**3GPP TSG-RAN4 Meeting #97-e *R4-2017228***

**Electronic Meeting, 2-13 Nov., 2020**

|  |
| --- |
| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **1277** | **rev** | **1** | **Current version:** | **16.5.0** |  |
|  |
| *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)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

|  |
| --- |
|  |
| ***Title:***  | CR on CSI-RS based intra-frequency measurement requirements |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_CSIRS\_L3meas-Core |  | ***Date:*** | 2020-11-09 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories 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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | 1. Based on RAN1’s discussion history, extended CP for CSI-RS based mobility measurement is not supported in Rel-16, so it implies the second condition of CP type comparison for intra-frequency measurement is always satisified in this release. In RAN2 a note is added to clarify this [R2-2007002].2. [R4-2012261] was endorsed at RAN4#96e, however the CR was implemented mixed with positioning in clause 9.9.2.4 and 9.9.2.6. |
|  |  |
| ***Summary of change:*** | 1. Adding a note for CSI-RS based intra-frequency measurement definition in order to allign with RAN2.
2. Implement intra-frequency measurement for CSI-RS correctly
 |
|  |  |
| ***Consequences if not approved:*** | CSI-RS measurement requirements are correct. |
|  |  |
| ***Clauses affected:*** | 9.9, 9.10 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

<Start of Change 1>

### 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 report DL RSTD measurements defined in TS 38.215 [4].

#### 9.9.2.2 Requirements Applicability

The requirements in clause 9.9.2 apply, 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 reported by the UE 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 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 for RSTD.

##### 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 defined further in this clause.

When measurement gaps and processing time T have overlap between different positioning frequency layers, is defined as:

Where ,

 is the index of positioning frequency layer,

 is total number of positioning frequency layers, and is the periodicity of PRS-RSTD measurement in positioning frequency layer i as defined further in this clause.

Editor’s note: FFS the RSTD measurement period when measurement gaps and processing time T do not have overlap between different positioning frequency layers.

 is the measurement period for PRS RSTD measurement in positioning frequency layer 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 the positioning frequency layer *i* as defined in clause 9.1.5.2 as CSSFwithin\_gap,i.

 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,  *= +*  ,

 *=*

*,* the least common multiple between and .

 is the time duration as defined in clause 5.1.6.5 of TS 38.214 [26, 5.1.6.5].

 is the maximum number of DL PRS resources in 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 processed every T ms for a given maximum bandwidth supported by UE as specified in clause 4.2.7.2 of TS 38.306 [14].

 is UE capability for number of DL PRS resources that it can process in a slot as specified in clause 4.2.7.2 of TS 38.306 [14].

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities, the maximum PRS periodicity among DL PRS resource sets is used to derive the measurement period of that positioning frequency layer.

If handover occurs while RSTD measurements are being performed then the UE shall complete the on-going positioning measurement session. The UE shall also meet the RSTD measurement and accuracy requirements. 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 PRS 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 Change 1>

<Start of Change 2>

#### 9.10.2 CSI-RS based intra-frequency measurements

##### 9.10.2.1 Introduction

A measurement is defined as a CSI-RS based intra-frequency measurement provided that:

- the SCS of the CSI-RS resource of the neighbour cell configured for measurement is the same as the SCS of the CSI-RS resource on the serving cell indicated for measurement, and

- the CP type of the CSI-RS resource of neighbour cell configured for measurement is the same as the CP type of the CSI-RS resource of the serving cell indicated for measurement, and

- It is applied for SCS = 60KHzs

- the centre frequency of the CSI-RS resource of the neighbour cell configured for measurement is the same as the centre frequency of the CSI-RS resource of the serving cell indicated for measurement

The UE shall be able to identify new intra-frequency cells and perform CSI-RSRP, CSI-RSRQ and CSI-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell or the PSCell.

Intra-frequency CSI-RS resources are completely contained within the active BWP bandwidth.

No measurement gap is needed for intra-frequency CSI-RS resources measurements.

For intra-frequency CSI-RS based measurements, UE may cause scheduling restriction as specified in clause 9.10.2.5.

Note: Extended CP for CSI-RS based measurement is not supported in this release.

##### 9.10.2.2 Requirements applicability

The associated SSB layer of the CSI-RS follows the same requirements as SSB based measurements defined in 9.2

The requirements in clause 9.10.2 apply, provided:

- Only one intra-frequency CSI-RS layer per serving cell is configured, and

- The BW of the CSI-RS on the intra-frequency neighbor cell is within the active BWP of the UE, and

- The CSI-RS resources and the associated SSB of the cell being identified or measured are detectable.

- The bandwidth of CSI-RS resources of intra-MO is the same as that of the CSI-RS resources configured for the serving cell

An intra-frequency cell shall be considered detectable when for each relevant CSI-RS and associated SSB:

- CSI-RSRP related side conditions given in clauses 10.1.x and 10.1.x for FR1 and FR2, respectively, for a corresponding Band,

- CSI-RSRQ related side conditions given in clauses 10.1.x and 10.1.x for FR1 and FR2, respectively, for a corresponding Band,

- CSI-SINR related side conditions given in clauses 10.1.x and 10.1.x for FR1 and FR2, respectively, for a corresponding Band,

- CSI\_RP and CSI-RS Ês/Iot according to Annex B.2.x for a corresponding Band.

SS-RSRP related side conditions given in clauses 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding Band,

- SS-RSRQ related side conditions given in clauses 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding Band,

- SS-SINR related side conditions given in clauses 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding Band,

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

##### 9.10.2.3 Number of cells and number of CSI-RS

9.10.2.3.1 Requirements for FR1

For each intra-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 32 CSI-RSs with different CSI-RS index and/or PCI on the intra-frequency layer, and

- the cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB

9.10.2.3.2 Requirements for FR2

For one single intra-frequency CSI-RS layer in a band, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 32 CSI-RSs with different CSI-RS index and/or PCI, and

- the cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB.

where this single intra-frequency layer shall be:

- PCC on which UE is configured to report CSI-RS measurement when UE is configured with SA NR operation mode with PCC in the band; or

- PSCC on which UE is configured to report CSI-RS measurement when UE is configured with EN-DC with PSCC in the band; or

- One of the SCCs on which UE is configured to report CSI-RS based measurements when neither PCC nor PSCC is in the same band, so that the selected SCC shall be an SCC where the UE is configured with CSI-RSRP measurement reporting if such SCC exists, otherwise the selected SCC is determined by UE implementation.

The UE shall also be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least 2 CSI-RSs on serving cell for each of the other intra-frequency layer(s) in the same band.

For each FR2 band, UE is only required to measure neighbour cell CSI-RS on the CSI-RS layer, whose associated SSB should be on the same SSB layer as the one where UE is required to measure neighbour cell SSB.

##### 9.10.2.4 Measurement Reporting Requirements

###### 9.10.2.4.1 Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.

###### 9.10.2.4.2 Event-triggered Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.9.2.4.3.

###### 9.10.2.4.3 Event Triggered Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI- SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.

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

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

The event triggered measurement reporting delay, measured without L3 filtering shall be less than the CSI-RS based measurement defined in clause 9.10.2.5. When L3 filtering is used an additional delay can be expected.

##### 9.10.2.5 Intra-frequency measurements without measurement gaps

If a UE is configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB*, the CSI-RS based measurement shall include PSS/SSS detection time of associatedSSB, the time period used to acquire the SFN information and CSI-RS based measurement period without gap.

PSS/SSS detection time of associatedSSB is the intra-frequency TPSS/SSS\_sync\_intra in Clause 9.2.5.1. If the associatedSSB is already detected, the time period is equal to 0.

The time period used to acquire the SFN information is intra-frequency TSSB\_time\_index\_intra in Clause 9.2.5.1 or in clause 9.2.6.2 or inter-frequency TSSB\_time\_index\_inter in clause 9.3.4. If the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled), the time period is equal to 0. It is assumed that deriveSSB-IndexFromCell is always enabled for FR1 TDD and FR2.

The measurement period for intrafrequency measurements without gaps is as shown in table 9.10.2.5-1, Table 9.10.2.5-2.

Additionally, for a given CSI-RS resource, if the associated SS/PBCH block is configured but not detected by the UE, or if CSI-RS configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10.2.5-1: Measurement period for intrafrequency CSI-RS based measurements without gaps(Frequency FR1)

|  |  |
| --- | --- |
| DRX cycle | T CSI-RS\_measurement\_period\_intra  |
| No DRX | max(200ms, ceil( [5] x Kp) x CSI-RS period) x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x [5] x Kp) x max(CSI-RS period, DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil( [5] x Kp ) x DRX cycle x CSSFintra |
| NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS38.211 [6]. |

Table 9.10.2.5-2: Measurement period for intrafrequency CSI-RS based measurements without gaps(Frequency FR2)

|  |  |
| --- | --- |
| DRX cycle | T CSI-RS\_measurement\_period\_intra  |
| No DRX | max(400ms, ceil(Mmeas\_period\_w/o\_gaps x Kp) x CSI-RS period) x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5x Mmeas\_period\_w/o\_gaps x Kp) x max(CSI-RS period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Mmeas\_period\_w/o\_gaps x DRX cycle x CSSFintra |
| NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS38.211 [6]. |

Mmeas\_period\_w/o\_gaps : For a UE supporting power class 1, Mmeas\_period\_w/o\_gaps =[40]. For a UE supporting FR2 power class 2, Mmeas\_period\_w/o\_gaps =[24]. For a UE supporting power class 3, Mmeas\_period\_w/o\_gaps =[24]. For a UE supporting power class 4, Mmeas\_period\_w/o\_gaps =[24].

CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause 9.1.5.

 If any CSI-RS resource in the CSI-RS MO is fully overlapping with gap, then the CSI-RS MO shall be measured within gap, otherwise,

- if intra-frequency CSI-RS resource is fully non overlapping with measurement gaps, Kp=1;

- if intra-frequency CSI-RS resource is partially overlapping with measurement gaps, Kp = 1/(1- (CSI-RS resource period /MGRP)).

<End of Change 2>