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Foreword

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1 Scope

The present document contains the definition of the LTE Positioning Protocol (LPP) for the radio access technologies E-UTRA/LTE and NR.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 36.305: "Stage 2 functional specification of User Equipment (UE) positioning in E-UTRAN".
- [3] 3GPP TS 23.271: "Functional stage 2 description of Location Services (LCS)".
- [4] IS-GPS-200, Revision D, Navstar GPS Space Segment/Navigation User Interfaces, March 7th, 2006.
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- [9] Global Navigation Satellite System GLONASS Interface Control Document, Version 5.1, 2008.
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- [11] RTCM-SC104, RTCM Recommended Standards for Differential GNSS Service (v.2.3), August 20, 2001.
- [12] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); "Radio Resource Control (RRC); Protocol specification".
- [13] 3GPP TS 25.331: "Radio Resource Control (RRC); Protocol Specification".
- [14] 3GPP TS 44.031: "Location Services (LCS); Mobile Station (MS) - Serving Mobile Location Centre (SMLC) Radio Resource LCS Protocol (RRLP)".
- [15] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".
- [16] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation".
- [17] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer – Measurements".

- [18] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".
- [19] 3GPP TS 23.003: "Numbering, addressing and identification".
- [20] OMA-TS-LPPe-V1_0, LPP Extensions Specification, Open Mobile Alliance.
- [21] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".
- [22] ITU-T Recommendation X.691 (07/2002) "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)" (Same as the ISO/IEC International Standard 8825-2).
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- [24] ATIS-0500027: "Recommendations for Establishing Wide Scale Indoor Location Performance", May 2015.
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- [28] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures".
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- [30] RTCM Standard 10403.3: "Differential GNSS (Global Navigation Satellite Systems) Services" – Version 3, October 7, 2016.
<https://standards.iteh.ai/catalog/standards/sist/ceccc6bb-de2c-4ff7-9c51-fc7d19c51d0e/etsi-ts-137-355-v15-1-0-2021-01>
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- [35] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".
- [36] 3GPP TS 38.215: "NR; Physical layer measurements".
- [37] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], TS 36.305 [2] and TS 23.271 [3] apply. Other definitions are provided below.

Anchor carrier: In NB-IoT, a carrier where the UE assumes that NPSS/NSSS/NPBCH/SIB-NB for FDD or NPSS/NSSS/NPBCH for TDD are transmitted.

Location Server: a physical or logical entity (e.g., E-SMLC or SUPL SLP) that manages positioning for a target device by obtaining measurements and other location information from one or more positioning units and providing assistance data to positioning units to help determine this. A Location Server may also compute or verify the final location estimate.

NB-IoT: NB-IoT allows access to network services via E-UTRA with a channel bandwidth limited to 200 kHz.

Reference Source: a physical entity or part of a physical entity that provides signals (e.g., RF, acoustic, infra-red) that can be measured (e.g., by a Target Device) in order to obtain the location of a Target Device.

Target Device: the device that is being positioned (e.g., UE or SUPL SET).

Transmission Point (TP): A set of geographically co-located transmit antennas for one cell, part of one cell or one PRS-only TP. Transmission Points can include base station (eNodeB) antennas, remote radio heads, a remote antenna of a base station, an antenna of a PRS-only TP, etc. One cell can be formed by one or multiple transmission points. For a homogeneous deployment, each transmission point may correspond to one cell.

Observed Time Difference Of Arrival (OTDOA): The time interval that is observed by a target device between the reception of downlink signals from two different TPs. If a signal from TP 1 is received at the moment t_1 , and a signal from TP 2 is received at the moment t_2 , the OTDOA is $t_2 - t_1$.

PRS-only TP: A TP which only transmits PRS signals for PRS-based TBS positioning and is not associated with a cell.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply.

| | |
|---------|--|
| ADR | Accumulated Delta-Range |
| A-GNSS | Assisted-GNSS |
| AP | Access Point |
| ARFCN | Absolute Radio Frequency Channel Number |
| ARP | Antenna Reference Point |
| BDS | BeiDou Navigation Satellite System |
| BSSID | Basic Service Set Identifier |
| BTS | Base Transceiver Station (GERAN) |
| CID | Cell-ID (positioning method) |
| CNAV | Civil Navigation |
| CRS | Cell-specific Reference Signals |
| ECEF | Earth-Centered, Earth-Fixed |
| ECGI | Evolved Cell Global Identifier |
| ECI | Earth-Centered-Inertial |
| E-CID | Enhanced Cell-ID (positioning method) |
| EGNOS | European Geostationary Navigation Overlay Service |
| E-SMLC | Enhanced Serving Mobile Location Centre |
| E-UTRA | Evolved Universal Terrestrial Radio Access |
| E-UTRAN | Evolved Universal Terrestrial Radio Access Network |
| EOP | Earth Orientation Parameters |
| EPDU | External Protocol Data Unit |
| FDMA | Frequency Division Multiple Access |
| FEC | Forward Error Correction |
| FKP | (German) Flächen-Korrektur-Parameter (area correction parameter) |
| FTA | Fine Time Assistance |
| 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 |
| HA GNSS | High-Accuracy GNSS (RTK, PPP) |
| ICD | Interface Control Document |
| IGS | International GNSS Service |
| IOD | Issue of Data |
| IS | Interface Specification |
| LLA | Latitude Longitude Altitude |

| | |
|--------|---|
| LPP | LTE Positioning Protocol |
| LPPa | LTE Positioning Protocol Annex |
| LSB | Least Significant Bit |
| MAC | Master Auxiliary Concept |
| MBS | Metropolitan Beacon System |
| MO-LR | Mobile Originated Location Request |
| MSAS | Multi-functional Satellite Augmentation System |
| MSB | Most Significant Bit |
| msd | mean solar day |
| MT-LR | Mobile Terminated Location Request |
| NAV | Navigation |
| NB-IoT | NarrowBand Internet of Things |
| NCGI | NR Cell Global Identifier |
| NICT | National Institute of Information and Communications Technology |
| NI-LR | Network Induced Location Request |
| NPRS | Narrowband Positioning Reference Signals |
| NR | NR Radio Access |
| NRSRP | Narrowband Reference Signal Received Power |
| NRSRQ | Narrowband Reference Signal Received Quality |
| NTSC | National Time Service Center of Chinese Academy of Sciences |
| OSR | Observation Space Representation |
| OTDOA | Observed Time Difference Of Arrival |
| PDU | Protocol Data Unit |
| PPP | Precise Point Positioning |
| PRB | Physical Resource Block |
| PRC | Pseudo-Range Correction |
| PRS | Positioning Reference Signals |
| posSIB | Positioning System Information Block |
| PZ-90 | Parametry Zemli 1990 Goda – Parameters of the Earth Year 1990 |
| QZS | Quasi Zenith Satellite |
| QZSS | Quasi-Zenith Satellite System |
| QZST | Quasi-Zenith System Time |
| RF | Radio Frequency |
| RRC | Range-Rate Correction
Radio Resource Control |
| RSRP | Reference Signal Received Power |
| RSRQ | Reference Signal Received Quality |
| RSTD | Reference Signal Time Difference |
| RTK | Real-Time Kinematic |
| RTT | Round Trip Time |
| RU | Russia |
| SBAS | Space Based Augmentation System |
| SET | SUPL Enabled Terminal |
| SFN | System Frame Number |
| SLP | SUPL Location Platform |
| SSID | Service Set Identifier |
| SSR | State Space Representation |
| SUPL | Secure User Plane Location |
| SV | Space Vehicle |
| TB | Terrestrial Beacon |
| TBS | Terrestrial Beacon System |
| TLM | Telemetry |
| TOD | Time Of Day |
| TOW | Time Of Week |
| TP | Transmission Point |
| UDRE | User Differential Range Error |
| ULP | User Plane Location Protocol |
| USNO | US Naval Observatory |
| UT1 | Universal Time No.1 |
| UTC | Coordinated Universal Time |
| WAAS | Wide Area Augmentation System |
| WGS-84 | World Geodetic System 1984 |