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Part LCS Extension (BSSAP-LE)
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Foreword

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

The present document defines the coding of information in an extension of the Base Station System Application Part (BSSAP) that is needed to support location services on interfaces based on use of BSSAP.

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1 Scope

The present document specifies procedures and information coding that are needed to define and support the BSSAP LCS Extension (BSSAP-LE). The BSSAP-LE message set is applicable to the following GSM interfaces defined in 3GPP TS 43.059:

- Lb interface (BSC-SMLC).
- Lp interface (SMLC-SMLC).

The present document defines message formats and encoding for BSSAP-LE and the particular subsets of it that are applicable to each of the above interfaces. The present document also defines the support for BSSAP-LE message transfer on each of these interfaces using either ITU-T and ANSI versions of SS7 MTP or IETF M3UA/SCTP and SCCP. Additional requirements for the above interfaces that are applicable to BSSAP-LE are also defined – e.g. usage of BSSAP (as defined in 3GPP TS 24.008 and 48.008) on the Lb interface.

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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [1a] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".
- [2] 3GPP TS 43.059: "Functional Stage 2 Description of Location Services in GERAN".
- [3] 3GPP TS 44.018: "Mobile radio interface layer 3 specification; Radio Resource Control Protocol".
- [3a] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core Network Protocols; Stage 3".
- [4] 3GPP TS 44.031: "Location Services (LCS); Mobile Station (MS) – Serving Mobile Location Center (SMLC); Radio Resource LCS Protocol (RRLP)".
- [5] 3GPP TS 44.071: "Location Services (LCS); Mobile radio interface layer 3 Location Services (LCS) specification".
- [6] 3GPP TS 48.006: "Signaling transport mechanism specification for the Base Station Subsystem – Mobile-services Switching Centre (BSS - MSC) interface".
- [7] 3GPP TS 48.008: "Mobile-services Switching Centre – Base Station System (MSC-BSS) interface; Layer 3 specification".
- [8] 3GPP TS 48.031: "Location Services (LCS); Serving Mobile Location Center – Serving Mobile Location Center (SMLC - SMLC); SMLCPP specification".
- [9] 3GPP TS 48.071: "Serving Mobile Location Center – Base Station Subsystem (SMLC-BSS) interface Layer 3 specification".
- [10] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".
- [10a] 3GPP TS 23.003: "Numbering, addressing and identification".

- [11] ITU-T Recommendation Q.702: "Signalling data link".
- [12] ITU-T Recommendation Q.703: "Signalling link".
- [13] ITU-T Recommendation Q.704: "Signalling network functions and messages".
- [14] ITU-T Recommendation Q.707: "Testing and maintenance".
- [15] ITU-T Recommendation Q.711: "Functional description of the signalling connection control part".
- [16] ITU-T Recommendation Q.712: "Definition and function of signalling connection control part messages".
- [17] ITU-T Recommendation Q.713: "Signalling connection control part formats and codes".
- [18] ITU-T Recommendation Q.714: "Signalling connection control part procedures".
- [19] ANSI T1.111 (1996): "Signalling System Number 7 – Message Transfer Part".
- [20] ANSI T1.112 (1996): "Signalling System Number 7 (SS7) - Signalling Connection Control Part Functional Description".
- [21] TIA/EIA/IS-J-STD-036 (2000): "Wireless Enhanced Emergency Services".
- [22] 3GPP TS 48.018: "General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".
- [23] IETF STD 51, RFC 1661(07/1994): "The Point-To-Point Protocol (PPP)".
- [24] IETF STD 51, RFC 1662(07/1994): "PPP in HDLC-like Framing".
- [25] IETF RFC 2507(02/1999): "IP header compression".
- [26] IETF RFC 1990(07/1994): "The PPP Multilink Protocol (MP)".
- [27] IETF RFC 2686(09/1999): "The Multi-Class Extension to Multi-Link PPP".
- [28] IETF RFC 2509(02/1999): "IP Header Compression over PPP".
- [29] 3GPP TS 29.202: "SS7 Signalling Transport in Core Network; Stage 3".
- [30] Galileo OS SIS ICD/D.0 "Galileo Open Service, Signal In Space Interface Control Document/Draft 0".
- [31] Global Navigation Satellite System GLONASS Interface Control Document, Version 5, 2002.
- [32] BDS-SIS-ICD-B1I-1.0: "BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal B1I (Version 1.0)", December 2012.

3 Definitions, abbreviations and symbols

For the purposes of the present document, the definitions, symbols and abbreviations listed in 3GPP TS 21.905 and 3GPP TS 43.059 apply.

4 Definition of BSSAP-LE

BSSAP-LE is an extension to BSSAP that contains messages and parameters specific to the support of LCS. The following subsets of BSSAP-LE are defined: DTAP-LE, BSSMAP-LE.

4.1 DTAP-LE Messages

DTAP-LE messages are transferred between an SMLC and a Type A LMU and comprise the following individual messages:

- REGISTER;
- FACILITY;
- RELEASE COMPLETE.

The content, encoding and certain procedures associated with DTAP-LE messages are defined in 3GPP TS 44.071.

4.2 BSSMAP-LE Messages

BSSMAP-LE messages are transferred between a BSS and SMLC and comprise the following individual messages:

BSSMAP-LE Positioning Messages:

- Perform Location Request;
- Perform Location Response;
- Perform Location Abort;
- Perform Location Information.

BSSMAP-LE Information Messages:

- Connection Oriented Information;
- Connectionless Information.

BSSMAP-LE General Messages:

- Reset;
- Reset Acknowledge.

The content and encoding of BSSMAP-LE messages are defined in the present document.

5 Procedures applicable to use of BSSAP-LE

5.1 Location Request

The Location Request procedure is applicable to the Lb interface. Its purpose is to obtain a location estimate for a target MS that is already in dedicated mode, in packet transfer mode, in packet idle mode, or in dual transfer mode. It is also used to provide an MS with LCS assistance data or with a deciphering key for LCS broadcast assistance data. The initiator of a location request is the BSS. The procedure makes use of SCCP connection oriented signaling on the Lb interface.

5.1.1 Successful Operation

The initiator of the location request sends a BSSMAP-LE Perform Location Request to the SMLC associated with the current serving cell for the target MS. The message contains the following mandatory (M), conditional (C) and optional (O) information, where conditional parameters are required if available.

- Location Type (M).
- GANSS Location Type (C)
- Cell Identifier (M).
- Classmark Information Type 3 (C).
- LCS Client Type (C).
- Chosen Channel (C).
- LCS Priority (C).
- LCS QoS (C).
- Requested GPS Assistance Data (C).
- BSSLAP APDU (C).
- LCS Capability (O).
- Packet Measurement Report (O).
- Measured Cell Identity List (O).
- IMSI of target MS (O).
- IMEI of target MS (O).
- Requested GANSS Assistance Data (C).

If requested, the SMLC performs positioning of the target MS using a particular position method or a combination of more than one positioning method. If neither the Classmark Information Type 3 IE nor the LCS Capability IE is present, the SMLC shall instigate only network based positioning methods (e.g. TA and U-TDOA but not GPS or E-OTD).

Alternatively, if requested otherwise, the SMLC may provide positioning assistance data to the MS. The SMLC may invoke the following other BSSAP-LE procedures to perform these procedures:

- connection oriented information transfer;
- connectionless information transfer;
- LMU connection establishment;
- LMU connection release;
- DTAP-LE information transfer.

Additional procedures defined in 3GPP TS 24.008 and 3GPP TS 48.008 may also be performed. If a location estimate was requested and was subsequently obtained, the SMLC shall return a BSSMAP-LE Perform Location Response to the initiator of the location request. This message contains the following mandatory, conditional and optional parameters.

- Location Estimate (M).
- Positioning Data (C).
- GANSS Positioning Data (C).

Restrictions on the geographic shape encoded within the Location Estimate parameter may exist for certain LCS client types. The SMLC shall comply with any restrictions defined in 3GPP specifications and, in a particular country, with any restrictions defined for a specific LCS client type in relevant national standards. For example, in the US, national

interim standard TIA/EIA/IS-J-STD-036 [21] restricts the geographic shape for an emergency services LCS client to minimally either an "ellipsoid point" or an "ellipsoid point with uncertainty circle and confidence" as defined in 3GPP TS 23.032.

If assistance data was instead requested for an MS and the SMLC was able successfully to transfer this to the MS, the SMLC shall return a BSSMAP-LE Perform Location Response to the initiator of the location request (serving BSC). This message shall contain no parameters. The absence of an LCS Cause parameter in this case implies that the transfer was successful.

Otherwise, if a deciphering key was requested for LCS broadcast assistance data and the SMLC has access to the appropriate keys, the SMLC shall return a BSSMAP-LE Perform Location Response to the initiator of the location request. This message contains the following mandatory parameters.

- Deciphering Keys (M).

5.1.2 Unsuccessful Operation

If the SMLC is unable to obtain any of the location information requested or if requested LCS assistance data could not be transferred or requested deciphering keys for broadcast assistance data could not be returned, the SMLC shall return a BSSMAP-LE Perform Location Response to the initiator of the Location Request carrying the following parameters:

- LCS Cause (M);
- Positioning Data (O).
- GANSS Positioning Data (O).

If assistance data or deciphering keys for a specific positioning method is not supported in the network or in the location area, the SMLC shall indicate this with LCS Cause value "Position method failure" accompanied with diagnostic value "Position Method Not Available in Network" or "Position Method Not Available in Location Area".

5.1.3 Abnormal Conditions

If an ongoing location request is preempted at the initiator by an inter-BSC handover or if the main signaling link to the target MS is lost or released or if there is a timeout waiting for the positioning response, or if there is an Inter NSE cell change in the PS Domain (e.g. detected by the BSS at receipt of BSSGP FLUSH-LL PDU) for which the BSS is unable to maintain the positioning procedure, the initiator shall send a BSSMAP-LE Perform Location Abort to the SMLC containing the following parameters.

- LCS Cause (M).

On receipt of this message, the SMLC shall stop positioning of the target MS and may release any resources (e.g. LMUs) previously allocated. If the SMLC has not yet returned a BSSMAP-LE Perform Location Response to the initiator, it shall return this message containing an LCS Cause indicating an abort and, optionally, positioning data, GANSS positioning data. The initiator shall then release the SCCP connection. If the SMLC cannot proceed with positioning due to some protocol violation or error condition (e.g. inter-BSC handover indication received from the serving BSC), it shall return a BSSMAP-LE Perform Location Response to the initiator containing an LCS cause and, optionally, positioning data, GANSS positioning data. The initiator need not reply at the BSSAP-LE level to this message. However, the initiator may return a BSSMAP-LE perform Location Abort which shall not be treated as an error by the SMLC.

5.1.4 Overload

If the SMLC is in an overload condition, it may reject a BSSMAP-LE Perform Location request by returning a BSSMAP-LE Perform Location response containing an LCS Cause parameter indicating congestion. The initiator of the location service request (BSC) may reduce the frequency of future location service requests until rejection due to overload has ceased. In reducing the frequency of location service requests, a BSC shall reduce lower priority requests, to zero if necessary, before reducing the frequency of higher priority requests. An SMLC shall similarly reject location service requests of a lower priority, to zero if necessary, due to overload before rejecting location service requests of a higher priority. An SMLC in an overload condition may optionally employ the following procedures to alleviate overload:

- a) Allow higher priority location service requests to preempt lower priority requests for which location service procedures are already in progress.
- b) Abort lower priority location service requests already in progress.
- c) Reduce the supported QoS for lower priority requests for a location estimate – e.g. by reducing accuracy or increasing response time.
- d) Employ MS based positioning methods, where supported by the target MS and SMLC, rather than MS assisted or network based methods (except TA).

The priority of a location service request shall be defined according to the value in the LCS Priority parameter. If this parameter is absent in a BSSMAP-LE Perform Location request, the lowest priority shall be assumed.

5.2 Connection Oriented Information Transfer

The Connection Oriented Information transfer procedure is applicable to the Lb interface. It enables two way transfer of BSSLAP messages between an SMLC and the BSS serving a target MS. The initiator of the procedure can be either the BSS serving the target MS or the SMLC. The procedure is only valid while a location request procedure for the target MS is ongoing. The procedure makes use of SCCP connection oriented signaling on the Lb interface and uses the same SCCP connection as the location request procedure for the particular target MS.

5.2.1 Successful Operation

An SMLC or BSS with a BSSLAP message to transfer concerning a particular target MS sends a BSSMAP-LE Connection Oriented Information message to a recipient carrying the following parameters:

- BSSLAP APDU (M);
- (Segmentation (C)).

If the sender is an SMLC, the message is transferred to the BSS. The BSS shall then perform the positioning operation requested by the BSSLAP APDU (refer to 3GPP TS 48.071). If the BSSLAP APDU contains an RRLP APDU, the BSS shall transfer this to the target MS.

If the sender is a BSS and the intended recipient is the SMLC for a target MS, the message is transferred to the SMLC. The SMLC shall then perform interpretation of the BSSLAP APDU.

5.2.2 Abnormal Conditions

At an intermediate entity, if a received BSSMAP-LE Connection Oriented Information message contains unrecognized information or if the message cannot be sent on, the message shall be discarded.

At the recipient entity, if a received BSSMAP-LE Connection Oriented Information message contains invalid or unrecognized information as defined for BSSAP-LE, any ongoing positioning procedure shall be terminated and associated resources may be released. If the recipient is a BSS, the SMLC shall be notified – e.g. using a BSSLAP Reject or Abort. If the recipient is an SMLC, a new positioning attempt (e.g. using a different position method) may be started.

If a BSS receives an error from SGSN after having attempted to transfer the information via SGSN to an MS for PS domain positioning, the BSS shall notify the SMLC with a BSSLAP Abort message.

5.2.3 Segmentation

Segmentation is only included for support of interoperability with Legacy (3GPP R4 and older) equipment when a segmented message is received from a Legacy node. 3GPP R5 and later equipment shall not initiate the use of segmentation.

The Segmentation parameter shall not be included if the BSSLAP message is not segmented.