**3GPP TSG SA WG-2 Meeting #160 S2-231uuuu**

**Chicago, USA, November 13 – 17, 2023** **(revision of S2-2311651 of S2-2310444)**

**Source: LG Electronics (Moderator)**

**Title: New SID on Phase 3 for UAS, UAV and UAM**

**Document for: Approval**

**Agenda Item: 30.1**

*The revision marks show delta from S2-2311651.*

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Study on Phase 3 for UAS, UAV and UAM

Acronym: FS\_UAS\_Ph3

Unique identifier:

Potential target Release: Rel-19

# 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Affects: | UICC apps | ME | AN | CN | Others (specify) |
| Yes |  | X | X | X |  |
| No | X |  |  |  | X |
| Don't know |  |  |  |  |  |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

|  |  |
| --- | --- |
| X | Study  |
|  | Normative – Stage 1 |
|  | Normative – Stage 2 |
|  | Normative – Stage 3 |
|  | Normative – Other\* |

**\* Other = e.g. testing**

## 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
| UAV\_Ph3 | SA1 | 1000032 | Uncrewed Aerial System Phase 3 |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 980012 | Further Architecture Enhancement for UAV and UAM | Rel-18 SA2 UAS\_Ph2 |
|  |  |  |
|  |  |  |
|  |  |  |

# 3 Justification

SA1 has studied how to further enhance the interaction between 5GS and UAV (Uncrewed Aerial Vehicle) system, including the UAV operations and management in Rel-19 (i.e. FS\_UAV\_Ph3: TR 22.843). The study addressed new requirements aspects in different scenarios such as pre-flight or in-flight network status monitoring, UAV DAA (Detect And Avoid), reliability of C2 (Command and Control) traffic for UAV and flexible control of UAV communication over the identified flight zone. Based on the conclusions of FS\_UAV\_Ph3, SA1 will specify 5G service requirements to further support UAV application in 3GPP system in TS 22.125.

Network-assisted/ground-based mechanism for DAA for tactical deconfliction and collision avoidance as well as UTM control of UAV flight path can be considered as a complement for DAA based on PC5 reference point specified in Rel-18.

ICAO (International Civil Aviation Organization), FAA (Federal Aviation Administration), JARUS (Joint Authorities for Rulemaking on Unmanned Systems), and other regulatory bodies have been defining the concept of C2CSP (Command and Control Connectivity Service Provider) and associated requirements and expectations for providing and managing C2 connectivity for aerial vehicles. C2CSP is an entity which provides a portion of, or all, the C2 Link service for the operation of an UAS (Uncrewed Aerial System). ACJA (Aerial Connectivity Joint Activity) has published a "Landscape Whitepaper on UAS Cellular Ecosystem" identifying the building blocks for the deployment of C2CSPs using cellular technologies (<https://www.gsma.com/iot/resources/landscape-whitepaper-on-uas-cellular-ecosystem/>). Rel-17 specified USS (UAS Service Supplier) authorization of C2 Communication where it is assumed that the AF involved in the UUAA (USS UAV Authorization/Authentication) procedure is also involved in C2 authorization, and authorization by separate AFs (e.g., UUAA by USS and C2 authorization by a C2CSP different from the USS) is not supported. Therefore, identifying how to enable the C2CSP concept with 3GPP tools can be the next steps in ensuring the UAS cellular ecosystem is completely defined based on 3GPP technologies.

The CEPT (European Conference of Postal and Telecommunications) Decision 22(07) on harmonised technical conditions for the usage of aerial UEs for communications based on LTE and 5G NR in several bands harmonized for MFCN (Mobile/Fixed Communications Networks) includes the requirement related to operational restrictions in the form no-transmit zones (NTZs). Regarding this aspect, TSG RAN agreed that the NTZ requirement will be addressed and sent LS on support of no-transmit zones for UAVs (S2-2308327/RP-231485) to SA2. Therefore, support of no-transmit zones for UAVs needs to be considered.

# 4 Objective

The aim of this study work is to investigate and identify potential architecture and system level enhancements to support additional scenarios and requirements for UAV (Uncrewed Aerial Vehicle) and UAM (Urban Air Mobility).

Specifically, the objectives include:

- **WT#1:** Based on SA1 requirements and input from aviation fora, study whether and how to enhance NEF services to support service exposure and interactions between MNOs and UTM functions for i.e. pre-mission flight planning, in-mission flight monitoring, C2 communication reliability, interfacing with UTM infrastructure (e.g. supporting multiple USS serving different geographical areas).

- **WT#2:** Based on SA1 requirements, study whether and how to enable network-assisted/ground-based mechanism for DAA (Detect And Avoid) that leverages information collected and generated in the 5GS, including whether and what new information is needed.

NOTE 1: The solution shall co-exist with and leverage, to the extent possible, Direct DAA solutions considered in Release 18.

NOTE 2: Sensing related information is out of scope of this study.

- **WT#3:** Study whether and how to improve C2 communication reliability and service continuity using multi-PLMN connectivity or path switching between PC5 path and Uu path. A UAV uses dual subscriptions for multi-PLMN connectivity, and to support multi-PLMN connectivity the existing Rel-18 mechanisms are reused without impact on TS 23.501 and TS 23.502.

- **WT#4:** Study use cases for C2CSP (Command and Control Connectivity Service Provider), and whether and how to enhance the existing mechanism to support C2 Communication for C2CSP different from USS.

NOTE 3: Existing 3GPP solutions and potentially extensions (e.g. USS authorization of C2 Communication) can be considered and leveraged.

- **WT#5:** Study whether and how to support aerial flight zones where communication QoS and policy for UAV application (e.g. DAA) may be different.

- **WT#6:** Study how to support no-transmit zones for UAVs.

## TU estimates and dependencies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Work Task ID** | **TU Estimate****(Study)** | **TU Estimate****(Normative)** | **RAN Dependency****(Yes/No/Maybe)**  | **Inter Work Tasks Dependency** |
| WT#1 | 1 | 1 | No |  |
| WT#2 | 1.5 | 1 | Maybe |  |
| WT#3 | 1 | 1 | Maybe |  |
| WT#4 | 1.5 | 1 | No |  |
| WT#5 | 0.5 | 0.5 | Maybe |  |
| WT#6 | 1 | 1 | Yes |  |

**Total TU estimates for the study phase: 6.5**

**Total TU estimates for the normative phase: 5.5**

**Total TU estimates: 12**

# 5 Expected Output and Time scale

|  |
| --- |
| New specifications {One line per specification. Create/delete lines as needed} |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Rapporteur |
| Internal TR | 23.xyz | Study on Phase 3 for UAS, UAV and UAM | TSG#104Jun. 2024 | TSG#104Jun. 2024 | TBD |
|  |  |  |  |  |  |

|  |
| --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
|  |  |  |  |
|  |  |  |  |

# 6 Work item Rapporteur(s)

TBD

# 7 Work item leadership

SA2

# 8 Aspects that involve other WGs

The following aspects involving other WGs may arise related to this SID:

- Security aspects

- RAN aspects

# 9 Supporting Individual Members

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| --- |
| Supporting IM name |
| BT |
| China Mobile |
| Ericsson |
| FirstNet |
| Futurewei |
| InterDigital |
| LG Electronics |
| LG Uplus |
| Lockheed Martin |
| Qualcomm Incorporated |
| TNO |
| ZTE |
|  |