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**Technical requirements for LTE mobile terminals supporting
BDS positioning**

LTE移动通信终端支持北斗定位的技术要求

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5 Terminal positioning architecture

5.1 In the E-UTRAN control plane positioning architecture the user equipment receives the satellite positioning assistance information and, on the basis of it, solves the measured values of the satellite positioning signals to obtain the positioning result; the base station sends the assistance information to the terminal; the enhanced serving mobile location centre obtains the assistance information and can provide assistance data for the

corresponding area according to the position of the base station, sending it to the terminal for use; and the mobility management entity triggers the positioning service and sends the positioning service request to the location centre, which triggers the related positioning process and completes the positioning of the user equipment.

5.2 In the E-UTRAN user plane positioning architecture the SUPL platform is the network-side server, whose function is to exchange information related to user plane positioning with the user equipment using the SUPL protocol.

6 Terminal positioning procedures

6.1.1 The two sides of an LPP session are called the target and the server; on the control plane they are the user equipment and the enhanced serving mobile location centre, and on the user plane the user equipment and the SUPL platform. The terminal positioning procedure of the LTE system is embodied in one or more LPP sessions, which comprise the transfer of positioning capabilities, the transfer of assistance data, the transfer of location information, error handling and session termination. The transfer of positioning capabilities is one-way and supports only the transfer of the capabilities of the target to the server, those capabilities being the ability to support different positioning methods, the ability to support different aspects of a particular method such as different types of satellite positioning assistance data, and certain capabilities common to several methods such as the ability to manage concurrent LPP sessions. The transfer of assistance data is one-way from server to target and is possible only over a unicast channel, the server being able to send further LPP messages with other assistance data besides the data matching the request of the target. The transfer of location information is one-way from target to server, the location information comprising the location estimate and the parameters used to calculate the location such as radio measurements and position measurements, and the target likewise being able to send further messages. Error handling is the notification by one side that the LPP message it has received is in error or does not match the request it sent, and may occur in both directions. Session termination is the notification by one side that it is going to terminate the LPP session in progress, and may also occur in both directions.

6.1.2 An LPP session occurs in the following conditions. For the transfer of capabilities, assistance data and location information, the session may begin with a request by one side, that side sending an LPP message requesting information and the other replying with an LPP message providing it; for assistance data and location information the replying side may provide additional information beyond the request, that information having to be of the same type as the information requested. A session may also occur without a request, one side sending a message providing information directly. To make sessions more flexible and effective, several LPP sessions may run concurrently between target and server, a new session being started before an earlier one has ended, but for one and the same

positioning method only one session at a time is to be used to obtain location information.

6.1.3 The concurrent LPP session flow has four steps: the server sends the target a request for a location measurement; the target sends the server a request for particular assistance data; the server sends the target the assistance data requested; and the target calculates the location information on the basis of that assistance data and sends it to the server in response to the first step. The order of LPP sessions need not be fixed; the user equipment may request assistance data from the location centre at any time so as to calculate the location information the centre has asked for; where the location information the user equipment returns does not meet the quality of service the centre requires, the centre may issue several requests for location information such as position-related measurements and a position estimate; and where the capability information the centre has requested has not been reported in full, the user equipment may report it at any time. Although the order may vary, the preferred order is the transfer of positioning capabilities, then of assistance data, then of location information.

6.2 The positioning and data acquisition procedures between the location centre and the base station may be embodied in one or more LPPa sessions, of which there are two types, the user equipment associated session, in which information for a particular terminal such as its positioning measurements is transferred, and the non-associated session, in which information about the base station such as its timing offset is transferred. An LPPa session is to be started only by a request from the location centre and is not to occur without such a request; in a session the centre sends the base station an LPPa request message and the base station sends back an LPPa response message. Where the session is associated with a terminal the base station may send one or more response messages; where it is not, the base station is to send only one. As with LPP sessions, several LPPa sessions may run concurrently. The flow of a session for the transfer of location information has three steps: the location centre sends an LPPa message requesting location information, stating the type of information and the corresponding quality of service, the request being able to concern a particular terminal; the base station sends an LPPa message providing location information in response, which is to match the request; and where the positioning method is the enhanced cell identity, the base station may send one or more further response messages carrying other location-related information. A note states that location information here comprises the location estimate and the parameters used to calculate the location, such as radio or positioning measurements.

6.3 The service layer support procedures combining LPP and LPPa cover the terminal positioning procedure for the network induced or mobile terminating location request and that for the mobile originating location request. For the first, the related services are led by the evolved packet core and the positioning procedure on that side is to conform to 3GPP TS 23.271 V16.0.0 (2020-07); the scenario described applies only to terminals in the connected state, an idle terminal being brought into the connected state by paging. The flow has four steps: the mobility management entity sends the location centre a location request

for the target terminal, possibly carrying the corresponding quality of service; the centre may obtain location-related information from the terminal, from the base station or from both, starting one or more LPP sessions with the terminal to transfer its positioning capabilities, to provide it with assistance information or to obtain its location information, the terminal itself being able to start one or more sessions after receiving the first LPP message, for instance to request assistance data; where the centre obtains location-related information from the base station it may start one or more LPPa sessions, which may take place before or at the same time as the LPP sessions; and the centre obtains the location estimate from the results and sends it to the mobility management entity in response to the first step. For the mobile originating location request the services are led by the terminal and the flow has seven steps, beginning with a non-access stratum request from the terminal to the mobility management entity which may carry an LPP protocol data unit, and ending with the forwarding of the location estimate to a third party where the request so requires and with the response sent back to the terminal.

6.4 The general SLMAP procedures are the measurement request, the measurement update and the measurement termination. In the measurement request the location centre obtains a timing measurement for a particular target terminal from the location measurement unit: the centre sends the unit a measurement request stating the target terminal and the data used for the measurement, such as the sounding reference signal configuration of that terminal, and the unit sends the centre the uplink relative time of arrival measurement result. In the measurement update the centre informs the unit, during a measurement request procedure, of an update to the sounding reference signal configuration of the target terminal: where the configuration the centre sent is no longer valid the centre is to send a measurement update, and where it has already received the measurement response the update is not to be sent, the unit then continuing the measurement with the updated configuration. In the measurement termination the centre terminates a measurement request procedure in progress, for instance because the terminal has left the network or has been handed over between mobility management entities; the measurement report in progress is discarded, and where the centre has already received the measurement response the termination is not to be sent. The abbreviation SLMAP is glossed in clause 4 with an expansion that describes an authentication protocol, which does not match the use made of it in this clause as the protocol between the location centre and the location measurement unit.

6.5 The service layer support procedures combining SLMAP and LPPa again cover the network induced and mobile terminating case and the mobile originating case. In the first the flow starts when the mobility management entity sends the location centre a location request for the target terminal, possibly with the quality of service; the centre obtains the configuration information of the target terminal from the base station; where it needs measurement results from several location measurement units it is to start an SLMAP session with each of them; and it obtains the location estimate from the results and sends it