**SA WG2 Meeting #143eS2-2100075**

**Feb 24th – March 9th, 2021 ; Elbonia (revision of S2-2100075)**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **23.501** | **CR** | **2527** | **rev** | **-** | **Current version:** | **16.7.0** |  |
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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 |  | Core Network | **X** |

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| ***Title:***  | MA PDU sessions with connectivity over E-UTRAN/EPC and non-3GPP access to 5GC |
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| ***Source to WG:*** | Nokia, Nokia Shanghai Bell, Deutsche Telekom, Ericsson, InterDigital, LG Electronics |
| ***Source to TSG:*** | S2 |
|  |  |
| ***Work item code:*** | ATSSS\_Ph2 |  | ***Date:*** | 2021-01-18 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *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:*** | Objectives of ATSSS\_Ph2 WID in S P-200977b) Support for UEs to establish MA PDU Sessions with a 3GPP access leg over EPC and a non-3GPP access leg over 5GC, according to the conclusions in TR 23.700-93, clause 8.3. |
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| ***Summary of change:*** | The text that was text currently in R16 23.316 § 4.12.3 and was describing the feature to apply only to 5G RG is moved to 23.501 § 5.32 and adapted to:- apply to any UE and over and non-3GPP access- support Ethernet PDU Session type (for non 5G RG) as documented in TR 23.700-93, clause 8.3 |
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| ***Consequences if not approved:*** | No Support for UEs to establish MA PDU Sessions with a 3GPP access leg over EPC and a non-3GPP access leg over 5GC |
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| ***Clauses affected:*** | 5.32.1; 5.32.X (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 23.316 CR 2056  |
| ***affected:*** |  | **x** |  Test specifications |  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | § 5.32.X (new) has been built by copying the text currently in R16 23.316 § 4.12.3 (also updating the clause Nr) using word user LTHBM0 and then doing updates with word user LTHBM1 to make the description generic i.e. applicable beyond the support of 5G RG and wireline access;This has created changes on changes that will need to be cleaned upTO BE DISCUSSED If Ethernet type PDN Type is not supported in EPS, Non-IP PDN Type PDN Connection can be used |

*FIRST CHANGE*

### 5.32.1 General

The ATSSS feature is an optional feature that may be supported by the UE and the 5GC network.

The ATSSS feature enables a multi-access PDU Connectivity Service, which can exchange PDUs between the UE and a data network by simultaneously using one 3GPP access network and one non-3GPP access network and two independent N3/N9 tunnels between the PSA and RAN/AN. The multi-access PDU Connectivity Service is realized by establishing a Multi-Access PDU (MA PDU) Session, i.e. a PDU Session that may have user-plane resources on two access networks.

The UE may request a MA PDU Session when the UE is registered via both 3GPP and non-3GPP accesses, or when the UE is registered via one access only.

After the establishment of a MA PDU Session, and when there are user-plane resources on both access networks, the UE applies network-provided policy (i.e. ATSSS rules) and considers local conditions (such as network interface availability, signal loss conditions, user preferences, etc.) for deciding how to distribute the uplink traffic across the two access networks. Similarly, the UPF anchor of the MA PDU Session applies network-provided policy (i.e. N4 rules) and feedback information received from the UE via the user-plane (such as access network Unavailability or Availability) for deciding how to distribute the downlink traffic across the two N3/N9 tunnels and two access networks. When there are user-plane resources on only one access network, the UE applies the ATSSS rules and considers local conditions for triggering the establishment or activation of the user plane resources over another access.

The type of a MA PDU Session may be one of the following types defined in clause 5.6.1: IPv4, IPv6, IPv4v6, and Ethernet. In this release of the specification, the Unstructured type is not supported. The clause 5.32.6.2.1 and the clause 5.32.6.3.1 below define what Steering Functionalities can be used for each supported type of a MA PDU Session.

The handling of 3GPP PS Data Off feature for MA PDU Session is specified in clause 5.24.

The ATSSS feature can be supported over any type of access network, including untrusted and trusted non-3GPP access networks (see clauses 4.2.8 and 5.5), wireline 5G access networks (see clause 4.2.8), etc., as long as a MA PDU Session can be established over this type of access network.

In this Release of the specification, a MA PDU Session using IPv6 multi-homing (see clause 5.6.4.3) or UL Classifier (see clause 5.6.4.2) is not specified.

In this Release of the specification, support for ATSSS assumes SMF Service Areas covering the whole PLMN or that a MA PDU Session is released over both accesses when the UE moves out of the SMF Service Area.

A Multi-Access PDU Session may use user-plane resources of an associated PDN Connection on 3GPP access in EPC. This enables a scenario where a MA PDU Session can simultaneously be associated with user-plane resources on 3GPP access network connected to EPC and non-3GPP access connected to 5GC. Such a PDN Connection in EPS would thus be associated with multi-access capability in the UE and the PGW-C+SMF. This feature is further defined in clause 5.32.7.X

If the UE, due to mobility, moves from being served by a source AMF supporting ATSSS to a target AMF not supporting ATSSS, the MA PDU Session is released as described in TS 23.502 [3].

NOTE: Deployment of ATSSS that is homogeneous per PLMN or network slice enables consistent behaviour. In the case of non-homogenous support of ATSSS in a PLMN/slice (i.e. some NFs in a PLMN/slice may not support ATSSS), MA PDU Sessions can be released due to UE mobility.

The following clauses specify the functionality that enables ATSSS.

*NEXT CHANGE (2)*

#### 5.32.7.X MA PDU sessions using E-UTRAN/EPC and non-3GPP access connected to 5GC

##### 5.32.7.X.1 General

This clause applies to the case where, for a PDU Session, multi-access connectivity via both EPC and 5GC is supported and allowed in the UE and network. In this case, multi-access connectivity using ATSSS via both 3GPP access to EPC and non-3GPP access to 5GC may be provided as described in this clause.

NOTE: Co-existence with NBIFOM is not defined. It is assumed that NBIFOM and the multi-access connectivity described in this clause are not deployed in the same network.

The use of ATSSS with EPS interworking applies to Ethernet and IP-based PDU Session and PDN Connection types.

NOTE: If Ethernet type PDN Type is not supported in EPS, Non-IP PDN Type PDN Connection can be used.

For this scenario, the general principles for ATSSS as described in other clauses of 5.32 apply, with the additions provided in this clause 5.32.7.X.

A Multi-Access PDU Session may be extended with user-plane resources via an associated PDN Connection on 3GPP access in EPC. This enables a scenario where a MA PDU Session can simultaneously be associated with user-plane resources on 3GPP access network connected to EPC and non-3GPP access connected to 5GC. Such a PDN Connection in EPS would thus be associated with multi-access capability in the UE and PGW-C+SMF.

NOTE: To the MME and SGW this is a regular PDN Connection and the support for ATSSS is transparent to MME and SGW.

The UE may operate in either single-registration mode or dual-registration mode in 3GPP access. Irrespective of whether the UE operates in single-registration mode or dual-registration mode in 3GPP access, it is assumed that the UE supports simultaneous registrations for non-3GPP access in 5GC and 3GPP access in EPC.

The ATSSS rules are provided from the PGW-C+SMF to the UE via SM NAS signalling over 5GC, as described in clause 5.32.2. ATSSS rules are not provided via the EPC.

After the establishment of a MA PDU Session and setting up user-plane resources in 3GPP access in EPC and non-3GPP access in 5GC, the UE distributes the uplink traffic across the two access networks as described in clause 5.32.1. Similarly, the PDU Session Anchor UPF performs distribution of downlink traffic across the two access networks as described in clause 5.32.1.

The PMF protocol may be used via any user plane connection, i.e. via 3GPP access in EPC or non-3GPP access in 5GC.

The PCF functionality to support ATSSS, as described in clause 5.32.1 and TS 23.503 [4] applies also in the case of interworking with EPC.

When the 3GPP access leg of a MA PDU Session using both 3GPP and non-3GPP access connected to 5GC is transferred to EPC, the PDU Session continues to work as a MA PDU Session using E-UTRAN/EPC and non-3GPP access connected to 5GC, as described in clause 4.22.6 in TS 23.502[3].

##### 5.32.7.X.2 PDN Connections and Multi Access PDU Sessions

When the UE wants to request a new PDN Connection in EPC and wants to use this PDN Connection as user-plane resource associated with a MA PDU Session:

- The UE requests establishment of a new PDN Connection when the UE is registered via 3GPP access in EPS using PDN Connection Establishment procedure. The UE provides via PCO to PGW-C+SMF the following information:

- An indication that the PDN Connection is requested to be associated with a MA PDU Session

- The UE's ATSSS capabilities as described in clause 5.32.2 (i.e. whether the UE is capable of supporting the ATSSS-LL functionality, or the MPTCP functionality, or both)

- The MME may select a PGW-C+SMF as described in TS 23.401 [24] and TS 23.502 [3], clause 4.11.0a.4.

NOTE 1: The selection of PGW-C+SMF in the correct 5GC slice requires the same mapping between EPC and 5GC slices as required for single-access PDU sessions. In order to select an ATSSS capable PGW-C+SMF it is assumed that the operator deployment ensures that all PGW-C+SMF(s) configured to support the specific APN in this network slice are also capable to support ATSSS. There is however no assumption that all PGW-U+UPFs need to support ATSSS, since PGW-C+SMF can make a selection of PGW-U+UPF taking the multi-access properties into account.

- The PGW-C+SMF determines based its capabilities whether the request can be accepted. The PCF decides whether the multi-access connectivity is allowed or not based on operator policy and subscription data, as described in TS 23.502 [3], clause 4.22.2. The PGW-C+SMF provides the following information in the PCO to the UE:

- An indication whether the request for using the PDN Connection for MA-PDU Session is accepted or not.

- If the UE has indicated that it is capable of supporting the MPTCP functionality and the PGW-C+SMF accepts to activate the MPTCP functionality, then the network provides MPTCP proxy information to the UE, as described in clause 5.32.2.

- UE Measurement Assistance Information (as described in clause  clause 5.32.2).

After the PDN Connection establishment:

- If the UE registers to 5GC and wants to add non-3GPP user-plane resources, then the UE shall send a PDU Session Establishment Request over this access containing a "MA PDU Request" indication as described in clause 5.32.2.

NOTE 2: Adding the PDU Session connectivity and user plane resources over non-3GPP accessin 5GS allows the PGW-C+SMF to provide ATSSS rules to the UE.

When the UE wants to request a new MA PDU Session in 5GC/non-3GPP access, the description in clause 5.32.2, applies. After the MA PDU Session establishment in 5GS/non-3GPP access, the description in clause 5.32.2, applies with the following additions:

- If the UE is registered to EPC and wants to add user-plane resources on 3GPP access over EPC, then the UE shall send a PDN Connection Establishment Request over this access containing a "handover" indication and include a "MA PDU Request" indication in the PCO.

- When the UE deregisters from the EPC access (but remains registered on the 5GC access), the MME will notify the PGW-C+SMF that the PDN Connection is released, as described in TS 23.401 [24]. The SMF can then notify the UPF that the access type has become unavailable.

A UE that has an established MA-PDU session over non-3GPP access in 5GC and 3GPP access in EPS, may be able to use EN-DC for the 3GPP access leg.

Depending on the RAT types supported by the UE, the PDN connection may also be handed over to 3GPP access in 5GC. For a UE supporting both E-UTRAN/EPC access and NG-RAN/5GC access, the user plane resources for 3GPP access may be moved between E-UTRAN/EPC access and NG-RAN/5GC access as described in clause 5.17.2. The PDU Session and User Plane resources active over non-3GPP access are not affected by such inter 3GPP access RAT change.

##### 5.32.7.X.3 QoS Support

The general principles for QoS support with ATSSS as described in clause 5.32.4, apply, with the clarifications provided in this clause.

With an MA PDU Session associated to a PDN Connection on EPS there may be separate user-plane tunnels between the AN and the PGW-U+UPF, one associated with 3GPP access in EPC and one associated with non-3GPP access in 5GS.

As described in TS 23.502 [3], clause 4.11.1.1, the PGW-C+SMF maps the 5G QoS information received from PCC to EPS QoS parameters. This mapping is e.g. based on operator configuration and may result in that multiple QoS flows are mapped to a single EPS bearer. The PGW-C+SMF applies the appropriate QoS signalling in each access, e.g. to manage dedicated bearers in the access associated with EPC and QoS flows in the access associated with 5GC. The PGW-C+SMF also provides N4 rules to UPF for performing QoS enforcement and for mapping downlink traffic to appropriate GTP-U tunnels.

As described in clause 5.32.4, for a GBR QoS flow, the QoS profile is provided to a single access network at a given time. GBR QoS flows (and associated MBR, GBR) are thus only enforced in either the access associated to EPC or the access associated to 5GC. In order to maintain consistency between QoS information received via AS and NAS layers in each system, the PGW-C+SMF only provides the GBR QoS information to the UE for the access where the GBR traffic is enforced.

The UE shall treat the uplink traffic sent via EPC according to the EPS QoS information received in EPC (e.g. UL TFTs) and the uplink traffic sent via 5GC according to the 5G QoS rules received in 5GS. The UE thus need to determine what access to use (3GPP and Non-3GPP) before applying the uplink QoS treatment.

The UPF shall treat the downlink traffic according to the N4 rules (QER, etc.) received from PGW-C+SMF.

*NEXT CHANGE (3)*

### 5.32.7 Interworking with EPS

#### 5.32.7.1 General

Multi-access connectivity using ATSSS via EPS only is not supported.

Interworking for a MA PDU Session, if allowed by the network, is based on the interworking functionality specified in clause 5.17.2, with the differences and clarifications described in the following clauses.

Multi-access connectivity using ATSSS via both E-UTRAN/EPC and non-3GPP access connected to 5GC may be supported as defined in in clause 5.32.7.X. Clauses 5.32.7.2 and 5.32.7.3 describe the case where Multi-access connectivity using ATSSS via both E-UTRAN/EPC and non-3GPP access connected to 5GC is not supported for a PDU Session.

#### 5.32.7.2 Interworking with N26 Interface (with no support of MA PDU sessions using E-UTRAN/EPC)

When MA PDU sessions using E-UTRAN/EPC and non-3GPP access connected to 5GC as defined in clause 5.32.7.X is not supported for a PDU Session, Interworking with N26 interface is based on clause 5.17.2.2, with following differences and clarifications:

- When UE moves from 5GS to EPS, for both idle mode and connected mode mobility, if the MA PDU Session is moved to EPS as a PDN connection, the SMF triggers PDU Session Release procedure to release the MA PDU Session over Non-3GPP access in 5GS. UE and SMF remove ATSSS related contexts e.g. ATSSS rules, Measurement Assistance Information.

- When UE moves from 5GS to EPS, for both idle mode and connected mode mobility, if the MA PDU Session is not moved to EPS as a PDN connection, the 3GPP access of this MA PDU session becomes unavailable and the AMF notifies the SMF. In turn, the SMF may decide to move the traffic to Non-3GPP access of the MA PDU session, if it is available. When UE moves back from EPS to 5GS, after the UE is registered over the 3GPP, the UE may add user-plane resources over the 3GPP access to the MA PDU session by triggering PDU Session Establishment procedure as specified in clause 5.32.2.

- A PDN Connection in EPS may be modified into a MA PDU Session when transferred to 5GS if the UE and the SMF+PGW-C support the ATSSS feature : After UE moves from EPS to 5GS, for both idle mode and connected mode mobility, if the UE requires MA PDU session, or if no policy in the UE (e.g. no URSP rule) and no local restrictions mandate a single access for the PDU Session, UE triggers the PDU Session Modification procedure as described in clause 4.22.6.3 in TS 23.502 [3] to provide the ATSSS Capability to SMF+PGW-C. The SMF+PGW-C may determine whether to modify this PDU Session to a MA PDU Session in 5GS, e.g. based on SMF+PGW-C and UE's ATSSS Capability, subscription data and local policy. If dynamic PCC is to be used for the MA PDU Session, the PCF decides whether the MA PDU session is allowed or not based on operator policy and subscription data. If the MA PDU Session is allowed, the SMF provides ATSSS rule(s) and Measurement Assistance Information to the UE. If the UE receives ATSSS rules and is not registered to non-3GPP access, the UE establishes the second user-plane over non-3GPP access after the UE is registered to non-3GPP access. If UE was registered to non-3GPP access in 5GS, the UP resources over non-3GPP access are also established by the SMF using the PDU Session Modification procedure.

#### 5.32.7.3 Interworking without N26 Interface (with no support of MA PDU sessions using E-UTRAN/EPC)

When MA PDU sessions using E-UTRAN/EPC and non-3GPP access connected to 5GC as defined in clause 5.32.7.X is not supported for a PDU Session, Interworking without N26 interface is based on clause 5.17.2.3, with the following differences and clarifications:

- After UE moves from 5GS to EPS, UE may send a PDN Connectivity Request with "handover" indication to transfer the MA PDU Session to EPS. Then SMF+PGW-C triggers to release MA PDU in 5GS. If UE does not transfer the MA PDU Session to EPS, UE keeps the MA PDU Session in 5GS. In this case, UE may report to UPF that 3GPP access is unavailable, all MA PDU Session traffic is transported over N3GPP access. Later, if UE returns to 5GS, UE may report the 3GPP access availability to UPF.

- A PDN Connection in EPS may be modified into a MA PDU Session when transferred to 5GS if the UE and the SMF+PGW-C support the ATSSS feature: After UE moves from EPS to 5GS, UE may trigger PDU Session Establishment procedure to transfer the PDN Connection to 5GS. During the PDU Session Establishment procedure, UE may request to establish a MA PDU Session by including "MA PDU Request" or, if no policy in the UE (e.g. no URSP rule) and no local restrictions mandate a single access for the PDU Session, the UE may include the "MA PDU Network-Upgrade Allowed" indication.

*NEXT CHANGE (4)*

*END OF CHANGES*