



Test report No. : 4789507582-US-R5-V0
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Issued date : Dec. 16, 2020
FCC ID : 2AWKZ-QCNFA324

Maximum Permissible Exposure Report

Product : 2x2 802.11 A/B/G/N/AC WIFI+ Bluetooth Module

Model Name : QCNFA324

FCC ID : 2AWKZ-QCNFA324

Test Regulation : 47 CFR FCC Part 2.1091

Received Date : Jun. 9, 2020

Issued Date : Dec. 16, 2020

Applicant : ENLI INCORPORATION
4F., No. 42, Aly. 5, Ln. 12, Sec. 3, Bade Rd., Songshan
Dist., Taipei 10559, Taiwan

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building 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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REVISION HISTORY

Original Test Report No.: 4789507582-US-R5-V0

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1. Attestation of Test Results

APPLICANT: ENLI INCORPORATION
4F., No. 42, Aly. 5, Ln. 12, Sec. 3, Bade Rd., Songshan Dist.,
Taipei 10559, Taiwan

MANUFACTURER ENLI INCORPORATION
4F., No. 42, Aly. 5, Ln. 12, Sec. 3, Bade Rd., Songshan Dist.,
Taipei 10559, Taiwan

EUT DESCRIPTION: 2x2 802.11 A/B/G/N/AC WIFI+ Bluetooth Module

BRAND: ENLI

MODEL: QCNFA324

SAMPLE STAGE: Identical Prototype

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:

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Project Handler

Date : Dec. 16, 2020

Approved and Authorized By:

Waternil Guan Date : Dec. 16, 2020
Engineer

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2. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with KDB 447498 D01 General RF Exposure Guidance v06.

3. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building 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. The full scope of accreditation can be viewed at http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398

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4. Equipment Under Test

4.1. Description of EUT

Product Name	2x2 802.11 A/B/G/N/AC WIFI+ Bluetooth Module	
Brand Name	ENLI	
Model Name	QCNFA324	
S/N	E4AAEA8A1CE1	
Operating Frequency	BT EDR	2402MHz ~ 2480MHz
	BLE	2402MHz ~ 2480MHz
	WLAN	2.4GHz: 2412MHz ~ 2462MHz 5GHz: 5180 ~ 5240 MHz, 5260 ~ 5320 MHz 5500 ~ 5700 MHz, 5745 ~ 5825 MHz
Modulation	BT EDR	GFSK, $\pi/4$ -DQPSK, 8DPSK
	BLE	GFSK
	WLAN	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
Number of Channel	BT EDR	79
	BLE	40

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Number of Channel	2.4G WLAN 2412 ~ 2472 MHz	11 for 802.11b, 802.11g, 802.11n (HT20)
		7 for 802.11n (HT40)
	5G WLAN 5180 ~ 5240 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		2 for 802.11n (HT40), 802.11 ac (VHT40)
		1 for 802.11ac (VHT80)
	5G WLAN 5260 ~ 5320 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		2 for 802.11n (HT40), 802.11 ac (VHT40)
		1 for 802.11ac (VHT80)
	5G WLAN 5500 ~ 5700 MHz	8 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		3 for 802.11n (HT40), 802.11 ac (VHT40)
		1 for 802.11ac (VHT80)
	5G WLAN 5745 ~ 5825 MHz	5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		2 for 802.11n (HT40), 802.11 ac (VHT40)
1 for 802.11ac (VHT80)		
Bluetooth EDR	79	
Bluetooth LE	40	
Normal Voltage	3.3Vdc	
S/N	E4AAEA8A1CE1	
Software Version	N/A	

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Note:

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

Modulation Mode	Tx,Rx Function
802.11b	1TX,1RX
802.11g	1TX,1RX
802.11a	1TX,1RX
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

2. The EUT contains following accessory devices.

Product	Brand	Model	Ant. Type	Frequency Band (MHz)	Antenna Gain(dBi)
Ant 1	ANJIE Electronics	AEDQ4S-B0003	Dipole	2400 ~ 2500	5
				5150 ~ 5250	5.1
				5250 ~ 5350	5.1
				5470 ~ 5725	5.3
				5725 ~ 5850	5.3
Ant 2	ANJIE Electronics	AJDP2J-C0012	PIFA	2400 ~ 2500	3.62
				5150 ~ 5250	5
				5250 ~ 5350	5
				5470 ~ 5725	6
				5725 ~ 5850	5.8

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

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4.2. Description Of Available Antennas

Ant. No.	Brand Name	Model Name	Ant. Type	Frequency Band (MHz)	Ant. Gain (dBi)
1	ANJIE Electronics	AEDQ4S-B0003	Dipole	2400 ~ 2500	5
				5150 ~ 5250	5.1
				5250 ~ 5350	5.1
				5470 ~ 5725	5.3
				5725 ~ 5850	5.3
2	ANJIE Electronics	AJDP2J-C0012	PIFA	2400 ~ 2500	3.62
				5150 ~ 5250	5
				5250 ~ 5350	5
				5470 ~ 5725	6
				5725 ~ 5850	5.8

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.

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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)

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6. Radio Frequency Radiation Exposure Evaluation

BT EDR

Evaluation Frequency	Max. Average power	Antenna Gain	Max. EIRP	Max. EIRP	Power density @ 20 cm	Limit
(MHz)	(dBm)	(dBi)	(dBm)	(mW)	(mW/cm ²)	(mW/cm ²)
2402 ~ 2480	4.42	5	9.42	8.750	0.0017	1

BLE

Evaluation Frequency	Max. Average power	Antenna Gain	Max. EIRP	Max. EIRP	Power density @ 20 cm	Limit
(MHz)	(dBm)	(dBi)	(dBm)	(mW)	(mW/cm ²)	(mW/cm ²)
2402 ~ 2480	0.58	5	5.58	3.614	0.0007	1

WLAN 2.4GHz

802.11b/g (Diversity)

Evaluation Frequency	Max. Average power	Antenna Gain	Max. EIRP	Max. EIRP	Power density @ 20 cm	Limit
(MHz)	(dBm)	(dBi)	(dBm)	(mW)	(mW/cm ²)	(mW/cm ²)
2412 ~ 2462	18.48	5	23.48	222.844	0.044	1

802.11n (MIMO)

Evaluation Frequency	Max. Average power	Directional Gain	Max. EIRP	Max. EIRP	Power density @ 20 cm	Limit
(MHz)	(dBm)	(dBi)	(dBm)	(mW)	(mW/cm ²)	(mW/cm ²)
2412 ~ 2462	21.48	8.01	29.49	889.201	0.177	1

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WLAN 5GHz

802.11a(Diversity)

Evaluation Frequency (MHz)	Max. Average power (dBm)	Antenna Gain (dBi)	Max. EIRP (dBm)	Max. EIRP (mW)	Power density @ 20 cm (mW/cm ²)	Limit (mW/cm ²)
5150~5250	13.47	5.10	18.57	71.945	0.014	1
5250~5350	13.49	5.10	18.59	72.277	0.014	1
5470~5725	13.47	6.00	19.47	88.512	0.018	1
5725~5850	13.49	5.80	19.29	84.918	0.017	1

802.11n/ac(MIMO)

Evaluation Frequency (MHz)	Max. Average power (dBm)	Directional Gain (dBi)	Max. EIRP (dBm)	Max. EIRP (mW)	Power density @ 20 cm (mW/cm ²)	Limit (mW/cm ²)
5150~5250	15.85	8.11	23.96	248.886	0.050	1
5250~5350	15.91	8.11	24.02	252.348	0.050	1
5470~5725	15.89	9.01	24.90	309.030	0.061	1
5725~5850	15.94	8.81	24.75	298.538	0.059	1

Note:

1. Max. EIRP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi)
2. Max. EIRP (mW) = $10^{(\text{Max. EIRP (dBm)} / 10)}$
3. Power density (mW/cm²) = Max. EIRP (mW) / $[4 \times \pi \times (\text{calculated distance})^2]$, the calculated distance is 20 cm.

Conclusion:

The formula of calculated the MPE is:

$$\text{CPD1} / \text{LPD1} + \text{CPD2} / \text{LPD2} + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

WLAN 5GHz + BT EDR = 0.061 + 0.0017 = 0.063, therefore the maximum calculations of above situations are less than the "1" limit.

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

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