# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document specifies requirements for support of Radio Resource Management for the FDD and TDD modes of New Radio (NR). These requirements include requirements on measurements in NR and the UE as well as requirements on node dynamical behaviour and interaction, in terms of delay and response characteristics.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[2] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[3] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[4] 3GPP TS 38.215: "NR; Physical layer measurements".

[5] 3GPP TS 38.533: "NR; User Equipment (UE) conformance specification; Radio Resource Management (RRM)".

[6] 3GPP TS 38.211: "NR; Physical channels and modulation”.

[7] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[8] 3GPP TS 38.212 "NR; Multiplexing and channel coding".

[9] 3GPP TS 38.202: "NR; Physical layer services provided by the physical layer".

[10] 3GPP TS 38.300: "NR; Overall description; Stage-2".

[11] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[12] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[13] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

[14] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[15] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[16] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) protocol specification".

[17] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity", Stage 2.

[18] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[19] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[20] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[21] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".

[22] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[23] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation".

[24] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA); Overall description".

[25] 3GPP TS 36.101: "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

[26] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[27] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".

[28] Void.

[29] 3GPP TS 25.133: "Requirements for Support of Radio Resource Management (FDD)".

[30] 3GPP TS 25.302: "Services provided by the Physical Layer".

[31] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA), Evolved Universal Terrestrial Radio Access (E-UTRA) and Next Generation Radio Access; Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2".

[32] 3GPP TS 25.214: "Physical layer procedures (FDD)".

[33] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access"

[34] 3GPP TS 37.355: "LTE Positioning Protocol (LPP) ".

[35] 3GPP TS 38.455 : "NG-RAN; NR Positioning Protocol A (NRPPa) ".

[36] 3GPP TS 37.106: “User Equipment (UE) requirements for shared spectrum channel access”.

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [11] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [11].

**1 Rx RedCap**: RedCap UE for which requirements are derived assuming 1 Rx branch.

**2 Rx RedCap**: RedCap UE for which requirements are derived assuming 2 Rx branches.

**Active DL BWP**: Active DL bandwidth part as defined in TS 38.213 [3].

**Blackbox Approach:** Testing methodology, in which the UE internal implementation of certain specific UE functionality involved in the test, is unknown.

**CD-SSB:** Cell defining SSB as defined in TS 38.300 [10].

**Control Resource Set:** As defined in TS 38.213 [3].

**DL BWP**: DL bandwidth part as defined in TS 38.213 [3].

**EN-DC**: E-UTRA-NR Dual Connectivity as defined in clause 4.1.2 of TS 37.340 [17].

**en-gNB**: As defined in TS 37.340 [17].

**FR1**: Frequency range 1 as defined in clause 5.1 of TS 38.104 [13].

**FR2**: Frequency range 2 as defined in clause 5.1 of TS 38.104 [13].

**gNB**: as defined in TS 38.300 [10].

**IBM (Independent Beam Management):** As defined in TS 38.101-2 [19].

**LMF**: as defined in TS 38.305 [22].

**Master Cell Group:** As defined in TS 38.331 [2].

**Multi-Radio Dual Connectivity:** Dual Connectivity between E-UTRA and NR nodes, or between two NR nodes, as defined in TS 37.340 [17].

**NCD-SSB:** Non cell defining SSB as defined in TS 38.300 [10].

**ng-eNB**: As defined in TS 38.300 [10].

**NE-DC**: NR-E-UTRA Dual Connectivity as defined in clause 4.1.3.2 of TS 37.340 [17].

**NGEN-DC**: NG-RAN E-UTRA-NR Dual Connectivity as defined in clause 4.1.3.1 of TS 37.340 [17].

**NR-DC**: NR-NR Dual Connectivity as defined in clause 4.1.3.3 of TS 37.340 [17].

**Primary Cell**: As defined in TS 38.331 [2].

**PRS resource instance:** An instance in time of a configured PRS resource as defined in TS 38.331 [2], which may or not overlap with a measurement gap occasion.

**Quasi Co-Location:** As defined in TS 38.214 [26].

**RedCap UE:** A UE with reduced capabilities as defined in clause 4.2 in TS 38.306 [14].

**RLM-RS resource:** A resource out of the set of resources configured for RLM by higher layer parameter RLM-RS-List [2] as defined in TS 38.213 [3].

**SA operation mode**: Operation mode when the UE is configured with at least PCell and not any MR-DC.

**Secondary Cell**: As defined in TS 38.331 [2].

**Secondary Cell Group:** As defined in TS 38.331 [2].

**Serving Cell**: As defined in TS 38.331 [2].

**SMTC**: An SSB-based measurement timing configuration configured by *SSB-MeasurementTimingConfiguration* as specified in TS 38.331 [2].

**Special Cell:** As defined in TS 38.331 [2].

**SSB:** SS/PBCH block as defined in clause 7.8.3 of TS 38.211 [6].

**Timing Advance Group**: As defined in TS 38.331 [2].

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

BWChannel Channel bandwidth, defined in TS 38.101-1, 38.101-2 and 38.101-3 subclause 3.2

Ês Received energy per RE (power normalized to the subcarrier spacing) during the useful part of the symbol, i.e. excluding the cyclic prefix, at the UE antenna connector or radiated interface boundary

FC *RF reference frequency* on the channel raster, given in table 5.4.2.2-1 in TS 38.101-1 and 38.101-2

FC,low The Fc of the lowest carrier, expressed in MHz

Io The total received power density, including signal and interference, as measured at the UE antenna connector or radiated interface boundary.

Ioc The power spectral density (integrated in a noise bandwidth equal to the chip rate and normalized to the chip rate) of a band limited noise source (simulating interference from cells, which are not defined in a test procedure) as measured at the UE antenna connector or radiated interface boundary.

Iot The received power spectral density of the total noise and interference for a certain RE (power integrated over the RE and normalized to the subcarrier spacing) as measured at the UE antenna connector or radiated interface boundary

 The power spectral density of a white noise source (average power per RE normalised to the subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector or radiated interface boundary

 Physical Resource Block number as defined in clause 3.2 in TS 38.211.

 Timing offset between uplink and downlink radio frames at the UE, as defined in clause 4.2 in TS 38.213.

 Fixed timing advance offset, as defined in clause 7.1.2 in TS 38.133.

   Configured UE transmitted power as defined in clause 6.2.4 in TS 38.101-1, 38-101-2 and 38.101-3.

PCMAX,c Configured UE transmitted power on a serving cell *c* as defined in clause 6.2.4 in TS 38.101-1, 38-101-2 and 38.101-3

S Cell Selection Criterion defined in TS 38.304, subclause 5.2.3.2 for NR

SSB\_RP Received (linear) average power of the resource elements that carry NR synchronisation burst, measured at the UE antenna connector or radiated interface boundary

Srxlev Cell selection RX level, defined in TS 38.304, subclause 5.2.3.2

Squal Cell selection quality, defined in TS 38.304, subclause 5.2.3.2

Sintrasearch Defined in TS 38.304 , subclause 5.2.4.7 for E-UTRAN amd 38.304 subclause 5.2.4.7 for NR

Snonintrasearch Defined in TS 38.304 , subclause 5.2.4.7

Threshx, high Defined in TS 38.304 , subclause 5.2.4.7

Threshx, low Defined in TS 38.304 , subclause 5.2.4.7

Threshserving, low Defined in TS 38.304 , subclause 5.2.4.7

TRE-ESTABLISH-REQ The RRC Re-establishment delay requirement, the time between the moment when erroneous CRCs are applied, to when the UE starts to send preambles on the PRACH.

Tc Basic time unit, defined in clause 4.1 of TS 38.211 [6].

Ts Reference time unit, defined in clause 4.1 of TS 38.211 [6].

Treselection Defined in TS 25.304, subclause 5.2.6.1.5

TreselectionRAT Defined in TS 36.304 , subclause 5.2.4.7

TreselectionEUTRA Defined in TS 36.304 , subclause 5.2.4.7

TreselectionUTRA Defined in TS 36.304 , subclause 5.2.4.7

TreselectionGERANDefined in TS 36.304 , subclause 5.2.4.

Threshx, high Defined in TS 38.304 , subclause 5.2.4.7

Threshx, low Defined in TS 38.304 , subclause 5.2.4.7

Threshserving, low Defined in TS 38.304 , subclause 5.2.4.7

TUE\_re-establish\_delay Time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [11] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [11].

AoA Angle of Arrival

AoD Angle of Departure

BFD Beam Failure Detection

BFD-RS BFD Reference Signal

BLER Block Error Rate

BM-RS Beam Management Reference Signal

BWP Bandwidth Part

CA Carrier Aggregation

CBD Candidate Beam Detection

CBW Channel Bandwidth

CC Component Carrier

CCA Clear Channel Assessment

CG-SDT Configured Grant Small Data Transmisison

CLI Cross Link Interference

CMR Channel Measurement Resource

CORESET Control Resource Set

CP Cyclic Prefix

CSI Channel-State Information

CSI-RS CSI Reference Signal

CSI-RSRP CSI Reference Signal based Reference Signal Received Power

CSI-RSRQ CSI Reference Signal based Reference Signal Received Quality

CSI-SINR CSI Reference Signal based Signal to Noise and Interference Ratio

CSI\_RP Received (linear) average power of the resource elements that carry NR CSI-RS signals and channels, measured at the UE antenna connector

DBT Discovery Burst Transmission

DC Dual Connectivity

DCI Downlink Control Information

DL Downlink

DL-AoD Downlink Angle-of-Departure

DL-TDOA Downlink Time Difference Of Arrival

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

E-CID Enhanced Cell ID

E-UTRA Evolved UTRA

E-UTRAN Evolved UTRAN

EN-DC E-UTRA-NR Dual Connectivity

FDD Frequency Division Duplex

FR Frequency Range

GEO Geostationary Earth Orbit

HARQ Hybrid Automatic Repeat Request

HO Handover

GAP Refers to any of Measurement Gap, activated Pre-MG and NCSG

IMR Interference Measurement Resource

L1-RSRP Layer 1 RSRP

L1 SL-RSRP Layer 1 Sidelink RSRP which corresponds to PSCCH-RSRP and/or PSSCH-RSRP

LEO Low Earth Orbit

LMF Location Management Function

LPP LTE Positioning Protocol

MAC Medium Access Control

MCG Master Cell Group

MDT Minimization of Drive Tests

MG Measurement Gap

MGL Measurement Gap Length

MGRP Measurement Gap Repetition Period

MIB Master Information Block

ML Measurement Length

MN Master Node

MR-DC Multi-Radio Dual Connectivity

MUSIM Multi-Universal Subscriber Identity Module

NCSG Network Controlled Small Gap

NE-DC NR-E-UTRA Dual Connectivity

NGEN-DC NG-RAN E-UTRA-NR Dual Connectivity

NR New Radio

NR-DC NR-NR Dual Connectivity

NTN Non-Terrestrial Network

OFDM Orthogonal Frequency Division Multiplexing

OFDMA Orthogonal Frequency Division Multiple Access

OTDOA Observed Time Difference Of Arrival

PBCH Physical Broadcast Channel

PCC Primary Component Carrier

PCell Primary Cell

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PLMN Public Land Mobile Network

PRACH Physical RACH

Pre-MG Pre-configured Measurement Gap

PRP PRS Received Power

PRS Positioning Reference Signal

PRS-RSRP Positioning Reference Signal based Reference Signal Received Power

PPW PRS Processing Window

PSBCH Physical Sidelink Broadcast Channel

PSBCH-RSRP Physical Sidelink Broadcast Channel DMRS based Reference Signal Received Power

PSCCH Physical Sidelink Control Channel

PSCCH-RSRP Physical Sidelink Control Channel DMRS based Reference Signal Received Power

PSCell Primary SCell

PSS Primary Synchronization Signal

PSSCH Physical Sidelink Shared Channel

PSSCH-RSRP Physical Sidelink Shared Channel DMRS based Reference Signal Received Power

pTAG Primary Timing Advance Group

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

QCL Quasi Co-Location

RACH Random Access Channel

RAT Radio Access Technology

RLM Radio Link Monitoring

RLM-RS Reference Signal for RLM

RMSI Remaining Minimum System Information

RRC Radio Resource Control

RRH Remote Radio Head

RRM Radio Resource Management

RSSI Received Signal Strength Indicator

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSTD Reference Signal Time Difference

RTT Round Trip Time

S-SSB Sidelink Synchronization Signal Block

SSB\_RP Received (linear) average power of the resource elements that carry NR SSB signals and channels, measured at the UE antenna connector or radiated interface boundary.

SA Standalone operation mode

SAB Satellite access band

SAN Satellite Access Node

SCC Secondary Component Carrier

SCell Secondary Cell

SCG Secondary Cell Group

SCS Subcarrier Spacing

SCSSSB SSB subcarrier spacing

SDL Supplementary Downlink

SDT Small Data Transmission

SFN System Frame Number

SFTD SFN and Frame Timing DifferenceSI System Information

SIB System Information Block

SL-RSSI Sidelink Received Signal Strength Indicator

SLSS Sidelink Synchronization Signal

SMTC SSB-based Measurement Timing configuration

SpCell Special Cell

SRS Sounding Reference Signal

SRS-RSRP Sounding Reference Signal based Reference Signal Received Power

SS-RSRP Synchronization Signal based Reference Signal Received Power

SS-RSRQ Synchronization Signal based Reference Signal Received Quality

SS-SINR Synchronization Signal based Signal to Noise and Interference Ratio

SSB Synchronization Signal Block

SSB\_RP Received (linear) average power of the resource elements that carry NR SSB signals and channels, measured at the UE antenna connector.

SSS Secondary Synchronization Signal

sTAG Secondary Timing Advance Group

SUL Supplementary Uplink

TA Timing Advance

TAG Timing Advance Group

TCI Transmission Configuration Indicator

TDD Time Division Duplex

TDOA Time Difference Of Arrival

TN Terrestrial Network

TRP Transmission-Reception Point

TTI Transmission Time Interval

UE User Equipment

UL Uplink

VIL Visible Interruption Length

VIRP Visible Interruption Repetition Period

VSAT Very Small Aperture Terminal

## 3.4 Test tolerances

The requirements given in the present document make no allowance for measurement uncertainty. The test specification 38.533 [5] defines the test tolerances.

## 3.5 Frequency bands grouping

### 3.5.1 Introduction

The intention with the frequency band grouping below is to increase the readability of the specification.

The frequency bands grouping is derived based on UE REFSENS requirements specified in [18, 19, 20] and assuming 0.5 dB step between the neighbour groups. The groups are defined in the order of increasing REFSENS, i.e., the group A has the smallest REFSENS among the groups. For the same SCS and a given bandwidth, the bands within the same group have the same Io conditions in a corresponding requirement in this specification, provided the bands support this SCS. For different SCSs supported by a frequency band and the same bandwidth, different Io conditions may apply for the frequency band in the requirements, while the band group is the same, based on the lowest REFSENS requirement normalized by the number of subcarriers among its supported SCSs for this bandwidth. For the same SCS but different supported bandwidths, the group for a band is determined based on the lowest REFSENS requirement normalized by the number of subcarriers among its supported bandwidths.

### 3.5.2 NR operating bands in FR1

NR frequency bands grouping for FR1 is specified in Table 3.5.2-1.

Table 3.5.2-1: NR frequency band groups for FR1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Group | NR FDD | | NR TDD | | NR SDL | | NR CCA10 | |
|  | Band group notation | Operating bands | Band group notation | Operating bands | Band group notation | Operating bands | Band group notation | Operating bands |
| A | NR\_FDD\_FR1\_A | n1, n18, n24, n70, n744, n91, n92, n93, n94, n100 | NR\_TDD\_FR1\_A | n34, n389, n39, n40, n50, n51, n53, n54, n101 | NR\_SDL\_FR1\_A | n67, n75, n76 | NR\_CCA\_FR1\_A | - |
| B | NR\_FDD\_FR1\_B | n65, n66, n743 | NR\_TDD\_FR1\_B | n387 | NR\_SDL\_FR1\_B | - | NR\_CCA\_FR1\_B | - |
| C | NR\_FDD\_FR1\_C | n30 | NR\_TDD\_FR1\_C | n48, n771, n78, n79 | NR\_SDL\_FR1\_C | - | NR\_CCA\_FR1\_C | - |
| D | NR\_FDD\_FR1\_D | n28 | NR\_TDD\_FR1\_D | n772 | NR\_SDL\_FR1\_D | - | NR\_CCA\_FR1\_D | - |
| E | NR\_FDD\_FR1\_E | n2, n5, n7 | NR\_TDD\_FR1\_E | n41, n90 | NR\_SDL\_FR1\_E | - | NR\_CCA\_FR1\_E | - |
| F | NR\_FDD\_FR1\_F | n266 | NR\_TDD\_FR1\_F | - | NR\_SDL\_FR1\_F | - | NR\_CCA\_FR1\_F | - |
| G | NR\_FDD\_FR1\_G | n3, n8, n12, n13, n14, n20, n71, n85, n10511 | NR\_TDD\_FR1\_G | n104 | NR\_SDL\_FR1\_G | n29 | NR\_CCA\_FR1\_G | - |
| H | NR\_FDD\_FR1\_H | n25 | NR\_TDD\_FR1\_H | - | NR\_SDL\_FR1\_H | - | NR\_CCA\_FR1\_H | - |
| I | NR\_FDD\_FR1\_I | - | NR\_TDD\_FR1\_I |  | NR\_SDL\_FR1\_I | - | NR\_CCA\_FR1\_I | n46 |
| J | NR\_FDD\_FR1\_J | - | NR\_TDD\_FR1\_J | n478 | NR\_SDL\_FR1\_J | - | NR\_CCA\_FR1\_J | n96, n102 |
| NOTE 1: Except 3.8 GHz to 4.2 GHz.  NOTE 2: Only 3.8 GHz to 4.2 GHz.  NOTE 3: Except 1475.9 MHz to 1510.9 MHz.  NOTE 4: Only when the band is confined in 1475.9 MHz to 1510.9 MHz.  NOTE 5: These bands are used only in NR carrier aggregation with other NR bands according to NR CA band combinations specified in TS 38.101-1 [18] and TS 38.101-3 [20].  NOTE 6: The minimum Io condition is reduced by 0.5 dB when the carrier frequency of the assigned NR channel bandwidth is within 865-894 MHz.  NOTE 7: When this band is only used for V2X SL service, the band is exclusively used for NR V2X in particular regions.  NOTE 8: This band is unlicensed band used for V2X service. There is no expected network deployment in this band.  NOTE 9: When this band is only used for WAN service.  NOTE 10: Operating bands where operation on carrier frequencies with CCA is supported.  NOTE 11: The minimum Io condition is reduced by 0.5 dB when the downlink channel overlap the 612-617 MHz frequency range and the channel bandwidth is 5 MHz. | | | | | | | | |

### 3.5.2A NR operating bands for satellite access in FR1

NR frequency bands grouping for satellite access in FR1 is specified in Table 3.5.2A-1.

Table 3.5.2A-1: NR frequency band groups for satellite access in FR1

|  |  |  |
| --- | --- | --- |
| Group | NR FDD | |
|  | Band group notation | Operating bands |
| A | NR\_FDD\_SAB\_FR1\_A | n255, n256 |
| B | NR\_FDD\_SAB\_FR1\_B |  |
| C | NR\_FDD\_SAB\_FR1\_C |  |
| D | NR\_FDD\_SAB\_FR1\_D |  |
| E | NR\_FDD\_SAB\_FR1\_E |  |
| F | NR\_FDD\_SAB\_FR1\_F |  |
| G | NR\_FDD\_SAB\_FR1\_G |  |
| H | NR\_FDD\_SAB\_FR1\_H |  |
| I | NR\_FDD\_SAB\_FR1\_I |  |
| J | NR\_FDD\_SAB\_FR1\_J |  |

### 3.5.3 NR operating bands in FR2

NR frequency bands grouping for FR2 is specified in Table 3.5.3-1.

Table 3.5.3-1: NR frequency band groups for FR2

|  |  |  |
| --- | --- | --- |
| Group | Band group notation | Operating bands |
| A | NR\_TDD\_FR2\_A | n2571, n2581, n2611 |
| B | NR\_TDD\_FR2\_B | n2574, n2584, n2614 |
| C | NR\_TDD\_FR2\_C |  |
| D | NR\_TDD\_FR2\_D |  |
| E | NR\_TDD\_FR2\_E |  |
| F | NR\_TDD\_FR2\_F | n2604 |
| G | NR\_TDD\_FR2\_G | n2601 |
| H | NR\_TDD\_FR2\_H |  |
| I | NR\_TDD\_FR2\_I |  |
| J | NR\_TDD\_FR2\_J |  |
| K | NR\_TDD\_FR2\_K | n2575,6, n2585,6, n2621, n2616 |
| L | NR\_TDD\_FR2\_L | n2572, n2582, n2612 |
| M | NR\_TDD\_FR2\_M |  |
| N | NR\_TDD\_FR2\_N | n2624 |
| O | NR\_TDD\_FR2\_O |  |
| P | NR\_TDD\_FR2\_P |  |
| Q | NR\_TDD\_FR2\_Q | n2595 |
| R | NR\_TDD\_FR2\_R |  |
| S | NR\_TDD\_FR2\_S |  |
| T | NR\_TDD\_FR2\_T | n2573, n2583, n2613 |
| U | NR\_TDD\_FR2\_U |  |
| V | NR\_TDD\_FR2\_V |  |
| W | NR\_TDD\_FR2\_W | n2622 |
| X | NR\_TDD\_FR2\_X |  |
| Y | NR\_TDD\_FR2\_Y | n2603 |
| Z | NR\_TDD\_FR2\_Z | n2577, n2587, n2617 |
| AA | NR\_TDD\_FR2\_AA | n2593 |
| AB | NR\_TDD\_FR2\_AB |  |
| AC | NR\_TDD\_FR2\_AC |  |
| AD | NR\_TDD\_FR2\_AD |  |
| AE | NR\_TDD\_FR2\_AE | n2623 |
| NOTE 1: UE power class 1.  NOTE 2: UE power class 2.  NOTE 3: UE power class 3.  NOTE 4: UE power class 4.  NOTE 5: UE power class 5.  NOTE 6: UE power class 6.  NOTE 7: UE power class 7. | | |

## 3.6 Applicability of requirements in this specification version

In this specification,

- ‘cell’, ‘PCell’, ‘PSCell’ and ‘SCell’ refer to NR cell, NR PCell, NR PSCell, and NR SCell,

- E-UTRA cells are referred to as ‘E-UTRA cell’, ‘E-UTRA PCell’, ‘E-UTRA PSCell’, and ‘E-UTRA SCell’,

- E-UTRA-NR dual connectivity where E-UTRA is the master is referred to as ‘E-UTRA-NR dual connectivity’ or ‘EN-DC’.

- NR-NR dual connectivity which involves two gNB acting as Master gNB and Secondary gNB is referred to as “NR-NR dual connectivity” or “NR-DC”. NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.

- ‘active serving cell’ refers to PCell, PSCell and activated SCells

For UE configured with supplementary UL, the requirements in clause 7.1 and 7.3 shall also apply to uplink transmissions on supplementary UL.

Unless explictly stated, requirements do not apply when CCA is used on serving or neighbour cells.

### 3.6.1 RRC connected state requirements in DRX

For the requirements in RRC connected state specified in this version of the specification, the UE shall assume that no DRX is used provided the following conditions are met:

- DRX parameters are not configured or

- DRX parameters are configured and

- *drx-InactivityTimer* is running or

- *drx-RetransmissionTimerDL* is running or

- *drx-RetransmissionTimerUL* is running or

- *ra-ContentionResolutionTimer* is running or

- a Scheduling Request sent on PUCCH is pending or

- a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the preamble not selected by the MAC entity

Otherwise the UE shall assume that DRX is used.

### 3.6.2 Number of serving carriers

#### 3.6.2.1 Number of serving carriers for SA

Requirements for standalone NR with NR PCell are applicable for the UE configured with the following number of serving NR CCs:

- up to 16 NR DL CCs in total, with 1 UL (or 2 UL if SUL is configured) in PCell and up to 8 UL (or 9 UL if SUL is configured) in total for SCells.

- SUL may be configured together with one of the UL

#### 3.6.2.2 Number of serving carriers for EN-DC

Requirements for EN-DC operation of E-UTRA and NR with E-UTRA PCell and NR PSCell are applicable for the UE configured with the following number of serving NR CCs:

- up to 9 NR DL CCs in total, with 1 UL (or 2 UL if SUL is configured) in PSCell, up to 7 UL (or 8 UL if SUL is configured) in total for SCells in the FR of PSCell and up to 1 UL (or 2 UL if SUL is configured) in SCell in different FR with PSCell.

- SUL may be configured together with one of the UL

The applicable number of E-UTRA CC for EN-DC in the MCG for both UL and DL is specified in TS 36.133 [15].

#### 3.6.2.3 Number of serving carriers for NE-DC

Requirements for NE-DC operation of NR and E-UTRA with NR PCell and E-UTRA PSCell are applicable for the UE configured with the following number of serving NR CCs:

- up to 7 NR DL CCs in total, with 1 UL (or 2 UL if SUL is configured) in PCell and up to 1 UL (or 2 UL if SUL is configured) in SCell.

- SUL may be configured together with one of the UL

The applicable number of E-UTRA CC for NE-DC in the SCG for both UL and DL is specified in TS 36.133 [15].

#### 3.6.2.4 Number of serving carriers for NR-DC

Requirements for NR-DC are applicable for the UE configured with the following number of serving NR CCs:

- up to 2 NR DL CCs in total in FR1, up to 8 NR DL CCs in total in FR2, with 1 UL in PCell, 1 UL in PSCell, and up to 1 UL in each SCell.

### 3.6.3 Applicability for intra-band FR2

For the requirements in RRC connected state specified in this version of the specification, UE shall assume that the transmitted signals from the serving cells should have the same downlink spatial domain transmission filter on one OFDM symbol in the same band in FR2. Otherwise, the UE is not supposed to satisfy any requirements for SCell.

### 3.6.4 Applicability for FR2 UE power classes

For the requirements of each FR2 power class specified in this version of the specification, certain UE types with specific device architectures are assumed. The UE types can be found in TS 38.101-2 [19].

### 3.6.5 Applicability for SDL bands

The measurements accuracy requirements for SDL bands in this version of specification in clause 10.1 shall apply for NR intra-frequency measurements on SCC (SS-RSRP, SS-RSRQ, SS-SINR, and L1-RSRP) and inter-frequency measurements (SS-RSRP, SS-RSRQ, and SS-SINR).

### 3.6.6 Applicability of requirements for NGEN-DC operation

All the requirements in this specification applicable for EN-DC are also applicable for NGEN-DC.

### 3.6.7 Applicability of QCL

For the requirements specified in this version of the specification for TCI state switching, DL TCI state switching for unified TCI or UL TCI state switching for unified TCI, a reference signal is considered to be QCLed to another reference signal if it is in the same TCI chain as the other reference signal, provided that the number of Reference Signals in the chain is no more than 4. It is assumed there is single QCL type per TCI chain.

A DL TCI chain consists of an SSB, and one or more CSI-RS resources, and the TCI state of each Reference Signal includes another Reference Signal in the same TCI chain, where the SSB can be associated with serving cell PCID or associated with a PCID different from serving cell PCID.

DMRS of PDCCH or PDSCH is QCLed with the reference signal in its active TCI state and any other reference signal that is QCLed, based on the criteria for DL TCI chain, with the reference signal in the active TCI state.

A UL TCI chain consists of an SSB, and one or more CSI-RS resources, and the TCI state of each Reference Signal includes another Reference Signal in the same TCI chain, where the SSB can be associated with serving cell PCID or associated with a PCID different from serving cell PCID.

DMRS of PUCCH or PUSCH is QCLed with the reference signal in its active TCI state and any other reference signal that is QCLed, based on the criteria for UL TCI chain, with the reference signal in the active TCI state.

3.6.8 Applicability of 2-step RA and 4-step RA in RRM requirements

Unless explicitly stated otherwise the requirements under the following clauses, where the UE transmits random acess (with requirements in clause 6.2.2) to NR serving cell or NR target cell, are applicable for both 2-step RA and 4-step RA procedures [3]:

- Handover requirements in clause 6.1, except for clauses 6.1.2 and 6.1B,

- RRC connection re-establishment requirements in clause 6.2.1,

- RRC connection release with redirection to NR requirements in clause 6.2.3.2.1,

- UE transmit timing requirements in clause 7.1,

- PSCell addition delay requirements in clause 8.9.2,

- PSCell change requirements in clause 8.11 and

- Conditional PSCell change requirements in clause 8.11B.

Unless explicitly stated otherwise the requirements under the following clauses, where the UE transmits random acess (with requirements in clause 6.2.2A) to NR serving cell or NR target cell subject to uplink CCA, are applicable for both 2-step RA and 4-step RA procedures [3]:

- Handover requirements with CCA in clause 6.1B,

- RRC connection re-establishment requirements with CCA in clause 6.2.1A,

- RRC connection release with redirection to NR requirements with CCA in clause 6.2.3.2.3, and

- UE transmit timing requirements with CCA in clause 7.1.

### 3.6.9 Applicability of requirements for scheduling availability

The scheduling availability requirements in clause 8.1.7.3, 8.5.7.3, 8.5.8.3, 9.5.6.3 and 9.10.2.6.2 assumes that:

- The UE is not configured with simultaneous UL/DL between two FR2 bands if the UE does not have the capability of supporting *simultaneousRxTxInterBandCA*, and

- The UE is not configured with mixed numerology on two FR2 CCs if the UE does not have the capability of supporting simultaneous reception with two different numerologies between FR2 CCs in DL.

The scheduling availability requirements in clause 8.1.7.1, 8.1.7.2, 8.5.7.1, 8.5.7.2, 8.5.8.1, 8.5.8.2, 9.5.6.1, 9.5.6.2, 9.8.6.1, and 9.8.6.2 assumes that the UE is not configured with simultaneous UL/DL between two FR1 bands if the UE does not have the capability of supporting *simultaneousRxTxInterBandCA*.

The scheduling availability requirements in clause 8.1.7.4, 8.5.7.4, 8.5.8.4, 9.5.6.4 and 9.8.6.4 assumes that the UE is not configured with simultaneous UL/DL between FR1 and FR2 bands if the UE does not have the capability of supporting *simultaneousRxTxInterBandCA* on this band combination.

### 3.6.10 Applicability of requirements for measurement restrictions

The requirements for measurement restrictions in clause 8.1.2.3, 8.1.3.3, 8.5.2.3, 8.5.3.3, 8.5.5.3, 8.5.6.3, 8.18.2.3, 8.18.3.3, 8.18.5.3, 8.18.6.3, 9.5.5, 9.8.5 and 9.13.5 are not applicable if the following condition is met:

- The network configures mixed numerology on two CCs if the UE does not have the capability of supporting simultaneous reception with different numerologies between the two CCs in DL.

### 3.6.11 Applicability of requirements for Redcap UEs

#### 3.6.11.1 RRC connected state requirements in DRX

The requirements in clause 3.6.1 shall apply.

#### 3.6.11.2 Applicability for FR2 Redcap UE power classes

The requirements in clause 3.6.4 shall apply.

#### 3.6.11.3 Applicability of QCL

The requirements in clause 3.6.7 shall apply.

### 3.6.12 Applicability of requirements for Satellite Access

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

### 3.6.13 Applicability of requirements for FR2

Unless stated otherwise, the requirements for FR2 are applicable to both FR2-1 and FR2-2, except for the following cases:

SFTD measurement requirements in clause 9.2.5.4, 9.3.8, 10.1.21 for FR2 are only applicable for FR2-1,

CGI identification requirements in clause 9.11 for FR2 are only applicable for FR2-1,

Inter-band CA requirements in all corresponding clauses for FR2 are only applicable for FR2-1.

L1-RSRP measurements for a cell with different PCI from serving cell in clause 9.13 for FR2 are only applicable for FR2-1.

### 3.6.14 Applicability of requirements for FR2 Power Class 6

For Rel-17 FR2 power class 6 for the UE type of high speed train roof-mounted UE, UE shall only be in NR SA operation.

Measurement and evaluation period requirements with *highSpeedMeasFlagFR2-r17* configured in clause 4.2.2.3, 8.1.2.2, 8.5.2.2, 9.2.5, 9.2.6, 9.5.4, [9.8.4], delay requirements in clause 6.2.1.2.1, 8.10.3A, and UL timing adjustment in clause 7.1.2.3, are only applicable when any two SSBs from non-collocated adjacent RRHs are not on the same or consecutive symbols.

L1-SINR accuracy requirements for FR2 configured in clause 10.1.28 and intra-frequency SS-SINR accuracy requirements configured in clause 10.1.13 are not applicable to Rel-17 HST FR2 power class 6 UEs.

### 3.6.15 Applicability of requirements for per-FR gap

Requirements for per-FR gap are applicable for the UE indicating one of the following capabilities:

- Rel-15 capability “independentGapConfig”;

- Rel-17 capability “independentGapConfig-maxCC-r17,” and the number of configured serving cells is less than or equal to the indicated paramters “fr1-Only,” “fr2-Only,” and “fr1And2,” as specified in TS 38.306 [14].

# 4 SA: RRC\_IDLE state mobility

## 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.

## 4.2 Cell Re-selection

### 4.2.1 Introduction

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

When the UE is in either *Camped* *Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity

In the requirements of clause 4.2, the exceptions for side conditions apply as follows:

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

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

### 4.2.2 Requirements

#### 4.2.2.1 UE measurement capability

For idle mode cell re-selection purposes, and for UE supporting *IdleInactiveMeasurements-r16* or *idleInactiveEUTRA-MeasReport-r16*, for NR CA and MR-DC measurement purpose, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and

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

- Depending on UE capability, 7 FDD E-UTRA inter-RAT carriers, and

- Depending on UE capability, 7 TDD E-UTRA inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC\_IDLE state shall be capable of monitoring a total of at least 14 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers.

#### 4.2.2.2 Measurement and evaluation of serving cell

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

M1=2 if SMTC periodicity (TSMTC) > 20 ms and DRX cycle ≤ 0.64 second,

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 DRX cycle/2.

For UE not configured with *highSpeedMeasFlagFR2-r17*, Nserv is specified in Table 4.2.2.2-1. For FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*, Nserv is specified in Table 4.2.2.2-2.

If the UE is not configured with eDRX\_IDLE cycle and the UE has evaluated according to Table 4.2.2.2-1 or Table 4.2.2.2-4 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.

If the UE is configured with eDRX\_IDLE cycle and the UE has evaluated according to Table 4.2.2.2-2 and Table 4.2.2.2-3 in Nserv for eDRX cycles ≤ 10.24s, consecutive eDRX 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.

If the UE is configured with eDRX\_IDLE cycle and the UE has evaluated according to Table 4.2.2.2-2 and Table 4.2.2.2-3 in Nserv for eDRX cycles > 10.24s, consecutive DRX cycles within a single PTW 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.

For the UE configured with eDRX\_IDLE cycle, Nserv is specified in Table 4.2.2.2-2 for FR1 and in Table 4.2.2.2-3 for FR2.

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 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\_IDLE cycle, or

- T= MAX (10 s, one eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle in FR1, or

- T= MAX (10 s, N1\* eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle less than 20.48s in FR2,

- Otherwise, T= MAX (10 s, one eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle no less than 20.48 s in FR2

Table 4.2.2.2-1: Nserv

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | | Nserv [number of DRX cycles] |
|  | FR1 | FR2-1Note1 | FR2-2 Note2 |  |
| 0.32 | 1 | 8 | 12 | M1\*N1\*4 |
| 0.64 |  | 5 | 8 | M1\*N1\*4 |
| 1.28 |  | 4 | 6 | N1\*2 |
| 2.56 |  | 3 | 5 | N1\*2 |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length. | | | | |

Table 4.2.2.2-2: Nserv for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) | Nserv [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 |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥[1.28] (1) | N1\*M1\*2 |
|  | 0.64 | ≥ 1.28 (1) (M1=1) or ≥ 2.56 (2) (M1=2) | N1\*M1\*2 |
|  | 1.28 | ≥2.56 (2) | N1\*2 |
|  | 2.56 | ≥5.12 (4) | N1\*2 |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 4: The lower bound of PTW length is derived based on . | | | | |

Table 4.2.2.2-3: Nserv for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Nserv [number of DRX or eDRX cycles Note 4] |
| 2.56 | N/A | N/A | 3 | N1\*2 |
| 5.12 | N/A | N/A | 3 | N1\*2 |
| 10.24 | N/A | N/A | 3 | N1\*2 |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥5.12 (4) | 8 | N1\*2 |
|  | 0.64 | ≥6.4 (5) | 5 | N1\*2 |
|  | 1.28 | ≥10.24 (8) | 4 | N1\*2 |
|  | 2.56 | ≥15.36 (12) | 3 | N1\*2 |
| NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 5: The lower bound of PTW length is derived based on .  NOTE 6: When eDRX=20.48s and DRX=0.32s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles. | | | | |

Table 4.2.2.2-2: Nserv for UE configured with *highSpeedMeasFlagFR2-r17* (Frequency range FR2)

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | Nserv [number of DRX cycles] |
| 0.32 | N2Note1 | M1\*N1\*4 |
| 0.64 | 5 | M1\*N1\*4 |
| 1.28 | 4 | N1\*2 |
| 2.56 | 3 | N1\*2 |
| Note 1: N2 = 2 when [*highSpeedMeasFlagFR2-r17*] = [set1]; N2 = 6 when [*highSpeedMeasFlagFR2-r17*] = [set2]. | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, 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.

#### 4.2.2.3 Measurements of intra-frequency NR cells

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

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS38.304 [1] within Tdetect,NR\_Intrawhen that Treselection= 0. An intra frequency cell is considered to be detectable according to the conditions defined in Annex B.1.2 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every Tmeasure,NR\_Intra (see table 4.2.2.3-1, table 4.2.2.3-2, table 4.2.2.3-3, table 4.2.2.3-4 or table 4.2.2.3-5) for intra-frequency cells that are identified and measured according to the measurement rules.

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

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

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS38.304 [1] within Tevaluate,NR\_Intra when Treselection = 0as specified in table 4.2.2.3-1, table 4.2.2.3-2, table 4.2.2.3-3, table 4.2.2.3-4 or table 4.2.2.3-5 provided that:

when *rangeToBestCell* is not configured:

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

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

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

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

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

If Treselection timer has a non zero value and the intra-frequency cell is satisfied with the reselection criteria which are defined in TS38.304 [1], the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

For UE neither configured with *highSpeedMeasFlag-r16* nor *highSpeedMeasFlagFR2-r17*, Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate, NR\_intra are specified in Table 4.2.2.3-1. For UE configured with *highSpeedMeasFlag-r16*, Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate, NR\_intra are specified in Table 4.2.2.3-2. For FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*, Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate, NR\_intra are specified in Table 4.2.2.3-3.

For UE not configured with eDRX\_IDLE cycle, Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra are specified in Table 4.2.2.3-1, 4.2.2.3-2 and 4.2.2.3-3.

For UE configured with eDRX\_IDLE cycle, Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra are specified in Table 4.2.2.3-4 and Table 4.2.2.3-5 for FR1 and FR2 respectively, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra when multiple PTWs are used.

The requirements in Table 4.2.2.3-2 apply only when the UE supports *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16*. For UE neither supporting either *measurementEnhancement-r16* nor *intraNR-MeasurementEnhancement-r16*, the UE is not required to meet the requirements specified in Table 4.2.2.3-2.

Table 4.2.2.3-1: Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | | Tdetect,NR\_Intra [s] (number of DRX cycles) | Tmeasure,NR\_Intra [s] (number of DRX cycles) | Tevaluate,NR\_Intra  [s] (number of DRX cycles) |
|  | FR1 | FR2-1Note1 | FR2-2 Note2 |  |  |  |
| 0.32 | 1 | 8 | 12 | 11.52 x N1 x M2 (36 x N1 x M2) | 1.28 x N1 x M2 (4 x N1 x M2) | 5.12 x N1 x M2 (16 x N1 x M2) |
| 0.64 |  | 5 | 8 | 17.92 x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 |  | 4 | 6 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 |  | 3 | 5 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.  Note 3: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra is expected. | | | | | | |

Table 4.2.2.3-2: Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra for UE configured with *highSpeedMeasFlag-r16* (Frequency range FR1)

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Intra [s] (number of DRX cycles) | Tmeasure,NR\_Intra [s] (number of DRX cycles) | Tevaluate,NR\_Intra  [s] (number of DRX cycles) |
|
| 0.32 | 2.56 x M2 (8 x M2) | 0.32 x M3 (1 x M3) | 0.96 x M4 (3 x M4) |
| 0.64 | 5.12 (8) | 0.64 (1) | 1.92 (3) |
| 1.28 | 8.96 (7) | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| Note 1: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2  Note 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16.* | | | |

Table 4.2.2.3-3: Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra for UE configured with *highSpeedMeasFlagFR2-r17* (Frequency range FR2)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | Tdetect,NR\_Intra [s] (number of DRX cycles) | Tmeasure,NR\_Intra [s] (number of DRX cycles) | Tevaluate,NR\_Intra  [s] (number of DRX cycles) |
| 0.32 | N2Note2 | 2.56 x N1 x M2 (8 x N1 x M2) | 0.32 x N1 x M3 (1 x N1 x M3) | 0.96 x N1 x M4 (3 x N1 x M4) |
| 0.64 | 5 | 17.92 x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | 4 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| Note 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2  Note 2: N2 = 2 when [*highSpeedMeasFlagFR2-r17*] = [set1]; N2 = 6 when [*highSpeedMeasFlagFR2-r17*] = [set2]. | | | | |

Table 4.2.2.3-4: Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,NR\_Intra [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Intra [s] (number of DRX cycles or eDRX cycles Note 3) | Tevaluate,NR\_Intra [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) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥[1.28] ([1]) | (23) | 0.32 x M2 (1 x M2) | 0.64 x M2 (2 x M2) |
|  | 0.64 | ≥[1.28] ([1]) |  | 0.64 (1) | 1.28 (2) |
|  | 1.28 | ≥[2.56] ([2]) |  | 1.28 (1) | 2.56 (2) |
|  | 2.56 | ≥[5.12] ([4]) |  | 2.56 (1) | 5.12 (2) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  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 4.2.2.3-5: Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Tdetect,NR\_Intra [s] (number of DRX cycles or eDRX cycles Note 4) | Tmeasure,NR\_Intra [s] (number of DRX cycles or eDRX cycles Note 4) | Tevaluate,NR\_Intra [s] (number of DRX cycles or eDRX cycles Note 4) |
| 2.56 | - | - | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| 5.12 | - | - | 3 | 117.76 x N1 (23 x N1) | 5.12 x N1 (1 x N1) | 10.24 x N1 (2 x N1) |
| 10.24 | - | - | 3 | 235.52 x N1 (23 x N1) | 10.24 x N1 (1 x N1) | 20.48 x N1 (2 x N1) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥5.12 (4) | 8 | (23 x N1) | 0.32 x N1 (1 x N1) | 0.64 x N1 (2 x N1) |
|  | 0.64 | ≥6.4 (5) | 5 |  | 0.64 x N1 (1 x N1) | 1.28 x N1 (2 x N1) |
|  | 1.28 | ≥10.24 (8) | 4 |  | 1.28 x N1 (1 x N1) | 2.56 x N1 (2 x N1) |
|  | 2.56 | ≥15.36 (12) | 3 |  | 2.56 x N1 (1 x N1) | 5.12 x N1 (2 x N1) |
| NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 5: The lower bound of PTW length is derived based on .  NOTE 6: When eDRX=20.48s and DRX=0.32s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles. | | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, 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.

#### 4.2.2.4 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 then the UE shall search for inter-frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.7.

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

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS38.304 [1] within Kcarrier \* Tdetect,NR\_Inter + Kcarrier\_HST \* Tdetect,NR\_Inter\_HST 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 or 6.5dB in FR2 for reselections based on ranking or 6dB in FR1 or 7.5dB in FR2 for SS-RSRP reselections based on absolute priorities or 4dB in FR1 and 4dB in FR2 for SS-RSRQ reselections based on absolute priorities.

The parameter Kcarrier is the number of NR inter-frequency carriers which are not configured with *highSpeedMeasInterFreq-r17* for FR1 indicated by the serving cell. The parameter Kcarrier\_HST is the number of NR inter-frequency carriers which are configured with *highSpeedMeasInterFreq-r17* for FR1 indicated by the serving cell. The parameter Kcarrier for a UE configured with idle mode CA measurements (while T331 is running), is the combined number of NR inter-frequency carriers indicated by the serving cell and the number of NR inter-frequency carriers configured for idle mode CA measurements which are not configured with *highSpeedMeasInterFreq-r17* for FR1. The parameter Kcarrier\_HST for a UE configured with idle mode CA measurements (while T331 is running), is the combined number of NR inter-frequency carriers indicated by the serving cell and the number of NR inter-frequency carriers configured for idle mode CA measurements which are configured with *highSpeedMeasInterFreq-r17* for FR1.

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

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.3 for a corresponding Band.

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

The UE is not configured with eDRX\_IDLE cycle shall measure SS-RSRP or SS-RSRQ at least every Kcarrier \* Tmeasure,NR\_Inter + Kcarrier\_HST \* Tmeasure,NR\_Inter\_HST (see table 4.2.2.4-1 and table 4.2.2.4-2 if UE declares support of idle mode inter-frequency measurement enhancement when configured with *highSpeedMeasInterFreq-r17* for FR1, otherwise see table 4.2.2.4-1 only) 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 is not configured with eDRX\_IDLE cycle 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 for carriers which are not configured with *highSpeedMeasInterFreq-r17* for FR1or Tmeasure,NR\_Inter\_HST /2 for carriers which are configured with *highSpeedMeasInterFreq-r17* forFR1.

The UE is configured with eDRX\_IDLE cycle shall measure SS-RSRP or SS-RSRQ at least every Kcarrier \* Tmeasure,NR\_Inter (see table 4.2.2.4-3 and table 4.2.2.4-4) 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 is configured with eDRX\_IDLE cycle 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 is not configured with eDRX\_IDLE cycle shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within Kcarrier \* Tevaluate,NR\_Inter + Kcarrier\_HST \* Tevaluate,NR\_Inter\_HST when Treselection = 0as specified in table 4.2.2.4-1 and table 4.2.2.4-2 if UE declares support of idle mode inter-frequency measurement enhancement when configured with *highSpeedMeasInterFreq-r17* for FR1, otherwise see table 4.2.2.4-1 only, 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 5dB better ranked in FR1 or 6.5dB better ranked in FR2 or.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

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

- the cell is at least 5dB better ranked in FR1 or 6.5dB better ranked in FR2 if the current serving cell is among them. or

- 6dB in FR1 or 7.5dB in FR2 for SS-RSRP reselections based on absolute priorities or

- 4dB in FR1 or 4dB in FR2 for SS-RSRQ reselections based on absolute priorities.

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 is configured with eDRX\_IDLE cycle shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within Kcarrier \* Tevaluate,NR\_Inter when Treselection = 0as specified in table 4.2.2.4-3 and table 4.2.2.4-4, 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 5dB better ranked in FR1 or 6.5dB better ranked in FR2 or.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

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

- the cell is at least 5dB better ranked in FR1 or 6.5dB better ranked in FR2 if the current serving cell is among them. or

- 6dB in FR1 or 7.5dB in FR2 for SS-RSRP reselections based on absolute priorities or

- 4dB in FR1 or 4dB in FR2 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 4.2.2.4-1 and Table 4.2.2.4-2 under the following conditions:

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

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

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

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

- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS38.304 [1].

For UE not configured with eDRX\_IDLE cycle, Tdetect,NR\_Inter, Tmeasure,NR\_ Inter and Tevaluate,NR\_ Inter are specified in Table 4.2.2.4.1-1 and 4.2.2.4.1-2.

For UE configured with eDRX\_IDLE cycle, Tdetect,NR\_ Inter, Tmeasure,NR\_ Inter and Tevaluate,NR\_ Inter are specified in Table 4.2.2.4-3 and Table 4.2.2.4-4 for FR1 and FR2 respectively. The requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NR\_ Inter, Tmeasure,NR\_ Inter and Tevaluate,NR\_ Inter when multiple PTWs are used.

**Table 4.2.2.4-1: Tdetect,NR\_Inter, Tmeasure,NR\_Inter and Tevaluate,NR\_Inter**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | | | **Tdetect,NR\_Inter [s] (number of DRX cycles)** | **Tmeasure,NR\_Inter [s] (number of DRX cycles)** | **Tevaluate,NR\_Inter [s] (number of DRX cycles)** |
| **FR1** | **FR2-1Note1** | **FR2-2** Note2 |
| 0.32 | 1 | 8 | 12 | 11.52 x N1 x 1.5 (36 x N1 x 1.5) | 1.28 x N1 x 1.5 (4 x N1 x 1.5) | 5.12 x N1 x 1.5 (16 x N1 x 1.5) |
| 0.64 |  | 5 | 8 | 17.92x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 |  | 4 | 6 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 |  | 3 | 5 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length. | | | | | | |

Table 4.2.2.4-2: Tdetect,NR\_Inter\_HST, Tmeasure,NR\_Inter\_HST and Tevaluate,NR\_Inter\_HST for FR1 configured with *highSpeedMeasInterFreq-r17* note2

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter\_HST [s] (number of DRX cycles) | Tmeasure,NR\_Inter\_HST [s] (number of DRX cycles) | Tevaluate,NR\_Inter\_HST [s] (number of DRX cycles) |
|
| 0.32 | [3.2 x M2 (10 x M2)] Note 1 | [0.32 x M3 ([1] x M3)] Note 1 | 0.96 x M4 (3 x M4) Note 1 |
| 0.64 | [6.4 (10)] | [0.64 (1)] | 1.92 (3) |
| 1.28 | [10.24 (8)] | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| Note 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2  Note 2: The support of HST Idle mode inter-frequency measurement enhancement is optional without capability signalling. Apply for UE declarating supports idle mode inter-frequency measurement enhancement for HST, otherwise Table 4.2.2.4-1 shall be used. | | | |

Table 4.2.2.4-3: Tdetect,NR\_Inter, Tmeasure,NR\_Inter and Tevaluate,NR\_Inter for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,NR\_Inter [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Inter [s] (number of DRX cycles or eDRX cycles Note 3) | Tevaluate,NR\_Inter [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) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥1.28 (1) | (23) | 0.32 x 1.5 (1 x 1.5) | 0.64 x 1.5 (2 x 1.5) |
|  | 0.64 | ≥1.28 (1) |  | 0.64 (1) | 1.28 (2) |
|  | 1.28 | ≥2.56 (2) |  | 1.28 (1) | 2.56 (2) |
|  | 2.56 | ≥5.12 (4) |  | 2.56 (1) | 5.12 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 4: The lower bound of PTW length is derived based on . | | | | | |

Table 4.2.2.4-4: Tdetect,NR\_Inter, Tmeasure,NR\_Inter and Tevaluate,NR\_Inter for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Tdetect,NR\_Inter [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Inter [s] (number of DRX cycles or eDRX cycles Note 3) | | Tevaluate,NR\_Inter [s] (number of DRX cycles or eDRX cycles Note 3) |
| 2.56 | - | - | 3 | 58.88 x N1 (23 x N1) | | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| 5.12 | - | - | 3 | 117.76 x N1 (23 x N1) | | 5.12 x N1 (1 x N1) | 10.24 x N1 (2 x N1) |
| 10.24 | - | - | 3 | 235.52 x N1 (23 x N1) | | 10.24 x N1 (1 x N1) | 20.48 x N1 (2 x N1) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥5.12 (4) | 8 | (23 x N1) | | 0.32 x N1 (1 x N1) | 0.64 x N1 (2 x N1) |
|  | 0.64 | ≥6.4 (5) | 5 |  | | 0.64 x N1 (1 x N1) | 1.28 x N1 (2 x N1) |
|  | 1.28 | ≥10.24 (8) | 4 |  | | 1.28 x N1 (1 x N1) | 2.56 x N1 (2 x N1) |
|  | 2.56 | ≥15.36 (12) | 3 |  | | 2.56 x N1 (1 x N1) | 5.12 x N1 (2 x N1) |
| NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 5: The lower bound of PTW length is derived based on .  NOTE 6: When eDRX=20.48s and DRX=0.32s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles. | | | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, 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.

#### 4.2.2.5 Measurements of inter-RAT E-UTRAN cells

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

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

The requirements in this clause apply for 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.

Theparameter NEUTRA\_carrier is the total number of configured E-UTRA carriers indicated to meet non high speed requirements in the neighbour frequency list. The parameter NEUTRA\_carrier\_HST is the total number of configured E-UTRA carriers indicated to meet high speed requirements in the neighbour frequency list. If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, an inter-RAT E-UTRAN layer is indicated to meet high speed requirements if highSpeedMeasFlag-r16 is configured and the carrier to be measured is configured with highSpeedEUTRACarrier-r16 and UE supports the enhanced inter-RAT E-UTRAN measurement requirements. If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, UE is required to meet non high speed requirements no matter whether highSpeedMeasFlag-r16 or highSpeedEUTRACarrier-r16 is configured or not.

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

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

The UE shall filter RSRP and RSRQ measurements of each measured E-UTRA cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

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

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

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

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

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

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

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,EUTRAN. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects on an inter-RAT E-UTRAN carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

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

For a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE is 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\_HST \* Tevaluate,EUTRAN\_HST + NEUTRA\_carrier \* T evaluate,EUTRAN when Treselection = 0as speficied in table 4.2.2.5-1 and 4.2.2.5-2 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

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

If Treselection timer has a non zero value and the inter-RAT E-UTRA cell is satisfied with the reselection criteria which are 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 that cell.

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

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

Table 4.2.2.5-1: Tdetect,EUTRAN, Tmeasure,EUTRAN, and Tevaluate,EUTRAN

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN [s] (number of DRX cycles) | Tmeasure,EUTRAN [s] (number of DRX cycles) | Tevaluate,EUTRAN  [s] (number of DRX cycles) |
| 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) |
| 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) |

Table 4.2.2.5-2: Tdetect,EUTRAN\_HST, Tmeasure,EUTRAN\_HST, and Tevaluate,EUTRAN\_HST for UE configured with highSpeedMeasFlag-r16

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EURAN\_HST [s] (number of DRX cycles) | Tmeasure,EUTRAN\_HST [s] (number of DRX cycles) | Tevaluate,EUTRAN\_HST  [s] (number of DRX cycles) |
|  |
| 0.32 | 4.16 (13) | 0.64 (2) | 0.96 (3) |
| 0.64 | 7.68 (12) | 1.28 (2) | 1.92 (3) |
| 1.28 | 8.96 (7) | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| Note 1: When highSpeedMeasFlag-r16 is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[interRAT-MeasurementEnhancement-r16]*. | | | |

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

Table 4.2.2.5-3: Tdetect,EUTRAN, Tmeasure,EUTRAN, and Tevaluate,EUTRAN for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN [s] (number of DRX or eDRX cycles Note 3) | Tmeasure,EUTRAN [s] (number of DRX or eDRX cycles Note 3) | Tevaluate,E-UTRAN  [s] (number of DRX or eDRX cycles Note 3) |
| 2.56 | N/A | N/A | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| 5.12 | N/A | N/A | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 | N/A | N/A | 235.52 (23) | 10.24 (1) | 20.48 (2) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥1.28 (1) | (23) | 0.32 (1) | 0.64 (2) |
|  | 0.64 | ≥1.28 (1) |  | 0.64 (1) | 1.28 (2) |
|  | 1.28 | ≥2.56 (2) |  | 1.28 (1) | 2.56 (2) |
|  | 2.56 | ≥5.12 (4) |  | 2.56 (1) | 5.12 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise.  NOTE 4: The lower bound of PTW length is derived based on .  NOTE 5: When eDRX=20.48s and DRX=0.32s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles. | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, 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.

#### 4.2.2.6 Maximum interruption in paging reception

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

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 + 2\*Ttarget\_cell\_SMTC\_period ms. 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*.

At inter-RAT 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 for paging reception of the target inter-RAT cell. For NR to E-UTRAN cell re-selection the interruption time must not exceed TSI-EUTRA + 55 ms.

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.

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.

#### 4.2.2.7 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 and E-UTRA carrier frequencies broadcasted in system information.

For a UE configured with early measurement reporting, while T331 is running, Nlayers is the combined total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information and carriers configured for idle mode CA measurements.

Note: combined total number means that if a carrier is a high priority carrier and additionally a carrier configured for idle mode CA measurements, it only counts as one carrier.

#### 4.2.2.8 Minimum requirement at transitions

When switching from low mobility scenario or not-at-cell-edge scenario to low mobility and not-at-cell-edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to low mobility scenario or not-at-cell-edge scenario over measurement period (Trelaxed) and thereafter switch to requirements corresponding to low mobility and not-at-cell-edge scenario. The measurement period, Trelaxed, is any of:

- Tmeasure,NR\_Intra and Tevaluate,NR\_Intra, defined in section 4.2.2.9 for intra-frequency measurements on NR cells,

- Tmeasure,NR\_Inter and Tevaluate,NR\_Inter defined in section 4.2.2.10 for inter-frequency measurements on NR cells and

- Tmeasure,EUTRAN and Tevaluate,EUTRAN defined in sections 4.2.2.11 for inter-RAT E-UTRAN measurements.

When switching from low mobility and not-at-cell-edge scenario to low mobility scenario or not-at-cell-edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to low mobility scenario or not-at-cell-edge scenario upon fulfilling the switching criteria.

When switching from normal mode to low mobility scenario or not-at-cell-edge scenario or low mobility and not-at-cell-edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to normal mode over measurement period (Tnormal) and thereafter switch to requirements corresponding to low mobility scenario or not-at-cell-edge scenario or low mobility and not-at-cell-edge scenario. The measurement period, Tnormal, is any of:

- Tmeasure,NR\_Intra and Tevaluate,NR\_Intra, defined in section 4.2.2.3 for intra-frequency measurements on NR cells,

- Tmeasure,NR\_Inter and Tevaluate,NR\_Inter defined in section 4.2.2.4 for inter-frequency measurements on NR cells and

- Tmeasure,EUTRAN and Tevaluate,EUTRAN defined in sections 4.2.2.5 for inter-RAT E-UTRAN measurements.

When switching from low mobility scenario or not-at-cell-edge scenario or low mobility and not-at-cell-edge scenario to normal mode during cell-reselection period, the UE shall fulfill the requirements corresponding to normal mode upon fulfilling the switching criteria.

No requirement is defined for multiple transitions of scenarios within one measurement period.

#### 4.2.2.9 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion

##### 4.2.2.9.1 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 critera:

- 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.

##### 4.2.2.9.2 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 has fulfilled, or

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

The requirements defined in clause 4.2.2.3 apply for this clause except that:

- Tdetect,NR\_Intraas specified in Table 4.2.2.9. 2-1.

- Tmeasure,NR\_Intra as specified in Table 4.2.2.9. 2-1.

- Tevaluate,NR\_Intra as specified in Table 4.2.2.9. 2-1.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2.2.9.2-2 and Table 4.2.2.9.2-3 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2, respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2.2.9.2-4 and Table 4.2.2.9.2-5 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

Table 4.2.2.9.2-1: Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | | Tdetect,NR\_Intra [s] (number of DRX cycles) | Tmeasure,NR\_Intra [s] (number of DRX cycles) | Tevaluate,NR\_Intra  [s] (number of DRX cycles) |
|  | FR1 | FR2-1Note1 | FR2-2 Note2 |
| 0.32 | 1 | 8 | 12 | 11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1) | 1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1) | 5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1) |
| 0.64 |  | 5 | 8 | 17.92 x N1 x K1 (28 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) | 5.12 x N1 x K1 (8 x N1 x K1) |
| 1.28 |  | 4 | 6 | 32 x N1 x K1 (25 x N1 x K1) | 1.28 x N1 x K1 (1 x N1 x K1) | 6.4 x N1 x K1 (5 x N1 x K1) |
| 2.56 |  | 3 | 5 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.  Note 3: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If high layer signalling *smtc2-LP-r16* is configured, for cells indicated in the *pci-List* parameter in *smtc2-LP-r16*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2-LP-r16*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc*.  Note 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | | | | |

Table 4.2.2.9.2-2: Tdetect,NR\_Intra\_Relax, Tmeasure,NR\_Intra\_Relax and Tevaluate,NR\_Intra\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: Applies for UE of all supporting FR1 power classes.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2.2.9.2-3: Tdetect,NR\_Intra\_ Relax, Tmeasure,NR\_Intra\_ Relax and Tevaluate,NR\_Intra\_ Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2-1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x N1 x K1 (23 x N1 x K1) | 5.12 x N1 x K1 (1 x N1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x N1 x K1 (23 x N1 x K1) | 10.24 x N1 x K1 (1 x N1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: N1 = 3.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2.2.9.2-4: Tdetect,NR\_Intra\_Relax, Tmeasure,NR\_Intra\_Relax and Tevaluate,NR\_Intra\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tevaluate,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x M2 x K1 (1 x M2 x K1) | 0.64 x M2 x K1 (2 x M2 x K1) |
|  | 0.64 | ≥[3.84] ([3]) |  | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
|  | 1.28 | ≥[7.68] ([6]) |  | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
|  | 2.56 | ≥[15.36] ([12]) |  | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | | | |

Table 4.2.2.9.2-5: Tdetect,NR\_Intra\_Relax, Tmeasure,NR\_Intra\_Relax and Tevaluate,NR\_Intra\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2-1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Tdetect,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | | Tevaluate,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥15.36 (12) | 8 | K1 x  (23 x N1 x K1) | | 0.32 x N1 x K1 (1 x N1 x K1) | 0.64 x N1 x K1 (2 x N1 x K1) |
|  | 0.64 | ≥19.2 (15) | 5 |  | | 0.64 x N1 x K1 (1 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) |
|  | 1.28 | ≥30.72 (24) | 4 |  | | 1.28 x N1 x K1 (1 x N1 x K1) | 2.56 x N1 x K1 (2 x N1 x K1) |
|  | 2.56 | 40.96 (32) | 3 |  | | 20.48 | 40.96 |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: The measurement shall not be performed across PTW’s. In this case the measurement is performed in the next available PTW.  Note 6: The evaluation shall not be performed across PTW’s.  Note 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation criterion* [2]. | | | | | | | |

##### 4.2.2.9.3 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 has fulfilled, or

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

The requirements defined in clause 4.2.2.3 apply for this clause except that:

- Tdetect,NR\_Intraas specified in Table 4.2.2.9.3-1.

- Tmeasure,NR\_Intra as specified in Table 4.2.2.9.3-1.

- Tevaluate,NR\_Intra as specified in Table 4.2.2.9.3-1.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2.2.9.3-2 and Table 4.2.2.9.3-3 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2, respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2.2.9.3-4 and Table 4.2.2.9.3-5 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

Table 4.2.2.9.3-1: Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | | Tdetect,NR\_Intra [s] (number of DRX cycles) | Tmeasure,NR\_Intra [s] (number of DRX cycles) | Tevaluate,NR\_Intra  [s] (number of DRX cycles) |
|  | FR1 | FR2-1Note1 | FR2-2 Note2 |
| 0.32 | 1 | 8 | 12 | 11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1) | 1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1) | 5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1) |
| 0.64 |  | 5 | 8 | 17.92 x N1 x K1 (28 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) | 5.12 x N1 x K1 (8 x N1 x K1) |
| 1.28 |  | 4 | 6 | 32 x N1 x K1 (25 x N1 x K1) | 1.28 x N1 x K1 (1 x N1 x K1) | 6.4 x N1 x K1 (5 x N1 x K1) |
| 2.56 |  | 3 | 5 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.  Note 3: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If high layer signalling *smtc2-LP-r16* is configured, for cells indicated in the *pci-List* parameter in *smtc2-LP-r16*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2-LP-r16*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc*.  Note 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | | |

Table 4.2.2.9.3-2: Tdetect,NR\_Intra\_Relax, Tmeasure,NR\_Intra\_Relax and Tevaluate,NR\_Intra\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: Applies for UE of all supporting FR1 power classes.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2.2.9.3-3: Tdetect,NR\_Intra\_Relax, Tmeasure,NR\_Intra\_Relax and Tevaluate,NR\_Intra\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Intra\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x N1 x K1 (23 x N1 x K1) | 5.12 x N1 x K1 (1 x N1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x N1 x K1 (23 x N1 x K1) | 10.24 x N1 x K1 (1 x N1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: N1 = 3.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2.2.9.3-4: Tdetect,NR\_Intra\_Relax, Tmeasure,NR\_Intra\_Relax and Tevaluate,NR\_Intra\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tevaluate,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x M2 x K1 (1 x M2 x K1) | 0.64 x M2 x K1 (2 x M2 x K1) |
|  | 0.64 | ≥[3.84] ([3]) |  | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
|  | 1.28 | ≥[7.68] ([6]) |  | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
|  | 2.56 | ≥[15.36] ([12]) |  | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | |

Table 4.2.2.9.3-5: Tdetect,NR\_Intra\_Relax, Tmeasure,NR\_Intra\_Relax and Tevaluate,NR\_Intra\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Tdetect,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | | Tevaluate,NR\_Intra\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥15.36 (12) | 8 | K1 x  (23 x N1 x K1) | | 0.32 x N1 x K1 (1 x N1 x K1) | 0.64 x N1 x K1 (2 x N1 x K1) |
|  | 0.64 | ≥19.2 (15) | 5 |  | | 0.64 x N1 x K1 (1 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) |
|  | 1.28 | ≥30.72 (24) | 4 |  | | 1.28 x N1 x K1 (1 x N1 x K1) | 2.56 x N1 x K1 (2 x N1 x K1) |
|  | 2.56 | 40.96 (32) | 3 |  | | 20.48 | 40.96 |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: The measurement shall not be performed across PTW’s. In this case the measurement is performed in the next available PTW.  Note 6: The evaluation shall not be performed across PTW’s.  Note 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation criterion* [2]. | | | | | | | |

##### 4.2.2.9.4 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

- has also 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\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra as defined in Table 4.2.2.3-1.

#### 4.2.2.10 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

##### 4.2.2.10.1 Introduction

This clause contains the requirements for measurements on inter-frequency NR cells when the UE is configured with any of 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.

##### 4.2.2.10.2 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 has fulfilled, or

- UE is configured with both *lowMobilityEvaluation* [2] and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and

- UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

The UE shall not relax measurements on NR inter-frequency carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

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

- Tdetect,NR\_Inter\_Relaxas specified in Table 4.2.2.10.2-1.

- Tmeasure,NR\_Inter\_Relax as specified in Table 4.2.2.10.2-1.

- Tevaluate,NR\_Inter\_Relax as specified in Table 4.2.2.10.2-1.

- The UE shall be able to evaluate whether a newly detectable inter-frequency NR cell meets the reselection criteria defined in TS38.304 [1] within Ncarrier\_Relax \* Tdetect,NR\_Inter\_Relax + Ncarrier\_Non\_relax \* Tdetect,NR\_Inter. Cells which have been detected shall be measured at least every Ncarrier\_Relax \* Tmeasure,NR\_Inter\_Relax + Ncarrier\_Non\_relax \* Tmeasure,NR\_Inter. The UE shall be able to evaluate that an already identified inter-frequency NR cell has met reselection criterion defined in TS 38.304 [1] within Ncarrier\_Relax \*Tevaluate,NR\_Inter\_Relax + Ncarrier\_Non\_relax \* Tevaluate,NR\_Inter.

- When T331 is running,

- The parameter Ncarrier\_Relax is the total number of NR inter-frequency carriers not configured for idle mode CA/DC measurements.

- The parameter Ncarrier\_Non\_relax is the total number of NR inter-frequency carriers configured for idle mode CA/DC measurements.

- When T331 is not running,

- The parameter Ncarrier\_Relax is the total number of inter-frequency carriers configured for mobility measurements only and the number of inter-frequency carriers configured for both mobility measurement and idle mode CA/DC measurements.

- The parameter Ncarrier\_Non\_relax =0.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 4.2.2.7 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 4.2.2.7.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2.2.10.2-2 and Table 4.2.2.10.2-3 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2, respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2.2.10.2-4 and Table 4.2.2.10.2-5 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

Table 4.2.2.10.2-1: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | | | **Tdetect,NR\_Inter [s] (number of DRX cycles)** | **Tmeasure,NR\_Inter [s] (number of DRX cycles)** | **Tevaluate,NR\_Inter [s] (number of DRX cycles)** |
| **FR1** | **FR2-1Note1** | FR2-2 Note2 |
| 0.32 | 1 | 8 | 12 | 11.52 x N1 x K1 x 1.5 (36 x N1 x K1 x 1.5) | 1.28 x N1 x K1x 1.5 (4 x N1 x K1 x 1.5) | 5.12 x N1 x K1x 1.5 (16 x N1 x K1 x 1.5) |
| 0.64 |  | 5 | 8 | 17.92x N1 x K1 (28 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) | 5.12 x N1 x K1 (8 x N1 x K1) |
| 1.28 |  | 4 | 6 | 32 x N1 x K1 (25 x N1 x K1) | 1.28 x N1 x K1 (1 x N1 x K1) | 6.4 x N1 x K1 (5 x N1 x K1) |
| 2.56 |  | 3 | 5 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the low mobility. | | | | | | |

Table 4.2.2.10.2-2: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | Tdetect,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: Applies for UE of all supporting FR1 power classes.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2.2.10.2-3: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | Tdetect,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x N1 x K1 (23 x N1 x K1) | 5.12 x N1 x K1 (1 x N1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x N1 x K1 (23 x N1 x K1) | 10.24 x N1 x K1 (1 x N1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: N1 = 3.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2.2.10.2-4: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tevaluate,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x 1.5 x K1 (1 x M2 x K1) | 0.64 x 1.5 x K1 (2 x M2 x K1) |
|  | 0.64 | ≥[3.84] ([3]) |  | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
|  | 1.28 | ≥[7.68] ([6]) |  | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
|  | 2.56 | ≥[15.36] ([12]) |  | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | | | |

Table 4.2.2.10.2-5: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Tdetect,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | | Tevaluate,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥15.36 (12) | 8 | K1 x  (23 x N1 x K1) | | 0.32 x N1 x K1 (1 x N1 x K1) | 0.64 x N1 x K1 (2 x N1 x K1) |
|  | 0.64 | ≥19.2 (15) | 5 |  | | 0.64 x N1 x K1 (1 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) |
|  | 1.28 | ≥30.72 (24) | 4 |  | | 1.28 x N1 x K1 (1 x N1 x K1) | 2.56 x N1 x K1 (2 x N1 x K1) |
|  | 2.56 | 40.96 (32) | 3 |  | | 20.48 | 40.96 |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: The measurement shall not be performed across PTW’s. In this case the measurement is performed in the next available PTW.  Note 6: The evaluation shall not be performed across PTW’s.  Note 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation criterion* [2]. | | | | | | | |

##### 4.2.2.10.3 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 has fulfilled or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and

- UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

The UE shall not relax measurements on NR inter-frequency carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the requirements defined in clause 4.2.2.4 apply for this clause except that:

- Tdetect,NR\_Inter\_Relaxas specified in Table 4.2.2.10.3-1.

- Tmeasure,NR\_Inter\_Relax as specified in Table 4.2.2.10.3-1.

- Tevaluate,NR\_Inter\_Relax as specified in Table 4.2.2.10.3-1.

- The UE shall be able to evaluate whether a newly detectable inter-frequency NR cell meets the reselection criteria defined in TS38.304 [1] within Ncarrier\_Relax \* Tdetect,NR\_Inter\_Relax + Ncarrier\_Non\_relax \* Tdetect,NR\_Inter. Cells which have been detected shall be measured at least every Ncarrier\_Relax \* Tmeasure,NR\_Inter\_Relax + Ncarrier\_Non\_relax \* Tmeasure,NR\_Inter. The UE shall be able to evaluate that an already identified inter-frequency NR cell has met reselection criterion defined in TS 38.304 [1] within Ncarrier\_Relax \* Tevaluate,NR\_Inter\_Relax + Ncarrier\_Non\_relax \* Tevaluate,NR\_Inter.

- When T331 is running,

- The parameter Ncarrier\_Relax is the total number of NR inter-frequency carriers not configured for idle mode CA/DC measurements.

- The parameter Ncarrier\_Non\_relax is the total number of NR inter-frequency carriers configured for idle mode CA/DC measurements.

- When T331 is not running,

- The parameter Ncarrier\_Relax is the total number of inter-frequency carriers configured for mobility measurements only and the number of inter-frequency carriers configured for both mobility measurement and idle mode CA/DC measurements. - The parameter Ncarrier\_Non\_relax =0.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2.2.10.3-2 and Table 4.2.2.10.3-3 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2, respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2.2.10.3-4 and Table 4.2.2.10.3-5 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

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 4.2.2.7

Table 4.2.2.10.3-1: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | | | **Tdetect,NR\_Inter [s] (number of DRX cycles)** | **Tmeasure,NR\_Inter [s] (number of DRX cycles)** | **Tevaluate,NR\_Inter [s] (number of DRX cycles)** |
| **FR1** | **FR2-1Note1** | FR2-2 Note2 |
| 0.32 | 1 | 8 | 12 | 11.52 x N1 x K1 x 1.5 (36 x N1 x K1 x 1.5) | 1.28 x N1 x K1 x 1.5 (4 x N1 x K1 x 1.5) | 5.12 x N1 x K1 x 1.5 (16 x N1 x K1 x 1.5) |
| 0.64 |  | 5 | 8 | 17.92x N1 x K1 (28 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) | 5.12 x N1 x K1 (8 x N1 x K1) |
| 1.28 |  | 4 | 6 | 32 x N1 x K1 (25 x N1 x K1) | 1.28 x N1 x K1 (1 x N1 x K1) | 6.4 x N1 x K1 (5 x N1 x K1) |
| 2.56 |  | 3 | 5 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | | |

Table 4.2.2.10.3-2: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for UE of all supporting FR1 power classes.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2.2.10.3-3: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Inter\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x N1 x K1 (23 x N1 x K1) | 5.12 x N1 x K1 (1 x N1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x N1 x K1 (23 x N1 x K1) | 10.24 x N1 x K1 (1 x N1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: N1 = 3.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2.2.10.3-4: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tevaluate,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x M2 x K1 (1 x M2 x K1) | 0.64 x M2 x K1 (2 x M2 x K1) |
|  | 0.64 | ≥[3.84] ([3]) |  | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
|  | 1.28 | ≥[7.68] ([6]) |  | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
|  | 2.56 | ≥[15.36] ([12]) |  | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra is expected.  Note 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.10.10-6: Tdetect,NR\_Inter\_Relax, Tmeasure,NR\_Inter\_Relax and Tevaluate,NR\_Inter\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Tdetect,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | | Tevaluate,NR\_Inter\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥15.36 (12) | 8 | K1 x  (23 x N1 x K1) | | 0.32 x N1 x K1 (1 x N1 x K1) | 0.64 x N1 x K1 (2 x N1 x K1) |
|  | 0.64 | ≥19.2 (15) | 5 |  | | 0.64 x N1 x K1 (1 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) |
|  | 1.28 | ≥30.72 (24) | 4 |  | | 1.28 x N1 x K1 (1 x N1 x K1) | 2.56 x N1 x K1 (2 x N1 x K1) |
|  | 2.56 | 40.96 (32) | 3 |  | | 20.48 | 40.96 |
| Note 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: The measurement shall not be performed across PTW’s. In this case the measurement is performed in the next available PTW.  Note 6: The evaluation shall not be performed across PTW’s.  Note 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation criterion* [2]. | | | | | | | |

##### 4.2.2.10.4 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:

- T331 timer is not running for EMR measurements on inter-frequency NR carrier, and

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

- Has also fulfilled both criteria

In this case the UE is not required to meet Tdetect,NR\_Inter, Tmeasure,NR\_Inter and Tevaluate,NR\_Inter as defined in Table 4.2.2.4-1.

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.

#### 4.2.2.11 Measurements of inter-RAT E-UTRAN cells for UE configured with relaxed measurement criterion

##### 4.2.2.11.1 Introduction

This clause contains the requirements for measurements on inter-RAT E-UTRAN cells when the UE is configured with any of following relaxed measurement critera:

- 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.

##### 4.2.2.11.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- T331 timer is not running for EMR measurements on inter-RAT E-UTRAN, and

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled, or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and

- UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

The UE shall not relax measurements on inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the requirements defined in clause 4.2.2.5 apply for this clause except that:

- Tdetect,EUTRAN\_Relaxas specified in Table 4.2.2.11.2-1.

- Tmeasure,EUTRAN\_Relax as specified in Table 4.2.2.11.2-1.

- Tevaluate,EUTRAN\_Relax as specified in Table 4.2.2.11.2-1.

- The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS38.304 [1] within Ncarrier\_Relax \* Tdetect,EUTRAN\_Relax + Ncarrier\_Non\_relax \* Tdetect,EUTRAN. Cells which have been detected shall be measured at least every Ncarrier\_Relax \* Tmeasure,EUTRAN\_Relax + Ncarrier\_Non\_relax \* Tmeasure,EUTRAN. The UE shall be able to evaluate that an already identified inter-RAT E-UTRAN cell has met reselection criterion defined in TS 38.304 [1] within NEUTRAN carrier\_Relax \* Tevaluate,EUTRAN\_Relax + NEUTRAN carrier\_Non\_relax \* Tevaluate,EUTRAN.

- When T331 is running,

- The parameter Ncarrier\_Relax is the total number of inter-RAT E-UTRAN carriers not configured for idle mode CA/DC measurements.

- The parameter Ncarrier\_Non\_relax is the total number of inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements.

- When T331 is not running,

- The parameter Ncarrier\_Relax is the total number of inter-RAT E-UTRAN carriers configured for mobility measurements only and the number of inter-RAT E-UTRAN carriers configured for both mobility measurement and idle mode CA/DC measurements.

- The parameter Ncarrier\_Non\_relax =0.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2.2.11.2-2 are applicable for eDRX cycle < 10.24 s.

If the UE is configured with eDRX\_IDLE cycle ≥ 10.24 s, then the requirements in Table 4.2.2.11.2-3, apply provided that filtering of a measurement is done within a single PTW and provided that the eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ and the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every K2\*Thigher\_priority\_search seconds where Thigher\_priority\_search is described in clause 4.2.2.7 and, K2 = 60. Otherwise if the UE is not configured with *highPriorityMeasRelax* [2] then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.7.

Table 4.2.2.11.2-1: Tdetect,EUTRAN\_Relax, Tmeasure,EUTRAN\_Relax, and Tevaluate,EUTRAN\_Relax

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Relax [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Relax [s] (number of DRX cycles) | Tevaluate,EUTRAN\_Relax  [s] (number of DRX cycles) |
| 0.32 | 11.52 x K1 (36 x K1) | 1.28 x K1 (4 x K1) | 5.12 x K1 (16 x K1) |
| 0.64 | 17.92 x K1 (28 x K1) | 1.28 x K1 (2 x K1) | 5.12 x K1 (8 x K1) |
| 1.28 | 32 x K1 (25 x K1) | 1.28 x K1 (1 x K1) | 6.4 x K1 (5 x K1) |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2.2.11.2-2: Tdetect, EUTRAN\_Relax, Tmeasure, EUTRAN \_Relax and Tevaluate, EUTRAN \_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | Tdetect, EUTRAN \_Relax [s] (number of eDRX IDLE cycles) | Tmeasure, EUTRAN \_Relax [s] (number of eDRX IDLE cycles) | Tevaluate, EUTRAN \_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2.2.11.2-3: Tdetect, EUTRAN \_Relax, Tmeasure, EUTRAN \_Relax and Tevaluate, EUTRAN \_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect, EUTRAN \_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure, EUTRAN \_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tevaluate, EUTRAN \_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x K1 (1 x K1) | 0.64 x K1 (2 x K1) |
|  | 0.64 | ≥[3.84] ([3]) |  | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
|  | 1.28 | ≥[7.68] ([6]) |  | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
|  | 2.56 | ≥[15.36] ([12]) |  | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | | | |

##### 4.2.2.11.3 Measurements for UE fulfilling with not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- T331 timer is not running for EMR measurements on inter-RAT E-UTRAN, and

- UE is configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled, or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and

- UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

The UE shall not relax measurements on inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the requirements defined in clause 4.2.2.5 apply for this clause except that:

- Tdetect,EUTRAN\_Relaxas specified in Table 4.2.2.11.3-1.

- Tmeasure,EUTRAN\_Relax as specified in Table 4.2.2.11.3-1.

- Tevaluate,EUTRAN\_Relax as specified in Table 4.2.2.11.3-1.

- The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS38.304 [1] within Ncarrier\_Relax \* Tdetect,EUTRAN\_Relax + Ncarrier\_Non\_relax \* Tdetect,EUTRAN. Cells which have been detected shall be measured at least every Ncarrier\_Relax \* Tmeasure,EUTRAN\_Relax + Ncarrier\_Non\_relax \* Tmeasure,EUTRAN. The UE shall be able to evaluate that an already identified inter-RAT E-UTRAN cell has met reselection criterion defined in TS 38.304 [1] within NEUTRAN carrier\_Relax \* Tevaluate,EUTRAN\_Relax + NEUTRAN carrier\_Non\_relax \* Tevaluate,EUTRAN.

- When T331 is running,

- The parameter Ncarrier\_Relax is the total number of inter-RAT E-UTRAN carriers not configured for idle mode CA/DC measurements.

- The parameter Ncarrier\_Non\_relax is the total number of inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements.

- When T331 is not running,

- The parameter Ncarrier\_Relax is the total number of inter-RAT E-UTRAN carriers configured for mobility measurements only and the number of inter-RAT E-UTRAN carriers configured for both mobility measurement and idle mode CA/DC measurements.

- The parameter Ncarrier\_Non\_relax =0.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2.2.11.3-2 are applicable for eDRX cycle < 10.24 s.

If the UE is configured with eDRX\_IDLE cycle ≥ 10.24 s, then the requirements in Table 4.2.2.11.3-3, apply provided that filtering of a measurement is done within a single PTW and provided that the eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

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-RAT E-UTRAN frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.7.

Table 4.2.2.11.3-1: Tdetect,EUTRAN\_Relax, Tmeasure,EUTRAN\_Relax, and Tevaluate,EUTRAN\_Relax

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN [s] (number of DRX cycles) | Tmeasure,EUTRAN [s] (number of DRX cycles) | Tevaluate,EUTRAN  [s] (number of DRX cycles) |
| 0.32 | 11.52 x K1 (36 x K1) | 1.28 x K1 (4 x K1) | 5.12 x K1 (16 x K1) |
| 0.64 | 17.92 x K1 (28 x K1) | 1.28 x K1 (2 x K1) | 5.12 x K1 (8 x K1) |
| 1.28 | 32 x K1 (25 x K1) | 1.28 x K1 (1 x K1) | 6.4 x K1 (5 x K1) |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2.2.11.3-2: Tdetect, EUTRAN\_Relax, Tmeasure, EUTRAN\_Relax and Tevaluate, EUTRAN\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect, EUTRAN \_Relax [s] (number of eDRX IDLE cycles) | Tmeasure, EUTRAN\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate, EUTRAN\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2.2.11.3-3: Tdetect, EUTRAN\_Relax, Tmeasure, EUTRAN\_Relax and Tevaluate, EUTRAN\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect, EUTRAN\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,EUTRAN\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tevaluate,EUTRAN\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x K1 (1 x M2 x K1) | 0.64 x K1 (2 x M2 x K1) |
|  | 0.64 | ≥[3.84] ([3]) |  | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
|  | 1.28 | ≥[7.68] ([6]) |  | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
|  | 2.56 | ≥[15.36] ([12]) |  | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | |

##### 4.2.2.11.4 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- T331 timer is not running for EMR measurements on inter-RAT E-UTRAN, and

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

- has also fulfilled both criteria

In this case the UE is not required to meet Tdetect,EUTRAN , Tmeasure,EUTRAN and Tevaluate,EUTRAN as defined in Table 4.2.2.5-1.

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

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE shall search for inter-RAT E-UTRAN 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.

## 4.2A Cell Re-selection when subject to CCA

### 4.2A.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it. The requirements in clauses 4.2A.2.3, 4.2A.2.4, and 4.2A.2.6, apply when at least the target cell is on a carrier frequency subject to CCA, and the requirements in clauses 4.2A.2.2, and 4.2A.2.5 apply when at least the camping cell is on a carrier frequency subject to CCA.

When the UE is in either *Camped* *Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS 38.304, allowing the UE to limit its measurement activity.

In the requirements of clause 4.2A, the exceptions for side conditions apply as follows:

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

In the requirements of clause 4.2A.2, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but *N* candidate SSB positions for the same SS/PBCH block index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding detection, measurement, or evaluation period, where:

- For the cell detection procedure: *N* is at least one candidate SSB position (NOTE: the one candidate SSB position for the cell detection shall not be impacted by the set of candidate SSB positions which are already being measured by the UE within the current measurement period of the on-going measurements), and

- For other procedures in clause 4.2A.2: *N* are the first two successive candidate SSB positions when two or more candidate SSB positions are configured for this SSB index in one discovery burst transmission window, otherwise N is one candidate SSB position;

otherwise the SMTC occasion is considered as available at the UE.

### 4.2A.2 Requirements

#### 4.2A.2.1 UE measurement capability

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

- Intra-frequency carrier, and

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

- Depending on UE capability, 7 FDD E-UTRA inter-RAT carriers, and

- Depending on UE capability, 7 TDD E-UTRA inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC\_IDLE state shall be capable of monitoring a total of at least 14 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers. The inter-frequency carriers include carriers on unlicensed band and/or licensed band.

#### 4.2A.2.2 Measurement and evaluation when subject to CCA on the serving cell

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

- M1=2 if SMTC periodicity (TSMTC) > 20 ms and DRX cycle ≤ 0.64 second,

- otherwise M1=1.

- N1\*Mn is the maximum separation in DRX cycles between two measurements that are used for filtering.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2 but not separated in time by more than N1\*Mn, where Mn=2.

If the UE has evaluated according to Table 4.2A.2.2-1 in Nserv\_CCA 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.

UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure on the serving cell for at least N1\*Mp consecutive number of DRX cycles each with at least one SMTC occasion not available at the UE, where Mp=4 when DRX cycle length <1.28 s, Mp=2 when DRX cycle length ≥1.28 s.

UE shall initiate the measurements on neighbour cells of any intra-frequency or inter-frequency if it is unable to measure on serving cell during at least consecutive N1\*Mq number of DRX cycles each with at least one SMTC occasion not available at the UE, regardless of any condition of SnonIntraSearchP and SnonIntraSearchQ, where Mq=8 when DRX cycle length <1.28 s, Mq=4 when DRX cycle length ≥1.28 s.

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].

Table 4.2A.2.2-1: Nserv\_CCA

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | **Nserv\_CCA [number of DRX cycles]** |
| FR1 | FR2-2 Note 3 |
| 0.32 | 1 | 12 | N1\*M1\*(4+ Ms) |
| 0.64 |  | 8 | N1\*M1\*(4+ Ms) |
| 1.28 |  | 6 | N1\*(2+Ms) |
| 2.56 |  | 5 | N1\*(2+Ms) |
| Note 1: Ms is the number of groups of consecutive N1 DRX cycles each group with at least one SMTC occasion not available at the UE during Nserv\_CCA, and Ms< Ms,max  Note 2: Ms,max=8 for DRX cycle length < 1.28 s, Ms,max= 4 for DRX cycle length ≥ 1.28 s.  Note 3: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length. | | | |

The UE shall restart the measurements used for serving cell evaluation if Ms exceeds Ms,max.

#### 4.2A.2.3 Measurements of intra-frequency NR cells when subject to CCA on the serving cell and target cell

The UE shall be able to identify new intra-frequency cells with CCA 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.

When the intra-frequency measurement is performed on a neighbour cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17*of the cell configured in *SIB3*. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and perform measurement accordingly, and the requirements in clause 4.2A.2.3 shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in 4.2.2.3 shall apply.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS38.304 within Tdetect,NR\_Intra\_CCAwhen that Treselection= 0. An intra frequency cell is considered to be detectable according to the conditions defined in Annex B. 2. 8 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every Tmeasure,NR\_Intra\_CCA (see table 4.2A.2.3-1) for intra-frequency cells that are identified and measured according to the measurement rules. For a cell that is already identified, after 2 unsuccessful measurement attempts due to exceeding the maximum number of SMTC occasions not available at the UE, the UE shall detect cells on any of the configured serving- and/or non-serving carriers.

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\_CCA/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 [1] within Tevaluate,NR\_Intra\_CCA when Treselection = 0as specified in table 4.2A.2.3-1 provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3dB better ranked in FR1 or [4.5]dB better ranked in FR2-2.

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

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

- the cell is at least 3dB better ranked in FR1 or [4.5]dB better ranked in FR2-2 if the current serving cell is among them.

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

If Treselection timer has a non-zero value and the intra-frequency cell is satisfied with the reselection criteria, which are defined in TS38.304 [1], the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2A.2.3-1: Tdetect,NR\_Intra\_CCA, Tmeasure,NR\_Intra\_CCA and Tevaluate,NR\_Intra\_CCA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_Intra\_CCA [s] (number of DRX cycles) | Tmeasure,NR\_Intra\_CCA [s] (number of DRX cycles) | Tevaluate,NR\_Intra\_CCA  [s] (number of DRX cycles) |
| **FR1** | **FR2-2 Note 5** |
| 0.32 | 1 | 12 | 0.32xN1x(36+Md)xM2  {(36+Md)xN1xM2} | 0.32xN1x(4+Mm)xM2  {(4+Mm)xN1 xM2 | 0.32xN1x(16+Me) x M2  {(16+Me)xN1xM2} |
| 0.64 |  | 8 | 0.64xN1x(28+Md)  {(28+Md)xN1 } | 0.64xN1x(2+Mm)  {(2+Mm)xN1 } | 0.64xN1x(8+Me)  {(8+Me)xN1 } |
| 1.28 |  | 6 | 1.28xN1x(25+Md)  {(25+Md)xN1 } | 1.28xN1x(1+Mm)  {(1+Mm)xN1 } | 1.28xN1x(5+Me)  {(5+Me)xN1 } |
| 2.56 |  | 5 | 2.56xN1x(23+Md)  {(23+Md)xN1 } | 2.56xN1x(1+Mm)  {(1+Mm)xN1 } | 2.56xN1x(3+Me)  {(3+Me)xN1 } |
| Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 2: Md, Mm, Me are the number of groups of consecutive N1 DRX cycles each group with at least one SMTC occasion not available during the Tdetect,NR\_Intra\_CCA, Tmeasure,NR\_Intra\_CCA and Tevaluate,NR\_Intra\_CCA, and Mm ≤ Mm,max, Md ≤ Md,max and Me ≤  Me,max  Note 3: Mm,max = 16 for DRX cycle length = 0.32s; Mm,max = 8 for DRX cycle length = 0.64s; Mm,max = 4 for DRX cycle length = 1.28s; Mm,max = 4 for DRX cycle length = 2.56s.  Note 4: Md,max = 4\*Mm,max, Me,max = 2\*Mm,max.  Note 5: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length. | | | | | |

The UE shall restart the measurements upon exceeding Mm,max, Md,max, or Me,max.

#### 4.2A.2.4 Measurements of inter-frequency NR cells when subject to CCA on the target cell

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.

When the inter-frequency measurement is performed on a neighbour cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17*of the cell configured in *SIB4*. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and perform measurement accordingly, and the requirements in clause 4.2A.2.4 shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in 4.2.2.4 shall apply.

If Srxlev > SnonIntraSearchP  and Squal > SnonIntraSearchQ then the UE shall search for inter-frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2A.2.7.

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

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS38.304 within Kcarrier \* Tdetect,NR\_Inter + Kcarrier\_CCA \* Tdetect,NR\_Inter\_CCA 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 or [6.5]dB in FR2-2 for reselections based on ranking or 6dB in FR1 or [7.5]dB in FR2-2 for SS-RSRP reselections based on absolute priorities or 4dB in FR1 and [4]dB in FR2-2 for SS-RSRQ reselections based on absolute priorities. The parameter Kcarrier is the number of NR inter-frequency carriers on licensed band and Kcarrier\_CCA is the number of NR inter-frequency carriers on unlicensed band indicated by the serving cell. An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B. 2. 9 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\_CCA. If after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every Kcarrier \* Tmeasure,NR\_Inter + Kcarrier\_CCA \* Tmeasure,NR\_Inter\_CCA 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.

For a cell that is already identified, after 2 unsuccessful measurement attempts due to exceeding the maximum number of SMTC occasions not available at the UE, the UE shall detect cells on any of the configured serving- and/or non-serving carriers.

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\_CCA/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 within Kcarrier \* Tevaluate,NR\_Inter + Kcarrier\_CCA \* Tevaluate,NR\_Inter\_CCA when Treselection = 0as specified in table 4.2A.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 5dB better ranked in FR1 or [6.5]dB better ranked in FR2-2 or.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value [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 5dB better ranked in FR1 or [6.5]dB better ranked in FR2-2 if the current serving cell is among them. or

- 6dB in FR1 or [7.5]dB in FR2-2 for SS-RSRP reselections based on absolute priorities or

- 4dB in FR1 or [4]dB in FR2-2 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 4.2A.2.4-1 under the following conditions:

- TSMTC\_intra = TSMTC\_inter = 160 ms; where TSMTC\_intra and TSMTC\_inter are periodicities of the SMTC occasions configured for the intra-frequency carrier and the inter-frequency carrier respectively, and

- 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 [1].

Table 4.2A.2.4-1: Tdetect,NR\_Inter\_CCA, Tmeasure,NR\_Inter\_CCA and Tevaluate,NR\_Inter\_CCA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_Inter\_CCA [s] (number of DRX cycles) | Tmeasure,NR\_Inter\_CCA [s] (number of DRX cycles) | Tevaluate,NR\_Inter\_CCA  [s] (number of DRX cycles) |
| **FR1** | **FR2-2Note 5** |
| 0.32 | 1 | 12 | 0.32xN1x(36+Md)xM2  {(36+Md)xN1xM2} | 0.32xN1x(4+Mm) xM2  {(4+Mm)xN1xM2} | 0.32xN1x(16+Me) x M2  {(16+Me)xN1 xM2} |
| 0.64 |  | 8 | 0.64xN1x(28+Md)  {(28+Md)xN1 } | 0.64xN1x(2+Mm)  {(2+Mm)xN1 } | 0.64xN1x(8+Me)  {(8+Me)xN1 } |
| 1.28 |  | 6 | 1.28xN1x(25+Md)  {(25+Md)xN1 } | 1.28xN1x(1+Mm)  {(1+Mm)xN1 } | 1.28xN1x(5+Me)  {(5+Me)xN1} |
| 2.56 |  | 5 | 2.56xN1x(23+Md)  {(23+Md)xN1 } | 2.56xN1x(1+Mm)  {(1+Mm)xN1 } | 2.56xN1x(3+Me)  {(3+Me)xN1} |
| Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 2: Md, Mm, Me are the number of groups of consecutive N1 DRX cycles each group with at least one SMTC occasion not available at the UE during Tdetect,NR\_Inter\_CCA, Tmeasure,NR\_Inter\_CCA and Tevaluate,NR\_Inter\_CCA, and M m ≤ Mm,max, Md ≤ Md,max and Me ≤  Me,max  Note 3: Mm,max = 16 for DRX cycle length = 0.32s;  Mm,max = 8 for DRX cycle length = 0.64s;  Mm,max = 4 for DRX cycle length = 1.28s;  Mm,max = 4 for DRX cycle length = 2.56s  Note 4: Md,max = 4\*Mm,max, Me,max = 2\*Mm,max.  Note 5: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length. | | | | | |

The UE shall restart the measurements upon exceeding Mm,max, Md.max, or Me,max.

#### 4.2A.2.5 Measurements of inter-RAT E-UTRAN cells when subject to CCA on the serving cell

The requirements in clause 4.2.2.5 shall apply.

#### 4.2A.2.6 Maximum interruption in paging reception when subject to CCA on the target cell

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,CCA + 2\*Ttarget\_cell\_SMTC\_period.

At inter-RAT 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 for paging reception of the target inter-RAT cell. For NR to E-UTRAN cell re-selection the interruption time shall not exceed TSI-EUTRA + 55 ms.

TSI\_CCA 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.

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.

#### 4.2A.2.7 General requirements

The requirements in clause 4.2.2.7 shall apply.

## 4.2B Cell Re-selection for RedCap

### 4.2B.1 Introduction

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.

### 4.2B.2 Requirements

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

##### 4.2B.2.1.1 UE measurement capability for 1 Rx RedCap

For idle mode cell re-selection purposes, and for UE supporting *IdleInactiveMeasurements-r16* or *idleInactiveEUTRA-MeasReport-r16*, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and

- Depending on UE capability, 6 NR inter-frequency carriers, and

- Depending on UE capability, 6 FDD E-UTRA inter-RAT carriers, and

- Depending on UE capability, 6 TDD E-UTRA inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC\_IDLE state shall be capable of monitoring a total of at least 11 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers.

##### 4.2B.2.1.2 UE measurement capability for 2 Rx RedCap

The capability defined in section 4.2.2.1 apply for this section.

#### 4.2B.2.2 Measurement and evaluation of serving cell for RedCap UE

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

- M1=2 if SMTC periodicity (TSMTC) > 20 ms and DRX cycle ≤ 0.64 second,

- 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 DRX cycle/2.

If the UE is not configured with eDRX\_IDLE cycle and the UE has evaluated according to Table 4.2B.2.2-1 for both 1Rx RedCap and 2Rx RedCap in Nserv\_RedCap 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 4.2B.2.9.3, 4.2B.2.9.5, 4.2B.2.9.6, 4.2B.2.9.7, 4.2B.2.10.3, 4.2B.2.10.5, 4.2B.2.10.6, 4.2B.2.10.7, 4.2B.2.11.3, 4.2B.2.11.5, 4.2B.2.11.6, and 4.2B.2.11.7.

If the UE is configured with eDRX\_IDLE cycle and has evaluated according Nserv\_RedCap consecutive DRX cycles within a single PTW 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 4.2B.2.9.3, 4.2B.2.9.5, 4.2B.2.9.6, 4.2B.2.9.7, 4.2B.2.10.3, 4.2B.2.10.5, 4.2B.2.10.6, 4.2B.2.10.7, 4.2B.2.11.3, 4.2B.2.11.5, 4.2B.2.11.6, and 4.2B.2.11.7.

For the UE configured with eDRX\_IDLE cycle, Nserv\_RedCap is specified in Table 4.2B.2.2-2 for 1 Rx RedCap and 2 Rx RedCap in FR1 and in Table 4.2B.2.2-3 for FR2 for 2 Rx RedCap.

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 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\_IDLE cycle, or

- T= MAX (10 s, one eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle in FR1, or

- T= MAX (10 s, N1\* eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle less than 20.48s in FR2,

- Otherwise, T= MAX (10 s, one eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle no less than 20.48 s in FR2

Table 4.2B.2.2-1: Nserv\_RedCap

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Nserv\_RedCap [number of DRX cycles] |
|  | FR1 | FR2Note1 |  |
| 0.32 | 1 | 8 | M1\*N1\*4 |
| 0.64 |  | 5 | M1\*N1\*4 |
| 1.28 |  | 4 | N1\*2 |
| 2.56 |  | 3 | N1\*2 |
| Note 1: Applies for RedCap UE of all FR2 power class. | | | |

Table 4.2B.2.2-2: 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 1.28s 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 |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥[1.28] (1) | N1\*M1\*2 |
| 0.64 | ≥ 1.28 (1) (M1=1) or ≥ 2.56 (2) (M1=2) | N1\*M1\*2 |
| 1.28 | ≥2.56 (2) | N1\*2 |
| 2.56 | ≥5.12 (4) | N1\*2 |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 4: The lower bound of PTW length is derived based on . | | | | |

Table 4.2B.2.2-3: Nserv\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Nserv\_RedCap [number of DRX or eDRX cycles Note 4] |
| 2.56 | N/A | N/A | 3 | N1\*2 |
| 5.12 | N/A | N/A | 3 | N1\*2 |
| 10.24 | N/A | N/A | 3 | N1\*2 |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥5.12 (4) | 8 | N1\*2 |
| 0.64 | ≥6.4 (5) | 5 | N1\*2 |
| 1.28 | ≥10.24 (8) | 4 | N1\*2 |
| 2.56 | ≥15.36 (12) | 3 | N1\*2 |
| NOTE 1: Applies for RedCap UE of all FR2 power class.  NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 5: The lower bound of PTW length is derived based on .  NOTE 6: When eDRX=20.48s and DRX=0.32s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles. | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, 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.

#### 4.2B.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.

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 Tdetect,NR\_Intra\_RedCapwhen that Treselection= 0. An intra frequency cell is considered to be detectable according to the conditions defined in Annex B.1.4 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every Tmeasure,NR\_Intra\_RedCap 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 Tevaluate,NR\_Intra\_RedCap when Treselection = 0 provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3dB better ranked in FR1 or 4.5dB better ranked in FR2 for 2 Rx RedCap.

- the cell is at least 4dB 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 3dB better ranked in FR1 or 4.5dB better ranked in FR2 if the current serving cell is among them for 2 Rx RedCap.

- the cell is at least 4dB 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 signaled 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 non-zero 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 4.2B.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 4.2B.2.3-2 and Table 4.2B.2.3-3 for FR1 and FR2 respectively, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap when multiple PTWs are used.

Table 4.2B.2.3-1: Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_Intra\_RedCap [s] (number of DRX cycles) | Tmeasure,NR\_Intra\_RedCap [s] (number of DRX cycles) | Tevaluate,NR\_Intra\_RedCap  [s] (number of DRX cycles) |
|  | FR1 | FR2Note1 |  |  |  |
| 0.32 | 1 | 8 | 11.52 x N1 x M2 (36 x N1 x M2) | 1.28 x N1 x M2 (4 x N1 x M2) | 5.12 x N1 x M2 (16 x N1 x M2) |
| 0.64 |  | 5 | 17.92 x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 |  | 4 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 |  | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| Note 1: Applies for RedCap UE of all FR2 power class.  Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra\_RedCap is expected. | | | | | |

Table 4.2B.2.3-2: 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 1.28s 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) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥[1.28] ([1]) | (23) | 0.32 x M2 (1 x M2) | 0.64 x M2 (2 x M2) |
| 0.64 | ≥[1.28] ([1]) | 0.64 (1) | 1.28 (2) |
| 1.28 | ≥[2.56] ([2]) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥[5.12] ([4]) | 2.56 (1) | 5.12 (2) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  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 4.2B.2.3-3: Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Scaling Factor (N1)** Note1 | **Tdetect,NR\_Intra\_RedCap [s] (number of DRX cycles or eDRX cycles Note 4)** | **Tmeasure,NR\_Intra\_RedCap [s] (number of DRX cycles or eDRX cycles Note 4)** | **Tevaluate,NR\_Intra\_RedCap [s] (number of DRX cycles or eDRX cycles Note 4)** |
| 2.56 | - | - | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| 5.12 | - | - | 3 | 117.76 x N1 (23 x N1) | 5.12 x N1 (1 x N1) | 10.24 x N1 (2 x N1) |
| 10.24 | - | - | 3 | 235.52 x N1 (23 x N1) | 10.24 x N1 (1 x N1) | 20.48 x N1 (2 x N1) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥5.12 (4) | 8 | (23 x N1) | 0.32 x N1 (1 x N1) | 0.64 x N1 (2 x N1) |
| 0.64 | ≥6.4 (5) | 5 | 0.64 x N1 (1 x N1) | 1.28 x N1 (2 x N1) |
| 1.28 | ≥10.24 (8) | 4 | 1.28 x N1 (1 x N1) | 2.56 x N1 (2 x N1) |
| 2.56 | ≥15.36 (12) | 3 | 2.56 x N1 (1 x N1) | 5.12 x N1 (2 x N1) |
| NOTE 1: Applies for RedCap UE of all power class.  NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 5: The lower bound of PTW length is derived based on .  NOTE 6: When eDRX=20.48s and DRX=0.32s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles. | | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, 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.

#### 4.2B.2.4 Measurements of inter-frequency NR cells for RedCap UE

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

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

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

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within Kcarrier\_RedCap \* Tdetect,NR\_Inter\_RedCap 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 or 6.5 dB in FR2 for reselections based on ranking or

6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or

4 dB in FR1 and 4 dB in FR2 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\_RedCap is the number of NR inter-frequency carriers indicated by the serving cell. An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.5 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 Kcarrier\_RedCap \* Tmeasure,NR\_Inter\_RedCap 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 \* Tevaluate,NR\_Inter\_RedCap when Treselection = 0provided 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 5dB better ranked in FR1 or 6.5dB better ranked in FR2 for 2 Rx RedCap.

- the cell is at least [6dB] 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 TS38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

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

- the cell is at least 5dB better ranked in FR1 or 6.5dB better ranked in FR2 if the current serving cell is among them, or 6dB in FR1 or 7.5dB in FR2 for SS-RSRP reselections based on absolute priorities for 2 Rx RedCap or 4dB in FR1 or 4dB in FR2 for SS-RSRQ reselections based on absolute priorities for 2 Rx RedCap.

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

The 1 Rx RedCap UE applies *absThreshSS-BlocksConsolidation* as the signaled 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 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 and TSMTC\_inter are periodicities of the SMTC occasions configured for the intra-frequency carrier and the inter-frequency carrier respectively, and

- 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 defined in TS38.304 [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.2.4.1-1.

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 4.2B.2.4-2 and Table 4.2B.2.4-3 for FR1 and FR2 respectively. The requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the 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.

Table 4.2B.2.4-1: Tdetect,NR\_Inter\_RedCap, Tmeasure,NR\_Inter\_RedCap and Tevaluate,NR\_Inter\_RedCap

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_Inter\_RedCap [s] (number of DRX cycles) | Tmeasure,NR\_Inter\_RedCap [s] (number of DRX cycles) | Tevaluate,NR\_Inter\_RedCap [s] (number of DRX cycles) |
| FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x N1 x 1.5 (36 x N1 x 1.5) | 1.28 x N1 x 1.5 (4 x N1 x 1.5) | 5.12 x N1 x 1.5 (16 x N1 x 1.5) |
| 0.64 | 5 | 17.92x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | 4 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| Note 1: Applies for RedCap UE of all FR2 power class. | | | | | |

Table 4.2B.2.4-2: 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 1.28s 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) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥1.28 (1) | (23) | 0.32 x 1.5 (1 x 1.5) | 0.64 x 1.5 (2 x 1.5) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | 1.28 (2) |
| 1.28 | ≥2.56 (2) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥5.12 (4) | 2.56 (1) | 5.12 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 4: The lower bound of PTW length is derived based on . | | | | | |

Table 4.2B.2.4-3: Tdetect,NR\_Inter\_RedCap, Tmeasure,NR\_Inter\_RedCap and Tevaluate,NR\_Inter\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | 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 | - | - | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| 5.12 | - | - | 3 | 117.76 x N1 (23 x N1) | 5.12 x N1 (1 x N1) | 10.24 x N1 (2 x N1) |
| 10.24 | - | - | 3 | 235.52 x N1 (23 x N1) | 10.24 x N1 (1 x N1) | 20.48 x N1 (2 x N1) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥5.12 (4) | 8 | (23 x N1) | 0.32 x N1 (1 x N1) | 0.64 x N1 (2 x N1) |
| 0.64 | ≥6.4 (5) | 5 | 0.64 x N1 (1 x N1) | 1.28 x N1 (2 x N1) |
| 1.28 | ≥10.24 (8) | 4 | 1.28 x N1 (1 x N1) | 2.56 x N1 (2 x N1) |
| 2.56 | ≥15.36 (12) | 3 | 2.56 x N1 (1 x N1) | 5.12 x N1 (2 x N1) |
| NOTE 1: Applies for RedCap UE of all power class.  NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 5: The lower bound of PTW length is derived based on .  NOTE 6: When eDRX=20.48s and DRX=0.32s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles. | | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, 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.

#### 4.2B.2.5 Measurements of inter-RAT E-UTRAN cells for RedCap UE

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 4.2B.2.7.

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 for 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\_RedCap is the total number of configured E-UTRA carriers in the neighbour frequency list. 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 Tmeasure,EUTRAN\_RedCap/2.

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.x.y] are fulfilled for a corresponding Band, and

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

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

The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS38.304 [1] within (NEUTRA\_carrier\_RedCap) \* Tdetect,EUTRAN\_RedCap when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria are met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities for 2 Rx 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 that has not been reselected to, the filtering shall be such that the UE 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 = 0provided that the reselection criteria are met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities for 2 Rx 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 Treselection timer has a non-zero value and the inter-RAT E-UTRA cell is satisfied with the reselection criteria which are 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 that cell.

For 1 Rx RedCap and 2 Rx RedCap 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.

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 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.

Table 4.2B.2.5-1: Tdetect,EUTRAN\_RedCap, Tmeasure,EUTRAN\_RedCap, and Tevaluate,EUTRAN\_RedCap

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN [s] (number of DRX cycles) | Tmeasure,EUTRAN [s] (number of DRX cycles) | Tevaluate,EUTRAN  [s] (number of DRX cycles) |
| 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) |
| 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) |

Table 4.2B.2.5-2: Tdetect,EUTRAN\_RedCap, Tmeasure,EUTRAN\_RedCap, and Tevaluate,EUTRAN\_RedCap for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_RedCap [s] (number of DRX or eDRX cycles Note 3) | Tmeasure,EUTRAN\_RedCap [s] (number of DRX or eDRX cycles Note 3) | Tevaluate,E-UTRAN\_RedCap  [s] (number of DRX or eDRX cycles Note 3) |
| 2.56 | N/A | N/A | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| 5.12 | N/A | N/A | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 | N/A | N/A | 235.52 (23) | 10.24 (1) | 20.48 (2) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥1.28 (1) | (23) | 0.32 (1) | 0.64 (2) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | 1.28 (2) |
| 1.28 | ≥2.56 (2) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥5.12 (4) | 2.56 (1) | 5.12 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise.  NOTE 4: The lower bound of PTW length is derived based on .  NOTE 5: When eDRX=20.48s and DRX=0.32s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles. | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, 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.

#### 4.2B.2.6 Maximum interruption in paging reception for RedCap

The FDD, HD-FDD and TDD 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.

#### 4.2B.2.7 General requirements for RedCap

The requirements defined in section 4.2.2.7 apply for this section.

#### 4.2B.2.8 Minimum requirement at transitions

When switching from:

low mobility scenario to stationary scenario, or

from low mobility scenario to stationary and not-at-cell-edge scenario,

the UE shall fulfill the requirements corresponding to low mobility scenario over measurement period (Trelaxed) and thereafter switch to requirements corresponding to stationary scenario, or stationary and not-at-cell-edge scenario. The measurement period, Trelaxed, is any of:

- Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax, defined in section 4.2B.2.9 for intra-frequency measurements on NR cells,

- Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax defined in section 4.2B.2.10 for inter-frequency measurements on NR cells and

- Tmeasure,EUTRAN\_RedCap\_Relax and Tevaluate,EUTRAN\_RedCap\_Relax defined in sections 4.2B.2.11 for inter-RAT E-UTRAN measurements.

When switching from:

stationary scenario to low mobility scenario, or

stationary and not-at-cell-edge scenario to low mobility scenario,

the UE shall fulfill the requirements corresponding to low mobility scenario upon fulfilling the switching criteria.

When switching from normal mode to low mobility scenario, stationary scenario or stationary and not-at-cell edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to normal mode over measurement period (Tnormal) and thereafter switch to requirements corresponding to low mobility scenario, stationary scenario or stationary and not-at-cell edge scenario. The measurement period, Tnormal, is any of:

- Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap, defined in section 4.2B.2.3 for intra-frequency measurements on NR cells,

- Tmeasure,NR\_Inter\_RedCap and Tevaluate,NR\_Inter\_RedCap defined in section 4.2B.2.4 for inter-frequency measurements on NR cells and

- Tmeasure,EUTRAN\_RedCap and Tevaluate,EUTRAN\_RedCap defined in sections 4.2B.2.5 for inter-RAT E-UTRAN measurements.

When switching from:

low mobility scenario to normal mode, or

stationary scenario to normal mode, or

stationary and not-at-cell-edge scenario to normal mode

the UE shall fulfill the requirements corresponding to normal mode upon fulfilling the switching criteria.

No requirement is defined for multiple transitions of scenarios within one measurement period.

#### 4.2B.2.9 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion for RedCap

##### 4.2B.2.9.1 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 critera:

- Relaxed measurement criterion for a stationary UE defined in clause 5.2.4.9.3 in [1],

- Relaxed measurement criteria for a stationary UE and not-at-cell edge defined in clause 5.2.4.9.4 in [1],

- Both low mobility criterion and stationary criterion as defined in clause 5.2.4.9.1 and 5.2.4.9.3 or 5.2.4.9.4 in [1] respectively.

- 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.

##### 4.2B.2.9.2 Measurements for UE fulfilling stationary criterion

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

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and UE has fulfilled that criterion, or

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled only the *stationaryMobilityEvaluation* [2] criterion

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

- Tdetect,NR\_Intra\_RedCap\_Relaxas specified in Table 4.2B.2.9.2-1 and Table 4.2B.2.9.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,NR\_Intra\_RedCap\_Relax as specified in Table 4.2B.2.9.2-1 and Table 4.2B.2.9.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,NR\_Intra\_RedCap\_Relax as specified in Table 4.2B.2.9.2-1 and Table 4.2B.2.9.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.9.2-3 and Table 4.2B.2.9.2-4 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2 respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2B.2.9.2-5 and Table 4.2B.2.9.2-6 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

Table 4.2B.2.9.2-1: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UEs fulfilling stationary criterion for 1 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax  [s] (number of DRX cycles) |
|  |  |  |  |
| 0.32 | 11.52 x M2 x K3 (36 x M2 x K3) | 1.28 x M2 x K3 (4 x M2 x K3) | 5.12 x M2 x K3 (16 x M2 x K3) |
| 0.64 | 17.92 x K3 (28 x K3) | 1.28 x K3 (2 x K3) | 5.12 x K3 (8 x K3) |
| 1.28 | 32 x K3 (25 x K3) | 1.28x K3 (1 x K3) | 6.4 x K3 (5 x K3) |
| 2.56 | 58.88 x K3 (23 x K3) | 2.56 x K3 (1 x K3) | 7.68 x K3 (3 x K3) |
| Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra is expected.  Note 2: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.9.2-2: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UEs fulfilling stationary criterion for 2 Rx RedCap UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax  [s] (number of DRX cycles) |
|  | FR1 | FR2Note1 |  |  |  |
| 0.32 | 1 | 8 | 11.52 x N1 x M2 x K3 (36 x N1 x M2 x K3) | 1.28 x N1 x M2 x K3 (4 x N1 x M2 x K3) | 5.12 x N1 x M2 x K3 (16 x N1 x M2 x K3) |
| 0.64 |  | 5 | 17.92 x N1 x K3 (28 x N1 x K3) | 1.28 x N1 x K3 (2 x N1 x K3) | 5.12 x N1 x K3 (8 x N1 x K3) |
| 1.28 |  | 4 | 32 x N1 x K3 (25 x N1 x K3) | 1.28 x N1 x K3 (1 x N1 x K3) | 6.4 x N1 x K3 (5 x N1 x K3) |
| 2.56 |  | 3 | 58.88 x N1 x K3 (23 x N1 x K3) | 2.56 x N1 x K3 (1 x N1 x K3) | 7.68 x N1 x K3 (3 x N1 x K3) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra is expected.  Note 3: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.9.2-3: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles)** | **Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles)** | **Tevaluate,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles)** |
|
| 2.56 | 58.88 x K3 (23 x K3) | 2.56 x K3 (1 x K3) | 7.68 x K3 (3 x K3) |
| 5.12 | 117.76 x K3 (23 x K3) | 5.12 x K3 (1 x K3) | 10.24 x K3 (2 x K3) |
| 10.24 | 235.52 x K3 (23 x K3) | 10.24 x K3 (1 x K3) | 20.48 x K3 (2 x K3) |
| Note 1: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.9.2-4: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles)** | **Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles)** | **Tevaluate,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles)** |
|
| 2.56 | 58.88 x N1 x K3 (23 x N1 x K3) | 2.56 x N1 x K3 (1 x N1 x K3) | 7.68 x N1 x K3 (3 x N1 x K3) |
| 5.12 | 117.76 x N1 x K3 (23 x N1 x K3) | 5.12 x N1 x K3 (1 x N1 x K3) | 10.24 x N1 x K3 (2 x N1 x K3) |
| 10.24 | 235.52 x N1 x K3 (23 x N1 x K3) | 10.24 x N1 x K3 (1 x N1 x K3) | 20.48 x N1 x K3 (2 x N1 x K3) |
| Note 1: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.9.2-5: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[6.4] ([5]) | (23 x K3) | 0.32 x M2 x K3 (1 x M2 x K3) | 0.64 x M2 x K3 (2 x M2 x K3) |
| 0.64 | ≥[12.8] ([10]) | 0.64 x K3 (1 x K3) | 1.28 x K3 (2 x K3) |
| 1.28 | ≥[15.36] ([12]) | 1.28 x K3 (1 x K3) | 2.56 x K3 (2 x K3) |
| 2.56 | ≥[30.72] ([24]) | 2.56 x K3 (1 x K3) | 5.12 x K3 (2 x K3) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra\_RedCap is expected.  Note 5: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion. | | | | | |

Table 4.2B.2.9.2-6: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Scaling Factor (N1)** Note1 | **Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Intra\_RedCap\_Relax** **[s] (number of DRX cycles or eDRX cycles Note 3)** | | **Tevaluate,NR\_Intra\_RedCap\_Relax****[s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥30.72 (24) | 8 | K3 x  (23 x N1 x K3) | | 0.32 x N1 x K3 (1 x N1 x K3) | 0.64 x N1 x K3 (2 x N1 x K3) |
| 0.64 | ≥38.4 (30) | 5 | 0.64 x N1 x K3 (1 x N1 x K3) | 1.28 x N1 x K3 (2 x N1 x K3) |
| 1.28 | 40.96 (32) | 4 | 1.28 x N1 x K3 (1 x N1 x K3) | 2.56 x N1 x K3 (2 x N1 x K3) |
| 2.56 | 40.96 (32) | 3 | 20.48  (8) | 40.96  (16) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: The measurement shall not be performed across PTW’s. In this case the measurement is performed in the next available PTW.  Note 6: The evaluation shall not be performed across PTW’s. In this case the evaluation is performed in the next available PTW.  Note 7: For DRX cycle length is 0.32s, 0.64s, and 2.56s, K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion. For DRX cycle length is 1.28s, K3 = 4 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion. | | | | | | | |

##### 4.2B.2.9.3 Measurements for a UE fulfilling stationary and not-at-cell edge criteria

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

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and

- has also fulfilled both criteria, and,

- less than 4 hours have passed since measurements for cell reselection were last performed

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

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 clause 4.2B.2.3.

##### 4.2B.2.9.3A Measurements for a UE fulfilling stationary and Rel-16 not at cell edge criteria

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

- UE is configured with *cellEdgeEvaluation* [2] criterion and with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *cellEdgeEvaluation* and *stationaryMobilityEvaluation* [2] criteria

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

- Tdetect,NR\_Intra\_RedCap\_Relaxas specified in Table 4.2B.2.9.2-1 and Table 4.2B.2.9.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,NR\_Intra\_RedCap\_Relax as specified in Table 4.2B.2.9.2-1 and Table 4.2B.2.9.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,NR\_Intra\_RedCap\_Relax as specified in Table 4.2B.2.9.2-1 and Table 4.2B.2.9.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.9.2-3 and Table 4.2B.2.9.2-4 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2 respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2B.2.9.2-5 and Table 4.2B.2.9.2-6 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

##### 4.2B.2.9.4 Measurements for a UE fulfilling low mobility and stationary criteria

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

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

- UE is configured with *lowMobilityEvaluation* [2] criterion and with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *lowMobilityEvaluation* and *stationaryMobilityEvaluation* [2] criteria

The requirements defined in clause 4.2B.2.9.2 apply for this clause.

##### 4.2B.2.9.5 Measurements for a UE fulfilling low mobility criterion and stationary and not-at-cell edge criteria

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

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled this criterion, and

- UE is configured with *stationaryMobilityEvaluation* [2] and *cellEdgeEvaluationWhileStationary* [2] criterion, and UE has also fulfilled both criteria

The requirements defined in clause 4.2B.2.9.3 apply for this clause.

##### 4.2B.2.9.6 Measurements for a UE fulfilling not-at-cell edge criterion and stationary and not-at-cell edge criteria

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

* UE is configured with cellEdgeEvaluation [2] criterion and UE has fulfilled that criterion, and
* UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has also fulfilled both criteria

The requirements defined in clause 4.2B.2.9.3 apply for this clause.

##### 4.2B.2.9.7 Measurements for a UE fulfilling low mobility and not-at-cell edge criteria and stationary and notatcell 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 has fulfilled both criteria, and
* UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has also fulfilled both criteria

The requirements defined in clause 4.2B.2.9.3 apply for this clause.

##### 4.2B.2.9.8 Measurements for a UE fulfilling low mobility and not-at-cell edge criteria and stationary criterion

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 has fulfilled both criteria, and

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and has also fulfilled that criterion, or UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *stationaryMobilityEvaluation* [2] criteria

The requirements defined in clause 4.2.2.9.4 apply for this clause.

##### 4.2B.2.9.9 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 has fulfilled, or

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

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

- Tdetect,NR\_Intra\_RedCap\_Relaxas specified in Table 4.2B.2.9.9-1 and Table 4.2B.2.9.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,NR\_Intra\_RedCap\_Relax as specified in Table 4.2B.2.9.9-1 and Table 4.2B.2.9.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,NR\_Intra\_RedCap\_Relax as specified in Table 4.2B.2.9.9-1 and Table 4.2B.2.9.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.9.9-3 and Table 4.2B.2.9.9-4 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2, respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2B.2.9.9-5 and Table 4.2B.2.9.9-6 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

Table 4.2B.2.9.9-1: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UEs fulfilling low mobility criterion for 1 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax  [s] (number of DRX cycles) |
| 0.32 | 11.52 x M2 x K1 (36 x M2 x K1) | 1.28 x M2 x K1 (4 x M2 x K1) | 5.12 x M2 x K1 (16 x M2 x K1) |
| 0.64 | 17.92 x K1 (28 x K1) | 1.28 x K1 (2 x K1) | 5.12 x K1 (8 x K1) |
| 1.28 | 32 x K1 (25 x K1) | 1.28 x K1 (1 x K1) | 6.4 x K1 (5 x K1) |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.9.9-2: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UEs fulfilling low mobility criterion for 2 Rx RedCap UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax  [s] (number of DRX cycles) |
|  | FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1) | 1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1) | 5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1) |
| 0.64 |  | 5 | 17.92 x N1 x K1 (28 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) | 5.12 x N1 x K1 (8 x N1 x K1) |
| 1.28 |  | 4 | 32 x N1 x K1 (25 x N1 x K1) | 1.28 x N1 x K1 (1 x N1 x K1) | 6.4 x N1 x K1 (5 x N1 x K1) |
| 2.56 |  | 3 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.9.9-3: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.9.9-4: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x N1 x K1 (23 x N1 x K1) | 5.12 x N1 x K1 (1 x N1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x N1 x K1 (23 x N1 x K1) | 10.24 x N1 x K1 (1 x N1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: N1 = 3.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.9.9-5: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x M2 x K1 (1 x M2 x K1) | 0.64 x M2 x K1 (2 x M2 x K1) |
| 0.64 | ≥[3.84] ([3]) | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
| 1.28 | ≥[7.68] ([6]) | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
| 2.56 | ≥[15.36] ([12]) | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.9.9-6: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Scaling Factor (N1)** Note1 | **Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Intra\_RedCap\_Relax** **[s] (number of DRX cycles or eDRX cycles Note 3)** | | **Tevaluate,NR\_Intra\_RedCap\_Relax****[s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥15.36 (12) | 8 | K1 x  (23 x N1 x K1) | | 0.32 x N1 x K1 (1 x N1 x K1) | 0.64 x N1 x K1 (2 x N1 x K1) |
| 0.64 | ≥19.2 (15) | 5 | 0.64 x N1 x K1 (1 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) |
| 1.28 | ≥30.72 (24) | 4 | 1.28 x N1 x K1 (1 x N1 x K1) | 2.56 x N1 x K1 (2 x N1 x K1) |
| 2.56 | 40.96 (32) | 3 | 20.48  (8) | 40.96  (16) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: The measurement shall not be performed across PTW’s. In this case the measurement is performed in the next available PTW.  Note 6: The evaluation shall not be performed across PTW’s.  Note 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation criterion* [2]. | | | | | | | |

##### 4.2B.2.9.10 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 has fulfilled, or

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

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

- Tdetect,NR\_Intra\_RedCap\_Relaxas specified in Table 4.2B.2.9.10-1 and Table 4.2B.2.9.10-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,NR\_Intra\_RedCap\_Relax as specified in Table 4.2B.2.9.10-1 and Table 4.2B.2.9.10-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,NR\_Intra\_RedCap\_Relax as specified in Table 4.2B.2.9.10-1 and Table 4.2B.2.9.10-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.9.10-3 and Table 4.2B.2.9.10-4 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2, respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2B.2.9.10-5 and Table 4.2B.2.9.10-6 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

Table 4.2B.2.9.10-1: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UEs fulfilling not-at-cell edge criterion for 1 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax  [s] (number of DRX cycles) |
| 0.32 | 11.52 x M2 x K1 (36 x M2 x K1) | 1.28 x M2 x K1 (4 x M2 x K1) | 5.12 x M2 x K1 (16 x M2 x K1) |
| 0.64 | 17.92 x K1 (28 x K1) | 1.28 x K1 (2 x K1) | 5.12 x K1 (8 x K1) |
| 1.28 | 32 x K1 (25 x K1) | 1.28 x K1 (1 x K1) | 6.4 x K1 (5 x K1) |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2B.2.9.10-2: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UEs fulfilling not-at-cell edge criterion for 2 Rx RedCap UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax  [s] (number of DRX cycles) |
|  | FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1) | 1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1) | 5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1) |
| 0.64 |  | 5 | 17.92 x N1 x K1 (28 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) | 5.12 x N1 x K1 (8 x N1 x K1) |
| 1.28 |  | 4 | 32 x N1 x K1 (25 x N1 x K1) | 1.28 x N1 x K1 (1 x N1 x K1) | 6.4 x N1 x K1 (5 x N1 x K1) |
| 2.56 |  | 3 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.9.10-3: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2B.2.9.10-4: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Intra\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x N1 x K1 (23 x N1 x K1) | 5.12 x N1 x K1 (1 x N1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x N1 x K1 (23 x N1 x K1) | 10.24 x N1 x K1 (1 x N1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: N1 = 3.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2B.2.9.10-5: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_elax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x M2 x K1 (1 x M2 x K1) | 0.64 x M2 x K1 (2 x M2 x K1) |
| 0.64 | ≥[3.84] ([3]) | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
| 1.28 | ≥[7.68] ([6]) | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
| 2.56 | ≥[15.36] ([12]) | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.9.10-6: Tdetect,NR\_Intra\_RedCap\_Relax, Tmeasure,NR\_Intra\_RedCap\_Relax and Tevaluate,NR\_Intra\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Scaling Factor (N1)** Note1 | **Tdetect,NR\_Intra\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Intra\_RedCap\_Relax** **[s] (number of DRX cycles or eDRX cycles Note 3)** | | **Tevaluate,NR\_Intra\_RedCap\_Relax****[s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥15.36 (12) | 8 | K1 x  (23 x N1 x K1) | | 0.32 x N1 x K1 (1 x N1 x K1) | 0.64 x N1 x K1 (2 x N1 x K1) |
| 0.64 | ≥19.2 (15) | 5 | 0.64 x N1 x K1 (1 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) |
| 1.28 | ≥30.72 (24) | 4 | 1.28 x N1 x K1 (1 x N1 x K1) | 2.56 x N1 x K1 (2 x N1 x K1) |
| 2.56 | 40.96 (32) | 3 | 20.48 | 40.96 |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: The measurement shall not be performed across PTW’s. In this case the measurement is performed in the next available PTW.  Note 6: The evaluation shall not be performed across PTW’s.  Note 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation criterion* [2]. | | | | | | | |

##### 4.2B.2.9.11 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

- has also 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\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intrma\_RedCap as defined in Table 4.2B.2.3.

#### 4.2B.2.10 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

##### 4.2B.2.10.1 Introduction

This clause contains the requirements for measurements on inter-frequency NR cells when the UE is configured any of the following relaxed measurement critera:

- Relaxed measurement criterion for a stationary UE defined in clause 5.2.4.9.3 in [1],

- Relaxed measurement criterion for a stationary UE not at cell edge defined in clause 5.2.4.9.4 in [1],

- Both low mobility criterion and stationary criterion as defined in clause 5.2.4.9.1 and 5.2.4.9.3 or 5.2.4.9.4 in [1] respectively.

- 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.

##### 4.2B.2.10.2 Measurements for UE fulfilling stationary criterion

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

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and UE has fulfilled that criterion, or

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled only the *stationaryMobilityEvaluation* [2] criterion, and

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

- Tdetect,NR\_Inter\_RedCap\_Relaxas specified in Table 4.2B.2.10.2-1 and Table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,NR\_Inter\_RedCap\_Relax as specified in Table 4.2B.2.10.2-1 and Table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,NR\_Inter\_RedCap\_Relax as specified in Table 4.2B.2.10.2-1 and Table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.10.2-3 and Table 4.2B.2.10.2-4 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2 respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2B.2.10.2-5 and Table 4.2B.2.10.2-6 respectively apply provided that eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ 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 4.2.2.7 and, K2 = 240.

Table 4.2B.2.10.2-1: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for 1 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles) |
| 0.32 | 11.52 x 1.5 x K4(36 x 1.5 x K4) | 1.28 x 1.5 x K4 (4 x 1.5 x K4) | 5.12 x 1.5 x K4 (16 x 1.5 x K4) |
| 0.64 | 17.92 x K4 (28 x K4) | 1.28x K4 (2 x K4) | 5.12 x K4 (8 x K4) |
| 1.28 | 32 x K4 (25 x K4) | 1.28x K4 (1 x K4) | 6.4 x K4 (5 x K4) |
| 2.56 | 58.88 x K4 (23 x K4) | 2.56 x K4 (1 x K4) | 7.68 x K4 (3 x K4) |
| Note 1: K4 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.10.2-2: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for 2 Rx RedCap UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_Inter\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_Inter\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_Inter\_Relax [s] (number of DRX cycles) |
| FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x N1 x 1.5 x K4 (36 x N1 x 1.5 x K4) | 1.28 x N1 x 1.5 x K4 (4 x N1 x 1.5 x K4) | 5.12 x N1 x 1.5 x K4 (16 x N1 x 1.5 x K4) |
| 0.64 |  | 5 | 17.92x N1 x K4 (28 x N1 x K4) | 1.28 x N1 x K4 (2 x N1 x K4) | 5.12 x N1 x K4 (8 x N1 x K4) |
| 1.28 |  | 4 | 32 x N1 x K4 (25 x N1 x K4) | 1.28 x N1 x K4 (1 x N1 x K4) | 6.4 x N1 x K4 (5 x N1 x K4) |
| 2.56 |  | 3 | 58.88 x N1 x K4 (23 x N1 x K4) | 2.56 x N1 x K4 (1 x N1 x K4) | 7.68 x N1 x K4 (3 x N1 x K4) |
| Note 1: Applies for RedCap UE of all supporting power class.  Note 2: K4 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.10.2-3: Tdetect, NR\_Inter \_RedCap\_Relax, Tmeasure,NR\_,NR\_Inter \_RedCap\_Relax and Tevaluate, NR\_Inter \_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | Tdetect, NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure, NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate, NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles) |
|
| 2.56 | 58.88 x K3 (23 x K3) | 2.56 x K3 (1 x K3) | 5.12 x K3 (2 x K3) |
| 5.12 | 117.76 x K3 (23 x K3) | 5.12 x K3 (1 x K3) | 10.24 x K3 (2 x K3) |
| 10.24 | 235.52 x K3 (23 x K3) | 10.24 x K3 (1 x K3) | 20.48 x K3 (2 x K3) |
| Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra is expected.  Note 2: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.10.2-4: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles)** | **Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles)** | **Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles)** |
|
| 2.56 | 58.88 x N1 x K3 (23 x N1 x K3) | 2.56 x N1 x K3 (1 x N1 x K3) | 7.68 x N1 x K3 (3 x N1 x K3) |
| 5.12 | 117.76 x N1 x K3 (23 x N1 x K3) | 5.12 x N1 x K3 (1 x N1 x K3) | 10.24 x N1 x K3 (2 x N1 x K3) |
| 10.24 | 235.52 x N1 x K3 (23 x N1 x K3) | 10.24 x N1 x K3 (1 x N1 x K3) | 20.48 x N1 x K3 (2 x N1 x K3) |
| Note 1: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.10.2-5: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_ Inter \_RedCap\_Relax and Tevaluate,NR\_ Inter \_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle larger than 10.24 s

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[6.4] ([5]) | (23 x K3) | 0.32 x M2 x K3 (1 x M2 x K3) | 0.64 x M2 x K3 (2 x M2 x K3) |
| 0.64 | ≥[12.8] ([10]) | 0.64 x K3 (1 x K3) | 1.28 x K3 (2 x K3) |
| 1.28 | ≥[15.36] ([12]) | 1.28 x K3 (1 x K3) | 2.56 x K3 (2 x K3) |
| 2.56 | ≥[30.72] ([4]) | 2.56 x K3 (1 x K3) | 5.12 x K3 (2 x K3) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion. | | | | | |

Table 4.2B.2.10.2-6: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle larger than 10.24 s

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) | | Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥30.72 (24) | 8 | K3 x  (23 x N1 x K3) | | 0.32 x N1 x K3 (1 x N1 x K3) | 0.64 x N1 x K3 (2 x N1 x K3) |
| 0.64 | ≥38.4 (30) | 5 | 0.64 x N1 x K3 (1 x N1 x K3) | 1.28 x N1 x K3 (2 x N1 x K3) |
| 1.28 | 40.96 (32) | 4 | 1.28 x N1 x K3 (1 x N1 x K3) | 2.56 x N1 x K3 (2 x N1 x K3) |
| 2.56 | 40.96 (32) | 3 | 20.48  (8) | 40.96  (16) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: For DRX cycle length is 0.32s, 0.64s and 2.56s, K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion. For DRX cycle length is 1.28s, K3 = 4 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion. | | | | | | | |

##### 4.2B.2.10.3 Measurements for a UE fulfilling stationary not at cell edge criterion

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

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and

- has also fulfilled both criteria, and

- less than 4 hours have passed since measurements for cell reselection were last performed, and

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 4 hours.

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=240.

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

##### 4.2B.2.10.3A Measurements for a UE fulfilling stationary and Rel-16 not at cell edge criterion

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

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

- UE is configured with *cellEdgeEvaluation* [2] criterion and with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *cellEdgeEvaluation* and *stationaryMobilityEvaluation* [2] criteria

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

- Tdetect,NR\_Inter\_RedCap\_Relaxas specified in Table 4.2B.2.10.2-1 and Table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,NR\_Inter\_RedCap\_Relax as specified in Table 4.2B.2.10.2-1 and Table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,NR\_Inter\_RedCap\_Relax as specified in Table 4.2B.2.10.2-1 and Table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.10.2-3 and Table 4.2B.2.10.2-4 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2 respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2B.2.10.2-5 and Table 4.2B.2.10.2-6 respectively apply provided that eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ 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 4.2.2.7 and, K2 = 240.

##### 4.2B.2.10.4 Measurements for a UE fulfilling low mobility and stationary criteria

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

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

- UE is configured with *lowMobilityEvaluation* [2] criterion and with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *lowMobilityEvaluation* and *stationaryMobilityEvaluation* [2] criteria

The requirements defined in clause 4.2B.2.10.2 apply for this clause.

##### 4.2B.2.10.5 Measurements for a UE fulfilling low mobility and stationary not at cell edge criteria

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

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled this criterion, and

- UE is configured with *stationaryMobilityEvaluation* [2] and *cellEdgeEvaluationWhileStationary* [2] criterion, and UE has also fulfilled both criteria

The requirements defined in clause 4.2B.2.10.3 apply for this clause.

##### 4.2B.2.10.6 Measurements for a UE fulfilling not-at-cell edge criterion and stationary not at cell edge criteria

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

* UE is configured with cellEdgeEvaluation [2] criterion and UE has fulfilled that criterion, and
* UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has also fulfilled both criteria

The requirements defined in clause 4.2B.2.10.3 apply for this clause.

##### 4.2B.2.10.7 Measurements for a UE fulfilling low mobility not-at-cell edge criterion and stationary 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 has fulfilled both criteria, and
* UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has also fulfilled both criteria

The requirements defined in clause 4.2B.2.10.3 apply for this clause.

##### 4.2B.2.10.8 Measurements for a UE fulfilling low mobility not-at-cell edge criterion and stationary criteria

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

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and has also fulfilled that criterion, or UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *stationaryMobilityEvaluation* [2] criterion.

The requirements defined in clause 4.2.2.10.4 apply for this clause.

##### 4.2B.2.10.9 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 has fulfilled, or

- UE is configured with both *lowMobilityEvaluation* [2] and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and

- UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

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

- Tdetect,NR\_Inter\_RedCap\_Relaxas specified in Table 4.2B.2.10.9-1 and Table 4.2B.2.10.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,NR\_Inter RedCap Relax as specified in Table 4.2B.2.10.9-1 and Table 4.2B.2.10.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,NR\_Inter\_RedCap Relax as specified in Table 4.2B.2.10.9-1 and Table 4.2B.2.10.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.10.9-3 and Table 4.2B.2.10.9-4 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2, respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2B.2.10.9-5 and Table 4.2B.2.10.9-6 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

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.

Table 4.2B.2.10.9-1: Tdetect,NR\_ Inter\_RedCap\_Relax, Tmeasure,NR\_ Inter RedCap\_Relax and Tevaluate,NR\_ Inter RedCap\_Relax for UEs fulfilling low mobility criterion for 1 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_ Inter RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_ Inter RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_ Inter RedCap\_Relax  [s] (number of DRX cycles) |
| 0.32 | 11.52 x M2 x K1 (36 x M2 x K1) | 1.28 x M2 x K1 (4 x M2 x K1) | 5.12 x M2 x K1 (16 x M2 x K1) |
| 0.64 | 17.92 x K1 (28 x K1) | 1.28 x K1 (2 x K1) | 5.12 x K1 (8 x K1) |
| 1.28 | 32 x K1 (25 x K1) | 1.28 x K1 (1 x K1) | 6.4 x K1 (5 x K1) |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.10.9-2: Tdetect,NR\_ Inter\_RedCap\_Relax, Tmeasure,NR\_ Inter RedCap\_Relax and Tevaluate,NR\_ Inter RedCap\_Relax for UEs fulfilling low mobility criterion for 2 Rx RedCap UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_ Inter RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_ Inter RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_ Inter RedCap\_Relax  [s] (number of DRX cycles) |
|  | FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1) | 1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1) | 5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1) |
| 0.64 |  | 5 | 17.92 x N1 x K1 (28 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) | 5.12 x N1 x K1 (8 x N1 x K1) |
| 1.28 |  | 4 | 32 x N1 x K1 (25 x N1 x K1) | 1.28 x N1 x K1 (1 x N1 x K1) | 6.4 x N1 x K1 (5 x N1 x K1) |
| 2.56 |  | 3 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.10.9-3: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.10.9-4: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle upto 10.24 s for 2 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x N1 x K1 (23 x N1 x K1) | 5.12 x N1 x K1 (1 x N1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x N1 x K1 (23 x N1 x K1) | 10.24 x N1 x K1 (1 x N1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: N1 = 3.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.10.9-5: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_elax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x 1.5 x K1 (1 x M2 x K1) | 0.64 x 1.5 x K1 (2 x M2 x K1) |
| 0.64 | ≥[3.84] ([3]) | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
| 1.28 | ≥[7.68] ([6]) | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
| 2.56 | ≥[15.36] ([12]) | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.10.9-6: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Scaling Factor (N1)** Note1 | **Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Inter\_RedCap\_Relax** **[s] (number of DRX cycles or eDRX cycles Note 3)** | | **Tevaluate,NR\_Inter\_RedCap\_Relax****[s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥15.36 (12) | 8 | K1 x  (23 x N1 x K1) | | 0.32 x N1 x K1 (1 x N1 x K1) | 0.64 x N1 x K1 (2 x N1 x K1) |
| 0.64 | ≥19.2 (15) | 5 | 0.64 x N1 x K1 (1 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) |
| 1.28 | ≥30.72 (24) | 4 | 1.28 x N1 x K1 (1 x N1 x K1) | 2.56 x N1 x K1 (2 x N1 x K1) |
| 2.56 | 40.96 (32) | 3 | 20.48  (8) | 40.96  (16) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: The measurement shall not be performed across PTW’s. In this case the measurement is performed in the next available PTW.  Note 6: The evaluation shall not be performed across PTW’s.  Note 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation criterion* [2]. | | | | | | | |

##### 4.2B.2.10.10 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 has fulfilled or

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

- Tdetect,NR\_Inter RedCap Relaxas specified in Table 4.2B.2.10.10-1 and Table 4.2B.2.10.10-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,NR\_Inter\_RedCap Relax as specified in Table 4.2B.2.10.10-1 and Table 4.2B.2.10.10-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,NR\_Inter\_RedCap Relax as specified in Table 4.2B.2.10.10-1 and Table 4.2B.2.10.10-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.10.10-3 and Table 4.2B.2.10.10-4 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2, respectively.

If the UE is configured with eDRX\_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in Table Table 4.2B.2.10.10-5 and Table 4.2B.2.10.10-6 respectively apply provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

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 4.2B.2.7

Table 4.2B.2.10.10-1: Tdetect,NR\_ Inter\_RedCap\_Relax, Tmeasure,NR\_ Inter RedCap\_Relax and Tevaluate,NR\_ Inter RedCap\_Relax for UEs fulfilling low mobility criterion for 1 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_ Inter RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_ Inter RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_ Inter RedCap\_Relax  [s] (number of DRX cycles) |
| 0.32 | 11.52 x 1.5 x K1 (36 x 1.5 x K1) | 1.28 x 1.5 x K1 (4 x 1.5 x K1) | 5.12 x 1.5 x K1 (16 x 1.5 x K1) |
| 0.64 | 17.92 x K1 (28 x K1) | 1.28 x K1 (2 x K1) | 5.12 x K1 (8 x K1) |
| 1.28 | 32 x K1 (25 x K1) | 1.28 x K1 (1 x K1) | 6.4 x K1 (5 x K1) |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2B.2.10.10-2: Tdetect,NR\_ Inter\_RedCap\_Relax, Tmeasure,NR\_ Inter RedCap\_Relax and Tevaluate,NR\_ Inter RedCap\_Relax for UEs fulfilling low mobility criterion for 2 Rx RedCap UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_ Inter RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,NR\_ Inter RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,NR\_ Inter RedCap\_Relax  [s] (number of DRX cycles) |
|  | FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x N1 x 1.5 x K1 (36 x N1 x 1.5 x K1) | 1.28 x N1 x 1.5 x K1 (4 x N1 x 1.5 x K1) | 5.12 x N1 x 1.5 x K1 (16 x N1 x 1.5 x K1) |
| 0.64 |  | 5 | 17.92 x N1 x K1 (28 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) | 5.12 x N1 x K1 (8 x N1 x K1) |
| 1.28 |  | 4 | 32 x N1 x K1 (25 x N1 x K1) | 1.28 x N1 x K1 (1 x N1 x K1) | 6.4 x N1 x K1 (5 x N1 x K1) |
| 2.56 |  | 3 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.10.10-3: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2B.2.10.10-4: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2) for eDRX\_IDLE cycle upto 10.24 s for 1 Rx and 2 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 2.56 | 58.88 x N1 x K1 (23 x N1 x K1) | 2.56 x N1 x K1 (1 x N1 x K1) | 7.68 x N1 x K1 (3 x N1 x K1) |
| 5.12 | 117.76 x N1 x K1 (23 x N1 x K1) | 5.12 x N1 x K1 (1 x N1 x K1) | 10.24 x N1 x K1 (2 x N1 x K1) |
| 10.24 | 235.52 x N1 x K1 (23 x N1 x K1) | 10.24 x N1 x K1 (1 x N1 x K1) | 20.48 x N1 x K1 (2 x N1 x K1) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: N1 = 3.  Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2B.2.10.10-5: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x M2 x K1 (1 x M2 x K1) | 0.64 x M2 x K1 (2 x M2 x K1) |
| 0.64 | ≥[3.84] ([3]) | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
| 1.28 | ≥[7.68] ([6]) | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
| 2.56 | ≥[15.36] ([12]) | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra\_RedCap is expected.  Note 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | |

Table 4.2B.2.10.10-6: Tdetect,NR\_Inter\_RedCap\_Relax, Tmeasure,NR\_Inter\_RedCap\_Relax and Tevaluate,NR\_Inter\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Scaling Factor (N1)** Note1 | **Tdetect,NR\_Inter\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,NR\_Inter\_RedCap\_Relax** **[s] (number of DRX cycles or eDRX cycles Note 3)** | | **Tevaluate,NR\_Inter\_RedCap\_Relax****[s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥15.36 (12) | 8 | K1 x  (23 x N1 x K1) | | 0.32 x N1 x K1 (1 x N1 x K1) | 0.64 x N1 x K1 (2 x N1 x K1) |
| 0.64 | ≥19.2 (15) | 5 | 0.64 x N1 x K1 (1 x N1 x K1) | 1.28 x N1 x K1 (2 x N1 x K1) |
| 1.28 | ≥30.72 (24) | 4 | 1.28 x N1 x K1 (1 x N1 x K1) | 2.56 x N1 x K1 (2 x N1 x K1) |
| 2.56 | 40.96 (32) | 3 | 20.48  (8) | 40.96  (16) |
| Note 1: Applies for RedCap UE of all supporting FR2 power classes.  Note 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 4: The lower bound of PTW length is derived based on .  Note 5: The measurement shall not be performed across PTW’s. In this case the measurement is performed in the next available PTW.  Note 6: The evaluation shall not be performed across PTW’s.  Note 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation criterion* [2]. | | | | | | | |

##### 4.2B.2.10.11 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 also 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 hours.

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

#### 4.2B.2.11 Measurements of inter-RAT E-UTRAN cells for UE configured with relaxed measurement criterion

##### 4.2B.2.11.1 Introduction

This clause contains the requirements for measurements on inter-RAT E-UTRAN cells when the UE is configured any of the following relaxed measurement critera:

- Relaxed measurement criterion for a stationary UE defined in clause 5.2.4.9.3 in [1],

- Relaxed measurement criterion for a stationary UE not at cell edge defined in clause 5.2.4.9.4 in [1],

- Both low mobility criterion and stationary criterion as defined in clause 5.2.4.9.1 and 5.2.4.9.3 in [1] respectively.

- 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.

##### 4.2B.2.11.2 Measurements for UE fulfilling stationary criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and UE has fulfilled that criterion, or

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled only the *stationaryMobilityEvaluation* [2] criterion, and

When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the requirements defined in clause 4.2B.2.5 apply for this clause except that:

- Tdetect,EUTRAN\_RedCap Relax as specified in Table 4.2B.2.11.2-1 and Table 4.2B.2.11.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,EUTRAN RedCap Relax as specified in Table 4.2B.2.11.2-1 and Table 4.2B.2.11.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,EUTRAN RedCap Relax as specified in Table 4.2B.2.11.2-1 and Table 4.2B.2.11.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.11.2-3 are applicable for eDRX cycle < 10.24 s.

If the UE is configured with eDRX\_IDLE cycle ≥ 10.24 s, then the requirements in Table 4.2B.2.11.2-4 apply provided that filtering of a measurement is done within a single PTW and provided that the eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for E-UTRA inter-RAT 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 = 240.

Table 4.2B.2.11.2-1: Tdetect,EUTRAN\_RedCap\_Relax, Tmeasure,EUTRAN\_RedCap\_Relax, and Tevaluate,EUTRAN\_RedCap\_Relax for 1 Rx RedCap

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Relax [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Relax [s] (number of DRX cycles) | Tevaluate,EUTRAN\_Relax  [s] (number of DRX cycles) |
| 0.32 | 11.52 x K5 (36 x K5) | 1.28 x K5 (4 x K5) | 5.12 x K5 (16 x K5) |
| 0.64 | 17.92 x K5 (28 x K5) | 1.28 x K5 (2 x K5) | 5.12 x K5 (8 x K5) |
| 1.28 | 32 x K5 (25 x K5) | 1.28 x K5 (1 x K5) | 6.4 x K5 (5 x K5) |
| 2.56 | 58.88 x K5 (23 x K5) | 2.56 x K5 (1 x K5) | 7.68 x K5 (3 x K5) |
| Note 1: K5 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.11.2-2: Tdetect,EUTRAN\_Relax, Tmeasure,EUTRAN\_Relax, and Tevaluate,EUTRAN\_Relax for 2 Rx RedCap

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Relax [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Relax [s] (number of DRX cycles) | Tevaluate,EUTRAN\_Relax  [s] (number of DRX cycles) |
| 0.32 | 11.52 x K5 (36 x K5) | 1.28 x K5 (4 x K5) | 5.12 x K5 (16 x K5) |
| 0.64 | 17.92 x K5 (28 x K5) | 1.28 x K5 (2 x K5) | 5.12 x K5 (8 x K5) |
| 1.28 | 32 x K5 (25 x K5) | 1.28 x K5 (1 x K5) | 6.4 x K5 (5 x K5) |
| 2.56 | 58.88 x K5 (23 x K5) | 2.56 x K5 (1 x K5) | 7.68 x K5 (3 x K5) |
| Note 1: K5 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.11.2-3: Tdetect,E-UTRAN \_RedCap\_Relax, Tmeasure,NR\_,E-UTRAN \_RedCap\_Relax and Tevaluate,NR\_,E-UTRAN \_RedCap\_Relax for UE configured with eDRX\_IDLE cycle

|  |  |  |  |
| --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **Tdetect,NR\_E-UTRAN\_RedCap\_Relax [s] (number of DRX cycles)** | **Tmeasure,NR\_E-UTRAN\_RedCap\_Relax [s] (number of DRX cycles)** | **Tevaluate,NR\_E-UTRAN\_RedCap\_Relax [s] (number of DRX cycles)** |
|
| 5.12 | 117.76 x K3 (23 x K3) | 5.12 x K3 (1 x K3) | 10.24 x K3 (2 x K3) |
| Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra is expected.  Note 2: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.11.2-4: Tdetect,E-UTRAN \_RedCap\_Relax, Tmeasure,NR\_,E-UTRAN \_RedCap\_Relax and Tevaluate,NR\_,E-UTRAN \_RedCap\_Relax for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_RedCap\_Relax [s] (number of DRX or eDRX cycles Note 3) | Tmeasure,EUTRAN\_RedCap\_Relax [s] (number of DRX or eDRX cycles Note 3) | Tevaluate,E-UTRAN\_RedCap\_Relax  [s] (number of DRX or eDRX cycles Note 3) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.444 | 0.32 | ≥1.28 (1) | K3 x  (23 x K3) | 0.32 x K3 (1 x K3) | 0.64 x K3 (2 x K3) |
| 0.64 | ≥1.28 (1) | 0.64 x K3 (1 x K3) | 1.28 x K3 (2 x K3) |
| 1.28 | ≥2.56 (2) | 1.28 x K3 (1 x K3) | 2.56 x K3 (2 x K3) |
| 2.56 | ≥5.12 (4) | 2.56 x K3 (1 x K3) | 5.12 x K3 (2 x K3) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise.  NOTE 4: The lower bound of PTW length is derived based on .  NOTE 5: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. | | | | | |

##### 4.2B.2.11.3 Measurements for a UE fulfilling stationary not at cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and

- has also fulfilled both criteria, and

- less than 4 hours have passed since measurements for cell reselection were last performed, and

In this case the UE is not required to meet Tdetect,EUTRAN, Tmeasure,EUTRAN and Tevaluate,EUTRAN as defined in clause 4.2B.2.5.

When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, the UE shall search for, measure and evaluate inter-RAT E-UTRAN layers of higher or lower priority at least every 4 hour.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE shall search for inter-RAT E-UTRAN of higher priority at least every K2\*Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.7 and K2=240.

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

##### 4.2B.2.11.3A Measurements for a UE fulfilling stationary and Rel-16 not at cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

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

- UE is configured with *cellEdgeEvaluation* [2] criterion and with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *cellEdgeEvaluation* and *stationaryMobilityEvaluation* [2] criterion.

When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the requirements defined in clause 4.2B.2.5 apply for this clause except that:

- Tdetect,EUTRAN\_Relax as specified in Table 4.2B.2.11.2-1 and Table 4.2B.2.11.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tmeasure,EUTRAN\_Relax as specified in Table 4.2B.2.11.2-1 and Table 4.2B.2.11.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- Tevaluate,EUTRAN\_Relax as specified in Table 4.2B.2.11.2-1 and Table 4.2B.2.11.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.11.2-3 are applicable for eDRX cycle < 10.24 s.

If the UE is configured with eDRX\_IDLE cycle ≥ 10.24 s, then the requirements in Table 4.2B.2.11.2-4 apply provided that filtering of a measurement is done within a single PTW and provided that the eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE shall search for inter-RAT E-UTRAN of higher priority at least every K2\*Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.7 and K2=240.

##### 4.2B.2.11.4 Measurements for a UE fulfilling low mobility and stationary criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

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

- UE is configured with *lowMobilityEvaluation* [2] criterion and with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *lowMobilityEvaluation* and *stationaryMobilityEvaluation* [2] criteria

The requirements defined in clause 4.2B.2.11.2 apply for this clause.

##### 4.2B.2.11.5 Measurements for a UE fulfilling low mobility and stationary not at cell edge criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled this criterion, and

- UE is configured with *stationaryMobilityEvaluation* [2] and *cellEdgeEvaluationWhileStationary* [2] criterion, and UE has also fulfilled both criteria

The requirements defined in clause 4.2B.2.11.3 apply for this clause.

##### 4.2B.2.11.6 Measurements for a UE fulfilling not-at-cell edge criterion and stationary not at cell edge criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

* UE is configured with cellEdgeEvaluation [2] criterion and UE has fulfilled that criterion, and
* UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has also fulfilled both criteria

The requirements defined in clause 4.2B.2.11.3 apply for this clause.

##### 4.2B.2.11.7 Measurements for a UE fulfilling low mobility not-at-cell edge criterion and stationary not at cell edge criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

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

The requirements defined in clause 4.2B.2.11.3 apply for this clause.

##### 4.2B.2.11.8 Measurements for a UE fulfilling low mobility not-at-cell edge criterion and stationary criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

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

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and has also fulfilled that criterion, or UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *stationaryMobilityEvaluation* [2] criteria.

The requirements defined in clause 4.2.2.11.4 apply for this clause.

##### 4.2B.2.11.9 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with *lowMobilityEvalutation* [2] criterion and UE has fulfilled, or

- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and

- UE has fulfilled only the *lowMobilityEvalutation* [2] criterion.

When Srxlev ≤ SnonIntraSearchP and Squal ≤ SnonIntraSearchQ then the requirements defined in clause 4.2B.2.5 apply for this clause except that:

- Tdetect,EUTRAN\_RedCap\_Relaxas specified in Table 4.2B.2.11.9-1.

- Tmeasure,EUTRAN\_RedCap\_Relax as specified in Table 4.2B.2.11.9-1.

- Tevaluate,EUTRAN\_RedCap\_Relax as specified in Table 4.2B.2.11.9-1.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.11.9-2 are applicable for eDRX cycle < 10.24 s for 1 Rx and 2 Rx RedCap UE.

If the UE is configured with eDRX\_IDLE cycle ≥ 10.24 s, then the requirements in Table 4.2B.2.11.9-3, for 1 Rx and 2 Rx RedCap UE, apply provided that filtering of a measurement is done within a single PTW and provided that the eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ and the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every K2\*Thigher\_priority\_search seconds 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 E-UTRA inter-RAT frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2B.2.7.

Table 4.2B.2.11.9-1: Tdetect,EUTRAN\_RedCap\_Relax, Tmeasure,EUTRAN\_RedCap\_Relax, and Tevaluate,EUTRAN\_RedCap\_Relax for 1 Rx and 2 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,EUTRAN\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,EUTRAN\_RedCap\_Relax  [s] (number of DRX cycles) |
| 0.32 | 11.52 x K1 (36 x K1) | 1.28 x K1 (4 x K1) | 5.12 x K1 (16 x K1) |
| 0.64 | 17.92 x K1 (28 x K1) | 1.28 x K1 (2 x K1) | 5.12 x K1 (8 x K1) |
| 1.28 | 32 x K1 (25 x K1) | 1.28 x K1 (1 x K1) | 6.4 x K1 (5 x K1) |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 (1 x K1) | 7.68 x K1 (3 x K1) |
| Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvalutation* [2] criterion. | | | |

Table 4.2B.2.11.9-2: Tdetect,EUTRAN\_Relax, Tmeasure, EUTRAN\_RedCap\_Relax and Tevaluate, EUTRAN\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | Tdetect, EUTRAN\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure, EUTRAN\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate, EUTRAN\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | |

Table 4.2B.2.11.9-3: Tdetect, EUTRAN\_RedCap\_Relax, Tmeasure, EUTRAN\_RedCap\_Relax and Tevaluate, EUTRAN\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Tdetect,****EUTRAN\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,EUTRAN\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,EUTRAN\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x K1 (1 x K1) | 0.64 x K1 (2 x K1) |
| 0.64 | ≥[3.84] ([3]) | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
| 1.28 | ≥[7.68] ([6]) | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
| 2.56 | ≥[15.36] ([12]) | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion. | | | | | |

##### 4.2B.2.11.10 Measurements for UE fulfilling with not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled, or

- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and

- UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

When Srxlev ≤ SnonIntraSearchP and Squal ≤ SnonIntraSearchQ then the requirements defined in clause 4.2B.2.5 apply for this clause except that:

- Tdetect,EUTRAN\_RedCap\_Relaxas specified in Table 4.2B.2.11.10-1.

- Tmeasure,EUTRAN\_RedCap\_Relax as specified in Table 4.2B.2.11.10-1.

- Tevaluate,EUTRAN\_RedCap\_Relax as specified in Table 4.2B.2.11.10-1.

If the UE is configured with eDRX\_IDLE cycle then the requirements in Table 4.2B.2.11.10-2 are applicable for eDRX cycle < 10.24 s for 1 Rx and 2 Rx RedCap UE.

If the UE is configured with eDRX\_IDLE cycle ≥ 10.24 s, then the requirements in Table 4.2B.2.11.10-3, for 1 Rx and 2 Rx RedCap UE, apply provided that filtering of a measurement is done within a single PTW and provided that the eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

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-RAT E-UTRAN frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2B.2.7.

Table 4.2B.2.11.10-1: Tdetect,EUTRAN\_RedCap\_Relax, Tmeasure,EUTRAN\_RedCap\_Relax, and Tevaluate,EUTRAN\_RedCap\_Relax for 1 Rx and 2 Rx RedCap UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_RedCap\_Relax [s] (number of DRX cycles) | Tmeasure,EUTRAN\_RedCap\_Relax [s] (number of DRX cycles) | Tevaluate,EUTRAN\_RedCap\_Relax  [s] (number of DRX cycles) |
| 0.32 | 11.52 x K1 (36 x K1) | 1.28 x K1 (4 x K1) | 5.12 x K1 (16 x K1) |
| 0.64 | 17.92 x K1 (28 x K1) | 1.28 x K1 (2 x K1) | 5.12 x K1 (8 x K1) |
| 1.28 | 32 x K1 (25 x K1) | 1.28 x K1 (1 x K1) | 6.4 x K1 (5 x K1) |
| 2.56 | 58.88 x K1 (23 x K1) | 2.56 x K1 (1 x K1) | 7.68 x K1 (3 x K1) |
| Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2B.2.11.10-2: Tdetect, EUTRAN\_RedCap\_Relax, Tmeasure, EUTRAN\_RedCap\_Relax and Tevaluate, EUTRAN\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1) for eDRX\_IDLE cycle upto 10.24 s

|  |  |  |  |
| --- | --- | --- | --- |
| DRX\_IDLE cycle length [s] | Tdetect, EUTRAN\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tmeasure, EUTRAN\_RedCap\_Relax [s] (number of eDRX IDLE cycles) | Tevaluate, EUTRAN\_RedCap\_Relax [s] (number of eDRX IDLE cycles) |
|  |
| 5.12 | 117.76 x K1 (23 x K1) | 5.12 x K1 (1 x K1) | 10.24 x K1 (2 x K1) |
| 10.24 | 235.52 x K1 (23 x K1) | 10.24 x K1 (1 x K1) | 20.48 x K1 (2 x K1) |
| Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | |

Table 4.2B.2.11.10-3: Tdetect, EUTRAN\_RedCap\_Relax, Tmeasure, EUTRAN\_RedCap\_Relax and Tevaluate, EUTRAN\_RedCap\_Relax for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | **PTW length [s] (number of 1.28s periods)** | **Tdetect, EUTRAN\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tmeasure,EUTRAN\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** | **Tevaluate,EUTRAN\_RedCap\_Relax [s] (number of DRX cycles or eDRX cycles Note 3)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤[163.84] | 0.32 | ≥[3.84] ([3]) | (23 x K1) | 0.32 x K1 (1 x M2 x K1) | 0.64 x K1 (2 x M2 x K1) |
| 0.64 | ≥[3.84] ([3]) | 0.64 x K1 (1 x K1) | 1.28 x K1 (2 x K1) |
| 1.28 | ≥[7.68] ([6]) | 1.28 x K1 (1 x K1) | 2.56 x K1 (2 x K1) |
| 2.56 | ≥[15.36] ([12]) | 2.56 x K1 (1 x K1) | 5.12 x K1 (2 x K1) |
| Note 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  Note 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  Note 3: The lower bound of PTW length is derived based on .  Note 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion. | | | | | |

##### 4.2B.2.11.11 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

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

- has also 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,EUTRAN\_RedCap, Tmeasure,EUTRAN\_RedCap and Tevaluate,EUTRAN\_RedCap as defined in clause 4.2B.2.5.When Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, the UE shall search for, measure and evaluate inter-RAT E-UTRAN layers of higher, equal or lower priorivty at least every 1 hour.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE shall search for inter-RAT E-UTRAN 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 requirments defined in this clause apply regardless of eDRX\_IDLE configurations.

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

### 4.2C.1 Introduction

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

When the UE is in either *Camped* *Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency and inter-frequency cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity.

### 4.2C.2 Requirements

#### 4.2C.2.1 UE measurement capability

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

- Intra-frequency carrier, and

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

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

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

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

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

- otherwise M1=1.

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

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

If the UE has evaluated according to Table 4.2C.2.2-1 in Nserv consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities. Additionally, if the UE is configured with ‘*t-service*’ [2], the UE should start measurements of the neighbour cells indicated by the serving cell before ‘*t-service*’ is reached according to the requirements provided in clause 4.2C.2.3 and 4.2C.2.4.

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

If the UE is configured with ‘*t-Service*’ in the serving cell then the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 when any of the following conditions is fulfilled:

- If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information within 10 s since time instance T1 provided that ‘*t-Service*’ > T1 or

- If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information within 10 s since the time instance ‘*t-Service*’.

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

Table 4.2C.2.2-1: Nserv

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

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

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

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

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS38.304 [1] within Kmulti\_SMTC \* Tdetect,NR\_Intrawhen that Treselection= 0 if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within Kmulti\_SMTC \* Tdetect,NR\_Intra\_enhif the UE supports the feature for enhanced RRM requirements defined in TS38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled. An intra frequency cell is considered to be detectable according to the conditions defined in Annex B.1.6 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every Kmulti\_SMTC \* Tmeasure,NR\_Intra (see table 4.2C.2.3-1) if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or every Kmulti\_SMTC \* Tmeasure,NR\_Intra\_enh (see table 4.2C.2.3-2) if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled, for intra-frequency cells that are identified and measured according to the measurement rules.

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

If smtcs do not overlap with each other,

- , if GEO satellites are measured on the carrier;

- , if LEO satellites are measured on the carrier;

- If smtcs partially overlap with each other,

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

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

Where

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

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

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

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

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

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

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS38.304 [1] within Kmulti\_SMTC \* Tevaluate,NR\_Intra if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within Kmulti\_SMTC \* Tevaluate,NR\_Intra\_enh if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled, when Treselection = 0as specified in table 4.2C.2.3-1 or table 4.2C.2.3-2 provided that:

- when *rangeToBestCell* is not configured:

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

- when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

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

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

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

If Treselection timer has a nonzero value and the intra-frequency cell is satisfied with the reselection criteria which are defined in TS38.304 [1], the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

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

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

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

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

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

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

where

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

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

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

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

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

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

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

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

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS38.304 [1] within if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least [5]dB in FR1 for reselections based on ranking or [6]dB in FR1 for SS-RSRP reselections based on absolute priorities or [4]dB in FR1 for SS-RSRQ reselections based on absolute priorities. The parameter Kcarrier is the number of NR inter-frequency carriers indicated by the serving cell.

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

- If SMTCs do not overlap with each other,

- , if GEO satellites are measured on the carrier;

- , if LEO satellites are measured on the carrier;

- If SMTCs partially overlap with each other,

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

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

where

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

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

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

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

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

The UE shall measure SS-RSRP or SS-RSRQ at least every (see table 4.2C.2.4-1) if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or every (see table 4.2C.2.4-2) if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [14] and the *enhancedMeasurementLEO-r17*is enabled, for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,NR\_Inter/2.

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

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within if the UE does not support [capability for enhanced requriements] or if the [NW configuration for enhanced requirements] is not enabled, or within if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled, when Treselection = 0as specified in table 4.2C.2.4-1 provided that the reselection criteria is met by

- the condition when performing equal priority reselection and

when *rangeToBestCell* is not configured:

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

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

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

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

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

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

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

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

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

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

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

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

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

- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS38.304 [1].

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

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

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

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

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

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

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

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

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

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

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

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

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

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

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed TSI-NR + K\*Ttarget\_cell\_SMTC\_period ms.

Where,

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

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

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

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

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

The target cell is considered as known if it has been detectable during Tdetect,NR\_Intra or Tdetect,NR\_Inter, and the time span between SIB broadcasting cell stop time and the cell stop time is not less than Ttrigger. Otherwise, the target cell is considered as unknown, where Tdetect,NR\_Intra, Tdetect,NR\_Inter and Ttrigger are defined in 4.2C.2.3 and 4.2C.2.4. A longer interruption can be expected if the target cell is unknown.

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

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

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

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

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

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

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

#### 4.2C.2.9 General requirements

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

## 4.3 Minimization of Drive Tests (MDT)

### 4.3.1 Introduction

UE supporting minimisation of drive tests in RRC\_IDLE shall be capable of:

- logging measurements in RRC\_IDLE, reporting the logged measurements and meeting requirements in clause 4.3;

- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 4.3;

- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 4.3.

The logged MDT requirements consist of measurement requirements as specified in clause 4.3.2 and relative time stamp accuracy requirements as specified in clause 4.3.3. Both sets of requirements are applicable for intra-frequency, inter-frequency and inter-RAT cases in RRC\_IDLE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC\_IDLE state specified in clause 4.3.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 4.3.4.

### 4.3.2 Measurement Requirements

The requirements specified in this clause apply for the following measurements performed and logged by the UE for MDT in RRC\_IDLE:

- inter-RAT E-UTRA FDD and TDD RSRP,

- inter-RAT E-UTRA FDD and TDD RSRQ,

- SS-RSRP per cell,

- SS-RSRQ per cell,

- SS-RSRP per SSB index of the serving cell,

- SS-RSRQ per SSB index of the serving cell,

- best SSB index of the serving cell,

- the number of SSBs with different SSB index which are above the threshold *absThreshSS-BlocksConsolidation* for all detected cells whose cell-ranking criterion R value is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

The requirements apply for the measurements included in logged MDT reports and RRC connection establishment failure reports.

The measurement values that are used to meet

- serving cell and reselection requirements as specified in clauses 4.2.2.2−4.2.2.7

- shall also apply to values logged for MDT measurements in RRC\_IDLE state.

### 4.3.3 Requirements for Relative Time Stamp Accuracy

The relative time stamp for a logged measurement is defined as the time from the moment the MDT configuration was received at the UE until the measurement was logged, see TS 38.331 [2].

The accuracy of the relative time stamping is such that the drift of the time stamping shall be not more than ± 2 seconds per hour.

### 4.3.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

Relative time stamp for RRC connection establishment failure log reporting is defined as the time elapsed from the last RRC connection establishment failure to the time when the log is included in the report TS 38.331 [2]. The UE shall report the RRC connection establishment failure log, while meeting the accuracy requirement specified in this clause.

The accuracy of the relative time stamping for RRC connection establishment failure log reporting is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. The relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RRC connection establishment failure had been detected and until the log is time-stamped.

### 4.3.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The UE shall report the radio link and handover failure log, while meeting the accuracy requirements specified in this clause.

Relative time stamp accuracy requirements for *timeSinceFailure* reported for MDT in a radio link failure or handover failure log are specified in this clause. *timeSinceFailure* determines the time elapsed from the last radio link failure or handover failure in NR to the time when the log is included in the report TS 38.331 [2].

The accuracy of the relative time stamping for *timeSinceFailure* is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. These relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RLF or handover failure had been detected and until the log is time-stamped.

## 4.3C Minimization of Drive Tests (MDT) for Satellite Access

*Editor’s note: the exact signalling names in the clause and values are subject to confirmation by RAN2 and change during performance requirement phase, respectively. And the brackets shall be removed by further agreements.*

### 4.3C.1 Introduction

UE supporting minimisation of drive tests in RRC\_IDLE shall be capable of:

- logging measurements in RRC\_IDLE, reporting the logged measurements and meeting requirements in clause 4.3C;

- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 4.3C;

- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 4.3C.

The logged MDT requirements consist of measurement requirements as specified in clause 4.3C.2 and relative time stamp accuracy requirements as specified in clause 4.3C.3. Both sets of requirements are applicable for intra-frequency, inter-frequency and inter-RAT cases in RRC\_IDLE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC\_IDLE state specified in clause 4.3C.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 4.3C.4.

### 4.3C.2 Measurement Requirements

The requirements specified in this clause apply for the following measurements performed and logged by the UE for MDT in RRC\_IDLE:

- SS-RSRP per cell,

- SS-RSRQ per cell,

- SS-RSRP per SSB index of the serving cell,

- SS-RSRQ per SSB index of the serving cell,

- best SSB index of the serving cell,

- the number of SSBs with different SSB index which are above the threshold *absThreshSS-BlocksConsolidation* for all detected cells whose cell-ranking criterion R value is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

The requirements apply for the measurements included in logged MDT reports and RRC connection establishment failure reports.

The measurement values that are used to meet

* serving cell and reselection requirements as specified in clauses 4.2C.2.2−4.2C.2.9

shall also apply to values logged for MDT measurements in RRC\_IDLE state.

### 4.3C.3 Requirements for Relative Time Stamp Accuracy

The relative time stamp for a logged measurement is defined as the time from the moment the MDT configuration was received at the UE until the measurement was logged, see TS 38.331 [2].

The accuracy of the relative time stamping is such that the drift of the time stamping shall be not more than ± 2 seconds per hour.

### 4.3C.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

Relative time stamp for RRC connection establishment failure log reporting is defined as the time elapsed from the last RRC connection establishment failure to the time when the log is included in the report TS 38.331 [2]. The UE shall report the RRC connection establishment failure log, while meeting the accuracy requirement specified in this clause.

The accuracy of the relative time stamping for RRC connection establishment failure log reporting is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. The relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RRC connection establishment failure had been detected and until the log is time-stamped.

### 4.3C.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The UE shall report the radio link and handover failure log, while meeting the accuracy requirements specified in this clause.

Relative time stamp accuracy requirements for *timeSinceFailure* reported for MDT in a radio link failure or handover failure log are specified in this clause. *timeSinceFailure* determines the time elapsed from the last radio link failure or handover failure in NR to the time when the log is included in the report TS 38.331 [2].

The accuracy of the relative time stamping for *timeSinceFailure* is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. These relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RLF or handover failure had been detected and until the log is time-stamped.

## 4.4 Idle Mode CA/DC Measurements

### 4.4.1 Introduction

A UE supporting *idleInactiveNR-MeasReport-r16* or *idleInactiveEUTRA-MeasReport-r16* shall perform the idle mode measurement on the inter-frequency CA and DC candidate frequencies/cells and E-UTRAN inter-RAT DC candidate frequencies/cells indicated by higher layers and meet the requirement specified in this clause. The UE shall perform idle mode measurements provided that the serving cell support early measurement and is within the validity area. The idle mode measurement requirements apply to a configured carrier frequency and the serving cell are among the supported band combination of the UE.

### 4.4.2 Measurement Requirements

For a UE which supports *idleInactiveNR-MeasReport-r16* or *idleInactiveEUTRA-MeasReport-r16* the UE shall support the idle mode CA measurements on the serving cell, and carriers configured for idle mode CA/DC measurement reporting provided T331 has not expired, the serving cell is supporting idle mode CA/DC measurement reporting and the serving cell is in the validity area.

#### 4.4.2.1 Detected cell requirement during state transition and Idle mode

This subclause defines the requirements for the detected cell status for the idle mode CA/DC measurement when UE transitions from RRC Connected mode to Idle mode and after UE has entered Idle mode. The requirements are applicable to an NE-DC and NR carrier aggregation capable UE which has been configured with one or more of following, one or more SCells, one E-UTRAN PSCell or one or more downlink E-UTRAN SCells during the Connected mode and which supports *idleInactiveNR-MeasReport-r16* or *idleInactiveEUTRA-MeasReport-r16.* The requirements are applicable for SCell(s) and E-UTRAN FDD and TDD PSCell and SCells.

Upon releasing the connection and if the UE has been configured with idle mode CA measurement reporting, following requirements apply concerning the detected cells in Connected mode upon state transitioning to Idle mode and during Idle mode:

- A cell which is detected cell in Connected mode prior to connection release, shall remain detected after UE has entered Idle mode and during Idle mode, provided that the following conditions are met:

- The UE has been provided with a list of cells and/or carrier frequencies for early measurement reporting by dedicated RRC signaling and

- The detected cell is among the list of cells or on a carrier frequency provided for early measurement reporting, and

- The UE is provided with a valid timer T331 by dedicated RRC signaling, and

- The detected cell and SSBs remains detectable until UE reconnect to the network and transmits the early measurement report, and

- The carrier frequency of the detected cell and the carrier frequency of the serving cell are among the supported band combination of the UE.

An inter-RAT E-UTRAN cell is considered detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.1 and Annex B.1.2 in [15] for a corresponding Band. An inter-frequency cell is considered detectable according to the conditions in Annex B.1.2 and B.1.3 for a corresponding band. An SSB of an inter-frequency cell is considered detectable according to SSB\_RP and SSB Ês/Iot defined in Annex B.1.2 and B.1.3 for a corresponding Band.

#### 4.4.2.2 Measurements of inter-frequency CA/DC candidate cells

While T331 is running, the UE shall perform measurement on the configured inter-frequency carriers for idle mode CA/DC measurement reporting according to the UE measurement capability.

A UE which supports *idleInactiveNR-MeasReport-r16* shall support idle mode CA/DC measurements of:

- at least 7 inter-frequency carriers which are also configured for inter-frequency mobility measurements, and

- at least 7 inter-frequency carriers which are not configured for inter-frequency mobility measurements.

The UE shall be capable of monitoring a total of at least 7 inter-frequency carriers for idle mode CA/DC measurements comprising of carriers configured for inter-frequency mobility measurements and carriers not configured for inter-frequency mobility measurements.

For inter-frequency carriers configured for idle mode CA/DC measurements, if Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ the inter-frequency measurement requirements in clause 4.2.2.4 shall apply, where UE shall search for and measure inter-frequency layers configured for idle mode CA/DC measurements in preparation for possible reporting. If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ the UE shall search for inter-frequency layers configured for idle mode CA/DC measurements at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.7, where UE shall search for and measure inter-frequency layers configured for idle mode CA/DC measurements in preparation for possible reporting.

For UE supporting *idleInactiveNR-MeasBeamReport-r16*, if the UE is configured with *beamMeasConfigIdle-r16* for idle mode CA/DC measurement, the UE shall be capable of performing SS-RSRP, SS-RSRQ for at least

- 7 SSBs with different SSB index and/or PCI on an inter-frequency layer in FR1,

- 10 SSBs with different SSB index and/or PCI on an inter-frequency layer in FR2.

For UE supporting *idleInactiveNR-MeasBeamReport-r16*, if the UE is configured with *beamMeasConfigIdle-r16* on one or more carrier for idle mode CA/DC measurement, the UE, on each carrier, shall be able to:

- detect a newly detectable inter-frequency NR cell and perform RSRP/RSRQ measurement in preparation for reporting, and

- acquire the SSB index for a newly detectable inter-frequency NR cell if *beamMeasConfigIdle-r16* if configured on this carrier and perform RSRP/RSRQ measurement in preparation for reporting,

within the requirements defined in clause 4.2.2.4 plus k\*TSSB\_index,NR, where k is the number of carriers configured for idle mode CA measurement with *beamMeasConfigIdle-r16*, and TSSB\_index,NR is the additional time period used to acquire the index of the SSB being measured as defined in table 4.4.2.2-1.

Table 4.4.2.2-1: TSSB\_index,NR\_Inter

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | TSSB\_index,NR\_Inter [s] (number of DRX cycles) |
|  | FR1 | FR2Note1 |  |
| 0.32 | 1 | 8 | N2 x 1.28 x N1 x 1.5 (N2 x 4 x N1 x 1.5) |
| 0.64 |  | 5 | N2 x 1.28 x N1 (N2 x 2 x N1) |
| 1.28 |  | 4 | N2 x 1.28 x N1 (N2 x 1 x N1) |
| 2.56 |  | 3 | N2 x 2.56 x N1 (N2 x 1 x N1) |
| Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length.  NOTE 2: N2 = 3 if the NR inter-frequency carrier for idle mode CA/DC measurement reporting is in FR1, and N2 = 3, 5 if the NR inter-frequency carrier for idle mode CA/DC measurement reporting is in FR2. | | | |

In the absence or expiration of T331, it is up to UE implementation to perform the idle mode CA/DC measurement.

For inter-frequency carriers configured for idle mode CA/DC measurements, the UE shall be capable of performing SS-RSRP and SS-RSRQ measurements of the carriers, and the UE physical layer shall be capable of reporting SS-RSRP and SS-RSRQ measurements of the carriers configured for idle mode CA/DC measurements to higher layers, with measurement accuracy as specified in clauses 10.1.4B and 10.1.5B and 10.1.9B and 10.1.10B, respectively.

The UE shall be able to report idle mode CA/DC measurements when idle mode CA/DC measurement reporting is requested by the network.

#### 4.4.2.3 Measurements on serving cell

The UE shall measure the RSRP and RSRQ level of the serving cell and evaluate the cell selection criterion S defined in clause 4.2.2.2 and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements of the serving cell to higher layers, with measurement accuracy as specified in 10.1.2B, 10.1.3B, 10.1.7B and 10.1.8B.

#### 4.4.2.4 Measurements of E-UTRAN inter-RAT DC candidate cells

While T331 is running, the UE shall perform measurement on the configured inter-RAT carriers for idle mode CA/DC measurement reporting according to the UE measurement capability.

A UE which supports *idleInactiveEUTRA-MeasReport-r16* shall support idle mode DC measurements of:

- at least 7 E-UTRAN inter-RAT carriers which are also configured for E-UTRAN inter-RAT mobility measurements, and

- at least 1 E-UTRAN inter-RAT carrier which is not configured for E-UTRAN inter-RAT mobility measurements.

The UE shall be capable of monitoring a total of at least 7 inter-RAT carriers for idle mode CA/DC measurements comprising of carriers configured for inter-RAT mobility measurements and carriers not configured for inter-RAT mobility measurements.

For inter-RAT carriers configured for idle mode CA/DC measurements, if Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ the inter-RAT measurement requirements in clause 4.2.2.5 shall apply, where UE shall search for and measure inter-RAT layers configured for idle mode CA/DC measurements in preparation for possible reporting. If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ the UE shall search for inter-RAT layers configured for idle mode CA/DC measurements at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2, where UE shall search for and measure inter-RAT layers configured for idle mode CA/DC measurements in preparation for possible reporting.

For overlapping inter-RAT carriers configured for idle mode CA/DC measurements, the UE shall be capable of performing RSRP and RSRQ measurements of the carriers, and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements of the carriers configured for idle mode CA/DC measurements to higher layers, with measurement accuracy as specified in clauses in 9.1.3B.3 and 9.1.6B.2, respectively.

The UE shall be able to report idle mode CA measurements when idle mode CA measurement reporting is requested by the network.

# 5 SA: RRC\_INACTIVE state mobility

## 5.1 Cell Re-selection

### 5.1.1 Introduction

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

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS38.304 [1], allowing the UE to limit its measurement activity.

### 5.1.2 Requirements

#### 5.1.2.1 UE measurement capability

The requirements in clause 4.2.2.1 shall apply.

#### 5.1.2.2 Measurement and evaluation of serving cell

The requirements in clause 4.2.2.2 shall apply.

#### 5.1.2.3 Measurements of intra-frequency NR cells

The requirements in clause 4.2.2.3 shall apply. The requirements in clause 4.2.2.9 apply for UE configured with relaxed measurement criterion.

#### 5.1.2.4 Measurements of inter-frequency NR cells

If UE is not configured to perform PRS measurement, or if UE is configured to perform PRS measurement and supports *parallelPRS-MeasRRC-Inactive-r17*, the requirements in clause 4.2.2.4 shall apply regardless of whether the serving cell is subject to CCA or not.

If UE is configured to perform PRS measurement but does not support *parallelPRS-MeasRRC-Inactive-r17*, the requirements in clause 4.2.2.4 shall apply with Kcarrier being replaced with Kcarrier + 1, regardless of whether the serving cell is subject to CCA or not.

If UE is not configured to perform PRS measurement, or if UE is configured to perform PRS measurement and supports *parallelPRS-MeasRRC-Inactive-r17*, the requirements in clause 4.2.2.10 shall apply regardless of whether the serving cell is subject to CCA or not for UE configured with relaxed measurement criterion.

If UE is configured to perform PRS measurement but does not support *parallelPRS-MeasRRC-Inactive-r17*, the requirements in clause 4.2.2.10 shall apply with Kcarrier being replaced with Kcarrier + 1, regardless of whether the serving cell is subject to CCA or not for UE configured with relaxed measurement criterion.

#### 5.1.2.5 Measurements of inter-RAT E-UTRAN cells

The requirements in clause 4.2.2.5 shall apply. The requirements in clause 4.2.2.11 shall apply for UE configured with relaxed measurement criterion.

#### 5.1.2.6 Maximum interruption in paging reception

The requirements in clause 4.2.2.6 shall apply.

#### 5.1.2.7 General requirements

If UE is not configured to perform PRS measurement, or if UE is configured to perform PRS measurement and supports *parallelPRS-MeasRRC-Inactive-r17*, the requirements in clause 4.2.2.7 shall apply.

If UE is configured to perform PRS measurement but does not support *parallelPRS-MeasRRC-Inactive-r17*, the requirements in clause 4.2.2.7 shall apply with Nlayers being replaced with Nlayers + 1.

## 5.1A Cell Re-selection with CCA

### 5.1A.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it. The requirements in subclauses 5.1A.2.3, 5.1A.2.4, and 5.1A.2.6 apply when at least the target cell is on a carrier frequency with CCA, and the requirements in subclauses 5.1A.2.2 and 5.1A.2.5 apply when at least the camping cell is on a carrier frequency with CCA.

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS38.304, allowing the UE to limit its measurement activity.

### 5.1A.2 Requirements

#### 5.1A.2.1 UE measurement capability

The requirements in clause 4.2A.2.1 shall apply.

#### 5.1A.2.2 Measurement and evaluation when CCA is used on the serving cell

The requirements in clause 4.2A.2.2 shall apply.

#### 5.1A.2.3 Measurements of intra-frequency NR cells when CCA is used on the serving cell and target cell

The requirements in clause 4.2A.2.3 shall apply.

#### 5.1A.2.4 Measurements of inter-frequency NR cells when CCA is used on the target cell

The requirements in clause 4.2A.2.4 shall apply.

#### 5.1A.2.5 Measurements of inter-RAT E-UTRAN cells when CCA is used on the serving cell

The requirements in clause 4.2.2.5 shall apply.

#### 5.1A.2.6 Maximum interruption in paging reception when CCA is used on the target cell

The requirements in clause 4.2A.2.6 shall apply.

#### 5.1A.2.7 General requirements

The requirements in clause 4.2.2.7 shall apply.

## 5.1B Cell Re-selection for RedCap

### 5.1B.1 Introduction

### 5.1B.2 Requirements

#### 5.1B.2.1 UE measurement capability

The requirements in clause 4.2B.2.1 shall apply.

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

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

When UE is configured with eDRX\_IDLE, 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 dertermined 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 the UE has evaluated according to Table 5.1B.2.2-1or and Table 5.1B.2.2-2 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 5.1B.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 ≤10485.76 | 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 |
| Note1: T is dertermined according to clause 7.1 in [1].  Note2: M1=2 if SMTC periodicity (TSMTC) > 20 ms and T≤ 0.64 second, otherwise M1=1. | | | |

Table 5.1B.2.2-2: Nserv\_RedCapfor inactive Redcap UE configured with eDRX\_IDLE cycle, (Frequency range FR2)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX or eDRX INACTIVE cycle length[s] | T [s] | Scaling Factor (N1) | Nserv\_RedCap [number of T] |
| 2.56 ≤eDRX\_IDLE cycle length ≤10485.76 | 0.32 ≤DRX\_Inactive cycle length ≤2.56; or  2.56 ≤eDRX\_Inactive cycle length ≤10.24 if inactive eDRX is configured | 0.32 | 8 | 4\* N1 |
| 0.64 | 5 | 4\* N1 |
| 1.28 | 4 | 2\* N1 |
| 2.56 | 3 | 2\* N1 |
| 5.12 | 3 | 2\* N1 |
| 10.24 | 3 | 2\* N1 |
| Note1: T is dertermined according to clause 7.1 in [1]. | | | | |

When UE transitions from measurements within PTW and to measurements outside 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.

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

- T’= MAX (10 s, N1\* eDRX\_inactive cycle) if the UE is configured with eDRX\_inactive cycle for FR2.

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

The requirements in clause 4.2.2.3 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.2.2.3 shall apply with Tdetect,NR\_Intra\_RedCap, Tmeasure,NR\_Intra\_RedCap and Tevaluate,NR\_Intra\_RedCap defined in Table 5.1B.2.3-1 and Table 5.1B.2.3-2.

Table 5.1B.2.3-1: Tdetect, Tmeas and Tevaluate for inactive 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 ≤ 10485.76 | 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) |
| Note1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. | | | | |

Table 5.1B.2.3-2: Tdetect, Tmeas and Tevaluate for inactive Redcap UE configured with eDRX\_IDLE cycle, (Frequency range FR2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX or eDRX INACTIVE cycle length [s] | Scaling Factor (N1) | 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 eDRX INACTIVE cycles) |
|
| 2.56 ≤eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | 8 | 11.52 x N1 x M2 (36 x N1 x M2) | 1.28 x N1 x M2 (4 x N1 x M2) | 5.12 x N1 x M2 (16 x N1 x M2) |
| 0.64 | 5 | 17.92x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | 4 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| 5.12 | 3 | 117.76 x N1 (23 x N1) | 5.12 x N1 (1 x N1) | 15.36 x N1 (3 x N1) |
| 10.24 | 3 | 235.52 x N1 (23 x N1) | 10.24 x N1 (1 x N1) | 30.72 x N1 (3 x N1) |
| Note1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. | | | | | |

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

The requirements in clause 4.2.2.4 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.2.2.4 shall apply with Tdetect,NR\_Inter\_RedCap, Tmeasure,NR\_Inter\_RedCap and Tevaluate,NR\_Inter\_RedCap defined in Table 5.1B.2.4-1 and Table 5.1B.2.4-2.

Table 5.1B.2.4-1: Tdetect, Tmeas and Tevaluate for inactive 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 ≤ 10485.76 | 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) |

Table 5.1B.2.4-2: Tdetect, Tmeas and Tevaluate for inactive Redcap UE configured with eDRX\_IDLE cycle, (Frequency range FR2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX or eDRX INACTIVE cycle length [s] | Scaling Factor (N1) | 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 ≤ 10485.76 | 0.32 | 8 | 11.52 x N1 x 1.5 (36 x N1 x 1.5) | 1.28 x N1 x 1.5 (4 x N1 x 1.5) | 5.12 x N1 x 1.5 (16 x N1 x 1.5) |
| 0.64 | 5 | 17.92x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | 4 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| 5.12 | 3 | 117.76 x N1 (23 x N1) | 5.12 x N1 (1 x N1) | 15.36 x N1 (3 x N1) |
| 10.24 | 3 | 235.52 x N1 (23 x N1) | 10.24 x N1 (1 x N1) | 30.72 x N1 (3 x N1) |

#### 5.1B.2.5 Measurements of inter-RAT E-UTRAN cells

The requirements in clause 4.2B.2.5 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.2B.2.5 shall apply with Tdetect, EUTRAN\_RedCap, Tmeasure, EUTRAN \_RedCap and Tevaluate, EUTRAN \_RedCap defined in Table 5.1B.2.5-1.

Table 5.1B.2.5-1: Tdetect, EUTRAN\_RedCap, Tmeasure, EUTRAN \_RedCap and Tevaluate, EUTRAN \_RedCap for inactive Redcap UE configured with eDRX\_IDLE cycle, (Frequency range FR1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX or eDRX INACTIVE cycle length [s] | Tdetect, EUTRAN\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tmeasure, EUTRAN \_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tevaluate, EUTRAN \_RedCap [s] (number of DRX or eDRX INACTIVE cycles) |
|
| 2.56 ≤eDRX\_IDLE cycle length ≤ 10485.76 | 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) |

#### 5.1B.2.6 Maximum interruption in paging reception

The requirements in clause 4.2B.2.6 shall apply for RedCap UEs.

For RedCap UE in HD-FDD mode, if a paging occasion overlaps with CG-SDT transmission then the UE shall monitor the paging during the paging occasion. In this case the UE is allowed to drop the CG-SDT transmission.

#### 5.1B.2.7 General requirements

The requirements in sub-clause 4.2B.2.7 shall apply.

#### 5.1B.2.8 Minimum requirement at transitions

The requirements in sub-clause 4.2B.2.8 shall apply.

#### 5.1B.2.9 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2B.2.9 apply for UE configured with relaxed measurement criterion.

#### 5.1B.2.10 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2B.2.10 apply for UE configured with relaxed measurement criterion.

#### 5.1B.2.11 Measurements of inter-RAT E-UTRAN cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2B.2.11 apply for UE configured with relaxed measurement criterion.

## 5.1C Cell Re-selection

### 5.1C.1 Introduction

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

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS38.304 [1], allowing the UE to limit its measurement activity.

### 5.1C.2 Requirements

#### 5.1C.2.1 UE measurement capability

The requirements in clause 4.2C.2.1 shall apply.

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

The requirements in clause 4.2C.2.2 shall apply.

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

The requirements in clause 4.2C.2.3 shall apply. The requirements in clause 4.2C.2.7 apply for UE configured with relaxed measurement criterion.

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

The requirements in clause 4.2C.2.4 shall apply. The requirements in clause 4.2C.2.8 apply for UE configured with relaxed measurement criterion.

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

The requirements in clause 4.2C.2.5 shall apply.

#### 5.1C.2.6 General requirements

The requirements in clause 4.2C.2.9 shall apply.

## 5.2 Void

## 5.2B Configured Grant based Small Data Transmissions (CG-SDT) for RedCap

### 5.2B.1 Introduction

This section contains the requirements for Small Data Transmissions (SDT) for 1 Rx RedCap and 2 Rx RedCap.

The 1 Rx 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.

### 5.2B.2 Requirements on UE synchronization for small data transmissions for RedCap

The requirements in clause 5.5.2 shall apply for RedCap UEs.

### 5.2B.2.1 Void5.2B.3 TA validation requirements for RedCap

When *cg-SDT-RSRP-ChangeThreshold* [TS 38.331] is configured for TA validation based on the RSRP change criterion according to clause 5.8.2 in [TS 38.321], the UE is allowed to transmit using CG-SDT using the timing derived using the latest available value as specified in subclause 7.1 provided that

- the first RSRP (RSRP1) measurement and the second RSRP (RSRP2) measurements used in the TA validation are valid measurements and,

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

RSRP1 and RSRP2 are considered valid provided that the conditions in Table 5.2B.2-1 are met for FR1 when UE is not configured with any eDRX cycle by serving gNB or core network.

RSRP1 and RSRP2 are considered valid provided that the conditions in Table 5.2B.2-2 are met for FR2 regardless of whether the UE is configured with eDRX cycle by serving gNB or core network (AMF).

RSRP1 and RSRP2 are considered valid provided that the conditions in Table 5.2B.2-3 are met for FR1 when UE is configured:

- only with RAN eDRX cycle (TeDRX-RAN) by the serving gNB, or

- with both TeDRX-RAN by serving gNB and CN eDRX cycle (TeDRX-CN) by the core network (AMF)

Table 5.2B.3-1 Valid measurement for FR1 without eDRX cycle

|  |  |
| --- | --- |
| Measurement | FR1 |
| RSRP1 | (T1 – min(640ms, M1\*TDRX)) ≤ T1’ ≤ (T1 + min(640ms, M1\*TDRX)) |
| RSRP2 | (T2 – min(640ms, M1\*TDRX)) ≤ T2’ ≤ T2 |

Table 5.2B.3-2 Valid measurement for FR2

|  |  |
| --- | --- |
| Measurement | FR2 |
| RSRP1 | (T1 – max{480ms, 8\*SMTC periodicity}) ≤ T1’ ≤ (T1 + max{480ms, 8\*SMTC periodicity}) |
| RSRP2 | (T2 – max{480ms, 8\*SMTC periodicity}) ≤ T2’ ≤ T2 |

Table 5.2B.3-3 Valid measurement for FR1 with eDRX cycle

|  |  |
| --- | --- |
| Measurement | FR1 |
| RSRP1 | (T1 – min(640ms, M1\* T)) ≤ T1’ ≤ (T1 + min(640ms, M1\* T)) |
| RSRP2 | (T2 – min(640ms, M1\* TeDRX-RAN)) ≤ T2’ ≤ T2 |
| Note1: T is dertermined according to clause 7.1 in [1]. | |

If at least one of RSRP1 and RSRP2 is considered to be invalid based on the above conditions, then the UE shall not validate the CG-SDT using RSRP1 and RSRP2 and shall not transmit using CG-SDT. Additionally for the initial CG-SDT transmission, the UE shall not transmit in an CG-SDT occasion that occurs more than [640 ms] after T2.

Where:

- T1 is the time when the latest was obtained by the UE via:

- *RRCRelease* with CG-SDT configuration (TS 38.331 [2]) is received, or

- the latest TA is received if TA is received while in RRC\_INACITVE state.- T1’ is the time when the UE has completed RSRP1.

- T2 is the time when the UE performs TA validation as defined in clause 5.8.2.x in [TS 38.321] for transmission using CG-SDT.

- T2’ is the time when the UE has completed RSRP2.

- TDRX is the DRX cycle length in ms.

- M1 the scaling factor as defined in clause 4.2.2.2.

#### 5.2B.2.2 Void

Void

### 5.2B.4 Scheduling restriction

The requirements in clause 5.5.4 shall apply for RedCap UEs.

### 5.2B.5 Applicability conditions for CG-SDT for RedCap

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

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

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

## 5.3 Minimization of Drive Tests (MDT)

### 5.3.1 Introduction

UE supporting minimisation of drive tests in RRC\_INACTIVE shall be capable of:

- logging measurements in RRC\_INACTIVE, reporting the logged measurements and meeting requirements in clause 5.3.1;

- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 5.3.1;

- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 5.3.1.

The logged MDT requirements consist of measurement requirements as specified in clause 5.3.2 and relative time stamp accuracy requirements as specified in clause 5.3.3. Both sets of requirements are applicable for intra-frequency, inter-frequency and inter-RAT cases in RRC\_INACTIVE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC\_INACTIVE state specified in clause 5.3.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 5.3.4.

### 5.3.2 Measurement Requirements

The measurements and measurement requirements applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3.2.

### 5.3.3 Requirements for Relative Time Stamp Accuracy

The requirements for relative time stamp accuracy applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3.3.

### 5.3.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

The requirements for relative time stamp accuracy for RRC connection establishment failure applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3.4.

### 5.3.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The requirements for relative time stamp accuracy for RRC link failure and handover failure applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3.5.

### 5.3.6 Requirements for Relative Time Stamp Accuracy for RRC Resume Failure Log Reporting

The requirements for relative time stamp accuracy for RRC resume failure applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3.4.

## 5.3C Minimization of Drive Tests (MDT) for Satellite Access

*Editor’s note: the exact signalling names in the clause and values are subject to confirmation by RAN2 and change during performance requirement phase, respectively. And the brackets shall be removed by further agreements.*

### 5.3C.1 Introduction

UE supporting minimisation of drive tests in RRC\_INACTIVE shall be capable of:

- logging measurements in RRC\_INACTIVE, reporting the logged measurements and meeting requirements in clause 5.3C;

- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 5.3C;

- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 5.3C.

The logged MDT requirements consist of measurement requirements as specified in clause 5.3C.2 and relative time stamp accuracy requirements as specified in clause 5.3C.3. Both sets of requirements are applicable for intra-frequency and inter-frequency cases in RRC\_INACTIVE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC\_INACTIVE state specified in clause 5.3C.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 5.3C.4.

### 5.3C.2 Measurement Requirements

The measurements and measurement requirements applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3C.2.

### 5.3C.3 Requirements for Relative Time Stamp Accuracy

The requirements for relative time stamp accuracy applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3C.3.

### 5.3C.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

The requirements for relative time stamp accuracy for RRC connection establishment failure applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3C.4.

### 5.3C.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The requirements for relative time stamp accuracy for RRC link failure and handover failure applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3C.5.

### 5.3C.6 Requirements for Relative Time Stamp Accuracy for RRC Resume Failure Log Reporting

The requirements for relative time stamp accuracy for RRC resume failure applicable for MDT in RRC\_INACTIVE are the same as specified for MDT in RRC\_IDLE in clause 4.3C.4.

## 5.4 Idle Mode CA/DC Measurements

### 5.4.1 Introduction

A UE supporting *IdleInactiveMeasurements-r16* or *idleInactiveEUTRA-MeasReport-r16* shall perform the idle mode measurement on the inter-frequency CA and DC candidate frequencies/cells and E-UTRAN inter-RAT DC candidate frequencies/cells indicated by higher layers and meet the requirement specified in this clause. The UE shall perform idle mode measurements provided that the serving cell support early measurement and is within the validity area. The idle mode measurement requirements apply to a configured carrier frequency and the serving cell are among the supported band combination of the UE.

### 5.4.2 Measurement Requirements

The requirements in clause 4.4.2 shall apply.

#### 5.4.2.1 Detected cell requirement during state transition and Idle mode

The requirements in clause 4.4.2.1 shall apply.

#### 5.4.2.2 Measurements of inter-frequency CA/DC candidate cells

The requirements in clause 4.4.2.2 shall apply.

#### 5.4.2.3 Measurements on serving cell

The requirements in clause 4.4.2.3 shall apply.

#### 5.4.2.4 Measurements on E-UTRAN inter-RAT DC candidate cells

The requirements in clause 4.4.2.4 shall apply.

## 5.5 Configured Grant based Small Data Transmissions (CG-SDT)

### 5.5.1 Introduction

The requirements in this clause are applicable when the UE is configured with timing alignment (TA) validation using *cg-SDT-RSRP-ChangeThreshold* for transmitting in uplink using CG-SDT as specified in [TS 38.331].

### 5.5.2 Requirements on UE synchronization for small data transmissions

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

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 value as specified in subclause 7.1.2) 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 [TS 38.331].

### 5.5.3 TA validation requirements

When *cg-SDT-RSRP-ChangeThreshold* [TS 38.331] is configured for TA validation based on the RSRP change criterion according to clause 5.8.2 in [TS 38.321], the UE is allowed to transmit using CG-SDT using the timing derived using the latest available value as specified in subclause 7.1 provided that

- the first RSRP (RSRP1) measurement and the second RSRP (RSRP2) measurements used in the TA validation are valid measurements and,

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

RSRP1 and RSRP2 are considered valid provided that the conditions in Table 5.5.3-1 and Table 5.5.3-2 are met for FR1 and FR2-1.

Table 5.5.3-1 Valid measurement for FR1

|  |  |
| --- | --- |
| Measurement | FR1 |
| RSRP1 | (T1 – min(640ms, M1\*TDRX)) ≤ T1’ ≤ (T1 + min(640ms, M1\*TDRX)) |
| RSRP2 | (T2 – min(640ms, M1\*TDRX)) ≤ T2’ ≤ T2 |

Table 5.5.3-2 Valid measurement for FR2-1

|  |  |
| --- | --- |
| Measurement | FR2-1 |
| RSRP1 | (T1 – max(480ms, 8\*SMTC periodicity)) ≤ T1’ ≤ (T1 + max(480ms, 8\*SMTC periodicity)) |
| RSRP2 | (T2 – max(480ms, 8\*SMTC periodicity)) ≤ T2’ ≤ T2 |

If at least one of RSRP1 and RSRP2 is considered to be invalid based on the above conditions, then the UE shall not validate the CG-SDT using RSRP1 and RSRP2 and shall not transmit using CG-SDT. Additionally, for the initial CG-SDT transmission, the UE shall not transmit in an CG-SDT occasion that occurs more than 640 ms after T2.

Where:

- T1 is the time when

- *RRCRelease* with CG-SDT configuration (TS 38.331 [2]) is received, or

- the latest TA is received if TA is received while in RRC\_INACITVE state.

- T1’ is the time when the UE has completed RSRP1.

- 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.

- T2’ is the time when the UE has completed RSRP2.

- TDRX is the DRX cycle length in ms.

- M1 the scaling factor as defined in clause 4.2.2.2.

### 5.5.4 Scheduling restriction

#### 5.5.4.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP 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.

When the UE performs intra-frequency measurements in a TDD 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.

#### 5.5.4.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

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

- If *deriveSSB\_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH 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 *deriveSSB\_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH on all symbols within SMTC window duration.

For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to measurement of serving cell.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/ on SSB symbols of the serving cell.

#### 5.5.4.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP measurement on an FR2 intra-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH 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 (The signaling *deriveSSB\_IndexFromCell* is always enabled for FR2).

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 intra-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/ 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 (The signaling *deriveSSB\_IndexFromCellc* is always enabled for FR2).

The following scheduling restriction applies to measurement on an FR2 serving cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/ on SSB symbols of the serving cell.

### 5.5.5 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 5.1.2.4

- Measurements of inter-RAT E-UTRAN cells in clause 5.1.2.5

- Idle Mode CA/DC Measurements in clause 5.4

The UE is allowed to delay the reception of PRS resources on the positioning frequency layer until the SDT session is completed if the measurement using PRS resource overlaps with the SDT resources.

## 5.6 NR measurements for positioning

### 5.6.1 Introduction

This clause contains requirements for UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP, in RRC\_INACTIVE state.

The requirements in clauses 5.6.2, 5.6.3, 5.6.4 and 5.6.5 are applicable to PRS resources that do not collide with other DL signals/channels which include SSB, SIB1, CORESET0, MSG2/MSGB, paging and DL SDT. In addition, a UE is not expected to receive PRS resources that collide with a time interval starting at symbol *m* and ending at symbol *m + N2*, where symbol *m* is the last symbol in which the UE is configured to receive PDCCH and *N2* is defined in clause 6.4 of [26, TS 38.214] for the subcarrier spacing μ of the DL PRS.

If a PRS resource is outside the intitial DL BWP, a PRS resource instance collides with another DL signals/channel~~s~~ if any portion of the other DL signal/channel overlaps with the time interval starting X symbols before the PRS instance and ending X symbols after the PRS instance, taking into account *nr-DL- PRS-ExpectedRSTD-Uncertainty* and *nr-DL-PRS-ExpectedRSTD.* Where X is defined in Table 5.6.1-1.

Table 5.6.1-1: Value of X number of symbols

|  |  |  |  |
| --- | --- | --- | --- |
| FR |  | NR Slot  length (ms) | X symbols |
|  |  |
| FR1 | 0 | 1 | 7 |
| 1 | 0.5 | 14 |
| 2 | 0.25 | 28 |
| FR2 | 2 | 0.25 | 14 |
| 3 | 0.125 | 28 |
| Note 1: The FR1 value applies if one or both of the serving cell and the positioning frequency layer are in FR1. FR2 value applies both of the serving cell and the positioning frequency layer are in FR2. | | | |

All measurement requirements specified in clauses 5.6.2, 5.6.3, 5.6.4 and 5.6.5 shall apply for any DRX configuration specified in TS 38.331 [2].

The requirements in clauses 5.6.2, 5.6.3, 5.6.4 and 5.6.5 are applicable provided that the cell selection procedure for the selected PLMN defined in TS 38.304 [1] is not triggered during PRS measurement period.

The requirements in clauses 5.6.2, 5.6.3, 5.6.4 and 5.6.5 apply provided that all PRS resources within a PFL are within up to 2 separate windows withinTPRS,i for each positioning frequency layer *i* as defined in clauses 5.6.2, 5.6.3, 5.6.4 and 5.6.5, where each window is up to 10ms.

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

When the UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

### 5.6.2 RSTD measurements

#### 5.6.2.1 Introduction

The requirements in clause 5.6.2 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34] requesting the UE to measure and report DL RSTD measurements defined in TS 38.215 [4].

#### 5.6.2.2 Requirements Applicability

The requirements in clause 5.6.2 apply for periodic and triggered RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23 for FR1 and FR2 are fulfilled, for a corresponding Band.

#### 5.6.2.3 Measurement Capability

The UE PRS RSTD measurement capability in RRC\_INACTIVE state is as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355 [34].

5.6.2.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. If the UE supports reporting of NR positioning measurements via SDT, the UE may be able to report the measurements while it remains in RRC\_INACTIVE state; otherwise, the UE will transition to RRC\_CONNECTED state prior to transmitting the measurement report.

For RSTD measurements performed by the UE in RRC\_INACTIVE state, The measurement reporting delay excludes all of the following:

- additional delay caused other LPP signalling on the DCCH,

- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH, equal to 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,

- any delay caused by unavailability of UL resources to transmit the measurement report,

- any transmission delay needed by SDT,

- the time needed to transition to RRC\_CONNECTED state to report the measurements.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.23.3.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1.23, for each measured DL PRS resource.

#### 5.6.2.5 Measurements Period Requirements

After receiving both *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from the LMF via LPP [34]*,* the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the index of positioning frequency layer,

- is total number of positioning frequency layers, and

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

,

Where:

- is the UE Rx beam sweeping factor:

- = 1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-TDOA-RequestLocationInformation*.

- equals to 8, otherwise.

- is a scaling factor for PRS-based NR positioning measurements in RRC\_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, Kcarrier\_PRS = 1; otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, , where is defined in clause 4.2.2.4

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, , where is defined in clause 4.2.2.7.

- is the Rx TEG specific scaling factor:

- =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].

- is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- , if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case ‘n0’ is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- , if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

- is the time duration of available PRS in positioning frequency layer *i* to be measured , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the number of PRS RSTD samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

- is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, = + ,

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

=

Where:

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- , the least common multiple between and the DRX cycle length

- is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

- , is the PRS periodicity with muting per PRS resource,

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where

- is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- is the UE capability combination per band for RRC\_INACTIVE state where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], [ and T-N (>0) is the time required to process duration N of DL PRS symbols already buffered in memory], for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot [in RRC\_INACTIVE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

The time *s*tarts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the RSTD measurement period then the UE shall continue the RSTD measurement in the RRC\_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.

### 5.6.3 PRS-RSRP measurements

#### 5.6.3.1 Introduction

The requirements in clause 5.6.3 shall apply provided the UE has received a message from LMF via LPP [34] requesting the UE to measure and report PRS-RSRP measurements defined in TS 38.215 [4]. And the UE is capable of supporting the PRS-RSRP measurement in RRC INACTIVE state.

#### 5.6.3.2 Requirements applicability

The requirements in clause 5.6.3 apply for periodic and triggered PRS-RSRP measurements, provided:

- PRS-RSRP related side conditions given in clause 10.1.24 are met for a corresponding Band.

#### 5.6.3.3 Measurement Capability

UE PRS-RSRP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

#### 5.6.3.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. If the UE supports reporting of NR positioning measurements via SDT, the UE may be able to report the measurements while it remains in RRC\_INACTIVE state; otherwise, the UE will transition to RRC\_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRP measurements performed by the UE in RRC\_INACTIVE state, the measurement reporting delay excludes all of the following:

- any delay caused other LPP signalling on the DCCH,

- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,

- any delay caused by no UL resources for UE to send the measurement report,

- any transmission delay needed by SDT,

- the time needed to transition to RRC\_CONNECTED state to report the measurements.

The reported PRS-RSRP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.24.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requriements specified in the clauses 10.1.24.

#### 5.6.3.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within ms.

Where:

*- i* is the index of positioning frequency layer,

- L is total number of positioning frequency layers,

- is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

Where:

- is a scaling factor for PRS-based NR positioning measurements in RRC\_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, = 1. Otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, equals to the sum of Kcarrier in 4.2.2.4 and one positioning layer.

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, equals to the sum of Nlayer in 4.2.2.7 and one positioning layer.

- is the scaling factor for Rx beam sweeping:

* =1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-TDOA-RequestLocationInformation*.

- equals to 8, otherwise.

- is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

- is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17*in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* in clause 6.4.3 of TS 37.355 [34],

- is the number of PRS-RSRP measurement samples and

- = 1, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *requestedDL-PRS-ProcessingSamples* [34], and the following conditions are met:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *requestedDL-PRS-ProcessingSamples* [34], and the following conditions are not met

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise

*= +* is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

- is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- the least common multiple between and ,

- is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

- is the DRX cycle length.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, , the least common multiple of among the DL PRS resource sets is used to derive , where:

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

When PRS-RSRP measurements are configured for DL-AoD, the time starts from the first DRX cycle containing the DL PRS resources in the assistance data after both the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 5.6.2.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 5.6.4.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

Longer PRS-RSRP measurement period is expected when there is collision/overlap between other DL signals/channels and PRS resources in RRC\_INACTIVE state.

The requirements in clause 5.6.3 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If the DRX cycle is reconfigured during the PRS-RSRP measurement period then the PRS-RSRP measurement period can be longer.

If cell reselection occurs while PRS-RSRPP measurement is being performed, then the UE shall continue and complete the on-going PRS-RSRP measurement after the cell selection is completed. The PRS-RSRP measurement period can be longer.

If the UE’s RRC state changes from the RRC\_INACTIVE to RRC\_CONNECTED during the PRS-RSRP measurement period, then the UE shall continue the PRS-RSRP measurement in the RRC\_CONNECTED state. The PRS-RSRP measurement period can be longer.

The UE shall meet the PRS-RSRP measurement accuracy requirements in clause 10.1.24.

### 5.6.4 UE Rx-Tx time difference measurements

#### 5.6.4.1 Introduction

The requirements in this clause shall apply, provided 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].

#### 5.6.4.2 Requirements Applicability

The requirements in clause 5.6.4 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

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

- SRS is configured on the PCell.

#### 5.6.4.3 Measurement Capability

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

#### 5.6.4.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

This measurement reporting delay excludes the delay caused by any of the following:

- delay caused by other LPP signalling on the DCCH.

- delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

- delay caused due to lack of UL resources for UE to send the measurement report.

- delay required by SDT for reporting the measurement using SDT resouces.

- delay required for transition to RRC\_CONNECTED state for report the measurement in RRC\_CONNECTED.

The UE Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.X.

The UE Rx-Tx time difference measurement accuracy for all measured DL PRS resourcesshall be fulfilled according to the accuracy requirements specified in clause 10.1.X.

#### 5.6.4.5 Measurement Period Requirements

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34]*,* UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period ms.

Where:

- is the index of positioning frequency layer,

- is the measurement period for UE Rx-Tx time difference measurements in positioning frequency layer *i* as further defined in this clause,

- L is total number of positioning frequency layers,

- is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i* as defined further in this clause.

Where:

- =1 if the UE is capable of *parallelPRS-MeasRRC-Inactive-r17* defined in [34].

- if the UE is not capable of *parallelPRS-MeasRRC-Inactive-r17* defined in [34] and if Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ; where is defined in clause 4.2.2.7.

- if the UE is not capable of *parallelPRS-MeasRRC-Inactive-r17* defined in [34] and if Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ; where is defined in clause 4.2.2.4.

- is the scaling factor for UE Rx beam sweeping:

- =1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2.

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-Multi-RTT -RequestLocationInformation*.

- equals to 8, otherwise.

is the Rx TEG specific scaling factor:

- = 1 if UE is not configured by LMF with measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17 or measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17 [34].

- = measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17 or measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17 if UE is configured by LMF to measurement same DL PRS with multiple UE RxTx TEGs or multiple UE Rx TEGs [34], and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

- is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in clause 4.2.7.2 of TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot corresponding to *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* as specified in clause 6.4.3 of TS 37.355 [34],

- is the number of UE Rx-Tx time difference measurement samples:

- = 4 if the UE is not capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* defined in [34] or not configured to perform positioning measurements with reduced number of samples by *requestedDL-PRS-ProcessingSamples* [34].

- = 1 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* defined in [34] and LMF requests the UE to perform positioning measurements with reduced number of samples by *requestedDL-PRS-ProcessingSamples* [34] and the following conditions are met:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* defined in [34] and the LMF requests the UE to perform positioning measurements with reduced number of samples by *requestedDL-PRS-ProcessingSamples* [34] but the following conditions are not met:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time,  *= +*  ,

- is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

Where:

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- , the least common multiple between and .

- is the DRX cycle of the UE in the serving cell.

- is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, , the least common multiple of among DL PRS resource sets is used to derive , where:

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap

The time starts from the first DRX cycle containing the DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the RRC state transion occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the serving cell.

If cell reselection occurs during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the new serving cell.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If the DRX cycle is reconfigured during the UE Rx-Tx time difference measurement period then the UE Rx-Tx time difference measurement period can be longer.

If during UE Rx-Tx time difference measurement period PRS resources overlap with other DL signals/channels then the UE Rx-Tx time difference measurement period can be longer.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

The requirements in clause 5.6.4 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

The UE shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1.25.

### 5.6.5 PRS-RSRPP measurements

#### 5.6.5.1 Introduction

The requirements in clause 5.6.5 shall apply provided the UE has received a message from LMF via LPP requesting the UE to measure and report PRS-RSRPP measurements defined in TS 38.215 [4]. And the UE is capable of supporting the PRS-RSRPP measurement in RRC INACTIVE state.

#### 5.6.5.2 Requirements applicability

The requirements in clause 5.6.5 apply for periodic and triggered PRS-RSRPP measurements, provided:

- PRS-RSRPP related side conditions given in clause 10.1.x are met for a corresponding Band.

#### 5.6.5.3 Measurement capability

UE PRS-RSRPP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

#### 5.6.5.4 Measurement reporting requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. If the UE supports reporting of NR positioning measurements via SDT, the UE may be able to report the measurements while it remains in RRC\_INACTIVE state; otherwise, the UE will transition to RRC\_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRPP measurements performed by the UE in RRC\_INACTIVE state, the measurement reporting delay excludes all of the following:

- any delay caused other LPP signalling on the DCCH,

- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,

- any delay caused by no UL resources for UE to send the measurement report,

- any transmission delay needed by SDT,

- the time needed to transition to RRC\_CONNECTED state to report the measurements.

T The reported PRS-RSRPP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.x.

The PRS-RSRPP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requriements specified in the clauses 10.1.x.

#### 5.6.5.5 Measurement period requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message in RRC\_INACTIVE state, measurement period requirements for PRS-RSRP defined in 5.6.3 is re-used for PRS-RSRPP measurement.

## 5.7 Random access based Small Data Transmissions (RA-SDT)

### 5.7.1 Introduction

The requirements in this clause are applicable for the UE performing small data transmissions using 2-step RA or 4-step RA procedures [3].

### 5.7.2 Requirements for small data transmissions based on 2-step RA

The requirements in clause 6.2.2.3 shall apply.

### 5.7.3 Requirements for small data transmissions based on 4-step RA

The requirements in clause 6.2.2.2 shall apply.

### 5.7.4 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 5.1.2.4

- Measurements of inter-RAT E-UTRAN cells in clause 5.1.2.5

- Idle Mode CA/DC Measurements in clause 5.4

The UE is allowed to delay the reception of PRS resources on the positioning frequency layer until the SDT session is completed if the measurement using PRS resource overlaps with the SDT resources.

## 5.7B Random access based Small Data Transmissions (RA-SDT) for RedCap

### 5.7B.1 Introduction

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

The 1 Rx 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.

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

The requirements in clause 6.2.2.3 shall apply.

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

The requirements in clause 6.2.2.2 shall apply.

### 5.7B.4 Applicability conditions for RA-SDT for RedCap

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

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

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

# 6 RRC\_CONNECTED state mobility

## 6.1 Handover

### 6.1.1 NR Handover

#### 6.1.1.1 Introduction

The purpose of NR handover is to change the NR PCell to another NR cell. The requirements in this clause are applicable to SA NR, NE-DC and NR-DC.

#### 6.1.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell, and to inter-frequency handover from NR FR1 cell in a carrier frequency with CCA to NR FR1 cell.

##### 6.1.1.2.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover msec from the end of the last TTI containing the RRC command.

Where:

Dhandover equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.2.2.

##### 6.1.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

Tsearch is the time required to search the target 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 = Trs ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = 3\* Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = Trs for both known and unknown target cell.

Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*prior to the handover command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2.5 for intra-frequency handover and Clause 9.3.4 for inter-frequency handover.

#### 6.1.1.3 NR FR2- NR FR1 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR2 cell to NR FR1 cell.

##### 6.1.1.3.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover  ms from the end of the last TTI containing the RRC command.

Where:

Dhandover equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.3.2.

##### 6.1.1.3.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

Tsearch is the time required to search the target 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 inter-frequency cell and the target cell Es/Iot ≥ -2 dB, then Tsearch = 3\* Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = Trs for both known and unknown target cell.

Tprocessing is time for UE processing. Tprocessing can be up to 40ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If such measObjectNRs configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2.5 for intra-frequency handover and Clause 9.3.4 for inter-frequency handover.

#### 6.1.1.4 NR FR2- NR FR2 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR2 cell to NR FR2 cell.

##### 6.1.1.4.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover ms from the end of the last TTI containing the RRC command.

Where:

Dhandover equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.4.2.

##### 6.1.1.4.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

Tsearch is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then Tsearch = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = N\* Trs ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = N\*3\* Trs ms. N = 8 when the target cell is in FR2-1, and N = 12 when the target cell is in FR2-2. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = Trs for both known and unknown target cell.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If such measObjectNRs configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*prior to the handover command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In FR2, the target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the handover command:

- the UE has sent a valid measurement report for the target cell and

- One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell,

- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell.

otherwise it is unknown.

#### 6.1.1.5 NR FR1- NR FR2 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR2 cell.

##### 6.1.1.5.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover ms from the end of the last TTI containing the RRC command.

Where:

Dhandover equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.5.2.

##### 6.1.1.5.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When in inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

Tsearch is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then Tsearch = 0 ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = N\*3\* Trs ms. N = 8 when the target cell is in FR2-1, and N = 12 when the target cell is in FR2-2. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

Tprocessing is time for UE processing. Tprocessing can be up 40ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = Trs for both known and unknown target cell.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If such measObjectNRs configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms.

In FR2, the target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the handover command:

- the UE has sent a valid measurement report for the target cell and

- One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.3,

- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.3.

otherwise it is unknown.

### 6.1.2 NR Handover to other RATs

#### 6.1.2.1 NR – E-UTRAN Handover

##### 6.1.2.1.1 Introduction

The purpose of inter-RAT handover from NR to E-UTRAN is to change the radio access mode of PCell from NR to E-UTRAN. The handover procedure is initiated from NR with a RRC message that implies a handover as described in TS 38.331 [2]. The requirements in this clause are applicable to SA NR, NE-DC and NR-DC, and to handover from SA NR cell in a carrier frequency with CCA to E-UTRAN.

##### 6.1.2.1.2 Handover delay

When the UE receives a RRC message implying handover to E-UTRAN the UE shall be ready to start the transmission of the uplink PRACH channel in E-UTRA within Dhandover ms from the end of the last TTI containing the RRC command. Dhandover is defined as

Dhandover = TRRC\_procedure\_delay + Tinterrupt

Where:

TRRC\_procedure\_delay: it is the RRC procedure delay, which is 50ms

Tinterrupt: it is the time between end of the last TTI containing the RRC command on the NR PDSCH and the time the UE starts transmission of the PRACH in E-UTRAN, excluding TRRC\_procedure\_delay. Tinterrupt is defined in clause 6.1.2.1.3.

##### 6.1.2.1.3 Interruption time

When the inter-RAT handover to E-UTRAN is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

Where:

Tsearch is the time required to search the target 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 unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to 30 ms.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant E-UTRAN cell identification requirements are described in clause 9.4.1.

#### 6.1.2.2 NR – UTRAN Handover

#### 6.1.2.2.1 Introduction

The purpose of inter-RAT handover from NR to UTRAN is to change the radio access mode from NR to UTRAN. The handover procedure is initiated from NR with a RRC message that implies a hard handover as described in TS 38.331 [2].

##### 6.1.2.2.2 Handover delay

When the UE receives a RRC message implying handover to UTRAN the UE shall be ready to start the transmission of the new UTRA uplink DPCCH within Dhandover msfrom the end of the last NR TTI containing the RRC *MobilityfromNRCommand* command.

where:

- Dhandover equals the RRC procedure delay, which is 50 ms plus the interruption time stated in clause 6.1.2.2.3.

##### 6.1.2.2.3 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the NR PDSCH and the time the UE starts transmission on the uplink DPCCH in UTRAN, excluding the RRC procedure delay. The interruption time depends on whether the target cell is known to the UE or not.

The target cell is known if it has been measured by the UE during the last 5 seconds otherwise it is unknown. The UE shall always perform a UTRA synchronisation procedure as part of the handover procedure.

If the target cell is known the interruption time shall be less than Tinterrupt1

Tinterrupt1 = TIU+Tsync+50+ 10\*Fmax + TMC ms

If the target cell is unknown the interruption time shall be less than Tinterrupt2

Tinterrupt2 = TIU+Tsync+150 + 10\*Fmax + TMC ms

This requirement shall be met, provided that there is one target cell in the *MobilityfromNRCommand* command. Performance requirements for E-UTRA to UTRA soft handover are not specified. When UE is connected to an NR cell, UTRA SFN timing measurements are not reported. This implies that the timing of the DPCH of the UTRA target cells in the active set cannot be configured by UTRAN to guarantee that all target cells fall within the UE reception window of T0 +/- 148 chips.

Where:

- TIU is the interruption uncertainty when changing the timing from the NR to the new UTRAN cell. TIU can be up to one UTRA frame (10 ms).

- Fmax denotes the maximum number of radio frames within the transmission time intervals of all transport channels that are multiplexed into the same CCTrCH on the UTRA target cell. If HS-PDSCH is configured in the UTRA target cell, Fmax is 4 radio frames.

- Tsync is the time required for measuring the downlink DPCCH channel as stated in TS 25.214 [32], clause 4.3.1.2. In case higher layers indicate the usage of a post-verification period Tsync=0 ms. Otherwise Tsync=40 ms.

- TMC is 0ms if a single UTRA cell is configured as the handover target, otherwise 20ms if handover to UTRA with 1, 2 or 3 UTRA carriers with secondary HS-PDSCH is configured.

The phase reference is the primary CPICH.

The requirements in this clause assume that N312 has the smallest possible value i.e. only one insync is required.

### 6.1.3 NR DAPS Handover

#### 6.1.3.1 Introduction

The requirements in this clause are applicable to DAPS handover to change the NR PCell to another NR cell.

Note: requirements only apply if

- the UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement of source cell and intra-frequency measurement of target cell, or

- the SSB of source cell is completely contained in the active DL BWP of the source cell, and the SSB of target cell is completely contained in the active DL BWP of the target cell, or

- the initial DL and UL BWP of source cell is confined within the active DL and UL BWP of the source cell respectively, and the initial DL and UL BWP of target cell is confined within the active DL and UL BWP of the target cell respectively.

#### 6.1.3.2 NR FR1 - NR FR1 DAPS Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell. A DAPS handover is intra-frequency if the centre frequency of the SSB of the source cell and the centre frequency of the SSB of the target cell are the same, and the subcarrier spacing of the two SSBs are also the same.

Note: For intra-frequency DAPS handover, no requirement applies if active DL and UL BWP of target cell is not confined within the active DL and UL BWP of the source cell respectively.

Note: For inter-frequency DAPS handover, no requirement applies if the BWP of target cell is overlaped with the BWP of source cell in frequency domain.

An FR1 DAPS handover is synchronous if it meets the conditions in table 6.1.3.2-1, otherwise it is asynchronous

Table 6.1.3.2-1: Sync conditions for FR1 DAPS handover

|  |  |  |
| --- | --- | --- |
| Type of handover | Maximum receive timing difference between source and target cell (µs) for sync DAPS handover | Maximum transmit timing difference between source and target cell (µs) for sync DAPS handover |
| Intra-frequencyNote 1,2,3 | 6µs | 7.6 µs |
| Intra-band inter-frequency Note 1,2,3 | 6µs | 7.6 µs |
| Inter-band inter-frequency | 33 µs | 34.6 µs |
| Note 1: For synchonous DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected for the first symbol of the slot. For asynchronous DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, interruptions may occur depending on UE implementation. The duration and frequency of occurrence of such interruptions is not specified.  Note 2: For DAPS handover on a TDD band, after starting RACH procedure, a UE is not required to transmit in the uplink to any of source and target cells earlier than NRX-TX after the end of the last received downlink symbol from any of source and target cells in the same TDD band where NRX-TX=25600Tc.  Note 3: For DAPS handover on a TDD band, after starting RACH procedure, a UE is not required to receive in the downlink from any of source and target cells earlier than NTX-RX after the end of the last transmitted uplink symbol to any of source and target cells in the same TDD band where NTX-RX=25600Tc. | | |

##### 6.1.3.2.1 DAPS handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover1 seconds from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

Dhandover1 = TRRC\_procedure + Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

TRRC\_procedure is the maximum RRC procedure delay as specified in clause 12 in TS 38.331 [2].

Tsearch, TIU, Tprocessing, T∆ and Tmargin are defined in clause 6.1.1.2.2.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 38.331 [2] within Dhandover2.

Dhandover2 = TRRC\_procedure+ Tinterrupt2

Where:

TRRC\_procedure is the RRC procedure delay as specified in clause 12 in TS 38.331 [2].

Tinterrupt2 is defined in clause 6.1.3.2.2.

##### 6.1.3.2.2 Interruption time

During Dhandover1, the UE is allowed an interruption of up to Tinterrupt1 on source cell.

For FR1-to-FR1 intra-frequency handover, Tinterrupt1 is specified in Table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: Tinterrupt1 for FR1-to-FR1 intra-frequency DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Interruption length Tinterrupt1 (slotsNote 1), synchronous DAPS HO | Interruption length Tinterrupt1 (slotsNote 1), asynchronous DAPS HO |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 2 | 3 |
| 2 | 0.25 | 4 | 5 |
| Note 1: The same SCS of source cell and target cell is assumed.  Note 2: It is assumed that the BWP of target cell is not larger than the BWP of source cell. It is assumed that the CBW of target cell is not larger than the CBW of source cell  Note 3: Void | | | |

For FR1-to-FR1 intra-band inter-frequency handover, Tinterrupt1 is specified in Table 6.1.3.2.2-2.

Table 6.1.3.2.2-2: Tinterrupt1 for FR1-to-FR1 intra-band inter-frequency DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Tinterrupt1 (slotsNote 1), synchronous DAPS HO | Tinterrupt1 (slotsNote 1), asynchronous DAPS HO |
| 0 | 1 | 1 + TSMTC\_duration \* | 2+ TSMTC\_duration \* |
| 1 | 0.5 | 2 + TSMTC\_duration \* | 3+ TSMTC\_duration \* |
| 2 | 0.25 | 4 + TSMTC\_duration \* | 5+ TSMTC\_duration \* |
| Note 1: The same SCS of source cell and target cell is assumed.  Note 2: TSMTC\_duration measured in subframes is the longest SMTC duration between source cell and target cell.  Note 3: Void  Note 4: is as defined in TS 38.211 [6]. | | | |

For FR1-to-FR1 inter-band handover, Tinterrupt1 is specified in Table 6.1.3.2.2-3.

Table 6.1.3.2.2-3: Tinterrupt1 for FR1-to-FR1 inter-band DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Tinterrupt1 (slots) | |
|  | of source cell | Sync | Async |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 2 | 3 |
| 2 | 0.25 | 5 | 5 |

For FR1-to-FR1 intra-frequency handover, Tinterrupt2 is specified in Table 6.1.3.2.2-4 when the BWP of target cell is smaller than the BWP of source cell, and Tinterrupt2 is specified in Table 6.1.3.2.2-5 when the same BWP is used for target cell and source cell.

Table 6.1.3.2.2-4: Tinterrupt2 for FR1-to-FR1 intra-frequency DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Interruption length X (slotsNote 1) | Tinterrupt2 (slotsNote 1) for asynchronous DAPS HO |
| 0 | 1 | 2 | 3 |
| 1 | 0.5 | 4 | 5 |
| 2 | 0.25 | 8 | 9 |
| Note 1: The same SCS of source cell and target cell is assumed.  Note 2: It is assumed that the BWP of target cell is smaller than the BWP of source cell. | | | |

Table 6.1.3.2.2-5: Tinterrupt2 for FR1-to-FR1 intra-frequency DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Interruption length X (slotsNote 1) | Tinterrupt2 (slotsNote 1) for asynchronous DAPS HO |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 2 | 3 |
| 2 | 0.25 | 4 | 5 |
| Note 1: The same SCS of source cell and target cell is assumed.  Note 2: It is assumed that the BWP of target cell is the same as the BWP of source cell.  Note 3: Void | | | |

For FR1-to-FR1 intra-band inter-frequency handover, Tinterrupt2 is specified in Table 6.1.3.2.2-6.

Table 6.1.3.2.2-6: Tinterrupt2 for FR1-to-FR1 intra-band inter-frequency DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Tinterrupt2 (slotsNote 1) for synchronous DAPS HO | Tinterrupt2 (slotsNote 1) for asynchronous DAPS HO |
| 0 | 1 | 1 + TSMTC\_duration \* | 2+ TSMTC\_duration \* |
| 1 | 0.5 | 2 + TSMTC\_duration \* | 3+ TSMTC\_duration \* |
| 2 | 0.25 | 4 + TSMTC\_duration \* | 5+ TSMTC\_duration \* |
| Note 1: The same SCS of source cell and target cell is assumed.  Note 2: TSMTC\_duration measured in subframes is the longest SMTC duration between source cell and target cell.  Note 3: Void.  Note 4: is as defined in TS 38.211 [6]. | | | |

For FR1-to-FR1 inter-band handover, Tinterrupt2 is specified in Table 6.1.3.2.2-7.

Table 6.1.3.2.2-7: Tinterrupt2 for FR1-to-FR1 inter-band DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR slot length (ms) | Tinterrupt2 (slots) | |
|  | of target cell | Sync | Async |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 2 | 3 |
| 2 | 0.25 | 5 | 5 |

#### 6.1.3.3 NR FR2- NR FR1 DAPS Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR2 cell to NR FR1 cell.

An FR2-FR1 DAPS handover is synchronous if it meets the conditions in table 6.1.3.3-1, otherwise it is asynchronous

Table 6.1.3.3-1: Sync condition for FR2-FR1 DAPS handover

|  |  |  |
| --- | --- | --- |
| Frequency Range of the pair of carriers | Maximum receive timing difference between source and taget cell (µs) for sync DAPS handover | Maximum transmit timing difference between source and taget cell (µs) for sync DAPS handover |
| Between FR1 and FR2 | 25 | 26.1 |

##### 6.1.3.3.1 DAPS handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover1 ms from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

Dhandover1 = TRRC\_procedure + Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

TRRC\_procedure is the maximum RRC procedure delay as specified in clause 12 in TS 38.331 [2].

Tsearch, TIU, Tprocessing, T∆ and Tmargin are defined in clause 6.1.1.3.2.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 38.331 [2] within Dhandover2.

Dhandover2 = TRRC\_procedure+ Tinterrupt2

Where:

TRRC\_procedure is the RRC procedure delay as specified in clause 12 in TS 38.331 [2].

Tinterrupt2 is defined in clause 6.1.3.3.2.

##### 6.1.3.3.2 Interruption time

During Dhandover1, the UE is allowed an interruption of up to Tinterrupt1 on source cell.

For FR2-to-FR1 inter-band handover, Tinterrupt1 is specified in Table 6.1.3.3.2-1.

Table 6.1.3.3.2-1: Tinterrupt1 for FR2-to-FR1 inter-band DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR slot length (ms) | Tinterrupt1 (slots) | |
|  | of source cell | Sync | Async |
| 2 | 0.25 | 5 | 5 |
| 3 | 0.125 | 9 | 9 |

During Dhandover2, the UE is allowed an interruption of up to Tinterrupt2 on target cell.

For FR2-to-FR1 inter-band handover, Tinterrupt2 is specified in Table 6.1.3.3.2-2.

Table 6.1.3.3.2-2: Tinterrupt2 for FR2-to-FR1 inter-band DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR slot length (ms) | Tinterrupt2 (slots) | |
|  | of target cell | Sync | Async |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 2 | 3 |
| 2 | 0.25 | 5 | 5 |

#### 6.1.3.4 NR FR1- NR FR2 DAPS Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR2 cell.

An FR1-FR2 DAPS handover is synchronous if it meets the conditions in table 6.1.3.4-1, otherwise it is asynchronous

Table 6.1.3.4-1, : Sync condition for FR1-FR2 DAPS handover

|  |  |  |
| --- | --- | --- |
| Frequency Range of the pair of carriers | Maximum receive timing difference between source and taget cell (µs) for sync DAPS handover | Maximum transmit timing difference between source and taget cell (µs)Note 1 sync DAPS handover |
| Between FR1 and FR2 | 25 | 26.1 |

##### 6.1.3.4.1 DAPS handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover1 ms from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

Dhandover1 = TRRC\_procedure + Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

TRRC\_procedure is the maximum RRC procedure delay as specified in clause 12 in TS 38.331 [2].

Tsearch, TIU, Tprocessing, T∆ and Tmargin are defined in clause 6.1.1.5.2.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 38.331 [2] within Dhandover2.

Dhandover2 = TRRC\_procedure+ Tinterrupt2

Where:

TRRC\_procedure is the RRC procedure delay as specified in clause 12 in TS 38.331 [2].

Tinterrupt2 is defined in clause 6.1.3.4.2.

##### 6.1.3.4.2 Interruption time

During Dhandover1, the UE is allowed an interruption of up to Tinterrupt1 on source cell.

For FR1-to-FR2 inter-band handover, Tinterrupt1 is specified in Table 6.1.3.4.2-1.

Table 6.1.3.4.2-1: Tinterrupt1 for FR1-to-FR2 inter-band DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR slot length (ms) | Tinterrupt1 (slots) | |
|  | of source cell | Sync | Async |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 2 | 3 |
| 2 | 0.25 | 5 | 5 |

During Dhandover2, the UE is allowed an interruption of up to Tinterrupt2 on target cell.

For FR1-to-FR2 inter-band handover, Tinterrupt2 is specified in Table 6.1.3.4.2-2.

Table 6.1.3.4.2-2: Tinterrupt2 for FR1-to-FR2 inter-band DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR slot length (ms) | Tinterrupt2 (slots) | |
|  | of target cell | Sync | Async |
| 2 | 0.25 | 5 | 5 |
| 3 | 0.125 | 9 | 9 |

### 6.1.4 NR Conditional Handover

#### 6.1.4.1 Introduction

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

#### 6.1.4.2 NR FR1 – NR FR1 conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR FR1 cell to NR FR1 cell.

6.1.4.2.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel within DCHO seconds from the end of the last TTI containing the RRC command.

DCHO = TRRC + TEvent\_DU + Tmeasure + Tinterrupt + TCHO\_execution

Where:

TRRC is the RRC procedure delay defined in clause 12 in TS 38.331 [2].

TEvent\_DU is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover.

Tmeasure is the measurements time stated in clause 6.1.4.2.2.

TCHO\_execution is the conditional execution preparation time in clause 6.1.4.2.3.

Tinterrupt is the interruption time stated in clause 6.1.4.2.4.

6.1.4.2.2 Measurement time

The measurement time delay is defined from the end of TEvent\_DU until UE executes a handover to a target cell and interruption time starts.

For intra-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than Tidentify intra with index or Tidentify\_intra\_without\_index defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than Tidentify\_inter\_with\_index or Tidentify\_inter\_without\_index defined in clause 9.3.4.

When TTT or 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\_intra\_without\_index or Tidentify\_intra\_with\_index for intra-frequency handover or Tidentify\_inter\_without\_index for inter-frequency handover. If a cell which has been detectable at least for the time period Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index for intra-frequency handover or Tidentify\_inter\_without\_index for inter-frequency handover becomes undetectable for a period and then the cell becomes detectable again and triggers a handover, the measurement time delay shall be less than TSSB\_measurement\_period\_intra or 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 the L3 filter 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.

6.1.4.2.3 Preparation time

TCHO\_execution is the UE execution preparation time for conditional handover, and starts after UE realizes the condition of CHO is met and identity of the target cell is determined. TCHO\_execution can be up to 10ms.

6.1.4.2.4 Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH.

For intra-frequency or inter-frequency conditional conditional handover, the interruption time shall be less than

Tinterrupt = Tprocessing + TIU + T∆ + Tmargin ms

Where:

Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3]

T∆ is time for fine time tracking and acquiring full timing information of the target cell. TΔ = Trs.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*prior to the handover command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

#### 6.1.4.3 NR FR2 – NR FR1 conditional handover

The requirements in this clause are applicable to inter-frequency conditional handover from NR FR2 cell to NR FR1 cell.

The requirements defined in clause 6.1.4.2 applies assuming inter-frequency handover and:

Tprocessing is time for UE processing. Tprocessing can be up to 40ms.

#### 6.1.4.4 NR FR2 – NR FR2 conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR FR2 cell to NR FR2 cell.

##### 6.1.4.4.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel within DCHO seconds from the end of the last TTI containing the RRC command.

DCHO = TRRC + TEvent\_DU + Tmeasure + Tinterrupt + TCHO\_execution

Where:

TRRC is the RRC procedure delay defined in clause 12 in TS 38.331 [2].

TEvent\_DU is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover.

Tmeasure is the measurements time stated in clause 6.1.4.4.2.

TCHO\_execution is the conditional execution preparation time in clause 6.1.4.4.3. Tinterrupt is the interruption time stated in clause 6.1.4.4.4.

##### 6.1.4.4.2 Measurement time

The measurement time delay is defined from the end of TEvent\_DU until UE executes a handover to a target cell and interruption time starts.

For intra-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than Tidentify intra with index or Tidentify\_intra\_without\_index defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than Tidentify\_inter\_with\_index or Tidentify\_inter\_without\_index defined in clause 9.3.4.

When TTT or 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\_intra\_without\_index or Tidentify\_intra\_with\_index for intra-frequency handover or Tidentify\_inter\_without\_index for inter-frequency handover. If a cell which has been detectable at least for the time period Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index for intra-frequency handover or Tidentify\_inter\_without\_index for inter-frequency handover becomes undetectable for a period and then the cell becomes detectable again and triggers a handover, the measurement time delay shall be less than TSSB\_measurement\_period\_intra or 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 the L3 filter 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.

##### 6.1.4.4.3 Preparation time

TCHO\_execution is the UE execution preparation time for conditional handover, and starts after UE realizes the condition of CHO is met and identity of the target cell is determined. TCHO\_execution can be up 10ms.

##### 6.1.4.4.4 Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH.

For intra-frequency or inter-frequency conditional conditional handover, the interruption time shall be less than

Tinterrupt = Tprocessing + TIU + T∆ + Tmargin ms

Where:

Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3]

T∆ is time for fine time tracking and acquiring full timing information of the target cell. TΔ = Trs.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*prior to the handover command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

#### 6.1.4.5 NR FR1 – NR FR2 conditional handover

The requirements in this clause are applicable to inter-frequency conditional handover from NR FR1 cell to NR FR2 cell.

The requirements defined in clause 6.1.4.4 applies assuming inter-frequency handover and:

Tprocessing is time for UE processing. Tprocessing can be up to 40ms.

### 6.1.5 NR Handover with PSCell

#### 6.1.5.1 Introduction

The purpose of NR handover with PSCell is to change the NR PCell to another NR cell or E-UTRA cell and add or change the PSCell along with PCell handover. The requirements in this clause are applicable to:

- Handover with PSCell from NR SA to EN-DC

- Handover with PSCell from NR-DC to NR-DC

- Requirements in this clause only applies to FR1+FR2 NR-DC

- Handover with PSCell from NE-DC to NE-DC

- Requirements in this clause only applies to NE-DC with FR1 PCell

#### 6.1.5.2 Handover with PSCell from NR SA to EN-DC

The requirements in this clause are applicable to inter-RAT handover from NR to E-UTRAN and FR1/FR2 PSCell addition.

When the UE receives a RRC message implying handover with PSCell, the UE shall be ready to start the transmission of the new uplink PRACH channel on target E-UTRA PCell within DHOwithPSCell\_PCell msec from the end of the last TTI containing the RRC command, and the UE shall be ready to start the transmission of the new uplink PRACH channel on target PSCell within DHOwithPSCell\_PSCell msec from the end of the last TTI containing the RRC command.

Where:

- DHOwithPSCell\_PCell equals the applicable RRC procedure delay (i.e., 50ms) plus the interruption time stated in clause 6.1.5.2.1.

- DHOwithPSCell\_PSCell equals the PSCell addition delay stated in clause 6.1.5.2.2.

##### 6.1.5.2.1 Interruption time for inter-RAT HO from NR to E-UTRAN

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay

When handover with PSCell from NR SA to EN-DC is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch\_HO + TIU + Tprocessing

Where:

- Tsearch\_HO is same as the Tsearch defined in section 6.1.2.1.3.

- TIU is same as the one defined in section 6.1.2.1.3.

- Tprocessing is the SW processing time needed by UE, including RF warm up period. When target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2], Tprocessing = 30ms if new PSCell is in FR1, Tprocessing = 50ms if new PSCell is in FR2; otherwise, Tprocessing = 25ms if new PSCell is in FR1, Tprocessing = 45ms if new PSCell is in FR2.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant E-UTRA cell identification requirements are described in clause 9.4.1.

##### 6.1.5.2.2 PSCell addition in HO with PSCell for NR SA to EN-DC

The requirements in this section shall apply for PSCell addition during handover with PSCell from NR SA to EN-DC.

When handover with PSCell from NR SA to EN-DC is commanded, the PSCell addition time shall be less than DHOwithPSCell\_PSCell:

- DHOwithPSCell\_PSCell = TRRC\_delay + Tprocessing + Tsearch\_PCell + Tsearch\_PSCell + T∆ + TPSCell\_ DU + 2 ms

Where:

- TRRC\_delay is the RRC procedure delay. TRRC\_delay = 50ms.

- Tprocessing is as defined in section 6.1.5.2.1.

- Tsearch\_PCell is the time for obtaining the timing reference of target PCell. Tsearch\_PCell = Tsearch\_HO which is as defined in section 6.1.5.2.1 if target PSCell is unknown and SMTC configuration of target unknown PSCell is configured in *RRCConnectionReconfiguration* of *targetRAT-MessageContainer* [2]. Otherwise, Tsearch\_PCell = 0.

- Tsearch\_PSCell is same as Tsearch in section 7.31.2 of TS36.133[15], and T∆ and TPSCell\_ DU is same as the one defined in section 7.31.2 of TS36.133[15]. The Trs definition from section 7.31.2 of TS36.133[15] is modified as following for requirement in this section:

- Trs is the SMTC periodicity of the target NR cell if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2], otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

PSCell known and unknown condition is as defined in section 7.31.2 of TS36.133[15].

#### 6.1.5.3 HO with PSCell from NE-DC to NE-DC

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR PCell to NR PCell on FR1, and the PSCell addition is on LTE.

##### 6.1.5.3.1 Handover delay

When the UE receives a RRC message implying PCell handover with PSCell change, the UE shall be ready to start the transmission of the new uplink PRACH channel on target NR PCell within DHOwithPSCell\_PCell from the end of the last TTI containing the RRC command, and UE shall be ready to start the transmission of the new uplink PRACH channel on target E-UTRA PSCell within DHOwithPSCell\_PSCell from the end of the last TTI containing the RRC command.

The PCell handover delay, DHOwithPSCell\_PCell, is equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the PCell interruption time (Tinterrupt) define in clause 6.1.5.3.2.

PSCell addition/change delay, DHOwithPSCell\_PSCell is defined in clause 6.1.5.3.3.

##### 6.1.5.3.2 HO with PSCell - PCell Interruption time

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch\_PCell + T∆\_PCell + Tmargin\_PCell + TIU\_PCell + Tprocessing ms

Where:

- If the source cell is in FR1 and target cell is in FR1, Tsearch\_PCell,  T∆\_PCell, Tmargin\_PCell is same as the Tsearch, T∆, Tmargin defined in section 6.1.1.2.2 respectively. Tprocessing is UE software processing and RF warmup delay for PCell HO and for this case Tprocessing can be up to 25ms. TIU\_PCell can be up to the summation of SSB to PRACH occasion association period and 10 ms if there is no collision between PCell RACH and PSCell RACH occasion or UE can perform PCell RACH and PSCell RACH occasion simaltaneously as defined in TS38.213[39] section 7.6.1A; otherwise, longer TIU\_PCell is expected to include the uncertainty in acquiring the next available RACH occasion for PCell RACH transmission.

##### 6.1.5.3.3 PSCell addition/change in NE-DC to NE-DC HO with PSCell

When HO with PSCell addition is commanded, the PSCell addition/change time shall be less than DHOwithPSCel\_PSCell.

- DHOwithPSCel\_PSCell = Tconfig\_EUTRAN-PSCell + Tprocessing\_margin .

where

- Tconfig\_EUTRAN-PSCell isdefined in clause8.8.2, and

- Tprocessing\_margin = 5ms is the additional delay margin for RF warm-up and software processing in handover with PSCell.

#### 6.1.5.4 HO with PSCell from NR-DC to NR-DC

The requirements in this clause are applicable to handover with PSCell from NR-DC to NR-DC. The requirements in this clause are only applicable to FR1+FR2 NR-DC.

This clause defines requirements for the delay within which the UE shall be able to handover from NR cell to NR cell and add NR PSCell in the meantime.

When the UE receives a RRC message implying handover with PSCell,

- The UE shall be ready to start the transmission of the new uplink PRACH channel of the target PCell within DHOwithPSCell\_PCell ms from the end of the last TTI containing the RRC command, and

- The UE shall be capable of transmitting PRACH preamble towards the target PSCell no later than DHOwithPSCell\_PSCell ms from the end of the last TTI containing the RRC command.

Where:

- DHOwithPSCell\_PCell equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.5.4.1.

- DHOwithPSCell\_PSCell is the PSCell change delay stated in clause 6.1.5.4.2.

6.1.5.4.1 HO with PSCell – PCell Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When handover with PSCell from NR-DC to NR-DC is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

- Tsearch, TIU, T∆ and Tmargin are the same as defined in clause 6.1.1.2.2.

- Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing = 30 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, Tprocessing = 25 ms.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2.5 for intra-frequency handover and Clause 9.3.4 for inter-frequency handover.

6.1.5.4.2 HO with PSCell – PSCell change delay

The requirements in this section shall apply for PSCell change during handover with PSCell from NR DC to NR-DC.

When handover with PSCell from NR-DC to NR-DC is commanded, the PSCell change time shall be less than DHOwithPSCell\_PSCell:

- DHOwithPSCell\_PSCell = TRRC\_delay + Tprocessing + Tsearch\_PCell + Tsearch\_PSCell + T∆ + TPSCell\_ DU + 2 ms

Where:

- TRRC\_delay Tprocessing, Tsearch\_PSCell, T∆ and TPSCell\_ DU are the same as defined in clause 8.9.2.

- Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing = 30 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, Tprocessing = 25 ms.

- Tsearch\_PCell is the time for obtaining the timing reference of target PCell. If SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*, Tsearch\_PCell = Tsearch + TΔ + Tmargin, where Tsearch, TΔ and Tmargin are specified in clause 6.1.5.4.1. Otherwise, Tsearch\_PCell = 0 ms.

The Trs definition from clause 8.9.2 is modified as following for requirements in this section:

- Trs is the SMTC periodicity of the target NR cell if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in either *targetcellSMTC-SCG-r16* or *reconfigurationWithSync*, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

PSCell known and unknown condition is as defined in clause 8.9.2.

#### 6.1.5.5 Handover with PSCell from NR SA to EN-DC with PSCell using CCA

##### 6.1.5.5.1 Introduction

When the UE receives a RRC message implying handover with PSCell change, the UE shall be ready to start the transmission of the new uplink PRACH channel on target E-UTRA PCell within DHOwithPSCell\_PCell ms from the end of the last TTI containing the RRC command, and UE shall be ready to start the transmission of the new uplink PRACH channel on a target PSCell on a carrier frequency with CCA within DHOwithPSCell\_PSCell seconds and from the end of the last TTI containing the RRC command.

Where:

DHOwithPSCell\_PCell equals the maximum RRC procedure delay defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 6.1.5.5.2.

DHOwithPSCell\_PSCell is the PSCell addition delay stated in clause 6.1.5.5.3

##### 6.1.5.5.2 NR SA to EN-DC HO with PSCell- NR to E-UTRA HO Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH or on the new PUSCH.

When Handover with PSCell is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing ms

Where:

Tsearch is same as the Tsearch defined in section 6.1.2.1.3

TIU is same as the one defined in section 6.1.2.1.3.

Tprocessing is the SW processing time needed by UE, including RF warm up period. When target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2], Tprocessing = 30ms, otherwise, Tprocessing­­­ = 25 ms.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target E-UTRA cell.

In the interruption requirement, a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds. Otherwise, it is unknown. Relevant E-UTRA cell identification requirements are described in clause 9.4.1.

##### 6.1.5.5.3 NR SA to EN-DC HO with PSCell - NR PSCell Addition Delay requirements

When Handover with PSCell is commanded, the NR PSCell on a carrier frequency with CCA changing delay shall be less than DHOwithPSCell\_PSCell:

DHOwithPSCell\_PSCell = TRRC\_delay + Tprocessing + Tsearch\_PCell + Tsearch\_PSCell + T∆ + TIU\_PSCell + 2 ms

Where:

TRRC\_delay is maximum RRC procedure delay defined in clause 11.2 in TS 36.331 [2].

Tsearch\_PCell is the time for obtaining the timing reference of target PCell. Tsearch\_PCell is same as Tsearch\_HO as defined in section 6.1.5.2.1, if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2]. Otherwise, Tsearch\_PCell = 0

Tsearch\_PSCell is the time required to search the target 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\_PSCell = 0 ms. If the target cell is an unknown cell and target cell Es/Iot ≥ [-2] dB, then Tsearch\_PSCell = (3+L1) \*Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

L1 is the number of SMTC occasions not available at the UE during the inter-RAT detection period. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

T∆ is same as T∆ in section 7.31A.2.

Tprocessing is time for UE processing and is same as defined in 6.1.5.5.2.

Tmargin is time for SSB post-processing. Tmargin can be up to 2 ms.

TIU\_PSCell is the delay uncertainty due to the random-access procedure when sending PRACH to the new cell. TIU\_PSCell can be up to: (1+ L3) \*TSSB,RO + 10 ms; where TSSB,RO is the SSB to PRACH occasion association period as defined in Table 8.1-1 of TS 38.213 [39] and L3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures or RACH collision between PCell and PSCell. L3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [57] and when there are no RACH collisions between PCell and PSCell.When the UE is configured with both the UL BWP with PRACH occasion on the target cell and UL LBT failure detection/recovery, the interruption can be longer.

NOTE 1: The actual value of TIU\_PSCell shall depend upon the PRACH configuration used in the target cell.

NOTE 2: The interruption time extended by L1, L2, and L3 parameters, and by the UL LBT failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is specified in TS 38.331 [38].

Trs is the SMTC periodicity of the target NR cell if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2], otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

A cell on a carrier frequency with CCA is known if it has been meeting the relevant cell identification requirement during the last 5 seconds. Otherwise, it is unknown. Relevant cell identification requirements are described in clause 8.1.2.4.21A, and 8.1.2.4.22A.

## 6.1A Void

### 6.1A.1 Void

#### 6.1A.1.1 Void

#### 6.1A.1.2 Void

##### 6.1A.1.2.1 Void

##### 6.1A.1.2.2 Void

## 6.1B Handover to target cell using CCA

### 6.1B.1 NR Handover

#### 6.1B.1.1 Introduction

The purpose of NR handover to target cell using CCA is to change the NR PCell to a target NR cell in a carrier frequency with CCA. The requirements in this clause are applicable to NR SA.

In the requirements of clause 6.1B.1, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding detection or time tracking period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 6.1B.1, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE.

#### 6.1B.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR1 cell in carrier frequencies with CCA, and to both intra-frequency and inter-frequency handovers from NR FR1 cell in carrier frequencies with CCA to NR FR1 cell in carrier frequencies with CCA.

##### 6.1B.1.2.1 Handover delay

When the UE receives an RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover ms from the end of the last TTI containing the RRC command.

Where:

Dhandover equals the applicable RRC procedure delay to be defined in clause12 in TS 38.331 [2] plus the interruption time stated in clause 6.1B.1.2.2.

##### 6.1B.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

Tsearch is the time required to search the target 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 = (1+L1) \*Trs. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = (3+L1´) \*Trs where L1 and L1´ are the number of SMTC occasions not available at the UE during the intra-frequency and inter-frequency detection period, respectively. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = (1+ L2) \*Trs ms, where L2 is the number of SMTC occasions not available at the UE during the time tracking period.

Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

TIU is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. TIU can be up to: (1+ L3)\*TSSB,RO + 10 ms where TSSB,RO is the SSB to PRACH occasion association period as defined in Table 8.1-1 of TS 38.213 [3] and L3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [33]. When the UE is configured with both the UL BWP with PRACH occasion on the target cell and UL CCA failure detection/recovery, the interruption can be longer.

Trs is the SMTC periodicity of the target NR cell in a carrier frequency with CCA if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms.

NOTE 1: The interruption time considering the potential extensions caused by L1,L1´,L2 , L3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2A.5 for intra-frequency handover and Clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA.

#### 6.1B.1.3 NR FR2-2 NR FR2-2 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR2-2 cell to NR FR2-2 cell in carrier frequencies with CCA, and to both intra-frequency and inter-frequency handovers from NR FR2-2 cell in carrier frequencies with CCA to NR FR2-2 cell in carrier frequencies with CCA.

##### 6.1B.1.3.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover ms from the end of the last TTI containing the RRC command.

Where:

- Dhandover equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1B.1.3.2.

##### 6.1B.1.3.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

- Tsearch is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then Tsearch = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = (1+L1) \* N \* Trs ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = (3+L1´) \* N \* Trs where L1 and L1´ are the number of SMTC occasion groups not available at the UE during the intra-frequency and inter-frequency detection period, respectively. An SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. N is equal to 12. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

- Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

- Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

- T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = (1+ L2) \* Trs, where L2 is the number of SMTC occasions not available at the UE during the time tracking period.

- TIU is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. TIU can be up to (1+ L3)\*TSSB,RO + 10ms, where TSSB,RO is SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3] and L3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L3 = 0 for Type 3 channel access procedure as defined in TS 37.213 [33] L3 = 0 if *ra-ChannelAccess-r17* is not configured in FR2-2.

- Trs is the SMTC periodicity of the target NR cell in a carrier frequency with CCA if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms.

NOTE 1: The interruption time considering the potential extensions caused by L1,L1, L2 , L3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

In FR2-2, the target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the handover command:

- the UE has sent a valid measurement report for the target cell and

- One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in Clause 9.2A.5 for intra-frequency handover and Clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA,

- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in Clause 9.2A.5 for intra-frequency handover and Clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA.

otherwise it is unknown.

#### 6.1B.1.4 NR FR1- NR FR2-2 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR2-2 cell in carrier frequencies with CCA.

##### 6.1B.1.4.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover ms from the end of the last TTI containing the RRC command.

Where:

Dhandover equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1B.1.4.2.

##### 6.1B.1.4.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When in inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

Tsearch is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then Tsearch = 0 ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = (3+L1) \* N \* Trs, where L1 is the number of SMTC occasion groups not available at the UE during the inter-frequency detection period. An SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. N is equal to 12. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

Tprocessing is time for UE processing. Tprocessing can be up 40ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = (1+ L2) \* Trs, where L2 is the number of SMTC occasions not available at the UE during the time tracking period.

TIU is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. TIU can be up to (1+ L3)\*TSSB,RO + 10ms, where TSSB,RO is SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3] and L3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L3 = 0 for Type 3 channel access procedure as defined in TS 37.213 [33] L3 = 0 if *ra-ChannelAccess-r17* is not configured in FR2-2.

- Trs is the SMTC periodicity of the target NR cell in a carrier frequency with CCA if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms.

NOTE 1: The interruption time considering the potential extensions caused by L1,L2, L3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

In FR2-2, the target cell is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the handover command:

- the UE has sent a valid measurement report for the target cell and

One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in Clause 9.2A.5 for intra-frequency handover and Clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA,

- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in Clause 9.2A.5 for intra-frequency handover and Clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA.

otherwise it is unknown.

## 6.1C Handover for SAN

### 6.1C.1 NR SAN Handover

#### 6.1C.1.1 Introduction

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

#### 6.1C.1.2 NR SAN FR1 – NR SAN FR1 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR SAN FR1 cell to NR SAN FR1 cell. The requirements in this clause apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, Koffset, and Kmac for target NR SAN cell during Dhandover, otherwise interruption time may be longer than the requirements in clause 6.1C.1.2.2.

##### 6.1C.1.2.1 Handover delay

When the UE receives a RRC message implying handover to NR SAN cell, the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover msec from the end of the last TTI containing the RRC command.

Where:

- Dhandover equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1C.1.2.2.

##### 6.1C.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover to NR SAN cell is commanded,

the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Otherwise, no interruption time requirement is applied.

Where:

- 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 = Trs ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot ≥ -2 dB, then Tsearch = 3\* Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

- T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = Trs.

- Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

- Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

- TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and [10] ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

- Trs is the SMTC periodicity of the target NR SAN cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*prior to the handover command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2.5 for intra-frequency handover and Clause 9.3.4 for inter-frequency handover.

### 6.1C.2 NR SAN Conditional Handover

#### 6.1C.2.1 Introduction

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

#### 6.1C.2.2 NR SAN FR1 – NR SAN FR1 conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR SAN FR1 cell to NR SAN FR1 cell. The requirements in this clause apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, Koffset, and Kmac for target NR SAN cell during DCHO, otherwise the measurement time, preparation time and interruption time may be longer than the requirements in clause 6.1C.2.2.2, 6.1C.2.2.3 and 6.1C.2.2.4.

##### 6.1C.2.2.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2]. UE should start RRM measurement before the time or distance condition is met, the time/distance condition is defined in clause 5.5.4 in TS 38.331[2]

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel within DCHO seconds from the end of the last TTI containing the RRC command.

DCHO = TRRC + TEvent\_DU + Tmeasure + Tinterrupt + TCHO\_execution

Where:

- TRRC is the RRC procedure delay defined in clause 12 in TS 38.331 [2].

- TEvent\_DU is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover

- Tmeasure is the measurements time stated in clause 6.1C.4.2.2.

- TCHO\_execution is the UE conditional execution preparation time for conditional handover in clause 6.1C.2.2.3.

- Tinterrupt is the interruption time stated in clause 6.1C.2.2.4.

The conditional handover delay requirements are applied if condition T1-2 is later than the end of Tmeasure for time based CHO, or both condition D1-1 and condition D1-2 are fulfilled before the end of Tmeasure for location-based CHO, otherwise no CHO requirement is applied.

##### 6.1C.2.2.2 Measurement time

The measurement time delay is defined from the end of TEvent\_DU until UE executes a handover to a target cell and interruption time starts.

For intra-frequency handover, the requirements for identifying a new detectable intra frequency cell measured without Time To Trigger (TTT) and L3 filtering, Tidentify\_intra\_with\_index or Tidentify\_intra\_without\_index, defined in clause 9.2C.5.1 and clause 9.2C.6.1 are used.

For time-based conditional intra-frequency handover:

- If condition T1-1 occurs earlier than TEvent\_DU + Tidentify\_intra\_with\_index or TEvent\_DU + Tidentify\_intra\_without\_index, then the measurement time delay equal to Tidentify\_intra\_with\_index or Tidentify\_intra\_without\_index assuming UE only performs the measurements within SMTC window of the target cell.

- If condition T1-1 occurs later than TEvent\_DU + Tidentify\_intra\_with\_index or TEvent\_DU + Tidentify\_intra\_without\_index, then the measurement time delay equals to the time from the end of Tevent\_DU until condition T1-1.

For location-based conditional intra-frequency handover:

- If both condition D1-1 and condition D1-2 are fulfilled earlier than TEvent\_DU + Tidentify\_intra\_with\_index or TEvent\_DU + Tidentify\_intra\_without\_index, then the measurement time delay equal to Tidentify\_intra\_with\_index or Tidentify\_intra\_without\_index assuming UE only performs measurements within SMTC window of the target cell.

- If both condition D1-1 and condition D1-2 are fulfilled is later than TEvent\_DU plus Tidentify\_intra\_with\_index or Tidentify\_intra\_without\_index for intra-frequency handover, then the measurement time delay equal to the time from the end of Tevent\_DU until time when both condition D1-1 and condition D1-2 are fulfilled.

For inter-frequency handover, the requirements for identifying a new detectable inter frequency cell measured without Time To Trigger (TTT) and L3 filtering, Tidentify\_inter\_with\_index or Tidentify\_inter\_without\_index, defined in clause 9.3C.7.1 are used.

For time-based conditional inter-frequency handover:

- If condition T1-1 occurs earlier than TEvent\_DU + Tidentify\_inter\_with\_index or TEvent\_DU + Tidentify\_inter\_without\_index, then the measurement time delay equal to Tidentify\_inter\_with\_index or Tidentify\_inter\_without\_index assuming that the UE uses only the SMTC window of the target inter-frequency carrier for performing the measurements. In this case Ksatellite=1, CSSFinter=1.

- If condition T1-1 occurs later than TEvent\_DU + Tidentify\_inter\_with\_index or TEvent\_DU + Tidentify\_inter\_without\_index, then the measurement time delay equals to the time from the end of Tevent\_DU until condition T1-1.

For location-based conditional inter-frequency handover,

- If both condition D1-1 and condition D1-2 are fulfilled earlier than TEvent\_DU + Tidentify\_inter\_with\_index or TEvent\_DU + Tidentify\_inter\_without\_index, then the measurement time delay equal to Tidentify\_inter\_with\_index or Tidentify\_inter\_without\_index, assuming that the UE uses only the SMTC window of the target inter-frequency carrier for performing the measurements. In this case Ksatellite=1, CSSFinter=1.

- If both condition D1-1 and condition D1-2 are fulfilled later than TEvent\_DU plus Tidentify\_inter\_with\_index or Tidentify\_inter\_without\_index, then the measurement time delay equal to the time from the end of Tevent\_DU until time of both condition D1-1 and condition D1-2 are fulfilled.

When TTT or 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\_intra\_without\_index] or [Tidentify\_intra\_with\_index] for intra-frequency handover or [Tidentify\_inter\_without\_index] for inter-frequency handover.

##### 6.1C.2.2.3 Preparation time

TCHO\_execution is the UE execution preparation time for conditional handover, and starts after UE realizes the condition of CHO is met and identity of the target cell is determined. TCHO\_execution can be up to 10ms.

##### 6.1C.2.2.4 Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH.

For intra-frequency or inter-frequency conditional conditional handover, the measurment time shall be less than

Tinterrupt = Tprocessing + TIU + T∆ + Tmargin ms

Where:

- Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

- TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and [10] ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3]

- T∆ is time for fine time tracking and acquiring full timing information of the target cell. TΔ = Trs.

- Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

- Trs is the SMTC periodicity of the target NR SAN cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*prior to the handover command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

## 6.1D Handover for RedCap

### 6.1D.1 NR Handover

#### 6.1D.1.1 Introduction

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

*Editor notes: The intra-frequency handover definition of no SSB within the active DL BWP of the serving/target cell is FFS.*

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.

The requirements in this clause apply for the following handover scenarios:

* Handover to a target cell’s initial DL BWP associated with CD-SSB;
* Handover to a target cell’s Redcap specific DL BWP associated with NCD-SSB.

#### 6.1D.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell.

##### 6.1D.1.2.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover msec from the end of the last TTI containing the RRC command.

Where:

Dhandover equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1D.1.2.2.

##### 6.1D.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

Tsearch is the time required to search the target cell which depends on whether the target cell is already known when the handover command is received by the UE.

- If the target cell is a known intra-frequency cell, Tsearch = 0ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = 1\*Trs ms if UE is capable of 2 Rx antennas; Tsearch = 2\*Trs ms if UE is only required to support 1 Rx antenna.

- If the target cell is a known inter-frequency cell, then

if the measured SSB is the target SSB for HO of the target cell, Tsearch = 0ms;

if the measured SSB and the target SSB for HO belong to the same NR target cell and fulfil the following conditions, Tsearch = Trs ms:

* + - CD-SSB in initial DL BWP is the measured SSB and NCD-SSB in RedCap specific DL BWP is the target SSB for HO
    - NCD-SSB in RedCap specific DL BWP is the measured SSB and CD-SSB in initial DL BWP is the target SSB for HO
    - Both measured SSB and the target SSB for HO are NCD-SSBs within different RedCap specific DL BWPs

Otherwise, the target cell is an unknown inter-frequency cell. In this case, if the target cell Es/Iot≥-2 dB, then Tsearch = 3\* Trs ms if the UE is operating with 2 Rx antennas; Tsearch = 5\*Trs ms if UE is operating with only 1 Rx antenna.

Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = Trs for both known and unknown target cell.

Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise,

- Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing as NCD-SSB indicated by nonCellDefiningSSB-r17 if the first active DL BWP included in handover command is configured with nonCellDefiningSSB-r17, otherwise, as CD-SSB indicated by *absoluteFrequencySSB* in *frequencyInfoDL* in handover command.

- If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*prior to the handover command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

For RedCap UE with HD-FDD, the handover requirements 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.

[In FR1, the target cell is known if it has been meeting the following conditions:

- At least one of the SSBs measured belongs to the same NR target cell,

- During the last 5 seconds before the reception of the handover command:

- at least one of the SSBs measured which belongs to the same NR target cell remains detectable according to the cell identification requirements as described in clause 9.2B for intra-frequency measurements and clause 9.3B for inter-frequency measurements,

- The reference SSB of the NR target cell also remains detectable during the handover delay according to the cell identification requirements are described in clause 9.2B for intra-frequency handover and clause 9.3B for inter-frequency handover.

Otherwise, it is unknown.]

#### 6.1D.1.3 NR FR2- NR FR2 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR2 cell to NR FR2 cell.

##### 6.1D.1.3.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover msec from the end of the last TTI containing the RRC command.

Where:

Dhandover equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1D.1.3.2.

##### 6.1D.1.3.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Where:

Tsearch is the time required to search the target cell which depends on whether the target cell is already known when the handover command is received by the UE.

- If the target cell is a known intra-frequency cell, Tsearch = 0ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then Tsearch = 8\*Trs ms.

- If the target cell is a known inter-frequency cell, then

if the measured SSB is the target SSB for HO of the target cell, Tsearch = 0ms;

if the measured SSB and the target SSB for HO belong to the same NR target cell and fulfil the following conditions, Tsearch = Trs ms:

* + - CD-SSB in initial DL BWP is the measured SSB and NCD-SSB in RedCap specific DL BWP is the target SSB for HO
    - NCD-SSB in RedCap specific DL BWP is the measured SSB and CD-SSB in initial DL BWP is the target SSB for HO
    - Both measured SSB and the target SSB for HO are NCD-SSBs within different RedCap specific DL BWPs

Otherwise, the target cell is an unknown inter-frequency cell. In this case, if the target cell Es/Iot≥-2 dB, then Tsearch = 3\* Trs ms.

Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = Trs for both known and unknown target cell.

Tprocessing is time for UE processing. Tprocessing can be up to 20ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise,

- Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing as NCD-SSB indicated by nonCellDefiningSSB-r17 if the first active DL BWP included in handover command is configured with nonCellDefiningSSB-r17, otherwise, as CD-SSB indicated by absoluteFrequencySSB in frequencyInfoDL in handover command.

- If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*prior to the handover command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In FR2, the target cell is known if it has been meeting the following conditions:

- At least one of the SSBs measured belongs to the same NR target cell,

- During the last 5 seconds before the reception of the handover command:

- the UE has sent a valid measurement report for the target cell and

- at least one of the SSBs measured which belongs to the same NR target cell remains detectable according to the cell identification requirements as described in clause 9.2B for intra-frequency measurements and clause 9.3B for inter-frequency measurements,

- The reference SSB of the NR target cell also remains detectable during the handover delay according to the cell identification requirements are described in clause 9.2B for intra-frequency handover and clause 9.3B for inter-frequency handover.

Otherwise, it is unknown.

### 6.1D.2 NR Handover to other RATs

#### 6.1D.2.1 NR – E-UTRAN Handover

The purpose of inter-RAT handover from NR to E-UTRAN is to change the radio access mode of PCell from NR to E-UTRAN for RedCap UE. The handover procedure is initiated from NR with a RRC message that implies a handover as described in TS 38.331 [2]. The requirements in this clause are applicable to SA NR.

The requirements in clause 6.1.2.1 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements for category 1bis UE defined in clause 5.1.2 in [15] shall apply.

## 6.2 RRC Connection Mobility Control

### 6.2.1 SA: RRC Re-establishment

#### 6.2.1.1 Introduction

This clause contains requirements on the UE regarding RRC connection re-establishment procedure. RRC connection re-establishment is initiated when a UE in RRC\_CONNECTED state on the carrier without CCA or on the carrier with CCA 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].

The requirements in this clause are applicable for RRC connection re-establishment to NR cell.

#### 6.2.1.2 Requirements

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

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

The UE re-establishment delay (TUE\_re-establish\_delay) is specified in clause 6.2.1.2.1.

##### 6.2.1.2.1 UE Re-establishment delay requirement

The UE re-establishment delay (TUE\_re-establish\_delay) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell. The UE re-establishment delay (TUE\_re-establish\_delay) requirement shall be less than:

The intra-frequency target NR cell shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clause 10.1.2 and 10.1.3 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively, and

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.4 and 10.1.5 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively, and

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding NR Band are fulfilled.

Tidentify\_intra\_NR: It is the time to identify the target intra-frequency NR cell and it depends on whether the target NR cell is known cell or unknown cell and on the FR of the target NR cell. If the UE is not configured with intra-frequency NR carrier for RRC re-establishment then Tidentify\_intra\_NR=0; otherwise Tidentify\_intra\_NR shall not exceed the values defined in Table 6.2.1.2.1-1 when *highSpeedMeasFlagFR2-r17* is not configured or UE is not capable of FR2 power class 6 and Table 6.2.1.2.1-3 when *highSpeedMeasFlagFR2-r17* is configured and UE is capable of FR2 power class 6.

Tidentify\_inter\_NR,i: It is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* configured for RRC re-establishment and it depends on whether the target NR cell is known cell or unknown cell and on the FR of the target NR cell. Tidentify\_inter\_NR,i shall not exceed the values defined in Table 6.2.1.2.1-2.

TSMTC: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*, Tsmtc follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

TSMTC,i: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If it is not configured, the UE may assume that the target SSB periodicity is no larger than 20 ms.

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

TPRACH: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. TPRACH can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

Nfreq: It is the total number of NR frequencies to be monitored for RRC re-establishment; Nfreq = 1 if the target intra-frequency NR cell is known, else Nfreq = 2 and Tidentify\_intra\_NR = 0 if the target inter-frequency NR cell is known.

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

In the requirement defined in the below tables, the target FR1 cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown.

Table 6.2.1.2.1-1: 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, 5 x TSMTC) | MAX (800 ms, 10 x TSMTC) |
| ≥ -8 | FR2-1 | N/A | MAX (1000 ms, 80 x TSMTC)) |
| ≥ -8 | FR2-2 | N/A | MAX (1000 ms, 120 x TSMTC)) |
| < -8 | FR1 | N/A | 800Note1 |
| < -8 | FR2-1 | N/A | 3520Note1 |
| < -8 | FR2-2 | N/A | 5280Note1 |
| 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. | | | |

T Table 6.2.1.2.1-2: 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, 6 x TSMTC, i) | MAX (800 ms, 13 x TSMTC, i) |
| ≥ -8 | FR2-1 | N/A | MAX (1000 ms, 104 x TSMTC, i)) |
| ≥ -8 | FR2-2 | N/A | MAX (1000 ms, 156 x TSMTC, i)) |
| < -8 | FR1 | N/A | 800Note1 |
| < -8 | FR2-1 | N/A | 4000Note1 |
| < -8 | FR2-2 | N/A | 6000 Note1 |
| 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. | | | |

Table 6.2.1.2.1-3: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell when *highSpeedMeasFlagFR2-r17* is configured (Frequency range FR2)

|  |  |  |  |
| --- | --- | --- | --- |
| Serving cell | FR of target NR | Tidentify\_intra\_NR [ms] | |
| SSB Ês/Iot (dB) | cell | Known NR cell | Unknown NR cell |
| ≥ -8 | FR2 | N/A | MAX (1000 ms, 10 xN2 x TSMTC)) |
|  |  |  |  |
| 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.  Note 2: When SMTC <= 40ms, N2=2 when *highSpeedMeasFlagFR2-r17* = set1; N2=6 when *highSpeedMeasFlagFR2-r17* = set2. | | | |

### 6.2.1A RRC Re-establishment with CCA

#### 6.2.1A.1 Introduction

This clause contains requirements on the UE regarding RRC connection re-establishment procedure on the carrier with CCA. RRC connection re-establishment on the carrier with CCA is initiated when a UE in RRC\_CONNECTED state on the carrier w/o or with CCA 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].

In the requirements of clause 6.2.1A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding RRC re-establishment period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 6.2.1A, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE; otherwise the PRACH occasion is considered as available for transmission.

The requirements in this clause are applicable for RRC connection re-establishment to NR cell on the carrier with CCA.

When the RRC connection re-establishment is performed on a cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17* if configured. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and perform measurement accordingly, and the requirements in clause 6.2.1A shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in 6.2.1 shall apply.

#### 6.2.1A.2 Requirements

In RRC\_CONNECTED state on the carrier w/o or with CCA the UE shall be capable of sending *RRCReestablishmentRequest* message within Tre-establish\_delay\_CCA seconds from the moment it detects a loss in RRC connection. The total RRC connection delay (Tre-establish\_delay\_CCA) shall be less than:

TUL\_grant: It is the time required to acquire and process uplink grant from the target PCell with CCA. The uplink grant is required to transmit *RRCReestablishmentRequest* message.

The UE re-establishment delay (TUE\_re-establish\_delay\_CCA) is specified in clause 6.2.1A.2.1.

##### 6.2.1A.2.1 UE Re-establishment with CCA delay requirement

The UE re-establishment on the carrier with CCA delay (TUE\_re-establish\_delay\_CCA) is the time between the moments when any of the conditions requiring RRC re-establishment on the carrier with CCA as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell on the carrier with CCA . The UE re-establishment delay requirement (TUE\_re-establish\_delay\_CCA) on the carrier with CCA shall be less than:

The intra-frequency target NR cell with CCA shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clause 10.1.2 and 10.1.3 are fulfilled for a corresponding NR Band for FR1 and FR2-2, respectively, and

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell on the carrier with CCA shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.4 and 10.1.5 are fulfilled for a corresponding NR Band for FR1 and FR2-2, respectively, and

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band are fulfilled.

Tidentify\_intra\_NR\_CCA: If the target intra-frequency carrier is the carrier without CCA, it is the time to identify the target intra-frequency NR cell which is defined in clause 6.2.1; otherwise it is the time to identify the target intra-frequency NR cell on the carrier with CCA and it depends on whether the target NR cell on the carrier with CCA is known cell or unknown cell and on the frequency range (FR) of the target NR cell on the carrier with CCA. If the UE is not configured with intra-frequency NR carrier with CCA for RRC re-establishment then Tidentify\_intra\_NR\_CCA=0; otherwise Tidentify\_intra\_NR\_CCA shall not exceed the values defined in Table 6.2.1A.2.1-1.

Tidentify\_inter\_NR\_CCA,i: If the target inter-frequency carrier is the carrier without CCA, it is the time to identify the target inter-frequency NR cell which is defined in clause 6.2.1; otherwise it is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* with CCA configured for RRC re-establishment and it depends on whether the target NR cell on the inter-frequency carrier with CCA is known or unknown. Tidentify\_inter\_NR\_CCA,i shall not exceed the values defined in Table 6.2.1A.2.1-2.

TSMTC: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*, Tsmtc follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

TSMTC,i: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If it is not configured, the UE may assume that the target SSB periodicity is not larger than 20 ms.

TSI-NR\_CCA: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for the target NR cell on the carrier with CCA.

TPRACH\_CCA is the delay uncertainty in acquiring the first available PRACH occasion in the target NR Cell on the carrier with CCA:

TPRACH\_CCA = (1+ K3)\*TSSB,RO + 10 ms, where:

- TSSB,RO is the SSB to PRACH occasion association period as defined inTable 8.1-1 of TS 38.213 [39].

- K3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. K3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [57]. L3 = 0 if *ra-ChannelAccess-r17* is not configured in FR2-2.

Nfreq: It is the total number of NR frequencies to be monitored for RRC re-establishment; Nfreq = 1 if the target NR cell on the intra-frequency carrier with CCA is known, else Nfreq = 2 and Tidentify\_intra\_NR\_CCA = 0 if the target NR cell on the inter-frequency carrier with CCA is known.

There is no requirement if the target cell on the carrier with CCA does not contain the UE context.

In the requirement defined in the below tables, the target FR1 cell on the carrier with CCA is known if it has been meeting the relevant cell identification requirement during the last 8 seconds otherwise it is unknown.

Table 6.2.1A.2.1-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell with CCA

|  |  |  |  |
| --- | --- | --- | --- |
| Serving cell | Frequency range | Tidentify\_intra\_NR\_CCA [ms] | |
| SSB Ês/Iot (dB) | (FR) of target NR cell | Known NR cell | Unknown NR cell |
| ≥ -8 | FR1 | MAX (200 ms, (5+K1) x TSMTC) | MAX (800 ms, (10+ K1) x TSMTC) |
| ≥ -8 | FR2-2 | N/A | MAX (1000 ms, N x (10+ K3) x TSMTC) |
| < -8 | FR1 | N/A | (800+20 x K1)Note1 |
| < -8 | FR2-2 | N/A | N x (440+20 x K3)Note1 |
| Note 1: The UE is not required to successfullyidentify a cell on any NR frequency layer with CCA when TSMTC > 20 ms and serving cell SSB Ês/Iot < -8 dB.  Note 2: K1 is the number of SMTC occasions not available at the UE due during RRC re-establishment period on the carrier with CCA.  Note 3: K3 is the number of SMTC occasion groups not available at the UE during RRC re-establishment period on the carrier with CCA. An SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. N is equal to 12. | | | |

Table 6.2.1A.2.1-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell on the carrier with CCA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Serving cell SSB Ês/Iot (dB) | Frequency range | Tidentify\_inter\_NR\_CCA, i [ms] | | |
|  | (FR) of target NR cell | Known NR cell | | Unknown NR cell |
| ≥ -8 | FR1 | MAX (200 ms, ([6]+K2,i) x TSMTC, i) | MAX (800 ms, ([13]+K2,i) x TSMTC, i) | |
| < -8 | FR1 | N/A | (800+20 x K2,i) Note1 | |
| Note 1: The UE is not required to successfully identify a cell on any NR frequency layer with CCA when TSMTC,i > 20 ms and serving cell SSB Ês/Iot < -8 dB.  Note 2: K2,i is the number of SMTC occasions not available at the UE during RRC re-establishment period on the “i” th carrier with CCA, | | | | |

### 6.2.1B SA: RRC Re-establishment for RedCap

#### 6.2.1B.1 Introduction

This clause contains requirements on the RedCap UE regarding RRC connection re-establishment procedure.

#### 6.2.1B.2 Requirements

The requirements in clause 6.2.1 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 6.2.1 shall apply except that:

- Tidentify\_intra\_NRas specified in Table 6.2.1B.2-1.

- Tidentify\_inter\_NR, i as specified in Table 6.2.1B.2-2.

Table 6.2.1B.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 6.2.1B.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. | | | |

When the Redcap specific initial BWP is configured for random access, in clause 6.2.1 is extended by 6ms.

### 6.2.2 Random access

#### 6.2.2.1 Introduction

This clause contains requirements on the 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 for the 4-step RA type procedure are described in clause 6.2.2.2, whereas the requirements for the 2-step RA type procedure are described in the clause 6.2.2.3 of this specification.

#### 6.2.2.2 Requirements for 4-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in Table 6.3.4.2-1 of TS 38.101-1 [18] for FR1 and in Table 6.3.4.2-1 of TS 38.101-2 [19] for FR2. The relative power applied to additional preambles shall have an accuracy as specified in Table 6.3.4.3-1 of TS 38.101-1 [18] for FR1 and clause 6.3.4.3 of TS38.101-2 [19] for FR2.

The UE shall indicate a random access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4 in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode or any MR-DC operation mode.

##### 6.2.2.2.1 Contention based random access

###### 6.2.2.2.1.1 Correct behaviour when transmitting Random Access Preamble

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SSB is configured, as specified in clause 5.1.2 in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

###### 6.2.2.2.1.2 Correct behaviour when receiving Random Access Response

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

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2.2.2.1.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 in TS 38.321 [7].

###### 6.2.2.2.1.4 Correct behaviour when receiving an UL grant for msg3 retransmission

The UE shall re-transmit the msg3 upon the reception of anUL grant for msg3 retransmission.

###### 6.2.2.2.1.5 SA: Correct behaviour when receiving a message over Temporary C-RNTI

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

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

###### 6.2.2.2.1.6 Correct behaviour when contention Resolution timer expires

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

##### 6.2.2.2.2 Non-Contention based random access

###### 6.2.2.2.2.1 Correct behaviour when transmitting Random Access Preamble

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs is configured, with the UE selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs, UE shall have the capability to select the Random Access Preamble corresponding to the selected CSI-RS, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the random access procedure is initialized for beam failure recovery and if the contention-free Random Access Resources and the contention-free PRACH occasions for beam failure recovery request associated with any of the SSBs and/or CSI-RSs is configured, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs or the selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, or from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB assocated PRACH occasions or the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

###### 6.2.2.2.2.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s), if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble, unless the random access procedure is initialized for Other SI request from UE.

The UE may stop monitoring for Random Access Response(s) and shall monitor the Other SI transmission if the Random Access Response only contains a Random Access Preamble identifier which is corresponding to the transmitted Random Access Preamble and the random access procedure is initialized for SI request from UE, as specified in clause 5.1.4 in TS 38.321 [7].

The UE may stop monitoring for Random Access Response(s), if the contention-free Random Access Preamble for beam failure recovery request was transmitted and if the PDCCH addressed to UE’s C-RNTI is received, as specified in clause 5.1.4 in TS 38.321 [7].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamblewith the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2.2.2.2.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power, if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon* or if no PDCCH addressed to UE’s C-RNTI is received within the RA Response window configured in *BeamFailureRecoveryConfig*, as defined in clause 5.1.4 in TS 38.321 [7].

##### 6.2.2.2.3 UE behaviour when configured with supplementary UL

In addition to the requirements defined in clause 6.2.2.2.1 and 6.2.2.2.2, a UE configured with supplementary UL carrier shall use RACH configuration for the supplementary UL carrier contained in RMSI and RRC dedicated signalling. If the cell for the random access procedure is configured with supplementary UL, the UE shall transmit or re-transmit PRACH preamble on the supplementary UL carrier if the SS-RSRP measured by the UE on the DL carrier is lower than the *rsrp-ThresholdSSB-SUL* as defined in TS 38.331 [2].

#### 6.2.2.3 Requirements for 2-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate MsgA PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and the MsgA PUSCH power formula of clause 7.1.1 of TS 38.213 [3] and apply this power level at the first MsgA or additional MsgA repetitions. The absolute power applied to the first preamble shall have an accuracy as specified in Table 6.3.4.2-1 of TS 38.101-1 [18] for frequency range 1 and in Table 6.3.4.2-1 of TS 38.101-2 [19] for frequency range 2. The relative power applied to additional preambles shall have an accuracy as specified in Table 6.3.4.3-1 of TS 38.101-1 [18] for frequency range 1 and clause 6.3.4.3 of TS38.101-2 [19] for frequency range 2.

The UE shall switch to 4-step RA type procedure if the MsgA transmission counter has exceeded *msgA-TransMax*, if configured, as specified in clause 5.1.4a of TS 38.321 [7]. The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4a in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode or any MR-DC operation mode.

##### 6.2.2.3.1 Contention based random access

###### 6.2.2.3.1.1 Correct behaviour when transmitting MsgA

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, the UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SS blocks is configured, as specified in clause 5.1.2a in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, UE shall have the capability to transmit MsgA PRACH on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured.

The PRACH preamble and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE should have the capability to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH ocasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

###### 6.2.2.3.1.2 Correct behaviour when receiving MsgB

The UE shall stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

The UE shall send ACK if Success RAR is received in MsgB and the Contention Resolution is successful, as defined in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH and monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

###### 6.2.2.3.1.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

##### 6.2.2.3.2 Non-Contention based random access

###### 6.2.2.3.2.1 Correct behaviour when transmitting MsgA

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE should have the capability to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH ocasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

###### 6.2.2.3.2.2 Correct behaviour when receiving MsgB

The UE may stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamblewith the calculated MsgA PRACH and MsgA PUSCH transmission power if all received MsgBs contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2.2.3.2.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power, if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA* and the Random Access Response Reception has not been considered as successful as defined in clause 5.1.4a in TS 38.321 [7].

##### 6.2.2.3.3 UE behaviour when configured with supplementary UL

In addition to the requirements defined in clause 6.2.2.3.1 and 6.2.2.3.2, a UE configured with supplementary UL carrier shall use RACH configuration for the supplementary UL carrier contained in RMSI and RRC dedicated signalling. If the cell for the random access procedure is configured with supplementary UL, the UE shall transmit or re-transmit PRACH preamble on the supplementary UL carrier if the SS-RSRP measured by the UE on the DL carrier is lower than the *rsrp-ThresholdSSB-SUL* as defined in TS 38.321 [7].

### 6.2.2A Random access when CCA is used on target frequency

#### 6.2.2A.1 Introduction

This clause contains requirements on the UE regarding random access procedure when CCA is used on the target frequency. 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 for the 4-step RA type procedure are described in clause 6.2.2A.2, whereas the requirements for the 2-step RA type procedure are described in the clause 6.2.2A.3 of this specification.

#### 6.2.2A.2 Requirements for 4-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in Table 6.3.4.2-1 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy as specified in Table 6.3.4.3-1 of TS 38.101-1 [18].

The UE shall indicate a random access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4 in TS 38.321 [7].

The requirements in this clause apply for UE operating in a carrier frequency with CCA in SA operation mode or any MR-DC operation mode, in a carrier frequency with CCA.

##### 6.2.2A.2.1 Contention based random access

###### 6.2.2A.2.1.1 Correct behaviour when transmitting Random Access Preamble

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SSB is configured, as specified in clause 5.1.2 in TS 38.321 [7].

If the UL CCA is successful on the next available PRACH occasion, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If UE is configured *lbt-FailureRecoveryConfig* and is capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for random access preamble transmission, as outlined in Clause 5.21.2 of TS 38.321 [7], the UE shall perform the Random Access Resource selection procedure again, as specified in clause 5.1.3 in TS 38.321 [7].

If UE is not configured *lbt-FailureRecoveryConfig* or is not capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for random access preamble transmission, as outlined in Clause 5.21.2 of TS 38.321 [7], the UE shall increment PREAMBLE\_TRANSMISSION\_COUNTER by 1. The UE shall again perform the Random Access Resource selection procedure if PREAMBLE\_TRANSMISSION\_COUNTER < *preambleTransMax* + 1, as specified in clause 5.1.3 in TS 38.321 [7].

###### 6.2.2A.2.1.2 Correct behaviour when receiving Random Access Response

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

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2.2A.2.1.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], if the UL CCA is successful, and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 in TS 38.321 [7].

###### 6.2.2A.2.1.4 Correct behaviour when receiving an UL grant for msg3 retransmission

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission, if the UL CCA is successful,

6.2.2A.2.1.5 Correct behaviour when receiving a message over Temporary C-RNTI

If the UL CCA is successful, The UE shall send ACK if the Contention Resolution is successful.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires and the UL CCA is successful, unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

###### 6.2.2A.2.1.6 Correct behaviour when contention Resolution timer expires

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

##### 6.2.2A.2.2 Non-Contention based random access

###### 6.2.2A.2.2.1 Correct behaviour when transmitting Random Access Preamble

If the UL CCA is successful on the next available PRACH occasion and if the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the UL CCA is successful, and if the random access procedure is initialized for beam failure recovery and if the contention-free Random Access Resources and the contention-free PRACH occasions for beam failure recovery request associated with SSBs configured, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If UE is configured *lbt-FailureRecoveryConfig* and is capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for random access preamble transmission, as outlined in Clause 5.21.2 of TS 38.321 [7], the UE shall perform the Random Access Resource selection procedure again, as specified in clause 5.1.3 in TS 38.321 [7].

If UE is not configured *lbt-FailureRecoveryConfig* or is not capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for random access preamble transmission, as outlined in Clause 5.21.2 of TS 38.321 [7], the UE shall increment PREAMBLE\_TRANSMISSION\_COUNTER by 1. The UE shall again perform the Random Access Resource selection procedure if PREAMBLE\_TRANSMISSION\_COUNTER < *preambleTransMax* + 1, as specified in clause 5.1.3 in TS 38.321 [7].

###### 6.2.2A.2.2.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s), if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble, unless the random access procedure is initialized for Other SI request from UE.

The UE may stop monitoring for Random Access Response(s) and shall monitor the Other SI transmission if the Random Access Response only contains a Random Access Preamble identifier which is corresponding to the transmitted Random Access Preamble and the random access procedure is initialized for SI request from UE, as specified in clause 5.1.4 in TS 38.321 [7].

The UE may stop monitoring for Random Access Response(s), if the contention-free Random Access Preamble for beam failure recovery request was transmitted and if the PDCCH addressed to UE’s C-RNTI is received, as specified in clause 5.1.4 in TS 38.321 [7].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion if the UL CCA is successful, and transmit the preamblewith the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2.2A.2.2.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion if the UL CCA is successful, and transmit the preamble with the calculated PRACH transmission power, if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon* or if no PDCCH addressed to UE’s C-RNTI is received within the RA Response window configured in *BeamFailureRecoveryConfig*, as defined in clause 5.1.4 in TS 38.321 [7].

#### 6.2.2A.3 Requirements for 2-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate MsgA PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and the MsgA PUSCH power formula of clause 7.1.1 of TS 38.213 [3] and apply this power level at the first MsgA or additional MsgA repetitions. The absolute power applied to the first preamble shall have an accuracy as specified in Table 6.3.4.2-1 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy as specified in Table 6.3.4.3-1 of TS 38.101-1 [18].

The UE shall switch to 4-step RA type procedure if the MsgA transmission counter has exceeded *msgA-TransMax*, if configured, as specified in clause 5.1.4a of TS 38.321 [7]. The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4a in TS 38.321 [7].

The requirements in this clause apply for UE operating in a carrier frequency with CCA in SA operation mode or any MR-DC operation mode, in a carrier frequency with CCA.

##### 6.2.2A.3.1 Contention based random access

###### 6.2.2A.3.1.1 Correct behaviour when transmitting MsgA

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, the UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SS blocks is configured, as specified in clause 5.1.2a in TS 38.321 [7].

If the UL CCA is successful on the next available PRACH occasion, with the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, UE shall have the capability to transmit MsgA PRACH on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured.

The PRACH preamble and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, if the UL CCA is successful, the UE should have the capability to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH occasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

If UE is configured *lbt-FailureRecoveryConfig* and is capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for MsgA transmission, as outlined in Clause 5.21.2 of TS 38.321 [7], the UE shall cancel the transmission of the MsgA payload on the associated PUSCH resource and perform the Random Access Resource selection procedure, as specified in clause 5.1.3a in TS 38.321 [7].

If UE is not configured *lbt-FailureRecoveryConfig* or is not capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for MsgA transmission, as outlined in Clause 5.21.2 of TS 38.321 [7], the UE shall cancel the transmission of the MsgA payload on the associated PUSCH resource and increment PREAMBLE\_TRANSMISSION\_COUNTER by 1. The UE shall again perform the Random Access Resource selection procedure if PREAMBLE\_TRANSMISSION\_COUNTER < *preambleTransMax* + 1, as specified in clause 5.1.3a in TS 38.321 [7]. If the Random Access Procedure is not complete and the UE is configured with *msgA-TransMax* then, as specified in clause 5.1.3a in TS 38.321 [7], the UE shall perform the Random Access Resource selection procedure with 4-step RA type provided that PREAMBLE\_TRANSMISSION\_COUNTER = *msgA-TransMax* + 1.

###### 6.2.2A.3.1.2 Correct behaviour when receiving MsgB

The UE shall stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

If the UL CCA is successful, the UE shall send ACK if Success RAR is received in MsgB and the Contention Resolution is successful, as defined in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH if the UL CCA is successful, and monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power, if the UL CCA is successful on the next available PRACH occasion, when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

###### 6.2.2A.3.1.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and if the UL CCA is successful, transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power if the UL CCA is successful on the next available PRACH occasion when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

##### 6.2.2A.3.2 Non-Contention based random access

###### 6.2.2A.3.2.1 Correct behaviour when transmitting MsgA

If the UL CCA is successful, if the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE should have the capability to transmit MsgA PUSCH, if the UL CCA is successful, on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH occasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

If UE is configured *lbt-FailureRecoveryConfig* and is capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for MsgA transmission, as outlined in Clause 5.21.2 of TS 38.321 [7], the UE shall have cancel the transmission of the MsgA payload on the associated PUSCH resource and perform the Random Access Resource selection procedure, as specified in clause 5.1.3a in TS 38.321 [7].

If UE is not configured *lbt-FailureRecoveryConfig* or is not capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for MsgA transmission, as outlined in Clause 5.21.2 of TS 38.321 [7], the UE shall cancel the transmission of the MsgA payload on the associated PUSCH resource and increment PREAMBLE\_TRANSMISSION\_COUNTER by 1. The UE shall again perform the Random Access Resource selection procedure if PREAMBLE\_TRANSMISSION\_COUNTER < *preambleTransMax* + 1, as specified in clause 5.1.3a in TS 38.321 [7]. If the Random Access Procedure is not complete and the UE is configured with *msgA-TransMax* then, as specified in clause 5.1.3a in TS 38.321 [7], the UE shall perform the Random Access Resource selection procedure with 4-step RA type provided that PREAMBLE\_TRANSMISSION\_COUNTER = *msgA-TransMax* + 1.

###### 6.2.2A.3.2.2 Correct behaviour when receiving MsgB

The UE may stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH if the UL CCA is successful, as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamblewith the calculated MsgA PRACH and MsgA PUSCH transmission power if the UL CCA is successful, if all received MsgBs contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2.2A.3.2.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power if the UL CCA is successful on the next available PRACH occasion, if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA* and the Random Access Response Reception has not been considered as successful as defined in clause 5.1.4a in TS 38.321 [7].

### 6.2.2B Random access for RedCap

#### 6.2.2B.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 1 Rx RedCap UE for performing the random access procedure defined in clause 5.1 [7] 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.

#### 6.2.2B.2 Requirements

The requirements for the 4-step RA type procedure described in clause 6.2.2.2 and the requirements for the 2-step RA type procedure described in the clause 6.2.2.3 are applicable for TDD and FDD RedCap UEs. The 4-step and 2-step RA requirements for contention based random access defined in clause 6.2.2.2 and 6.2.2.3 respectively apply to HD-FDD UE with the following conditions:

* The RedCap UE operating in HD-FDD mode is not expected to perform PRACH transmission on a PRACH resource of a cell if UE has not received at least one SSB associated with that PRACH resource during the last Tp period in the cell, where Tp=160 ms.
* The RedCap UE operating in HD-FDD mode shall meet the PRACH requirements when performing PRACH transmission on a PRACH resource of a cell provided that the UE has received at least one SSB associated with that PRACH resource during the last Tp period before the PRACH transmission, where Tp=160 ms.

### 6.2.3 SA: RRC Connection Release with Redirection

#### 6.2.3.1 Introduction

This clause contains requirements on the UE regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCRelease* message with redirection to E-UTRAN or 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].

In the requirements of clause 6.2.3.2, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding identification period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 6.2.3.2, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE.

When the RRC connection release with redirection is performed on a cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17* if configured. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and perform measurement accordingly, and the requirements in clause 6.2.3.2.3 shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in 6.2.3.2.1 shall apply.

#### 6.2.3.2 Requirements

##### 6.2.3.2.1 RRC connection release with redirection to NR

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell within Tconnection\_release\_redirect\_NR.

The time delay (Tconnection\_release\_redirect\_NR) is the time between the end of the last slot containing the RRC command, “*RRCRelease*” (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay (Tconnection\_release\_redirect\_NR) shall be less than:

Tconnection\_release\_redirect\_NR = TRRC\_procedure\_delay + Tidentify-NR + TSI-NR + TRACH

The target NR cell shall be considered detetable when for each relevant SSB, the side conditions should be met that,

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.5 for a corresponding NR Band are fulfilled.

TRRC\_procedure\_delay: It is the RRC procedure delay for processing the received message “*RRCRelease*” as defined in clause 6.2.2 of TS 38.331 [2].

Tidentify-NR: It is the time to identify the target NR cell and depends on the FR of the target NR cell. It is defined in Table 6.2.3.2.1-1. Note that Tidentify-NR = TPSS/SSS-sync + Tmeas, in which TPSS/SSS-sync is the cell search time and Tmeas is the measurement time due to cell selection criteria evaluation.

TSI-NR: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released. TRACH: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. TRACH can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise Trs is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with Trs = 20 ms if the SSB transmission periodicity is not larger than 20 ms; otherwise,

- there is no requirement if the SSB transmission periodicity is larger than 20ms.

Table 6.2.3.2.1-1: 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, 11 x Trs) |
| FR2-1 | MAX (880 ms, 8x11 x Trs) |
| FR2-2 | MAX (880 ms, 12x11 x Trs) |
| Note: If the UE has been provided with higher layer signaling 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. | |

##### 6.2.3.2.2 RRC connection release with redirection to E-UTRAN

The UE shall be capable of performing the RRC connection release with redirection to the target E-UTRAN cell within Tconnection\_release\_redirect\_E-UTRA.

The time delay (Tconnection\_release\_redirect\_E-UTRA) is the time between the end of the last slot containing the RRC command, “*RRCRelease*” (TS 38.331 [2]) on the PDSCH and the time the UE starts to send random access to the target E-UTRA cell. The time delay (Tconnection\_release\_redirect\_E-UTRA) shall be less than:

Tconnection\_release\_redirect\_E-UTRA = TRRC\_procedure\_delay + Tidentify-E-UTRA + TSI-E-UTRA + TRACH

The target E-UTRA FDD or TDD cell shall be considered detectable provided the following conditions are fulfilled:

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

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

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

TRRC\_procedure\_delay: It is the RRC procedure delay for processing the received message “*RRCRelease*” as defined in clause 6.2.2 of TS 38.331 [2].

Tidentify-E-UTRA: It is the time to identify the target E-UTRA cell. It shall be less than 320 ms.

TSI-E-UTRA: It is the time required for acquiring all the relevant system information of the target E-UTRA cell. This time depends upon whether the UE is provided with the relevant system information (SI) of the target E-UTRA cell or not by the old NR cell before the RRC connection is released.

TRACH: It is the delay caused due to the random access procedure when sending random access to the target E-UTRA cell.

##### 6.2.3.2.3 RRC connection release with redirection to NR carrier subject to CCA

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell subject to CCA within Tconnection\_release\_redirect\_NR\_CCA.

The time delay (Tconnection\_release\_redirect\_NR\_CCA) is the time between the end of the last slot containing the RRC command, “*RRCRelease*” (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay (Tconnection\_release\_redirect\_NR\_CCA) shall be less than:

Tconnection\_release\_redirect\_NR\_CCA = TRRC\_procedure\_delay + Tidentify-NR\_CCA + TSI-NR\_CCA + TRACH\_CCA

The target NR cell shall be considered detetable when for each relevant SSB, the side conditions should be met that,

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.5 for a corresponding NR Band are fulfilled.

- TRRC\_procedure\_delay: It is the RRC procedure delay for processing the received message “*RRCRelease*” as defined in clause 6.2.2 of TS 38.331 [2].

- Tidentify-NR\_CCA: It is the time to identify the target NR cell and is defined as:

- Tidentify-NR\_CCA = TPSS/SSS-sync + Tmeas; TPSS/SSS-sync is the cell search time and Tmeas is the measurement time due to cell selection criteria evaluation.

- For FR1 target NR cell: Tidentify-NR\_CCA = MAX (680 ms, (L1+11) × Trs);

- For FR2-2 target NR cell: Tidentify-NR\_CCA = MAX (880 ms, N×(L1´+11) × Trs);

- where L1 is the number of SMTC occasions not available at the UE due to DL CCA failures and L1´ is the number of SMTC occasion groups not available at the UE due to DL CCA failures. An SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. N is equal to 12. If L1 > L1,max or L1´ > L1,max then the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1]; where L1,max is defined in Table 6.2.3.2.3-1.

- TSI-NR\_CCA: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released.

- TRACH\_CCA: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell:

- TRACH\_CCA = (1+L2)×TSSB,RO + 10 ms TPRACH; where:

- L2 is the consecutive number of SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures. L2 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [33]. L3 = 0 if *ra-ChannelAccess-r17* is not configured in FR2-2.

- TSSB,RO is the SSB to PRACH occasion association period as defined in the table 8.1-1 of TS 38.213 [3].

- The value of L2 is limited by *PREAMBLE\_TRANSMISSION\_COUNTER*, which is increased when PRACH occasion is unavailable for PRACH transmission due to UL CCA failure as specified in TS 38.321 [7]. The UE behaviour when *PREAMBLE\_TRANSMISSION\_COUNTER* reaches the *preambleTransMax* is specified in TS 38.321 [7].

- Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise Trs is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with Trs = 20 ms if the SSB transmission periodicity is not larger than 20 ms;

- otherwise, there is no requirement if the SSB transmission periodicity is larger than 20ms.

Table 6.2.3.2.3-1: Maximum allowed number of missed SMTC occasions during cell identification

|  |  |
| --- | --- |
| SMTC periodicity (Trs) [ms] | Maximum allowed number of missed SMTC occasions (L1,max) |
| Trs ≤ 40 | 8 |
| Trs > 40 | 4 |

### 6.2.3A SA: RRC Connection Release with Redirection for RedCap

#### 6.2.3A.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 E-UTRAN or 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].

#### 6.2.3A.2 Requirements

##### 6.2.3A.2.1 RRC connection release with redirection to NR

The requirements in clause 6.2.3.2.1 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 6.2.3.2.1 shall apply except that:

- Tidentify-NRas specified in Table 6.2.3A.2.1-1.

Table 6.2.3A.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 signaling 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. | |

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.

When the Redcap specific initial BWP is configured for random access, Tconnection\_release\_redirect\_NR in clause 6.2.3.2.1 is extended by 6ms.

##### 6.2.3A.2.2 RRC connection release with redirection to E-UTRAN

The requirements in clause 6.2.3.2.2 shall apply.

## 6.2C RRC Connection Mobility Control for Satellite Access

### 6.2C.1 SA: RRC Re-establishment for Satellite Access

#### 6.2C.1.1 Introduction

This clause contains requirements on the 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].

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

#### 6.2C.1.2 Requirements

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

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

The UE re-establishment delay (TUE\_re-establish\_delay) is specified in clause 6.2C.1.2.1.

##### 6.2C.1.2.1 UE Re-establishment delay requirement

The UE re-establishment delay (TUE\_re-establish\_delay) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause [5.3.7] in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell. The UE re-establishment delay (TUE\_re-establish\_delay) requirement shall be less than:

The intra-frequency target NR cell shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clause 10.1.2 and 10.1.3 are fulfilled for a corresponding NR Band for FR1, and

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.x1 for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.4 are fulfilled for a corresponding NR Band for FR1, and

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.x2 for a corresponding NR Band are fulfilled.

Tidentify\_intra\_NR: It is the time to identify the target intra-frequency NR cell and it depends on whether the target NR cell is known cell or unknown cell. If the UE is not configured with intra-frequency NR carrier for RRC re-establishment then Tidentify\_intra\_NR=0; otherwise Tidentify\_intra\_NR shall not exceed the values defined in Table 6.2C.1.2.1-1.

Tidentify\_inter\_NR,i: It is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* configured for RRC re-establishment and it depends on whether the target NR cell is known cell or unknown cell. Tidentify\_inter\_NR,i shall not exceed the values defined in Table 6.2C.1.2.1-2.

TSMTC: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*, Tsmtc follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

TSMTC,i: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If it is not configured, the UE may assume that the target SSB periodicity is no larger than 20 ms.

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

TPRACH: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. TPRACH can be up to the summation of SSB to PRACH occasion association period and [10] ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

Nfreq: It is the total number of NR frequencies to be monitored for RRC re-establishment; Nfreq = 1 if the target intra-frequency NR cell is known, else Nfreq = 2 and Tidentify\_intra\_NR = 0 if the target inter-frequency NR cell is known.

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

In the requirement defined in the below tables, the target FR1 cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown.

The requirements in this clause apply provided that the ephemeris information provided by the serving cell for the target cell is valid during UE re-establishment delay (TUE\_re-establish\_delay).

Table 6.2C.1.2.1-1: 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, 5 x TSMTC) | Kmulti\_SMTC \* MAX (800 ms, 10 x TSMTC) |
| < -8 | FR1 | N/A | k \* 800 ms Note1, 3 |
| 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.  Note 2: Kmulti\_SMTC is defined in clause 9.2C.5.1.  Note 3: k = 1 if the cells on the target frequency are served by GEO. k = (N+1) if the cells on the target frequency are served by LEO, where N is the number of different satellites associated to the list of configured neighbor cells in ntn-NeighCellConfigList and ntn-NeighCellConfigListExt. | | | |

Table 6.2C.1.2.1-2: 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, 6 x TSMTC, i) | K\_satellite \* MAX (800 ms, 13 x TSMTC, i) |
| < -8 | FR1 | N/A | k \* 800 ms Note1, 3 |
| 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.  Note 2: K\_satellite is defined in clause 9.3C.4.  Note 3: k = 1 if the cells on the target frequency are served by GEO. k = (N+1) if the cells on the target frequency are served by LEO, where N is the number of different satellites associated to the list of configured neighbor cells in ntn-NeighCellConfigList and ntn-NeighCellConfigListExt. | | | |

### 6.2C.2 Random access for satellite access

#### 6.2C.2.1 Introduction

This clause contains requirements on the 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 for the 4-step RA type procedure are described in clause 6.2.2.2, whereas the requirements for the 2-step RA type procedure are described in the clause 6.2.2.3 of this specification.

#### 6.2C.2.2 Requirements for 4-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in Table 6.3.4.2-1 of TS 38.101-1 [18] for FR1. The relative power applied to additional preambles shall have an accuracy as specified in Table 6.3.4.3-1 of TS 38.101-1 [18] for FR1.

The UE shall indicate a random access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4 in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode.

##### 6.2C.2.2.1 Contention based random access

###### 6.2C.2.2.1.1 Correct behaviour when transmitting Random Access Preamble

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SSB is configured, as specified in clause 5.1.2 in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

###### 6.2C.2.2.1.2 Correct behaviour when receiving Random Access Response

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

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2C.2.2.1.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 in TS 38.321 [7].

###### 6.2C.2.2.1.4 Correct behaviour when receiving an UL grant for msg3 retransmission

The UE shall re-transmit the msg3 upon the reception of anUL grant for msg3 retransmission.

###### 6.2C.2.2.1.5 SA: Correct behaviour when receiving a message over Temporary C-RNTI

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

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

###### 6.2C.2.2.1.6 Correct behaviour when contention Resolution timer expires

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

##### 6.2C.2.2.2 Non-Contention based random access

###### 6.2C.2.2.2.1 Correct behaviour when transmitting Random Access Preamble

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs is configured, with the UE selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs, UE shall have the capability to select the Random Access Preamble corresponding to the selected CSI-RS, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the random access procedure is initialized for beam failure recovery and if the contention-free Random Access Resources and the contention-free PRACH occasions for beam failure recovery request associated with any of the SSBs and/or CSI-RSs is configured, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs or the selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, or from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB assocated PRACH occasions or the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

###### 6.2C.2.2.2.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s), if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble, unless the random access procedure is initialized for Other SI request from UE.

The UE may stop monitoring for Random Access Response(s) and shall monitor the Other SI transmission if the Random Access Response only contains a Random Access Preamble identifier which is corresponding to the transmitted Random Access Preamble and the random access procedure is initialized for SI request from UE, as specified in clause 5.1.4 in TS 38.321 [7].

The UE may stop monitoring for Random Access Response(s), if the contention-free Random Access Preamble for beam failure recovery request was transmitted and if the PDCCH addressed to UE’s C-RNTI is received, as specified in clause 5.1.4 in TS 38.321 [7].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamblewith the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2C.2.2.2.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power, if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon* or if no PDCCH addressed to UE’s C-RNTI is received within the RA Response window configured in *BeamFailureRecoveryConfig*, as defined in clause 5.1.4 in TS 38.321 [7].

#### 6.2C.2.3 Requirements for 2-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate MsgA PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and the MsgA PUSCH power formula of clause 7.1.1 of TS 38.213 [3] and apply this power level at the first MsgA or additional MsgA repetitions. The absolute power applied to the first preamble shall have an accuracy as specified in Table 6.3.4.2-1 of TS 38.101-1 [18] for frequency range 1 and in Table 6.3.4.2-1 of TS 38.101-2 [19] for frequency range 2. The relative power applied to additional preambles shall have an accuracy as specified in Table 6.3.4.3-1 of TS 38.101-1 [18] for frequency range 1 and clause 6.3.4.3 of TS38.101-2 [19] for frequency range 2.

The UE shall switch to 4-step RA type procedure if the MsgA transmission counter has exceeded *msgA-TransMax*, if configured, as specified in clause 5.1.4a of TS 38.321 [7]. The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4a in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode or any MR-DC operation mode.

##### 6.2C.2.3.1 Contention based random access

###### 6.2C.2.3.1.1 Correct behaviour when transmitting MsgA

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, the UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SS blocks is configured, as specified in clause 5.1.2a in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, UE shall have the capability to transmit MsgA PRACH on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured.

The PRACH preamble and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE should have the capability to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH ocasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

###### 6.2C.2.3.1.2 Correct behaviour when receiving MsgB

The UE shall stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

The UE shall send ACK if Success RAR is received in MsgB and the Contention Resolution is successful, as defined in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH and monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

###### 6.2C.2.3.1.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

##### 6.2C.2.3.2 Non-Contention based random access

###### 6.2C.2.3.2.1 Correct behaviour when transmitting MsgA

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE should have the capability to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH ocasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

###### 6.2C.2.3.2.2 Correct behaviour when receiving MsgB

The UE may stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamblewith the calculated MsgA PRACH and MsgA PUSCH transmission power if all received MsgBs contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2C.2.3.2.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power, if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA* and the Random Access Response Reception has not been considered as successful as defined in clause 5.1.4a in TS 38.321 [7].

### 6.2C.3 SA: RRC Connection Release with Redirection for Satellite Access

#### 6.2C.3.1 Introduction

This clause contains requirements on the 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].

#### 6.2C.3.2 Requirements

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

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell within Tconnection\_release\_redirect\_NR.

The time delay (Tconnection\_release\_redirect\_NR) is the time between the end of the last slot containing the RRC command, “*RRCRelease*” (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay (Tconnection\_release\_redirect\_NR) shall be less than:

Tconnection\_release\_redirect\_NR = TRRC\_procedure\_delay + Tidentify-NR + TSI-NR + TRACH

The target NR cell shall be considered detetable when for each relevant SSB, the side conditions should be met that,

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.5 for a corresponding NR Band are fulfilled.

- TRRC\_procedure\_delay: It is the RRC procedure delay for processing the received message “*RRCRelease*” as defined in clause 6.2.2 of TS 38.331 [2].

- Tidentify-NR: It is the time to identify the target NR cell and depends on the FR of the target NR cell. It is defined in Table 6.2C.3.2.1-1. Note that Tidentify-NR = TPSS/SSS-sync + Tmeas, in which TPSS/SSS-sync is the cell search time and Tmeas is the measurement time due to cell selection criteria evaluation.

- TSI-NR: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released. TRACH: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. TRACH can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

- Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise Trs is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with Trs = 20 ms if the SSB transmission periodicity is not larger than 20 ms; otherwise,

- there is no requirement if the SSB transmission periodicity is larger than 20ms.

The requirements in this clause apply provided that the ephemeris information provided by the serving cell for the target cell is valid during time delay (Tconnection\_release\_redirect\_NR).

Table 6.2C.3.2.1-1: Time to identify target NR cell for RRC connection release with redirection to NR

|  |  |
| --- | --- |
| FR of target NR cell | Tidentify-NR |
| FR1 | K\_satellite \* MAX (680 ms, 11 x Trs) |
| Note 1: If the UE has been provided with higher layer signaling 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.  Note 2: K\_satellite is defined in clause 9.3C.4. | |

# 7 Timing

## 7.1 UE transmit timing

### 7.1.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in connected state or when transmiting PUSCH on CG resources for SDT in RRC\_Inactive. 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. For serving cell(s) in pTAG, UE shall use the SpCell as the reference cell for deriving the UE transmit timing for cells in the pTAG. For serving cell(s) in sTAG, UE shall use any of the activated SCells as the reference cell for deriving the UE transmit timing for the cells in the sTAG. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

In the requirements of clause 7.1.2, the term reference cell on a carrier frequency subject to CCA is not available at the UE refers to when at least one SSB is configured by gNB, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available during at least one discovery burst transmission window, at the UE due to DL CCA failures at gNB during the last 1280 ms; otherwise the reference cell on the carrier frequency subject to CCA is considered as available at the UE.

### 7.1.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.1.2-1. This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission, or it is the first transmission sent on the PSCell for activating the deactivated SCG without RACH.

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

When the UL SCS is 120 kHz or smaller, the UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. When the UL SCS is 480 kHz the UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available in the last 80 ms. When the UL SCS is 960 kHz the UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available in the last 40 ms. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus . The downlink timing is defined as the time when the first path (in time) of the corresponding downlink frame used by the UE to determine downlink timing is received from the reference cell at the UE antenna. *N*TA for PRACH is defined as 0.

 (in *Tc* units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3 was applied. *N*TA for other channels is not changed until next timing advance is received. The value ofdepends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). is defined in Table 7.1.2-2.

Table 7.1.2-1: Te Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of SSB signals (kHz) | SCS of uplink signals (kHz) | Te |
| 1 | 15 | 15 | 12\*64\*Tc |
|  |  | 30 | 10\*64\*Tc |
|  |  | 60 | 10\*64\*Tc |
|  | 30 | 15 | 8\*64\*Tc |
|  |  | 30 | 8\*64\*Tc |
|  |  | 60 | 7\*64\*Tc |
| 2-1 | 120 | 60 | 3.5\*64\*Tc |
|  |  | 120 | 3.5\*64\*Tc |
|  | 240 | 60 | 3\*64\*Tc |
|  |  | 120 | 3\*64\*Tc |
| 2-2 | 120 | 120 | 3.5\*64\*Tc |
|  |  | 480 | [1.58]\*64\*Tc |
|  | 480 | 120 | 2.86\*64\*Tc |
|  |  | 480 | [1.35]\*64\*Tc |
|  |  | 960 | [0.90]\*64\*Tc |
|  | 960 | 120 | 2.80\*64\*Tc |
|  |  | 480 | [1.13]\*64\*Tc |
|  |  | 960 | [0.86]\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6] | | | |

Table 7.1.2-2: The Value of 

|  |  |
| --- | --- |
| Frequency range and band of cell used for uplink transmission | (Unit: TC) |
| FR1 FDD or TDD band with neither E-UTRA–NR nor NB-IoT–NR coexistence case | 25600 (Note 1) |
| FR1 FDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case | 0 (Note 1) |
| FR1 TDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case | 39936 (Note 1) |
| FR2 | 13792 |
| Note 1: The UE identifies  based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of  is set as 25600 for FR1 band. In case of multiple UL carriers in the same TAG, UE expects that the same value of n-TimingAdvanceOffset is provided for all the UL carriers according to clause 4.2 in TS 38.213 [3] and the value 39936 of  can also be provided for a FDD serving cell.  Note 2: Void | |

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in clause 7.3 is applied.

Table 7.1.2-3: void

If the UE uses a reference cell on a carrier frequency subject to CCA for deriving the UE transmit timing, then the UE shall meet all the transmit timing requirements defined in clause 7.1.2 provided that the reference cell is available at the UE. If the reference cell is not available at the UE on a carrier frequency subject to CCA, then the UE is allowed to transmit in the uplink provided that the UE meets all the transmit timing requirements defined in clause 7.1.2; otherwise the UE shall not transmit any uplink signal.

If a reference cell on a carrier frequency belonging to the PTAG, which is subject to CCA, is not available at the UE then the UE is allowed to use any of available activated SCell(s) at the UE in PTAG as a new reference cell. If the SCell used as reference cell is deactivated, or becomes not available, the UE is allowed to use another active serving cell in PTAG as new reference cell.

If a reference cell on a carrier frequency belonging to the STAG, which is subject to CCA is not available at the UE then the UE is allowed to use any of available activated SCell(s) at the UE in STAG as a new reference cell.

#### 7.1.2.1 Gradual timing adjustment

Requirements in this section shall apply regardless of whether the reference cell is on a carrier frequency subject to CCA or not.

When the transmission timing error between the UE and the reference timing exceeds ±Te then the UE is required to adjust its timing to within ±Te. The reference timing shall be  before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be Tq.

2) The minimum aggregate adjustment rate shall be Tp per second.

3) The maximum aggregate adjustment rate shall be Tq per 200 ms for SCS of UL signals smaller or equal to 120 kHz and 100 ms for SCS of upling signals larger or equal to 480 kHz.

where the maximum autonomous time adjustment step Tq and the aggregate adjustment rate Tp are specified in Table 7.1.2.1-1.

Table 7.1.2.1-1: Tq Maximum Autonomous Time Adjustment Step and Tp Minimum Aggregate Adjustment rate

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of uplink signals (kHz) | Tq | Tp |
| 1 | 15 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 30 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 60 | 5.5\*64\*Tc | 5.5\*64\*Tc |
| 2-1 | 60 | K\*64\*Tc | 2.5\*64\*Tc |
|  | 120 | K\*64\*Tc | 2.5\*64\*Tc |
| 2-2 | 120 | 2.5\*64\*Tc | 2.5\*64\*Tc |
|  | 480 | [0.8]\*64\*Tc | [0.8]\*64\*Tc |
|  | 960 | [0.8]\*64\*Tc | [0.8]\*64\*Tc |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]  NOTE 2: When *highSpeedMeasFlagFR2-r17* is configured for UE supporting power class 6, K = 4.5; otherwise, K = 2.5. | | | |

#### 7.1.2.2 Void

Table 7.1.2.2-1: Void

#### 7.1.2.3 One shot large UL timing adjustment for FR2 Power Class 6 UE

When *highSpeedMeasFlagFR2-r17* is configured and *highSpeedLargeOneStepUL-TimingFR2-r17* is enabled for UE supporting FR2 power class 6 and [*largeOneStepUL-timingFR2-r17*] capability, the following requirements apply to the UE:

- If the absolute value , the requirement in clause 7.1.2.1 apply to the first UL transmission after a TCI state switch.

- Otherwise, the UE transmit timing immediately after TCI state switch shall be and clause 7.1.2.1 requirements don’t apply.

- The UE UL transmission timing error after the TCI state switching procedure shall be less than or equal to ±Te as specified in clause 7.1.2 if the new target TCI state is within active TCI state list, otherwise ±7\*64\*Tc, and the reference point is .

Above,

- (in units) is the DL timing defined as the time when UE receives downlink frame with new target TCI state.

- (in units) is the DL timing defined as the time when UE receives downlink frame with old source TCI state.

## 7.1A UE transmit timing for RedCap

### 7.1A.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in connected state or when transmiting PUSCH on CG resources for SDT in RRC\_Inactive. 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.

### 7.1A.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.1A.2-1. This requirement applies:

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

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

The UE shall meet the Te requirement for an initial transmission provided that at least one SSB (CD-SSB or NCD-SSB) is available at the UE for acquiring the frame timing of the reference cell during the last 160 ms on the condition that:

- the SSB is within the UE’s active BWP, or

- the SSB is not within the UE’s active BWP, and the measurement gap is configured.

The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus . The downlink timing is defined as the time when the first ~~detected~~ path (in time) of the corresponding downlink frame used by the UE to determine downlink timing is received from the reference cell at UE antenna. *N*TA for PRACH is defined as 0.

 (in *Tc* units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3A was applied. *N*TA for other channels is not changed until next timing advance is received. The value ofdepends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). is defined in Table 7.1A.2-2.

Table 7.1A.2-1: Te Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of SSB signals (kHz) | SCS of uplink signals (kHz) | Te |
| 1 | 15 | 15 | 12\*64\*Tc |
|  |  | 30 | 10\*64\*Tc |
|  |  | 60 | 10\*64\*Tc |
|  | 30 | 15 | 8\*64\*Tc |
|  |  | 30 | 8\*64\*Tc |
|  |  | 60 | 7\*64\*Tc |
| 2 | 120 | 60 | 3.5\*64\*Tc |
|  |  | 120 | 3.5\*64\*Tc |
|  | 240 | 60 | 3\*64\*Tc |
|  |  | 120 | 3\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6] | | | |

Table 7.1A.2-2: The Value of 

|  |  |
| --- | --- |
| Frequency range and band of cell used for uplink transmission | (Unit: TC) |
| FR1 FDD or TDD band with neither E-UTRA–NR nor NB-IoT–NR coexistence case | 25600 (Note 1) |
| FR1 FDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case | 0 (Note 1) |
| FR1 TDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case | 39936 (Note 1) |
| FR2 | 13792 |
| Note 1: The UE identifies  based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of  is set as 25600 for FR1 band.  Note 2: Void | |

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in clause 7.3A is applied.

#### 7.1A.2.1 Gradual timing adjustment

When the transmission timing error between the UE and the reference timing exceeds ±Te then the UE is required to adjust its timing to within ±Te. The reference timing shall be  before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be Tq.

2) The minimum aggregate adjustment rate shall be Tp per second.

3) The maximum aggregate adjustment rate shall be Tq per 200 ms.

where the maximum autonomous time adjustment step Tq and the aggregate adjustment rate Tp are specified in Table 7.1A.2.1-1.

Table 7.1A.2.1-1: Tq Maximum Autonomous Time Adjustment Step and Tp Minimum Aggregate Adjustment rate

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | SCS of uplink signals (kHz) | Tq | Tp |
| 1 | 15 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 30 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 60 | 5.5\*64\*Tc | 5.5\*64\*Tc |
| 2 | 60 | 2.5\*64\*Tc | 2.5\*64\*Tc |
|  | 120 | 2.5\*64\*Tc | 2.5\*64\*Tc |
| NOTE: Tc is the basic timing unit defined in TS 38.211 [6] | | | |

## 7.1C UE transmit timing for Satellite Access

### 7.1C.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in 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.

### 7.1C.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te\_NTN where the timing error limit value Te\_NTN is specified in Table 7.1C.2-1. This requirement applies:

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

The UE shall meet the Te\_NTN requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. and the UE has a validity time running for *N*TA,commonand *N*TA,UE-specific. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus .

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

*N*TA for PRACH is defined as 0. (in *T*c units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3 was applied. or after the last update in or .

The value of *N*TA-offset depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). *N*TA-offset is defined in Table 7.1.2-2.

and are as defined in TS38.211 [6].

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

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

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell, the updating of and the updating of , except when the timing advance in clause 7.3C is applied.

#### 7.1C.2.1 Gradual timing adjustment

When the transmission timing error between the UE and the reference timing exceeds ±Te\_NTN then the UE is required to adjust its timing to within ±Te\_NTN. The reference timing shall be before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

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

2) The minimum aggregate adjustment rate, apart from a change of due to satellite position update and during the last one second, shall be Tp\_NTN per second.

3) The maximum aggregate adjustment rate, apart from a change of due to satellite position update and during the last 200ms, shall be Tq\_NTN per 200 ms.

Where, the maximum autonomous time adjustment step Tq\_NTN and the aggregate adjustment rate Tp\_NTN are specified in Table 7.1C.2.1-1.

**Table 7.1C.2.1-1: Tq\_NTN Maximum Autonomous Time Adjustment Step and Tp\_NTN Minimum Aggregate Adjustment rate**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of uplink signals (kHz)** | **Tq\_NTN** | **Tp\_NTN** |
| 1 | 15 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 30 | 5.5\*64\*Tc | 5.5\*64\*Tc |
|  | 60 | N/A | N/A |
| NOTE: Tc is the basic timing unit defined in TS 38.211 [6] | | | |

## 7.2 UE timer accuracy

### 7.2.1 Introduction

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

### 7.2.2 Requirements

For UE timers specified in TS 38.331 [2], the UE shall comply with the timer accuracies according to Table 7.2.2-1.

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

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

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

Table 7.2.2-1

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

## 7.2A UE timer accuracy for RedCap

### 7.2A.1 Introduction

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

### 7.2A.2 Requirements

For UE timers specified in TS 38.331 [2], the UE shall comply with the timer accuracies according to Table 7.2A.2-1.

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

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

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

Table 7.2A.2-1

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

## 7.2C UE timer accuracy for satellite access

### 7.2C.1 Introduction

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

### 7.2C.2 Requirements

For UE timers specified in TS 38.331 [2], the UE shall comply with the timer accuracies according to Table 7.2C.2-1.

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

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

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

Table 7.2C.2-1

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

## 7.3 Timing advance

### 7.3.1 Introduction

The timing advance is initiated from gNB to UE in EN-DC, NR-DC, NE-DC and NR SA operation modes, with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

### 7.3.2 Requirements

#### 7.3.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission timing at time slot *n*+ *k+1* for a timing advance command received in time slot *n*, and the value of *k* is defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

#### 7.3.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in Table 7.3.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3.2.2-1: UE Timing Advance adjustment accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| UL Sub Carrier Spacing(kHz) | 15 | 30 | 60 | 120 | 480 | 960 |
| UE Timing Advance adjustment accuracy | ±256 Tc | ±256 Tc | ±128 Tc | ±32 Tc | ±10 Tc | ±6 Tc |

## 7.3A Timing Advance for RedCap

### 7.3A.1 Introduction

The timing advance is initiated from gNB to UE configured with only PCell, with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

### 7.3A.2 Requirements

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

UE shall adjust the timing of its uplink transmission at time slot *n*+ *k+1* for a timing advance command received in time slot *n*, and the value of *k* is defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

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

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in Table 7.3A.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3A.2.2-1: UE Timing Advance adjustment accuracy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UL Sub Carrier Spacing(kHz) | 15 | 30 | 60 | 120 |
| UE Timing Advance adjustment accuracy | ±256 Tc | ±256 Tc | ±128 Tc | ±32 Tc |

## 7.3C Timing advance for satellite access

### 7.3C.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].

### 7.3C.2 Requirements

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

UE shall adjust the timing of its uplink transmission timing from the beginning of uplink at time slot *n*+ *k+1+2µ* for a timing advance command received in time slot *n*, and the value of *k, µ* and are defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

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

The UE shall adjust the timing of its transmissions, apart from a change of and between the preceding uplink transmission and the current transmission, with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in Table 7.3C.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3C.2.2-1: UE Timing Advance adjustment accuracy

|  |  |  |  |
| --- | --- | --- | --- |
| UL Sub Carrier Spacing(kHz) | 15 | 30 | 60 |
| UE Timing Advance adjustment accuracy | ±256 Tc | ±256 Tc | N/A |

*Editor’s Note: it would be further clairified with the additional conditions for TA adjustment accuracy requirement for satellite access*

## 7.4 Cell phase synchronization accuracy

### 7.4.1 Definition

Cell phase synchronization accuracy for TDD is defined as the maximum absolute deviation in frame start timing between any pair of cells on the same frequency that have overlapping coverage areas.

### 7.4.2 Minimum requirements

The cell phase synchronization accuracy measured at BS antenna connectors or radiated interface boundaries shall be better than 3 µs.

## 7.5 Maximum Transmission Timing Difference

### 7.5.1 Introduction

A UE shall be capable of handling a relative transmission timing difference between subframe timing boundary of E-UTRA PCell and the closest slot timing boundary of PSCell to be aggregated for EN-DC operation.

A UE shall be capable of handling a relative transmission timing difference among the closest slot timing boundaries of different carriers in FR1 and/or FR2-1 to be aggregated in NR carrier aggregation.

A UE shall be capable of handling a relative transmission timing difference among the closest subframe timing boundaries of different carriers to be aggregated in FR1 and FR2-2 NR inter-band carrier aggregation.

A UE shall be capable of handling a relative transmission timing difference between slot timing boundary of PCell and subframe timing boundary of E-UTRA PSCell to be aggregated for NE-DC operation.

A UE shall be capable of handling a relative transmission timing difference between slot timing boundaries of PCell in FR1 or FR2-1 and the closest slot timing boundary of PSCell in FR1 or FR2-1 to be aggregated in NR DC operation.

A UE shall be capable of handling a relative transmission timing difference between subframe timing boundaries of PCell in FR1 and the closest subframe timing boundary of PSCell in FR2-2 to be aggregated in NR DC operation.

### 7.5.2 Minimum Requirements for inter-band EN-DC

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.2-1.

Table 7.5.2-1 Maximum uplink transmission timing difference requirement for asynchronous EN-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing in E-UTRA PCell (kHz) | UL Sub-carrier spacing for data in PSCell (kHz) | Maximum uplink transmission timing difference (µs) |
| 15 | 15 | 500 |
| 15 | 30 | 250 |
| 15 | 60 | 125 |
| 15 | 120Note1 | 62.5 |
| NOTE 1: For E-UTRA FDD-NR FDD intra-band EN-DC, for which the requirement is defined in clause 7.5.3 and this Table 7.5.2-1 is also applicable, the scenario with 120kHz PSCell does not exist. | | |

Table 7.5.2-2 Void

#### 7.5.2.1 Minimum Requirements for inter-band synchronous EN-DC

The requirements in this clause apply as a reference for inter-band synchronous EN-DC.

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell for inter-band synchronous EN-DC as shown in Table 7.5.2.1-1 1. The requirements for synchronous EN-DC are applicable for E-UTRA TDD-NR TDD, E-UTRA FDD-NR FDD, E-UTRA TDD-NR FDD and E-UTRA FDD-NR TDD inter-band EN-DC.

For E-UTRA TDD-NR TDD inter-band EN-DC with overlapping DL bands, only synchronized operation is assumed. The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.2.1-1 provided that UE indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16*, and in Table 7.5.3-1 provided that it is not capable of *interBandMRDC-WithOverlapDL-Bands-r16*.

Table 7.5.2.1-1 Maximum uplink transmission timing difference requirement for inter-band synchronous EN-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing in E-UTRA PCell (kHz) | UL Sub-carrier spacing for data in PSCell (kHz) | Maximum uplink transmission timing difference (µs) |
| 15 | 15 | 35.21 |
| 15 | 30 | 35.21 |
| 15 | 60 | 35.21 |
| 15 | 120 | 35.21 |

### 7.5.3 Minimum Requirements for intra-band EN-DC

For intra-band EN-DC, only co-located deployment is applied.

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.2-1 for E-UTRA FDD-NR FDD intra-band EN-DC provided the UE indicates that it is capable of asynchronous EN-DC operation [2].

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.3-1 for E-UTRA TDD-NR TDD and E-UTRA FDD-NR FDD intra-band EN-DC provided the UE does not indicate that it is capable of asynchronous FDD-FDD EN-DC operation [16].

Table 7.5.3-1: Maximum uplink transmission timing difference requirement for intra-band synchronous EN-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing in E-UTRA PCell (kHz) | UL Sub-carrier spacing for data in PSCell (kHz) | Maximum uplink transmission timing difference (µs) |
| 15 | 15 | 5.21Note1,Note 2 |
| 15 | 30 | 5.21Note 2 |
| 15 | 60 | 5.21 Note 2 |
| NOTE 1: This is not applicable for a UE which indicates the capability of only supporting single UL timing (*ul-TimingAlignmentEUTRA-NR* is signalled). Single UL timing for E-UTRA and NR cell is assumed for this UE.  NOTE 2: If the transmission timing difference exceeds the cyclic prefix length of the UL Sub-carrier spacing for data in PSCell, NR UE Tx EVM degradation is expected for the symbol that is overlapping the LTE subframe boundary | | |

### 7.5.4 Minimum Requirements for NR Carrier Aggregation

The UE shall be capable of handling at least a relative transmission timing difference between slot timing of all pairs of TAGs in FR1 and/or FR2-1 as shown in Table 7.5.4-1, provided that the UE is:

- configured with the pTAG and the sTAG for inter-band NR carrier aggregation in SA or NR-DC mode, or

- configured with more than one sTAG for inter-band NR carrier aggregation in EN-DC or NE-DC mode.

The UE shall be capable of handling at least a relative transmission timing difference between subframe timing of all pairs of TAGs between FR1 and FR2-2 as shown in Table 7.5.4-1, provided that the UE is:

- configured with the pTAG and the sTAG for inter-band NR carrier aggregation in SA or NR-DC mode.

Table 7.5.4-1: Maximum uplink transmission timing difference requirement for inter-band NR carrier aggregation

|  |  |
| --- | --- |
| Frequency Range of the pair of TAGs | Maximum uplink transmission timing difference (µs) |
| FR1 | 34.6 |
| FR2-1 | 8.5 Note1 |
| Between FR1 and FR2-1 | 26.1 |
| Between FR1 and FR2-2 | 26.1 |
| Note1: This requirement applies to the UE capable of independent beam management for FR2-1 inter-band CA. | |

### 7.5.5 Minimum Requirements for inter-band NE-DC

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and E-UTRA PSCell as shown in Table 7.5.5-1 for inter-band asynchronous NE-DC.

Table 7.5.5-1: Maximum uplink transmission timing difference requirement for inter-band asynchronous NE-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing in PCell (kHz) | UL Sub-carrier spacing for data in E-UTRA PSCell (kHz) | Maximum uplink transmission timing difference (µs) |
| 15 | 15 | 500 |
| 30 | 15 | 250 |
| 60 | 15 | 125 |
| 120 | 15 | 62.5 |
| NOTE 1: Void | | |

Table 7.5.5-2 Void

#### 7.5.5.1 Minimum Requirements for inter-band synchronous NE-DC

The requirements in this clause apply as a reference for inter-band synchronous NE-DC.

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and E-UTRA PSCell for inter-band synchronous NE-DC as shown in Table 7.5.5.1-1. The requirements for synchronous NE-DC are applicable for NR TDD- E-UTRA TDD, NR FDD- E-UTRA FDD, NR TDD- E-UTRA FDD and NR FDD- E-UTRA TDD inter-band NE-DC.

Table 7.5.5.1-1: Maximum uplink transmission timing difference requirement for inter-band synchronous NE-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing in PCell (kHz) | UL Sub-carrier spacing for data in E-UTRA PSCell (kHz) | Maximum uplink transmission timing difference (µs) |
| 15 | 15 | 35.21 |
| 30 | 15 | 35.21 |
| 60 | 15 | 35.21 |
| 120 | 15 | 35.21 |

### 7.5.6 Minimum Requirements for inter-band NR DC

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell as shown in Table 7.5.6-1 provided that the UE indicates that it is capable of synchronous NR DC only [14].

Table 7.5.6-1: Maximum uplink transmission timing difference requirement for inter-band synchronous NR DC

|  |  |  |
| --- | --- | --- |
| Frequency Range | | Maximum uplink transmission timing difference (µs) |
| Cell in MCG | Cell in SCG |  |
| FR1 | FR1 | 34.6 |
| FR2-1 | FR2-1 | 8.5 |
| FR1 | FR2-1 | 34.1 |
| FR1 | FR2-2 | 34.1 |

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell as shown in Table 7.5.6-2 provided that the UE indicates that it is capable of asynchronous NR DC [14].

Table 7.5.6-2 Maximum uplink transmission timing difference requirement for inter-band asynchronous NR DC

|  |  |
| --- | --- |
| Max {Sub-carrier spacing in PCell (kHz), Sub-carrier spacing in PSCell (kHz)} | Maximum uplink transmission timing difference (µs) |
| 15 | 500 |
| 30 | 250 |
| 60 | 125 |
| 120 | 62.5 |
| 480 | 15.625 |
| 960 | 7.8125 |

## 7.6 Maximum Receive Timing Difference

### 7.6.1 Introduction

A UE shall be capable of handling a relative receive timing difference between subframe timing boundary of an E-UTRA cell belonging to the MCG and the closest slot timing boundary of a cell belonging to SCG to be aggregated for EN-DC operation.

A UE shall be capable of handling a relative receive timing difference between subframe timing boundary of an E-UTRA cell belonging to the SCG to be aggregated for NE-DC operation and the closest slot timing boundary of a cell belonging to MCG.

A UE shall be capable of handling a relative receive timing difference between slot timing boundary of a cell belonging to MCG in FR1 or FR2-1 and the closest slot timing boundary of a cell belonging to the SCG FR1 or FR2-1 to be aggregated for NR DC operation.

A UE shall be capable of handling a relative receive timing difference between subframe timing boundary of a cell belonging to MCG in FR1 and the closest subframe timing boundary of a cell belonging to the SCG in FR2-2 to be aggregated for NR DC operation.

A UE shall be capable of handling a relative receive timing difference among the closest slot timing boundaries of different carriers in FR1 and/or FR2-1 to be aggregated in NR carrier aggregation.

A UE shall be capable of handling a relative receive timing difference among the closest subframe timing boundaries of different carriers to be aggregated in FR1 and FR2-2 NR inter-band carrier aggregation.

The requirements defined in clause 7.6 are also applicable when UE is configured to receive multiple PDSCH transmission occasions from one or more QCL sources on any one of the aggregated NR carriers.

### 7.6.2 Minimum Requirements for inter-band EN-DC

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to SCG at the UE receiver as shown in Table 7.6.2-1.

Table 7.6.2-1: Maximum receive timing difference requirement for asynchronous EN-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing of E-UTRA cell in MCG (kHz) | DL Sub-carrier spacing of cell in SCG (kHz) (Note 1) | Maximum receive timing difference (µs) |
| 15 | 15 | 500 |
| 15 | 30 | 250 |
| 15 | 60 | 125 |
| 15 | 120Note2 | 62.5 |
| NOTE 1: DL Sub-carrier spacing is min{SCSSS, SCSDATA}.  NOTE 2: For E-UTRA FDD-NR FDD intra-band EN-DC, for which the requirement is defined in clause 7.6.3 and this Table 7.6.2-1 is also applicable, the scenario with 120 kHz does not exit. | | |

Table 7.6.2-2 Void

Table 7.6.2-3 Void

#### 7.6.2.1 Minimum Requirements for inter-band synchronous EN-DC

The requirements in this clause apply as a reference for inter-band synchronous EN-DC.

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from an E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to SCG at the UE receiver for inter-band synchronous EN-DC as shown in Table 7.6.2.1-1. The requirements for synchronous EN-DC are applicable for E-UTRA TDD-NR TDD, E-UTRA FDD-NR FDD, E-UTRA TDD-NR FDD and E-UTRA FDD-NR TDD inter-band EN-DC.

For E-UTRA TDD-NR TDD inter-band EN-DC with overlapping DL bands, only synchronized operation is assumed. The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in Table 7.6.2.1-1 provided that UE indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16*, and in Table 7.6.3-1 provided that it is not capable of *interBandMRDC-WithOverlapDL-Bands-r16*.

Table 7.6.2.1-1: Maximum receive timing difference requirement for inter-band synchronous EN-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing of E-UTRA cell in MCG (kHz) | DL Sub-carrier spacing of cell in SCG (kHz) (Note1) | Maximum receive timing difference (µs) |
| 15 | 15 | 33 |
| 15 | 30 |  |
| 15 | 60 |  |
| 15 | 120 |  |
| Note 1: DL Sub-carrier spacing is min{SCSSS, SCSDATA}. | | |

### 7.6.3 Minimum Requirements for intra-band EN-DC

For intra-band EN-DC, only co-located deployment is applied.

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG as shown in Table 7.6.2-1 for E-UTRA FDD-NR FDD intra-band EN-DC provided the UE indicates that it is capable of asynchronous EN-DC operation [2].

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG as shown in Table 7.6.3-1 for E-UTRA FDD-NR FDD and E-UTRA TDD-NR TDD intra-band EN-DC provided the UE does not indicate that it is capable of asynchronous FDD-FDD EN-DC operation [16].

Table 7.6.3-1 Maximum receive timing difference requirement for intra-band synchronous EN-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing of E-UTRA cell in MCG (kHz) | DL Sub-carrier spacing of cell in SCG (kHz) Note1 | Maximum receive timing difference (µs) |
| 15 | 15 | 3 |
| 15 | 30 | 3 |
| 15 | 60 | 3 |
| NOTE 1: DL Sub-carrier spacing is min{SCSSS, SCSDATA}. | | |

Table 7.6.3-2: Void

### 7.6.4 Minimum Requirements for NR Carrier Aggregation

For intra-band CA, only co-located deployment is applied. For intra-band non-contiguous NR carrier aggregation, the UE shall be capable of handling at least a relative receive timing difference between slot timing of different carriers to be aggregated at the UE receiver as shown in Table 7.6.4-1 below.

Table 7.6.4-1: Maximum receive timing difference requirement for intra-band non-contiguous NR carrier aggregation

|  |  |
| --- | --- |
| Frequency Range | Maximum receive timing difference (µs) |
| FR1 | 31 |
| FR2-1 | 0.26 |
| Note 1: In the case of different SCS on different CCs, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected for the first symbol of the slot. | |

For inter-band NR carrier aggregation,

- the UE shall be capable of handling at least a relative receive timing difference between slot timing of all pairs of carriers in FR1 and FR2-1 to be aggregated at the UE receiver as shown in Table 7.6.4-2 below.

- the UE shall be capable of handling at least a relative receive timing difference between subframe timing of all pairs of carriers in FR1 and FR2-2 to be aggregated at the UE receiver as shown in Table 7.6.4-2 below.

Table 7.6.4-2: Maximum receive timing difference requirement for inter-band NR carrier aggregation

|  |  |
| --- | --- |
| Frequency Range of the pair of carriers | Maximum receive timing difference (µs) |
| FR1 | 33 |
| FR2-1 | 8 note1 |
| Between FR1 and FR2-1 | 25 |
| Between FR1 and FR2-2 | 25 |
| Note1: This requirement applies to the UE capable of independent beam management for FR2-1 inter-band CA. | |

### 7.6.5 Minimum Requirements for inter-band NE-DC

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and subframe timing of signal from an E-UTRA cell belonging to the SCG at the UE receiver for asynchronous NE-DC as shown in Table 7.6.5-1.

Table 7.6.5-1: Maximum receive timing difference requirement for asynchronous NE-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing of cell in MCG (kHz) | DL Sub-carrier spacing of EUTRA cell in SCG (kHz) (Note 1) | Maximum receive timing difference (µs) |
| 15 | 15 | 500 |
| 30 | 15 | 250 |
| 60 | 15 | 125 |
| 120 | 15 | 62.5 |
| NOTE 1: DL Sub-carrier spacing is min{SCSSS, SCSDATA}.  NOTE 2: Void | | |

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and subframe timing of signal from a E-UTRA cell belonging to the SCG at the UE receiver for inter-band synchronous NE-DC as shown in Table 7.6.5-2. The requirements for synchronous NE-DC are applicable for NR TDD- E-UTRA TDD, NR FDD- E-UTRA FDD, NR TDD- E-UTRA FDD and NR FDD- E-UTRA TDD inter-band NE-DC.

Table 7.6.5-2: Void

#### 7.6.5.1 Minimum Requirements for inter-band synchronous NE-DC

The requirements in this clause apply as a reference for inter-band synchronous NE-DC.

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and subframe timing of signal from a E-UTRA cell belonging to the SCG at the UE receiver for inter-band synchronous NE-DC as shown in Table 7.6.5.1-1. The requirements for synchronous NE-DC are applicable for NR TDD- E-UTRA TDD, NR FDD- E-UTRA FDD, NR TDD- E-UTRA FDD and NR FDD- E-UTRA TDD inter-band NE-DC.

Table 7.6.5.1-1: Maximum receive timing difference requirement for inter-band synchronous NE-DC

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing of cell in MCG (kHz) | DL Sub-carrier spacing of EUTRA cell in SCG (kHz) (Note1) | Maximum receive timing difference (µs) |
| 15 | 15 | 33 |
| 30 | 15 |  |
| 60 | 15 |  |
| 120 | 15 |  |

### 7.6.6 Minimum Requirements for inter-band NR DC

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG in FR1 or FR2-1 and slot timing of signal from a cell belonging to the SCG in FR1 or FR2-1 at the UE receiver as shown in Table 7.6.6-1 provided that the UE indicates that it is capable of synchronous NR DC only [16].

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a cell belonging to the MCG in FR1 and subframe timing of signal from a cell belonging to the SCG in FR2-2 at the UE receiver as shown in Table 7.6.6-1 provided that the UE indicates that it is capable of synchronous NR DC only [16].

Table 7.6.6-1: Maximum receive timing difference requirement for inter-band synchronous NR DC

|  |  |  |
| --- | --- | --- |
| Frequency Range | | Maximum receive timing difference (µs) |
| Cell in MCG | Cell in SCG |  |
| FR1 | FR1 | 33 |
| FR2-1 | FR2-1 | 8 |
| FR1 | FR2-1 | 33 |
| FR1 | FR2-2 | 33 |

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG in FR1 or FR2-1 and slot timing of signal from a cell belonging to the SCG in FR1 or FR2-1 at the UE receiver as shown in Table 7.6.6-2 provided that the UE indicates that it is capable of asynchronous NR DC [16].

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a cell belonging to the MCG in FR1 and subframe timing of signal from a cell belonging to the SCG in FR2-2 at the UE receiver as shown in Table 7.6.6-2 provided that the UE indicates that it is capable of asynchronous NR DC [16].

Table 7.6.6-2 Maximum receive timing difference requirement for inter-band asynchronous NR DC

|  |  |
| --- | --- |
| Max {Sub-carrier spacing in PCell (kHz), Sub-carrier spacing in PSCell (kHz)} | Maximum receive timing difference (µs) |
| 15 | 500 |
| 30 | 250 |
| 60 | 125 |
| 120 | 62.5 |
| 480 | 15.625 |
| 960 | 7.8125 |

## 7.7 *deriveSSB-IndexFromCell* tolerance

### 7.7.1 Minimum requirements

When *deriveSSB-IndexFromCell* is enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than

- min (2 SSB symbols, 1 PDSCH symbol) for sub-carrier spacings of SSB and PDSCH up-to 240 kHz,

- min (3 SSB symbols, NPDSCH PDSCH symbols) for sub-carrier spacing of 480 kHz and 960kHz of either SSB or PDSCH where NPDSCH is defined in Table 7.7.1-1

and the SFNs of all cells on the same frequency carrier are the same.

Table 7.7.1-1 NPDSCH when deriveSSB-IndexFromCell is enabled

|  |  |  |
| --- | --- | --- |
| SSB SCS (KHz) | PDSCH SCS (KHz) | NPDSCH |
| 120 | 480 | 3 |
| 120 | 960 | 6 |
| 480 | 120 | 1 |
| 480 | 480 | 3 |
| 480 | 960 | 6 |
| 960 | 120 | 1 |
| 960 | 480 | 2 |
| 960 | 960 | 3 |

When *deriveSSB-IndexFromCell* is not enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than 6 SSB symbols for sub-carrier spacing of 960kHz and the SFNs of all cells on the same frequency carrier are the same.

## 7.7A deriveSSB-IndexFromCell tolerance for RedCap

### 7.7A.1 Minimum requirements

When *deriveSSB-IndexFromCell* is enabled, the RedCap UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than min(2 SSB symbols, 1 PDSCH symbol) and the SFNs of all cells on the same frequency carrier are the same.

## 7.8 Void

## 7.9 *deriveSSB-IndexFromCellInter-r17* tolerance

### 7.9.1 Minimum requirements

When *deriveSSB-IndexFromCellInter-r17* is enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the target carrier and reference cell is within a tolerance not worse than min(2 SSB symbols of target carrier, 1 PDSCH symbol of the reference cell) and the SFNs of all cells on the target carrier and reference cell are the same. The reference cell is the serving cell which is used for SSB indexes derivation as indicated via *deriveSSB-IndexFromCellInter-r17*.