ETSI TS 101 527 V7.3.0 (2000-11)

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 04.31 version 7.3.0 Release 1998)**

GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS

Reference
RTS/TSGG-020431Q7R4

Keywords
GSM

ETSI

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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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.

[1] 3GPP TS 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] 3GPP TS 03.71: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); (Functional description) - Stage 2".

[3] 3GPP TS 09.02: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".

[4] ITU-T Recommendation X.691: "Specification of packet encoding rules for Abstract Syntax Notation One (ASN.1)".

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

[6] 3GPP TS 03.32:"Digital cellular telecommunications system (Phase 2+); Universial Geographic Area Description".

[7] 3GPP TS 09.31

1.2 Abbreviations

Abbreviations used in the present document are listed in 3GPP TS 01.04 or in 3GPP TS 03.71.

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 the reference [2] 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 subchapters describe the usage of these components.

Segmentation of components and messages is not supported in the RRLP level. The lower transport levels take care of segmentation.

2.2 Position Measurement Procedure

This procedure is the same that is described on a more general level in the reference [2] in the chapter "E-OTD and GPS Positioning Procedures" in subchapters "Positioning for BSS based SMLC" and "Positioning for NSS based SMLC". 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.

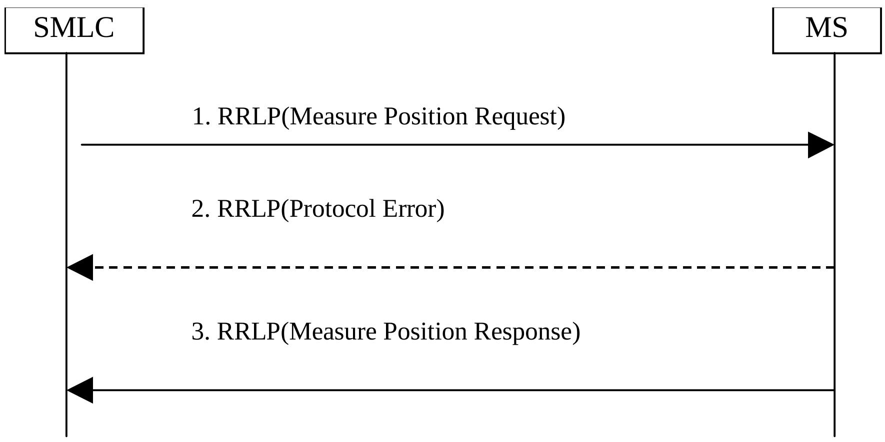

Figure 2.1: Position Measurement procedure

1. The 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 of the request.

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 Measure Position Request component. The RRLP message contains the reference number 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 1), abort location, or send a new measure Position Request (e.g. with updated assistance data).

3. 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 SMLCThe RRLP message contains the reference number of the request originally received in the step 1. 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 send a new Measure Position Request component instead.

2.3 Assistance Data Delivery Procedure

This procedure is the same that is described on a more general level in the reference [2] in the chapter "E-OTD and GPS Positioning Procedures" in subchapters "Assistance Data Delivery from BSS based SMLC" and "Assistance Data Delivery from NSS based SMLC". 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.

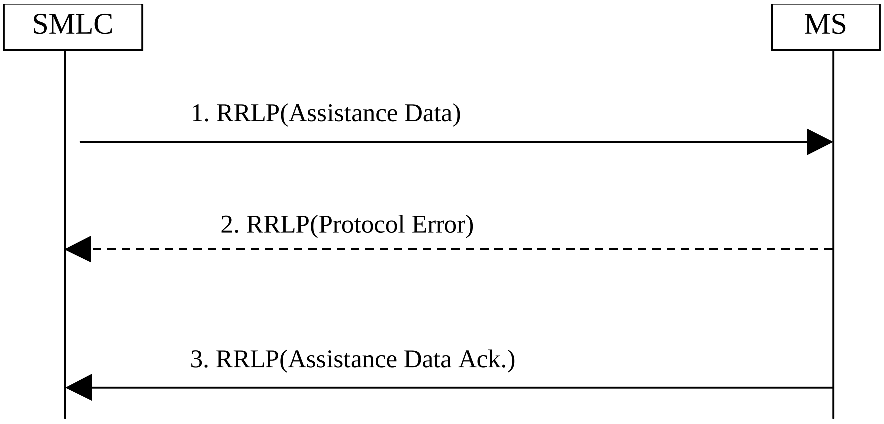

Figure 2.2: Assistance Data Delivery procedure

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 of the delivery.

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 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 (go back to the step 1), abort delivery, send a new measure Assistance Data (e.g. with updated assistance data), or abort the delivery.

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

2.4 Void

2.5 Error Handling Procedures

2.5.1 General

In this subchapter 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'. 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 Reference Number, when:

- 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.

The SMLC shall discard the message.

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'. 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'. 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, the MS ignores the later component;
- if the old and new Measure Position Request components have different Reference Numbers, 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, the MS ignores the later component;
- if the old and new Measure Position Request components have different Reference Numbers, the MS ignores the former component, and sends an acknowledgement to the latter 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 a Measure Position Response or Protocol Error component from the MS with the same Reference Number as in sent component, it may abort location attempt or send a new Measure Position Response.

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, it may abort delivery attempt or send a new Assistance Data.

2.5.8 Unforeseen Component

When the MS receives an Assistance Data component, that it is not expecting, MS may discard it.

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 (Specification of Abstract Syntax Notation One (ASN.1);
- ITU-T Recommendation X.691 (Specification of packet encoding rules for Abstract Syntax Notation One);

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 X.680 recommendations (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 09.02 and shall be supported on the radio interface by the MS and the network for all operations defined in the present document.

```
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 subchapters.

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 3.1. This element contains the reference number that can be used as follows:

- in the Position Measurement procedure the SMLC can 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 uses the same Reference number value 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 uses '0' as the Reference number. 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;
- on the Assistance Data Delivery procedure the SMLC can 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 or Assistance Data Acknowledgement component or the Protocol Error component, it uses the same Reference number value 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 uses '0' as the Reference number.

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.

```
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:

```
-- add this defintion 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,
    ...
}
```

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:

```
-- 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,
    ...
}
```

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:

```
-- 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,
    extensionContainer      ExtensionContainer      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:

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

-- Protocol Error component
ProtocolError ::= SEQUENCE {
    errorCause          ErrorCodes,
    extensionContainer      ExtensionContainer      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.

```
-- 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 03.32 (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
}



-- ellipsis point and
-- ellipsoid point with altitude 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)


-- Rough RTD value between one base station and reference BTS
RoughRTD ::= INTEGER (0..1250)


-- 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
    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-MesurementsOfRef ::= 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
    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
    gpsTOW      INTEGER (0..14399999)   OPTIONAL,   -- GPS TOW
    fixType     FixType,

    -- Possible shapes carried in posEstimate are
    -- ellipsoid point,
    -- ellipsoid point with uncertainty circle
    -- ellipsoid point with uncertainty ellipse
    -- ellipsoid point with altitude
    -- 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

--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
    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 09.31

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
}


-- 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),     -- value definitions in 04.72

    -- 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
    -- -655.34 - +655.34,
    pseudoRangeCor  INTEGER (-2047..2047),

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

-- Delta Pseudo Range Correction 2, range is -127 - +127
    deltaPseudoRangeCor2    INTEGER (-127..127),

    -- Delta Pseudo Range Correction 2, range is -0.224 - +0.224
    deltaRangeRateCor2      INTEGER (-7..7),

    -- Delta Pseudo Range Correction 3, range is -127 - +127
    deltaPseudoRangeCor3    INTEGER (-127..127),

    -- Delta Pseudo Range Correction 3, range is -0.224 - +0.224
    deltaRangeRateCor3      INTEGER (-7..7)
}

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
-- For further information see 3GPP TS 04.31
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..604784),
    ephemAF2        INTEGER (-128..127),
    ephemAF1        INTEGER (-32768..32767),
    ephemAF0        INTEGER (-209712..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..604784),
    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,
    -- -5.120 - 5.117.5 Hz (= -2048 - 2047 Hz with 2,5 Hz resolution)
    doppler0            INTEGER (-2048..2047),

    -- Doppler 1st order term, -1 - 0.5 resolution
    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 {
    doppler1            INTEGER (0..63),
    dopplerUncertainty  INTEGER (0..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
```

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

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

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 03.32.

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 03.32. This field is optional, but should be present for MS based E-OTD positioning. The allowed shapes are:

- ellipsoid point;
- ellipsoid point with altitude.

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 neighbour BTSs). Thus the sum of **Number of BTSs** field in this IE and total amount of **E-OTD Neighbour 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 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 mandatory.

Range: 0 - 51

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

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

The following fields tell the co-ordinates 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.2.2.4 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 send in the dedicated 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 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 mandatory.

Range: 0 - 51

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

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.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.

TableA.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

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 refering to the BTS listed in the Measure Position Request component (the indicated reference BTS is 1)

'3' = Cell identity is told using an index refering to the BTS listed in the BCCH allocation list (System Information Neighbor Lists) of the serving BTS.

'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 refering 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 refering 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.

The E-OTD and 51 multiframe offset values are reported relative to the reference BTS as defined in the previous 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: 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: 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 refering to the BTS listed in the Measure Position Request component (the indicated reference BTS is 1).

'4' = Cell identity is told using an index refering to the BTS listed in the BCCH allocation list (System Information Neighbor Lists) of the serving BTS.

'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 refering 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 refering 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: 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.3.2.4 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 for which the location estimate is valid. This field is mandatory.

Table A.3: Reference Frame field contents

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

GPS TOW

This field specifies the GPS TOW for which the location estimate is valid. This field is optional.

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 03.32. The allowed shapes are:

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

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 below, and the individual fields are described subsequently.

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

Table A.6: Reference Frame field contents

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

GPS TOW

This field specifies the GPS TOW for which the location estimate is valid. 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*)

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 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.

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 – 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 09.31 excluding the IEI and length octets)

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. 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

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 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 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 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, only the Control Header field is mandatory. Other fields are conditionally present based on the value of the Fields Present IE in the Control Header.

NOTE: 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 the Bad Satellite Present flag has been set, if the satellites return to healthy condition for some period of time, the flag shall be reset.

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

Parameter	Presence
Control Header	M
Reference Time	O
Reference Location	O
DGPS Corrections	O
Navigation Model	O
Ionospheric Model	O
UTC Model	O
Almanac	O
Acquisition Assistance	O
Real-Time Integrity	O

Control Header

These fields are used for control in the GPS assistance protocol. They are shown in table A.13.

Table A.13: GPS Control Header (Fields occurring once per message)

Parameter	Bits	Scale Factor	Range	Units	Presence
Field Types Present	8	1	---	bit field	M

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.

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

Parameter	# Bits	Scale Factor	Range	Units	Incl.
GSM Time Present	1	---	Boolean	---	M
GPS Week	10	1	0 – 1023	weeks	M
GPS TOW	23	0.08	0-604799.92	sec	M
BCCH Carrier	10	1	0 – 1023	---	C
BSIC	6	1	0 – 63	---	C
FNm	21	1	0 – $(2^{21}-1)$	frames	O
TN	3	1	0 – 7	timeslots	O
BN	8	1	0 – 156	bits	O
GPS TOW Assist	24*N_SAT	---	----	---	O

GSM Time Present

This field indicates whether or not GSM air-interface timing information for the reference cell is present in this message. The MS shall interpret a value of "1" to mean that GSM timing information is present, and "0" to mean that only the GPS Week, GPS TOW and optionally GPS TOW Assist fields are provided. This field is mandatory.

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. When GSM Time Present is "0", GPS TOW is simply an estimate of current GPS time of week.

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. These fields are conditionally present when GSM Time Present is "1". 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.14a below.

Table A.14a. 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 (without uncertainty) specified as per GSM 03.32. The purpose of this field is to provide the MS with a priori knowledge of its location in order to improve GPS receiver performance. This field is present when Reference Location Present bit in Field Types Present is "1".

DGPS Corrections

These fields specify the DGPS corrections to be used by the MS. These fields are present when DGPS Corrections Present bit in Field Types Present is "1". 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	---	1 – 64	---	M
IODE	8	---	0 – 239	---	M
UDRE	2	---	0 – 3	---	M
PRC	12	0.32	±655.34	meters	M
RRC	8	0.032	±4.064	Meter/sec	M
Delta PRC2	8	1	±127	meters	M
Delta RRC2	4	0.032	±0.224	meter/sec	M
Delta PRC3	8	1	±127	meters	M
Delta RRC3	4	0.032	±0.024	Meter/sec	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	No data available
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 providing information. The value "111" indicates that the corrections provided by the source are invalid, as judged by the source. In either 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 is incremented for each new set of ephemeris for the satellite and may occupy the numerical range of [0, 239] during normal operations. For more information about this field can be found from [14].

User Differential Range Error (UDRE)

This field provides an estimate of the uncertainty (1-σ) 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 below.

Table A.18: Values of UDRE IE

Value	Indication
00	UDRE ≤ 1.0 m
01	1.0 m < UDRE ≤ 4.0 m
10	4.0 m < UDRE ≤ 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 1, as shown in table A.17 above. The method of calculating this field is described in [3].

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.17 above. For some time $t_1 > t_0$, the corrections for IODE are estimated by

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

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

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

Delta Pseudo-Range Correction 2 (Delta PRC2)

This IE indicates the difference in the pseudorange correction between the satellite's ephemeris identified by IODE and the previous ephemeris two issues ago IODE – 2. The value of this IE is given in meters (m) and the resolution is 0.32. The method of calculating this IE are described in [14].

Delta Pseudo-Range Rate Correction 2 (Delta RRC2)

This IE indicates the difference in the pseudorange rate-of-change correction between the satellite's ephemeris identified by IODE and IODE-2. The value of this IE is given in meters per second (m/sec) and the resolution is 0.032. For some time $t_1 > t_0$, the corrections for IODE–2 are estimated by

$$\mathrm{PRC}(t_1, \mathrm{IODE–2}) = [\mathrm{PRC}(t_0, \mathrm{IODE}) + \mathrm{DeltaPRC}(t_0, \mathrm{IODE})] + [\mathrm{RRC}(t_0, \mathrm{IODE}) + \mathrm{DeltaRRC}(t_0, \mathrm{IODE})]\cdot(t_1 - t_0)\ ,$$

and the MS uses this to correct the pseudorange it measures at t_1 using ephemeris IODE-2, $\mathrm{PR_m}(t_1, \mathrm{IODE\text{-}2})$, by

$$\mathrm{PR}(t_1, \mathrm{IODE–2}) = \mathrm{PR_m}(t_1, \mathrm{IODE–2}) + \mathrm{PRC}(t_1, \mathrm{IODE–2})\ .$$

Delta Pseudo-Range Correction 3 (Delta PRC3)

This IE indicates the difference in the pseudorange correction between the satellite's ephemeris identified by IODE and the previous ephemeris three issues ago IODE – 3. The value of this IE is given in meters (m) and the resolution is 1. The method of calculating this IE are described in [14].

Delta Pseudo-Range Rate Correction 3 (Delta RRC3)

This IE indicates the difference in the pseudorange rate-of-change correction between the satellite's ephemeris identified by IODE and IODE-3. The value of this IE is given in meters per second (m/sec) and the resolution is 0,032. For some time $t_1 > t_0$, the corrections for IODE–3 are estimated by

$$\mathrm{PRC}(t_1, \mathrm{IODE}–3) = [\mathrm{PRC}(t_0, \mathrm{IODE}) + \mathrm{DeltaPRC}(t_0, \mathrm{IODE})] + [\mathrm{RRC}(t_0, \mathrm{IODE}) + \mathrm{DeltaRRC}(t_0, \mathrm{IODE})]\cdot(t_1 - t_0),$$

and the MS uses this to correct the pseudorange it measures at t_1 using ephemeris IODE-3, $\mathrm{PR}_m(t_1, \mathrm{IODE}-3)$, by

$$\mathrm{PR}(t_1, \mathrm{IODE}–3) = \mathrm{PR}_m(t_1, \mathrm{IODE}–3) + \mathrm{PRC}(t_1, \mathrm{IODE}–3)\ .$$

If there is not an ephemeris set for a currently visible satellite that is two and three issues old, then the parameters Delta PRC2, Delta RRC2, Delta PRC3, Delta RRC3 are set to zero.

Navigation Model

This set of fields contain information required to manage the transfer of precise navigation data to the GPS-capable MS. This information includes control bit fields as well as satellite ephemeris and clock corrections. This field is present when Navigation Model Present bit in Field Types Present is "1". 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 Assosicated 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
Δn	16	2^{-43}	semi-circles/sec	C
M_0	32	2^{-31}	semi-circles	C
C_{uc}	16	2^{-5}	meters	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^{-29}	radians	C
ω	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 [7].

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 below. 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. This field is present when Ionospheric Model Present bit in Field Types Present is "1". 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.
α_0	8	2^{-30}	seconds	C
α_1	8	2^{-27}	sec/semi-circle	C
α_2	8	2^{-24}	sec/(semi-circle)^2	C
α_3	8	2^{-24}	sec/(semi-circle)^3	C
β_0	8	2^{11}	seconds	C
β_1	8	2^{14}	sec/semi-circle	C
β_2	8	2^{16}	sec/(semi-circle)^2	C
β_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). This field is present when UTC Model Present bit in Field Types Present is "1". 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
Δt_{LS}	8	1	seconds	C
WN_{LSF}(1)	8	1	weeks	C
DN	8	1	days	C
Δt_{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 below. 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 [7]. 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 [7], 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^{-21}	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.

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).

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 –604799.92sec	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 1: 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 (0th order term)	-5,120 Hz to 5,117.5 Hz	12	2.5 Hz	M	
Doppler (1st order term)	--1 – 0.5	6		O[1]	
Doppler Uncertainty	12.5 Hz – 200 Hz [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 2: Both of these fields shall be present together, or none of them shall be present.

NOTE 3: Both of these fields shall be present together, or none of them shall be present.

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. This subfield is mandatory when the GPS Acquisition Assistance Data Information Element is included.

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 (0th order term)

This field contains the Doppler (0th order term) value. This field is mandatory.

Range: 5,120 Hz to 5,117.5 Hz

Doppler (1st order term)

This field contains the Doppler (1st order term) value. This field is optional.

Range: -1.0 to 0.5 Hz / s

Doppler Uncertainty

This field contains the Doppler uncertainty value. This field is optional.

Range: 12,5 Hz – 200 Hz

Code Phase

This field contains code phase. This field is mandatory.

Range. 0-1022 chips

Integer Code Phase

This field contains integer code phase. This field is mandatory.

Range: 0-19

GPS Bit Number

This field contains GPS bit number. This field is mandatory.

Range: 0-3

Code Phase Search Window

This field contains the 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. This field is optional.

Range: 0 – 348.75 degrees.

Elevation

This field contains the elevation angle. 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 Tables 38 - 40.

Table 38: Real-Time Integrity (Fields occurring once per message)

Parameter	# Bits	Scale Factor	Range	Units	Incl.
Bad Satellite Present	1	1	Boolean	---	M

Table 39: Real-Time Integrity - Parameters appearing when Bad Satellite Present is set

Parameter	# Bits	Scale Factor	Range	Units	Incl.
NBS	4	1	1 - 16	---	C

Table 40: Real-Time Integrity - Parameters appearing NBS times

Parameter	# Bits	Scale Factor	Range	Units	Incl.
Bad_SVID	6	1	1 – 64 (0-63)	---	C

Bad Satellite Present

This single bit parameter indicates that (0) all GPS satellites in the constellation are OK to use at this time, or (1) that there is at least one satellite that should be ignored by the MS-based GPS application.

NBS (Number of Bad Satellites)

This four bit field is dependent on Bad Satellite Present being set to one. In this case, the NBS field indicates the number of satellite ID's that follow that the user should not use at this time in a fix. This field is conditional.

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. This field is conditional.

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.7 References of Annex A

[1] T1P1.5/98-132r2, Evaluation Worksheet for Assisted-GPS (Ericsson).

[2] T1P1.5/99-181r0, Change Request against GSM 03.32 (CPS Ltd.).

[3] T1P1.5/98-440r0, Low-Complexity Assisted-GPS Positioning (Ericsson).

[4] TR45.5.2.3.LocParAdHoc/99.03.03.01, Draft Location Parameters and Message Structure (v8.0) (Motorola).

[5] T1P1.5/99-402r0, Proposed Point-to-Multipoint Message for GPS Differential Corrections (Ericsson/Nokia/Motorola).

[6] B. Parkinson and J. Spilker (eds.), Global Positioning System: Theory and Applications (I and II), AIAA, 1996.

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

[8] T1P1.5/99-027r4, GSM 04.71 version 1.0.1 for Release 1998.

[9] T1P1.5/99-276r0, Quantization Techniques for GPS Assistance Parameters (Ericsson).

[10] T1P1.5/99-424r1, Point-to-Point and Broadcast Signaling Messages for GPS Capable GSM Mobile Stations (Motorola).

[11] T1P1.5/99-563r0, Additions to GPS Acquisition Assistance Field (Motorola).

[12] T1P1.5/99-572r0, Message Supporting Simplified GPS Assistance (Motorola).

[13] T1P1.5/99-536r0, Comments to T1P1.5/99-187r3 (Ericsson).

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

Annex B (informative): Change History

Meeting	TDoc	CR	REV	SUBJECT	NEW_ VERS
SMG#29	P-99-510	A371	2	BCIE modifications due to EDGE	8.0.0
GP-02		A017r 1		Correction of E-OTD Measurement Quality Indications	7.3.0
GP-02		A015		Corrections to RRLP specification	7.3.0
-	-	-	-	Table formatting improved. References corrected.	7.3.0

History

Document history		
V7.0.0	August 1999	Publication
V7.0.1	January 2000	Publication
V7.1.0	February 2000	Publication
V7.2.0	May 2000	Publication
V7.3.0	November 2000	Publication