**3GPP TSG-RAN WG2 Meeting #109bis-e *R2-2003994***

**Electronic meeting, Online, 20th – 30th April 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.305** | **CR** | **0012** | **rev** | **1** | **Current version:** | **16.0.0** |  |
|  | | | | | | | | |
| *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:*** | CR to clarify the meaning of GNSS term in 38.305 Rel-16 | | | | | | | | | |
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| ***Source to WG:*** | ESA, Nokia, Nokia Shanghai Bell | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos-Core | | | | |  | ***Date:*** | | | 2020-04-22 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **A** |  | | | | | ***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 can be 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)* | |
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| ***Reason for change:*** | | The meaning of the term “GNSS” is confusing because, while the letter ‘G’ in the GNSS acronym stands for “Global”, the GNSS term is implicitly used in the specs as an umbrella term including global, regional and augmentation systems. A clarification on how the GNSS term should be understood within the specs along with an explanation of the different categories of satellite navigation systems is therefore put forward. | | | | | | | | |
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| ***Summary of change:*** | | Explicitly define how the GNSS term should be understood in the specs and recategorize the various navigation systems in global, regional, and augmentation. | | | | | | | | |
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| ***Consequences if not approved:*** | | The term GNSS is misused in stage 2 | | | | | | | | |
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| ***Clauses affected:*** | | 4.3.2, 8.1.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | | Mirror of CR 0011 | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Start of changed section>

4.3.2 Network-assisted GNSS methods

These methods make use of UEs that are equipped with radio receivers capable of receiving GNSS signals. In 3GPP specifications the term GNSS encompasses both global and regional/augmentation navigation satellite systems.

Examples of global navigation satellite systems include GPS, Modernized GPS, Galileo, GLONASS, and BeiDou Navigation Satellite System (BDS). Regional navigation satellite systems include Quasi Zenith Satellite System (QZSS) while the many augmentation systems, listed in 8.1.1, are classified under the generic term of Space Based Augmentation Systems (SBAS) and provide regional augmentation services.

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.

<End of changed section>

<Start of changed section>

8.1.1 General

A navigation satellite system provides autonomous geo-spatial positioning with either global or regional coverage. Augmentation systems, such as SBAS, are navigation satellite systems that provide regional coverage to augment the navigation systems with global coverage.

By definition, GNSS refers to satellite constellations that achieve global coverage, however, in 3GPP specifications the term GNSS is used to encompass global, regional, and augmentation satellite systems. The following GNSSs are supported in this version of the specification:

- GPS and its modernization [5], [6], [7]; (global coverage)

- Galileo [8]; (global coverage)

- GLONASS [9]; (global coverage)

- Satellite Based Augmentation Systems (SBAS), including WAAS, EGNOS, MSAS, and GAGAN [11]; (regional coverage)

- Quasi-Zenith Satellite System (QZSS) [10]; (regional coverage)

- BeiDou Navigation Satellite System (BDS) [20], [34]. (global coverage)

Each global GNSS can be used individually or in combination with others, including regional navigation systems and augmentation systems. 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 NG-RAN, 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 NG-RAN 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 NG-RAN 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 LMF 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 location, possibly using additional measurements from other (non GNSS) sources and assistance data from the LMF.

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, clock corrections, 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.

<End of changed section>