**3GPP TSG-RAN2 Meeting #109-e *R2-2000xxx***

**Online, , 24th Feb 2020 - 6th Mar 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **36.305** | **CR** | **0084** | **rev** | **4** | **Current version:** | **15.4.0** |  |
|  |
| *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 changeaffects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network | **X** |

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| ***Title:***  | CR of TS 36.305 for introducing NavIC in LTE – core part |
|  |  |
| ***Source to WG:*** | Reliance Jio, CEWiT, Huawei, ISRO, MediaTek Inc., Qualcomm Incorporated, Saankhya Labs Private Limited, Tejas Networks Ltd. |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | LCS\_NAVIC-Core |  | ***Date:*** | 2020-02-28 |
|  |  |  |  |  |
| ***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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | Introduce the network-assisted NAVigation with Indian Constellation(NavIC) positioning method in LTE |
|  |  |
| ***Summary of change:*** | NavIC Navigation Satellite System position related information is introduced based on NavIC ICD. 1. ICD specification of NavIC is added in section 2 as reference.
2. The abbreviation of NavIC Navigation Satellite System is added in section 3.2
3. Added NavIC to the list of Network-assisted GNSS Methods in section 4.3.1.
4. Added NavIC details toReference time, Ionosheric models, GNSS-GNSS time offset and positioning method lists under section 8.1.
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| ***Consequences if not approved:*** | Network-assistedNAVigation with Indian Constellation(NavIC) positioning method will not be supported in LTE. |
|  |  |
| ***Clauses affected:*** | 2, 3.2, 4.3.1, 8.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 37.355, TS 36.331 |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Revision of R2-2000158 |

----------------------------Start of change----------------------

# 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 23.271: "Functional stage 2 description of Location Services (LCS)"

[3] 3GPP TS 22.071: "Location Services (LCS); Service description, Stage 1".

[4] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".

[5] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access (E-UTRA); "User Equipment (UE) radio access capabilities".

[6] IS-GPS-200, Revision D, Navstar GPS Space Segment/Navigation User Interfaces, March 7th, 2006.

[7] IS-GPS-705, Navstar GPS Space Segment/User Segment L5 Interfaces, September 22, 2005.

[8] IS-GPS-800, Navstar GPS Space Segment/User Segment L1C Interfaces, September 4, 2008.

[9] Galileo OS Signal in Space ICD (OS SIS ICD), Draft 0, Galileo Joint Undertaking, May 23rd, 2006.

[10] Global Navigation Satellite System GLONASS Interface Control Document, Version 5, 2002.

[11] IS-QZSS, Quasi Zenith Satellite System Navigation Service Interface Specifications for QZSS, Ver.1.0, June 17, 2008.

[12] Specification for the Wide Area Augmentation System (WAAS), US Department of Transportation, Federal Aviation Administration, DTFA01-96-C-00025, 2001.

[13] RTCM 10402.3, RTCM Recommended Standards for Differential GNSS Service (v.2.3), August 20, 2001.

[14] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); "Radio Resource Control (RRC); Protocol specification".

[15] 3GPP TS 25.331: " Radio Resource Control (RRC); Protocol Specification".

[16] 3GPP TS 44.031: "Location Services (LCS); Mobile Station (MS) - Serving Mobile Location Centre (SMLC) Radio Resource LCS Protocol (RRLP)".

[17] OMA-AD-SUPL-V2\_0: "Secure User Plane Location Architecture Approved Version 2.0".

[18] OMA-TS-ULP-V2\_0\_3: "UserPlane Location Protocol Approved Version 2.0.3".

[19] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[20] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); "Physical layer – Measurements".

[21] 3GPP TS 36.302: "Evolved Universal Terrestrial Radio Access (E-UTRA); "Services provided by the physical layer ".

[22] 3GPP TS 25.305: "Stage 2 functional specification of User Equipment (UE) positioning in UTRAN".

[23] 3GPP TS 43.059: "Functional stage 2 description of Location Services in GERAN".

[24] 3GPP TR 23.891: "Evaluation of LCS Control Plane Solutions for EPS".

[25] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".

[26] 3GPP TS 24.171: "Control Plane Location Services (LCS) procedures in the Evolved Packet System (EPS)".

[27] 3GPP TS 29.171: "Location Services (LCS); LCS Application Protocol (LCS-AP) between the Mobile Management Entity (MME) and Evolved Serving Mobile Location Centre (E-SMLC); SLs interface".

[28] BDS-SIS-ICD-2.0: "BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal (Version 2.0)", December 2013.

[29] IEEE 802.11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[30] Bluetooth Special Interest Group: "Bluetooth Core Specification v4.2", December 2014.

[31] ATIS-0500027: "Recommendations for Establishing Wide Scale Indoor Location Performance", May 2015.

[32] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation".

[33] RTCM 10403.3, RTCM Recommended Standards for Differential GNSS Services (v.3.3), October 7, 2016.

[xx] IRNSS Signal-In-Space (SPS) Interface Control Document (ICD) for standard positioning service version 1.1, August 2017.

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## 3.2 Abbreviations

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

ADR Accumulated Delta Range

AoA Angle of Arrival

AP Access Point

ARP Antenna Reference Point

BDS BeiDou Navigation Satellite System

BSSID Basic Service Set Identifier

CID Cell-ID (positioning method)

CIoT Cellular IoT

E-SMLC Enhanced Serving Mobile Location Centre

E-CID Enhanced Cell-ID (positioning method)

ECEF Earth-Centered, Earth-Fixed

ECI Earth-Centered-Inertial

EGNOS European Geostationary Navigation Overlay Service

E-UTRAN Evolved Universal Terrestrial Radio Access Network

FDMA Frequency Division Multiple Access

FKP Flächenkorrekturparameter (Engl: Area Correction Parameters)

GAGAN GPS Aided Geo Augmented Navigation

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

GMLC Gateway Mobile Location Center

GNSS Global Navigation Satellite System

GPS Global Positioning System

GRS80 Geodetic Reference System 1980

HESSID Homogeneous Extended Service Set Identifier

IoT Internet of Things

LCS LoCation Services

LCS-AP LCS Application Protocol

LMU Location Measurement Unit

LPP LTE Positioning Protocol

LPPa LTE Positioning Protocol Annex

MAC Master Auxiliary Concept

MBS Metropolitan Beacon System

MO-LR Mobile Originated Location Request

MT-LR Mobile Terminated Location Request

NavIC NAVigation with Indian Constellation

NB-IoT NarrowBand Internet of Things

NI-LR Network Induced Location Request

N-RTK Network – Real-Time Kinematic

OTDOA Observed Time Difference Of Arrival

PDU Protocol Data Unit

posSIB Positioning SIB

PPP Precise Point Positioning

PRS Positioning Reference Signal

QZSS Quasi-Zenith Satellite System

RRM Radio Resource Management

RSSI Received Signal Strength Indicator

RTK Real-Time Kinematic

SBAS Space Based Augmentation System

SET SUPL Enabled Terminal

SIB System Information Block

SLP SUPL Location Platform

SSID Service Set Identifier

SSR State Space Representation

SUPL Secure User Plane Location

TADV Timing Advance

TBS Terrestrial Beacon System

TP Transmission Point

UE User Equipment

UTDOA Uplink Time Difference of Arrival

WAAS Wide Area Augmentation System

WGS-84 World Geodetic System 1984

WLAN Wireless Local Area Network

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### 4.3.1 Network-assisted GNSS Methods

These methods make use of UEs that are equipped with radio receivers capable of receiving GNSS signals.

Examples of GNSS include GPS, Modernized GPS, Galileo, GLONASS, Space Based Augmentation Systems (SBAS), Quasi Zenith Satellite System (QZSS), BeiDou Navigation Satellite System (BDS), and NAVigation with Indian Constellation (NavIC).

In this concept, different GNSSs (e.g. GPS, Galileo, etc.) can be used separately or in combination to determine the location of a UE.

The operation of the network-assisted GNSS methods is described in clause 8.1.

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## 8.1 GNSS positioning methods

### 8.1.1 General

Global Navigation Satellite System (GNSS) is the standard generic term for satellite navigation systems that provide autonomous geo-spatial positioning with global or regional coverage. The following GNSSs are supported in this version of the specification:

- GPS and its modernization [6,7,8];

- Galileo [9];

- GLONASS [10];

- Satellite Based Augmentation Systems (SBAS), including WAAS, EGNOS, MSAS, and GAGAN [12];

- Quasi-Zenith Satellite System (QZSS) [11];

- BeiDou Navigation Satellite System (BDS) [28].

- NAVigation with Indian Constellation (NavIC) [xx].

Each global GNSS can be used individually or in combination with others. When used in combination, the effective number of navigation satellite signals would be increased:

- extra satellites can improve availability (of satellites at a particular location) and results in an improved ability to work in areas where satellite signals can be obscured, such as in urban canyons;

- extra satellites and signals can improve reliability, i.e., with extra measurements the data redundancy is increased, which helps identify any measurement outlier problems;

- extra satellites and signals can improve accuracy due to improved measurement geometry and improved ranging signals from modernized satellites.

When GNSS is designed to inter-work with the E-UTRAN, the network assists the UE GNSS receiver to improve the performance in several respects. These performance improvements will:

- reduce the UE GNSS start-up and acquisition times; the search window can be limited and the measurements speed up significantly;

- increase the UE GNSS sensitivity; positioning assistance messages are obtained via E-UTRAN so the UE GNSS receiver can operate also in low SNR situations when it is unable to demodulate GNSS satellite signals;

- allow the UE to consume less handset power than with stand-alone GNSS; this is due to rapid start-up times as the GNSS receiver can be in idle mode when it is not needed;

- allow the UE to compute its position with a better accuracy; RTK corrections (for N-RTK) and GNSS physical models (for SSR/PPP) are obtained via E-UTRAN so the UE can use these assistance data, together with its own measurements, i.e., code and carrier phase measurements, to enable computation of a position with a high accuracy.

The network-assisted GNSS methods rely on signalling between UE GNSS receivers (possibly with reduced complexity) and a continuously operating GNSS reference receiver network, which has clear sky visibility of the same GNSS constellation as the assisted UEs. Two assisted modes are supported:

*- UE-Assisted*: The UE performs GNSS measurements (pseudo-ranges, pseudo Doppler, carrier phase ranges, etc.) and sends these measurements to the E-SMLC where the position calculation takes place, possibly using additional measurements from other (non GNSS) sources;

*- UE-Based*: The UE performs GNSS measurements and calculates its own position location, possibly using additional measurements from other (non GNSS) sources and assistance data from the E-SMLC.

The assistance data content may vary depending on whether the UE operates in UE-Assisted or UE-Based mode.

The assistance data signalled to the UE can be broadly classified into:

- *data assisting the measurements*: e.g. reference time, visible satellite list, satellite signal Doppler, code phase, Doppler and code phase search windows;

- *data providing means for position calculation*: e.g. reference time, reference position, satellite ephemeris, code and carrier phase measurements from a GNSS reference receiver or network of receivers;

- *data increasing the position accuracy*: e.g. satellite code biases, satellite orbit corrections, satellite clock corrections, atmospheric models. RTK residuals, gradients.

A UE with GNSS measurement capability may also operate in an autonomous (standalone) mode. In autonomous mode the UE determines its position based on signals received from GNSS without assistance from the network.

### 8.1.2 Information to be transferred between E-UTRAN Elements

This subclause defines the information (e.g., assistance data, measurement data) that may be transferred between E-UTRAN elements.

#### 8.1.2.1 Information that may be transferred from the E-SMLC to UE

Table 8.1.2.1-1 lists assistance data for both UE-assisted and UE-based modes that may be sent from the E-SMLC to the UE.

NOTE: The provision of these assistance data elements and the usage of these elements by the UE depend on the E‑UTRAN and UE capabilities, respectively.

Table 8.1.2.1-1: Information that may be transferred from the E-SMLC to UE

|  |
| --- |
| Assistance Data  |
| Reference Time |
| Reference Location |
| Ionospheric Models |
| Earth Orientation Parameters |
| GNSS-GNSS Time Offsets |
| Differential GNSS Corrections |
| Ephemeris and Clock Models |
| Real-Time Integrity |
| Data Bit Assistance |
| Acquisition Assistance |
| Almanac |
| UTC Models  |
| RTK Reference Station Information |
| RTK Auxiliary Station Data |
| RTK Observations |
| RTK Common Observation Information |
| GLONASS RTK Bias Information |
| RTK MAC Correction Differences |
| RTK Residuals |
| RTK FKP Gradients |
| SSR Orbit Corrections |
| SSR Clock Corrections |
| SSR Code Bias |

##### 8.1.2.1.1 Reference Time

Reference Time assistance provides the GNSS receiver with coarse or fine GNSS time information. The specific GNSS system times (e.g., GPS, Galileo, GLONASS, BDS system time) shall be indicated with a GNSS ID.

In case of coarse time assistance only, the Reference Time provides an estimate of the current GNSS system time (where the specific GNSS is indicated by a GNSS ID). The E-SMLC should achieve an accuracy of +/- 3 seconds for this time including allowing for the transmission delay between E-SMLC and UE.

In case of fine time assistance, the Reference Time provides the relation between GNSS system time (where the specific GNSS is indicated by a GNSS ID) and E-UTRAN air-interface timing.

##### 8.1.2.1.2 Reference Location

Reference Location assistance provides the GNSS receiver with an a priori estimate of its location (e.g., obtained via Cell-ID, downlink positioning, etc.) together with its uncertainty.

The geodetic reference frame shall be WGS-84, as specified in TS 23.032 [4].

##### 8.1.2.1.3 Ionospheric Models

Ionospheric Model assistance provides the GNSS receiver with parameters to model the propagation delay of the GNSS signals through the ionosphere. Ionospheric Model parameters as specified by GPS [6], Galileo [9], QZSS [11], BDS [28], and NavIC [xx] may be provided.

##### 8.1.2.1.4 Earth Orientation Parameters

Earth Orientation Parameters (EOP) assistance provides the GNSS receiver with parameters needed to construct the ECEF-to-ECI coordinate transformation as specified by GPS [6].

##### 8.1.2.1.5 GNSS-GNSS Time Offsets

GNSS-GNSS Time Offsets assistance provides the GNSS receiver with parameters to correlate GNSS time (where the specific GNSS is indicated by a GNSS-1 ID) of one GNSS with other GNSS time (where the specific GNSS is indicated by a GNSS-2 ID). GNSS-GNSS Time Offsets parameters as specified by GPS [6], Galileo [9], GLONASS [10], QZSS [11], BDS [28], and NavIC [xx] may be provided.

**< Unchanged parts are omitted >**

#### 8.1.3.3 Location Information Transfer Procedure

The purpose of this procedure is to enable the E-SMLC to request position measurements or location estimate from the UE, or to enable the UE to provide location measurements to the E-SMLC for position calculation (e.g., in case of basic self location where the UE requests its own location).

##### 8.1.3.3.1 E-SMLC initiated Location Information Transfer Procedure

Figure 8.1.3.3.1-1 shows the Location Information Transfer operations for the network-assisted GNSS method when the procedure is initiated by the E-SMLC.



Figure 8.1.3.3.1-1: E-SMLC-initiated Location Information Transfer Procedure

(1)The E-SMLC sends a LPP Request Location Information message to the UE for invocation of A-GNSS positioning. This request includes positioning instructions such as the GNSS mode (UE-assisted, UE-based, UE-based preferred but UE-assisted allowed, UE-assisted preferred, but UE-based allowed, standalone), positioning methods (GPS, Galileo, GLONASS, BDS, NavIC, etc. and possibly non-GNSS methods, such as downlink positioning or E-CID), specific UE measurements requested if any, such as fine time assistance measurements, velocity, carrier phase, multi-frequency measurements, and quality of service parameters (accuracy, response time).

(2) The UE performs the requested measurements and possibly calculates its own location. The UE sends an LPP Provide Location Information message to the E-SMLC before the Response Time provided in step (1) elapsed. If the UE is unable to perform the requested measurements, or if the Response Time provided in step 1 elapsed before any of the requested measurements have been obtained, the UE returns any information that can be provided in an LPP message of type Provide Location Information which includes a cause indication for the not provided location information.

----------------------------End of change----------------------