

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

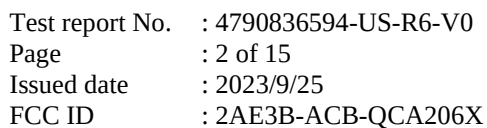
Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan



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Original Test Report No.: 4790836594-US-R6-V0

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Facsimile (FAX) :+886-3-583-7948 Doc No: Form-ULID-004725 (DCS:17-

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

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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

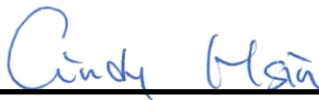
APPLICABLE STANDARDS

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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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:

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

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)

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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	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.

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7. Radio Frequency Radiation Exposure Evaluation

(1) General RF Exposure Test Exemption

Option	Evaluation Method	Clause
☐	Blanket Exempt	47 CFR 1.1307(b)(3)(i)(A)
☐	SAR Exempt	47 CFR 1.1307(b)(3)(i)(B)
☒	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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