3GPP TSG-RAN WG3 Meeting #121 R3-234327

Toulouse, France, 21 - 25 August 2023

**Agenda item: 23.2.3**

**Source: Nokia, Nokia Shanghai Bell, Ericsson, Huawei**

**Title: (TP for TS 38.455 BL CR) UL Carrier phase positioning**

**Document for: Other**

# 1 Introduction

The latest version of the WID on Expanded and Improved NR Positioning was approved by RAN plenary in [1], and includes the following objectives:

# Annex A: Text Proposal for TS 38.455

*Start of modifications*

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

ARP Antenna Reference Point

BDS BeiDou Navigation Satellite System

CG-SDT Configured Grant Small Data Transmission

CID Cell-ID (positioning method)

DL-PRS Downlink Positioning Reference Signal

E-CID Enhanced Cell-ID (positioning method)

EGNOS European Geostationary Navigation Overlay Service

GAGAN GPS Aided Geo Augmented Navigation

GLONASS GLObal'naya NAvigatsionnaya Sputnikovaya Sistema (Engl.: Global Navigation Satellite System

GNSS Global Navigation Satellite System

GPS Global Positioning System

LMF Location Management Function

LPP LTE Positioning Protocol

MSAS Multi-functional Satellite Augmentation System

NavIC NAVigation with Indian Constellation

NRPPa NR Positioning Protocol A

OTDOA Observed Time Difference of Arrival

posSIB Positioning SIB

PRS Positioning Reference Signal (for E-UTRA)

QZSS Quasi-Zenith Satellite System

RSRP Reference Signal Received Power

RSSI Received Signal Strength Indicator

RSTD Reference Signal Time Difference

SBAS Space Based Augmentation System

SRS Sounding Reference Signal

TEG Timing Error group

TRP Transmission-Reception Point

UE User Equipment

UL-AoA Uplink Angle of Arrival

UL-RTOA Uplink Relative Time of Arrival

UL-SRS Uplink Sounding Reference Signal

UL SRS-RSRPP UL SRS reference signal received path power

UL-RSCP UL Reference Signal Carrier Phase

WAAS Wide Area Augmentation System

Z-AoA Zenith Angles of Arrival

*next modification*

### 8.2.6 Positioning Information Exchange

#### 8.2.6.1 General

The Positioning Information Exchange procedure is initiated by the LMF to request to the NG-RAN node positioning information for the UE. This procedure applies only if the NG-RAN node is a gNB.

#### 8.2.6.2 Successful Operation



Figure 8.2.6.2-1: Positioning Information Exchange procedure, successful operation

The LMF initiates the procedure by sending a POSITIONING INFORMATION REQUEST message to the NG-RAN node.

If the *Requested SRS Transmission Characteristics* IE is included in the POSITIONING INFORMATION REQUEST message, the NG-RAN node may take this information into account when configuring SRS transmissions for the UE, and it shall include the *SRS Configuration* IE and the *SFN Initialisation Time* IE in the POSITIONING INFORMATION RESPONSE message.

If the *Spatial Relation Information per SRS Resource* IE and the *Periodicity List* IE are both included in the *Requested SRS Transmission Characteristics* IE, the NG-RAN node shall consider that the *Spatial Relation per SRS Resource Item* IE and the *Periodicity List Item* IE have one-to-one mapping relation.

If the *UE Reporting Information* IE is included in the POSITIONING INFORMATION REQUEST message, the NG-RAN node may take this information into account for allocating proper CG-SDT resources when positioning a UE.

If the *UE TEG Information Request* IE is included in the POSITIONING INFORMATION REQUEST message and set to "onDemand", the NG-RAN node shall, if supported, provide the UE Tx TEG association in the POSITIONING INFORMATION RESPONSE message.

If the *UE TEG Information Request* IE is set to "periodic", the NG-RAN node shall, if supported, reply with the POSITIONING INFORMATION RESPONSE message without including any UE Tx TEG association in this message. The NG-RAN node shall then take the *UE TEG Reporting Periodicity* IE into account when configuring the UE’s periodic UE Tx TEG association reporting and initiate the Positioning Information Update procedure for reporting the UE Tx TEG association received from the UE, if any.

If the *Time Window Information for SRS* IE is included in the POSITIONING INFORMATION REQUEST message, the NG-RAN node shall, if supported, configure the UE to start transmitting its UL SRS transmission at the indicated time instance.

*next modification*

#### 9.1.1.10 POSITIONING INFORMATION REQUEST

This message is sent by the LMF to request positioning information.

Direction: LMF → NG-RAN node.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
| Message Type | M |  | 9.2.3 |  | YES | reject |
| NRPPa Transaction ID | M |  | 9.2.4 |  | - |  |
| Requested SRS Transmission Characteristics | O |  | 9.2.27 |  | YES | ignore |
| UE Reporting Information | O |  | 9.2.70 |  | YES | ignore |
| UE TEG Information Request | O |  | ENUMERATED(onDemand, periodic, stop, …) |  | YES | ignore |
| UE TEG Reporting Periodicity | C-ifUeTegInfoReqPeriodic |  | ENUMERATED (160ms, 320ms, 1280ms, 2560ms, 61440ms, 81920ms, 368640ms, 737280ms, …) |  | YES | reject |
| Time Window Information for SRS (FFS) | O |  | 9.2.x1 |  | YES | Reject |

|  |  |
| --- | --- |
| Condition | Explanation |
| ifUeTegInfoReqPeriodic | This IE shall be present if the *UE TEG Information Request* IE is set to the value "periodic". |

*next modification*

#### 9.1.4.1 MEASUREMENT REQUEST

This message is sent by the LMF to request the NG-RAN node to configure a positioning measurement.

Direction: LMF → NG-RAN node.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
| Message Type | M |  | 9.2.3 |  | YES | reject |
| NRPPa Transaction ID | M |  | 9.2.4 |  | - |  |
| LMF Measurement ID | M |  | INTEGER (1..65536, …) |  | YES | reject |
| **TRP Measurement Request List** |  | *1* |  |  | YES | reject |
| **>TRP Measurement Request Item** |  | *1..<maxnoofMeasTRPs>* |  |  | EACH | reject |
| >>TRP ID | M |  | 9.2.24 |  | - |  |
| >>Search Window Information | O |  | 9.2.26 |  | - |  |
| >>Cell ID | O |  | NR CGI  9.2.9 | The Cell ID of the TRP identified by the *TRP ID* IE. | YES | ignore |
| >>AoA Search Window Information | O |  | UL-AoA Assistance Information 9.2.66 |  | YES | ignore |
| >>Number of TRP Rx TEGs | O |  | ENUMERATED (2, 3, 4, 6, 8, …) |  | YES | ignore |
| >>Number of TRP RxTx TEGs | O |  | ENUMERATED (2, 3, 4, 6, 8, …) |  | YES | ignore |
| Report Characteristics | M |  | ENUMERATED (OnDemand, Periodic, ...) |  | YES | reject |
| Measurement Periodicity | C-ifReportCharacteristicsPeriodic |  | ENUMERATED (120ms, 240ms, 480ms, 640ms, 1024ms, 2048ms, 5120ms, 10240ms, 1min, 6min, 12min, 30min, 60min,…, 20480ms, 40960ms, extended) | The codepoint 120ms, 240ms, 480ms, 1024ms, 2048ms, 1min, 6min, 12min, 30min, and 60min are not applicable | YES | reject |
| **TRP Measurement Quantities** |  | *1* |  |  | YES | reject |
| **>TRP Measurement Quantities Item** |  | *1 .. <maxnoPosMeas>* |  |  | EACH | reject |
| >TRP Measurement Type | M |  | ENUMERATED (gNB-RxTxTimeDiff, UL-SRS-RSRP, UL-AoA, UL-RTOA,…, Multiple UL-AoA, UL SRS-RSRPP, UL-RSCP) |  | - |  |
| >Timing Reporting Granularity Factor | O |  | INTEGER (0..5) | Value (0..5) corresponds to (k0..k5)  TS 38.133 [16] | - |  |
| SFN initialisation Time | O |  | Relative Time 1900  9.2.36 | If this IE is not present, the TRP may assume that the value is same as its own SFN initialisation time. | YES | ignore |
| SRS Configuration | O |  | 9.2.28 |  | YES | ignore |
| Measurement Beam Information Request | O |  | ENUMERATED (true,...) | This IE is ignored when the *Measurement Characteristics Request Indicator* IE is included. | YES | ignore |
| System Frame Number | O |  | INTEGER(0..1023) |  | YES | ignore |
| Slot Number | O |  | INTEGER(0..79) |  | YES | ignore |
| Measurement Periodicity Extended | C-ifMeasPerExt |  | ENUMERATED (160ms, 320ms, 1280ms, 2560ms, 61440ms, 81920ms, 368640ms, 737280ms, 1843200ms, …) |  | YES | reject |
| Response Time | O |  | 9.2.68 | This IE is ignored when the *Report Characteristics* IE is set to “periodic”. | YES | ignore |
| Measurement Characteristics Request Indicator | O |  | 9.2.81 |  | YES | ignore |
| Measurement Time Occasion | O |  | ENUMERATED (o1, o4, …) |  | YES | ignore |
| Measurement Amount | O |  | ENUMERATED (0, 1, 2, 4, 8, 16, 32, 64) | This IE is ignored if the *Report Characteristics* IE is set to ‘OnDemand’.  Value 0 represents an infinite number of periodic reporting. | YES | ignore |
| Time Window Information for Measurement (FFS) | O |  | 9.2.x2 |  | YES | ignore |

|  |  |
| --- | --- |
| Condition | Explanation |
| ifReportCharacteristicsPeriodic | This IE shall be present if the *Report Characteristics* IE is set to the value "Periodic". |
| ifMeasPerExt | This IE shall be present if the *Measurement Periodicity* IE is set to the value "extended". |

Editor’s Note: It is FFS if a Time Window Information for Measurement is needed, or if the existing SFN Initialisation Time (System Frame Number and Slot Number) can be re-used.

|  |  |
| --- | --- |
| Range bound | Explanation |
| maxnoPosMeas | Maximum no. of measured quantities that can be configured and reported with one positioning measurement message. Value is 16384. |
| maxnoofMeasTRPs | Maximum no. of TRPs that can be included within one message. Value is 64. |

*next modification*

### 9.2.37 TRP Measurement Result

This information element contains the measurement result.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description | Criticality | Assigned Criticality |
| **Measured Result Item** |  | *1 .. <maxnoPosMeas>* |  |  |  |  |
| >CHOICE *Measured Results Value* | M |  |  |  |  |  |
| >>UL Angle of Arrival | M |  | 9.2.38 |  | - |  |
| >>UL SRS-RSRP | M |  | INTEGER (0..126) |  | - |  |
| >>UL RTOA | M |  | 9.2.39 |  | - |  |
| >>gNB Rx-Tx Time Difference | M |  | 9.2.40 |  | - |  |
| >>Z-AoA | M |  | 9.2.67 |  | YES | reject |
| >>Multiple UL-AoA | M |  | 9.2.71 |  | YES | reject |
| >>UL SRS-RSRPP | M |  | 9.2.72 |  | YES | reject |
| >>UL RSCP | M | FFS | 9.2.x3 |  | YES | reject |
| >Time Stamp | M |  | 9.2.42 |  | - |  |
| >Measurement Quality | O |  | 9.2.43 |  | - |  |
| >Measurement Beam Information | O |  | 9.2.57 |  | - |  |
| >SRS Resource type | O |  | 9.2.73 |  | YES | ignore |
| >ARP ID | O |  | 9.2.75 |  | YES | ignore |
| >LoS/NLoS Information | O |  | 9.2.77 |  | YES | ignore |

|  |  |
| --- | --- |
| Range bound | Explanation |
| maxnoPosMeas | Maximum no. of measured quantities that can be configured and reported with one positioning measurement message. Value is 16384. |

*next modification*

### 9.2.x1 Time Window Information of SRS (FFS)

This IE contains the time window(s) when UL SRS transmission is requested.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
| [FFS] |  |  |  |  |

### 9.2.x2 Time Window Information of Measurement (FFS)

This IE contains the time window(s) when UL SRS measurement is requested.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
| [FFS] |  |  |  |  |

### 9.2.x3 UL RSCP(FFS)

This IE contains the UL Reference Signal Carrier Phase (RSCP) measurement.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
| [FFS] |  |  |  |  |

*End of modifications*