**3GPP TSG- Meeting #121-bis-e**

**Online, 17th – 26th April 2023 Revision of R2-2304048**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.355** | **CR** | **0440** | **rev** | **1** | **Current version:** | **17.4.0** |  |
|  | | | | | | | | |
| *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 change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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|  | | | | | | | | | | |
| ***Title:*** | Correction of Location Server behaviour | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos\_enh-Core | | | | |  | ***Date:*** | | | 2023-04-24 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | | 7 |
|  | *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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | In RAN2 specification, it has always been taken as a general guiding rule that the requirements are written in the specification for the terminal whereas the expected behaviour is written for the Network node without any explict shall requirements. However, in LPP specification, few corrections are needed as this general principle has not been adhered. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Changed the location server shall condition to the expected behaviour condition  **Impact Analysis**  Impacted 5G architecture options: NR SA, (NG)EN-DC, NE-DC,NR-DC  Impacted functionality:  Location Server behaviour  Inter-operability:   * There are no interoperability issues. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Violation of 3GPP drafting rules | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.5.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

*Beginning of Changes*

#### 6.5.2.2 GNSS Assistance Data Elements

#### – *GNSS-ReferenceTime*

The IE *GNSS-ReferenceTime* is used by the location server to provide the GNSS specific system time with uncertainty and the relationship between GNSS system time and network air-interface timing of the eNodeB/NodeB/BTS transmission in the reference cell.

If the IE *networkTime* is present, the IEs *gnss-SystemTime* and *networkTime* provide a valid relationship between GNSS system time and air-interface network time, as seen at the approximate location of the target device, i.e. the propagation delay from the gNB/ng-eNB/eNodeB/NodeB/BTS to the target device shall be compensated for by the location server. Depending on implementation, the relation between GNSS system time and air-interface network time may have varying accuracy. The uncertainty of this timing relation is provided in the IE *referenceTimeUnc*. If the propagation delay from the eNodeB/NodeB/BTS to the target device is not accurately known, the location server uses the best available approximation of the propagation delay and take the corresponding delay uncertainty into account in the calculation of the IE *referenceTimeUnc*.

If the IE *networkTime* is not present, the IE *gnssSystemTime* is an estimate of current GNSS system time at time of reception of the IE *GNSS-ReferenceTime* by the target device. The location server should achieve an accuracy of +/- 3 seconds for this estimate including allowing for the transmission delay between the location server and the target device. Note that the target device should further compensate *gnss-SystemTime* for the time between the reception of *GNSS-ReferenceTime* and the time when the *gnss-SystemTime* is used.

The location server provides a value for the *gnss-TimeID* only for GNSSs supported by the target device.

The IE *GNSS-ReferenceTimeForOneCell* can be provided multiple times (up to 16) to provide fine time assistance for several (neighbour) cells.

<Skipped Unmodified changes>

– *GNSS-DifferentialCorrections*

The IE *GNSS-DifferentialCorrections* is used by the location server to provide differential GNSS corrections to the target device for a specific GNSS. Differential corrections can be provided for up to 3 signals per GNSS.

-- ASN1START

GNSS-DifferentialCorrections ::= SEQUENCE {

dgnss-RefTime INTEGER (0..3599),

dgnss-SgnTypeList DGNSS-SgnTypeList,

...

}

DGNSS-SgnTypeList ::= SEQUENCE (SIZE (1..3)) OF DGNSS-SgnTypeElement

DGNSS-SgnTypeElement ::= SEQUENCE {

gnss-SignalID GNSS-SignalID,

gnss-StatusHealth INTEGER (0..7),

dgnss-SatList DGNSS-SatList,

...

}

DGNSS-SatList ::= SEQUENCE (SIZE (1..64)) OF DGNSS-CorrectionsElement

DGNSS-CorrectionsElement ::= SEQUENCE {

svID SV-ID,

iod BIT STRING (SIZE(11)),

udre INTEGER (0..3),

pseudoRangeCor INTEGER (-2047..2047),

rangeRateCor INTEGER (-127..127),

udreGrowthRate INTEGER (0..7) OPTIONAL, -- Need ON

udreValidityTime INTEGER (0..7) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| ***GNSS-DifferentialCorrections* field descriptions** |
| --- |
| ***dgnss-RefTime***  This field specifies the time for which the DGNSS corrections are valid, modulo 1 hour. *dgnss-RefTime* is given in GNSS specific system time.  Scale factor 1‑second. |
| ***dgnss-SgnTypeList***  This list includes differential correction data for different GNSS signal types, identified by *GNSS-SignalID*. |
| ***gnss-StatusHealth***  This field specifies the status of the differential corrections. The values of this field and their respective meanings are defined as in table *gnss-StatusHealth* Value to Indication relation below.  The first six values in this field indicate valid differential corrections. When using the values described below, the "UDRE Scale Factor" value is applied to the UDRE values contained in the element. The purpose is to indicate an estimate in the amount of error in the corrections.  The value "110" indicates that the source of the differential corrections (e.g., reference station or external DGNSS network) is currently not being monitored. The value "111" indicates that the corrections provided by the source are invalid, as judged by the source. |
| ***dgnss-SatList***  This list includes differential correction data for different GNSS satellites, identified by *SV-ID*. |
| ***iod***  This field specifies the Issue of Data field which contains the identity for the *GNSS-NavigationModel.* |
| ***udre***  This field provides an estimate of the uncertainty (1-σ) in the corrections for the particular satellite. The value in this field shall be multiplied by the UDRE Scale Factor in the *gnss-StatusHealth* field to determine the final UDRE estimate for the particular satellite. The meanings of the values for this field are shown in the table *udre Value* to Indication relation below. |
| ***pseudoRangeCor***  This field specifies the correction to the pseudorange for the particular satellite at *dgnss-RefTime*, t0. The value of this field is given in metres and the scale factor is 0.32 metres in the range of ±655.04 metres. The method of calculating this field is described in [11].  If the location server has received a request for GNSS assistance data from a target device which included a request for the GNSS Navigation Model and DGNSS, the location server determines, for each satellite, if the navigation model stored by the target device is still suitable for use with DGNSS corrections and if so and if DGNSS corrections are supported the location server should send DGNSS corrections without including the GNSS Navigation Model.  The *iod* value sent for a satellite shall always be the IOD value that corresponds to the navigation model for which the pseudo-range corrections are applicable.  The target device shall only use the *pseudoRangeCor*value when the IOD value received matches its available navigation model.  Pseudo-range corrections are provided with respect to GNSS specific geodetic datum (e.g., PZ-90.02 if *GNSS‑ID* indicates GLONASS).  Scale factor 0.32 metres. |
| ***rangeRateCor***  This field specifies the rate-of-change of the pseudorange correction for the particular satellite, using the satellite ephemeris and clock corrections identified by the *iod* field. The value of this field is given in metres per second and the resolution is 0.032 metres/second in the range of ±4.064 metres/second. For some time t1 > t0, the corrections for *iod* are estimated by  PRC(t1,IOD) = PRC(t0, IOD) + RRC(t0,IOD)⋅(t1 - t0),  and the target device uses this to correct the pseudorange it measures at t1, PRm(t1,IOD), by  PR(t1, IOD) = PRm(t1, IOD) + PRC(t1, IOD) .  The location server always sends the RRC value that corresponds to the PRC value that it sends. The target device shall only use the RRC value when the *iod* value received matches its available navigation model.  Scale factor 0.032 metres/second. |
| ***udreGrowthRate***  This field provides an estimate of the growth rate of uncertainty (1-σ) in the corrections for the particular satellite identified by *SV-ID*. The estimated UDRE at time value specified in the *udreValidityTime**t1* is calculated as follows:  UDRE(*t0*+*t1*) = UDRE(*t0*) × *udreGrowthRate ,*  where *t0* is the DGNSS Reference Time *dgnss-RefTime*for which the corrections are valid, *t1* is the *udreValidityTime*  field, UDRE(*t0*) is the value of the *udre* field, and *udreGrowthRate* field is the factor as shown in the table Value of *udreGrowthRate* to Indication relation below. |
| ***udreValidityTime***  This field specifies the time when the *udreGrowthRate* field applies and is included if *udreGrowthRate* is included. The meaning of the values for this field is as shown in the table Value of *udreValidityTime* to Indication relation below. |

<Skipped Unmodified changes>

#### – *GNSS-NavigationModel*

The IE *GNSS-NavigationModel* is used by the location server to provide precise navigation data to the GNSS capable target device. In response to a request from a target device for GNSS Assistance Data, the location server determines whether to send the navigation model for a particular satellite to a target device based upon factors like the T-Toe limit specified by the target device and any request from the target device for DGNSS (see also *GNSS-DifferentialCorrections*). GNSS Orbit Model can be given in Keplerian parameters or as state vector in Earth-Centered Earth-Fixed coordinates, dependent on the *GNSS-ID* and the target device capabilities. The meaning of these parameters is defined in relevant ICDs of the particular GNSS and GNSS specific interpretations apply. For example, GPS and QZSS use the same model parameters but some parameters have a different interpretation [7].

<Skipped Unmodified changes>

#### – *StandardClockModelList*

-- ASN1START

StandardClockModelList ::= SEQUENCE (SIZE(1..2)) OF StandardClockModelElement

StandardClockModelElement ::= SEQUENCE {

stanClockToc INTEGER (0..16383),

stanClockAF2 INTEGER (-32..31),

stanClockAF1 INTEGER (-1048576..1048575),

stanClockAF0 INTEGER (-1073741824..1073741823),

stanClockTgd INTEGER (-512..511) OPTIONAL, -- Need ON

sisa INTEGER (0..255),

stanModelID INTEGER (0..1) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *StandardClockModelList* field descriptions |
| --- |
| ***standardClockModelList***  *gnss-ClockModel* Model-1 contains one or two clock model elements. If included, clock Model-1 shall be included once or twice depending on the target device capability.  If the target device is supporting multiple Galileo signals, the location server includes both F/Nav and I/Nav clock models in *gnss-ClockModel* if the location server assumes the target device to perform location information calculation using multiple signals. |
| ***stanClockToc***  Parameter toc defined in [8].  Scale factor 60 seconds. |
| ***stanClockAF2***  Parameter af2 defined in [8].  Scale factor 2-59 seconds/second2. |
| ***stanClockAF1***  Parameter af1 defined in [8].  Scale factor 2-46 seconds/second. |
| ***stanClockAF0***  Parameter af0 defined in [8].  Scale factor 2-34 seconds. |
| ***stanClockTgd***  Parameter TGD, Broadcast Group Delay (BGD), defined in [8].  Scale factor 2-32 seconds.  This field is required if the target device supports only single frequency Galileo signal. |
| ***sisa***  Signal-In-Space Accuracy (SISA), defined in [8] clause 5.1.11. |
| ***stanModelID***  This field specifies the identity of the clock model according to the table Value of *stanModelID* to Identity relation below. This field is required if the location server includes both F/Nav and I/Nav Galileo clock models in *gnss-ClockModel.* |

<Skipped Unmodified changes>

#### – *GNSS-RealTimeIntegrity*

The IE *GNSS-RealTimeIntegrity* is used by the location server to provide parameters that describe the real-time status of the GNSS constellations. *GNSS-RealTimeIntegrity* data communicates the health of the GNSS signals to the mobile in real‑time.

The location server always transmits the *GNSS-RealTimeIntegrity* with the current list of unhealthy signals (i.e., not only for signals/SVs currently visible at the reference location), for any GNSS positioning attempt and whenever GNSS assistance data are sent. If the number of bad signals is zero, then the *GNSS-RealTimeIntegrity* IE is omitted.

<Skipped Unmodified changes>

#### – *GNSS-AcquisitionAssistance*

The IE *GNSS-AcquisitionAssistance* is used by the location server to provide parameters that enable fast acquisition of the GNSS signals. Essentially, these parameters describe the range and derivatives from respective satellites to the reference location at the reference time *GNSS-SystemTime* provided in IE *GNSS-ReferenceTime*.

Whenever *GNSS-AcquisitionAssistance* is provided by the location server, the IE *GNSS-ReferenceTime* is provided as well. E.g., even if the target device request for assistance data includes only a request for *GNSS-AcquisitionAssistance,* the location server also provides the corresponding IE *GNSS-ReferenceTime.*

Figure 6.5.2.2-1 illustrates the relation between some of the fields, using GPS TOW as exemplary reference.

<Skipped Unmodified changes>

#### – *AlmanacKeplerianSet*

-- ASN1START

AlmanacKeplerianSet ::= SEQUENCE {

svID SV-ID,

kepAlmanacE INTEGER (0..2047),

kepAlmanacDeltaI INTEGER (-1024..1023),

kepAlmanacOmegaDot INTEGER (-1024..1023),

kepSV-StatusINAV BIT STRING (SIZE (4)),

kepSV-StatusFNAV BIT STRING (SIZE (2)) OPTIONAL, -- Need ON

kepAlmanacAPowerHalf INTEGER (-4096..4095),

kepAlmanacOmega0 INTEGER (-32768..32767),

kepAlmanacW INTEGER (-32768..32767),

kepAlmanacM0 INTEGER (-32768..32767),

kepAlmanacAF0 INTEGER (-32768..32767),

kepAlmanacAF1 INTEGER (-4096..4095),

...

}

-- ASN1STOP

| *AlmanacKeplerianSet* field descriptions |
| --- |
| ***svID***  This field identifies the satellite for which the GNSS Almanac Model is given. |
| ***kepAlmanacE***  Parameter e, eccentricity, dimensionless [8].  Scale factor 2-16. |
| ***kepAlmanacDeltaI***  Parameter δi, inclination at reference time relative to i0=56°; semi-circles [8].  Scale factor 2-14 semi-circles. |
| ***kepAlmanacOmegaDot***  Parameter , rate of change of right ascension (semi-circles/sec) [8].  Scale factor 2-33 semi-circles/seconds. |
| ***kepSV-StatusINAV***  This field contains the I/NAV signal health status [8], clause 5.1.10 , E5bHS and E1-BHS, where E5bHS occupies the 2 MSBs in *kepSV-StatusINAV*, and E1-BHS the two LSBs. |
| ***kepSV-StatusFNAV***  This field contains the F/NAV signal health status [8], clause 5.1.10 ,E5aHS. If the target device is supporting multiple Galileo signals, the location server includes this field. |
| ***kepAlmanacAPowerHalf***  Parameter (a1/2), difference with respect to the square root of the nominal semi-major axis, (metres)1/2 [8].  Scale factor 2-9 metres½ . |
| ***kepAlmanacOmega0***  Parameter OMEGA0, longitude of ascending node of orbital plane at weekly epoch (semi-circles) [8].  Scale factor 2-15 semi-circles. |
| ***kepAlmanacW***  Parameter ω, argument of perigee (semi-circles) [8].  Scale factor 2-15 semi-circles. |
| ***kepAlmanacM0***  Parameter M0, mean anomaly at reference time (semi-circles) [8].  Scale factor 2-15 semi-circles. |
| ***kepAlmanacAF0***  Parameter af0, satellite clock correction bias, seconds [8].  Scale factor 2-19 seconds. |
| ***kepAlmanacAF1***  Parameter af1, satellite clock correction linear, sec/sec [8].  Scale factor 2-38 seconds/second. |

*End of Changes*