**3GPP SA WG2 Meeting #162 S2-2405225**

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**Source: MediaTek Inc.**

**Title:** **New Sol: Registration Management and Policy Control for DualSteer Device**

**Document for: Approval**

**Agenda Item: 19.13**

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*Abstract of the contribution:* *This paper proposes solutions to resolve issues from KI#1.1, #1.2 and #1.4*

# Discussion

This paper proposes solutions to resolve the following Key issues:

"Whether and how the 5G System identifies and associates the two subscriptions/SUPIs for DualSteer." from KI#1.1

"Whether and what enhancements are needed in functions and procedures of registration, deregistration and mobility management for supporting DualSteer." from KI#1.2

"For DualSteer traffic steering, whether and what policies need to be provided by the HPLMN to guide the DualSteer device to select a 3GPP access network to be used for the new service" from KI#1.4

"For DualSteer traffic switching, whether and what policies need to be provided by the HPLMN to guide the DualSteer device for traffic switching between two connected 3GPP access networks" from KI#1.4

# Proposal

It is proposed to include the below solution to the TR 23.700-54

\*\*\* Start of changes \*\*\*

## 6.0 Mapping of Solutions to Key Issues

Table 6.0-1: Mapping of DualSteer Solutions to Key Issues

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Key Issues for DualSteer | | | |
| Solution# | Key Issue #1.1 | Key Issue #1.2 | Key Issue #1.3 | Key Issue #1.4 |
| #X | X | X |  | X |
|  |  |  |  |  |

\*\*\* Second change (All New Text) \*\*\*

## 6.X Solution #X: Registration Management and Policy Control for DualSteer Device

### 6.X.1 Description

#### 6.X.1.1 Registration management for DualSteer device

A DualSteer device has two subscriptions/SUPIs, sharing one subscription profile from the same operator. However, the 5GC does not know a priori whether these two subscriptions/SUPIs are in the same DualSteer device. Therefore, the DualSteer device and the 5GC which supports the DualSteer feature cannot use the DualSteer feature efficiently for traffic transmission without some indication. To resolve the above issue, the UE(s) in the DualSteer device needs to indicate to the 5GC that the two subscriptions/SUPIs are in the same DualSteer device during Registration procedure. Therefore, the 5GC can do identification and association for these two subscriptions/SUPIs in the network for DualSteer feature.

To achieve this, the following principles are applied:

- Two subscriptions/SUPIs require separate registration procedures for each of the subscriptions/SUPIs in the DualSteer device (regardless of non-simultaneous transmission or simultaneous transmission).

- The UE(s) in the DualSteer device is aware of belonging to the DualSteer device to support DualSteer feature and decides which subscription/SUPI is primary or secondary by implementation manner. To ensure the DualSteer feature can be activated between the UE(s) in the DualSteer device and 5GC, the network for the secondary subscription/SUPI to register is decided after the registration of the primary subscription/SUPI is completed and the network information for the secondary subscription/SUPI is transmitted to the primary subscription/SUPI during the Registration procedure (e.g., in Registration accept message).

- After PLMN selection as specified in TS 23.122 [xx] for primary subscription/SUPI, during the Registration procedure for the primary subscription/SUPI, the UE(s) in the DualSteer device can transmit "UE assisted information for DualSteer "(e.g., the available PLMNs, additional RATs, UE location) to 5GC, and the 5GC can decide which network (possibly with RAT type) can be dedicated to the secondary subscription/SUPI to register for DualSteer and transfer the network information to primary subscription/SUPI.

Editor’s note: what information can be included in "UE assisted information for DualSteer" is FFS.

Editor’s note: whether the PLMN selection is involved in Dualsteer device is FFS

- When the primary subscription/SUPI completes the Registration procedure, the UE(s) in the DualSteer device selects and registers to the network obtained from the primary subscription/SUPI.

**Registration to same PLMN**

When the UE(s) in DualSteer device triggers the registration procedure for one of the subscriptions/SUPIs (e.g., SUPI1) for primary subscription/SUPI, the DualSteer device includes SUCI1 of SUPI1 or 5G-GUTI 1 of SUPI1 (if available) along with the UE assisted information and the SUCI2 of SUPI2 in the Registration Request to the 5GC. When the 5GC receives the identity information from SUPI1 along with the identity information of SUPI2, the 5GC knows the subscription/SUPI from the DualSteer device in current registration procedure supports DualSteer feature for the SUPI1. Furthermore, the 5GC will proceed to handle the UE assisted information for deciding the network (additional RAT) for the secondary subscription/SUPI if the primary subscription/SUPI can successfully register to 5GC. If the 5GC does not support DualSteer feature, the 5GC ignores the UE assisted information and the identity information from SUPI2 and considers the registration procedure as normal registration for SUPI1 as specified in clause 4.2.2.2.2 in TS 23.502 [4].

Similar to the registration operation of SUPI1,when the DualSteer device triggers the registration procedure for the secondary subscription/SUPI (e.g. SUPI2) to access the network obtained from the Registration procedure from primary subscription/SUPI, the DualSteer device includes the SUCI2 of SUPI2 or 5G-GUTI2 along with the SUCI1 of SUPI1 in the Registration Request to the 5GC. When the 5GC receives the identity information from SUPI2 along with the identity information from SUPI1, the 5GC knows the DualSteer device supports DualSteer feature for the SUPI2. If the 5GC does not support DualSteer feature, the 5GC ignores the SUCI1 of SUPI1 and considers the registration as normal registration for SUPI2 as specified in clause 4.2.2.2.2 in TS 23.502 [4].

When the 5GC receives the above registration information from SUPI1 and SUPI2, the 5GC knows SUPI1 and SUPI2 are associated to the same DualSteer device and these two subscriptions/SUPIs are ready for DualSteer feature. Therefore, the 5GC and the DualSteer device can use the DualSteer feature (e.g., DualSteer steering, or DualSteer switching) in the serving PLMN.

If the serving PLMN is not the subscriptions owner of the SUPI1 and SUPI2, the serving PLMN needs to forward the received information from SUPI1 and SUPI2 to the subscription owner of SUPI1 and SUPI2 (i.e., to the UDM of the subscription owner).

**Registering to different PLMNs**:

Similarly, if DualSteer device triggers the separate registration procedures for SUPI1 and SUPI2 to different PLMN (e.g., PLMN1 and PLMN2), the similar behavior of the DualSteer device as registering to the same PLMN.

If one of the PLMNs are the subscription owner of SUPI1 and SUPI2 (e.g., PLMN1), the other PLMN (e.g., PLMN2) needs to forward the received information from SUPI2 to the subscription owners (e.g., PLMN 1) for using DualSteer feature.

If none of PLMN1 and PLMN2 are the subscription owner of SUPI1 and SUPI2, PLMN1 and PLMN2 need to forward the received information from SUPI1 and SUPI 2 to the subscription owner for using DualSteer feature.

**Handling in UDM**

The UDM verifies whether the DualSteer feature can be activated for these two subscriptions/SUPIs in the DualSteer device. After handling, if the UDM activates the DualSteer feature for SUPI1, the UDM also includes the network information (additional RAT type) for the secondary subscription/SUPI to primary subscription/SUPI. If the UDM finds the primary subscription/SUPI cannot perform DualSteer feature, the UDM may accept the Registration from primary without supporting DualSteer feature.

**Out of Service Handling for Primary subscription/SUPI:**

Similar to SoR-CMCI in Annex C.4 in TS 23.122 [xx], if the UE is in CONNECTED mode, the UE delays the PLMN selection for the ongoing service. To avoid the DualSteer traffic transmission interruption, a DualSteer guard timer may be configured in the UE(s) to keep the DualSteer traffic transmission as long as possible in the connectivity of the secondary subscription/SUPI. Otherwise, based on the behavior of recovery from lack of coverage in TS 23.122 [xx], the primary subscription/SUPI needs to perform the PLMN selection to select a PLMN. This may result in the DualSteer traffic not to be transmitted using the connectivity of the secondary subscription/SUPI since the network for the secondary subscription/SUPI is dependent on the network registered by the primary subscription/SUPI as described in the above descriptions (i.e. the descriptions of "Registering to same PLMN" or "Registering to different PLMNs")

#### 6.X.1.2 DualSteer policy for DualSteer device after registration for DualSteer device

After two subscriptions/SUPIs registered to the network(s), the DualSteer device needs guidance, when a first application needs to send PDUs (e.g., IP Packets), to determine which subscription/SUPI or which PLMN or which RAT to send (steer/switch) the first application’s PDU by using Dualsteer traffic steering or switching.

The UE(s) in the Dualsteer device receives Dualsteer policy which includes the list of the applications can use Dualsteer feature. The UE(s) establishes the PDU Session(s) for the transmission of the applications, e.g., the UE establishes the PDU Session(s) over the registered accesse(s) in both networks or both RATs.

The list of applications can contain Traffic Description (for application), e.g., the information for Application, it could be e.g., Traffic Descriptor information as included in the URSP rules, application ID, S-NSSAI, DNN, IP address, FQDN information to be used in this field. Each traffic descriptor is associated with a prioritized list of (preferred) steering or switching using which subscription/USIM/SUPI/path/route/PLMN.

NOTE: The PDU Session established in both networks could be SA-PDU Session or MA-PDU Session based on the URSP rules.

Dualsteer policy further includes the dualsteer steering/switching rules for the traffic across the PDU Sessions between the primary and secondary networks. The conditions to apply dualsteer steering/switching rules can be similar like to ATSSS rules but the measurements are performed across the PDU sessions between both networks across subscriptions/SUPIs regardless of 3GPP or non-3GPP access.

The DualSteer policies contains zero or more of the following elements:

- an indication to indicate "Terrestrial Network (TN) access has higher priority than Non-Terrestrial Network (NTN) access " or " Non-Terrestrial Network (NTN) access has higher priority than Terrestrial Network (TN) access ";

- an indication to indicate "HPLMN has higher priority than VPLMN" or "VPLMN has higher priority than HPLMN";

- a list (in prioritized order), the list contains zero or more entries, each entry contains:

i. Traffic descriptor (for application) e.g., the information for Application, it could be e.g., Traffic Descriptor information, application ID, S-NSSAI, DNN, IP address, FQDN information to be used in this field. Each traffic descriptor is associated with a prioritized list of (preferred) steering or switching subscription/USIM/SUPI/path/route/PLMN, each entry of which contains at least one or more of the following information

1) one or more PLMN ID, or a range of PLMN ID, or one or more MCC, or a range of MCC, or wildcard PLMN or MCC, or one or more cell id/TA/ID, zero or more time of day, validity area;

2) one or more RAT (NG-RAN, Satellite NG-RAN,) and/or (3GPP or non-3GPP) access information;

3) (Primary or Secondary) subscription/SUPI

Each validity area consists of e.g.,

- 3GPP location; and/or

- Geo location.

Each time of day consists of e.g.,

- time start;

- time stop;

- date start;

- date stop; and/or

- day of week.

The 3GPP location of the first network is e.g.,

- PLMN Id;

- RAT

- TA/RA

- BAND

- TAC

- NR CI

Home PLMN can have different principles/policies regarding how to configure the DualSteer policy.

For example, Home PLMN may generate the DualSteer Policy based on the one or more of below principles:

* a) The traffic transmission for applications is preferred to be sent/transmitted on/over Terrestrial Network (TN) access if both TN access and Non-Terrestrial Network (NTN) access exist (available (and not congested) and/or registered)
* b) The traffic transmission for applications is preferred to be sent/transmitted on/over HPLMN (if available and/or registered) than VPLMN
* c) the preference of the DualSteer policy is generated based on currently registered networks and accesses information. Under this principle, when the DualSteer device changes PLMN or RAT due to mobility or other conditions (e.g., congestion, out of service), the subscription owner network/HPLMN/MNO can optionally update DualSteer policy accordingly.

Combining principles described above, the following scenarios/use case are described by what information that the subscription owner network/HPLMN/MNO provides in the DualSteer policy to DualSteer device:

* Example 1: DualSteer device in case of separate UEs, UE1/USIM1 registered to PLMN1 on TN access (e.g., NR/NG-RAN, EUTRA(N)), UE2/USIM2 registered to PLMN2 on NTN access (e.g., satellite NG-RAN, satellite EUTRAN, IoT NTN access, etc) PLMN1 and PLMN2 are not subscription owner/HPLMN/MNO who provides these two USIMs. Based on this, the subscription owner network/HPLMN/MNO provides DualSteer policy considering principles a) and b), it would be like:

|  |  |
| --- | --- |
| **Traffic descriptor** | **PLMN and access combination based on principles a) ,b) and/or c) after the UE1/USIM1 and UE2/USIM2 registers to PLMN 1 and PLMN2 for steering/switching (in prioritized order)** |
| Application a (e.g., the information for Application a could be Traffic Descriptor information, application ID, S-NSSAI, DNN, IP address, FQDN information to be used in this field) | 1. PLMN1 with TN access of USIM1 2. PLMN1 with non-3GPP access of USIM1 3. PLMN2 with NTN access of USIM2 4. PLMN2 with non-3GPP access of USIM2 |
| Application b(e.g., the information for Application a could be Traffic Descriptor information, application ID, S-NSSAI, DNN, IP address, FQDN information to be used in this field) | 1. PLMN1 with TN access of USIM1 2. PLMN1 with non-3GPP access of USIM1 3. PLMN2 with NTN access of USIM2 4. PLMN2 with non-3GPP access of USIM2 |
| Application c  (e.g., the information for Application a could be Traffic Descriptor information, application ID, S-NSSAI, DNN, IP address, FQDN information to be used in this field) | 1. PLMN1 with TN access of USIM1 2. PLMN1 with non-3GPP access of USIM1 3. PLMN2 with NTN access of USIM2 4. PLMN2 with non-3GPP access of USIM2 |

* Example 2: DualSteer device in case of separate UEs, UE1/USIM1 registered to HPLMN on TN access (e.g., NR, EUTRA), UE2/USIM2 registered to PLMN2 on TN access. PLMN2 is not subscription owner /HPLMN/MNO who provides these two USIMs. Based on this, the subscription owner network/HPLMN/MNO provides DualSteer policy considering principles a) and b), it would be like:

|  |  |
| --- | --- |
| **Traffic descriptor** | **PLMN and access combination based on principles a), b) and/or c) after the UE1/USIM1 and UE2/USIM2 registers to HPLMN and PLMN2 for steering/switching (in prioritized order)** |
| Application a (e.g., the information for Application a could be Traffic Descriptor information, application ID, S-NSSAI, DNN, IP address, FQDN information to be used in this field) | 1. HPLMN with TN access of USIM1 2. HPLMN with non-3GPP access of USIM1 3. PLMN2 with TN access of USIM2 4. PLMN2 with non-3GPP access of USIM2 |
| Application b(e.g., the information for Application a could be Traffic Descriptor information, application ID, S-NSSAI, DNN, IP address, FQDN information to be used in this field) | 1. HPLMN with TN access of USIM1 2. HPLMN with non-3GPP access of USIM1 3. PLMN2 with TN access of USIM2 4. PLMN2 with non-3GPP access of USIM2 |
| Application c  (e.g., the information for Application a could be Traffic Descriptor information, application ID, S-NSSAI, DNN, IP address, FQDN information to be used in this field) | 1. HPLMN with TN access of USIM1 2. HPLMN with non-3GPP access of USIM1 3. PLMN2 with TN access of USIM2 4. PLMN2 with non-3GPP access of USIM2 |

After checking the DualSteer policy, the UE(s) in the DualSteer device can initiate the PDU Session establishment based on the existing mechanism for DualSteer traffic steering and/or switching using the connectivity from the network(s) registered by the two subscriptions/SUPIs in the DualSteer policy

### 6.X.2 Procedures

Editor’s note: the details of call flows are FFS

### 6.X.3 Impacts on services, entities and interfaces

UE(s) with two SUPIs (SUPI1 and SUPI2) in DualSteer Device:

* Needs to determine primary and secondary subscription/SUPI
* Needs to include the identity information of the other subscription/SUPI (may additionally include UE assisted information) in Registration Requests
* Is aware of belonging to DualSteer Device/ support for two SUPIs

V-AMF:

* Needs to forward the pair identity information (additionally with UE assisted information) to the UDM of subscription owner of SUPI1 and SUPI2
* Needs to forward the network information (possibly with additional RAT) to the primary subscription/SUPI

H-UDM:

* Needs to access the sharing subscription profile to determine whether two subscriptions/SUPIs are for DualSteer feature
* Needs to determine whether two subscriptions/SUPIs are in the same DualSteer device and to decide whether to activate DualSteer feature for the DualSteer device
* Needs to provide the network information to (V)-AMF

H-PCF:

- Provides DualSteering policies to DualSteer device for application traffic transmission using DualSteer traffic steering and switching

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