**3GPP TSG-WG SA2 Meeting #165S2-2408381**

**Hyderabad, IN, 14th Oct – 18th Oct, 2024 (revision of S2-240xxxx)**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **23.401** | **CR** | **3806** | **rev** | **-** | **Current version:** | **18.6.0** |  |
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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 |  | Radio Access Network | **X** | Core Network | **X** |

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|  |
| ***Title:***  | Support of Regenerative-based satellite access |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon, OPPO |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | 5GSAT\_Ph3\_ARCH |  | ***Date:*** | 2024-10-04 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-19 |
|  | *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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | 5GSAT\_Ph3 introduces support of Regenerative-based satellite access which has impacts to S1 connection management and CN functions determining it is use based on RAN node IDs (e.g. by the MME or PCRF). |
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| ***Summary of change:*** | Introduce the impact that regenerative-based satellite access brought to S1 connection management and note how CN functions can determine its use. |
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| ***Consequences if not approved:*** | Regenerative-based satellite access operation is not supported |
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| ***Clauses affected:*** | 4.3.8.3, 4.4.2, 4.13.1, 4.13.2, 4.13.x (new) |
|  |  |
|  | **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:*** |  |

\* \* \* \* First change \* \* \* \*

#### 4.3.8.3 MME selection function

The MME selection function selects an available MME for serving a UE. The selection is based on network topology, i.e. the selected MME serves the UE's location and for overlapping MME service areas, the selection may prefer MMEs with service areas that reduce the probability of changing the MME. When a MME/SGSN selects a target MME, the selection function performs a simple load balancing between the possible target MMEs. In networks that deploy dedicated MMEs/SGSNs for UEs configured for low access priority, the possible target MME selected by source MME/SGSN is typically restricted to MMEs with the same dedication.

When a MME/SGSN supporting DCNs selects a target MME, the selected target MME should be restricted to MMEs that belong to the same DCN. The DNS procedure may be used by the source CN node to select the target MME from a given DCN. If both low access priority and UE Usage Type parameter are used for MME selection, selection based on UE Usage type parameter overrides selection based on the low access priority indication.

When a MME supporting CIoT EPS Optimisation(s) selects a target MME, the selected MME should all support the CIoT EPS Optimisations applicable to the given UE's attachment. if the source MME is unable to find a target MME matching all CIoT EPS Optimisation(s) applicable to a given UE's attachment, then the source MME, based on implementation, selects a target MME which provides the CIoT EPS Optimisation(s) best applicable to that UE's attachment.

When an eNodeB selects an MME, the eNodeB may use a selection function which distinguishes if the GUMMEI is mapped from P-TMSI/RAI or is a native GUMMEI. The indication of mapped or native GUMMEI shall be signalled by the UE to the eNodeB as an explicit indication. The eNodeB may differentiate between a GUMMEI mapped from P‑TMSI/RAI and a native GUMMEI based on the indication signalled by the UE. Alternatively, the differentiation between a GUMMEI mapped from P-TMSI/RAI and a native GUMMEI may be performed based on the value of most significant bit of the MME Group ID, for PLMNs that deploy such mechanism. In this case, if the MSB is set to "0" then the GUMMEI is mapped from P-TMSI/RAI and if MSB is set to "1", the GUMMEI is a native one. Alternatively the eNodeB makes the selection of MME only based on the GUMMEI without distinguishing on mapped or native.

When an eNodeB selects an MME, the selection shall achieve load balancing as specified in clause 4.3.7.2.

When an eNodeB selects an MME, the selection shall consider the IAB support capability if the UE includes an IAB-Indication in the RRC connection establishment signalling as defined in TS 36.331 [37].

When the UE attempts to establish a signalling connection and the following conditions are met:

- the eNodeB serves more than one country (e.g. it supports E-UTRA satellite access); and

- the eNodeB knows in what country the UE is located; and

- the eNodeB is connected to MMEs serving different PLMNs of different countries; and

- the UE provides an S-TMSI or GUMMEI, which indicates an MME serving a different country to where the UE is currently located; and

- the eNodeB is configured to enforce selection of the MME based on the country the UE is currently located;

then the eNodeB shall select an MME serving a PLMN corresponding to the UE's current location. How the eNodeB selects the MME in this case is defined in TS 36.410 [92].

NOTE x: When the UE accesses an eNodeB onboard a satellite (i.e. regenerative based satellite access), the eNodeB can be configured to enforce selection of dedicated MME supporting regenerative-based satellite access.

When DCNs are deployed, to maintain a UE in the same DCN when the UE enters a new MME pool area, the eNodeB's NNSF should have configuration that selects, based on the MMEGIs or NRIs of neighbouring pool areas, a connected MME from the same DCN. Alternately, for PLMN wide inter-pool intra-RAT mobility, the operator may divide up the entire MMEGI and NRI value space into non-overlapping sets with each set allocated to a particular DCN. In this case all eNodeBs may be configured with the same MME selection configuration. If UE assisted DCN selection feature is supported and a DCN-ID is provided by the UE, the DCN-ID shall be used in the eNodeB for MME selection to maintain the same DCN when the serving MME is not available.

When selecting an MME for a UE that is using the NB-IoT RAT, and/or for a UE that signals support for CIoT EPS Optimisations in RRC signalling (as specified in TS 36.331 [37], for NB-IoT, UE indicates whether it supports "User Plane CIoT EPS Optimisation" and "EPS Attach without PDN Connectivity". And for WB-E-UTRAN, UE indicates whether it supports "Control Plane CIoT EPS Optimisation", "User Plane CIoT EPS Optimisation" and "EPS Attach without PDN Connectivity"), the eNodeB's MME selection algorithm shall select an MME taking into account the MME's support (or non-support) for the Release 13 NAS signalling protocol.

When DCN are deployed for the purpose of CIoT EPS Optimisation, UE included CIoT EPS Optimisation information in the RRC signalling, may depending on eNodeB configuration, be used to perform initial DCN selection.

When Restricted Local Operator Services feature is supported, a UE initiates access to Restricted Local Operator Services via RRC signalling as defined in TS 36.331 [37]. The UE included RLOS indication in RRC signalling may be used by the eNodeB to select an appropriate MME.

\* \* \* \* Second change \* \* \* \*

### 4.4.2 MME

MME functions include:

- NAS signalling;

- NAS signalling security;

- Inter CN node signalling for mobility between 3GPP access networks (terminating S3);

- UE Reachability in ECM-IDLE state (including control, execution of paging retransmission and optionally Paging Policy Differentiation);

- Tracking Area list management;

- Mapping from UE location (e.g. TAI) to time zone, and signalling a UE time zone change associated with mobility,

- PDN GW and Serving GW selection;

- MME selection for handovers with MME change;

- SGSN selection for handovers to 2G or 3G 3GPP access networks;

- Roaming (S6a towards home HSS);

- Authentication;

- Authorization;

- Bearer management functions including dedicated bearer establishment;

- Lawful Interception of signalling traffic;

- Warning message transfer function (including selection of appropriate eNodeB);

- UE Reachability procedures;

- Support Relaying function (RN Attach/Detach);

- Change of UE presence in Presence Reporting Area reporting upon PCC request,

- in the case of Change of UE presence in Presence Reporting Area reporting, management of Core Network pre-configured Presence Reporting Areas.

- For the Control Plane CIoT EPS Optimisation:

a) transport of user data (IP, Non-IP and Ethernet));

b) local Mobility Anchor point;

c) header compression (for IP user data);

d) ciphering and integrity protection of user data;

e) Lawful Interception of user traffic not transported via the Serving GW (e.g. traffic using T6a).

NOTE: The Serving GW and the MME may be implemented in one physical node or separated physical nodes. For CIoT EPS Optimisation, the Serving GW and the MME can be implemented in one physical node (e.g. C-SGN) or separated physical nodes. The C-SGN can also encompass the PDN GW function.

In addition to the functionalities of the MME described above, the MME may also include following functionalities to support regenerative-based satellite access:

- Support for S1 Removal procedure defined in TS 36.413 [36].

The MME shall signal a change in UE Time Zone only in the case of mobility and in the case of UE triggered Service Request, PDN Disconnection and UE Detach. If the MME cannot determine whether the UE Time Zone has changed (e.g. the UE Time Zone is not sent by the old MME during MME relocation), the MME should not signal a change in UE Time Zone. A change in UE Time Zone caused by a regulatory mandated time change (e.g. daylight saving time or summer time change) shall not trigger the MME to initiate signalling procedures due to the actual change. Instead the MME shall wait for the UE's next mobility event or Service Request procedure and then use these procedures to update the UE Time Zone information in the PDN GW.

\* \* \* \* Third change \* \* \* \*

## 4.13 Introduction of satellite support for Cellular IoT

### 4.13.1 General

This clause describes the functionality for supporting Cellular IoT over satellite access, including transparent satellite payloads and regenerative satellite payloads. Support for WB-E-UTRAN, NB-IoT and LTE-M satellite access is specified in TS 36.300 [5].

\* \* \* \* Forth change \* \* \* \*

### 4.13.2 Support of RAT types defined in EPC for satellite access

In the case of satellite access with WB-E-UTRAN, NB-IoT or LTE-M, the RAT Types values "WB-E-UTRAN(LEO)", "WB-E-UTRAN(MEO)", " WB-E-UTRAN(GEO)", " WB-E-UTRAN(OTHERSAT)", "NB-IoT(LEO)", "NB-IoT(MEO)", "NB-IoT(GEO)", "NB-IoT(OTHERSAT)", "LTE-M(LEO)", "LTE-M(MEO)", "LTE-M(GEO)" and "LTE-M(OTHERSAT)" are used in EPC to distinguish the different WB-E-UTRAN, NB-IoT and LTE-M satellite access types.

In order to enable efficient enforcement of mobility restrictions:

- Cells of each NB-IoT satellite RAT type (NB-IoT(LEO), NB-IoT(MEO), NB-IoT(GEO) or NB-IoT(OTHERSAT)) need to be deployed in TAs that are:

- different from TAs for other NB-IoT satellite RAT types; and

- different from TAs supporting terrestrial NB-IoT RAT type; and

- different from TAs for WB-E-UTRAN satellite RAT types; and

- different from TAs for WB-E-UTRAN terrestrial RAT types.

The MME may initiate Detach of the UE when an S1 UE Context Release Request is received with Cause indicating the release is requested due to a UE using satellite access moved out of PLMN serving area, as specified in TS 36.413 [36].

NOTE X: There is no differentiation of whether the RAT type is a transparent satellite payload or a regenerative satellite payload. The e.g. Global RAN Node IDs associated with satellite payload can be used to determine whether the UE is accessing via transparent or regenerative satellite payload, if needed, by e.g. the MME, PCRF, etc.

\* \* \* \* Fifth change \* \* \* \*

#### 4.13.x S1 connection management for regerative satellite payload

The S1 Removal procedure defined in TS 36.413 [36] can be used to remove the interface between an eNodeB and a MME in a controlled manner, e.g. when the eNodeB is leaving the service area of an MME.

When the feeder-link for an eNodeB changes to allow the serving MME for a UE to change then e.g. the S1 Release procedure, or Load re-balancing between MMEs procedure (see clause 4.3.7.3) with setting the Weight Factor for an MME may be performed for UEs in ECM\_CONNECTED.NOTE: If TAC value changes as the cells move across the Earth’s surface (see clause 4.13.7) then the UE will initiate a Tracking Area Update procedure, as defined in clause 5.3.3.0, which allows the serving MME to change.

\* \* \* \* End of changes \* \* \* \*