**3GPP TSG RAN WG2 #121 R2-23xxxxx**

**Athens, Greece, Feb 26 – 03 Mar, 2022**

**Agenda item:** 8.20.2

**Source:** Swift Navigation (Moderator)

**Title:**  [AT121][401][POS] Yaw and APC (Swift)

**Document for:**  Discussion, Agreement

# 1. Introduction

\* **[AT121][401][POS] Yaw and APC (Swift)**

Scope: Discuss the proposals in R2-2301645 / R2-2301667 and related CRs, and produce agreeable updates if consensus can be reached.

      Intended outcome: Report to TEI18 session in R2-2302122 (+potentially updated CRs)

      Deadline: Wednesday 2023-03-01 1900 EET

APC and Yaw were discussed in email discussion [R2-2213149](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_120/Docs/R2-2213149.zip) [1] at RAN2#120 and the following agreement was made:

Agreement:

RAN2 intend to address nonzero yaw condition and APC in LPP. FFS which release.

The following submissions are made to RAN2#121 and are the subject of this email discussion:

SSR Phase Bias with Yaw

[R2-2301667](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121/Docs/R2-2301667.zip) Support for SSR Phase Bias with Yaw Swift Navigation, Intel Corporation, InterDigital discussion Rel-18

R2-2301668 Stage 2 support for SSR Phase Bias with Yaw [Rel18Yaw] Swift Navigation, Intel Corporation, InterDigital draftCR Rel-18 36.305 17.2.0 C NR\_pos-Core, TEI18

R2-2301670 Stage 2 support for SSR Phase Bias with Yaw [Rel18Yaw] Swift Navigation, Intel Corporation, InterDigital draftCR Rel-18 38.305 17.3.0 C NR\_pos-Core, TEI18

R2-2301671 Support for SSR Phase Bias with Yaw in LPP [Rel18Yaw] Swift Navigation, Intel Corporation, InterDigital draftCR Rel-18 37.355 17.3.0 C NR\_pos-Core, TEI18

GNSS Satellite APC

[R2-2301645](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121/Docs/R2-2301645.zip) Support for GNSS Satellite APC Swift Navigation, Intel Corporation, InterDigital, CATT discussion Rel-18

R2-2301652 Stage 2 support for GNSS Satellite APC [Rel18APC] Swift Navigation, Intel Corporation, InterDigital, CATT draftCR Rel-18 36.305 17.2.0 C NR\_pos-Core, TEI18

R2-2301654 Stage 2 support for GNSS Satellite APC [Rel18APC] Swift Navigation, Intel Corporation, InterDigital, CATT draftCR Rel-18 38.305 17.3.0 C NR\_pos-Core, TEI18

R2-2301666 Support for GNSS Satellite APC in LPP [Rel18APC] Swift Navigation, Intel Corporation, InterDigital, CATT draftCR Rel-18 37.355 17.3.0 C NR\_pos-Core, TEI18

# 2. Discussion

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| Swift Navigation | Grant Hausler (grant@swiftnav.com) |
|  |  |
|  |  |

An offline discussion has also been scheduled for this topic at the meeting:

**Date/Time:** 28 Feb 2023 @ 4.30-5.00 pm EET

**Room:** Delta/Sigma

**GTW:** RAN2/RAN3 offline discussion

**Tohru:** RAN2\_Brk3

If necessary we can add a second round of discussion following the offline.

## 2.1 Yaw

R2-2301667 Support for SSR Phase Bias with Yaw Swift Navigation, Intel Corporation, InterDigital discussion Rel-18

* Yaw angle and rate are used to correct for satellite phase wind-up errors which can impact fixing rates and therefore overall positioning performance at the UE. Yaw angle can also be used to correct for variations in the Phase Center Offset (PCO).
* Some correction providers use a zero-yaw condition (e.g. CLAS) by pre-correcting yaw at the Network. Others send yaw the parameters explicitly (see IGS SSR Standards and RTCM Drafts).
* LPP can only support the zero-yaw condition today (inherited from CLAS), thereby limiting interoperability with correction providers who send yaw explicitly.
* In R16, RAN2 already made adaptations to CLAS to address similar issues of interoperability when mapping to 3GPP, e.g. grid definitions were generalised for global scalability. Yaw was overlooked.
* A new SSR Phase Bias with Yaw message has been proposed as a separate IE to avoid any issues of backward compatibility (i.e. to avoid changing how the existing SSR Phase Bias is interpreted).
* See **Appendix A.1 (Stage 2 - Yaw)**, **Appendix A.2 (LPP - Yaw)**, **Appendix A.3 (RRC - Yaw)**.

**Question 1: Do you agree that adding yaw parameters (TEI18) is necessary to avoid an interoperability issue? Please detail your reasoning if not.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  | Not all 3rd party services are expected to conform to CLAS convention and introducing yaw will ensure that services which output natively in draft RTCM, IGS or other formats that support yaw will be possible to transport over LPP. |
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**Question 2: Do you agree that a new IE (*GNSS-SSR-PhaseBiasYaw*) should be created (TEI18) to avoid any issues of backward compatibility? Please detail your reasoning if not.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  |  |
|  |  |  |  |
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**Question 3: Do you agree with the Stage 2 text proposals contained in Appendix A.1 (Stage 2 - Yaw)? Please suggest alternative text in the comments below if not.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  |  |
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**Question 4: Do you agree with the Stage 2 text proposals contained in Appendix A.2 (LPP - Yaw)? Please suggest alternative text in the comments below if not.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  |  |
|  |  |  |  |
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**Question 5: Do you agree with the LPP text proposals contained in Appendix A.3 (RRC - Yaw)? Please suggest alternative text in the comments below if not.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  |  |
|  |  |  |  |
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**Question 6: Any other comments on the yaw proposal?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
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## 2.2 Satellite Antenna Phase Center (APC)

Moderator summarises the following key points from the discussion paper in addition to offline feedback already received in association with this paper:

R2-2301645 Support for GNSS Satellite APC Swift Navigation, Intel Corporation, InterDigital, CATT discussion Rel-18

* Satellite APC is currently hardcoded and/or manually updated on the device. Different model parameters exist for the APC information and these models are updated from time to time as new satellites are launched or the model parameters are updated.
* ANTEX is commonly used (and is the basis of the message design) but the choice of APC model is ultimately implementation-dependent. There are also different techniques for how to mitigate the APC errors (e.g. Network-only, UE-only or some combination of both) but no way to identify in LPP which technique is associated with the provided corrections (in fact even for CLAS there are various ways a provider could interpret how to handle the APC at the Network).
* In LPP, users currently require further knowledge outside of the specifications on which assumptions have been made at the Network to handle the APC (e.g. choice of satellite antenna reference point in the orbit corrections; whether PCO/PCV are fully or partially ignored).
* Sending APC parameters can resolve potential issues of interoperability by a) clarifying which assumptions are made in the corrections, b) supporting multiple techniques for addressing APC.
* The APC message has been proposed as a separate IE to avoid issues of backward compatibility.
* There are open questions to address on whether to support APC in the posSIBs.
* See **Appendix B.1 (Stage 2 - APC)**, **Appendix B.2 (LPP - APC)**, **Appendix B.3 (RRC - APC)**.

We have further decomposed the questions into two themes: **Interoperability** and **Message Proposal**.

### 2.2.1 Interoperability

**Question 7: Do you agree that further clarification is required in LPP to unambiguously determine what assumptions have been made on satellite APC in the provided corrections (e.g. even in the case of CLAS)? Please detail your reasoning if not.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  | In LPP today the UE has no way of knowing:1. Which APC model (if any) is used by the NW (e.g. ANTEX or others), which is implementation-dependent.
2. Which satellite antenna reference point the orbit corrections are aligned to (e.g. iono-free phase center, L1 phase center, CoM etc), which is implementation-dependent.
3. Which technique the provider has used to mitigate the impact of APC (e.g. fully, partially or not at all at the NW), which is implementation-dependent.

Sending APC parameters resolves these issues by enabling the PCO/PCV offsets corresponding to a given satellite antenna reference point and (by implication) APC mitigation technique to be sent explicitly in the assistance data. |
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**Question 8: For the purpose of interoperability, do you agree that LPP should support multiple techniques for handling the satellite APC (e.g. other than CLAS)? Please detail your reasoning if not.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Yes |  | Further to Q6, attempting to specify any one of a), b) or c) in the standard will limit interoperability by constraining users to one type of implementation. |
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### 2.2.2 Message Proposal

**Question 9: Do you agree that LPP should optionally support sending the Phase Center Offset (PCO) parameters? Please explain your reasoning if not?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  | PCOs must be consistent with the choice of satellite antenna reference point in the orbit correction. Sending PCOs in the assistance ensures this relationship can be signaled unambiguously in the provided corrections. |
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**Question 10: Do you agree that LPP should optionally support sending the Phase Center Variation parameters based on the following options (Yes/No):**

1. **Nadir-only (i.e. elevation-dependent) variations:**
2. **Nadir and azimuth dependent variations (with optional choice, as per current proposal)**
3. **Neither**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **a)** | **b)** | **c)** | **Comments** |
| Swift Navigation | Y | ? |  | We at least need a) to mitigate errors at the cm-level and could probably accept just a) only given azimuthal variations are typically at the mm-level. |
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**Question 11: Do you agree with updating the *Value of ssrUpdateInterval to SSR Update Interval relation* table to enable the validity of the APC parameters to extend beyond 3 hours? Please detail your reasoning.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  | Enables long-term validity of the corrections. TBD if we also require an APC IOD to unambiguously associate APC parameters between sessions or different correction providers, without needing to resend the parameters. It seems a Provider ID would also necessary to satisfy the use case for using different providers (relevant to the APC as well as for other SSR corrections). |
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**Question 12: Do you agree with adding the APC parameters as a separate IE to maintain backward compatibility?**

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| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  |  |
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**Question 13: Do agree the APC parameters should be supported in the PosSIBs? Please outline your reasoning.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation | Y |  | Yes. We don’t see it as the typical use case but we don’t think it should be excluded as an option if operators wish to support it. |
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**Question 14: Any other comments on the APC proposal?**

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| --- | --- | --- | --- |
| **Company** | **Yes** | **No** | **Comments** |
| Swift Navigation |  |  | Message proposal to be updated subject to the discussion above. |
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# 3. Conclusions and Proposals

# 4. References

1. R2-2213149, “[AT120][402][POS] Yaw angle and APC (Swift)”, Moderator (Swift Navigation, RAN2#120.

# Appendix A.1 (Stage 2 - Yaw)

START OF CHANGE

**/\*\*Skip unmodified parts\*\*/**

### 8.1.2 Information to be transferred between NG-RAN/5GC Elements

This clause defines the information that may be transferred between LMF and UE.

#### 8.1.2.1 Information that may be transferred from the LMF 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 LMF to the UE.

NOTE: The provision of these assistance data elements and the usage of these elements by the UE depend on the NG-RAN/5GC and UE capabilities, respectively.

Table 8.1.2.1-1: Information that may be transferred from the LMF 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 |
| SSR Phase Bias |
| SSR STEC Corrections |
| SSR Gridded Correction |
| SSR URA |
| SSR Correction Points |
| Integrity Service Parameters |
| Integrity Alerts |
| SSR Phase Bias with Yaw |

NEXT CHANGE

**/\*\*Skip unmodified parts\*\*/**

##### 8.1.2.1.24 SSR Phase Bias

SSR Phase Bias provides the GNSS receiver with the GNSS signal phase bias that are added to the carrier phase measurements of the corresponding signal to get corrected phase ranges. An indicator used to count events when phase bias is discontinuous is provided. An optional indicator is also provided to indicate whether fixed, widelane fixed or float PPP-RTK positioning modes are supported on a per signal basis.

NOTE 1: On the UE side, phase bias corrections of appropriate type are needed to restore the integer nature of the phase ambiguities in PPP-RTK. Their absence will affect the quality of the positioning solution and prevent a fast convergence time.

NOTE 2: PPP-RTK Fixed position mode corresponds to the UE fixing the carrier phase ambiguity to an integer value. The PPP-RTK Widelane Fixed positioning mode corresponds to forming the widelane combination of carrier phase measurements and fixing the resulting ambiguity as an integer value. In PPP-RTK Float positioning mode the carrier phase ambiguity is not treated as an integer value.

NOTE 3: The SSR Phase Bias values must be consistent with a satellite yaw angle of zero as per [43].

For integrity purposes, SSR Phase Bias also provides the mean and standard deviation that bounds the residual Phase Bias Error and its associated error rate.

*NEXT CHANGE*

**/\*\*Skip unmodified parts\*\*/**

##### 8.1.2.1.3x SSR Phase Bias with Yaw

SSR Phase Bias with Yaw provides the GNSS receiver with the GNSS signal phase bias and yaw information that are used to adjust the carrier phase measurements of the corresponding signal to get corrected phase ranges. An indicator used to count events when phase bias is discontinuous is provided. An optional indicator is also provided to indicate whether fixed, widelane fixed or float PPP-RTK positioning modes are supported on a per signal basis.

NOTE 1: On the UE side, phase bias corrections of appropriate type are needed to restore the integer nature of the phase ambiguities in PPP-RTK. Their absence will affect the quality of the positioning solution and prevent a fast convergence time.

NOTE 2: PPP-RTK Fixed position mode corresponds to the UE fixing the carrier phase ambiguity to an integer value. The PPP-RTK Widelane Fixed positioning mode corresponds to forming the widelane combination of carrier phase measurements and fixing the resulting ambiguity as an integer value. In PPP-RTK Float positioning mode the carrier phase ambiguity is not treated as an integer value.

For integrity purposes, SSR Phase Bias with Yaw also provides the mean and standard deviation that bounds the residual Phase Bias Error and its associated error rate.

#### 8.1.2.1a Recommendations for grouping of assistance data to support different RTK service levels

This clause provides recommendations for the different high-accuracy GNSS service levels: RTK, N-RTK, PPP and PPP-RTK.

The high-accuracy GNSS methods can be classified as:

- *Single base RTK service*: RTK is a technique that uses carrier-based ranging measurements i.e., phase-range to improve the positioning accuracy in a differential approach. The basic concept is to reduce and remove errors common to a Reference Station, with known position, and UE pair. When only pseudo ranges (code-based measurements) are used to compute the UE location, this method is known as DGNSS (Differential GNSS).

Table 8.1.2.1a-1: Single base RTK service: Specific information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| RTK Reference Station Information |
| RTK Observations |
| RTK Common Observation Information |
| GLONASS RTK Bias Information (if GLONASS data is transmitted) |
| Ephemeris and Clock (if UE did not acquire the navigation message) |

- *Non-Physical Reference Station Network RTK service*: In this approach the target UE receives synthetic observations from a fictitious Reference Station. The Network RTK software at the location server is performing the error estimation and creates a virtual Reference Station close to the initial location of the target device (provided a priori to the location server). The target UE interprets and uses the data just as if it had come from a single, real Reference Station. Additionally, the target UE can also receive network information such as RTK Network Residuals (see clause 8.1.2.1.19) or even FKP gradients (see clause 8.1.2.1.20).

Table 8.1.2.1a-2: Non-Physical Reference Station Network RTK service: Specific information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| RTK Reference Station Information |
| RTK Observations |
| RTK Common Observation Information |
| GLONASS RTK Bias Information (if GLONASS data is transmitted) |
| RTK Residuals |
| RTK FKP Gradients |
| Ephemeris and Clock (if UE did not acquire the navigation message) |

- *MAC Network RTK service*: In MAC network RTK, a group of Reference Stations are used and one of them is chosen as a Master station. The other stations are then called Auxiliary stations. In this service, the location server sends full raw observations and coordinate information for a single Reference Station, the Master Station. For all auxiliary stations in the network (or a suitable subset of stations) the information is provided to the UE in a highly compact form: their reduced ambiguity-levelled observations, coordinate differences (to the Master Station observations and coordinates), and network residuals. Two Reference Stations are said to be on a common ambiguity level if the integer ambiguities for each phase range (satellite-receiver pair) have been removed (or adjusted) so that the integer ambiguities cancel when double-differences (involving two receivers and two satellites) are formed during processing. The maintenance of a common ambiguity level at a specific set of stations rather than across the whole GNSS network will lead to a grouping in network clusters or subnetworks of all ambiguity-levelled Reference Stations. If one network has only one subnetwork, this indicates that an ambiguity level throughout the whole network is established. When subnetworks are predefined, the assistance data can be broadcast to all UEs located in the assigned sub-network. More details on the usage of subnetworks can be found in [31].

Table 8.1.2.1a-3: MAC Network RTK service: Specific Information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| RTK Reference Station Information |
| RTK Auxiliary Station Data |
| RTK Observations |
| RTK Common Observation Information |
| GLONASS RTK Bias Information (if GLONASS data is transmitted) |
| RTK MAC Correction Differences |
| RTK Residuals |
| Ephemeris and Clock (if UE did not acquire the navigation message) |

- *FKP Network RTK service*: With the concept of FKP, horizontal gradients of distance-dependent errors like ionosphere, troposphere and orbits are derived from a network of GNSS Reference Stations and transmitted to a target device together with raw or correction data of a corresponding Reference Station (physical or non physical). The target UE may use the gradients to compute the effect of the distance-dependent errors for its own position.

Table 8.1.2.1a-4: FKP Network RTK service: Information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| RTK Reference Station Information |
| RTK Observations |
| RTK Common Observation Information |
| GLONASS RTK Bias Information (if GLONASS data is transmitted) |
| RTK Residuals |
| RTK FKP Gradients |
| Ephemeris and Clock (if UE did not acquire the navigation message) |

- *PPP service*: This concept uses precise satellite orbit and clock parameters derived from global networks of Reference Stations as well as atmospheric models to perform single station positioning [31]. Compared to RTK and Network RTK, PPP is not a differential technique as there is no baseline limitation. When the orbits and clocks assistance data elements are provided in real-time, with no latency, the method is called Real-Time PPP.

Table 8.1.2.1a-5: SSR PPP service: Information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| SSR Orbit Corrections |
| SSR Clock corrections |
| SSR Code Bias |
| Ephemeris and Clock (if UE did not acquire the navigation message) |

- *PPP-RTK service*: This concept uses precise satellite orbits and clock parameters, the satellite signal biases derived from global networks of Reference Stations as well as ionosphere and troposphere corrections to perform single station positioning IS-QZSS-L6-001 [36]. Therefore, PPP-RTK services compensate the global and local corrections for a more accurate location information. Compared to PPP, PPP-RTK requires the UE to be located within the region covered by the ionosphere and troposphere corrections.

Table 8.1.2.1a-6: SSR PPP-RTK service: Information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| SSR Orbit Corrections |
| SSR Clock corrections |
| SSR Code Bias |
| Ephemeris and Clock (if UE did not acquire the navigation message) |
| SSR Phase Bias |
| SSR STEC Corrections |
| SSR Gridded Correction |
| SSR URA |
| SSR Correction Points |
| SSR Phase Bias with Yaw |

#### 8.1.2.1b Mapping of integrity parameters

Table 8.1.2.1b-1 shows the mapping between the integrity fields and the SSR assistance data according to the Integrity Principle of Operation (Clause 8.1.1a). The corresponding field descriptions for each of the field names listed in Table 8.1.2.1b-1 are specified under Clause 6.5.2.2 of TS 37.355 [42].

Table 8.1.2.1b-1: Mapping of Integrity Parameters

|  |  |  |
| --- | --- | --- |
| Error | GNSS Assistance Data | Integrity Fields |
| Integrity Alerts | Integrity Bounds (Mean) | Integrity Bounds (StdDev) | Residual Risks | Integrity Correlation Times |
| Orbit | SSR Orbit Corrections | Real-Time Integrity(see Clause 8.1.2.1.8) | Mean Orbit ErrorMean Orbit Rate Error(Calculated according to Equation 8.1.2.1.21-1) | Variance Orbit ErrorVariance Orbit Rate Error(Calculated according to Equation 8.1.2.1.21-1) | Probability of Onset of Constellation FaultProbability of Onset of Satellite FaultMean Constellation Fault DurationMean Satellite Fault Duration | Orbit Range Error Correlation TimeOrbit Range Rate Error Correlation Time |
| Clock | SSR Clock Corrections | Mean Clock ErrorMean Clock Rate Error | Standard Deviation Clock ErrorStandard Deviation Clock Rate Error | Clock Range Error Correlation TimeClock Range Rate Error Correlation Time |
| Code Bias | SSR Code Bias | Mean Code Bias ErrorMean Code Bias Rate Error | Standard Deviation Code Bias ErrorStandard Deviation Code Bias Rate Error |  |
| Phase Bias | SSR Phase BiasSSR Phase Bias with Yaw | Mean Phase Bias ErrorMean Phase Bias Rate Error | Standard Deviation Phase Bias ErrorStandard Deviation Phase Bias Rate Error |
| Ionosphere | SSR STEC Correction | Ionosphere DNU | Mean Ionospherre ErrorMean Ionospherre Rate Error | Standard Deviation Ionosphere ErrorStandard Deviation Ionosphere Rate Error | Probability of Onset of Ionosphere FaultMean Ionosphere Fault Duration | Ionosphere Range Error Correlation TimeIonosphere Range Rate Error Correlation Time |
| Troposphere Vertical Hydro Static Delay | SSR Gridded Corrections | Troposphere DNU | Mean Troposphere Vertical Hydro Static Delay ErrorMean Troposphere Vertical Hydro Static Delay Rate Error | Standard Deviation Troposphere Vertical Hydro Static Delay ErrorStandard Deviation Troposphere Vertical Hydro Static Delay Rate Error | Probability of Onset of Troposphere FaultMean Troposphere Fault Duration | Troposphere Range Error Correlation TimeTroposphere Range Rate Error Correlation Time |
| TroposphereVertical WetDelay | Mean Troposphere Vertical Wet Delay ErrorMean Troposphere Vertical Wet Delay Rate Error | Standard Deviation Troposphere Vertical Wet Delay ErrorStandard Deviation Troposphere Vertical Wet Delay Rate Error |

END OF CHANGE

# Appendix A.2 – (LPP -Yaw)

START OF CHANGE

**/\*\*Skip unmodified parts\*\*/**

### 6.5.2 A-GNSS Positioning

#### 6.5.2.1 GNSS Assistance Data

#### – *A-GNSS-ProvideAssistanceData*

The IE *A-GNSS-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑based and UE‑assisted A‑GNSS. It may also be used to provide GNSS positioning specific error reasons.

-- ASN1START

A-GNSS-ProvideAssistanceData ::= SEQUENCE {

 gnss-CommonAssistData GNSS-CommonAssistData OPTIONAL, -- Need ON

 gnss-GenericAssistData GNSS-GenericAssistData OPTIONAL, -- Need ON

 gnss-Error A-GNSS-Error OPTIONAL, -- Need ON

 ...,

 [[

 gnss-PeriodicAssistData-r15 GNSS-PeriodicAssistData-r15 OPTIONAL -- Cond CtrTrans

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *CtrTrans* | The field is mandatory present in the control transaction of a periodic assistance data delivery session as described in clauses 5.2.1a and 5.2.2a. Otherwise it is not present. |

#### – *GNSS-CommonAssistData*

The IE *GNSS-CommonAssistData* is used by the location server to provide assistance data which can be used for any GNSS.

-- ASN1START

GNSS-CommonAssistData ::= SEQUENCE {

 gnss-ReferenceTime GNSS-ReferenceTime OPTIONAL, -- Need ON

 gnss-ReferenceLocation GNSS-ReferenceLocation OPTIONAL, -- Need ON

 gnss-IonosphericModel GNSS-IonosphericModel OPTIONAL, -- Need ON

 gnss-EarthOrientationParameters GNSS-EarthOrientationParameters OPTIONAL, -- Need ON

 ...,

 [[

 gnss-RTK-ReferenceStationInfo-r15

 GNSS-RTK-ReferenceStationInfo-r15 OPTIONAL, -- Need ON

 gnss-RTK-CommonObservationInfo-r15

 GNSS-RTK-CommonObservationInfo-r15 OPTIONAL, -- Cond RTK

 gnss-RTK-AuxiliaryStationData-r15

 GNSS-RTK-AuxiliaryStationData-r15 OPTIONAL -- Need ON

 ]],

 [[

 gnss-SSR-CorrectionPoints-r16

 GNSS-SSR-CorrectionPoints-r16 OPTIONAL -- Need ON

 ]],

 [[

 gnss-Integrity-ServiceParameters-r17

 GNSS-Integrity-ServiceParameters-r17 OPTIONAL, -- Need ON

 gnss-Integrity-ServiceAlert-r17

 GNSS-Integrity-ServiceAlert-r17 OPTIONAL -- Need OR

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *RTK* | The field is mandatory present if the IE *GNSS-RTK-Observations* is included in IE *GNSS‑GenericAssistData*; otherwise it is not present. |

#### – *GNSS-GenericAssistData*

The IE *GNSS-GenericAssistData* is used by the location server to provide assistance data for a specific GNSS. The specific GNSS for which the provided assistance data are applicable is indicated by the IE *GNSS‑ID* and (if applicable) by the IE *SBAS‑ID*. Assistance for up to 16 GNSSs can be provided.

-- ASN1START

GNSS-GenericAssistData ::= SEQUENCE (SIZE (1..16)) OF GNSS-GenericAssistDataElement

GNSS-GenericAssistDataElement ::= SEQUENCE {

 gnss-ID GNSS-ID,

 sbas-ID SBAS-ID OPTIONAL, -- Cond GNSS-ID-SBAS

 gnss-TimeModels GNSS-TimeModelList OPTIONAL, -- Need ON

 gnss-DifferentialCorrections GNSS-DifferentialCorrections OPTIONAL, -- Need ON

 gnss-NavigationModel GNSS-NavigationModel OPTIONAL, -- Need ON

 gnss-RealTimeIntegrity GNSS-RealTimeIntegrity OPTIONAL, -- Need ON

 gnss-DataBitAssistance GNSS-DataBitAssistance OPTIONAL, -- Need ON

 gnss-AcquisitionAssistance GNSS-AcquisitionAssistance OPTIONAL, -- Need ON

 gnss-Almanac GNSS-Almanac OPTIONAL, -- Need ON

 gnss-UTC-Model GNSS-UTC-Model OPTIONAL, -- Need ON

 gnss-AuxiliaryInformation GNSS-AuxiliaryInformation OPTIONAL, -- Need ON

 ...,

 [[

 bds-DifferentialCorrections-r12

 BDS-DifferentialCorrections-r12 OPTIONAL, -- Cond GNSS-ID-BDS

 bds-GridModel-r12 BDS-GridModelParameter-r12 OPTIONAL -- Cond GNSS-ID-BDS

 ]],

 [[

 gnss-RTK-Observations-r15 GNSS-RTK-Observations-r15 OPTIONAL, -- Need ON

 glo-RTK-BiasInformation-r15 GLO-RTK-BiasInformation-r15 OPTIONAL, -- Cond GNSS-ID-GLO

 gnss-RTK-MAC-CorrectionDifferences-r15

 GNSS-RTK-MAC-CorrectionDifferences-r15

 OPTIONAL, -- Need ON

 gnss-RTK-Residuals-r15 GNSS-RTK-Residuals-r15 OPTIONAL, -- Need ON

 gnss-RTK-FKP-Gradients-r15 GNSS-RTK-FKP-Gradients-r15 OPTIONAL, -- Need ON

 gnss-SSR-OrbitCorrections-r15

 GNSS-SSR-OrbitCorrections-r15 OPTIONAL, -- Need ON

 gnss-SSR-ClockCorrections-r15

 GNSS-SSR-ClockCorrections-r15 OPTIONAL, -- Need ON

 gnss-SSR-CodeBias-r15 GNSS-SSR-CodeBias-r15 OPTIONAL -- Need ON

 ]],

 [[

 gnss-SSR-URA-r16 GNSS-SSR-URA-r16 OPTIONAL, -- Need ON

 gnss-SSR-PhaseBias-r16 GNSS-SSR-PhaseBias-r16 OPTIONAL, -- Need ON

 gnss-SSR-STEC-Correction-r16 GNSS-SSR-STEC-Correction-r16

 OPTIONAL, -- Need ON

 gnss-SSR-GriddedCorrection-r16 GNSS-SSR-GriddedCorrection-r16

 OPTIONAL, -- Need ON

 navic-DifferentialCorrections-r16 NavIC-DifferentialCorrections-r16

 OPTIONAL, -- Cond GNSS-ID-NavIC

 navic-GridModel-r16 NavIC-GridModelParameter-r16

 OPTIONAL -- Cond GNSS-ID-NavIC

 ]],

 [[

 gnss-SSR-PhaseBiasYaw-r18 GNSS-SSR-PhaseBiasYaw-r18 OPTIONAL -- Need ON

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *GNSS‑ID‑BDS* | The field may be present if the *GNSS‑ID* = *bds*; otherwise it is not present. |
| *GNSS-ID-GLO* | The field is optionally present, need ON, if the *GNSS ID* = *glonass*; otherwise it is not present. |
| *GNSS-ID-NAVIC* | The field is optionally present, need ON, if the *GNSS‑ID* = *navic*; otherwise it is not present |

#### *– GNSS-PeriodicAssistData*

The IE *GNSS-PeriodicAssistData* is used by the location server to provide control parameters for a periodic assistance data delivery session (e.g., interval and duration) to the target device.

NOTE: Omission of a particular assistance data type field in IE *GNSS-PeriodicAssistData* means that the location server does not provide this assistance data type in a data transaction of a periodic assistance data delivery session, as described in clauses 5.2.1a and 5.2.2a. Inclusion of no assistance data type fields in IE *GNSS-PeriodicAssistData* means that a periodic assistance data delivery session is terminated.

-- ASN1START

GNSS-PeriodicAssistData-r15 ::= SEQUENCE {

 gnss-RTK-PeriodicObservations-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 glo-RTK-PeriodicBiasInformation-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-RTK-MAC-PeriodicCorrectionDifferences-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-RTK-PeriodicResiduals-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-RTK-FKP-PeriodicGradients-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicOrbitCorrections-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicClockCorrections-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicCodeBias-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 ...,

 [[

 gnss-SSR-PeriodicURA-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicPhaseBias-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicSTEC-Correction-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicGriddedCorrection-r16 GNSS-PeriodicControlParam-r15 OPTIONAL -- Need ON

 ]],

 [[

 gnss-Integrity-PeriodicServiceAlert-r17 GNSS-PeriodicControlParam-r15 OPTIONAL -- Need ON

 ]],

 [[

 gnss-SSR-PeriodicPhaseBiasYaw-r18 GNSS-PeriodicControlParam-r15 OPTIONAL -- Need ON

 ]]

}

-- ASN1STOP

#### 6.5.2.2 GNSS Assistance Data Elements

*NEXT CHANGE*

**/\*\*Skip unmodified parts\*\*/**

#### *– GNSS-SSR-PhaseBiasYaw*

The IE *GNSS-SSR-PhaseBiasYaw* is used by the location server to provide GNSS signal phase bias together with yaw and integrity information. The target device may use the phase bias and yaw values to adjust the phase-range measurement of the corresponding phase signal to get corrected phase-ranges.

The parameters provided in IE *GNSS-SSR-PhaseBiasYaw –* except for *SSR-IntegrityPhaseBiasBounds –* apply to all GNSSs and are used as specified for Compact SSR GNSS Satellite Phase Bias Messages (e.g., message type 4073,5) in [43] except that *GNSS-SSR-PhaseBiasYaw* also provides yaw angle and rate parameters rather than setting the yaw angle and rate to zero as in message type 4073,5 in [43].

-- ASN1START

GNSS-SSR-PhaseBiasYaw-r18 ::= SEQUENCE {

 epochTime-r18 GNSS-SystemTime,

 ssrUpdateInterval-r18 INTEGER (0..15),

 iod-ssr-r18 INTEGER (0..15),

 ssr-PhaseBiasYawSatList-r18 SSR-PhaseBiasSatList-r16,

 ...

}

SSR-PhaseBiasYawSignalList-r18 ::= SEQUENCE (SIZE(1..16)) OF SSR-PhaseBiasYawSignalElement-r18

SSR-PhaseBiasYawSignalElement-r18 ::= SEQUENCE {

 signal-and-tracking-mode-ID-r18 GNSS-SignalID,

 phaseBias-r18 INTEGER (-16384..16383),

 phaseDiscontinuityIndicator-r18 INTEGER (0..3),

 phaseBiasIntegerIndicator-r18 INTEGER (0..3) OPTIONAL, -- Need OP

 yawAngle-r18 INTEGER (0..511)

 yawRate-r18 INTEGER (-128..127) OPTIONAL, -- Need OR

 ssr-IntegrityPhaseBiasBounds-r18 SSR-IntegrityPhaseBiasBounds-r17 OPTIONAL -- Need OR

 ...

}

-- ASN1STOP

|  |
| --- |
| ***GNSS-SSR-PhaseBiasYaw* field descriptions** |
| ***epochTime***This field specifies the epoch time of the phase bias data. 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 in IE *GNSS‑SSR‑OrbitCorrections*. |
| ***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 GNSS satellite for which the phase biases are provided. |
| ***signal-and-tracking-mode-ID***This field specifies the GNSS signal for which the phase biases are provided.  |
| ***phaseBias***This field provides the phase bias for the GNSS signal indicated by *signal-and-tracking-mode-ID*.Scale factor 0.001 m; range ±16.383 m. |
| ***phaseDiscontinuityIndicator***This field provides the phase discontinuity counter for the GNSS signal indicated by *signal-and-tracking-mode-ID*. This counter is increased for every discontinuity in phase (roll-over from 3 to 0). |
| ***phaseBiasIntegerIndicator***This field informs whether the phase bias is Undifferenced Integer (Value 0), Widelane Integer (Value 1) or Non-Integer (Value 2):Value 0: The Undifferenced Integer Phase Bias supports PPP-RTK fixed, widelane or float mode.Value 1: The Widelane Integer Phase Bias indicates that after application of the Phase Bias value, this signal can be differenced with any other signal from the same satellite that also has Widelane Integer Phase Bias indicated to form a new combined carrier phase measurement of integer quality, supporting PPP-RTK widelane fixed mode.Value 2: The Non-Integer Phase Bias supports PPP-RTK float mode.Value 3: Reserved.If the *phaseBiasIntegerIndicator* field is not present then it is interpreted as having Value 0 (Undifferenced Integer). |
| ***yawAngle***Yaw angle used for computation of phase wind-up correction and partial orientation for use with satellite antenna phase center data. The yaw angle is defined as the rotation angle around the satellites z-axis which is pointing towards the center of the earth. The reference direction is the yaw origin, a unit vector to form an orthogonal basis for the orbit plane and is in the general direction of the satellite velocity vector.Units of 1/256 semi-circles. |
| ***yawRate***Rate of change of the yaw angle.Units of 1/8192 semi-circles/second. |

#### 6.5.2.3 GNSS Assistance Data Request

#### – *A-GNSS-RequestAssistanceData*

The IE *A-GNSS-RequestAssistanceData* is used by the target device to request GNSS assistance data from a location server.

-- ASN1START

A-GNSS-RequestAssistanceData ::= SEQUENCE {

 gnss-CommonAssistDataReq GNSS-CommonAssistDataReq OPTIONAL, -- Cond CommonADReq

 gnss-GenericAssistDataReq GNSS-GenericAssistDataReq OPTIONAL, -- Cond GenADReq

 ...,

 [[

 gnss-PeriodicAssistDataReq-r15

 GNSS-PeriodicAssistDataReq-r15 OPTIONAL -- Cond PerADReq

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *CommonADReq* | The field is mandatory present if the target device requests *GNSS-CommonAssistData*; otherwise it is not present. |
| *GenADReq* | This field is mandatory present if the target device requests *GNSS-GenericAssistData* for one or more specific GNSS; otherwise it is not present. |
| *PerADReq* | This field is mandatory present if the target device requests periodic GNSS assistance data delivery. This field may only be included if any of the fields are included in IE *GNSS‑GenericAssistDataReq:*- *GNSS-RTK-ObservationsReq*,- *GLO-RTK-BiasInformationReq*,- *GNSS-RTK-MAC-CorrectionDifferencesReq*,- *GNSS-RTK-ResidualsReq,*- *GNSS-RTK-FKP-GradientsReq*,- *GNSS-SSR-OrbitCorrectionsReq*,- *GNSS-SSR-ClockCorrectionsReq*,- *GNSS-SSR-CodeBiasReq.**- GNSS-SSR-URA-Req,**- GNSS-SSR-PhaseBiasReq,**- GNSS-SSR-STEC-CorrectionReq,**- GNSS-SSR-GriddedCorrectionReq,**- GNSS-Integrity-ServiceAlerReq,**- GNSS-SSR-PhaseBiasYawReq.* |

#### – *GNSS-CommonAssistDataReq*

The IE *GNSS-CommonAssistDataReq* is used by the target device to request assistance data that are applicable to any GNSS from a location server.

-- ASN1START

GNSS-CommonAssistDataReq ::= SEQUENCE {

 gnss-ReferenceTimeReq GNSS-ReferenceTimeReq

 OPTIONAL, -- Cond RefTimeReq

 gnss-ReferenceLocationReq GNSS-ReferenceLocationReq

 OPTIONAL, -- Cond RefLocReq

 gnss-IonosphericModelReq GNSS-IonosphericModelReq

 OPTIONAL, -- Cond IonoModReq

 gnss-EarthOrientationParametersReq GNSS-EarthOrientationParametersReq

 OPTIONAL, -- Cond EOPReq

 ...,

 [[

 gnss-RTK-ReferenceStationInfoReq-r15

 GNSS-RTK-ReferenceStationInfoReq-r15

 OPTIONAL, -- Cond ARPReq

 gnss-RTK-AuxiliaryStationDataReq-r15

 GNSS-RTK-AuxiliaryStationDataReq-r15

 OPTIONAL -- Cond AuxARPReq

 ]],

 [[

 gnss-SSR-CorrectionPointsReq-r16

 GNSS-SSR-CorrectionPointsReq-r16

 OPTIONAL -- Cond PointsReq

 ]],

 [[

 gnss-Integrity-ServiceParametersReq-r17

 GNSS-Integrity-ServiceParametersReq-r17

 OPTIONAL, -- Cond IntServiceReq

 gnss-Integrity-ServiceAlertReq-r17

 GNSS-Integrity-ServiceAlertReq-r17

 OPTIONAL -- Cond IntAlertReq

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *RefTimeReq* | The field is mandatory present if the target device requests *GNSS-ReferenceTime*; otherwise it is not present. |
| *RefLocReq* | This field is mandatory present if the target device requests *GNSS-ReferenceLocation*; otherwise it is not present. |
| *IonoModReq* | This field is mandatory present if the target device requests *GNSS-IonosphericModel*; otherwise it is not present. |
| *EOPReq* | This field is mandatory present if the target device requests *GNSS-EarthOrientationParameters*; otherwise it is not present. |
| *ARPReq* | This field is mandatory present if the target device requests *GNSS‑RTK‑ReferenceStationInfo*; otherwise it is not present. |
| *AuxARPReq* | This field is mandatory present if the target device requests *GNSS‑RTK‑AuxiliaryStationData*; otherwise it is not present. |
| *PointsReq* | This field is mandatory present if the target device requests *GNSS-SSR-CorrectionPoints*; otherwise it is not present. |
| *IntServiceReq* | This field is mandatory present if the target device requests *GNSS-Integrity-ServiceParameters*; otherwise it is not present. |
| *IntAlertReq* | This field is mandatory present if the target device requests *GNSS-Integrity-ServiceAlert*; otherwise it is not present. |

#### – *GNSS-GenericAssistDataReq*

The IE *GNSS-GenericAssistDataReq* is used by the target device to request assistance data from a location server for one or more specific GNSSs. The specific GNSS for which the assistance data are requested is indicated by the IE *GNSS‑ID* and (if applicable) by the IE *SBAS‑ID*. Assistance for up to 16 GNSSs can be requested.

-- ASN1START

GNSS-GenericAssistDataReq ::= SEQUENCE (SIZE (1..16)) OF GNSS-GenericAssistDataReqElement

GNSS-GenericAssistDataReqElement ::= SEQUENCE {

 gnss-ID GNSS-ID,

 sbas-ID SBAS-ID OPTIONAL, -- Cond GNSS-ID-SBAS

 gnss-TimeModelsReq GNSS-TimeModelListReq OPTIONAL, -- Cond TimeModReq

 gnss-DifferentialCorrectionsReq GNSS-DifferentialCorrectionsReq OPTIONAL, -- Cond DGNSS-Req

 gnss-NavigationModelReq GNSS-NavigationModelReq OPTIONAL, -- Cond NavModReq

 gnss-RealTimeIntegrityReq GNSS-RealTimeIntegrityReq OPTIONAL, -- Cond RTIReq

 gnss-DataBitAssistanceReq GNSS-DataBitAssistanceReq OPTIONAL, -- Cond DataBitsReq

 gnss-AcquisitionAssistanceReq GNSS-AcquisitionAssistanceReq OPTIONAL, -- Cond AcquAssistReq

 gnss-AlmanacReq GNSS-AlmanacReq OPTIONAL, -- Cond AlmanacReq

 gnss-UTCModelReq GNSS-UTC-ModelReq OPTIONAL, -- Cond UTCModReq

 gnss-AuxiliaryInformationReq GNSS-AuxiliaryInformationReq OPTIONAL, -- Cond AuxInfoReq

 ...,

 [[

 bds-DifferentialCorrectionsReq-r12

 BDS-DifferentialCorrectionsReq-r12

 OPTIONAL, -- Cond DBDS-Req

 bds-GridModelReq-r12 BDS-GridModelReq-r12 OPTIONAL -- Cond BDS-GridModReq

 ]],

 [[

 gnss-RTK-ObservationsReq-r15

 GNSS-RTK-ObservationsReq-r15 OPTIONAL, -- Cond RTK-OSR-Req

 glo-RTK-BiasInformationReq-r15

 GLO-RTK-BiasInformationReq-r15 OPTIONAL, -- Cond GLO-CPB-Req

 gnss-RTK-MAC-CorrectionDifferencesReq-r15

 GNSS-RTK-MAC-CorrectionDifferencesReq-r15

 OPTIONAL, -- Cond MAC-Req

 gnss-RTK-ResidualsReq-r15 GNSS-RTK-ResidualsReq-r15 OPTIONAL, -- Cond Res-Req

 gnss-RTK-FKP-GradientsReq-r15

 GNSS-RTK-FKP-GradientsReq-r15 OPTIONAL, -- Cond FKP-Req

 gnss-SSR-OrbitCorrectionsReq-r15

 GNSS-SSR-OrbitCorrectionsReq-r15

 OPTIONAL, -- Cond OC-Req

 gnss-SSR-ClockCorrectionsReq-r15

 GNSS-SSR-ClockCorrectionsReq-r15

 OPTIONAL, -- Cond CC-Req

 gnss-SSR-CodeBiasReq-r15 GNSS-SSR-CodeBiasReq-r15 OPTIONAL -- Cond CB-Req

 ]],

 [[

 gnss-SSR-URA-Req-r16 GNSS-SSR-URA-Req-r16 OPTIONAL, -- Cond URA-Req

 gnss-SSR-PhaseBiasReq-r16 GNSS-SSR-PhaseBiasReq-r16 OPTIONAL, -- Cond PB-Req

 gnss-SSR-STEC-CorrectionReq-r16

 GNSS-SSR-STEC-CorrectionReq-r16 OPTIONAL, -- Cond STEC-Req

 gnss-SSR-GriddedCorrectionReq-r16 GNSS-SSR-GriddedCorrectionReq-r16

 OPTIONAL, -- Cond Grid-Req

 navic-DifferentialCorrectionsReq-r16

 NavIC-DifferentialCorrectionsReq-r16

 OPTIONAL, -- Cond DNavIC-Req

 navic-GridModelReq-r16 NavIC-GridModelReq-r16 OPTIONAL -- Cond NavIC-GridModReq

 ]],

 [[

 gnss-SSR-PhaseBiasYawReq-r18 GNSS-SSR-PhaseBiasYawReq-r18 OPTIONAL -- Cond PBY-Req

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *TimeModReq* | The field is mandatory present if the target device requests *GNSS-TimeModelList*; otherwise it is not present. |
| *DGNSS-Req* | The field is mandatory present if the target device requests *GNSS-DifferentialCorrections*; otherwise it is not present. |
| *NavModReq* | The field is mandatory present if the target device requests *GNSS-NavigationModel*; otherwise it is not present. |
| *RTIReq* | The field is mandatory present if the target device requests *GNSS-RealTimeIntegrity*; otherwise it is not present. |
| *DataBitsReq* | The field is mandatory present if the target device requests *GNSS-DataBitAssistance*; otherwise it is not present. |
| *AcquAssistReq* | The field is mandatory present if the target device requests *GNSS-AcquisitionAssistance*; otherwise it is not present. |
| *AlmanacReq* | The field is mandatory present if the target device requests *GNSS-Almanac*; otherwise it is not present. |
| *UTCModReq* | The field is mandatory present if the target device requests *GNSS-UTCModel*; otherwise it is not present. |
| *AuxInfoReq* | The field is mandatory present if the target device requests *GNSS-AuxiliaryInformation*; otherwise it is not present. |
| *DBDS-Req* | The field is mandatory present if the target device requests *BDS-DifferentialCorrections*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *BDS-GridModReq* | The field is mandatory present if the target device requests *BDS-GridModel*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *RTK-OSR-Req* | The field is mandatory present if the target device requests *GNSS-RTK-Observations*; otherwise it is not present. |
| *GLO-CPB-Req* | The field is mandatory present if the target device requests *GLO-RTK-BiasInformation*; otherwise it is not present. |
| *MAC-Req* | The field is mandatory present if the target device requests *GNSS‑RTK‑MAC‑CorrectionDifferences*; otherwise it is not present. |
| *Res-Req* | The field is mandatory present if the target device requests *GNSS-RTK-Residuals*; otherwise it is not present. |
| *FKP-Req* | The field is mandatory present if the target device requests *GNSS-RTK-FKP-Gradients*; otherwise it is not present. |
| *OC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-OrbitCorrections*; otherwise it is not present. |
| *CC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-ClockCorrections*; otherwise it is not present. |
| *CB-Req* | The field is mandatory present if the target device requests *GNSS-SSR-CodeBias*; otherwise it is not present. |
| *URA-Req* | The field is mandatory present if the target device requests *GNSS-SSR-URA*; otherwise it is not present. |
| *PB-Req* | The field is mandatory present if the target device requests *GNSS-SSR-PhaseBias*; otherwise it is not present. |
| *STEC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-STEC-Correction*; otherwise it is not present. |
| *Grid-Req* | The field is mandatory present if the target device requests *GNSS‑SSR‑GriddedCorrection*; otherwise it is not present. |
| *DNavIC-Req* | The field is mandatory present if the target device requests *NavIC-DifferentialCorrections*; otherwise it is not present. This field may only be present if the *gnss-ID* indicates 'navic'. |
| *NavIC-GridModReq* | The field is mandatory present if the target device requests *NavIC-GridModel*; otherwise it is not present. This field may only be present if the *gnss-ID* indicates 'navic'. |
| *PBY-Req* | The field is mandatory present if the target device requests *GNSS-SSR-PhaseBiasYaw*; otherwise it is not present. |

#### *– GNSS-PeriodicAssistDataReq*

The IE *GNSS-PeriodicAssistDataReq* is used by the target device to request periodic assistance data delivery from a location server.

-- ASN1START

GNSS-PeriodicAssistDataReq-r15 ::= SEQUENCE {

 gnss-RTK-PeriodicObservationsReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pOSR

 glo-RTK-PeriodicBiasInformationReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pCPB

 gnss-RTK-MAC-PeriodicCorrectionDifferencesReq-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pMAC

 gnss-RTK-PeriodicResidualsReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pRes

 gnss-RTK-FKP-PeriodicGradientsReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pFKP

 gnss-SSR-PeriodicOrbitCorrectionsReq-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pOC

 gnss-SSR-PeriodicClockCorrectionsReq-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pCC

 gnss-SSR-PeriodicCodeBiasReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pCB

 ...,

 [[

 gnss-SSR-PeriodicURA-Req-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pURA

 gnss-SSR-PeriodicPhaseBiasReq-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pPB

 gnss-SSR-PeriodicSTEC-CorrectionReq-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pSTEC

 gnss-SSR-PeriodicGriddedCorrectionReq-r16

 GNSS-PeriodicControlParam-r15 OPTIONAL -- Cond pGrid

 ]],

 [[

 gnss-Integrity-PeriodicServiceAlertReq-r17

 GNSS-PeriodicControlParam-r15 OPTIONAL -- Cond pDNU

 ]],

 [[

 gnss-SSR-PeriodicPhaseBiasYawReq-r18 GNSS-PeriodicControlParam-r15 OPTIONAL -- Cond pPBY

 ]]

}

-- ASN1STOP

| *Conditional presence* | Explanation |
| --- | --- |
| *pOSR* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑Observations*; otherwise it is not present. |
| *pCPB* | The field is mandatory present if the target device requests periodic *GLO‑RTK‑BiasInformation*; otherwise it is not present. |
| *pMAC* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑MAC‑CorrectionDifferences*; otherwise it is not present. |
| *pRes* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑Residuals*; otherwise it is not present. |
| *pFKP* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑FKP‑Gradients*; otherwise it is not present. |
| *pOC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑OrbitCorrections*; otherwise it is not present. |
| *pCC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑ClockCorrections*; otherwise it is not present. |
| *pCB* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑CodeBias*; otherwise it is not present. |
| *pURA* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑URA*; otherwise it is not present. |
| *pPB* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑PhaseBias*; otherwise it is not present. |
| *pSTEC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑STEC‑Correction*; otherwise it is not present.  |
| *pGrid* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑GriddedCorrection*; otherwise it is not present. |
| *pDNU* | The field is mandatory present if the target device requests periodic *GNSS-Integrity-ServiceAlert*; otherwise it is not present. |
| *pPBY* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑PhaseBiasYaw*; otherwise it is not present. |

#### 6.5.2.4 GNSS Assistance Data Request Elements

**/\*\*Skip unmodified parts\*\*/**

*NEXT CHANGE*

#### *– GNSS-SSR-PhaseBiasYawReq*

The IE *GNSS-SSR-PhaseBiasYawReq* is used by the target device to request the *GNSS-SSR-PhaseBiasYaw* assistancefrom the location server.

-- ASN1START

GNSS-SSR-PhaseBiasYawReq-r18 ::= SEQUENCE {

 signal-and-tracking-mode-ID-Map-r18 GNSS-SignalIDs,

 storedNavList-r18 GNSS-NavListInfo-r15 OPTIONAL,

 ssr-IntegrityPhaseBiasBoundsReq-r18 ENUMERATED { requested } OPTIONAL

 ...

}

-- ASN1STOP

| ***GNSS-SSR-PhaseBiasYawReq* field descriptions** |
| --- |
| ***signal-and-tracking-mode-ID-Map***This field specifies the GNSS signal(s) for which the *GNSS-SSR-PhaseBiasYaw* is requested.  |
| ***storedNavList***This list provides information to the location server about which NAV data the target device has currently stored for the particular GNSS indicated by *GNSS-ID*. |
| ***ssr-IntegrityPhaseBiasBoundsReq***This field, if present, indicates that the *SSR-IntegrityPhaseBiasBounds* are requested. |

#### 6.5.2.5 GNSS Location Information

**/\*\*Skip unmodified parts\*\*/**

*NEXT CHANGE*

#### 6.5.2.10 GNSS Capability Information Elements

**/\*\*Skip unmodified parts\*\*/**

#### – *GNSS-GenericAssistanceDataSupport*

The IE *GNSS-GenericAssistanceDataSupport* is used by the target device to provide information on supported GNSS generic assistance data types to the location server for each supported GNSS.

-- ASN1START

GNSS-GenericAssistanceDataSupport ::=

 SEQUENCE (SIZE (1..16)) OF GNSS-GenericAssistDataSupportElement

GNSS-GenericAssistDataSupportElement ::= SEQUENCE {

 gnss-ID GNSS-ID,

 sbas-ID SBAS-ID OPTIONAL, -- Cond GNSS‑ID‑SBAS

 gnss-TimeModelsSupport GNSS-TimeModelListSupport

 OPTIONAL, -- Cond TimeModSup

 gnss-DifferentialCorrectionsSupport GNSS-DifferentialCorrectionsSupport

 OPTIONAL, -- Cond DGNSS-Sup

 gnss-NavigationModelSupport GNSS-NavigationModelSupport

 OPTIONAL, -- Cond NavModSup

 gnss-RealTimeIntegritySupport GNSS-RealTimeIntegritySupport

 OPTIONAL, -- Cond RTISup

 gnss-DataBitAssistanceSupport GNSS-DataBitAssistanceSupport

 OPTIONAL, -- Cond DataBitsSup

 gnss-AcquisitionAssistanceSupport GNSS-AcquisitionAssistanceSupport

 OPTIONAL, -- Cond AcquAssistSup

 gnss-AlmanacSupport GNSS-AlmanacSupport

 OPTIONAL, -- Cond AlmanacSup

 gnss-UTC-ModelSupport GNSS-UTC-ModelSupport

 OPTIONAL, -- Cond UTCModSup

 gnss-AuxiliaryInformationSupport GNSS-AuxiliaryInformationSupport

 OPTIONAL, -- Cond AuxInfoSup

 ...,

 [[

 bds-DifferentialCorrectionsSupport-r12

 BDS-DifferentialCorrectionsSupport-r12

 OPTIONAL, -- Cond DBDS-Sup

 bds-GridModelSupport-r12 BDS-GridModelSupport-r12

 OPTIONAL -- Cond BDS-GridModSup

 ]],

 [[

 gnss-RTK-ObservationsSupport-r15

 GNSS-RTK-ObservationsSupport-r15

 OPTIONAL, -- Cond RTK-OSR-Sup

 glo-RTK-BiasInformationSupport-r15

 GLO-RTK-BiasInformationSupport-r15

 OPTIONAL, -- Cond GLO-CPB-Sup

 gnss-RTK-MAC-CorrectionDifferencesSupport-r15

 GNSS-RTK-MAC-CorrectionDifferencesSupport-r15

 OPTIONAL, -- Cond MAC-Sup

 gnss-RTK-ResidualsSupport-r15 GNSS-RTK-ResidualsSupport-r15

 OPTIONAL, -- Cond Res-Sup

 gnss-RTK-FKP-GradientsSupport-r15

 GNSS-RTK-FKP-GradientsSupport-r15

 OPTIONAL, -- Cond FKP-Sup

 gnss-SSR-OrbitCorrectionsSupport-r15

 GNSS-SSR-OrbitCorrectionsSupport-r15

 OPTIONAL, -- Cond OC-Sup

 gnss-SSR-ClockCorrectionsSupport-r15

 GNSS-SSR-ClockCorrectionsSupport-r15

 OPTIONAL, -- Cond CC-Sup

 gnss-SSR-CodeBiasSupport-r15 GNSS-SSR-CodeBiasSupport-r15

 OPTIONAL -- Cond CB-Sup

 ]],

 [[

 gnss-SSR-URA-Support-r16 GNSS-SSR-URA-Support-r16 OPTIONAL, -- Cond URA-Sup

 gnss-SSR-PhaseBiasSupport-r16 GNSS-SSR-PhaseBiasSupport-r16

 OPTIONAL, -- Cond PB-Sup

 gnss-SSR-STEC-CorrectionSupport-r16

 GNSS-SSR-STEC-CorrectionSupport-r16

 OPTIONAL, -- Cond STEC-Sup

 gnss-SSR-GriddedCorrectionSupport-r16

 GNSS-SSR-GriddedCorrectionSupport-r16

 OPTIONAL, -- Cond Grid-Sup

 navic-DifferentialCorrectionsSupport-r16

 NavIC-DifferentialCorrectionsSupport-r16

 OPTIONAL, -- Cond DNavIC-Sup

 navic-GridModelSupport-r16 NavIC-GridModelSupport-r16

 OPTIONAL -- Cond NavIC-GridModSup

 ]] ,

 [[

 gnss-SSR-PhaseBiasYawSupport-r18 GNSS-SSR-PhaseBiasYawSupport-r18

 OPTIONAL -- Cond PBY-Sup

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *TimeModSup* | The field is mandatory present if the target device supports *GNSS-TimeModelList*; otherwise it is not present. |
| *DGNSS-Sup* | The field is mandatory present if the target device supports *GNSS-DifferentialCorrections*; otherwise it is not present. |
| *NavModSup* | The field is mandatory present if the target device supports *GNSS-NavigationModel*; otherwise it is not present. |
| *RTISup* | The field is mandatory present if the target device supports *GNSS-RealTimeIntegrity*; otherwise it is not present. |
| *DataBitsSup* | The field is mandatory present if the target device supports *GNSS-DataBitAssistance*; otherwise it is not present. |
| *AcquAssistSup* | The field is mandatory present if the target device supports *GNSS-AcquisitionAssistance*; otherwise it is not present. |
| *AlmanacSup* | The field is mandatory present if the target device supports *GNSS-Almanac*; otherwise it is not present. |
| *UTCModSup* | The field is mandatory present if the target device supports *GNSS-UTC-Model*; otherwise it is not present. |
| *AuxInfoSup* | The field is mandatory present if the target device supports *GNSS-AuxiliaryInformation*; otherwise it is not present. |
| *DBDS-Sup* | The field is mandatory present if the target device supports *BDS-DifferentialCorrections*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *BDS-GridModSup* | The field is mandatory present if the target device supports *BDS-GridModel*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *RTK-OSR-Sup* | The field is mandatory present if the target device supports *GNSS-RTK-Observations*; otherwise it is not present. Note, support for *GNSS-RTK-Observations* implies support for *GNSS-RTK-CommonObservationInfo* as well. |
| *GLO-CPB-Sup* | The field is mandatory present if the target device supports *GLO‑RTK‑BiasInformation*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'glonass'. |
| *MAC-Sup* | The field is mandatory present if the target device supports *GNSS‑RTK‑MAC‑CorrectionDifferences*; otherwise it is not present. |
| *Res-Sup* | The field is mandatory present if the target device supports *GNSS‑RTK‑Residuals*; otherwise it is not present. |
| *FKP-Sup* | The field is mandatory present if the target device supports *GNSS‑RTK‑FKP‑Gradients*; otherwise it is not present. |
| *OC-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑OrbitCorrections*; otherwise it is not present. |
| *CC-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑ClockCorrections*; otherwise it is not present. |
| *CB-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑CodeBias*; otherwise it is not present. |
| *URA-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-URA*; otherwise it is not present. |
| *PB-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-PhaseBias*; otherwise it is not present. |
| *STEC-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-STEC-Correction*; otherwise it is not present. |
| *Grid-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑GriddedCorrection*; otherwise it is not present. Note, support for *GNSS‑SSR‑GriddedCorrection* implies support for *GNSS-SSR-CorrectionPoints* as well. |
| *DNavIC-Sup* | The field is mandatory present if the target device supports *NavIC-DifferentialCorrections*; otherwise it is not present. This field may only be present if the *gnss-ID* indicates 'navic'. |
| *NavIC-GridModSup* | The field is mandatory present if the target device supports *NavIC-GridModel*; otherwise it is not present. This field may only be present if the *gnss-ID* indicates 'navic'. |
| *PBY-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-PhaseBiasYaw*; otherwise it is not present. |

**/\*\*Skip unmodified parts\*\*/**

*NEXT CHANGE*

– *GNSS-SSR-PhaseBiasYawSupport*

-- ASN1START

GNSS-SSR-PhaseBiasYawSupport-r18 ::= SEQUENCE {

 signal-and-tracking-mode-ID-Sup-r18 GNSS-SignalIDs,

 ssr-IntegrityPhaseBiasBoundsSup-r18 ENUMERATED { supported } OPTIONAL

 ...

}

-- ASN1STOP

| ***GNSS-SSR-PhaseBiasYawSupport* field descriptions** |
| --- |
| ***signal-and-tracking-mode-ID-Sup***This field specifies the GNSS signal(s) for which the *GNSS-SSR-PhaseBiasYaw* is supported by the target device.  |
| ***ssr-IntegrityPhaseBiasBoundsSup***This field, if present, indicates that the target device supports the IE *SSR-IntegrityPhaseBiasBounds*. |

#### 6.5.2.11 GNSS Capability Information Request

**/\*\*Skip unmodified parts\*\*/**

*NEXT CHANGE*

**/\*\*Skip unmodified parts\*\*/**

## 7.2 Mapping of *posSibType* to assistance data element

The supported *posSibType*'s are specified in Table 7.2-1. The GNSS Common and Generic Assistance Data IEs are defined in clause 6.5.2.2. The OTDOA Assistance Data IEs and NR DL-TDOA/DL-AoD Assistance Data IEs are defined in clause 7.4.2. The Barometric Assistance Data IEs are defined in clause 6.5.5.8. The TBS (based on MBS signals) Assistance Data IEs are defined in clause 6.5.4.8.

Table 7.2-1: Mapping of posSibType to assistanceDataElement

|  |  |  |
| --- | --- | --- |
|  | *posSibType* | *assistanceDataElement* |
| GNSS Common Assistance Data (clause 6.5.2.2) | *posSibType1-1* | *GNSS-ReferenceTime* |
| *posSibType1-2* | *GNSS-ReferenceLocation* |
| *posSibType1-3* | *GNSS-IonosphericModel* |
| *posSibType1-4* | *GNSS-EarthOrientationParameters* |
| *posSibType1-5* | *GNSS-RTK-ReferenceStationInfo* |
| *posSibType1-6* | *GNSS-RTK-CommonObservationInfo* |
| *posSibType1-7* | *GNSS-RTK-AuxiliaryStationData* |
| *posSibType1-8* | *GNSS-SSR-CorrectionPoints* |
| *posSibType1-9* | *GNSS-Integrity-ServiceParameters* |
| *posSibType1-10* | *GNSS-Integrity-ServiceAlert* |
| GNSS Generic Assistance Data (clause 6.5.2.2) | *posSibType2-1* | *GNSS-TimeModelList* |
| *posSibType2-2* | *GNSS-DifferentialCorrections* |
| *posSibType2-3* | *GNSS-NavigationModel* |
| *posSibType2-4* | *GNSS-RealTimeIntegrity* |
| *posSibType2-5* | *GNSS-DataBitAssistance* |
| *posSibType2-6* | *GNSS-AcquisitionAssistance* |
| *posSibType2-7* | *GNSS-Almanac* |
| *posSibType2-8* | *GNSS-UTC-Model* |
| *posSibType2-9* | *GNSS-AuxiliaryInformation* |
| *posSibType2-10* | *BDS-DifferentialCorrections* |
| *posSibType2-11* | *BDS-GridModelParameter* |
| *posSibType2-12* | *GNSS-RTK-Observations* |
| *posSibType2-13* | *GLO-RTK-BiasInformation* |
| *posSibType2-14* | *GNSS-RTK-MAC-CorrectionDifferences* |
| *posSibType2-15* | *GNSS-RTK-Residuals* |
| *posSibType2-16* | *GNSS-RTK-FKP-Gradients* |
| *posSibType2-17* | *GNSS-SSR-OrbitCorrections* |
| *posSibType2-18* | *GNSS-SSR-ClockCorrections* |
| *posSibType2-19* | *GNSS-SSR-CodeBias* |
| *posSibType2-20* | *GNSS-SSR-URA* |
| *posSibType2-21* | *GNSS-SSR-PhaseBias* |
| *posSibType2-22* | *GNSS-SSR-STEC-Correction* |
| *posSibType2-23* | *GNSS-SSR-GriddedCorrection* |
| *posSibType2-24* | *NavIC-DifferentialCorrections* |
| *posSibType2-25* | *NavIC-GridModelParameter* |
| *posSibType2-xy* | *GNSS-SSR-PhaseBiasYaw* |
| OTDOA Assistance Data (clause 7.4.2) | *posSibType3-1* | *OTDOA-UE-Assisted* |
| Barometric Assistance Data(clause 6.5.5.8) | *posSibType4-1* | *Sensor-AssistanceDataList* |
| TBS Assistance Data(clause 6.5.4.8) | *posSibType5-1* | *TBS-AssistanceDataList* |
| NR DL-TDOA/DL-AoD Assistance Data (clauses 6.4.3, 7.4.2) | *posSibType6-1* | *NR-DL-PRS-AssistanceData* |
| *posSibType6-2* | *NR-UEB-TRP-LocationData* |
| *posSibType6-3* | *NR-UEB-TRP-RTD-Info* |
| *posSibType6-4* | *NR-TRP-BeamAntennaInfo* |
| *posSibType6-5* | *NR-DL-PRS-TRP-TEG-Info* |
| On-demand DL-PRS Configurations (clause 6.4.3) | *posSibType6-6* | *NR-On-Demand-DL-PRS-Configurations* |

END OF CHANGE

# Appendix A.3 (RRC – Yaw)

*START OF CHANGE*

– *DedicatedSIBRequest*

The *DedicatedSIBRequest* message is used to request SIB(s) required by the UE in RRC\_CONNECTED as specified in clause 5.2.2.3.5.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

***DedicatedSIBRequest message***

-- ASN1START

-- TAG-DEDICATEDSIBREQUEST-START

DedicatedSIBRequest-r16 ::= SEQUENCE {

 criticalExtensions CHOICE {

 dedicatedSIBRequest-r16 DedicatedSIBRequest-r16-IEs,

 criticalExtensionsFuture SEQUENCE {}

 }

}

DedicatedSIBRequest-r16-IEs ::= SEQUENCE {

 onDemandSIB-RequestList-r16 SEQUENCE {

 requestedSIB-List-r16 SEQUENCE (SIZE (1..maxOnDemandSIB-r16)) OF SIB-ReqInfo-r16 OPTIONAL,

 requestedPosSIB-List-r16 SEQUENCE (SIZE (1..maxOnDemandPosSIB-r16)) OF PosSIB-ReqInfo-r16 OPTIONAL

 } OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

SIB-ReqInfo-r16 ::= ENUMERATED { sib12, sib13, sib14, sib20-v1700, sib21-v1700, spare3, spare2, spare1 }

PosSIB-ReqInfo-r16 ::= SEQUENCE {

 gnss-id-r16 GNSS-ID-r16 OPTIONAL,

 sbas-id-r16 SBAS-ID-r16 OPTIONAL,

 posSibType-r16 ENUMERATED { posSibType1-1, posSibType1-2, posSibType1-3, posSibType1-4, posSibType1-5, posSibType1-6,

 posSibType1-7, posSibType1-8, posSibType2-1, posSibType2-2, posSibType2-3, posSibType2-4,

 posSibType2-5, posSibType2-6, posSibType2-7, posSibType2-8, posSibType2-9, posSibType2-10,

 posSibType2-11, posSibType2-12, posSibType2-13, posSibType2-14, posSibType2-15,

 posSibType2-16, posSibType2-17, posSibType2-18, posSibType2-19, posSibType2-20,

 posSibType2-21, posSibType2-22, posSibType2-23, posSibType3-1, posSibType4-1,

 posSibType5-1, posSibType6-1, posSibType6-2, posSibType6-3,..., posSibType1-9-v1710,

 posSibType1-10-v1710, posSibType2-24-v1710, posSibType2-25-v1710,

 posSibType6-4-v1710, posSibType6-5-v1710, posSibType6-6-v1710,..., posSibType2-xy-v1800 }

}

-- TAG-DEDICATEDSIBREQUEST-STOP

-- ASN1STOP

|  |
| --- |
| ***DedicatedSIBRequest field descriptions*** |
| ***requestedSIB-List***Contains a list of SIB(s) the UE requests while in RRC\_CONNECTED. |
| ***requestedPosSIB-List***Contains a list of posSIB(s) the UE requests while in RRC\_CONNECTED. |

|  |
| --- |
| ***PosSIB-ReqInfo* field descriptions** |
| ***gnss-id***The presence of this field indicates that the request positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]) |
| ***sbas-id***The presence of this field indicates that the request positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]). |

*NEXT CHANGE*

6.3.1a Positioning System information blocks

– *PosSystemInformation-r16-IEs*

-- ASN1START

-- TAG-POSSYSTEMINFORMATION-R16-IES-START

PosSystemInformation-r16-IEs ::= SEQUENCE {

 posSIB-TypeAndInfo-r16 SEQUENCE (SIZE (1..maxSIB)) OF CHOICE {

 posSib1-1-r16 SIBpos-r16,

 posSib1-2-r16 SIBpos-r16,

 posSib1-3-r16 SIBpos-r16,

 posSib1-4-r16 SIBpos-r16,

 posSib1-5-r16 SIBpos-r16,

 posSib1-6-r16 SIBpos-r16,

 posSib1-7-r16 SIBpos-r16,

 posSib1-8-r16 SIBpos-r16,

 posSib2-1-r16 SIBpos-r16,

 posSib2-2-r16 SIBpos-r16,

 posSib2-3-r16 SIBpos-r16,

 posSib2-4-r16 SIBpos-r16,

 posSib2-5-r16 SIBpos-r16,

 posSib2-6-r16 SIBpos-r16,

 posSib2-7-r16 SIBpos-r16,

 posSib2-8-r16 SIBpos-r16,

 posSib2-9-r16 SIBpos-r16,

 posSib2-10-r16 SIBpos-r16,

 posSib2-11-r16 SIBpos-r16,

 posSib2-12-r16 SIBpos-r16,

 posSib2-13-r16 SIBpos-r16,

 posSib2-14-r16 SIBpos-r16,

 posSib2-15-r16 SIBpos-r16,

 posSib2-16-r16 SIBpos-r16,

 posSib2-17-r16 SIBpos-r16,

 posSib2-18-r16 SIBpos-r16,

 posSib2-19-r16 SIBpos-r16,

 posSib2-20-r16 SIBpos-r16,

 posSib2-21-r16 SIBpos-r16,

 posSib2-22-r16 SIBpos-r16,

 posSib2-23-r16 SIBpos-r16,

 posSib3-1-r16 SIBpos-r16,

 posSib4-1-r16 SIBpos-r16,

 posSib5-1-r16 SIBpos-r16,

 posSib6-1-r16 SIBpos-r16,

 posSib6-2-r16 SIBpos-r16,

 posSib6-3-r16 SIBpos-r16,

 ... ,

 posSib1-9-v1700 SIBpos-r16,

 posSib1-10-v1700 SIBpos-r16,

 posSib2-24-v1700 SIBpos-r16,

 posSib2-25-v1700 SIBpos-r16,

 posSib6-4-v1700 SIBpos-r16,

 posSib6-5-v1700 SIBpos-r16,

 posSib6-6-v1700 SIBpos-r16

 ... ,

 posSib2-xy-v1800 SIBpos-r16

 },

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- TAG-POSSYSTEMINFORMATION-R16-IES-STOP

-- ASN1STOP

– *PosSI-SchedulingInfo*

-- ASN1START

-- TAG-POSSI-SCHEDULINGINFO-START

PosSI-SchedulingInfo-r16 ::= SEQUENCE {

 posSchedulingInfoList-r16 SEQUENCE (SIZE (1..maxSI-Message)) OF PosSchedulingInfo-r16,

 posSI-RequestConfig-r16 SI-RequestConfig OPTIONAL, -- Cond MSG-1

 posSI-RequestConfigSUL-r16 SI-RequestConfig OPTIONAL, -- Cond SUL-MSG-1

 ...,

 [[

 posSI-RequestConfigRedCap-r17 SI-RequestConfig OPTIONAL -- Cond REDCAP-MSG-1

 ]]

}

PosSchedulingInfo-r16 ::= SEQUENCE {

 offsetToSI-Used-r16 ENUMERATED {true} OPTIONAL, -- Need R

 posSI-Periodicity-r16 ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},

 posSI-BroadcastStatus-r16 ENUMERATED {broadcasting, notBroadcasting},

 posSIB-MappingInfo-r16 PosSIB-MappingInfo-r16,

 ...

}

PosSIB-MappingInfo-r16 ::= SEQUENCE (SIZE (1..maxSIB)) OF PosSIB-Type-r16

PosSIB-Type-r16 ::= SEQUENCE {

 encrypted-r16 ENUMERATED { true } OPTIONAL, -- Need R

 gnss-id-r16 GNSS-ID-r16 OPTIONAL, -- Need R

 sbas-id-r16 SBAS-ID-r16 OPTIONAL, -- Need R

 posSibType-r16 ENUMERATED { posSibType1-1, posSibType1-2, posSibType1-3, posSibType1-4, posSibType1-5, posSibType1-6,

 posSibType1-7, posSibType1-8, posSibType2-1, posSibType2-2, posSibType2-3, posSibType2-4,

 posSibType2-5, posSibType2-6, posSibType2-7, posSibType2-8, posSibType2-9, posSibType2-10,

 posSibType2-11, posSibType2-12, posSibType2-13, posSibType2-14, posSibType2-15,

 posSibType2-16, posSibType2-17, posSibType2-18, posSibType2-19, posSibType2-20,

 posSibType2-21, posSibType2-22, posSibType2-23, posSibType3-1, posSibType4-1,

 posSibType5-1,posSibType6-1, posSibType6-2, posSibType6-3, posSibType2-xy,... },

 areaScope-r16 ENUMERATED {true} OPTIONAL -- Need S

}

GNSS-ID-r16 ::= SEQUENCE {

 gnss-id-r16 ENUMERATED{gps, sbas, qzss, galileo, glonass, bds, ...},

 ...

}

SBAS-ID-r16 ::= SEQUENCE {

 sbas-id-r16 ENUMERATED { waas, egnos, msas, gagan, ...},

 ...

}

-- TAG-POSSI-SCHEDULINGINFO-STOP

-- ASN1STOP

|  |
| --- |
| ***PosSI-SchedulingInfo* field descriptions** |
| ***areaScope***Indicates that a posSIB is area specific. If the field is absent, the posSIB is cell specific. |
| ***encrypted***The presence of this field indicates that the *pos-sib-type* is encrypted as specified in TS 37.355 [49]. |
| ***gnss-id***The presence of this field indicates that the positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]) |
| ***posSI-BroadcastStatus***Indicates if the SI message is being broadcasted or not. Change of *posSI-BroadcastStat*us should not result in system information change notifications in Short Message transmitted with P-RNTI over DCI (see clause 6.5). The value of the indication is valid until the end of the BCCH modification period when set to *broadcasting*.If *si-SchedulingInfo-v1700* is present, the network ensures that the total number of SI messages with *posSI-BroadcastStatus*and *si-BroadcastStatus*set to *notBroadcasting* in the concatenated list of SI messages configured by *schedulingInfoList* in *si-SchedulingInfo* and SI messages containing type2 SIB configured by *schedulingInfoList2* in *si-SchedulingInfo-v1700* does not exceed the limit of *maxSI-Message* when *posSI-RequestConfig* or *posSI-RequestConfigRedCap* or *posSI-RequestConfigSUL* is configured. |
| ***posSI-RequestConfig***Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to notBroadcasting. |
| ***posSI-RequestConfigRedCap***Configuration of Msg1 resources for *initialUplinkBWP-RedCap*that the RedCap UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to *notBroadcasting*. |
| ***posSI-RequestConfigSUL***Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to notBroadcasting. |
| ***posSIB-MappingInfo***List of the posSIBs mapped to this *SystemInformation* message. |
| ***posSibType***The positioning SIB type is defined in TS 37.355 [49]. |
| ***posSI-Periodicity***Periodicity of the SI-message in radio frames, such that rf8 denotes 8 radio frames, rf16 denotes 16 radio frames, and so on. If the *offsetToSI-Used* is configured, the *posSI-Periodicity* of rf8 cannot be used. |
| ***offsetToSI-Used***This field, if present indicates that all the SI messages in *posSchedulingInfoList* are scheduled with an offset of 8 radio frames compared to SI messages in *schedulingInfoList*. *offsetToSI-Used* may be present only if the shortest configured SI message periodicity for SI messages in *schedulingInfoList* is 80ms. If SI offset is used, this field is present in each of the SI messages in the *posSchedulingInfoList*. |
| ***sbas-id***The presence of this field indicates that the positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]). |

| **Conditional presence** | **Explanation** |
| --- | --- |
| *MSG-1* | The field is optionally present, Need R, if *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. It is absent otherwise. |
| *SUL-MSG-1* | The field is optionally present, Need R, if *supplementaryUplink* is configured in *ServingCellConfigCommonSIB* and if *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. It is absent otherwise. |
| *REDCAP-MSG-1* | The field is optionally present, Need R, if *initialUplinkBWP-RedCap* is configured in *UplinkConfigCommonSIB* and if *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. It is absent otherwise. |

– *SIBpos*

The IE *SIBpos* contains positioning assistance data as defined in TS 37.355 [49].

***SIBpos* information element**

-- ASN1START

-- TAG-SIPOS-START

SIBpos-r16 ::= SEQUENCE {

 assistanceDataSIB-Element-r16 OCTET STRING,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 ...

}

-- TAG-SIPOS-STOP

-- ASN1STOP

| ***SIBpos* field descriptions** |
| --- |
| ***assistanceDataSIB-Element***Parameter *AssistanceDataSIBelement* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit. |

END OF CHANGE

# Appendix B.1 (Stage 2 - APC)

START OF CHANGE

**/\*\*Skip unmodified parts\*\*/**

### 8.1.2 Information to be transferred between NG-RAN/5GC Elements

This clause defines the information that may be transferred between LMF and UE.

#### 8.1.2.1 Information that may be transferred from the LMF 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 LMF to the UE.

NOTE: The provision of these assistance data elements and the usage of these elements by the UE depend on the NG-RAN/5GC and UE capabilities, respectively.

Table 8.1.2.1-1: Information that may be transferred from the LMF 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 |
| SSR Phase Bias |
| SSR STEC Corrections |
| SSR Gridded Correction |
| SSR URA |
| SSR Correction Points |
| Integrity Service Parameters |
| Integrity Alerts |
| SSR Satellite APC Corrections |

##### 8.1.2.1.3x SSR Satellite APC Corrections

SSR Satellite Antenna Phase Center (APC) Corrections provide the GNSS receiver with the satellite antenna phase center offsets and phase center variations that are used to correct the carrier phase measurements of the corresponding signal to determine the location of the effective center of the satellite antenna for a particular signal frequency and direction.

#### 8.1.2.1a Recommendations for grouping of assistance data to support different RTK service levels

This clause provides recommendations for the different high-accuracy GNSS service levels: RTK, N-RTK, PPP and PPP-RTK.

The high-accuracy GNSS methods can be classified as:

- *Single base RTK service*: RTK is a technique that uses carrier-based ranging measurements i.e., phase-range to improve the positioning accuracy in a differential approach. The basic concept is to reduce and remove errors common to a Reference Station, with known position, and UE pair. When only pseudo ranges (code-based measurements) are used to compute the UE location, this method is known as DGNSS (Differential GNSS).

Table 8.1.2.1a-1: Single base RTK service: Specific information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| RTK Reference Station Information |
| RTK Observations |
| RTK Common Observation Information |
| GLONASS RTK Bias Information (if GLONASS data is transmitted) |
| Ephemeris and Clock (if UE did not acquire the navigation message) |

- *Non-Physical Reference Station Network RTK service*: In this approach the target UE receives synthetic observations from a fictitious Reference Station. The Network RTK software at the location server is performing the error estimation and creates a virtual Reference Station close to the initial location of the target device (provided a priori to the location server). The target UE interprets and uses the data just as if it had come from a single, real Reference Station. Additionally, the target UE can also receive network information such as RTK Network Residuals (see clause 8.1.2.1.19) or even FKP gradients (see clause 8.1.2.1.20).

Table 8.1.2.1a-2: Non-Physical Reference Station Network RTK service: Specific information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| RTK Reference Station Information |
| RTK Observations |
| RTK Common Observation Information |
| GLONASS RTK Bias Information (if GLONASS data is transmitted) |
| RTK Residuals |
| RTK FKP Gradients |
| Ephemeris and Clock (if UE did not acquire the navigation message) |

- *MAC Network RTK service*: In MAC network RTK, a group of Reference Stations are used and one of them is chosen as a Master station. The other stations are then called Auxiliary stations. In this service, the location server sends full raw observations and coordinate information for a single Reference Station, the Master Station. For all auxiliary stations in the network (or a suitable subset of stations) the information is provided to the UE in a highly compact form: their reduced ambiguity-levelled observations, coordinate differences (to the Master Station observations and coordinates), and network residuals. Two Reference Stations are said to be on a common ambiguity level if the integer ambiguities for each phase range (satellite-receiver pair) have been removed (or adjusted) so that the integer ambiguities cancel when double-differences (involving two receivers and two satellites) are formed during processing. The maintenance of a common ambiguity level at a specific set of stations rather than across the whole GNSS network will lead to a grouping in network clusters or subnetworks of all ambiguity-levelled Reference Stations. If one network has only one subnetwork, this indicates that an ambiguity level throughout the whole network is established. When subnetworks are predefined, the assistance data can be broadcast to all UEs located in the assigned sub-network. More details on the usage of subnetworks can be found in [31].

Table 8.1.2.1a-3: MAC Network RTK service: Specific Information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| RTK Reference Station Information |
| RTK Auxiliary Station Data |
| RTK Observations |
| RTK Common Observation Information |
| GLONASS RTK Bias Information (if GLONASS data is transmitted) |
| RTK MAC Correction Differences |
| RTK Residuals |
| Ephemeris and Clock (if UE did not acquire the navigation message) |

- *FKP Network RTK service*: With the concept of FKP, horizontal gradients of distance-dependent errors like ionosphere, troposphere and orbits are derived from a network of GNSS Reference Stations and transmitted to a target device together with raw or correction data of a corresponding Reference Station (physical or non physical). The target UE may use the gradients to compute the effect of the distance-dependent errors for its own position.

Table 8.1.2.1a-4: FKP Network RTK service: Information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| RTK Reference Station Information |
| RTK Observations |
| RTK Common Observation Information |
| GLONASS RTK Bias Information (if GLONASS data is transmitted) |
| RTK Residuals |
| RTK FKP Gradients |
| Ephemeris and Clock (if UE did not acquire the navigation message) |

- *PPP service*: This concept uses precise satellite orbit and clock parameters derived from global networks of Reference Stations as well as atmospheric models to perform single station positioning [31]. Compared to RTK and Network RTK, PPP is not a differential technique as there is no baseline limitation. When the orbits and clocks assistance data elements are provided in real-time, with no latency, the method is called Real-Time PPP.

Table 8.1.2.1a-5: SSR PPP service: Information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| SSR Orbit Corrections |
| SSR Clock corrections |
| SSR Code Bias |
| Ephemeris and Clock (if UE did not acquire the navigation message) |
| SSR Satellite APC Corrections |

- *PPP-RTK service*: This concept uses precise satellite orbits and clock parameters, the satellite signal biases derived from global networks of Reference Stations as well as ionosphere and troposphere corrections to perform single station positioning IS-QZSS-L6-001 [36]. Therefore, PPP-RTK services compensate the global and local corrections for a more accurate location information. Compared to PPP, PPP-RTK requires the UE to be located within the region covered by the ionosphere and troposphere corrections.

Table 8.1.2.1a-6: SSR PPP-RTK service: Information that may be transferred from the LMF to the UE

|  |
| --- |
| Assistance Data  |
| SSR Orbit Corrections |
| SSR Clock corrections |
| SSR Code Bias |
| Ephemeris and Clock (if UE did not acquire the navigation message) |
| SSR Phase Bias |
| SSR STEC Corrections |
| SSR Gridded Correction |
| SSR URA |
| SSR Correction Points |
| SSR Satellite APC Corrections |

END OF CHANGE

# Appendix B.2 (LPP - APC)

START OF CHANGE

**/\*\*Skip unmodified parts\*\*/**

### 6.5.2 A-GNSS Positioning

#### 6.5.2.1 GNSS Assistance Data

#### – *A-GNSS-ProvideAssistanceData*

The IE *A-GNSS-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑based and UE‑assisted A‑GNSS. It may also be used to provide GNSS positioning specific error reasons.

-- ASN1START

A-GNSS-ProvideAssistanceData ::= SEQUENCE {

 gnss-CommonAssistData GNSS-CommonAssistData OPTIONAL, -- Need ON

 gnss-GenericAssistData GNSS-GenericAssistData OPTIONAL, -- Need ON

 gnss-Error A-GNSS-Error OPTIONAL, -- Need ON

 ...,

 [[

 gnss-PeriodicAssistData-r15 GNSS-PeriodicAssistData-r15 OPTIONAL -- Cond CtrTrans

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *CtrTrans* | The field is mandatory present in the control transaction of a periodic assistance data delivery session as described in clauses 5.2.1a and 5.2.2a. Otherwise it is not present. |

#### – *GNSS-CommonAssistData*

The IE *GNSS-CommonAssistData* is used by the location server to provide assistance data which can be used for any GNSS.

-- ASN1START

GNSS-CommonAssistData ::= SEQUENCE {

 gnss-ReferenceTime GNSS-ReferenceTime OPTIONAL, -- Need ON

 gnss-ReferenceLocation GNSS-ReferenceLocation OPTIONAL, -- Need ON

 gnss-IonosphericModel GNSS-IonosphericModel OPTIONAL, -- Need ON

 gnss-EarthOrientationParameters GNSS-EarthOrientationParameters OPTIONAL, -- Need ON

 ...,

 [[

 gnss-RTK-ReferenceStationInfo-r15

 GNSS-RTK-ReferenceStationInfo-r15 OPTIONAL, -- Need ON

 gnss-RTK-CommonObservationInfo-r15

 GNSS-RTK-CommonObservationInfo-r15 OPTIONAL, -- Cond RTK

 gnss-RTK-AuxiliaryStationData-r15

 GNSS-RTK-AuxiliaryStationData-r15 OPTIONAL -- Need ON

 ]],

 [[

 gnss-SSR-CorrectionPoints-r16

 GNSS-SSR-CorrectionPoints-r16 OPTIONAL -- Need ON

 ]],

 [[

 gnss-Integrity-ServiceParameters-r17

 GNSS-Integrity-ServiceParameters-r17 OPTIONAL, -- Need ON

 gnss-Integrity-ServiceAlert-r17

 GNSS-Integrity-ServiceAlert-r17 OPTIONAL -- Need OR

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *RTK* | The field is mandatory present if the IE *GNSS-RTK-Observations* is included in IE *GNSS‑GenericAssistData*; otherwise it is not present. |

#### – *GNSS-GenericAssistData*

The IE *GNSS-GenericAssistData* is used by the location server to provide assistance data for a specific GNSS. The specific GNSS for which the provided assistance data are applicable is indicated by the IE *GNSS‑ID* and (if applicable) by the IE *SBAS‑ID*. Assistance for up to 16 GNSSs can be provided.

-- ASN1START

GNSS-GenericAssistData ::= SEQUENCE (SIZE (1..16)) OF GNSS-GenericAssistDataElement

GNSS-GenericAssistDataElement ::= SEQUENCE {

 gnss-ID GNSS-ID,

 sbas-ID SBAS-ID OPTIONAL, -- Cond GNSS-ID-SBAS

 gnss-TimeModels GNSS-TimeModelList OPTIONAL, -- Need ON

 gnss-DifferentialCorrections GNSS-DifferentialCorrections OPTIONAL, -- Need ON

 gnss-NavigationModel GNSS-NavigationModel OPTIONAL, -- Need ON

 gnss-RealTimeIntegrity GNSS-RealTimeIntegrity OPTIONAL, -- Need ON

 gnss-DataBitAssistance GNSS-DataBitAssistance OPTIONAL, -- Need ON

 gnss-AcquisitionAssistance GNSS-AcquisitionAssistance OPTIONAL, -- Need ON

 gnss-Almanac GNSS-Almanac OPTIONAL, -- Need ON

 gnss-UTC-Model GNSS-UTC-Model OPTIONAL, -- Need ON

 gnss-AuxiliaryInformation GNSS-AuxiliaryInformation OPTIONAL, -- Need ON

 ...,

 [[

 bds-DifferentialCorrections-r12

 BDS-DifferentialCorrections-r12 OPTIONAL, -- Cond GNSS-ID-BDS

 bds-GridModel-r12 BDS-GridModelParameter-r12 OPTIONAL -- Cond GNSS-ID-BDS

 ]],

 [[

 gnss-RTK-Observations-r15 GNSS-RTK-Observations-r15 OPTIONAL, -- Need ON

 glo-RTK-BiasInformation-r15 GLO-RTK-BiasInformation-r15 OPTIONAL, -- Cond GNSS-ID-GLO

 gnss-RTK-MAC-CorrectionDifferences-r15

 GNSS-RTK-MAC-CorrectionDifferences-r15

 OPTIONAL, -- Need ON

 gnss-RTK-Residuals-r15 GNSS-RTK-Residuals-r15 OPTIONAL, -- Need ON

 gnss-RTK-FKP-Gradients-r15 GNSS-RTK-FKP-Gradients-r15 OPTIONAL, -- Need ON

 gnss-SSR-OrbitCorrections-r15

 GNSS-SSR-OrbitCorrections-r15 OPTIONAL, -- Need ON

 gnss-SSR-ClockCorrections-r15

 GNSS-SSR-ClockCorrections-r15 OPTIONAL, -- Need ON

 gnss-SSR-CodeBias-r15 GNSS-SSR-CodeBias-r15 OPTIONAL -- Need ON

 ]],

 [[

 gnss-SSR-URA-r16 GNSS-SSR-URA-r16 OPTIONAL, -- Need ON

 gnss-SSR-PhaseBias-r16 GNSS-SSR-PhaseBias-r16 OPTIONAL, -- Need ON

 gnss-SSR-STEC-Correction-r16 GNSS-SSR-STEC-Correction-r16

 OPTIONAL, -- Need ON

 gnss-SSR-GriddedCorrection-r16 GNSS-SSR-GriddedCorrection-r16

 OPTIONAL, -- Need ON

 navic-DifferentialCorrections-r16 NavIC-DifferentialCorrections-r16

 OPTIONAL, -- Cond GNSS-ID-NavIC

 navic-GridModel-r16 NavIC-GridModelParameter-r16

 OPTIONAL -- Cond GNSS-ID-NavIC

 ]],

 [[

 gnss-SSR-SatelliteAPC-r18 GNSS-SSR-SatelliteAPC-r18 OPTIONAL -- Need ON

 ]]}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *GNSS‑ID‑BDS* | The field may be present if the *GNSS‑ID* = *bds*; otherwise it is not present. |
| *GNSS-ID-GLO* | The field is optionally present, need ON, if the *GNSS ID* = *glonass*; otherwise it is not present. |
| *GNSS-ID-NAVIC* | The field is optionally present, need ON, if the *GNSS‑ID* = *navic*; otherwise it is not present |

#### *– GNSS-PeriodicAssistData*

The IE *GNSS-PeriodicAssistData* is used by the location server to provide control parameters for a periodic assistance data delivery session (e.g., interval and duration) to the target device.

NOTE: Omission of a particular assistance data type field in IE *GNSS-PeriodicAssistData* means that the location server does not provide this assistance data type in a data transaction of a periodic assistance data delivery session, as described in clauses 5.2.1a and 5.2.2a. Inclusion of no assistance data type fields in IE *GNSS-PeriodicAssistData* means that a periodic assistance data delivery session is terminated.

-- ASN1START

GNSS-PeriodicAssistData-r15 ::= SEQUENCE {

 gnss-RTK-PeriodicObservations-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 glo-RTK-PeriodicBiasInformation-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-RTK-MAC-PeriodicCorrectionDifferences-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-RTK-PeriodicResiduals-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-RTK-FKP-PeriodicGradients-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicOrbitCorrections-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicClockCorrections-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicCodeBias-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 ...,

 [[

 gnss-SSR-PeriodicURA-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicPhaseBias-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicSTEC-Correction-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

 gnss-SSR-PeriodicGriddedCorrection-r16 GNSS-PeriodicControlParam-r15 OPTIONAL -- Need ON

 ]],

 [[

 gnss-Integrity-PeriodicServiceAlert-r17 GNSS-PeriodicControlParam-r15 OPTIONAL -- Need ON

 ]],

 [[

 gnss-SSR-SatelliteAPC-r18 GNSS-PeriodicControlParam-r15 OPTIONAL -- Need ON

 ]]

}

-- ASN1STOP

#### 6.5.2.2 GNSS Assistance Data Elements

*NEXT CHANGE*

**/\*\*Skip unmodified parts\*\*/**

#### *– 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

 ]]

}

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. |

| *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. |
| ***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:$$t=\left\{\begin{array}{c}10i, \&i\leq 180\\1800+100(i-180), 180<\&i\leq 234 \\7200+1000\left(i-234\right), \&i>234\end{array} [s]\right.$$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:$$t=\left\{\begin{array}{c}10i, \&i\leq 180\\1800+100(i-180), 180<\&i\leq 234 \\7200+1000\left(i-234\right), \&i>234\end{array} [s]\right.$$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:$$μ=\left\{\begin{array}{c}0.01i, \&i\leq 200\\2+0.1(i-200), 200<\&i\leq 230 \\5+0.5\left(i-230\right), \&i>230\end{array} [m]\right.$$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:$$σ=\left\{\begin{array}{c}0.01i, \&i\leq 200\\2+0.1(i-200), 200<\&i\leq 230 \\5+0.5\left(i-230\right), \&i>230\end{array} [m]\right.$$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. |

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' or 'qzss', the *iod* refers to the NAV broadcast ephemeris (GPS L1 C/A or QZSS QZS-L1, 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*.

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 |
| 16 | 21600 seconds |
| 17 | 43200 seconds |
| 18 | 86400 seconds |
| 19 | 172800 seconds |
| 20 | 345600 seconds |
| 21 | 691200 seconds |
| 22 | 1382400 seconds |
| 23 | 2764800 seconds |
| 24 | 5529600 seconds |
| 25 | 11059200 seconds |
| 26 | 22118400 seconds |
| 27 | 44236800 seconds |

NOTE 4: Some IEs only support a Value of *ssrUpdateInterval* up to 15 to maintain backward compatibility.*NEXT CHANGE*

**/\*\*Skip unmodified parts\*\*/**

#### *– GNSS-SSR-SatelliteAPC*

The IE GNSS-SSR-SatelliteAPC is used by the location server to provide the phase center offsets from the satellite center of mass along the x-, y- and z-axis as well as the phase center variations (azimuth and nadir). The target device may use the phaseCenterVariations to choose between using nadir only variations of the phase center or nadir and azimuth angle variations of the phase center.

-- ASN1START

GNSS-SSR-SatelliteAPC-r18 ::= SEQUENCE {

 epochTime-r18 GNSS-SystemTime,

 ssrUpdateInterval-r18 INTEGER (0..27),

 iod-ssr-r18 INTEGER (0..15),

 ssr-SatelliteAPC-List-r18 SSR-SatelliteAPC-List-r18,

 ...

}

SSR-SatelliteAPC-List-r18 ::= SEQUENCE (SIZE(1..64)) OF SSR-SatelliteAPC-Element-r18

SSR-SatelliteAPC-Element-r18 ::= SEQUENCE {

 svID-r18 SV-ID,

 ssr-SatelliteAPC-FrequencyList-r18 SSR-SatelliteAPC-FrequencyList-r18,

 ...

}

SSR-SatelliteAPC-FrequencyList-r18 ::= SEQUENCE (SIZE(1..8)) OF SSR-SatelliteAPC-FrequencyElement-r18

SSR-SatelliteAPC-FrequencyElement-r18 ::= SEQUENCE {

 frequencyID-r18 GNSS-FrequencyID-r15,

 phaseCenterOffsetX-r18 INTEGER (-16384..16383),

 phaseCenterOffsetY-r18 INTEGER (-16384..16383),

 phaseCenterOffsetZ-r18 INTEGER (-16384..16383),

 nadirStepSize-r18 INTEGER(1..20) OPTIONAL, -- Cond PCV

 phaseCenterVariations-r18 CHOICE {

 phaseCenterVariationsNoAzimuth-r18 SSR-PhaseCenterVariationList-r18,

 phaseCenterVarationsWithAzimuthVariations-r18 SEQUENCE {

 azimuthStepSize-r18 INTEGER(1..30),

 phaseCenterVariationsAzimuth-r18 SSR-PhaseCenterVariationAzimuthList-r18

 }

 } OPTIONAL -- Need OP

 ...

}

SSR-PhaseCenterVariationAzimuthList-r18 ::= SEQUENCE (SIZE(12..360)) OF SSR-PhaseCenterVariationList-r18

SSR-PhaseCenterVariationList-r18 ::= SEQUENCE (SIZE(1..900)) OF INTEGER(-128..127)

-- ASN1STOP

| *GNSS-SSR-SatelliteAPC* field descriptions |
| --- |
| ***epochTime***This field specifies the epoch time of the satellite APC 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 in IE *GNSS‑SSR‑OrbitCorrections*. |
| ***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 satellite APC corrections are provided. |
| ***frequencyID*** This field specifies the satellite carrier frequency to which this correction applies. |
| ***phaseCenterOffsetX***This field specifies the mean offset from the satellite antenna reference point as defined by the *GNSS-SSR-OrbitCorrection*, along the x-axis. The coordinate system follows the convention in the IGS ANTEX file format [31], the x-axis completes the right-handed system (cross product of x and y = z) (see definitions of the z and y axis in phaseCenterOffsetZ and phaseCenterOffsetY)In units of 1 mm. |
| ***phaseCenterOffsetY***This field specifies the mean offset from the satellite antenna reference point as defined by the *GNSS-SSR-OrbitCorrection*, along the y-axis. The coordinate system follows the convention in the IGS ANTEX file format [31], the y-axis (rotation axis of the solar panels) corresponds to the cross product of the z-axis with the vector from the satellite to the Sun.In units of 1 mm. |
| ***phaseCenterOffsetZ***This field specifies the mean offset from the satellite antenna reference point as defined by the *GNSS-SSR-OrbitCorrection*, along the z-axis. The coordinate system follows the convention in the IGS ANTEX [31] file format, the z-axis points toward the geocenter.In units of 1 mm |
| ***nadirStepSize***Step size between nadir buckets. In units of 0.1 degrees. |
| ***phaseCenterVariations***This field optionally contains the phase center variations. The field *phaseCentreVariationsNoAzimuth* will be selected when there is nadir only phase center variation (PCV) values. Otherwise, if there are nadir and azimuth dependent variations the *phaseCenterVariationsWithAzimuth* field is selected.If the field *phaseCenterVariations* is not present, then it is interpreted that all PCV values are 0. |
| ***phaseCenterVariationNoAzimuth***This field specified the nadir only variations of the phase center. The nadir angle is defined to be the angle away from the z-axis. The first element is the variation at zero degrees, and subsequent elements are variations in *nadirStepSize* degree steps.For nadir angles > element count \* *nadirStepSize,* the value will be interpreted as 0.The number of elements must not exceed 90 degrees / *nadirStepSize*. |
| ***phaseCenterVariationsWithAzimuth***This field contains the phase center variations (PCV) for the case of nadir and azimuth dependent PCVs. |
| ***azimuthStepSize***Step size between azimuth buckets. In units of 1 degree. The value must be a factor of 360 degrees. |
| ***phaseCenterVariationsAzimuth***This field specifies the azimuth and nadir dependent variations of the phase center. The azimuth angle is zero degrees when aligned with the x-axis, and 90 degrees with the y-axis. Each element in the list is a set of variations for a particular azimuth bin. The distance between bins is defined by the *azimuthStepSize* field. Once the correct azimuth bin is located, the *SSR-PhaseCenterVariationList* element is a list of nadir angle dependent variations at that azimuth.The number of elements must = 360 degrees / *azimuthStepSize*. |

|  |  |
| --- | --- |
| Conditional presence | Explanation |
| *PCV* | The field is mandatory present if phaseCentreVariations is present; otherwise, it is not present. |

#### 6.5.2.3 GNSS Assistance Data Request

#### – *A-GNSS-RequestAssistanceData*

The IE *A-GNSS-RequestAssistanceData* is used by the target device to request GNSS assistance data from a location server.

-- ASN1START

A-GNSS-RequestAssistanceData ::= SEQUENCE {

 gnss-CommonAssistDataReq GNSS-CommonAssistDataReq OPTIONAL, -- Cond CommonADReq

 gnss-GenericAssistDataReq GNSS-GenericAssistDataReq OPTIONAL, -- Cond GenADReq

 ...,

 [[

 gnss-PeriodicAssistDataReq-r15

 GNSS-PeriodicAssistDataReq-r15 OPTIONAL -- Cond PerADReq

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *CommonADReq* | The field is mandatory present if the target device requests *GNSS-CommonAssistData*; otherwise it is not present. |
| *GenADReq* | This field is mandatory present if the target device requests *GNSS-GenericAssistData* for one or more specific GNSS; otherwise it is not present. |
| *PerADReq* | This field is mandatory present if the target device requests periodic GNSS assistance data delivery. This field may only be included if any of the fields are included in IE *GNSS‑GenericAssistDataReq:*- *GNSS-RTK-ObservationsReq*,- *GLO-RTK-BiasInformationReq*,- *GNSS-RTK-MAC-CorrectionDifferencesReq*,- *GNSS-RTK-ResidualsReq,*- *GNSS-RTK-FKP-GradientsReq*,- *GNSS-SSR-OrbitCorrectionsReq*,- *GNSS-SSR-ClockCorrectionsReq*,- *GNSS-SSR-CodeBiasReq.**- GNSS-SSR-URA-Req,**- GNSS-SSR-PhaseBiasReq,**- GNSS-SSR-STEC-CorrectionReq,**- GNSS-SSR-GriddedCorrectionReq,**- GNSS-Integrity-ServiceAlerReq,**- GNSS-SSR-SatelliteAPCReq.* |

#### – *GNSS-CommonAssistDataReq*

The IE *GNSS-CommonAssistDataReq* is used by the target device to request assistance data that are applicable to any GNSS from a location server.

-- ASN1START

GNSS-CommonAssistDataReq ::= SEQUENCE {

 gnss-ReferenceTimeReq GNSS-ReferenceTimeReq

 OPTIONAL, -- Cond RefTimeReq

 gnss-ReferenceLocationReq GNSS-ReferenceLocationReq

 OPTIONAL, -- Cond RefLocReq

 gnss-IonosphericModelReq GNSS-IonosphericModelReq

 OPTIONAL, -- Cond IonoModReq

 gnss-EarthOrientationParametersReq GNSS-EarthOrientationParametersReq

 OPTIONAL, -- Cond EOPReq

 ...,

 [[

 gnss-RTK-ReferenceStationInfoReq-r15

 GNSS-RTK-ReferenceStationInfoReq-r15

 OPTIONAL, -- Cond ARPReq

 gnss-RTK-AuxiliaryStationDataReq-r15

 GNSS-RTK-AuxiliaryStationDataReq-r15

 OPTIONAL -- Cond AuxARPReq

 ]],

 [[

 gnss-SSR-CorrectionPointsReq-r16

 GNSS-SSR-CorrectionPointsReq-r16

 OPTIONAL -- Cond PointsReq

 ]],

 [[

 gnss-Integrity-ServiceParametersReq-r17

 GNSS-Integrity-ServiceParametersReq-r17

 OPTIONAL, -- Cond IntServiceReq

 gnss-Integrity-ServiceAlertReq-r17

 GNSS-Integrity-ServiceAlertReq-r17

 OPTIONAL -- Cond IntAlertReq

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *RefTimeReq* | The field is mandatory present if the target device requests *GNSS-ReferenceTime*; otherwise it is not present. |
| *RefLocReq* | This field is mandatory present if the target device requests *GNSS-ReferenceLocation*; otherwise it is not present. |
| *IonoModReq* | This field is mandatory present if the target device requests *GNSS-IonosphericModel*; otherwise it is not present. |
| *EOPReq* | This field is mandatory present if the target device requests *GNSS-EarthOrientationParameters*; otherwise it is not present. |
| *ARPReq* | This field is mandatory present if the target device requests *GNSS‑RTK‑ReferenceStationInfo*; otherwise it is not present. |
| *AuxARPReq* | This field is mandatory present if the target device requests *GNSS‑RTK‑AuxiliaryStationData*; otherwise it is not present. |
| *PointsReq* | This field is mandatory present if the target device requests *GNSS-SSR-CorrectionPoints*; otherwise it is not present. |
| *IntServiceReq* | This field is mandatory present if the target device requests *GNSS-Integrity-ServiceParameters*; otherwise it is not present. |
| *IntAlertReq* | This field is mandatory present if the target device requests *GNSS-Integrity-ServiceAlert*; otherwise it is not present. |

#### – *GNSS-GenericAssistDataReq*

The IE *GNSS-GenericAssistDataReq* is used by the target device to request assistance data from a location server for one or more specific GNSSs. The specific GNSS for which the assistance data are requested is indicated by the IE *GNSS‑ID* and (if applicable) by the IE *SBAS‑ID*. Assistance for up to 16 GNSSs can be requested.

-- ASN1START

GNSS-GenericAssistDataReq ::= SEQUENCE (SIZE (1..16)) OF GNSS-GenericAssistDataReqElement

GNSS-GenericAssistDataReqElement ::= SEQUENCE {

 gnss-ID GNSS-ID,

 sbas-ID SBAS-ID OPTIONAL, -- Cond GNSS-ID-SBAS

 gnss-TimeModelsReq GNSS-TimeModelListReq OPTIONAL, -- Cond TimeModReq

 gnss-DifferentialCorrectionsReq GNSS-DifferentialCorrectionsReq OPTIONAL, -- Cond DGNSS-Req

 gnss-NavigationModelReq GNSS-NavigationModelReq OPTIONAL, -- Cond NavModReq

 gnss-RealTimeIntegrityReq GNSS-RealTimeIntegrityReq OPTIONAL, -- Cond RTIReq

 gnss-DataBitAssistanceReq GNSS-DataBitAssistanceReq OPTIONAL, -- Cond DataBitsReq

 gnss-AcquisitionAssistanceReq GNSS-AcquisitionAssistanceReq OPTIONAL, -- Cond AcquAssistReq

 gnss-AlmanacReq GNSS-AlmanacReq OPTIONAL, -- Cond AlmanacReq

 gnss-UTCModelReq GNSS-UTC-ModelReq OPTIONAL, -- Cond UTCModReq

 gnss-AuxiliaryInformationReq GNSS-AuxiliaryInformationReq OPTIONAL, -- Cond AuxInfoReq

 ...,

 [[

 bds-DifferentialCorrectionsReq-r12

 BDS-DifferentialCorrectionsReq-r12

 OPTIONAL, -- Cond DBDS-Req

 bds-GridModelReq-r12 BDS-GridModelReq-r12 OPTIONAL -- Cond BDS-GridModReq

 ]],

 [[

 gnss-RTK-ObservationsReq-r15

 GNSS-RTK-ObservationsReq-r15 OPTIONAL, -- Cond RTK-OSR-Req

 glo-RTK-BiasInformationReq-r15

 GLO-RTK-BiasInformationReq-r15 OPTIONAL, -- Cond GLO-CPB-Req

 gnss-RTK-MAC-CorrectionDifferencesReq-r15

 GNSS-RTK-MAC-CorrectionDifferencesReq-r15

 OPTIONAL, -- Cond MAC-Req

 gnss-RTK-ResidualsReq-r15 GNSS-RTK-ResidualsReq-r15 OPTIONAL, -- Cond Res-Req

 gnss-RTK-FKP-GradientsReq-r15

 GNSS-RTK-FKP-GradientsReq-r15 OPTIONAL, -- Cond FKP-Req

 gnss-SSR-OrbitCorrectionsReq-r15

 GNSS-SSR-OrbitCorrectionsReq-r15

 OPTIONAL, -- Cond OC-Req

 gnss-SSR-ClockCorrectionsReq-r15

 GNSS-SSR-ClockCorrectionsReq-r15

 OPTIONAL, -- Cond CC-Req

 gnss-SSR-CodeBiasReq-r15 GNSS-SSR-CodeBiasReq-r15 OPTIONAL -- Cond CB-Req

 ]],

 [[

 gnss-SSR-URA-Req-r16 GNSS-SSR-URA-Req-r16 OPTIONAL, -- Cond URA-Req

 gnss-SSR-PhaseBiasReq-r16 GNSS-SSR-PhaseBiasReq-r16 OPTIONAL, -- Cond PB-Req

 gnss-SSR-STEC-CorrectionReq-r16

 GNSS-SSR-STEC-CorrectionReq-r16 OPTIONAL, -- Cond STEC-Req

 gnss-SSR-GriddedCorrectionReq-r16 GNSS-SSR-GriddedCorrectionReq-r16

 OPTIONAL, -- Cond Grid-Req

 navic-DifferentialCorrectionsReq-r16

 NavIC-DifferentialCorrectionsReq-r16

 OPTIONAL, -- Cond DNavIC-Req

 navic-GridModelReq-r16 NavIC-GridModelReq-r16 OPTIONAL -- Cond NavIC-GridModReq

 ]],

 [[

 gnss-SSR-SatelliteAPC-r18 GNSS-SSR-SatelliteAPC-r18 OPTIONAL -- Cond SatAPC-Req

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *TimeModReq* | The field is mandatory present if the target device requests *GNSS-TimeModelList*; otherwise it is not present. |
| *DGNSS-Req* | The field is mandatory present if the target device requests *GNSS-DifferentialCorrections*; otherwise it is not present. |
| *NavModReq* | The field is mandatory present if the target device requests *GNSS-NavigationModel*; otherwise it is not present. |
| *RTIReq* | The field is mandatory present if the target device requests *GNSS-RealTimeIntegrity*; otherwise it is not present. |
| *DataBitsReq* | The field is mandatory present if the target device requests *GNSS-DataBitAssistance*; otherwise it is not present. |
| *AcquAssistReq* | The field is mandatory present if the target device requests *GNSS-AcquisitionAssistance*; otherwise it is not present. |
| *AlmanacReq* | The field is mandatory present if the target device requests *GNSS-Almanac*; otherwise it is not present. |
| *UTCModReq* | The field is mandatory present if the target device requests *GNSS-UTCModel*; otherwise it is not present. |
| *AuxInfoReq* | The field is mandatory present if the target device requests *GNSS-AuxiliaryInformation*; otherwise it is not present. |
| *DBDS-Req* | The field is mandatory present if the target device requests *BDS-DifferentialCorrections*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *BDS-GridModReq* | The field is mandatory present if the target device requests *BDS-GridModel*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *RTK-OSR-Req* | The field is mandatory present if the target device requests *GNSS-RTK-Observations*; otherwise it is not present. |
| *GLO-CPB-Req* | The field is mandatory present if the target device requests *GLO-RTK-BiasInformation*; otherwise it is not present. |
| *MAC-Req* | The field is mandatory present if the target device requests *GNSS‑RTK‑MAC‑CorrectionDifferences*; otherwise it is not present. |
| *Res-Req* | The field is mandatory present if the target device requests *GNSS-RTK-Residuals*; otherwise it is not present. |
| *FKP-Req* | The field is mandatory present if the target device requests *GNSS-RTK-FKP-Gradients*; otherwise it is not present. |
| *OC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-OrbitCorrections*; otherwise it is not present. |
| *CC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-ClockCorrections*; otherwise it is not present. |
| *CB-Req* | The field is mandatory present if the target device requests *GNSS-SSR-CodeBias*; otherwise it is not present. |
| *URA-Req* | The field is mandatory present if the target device requests *GNSS-SSR-URA*; otherwise it is not present. |
| *PB-Req* | The field is mandatory present if the target device requests *GNSS-SSR-PhaseBias*; otherwise it is not present. |
| *STEC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-STEC-Correction*; otherwise it is not present. |
| *Grid-Req* | The field is mandatory present if the target device requests *GNSS‑SSR‑GriddedCorrection*; otherwise it is not present. |
| *DNavIC-Req* | The field is mandatory present if the target device requests *NavIC-DifferentialCorrections*; otherwise it is not present. This field may only be present if the *gnss-ID* indicates 'navic'. |
| *NavIC-GridModReq* | The field is mandatory present if the target device requests *NavIC-GridModel*; otherwise it is not present. This field may only be present if the *gnss-ID* indicates 'navic'. |
| *SatAPC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-SatelliteAPC*; otherwise it is not present. |

#### *– GNSS-PeriodicAssistDataReq*

The IE *GNSS-PeriodicAssistDataReq* is used by the target device to request periodic assistance data delivery from a location server.

-- ASN1START

GNSS-PeriodicAssistDataReq-r15 ::= SEQUENCE {

 gnss-RTK-PeriodicObservationsReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pOSR

 glo-RTK-PeriodicBiasInformationReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pCPB

 gnss-RTK-MAC-PeriodicCorrectionDifferencesReq-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pMAC

 gnss-RTK-PeriodicResidualsReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pRes

 gnss-RTK-FKP-PeriodicGradientsReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pFKP

 gnss-SSR-PeriodicOrbitCorrectionsReq-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pOC

 gnss-SSR-PeriodicClockCorrectionsReq-r15

 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pCC

 gnss-SSR-PeriodicCodeBiasReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pCB

 ...,

 [[

 gnss-SSR-PeriodicURA-Req-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pURA

 gnss-SSR-PeriodicPhaseBiasReq-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pPB

 gnss-SSR-PeriodicSTEC-CorrectionReq-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pSTEC

 gnss-SSR-PeriodicGriddedCorrectionReq-r16

 GNSS-PeriodicControlParam-r15 OPTIONAL -- Cond pGrid

 ]],

 [[

 gnss-Integrity-PeriodicServiceAlertReq-r17

 GNSS-PeriodicControlParam-r15 OPTIONAL -- Cond pDNU

 ]],

 [[

 gnss-SSR-SatelliteAPC-r18 GNSS-PeriodicControlParam-r15 OPTIONAL -- Cond pSAPC

 ]]

}

-- ASN1STOP

| *Conditional presence* | Explanation |
| --- | --- |
| *pOSR* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑Observations*; otherwise it is not present. |
| *pCPB* | The field is mandatory present if the target device requests periodic *GLO‑RTK‑BiasInformation*; otherwise it is not present. |
| *pMAC* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑MAC‑CorrectionDifferences*; otherwise it is not present. |
| *pRes* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑Residuals*; otherwise it is not present. |
| *pFKP* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑FKP‑Gradients*; otherwise it is not present. |
| *pOC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑OrbitCorrections*; otherwise it is not present. |
| *pCC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑ClockCorrections*; otherwise it is not present. |
| *pCB* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑CodeBias*; otherwise it is not present. |
| *pURA* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑URA*; otherwise it is not present. |
| *pPB* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑PhaseBias*; otherwise it is not present. |
| *pSTEC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑STEC‑Correction*; otherwise it is not present.  |
| *pGrid* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑GriddedCorrection*; otherwise it is not present. |
| *pDNU* | The field is mandatory present if the target device requests periodic *GNSS-Integrity-ServiceAlert*; otherwise it is not present. |
| *pSAPC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑SatelliteAPC*; otherwise it is not present. |

#### 6.5.2.4 GNSS Assistance Data Request Elements

**/\*\*Skip unmodified parts\*\*/**

*NEXT CHANGE*

#### *–* *GNSS-SSR-SatelliteAPCReq*

The IE *GNSS-SSR-SatelliteAPCReq* is used by the target device to request the *GNSS-SSR- SatelliteAPC* assistancefrom the location server.

-- ASN1START

GNSS-SSR-SatelliteAPCReq-r18 ::= SEQUENCE {

 signal-and-tracking-mode-ID-Map-r18 GNSS-SignalIDs,

 storedNavList-r18 GNSS-NavListInfo-r15 OPTIONAL,

 ...

}

-- ASN1STOP

| ***GNSS-SSR-SatelliteAPCReq* field descriptions** |
| --- |
| ***signal-and-tracking-mode-ID-Map***This field specifies the GNSS signal(s) for which the *GNSS-SSR-SatelliteAPC* is requested.  |
| ***storedNavList***This list provides information to the location server about which NAV data the target device has currently stored for the particular GNSS indicated by *GNSS-ID*. |

#### 6.5.2.5 GNSS Location Information

**/\*\*Skip unmodified parts\*\*/**

*NEXT CHANGE*

#### 6.5.2.10 GNSS Capability Information Elements

**/\*\*Skip unmodified parts\*\*/**

#### – *GNSS-GenericAssistanceDataSupport*

The IE *GNSS-GenericAssistanceDataSupport* is used by the target device to provide information on supported GNSS generic assistance data types to the location server for each supported GNSS.

-- ASN1START

GNSS-GenericAssistanceDataSupport ::=

 SEQUENCE (SIZE (1..16)) OF GNSS-GenericAssistDataSupportElement

GNSS-GenericAssistDataSupportElement ::= SEQUENCE {

 gnss-ID GNSS-ID,

 sbas-ID SBAS-ID OPTIONAL, -- Cond GNSS‑ID‑SBAS

 gnss-TimeModelsSupport GNSS-TimeModelListSupport

 OPTIONAL, -- Cond TimeModSup

 gnss-DifferentialCorrectionsSupport GNSS-DifferentialCorrectionsSupport

 OPTIONAL, -- Cond DGNSS-Sup

 gnss-NavigationModelSupport GNSS-NavigationModelSupport

 OPTIONAL, -- Cond NavModSup

 gnss-RealTimeIntegritySupport GNSS-RealTimeIntegritySupport

 OPTIONAL, -- Cond RTISup

 gnss-DataBitAssistanceSupport GNSS-DataBitAssistanceSupport

 OPTIONAL, -- Cond DataBitsSup

 gnss-AcquisitionAssistanceSupport GNSS-AcquisitionAssistanceSupport

 OPTIONAL, -- Cond AcquAssistSup

 gnss-AlmanacSupport GNSS-AlmanacSupport

 OPTIONAL, -- Cond AlmanacSup

 gnss-UTC-ModelSupport GNSS-UTC-ModelSupport

 OPTIONAL, -- Cond UTCModSup

 gnss-AuxiliaryInformationSupport GNSS-AuxiliaryInformationSupport

 OPTIONAL, -- Cond AuxInfoSup

 ...,

 [[

 bds-DifferentialCorrectionsSupport-r12

 BDS-DifferentialCorrectionsSupport-r12

 OPTIONAL, -- Cond DBDS-Sup

 bds-GridModelSupport-r12 BDS-GridModelSupport-r12

 OPTIONAL -- Cond BDS-GridModSup

 ]],

 [[

 gnss-RTK-ObservationsSupport-r15

 GNSS-RTK-ObservationsSupport-r15

 OPTIONAL, -- Cond RTK-OSR-Sup

 glo-RTK-BiasInformationSupport-r15

 GLO-RTK-BiasInformationSupport-r15

 OPTIONAL, -- Cond GLO-CPB-Sup

 gnss-RTK-MAC-CorrectionDifferencesSupport-r15

 GNSS-RTK-MAC-CorrectionDifferencesSupport-r15

 OPTIONAL, -- Cond MAC-Sup

 gnss-RTK-ResidualsSupport-r15 GNSS-RTK-ResidualsSupport-r15

 OPTIONAL, -- Cond Res-Sup

 gnss-RTK-FKP-GradientsSupport-r15

 GNSS-RTK-FKP-GradientsSupport-r15

 OPTIONAL, -- Cond FKP-Sup

 gnss-SSR-OrbitCorrectionsSupport-r15

 GNSS-SSR-OrbitCorrectionsSupport-r15

 OPTIONAL, -- Cond OC-Sup

 gnss-SSR-ClockCorrectionsSupport-r15

 GNSS-SSR-ClockCorrectionsSupport-r15

 OPTIONAL, -- Cond CC-Sup

 gnss-SSR-CodeBiasSupport-r15 GNSS-SSR-CodeBiasSupport-r15

 OPTIONAL -- Cond CB-Sup

 ]],

 [[

 gnss-SSR-URA-Support-r16 GNSS-SSR-URA-Support-r16 OPTIONAL, -- Cond URA-Sup

 gnss-SSR-PhaseBiasSupport-r16 GNSS-SSR-PhaseBiasSupport-r16

 OPTIONAL, -- Cond PB-Sup

 gnss-SSR-STEC-CorrectionSupport-r16

 GNSS-SSR-STEC-CorrectionSupport-r16

 OPTIONAL, -- Cond STEC-Sup

 gnss-SSR-GriddedCorrectionSupport-r16

 GNSS-SSR-GriddedCorrectionSupport-r16

 OPTIONAL, -- Cond Grid-Sup

 navic-DifferentialCorrectionsSupport-r16

 NavIC-DifferentialCorrectionsSupport-r16

 OPTIONAL, -- Cond DNavIC-Sup

 navic-GridModelSupport-r16 NavIC-GridModelSupport-r16

 OPTIONAL -- Cond NavIC-GridModSup

 ]] ,

 [[

 gnss-SSR-PhaseBiasYawSupport-r18 GNSS-SSR-PhaseBiasYawSupport-r18

 OPTIONAL -- Cond SatAPC-Sup

 ]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *TimeModSup* | The field is mandatory present if the target device supports *GNSS-TimeModelList*; otherwise it is not present. |
| *DGNSS-Sup* | The field is mandatory present if the target device supports *GNSS-DifferentialCorrections*; otherwise it is not present. |
| *NavModSup* | The field is mandatory present if the target device supports *GNSS-NavigationModel*; otherwise it is not present. |
| *RTISup* | The field is mandatory present if the target device supports *GNSS-RealTimeIntegrity*; otherwise it is not present. |
| *DataBitsSup* | The field is mandatory present if the target device supports *GNSS-DataBitAssistance*; otherwise it is not present. |
| *AcquAssistSup* | The field is mandatory present if the target device supports *GNSS-AcquisitionAssistance*; otherwise it is not present. |
| *AlmanacSup* | The field is mandatory present if the target device supports *GNSS-Almanac*; otherwise it is not present. |
| *UTCModSup* | The field is mandatory present if the target device supports *GNSS-UTC-Model*; otherwise it is not present. |
| *AuxInfoSup* | The field is mandatory present if the target device supports *GNSS-AuxiliaryInformation*; otherwise it is not present. |
| *DBDS-Sup* | The field is mandatory present if the target device supports *BDS-DifferentialCorrections*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *BDS-GridModSup* | The field is mandatory present if the target device supports *BDS-GridModel*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *RTK-OSR-Sup* | The field is mandatory present if the target device supports *GNSS-RTK-Observations*; otherwise it is not present. Note, support for *GNSS-RTK-Observations* implies support for *GNSS-RTK-CommonObservationInfo* as well. |
| *GLO-CPB-Sup* | The field is mandatory present if the target device supports *GLO‑RTK‑BiasInformation*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'glonass'. |
| *MAC-Sup* | The field is mandatory present if the target device supports *GNSS‑RTK‑MAC‑CorrectionDifferences*; otherwise it is not present. |
| *Res-Sup* | The field is mandatory present if the target device supports *GNSS‑RTK‑Residuals*; otherwise it is not present. |
| *FKP-Sup* | The field is mandatory present if the target device supports *GNSS‑RTK‑FKP‑Gradients*; otherwise it is not present. |
| *OC-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑OrbitCorrections*; otherwise it is not present. |
| *CC-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑ClockCorrections*; otherwise it is not present. |
| *CB-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑CodeBias*; otherwise it is not present. |
| *URA-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-URA*; otherwise it is not present. |
| *PB-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-PhaseBias*; otherwise it is not present. |
| *STEC-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-STEC-Correction*; otherwise it is not present. |
| *Grid-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑GriddedCorrection*; otherwise it is not present. Note, support for *GNSS‑SSR‑GriddedCorrection* implies support for *GNSS-SSR-CorrectionPoints* as well. |
| *DNavIC-Sup* | The field is mandatory present if the target device supports *NavIC-DifferentialCorrections*; otherwise it is not present. This field may only be present if the *gnss-ID* indicates 'navic'. |
| *NavIC-GridModSup* | The field is mandatory present if the target device supports *NavIC-GridModel*; otherwise it is not present. This field may only be present if the *gnss-ID* indicates 'navic'. |
| *SatAPC-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-SatelliteAPC*; otherwise it is not present. |

**/\*\*Skip unmodified parts\*\*/**

*NEXT CHANGE*

– *GNSS-SSR-SatelliteAPC-Support*

-- ASN1START

GNSS-SSR-SatelliteAPC-Support-r18 ::= SEQUENCE {

 signal-and-tracking-mode-ID-Sup-r18 GNSS-SignalIDs,

 ...

}

-- ASN1STOP

| ***GNSS-SSR-SatelliteAPC-Support* field descriptions** |
| --- |
| ***signal-and-tracking-mode-ID-Sup***This field specifies the GNSS signal(s) for which the *GNSS-SSR-SatelliteAPC* is supported by the target device.  |

#### 6.5.2.11 GNSS Capability Information Request

**/\*\*Skip unmodified parts\*\*/**

*NEXT CHANGE*

**/\*\*Skip unmodified parts\*\*/**

## 7.2 Mapping of *posSibType* to assistance data element

The supported *posSibType*'s are specified in Table 7.2-1. The GNSS Common and Generic Assistance Data IEs are defined in clause 6.5.2.2. The OTDOA Assistance Data IEs and NR DL-TDOA/DL-AoD Assistance Data IEs are defined in clause 7.4.2. The Barometric Assistance Data IEs are defined in clause 6.5.5.8. The TBS (based on MBS signals) Assistance Data IEs are defined in clause 6.5.4.8.

Table 7.2-1: Mapping of posSibType to assistanceDataElement

|  |  |  |
| --- | --- | --- |
|  | *posSibType* | *assistanceDataElement* |
| GNSS Common Assistance Data (clause 6.5.2.2) | *posSibType1-1* | *GNSS-ReferenceTime* |
| *posSibType1-2* | *GNSS-ReferenceLocation* |
| *posSibType1-3* | *GNSS-IonosphericModel* |
| *posSibType1-4* | *GNSS-EarthOrientationParameters* |
| *posSibType1-5* | *GNSS-RTK-ReferenceStationInfo* |
| *posSibType1-6* | *GNSS-RTK-CommonObservationInfo* |
| *posSibType1-7* | *GNSS-RTK-AuxiliaryStationData* |
| *posSibType1-8* | *GNSS-SSR-CorrectionPoints* |
| *posSibType1-9* | *GNSS-Integrity-ServiceParameters* |
| *posSibType1-10* | *GNSS-Integrity-ServiceAlert* |
| GNSS Generic Assistance Data (clause 6.5.2.2) | *posSibType2-1* | *GNSS-TimeModelList* |
| *posSibType2-2* | *GNSS-DifferentialCorrections* |
| *posSibType2-3* | *GNSS-NavigationModel* |
| *posSibType2-4* | *GNSS-RealTimeIntegrity* |
| *posSibType2-5* | *GNSS-DataBitAssistance* |
| *posSibType2-6* | *GNSS-AcquisitionAssistance* |
| *posSibType2-7* | *GNSS-Almanac* |
| *posSibType2-8* | *GNSS-UTC-Model* |
| *posSibType2-9* | *GNSS-AuxiliaryInformation* |
| *posSibType2-10* | *BDS-DifferentialCorrections* |
| *posSibType2-11* | *BDS-GridModelParameter* |
| *posSibType2-12* | *GNSS-RTK-Observations* |
| *posSibType2-13* | *GLO-RTK-BiasInformation* |
| *posSibType2-14* | *GNSS-RTK-MAC-CorrectionDifferences* |
| *posSibType2-15* | *GNSS-RTK-Residuals* |
| *posSibType2-16* | *GNSS-RTK-FKP-Gradients* |
| *posSibType2-17* | *GNSS-SSR-OrbitCorrections* |
| *posSibType2-18* | *GNSS-SSR-ClockCorrections* |
| *posSibType2-19* | *GNSS-SSR-CodeBias* |
| *posSibType2-20* | *GNSS-SSR-URA* |
| *posSibType2-21* | *GNSS-SSR-PhaseBias* |
| *posSibType2-22* | *GNSS-SSR-STEC-Correction* |
| *posSibType2-23* | *GNSS-SSR-GriddedCorrection* |
| *posSibType2-24* | *NavIC-DifferentialCorrections* |
| *posSibType2-25* | *NavIC-GridModelParameter* |
| *posSibType2-wz* | *GNSS-SSR-SatelliteAPC* |
| OTDOA Assistance Data (clause 7.4.2) | *posSibType3-1* | *OTDOA-UE-Assisted* |
| Barometric Assistance Data(clause 6.5.5.8) | *posSibType4-1* | *Sensor-AssistanceDataList* |
| TBS Assistance Data(clause 6.5.4.8) | *posSibType5-1* | *TBS-AssistanceDataList* |
| NR DL-TDOA/DL-AoD Assistance Data (clauses 6.4.3, 7.4.2) | *posSibType6-1* | *NR-DL-PRS-AssistanceData* |
| *posSibType6-2* | *NR-UEB-TRP-LocationData* |
| *posSibType6-3* | *NR-UEB-TRP-RTD-Info* |
| *posSibType6-4* | *NR-TRP-BeamAntennaInfo* |
| *posSibType6-5* | *NR-DL-PRS-TRP-TEG-Info* |
| On-demand DL-PRS Configurations (clause 6.4.3) | *posSibType6-6* | *NR-On-Demand-DL-PRS-Configurations* |

END OF CHANGE

# Appendix B.3 (RRC – APC)

*START OF CHANGE*

– *DedicatedSIBRequest*

The *DedicatedSIBRequest* message is used to request SIB(s) required by the UE in RRC\_CONNECTED as specified in clause 5.2.2.3.5.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

***DedicatedSIBRequest message***

-- ASN1START

-- TAG-DEDICATEDSIBREQUEST-START

DedicatedSIBRequest-r16 ::= SEQUENCE {

 criticalExtensions CHOICE {

 dedicatedSIBRequest-r16 DedicatedSIBRequest-r16-IEs,

 criticalExtensionsFuture SEQUENCE {}

 }

}

DedicatedSIBRequest-r16-IEs ::= SEQUENCE {

 onDemandSIB-RequestList-r16 SEQUENCE {

 requestedSIB-List-r16 SEQUENCE (SIZE (1..maxOnDemandSIB-r16)) OF SIB-ReqInfo-r16 OPTIONAL,

 requestedPosSIB-List-r16 SEQUENCE (SIZE (1..maxOnDemandPosSIB-r16)) OF PosSIB-ReqInfo-r16 OPTIONAL

 } OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

SIB-ReqInfo-r16 ::= ENUMERATED { sib12, sib13, sib14, sib20-v1700, sib21-v1700, spare3, spare2, spare1 }

PosSIB-ReqInfo-r16 ::= SEQUENCE {

 gnss-id-r16 GNSS-ID-r16 OPTIONAL,

 sbas-id-r16 SBAS-ID-r16 OPTIONAL,

 posSibType-r16 ENUMERATED { posSibType1-1, posSibType1-2, posSibType1-3, posSibType1-4, posSibType1-5, posSibType1-6,

 posSibType1-7, posSibType1-8, posSibType2-1, posSibType2-2, posSibType2-3, posSibType2-4,

 posSibType2-5, posSibType2-6, posSibType2-7, posSibType2-8, posSibType2-9, posSibType2-10,

 posSibType2-11, posSibType2-12, posSibType2-13, posSibType2-14, posSibType2-15,

 posSibType2-16, posSibType2-17, posSibType2-18, posSibType2-19, posSibType2-20,

 posSibType2-21, posSibType2-22, posSibType2-23, posSibType3-1, posSibType4-1,

 posSibType5-1, posSibType6-1, posSibType6-2, posSibType6-3,..., posSibType1-9-v1710,

 posSibType1-10-v1710, posSibType2-24-v1710, posSibType2-25-v1710,

 posSibType6-4-v1710, posSibType6-5-v1710, posSibType6-6-v1710,..., posSibType2-wz-v1800 }

}

-- TAG-DEDICATEDSIBREQUEST-STOP

-- ASN1STOP

|  |
| --- |
| ***DedicatedSIBRequest field descriptions*** |
| ***requestedSIB-List***Contains a list of SIB(s) the UE requests while in RRC\_CONNECTED. |
| ***requestedPosSIB-List***Contains a list of posSIB(s) the UE requests while in RRC\_CONNECTED. |

|  |
| --- |
| ***PosSIB-ReqInfo* field descriptions** |
| ***gnss-id***The presence of this field indicates that the request positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]) |
| ***sbas-id***The presence of this field indicates that the request positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]). |

*NEXT CHANGE*

6.3.1a Positioning System information blocks

– *PosSystemInformation-r16-IEs*

-- ASN1START

-- TAG-POSSYSTEMINFORMATION-R16-IES-START

PosSystemInformation-r16-IEs ::= SEQUENCE {

 posSIB-TypeAndInfo-r16 SEQUENCE (SIZE (1..maxSIB)) OF CHOICE {

 posSib1-1-r16 SIBpos-r16,

 posSib1-2-r16 SIBpos-r16,

 posSib1-3-r16 SIBpos-r16,

 posSib1-4-r16 SIBpos-r16,

 posSib1-5-r16 SIBpos-r16,

 posSib1-6-r16 SIBpos-r16,

 posSib1-7-r16 SIBpos-r16,

 posSib1-8-r16 SIBpos-r16,

 posSib2-1-r16 SIBpos-r16,

 posSib2-2-r16 SIBpos-r16,

 posSib2-3-r16 SIBpos-r16,

 posSib2-4-r16 SIBpos-r16,

 posSib2-5-r16 SIBpos-r16,

 posSib2-6-r16 SIBpos-r16,

 posSib2-7-r16 SIBpos-r16,

 posSib2-8-r16 SIBpos-r16,

 posSib2-9-r16 SIBpos-r16,

 posSib2-10-r16 SIBpos-r16,

 posSib2-11-r16 SIBpos-r16,

 posSib2-12-r16 SIBpos-r16,

 posSib2-13-r16 SIBpos-r16,

 posSib2-14-r16 SIBpos-r16,

 posSib2-15-r16 SIBpos-r16,

 posSib2-16-r16 SIBpos-r16,

 posSib2-17-r16 SIBpos-r16,

 posSib2-18-r16 SIBpos-r16,

 posSib2-19-r16 SIBpos-r16,

 posSib2-20-r16 SIBpos-r16,

 posSib2-21-r16 SIBpos-r16,

 posSib2-22-r16 SIBpos-r16,

 posSib2-23-r16 SIBpos-r16,

 posSib3-1-r16 SIBpos-r16,

 posSib4-1-r16 SIBpos-r16,

 posSib5-1-r16 SIBpos-r16,

 posSib6-1-r16 SIBpos-r16,

 posSib6-2-r16 SIBpos-r16,

 posSib6-3-r16 SIBpos-r16,

 ... ,

 posSib1-9-v1700 SIBpos-r16,

 posSib1-10-v1700 SIBpos-r16,

 posSib2-24-v1700 SIBpos-r16,

 posSib2-25-v1700 SIBpos-r16,

 posSib6-4-v1700 SIBpos-r16,

 posSib6-5-v1700 SIBpos-r16,

 posSib6-6-v1700 SIBpos-r16

 ... ,

 posSib2-wz-v1800 SIBpos-r16

 },

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- TAG-POSSYSTEMINFORMATION-R16-IES-STOP

-- ASN1STOP

– *PosSI-SchedulingInfo*

-- ASN1START

-- TAG-POSSI-SCHEDULINGINFO-START

PosSI-SchedulingInfo-r16 ::= SEQUENCE {

 posSchedulingInfoList-r16 SEQUENCE (SIZE (1..maxSI-Message)) OF PosSchedulingInfo-r16,

 posSI-RequestConfig-r16 SI-RequestConfig OPTIONAL, -- Cond MSG-1

 posSI-RequestConfigSUL-r16 SI-RequestConfig OPTIONAL, -- Cond SUL-MSG-1

 ...,

 [[

 posSI-RequestConfigRedCap-r17 SI-RequestConfig OPTIONAL -- Cond REDCAP-MSG-1

 ]]

}

PosSchedulingInfo-r16 ::= SEQUENCE {

 offsetToSI-Used-r16 ENUMERATED {true} OPTIONAL, -- Need R

 posSI-Periodicity-r16 ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},

 posSI-BroadcastStatus-r16 ENUMERATED {broadcasting, notBroadcasting},

 posSIB-MappingInfo-r16 PosSIB-MappingInfo-r16,

 ...

}

PosSIB-MappingInfo-r16 ::= SEQUENCE (SIZE (1..maxSIB)) OF PosSIB-Type-r16

PosSIB-Type-r16 ::= SEQUENCE {

 encrypted-r16 ENUMERATED { true } OPTIONAL, -- Need R

 gnss-id-r16 GNSS-ID-r16 OPTIONAL, -- Need R

 sbas-id-r16 SBAS-ID-r16 OPTIONAL, -- Need R

 posSibType-r16 ENUMERATED { posSibType1-1, posSibType1-2, posSibType1-3, posSibType1-4, posSibType1-5, posSibType1-6,

 posSibType1-7, posSibType1-8, posSibType2-1, posSibType2-2, posSibType2-3, posSibType2-4,

 posSibType2-5, posSibType2-6, posSibType2-7, posSibType2-8, posSibType2-9, posSibType2-10,

 posSibType2-11, posSibType2-12, posSibType2-13, posSibType2-14, posSibType2-15,

 posSibType2-16, posSibType2-17, posSibType2-18, posSibType2-19, posSibType2-20,

 posSibType2-21, posSibType2-22, posSibType2-23, posSibType3-1, posSibType4-1,

 posSibType5-1,posSibType6-1, posSibType6-2, posSibType6-3, posSibType2-wz,... },

 areaScope-r16 ENUMERATED {true} OPTIONAL -- Need S

}

GNSS-ID-r16 ::= SEQUENCE {

 gnss-id-r16 ENUMERATED{gps, sbas, qzss, galileo, glonass, bds, ...},

 ...

}

SBAS-ID-r16 ::= SEQUENCE {

 sbas-id-r16 ENUMERATED { waas, egnos, msas, gagan, ...},

 ...

}

-- TAG-POSSI-SCHEDULINGINFO-STOP

-- ASN1STOP

|  |
| --- |
| ***PosSI-SchedulingInfo* field descriptions** |
| ***areaScope***Indicates that a posSIB is area specific. If the field is absent, the posSIB is cell specific. |
| ***encrypted***The presence of this field indicates that the *pos-sib-type* is encrypted as specified in TS 37.355 [49]. |
| ***gnss-id***The presence of this field indicates that the positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]) |
| ***posSI-BroadcastStatus***Indicates if the SI message is being broadcasted or not. Change of *posSI-BroadcastStat*us should not result in system information change notifications in Short Message transmitted with P-RNTI over DCI (see clause 6.5). The value of the indication is valid until the end of the BCCH modification period when set to *broadcasting*.If *si-SchedulingInfo-v1700* is present, the network ensures that the total number of SI messages with *posSI-BroadcastStatus*and *si-BroadcastStatus*set to *notBroadcasting* in the concatenated list of SI messages configured by *schedulingInfoList* in *si-SchedulingInfo* and SI messages containing type2 SIB configured by *schedulingInfoList2* in *si-SchedulingInfo-v1700* does not exceed the limit of *maxSI-Message* when *posSI-RequestConfig* or *posSI-RequestConfigRedCap* or *posSI-RequestConfigSUL* is configured. |
| ***posSI-RequestConfig***Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to notBroadcasting. |
| ***posSI-RequestConfigRedCap***Configuration of Msg1 resources for *initialUplinkBWP-RedCap*that the RedCap UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to *notBroadcasting*. |
| ***posSI-RequestConfigSUL***Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to notBroadcasting. |
| ***posSIB-MappingInfo***List of the posSIBs mapped to this *SystemInformation* message. |
| ***posSibType***The positioning SIB type is defined in TS 37.355 [49]. |
| ***posSI-Periodicity***Periodicity of the SI-message in radio frames, such that rf8 denotes 8 radio frames, rf16 denotes 16 radio frames, and so on. If the *offsetToSI-Used* is configured, the *posSI-Periodicity* of rf8 cannot be used. |
| ***offsetToSI-Used***This field, if present indicates that all the SI messages in *posSchedulingInfoList* are scheduled with an offset of 8 radio frames compared to SI messages in *schedulingInfoList*. *offsetToSI-Used* may be present only if the shortest configured SI message periodicity for SI messages in *schedulingInfoList* is 80ms. If SI offset is used, this field is present in each of the SI messages in the *posSchedulingInfoList*. |
| ***sbas-id***The presence of this field indicates that the positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]). |

| **Conditional presence** | **Explanation** |
| --- | --- |
| *MSG-1* | The field is optionally present, Need R, if *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. It is absent otherwise. |
| *SUL-MSG-1* | The field is optionally present, Need R, if *supplementaryUplink* is configured in *ServingCellConfigCommonSIB* and if *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. It is absent otherwise. |
| *REDCAP-MSG-1* | The field is optionally present, Need R, if *initialUplinkBWP-RedCap* is configured in *UplinkConfigCommonSIB* and if *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. It is absent otherwise. |

– *SIBpos*

The IE *SIBpos* contains positioning assistance data as defined in TS 37.355 [49].

***SIBpos* information element**

-- ASN1START

-- TAG-SIPOS-START

SIBpos-r16 ::= SEQUENCE {

 assistanceDataSIB-Element-r16 OCTET STRING,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 ...

}

-- TAG-SIPOS-STOP

-- ASN1STOP

| ***SIBpos* field descriptions** |
| --- |
| ***assistanceDataSIB-Element***Parameter *AssistanceDataSIBelement* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit. |

END OF CHANGE