

Maximum Permissible Exposure Report

Product : IEEE 802.11ax/ac/a/b/g/n WiFi6E with BT5.2 Module

Model Name : ACB-QCA206x

Series Model : ACB-QCA2066-0WI1, ACB-QCA2066-0WX1,
ACB-QCA2066-5WI1, ACB-QCA2066-5WX1,
ACB-QCA2066-0WI4, ACB-QCA2066-0WX4,
ACB-QCA2066-5WI4, ACB-QCA2066-5WX4

FCC ID : 2AE3B-ACB-QCA206X

Test Regulation : 47 CFR FCC Part 2.1091

Received Date : 2023/6/26

Test Date : 2023/7/1 ~ 2023/8/11

Issued Date : 2023/9/25

Applicant : VOXMICRO LTD
20955 Pathfinder Rd., STE 100, Diamond Bar, California
91765, USA

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan



The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report are responsible of the test sample(s) provided by the client only and are not to be used to indicate applicability to other similar products.

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1. Attestation of Test Results

APPLICANT: VOXMICRO LTD
20955 Pathfinder Rd., STE 100, Diamond Bar, California 91765, USA

MANUFACTURER: VOXMICRO LTD
8F.-3, No.5, Aly. 22, Ln. 513, Rueiguang Rd., Neihu Dist., Taipei
City 114, Taiwan

EUT DESCRIPTION: IEEE 802.11ax/ac/a/b/g/n WiFi6E with BT5.2 Module

BRAND: AIRETOS

MODEL: ACB-QCA206x

SERIES MODEL: ACB-QCA2066-0WI1, ACB-QCA2066-0WX1,
ACB-QCA2066-5WI1, ACB-QCA2066-5WX1,
ACB-QCA2066-0WI4, ACB-QCA2066-0WX4,
ACB-QCA2066-5WI4, ACB-QCA2066-5WX4

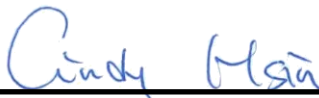
SAMPLE STAGE: Engineering Verification Test sample

| APPLICABLE STANDARDS | |
|------------------------|--------------|
| STANDARD | Test Results |
| 47 CFR FCC Part 2.1091 | PASS |

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:



Cindy Hsin
Project Handler

Date : 2023/9/25

Approved and Authorized By:



Eric Lee
Senior Laboratory Engineer

Date : 2023/9/25

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2. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with KDB 447498 D04 Interim General RF Exposure Guidance v01.

3. Facilities and Accreditation

| | |
|----------------------------------|---|
| Test Location | Underwriters Laboratories Taiwan Co., Ltd. |
| Address | Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan |
| Accreditation Certificate | Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. |

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Doc No: Form-ULID-004725 (DCS:17-EM-F0864) / 5.1

4. Equipment Under Test

4.1. Description of EUT

| | | |
|----------------------------|---|---|
| Product Name | IEEE 802.11ax/ac/a/b/g/n WiFi6E with BT5.2 Module | |
| Brand Name | AIRETOS | |
| Model Name | ACB-QCA206x | |
| Series Model | ACB-QCA2066-0WI1, ACB-QCA2066-0WX1, ACB-QCA2066-5WI1, ACB-QCA2066-5WX1, ACB-QCA2066-0WI4, ACB-QCA2066-0WX4, ACB-QCA2066-5WI4, ACB-QCA2066-5WX4 | |
| Operating Frequency | Bluetooth EDR | 2402MHz ~ 2480MHz |
| | Bluetooth LE | 2402MHz ~ 2480MHz |
| | WLAN | 2.4GHz: 2412MHz ~ 2462MHz 5GHz: 5180MHz ~ 5240MHz 5260MHz ~ 5320MHz 5500MHz ~ 5720MHz 5745MHz ~ 5825MHz 6GHz: 5955MHz ~ 6415MHz 6435MHz ~ 6525MHz 6525MHz ~ 6875MHz 6875MHz ~ 7115MHz |
| Modulation | Bluetooth EDR | GFSK, $\pi/4$ -DQPSK, 8DPSK |
| | Bluetooth LE | GFSK |
| | WLAN | CCK, DQPSK, DBPSK for DSSS 1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM |
| Number of Channel | Bluetooth EDR | 79 |
| | Bluetooth LE | 40 |

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| | | |
|--------------------------|------------------------------|---|
| Number of Channel | 2.4G WLAN 2412 ~ 2462 MHz | 11 for 802.11b, 802.11g, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20) 7 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40) |
| | 5G WLAN 5180 ~ 5240 MHz | 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20) |
| | | 2 for 802.11n (HT40), 802.11 ac (VHT40), 802.11ax (HE40) |
| | | 1 for 802.11ac (VHT80), 802.11ax (HE80) |
| | 5G WLAN 5260 ~ 5320 MHz | 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20) |
| | | 2 for 802.11n (HT40), 802.11 ac (VHT40), 802.11ax (HE40) |
| | | 1 for 802.11ac (VHT80), 802.11ax (HE80) |
| | | 1 for 802.11ac (VHT160), 802.11ax (HE160) |
| | 5G WLAN 5500 ~ 5720 MHz | 12 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20) |
| | | 6 for 802.11n (HT40), 802.11 ac (VHT40), 802.11ax (HE40) |
| | | 3 for 802.11ac (VHT80), 802.11ax (HE80) |
| | | 1 for 802.11ac (VHT160), 802.11ax (HE160) |
| | 5G WLAN 5745 ~ 5825 MHz | 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20) |
| | | 2 for 802.11n (HT40), 802.11 ac (VHT40), 802.11ax (HE40) |
| | | 1 for 802.11ac (VHT80), 802.11ax (HE80) |

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| | | |
|---------------------------|--------------------------------|---------------------------------|
| Number of Channel | 6G WLAN 5925 ~ 6425MHz | 25 for 802.11a, 802.11ax (HE20) |
| | | 12 for 802.11ax (HE40) |
| | | 6 for 802.11ax (HE80) |
| | | 3 for 802.11ax (HE160) |
| | 6G WLAN 6425 ~ 6525MHz | 5 for 802.11a,802.11ax (HE20) |
| | | 3 for 802.11ax (HE40) |
| | | 2 for 802.11ax (HE80) |
| | | 1 for 802.11ax (HE160) |
| | 6G WLAN 6525 ~ 6855MHz | 17 for 802.11a,802.11ax (HE20) |
| | | 8 for 802.11ax (HE40) |
| | | 3 for 802.11ax (HE80) |
| | | 1 for 802.11ax (HE160) |
| 6G WLAN 6875 ~ 7125MHz | 13 for 802.11a,802.11ax (HE20) | |
| | 6 for 802.11ax (HE40) | |
| | 3 for 802.11ax (HE80) | |
| | 2 for 802.11ax (HE160) | |
| Normal Voltage | 3.3 Vdc from host system | |
| Sample ID | 6199534 | |

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Note:

1. The models difference table as below:

| Model | Difference |
|------------------|---|
| ACB-QCA206x | Market assignment classification for application and grade finish |
| ACB-QCA2066-0WI1 | |
| ACB-QCA2066-0WX1 | |
| ACB-QCA2066-5WI1 | |
| ACB-QCA2066-5WX1 | |
| ACB-QCA2066-0WI4 | |
| ACB-QCA2066-0WX4 | |
| ACB-QCA2066-5WI4 | |
| ACB-QCA2066-5WX4 | |

2. The EUT provides two completed transmitters and two receivers.

| Modulation Mode | Tx,Rx Function |
|-------------------|----------------|
| 802.11a | 2TX,2RX |
| 802.11b | 2TX,2RX |
| 802.11g | 2TX,2RX |
| 802.11n (HT20) | 2TX,2RX |
| 802.11n (HT40) | 2TX,2RX |
| 802.11ac (VHT20) | 2TX,2RX |
| 802.11ac (VHT40) | 2TX,2RX |
| 802.11ac (VHT80) | 2TX,2RX |
| 802.11ac (VHT160) | 2TX,2RX |
| 802.11ax (HE20) | 2TX,2RX |
| 802.11ax (HE40) | 2TX,2RX |
| 802.11ax (HE80) | 2TX,2RX |
| 802.11ax (HE160) | 2TX,2RX |

3. The EUT contains following accessory devices:

| Product | Brand | Model | Description |
|---------|-----------|---------------|-------------|
| Antenna | OXFORDTEC | WANT-4DBI-SMA | - |

4. For this report measurement uncertainty, statement of conformity, determining compliance, it is necessary to refer to the original measurement report of EUT.

5. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual, the laboratory shall not be held responsible.

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4.2. Description of Available Antennas

| Ant. No. | Transmitter Circuit | Brand Name | Model Name | Ant. Type | Maximum Gain (dBi) |
|----------|---------------------|------------|---------------|-----------|---|
| 1 | Chain (0+1) | OXFORDTEC | WANT-4DBI-SMA | Omni | 2.4~2.5GHz: 3.5 4.9~5.8GHz: 3.8 5.8~7.1GHz: 3.8 |

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual, the laboratory shall not be held responsible.

5. Requirement

Limits for General Population/Uncontrolled Exposure

| Limits for General Population/Uncontrolled Exposure | | | | |
|---|-----------------------------------|-----------------------------------|---|---|
| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm ²) | Averaging Time E ² , H ² or S (minutes) |
| 0.3-1.34 | 614 | 1.63 | *100 | 30 |
| 1.34-30 | 824/f | 2.19/f | *180/f ² | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | -- | -- | f/1500 | 30 |
| 1500-100,000 | -- | -- | 1.0 | 30 |

Note 1: f = frequency in MHz, * means Plane-wave equivalent power density

Note 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Power Density (S) is calculated by the following formula:

$$S = (P * G) / 4\pi R^2$$

where: S = power density (in appropriate units, e.g. mW/ cm²)

P = power input to the antenna (in appropriate units, e.g., mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

6. General RF Exposure Test Exemption

The corresponding Exclusion Threshold condition, listed below:

- 1) Blanket Exempt: Following 47 CFR 1.1307(b)(3)(i)(A), the available maximum time-averaged power is no more than 1 mW.
- 2) SAR Exempt: Following 47 CFR 1.1307(b)(3)(i)(B), the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz};$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

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- 3) MPE Exempt: Following 47 CFR 1.1307(b)(3)(i)(C), using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

| RF Source frequency (MHz) | Threshold ERP (watts) |
|---------------------------|-----------------------|
| 0.3-1.34 | $1,920 R^2$. |
| 1.34-30 | $3,450 R^2/f^2$. |
| 30-300 | $3.83 R^2$. |
| 300-1,500 | $0.0128 R^2f$. |
| 1,500-100,000 | $19.2R^2$. |

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7. Radio Frequency Radiation Exposure Evaluation

(1) General RF Exposure Test Exemption

| Option | Evaluation Method | Clause |
|-------------------------------------|-------------------|---------------------------|
| <input type="checkbox"/> | Blanket Exempt | 47 CFR 1.1307(b)(3)(i)(A) |
| <input type="checkbox"/> | SAR Exempt | 47 CFR 1.1307(b)(3)(i)(B) |
| <input checked="" type="checkbox"/> | MPE Exempt | 47 CFR 1.1307(b)(3)(i)(C) |

Note: Max. ERP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi) - 2.15 (dB)

Bluetooth EDR

| Evaluation Frequency | $\lambda/2\pi$ | R | Max. ERP | Max. ERP | Threshold ERP |
|----------------------|----------------|------|----------|----------|---------------|
| (MHz) | (m) | (m) | (dBm) | (W) | (W) |
| 2402 ~ 2480 | 0.0199 | 0.27 | 5.72 | 0.004 | 1.3997 |

Bluetooth LE

| Evaluation Frequency | $\lambda/2\pi$ | R | Max. ERP | Max. ERP | Threshold ERP |
|----------------------|----------------|------|----------|----------|---------------|
| (MHz) | (m) | (m) | (dBm) | (W) | (W) |
| 2402 ~ 2480 | 0.0199 | 0.27 | 3.86 | 0.002 | 1.3997 |

WLAN 2.4GHz

| Evaluation Frequency | $\lambda/2\pi$ | R | Max. ERP | Max. ERP | Threshold ERP |
|----------------------|----------------|------|----------|----------|---------------|
| (MHz) | (m) | (m) | (dBm) | (W) | (W) |
| 2412 ~ 2462 | 0.0198 | 0.27 | 28.45 | 0.7 | 1.3997 |

WLAN 5GHz

| Evaluation Frequency | $\lambda/2\pi$ | R | Max. ERP | Max. ERP | Threshold ERP |
|----------------------|----------------|------|----------|----------|---------------|
| (MHz) | (m) | (m) | (dBm) | (W) | (W) |
| 5180 ~ 5240 | 0.0092 | 0.27 | 23.73 | 0.236 | 1.3997 |
| 5260 ~ 5320 | 0.0091 | 0.27 | 23.72 | 0.236 | 1.3997 |
| 5500 ~ 5720 | 0.0087 | 0.27 | 26.93 | 0.493 | 1.3997 |
| 5745 ~ 5825 | 0.0083 | 0.27 | 27.78 | 0.6 | 1.3997 |

WLAN 6GHz

| Evaluation Frequency | $\lambda/2\pi$ | R | Max. ERP | Max. ERP | Threshold ERP |
|----------------------|----------------|------|----------|----------|---------------|
| (MHz) | (m) | (m) | (dBm) | (W) | (W) |
| 5935 ~ 6415 | 0.0079 | 0.27 | 15.00 | 0.032 | 1.3997 |
| 6435 ~ 6515 | 0.0073 | 0.27 | 14.98 | 0.031 | 1.3997 |
| 6535 ~ 6855 | 0.0072 | 0.27 | 14.82 | 0.03 | 1.3997 |
| 6875 ~ 7115 | 0.0070 | 0.27 | 14.93 | 0.031 | 1.3997 |

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(2) Simultaneously transmission condition:

| Condition | Technology | |
|-----------|---------------|---------------|
| 1 | BT-EDR | WLAN (2.4GHz) |
| 2 | BT-EDR | WLAN (5GHz) |
| 3 | BT-EDR | WLAN (6GHz) |
| 4 | WLAN (2.4GHz) | WLAN (5GHz) |
| 5 | WLAN (2.4GHz) | WLAN (6GHz) |

| Condition 1 | R | Max. ERP | Threshold ERP | Transmit Simultaneously | Transmit Simultaneously Limit |
|---------------|------|----------|---------------|-------------------------|-------------------------------|
| | (m) | (W) | (W) | | |
| BT-EDR | 0.27 | 0.004 | 1.3997 | 0.503 | ≤ 1 |
| WLAN (2.4GHz) | 0.27 | 0.7 | 1.3997 | | |

| Condition 2 | R | Max. ERP | Threshold ERP | Transmit Simultaneously | Transmit Simultaneously Limit |
|-------------|------|----------|---------------|-------------------------|-------------------------------|
| | (m) | (W) | (W) | | |
| BT-EDR | 0.27 | 0.004 | 1.3997 | 0.432 | ≤ 1 |
| WLAN (5GHz) | 0.27 | 0.6 | 1.3997 | | |

| Condition 2 | R | Max. ERP | Threshold ERP | Transmit Simultaneously | Transmit Simultaneously Limit |
|-------------|------|----------|---------------|-------------------------|-------------------------------|
| | (m) | (W) | (W) | | |
| BT-EDR | 0.27 | 0.004 | 1.3997 | 0.026 | ≤ 1 |
| WLAN (6GHz) | 0.27 | 0.032 | 1.3997 | | |

| Condition 1 | R | Max. ERP | Threshold ERP | Transmit Simultaneously | Transmit Simultaneously Limit |
|---------------|------|----------|---------------|-------------------------|-------------------------------|
| | (m) | (W) | (W) | | |
| WLAN (2.4GHz) | 0.27 | 0.7 | 1.3997 | 0.929 | ≤ 1 |
| WLAN (5GHz) | 0.27 | 0.6 | 1.3997 | | |

| Condition 1 | R | Max. ERP | Threshold ERP | Transmit Simultaneously | Transmit Simultaneously Limit |
|---------------|------|----------|---------------|-------------------------|-------------------------------|
| | (m) | (W) | (W) | | |
| WLAN (2.4GHz) | 0.27 | 0.7 | 1.3997 | 0.523 | ≤ 1 |
| WLAN (6GHz) | 0.27 | 0.032 | 1.3997 | | |

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.

END OF REPORT

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