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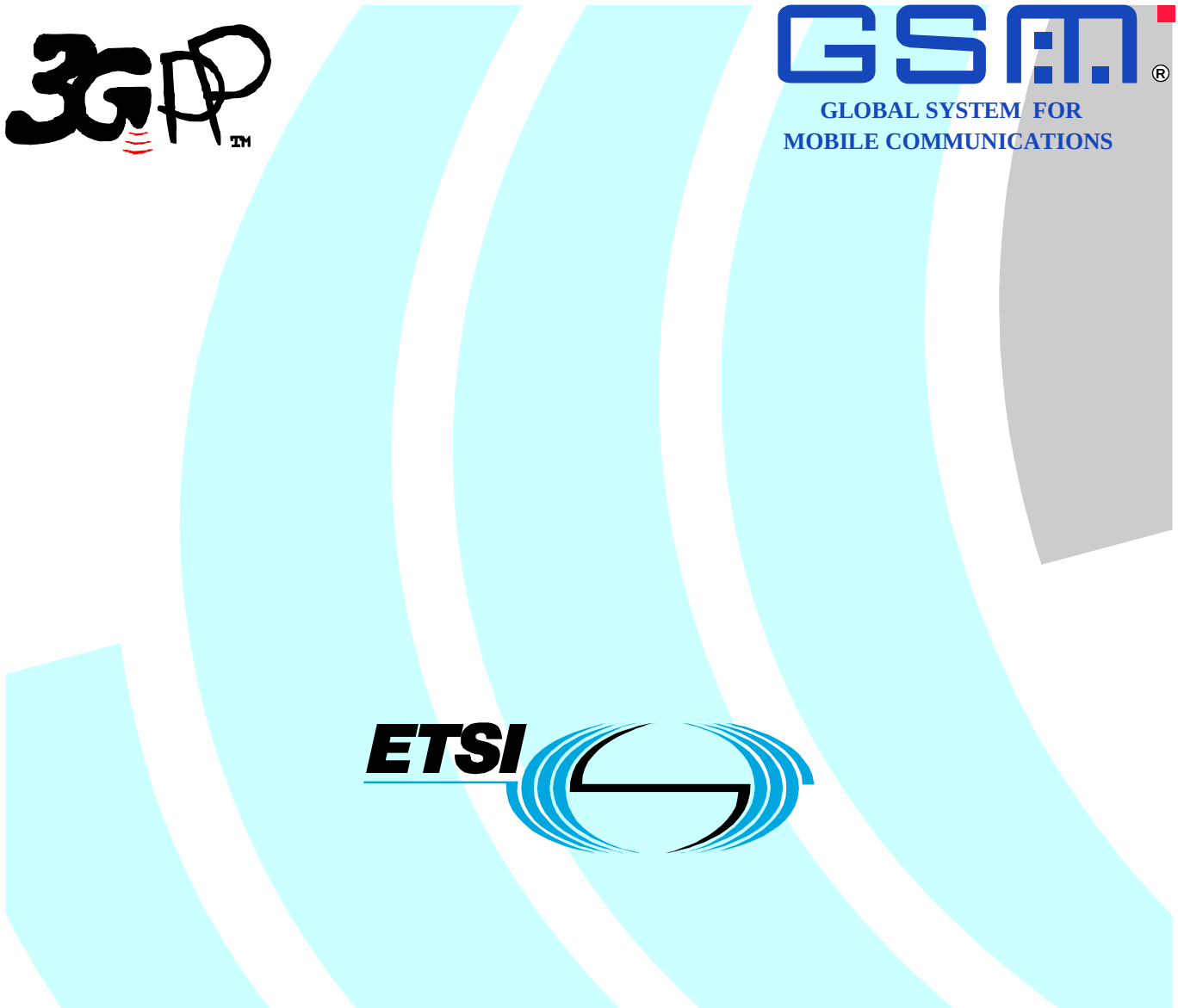
*Technical Specification*

**Digital cellular telecommunications system (Phase 2+);**
**Location Services (LCS);**
**Mobile Station (MS) - Serving Mobile Location Centre (SMLC)**
**Radio Resource LCS Protocol (RRLP)**
**(3GPP TS 44.031 version 6.7.0 Release 6)**



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***ETSI***

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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# Foreword

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# 1 Scope

The present document contains the definition of the Radio Resource LCS Protocol (RRLP) to be used between the Mobile Station (MS) and the Serving Mobile Location Centre (SMLC).

Clause 2 defines the functionality of the protocol. Clause 3 describes the message structure, and Clause 4 the structure of components. Clause 5 contains the ASN.1 description of the components.

## 1.1 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 43.059: "Functional Stage 2 Description of Location Services in GERAN".

[3] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[4] ITU-T Recommendation X.691: "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)".

[5] ITU-T Recommendation X.680: "Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation".

[6] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".

[7] 3GPP TS 49.031: "Location Services (LCS); Base Station System Application Part LCS Extension (BSSAP-LE)".

[8] ICD-GPS-200, Navstar GPS Space Segment/Navigation User Interfaces.

[9] RTCM-SC104, RTCM Recommended Standards for Differential GNSS Service (v.2.2).

[10] 3GPP TS 44.064: "General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN); Logical Link Control (LLC) layer specification".

## 1.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 or in 3GPP TS 43.059 apply.

# 2 Functionality of Protocol

## 2.1 General

The present document defines one generic RRLP message that is used to transfer Location Services (LCS) related information between the Mobile Station (MS) and the Serving Mobile Location Centre (SMLC). Usage of the RRLP protocol on a general level is described in 3GPP TS 43.059 that includes Stage 2 description of LCS.

One message includes one of the following components:

- Measure Position Request;
- Measure Position Response;
- Assistance Data;
- Assistance Data Acknowledgement;
- Protocol Error.

Next sub-clauses describe the usage of these components.

Delivery of components may be supported in the RRLP level using pseudo-segmentation by sending several shorter messages instead of one long message. Any assistance data that is successfully delivered to an MS and acknowledged prior to the interruption of the positioning procedure by an event like handover, or by any other event that causes an MS to terminate the positioning procedure or delivery of assistance data (see 3GPP TS 43.059), shall be retained by the MS and need not be resent by the SMLC when positioning or delivery of assistance data is again re-attempted.

The RRLP maximum PDU size is 242 octets. If the amount of data that needs to be sent is larger than RRLP maximum PDU size, the RRLP pseudo-segmentation shall be used. The RRLP pseudo-segmentation is the use of several RRLP components (one in each RRLP message) to deliver a large amount of information. For SMLC to MS messages, the Assistance Data component is the one that is sent several times in order to deliver the information. For MS to SMLC messages, the Measure Position Response component may be sent twice in order to deliver the information. Legacy MS and SMLC (3GPP Rel-4 or older) may send RRLP components that are larger than the RRLP maximum PDU size. In this case lower level segmentation will be used.

## 2.2 Position Measurement Procedure

This procedure is the same that is described on a more general level in the reference 3GPP TS 43.059 in the chapter "E-OTD and GPS Positioning Procedures". The purpose of this procedure is to enable the SMLC to request for position measurement data or location estimate from the MS, and the MS to respond to the request with measurements or location estimate.

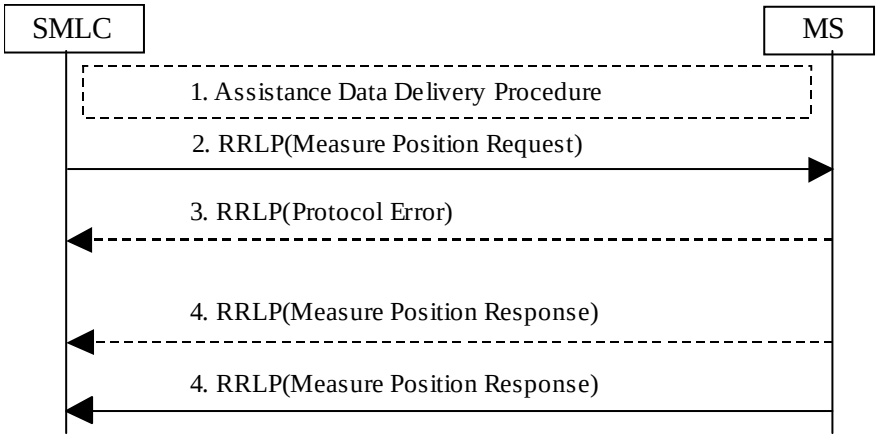


**Figure 2.1: Position Measurement procedure**

1. The Measure Position Request component may be preceded by an Assistance Data Delivery Procedure (see sub-clause 2.3) to deliver some or all of the entire set of assistance data that is needed by the subsequent positioning procedure (steps 2-4).

2. The SMLC sends the Measure Position Request component in a RRLP message to the MS. The component includes QoS, other instructions, and possible assistance data to the MS. The RRLP message contains a reference number and an extended reference ID of the request.

3. The MS sends a RRLP message containing the Protocol Error component to the SMLC, if there is a problem that prevents the MS to receive a complete and understandable Measure Position Request component. The RRLP message contains the reference number and, if available, the extended reference ID included in the Measure Position Request received incomplete. The Protocol Error component includes a more specific reason. When the SMLC receives the Protocol Error component, it may try to resend the Measure Position Request (go back to the step 2), abort location, or start a new position measurement procedure (e.g. with updated assistance data).

4. The MS tries to perform the requested location measurements, and possibly calculates it own position. When the MS has location measurements, location estimate, or an error indication (measurements/location estimation not possible), it sends the results in the Measure Position Response component to the SMLC. The RRLP message contains the reference number and, if received, the extended reference ID of the request originally received in the step 2. The MS may optionally send one additional Measure Position Response component in a second RRLP message to the SMLC if the amount of information it needs to transfer to the SMLC is too large to fit into one single Measure Position Response component (uplink RRLP pseudo-segmentation). This RRLP message also contains the reference number and, if received, the extended reference ID of the request originally received in the step 2. If two components are sent, the MS shall indicate in the first component that it is the first of many components and in the second one that it is the second of many components. If there is a problem that prevents the SMLC to receive a complete and understandable Measure Position Response component, the SMLC may decide to abort location, or start a new position measurement procedure instead. If additional Measure Position Response components are received by the SMLC after the 1st and optional 2nd one, they shall be ignored.

## 2.3 Assistance Data Delivery Procedure

This procedure is the same that is described on a more general level in the reference 3GPP TS 43.059 in the sub-clause "E-OTD and GPS Positioning Procedures". The purpose of this procedure is to enable the SMLC to send assistance data to the MS related to position measurement and/or location calculation. Notice that RRLP protocol is not used by the MS to request assistance data, only to deliver it to the MS. The entire set of assistance data (i.e. the total amount of assistance data that the SMLC has decided to send in the current procedure) may be delivered in one or several Assistance Data components. In this case steps 1 and 3 below may be repeated several times by the SMLC. If several components are sent, the SMLC shall await the acknowledgement of each component before the next Assistance Data component is sent. If Assistance Data Delivery is used as part of the Position Measurement Procedure, as described in sub-clause 2.2, then some assistance data may be delivered in the final RRLP Measure Position Request.

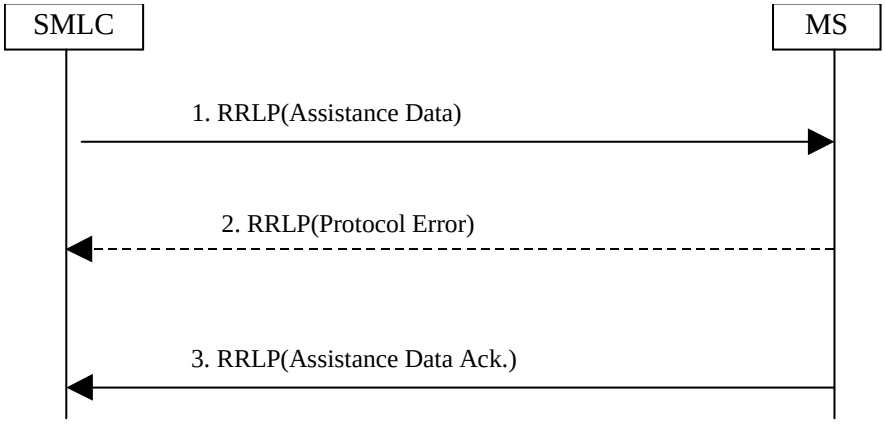


**Figure 2.2: Assistance Data Delivery procedure**

1. The SMLC sends the Assistance Data component to the MS. The component includes assistance data for location measurement and/or location calculation. The RRLP message contains a reference number and an extended reference ID of the delivery. The More Assistance Data To Be Sent Element in the Assistance Data component is used by the SMLC to indicate to the MS if either more Assistance Data components (in the current Assistance Data Delivery procedure) or a final RRLP Measure Position Request (if the Assistance Data Delivery Procedure forms part of a Position Measurement procedure as described in sub-clause 2.2) will be sent.

2. The MS sends a RRLP message containing the Protocol Error component to the SMLC, if there is a problem that prevents the MS to receive a complete and understandable Assistance Data component. The RRLP message contains the reference number and, if available, the extended reference ID included in the Assistance Data component received incomplete. The Protocol Error component includes a more specific reason. When the

SMLC receives the Protocol Error component, it may try to resend the Assistance Data component (go back to the step 1), send a new measure Assistance Data set (e.g. with updated assistance data), or abort the delivery.

3. When the MS has received a complete Assistance Data component, it send the Assistance Data Acknowledgement component to the SMLC. The RRLP message contains the reference number of the Assistance Data originally received in step 1.

## 2.4 (void)

## 2.5 Error Handling Procedures

### 2.5.1 General

In this sub-clause it is described how a receiving entity behaves in cases when it receives erroneous data or detects that certain data is missing.

### 2.5.1a Message Too Short

When MS receives a RRLP message, that is too short to contain all mandatory IEs, the MS sends a Protocol Error component with indication "Message Too Short". If the Reference Number can be found, it is included. If the Reference Number is not available, the Reference Number of the RRLP message carrying the Protocol Error component is set to '0'. If the Extended Reference IE can be found, it shall be included in the returned Protocol Error Component. If the Extended Reference IE is not available, an Extended Reference IE shall not be included. The original sending entity that receives the Protocol Error, may then resend the original message, or abort the procedure.

### 2.5.2 Unknown Reference Number

A SMLC detects that it has received a RRLP message with an unknown or invalid Reference Number, when one or more of the following conditions occur:

- a Measure Position Response, Assistance Data Acknowledgement, or Protocol Error component is received with a Reference Number that the SMLC has not sent in a Measure Position Request, or Assistance Data components during a pending Position Measurement or Assistance Data Delivery procedures.

- a Measure Position Response or Protocol Error component is received with an Extended Reference IE value that the SMLC has not sent in a Measure Position Request or Assistance Data component during a pending Position Measurement or Assistance Data Delivery procedures.

- a Measure Position Response or Protocol Error component is received with a Reference Number and an Extended Reference IE value that the SMLC has not sent together in the same Measure Position Request or the same Assistance data component during a pending Position Measurement or Assistance Data Delivery procedures.

The SMLC shall then discard the message. If the SMLC receives a Measure Position Response or a Protocol Error component containing no Extended Reference ID, then the SMLC shall assume that the target MS is for Release 4 or earlier and shall only verify the received Reference Number.

### 2.5.3 Missing Information Element or Component Element

When MS receives a RRLP message, that does not contain IEs or component elements expected to be present, the MS sends a Protocol Error component with indication "Missing Information Element or Component Element". If the Reference Number can be found, it is included. If the Reference Number is not available, the Reference Number of the RRLP message carrying the Protocol Error component is set to '0'. If the Extended Reference IE can be found, it shall be included in the returned Protocol Error Component. If the Extended Reference IE is not available, an Extended Reference IE shall not be included. The SMLC that receives the Protocol Error, may then resend the original message, or abort the procedure.

### 2.5.4 Incorrect Data

When MS receives a RRLP message, that is contains IEs or elements of components that are syntactically incorrect, the MS sends a Protocol Error component with indication "Incorrect Data". If the Reference Number can be found, it is included. If the Reference Number is not available, the Reference Number of the RRLP message carrying the Protocol Error component is set to '0'. If the Extended Reference IE can be found, it shall be included in the returned Protocol Error Component. If the Extended Reference IE is not available, an Extended Reference IE shall not be included. The SMLC that receives the Protocol Error, may then resend the original message, or abort the procedure.

### 2.5.5 Repeated Component

When after the reception of a Measure Position Request component, but before responding with a Measure Position Response or a Protocol Error component, the MS receives a new RRLP message with the Measure Position Request component, it acts as follows:

- if the old and new Measure Position Request components have the same Reference Number and, if included, the same Extended Reference IE, the MS ignores the later component;

- if the old and new Measure Position Request components have different Reference Numbers or, if included, different Extended Reference IEs or if one Measure Position Request component (old or new) contains an Extended Reference IE but the other component does not, the MS aborts activity for the former component, and starts to acts according to the later component, and sends a response to that.

When after the reception of an Assistance Data component, but before responding with an Assistance Data Acknowledgement or a protocol Error component, the MS receives a new RRLP message with the Assistance Data component, it acts as follows:

- if the old and new an Assistance Data components have the same Reference Number and, if included, the same Extended Reference IE and if pseudo-segmentation does not apply (see sub-clause 2.5.9), the MS ignores the later component;

- if the old and new Assistance Data components have different Reference Numbers or, if included, different Extended Reference IEs or if one Assistance Data component (old or new) contains an Extended Reference IE but the other component does not, the MS ignores the former component and sends an acknowledgement to the latter component.

When after the reception of an Measure Position Response component, the SMLC receives a new RRLP message with the Measure Position Response component, it acts as follows:

- if the old and new Measure Position Response components have the same Reference Number and, if included, the same Extended Reference IE values, the SMLC may ignore the later component;

### 2.5.6 (void)

### 2.5.7 Missing Component

When the SMLC sends a Measure Position Request component to the MS, it starts a timer. If the timer expires before the SMLC receives the last Measure Position Response component or a Protocol Error component from the MS with the same Reference Number and, if included, the same Extended Reference IE value as in the sent component, it may abort location attempt or send a new Measure Position Request.

When the SMLC receives a Measure Position Response component with the same Reference Number and, if included, the same Extended Reference IE value as in the sent component indicating that it is the second of many segments, but the first of the many segments was never received by the SMLC, it may abort location attempt or send a new Measure Position Request.

When the SMLC sends a Assistance Data component to the MS, it starts a timer. If the timer expires before the SMLC receives a Assistance Data Acknowledgement or Protocol Error component from the MS with the same Reference Number as in the sent component and, in the case of a Protocol Error component, either the same extended reference ID as in the sent component or no extended reference ID, it may abort delivery attempt or send a new Assistance Data.

### 2.5.8 Unforeseen Component

When the MS receives a complete Assistance Data pseudo-segmentation sequence or an Assistance Data component that was sent without pseudo-segmentation, that it is not expecting, MS may discard it.

### 2.5.8a RRLP Procedure

The MS and SMLC shall only support one RRLP procedure at a time for either positioning or delivery of assistance data. The normal sequence of events for either procedure is defined in sub-clause 2.2 or sub-clause 2.3, respectively. If the MS is engaged in an RRLP procedure and receives a correctly encoded RRLP message from the SMLC that starts a new procedure, the MS shall abort the first procedure without sending a response and start the second.

### 2.5.9 Pseudo-Segmentation

When the SMLC employs pseudo-segmentation to send an RRLP Measure Position Request message or an RRLP Assistance Data message, the SMLC shall send one or more RRLP Assistance Data components followed by:

- a final RRLP Measure Position Request component (see sub-clause 2.2) or
- a final RRLP Assistance Data component (see sub-clause 2.3).

The SMLC shall indicate in all but the final component (Measure Position Request or Assistance Data, respectively) that more components are on the way.

When an MS receives an Assistance Data component indicating that more components are on the way, the MS may store the contents of the component. If the MS receives a subsequent Assistance Data component or a final Measure Position Request component that is correctly encoded, the MS shall assume that the new component continues the pseudo-segmentation of the earlier component and may then store the contents of the new component. If the new component is an Assistance Data component indicating that no more components are on the way or if it is a Measure Position Request, the MS shall assume that pseudo-segmentation is complete. The MS may then employ the rules defined in sub-clause 2.5.5 to verify if the new message is a repeated duplicate of a previous message.

# 3 Message Structure

## 3.1 General Format of RRLP Message

The general format of the RRLP message is given below, and based on:

- ITU-T Recommendation X.680;
- ITU-T Recommendation X.691;

and is consistent with these ITU-T recommendations. Also further definitions in the present document are based on ASN.1/94 defined in ITU-T Recommendation X.680 (ASN.1 1994). BASIC-PER, unaligned variant is used. Both RRLP ASN.1 modules, RRLP-Messages and RRLP-Components, are based on recommendations presented above.

ASN.1 identifiers have the same name as the corresponding parameters (information elements of the RRLP message, components, elements of components, fields of component elements etc) in other parts of the present document, except for the differences required by the ASN.1 notation (blanks between words are removed, the first letter of the first word is lower-case and the first letter of the following words are capitalized, e.g. "Reference Number" is mapped to "referenceNumber"). In addition some words may be abbreviated as follows:

| | |
|---|---|
| msr | measure |
| req | request |
| rsp | response |
| nbr | number |

ack acknowledgement

Ellipsis Notation shall be used in the same way as described in 3GPP TS 29.002 and shall be supported on the radio interface by the MS and the network for all operations defined in the present document.

**Table 3.1.a: RRLP Message Format**

```
RRLP-Messages
-- { RRLP-messages }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    MsrPosition-Req, MsrPosition-Rsp, AssistanceData,
    ProtocolError
FROM
    RRLP-Components     -- { RRLP-Components }
;

PDU ::= SEQUENCE {
    referenceNumber         INTEGER (0..7),
    component               RRLP-Component
}

RRLP-Component ::= CHOICE {
    msrPositionReq          MsrPosition-Req,
    msrPositionRsp          MsrPosition-Rsp,
    assistanceData          AssistanceData,
    assistanceDataAck       NULL,
    protocolError           ProtocolError,
    ...

}

END
```

The message consists of two information elements, that are further described in the following sub-clauses.

## 3.2 Reference Number IE

This element is mandatory, and appears only once per RRLP message. It has the range from 0 to 7. Value 0 is reserved for indicating unknown Reference Number. Its ASN.1 definition is in sub-clause 3.1. This element contains the Reference Number that shall be used as follows:

- in the Position Measurement procedure the SMLC shall select any number within the range 1- 7 that it is not already using with the particular MS. The Reference Number serves as an identification of the Measure Position request component that it sends to the MS. When the MS responds either with the Measure Position Response component, or the Protocol Error component, it shall use the same Reference Number value and, if an Extended Reference ID was included by the SMLC, the same Extended Reference ID to identify to which Measure Position Request it is responding, if the Reference Number has been obtained. If the MS has not been able to decode the Reference Number (e.g. IE missing), it shall use '0' as the Reference number in the response. This mechanism helps for example in the cases where the SMLC sends a Measure Position Request to the MS, and before it receives the Response, it needs to send another Request (e.g. assistance data changes). Then the SMLC can identify to which Request the Response is related to;

- in the Assistance Data Delivery procedure the SMLC shall select any number within the range 1 – 7 that it is not already using with the MS. The Reference Number serves as an identification of the Assistance Data component that it sends to the MS. When the MS responds either with the Assistance Data Acknowledgement component or the Protocol Error component, it shall use the same Reference Number value and, if an Extended Reference ID was included by the SMLC, the same Extended Reference ID to identify to which Assistance Data component it is responding, if the Reference Number has been obtained. If the MS has not been able to decode the Reference Number (e.g. IE missing), it shall use '0' as the Reference number in the response.

- the SMLC shall use the same Reference Number and same Extended Reference ID to resend any RRLP component for which a response was not received from the MS.

- the SMLC shall use a different Reference Number to that in any RRLP component for which a response was not received from the MS if the SMLC aborts an existing RRLP procedure and starts a new procedure.

- the SMLC may use the same Reference Number and same Extended Reference ID or different Reference Numbers and Extended Reference IDs for different RRLP components within the same pseudo-segmentation sequence.

In a Measure Position Request, Measure Position Response, Assistance Data and Protocol Error component, the Reference Number IE shall be supplemented by an Extended Reference IE in order to distinguish valid from invalid RRLP responses at the SMLC and duplicate from non-duplicate RRLP commands at the MS. In order to remain backward compatible, the receiving entity shall be able to receive messages without the Extended Reference IE. The ASN.1 definition of the Extended Reference IE is given in sub-clause 5.1 and the procedures associated with sending and receiving it are given in clause 2 and in Annex A, sub-clauses A.2.2.5, A.3.2.7 and A.6.6.

## 3.3 Component IE

This element is mandatory, and appears only once per RRLP message. It contains the actual component to be transferred.

Different components are described further in Chapter 4. This IE contains only one component, i.e. it is not possible to include two or more components.

# 4 Components

This ASN.1 module contains the definitions of the components and datatypes defined in the components.

**Table 4.a: RRLP-Components format**

```
RRLP-Components
-- { RRLP-Components }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    Ext-GeographicalInformation
FROM
    MAP-LCS-DataTypes {
    ccitt identified-organization (4) etsi (0) mobileDomain (0)
    gsm-Network (1) modules (3) map-LCS-DataTypes (25) version5 (5)}

    ExtensionContainer
FROM MAP-ExtensionDataTypes {
    ccitt identified-organization (4) etsi (0) mobileDomain (0)
    gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version4 (4)}
;

-- Add here other ASN.1 definitions presented below
-- in chapters 4 and 5.


END
```

# 4.1 Measure Position Request

This component is used by the SMLC to request location measurements or a location estimate from the MS. It includes QoS, other instructions, and possible assistance data to the MS. This component is defined as follows:

**Table 4.1.a: Measure Position Request**

```
-- add this definition to RRLP-Components module

-- Measurement Position request component
MsrPosition-Req ::= SEQUENCE {
    positionInstruct        PositionInstruct,
    referenceAssistData     ReferenceAssistData     OPTIONAL,
    msrAssistData           MsrAssistData           OPTIONAL,
    systemInfoAssistData    SystemInfoAssistData    OPTIONAL,
    gps-AssistData          GPS-AssistData          OPTIONAL,
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...,
    -- Release 98 extension element
rel98-MsrPosition-Req-extension         Rel98-MsrPosition-Req-Extension         OPTIONAL,
    -- Release 5 extension element
rel5-MsrPosition-Req-extension          Rel5-MsrPosition-Req-Extension          OPTIONAL
}
```

The elements of this component are defined in clause 5.

# 4.2 Measure Position Response

This component is used by the MS to respond to a Measure Position Request from the SMLC with location measurements, a location estimate, or an error indication. This component is defined as follows:

**Table 4.2.a: Measure Position Response**

```
-- add this defintion to RRLP-Components module

-- Measurement Position response component
MsrPosition-Rsp ::= SEQUENCE {
    multipleSets            MultipleSets            OPTIONAL,
    referenceIdentity       ReferenceIdentity       OPTIONAL,
    otd-MeasureInfo         OTD-MeasureInfo         OPTIONAL,
    locationInfo            LocationInfo            OPTIONAL,
    gps-MeasureInfo         GPS-MeasureInfo         OPTIONAL,
    locationError           LocationError           OPTIONAL,
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...,
    -- Release extension here
    rel-98-MsrPosition-Rsp-Extension
                            Rel-98-MsrPosition-Rsp-Extension        OPTIONAL,
    rel-5-MsrPosition-Rsp-Extension
                            Rel-5-MsrPosition-Rsp-Extension     OPTIONAL
    -- rel-5-MsrPosition-Rsp-Extension and other possible future extensions
    -- are the only information elements that may be included in the 2nd
    -- MsrPosition-Rsp component when RRLP pseudo-segmentation is used
}
```

The elements of this component are defined in clause 5.

# 4.3 Assistance Data

This component is used by the SMLC to deliver assistance data for location measurement and/or location calculation. This component is defined as follows:

**Table 4.3.a: Assistance Data**

```
-- add this defintion to RRLP-Components module
```

```
-- Assistance Data component
AssistanceData ::= SEQUENCE {
    referenceAssistData ReferenceAssistData         OPTIONAL,
    msrAssistData           MsrAssistData           OPTIONAL,
    systemInfoAssistData    SystemInfoAssistData    OPTIONAL,
    gps-AssistData          GPS-AssistData          OPTIONAL,
    moreAssDataToBeSent     MoreAssDataToBeSent     OPTIONAL,   -- If not present, interpret as only
                                                                -- Assistance Data component used to
                                                                -- deliver entire set of assistance
                                                                -- data.
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...,
    -- Release extension here
    rel98-AssistanceData-Extension  Rel98-AssistanceData-Extension  OPTIONAL,
    rel5-AssistanceData-Extension   Rel5-AssistanceData-Extension   OPTIONAL
}
```

The elements of this component are defined in clause 5.

## 4.4 Assistance Data Acknowledgement

This component does not have any information contents. It presence indicates that the MS has received the complete Assistance Data component.

## 4.5 Protocol Error

This component is used by the receiving entity (SMLC or MS) to indicate to the sending entity, that there is a problem that prevents the receiving entity to receive a complete and understandable component. This component is defined as follows:

**Table 4.5.a: Protocol Error**

```
-- add this defintion to RRLP-Components module

-- Protocol Error component
ProtocolError ::= SEQUENCE {
    errorCause              ErrorCodes,
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...,
    -- Release extensions here
    rel-5-ProtocolError-Extension Rel-5-ProtocolError-Extension     OPTIONAL
}
```

The elements of this component are defined in clause 5.

# 5 Elements of Components

## 5.1 ASN.1 Description

The following ASN.1 code defines the elements of components. See the Annex A for further description of the contents of components and their elements.

**Table 5.1.a: ASN.1 Description**

```
-- add these defintions to RRLP-Components module
-- Position instructions
PositionInstruct ::= SEQUENCE {
    -- Method type
    methodType              MethodType,
    positionMethod          PositionMethod,
    measureResponseTime     MeasureResponseTime,
    useMultipleSets         UseMultipleSets,
    environmentCharacter    EnvironmentCharacter    OPTIONAL
}

--
MethodType ::= CHOICE {
    msAssisted      AccuracyOpt,    -- accuracy is optional
    msBased         Accuracy,       -- accuracy is mandatory
    msBasedPref     Accuracy,       -- accuracy is mandatory
    msAssistedPref  Accuracy        -- accuracy is mandatory
}

-- Accuracy of the location estimation
AccuracyOpt ::= SEQUENCE {
    accuracy        Accuracy    OPTIONAL
}

-- The values of this field are defined in 3GPP TS 23.032 (Uncertainty code)
Accuracy ::= INTEGER (0..127)


-- Position Method
PositionMethod ::= ENUMERATED {
    eotd (0),
    gps (1),
    gpsOrEOTD (2)
}

-- Measurement request response time
MeasureResponseTime ::= INTEGER (0..7)


-- useMultiple Sets, FFS!
UseMultipleSets ::= ENUMERATED {
    multipleSets (0),       -- multiple sets are allowed
    oneSet (1)              -- sending of multiple is not allowed
}

-- Environment characterization
EnvironmentCharacter ::= ENUMERATED {
    badArea (0),        -- bad urban or suburban, heavy multipath and NLOS
    notBadArea (1),     -- light multipath and NLOS
    mixedArea (2),      -- not defined or mixed environment
    ...
}

-- E-OTD reference BTS for Assitance data IE
ReferenceAssistData ::= SEQUENCE {
    bcchCarrier     BCCHCarrier,                        -- BCCH carrier
    bsic            BSIC,                               -- BSIC
    timeSlotScheme  TimeSlotScheme,                     -- Timeslot scheme
    btsPosition     BTSPosition         OPTIONAL
}
```

```
-- ellipsoid point and
-- ellipsoid point with altitude and uncertainty ellipsoid shapes are supported
BTSPosition ::= Ext-GeographicalInformation


-- RF channel number of BCCH
BCCHCarrier ::= INTEGER (0..1023)


-- Base station Identity Code
BSIC ::= INTEGER (0..63)


-- Timeslot scheme
TimeSlotScheme ::= ENUMERATED {
    equalLength (0),
    variousLength (1)
}

-- Time slot (modulo)
ModuloTimeSlot ::= INTEGER (0..3)


-- E-OTD measurement assistance data IE
-- The total number of neighbors in this element (MsrAssistData)
-- and in SystemInfoAssistData element (presented neighbors
-- can be at a maximum 15!)
MsrAssistData ::= SEQUENCE {
     msrAssistList SeqOfMsrAssistBTS
}
SeqOfMsrAssistBTS ::= SEQUENCE (SIZE(1..15)) OF MsrAssistBTS

MsrAssistBTS ::= SEQUENCE {
    bcchCarrier         BCCHCarrier,        -- BCCH carrier
    bsic                BSIC,               -- BSIC
    multiFrameOffset    MultiFrameOffset,   -- multiframe offset
    timeSlotScheme      TimeSlotScheme,     -- Timeslot scheme
    roughRTD            RoughRTD,           -- rough RTD value

    -- Location Calculation Assistance data is moved here
    calcAssistanceBTS   CalcAssistanceBTS   OPTIONAL
}

-- Multiframe offset
MultiFrameOffset ::= INTEGER (0..51)
-- The Multiframe Offset value 51 shall not be encoded by the transmitting entity and
-- shall be treated by the receiving entity as 0.

-- Rough RTD value between one base station and reference BTS
RoughRTD ::= INTEGER (0..1250)
-- The RoughRTD value 1250 shall not be encoded by the transmitting entity and shall
-- be treated by the receiving entity as 0.

-- E-OTD Measurement assistance data for system information List IE
-- The total number of base stations in this element (SystemInfoAssistData
-- presented neighbors) and in MsrAssistData element can be at a maximum 15.
SystemInfoAssistData ::= SEQUENCE {
    systemInfoAssistList    SeqOfSystemInfoAssistBTS
}
SeqOfSystemInfoAssistBTS::= SEQUENCE (SIZE(1..32)) OF SystemInfoAssistBTS


-- whether n.th is present or not ?
SystemInfoAssistBTS ::= CHOICE {
    notPresent      NULL,
    present         AssistBTSData
}
```

```
-- Actual assistance data for system information base station
AssistBTSData ::= SEQUENCE {
    bsic                BSIC,               -- BSIC
    multiFrameOffset    MultiFrameOffset,   -- multiframe offset
    timeSlotScheme      TimeSlotScheme,     -- Timeslot scheme
    roughRTD            RoughRTD,           -- rough RTD value

    -- Location Calculation Assistance data
    calcAssistanceBTS   CalcAssistanceBTS   OPTIONAL
}

-- E-OTD Location calculation assistance data,
-- CalcAssistanceBTS element is optional not subfields
CalcAssistanceBTS ::= SEQUENCE {
    fineRTD             FineRTD,        -- fine RTD value between base stations
    referenceWGS84      ReferenceWGS84  -- reference coordinates
}

-- Coordinates of neighbour BTS, WGS-84 ellipsoid
ReferenceWGS84 ::= SEQUENCE {
    relativeNorth   RelDistance,                -- relative distance (south negative)
    relativeEast    RelDistance,                -- relative distance (west negative)
    -- Relative Altitude is not always known
    relativeAlt     RelativeAlt     OPTIONAL    -- relative altitude
}

-- Fine RTD value between this BTS and the reference BTS
FineRTD ::= INTEGER (0..255)


-- Relative north/east distance
RelDistance ::= INTEGER (-200000..200000)


-- Relative altitude
RelativeAlt ::= INTEGER (-4000..4000)


-- Measure position response IEs
-- Reference Identity
-- Multiple sets
MultipleSets ::= SEQUENCE {
    -- number of reference sets
    nbrOfSets           INTEGER (2..3),

    -- This field actually tells the number of reference BTSs
    nbrOfReferenceBTSs  INTEGER (1..3),

    -- This field is conditional and included optionally only if
    -- nbrOfSets is 3 and number of reference BTSs is 2.
    referenceRelation       ReferenceRelation       OPTIONAL
}

-- Relation between refence BTSs and sets
ReferenceRelation ::= ENUMERATED {
    secondBTSThirdSet (0),  -- 1st BTS related to 1st and 2nd sets
    secondBTSSecondSet (1), -- 1st BTS related to 1st and 3rd sets
    firstBTSFirstSet (2)    -- 1st BTS related to 1st set
}

-- Reference BTS Identity, this element contains number of
-- BTSs told nbrOfReferenceBTSs field in Multiple sets element)
ReferenceIdentity ::= SEQUENCE {
    -- Reference BTS list
    refBTSList      SeqOfReferenceIdentityType
}
SeqOfReferenceIdentityType ::= SEQUENCE (SIZE(1..3)) OF ReferenceIdentityType
```

```
-- Cell identity
ReferenceIdentityType ::= CHOICE {
    bsicAndCarrier  BSICAndCarrier,     -- BSIC and Carrier
    ci              CellID,             -- Cell ID, LAC not needed
    requestIndex    RequestIndex,       -- Index to Requested Neighbor List
    systemInfoIndex SystemInfoIndex,    -- Index to System info list, this type of ref. identity
                                        -- shall not be used by the MS unless it has received
                                        -- the SystemInfoAssistData from the SMLC for this cell.
    ciAndLAC        CellIDAndLAC        -- CI and LAC
}

BSICAndCarrier ::= SEQUENCE {
    carrier BCCHCarrier,
    bsic        BSIC
}

RequestIndex ::= INTEGER (1..16)

SystemInfoIndex ::= INTEGER (1..32)

CellIDAndLAC ::= SEQUENCE {
    referenceLAC    LAC,                -- Location area code
    referenceCI     CellID              -- Cell identity
}
CellID ::= INTEGER (0..65535)
LAC ::= INTEGER (0..65535)


-- OTD-MeasureInfo
OTD-MeasureInfo ::= SEQUENCE {
    -- Measurement info elements, OTD-MsrElement is repeated number of times
    -- told in nbrOfReferenceBTSs in MultipleSets, default value is 1
    otdMsrFirstSets     OTD-MsrElementFirst,

    -- if more than one sets are present this element is repeated
    -- NumberOfSets - 1 (-1 = first set)
    otdMsrRestSets      SeqOfOTD-MsrElementRest     OPTIONAL

}

SeqOfOTD-MsrElementRest ::= SEQUENCE (SIZE(1..2)) OF OTD-MsrElementRest


-- OTD measurent information for 1 set
OTD-MsrElementFirst ::= SEQUENCE {
    refFrameNumber          INTEGER (0..42431),                 -- Frame number modulo 42432
    referenceTimeSlot       ModuloTimeSlot,
    toaMeasurementsOfRef    TOA-MeasurementsOfRef   OPTIONAL,
    stdResolution           StdResolution,
    taCorrection            INTEGER (0..960)        OPTIONAL,   -- TA correction

    -- measured neighbors in OTD measurements
    otd-FirstSetMsrs        SeqOfOTD-FirstSetMsrs   OPTIONAL
}
SeqOfOTD-FirstSetMsrs ::= SEQUENCE (SIZE(1..10)) OF OTD-FirstSetMsrs


-- OTD measurent information 2 and 3 sets if exist
OTD-MsrElementRest ::= SEQUENCE {
    refFrameNumber          INTEGER (0..42431),                     -- Frame number modulo 42432
    referenceTimeSlot       ModuloTimeSlot,
    toaMeasurementsOfRef    TOA-MeasurementsOfRef       OPTIONAL,
    stdResolution           StdResolution,
    taCorrection            INTEGER (0..960)            OPTIONAL,   -- TA correction

    -- measured neighbors in OTD measurements
    otd-MsrsOfOtherSets     SeqOfOTD-MsrsOfOtherSets    OPTIONAL

}
SeqOfOTD-MsrsOfOtherSets ::= SEQUENCE (SIZE(1..10)) OF OTD-MsrsOfOtherSets
```

```
-- Standard deviation of the TOA measurements from the reference BTS
TOA-MeasurementsOfRef ::= SEQUENCE {
    refQuality          RefQuality,
    numOfMeasurements   NumOfMeasurements
}

RefQuality ::= INTEGER (0..31)          -- St Dev of TOA of reference as defined in annex
NumOfMeasurements ::= INTEGER (0..7)    -- No. of measurements for RefQuality as defined in annex
StdResolution ::= INTEGER (0..3)        -- Values of resolution are defined in annex

OTD-FirstSetMsrs ::= OTD-MeasurementWithID


-- Neighbour info in OTD measurements 0-10 times in TD measurement info
OTD-MsrsOfOtherSets ::= CHOICE {
    identityNotPresent  OTD-Measurement,
    identityPresent     OTD-MeasurementWithID
}

-- For this OTD measurement identity is same as the identity of BTS
-- in the first set with same sequence number
OTD-Measurement ::= SEQUENCE {
    nborTimeSlot    ModuloTimeSlot,
    eotdQuality     EOTDQuality,
    otdValue        OTDValue
}

-- This measurement contains the BTS identity and measurement
OTD-MeasurementWithID ::=SEQUENCE {
    neighborIdentity    NeighborIdentity,
    nborTimeSlot        ModuloTimeSlot,
    eotdQuality         EOTDQuality,
    otdValue            OTDValue
}

EOTDQuality ::= SEQUENCE {
    nbrOfMeasurements   INTEGER (0..7),
    stdOfEOTD           INTEGER (0..31)
}

NeighborIdentity ::= CHOICE {
    bsicAndCarrier      BSICAndCarrier,     -- BSIC and Carrier
    ci                  CellID,             -- Cell ID, LAC not needed
    multiFrameCarrier   MultiFrameCarrier,  -- MultiFrameOffest and BSIC
    requestIndex        RequestIndex,       -- Index to Requested Neighbor List
    systemInfoIndex     SystemInfoIndex,    -- Index to System info list, this type of neighbour
                                            -- identity shall not be used by the MS unless it has
                                            -- received the SystemInfoAssistData from the SMLC for
                                            -- this cell.
    ciAndLAC            CellIDAndLAC        -- CI and LAC
}

-- Multiframe and carrier
MultiFrameCarrier ::= SEQUENCE {
    bcchCarrier         BCCHCarrier,
    multiFrameOffset    MultiFrameOffset
}

-- OTD measurement value for neighbour
OTDValue ::= INTEGER (0..39999)
```

```
-- Location information IE
LocationInfo ::= SEQUENCE {
    refFrame        INTEGER (0..65535),         -- Reference Frame number
    -- If refFrame is within (42432..65535), it shall be ignored by the receiver
    -- in that case the MS should provide GPS TOW if available
    gpsTOW          INTEGER (0..14399999)   OPTIONAL,   -- GPS TOW
    fixType         FixType,
    -- Note that applicable range for refFrame is 0 - 42431
    -- Possible shapes carried in posEstimate are
    -- ellipsoid point,
    -- ellipsoid point with uncertainty circle
    -- ellipsoid point with uncertainty ellipse
    -- ellipsoid point with altitude and uncertainty ellipsoid
    posEstimate     Ext-GeographicalInformation

}

FixType ::= INTEGER {
    twoDFix (0),
    threeDFix (1)
} (0..1)


-- GPS-Measurement information
GPS-MeasureInfo ::= SEQUENCE {
    -- Measurement info elements
    -- user has to make sure that in this element is number of elements
    -- defined in reference BTS identity
    gpsMsrSetList   SeqOfGPS-MsrSetElement
}
SeqOfGPS-MsrSetElement ::= SEQUENCE (SIZE(1..3)) OF GPS-MsrSetElement


-- OTD measurent information 1-3 times in message
GPS-MsrSetElement ::= SEQUENCE {
    refFrame        INTEGER (0..65535)  OPTIONAL,   -- Reference Frame number
    gpsTOW          GPSTOW24b,                      -- GPS TOW
    -- Note that applicable range for refFrame is 0 - 42431

--N_SAT can be read from number of elements of gps-msrList

    gps-msrList     SeqOfGPS-MsrElement
}

-- 24 bit presentation for GPSTOW
GPSTOW24b ::= INTEGER (0..14399999)


-- measured elements in measurement parameters field
SeqOfGPS-MsrElement ::= SEQUENCE (SIZE(1..16)) OF GPS-MsrElement

GPS-MsrElement ::= SEQUENCE {
    satelliteID     SatelliteID,                -- Satellite identifier
    cNo             INTEGER (0..63),            -- carrier noise ratio
    doppler         INTEGER (-32768..32767),    -- doppler, mulltiply by 0.2
    wholeChips      INTEGER (0..1022),          -- whole value of the code phase measurement
    fracChips       INTEGER (0..1024),          -- fractional value of the code phase measurement
                                                -- a value of 1024 shall not be encoded by the sender
                                                -- the receiver shall consider a value of 1024 to be
                                                -- invalid data
    mpathIndic      MpathIndic,                 -- multipath indicator
    pseuRangeRMSErr INTEGER (0..63)             -- index
}

-- Multipath indicator
MpathIndic ::= ENUMERATED {
    notMeasured (0),
    low (1),
    medium (2),
    high (3)
}
```

```
-- Location error IE
LocationError ::= SEQUENCE {
    locErrorReason              LocErrorReason,
    additionalAssistanceData    AdditionalAssistanceData    OPTIONAL,
    ...
}

LocErrorReason ::= ENUMERATED {
    unDefined (0),
    notEnoughBTSs (1),
    notEnoughSats (2),
    eotdLocCalAssDataMissing (3),
    eotdAssDataMissing (4),
    gpsLocCalAssDataMissing (5),
    gpsAssDataMissing (6),
    methodNotSupported (7),
    notProcessed (8),
    refBTSForGPSNotServingBTS (9),
    refBTSForEOTDNotServingBTS (10),
    ...
}

-- exception handling:
-- an unrecognized value shall be treated the same as value 0


-- defines additional assistance data needed for any new location attempt
-- MS shall retain any assistance data already received
AdditionalAssistanceData ::= SEQUENCE {
    gpsAssistanceData       GPSAssistanceData       OPTIONAL,
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

GPSAssistanceData ::= OCTET STRING (SIZE (1..maxGPSAssistanceData))
-- GPSAssistanceData has identical structure and encoding to octets 3 to n of the
-- GPS Assistance Data IE in 3GPP TS 49.031

maxGPSAssistanceData    INTEGER ::= 40


-- Protocol Error Causes
ErrorCodes ::= ENUMERATED {
    unDefined (0),
missingComponet (1),
incorrectData (2),
missingIEorComponentElement (3),
messageTooShort (4),
unknowReferenceNumber (5),
...
}

-- exception handling:
-- an unrecognized value shall be treated the same as value 0



-- GPS assistance data IE
GPS-AssistData ::= SEQUENCE {
    controlHeader       ControlHeader
}

-- More Assistance Data To Be Sent IE
-- More Assistance Data Components On the Way indication for delivery of an entire set of assistance
-- data in multiple Assistance Data components.

MoreAssDataToBeSent ::= ENUMERATED {
    noMoreMessages (0),         -- This is the only or last Assistance Data message used to deliver
                                -- the entire set of assistance data.
    moreMessagesOnTheWay (1)    -- The SMLC will send more Assistance Data messages or a final RRLP
                                -- Measure Position Request message to deliver the
                                -- the entire set of assistance data.
}
```

```
-- Control header of the GPS assistance data
ControlHeader ::= SEQUENCE {

    -- Field type Present information
    referenceTime       ReferenceTime       OPTIONAL,
    refLocation         RefLocation         OPTIONAL,
    dgpsCorrections     DGPSCorrections     OPTIONAL,
    navigationModel     NavigationModel     OPTIONAL,
    ionosphericModel        IonosphericModel        OPTIONAL,
    utcModel            UTCModel            OPTIONAL,
    almanac         Almanac         OPTIONAL,
    acquisAssist        AcquisAssist        OPTIONAL,
    realTimeIntegrity SeqOf-BadSatelliteSet OPTIONAL
}


ReferenceTime ::= SEQUENCE {
    gpsTime             GPSTime,
    gsmTime             GSMTime             OPTIONAL,
    gpsTowAssist        GPSTOWAssist        OPTIONAL
}

-- GPS Time includes week number and time-of-week (TOW)
GPSTime ::= SEQUENCE {
    gpsTOW23b           GPSTOW23b,
    gpsWeek             GPSWeek
}

-- GPSTOW, range 0-604799.92, resolution 0.08 sec, 23-bit presentation
GPSTOW23b ::= INTEGER (0..7559999)


-- GPS week number
GPSWeek ::= INTEGER (0..1023)


-- GPSTOWAssist consists of TLM message, Anti-spoof flag, Alert flag, and 2 reserved bits in TLM
Word
-- for each visible satellite.
-- N_SAT can be read from number of elements in GPSTOWAssist
GPSTOWAssist ::= SEQUENCE (SIZE(1..12)) OF GPSTOWAssistElement

GPSTOWAssistElement ::= SEQUENCE {
    satelliteID         SatelliteID,
    tlmWord             TLMWord,
    antiSpoof           AntiSpoofFlag,
    alert               AlertFlag,
    tlmRsvdBits         TLMReservedBits
}

-- TLM Word, 14 bits
TLMWord ::= INTEGER (0..16383)

-- Anti-Spoof flag
AntiSpoofFlag ::= INTEGER (0..1)

-- Alert flag
AlertFlag ::= INTEGER (0..1)

-- Reserved bits in TLM word, MSB occurs earlier in TLM Word transmitted by satellite
TLMReservedBits ::= INTEGER (0..3)

GSMTime ::= SEQUENCE {
    bcchCarrier     BCCHCarrier,    -- BCCH carrier
    bsic            BSIC,           -- BSIC
    frameNumber     FrameNumber,
    timeSlot        TimeSlot,
    bitNumber       BitNumber
}
```

```
-- Frame number
FrameNumber ::= INTEGER (0..2097151)

-- Time slot number
TimeSlot ::= INTEGER (0..7)

-- Bit number
BitNumber ::= INTEGER (0..156)


-- Reference Location IE
RefLocation ::= SEQUENCE {
    threeDLocation          Ext-GeographicalInformation
}

-- DGPS Corrections IE
DGPSCorrections ::= SEQUENCE {

    gpsTOW      INTEGER (0..604799),    -- DGPS reference time

    status      INTEGER (0..7),

    -- N_SAT can be read from number of elements of satList

    satList     SeqOfSatElement
}
SeqOfSatElement ::= SEQUENCE (SIZE (1..16)) OF SatElement


-- number of correction for satellites
SatElement ::= SEQUENCE {
    satelliteID     SatelliteID,


--- Sequence number for ephemeris
    iode            INTEGER (0..239),
    -- User Differential Range Error
    udre            INTEGER (0..3),

    -- Pseudo Range Correction, range is
    -- -655.04 - +655.04,
    pseudoRangeCor  INTEGER (-2047..2047),

    -- Pseudo Range Rate Correction, range is
    -- -4.064 - +4.064,
    rangeRateCor    INTEGER (-127..127),


-- Delta Pseudo Range Correction 2
    deltaPseudoRangeCor2    INTEGER (-127..127),    -- This IE shall be ignored by the receiver and
                                                    -- set to zero by the sender
    -- Delta Pseudo Range Correction 2
    deltaRangeRateCor2      INTEGER (-7..7),        -- This IE shall be ignored by the receiver and
                                                    -- set to zero by the sender
    -- Delta Pseudo Range Correction 3
    deltaPseudoRangeCor3    INTEGER (-127..127),    -- This IE shall be ignored by the receiver and
                                                    -- set to zero by the sender
    -- Delta Pseudo Range Correction 3
    deltaRangeRateCor3      INTEGER (-7..7)         -- This IE shall be ignored by the receiver and
                                                    -- set to zero by the sender
}

SatelliteID ::= INTEGER (0..63) -- identifies satellite


-- Navigation Model IE
NavigationModel ::= SEQUENCE {
    navModelList    SeqOfNavModelElement
}

-- navigation model satellite list
SeqOfNavModelElement ::= SEQUENCE (SIZE(1..16)) OF NavModelElement

NavModelElement ::= SEQUENCE {
    satelliteID     SatelliteID,
    satStatus       SatStatus       -- satellite status
}
```

```
-- the Status of the navigation model
SatStatus ::= CHOICE {
    -- New satellite, new Navigation Model
    newSatelliteAndModelUC  UncompressedEphemeris,

    -- Existing satellite, Existing Navigation Model
    oldSatelliteAndModel    NULL,

    -- Existing satellite, new Navigation Model
    newNaviModelUC          UncompressedEphemeris,
    ...
}

-- Uncompressed satellite emhemeris and clock corrections
UncompressedEphemeris ::= SEQUENCE {
    ephemCodeOnL2   INTEGER (0..3),
    ephemURA        INTEGER (0..15),
    ephemSVhealth   INTEGER (0..63),
    ephemIODC       INTEGER (0..1023),
    ephemL2Pflag    INTEGER (0..1),
    ephemSF1Rsvd    EphemerisSubframe1Reserved,
    ephemTgd        INTEGER (-128..127),
    ephemToc        INTEGER (0..37799),
    ephemAF2        INTEGER (-128..127),
    ephemAF1        INTEGER (-32768..32767),
    ephemAF0        INTEGER (-2097152..2097151),
    ephemCrs        INTEGER (-32768..32767),
    ephemDeltaN     INTEGER (-32768..32767),
    ephemM0         INTEGER (-2147483648..2147483647),
    ephemCuc        INTEGER (-32768..32767),
    ephemE          INTEGER (0..4294967295),
    ephemCus        INTEGER (-32768..32767),
    ephemAPowerHalf INTEGER (0..4294967295),
    ephemToe        INTEGER (0..37799),
    ephemFitFlag    INTEGER (0..1),
    ephemAODA       INTEGER (0..31),
    ephemCic        INTEGER (-32768..32767),
    ephemOmegaA0    INTEGER (-2147483648..2147483647),
    ephemCis        INTEGER (-32768..32767),
    ephemI0         INTEGER (-2147483648..2147483647),
    ephemCrc        INTEGER (-32768..32767),
    ephemW          INTEGER (-2147483648..2147483647),
    ephemOmegaADot  INTEGER (-8388608..8388607),
    ephemIDot       INTEGER (-8192..8191)
}

-- Reserved bits in subframe 1 of navigation message
EphemerisSubframe1Reserved ::= SEQUENCE {
    reserved1       INTEGER (0..8388607),   -- 23-bit field
    reserved2       INTEGER (0..16777215),  -- 24-bit field
    reserved3       INTEGER (0..16777215),  -- 24-bit field
    reserved4       INTEGER (0..65535)      -- 16-bit field
}

-- Ionospheric Model IE
IonosphericModel ::= SEQUENCE {
    alfa0           INTEGER (-128..127),
    alfa1           INTEGER (-128..127),
    alfa2           INTEGER (-128..127),
    alfa3           INTEGER (-128..127),
    beta0           INTEGER (-128..127),
    beta1           INTEGER (-128..127),
    beta2           INTEGER (-128..127),
    beta3           INTEGER (-128..127)
}

-- Universal Time Coordinate Model
UTCModel ::= SEQUENCE {
    utcA1           INTEGER (-8388608..8388607),
    utcA0           INTEGER (-2147483648..2147483647),
    utcTot          INTEGER (0..255),
    utcWNt          INTEGER (0..255),
    utcDeltaTls     INTEGER (-128..127),
    utcWNlsf        INTEGER (0..255),
    utcDN           INTEGER (-128..127),
    utcDeltaTlsf    INTEGER (-128..127)
}
```

```
-- Almanac, Long term model
-- NOTE: These are parameters are subset of the ephemeris
-- NOTE: But with reduced resolution and accuracy
Almanac ::= SEQUENCE {
    alamanacWNa     INTEGER (0..255),   -- Once per message

    -- navigation model satellite list.
    -- The size of almanacList is actually Nums_Sats_Total field
    almanacList     SeqOfAlmanacElement
}
SeqOfAlmanacElement ::= SEQUENCE (SIZE(1..64)) OF AlmanacElement


-- Almanac info once per satellite
AlmanacElement ::= SEQUENCE {
    satelliteID         SatelliteID,
    almanacE            INTEGER (0..65535),
    alamanacToa         INTEGER (0..255),
    almanacKsii         INTEGER (-32768..32767),
    almanacOmegaDot     INTEGER (-32768..32767),
    almanacSVhealth     INTEGER (0..255),
    almanacAPowerHalf   INTEGER (0..16777215),
    almanacOmega0       INTEGER (-8388608..8388607),
    almanacW            INTEGER (-8388608..8388607),
    almanacM0           INTEGER (-8388608..8388607),
    almanacAF0          INTEGER (-1024..1023),
    almanacAF1          INTEGER (-1024..1023)
}

-- Acquisition Assistance
AcquisAssist ::= SEQUENCE {

    -- Number of Satellites can be read from acquistList
    timeRelation    TimeRelation,

    -- Acquisition assistance list
    -- The size of Number of Satellites is actually Number of Satellites field
    acquisList      SeqOfAcquisElement
}
SeqOfAcquisElement ::= SEQUENCE (SIZE(1..16)) OF AcquisElement


-- the relationship between GPS time and air-interface timing
TimeRelation ::= SEQUENCE {
    --
    gpsTOW      GPSTOW23b,      -- 23b presentation


    gsmTime     GSMTime     OPTIONAL
}
```

```
-- data occuring per number of satellites
AcquisElement ::= SEQUENCE {
    svid                    SatelliteID,

    -- Doppler 0th order term,
    -- -5120.0 - 5117.5 Hz (= -2048 - 2047 with 2.5 Hz resolution)
    doppler0                INTEGER (-2048..2047),

    addionalDoppler         AddionalDopplerFields   OPTIONAL,
    codePhase               INTEGER (0..1022),  -- Code Phase
    intCodePhase            INTEGER (0..19),    -- Integer Code Phase
    gpsBitNumber            INTEGER (0..3),     -- GPS bit number
    codePhaseSearchWindow   INTEGER (0..15),    -- Code Phase Search Window

    addionalAngle           AddionalAngleFields     OPTIONAL
}

AddionalDopplerFields ::= SEQUENCE {
    -- Doppler 1st order term, -1.0 - +0.5 Hz/sec
    -- (= -42 + (0 to 63) with 1/42 Hz/sec. resolution)
    doppler1                INTEGER (0..63),
    dopplerUncertainty      INTEGER (0..7)
    -- a sender shall not encode any DopplerUncertainty value in the range 5 to 7
    -- a receiver shall ignore any value between 5 and 7.
}

AddionalAngleFields ::= SEQUENCE {
    -- azimuth angle, 0 - 348.75 deg (= 0 - 31 with 11.25 deg resolution)
    azimuth                 INTEGER (0..31),
    -- elevation angle, 0 - 78.75 deg (= 0 - 7 with 11.25 deg resolution)
    elevation               INTEGER (0..7)
}

-- Real-Time Integrity
-- number of bad satellites can be read from this element
SeqOf-BadSatelliteSet ::= SEQUENCE (SIZE(1..16)) OF SatelliteID


-- Extension Elements

-- Release 98 Extensions here
Rel98-MsrPosition-Req-Extension ::= SEQUENCE {
    rel98-Ext-ExpOTD            Rel98-Ext-ExpOTD        OPTIONAL,   -- ExpectedOTD extension
    ...,
    gpsTimeAssistanceMeasurementRequest   NULL   OPTIONAL,
    gpsReferenceTimeUncertainty        GPSReferenceTimeUncertainty   OPTIONAL

   -- Further R98 extensions here
}
Rel98-AssistanceData-Extension ::= SEQUENCE {
    rel98-Ext-ExpOTD            Rel98-Ext-ExpOTD        OPTIONAL,   -- ExpectedOTD extension
    ...,
    gpsTimeAssistanceMeasurementRequest   NULL   OPTIONAL,
    gpsReferenceTimeUncertainty    GPSReferenceTimeUncertainty   OPTIONAL

   -- Further R98 extensions here
}

-- Release 98 ExpOTD extension
Rel98-Ext-ExpOTD ::= SEQUENCE {
-- If MsrAssistBTS is included in message, msrAssistData-R98-ExpOTD shall be included.
    msrAssistData-R98-ExpOTD            MsrAssistData-R98-ExpOTD            OPTIONAL,

-- If SystemInfoAssistaData is included in message, systemInfoAssistData-R98-ExpOTD shall be
-- included.
    systemInfoAssistData-R98-ExpOTD SystemInfoAssistData-R98-ExpOTD OPTIONAL
}

-- MsrAssistData R98 extension
MsrAssistData-R98-ExpOTD ::= SEQUENCE {
     msrAssistList-R98-ExpOTD           SeqOfMsrAssistBTS-R98-ExpOTD
}
```

```
-- Indexes in SeqOfMsrAssistBTS-R98-ExpOTD refer to SeqOfMsrAssistBTS
-- If the index exceeds the SegOfMsrAssistBTS range or if there is other
-- inconsistencies between the BTS indices, the MS shall apply protocol
-- error cause incorrectData
SeqOfMsrAssistBTS-R98-ExpOTD ::= SEQUENCE (SIZE(1..15)) OF MsrAssistBTS-R98-ExpOTD

-- This element completes MsrAssistBTS IE
MsrAssistBTS-R98-ExpOTD ::= SEQUENCE {
    expectedOTD             ExpectedOTD,
    expOTDUncertainty       ExpOTDUncertainty
}

-- SystemInfoAssistData R98 extension
SystemInfoAssistData-R98-ExpOTD ::= SEQUENCE {
    systemInfoAssistListR98-ExpOTD  SeqOfSystemInfoAssistBTS-R98-ExpOTD
}

-- SeqOfSystemInfoAssistBTS-R98-ExpOTD index refer to SeqOfSystemInfoAssistBTS
-- If the index exceeds the SegOfSystemInfoAssistBTS range or if there is other
-- inconsistencies between the BTS indices, the MS shall apply protocol
-- error cause incorrectData
SeqOfSystemInfoAssistBTS-R98-ExpOTD ::= SEQUENCE (SIZE(1..32)) OF SystemInfoAssistBTS-R98-ExpOTD

-- whether n.th is present or not ?
SystemInfoAssistBTS-R98-ExpOTD ::= CHOICE {
    notPresent      NULL,
    present         AssistBTSData-R98-ExpOTD
}

-- This element completes AssistBTSData IE
AssistBTSData-R98-ExpOTD ::= SEQUENCE {
    expectedOTD             ExpectedOTD,
    expOTDuncertainty       ExpOTDUncertainty   -- Uncertainty of expected OTD
}

-- Expected OTD value between nbor base station and reference BTS
-- at MS's current estimated location.
ExpectedOTD ::= INTEGER (0..1250)
-- The ExpectedOTD value 1250 shall not be encoded by the transmitting entity and
-- shall be treated by the receiving entity as 0.
-- Uncertainty of Exptected OTD in bits
ExpOTDUncertainty ::= INTEGER(0..7)

-- Release 98 extensions

GPSReferenceTimeUncertainty ::= INTEGER (0 .. 127) --  Coding according to Annex

GPSTimeAssistanceMeasurements ::= SEQUENCE {
    referenceFrameMSB  INTEGER (0 .. 63), -- MSB of frame number
    gpsTowSubms        INTEGER (0 .. 9999)   OPTIONAL, -- in units of 100ns, for MS based AGPS
    deltaTow           INTEGER (0 .. 127)   OPTIONAL,  -- for MS assisted AGPS
    gpsReferenceTimeUncertainty        GPSReferenceTimeUncertainty   OPTIONAL
}

Rel-98-MsrPosition-Rsp-Extension ::= SEQUENCE {

    -- First extension to Release 98
    rel-98-Ext-MeasureInfo  SEQUENCE {
        otd-MeasureInfo-R98-Ext OTD-MeasureInfo-R98-Ext     OPTIONAL
    },
    ...,
    timeAssistanceMeasurements    GPSTimeAssistanceMeasurements   OPTIONAL
    -- Further R98 extensions here
}

-- This is an addition to OTD-MeasureInfo element defined in original message,
-- If OTD-MeasureInfo is absent, or if one or more OTD-MsrElementRest are present
-- OTD-MeasureInfo-R98-Ext shall be absent.
-- OTD-MeasureInfo-R98-Ext
OTD-MeasureInfo-R98-Ext ::= SEQUENCE {
    -- Measurement info elements
    otdMsrFirstSets-R98-Ext     OTD-MsrElementFirst-R98-Ext
}
```

```
-- OTD measurement information Ext for the first set only
OTD-MsrElementFirst-R98-Ext ::= SEQUENCE {
    -- additional measured neighbors in OTD measurements
    otd-FirstSetMsrs-R98-Ext    SeqOfOTD-FirstSetMsrs-R98-Ext   OPTIONAL
}
SeqOfOTD-FirstSetMsrs-R98-Ext ::= SEQUENCE (SIZE(1..5)) OF OTD-FirstSetMsrs

Rel-5-MsrPosition-Rsp-Extension ::= SEQUENCE {

    extended-reference  Extended-reference  OPTIONAL,
    -- The extended-reference shall be included by the MS if and only if previously
    -- received from the SMLC in a Measure Position Request. When included, the value sent
    -- by the MS shall equal the value received from the SMLC.

    -- extension to Release 5, for RRLP pseudo-segmentation here
    otd-MeasureInfo-5-Ext   OTD-MeasureInfo-5-Ext   OPTIONAL,
    ulPseudoSegInd          UlPseudoSegInd          OPTIONAL,   -- Included when uplink RRLP
    -- Pseudo-segmentation is used, not included when no uplink pseudo-segmentation is used
    ...
                    -- Possibly more extensions for Release 5 here later
}

Extended-reference ::= SEQUENCE {
    smlc-code           INTEGER (0..63),
    transaction-ID      INTEGER (0..262143)
}

OTD-MeasureInfo-5-Ext ::= SeqOfOTD-MsrElementRest
    -- if more than one measurement sets are present this element is repeated
    -- NumberOfSets - 1 (-1 = first set) combined in OTD-MeasureInfo-5-Ext and
    -- OTD-MeasureInfo (e.g. if NumberOfSets is 3, then one otdMsrRestSets may
    -- be sent in OTD-MeasureInfo-5-Ext and one in OTD-MeasureInfo)

-- First part of Uplink RRLP Pseudo-segmentation indication, possibly more may be defined
-- in the future for segmentation with more than two segments.
UlPseudoSegInd ::= ENUMERATED {
    firstOfMany (0),
    secondOfMany(1)
}

Rel5-MsrPosition-Req-Extension ::= SEQUENCE {
    extended-reference          Extended-reference,
    ...
    -- Possibly more extensions for Release 5 here later
}

Rel5-AssistanceData-Extension ::= SEQUENCE {
    extended-reference          Extended-reference,
    ...

   -- Possibly more extensions for Release 5 here later
}

Rel-5-ProtocolError-Extension::= SEQUENCE {
    extended-reference          Extended-reference  OPTIONAL,
    -- The extended-reference shall be included by the MS if and only if previously
    -- received from the SMLC.
    -- When included, the value sent by the MS shall equal the value received from the SMLC.
    ...

    -- Possibly more extensions for Release 5 here later
}
```

# 6 TOM Protocol Header for RRLP Transport

## 6.1 General

For the specification of the TOM protocol, see 3GPP TS 44.064.

# 6.2 Remaining Octets of TOM Protocol Header for RRLP

The number of remaining octet following the first octets of the TOM protocol header for RRLP is one. The encoding of this octet is defined in the figure 6.1 and the table 6.1.

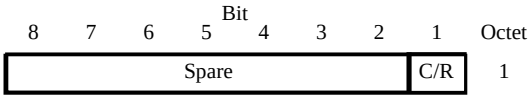


**Figure 6.1: Remaining Octets of TOM Protocol Header for RRLP**

**Table 6.1: C/R bit content**

| C/R | UI frame information field |
|---|---|
| 0 | Command (SMLC to MS) or Final Response (MS to SMLC) |
| 1 | Not Command or Final Response |

The setting of the C/R flag is provided by the sending RRLP entity, for further details see 3GPP TS 43.059.

The Spare bits shall be ignored by the receiver and set to 0 by the sender. If a protocol header with more than one remaining octet of the TOM protocol header is received, the additional octets after the first remaining octet shall be ignored by the receiver.

# Annex A (informative): Description of Components

## A.1 Introduction

This annex describes the contents of components.

## A.2 Measure Position Request

### A.2.1 General

The Measure Position Request is a RRLP component from the SMLC to the MS. This component is common to both E-OTD and GPS location methods. As a response to this component, the MS performs E-OTD or GPS measurements and possibly calculates its own position, if the MS and/or the network support these options. It contains the following elements.

**Table A.1: Measure Position Request component content**

| Element | Type/Reference | Presence |
|---|---|---|
| Positioning Instructions | Positioning Instructions 2.2.1 | M |
| E-OTD Reference BTS for Assistance Data | E-OTD Reference BTS for Assistance Data 2.2.2 | O |
| E-OTD Measurement Assistance Data | E-OTD Measurement Assistance Data 2.2.3 | O |
| E-OTD Measurement Assistance Data for System Information List | E-OTD Measurement Assistance Data for System Information List 2.2.4 | O |
| GPS Assistance Data | GPS Assistance Data 4.2.4 | O |
| GPS Time Assistance Measurement Request | GPS Time Assistance Measurement Request 2.2.4a | O |
| GPS Reference Time Uncertainty | GPS Reference Time Uncertainty 2.2.4b | O |
| Extended Reference | Extended Reference 2.2.5 | O |

### A.2.2 Elements

#### A.2.2.1 Positioning Instructions Element

The purpose of Positioning Instructions element is to express the allowed/required location method(s), and to provide information required QoS. This element is mandatory in the Measure Position Request message, and contains the following fields:

**Method Type**

This field indicates whether MS based or assisted version is allowed/requested. If the Methods field includes more than one method, the Method Type applies to all of them. This field is mandatory, and has the following values:

'0': MS assisted;

'1': MS based;

'2': MS based is preferred, but MS assisted is allowed;

'3': MS assisted is preferred, but MS based is allowed.

In GPS positioning methods, ‘MS based’ may indicate either MS Based Assisted GPS method or Conventional GPS method. If ‘MS based is indicated with no GPS assistance data then the MS may interpret this as either Conventional GPS or MS based A-GPS without assistance data.

**Positioning Methods**

This field indicates which location method or methods should be used. This field is mandatory.

'0': E-OTD;

'1': GPS;

'2': E-OTD or GPS (i.e. both can be reported).

**Response Time**

This field indicates the desired response time. However, when performing measurements, the desired response time may be exceeded. This field is mandatory.

The response time is $2^N$ seconds, where N is the value in this field. Thus the desired maximum response time can be 1, 2, 4, 8, 16, 32, 64, or 128 seconds.

Range: 0-7

**Accuracy**

This field indicates the required accuracy of the location estimate. This is field is mandatory when Method Type is '1', '2', or '3' and optional when Method Type is '0'.

This field is 7 bit Uncertainty Code as defined in 3GPP TS 23.032.

**Multiple Sets**

This field indicates whether MS is requested to send multiple *E-OTD/GPS Measurement Information Sets*. The maximum number of measurement sets is three. This is field is mandatory. MS is expected to include the current measurement set. Additionally MS may include historical measurement sets, or measure new additional sets if the response time allows that:

'0': multiple IEs can be send;

'1': sending of multiple sets is not allowed.

**Environment Characterization**

Environment Characterization field provides the MS with information about expected multipath and NLOS in the current area. This field is optional.

'0': possibly heavy multipath and NLOS conditions (e.g. bad urban or urban).

'1': no or light multipath and usually LOS conditions (e.g. suburban or rural).

'2': not defined or mixed environment.

'3': reserved for future use.

### A.2.2.2 E-OTD Reference BTS for Assistance Data Element

The RTD and 51 multiframe offset values in the E-OTD Measurement Assistance Data element and the E-OTD Measurement Assistance Data for System Information List element are calculated relative to the BTS indicated in this element. Also the E-OTD Measurement Assistance data for System Information List element, if present, refers to the System Information Neighbor List of this reference BTS.

Inclusion of this parameter is mandatory for E-OTD since it is not possible to reliably default to the current serving BTS for the target MS, as there is a small chance that the SMLC does not know this. If the E-OTD Measurement Assistance data for System Information List element is present, the current serving cell must be the same as reference BTS identified in this element.

**BCCH Carrier**

This field indicates the absolute RF channel number of BCCH of the reference BTS. This field is mandatory.

Range: 0 – 1023

**BSIC**

This field indicates the BSIC (Base Station Identity Code) of the reference BTS. This field is mandatory.

Range: 0 - 63

**Time Slot Scheme**

The Time Slot Scheme field indicates the type of transmission scheme the reference BTS is using. If the MS measures BTSs signals from time slots other than 0 or 4, and it is informed about the burst length schemes used by BTSs, then it can compensate for the possible error. (This is necessary if the MS averages bursts from different time slots, and the BTS uses varying lengths of bursts.) This field is mandatory.

'0' = all time slots are 156.25 bits long.

'1' = time slots 0 and 4 are 157 bits long and other time slots are 156 bits long.

**BTS Position**

This field contains the BTS position in the format defined in 3GPP TS 23.032. This field is optional, but should be present for MS based E-OTD positioning. The allowed shapes are:

- ellipsoid point;
- ellipsoid point with altitude and uncertainty ellipsoid.

### A.2.2.3 E-OTD Measurement Assistance Data Element

This element identifies BTSs that are used for E-OTD measurements. This element helps the MS to make measurements from neighbor BTS (even below decoding level). This element is optional in the Measure Position Request component. The presence of this element means that the MS should try to measure the E-OTD values between the reference BTS and the BTSs identified in this element.

This element is used to deliver E-OTD measurement assistance data for those BTSs, that are not included in the System Information Neighbor List of the reference BTS, if necessary.

The RTD and 51 multiframe offset values are calculated relative to the BTS indicated in the E-OTD Reference BTS for Assistance Data element. This element contains the following fields.

**Number of BTSs**

This field indicates how many BTSs are included in this IE. This field is mandatory. The maximum number of BTSs in this message for whom the assistance data can be given is 16 (reference BTS and 15 neigbour BTSs). Thus the sum of **Number of BTSs** field in this IE and total amount of **E-OTD Neighbor present** bits with value '1' in **E-OTD Measurement Assistance Data for System Information List IE** can be at a maximum 15.

Range: 1 to 15.

The following fields are repeated for the number of BTSs included in the Number of BTSs field.

**BCCH Carrier**

This field indicates the absolute RF channel number of BCCH of the particular BTS. This field is mandatory.

Range: 0 – 1023

**BSIC**

This field indicates the BSIC (Base Station Identity Code) of the particular BTS. This field is mandatory.

Range: 0 - 63

**Multiframe Offset**

This field indicates the frame difference between the start of the 51 multiframes frames being transmitted from this BTS and the reference BTS. The multiframe offset is defined as $T_{BTS}$ - $T_{Ref}$, where $T_{BTS}$ is the time of the start of the 51 multiframe in the BTS in question, and $T_{Ref}$ is the time of the start of the 51 multiframe in the reference BTS. This field is mandatory. Multiframe Offset may be used to calculate the Expected Multiframe Offset (the Multiframe Offset value that MS is expected to measure between this BTS and reference BTS in its current estimated location).

Expected Multiframe Offset = (Multiframe Offset + Adjustment) modulo 51

Adjustment = 1 if Rough RTD – Expected OTD >= 850

Adjustment = -1 if Rough RTD – Expected OTD =< -850

Adjustment = 0 if –400 =< Rough RTD – Expected OTD =< 400

If the Rough RTD – Expected OTD is not within any of the ranges above, an error has occurred and the Expected OTD should be ignored and no Expected Multiframe Offset can be calculated.

Range: 0 - 51

Usable range of Multiframe Offset value is 0 – 50. The Multiframe Offset value 51 shall not be encoded by the transmitting entity and shall be treated by the receiving entity as 0.

**Time Slot Scheme**

The Time Slot Scheme field indicates the type of transmission scheme the particular BTS is using. If the MS measures BTSs signals from time slots other than 0 or 4, and it is informed about the burst length schemes used by BTSs, then it can compensate for the possible error. (This is necessary if the MS averages bursts from different time slots, and the BTS uses varying lengths of bursts.) This field is mandatory.

'0' = all time slots are 156.25 bits long.

'1' = time slots 0 and 4 are 157 bits long and other time slots are 156 bits long.

**Rough RTD**

This field indicates the rough RTD value between this BTS and reference BTS. The used resolution is 1 bits. This RTD value is the RTD value of TS0s (i.e. the difference in starting of TS0), not only the RTD between starts of bursts. The RTD is defined as $T_{BTS}$ - $T_{Ref}$, where $T_{BTS}$ is the time of the start of TS0 in the BTS in question, and $T_{Ref}$ is the time of the start of the TS0 in the reference BTS. This field is mandatory.

Range: 0 - 1250

Usable range of Rough RTD value is 0 - 1249. The Rough RTD value 1250 shall not be encoded by the transmitting entity and shall be treated by the receiving entity as 0.

Accurate RTD values are needed for MS based E-OTD, i.e. when the MS calculates its own position.

**Expected OTD**

This field indicates the OTD value that MS is expected to measure between this BTS and reference BTS in its current estimated location. SMLC can estimate MS's location roughly e.g. based on serving BTS coordinates, TA, and possibly some other information. The used resolution is 1 bits. This OTD value is the OTD value of TS0s (i.e. the difference in starting of TS0), not only the OTD between starts of bursts. The OTD is defined as $T_{BTS}$ - $T_{Ref}$, where $T_{BTS}$ is the time of the start of TS0 in the BTS in question, and $T_{Ref}$ is the time of the start of the TS0 in the reference BTS. This is element is Release 98 extension and it is an optional element included in Release98-Ext IE. SMLC shall send this element to MS supporting MS Assisted or MS Based E-OTD.

Range: 0 – 1250

Usable range of Expected OTD value is 0 – 1249. The Expected OTD value 1250 shall not be encoded by the transmitting entity and shall be treated by the receiving entity as 0.

**Uncertainty Of Expected OTD**

This field indicates the uncertainty in Expected OTD value. The uncertainty is related to SMLC's estimation of MS's location. The uncertainty defines following search window for MS, that it can use to speed up the OTD measurements:

Expected OTD – Uncertainty < measured OTD < Expected OTD + Uncertainty.

This is element is Release 98 extension and it is an optional element included in Release98-Ext IE. SMLC shall send this element to MS supporting MS Assisted or MS Based E-OTD.

Range is 0 – 7 with following encoding:

| | |
|---|---|
| '0' | 0 < uncertainty <= 2 bit; |
| '1' | 2 < uncertainty <= 4 bit; |
| '2' | 4 < uncertainty <= 8 bit; |
| '3' | 8 < uncertainty <= 12 bit; |
| '4' | 12 < uncertainty <= 16 bit; |
| '5' | 16 < uncertainty <= 22 bit; |
| '6' | 22 < uncertainty <= 30 bit; |
| '7' | uncertainty > 30 bit. |

NOTE: If uncertainty in MS's location is x bits, uncertainty in Expected OTD is 2*x (in the worst case). When the uncertainty is given with value '7' no upper bound exist for the uncertainty.

The following fields tell the coordinates of neighbor BTSs that are used for E-OTD measurements, and also fine RTD values. This information allows the MS to calculate its own location. These fields (Fine RTD, Relative north, Relative east and Relative altitude) are optional. All of Fine RTD, Relative north, and Relative east fields must be present, if some of them is included.

**Fine RTD**

This field indicates the fine RTD value between this BTS and reference BTS. It provides the 1/256 bit duration resolution to the value expressed in the corresponding Rough RTD field. This RTD value is the RTD value of TS0s (i.e. the difference in starting of TS0), not only the RTD between starts of bursts. The RTD is defined as $T_{BTS} - T_{Ref}$, where $T_{BTS}$ is the time of the start of TS0 in the BTS in question, and $T_{Ref}$ is the time of the start of the TS0 in the reference BTS. This field is optional.

Range: 0 - 255

**Relative North**

This field indicates the distance of the neighbor BTS from the reference BTS in north- (negative values mean south) direction. This field is optional. The units are 0.03 seconds. The used reference ellipsoid is WGS 84 ellipsoid.

Range: -200000…200000

**Relative East**

This field indicates the distance of the neighbor BTS from the reference BTS in east (negative values mean west) direction. This field is optional. The units are 0.03 seconds. The used reference ellipsoid is WGS 84 ellipsoid.

Range: -200000 … 200000

**Relative Altitude**

This field indicates the altitude of the neighbor BTS relative to the reference BTS in meters. This field is optional.

Range: -4000 .. 4000 meters

## A.2.2.4a GPS Time Assistance Measurement Request element

This component does not have any information contents. If this component is present, the MS is requested to return GPS time assistance measurements.

## A.2.2.4b GPS Reference Time Uncertainty element

This element provides the accuracy of the relation GPS and GSM time in the Reference Time field in GPS Assistance Data IE. If GPS TOW is the given GPS time, then the true GPS time, corresponding to the provided GSM time as observed at the MS location, lies in the interval (GPS TOW - GPS Reference Time Uncertainty, GPS TOW + GPS Reference Time Uncertainty). An entity that supports this element shall always include it when appropriate. This means that when the element is expected but is not received, lack of support at the sender can be assumed and some implementation dependent default interpretation can then be applied.

The uncertainty *r*, expressed in microseconds, is mapped to a number K, with the following formula:

$r = C*(((1+x)^K)-1)$

with $C = 0.0022$ and $x = 0.18$. With $0 \leq K \leq 127$, a suitably useful range between 0 and 3 second is achieved for the uncertainty, while still being able to code down to values as small as 0.3 nanoseconds. To encode any higher value of uncertainty than that corresponding in the above formula to K=127, the same value, K=127, shall also be used. The uncertainty is then coded on 7 bits, as the binary encoding of K.

**Table A.1a: Example values for the GPS Reference Time Uncertainty Parameter Format**

| Value of K | Value of uncertainty |
|---|---|
| 0 | 0 nanoseconds |
| 1 | 0.396 nanoseconds |
| 2 | 0.863 nanoseconds |
| - | - |
| 50 | 8.64 microseconds |
| - | - |
| 127 | $\geq$ 2.96 seconds |

## A.2.2.4 E-OTD Measurement Assistance Data for System Information List Element

This element identifies those BTSs in the System Information Neighbor List that are used for E-OTD measurements. The System Information Neighbor Lists, to which this assistance data is given, are System Information Neighbor Lists that are sent in the dedicated mode, packet idle mode, packet transfer mode, or dual transfer mode. This element helps the MS to make measurements from those neighbor BTS (even below decoding level). This element is optional in the Measure Position Request component. The presence of this element means that the MS should use the BTSs identified here to the E-OTD measurements.

The RTD and 51 multiframe offset values are calculated relative to the reference BTS. This element contains the following fields.

**Number of Neighbors**

This field indicates how many neighbors are included in this IE.

Range: 1-32

The following fields are repeated for the number indicated in the Number of Neighbors field.

**E-OTD Neighbor present**

This field indicates whether the information concerning a certain BTS in the Neighbor List is present. Altogether no more than 15 BTS can have the indication "Neighbor is included". The maximum number of BTSs in this message for whom the assistance data can be given is 16 (reference BTS and 15 neigbour BTSs). Thus the sum of total amount of **E-OTD Neighbor present** bits with value '1' in this IE and **Number of BTSs** field in **E-OTD Measurement Assistance Data IE** can be at a maximum 15.

'0' Neighbor not included;

'1' Neighbor is included.

The following fields (BSIC, Multiframe Offset, Time Slot Sscheme and Rough RTD) are included if E-OTD neighbor present field is set to '1'.

**BSIC**

This field indicates the BSIC (Base Station Identity Code) of the particular BTS. This field is mandatory.

Range: 0 - 63

**Multiframe Offset**

This field indicates the frame difference between the start of the 51 multiframes frames being transmitted from this BTS and the reference BTS. The multiframe offset is defined as $T_{BTS}$ - $T_{Ref}$, where $T_{BTS}$ is the time of the start of the 51 multiframe in the BTS in question, and $T_{Ref}$ is the time of the start of the 51 multiframe in the reference BTS. This field is mandatory. Multiframe Offset may be used to calculate the Expected Multiframe Offset (the Multiframe Offset value that MS is expected to measure between this BTS and reference BTS in its current estimated location).

Expected Multiframe Offset = (Multiframe Offset + Adjustment) modulo 51

Adjustment = 1 if Rough RTD – Expected OTD >= 850

Adjustment = -1 if Rough RTD – Expected OTD =< -850

Adjustment = 0 if –400 =< Rough RTD – Expected OTD =< 400

Range: 0 - 51

Usable range of Multiframe Offset value is 0 – 50. The Multiframe Offset value 51 shall not be encoded by the transmitting entity and shall be treated by the receiving entity as 0.

**Time Slot Scheme**

The Time Slot Scheme field indicates the type of transmission scheme the particular BTS is using. If the MS measures BTSs signals from time slots other than 0 or 4, and it is informed about the burst length schemes used by BTSs, then it can compensate for the possible error. (This is necessary if the MS averages bursts from different time slots, and the BTS uses varying lengths of bursts.) This field is mandatory.

'0' = all time slots are 156.25 bits long;

'1' = time slots 0 and 4 are 157 bits long and other time slots are 156 bits long.

**Rough RTD**

This field indicates the RTD value between this BTS and the reference BTS. The used resolution is 1 bit. This RTD value is the RTD value of TS0s (i.e. the difference in starting of TS0), not only the RTD between starts of bursts. The RTD is defined as $T_{BTS}$ - $T_{Ref}$, where $T_{BTS}$ is the time of the start of TS0 in the BTS in question, and $T_{Ref}$ is the time of the start of the TS0 in the reference BTS. This field is mandatory.

Range: 0 - 1250

Usable range of Rough RTD value is 0 - 1249. The RoughRTD value 1250 shall not be encoded by the transmitting entity and shall be treated by the receiving entity as 0.

**Expected OTD**

This field indicates the OTD value that MS is expected to measure between this BTS and reference BTS in its current estimated location. SMLC can estimate MS's location roughly e.g. based on serving BTS coordinates, TA, and possibly some other information. The used resolution is 1 bits. This OTD value is the OTD value of TS0s (i.e. the difference in starting of TS0), not only the OTD between starts of bursts. The OTD is defined as $T_{BTS}$ - $T_{Ref}$, where $T_{BTS}$ is the time of the start of TS0 in the BTS in question, and $T_{Ref}$ is the time of the start of the TS0 in the reference BTS. This element is Release 98 extension and it is an optional element included in Release98-Ext IE. SMLC shall send this element to MS supporting MS Assisted or MS Based E-OTD.

Range: 0 – 1250

Usable range of Expected OTD value is 0 – 1249. The Expected OTD value 1250 shall not be encoded by the transmitting entity and shall be treated by the receiving entity as 0.

**Uncertainty Of Expected OTD**

This field indicates the uncertainty in Expected OTD value. The uncertainty is related to SMLC's estimation of MS's location. The uncertainty defines following search window for MS, that it can use to speed up the OTD measurements:

Expected OTD – Uncertainty < measured OTD < Expected OTD + Uncertainty.

This element is Release 98 extension and it is an optional element included in Release98-Ext IE. SMLC shall send this element to MS supporting MS Assisted or MS Based E-OTD.

Range is 0 – 7 with following encoding:

| | |
|---|---|
| '0' | 0 < uncertainty <= 2 bit; |
| '1' | 2 < uncertainty <= 4 bit; |
| '2' | 4 < uncertainty <= 8 bit; |
| '3' | 8 < uncertainty <= 12 bit; |
| '4' | 12 < uncertainty <= 16 bit; |
| '5' | 16 < uncertainty <= 22 bit; |
| '6' | 22 < uncertainty <= 30 bit; |
| '7' | uncertainty > 30 bit. |

NOTE: If uncertainty in MS's location is x bits, uncertainty in Expected OTD is 2*x (in the worst case). When the uncertainty is given with value '7' no upper bound exist for the uncertainty.

The following fields tell the coordinates of neighbor BTSs that are used for E-OTD measurements, and also fine RTD values. This information allows the MS to calculate its own location. These fields (Fine RTD, Relative north, Relative east and Relative altitude) are optional. All of Fine RTD, Relative north, and Relative east fields must be present, if some of them is included.

**Fine RTD**

This field indicates the fine RTD value between this BTS and reference BTS. It provides the 1/256 bit duration resolution to the value expressed in the corresponding Rough RTD field. This RTD value is the RTD value of TS0s (i.e. the difference in starting of TS0), not only the RTD between starts of bursts. The RTD is defined as $T_{BTS}$ - $T_{Ref}$, where $T_{BTS}$ is the time of the start of TS0 in the BTS in question, and $T_{Ref}$ is the time of the start of the TS0 in the reference BTS. This field is optional.

Range: 0 - 255

**Relative North**

This field indicates the distance of the neighbor BTS from the reference BTS in north- (negative values mean south) direction. This field is optional. The units are 0.03 seconds. The used reference ellipsoid is WGS 84 ellipsoid.

Range: -200000…200000

**Relative East**

This field indicates the distance of the neighbor BTS from the reference BTS in east (negative values mean west) direction. This field is optional. The units are 0.03 seconds. The used reference ellipsoid is WGS 84 ellipsoid.

Range: -200000 … 200000

**Relative Altitude**

This field indicates the altitude of the neighbor BTS relative to the reference BTS in meters. This field is optional.

Range: -4000 .. 4000 meters

## A.2.2.5 Extended Reference IE

This element is mandatory in any RRLP Measure Position Request component and in any RRLP Assistance Data component.

NOTE: For reasons of backward compatibility, the IE is not defined for a Release 4 or earlier SMLC and would be ignored, when received, by a Release 4 or earlier MS. Additionally, other requirements associated with this IE would not be supported by a Release 4 or earlier MS or SMLC.

The Extended Reference IE contains the following elements:

SMLC code: an integer in the range 0-63 distinguishing any SMLC from other neighbour SMLCs in the same Routing Area. Each SMLC is assigned a specific SMLC ID value. The values assigned to neighbour SMLCs in the same Routing Area between which inter-NSE cell change is possible should be different.

Transaction ID: an integer in the range 0-262143 distinguishing different RRLP transactions in different MSs currently being served by the same SMLC. An SMLC shall assign a different transaction ID to each currently open RRLP transaction for positioning and assistance data delivery among all target MSs. When any RRLP transaction for any MS is completed in the SMLC (e.g. the MS has sent a correctly formatted RRLP Measure Position Response or Assistance Data Ack.) or if the transaction is aborted (e.g. SMLC timeout on an RRLP response), the associated transaction ID value shall become free and may be later assigned to a new RRLP transaction by the SMLC. When any transaction ID value becomes free, an SMLC should attempt to wait for at least 128 seconds (the maximum defined RRLP response time from an MS) before reassigning the same value.

# A.3 Measure Position Response

## A.3.1 General

The Measure Position Response is a RRLP component from the MS to the network. It is the response to the Measure Position Request. It contains the following elements. One of the three elements containing measurement data or location estimate (*E-OTD Measurement Information*, *Location Information* or *GPS Measurement Information)* or *Location Information Error element* must be included.

**Table A.2: Measure Position Response component content**

| Element | Type/Reference | Presence |
|---|---|---|
| Multiple Sets | Multiple Sets 3.2.1 | O |
| Reference BTS Identity | Reference BTS Identity 3.2.2 | O |
| E-OTD Measurement Information | E-OTD Measurement Information 3.2.3 | O |
| Location Information | Location Information 3.2.4 | O |
| GPS Measurement Information | GPS Measurement Information 3.2.5 | O |
| Location Information Error | Location Information Error 3.2.6 | C |
| GPS Time Assistance Measurements | GPS Time Assistance Measurements 3.2.6a | O |
| Extended Reference | Extended Reference 3.2.7 | C |
| Uplink RRLP Pseudo Segmentation Indication | Uplink RRLP Pseudo Segmentation Indication 3.2.8 | C |

## A.3.2 Elements

### A.3.2.1 Multiple Sets Element

This element indicates how many E-OTD Measurement Information sets or GPS Measurement Information sets, and Reference BTS Identities are included to this element. This element is optional. If this element is absent, a single measurement set is included.

**Number of E-OTD/GPS Measurement Information Sets**

This field indicates the number of *Number of E-OTD/GPS Measurement Information* sets included to this component. This field is mandatory. If both types of measurement elements are present, then there are the equal number of them, and each pair has the same reference BTS.

Range: 2 - 3

**Number of Reference BTS**

This field indicates the number of reference BTSs used in this component. This field is mandatory.

Range: 1-3

**Reference BTS relation to Measurement Elements**

This field indicates how the reference BTSs listed in this element relate to measurement sets later in this component. This field is conditional and included only if Number of E-OTD/GPS Measurement Information Sets is '3' and Number of Reference BTSs is '2'.

'0' = First reference BTS is related to first and second E-OTD/GPS Measurement Information Sets, and second reference BTS is related to third E-OTD/GPS Measurement Information Sets.

'1' = First reference BTS is related to first and third E-OTD/GPS Measurement Information Sets, and second reference BTS is related to second E-OTD/GPS Measurement Information Sets.

'2' = First reference BTS is related to first E-OTD/GPS Measurement Information Sets, and second reference BTS is related to second and third E-OTD/GPS Measurement Information Sets.

If this field is not included, the relation between reference BTS and Number of E-OTD/GPS Measurement Information Sets is as follows:

- if there are three sets and three reference BTSs -> First reference BTS relates to first set, second reference BTS relates to second set, and third reference BTS relates to third set;
- if there are two sets and two reference BTS -> First reference BTS relates to first set, and second reference BTS relates to second set;
- if there is only one reference BTS and 1-3 sets -> this reference BTS relates to all sets.

### A.3.2.2 Reference BTS Identity Element

This element identifies the reference BTS(s). This element is conditional to the number of reference BTSs. It is mandatory, if there is more than one reference BTS, and optional otherwise. If this element is not included, the Reference BTS, used in other elements, is the current serving BTS of MS. If this element is included, the BTSs defined here are used as Reference BTSs in all other elements.

*The following fields are repeated for the number of reference BTSs included in the Number of Reference BTS field.*

**CellIdType**

This field indicates is the identity method of the Reference BTS. This field is mandatory within this element.

'0' = Cell identity is told using BSIC and BCCH carrier.

'1' = Cell identity is told using CI, and the LAC is the same as the current serving BTS.

'2' = Cell identity is told using an index referring to the BTS listed in the Measure Position Request component (the indicated reference BTS is 1)

'3' = Cell identity is told using an index referring to the BTS listed in the BCCH allocation list (System Information Neighbor Lists) of the serving BTS. This type of reference identity shall not be used by the MS unless it has received the “E-OTD Measurement Assistance Data for System Information List Element” from the SMLC for this cell.

'4' = Cell identity is told using CI, and the LAC.

**Reference LAC**

This field indicates the Location Area Code of the reference BTS. The purpose of the Location Area Code is to identify a location area. This field is conditional, and included, if CellIDType field is '4'.

Range: 0 - 65535

**Reference CI**

This field indicates the Cell Identity value of the reference BTS. The purpose of the Cell Identity value is to identify a cell within a location area. This field is conditional, and included, if CellIDType field is '1' or '4'.

Range: 0 – 65535

**Reference BCCH Carrier**

This field indicates the absolute RF channel number of the BCCH of the reference base station. BCCH carrier field is conditional and is included only if CellIdType is set '0'.

Range: 0 - 1023

**Reference BSIC**

This field indicates the BSIC (Base Station Identity Code of the base station).

BSIC field is conditional and is included only if CellIdType is set '0' or '3'.

Range: 0 - 63

**Request Index**

This field indicates an index identifying the reference BTS by referring to the BTSs listed in the Measure Position Request component (the indicated reference BTS in the Measure Position Request component has the index value 1, and possible next BTS '2', and so on )

This field is conditional and included only if CellIdType is set to '2'.

Range: 1-16

**System Info Index**

This field indicates an index identifying the reference BTS by referring to the BCCH allocation list (System Information Neighbor List) of the serving BTS .

This field is conditional and included only if CellIdType is set to '3'.

Range: 1-32

### A.3.2.3 E-OTD Measurement Information Element

The purpose of the E-OTD Measurement Information element is to provide OTD measurements of signals sent from the reference and neighbor based stations. The length of this element depends on the number of neighbor cells for which OTD measurements have been collected. This element is optional in the Measure Position Response component. It is included in the Measure Position Response component, if the network has requested the mobile to perform the MS assisted E-OTD method. BTSs which cannot be measured or whose measurements are excessively inaccurate need not be reported. The MS may include measurements for other BTSs not given in the assistance data by the SMLC.

The E-OTD and 51 multiframe offset values are reported relative to the reference BTS as defined in the previous sub-clauses.

The following fields are repeated for each measurement set.

**Reference Frame Number**

This field indicates the frame number of the last measured burst from the reference BTS modulo 42432. This information can be used as a time stamp for the measurements. This field is mandatory.

Range: 0 – 42431

**Reference Time Slot**

Reference Time Slot indicates the time slot modulo 4 relative to which the MS reports the reference BTS measurements. This field is mandatory.

Range: 0 to 3

NOTE 1: If MS does not know timeslot scheme, the MS reports the used timeslot. MS can only report results based on one time slot (N) or two time slots (N and N+4). If the MS knows the timeslot scheme, it can make measurements from several timeslots and reports that the used timeslot is zero (and makes correction).

**Reference Quality**

Reference Quality field includes the standard deviation of the TOA measurements from the reference BTS with respect to $T_{Ref}$ (where $T_{Ref}$ is the time of arrival of signal from the reference BTS used to calculate the OTD values). This field

is optional. The Reference Quality field can be used to evaluate the reliability of E-OTD measurements in the SMLC and in weighting of the E-OTD values in the location calculation.

Following linear 5 bit encoding is used:

'00000' 0 – (R*1-1) meters;
'00001' R*1 – (R*2-1) meters;
'00010' R*2 – (R*3-1) meters;
…
'11111' R*31 meters or more.

where R is the resolution defined by Std Resolution field. For example, if R=20 meters, corresponding values are 0 – 19 meters, 20 – 39 meters, 40 – 59 meters, …, 620+ meters.

**Number of Measurements**

Number of Measurements for the Reference Quality field is used together with Reference Quality to define quality of the reference base site TOA. The field indicates how many measurements have been used in the MS to define the standard deviation of the measurements. Following 3 bit encoding is used:

'000': 2-4;
'001': 5-9;
'010': 10-14;
'011': 15-24;
'100': 25-34;
'101': 35-44;
'110': 45-54;
'111': 55 or more.

This field is optional.

**Std Resolution**

Std Resolution field includes the resolution used in Reference Quality field and Std of EOTD Measurements field. Encoding on 2 bits as follows:

'00' 10 meters;
'01' 20 meters;
'10' 30 meters;
'11' Reserved.

This field is mandatory.

**TA Correction**

This field indicates the estimate of the time difference between the moment that the MS uses to adjust its internal timing for reception and transmission (e.g. corresponding to maximum energy) and the estimate of the reception of the first arriving component from the serving BTS. This value can be used as a correction by the SMLC to the Timing Advance (TA) value when the distance between the MS and the serving BTS is estimated based on TA.

The value *TACor* in this field corresponds to the TA Correction in bit periods as follows:

- TA Correction in bit periods = *TACor*/64 –8.

TA Correction has the resolution of 1/64 bit period, and the range – 8 … +7 bit periods. Negative TA Correction in bits indicates that the first signal component from the serving BTS is estimated to arrive before the moment used for communication. This field is optional.

Range: 0-960

**Number of Measured Neighbors**

This field indicates the number of different neighbor BTSs. This field is mandatory.

Range: 0 - 10

NOTE 2: If the MS can not measure any neighbor BTSs, then this value is set to '0'.

*The following fields are repeated for the number of BTSs included in the Number of Measured Neighbors field.*

**Neighbor Identity Present**

The presence of this field is conditional, it shall not be present in the first set. It is mandatory for the other sets. This field indicates whether the identity information (i.e. CellIDType and possibly Neighbor CI / Neighbor BCCH Carrier / Neighbor BSIC / Neighbor Multiframe Offset / Request Index / System Info Index fields) concerning a certain BTS is present or whether the BTS identity is given as reference to the first measurement set.

'0' Identity information not included, and identity of this BTS is same as the identity of BTS in first set with same sequence number.

'1' Identity information is included.

**CellIdType**

This field indicates is the identity method of the cell. This field is conditional, and included if Neighbor Identity Present is '1'**.** If CellIdType field is not present, the following fields can not be present either: Neighbor CI, Neighbor BCCH Carrier, Neighbor BSIC, Neighbor Multiframe Offset, Request Index, System Info Index.

'0' = Cell identity is told using BSIC and BCCH carrier.

'1' = Cell identity is told using CI, and the LAC is the same as the current serving BTS.

'2' = Cell identity is told using 51 Multiframe offset and BCCH carrier.

'3' = Cell identity is told using an index referring to the BTS listed in the Measure Position Request component (the indicated reference BTS is 1).

'4' = Cell identity is told using an index referring to the BTS listed in the BCCH allocation list (System Information Neighbor Lists) of the serving BTS. This type of neighbor identity shall not be used by the MS unless it has received the “E-OTD Measurement Assistance Data for System Information List Element” from the SMLC for this cell.

'5' = Cell identity is told using CI and the LAC.

NOTE: The MS can decide which of these methods to use. The CellIdType '3' and '4' are preferred.

**Neighbor LAC**

This field indicates the Location Area Code of the neighbor BTS. The purpose of the Location Area Code is to identify a location area. This field is conditional, and included, if CellIDType field is '5'.

Range: 0 - 65535

**Neighbor CI**

This field indicates the Cell Identity of the particular neighbor cell. The purpose of the Cell Identity value is to identify a cell within a location area.

Neighbor CI field is conditional and is included only if CellIdType is set '1' or '5' and the CI value of the given cell is available.

Range: 0 - 65535

**Neighbor BCCH Carrier**

This field indicates the absolute RF channel number of the BCCH of the neighbor base station. BCCH carrier field is conditional and is included only if CellIdType is set '0' or '2'.

Range: 0 - 1023

**Neighbor BSIC**

This field indicates the BSIC (Base Station Identity Code of the base station).

BSIC field is conditional and is included only if CellIdType is set '0' or '4'.

Range: 0 - 63

**Neighbor Multiframe Offset**

This field indicates the frame difference between the start of the 51 multiframes frames arriving from this BTS and the reference BTS. The multiframe offset is defined as $T_{BTS} - T_{Ref}$, where $T_{BTS}$ is the time of the start of the 51 multiframe in the BTS in question, and $T_{Ref}$ is the time of the start of the 51 multiframe in the reference BTS. This field is conditional and included only if CellIdType is set to '2'.

Range: 0 - 51

**Request Index**

This field indicates an index identifying the reference BTS by referring to the BTSs listed in the Measure Position Request component (the indicated reference BTS in the Measure Position Request component has the index value 1, and possible next BTS '2', and so on).

This field is conditional and included only if CellIdType is set to '3'.

Range: 1-16

**System Info Index**

This field indicates an index identifying the reference BTS by referring to the BCCH allocation list (System Information Neighbor List) of the serving BTS.

This field is conditional and included only if CellIdType is set to '4'.

Range: 1-32

**Neighbor Time Slot**

Neighbor Time Slot indicates the time slot modulo 4 relative to which the MS reports the neighbor BTS measurements. This field is mandatory.

Range: 0 to 3

NOTE 3: If the MS does not know the timeslot scheme, the MS reports the used timeslot. MS can only report a result based on one time slot (N) or two time slots (N and N+4). If the MS knows the timeslot scheme, the MS can make measurements from several timeslots and reports that the used timeslot is zero (and makes correction).

**Number of EOTD Measurements**

Number of Measurements field is used together with Std of EOTD Measurements field to define quality of a reported EOTD measurement. The field indicates how many EOTD measurements have been used in the MS to define the standard deviation of these measurements. Following 3 bit encoding is used.

'000': 2-4;
'001': 5-9;
'010': 10-14;
'011': 15-24;
'100': 25-34;
'101': 35-44;
'110': 45-54;
'111': 55 or more.

This field is mandatory.

**Std of EOTD Measurements**

Std of EOTD Measurements field includes standard deviation of EOTD measurements. This field is mandatory. It can be used to evaluate the reliability of EOTD measurements in the SMLC and in weighting of the OTD values in location calculation.

Following linear 5 bit encoding is used:

'00000' 0 - (R*1-1) meters;
'00001' R*1 - (R*2-1) meters;
'00010' R*2 - (R*3-1) meters;
…
'11111' R*31 meters or more.

where R is the resolution defined by Std Resolution field. For example, if R=20 meters, corresponding values are 0 – 19 meters, 20 – 39 meters, 40 – 59 meters, …, 620+ meters.

**OTD**

This field indicates the measured OTD value between the receptions of signals from the reference and the neighbor BTS. The OTD is defined as $T_{Nbor}$ - $T_{Ref}$ (modulo burst length) where $T_{Nbor}$ is the time of arrival of signal from the neighbor BTS, and $T_{Ref}$ is the time of arrival of signal from the reference BTS. The reporting resolution of the OTD value is 1/256 bit. This field is mandatory.

Range: 0 – 39999

## A.3.2.3a E-OTD Measurement Extended Information Element

The purpose of the E-OTD Measurement Ext Information element is to provide OTD measurements of signals sent from the reference and neighbour base stations. The length of this element depends on the number of neighbour cells for which OTD measurements have been collected. This element is optional in the Measure Position Response component. It is included in the Measure Position Response component, if E-OTD measurements didn't fit in the E-OTD Measurement Information Element.

The E-OTD and 51 multiframe offset values are reported relative to the reference BTS as defined in the previous sub-clauses.

The following fields are valid only for the first set of measurements

**Number of Measured Neighbors**

This field indicates the number of different neighbor BTSs. This field is mandatory.

Range: 0 - 5

NOTE: If the MS can not measure any neighbor BTSs, then this value is set to '0'.

*The following fields are repeated for the number of BTSs included in the Number of Measured Neighbors field. They are defined in the previous sub-clause :*

- CellIdType,
- Neighbor LAC,
- Neighbor CI,
- Neighbor BCCH Carrier,
- Neighbor BSIC,
- Neighbor Multiframe Offset,
- Request Index,
- System Info Index,
- Neighbor Time Slot,
- Number of EOTD Measurements,
- Std of EOTD Measurements,
- OTD

### A.3.2.4 Location Information Element

The purpose of Location Information element is to provide the location estimate from the MS to the network, if the MS is capable of determining its own position. Optionally, the element may contain the velocity parameters computed by the MS.

This element is optional. This element contains the following fields.

**Reference Frame**

This field specifies the reference BTS Reference Frame number during which the location estimate was measured. The time of the Reference Frame boundary is as observed by the MS, ie without Timing Advance compensation. This field is mandatory. However, if the Reference Frame number is within (42432..65535), the value of this field shall be ignored and in that case the MS should provide GPS TOW if available.

**Table A.3: Reference Frame field contents**

| Parameter | # of Bits | Resolution | Range | Units |
|---|---|---|---|---|
| Reference Frame | 16 | --- | 0 - 65535 | frames |

Note that expected values for Reference Frame are in range 0 – 42431.

**GPS TOW**

This field specifies the GPS TOW for which the location estimate is valid , rounded down to the nearest millisecond unit. This field is optional but shall be included if GPS Time Assistance Measurements are included. If GPS Time Assistance Measurements are included in the RRLP Measure Position Response, the MS shall align GPS System time (as defined by the GPS TOW and the GPS TOW Subms fields) with the reported GSM frame boundary observed by the MS at that time.

**Table A.4: GPS TOW field contents**

| Parameter | # of Bits | Resolution | Range | Units |
|---|---|---|---|---|
| GPS TOW | 24 | 1 ms | 0 – 14399999 | ms |

The 24 bits of GPS TOW are the least significant bits. The most significant bits shall be derived by the Serving Mobile Location Center to unambiguously derive the GPS TOW.

**Fix Type**

This field contains an indication as to the type of measurements performed by the MS: 2D or 3D. This field is mandatory.

'0' = 2D fix.

'1' = 3D fix.

**Position Estimate**

This field contains the calculated position estimate in the format defined in 3GPP TS 23.032. The allowed shapes are:

- ellipsoid Point;
- ellipsoid point with uncertainty circle;
- ellipsoid point with uncertainty ellipse;
- ellipsoid point with altitude and uncertainty ellipsoid.

### A.3.2.5 GPS Measurement Information Element

The purpose of the GPS Measurement Information element is to provide GPS measurement information from the MS to the SMLC. This information includes the measurements of code phase and Doppler, which enables the network-based GPS method where position is computed in the SMLC. The proposed contents are shown in table A.5, and the individual fields are described subsequently. See also Figure A.1 for an illustration of the relation between some of the fields.

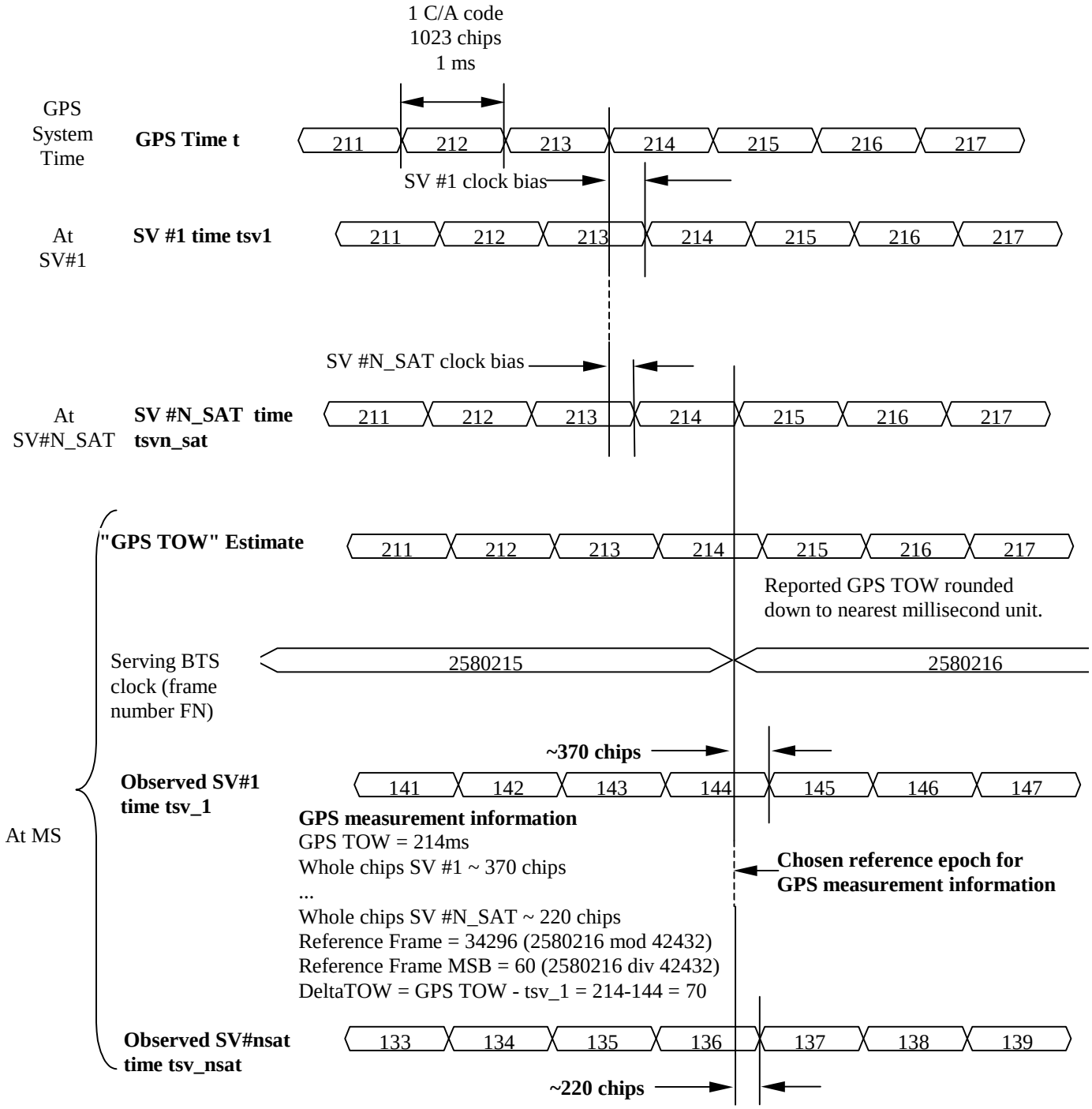


**Figure A.1. Exemplary definitions of GPS measurement information fields.**

This element is included in the Measure Position Response component if the network has requested the mobile to perform mobile-assisted location measurements using a GPS location method.

Following fields are repeated a number of times told in Number of E-OTD/GPS Measurement *Sets* field if Multiple Sets element is included. If Multiple Sets element is not included, the default value for sets is one (i.e. the following fields are present only once).

**Table A.5: GPS Measurement Information element content**

| Element fields | Presence | Occurrences |
|---|---|---|
| Reference Frame | O | 1 |
| GPS TOW | M | 1 |
| # of Satellites (*N_SAT*) | M | 1 |
| Measurement Parameters | M | *N_SAT* |

The following paragraphs describe the content of each information field of this element.

**Reference Frame**

This field is optional.

**Table A.6: Reference Frame field contents**

| Parameter | # of Bits | Resolution | Range | Units |
|---|---|---|---|---|
| Reference Frame | 16 | --- | 0 - 65535 | frames |

Note that expected values for Reference Frame are in range 0 – 42431. If Reference Frame and GPS Time Assistance Measurements both are included in the RRLP Measure Position Response, the code phase measurements shall be aligned with the reported GSM frame boundary observed by the MS at that time, as indicated in Figure A.1. The time of the Reference Frame boundary is as observed by the MS, ie without Timing Advance compensation.

**GPS TOW**

This field specifies the GPS TOW for which the location estimate is valid, rounded down to the nearest millisecond unit.This field is mandatory.

**Table A.7: GPS TOW field contents**

| Parameter | # of Bits | Resolution | Range | Units |
|---|---|---|---|---|
| GPS TOW | 24 | 1 ms | 0 – 14399999 | ms |

The 24 bits of GPS TOW are the least significant bits. The most significant bits shall be derived by the Serving Mobile Location Center to unambiguously derive the GPS TOW.

**# of Satellites (*N_SAT*)**

**Number of Measurements**

This field specifies the number of measurements for which measurements satellites are provided in the component. This value represents the number of satellites that were measured by the MS. This value of *N_SAT* determines the length of the payload portion of the component. Typical range for *N_SAT* is four to a maximum of 12. This field is mandatory and occurs once per set.

**Table A.7a: # of Satellites field contents**

| Parameter | # of Bits | Resolution | Range | Units |
|---|---|---|---|---|
| N_SAT | 4 | --- | 1 – 16 | --- |

**Measurement Parameters**

This field contains information about the measurements of code phase and Doppler, which enables the network-based method where position is computed in the SMLC. This field is mandatory and occurs *N_SAT* times per message.

**Table A.8: Measurement Parameters field contents**

| Parameter | # of Bits | Resolution | Range | Units |
|---|---|---|---|---|
| Satellite ID | 6 | --- | 0 – 63 | --- |
| $C/N_o$ | 6 | 1 | 0 – 63 | dB-Hz |
| Doppler | 16 | 0.2 | ±6553.6 | Hz |
| Whole Chips | 10 | 1 | 0 – 1022 | chips |
| Fractional Chips | 10 | $2^{-10}$ | 0 – $(1-2^{-10})$ | chips |
| Multipath Indicator | 2 | see Table A.9 | TBD | --- |
| Pseudorange RMS Error | 6 | 3 bit mantissa<br>3 bit exp | 0.5 – 112 | m |

**Satellite ID**

This field identifies the particular satellite for which the measurement data is valid. This values 0 – 63 represent satellite PRNs 1 – 64, respectively.

**$C/N_0$**

This field contains the estimate of the carrier-to-noise ratio of the received signal from the particular satellite used in the measurement. It is given in whole dBs and has a range of 0 to 63. Typical levels observed by MS-based GPS units will be in the range of 20 dB to 50 dB.

**Doppler**

This field contains the Doppler measured by the MS for the particular satellite signal. This information can be used to compute the 3-D velocity of the MS. The Doppler range is sufficient to cover the potential range of values measured by the MS.

**Whole Chips**

This field contains the whole value of the code-phase measurement made by the MS for the particular satellite signal at the time of measurement, in units of 1 GPS chip in the range from 0 to 1022 chips, where increasing binary values of the field signify increasing measured pseudoranges. The code phase measurement is divided into two fields, "Whole Chips" and "Fractional Chips".

**Fractional Chips**

This field contains the fractional value of the code-phase measurement made by the MS for the particular satellite signal at the time of measurement. The resolution of the fractional portion is approximately 0,3 m.

**Multipath Indicator**

This field contains the Multipath Indicator value. This parameter is specified according to the representation described in table A.9.

**Table A.9: Multipath Indicator values and associated indications**

| Value | Multipath Indication |
|---|---|
| 00 | Not measured |
| 01 | Low, MP error < 5m |
| 10 | Medium, 5m < MP error < 43m |
| 11 | High, MP error > 43m |

Range: 0 – 3

**Pseudorange RMS Error**

This field contains a Pseudorange RMS Error value.

Range: 0,5 m to 112 m

NOTE: This parameter is specified according to a floating-point representation as described in Table A.10.

**Table A.10: Pseudorange RMS Error representation**

| Index | Mantissa | Exponent | Floating-Point value, $x_i$ | Pseudorange value, P |
|---|---|---|---|---|
| 0 | 000 | 000 | 0.5 | P < 0.5 |
| 1 | 001 | 000 | 0.5625 | 0.5 <= P < 0.5625 |
| I | x | y | $0.5 * (1 + x/8) * 2^y$ | $x_{i-1}$ <= P < $x_i$ |
| 62 | 110 | 111 | 112 | 104 <= P < 112 |
| 63 | 111 | 111 | -- | 112 <= P |

## A.3.2.6 Location Information Error Element

The purpose of Location Information Error element is to provide the indication of error and the reason for it, when the MS can not perform the required location or the network can not determine the position estimate. The element may also indicate what further assistance data may be needed by the target MS to produce a successful location estimate or location measurements. This element is optional. This element has the following fields.

**Error Reason**

This field indicates the reason for error. This field is mandatory.

'0': Undefined error.
'1': There were not enough BTSs to be received when performing mobile based E-OTD.
'2': There were not enough GPS satellites to be received, when performing GPS location.
'3': E-OTD location calculation assistance data missing.
'4': E-OTD assistance data missing.
'5': GPS location calculation assistance data missing.
'6': GPS assistance data missing.
'7': Requested method not supported.
'8': Location request not processed.
'9': Reference BTS for GPS is not the serving BTS.
'10': Reference BTS for E-OTD is not the serving BTS.

**Additional Assistance Data**

This field is optional. Its presence indicates that the target MS will retain assistance data already sent by the SMLC. The SMLC may send further assistance data for any new location attempt but need not resend previous assistance data. The field may contain the following:

GPS Assistance Data: Necessary additional GPS assistance data (structure and encoding as for the GPS Assistance Data IE in 3GPP TS 49.031 excluding the IEI and length octets)

## A.3.2.6a GPS Time Assistance Measurements Element

This IE contains measurements that are used to define an accurate relation between GSM and GPS time or to provide additional GPS TOW information for MS Assisted A-GPS. The contents are shown in Table A.10a, and the individual fields are described subsequently.

**Table A.10a: GPS Time Assistance Measurements Information element content**

| Element fields | Presence |
|---|---|
| Reference Frame MSB | O |
| GPS TOW Subms | O |
| Delta TOW | O |
| GPS Reference Time Uncertainty | O |

**Reference Frame MSB**

This field shall be included when GPS-GSM time association is provided for either MS Based A-GPS or MS Assisted A-GPS. It indicates the Most Significant Bits (MSBs) of the frame number of the reference BTS corresponding to the GPS measurement or location estimate. Starting from the complete GSM frame number denoted FN, the MS calculates Reference Frame MSB as

Reference Frame MSB = floor(FN/42432)

The complete GSM frame number FN can then be reconstructed in the SMLC by combining the fields Reference Frame with Reference Frame MSB in the following way

FN = Reference Frame MSB*42432+Reference Frame

Range: 0-63

**GPS TOW Subms**

This field is only applicable for MS-Based A-GPS. This field indicates in units of 100ns the submillisecond part of the GPS time of measurement. This field together with the GPS TOW field in the Location Information Element provides a more accurate time stamp of the location estimate for MS based AGPS Expressed in units of microseconds. The precise GPS time of measurements in milliseconds is thus equal to

GPS TOW + 0.0001*GPS TOW Subms

The estimation of precise GPS time of measurement using AGPS is vulnerable to millisecond ambiguities. Therefore the MS shall only report this field when it is confident that any millisecond ambiguities have been avoided.

Range: 0-9999

**Delta TOW**

This field is only applicable for MS-Assisted A-GPS. This field specifies the difference in milliseconds between the GPS TOW reported in the GPS Measurement Information Element and the millisecond part of the SV time tsv_1 of the first SV in the list reported from the MS. Figure A.1 shows an example of Delta TOW calculation. The Delta TOW is defined as Delta TOW = GPS TOW - fix(tsv_1)

where fix() denotes rounding to the nearest integer towards zero. The estimation of tsv_1 which forms the basis for the calculation of Delta TOW is vulnerable to millisecond ambiguities. Therefore the MS shall only report this field when it is confident that the correct millisecond event has been recovered.

Range: 0-127

**GPS Reference Time Uncertainty**

This element is optional. It provides the accuracy of the relation GPS and GSM time in the Location Information or GPS Measurement Information Element when GPS-GSM time association is provided. For MS Assisted A-GPS when GPS-GSM time association is not provided, even if GPS Time Assistance Measurement Request is not included in the Measure Position Request, this element can be included to provide the accuracy of the reported GPS TOW. The interval, range and treatment is as described in sub-clause 2.2.4b.

## A.3.2.7 Extended Reference IE

This IE shall be included in any Measure Position Response if and only if an Extended Reference IE was received in the corresponding previous Measure Position Request message.

NOTE: For reasons of backward compatibility, a Release 4 or earlier MS will not include this IE.

The Extended Reference IE contains the following elements.

SMLC code: an integer in the range 0-63. The value returned by a target MS in a Measure Position Response shall equal the value received from the SMLC in the earlier Measure Position Request.

Transaction ID: an integer in the range 0-262143 distinguishing different RRLP transactions in different MSs currently being served by the same SMLC. The value returned by a target MS in a Measure Position Response shall equal the value received from the SMLC in the earlier Measure Position Request.

When an MS employs pseudo-segmentation to return an RRLP response, the same Extended Reference IE shall be included in each RRLP Measure Position Response component.

#### A.3.2.8 Uplink RRLP Pseudo Segmentation Indication

This element is included by the MS when up-link RRLP pseudo-segmentation is used. In the first segment, 'first of many' is indicated and in the second 'second of many' is indicated. It is not included when up-link pseudo-segmentation is not used.

## A.4 Assistance Data

### A.4.1 General

The Assistance Data is a RRLP component from the network to the MS. It is used by the network to provide assistance data to enable MS-based E-OTD or MS-based Assisted GPS capabilities in the MS and may be used to help support MS-assisted E-OTD and MS-assisted Assisted GPS. It contains the following elements.

**Table A.11: Assistance Data component content**

| Element | Type/Reference | Presence |
|---|---|---|
| E-OTD Reference BTS for Assistance Data | E-OTD Reference BTS for Assistance Data 2.2.3 | C |
| E-OTD Measurement Assistance Data | E-OTD Measurement Assistance Data 2.2.4 | C |
| E-OTD Measurement Assistance Data for System Information List | E-OTD Measurement Assistance Data for System Information List 2.2.5 | C |
| GPS Assistance Data | GPS Assistance Data 4.2.4 | C |
| GPS Time Assistance Measurement Request | GPS Time Assistance Measurement Request 4.2.4a | O |
| GPS Reference Time Uncertainty | GPS Reference Time Uncertainty 4.2.4b | O |
| More Assistance Data To Be Sent | More Assistance Data To Be Sent 4.2.5 | C |
| Extended Reference | Extended Reference 2.2.5 | C |

### A.4.2 Elements

#### A.4.2.1 E-OTD Reference BTS for Assistance Data Element

This element is conditional. It is as described in sub-clause 2.2.3. If the network can provide assistance data, and data for E-OTD has been requested, this element is included.

#### A.4.2.2 E-OTD Measurement Assistance Data Element

This element is conditional. It is as described in sub-clause 2.2.4. If the network can provide assistance data, and data for E-OTD has been requested, this element is included.

### A.4.2.3 E-OTD Measurement Assistance Data for System Information List Element

This element is conditional. It is as described in sub-clause 2.2.5. If the network can provide assistance data, and data for E-OTD has been requested, this element is included.

### A.4.2.4 GPS Assistance Data Element

The GPS Assistance Data element contains a single GPS assistance message that supports both MS-assisted and MS-based GPS methods. This element can contain one or more of the fields listed in table A.12 below, which support both MS-assisted and MS-based GPS methods. As table A.12 shows, all fields are optional.

Note that certain types of GPS Assistance data may be derived, wholly or partially, from other types of GPS Assistance data.

In addition, an Integrity Monitor (IM) shall detect unhealthy (e.g., failed/failing) satellites and also shall inform users of measurement quality in DGPS modes when satellites are healthy. Excessively large pseudo range errors, as evidenced by the magnitude of the corresponding DGPS correction, shall be used to detect failed satellites. Unhealthy satellites should be detected within 10 seconds of the occurrence of the satellite failure. When unhealthy (e.g., failed/failing) satellites are detected, the assistance and/or DGPS correction data shall not be supplied for these satellites. When the error in the IM computed position is excessive for solutions based upon healthy satellites only, DGPS users shall be informed of measurement quality through the supplied UDRE values. After bad satellites have been indicated in the Real Time Integrity field, if the satellites return to healthy condition for some period of time, the indications for them shall be removed from this field.

**Table A.12: Fields in the GPS Assistance Data element**

| Parameter | Presence | Repetition |
|---|---|---|
| Reference Time | O | Yes |
| Reference Location | O | No |
| DGPS Corrections | O | Yes |
| Navigation Model | O | Yes |
| Ionospheric Model | O | No |
| UTC Model | O | No |
| Almanac | O | Yes |
| Acquisition Assistance | O | Yes |
| Real-Time Integrity | O | Yes |

When RRLP pseudo-segmentation is used, Table A.12 indicates which parameters may be repeated in more than one RRLP segment in order to provide data for multiple satellites. When any such parameter appears in more than one segment, the following rules shall apply.

1. There shall be no repetition of data for the same satellite.
2. Optional and conditional elements in the parameter not associated with a particular satellite shall each appear in at most one RRLP segment.
3. Any mandatory element not associated with a particular satellite shall assume consistent values in the case of an element related to current GPS time and the same value otherwise.
4. The maximum number of satellites defined in sub-clause 5.1 for which data can be included for any parameter in one RRLP segment shall apply also when counted over all RRLP segments.

**Reference Time**

These fields specify the relationship between GPS time and air-interface timing of the BTS transmission in the reference cell. These fields occur once per message; some are mandatory and some are conditional, as shown in table A.14. Note that Reference Time may also be present within the Acquisition Assistance parameter. In such a case, the SMLC shall ensure consistency.

**Table A.14: Reference Time (Fields occurring once per message)**

| Parameter | # Bits | Scale Factor | Range | Units | Incl. |
|---|---|---|---|---|---|
| GPS Week | 10 | 1 | 0 – 1023 | weeks | M |
| GPS TOW | 23 | 0.08 | 0-604799.92 | sec | M |
| BCCH Carrier | 10 | 1 | 0 – 1023 | --- | O (note 1) |
| BSIC | 6 | 1 | 0 – 63 | --- | O (note 1) |
| FNm | 21 | 1 | 0 – ($2^{21}$-1) | frames | O (note 1) |
| TN | 3 | 1 | 0 – 7 | timeslots | O (note 1) |
| BN | 8 | 1 | 0 – 156 | bits | O (note 1) |
| GPS TOW Assist | 24*N_SAT | --- | ---- | --- | O |
| NOTE 1: All of these fields shall be present together, or none of them shall be present. | | | | | |

**GPS Week**

This field specifies the GPS week number of the assistance being provided. GPS Week eliminates one-week ambiguities from the time of the GPS assistance. This field is mandatory.

**GPS TOW**

The GPS TOW (time-of-week) is a mandatory field and is specified with 80 msec resolution. When GSM Time Present is "1", GPS TOW and BCCH/BSIC/FNm/TN/BN IEs provide a valid relationship between GPS and GSM time, as seen at the approximate location of the MS, ie the propagation delay from BTS to MS shall be compensated for by the SMLC. Depending on implementation, the relation between GPS and GSM time may have varying accuracy. Therefore, the uncertainty of the timing relation may be provided in the optional field GPS Reference Time Uncertainty. If the propagation delay from BTS to MS is not accurately known, the SMLC shall use the best available approximation of the propagation delay and take the corresponding delay uncertainty into account in the calculation of the field GPS Reference Time Uncertainty. When GSM Time Present is "0", GPS TOW is an estimate of current GPS time of week at time of reception of the RRLP segment containing this data by the MS. The SMLC should achieve an accuracy of +/- 3 seconds for this estimate including allowing for the transmission delay between SMLC and MS of the RRLP segment containing GPS TOW. Note that the MS should further compensate GPS TOW for the time between the reception of the segment containing GPS TOW and the time when the GPS TOW field is used.

**BCCH Carrier/BSIC/FNm/TN/BN**

These fields specify the state of the GSM frame number, timeslot number, and bit number, respectively, of the reference BTS with the specified BCCH carrier and BSIC at the time that correspond to GPS TOW. The SMLC shall use the current serving BTS as the reference BTS. The frame number field is given modulo $2^{21}$, i.e., the MSB of the GSM frame number is truncated. The MS shall interpret FNm as the most recent of the two possible frame numbers that FNm could represent. The target MS has the option of rejecting a GPS position request or GPS assistance data if the reference BTS is not the serving BTS.

**GPS TOW Assist**

This field contains several fields in the Telemetry (TLM) Word and Handover Word (HOW) that are currently being broadcast by the respective GPS satellites. Combining this information with GPS TOW enables the MS to know the entire 1.2-second (60-bit) pattern of TLM and HOW that is transmitted at the start of each six-second subframe by the particular GPS satellite. This field contains information for each of N_SAT satellites, and optional. The individual fields for each satellite in the message are shown in table A.15a.

**Table A.15a: GPS TOW Assist (Fields occurring N_SAT times per message)**

| Parameter | # Bits | Scale Factor | Range | Units | Incl. |
|---|---|---|---|---|---|
| SatID | 6 | --- | 0 - 63 | --- | M |
| TLM Message | 14 | --- | 0 – 16383 | Bit field | M |
| Anti-Spoof | 1 | 1 | 0 –1 | Bit field | M |
| Alert | 1 | 1 | 0 – 1 | Bit field | M |
| TLM Reserved | 2 | --- | 0 – 3 | Bit field | M |

**SatID**

This field identifies the satellite for which the corrections are applicable. The values ranging from 0 to 63 represent satellite PRNs ranging from 1 to 64, respectively.

**TLM Message**

This field contains a 14-bit value representing the Telemetry Message (TLM) being broadcast by the GPS satellite identified by the particular SatID, with the MSB occurring first in the satellite transmission.

**Anti-Spoof/Alert**

These fields contain the Anti-Spoof and Alert flags that are being broadcast by the GPS satellite identified by SatID.

**TLM Reserved**

These fields contain the two reserved bits in the TLM Word being broadcast by the GPS satellite identified by SatID, with the MSB occurring first in the satellite transmission.

**Reference Location**

The Reference Location field contains a 3-D location (with uncertainty) specified as per 3GPP TS 23.032. The purpose of this field is to provide the MS with a priori knowledge of its location in order to improve GPS receiver performance. The allowed shape is 3-D location with uncertainty (ellipsoid point with altitude and uncertainty ellipsoid).

**DGPS Corrections**

These fields specify the DGPS corrections to be used by the MS. All fields are mandatory when DGPS Corrections are present in the GPS Assistance Data.

**Table A.15: DGPS Corrections**

| Parameter | # Bits | Scale Factor | Range | Units | Incl. |
|---|---|---|---|---|---|
| The following fields occur once per message | | | | | |
| GPS TOW | 20 | 1 | 0 – 604799 | sec | M |
| Status/Health | 3 | 1 | 0-7 | --- | M |
| N_SAT | 4 | 1 | 1-16 | --- | M |
| The following fields occur once per satellite (N_SAT times) | | | | | |
| SatID | 6 | --- | 0 – 63 | --- | M |
| IODE | 8 | --- | 0 – 255 | --- | M |
| UDRE | 2 | --- | 0 – 3 | --- | M |
| PRC | 12 | 0.32 | ±655.04 | meters | M |
| RRC | 8 | 0.032 | ±4.064 | meters/sec | M |
| Delta PRC2 | 8 | --- | --- | --- | M |
| Delta RRC2 | 4 | --- | --- | --- | M |
| Delta PRC3 | 8 | --- | --- | --- | M |
| Delta RRC3 | 4 | --- | --- | --- | M |

**GPS TOW**

This field indicates the baseline time for which the corrections are valid.

**Status/Health**

This field indicates the status of the differential corrections contained in the broadcast message. The values of this field and their respective meanings are shown below in table A.16.

**Table A.16: Values of Status/Health IE**

| Code | Indication |
|---|---|
| 000 | UDRE Scale Factor = 1.0 |
| 001 | UDRE Scale Factor = 0.75 |
| 010 | UDRE Scale Factor = 0.5 |
| 011 | UDRE Scale Factor = 0.3 |
| 100 | UDRE Scale Factor = 0.2 |
| 101 | UDRE Scale Factor = 0.1 |
| 110 | Reference Station Transmission Not Monitored |
| 111 | Data is invalid - disregard |

The first six values in this field indicate valid differential corrections. When using the values described below, the "UDRE Scale Factor" value is applied to the UDRE values contained in the message. The purpose is to indicate an estimate in the amount of error in the corrections.

The value "110" indicates that the source of the differential corrections (e.g., reference station or external DGPS network) is currently not being monitored. The value "111" indicates that the corrections provided by the source are invalid, as judged by the source. In the later case, the message shall contain no corrections for individual satellites. Any MS that receives DGPS Corrections in a GPS Assistance Data IE shall contain the appropriate logic to properly interpret this condition and look for the next IE.

**N_SAT**

This field indicates the number of satellites for which differential corrections are available. Corrections for up to 16 satellites.

**SatID**

This field identifies the satellite for which the corrections are applicable. The values ranging from 0 to 63 represent satellite PRNs ranging from 1 to 64, respectively.

**IODE**

This IE is the sequence number for the ephemeris for the particular satellite. The MS can use this IE to determine if new ephemeris is used for calculating the corrections that are provided in the broadcast message. This eight-bit IE identifies a particular set of ephemeris data for a GPS satellite and may occupy the numerical range of [0, 255]. The transmitted IODE value will be different from any value transmitted by the GPS satellite during the preceding six hours. For more information about this field can be found from RTCM-SC104.

**User Differential Range Error (UDRE)**

This field provides an estimate of the uncertainty (1-$\sigma$) in the corrections for the particular satellite. The value in this field shall be multiplied by the UDRE Scale Factor in the common Corrections Status/Health field to determine the final UDRE estimate for the particular satellite. The meanings of the values for this field are described in table A.18.

**Table A.18: Values of UDRE IE**

| Value | Indication |
|---|---|
| 00 | UDRE $\leq$ 1.0 m |
| 01 | 1.0 m < UDRE $\leq$ 4.0 m |
| 10 | 4.0 m < UDRE $\leq$ 8.0 m |
| 11 | 8.0 m < UDRE |

Each UDRE value shall be adjusted based on the operation of an Integrity Monitor (IM) function which exists at the network (SMLC, GPS server, or reference GPS receiver itself). Positioning errors derived at the IM which are excessive relative to DGPS expected accuracy levels shall be used to scale the UDRE values to produce consistency.

**Pseudo-Range Correction (PRC)**

This field indicates the correction to the pseudorange for the particular satellite at the GPS Reference Time, $t_0$. The value of this field is given in meters (m) and the resolution is 0.32, as shown in table A.15 above. The method of calculating this field is described in 3GPP TS 29.002.

If the SMLC has received a request for GPS assistance data from an MS which included a request for the navigation models and DGPS (i.e., bit D and E are set to one in 'Requested GPS Assistance Data, see 3GPP TS 49.031), the SMLC shall determine, for each satellite, if the navigation model stored by the MS is still suitable for use with DGPS corrections (also see navigation model update conditions right before Table A.19) and if so and if DGPS corrections are supported the SMLC should send DGPS corrections without including the navigation model.

The IODE value sent for a satellite shall always be the IODE value that corresponds to the navigation model for which the pseudo-range corrections are applicable.

The pseudo-range correction shall correspond to the available navigation model (the one already stored in and identified by the MS or the one included in the same procedure as the pseudo-range correction). The MS shall only use the PRC value when the IODE value received matches its available navigation model.

**Pseudo-Range Rate Correction (RRC)**

This field indicates the rate-of-change of the pseudorange correction for the particular satellite, using the satellite ephemeris identified by the IODE IE. The value of this field is given in meters per second (m/sec) and the resolution is 0.032, as shown in table A.15 above. For some time $t_1 > t_0$, the corrections for IODE are estimated by

$$PRC(t_{1,\,IODE}) = PRC(t_{0,\,IODE}) + RRC(t_{0,\,IODE})\cdot(t_1 - t_0)\ ,$$

and the MS uses this to correct the pseudorange it measures at $t_1$, $PR_m(t_{1,}\,IODE)$, by

$$PR(t_{1,\,IODE}) = PR_m(t_{1,\,IODE}) + PRC(t_{1,\,IODE})\ .$$

The SMLC shall always send the RRC value that corresponds to the PRC value that it sends (see above for details). The MS shall only use the RRC value when the IODE value received matches its available navigation model.

**Delta Pseudo-Range Correction 2 (Delta PRC2)**

This IE is not used. The sender shall set it to zero and the receiver shall ignore it.

**Delta Pseudo-Range Rate Correction 2 (Delta RRC2)**

This IE is not used. The sender shall set it to zero and the receiver shall ignore it.

**Delta Pseudo-Range Correction 3 (Delta PRC3)**

This IE is not used. The sender shall set it to zero and the receiver shall ignore it.

**Delta Pseudo-Range Rate Correction 3 (Delta RRC3)**

This IE is not used. The sender shall set it to zero and the receiver shall ignore it.

**Navigation Model**

This set of fields contains information required to manage the transfer of precise navigation data to the GPS-capable MS. In response to a request from an MS for GPS assistance data, the SMLC shall determine whether to send the navigation model for a particular satellite to an MS based upon factors like the T-Toe limit specified by the MS and any request from the MS for DGPS (also see above). This information includes control bit fields as well as satellite ephemeris and clock corrections. The individual fields are given in Table A.19 below, and the conditions for their presence is discussed below.

**Table A.19: Navigation Model (per-satellite fields - (1) = Positive range only)**

| Parameter | # Bits | Scale Factor | Units | Incl. |
|---|---|---|---|---|
| Navigation Model Flow Control (once per message) | | | | |
| Num_Sats_Total | 4(1) | 1 | --- | M |
| Satellite and Format Identification (once per satellite) | | | | |
| SatID | 6(1) | --- | --- | M |
| Satellite Status | 2 | --- | Boolean | M |
| Satellite Navigation Model and Associated Bits (once per satellite) | | | | |
| C/A or P on L2 | 2 | --- | Boolean | C |
| URA Index | 4 | --- | Boolean | C |
| SV Health | 6 | --- | Boolean | C |
| IODC | 10(1) | --- | --- | C |
| L2 P Data Flag | 1 | --- | Boolean | C |
| SF 1 Reserved | 87 | --- | --- | C |
| $T_{GD}$ | 8 | $2^{-31}$ | sec | C |
| $t_{oc}$ | 16(1) | $2^{4}$ | sec | C |
| $af_2$ | 8 | $2^{-55}$ | $sec/sec^2$ | C |
| $af_1$ | 16 | $2^{-43}$ | sec/sec | C |
| $af_0$ | 22 | $2^{-31}$ | sec | C |
| $C_{rs}$ | 16 | $2^{-5}$ | meters | C |
| $\Delta n$ | 16 | $2^{-43}$ | semi-circles/sec | C |
| $M_0$ | 32 | $2^{-31}$ | semi-circles | C |
| $C_{uc}$ | 16 | $2^{-29}$ | radians | C |
| e | 32(1) | $2^{-33}$ | --- | C |
| $C_{us}$ | 16 | $2^{-29}$ | radians | C |
| $(A)^{1/2}$ | 32(1) | $2^{-19}$ | $meters^{1/2}$ | C |
| $t_{oe}$ | 16(1) | $2^{4}$ | sec | C |
| Fit Interval Flag | 1 | --- | Boolean | C |
| AODO | 5 | 900 | sec | C |
| $C_{ic}$ | 16 | $2^{-29}$ | radians | C |
| $OMEGA_0$ | 32 | $2^{-31}$ | semi-circles | C |
| $C_{is}$ | 16 | $2^{-29}$ | radians | C |
| $i_0$ | 32 | $2^{-31}$ | semi-circles | C |
| $C_{rc}$ | 16 | $2^{-5}$ | meters | C |
| $\omega$ | 32 | $2^{-31}$ | semi-circles | C |
| OMEGAdot | 24 | $2^{-43}$ | semi-circles/sec | C |
| Idot | 14 | $2^{-43}$ | semi-circles/sec | C |

**Num_Sats_Total**

This field specifies the number of satellites that are included in the provided Navigation Model. A range of 1-16 is available. This field is mandatory when the Navigation Model field is included in the message.

**SatID**

This field identifies the satellite for which the assistance is applicable. This value is the same as the PRN number provided in the navigation message transmitted by the particular satellite. The range is 0 to 63, with 0-31 indicating GPS satellites 1-32, respectively, and 32-63 indicating satellites in future augmentation systems (e.g., WAAS or EGNOS). This field is mandatory for each included satellite.

**Satellite Status**

This field is a two-bit value that indicates the status of the Navigation Model for the particular satellite specified by SatID. This field is mandatory for each included satellite. The MS shall interpret the combinations of the two bits as follows.

**Table A.20: Satellite Status (per-satellite field)**

| MSB | LSB | Interpretation |
|---|---|---|
| 0 | 0 | New satellite, new Navigation Model |
| 0 | 1 | Existing satellite, same Navigation Model |
| 1 | 0 | Existing satellite, new Navigation Model |
| 1 | 1 | Reserved |

This Satellite Navigation Model and associated bit fields include the parameters that accurately model the orbit and clock state of the particular satellite. For the particular satellite, these fields are conditional based on the value of Satellite Status for that satellite. The fields are absent when Satellite Status is "01", and present for all other values. The format for the ephemeris, clock corrections, and associate bits are specified in ICD-GPS-200.

**Ionospheric Model**

The Ionospheric Model contains fields needed to model the propagation delays of the GPS signals through the ionosphere. The information elements in this field are shown in table A.21. Proper use of these fields allows a single-frequency GPS receiver to remove approximately 50 % of the ionospheric delay from the range measurements. The Ionospheric Model is valid for the entire constellation and changes slowly relative to the Navigation Model. All of the fields must be included when Ionospheric Model is present.

**Table A.21: Ionospheric Model (occurs once per message, when present)**

| Parameter | # Bits | Scale Factor | Units | Incl. |
|---|---|---|---|---|
| $\alpha_0$ | 8 | $2^{-30}$ | seconds | C |
| $\alpha_1$ | 8 | $2^{-27}$ | sec/semi-circle | C |
| $\alpha_2$ | 8 | $2^{-24}$ | sec/(semi-circle)$^2$ | C |
| $\alpha_3$ | 8 | $2^{-24}$ | sec/(semi-circle)$^3$ | C |
| $\beta_0$ | 8 | $2^{11}$ | seconds | C |
| $\beta_1$ | 8 | $2^{14}$ | sec/semi-circle | C |
| $\beta_2$ | 8 | $2^{16}$ | sec/(semi-circle)$^2$ | C |
| $\beta_3$ | 8 | $2^{16}$ | sec/(semi-circle)$^3$ | C |

**UTC Model**

The UTC Model field contains a set of parameters needed to relate GPS time to Universal Time Coordinate (UTC). All of the fields in the UTC Model are mandatory when the field is present.

**Table A.22: UTC Model (occurs once per message, when present per-satellite fields - (1) = Positive range only)**

| Parameter | # Bits | Scale Factor | Units | Incl. |
|---|---|---|---|---|
| $A_1$ | 24 | $2^{-50}$ | sec/sec | C |
| $A_0$ | 32 | $2^{-30}$ | seconds | C |
| $t_{ot}^{(1)}$ | 8 | $2^{12}$ | seconds | C |
| $WN_t^{(1)}$ | 8 | 1 | weeks | C |
| $\Delta t_{LS}$ | 8 | 1 | seconds | C |
| $WN_{LSF}^{(1)}$ | 8 | 1 | weeks | C |
| DN | 8 | 1 | days | C |
| $\Delta t_{LSF}$ | 8 | 1 | seconds | C |

**Almanac**

These fields specify the coarse, long-term model of the satellite positions and clocks. These fields are given in table A.23. With one exception (δi), these parameters are a subset of the ephemeris and clock correction parameters in the Navigation Model, although with reduced resolution and accuracy. The almanac model is useful for receiver tasks that require coarse accuracy, such as determining satellite visibility. The model is valid for up to one year, typically. Since it is a long-term model, the field should be provided for all satellites in the GPS constellation. All fields in the Almanac are mandatory when the Almanac is present. The fields $t_{oa}$ and $WN_a$ specify the GPS time-of-week and week number, respectively, that are the reference points for the Almanac parameters.

The Almanac also is useful as an acquisition aid for network-based GPS methods. Given a recent Almanac (< 3-4 weeks old), the MS only needs Reference Time and Reference Location information to quickly acquire the signals and return measurements to the network.

The Almanac also contains information about the health of that satellite as described in ICD-GPS-200. If this Alamanc has been captured from the satellite signal, the SV Health field represents the predicted satellite health at the time the GPS control segment uploaded the Almanac to the satellite. According to ICD-GPS-200, this health information may differ from the SV Health field in the Navigation Model (table A.19) due to different upload times.

The parameters Num_Sats_Total and SatID shall be interpreted in the same manner as described under table A19.

**Table A.23: Almanac (per-satellite fields - (1) = Positive range only)**

| Parameter | # Bits | Scale Factor | Units | Incl. |
|---|---|---|---|---|
| The following fields occur once per message | | | | |
| Num_Sats_Total | 6(1) | 1 | --- | M |
| $WN_a$ | 8(1) | 1 | weeks | M |
| The following fields occur once per satellite | | | | |
| SatID | 6(1) | --- | --- | M |
| $e^{(1)}$ | 16 | $2^{-21}$ | dimensionless | M |
| $t_{oa}^{(1)}$ | 8 | $2^{12}$ | sec | M |
| δi | 16 | $2^{-19}$ | semi-circles | M |
| OMEGADOT | 16 | $2^{-38}$ | semi-circles/sec | M |
| SV Health | 8 | --- | Boolean | M |
| $A^{1/2(1)}$ | 24 | $2^{-11}$ | $meters^{1/2}$ | M |
| $OMEGA_0$ | 24 | $2^{-23}$ | semi-circles | M |
| ω | 24 | $2^{-23}$ | semi-circles | M |
| $M_0$ | 24 | $2^{-23}$ | semi-circles | M |
| $af_0$ | 11 | $2^{-20}$ | seconds | M |
| $af_1$ | 11 | $2^{-38}$ | sec/sec | M |

**Acquisition Assistance**

The Acquisition Assistance field of the GPS Assistance Data Information Element contains parameters that enable fast acquisition of the GPS signals in network-based GPS positioning. Essentially, these parameters describe the range and derivatives from respective satellites to the Reference Location at the Reference Time. Table A.24 illustrates the assistance data occurring once per message and table A.25 illustrates the assistance data occurring per number of satellites for which acquisition assistance is being provided. Figure A.2 illustrates the relation between some of the fields.

This field is optional. The field would probably appear when the Method Type field of the Positioning Instructions IE is set to 0 (MS-Assisted) and the Positioning Methods field of the Position Instructions IE is set to 1 (GPS) or 2 (GPS or E-OTD).

**Table A.24: GPS Acquisition Assist - Parameters appearing once per message**

| Parameter | | Range | Bits | Resolution | Incl. | Notes |
|---|---|---|---|---|---|---|
| Number of Satellites | | 0 – 15 | 4 | | M | |
| Reference Time | GPS TOW | 0 –604799.92 sec | 23 | 0.08 sec | M | |
| | BCCH Carrier | 0 - 1023 | 10 | | O[1] | |
| | BSIC | 0 - 63 | 6 | | O[1] | |
| | Frame # | 0 – 2097151 | 21 | | O[1] | |
| | Timeslots # | 0 – 7 | 3 | | O[1] | |
| | Bit # | 0 – 156 | 8 | | O[1] | |
| NOTE: All of these field shall be present together, or none of them shall be present. | | | | | | |

**Table A.25: GPS Acquisition Assist - Parameters appearing [number of satellites] times per message**

| Parameter | Range | Bits | Resolution | Incl. | Notes |
|---|---|---|---|---|---|
| SVID/PRNID | 1 – 64 (0 – 63 ) | 6 | | M | |
| Doppler ($0^{th}$ order term) | -5,120 Hz to 5,117.5 Hz | 12 | 2.5 Hz | M | |
| Doppler ($1^{st}$ order term) | -1.0 – 0.5 Hz/sec. | 6 | 1/42 Hz/sec. | O[1] | |
| Doppler Uncertainty | 12.5 Hz – 200 Hz<br>$[2^{-n}(200)$ Hz, n = 0 – 4] | 3 | | O[1] | |
| Code Phase | 0 – 1022 chips | 10 | 1 chip | M | |
| Integer Code Phase | 0-19 | 5 | 1 C/A period | M | |
| GPS Bit number | 0 – 3 | 2 | | M | |
| Code Phase Search Window | 1 – 192 chips | 4 | | M | |
| Azimuth | 0 – 348.75 deg | 5 | 11.25 deg | O[2] | |
| Elevation | 0 – 78.75 deg | 3 | 11.25 deg | O[2] | |
| NOTE 1: Both of these fields shall be present together, or none of them shall be present.<br>NOTE 2: Both of these fields shall be present together, or none of them shall be present. | | | | | |

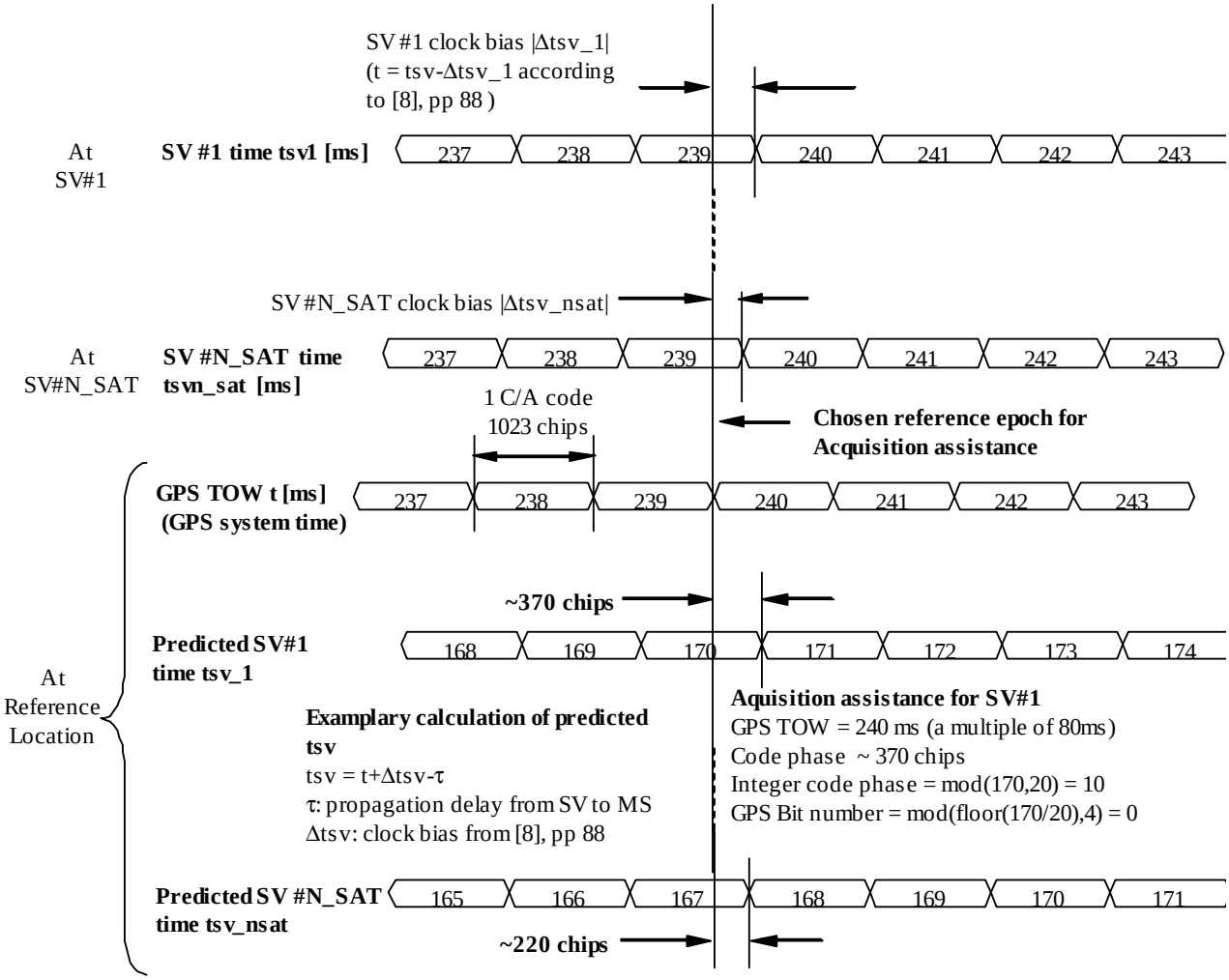


**Figure A.2. Exemplary calculations of Acquisition Assistance fields.**

This field indicates whether or not angle information is present in this message. The MS shall interpret a value of "1" to mean that angle (Azimuth and Elevation) information is present, and "0" to mean that it is not provided. This field is mandatory.

**Number of Satellites**

This field contains the number of satellites identified in this information element. This field is mandatory.

Range: 0 – 15

**Reference Time**

The Reference Time field of the GPS Acquisition Assistance Data IE specifies the relationship between GPS time and air-interface timing of the BTS transmission in the reference cell.

**GPS TOW** subfield specifies the GPS TOW for which the location estimate is valid. When the parameters BCCH Carrier/BSIC/Frame #/Timeslots #/Bit # are present, together with GPSTOW they provide a valid relationship between GPS and GSM time, as seen at the approximate location of the MS, ie the propagation delay from BTS to MS shall be compensated for by the SMLC. Depending on implementation, the relation between GPS and GSM time may have varying accuracy. The uncertainty of the timing relation may be provided in the optional field GPS Reference Time Uncertainty. If the propagation delay from BTS to MS is not accurately known, the SMLC shall use the best available approximation of the propagation delay and take the corresponding delay uncertainty into account in the calculation of the field GPS Reference Time Uncertainty. GPS TOW is mandatory when the GPS Acquisition Assistance Data

Information Element is included. When the GSM time parameters are not present the GPS TOW is an estimate of current GPS time of week at time of reception of the RRLP segment containing the GPS TOW by the MS. The SMLC should achieve an accuracy of +/- 3 seconds for this estimate including allowing for the transmission delay between SMLC and MS of the RRLP segment containing GPS TOW. Note that the MS should further compensate GPS TOW for the time between the reception of the segment containing GPS TOW and the time when the GPS TOW field is used.

Range: 0 – 604799.92 sec

The **BCCH Carrier** # and **BSIC** subfields specify the reference cell for which GSM timing is provided. These subfields are optional when the GPS Acquisition Assistance Data Information Element is included. If included, the SMLC shall set the reference cell to the current serving cell. A target MS has the option of rejecting a GPS position request or GPS assistance data if the reference cell is not the serving cell.

The **Frame #** subfield specifies the GSM frame number of the BTS transmissions for the reference cell that occur at the given GPS TOW. This subfield is optional when the GPS Acquisition Assistance Data Information Element is included.

Range: 0 – 2097151

The **Timeslots #** subfield specifies the GSM timeslot of the BTS transmissions for the reference cell that occur at the given GPS TOW. This subfield is optional when the GPS Acquisition Assistance Data Information Element is included.

Range: 0 – 7

The **Bit #** subfield specifies the GSM and bit number of the BTS transmissions for the reference cell that occur at the given GPS TOW. This subfield is optional when the GPS Acquisition Assistance Data Information Element is included.

Range: 0 – 156

**SVID/PRNID**

This field identifies the particular satellite for which the measurement data is supplied. This value is the same as the PRN number provided in the navigation message transmitted by the particular satellite.

The range is 0 to 63, where SVID = PRNID – 1

**Doppler ($0^{th}$ order term)**

This field contains the Doppler ($0^{th}$ order term) value. A positive value defines the increase in satellite signal frequency due to velocity towards the MS. A negative value defines the decrease in satellite signal frequency due to velocity away from the MS. This field is mandatory.

Range: 5,120 Hz to 5,117.5 Hz

**Doppler ($1^{st}$ order term**)

This field contains the Doppler ($1^{st}$ order term) value. A positive value defines the rate of increase in satellite signal frequency due to acceleration towards the MS. A negative value defines the rate of decrease in satellite signal frequency due to acceleration away from the MS. This field is optional.

Range: -1,0 Hz to 0,5 Hz / s

**Doppler Uncertainty**

This field contains the Doppler uncertainty value. It is defined such that the Doppler experienced by a stationary MS is in the range “Doppler – Doppler Uncertainty” to “Doppler + Doppler Uncertainty”. This field is optional.

Permitted Values: 12.5 Hz, 25 Hz, 50 Hz, 100 Hz, 200 Hz as encoded by an integer n in the range 0-4 according to the formula in Table A.25

**Code Phase**

This field contains code phase, in units of 1 GPS chip, in the range from 0 to 1022 GPS chips, where increasing binary values of the field signify increasing predicted pseudoranges, as seen by a receiver at the Reference Location at the time GPS TOW. The Reference Location would typically be an apriori estimate of the MS location. This field is mandatory.

Range. 0-1022 chips

**Integer Code Phase**

This field contains integer code phase, i.e. the number of the code periods that have elapsed since the latest GPS bit boundary, in units of C/A code period, as seen by a receiver at the Reference Location at the time GPS TOW. This field is mandatory.

Range: 0-19

**GPS Bit Number**

This field contains GPS bit number (expressed modulo 4) currently being transmitted at the time GPS TOW, as seen by a receiver at the Reference Location. This field is mandatory.

Range: 0-3

**Code Phase Search Window**

This field contains the code phase search window. The code phase search window accounts for the uncertainty in the estimated MS location but not any uncertainty in GPS TOW. It is defined such that the expected code phase is in the range “Code Phase - Code Phase Search Window” to “Code Phase + Code Phase Search Window”. This field is mandatory.

Range: 0-15 (i.e. 1-192 chips according to following table)

**Table A.26: Code Phase Search Window Parameter Format**

| CODE_PHASE_WIN | Code Phase Search Window (GPS chips) |
|---|---|
| '0000' | 1023 |
| '0001' | 1 |
| '0010' | 2 |
| '0011' | 3 |
| '0100' | 4 |
| '0101' | 6 |
| '0110' | 8 |
| '0111' | 12 |
| '1000' | 16 |
| '1001' | 24 |
| '1010' | 32 |
| '1011' | 48 |
| '1100' | 64 |
| '1101' | 96 |
| '1110' | 128 |
| '1111' | 192 |

**Azimuth**

This field contains the azimuth angle. An angle of x degrees means the satellite azimuth a is in the range ($x \leq a < x+11.25$) degrees. This field is optional.

Range: 0 – 348.75 degrees.

**Elevation**

This field contains the elevation angle. An angle of y degrees means the satellite elevation e is in the range ($y \leq e < y+11.25$) degrees except for y = 78.75 where the range is extended to include 90 degrees. This field is optional.

Range: 0 – 78.75 degrees

**Real-Time Integrity**

The Real-Time Integrity field of the GPS Assistance Data Information Element contains parameters that describe the real-time status of the GPS constellation. Primarily intended for non-differential applications, the real-time integrity of the satellite constellation is of importance as there is no differential correction data by which the mobile can determine the soundness of each satellite signal. The Real-Time GPS Satellite Integrity data communicates the health of the

constellation to the mobile in real-time. The format is shown in table A.29. The SMLC shall always transmit the Real Time Integrity field with the current list of unhealthy satellites, for any A-GPS positioning attempt and whenever A-GPS assistance data is sent. If the number of bad satellites (NBS) is zero, then the Real Time Integrity field shall be omitted. When the Extended Reference IE is included in the RRLP Measure Position Request message or in the RRLP Assistance Data message, then the MS shall interpret the absence of a Real Time Integrity field in the assistance data provided by the SMLC to mean that NBS is zero. If the Extended Reference IE is not present, this interpretation applies when the assistance data is provided by the SMLC following a previous request of the MS for Real Time Integrity data.

**Table A.29: Real-Time Integrity - Parameters appearing NBS times**

| Parameter | # Bits | Scale Factor | Range | Units | Incl. |
|---|---|---|---|---|---|
| Bad_SVID | 6 | 1 | 0-63 | --- | C |

**NBS (Number of Bad Satellites)**

The NBS value indicates the number of satellite ID's that follow that the user should not use at this time in a fix. This NBS value is determined from the Bad_SVID list.

**Bad_SVID**

This six bit field appears NBS times, and indicates the SVID of satellites that should not be used for fix by the user at this time. The values ranging from 0 to 63 represent satellite PRNs ranging from 1 to 64, respectively.

### A.4.2.4a GPS Time Assistance Measurement Request Element

This element is optional and controls if the MS should return GPS time assistance measurements or not to the SMLC. The inclusion of this parameter implies use of measure Position Request The description is found in sub-chapter 2.2.4a.

### A.4.2.4b GPS Reference Time Uncertainty Element

This element is conditional and provides the accuracy of the relation GPS and GSM time in the Acquisition Assistance in GPS Assistance Data Element. The interval, range and treatment is as described in sub-clause 2.2.4b.

### A.4.2.5 More Assistance Data To Be Sent Element

This element is set by the SMLC to indicate to the MS if more Assistance Data components or a the final RRLP Measure Position Request component will be sent in the current procedure in order to deliver the entire set of assistance data.

## A.5 Assistance Data Acknowledgement

### A.5.1 General

The MS sends the Assistance Data Acknowledgement component to the SMLC to indicate that it has received the whole Assistance Data component.

## A.6 Protocol Error

### A.6.1 General

This component is used by the receiving entity (SMLC or MS) to indicate to the sending entity, that there is a problem that prevents the receiving entity to receive a complete and understandable component.

This component has the following values:

'0': Undefined;
'1': Missing Component;
'2': Incorrect Data;
'3': Missing Information Element or Component Element;
'4': Message Too Short;
'5': Unknown Reference Number.

## A.6.2 Extended Reference IE

This IE shall be included in any Protocol Error message if and only if an Extended Reference IE was received in the corresponding previous Measure Position Request or Assistance Data message.

NOTE: For reasons of backward compatibility, a Release 4 or earlier MS will not include this IE.

The Extended Reference IE contains the following elements.

SMLC code: an integer in the range 0-63. The value returned by a target MS in a Protocol Error message shall equal the value received from the SMLC in the earlier Measure Position Request or Assistance Data message.

Transaction ID: an integer in the range 0-262143 distinguishing different RRLP transactions in different MSs currently being served by the same SMLC. The value returned by a target MS in a Protocol Error message shall equal the value received from the SMLC in the earlier Measure Position Request or Assistance Data message.

# Annex B (informative): Change History

| Meeting# | Tdoc | CR | Rev | Subject/Comment | New Version |
|---|---|---|---|---|---|
| GP-06 | GP-011880 | 008 | 1 | Rel-5 version based on 4.2.0.<br>Introduction of LCS for GPRS to RRLP (Rel-5) | 5.0.0 |
| GP-07 | GP-012170 | 024 | | Editorial Corrections | 5.1.0 |
| GP-07 | GP-012309 | 028 | | “Expected” Multiframe Offset | 5.1.0 |
| GP-07 | GP-011983 | 014 | 1 | Corrections to Rough RTD, Multiframe Offset and Expected OTD ranges. | 5.1.0 |
| GP-07 | GP-012031 | 018 | | Correction to Toc and Toe ephemeris parameters | 5.1.0 |
| GP-07 | GP-012029 | 016 | | Addition of extension field to assistance data component and some ASN.1 corrections. | 5.1.0 |
| GP-07 | GP-012220 | 026 | | RRLP – Remove references to NSS based SMLC | 5.1.0 |
| GP-07 | GP-012032 | 019 | | RRLP – Incomplete interpretation of Assistance Data | 5.1.0 |
| GP-07 | GP-012847 | 030 | 2 | Correction of Reference Frame in Location Information Element | 5.1.0 |
| GP-07 | GP-012033 | 022 | | RRLP - Correction of Error Handling Procedures | 5.1.0 |
| GP-07 | - | - | | Missing table headings included | 5.1.0 |
| GP-08 | GP-020071 | 031 | 1 | TOM Protocol Header Definition for LCS for GPRS | 5.2.0 |
| GP-08 | GP-020434 | 033 | 3 | Addition of an extended Reference ID to LCS RRLP Messages | 5.2.0 |
| GP-08 | GP-020490 | 047 | 4 | Correction to OTD Measurement Response | 5.2.0 |
| GP-09 | GP-020547 | 057 | | Usage of "SystemInfoIndex" by the MS in E-OTD measurement reporting | 5.3.0 |
| GP-09 | GP-020677 | 052 | | Removing condition to Control Header parameter | 5.3.0 |
| GP-09 | GP-020709 | 035 | 3 | Clarification and Correction of DGPS Data Fields | 5.3.0 |
| GP-09 | GP-021224 | 032 | 3 | Final Response Indication in RRLP for Uplink Pseudo-segmentation | 5.3.0 |
| GP-09 | GP-021266 | 055 | 2 | Correction of syntax faults in the ASN.1 | 5.3.0 |
| GP-10 | GP-021351 | 062 | | ASN.1 Faults in GPS Assistance Data | 5.4.0 |
| GP-10 | GP-021355 | 064 | | ASN.1 Faults in GPS Measurement Parameters | 5.4.0 |
| GP-10 | GP-021708 | 060 | | Correction to Extended Reference IE sub-clause | 5.4.0 |
| GP-10 | GP-021917 | 066 | 1 | Clean up of downlink segmentation concept | 5.4.0 |
| GP-10 | GP-022107 | 055 | 6 | Correction of syntax faults in the ASN.1 | 5.4.0 |
| GP-11 | GP-022600 | 068 | 1 | Correction of Pseudo Range Correction range | 5.5.0 |
| GP-11 | GP-022647 | 069 | 1 | Corrections to GPS Assistance Data Element | 5.5.0 |
| GP-15 | GP-031160 | 072 | 1 | Correction of the definition of the Real Time Integrity Field for A-GPS | 6.0.0 |
| GP-16 | GP-032272 | 075 | 3 | Correction of RRLP Pseudo-Segmentation Description | 6.1.0 |
| GP-18 | GP-040424 | 083 | 1 | Definition of code and Doppler search windows for MS assisted A-GPS | 6.2.0 |
| GP-18 | GP-040434 | 089 | 1 | Clarification to signalling for conventional GPS location method | 6.2.0 |
| GP-19 | GP-040842 | 086 | 2 | Definition of code and Doppler search windows for MS assisted A-GPS | 6.3.0 |
| GP-19 | GP-040821 | 094 | | Correction to encoding of A-GPS Doppler Uncertainty | 6.3.0 |
| GP-19 | GP-040822 | 095 | | Correction and Clarification of A-GPS Doppler Uncertainty | 6.3.0 |
| GP-20 | GP-041673 | 100 | 4 | Clarification of GPSTOW in Reference Time | 6.4.0 |
| GP-20 | GP-041294 | 103 | 3 | Correction of inconsistencies between RRLP and MAP specification | 6.4.0 |
| GP-20 | GP-041297 | 106 | | Correction of A-GPS Doppler0, Doppler1, Azimuth, Elevation | 6.4.0 |
| GP-21 | GP-042126 | 117 | 1 | Define rules for pseudo-segmentation of A-GPS Assistance Data | 6.5.0 |
| GP-22 | GP-042578 | 120 | 3 | Correction of relation between GSM Reference Frame and GPS TOW to achieve high-accuracy timing assistance for AGPS | 6.6.0 |
| GP-22 | GP-042691 | 123 | 4 | Correction of the Real-Time Integrity field | 6.6.0 |
| GP-22 | GP-042321 | 127 | 1 | Correction of allowed RRLP GPS reference location shapes for compatibility and consistent operation | 6.6.0 |
| GP-23 | GP-050414 | 131 | 1 | Correction of the ASN.1 code | 6.7.0 |
| gp-23 | GP-050372 | 132 | | Corrections to units in Navigation Model | 6.7.0 |

# History

| Document history | | |
|---|---|---|
| V6.7.0 | January 2005 | Publication |
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