**3GPP TSG-RAN WG4 Meeting#106bis R4-221xxxx**

**E-meeting,April 17 – April 26,2023**

**Agenda item: 5.36.2**

**Source: ZTE Corporation**

**Title: Further discussion on NR based UAV**

**Document for:** **Approval**

1. Introduction

In RAN#99e meeting, the NR UAV work item was revised to [[RP-230782](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_99/Docs/RP-230782.zip%22%20%5Ct%20%22https%3A//portal.3gpp.org/ngppapp/_blank)] according to the incoming LS from ECC, the following RAN4 related objective are included for further discussion in RAN4. Therefore in this contribution, we want to share some initial views on the NR UAV especially from its supported operating bands and its power class.

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| 5. Based on the technical conditions defined for aerial UE usage in ECC Decision (22)07, 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. [RAN4].Note: In other frequency bands, OOBE limits applicable to terrestrial UE remain unchanged for aerial UENote2: Applicability of power classes for aerial UE may need to be addressed in RAN4Note3: RAN4 to identify the supported bands for aerial UE impacted by above information |

1. Discussion

First of all, based on the ECC decision 22(07) as following, ECC indicate the following uplink spectrum to be used for UAV UL transmission, however there are no clear indication where the DL spectrum should be. Based on the FR1 band definition in 3GPP specification, it seems that the spectrum mentioned in ECC decision could be mapped with the following bands highlighted in green and yellow color. For bands highlighted in yellow, ECC specify the additional OOBE requirement, for bands highlighted in green, then the existing OOBE limit could be apply.

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| Harmonised technical conditions for the usage of aerial UE for communications based on LTE and 5G NR in the bands 703-733 MHz, 832-862 MHz, 880-915 MHz, 1710-1785 MHz, 1920-1980 MHz, 2500-2570 MHz and 2570-2620 MHz harmonised for MFCN |

**Proposal 1:** to confirm whether operation bands for NR UAV is limited in the following bands in Table 1.

Table 1: NR *operating bands* in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | Uplink (UL) *operating band*BS receive / UE transmitFUL,low – FUL,high | Downlink (DL) *operating band*BS transmit / UE receiveFDL,low – FDL,high | Duplex mode |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD |
| n3 | 1710 MHz – 1785 MHz | 1805 MHz – 1880 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |
| n8 | 880 MHz – 915 MHz | 925 MHz – 960 MHz | FDD |
| n20 | 832 MHz – 862 MHz | 791 MHz – 821 MHz | FDD |
| n28 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD |
| n38 | 2570 MHz – 2620 MHz | 2570 MHz – 2620 MHz | TDD |
| n41 | 2496 MHz – 2690 MHz | 2496 MHz – 2690 MHz | TDD |

In addition, since the band n38 is subset of n41, we need to further discuss whether this band could be added for UAV operation. From our understanding, the interested band proposed by ECC is limited to the spectrum in EU, therefore the band is restricted to band n38 instead of band n41, however it should be known that this band was widely used in other regions e.g. China, Japan, North America and Latin America, Middle East/Africa and India and South East Asia. Therefore from this perspective, it should be reasonable to add the band n41 for the UAV operation if possible.

**Proposal 2:** to further discuss the band n41 for UAV operation since this is extended band n38.

In the contribution [3], there are also some relevant analysis from the USA regulation perspective e.g.whether dedicated spectrum should be used for UAV operation and whether unlicensed band should be precluded at the current stage.

**Proposal 3:** to further discuss whether UAV operation is limited for licensed band only.

In addition, there are no generic requirement discussion for NR UAV or LTE UAV in the past, therefore we need to further discuss its generic RF requirement for UAV firstly. From our understanding, the UAV is quite different from existing the handheld UE or CPE device since NR UAV is supposed to support the beamforming capability similar ATG CPE. And for NR UAV, its antenna array size is supposed to be lower than that of ATG CPE (8x2x2 array size for ATG) and its output power is also expected lower than it due to its capability.

**Proposal 4:** to discuss power class or total conducted output power of NR UAV firstly and then further discuss the generic RF requirements for NR UAV similar as the discussion of NR ATG.

1. Conclusions

In this contribution, we want to share some initial views on NR UAV .and proposals are made as following:

**Proposal 1:** to confirm whether operation bands for NR UAV is limited in the following bands in Table 1.

Table 1: NR *operating bands* in FR1

|  |  |  |  |
| --- | --- | --- | --- |
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| n3 | 1710 MHz – 1785 MHz | 1805 MHz – 1880 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |
| n8 | 880 MHz – 915 MHz | 925 MHz – 960 MHz | FDD |
| n20 | 832 MHz – 862 MHz | 791 MHz – 821 MHz | FDD |
| n28 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD |
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**Proposal 2:** to further discuss the band n41 for UAV operation since this is extended band n38.

**Proposal 3:** to further discuss whether UAV operation is limited for licensed band only.

**Proposal 4:** to discuss power class or total conducted output power of NR UAV firstly and then further discuss the generic RF requirements for NR UAV similar as the discussion of NR ATG.

1. References

[1] [RP-230782](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_99/Docs/RP-230782.zip%22%20%5Ct%20%22https%3A//portal.3gpp.org/ngppapp/_blank), Revised WID: NR Support for UAV (Uncrewed Aerial Vehicles), Approved.

[2] ECC decision (22)07

[3] RP-230668,Discussion on UAV BRID/DAA Objective, Noted.