**3GPP TSG-SA WG2 Meeting #154AH-E (e-meeting)S2-2301773**

**January 16 – 20, 2023, Elbonia (revision of S2-23011773)**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.256** | **CR** | **0076** | **rev** | **2** | **Current version:** | **17.5.0** |  |
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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 | **x** | Core Network | **x** |

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| ***Title:*** | Architectural enhancements for Rel. 18 UAS features | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Incorporated | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | UAS\_Ph2 | | | | |  | ***Date:*** | | | 2023-02-01 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | TR 23.700-58 contains the following conclusions.  TR 23.700-58 conclusion for DAA include the following:  - For BRID, It is proposed to progress to normative phase the following:  - a mechanism based on PC5 leveraging U2X (UAV-to-everything) as described by the architectural enhancements identified in solution #5, applicable to both UAV UE that registers to the MNO network, and to UAVs that operate out of coverage  - [...]  - for DAA:  - a mechanism for DAA leveraging U2X (UAV-to-everything), with the architectural enhancements identified in solution #5, with the following principles:  - The detection and resolution of collisions is locally performed between UAVs using direct UAV to UAV communication over PC5.  - The USS can (optionally) be informed of the collision situation.  - Both unicast and broadcast mode direct communication over PC5 is supported for DAA.  - Additionally, may support network-assisted (ground based) DAA solution #7. It is applicable for a specific area, such as a stadium or arena where drones are used.  It is assumed that security of the U2X solution will be addressed by SA WG3. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | With respect to the TR solutions and conclusions, the following applies:   * U2X is renamed to A2X (Aircraft-to-everything) to align to terminology adopted in ICAO, ACJA, RTCA, and EUROCAE * PC5-U is assumed for broadcast and unicast application layer exchange, to re-use V2X PC5 mechanisms | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Conclusions of TS 23.700-58 are not implemented in Rel. 18 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 3.1, 3.2, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.4A (new), 4.2.6, 4.3.3, 4.3.4, 4.3.X (new), 4.3.Y (new), 4.3.Z (new), 4.3.M (new), 4.3.N (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

\* \* \* \* Start of 1st Change \* \* \* \*

# References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System architecture for the 5G System (5GS)".

[3] 3GPP TS 23.502: "Procedures for the 5G System (5GS)".

[4] 3GPP TS 23.222: "Common API Framework for 3GPP Northbound APIs".

[5] 3GPP TS 22.125: "Unmanned Aerial System (UAS) support in 3GPP".

[6] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[7] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[8] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

[9] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".

[10] 3GPP TS 33.256: "Security aspects of Uncrewed Aerial Systems (UAS)".

[X] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[Y] 3GPP TS 23.285: "Architecture enhancements for V2X services".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] 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 [1] or TS 23.501 [2].

**3GPP UAV ID:** Identifier assigned by the 3GPP system and used by external AF (e.g. USS) to identify the UAV. GPSI is used as the 3GPP UAV ID.

**A2X communication:** A communication to support Aircraft-to-Everything (A2X) services leveraging PC5 reference points. A2X services are realized by various types of A2X applications, e.g. Broadcast Remote ID (BRID) and Detect And Avoid (DAA).

**A2X message:** A dedicated messaging type of A2X service.

**A2X service:** A data service, offered to A2X applications and optionally A2X Application Servers. An A2X service belongs to one A2X service type. An A2X service can be associated with one or more A2X applications, and a A2X application can be associated with one or more A2X services.

**A2X service type:** A type of A2X service, which is identified by any one of ITS-AID (ITS Application Identifier), PSID (Provider Service Identifier) or AID (Application Identifier) according to values defined specifically for aviation applications.

NOTE 1: It is expected a dedicated set of A2X services will be defined with associated A2X service types. The definition of DAA/UAV service type is out of scope of 3GPP.

**Broadcast Remote ID:** The capability of providing Remote Identification and Tracking over broadcast radio links.

NOTE 2: In the scope of this release, the radio link for Broadcast Remote ID is assumed to utilize radio technologies outside the scope of 3GPP.

**CAA (Civil Aviation Administration)-Level UAV Identity:** a UAV identity assigned by USS/UTM, and uniquely identifies a UAV at least within the scope of a USS.

**Command and Control (C2) Communication:** the user plane link to deliver messages with information of command and control for UAV operation from a UAV controller or a UTM to a UAV or to report telemetry data from a UAV to its UAV controller or a UTM.

**C2 Aviation Payload:** Contains application layer information sent by the UAS to the USS containing UAV pairing information and/or flight authorization information that is transparent to the 3GPP System.

**C2 Authorization Payload:** Contains application layer information sent by the USS to the UAV containing e.g. C2 pairing information and/or C2 security information that is transparent to the 3GPP System.

**C2 Pairing Information:** Contains UAV-C Addressing Information which may e.g. include the UAV-C IP Address.

**Detect And Avoid:** The capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action.

**Direct Detect And Avoid:** DAA that leverages communications over PC5 reference point.

**Networked UAV Controller:** a UAV Controller connected to the 3GPP network and connected to the UAV via a 3GPP network.

**Non-Networked UAV Controller:** a UAV Controller not connected to the 3GPP network and connected to UAV via a transport outside the scope of 3GPP, e.g. internet connectivity or direct wireless communication over a technology outside the scope of 3GPP.

**Networked Remote ID:** The capability of providing Remote Identification and Tracking to a USS over 3GPP network.

**Remote Identification (Remote ID) of UAS:** The ability of a UAS in flight to provide identification and tracking information that can be received by other parties, to facilitate advanced operations for the UAS (such as Beyond Visual Line of Sight operations as well as operations over people), assist regulatory agencies, air traffic management agencies, law enforcement, and security agencies when a UAS appears to be flying in an unsafe manner or where the UAS is not allowed to fly. The Remote ID information payload may include Serial Number or Session ID assigned to the UAV, location of the ground-station controller, emergency status indication, etc.

**Third Party Authorized Entity:** is either a privileged Networked UAV Controller, or a privileged Non-Networked UAV Controller, or another entity which gets information on sets of UAV controllers and UAVs from the 3GPP network, and may be connected to the UAV via the Internet; it may be authorized by the UTM to interface with sets of UAV(s).

**UAS NF:** a 3GPP UAS Network Function for support of aerial functionality related to UAV identification, authentication/authorization and tracking, and to support Remote Identification.

**UAS Service Supplier (USS):** An entity that provides services to support the safe and efficient use of airspace by providing services to the operator / pilot of a UAS in meeting UTM operational requirements. A USS can provide any subset of functionality to meet the provider's business objectives (e.g. UTM, Remote Identification). In the scope of this specification, the term USS refers to both USS and USS/UTM.

**UAS Traffic Management (UTM):** a system that can safely and efficiently integrate the flying UAV along with other airspace users. It provides a set of functions and services for managing a range of autonomous vehicle operations (e.g. authenticating UAV, authorizing UAS services, managing UAS policies, and controlling UAV traffics in the airspace).

**UAV controller:** The UAV controller of a UAS enables a drone pilot to control an UAV.

**UAV operator:** the entity owning and operating a UAV.

**UAS Container:** A container to the 3GPP system that includes UUAA Aviation/Authorization Payload and/or C2 Aviation/Authorization Payload. The internal content of the individual payloads is transparent to the 3GPP system.

**UAS Services:** refers to establishment of connectivity for a UAS for communication with USS, for C2, for remote identification, and for UAV location and tracking.

**USS communication:** A communication between a UAV and a USS other than C2 communication, by means of user plane data transmission for some UAS Services.

NOTE 3: The PDU session/PDN connection for C2 communication and the PDU session/PDN connection for USS communication can be common or separate.

**UUAA Authorization Payload**: Contains application layer information optionally including UUAA result for UAV consumption provided by the USS to the UAS which is transparent to the 3GPP System.

**UUAA Aviation Payload:** Contains application layer information provided by the UAS to USS and is transparent to the 3GPP System

**Uncrewed Aerial System (UAS):** Composed of Uncrewed Aerial Vehicle (UAV) and related functionality, including command and control (C2) links between the UAV and the control station, the UAV and the network, and for remote identification. An UAS may comprise of a UAV and a UAV controller.

**Unknown UAVs**: A list of the UAVs to be identified in the target area and served by the PLMN as the result of the UAV tracking requested by USS/UTM.

**UUAA:** UAV USS authentication and authorization procedure of the UAV to ensure that the UAV has successfully registered with a USS and has therefore been authorized for operations by the USS. An UAV is authenticated and authorized by USS via a UUAA procedure with the support of the 3GPP system before connectivity for UAS services is enabled.

**UUAA-MM:** the UUAA procedure optionally performed during registration to a 5GS.

**UUAA-SM:** the UUAA procedure performed during the establishment of a PDU session and performed during the establishment of a PDN connection.

For the purposes of the present document, the following term and definition given in TS 23.287 [X] apply:

**NR Tx Profile**

**Intelligent Transport Systems**

**ITS Application Identifier**

**Provider Service Identifier**

**Application Identifier**

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

A2X Aircraft-to-anything

BRID Broadcast Remote Identification

BVLOS Beyond Visual Line of Sight

C2 Command and Control

DAA Detect And Avoid

DDAA Direct Detect And Avoid

NRID Networked Remote Identification

RID Remote Identification

TPAE Third Party Authorized Entity

UAS Uncrewed Aerial System

UAV Uncrewed Aerial Vehicle

USS UAS Service Supplier

UTM Uncrewed Aerial System Traffic Management

UUAA USS UAV Authorization/Authentication

UUID Universal Unique Identifier

\* \* \* \* Start of Next Change \* \* \* \*

## 4.2 Architectural reference model

### 4.2.1 General

#### 4.2.1.1 Support for general UAV features

This specification covers UAV functionality provided by 5GC connected to NG-RAN and EPC connected to LTE.

The following functionality is defined for UAV support in the 3GPP system:

- An UAV is authenticated and authorized by USS via a USS UAV Authentication & Authorization (UUAA) with the support of the 3GPP system before connectivity for UAS services is enabled.

- Depending on 3GPP network operator and/or regulatory requirements, the UUAA is performed:

- In 5GS: either as a separate procedure during the 5GS registration procedure (optional and based on specific PLMN policies, USS requirements, and geographic regulatory requirements), or when the UAV requests user plane resources for UAV operation (i.e. PDU session establishment). The UAV shall support UUAA during Registration and PDU session establishment procedure. The network shall support UUAA during PDU session establishment.

- In EPS: during the attach procedure and the corresponding PDN connection establishment. The network shall support UUAA during PDN connection establishment. The UAV shall support UUAA during PDN connection establishment procedure.

- A UAV that is provisioned with a CAA-Level UAV ID shall provide the CAA-Level UAV ID in 5GS in both Registration and in PDU Session establishment. In EPC, a UAV that is provisioned with a CAA-Level UAV ID provides the CAA-Level UAV ID in PDN Connection establishment in SM-PCO. The CN determine whether UUAA is executed at 5GS registration or at PDU session/PDN Connection establishment, based on local policies.

- If UUAA is not performed during the Registration procedure in 5GS, the UUAA is performed at PDU session establishment when the UAV requests user plane resources for UAV operation and the UAV provides its CAA Level ID during PDU session (PDN connection) establishment.

- The UAV flight authorization and UAV-UAVC pairing authorization is performed at PDU session/PDN connection establishment/modification procedures.

- The 3GPP system supports USS authorization of pairing between a UAV and a networked UAVC or a UAVC that connects to the UAV via Internet connectivity during either the establishment of the PDN connection/PDU session for C2 communication or a modification of a PDN connection/PDU session either dedicated to C2 communication or common to USS communication and C2 communication. Modifications of the pairing or re-authorization take place via modification of the established PDN connection/PDU session. During such procedures, the USS provides to the 3GPP system information (e.g. QoS requirement, data flow descriptors, etc.) that enable traffic between the UAV and the UAVC.

NOTE 1: How the USS is made aware of the UAVC is outside the scope of 3GPP in this Release.

- For EPC, the PDN connections used by UAV are served by SMF+PGW-C regardless of whether the UAV support 5G NAS or whether their subscription allows access to 5GC. The APN(s) used by the UAV for contacting USS or for C2 communication always resolves to a SMF+PWG-C.

The following architectural assumptions apply:

- It is assumed that the UAV trying to access UAS services using 3GPP connectivity is already registered with a USS and has been assigned a CAA-Level-UAV ID. The procedure for UAV registration and assignment of CAA-Level-UAV ID is out of scope of 3GPP. The USS assigns to the UAV a CAA-Level UAV ID, or is made aware of the assigned CAA-Level UAV ID.

- A UAV is associated with an Aerial subscription in the UDM. The Aerial subscription contains aerial UE indication in the Access and Mobility Subscription data (to be used similarly to aerial UE indication defined in EPS), an aerial service indication in the Session Management Subscription data for each DNN dedicated for UAS services (C2 and UUAA-SM) which indicates that corresponding authentication/authorization has to be done using API based mechanism.

- An UAV is identified by USS using a CAA-level UAV ID, and identified by the 3GPP System using a 3GPP UAV ID assigned by the MNO:

- It is assumed that an aerial subscription associated to a UAV includes at least one GPSI to be used as 3GPP UAV ID.

- A UAV is registered with the USS either before connecting with the 3GPP system or using plain internet connectivity via the 3GPP system. Before registering for UAS services with the 3GPP system, the UAV shall be provisioned with a CAA-Level UAV Identity.

- In roaming scenarios, it is assumed that access to USS is in the VPLMN, thus packet data connectivity for UAV-USS communication is in local breakout, and the UAS NF function is located in the VPLMN.

- In this Release, the UAV uses 3GPP access (i.e. LTE & NR) for 3GPP UAV related operations.

- Activation of RAN aerial features for UAV accessing via E-UTRA reuses the existing mechanism defined in TS 36.300 [7].

NOTE 2: In this Release, an UAV is served by single USS for the duration of the connectivity between the USS and the UAV.

- One or more USS(s) may be present in a specific region and may manage UAVs over one or more 3GPP networks.

- The 3GPP Network subscription for the UAV is not assumed to contain any information about the USS.

- The USS address, if known to the UAV, is configured in the UAV via mechanisms outside the scope of 3GPP.

#### 4.2.1.2 A2X UAV communication over PC5 reference point

##### 4.2.1.2.1 General

This clause describes the support of an Aircraft-to-everything (A2X) mechanism based on PC5 reference point. A2X leverages V2X mechanisms as defined in TS 23.287 [X] to support Broadcast Remote ID (BRID) and Direct Detect And Avoid (DDAA). A2X leverages both LTE PC5 as defined in TS 23.285 [17] and NR PC5.

A2X supports the following communication modes:

- Broadcast communication mode is used for BRID.

- Broadcast communication mode is used for DDAA to advertise UAV information.

- Broadcast over PC5 or unicast over PC5 may be used between two or more UAVs for DDAA deconfliction triggered at the application layer by the information received by UAV via DAA messages received in broadcast.

Groupcast mode for NR based PC5 is not supported.

Subscription to A2X services is based on user's profile stored in the UDM containing the subscription information to give the user permission to use A2X services, as described in clause 5.5 of TS 23.287 [X] with the following differences:

* The distinction between Vehicle UE and Pedestrian UE is not applicable to A2X.

Both UAV UEs that utilize Uu connectivity and that do not utilize Uu connectivity (i.e. either UAV UEs that are Uu capable and do not use Uu) are supported. A UAV without utilizing Uu capabilities may use A2X for BRID and DDAA and be configured via A2X1 over a transport outside the scope of 3GPP.NOTE 1: UAV UEs without utilizing Uu capabilities are part of the 3GPP ecosystem since they use A2X1 for configuration by a A2X Application Server and implement PC5 connectivity specified by 3GPP.

Both UAVs with UICC and UAVs without UICC (i.e. with no subscription to an MNO) are supported. UAVs with no UICC can only perform A2X communications when authorized for "not served by E-UTRA" and "not served by NR".

In this version of the specification, it is assumed all UAV UEs support A2X capability.

Editor's note: Whether A2X communication over PC5 between the UAV UEs served by different PLMNs and with subscriptions to different PLMNs is supported depends on the RAN2 feedback.

NOTE 2: It is assumed that security of the U2X solution will be addressed by SA WG3.

NOTE 3: the A2X application layer schemes developed in other SDOs are outside the scope of this specification.

##### 4.2.1.2.2 A2X Policy Provisioning

An A2X Policy (A2XP) is defined to provide configuration parameters to the UE for A2X communication over the PC5 reference point:

- The configuration parameters may be pre-configured in the ME, or configured in the UICC, or preconfigured in the ME and configured in the UICC, or provided/updated by the A2X Application Server via PCF and/or A2X1 reference point, or provided/updated by the PCF to the UE.

- The UE shall consider them in the following priority order: provided/updated by the PCF, provided/updated by the A2X Application Server via A2X1 reference point, configured in the UICC, pre-configured in the ME.

- Deconflicting policy which indicates the communication mode (unicast or broadcast) for deconflicting.

NOTE 1: How frequently a UAV sends deconfliction-related messages is an application layer aspect outside the scope of 3GPP.

RAT selection between LTE PC5 and NR PC5 is based on the A2XP.

A2X communications parameters from A2X Application Server or PCF may be delivered to the UAV UE via UAV-C UE.

NOTE 2: The transmission method for forwarding the A2XP between the UAV-C and the UAV is out of the scope of the specification.

In addition to existing parameters for V2X, the radio parameters per PC5 RAT (i.e. LTE PC5, NR PC5) can be configured with Geographical Area, Altitude Range, and Validity timer. This additional information may be needed to enable policing the use of PC5 depending on the specific location of the UAV.

The use of PC5-based communications for BRID and DDAA for UAV with UICC is subjected to successful UUAA authentication/authorization of the UAV and authorization via A2XP. No specific authorization of the use of PC5 for either BRID or DDAA is required by the USS. For UAVs without UICC, the use of PC5-based communications for BRID and DDAA is authorized only by A2XP.

As in the case of TS 23.287 [X], the security for broadcast A2X communication over PC5 reference point is supported in the A2X application layer schemes.

##### 4.2.1.2.3 AF-based service parameter provisioning for A2X communications

As defined in TS 23.287 [X], the 5GS provides NEF services to enable communication between NFs in the PLMN and A2X Application Server. Figure 4.2.1.2.3-1 shows the high-level view of AF-based service parameter provisioning for A2X communications. The A2X Application Server may provide A2X service parameters to the PLMN via NEF. The NEF stores the A2X service parameters in the UDR.

NOTE: The A2X service parameters may also be pre-configured in UAVs (e.g. UAVs that don't utilize Uu capabilities) using methods that are out of 3GPP scope.



Figure 4.2.1.2.3-1: 5G System architecture for AF-based service parameter provisioning for A2X communications

\* \* \* \* Start of Next Change \* \* \* \*

### 4.2.2 Logical UAV Reference Architecture



Figure 4.2.2-1: Logical 5GS and EPS architecture for UAV

NOTE 1: Provisioning of UAS services over EPC is based on the use of an SMF+PGW-C node.



Figure 4.2.2-2: Non-roaming architecture for interworking between 5GS and EPC/E-UTRAN



Figure 4.2.2-3: Local breakout roaming architecture for interworking between 5GS and EPC/E-UTRAN

NOTE 2: Transferring the UUAA context from AMF to MME when the UE moves from 5GS to EPS and the UUAA was performed at 5GS registration is not supported on the N26 interface.

NOTE 3: No new UAV-specific functionality is defined for T6a.

### 4.2.3 5GS Non-roaming Reference Architecture



Figure 4.2.3-1: 5G System non-roaming architecture for UAVs and for A2X communication over PC5 and Uu reference points

### 4.2.4 5GS Roaming Reference Architecture



Figure 4.2.4-1: Roaming 5G System architecture for UAVs and for A2X communication over PC5 and Uu reference points - local breakout scenario in service-based interface representation



Figure 4.2.4-2: Roaming 5G System architecture for UAVs and for A2X communication over PC5 and Uu reference points - Home routed scenario

### 4.2.4A Inter-PLMN 5G System architecture for A2X communication over PC5 reference point

In the case of inter-PLMN A2X communication over PC5 reference point, the PC5 parameters need to be configured in a consistent way among the UEs within a certain region. The architecture for the Inter-PLMN PC5 case is similar to the one defined in clauses 4.2.3 and 4.2.4.

### 4.2.5 Service-based interfaces

The 5G System Architecture for UAVs contains the service-based interfaces defined in TS 23.501 [2].

### 4.2.6 Reference points

The 5G System Architecture for UAV contains the reference points defined in TS 23.501 [2]. In addition, the reference points of TS 23.287 [X] apply, with the following differences:

**A2X1**: The reference point between the A2X applications in the UAV UE and in the UAV-C, and the A2X Application Server. This reference point is out of scope of this specification.

**A2X5**: The reference point between the A2X applications in the UEs. This reference point is not specified in this release of the specification.

**N1**: In addition to the relevant functions defined in TS 23.501 [2] for N1, in the case of A2X Service it is also used to convey the A2X Policy and parameters (including service authorization) from AMF to UE and to convey the UE's A2X Capability and PC5 Capability for A2X information from UE to AMF.

**N2**: In addition to the relevant functions defined in TS 23.501 [2] for N2, in the case of A2X Service it is also used to convey the A2X Policy and parameters (including service authorization) from AMF to NG-RAN.

\* \* \* \* Start of Next Change \* \* \* \*

## 4.3 Functional entities

### 4.3.1 General

In addition to the 5GS functional entities defined in TS 23.501 [2] and the EPS functional entities defined in TS 23.401 [6], the following functional entities are defined for UAS.

### 4.3.2 UAS NF

The UAS Network Function is supported by the NEF or SCEF+NEF and used for external exposure of services to the USS. The UAS-NF makes use of existing NEF/SCEF exposure services for UAV authentication/authorization, for UAV flight authorization, for UAV-UAVC pairing authorization, and related re-authentication/re-authorization and revocation; for location reporting, presence monitoring, obtaining list of Aerial UEs in a geographic area and control of QoS/traffic filtering for C2 communication.

The UAS NF may coordinate with the USS to assist CAA-Level UAV ID assignment.

A dedicated NEF may be deployed to provide only the UAS NF functionality, i.e. to support the UAS specific features/APIs and the NEF features/APIs that are specified for capability exposure towards the USS.

For external exposure of services related to specific UAV(s), the UAS NF resides in the VPLMN, in order to interface with country specific USS(es).

When CAPIF is supported by the UAS NF, the UAS NF supports the CAPIF API provider domain functions as specified in TS 23.222 [4].

To support re-authentication/re-authorization and revocation request by USS, the UAS NF stores information as to whether the re-authentication/re-authorization and revocation is towards an AMF or SMF/SMF+PGW-C and the address of the serving AMF or SMF/SMF+PGW-C.

UAS NF stores the result of UUAA-MM procedures and the result of UUAA-SM procedures.

### 4.3.3 UAV

The UAV is a 3GPP UE supporting the UE functionality defined in TS 23.401 [6] and in TS 23.501 [2].

In addition:

- a UAV that is configured for UAS services is provisioned with a single CAA-Level UAV ID;

- a UAV that is configured for UAS services (i.e. is provisioned with a CAA-Level UAV ID) registers to the 3GPP system for UAS services (i.e. to take advantage of aerial features, connectivity with USS and for C2 connectivity) and provides the CAA-Level UAV ID and a UUAA Aviation Payload to 5GS or EPS. A UAV that has not performed a registration with aviation authorities shall not attempt to request for UAS services.

NOTE: A UAV that is configured for UAS services but does not have an aerial subscription is not allowed by the network to register for UAS services.

- a UAV that is configured for UAS services may support the following functions:

- reports the A2X Capability and PC5 Capability for A2X (i.e. LTE PC5 and/or NR PC5) to 5GC over N1 reference point.

- indicates A2X Policy Provisioning Request in UE Policy Container for UE triggered A2X Policy provisioning.

- receives the A2X parameters from 5GC over N1 reference point.

- supports procedures for A2X communication over PC5 reference point.

- Configuration of parameters for A2X communication. These parameters can be pre-configured in the UE, or, if in coverage, provisioned or updated by signalling over the N1 reference point from the PCF in the HPLMN or over A2X1 reference point from the A2X Application Server.

### 4.3.4 AMF

In addition to the functionality defined in TS 23.501 [2], the AMF:

- may trigger the UUAA-MM procedure for a UE requiring UAV authentication and authorization by a USS when registering with 5GS when the UE has Aerial UE subscription information and based on local operator policy, or when the USS that authenticated the UAV triggers a re-authentication, or when AMF itself determines to re-authentication the UAV after the initial registration.

An AMF supporting A2X additionally performs the following functions:

- Obtain from UDM the subscription information related to A2X and store them as part of the UE context data.

- Select a PCF supporting A2X Policy/Parameter provisioning and report the PC5 Capability for A2X to the selected PCF.

- Obtain from PCF the PC5 QoS information related to A2X and store it as part of the UE context data.

- Provision the NG-RAN with indication about the UE authorization status about A2X communication over PC5 reference point.

- Provision the NG-RAN with PC5 QoS parameters related to A2X communication.

\* \* \* \* Start of Next Change \* \* \* \*

### 4.3.X PCF

In addition to the functions defined in TS 23.501 [2], the PCF includes the functions described in 23.287 [X] to provision the UE and AMF with necessary parameters in order to use A2X communication.

### 4.3.Y UDM

In addition to the functions defined in TS 23.501 [2], the UDM performs subscription management for A2X communication over PC5 reference point.

With respect to TS 23.502 [X], the UE subscription data types are extended according to the following table.

Table 4.3.Y-1

|  |  |  |
| --- | --- | --- |
| A2X Subscription data | NR A2X Services Authorization | Indicates whether the UE is authorized to use the NR sidelink for A2X services as UAV UE, UAV-C UE, or Authority UE. |
|  | LTE A2X Services Authorization | Indicates whether the UE is authorized to use the LTE sidelink for A2X services as UAV UE, UAV-C UE, or Authority UE. |
|  | NR UE-PC5-AMBR | AMBR of UE's NR sidelink (i.e. PC5) communication for A2X services. |
|  | LTE UE-PC5-AMBR | AMBR of UE's LTE sidelink (i.e. PC5) communication for A2X services. |

### 4.3.Z A2X Application Server

The A2X Application Server implements a subset of the V2X AS functionality specified in TS 23.287 [X]:

- includes AF functionality, and may support at least the following capabilities:

- For A2X service parameters provisioning, the A2X AS provides the 5GC and the UAV UE (possibly via the UAVC) with parameters for A2X communications over PC5 reference point.

NOTE: The A2X AS and the USS serving a UAV can be the same or different entities.

### 4.3.M UDR

In addition to the functions defined in TS 23.501 [2], the UDR stores A2X service parameters.

### 4.3.N NRF

In addition to the functions defined in TS 23.501 [2], the NRF performs PCF discovery by considering A2X capability.

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