**3GPP TSG-WG SA2 Meeting #143E e-meeting  *S2-210xxxx***

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network | **X** |

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|  |
| ***Title:***  | Introduction of busy response to paging |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | MUSIM |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | Intoduction of the new feature where a UE can respond to paging with a busy indication. |
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| ***Summary of change:*** | Add the option to respond with a busy indicator when paged. |
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| ***Consequences if not approved:*** | The new agreed feature from the FS\_MuSIM is not introdused. |
|  |  |
| ***Clauses affected:*** | 5.3.3.0, 5.3.3.1,5.3.3.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\*\*\*\*\* BEGIN 1st CHANGE \*\*\*\*\*

NEXT CHANGE

#### 5.3.3.0 Triggers for tracking area update

A stand-alone tracking area update (with or without S‑GW change, described in clauses 5.3.3.1 and 5.3.3.2 respectively) occurs when a GPRS-attached or E‑UTRAN-attached UE experiences any of the following conditions:

- UE detects it has entered a new TA that is not in the list of TAIs that the UE registered with the network (except for the case of a UE configured to perform Attach with IMSI when entering a TA in a new non-equivalent PLMN in RRC-IDLE mode);

- the periodic TA update timer has expired;

- UE was in UTRAN PMM\_Connected state (e.g. URA\_PCH) when it reselects to E‑UTRAN;

- UE was in GPRS READY state when it reselects to E‑UTRAN;

- the TIN indicates "P-TMSI" when the UE reselects to E-UTRAN (e.g. due to bearer configuration modifications performed on GERAN/UTRAN);

- the RRC connection was released with release cause "load re-balancing TAU required";

- the RRC layer in the UE informs the UE's NAS layer that an RRC connection failure (in either E-UTRAN or UTRAN) has occurred;

- a change of the UE Network Capability and/or MS Network Capability and/or UE Specific DRX Parameters and/or TS 24.008 [47] MS Radio Access capability (e.g. due to GERAN radio capability change, E-UTRAN, NG-RAN capability change or cdma2000 Radio Access Technology Capability change) information of the UE.

- for UE supporting RACS in ECM-IDLE as defined in clause 5.11.3a, a change in UE Radio Access capability (e.g. due to GERAN radio capability change, E-UTRAN, NG-RAN capability change or cdma2000 Radio Access Technology Capability change) corresponding to signalling a different UE Radio Capability ID.

- a change in conditions in the UE require a change in the extended idle mode DRX parameters previously provided by the MME.

- for a UE supporting CS fallback, or configured to support IMS voice, or both, a change of the UE's usage setting or voice domain preference for E-UTRAN.

- for a SR-VCC capable UE, a change of MS Classmark 2 and/or MS Classmark 3 and/or Supported Codecs.

- UE manually selects a CSG cell whose CSG ID and associated PLMN is absent from both the UE's Allowed CSG list and the UE's Operator CSG list.

- UE receives a paging request from the MME while the Mobility Management back off timer is running and the UE's TIN indicates "P-TMSI".

- a change in any of the values of information included in Preferred Network Behaviour as defined in clause 4.3.5.10 that would create incompatibility with the Supported Network Behaviour provided by the serving MME.

NOTE 1: The complete list of TAU triggers is specified in TS 24.301 [46].

The procedure is initiated by an UE in either ECM-IDLE state or ECM-CONNECTED state. The decision to perform S‑GW change during the tracking area update procedure is made by the MME independently from the triggers above.

If SIPTO is allowed for the APN associated with a PDN connection, the MME should re-evaluate whether the PDN GW location is still acceptable. If the MME determines that PDN GW re-location is needed, the MME may initiate PDN deactivation with reactivation requested according to clause 5.10.3 at the end of the tracking area/routing area update procedure.

NOTE 2. It depends on the operator's configuration in the MME whether to use the deactivation with reactivation request or allow the continued usage of the already connected GW.

If SIPTO at the local network is allowed for the APN associated with a PDN connection the MME handles the SIPTO at the Local Network PDN connection as follows.

 For a L‑GW collocated with (H)eNB:

- For intra-MME mobility, upon completion of the TAU procedure the MME shall deactivate the SIPTO at the local Network PDN connection with the "reactivation requested" cause value according to clause 5.10.3. If the UE has no other PDN connection, the MME initiates "explicit detach with reattach required" procedure according to clause 5.3.8.3.

- For Inter-MME/SGSN mobility, as part of the Tracking Area Update procedure, the source MME shall remove the bearer(s) corresponding to the SIPTO at Local Network PDN connection and shall release the core network resources associated to the SIPTO at the Local Network PDN connection by performing the MME-initiated PDN Connection Deactivation before sending the Context Response message.

 For a stand-alone GW:

- For intra-MME mobility, upon completion of the TAU procedure the MME checks that the Local Home Network ID has changed and decides whether to deactivate the SIPTO at the local Network PDN connection with the "reactivation requested" cause value according to clause 5.10.3. If the UE has no other PDN connection, the MME initiates "explicit detach with reattach required" procedure according to clause 5.3.8.3.

- For Inter-MME/SGSN mobility, upon completion of the TAU/RAU procedure the new MME/SGSN checks that the Local Home Network ID has changed and decides whether to deactivate the SIPTO at the Local Network PDN connection with the "reactivation requested" cause value according to clause 5.10.3. If the UE has no other PDN connection, the MME initiates "explicit detach with reattach required" procedure according to clause 5.3.8.3.

If LIPA is active for a PDN connection of the UE, the source MME (or S4-SGSN) shall not include LIPA bearer(s) in the EPS bearer Context during Tracking Area Update procedure and shall release the core network resources of this LIPA PDN connection by peforming the MME requested PDN disconnection procedure according to steps 2 to 6 of clause 5.10.3 before it responds with the Context Response message in the case of inter-MME/SGSN mobility or after it receives Tracking Area Update Request in the case of intra-MME mobility.

NOTE 3: The source MME may not be able to release the LIPA PDN connection after the Context Response is sent as when there is no S-GW relocation, the S-GW will assign the S11 control tunnel of the UE to the new MME after the new MME updates the context information.

During the Tracking Area Update procedure, if the MME supports SRVCC and if the UE SRVCC capability has changed, the MME informs the HSS with the UE SRVCC capability e.g. for further IMS registration.

The cell selection for UTRAN is described in TS 25.304 [12] and TS 25.331 [33].

If during the Tracking Area Update procedure the MME detects that the Serving GW or/and the MME needs be relocated, the old MME may reject any PDN GW initiated EPS bearer(s) request received since the Tracking Area Update procedure started and if rejected, the old MME shall include an indication that the request has been temporarily rejected due to mobility procedure in progress. The rejection is forwarded by the Serving GW to the PDN GW, with the indication that the request has been temporarily rejected.

Upon reception of a rejection for an EPS bearer(s) PDN GW initiated procedure with an indication that the request has been temporarily rejected due to mobility procedure in progress, the PDN GW start a locally configured guard timer. The PDN GW shall re-attempt, up to a pre-configured number of times, when either it detects that the Tracking Area Update procedure is completed or has failed using message reception or at expiry of the guard timer.

A Multi-USIM UE, when it has received a Paging message and it determines it does not accept it due to competing services for another USIM, subject to implementation constraints, attempts a TAU to signal it does not accept the incoming paging message, providing a BUSY Indication as defined in clause 5.3.3.2. If the MME receives this BUSY indication, it signals to the SGW the paging has failed.

More CHANGES

#### 5.3.3.2 E-UTRAN Tracking Area Update without S‑GW Change



Figure 5.3.3.2-1: E-UTRAN Tracking Area Update without S‑GW change

NOTE 1: For a PMIP-based S5/S8, procedure steps (A) are defined in TS 23.402 [2]. Steps 12 and 14 concern GTP based S5/S8.

NOTE 2: In the case of Tracking Area Update without MME change the signalling in steps 4, 5, 7 and steps 9-19 are skipped. A change of UE Time Zone, User CSG information or Serving Network is signalled in the next Service Request. If TAI change need to be reported to the PDN GW, location information change reporting procedure described in clause 5.9.2 is performed.

NOTE 3: Deferred reporting of UE Time Zone, or Serving Network per NOTE 2 may fail when inter-MME/SGSN mobility occurs before a UE sends SERVICE REQUEST and the target MME/SGSN (e.g. pre-Release 10) does not support the "Change to Report" flag.

1. One of the triggers described in clause 5.3.3.0 for starting the TAU procedure occurs.

2. The UE initiates a TAU procedure by sending, to the eNodeB, a Tracking Area Update Request (UE Core Network Capability, MS Network Capability, Preferred Network behaviour, Support for restriction of use of Enhanced Coverage, active flag, signalling active flag, EPS bearer status, old GUTI, Old GUTI Type, last visited TAI, P-TMSI signature, additional GUTI, KSISGSN, KSIASME, NAS sequence number, NAS-MAC, Voice domain preference and UE's usage setting, UE has UE Radio Capability ID assigned for the selected PLMN, BUSY Indication) message together with RRC parameters indicating the Selected Network and the old GUMMEI. An exception is that, if the TAU was triggered for load re-balancing purposes (see clause 4.3.7.3), the old GUMMEI is not included in the RRC parameters. The UE shall set the Old GUTI Type to indicate whether the Old GUTI is a native GUTI or is mapped from a P-TMSI and RAI.

 If the UE's TIN indicates "GUTI" or "RAT‑related TMSI" and the UE holds a valid GUTI then the old GUTI indicates this valid GUTI. If the UE's TIN indicates "P‑TMSI" and the UE holds a valid P‑TMSI and related RAI then these two elements are indicated as the old GUTI. Mapping a P‑TMSI and RAI to a GUTI is specified in Annex H. When the UE is in connected mode (e.g. in URA\_PCH) when it reselects to E-UTRAN, the UE shall set its TIN to "P‑TMSI".

 If the UE holds a valid GUTI and the old GUTI indicates a GUTI mapped from a P-TMSI and RAI, then the UE indicates the GUTI as additional GUTI. If the old GUTI indicates a GUTI mapped from a P-TMSI and RAI, and the UE has a valid P-TMSI signature, the P-TMSI signature shall be included.

 The additional GUTI in the Tracking Area Update Request message allows the new MME to find any already existing UE context stored in the new MME when the old GUTI indicates a value mapped from a P-TMSI and RAI.

 Alternatively, when a UE only supports E-UTRAN, it identifies itself with the old GUTI and sets the Old GUTI Type to 'native'.

 The RRC parameter "old GUMMEI" takes its value from the identifier that is signalled as the old GUTI according to the rules above. For a combined MME/SGSN the eNodeB is configured to route the MME‑code(s) of this combined node to the same combined node. This eNodeB is also configured to route MME‑code(s) of GUTIs that are generated the UE's mapping of the P‑TMSIs allocated by the combined node. Such an eNodeB configuration may also be used for separate nodes to avoid changing nodes in the pool caused by inter RAT mobility.

 The last visited TAI shall be included in order to help the MME produce a good list of TAIs for any subsequent TAU Accept message. Selected Network indicates the network that is selected. Active flag is a request by the UE to activate the radio and S1 bearers for all the active EPS Bearers by the TAU procedure. Signalling active flag is a request by UE using Control Plane CIoT EPS Optimisation to maintain the NAS signalling connection after Tracking Area Update Procedure is completed in order to transmit pending Data using the Data Transport in Control Plane CIoT EPS Optimisation or NAS signalling. The UE's ISR capability is included in the UE Core Network Capability element. The EPS bearer status indicates each EPS bearer that is active in the UE. The TAU Request message shall be integrity protected by the NAS-MAC as described in TS 33.401 [41]. KSIASME is included if the UE has valid security parameters. NAS sequence number indicates the sequential number of the NAS message.

 In the RRC connection establishment signalling associated with the TAU Request, the UE indicates its support of the CIoT EPS Optimisations relevant for MME selection.

 For UE using CIoT EPS Optimisation without any activated PDN connection, there is no active flag or EPS bearer status included in the TAU Request message. For a UE with a running Service Gap timer in the UE the UE shall not set the active flag or the signalling active flag in the TAU request message (see clause 4.3.17.9) except for network access for regulatory prioritized services like Emergency services or exception reporting.

 If the UE has any PDN connection of PDN Type "non-IP" or "Ethernet", the UE shall send the EPS bearer status in the TAU Request message.

 KSISGSN is included if the UE indicates a GUTI mapped from a P‑TMSI in the information element "old GUTI".

 The UE sets the voice domain preference and UE's usage setting according to its configuration, as described in clause 4.3.5.9.

 The UE includes extended idle mode DRX parameters information element if it needs to enable extended idle mode DRX, even if extended idle mode DRX parameters were already negotiated before.

 If a UE includes a Preferred Network Behaviour, this defines the Network Behaviour the UE is expecting to be available in the network as defined in clause 4.3.5.10.

 If the UE supports RACS as defined in clause 5.11.3a, and if the UE is provisioned with a UE Radio Capability ID for use in the selected PLMN (i.e.PLMN-assigned for the specific PLMN or manufacturer-assigned), the UE includes a flag that indicates it has an assigned UE Radio Capability ID for use in the selected PLMN but the actual UE Radio Capability is provided to MME after security context is established in step 6 (see below).

If the Multi-USIM UE triggers a TAU to signal it does not accept an incoming paging message due to services ongoing with another USIM, it includes a BUSY indication as defined in clause x.x, and the MME skips steps all steps after step 7 and continues from step 20. After completion of the TAU procedure, the MME releases the UE with a S1 Release procedure (see clause 5.3.5).

3. The eNodeB derives the MME address from the RRC parameters carrying the old GUMMEI, the indicated Selected Network and the RAT (NB-IoT or WB-E-UTRAN). If that GUMMEI is not associated with the eNodeB, or the GUMMEI is not available or the UE indicates that the TAU procedure was triggered by load re-balancing, the eNodeB selects the MME as described in clause 4.3.8.3 on "MME Selection Function". The eNodeB forwards the TAU Request message together with the CSG access mode, CSG ID, TAI+ECGI of the cell from where it received the message and with the Selected Network to the MME. CSG ID is provided by RAN if the UE sends the TAU Request message via a CSG cell or a hybrid cell. CSG access mode is provided if the UE sends the TAU Request message via a hybrid cell. If the CSG access mode is not provided but the CSG ID is provided, the MME shall consider the cell as a CSG cell. For SIPTO at the Local Network with stand-alone GW architecture the eNodeB includes the Local Home Network ID in the Initial UE Message and in Uplink NAS Transport message if the target cell is in a Local Home Network.

 To assist Location Services, the eNB indicates the UE's Coverage Level to the MME.

 If the MME supports RACS, and the MME detects that the selected PLMN is different from the currently registered PLMN for the UE, the MME provides the UE Radio Capability ID of the newly selected PLMN in the UE context to the eNB as described in clause 5.11.3a.

4. The new MME differentiates the type of the old node, i.e. MME or SGSN, as specified in clause 4.3.19, uses the GUTI received from the UE to derive the old MME/S4 SGSN address and sends a Context Request (old GUTI, MME Address, UE Validated, complete TAU Request message, P‑TMSI Signature, CIoT EPS Optimisation support inidication) message to the old MME/S4 SGSN to retrieve the user information. UE Validated indicates that the new MME has validated the integrity protection of the TAU message, e.g. based on native EPS security context for the UE. To validate the Context Request the old MME uses the complete TAU Request message and the old S4 SGSN uses the P-TMSI Signature and responds with an appropriate error if integrity check fails in old MME/S4 SGSN. This shall initiate the security functions in the new MME. If the security functions authenticate the UE correctly, the new MME shall send a Context Request (IMSI, complete TAU Request message, MME Address, UE Validated) message to the old MME/S4 SGSN with the UE Validated set. If the new MME indicates that it has authenticated the UE or if the old MME/old S4 SGSN authenticates the UE, the old MME/old S4 SGSN starts a timer.

 If the UE with emergency bearers is not authenticated in the old MME/old S4 SGSN (in a network supporting unauthenticated UEs) the old MME/old S4 SGSN continues the procedure with sending a Context Response and starting the timer also when it cannot validate the Context Request.

 If a RLOS attached UE is not successfully authenticated in the old MME and/or the Context Request cannot be validated, the old MME continues the procedure with sending a Context Response and starting the existing timer.

 If the new MME supports CIoT EPS Optimisation, CIoT EPS Optimisation support indication is included in the Context Request indicating support for various CIoT EPS Optimisations (e.g. support for header compression for CP CIoT EPS Optimisation, etc.).

5. If the Context Request is sent to an old MME the old MME responds with a Context Response (IMSI, ME Identity (IMEISV), unused EPS Authentication Vectors, KSIASME, KASME, EPS Bearer Context(s), Serving GW signalling Address and TEID(s), MS Info Change Reporting Action (if available), CSG Information Reporting Action (if available), UE Time Zone, UE Core Network Capability, UE Specific DRX Parameters, Change to Report (if present), Remaining Running Service Gap timer, LTE-M UE Indication) message. If the new MME supports CIoT EPS Optimisation and the use of header compression has been negotiated between the UE and old MME, the Context Response also includes the Header Compression Configuration which includes the information necessary for the ROHC channel setup but not the RoHC context itself.

 If the Context Request is sent to an old S4 SGSN the old S4 SGSN responds with a Context Response (IMSI, ME Identity (if available), unused Authentication Quintets, CK, IK, KSISGSN, EPS Bearer Context(s), Serving GW signalling Address and TEID(s), ISR Supported, MS Info Change Reporting Action (if available), CSG Information Reporting Action (if available), UE Time Zone, UE Core Network Capability, UE Specific DRX Parameters, Change to Report (if present)) message. The Authentication Quintets are maintained by the old S4 SGSN. TS 33.401 [41] gives further details on the transfer of security related information.

 Change to Report flag is included by the old MME or the old S4 SGSN if reporting of change of UE Time Zone, or Serving Network, or both towards Serving GW / PDN GW was deferred by the old MME or old S4 SGSN.

 If the Context Response message did not include IMEISV and the MME does not already store the IMEISV of the UE, the MME shall retrieve the ME Identity (IMEISV) from the UE.

 The PDN GW Address and TEID(s) (for GTP-based S5/S8) or GRE Keys (PMIP-based S5/S8 at the PDN GW(s) for uplink traffic and the TI(s), is part of the EPS Bearer Context. ISR Supported is indicated if the old SGSN and associated Serving GW are capable to activate ISR for the UE.

 The new MME shall ignore the UE Core Network Capability contained in the Context Response only when it has previously received an UE Core Network Capability in the Tracking Area Update Request. If the UE is not known in the old MME/old S4 SGSN or if the integrity check for the TAU request message fails, the old MME/old S4 SGSN responds with an appropriate error cause.

 If the DL Data Buffer Expiration Time for the UE has not expired (see High latency communication in clause 4.3.17.7), the old MME/old S4-SGSN indicates Buffered DL Data Waiting in the Context Response. When this is indicated, the new MME shall setup the user plane in conjunction to the TAU procedure for delivery of the buffered DL data.

 If the UE receives emergency bearer services from the old MME/old S4 SGSN and the UE is UICCless, IMSI can not be included in the Context Response. For emergency attached UEs, if the IMSI cannot be authenticated, then the IMSI shall be marked as unauthenticated. Also, in this case, security parameters are included only if available.

 For a RLOS attached UE, the old MME includes an RLOS indication to the new MME. If the RLOS attached UE in the old MME does not have a USIM, IMSI can not be included in the Context Response. If the RLOS attached UE has USIM but the IMSI cannot be successfully authenticated, then the IMSI shall be marked as unauthenticated. Also, in this case, security parameters are included only if available.

 If SIPTO at the Local Network is active for a PDN connection in the architecture with stand-alone GW, the old MME/old S4 SGSN shall include the Local Home Network ID of the old cell in the EPS Bearer context corresponding to the SIPTO at the Local Network PDN connection.

 For UE using CIoT EPS Optimisation without any activated PDN connection, there is no EPS Bearer Context(s) included in the Context Response message.

 Based on the CIoT EPS Optimisation support indication, old MME only transfers the EPS Bearer Context(s) that the new MME supports. If the new MME does not support CIoT EPS Optimisation, EPS Bearer Context(s) of non-IP PDN connection are not transferred to the new MME. If the new MME does not support Ethernet PDN Type, EPS Bearer Context(s) of Ethernet PDN type are not transferred to the new MME. If the EPS Bearer Context(s) of a PDN connection has not been transferred, the old MME shall consider all bearers of that PDN connection as failed and release that PDN connection by triggering the MME requested PDN disconnection procedure specified in clause 5.10.3. The buffered data in the old MME is discarded after receipt of Context Acknowledgement.

 If the EPS Bearer Context(s) are to be transferred to the new MME, the old MME also includes the Serving GW IP address and TEID for both S1-U and S11-U, if available.

 If the Old MME is aware the UE is a LTE-M UE, it provides the LTE-M UE Indication to the new MME.

6. If the integrity check of TAU Request message (sent in step 2) failed, then authentication is mandatory. The authentication functions are defined in clause 5.3.10 on "Security Function". Ciphering procedures are described in clause 5.3.10 on "Security Function". If GUTI allocation is going to be done and the network supports ciphering, the NAS messages shall be ciphered.

 If this TAU request is received for a UE which is already in ECM\_CONNECTED state and the PLMN-ID of the TAI sent by the eNodeB in Step 3 is different from that of the GUTI included in the TAU Request message, the MME shall delay authenticating the UE until after Step 21 (TAU Complete message).

NOTE 4: The MME delays the authentication such that the UE first updates its registered PLMN-ID to the new PLMN-ID selected by the RAN during handover. The new PLMN-ID is provided by the MME to the UE as part of the GUTI in the TAU accept message in Step 20. Doing this ensures that the same PLMN-ID is used in the derivation of the Kasme key by both the network and the UE.

 If the new MME is configured to allow emergency bearer services for unauthenticated UE the new MME behave as follows:

- where a UE has only emergency bearer services, the MME either skip the authentication and security procedure or accepts that the authentication may fail and continues the Tracking Area Update procedure; or

- where a UE has both emergency and non emergency bearer services and authentication fails, the MME continues the Tracking Area Update procedure and deactivates all the non-emergency PDN connections as specified in clause 5.10.3.

 If the new MME is configured to support Restricted Local Operator Services, the new MME, based on local regulation and operator policy, may skip the authentication and security procedure, or may perform authentication if security parameters are available or obtainable from HSS and continues the Tracking Area Update procedure regardless of the authentication result.

 If the UE indicated it has a UE Radio Capability ID assigned for use in the selected PLMN in step 2, the MME may request the UE to provide the UE Radio Capability ID in Security Mode Command, if the MME needs to get the UE Radio Capability ID from the UE e.g. at inter-PLMN mobility. If enquired by the MME the UE shall include the UE Radio Capability ID in Security Mode Command Accept for the supported UE radio capabilities.

7. If the old node is an old MME the new MME sends a Context Acknowledge message to the old MME. The old MME marks in its context that the information in the GW and the HSS are invalid. This ensures that the MME updates the GWs and the HSS if the UE initiates a TAU procedure back to the MME before completing the ongoing TAU procedure.

NOTE 5: Updating the GWs refers to modification of session(s) on the Serving GW. This will result in successful re-establishment of the S11/S4 tunnel between the MME/SGSN and the Serving GW.

 If the old node is an old S4 SGSN the MME sends a Context Acknowledge (ISR Activated) message to the old SGSN. Unless ISR Activated is indicated by the MME, the old S4 SGSN marks in its context that the information in the GWs is invalid. This ensures that the old S4 SGSN updates the GWs if the UE initiates a RAU procedure back to the old S4 SGSN before completing the ongoing TAU procedure. If ISR Activated is indicated to the old S4 SGSN, this indicates that the old S4 SGSN shall maintain its UE context including authentication quintets and stop the timer started in step 4. In this case, if the Implicit Detach timer is running, the old S4 SGSN shall re-start it with a slightly larger value than the UE's GERAN/UTRAN Deactivate ISR timer. Also, in this case, if the old SGSN has maintained the Serving GW address for user plane and S4 GTP-U TEID, the old SGSN shall remove Serving GW address for user plane and S4 GTP-U TEID locally. When ISR Activated is not indicated and this timer expires the old SGSN deletes all bearer resources of that UE. As the Context Acknowledge from the MME does not include any S‑GW change the S4 SGSN does not send any Delete Session Request message to the S‑GW. The MME shall not activate ISR if the associated Serving GW does not support ISR.

 If the security functions do not authenticate the UE correctly, then the TAU shall be rejected, and the MME shall send a reject indication to the old MME/old S4 SGSN. The old MME/old S4 SGSN shall continue as if the Identification and Context Request was never received.

 For UE using CIoT EPS Optimisation without any activated PDN connection, the steps 9, 10, 11, 12 and 13 are skipped.

8. Void.

9. If the MME has changed the new MME adopts the bearer contexts received from the old MME/SGSN as the UE's EPS bearer contexts to be maintained by the new MME. The MME establishes the EPS bearer(s) in the indicated order. The MME deactivates the EPS bearers which cannot be established.

 The MME verifies the EPS bearer status received from the UE with the EPS bearer contexts it maintains and releases any network resources related to EPS bearers that are not active in the UE. If there is no bearer context at all, the MME rejects the TAU Request. If the MME has changed the new MME sends a Modify Bearer Request (new MME address and TEID, ISR Activated, RAT type, LTE-M RAT type reporting to PGW flag) message per PDN connection to the Serving GW. If there is no need for the SGW to send the signalling to the PDN GW, the MME may send Modify Access Bearers Request (new MME address and TEID) per UE to the Serving GW to optimise the signalling. The PDN GW address is indicated in the bearer contexts. If indicated, the information ISR Activated indicates that ISR is activated. If it is a mobility from a SGSN to a MME and if the MME supports location information change reporting, the MME shall include the User Location Information (according to the supported granularity) in the Modify Bearer Request, regardless of whether location information change reporting had been requested in the previous RAT by the PDN GW. If it is an inter MME mobility and if the PDN GW requested location information change reporting, the MME includes the User Location Information IE in this message if it is different compared to the previously sent information. If the PDN GW requested User CSG information, the MME also includes the User CSG Information IE in this message. If either the UE Time Zone has changed or Context Response message indicated pending UE Time Zone change reporting (via Change to Report flag), the MME includes the UE Time Zone IE in this message. If either the Serving Network has changed or Context Response message indicated pending Serving Network change reporting (via Change to Report flag) the MME includes the new Serving Network IE in this message. In network sharing scenarios Serving Network denotes the serving core network. If the old node is an old MME at a Tracking Area Update with a MME change ISR Activated shall not be indicated.

NOTE 6: The User CSG Information IE is only sent in step 9 if the "Active flag" is set in the TAU Request message.

 When the Modify Access Bearers Request or Modify Bearer Request does not indicate ISR Activated the S‑GW deletes any ISR resources by sending a Delete Bearer Request to the other CN node that has bearer resources on the S‑GW reserved.

 If the new MME receives the EPS bearer context with SCEF, then the new MME updates the SCEF as defined in TS 23.682 [74].

 For Control Plane CIoT EPS Optimisation, if the DL data is buffered in the Serving GW, and if this is a Tracking Area Update without MME change and the DL Data Buffer Expiration Time in the MM context for the UE in the MME has not expired, or if this is a Tracking Area Update with MME change and the old MME/old S4-SGSN indicated Buffered DL Data Waiting in the Context Response in step 5, the MME shall also indicate S11-U tunnelling of NAS user data and include it's own S11-U IP address and MME DL TEID for DL data forwarding by the SGW in the Modify Bearer Request. The MME may also do so without DL data buffered in the SGW.

 If the UE is using the LTE-M RAT type and the PDN GW expects the LTE-M RAT type reporting as specified in clause 5.11.5, the MME also includes the LTE-M RAT type reporting to PGW flag to indicate to the Serving GW to forward the LTE-M RAT type to the PDN GW.

10. If the RAT type has changed, or the Serving GW has received the User Location Information IE or the UE Time Zone IE or User CSG Information IE and/or the Serving Network IE from the MME in step 9, the Serving GW informs the PDN GW(s) about this information that e.g. can be used for charging, by sending the message Modify Bearer Request (RAT type) per PDN connection to the PDN GW(s) concerned. User Location Information IE and/or UE Time Zone IE and/or User CSG Information IE and/or Serving Network IE are also included if they are present in step 9.

 If the Modify Bearer Request message is not sent because of above reasons and the PDN GW charging is paused, then the SGW shall send Modify Bearer Request message with PDN Charging Pause Stop Indication to inform the PDN GW that the charging is no longer paused. Other IEs are not included in this message.

 If LTE-M RAT type and the LTE-M RAT type reporting to PGW flag were received at step 9, the Serving GW shall include the LTE-M RAT type in the Modify Bearer Request message to the PGW. Otherwise the Serving GW includes RAT type WB-E-UTRAN.

11. If dynamic PCC is deployed, and RAT type information or UE location information needs to be conveyed from the PDN GW to the PCRF, then the PDN GW shall send this information to the PCRF by means of an IP‑CAN Session Modification procedure as defined in TS 23.203 [6].

NOTE 7: The PDN GW does not need to wait for the PCRF response, but continues in the next step. If the PCRF response leads to an EPS bearer modification the PDN GW should initiate a bearer update procedure.

12. The PDN GW updates its context field to allow DL PDUs to be routed to the correct Serving GW. PDN GW returns a Modify Bearer Response (MSISDN) to the Serving GW. The MSISDN is included if the PDN GW has it stored in its UE context. If there has been a RAT change towards E-UTRAN and location information change reporting is required and supported in the target MME, the PDN GW shall provide MS Info Change Reporting Action in the Modify Bearer Response.

13. The Serving GW updates its bearer context. If ISR Activated is indicated in step 9 and RAT Type received in step 9 indicates E‑UTRAN, then the Serving GW only updates the MME Control Plane Address stored locally and keep the SGSN related information unchanged. Also, in this case, if the Serving GW has maintained the SGSN address for user plane and S4 GTP-U TEID, the Serving GW removes the SGSN address for user plane and S4 GTP-U TEID locally. Otherwise the Serving GW shall update all of the information stored locally for this UE with the related information received from the MME. This allows the Serving GW to route Bearer PDUs to the PDN GW when received from eNodeB. The Serving GW shall return a Modify Bearer Response (Serving GW address and TEID for uplink traffic, MS Info Change Reporting Action) message to the new MME as a response to a Modify Bearer Request message, or a Modify Access Bearers Response (Serving GW address and TEID for uplink traffic) as a response to a Modify Access Bearers Request message. If the Serving GW cannot serve the MME Request in the Modify Access Bearers Request message without S5/S8 signalling other than to unpause charging in the PDN GW or without corresponding Gxc signalling when PMIP is used over the S5/S8 interface, it shall respond to the MME with indicating that the modifications are not limited to S1-U bearers, and the MME shall repeat its request using Modify Bearer Request message per PDN connection.

 When the MME receives the Modify Bearer Response or the Modify Access Bearers Response message, the MME checks if there is a "Availability after DDN Failure" monitoring event or a "UE Reachability" monitoring event configured for the UE in the MME and in such a case sends an event notification (see TS 23.682 [74] for further information).

 For Control Plane CIoT EPS Optimisation, if the MME address and MME DL TEID are provided in step 9, the Serving GW includes Serving GW address and Serving GW UL TEID in the Modify Bearer Response message. The DL data is sent to the MME from the Serving GW.

 The buffered DL data is sent to the UE as described in steps 12-14 of clause 5.3.4B.3.

14. The new MME verifies whether it holds subscription data for the UE identified by the GUTI, the additional GUTI or by the IMSI received with the context data from the old CN node.

 If there are no subscription data in the new MME for this UE, or for some network sharing scenario (e.g. GWCN) if the PLMN-ID of the TAI supplied by the eNodeB is different from that of the GUTI in the UE's context, then the new MME informs the HSS of the change of MME by sending an Update Location Request (MME Id, IMSI, ULR-Flags, MME Capabilities, Homogenous Support of IMS Voice over PS Sessions, UE SRVCC capability, equivalent PLMN list, ME Identity (IMEISV)) message to the HSS. ULR-Flags indicates that update location is sent from an MME and the MME registration shall be updated in HSS. The HSS does not cancel any SGSN registration. The MME capabilities indicate the MME's support for regional access restrictions functionality. The inclusion of the equivalent PLMN list indicates that the MME supports the inter-PLMN handover to a CSG cell in an equivalent PLMN using the subscription information of the target PLMN. The "Homogenous Support of IMS Voice over PS Sessions" indication (see clause 4.3.5.8A) shall not be included unless the MME has completed its evaluation of the support of "IMS Voice over PS Session" as specified in clause 4.3.5.8. The ME Identity is included if step 5 caused the MME to retrieve the IMEISV from the UE.

NOTE 8: At this step, the MME may not have all the information needed to determine the setting of the IMS voice over PS Session Supported indication for this UE (see clause 4.3.5.8). Hence the MME can send the "Homogenous Support of IMS Voice over PS Sessions" later on in this procedure.

 If the UE initiates the TAU procedure in a VPLMN supporting Autonomous CSG Roaming and the HPLMN has enabled Autonomous CSG Roaming in the VPLMN (via Service Level Agreement) and the MME needs to retrieve the CSG subscription information of the UE from the CSS, the MME initiates the Update CSG Location Procedure with CSS as described in clause 5.3.12.

 If the MME determines that only the UE SRVCC capability has changed, the MME sends a Notify Request to the HSS to inform about the changed UE SRVCC capability.

 If all the EPS bearers of the UE have emergency ARP value, the new MME may skip the update location procedure or proceed even if the update location fails.

 If the UE is RLOS attached, the new MME skips the update location procedure and the TAU procedure proceeds.

15. The HSS sends a Cancel Location (IMSI, Cancellation type) message to the old MME with a Cancellation Type set to Update Procedure.

16. When receiving a Cancel Location message and the timer started in step 4 is not running, the old MME removes the MM and bearer contexts. Otherwise, the contexts are removed when the timer expires. It also ensures that the MM context is kept in the old MME for the case the UE initiates another TAU procedure before completing the ongoing TAU procedure to the new MME. The old MME acknowledges with a Cancel Location Ack (IMSI) message.

NOTE 9: ISR Activated is never indicated from new to old MME.

 So an old MME deletes all the bearer resources of the UE in any case when the timer started in step 4 expires, which is independent on receiving a Cancel Location message.

17. When receiving the Context Acknowledge message and if the UE is Iu Connected, the old SGSN sends an Iu Release Command message to the RNC after the timer started in step 4 has expired.

18. The RNC responds with an Iu Release Complete message.

19. The HSS acknowledges the Update Location Request by returning an Update Location Ack (IMSI, Subscription Data) message to the new MME after the cancelling of the old MME context is finished. If all checks are successful, the MME constructs an MM context for the UE. The Subscription Data may contain the CSG subscription data for the registered PLMN and for the equivalent PLMN list requested by MME in step 14.

 The subscription data may contain Enhanced Coverage Restricted parameter. If received from the HSS, MME stores this Enhanced Coverage Restricted parameter in the MME MM context.

 The subscription data may contain Service Gap Time. If received from the HSS, the MME stores this Service Gap Time in the MME MM context for the UE and passes it to the UE in the Tracking Area Update Accept message if the UE has indicated Service Gap Control capability.

 The subscription data may contain Subscribed Paging Time Window parameter that applies to the UEs on a specific RAT, e.g. NB-IoT. If received from the HSS, MME stores this Subscribed Paging Time Window parameter in the MME MM context.

 If the UE initiates the TAU procedure at a CSG cell, the new MME shall check whether the CSG ID and associated PLMN is contained in the CSG subscription and is not expired. If the CSG ID and associated PLMN is not present or expired, the MME shall send a Tracking Area Update reject message to the UE with an appropriate cause value. The UE shall remove the CSG ID and associated PLMN from its Allowed CSG list if present.

 If the Update Location is rejected by the HSS, the new MME rejects the TAU Request from the UE with an appropriate cause sent in the TAU Reject message to the UE. In such cases, the new MME releases any local MME EPS Bearer contexts for this particular UE.

20. If due to regional subscription restrictions or access restrictions (e.g. CSG restrictions) (received in update location procedure in step 19) the UE is not allowed to access the TA:

- The MME rejects the Tracking Area Update Request with an appropriate cause to the UE.

- For UEs with emergency EPS bearers, i.e. at least one EPS bearer has an ARP value reserved for emergency services, the new MME accepts the Tracking Area Update Request and deactivates all non-emergency PDN connections as specified in clause 5.10.3. If the Tracking Area Update procedure is initiated in ECM-IDLE state, all non-emergency EPS bearers are deactivated by the Tracking Area Update procedure without bearer deactivation signalling between the UE and the MME.

 The MME responds to the UE with a Tracking Area Update Accept (GUTI, TAI-list, EPS bearer status, NAS sequence number, NAS-MAC, ISR Activated, IMS Voice over PS session supported, Emergency Service Support indicator, LCS Support Indication, Supported Network Behaviour, Service Gap Time, Enhanced Coverage Restricted, Indication of support of 15 EPS bearers per UE, PLMN-assigned UE Radio Capability ID) message. If the active flag is set the Handover Restriction List may be sent to eNodeB as eNodeB handles the roaming restrictions and access restrictions in the Intra E-UTRAN case. If the active flag is set in the TAU Request message the user plane setup procedure is activated in conjunction with the TAU Accept message. If this is a Tracking Area Update without MME change and the DL Data Buffer Expiration Time in the MM context for the UE in the MME has not expired, or if this is a Tracking Area Update with MME change and the old MME/old S4-SGSN indicated Buffered DL Data Waiting in the Context Response in step 5, the user plane setup procedure is activated even if the MME did not receive the active flag in the TAU Request message. If the new MME receives the Downlink Data Notification message or any downlink signalling message while the UE is still connected, the user plane setup procedure may be activated even if the new MME did not receive the active flag in the TAU Request message. The procedure is described in detail in TS 36.300 [5]. The message sequence should be the same as for the UE triggered Service Request procedure specified in clause 5.3.4.1 from the step when MME establish the bearers(s). The EPS bearer status indicates the active bearers in the network. The UE removes any internal resources related to bearers not marked active in the received EPS bearer status. If the EPS bearer status information was in the TAU Request, the MME shall indicate the EPS bearer status to the UE. If ISR Activated is indicated to the UE, this indicates that its P-TMSI and RAI shall remain registered with the network and shall remain valid in the UE. At a Tracking Area Update with an MME change ISR Activated shall not be indicated. At a Tracking Area Update without an MME change, if ISR is activated for the UE when the MME receives the Tracking Area Update Request, the MME should maintain ISR by indicating ISR Activated in the Tracking Area Update Accept message. Handover Restriction List is described in clause 4.3.5.7 "Mobility Restrictions". The MME sets the IMS Voice over PS session supported as described in clause 4.3.5.8.

 For UE using CIoT EPS Optimisation without any activated PDN connection, there is no EPS bearer status included in the TAU Accept message.

 The MME indicates the CIoT EPS Optimisations it supports and prefers in the Supported Network Behaviour information as defined in clause 4.3.5.10.

 If there is a Service Gap timer running for the UE in the MME, the MME shall ignore the active flag and signalling active flag and not perform any of the actions related to these flags except if the TAU Request message has been received when the UE has a PDN connection for emergency bearer services established or is establishing a PDN connection for emergency bearer services or if the UE is configured to use high priority access (AC 11-15) in selected PLMN.

 The MME shall include the Service Gap Time in the TAU Accept message if the UE has indicated Service Gap Control capability and either if Service Gap Time was received in step 19 from HSS in the subscription information or if the Service Gap Time in the subscription information has been updated by HSS User Profile management (i.e. the Insert Subscriber Data procedure in clause 5.3.9.2).

 If the UE included support for restriction of use of Enhanced Coverage in step 1, the MME sends Enhanced Coverage Restricted parameter to the eNB in the S1-AP message as defined in clause 4.3.28. The MME also sends the Enhanced Coverage Restricted parameter to the UE in the TAU Accept message. UE shall store Enhanced Coverage Restricted parameter and shall use the value of Enhanced Coverage Restricted parameter to determine if enhanced coverage feature should be used or not.

 If the MME successfully obtained Header Compression Configuration parameters in step 5 it indicates he continued use of previous negotiated configuration to the UE in the Header Compression Context Status for each EPS Bearer of the UE. When Header Compression Context Status indicates that the previous negotiated configuration can no longer be used for some EPS bearers, the UE shall stop performing header compression and decompression when sending or receiving data using Control Plane CIoT EPS Optimisation on these EPS bearers.

 The MME checks if there is a "Availability after DDN Failure" monitoring event or a "UE Reachability" monitoring event configured for the UE in the MME for which an event notification has not yet been sent. In such a case an event notification is sent (see TS 23.682 [74] for further information).

 If the MME did not receive the Voice support match indicator in the MM Context, then the MME may send a UE Radio Capability Match Request to the eNB as described in clause 5.3.14. If the MME hasn't received Voice support match indicator from the eNB then based on implementation MME may set IMS Voice over PS session supported Indication and update it at a later stage. After step 14, and in parallel to any of the preceding steps, the MME shall send a Notify Request (Homogeneous Support of IMS Voice over PS Sessions) message to the HSS:

- If the MME has evaluated the support of IMS Voice over PS Sessions, see clause 4.3.5.8, and

- If the MME determines that it needs to update the Homogeneous Support of IMS Voice over PS Sessions, see clause 4.3.5.8A.

 The Emergency Service Support indicator informs the UE that Emergency bearer services are supported. LCS Support Indication indicates whether the network supports the EPC-MO-LR and/or CS-MO-LR as described in TS 23.271 [57]. Indication for support of 15 EPS bearers per UE indicates the network supports 15 EPS bearers as defined in clause 4.12.

 When receiving the TAU Accept message and there is no ISR Activated indication the UE shall set its TIN to "GUTI". When ISR Activated is indicated and the UE's TIN indicates "GUTI" the UE's TIN shall not be changed. When ISR Activated is indicated and the TIN is "P‑TMSI" or "RAT‑related TMSI" the UE shall set its TIN to "RAT‑related TMSI".

 For an MME change ISR is not activated by the new MME to avoid context transfer procedures with two old CN nodes.

 For an emergency attached UE, emergency ISR is not activated.

 If the TAU procedure is initiated by manual CSG selection and occurs via a CSG cell, the UE upon receiving TAU Accept message shall add the CSG ID and associated PLMN to its Allowed CSG list if it is not already present. Manual CSG selection is not supported if the UE has emergency bearers established.

 If the UE included extended idle mode DRX parameters information element, the MME includes extended idle mode DRX parameters information element in the TAU accept if it decides to enable extended idle mode DRX with Paging Time Window length assigned considering Subscribed Paging Time Window (if available) and the local policy.

 If the user plane setup is performed in conjunction with the TAU Accept message and the TAU is performed via a hybrid cell, then the MME shall send an indication whether the UE is a CSG member to the RAN along with the S1-MME control message. Based on this information the RAN may perform differentiated treatment for CSG and non-CSG members.

NOTE 10: If the UE receives a TAU Accept message via a hybrid cell, the UE does not add the corresponding CSG ID and associated PLMN to its Allowed CSG list. Adding a CSG ID and associated PLMN to the UE's local Allowed CSG list for a hybrid cell is performed only by OTA or OMA DM procedures.

 If the UE receives a Service Gap Time in the TAU Accept message, the UE shall store this parameter and apply Service Gap Control (see clause 4.3.17.9).

 If the UE has indicated support for dual connectivity with NR in the TAU Request and the UE is not allowed to use NR as Secondary RAT, the MME indicates that to the UE in the TAU Accept message.

 If the user plane setup is performed and if RACS is supported and MME has UE Radio Capability ID in UE context, valid for the PLMN the UE is currently in, it signals the UE Radio Capability ID to the eNB as defined in clause 5.11.3a. If the eNB does not have mapping between the specific UE Radio Capability ID and the UE radio capabilities, it shall use the procedure described in TS 36.413 [36] to retrieve the mapping from the Core Network.

 When the UE supports RACS, and the MME needs to configure the UE with a UE Radio Capability ID, and the MME already has the UE radio capabilities for the UE, the MME may provide the UE with the UE Radio Capability ID for the UE radio capabilities the UCMF returns to the MME for this UE.

 If the UE had included a UE Specific DRX parameter for NB-IoT in the Tracking Area Update Request, the MME includes the Accepted NB-IoT DRX parameter.

21. If the GUTI was changed the UE acknowledges the new GUTI by returning a Tracking Area Update Complete message to the MME.

 When the "Active flag" is not set in the TAU Request message and the Tracking Area Update was not initiated in ECM-CONNECTED state, the MME releases the signalling connection with UE, according to clause 5.3.5. For a UE using Control Plane CIoT EPS Optimisation, when the "Signalling active flag" is set, the new MME shall not release the NAS signalling connection with the UE immediately after the TAU procedure is completed.

NOTE 11: The new MME may initiate E‑RAB establishment (see TS 36.413 [36]) after execution of the security functions, or wait until completion of the TA update procedure. For the UE, E‑RAB establishment may occur anytime after the TA update request is sent.

In the case of a rejected tracking area update operation, due to regional subscription, roaming restrictions, or access restrictions (see TS 23.221 [27] and TS 23.008 [28]) the new MME should not construct an MM context for the UE. In the case of receiving the subscriber data from HSS, the new MME may construct an MM context and store the subscriber data for the UE to optimise signalling between the MME and the HSS. A reject shall be returned to the UE with an appropriate cause and the S1 connection shall be released. Upon return to idle, the UE shall act according to TS 23.122 [10].

If the new MME is unable to update the bearer context in one or more P‑GWs, the new MME shall deactivate the corresponding bearer contexts as described in clause "MME Initiated Dedicated Bearer Deactivation Procedure". This shall not cause the MME to reject the tracking area update.

The new MME shall determine the Maximum APN restriction based on the received APN Restriction of each bearer context in the Context Response message and then store the new Maximum APN restriction value.

The bearer contexts shall be prioritized by the new MME. If the new MME is unable to support the same number of active bearer contexts as received from old MME/SGSN, the prioritisation is used to decide which bearer contexts to maintain active and which ones to delete. In any case, the new MME shall first update all contexts in one or more P‑GWs and then deactivate the context(s) that it cannot maintain as described in clause "MME Initiated Dedicated Bearer Deactivation Procedure". This shall not cause the MME to reject the tracking area update.

The new MME shall not deactivate emergency service related EPS bearers, i.e. EPS bearers with ARP value reserved for emergency services.

NOTE 12: If MS (UE) was in PMM-CONNECTED state the bearer contexts are sent already in the Forward Relocation Request message as described in clause "Serving RNS relocation procedures" of TS 23.060 [7].

If the tracking area update procedure fails a maximum allowable number of times, or if the MME returns a Tracking Area Update Reject (Cause) message, the UE shall enter EMM DEREGISTERED state.

If the new MME identifies that the RAT type has changed, the MME checks the subscription information to identify for each APN whether to maintain the PDN connection, disconnect the PDN connection with a reactivation request, or, disconnect the PDN connection without reactivation request. If the MME decides to deactivate a PDN connection it performs MME-initiated PDN Connection Deactivation procedure after the tracking area update procedure is completed but before the S1/RRC interface connection is released. Existing ESM cause values as specified in TS 24.301 [46] (e.g. #39, "reactivation requested"; #66 "Requested APN not supported in current RAT and PLMN combination"; and for a dedicated bearer, possibly #37 "EPS QoS not accepted") are used to cause predictable UE behaviour. If all the PDN connections are disconnected and the UE does not support "attach without PDN connectivity", the MME shall request the UE to detach and reattach.

END of CHANGES