RxNetworks Assisted GNSS Server Interface Specification

Introduction

The ST Teseo III Binary Image supports server based Predictive and Real Time Assisted GNSS through the partnership with RxNetwors.

This document reports information coming from RxNetworks's "Location.io Mobile Device Interface - HTTP Interface Specification 1.0.0" available without NDA, to describe only how to access the services. If needed, please contact ST-Sale-Office for further information.

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1   Scope

The location.io Real-Time GNSS HTTP service is a real-time data stream that provides GNSS information over an HTTP transport protocol. This service can easily be customized to deliver a specific mix of assistance data elements based on customer configuration, geographical coverage and subscription licensing requirements.

Assistance data elements are provided in a format closely modeled after the 3GPP RRLP or LPP specifications in order to facilitate integration at the partner's AGPS chip/firmware interface.

A location.io subscription profile can contain any of the assistance data elements described below, in *Table 4: Real-time assistance message types*.

2 RxNetworks introduction

2.1 Foreword

Location.io is a worldwide location service to provide Real Time GNSS ephemeris, Predicted GNSS ephemeris and Wi-Fi based location services to mobile devices, Location Based Platforms and M2M applications. The service supports multiple constellations (GPS, GLONASS, Galileo and BeiDou) and is globally available.

3 Overview

The location.io HTTPS service provides Predicted GNSS ephemeris, Real-Time GNSS ephemeris, Wi-Fi / Cell ID positioning and supporting information, over an HTTP transport protocol.

For Predicted GNSS ephemeris a subscription profile can contain any of the following constellations:

- GPS
- GLONASS
- BeiDou
- Galileo

The Predicted GNSS ephemeris subscription profile is always for global coverage.

For Real-Time GNSS ephemeris a subscription profile can contain any of the following constellations:

- GPS
- Galileo
- GLONASS
- BeiDou

The Real-Time GNSS ephemeris subscription profile is always for global coverage.

4 Request

The request is sent in the form of an HTTP POST, with parameters included as form data in JSON format. Authentication information is included in the Authorization HTTP request header field.

4.1 Request Header Fields

4.1.1 Authorization

The Requests to the location.io HTTPS service must include an Authorization request header field that includes authentication information.

There are a few options for the authentication scheme. Your location.io account contact person will inform you which one to use.

An example Authorization request header is:

```
Authorization: RXN-SP cId=<cId>,mId=<mId>,dId=<dId>,pw=<base64-
encoded-pw>
```

Where <cId>, <mId>, <dId>, and ,<base64-encoded-pw> are as follows:

Table 1. Authorization parameters

Name	Description	Valid Values	Mandatory Optional	Error Conditions/Comments
cId	An identifier for the customer making the request.	Each value corresponds to one customer and is assigned by the location.io administrator.	Mandatory	If a request is received without a valid cId, then the service returns "Not Authorized" error to the client. (Error code 401.)
mId	A unique identifier for the type / model of the device that is requesting the service.		Mandatory	
dId	A unique device identifier		Mandatory	
Base64-encoded-pw	The password, encoded as base-64		Mandatory	

Further details on the Authorization header field parameters follow.

4.1.1.1 Client ID parameter

This parameter is assigned by the location.io administrator to identify the customer making the request. It must be provided in every request for assistance data.

4.1.1.2 Model ID parameter

This is set by the client to indicate the type or model of client that is making the request. An example would be a string like "ProductModel123" or "CellPhoneModel4". This field has a maximum length of 25 alphanumeric characters.

4.1.1.3 Device ID parameter

This is set by the client to indicate the unique device or username. This field has a maximum length of 50 alphanumeric characters.

The customer organization must ensure each client device using the service uses a unique value for this parameter. E.g. MAC address, IMEI. If unique values are not used, access frequency restrictions may be applied when multiple devices are used simultaneously.

Note that if the device id is not alphanumeric (e.g. MAC address contains ":"), then it must be a quoted-string (as defined in RFC 2616).

This parameter is optional, so that individual users cannot be identified or tracked by the service, guaranteeing privacy.

4.1.1.4 Password parameter

Initially, passwords are static, and assigned by the location.io administrator. Passwords may be specific to either a cId, or a cId/mId combination.

In the future, this may be a unique password that is generated on the client for each access. Password generation client software and passwords are unique to each cId, or a cId/mId combination. Customer ID's and Model ID's must be registered for their passwords to work. To generate passwords, clients must use the appropriate security library provided by location.io administrator.

This parameter has a maximum length of 50 alphanumeric characters. This parameter is mandatory.

4.1.2 Content-Type

The request should include a Content-Type header, indicating JSON format:

```
Content-Type: application/json
```

4.2 Request Message Body

The request message body is a JSON document, that includes request details.

The JSON document must be composed of a single array, whose values are objects that each describes a request for a particular type of location assistance.

Each object in the request array must include a single name/value pair. The name must be the name of a particular type of location assistance, and the value must be an object containing request details specific to that type of location assistance.

4.2.1 Extended Ephemeris Request

The object that describes a request for extended ephemeris must contain a single name/value pair. The name must be "ee", and the value must be an object containing the following name/value pairs:

Table 2. Extended Ephemeris Request parameters

Name	Description	Valid Values	Mandatory/Optional	Error Conditions/ Comments
version	The EE seed version number.	8	Mandatory	The location.io HTTP Server only supports seed version 8. If any version number other than 8 is requested, then a "Bad Request" error will be returned to the client (Error code 400). In the future, multiple seed versions may be supported.
seedAge	The age of the seed requested, in days. Only used for test purposes.	0 – 14	Optional. Defaults to 0 (current seed).	If a seed within the timeframe is not available, then error code 503 is returned. If a seedAge is negative then error code 400 is returned. Values greater than 14 are unsupported, and should not be used, even if a response is received.
constellations	Indicates the type of constellation(s) requested.	An array containing one or more of: – gps – glonass – beidou – galileo	Optional. Defaults to all authorized constellations.	

Further details on the request parameters follow.

4.2.1.1 Version Parameter

This indicates the requested seed version. This allows a single server to support multiple seed versions, handling requests for the latest seed version, while still supporting requests for older versions from older clients that may still be in the field.

4.2.1.2 Seed Age Parameter

The seedAge parameter indicates the requested age of the seeds. This parameter is in units of days. If it is set to 0, then the server will return the most current seeds. If this parameter is set to 3, then the server will return seeds that are 3 days old. This parameter has a maximum value of 14. This parameter is optional and should only be used in test scenarios.

4.2.1.3 Constellations Parameter

The constellations parameter indicates which satellite constellation(s) is/are requested. A client can request any combination of gps, glonass, beidou, and galileo. The value of this parameter is a JSON array.

4.2.2 Real-Time Assistance Request

The object that describes a request for real-time assistance must contain a single name/value pair. The name must be "rtAssistance", and the value must be an object containing the following name/value pairs:

Table 3. Real-time assistance request parameters

Name	Description	Valid values	Mandatory/Optional	Error Conditions/ Comments
msgs	Indicates the type of assistance messages(s) requested	An array containing one or more of: – GPS:1NAC – GPS:1ALM – GPS:1RTC – GPS:1ION – GPS:1UTC – GLO:2NAC – GLO:2NKC – GLO:2ALM – BDS:2NAC – BDS:2ALM – GAL:2NAC – GAL:2ALM	Mandatory	Galileo assistance data will be available in a future version

Further details on the request parameters follow.

4.2.2.1 Msgs parameter

The msgs parameter indicates which assistance message(s) is/are requested. The value of this parameter is a JSON array containing one or more assistance messages types from the list below.

Table 4. Real-time assistance message types

Type	Description
GPS:1NAC	GPS Navigation Model
GPS:1ALM	GPS Almanac
GPS:1RTC	GPS Reference Time Composite
GPS:1ION	GPS Ionospheric Model
GPS:1UTC	GPS UTC Model
GLO:2NAC	GLONASS Navigation Model (Native format)
GLO:2NKC	GLONASS Navigation Model (Keplerian format)
GLO:2ALM	GLONASS Almanac
BDS:2NAC	BeiDou Navigation Model
BDS:2ALM	BeiDou Almanac

Table 4. Real-time assistance message types (continued)

Type	Description
GAL:2NAC	Galileo Navigation Model
GAL:2ALM	Galileo Almanac

5 Response

The HTTP response consists of an HTTP status code, HTTP response header fields, and a message body in JSON format.

5.1 Response Status Code

When a request is processed successfully, the response status code is 200 and the response reason phrase is 'OK'. If a request is not processed successfully, then the response contains one of the errors listed in the *Table 5*.

Table 5. Response Error codes

HTTP error code	HTTP reason phrase	Causes
400	Bad Request	The request is mal-formed.
401	Not Authorized	The authentication information is not valid.
500	Internal Server Error	The HTTP service has encountered an unexpected error.
503	Service Unavailable	The HTTP service is temporarily unavailable.

Note that, this is the status of the overall request. There are also individual status codes for each type of location assistance requested, as described below.

5.2 Response Header Fields

The `Content-Length` parameter of the HTTP response is set to the length of the HTTP response body.

The `Content-Type` parameter of the HTTP response is set to "application/json".

5.3 Response Message Body

The response data is returned as a JSON document in the message body of the HTTP response.

The JSON document will be composed of a single array, whose values are objects that each describes the response for one type of location assistance. The length and order of the response array will match the length and order of the request array.

Each object in the response array includes a single name/value pair. The name will be the name of a particular type of location assistance, and the value will be an object containing the following name/value pairs:

Table 6. Response parameters

Name	Description	Valid values	Mandatory/Optional	Error Conditions/ Comments
status	An HTTP status code that indicates the status of the request for this particular type of location assistance.	200, 400, 401, 500, 503	Mandatory	The location.io HTTP Server only supports seed version 8. If any version number other than 8 is requested, then a "Bad Request" error will be returned to the client (Error code 400). In the future, multiple seed versions may be supported.
body	Response details specific to this particular type of location assistance	A JSON object	Mandatory	See below for response details of each type of assistance data.

Binary data within the response JSON document is encoded as base64 strings.

In order to handle future additions to the service, client applications should be implemented to ignore any elements in the JSON document that they do not recognize.

5.3.1 Extended Ephemeris Response

The body in an extended ephemeris response will be an object containing a name/value pairs for leap second information, for each constellation included in the response, and possibly for an end-of-life indication (see below).

All fields within byte-packed binary data are big-endian, and all signed values are in 2's-complement representation.

5.3.1.1 Leap Second Information

In the extended ephemeris response body object, a name/value pair with name "leap" contains leap second information. Its value is an object containing name/value pairs for the current number of leap seconds ("currSecs"), the GPS time of the next leap second transition, if known ("nextGpsTime"), and the number of leap seconds after the next transition ("nextSecs"). If the time of the next leap second transition is unknown, "nextGpsTime" will be zero, and "nextSecs" should be ignored.

5.3.1.2 Extended Ephemeris Seed Data

The seed data is in a binary format that is proprietary to Rx Networks. It can be decoded with the appropriate client-side libraries provided.

5.3.1.3 Block Types

The blockType field provides the satellite block type of each SV_ID of the indicated constellation.

The value of the field is a base64-encoded representation of byte-packed binary data in this format:

Table 7. Block Type

Field Name	Type	Size	Description
N_SAT	BYTE	1	Number of satellites (0..63)
The shaded fields below repeat for each of the SVs			
SV_ID	BYTE	1	SV_ID(0..63)
Block Type Number	BYTE	1	GPS: IIA=1, IIR=2, IIRM=3, IIF=4 and III=5 GLONASS: GS=1, GSM=2 and GSK=3
	Total		1 byte plus 2 bytes per satellite.

The blockType field is available for GPS and GLONASS only.

5.3.1.4 Time Model

The timeModel field provides the information that relates the GNSS system time to UTC and other GNSS system times. This message is currently available for GPS, GLONASS and BeiDou, with Galileo anticipated to be available in 2017.

For GPS, it is in the form of a UTC Model message. For other constellations, it is in the form of a generic GANSS Time Model message.

The value of the field is a base64-encoded representation of byte-packed binary data.

For GPS, the UTC Model is in this format:

Table 8. UTC Model for GPS

Field Name	Type	Size	Description
sA1	INT4	4	A1 (-8388608...8388607) Scale: sA1 * 2^{-50} = A1
sA1	INT4	4	A0 (-2147483648...2147483647) Scale: sA0 * 2^{-30} = A0
sTot	UINT2	2	Reference Time of Week (0...255) Scale: sTot * 2^{12} = Tot
WNt	UINT2	2	Reference Week Number (0...255)
DELTAtls	INT2	2	Delta time leap seconds (-128...127)
WNlsf	UINT2	2	Week number of scheduled future or recent past leap second change (0...255)
DN	INT2	2	Day number of scheduled future or recent past leap second change (1...7) "Day one" is the first day relative to the end/start of week.
DELTAtlsf	INT2	2	Delta time leap seconds as of scheduled future or recent past leap second change (-128...127)
	Total	20	

For GLONASS, the GANSS Time Model is in this format:

Table 9. GANSS Time Model for GLONASS

Field Name	Type	Size	Description
sGANSS Time Model Reference Time	UINT2	2	Range:(0...65535) Scale: sGANSS Time Model Reference Time * 2^4 = GANSS Time Model Reference Time
sT_{A0}	INT4	4	Range: (-2147483648...2147483647) Scale: sTA0 * 2^{-35} = TA0
sT_{A1}	INT4	4	Range: (-8388608...8388607) Scale: sTA1 * 2^{-51} = TA1
sT_{A2}	BYTE	1	Range: (-64...63) Scale: sTA2 * 2^{-68} = TA2
GNSS_TO_ID	BYTE	1	Range: (0...7)[1]
Week Number	UINT2	2	Range: (0 – 8191)[2]
	Total	14	

1. For GLONASS GNSS_TO_ID will always be 0, indicating that GLONASS system time is being related to GPS system time.

2. For GLONASS, Week Number will always be 0, and should not be used.

For GLONASS the TA0 and TA1 parameters are estimated as follows:

- Collect tauGPS values from the GLONASS satellites.
- Using a historical tauGPS data of some period (~7 days to be refined based on experimentation) perform polynomial fit of order 1 using Iterative Least Squares.
- The slope of the polynomial is TA1.
- The variation in tauGPS is fairly linear, so we don't estimate the TA2 parameter.

For BeiDou, the GANSS Time Model is in this format:

Table 10. GANSS Time Model for BeiDou

Field Name	Type	Size	Description
Num Time Models	BYTE	1	Range: (1...15)
The shaded fields below repeat for each time model.			
sGANSS Time Model Reference Time	UINT2	2	Range:(0...65535) Scale: sGANSS Time Model Reference Time * 2^4 = GANSS Time Model Reference Time
sT_{A0}	INT4	4	Range: (-67108864...67108863)
sT_{A1}	INT4	4	Range: (-32768...32767)
sT_{A2}	BYTE	1	Range: (-64...63)
GNSS_TO_ID	BYTE	1	Range: (1...15)[1]
Week Number	UINT2	2	Range: (0 – 8191)
deltaT	BYTE	1	Range: (-128...127) Scale: 1 second
	Total		1 byte plus 15 bytes per time model

1. GPS = 1, Galileo = 2, GLONASS = 4.

For BeiDou, 0 – 3 sets of values are returned. BeiDou provides time model parameters against GPS, Galileo and GLONASS. The values in this message are provided as follows:

- sGANSS Time Model Reference Time: BeiDou system time of week.
- TA0: This is the A0yyy field where yyy is the constellation, as described in sections 5.2.4.18, 5.2.4.19 and 5.2.4.20 of the BeiDou ICD.
- TA1: This is the A1yyy field where yyy is the constellation, as described in sections 5.2.4.18, 5.2.4.19 and 5.2.4.20 of the BeiDou ICD.

Currently BeiDou broadcasts zero in the A0yyy and A1yyy fields. These values should not be used if sTA0 and sTA1 are both zero.

5.3.1.5   GANSS auxiliary information

For GLONASS, the slotFreq field provides the information that maps satellite slot Ids to the corresponding FDMA frequency. It is in the form of a generic GANSS Auxiliary Information message.

This message is currently only available for GLONASS.

The value of the field is a base64-encoded representation of byte-packed binary data in this format:

Table 11. GANSS auxiliary information for GLONASS

Field Name	Type	Size	Description
N_SAT	BYTE	1	Number of satellites (0...63)
The shaded fields below repeat for each of the SVs			
SV_ID	BYTE	1	Satellite ID (0...63)
Channel Number	BYTE	1	(-7...13)
Signals Available	BYTE	1	Eight bit flags representing signal 1 – signal 8. Signal 1 is the most significant bit and signal 8 is the least significant bit.
Total			1 byte plus 3 bytes per satellite.

5.3.1.6   End pf Life indicator

If the extended ephemeris service for the requested version is being decommissioned, then an end of life indicator will be sent in the response to a request for that service. After the EOL time, the location assistance service will no longer respond to requests.

The end of life indicator is a name/value pair where the name is "eol" and the value is a date/time after which the service is no longer available.

5.3.2   Real-Time assistance response

The body in a real-time assistance response will be an array containing objects for each of the requested message types. These objects contain a single name/value pair, where the name is the message type name, and the value is the base64-encoded byte-packed data. All fields within byte-packed data are big-endian, and all signed values are in 2's-complement representation.

5.3.2.1   GPS:1NAC

The GPS Navigation Model message will contain data for all healthy satellites.

Table 12. GPS:1NAC

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

5.3.2.2   GPS:1ALM

The GPS Almanac message will contain data for all healthy and unhealthy satellites unless the satellite is not included in the broadcasted Almanac information.

Table 13. GPS:1ALM

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

5.3.2.3   GPS:1RTC

The GPS Reference Time Composite message contains data for all healthy satellites.

Table 14. GPS:1RTC

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

5.3.2.4   GPS:1ION

The GPS Ionospheric Model message contains the Klobuchar model that is broadcast by GPS satellites.

Table 15. GPS:1ION

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

5.3.2.5   GPS:1UTC

The GPS UTC Model message contains data to relate GPS system time to UTC.

Table 16. GPS:1UTC

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

5.3.2.6   GLO:2NAC

The GLONASS Navigation Model (Native) message contains data for all healthy satellites, in the GLONASS native format.

Table 17. GLO:2NAC

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

NOTE: This message is modelled after the GANSS Navigation Model information element of RRLP v8.6.1 (3GPP TS 44.031 V8.6.1 (2010-04)). As with the RRLP v8.6.1 GANSS Navigation Model, in case of native GLONASS ephemeris, the IOD contains the parameter tb as defined in the GLONASS ICD.

5.3.2.7 GLO:2NKC

The GLONASS Navigation Model (Keplerian) message contains data for all healthy satellites, in Keplerian format.

Table 18. GLO:2NKC

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

5.3.2.8 GLO:2ALM

For the GLONASS constellation the response will contain data for all healthy and unhealthy satellites. If Cn^A indicates unhealthy, the other parameters *may* all be set to zero (except n^A and H_n^A).

Table 19. GLO:2ALM

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

5.3.2.9 BDS:2NAC

The BeiDou Navigation Model message will contain data for all satellites.

Table 20. BDS:2NAC

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

5.3.2.10 BDS:2ALM

The BeiDou Almanac message will contain data for all satellites for which almanac data is available.

Table 21. BDS:2ALM

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

5.3.2.11 GAL:2NAC

The following is the data payload for the Galileo constellation in native format, which is a keplerian format.

Table 22. GAL:2NAC

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

This message is modeled after the 3GPP TS 36.355 v12.3.0 (2014-12) (LTE Positioning Protocol (LPP)) GNSS-NavigationModel element, with the StandardClockModelList clock model and NavModelKeplerianSet orbit model.

5.3.2.12 GAL:2ALM

The Galileo Almanac message will contain data for all satellites for which almanac data is available.

Table 23. GAL:2ALM

Field Name	Relates to 3GPP	Type	Size	Description
Information under NDA				

6 JSON Schema

6.1 Request schema

A request must match the following JSON schema:

```json
{
"$schema": "http://json-schema.org/draft-04/schema#",
"description": "location.io API Request Schema version 1",
"definitions": {
  "ee": {
    "definitions": {
      "version": {
        "type": "integer",
        "minimum": 8,
        "maximum": 8
      },
      "seedAge": {
        "type": "integer",
        "minimum": 0,
        "maximum": 14
      },
      "constellation": {
        "enum": [
        "gps",
        "glonass",
        "beidou",
        "galileo"
        ]
      },
    "request": {
      "type": "object",
      "properties": {
        "ee": {
          "type": "object",
          "properties": {
```

```
        "version": {
            "$ref": "#/definitions/ee/definitions/version"
        },
        "seedAge": {
            "$ref": "#/definitions/ee/definitions/seedAge"
        },
        "constellations": {
          "type": "array",
          "minItems": 1,
          "uniqueItems": true,
          "items": {
            "$ref": "#/definitions/ee/definitions/constellation"
          }
        }
      },
      "required": [
        "version"
      ],
      "additionalProperties": false
      }
    },
    "required": [
      "ee"
    ],
    "additionalProperties": false
    }
  }
},
"rtAssistance": {
  "definitions": {
    "format": {
      "enum": [
        "byte",
        "rinex210",
        "rinex212",
```

```
            "rinex302",
            "rrlp861",
            "lpp122"
          ]
        },
      "msg": {
        "enum": [
            "GPS:1NAC",
            "GPS:1ALM",
            "GPS:1RTC",
            "GPS:1ION",
            "GPS:1UTC",
            "GLO:2NAC",
            "GLO:2NKC",
            "GLO:2ALM",
            "BDS:2NAC",
            "BDS:2ALM",
            "GAL:2NAC",
            "GAL:2ALM"
          ]
        },
      "request": {
      "type": "object",
      "properties": {
        "rtAssistance": {
          "type": "object",
          "properties": {
            "format": {
            "$ref": "#/definitions/rtAssistance/definitions/format"
          },
          "msgs": {
            "type": "array",
            "minItems": 1,
            "uniqueItems": true,
            "items": {
```

```
                   "$ref": "#/definitions/rtAssistance/definitions/msg"
                   }
                 }
             },
             "required": [
               "msgs"
             ],
             "additionalProperties": false
          }
       },
       "required": [
         "rtAssistance"
       ],
       "additionalProperties": false
       }
    }
    },
    "rtLocation": {
      "definitions": {
        "gsmCell": {
          "type": "object",
          "properties": {
            "mcc": {
              "description": "Mobile country code",
              "type": "integer",
              "minimum": 0,
              "maximum": 999
            },
        "mnc": {
            "description": "Mobile network code",
            "type": "integer",
            "minimum": 0,
            "maximum": 999
          },
        "lac": {
```

```
    "description": "Location area code",
        "type": "integer",
        "minimum": 1,
        "maximum": 65535
    },
    "cid": {
        "description": "Cell identity",
        "type": "integer",
        "minimum": 0,
        "maximum": 268435455
    },
    "ta": {
        "description": "Cell timing advance, in units of
microseconds",
        "type": "integer",
        "minimum": 0,
        "maximum": 1024
    },
    "rxlev": {
        "description": "Received signal level",
        "type": "integer",
        "minimum": -121,
        "maximum": -25
    }
},
    "required": [
        "mcc",
        "mnc",
        "lac",
        "cid"
    ],
    "additionalProperties": false
    },
"wcdmaCell": {
    "type": "object",
```

```
"properties": {
  "mcc": {
    "description": "Mobile country code",
    "type": "integer",
    "minimum": 0,
    "maximum": 999
  },
  "mnc": {
    "description": "Mobile network code",
    "type": "integer",
    "minimum": 0,
    "maximum": 999
  },
  "lac": {
    "description": "Location area code",
    "type": "integer",
    "minimum": 1,
    "maximum": 65535
  },
  "rncid": {
    "description": "RNC ID",
    "type": "integer",
    "minimum": 0,
    "maximum": 65535
    },
  "cid": {
    "description": "Cell identity",
    "type": "integer",
    "minimum": 0,
    "maximum": 268435455
  },
  "rtt": {
    "description": "Round trip time. Unused. Reserved for a future
release.",
    "type": "integer",
```

```
        "minimum": 0
      },
      "ta": {
        "description": "Cell timing advance, in units of
microseconds",
        "type": "integer",
        "minimum": 0,
        "maximum": 1024
        },
      "rxlev": {
        "description": "Received signal level",
        "type": "integer",
        "minimum": -121,
        "maximum": -25
      }
    },
      "required": [
        "mcc",
        "mnc",
        "rncid",
        "cid"
      ],
    "additionalProperties": false
  },
    "cdmaCell": {
      "type": "object",
      "properties": {
        "sid": {
          "description": "System ID",
          "type": "integer",
          "minimum": 0,
          "maximum": 32767
        },
        "nid": {
          "description": "Network ID",
```

```
          "type": "integer",
          "minimum": 0,
          "maximum": 65535
        },
        "baseid": {
          "description": "Base station ID",
          "type": "integer",
          "minimum": 1,
          "maximum": 65535
        },
        "refpn": {
          "description": "Base station PN code",
          "type": "integer",
          "minimum": 0,
          "maximum": 511
        }
      },
      "required": [
          "sid",
          "nid",
          "baseid"
      ],
      "additionalProperties": false
    },
    "lteCell": {
      "type": "object",
      "properties": {
        "mcc": {
          "description": "Mobile country code",
          "type": "integer",
          "minimum": 0,
          "maximum": 999
        },
        "mnc": {
          "description": "Mobile network code",
```

```
        "type": "integer",
         "minimum": 0,
         "maximum": 999
      },
      "tac": {
         "description": "Tracking area code",
         "type": "integer",
         "minimum": 1,
         "maximum": 65535
      },
      "eci": {
         "description": "E-UTRAN cell identifier. A 28-bit
combination of the 20-bit eNB ID and an 8 - bit cell ID.",
         "type": "integer",
         "minimum": 0,
         "maximum": 268435455
      },
      "phycid": {
         "description": "Physical cell ID",
         "type": "integer",
         "minimum": 0,
         "maximum": 503
      },
      "ta": {
         "description": "Cell timing advance, in units of
microseconds",
         "type": "integer",
         "minimum": 0,
         "maximum": 1024
      },
      "rxlev": {
         "description": "Received signal level",
         "type": "integer",
         "minimum": -141,
         "maximum": -44
      }
```

```
        },
      "required": [
        "mcc",
        "mnc",
        "tac",
        "eci"
      ],
  "additionalProperties": false
},
"tdscdmaCell": {
  "type": "object",
  "properties": {
    "mcc": {
      "description": "Mobile country code",
      "type": "integer",
      "minimum": 0,
      "maximum": 999
    },
    "mnc": {
      "description": "Mobile network code",
      "type": "integer",
      "minimum": 0,
      "maximum": 999
      },
      "lac": {
        "description": "Location area code",
        "type": "integer",
        "minimum": 0,
        "maximum": 65535
      },
      "ucid": {
        "description": "Cell identity",
        "type": "integer",
        "minimum": 0,
        "maximum": 268435455
```

```
            },
              "rtt": {
                "description": "Round trip time. Unused. Reserved for a
      future release.",
                "type": "integer",
                "minimum": 0
                },
              "ta": {
                "description": "Cell timing advance, in units of
      microseconds",
                "type": "integer",
                "minimum": 0,
                "maximum": 1024
              },
            "rxlev": {
              "description": "Received signal level",
              "type": "integer",
              "minimum": -121,
              "maximum": -25
            }
          },
          "required": [
            "mcc",
            "mnc",
            "lac",
            "cid"
          ],
          "additionalProperties": false
        },
        "wifiAP": {
          "type": "object",
          "properties": {
            "mac": {
              "description": "Unique identifier",
              "type": "string"
            },
```

```
"rxlev": {
  "description": "Received signal level",
  "type": "integer",
  "minimum": -113,
  "maximum": 0
},
"speed": {
  "description": "Connection speed. Units of Mbps.",
  "type": "integer",
  "minimum": 0,
  "maximum": 6930
},
"ssid": {
  "description": "Service set identifier",
  "type": "string",
  "minLength": 1,
  "maxLength": 32
},
"type": {
  "description": "WiFi type",
  "enum": [
    "A",
    "B",
    "G",
    "N",
    "AC"
  ]
}
},
"required": [
  "mac"
],
"additionalProperties": false
},
"cell": {
```

```
"oneOf": [
  {
    "type": "object",
    "properties": {
      "gsm": {
        "$ref": "#/definitions/rtLocation/definitions/gsmCell"
      }
    },
    "additionalProperties": false
  },
{
  "type": "object",
  "properties": {
  "wcdma": {
    "$ref": "#/definitions/rtLocation/definitions/wcdmaCell"
  }
},
"additionalProperties": false
},
{
  "type": "object",
  "properties": {
    "cdma": {
      "$ref": "#/definitions/rtLocation/definitions/cdmaCell"
    }
  },
  "additionalProperties": false
},
{
  "type": "object",
  "properties": {
    "lte": {
      "$ref": "#/definitions/rtLocation/definitions/lteCell"
    }
  },
```

```
  "additionalProperties": false
},
{
  "type": "object",
  "properties": {
  "tdscdma": {
    "$ref": "#/definitions/rtLocation/definitions/tdscdmaCell"
  }
},
"additionalProperties": false
},
{
"type": "object",
"properties": {
  "wifi": {
    "$ref": "#/definitions/rtLocation/definitions/wifiAP"
  }
},
"additionalProperties": false
}
]
},
"request": {
"type": "object",
"properties": {
  "rtLocation": {
    "type": "object",
    "properties": {
      "cells": {
      "type": "array",
      "minItems": 1,
      "items": {
        "$ref": "#/definitions/rtLocation/definitions/cell"
      }
    }
```

```
      },
      "required": [
        "cells"
      ],
      "additionalProperties": false
    }
  },
      "required": [
        "rtLocation"
      ],
      "additionalProperties": false
    }
  }
  }
  },
  "type": "array",
  "minItems": 1,
  "items": {
    "oneOf": [
      {
        "$ref": "#/definitions/rtAssistance/definitions/request"
      },
      {
        "$ref": "#/definitions/ee/definitions/request"
      },
      {
        "$ref": "#/definitions/rtLocation/definitions/request"
      }
    ]
  }
  }
```

6.2 Response schema

Responses will be valid against the following JSON schema:

```json
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "description": "location.io API Response Schema version 1",
  "definitions": {
    "ee": {
      "definitions": {
        "leapSecond": {
          "type": "object",
          "properties": {
            "currSecs": {
              "type": "integer"
            },
            "nextSecs": {
              "type": "integer"
            },
            "nextGpsTime": {
              "type": "integer"
            }
          }
        },
        "gps": {
          "type": "object",
          "properties": {
            "seed": {
              "type": "string"
            },
            "blockTypes": {
              "type": "string"
            },
            "timeModel": {
              "type": "string"
            }
          }
```

```
          },
             "glonass": {
               "type": "object",
               "properties": {
                 "seed": {
                   "type": "string"
                 },
                 "blockTypes": {
                   "type": "string"
                 },
                 "timeModel": {
                   "type": "string"
                 },
                 "slotFreq": {
                   "type": "string"
                 }
               }
             },
             "beidou": {
               "type": "object",
               "properties": {
                 "seed": {
                   "type": "string"
                 },
                 "timeModel": {
                "type": "string"
                 }
               }
             },
             "galileo": {
               "type": "object",
               "properties": {
                 "seed": {
                   "type": "string"
                 },
```

```
              "timeModel": {
                    "type": "string"
                }
            }
        },
        "response": {
          "type": "object",
          "properties": {
            "ee": {
              "type": "object",
              "properties": {
                "status": {
                  "type": "integer"
                },
                "body": {
                  "type": "object",
                  "properties": {
                    "leap": {
                      "$ref":
"#/definitions/ee/definitions/leapSecond"
                    },
                    "gps": {
                      "$ref": "#/definitions/ee/definitions/gps"
                    },
                    "glonass": {
                     "$ref": "#/definitions/ee/definitions/glonass"
                    },
                "beidou": {
                      "$ref": "#/definitions/ee/definitions/beidou"
                    },
                    "galileo": {
                     "$ref": "#/definitions/ee/definitions/galileo"
                    },
                    "eol": {
                      "type": "string",
```

```
                        "format": "date-time"
                       }
                      }
                     }
                   },
                   "required": [
                     "status"
                   ]
                 }
               },
               "required": [
                 "ee"
               ]
             }
           }
         },
         "rtAssistance": {
           "definitions": {
             "response": {
               "type": "object",
               "properties": {
                 "rtAssistance": {
                   "type": "object",
                   "properties": {
                     "status": {
                       "type": "integer"
                     },
                     "body": {
                       "type": "array",
                       "items": {
                         "type": "object",
                         "minProperties": 1,
                         "maxProperties": 1
                       }
                     }
```

```
                    },
                    "required": [
                        "status"
                    ]
                }
            },
            "required": [
                "rtAssistance"
            ]
        }
    }
},
"rtLocation": {
    "definitions": {
        "location": {
            "type": "object",
            "properties": {
                "lat": {
                    "type": "number"
                },
                "lon": {
                    "type": "number"
                },
                "alt": {
                    "type": "number"
                },
                "uncertainty": {
                    "type": "number"
                }
            },
            "required": [
                "lat",
                "lon"
            ]
        },
```

```
      "response": {
        "type": "object",
        "properties": {
          "rtLocation": {
            "type": "object",
            "properties": {
              "status": {
              "type": "integer"
        },
              "body": {
                "type": "object",
                "properties": {
                  "location": {
                      "$ref":
"#/definitions/rtLocation/definitions/location"
                  }
                }
              }
            },
            "required": [
              "status"
            ]
          }
        },
        "required": [
          "rtLocation"
        ]
      }
    }
  }
},
  "type": "array",
  "minItems": 1,
  "items": {
    "oneOf": [
```

```
          {
          "$ref": "#/definitions/ee/definitions/response"
          },
          {
            "$ref": "#/definitions/rtAssistance/definitions/response"
          },
          {
            "$ref": "#/definitions/rtLocation/definitions/response"
          }
      ]
    }
    }
```

7 Request Example

A typical request looks like the following:

```
POST http://<SERVER>:<PORT>/rxn-api/locationApi HTTP /1.1

Authorization: RXN-SP cId=<CUSTOMER>,mId=<MODEL>,dId=<DEVICEID>,
pw=<BASE64-ENCODED-PASSWORD>=

Content-Type: application/json
[
  {
    "ee":{
      "version":8,
      "constellations":[
        "gps",
        "glonass",
        "beidou",
        "galileo"
      ],
      "seedAge":0
    }
  },
  {
    "rtAssistance":{
      "format":"byte",
      "msgs":[
        "GPS:1NAC",
        "GPS:1RTC",
        "GLO:2NAC",
        "BDS:2NAC",
        "GAL:2NAC"
      ]
    }
  },
  {
    "rtLocation":{
      "cells":[
```

```json
        {
        "gsm":{
          "mcc":302,
          "mnc":220,
          "lac":11101,
          "cid":345,
          "rxlev":-79
        }
      },
      {
        "gsm":{
        "mcc":302,
        "mnc":220,
        "lac":11101,
        "cid":456,
        "rxlev":-62
        }
      }
    }
  ]
}
}
]
```

This requests extended ephemeris for all four supported constellations, reference time composite for GPS, several real-time GNSS assistance messages, and real-time location based on two GSM cells. In this case, the optional mId is included in the Authorize header field, and the optional dId is not.

Note that the URL may vary, depending on installation.

8 Response Example

The following is an example of a response to the above request.

[

{

"ee": {

"status": 200,

"body": {

"glonass": {

"slotFreq":
"GAABwAH8wAIFwAMGwAQBwAX8wAYFwAcGwAj+wAn5wAoAwAv/wAz+wA35wA4AwA//wB
D6wBH9wBIDwBMCwBQEwBX9wBYDwBcCwA==",

"timeModel": "cE4AAABAAAAAAAAAAA=",

"seed":
"AAQAoYTKCCGE7WIAAAAAIYTKCAciw4kuTM6Bs+wIO73PQ8XDCdd8Cvo/zOdiS6kA4y
2qn/gT5d/0xDhAAB4f1aRAAAAfmeYf6qf/+Vef/mnf/3ggItgf5PTAI2EhGzFWDetBc
lUgYOZhGl//QAcACH/zQAbgCx/PoKhgDD/sX/8fYuAAAAAAAAAq9gAAAAwAAAAAA
ABngAAAAAAAAAAAGNAAAABIAAAB//8AAGg5ij4J4yJ+OzbeRNAGAqxe1xRIEPTz9
JhqEfUxdgByHn4A9xogABgoAZMyAAAB/BtMAo28AX7B/tggAd6b/9ZQBrOp/vZx4vdJ
kjAT9KZUJXBb7x//PACb/RoD9ADIAEgG0/XSAK4CEABumAgAAUwAAAAACMuAAAABAA
AAAAAAJOAAAACAAAAAAACxCAAAABAAAAH/wAAc8RmgXLx+tdINPdcSFX95szV4r
5D99WFyrIQJvb4AC8F6/7trbwAJywDmSoAAAACFMYCH5AABzH/7uX+GX//5BwAnrIDm
0un6gIO7vP+zjHlRC3uv//cAJv85gir/04AqAff97AAjgMEABt/GAAAPAAAAAAI+AA
AAAKAAAAAAAeoAAAAKAAAAAAAUJoAAAASAAAAf//AACbxWtdxB93fgaIgwif3dZ
YMCUyIY5dELSGCBDwYkgBV2VQAF/jZAA4KgCsXAAAAf81K/7QzAAypf/yQf57hAAkhf
/PjAFwNAaYqe6RwgOPvgnvOBG3/5wAxAHP/WX/CABoC/fwRABgAWf/m5MP//96AAAA
AAmff////4AAAAAAAAvgAAAAIAAAAAAAJxAAAAC4AAAAB//8AAJOuKBqk+8hn8Qr7
UVWgDYyTzFVoUY/Ufb76EJHjU/+lJwP8bdWj/8+MAt6EAAAAIHF/kix/83D/5D6AHf
n/i/+ACbP/5L+LIT17cTH5zD2A4F2Ep390ADEAdf6b/9MAIYMs/DEAIADif+5hgH//8
AAAAAAACHGAAAABgAAAAAAF4AAABAAAAAAABLCAAAAAAAAH//wAAYJjNk/fiw
MXlvihL6lKvPv/Q7MK3QaZV9QgN3NiMALgJygAjBEIABVv/GFwAAAH/L3QC+tX/4t39
v1wBRgn+j+f9MWH8hBGXGC/cMbo2BAf17OXvlf6WAJv+cgQ3/yQA5fgaDQ4AT/7B/vr
SCf//kAAAAAAIyoAAAIAAAAAAABCQAAAAGAAAAAAAEeIAAAAEAAAAf//AABQQQ
Mu8g1WWr8K9ztO6h7sYEIssFyoN5J1chGuV2IBKakMARCPgf/+6fu8SgAAf0Rq/3Wb
ABohgAa6/3/X/95Bf99Uf10xlw3KcA0j/zE3+rgbe9j/sQAm/4mAkoAqACl9uYJnACR
/A4ABvy2AAwAAAAAAlSgAAAAIAAAAB////gAAAABAAAAAAAAA/AAAAAoAAAAB//8
AAIvtIM6Oi2QeeBAZruHFST9BhvcxaKOqlSpFSDp7GvABvM7P/UOTuABBaAx3UAAAB/7
nwAwwf/+08AAm9/nwWAJ1WAH7KASW5mh5D/QEWAbb/8hRmEYYAEADGAdX9bgCSADAMc
+68AKQDEAAiDngAAHYAAAAAQ6AAAADAAAAAAAGWAAAABAAAAAAACyeAAAABAAA
AAH//wAAo/0jlDAwOuEYQaUxXjzdjaSPhqfqJaXDaoYRvyJeAPNfA/7WhowAH7P98FQ
AAAH/9/v+2uf/484AMGIBXTv/RNYAuG4B/pQE3IoGthXmNhIWdvQRdAAqAMYB2/zt/y
AAWfIIE6wAw/0kAA4GCgAAdgAAAAAKjv////6AAAAAAAhAAAAGAAAAAAAAgQAA
AAKAAAAf//AAAsDv6Bg0QVEdEAgH+gRjDGmnu1kf+dVK+lgySLmYA71g2AyzzQf+/
5f3bigAAAAR+T/rUw/9eeAD8H/6LQAFYUAB1o/6nXm+UCj1pVdEWscrBfhFeAIYAbgB
WABIAkACD/IIMHACt/OH/sOqkAAAcAAAAAAAxf//////4AAAAAAAAABhgAAAAIAAAAAAA
AU9gAAAgAAAAB//8AAKg4K2BBJnQ0Zfl5yO/9tx+pIj2rL4FZZfmwqE3Z6KAGDmzn/J"

wgIADR7/MQKAAAAARPn/ClN/9T///+x/nicADIj//l//mvAdGSeGn7UALtx/e06ERAA
7ADGAjP8tACcALHzAhH4AKX9VgBbCJIAAFYAAAAACVcAAAACgAAAAAAAL8AAAABgA
AAAAAAAs4AAAAAAAAAH//wAAsFJ+VrUEpzo6tQn1+FABvHazqLAXEDHkK2IRSRcuAY
hwwf2aWXwARZn9VqIAAAH/g8oDACoAehgALUn/9lf+Xi//sEwBE1PAc7IYk04EzvYGt
nwRKACoAMQBCf4UAMoAhfRAERgAf/zh//I67f//EAAAAAAAJMf////+AAAAAAAC5QA
AAAGAAAAAAAFlgAAAAoAAAAf//AAAroFROmApqoRn1ugMWKkrajBX6xVockrwJAhJ
FNFX+PS1YAb4TwABHFf5vdgAAAcKD/4d8gA3Uf/juAJAo/7lwAAuOf+EEhdosIZikh
KQv+/BKhHJ/8QAb//6AJv/QgBmBLH0aACB/pgAJq7oAAAwAAAAAAAq5f////wAAAAAA
AADAAAAAAIAAAAAAABTgAAACQAAAB//8AACNQbpzd84odwLvHRDL+we0NVgu2OhmH
ZuXIDa3JV/+XxGYVAMBh/9rQAStqAAAB/qH1/fJ9/2XZ/7R9/gO3/YXh/9CN/3koJwa
J0qaMBCAgBUzwEfv/dgBx/yoB1/+6AJICofbmAJoAaAAEiGgAAAQAAAAAEYz////6A
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAH////+uDz/tJbi5uf5dwNxBFIZMIfy8
YYJXwequgoQ7biGAV08Q/zdNlQAQO//yqwAAAH/wTIBbpp4AS+H/5qf/osf+drYAMSYB
5HflI2IEI5gC5iXxeTAQ7gEuAMQAy/9wAPIAa/RkEygAX//J/7zRXf//5AAAAAAAJAH
////8AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAf////5DZYEHiBzy96RBsToLzV
+smJ8GHwXKWssyohGlSnoANKRH/j1eggAeMgEdnAAAAfwpRgAzwgC4iAA0D/5m2/7xN
f1pI/3rO/noBZ8P5+XCAiMKg+5CAQgAmfruCHn/CgBn+xYCAgCmANoABrniAABOAAAA
AAAlTAAAAAQAAAAAADPAAAAgAAAAAACGAAAABIAAAB//8AAFieeZyc9LYUxIa
GN95Nt4h8QjyIrFFXH6BOEpCk1//nYJoCIH7aACjH/P0OAAAB/jruA1tCACw5/+KYAc
+d/+4CATCb+3l9lcw/4nliIPzB7aS37mQArgCb/aADWgDUAIX2qAiWAG/9wgAI3MAAA
FoAAAAACeh/////AAAAAH///9+AAAAFAAAAAAAB4qAAAAGAAAAH//wAAe2BP+DkM
M7W1ucbN9WIRho4VyTeudp7m6vASiOVwABiIL/xLQ+IAEvADtAwAAAABjYP9mPv/8Eo
ADQoBwp3/iCIA6XgBnHpaseAWOnAOZxntPSHv3/2kAJ3+aAOGAMgAAj8qAAZAPyAA
dAJgAAYgAAAAAIkoAAAAGAAAAAAAuIAAAAIAAAAAABqYAAAAmAAAAf//AAAba
2F+BuTtyx7EAD7aw7Zwyx9HHCcdjArZIBHarUIABiW6A4ahEf/mWgSTpAAAAASBq//N
FAA33gA4MADvKgHze/4MZ/+OohpkioGzTB+cX/Os5BH1/zQAcAA3/iX/ZACyBUv8egC
YA7QARrleAABuAAAAAAr2gAAAIAAAAAAACAAAAIAAAAAAALUgAAACoAAAAB//
8AABPeiJnk5jKwwEofAC52mp3psPZxkzCl30U2Epq7wf/RhWwBF80P//RaAkTeAAAAA
jvv+qAUAC2L//oOAQMSAe3H/gBn/xMUe7x6QNr77I436/MEEbX/xgBx/zgEB/86AM/7
dgkWAGABKgAZzJIAADwAAAAACb0AAAABAAAAAAALgAAAAgAAAAAABp2AAAABAA
AAAH//wAAMCMETnQZ2PvFtfOMcolj1GRPDRaOR1XNXtISEk3l/2G+NAHWRy4AEd/88q
AAAAH+rOYICK//2+/v/2X4BDroB8FABre//caNVnrXOP9/qdpff45IRtf/GAG4A3f2iA
LIA0gP59XIAWf5L/71xr///1AAAAAAKwgAAAAAAAAAAANIAAAACAAAAAAACAgA
AAAQAAAAf//AACAFVM0adHXYNB8VSLRgvxh/lEsiV96bSDrDBAIYaoBsKKVX/uNdAAB
PugE80AAAAACutgAMj//e4AAf0f6A8gAFYgEVDf3Wz/eUVAu13eFpNfYSthCaAdgAxA
H7+5oA7ABaC8XrNADIAboAFIHSAACmAAAAAApBf////oAAAAAAAMKgAAAYAAAAAA
AAWWAAAACgAAAB//8AAhkADd49uBzL0oyfy9lkUK/kg0AKFdfndOSEG19V/+sTM//
3QOf//9F/tNSAAAB/nsL+dFkAFMx/9GaATuoAdrT/I+v/8Z6e5dv4Jsp3bHWF8j6EVA
ArABv/7oChgDOAGX7nAvUAIP9pgBOVPgAAH4AAAAACc//////gAAAAAADWAAAAA
AAAAAAAAGyAAAADAAAAH//wAAA=",

"blockTypes":
"GAACAQICAgMCBAIFAgYCBwIIAgkCCgILAgwCDQIOAg8CEAIRAhICEwIUAhUCFgIXAg
=="

},

"eol": "2099-12-31T23:59:59Z",

"galileo": {

"seed":
"AAQBIYTKCCGE7WIAAAAAIYTKCACgRT7/WJyMgGwtTBkWnpM9sw19eMlqtqm4UwYAp7
lFgBfv8n/f4k5AA+WgDaEAAAAAFsPADTW//vcgAmw/8MSf9XOAJ/TgAvlfDxEBgEtAd
c+eSTRBMiAGQAwgY78/IApACh/jQCChgB2AlgAYaxqAAAMEAAAAAnpf////wAAAAAA

AHLgAAAAIAAAAAAAGwAAAACQAAAAB//8AAFhHnah/0OkNxDmgFawTOfnvmeLFj1LTS
xEmCytzvAEEN3IAYJ6MACNV/dUMAAAB/4paBDYeAAFWAAb3/7Mx/rhMAChKAJBNtisM
FXumA6eAB8uGEaYDtgDCAh389ABEAJP9eASkAH38B/t0Dl//1lwAAAAAACIX//////AA
AAAAAAWOAAAAAgAAAAAAAPB2AAACsAAAAH//wAAkMRWlhMGz8iUBsKcFTHWZ7sKYl
mEWt1oTlgH00U1/39vLADA+jQACY39UAYAAAAFiJn/yxH/6tAADOf98Un/mzoBQV4At
R4q9aJplVYHi/nl/74TMgB2AG/9LAd3/voAfgPz+lgAdftb//gEef//tgAAAAAMEIA
AAAKAAAAf///igAAAAKAAAAAAABgQAAAAKAAAAf//AAA==

},

"leap": {

"nextSecs": 18,

"nextGpsTime": 0,

"currSecs": 17

},

"gps": {

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9 ST account on RxNetworks system

To access RxNetworks services an ST account for developers is available. Contact ST-Sale-Office for further information.

For permission right and service restriction have a look into the GNSS product specific Software User Manual or contact ST Sale Office and/or ST Online Support.

Appendix A   Acronyms

Table 24. Acronyms

Keyword	Definition
Accuracy	Deviation of a GPS-based calculated position from the true position
ADC	Analogue to Digital Converter
Almanac	Contains the information about all available satellites, their orbit data and time of their clocks.
ANF	Adaptive Notch Filter
Azim	Azimuth - Angular distance from a reference
Bank Swap	Exchanging two memory banks for storage of data
BAUD rate	Transmission Rate Measure for the effective transmission of data content. (may differ from Bits/sec).
BEIDOU	China's regional navigation satellite system
Checksum	Calculated from the transmitted characters of a message by "ex-OR"ing the 8 bit character values excluding delimiters $ and *
CN0	Carrier to Noise Ratio - Identifies the quality of a received signal
Cold Start	Start Condition for a GPS system having no position nor time. Almanac and Ephemeris is not available, too.
BeiDou	China's global navigation satellite system (also known as Beidou-2, BD2)
Dead Reckoning	Sensor based process to determine the movement of a mobile unit, utilizing Gyro, Odometer and Wheel Pulses.
Delimiter (within NMEA 0183)	ASCII "$" to indicate Address Field ASCII "," to indicate Data Field ASCII "*" to indicate Checksum Field
DGPS	Differential GPS - GPS Augmentation System providing the accurate location of a Reference Station to reduce system errors.
EGNOS	European Geostationary Navigation Overlay System
Elev	Elevation - Angle between a high level or non-earth bound point and the horizontal plane of the viewer.
Ephemeris	Ephemeris Data is transmitted by each satellite and contains current and predicted satellite position.
FDA	Failure Detection Algorithm - Specific Algorithm to detect failures in position calculation
FDE	False Detection Exclusion
GALILEO	Europe's global navigation satellite system
GDOP	Geometric Dilution Of Position - Quality value representing all geometry based error factors in a system.
GNSS	Global Navigation Satellite System - Satellite based system to calculate the position of the Teseo on the earth surface.
GPS	Global Positioning System - United States Satellite Navigation System

Table 24. Acronyms (continued)

Keyword	Definition
GPS Library	STMicroelectronics C-Library containing all GPS relevant Functions
Gyro	Gyroscope - Sensor to determine rotational movements
HDOP	Horizontal Dilution Of Precision - Quality value representing all 2D plane geometry based error factors in a system.
Hot Start	Start Condition for a GPS System having position, time, Almanac and Ephemeris already available. High time accuracy is required.
IMU	Inertial Measurement Unit
Lat	Lattitude - Angular difference of a given position to the Equator. Values include 0°-90° either North or South
Lat-Ref	Lattitude Reference - Reference if a Latitude value is North or South
Long	Longitude - Angular difference to a "reference" Longitude indicated as "000". Values include 0°… 180° either West or East.
Long-Ref	Longitude Reference - Reference if a Longitude value is East or West of the "000" Meridian.
NMEA	National Marine Electronics Association - United States Standards Organisation For Marine Equipment
NMEA 0183	National Marine Electronics Association - Standard for Interfacing Marine Electronics Devices
NVM	Non Volatile Memory - Any type of memory that conserves data in the absence of regular supply voltage (includes battery buffered memories)
Proprietary Message	Messages within the scope of NMEA0183 which are not standardized. They start with $P and a 3 character identifier.
PRN	Pseudo Random Number - Satellite Specific 1023 Bit Number used for Spread Spectrum Modulation
RAIM	Teseo Autonomous Integrity Monitoring
RF	Radio Frequency - High Frequency for Reception with a RF-Teseo
RS232	IEEE Standard - Physical Layer Standard for Data Transmission
Sat-ID	Satellite Identifier - Satellite specific Number used to generate the corresponding PRN code
SBAS	Satellite Based Augmentation System - GPS enhancement system based on geostationary satellites.
SPS	Standard Positioning Service
Static Position Filtering	Algorithm to detect that the GPS Teseo doesn´t move and position output is kept stable.
UTC	Universal Time Coordinated
WAAS	Wide Area Augmentation System - American GPS Augmentation System delivering accurate Ionosphere Data
Warm Start	Start Condition for a GPS system having current Almanac, position and time availability. Ephemeris are not available. Time needs to be available with reasonable accuracy (some seconds).

Table 24. Acronyms (continued)

Keyword	Definition
2D Fix	Fix based on the use of 3 satellites
3D Fix	Fix based on the use of 4 satellites

Revision history

Table 25. Document revision history

Date	Revision	Changes
16-Apr-2018	1	Initial release.
25-Jan-2019	2	Updated *Section 4.1.1*, *Table 1*, *Chapter 7* and *Chapter 9*.

IMPORTANT NOTICE – PLEASE READ CAREFULLY