**3GPP TSG-WG SA2 Meeting #164S2-240xxxx**

**Maastricht, NL, 19th Aug – 23rd Aug, 2024 (revision of S2-240xxxx)**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.228** | **CR** | **XXXX** | **rev** | **X** | **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 | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** | Support of UE-satellite-UE communicaitons | | | | | | | | | |
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| ***Source to WG:*** | vivo | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5G SAT\_Ph3 | | | | |  | ***Date:*** | | | 2024-08-09 |
|  |  | | | |  | |  | | |  |
| ***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 can be 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)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Addition of features to support UE-satellite-UE communications for satellite communications based on the conclusions for KI#3 in TR 23.700-29. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Update the definitions to include UE-satellite-UE communication 2. Add a new Annex to show the architecture of UE-satellite-UE communication 3. Add a new clause to describe the functionalities of UE-satellite-UE communication 4. Add a new clause to describe the high level featuresre of U-S-U determination 5. Add a new clause to describe the high level featuresre of U-S-U deactivation 6. Add a new clause to describe the high level featuresre of IMS-AGW relocation | | | | | | | | |
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| ***Consequences if not approved:*** | | UE-satellite-UE communication will not be supported. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 \* \* \* \*

## 3.1 Definitions

Refer to TS 23.002 [1] for the definitions of some terms used in this document.

For the purposes of the present document the terms and definitions given in TR 21.905 [68] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [68].

For the purposes of the present document, the following terms and definitions given in TS 23.003 [24] apply:

**- Distinct Public Service Identity**

**- Public User Identity**

**- Wildcarded Public User Identity**

**- Wildcarded Service User Identity**

**Alias Public User Identities:** A set of Public User Identities that belong to the same alias group as specified in TS 29.228 [30].

**ALG:** Application Level Gateway (ALG) is an application specific functional entity that allows communication between disparate address realm or IP versions, e.g. an IPv6 node to communicate with an IPv4 node and vice versa, when certain applications carry network addresses in the payloads like SIP/SDP. NA(P)T-PT or NA(P)T is application unaware whereas ALGs are application specific translation entities that allow a host running an application to communicate transparently with another host running the same application but in a different IP version or IP address realm. See IETF RFC 2663 [34] for more details.

For IMS, an IMS ALG provides the necessary application function for SIP/SDP protocols in order to communicate between different address realms or IP versions, e.g. IPv6 and IPv4 SIP applications.

**Application data channel:** A data channel within an IMS session used to transfer data of data channel applications between UEs or between the UE and the network.

**AR Application Server:** An application server used to control the service logic related to AR communication via IMS data channel.

**Bootstrap data channel:** A data channel established within an IMS session between the UE and the network, to transfer a graphical user interface that can include a list of data channel applications.

**Business trunking:** as defined in TS 24.525 [81].

**Data channel application:** A HTML page including JavaScript(s) and optionally image(s) and style sheet(s). It is downloaded from the network to the UE through the bootstrap data channel.

**DC Application Server:** An application server that interacts with the DCSF and the DC media function for data channel traffic handling.

**Distinct Public User Identity:** used in relation to wildcarded Public User/Service Identities to denote an explicitly provisioned Public User/Service Identity. See more details in TS 23.003 [24].

**Entry point:** In the case that border control concepts are to be applied in an IM CN subsystem, then these are to be provided by capabilities within the IBCF, and the IBCF acts as an entry point for this network (instead of the I‑CSCF). In this case the IBCF and the I‑CSCF can be co-located as a single physical node. If border control concepts are not applied, then the I-CSCF is considered as an entry point of a network. If the P‑CSCF is in the home network, then the I‑CSCF is considered as an entry point for this document.

**Exit point:** If operator preference requires the application of border control concepts then these are to be provided by capabilities within the IBCF, and requests sent towards another network are routed via a local network exit point (IBCF), which will then forward the request to the other network (discovering the entry point if necessary).

**Geographical Identifier:** A Geographical Identifier identifies a geographical area within a country or territory. See more details in clause E.8.

**Geo-local service number:** A local service number that is used to access a service in the roamed network (a local service where the subscriber is located).

**Home local service number:** A local service number is used to access a service that is located in the home network of the user.

**HSS Group ID:** This refers to one or more SBI capable HSS instances managing a specific set of IMPIs/IMPUs.

**IMC:** IMS Credentials as defined in TR 21.905 [68].

**IMS application reference:** An IMS application reference is the means by which an IMS communication service identifies an IMS application.

**IMS application:** An IMS application is an application that uses an IMS communication service(s) in order to provide a specific service to the end-user. An IMS application utilises the IMS communication service(s) as they are specified without extending the definition of the IMS communication service(s).

**IMS communication service identifier:** An IMS communication service identifier uniquely identifies the IMS communication service associated with the particular IMS request.

**IMS communication service:** An IMS communication service is a type of communication defined by a service definition that specifies the rules and procedures and allowed medias for a specific type of communication and that utilises the IMS enablers.

**IMS enabler:** An IMS enabler is a set of IMS procedures that fulfils specific function. An IMS enabler may be used in conjunction with other IMS enablers in order to provide an IMS communication service.

**Instance identifier:** An identifier, that uniquely identifies a specific UE amongst all other UEs registered with the same Public User Identity.

**Inter-IMS Network to Network Interface:** The interface which is used to interconnect two IM CN subsystem networks. This interface is not constrained to a single protocol.

**IP Flow:** Unidirectional flow of IP packets with the following properties:

- same destination IP address and port number;

- same source IP address and port number;

- same transport protocol (port numbers are only applicable if used by the transport protocol).

**IP-Connectivity Access Network:** refers to the collection of network entities and interfaces that provides the underlying IP transport connectivity between the UE and the IMS entities. An example of an "IP-Connectivity Access Network" is GPRS.

**IP SM GW (IP short message gateway):** An IP SM GW is an AS providing the support of Short Message Service of the IMS domain. See more details in TS 23.204 [56].

**Local Service Number:** A local service number is a telephone number in non-international format. A local service number is used to access a service that may be located in the home network of the user (home local service number) or the roamed network of the user (geo-local service number).

**Media Flow:** One or more IP flows carrying a single media instance, e.g. an audio stream or a video stream. In the context of this specification the term Media Flow is used instead of IP Flow regardless of whether the actual IP packet corresponds to media plane information (e.g. audio RTP flow) or control signalling (e.g. RTCP or SIP Signalling).

**MPS:** Based on TS 22.153 [77]. Multimedia Priority Service allows authorized users to obtain and maintain radio and network resources with priority, also during national security or emergency situations when PLMN congestion may occur.

**MPS session:** A session (e.g. voice, video, data session) for which priority treatment is applied for allocating and maintaining radio and network resources.

**MPS-subscribed UE:** A UE having a USIM with MPS subscription.

NAT-PT/NAPT-PT: NAT-PT uses a pool of globally unique IPv4 addresses for assignment to IPv6 nodes on a dynamic basis as sessions are initiated across the IP version boundaries. NAT-PT binds addresses in IPv6 network with addresses in IPv4 network and vice versa to provide transparent routing between the two IP domains without requiring any changes to end points, like the UE. NAT-PT needs to track the sessions it supports and mandates that inbound and outbound data for a specific session traverse the same NAT-PT router.

NAPT-PT provides additional translation of transport identifier (e.g. TCP and UDP port numbers, ICMP query identifiers). This allows the transport identifiers of a number of IPv6 hosts to be multiplexed into the transport identifiers of a single assigned IPv4 address. See IETF RFC 2766 [33] for more details.

**Network Address Translation (NA(P)T):** method by which IP addresses are mapped from one group to another, transparently to end users. Network Address Port Translation, or NA(P)T is a method by which many network addresses and their TCP/UDP (Transmission Control Protocol/User Datagram Protocol) ports are translated into a single network address and its TCP/UDP ports. See RFC 3022 [65] for further details.

**Outbound:** Managing Client Initiated Connections in the Session Initiation Protocol (Outbound) defines behaviours for User Agents, registrars and proxy servers that allow requests to be delivered on existing connections established by the User Agent. See RFC 5626 [48] for further details.

**Preferred Circuit Carrier Access:** An IMS service that allows a specific long distance circuit carrier to be selected for a long distance call.

**Preferred Circuit Carrier Selection:** An IMS service that allows the subscriber to select a long distance circuit carrier per call when dialling a call origination.

**Service User:** According to TS 22.153 [77].

**Stand-alone Non-Public Network:** A non-public network not relying on network functions provided by a PLMN.

**STUN:** Simple Traversal of UDP Through NAT (STUN), provides a toolkit of functions. These functions allow entities behind a NAT to learn the address bindings allocated by the NAT, to keep those bindings open, and communicate with other STUN-aware devices to validate connectivity. See RFC 5389 [47] for further details.

**STUN Keep-alive:** Is a usage of STUN, to keep NAT bindings open.

**STUN Relay:** Is a usage of STUN, that allows a client to request an address on the STUN server itself, so that the STUN server acts as a relay. See IETF RFC 5766 [46] for further details.

**Subscriber:** A Subscriber is an entity (comprising one or more users) that is engaged in a Subscription with a service provider. The subscriber is allowed to subscribe and unsubscribe services, to register a user or a list of user authorized to enjoy these services, and also to set the limits relative to the use that users make of these services.

**Transport address:** A unique identifier of transport-layer address, i.e. a combination of a network address, protocol identifier and port number. For example an IP address and a UDP port.

**UE-Satellite-UE Communication**: The communication among UEs under the coverage of one or more serving satellites without the user plane traffic going through the ground network.

\* \* \* \* Second change (new) \* \* \* \*

Annex XY (normative):  
Support of UE-satellite-UE communications

# XY.1 General

This annex clarifies the support of IMS voice/video service traffic using UE-Satellite-UE communication between MO UE and MT UE without traversing back to the gateway on the ground.

NOTE 1: in this Release of the specification, only 2 UEs from the same HPLMN are supported.

NOTE 2: in this Release of the specification, the serving satellite is only of LEO and MEO type.

# XY.2 Architecture

As depicted in Figure 4.x-1, the 5G System architecture allows the UE-satellite-UE communication with gNB, UPF, and IMS-AGW onboarding satellites.



Figure XY.2-1: UE-Satellite-UE communication architecture in Reference points representation

NOTE 1: N2, N4, N9 and Iq interfaces are over satellite transport layer links (feeder link and optionally inter-satellite links), where the lower layer protocol is out of 3GPP scope

NOTE 2: N3 and N6 interfaces may be internal interfaces if gNB, UPF, and IMS-AGW are onboarding the same satellite, or over inter-satellite links if gNB, UPF and IMS-AGW are onboarding different satellites, where the lower layer is out of 3GPP scope; N9 interface is over satellite transport layer links

NOTE 3: For clarity, the connections within 5GC and IMS core are not depicted in the point-to-point and service-based architecture diagrams. For more information on 5GC architectures refer to clause 4.2.3 in TS23.501 [x].

The functionalities executed by N2, N3, N4, N6 and N9 are described in clause 4.2.7 in TS 23.501 [xx], and the functionalities executed by Iq are described in TS 29.334 [xx].

# XY.3 Network function functional enhancements

## XY.3.1 P-CSCF

The P-CSCF supports the following supports functionality:

* Determining activation/deactivation of UE-satellite-UE communication
* Informing PCF of the request for utilization of UE-satellite-UE communication
* Receiving the satellite ID and access information from PCF when UE’s serving satellite changes

## XY.3.2 IMS-ALG

The IMS-ALG supports the following supports functionality:

* Relocation of IMS-AGW during an IMS session

## XY.3.3 IMS-AGW

The IMS-AGW supports the following supports functionality:

* Lawful Interception for UE-satellite-UE communications
* Session continuity for UE-satellite-UE communications when the IMS session falls back to the ground

# XY.3 High level features

## XY.3.1 Determination of activating UE-satellite-UE communications

The determination of activating UE-satellite-UE communication is executed separately at the MO/MT UE side. During the call setup period, the serving P-CSCF determines to activate the UE-Satellite-UE communication if

* the UE is accessing via a satellite (constellation) that has gNB, UPF and IMS-AGW onboard,
* the other UE is also accessing via a satellite (constellation) that has gNB, UPF and IMS-AGW onboard and
* both UEs’ serving satellite(s) (constellation) can communicate.

To support the determination of the UE-satellite-UE communication activation, the serving P-CSCF should obtain the satellite ID and access network information from PCF

NOTE: How the P-CSCF obtains the connection relationship between the MO UE’s serving satellite (constellation) and MT UE’s serving satellite (constellation) is out of 3GPP scope.

If the serving P-CSCF determines to activate the UE-satellite-UE communication, the serving PCF should be informed of an indication indicating that the UE-Satellite-UE call should be performed and forward the indication to the SMF during the voice-dedicated QoS flow establishment procedure.

The serving P-CSCF (IMS-ALG) also selects the onboarding IMS-AGW as the media gateway and informs the onboarding IMS-AGW to allocate IP addresses to both the MO side and the MT side, sends the allocated IP addresses to UE and the other P-CSCF (IMS-ALG) as specified in clause G.4.3.



Figure XY.3-1: IMS signalling and media path after activating the onboarding UPF and IMS-AGW

Figure XY.3-1 depicts the media path between UE 1 and UE 2 after activating the UE-satellite-UE communication link:

- UE-1 sends the voice media packets (e.g. RTP packets) to the onboarding gNB and local PSA (via UE-1’s PDU session), and the local PSA forwards the voice packet to the onboarding IMS-AGW (via N6).

- UE-1’s onboarding IMS-AGW forwards the voice packet to the UE-2’s onboarding IMS-AGW based on the address information exchanges during the call setup period.

- The onboarding IMS-AGW then forwards the voice packet to the onboarding local PSA ( via N6) and finally to the UE-2 (via UE-2’s PDU session).

## XY.3.2 Determination of deactivating UE-satellite-UE communications

The determination of deactivating UE-satellite-UE communication is executed separately at the MO/MT UE side. During the call setup period, the serving P-CSCF determines to deactivate the UE-Satellite-UE communication if

* one of the UEs’ serving satellite changes,
* and the new serving satellite has no connection with the other UE’s serving satellite.



Figure XY.3-2: IMS signalling and media path after activating the onboarding UPF and IMS-AGW

Figure XY.3-2 depicts the media path between UE 1 and UE 2 after deactivating the UE-satellite-UE communication link:

- UE-1 sends the voice media packets (e.g. RTP packets) to the onboarding gNB and ground PSA, and the ground PSA forwards the voice packet to the ground IMS-AGW (via N6).

- UE-1’s ground IMS-AGW forwards the voice packet to the UE-2’s ground IMS-AGW based on the address information exchanges during the call setup period.

## XY.3.2 IMS-AGW relocation

The determination of IMS-AGW relocation is executed separately at the MO/MT UE side. When one of the UEs’ serving satellite changes, the serving P-CSCF (IMS-ALG) determines to relocate the IMS-AGW if

* the new serving satellite has no connection to the other UE’s serving satellite, the communication should fall back to the ground;
* the new serving satellite has a connection to the other UE’s serving satellite, the communication should continued via UE-satellite-UE communication;

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