**3GPP TSG- Meeting #95eR4-2008662**

**, –** revision of R4-2006217

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **0632** | **rev** | **1** | **Current version:** | **16.3.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:*** | Rapporteur editorial CR in 38.133 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Apple | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | TEI16 | | | | |  | ***Date:*** | | | 2020-05-15 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | TBD, square bracket removal and other editorial changes | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 67 square brackets for tentative values are removed based on v15.9.0  20 TBD and 6 FFS are identified and for further discussion in RAN4#95e  TBD in section 6 are addressed in CR R4-2005307 or its revision  TBD in section 10 are addressed in CR R4-2007826 or its revision  TBD in section 12 are addressed in CR R4-2006709 or its revision  Many tentative values and TBD are found in section 12. Further discussion is needed | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | TBD and square brakets remain in specification | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3, 4, 5, 6, 7, 8, 9, 10, 12 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*Beginning of Change 1*

## 3.2 Symbols

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

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].

## 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].

BFD Beam Failure Detection

BFD-RS BFD Reference Signal

BLER Block Error Rate

BM-RS Beam Management Reference Signal

BWP Bandwidth Part

*End of Change 1*

*Beginning of Change 2*

#### 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 ms from 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 [20], 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.

#### 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.

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.

##### 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 a [TBD] 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:

Dhandover2 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 X (slotsNote 1) |
|
| 0 | 1 | 1 |
| 1 | 0.5 | 2 |
| 2 | 0.25 | [TBD] |
| 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 no larger than the BWP of source cell.  Note 3: The power imbalance between source cell and target cell shall be within [TBD] dB. | | |

*Editor’s Note: FFS on the interruption requirement when the relationship between CBW of target and source cell is different the relationship between BWP of target and source cell.*

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)** | **Interruption length (slotsNote 1)** |
| 0 | 1 | 1 + TSMTC\_duration |
| 1 | 0.5 | 2 + TSMTC\_duration |
| 2 | 0.25 | 4 + TSMTC\_duration |
| Note 1: The same SCS of source cell and target cell is assumed.  Note 2: TSMTC\_duration is the longest SMTC duration between source cell and target cell.  Note 3: It is assumed that source cell and target cell are synchronous. | | |

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) of source cell** | **Tinterrupt1 (slots)** | |
| **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-FR1 intra-frequency handover, Tinterrupt2 equals to 2ms when the BWP of target cell is smaller than the BWP of source cell, and Tinterrupt2 is specified in Table 6.1.3.2.2-4 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) |
|
| 0 | 1 | 1 |
| 1 | 0.5 | 2 |
| 2 | 0.25 | [TBD] |
| 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: The power imbalance between source cell and target cell shall be within [TBD] dB. | | |

For FR1-to-FR1 intra-band inter-frequency handover, Tinterrupt2 is specified in Table 6.1.3.2.2-5.

**Table 6.1.3.2.2-5:** **Tinterrupt2 for FR1-to-FR1 intra-band inter-frequency DAPS HO**

|  |  |  |
| --- | --- | --- |
|  | **NR Slot length (ms)** | **Interruption length (slotsNote 1)** |
| 0 | 1 | 1 + TSMTC\_duration |
| 1 | 0.5 | 2 + TSMTC\_duration |
| 2 | 0.25 | 4 + TSMTC\_duration |
| Note 1: The same SCS of source cell and target cell is assumed.  Note 2: TSMTC\_duration is the longest SMTC duration between source cell and target cell.  Note 3: It is assumed that source cell and target cell are synchronous. | | |

For FR1-to-FR1 inter-band handover, Tinterrupt2 is specified in Table 6.1.3.2.2-6.

Table 6.1.3.2.2-6: Tinterrupt2 for FR1-to-FR1 inter-band DAPS HO

|  |  |  |  |
| --- | --- | --- | --- |
|  | **NR slot length (ms) of target cell** | **Tinterrupt2 (slots)** | |
| **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.

##### 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 a [TBD] 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:

Dhandover2 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) of source cell** | **Tinterrupt1 (slots)** | |
| **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) of target cell** | **Tinterrupt2 (slots)** | |
| **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.

##### 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 a [TBD] 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:

Dhandover2 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) of source cell** | **Tinterrupt1 (slots)** | |
| **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) of target cell** | **Tinterrupt2 (slots)** | |
| **Sync** | **Async** |
| 2 | 0.25 | 5 | 5 |
| 3 | 0.125 | 9 | 9 |

*End of Change 2*

*Beginning of Change 3*

##### 8.2.3.2.8 Interruptions at direct SCell activation and hibernation

8.2.1.2.8.1 Interruptions during direct SCell activation and hibernation of E-UTRA SCell

When one E-UTRA SCell in SCG is directly activated and hibernated:

- the UE is allowed an interruption on any active serving cell in MCG:

- of up to X1 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being directly activated or hibernated, or

- of up to max{Y1 slots + TSMTC\_duration, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being directly activated or hibernated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being directly activated or hibernated are available in the same slot, where TSMTC\_duration is the longest SMTC duration among all above active serving cells in MCG.

Where X1 and Y1 are specified in Table 8.2.3.2.3-1.

##### 8.2.3.2.9 Interruptions at SCell hibernation

When one E-UTRA SCell in SCG is hibernated:

- the UE is allowed an interruption on any active serving cell in MCG:

- of up to X2 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being hibernated, or

- of up to max{Y2 slots + TSMTC\_duration, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being hibernated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being hibernated are available in the same slot, where TSMTC\_duration is the longest SMTC duration among all above active serving cells in MCG.

Where X2 and Y2 are specified in Table 8.2.3.2.4-1.

*End of Change 3*

*Beginning of Change 4*

### 8.3.4 Direct SCell Activation at SCell addition

The requirements in this clause apply for UE being configured in the RRC reconfiguration message [2] with one SCell for which the parameter *sCellState* is set to *activated*.

*Editor’s Note: FFS for the direct activation requriements for multiple SCells.*

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. Upon receiving the RRC reconfiguration message in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot ,

where:

*Ndirect* = *TRRC\_Process* + *T1* + *Tactivation\_time* + *TCSI\_Reporting*

*TRRC\_Process*: RRC procedure delay defined in clause 12 of TS 38.331 [2],

*T1*: Delay from slot until the transmission of RRCConnectionReconfigurationComplete message,

Note: *T1* is UE implementation dependent.

*Tactivation\_time* and *TCSI\_Reporting* are specified in clause 8.3.2.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

*Editor’s Note: FFS during which time period of the activation delay interruption is allowed*

Starting from the slot until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

### 8.3.5 Direct SCell Activation at Handover

The requirements in this clause apply for UE being configured in the RRC reconfiguration message [2] for handover with one SCell for which the parameter *sCellState* is set to *activated*.

*Editor’s Note: FFS for the direct activation requriements for multiple SCells.*

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. Upon receiving the RRC reconfiguration message in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot ,

where:

*Ndirect* = *TRRC\_process + Tinterrupt + T2 + T3* + *Tactivation\_time* + *TCSI\_Reporting*

*TRRC\_Process*: RRC procedure delay defined in clause 12 of TS 38.331 [2],

*Tinterrupt*: Interruption time during hanover as specified in clause 6.1.1,

*T2*: Delay from slot until UE has obtained a valid TA command for the target PCell,

*T3*: Delay for applying the received TA for upling transmission in the target PCell, and greater than or equal to *k+1* slot, where *k* is defined in clause 4.2 in TS 38.213 [3],

*Tactivation\_time* and *TCSI\_Reporting* are specified in clause 8.3.2.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

*Editor’s Note: FFS during which time period of the activation delay interruption is allowed*

Starting from the slot and until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

8.3.6 Direct SCell Activation at RRCResume

The requirements in this section apply for UE being configured in the RRC reconfiguration message in TS38.331 [2] for RRC Resume with one SCell for which the parameter *sCellState* is set to *activated*.

The requirements in section 8.3.4 shall apply, except that the definition of *T1* shall be deemed to be replaced with

*T1*: Delay from slot until the transmission of RRCResumeComplete message,

*End of Change 4*

*Beginning of Change 5*

### 10.1.22 CLI measurement accuracy requirements

10.1.22.1 SRS-RSRP

10.1.22.1.1 SRS-RSRP Accuracy

The SRS-RSRP measurement reported by the UE shall fulfil the accuracy requirements defined in Table 10.1.22.1.1-1 for FR1 and Table 10.1.22.1.1-2 for FR2, provided that the following conditions are met.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for SRS-RSRP measurements are fulfilled according to Annex B.2.z for a corresponding Band for each relevant SRS resource configured for measurement.

- The time difference between UE’s DL reference timing in the serving cell and SRS arrival time is no larger than Terror\_SRS\_RSRP, where

- Terror\_SRS\_RSRP = TC × NTA\_offset + 4.67us for FR1

- Terror\_SRS\_RSRP = TC × NTA\_offset + 3.67us for FR2

- NTA\_offset is defined in Table 7.1.2-2

- TC is 0.509ns

- The bandwidth of the SRS resource is 48 PRBs.

- One of the following conditions is met

- There is no other SRS resource with the same root sequence and on the same symbol and with same comb as the relevant SRS resource.

- If multiple SRS resources are on the same symbol and with same comb, the distance between cyclic shifts of any two resources is no less than 6 if transmissionComb = n4, and no less than 4 if transmissionComb = n2.

**Table 10.1.22.1.1-1: SRS-RSRP absolute accuracy in FR1**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | | | | | **Conditions** | | | | | | |
| **Normal condition** | | | **Extreme condition** | | | **SRS Ês/Iot** | **Io Note 1 range** | | | | | |
| **NR operating band groups Note 2** | **Minimum Io** | | | | **Maximum Io** |
| **dB** | | | | | | **dB** |  | **dBm / SCSSRS** | | | **dBm/BW Channel** | **dBm/BW Channel** |
| **SCSSRS (kHz)** | | | **SCSSRS (kHz)** | | |
| **15** | **30** | **60** | **15** | **30** | **60** | **SCSSRS = 15 kHz** | **SCSSRS = 30 kHz** | **SCSSRS = 60 kHz** |
| ±3 | ±4 | ±5.5 | ±7.5 | ±8.5 | ±10 | ≥1 | NR\_TDD\_FR1\_A, | -120 | -117 | -114 | N/A | -70 |
| NR\_TDD\_FR1\_C | -119 | -116 | -113 | N/A | -70 |
| NR\_TDD\_FR1\_D | -118.5 | -115.5 | -112.5 | N/A | -70 |
| NR\_TDD\_FR1\_E | -118 | -115 | -112 | N/A | -70 |
| ±6.5 | ±7.5 | ±9 | ±9.5 | ±10.5 | ±12 | ≥1 | NR\_TDD\_FR1\_A,  NR\_TDD\_FR1\_C, NR\_TDD\_FR1\_D, NR\_TDD\_FR1\_E | N/A | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2. | | | | | | | | | | | | |

**Table 10.1.22.1.1-2: SRS-RSRP absolute accuracy in FR2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | | | **Conditions** | | | | |
| **Normal condition** | | **Extreme condition** | | **SRS Ês/Iot** | **Io Note 1 range** | | | |
| **Minimum Io** | | | **Maximum Io** |
| **dB** | | | | **dB** | **dBm / SCSSRS Note 2** | | **dBm/BWChannel** | **dBm/BWChannel** |
| **SCSSRS (kHz)** | | **SCSSRS (kHz)** | | **SCSSRS = 60kHz** | **SCSSRS = 120kHz** |
| **60** | **120** | **60** | **120** |
| ±6.5 | TBD | ±9.5 | TBD | ≥1 | Same value as SRS\_RP in Table TBD, according to UE Power class, operating band and angle of arrival | | N/A | -70 |
| ±9.5 | TBD | ±11.5 | TBD | ≥1 | N/A | | -70 | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | | | | | | |

10.1.22.1.2 SRS-RSRP report mapping

The reporting range of SRS-RSRP is defined from -140 dBm to -44 dBm with 1 dB resolution. The mapping of measured quantity is defined in Table 10.1.22.1.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

**Table 10.1.22.1.2-1: SRS-RSRP measurement report mapping**

|  |  |  |
| --- | --- | --- |
| **Reported value** | **Measured quantity value** | **Unit** |
| SRS-RSRP\_0 | SRS-RSRP<-140 | dBm |
| SRS-RSRP\_1 | -140≤ SRS-RSRP<-139 | dBm |
| SRS-RSRP\_2 | -139≤ SRS-RSRP<-138 | dBm |
| SRS-RSRP\_3 | -138≤ SRS-RSRP<-137 | dBm |
| SRS-RSRP\_4 | -137≤ SRS-RSRP<-136 | dBm |
| .. | .. | … |
| SRS-RSRP\_95 | -46≤ SRS-RSRP<-45 | dBm |
| SRS-RSRP\_96 | -45≤ SRS-RSRP<-44 | dBm |
| SRS-RSRP\_97 | -44≤ SRS-RSRP | dBm |
| SRS-RSRP\_98 | Infinity |  |
| Note: ‘Infinity’ means that UE cannot detect SRS due to too strong signal to measure. | | |

10.1.22.2 CLI-RSSI

10.1.22.2.1 CLI-RSSI Accuracy

The CLI-RSSI measurement reported by the UE shall fulfil the accuracy requirements defined in Table 10.1.22.2.1-1 for FR1 and Table 10.1.22.2.1-2 for FR2, provided that the following conditions are met.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

**Table 10.1.22.2.1-1: CLI-RSSI absolute accuracy in FR1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | | |
| **Normal condition** | **Extreme condition** | **Io Note 1 range** | | | | | |
| **NR operating band groups Note 2** | **Minimum Io** | | | | **Maximum Io** |
| **dB** | **dB** |  | **dBm / SCSSRS** | | | **dBm/BWChannel** | **dBm/BWChannel** |
| **SCSSRS = 15 kHz** | **SCSSRS = 30 kHz** | **SCSSRS = 60 kHz** |
| ±3.5 | ±6.5 | NR\_TDD\_FR1\_A, | -120 | -117 | -114 | N/A | -70 |
| NR\_TDD\_FR1\_C | -119 | -116 | -113 | N/A | -70 |
| NR\_TDD\_FR1\_D | -118.5 | -115.5 | -112.5 | N/A | -70 |
| NR\_TDD\_FR1\_E | -118 | -115 | -112 | N/A | -70 |
| ±5.5 | ±8.5 | Note 3 | Note 3 | Note 3 | Note 3 | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. | | | | | | | |

**Table 10.1.22.2.1-2: CLI-RSSI absolute accuracy in FR2**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | |
| **Normal condition** | **Extreme condition** | **Io Note 1 range** | | | |
| **Minimum Io** | | | **Maximum Io** |
| **dB** | **dB** | **dBm / SCSSRS Note 2** | | **dBm/BWChannel** | **dBm/BWChannel** |
| **SCSSRS = 60kHz** | **SCSSRS = 120kHz** |
| ±5 | ±8 | Same value as SRS\_RP in Table TBD, according to UE Power class, operating band and angle of arrival | | N/A | -70 |
| ±7 | ±10 | Note 4 | | -70 | -50 |
| NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. | | | | | |

10.1.22.2.2 CLI-RSSI report mapping

The reporting range of CLI-RSSI is defined from -100 dBm to -25 dBm with 1 dB resolution. The mapping of measured quantity is defined in Table 10.1.22.2.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

**Table 10.1.22.2.2-1: CLI-RSSI measurement report mapping**

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| CLI-RSSI\_00 | CLI-RSSI < ‑100 | dBm |
| CLI-RSSI\_01 | -100 ≤ CLI-RSSI < ‑99 | dBm |
| CLI-RSSI\_02 | -99 ≤ CLI-RSSI < ‑98 | dBm |
| … | … | … |
| CLI-RSSI\_74 | -27 ≤ CLI-RSSI < -26 | dBm |
| CLI-RSSI\_75 | -26 ≤ CLI-RSSI < -25 | dBm |
| CLI-RSSI\_76 | -25 ≤ CLI-RSSI | dBm |

## 10.2 E-UTRAN measurements

### 10.2.1 Introduction

Accuracy requirements for measurements on E-UTRAN carrier frequencies are specified in clause 10.2 and apply for UE in SA or NR-DC or NE-DC operation mode.

The requirements in clause 10.2 are applicable for a UE:

- in RRC\_CONNECTED state

- performing measurements with appropriate measurement gaps according to clause 9.1.2.

- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 36.300 [24].

The accuracy requirements of E-UTRA measurements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

If the UE needs measurement gaps to perform the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD measurements, the relevant measurement procedure and measurement gap patterns stated in clause 9.1.2 shall apply.

### 10.2.2 E-UTRAN RSRP measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRP in RRC\_CONNECTED state is specified in clause 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RSRP measurements in RRC\_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRP Accuracy Requirements in clause 9.1.3 of TS 36.133 [15].

The reporting range and mapping specified for RSRP measurements in clause 9.1.4 of TS 36.133 [15] shall apply.

### 10.2.3 E-UTRAN RSRQ measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRQ in RRC\_CONNECTED state is specified in clause 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RSRQ measurements in RRC\_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ Accuracy Requirements in clause 9.1.6 of TS 36.133 [15].

The requirements for accuracy of E-UTRA RSRQ measurements in RRC\_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ Accuracy Requirements in clause 9.1.6 of TS 36.133 [15].

The reporting range and mapping specified for RSRQ measurements in clause 9.1.7 of TS 36.133 [15] shall apply.

### 10.2.4 E-UTRAN RSTD measurements

The requirements in this clause are valid for UE supporting this capability.

The measurement period is specified in clauses 9.4.4.1 and 9.4.4.2 for inter-RAT NR ─ E-UTRAN FDD and inter-RAT NR ─ E-UTRAN TDD RSTD measurements, respectively.

The accuracy requirements and the corresponding side conditions shall be the same as the inter-frequency measurement accuracy requirements for RSTD measurements in RRC\_CONNECTED in clause 9.1.10.2 of TS 36.133 [15].

If the UE needs measurement gaps to perform the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD RSTD measurements, the relevant measurement procedure and measurement gap patterns stated in clause 9.1.2 shall apply.

The reporting range and mapping for the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD RSTD measurements is the same as specified for RSTD measurements in TS 36.133 [15, clauses 9.1.10.3 and 9.1.10.4].

### 10.2.5 E-UTRAN RS-SINR measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RS-SINR in RRC\_CONNECTED state is specified in clause 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RS-SINR measurements in RRC\_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RS-SINR Accuracy Requirements in clause 9.1.17.3 of TS 36.133 [15].

The reporting range and mapping for E-UTRA RS-SINR measurements shall be the same as specified for RS-SINR measurements in clause 9.1.17.1 of TS 36.133 [15].

## 10.3 UTRAN FDD Measurements

The requirements in this clause are applicable for a UE:

- in state RRC\_CONNECTED

- performing measurements according to clause 9.4.6 with appropriate measurement gaps

- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 25.302 [30].

The accuracy requirements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

### 10.3.1 UTRAN FDD CPICH RSCP

NOTE: This measurement is for handover between E-UTRAN and UTRAN FDD.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC\_CONNECTED state is specified in clause 9.4.6.

In RRC\_CONNECTED state the accuracy requirements shall meet the absolute accuracy requirements in table 10.3.1-1, under the following conditions:

- CPICH Ec/Io condition for a detectable cell is as specified in clause 9.4.6;

- SCH\_Ec/Io condition for a detectable cell is as specified in clause 9.4.6.

Table 10.3.1-1: UTRAN FDD CPICH\_RSCP absolute accuracy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | |
| Normal condition | Extreme condition | Io range | | |
| UTRA operating bands | Minimum Io | Maximum Io |
| dB | dB |  | dBm/3.84 MHz | dBm/3.84 MHz |
| ±6 | ±9 | Band I, IV, VI, X XI, XIX and XXI | -94 | -70 |
| Band IX | -93 | -70 |
| Band II, V and VII | -92 | -70 |
| Band III, VIII, XII, XIII, XIV , XX and XXII | -91 | -70 |
| Band XXV, XXVI Note 1 | -90.5 | -70 |
| ±8 | ±11 | Note 2 | -70 | -50 |
| NOTE 1: For Band XXVI, the condition has the minimum Io of -92 dBm/3.84 MHz when the carrier frequency of the assigned UTRA channel is within 869-894 MHz for the UE which supports both Band V and Band XXVI operating frequencies.  NOTE 2: The same bands apply for this requirement as for the corresponding highest accuracy requirement. | | | | |

If the UE, in RRC\_CONNECTED state, needs measurement gaps to perform UTRAN FDD measurements, the relevant UTRAN FDD measurement procedure and measurement gap pattern stated in clause 9.4.6 shall apply.

The reporting range and mapping specified for FDD CPICH RSCP in TS 25.133 [29] shall apply.

### 10.3.2 UTRAN FDD CPICH Ec/No

NOTE: This measurement is for handover between E-UTRAN and UTRAN FDD.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC\_CONNECTED state is specified in clause 9.4.6.

In RRC\_CONNECTED state the accuracy requirements shall be the same as the inter-frequency measurement accuracy requirements for FDD CPICH Ec/No in TS 25.133 [18].

If the UE, in RRC\_CONNECTED state, needs measurement gaps to perform UTRAN FDD measurements, the UTRAN FDD measurement procedure and measurement gap pattern stated in clause 9.4.6 shall apply.

The reporting range and mapping specified for FDD CPICH Ec/No in TS 25.133 [29] shall apply.

# 11 Void

# 12 V2X Requirements

## 12.1 Introduction

This section contains the requirements for the UE capable of V2X sidelink communication when the UE is out of coverage on the carrier used for V2X sidelink operation, as defined in [1]. The requirements apply when the UE is:

- in any cell selection state, or,

- configured for V2X SL operation on a V2X carrier which is dedicated to only V2X SL operation and configured with only a PCell on WAN carrier.Note: Any cell selection state refers to a UE that is out of network coverage and is not associated with a serving cell on any carrier [1].

Note: When a UE in RRC\_CONNECTED state is performing transmissions and/or reception for V2X sidelink communication, the UE shall meet all the requirements specified in Section 9 assuming that UE has a dedicated RX/TX chain for V2X sidelink communication. Otherwise, the UE may interrup the V2X sidelink communication in order to meet the measurement requirements specified in Section 9.

*Editor Notes: gNB/eNB related requirements may be revised depending on technical issue or RF’s operating band conclusion.*

## 12.2 UE Transmit Timing

### 12.2.1 Introduction

This clause contains requirements of transmission timing for V2X sidelink communication when:

- GNSS is used as the synchronization reference source;

- NR Cell is used as the synchronization reference source;

- E-UTRAN Cell is used as the synchronization reference source;

- SyncRef UE is used as the synchronization reference source.

### 12.2.2 GNSS as synchronization reference source

The requirements in this subclause are applicable when the reference timing used by the UE for V2X sidelink communication is derived from GNSS.

The sidelink transmissions takes place  before the subframe starting boundary as defined in TS 38.331 [2], where  = 0 and=0.

The transmission timing error for sidelink transmissions shall be less than or equal to ±Te where the timing error limit value Te is defined in Table 12.2.2-1.

Table 12.2.2-1: Te Timing Error Limit

|  |  |
| --- | --- |
| Frequency Range of sidelink | Te\_ |
| 1 | 12\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6]. | |

### 12.2.3 NR Cell as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for sidelink transmissions is a NR serving cell on a non-V2X sidelink carrier.

The sidelink transmissions takes place  before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell, where  = 0 and=0.

The transmission timing error for sidelink transmissions shall be less than or equal to ±Te where the timing error limit value Te is defined in Table 12.2.3-1.

Table 12.2.3-1: Te Timing Error Limit

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range of sidelink** | **SCS of SSB signals ( kHz)** | **SCS of sidelink signals (kHz)** | **Te** |
| 1 | 15 | 15 | 14\*64\*Tc |
| 30 | 12\*64\*Tc |
| 60 | 12\*64\*Tc |
| 30 | 15 | 10\*64\*Tc |
| 30 | 12\*64\*Tc |
| 60 | 9\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6]. | | | |

### 12.2.4 E-URTAN Cell as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for sidelink transmissions is an E-UTRAN serving cell on a non-V2X sidelink carrier.

The sidelink transmissions takes place  before the reception of the first detected path (in time) of the corresponding E-UTRAN downlink frame from the reference cell, where  = 0 and=0.

The transmission timing error for sidelink transmissions shall be less than or equal to ±Te where the timing error limit value Te is defined in Table 12.2.4-1.

Table 12.2.4-1: Te Timing Error Limit

|  |  |  |
| --- | --- | --- |
| Frequency Range of sidelink | E-UTRAN downlink bandwidth (MHz) | Te\_ |
| 1 | ≥3 | 14\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6]. | | |

### 12.2.5 SyncRef UE as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for deriving sidelink transmission is from SyncRef UE transmitting sidelink synchronization signals.

The sidelink transmissions takes place  before the reception of the first detected path (in time) of the corresponding timing reference frame from the SyncRef UE, where  = 0 and=0.

The transmission timing error for sidelink transmissions shall be less than or equal to ±Te where the timing error limit value Te is defined in Table 12.2.5-1.

Table 12.2.5-1: Te Timing Error Limit

|  |  |  |
| --- | --- | --- |
| **Frequency Range of sidelink** | **SCS of sidelink signals (kHz)** | **Te** |
| 1 | 15 | 12\*64\*Tc |
| 30 | 8\*64\*Tc |
| 60 | 5\*64\*Tc |
| Note 1: Tc is the basic timing unit defined in TS 38.211 [6]. | | |

## 12.3 Initiation/Cease of SLSS Transmissions

### 12.3.1 Introduction

The requirements in this subclause are applicable to the UE capable of V2X sidelink communication when:

- GNSS is used as the synchronization reference source;

- NR Cell is used as the synchronization reference source;

- EUTRAN Cell is used as the synchronization reference source;

- SyncRef UE is used as the synchronization reference source.

#### 12.3.1.1 Initiation/Cease of SLSS transmissions with NR cell as synchronization reference source

*Editor Notes: This section may need to be revised depending on conclusion.*

The requirements apply when the NR Cell is used as synchronization reference source and when the UE is

- out of coverage on the V2X NR sidelink carrier and in-coverage with a serving cell on a NR non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in [2] are met; *networkControlledSyncTx* is not configured; and [*syncTxThreshIC*] is included in *SystemInformationBlockTypeXX*. The UE shall be capable of measuring the RSRP of the cell used as synchronization reference source to evaluate to initiate/cease SLSS transmissions within Tevaluate,SLSS

where,

- Tevaluate,SLSS is as specified in Table 13.3.1.1-1 when UE performs SSB based measurements without measurement gaps.

- Tevaluate,SLSS is as specified in Table 13.3.1.1-2 when UE performs SSB based measurements with measurement gaps.

Table 12.3.1.1-1: Tevaluate,SLSS for measurements without gaps when NR cell as synchronization reference source (FR1)

|  |  |
| --- | --- |
| **DRX cycle in NR cell** | **Tevaluate,SLSS** |
| No DRX | max([400ms], ceil( 2 x 5 x Kp) x SMTC period)Note 1 |
| DRX cycle≤ 320ms | max([400ms], ceil(1.5 x 2 x 5 x Kp) x max(SMTC period, DRX cycle)) |
| DRX cycle>320ms | ceil( 7 x Kp ) x DRX cycle |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

**Table 12.3.1.1-2: Tevaluate,SLSS for measurements with gaps when NR cell as synchronization reference source (FR1)**

|  |  |
| --- | --- |
| **DRX cycle in NR cell** | **Tevaluate,SLSS** |
| No DRX | max(400ms, 2 x 5 x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(2 x 1.5x 5) x max(MGRP, SMTC period,DRX cycle))x CSSFintra |
| DRX cycle>320ms | 7 x max(MGRP, DRX cycle) x CSSFintra |

If higher layer filtering is configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the NR cell as synchronization reference source:

- SS-RSRP related side conditions given in clauses 10.1.2 for FR1, respectively, for a corresponding Band,

- SS-RSRQ related side conditions given in clauses 10.1.7 for FR1, respectively, for a corresponding Band,

- SS-SINR related side conditions given in clauses 10.1.12 for FR1, respectively, for a corresponding Band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding Band.

#### 12.3.1.2 Initiation/Cease of SLSS transmissions with EUTRAN cell as synchronization reference source

*Editor Notes: This section may need to be revised depending on conclusion.*

The requirements apply when the EUTRAN Cell is used as synchronization reference source and when the UE is

- out of coverage on the V2X NR sidelink carrier and in-coverage with a serving cell on a LTE non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in [2] are met; *networkControlledSyncTx* is not configured; and [*syncTxThreshIC*] is included in *SystemInformationBlockTypeXX*. The UE shall be capable of measuring the RSRP of the cell used as synchronization reference source to evaluate to initiate/cease SLSS transmissions within Tevaluate,SLSS

where,

- Tevaluate,SLSS = 0.4 seconds when UE is not configured with DRX.

- Tevaluate,SLSS = as specified in Table 13.3.1.1-1 when UE is configured with DRX.

Table 12.3.1.2-1: Tevaluate,SLSS when EUTRAN cell as synchronization reference source

|  |  |
| --- | --- |
| DRX cycle length in EUTRAN cell[s] | Tevaluate,SLSS  [s] (number of DRX cycles) |
| ≤0.04 | 0.4 (Note 1) |
| 0.04<DRX-cycle≤2.56 | Note 2 (6) |
| Note1: Number of DRX cycles depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycles in use | |

If higher layer filtering is configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the cell as synchronization reference source:

- RSRP related side conditions given in TS 36.133 Sections 9.1.2.1 and 9.1.2.2 and RSRQ related side conditions given in TS 36.133 Clause 9.1.5.1 for a corresponding Band are fulfilled,

- SCH\_RP and SCH Ês/Iot according to TS 36.133 Annex B.2.1 for a corresponding Band are fulfilled.

#### 12.3.1.3 Initiation/Cease of SLSS transmissions with GNSS as synchronization reference source

The requirements apply when GNSS is used as synchronization reference source and when the UE is

* out of coverage on the V2X sidelink carrier and in-coverage with a serving cell on a non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in [2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockTypeXX*.

The requirements in Section 12.3.1.1 shall apply if the serving cell is a NR cell.

The requirements in Section 12.3.1.2 shall apply if the serving cell is a EUTRAN cell.

#### 12.3.1.4 Initiation/Cease of SLSS transmissions with SyncRef UE as synchronization reference source

The requirements apply when SyncRef UE is used as synchronization reference source and when the UE is

* in any cell selection state, or
* out of coverage on the V2X sidelink carrier and is associated with a serving cell on a non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in [2] are met and when SyncRef UE is used as synchronization reference source and if *syncTxThreshOoC* is included in the preconfigured V2X parameters.

The UE shall be capable of measuring the [PSBCH-RSRP] of the selected SyncRef UE used as synchronization reference source and evaluate it to initiate/cease SLSS transmissions within Tevaluate,SLSS = 4 S-SSB periods.

If higher layer filtering for PSBCH-RSRP measurements is pre-configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the selected SyncRef UE [2] used to derive transmission timing for V2X sidelink communication:

- PSBCH-RSRP related side conditions given in Section 12.4 for a corresponding Band are fulfilled,

- V2X S-SSB\_RP and S-SSB Ês/Iot according to Annex B. 4 for a corresponding Band are fulfilled.

## 12.4 Selection / Reselection of V2X Synchronization Reference Source

The requirements defined in section 12.4 do not apply to the UEs that do not support transmission and reception of SLSS.

A V2X SyncRef UE is considered to be detectable when

- S-RSRP related side conditions given in Section [TBD] are fulfilled for a corresponding Band,

- V2X SCH\_RP and SCH Ês/Iot according to Annex [TBD] for a corresponding Band are fulfilled.

When GNSS synchronization reference source is configured as the highest priority and

- UE is synchronized to GNSS directly,

- UE shall not drop any V2X SLSS and data transmission for the purpose of selection/reselection to the SyncRef UE.

- UE is synchronized to a SyncRef UE that is synchronized to GNSS directly or in-directly,

- UE shall not drop any V2X data transmission for the purpose of selection/reselection to the SyncRef UE. The UE shall be able to identify newly detectable intra-frequency V2X SyncRef UE within Tdetect,SyncRef UE\_V2X seconds if the V2X SyncRef UE meets the selection / reselection criterion defined in TS 38.331. Tdetect,SyncRef UE\_V2X is defined as 1.6 seconds at SCH Es/Iot ≥ 0 dB, provided that the UE is allowed to drop a maximum of [30]% of its SLSS transmissions during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

- in other case

- The UE shall be able to identify newly detectable intra-frequency V2X SyncRef UE within Tdetect,SyncRef UE\_V2X seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331. Tdetect,SyncRef UE\_V2X is defined as 8 seconds at SCH Es/Iot ≥ 0 dB, provided that the UE is allowed to drop a maximum of 6 % of its V2X data and SLSS transmissions during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

- UE is allowed to drop up to 2 slots of its V2X data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

When serving cell/PCell synchronization reference source is configured as the highest priority,

- UE shall be able to identify newly detectable intra-frequency V2X SyncRef UE within Tdetect,SyncRef UE\_V2X seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331. Tdetect,SyncRef UE\_V2X is defined as 8 seconds at SCH Es/Iot ≥ 0 dB, provided that the V2X UE is allowed to drop a maximum of 6 % of its V2X data and SLSS transmissions for the purpose of selection / reselection to the SyncRef UE.

- UE is allowed to drop up to 2 slots of its V2X data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

UE shall be capable of performing S-RSRP measurements for [3] identified intra-frequency V2X SyncRef UE with the measurement period of 320 ms. It is assumed that the V2X SyncRef UE do not drop or delay any SLSS transmission within the measurement period. Otherwise, the measurement period may be extended.

When UE is synchronized to GNSS directly, before selection / reselection of the new synchronization reference source UE shall evaluate the GNSS synchronization source reliability for at least 20 seconds before changing the synchronization reference from GNSS to another synchronization reference source. UE shall be always synchronized to GNSS directly during the evaluation of GNSS synchronization source reliability.

## 12.5 L1 SL-RSRP measurements

## 12.5.1 Introduction

This section contains the measurement requirements related to resource reselection and resource pre-emption of the UE capable of V2X sidelink communication.

## 12.5.2 SL-RSRP measurements

The UE physical layer shall be capable of performing the L1 SL-RSRP measurements on the carrier operating V2X sidelink communication for determining the subset of resources to be excluded in PSSCH resource selection in sidelink transmission mode 2. The L1 SL-RSRP measurement period corresponds to [TBD] and the measurement shall meet the L1 SL-RSRP measurement accuracy requirement in Section [TBD].

When the pre-emption mechanism is enabled for the resource pool that UE is monitoring and selecting resource from, after UE selects from the resource not excluded based on L1 SL-RSRP measurement procedure, the UE shall be capable of triggering reselection of already signalled resource(s) as a resource reservation when the conditions specified in [16] are satisfied.

## 12.6 Congestion Control measurements

The UE shall be capable of estimating the channel busy ratio for one or more transmission pools indicated by higher layers [16], based on S-RSSI measurements provided by the physical layer.

When no sidelink transmissions occur, the UE physical layer shall perform a single-shot S-RSSI measurement for each sub-channel included in all the slots configured as transmission pools.

The S-RSSI measurement performed according to this section shall meet the S-RSSI measurement accuracy requirements defined in Section [TBD].

The UE shall perform channel busy ratio (CBR) measurement based on S-RSSI measurements as described in TS 38.215.

## 12.7 Interruption

### 12.7.1 Interruptions to WAN due to V2X Sidelink Communication

This sub-clause contains the requirements related to the interruptions on the PCell due to V2X sidelink communication.

A UE capable of V2X sidelink communication may indicate its interest (initiation or termination) in V2X sidelink communication to the connected gNodeB using IE *SidelinkUEInformation*.

The UE is allowed an interruption of up to the duration shown in table 12.7.1-1 on the serving cell(s) during the RRC reconfiguration procedure that includes the V2X sidelink communication configuration message *sl-V2X-ConfigDedicated* (setup and release). This interruption is for both uplink and downlink of the PCell.

Table : Interruption length at V2X RRC reconfiguration

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Interruption length  (number of slots) | |
| Sync | Async |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 2 | 3 |
| 2 | 0.25 | 5 | |
| 3 | 0.125 | 9 | |

### 12.7.2 V2X Sidelink Communication Dropping due to synchronization source change

This sub-clause contains the requirements related to the interruptions on the V2X sidelink communication due to synchronization source change.

UE is allowed to drop V2X SL transmission or reception for up to [1] ms when GNSS synchronization source is changed:

* From GNSS
  + to syncRef UE that is synchronized to GNSS directly
  + to syncRef UE that is synchronized to GNSS in-directly
  + to gNB/eNB
  + to syncRef UE that is synchronized to gNB/eNB directly
  + to syncRef UE that is synchronized to gNB/eNB in-directly
  + to syncRef UE that has the lowest priority
* From syncRef UE that is synchronized to GNSS directly
  + to GNSS
  + to syncRef UE that is synchronized to GNSS in-directly
  + to gNB/eNB
  + to syncRef UE that is synchronized to gNB/eNB directly
  + to syncRef UE that is synchronized to gNB/eNB in-directly
  + to syncRef UE that has the lowest priority
* From syncRef UE that is synchronized to GNSS in-directly
  + to GNSS
  + to syncRef UE that is synchronized to GNSS directly
  + to gNB/eNB
  + to syncRef UE that is synchronized to gNB/eNB directly
  + to syncRef UE that is synchronized to gNB/eNB in-directly
  + to syncRef UE that has the lowest priority
* From gNB/eNB
  + to GNSS
  + to syncRef UE that is synchronized to GNSS directly
  + to syncRef UE that is synchronized to GNSS in-directly
  + to syncRef UE that is synchronized to gNB/eNB directly
  + to syncRef UE that is synchronized to gNB/eNB in-directly
  + to syncRef UE that has the lowest priority
* From syncRef UE that is synchronized to gNB/eNB directly
  + to GNSS
  + to syncRef UE that is synchronized to GNSS directly
  + to syncRef UE that is synchronized to GNSS in-directly
  + to gNB/eNB
  + to syncRef UE that is synchronized to gNB/eNB in-directly
  + to syncRef UE that has the lowest priority
* From syncRef UE that is synchronized to gNB/eNB in-directly
  + to GNSS
  + to syncRef UE that is synchronized to GNSS directly
  + to syncRef UE that is synchronized to GNSS in-directly
  + to gNB/eNB
  + to syncRef UE that is synchronized to gNB/eNB directly
  + to syncRef UE that has the lowest priority
* From syncRef UE that has the lowest priority
  + to GNSS
  + to syncRef UE that is synchronized to GNSS directly
  + to syncRef UE that is synchronized to GNSS in-directly
  + to gNB/eNB
  + syncRef UE that is synchronized to gNB/eNB directly
  + syncRef UE that is synchronized to gNB/eNB in-directly

UE is allowed to interruption any V2X sidelink signals including PSSCH, PSCCH, PSBCH, PSFCH and SLSS signals.

## 12.8 Reliability of GNSS signal

This clause contains requirements regarding reliability of GNSS signal for the UE capable of V2X sidelink communication under the following additional condition:

- The UE is configured or pre-configured with parameters for enabling the UE to acquire the GNSS synchronization.

If UE considers GNSS is a reliable synchronization reference, the UE shall meet timing accuracy requirement as specified in 12.2 and frequency accuracy requirement as specified in 6.4E of TS38.101-1. Otherwise, the UE shall be capable to select another synchronization reference source.

*End of Change 5*