3GPP TSG-RAN WG2 Meeting #123bis R2-2311572

Xiamen, China, October 9th – 13th, 2023

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.355** | **CR** | **0466** | **rev** | **2** | **Current version:** |  |  |
|  | | | | | | | | |
| *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:*** | Correction of existing SSR IEs in A-GNSS for BDS system | | | | | | | | | |
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| ***Source to WG:*** | CATT, CAICT, CMCC, China Telecom, China Unicom, Huawei, ZTE Corporation, MediaTek Inc., OPPO, xiaomi, vivo, Spreadtrum | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos\_enh-Core | | | | |  | Date: | | | 2023-10-12 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The SSR Corrections apply to all GNSSs including B1I and B1C, however the updated clarification in TS 37.355 v17.6.0 only includes B1I/B3I as reference signal. The issue is that BDS SSR service based on B1C won’t be provided if follows the updated Note 2 here:  NOTE 2: In the cases that *gnss-ID* indicates 'gps', 'qzss' or 'bds', the *iod* refers to the NAV broadcast ephemeris (GPS L1 C/A, QZSS QZS-L1 or BDS B1I/B3I, respectively, in table GNSS to iod Bit String(11) relation in IE *GNSS‑NavigationModel).*”  The BDS SSR service can be provided to custmers based on both B1I/B3I and B1C/B2a signals in BDS ecosystem. So a flag in LPP indicating if B1C as reference signal will be introduced to distinguaish the reference siganl of SSR from B1I. The UE reports the capability to support B1C signal or not to server, so the server will provide the proper SSR corrections in unicast to UE based on the capability.  **Impact analysis**  Architecture options  LTE, NR SA, NSA  Impacted functionality:  Positioning assistance data transfer of SSR  Inter-operability:  If only the network is implemented according to the CR and the UE is not, no interoperability problems are foreseen.  If only the UE is implemented according to the CR and the network is not, no interoperability problems are foreseen. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. ICD specification of BDS PPP-B2b is added in section 2 as reference for B1C. 2. A flag identifying the reference signal of B1C is included in *GNSS-SSR-OrbitCorrections*. 3. The capability to support reference signal of B1C or not is included in *GNSS-SSR-OrbitCorrectionsSupport*. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | SSR of BDS doesn't apply to B1C in unicast. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 6.5.2.2, 6.5.2.10 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | | Revision of R2-2311263. | | | | | | | | |

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| **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 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.

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

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

[7] IS-QZSS, Quasi Zenith Satellite System Navigation Service Interface Specifications for QZSS, Ver.1.1, July 31, 2009.

[8] Galileo OS Signal in Space ICD (OS SIS ICD), Issue 1.2, February 2014, European Union.

[9] Global Navigation Satellite System GLONASS Interface Control Document, Version 5.1, 2008.

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

[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).

[23] BDS-SIS-ICD-B1I-3.0: "BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal B1I (Version 3.0)", February, 2019.

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

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

[26] IEEE 802.11, Part 11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[27] IETF RFC 6225, "Dynamic Host Configuration Protocol Options for Coordinate-Based Location Configuration Information", July 2011.

[28] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures".

[29] "Earth Gravitational Model 96 (EGM96)", National Geospatial-Intelligence Agency, NASA.

[30] RTCM Standard 10403.3: "Differential GNSS (Global Navigation Satellite Systems) Services" – Version 3, October 7, 2016.

[31] IGS ANTEX: "The Antenna Exchanged Format" – version 1.4, September 15, 2010.

[32] Federal Information Processing Standards Publication 197, "Specification for the ADVANCED ENCRYPTION STANDARD (AES)", November 26, 2001.

[33] NIST Special Publication 800-38A, "Recommendation for Block Cipher Modes of Operation Methods and Techniques", 2001.

[34] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[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".

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

[39] BDS-SIS-ICD-B1C-1.0: "BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal B1C (Version 1.0)", December, 2017.

[40] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[41] 3GPP TS 38.211: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical channels and modulation".

[42] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

[43] IS-QZSS-L6-001, Quasi-Zenith Satellite System Interface Specification – Centimetre Level Augmentation Service, Cabinet Office, November 5, 2018.

[44] 3GPP TR 38.901: "Technical Specification Group Radio Access Network; Study on channel model for frequencies from 0.5 to 100 GHz".

[45] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[46] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[47] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description; Stage 2".

[48] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[49] BDS-SIS-ICD-B2a-1.0: "BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal B2a (Version 1.0)", December, 2017.

[50] BDS-SIS-ICD-B3I-1.0: "BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal B3I (Version 1.0)", February, 2018.

[51] NMEA standard 0183, Version 4.11, November 2018.

[XX] BDS-SIS-ICD-PPP-B2b-1.0: "BeiDou Navigation Satellite System Signal In Space Interface Control Document Precise Point Positioning Service Signal PPP-B2b (Version 1.0)", July, 2020.

|  |
| --- |
| **The next change** |

#### 6.5.2.2 GNSS Assistance Data Elements

#### *– GNSS-SSR-OrbitCorrections*

The IE *GNSS-SSR-OrbitCorrections* is used by the location server to provide radial, along-track and cross-track orbit corrections together with integrity information. The target device may use the *SSR-OrbitCorrectionList* to compute a satellite position correction to be combined with the satellite position calculated from broadcast ephemeris.

The parameters provided in IE *GNSS-SSR-OrbitCorrections –* except for *ORBIT-IntegrityParameters* and *SSR-IntegrityOrbitBounds –* are used as specified for SSR Clock Messages (e.g., message type 1057 and 1063) in [30] and apply to all GNSSs.

-- ASN1START

GNSS-SSR-OrbitCorrections-r15 ::= SEQUENCE {

epochTime-r15 GNSS-SystemTime,

ssrUpdateInterval-r15 INTEGER (0..15),

satelliteReferenceDatum-r15 ENUMERATED { itrf, regional, ... },

iod-ssr-r15 INTEGER (0..15),

ssr-OrbitCorrectionList-r15 SSR-OrbitCorrectionList-r15,

...,

[[

orbit-IntegrityParameters-r17 ORBIT-IntegrityParameters-r17 OPTIONAL -- Need OR

]]

}

SSR-OrbitCorrectionList-r15 ::= SEQUENCE (SIZE(1..64)) OF SSR-OrbitCorrectionSatelliteElement-r15

SSR-OrbitCorrectionSatelliteElement-r15 ::= SEQUENCE {

svID-r15 SV-ID,

iod-r15 BIT STRING (SIZE(11)),

delta-radial-r15 INTEGER (-2097152..2097151),

delta-AlongTrack-r15 INTEGER (-524288..524287),

delta-CrossTrack-r15 INTEGER (-524288..524287),

dot-delta-radial-r15 INTEGER (-1048576..1048575) OPTIONAL, -- Need ON

dot-delta-AlongTrack-r15 INTEGER (-262144..262143) OPTIONAL, -- Need ON

dot-delta-CrossTrack-r15 INTEGER (-262144..262143) OPTIONAL, -- Need ON

...,

[[

ssr-IntegrityOrbitBounds-r17 SSR-IntegrityOrbitBounds-r17 OPTIONAL -- Cond Integrity1

]],

[[

refEmph-r17 ENUMERATED { b1c, ... } OPTIONAL -- Cond REF

]]

}

ORBIT-IntegrityParameters-r17 ::= SEQUENCE {

probOnsetConstFault-r17 INTEGER (0..255),

meanConstFaultDuration-r17 INTEGER (1..3600),

probOnsetSatFault-r17 INTEGER (0..255),

meanSatFaultDuration-r17 INTEGER (1..3600),

orbitRangeErrorCorrelationTime-r17 INTEGER (0..255) OPTIONAL, -- Need OR

orbitRangeRateErrorCorrelationTime-r17 INTEGER (0..255) OPTIONAL, -- Cond Integrity2

...

}

SSR-IntegrityOrbitBounds-r17 ::= SEQUENCE {

meanOrbitError-r17 RAC-OrbitalErrorComponents-r17,

stdDevOrbitError-r17 RAC-OrbitalErrorComponents-r17,

meanOrbitRateError-r17 RAC-OrbitalErrorComponents-r17,

stdDevOrbitRateError-r17 RAC-OrbitalErrorComponents-r17,

...

}

RAC-OrbitalErrorComponents-r17 ::= SEQUENCE {

radial-r17 INTEGER (0..255),

alongTrack-r17 INTEGER (0..255),

crossTrack-r17 INTEGER (0..255)

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *Integrity1* | The field is mandatory present if *ORBIT-IntegrityParameters* is present*;* otherwise it is not present. |
| *Integrity2* | The field is mandatory present if *orbitRangeErrorCorrelationTime* is present*;* otherwise it is not present. |
| *REF* | The field is optionally present, Need ON, for none default reference signal (e.g. B1C in [XX]); otherwise it is not present. |

| *GNSS-SSR-OrbitCorrections* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the orbit corrections. The *gnss-TimeID* in *GNSS-SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***ssrUpdateInterval***  This field specifies the SSR Update Interval. The SSR Update Intervals for all SSR parameters start at time 00:00:00 of the GPS time scale. A change of the SSR Update Interval during the transmission of SSR data should ensure consistent data for a target device. See table Value of *ssrUpdateInterval* to SSR Update Interval relation below. NOTE 1. |
| ***satelliteReferenceDatum***  This field specifies the satellite refence datum for the orbit corrections. |
| ***iod-ssr***  This field specifies the Issue of Data number for the SSR data. A change of *iod-ssr* is used to indicate a change in the SSR generating configuration. |
| ***svID***  This field specifies the satellite for which the orbit corrections are provided. |
| ***iod***  This field specifies the IOD value of the broadcast ephemeris for which the orbit corrections are valid (see IE *GNSS‑NavigationModel*). NOTE 2, NOTE4. |
| ***delta-radial***  This field specifies the radial orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.1 mm; range ±209.7151 m. |
| ***delta-AlongTrack***  This field specifies the along-track orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.4 mm; range ±209.7148 m. |
| ***delta-CrossTrack***  This field specifies the cross-track orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.4 mm; range ±209.7148 m. |
| ***dot-delta-radial***  This field specifies the velocity of radial orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.001 mm/s; range ±1.048575 m/s. |
| ***dot-delta-AlongTrack***  This field specifies the velocity of along-track orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.004 mm/s; range ±1.048572 m/s. |
| ***dot-delta-CrossTrack***  This field specifies the velocity of cross-track orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.004 mm/s; range ±1.048572 m/s. |
| ***probOnsetConstFault***  This field specifies the Probability of Onset of Constellation Fault per Time Unit where a constellation fault is at least two satellites being faulty simultaneously due to the same event.  This field specifies the onset probability that the residual range or range rate error exceeds a bound created using the minimum allowed inflation factor *Kmin*, and bounding parameters as *mean* + *Kmin* \* *stdDev* where *Kmin* = *normInv*(*irMaximum* / 2), with *irMaximum* as provided in IE *GNSS-Integrity-ServiceParameters*.  The probability is calculated by *P*=10-0.04*n* [hour-1] where *n* is the value of *probOnsetConstFault* and the range is 10-10.2 to 1 per hour. |
| ***meanConstFaultDuration***  This field specifies the Mean Constellation Fault Duration which is the mean duration between when a constellation fault occurs, and the user is alerted by IE *GNSS-RealTimeIntegrity* (or the integrity violation is over).  Scale factor 1 s; range 1-3600 s. |
| ***probOnsetSatFault***  This field specifies the Probability of Onset of Satellite Fault per Time Unit which is the probability of occurrence of satellite error to exceed the residual error bound for more than the Time to Alert (TTA).  This field specifies the onset probability that the residual range or range rate error exceeds a bound created using the minimum allowed inflation factor *Kmin*, and bounding parameters as *mean* + *Kmin* \* *stdDev* where *Kmin* = *normInv*(*irMaximum* / 2), with *irMaximum* as provided in IE *GNSS-Integrity-ServiceParameters*.  The probability is calculated by *P*=10-0.04*n* [hour-1] where *n* is the value of *probOnsetSatFault* and the range is 10-10.2 to 1 per hour. |
| ***meanSatFaultDuration***  This field specifies the Mean Satellite Fault Duration which is the mean duration between when a satellite fault occurs, and the user is alerted by IE *GNSS-RealTimeIntegrity* (or the integrity violation is over).  Scale factor 1 s; range 1-3,600 s. |
| ***orbitRangeErrorCorrelationTime***  This field specifies the Orbit Range Error Correlation Time which is the upper bound of the correlation time of the satellite residual range error due to orbit.  The time is calculated using:  Range is 1-28,200 s. |
| ***orbitRangeRateErrorCorrelationTime***  This field specifies the Orbit Range Rate Error Correlation Time which is the upper bound of the correlation time of the satellite residual range rate error due to orbit.  The time is calculated using:  Range is 1-28,200 s. |
| ***meanOrbitError***  This field specifies the Mean Orbit Error bound in satellite radial, along-track and cross-track coordinates, which are the mean values for a set of three overbounding models that bound the residual orbit error in satellite radial, along-track and cross-track directions.  Each mean is calculated using:  Range is 0-17.5 m. |
| ***stdDevOrbitError***  This field specifies the Standard Deviation Orbit Error bound in satellite radial, along-track and cross-track coordinates, which are the standard deviation values for a set of three overbounding models that bound the residual orbit error in satellite radial, along-track and cross-track directions.  Each standard deviation is calculated using:  Range is 0-17.5 m. |
| ***meanOrbitRateError***  This field specifies the Mean Orbit Rate Error in satellite radial, along-track and cross-track coordinates, which are the mean values for a set of three overbounding models that bound the residual satellite orbit rate error in satellite radial, along-track and cross-track directions.  Scale factor 0.001 m/s; range 0-0.255 m/s. |
| ***stdDevOrbitRateError***  This field specifies the Standard Deviation Orbit Rate Error in satellite radial, along-track and cross-track coordinates, which are the standard deviation values for a set of three overbounding models that bound the residual satellite orbit rate error in satellite radial, along-track and cross-track directions.  Scale factor 0.001 m/s; range 0-0.255 m/s. |
| ***refEmph***  This field specifies which signal is the reference signal that the iod field refers to (see the IE *GNSS‑NavigationModel*) if present. |

NOTE 1: The update intervals are aligned to the GPS time scale for all GNSSs in order to allow synchronous operation for multiple GNSS services. This means that the update intervals may not be aligned to the beginning of the day for another GNSS. Due to the leap seconds, this is generally the case for GLONASS.

NOTE 2: In the cases that *gnss-ID* indicates 'gps', 'qzss' or 'bds', the *iod* refers to the NAV broadcast ephemeris (GPS L1 C/A, QZSS QZS-L1 or BDS B1I/B3I, respectively, in table GNSS to iod Bit String(11) relation in IE *GNSS‑NavigationModel*).

NOTE 3: The reference time *t0* is *epochTime* + ½ × *ssrUpdateInterval*. The reference time *t0* for *ssrUpdateInterval* '0' is *epochTime*.

NOTE 4: In the cases that *gnss-ID* indicates 'bds' and if *refEmph* is present, the *iod* refers to the indicated broadcast ephemeris (e.g. *b1c* for B-CNAV1 broadcast ephemeris (BDS B1C/B2a in table GNSS to iod Bit String(11) relation in IE *GNSS‑NavigationModel*).

Value of *ssrUpdateInterval* to SSR Update Interval relation

|  |  |
| --- | --- |
| Value of *ssrUpdateInterval* | SSR Update Interval |
| 0 | 1 second |
| 1 | 2 seconds |
| 2 | 5 seconds |
| 3 | 10 seconds |
| 4 | 15 seconds |
| 5 | 30 seconds |
| 6 | 60 seconds |
| 7 | 120 seconds |
| 8 | 240 seconds |
| 9 | 300 seconds |
| 10 | 600 seconds |
| 11 | 900 seconds |
| 12 | 1800 seconds |
| 13 | 3600 seconds |
| 14 | 7200 seconds |
| 15 | 10800 seconds |

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| **The next change** |

#### 6.5.2.10 GNSS Capability Information Elements

#### – *GNSS-SSR-OrbitCorrectionsSupport*

-- ASN1START

GNSS-SSR-OrbitCorrectionsSupport-r15 ::= SEQUENCE {

...,

[[

orbit-IntegritySup-r17 BIT STRING { correlationTimeSup (0)

} (SIZE(1..8)) OPTIONAL

]],

[[

bds-B1C-SSR-OrbitCorrectionsSupport-r17 ENUMERATED { supported } OPTIONAL

]]

}

-- ASN1STOP

| *GNSS-SSR-OrbitCorrectionsSupport* field descriptions |
| --- |
| ***orbit-IntegritySup***  This field, if present, indicates that the target device supports the IEs *ORBIT-IntegrityParameters* and *SSR-IntegrityOrbitBounds*.  A one‑value at the bit position '0' means that the target device supports the fields *orbitRangeErrorCorrelationTime* and *orbitRangeRateErrorCorrelationTime* in IE *ORBIT-IntegrityParameters*. |
| ***bds-B1C-SSR-OrbitCorrectionsSupport***  This field, if present, indicates that the target device supports the SSR oribit correction for B1C. |

|  |
| --- |
| **The end** |