**3GPP TSG-RAN4 WG4 Meeting #** **100-e *R4-2115467***

**Electronic meeting, August 16 - 27, 2021**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-1** | **CR** | xxxx | **rev** | **-** | **Current version:** | **17.2.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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| ***Title:*** | Big CR to TS 38.133: NR\_pos maintenance (Rel-17) | | | | | | | | | |
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| ***Source to WG:*** | MCC, Intel Corporation | | | | | | | | | |
| ***Source to TSG*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos | | | | |  | ***Date:*** | | | 2021-08-31 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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:*** | | This big CRs merge the mutile endorsed draf CRs. The reason for change in each endorsed draft CR is copied below.  R4-2111988 Draft CR on ECID measurement requirements and AoA/ZoA report mapping  The chapter instructions for ECID measurement and accuracy requirements are incomplete. The measured quantity value in AoA/ZoA report mapping table is wrong.  R4-2112564 Draft CR to 38.133 correction to PRS RSTD measurement requirements   1. The measurement period TRSTD,Total does not include report time. 2. FFS: RSTD measurement period requirements when MG pattern is reconfigured are FFS. 3. PRS dropping applicability has not been specified.   R4-2114454 PRS-RSRP measurement requirements  To introduce missing or undefined PRS-RSRP measurement requirements.  R4-2113262 Draft CR to TS 38.133 on UE Rx-Tx time difference measurements  To complete remaining UE Rx-Tx time difference measurement period.  R4-2114280 CR on CSSF requirement applicability for PRS measurement.  There is an editor note regarding which one PFL should be selected for CSSF calculation.  Muting option 2 would impact the available resource repetitions, but it is currently not considered in definition of PRS resource overalpping with MG.  The term ‘PRS resource instance’ is not defined in TS 38.211. Thus, the definition is included in TS 38.133.  The applicability condition regarding mixed PRS resources with long periodicity and short periodicity in a single PFL are not defined.  R4-2114206 [draftCR] Corrections to NR positioning measurement requirements  PRS-based measurements are supported only with per-UE MG (discussion paper R4-2114193).  Correct the starting point of the measurement period for PRS-RSTD, PRS-RSRP and UE Rx-Tx time difference (discussion paper R4-2114195).  R4-2114284 CR to update RSTD measurement requirements  There are several open issues with RSTD accraucy requirements:   1. The requirement for 30kHz + 24 RB is TBD.   R4-2111992 Draft CR on PRS-RSRP accuracy requirements  The RF margin for PRS-RSRP measurement relative accuracy requirements is not decided.  The accuracy requirements in extreme condition are TBD.  R4-2114461 UE Rx-Tx measurement accuracy requirements  To introduce missing or undefined Rx-Tx measurement requirements  R4-2111994 Draft CR on test case for PRS-RSRP measurement requirements for FR2 in SA  The gap configuration is in bracket.  The measurement requirements are not related to UE power class, so the PC differentiation in the time of T2 is not needed.  R4-2113446 Draft CR on test case for RSTD measurement requirements in SA  In NR, RSTD measurement is used in DL-TDOA assistant data not OTDOA.  The reference should be NR specifications.  SSB\_RP should be configured.  R4-2114289 CR to update PRS RMC for positioning tests  There are several issues with PRS RMC:  All the configurations are with single PRS resource, but for PRS-RSRP accuracy tests, 2 resources are needed per resource set.  The RE offset for the PRS resource is fixed as 0, but for test cases with 3 TRPs, different RE offsets need to be used to make resources orthogonal as agreed in RAN4#99-e.  Channel BW is not a PRS related parameter.  R4-2114291 CR to update TC for PRS-RSRP measurement requirements for FR1 in SA  There are several issues with TC for PRS-RSRP measurement requirements for FR1:  The description about the starting point of T2 is ambiguous and the value for ΔT is in []  PRS muting info is missed.  R4-2114293 CR to update TC for RSTD measurement accuracy for FR1 and FR2 in SA  There are several issues with TC for RSTD accuracy requirements for FR1 and FR2:  The provision of assistance data and location info request as well as the test duration are not defined.  PRS muting info is missed and as such the PRS resource from two TRPs are not orthogonal.  PRS configuration in FR2 test case is wrong (same configuration used in two sub-tests)  There is no applicable accuracy requirements for dual PFL case.  R4-2114049 Corrections to gNB Rx-Tx measurement in 38.133  gNB Rx-Tx measurement accuracy requirements updated based on current simulation results  R4-2114295 CR to update SRS-RSRP requirements  There are [] in the SRS-RSRP requirements.  R4-2115429 Positioning RRM performance requirements in Rel-17  To introduce missing or undefined Rx-Tx measurement requirements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The summary of change in each each endorsed draft CR is copied below.  R4-2111988 Draft CR on ECID measurement requirements and AoA/ZoA report mapping  Clarify the indication of ECID measurement and accuracy requirements. Correct the measured quantity value in AoA/ZoA report mapping table.  R4-2112564 Draft CR to 38.133 correction to PRS RSTD measurement requirements  Remove the word ‘and report’ in the RSTD measurement period requirements.  UE behaviour when MG pattern is reconfigured during RSTD measurement period is specified.  Specified PRS dropping applicabliltiy.  Editorial changes  R4-2114454 PRS-RSRP measurement requirements  When PRS-RSRP is configured with UE Rx-Tx measurement  When PRS-RSRP is configured with RSTD measurement  R4-2113262 Draft CR to TS 38.133 on UE Rx-Tx time difference measurements  Specify the requirements when MG pattern is reconfigured.  Specify the requirements in case of PRS dropping.  Remove the bracket in N\_sample= [4]  Change "T" \_"last" to "T" \_"last,i" .  Update the definition of L\_(available\_PRS,i).  Update UE behaviour when UL transmission timing changes due to network configured TA command or NTA\_offset.  R4-2114280 CR on CSSF requirement applicability for PRS measurement.  Clarify how to define CSSF when multiple PFLs are configured.  Clarify that definition of PRS resource overalpping with MG is based on unmuted PRS resource repetitions.  In clause 3.1, the definition for the term ‘PRS resource instance’ is added.  Clarify the applicability condition regarding mixed PRS resources with long periodicity and short periodicity in a single PFL.  R4-2114206 [draftCR] Corrections to NR positioning measurement requirements  In Table 9.1.2-2, modify and add notes about inclusion of positioning measurements to exclude applicability for per-FR measurement gaps.  In Table 9.1.2-3, modify and add notes about inclusion of positioning measurements to exclude applicability for per-FR measurement gaps.  In section 9.9.1, clarify that applicability of NR positioning measurement requirements are subject to per-UE measurement gaps being configured.  In section 9.9.2.5, correct the starting point of the measurement period for PRS-RSTD.  In section 9.9.3.5, correct the starting point of the measurement period for PRS-RSRP.  In section 9.9.3.5, correct the starting point of the measurement period for UE Rx-Tx time difference.  R4-2114284 CR to update RSTD measurement requirements  Address the above issues:  Add the missing requirements for 30kHz + 24 RB  R4-2111992 Draft CR on PRS-RSRP accuracy requirements  Add the RF margin for PRS-RSRP measurement relative accuracy requirements.  Remove the bracket for accuracy requirements.  R4-2114461 UE Rx-Tx measurement accuracy requirements  The following aspects of the Rx-Tx measurement requirements are corrected, added or updated:  PRS/SRS proximity condition  UE Rx-Tx measurement procedure under cell TA command change  UE Rx-Tx measurement procedure under cell NTA\_offset change  UE Rx-Tx measurement procedure under cell change  Some accuacy values and smallest BWs for 120 kHz are aligned with the results in R4-2108313  R4-2111994 Draft CR on test case for PRS-RSRP measurement requirements for FR2 in SA  Remove the bracket in gap configuration.  Remove the PC differentiation in T2.  Some editorial corrections.  R4-2113446 Draft CR on test case for RSTD measurement requirements in SA  Change OTDOA to DL-TDOA.  Correct the reference specifications.  Add the configuration of SSB\_RP.  Some editorial correction.  R4-2114289 CR to update PRS RMC for positioning tests  Update PRS RMC to address the above issues:  Add two configurations each with two PRS resources per resource set.  Apply note 1 (Unless otherwise specified in the test case) to the PRS RE offset, so that it can be set differently in applicable test cases.  Remove the parameter Channel BW and replace it with a new parameter PRS resource index within the resource set  R4-2114291 CR to update TC for PRS-RSRP measurement requirements for FR1 in SA  Update TC for PRS-RSRP measurement requirements for FR1:  Update the description about the starting point of T2 and vlaue of T  Add PRS muting info  R4-2114293 CR to update TC for RSTD measurement accuracy for FR1 and FR2 in SA  Update TC for RSTD accuracy requirements for FR1 and FR2:  Define provision of assistance data and location info request as well as the test duration  Add PRS muting info  Correct PRS configuration in FR2 test case  Remove the TC for dual PFL  R4-2114049 Corrections to gNB Rx-Tx measurement in 38.133  gNB Rx-Tx measurement accuracy requirements updated based on current simulation results  R4-2114295 CR to update SRS-RSRP requirements  Remove [] in the SRS-RSRP requirements  R4-2115429 Positioning RRM performance requirements in Rel-17  NR Positioning RRM performance requirements for Rel-16 version was agreed in R4-2108300 and Rel-17 version (cat A) in R4-2108301 (RAN4#99-e). But some requirements in cat A CR was not implemented in Rel-17.  The following aspects of the Rx-Tx measurement requirements are also corrected, added or updated with respect to the original Rel-16 version:  PRS/SRS proximity condition  UE Rx-Tx measurement procedure under cell TA command change  UE Rx-Tx measurement procedure under cell NTA\_offset change  UE Rx-Tx measurement procedure under cell change  Some accuacy values and smallest BWs for 120 kHz are aligned with the results in R4-2108313. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The consequences if not approved for each endorsed draft CR are coppied below.  R4-2111988 Draft CR on ECID measurement requirements and AoA/ZoA report mapping  The ECID measurement and accuracy requirements are not clear. The AoA/ZoA report mapping table is not correct.  R4-2112564 Draft CR to 38.133 correction to PRS RSTD measurement requirements  RSTD measurment period requirements are not finished.  R4-2114454 PRS-RSRP measurement requirements  Requirements  UE PRS-RSRP measurement requirement and UE behaviour will be undefined.  R4-2113262 Draft CR to TS 38.133 on UE Rx-Tx time difference measurements  Core requirements for UE Rx-Tx time difference are incomplete.  R4-2114280 CR on CSSF requirement applicability for PRS measurement.  CSSF calculation when multiple PFLs are configured is incomplete. Definition of PRS resource overlapping with MG is incomplete.  R4-2114206 [draftCR] Corrections to NR positioning measurement requirements  NR positioning measurement requirements would be incorrect.  R4-2114284 CR to update RSTD measurement requirements  RSTD accuracy requirements are incomplete.  R4-2111992 Draft CR on PRS-RSRP accuracy requirements  The performance requirements for PRS-RSRP measurement are incomplete.  R4-2114461 UE Rx-Tx measurement accuracy requirements  UE Rx-Tx measurement requirement and UE behaviour will be undefined.  R4-2111994 Draft CR on test case for PRS-RSRP measurement requirements for FR2 in SA  The test case for PRS-RSRP measurement requirements in SA is incomplete.  R4-2113446 Draft CR on test case for RSTD measurement requirements in SA  The test case for RSTD measurement requirements in SA is incomplete.  R4-2114289 CR to update PRS RMC for positioning tests  PRS RMC cannot meet the need for all the test cases.  R4-2114291 CR to update TC for PRS-RSRP measurement requirements for FR1 in SA  TC for PRS-RSRP measurement requirements for FR1 are incomplete.  R4-2114293 CR to update TC for RSTD measurement accuracy for FR1 and FR2 in SA  TC for RSTD accuracy requirements for FR1 and FR2 are incomplete.  R4-2114049 Corrections to gNB Rx-Tx measurement in 38.133  Incorrect gNB Rx-Tx measurement accuracy requirements  R4-2114295 CR to update SRS-RSRP requirements  SRS-RSRP requirements are not complete.  R4-2115429 Positioning RRM performance requirements in Rel-17  UE Rx-Tx measurement requirement and UE behaviour will be undefined. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | R4-2111988 Draft CR on ECID measurement requirements and AoA/ZoA report mapping  9.9.5, 13.4.1  R4-2112564 Draft CR to 38.133 correction to PRS RSTD measurement requirements  9.9.2  R4-2114454 PRS-RSRP measurement requirements  Requirements  9.9.3.5  R4-2113262 Draft CR to TS 38.133 on UE Rx-Tx time difference measurements  9.9.4.5  R4-2114280 CR on CSSF requirement applicability for PRS measurement.  9.1.5.2.2~9.1.5.2.7, 9.9.1, 3.1  R4-2114206 [draftCR] Corrections to NR positioning measurement requirements  9.1.2, 9.9.1, 9.9.2.5, 9.9.3.5, 9.9.4.5  R4-2114284 CR to update RSTD measurement requirements  10.1.23.2  R4-2111992 Draft CR on PRS-RSRP accuracy requirements  10.1.24.2.1, 10.1.24.2.2  R4-2114461 UE Rx-Tx measurement accuracy requirements  10.1.25.2  R4-2111994 Draft CR on test case for PRS-RSRP measurement requirements for FR2 in SA  A.6.7.9.3.3, A.7, A.6.6.13, A.7.6.10  R4-2113446 Draft CR on test case for RSTD measurement requirements in SA  A.6.6.12, A.7.6.9  R4-2114289 CR to update PRS RMC for positioning tests  A.3.31  R4-2114291 CR to update TC for PRS-RSRP measurement requirements for FR1 in SA  A.6.6.13  R4-2114293 CR to update TC for RSTD measurement accuracy for FR1 and FR2 in SA  A.6.7.13, A.7.7.10  R4-2114049 Corrections to gNB Rx-Tx measurement in 38.133  13.2.2.2  R4-2114295 CR to update SRS-RSRP requirements  13.3.2.2  R4-2115429 Positioning RRM performance requirements in Rel-17  10.1.25.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR … CR … | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS 38.533 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR … CR … | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |

|  |  |
| --- | --- |
| ***This CR’s revision history:*** |  |

# *<Start of change1>*

### 9.9.5 NR E-CID measurements

#### 9.9.5.1 Introduction

The requirements in clause 9.9.5 shall apply provided the UE has received *nr-ECID-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to report one or more of the following measurements for NR E-CID positioning [22]: SS-RSRP, SS-RSRQ, CSI-RSRP, and CSI-RSRQ.

#### 9.9.5.2 Measurement Requirements

##### 9.9.5.2.1 Intra-frequency Measurement Requirements

The intra-frequency NR E-CID measurements shall meet the requirements in clause 9.2 and clause 9.10.2, except the measurement reporting requirements. The NR E-CID measurement reporting requirements are defined in clause 9.9.5.2.3.

The reported intra-frequency NR E-CID measurements shall also meet:

- for FR1 SS-RSRP, the accuracy requirements in clauses 10.1.2.1,

- for FR1 SS-RSRQ, the accuracy requirements in clauses 10.1.7.1,

- for FR1 CSI-RSRP, the accuracy requirements in clause 10.1.2.3,

- for FR1 CSI-RSRQ, the accuracy requirements in clause 10.1.7.2,

- for FR2 SS-RSRP, the accuracy requirements in clauses 10.1.3.1,

- for FR2 SS-RSRQ, the accuracy requirements in clauses 10.1.8.1,

- for FR2 CSI-RSRP, the accuracy requirements in clause 10.1.3.3,

- for FR2 CSI-RSRQ, the accuracy requirements in clause 10.1.8.2.

##### 9.9.5.2.2 Inter-frequency Measurement Requirements

The inter-frequency NR E-CID measurements shall meet the requirements in clause 9.3 and 9.10.4, except the measurement reporting requirements. The NR E-CID measurement reporting requirements are defined in clause 9.9.5.2.3.

The reported inter-frequency NR E-CID measurements shall also meet:

- for FR1 SS-RSRP, the accuracy requirements in clauses 10.1.4.1,

- for FR1 SS-RSRQ, the accuracy requirements in clauses 10.1.9.1,

- for FR1 CSI-RSRP, the accuracy requirements 10.1.4.3,

- for FR1 CSI-RSRQ, the accuracy requirements 10.1.9.2,

- for FR2 SS-RSRP, the accuracy requirements in clauses 10.1.5.1,

- for FR2 SS-RSRQ, the accuracy requirements in clauses 10.1.10.1,

- for FR2 CSI-RSRP, the accuracy requirements 10.1.5.3,

- for FR2 CSI-RSRQ, the accuracy requirements 10.1.10.2.

##### 9.9.5.2.3 Measurement Reporting Delay

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 starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH 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. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported NR E-CID measurement values contained in periodically triggered measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.6 for SS-RSRP and CSI-RSRP, and clause 10.1.11 for SS-RSRQ and CSI-RSRQ.

The UE shall not send any measurement reports as long as no corresponding reporting criteria specified in clause 9.1.4 are fulfilled.

# *<End of change1>*

# *<Start of change2>*

## 13.4 AoA/ZoA

### 13.4.1 Report mapping

The reporting range of UL Angle of Arrival, as defined in Clause 5.2.4 of TS 38.215 [4], is defined from -180 degree to +180 degree for azimuth angle (AoA). The reporting resolution is 0.1 degree.

The reporting range of UL Angle of Arrival, as defined in Clause 5.2.4 of TS 38.215 [4], is defined from 0 degree to +180 degree for vertical angle (ZoA). The reporting resolution is 0.1 degree.

The mapping of AoA measured quantity is defined in Table 13.4.1-1. The mapping of ZoA measured quantity is defined in Table 13.4.1-2.

Table 13.4.1-1: AoA measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value (AoA) | Unit |
| AoA\_0 | -180 ≤ AoA < -179.9 | degree |
| AoA\_1 | -179.9 ≤ AoA < -179.8 | degree |
| AoA\_2 | -179.8 ≤ AoA < -179.7 | degree |
| … | … | … |
| AoA\_1798 | -0.2 ≤ AoA ≤ -0.1 | degree |
| AoA\_1799 | -0.1 ≤ AoA < 0 | degree |
| AoA\_1800 | 0 ≤ AoA < 0.1 | degree |
| AoA\_1801 | 0.1 ≤ AoA < 0.2 | degree |
| AoA\_1802 | 0.2 ≤ AoA < 0.3 | degree |
| … | … | … |
| AoA\_3598 | 179.8 ≤ AoA < 179.9 | degree |
| AoA\_3599 | 179.9 ≤ AoA < 180 | degree |

Table 13.4.1-2: ZoA measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value (ZoA) | Unit |
| ZoA\_0 | 0 ≤ ZoA < 0.1 | degree |
| ZoA \_1 | 0.1 ≤ ZoA < 0.2 | degree |
| ZoA \_2 | 0.2 ≤ ZoA < 0.3 | degree |
| … | … | … |
| ZoA \_1798 | 179.8 ≤ ZoA < 179.9 | degree |
| ZoA \_1799 | 179.9 ≤ ZoA < 180 | degree |

# *<End of change2>*

# *<Start of change3>*

## 9.9 NR measurements for positioning

### 9.9.1 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 NR E-CID measurements.

For RSTD, PRS-RSRP and UE Rx-Tx time difference measurements, the requirements in clauses 9.9.2, 9.9.3 and 9.9.4 apply provided:

- UE is configured with measurement gaps

- No active BWP switching occurs during the measurement gaps for PRS measurement, and

All measurement requirements specified in clause 9.9.2, 9.9.3 and 9.9.4 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

UE is only required to measure PRS resources that are fully or partially overlapped with measurement gaps, and the requirements in clause 9.9.2, 9.9.3 and 9.9.4 are applicable to PRS resources that are fully or partially overlapped with measurement gaps.

A PRS resource is considered to be fully (partially) overlapped with measurement gaps if all (some) of its instances are overlapped with a measurement gap occasion. A PRS resource instance is considered to be overlapped with measurement gap occasion if the minimum number of repetitions of the instance is fully covered by the MGL excluding RF switching time, where the minimum number is given in the accuracy requirements in clause 10.1.23, 10.1.24 and 10.1.25 for RSTD, PRS-RSRP and UE Rx-Tx time difference, respectively.When 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.

### 9.9.2 RSTD measurements

#### 9.9.2.1 Introduction

The requirements in clause 9.9.2 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report DL RSTD measurements defined in TS 38.215 [4].

#### 9.9.2.2 Requirements Applicability

The requirements in clause 9.9.2 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.

#### 9.9.2.3 Measurement Capability

UE PRS RSTD measurement capability is as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355[34].

#### 9.9.2.4 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 starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH 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. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

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.

##### 9.9.2.4.1 Void

##### 9.9.2.4.2 Void

##### 9.9.2.4.3 Void

#### 9.9.2.5 Measurements Period Requirements

When physical layer receives last of *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.2.3) 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. In FR1, = 1; and in FR2, = 8.

is the carrier-specific scaling factor for NR PRS-based positioning measurements in positioning frequency layer *i* as defined in clause 9.1.5.2.

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 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 the PRS resources unmuted and fully or partially overlapped with MG are considered.

is the number of PRS RSTD samples and = 4.

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* in TS 37.355 [34],

*,* the least common multiple between and .

is the repetition periodicity of the measurement gap applicable for measurement in the PRS frequency layer i.

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 the measurement period of that positioning frequency layer *i*. 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. If bitmap for higher-layer parameter *DL-PRS-MutingPattern* is provided, and , then ; otherwise, if bitmap is not provided or , then .

is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L is the size of the bitmap .

* Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* 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* specified in TS 37.355 [34].

The time *s*tarts from the first MG instance aligned with a DL PRS resource(s) of positioning frequency layer *i* closest in time after both the *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

* Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured, the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period TRSTD,Total within measurement gaps due to collisions with other signals; otherwise, the measurement period can 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 LPRS.

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. If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The UE shall also meet the RSTD measurement requirements in this clause and measurement accuracy requirements in clause 10.1.23. However, in this case the RSTD measurement period shall be as follows:

Where,

- is the number of times handover occurs during ;

- is the largest among all positioning frequency layers;

- is the time during which the RSTD measurement may not be possible due to handover; it can be up to Tinterrupt as defined in clause 6.1.

#### 9.9.2.6 Void

# *<End of change3>*

# *<Start of change4>*

9.9.3.5 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 9.9.3.3) 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 the carrier specific scaling factor for PRS-RSRP measurements specified in clause 9.1.5.2,

is the scaling factor for Rx beam sweeping, and =1 if positioning frequency layer *i* is in FR1 and =8 if positioning frequency layer *i* is in FR2,

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 the PRS resources unmuted and fully or partially overlapped with MG 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-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* 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* in clause 6.4.3 of TS 37.355 [34],

is the number of PRS-RSRP measurement samples and = 4,

*= +* 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 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 measurement gap repetition period in positioning frequency layer i.

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 the measurement period of that positioning frequency layer. 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. If bitmap for higher-layer parameter *DL-PRS-MutingPattern* is provided, and , then ; otherwise, if bitmap is not provided or , then . is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L is the size of the bitmap .

Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

When PRS-RSRP measurements are configured for DL-AoD, the time starts from the first MG instance aligned with DL PRS resources of positioning frequency layer *i* closest in time 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 9.9.2.

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 9.9.4.

The requirements in this section apply, provided no PRS symbols are dropped during the measurement period TPRS-RSRP,Total within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

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 during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this section apply, provided no PRS symbols are dropped during the measurement period within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

If handover occurs while PRS-RSRP measurements are being performed then the UE shall complete the ongoing PRS-RSRP measurements session. The UE shall also meet the PRS-RSRP measurement requirements in this clause and measurement accuracy requirements in clause 10.1.24. However, in this case the PRS-RSRP measurement period shall be as follows:

where

is the number of times handover occurs during ;

is the largest among all positioning frequency layers;

is the time during which the PRS-RSRP measurement may not be possible due to handover; it can be up to Tinterrupt as defined in clause 6.1.

# *<End of change4>*

# *<Start of change5>*

9.9.4.5 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 9.9.4.3) 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, and

is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i* as defined further in this clause.

Where

is the carrier-specific scaling factor for NR PRS-based measurement in the positioning frequency layer *i* as defined in clause 9.1.5.2,

is the scaling factor for Rx beam sweeping, and =1 if positioning frequency layer *i* is in FR1 and =8 if positioning frequency layer *i* is in FR2,

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 the PRS resources unmuted and fully or partially overlapped with MG 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-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* 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* as specified in clause 6.4.3 of TS 37.355 [34],

is the number of UE Rx-Tx time difference measurement samples and = 4,

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* in TS 37.355 [34],

, the least common multiple between and

is the measurement gap repetition periodicity in positioning frequency layer *i*.

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 the measurement period of that positioning frequency layer.

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. If bitmap for higher-layer parameter *DL-PRS-MutingPattern* is provided, and , then ; otherwise, if bitmap is not provided or , then . is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L is the size of the bitmap .

Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

The time starts from the first MG instance aligned with DL PRS resources of positioning frequency layer *i* closest in time 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.

The UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

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 during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this section apply, provided no PRS symbols are dropped during the measurement period TUERxTx,Total within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

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.

*Editor’s note: FFS: Measurement period requirements when cell change does not impact SRS configuration*

*Editor’s note: FFS: Measurement period requirements when cell change does impact SRS configuration*

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.

# *<End of change5>*

# *<Start of change6>*

##### 9.1.5.2.2 SA mode: carrier-specific scaling factor for SSB, CSI-RS-based L3 measurements and RSSI and channel occupancy measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as CSSFwithin\_gap,i and is derived as described in this clause.

If measurement object *i* refers to a long-periodicity measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured, or

- an NR measurement for positioning frequency layer i with Tavailable\_PRS,i >160ms, where Tavailable\_PRS,i is defined in clauses 9.9.2.5, 9.9.3.5 and 9.9.4.5 for RSTD, PRS-RSRP and UE Rx-Tx time difference measurements, respectively.

then CSSFwithin\_gap,i=1. Otherwise, the CSSFwithin\_gap,i for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160ms) participate in the gap competition and the CSSFwithin\_gap,i are derived as below.

Table 9.1.5.2.2-1: void

When multiple positioning frequency layers are configured,

* for each positioning frequency layer *i*, CSSFwithin\_gap,i is derived with the following steps assuming no other positioning frequency layer is configured.
* for each RRM frequency layer *i*, CSSFwithin\_gap,i is derived as follows:
  + an intermediate CSSFwithin\_gap,i,k is derived with the following steps assuming only positioning frequency layer *k* is configured, and
  + CSSFwithin\_gap,i= max(CSSFwithin\_gap,i,k), where *k*=0…K-1, and K is the number of configured positioning frequency layers.

For each measurement gap *j* not used for a long-periodicity measurement defined above, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and NR PRS measurements on all positioning frequency layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- An NR measurement object with RSSI and channel occupancy measurement is a candidate to be measurement in a gap if the RMTC duration is fully covered by MGL excluding RF switching time.

- An inter-frequency SFTD measurement object, if to be measured with measurement gaps, is a candidate to be measured in all measurement gaps.

- A positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.

- For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

- Mintra,i,j: Number of intra-frequency measurement objects, including both SSB, CSI-RS based and RSSI/CO measurements, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Mintra,i,j equals 0.

- Minter,i,j : Number of NR inter-frequency layers including both SSB and CSI-RS based, EUTRA inter-RAT and UTRA inter-RAT frequency layers, up to one positioning frequency layer, RSSI/CO measurements, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Minter,i,j equals 0.

- A measurement object *i* in Mintra,i,j and in Minter,i,j is counted twice if the measurement object is configured with both RMTC and SMTC which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate

- Mtot,i,j = Mintra,i,j + Minter,i,j : Total number of intra-frequency, inter-frequency and inter-RAT frequncy layers and up to one NR PRS measurement on any one positioning frequency layer, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Mtot,i,j equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, Mintra,i,j = Minter,i,j = Mtot,i,j =0. The carrier specific scaling factor CSSFwithin\_gap,i is given by:

If *measGapSharingScheme* is equal sharing, CSSFwithin\_gap,i= max(ceil(Ri×Mtot,i,j)), where *j*=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kintra×Mintra,i,j) in gaps where Minter,i,j≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×Mintra,i,j) in gaps where Minter,i,j=0, where *j*=0…(160/MGRP)-1

- measurement object *i* is an inter-frequency or inter-RAT measurement object or NR PRS measurement on any one positioning frequency layer, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kinter×Minter,i,j) in gaps where Mintra,i,j ≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×Minter,i,j)in gaps where Mintra,i,j=0, where *j*=0…(160/MGRP)-1

Where Ri is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

CSSFwithin\_gap,k=1 during TDetect, E-UTRAN FDD specified in clause 9.4.4.1.2.2 and TDetect, E-UTRAN TDD specified in clause 9.4.4.2.2.2, where k is the carrier frequency where the UE is performing cell detection of the inter-RAT E-UTRA OTDOA assistance data reference cell when acquiring the subframe and slot timing of the cell according to clause 9.4.4. In this case, the UE cell identification and measurement periods derived based on CSSFwithin\_gap,i in clauses 9.2.5.1, 9.2.5.2, 9.2.6.2, 9.2.6.3, 9.3.4, 9.3.5, 9.4.2.2, 9.4.2.3 and 9.10.2 may be extended for measurement objects of which the cell identification and measurement periods are overlapped with TDetect, E-UTRAN FDD and TDetect, E-UTRAN TDD.

##### 9.1.5.2.3 NE-DC: carrier-specific scaling factor for SSB-based and CSI-RS based L3 measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as CSSFwithin\_gap,i and is derived as described in this clause.

If measurement object *i* refers to a long-periodicty measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured, or

- an NR measurement for positioning frequency layer i with Tavailable\_PRS,i >160ms, where Tavailable\_PRS,i is defined in clauses 9.9.2.5, 9.9.3.5 and 9.9.4.5 for RSTD, PRS-RSRP and UE Rx-Tx time difference measurements, respectively.

then CSSFwithin\_gap,i=1. Otherwise, the CSSFwithin\_gap,i for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160ms) participate in the gap competition are derived as below.

When multiple positioning frequency layers are configured,

* for each positioning frequency layer *i*, CSSFwithin\_gap,i is derived with the following steps assuming no other positioning frequency layer is configured.
* for each RRM frequency layer *i*, CSSFwithin\_gap,i is derived as follows:
  + an intermediate CSSFwithin\_gap,i,k is derived with the following steps assuming only positioning frequency layer *k* is configured, and
  + CSSFwithin\_gap,i= max(CSSFwithin\_gap,i,k), where *k*=0…K-1, and K is the number of configured positioning frequency layers.

For each measurement gap *j* not used for a long-periodicity measurement defined above, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and NR PRS measurements on all positioning frequency layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- An inter-RAT measurement object is a candidate to be measured in all measurement gaps.

- An inter-frequency E-UTRA measurement object is a candidate to be measured in all measurement gaps.

- A positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.

For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

If the number of configured interfrequency and interRAT measuerement objects and NR PRS measurements on all positioning frequency layers is non-zero and the UE is configured with per UE gaps, or if the UE is configured with per FR gaps:

FR1 and FR2 intrafrequency measurement objects belong to group A

Interfrequency and interRAT measurement objects belong to group B

MgroupA,i,j: Sum of the number of FR1 intra-frequency measurement objects Mintra-FR1,i,j and the number of FR2 intra-frequency measurement objects Mintra-FR2,i,j , including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise MgroupA,i,j equals 0.

MgroupBi,j: Number of NR inter-frequency layers including both SSB and CSI-RS based, EUTRA inter-RAT and UTRA inter-RAT measurement objects, up to one positioning frequency layer, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise MgroupB,i,j equals 0.

If the number of configured inter-frequency and inter-RAT measuerement objects and NR PRS measurements on all positioning frequency layers is zero and the UE is configured with per UE gaps:

FR1 intrafrequency measurement objects belong to group A

FR2 intrafrequency measurement objects belong to group B

MgroupA,i,j: The number of FR1 intrafrequency measurement objects Mintra-FR1,i,j , including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise MgroupA,i,j equals 0.

MgroupBi,j : The number of FR2 intrafrequency measurement objects Mintra-FR2,i,j , including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise MgroupB,i,j equals 0.

Mtot,i,j = MgroupA,i,j + MgroupB,i,j : Total number of group A and group B measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Mtot,i,j equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, Mintra,i,j = Minter,i,j = Mtot,i,j =0. The carrier specific scaling factor CSSFwithin\_gap,i is given by:

If *measGapSharingScheme* is equal sharing, CSSFwithin\_gap,i= max(ceil(Ri×Mtot,i,j)), where *j*=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is a group A measurement object, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kintra×MgroupA,i,j) in gaps where MgroupB,i,j≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×MgroupA,i,j) in gaps where MgroupB,i,j=0, where *j*=0…(160/MGRP)-1

- measurement object *i* is an group B measurement object, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kinter×MgroupBi,j) in gaps where MgroupA,i,j ≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×MgroupB,i,j)in gaps where MgroupA,i,j=0, where *j*=0…(160/MGRP)-1

Where Ri is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

##### 9.1.5.2.4 NR-DC: carrier-specific scaling factor for SSB-based and CSI-RS-based L3 measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as CSSFwithin\_gap,i and is derived as described in this clause.

If measurement object *i* refers to a long-periodicity measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured, or

- an NR measurement for positioning frequency layer i with Tavailable\_PRS,i >160ms, where Tavailable\_PRS,i is defined in clauses 9.9.2.5, 9.9.3.5 and 9.9.4.5 for RSTD, PRS-RSRP and UE Rx-Tx time difference measurements, respectively.

then CSSFwithin\_gap,i=1. Otherwise, the CSSFwithin\_gap,i for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160ms) participate in the gap competition and the CSSFwithin\_gap,i are derived as below.

When multiple positioning frequency layers are configured,

* for each positioning frequency layer *i*, CSSFwithin\_gap,i is derived with the following steps assuming no other positioning frequency layer is configured.
* for each RRM frequency layer *i*, CSSFwithin\_gap,i is derived as follows:
  + an intermediate CSSFwithin\_gap,i,k is derived with the following steps assuming only positioning frequency layer *k* is configured, and
  + CSSFwithin\_gap,i= max(CSSFwithin\_gap,i,k), where *k*=0…K-1, and K is the number of configured positioning frequency layers.

For each measurement gap *j* not used for an RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured within an arbitrary 160ms period, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and NR PRS measurements on all positioning frequency layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- A positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.

For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

If the number of configured interfrequency and interRAT measuerement objects and NR PRS measurements on all positioning frequency layers is non-zero and the UE is configured with per UE gaps, or if the UE is configured with per FR gaps:

FR1 and FR2 intrafrequency measurement objects belong to group A

Interfrequency and interRAT measurement objects and up to one NR PRS measurement on any one positioning frequency layer belong to group B

MgroupA,i,j: Sum of the number of FR1 intra-frequency measurement objects Mintra-FR1,i,j and the number of FR2 intra-frequency measurement objects Mintra-FR2,i,j , including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise MgroupA,i,j equals 0.

MgroupBi,j : Number of NR inter-frequency layers including both SSB and CSI-RS based, EUTRA inter-RAT and UTRA inter-RAT measurement objects and up to one positioning frequency layer, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise MgroupB,i,j equals 0.

If the number of configured interfrequency and interRAT measuerement objects and NR PRS measurements on all positioning frequency layers is zero and the UE is configured with per UE gaps:

FR1 intrafrequency measurement objects belong to group A

FR2 intrafrequency measurement objects belong to group B

MgroupA,i,j: The number of FR1 intrafrequency measurement objects Mintra-FR1,i,j , including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise MgroupA,i,j equals 0.

MgroupBi,j : The number of FR2 intrafrequency measurement objects Mintra-FR2,i,j , including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise MgroupB,i,j equals 0.

Mtot,i,j = MgroupA,i,j + MgroupB,i,j : Total number of group A and group B measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Mtot,i,j equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, Mintra,i,j = Minter,i,j = Mtot,i,j =0. The carrier specific scaling factor CSSFwithin\_gap,i is given by:

If *measGapSharingScheme* is equal sharing, CSSFwithin\_gap,i= max(ceil(Ri×Mtot,i,j)), where *j*=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is a group A measurement object, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kintra×MgroupA,i,j) in gaps where MgroupB,i,j≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×MgroupA,i,j) in gaps where MgroupB,i,j=0, where *j*=0…(160/MGRP)-1

- measurement object *i* is an group B measurement object, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kinter×MgroupBi,j) in gaps where MgroupA,i,j ≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×MgroupB,i,j)in gaps where MgroupA,i,j=0, where *j*=0…(160/MGRP)-1

Ri is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

##### 9.1.5.2.5 SA mode: carrier-specific scaling factor for PRS-based measurements performed within gaps

The requirements in this clause apply for NR PRS-based measurements for positioning in clause 9.9.

When NR PRS-based measurements for positioning are configured on one or more positioning frequency layers within measurement gaps, the carrier specific scaling factor for a target PRS-based positioning measurement on a positioning frequency layer with index *i* is designated as CSSFwithin\_gap,i and is derived as described in clause 9.1.5.2.2.

NR Positioning measurement requirements for long periodicity measurements apply in case all PRS resources in the PFL are configured with periodicity > 160 ms.

##### 9.1.5.2.6 NE-DC: carrier-specific scaling factor for PRS-based measurements performed within gaps

The requirements in this clause apply for NR PRS-based measurements for positioning in clause 9.9.

When NR PRS-based measurements for positioning are configured on one or more positioning frequency layers within measurement gaps, the carrier specific scaling factor for a target measurement on a positioning frequency layer with index *i* is designated as CSSFwithin\_gap,i and is derived as described in clause 9.1.5.2.3.

NR Positioning measurement requirements for long periodicity measurements apply in case all PRS resources in the PFL are configured with periodicity > 160 ms.

##### 9.1.5.2.7 NR-DC: carrier-specific scaling factor for PRS-based measurements performed within gaps

The requirements in this clause apply for NR PRS-based measurements for positioning in clause 9.9.

When NR PRS-based measurements for positioning are configured on one or more positioning frequency layers within measurement gaps, the carrier specific scaling factor for a target measurement on a positioning frequency layer with index *i* is designated as CSSFwithin\_gap,i and is derived as described in clause 9.1.5.2.4.

NR Positioning measurement requirements for long periodicity measurements apply in case all PRS resources in the PFL are configured with periodicity > 160 ms.

# *<End of change6>*

# *<Start of change7>*

### 9.9.1 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 NR E-CID measurements.

For RSTD, PRS-RSRP and UE Rx-Tx time difference measurements, the requirements in clauses 9.9.2, 9.9.3 and 9.9.4 apply provided:

- UE is configured with measurement gaps

- No active BWP switching occurs during the measurement gaps for PRS measurement, and

All measurement requirements specified in clause 9.9.2, 9.9.3 and 9.9.4 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

UE is only required to measure PRS resources that are fully or partially overlapped with measurement gaps, and the requirements in clause 9.9.2, 9.9.3 and 9.9.4 are applicable to PRS resources that are fully or partially overlapped with measurement gaps.

A PRS resource is considered to be fully (partially) overlapped with measurement gaps if all (some) of its instances are overlapped with a measurement gap occasion. A PRS resource instance is considered to be overlapped with measurement gap occasion if the minimum number of unmuted repetitions of the instance is fully covered by the MGL excluding RF switching time, where the minimum number is given in the accuracy requirements in clause 10.1.23, 10.1.24 and 10.1.25 for RSTD, PRS-RSRP and UE Rx-Tx time difference, respectively.

When 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.

# *<End of change7>*

# *<Start of change8>*

## 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].

**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.

**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].

**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].

**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].

**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].

# *<End of change8>*

# *<Start of change9>*

#### 10.1.23.2 Measurement Accuracy Requirements

The RSTD measurement reported by the UE shall fulfil the accuracy requirements defined in Table 10.1.23.2-1 for AWGN channel and Table 10.1.23.2-3 for fading channel for FR1, 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 RSTD measurements are fulfilled according to Annex B.2.z for a corresponding Band for each relevant PRS resource configured for measurement.

The RSTD measurement reported by the UE shall fulfil the accuracy requirements defined in Table 10.1.23.2-2 for AWGN channel and Table 10.1.23.2-4 for fading channel for FR2, provided that the following conditions are met.

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

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

Note: The requriements for fading channel in this clause are derived based on TDL-A (30 ns delay spread, 5Hz) and TDL-C (60 ns delay spread, 300 Hz) channel models for FR1 and FR2 respectively.

When UE measures RSTD on PRS resources belonging to different PFLs, then the RSTD accuracy is defined as the accuracy corresponding to the largest accuracy value among different PFLs.

[*Editor notes: The margins for measurements on different PFLs shall be considered in the group delay margin]*

Table 10.1.23.2-1: RSTD absolute accuracy in FR1 for AWGN channel

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | PRS SCS | PRS bandwidth  Note 1 | PRS resource repetition ()  Note 2 | Io Note 3 range | | |
| NR operating band groups Note 4 | Minimum Io | Maximum Io |
| Tc Note 5 | dB | kHz | RB |  |  | dBm/SCS | dBm/BWChannel |
| [132] +ΔNote 7 | (PRS Ês/Iot)ref ≥-6dB  (PRS Ês/Iot)*i* ≥-13dB | 15 | ≥ [24] | ≥ [4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -121 | -50 |
| NR\_FDD\_FR1\_B | -120.5 | -50 |
| NR\_TDD\_FR1\_C | -120 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -119.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -119 | -50 |
| NR\_FDD\_FR1\_F | -118.5 | -50 |
| NR\_FDD\_FR1\_G | -118 | -50 |
| NR\_FDD\_FR1\_H | -117.5 | -50 |
| [98] +Δ | ≥ [52] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [42] +Δ | ≥ [104] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [75] +Δ | 30 | ≥ [24] | ≥ [4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -118 | -50 |
| NR\_FDD\_FR1\_B | -117.5 | -50 |
| NR\_TDD\_FR1\_C | -117 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -116.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -116 | -50 |
| NR\_FDD\_FR1\_F | -115.5 | -50 |
| NR\_FDD\_FR1\_G | -115 | -50 |
| NR\_FDD\_FR1\_H | -114.5 | -50 |
| [48] +Δ | ≥ [48] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [24] +Δ | ≥ [132] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [50] +Δ | 60 | ≥ [24] | ≥ [4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -115 | -50 |
| NR\_FDD\_FR1\_B | -114.5 | -50 |
| NR\_TDD\_FR1\_C | -114 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -113.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -113 | -50 |
| NR\_FDD\_FR1\_F | -113.5 | -50 |
| NR\_FDD\_FR1\_G | -113 | -50 |
| NR\_FDD\_FR1\_H | -111.5 | -50 |
| [24] +Δ | ≥ [64] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [10] +Δ | ≥ [132] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.  NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.  NOTE 3: Io is assumed to have constant EPRE across the bandwidth.  NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS.  NOTE 7: Δ=TBD. | | | | | | | |

Table 10.1.23.2-2: RSTD absolute accuracy in FR2 for AWGN channel

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| PRS Ês/Iot | PRS SCS | PRS bandwidth  Note 1 | PRS resource repetition  () Note 2 | Io Note 3 range | |
| Minimum Io | Maximum Io |
| Tc Note 4 | dB | kHz | RB |  | dBm/SCS | dBm/BWChannel |
| [35] +ΔNote 6 | (PRS Ês/Iot)ref ≥-6dB  (PRS Ês/Iot)*i* ≥-13dB | 60 | ≥ [24] | ≥ [1] | Same value as PRS\_RP in Table B.2.z-2, according to UE Power class, operating band and angle of arrival | -50 |
| [24] +Δ | ≥ [64] | ≥ [1] | Note 5 | Note 5 |
| [11] +Δ | ≥ [132] | ≥ [1] | Note 5 | Note 5 |
| [24] +Δ | 120 | ≥ [32] | ≥ [1] | Same value as PRS\_RP in Table B.2.z-2, according to UE Power class, operating band and angle of arrival | -50 |
| [13] +Δ | ≥ [64] | ≥ [1] | Note 5 | Note 5 |
| [6] +Δ | ≥ [128] | ≥ [1] | Note 5 | Note 5 |
| NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.  NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.  NOTE 3: Io is assumed to have constant EPRE across the bandwidth.  NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS.  NOTE 6: Δ=TBD. | | | | | | |

Table 10.1.23.2-3: RSTD absolute accuracy in FR1 for fading channel

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | PRS SCS | PRS bandwidth  Note 1 | PRS resource repetition ()  Note 2 | Io Note 3 range | | |
| NR operating band groups Note 4 | Minimum Io | Maximum Io |
| Tc Note 5 | dB | kHz | RB |  |  | dBm/SCS | dBm/BWChannel |
| [247] +ΔNote 7 | (PRS Ês/Iot)ref ≥-6dB  (PRS Ês/Iot)*i* ≥-13dB | 15 | ≥ [24] | ≥ [4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -121 | -50 |
| NR\_FDD\_FR1\_B | -120.5 | -50 |
| NR\_TDD\_FR1\_C | -120 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -119.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -119 | -50 |
| NR\_FDD\_FR1\_F | -118.5 | -50 |
| NR\_FDD\_FR1\_G | -118 | -50 |
| NR\_FDD\_FR1\_H | -117.5 | -50 |
| [140] +Δ | ≥ [52] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [86] +Δ | ≥ [104] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [118] +Δ | 30 | ≥ [24] | ≥ [4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -118 | -50 |
| NR\_FDD\_FR1\_B | -117.5 | -50 |
| NR\_TDD\_FR1\_C | -117 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -116.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -116 | -50 |
| NR\_FDD\_FR1\_F | -115.5 | -50 |
| NR\_FDD\_FR1\_G | -115 | -50 |
| NR\_FDD\_FR1\_H | -114.5 | -50 |
| [109] +Δ | ≥ [48] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [28] +Δ | ≥ [132] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [147] +Δ | 60 | ≥ [24] | ≥ [4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -115 | -50 |
| NR\_FDD\_FR1\_B | -114.5 | -50 |
| NR\_TDD\_FR1\_C | -114 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -113.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -113 | -50 |
| NR\_FDD\_FR1\_F | -113.5 | -50 |
| NR\_FDD\_FR1\_G | -113 | -50 |
| NR\_FDD\_FR1\_H | -111.5 | -50 |
| [27] +Δ | ≥ [64] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| [21] +Δ | ≥ [132] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.  NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.  NOTE 3: Io is assumed to have constant EPRE across the bandwidth.  NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS.  NOTE 7: Δ=TBD. | | | | | | | |

Table 10.1.23.2-4: RSTD absolute accuracy in FR2 for fading channel

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| PRS Ês/Iot | PRS SCS | PRS bandwidth  Note 1 | PRS resource repetition  () Note 2 | Io Note 3 range | |
| Minimum Io | Maximum Io |
| Tc Note 4 | dB | kHz | RB |  | dBm/SCS | dBm/BWChannel |
| [83] +ΔNote 6 | (PRS Ês/Iot)ref ≥-6dB  (PRS Ês/Iot)*i* ≥-13dB | 60 | ≥ [24] | ≥ [4] | Same value as PRS\_RP in Table B.2.z-2, according to UE Power class, operating band and angle of arrival | -50 |
| [64] +Δ | ≥ [64] | ≥ [1] | Note 5 | Note 5 |
| [46] +Δ | ≥ [132] | ≥ [1] | Note 5 | Note 5 |
| [48] +Δ | 120 | ≥ [32] | ≥ [4] | Same value as PRS\_RP in Table B.2.z-2, according to UE Power class, operating band and angle of arrival | -50 |
| [54] +Δ | ≥ [64] | ≥ [1] | Note 5 | Note 5 |
| [36] +Δ | ≥ [128] | ≥ [1] | Note 5 | Note 5 |
| NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.  NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34], respectively.  NOTE 3: Io is assumed to have constant EPRE across the bandwidth.  NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS.  NOTE 6: Δ=TBD. | | | | | | |

# *<End of change9>*

# *<Start of change10>*

### 10.1.24 PRS-RSRP Measurements

#### 10.1.24.1 Introduction

The requirements in Clause 10.1.24 shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* or *nr-Multi-RTT-RequestLocationInformation* or *nr-DL-AoD-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to report one or more DL PRS-RSRP measurements defined in TS 38.215 [4].

#### 10.1.24.2 Measurement Accuracy Requirements

##### 10.1.24.2.1 Absolute PRS RSRP accuracy

The absolute accuracy requirements for PRS-RSRP measurement for FR1 defined in Table 10.1.24.2.1-1 are valid under the following conditions:

Conditions defined in 38.101-1 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.2.14 for a corresponding Band

The absolute accuracy requirements for PRS-RSRP measurement for FR2 defined in Table 10.1.24.2.1-2 are valid under the following conditions:

Conditions defined in 38.101-2 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.2.14 for a corresponding Band

Table 10.1.24.2.1-1: PRS-RSRP absolute accuracy for FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | | | | |
| Normal condition | Extreme condition | PRS Ês/Iot | PRS BW | Repetition factor  ( | Io Note 7 range | | | | |
| NR operating band groups Note 8 | Minimum Io Note 1  dBm / SCSPRS | | | Maximum Io |
| dB | dB | dB | PRB | - |  | dBm / SCSPRS | | | dBm/BWChannel |
| **dBm/15kHz** Note 6 | **dBm/30kHz** Note 6 | **dBm/60kHz** Note 6 |
| ±3.5 | [TBD] | ≥-3dB | ≥24 | All | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A, NR\_SDL\_FR1\_A | -127 | -124 | -121 | -50 |
| NR\_FDD\_FR1\_B | -126.5 | -123.5 | -120.5 | -50 |
| NR\_TDD\_FR1\_C | -126 | -123 | -120 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -125.5 | -122.5 | -119.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -125 | -122 | -119 | -50 |
| NR\_FDD\_FR1\_F | -124.5 | -121.5 | -118.5 | -50 |
| NR\_FDD\_FR1\_G | -124 | -121 | -118 | -50 |
| NR\_FDD\_FR1\_H | -123.5 | -120.5 | -117.5 | -50 |
| Note 4 | | | | |
| Note 4 | | | | |
| ±8.5 | [TBD] | ≥-13dB | 24 ≤ BW ≤ 52 | All | Note 4 | | | | |
| ±6 | 52< BW≤ 104 | All | Note 4 | | | | |
| ±4.5 | BW >104 | All | Note 4 | | | | |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Void.  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The condition level is increased by ∆>0, when applicable, as described in Sections B.3.2 and B.3.3.  NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 8: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | | |

Table 10.1.24.2.1-2: PRS-RSRP absolute accuracy for FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | | |
| Normal condition | Extreme condition | PRS Ês/Iot | PRS BW | Repetition factor  ( | Io Note 7 range | | |
| Minimum Io Note 1  dBm / SCSPRS | | Maximum Io |
| dB | dB | dB | PRB | - | dBm / SCSPRS | | dBm/BWChannel |
| **dBm/120kHz** Note 6 | **dBm/60kHz** Note 6 |
| ±5 | [TBD] | ≥-3dB | ≥24 | All | Same value as PRP in Table B.2.14 -2, according to UE Power class, operating band and angle of arrival | | -50 |
| Note 4 | | |
| Note 4 | | |
| ±8.5 | [TBD] | ≥-13dB | 24 ≤ BW ≤ 64 | All | Note 4 | | |
| ±6 | BW >64 | All | Note 4 | | |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Void.  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The condition level is increased by ∆>0, when applicable, as described in Sections B.3.2 and B.3.3.  NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 8: NR operating band groups are as defined in Section 3.5.2. | | | | | | | |

10.1.24.2.2 Relative PRS RSRP accuracy

The relative accuracy of PRS-RSRP is defined as the PRS-RSRP measured from one cell compared to the PRS-RSRP measured from another cell on the same frequency, or between any two PRS-RSRP levels measured on the same cell.

The relative PRS-RSRP accuracy requirements apply for the cases when PRS-RSRP is measured from resources in the same resource set, and PRS-RSRP is measured with same Rx beam in case of FR2.

The accuracy requirements for PRS-RSRP measurement for FR1 defined in Table 10.1.24.2.2-1 are valid under the following conditions:

Conditions defined in 38.101-1 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.2.14 for a corresponding Band

The accuracy requirements for PRS-RSRP measurement for FR2 defined in Table 10.1.24.2.2-2 are valid under the following conditions:

Conditions defined in 38.101-2 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.2.14 for a corresponding Band

Table 10.1.24.2.2-1: PRS-RSRP relative accuracy for FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | | | | |
| Normal condition | Extreme condition | PRS Ês/Iot | PRS BW | Repetition factor  ( | Io Note 7 range | | | | |
| NR operating band groups Note 8 | Minimum Io Note 1  dBm / SCSPRS | | | Maximum Io |
| dB | dB | dB | PRB | - |  | dBm / SCSPRS | | | dBm/BWChannel |
| **dBm/15kHz** Note 6 | **dBm/30kHz** Note 6 | **dBm/60kHz** Note 6 |
| [±3.5] | [TBD] | ≥-3dB | ≥24 | All | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A, NR\_SDL\_FR1\_A | -127 | -124 | -121 | -50 |
| NR\_FDD\_FR1\_B | -126.5 | -123.5 | -120.5 | -50 |
| NR\_TDD\_FR1\_C | -126 | -123 | -120 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -125.5 | -122.5 | -119.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -125 | -122 | -119 | -50 |
| NR\_FDD\_FR1\_F | -124.5 | -121.5 | -118.5 | -50 |
| NR\_FDD\_FR1\_G | -124 | -121 | -118 | -50 |
| NR\_FDD\_FR1\_H | -123.5 | -120.5 | -117.5 | -50 |
| Note 4 | | | | |
| Note 4 | | | | |
| ±9.5 | [TBD] | ≥-13dB | 24 ≤ BW ≤ 52 | All | Note 4 | | | | |
| ±6.5 | 52< BW≤ 104 | All | Note 4 | | | | |
| ±5.0 | BW >104 | All | Note 4 | | | | |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Void.  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The condition level is increased by ∆>0, when applicable, as described in Sections B.3.2 and B.3.3.  NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 8: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | | |

Table 10.1.24.2.2-2: PRS-RSRP relative accuracy for FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | | |
| Normal condition | Extreme condition | PRS Ês/Iot | PRS BW | Repetition factor  ( | Io Note 7 range | | |
| Minimum Io Note 1  dBm / SCSPRS | | Maximum Io |
| dB | dB | dB | PRB | - | dBm / SCSPRS | | dBm/BWChannel |
| **dBm/120kHz** Note 6 | **dBm/60kHz** Note 6 |
| ±5.0 | [TBD] | ≥-3dB | ≥24 | All | Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | | -50 |
| Note 4 | | |
| Note 4 | | |
| ±10 | [TBD] | ≥-13dB | 24 ≤ BW ≤ 64 | All | Note 4 | | |
| ±7.5 | BW >64 | All | Note 4 | | |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Void.  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The condition level is increased by ∆>0, when applicable, as described in Sections B.3.2 and B.3.3.  NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 8: NR operating band groups are as defined in Section 3.5.2. | | | | | | | |

# *<End of change10>*

# *<Start of change11>*

10.1.25.2 Measurement Accuracy Requirements

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall not apply, if:

NTA\_offset defined in Table 7.1.2-2 changes during the UE Rx-Tx measurement period or

if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the network-configured Timing Advance.

*FFS: whether UE Rx-Tx time difference measurement accuracy requirements in this clause shall also apply if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the autonomous timing adjustment defined in clause 7.1.2.*

The UE shall continue and complete a UE Rx-Tx measurement while meeting UE Rx-Tx measurement accuracy requirements defined in this clause when a serving cell change occurs during the UE Rx-Tx measurement provided that the serving cell change does not impact the SRS configuration for the UE Rx-Tx measurement.

Note: The requriements for fading channel in this clause are derived based on TDL-A (30 ns delay spread, 5Hz) and TDL-C (60 ns delay spread, 300 Hz) channel models for FR1 and FR2 respectively.

*Editor’s note: In accuracy tables δ is margin and is FFS*

The accuracy requirements in Table 10.1.25.2-1 for FR1 are valid under the following conditions:

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

PRP|dBm according to Annex B.2.x for a corresponding Band.

AWGN propagation condition.

**Table 10.1.25.2-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN**

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| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS bandwidth** | **PRS SCS** | **PRS resource repetition Note 3** | **NR operating band groupsNote 2** | **IoNote 4 range** | |
| **Minimum IoNote 1** | **Maximum Io** |
| **TcNote 5** | **dB** | **RB** | **kHz** |  |  | **dBm / SCSPRS** | **dBm/BW** |
| ± [78+δ] | -3 | ≥[24] | 15 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -121 | -50 |
| NR\_FDD\_FR1\_B | -120.5 |
| NR\_TDD\_FR1\_C | -120 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -119.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -119 |
| NR\_FDD\_FR1\_F | -118.5 |
| NR\_FDD\_FR1\_G | -118 |
| NR\_FDD\_FR1\_H | -117.5 |
| ± [59+δ] | ≥[52] | ≥[1] | Note 6 | Note 6 | Note 6 |
| ± [30+δ] | >[104] | ≥[1] | Note 6 | Note 6 | Note 6 |
| ± [57+δ] |  | ≥[24] | 30 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -118 | -50 |
| NR\_FDD\_FR1\_B | -117.5 |
| NR\_TDD\_FR1\_C | -117 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -116.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -116 |
| NR\_FDD\_FR1\_F | -115.5 |
| NR\_FDD\_FR1\_G | -115 |
|  | NR\_FDD\_FR1\_H | -114.5 |
| ± [30+δ] |  | ≥[48] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [15+δ] |  | ≥[132] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [29+δ] | ≥[24] | 60 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -115 | -50 |
| NR\_FDD\_FR1\_B | -114.5 |
| NR\_TDD\_FR1\_C | -114 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -113.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -113 |
| NR\_FDD\_FR1\_F | -113.5 |
| NR\_FDD\_FR1\_G | -113 |
| NR\_FDD\_FR1\_H | -111.5 |
| ± [15+δ] |  | ≥ [64] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [7+δ] |  | ≥ [132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [101+δ] | -13 | ≥[24] | 15 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [75+δ] | ≥[52] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [37+δ] | >[104] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [58+δ] |  | ≥[24] | 30 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [39+δ] |  | ≥[48] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [16+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [36+δ] | ≥[24] | 60 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [16+δ] |  | ≥ [64] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [8+δ] |  | ≥ [132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: NR operating band groups are as defined in Section 3.5.  NOTE 3: are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34].  NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. | | | | | | | |

The accuracy requirements in Table 10.1.25.2-2 for FR1 are valid under the following conditions:

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

PRP|dBm according to Annex B.2.x for a corresponding Band.

Fading propagation condition.

**Table 10.1.25.2-2: UE Rx-Tx time difference measurement accuracy in FR1 in fading**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS bandwidth** | **PRS SCS** | **PRS resource repetition Note 3** | **NR operating band groupsNote 2** | **IoNote 4 range** | |
| **Minimum IoNote 1** | **Maximum Io** |
| **TcNote 5** | **dB** | **RB** | **kHz** |  |  | **dBm / SCSPRS** | **dBm/BW** |
| ± [137+δ] | -3 | ≥[24] | 15 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -121 | -50 |
| NR\_FDD\_FR1\_B | -120.5 |
| NR\_TDD\_FR1\_C | -120 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -119.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -119 |
| NR\_FDD\_FR1\_F | -118.5 |
| NR\_FDD\_FR1\_G | -118 |
| NR\_FDD\_FR1\_H | -117.5 |
| ± [96+δ] | ≥[52] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [62+δ] | >[104] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [87+δ] |  | ≥[24] | 30 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -118 | -50 |
| NR\_FDD\_FR1\_B | -117.5 |
| NR\_TDD\_FR1\_C | -117 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -116.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -116 |
| NR\_FDD\_FR1\_F | -115.5 |
| NR\_FDD\_FR1\_G | -115 |
|  | NR\_FDD\_FR1\_H | -114.5 |
| ± [68+δ] |  | ≥[48] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [44+δ] |  | ≥[132] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [59+δ] | ≥[24] | 60 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -115 | -50 |
| NR\_FDD\_FR1\_B | -114.5 |
| NR\_TDD\_FR1\_C | -114 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -113.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -113 |
| NR\_FDD\_FR1\_F | -113.5 |
| NR\_FDD\_FR1\_G | -113 |
| NR\_FDD\_FR1\_H | -111.5 |
| ± [42+δ] |  | ≥ [64] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [36+δ] |  | ≥ [132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [180+δ] | -13 | ≥[24] | 15 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [98+δ] | ≥[52] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [68+δ] | >[104] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [87+δ] |  | ≥[24] | 30 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [85+δ] |  | ≥[48] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [44+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [139+δ] | ≥[24] | 60 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [46+δ] |  | ≥ [64] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [30+δ] |  | ≥ [132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: NR operating band groups are as defined in Section 3.5.  NOTE 3: are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34].  NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. | | | | | | | |

The accuracy requirements in Table 10.1.25.2-3 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

PRP|dBm according to Annex B.2.x for a corresponding Band.

AWGN propagation condition.

**Table 10.1.25.2-3: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN**

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| **Accuracy** | **Conditions** | | | | | |
| **PRS Ês/Iot** | **Minimum PRS bandwidth** | **PRS SCS** | **PRS resource repetitionNote 3** | **IoNote 4 range** | |
| **Minimum IoNote 1** | **Maximum Io** |
| **TcNote 5** | **dB** | **RB** | **kHz** |  | **dBm / SCSPRS** | **dBm/BWChannel** |
| ± [22+δ] | -3 | ≥[24] | 60 | ≥[1] | Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| ± [15+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [7+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [12+δ] | ≥[32] | 120 | ≥[1] | Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| ± [7+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [4+δ] |  | ≥[128] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [35+δ] | -13 | ≥[24] | 60 | ≥[1] | NOTE 6 | NOTE 6 |
| ± [15+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [7+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [14+δ] | ≥[32] | 120 | ≥[1] | NOTE 6 | NOTE 6 |
| ± [9+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [4+δ] |  | ≥[128] |  | ≥[1] | NOTE 6 | NOTE 6 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: NR operating band groups are as defined in Section 3.5.  NOTE 3: are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34].  NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. | | | | | | |

The accuracy requirements in Table 10.1.25.2-4 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

PRP|dBm according to Annex B.2.x for a corresponding Band.

Fading propagation condition.

**Table 10.1.25.2-4: UE Rx-Tx time difference measurement accuracy in FR2 in fading**

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| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | |
| **PRS Ês/Iot** | **Minimum PRS bandwidth** | **PRS SCS** | **PRS resource repetitionNote 3** | **IoNote 4 range** | |
| **Minimum IoNote 1** | **Maximum Io** |
| **TcNote 5** | **dB** | **RB** | **kHz** |  | **dBm / SCSPRS** | **dBm/BWChannel** |
| ± [75+δ] | -3 | ≥[24] | 60 | ≥[4] | Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| ± [72+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [57+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [61+δ] | ≥[32] | 120 | ≥[1] | Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| ± [64+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [55+δ] |  | ≥[128] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [92+δ] | -13 | ≥[24] | 60 | ≥[4] | NOTE 6 | NOTE 6 |
| ± [70+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [57+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [60+δ] | ≥[32] | 120 | ≥[1] | NOTE 6 | NOTE 6 |
| ± [66+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [62+δ] |  | ≥[128] |  | ≥[1] | NOTE 6 | NOTE 6 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: NR operating band groups are as defined in Section 3.5.  NOTE 3: are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34].  NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. | | | | | | |

# *<End of change11>*

# *<Start of change12>*

### A.7.6.10 PRS-RSRP measurements

#### A.7.6.10.1 PRS-RSRP reporting delay test case for single positioning frequency layer

##### A.7.6.10.1.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in Clause 9.9.3.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.7.6.10.1.1-1

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.6.10.1.1-2, and table A.7.6.10.1.1-3.

Table A. 7.6.6.1.1-1: supported test configurations for PRS RSRP measurement for FR2-FR2

|  |  |
| --- | --- |
| **Config** | **Description** |
| 1 | 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

Table A.7.6.10.1.1-2: General test parameters for PRS RSRP measurement reporting delay

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test configuration** | **Value** | **Comment** |
| NR RF Channel Number |  | Config 1 | 1: Cell 1 and Cell 2 | One TDD carrier frequency is used for the NR cells. |
| Active cell |  | Config 1 | NR cell 1 (Pcell) | Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data. |
| Neighbour cell |  | Config 1 | NR cell 2 | Cell 2 is a neighbour cell in the positioning assistance data. |
| Gap Pattern Id |  | Config 1 | GP#13 or GP#24Note1 | As specified in clause 9.1.2-1. |
| Measurement gap offset |  | Config 1 | 39 |  |
| SMTC parameters |  | Config 1 | SMTC.1 | As specified in clause A.3.11 |
| SSB parameters |  | Config 1 | SSB.3 FR2 | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1 | -6 |  |
| Hysteresis | dB | Config 1 | 0 |  |
| CP length |  | Config 1 | Normal |  |
| TimeToTrigger | s | Config 1 | 0 |  |
| Filter coefficient |  | Config 1 | 0 | L3 filtering is not used |
| DRX |  | Config 1 | OFF | DRX is not used |
| Time offset between serving and neighbour cells |  | Config 1 | 3μs | Synchronous cells. |
| Expected RSTD | μs | Config 1 | 3 |  |
| Expected RSTD uncertainty | μs | Config 1 | 5 |  |
| T1 | s | Config 1 | 5 |  |
| T2 | s | Config 1 | 7 |  |
| Note 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured. | | | | |

Table A.7.6.10.1.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test configuration | Cell 1 | | Cell 2 | |
|  | |  | T1 | T2 | T1 | T2 |
| AoA setup | |  | Config 1 | Setup 1 as specified in clause A.3.15 | | | |
| Beam AssumptionNote 7 | |  | Config 1 | Rough | | Rough | |
| TDD configuration | |  | Config 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| Duplex mode | |  | Config 1 | TDD | | TDD | |
| BWchannel | | MHz | Config 1 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| BWP BW | | MHz | Config 1 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| BWP configuration | Initial DL BWP |  | Config 1 | DLBWP.0.1 | | N/A | |
|  | Initial UL BWP |  |  | ULBWP.0.1 | | N/A | |
|  | Dedicated DL BWP |  |  | DLBWP.1.1 | | N/A | |
|  | Dedicated UL BWP |  |  | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | |  | Config 1 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | |  | Config 1 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | |  | Config 1 | CR.3.1 TDD | | - | |
| Dedicated CORESET RMC configuration | |  | Config 1 | CCR.3.1 TDD | | - | |
| TRS configuration | |  | Config 1 | TRS.2.1 TDD | | - | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1 | 120 | | 120 | |
| PRS configuration | |  | Config 1 | PRS.1.1 FR2 | | PRS.1.2 FR2 | |
| PRS muting configuration | |  | Config 1 | ‘10’ | | ‘01’ | |
| EPRE ratio of PSS to SSS | |  |  |  | |  | |
| EPRE ratio of PBCH DMRS to SSS | |  |  |  | |  | |
| EPRE ratio of PBCH to PBCH DMRS | |  |  |  | |  | |
| EPRE ratio of PDCCH DMRS to SSS | |  |  |  | |  | |
| EPRE ratio of PDCCH to PDCCH DMRS | |  | Config 1 | 0 | | 0 | |
| EPRE ratio of PDSCH DMRS to SSS | |  |  |  | |  | |
| EPRE ratio of PDSCH to PDSCH | |  |  |  | |  | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |  |  |  | |  | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |  |  |  | |  | |
| Note2 | | dBm/15kHz Note5 |  | -102 | | -102 | |
| Note2 | | dBm/SCS Note4 | Config 1 | -93 | | -93 | |
| SS-RSRP Note 3 | | dBm/SCS Note5 | Config 1 | -89.7 | -89.7 | -Infinity | -86.7 |
| PRS-RSRP Note 3 | | dBm/SCS Note5 | Config 1 | -Infinity | -96 | -Infinity | -103 |
| PRS | | dB | Config 1 | -Infinity | -3 | -Infinity | -10 |
| PRS | | dB | Config 1 | -Infinity | -3 | -Infinity | -10 |
| IoNote3 | | dBm/95.04 MHz Note5 | Config 1 | -58.56 | | -55.38 | |
| Propagation Condition | |  | Config 1 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone  Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | | |

##### A.7.6.10.1.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in Clause 9.9.3.5.The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in section 9.9.3.5 starting from the beginning of time interval T2.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in Clause 10.1.24.3, i.e., between PRS RSRP\_0 and PRS RSRP\_126.

#### A.7.6.10.2 PRS-RSRP reporting delay test case for dual positioning frequency layer

##### A.7.6.10.2.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in Clause 9.9.3.5 for dual positioning frequency layers under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.7.6.10.2.1-1

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the different frequency from the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.6.10.2.1-2, and table A.7.6.10.2.1-3.

Table A.7.6.10.2.1-1: supported test configurations for PRS RSRP measurement for FR2-FR2

|  |  |
| --- | --- |
| **Config** | **Description** |
| 1 | 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

Table A.7.6.10.2.1-2: General test parameters for PRS RSRP measurement reporting delay

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| Active cell |  | Config 1 | NR cell 1 (Pcell) | Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data. |
| Neighbour cell |  | Config 1 | NR cell 2 | Cell 2 is a neighbour cell in the positioning assistance data. |
| Gap Pattern Id |  | Config 1 | GP#13 or GP#24Note1 | As specified in clause 9.1.2-1. |
| Measurement gap offset |  | Config 1 | 39 |  |
| SMTC parameters |  | Config 1 | SMTC.1 | As specified in clause A.3.11 |
| SSB parameters |  | Config 1 | SSB.3 FR2 | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1 | -6 |  |
| Hysteresis | dB | Config 1 | 0 |  |
| CP length |  | Config 1 | Normal |  |
| TimeToTrigger | s | Config 1 | 0 |  |
| Filter coefficient |  | Config 1 | 0 | L3 filtering is not used |
| DRX |  | Config 1 | OFF | DRX is not used |
| Time offset between serving and neighbour cells |  | Config 1 | 3μs | Synchronous cells. |
| Expected RSTD | μs | Config 1 | 3 |  |
| Expected RSTD uncertainty | μs | Config 1 | 5 |  |
| T1 | s | Config 1 | 5 |  |
| T2 | s | Config 1 | 7 |  |
| Note 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured. | | | | |

Table A.7.6.10.2.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test configuration | Cell 1 | | Cell 2 | |
|  | |  | T1 | T2 | T1 | T2 |
| AoA setup | |  | Config 1 | Setup 1 as specified in clause A.3.15 | | | |
| Beam AssumptionNote 7 | |  | Config 1 | Rough | | Rough | |
| NR RF Channel Number | |  | Config 1 | 1 | | 2 | |
| TDD configuration | |  | Config 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| Duplex mode | |  | Config 1 | TDD | | TDD | |
| BWchannel | | MHz | Config 1 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| BWP BW | | MHz | Config 1 | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| BWP configuration | Initial DL BWP |  | Config 1 | DLBWP.0.1 | | N/A | |
|  | Initial UL BWP |  |  | ULBWP.0.1 | | N/A | |
|  | Dedicated DL BWP |  |  | DLBWP.1.1 | | N/A | |
|  | Dedicated UL BWP |  |  | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | |  | Config 1 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | |  | Config 1 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | |  | Config 1 | CR.3.1 TDD | | - | |
| Dedicated CORESET RMC configuration | |  | Config 1 | CCR.3.1 TDD | | - | |
| TRS configuration | |  | Config 1 | TRS.2.1 TDD | | - | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1 | 120 | | 120 | |
| PRS configuration | |  | Config 1 | PRS.1.1 FR2 | | PRS.1.2 FR2 | |
| PRS muting configuration | |  | Config 1 | ‘10’ | | ‘01’ | |
| EPRE ratio of PSS to SSS | |  |  |  | |  | |
| EPRE ratio of PBCH DMRS to SSS | |  |  |  | |  | |
| EPRE ratio of PBCH to PBCH DMRS | |  |  |  | |  | |
| EPRE ratio of PDCCH DMRS to SSS | |  |  |  | |  | |
| EPRE ratio of PDCCH to PDCCH DMRS | |  | Config 1 | 0 | | 0 | |
| EPRE ratio of PDSCH DMRS to SSS | |  |  |  | |  | |
| EPRE ratio of PDSCH to PDSCH | |  |  |  | |  | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |  |  |  | |  | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |  |  |  | |  | |
| Note2 | | dBm/15kHz Note5 |  | -104.7 | | -104.7 | |
| Note2 | | dBm/SCS Note4 | Config 1 | -95.7 | | -95.7 | |
| SS-RSRP Note 3 | | dBm/SCS Note5 | Config 1 | -92.7 | -92.7 | -Infinity | -85.7 |
| PRS-RSRP Note 3 | | dBm/SCS Note5 | Config 1 | -Infinity | -92.7 | -Infinity | -85.7 |
| PRS | | dB | Config 1 | -Infinity | -3 | -Infinity | -10 |
| PRS | | dB | Config 1 | -Infinity | -3 | -Infinity | -10 |
| IoNote3 | | dBm/95.04 MHz Note5 | Config 1 | -59.7 | -59.7 | -66.7 | -57.2 |
| Propagation Condition | |  | Config 1 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone  Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | | | |

##### A.7.6.10.2.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in Clause 9.9.3.5.The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in section 9.9.3.5 starting from the beginning of time interval T2.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in Clause 10.1.24.3, i.e., between PRS RSRP\_0 and PRS RSRP\_126.

# *<End of change12>*

# *<Start of change13>*

### A.6.6.12 RSTD measurements

#### A. 6.6.12.1 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA

##### A. 6.6.12.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in Clause 9.9.2 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in Table A.6.6.12.1.1-1.

Table A.6.6.12.1.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the *NR-DL-TDOA-ProvideAssistanceData* shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #0 before T2.

The general test parameters are listed in Table A.6.6.12.1.1-2, and cell specific test parameters are listed in Table A.6.6.12.1.1-3.

Table A.6.6.12.1.1-2: General test parameters for RSTD measurement reporting delay

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | Comment |
| Reference cell | |  | Cell 1 | Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355[34]. The reference cell is the PCell in this test case. |
| Neighbor cells | |  | Cell 2 and Cell 3 | Cell 2 and Cell 3 appear at random places in the neighbour cell list in the DL-TDOA assistance data, but Cell 2 always appears in the first half of the list, whilst Cell 3 appears in the second half of the list. |
| SSB configuration | Config 1 |  | SSB.1 FR1 |  |
| Config 2 |  | SSB.1 FR1 |
| Config 3 |  | SSB.2 FR1 |
| SMTC configuration | Config 1 |  | SMTC.2 |  |
| Config 2 |  | SMTC.1 |
| Config 3 |  | SMTC.1 |
| PDSCH RMC configuration | Config 1 |  | SR.1.1 FDD |  |
| Config 2 |  | SR.1.1 TDD |  |
| Config 3 |  | SR.2.1 TDD |  |
| RMSI CORESET RMC configuration | Config 1 |  | CR.1.1 FDD | As specified in clause A.3.1.2.1 |
| Config 2 |  | CR.1.1 TDD |  |
| Config 3 |  | CR.2.1 TDD |  |
| Dedicated CORESET RMC configuration | Config 1 |  | CR.1.1 FDD |  |
| Config 2 |  | CR.1.1 TDD |  |
| Config 3 |  | CR.2.1 TDD |  |
| Initial BWP configuration | Config 1,2,3 |  | DLBWP.0.1  ULBWP.0.1 |  |
| Active DL BWP configuration | Config 1,2,3 |  | DLBWP.1.1 |  |
| Active UL BWP configuration | Config 1,2,3 |  | ULBWP.1.1 |  |
| PRS Configuration | Config 1 |  | PRS.1.1 FR1 | As specified in clause A.3.31 |
| Config 2 |  | PRS.1.2 FR1 |
| Config 3 |  | PRS.2.1 FR1 |
| Physical cell ID PCI | |  | (PCI of Cell 1 – PCI of Cell 2)mod6=0  and  (PCI of Cell 1 – PCI of Cell 3)mod6=0 | The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters |
| CP length | |  | Normal |  |
| DRX | |  | OFF |  |
| Measurement gap | |  | GP#24 or GP#0 | GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured |
| Radio frame receive time offset between the cells at the UE antenna connector | | μs | Cell 2 to Cell 1: 0  Cell 3 to Cell 1: 3 | PRS are transmitted from synchronous cells |
| Expected RSTD | | μs | Cell 2: 3  Cell 3: 3  Other neighbour cells: randomly between -3 and 3 | The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355[34] is the expectedRSTD indicator |
| Expected RSTD uncertainty for all neighbour cells | | μs | 5 | The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355[34] is the expectedRSTD-Uncertainty index |
| Number of cells provided in DL-TDOA assistance data | |  | 16 | Including the reference cell |
| PRS muting info | |  | Cell 1: ‘10’  Cell 2: ‘01’  Cell 3: ‘10’ | Correponds to prs-MutingInfo defined in TS 37.355 [34]  Cell 1 and Cell 3 will be configured with different Comb patterns or resource offsets |
| T1 | | s | 3 | The length of the time interval from the beginning of each test |
| T2 | | s | [1.28] | The length of the time interval that follows immediately after time interval T1 |

Table A.6.6.12.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| NR RF Channel Number | |  | 1 | 1 | 1 |
| Positiong frequency layer | |  | 1 | 1 | 1 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 1x2 Low |
| OCNG patterns defined in A.3.2.1 | |  | OP.1 | N/A | N/A |
| Note 3 | Config 1 | dBm/SCS | -98 | | |
| Config 2 | dBm/SCS | -98 | | |
| Config 3 | dBm/SCS | -95 | | |
| PRS | | dB | -Infinity | -Infinity | -Infinity |
| SSB | | dB | 10 | -Infinity | -Infinity |
| Io Note 4 | Config 1 | dBm/  9.36MHz | -68.63 | -70.05 | -70.05 |
| Config 2 | dBm/  9.36MHz | -68.63 | -70.05 | -70.05 |
| Config 3 | dBm/  38.16MHz | -63.20 | -63.96 | -63.96 |
| SSB RP Note4 | Config 1 | dBm/SCS | -88 | -Infinity | -Infinity |
| Config 2 | dBm/SCS | -88 | -Infinity | -Infinity |
| Config 3 | dBm/SCS | -88 | -Infinity | -Infinity |
| Propagation Condition | |  | AWGN | | |
| Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. | | | | | |

Table A.6.6.12.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| T2 | T2 | T2 |
| NR RF Channel Number | |  | 1 | 1 | 1 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 1x2 Low |
| OCNG patterns defined in A.3.2.1 | |  | OP.1 | OP.1 | OP.1 |
| PRACH configuration | |  | FR1 PRACH configuration 1 | FR1 PRACH configuration 1 | FR1 PRACH configuration 1 |
| Note 3 | Config 1 | dBm/SCS | -98 | -98 | -98 |
| Config 2 | dBm/SCS | -98 | -98 | -98 |
| Config 3 | dBm/SCS | -95 | -95 | -95 |
| PRS | Config 1 | dB | -5.45 | -11.67 | -11.67 |
| Config 2 | dB | -5.45 | -11.67 | -11.67 |
| Config 3 | dB | -5.45 | -11.67 | -11.67 |
| Io Note 4 | Config 1 | dBm/  9.36MHz | -69.59 | -69.93 | -69.93 |
| Config 2 | dBm/  96.48MHz | -69.59 | -69.93 | -69.93 |
| Config 3 | dBm/  38.16MHz | -63.72 | -63.89 | -63.89 |
| PRS | | dB | -6 | -13 | -13 |
| Propagation Condition | |  | AWGN | | |
| Note 1: OCNG shall be used such that active cells (all, except Cell 3 in T3) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.  Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | | | |

##### A.6.6.12.1.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in Clause 9.9.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.1.5 starting from the beginning of time interval T2.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in Clause 10.1.23.3, i.e., between RSTD\_0000000 and RSTD1970049

#### A. 6.6.12.2 NR RSTD measurement reporting delay test case for dual positioning frequency layers in FR1 SA

##### A. 6.6.12.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in Clause 9.9.2 in an environment with AWGN propagation conditions in FR1 in standalone scenario when dual positioning frequency layers are configured.

The supported test configurations are specified in Table A.6.6.12.2.1-1.

Table A.6.6.12.2.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. Cell 3 is on a different RF channel with Cell 1 and Cell 2.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the *NR-DL-TDOA-ProvideAssistanceData* shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #0 before T2.

The general test parameters are listed in Table A.6.6.12.2.1-2, and cell specific test parameters are listed in Table A.6.6.12.2.1-3.

Table A.6.6.12.2.1-2: General test parameters for RSTD measurement reporting delay

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | Comment |
| Reference cell | |  | Cell 1 | Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355[34]. The reference cell is the PCell in this test case. |
| Neighbor cells | |  | Cell 2 and Cell 3 | Cell 2 and Cell 3 appear at random places in the neighbour cell list in the DL-TDOA assistance data, but Cell 2 always appears in the first half of the list, whilst Cell 3 appears in the second half of the list. |
| SSB configuration | Config 1 |  | SSB.1 FR1 |  |
| Config 2 |  | SSB.1 FR1 |
| Config 3 |  | SSB.2 FR1 |
| SMTC configuration | Config 1 |  | SMTC.2 |  |
| Config 2 |  | SMTC.1 |
| Config 3 |  | SMTC.1 |
| PDSCH RMC configuration | Config 1 |  | SR.1.1 FDD |  |
| Config 2 |  | SR.1.1 TDD |  |
| Config 3 |  | SR.2.1 TDD |  |
| RMSI CORESET RMC configuration | Config 1 |  | CR.1.1 FDD | As specified in clause A.3.1.2.1 |
| Config 2 |  | CR.1.1 TDD |  |
| Config 3 |  | CR.2.1 TDD |  |
| Dedicated CORESET RMC configuration | Config 1 |  | CR.1.1 FDD |  |
| Config 2 |  | CR.1.1 TDD |  |
| Config 3 |  | CR.2.1 TDD |  |
| Initial BWP configuration | Config 1,2,3 |  | DLBWP.0.1  ULBWP.0.1 |  |
| Active DL BWP configuration | Config 1,2,3 |  | DLBWP.1.1 |  |
| Active UL BWP configuration | Config 1,2,3 |  | ULBWP.1.1 |  |
| PRS Configuration | Config 1 |  | PRS.1.1 FR1 | As specified in clause A.3.31 |
| Config 2 |  | PRS.1.2 FR1 |
| Config 3 |  | PRS.2.1 FR1 |
| Physical cell ID PCI | |  | (PCI of Cell 1 – PCI of Cell 2)mod6=0  and  (PCI of Cell 1 – PCI of Cell 3)mod6=0 | The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters |
| CP length | |  | Normal |  |
| DRX | |  | OFF |  |
| Measurement gap | |  | GP#24 or GP#0 | GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured |
| Radio frame receive time offset between the cells at the UE antenna connector | | μs | Cell 2 to Cell 1: 0  Cell 3 to Cell 1: 3 | PRS are transmitted from synchronous cells |
| Expected RSTD | | μs | Cell 2: 3  Cell 3: 3  Other neighbour cells: randomly between -3 and 3 | The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355[34] is the expectedRSTD indicator |
| Expected RSTD uncertainty for all neighbour cells | | μs | 5 | The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355[34] is the expectedRSTD-Uncertainty index |
| Number of cells provided in DL-TDOA assistance data | |  | 16 | Including the reference cell |
| PRS muting info | |  | Cell 1: ‘10’  Cell 2: ‘01’  Cell 3: ‘10’ | Correponds to prs-MutingInfo defined in TS 37.355 [34]  Cell 1 and Cell 3 will be configured with different Comb patterns or resource offsets |
| T1 | | s | 3 | The length of the time interval from the beginning of each test |
| T2 | | s | [1.28] | The length of the time interval that follows immediately after time interval T1 |

Table A.6.6.12.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| NR RF Channel Number | |  | 1 | 1 | 2 |
| Positiong frequency layer | |  | 1 | 1 | 2 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 1x2 Low |
| OCNG patterns defined in A.3.2.1 | |  | OP.1 | N/A | N/A |
| Note 3 | Config 1 | dBm/SCS | -98 | | |
| Config 2 | dBm/SCS | -98 | | |
| Config 3 | dBm/SCS | -95 | | |
| PRS | | dB | -Infinity | -Infinity | -Infinity |
| Io Note 4 | Config 1 | dBm/  9.36MHz | -68.63 | -70.05 | -70.05 |
| Config 2 | dBm/  9.36MHz | -68.63 | -70.05 | -70.05 |
| Config 3 | dBm/  38.16MHz | -63.20 | -63.96 | -63.96 |
| SSB RP Note4 | Config 1 | dBm/SCS | -88 | -Infinity | -Infinity |
| Config 2 | dBm/SCS | -88 | -Infinity | -Infinity |
| Config 3 | dBm/SCS | -88 | -Infinity | -Infinity |
| Propagation Condition | |  | AWGN | | |
| Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. | | | | | |

Table A.6.6.12.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2 and T3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| T2 | T2 | T2 |
| NR RF Channel Number | |  | 1 | 1 | 2 |
| Positiong frequency layer | |  | 1 | 1 | 2 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 1x2 Low |
| OCNG patterns defined in A.3.2.1 | |  | OP.1 | OP.1 | OP.1 |
| PRACH configuration | |  | FR1 PRACH configuration 1 | FR1 PRACH configuration 1 | FR1 PRACH configuration 1 |
| Note 3 | Config 1 | dBm/SCS | -98 | -98 | -98 |
| Config 2 | dBm/SCS | -98 | -98 | -98 |
| Config 3 | dBm/SCS | -95 | -95 | -95 |
| PRS | Config 1 | dB | -5.45 | -11.67 | -11.67 |
| Config 2 | dB | -5.45 | -11.67 | -11.67 |
| Config 3 | dB | -5.45 | -11.67 | -11.67 |
| Io Note 4 | Config 1 | dBm/  9.36MHz | -69.59 | -69.93 | -69.93 |
| Config 2 | dBm/  96.48MHz | -69.59 | -69.93 | -69.93 |
| Config 3 | dBm/  38.16MHz | -63.72 | -63.89 | -63.89 |
| PRS | | dB | -6 | -13 | -13 |
| Propagation Condition | |  | AWGN | | |
| Note 1: OCNG shall be used such that active cells (all, except Cell 3 in T3) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.  Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | | | |

##### A.6.6.12.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in Clause 9.9.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.1.5 starting from the beginning of time interval T2.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in Clause 10.1.23.3, i.e., between RSTD\_0000000 and RSTD\_1970049.

# *<End of change13>*

# *<Start of change14>*

### A.7.6.9 RSTD measurements

#### A.7.6.9.1 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA

##### A.7.6.9.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in Clause 9.9.2 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

Supported test configurations are shown in table A.7.7.1.1-1. The test parameters are as given in Table 7.6.7.1.1-2, Table A.7.6.9.1.1-3 and , Table A.7.6.9.1.1-4.

Table A.7.6.9.1.1-1: Supported test configurations for NR RSTD

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the *NR-DL-TDOA-ProvideAssistanceData* shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

Table A.7.6.9.1.1-2: General test parameters for RSTD measurement reporting delay

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | Comment |
| Reference cell | |  | Cell 1 | Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355[34]. The reference cell is the PCell in this test case. |
| Neighbor cells | |  | Cell 2 and Cell 3 | Cell 2 and Cell 3 appear at random places in the neighbour cell list in the DL-TDOA assistance data, but Cell 2 always appears in the first half of the list, whilst Cell 3 appears in the second half of the list. |
| SSB configuration | Config 1 |  | SSB.2 FR2 |  |
| SMTC configuration | Config 1 |  | SMTC.1 |  |
| PDSCH RMC configuration | Config 1 |  | SR.1.1 FDD |  |
| RMSI CORESET RMC configuration | Config 1 |  | CR.3.1 TDD | As specified in clause A.3.1.2.1 |
| Dedicated CORESET RMC configuration | Config 1 |  | CR.1.1 FDD |  |
| PRS Configuration | Config 1 |  | PRS.1.1. FR2 | As specified in clause A.3.31 |
| Physical cell ID PCI | |  | (PCI of Cell 1 – PCI of Cell 2)mod6=0  and  (PCI of Cell 1 – PCI of Cell 3)mod6=0 | The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters |
| CP length | |  | Normal |  |
| DRX | |  | OFF |  |
| Measurement gap | |  | GP#24 or GP#13 | GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured |
| Radio frame receive time offset between the cells at the UE antenna connector | | μs | Cell 2 to Cell 1: 0  Cell 3 to Cell 1: 3 | PRS are transmitted from synchronous cells |
| Expected RSTD | | μs | Cell 2: 3  Cell 3: 3  Other neighbour cells: randomly between -3 and 3 | The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355[34] is the expectedRSTD indicator |
| Expected RSTD uncertainty for all neighbour cells | | μs | 5 | The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355[34] is the expectedRSTD-Uncertainty index |
| Number of cells provided in DL-TDOA assistance data | |  | 16 | Including the reference cell |
| PRS muting info | |  | Cell 1: ‘10’  Cell 2: ‘01’  Cell 3: ‘10’ | Correponds to prs-MutingInfo defined in TS 37.355 [24]  Cell 1 and Cell 3 will be configured with different Comb patterns or resource offsets |
| T1 | | s | 3 | The length of the time interval from the beginning of each test |
| T2 | | s | [1.28] | The length of the time interval that follows immediately after time interval T1 |

Table A.7.6.9.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| NR RF Channel Number | |  | 1 | 1 | 1 |
| Positiong frequency layer | |  | 1 | 1 | 1 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 1x2 Low |
| OCNG patterns defined in A.3.2.1 | |  | OP.5 FDD | N/A | N/A |
| Note 3 | Config 1 | dBm/SCS | -89 | | |
| PRS | | dB | -Infinity | -Infinity | -Infinity |
| Io Note 4 | Config 1 | dBm/  95.04MHz | -58.86 | -60.01 | -60.01 |
| SSB RP Note4 | Config 1 | dBm/SCS | -89 | -Infinity | -Infinity |
|  |  | dB | 0 | -Infinity | -Infinity |
| Propagation Condition | |  | AWGN | | |
| Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. | | | | | |

Table A.7.6.9.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| T2 | T2 | T2 |
| RF Channel Number | |  | 1 | 1 | 1 |
| Positiong frequency layer | |  | 1 | 1 | 1 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 1x2 Low |
| OCNG patterns defined in A.3.2.1 | |  | OP.1 | OP.1 | OP.1 |
| PRACH configuration | |  | FR1 PRACH configuration 1 | FR1 PRACH configuration 1 | FR1 PRACH configuration 1 |
| Note 3 | Config 1 | dBm/SCS | -89 | -89 | -89 |
| PRS | Config 1 | dB | -5.44 | -11.67 | -11.67 |
| Io | Config 1 | dBm/  9.36MHz | -59.65 | -59.92 | -59.92 |
| PRS | | dB | -6 | -13 | -13 |
| Propagation Condition | |  | AWGN | | |
| Note 1: OCNG shall be used such that active cells (all, except Cell 3 in T3) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.  Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | | | |

Table A.7.6.9.1.-5: NR OTA Cell specific test parameters for SA RSTD reporting for PCell and neighbour cell UE in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Cell 1 | | Cell2 and cell3 | |
|  |  |  | T1 | T2 | T1 | T2 |
| AoA setup |  | 1 | Setup 1 defined in A.3.15.1 | | | |
| Beam assumption Note 4 |  | 1 | Rough | | | |
| Note 2 | dBm/SCS | 1 |  | -89 |  | -89 |
|  | dB | 1 | - | 4 | -infinity | 4 |
|  | dB | 1 | - | 4 | -infinity | 4 |
| Io | dBm/95.04 MHz | 1 | -70.05 | -59.92 | -70.05 | -59.92 |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | | | | |

##### A.7.6.9.1.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in Clause 9.9.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.1.5 starting from the beginning of time interval T2.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in Clause 10.1.23.3, i.e., between RSTD\_0000000 and RSTD\_1970049.

#### A.7.6.9.2 NR RSTD measurement reporting delay test case for dual positioning frequency layers in FR2 SA

##### A.7.6.9.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in Clause 9.9.2 in an environment with AWGN propagation conditions in FR2 in standalone scenario when dual positioning frequency layer is configured.

Supported test configurations are shown in table A.7.6.9.2.1-1. The test parameters are as given in Table 7.6.7.2.1-2, Table A.7.6.9.2.1-3 and , Table A.7.6.9.2.1-4.

Table A.7.6.9.2.1-1: Supported test configurations for NR RSTD

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the 2 RF channels distributed in dual positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the *NR-DL-TDOA-ProvideAssistanceData* shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

Table A.7.6.9.2.1-2: General test parameters for RSTD measurement reporting delay

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | Comment |
| Reference cell | |  | Cell 1 | Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 36.214 [4] and TS 37.355[34]. The reference cell is the PCell in this test case. |
| Neighbor cells | |  | Cell 2 and Cell 3 | Cell 2 and Cell 3 appear at random places in the neighbour cell list in the DL-TDOA assistance data, but Cell 2 always appears in the first half of the list, whilst Cell 3 appears in the second half of the list. |
| SSB configuration | Config 1 |  | SSB.2 FR2 |  |
| SMTC configuration | Config 1 |  | SMTC.1 |  |
| PDSCH RMC configuration | Config 1 |  | SR.1.1 FDD |  |
| RMSI CORESET RMC configuration | Config 1 |  | CR.3.1 TDD | As specified in clause A.3.1.2.1 |
| Dedicated CORESET RMC configuration | Config 1 |  | CR.1.1 FDD |  |
| PRS Configuration | Config 1 |  | PRS.1.1. FR2 | As specified in clause A.3.31 |
| Physical cell ID PCI | |  | (PCI of Cell 1 – PCI of Cell 2)mod6=0  and  (PCI of Cell 1 – PCI of Cell 3)mod6=0 | The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters |
| CP length | |  | Normal |  |
| DRX | |  | OFF |  |
| Measurement gap | |  | GP#24 or GP#13 | GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured |
| Radio frame receive time offset between the cells at the UE antenna connector | | μs | Cell 2 to Cell 1: 0  Cell 3 to Cell 1: 3 | PRS are transmitted from synchronous cells |
| Expected RSTD | | μs | Cell 2: 3  Cell 3: 3  Other neighbour cells: randomly between -3 and 3 | The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355[34] is the expectedRSTD indicator |
| Expected RSTD uncertainty for all neighbour cells | | μs | 5 | The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355[34] is the expectedRSTD-Uncertainty index |
| Number of cells provided in DL-TDOA assistance data | |  | 16 | Including the reference cell |
| PRS muting info | |  | Cell 1: ‘10’  Cell 2: ‘01’  Cell 3: ‘10’ | Correponds to prs-MutingInfo defined in TS 37.355 [24]  Cell 1 and Cell 3 will be configured with different Comb patterns or resource offsets |
| T1 | | s | 3 | The length of the time interval from the beginning of each test |
| T2 | | s | 1.28 | The length of the time interval that follows immediately after time interval T1 |

Table A.7.6.9.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| NR RF Channel Number | |  | 1 | 1 | 2 |
| Positiong frequency layer | |  | 1 | 1 | 2 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 1x2 Low |
| OCNG patterns defined in A.3.2.1 | |  | OP.1 | N/A | N/A |
| EPRE ratio of PBCH DMRS to SSS | |  |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS | |
| EPRE ratio of PDCCH DMRS to SSS | |
| EPRE ratio of PDCCH to PDCCH DMRS | |
| EPRE ratio of PDSCH DMRS to SSS | |
| EPRE ratio of PDSCH to PDSCH | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | |
| Note 3 | Config 1 | dBm/SCS | -89 | | |
| PRS | | dB | -Infinity | -Infinity | -Infinity |
| Io Note 4 | Config 1 | dBm/95.04MHz | -58.86 | -60.01 | -60.01 |
| SSB RP Note4 | Config 1 | dBm/SCS | -89 | -Infinity | -Infinity |
|  |  | dB | 0 | -Infinity | -Infinity |
| Propagation Condition | |  | AWGN | | |
| Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. | | | | | |

Table A.7.6.9.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2 and T3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| T2 | T2 | T2 |
| RF Channel Number | |  | 1 | 1 | 2 |
| Positiong frequency layer | |  | 1 | 1 | 2 |
| Correlation Matrix and Antenna Configuration | |  | 1x2 Low | 1x2 Low | 1x2 Low |
| OCNG patterns defined in A.3.2.1 | |  | OP.1 | OP.1 | OP.1 |
| PRACH configuration | |  | FR1 PRACH configuration 1 | FR1 PRACH configuration 1 | FR1 PRACH configuration 1 |
| Note 3 | Config 1 | dBm/SCS | -89 | -89 | -89 |
| PRS | Config 1 | dB | -5.44 | -11.67 | -11.67 |
| Io | Config 1 | dBm/  9.36MHz | -59.65 | -59.92 | -59.92 |
| PRS | | dB | -6 | -13 | -13 |
| Propagation Condition | |  | AWGN | | |
| Note 1: OCNG shall be used such that active cells (all, except Cell 3 in T3) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.  Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | | | |

Table A.7.6.9.2.1-5: NR OTA Cell specific test parameters for SA RSTD reporting for PCell and neighbour cell UE in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Cell 1 | | Cell2 and cell3 | |
|  |  |  | T1 | T2 | T1 | T2 |
| AoA setup |  | 1 | Setup 1 defined in A.3.15.1 | | | |
| Beam assumption Note 4 |  | 1 | Rough | | | |
| Note 2 | dBm/SCS | 1 |  | -89 |  | -89 |
|  | dB | 1 | - | 4 | -infinity | 4 |
|  | dB | 1 | - | 4 | -infinity | 4 |
| Io | dBm/95.04 MHz | 1 | -70.05 | -59.92 | -70.05 | -59.92 |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled. | | | | | | |

##### A.7.6.9.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in Clause 9.9.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.1.5 starting from the beginning of time interval T2.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in Clause 10.1.23.3, i.e., between RSTD\_0000000 and RSTD\_1970049.

# *<End of change14>*

# *<Start of change15>*

## A.3.31 PRS Configurations

### A.3.31.1. PRS Configurations for FR1

#### A.3.31.1.1. PRS pattern 1 in FR1: SCS=15 KHz

Table A.3.31.1.1 -1: PRS.1 FR1: PRS Pattern 1 for SSB SCS=15 KHz



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **PRS Parameters** | **Values** | | | | | |
| Reference channel | PRS.1.1 FR1 | PRS.1.2 FR1 | PRS.1.3 FR1 | | PRS.1.4 FR1 | |
| Resource index in resource set | 0 | 0 | 0 | 1 | 0 | 1 |
| PRS periodicity | 160ms | | | | | |
| PRS Resource set slot offset Note 1 | 10 ms | | | | | |
| PRS Resource slot offset (slot) Note 1 | 0 | 4 | 0 | | 4 | |
| PRS RE offset Note 1 | 0 | | 0 | 1 | 0 | 1 |
| SCS | 15kHz | | | | | |
| PRS comb size | 2 | 4 | 2 | | 4 | |
| Number of PRS symbol | 4 | 4 | 4 | | 4 | |
| Repetion factor | 2 | 1 | 2 | | 1 | |
| PRS resource time gap (slot) | 1 | 1 | 1 | | 1 | |
| RB numbers containing PRS within channel BW | 0-23 | 0-103 | 0-23 | | 0-103 | |
| PRS Start PRB | 0 | | | | | |
| Note 1: Unless otherwise specified in the test case | | | | | | |

#### A.3.31.1.2. PRS pattern 2 in FR1: SCS=30 KHz

Table A.3.31.1.2 -1: PRS.2 FR1: PRS Pattern 2 for SCS=30 KHz



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **PRS Parameters** | **Values** | | | | | |
| Reference channel | PRS.2.1 FR1 | PRS.2.2 FR1 | PRS.2.3 FR1 | | PRS.2.4 FR1 | |
| Resource index in resource set | 0 | 0 | 0 | 1 | 0 | 1 |
| PRS periodicity | 160ms | | | | | |
| PRS Resource set slot offset Note 1 | 10 ms | | | | | |
| PRS Resource slot offset (slot) Note 1 | 0 | 4 | 0 | | 4 | |
| PRS RE offset Note 1 | 0 | | 0 | 1 | 0 | 1 |
| SCS | 30kHz | | | | | |
| PRS comb size | 2 | 4 | 2 | | 4 | |
| Number of PRS symbol | 4 | 4 | 4 | | 4 | |
| Repetion factor | 2 | 1 | 2 | | 1 | |
| PRS resource time gap (slot) | 1 | 1 | 1 | | 1 | |
| RB numbers containing PRS within channel BW | 0-23 | 0-131 | 0-23 | | 0-131 | |
| PRS Start PRB | 0 | | | | | |
| Note 1: Unless otherwise specified in the test case | | | | | | |

### A.3.31.2. PRS Configurations for FR2

#### A.3.31.2.1. PRS pattern 1 in FR2: SCS=120 KHz

Table A.3.31.2.1 -1: PRS.1 FR2: PRS Pattern 1 for SCS=120 KHz



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **PRS Parameters** | **Values** | | | | | |
| Reference channel | PRS.1.1 FR2 | PRS.1.2 FR2 | PRS.1.3 FR2 | | PRS.1.4 FR2 | |
| Resource index in resource set | 0 | 0 | 0 | 1 | 0 | 1 |
| PRS periodicity | 160ms | | | | | |
| PRS Resource set slot offset Note 1 | 10 ms | | | | | |
| PRS Resource slot offset (slot) Note 1 | 0 | 4 | 0 | | 4 | |
| PRS RE offset Note 1 | 0 | | 0 | 1 | 0 | 1 |
| SCS | 120kHz | | | | | |
| PRS comb size | 2 | 4 | 2 | | 4 | |
| Number of PRS symbol | 4 | 4 | 4 | | 4 | |
| Repetion factor | 2 | 1 | 2 | | 1 | |
| PRS resource time gap (slot) | 1 | 1 | 1 | | 1 | |
| RB numbers containing PRS within channel BW | 0-23 | 0-127 | 0-23 | | 0-127 | |
| PRS Start PRB | 0 | | | | | |
| Note 1: Unless otherwise specified in the test case | | | | | | |

# *<End of change15>*

# *<Start of change16>*

### A.6.6.13 PRS-RSRP measurements

#### A.6.6.13.1 PRS-RSRP reporting delay test case for single positioning frequency layer

##### A.6.6.13.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement meets the delay requirements specified in clause 9.9.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in Table A.6.6.13.1.1-1.

Table A.6.6.13.1.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in Table A.6.6.13.1.1-2, and cell specific test parameters are listed in Table A.6.6.13.1.1-3.

Table A.6.6.13.1.1-2: General test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| Reference cell |  | 1, 2, 3 | Cell 1 | Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data. |
| Neighbour cell |  | 1, 2, 3 | Cell 2 | Cell 2 is a neighbour cell in the positioning assistance data. |
| RF Channel Number |  | 1, 2, 3 | 1: Cell 1 and Cell 2 |  |
| BWchannel | MHz | 1 | 10: NRB,c = 52 |  |
| 2 | 10: NRB,c = 52 |  |
| 3 | 40: NRB,c = 106 |  |
| SSB configuration |  | 1 | SSB.1 FR1 |  |
|  |  | 2 | SSB.1 FR1 |  |
|  |  | 3 | SSB.2 FR1 |  |
| SMTC configuration |  | 1 | SMTC.2 |  |
|  |  | 2 | SMTC.1 |  |
|  |  | 3 | SMTC.1 |  |
| Measurement gap |  | 1, 2, 3 | GP#24 or GP#0 Note 1 |  |
| CP length |  | 1, 2, 3 | Normal |  |
| DRX |  | 1, 2, 3 | NA | OFF |
| Time offset between serving and neighbour cells | μs | 1, 2, 3 | 3 | Synchronous cells |
| Expected RSTD | μs | 1, 2, 3 | 3 |  |
| Expected RSTD uncertainty | μs | 1, 2, 3 | 5 |  |
| T1 | s | 1, 2, 3 | 2 |  |
| T2 | s | 1, 2, 3 | [5] |  |
| NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. | | | | |

Table A.6.6.13.1.1-3: Cell specific test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Cell 1 | | Cell 2 | |
| T1 | T2 | T1 | T2 |
| TDD configuration |  | 1 | N/A | | N/A | |
|  |  | 2 | TDDConf.1.1 | | TDDConf.1.1 | |
|  |  | 3 | TDDConf.2.1 | | TDDConf.2.1 | |
| PDSCH RMC configuration |  | 1 | SR.1.1 FDD | | N/A | |
|  | 2 | SR.1.1 TDD | |  | |
|  | 3 | SR.2.1 TDD | |  | |
| RMSI CORESET RMC configuration |  | 1 | CR.1.1 FDD | | N/A | |
|  | 2 | CR.1.1 TDD | |
|  | 3 | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration |  | 1 | CCR.1.1 FDD | | N/A | |
|  | 2 | CCR.1.1 TDD | |
|  | 3 | CCR.2.1 TDD | |
| OCNG Patterns |  | 1, 2, 3 | OP.1 | | OP.1 | |
| TRS Configuration |  | 1 | TRS.1.1 FDD | | N/A | |
|  | 2 | TRS.1.1 TDD | |
|  | 3 | TRS.1.2 TDD | |
| Initial BWP configuration |  | 1, 2, 3 | DLBWP.0.1 ULBWP.0.1 | | N/A | |
| Active DL BWP configuration |  | 1, 2, 3 | DLBWP.1.1 | | N/A | |
| Active UL BWP configuration |  | 1, 2, 3 | ULBWP.1.1 | | N/A | |
| PRS configuration |  | 1 | PRS.1.4 FR1 | | PRS.1.4 FR1 | |
|  | 2 | PRS.1.4 FR1 | | PRS.1.4 FR1 | |
|  | 3 | PRS.2.4 FR1 | | PRS.2.4 FR1 | |
| PRS muting info |  | 1, 2, 3 | ‘10’ | | ‘01’ | |
| Note 2 | dBm/SCS | 1 | -98 | | | |
|  | 2 | -98 | | | |
|  | 3 | -95 | | | |
| Note 2 | dBm/15 kHz | 1 | -98 | | | |
|  | 2 |  | | | |
|  | 3 |  | | | |
| PRS | dB | 1 | -Infinity | -3 | -Infinity | -10 |
|  | 2 |  |  |  |  |
|  | 3 |  |  |  |  |
| PRS | dB | 1 | -Infinity | -3 | -Infinity | -10 |
|  | 2 |  |  |  |  |
|  | 3 |  |  |  |  |
| PRS-RSRP Note 3 | dBm/SCS kHz | 1 | -Infinity | -101 | -Infinity | -108 |
|  |  | 2 | -Infinity | -101 | -Infinity | -108 |
|  |  | 3 | -Infinity | -98 | -Infinity | -105 |
| SS-RSRP Note 3 | dBm/SCS kHz | 1 | -88 | -88 | -88 | -88 |
| 2 | -88 | -88 | -88 | -88 |
| 3 | -85 | -85 | -85 | -85 |
| Io | dBm/9.36 MHz | 1 | N/A | -62.25 | N/A | -62.25 |
|  | dBm/9.36 MHz | 2 | -62.25 | -62.25 |
|  | dBm/38.16 MHz | 3 | -56.16 | -56.16 |
| Propagation Condition |  | 1, 2, 3 | AWGN | | | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

##### A.6.6.13.1.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.3.5, starting from the beginning of time interval T2.

The rate of correct events observed during repeated tests shall be at least 90%.

#### A.6.6.13.2 PRS-RSRP reporting delay test case for dual positioning frequency layer

##### A.6.6.13.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement meets the delay requirements specified in clause 9.9.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in Table A.6.6.13.2.1-1.

Table A.6.6.13.2.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell on NR RF channel #1 in FR1. Cell 2 is a neighbour cell on a different NR RF channel #2 in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in Table A.6.6.13.2.1-2, and cell specific test parameters are listed in Table A.6.6.13.2.1-3.

Table A.6.6.13.2.1-2: General test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Value | Comment |
| Reference cell |  | 1, 2, 3 | Cell 1 | Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data. |
| Neighbour cell |  | 1, 2, 3 | Cell 2 | Cell 2 is a neighbour cell in the positioning assistance data. |
| RF Channel Number |  | 1, 2, 3 | 1: Cell 1  2: Cell 2 | Cell 1 and Cell 2 are on differnet positioning frequency layers |
| BWchannel | MHz | 1 | 10: NRB,c = 52 |  |
| 2 | 10: NRB,c = 52 |  |
| 3 | 40: NRB,c = 106 |  |
| SSB configuration |  | 1 | SSB.1 FR1 |  |
|  |  | 2 | SSB.1 FR1 |  |
|  |  | 3 | SSB.2 FR1 |  |
| SMTC configuration |  | 1 | SMTC.2 |  |
|  |  | 2 | SMTC.1 |  |
|  |  | 3 | SMTC.1 |  |
| Measurement gap |  | 1, 2, 3 | GP#24 or GP#0 Note 1 |  |
| CP length |  | 1, 2, 3 | Normal |  |
| DRX |  | 1, 2, 3 | NA | OFF |
| Time offset between serving and neighbour cells | μs | 1, 2, 3 | 3 | Synchronous cells |
| Expected RSTD | μs | 1, 2, 3 | 3 |  |
| Expected RSTD uncertainty | μs | 1, 2, 3 | 5 |  |
| T1 | s | 1, 2, 3 | 2 |  |
| T2 | s | 1, 2, 3 | [10] |  |
| NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. | | | | |

**Table A.6.6.13.2.1-3: Cell specific test parameters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test configuration | Cell 1 | | Cell 2 | |
|  |  | T1 | T2 | T1 | T2 |
| TDD configuration |  | 1 | N/A | | N/A | |
|  |  | 2 | TDDConf.1.1 | | TDDConf.1.1 | |
|  |  | 3 | TDDConf.2.1 | | TDDConf.2.1 | |
| PDSCH RMC configuration |  | 1 | SR.1.1 FDD | | N/A | |
|  | 2 | SR.1.1 TDD | |  | |
|  | 3 | SR.2.1 TDD | |  | |
| RMSI CORESET RMC configuration |  | 1 | CR.1.1 FDD | | N/A | |
|  | 2 | CR.1.1 TDD | |
|  | 3 | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration |  | 1 | CCR.1.1 FDD | | N/A | |
|  | 2 | CCR.1.1 TDD | |
|  | 3 | CCR.2.1 TDD | |
| OCNG Patterns |  | 1, 2, 3 | OP.1 | | OP.1 | |
| TRS Configuration |  | 1 | TRS.1.1 FDD | | N/A | |
|  | 2 | TRS.1.1 TDD | |
|  | 3 | TRS.1.2 TDD | |
| Initial BWP configuration |  | 1, 2, 3 | DLBWP.0.1 ULBWP.0.1 | | N/A | |
| Active DL BWP configuration |  | 1, 2, 3 | DLBWP.1.1 | | N/A | |
| Active UL BWP configuration |  | 1, 2, 3 | ULBWP.1.1 | | N/A | |
| PRS configuration |  | 1 | PRS.1.4 FR1 | | PRS.1.4 FR1 | |
|  | 2 | PRS.1.4 FR1 | | PRS.1.4 FR1 | |
|  | 3 | PRS.2.4 FR1 | | PRS.2.4 FR1 | |
| PRS muting info |  | 1, 2, 3 | ‘10’ | | ‘01’ | |
| Note 2 | dBm/SCS | 1 | -98 | | | |
|  | 2 | -98 | | | |
|  | 3 | -95 | | | |
| Note 2 | dBm/15 kHz | 1 | -98 | | | |
|  | 2 |  | | | |
|  | 3 |  | | | |
| PRS | dB | 1 | -Infinity | -3 | -Infinity | -10 |
|  | 2 |  |  |  |  |
|  | 3 |  |  |  |  |
| PRS | dB | 1 | -Infinity | -3 | -Infinity | -10 |
|  | 2 |  |  |  |  |
|  | 3 |  |  |  |  |
| PRS-RSRP Note 3 | dBm/SCS kHz | 1 | -Infinity | -101 | -Infinity | -108 |
|  |  | 2 | -Infinity | -101 | -Infinity | -108 |
|  |  | 3 | -Infinity | -98 | -Infinity | -105 |
| SS-RSRP Note 3 | dBm/SCS kHz | 1 | -88 | -88 | -88 | -88 |
| 2 | -88 | -88 | -88 | -88 |
| 3 | -85 | -85 | -85 | -85 |
| Io | dBm/9.36 MHz | 1 | N/A | -62.25 | N/A | -62.25 |
|  | dBm/9.36 MHz | 2 | -62.25 | -62.25 |
|  | dBm/38.16 MHz | 3 | -56.16 | -56.16 |
| Propagation Condition |  | 1, 2, 3 | AWGN | | | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

##### A.6.6.13.2.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.3.5, starting from the beginning of time interval T2.

The rate of correct events observed during repeated tests shall be at least 90%.

# *<End of change16>*

# *<Start of change17>*

### A.6.7.13 RSTD measurements

#### A.6.7.13.1 RSTD measurement accuracy test case for single positioning frequency layer

##### A.6.7.13.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in Table A.6.7.13.1.1-1.

Table A.6.7.13.1.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cells. Both cells are on the same NR RF channel in FR1. GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

Table A.6.7.13.1.1-2: RSTD accuracy test parameters

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | | | | Test 2 | | |
| Cell 1 | | | Cell 2 | Cell 1 | | Cell 2 |
| PRS ARFCN | 1~3 |  | freq1 | | | Freq1 | freq1 | | Freq1 |
| BWchannel | 1 | MHz | 10: NRB,c = 52 | | | | 10: NRB,c = 52 | | |
| 2 | 10: NRB,c = 52 | | | | 10: NRB,c = 52 | | |
| 3 | 40: NRB,c = 106 | | | | 40: NRB,c = 106 | | |
| Duplex mode | 1 |  | FDD | | | | FDD | | |
| 2 | TDD | | | | TDD | | |
| 3 | TDD | | | | TDD | | |
| TDD configuration | 1 |  | N/A | | | | N/A | | |
| 2 | TDDConf.1.1 | | | | TDDConf.1.1 | | |
| 3 | TDDConf.2.1 | | | | TDDConf.2.1 | | |
| PDSCH Reference measurement channel | 1 |  | SR.1.1 FDD | | | - | SR.1.1 FDD | | - |
| 2 | SR.1.1 TDD | | |  | SR.1.1 TDD | |  |
| 3 | SR.2.1 FDD | | |  | SR.2.1 FDD | |  |
| RMSI CORESET Reference Channel | 1 |  | CR.1.1 FDD | | | - | CR.1.1 FDD | | - |
| 2 | CR.1.1 TDD | | | - | CR.1.1 TDD | | - |
| 3 | CR.2.1 FDD | | | - | CR.2.1 FDD | | - |
| Dedicated CORESET Reference Channel | 1 |  | CCR.1.1 FDD | | | - | CCR.1.1 FDD | | - |
| 2 | CCR.1.1 TDD | | | - | CCR.1.1 TDD | | - |
| 3 | CCR.2.1 TDD | | | - | CCR.2.1 TDD | | - |
| SSB configuration | 1 |  | SSB.1 FR1 | | | | SSB.1 FR1 | | |
| 2 | SSB.1 FR1 | | | | SSB.1 FR1 | | |
| 3 | SSB.2 FR1 | | | | SSB.2 FR1 | | |
| OCNG Patterns | 1~3 |  | OP.1 | | | | OP.1 | | |
| TRS configuration | 1 |  | TRS.1.1 FDD | | - | | TRS.1.1 FDD | |  |
| 2 | TRS.1.1 TDD | |  | | TRS.1.1 TDD | |  |
| 3 | TRS.1.2 TDD | |  | | TRS.1.2 TDD | |  |
| Initial BWP Configuration | 1~3 |  | DLBWP.0.1  ULBWP.0.1 | | | | DLBWP.0.1  ULBWP.0.1 | | |
| Dedicated BWP configuration | 1~3 |  | DLBWP.1.1  ULBWP.1.1 | | | | DLBWP.1.1  ULBWP.1.1 | | |
| Time offset with Cell 1 | 1 | μs | - | 3 | | | - | 3 | |
| 2,3 | - | 3 | | | - | 3 | |
| SMTC configuration | 1 |  | SMTC.2 | | | | SMTC.2 | | |
| 2,3 | SMTC.1 | | | | SMTC.1 | | |
| PRS configuration | 1 |  | PRS.1.1 FR1 | | | | PRS.1.2 FR1 | | |
| 2 | PRS.1.1 FR1 | | | | PRS.1.2 FR1 | | |
| 3 | PRS.2.1 FR1 | | | | PRS.2.2 FR1 | | |
| PRS muting info | 1~3 |  | ‘10’ | ‘01’ | | | ‘10’ | ‘01’ | |
| Expected RSTD | 1, 2, 3 | μs | N/A | 3 | | | N/A | 3 | |
| Expected RSTD uncertainty | 1, 2, 3 | μs | N/A | 5 | | | N/A | 5 | |
| EPRE ratio of PSS to SSS | 1~3 | dB | 0 | | | 0 | 0 | | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Note2 | 1,2 | dBm/ SCS | -98 | | | | -98 | | |
| 3 | -95 | | | | -95 | | |
|  | 1~3 | dB | -6 | | | -13 | -6 | | -13 |
| PRS-RSRPNote3 | 1,2 | dBm/SCS | -104 | | | -111 | -104 | | -111 |
| 3 | -101 | | | -108 | -101 | | -108 |
| IoNote3 | 1,2 | dBm/  9.36MHz | -69.07 | | | -69.83 | -69.07 | | -69.83 |
| 3 | dBm/  38.16MHz | -62.98 | | | -63.74 | -62.98 | | -63.74 |
|  | 1~3 | dB | -6 | | | -13 | -6 | | -13 |
| Propagation condition | 1~3 | - | AWGN | | | | AWGN | | |
| Antenna configuration | 1~3 |  | 1x2 | | | | 1x2 | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification. | | | | | | | | | |

##### A.6.7.13.1.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

#### A.6.7.13.2 RSTD measurement accuracy test case for dual positioning frequency layer

##### A.6.7.13.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in Table A.6.7.13.2.1-1.

Table A.6.7.13.2.1-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell on NR RF channel #1 in FR1. Cell 2 is a neighbour cell on a different NR RF channel #2 in FR1. GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

Table A.6.7.13.2.1-2: RSTD accuracy test parameters

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Config | Unit | Test 1 | | | | Test 2 | | |
| Cell 1 | | | Cell 2 | Cell 1 | | Cell 2 |
| PRS ARFCN | 1~3 |  | freq1 | | | freq2 | freq1 | | freq2 |
| BWchannel | 1 | MHz | 10: NRB,c = 52 | | | | 10: NRB,c = 52 | | |
| 2 | 10: NRB,c = 52 | | | | 10: NRB,c = 52 | | |
| 3 | 40: NRB,c = 106 | | | | 40: NRB,c = 106 | | |
| Duplex mode | 1 |  | FDD | | | | FDD | | |
| 2 | TDD | | | | TDD | | |
| 3 | TDD | | | | TDD | | |
| TDD configuration | 1 |  | N/A | | | | N/A | | |
| 2 | TDDConf.1.1 | | | | TDDConf.1.1 | | |
| 3 | TDDConf.2.1 | | | | TDDConf.2.1 | | |
| PDSCH Reference measurement channel | 1 |  | SR.1.1 FDD | | | - | SR.1.1 FDD | | - |
| 2 | SR.1.1 TDD | | |  | SR.1.1 TDD | |  |
| 3 | SR.2.1 FDD | | |  | SR.2.1 FDD | |  |
| RMSI CORESET Reference Channel | 1 |  | CR.1.1 FDD | | | - | CR.1.1 FDD | | - |
| 2 | CR.1.1 TDD | | | - | CR.1.1 TDD | | - |
| 3 | CR.2.1 FDD | | | - | CR.2.1 FDD | | - |
| Dedicated CORESET Reference Channel | 1 |  | CCR.1.1 FDD | | | - | CCR.1.1 FDD | | - |
| 2 | CCR.1.1 TDD | | | - | CCR.1.1 TDD | | - |
| 3 | CCR.2.1 TDD | | | - | CCR.2.1 TDD | | - |
| SSB configuration | 1 |  | SSB.1 FR1 | | | | SSB.1 FR1 | | |
| 2 | SSB.1 FR1 | | | | SSB.1 FR1 | | |
| 3 | SSB.2 FR1 | | | | SSB.2 FR1 | | |
| OCNG Patterns | 1~3 |  | OP.1 | | | | OP.1 | | |
| TRS configuration | 1 |  | TRS.1.1 FDD | | - | | TRS.1.1 FDD | |  |
| 2 | TRS.1.1 TDD | |  | | TRS.1.1 TDD | |  |
| 3 | TRS.1.2 TDD | |  | | TRS.1.2 TDD | |  |
| Initial BWP Configuration | 1~3 |  | DLBWP.0.1  ULBWP.0.1 | | | | DLBWP.0.1  ULBWP.0.1 | | |
| Dedicated BWP configuration | 1~3 |  | DLBWP.1.1  ULBWP.1.1 | | | | DLBWP.1.1  ULBWP.1.1 | | |
| Time offset with Cell 1 | 1 | μs | - | 3 | | | - | 3 | |
| 2,3 | - | 3 | | | - | 3 | |
| SMTC configuration | 1 |  | SMTC.2 | | | | SMTC.2 | | |
| 2,3 | SMTC.1 | | | | SMTC.1 | | |
| PRS configuration | 1 |  | PRS.1.1 FR1 | | | | PRS.1.2 FR1 | | |
| 2 | PRS.1.1 FR1 | | | | PRS.1.2 FR1 | | |
| 3 | PRS.2.1 FR1 | | | | PRS.2.2 FR1 | | |
| Expected RSTD | 1, 2, 3 | μs | N/A | 3 | | | N/A | 3 | |
| Expected RSTD uncertainty | 1, 2, 3 | μs | N/A | 5 | | | N/A | 5 | |
| EPRE ratio of PSS to SSS | 1~3 | dB | 0 | | | 0 | 0 | | 0 |
| EPRE ratio of PBCH DMRS to SSS |
| EPRE ratio of PBCH to PBCH DMRS |
| EPRE ratio of PDCCH DMRS to SSS |
| EPRE ratio of PDCCH to PDCCH DMRS |
| EPRE ratio of PDSCH DMRS to SSS |
| EPRE ratio of PDSCH to PDSCH DMRS |
| EPRE ratio of OCNG DMRS to SSSNote 1 |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |
| Note2 | 1,2 | dBm/ SCS | -98 | | | | -98 | | |
| 3 | -95 | | | | -95 | | |
|  | 1~3 | dB | -6 | | | -13 | -6 | | -13 |
| PRS-RSRPNote3 | 1,2 | dBm/SCS | -104 | | | -111 | -104 | | -111 |
| 3 | -101 | | | -108 | -101 | | -108 |
| IoNote3 | 1,2 | dBm/  9.36MHz | -69.07 | | | -69.83 | -69.07 | | -69.83 |
| 3 | dBm/  38.16MHz | -62.98 | | | -63.74 | -62.98 | | -63.74 |
|  | 1~3 | dB | -6 | | | -13 | -6 | | -13 |
| Propagation condition | 1~3 | - | AWGN | | | | AWGN | | |
| Antenna configuration | 1~3 |  | 1x2 | | | | 1x2 | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.  Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification. | | | | | | | | | |

##### A.6.7.13.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

# *<End of change17>*

# *<Start of change18>*

### A.7.7.10 RSTD measurements

#### A.7.7.10.1 RSTD measurement accuracy test case for single positioning frequency layer

##### A.7.7.10.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in Table A.7.7.10.1.1-1.

Table A.7.7.10.1.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cells. Both cells are on the same NR RF channel in FR2. GP#13 is configured for the test. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

Table A.7.7.10.1.1-2: RSTD accuracy test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
|  |  | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| PRS ARFCN |  | freq1 | | freq1 | |
| Duplex mode |  | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Downlink initial BWP configuration |  | DLBWP.0.1 | - | DLBWP.0.1 | - |
| Downlink dedicated BWP configuration |  | DLBWP.1.1 | - | DLBWP.1.1 | - |
| Uplink initial BWP configuration |  | ULBWP.0.1 | - | ULBWP.0.1 | - |
| Uplink dedicated BWP configuration |  | ULBWP.1.1 | - | ULBWP.1.1 | - |
| DRX cycle configuration |  | Not applicable | - | Not applicable | - |
| TRS configuration |  | TRS.2.1 TDD | - | TRS.2.1 TDD | - |
| TCI state |  | TCI.State.0 | - | TCI.State.0 | - |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Control channel RMC |  | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns |  | OP.3 | OP.3 | OP.3 | OP.3 |
| SSB configuration |  | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 |
| SMTC configuration |  | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 |
| PRS configuration |  | PRS.1.1 FR2 | PRS.1.1 FR2 | PRS.1.2 FR2 | PRS.1.2 FR2 |
| PRS muting info |  | ‘10’ | ‘01’ | ‘10’ | ‘01’ |
| Expected RSTD | μs | N/A | 3 | N/A | 3 |
| Expected RSTD uncertainty | μs | N/A | 5 | N/A | 5 |
| Time offset with Cell 1 | μs | - | 3 | - | 3 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS |  |  |  |  |  |
| EPRE ratio of PBCH to PBCH\_DMRS |  |  |  |  |  |
| EPRE ratio of PDCCH\_DMRS to SSS |  |  |  |  |  |
| EPRE ratio of PDCCH to PDCCH\_DMRS |  |  |  |  |  |
| EPRE ratio of PDSCH\_DMRS to SSS |  |  |  |  |  |
| EPRE ratio of PDSCH to PDSCH\_DMRS |  |  |  |  |  |
| EPRE ratio of OCNG DMRS to SSSNote 1 |  |  |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |  |  |  |  |
| Propagation conditions |  | AWGN | AWGN | AWGN | AWGN |
| Antenna configuration |  | 1x2 | 1x2 | 1x2 | 1x2 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | | | |

Table A.7.7.10.1.1-3: RSTD accuracy OTA related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
|  |  | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| Angle of arrival configuration |  | Setup 1 according to clause A.3.15.1 | | | |
| Assumption for UE beamsNote 5 |  | Rough | | Rough | |
| Note1 | dBm/SCSNote3 | -98 | | -98 | |
|  | dB | -6 | -13 | -6 | -13 |
| PRS-RSRPNote2 | dBm/SCS | -104 | -111 | -104 | -111 |
| BB Note4 | dB | -6 | -13 | -6 | -13 |
| IoNote2 | dBm/95.04 MHz Note3 | -68.04 | -68.80 | -68.04 | -68.80 |
| Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SSB\_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 4: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4.  Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | |

##### A.7.7.10.1.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

#### A.7.7.10.2 RSTD measurement accuracy test case for dual positioning frequency layer

##### A.7.7.10.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

The supported test configurations are specified in Table A.7.7.10.2.1-1.

Table A.7.7.10.2.1-1: Supported test configurations

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell on NR RF channel #1 in FR2. Cell 2 is a neighbour cell on a different NR RF channel #2 in FR2. GP#13 is configured for the test.

Table A.7.7.10.2.1-2: RSTD accuracy test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
|  |  | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| PRS ARFCN |  | freq1 | | freq1 | |
| PRS ARFCN |  | freq1 | freq2 | freq1 | freq2 |
| Duplex mode |  | TDD | | TDD | |
| TDD configuration |  | TDDConf.3.1 | | TDDConf.3.1 | |
| BWchannel | MHz | 100: NRB,c = 66 | | 100: NRB,c = 66 | |
| Downlink initial BWP configuration |  | DLBWP.0.1 | - | DLBWP.0.1 | - |
| Downlink dedicated BWP configuration |  | DLBWP.1.1 | - | DLBWP.1.1 | - |
| Uplink initial BWP configuration |  | ULBWP.0.1 | - | ULBWP.0.1 | - |
| Uplink dedicated BWP configuration |  | ULBWP.1.1 | - | ULBWP.1.1 | - |
| DRX cycle configuration |  | Not applicable | - | Not applicable | - |
| TRS configuration |  | TRS.2.1 TDD | - | TRS.2.1 TDD | - |
| TCI state |  | TCI.State.0 | - | TCI.State.0 | - |
| PDSCH Reference measurement channel |  | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel |  | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Control channel RMC |  | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns |  | OP.3 | OP.3 | OP.3 | OP.3 |
| SSB configuration |  | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 | SSB.3 FR2 |
| SMTC configuration |  | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 |
| PRS configuration |  | PRS.1.1 FR2 | PRS.1.1 FR2 | PRS.1.2 FR2 | PRS.1.2 FR2 |
| Expected RSTD | μs | N/A | 3 | N/A | 3 |
| Expected RSTD uncertainty | μs | N/A | 5 | N/A | 5 |
| Time offset with Cell 1 | μs | - | 3 | - | 3 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH\_DMRS to SSS |  |  |  |  |  |
| EPRE ratio of PBCH to PBCH\_DMRS |  |  |  |  |  |
| EPRE ratio of PDCCH\_DMRS to SSS |  |  |  |  |  |
| EPRE ratio of PDCCH to PDCCH\_DMRS |  |  |  |  |  |
| EPRE ratio of PDSCH\_DMRS to SSS |  |  |  |  |  |
| EPRE ratio of PDSCH to PDSCH\_DMRS |  |  |  |  |  |
| EPRE ratio of OCNG DMRS to SSSNote 1 |  |  |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS Note 1 |  |  |  |  |  |
| Propagation conditions |  | AWGN | AWGN | AWGN | AWGN |
| Antenna configuration |  | 1x2 | 1x2 | 1x2 | 1x2 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | | | |

Table A.7.7.10.2.1-3: RSTD accuracy OTA related test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Test 1 | | Test 2 | |
|  |  | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| Angle of arrival configuration |  | Setup 1 according to clause A.3.15.1 | | | |
| Assumption for UE beamsNote 5 |  | Rough | | Rough | |
| Note1 | dBm/SCSNote3 | -98 | | -98 | |
|  | dB | -6 | -13 | -6 | -13 |
| PRS-RSRPNote2 | dBm/SCS | -104 | -111 | -104 | -111 |
| BB Note4 | dB | -6 | -13 | -6 | -13 |
| IoNote2 | dBm/95.04 MHz Note3 | -68.04 | -68.80 | -68.04 | -68.80 |
| Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: SSB\_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone  Note 4: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4.  Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation | | | | | |

##### A.7.7.10.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

# *<End of change18>*

# *<Start of change19>*

### 13.3.2 Measurement accuracy requirements

13.2.2.1 Introduction

This clause defines accuracy requirements for gNB Rx-Tx time difference measurement in FR1 and FR2. The requirements are applicable for gNB supporting gNB Rx-Tx time difference measurement. The gNB, which declares the support for gNB Rx-Tx time difference measurement also declares that it meets gNB Rx-Tx time difference accuracy requirements at least for one side condition Ês/Iot ≥ +3 dB or Ês/Iot ≥ -13 dB.

13.2.2.2 Requirements

The accuracy requirements for gNB Rx-Tx time difference measurement shall be within ±(X+Y) Tc under the following conditions:

- AWGN propagation conditions.

- The measured signals are in the directions covered by RoAoA of OTA reference sensitivity requirements for gNB type 1-O and 2-O BS

where

- X is defined in Table 13.2.2.2-1 for gNB types 1-C, 1-H and 1-O and in Table 13.2.2.2-2 for gNB type 2-O.

- Y is declared by manufacturer and can be different for different gNB types 1-C, 1-H, 1-O and 2-O.

Note: The measurement accuracy requirements in Table 13.2.2.2-1 and Table 13.2.2.2-2 are defined under an assumption that gNB is not mandated to perform receive beam sweeping.

**Table 13.2.2.2-1: gNB Rx-Tx time difference absolute accuracy in FR1 for gNB type 1-C, 1-H and 1-O**

|  |  |  |  |
| --- | --- | --- | --- |
| **Accuracy** | **SRS Ês/Iot** | **SCS** | **SRS bandwidth range** |
| **Unit: Tc** | **Unit: dB** | **Unit: kHz** | **Unit: RB** |
| 123 | ≥ -13 | 15 | 44 ≤ BW ≤ 84 |
| 48 | 88 ≤ BW ≤ 168 |
| 17 | 176 ≤ BW |
| 122 | ≥ +3 | 24 ≤ BW ≤ 40 |
| 62 | 44 ≤ BW ≤ 84 |
| 32 | 88 ≤ BW ≤ 168 |
| 16 | 176 ≤ BW |
| 42 | ≥ -13 | 30 | 48 ≤ BW ≤ 84 |
| 24 | 88 ≤ BW ≤ 168 |
| 8 | 176 ≤ BW |
| 32 | ≥ +3 | 48 ≤ BW ≤ 84 |
| 17 | 88 ≤ BW ≤ 168 |
| 9 | 176 ≤ BW |
| 21 | ≥ -13 | 60 | 48 ≤ BW ≤ 84 |
| 12 | 88 ≤ BW |
| 16 | ≥ +3 | 48 ≤ BW ≤ 84 |
| 9 | 88 ≤ BW |

**Table 13.2.2.2-2: gNB Rx-Tx time difference absolute accuracy in FR2 for gNB type 2-O**

|  |  |  |  |
| --- | --- | --- | --- |
| **Accuracy** | **SRS Ês/Iot** | **SCS** | **SRS bandwidth range** |
| **Unit: Tc** | **Unit: dB** | **Unit: kHz** | **Unit: RB** |
| 9 | ≥ -13 | 60 | 132 ≤ BW ≤ 168 |
| 8 | 176 ≤ BW |
| 9 | ≥ +3 | 132 ≤ BW ≤ 168 |
| 8 | 176 ≤ BW |
| 22 | ≥ -13 | 120 | 32 ≤ BW ≤ 40 |
| 15 | 44 ≤ BW ≤ 84 |
| 8 | 88 ≤ BW |
| 16 | ≥ +3 | 32 ≤ BW ≤ 40 |
| 9 | 44 ≤ BW ≤ 84 |
| 8 | 88 ≤ BW |

# *<End of change19>*

# *<Start of change20>*

**Table 9.1.2-2: Applicability for Gap Pattern Configurations supported by the E-UTRA-NR dual connectivity UE or NR-E-UTRA dual connectivity UE**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measurement gap pattern configuration** | **Serving cell** | **Measurement PurposeNote 5** | **Applicable Gap Pattern Id** |
| Per-UE | E-UTRA + FR1, or | non-NR RAT Note1,2 | 0,1,2,3 |
| Measurement gap | E-UTRA + FR2, or E-UTRA + FR1 + FR2 | FR1 and/or FR2 Note 7 | 0-11, 24, 25 |
|  |  | non-NR RATNote1,2 and FR1 and/or FR2 Note 7 | 0, 1, 2, 3, 4, 6, 7, 8,10, 24 |
|  | E-UTRA and, FR1 if configured | non-NR RAT Note1,2 | 0,1,2,3 |
|  | FR2 if configured |  | No gap |
|  | E-UTRA and, FR1 if configured | FR1 only | 0-11 |
|  | FR2 if configured |  | No gap |
|  | E-UTRA and, FR1 if configured | FR2 only | No gap |
| Per-FR | FR2 if configured |  | 12-23 |
| measurement gap | E-UTRA and, FR1 if configured | non-NR RAT Note1,2 and FR1 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured |  | No gap |
|  | E-UTRA and, FR1 if configured | FR1 and FR2 | 0-11 |
|  | FR2 if configured |  | 12-23 |
|  | E-UTRA and, FR1 if configured | non-NR RAT Note1,2 and FR2 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured |  | 12-23 |
|  | E-UTRA and, FR1 if configured | non-NR RAT Note1,2 and FR1 and FR2 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured |  | 12-23 |
| Note: In E-UTRA-NR dual connectivity mode, if GSM or UTRA TDD or UTRA FDD inter-RAT frequency layer is configured to be monitored, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap. In NR-E-UTRA dual connectivity mode, if UTRA FDD inter-RAT frequency layer is configured to be monitored for SRVCC, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap.  NOTE 1: In E-UTRA-NR dual connectivity mode, non-NR RAT includes E-UTRA, UTRA and/or GSM. In NR-E-UTRA dual connectivity mode, non-NR RAT means E-UTRA, and UTRA for SRVCC.  NOTE 2: Void  NOTE 3: When E-UTRA inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.  NOTE 4: For UE only supporting *supportedGapPattern-NRonly* for any gap patterns among GP2-11, the corresponding gap patterns are not applicable to any measurement in this table. For UE supporting *supportedGapPattern-NRonly-NEDC* or *measGapPatterns-NRonly-ENDC-r16* but not supporting *supportedGapPattern* for the corresponding gap patterns among GP2-11, the corresponding gap patterns are not applicable to measurement of non-NR RATs as defined in NOTE 1.  NOTE 5: Inclusion of positioning measurements: Measurement purpose which includes E-UTRA measurements includes also E-UTRA RSRP and E-UTRA RSRQ measurements for E-CID.  NOTE 6: Measurement gap patterns #24 and #25 can be requested [2] only when the UE is configured at least with any of RSTD, UE Rx-Tx, or PRS-RSRP measurements requiring such gaps and can only be used during the corresponding positioning measurement period  NOTE 7: Inclusion of positioning measurements for per-UE measurement gaps: Measurement purpose which includes any of FR1 and FR2 measurements includes also RSTD, UE Rx-Tx, and PRS-RSRP measurements. | | | |

# *<End of change20>*

# *<Start of change21>*

**Table 9.1.2-3: Applicability for Gap Pattern Configurations supported by the UE with NR standalone operation (with single carrier, NR CA and NR-DC configuration)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measurement gap pattern configuration** | **Serving cell** | **Measurement Purpose NOTE 2** | **Applicable Gap Pattern Id** |
|  | FR1 NOTE5, or  FR1 + FR2 | non-NR RAT NOTE3,6 | 0,1,2,3 |
|  |  | FR1 and/or FR2 NOTE 9 | 0-11, 24, 25 |
|  |  | non-NR RATand FR1 and/or FR2 NOTE3,6,9 | 0, 1, 2, 3, 4, 6, 7, 8,10, 24 |
| Per-UE measurement | FR2 NOTE5 | non-NR RATonly  NOTE3,6 | 0,1,2,3 |
| gap |  | FR1 only NOTE 9 | 0-11, 24, 25 |
|  |  | FR1 and FR2 NOTE 9 | 0-11, 24, 25 |
|  |  | non-NR RATand FR1 and/or FR2 NOTE3,6,9 | 0, 1, 2, 3, 4, 6, 7, 8,10, 24 |
|  |  | FR2 only NOTE 9 | 12-23 |
|  | FR1 if configured | non-NR RATonly | 0,1,2,3 |
|  | FR2 if configured | NOTE3,6 | No gap |
|  | FR1 if configured | FR1 only | 0-11 |
|  | FR2 if configured |  | No gap |
|  | FR1 if configured | FR2 only | No gap |
| Per-FR | FR2 if configured |  | 12-23 |
| measurement | FR1 if configured | non-NR RATand | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| gap | FR2 if configured | FR1 NOTE3,6 | No gap |
|  | FR1 if configured | FR1 and FR2 | 0-11 |
|  | FR2 if configured |  | 12-23 |
|  | FR1 if configured | non-NR RATand | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured | FR2 NOTE3,6 | 12-23 |
|  | FR1 if configured | non-NR RATand | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured | FR1 and FR2 NOTE3,6 | 12-23 |
| NOTE 1: When E-UTRA inter-RAT RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.  NOTE 2: Measurement purpose which includes E-UTRA measurements includes also inter-RAT E-UTRA RSRP and RSRQ measurements for E-CID; measurement purpose which includes E-UTRA measurements includes also E-UTRA RSRP and E-UTRA RSRQ measurements for E-CID.  NOTE 3: Void  NOTE4: If per-UE measurement gap is configured with MG timing advance of TMG ms, the measurement gap starts at time TMG ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among all serving cells subframes.  If per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR1.  If per-FR measurement gap for FR2 is configured with MG timing advance of TMG ms, the measurement gap for FR2 starts at time TMG ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR2.  TMG is the MG timing advance value provided in *mgta* according to [2].  In determining the measurement gap starting point, UE shall use the DL timing of the latest subframe occurring immediately before the configured measurement gap among serving cells.  NOTE 5: 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.  NOTE 6: In NR single carrier, NR CA, and NR-DC mode, non-NR RAT means E-UTRA, and UTRA for SRVCC. In NR single carrier, NR CA, and NR-DC mode, if UTRA FDD inter-RAT frequency layer is configured to be monitored for SRVCC, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap.  NOTE 7: For UE only supporting *supportedGapPattern-NRonly* for any gap patterns among GP2-11, the corresponding gap patterns are not applicable to measurement of non-NR RATs as defined in NOTE 6.  NOTE 8: Measurement gap patterns #24 and #25 can be requested [2] only when the UE is configured with any of RSTD, UE Rx-Tx, or PRS-RSRP measurements requiring such gaps and can only be used during the corresponding positioning measurement period.  NOTE 9: Inclusion of positioning measurements for per-UE measurement gaps: Measurement purpose which includes any of FR1 and FR2 measurements includes also RSTD, UE Rx-Tx, and PRS-RSRP measurements. | | | |

# *<End of change21>*

# *<Start of change22>*

9.9.1 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 NR E-CID measurements.

For RSTD, PRS-RSRP and UE Rx-Tx time difference measurements, the requirements in clauses 9.9.2, 9.9.3 and 9.9.4 apply provided:

- UE is configured with per-UE measurement gaps

- No active BWP switching occurs during the measurement gaps for PRS measurement, and

All measurement requirements specified in clause 9.9.2, 9.9.3 and 9.9.4 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

UE is only required to measure PRS resources that are fully or partially overlapped with measurement gaps, and the requirements in clause 9.9.2, 9.9.3 and 9.9.4 are applicable to PRS resources that are fully or partially overlapped with measurement gaps.

A PRS resource is considered to be fully (partially) overlapped with measurement gaps if all (some) of its instances are overlapped with a measurement gap occasion. A PRS resource instance is considered to be overlapped with measurement gap occasion if the minimum number of repetitions of the instance is fully covered by the MGL excluding RF switching time, where the minimum number is given in the accuracy requirements in clause 10.1.23, 10.1.24 and 10.1.25 for RSTD, PRS-RSRP and UE Rx-Tx time difference, respectively.When 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.

# *<End of change22>*

# *<Start of change23>*

9.9.2.5 Measurements Period Requirements

When physical layer receives last of *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* the UE shall be able to measure and report multiple (up to the UE capability specified in Clause 9.9.2.3) 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. In FR1, = 1; and in FR2, = 8.

is the carrier-specific scaling factor for NR PRS-based positioning measurements in positioning frequency layer *i* as defined in clause 9.1.5.2.

is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

is the time duration of available PRS to be measured in the positioning frequency layer i, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26].

is the number of PRS RSTD samples and = 4.

is the measurement duration for the last PRS RSTD sample, 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* in TS 37.355 [34],

*,* the least common multiple between and .

is the repetition periodicity of the measurement gap applicable for measurement in the PRS frequency layer i.

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 the measurement period of that positioning frequency layer *i*. 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. If bitmap for higher-layer parameter *DL-PRS-MutingPattern* is provided, and , then ; otherwise, if bitmap is not provided or , then .

is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L is the size of the bitmap .

* Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* 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* specified in TS 37.355 [34].

The time *s*tarts from the first MG instance aligned with a 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 physical layer of UE via LPP [34].

* Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

*Editor’s note: FFS: RSTD measurement period when MG pattern is reconfigured during measurement period.*

When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration LPRS.

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.

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The UE shall also meet the RSTD measurement requirements in this clause and measurement accuracy requirements in clause 10.1.23. However, in this case the RSTD measurement period shall be as follows:

Where,

- is the number of times handover occurs during ;

- is the largest among all positioning frequency layers;

- is the time during which the RSTD measurement may not be possible due to handover; it can be up to Tinterrupt as defined in clause 6.1.

- is the time during which the RSTD measurement may not be possible due to handover; it can be up to Tinterrupt as defined in clause 6.1.

# *<End of change23>*

# *<Start of change24>*

9.9.3.5 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 9.9.3.3) 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 the carrier specific scaling factor for PRS-RSRP measurements specified in clause 9.1.5.2,

is the scaling factor for Rx beam sweeping, and =1 if positioning frequency layer *i* is in FR1 and =8 if positioning frequency layer *i* is in FR2,

is the time duration of available PRS to be measured in the positioning frequency layer i, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26],

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-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* 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* in clause 6.4.3 of TS 37.355 [34],

is the number of PRS-RSRP measurement samples and = 4,

*= +* 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 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 measurement gap repetition period in positioning frequency layer i.

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 the measurement period of that positioning frequency layer. 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. If bitmap for higher-layer parameter *DL-PRS-MutingPattern* is provided, and , then ; otherwise, if bitmap is not provided or , then . is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L is the size of the bitmap .

Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

When PRS-RSRP measurements are configured for DL-AoD, the time starts from the first MG instance aligned with 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.

*Editor’s note: FFS: PRS-RSRP measurement period when PRS-RSRP measurement is configured together with RSTD.*

*Editor’s note: FFS: PRS-RSRP measurement period when PRS-RSRP measurement is configured together with UE Rx-Tx.*

The requirements in this section apply, provided no PRS symbols are dropped during the measurement period TPRS-RSRP,Total within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

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 handover occurs while PRS-RSRP measurements are being performed then the UE shall complete the ongoing PRS-RSRP measurements session. The UE shall also meet the PRS-RSRP measurement requirements in this clause and measurement accuracy requirements in clause 10.1.24. However, in this case the PRS-RSRP measurement period shall be as follows:

where

is the number of times handover occurs during ;

is the largest among all positioning frequency layers;

is the time during which the PRS-RSRP measurement may not be possible due to handover; it can be up to Tinterrupt as defined in clause 6.1.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement, the UE behaviour at a serving cell (SpCell or SCell) change for the PRS-RSRP measurement is the same as the UE behaviour for the UE Rx-Tx time difference measurement specified in clause 9.9.4.5, and the PRS-RSRP measurement shall meet the accuracy requirements in clause 10.1.24.

When the PRS-RSRP measurement is configured together with RSTD measurement, the UE behaviour at a serving cell (SpCell or SCell) change for the PRS-RSRP measurement is the same as the UE behaviour for the RSTD measurement specified in clause 9.9.2.5, and the PRS-RSRP measurement shall meet the accuracy requirements in clause 10.1.24.

# *<End of change24>*

# *<Start of change25>*

9.9.4.5 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 9.9.4.3) 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, and

is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i* as defined further in this clause.

Where

is the carrier-specific scaling factor for NR PRS-based measurement in the positioning frequency layer *i* as defined in clause 9.1.5.2,

is the scaling factor for Rx beam sweeping, and =1 if positioning frequency layer *i* is in FR1 and =8 if positioning frequency layer *i* is in FR2,

is the time duration of available PRS can be measured in the positioning frequency layer *i*, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26].

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-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* 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* as specified in clause 6.4.3 of TS 37.355 [34],

is the number of UE Rx-Tx time difference measurement samples and = [4],

is the measurement duration for the last UE Rx-Tx time difference measurement sample, 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 in TS 37.355 [34],

, the least common multiple between and

is the measurement gap repetition periodicity in positioning frequency layer i.

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 the measurement period of that positioning frequency layer.

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. If bitmap for higher-layer parameter *DL-PRS-MutingPattern* is provided, and , then ; otherwise, if bitmap is not provided or , then . is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L is the size of the bitmap .

Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

The time starts from the first MG instance aligned with 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.

The UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

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.

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.

*Editor’s note: FFS: Measurement period requirements when cell change does not impact SRS configuration*

*Editor’s note: FFS: Measurement period requirements when cell change does impact SRS configuration*

*Editor’s note: FFS: The UE Rx-Tx time difference measurement period requirements in this clause shall not apply, if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the network-configured Timing Advance.*

*Editor’s note: FFS: The UE Rx-Tx time difference measurement period requirements in this clause shall not apply, if NTA\_offset defined in Table 7.1.2-2 changes during the UE Rx-Tx measurement period..*

# *<End of change25>*

# *<Start of change26>*

13.3.2 Measurement accuracy requirements

13.3.2.1 Introduction

This clause defines accuracy requirements for SRS-RSRP measurement in FR1 and FR2. The requirements are applicable for gNB supporting SRS-RSRP measurement. The gNB, which declares the support for SRS-RSRP measurement also declares that it meets SRS-RSRP accuracy requirements at least for one side condition Ês/Iot ≥ +3 dB or Ês/Iot ≥ -13 dB.

13.3.2.2 Requirements

The accuracy requirements in Table 13.3.2.2-1, Table 13.3.2.2-2 and Table 13.3.2.2-3 are valid under the following conditions:

AWGN propagation conditions.

The measured signals are in the directions covered by RoAoA of OTA reference sensitivity requirements for gNB type 1-O and 2-O BS

Note: The measurement accuracy requirements in Table 13.3.2.2-1, Table 13.3.2.2-2 and Table 13.3.2.2-3 are defined under an assumption that gNB is not mandated to perform receive beam sweeping.

**Table 13.3.2.2-1 gNB SRS-RSRP absolute accuracy requirements in FR1 for gNB type 1-C**

|  |  |  |
| --- | --- | --- |
| **Accuracy** | **Conditions** | |
| **SRS Ês/Iot** | **SRS bandwidth range** |
|  |
| **dB** | **dB** | **RB** |  |
| ±4 | Ês/Iot ≥ +3 | 24 ≤ BW < 48 |  |
| ±4 | 48 ≤ BW < 132 |  |
| ±4 | 132 ≤ BW |  |
| ±6.5 | Ês/Iot ≥ -13 | 48 ≤ BW < 132 |  |
| ±5.5 | 132 ≤ BW |  |

**Table 13.3.2.2-2 gNB SRS-RSRP absolute accuracy requirements in FR1 for gNB type 1-H and 1-O**

|  |  |  |
| --- | --- | --- |
| **Accuracy** | **Conditions** | |
| **SRS Ês/Iot** | **SRS bandwidth range** |
|  |
| **dB** | **dB** | **RB** |  |
| ±5.5 | Ês/Iot ≥ +3 | 24 ≤ BW < 48 |  |
| ±5.5 | 48 ≤ BW < 132 |  |
| ±5.5 | 132 ≤ BW |  |
| ±8 | Ês/Iot ≥ -13 | 48 ≤ BW < 132 |  |
| ±7 | 132 ≤ BW |  |

**Table 13.3.2.2-3 gNB SRS-RSRP absolute accuracy requirements in FR2 for gNB type 2-O**

|  |  |  |
| --- | --- | --- |
| **Accuracy** | **Conditions** | |
| **SRS Ês/Iot** | **SRS bandwidth range** |
|  |
| **dB** | **dB** | **RB** |  |
| ±5.5 | Ês/Iot ≥ +3 | 32 ≤ BW < 64 |  |
| ±5.5 | 64 ≤ BW < 132 |  |
| ±5.5 | 132 ≤ BW |  |
| ±8 | Ês/Iot ≥ -13 | 64 ≤ BW < 132 |  |
| ±7 | 132 ≤ BW |  |

# *<End of change26>*

# *<Start of change27>*

10.1.25.2 Measurement Accuracy Requirements

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall not apply, if:

NTA\_offset defined in Table 7.1.2-2 changes during the UE Rx-Tx measurement period or

if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the network-configured Timing Advance.

*FFS: whether UE Rx-Tx time difference measurement accuracy requirements in this clause shall also apply if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the autonomous timing adjustment defined in clause 7.1.2.*

The UE shall continue and complete a UE Rx-Tx measurement while meeting UE Rx-Tx measurement accuracy requirements defined in this clause when a serving cell change occurs during the UE Rx-Tx measurement provided that the serving cell change does not impact the SRS configuration for the UE Rx-Tx measurement.

Note: The requriements for fading channel in this clause are derived based on TDL-A (30 ns delay spread, 5Hz) and TDL-C (60 ns delay spread, 300 Hz) channel models for FR1 and FR2 respectively.

*Editor’s note: In accuracy tables δ is margin and is FFS*

The accuracy requirements in Table 10.1.25.2-1 for FR1 are valid under the following conditions:

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

PRP|dBm according to Annex B.2.x for a corresponding Band.

AWGN propagation condition.

**Table 10.1.25.2-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS bandwidth** | **PRS SCS** | **PRS resource repetition Note 3** | **NR operating band groupsNote 2** | **IoNote 4 range** | |
| **Minimum IoNote 1** | **Maximum Io** |
| **TcNote 5** | **dB** | **RB** | **kHz** |  |  | **dBm / SCSPRS** | **dBm/BW** |
| ± [78+δ] | -3 | ≥[24] | 15 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -121 | -50 |
| NR\_FDD\_FR1\_B | -120.5 |
| NR\_TDD\_FR1\_C | -120 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -119.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -119 |
| NR\_FDD\_FR1\_F | -118.5 |
| NR\_FDD\_FR1\_G | -118 |
| NR\_FDD\_FR1\_H | -117.5 |
| ± [59+δ] | ≥[52] | ≥[1] | Note 6 | Note 6 | Note 6 |
| ± [30+δ] | >[104] | ≥[1] | Note 6 | Note 6 | Note 6 |
| ± [57+δ] |  | ≥[24] | 30 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -118 | -50 |
| NR\_FDD\_FR1\_B | -117.5 |
| NR\_TDD\_FR1\_C | -117 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -116.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -116 |
| NR\_FDD\_FR1\_F | -115.5 |
| NR\_FDD\_FR1\_G | -115 |
|  | NR\_FDD\_FR1\_H | -114.5 |
| ± [30+δ] |  | ≥[48] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [15+δ] |  | ≥[132] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [29+δ] | ≥[24] | 60 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -115 | -50 |
| NR\_FDD\_FR1\_B | -114.5 |
| NR\_TDD\_FR1\_C | -114 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -113.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -113 |
| NR\_FDD\_FR1\_F | -113.5 |
| NR\_FDD\_FR1\_G | -113 |
| NR\_FDD\_FR1\_H | -111.5 |
| ± [15+δ] |  | ≥ [64] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [7+δ] |  | ≥ [132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [101+δ] | -13 | ≥[24] | 15 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [75+δ] | ≥[52] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [37+δ] | >[104] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [58+δ] |  | ≥[24] | 30 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [39+δ] |  | ≥[48] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [16+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [36+δ] | ≥[24] | 60 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [16+δ] |  | ≥ [64] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [8+δ] |  | ≥ [132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: NR operating band groups are as defined in Section 3.5.  NOTE 3: are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34].  NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. | | | | | | | |

The accuracy requirements in Table 10.1.25.2-2 for FR1 are valid under the following conditions:

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

PRP|dBm according to Annex B.2.x for a corresponding Band.

Fading propagation condition.

**Table 10.1.25.2-2: UE Rx-Tx time difference measurement accuracy in FR1 in fading**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | | |
| **PRS Ês/Iot** | **Minimum PRS bandwidth** | **PRS SCS** | **PRS resource repetition Note 3** | **NR operating band groupsNote 2** | **IoNote 4 range** | |
| **Minimum IoNote 1** | **Maximum Io** |
| **TcNote 5** | **dB** | **RB** | **kHz** |  |  | **dBm / SCSPRS** | **dBm/BW** |
| ± [137+δ] | -3 | ≥[24] | 15 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -121 | -50 |
| NR\_FDD\_FR1\_B | -120.5 |
| NR\_TDD\_FR1\_C | -120 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -119.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -119 |
| NR\_FDD\_FR1\_F | -118.5 |
| NR\_FDD\_FR1\_G | -118 |
| NR\_FDD\_FR1\_H | -117.5 |
| ± [96+δ] | ≥[52] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [62+δ] | >[104] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [87+δ] |  | ≥[24] | 30 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -118 | -50 |
| NR\_FDD\_FR1\_B | -117.5 |
| NR\_TDD\_FR1\_C | -117 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -116.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -116 |
| NR\_FDD\_FR1\_F | -115.5 |
| NR\_FDD\_FR1\_G | -115 |
|  | NR\_FDD\_FR1\_H | -114.5 |
| ± [68+δ] |  | ≥[48] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [44+δ] |  | ≥[132] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [59+δ] | ≥[24] | 60 | ≥[4] | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A,  NR\_SDL\_FR1\_A | -115 | -50 |
| NR\_FDD\_FR1\_B | -114.5 |
| NR\_TDD\_FR1\_C | -114 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -113.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -113 |
| NR\_FDD\_FR1\_F | -113.5 |
| NR\_FDD\_FR1\_G | -113 |
| NR\_FDD\_FR1\_H | -111.5 |
| ± [42+δ] |  | ≥ [64] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [36+δ] |  | ≥ [132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [180+δ] | -13 | ≥[24] | 15 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [98+δ] | ≥[52] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [68+δ] | >[104] | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [87+δ] |  | ≥[24] | 30 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [85+δ] |  | ≥[48] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [44+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [139+δ] | ≥[24] | 60 | ≥[4] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [46+δ] |  | ≥ [64] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| ± [30+δ] |  | ≥ [132] |  | ≥[1] | NOTE 6 | NOTE 6 | NOTE 6 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: NR operating band groups are as defined in Section 3.5.  NOTE 3: are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34].  NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. | | | | | | | |

The accuracy requirements in Table 10.1.25.2-3 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

PRP|dBm according to Annex B.2.x for a corresponding Band.

AWGN propagation condition.

**Table 10.1.25.2-3: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | |
| **PRS Ês/Iot** | **Minimum PRS bandwidth** | **PRS SCS** | **PRS resource repetitionNote 3** | **IoNote 4 range** | |
| **Minimum IoNote 1** | **Maximum Io** |
| **TcNote 5** | **dB** | **RB** | **kHz** |  | **dBm / SCSPRS** | **dBm/BWChannel** |
| ± [22+δ] | -3 | ≥[24] | 60 | ≥[1] | Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| ± [15+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [7+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [12+δ] | ≥[32] | 120 | ≥[1] | Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| ± [7+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [4+δ] |  | ≥[128] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [35+δ] | -13 | ≥[24] | 60 | ≥[1] | NOTE 6 | NOTE 6 |
| ± [15+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [7+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [14+δ] | ≥[32] | 120 | ≥[1] | NOTE 6 | NOTE 6 |
| ± [9+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [4+δ] |  | ≥[128] |  | ≥[1] | NOTE 6 | NOTE 6 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: NR operating band groups are as defined in Section 3.5.  NOTE 3: are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34].  NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. | | | | | | |

The accuracy requirements in Table 10.1.25.2-4 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

PRP|dBm according to Annex B.2.x for a corresponding Band.

Fading propagation condition.

**Table 10.1.25.2-4: UE Rx-Tx time difference measurement accuracy in FR2 in fading**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | **Conditions** | | | | | |
| **PRS Ês/Iot** | **Minimum PRS bandwidth** | **PRS SCS** | **PRS resource repetitionNote 3** | **IoNote 4 range** | |
| **Minimum IoNote 1** | **Maximum Io** |
| **TcNote 5** | **dB** | **RB** | **kHz** |  | **dBm / SCSPRS** | **dBm/BWChannel** |
| ± [75+δ] | -3 | ≥[24] | 60 | ≥[4] | Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| ± [72+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [57+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [61+δ] | ≥[32] | 120 | ≥[1] | Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival | -50 |
| ± [64+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [55+δ] |  | ≥[128] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [92+δ] | -13 | ≥[24] | 60 | ≥[4] | NOTE 6 | NOTE 6 |
| ± [70+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [57+δ] |  | ≥[132] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [60+δ] | ≥[32] | 120 | ≥[1] | NOTE 6 | NOTE 6 |
| ± [66+δ] |  | ≥[64] |  | ≥[1] | NOTE 6 | NOTE 6 |
| ± [62+δ] |  | ≥[128] |  | ≥[1] | NOTE 6 | NOTE 6 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: NR operating band groups are as defined in Section 3.5.  NOTE 3: are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN*defined in TS 37.355 [34].  NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.  NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].  NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS. | | | | | | |

# *<End of change27>*