**3GPP TSG-RAN WG4 Meeting # 109 R4-2318154**

**Chicago, USA, 13th November – 17th, 2023**

**Agenda item:** 8.35.3

**Source:** Moderator (Nokia)

**Title:** Topic Summary for [109][148] NR\_LTE\_UAV

**Document for:** Information

# Introduction

During RAN99, an objective with RAN4 impact was added to the UAV WID in RP-230782. RAN4 is requested, based on the technical conditions defined for aerial UE usage in ECC Decision (22)07, to study and specify the necessary UE types and additional OOBE requirements for aerial UEs in 1710-1785 MHz, 2500-2570 MHz and 2570-2620 MHz.

Per RAN4 agreement at RAN4#106bis and Chair guidance this moderator thread treats both the NR and LTE Work-Item.

This summary handles the Tdocs submitted for agendas:

 **8.35** NR Support for UAV [NR\_UAV]

 **8.35.1** General aspects (big CR) [NR\_UAV-Core]

 **8.35.2** Necessary UE types and additional OOBE requirements for aerial UEs [NR\_UAV-Core]

 **8.35.3** Moderator summary and conclusions [NR\_UAV]

 **9.7** Enhanced LTE Support for UAV [LTE\_UAV\_enh]

 **9.7.1** General aspects (big CR) [LTE\_UAV\_enh]

 **9.7.2** Necessary UE types and additional OOBE requirements for aerial UEs [LTE\_UAV\_enh]

 **9.7.3** Moderator summary and conclusions [LTE\_UAV\_enh]

## Companies’ contributions summary for NR WI

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Title / Proposals / Observations** |
| [**R4-2319587**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319587.zip) | Ericsson, Nokia, Huawei | ***Running CR to TS 38.101-1 - Introduction of Aerial UEs support*** |
| [**R4-2319588**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319588.zip) | Ericsson | ***Aerial UE - NR definition update*****Proposal 1: Agree with the following Aerial UE’s definition for LTE:****Aerial UE:** A UE supporting Aerial UE function and have an aerial subscription as described in TS 23.401. The eNodeB supporting Aerial UE function handling uses the per user information supplied by the MME to determine whether or not to allow the UE to use Aerial UE function.**Proposal 2: Agree with the following Aerial UE’s definition for NR:****Aerial UE:** A UE supporting UAS (Uncrewed Aircraft Systems) features, and have an aerial subscription as described in TS 23.256. The UE is considered to have access to UAS services after the UE has performed a successful authentication and authorization with the USS as described in TS 23.256 |
| [**R4-2320734**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320734.zip) | Nokia, Nokia Shanghai Bell | ***Clarification of the applicability of NS\_UAV\_01 for aerial UEs*****Proposal 1:** Clarify in specification the application of NS\_UAV\_01:“When the aerial NS to be applied by an aerial UE is the NS\_UAV\_01, the UE shall apply the terrestrial NS for the corresponding band, if configured” |
| [**R4-2320836**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320836.zip) | Huawei, HiSilicon | ***Discussion on UAV operating bands*****Proposal 1:** Capture in TS 36.101 and TS 38.101-1 that the UAV operation is allowed in the following MFCN harmonised bands in ECC countries: 1. Band 1/n1,2. Band 3/n3,3. Band 7/n7,4. Band 8/n8,5. Band 20/n20,6. Band 28/n28, restricted to 703-733 MHz.7. Band 38/n38.The above proposal applies to NR\_UAV, as well as to the LTE\_UAV\_enh WI. |
| [**R4-2320837**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320837.zip) | Huawei, HiSilicon | ***Draft CR to TS 38.101-1: harmonized MFCN bands for UAV operation in ECC countries, Rel-18*** |
| [**R4-2320839**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320839.zip) | Huawei, HiSilicon | ***draft LS on the UAV OOBE implementation for MFCN harmonized bands*****LS TO:** ETSI TC MSG/TFES, 3GPP TSG RAN |
| **[R4-2318810](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318810.zip)** | Qualcomm Incorporated | ***UAV AMPR comparison CP-OFDMA***Simulation results presented and compared. Concluded that AMPR in [16] is sufficient  |
| [**R4-2320027**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320027.zip) | Nokia, Nokia Shanghai Bell | ***On power back off for aerial NR UEs*****Observation 1:** Very large values of A-MPR, even above 20 dB, are required if the channel is placed at the lower edge of the band n3.**Observation 2:** Smaller A-MPR is required for channel BWs from 30 to 50 MHz if the channel is at the upper edge of the band n3.**Observation 3:** A-MPR can be avoided for some channel placements of specific channel bandwidths.**Observation 4:** In multiple cases there are excessive A-MPR available for the UE.**Observation 5:** There are cases, especially for 60 kHz SCS, where the A-MPR proposal is insufficient.**Proposal 1:** RAN4 shall consider the correction to the A-MPR for n3 as presented in the accompanying draftCR [8].**Observation 6:** There is no need for further verification of A-MPR for band n38. |
| [**R4-2320028**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320028.zip) | Nokia, Nokia Shanghai Bell | ***draftCR for remaining open issues for power back off for aerial NR UEs*** |

## Companies’ contributions summary for LTE WI

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| --- | --- | --- |
| **T-doc number** | **Company** | **Title / Proposals / Observations** |
| [**R4-2319589**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319589.zip) | Ericsson | ***Aerial UE - LTE definition update***Same as R4-2319588 |
| [**R4-2320735**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320735.zip) | Nokia, Nokia Shanghai Bell | ***LS response to RAN2 and Clarifications on the mapping of NS\_UAV for LTE*****Observation 1:** RAN2 will define the new field additionalSpectrumEmissionUAV to indicate the NSs applicable only to aerial UEs.**Observation 2:** There may be an ambiguous meaning, it is assumed that, currently, an aerial UE shall support multiple NSs at the same time.**Proposal 1:** RAN4 shall inform RAN2 that any other additional regulatory requirements applicable in the area of deployment of the aerial UE is taken into account when defining the aerial NS via the LS within this contribution.**Proposal 2:** In the table 6.2.4-1, include the following note: “NOTE X: The index of the sequence NS\_UAV corresponds to the value of [additionalSpectrumEmissionUAV]**Proposal 3:** Adopt the same clarification of the applicability of NS\_UAV\_01 for LTE as done for NR. |
| [**R4-2320838**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320838.zip) | Huawei, HiSilicon | ***Draft CR to TS 36.101: harmonized MFCN bands for UAV operation in ECC countries, Rel-18*** |
| [**R4-2320029**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320029.zip) | Nokia, Nokia Shanghai Bell | ***On power back off for aerial LTE UEs*****Observation 1:** Very large values of A-MPR, even above 15 dB, are required if the channel is placed at the lower edge of the band n3.**Observation 2:** A-MPR can be avoided for some channel placements of specific channel bandwidths.**Observation 3:** In multiple cases there are excessive A-MPR available for the UE.**Observation 4:** The A-MPR proposal for LTE covers all cases based on the comparison.**Proposal 1:** RAN4 shall consider the correction as presented in the accompanying draftCR [9]. |
| [**R4-2320030**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320030.zip) | Nokia, Nokia Shanghai Bell | ***draftCR for remaining open issues for power back off for aerial LTE UEs*** |
| [**R4-2320835**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320835.zip) | Huawei, HiSilicon | ***CR to TS 36.101: Additional OOBE requirements for Aerial Ues, Rel-18*** |

**List of targets of discussions for this topic during the meeting.**

1. Develop the needed CRs to introduce UAV support to the RAN4 specification.

# Topic #1: Remaining Open Issues

## Sub-topic 1-2: Definition of an aerial UE

Currently the agreement in RAN4 is to define an aerial UE as:

Uncrewed Aerial UE: A UE supporting UAS (Uncrewed Aircraft Systems) capability (Replace with reference to RAN2 specification where the capability will be defined), and have an aerial subscription as described in TS 25.401 The UE is considered to have an aerial subscription after the UE has performed a successful authentication and authorization of the aerial subscription.

At this meeting, there are proposals for updating this definition to add further clarification.

**Issue 1-1-1: Update of the definition of an aerial UE for NR.**

* Proposals
	+ Option 1: Change the definition of an aerial UE to.

**Aerial UE:** A UE supporting UAS (Uncrewed Aircraft Systems) features, and have an aerial subscription as described in TS 23.256. The UE is considered to have access to UAS services after the UE has performed a successful authentication and authorization with the USS as described in TS 23.256

* + Option 2: No updates are needed.
* Recommended WF
	+ TBA

Ericsson: for NR we refer to 23.256.

Huawei: We still need check with RAN2. This is RAN2-led WI. As long as RAN2 gives us LS, we are fine.

Moderator: fine to check with RAN2.

Agreement: Take Option 1 as the starting point aiming at capturing the updated definition in the CR, and check with RAN2.

**Issue 1-1-2: Update of the definition of an aerial UE for LTE.**

* Proposals
	+ Option 1: Change the definition of an aerial UE to.

**Aerial UE:** A UE supporting Aerial UE function and have an aerial subscription as described in TS 23.401. The eNodeB supporting Aerial UE function handling uses the per user information supplied by the MME to determine whether or not to allow the UE to use Aerial UE function.

* + Option 2: Change the definition of an aerial UE to.

**Aerial UE:** UE supporting UAS (Uncrewed Aircraft Systems) capabilities mandatory for UEs with an aerial subscription as defined in TS 36.306 [14] (e.g. multipleCellsMeasExtension-r15 and heightMeas-r15 ), and have an aerial subscription as described in TS 25.401. The UE is considered to have an aerial subscription after the UE has performed a successful authentication and authorization of the aerial subscription.

* + Option 3: No updates are needed.
* Recommended WF
	+ TBA

Nokia: we can use the same approach as for NR.

Agreement: Merge Option 1 and Option 2 aiming at capturing the updated definition in the CR, and check with RAN2.

## Sub-topic 1-2: NS\_UAV\_01 for aerial UEs

It is proposed that RAN4 shall add clarification of the applicability of NS\_UAV\_01 for aerial UE. The objective is to ensure that if no specific NS

**Issue 1-2: Clarification of the applicability of NS\_UAV\_01 for aerial UEs.**

* Proposals
	+ Option 1: RAN4 shall add clarification of the applicability of NS\_UAV\_01 for aerial UE.
	+ Option 2: There is no need to add this clarification.
* Recommended WF
	+ TBA

Agreement: RAN4 shall add clarification of the applicability of NS\_UAV\_01 for aerial UE.

## Sub-topic 1-3: Bands for deployment of Arial UEs

It is proposed that RAN4 UAV operation is allowed in a sub-set of bands by one company.

From the moderator it is noted that the RAN4 already discussed this at RAN4#106 with the following agreement as captured in the agreed WF R4-2310487.

Aerial UEs can be operated in all bands, when complying to requirements and potential additional requirements specific for the UE type.

Further it can be noted that this work was initiated by additional requirements from ECC related to a specific UE type in specific frequency ranges. This meaning there should be no general implication to this UE type, nor for different regions than what is governed by ECC regulations.

However, it seems there are still a proposal to limit to bands available to Arial UEs to a sub-set of the NR bands and list these explicitly in the specification.

**Issue 1-3: Bands for deployment of Arial UEs**

* Proposals
	+ Option 1: Aerial UEs can be operated in all bands, when complying to requirements and potential additional requirements specific for the UE type.
	+ Option 2: Aerial UEs can ONLY be operated in selected bands, when complying to requirements and potential additional requirements specific for the UE type.
* Recommended WF
	+ Option 1 as this is according to previous agreements.

Huawei: the whole thing is started by ECC. That is EU specific. We should not extend ECC rule to global. The existing restriction is too restrictive.

Ericsson: We just focus on ECC right now. It is too risky to list those bands.

CMCC: This WI is triggered by ECC. In China, all the operators’ licensed band can deploy UAV and we do not want to see the restriction.

Nokia: Only when network configures this information, the requirements can be applied.

Huawei: I am fine not to have restriction. We should extend ECC to global.

# Topic #3: A-MPR values for aerial UEs

## Needed A-MPR for aerial UEs

At RAN4#108 it was agreed that A-MPR were needed defined for band 3 and 38. In RAN4#108bis A-MPR values were tentatively agreed for further checking for RAN4#109.

### Sub-topic 2-1: A-MPR proposals for NR

For this meeting specific changes to A-MPR values for NR have been proposed in R4-2320028 while R4-2318810 concluded the original proposal is sufficient.

**Issue 2-1: A-MPR for NR**

* Proposals
	+ Option 1: RAN4 shall update A-MPR values for NR as proposed for this meeting.
	+ Option 2: No update to the A-MPR values for NR is needed.
* Recommended WF
	+ Option 1

Agreement: Agree on Option 1.

### Sub-topic 2-2: A-MPR proposals for LTE

For this meeting specific changes to A-MPR values for LTE have been proposed in R4-2320030 while no other proposals have been submitted which can be interpreted as no changes are needed.

**Issue 2-1: A-MPR for NR**

* Proposals
	+ Option 1: RAN4 shall update A-MPR values for LTE as proposed for this meeting.
	+ Option 2: No update to the A-MPR values for LTE is needed.
* Recommended WF
	+ Option 1

Agreement: Agree on Option 1.

# Topic #3: CR development

## Draft CR for NR

This meeting a draft Running CR have been presented in R4-2315774. It is suggested that this is used as baseline to capture agreements at this meeting taking into account both other submitted draft CRs and TPs.

**Issue 3-1: Running CR for NR**

* Proposals
	+ Option 1: Use a revision of R4-2319587 to capture agreements for arial UEs. Other submitted draftCRs/CRs are to be merged to this revision.
	+ Option 2: Other.
* Recommended WF
	+ Option 1

Agreement: Agree on Option 1.

## Draft CR for LTE

This meeting a draft Running CR have been presented in R4-2316845. It is suggested that this is used as baseline to capture agreements at this meeting taking into account both other submitted draft CRs and TPs.

**Issue 3-2: Running CR for LTE**

* Proposals
	+ Option 1: Use a revision of R4-2320835 to capture agreements for arial UEs. Other submitted draftCRs/CRs are to be merged to this revision.
	+ Option 2: Other.
* Recommended WF
	+ Option 1

Agreement: Agree on Option 1.