**3GPP TSG-SA WG2 Meeting #171S2-2508288**

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**Source: Skylo Technologies, ViaSat, Boost Mobile Network, EchoStar, Verizon**

**Title: Interim Conclusion for KI#1**

**Agenda item: 20.1.1**

**Document for: Agreement**

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*Abstract of the contribution:* *This paper proposes Interim conclusions for KI#1*

# 1. Discussion

TS 234.700-19 v0.3.0 has documented 20 solutions relevant to KI#1 and KI#2.

Regarding KI#1, while evaluating these solutions, we propose the following system enhancements to support IMS voice service over NB-IoT via GEO satellite connection to EPC, taking into account the LS Response from RAN1,

* to establish separate Data Radio Bearers (DRBs) for signalling and voice media packets due to different transport requirements for these two types of packets. Voice packets require consistent jitter and delay handling and may benefit from prioritization or special treatment in satellite links. This separation also aligns with how IMS networks typically handle control and media, enabling better traffic management and potential for differentiated satellite resource allocation.
* A default bearer with a QCI for voice over GEO signalling, and dedicated bearer with QCI for voice packets.
* UP NIDD provides the lowest protocol overhead, making it especially suitable for constrained and high-latency environments such as GEO-based NTN. UP NIDD, operating over the user plane, also enables the use of AS-level security mechanisms.
* IP with RoHC adds additional complexity and CPU processing for both the UE and the network. This makes it less efficient for NB-IoT, where devices are constrained by limited processing capability, power consumption, and memory footprint. ROHC is not a fit for voice over GEO ROHC’s two-party negotiation process adds several seconds to call setup and increases latency, a significant issue in GEO. ROHC's initial state introduces a large IP overhead, which isn't suitable for the narrowband channels used in IoT NTN.

Regarding KI#2, while evaluating various solutions, and considering the constrained transmission environment of GEO, we propose the following EMS enhancement to optimize data rate and call setup time.

In IMS network, the I1 protocol is a lightweight application protocol specified in TS 24.294 to enable I1 session control entities to exchange the I1 protocol messages over any transport-layer protocol that connects the ICS UE and the SCC AS. The I1 protocol allows the ICS UE and SCC AS to exchange service control information related to session setup, modification, and release, regardless of the underlying access technology or transport layer.

The principles of service centralization and continuity in the IMS, as specified in TS 23.237 and TS 23.292, ensure a consistent user experience regardless of the attached access network. This approach is particularly suitable for scenarios in which the transport used for IMS call control is bandwidth-constrained, yet IMS service control remains necessary. These principles can also be applied to IMS voice calls over NB-IoT NTN GEO satellite links, where low bandwidth and high latency transmission conditions exit.

As described in clause 6.4 in TR 23.700-19, by applying these principles, sessions that are originated or terminated via the NB-IoT NTN domain can be anchored in the SCC AS within the IMS core. This anchoring provides a centralized point for service control and continuity management.

The SCC AS is inserted into the session path using originating and terminating initial Filter Criteria (iFC), as specified in TS 23.228.

* For Mobile Originated (MO) calls, the SCC AS is the first invoked Application Server (AS). It acts as the initial point of contact for the call from the UE.
* For Mobile Terminated (MT) calls, after the session is routed to the Serving-CSCF (S-CSCF), the SCC AS is invoked before the session is routed to the NB-IoT NTN domain. In this case, the SCC AS acts as the last invoked AS in the session path.

As specified in TS 23.292, the SCC AS functions as a gateway, translating between the I1 protocol used by the IMS Centralized Services (ICS) UE and the SIP-based IMS core. This enables the lightweight I1 protocol to control sessions within a full-featured IMS network.

# 2 Proposal

It is proposed to include the following changes in TR 23.700-19 V0.3.0.

\* \* \* First Change \* \* \* \*

# 7 Interim Agreements

## 7.1 Agreed Principles

### 7.1.1 Agreed principles for KI#5 of UE-SAT-UE communication via UPF only onboard satellite for non-IMS services

To supports KI#5 of UE-SAT-UE communication via UPF only onboard satellite for non-IMS services, the following principles are concluded:

**Principle 1:** The existing R18 mechanism (Local switch for UE-to-UE communications via UPF deployed on GEO satellite) can be reused to trigger UE-SAT-UE communication, select UPF(s) onboard satellite(s) and establish UE-SAT-UE communication via UPF(s) only onboard NGSO satellite(s).

**Principle 2:** The following existing 5G VN features apply for KI#5:

- A single SMF or a single SMF set is supported.

- The UEs are in the same 5G VN group.

- Local switch within UPF on-board satellite, N6 and N19 tunnel between UPFs on-board different satellites are supported.

- Both IP PDU Session type and Ethernet PDU Session type are supported.

- Only unicast UE-SAT-UE communication is supported.

**Principle 3:** The SMF determines whether to continue or to fall back the UE-SAT-UE communication due to serving satellite change, based on the information about the availability of ISL(s) between satellites serving the UEs as well as the 5G VN group supporting UE-SAT-UE communication. How SMF gets the information is per implementation, e.g. based on UPF report or from transport network via a proprietary interface.

**Principle 4:** PSA UPF on ground and UL CL/BP/local PSA UPF onboard satellite is supported as baseline. To support service continuity, the following apply:

- For the UE-SAT-UE communication continuity case, the SMF reuses existing procedures for Simultaneous change of Branching Point or UL CL and additional PSA for a PDU Session as described in clause 4.3.5.7 of TS 23.502 [3] for the UE.

- For the ground fallback case the SMF coordinates existing procedures at both UEs for Removal of additional PDU Session Anchor and Branching Point or UL CL as described in clause 4.3.5.5 of TS 23.502 [3]. The SMF firstly removes UL CL/L-UPF of peer UE and configure PDR&FAR and N6/N19 routing in ground PSA UPF(s) (if two UEs are using different PSA UPFs) during the satellite handover of local UE, then removes UL CL/L-UPF of local UE after satellite handover of local UE.

**Principle 5:** For PSA UPF on satellite, SSC mode 2 or 3 can be used to support service continuity. It is assumed that all the 5G VN group members are accessing NTN (no DN connectivity while UE-Sat-UE with PSA UPF).

### 7.1.x Agreed principles for KI#1 on support of IMS voice call over NB-IoT NTN via GEO satellite connecting to EPC

The following high-level principles apply for KI#1

* Separate DRBs shall be established for voice-over-GEO signalling and voice media traffic, respectively.
* A default bearer shall be used for voice-over-GEO signalling, while a dedicated bearer (different PDN connections) shall be used for the voice packets.
* UP NIDD shall be used for data transfer for both DRBs.
* Point-to-point tunnelling by UDP/IP encapsulation shall be used as described in TS 23.401 sub-clause 4.3.17.8.3.3.2.

\* \* \* End of Changes \* \* \* \*