**[R19 FS\_UAS\_Ph3] Pre-SA2#163 NWM Discussion for conclusions - Version 0.0.2**

**SA2**

[**https://nwm-trial.etsi.org/#/documents/8836**](https://nwm-trial.etsi.org/#/documents/8836)

# 1 Introduction

**After SA2#162 meeting (April 2024), TR 23.700-59v0.3.0 includes 17 solutions as below.**

**Table 1: Mapping of Solutions to Key Issues**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | KI#1  (NEF service enhancements) |  |  | KI#2 (NW-  assisted/ground-  based DAA) | KI#3  (NTZ) |
| Solutions | Flight plan-  ning/monitoring | Multiple USS | C2 reliability |  |  |
| #1 | ♥ |  |  |  |  |
| #2 | ♥ |  |  |  |  |
| #3 | ♥ |  |  |  |  |
| #4 |  |  |  | ♥ |  |
| #5 |  |  |  | ♥ |  |
| #6 |  |  |  | ♥ |  |
| #7 |  |  |  |  | ♥ |
| #8 |  |  |  |  | ♥ |
| #9 |  |  |  |  | ♥ |
| #10 |  | ♥ |  |  |  |
| #11 |  | ♥ |  |  |  |
| #12 |  |  | ♥ |  |  |
| #13 |  |  | ♥ |  |  |
| #14 |  |  | ♥ |  |  |
| #15 |  |  |  |  | ♥ |
| #16 |  |  |  |  | ♥ |
| #17 |  |  |  |  | ♥ |

Solution #1: Support Pre-Mission Planning and In-Mission Monitoring Flight

Solution #2: UAV flight path deviation exposure

Solution #3: UAV flight planning and monitoring

Solution #10: Enabling 5GC support for multiple USS serving different geographical areas

Solution #11: Multi-USS Support in 5GC

Solution #12: Support redundant connections for C2 communication reliability

Solution #13: Enhancement of NEF services for C2 communication assistance information

Solution #14: C2 Communication Reliability with Redundant User Plane Paths

Solution #4: Network-supported Tactical Deconfliction

Solution #5: Support Network-assisted DAA with Existing 5GC Services

Solution #6: UTM requests information used for DAA

Solution #7: Mobility Enhancements for enforcements of NTZ

Solution #8: Network support for NTZ management

Solution #9: Enabling NTZ support for aerial UEs

Solution #15: NTZ restriction Provisioning aspects

Solution #16: NTZ Enforcement in 5GC

Solution #17: Support of No Transmit Zone

# 2 Collecting companies view to be considered for conclusions

**2.0 General**

1. Companies may include their assumptions/conditions in order to better understand the proposed conclusion.
2. Companies should, where possible, describe any Editor’s Note(s) resolution proposal(s) in their description/explanation or indicate Solution update Tdoc# submitted to SA2#162 for resolving EN(s). As we will not be able to address the ENs to update the solutions, this will allow better understanding of the final conclusion, where applicable.

## 2.1 KI#1 (NEF service enhancements) - Flight planning/monitoring

### 2.1.1 Candidate solutions for KI#1 - Flight planning/monitoring

**Solution #1: Support Pre-Mission Planning and In-Mission Monitoring Flight**

**Solution #2: UAV flight path deviation exposure**

**Solution #3: UAV flight planning and monitoring**

### 2.1.2 Companies View for KI#1 - Flight planning/monitoring

**Feedback Form 1: Q1: Which principles can be selected or considered for conclusion in developing final solution? Also identify, if possible, which solution(s) the principles are taken from.**

|  |
| --- |
| **1 – QUALCOMM Europe Inc. - Italy**  - Solution support enhancements to NEF services to enable USS/UTM to request NEF assistance for premission flight planning and in-mission flight monitoring, based on solution #1 with the restriction this is focused on UAV and excludes UAV-C. Both pre-flight planning and in-mission flight monitoring is considered.  o Solution should incorporate concepts of QoS Sustainability Analytics from solution #3 and NWDAF determination of QoS analytics considering height.   * Solutions exclude the use of NWDAF to determine flight path deviation, since NWDAF generates analytics and statistics and is not suitable to identify the specific deviation of a single UAV. * Solutions to support C2-reliability based on redundant connectivity shall re-use existing mechanisms defined in 3GPP without normative impact (e.g. solution #12, solution #14), and leverage applicationlevel solutions to provide the additional information required. Solutions may recommend the use of such existing mechanisms, with the details as per solution #14. |
| **2 – CATT**  The following principles which are taken from Solution #1 and #3 should be selected for conclusion: |

* The USS/UTM sends Pre-mission flight planning assist request to NEF, which includes identifier of the UAV (e.g. GPSI), information of flight route (e.g. waypoints, time interval).
* The NEF/UAV NF maps the parameters in the request from the USS/UTM to information used by the 3GPP system (e.g. map the waypoints/geographical areas into a list of Cell IDs, gNB IDs or TAIs).
* If the NEF/UAV NF determines the requirements on flight planning can’t be satisfied, the NEF responses to the USS/UTM to reject the Pre-mission flight planning assist request, and may include the detail reason.
* The NEF generates assistance information for pre-mission flight planning based on the information and analytics received from NFs (e.g. NWDAF).
* The NEF/UAV NF responses to the USS/UTM with the assistance information and the monitoring results (e.g. the location of the target UAV, indication on whether the UAV is flight in right route).
* USS/UTM requests notifications on QoS Sustainability Analytics from the NEF for an indicated geographic area or a path of interest and a target time interval, and provides location information (waypoints defined as 3D locations) to NEF.

**3 – Ericsson LM**

Ericsson: the following principles should be considered in the final solution:

§ The exisiting NEF services need to be reused and enhance whenever required to introduce 5GS support for pre-mission and in-mission flight management via service exposure.

§ The introduce ehancements shall have minimum impact on other NFs and the exisiting mechanisms need to be reuseed as much as possible.

Based on the aforementioned principles, Solution#1 can be considered as the baseline for developing a framework for NEF-assisted pre-mission flight planning and in-mission flight monitoring by a 3GPP network. However, Solution#1 can be complemented with the following aspects from other solutions: the use of flight path deviation analytics from Solution#2 and the use of QoS Sustainability analytics from Solution #3. Both these aspects complement the solution framework relying on Solution#1. For example, the flight path deviation analytics introduced by Solution#2 can be added to step 9 of the procedure in clause 6.1.3.1, and/or add new step to the procedure in clause 6.1.3.2 for UAS

NF/NEF collection analytics from NWDAF to generate assistance information. In the similar way, the use of QoS Sustainability analytics introduced by Solution#3 can be incorporated in the framework.

**4 – Samsung R&D Institute India**

[Samsung]: The existing UASNF/NEF services shall be enhanced to expose additional capability of providing pre-mission and in-mission flight planning assistance information.

> For pre-mission flight planning, USS can request for assistance information for a single UAV or group of UAVs by providing the details of individual UAVs.

> For in-mission flight planning, USS can request for assistance information by providing the specific PDU session details like DNN and S-NSSAI

> The details of assistance information including allowed deviation path and/or QoS analytics can be decided during normative phase along with whether the NWDAF is the right node to do such operation or existing UASNF can do can be decided .

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| **5 – LG Electronics France**  **Princlple1-1** (from Sol#1): NEF services and NEF/UAS NF functionalities are enhanced to support premission flight planning assistance service and in-mission flight monitoring assistance service as proposed by Solution#1. Solution#1 is selected for normative work. |
| **6 – Huawei Technologies France**  On ”Pre-mission Flight Planning”:  solution#1 In the impact clause says ”Enhance the inputs and the outputs of Movement Behaviour Analytics.”. However, in the procedure it is not clarified what the output enhancement is.  In general, it is not clear what information NEF can generate as assistance information for pre-mission flight planning.  **Proposal 1: no principle for Pre-mission Flight Planning** On ”In-mission Flight Monitoring”:  It is not convinced how the NEF can determine whether the UAV is flight in right route. What is known by the NEF is the UAV location and the UAV flight route identified by way points. However the path between two consecutive way points can be staight or curved line, which is not known by NEF, so it cannot determine whether the UAV is in right route / whether it deviates from the scheduled flight route.  Instead, USS/UTM can subscribe to the network for UAV location periodically, and based on that to determine whether UAV is flight in right route / any deviation happend.  **Proposal 2: USS/UTM can subscribe to the network for UAV location periodically, and based on that to determine e.g. whether UAV is flight in right route / any deviation happend.**  On QoS related analytics along the flight path:  Solution #3 proposed to consider 3D location for deriving QoS Sustainability Analytics in order to identify the performance measurement information of the most appropriate ground and/or sky cell and to estimate the coverage area of the ground cell at the respective height. This is our preferred solution.  **Proposal 3: solution#3 is agreed as baseline to address QoS related analytics along the flight path.** |

## 2.2 KI#1 (NEF service enhancements) - Multiple USS

### 2.2.1 Candidate solutions for KI#1 - Multiple USS

**Solution #10: Enabling 5GC support for multiple USS serving different geographical areas**

**Solution #11: Multi-USS Support in 5GC**

### 2.2.2 Companies View for KI#1 - Multiple USS

**Feedback Form 2: Q2: Which principles can be selected or considered for conclusion in developing final solution? Also identify, if possible, which solution(s) the principles are taken from.**

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| --- |
| **1 – QUALCOMM Europe Inc. - Italy**  Solutions are based on the following principles   * The serving USS may identify the new target USS on the UAV location and flight path, or the UAS NF/NEF may be configured to identify the new target USS based on the UAV location and flight path. Triggering of change of USS may take place from old USS or UAS NF (to cater for USS from different providers) * The correct serving USS may be determined at flight planning time, since the USS knows where the UAV will be flying and determine a-priori the required serving USS(es) during the flight path. * Any change of USS requires an authentication and authorization (UUAA) procedure to be performed between the UAV and the new USS. Solutions where the old USS informs the UAV that it should be using the new USS without an appropriate UUAA between UAV and new USS are not suitable due to security concerns * Aspects related to information exchange between USS(es) are out of scope of 3GPP |
| **2 – InterDigital Communications**  For KI#1(multi USS) both solution #10 and solution #11 should be pursued as they complements the scenario.  Solution #11 handles that multi-USS information is configured in UAV and UAS NF and it may be utilized when UAV newly registered for USS service at the new location once it has registered successfully.  And Solution #10 handles context transfer scenario between old USS and new USS based on location tracking of UAV by USS. |
| **3 – CATT**  The following principles which are taken from Solution #10 should be selected for conclusion:   * The NEF/UAS NF determines a UAV enters/leaves a border cell/TA (belongs to the service area of serving USS) and sends the notification to the USS. * When the USS receives event report about a UAV enters/leaves a border cell/TA (belongs to the service area of serving USS) by invoking the existing Deferred 5GC-MT-LR Procedure in clause 6.3 in TS 23.273 (the event type is set to area, the geographical area is set to the border area of USS), it may determine to trigger USS/UTM changeover to a new USS/UTM to serve the UAV. * The NEF/UAS NF mapps information about geographical areas served by USS-s to 3GPP identifiers (such as cell IDs, TAI)), specifically, some enhancements to map back a 3GPP identifier (e.g. border cell   ID or TAI) to a specific border-crossing point information understandable by a USS. |
| **4 – Ericsson LM**  Ericsson: In order for 3GPP network to perform a changeover from one UAS Service Supplier (USS) to another, the following main principles apply: |

* USS is responsible for its geographical area, and a geographical area do not necessarily identically matchtracking areas or cells of a 3GPP network. However, it is assumed that TAs and Cells IDs can be used to describe/map this information. NEF can used to make a translation from a geographical description of an area to 3GPP identifiers and vice versa whenever such mappings are required.
* The overall assumption is that each USS is aware of its neighbouring USS-s, border areas that it haswith its neighbour USS, possible USS border-crossing points, and USS-s can communicate with each other using means outside the scope of the 3GPP.
* A changeover procedure (i.e., a handover of a UAV from a source USS to a target USS during the flight)can be triggered either from a UAV that is an object of the changeover or from a source USS:
* A UAV can trigger a changeover procedure by sending a pre-mission flight planning request with adestination point outside an area of authority/responsibility of a serving USS;
* USS can trigger the changeover by determining that a UAV is approaching a border TA/cell of its serviceand requesting an NEF/UAS NF to assist with the changeover; for this purpose, the USS can use either the existing service operation (e.g., Naf\_Authentication\_Notification) or a new service operation, which can be determines in the normative phase.
* Once the serving USS determines the changeover needs to take place, the serving USS determines possibleUSS (one or more) that may serve as a target USS based on the pre-established knowledge (e.g. via preconfiguration, OAM, other proprietary means etc. that are not in the scope of the study). After that, the serving USS triggers communication with possible/suitable USS-s to determines candidate USS bordercrossing point(s) for the UAV.
* After receiving the required inputs from all suitable target USS-s, the serving USS requests a network(via NEF/UAS NF) to get notified when it is time to make the changeover and provides any additional information the NEF might need to perform this task (e.g., requirements on the flight path, candidate flight path(s), accuracy level of predictions relevant to the flight monitoring).
* To assist the serving USS with the changeover, the NEF/UAS NF determines the relevant NFs and specificservice operations it needs to invoke to collect the required information for UAV flight planning/monitoring to determine with a defined likelihood that the UAV will leave the service area of one USS and moves into area of another USS (e.g. NWDAF analytics service for Movement Behaviour analytics, GMLC service for Ranging/Sidelink Positioning location, AMF for UAV’s presence in bordering cells/TAs, AMF service for UAV’s deviation for the expected/assigned trajectory).
* If the serving USS/UTM detects that the UAV has left or is about to leave its service area (for instance,based on UAV’s presence in a border TA/cell and prediction about UAV’s probable flight direction), the serving USS/UTM may determine to trigger USS/UTM changeover to a new USS/UTM to serve the UAV. For the changeover, the serving USS communicates with the selected target USS; this communication and details are outside the scope of the 3GPP, however, it is expected that the serving USS pass the target USS the information regarding which exposure services/notification are of relevance for the UAV, information about UAV’s identifiers or any other information required by the target USS or by the UAV itself to establish the connection.
* The source USS informs the UAV about the changeover to the new USS and may instruct the UAV toreconnect with the target USS and trigger the exposure services towards 5GC NFs similar to what the previous serving USS (USS 1) had before the changeover. The target USS informs the source USS about the completion of the changeover once it receives a notification from the AMF serving a TA/cell on its side about the UAV presence in that specific TA/cell. The new serving USS responds to the notification conforming to the network about the completion of the changeover for the UAV.

**5 – China Mobile Com. Corporation**

Regarding USS relocation, main principles as described in the procedures are as follows:

* The serving USS subscribes to UAV location reporting events to AMF/GMLC/LMF;
* If the serving USS/UTM detects that the UAV has left or is about to leave its service area based on the location subscription from GMLC/LMF/AMF, the USS/UTM may determine to trigger USS/UTM changeover to a new USS/UTM to serve the UAV;
* The serving USS/UTM triggers the process of changeover of the UAV to the new USS/UTM (e.g. to assist in transferring the UAV context including e.g., subscribed events, UAS NF address, etc., how this is performed is out of 3GPP scope).

1. **– Samsung R&D Institute India**

[Samsung] In multi-USS deployment, there will be different USS which serves different geographic or service area of an PLMN. Hence the there is a need for impacted entities to be aware of the exact USS on that particular location for providing uninterrupted service. So in principle

> Both UAV and UASNF should be pre-configured with USS addresses along with the service area information it serves.

> During connected mode mobility, either UAV or serving/source USS discover the target USS and accordingly can request for the service.

> During registration (UUAA-MM) or PDU session establishment (UUAA-SM), if UAV provides the USS address then it should provide the USS address of the service area where UAV is currently located/sending request

1. **– LG Electronics France**

**Principle2-1** (from Sol#10): NEF services and NEF/UAS NF functionalities are enhanced to support notifying UAV UE’s serving USS/UTM that the UAV UE will leave the service area so that the serving USS/UTM can trigger the process of changeover of the UAV UE to the target USS/UTM, as proposed by Solution#10. Solution#10 is selected for normative work.

**Principle2-2** (from Sol#11): UUAA procedures are enhanced to provide a list of serving USS info with serving area to UAS NF/NEF and UAV UE as proposed by Solution#11. It is also possible that list of serving USS info is preconfigured in UAS NF/NEF and UAV UE. Solution#11 is selected for normative work.

1. **– Huawei Technologies France**

Following principles are preferred:

* It is assumed multiple USSes can communicate with each other, through interfaces not defined by 3GPP.
* UAV is configued with a single CAA-level UAV ID, which may be assigned by a single USS. How the other USS understand and use the CAA-level UAV ID e.g. for UAV authentication will be addressed during normative phase.
* Serving USS subscribes to network for UAV location via NEF(UAS NF), and based on the notifed UAV location and its flight path to determine USS-relocation is needed.
* Relocation of USS requires an authentication and authorization (UUAA) procedure to be performed between the UAV and the new USS.
* Serving USS indicates to UAV about the USS relocation, and provides the address of the new USS. UAV initiates UUAA procedure to the new USS, and provides its CAA-level UAV ID. How the new USS understand and use the CAA-level UAV ID e.g. for UAV authentication will be addressed during normative phase.

## 2.3 KI#1 (NEF service enhancements) - C2 reliability

### 2.3.1 Candidate solutions for KI#1 - C2 reliability

**Solution #12: Support redundant connections for C2 communication reliability**

**Solution #13: Enhancement of NEF services for C2 communication assistance information**

**Solution #14: C2 Communication Reliability with Redundant User Plane Paths**

### 2.3.2 Companies View for KI#1 - C2 reliability

**Feedback Form 3: Q3: Which principles can be selected or considered for conclusion in developing final solution? Also identify, if possible, which solution(s) the principles are taken from.**

|  |
| --- |
| **1 – QUALCOMM Europe Inc. - Italy**  - Solution support enhancements to NEF services to enable USS/UTM to request NEF assistance for premission flight planning and in-mission flight monitoring, based on solution #1 with the restriction this is focused on UAV and excludes UAV-C. Both pre-flight planning and in-mission flight monitoring is considered.  o Solution should incorporate concepts of QoS Sustainability Analytics from solution #3 and NWDAF determination of QoS analytics considering height.   * Solutions exclude the use of NWDAF to determine flight path deviation, since NWDAF generates analytics and statistics and is not suitable to identify the specific deviation of a single UAV. * Solutions to support C2-reliability based on redundant connectivity shall re-use existing mechanisms defined in 3GPP without normative impact (e.g. solution #12, solution #14), and leverage applicationlevel solutions to provide the additional information required. Solutions may recommend the use of such existing mechanisms, with the details as per solution #14. |
| **2 – CATT**  The following principles which are taken from Solution #13 should be selected for conclusion:   * The USS/UTM sends C2 connectivity assistance request to NEF/UAV NF. * The NEF/UAV NF maps parameters included in the request from the USS/UTM to information used by the 3GPP system (e.g. map the geographical area into an area of interest that is represented by a list of Cell IDs, gNB IDs or TAIs). |

* The NEF/UAV NF determines to request NWDAF analytics service (QoS Sustainability Analytics, Network Performance Analytics). Also, the NEF determines parameters used to request the analytics, e.g. QoS requirements, location information.
* The NEF/UAV NF generates assistance information for C2 connectivity based on the analytics from NWDAF. The assistance information may include the location information (e.g. waypoints/geographical areas that map tothe CellID(s), TAI(s), gNBID(s)) andtime information to indicatethat C2communication reliability (e.g. QoS requirements) cannot be sustained at specific location and time interval.

**3 – Ericsson LM**

Ericsson: In order to achieve C2 communication reliability, at least one of the following criteria needs be satisfied by the final solution:

* It can be used to set up reliable C2 communication, and
* it needs to improve C2 communication reliability which can be exploited/affectuated in cases of deterioration/failure of C2 communication.

Solution#12 reuses the existing redundant transmission mechanism with different 5GS paths defined in clause 5.33.2 in TS 23.501, with the only difference being additional redundant information in C2 aviation payload and C2 authorization payload to allow a UAV or UTM to synchronize information about the use of redundant C2 connections via 5G system which can be left to implementation.

Solution#13 enhances NEF services and enables USS/UTM to request NEF assistance for C2 communication reliability. Specifically, USS/UTM requests and receives assistance information on C2 connectivity related information from NEF. The NEF generates the assistance information based on the analytics on QoS Sustainability Analytics and Network Performance Analytics provided by NWDAF as defined in TS 23.288. A UAV can decide to use or change to other C2 connectivity based on the C2 connectivity related information received from the USS/UTM, i.e., C2 communication reliability (e.g., QoS requirements) cannot be sustained at specific location and/or time interval.

Solution#14 reuses the existing mechanism with redundant user plane paths defined in Annex F in TS 23.501, with some tailoring specifically for UAS purposes.

Solutions #12 and #14 reuse the existing mechanisms without changes for UAS. Solution#13 makes further use of the existing analytics service provided by NWDAF to enhance NEF. However, all the three solutions are based on existing mechanisms. It is questionable if soln#12 really achieves reliability but if desired can be used with some adaptation and #14 is implementation guidelines that do not require specification work if followed as is.

1. **– Samsung R&D Institute India**

[Samsung] Samsung also prefers to avoid any normative impacts to achieve any C2 reliability requirement but not sure about the claims that the proposed solution (particularly sol 14) can be achieved by implementation. But in our understanding it may bring impacts to UAV, NG-RAN, AMF to address proposed reliability group concept. So need more time on this topic to analyze further, may be by 2nd round .

1. **– LG Electronics France**

**Principle3-1** (from Sol#12 and Sol#14): UAV UE supports redundant C2 communications based on the existing redundant transmission mechanisms such as redundant PDU Sessions defined in clause 5.33.2 in TS 23.501 and redundant user plane paths described in Annex F of TS 23.501, as proposed by Solution#12

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| and Solution#14. It is recommended to capture Solution#12 and Solution#14 as Informative Annex in TS 23.256.  **Principle3-2** (from Sol#13): NEF services and NEF/UAS NF functionalities are enhanced to support C2 connectivity assistance service as proposed by Solution#13. Solution#13 is selected for normative work. |
| **6 – Huawei Technologies France**  Following principles are preferred:   * solution #12 and #14 are both suitable solutions support dual C2 communication for E2E reliability. Therefore, both solutions can be baseline solutions for normative work. * Sol#13 proposes to use NWDAF QoS analysis to support C2 reliability. Howerver, what information can be provided to UE from USS via the application level, and whether the information will be the same as the information provided from existing NWDAF analytics is not clear. We don’t prefer this solution as study conclusion. |

## 2.4 KI#2 (NW-assisted/ground-based DAA)

### 2.4.1 Candidate solutions for KI#2

**Solution #4: Network-supported Tactical Deconfliction**

**Solution #5: Support Network-assisted DAA with Existing 5GC Services**

**Solution #6: UTM requests information used for DAA**

### 2.4.2 Companies View for KI#2

**Feedback Form 4: Q4: Which principles can be selected or considered for conclusion in developing final solution? Also identify, if possible, which solution(s) the principles are taken from.**

#### 1 – QUALCOMM Europe Inc. - Italy

* Network-based DAA (NWDAA) refers to tactical deconfliction solutions that utilize a network-based or ground-based component to collect, elaborate, and distribute tactical deconfliction information.
* Network-based DAA re-uses existing service exposure to enable USS to have access to additional data to support network-assisted DAA tactical deconfliction
* Solutions leverage location based services, information generated by UAVs based on A2X, and enables the use of additional information that may be generated by sensors (e.g. ADS-B receivers, radar, etc.)
* Solution leverages positioning mechanisms to determine relative position of a pair or multiple UAVs, with USS acting as AF/LCS and leveraging GMLC as described in solution #5. Both GMLC-calculate and USS-calculated positions are considered.
* Solution enables the use of an AIML-based localized USS/UTM function called Localized DAA Server (LDS) for tactical deconfliction tailored specifically to provide NWDAA services to UAVs and UTM, which may be provided/supported by an MNO or be an external entity, as described in solution #4.

**2 – CATT**

The following principles which are taken from Solution #5 and #6 should be selected for conclusion:

* Network-assisted DAA procedure can be triggered by UAV/UAV-C or USS/UTM.
* When the Network-assisted DAA is triggered, the USS/UTM estimates the potential collision based on the existing information including:
* Sidelink positioning location result which is obtained by invoking the Ranging/Sidelink Positioning procedures in clause 6.20.3 or 6.20.4 in TS 23.273.
* Relative proximity analytics obtained from NWDAF by invoking the procedure in clause 6.19.4 in TS

23.288.

* When the collision is detected,

-Ifthenetwork-assistedDAAprocedureistriggeredbyUSS/UTM,itinitiatesacollisionavoidance/conflict resolution procedure, e.g. update the planned flight path of UAV.

* If the network-assisted DAA procedure is triggered by UAV/UAV-C, the USS/UTM informs the UAVC(s) the potential collision. The UAV-C(s) informs its paired UAV(s) which performs operations to avoid collision, e.g. trajectory correction or conflict resolution procedure described in clause 5.6.1 in TS 23.256.

**3 – Ericsson LM**

Ericsson: As this key issue is about Network-assisted/ground-based DAA, and the following principles should be considered:

The solution provides valid method for to allow Network-assisted/ground-based DAA.

The solution reuses as much as possible the existing 5GS information.

Solution#4 proposes a new function named Localized DAA Server (LDS) for tactical deconfliction, which is a functionality separate from USS/UTM. The LDS provides a subscription-based service available to all aerial UEs or a subset of the aerial UE, interacts with UE directly as mentioned in the step descriptions. This solution is more relevant to enabler layer, and out the scope of core network.

Solution#5providesUAV/UAV-CTriggeredNetwork-assistedDAAandAAMTriggeredNetwork-assisted DAA with reuse of the GMLC service on Ranging/Sidelink Positioning location and Relative Proximity predictions on collision generated at NWDAF. USS requests service from 5G NFs via NEF.

Solution#6 proposes similarmethod asgiven in Soliton#5, the onlydifferenceisUSS/UTM requestsservice from 5G NFs directly.

Based on the principles listed in above, Solution#5 can be considered as the baseline for the structure of Network-assisted DAA. Solution#6 can be merged into Solution#5 after removing the content about NEF request service from 5G NFs directly. Solution#4 is out the scope of core network, will not be considered for normative phase.

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| **4 – LG Electronics France**  **Principle4:** Solution#5 proposing UAV/UAV-C Triggered Network-assisted DAA and AAM Triggered Network-assisted DAA, and Solution#6 proposing DAA performed by USS/UTM based on 5GC information are selected for normative work. |
| **5 – Huawei Technologies France**  We share the view from Ericsson, on the following proposals:  Solution#5 can be considered as the baseline for the structure of Network-assisted DAA.  Solution#6 can be merged into Solution#5 after removing the content about NEF request service from 5G NFs directly. Solution#4 is out the scope of core network, will not be considered for normative phase. |

## 2.5 KI#3 (NTZ)

### 2.5.1 Candidate solutions for KI#3

**Solution #7: Mobility Enhancements for enforcements of NTZ**

**Solution #8: Network support for NTZ management**

**Solution #9: Enabling NTZ support for aerial UEs**

**Solution #15: NTZ restriction Provisioning aspects**

**Solution #16: NTZ Enforcement in 5GC**

**Solution #17: Support of No Transmit Zone**

### 2.5.2 Companies View for KI#3

**Feedback Form 5: Q5: Which principles can be selected or considered for conclusion in developing final solution? Also identify, if possible, which solution(s) the principles are taken from. Note that SA2 will focus on aspects that are independent/not related to RAN as the basis for conclusion. In case of KI#3, please include any assumptions you maybe making to ensure there is common understanding/interpretation of the conclusion proposal.**

1. **– T-Mobile Austria GmbH**

[Deutsche Telekom]: We agree on including the following principles:

* + Provision of NTZ information on the UE triggered by USS. OK to have it via CN if it is via existing procedures
  + Enforcement of the NTZ from UE side, i.e. OK to have UE impact. We are not aware of Rel’18 Aerial UEs being available, so we do not really see a backwards compatibility issue. We assume that if there is regulatory obligation, it is feasible to realize such functionality as long as we agree on clear, simple principles + normative phase

We do not see an argument to include RAN impact or to include any interaction with RAN that would have any impact on the specification. We propose to:

* + Leave the RAN impact as an EN
  + Send an LS to RAN/RAN2/RAN3 with the principles we can agree to and asking for guidance

Our view is that RAN impact should be as minimal as possible, preferably zero. Any RAN impact would automatically place the operator in a position of responsibility to enforce NTZs, even if conceptually this is a UE issue, as it is the UE which is entering the NTZ. Based on our experience, radio planning including UAVs turns very complex very quickly. Unless we have clear guidance on what RAN considers necessary, we have grave concerns what any RAN impact could lead to.

1. **– Motorola Mobile Com Technology**

Lenovo prefers a network-based solution with the following principles:

Principle 1: USS provides NTZ information (e.g. restricted frequencies, geographical areas, elevation) to the UAS NF/NEF

Principle 2: UAS NF/NEF translates the NTZ information into 3GPP specific information (e.g. cell ID, RSFP index, etc) and provides to PCF responsible for AM policies

Principle 3: PCF makes policy decisions and initiate an AM policy update to provide updated NTZ information to the AMF and RAN.

We believe that a UE-only solution where the Aerial UE receives configuration information of NTZ zones is not sufficient to cover the regulatory requirements as the LS response from ETSI TC MSG/TFES indicates (as part of Q2 response) that aerial UE data reception in NTZs is allowed given the regulatory requirements or coordination zone conditions are not violated. The response implies that RAN and CN are also need to be aware of NTZ zones and determine whether transmission to aerial UEs when in NTZ zones is allowed or not.

**3 – Samsung R&D Institute India**

[Samsung] : NTZ is not a static information and hence provisioning by USS to 5GC should have minimum impact keeping any further update to NTZ information happens in future. In 5GC as both AMF and NGRAN need to enforce the UAV restriction to NTZ, it is also suggested not to provision at multiple places .So in principle we agree on

1. USS provisioning NTZ information at single NF which is UDM and during registration of UAV, these NTZ information which AMF receives from UDM, provides to both NG-RAN and UAV for enforcement.

I

1. There is no relevance of any policy here, hence we don’t see the need of AM-PCF to provide these NTZ information to AMF.
2. UAV supporting NTZ feature ensures not selecting/reselecting any cells for idle mode and NG-RAN does not handover to a restricted target cell for connected mode
3. UAV not supporting NTZ will be ensured by network that until unless UAV does not move outside of NTZ, does not try to register with network

**4 – QUALCOMM Europe Inc. - Italy**

Provisioning of NTZ Information and content of NTZ information

- NTZ information is configured/provided to 5G network by external functions (regulators, etc.) o Semi-static NTZ information can be provided via OAM (the idea is that at national level there will be entities in charge of defining NTZs and providing related information to PLMNs) o It is FFS whether NEF services need to be extended to support provision of NTZ information o Per-UE NTZ information (i.e. specific to a UAV UE) is not required nor supported o Dynamic enforcement of NTZs is not supported, there is no requirement for dynamic NTZs - NTZ information provided to the MNO network and to the UE includes at a minimum:

o geographical area in form of coordinates (i.e. latitude, longitude, and altitude limits of the NTZ) and restricted frequency band(s)

* To support mechanisms for NTZ enforcement/support by RAN, RAN node(s) are configured by OAM with the NTZ information
* To support updating NTZ information in the UE by the 3GPP network:
* Actual NTZ information is provided to the UAV UE, without translation into 3GPP information (e.g.TAIs, Cell IDs, etc.). The UAV UE uses its location and NTZ information to determine whether it is in an NTZ, in order to cater for all scenario of cell/TA size wrt NTZ size.
* For supporting UAV UEs (i.e. Rel. 19 UEs), the CN may provide updated information related to NTZas described in the more detailed conclusions. No mechanisms are required for RAN to provide NTZ information to the UAV UE

Enforcement by the network of NTZs

* NTZ enforcement by the 3GPP system applies only to Aerial UEs that have an aerial subscription and that have indicated the intent to behave as an aerial UE
* Solutions shall minimize the chance that an Aerial UE transmits any data in an NTZ

o UAV UEs intending to behave as an aerial UE are assumed to have configuration information regarding NTZs in the region of operation (e.g. provided by USS or UAS operator via mechanisms outside the scope of 3GPP) and use such configuration and their location (self-determined) to decide whether to attempt to connect to a network or not. If the UAV UE determines it is in an NTZ (i.e. location and restricted frequencies), the UAV UE shall not attempt to register to the network in the NTZ

* Impact on NFs should be minimized to simplify deployments

oConfiguringallAMFswithdetailedNTZinformationleadstowidespreadnetworkimpactthatmayhinder deployment

UAV UE behavior

* UAV UEs not supporting Rel. 19 mechanisms (this includes any UAV UE pre Rel. 19) o UAV UE must be pre-configured via application layer mechanisms with NTZ information o When the UAV UE detects it is about to enter an NTZ area, the UAV UE deactivates the AS layer or ceases to transmit any data when entering an area corresponding to the NTZ (TBD with RAN which behavior is more appropriate)

o For connected mode UAV UEs not supporting Rel. 19 mechanisms, it is expected that the network is configured to know which cells correspond to an NTZ and the RAN will attempt to avoid handing over a UAV UE to a cell corresponding to an NTZ. the Source NG-RAN shall not handover the UAV to a target

NG-RAN node, and the target NG-RAN shall reject the N2 based handover procedure

- For UAV UEs supporting rel. 19 mechanisms

* The UAV UE provides an indication that it supports NTZ restrictions during Registration Procedure tothe AMF. This enables the AMF to identify supporting UAV UEs
* When the UAV UE determines it is in an NTZ, the UE does not do cell search or any radio transmissionin the frequency bands corresponding to the NTZ.
* The UAV UE may perform a registration update before entering the NTZ with an indication that the UAVUE is about to enter an NTZ, so that the network considers the UAV UE unreachable but registered (this is similar to the mechanisms adopted in previous releases for high latency communication behavior). The UAV UE would then perform re-registration when exiting the NTZ. This enables the network to know the exact status of the UAV UE.
* For connected mode UAV UEs, it is expected that the network is configured to know which cells corre-spond to an NTZ and the RAN will attempt to avoid handing over a UAV UE to a cell corresponding to an NTZ.

§ If the target is a cell completely restricted (i.e. NTZ overlaps completely with the cell): the Source NGRAN shall not handover the UAV to a target NG-RAN node, and the target NG-RAN shall reject the N2 based handover procedure.

§ If the target cell is not completely restricted wrt to the NTZ (i.e. the cell is larger than the NTZ), then the UAV UE may use the NTZ information to determine in which parts of the cell the UAV UE can transmit, and deactivate transmission when in the NTZ.

o If the UE can receive DL data, the UE shall perform any actions that require any transmission while in the area corresponding to an NTZ

Core Network Behavior

- To support mechanisms for NTZ enforcement/support by the CN, AMF is configured with NTZ information:

o This may be detailed NTZ information or simply an indication that NTZ are present in the serving area of the AMF. Which mechanism is used depends on the actual size of NTZs and operator policies, depending on the amount of impact desired on AMFs

- The AMF may provide to the UAV UE an indication that NTZs are present in the Registration Area:

* AMF may provide enhanced service restrictions in the form of a Restricted Transmission Area (similarlyto non-allowed area) composed of one or more TAs where the UE is not allowed any transmission (NOTE: this is useful when the NTZ is very large and may encompass multiple cells or TAs)
* Alternatively, AMF pay provide NTZ Restriction Policies to the UAV UE, either retrieving the policiesfrom the PCF or indicating to the UE that there is at least one NTZ in the serving area, and the UE uses existing procedure to retrieve updated policies from PCF which contain NTZ Restriction Policies with the NTZ information.
* Upon determiningthat the UE isan Aerial UE(i.e. the UE provided indication of NTZrestrictions support, the UE has an aerial subscription, and after successful UUAA procedure when it is performed), the AMF sends to the RAN the indication to activate aerial features in an N2 message based on current mechanisms. This is used by RAN to determine that NTZ enforcement is necessary, and no additional indication to the RAN is needed to enforce NTZ

Assumptions on RAN-based solutions

Assumptions are required to handle scenarios where e.g. NTZ may be smaller than a serving cell, especially to cater for scenarios where there is only one valid serving cell for the UAV UE (e.g. large rural cells). From an SA2 perspective, RAN solutions need to allow:

* Any cell-level enforcement of NTZ must allow terrestrial UE (i.e. UEs that are not AUV UEs) to use the resources of a cell corresponding to an NTZ
* Any cell-level enforcement of NTZ must allow UAV UEs to use any resources of a cell intersecting an NTZ that are not part of the NTZ.

General

* 3GPP does not define solutions for UEs that behave as an aerial UE but do not support at least Rel. 17 UAV features

1. **– InterDigital Communications**

**Proposed principles**

NTZ information may be preconfigured in the UAVs and may be updated via 5GS upon request of USS (#8, #9, #15, #16).

NTZ information includes restricted area and frequency information (#7, #9, #15, #16, #17).

NTZ information is provided to affected UAVs via NAS signaling (#8, #9, #15, #16, #17).

NTZ information is also provided to RANs that cover NTZ areas (#9, #16).

For connected UAVs in NTZ, 5GC initiates resource release (#16).

1. **– CATT**

The following principles which are taken from the existing solutions should be selected for conclusion:

* NTZ information includes geographical area of an NTZ and restricted frequencies corresponding to the area.
* NTZ support in 5GS:
* UE indicates the capability to support the NTZ during Registration procedure.
* NTZ information provision:
* Provision to AMF: USS/UTM provides NTZ information to AMF via NEF.

NOTE: the existing solutions of provisioning the NTZ information to AMF include: 1) sol#7: OAM configuration, 2) sol#8: local configuration, 3) sol#8, sol#9 and sol#16: USS/UTM providing the NTZ information via NEF, 4) sol#9: PCF providing the NTZ information via AM policy association procedure, 5) sol#17: UDM providing the NTZ information as subscription data UDM. The idea of USS/UTM providing the NTZ information via NEF has the more supportors, so this idea is selected for conclusion here. The sol#8, sol#9 and sol#16 share the similar idea, but different messages are used to transfer the NTZ information, so it is proposed to determine the messages during normative phase.

* Provision to NG-RAN: AMF provides NTZ information to NG-RAN.

NOTE: the existing solutions of provisioning the NTZ information to NG-RAN include: 1) sol#7: local configuration, 2) sol#9, sol#16 and sol#17: AMF providing the NTZ information, 3) sol#9: OAM configuration. The idea of AMF providing NTZ information to NG-RAN has more supportors, so this idea is selected for conclusion.

* Provision to UE: AMF provides the NTZ information to UE.

NOTE: the existing solutions to provide NTZ information to UE include: 1) sol#7, sol#9, sol#16 and sol#17: AMF providing the NTZ information, 2) sol#7 and sol#15: PCF providing the NTZ policy to UE, 3) sol#7: AF providing the NTZ information to UE via user plane, 4) sol#15: pre-configuration, 5) sol#9: RAN providing the NTZ information to UE. The idea of AMF providing NTZ information to UE has more supportors, so this idea is selected for conclusion.

* NTZ enforcement:
* UE obeys the NTZ information
* NTZ information enformcement in NG-RAN (e.g. HO optimization) is in scope of RAN WGs.

1. **– Ericsson LM**

Ericsson: Need to analyse further so may not be able to provide detailed views by first deadline.

1. **– China Mobile Com. Corporation**

We supports the use case of non-support NTZ UAV, whose solution is suggested to be defined in R19, since we can’t guarantee all the UEs will automatically enforce NTZ features.

1. **– LG Electronics France**

Based on the Architectural Assumptions and Requirements described in clauses 4.1 and 4.2 of TR 23.70059, and the following additional assumption, the following principles are proposed.

**Additional Assumption:** It is assumed that there is no UAV UE that transmits in the NTZ.

**Principle5-1:** UAV UEs supporting NTZ are configured with the following NTZ information:

- A list of the restricted frequency band(s) per Uu RAT (i.e. LTE, NR) with Geographical Area.

(It is FFS whether to configure UAV UE with indication on whether reception in the NTZ is allowed.)

**Principle5-2:** NTZ information may be pre-configured in the UAV UE, provided/updated by the PCF (by the PCF itself or from the AF), provided/updated by the AF, and provided/updated by the AMF.

**Principle5-3:** UAV UEs supporting NTZ enforces NTZ based on e.g., NTZ information.

**Principle5-4:** How to ensure UAV UEs not supporting 3GPP Rel-19 NTZ mechanism can be achieved by the existing 3GPP mechanisms (e.g. Mobility Restrictions as specified in TS 23.501 and TS 23.401).

**Principle5-5:** Whether RAN nodes need NTZ information for NTZ enforcement is depending on RAN decision. If needed, how to configure RAN nodes with NTZ information will be decided by coordination with the relevant RAN WGs.

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| **10 – LG Electronics France**  Some clarification on the **Additional Assumption** posted above:  **Additional Assumption:** It is assumed that there is no UAV UE that transmits or attempts to transmit in  the NTZ due to NTZ enforcement. |
| **11 – Huawei Technologies France**  We share the view from Deutsche Telekom.  On the comment from DT ”Any RAN impact would automatically place the operator in a position of responsibility to enforce NTZs, even if conceptually this is a UE issue, as it is the UE which is entering the NTZ.”  We propose the following principle:   1. no new impact on the network to monitor or control the UAV bevavior to comply NTZ. The reason isECC requirement on operator network is not clear on this aspect. 2. solution#8 can be accpetable because it re-uses R15 feature ”Non-Allowed Area” from the networkview, so it has no standard impact. |

3 Any Other Comments?

**Feedback Form 6: Q6: If there are any other comments you would like to provide, please provide them.**

# 4 Summary of the 1st round NWM discussion

## 4.1 KI#1 (NEF service enhancements) - Flight planning/monitoring

**Table 2:**

|  |  |
| --- | --- |
| # of companies that provided feedback on Q#1 | 6companies(Qualcomm, CATT,Ericsson, Samsung,  LG Electronics, Huawei) |

|  |  |
| --- | --- |
| **Solution#1:** Support Pre-Mission Planning and In-  Mission Monitoring Flight | 1. **Procedure for NEF Assist Pre-mission Flight**   **Planning**  Mostly supported.  Questions for clarification were provided about   * + what the output enhancement for Movement Behaviour Analytics   + what information NEF can generate as assistance information for pre-mission flight planning.   Comment was provided that the procedure should focus on UAV while excluding UAV-C.   1. **Procedure for NEF Assist In-mission Flight**   **Monitoring**  Mostly supported.  Question was raised regarding how the NEF can determine whether the UAV is flight in right route. Then, alternative means for In-mission Flight Monitoring was provided that USS/UTM can subscribe to the network for UAV location periodically, and based on that to determine e.g. whether UAV is flight in right route / any deviation happened.  Comment was provided that the procedure should focus on UAV while excluding UAV-C.  **Question derived for the 2nd round NWM discussion »**  - Do you agree to select Solution#1 as baseline for normative work? (Questions for clarification and comment provided at the 1st round NWM discussion need to be addressed during the study conclusion and normative phase) |
| **Solution#2:** UAV flight path deviation exposure | This solution has little support and concern. Suggestion was provided that this solution can be used for Solution#1. |
| **Solution#3:** UAV flight planning and monitoring | Mostly supported.  Suggestion was provided that this solution can be used for Solution#1.  **Question derived for the 2nd round NWM discussion »**  - Do you agree to select Solution#3 as baseline for normative work? |

## 4.2 KI#1 (NEF service enhancements) - Multiple USS

**Table 3:**

|  |  |
| --- | --- |
| # of companies that provided feedback on Q#2 | 8 companies (Qualcomm, InterDigital, CATT, Ericsson, China Mobile, Samsung, LG Electronics,  Huawei) |
| **Solution#10:** Enabling 5GC support for multiple  USS serving different geographical areas | Mostly supported.  **Question derived for the 2nd round NWM discussion »**  - Do you agree to select Solution#10 as baseline for normative work? |
| **Solution#11:** Multi-USS Support in 5GC | This solution has little support. |
| **Aspect on CAA-level UAV ID** | Comment was provided that aspect on CAA-level UAV ID due to change of USS needs to be addressed during normative phase.  **Question derived for the 2nd round NWM discussion »**  - Do you agree to address aspect on CAA-level UAV ID due to change of USS during normative phase? |

## 4.3 KI#1 (NEF service enhancements) - C2 reliability

**Table 4:**

|  |  |
| --- | --- |
| # of companies that provided feedback on Q#3 | 6companies(Qualcomm, CATT,Ericsson, Samsung,  LG Electronics, Huawei) |
| **Solution#12:** Support redundant connections for C2 communication reliability | Mostly supported.  Suggestion was provided that it is recommended to capture this solution as Informative Annex in TS 23.256.  **Question derived for the 2nd round NWM discussion »**  - Do you agree to capture Solution#12 principles usage for C2 reliability as Informative Annex in TS  23.256? |
| **Solution#13:** Enhancement of NEF services for C2 communication assistance information | This solution has little support and concern. |
| **Solution#14:** C2 Communication Reliability with  Redundant User Plane Paths | Mostly supported.  Suggestion was provided that it is recommended to capture this solution as Informative Annex in TS 23.256.  Comment was provided that this solution can be implementation guidelines that do not require specification work if followed as is.  Question for clarification was provided about whether this solution has no normative impact. So this needs more time to analyze further, may be by 2nd round.  **Question derived for the 2nd round NWM discussion »**  - Do you agree to capture Solution#14 as basis for use for C2 reliability in an Informative Annex in TS  23.256? |

## 4.4 KI#2 (NW-assisted/ground-based DAA)

**Table 5:**

|  |  |
| --- | --- |
| # of companies that provided feedback on Q#4 | 5 companies (Qualcomm, CATT, Ericsson, LG Electronics, Huawei) |
| **Solution#4:** Network-supported Tactical Deconfliction | This solution has little support and concern. |
| **Solution#5:** Support Network-assisted DAA with  Existing 5GC Services | Mostly supported.  **Question derived for the 2nd round NWM discussion »**  - Do you agree to select Solution#5 as basis for normative work? |
| **Solution#6:** UTM requests information used for  DAA | Mostly supported.  Suggestion was provided that this solution can be merged into Solution#5 after removing the content about NEF request service from 5G NFs directly.  **Question derived for the 2nd round NWM discussion »**  - Do you agree to select Solution#6 as basis for normative work? (Suggestion about merging into Solution#5 provided at the 1st round NWM discussion need to be addressed during normative phase) |

## 4.5 KI#3 (NTZ)

**Table 6:**

|  |  |
| --- | --- |
| # of companies that provided feedback on Q#5 | 10 companies (Deutsche Telekom, Lenovo, Samsung, Qualcomm, InterDigital, CATT, Ericsson, China Mobile, LG Electronics, Huawei)  *\* Ericsson comment: Need to analyse further so may notbeabletoprovidedetailedviewsbyfirstdeadline.* |

|  |  |
| --- | --- |
| **NTZ enforcement by UE** | Significantly supported.  The following aspects were mainly mentioned.   * NTZ information: geographical area in form of coordinates (i.e. latitude, longitude, and altitude limits of the NTZ) and restricted frequency band(s)   Whether to configure UAV UE with indication on whether reception in the NTZ is allowed as part of NTZ information?  ○   * Means for provisioning/configuring NTZ information to UAV UE, e.g., pre-configured   1. from PCF (by the PCF itself or from the   ○  AF)  ○ from AF  ○ from AMF (via OAM, local configuration, from USS and then UAS NF/NEF, from UDM, from PCF)   * AMF may provide UAV UE with enhanced service restrictions in the form of a Restricted Transmission Area (similarly to non-allowed area) composed of one or more TAs where the UE is not allowed any transmission (NOTE: this is useful when the NTZ is very large and may encompass multiple cells or TAs). * UAV UE behavior, e.g., not select/reselect any restricted cells.   1. not attempt to register to the network in the NTZ.   ○  ○ not performing cell search.  ○ not performing any radio transmission in the frequency bands corresponding to the  NTZ.  registration update before entering the NTZ with an indication that the UAV UE is about to enter an NTZ.  ○  **Questions derived for the 2nd round NWM discussion »**  - Do you believe 3GPP only develops feature as per |
| 2 | 4ECC ruling or shall 3GPP system be able to ensure NTZ requirements does not cause any issues outside |

of ECC ruling areas (i.e. non CEPT regions)?

|  |  |
| --- | --- |
| **NTZ enforcement by CN** | The following aspects were mainly mentioned.   * provisioning/configuring NTZ information to   AMF, e.g. via OAM, local configuration, from USS and then UAS NF/NEF, from UDM, from PCF.   * AMF behavior, e.g.,   ○  ○  ensures that UAV UE does not try to register with network.  For connected UAV UEs in NTZ, 5GC initiates resource release.  **Question derived for the 2nd round NWM discussion »**  - Does NTZ enforcement by CN require only to handle UAV UEs not supporting 3GPP Rel-19 NTZ mechanismorcanworkalsoforUAVUEssupporting 3GPP Rel-19 NTZ mechanism, e.g., when the latest NTZ information is not yet available to the UAV UE? |
| **NTZ enforcement by RAN** | Opinion and suggestion were provided that this aspect is depending on RAN decision, so sending an LS to RAN/RAN2/RAN3 is needed with the principles SA2 can agree to and asking for guidance.  **Question derived for the 2nd round NWM discussion »**  - Do you agree to send an LS to RAN2 (RAN3, RAN CCed) to get feedback on NTZ enforcement solution(s) and assumptions of SA2 work, and potential open issues from RAN WGs? |

|  |  |  |  |
| --- | --- | --- | --- |
| **Backward compatibility issue (i.e. Whether and how to support NTZ enforcement for UAV UEs not supporting 3GPP Rel-19 NTZ mechanism)** | | Some companies’ opinion is that there is no backwardcompatibilityissuewithassumptionthatifthere is regulatory obligation, it is feasible to realize such functionality as long as we agree on clear, simple principles + normative phase.  Some companies’ opinion is that network has to handle UAV UEs not supporting 3GPP Rel-19 NTZ mechanism to support NTZ enforcement or UAV UEs not supporting 3GPP Rel-19 NTZ mechanism can handle NTZ enforcement. The following mechanisms were mentioned:   * using AM policies, e.g. RSFP index. ● attempt to avoid handing over a UAV UE to a cell corresponding to an NTZ. * When the UAV UE detects it is about to enter an NTZ area, the UAV UE deactivates the AS layer or ceases to transmit any data when entering an area corresponding to the NTZ, based on the NTZ information pre-configured via application layer mechanisms.   Some companies’ opinion is that network has to handle UAV UEs not supporting 3GPP Rel-19 NTZ mechanism to support NTZ enforcement. The following mechanisms were mentioned:  **Question derived for the 2nd round NWM discussion »**  - Please provide way forward suggestion on this topic. | |
| **Additional Assumption** | | Additional Assumption was proposed as below:   * It is assumed that there is no UAV UE that transmits or attempts to transmit in the NTZ due to NTZ enforcement.   The proposed assumption can be refined further as below:   * It is assumed that there is no UAV UE that transmits or attempts to transmit in the restrictedfrequencies andheight definedby NTZ due to NTZ enforcement. But UAV UEs can transmit/receive normally outside of these restrictions, as indicatedby the LS response from ETSI TC MSG/TFES. * NTZ information is assumed not static.   **Questions derived for the 2nd round NWM discussion »**   * Do you agree with the above assumptions? * Do you think there may be UAV UE that transmits or attempts to transmit in the restricted frequencies while in NTZ, for example, UAV UE not supporting 3GPP Rel-19 NTZ mechanism or UAV UE that the latest NTZ information is not yet available, sends Registration Request in the NTZ? | |
| 5 | Collecting companies view to be considered for conclusions (2nd round) | |
| 5.1 | KI#1 (NEF service enhancements) - Flight planning/monitoring | |
| 5.1.1 | Companies View for KI#1 - Flight planning/monitoring  **Feedback Form 7: Q1: Do you agree to select Solution#1 as baseline for normative work? (Questions for clarification and comment provided at the 1st round NWM discussion need to be addressed during the study conclusion and normative phase)** | |

**1 – Ericsson LM** Yes agree to use as baseline.

|  |
| --- |
| **2 – LG Electronics France** Agree. |
| **3 – CATT**  Agree |
| **4 – China Mobile Com. Corporation** Agree. |
| **5 – Samsung R&D Institute India**  Agree but additional aspect like USS/UTM triggered pre-flight assistance information should be considered for UAV/UAVs without having any PDU session for those UAVs. |
| **6 – QUALCOMM Europe Inc. - Italy**  Yes, but there is no need to consider scenarios where the NEF determines whether the UAV is flying the correct route. |

**Feedback Form 8: Q2: Do you agree to select Solution#3 as baseline for normative work?**

|  |
| --- |
| **1 – Ericsson LM**  No, though some of the aspects from Solution#3 (in particular the use of QoS Sustainability Analytics) can be used to complement Sol#1. |
| **2 – LG Electronics France** Agree. |
| **3 – CATT**  Agree |
| **4 – Samsung R&D Institute India**  Agree with Ericsson that QoS sustainability Analytics can be added as flight assistance information to the  Solution 1 |
| **5 – QUALCOMM Europe Inc. - Italy**  Not for the entire solution, only roll into solution #1 the relevant aspects (QoS) |

## 5.2 KI#1 (NEF service enhancements) - Multiple USS

### 5.2.1 Companies View for KI#1 - Multiple USS

**Feedback Form 9: Q3: Do you agree to select Solution#10 as baseline for normative work?**

|  |
| --- |
| **1 – Ericsson LM**  Yes |
| **2 – LG Electronics France** Agree. |
| **3 – CATT**  Agree |
| **4 – China Mobile Com. Corporation**  The solution should cover all the scenarios, subject to main principles as described in the procedures of solution#10 are as follows:   * The serving USS subscribes to UAV location reporting events to AMF/GMLC/LMF; * If the serving USS/UTM detects that the UAV has left or is about to leave its service area, the USS/UTM may determine to trigger USS/UTM changeover to a new USS/UTM to serve the UAV; * The serving USS/UTM triggers the process of changeover of the UAV to the new USS/UTM (e.g. to assist in transferring the UAV context including e.g. subscribed events, UAS NF address, etc. how this is performed is out of 3GPP scope). |
| **5 – InterDigital Communications**  Per key Issue #1, the scenario of multiple USS serving different geographical area corresponding to the UAV flight path.  Therefore, multiple USS scenario can be supported via either Pre-mission flight planning or in-mission flight monitoring for UAVs.  The solution #10 is handling multiple USS with in-mission flight monitoring for UAVs. It is Ok to consider sol#10 as baseline for the scenario multiple USS supports with in-mission flight monitoring for UAVs.  But, we believe the key Issue also needs to address support multiple USS without in-mission flight monitoring for UAVs (e.g., based on pre-mission flight planning.). |
| **6 – Samsung R&D Institute India**  No, particularly multi-USS has no relation to flight assistance information. The Rel 18 UAV features should work seamlessly in the multi-USS deployment. In our view for this item, solution principle should be taken instead of referring to any specific solution as some aspect of both solution addresses the requirement. |

#### 7 – QUALCOMM Europe Inc. - Italy

Yes but we need to ensure the following is covered:

* triggering of the USS change is from source USS or UAS NF
* before the UAV can use the new USS, a complete successful UUAA procedure with authentication needs to be performed between the UAV and the new USS

**Feedback Form 10: Q4: Do you agree to address aspect on CAA-level UAV ID due to change of USS during normative phase?**

|  |
| --- |
| **1 – Ericsson LM**  Yes |
| **2 – LG Electronics France** Agree. |
| **3 – CATT**  Agree |
| **4 – InterDigital Communications** agee |
| **5 – Samsung R&D Institute India**  We didn’t understand how it was concluded that solution 11 has little support as some aspects are proposed by most of the companies. Solution 11 does not propose anything related to CAA-Level-UAV-ID, not sure how this question derived again for round 2 from this solution.  In our view multi-USS is a deployment where all the existing and Rel 19 UAV feature should work starting from the UUAA procedure. |
| **6 – QUALCOMM Europe Inc. - Italy**  Yes we can address aspects, but what aspects? the question is way too vague. UUAA allows to issue a new CAA\_Level UAV ID everytime there is a re-authentication. If the new USS decides a new CAA Level UAV ID is needed, what is new? the new USS will issue a new one during UUAA. |

## 5.3 KI#1 (NEF service enhancements) - C2 reliability

### 5.3.1 Companies View for KI#1 - C2 reliability

**Feedback Form 11: Q5: Do you agree to capture Solution#12 principles usage for C2 reliability as Informative Annex in TS 23.256?**

|  |
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| **1 – Futurewei Technologies**  Agree to capture #12 principles usage as informative annex in TS23.256. But the information synchronization between UAV and UTM/USS in the application level regarding supporting this redundant C2 connections is needed, which can have impact on the normative part of TS23.256 related to application-level information exchange, e.g. C2 payload content needs to be improved for C2 redundancy as indicated in Solution #2. |
| **2 – Ericsson LM**  Solution#14ismoresuitableandindeedensuresC2reliabilityincaseoffailure, whereasSoln#12onlydeals with reliability within certain parts, but we are not opposed to further looking into Informative description reusing Soln#12 |
| **3 – LG Electronics France**  We are fine to capture Solution#12 principles usage for C2 reliability as Informative Annex in TS 23.256. We don’t accept to capture Solution#12 as normative part/texts because this solution has only application layer impact that is out of SA2 scope. |
| **4 – CATT**  Agree to capture this solution as informative Annex. |
| **5 – Samsung R&D Institute India** Agree to capture as informative Annex. |
| **6 – QUALCOMM Europe Inc. - Italy**  we maintain the comment that the solution addresses a minute aspect of C2 reliability that is really irrelevant in real life cases. we see no value at all in capturing this solution |

**Feedback Form 12: Q6: Do you agree to capture Solution#14 as basis for use for C2 reliability in an Informative Annex in TS 23.256?**

#### 1 – Futurewei Technologies

can catch solution #14 principles usage in the informative Annex in TS23.256 as another C2 reliability methods but not as the basis for C2 reliability, before the EN on the UAV ID being addressed. Using single UAV ID or two UAV IDs for a single UAV with 2 SIMs may have normative impact, because existing solutions in TS23.235 are based on the assumption that UTM see one UAV ID per UAV which has one SIM.

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| **2 – Ericsson LM**  Yes, but with the assumption that no normative work is feasible so if any, like currently done in 23.501, informative Annex approach would be possible |
| **3 – LG Electronics France**  We are fine to capture Solution#14 as basis for use for C2 reliability in an Informative Annex in TS 23.256. We don’t accept to capture Solution#14 as normative part/texts because the mechanism itself about redundant user plane paths reused for Solution#14 is described in Informative Annex of TS 23.501. |
| **4 – CATT**  Agree to capture this solution as informative Annex. |
| **5 – Samsung R&D Institute India** Agree to capture as informative Annex. |
| **6 – QUALCOMM Europe Inc. - Italy**  yes |

## 5.4 KI#2 (NW-assisted/ground-based DAA)

### 5.4.1 Companies View for KI#2

**Feedback Form 13: Q7: Do you agree to select Solution#5 as basis for normative work?**

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| **1 – Ericsson LM**  Yes, Solution#5 can be considered as the baseline for the structure of Network-assisted DAA. Solution#6 can be merged into Solution#5 after removing the content about NEF request service from 5G NFs directly. |
| **2 – LG Electronics France** Agree. |
| **3 – CATT**  Agree |

#### 4 – QUALCOMM Europe Inc. - Italy

Yes, but we need to address some relevant aspects raised in other solutions, like the ability to consider input from UAVs (e.g. UAVs sending A2X message content to USS) or possible ground sensors (e.g. ground A2X receivers) to create a real situational awareness. Otherwise, this will be another paper solution with no market value. I recommend companies to read up a bit on the real needs from regulators.

**Feedback Form 14: Q8: Do you agree to select Solution#6 as basis for normative work? (Suggestion about merging into Solution#5 provided at the 1st round NWM discussion need to be addressed during normative phase)**

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| **1 – Ericsson LM**  No, we believe Soln#5 is more complete and to be used as the solution with potential merging of Soln#6 in the conclusion phase |
| **2 – LG Electronics France**  Agree. Anyhow, merging Solution#6 into Solution#5 seems appropriate. |
| **3 – CATT**  Agree. The merging can be addressed during normative phase. |
| **4 – QUALCOMM Europe Inc. - Italy**  Sol. #6 should be considered only if merged into solution 5 |

## 5.5 KI#3 (NTZ)

### 5.5.1 Companies View for KI#3

**Feedback Form 15: Q9: Do you believe 3GPP only develops feature as per ECC ruling or shall 3GPP system be able to ensure NTZ requirements does not cause any issues outside of ECC ruling areas (i.e. non CEPT regions)?**

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| **1 – T-Mobile Austria GmbH**  [Deutsche Telekom]: We should defintiely **not** work on regulatory features without a clear requirement of  what is the regulatory requirement. We would have grave concerns to start work on hypothetical regulatory requirements. If additional regulatory requirements come, we can then act accordingly, as we have always done. |

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| **2 – Ericsson LM**  3GPP provides regulatory requirements together with ensuring where there is no similar requirement, deployment of features do not adversely impact operator’s network and same needs to be done here where non-CEPT countries may be able to enable restriction of zones generally. |
| **3 – LG Electronics France**  3GPP receivedNTZ related input/request only from ETSI, so NTZ requirements are only related to ECC ruling at this stage. So, we can develop solutions for NTZ enforcement per ECC ruling. Anyhow, as biz as usual, we will be able to specify NTZ related feature generic. |
| **4 – CATT**  CATT: Based on the LS reply from ETSI MSG TFES as followed, we think 3GPP system should be able to ensure NTZ requirement does not cause any issues in the NTZ zones.  “In NTZs, aerial UEs shall not transmit in the geographical area corresponding to the NTZ and in the protected Harmonised MFCN band (or part of it) corresponding to the NTZ, independent of the overlay cell(s) size. In case of cell sizes larger than the geographical area of the NTZ, geographical regions outside the NTZ(s) may be utilized and shall have no transmission restrictions imposed in accordance with the defined NTZ. While in NTZ, the aerial UE is still allowed to transmit and receive in all other supported bands, which are not part of the NTZ restriction.”  So we don’t see the definite requirement related to NTZ enforcement in the area outside of ECC ruling areas. |
| **5 – China Mobile Com. Corporation**  We think universality is one of the important preconditions before we involve one new feature into 3GPP network. At least, we should ensure the new feature will not cause any issue for other areas besides the area of the feature-requirement. |
| **6 – InterDigital Communications**  We believe 3GPP should consider globally applicable requirements. Therefore, the solution should be generic. |
| **7 – Samsung R&D Institute India**  Agree with InterDigital |
| **8 – Motorola Mobile Com Technology**  We support specifying a generic solution that can be used to support other/future regulatory requirements.  However, the solution selected should not override the ECC requirements. |

#### 9 – QUALCOMM Europe Inc. - Italy

We support universality when the requirements of other regions are known and made available. 3GPP has received only one set of requirements, the ECC one via ETSI TFES. It has been asked multiple times if there are other published requirements, and none were provided (just statements that there are). Thus, we should focus on the actual concrete requirements and stop wasting time on potential requirements that no one can produce. THus, focus on ECC requirements and TFES harmonized standard.

**Feedback Form 16: Q10: Which means do you support for provisioning/configuring NTZ information to UAV UE? (You can indicate means you don’t support/prefer if you support/prefer most of them) Means for provisioning/configuring NTZ information to UAV UE, e.g., pre-configured; from PCF (by the PCF itself or from the AF); from AF; from AMF (via OAM, local configuration, from USS and then UAS NF/NEF, from UDM, from PCF).**

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| **1 – Ericsson LM**  We may require multiple options including preconfiguration in the UAV, AMF, (if so determined by RAN ) and from USS via NEF/UASNF - PCF-AMF (node level). Further analysis and input discussion maybe required |
| **2 – LG Electronics France**  We don’t support that UDM stores and provides NTZ information to AMF. We can support other means. |
| **3 – CATT**  We support AMF provides the NTZ information to UAV UE. Considering the NTZ information is nationally determined information which does not change dynamically, so we prefer the AMF obtain the NTZ information from OAM. |
| **4 – InterDigital Communications**  We support AMF provides the NTZ information to UAV UE. But, as AMF is not the source of NTZ information, the information should be provisioned from USS and AMF receives it via UAS NF. |
| **5 – Samsung R&D Institute India**  We support NTZ information is provided to UE and NG-ARN from AMF but availability at AMF should be made as part of confirmation from USS -> UASNF -> UDM >AMF. Also, we are ok to have local NTZ configuration in AMF or configuring from OAM, but we are not ok to bring AM-PCF to the call flow. |
| **6 – Motorola Mobile Com Technology**  Share the same view as Ericsson. Option to use depends on many factors such as the NTZ zone profile (e.g. NTZ zone is enforced at specific altitude, whether the UE can receive transmission in specific NTZ zone etc). Further discussion is needed. |

#### 7 – QUALCOMM Europe Inc. - Italy

We need to support multiple mechanisms: pre-configuration (or configuration at application level for devices not supporting other mechanisms), by PCF, by AF, and solutions where AMF can provide new service restrictions to supporting UEs

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**Feedback Form 17: Q11: Does NTZ enforcement by CN require only to handle UAV UEs not supporting 3GPP Rel-19 NTZ mechanism or can work also for UAV UEs supporting 3GPP Rel-19 NTZ mechanism, e.g., when the latest NTZ information is not yet available to the UAV UE?**

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| **1 – Ericsson LM**  Both UAVs not supporting rel-19 and UAVs without latest/up to date NTZ need to be handled. |
| **2 – LG Electronics France**  We think that NTZ enforcement by CN require only to handle UAV UEs not supporting 3GPP Rel-19 NTZ mechanism.  We are not sure about the case when the latest NTZ information is not yet available to the UAV UE although NTZ information is assumed not static (i.e. whether this case really exists, so whether we need to deal with it).   * For the case that certain area belonging to NTZ is changed to non-NTZ, UAV UEs in the area can be updated with the latest NTZ information by the network. * On the other hand, for the case that certain area not belonging to NTZ is changed to NTZ, that transition can/should be made during the period/hour that there is no UAV UE in the area OR air traffic control/USS can/should make sure that no UAV UE flies in the area during the transition period/hour (e.g. by using pre-mission flight planning). |
| **3 – CATT**  We think both scenarios should be supported. |
| **4 – China Mobile Com. Corporation**  We think the both scenarios should be classified as the the UEs don’t follow NTZ setting, the CN should take action for these UEs. |
| **5 – InterDigital Communications**  NTZ enforcement by CN should cover all UAVs. Not only because that R19 UAVs may not have latest NTZ information, but also some actions (e.g. release or handover connected UAVs) may be required.  CN/RAN may also need to detect non-compliant UAVs and report them. |
| **6 – Samsung R&D Institute India**  CN should provision with updated NTZ information and enforce for both UAV supporting NTZ feature and not supporting NTZ feature because it may happen that for supporting UAV also, some request network may receive within NTZ because of not having updated NTZ information available. |
| **7 – Motorola Mobile Com Technology**  Both scenarios should be in scope of the Rel 19 work |
| **8 – QUALCOMM Europe Inc. - Italy**  Both |

**Feedback Form 18: Q12: Do you agree to send an LS to RAN2 (RAN3, RAN CCed) to get feedback on NTZ enforcement solution(s) and assumptions of SA2 work, and potential open issues from RAN WGs?**

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| **1 – T-Mobile Austria GmbH**  [Deutsche Telekom]: Yes. We should definitely do this. |
| **2 – Ericsson LM**  Yes, we must do so. |
| **3 – LG Electronics France** Agree. |
| **4 – CATT**  Agree. |
| **5 – China Mobile Com. Corporation**  Yes, we should align the definition and understanding within 3GPP WGs. |
| **6 – InterDigital Communications**  We are not against sending a LS but doubtful any meaningful feedback can be obtained. |
| **7 – Samsung R&D Institute India**  Agree |
| **8 – Motorola Mobile Com Technology**  Yes |
| **9 – QUALCOMM Europe Inc. - Italy**  An LS needs to be sent, but not to ask for feedback. RAN has already indicated that they have no TUs allocated for this, thus they cannot have sufficient time to have a technical discussion and provide feedback. What the LS needs to say is that we need them to do some technical work on this, and that we will align our specs once they have conclusions. |

**Feedback Form 19: Q13: Please provide way forward suggestion on Backward compatibility issue (i.e. Whether and how to support NTZ enforcement for UAV UEs not supporting 3GPP Rel-19 NTZ mechanism).**

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| **1 – Ericsson LM**  We need to work together with RAN, maybe something we need to give more time and wait for additional feedback and also invite input to May SA2#163? |
| **2 – LG Electronics France**  How to ensure UAV UEs not supporting 3GPP Rel-19 NTZ mechanism can be achieved by the existing 3GPP mechanisms (e.g. Mobility Restrictions as specified in TS 23.501 and TS 23.401). No additional normative work is needed to support NTZ enforcement for UAV UEs not supporting 3GPP Rel-19 NTZ mechanism because these UAV UEs are legacy UEs. |
| **3 – CATT**  To support backward compatibility issue, sol#8 can be used as a baseline for normative work. |
| **4 – China Mobile Com. Corporation**  Yes, we should align the definition and understanding within 3GPP WGs. |
| **5 – China Mobile Com. Corporation**  Please ignore the previous answer.  In our view, we can’t skip this scenario with simply adding the assumption to ignore the possible risk for the network. There is a need for the network to support the effective of the NTZ setting if we involve NTZ into 3GPP. |
| **6 – Samsung R&D Institute India**  Network must ensure not supporting UAVs does not transmit within the NTZ area by drifting the UAV out of the NTZ area and for this existing 3GPP procedure can be enhanced, particularly to address the height restriction as part of NTZ information |
| **7 – Motorola Mobile Com Technology**  Existing mechanisms at AMF and PCF can be used to avoid pre-Release 19 UAVs to transmit in NTZ zone. However, it is required that the network is aware of the NTZ zone configuration (e.g. based on USS providing NTZ info to the network) |
| **8 – QUALCOMM Europe Inc. - Italy**  Waiting for RAN to provide feedback by May meeting is a pipe dream, they have no TUs to discuss this and they told us already very clearly. SA2 needs to proceed and make assumptions, and once RAN2 has done its work we may need to revise our specs.  We believe we need to consider a solution with 3 components: (i) pre-configuration (or app layer configuration) of UAVs (supporting and non-supporting Rel. 19), (ii) enforcement mechanisms by RAN (probably just Rel. 19 UEs but they may have solutions that help for Rel. 18 also), and CN enforcement mechanisms |

**Feedback Form 20: Q14: Do you agree with the following assumptions? 1) It is assumed that there is no UAV UE that transmits or attempts to transmit in the restricted frequencies and height defined by NTZ due to NTZ enforcement. But UAV UEs can transmit/receive normally outside of these restrictions, as indicated by the LS response from ETSI TC MSG/TFES. 2) NTZ information is assumed not static.**

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| **1 – T-Mobile Austria GmbH**  [Deutsche Telekom]: Need to **add** location (I assume it was forgotten?): *in the restricted frequencies****,***  ***locations*** *and height defined by NTZ due to NTZ enforcement*. |
| **2 – Ericsson LM**  Location, restricted frequences and height at least |
| **3 – Ericsson LM**  Yes, the solution needs to have mechanisms on how to update the NTZ information whenever required, especially, considering that a UAV can fly over area served by different USS and each USS might have NTZ info for its specific region/service area. |
| **4 – LG Electronics France**  We agree on the both assumptions. That is, after NTZ is enforced (e.g. by UAV UE, by CN, by RAN), there will be no UAV UE that transmits or attempts to transmit in the restricted frequencies and height defined by NTZ.  As Deutsche Telekom commented, in Assumption 1), ”locations” can be added or ”height” can be modified to ”areas including height” for clarification. |
| **5 – CATT**  Agree. For the second point, we think that the NTZ information is not static and will not change dynamically. |
| **6 – China Mobile Com. Corporation**  We have concern about the assumption as it only mentioned UAV UE without the clear classify whether the UE is support NTZ or not. The NTZ is the mandatory requirement for all UAV UEs supporting different releases. With this assumption, we must align this requirement is mandatory for all the UAV UE related Releases. |
| **7 – InterDigital Communications**  For 1), agree. For 2), agree. At least, they are not permanent and subject to changes. |
| **8 – Samsung R&D Institute India**   1. Not agree because non supporting UAV may transmit. Also supporting UAV without having updated NTZ information may transmit but network must ensure they should not continue to transmit while being inside the NTZ. 2. Agree because the NTZ information like area or height or frequency can be updated by USS to 5G CN. hence it is dynamic and not static. |
| **9 – Motorola Mobile Com Technology**  Agree to 1) and 2) |
| **10 – QUALCOMM Europe Inc. - Italy**  Agree with (1).  (2) is partially true: they are not dynamic to the point to require per UE or per mission provisioning to UE and CN, but they may still change overtime. |

**Feedback Form 21: Q15: Do you think there may be UAV UE thattransmitsorattemptstotransmitintherestrictedfrequencies while in NTZ, for example, UAV UE not supporting 3GPP Rel-19 NTZ mechanism or UAV UE that the latest NTZ information is not yet available, sends Registration Request in the NTZ?**

#### 1 – T-Mobile Austria GmbH

[Deutsche Telekom]: The 3GPP specification does not cover every possible UE misbehavior. There is no need to cover in the specification the case of a misconfigured, wrongly implemented and/or misbehaving UE. NTZ support capability would be OK to have (e.g. to reject UEs with UAV subscription not supporting

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| NTZs). |
| **2 – Ericsson LM**  As this is potentially can lead to serious consequences in real life operations, we believe need to take some actions to safeguard the network and potential consequences. |
| **3 – LG Electronics France**  How to ensure UAV UEs not supporting 3GPP Rel-19 NTZ mechanism can be achieved by the existing 3GPP mechanisms (e.g. Mobility Restrictions as specified in TS 23.501 and TS 23.401).  We are not sure about the case when the latest NTZ information is not yet available to the UAV UE (Please see our feedback on Q11 of the 2nd round NWM). |
| **4 – CATT**  We share the similar view as Ericsson. |
| **5 – China Mobile Com. Corporation**  UAV UE not supporting 3GPP Rel-19 NTZ mechanism is not rare case, even there also be the scenario that the Rel-19 supporting UAV UE perform wrongly when the latest NTZ information is not yet available in it. Same to Q11 and Q13, if we don’t consider the backward compatibility issue, we have some concern of network security and responsibility referring to NTZ. |
| **6 – InterDigital Communications**  We think it is possible scenario. (There may be R19 UAVs but non-NTZ compliant.) |
| **7 – Samsung R&D Institute India**  Yes |
| **8 – Motorola Mobile Com Technology**  Yes but this would be abnormal UE behaviour especially if the UAV is Rel-19 compliant with NTZ configuration. |
| **9 – QUALCOMM Europe Inc. - Italy**  No, there shall not be any because this would be a violation of strong government requirements, thus we need clear mechanisms to ensure this does not happen. A UAV UE that, even just in extreme circumstances, may transmit in an NTZ will not pass certification (aviation certification, not 3GPP certification). Most comments above focus only on 3GPP but these are UAV UEs that require aviation certification also. |

# 6 Summary of the 2nd round NWM discussion

**Total 10 companies provided feedbacks (listed in alphabetical order) :**

**CATT, China Mobile, Deutsche Telekom,** **Ericsson, Futurewei, InterDigital, Lenovo, LG Electronics, Qualcomm, Samsung**

## 6.1 KI#1 (NEF service enhancements) - Flight planning/monitoring

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| Q1: Do you agree to select Solution#1 as baseline for normative work? (Questions for clarification and comment provided at the 1st round NWM discussion need to be addressed during the study conclusion and normative phase) |
| * **Yes: 6 companies (Ericsson, LG Electronics, CATT, China Mobile, Samsung, Qualcomm)**   + [Samsung] additional aspect like USS/UTM triggered pre-flight assistance information should be considered for UAV/UAVs without having any PDU session for those UAVs.   + [Qualcomm] there is no need to consider scenarios where the NEF determines whether the UAV is flying the correct route. |

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| Q2: Do you agree to select Solution#3 as baseline for normative work? |
| * **Solution#3 needs to be added as flight assistance information to Solution#1: 3 companies (Ericsson, Samsung, Qualcomm)** * **Yes: 2 companies (LG Electronics, CATT)** |

## 6.2 KI#1 (NEF service enhancements) - Multiple USS

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| Q3: Do you agree to select Solution#10 as baseline for normative work? |
| * **Yes: 6 companies (Ericsson, LG Electronics, CATT, China Mobile, InterDigital, Qualcomm)**   + [China Mobile] The solution should cover all the scenarios, subject to main principles as described in the procedures of solution#10.   + [InterDigital] It is Ok to consider sol#10 as baseline for the scenario multiple USS supports with in-mission flight monitoring for UAVs. But, we believe the key Issue also needs to address support multiple USS without in-mission flight monitoring for UAVs (e.g., based on pre-mission flight planning.).   + [Qualcomm] we need to ensure the following is covered: triggering of the USS change is from source USS or UAS NF; before the UAV can use the new USS, a complete successful UUAA procedure with authentication needs to be performed between the UAV and the new USS. * **No: 1 company (Samsung)**   + [Samsung] The Rel 18 UAV features should work seamlessly in the multi-USS deployment. In our view for this item, solution principle should be taken instead of referring to any specific solution as some aspect of both solution addresses the requirement. |

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| Q4: Do you agree to address aspect on CAA-level UAV ID due to change of USS during normative phase? |
| * **Yes: 5 companies (Ericsson, LG Electronics, CATT, InterDigital, Qualcomm)**   + [Qualcomm] what aspects? the question is way too vague. UUAA allows to issue a new CAA\_Level UAV ID everytime there is a re-authentication. If the new USS decides a new CAA Level UAV ID is needed, what is new? the new USS will issue a new one during UUAA. * **Comment on Solution#11 (seems concern on the 1st round discussion's summary related to Solution#11): 1 company (Samsung)**   + [Samsung] We didn't understand how it was concluded that solution 11 has little support as some aspects are proposed by most of the companies. Solution 11 does not propose anything related to CAA-Level-UAV-ID, not sure how this question derived again for round 2 from this solution. In our view multi-USS is a deployment where all the existing and Rel 19 UAV feature should work starting from the UUAA procedure. |

## 6.3 KI#1 (NEF service enhancements) - C2 reliability

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| Q5: Do you agree to capture Solution#12 principles usage for C2 reliability as Informative Annex in TS 23.256? |
| * **Yes: 5 companies (Futurewei, Ericsson, LG Electronics, CATT, Samsung)**   + [Futurewei] the information synchronization between UAV and UTM/USS in the application level regarding supporting this redundant C2 connections is needed, which can have impact on the normative part of TS23.256.   + [LGE] We don't accept to capture Solution#12 as normative part/texts because this solution has only application layer impact that is out of SA2 scope. * **No: 1 company (Qualcomm)** |

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| Q6: Do you agree to capture Solution#14 as basis for use for C2 reliability in an Informative Annex in TS 23.256? |
| * **Yes: 6 companies (Futurewei, Ericsson, LG Electronics, CATT, Samsung, Qualcomm)**   + [Futurewei] can catch solution #14 principles usage in the informative Annex in TS23.256 as another C2 reliability methods but not as the basis for C2 reliability, before the EN on the UAV ID being addressed. Using single UAV ID or two UAV IDs for a single UAV with 2 SIMs may have normative impact, because existing solutions in TS23.235 are based on the assumption that UTM see one UAV ID per UAV which has one SIM.   + [LGE] We don't accept to capture Solution#14 as normative part/texts because the mechanism itself about redundant user plane paths reused for Solution#14 is described in Informative Annex of TS 23.501. |

## 6.4 KI#2 (NW-assisted/ground-based DAA)

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| Q7: Do you agree to select Solution#5 as basis for normative work? |
| * **Yes: 4 companies (Ericsson, LG Electronics, CATT, Qualcomm)**   + [Ericsson] Solution#6 can be merged into Solution#5 after removing the content about NEF request service from 5G NFs directly.   + [Qualcomm] we need to address some relevant aspects raised in other solutions, like the ability to consider input from UAVs (e.g. UAVs sending A2X message content to USS) or possible ground sensors (e.g. ground A2X receivers) to create a real situational awareness. Otherwise, this will be another paper solution with no market value. I recommend companies to read up a bit on the real needs from regulators. |

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| Q8: Do you agree to select Solution#6 as basis for normative work? (Suggestion about merging into Solution#5 provided at the 1st round NWM discussion need to be addressed during normative phase) |
| * **Merging Solution#6 into Solution#5: 4 companies (Ericsson, LG Electronics, CATT, Qualcomm)** |

## 6.5 KI#3 (NTZ)

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| Q9: Do you believe 3GPP only develops feature as per ECC ruling or shall 3GPP system be able to ensure NTZ requirements does not cause any issues outside of ECC ruling areas (i.e. non CEPT regions)? |
| * The following principles can be derived based on the feedback provided by 9 companies (Deutsche Telekom, Ericsson, LG Electronics, CATT, China Mobile, InterDigital, Samsung, Lenovo, Qualcomm):   + Solution/feature to support NTZ should be generic and universal.   + In this release, the requirements that should be considered for solution/feature to support NTZ and focused on are the ECC one provided by ETSI TC MSG/TFES. |

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| Q10: Which means do you support for provisioning/configuring NTZ information to UAV UE? (You can indicate means you don't support/prefer if you support/prefer most of them) ※ Means for provisioning/configuring NTZ information to UAV UE, e.g., pre-configured; from PCF (by the PCF itself or from the AF); from AF; from AMF (via OAM, local configuration, from USS and then UAS NF/NEF, from UDM, from PCF). |
| * Regarding NTZ information provisioning/configuring, the following summary can be derived based on the feedback provided by 7 companies (Ericsson, LG Electronics, CATT, InterDigital, Samsung, Lenovo, Qualcomm):   + Multiple options can be supported.   + Pre-configuration in the UAV UE can be supported.   + Configuration in the AMF via OAM/local configuration can be supported.   + Regarding which means/procedures can be supported for NTZ information configuration/update (e.g. from 5GC NFs, from AF, from USS), further analysis and discussion are required. |

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| Q11: Does NTZ enforcement by CN require only to handle UAV UEs not supporting 3GPP Rel-19 NTZ mechanism or can work also for UAV UEs supporting 3GPP Rel-19 NTZ mechanism, e.g., when the latest NTZ information is not yet available to the UAV UE? |
| * **Both scenarios: 7 companies (Ericsson, CATT, China Mobile, InterDigital, Samsung, Lenovo, Qualcomm)**   + [China Mobile] both scenarios should be classified as the UEs don't follow NTZ setting, the CN should take action for these UEs. * **Only for UAV UEs not supporting 3GPP Rel-19 NTZ mechanism: 1 company (LG Electronics)**   + [LGE] We are not sure about the case when the latest NTZ information is not yet available to the UAV UE although NTZ information is assumed not static (i.e. whether this case really exists, so whether we need to deal with it). For the case that certain area belonging to NTZ is changed to non-NTZ, UAV UEs in the area can be updated with the latest NTZ information by the network; On the other hand, for the case that certain area not belonging to NTZ is changed to NTZ, that transition can/should be made during the period/hour that there is no UAV UE in the area OR air traffic control/USS can/should make sure that no UAV UE flies in the area during the transition period/hour (e.g. by using pre-mission flight planning). |

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| Q12: Do you agree to send an LS to RAN2 (RAN3, RAN CCed) to get feedback on NTZ enforcement solution(s) and assumptions of SA2 work, and potential open issues from RAN WGs? |
| * **Yes: 8 companies (Deutsche Telekom, Ericsson, LG Electronics, CATT, China Mobile, Samsung, Lenovo, Qualcomm)**   + [Qualcomm] An LS needs to be sent, but not to ask for feedback. RAN has already indicated that they have no TUs allocated for this, thus they cannot have sufficient time to have a technical discussion and provide feedback. What the LS needs to say is that we need them to do some technical work on this, and that we will align our specs once they have conclusions. * **No against: 1 company (InterDigital)**   + [InterDigital] We are not against sending a LS but doubtful any meaningful feedback can be obtained. |

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| Q13: Please provide way forward suggestion on Backward compatibility issue (i.e. Whether and how to support NTZ enforcement for UAV UEs not supporting 3GPP Rel-19 NTZ mechanism). |
| * Regarding backward compatibility issue (i.e. Whether and how to support NTZ enforcement for UAV UEs not supporting 3GPP Rel-19 NTZ mechanism), the following summary can be derived based on the feedback provided by 7 companies (Ericsson, LG Electronics, CATT, China Mobile, Samsung, Lenovo, Qualcomm):   + Backward compatibility issue needs to be resolved.   + Work together with RAN may be needed. However considering timeline of UAS\_Ph3 normative work, SA2 needs to proceed and make assumptions, and once RAN2 has done its work SA2 may need to revise our specs.   + The existing 3GPP mechanisms can be considered to support NTZ enforcement for UAV UEs not supporting 3GPP Rel-19 NTZ mechanism (i.e. NTZ enforcement by network).   + Pre-configuration (or app layer configuration) of UAV UEs not supporting 3GPP Rel-19 NTZ mechanism may be considered. |

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| Q14: Do you agree with the following assumptions? 1) It is assumed that there is no UAV UE that transmits or attempts to transmit in the restricted frequencies and height defined by NTZ due to NTZ enforcement. But UAV UEs can transmit/receive normally outside of these restrictions, as indicated by the LS response from ETSI TC MSG/TFES. 2) NTZ information is assumed not static. |
| * The two assumptions described in Q14 can be modified and clarified based on the feedback provided by 9 companies (Deutsche Telekom, Ericsson, LG Electronics, CATT, China Mobile, InterDigital, Samsung, Lenovo, Qualcomm):   1) It is assumed that there is no UAV UE that transmits or attempts to transmit in the restricted frequencies, location and height defined by NTZ due to NTZ enforcement (i.e. after NTZ is enforced). But UAV UEs can transmit/receive normally outside of these restrictions, as indicated by the LS response from ETSI TC MSG/TFES.  2) NTZ information is assumed not static, but it is not changed dynamically.   * Comments from rapporteurs for clarification:   + The assumption 1) is about the scenario ***after NTZ is enforced (e.g. by UE, by network)***.   + On the other hand, Q15 asks whether there may be UAV UE that transmits or attempts to transmit in the restricted frequencies while in NTZ, e.g., UAV UE not supporting 3GPP Rel-19 NTZ mechanism, UAV UE that the latest NTZ information is not yet available is handled. (Q11 above is also a bit related on this matter) |

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| Q15: Do you think there may be UAV UE that transmits or attempts to transmit in the restricted frequencies while in NTZ, for example, UAV UE not supporting 3GPP Rel-19 NTZ mechanism or UAV UE that the latest NTZ information is not yet available, sends Registration Request in the NTZ? |
| * **Yes for all scenarios: 6 companies (Ericsson, CATT, China Mobile, InterDigital, Samsung, Lenovo)**   + [Lenovo] this would be abnormal UE behaviour especially if the UAV is Rel-19 compliant with NTZ configuration. * **Yes for UAV UEs not supporting 3GPP Rel-19 NTZ mechanism: 2 companies (Deutsche Telekom, LG Electronics)**   + [Deutsche Telekom] The 3GPP specification does not cover every possible UE misbehavior. There is no need to cover in the specification the case of a misconfigured, wrongly implemented and/or misbehaving UE. NTZ support capability would be OK to have (e.g. to reject UEs with UAV subscription not supporting NTZs).   + [LGE] We are not sure about the case when the latest NTZ information is not yet available to the UAV UE (Please see our feedback on Q11 of the 2nd round NWM). * **No: 1 company (Qualcomm)**   + [Qualcomm] there shall not be any because this would be a violation of strong government requirements, thus we need clear mechanisms to ensure this does not happen. A UAV UE that, even just in extreme circumstances, may transmit in an NTZ will not pass certification (aviation certification, not 3GPP certification). Most comments above focus only on 3GPP but these are UAV UEs that require aviation certification also. |