**3GPP TSG-RAN WG4 Meeting #115 *R4-2508462***

**Malta , MT, 19th – 23rd May, 2025**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.133** | **CR** | **Draft** | **rev** | **-** | **Current version:** | **19.0.0** |  |
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| *For* ***HE******LP*** *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 big CR for RRM requirements of NR NTN Phase 3 | | | | | | | | | |
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| ***Source to WG:*** | CATT, Qualcomm | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_NTN\_Ph3-Core | | | | |  | ***Date:*** | | | 2025-05-27 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | | | | | | | *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:*** | | Introduce the core requirements for NR NTN Phase 3, including RedCap UEs with NTN. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | This draft bigCR includes the following endorsed draft CRs:  **Draft CRs endorsed in RAN4#115:**  RedCap UEs with NTN:   |  |  |  | | --- | --- | --- | | **T-doc** | **Company** | **Title** | | R4-2508406 | OPPO | draftCR on requirements of Link Recovery Procedures for RedCap UEs with NTN | | R4-2508418 | Xiaomi | draftCR on 9.5X L1-RSRP measurements for Reporting for RedCap UEs with NTN | | R4-2508407 | Samsung | Draft CR on RRC Connection Mobility Control for RedCap UEs with NTN | | R4-2508408 | Apple | draft CR for NR measurements for positioning for RedCap UEs with NTN | | R4-2508409 | CATT | Draft CR to TS 38.133 on applicability of requirements and Cell Selection for RedCap UEs with NTN | | R4-2508410 | Ericsson | (NR\_NTN\_Ph3-Core) Draft CR on measurement requirement for RedCap UEs with NTN | | R4-2508411 | CMCC | draftCR on Introduce inter-frequency measurement requirements for RedCap UEs over NTN | | R4-2508412 | MediaTek inc. | DraftCR on timing requirements for NTN Redcap | | R4-2508413 | vivo | Draft CR for requirements in signalling characteristics for (e)Redcap UEs with FR1-NTN | | R4-2506794 | Huawei, HiSilicon | draftCR on HO requirements for RedCap UE in NTN | | R4-2508415 | ZTECorporation,Sanechips | (NR\_NTN\_Ph3-Core) Cell Re-selection for RedCap UEs with NTN in IDLE state | | R4-2508416 | ZTECorporation,Sanechips | (NR\_NTN\_Ph3-Core) Cell Re-selection for RedCap UEs with NTN in INACTIVE state | | R4-2508377 | Nokia | Draft CR38.133 CG-SDT requirements for RedCap in NTN | | R4-2508378 | Nokia | Draft CR38.133 RA-SDT requirements for RedCap in NTN | | R4-2508417 | Qualcomm Incorporated | draft Cat-B CR on 8.1X Radio Link Monitoring for RedCap UEs with NTN | | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The core requirements for NR NTN Phase 3, including RedCap UEs with NTN, will be missed in R19 spec. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.6.Y(new), 4.1,  4.2X(new), 5.1X(new), 5.5X(new), 5.7X(new)  6.1X(new), 6.2X(new), 7.1X(new), 7.2X(new), 7.3X(new)  8.1X(new), 8.5X(new), 8.6X(new), 8.10X(new), 8.13X(new), 8.14X(new)  9.1X(new), 9.2X(new), 9.3X(new), 9.5X(new), 9.9X(new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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>

### 3.6.Y Applicability of requirements for RedCap UE with satellite access

The requirements for RedCap UEs with satellite access defined in clauses with suffix ‘X’ apply provided that [FFS: UE indicates *supportOfRedCap-r17 or supportOfERedCap-r18* and indicates *nonTerrestrialNetwork-r17*] and is accessing a cell served by a Satellite Access Node (SAN) and operating in FR1-NTN bands. The requirements apply provided that serving and all neighbour satellites on the same layer are of same satellite type (LEO or GEO).

The applicability defined for RedCap UEs in clause 3.6.11 is also applicable to RedCap UEs with satellite access except for FR2 related requirements.

<End of Change 1>

<Start of Change 2>

## 4.1 Cell Selection

After a UE has switched on and a PLMN has been selected, the Cell selection process takes place, as described in TS 38.304 [1]. This process allows the UE to select a suitable cell where to camp on in order to access available services. In this process, the UE can use stored information (*Stored information cell selection*) or not (*Initial cell selection*).

The 1 Rx RedCap UE for the cell selection procedure [1] applies:

*- Qrxlevmin* as the signaled value of *Qrxlevmin* [2] -1 dB.

*- Qqualmin* as the signaled value of *Qqualmin* [2] -1 dB.

The above offsetfor *Qrxlevmin* and *Qqualmin* is also applicable to RedCap UEs with satellite access.

<End of Change 2>

<Start of Change 3>

## 4.2X Cell Re-selection for NR RedCap UE with Satellite Access

### 4.2X.1 Introduction

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

When the RedCap UE is in either *Camped* *Normally* state or *Camped on Any Cell* state on a cell, the RedCap UE shall attempt to detect, synchronise, and monitor intra-frequency , inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency ,inter-frequency and inter-RAT cells, the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. RedCap UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the RedCap UE to limit its measurement activity.

For intra-frequency cell re-selection, requirements defined in clause 4.2X.2.3 apply.

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

For inter-RAT cell re-selection, requirements defined in clause 4.2X.2.11 apply.

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

The requirements specified in clause 4.2X apply to FR1-NTN as defined in TS 38.101-5 [43].

The terms SSB and SMTC in this clause apply to CD-SSB only if not specified otherwise.

The 1 Rx RedCap UE for performing the cell reselection procedure [1] applies:

*- Qrxlevmin* as the signaled value of *Qrxlevmin* [2] -1 dB.

*- Qqualmin* as the signaled value of *Qqualmin* [2] -1 dB.

### 4.2X.2 Requirements for RedCap UE with Satellite Access

#### 4.2X.2.1 UE measurement capability for RedCap

##### 4.2X.2.1.1 UE measurement capability for 1Rx RedCap UEs

The capability defined in section 4.2B.2.1.1 shall apply.

##### 4.2X.2.1.2 UE measurement capability for 2Rx RedCap UEs

The capability defined in section 4.2C.2.1 shall apply.

#### 4.2X.2.2 Measurement and evaluation of serving cell for RedCap UEs

The RedCap 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 eDRX cycle/2; otherwise DRX cycle/2.

If the UE is not configured with eDRX\_IDLE cycle and the UE has evaluated according to table 4.2C.2.2-1 (only FR1) for both 1Rx RedCap and 2Rx RedCap 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. In this case the UE shall not relax measurements on any of the neighbour cells even if UE has fulfilled the criteria for meeting the relaxed measurement requirements defined clauses 4.2C.2.7 and 4.2C.2.8.

If the UE is configured with eDRX\_IDLE cycle and has evaluated according to table 4.2X.2.2-1, in Nserv\_RedCap consecutive eDRX cycles, 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. In this case the UE shall not relax measurements on any of the neighbour cells even if UE has fulfilled the criteria for meeting the relaxed measurement requirements defined clauses 4.2C.2.7 and 4.2C.2.8.

For the UE configured with eDRX\_IDLE cycle, Nserv\_RedCap is specified in table 4.2X.2.2-1 for 1 Rx RedCap and 2 Rx RedCap in FR1.

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 clauses 4.2X.2.3 and 4.2X.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 [1] 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 4.2X.2.2-1: Nserv\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28 s periods) | Scaling Factor (N1) | Nserv\_RedCap [number of DRX or eDRX cycles Note 3] |
| 2.56 | N/A | N/A | 1 | N1\*2 |
| 5.12 | N/A | N/A | N1\*2 |
| 10.24 | N/A | N/A | N1\*2 |
| NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s.  NOTE 4: The lower bound of PTW length is derived based on . | | | | |

#### 4.2X.2.3 Measurements of intra-frequency NR cells for RedCap UE

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

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

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within Kmulti\_SMTC \* Tdetect,NR\_Intra\_RedCapwhen that Treselection= 0 if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within Kmulti\_SMTC \* Tdetect,NR\_Intra\_enh\_RedCapif the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled. An intra frequency cell is considered to be detectable according to the conditions defined in annex B.1. 6for a corresponding band.

The UE shall measure SS-RSRP and SS-RSRQ at least every Kmulti\_SMTC \* Tmeasure,NR\_Intra\_RedCap (see table 4.2X.2.3-1) if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or every Kmulti\_SMTC \* Tmeasure,NR\_Intra\_enh\_RedCap (see table 4.2X.2.3-2) if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-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\_RedCap/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 intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS 38.304 [1] within Kmulti\_SMTC \* Tevaluate,NR\_Intra\_RedCap if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within Kmulti\_SMTC \* Tevaluate,NR\_Intra\_enh\_RedCap if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, when Treselection = 0as specified in table 4.2C.2.3-1 or table 4.2C.2.3-2 provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3 dB better ranked in FR1 for 2 Rx RedCap.

- the cell is at least 4 dB better ranked in FR1 for 1 Rx RedCap.

when *rangeToBestCell* is configured:

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

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

- the cell is at least 3 dB better ranked in FR1 if the current serving cell is among them for 2 Rx RedCap.

- the cell is at least 4 dB better ranked in FR1 if the current serving cell is among them for 1 Rx RedCap.

The 1 Rx RedCap UE applies *absThreshSS-BlocksConsolidation* as the signalled value of *absThreshSS-BlocksConsolidation* [2] + 1 dB.

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

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

For both 1Rx RedCap and 2Rx RedCap not configured with eDRX\_IDLE cycle, Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap are specified in table 4.2C.2.3-1.

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX\_IDLE cycle, Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap are specified in table 4.2X.2.3-1 for FR1, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE.

For both 1Rx RedCap and 2Rx RedCap, Tdetect,NR\_Intra\_enh\_RedCap ,Tmeasure,NR\_Intra\_enh\_RedCap ,Tevaluate,NR\_Intra\_enh\_RedCap are defined in table 4.2X.2.3-2.

The parameter Kmulti\_SMTC,i is the scaling factor for measurement of multiple SMTCs or multiple satellites, which refers to clause 4.2C.2.3.

**Table 4.2X.2.3-1: Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR1)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28 s periods)** | **Tdetect,NR\_Intra\_RedCap [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Intra\_RedCap [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,NR\_Intra\_RedCap [s] (number of DRX cycles or eDRX cycles Note 3)** |
| 2.56 | - | - | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| 5.12 | - | - | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 | - | - | 235.52 (23) | 10.24 (1) | 20.48 (2) |
| NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s.  NOTE 4: The lower bound of PTW length is derived based on .  NOTE 5: M2 = 2 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. | | | | | |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,NR\_Intra\_enh\_RedCap [s] (number of DRX cycles)** | **Tmeasure,NR\_Intra\_enh\_RedCap [s] (number of DRX cycles)** | **Tevaluate,NR\_Intra\_enh\_RedCap [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 | [11.52] ([9]) | 1.28 (1) | 3.84 (3) |
| 2.56 | [64] ([25]) | 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 | | | |

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.

If ‘*t-Service*’ is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or serving cell moving reference location is met or the legacy Srxlev/Squal condition are met, and when to start the detection, measurement and evaluation on neighbour cells is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is acquired by the UE for the first time to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than Ttrigger.

Ttrigger = max(Kmulti\_SMTC\*Tdetect,NR\_Intra\_RedCap, Kmulti\_SMTC\*Kcarrier\* Tdetect,NR\_Inter\_RedCap),

where

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

- Tdetect,NR\_Intra\_RedCap refers to intra-frequency cell detection delay in IDLE/INACTIVE mode defined in table 4.2X.2.3-1,

- Tdetect,NR\_Inter\_RedCap refers to inter-frequency cell detection delay in IDLE/INACTIVE mode defined in table 4.2B.2.4-1.

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

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

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

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

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

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within  if the UE does not support t *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within  if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-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

For 2 Rx RedCap 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

For 1 Rx RedCap by a margin of at least

6 dB in FR1 for reselections based on ranking or

7 dB in FR1 for SS-RSRP reselections based on absolute priorities or

5 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, which refers to clause 4.2C.2.4

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\_RedCap. 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  if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or every  if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-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\_RedCap/2.

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

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within  if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within  if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-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 for 2 Rx RedCap.

- the cell is at least 6 dB better ranked in FR1 for 1 Rx RedCap.

- 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 defined in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

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

- the cell is at least 5 dB better ranked in FR1 if the current serving cell is among them, or 6 dB in FR1 for SS-RSRP reselections based on absolute priorities for 2 Rx RedCap or 4 dB in FR1 for SS-RSRQ reselections based on absolute priorities for 2 Rx RedCap.

- the cell is at least 6 dB better ranked in FR1 if the current serving cell is among them, or 7 dB in FR1 for SS-RSRP reselections based on absolute priorities or 5 dB in FR1 for SS-RSRQ reselections based on absolute priorities for 1 Rx RedCap.

The 1 Rx RedCap UE applies *absThreshSS-BlocksConsolidation* as the signalled value of *absThreshSS-BlocksConsolidation* [2] + 1 dB.

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 this cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2B.2.4-1 for both 1Rx RedCap and 2Rx RedCap 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\_RedCap 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\_RedCap is expected.

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

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

For 1 Rx RedCap and 2 Rx RedCap not configured with eDRX\_IDLE cycle, Tdetect,NR\_Inter\_RedCap, Tmeasure,NR\_ Inter \_RedCap and Tevaluate,NR\_ Inter \_RedCap are specified in table 4.2B.2.4-1 with FR1.

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX\_IDLE cycle, Tdetect,NR\_ Inter \_RedCap, Tmeasure,NR\_ Inter \_RedCap and Tevaluate,NR\_ Inter \_RedCap are specified in table 4.2X.2.4-1 for FR1. The requirements apply provided that the serving cell is configured with eDRX\_IDLE and the DRX cycle length is same in all PTWs during any of Tdetect,NR\_ Inter \_RedCap, Tmeasure,NR\_ Inter \_RedCap and Tevaluate,NR\_ Inter \_RedCap when multiple PTWs are used.

For both 1Rx RedCap and 2Rx RedCap, Tdetect,NR\_Inter\_RedCap\_enh ,Tmeasure,NR\_Intra\_RedCap\_enh ,Tevaluate,NR\_Intra\_RedCap\_enh refer to table 4.2X.2.4-2.

**Table 4.2X.2.4-1: Tdetect,NR\_Inter\_RedCap, Tmeasure,NR\_Inter\_RedCap and Tevaluate,NR\_Inter\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR1)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28 s periods)** | **Tdetect,NR\_Inter\_RedCap [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Inter\_RedCap [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,NR\_Inter\_RedCap [s] (number of DRX cycles or eDRX cycles Note 3)** |
|
| 2.56 | - | - | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| 5.12 | - | - | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 | - | - | 235.52 (23) | 10.24 (1) | 20.48 (2) |
| NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s.  NOTE 4: The lower bound of PTW length is derived based on . | | | | | |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,NR\_Inter\_RedCap\_enh [s] (number of DRX cycles)** | **Tmeasure,NR\_Inter\_RedCap\_enh [s] (number of DRX cycles)** | **Tevaluate,NR\_Inter\_RedCap\_enh [s] (number of DRX cycles)** |
|
| 0.32 | [3.84 x M2 ([12] x M2)] Note 1 | [0.32 x M3 ([1] x M3)] Note 1 | 0.96 x M4 (3 x M4) Note 1 |
| 0.64 | [7.68 ([12])] | [0.64 (1)] | 1.92 (3) |
| 1.28 | [12.8 ([10])] | 1.28 (1) | 3.84 (3) |
| 2.56 | [64] ([25]) | 2.56 (1) | 7.68 (3) |
| NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 | | | |

If *t-Service* is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or serving cell moving reference location or the legacy Srxlev/Squal condition are met, and when to start detection, measurement, and evaluation is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is acquired by the UE for the first time to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than Ttrigger, and Ttrigger = max(Kmulti\_SMTC\*Tdetect,NR\_Intra, Kmulti\_SMTC\*Kcarrier\* Tdetect,NR\_Inter) when serving cell is below the search threshold, and Ttrigger = max(Kmulti\_SMTC\*Tdetect,NR\_Intra, Nlayer\* [60 s]) when serving cell is above the search threshold, where

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

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

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

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

The requirements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the values indicated by *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially until all of the SMTCs can be measured, the selection of SMTCs to be used is up to UE implementation, and longer measurement delay than the corresponding measurement period specified in table 4.2B.2.4-1 with FR1 and table 4.2X.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.

#### 4.2X.2.5 Maximum interruption in paging reception for RedCap

The FDD and HD-FDD RedCap UE shall meet all applicable requirements specified in clause 4.2.2.6. In addition, when the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

The 1 Rx RedCap in HD-FDD shall meet all applicable requirements specified in clause 4.2.2.6 under the following conditions

- at least 1 SSB is available at the UE in the serving cell during the last 160 ms duration.

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.

At inter-frequency cell re-selection with TN carrier, 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 inter-frequency cell for paging reception. The interruption time shall not exceed TSI-NR + K\*Ttarget\_cell\_SMTC\_period ms.

At inter-RAT cell re-selection with TN carrier, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels for paging reception of the target inter-RAT cell. The interruption time must not exceed TSI-EUTRA + 55 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.

If the target cell is NR cell with TN carrier, then K = 2.

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.

TSI-EUTRA 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 36.331 [16] for an E-UTRAN cell.

The target cell is considered as known if it has been detectable during Tdetect,NR\_Intra\_RedCap or Tdetect,NR\_Inter\_RedCap, 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\_RedCap, Tdetect,NR\_Inter\_RedCap and Ttrigger are defined in clauses 4.2X.2.3 and 4.2X.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.

#### 4.2X.2.6 Minimum requirement at transitions for RedCap UE

The requirements in clause 4.2B.2.8 apply provided that target cell’s satellite is GEO.

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

##### 4.2X.2.7.1 Introduction

This clause contains the requirements for measurements on intra-frequency NR cells when Srxlev ≤ SIntraSearchP or Squal ≤ SIntraSearchQ and when the UE is configured any of the following relaxed measurement criteria:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],

- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4.9.2 in [1],

- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.2 in [1] respectively.

##### 4.2X.2.7.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

UE is configured with *lowMobilityEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

The requirements defined in clause 4.2X.2.3 apply for this clause except that:

- For a UE not configured with eDRX\_IDLE, Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax refer to table 4.2B.2.9.9-1 and table 4.2B.2.9.9-2 with FR1 only for 1 Rx RedCap and 2 Rx RedCap respectively.

- [For a UE configured with eDRX\_IDLE up-to 10.24 s, Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax refer to table 4.2B.2.9.9-3 and table 4.2B.2.9.9-4 for 1 Rx RedCap and 2 Rx RedCap respectively.]

##### 4.2X.2.7.3 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

UE is configured with *cellEdgeEvaluation* [2] criterion and UE is not configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *cellEdgeEvaluation* [2] criterion, or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criteria and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

The requirements defined in clause 4.2X.2.3 apply for this clause except that:

- For a UE not configured with eDRX\_IDLE, Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax refer to table 4.2B.2.9.10-1 and table 4.2B.2.9.10-2 with FR1 only for 1 Rx RedCap and 2 Rx RedCap respectively.

- [For a UE configured with eDRX\_IDLE up to 10.24s, Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax refer to table 4.2B.2.9.10-3 and table 4.2B.2.9.10-4 for 1 Rx RedCap and 2 Rx RedCap respectively.]

##### 4.2X.2.7.4 Measurements for UE fulfilling low mobility and not-at-cell edge criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and

- both criteria are fulfilled, and

- less than 1 hour have passed since measurements for cell reselection were performed

In this case the UE is not required to meet Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap as defined in table 4.2X.2.3.

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

##### 4.2X.2.8.1 Introduction

This clause contains the requirements for measurements on inter-frequency NR cells when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ and when the UE is configured any of the following relaxed measurement criteria:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],

- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4. 9.2 in [1],

- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4. 9.1 and 5.2.4.9.2 in [1] respectively.

##### 4.2X.2.8.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, or

- UE is configured with both *lowMobilityEvaluation* [2] and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the requirements are defined as follows:

- For a UE not configured with eDRX\_IDLE, Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax refer to table 4.2B.2.10.9-1 and table 4.2B.2.10.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively

- For a UE configured with eDRX\_IDLE up to 10.24s, Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax refer to table 4.2B.2.10.9-3 and table 4.2B.2.10.9-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ and the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for inter-frequency layers of higher priority at least every K2\*Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2B.2.7 and, K2 = 60. Otherwise, if the UE is not configured with *highPriorityMeasRelax* [2] 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 4.2B.2.7.

##### 4.2X.2.8.3 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with *cellEdgeEvaluation* [2] criterion, and UE is not configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *cellEdgeEvaluation* [2] criterion or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the requirements defined in clause 4.2B.2.4 apply for this clause except that:

- For a UE not configured with eDRX\_IDLE, Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax are as specified in table 4.2B.2.10.10-1 and table 4.2B.2.10.10-2 with FR1 only for 1 Rx RedCap and 2 Rx RedCap respectively.

- [For a UE configured with eDRX\_IDLE up to 10.24s, Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax are as specified in table 4.2B.2.10.10-3 and table 4.2B.2.10.10-4 for 1 Rx RedCap and 2 Rx RedCap respectively.]

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ and regardless of whether the UE is configured with *highPriorityMeasRelax* [2] or not, 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 4.2X.2.9.

##### 4.2X.2.8.4 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, and

- less than 1 hour have passed since measurements for cell reselection were last performed

In this case the UE is not required to meet Tdetect,NR\_Inter\_RedCap, Tmeasure,NR\_Inter\_RedCap and Tevaluate,NR\_Inter\_RedCap as defined in clause 4.2B.2.4.

When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, the UE shall search for, measure and evaluate inter-frequency layers of higher, equal or lower priority at least every 1 hour.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE shall search for inter-frequency layers of higher priority at least every K2\*Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.7 and K2=60.

The requiresments defined in this clause apply regardless of eDRX\_IDLE configurations.

#### 4.2X.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.

#### 4.2X.2.10 Measurements of inter-frequency NR cells with TN carrier

This clause applies for the inter-frequency cell re-selection for TN carriers, and NTN carriers if configured. The requirements in clause 4.2X.2.10 apply provided that network provides SIB19 and UE is configured with and one or more TN carriers.

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 clause considers the inter-frequency cell reselection from NTN to TN in FR1.

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 TS 38.304 [1] within Kcarrier\_TN \* Tdetect,NR\_Inter\_TN +  if the UE does not support Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or withinKcarrier\_TN \* Tdetect,NR\_Inter\_TN +  if the UE supports Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-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 Kmulti\_SMTC,i refers to 4.2C.2.10

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.

Tdetect,NR\_Inter\_TN ,Tmeasure,NR\_Inter\_TN and Tevaluate,NR\_Inter\_TN are the NR TN inter-frequency cell re-selection requirement defined in table 4.2.2.4-1 in TS 38.133

Tdetect,NR\_Inter\_NTN\_RedCap ,Tmeasure,NR\_Inter\_NTN\_RedCap and Tevaluate,NR\_Inter\_NTN-RedCap are the NR NTN inter-frequency cell re-selection requirement defined in table 4.2B.2.4-1 with FR1 in TS 38.133.

Tdetect,NR\_Inter\_NTN\_RedCap\_enh, Tmeasure,NR\_Inter\_NTN\_RedCap\_enh and Tevaluate,NR\_Inter\_NTN\_RedCap\_enh are the NR NTN inter-frequency cell re-selection requirement defined in table 4.2X.2.4-2 in TS 38.133.

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\_RedCap. If, after detecting a cell in a higher priority search, it is determined that re-selection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of re-selection. 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 +  if the UE does not support Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or every Kcarrier\_TN \* Tmeasure,NR\_Inter\_TN +  if the UE supports Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-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 +  if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within Kcarrier\_TN \* Tevaluate,NR\_Inter\_TN +  if the UE supportsEnhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, when Treselection = 0as specified in table 4.2C.2.4-1 provided that the reselection criteria is met by

- For 2 Rx RedCap 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

For 1 Rx RedCap by a margin of at least

6 dB in FR1 for reselections based on ranking or

7 dB in FR1 for SS-RSRP reselections based on absolute priorities or

5 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 4.2B.2.4-1 for both 1Rx RedCap and 2Rx RedCap under the following conditions:

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

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

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

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

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

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

For 1 Rx RedCap and 2 Rx RedCap not configured with eDRX\_IDLE cycle, Tdetect,NR\_Inter\_RedCap, Tmeasure,NR\_ Inter \_RedCap and Tevaluate,NR\_ Inter \_RedCap are specified in table 4.2B.2.4-1 with FR1.

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX\_IDLE cycle, Tdetect,NR\_ Inter \_RedCap, Tmeasure,NR\_ Inter \_RedCap and Tevaluate,NR\_ Inter \_RedCap are specified in table 4.2X.2.4-1 for FR1. The requirements apply provided that the serving cell is configured with eDRX\_IDLE and the DRX cycle length is same in all PTWs during any of Tdetect,NR\_ Inter \_RedCap, Tmeasure,NR\_ Inter \_RedCap and Tevaluate,NR\_ Inter \_RedCap when multiple PTWs are used.

For both 1Rx RedCap and 2Rx RedCap, Tdetect,NR\_Inter\_RedCap\_enh ,Tmeasure,NR\_Intra\_RedCap\_enh ,Tevaluate,NR\_Intra\_RedCap\_enh are defined in table 4.2X.2.4-2.

#### 4.2X.2.11 Measurements of inter-RAT E-UTRAN cells with TN carrier

This clause applies for the inter-RAT cell re-selection for TN carriers, and NTN carriers if configured. The requirements in clause 4.2X.2.11 apply provided that network provides SIB19 and UE is configured with and one or more TN carriers.

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 clause considers the inter-RAT cell reselection from NTN to E-UTRAN TN in FR1.

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.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, UE supports the enhanced inter-RAT E-UTRAN measurement requirements.

The parameter NEUTRA\_carrier\_RedCap 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.

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 TS 38.304 [1] within NEUTRA\_carrier\_RedCap \* Tdetect,EUTRAN\_RedCap when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria is met by a margin of at least 6 dB for RSRP reselections based on absolute priorities or 4 dB for RSRQ reselections based on absolute priorities for 2Rx RedCap and at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities for 1 Rx RedCap.

Cells which have been detected shall be measured at least every NEUTRA\_carrier\_RedCap \* Tmeasure,EUTRAN\_RedCap 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\_RedCap. 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\_RedCap \* Tevaluate,EUTRAN\_RedCap when Treselection = 0as specifie 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 6 dB for RSRP reselections based on absolute priorities or 4 dB for RSRQ reselections based on absolute priorities for 2Rx RedCap and at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities for 1 Rx RedCap.

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 1 Rx RedCap and 2 Rx RedCap configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_RedCap, Tmeasure,EUTRAN\_RedCap and Tevaluate, E-UTRAN\_RedCap are specified in table 4.2B.2.5-2, 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\_RedCap, Tmeasure,EUTRAN\_RedCap and Tevaluate, E-UTRAN\_RedCap when multiple PTWs are used.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_RedCap, Tmeasure,EUTRAN\_RedCap and Tevaluate, E-UTRAN\_RedCap are specified in table 4.2B.2.5-1.

<End of Change 3>

<Start of Change 4>

## 5.1X Cell Re-selection for RedCap UE with satellite access

### 5.1X.1 Introduction

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

When the RedCap UE is in either *Camped* *Normally* state on a cell, the RedCap UE shall attempt to detect, synchronise, and monitor intra-frequency , inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency ,inter-frequency and inter-RAT cells, the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. RedCap UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the RedCap 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 1 Rx RedCap UE for performing the cell reselection procedure [1] applies:

*- Qrxlevmin* as the signaled value of *Qrxlevmin* [2] -1 dB.

*- Qqualmin* as the signaled value of *Qqualmin* [2] -1 dB.

### 5.1X.2 Requirements for RedCap

#### 5.1X.2.1 UE measurement capability

The requirements in clause 4.2X.2.1 shall apply.

#### 5.1X.2.2 Measurement and evaluation of serving cell

The requirements in clause 4.2X.2.2 shall apply when UE is not configured with eDRX\_IDLE.

When UE is configured with eDRX\_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, 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\* T for FR1 and N1\*T for FR2; where:

- T is determined according to clause 7.1 in [1],

- M1=2 if SMTC periodicity (TSMTC) > 20 ms and T ≤ 0.64 second, otherwise M1=1.

When UE is configured with eDRX\_IDLE and eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, within a single eDRX INACTIVE PTW, 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\* T for FR1 and N1\*T for FR2; where:

- T is determined according to clause 7.1 in [1],

- M1=2 if SMTC periodicity (TSMTC) > 20 ms and T ≤ 0.64 second, otherwise M1=1.

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 T/2.

If UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1 and the UE has evaluated according to table 5.1X.2.2-1 in Nserv\_RedCap consecutive T 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.

Table 5.1X.2.2-1: Nserv\_RedCapfor inactive Redcap UE configured with eDRX\_IDLE cycle, (Frequency range FR1)

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX or eDRX INACTIVE cycle length[s] | T [s] | Nserv \_RedCap [number of T ] |
| 2.56 ≤eDRX\_IDLE cycle length ≤10.24 | 0.32 ≤DRX\_Inactive cycle length ≤2.56; or  2.56 ≤eDRX\_Inactive cycle length ≤10.24 if inactive eDRX is configured | 0.32 | 4\*M1 |
| 0.64 | 4\*M1 |
| 1.28 | 2 |
| 2.56 | 2 |
| 5.12 | 2 |
| 10.24 | 2 |
| NOTE 1: T is determined according to clause 7.1 in [1].  NOTE 2: M1=2 if SMTC periodicity (TSMTC) > 20 ms and T≤ 0.64 second, otherwise M1=1. | | | |

If UE is not configured with eDRX\_INACTIVE ≥ 10.24 s, when UE transitions from measurements within eDRX\_IDLE PTW and to measurements outside eDRX\_IDLE PTW or vice versa during one measurement period, the UE measurement requirements apply based on the longer measurement period requirements before or after the transition.

When the UE transitions between any two states when changing eDRX\_IDLE cycle length, eDRX\_INACTIVE 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.

If the UE in RRC\_INACTIVE 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 during the time T’, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where

- T’= 10 s, if the UE is not configured with eDRX\_INACTIVE cycle, or

- T’= MAX (10 s, one eDRX\_INACTIVE cycle) if the UE is configured with eDRX\_INACTIVE cycle for FR1, or

#### 5.1X.2.3 Measurements of intra-frequency NR cells

The requirements in clause 4.2X.2.3 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2X.2.3 shall apply with Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap defined in table 5.1X.2.3-1.

Table 5.1X.2.3-1: Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap for Redcap UE configured with eDRX\_IDLE cycle, (Frequency range FR1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX or eDRX INACTIVE cycle length [s] | Tdetect,NR\_Intra\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tmeasure,NR\_Intra\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tevaluate,NR\_Intra\_RedCap [s] (number of DRX or INACTIVE eDRX cycles) |
|
| 2.56 ≤eDRX\_IDLE cycle length ≤ 10.24 | 0.32 | 11.52 x M2 (36 x M2) | 1.28 x M2 (4 x M2) | 5.12 x M2 (16 x M2) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) |
| 1.28 | 32 (25) | 1.28 (1) | 6.4 (5) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| 5.12 | 117.76 (23) | 5.12 (1) | 15.36 (3) |
| 10.24 | 235.52 (23) | 10.24 (1) | 30.72 (3) |
| NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. | | | | |

When the UE transitions between any two states when changing eDRX\_IDLE cycle length, eDRX\_INACTIVE 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.

#### 5.1X.2.4 Measurements of inter-frequency NR cells

The requirements in clause 4.2X.2.4 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2X.2.4 shall apply with Tdetect,NR\_Inter\_RedCap, Tmeasure,NR\_Inter\_RedCap and Tevaluate,NR\_Inter\_RedCap defined in table 5.1X.2.4-1.

Table 5.1X.2.4-1: Tdetect,NR\_Inter\_RedCap, Tmeasure,NR\_Inter\_RedCap and Tevaluate,NR\_Inter\_RedCap for Redcap UE configured with eDRX\_IDLE cycle, (Frequency range FR1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX or eDRX INACTIVE cycle length [s] | Tdetect,NR\_Inter\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tmeasure,NR\_Inter\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tevaluate,NR\_Inter\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) |
|
| 2.56 ≤eDRX\_IDLE cycle length ≤ 10.24 | 0.32 | 11.52 x 1.5 (36 x 1.5) | 1.28 x 1.5 (4 x 1.5) | 5.12 x 1.5 (16 x 1.5) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) |
| 1.28 | 32 (25) | 1.28 (1) | 6.4 (5) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| 5.12 | 117.76 (23) | 5.12 (1) | 15.36 (3) |
| 10.24 | 235.52(23) | 10.24 (1) | 30.72 (3) |

When the UE transitions between any two states when changing eDRX\_IDLE cycle length, eDRX\_INACTIVE 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.

#### 5.1X.2.5 Maximum interruption in paging reception

The requirements in clause 4.2X.2.5 shall apply for RedCap UEs.

For RedCap UE in HD-FDD mode, if paging occasions partially overlap with CG-SDT transmission, the UE is only required to monitor for SI change indication in any paging occasion at least once per modification period [2] during SDT if the initial downlink BWP on which the SDT procedure is ongoing is associated with a CD-SSB.

#### 5.1X.2.6 General requirements

The requirements in clause 4.2X.2.9 shall apply.

#### 5.1X.2.7 Measurements of inter-frequency NR cells with TN carrier

The requirements in clause 4.2X.2.10 shall apply.

#### 5.1X.2.8 Measurements of inter-RAT E-UTRAN cells with TN carrier

The requirements in clause 4.2X.2.11 shall apply.

<End of Change 4>

<Start of Change 5>

5.5X Configured Grant based Small Data Transmissions (CG-SDT) for RedCap UE with satellite access

5.5X.1 Introduction

The requirements in this clause are applicable for 1 Rx (e)RedCap and 2 Rx (e)RedCap UEs with FR1-NTN when the UE is configured with timing alignment (TA) validation for transmitting in uplink using CG-SDT as specified in TS 38.331 [2].

The 1 Rx (e)RedCap UE for determining whether to perform SDT procedure defined in clause 5.27 [7] applies:

- sdt-RSRP-Threshold-r17 as the signaled value of sdt-RSRP-Threshold-r17 [2] + 1 dB.

5.5X.2 Requirements on UE synchronization for small data transmissions

The requirements in this clause are applicable for the UE performing small data transmissions using configured resources as TS 38.331 [2].

The UE is allowed to transmit using the configured uplink resources provided that the UE is synchronized towards (i.e. using the timing derived using the latest available , , and values as specified in subclause 7.1X.2) the serving cell prior to transmission. If the UE is not able to obtain the synchronization towards the serving cell, then the UE shall drop the small data transmission. The UE determines the small data transmission occasion according to the received CG-SDT configuration [2].

5.5X.3 TA validation requirements

The UE is allowed to transmit using CG-SDT using the timing derived using the latest available , , and values as specified in subclause 7.1C before CG-SDT transmission provided that

- timing alignment validation for transmission using CG-SDT is valid according to the validation criteria in clause 5.8.2 in TS 38.321 [7], and

- either *cg-SDT-TimeAlignmentTimer* is not configured or *cg-SDT-TimeAlignmentTimer* is running as confirmed by lower layers, as defined in clause 5.27.2 in TS 38.321 [7] with UE expected to not perform any threshold comparison against *cg-SDT-RSRP-ChangeThreshold*.

Additionally, for the initial CG-SDT transmission, the UE shall not transmit in an CG-SDT occasion that occurs more than 640ms after T2, where T2 is the time when the UE performs TA validation as defined in clause 5.27.2 in (TS 38.321 [7]) for transmission using CG-SDT.

5.5X.4 Scheduling restriction

[FFS: The requirements in clause 5.5.4 shall apply for RedCap UEs with FR1-NTN.]

*Editor’s Note: The above is under discussion in RAN4.*

5.5X.5 Applicability conditions for SDT

The UE is not required to meet the following measurement requirements during subsequent SDT transmissions:

- Measurements of inter-frequency NR cells in clause 5.1X.2.4

- Measurements of inter-RAT E-UTRAN cells in clause 5.1X.2.5

<End of Change 5>

<Start of Change 6>

5.7X Random access based Small Data Transmissions (RA-SDT) for RedCap UE with satellite access

5.7X.1 Introduction

The requirements in this clause are applicable for the 1 Rx (e)RedCap and 2 Rx (e)RedCap UE with FR1-NTN performing small data transmissions using 2-step RA or 4-step RA procedures [3].

The 1 Rx (e)RedCap UE for determining whether to perform SDT procedure defined in clause 5.27 [7] applies:

- sdt-RSRP-Threshold-r17 as the signaled value of sdt-RSRP-Threshold-r17 [2] + 1 dB.

### 5.7X.2 Requirements for small data transmissions based on 2-step RA

The requirements in clause 6.2C.2.3 shall apply.

### 5.7X.3 Requirements for small data transmissions based on 4-step RA

The requirements in clause 6.2C.2.2 shall apply.

5.7X.4 Applicability conditions for RA-SDT

The UE is not required to meet the following measurement requirements during subsequent SDT transmissions:

- Measurements of inter-frequency NR cells in clause 5.1X.2.4

- Measurements of inter-RAT E-UTRAN cells in clause 5.1X.2.5

<End of Change 6>

<Start of Change 7>

6.1X Handover for RedCap UE with satellite access

6.1X.1 NR SAN Handover

6.1X.1.1 Introduction

The purpose of NR SAN handover is to change the NR SAN PCell to another NR SAN cell for RedCap UE. The requirements in this clause are applicable to SA NR SAN.

Handover for a RedCap UE is defined as intra-frequency handover if the center frequency and subcarrier spacing (SCS) of the reference SSB of the serving cell is same as the center frequency and SCS of the reference SSB of the target cell, where:

- The reference SSB of the serving cell is the SSB in the active DL BWP of serving cell

- The reference SSB of the target cell is the SSB in the first active DL BWP of the target cell upon reconfiguration.

6.1X.1.2 NR SAN FR1 – NR SAN FR1 Handover

The applicability defined in clause 6.1X.1.2 apply for the requirements in this clause.

6.1X.1.2.1 Handover delay

The requirements in clause 6.1C.1.2.1 shall apply except that

- clause 6.1C.1.2.2.1 is replaced with 6.1X.1.2.2.1, and

- clause 6.1C.1.2.2.2 is replaced with 6.1X.1.2.2.2.

6.1X.1.2.2 Interruption time

The requirements in clause 6.1C.1.2.2 shall apply except that

- clause 9.2C.5 is replaced with 9.2X.5, and

- clause 9.3C.4 is replaced with 9.3X.4.

6.1X.1.2.2.1 Interruption time for RACH-based handover

The requirements in clause 6.1C.1.2.2.1 shall apply for RedCap UE with 2 Rx antennas.

The requirements in clause 6.1C.1.2.2.1 shall apply for RedCap UE with 1 Rx antennas except that Tsearch is defined as

- Tsearch is the time required to search the target NR SAN cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot ≥ -2 dB, then Tsearch = 2\*Trs ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot ≥ -2 dB, then Tsearch = 5\* Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

[For RedCap UE with HD-FDD, the requirements in this clause are met provided that

- SSB is available at the UE once every SMTC period during Tsearch

- One SSB is available during T∆

- One SSB is available during TIU. ]

6.1X.1.2.2.2 Interruption time for RACH-less handover

The requirements in clause 6.1C.1.2.2.2 shall apply except that clause 6.1X.1.2.2.1 is replaced with 6.1X.1.2.2.1.

6.1X.2 NR SAN Conditional Handover

6.1X.2.1 Introduction

The requirements in this clause are applicable to conditional handover to change the NR SAN PCell to another NR SAN cell for RedCap UE.

6.1X.2.2 NR SAN FR1 – NR SAN FR1 conditional handover

The applicability defined in clause 6.1X.2.2 apply for the the requirements in this clause except that

- clause 6.1C.2.2.2 is replaced with 6.1X.2.2.2, and

- clause 6.1C.2.2.3 is replaced with 6.1X.2.2.3, and

- clause 6.1C.2.2.4 is replaced with 6.1X.2.2.4.

6.1X.2.2.1 Handover delay

The requirements in clause 6.1C.2.2.1 shall apply except that

- clause 6.1C.2.2.2 is replaced with 6.1X.2.2.2, and

- clause 6.1C.2.2.3 is replaced with 6.1X.2.2.3, and

- clause 6.1C.2.2.4 is replaced with 6.1X.2.2.4.

6.1X.2.2.2 Measurement time

The requirements in clause 6.1C.2.2.2 shall apply except that

- clause 9.2C.5.1 is replaced with 9.2X.5.1, and

- clause 9.2C.6.1 is replaced with 9.2X.6.1, and

- clause 9.3C.7.1 is replaced with 9.3X.7.1.

6.1X.2.2.3 Preparation time

The requirements in clause 6.1C.2.2.3 shall apply.

6.1X.2.2.4 Interruption time

The requirements in clause 6.1C.2.2.4 shall apply.

[For RedCap UE with HD-FDD, the requirements in this clause are met provided that

- SSB is available at the UE once every SMTC period during Tsearch

- One SSB is available during T∆

- One SSB is available during TIU. ]

6.1X.2.3 NR SAN FR1 – NR SAN FR1 conditional handover without L3 measurement criteria

The applicability defined in clause 6.1C.2.3 apply for the requirements in this clause except that

- clause 6.1C.2.3.2 is replaced with 6.1C.2.3.2, and

- clause 6.1C.2.3.3 is replaced with 6.1C.2.3.3.

6.1X.2.3.1 Handover delay

The requirements in clause 6.1C.2.3.1 shall apply except that

- clause 6.1C.2.3.2 is replaced with 6.1C.2.3.2, and

- clause 6.1C.2.3.3 is replaced with 6.1C.2.3.3.

6.1X.2.3.2 Preparation time

The requirements in clause 6.1C.2.3.2 shall apply.

6.1X.2.3.3 Interruption time

The requirements in clause 6.1C.2.3.3 shall apply for RedCap UE with 2 Rx antennas.

The requirements in clause 6.1C.2.3.3 shall apply for RedCap UE with 1 Rx antennas except that Tsearch is defined as

- Tsearch is the time required to search the target NR SAN cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot ≥ -2 dB, then Tsearch = 2\*Trs ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot ≥ -2 dB, then Tsearch = 5\* Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

[For RedCap UE with HD-FDD, the requirements in this clause are met provided that

- One SSB is available during T∆

- One SSB is available during TIU. ]

6.1X.3 NR SAN Satellite switching with re-synchronization

6.1X.3.1 Introduction

The purpose of NR SAN Satellite switching with re-synchronization is to switch satellite in the same SSB frequency and same gNB without PCI changing for RedCap UE. The requirements in this clause are applicable to SA NR SAN.

6.1X.3.2 NR SAN FR1 – NR SAN FR1 Satellite switching with re-synchronization

The applicability defined in clause 6.1C.3.2 apply for the the requirements in this clause except that

- clause 6.1C.3.2.2 is replaced with 6.1X.3.2.2, and

- clause 6.1C.3.2.3 is replaced with 6.1X.3.2.3.

6.1X.3.2.1 Satellite switching delay

The requirements in clause 6.1C.3.2.1 apply for the the requirements in this clause except that

- clause 6.1C.3.2.2 is replaced with 6.1X.3.2.2, and

- clause 6.1C.3.2.3 is replaced with 6.1X.3.2.3.

[For RedCap UE with HD-FDD, the requirements in this clause are met provided that

- SSB is available at the UE once every SMTC period during Tsearch

- One SSB is available during T∆

- One SSB is available during TIU. ]

6.1X.3.2.2 Interruption time for hard satellite switch with re-sync

The requirements in clause 6.1C.3.2.2 shall apply for RedCap UE with 2 Rx antennas except that

- clause 6.1C.1.2.2.1 is replaced with 6.1X.1.2.2.1.

The requirements in clause 6.1C.3.2.2 shall apply for RedCap UE with 1 Rx antennas except that

- Tsearch is the time required to search the target NR SAN cell assuming the target cell is not already known when UE starts synchronizing with target satellite. If the target cell Es/Iot ≥ -2 dB, then Tsearch = Tfirst\_SSB + TSSB ms, where TSSB is the periodicity of the SSB of the source satellite. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

- clause 6.1C.1.2.2.1 is replaced with 6.1X.1.2.2.1.

6.1X.3.2.3 Satellite switch delay for soft satellite switch with re-sync

The requirements in clause 6.1C.3.2.3 shall apply for RedCap UE with 2 Rx antennas except that

- clause 6.1C.1.2.2.1 is replaced with 6.1X.1.2.2.1, and

- clause 9.2C.5.3 is replaced with 9.2X.5.3.

The requirements in clause 6.1C.3.2.2 shall apply for RedCap UE with 1 Rx antennas except that

- Tsearch is the time required to search the target NR SAN cell assuming the target cell is not already known when UE starts synchronizing with target satellite. If the target cell Es/Iot ≥ -2 dB, then Tsearch = Tfirst\_SSB + TSSB ms, where TSSB is the periodicity of the SSB of the source satellite. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

- clause 6.1C.1.2.2.1 is replaced with 6.1X.1.2.2.1, and

- clause 9.2C.5.3 is replaced with 9.2X.5.3.

<End of Change 7>

<Start of Change 8>

## 6.2X RRC Connection Mobility Control for RedCap UE with Satellite Access

### 6.2X.1 SA: RRC Re-establishment for RedCap UE with Satellite Access

#### 6.2X.1.1 Introduction

This clause contains requirements on the RedCap UE regarding RRC connection re-establishment procedure. RRC connection re-establishment is initiated when a UE in RRC\_CONNECTED state on the carrier loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [2].

A neighbour cell for RRC re-establishment procedures for a RedCap UE is defined as an intra-frequency cell if the centre frequency and subcarrier spacing (SCS) of the reference SSB of the serving cell is same as the centre frequency and SCS of the reference SSB of the neighbour cell; else it is considered as inter-frequency cell, where:

- The reference SSB of the target cell is the CD-SSB of the target cell.

- The reference SSB of the serving cell is the CD-SSB of the serving cell.

The requirements in this clause are applicable for RRC connection re-establishment to NR cell, which is served by satellite access node (SAN).

#### 6.2X.1.2 Requirements

The requirements in clause 6.2C.1.2 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 6.2C.1.2 shall apply except that:

- Tidentify\_intra\_NRas specified in table 6.2.1X.2-1.

- Tidentify\_inter\_NR, i as specified in table 6.2.1X.2-2.

Table 6.2.1X.2-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Serving cell | FR of target NR | Tidentify\_intra\_NR [ms] | |
| SSB Ês/Iot (dB) | cell | Known NR cell | Unknown NR cell |
| ≥ -8 | FR1 | MAX (200 ms, 6 x TSMTC) | MAX (800 ms, [11] x TSMTC) |
| < -8 | FR1 | N/A | 800Note1 |
| NOTE 1: The UE is not required to successfullyidentify a cell on any NR frequency layer when TSMTC > 20 ms and serving cell SSB Ês/Iot < -8 dB. | | | |

Table 6.2.1X.2-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Serving cell SSB Ês/Iot (dB) | FR of target NR cell | Tidentify\_inter\_NR, i [ms] | |
|  |  | Known NR cell | Unknown NR cell |
| ≥ -8 | FR1 | MAX (200 ms, 7 x TSMTC, i) | MAX (800 ms, [14] x TSMTC, i) |
| < -8 | FR1 | N/A | 800Note1 |
| NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when TSMTC,i > 20 ms and serving cell SSB Ês/Iot < -8 dB. | | | |

### 6.2X.2 Random access for RedCap UE with satellite access

#### 6.2X.2.1 Introduction

This clause contains requirements on the RedCap UE regarding random access procedure. The random access procedure is initiated to establish uplink time synchronization for a UE which either has not acquired or has lost its uplink synchronization, or to convey UE’s request Other SI, or for beam failure recovery. The random access is specified in clause 8 of TS 38.213 [3] and the control of the RACH transmission is specified in clause 5.1 of TS 38.321 [7]. Two types of procedure are defined for the random access, the 4-step RA type, and the 2-step RA type [7]. The decision on which type of procedure to adopt is as described in clause 5.1.1 of TS 38.321 [7].

The requirements in clause 6.2C.2.2 and 6.2C.2.3 shall apply when RedCap UE is capable of 2 Rx.

The 1 Rx RedCap UE for performing the random access procedure applies:

- *rsrp-ThresholdSSB* as the signaled value of *rsrp-ThresholdSSB* [2] + 1 dB.

- *msgA-RSRP-ThresholdSSB* as the signaled value of *msgA-RSRP-ThresholdSSB* [2] + 1 dB.

- *msgA-RSRP-Threshold* as the signaled value of *msgA-RSRP-Threshold* [2] + 1 dB.

- *rsrp-ThresholdMsg3* as the signaled value of *rsrp-ThresholdMsg3* [2] - 1 dB.

### 6.2X.3 SA: RRC Connection Release with Redirection for RedCap UE with Satellite Access

#### 6.2X.3.1 Introduction

This clause contains requirements on the RedCap UE regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCRelease* message with redirection to NR from NR specified in TS 38.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 of TS 38.331 [2].

#### 6.2X.3.2 Requirements

##### 6.2X.3.2.1 RRC connection release with redirection to NR

The requirements in clause 6.2C.3.2.1 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 6.2C.3.2.1 shall apply except that:

- Tidentify-NRas specified in table 6.2.3X.2.1-1.

Table 6.2.3X.2.1-1: Time to identify target NR cell for RRC connection release with redirection to NR

|  |  |
| --- | --- |
| FR of target NR cell | Tidentify-NR |
| FR1 | MAX (680 ms, [12] x Trs) |
| NOTE: If the UE has been provided with higher layer signalling of *smtc2*specified in TS 38.331 [2] prior to the redirection command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell. | |

*FFS on: The HD-FDD UE shall meet the RRC connection release with redirection requirements provided that SSB is available at the UE once every SMTC period during Tsearch.*

<End of Change 8>

<Start of Change 9>

7.1X UE transmit timing for Redcap with Satellite Access

7.1X.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in RRC\_CONNECTED state. The uplink frame transmission takes place before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

7.1X.2 Requirements

The requirements in clause 7.1C.2 for FR1-NTN shall apply:

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

-     when it is the transmission for PUSCH on CG resources for SDT in RRC\_INACTIVE.

7.1X.2.1 Gradual timing adjustment

The requirements in clause 7.1C.2.1 for FR1-NTN shall apply

## 7.2X UE timer accuracy for Redcap with Satellite Access

### 7.2X.1 Introduction

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

### 7.2X.2 Requirements

The requirements in clause 7.2C.2 for FR1-NTN shall apply

## 7.3X Timing advance for Redcap with Satellite Access

### 7.3X.1 Introduction

The timing advance is initiated by UE configured with only PCell served by SAN, upon initiating a validity timer for and . The timing advance can be adjusted with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

### 7.3X.2 Requirements

#### 7.3X.2.1 Timing Advance adjustment delay

The requirements in clause 7.3C.2.1 for FR1-NTN shall apply

#### 7.3X.2.2 Timing Advance adjustment accuracy

The requirements in clause 7.2C.2.2 for FR1-NTN shall apply

<End of Change 9>

<Start of Change 10>

8.1X Radio Link Monitoring for RedCap UE with Satellite Access

8.1X.1 Introduction

The requirements in clause 8.1X apply for radio link monitoring on PCell and the UE is configured with only PCell, which is served by satellite access node (SAN). The UE shall monitor the downlink radio link quality based on the reference signal configured as RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell as specified in TS 38.213 [3]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. UE is not required to perform RLM outside the active DL BWP.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds Qout and Qin for the purpose of monitoring downlink radio link quality of the cell.

The threshold Qout is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate (BLERout) as defined in table 8.1X.1-1. For SSB based radio link monitoring, Qout\_SSB is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1X.2.1-1. For CSI-RS based radio link monitoring, Qout\_CSI-RS is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1X.3.1-1.

The threshold Qin is defined as the level at which the downlink radio link quality can be received with significantly higher reliability than at Qout and shall correspond to the in-sync block error rate (BLERin) as defined in table 8.1X.1-1. For SSB based radio link monitoring, Qin\_SSB is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1X.2.1-2. For CSI-RS based radio link monitoring, Qin\_CSI-RS is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1X.3.1-2.

The out-of-sync block error rate (BLERout) and in-sync block error rate (BLERin) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *rlmInSyncOutOfSyncThreshold* from the network, UE determines out-of-sync and in-sync block error rates from Configuration #0 in table 8.1X.1-1 by default. All requirements in clause 8.1X are applicable for BLER Configuration #0 in table 8.1X.1-1.

**Table 8.1X.1-1: Out-of-sync and in-sync block error rates**

|  |  |  |
| --- | --- | --- |
| **Configuration** | **BLERout** | **BLERin** |
| 0 | 10 % | 2 % |

UE shall be able to monitor up to NRLM RLM-RS resources of the same or different types in each corresponding carrier frequency range, depending on a maximum number Lmax of SSBs per half frame according to TS 38.213 [3], where NRLM is specified in table 8.1X.1-2 according TS 38.213 [3], and meet the requirements as specified in clause 8.1X. UE is not required to meet the requirements in clause 8.1X if RLM-RS is not configured and no TCI state for PDCCH is activated.

**Table 8.1X.1-2: Maximum number of RLM-RS resources NRLM**

|  |  |  |
| --- | --- | --- |
| **Carrier frequency range of PCell** | Lmax | **Maximum number of RLM-RS resources, NRLM** |
| FR1, ≤ 3 GHzNote | 4 | 2 |
| FR1, > 3 GHzNote | 8 | 4 |
| NOTE: For unpaired spectrum operation with Case C - 30 kHz SCS, 3 GHz is replaced by 1.88 GHz, as specified in clause 4.1 in TS 38.213 [3]. | | |

8.1X.2 Requirements for SSB based radio link monitoring

8.1X.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell, provided that the SSB configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1X.2.2.

**Table 8.1X.2.1-1: PDCCH transmission parameters for out-of-sync evaluation**

|  |  |
| --- | --- |
| **Attribute** | **Value for BLER Configuration #0** |
| DCI format | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 16; for RedCap UE with 1Rx branch.  8; for RedCap UE with 2Rx branches. |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 4 dB |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 4 dB |
| Bandwidth (PRBs) | 48; for RedCap UE with 1Rx branch.  24; for RedCap UE with 2Rx branches. |
| Sub-carrier spacing (kHz) | SCS of the active DL BWP |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

**Table 8.1X.2.1-2: PDCCH transmission parameters for in-sync evaluation**

|  |  |
| --- | --- |
| **Attribute** | **Value for BLER Configuration #0** |
| DCI payload size | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 8; for RedCap UE with 1Rx branch.  4; for RedCap UE with 2Rx branches. |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 0 dB |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 0 dB |
| Bandwidth (PRBs) | 48; for RedCap UE with 1Rx branch.  24; for RedCap UE with 2Rx branches. |
| Sub-carrier spacing (kHz) | SCS of the active DL BWP |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

8.1X.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_SSB period becomes worse than the threshold Qout\_SSB within TEvaluate\_out\_SSB evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_in\_SSB period becomes better than the threshold Qin\_SSB within TEvaluate\_in\_SSB evaluation period.

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in table 8.1X.2.2-1 and table 8.1X.2.2-1 for UE with 2Rx RedCap and 1Rx RedCap, respectively.

P value for an RLM-RS resource to be measured is defined as

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- Ntotal / Navailable with Navailable > 0

For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- Ntotal is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is

- the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction* and LEO satellites are measured for intra-frequency measurement, and

- same as Noutside\_MG, otherwise

- TL1 is periodicity of the target RLM-RS

- Psharing factor = 3.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For a serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

**Table 8.1X.2.2-1: Evaluation period TEvaluate\_out\_SSB and TEvaluate\_in\_SSB for 2Rx RedCap UE**

|  |  |  |
| --- | --- | --- |
| **Configuration** | **TEvaluate\_out\_SSB (ms)** | **TEvaluate\_in\_SSB (ms)** |
| no DRX | Max(200, Ceil(10  P)  TSSB) | Max(100, Ceil(5  P)  TSSB) |
| DRX cycle≤320 ms | Max(200, Ceil(15  P)  Max(TDRX,TSSB)) | Max(100, Ceil(7.5  P)  Max(TDRX,TSSB)) |
| DRX cycle>320 ms | Ceil(10  P)  TDRX | Ceil(5  P)  TDRX |
| NOTE: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length. | | |

Table 8.1X.2.2-2: Evaluation period TEvaluate\_out\_SSB,RedCap and TEvaluate\_in\_SSB,RedCap 1Rx RedCap UE

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB,RedCap (ms) | TEvaluate\_in\_SSB,RedCap (ms) |
| no DRX | Max(400, Ceil(20 × P) × TSSB) | Max(100, Ceil(5 × P) × TSSB) |
| DRX cycle≤320 ms | Max(400, Ceil(30 × P) × Max(TDRX,TSSB)) | Max(100, Ceil(7.5 × P) × Max(TDRX,TSSB)) |
| DRX cycle>320 ms | Ceil(20 × P) × TDRX | Ceil(5 × P) × TDRX |
| NOTE: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length. | | |

8.1X.2.3 Measurement restrictions for SSB based RLM

The UE is required to be capable of measuring SSB for RLM without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

When the SSB for RLM is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for RLM without any restriction;

- If SSB and CSI-RS have different SCS,

- If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for RLM without any restriction;

- If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

8.1X.3 Requirements for CSI-RS based radio link monitoring

8.1X.3.1 Introduction

The requirements in this clause apply for each CSI-RS based RLM-RS resource configured for PCell, provided that the CSI-RS configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1X.3.2. UE is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not in the active TCI state of any CORESET configured in the UE active BWP.

**Table 8.1X.3.1-1: PDCCH transmission parameters for out-of-sync evaluation**

|  |  |
| --- | --- |
| **Attribute** | **Value for BLER Configuration #0** |
| DCI format | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 16; for RedCap UE with 1Rx branch.  8; for RedCap UE with 2Rx branches. |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | 4 dB |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | 4 dB |
| Bandwidth (PRBs) | 48 |
| Sub-carrier spacing (kHz) | SCS of the active DL BWP |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

**Table 8.1X.3.1-2: PDCCH transmission parameters for in-sync evaluation**

|  |  |
| --- | --- |
| **Attribute** | **Value for BLER Configuration #0** |
| DCI payload size | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 8; for RedCap UE with 1Rx branch.  4; for RedCap UE with 2Rx branches. |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | 0 dB |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | 0 dB |
| Bandwidth (PRBs) | 48 |
| Sub-carrier spacing (kHz) | SCS of the active DL BWP |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

8.1X.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_CSI-RS period becomes worse than the threshold Qout\_CSI-RS within TEvaluate\_out\_CSI-RS evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_in\_CSI-RS period becomes better than the threshold Qin\_CSI-RS within TEvaluate\_in\_CSI-RS evaluation period.

- TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS are defined in table 8.1X.3.2-1 and table 8.1X.3.2-1 for 2Rx RedCap and 1Rx RedCap, respectively.

The requirements of TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS apply provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements do not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

P value for an RLM-RS resource to be measured is defined as

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- Ntotal / Navailable with Navailable > 0

For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- Ntotal is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is

- the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction* and LEO satellites are measured for intra-frequency measurement, and

- same as Noutside\_MG, otherwise

- TL1 is periodicity of the target RLM-RS

- Psharing factor = 3.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For aa serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

The values of Mout and Min used in table 8.1X.3.2-1 are defined as:

- Mout = 20 and Min = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth ≥ 24 PRBs.

The values of Mout and Min used in table 8.1X.3.2-2 are defined as:

- Mout = 40 and Min = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* TS 38.211 [6], clause 7.4.1, set to 3 and over the bandwidth ≥ 24 PRBs.

**Table 8.1X.3.2-1: Evaluation period TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS for 2Rx RedCap UE**

|  |  |  |
| --- | --- | --- |
| **Configuration** | **TEvaluate\_out\_CSI-RS (ms)** | **TEvaluate\_in\_CSI-RS (ms)** |
| no DRX | Max(200, Ceil(Mout×P)×TCSI-RS) | Max(100, Ceil(Min×P) × TCSI-RS) |
| DRX ≤ 320 ms | Max(200, Ceil(1.5×Mout×P)× Max(TDRX, TCSI-RS)) | Max(100, Ceil(1.5×Min×P)× Max(TDRX, TCSI-RS)) |
| DRX > 320 ms | Ceil(Mout×P) × TDRX | Ceil(Min×P) × TDRX |
| NOTE: TCSI-RS is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10 ms, 20 ms or 40 ms. TDRX is the DRX cycle length. | | |

Table 8.1X.3.2-2: Evaluation period TEvaluate\_out\_CSI-RS,RedCap and TEvaluate\_in\_CSI-RS,RedCap 1Rx RedCap UE

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_CSI-RS,RedCap (ms) | TEvaluate\_in\_CSI-RS,RedCap (ms) |
| no DRX | Max(400, Ceil(Mout,RedCap×P)×TCSI-RS) | Max(100, Ceil(Min,RedCap×P) × TCSI-RS) |
| DRX ≤ 320 ms | Max(400, Ceil(1.5×Mout,RedCap ×P)× Max(TDRX, TCSI-RS)) | Max(100, Ceil(1.5×Min,RedCap×P)× Max(TDRX, TCSI-RS)) |
| DRX > 320 ms | Ceil(Mout,RedCap ×P) × TDRX | Ceil(Min,RedCap ×P) × TDRX |
| NOTE: TCSI-RS is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10 ms, 20 ms or 40 ms. TDRX is the DRX cycle length. | | |

8.1X.3.3 Measurement restrictions for CSI-RS based RLM

The UE is required to be capable of measuring CSI-RS for RLM without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

When the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for RLM in the PRBs that overlap with an SSB.

When the SSB for RLM, BFD, CBD, or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement without restrictions.

When the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS for RLM measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

When the CSI-RS for RLM is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for RLM without any restriction.

8.1X.4 Minimum requirement at transitions

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

When the UE transitions from a first configuration of RLM resources to a second configuration of RLM resources that is different from the first configuration, for each RLM resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each RLM resource present in the second configuration. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of active TCI state of the CORESET to a second configuration of active TCI state of the CORESET, for each CSI-RS for RLM present in the second configuration, the UE shall use an evaluation period corresponding to the second configuration from the time of transition. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

8.1X.5 Minimum requirement for UE turning off the transmitter

The transmitter power of the UE in the monitored cell shall be turned off within 40 ms after expiry of T310 timer as specified in TS 38.331 [2].

8.1X.6 Minimum requirement for L1 indication

When the downlink radio link quality on all the configured RLM-RS resources is worse than Qout, layer 1 of the UE shall send an out-of-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331 [2].

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than Qin, layer 1 of the UE shall send an in-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [2].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least TIndication\_interval.

When DRX is not used TIndication\_interval is max(10 ms, TRLM-RS,M), where TRLM-RS,M is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to TSSB specified in clause 8.1X.2 if the RLM-RS resource is SSB, or TCSI-RS specified in clause 8.1X.3 if the RLM-RS resource is CSI-RS.

In case DRX is used, TIndication\_interval is Max(10ms, 1.5 × DRX\_cycle\_length, 1.5 × TRLM-RS,M)) if DRX\_cycle\_length is less than or equal to 320ms, and TIndication\_interval is DRX\_cycle\_length if DRX\_cycle\_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

When DRX is not used for HD-FDD RedCap UEs, TIndication\_interval is max(10 ms, TRLM-RS,M), where TRLM,M is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to TSSB specified in clause 8.1X.2 if the RLM-RS resource is SSB, or TCSI-RS specified in clause 8.1X.3 if the RLM-RS resource is CSI-RS, under the following condition

- For each RLM-RS configuration, at least one RLM-RS sample must fall with DL occasion within an indication period.

In case DRX is used for HD-FDD RedCap UEs, TIndication\_interval is Max(10ms, 1.5 × DRX\_cycle\_length, 1.5 × TRLM-RS,M)) if DRX\_cycle\_length is less than or equal to 320ms, and TIndication\_interval is DRX\_cycle\_length if DRX\_cycle\_length is greater than 320ms, under the following condition

In addition, for HD-FDD UE, the conditions and requirements for TIndication\_interval apply given that for each RLM-RS configuration, at least one RLM-RS sample must fall with DL occasion within an indication period.

8.1X.7 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM has different subcarrier spacing than PDSCH/PDCCH , there are restrictions on the scheduling availability as described in the following clauses.

8.1X.7.1 Scheduling availability of UE performing radio link monitoring with a same subcarrier spacing as PDSCH/PDCCH

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH.

In addition, for HD-FDD UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during beam failure detection, except when UE is indicated that UL transmission is prioritized over RLM evaluation in case of collision between CSI-RS resouces to be meaured and UL transmission.

8.1X.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

In addition, for HD-FDD UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during beam failure detection, except when UE is indicated that UL transmission is prioritized over RLM evaluation in case of collision between CSI-RS resources to be measured and UL transmission.

<End of Change 10>

<Start of Change 11>

8.5X Link Recovery Procedures for RedCap UE with Satellite Access

8.5X.1 Introduction

The RedCap UE shall assess the downlink radio link quality of a serving cell based on the reference signal in the set as specified in TS 38.213 [3] in order to detect beam failure on PCell and the UE is configured with only PCell, which is served by satellite access node (SAN).

The RS resource configurations in the set on PCell can be periodic CSI-RS resources and/or SSBs. UE is not required to perform beam failure detection outside the active DL BWP. UE is not required to meet the requirements in clause 8.5X.2 and 8.5X.3 if UE does not have set .

On each RS resource configuration in the set , the UE shall estimate the radio link quality and compare it to the threshold Qout\_LR\_RedCap for the purpose of accessing downlink radio link quality of the serving cell beams.

The threshold Qout\_LR\_RedCap is defined as the level at which the downlink radio level link of a given resource configuration on set cannot be reliably received and shall correspond to the BLERout = 10% block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, Qout\_LR\_SSB is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5X.2.1-1. For CSI-RS based beam failure detection, Qout\_LR\_CSI-RS is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5X.3.1-1.

Upon request the UE shall deliver configuration indexes from the set as specified in TS 38.213 [3], to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold Qin\_LR\_RedCap, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the Qin\_LR\_RedCap threshold to the L1-RSRP measurement obtained from an SSB. The UE applies the Qin\_LR\_RedCap threshold to the L1-RSRP measurement obtained for a CSI-RS resource after scaling a respective CSI-RS reception power with a value provided by higher layer parameter *powerControlOffsetSS*. The RS resource configurations in the set can be periodic CSI-RS resources or SSBs or both SSB and CSI-RS resources. UE is not required to perform candidate beam detection outside the active DL BWP.

8.5X.2 Requirements for SSB based beam failure detection for RedCap UE with satellite access

8.5X.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5X.2.2.

**Table 8.5X.2.1-1: PDCCH transmission parameters for beam failure instance**

|  |  |
| --- | --- |
| **Attribute** | **Value for BLER** |
| DCI format | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 16 for 1 Rx UE; 8 for 2 Rx UE |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 0 dB |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 0 dB |
| Bandwidth (PRBs) | 48 for 1 Rx UE; 24 for 2 Rx UE |
| Sub-carrier spacing (kHz) | Same as the SCS of RMSI CORESET |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |
| NOTE 1: SCS=60 kHz is not applicable for FR1 | | |

8.5X.2.2 Minimum requirementThe requirements in clause 8.5C.2.2 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 8.5C.2.2 shall apply except:

- TEvaluate\_BFD\_SSB\_RedCap as defined in table 8.5X.2.2-1 for FR1.

**Table 8.5X.2.2-1: Evaluation period TEvaluate\_BFD\_SSB\_RedCap for 1 Rx Redcap**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_SSB\_RedCap (ms)** |
| no DRX | Max(50, Ceil(10 × P) × TSSB) |
| DRX cycle ≤ 320 ms | Max(50, Ceil(15 × P) × Max(TDRX,TSSB)) |
| DRX cycle > 320 ms | Ceil(10 × P) × TDRX |
| NOTE: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

8.5X.3 Requirements for CSI-RS based beam failure detection for RedCap UE with satellite access

8.5X.3.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set of resource configurations for a serving cell, provided that the CSI-RS resource(s) in set for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5X.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured for BFD if the CSI-RS is not QCL-ed, with QCL-TypeD when applicable, with the RS in the active TCI state of any CORESET configured in the UE active BWP.

**Table 8.5X.3.1-1: PDCCH transmission parameters for beam failure instance**

|  |  |
| --- | --- |
| **Attribute** | **Value for BLER** |
| DCI format | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 16 for 1 Rx UE; 8 for 2 Rx UE |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | 0 dB |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | 0 dB |
| Bandwidth (PRBs) | 48 for 1 Rx UE; 24 for 2 Rx UE |
| Sub-carrier spacing (kHz) | SCS of the active DL BWP |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |
| NOTE 1: SCS=60 kHz is not applicable for FR1 | | |

8.5X.3.2 Minimum requirement

The requirements in clause 8.5C.3.2 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 8.5C.3.2 shall apply except:

- TEvaluate\_BFD\_SSB\_RedCap as defined in table 8.5X.3.2-1 for FR1.

**Table 8.5X.3.2-1: Evaluation period TEvaluate\_BFD\_CSI-RS\_RedCap for 1 Rx RedCap**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_CSI-RS\_RedCap (ms)** |
| no DRX | Max(50, Ceil(2×MBFD × P × PBFD) × TCSI-RS) |
| DRX cycle ≤ 320 ms | Max(50, Ceil(2×1.5 × MBFD × P × PBFD) × Max(TDRX, TCSI-RS)) |
| DRX cycle > 320 ms | Ceil(2×MBFD × P × PBFD) × TDRX |
| NOTE: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

8.5X.3.3 Measurement restrictions for CSI-RS beam failure detection

The requirements in clause 8.5C.3.3 shall apply.

8.5X.4 Minimum requirement for L1 indication for RedCap UE with satellite access

The requirements in clause 8.5C.4 shall apply.

In addition, for HD-FDD UE, the conditions and requirements for TIndication\_interval\_BFD\_Redcap apply given that for each BFD-RS configuration, at least one BFD-RS sample must fall with DL occasion within an indication period.

8.5X.5 Requirements for SSB based candidate beam detection for RedCap UE with satellite access

The requirements in clause 8.5C.5 shall apply when RedCap UE is capable of 2 Rx and 1 Rx RedCap UE.

8.5X.6 Requirements for CSI-RS based candidate beam detection for RedCap UE with satellite access

The requirements in clause 8.5C.6 shall apply when RedCap UE is capable of 2 Rx and 1 Rx RedCap UE.

8.5X.7 Scheduling availability of UE during beam failure detection for RedCap UE with satellite access

The requirements in clause 8.5C.7 shall apply.

In addition, for HD-FDD UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during beam failure detection, except when UE is indicated that UL transmission is prioritized over BFD evaluation in case of collision between CSI-RS resouces to be meaured and UL transmission.

8.5X.8 Scheduling availability of UE during candidate beam detection for RedCap UE with satellite access

The requirements in clause 8.5C.8 shall apply.

In addition, for HD-FDD UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during candidate beam detection, expect when UE is indicated that UL transmission is prioritized over CBD evaluation in case of collision between CSI-RS resouces to be meaured and UL transmission.

8.5X.9 Minimum requirement at transitions for beam failure detection for RedCap UE with satellite access

The requirements in clause 8.5C.9 shall apply.

<End of Change 11>

<Start of Change 12>

## 8.6X Active BWP switch delay for RedCap UE with satellite access

### 8.6X.1 Introduction

The requirements in this clause apply for a RedCap UE configured with only PCell, which is served by satellite access node (SAN). The requirements in this clause also apply for a UE configured with more than one BWP on PCell.

UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

### 8.6X.2 DCI and timer based BWP switch delay on a single CC

The requirements in clause 8.6C.2 shall apply.

### 8.6X.3 RRC based BWP switch delay on a single CC

The requirements in clause 8.6C.3 shall apply.

<End of Change 12>

<Start of Change 13>

## 8.10X Active TCI state switching delay for RedCap UE with satellite access

### 8.10X.1 Introduction

The requirements in this clause apply for a RedCap UE configured with one or more TCI state configurations on PCell in satellite access. UE shall complete the switch of active TCI state within the delay defined in this clause.

### 8.10X.2 MAC-CE based TCI state switch delay

The requirements in clause 8.10C.2 shall apply.

### 8.10X.4 DCI based TCI state switch delay

The requirements in clause 8.10C.4 shall apply.

### 8.10X.5 RRC based TCI state switch delay

The requirements in clause 8.10C.5 shall apply.

### 8.10X.6 Active TCI state list update delay

The requirements in clause 8.10C.6 shall apply.

<End of Change 13>

<Start of Change 14>

## 8.13X UE-specific CBW change for RedCap UE with satellite access

### 8.13X.1 Introduction

The requirements in this clause apply for a RedCap UE with NTN receiving reconfiguration of *offsetToCarrier* or *carrierBandwidth* to change channel bandwidth.

### 8.13X.2 UE-specific CBW change delay

The requirements in clause 8.13C.2 shall apply.

<End of Change 14>

<Start of Change 15>

## 8.14X Pathloss reference signal switching delay for RedCap UE with satellite access

### 8.14X.1 Introduction

The requirements in this clause apply for pathloss reference signal activated or updated on PCell in clause 7.1.1 in TS 38.213 [3] and the RedCap UE is configured with only PCell, which is served by satellite access node (SAN).

UE shall complete the switch of pathloss reference signal within the delay defined in this clause.

### 8.14X.2 Known conditions for pathloss reference signal

The requirements in clause 8.14C.2 shall apply.

### 8.14X.3 MAC-CE based pathloss reference signal switch delay

The requirements in clause 8.14C.3 shall apply.

<End of Change 15>

<Start of Change 16>

## 9.1X General measurement requirement for RedCap with satellite access

### 9.1X.1 Introduction

This clause contains general requirements on the RedCap UE regarding measurement reporting in RRC\_CONNECTED state. The requirements are split in intra-frequency, inter-frequency and L1-RSRP measurements requirements. These measurements may be used by the NG-RAN. The measurement quantities are defined in TS 38.215 [4], the measurement model is defined in TS 38.300 [10], TS 37.340 [17] and measurement accuracies are specified in clause 10. Control of measurement reporting is specified in TS 38.331 [2].

### 9.1X.2 Measurement gap

The requirements in clause 9.1C.2 shall apply.

### 9.1X.8 Concurrent measurement gaps for RedCap with SAN

#### 9.1X.8.1 Introduction

When UE supports concurrent measurement gap pattern capability, network can provide multiple measurement gaps configured by RRC message(s) as specified in TS 38.331 [2].

#### 9.1X.8.2 Requirements

The requirements in clause 9.1C.8.2 shall apply.

#### 9.1X.8.3 Collision between concurrent measurement gaps

The requirements in clause 9.1C.8.3 shall apply except that

- If UE supports *parallelMeasurementWithoutRestriction-r17,*

- If UE is configured to measure 1 satellite in each of the SMTC occasions, the distance between the two occasions is equal to or smaller than 4 ms.

- Otherwise, the distance between the two occasions is equal to or smaller than 5 ms.

- If UE doesn’t support *parallelMeasurementWithoutRestriction-r17,*

- The distance between the two occasions is equal to or smaller than 5 ms.

#### 9.1X.8.4 Measurement gap related requirements of concurrent measurement gaps

The requirements in clause 9.1C.8.4 shall apply.

### 9.1X.9 Collision between SMTC and measurement gap for RedCap with SAN

#### 9.1X.9.1 Introduction

This clause contains definition of collision between SMTCs and measurement gap for SAN].

#### 9.1X.9.2 Collision between SMTCs and measurement gap

The requirements in clause 9.1C.9.2 shall apply except that

- If UE supports *parallelMeasurementWithoutRestriction-r17,*

- If UE is configured to measure 1 satellite in each of the SMTC occasions, the magnitude of the distance between the SMTC occasion and the measurement gap occasion in time domain is less than or equals to 4 ms.

- Otherwise, the magnitude of the distance between the SMTC occasion and the measurement gap occasion in time domain is less than or equals to 5 ms.

- If UE doesn’t support *parallelMeasurementWithoutRestriction-r17,*

- The magnitude of the distance between the SMTC occasion and the measurement gap occasion in time domain is less than or equals to 5 ms.

#### 9.1X.9.3 Collision between multiple SMTCs on a SAN carrier

The requirements in clause 9.1C.9.2 shall apply except that

- If UE supports *parallelMeasurementWithoutRestriction-r17,*

- If UE is configured to measure 1 satellite in each of the SMTC occasions, the magnitude of the distance between two SMTC occasions in time domain is less than or equals to 4 ms.

- Otherwise, the magnitude of the distance between two SMTC occasions in time domain is less than or equals to 5 ms.

- If UE doesn’t support *parallelMeasurementWithoutRestriction-r17,*

- The magnitude of the distance between two SMTC occasions in time domain is less than or equals to 5 ms.

<End of Change 16>

<Start of Change 17>

## 9.2X NR intra-frequency measurements for RedCap with satellite access

### 9.2X.1 Introduction

The requirements in clause 9.2X apply for intra-frequency measurements for RedCap on an SAN carrier frequency. The requirements apply provided that the valid parameters of ephemeris information, epoch time of the ephemeris, common TA, validity timer information, downlink polarization information for target NR SAN cell are send to UE.

The requirements in clause 9.2C.1 shall apply except that

- clause 9.2C.5.3 is replaced with clause 9.2X.5.3, and

- clause 9.2C.5 is replaced with clause 9.2C.5, and

- clause 9.2C.6 is replaced with clause 9.2C.6

### 9.2X.2 Requirements applicability

The requirements in clause 9.2X apply, provided:

- The cell being identified or measured is detectable.

- Valid information for the satellite serving the target cell has been provided

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- For 2Rx RedCap with NTN:

- SS-RSRP related side conditions given in clauses 10.1.2C for FR1 and 10.1.3C for FR2-NTN, for a corresponding band,

- SS-RSRQ related side conditions given in clauses 10.1.7C for FR1 and 10.1.8C for FR2-NTN, for a corresponding band,

- SS-SINR related side conditions given in clauses 10.1.12C for FR1 and 10.1.13C for FR2-NTN, for a corresponding band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.17 for a corresponding band.

- For 1Rx RedCap with NTN:

- SS-RSRP related side conditions given in clauses 10.1A.2 for FR1 for a corresponding band,

- SS-RSRQ related side conditions given in clauses 10.1A.6 for FR1 for a corresponding band,

- SS-SINR related side conditions given in clauses 10.1A.10 for FR1 for a corresponding band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.15 for a corresponding band.

### 9.2X.3 Number of cells and number of SSB

#### 9.2X.3.1 Requirements for FR1

The requirements in clause 9.2C.3.1 shall apply.

### 9.2X.4 Measurement Reporting Requirements

#### 9.2X.4.1 Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses [10.1A.2.1] (SS-RSRP for FR1), [10.1A.6.1] (SS-RSRQ for FR1) and [10.1A.10.1] (SS-SINR for FR1).

#### 9.2X.4.2 Event-triggered Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses [10.1A.2.1] (SS-RSRP for FR1), [10.1A.6.1] (SS-RSRQ for FR1) and [10.1A.10.1] (SS-SINR for FR1).

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2X.4.3.

#### 9.2X.4.3 Event Triggered Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses [10.1A.2.1] (SS-RSRP for FR1), [10.1A.6.1] (SS-RSRQ for FR1) and [10.1A.10.1] (SS-SINR for FR1).

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify intra with index or Tidentify intra without index defined in clause 9.2X.5.1 or clause 9.2X.6.2.When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index as defined in clause 9.2X.5.1 or clause 9.2X.6.2. When L3 filtering is used, an additional delay can be expected.

### 9.2X.5 Intra-frequency measurements without measurement gaps

#### 9.2X.5.1 Intra-frequency cell identification

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

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

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

Where:

TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 9.2X.5.1-1, 9.2X.5.1-2.

TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2X.5.1-3, 9.2X.5.1-4.

TSSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2X.5.2-1, 9.2X.5.2-2.

Kmulti\_SMTC is the scaling factor for measurement of multiple SMTCs or multiple satellites, and

if SMTCs do not overlap with each other,

- , if GEO satellites are measured on the carrier;

- , if LEO satellites are measured on the carrier;

if SMTCs partially overlap with each other,

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

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

where

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

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

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

CSSFintra\_RedCap: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap\_RedCap,i in clause 9.1A.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to CSSFwithin\_gap\_RedCap,i in clause 9.1A.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps.

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

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

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

- If UE supports *parallelMeasurementGap-r17* and is configured with concurrent measurement gaps, MGRP\_max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP\_max is the MGRP of configured measurement gap.

- Starting from the beginning of any SMTC occasion:

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

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

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

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

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

Klayer1\_measurement: it is scaling factor for sharing between L3 and L1 measurement, and Klayer1\_measurement =1, if GEO satellites are measured on the carrier, or if LEO satellites are measured on the carrier and UE supports *parallelMeasurementWithoutRestriction-r17*, otherwise

Klayer1\_measurement =1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or

- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, and RSSI symbols are indicated by *SS-RSSI-Measurement*;

Klayer1\_measurement =1.5, otherwise.

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

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

Table 9.2X.5.1-1: Time period for PSS/SSS detection, (Frequency range FR1) for RedCap UE with NTN

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

Table 9.2X.5.1-2: Time period for PSS/SSS detection, (Frequency range FR1) for 1Rx RedCap UE with NTN

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max( 600 ms, ceil( 7 x Kp x Klayer1\_measurement) x Kmulti\_SMTC x SMTC period )Note 1 x CSSFintra\_RedCap |
| DRX cycle≤ 320 ms | max( 600 ms, ceil(1.5x 7 x Kp x Klayer1\_measurement) x Kmulti\_SMTC x max(SMTC period,DRX cycle)) x CSSFintra\_RedCap |
| DRX cycle>320 ms | ceil(7 x Kp x Klayer1\_measurement) x Kmulti\_SMTC x DRX cycle x CSSFintra\_RedCap |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

Table 9.2X.5.1-3: Time period for time index detection (FR1) for 2Rx RedCap UE with NTN

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

Table 9.2X.5.1-4: Time period for time index detection (FR1) for 1Rx RedCap UE with NTN

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(160 ms, ceil( 6 x Kp x Klayer1\_measurement)x Kmulti\_SMTC x SMTC period)Note 1 x CSSFintra\_RedCap |
| DRX cycle≤ 320 ms | max(160 ms, ceil (1.5 x 6 x Kp x Klayer1\_measurement) x Kmulti\_SMTC x max(SMTC period,DRX cycle)) x CSSFintra\_RedCap |
| DRX cycle>320 ms | Ceil( 3 x Kp x Klayer1\_measurement) x Kmulti\_SMTC x DRX cycle x CSSFintra\_RedCap |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

The UE is allowed to skip measurements on intra-frequency cells, in the interval between *t-serviceStart* and the satellite switch completion, when it is performing soft satellite switching with resynchronization. In this case, for the measurement initiated but not completed before the beginning interval, the total time to detection can be longer.

The requirements in clause 9.2X.5.1 and 9.2X.5.2 are not applicable when the overall overhead ratio due to scheduling restriction caused by all configured SMTCs (i.e. scheduling restriction overhead of all SMTCs in one SMTC periodicity), is larger than 75%.

#### 9.2X.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2X.5.2-1.

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

Table 9.2X.5.2-1: Measurement period for intra-frequency measurements without gaps (FR1) for RedCap UE with NTN

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

#### 9.2X.5.3 Scheduling availability of UE during intra-frequency measurements

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

##### 9.2X.5.3.1 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

The requirements in clause 9.2C.5.3.1 shall apply.

##### 9.2X.5.3.2 Scheduling availability of UE performing measurements on a neighbor cell served by a different satellite in LEO

The requirements in clause 9.2C.5.3.1 shall apply.

##### 9.2B.5.3.4 Scheduling availability of UE performing measurements in HD-FDD bands on FR1

When the UE performs intra-frequency measurements in a HD-FDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2*is configured, the SMTC periodicityfollows *smtc2*; Otherwise SMTC periodicity follows *smtc1.*

When the UE performs intra-frequency measurements in a HD-FDD band, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration. If the high layer signalling of *smtc2*is configured in TS 38.331 [2], the SMTC periodicityfollows *smtc2*; Otherwise the SMTC periodicity follows *smtc1.*

### 9.2X.6 Intra-frequency measurements with measurement gaps

#### 9.2X.6.1 Intra-frequency cell identification

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

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

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

Where:

TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 9.2X.6.2-1, 9.2X.6.2-2.

TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2X.6.2-3, 9.2X.6.2-4.

TSSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2X.6.3-1, 9.2X.6.3-2.

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

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

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

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

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

CSSFintra\_RedCap: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap\_RedCap,i in clause 9.1A.5.2 for measurement conducted within measurement gaps.

Kmulti\_SMTC is the scaling factor for measurement of multiple SMTCs or multiple satellites, and

if SMTCs within a measurement gap do not overlap with each other,

- , if GEO satellites are measured on the carrier;

- , if LEO satellites are measured on the carrier;

if SMTCs within a measurement gap partially overlap with each other,

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

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

where

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

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

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

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

Table 9.2X.6.2-1: Time period for PSS/SSS detection (FR1) for 2Rx RedCap UE

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

Table 9.2X.6.2-1: Time period for PSS/SSS detection (FR1) for 1Rx RedCap UE

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600 ms, 7 x Kgap x Kmulti\_SMTC x max(MGRP, SMTC period)) x CSSFintra\_RedCap |
| DRX cycle≤ 320 ms | max(600 ms, ceil(1.5x 7) x Kgap x Kmulti\_SMTC x max(MGRP, SMTC period,DRX cycle)) x CSSFintra\_RedCap |
| DRX cycle>320 ms | 7 x Kgap x Kmulti\_SMTC x max(MGRP, DRX cycle) x CSSFintra\_RedCap |

Table 9.2X.6.2-3: Time period for time index detection (FR1) for 2Rx RedCap UE

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

Table 9.2X.6.2-4: Time period for time index detection (FR1) for 1Rx RedCap UE

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(160 ms, 6 x Kgap x Kmulti\_SMTC x max(MGRP, SMTC period)) x CSSFintra\_RedCap |
| DRX cycle≤ 320 ms | max(160 ms, ceil(1.5 x 6) x Kgap x Kmulti\_SMTC x max(MGRP, SMTC period,DRX cycle) x CSSFintra) |
| DRX cycle>320 ms | 6 x Kgap x Kmulti\_SMTC x max(MGRP, DRX cycle) x CSSFintra |

#### 9.2X.6.3 Intrafrequency Measurement Period

The measurement period for FR1 intrafrequency measurements with gaps is as shown in table 9.2X.6.3-1, 9.2X.6.3-2.

Table 9.2X.6.3-1: Measurement period for intra-frequency measurements with gaps (FR1) for 2Rx RedCap UE

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200 ms, 5 x Kgap x Kmulti\_SMTC x max(MGRP, SMTC period)) x CSSFintra\_RedCap |
| DRX cycle≤ 320 ms | max(200 ms, ceil(1.5x 5) x Kmulti\_SMTC x Kgap x max(MGRP, SMTC period,DRX cycle))x CSSFintra\_RedCap |
| DRX cycle>320 ms | 5 x Kgap x Kmulti\_SMTC x max(MGRP, DRX cycle) x CSSFintra\_RedCap |

Table 9.2X.6.3-2: Measurement period for intra-frequency measurements with gaps (FR1) for 1Rx RedCap UE

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400 ms, [5] x Kgap x Kmulti\_SMTC x max(MGRP, SMTC period)) x CSSFintra\_RedCap |
| DRX cycle≤ 320 ms | max(400 ms, ceil(1.5x [5]) x Kmulti\_SMTC x Kgap x max(MGRP, SMTC period,DRX cycle))x CSSFintra\_RedCap |
| DRX cycle>320 ms | [5] x Kgap x Kmulti\_SMTC x max(MGRP, DRX cycle) x CSSFintra\_RedCap |

The UE is allowed to skip measurements on intra-frequency cells, in the interval between *t-serviceStart* and the satellite switch completion, when it is performing soft satellite switching with resynchronization. In this case, for the measurement initiated but not completed before the beginning of this interval, the total time to measure can be longer.

<End of Change 17>

<Start of Change 18>

## 9.3X NR inter-frequency measurements for Redcap UEs with satellite access

### 9.3X.1 Introduction

The requirements in clause 9.3C.1 shall apply except that:

A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause [9.2X].

For inter-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause [9.3X.5.3].

The inter-frequency measurement requirements in clause [9.3X.4] and clause [9.3X.5] apply for the following scenarios:

- SSB-based inter-frequency measurement object with measurement gap.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* when

- all of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent measurement gaps, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of concurrent measurement gaps, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or associated measurement gap in concurrent measurement gaps and the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.

The inter-frequency measurement requirements in clause [9.3X.7] apply for the following scenarios:

- SSB-based inter-frequency measurement with no measurement gap, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gap, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

### 9.3X.2 Requirements applicability

The requirements in clause 9.3X apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- For 2 Rx RedCap UE:

- SS-RSRP related side conditions given in clauses [10.1.4C] for FR1 for a corresponding band,

- SS-RSRQ related side conditions given in clauses [10.1.9C] for FR1 for a corresponding band,

- SS-SINR related side conditions given in clauses [10.1.14C] for FR1 for a corresponding band,

- SSB\_RP and SSB Ês/Iot according to Annex [B.2.18] for a corresponding band.

- For 1 Rx RedCap UE:

- SS-RSRP related side conditions given in clauses [10.1.4C] for FR1 for a corresponding Band,

- SS-RSRQ related side conditions given in clauses [10.1.9C] for FR1 for a corresponding Band,

- SS-SINR related side conditions given in clauses [10.1.14C] for FR1 for a corresponding Band,

- SSB\_RP and SSB Ês/Iot according to Annex [B.2.18] for a corresponding Band.

### 9.3X.3 Number of cells and number of SSB

#### 9.3X.3.1 Requirements for FR1

The requirements in clause 9.3C.3.1 shall apply.

### 9.3X.4 Inter-frequency measurement with measurement gaps

The requirements in clause 9.3C.4 shall apply except that:

TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection given in table 9.3C.4-1 for 2Rx RedCap UE and table 9.3X.4-1 for 1Rx RedCap UE.

TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3C.4-2 for 2Rx RedCap UE and table 9.3X.4-2 for 1Rx RedCap UE.

TSSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3C.5-1 for 2Rx RedCap UE and table 9.3X.5-1 for 1Rx RedCap UE..

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

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

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

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

- Navailable is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for measurement gap collisions by applying the measurement gap collision rule in clause [9.1.8C.3].



Table 9.3X.4-1: Time period for PSS/SSS detection (FR1) for 1Rx RedCap UE

|  |  |
| --- | --- |
| **Condition NOTE1** | **TPSS/SSS\_sync\_inter** |
| No DRX | Max(600 ms, Ceil(10 x Kgap) × Max(MGRP, SMTC period **NOTE2**)) × CSSFinter × K\_satellite |
| DRX cycle ≤ 320 ms | Max(600 ms, Ceil(10\*1.5 x Kgap) × Max(MGRP, SMTC period**NOTE2**, DRX cycle)) × CSSFinter × K\_satellite |
| DRX cycle > 320 ms | Ceil(10 x Kgap) × DRX cycle × CSSFinter × K\_satellite |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. | |



Table 9.3X.4-2: Time period for time index detection (FR1) for 1Rx RedCap UE

|  |  |
| --- | --- |
| **Condition NOTE1** | **TSSB\_time\_index\_inter** |
| No DRX | Max(160 ms, Ceil(6 x Kgap) × Max(MGRP, SMTC period **NOTE2**)) × CSSFinter × K\_satellite |
| DRX cycle ≤ 320 ms | Max(160 ms, Ceil(6 × 1.5 x Kgap) × Max(MGRP, SMTC period**NOTE2**, DRX cycle)) × CSSFinter × K\_satellite |
| DRX cycle > 320 ms | Ceil(6 x Kgap) × DRX cycle × CSSFinter × K\_satellite |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. | |

### 9.3X.5 Inter-frequency measurements

The requirements in clause 9.3C.5 shall apply except that:

When measurement gaps are provided for inter-frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses [10.1.4C, 10.1.9C and 10.1.14C], respectively, as shown in table 9.3C.5-1 for 2Rx RedCap UE and table 9.3X.5-1 for 1Rx RedCap UE.



Table 9.3X.5-1: Measurement period for inter-frequency measurements with gaps (FR1) for 1Rx RedCap UE

|  |  |
| --- | --- |
| **Condition NOTE1** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(400 ms, Ceil(8 x Kgap) × Max(MGRP, SMTC period **NOTE2**)) × CSSFinter × K\_satellite |
| DRX cycle ≤ 320 ms | Max(400 ms, Ceil(8 × 1.5 x Kgap) × Max(MGRP, SMTC period**NOTE2**, DRX cycle)) × CSSFinter × K\_satellite |
| DRX cycle > 320 ms | Ceil(8 x Kgap) × DRX cycle × CSSFinter × K\_satellite |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. | |

### 9.3X.6 Inter-frequency measurements reporting requirements

#### 9.3X.6.1 Periodic Reporting

For 2Rx Redcap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses [10.1.4C, 10.1.9C and 10.1.14C], respectively.

For 1Rx Redcap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses [10.1.4C, 10.1.9C and 10.1.14C], respectively.

#### 9.3X.6.2 Event-triggered Periodic Reporting

For 2Rx Redcap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses [10.1.4C, 10.1.9C and 10.1.14C], respectively.

For 1Rx Redcap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses [10.1.4C, 10.1.9C and 10.1.14C], respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3X.6.3.

#### 9.3X.6.3 Event-triggered Reporting

For 2Rx Redcap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses [10.1.4C, 10.1.9C and 10.1.14C], respectively.

For 1Rx Redcap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses [10.1.4C, 10.1.9C and 10.1.14C], respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 × TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within Tidentify\_inter\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter-frequency cell within Tidentify\_inter\_with\_index. Both Tidentify\_inter\_without\_index and Tidentify\_inter\_with\_index are defined in clause 9.3X.4.When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the Cell being configured remains detectable during the time period Tidentify\_inter\_without\_index or Tidentify\_inter\_with\_index as defined in clause 9.3X.4 or clause 9.3X.7. If a cell which has been detectable at least for the time period Tidentify\_inter\_without\_index or Tidentify\_inter\_with\_index defined in clause 9.3X.4 or clause 9.3X.7 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than TSSB\_measurement\_period\_inter provided the timing to that cell has not changed more than ± 3200/ Tc while the measurement gap has not been available and L3 filtering has not been used, where *µ* is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

### 9.3X.7 Inter-frequency measurements without measurement gaps

#### 9.3X.7.1 Inter-frequency Cell identification

The requirements in clause 9.3C.7.1 shall apply except that:

TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection given in table 9.3C.7.1-1 for 2Rx RedCap UE and table 9.3X.7.1-1 for 1Rx RedCap UE.

TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3C.7.1-2 for 2Rx RedCap UE and table 9.3X.7.1-2 for 1Rx RedCap UE.

TSSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3C.7.2-1for 2Rx RedCap UE and table 9.3X.7.2-1 for 1Rx RedCap UE.

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause [9.1.5.1].

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

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

- If UE supports *parallelMeasurementGap-r17* and is configured with concurrent measurement gaps, MGRP\_max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP\_max is the MGRP of configured measurement gap.

- Starting from the beginning of any SMTC occasion:

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

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

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

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



Table 9.3X.7.1-1: Time period for PSS/SSS detection, (FR1) for 1Rx RedCap UE

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600 ms, ceil( 7 x Kp) x SMTC period )Note 1 x CSSFinter × Ksatellite |
| DRX cycle≤ 320 ms | max( 600 ms, ceil(1.5x 7 x Kp) x max(SMTC period,DRX cycle)Note 1) x CSSFinter × Ksatellite |
| DRX cycle>320 ms | ceil(7 x Kp) x DRX cycle x CSSFinter × Ksatellite |
| NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. | |



Table 9.3X.7.1-2: Time period for time index detection (FR1) for 1Rx RedCap UE

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_inter |
| No DRX | max(160 ms, ceil( 6 x Kp )x SMTC period)Note 1 x CSSFinter × Ksatellite |
| DRX cycle≤ 320 ms | max(160 ms, ceil (1.5 x 6 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter × Ksatellite |
| DRX cycle>320 ms | Ceil(6 x Kp) x DRX cycle x CSSFinter × Ksatellite |
| NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. | |

#### 9.3X.7.2 Measurement period



The UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses [10.1.4C, 10.1.9C and 10.1.14C], respectively, as shown in table 9.3C.7.2-1 for 2Rx RedCap UE and table 9.3X.7.2-1 for 1Rx RedCap UE, if UE supports inter-frequency measurement without measurement gaps.

Table 9.3X.7.2-1: Measurement period for inter-frequency measurements without gaps (FR1) for 1Rx RedCap UE

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

#### 9.3X.7.3 Scheduling availability of UE during inter-frequency measurements

The requirements in clause 9.3C.7.3 shall apply.

##### 9.3X.7.3.1 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

The requirements in clause 9.3C.7.3.1 shall apply.

##### 9.3X.7.3.2 Scheduling availability of UE performing measurements in HD-FDD bands on FR1

When UE performs inter-frequency measurements without measurement gaps in a HD-FDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration.

When UE performs inter-frequency measurements without measurement gaps in a HD-FDD band, the following restrictions apply due to SS-RSRQ measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration.

<End of Change 18>

<Start of Change 19>

9.5X L1-RSRP measurements for Reporting for RedCap UE with satellite access

9.5X.1 Introduction

When configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP. The measurements shall be performed for PCell, on the resources configured for L1-RSRP measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet* within the CSI-Resource*Config* settings configured for L1-RSRP for the active BWP, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

9.5X.2 Requirements applicability

The requirements in clause 9.5X apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

For 1 Rx RedCap UE with NTN:

- L1-RSRP related side conditions given in clauses [10.X.X.X] for FR1, for a corresponding band,

- CSI-RS\_RP and CSI-RS Ês/Iot according to [Annex B.2.19.2] for a corresponding band.

For 2 Rx RedCap UE with NTN:

- L1-RSRP related side conditions given in clauses [10.1.19C.2] for FR1, for a corresponding band,

- CSI-RS\_RP and CSI-RS Ês/Iot according to [Annex B.2.19.2] for a corresponding band.

A CSI-RS resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS the following conditions are met:

For 1 Rx RedCap UE with NTN:

- L1-RSRP related side conditions given in clauses [10.X.X.X] for FR1, for a corresponding band,

- CSI-RS\_RP and CSI-RS Ês/Iot according to [Annex B.2.19.2] for a corresponding band.

For 2 Rx RedCap UE with NTN:

- L1-RSRP related side conditions given in clauses [10.1.19C.2] for FR1, for a corresponding band,

- CSI-RS\_RP and CSI-RS Ês/Iot according to [Annex B.2.19.2] for a corresponding band.

A CSI-RS and SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for both CSI-RS resource and SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

9.5X.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1 dB step size according to clause 10.1.19C for FR1 for 2 Rx RedCap UE with NTN, and clause [10.X.X.X] for FR1 for 1 Rx RedCap UE with NTN, if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19C for FR1 for 2 Rx RedCap UE with NTN, and clause [10.X.X.X] for FR1 for 1 Rx RedCap UE with NTN. The differential L1-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6.

9.5X.3.1 Periodic Reporting

For 1 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clause [10.X.X.X] for FR1.

For 2 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clause [10.1.19C].

The UE shall only send periodic L1-RSRP measurement reports for an active BWP.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5X.3.2 Semi-Persistent Reporting

For 1 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clause [10.X.X.X]. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

For 2 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clause [10.1.19C]. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5X.3.3 Aperiodic Reporting

For 1 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clause [10.X.X.X].

For 2 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in claus [10.1.19C].

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.5X.4 L1-RSRP measurement requirements

9.5X.4.1 SSB based L1-RSRP Reporting

The requirements in clause 9.5C.4.1 shall apply for both 1Rx and 2Rx RedCap UE.

9.5X.4.2 CSI-RS based L1-RSRP Reporting

When Network indicates [UL overriding DL for collision handling],

* the requirements in clause 9.5C.4.2 shall apply for both 1Rx and 2Rx RedCap UE, provided that no collision between the CSI-RS resources for L1-RSRP measurements and UL transmission;

Otherwise,

* the requirements in clause 9.5C.4.2 shall apply for both 1Rx and 2Rx RedCap UE, as CSI-RS based L1-RSRP measurement is prioritized over UL transmission.

9.5X.5 Measurement restriction for L1-RSRP measurement

The requirements in clause 9.5C.5 shall apply for both 1Rx and 2Rx RedCap UE, when the L1-RSRP measurement requirements in 9.5X.4 are applicable.

9.5X.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions when the UE is performing L1-RSRP measurement are described in the following clauses. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.5X.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

For FD-FDD and TDD RedCap UEs, there are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

For HD-FDD RedCap UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during the L1-RSRP measurement period, when the L1-RSRP measurement is prioritized over UL transmission.

9.5X.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14], the requirements in clause 9.5X.6.1 shall apply.

For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement. The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

<End of Change 19>

<Start of Change 20>

## 9.9X NR measurements for positioning for RedCap with Satellite Access

### 9.9X.1 Introduction

This clause contains requirements for RedCap UE capable of performing NR positioning measurements defined in TS 38.215 [4], including UE Rx-Tx time difference , when the PCell is served by a Satellite Access Node (SAN).

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

#### 9.9X.1.1 General Aspects of Gap-based Measurement

The requirements in clause 9.9C.1.1shall apply.

#### 9.9X.1.2 General Aspects of Gapless Measurement

The requirements in clause 9.9C.1.2 shall apply.

#### 9.9X.1.3 Scheduling Availability of UE during PRS Measurement without Measurement Gaps

The requirements in clause 9.9C.1.3 shall apply.

### 9.9X.2 Void

### 9.9X.3 Void

### 9.9X.4 UE Rx-Tx time difference measurements

#### 9.9X.4.1 Introduction

The requirements in this clause shall apply for RedCap UE, when the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

#### 9.9X.4.2 Requirements Applicability

For RedCap UE not in HD-FDD mode, the requirements in clause 9.9X.4 apply for periodic and triggered RedCap UE Rx-Tx time difference measurements, provided:

- RedCap UE Rx-Tx time difference measurement related side conditions given in [clause 10.1.25X] are met for a corresponding band.

- SRS is configured on the PCell.

- The RedCap UE transmits SRS within [-160, 160] msec of the DL PRS resource of the TRP corresponding to the PCell in the assistance data.

For RedCap UE in HD-FDD mode, the requirements in clause 9.9X.4 apply for periodic and triggered RedCap UE Rx-Tx time difference measurements, provided:

- RedCap UE Rx-Tx time difference measurement related side conditions given in [clause 10.1.25X] are met for a corresponding band.

- SRS is configured on the PCell.

- The RedCap UE transmits SRS within [-160, 160] msec of the DL PRS resource of the TRP corresponding to the PCell in the assistance data.

- When network indicates UL transmission overriding DL reception for collision handling, no collision occurs between PRS and UL transmission.

#### 9.9X.4.3 Measurement Capability

RedCap UE Rx-Tx time difference measurement capability is as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities,* according to TS 37.355 [34].

#### 9.9X.4.4 Measurement Reporting Requirements without MG

The requirements in clause 9.9C.4.6 shall apply except that the RedCap UE Rx-Tx time difference measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in [clause TBD].

<End of Change 20>