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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Location Services (LCS);
Serving Mobile Location Centre - Serving Mobile Location Centre (SMLC - SMLC);
SMLCPP specification
(GSM 08.31 version 8.0.0 Release 1999)**

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Contents

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Foreword

This Technical Specification (TS) has been produced by the Special Mobile Group (SMG).

The present document defines the SMLCPP protocol to be used between two peer Serving Mobile Location Centres (SMLC).

The contents of the present document are subject to continuing work within SMG and T1P1 and may change following formal SMG and T1P1 approval. Should SMG or T1P1 modify the contents of the present document it will then be re-issued with an identifying change of release date and an increase in version number as follows:

Version 8.x.y

where:

8 GSM Phase 2+ Release 1999;

x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.;

y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document contains the definition of the SMLCPP protocol to be used between two Serving Mobile Location Centres (SMLC).

The LCS architecture is described in 03.71. The following aspects of it are relevant to the issue:

- each SMLC controls a number of LMUs, and a given LMU is under the direct control of a single SMLC;
- there is a direct communication path, independent of SMLCPP, between a LMU and the SMLC that controls it;
- deciphering keys are controlled by one SMLC in the location area and sent to other SMLCs in the same location area.

SMLCPP runs between two SMLC functions in the same PLMN. Transport is outside the scope of the present document. It assumes a transport service between these functions, as provided by BSSAP-LE. The present document assumes that the underlying transport (e.g., as described by BSSMAP-LE specifications) provides for transport and routing for any two pairs of SMLCs which need to run SMLCPP exchanges, whatever the implementation options for each of the SMLCs (BSS based or NSS based).

The main functions of SMLCPP are described in [5]. The key aspects are:

a) allowing an SMLC to ask for and obtain measurements on specific MSs performed by LMUs not under its direct control (e.g., for TOA);

b) allowing an SMLC to ask for and obtain information about Radio Interface Timing (RIT), as known from measurements done by LMUs not under its direct control;

c) allowing an SMLC, that controls deciphering keys in the location area, to sent them to other SMLCs in the same location area.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1999 document, references to GSM documents are for Release 1999 versions (version 8.x.y).

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

[2] GSM 04.06: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[3] GSM 04.07: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3; General aspects".

[4] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

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

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

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

[8] Void

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

[10] Void

[11] GSM 04.71: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 Location Services (LCS) specification".

[12] GSM 09.31: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Base Station System Application Part LCS Extension (BSSAP-LE)".

3 Abbreviations

Abbreviations used in the present document are listed in GSM 01.04 and GSM 03.71.

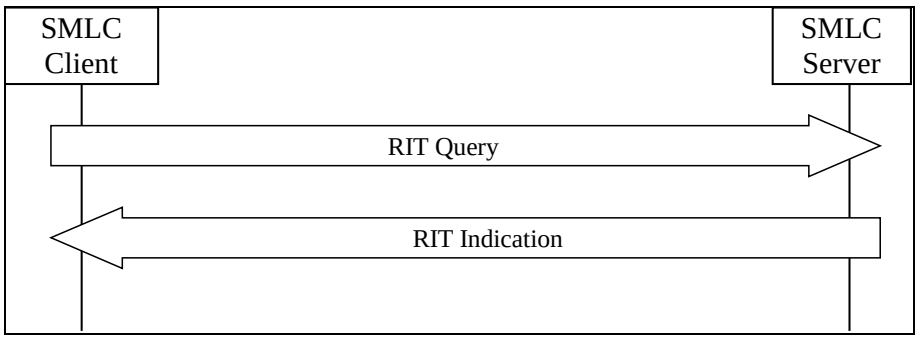
4 Procedures

4.1 RIT Procedures

Two modes of operation are supported:

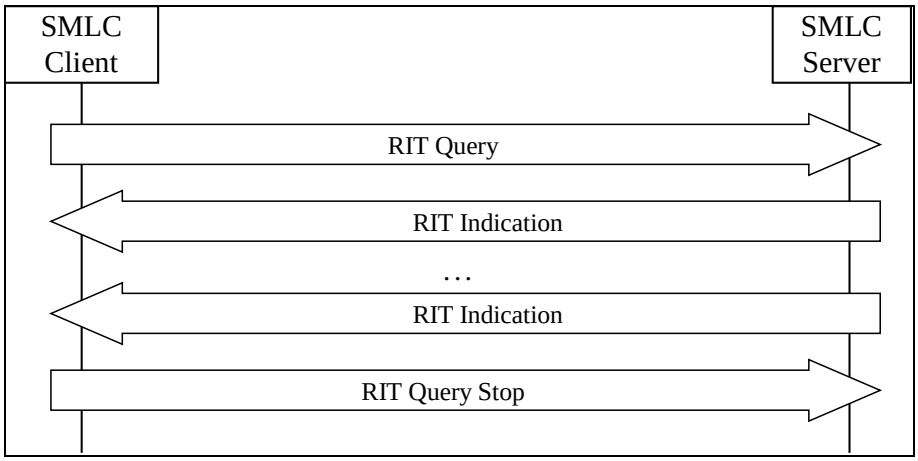
- provision of RIT information on request. In this mode a SMLC Client needing RIT information requests it from another SMLC using the RIT Query operation. The SMLC Server sends the requested RIT information using the RIT Indication operation. There are two cases:

  - single indication: RIT Indication is requested only once.



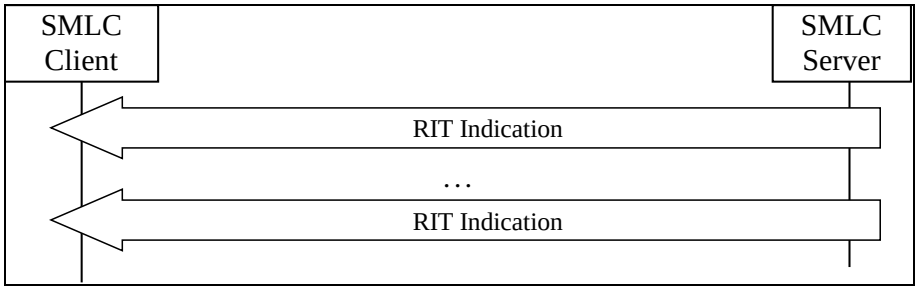
    In this case the procedure consists of one RIT Query and one RIT Indication operations.

  - Open-ended repetitive RIT Indications: RIT information is requested on a regular basis until the RIT Query Stop operation.



In this case the procedure consists of one RIT Query, one or more RIT Indication, and one RIT Query Stop operations.

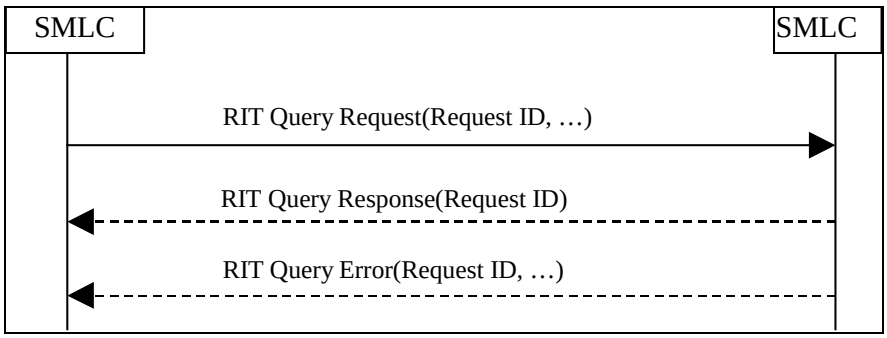
- Autonomous provision of RIT information. In this mode, the RIT information is provided automatically by the SMLC Server, according to an internal configuration not managed through SMLCPP (e.g., by O&M).



In the autonomous mode the procedure consists of one or more RIT Indication operations.

Three RIT related operations are then included in the SMLCPP, one for requesting the provision of RIT data, the second for provision, and the third one for stopping open-ended repetitive indications.

4.1.1 RIT Query Operation

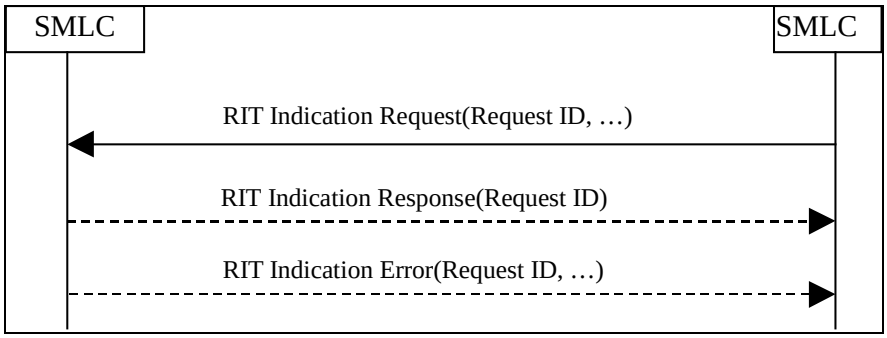


This operation allows a SMLC to query RIT information from another SMLC. This operation consists of sending of a RIT Query Request. It includes the Request ID , that is used to identify different queries. The RIT Query Request also includes the description of the scheduling of RIT Indication operations in the reverse direction. This includes the following cases:

- single indication; RIT Indication is requested only once;
- open-ended repetitive indications; RIT Indication operations are requested on a regular basis until the RIT Query Stop operation.

A RIT Query Response includes the same Request ID that the Request included, and it is used as a positive acknowledgement. A RIT Query Error message can be sent in return, if the SMLC Server detects an error situation (e.g. syntax errors, or overlapping Request ID values), or it can not fullfil the Request (e.g. RIT information is requested for unknown BTSs). It contains the same Request ID values as the Request.

4.1.2 RIT Indication Operation



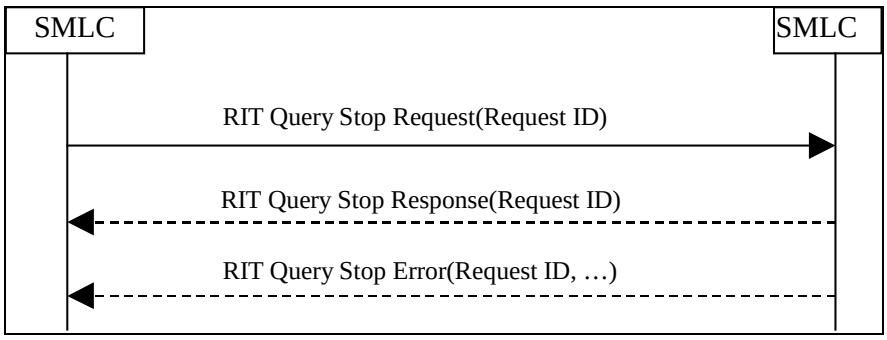
This operation allows a SMLC to send RIT information to another SMLC. It can be used both in the cased of autonomous provision, and the provision of RIT information on request.

The RIT Indication Request contains RIT information to be delivered. It also contains the Request ID that:

- has the same value as the RIT Query operation, that invoked the RIT Indication (RIT provision on request);
- has a reserved value indicating autonomous provision.

A RIT Indication Response includes the same Request ID that the Request included, and it is used as a positive acknowledgement. The SMLC Client can send a RIT Indication Error to the SMLC Server, if it detects an error situation (e.g. syntax errors, or unknown Request ID values).

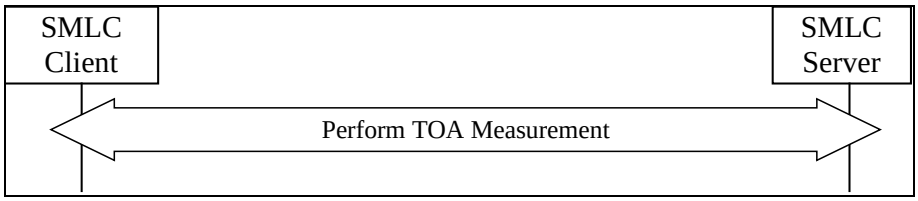
4.1.3 RIT Query Stop Operation



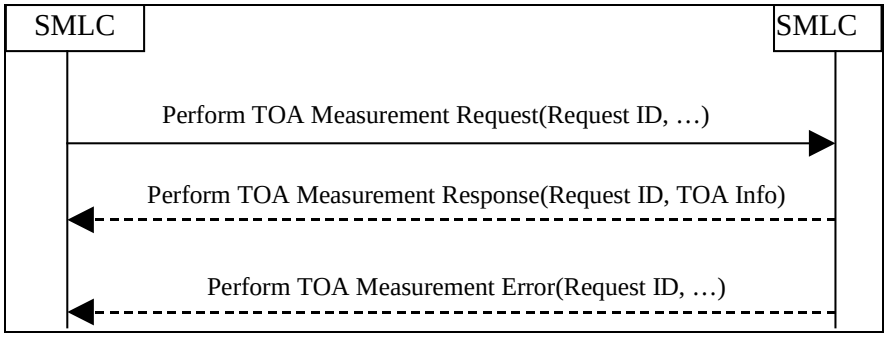
This operation allows a SMLC to send an indication to another SMLCPP to stop sending RIT information, that it has originally asked to obtain on open-ended repetitive basis. The RIT Query Stop Request includes the Request ID values that is the same as in the corresponding RIT Query that should be stopped. A RIT Query Stop Response includes the same Request ID that the Request included, and it is used as a positive acknowledgement. The SMLC Server can send a RIT Query Stop Error to the SMLC Client, if it detects an error situation (e.g. syntax errors, or unknown Request ID values).

4.2 TOA Procedure

This procedure includes a single operation, for requesting and obtaining TOA measurements for a single MS, and performed by one or several LMUs, as determined by the SMLC Server.



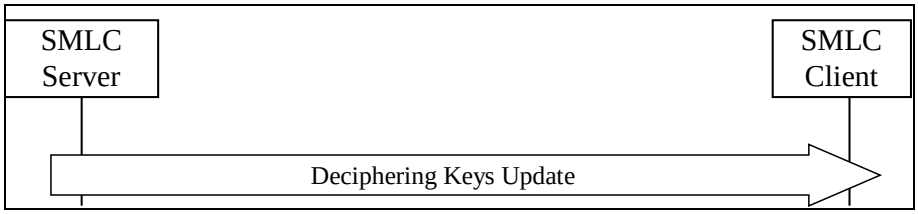
4.2.1 Perform TOA Measurement Operation



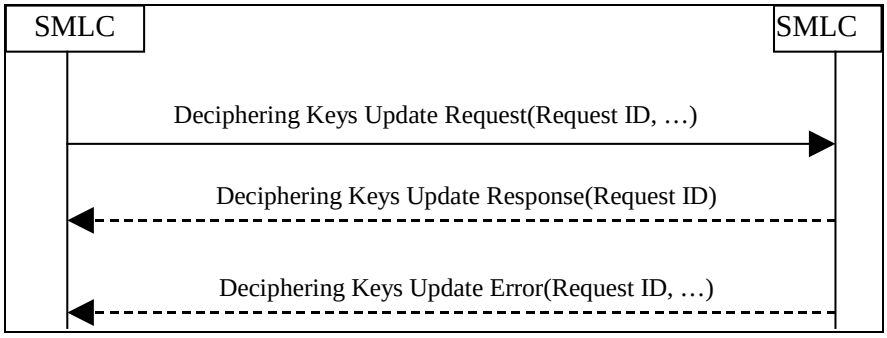
The Perform TOA Measurement Request message includes all the relevant details pertaining to the MS from which to measure signals. The Response message includes the results from one or several LMUs. An error message is returned by the SMLC Server in the case the request cannot be fulfilled (e.g. the LMUs can not measure the MS), or there is another error situation (syntax errors). The Request ID value in the Response, and the possible Error are the same as in the Request.

4.3 Deciphering Keys Procedure

This procedure includes one operation that is related to LCS assistance data broadcast deciphering keys. With this operation the SMLC Server controlling the deciphering keys (needed in LCS Assistance Data broadcast) can send the deciphering keys to other SMLC Clients in the same location area. One SMLC (i.e. SMLC Server) in location area is selected to control the deciphering keys and sending the keys to other SMLC Clients in location area. The sending has to be done to each SMLC Client with a separate message.



4.3.1 Deciphering Keys Update Operation



This operation allows a SMLC controlling deciphering keys to send the keys to another SMLC Client.

The Deciphering Keys Update Request includes the Request ID and information of keys. A Deciphering Keys Update Response includes only the same Request ID that the Request included, and it is used as a positive acknowledgement. The SMLC Client can send a Deciphering Keys Update Error to the SMLC Server, if it detects an error situation (e.g. syntax errors). It contains the same Request ID values as the Request.

5 Error Handling

In this Clause it is described how the SMLC should act in different error situations.

5.1 Missing Message Part

When a SMLC receives a Request message that does not contain one or more expected message parts (e.g. information elements, Arguments, Request ID), it sends an Error with the indication 'Missing Message Part' (if the operation type is known), and ignores the Request.

When a SMLC receives a Response or Error message that does not contain one or more expected message parts, it ignores the message.

5.2 Repeated Message Part

When a SMLC receives a Request message that contains one or more message parts (e.g. information elements, Arguments, Request ID) more times than expected, it sends an Error with the indication 'Repeated Message Part', and ignores the Request.

When a SMLC receives a Response or Error message that contains one or more message parts more times than expected, it ignores the message.

5.3 Unforeseen Message Part

When a SMLC receives a Request message that contains one or more unforeseen message parts (e.g. information elements, Result), it sends an Error with the indication 'Unforeseen Message Part', and ignores the Request.

When a SMLC receives a Response or Error message that contains one or more unforeseen message parts, it ignores the message.

5.4 Incorrect Data

When a SMLC receives a Request message that it can not fully understand, that contains syntax errors, or incorrect values, and no other Error Indication applies, it sends an Error with the indication 'Incorrect Data' (if the operation type is known), and ignores the Request. If the SMLC can not understand the operation of the Request,it just ignores the Request.

When a SMLC receives a Response or Error message that it can not fully understand, that contains syntax errors, or incorrect values, it ignores the message.

5.5 Repeated Operation

When a SMLC receives a Request message containing a Request ID, that is already in use by the same type of operation, the SMLC sends an Error with the indication 'Repeated Operation', and ignores the latter Request.

5.6 Unforeseen Operation

When a SMLC receives a Request for an operation that is unexpected, and none of the situations in subclause 5.5 applies,then the SMLC sends an Error with the indication 'Unforeseen Operation', and ignores the Request.

5.7 Unknown Request ID

When a SMLC receives a RIT Indication Request that contains a Request ID value, that is not connected to any pending RIT Query operation, or autonomous provision of RIT information, it sends a RIT Indication Error with the indication 'Unknown Request ID'.

When a SMLC receives a RIT Query Stop that contains a Request ID value, that is not connected to any pending RIT Query operation, it sends a RIT Query Stop Error with the indication 'Unknown Request ID'.

When a SMLC receives a Response or Error message, that contains a Request ID that is not connected to any pending operation of that type,the SMLC ignores the message.

5.8 Dublicate Request ID

When a SMLC receives a Request message containing a Request ID, that is already in use by another type of operation, the SMLC sends an Error with the indication 'Dublicate Request ID'.

5.9 No RIT Information

When a SMLC receives a RIT Query Request, and does not have any of the requested RIT information (e.g. all cells, whose RIT information is asked for, are unknown) then the SMLC sends a RIT Query Error with the indication 'No RIT Information'.

When during open-ended repetitive RIT indications, or autonumous provision of RIT information, there is no RIT information available, the requested SMLC refrains from sending RIT Indication Requests.

When the requesting SMLC has asked for open-ended repetitive RIT indications, but it does not receive expected RIT information, it can send a RIT Query Stop, and then a new RIT Query.

5.10 No TOA Measurements

When a SMLC receives a Perform TOA Measurement Request, and it can not perform requested measurements (e.g. it has lost connections to its LMUs, LMUs are busy, or no LMU can receive a MS) then the SMLC sends a Perform TOA Measurement Error with the indication 'NO TOA Measurements'.

5.11 Deciphering Keys Error

When a SMLCPP receives a Send Deciphering Keys Request, and it it detects an error situation connected with the contents of the message (e.g.the SMLC acts as a controller of deciphering keys for a location area, but it receives from another SMLC keys for the same location area), it sends a Send Deciphering Keys Error message with the indication 'Deciphering Keys Error'.

5.12 Internal Error

When a SMLCPP has any internal errors, that prevent it to act according to a Request, it can use 'Internal Error' indication in the Error message.

5.13 Other Error Situations

When a SMLCPP detects any other error situation when receiving a Request, it can use 'No Indication' indication in the Error message.

5.14 Summary of Indications

The following table summarizes the error indications, and which operations use them.

Table 1: Error Indications and operations

Error Indication	RIT Query	RIT Indication	RIT Query Stop	Perform TOA Measurement	Send Deciphering Keys
Missing Message Part	X	X	X	X	X
Repeated Message Part	X	X	X	X	X
Unforeseen Message Part	X	X	X	X	X
Incorrect Data	X	X	X	X	X
Repeated Operation	X	X	X	X	X
Unforeseen Operation		X	X		
UnknownRequest ID	X	X	X	X	X
Dublicate Request ID	X	X	X	X	X
No RIT Information	X				
No TOA Measurements				X	
Deciphering Keys Error					X
Internal Error	X	X	X	X	X
No Indication	X	X	X	X	X

6 Signalling Elements

In this Clause the messages are described.

The formal definitions of the SMLCPP messages are 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 this document are based on the same X.680 and X.691. BASIC-PER, unaligned variant is used.

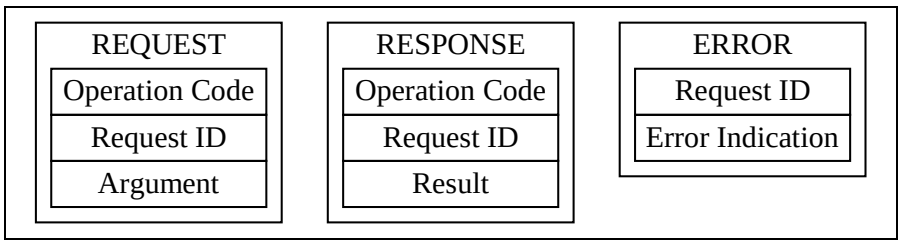
6.1 Messages

This clause describes the contents of the different messages.

There are three different types of messages:

- request;
- response;
- error

Operations use some or all of these message types, as described in Clause 4. The messages structures are as follows.



The following ASN.1 description gives the formal definition of the messages.

```
SMLCPP-PDUs
-- { SMLCPP-Operations object identifier }

DEFINITIONS AUTOMATIC TAGS::=

BEGIN

-- Export all operations as default


IMPORTS
    SMLCPP-OPERATION, ERROR
FROM
    SMLCPP-OperationDefinition

    rit-Query-Req, rit-Indication-Req, toa-PerformMeasure-Req,
    decipheringKeysUpdate-Req, rit-QueryStop-Req
FROM
    SMLCPP-Operations
;

-- PDU definitions for Requests
SMLCPP-REQ-PDU ::= SEQUENCE {
    code            SMLCPP-OPERATION.&code ({SMLCPP-Operation-table}),
    requestID       INTEGER (0..255),
    value       SMLCPP-OPERATION.&Argument ({SMLCPP-Operation-table}{@code})

}

-- PDU definitions for Responses
SMLCPP-RSP-PDU ::= SEQUENCE {
```

```
    code            SMLCPP-OPERATION.&code ({SMLCPP-Operation-table}),
    requestID       INTEGER (0..255),
    value       SMLCPP-OPERATION.&Result ({SMLCPP-Operation-table}{@code})
}

-- PDU definition for ERROR messages
SMLCPP-ERROR-PDU ::= SEQUENCE {
    requestID       INTEGER (0..255),
    value       ERROR.&code
}


SMLCPP-Operation-table SMLCPP-OPERATION ::= {
    rit-Query-Req |
    rit-Indication-Req |
    toa-PerformMeasure-Req |
    decipheringKeysUpdate-Req |
    rit-QueryStop-Req,
    ...
}

END
```

6.1.1 Operation Code

Operation code identifies different operations. Possible operations are those described in clause 4:

- RIT Query;
- RIT Indication;
- RIT Query Stop;
- Perform TOA Measurement;
- Deciphering Keys Update.

The following ASN.1 operation description is based on the operation definition in the Annex A, and gives the formal definition of operations.

```
SMLCPP-Operations
-- { SMLCPP-Operations object identifier }

DEFINITIONS AUTOMATIC TAGS::=

BEGIN

-- Export all operations as default


IMPORTS

-- SMLCPP-OPERATION and ERROR definitions from
    SMLCPP-OPERATION, ERROR
FROM
    SMLCPP-OperationDefinition

-- SMLCPP Datatypes
    RIT-Query-Arg, RIT-QueryRsp-Arg, RIT-Indication-Arg, RIT-IndicationRsp-Arg,
    TOA-PerformReq-Arg, TOA-PerformRsp-Arg, DecipheringKeys-Arg,
    DecipheringKeysRsp-Arg, RIT-StopQuery-Arg, RIT-StopQueryRsp-Arg
FROM
    SMLCPP-DataTypes

-- SMLCPP Errors
    missingMsgPart, repeatedMsgPart, unforeseenMsgPart, incorrectData,
    repeatedOperation, unforeseenOperation, unknownRequestID,
    dublicateErrorID, noRITInfo, noTOAMeasurements,
    decipheringKeyError, internalError, noIndication
FROM
    SMLCPP-Errors
;
```

```
-- SMLCPP Operations

-- RIT Query Request Operation
rit-Query-Req SMLCPP-OPERATION ::= {
    ARGUMENT    RIT-Query-Arg
    RESULT  RIT-QueryRsp-Arg
    ERRORS {    missingMsgPart |
            repeatedMsgPart |
            unforeseenMsgPart |
            incorrectData |
            repeatedOperation |
            unknownRequestID |
            dublicateErrorID |
            noRITInfo |
            internalError |
            noIndication
    }
    CODE    1
}

-- RIT Indication Operation
rit-Indication-Req SMLCPP-OPERATION ::= {
    ARGUMENT    RIT-Indication-Arg
    RESULT  RIT-IndicationRsp-Arg
    ERRORS {    missingMsgPart |
            repeatedMsgPart |
            unforeseenMsgPart |
            incorrectData |
            repeatedOperation |
            unforeseenOperation |
            unknownRequestID |
            dublicateErrorID |
            internalError |
            noIndication
    }
    CODE    2
}


-- Perform TOA Measurement Operation
toa-PerformMeasure-Req SMLCPP-OPERATION ::= {
    ARGUMENT    TOA-PerformReq-Arg
    RESULT  TOA-PerformRsp-Arg
    ERRORS {    missingMsgPart |
            repeatedMsgPart |
            unforeseenMsgPart |
            incorrectData |
            repeatedOperation |
            unforeseenOperation |
            dublicateErrorID |
            noTOAMeasurements |
            internalError |
            noIndication
    }
    CODE    3
}

-- Deciphering Keys Update Operation
decipheringKeysUpdate-Req SMLCPP-OPERATION ::= {
    ARGUMENT    DecipheringKeys-Arg
    RESULT  DecipheringKeysRsp-Arg
    ERRORS {    missingMsgPart |
            repeatedMsgPart |
            unforeseenMsgPart |
            incorrectData |
            repeatedOperation |
            unforeseenOperation |
            dublicateErrorID |
            decipheringKeyError |
            internalError |
            noIndication
    }
    CODE    4
}

-- RIT Query Stop Operation
rit-QueryStop-Req SMLCPP-OPERATION ::= {
```

```
    ARGUMENT    RIT-StopQuery-Arg
    RESULT  RIT-StopQueryRsp-Arg
    ERRORS {    missingMsgPart |
            repeatedMsgPart |
            unforeseenMsgPart |
            incorrectData |
            repeatedOperation |
            unforeseenOperation |
            unknownRequestID |
            dublicateErrorID |
            internalError |
            noIndication
    }
    CODE    5
}

END
```

6.1.2 Request ID

Request ID is used to refer to different requests from the same SMLC, or to refer to autonomous sending in the case of RIT Indication operation.

Value '0' may indicate autonomous sending in the case of the RIT Indication operation. This value is not used by any other operation.

Other values 1-255 indicate an ID from the requesting SMLC, that can select the value from those not already used between it and a certain recipient SMLC. No certain order of Request ID values is used (e.g. the value does not need to be sequential 1, 2, 3,…).

Within an operation possible Response and Error use the same Request ID that was in the Request.

In the case of open ended repetitive RIT Indications, the RIT Query operation contains a certain Request ID value, that the successive RIT Indication operations and the RIT Query Stop operation also use to refer to this reporting task. The value shall not be the one for autonomous sending.

6.1.3 Argument

Argument contains operation specific information in the Request message. See Annex B for the contents in each operation, and 6.2 for the formal ASN.1 definition.

6.1.4 Result

Result contains operation specific information in the Response message. See annex B for the contents in each operation, and subclause 6.2 for the formal ASN.1 definition.

6.1.5 Error Indication

Error Indication provides some precision on a detected error. The possible values of Error Indication are listed in table 1 in clause 5.

If an Error Indication is received encoding a value not in that table, the receiver shall behave as if the value was 'No indication'.

The following ASN.1 error description is based on the error definition in the annex A, and gives the formal definition of errors.

```
SMLCPP-Errors
-- { SMLCPP-Errors object identifier }

DEFINITIONS AUTOMATIC TAGS::=

BEGIN

-- Export all errors as default


IMPORTS

-- Operation definitions
    ERROR
FROM
    SMLCPP-OperationDefinition
;

-- Message contents errors

missingMsgPart  ERROR ::= {CODE 1}  -- Missing message Part
repeatedMsgPart     ERROR ::= {CODE 2}  -- Repeated message Part
unforeseenMsgPart   ERROR ::= {CODE 3}  -- Unforeseen message Part
incorrectData       ERROR ::= {CODE 4}  -- Incorrect Data

-- Operation errors

repeatedOperation   ERROR ::= {CODE 5}  -- Repeated Operation
unforeseenOperation ERROR ::= {CODE 6}  -- Unforeseen Operation

-- Request ID errors

unknownRequestID    ERROR ::= {CODE 7}  -- Unknown request ID
dublicateErrorID    ERROR ::= {CODE 8}  -- Duplicate Request ID

-- SMLCPP data errors

noRITInfo       ERROR ::= {CODE 9}  -- No RIT information
noTOAMeasurements   ERROR ::= {CODE 10} -- No TOA measurements
decipheringKeyError ERROR ::= {CODE 11} -- Deciphering Key error

-- Other errors

internalError       ERROR ::= {CODE 12} -- Internal Error
noIndication        ERROR ::= {CODE 13} -- No indication

END
```

6.2 ASN.1 Definition of Arguments, Results, and IEs

The following ASN.1 description gives the formal definition of Arguments, Results, and Information Elements.

```
SMLCPP-DataTypes
-- { object identifier }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- Export all operations as default


IMPORTS

-- 03.32 definition from 09.02, MAP
    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)}

-- Datatypes from 04.71, LLP
    CI, LAC, TimeSlot, FrameNumber,
    MeasuredTOA, TOA-QualityInfo, TOA-TimingReferenceInfo,
    TOA-ChannelDescr, TOA-SignalDescr, TOA-TimingDescr,
    TOA-MeasurementOpt, TOA-AddMeasurementInfo, TOA-MeasuredPeakList
FROM
    LLP-DataTypes
    -- { LLP-DataTypes object identifier }

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


;


-- ARGUMENT DEFINITIONS

-- RIT Indication Request (ARGUMENT)
RIT-Indication-Arg ::= SEQUENCE {
    referenceClock          ReferenceClock,
    rit-Data                SeqOfRITData,
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- RIT Indication Response (RESULT)
RIT-IndicationRsp-Arg ::= SEQUENCE {
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- RIT Query Request (ARGUMENT)
RIT-Query-Arg ::= SEQUENCE {
    requestType         RequestType,
    rit-RequestDellList SeqOfRequestedRITCell,
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- RIT Query Response (RESULT)
RIT-QueryRsp-Arg ::= SEQUENCE {
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- TOA Perform Request (ARGUMENT)
TOA-PerformReq-Arg ::= SEQUENCE {
    --
    --
    msPosition      MS-Position,
```

```
    -- Following elements are directly from 04.71
    channelDescription      TOA-ChannelDescr,
    signalDescription       TOA-SignalDescr,
    timingDescription       TOA-TimingDescr,
measureOptions          TOA-MeasurementOpt      OPTIONAL,
extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- TOA Perform Response (RESULT)
TOA-PerformRsp-Arg ::= SEQUENCE {
timingInformation       TOA-TimingReferenceInfo,
    deviceList          SeqOfDeviceList,
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- RIT Stop Query (ARGUMENT)
RIT-StopQuery-Arg ::= SEQUENCE {
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- RIT Stop Query Rsp (RESULT)
RIT-StopQueryRsp-Arg ::= SEQUENCE {
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- Deciphering Keys (ARGUMENT)
DecipheringKeys-Arg ::= SEQUENCE {
    decipheringKeyType      DecipheringKeyType,
    decipheringKeySet   DecipheringKeys,
    lac                 LAC,
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- Deciphering Keys Rsp(RESULT)
DecipheringKeysRsp-Arg ::= SEQUENCE {
    extensionContainer      ExtensionContainer      OPTIONAL,
    ...
}

-- FIELDS IN ARGUMENTS

-- RIT-Query-Arg DEFINITIONS
-- RequestType
RequestType ::= CHOICE {
    -- Send only one RIT Indication
    singleSending           NULL,

    -- Send RIT Indications until stop is received
    openEnded               OpenEndedType
}

OpenEndedType ::= SEQUENCE {
    -- Reporting period
    reportingPeriodInfo ReportingPeriodInfo,

    -- Tresholds for change of AT and deviation of AT
    changeLimit         INTEGER (0..250)    OPTIONAL,
    deviationLimitInfo      INTEGER (0..250)    OPTIONAL
}

-- Units and value of Reporting Period
ReportingPeriodInfo ::= SEQUENCE {
    periodFormat            PeriodFormat,
    periodValue         INTEGER (0..120)
}
PeriodFormat ::= ENUMERATED {
    tensOfSeconds (0),
    tensOfMinutes(1)
}
```

```
-- RequestedRITCell is actually a sequence of requested cells
SeqOfRequestedRITCell ::= SEQUENCE (SIZE (1..16)) OF RequestedRITCell
RequestedRITCell ::= SEQUENCE {
    cellLAC             LAC,
    cellCI              CI
}

-- RIT-Indication-Arg DEFINITIONS
-- Reference clock definition, including reference cell and time
ReferenceClock ::= SEQUENCE {
    referenceLAC            LAC,
    referenceCI         CI,
    referenceFrameNumber    FrameNumber,
    referenceTimeSlot       TimeSlot,

    -- If absoluteTime is absent, AT value of reference
    -- cell is not known
    absoluteTime            AbsoluteTime    OPTIONAL
}

-- Absolute time definition for reference cell
AbsoluteTime ::= SEQUENCE {
    universalClock          UniversalClockType,

    -- AT and ATChange definitions
    referenceAT         INTEGER (0..159999999999),
    referenceATChange       INTEGER (-1000..1000)
}
UniversalClockType ::= ENUMERATED {
    gpsClock (0),
    ...
}

-- RIT Data is actually a sequence of RIT data elements
SeqOfRITData ::= SEQUENCE (SIZE (1..16)) OF RIT-Data
RIT-Data ::= SEQUENCE {
    lac                 LAC,
    ci                  CI,
    frameNumber         FrameNumber,
    timeSlot                TimeSlot,

    -- ATD/RTD value and ATD/RTD change
    atdRTD              INTEGER (0..115400),
    atdRTDChange            INTEGER (-2000..2000)
}


-- TOA Perform Request DEFINITIONS

-- All needed elements are imported from 04.71 and 03.32 except the following

MS-Position ::= SEQUENCE {
    msLAC           LAC,
    msCI                CI,
    msTA                INTEGER (0..63)

}

-- TOA Perform Response DEFINITIONS


SeqOfDeviceList ::= SEQUENCE (SIZE (1..6)) OF DeviceList

DeviceList ::= SEQUENCE {
    devicePosition  Ext-GeographicalInformation,
    measureInfo         TOA-AddMeasurementInfo,

    -- Imported from 04.71
    peakList                TOA-MeasuredPeakList
}
```

```
-- CIPHERING KEY INFORMATION
-- Octets in DecipheringKeys are coded in the same way as the octets 3
-- to 17 of Deciphering Key IE in GSM 09.31. I.e. these octets contain
-- Current Deciphering Key, Next Deciphering Key and Ciphering Key Flag.
DecipheringKeys ::= OCTET STRING (SIZE (15))

-- Deciphering key type indicates the positioning method
-- value 0 corresponds to E-OTD
-- value 1 corresponds to GPS
DecipheringKeyType ::= INTEGER (0..1)

END
```

Annex A (normative): Operation and Error Definition

The following ASN.1 operation and error definition is the basis for the ASN.1 description of operations and errors in this specification.

```
SMLCPP-OperationDefinition
-- {object identifier }

DEFINITIONS AUTOMATIC TAGS::=

BEGIN

SMLCPP-OPERATION ::= CLASS {
    &Argument,
    &Result     OPTIONAL,
    &Errors     ERROR,
    &code       INTEGER (0..255)
}
WITH SYNTAX {
    ARGUMENT        &Argument
    [RESULT     &Result]
    ERRORS      &Errors
    CODE            &code
}

ERROR ::= CLASS {
    &code       INTEGER (0..255)
}
WITH SYNTAX {
    CODE            &code
}

END
```

Annex B (informative): Description of Arguments, Results and Information elements

B.1 Description of elements

B.1.1 Arguments and Results

The following subchapters describe the contents of Arguments and Results of different operations. The formal ASN.1 definitions of Arguments, Results, and the Information Elements in them is given in 6.2.

B.1.1.1 RIT Query Operation

B.1.1.1.1 Argument

Table B.1: RIT Query operation Argument

Information element	Type/Reference	Presence
Request Type	Request Type B.1.2.1	M
Cell List	Cell List B.1.2.2	M

Request Type IE

This IE provides the parameters for the requested RIT Indication operations and their scheduling.

Cell List IE

This IE defines the cells whose RIT information is requested.

B.1.1.1.2 Result

The Result is empty in the case of RIT Query operation. The RIT Query Response message is interpreted as a positive acknowledgement.

B.1.1.2 RIT Indication

B.1.1.2.1 Argument

Table B.2: RIT Indication operation Argument

Information element	Type/Reference	Presence
Reference Clock	Reference Clock B.1.2.3	M
RIT Data	RIT Data B.1.2.4	M

Reference Clock IE

The RTD and/or ATD values in this message are expressed relative to the reference clock indicated in this IE. In this version of the standard, the reference clock is the internal clock of some BTS or the GPS time reference. In the former case the BTS has to be measured by LMUs of both SMLCs.

RIT Data IE

This IE contains the RIT information from different cells reported relative to the reference clock defined in the previous IE.

B.1.1.2.2 Result

The RIT Indication operation has an empty Response message.

B.1.1.3 RIT Query Stop

B.1.1.3.1 Argument

The RIT Query Stop operation has an empty Argument.

B.1.1.3.2 Result

The RIT Query Stop operation has an empty Response message.

B.1.1.4 Perform TOA Measurement

B.1.1.4.1 Argument

Table B.3: Perform TOA Measurement operation Argument

Information element	Type/Reference	Presence
MS Position	MS Position 1.2.19	M
Channel Description	Channel Description B.1.2.6	M
Signal Description	Signal Description B.1.2.7	M
Timing Description	Timing Description B.1.2.8	M
Measurement Options	Measurement Options 1.2.10	O

The MS Position IE gives the approximate position of the MS. OtherIEs have the same meaning as those of the corresponding message in GSM 04.71. Some minor differences are described specifically for some of the IEs.

B.1.1.4.2 Result

Table B.4: Perform TOA Measurement operation Result

Information element	Type/Reference	Presence
Number of Measurement Devices	Number of Measurement Devices 1.2.12	M
Timing Information	Timing Information 1.2.13	M
The following is repeated "Number of Measurement Devices" times		
Device position	Geographical Area B.1.2.5	M
Measurement Info	Measurement Info 1.2.14	M
Number of Peaks	Number of Peaks 1.2.15	M
The following is repeated "Number of Peaks" times		
Measured TOA	Measured TOA 1.2.16	M
TOA Quality	TOA Quality 1.2.17	M

The fields and IEs are the same as the corresponding message in GSM 04.71, with the exception of the 'Device position'. The 'Device Position' IE indicates the geographical position of the device that performed the measurements.

B.1.1.5 Send Deciphering Keys

B.1.1.5.1 Request

Table B.5: Send Deciphering Keys operation Argument

Information element	Type/Reference	Presence
Deciphering Key Type	Deciphering Key Type 7	M
Deciphering Keys	Deciphering Keys 1.2.19	M
Location Area	Location Area 1.2.20	M

Deciphering Key Type IE

This IE defines the type of deciphering keys, i.e. whether the keys are applicable to E-OTD or GPS positioning method.

Deciphering Keys IE

This IE contains the Deciphering Keys information to be sent.

Location Area

This IE contains the LAC of the Location Area for which the deciphering keys are valid.

B.1.1.5.2 Result

The Send Deciphering Keys operation has an empty Result.

B.1.2 Information elements

This clause describes the information structure of information elements independently from the messages where they appear. The formal ASN.1 definition of information elements is given in subclause 6.2.

B.1.2.1 Request Type IE

This IE gives the description of the type of the RIT information request. It contains the following fields:

Reporting Type

This field indicates how long the SMLC should report RIT information. This field is mandatory. This field has the following values:

'0': 'Single Indication': Send only one RIT Indication;

'1': 'Open ended repetitive RIT Indications': Send RIT Indications, according to instructions in the following fields, until told otherwise with a RIT Query Stop operation.

Reporting Period Format

This field describes the units of the Reporting Period field. This field is conditional, and included, if the Reporting Type field is '1', i.e. open ended repetitive RIT Indications are requested. If this field is included the minimal time period between the RIT Indication operations is as expressed in this and Reporting Period fields.

'0': Reporting Period is told in tens of seconds;

'1': Reporting Period is in tens of minutes.

Reporting Period

This field together with the Reporting Period Format field describes the maximum time period between the RIT Indication operations. This field is conditional and included only if the Reporting Type has the value '1', i.e. open ended repetitive RIT Indications are requested.

The encoding shall provide for the range from 10 seconds to 20 hours, with a quantization of 10 minutes on the whole range, and no greater than 10 seconds in the range 10 seconds to 20 minutes. The Reporting Period Format field indicates the units for the value expressed in this field. Value '0' means that the RIT Indication operations should be performed as often as possible.

Range: 0 - 120.

Change Limit

This field indicates a threshold for the change of AT or ATD /RTD values. If any requested AT or ATD/RTD value has changed more than the threshold since the last RIT Indication for the same request, a new RIT Indication operation is performed. In rigorous terms, noting RITi the last reported value, and RITc the current one, a RIT Indication operation is performed when RITc moves out of the interval [RITi-threshold, RITi+threshold].

This field is meaningless unless the Reporting Type is '1', i.e. open ended repetitive RIT Indications are requested, in which case the field is optional. If this field is not included and the Reporting Type 1', the threshold is infinite (in other words, the difference since the last RIT Indication for the same request is not a trigger for a new Indication).

The encoding shall provide for a time in a range of 0.02 microseconds to 5 microseconds, with a quantization of 0.02 microseconds.

Range: 1-250.

Deviation Limit

This field indicates the threshold for the deviation of the AT or ATD/RTD values. If any time the predicted AT or ATD/RTD value, as computed from the reported AT or ATD/RTD values and rates of change in the last RIT Indication operation, has deviated more than the threshold compared to the current measurement result, a new RIT Indication operation is performed.

This field is meaningless unless the Reporting Type is '1', i.e. open ended repetitive RIT Indications have been requested, in which case the field is optional. If this field is not included and the Reporting Type is '1', the threshold is infinite (in other words, the difference with the predicted value is not a trigger for a new Indication).

The encoding shall provide for the range 0.02 to 5 microseconds, with a quantization of 0.02 microseconds.

Range: 1-250.

B.1.2.2 Cell List IE

This IE contains a list of one or several cells whose RIT information is requested.

This IE contains the following fields.

Number of Cells

This field indicates the number of cells in this IE. This field is mandatory.

Range: 1 - 16.

The following fields are repeated the number of times included in the Number of Cells field.

LAC

This field indicates the Location Area Code of the cell whose RIT information is requested, within the PLMN. This field is mandatory.

Range: 0 - 65535.

NOTE: The protocol does not provide for data exchange between SMLCs of different PLMNs.

CI

This field indicates the Cell Identity of the cell whose RIT information is requested, within the PLMN. This field is mandatory.

Range: 0 - 65535.

B.1.2.3 Reference Clock IE

This IE describes a reference clock. A clock includes a time reference, and a frequency reference. In this version of the document, the only supported method for indicating a time reference consists in indicating a particular time slot in a particular reference cell. The frequency reference is then that of the cell. The time reference is then the beginning of this time slot in the downlink direction, as perceived by a receiver as close as possible from transmitting antennae for the reference cell. In addition, and optionally, the time reference is indicated relative to a universal time reference, and an indication of the drift of the frequency reference relative to the universal time reference is provided.

This IE contains the following fields.

LAC

This field indicates the Location Area Code of the reference cell, within the PLMN. This field is mandatory.

Range: 0 - 65535.

NOTE: The protocol does not provide for data exchange between SMLCs of different PLMNs.

CI

This field indicates the Cell Identity of the reference cell, within the PLMN. This field is mandatory.

Range: 0 - 65535.

Reference Frame Number

This field indicates the TDMA frame number FN, as numbered according to GSM 05.10, of the reference cell corresponding to the reported values in this message, i.e. the FN during the time reference. This field is mandatory.

The encoding shall provide for a range of at least 2 hours before the instant the field is received.

Range: 0 - 2715647.

Reference Time Slot

Reference Time Slot indicates the time slot number TS,as numbered according to GSM 05.10, of the reference cell relative to which the timing values of the reference cell are given, i.e. the TS of the time slot whose beginning serves as the time reference. This field is mandatory.

Range: 0 to 7.

Absolute Time Present

This field indicates whether AT of the reference cell is reported or not. This field is mandatory.

'0': AT of reference cell is not reported;

'1':AT of reference cell is reported.

Universal Clock

This field indicates the type of the universal reference clock for absolute time (AT) indications. This field is optional, and included only if the Absolute Time Present field is '1'.

'0': GPS clock is used;

'1': Reserved for future use (e.g. Synchronized atomic clocks, or GLONASS).

Thus in the present state of this document, a single case (GPS) is supported.

Reception of this field not encoding the 'GPS clock' case will lead to a treatment of the information element as if the Absolute Time field was not present.

Reference AT

This field indicates the time of the reference instant, relative to the universal reference clock indicated in the previous field.

It is counted as elapsed time in units of 0.004 micro-seconds since last minute change. This field is conditional, and included only if the Absolute Time Present field is '1'.

Range: 0 - 15,999,999,999.

Reference AT Change

This field indicates the first time derivative of the AT value relative to the clock of the reference cell. A positive value indicates that the clock of the reference cell lags behind that of the universal reference clock. This field is conditional, and included only if the Absolute Time Present field is '1'.

The range is -0,05 … 0,05 ppm, with a quantization of 0,00005 ppm.

Range: -1 000 … 1 000.

B.1.2.4 RIT Data IE

This IE contains the requested RIT information. It contains the following fields.

Number of Cells

This field indicates the number of cells in this IE. This field is mandatory.

Range: 1 - 16.

The following fields are repeated the number of times included in the Number of Cells field.

LAC

This field indicates the Location Area Code of the cell whose RIT information is given, within the PLMN. This field is mandatory.

Range: 0 - 65535.

CI

This field indicates the Cell Identity of the cell whose RIT information is given, within the PLMN. This field is mandatory.

Range: 0 - 65535.

Cell Frame Number

This field indicates the TDMA frame number, as numbered according to GSM 05.10, of the first whole slot that has been (or would have been) sent by the cell at the time reference or immediately after. This field is mandatory.

Range: 0 - 2715647.

Cell Time Slot

This field indicates the time slot number TS, as numbered according to GSM 05.10, of the of first whole slot that has been (or would have been) sent by the cell at the time reference or immediately after.

This information is mandatory as the information about the TS is needed to correct for the different bit lengths of the timeslots.

Range: 0 to 7.

ATD/RTD Value

This field indicates the time elapsed between the time reference and the beginning of first slot from the measured cell in the downlink direction, beginning at the reference time or after, as perceived by a receiver as close as possible from transmitting antennae for the cell. The result is thus always positive. This field is mandatory.

The encoding shall provide for a range of 0 to 156.25 bit periods, with a quantization of 0,005 microseconds (around 1,5 metres at light speed).

Range: 0 …. 115400.

ATD/RTD Change

This field indicates the first time derivative of the ATD/RTD value between the transmissions of signals from the reference cell and the measured cell. This field is mandatory.

The encoding shall provide for a range of -0,10 … 0,10 ppm , with a quantization of 0,00005 ppm.

Range: -2 000 … 2 000.

B.1.2.5 Geographical Area IE

This IE encodes a geographical area as specified in GSM 03.32.

[Editor's Note: More accuracte definition is needed, e.g. is altitude,or uncertainty area included?]

B.1.2.6 Channel Description IE

This IE encodes a channel description as specified in GSM 04.71.

B.1.2.7 Signal Description IE

This IE encodes a signal description as specified in GSM 04.71.

B.1.2.8 Timing description IE

This IE is a delta from the corresponding IE in GSM 04.71. The only difference is that the start time at the MS is indicated, rather than the arrival time at the LMU (which is unknown since the LMU is unknown).

This IE provides information about the predicted arrival time of MS signals.

It contains almost exactly the same fields as the corresponding IE in GSM 04.71, and the requirement specifications are given here as a delta from the GSM 04.71 specification.

Time Reference

As in GSM 04.71.

GPS Start Time

When the Time Reference indicates 'GPS Time', this field indicates the time the MS starts sending the signal to measure.

The presence, range and accuracy requirements as those of the corresponding field in GSM 04.71.

GPS SV

As in GSM 04.71.

BCCH

As in GSM 04.71.

BSIC

As in GSM 04.71.

GSM Start Time

When the Time Reference indicates 'GSM Time', this field indicates the time the MS starts sending the signal to measure.

The presence, range and accuracy requirements as those of the corresponding field in GSM 04.71.

Start Time Uncertainty

This field indicates the uncertainty in the start of the signal from MS. The beginning of the signal to measure is expected to arrive in the interval.

[Start Time - Start Time Uncertainty, Start Time + Start Time Uncertainty]

The presence, range and accuracy requirements as those of the corresponding field in GSM 04.71.

B.1.2.9 Measurement Options IE

This field encodes measurement options as specified in GSM 04.71.

B.1.2.10 Number of Measurement Devices IE

As in GSM 04.71.

B.1.2.11 Timing Information IE

As in GSM 04.71.

B.1.2.12 Measurement Info IE

As in GSM 04.71.

B.1.2.13 Number of Peaks IE

As in GSM 04.71.

B.1.2.14 Measured TOA IE

As in GSM 04.71.

B.1.2.15 TOA Quality IE

As in GSM 04.71.

B.1.2.16 Deciphering Key Type IE

This IE defines the type of deciphering keys, i.e. whether the keys are applicable to E-OTD or GPS positioning method.

'0' E-OTD;

'1' GPS.

B.1.2.17 Deciphering Keys IE

The contents of this IE are as in GSM 09.31 in the corresponding IE excluding the BSSAP-LE Information Element Identifier, the length indicator, and the spare bits.

B.1.2.18 Location Area IE

This IE includes the LAC of the Location Area. This IE contains the following fields.

LAC

This field indicates the Location Area Code of the location area whose deciphering keys are included in this IE. This field is mandatory.

Range: 0 - 65535.

B.1.2.19 MS Position IE

This IE includes an approximate position of the MS, as expressed using LAC, CI, and TA. This IE contains the following fields:

LAC

This field indicates the Location Area Code of the location area of the MS. This field is mandatory.

Range: 0 - 65535.

CI

This field indicates the Cell Identity of the cell serving the MS. This field is mandatory.

Range: 0 - 65535.

TA

This field indicates the TA of the MS. This field is mandatory.

Range: 0 - 63.

Annex C (informative): Change History

Change history						
Meeting#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
SMG#30bis	08.31		-	R98	7.0.1	Approved at SMG#30bis as Release 98
	08.31			R99	8.0.0	Version for Release 99

History

Document history		
V8.0.0	May 2000	Publication