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## TECHNICAL SPECIFICATION

**Digital cellular telecommunications system (Phase 2+) (GSM);  
Universal Mobile Telecommunications System (UMTS);  
LTE;  
5G;  
Non-Access-Stratum (NAS)  
functions related to Mobile Station (MS) in idle mode  
(3GPP TS 23.122 version 19.6.0 Release 19)**



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**Reference**

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**Keywords**

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# Foreword

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In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

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**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

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# 1 Scope

The present document gives an overview of the tasks undertaken by the Core network protocols of a Mobile Station (MS) when in idle mode, that is, switched on but typically not having a dedicated channel allocated. It also describes the corresponding network functions. The idle mode functions are also performed by a GPRS MS as long as no dedicated channel is allocated to the MS. The conditions when the idle mode functions are performed by an MS in the UTRA RRC connected mode states are specified in 3GPP TS 25.331 [33]. The conditions when the idle mode functions are performed by an MS in the E-UTRAN are specified in 3GPP TS 36.304 [43]. The conditions when the idle mode functions are performed by an MS in the NG-RAN are specified in 3GPP TS 36.304 [43] and 3GPP TS 38.304 [61]. The conditions when the idle mode functions are performed by an MS in the NG-RAN RRC inactive state are specified in 3GPP TS 36.331 [42] and 3GPP TS 38.331 [65].

The present document defines the PLMN selection for a multi mode MS that supports both 3GPP and 3GPP2 systems. The common PLMN selection logic covers also PLMNs that are available in 3GPP2 system, but the present document makes no changes on the cdma2000<sup>®</sup> signalling towards networks that are available via 3GPP2 system.

The present document gives procedures for using the CSG cells, whenever such use is permitted.

The present document gives procedures for using the CAG cells, when the MS supports CAG.

The present document specifies the SNPN selection.

This 3GPP TS outlines how the requirements of the 22 series Technical Specifications (especially 3GPP TS 22.011 [9]) on idle mode operation shall be implemented. Further details are given in 3GPP TS 24.008 [23].

Clause 2 of this 3GPP TS gives a general description of the idle mode process. Clause 3 outlines the main requirements and technical solutions of those requirements. Clause 4 describes the processes used in idle mode. There is inevitably some overlap between these clauses.

NOTE: cdma2000<sup>®</sup> is a registered trademark of the Telecommunications Industry Association (TIA-USA).

The present document describes the procedures for control plane solution of steering of roaming in 5GS in annex C.

Annex C is applicable to the MS, the AMF, the UDM and the SOR-AF in the 5GS.

The present document does not consider GERAN Iu mode.

## 1.1 References

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

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

- [1] Void.
- [2] Void.
- [3] Void.
- [4] Void.
- [5] Void.
- [6] Void.
- [7] Void.

- [8] Void.
- [9] 3GPP TS 22.011: "Service accessibility".
- [10] Void.
- [11] Void.
- [12] Void.
- [13] Void.
- [14] Void.
- [15] Void.
- [16] Void.
- [17] Void.
- [18] Void.
- [19] Void.
- [20] Void.
- [21] Void.
- [22] Void.
- [22A] 3GPP TS 23.003: "Numbering, addressing and identification".
- [23] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification, Core Network Protocols - Stage 3".
- [23A] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".
- [24] 3GPP TS 45.002: "Multiplexing and multiple access on the radio path".
- [25] 3GPP TS 45.008: "Radio subsystem link control".
- [26] Void.
- [27] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".
- [27A] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".
- [28] Void.
- [29] Void.
- [30] Void.
- [31] Void.
- [32] 3GPP TS 25.304: "UE Procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode".
- [33] 3GPP TS 25.331: "RRC Protocol Specification".
- [34] 3GPP TS 44.018: "Mobile radio interface layer 3 specification, Radio Resource Control Protocol".
- [35] 3GPP TS 43.022: "Functions related to Mobile Station (MS) in idle mode and group receive mode".
- [35A] 3GPP TS 43.318: "Generic Access Network (GAN); Stage 2".

- [35B] 3GPP TS 44.318: "Generic Access Network (GAN); Mobile GAN interface layer 3 specification; Stage 3".
- [36] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [37] Void.
- [38] 3GPP TS 21.111: "USIM and IC card requirements".
- [39] 3GPP TS 44.060: "General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol".
- [40] 3GPP TS 31.102: "Characteristics of the USIM Application".
- [41] 3GPP TS 31.111: "Universal Subscriber Identity Module (USIM), Application Toolkit (USAT)".
- [42] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA) Radio Resource Control (RRC); Protocol specification".
- [43] 3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode".
- [44] 3GPP2 C.S0016-D v1.0: "Over-the-Air Service Provisioning of Mobile Stations in Spread Spectrum Standards".
- [45] 3GPP2 C.S0011-C v2.0: "Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations".
- [46] 3GPP2 C.S0033-A v2.0: "Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access Terminal".
- [47] 3GPP TS 24.285: "Allowed Closed Subscriber Group (CSG) List Management Object (MO)".
- [48] Void.
- [49] 3GPP TS 22.220: "Service requirements for Home Node B (HNB) and Home eNode B (HeNB)".
- [50] 3GPP TS 24.368: "Non-Access Stratum (NAS) configuration Management Object (MO)".
- [51] 3GPP TS 24.334: "Proximity-services (ProSe) User Equipment (UE) to Proximity-services (ProSe) Function Protocol aspects; Stage 3".
- [52] 3GPP TS 24.333: "Proximity-services (ProSe) Management Objects (MO)".
- [53] 3GPP TS 24.105: "Application specific Congestion control for Data Communication (ACDC) Management Object (MO)".
- [54] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities".
- [55] 3GPP TS 43.064: "Overall description of the GPRS Radio Interface; Stage 2".
- [56] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description".
- [57] 3GPP TS 23.167: "IP Multimedia Subsystem (IMS) emergency sessions".
- [58] 3GPP TS 23.401: "GPRS enhancements for E-UTRAN access".
- [59] 3GPP TS 24.386: "User Equipment (UE) to V2X control function; protocol aspects; Stage 3".
- [60] 3GPP TS 24.385: "V2X services Management Object (MO)".
- [61] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in Idle mode and RRC Inactive state".
- [62] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".
- [63] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

- [64] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".
- [65] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".
- [66] 3GPP TS 33.501: "Security architecture and procedures for 5G System".
- [67] 3GPP TS 31.115: "Secured packet structure for (Universal) Subscriber Identity Module (U)SIM Toolkit applications".
- [68] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and Functional Description".
- [69] 3GPP TS 23.221: "Architectural requirements".
- [70] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS)".
- [71] 3GPP TS 29.544: "5G System (5GS); Secured Packet Application Function (SP-AF) services; Stage 3".
- [72] 3GPP TS 29.571: "5G System (5GS); Common Data Types for Service Based Interfaces; Stage 3".
- [73] ETSI TS 102 225: "Smart Cards; Secured packet structure for UICC based applications".
- [74] 3GPP TS 22.261: "Service requirements for the 5G system; Stage 1".
- [75] 3GPP TS 24.587: "Vehicle-to-Everything (V2X) services in 5G System (5GS); Stage 3".
- [76] ITU-T Recommendation E.212: "The international identification plan for public networks and subscriptions".
- [77] 3GPP TS 24.526: "UE policies for 5G System (5GS); Stage 3".
- [78] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".
- [79] 3GPP TS 24.588: "Vehicle-to-Everything (V2X) services in 5G System (5GS); User Equipment (UE) policies; Stage 3".
- [80] 3GPP TS 24.554: " Proximity-services (ProSe) in 5G System (5GS) protocol aspects; Stage 3".
- [81] 3GPP TS 24.555: "Proximity-services (ProSe) in 5G System (5GS); User Equipment (UE) policies; Stage 3".
- [82] 3GPP TS 29.504: "5G System; Unified Data Repository Services; Stage 3".
- [83] 3GPP TS 29.505: "5G System; Usage of the Unified Data Repository services for Subscription Data; Stage 3".
- [84] 3GPP TS 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".
- [85] 3GPP TS 23.247: "Architectural enhancements for 5G multicast-broadcast services; Stage 2".
- [86] 3GPP TS 24.577: "Aircraft-to-Everything (A2X) services in 5G System (5GS) protocol aspects; Stage 3".
- [87] 3GPP TS 24.578: "Aircraft-to-Everything (A2X) services in 5G System (5GS); UE policies; Stage 3".
- [88] 3GPP TS 29.550: "5G System; Steering of roaming application function services; Stage 3".
- [89] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

## 1.2 Definitions and abbreviations

For the purposes of the present document, the abbreviations defined in 3GPP TR 21.905 [36] apply.

**(A/Gb mode only):** Indicates this clause applies only to a GSM system which operates in A/Gb mode. For multi system case this is determined by the current serving radio access network.

**(Iu mode only):** Indicates this clause applies only to UMTS. For multi system case this is determined by the current serving radio access network.

NOTE 1: In accordance with the description of packet services in Iu mode in 3GPP TS 24.008 [23], the terms 'CS/PS mode of operation' and 'PS mode of operation' are not used in the present document. Instead the terms 'MS operation mode A' and 'MS operation mode C' are used.

**(S1 mode only):** Indicates this clause applies only to an EPS. For multi system case this is determined by the current serving radio access network.

**Acceptable Cell:** This is a cell that the MS may camp on to make emergency calls or to access RLOS. It must satisfy criteria which are defined for A/Gb mode in 3GPP TS 43.022 [35], for Iu mode in 3GPP TS 25.304 [32], for S1 mode in 3GPP TS 36.304 [43], and for NR access in N1 mode in 3GPP TS 38.304 [61] and for E-UTRA access in N1 mode in 3GPP TS 36.304 [43]. For an MS in eCall only mode, an acceptable cell must further satisfy the criteria defined in clause 4.4.3.1.1.

**Access Technology:** The access technology associated with a PLMN or SNPN. The MS uses this information to determine what type(s) of radio carrier to search for when attempting to select a specific PLMN or SNPN. The following access technologies are defined: GSM, UTRAN, GSM COMPACT, EC-GSM-IoT, cdma2000 1xRTT, cdma2000 HRPD, E-UTRAN (WB-S1 mode and NB-S1 mode), NG-RAN, satellite NG-RAN and satellite E-UTRAN (WB-S1 mode and NB-S1 mode). A PLMN may support more than one access technology. SNNs only support NG-RAN.

NOTE 2: Access technology "E-UTRAN" maps to core network type "EPC" and access technology "NG-RAN" maps to core network type "5GCN", see 3GPP TS 24.501 [64].

**ACDC:** Application specific Congestion control for Data Communication, see 3GPP TS 22.011 [9].

**Allowable PLMN:** In the case of an MS operating in MS operation mode A or B, this is a PLMN which is not in the list of "forbidden PLMNs" in the MS. In the case of an MS operating in MS operation mode C or an MS not supporting A/Gb mode and not supporting Iu mode, this is a PLMN which is not in the list of "forbidden PLMNs" and not in the list of "forbidden PLMNs for GPRS service" in the MS.

**Allowable SNPN:** In the case of an MS operating in SNPN access operation mode over 3GPP access and for an SNPN candidate which is not an SNPN selected for localized services in SNPN, this is an SNPN which is not in the list of "permanently forbidden SNNs" which is, if the MS supports access to an SNPN using credentials from a credentials holder, equivalent SNNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, and is not in the list of "temporarily forbidden SNNs" which is, if the MS supports access to an SNPN using credentials from a credentials holder, equivalent SNNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription. In the case of an MS operating in SNPN access operation mode over 3GPP access and for an SNPN candidate which is an SNPN selected for localized services in SNPN, this is an SNPN which is not in the list of "permanently forbidden SNNs for access for localized services in SNPN" which is associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, and is not in the list of "temporarily forbidden SNNs for access for localized services in SNPN" which is associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription. For onboarding services in SNPN, this is an SNPN which is not in the list of "permanently forbidden SNNs for onboarding services in SNPN" and is not in the list of "temporarily forbidden SNNs for onboarding services in SNPN".

**Allowable PLMN/access technology combination:** For an MS operating in MS operation mode C or an MS not supporting A/Gb mode and not supporting Iu mode, this is an allowable PLMN in any specific access technology. For an MS operating in MS operation mode A or B, this is a PLMN/access technology combination where:

- the PLMN is an allowable PLMN and the specific access technology is supporting non-GPRS services; or
- the PLMN is not in the list of "forbidden PLMNs" and not in the list of "forbidden PLMNs for GPRS service" in the MS and the specific access technology is only supporting GPRS services.

EXAMPLE: E-UTRAN, satellite E-UTRAN, satellite NG-RAN (see 3GPP TS 22.261 [74]) and NG-RAN are access technologies that are only supporting GPRS services.

**Available PLMN:** For GERAN A/Gb mode see 3GPP TS 43.022 [35]. For UTRAN see 3GPP TS 25.304 [32]. For E-UTRAN see 3GPP TS 36.304 [43]. For satellite E-UTRAN see 3GPP TS 36.304 [43]. For NG-RAN see

3GPP TS 36.304 [43] and 3GPP TS 38.304 [61]. For satellite NG-RAN, see 3GPP TS 38.304 [61]. For cdma2000<sup>®</sup> 1xRTT and cdma2000<sup>®</sup> HRPD see 3GPP2 C.S0016 [44].

**Available SNPN:** For NG-RAN see 3GPP TS 38.304 [61].

**Available PLMN/access technology combination:** This is an available PLMN in a specific access technology.

**CAG-ID authorized based on "Allowed CAG list":** A CAG-ID in an "Allowed CAG list", without a time validity information, or with a time validity information with at least one time period matching UE's current time.

**Camped on a cell:** The MS (ME if there is no SIM) has completed the cell selection/reselection process and has chosen a cell from which it plans to receive all available services. Note that the services may be limited, and that the PLMN or the SNPN may not be aware of the existence of the MS (ME) within the chosen cell.

**Country:** A country is identified by a single MCC value defined in ITU-T recommendation E.212 [76], with the exception of the following MCC ranges that identify a single country:

- values 310 through 316 (USA);
- values 404 through 406 (India);
- values 440 through 441 (Japan);
- values 460 through 461 (China); and
- values 234 through 235 (United Kingdom).

**Permitted CSG list:** See 3GPP TS 36.304 [43].

**Current serving cell:** This is the cell on which the MS is camped.

**CTS MS:** An MS capable of CTS services is a CTS MS.

**Discontinuous coverage:** Deployment option for satellite E-UTRAN access, in which shorter periods of satellite E-UTRAN access radio coverage are followed by longer periods of satellite E-UTRAN access coverage gaps. During coverage gaps, the access stratum may be deactivated. For more details see 3GPP TS 23.401 [58] and 3GPP TS 36.304 [43].

**EAB:** Extended Access Barring, see 3GPP TS 22.011 [9].

**Extended Coverage in GSM for Internet of Things (EC-GSM-IoT):** Extended coverage in GSM for IoT is a feature which enables extended coverage operation. See 3GPP TS 43.064 [55].

**EHPLMN:** Any of the PLMN entries contained in the Equivalent HPLMN list.

**Equivalent HPLMN list:** To allow provision for multiple HPLMN codes, PLMN codes that are present within this list shall replace the HPLMN code derived from the IMSI for PLMN selection purposes. This list is stored on the USIM and is known as the EHPLMN list. The EHPLMN list may also contain the HPLMN code derived from the IMSI. If the HPLMN code derived from the IMSI is not present in the EHPLMN list then the HPLMN code derived from the IMSI shall be treated as a Visited PLMN for PLMN selection purposes.

**E-UTRAN access technology:** A radio carrier deployed in E-UTRAN other than Satellite E-UTRAN access technology.

**Generic Access Network (GAN):** See 3GPP TS 43.318 [35A].

**GAN mode:** See 3GPP TS 43.318 [35A].

**GERAN access technology:** In the present specification, access technology "GERAN" is used as a synonym for access technology "GSM".

**GPRS MS:** An MS capable of GPRS services is a GPRS MS.

**MS operation mode:** See 3GPP TS 23.060 [27].

**High quality signal:** The high quality signal limit is used in the PLMN selection procedure. It is defined in the appropriate AS specification: 3GPP TS 43.022 [35] for the GSM radio access technology, 3GPP TS 25.304 [32] for the

UMTS radio access technology (FDD or TDD mode), 3GPP TS 36.304 [43] for the E-UTRAN radio access technology (WB-S1 mode, NB-S1 mode, WB-N1 mode or NB-N1 mode), 3GPP TS 36.304 [43] and 3GPP TS 38.304 [61] for the NG-RAN radio access technology. For 3GPP2 access technologies the high quality signal limit is defined in 3GPP2 C.S0011 [45] for cdma2000<sup>®</sup> 1xRTT and in 3GPP2 C.S0033 [46] for cdma2000<sup>®</sup> HRPD. A mobile station attempting to find a cell that supports EC-GSM-IoT (see 3GPP TS 43.064 [55]) does not use high quality signal limit in the PLMN selection procedure, i.e. for the purpose of PLMN selection, when attempting to find a cell that supports EC-GSM-IoT, any found cell supporting EC-GSM-IoT is considered to be received with high quality signal. A UE attempting to find a cell that supports enhanced coverage when operating in any WB-S1 or WB-N1 enhanced coverage mode does not use high quality signal limit in the PLMN selection procedure, i.e. for the purpose of PLMN selection, when attempting to find a cell that supports enhanced coverage, any found cell supporting enhanced coverage and satisfying the coverage specific quality signal limit defined for CE mode (see 3GPP TS 36.304 [43]) is considered to be received with high quality signal.

**Home PLMN:** This is a PLMN where the MCC and MNC of the PLMN identity match the MCC and MNC of the IMSI. Matching criteria are defined in Annex A.

**In A/Gb mode:** Indicates this clause applies only to a GSM system which operates in A/Gb mode. For multi system case this is determined by the current serving radio access network.

**In Iu mode:** Indicates this clause applies only to UMTS. For multi system case this is determined by the current serving radio access network.

**In N1 mode:** Indicates this clause applies only to an 5GS. For multi system case this is determined by the current serving radio access network.

**In NB-N1 mode:** Indicates this paragraph applies only to a system which operates in NB-N1 mode. For a multi-access system this case applies if the current serving radio access network provides access to 5G network services via E-UTRA connected to 5GCN by NB-IoT (see 3GPP TS 36.300 [56], 3GPP TS 36.331 [42], 3GPP TS 36.306 [54]).

**In WB-N1 mode:** Indicates this paragraph applies only to a system which operates in WB-N1 mode. For a multi-access system this case applies if the system operates in N1 mode with E-UTRA connected to 5GCN, but not in NB-N1 mode.

**In S1 mode:** Indicates this clause applies only to an EPS. The S1 mode includes WB-S1 mode and NB-S1 mode. For multi system case this is determined by the current serving radio access network.

**In NB-S1 mode:** Indicates this paragraph applies only to a system which operates in NB-S1 mode. For a multi-access system this case applies if the current serving radio access network provides access to network services via E-UTRA by NB-IoT (see 3GPP TS 36.300 [56], 3GPP TS 36.331 [22], 3GPP TS 36.306 [54]).

**In WB-S1 mode:** Indicates this paragraph applies only to a system which operates in WB-S1 mode. For a multi-access system this case applies if the system operates in S1 mode, but not in NB-S1 mode.

**Limited Service State:** See clause 3.5.

**Localised Service Area (LSA):** A localised service area consists of a cell or a number of cells. The cells constituting a LSA may not necessarily provide contiguous coverage.

**Localized services in NPN:** Localized services in NPN are services, which are provided by an NPN at specific or limited area, are bounded in time, or both.

**Localized services in SNPN:** Localized services in SNPN are localized services in NPN, which are provided by an SNPN at specific or limited area, are bounded in time, or both.

**Location Registration (LR):** An MS which is IMSI attached to non-GPRS services only performs location registration by the location updating procedure. A GPRS MS which is IMSI attached to GPRS services or to GPRS and non-GPRS services performs location registration by the routing area update procedure only when in a network of network operation mode I. Both location updating and routing area update procedures are performed independently by the GPRS MS when it is IMSI attached to GPRS and non-GPRS services in a network of network operation mode II (see 3GPP TS 23.060 [27]). An MS which is attached via the E-UTRAN performs location registration by the tracking area update procedure. An MS which is registered via the NG-RAN performs location registration by the registration procedure for mobility and periodic registration update (see 3GPP TS 24.501 [64]).

**MINT:** Minimization of service interruption (see 3GPP TS 22.261 [71]).