**3GPP TSG- RAN2 Meeting #121 *Draft* R2-23xxxxx**

**Athens, GR, 27th Feb – 3rd Mar, 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **37.355** | **CR** | **0410** | **rev** | **1** | **Current version:** | **16.9.0** |  |
|  | | | | | | | | |
| *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 |  | Core Network | **X** |

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| ***Title:*** | Clarifying Galileo NAV message in the GNSS Navigation model to clarify SSR clock correction signal reference | | | | | | | | | |
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| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos-Core | | | | |  | ***Date:*** | | | 2023-03-02 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The SSR orbit corrections are relative to broadcasted Ephemeris described by the IE *GNSS-NavigationModel.* To ensure that there is no ambiguity with the clock correction reference, since Galileo has both F/NAV and I/NAV messages, the IE *GNSS-NavigationModel iod* field needs to be clarified to refer to Galileo I/NAV. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The IE *GNSS-NavigationModel* GNSS to iod Bit String(11) relation has been clarified for Galileo to refer to Galileo I/NAV.  **Impact Analysis**  Impacted 5G architecture options: NR SA, (NG)EN-DC, NE-DC,NR-DC  Impacted functionality:  GNSS SSR Clock Corrections via GNSS Navigation model change  Inter-operability:  If NW implements the CR and UE does not   * UE may not be able to apply SSR clock corrections for GNSS Type Galileo, which may result in positioning error   If UE implements the CR and NW does not   * UE may apply the clock corrections with reference to I/NAV, while the network may provide clock corrections with reference to F/NAV signal (not very likely). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Incomplete specification and missing behaviour. The standard may not fully support high accuracy GNSS Galileo. | | | | | | | | |
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| ***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

#### ***<Skip 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 shall determine 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].

-- ASN1START

GNSS-NavigationModel ::= SEQUENCE {

nonBroadcastIndFlag INTEGER (0..1),

gnss-SatelliteList GNSS-NavModelSatelliteList,

...

}

GNSS-NavModelSatelliteList ::= SEQUENCE (SIZE(1..64)) OF GNSS-NavModelSatelliteElement

GNSS-NavModelSatelliteElement ::= SEQUENCE {

svID SV-ID,

svHealth BIT STRING (SIZE(8)),

iod BIT STRING (SIZE(11)),

gnss-ClockModel GNSS-ClockModel,

gnss-OrbitModel GNSS-OrbitModel,

...,

[[ svHealthExt-v1240 BIT STRING (SIZE(4)) OPTIONAL -- Need ON

]]

}

GNSS-ClockModel ::= CHOICE {

standardClockModelList StandardClockModelList, -- Model-1

nav-ClockModel NAV-ClockModel, -- Model-2

cnav-ClockModel CNAV-ClockModel, -- Model-3

glonass-ClockModel GLONASS-ClockModel, -- Model-4

sbas-ClockModel SBAS-ClockModel, -- Model-5

...,

bds-ClockModel-r12 BDS-ClockModel-r12, -- Model-6

bds-ClockModel2-r16 BDS-ClockModel2-r16, -- Model-7

navic-ClockModel-r16 NavIC-ClockModel-r16 -- Model-8

}

GNSS-OrbitModel ::= CHOICE {

keplerianSet NavModelKeplerianSet, -- Model-1

nav-KeplerianSet NavModelNAV-KeplerianSet, -- Model-2

cnav-KeplerianSet NavModelCNAV-KeplerianSet, -- Model-3

glonass-ECEF NavModel-GLONASS-ECEF, -- Model-4

sbas-ECEF NavModel-SBAS-ECEF, -- Model-5

...,

bds-KeplerianSet-r12 NavModel-BDS-KeplerianSet-r12, -- Model-6

bds-KeplerianSet2-r16 NavModel-BDS-KeplerianSet2-r16, -- Model-7

navic-KeplerianSet-r16 NavModel-NavIC-KeplerianSet-r16 -- Model-8

}

-- ASN1STOP

| *GNSS-NavigationModel* field descriptions |
| --- |
| ***nonBroadcastIndFlag***  This field indicates if the *GNSS-NavigationModel* elements are not derived from satellite broadcast data or are given in a format not native to the GNSS. A value of 0 means the *GNSS-NavigationModel* data elements correspond to GNSS satellite broadcasted data; a value of 1 means the *GNSS-NavigationModel* data elements are not derived from satellite broadcast. |
| ***gnss-SatelliteList***  This list provides ephemeris and clock corrections for GNSS satellites indicated by *SV‑ID*. |
| ***svHealth***  This field specifies the satellite's current health. The health values are GNSS system specific. The interpretation of *svHealth* depends on the *GNSS‑ID* and is as shown in table GNSS to svHealth Bit String(8) relation below. |
| ***iod***  This field specifies the Issue of Data and contains the identity for GNSS Navigation Model.  In the case of broadcasted GPS NAV ephemeris, the *iod* contains the IODC as described in [4].  In the case of broadcasted Modernized GPS ephemeris, the *iod* contains the 11-bit parameter toe as defined in [4, Table 30-I] [6, Table 3.5-1].  In the case of broadcasted SBAS ephemeris, the *iod* contains the 8 bits Issue of Data as defined in [10] Message Type 9.  In the case of broadcasted QZSS QZS-L1 ephemeris, the *iod* contains the IODC as described in [7].  In the case of broadcasted QZSS QZS-L1C/L2C/L5 ephemeris, the *iod* contains the 11-bit parameter toe as defined in [7].  In the case of broadcasted GLONASS ephemeris, the *iod* contains the parameter tb as defined in [9].  In the case of broadcasted Galileo ephemeris, the *iod* contains the IOD index as described in [8].  In the case of broadcasted BDS B1I/B3I ephemeris, the *iod* contains 11 MSB bits of the toe as defined in [23], [50].  In the case of broadcasted BDS B1C/B2a ephemeris, the *iod* contains the IODC as described in [39], [49].  In the case of broadcasted NavIC ephemeris, the iod contains 11 MSB bits of the toe as defined in [38].  The interpretation of *iod* depends on the *GNSS‑ID* and is as shown in table GNSS to iod Bit String(11) relation below. |
| ***svHealthExt***  This field specifies the satellite's additional current health. The health values are GNSS system specific. The interpretation of *svHealthExt* depends on the *GNSS‑ID* and is as shown in table GNSS to svHealthExt Bit String(4) relation below. |

GNSS to svHealth Bit String(8) relation

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| GNSS | *svHealth* Bit String(8) | | | | | | | |
| Bit 1  (MSB) | Bit 2 | Bit 3 | Bit 4 | Bit 5 | Bit 6 | Bit 7 | Bit 8 (LSB) |
| GPS L1/CA(1) | SV Health [4] | | | | | | '0'  (reserved) | '0'  (reserved) |
| Modernized GPS(2) | L1C Health  [6] | L1 Health [4,5] | L2 Health  [4,5] | L5 Health [4,5] | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| SBAS(3) | Ranging  On (0),Off(1) [10] | Corrections On(0),Off(1) [10] | Integrity  On(0),Off(1)[10] | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| QZSS(4)  QZS-L1 | SV Health [7] | | | | | | '0'  (reserved) | '0'  (reserved) |
| QZSS(5)  QZS‑  L1C/L2C/L5 | L1C Health  [7] | L1 Health  [7] | L2 Health  [7] | L5 Health  [7] | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| GLONASS | Bn (MSB)  [9, page 30] | FT [9, Table 4.4] | | | | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| Galileo  [8, clause 5.1.9.3] | E5a Data Validity Status | E5b Data Validity Status | E1-B Data Validity Status | E5a Signal Health Status | | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| BDS(6) B1I  [23] | B1I Health (SatH1) [23], [50] | B3I Health (SatH1) [23], [50] | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| BDS(7) B1C  [39]/B2a [49] | Sat Clock Health [39], [49] | B1C Health  [39], [49] | B2a Health  [39],[49] | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| NavIC | L5 health | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| Note 1: If *GNSS‑ID* indicates 'gps', and GNSS Orbit Model-2 is included, this interpretation of *svHealth* applies.  Note 2: If *GNSS‑ID* indicates 'gps', and GNSS Orbit Model-3 is included, this interpretation of *svHealth* applies. If a certain signal is not supported on the satellite indicated by *SV‑ID*, the corresponding health bit shall be set to '1' (i.e., signal can not be used).  Note 3: *svHealth,* in the case that *GNSS‑ID* indicates 'sbas', includes the 5 LSBs of the Health included in GEO Almanac Message Parameters (Type 17) [10].  Note 4: If *GNSS‑ID* indicates 'qzss', and GNSS Orbit Model-2 is included, this interpretation of *svHealth* applies.  Note 5: If *GNSS‑ID* indicates 'qzss', and GNSS Orbit Model-3 is included, this interpretation of *svHealth* applies.  Note 6: If *GNSS‑ID* indicates 'bds', and GNSS Orbit Model-6 is included, this interpretation of *svHealth* applies.  Note 7: If *GNSS‑ID* indicates 'bds', and GNSS Orbit Model-7 is included, this interpretation of *svHealth* applies. | | | | | | | | |

GNSS to iod Bit String(11) relation

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| GNSS | *iod* Bit String(11) | | | | | | | | | | |
| Bit 1  (MSB) | Bit 2 | Bit 3 | Bit 4 | Bit 5 | Bit 6 | Bit 7 | Bit 8 | Bit 9 | Bit 10 | Bit 11  (LSB) |
| GPS L1/CA | '0' | Issue of Data, Clock [4] | | | | | | | | | |
| Modernized GPS | toe (seconds, scale factor 300, range 0 – 604500) [4,5,6] | | | | | | | | | | |
| SBAS | '0' | '0' | '0' | Issue of Data ([10], Message Type 9) | | | | | | | |
| QZSS QZS-L1 | '0' | Issue of Data, Clock [7] | | | | | | | | | |
| QZSS  QZS-L1C/L2C/L5 | toe (seconds, scale factor 300, range 0 – 604500) [7] | | | | | | | | | | |
| GLONASS | '0' | '0' | '0' | '0' | tb (minutes, scale factor 15) [9] | | | | | | |
| Galileo I/NAV | '0' | IODnav [8] | | | | | | | | | |
| BDS B1I/B3I | 11 MSB bits of toe (seconds, scale factor 512, range 0 – 604672) [23], [50] | | | | | | | | | | |
| BDS B1C/B2a | '0' | Issue of Data, Clock [39], [49] | | | | | | | | | |
| NavIC | 11 MSB bits of toe (seconds, scale factor 512) [38] | | | | | | | | | | |

GNSS to svHealthExt Bit String(4) relation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GNSS | *svHealthExt* Bit String(4) | | | |
| Bit 1  (MSB) | Bit 2 | Bit 3 | Bit 4  (LSB) |
| Galileo [8, clause 5.1.9.3] | E5b Signal Health Status | | E1-B Signal Health Status | |

*End of Changes*