**3GPP TSG-SA WG2 Meeting #163S2-240xxx**

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**Source: Samsung, Sateliot, NOVAMINT, DISH Network, EchoStar, Inmarsat, Viasat, Intel**

**Title: KI#2: Conclusions.**

**Document for: Approval**

**Agenda Item: 19.1**

**Work Item / Release: FS\_5GSAT\_ARCH\_Ph3 / Rel-19**

*Abstract of the contribution: This contribution proposes conclusions for KI#2.*

# 1 Discussion

This paper proposes conclusion principles to support the important evaluation criteria as agreed in clause 7.

# 2 Proposal

It is proposed to agree below proposed changes to 23.700-29.

\*\*\* Next Change \*\*\*

# 8 Conclusions

## 8.2 KI #2: Conclusions for Support of Store and Forward Satellite operation

Editor's note: This clause will list conclusions for KI#2.

### 8.2.1 Principles of conclusion

The following conclusions apply to the split MME architecture. The text below presents one of the possible solutions for the completion of an attach procedure in the absence of an end-to-end link, however, more solutions need to be included in the normative phase of the work in close collaboration with SA3 to ensure secure authentication procedures. In the Split MME architecture, HSS is on the ground.

MME is split into two parts: MME-onboard - the MME part which is onboard the satellite and MME-ground – the MME part which is on the ground network, as described in clause 8.2.2.

The MME-ground and MME-onboard interface is outside the scope of 3GPP in this release. The terms MME-onboard or MME-ground used in this section implies a single MME entity from 3GPP perspective and should be described as a single MME entity during normative phase.

1) When feeder link is not available and the network supports S&F operation, the network shall be able to inform UE(s) whether S&F Satellite operation is applied, (e.g. eNB broadcast support of S&F operation as part of System Information).

NOTE 1: Whether eNB broadcast support of S&F operation is based on the decision of RAN WGs.

NOTE 2: If the network does not support S&F operation and the feeder link is not available then eNB switches off and does not broadcast any signal.

2) The UE initiates Attach procedure, indicates S&F mode to the MME-onboard following existing procedures, the MME-onboard sends Attach Reject message to the UE. The Attach Reject message includes:

a) A new EMM Cause that informs the UE that the attach procedure cannot be completed because of the S&F operation but that the UE can re-attempt the attach in a next satellite pass. i.e. this indicates to the UE that the information contained in the Attach Request message is stored by the MME-onboard and network will be available to the UE after authentication and subscription details are fetched by the MME-onboard from ground network.

b) Wait timer: Indicates to the UE the time it should wait before re-attempting the Attach procedure in the current or another satellite of the same PLMN. The UE shall not select any other network which will provide store and forward service to the UE till the wait timer is running.

c) The list of Satellite IDs over which the UE can re-attempt the Attach procedure, after wait timer expires. The Satellite IDs are based on the Satellite IDs available in SIB3 and SIB32.

NOTE 3: The security issues (if any) of this solution are in the scope of SA3.

NOTE 4: The legacy UEs can be provided with the reject cause Congestion.

4) MME-ground indicates to HSS the "Request Time", allowing the HSS to check that no other (e.g., terrestrial) MME has sent an Update Location Request after the "Request Time", and fetches the authentication vector and other details from HSS following current Authentication and security procedures. The MME-ground triggers Update location with the HSS and Update location ACK is received by MME-ground. i.e. all the subscription details are retrieved by MME-ground. The Update Location Request includes an indication that this location update is provisional i.e. the HSS must not consider the UE as registered until it receives the final Update Location Request.

5) When the wait timer has expired given to the UE in step 2 and the UE finds the cell which broadcast the Satellite ID valid to re-attempt the attach procedure, the UE re-sends the Attach Request message

6) MME-onboard executes the authentication, security procedure and executes remaining steps to complete Attach procedure with the UE. The MME-onboard also provide S&F policies to the UE which includes a UE context activation timer and list of Satellite IDs over which the UE may exchange the data. The UE starts UE context activation timer after it receives the NAS message, the UE should consider itself registered with the network at the expiry of this timer. The S&F policies are:

1) For CP CIoT service, the NAS procedures shall allow enforcing the S&F policies that might be applicable as per operator policy for data transmission, such as S&F data quotas, S&F data retention period, delivery priority levels and providing information on expected delivery times to the UE. The external SCA/AS is indicated by core network whether UE is registered in S&F Mode, Expected delivery time, and the feeder-link availability information.

NOTE 5: Whether any existing monitoring events or procedures can be used or enhanced to achieve above S&F policies will be determined during normative phase.

Additionally for MO SMS, upon reception of the MO SMS the MME-onboard stores the MO-SMS and immediately sends the delivery report to the UE i.e. as if the MO-SMS has already been successfully delivered to the Service Centre (SC).

### 8.2.2 Architecture(to be captured in informative annex)

eNB is assumed to be on board the satellite.

For supporting SMS and CP CIoT services:

* MME is split into two functions:
  + MME-onboard - the MME part which is onboard the satellite. MME-onboard is in charge of (1) handling the S1 interface with the onboard eNB and (2) terminating the NAS protocol signalling from/to UEs via the onboard eNB.
  + MME-ground – the MME part which is on the ground network. MME-ground is in charge of handling the rest of interfaces towards other CN functions (S6a towards HSS, SGd towards SMS-GMSC/IWMSC /SMS Router, T6a towards SCEF, T6ai towards IWF-SCEF, S11 towards SGW). One MME-ground instance can be connected to one or multiple MME-onboard instances via a new Ssf reference point (see Figure 8.2.1-1).
* Rest of the core network elements (HSS, SGW, PGW, SCEF/IWF-SCEF, SMS-GMSC/IWMSC/SMS Router) are on the ground.



Figure 8.2.1-1: “Split-MME” architecture for supporting S&F satellite operation for SMS and CP CIoT services

The Ssf interace is outside the scope of 3GPP in this release of the specification.

For supporting S1-UP and UP CIoT services, part of the SGW function should be also deployed on board the satellite..