**3GPP TSG-RAN WG4 Meeting #98bis-e *R4-2105751***

**Electronic Meeting, April 12 − April 20, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **DraftCR** | **Rev** | **1** | **Current version:** | **16.7.0** |  |
|  |
| *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 | **X** | Core Network |  |

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|  |
| ***Title:***  | Draft Big CR: Introduction of Rel-16 NR Positioning RRM performance requirements and test cases |
|  |  |
| ***Source to WG:*** | Ericsson, Intel |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_pos-Perf |  | ***Date:*** | 2021-04-23 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | No NR positioning measurement accuracy requirements and no NR positioning test cases are currently specified.This document includes the endoresed draft CRs:**Endorsed in 97-e**:* R4-2017157, CR on conditions for NR RSTD measurement, CATT, Ericsson
* R4-2017153, draftCR to introduce accuracy requirements for RSTD measurement, Huawei, HiSilicon
* R4-2017154, CR on PRS-RSRP accuracy requirements, CATT
* R4-2017155, UE Rx-Tx measurement accuracy, Ericsson
* R4-2016401, Correction to UE Rx-Tx measurement report mapping, Ericsson
* R4-2017152, NR RRM positioning test cases structure, Ericsson

**Endorsed in 98-e**:* R4-2103730, draftCR to introduce accuracy requirements for RSTD measurement, Huawei, HiSilicon
* R4-2103731, UE Rx-Tx measurement accuracy requirements, Ericsson
* R4-2103732, CR on PRS-RSRP accuracy requirements, CATT
* R4-2104052, gNB SRS-RSRP measurement, Ericsson
* R4-2104053, draftCR to introduce gNB Rx-Tx time difference requirements, Huawei, HiSilicon

**Endorsed in 98bis-e**:* R4-2105843 draftCR to introduce accuracy requirements for RSTD measurement, Huawei, HiSilicon
* R4-2105845 CR on PRS-RSRP accuracy requirements, CATT
* R4-2105844 UE Rx-Tx measurement accuracy requirements, Ericsson
* R4-2105837 [draftCR] PRS configurations for NR Pos RRM tests, Intel Corporation
* R4-2105756 gNB SRS-RSRP measurement, Ericsson
* R4-2105757 draftCR to introduce gNB Rx-Tx time difference requirements, Huawei, HiSilicon
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|  |  |
| ***Summary of change:*** | Following draft CRs endorsed at RAN4#98bis-e are implemented in this big CR: 1. R4-2105843 draftCR to introduce accuracy requirements for RSTD measurement, Huawei, HiSilicon
2. R4-2105844 UE Rx-Tx measurement accuracy requirements, Ericsson
3. R4-2105845 CR on PRS-RSRP accuracy requirements, CATT
4. R4-2105837 [draftCR] PRS configurations for NR Pos RRM tests, Intel
5. R4-2105756 gNB SRS-RSRP measurement, Ericsson
6. R4-2105757 draftCR to introduce gNB Rx-Tx time difference requirements, Huawei, HiSilicon
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|  |  |
| ***Consequences if not approved:*** | No NR positioning measurement accuracy requirements and no NR positioning test cases will be specified |
|  |  |
| ***Clauses affected:*** | 3.3;10.1.23.1, 10.1.23.2;10.1.24.1, 10.1.24.2;10.1.25.1, 10.1.25.2;10.1.25.3.1, 10.1.25.3.2, 10.1.25.3.3;New clauses: 10.1.24.2.1, 10.1.24.2.2;13.2.2, 13.2.2.1, 13.2.2.2;13.3.2, 13.3.2.1, 13.3.2.2;A.6.6.7, A.6.6.8, A.6.6.9, A.6.7.9, A.6.7.10, A.6.7.11;A.7.6.5, A.7.6.6, A.7.6.7, A.7.7.6, A.7.7.7, A.7.7.8;B.2.x; A.3.x |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ... |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | This draft CR is based on draft CR endorsed in R4-2103585 at RAN4#98-e. |

**--- start of change 1 ---**

## 3.3 Abbreviations

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

AoA Angle of Arrival

AoD Angle of Departure

BFD Beam Failure Detection

BFD-RS BFD Reference Signal

BLER Block Error Rate

BM-RS Beam Management Reference Signal

BWP Bandwidth Part

CA Carrier Aggregation

CBD Candidate Beam Detection

CBW Channel Bandwidth

CC Component Carrier

CCA Clear Channel Assessment

CLI Cross Link Interference

CMR Channel Measurement Resource

CORESET Control Resource Set

CP Cyclic Prefix

CSI Channel-State Information

CSI-RS CSI Reference Signal

CSI-RSRP CSI Reference Signal based Reference Signal Received Power

CSI-RSRQ CSI Reference Signal based Reference Signal Received Quality

DC Dual Connectivity

DCI Downlink Control Information

DL Downlink

DL-AoD Downlink Angle-of-Departure

DL-TDOA Downlink Time Difference Of Arrival

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

E-CID Enhanced Cell ID

E-UTRA Evolved UTRA

E-UTRAN Evolved UTRAN

EN-DC E-UTRA-NR Dual Connectivity

FDD Frequency Division Duplex

FR Frequency Range

HARQ Hybrid Automatic Repeat Request

HO Handover

IMR Interference Measurement Resource

L1-RSRP Layer 1 RSRP

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

LMF Location Management Function

LPP LTE Positioning Protocol

MAC Medium Access Control

MCG Master Cell Group

MDT Minimization of Drive Tests

MG Measurement Gap

MGL Measurement Gap Length

MGRP Measurement Gap Repetition Period

MIB Master Information Block

MN Master Node

MR-DC Multi-Radio Dual Connectivity

NE-DC NR-E-UTRA Dual Connectivity

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

NR New Radio

NR-DC NR-NR Dual Connectivity

OFDM Orthogonal Frequency Division Multiplexing

OFDMA Orthogonal Frequency Division Multiple Access

OTDOA Observed Time Difference Of Arrival

PBCH Physical Broadcast Channel

PCC Primary Component Carrier

PCell Primary Cell

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PLMN Public Land Mobile Network

PRACH Physical RACH

PRP PRS Received Power

PRS Positioning Reference Signal

PRS-RSRP Positioning Reference Signal based Reference Signal Received Power

PSBCH Physical Sidelink Broadcast Channel

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

PSCCH Physical Sidelink Control Channel

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

PSCell Primary SCell

PSS Primary Synchronization Signal PSS Primary Synchronization Signal

PSSCH Physical Sidelink Shared Channel

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

pTAG Primary Timing Advance Group

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

QCL Quasi Co-Location

RACH Random Access Channel

RAT Radio Access Technology

RLM Radio Link Monitoring

RLM-RS Reference Signal for RLM

RMSI Remaining Minimum System Information

RRC Radio Resource Control

RRM Radio Resource Management

RSSI Received Signal Strength Indicator

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSTD Reference Signal Time Difference

RTT Round Trip Time

S-SSB Sidelink Synchronization Signal Block

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

SA Standalone operation mode

SCC Secondary Component Carrier

SCell Secondary Cell

SCG Secondary Cell Group

SCS Subcarrier Spacing

SCSSSB SSB subcarrier spacing

SDL Supplementary Downlink

SFN System Frame Number

SFTD SFN and Frame Timing DifferenceSI System Information

SIB System Information Block

SL-RSSI Sidelink Received Signal Strength Indicator

SLSS Sidelink Synchronization Signal

SMTC SSB-based Measurement Timing configuration

SpCell Special Cell

SRS Sounding Reference Signal

SRS-RSRP Sounding Reference Signal based Reference Signal Received Power

SS-RSRP Synchronization Signal based Reference Signal Received Power

SS-RSRQ Synchronization Signal based Reference Signal Received Quality

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

SSB Synchronization Signal Block

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

SSS Secondary Synchronization Signal

sTAG Secondary Timing Advance Group

SUL Supplementary Uplink

TA Timing Advance

TAG Timing Advance Group

TCI Transmission Configuration Indicator

TDD Time Division Duplex

TDOA Time Difference Of Arrival

TRP Transmission-Reception Point

TTI Transmission Time Interval

UE User Equipment

UL Uplink

**--- end of change 1 ---**

**--- start of change 2 ---**

10.1.23 RSTD Measurements

10.1.23.1 Introduction

The requirements in Clause 10.1.23 shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to report one or more DL RSTD measurements defined in TS 38.215 [4].

#### 10.1.23.2 Measurement Accuracy Requirements

Editor’s Note: FFS The requirements for SCS=60k in FR2

Editor’s note: The number of PRS BW ranges for each SCS is FFS

The RSTD measurement reported by the UE shall fulfil the accuracy requirements defined in Table 10.1.23.2-1 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 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.

**Table 10.1.23.2-1: RSTD absolute accuracy in FR1**

|  |  |
| --- | --- |
| **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** |
| TBD+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 |
| TBD+Δ | ≥ [52] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| TBD+Δ | ≥ [104] | ≥ [1] | Note 6 | Note 6 | Note 6 |
| TBD+ΔNote 7 | 30 or 60 | ≥ [48] | ≥ [1] | 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 |
| 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**

|  |  |
| --- | --- |
| **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** |
| TBD+ΔNote 6 | (PRS Ês/Iot)ref ≥-6dB (PRS Ês/Iot)*i* ≥-13dB | 120 | ≥ [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 |
| TBD+Δ | ≥ [64] | ≥ [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 change 2 ---**

**--- start of change 3 ---**

### 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.x 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.x 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** | **MinimumIo Note 1****dBm / SCSPRS** | **MaximumIo** |
| **dB** | **dB** | **dB** | **PRB** | **-** |  | **dBm / SCSPRS** | **dBm/BWChannel** |
| **dBm/15kHz** Note 6 | **dBm/30kHz** Note 6 | **dBm/60kHz** Note 6 |
| [TBD] | [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] | [TBD] | ≥-13dB | 24 ≤ BW ≤ 52 | All | Note 4 |
| [±6] | 52< BW≤ 104 | All | Note 4 |
| [±5.5] | 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** |
| **MinimumIo Note 1****dBm / SCSPRS** | **MaximumIo** |
| **dB** | **dB** | **dB** | **PRB** | **-** | **dBm / SCSPRS** | **dBm/BWChannel** |
| **dBm/120kHz** Note 6 | **dBm/60kHz** Note 6 |
| [TBD] | [TBD] | ≥-3dB | ≥[24] | All | Same value as PRP in Table B.2.x-2, according to UE Power class, operating band and angle of arrival | -50 |
| Note 4 |
| Note 4 |
| [±9] | [TBD] | ≥-13dB | 24 ≤ BW ≤ 64 | All | Note 4 |
| [±7] | 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. |

*Editor’s note: the value in [] may be modified based on the additional simulation results in next meeting.*

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 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.x 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.x 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** | **MinimumIo Note 1****dBm / SCSPRS** | **MaximumIo** |
| **dB** | **dB** | **dB** | **PRB** | **-** |  | **dBm / SCSPRS** | **dBm/BWChannel** |
| **dBm/15kHz** Note 6 | **dBm/30kHz** Note 6 | **dBm/60kHz** Note 6 |
| [TBD] | [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 |
| [TBD] | [TBD] | ≥-13dB | 24 ≤ BW ≤ 52 | All | Note 4 |
| 52< BW≤ 104 | All | Note 4 |
| [TBD] | 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** |
| **MinimumIo Note 1****dBm / SCSPRS** | **MaximumIo** |
| **dB** | **dB** | **dB** | **PRB** | **-** | **dBm / SCSPRS** | **dBm/BWChannel** |
| **dBm/120kHz** Note 6 | **dBm/60kHz** Note 6 |
| [TBD] | [TBD] | ≥-3dB | ≥[24] | All | Same value as PRP in Table B.2.x-2, according to UE Power class, operating band and angle of arrival | -50 |
| Note 4 |
| Note 4 |
| [TBD] | [TBD] | ≥-13dB | 24 ≤ BW ≤ 64 | All | Note 4 |
| [TBD] | 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 change 3 ---**

**--- start of change 4 ---**

### 10.1.25 UE Rx-Tx Time Difference Measurements

#### 10.1.25.1 Introduction

The requirements in Clause 10.1.25 shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

#### 10.1.25.2 Measurement Accuracy Requirements

Editor’s note: FFS: 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.

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

Editor’s note: FFS the requirements for 60kHz SCS for FR2.

Editor’s note: The number of PRS BW ranges for each SCS is FFS

The accuracy requirements in Table 10.1.25.2-1 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.

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

|  |  |
| --- | --- |
| Accuracy | Conditions |
| PRS Ês/Iot | Minimum PRS bandwidth | PRS SCS | PRS resource repetition Note 3 |  | IoNote 4 range |
| NR operating band groupsNote 2 | MinimumIoNote 1 | MaximumIo |
| TcNote 5 | dB | RB | kHz |  |  | dBm / SCSPRS | dBm/BW |
| SCSPRS=15 kHz | SCSPRS=30 kHz | SCSPRS=60 kHz |
| TBD | -3 | ≥[24] | 15 | ≥[4] | TBD | TBD | TBD | TBD | TBD |
| TBD | ≥[52] | ≥[1] | TBD | TBD | TBD | TBD | TBD |
| TBD | >[104] | TBD | TBD | TBD | TBD | TBD |
| TBD | ≥[48] | 30,60 | ≥[4] | TBD | TBD | TBD | TBD | TBD |
| TBD | ≥132 | ≥[1] | TBD | TBD | TBD | TBD | TBD |
| TBD | -13 | ≥[24] | 15 | ≥[1] | TBD | TBD | TBD | TBD | TBD |
| TBD | ≥[52] | TBD | TBD | TBD | TBD | TBD |
| TBD | >[104] | TBD | TBD | TBD | TBD | TBD |
| TBD | ≥[48] | 30,60 | TBD | TBD | TBD | TBD | TBD |
| TBD | ≥132 | TBD | TBD | TBD | TBD | TBD |
|  | 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]. |

The accuracy requirements in Table 10.1.25.2-2 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.

Table 10.1.25.2-2: UE Rx-Tx time difference measurement accuracy in FR2

|  |  |
| --- | --- |
| Accuracy | Conditions |
| PRS Ês/Iot | Minimum PRS bandwidth | PRS SCS | PRS resource repetitionNote 3 | IoNote 4 range |
| NR operating band groupsNote 2 | MinimumIoNote 1 | MaximumIo |
| TcNote 5 | dB | RB | kHz |  |  | dBm / SCSPRS | dBm/BWChannel |
| SCSPRS = 60 kHz | SCSPRS = 120 kHz |
| TBD | -3 | ≥[24] | 60,120 | ≥[4] | TBD | TBD | TBD | TBD |
| TBD | ≥[64] | ≥[1] | TBD | TBD | TBD | TBD |
| TBD | -13 | ≥[24] | 60,120 | ≥[4] | TBD | TBD | TBD | TBD |
| TBD | ≥[64] | ≥[1] | TBD | TBD | TBD | TBD |
| 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]. |

**--- end of change 4 ---**

**--- start of change 5 ---**

10.1.25.3.1 Absolute UE Rx-Tx Measurement Report Mapping

The reporting range for the absolute UE Rx-Tx time difference measurement (TUE Rx-Tx) is defined from -985024Tc to 985024Tc with the resolution step of 2*k*Tc, where:

Tc is defined in TS 38.211 [6],

*kmin*≤*k*≤*kmax*,

*kmin*=[2] and *kmax*=5, when at least one of the PRS and the SRS resources configured for TUE Rx-Tx is in FR1,

*kmin*=0 and *kmax*=5, when both PRS and SRS resources configured for TUE Rx-Tx are in FR2,

*k≥* *timingReportingGranularityFactor* [34] configured by LMF via LPP for the UE Rx-Tx time difference measurement.

The TUE Rx-Tx report mapping for *k* = 0, 1, 2, 3, 4, and 5 are specified in Tables 10.1.25.3.1-1, 10.1.25.3.1-2, 10.1.25.3.1-3, 10.1.25.3.1-4, 10.1.25.3.1-5, and 10.1.25.3.1-6, respectively.

**Table 10.1.25.3.1-1: Absolute UE Rx-Tx time difference measurement report mapping for *k*=0**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| RX-TX\_TIME\_DIFFERENCE\_0000 | TUE Rx-Tx < -985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0001 | -985024  TUE Rx-Tx < -985023 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0002 | -985023  TUE Rx-Tx < -985022 | Tc |
|  |  | … |
| RX-TX\_TIME\_DIFFERENCE\_985024 | -1  TUE Rx-Tx < 0 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_985025 | 0  TUE Rx-Tx < 1 | Tc |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_1970047 | 985022  TUE Rx-Tx < 985023 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_1970048 | 985023  TUE Rx-Tx < 985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_1970049 | 985024  TUE Rx-Tx | Tc |

**Table 10.1.25.3.1-2: Absolute UE Rx-Tx time difference measurement report mapping for *k*=1**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| RX-TX\_TIME\_DIFFERENCE\_0000 | TUE Rx-Tx < -985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0001 | -985024  TUE Rx-Tx < -985022 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0002 | -985022  TUE Rx-Tx < -985020 | Tc |
|  |  | … |
| RX-TX\_TIME\_DIFFERENCE\_492512 | -2  TUE Rx-Tx < 0 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_492513 | 0  TUE Rx-Tx < 2 | Tc |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_985023 | 985020  TUE Rx-Tx < 985022 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_985024 | 985022  TUE Rx-Tx < 985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_985025 | 985024  TUE Rx-Tx | Tc |

**Table 10.1.25.3.1-3: Absolute UE Rx-Tx time difference measurement report mapping for *k*=2**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| RX-TX\_TIME\_DIFFERENCE\_0000 | TUE Rx-Tx < -985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0001 | -985024  TUE Rx-Tx < -985020 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0002 | -985020  TUE Rx-Tx < -985016 | Tc |
|  |  | … |
| RX-TX\_TIME\_DIFFERENCE\_246256 | -4  TUE Rx-Tx < 0 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_246257 | 0  TUE Rx-Tx < 4 | Tc |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_492511 | 985016  TUE Rx-Tx < 985020 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_492512 | 985020  TUE Rx-Tx < 985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_492513 | 985024  TUE Rx-Tx | Tc |

**Table 10.1.25.3.1-4: Absolute UE Rx-Tx time difference measurement report mapping for *k*=3**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| RX-TX\_TIME\_DIFFERENCE\_0000 | TUE Rx-Tx < -985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0001 | -985024  TUE Rx-Tx < -985016 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0002 | -985016  TUE Rx-Tx < -985008 | Tc |
|  |  | … |
| RX-TX\_TIME\_DIFFERENCE\_123128 | -8  TUE Rx-Tx < 0 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_123129 | 0  TUE Rx-Tx < 8 | Tc |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_246255 | 985008  TUE Rx-Tx < 985016 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_246256 | 985016  TUE Rx-Tx < 985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_246257 | 985024  TUE Rx-Tx | Tc |

**Table 10.1.25.3.1-5: Absolute UE Rx-Tx time difference measurement report mapping for *k*=4**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| RX-TX\_TIME\_DIFFERENCE\_0000 | TUE Rx-Tx < -985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0001 | -985024  TUE Rx-Tx < -985008 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0002 | -985008  TUE Rx-Tx < -984992 | Tc |
|  |  | … |
| RX-TX\_TIME\_DIFFERENCE\_61564 | -16  TUE Rx-Tx < 0 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_61565 | 0  TUE Rx-Tx < 16 | Tc |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_123127 | 984992  TUE Rx-Tx < 985008 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_123128 | 985008  TUE Rx-Tx < 985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_123129 | 985024  TUE Rx-Tx | Tc |

**Table 10.1.25.3.1-6: Absolute UE Rx-Tx time difference measurement report mapping for *k*=5**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| RX-TX\_TIME\_DIFFERENCE\_0000 | TUE Rx-Tx < -985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0001 | -985024  TUE Rx-Tx < -984992 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_0002 | -984992  TUE Rx-Tx < -984960 | Tc |
|  |  | … |
| RX-TX\_TIME\_DIFFERENCE\_30782 | -32  TUE Rx-Tx < 0 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_30783 | 0  TUE Rx-Tx < 32 | Tc |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_61563 | 984960  TUE Rx-Tx < 984992 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_61564 | 984992  TUE Rx-Tx < 985024 | Tc |
| RX-TX\_TIME\_DIFFERENCE\_61565 | 985024  TUE Rx-Tx | Tc |

10.1.25.3.2 Differential UE Rx-Tx Measurement Report Mapping

The reporting range for differential UE Rx-Tx time difference measurement (TUE Rx-Tx) is defined from 0 up to 8191Tc where:

TUE Rx-Tx = TUE Rx-Tx1 - TUE Rx-Tx2; where:

TUE Rx-Tx1 > TUE Rx-Tx2,

TUE Rx-Tx1 is the first absolute UE Rx-Tx time difference measurement,

TUE Rx-Tx1 is the second absolute UE Rx-Tx time difference measurement,

Tc is defined in TS 38.211 [6],

*kmin*≤*k*≤*kmax*,

*kmin*=[2] and *kmax*=5, when at least one of the PRS and the SRS resources configured for TUE Rx-Tx is in FR1,

*kmin*=0 and *kmax*=5, when all the PRS and SRS resources configured for TUE Rx-Tx are in FR2,

*k≥* *timingReportingGranularityFactor* [34] configured by LMF via LPP for the UE Rx-Tx time difference measurement.

The TUE Rx-Tx report mapping for *k* = 0, 1, 2, 3, 4, and 5 are specified in Tables 10.1.25.3.2-1, 10.1.25.3.2-2, 10.1.25.3.2-3, 10.1.25.3.2-4, 10.1.25.3.2-5, and 10.1.25.3.2-6, respectively.

**Table 10.1.25.3.2-1: Differential UE Rx-Tx time difference measurement report mapping for *k*=0**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0000 | 0  TUE Rx-Tx < 1 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0001 | 1  TUE Rx-Tx < 2 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0002 | 2  TUE Rx-Tx < 3 | Tc |
|  |  | … |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_8189 | 8189  TUE Rx-Tx < 8190 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_8190 | 8190  TUE Rx-Tx < 8191 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_8191 | 8191  TUE Rx-Tx | Tc |

**Table 10.1.25.3.2-2: Differential UE Rx-Tx time difference measurement report mapping for *k*=1**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0000 | 0  TUE Rx-Tx < 2 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0001 | 2  TUE Rx-Tx < 4 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0002 | 4  TUE Rx-Tx < 6 | Tc |
|  |  | … |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_4093 | 8186  TUE Rx-Tx < 8188 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_4094 | 8188  TUE Rx-Tx < 8190 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_4095 | 8190  TUE Rx-Tx | Tc |

**Table 10.1.25.3.2-3: Differential UE Rx-Tx time difference measurement report mapping for *k*=2**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0000 | 0  TUE Rx-Tx < 4 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0001 | 4  TUE Rx-Tx < 8 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0002 | 8  TUE Rx-Tx < 12 | Tc |
|  |  | … |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_2045 | 8180  TUE Rx-Tx < 8184 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_2046 | 8184  TUE Rx-Tx < 8188 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_2047 | 8188  TUE Rx-Tx | Tc |

**Table 10.1.25.3.2-4: Differential UE Rx-Tx time difference measurement report mapping for *k*=3**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0000 | 0  TUE Rx-Tx < 8 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0001 | 8  TUE Rx-Tx < 16 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0002 | 16  TUE Rx-Tx < 24 | Tc |
|  |  | … |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_1021 | 8168  TUE Rx-Tx < 8176 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_1022 | 8176  TUE Rx-Tx < 8184 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_1023 | 8184  TUE Rx-Tx | Tc |

**Table 10.1.25.3.2-5: Differential UE Rx-Tx time difference measurement report mapping for *k*=4**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0000 | 0  TUE Rx-Tx < 16 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0001 | 16  TUE Rx-Tx < 32 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0002 | 32  TUE Rx-Tx < 48 | Tc |
|  |  | … |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_509 | 8144  TUE Rx-Tx < 8160 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_510 | 8160  TUE Rx-Tx < 8176 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_511 | 8176  TUE Rx-Tx | Tc |

**Table 10.1.25.3.2-6: Differential UE Rx-Tx time difference measurement report mapping for *k*=5**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value** | **Measured Quantity Value** | **Unit** |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0000 | 0  TUE Rx-Tx < 32 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0001 | 32  TUE Rx-Tx < 64 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_0002 | 64  TUE Rx-Tx < 96 | Tc |
|  |  | … |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_253 | 8096  TUE Rx-Tx < 8128 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_254 | 8128  TUE Rx-Tx < 8160 | Tc |
| DIFF\_RX-TX\_TIME\_DIFFERENCE\_255 | 8160  TUE Rx-Tx | Tc |

10.1.25.3.3 Additional Path Report Mapping for UE Rx-Tx Time Difference

The reporting range for the additional path reporting for an UE Rx-Tx time difference measurement is defined up to the range from -8175×Tc to 8175×Tc with the resolution step of 2*k*×Tc, where

Tc is defined in TS 38.211 [6],

*kmin*≤*k*≤*kmax*,

*kmin*=[2] and *kmax*=5, when at least one of the PRS resource and SRS resource configured for the UE Rx-Tx time difference measurement is in FR1,

*kmin*=0 and *kmax*=5, when both of the PRS resource and SRS resource configured for the UE Rx-Tx time difference measurement is in FR2,

*k≥* *timingReportingGranularityFactor* [34] configured by LMF via LPP for the UE Rx-Tx time difference measurement.

The UE can report the timing of up to two additional paths with respect to the path timing determining the UE Rx-Tx time difference measurement.

The report mappings for different *k* values are specified in Tables 10.1.25.3.3-1 − 10.1.25.3.3-6.

**Table 10.1.25.3.3-1: Report mapping for *k*=0**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value,****path\_i** | **Measured Quantity Value,****Δpath** | **Unit** |
|
| path\_00000 | Δpath < -8175 | Tc |
| path\_00001 | -8175 ≤ Δpath < -8174 | Tc |
| path\_00002 | -8174 ≤ Δpath < -8173 | Tc |
| … | … | … |
| path\_08175 | -1 ≤ Δpath < 0 | Tc |
| path\_08176 | 0 ≤ Δpath < 1 | Tc |
| … | … | … |
| path\_ 16349 | 8173 ≤ Δpath < 8174 | Tc |
| path\_ 16350 | 8174 ≤ Δpath < 8175 | Tc |
| path\_ 16351 | 8175 ≤ Δpath | Tc |

**Table 10.1.25.3.3-2: Report mapping for *k*=1**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value,****path\_i** | **Measured Quantity Value,****Δpath** | **Unit** |
| path\_0000 | Δpath < -8175 | Tc |
| path\_0001 | -8175 ≤ Δpath < -8173 | Tc |
| path\_0002 | -8173 ≤ Δpath < -8171 | Tc |
| … | … | … |
| path\_4088 | -1 ≤ Δpath < 1 | Tc |
| … | … | … |
| path\_8174 | 8171 ≤ Δpath < 8173 | Tc |
| path\_8175 | 8173 ≤ Δpath < 8175 | Tc |
| path\_8176 | 8175 ≤ Δpath | Tc |

**Table 10.1.25.3.3-3: Report mapping for *k*=2**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value,****path\_i** | **Measured Quantity Value,****Δpath** | **Unit** |
| path\_0000 | Δpath < -8174 | Tc |
| path\_0001 | -8174 ≤ Δpath < -8170 | Tc |
| path\_0002 | -8170 ≤ Δpath < -8166 | Tc |
| … | … | … |
| path\_2044 | -2 ≤ Δpath < 2 | Tc |
| … | … | … |
| path\_4086 | 8166 ≤ Δpath < 8170 | Tc |
| path\_4087 | 8170 ≤ Δpath < 8174 | Tc |
| path\_4088 | 8174 ≤ Δpath | Tc |

**Table 10.1.25.3.3-4: Report mapping for *k*=3**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value,****path\_i** | **Measured Quantity Value,****Δpath** | **Unit** |
| path\_0000 | Δpath < -8172 | Tc |
| path\_0001 | -8172 ≤ Δpath < -8164 | Tc |
| path\_0002 | -8164 ≤ Δpath < -8156 | Tc |
| … | … | … |
| path\_1022 | -4 ≤ Δpath < 4 | Tc |
| … | … | … |
| path\_2042 | 8156 ≤ Δpath < 8164 | Tc |
| path\_2043 | 8164 ≤ Δpath < 8172 | Tc |
| path\_2044 | 8172 ≤ Δpath | Tc |

**Table 10.1.25.3.3-5: Report mapping for *k*=4**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value,****path\_i** | **Measured Quantity Value,****Δpath** | **Unit** |
| path\_0000 | Δpath < -8168 | Tc |
| path\_0001 | -8168 ≤ Δpath < -8152 | Tc |
| path\_0002 | -8152 ≤ Δpath < -8136 | Tc |
| … | … | … |
| path\_511 | -8 ≤ Δpath < 8 | Tc |
| … | … | … |
| path\_1020 | 8136 ≤ Δpath < 8152 | Tc |
| path\_1021 | 8152 ≤ Δpath < 8168 | Tc |
| path\_1022 | 8168 ≤ Δpath | Tc |

**Table 10.1.25.3.3-6: Report mapping for *k*=5**

|  |  |  |
| --- | --- | --- |
| **Reported Quantity Value,****path\_i** | **Measured Quantity Value,****Δpath** | **Unit** |
| path\_000 | Δpath < -8160 | Tc |
| path\_001 | -8160 ≤ Δpath < -8128 | Tc |
| path\_002 | -8128 ≤ Δpath < -8096 | Tc |
| … | … | … |
| path\_256 | 0 ≤ Δpath < 32 | Tc |
| … | … | … |
| path\_509 | 8096 ≤ Δpath < 8128 | Tc |
| path\_510 | 8128 ≤ Δpath < 8160 | Tc |
| path\_511 | 8160 ≤ Δpath | Tc |

**--- end of change 5 ---**

**--- start of change 6 ---**

### 13.2.2 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.

#### 13.2.2.2 Requirements

The accuracy requirements in Table 13.2.2.2-1, Table 13.2.2.2-2, Table 13.2.2.2-3 and Table 13.2.2.2-4 are valid under the following conditions:

- AWGN propagation conditions.

*Editor’s note: further conditions are FFS.*

*Editor’s note: The needed number of bandwidth ranges for which specific gNB Rx-Tx time difference measurement accuracy apply for given Ês/Iot side condition is FFS*

*Editor’s note: The dependency of gNB Rx-Tx time difference measurement accuracy on SRS CombSize and SRS SymbolSize is FFS and shall be captured in an updated version of following tables if needed.*

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Accuracy** | **SRS Ês/Iot** | **SCS** | **SRS bandwidth range** |
| **Unit: Tc** | **Unit: dB** | **Unit: kHz** | **Unit: RB** |
| TBD | ≥ -13 | 15 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ -13 | 30 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ -13 | 60 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |

**Table 13.2.2.2-2: gNB Rx-Tx time difference absolute accuracy in FR1 for gNB type 1-H**

|  |  |  |  |
| --- | --- | --- | --- |
| **Accuracy** | **SRS Ês/Iot** | **SCS** | **SRS bandwidth range** |
| **Unit: Tc** | **Unit: dB** | **Unit: kHz** | **Unit: RB** |
| TBD | ≥ -13 | 15 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ -13 | 30 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ -13 | 60 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |

**Table 13.2.2.2-3: gNB Rx-Tx time difference absolute accuracy in FR1 for gNB type 1-O**

|  |  |  |  |
| --- | --- | --- | --- |
| **Accuracy** | **SRS Ês/Iot** | **SCS** | **SRS bandwidth range** |
| **Unit: Tc** | **Unit: dB** | **Unit: kHz** | **Unit: RB** |
| TBD | ≥ -13 | 15 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ -13 | 30 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ -13 | 60 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |

**Table 13.2.2.2-4: 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** |
| TBD | ≥ -13 | 60 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ -13 | 120 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |

**--- end of change 6 ---**

**--- start of change 7 ---**

### 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.

#### 13.3.2.2 Requirements

The accuracy requirements in Table 13.3.2.2-1, Table 13.3.2.2-2, Table 13.3.2.2-3 and Table 13.3.2.2-4 are valid under the following conditions:

* AWGN propagation conditions.

*Editor’s note: further conditions are FFS.*

*Editor’s note: SRS bandwidth is TBD. The needed number of bandwidth ranges for which specific SRS-RSRP measurement accuracy apply for given Ês/Iot side condition is FFS*

*Editor’s note: The dependency of SRS-RSRP measurement accuracy on SRS CombSize and SRS SymbolSize is FFS and shall be captured in an updated version of following tables if needed.*Table 13.3.2.2-1 gNB SRS-RSRP absolute accuracy requirements in FR1 type 1-C

|  |  |
| --- | --- |
| Accuracy | Conditions |
| SRS Ês/Iot | SRS bandwidth range |
|
| dB | dB | RB |
| TBD | Ês/Iot ≥ -13 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | Ês/Iot ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |

Table 13.3.2.2-2 gNB SRS-RSRP absolute accuracy requirements in FR1 type 1-H

|  |  |
| --- | --- |
| Accuracy | Conditions |
| SRS Ês/Iot | SRS bandwidth range |
|
| dB | dB | RB |
| TBD | Ês/Iot ≥ -13 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | Ês/Iot ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |

Table 13.3.2.2-3 gNB SRS-RSRP absolute accuracy requirements in FR1 type 1-O

|  |  |
| --- | --- |
| Accuracy | Conditions |
| SRS Ês/Iot | SRS bandwidth range |
|
| dB | dB | RB |
| TBD | Ês/Iot ≥ -13 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | Ês/Iot ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |

Table 13.3.2.2-4 gNB SRS-RSRP absolute accuracy requirements in FR2 type 2-O

|  |  |
| --- | --- |
| Accuracy | Conditions |
| SRS Ês/Iot | SRS bandwidth range |
|
| dB | dB | RB |
| TBD | Ês/Iot ≥ -13 | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | Ês/Iot ≥ +3 | TBD |
| TBD | TBD |
| TBD | TBD |

**--- end of change 7 ---**

**--- start of change 8 ---**

### A.3.x PRS Configurations

A.3.x.1. PRS Configurations for FR1

A.3.x.1.1. PRS pattern 1 in FR1: SCS=15 KHz in 10 MHz

**Table A.3.x.1.1 -1: PRS.1 FR1: PRS Pattern 1 for SSB SCS=15 KHz in 10 MHz channel**

|  |  |
| --- | --- |
| **PRS Parameters** | **Values** |
| Reference channel | **PRS.1.1 FR1** | **PRS.1.2 FR1** |
| Channel bandwidth | 10 MHz |
| PRS periodicity | 160 ms |
| PRS Resourceset slot offset | 10 ms Note 1 |
| PRS Resource slot offset (slot) | 0 Note 1 | 4 Note 1 |
| PRS RE offset | 0 |
| SCS | 15 KHz |
| PRS comb size | [2 ] | [4 ] |
| Number of PRS symbol | [4 ] | [4 ] |
| Repetion factor  | [1 ] | [4 ] |
| RB numbers containing PRS within channel BW | 0-23 | 0~51 |
| PRS Start PRB | 0 |
| Note 1: Unless otherwise specified in the test case |

A.3.x.1.2. PRS pattern 2 in FR1: SCS=30 KHz in 50 MHz

**Table A.3.x.1.2 -1: PRS.2 FR1: PRS Pattern 2 for SCS=30 KHz in 50 MHz channel**

|  |  |
| --- | --- |
| **PRS Parameters** | **Values** |
| Reference channel | **PRS.2.1 FR1** | **PRS.2.2 FR1** |
| Channel bandwidth | 50 MHz |
| PRS periodicity | 80 ms |
| PRS Resourceset slot offset | 10 ms |
| PRS Resource slot offset (slot) | 0 | 4 |
| PRS RE offset | 0 |
| SCS | 30 KHz |  |
| PRS comb size | [2 ] | [4 ] |
| Number of PRS symbol | [2 ] | [4 ] |
| Repetion factor  | [4 ] | [1 ] |
| RB numbers containing PRS within channel BW | 0-23 | 0~131 |
| PRS Start PRB | 0 |
| Note 1: Unless otherwise specified in the test case |

A.3.x.2. PRS Configurations for FR2

A.3.x.2.1. PRS pattern 1 in FR2: SCS=120 KHz in 100 MHz

**Table A.3.x.2.1 -1: PRS.1 FR2: PRS Pattern 1 for SCS=120 KHz in 100 MHz channel**

|  |  |
| --- | --- |
| **PRS Parameters** | **Values** |
| Reference channel | **PRS.1.1 FR2** | **PRS.1.2 FR2** |
| Channel bandwidth | 100 MHz |
| PRS periodicity | 160 ms |
| PRS Resourceset slot offset | 10 ms Note 1 |
| PRS Resource slot offset (slot) | 0 Note 1 | 4 Note 1 |
| PRS RE offset | 0 |
| SCS | 120 KHz |
| PRS comb size | [2 ] | [4 ] |
| Number of PRS symbol | [4 ] | [4 ] |
| Repetion factor  | [2 ] | [1 ] |
| RB numbers containing PRS within channel BW | 0-23 | 0-63 |
| PRS Start PRB | 0 |
| Note 1: Unless otherwise specified in the test case |

**--- end of change 8 ---**

**--- start of change 9 ---**

# A.6 NR standalone tests with all NR cells in FR1

**--- unchanged clauses ---**

## A.6.6 Measurement procedure

**--- unchanged clauses ---**

### A.6.6.7 RSTD measurements

### A.6.6.8 PRS-RSRP measurements

### A.6.6.9 UE Rx-Tx time difference measurements

## A.6.7 Measurement Performance requirements

**--- unchanged clauses ---**

### A.6.7.9 RSTD measurements

### A.6.7.10 PRS-RSRP measurements

### A.6.7.11 UE Rx-Tx time difference measurements

# A.7 NR standalone tests with one or more NR cells in FR2

**--- unchanged clauses ---**

## A.7.6 Measurement procedure

**--- unchanged clauses ---**

### A.7.6.5 RSTD measurements

### A.7.6.6 PRS-RSRP measurements

### A.7.6.7 UE Rx-Tx time difference measurements

## A.7.7 Measurement Performance requirements

**--- unchanged clauses ---**

### A.7.7.6 RSTD measurements

### A.7.7.7 PRS-RSRP measurements

### A.7.7.8 UE Rx-Tx time difference measurements

**--- end of change 9 ---**

**--- start of change 10 ---**

## B.2.x Conditions for NR PRS-based measurements

This clause defines the following conditions for NR PRS-based measurements and corresponding procedures performed based on PRS: PRP and PRS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.2.x-1 for FR1 NR cells.

The conditions are defined in Table B.2.x-2 for FR2 NR cells.

Table B.2.x-1: Conditions for NR PRS-based measurements in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | NR operating band groups Note1 | Minimum PRP1,2 | PRS Ês/Iot |
| dBm / SCSPRS | dB |
| SCSPRS = 15 kHz | SCSPRS = 30 kHz | SCSPRS = 60 kHz |
| Conditions | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A, NR\_SDL\_FR1\_A | -127 | -124 | -121 | ≥ -6 Note2≥ -13 Note3 |
| NR\_FDD\_FR1\_B | -126.5 | -123.5 | -120.5 |
| NR\_TDD\_FR1\_C | -126 | -123 | -120 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -125.5 | -122.5 | -119.5 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -125 | -122 | -119 |
| NR\_FDD\_FR1\_F | -124.5 | -121.5 | -118.5 |
| NR\_FDD\_FR1\_G | -124 | -121 | -118 |
| NR\_FDD\_FR1\_H | -123.5 | -120.5 | -117.5 |
| NOTE 1: NR operating band groups are defined in clause 3.5.2.NOTE 2: PRS Ês/Iot for RSTD measurement reference cell PRS resource, FFS for PRS-RSRP and UE Rx-Tx. NOTE 3: PRS Ês/Iot for RSTD measurement neighbor cell PRS resource, FFS for PRS-RSRP and UE Rx-Tx. |

Table B.2.x-2: Conditions for NR PRS-based measurements in FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Angle of arrival | NR operating bands | Minimum PRP1,2 Note 2, Note 3 | PRS Ês/Iot |
| dBm / SCSPRS | dB |
| SCSPRS = 120 kHz | SCSPRS = 60 kHz |
| UE power class | UE power class |
| 1 | 2 | 3 | 4 | 1, 2, 3, 4 |
| **Conditions** | Rx Beam Peak | n257 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 | (Value for SCSPRS = 120 kHz) - 3dB  | ≥ -6 Note4≥ -13 Note5 |
| n258 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 |
| n259 |  |  | -108.5 |  |
| n260 | -125.3+Y1 |  | -109.5 | -125.8+Y4 |
| n261 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 |
| Spherical coverage Note 1 | n257 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 | (Value for SCSPRS = 120 kHz) - 3dB  | ≥ -6 Note4≥ -13 Note5 |
| n258 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 |
| n259 |  |  | -95.7 |  |
| n260 | -117.3+Z1 |  | -96.9 | -113.8+Z4 |
| n261 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 |
| NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.NOTE 2: Values specified at the Reference point to give minimum PRS Ês/Iot, with no applied noise.NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ∆MBP,n and spherical coverage values are increased by ∆MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].NOTE 4: PRS Ês/Iot for RSTD measurement reference cell PRS resource, FFS for PRS-RSRP and UE Rx-Tx.NOTE 5: PRS Ês/Iot for RSTD measurement neighbor cell PRS resource, FFS for PRS-RSRP and UE Rx-Tx. |

*Editor’s notes for Table B.2.x-2:*

*- The value of Y for power classes 1 and 4 is FFS, where Y1 and Y4 are the rough/fine beam gain differences in Rx beam peak direction for power classes 1 and 4 respectively*

*- The value of Z for power classes 1 and 4 is FFS, where Z1 and Z4 are the rough/fine beam gain differences in spherical coverage directions for power classes 1 and 4 respectively*

**--- end of change 10 ---**