MPE Report

Applicant	:	EmWicon Corporation
Product Type	:	Wi-Fi 5 802.11ac 2x2 dual-band Mini PCIe Module
Trade Name	:	emwicon
Model Number	:	WMX6218
Applicable Standard	:	47 CFR § 2.1091
Received Date	:	Dec.17, 2021
Issue Date	:	Feb. 10, 2022

Issued by

Approved By : Kris Pan

(Kris Pan)

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Taiwan Accreditation Foundation accreditation number: 1330
Test Firm MRA designation number: TW0010

Note:

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Revision History

Rev.	Issued Date	Revisions	Revised By
00	Feb. 10, 2022	Initial Issue	Tobey Cheng

Contents

1. General Information

1.1 Reference Applicable Standard

Standard	Description	Version
IEEE C95.1	American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300 KHz to 100 GHz, New York.	1992
47 CFR Part §2.1091	Radiofrequency radiation exposure evaluation: mobile devices.	-
47 CFR Part §1.1310	Radiofrequency radiation exposure limits.	-

2. Description of Equipment under Test (EUT)

Applicant	EmWicon Corporation 7F.-5, No. 258, Liancheng Rd., Zhonghe Dist., New Taipei City 235, Taiwan (R.O.C.)				
Product Type	Wi-Fi 5 802.11ac 2x2 dual-band Mini PCIe Module				
Trade Name	emwicon				
Model Number	WMX6218				
FCC ID	2A3G3-WMX6218				
Frequency Range	WLAN 2.4 GHz Band：2412 - 2472 MHz WLAN 5.2 GHz Band：5180 - 5320 MHz WLAN 5.6 GHz Band：5500 - 5720 MHz WLAN 5.8 GHz Band：5745 - 5825 MHz Bluetooth：2402 - 2480 MHz				
Supported Modulations	WLAN 2.4 GHz : 802.11b/g/n/ac HT20 / HT40 / VHT20 / VHT40				
	WLAN 5 GHz : 802.11a/n/ac HT20 / HT40 / VHT20 / VHT40 / VHT80				
	Bluetooth: BR / EDR / LE				
Antenna Information	Antenna	Model	Type	Max. Gain (dBi)	
				2.4 GHz	5 GHz
	ANT-0 / ANT-1	1461530150	Dipole antenna	2.8	3.7
		ATD6251	Dipole antenna	2.0	2.0
		ATD6351	Dipole antenna	3.0	3.0
		ATD6551(*)	Dipole antenna	5.0	5.0
	G_{ANT}			5.00	
	Directional			8.01	
	Antenna	Model	Type	Max. Gain (dBi)	
				Bluetooth	
	ANT-1	1461530150	Dipole antenna	2.8	
		ATD6251	Dipole antenna	2.0	
		ATD6351	Dipole antenna	3.0	
		ATD6551(*)	Dipole antenna	5.0	
Note：(*)This is the antenna worst.					
Antenna Delivery	IEEE 802.11b: 2TX (CDD) IEEE 802.11g : 2TX (CDD) IEEE 802.11n 2.4 GHz 20 MHz / 40 MHz: 2TX (CDD) IEEE 802.11a/n/ac 5 GHz 20 MHz / 40 MHz / 80 MHz: 2TX (CDD)				
RF Evaluation	0.202 mW/cm^2				

The above equipment was tested by A Test Lab Techno Corp. For compliance with the requirements set forth in 47 CFR § 2.1091 / 47 CFR § 1.1310. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

3. Human Exposure Assessment

Due to the design and installation of this product, it is not possible to conduct SAR evaluation. This is because client either manufactures or supplies the antenna(s) that will be used in the installation of this product. Therefore, this product will be evaluated as a mobile device per 47 CFR § 1.1310 titled “Radiofrequency radiation exposure limits”, generally referred to as MPE limits.

In 47 CFR § 2.1091, paragraph (b) defines a mobile device as “a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 cm is normally maintained between the transmitter’s radiating structure(s) and the body of the user or nearby persons. ” This product is intended to be installed into a vehicle such that the unit is physically secured at one location. In the installation guide supplied with the product,

Client has made the following statement: “IMPORTANT: To meet the FCC’s RF Exposure Guidelines, the antenna should be installed so there is at least 20 cm of separation between the body of the user and nearby persons and the antenna”. Based on the installation of the transceiver and the antenna, the transmitters radiating structure is more than 20 cm from the user. Thus, this product is a “mobile device” as defined in section § 2.1091 paragraph (b).

Exposure evaluation
$$S_{eirp} = \frac{EIRP}{4\pi d^2} = \frac{PG}{4\pi d^2}\left(W/m^2\right)$$

Where

S: is the input power (W);

G: is the antenna gain;

d : is the distance between antennas and evaluation point (m).

4. Power Density Limit – RF Exposure Evaluation

Thv In 47 CFR § 1.1310, use of the device as based upon the user's awareness and ability to exercise control over human exposure. The two categories defined are Occupational / Controlled Exposure and General Population / Uncontrolled. These two categories are defined as follow:

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 / 1,500	30
1,500-100,000	-	-	1.0	30
Limits for Occupational / Controlled 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)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1,842 / f	4.89 / f	($900 / f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1,500	-	-	F / 300	6
1,500-100,000	-	-	5	6

5. Conducted Power

Band	Date Rate or Sub-test	CH	Frequency (MHz)	ANT-0	ANT-0	ANT-1	ANT-1	ANT-(Total)	ANT-(Total)
				Average power	Tune-up Power	Average power	Tune-up Power	Average power	Tune-up Power
				dBm	dBm	dBm	dBm	dBm	dBm
802.11b	1M	1	2412	19.73	21.00	19.65	22.00	22.70	24.00
		6	2437	20.83	21.00	21.01	22.00	**23.93**	24.00
		11	2462	19.31	21.00	19.02	22.00	22.18	24.00
		12	2467	14.44	15.00	14.18	15.00	17.32	18.00
		13	2472	9.96	10.00	9.92	10.00	12.95	15.00
802.11g	6M	1	2412	13.93	15.00	13.99	15.00	16.97	18.00
		6	2437	20.87	21.00	20.98	22.00	23.94	24.00
		11	2462	13.89	15.00	13.85	15.00	16.88	18.00
		12	2467	10.96	11.50	10.92	11.50	13.95	15.00
		13	2472	8.03	9.00	8.04	9.00	11.05	13.00
802.11n_HT20	13M	1	2412	14.10	15.00	13.99	15.00	17.06	18.00
		6	2437	20.86	21.00	20.82	22.00	23.85	24.00
		11	2462	13.82	15.00	13.89	15.00	16.87	18.00
		12	2467	11.00	11.50	10.90	11.50	13.96	15.00
		13	2472	7.89	9.00	7.98	9.00	10.95	13.00
802.11n_HT40	27M	3	2422	12.80	15.00	12.69	15.00	15.76	18.00
		6	2437	16.86	17.00	16.81	17.00	19.85	20.00
		9	2452	14.10	15.00	14.04	15.00	17.08	18.00
		10	2457	10.93	11.50	10.74	11.50	13.85	15.00
		11	2462	7.43	8.00	7.23	8.00	10.34	13.00
802.11n_HT20 (256-QAM)	13M	1	2412	14.19	15.00	14.08	15.00	17.15	18.00
		6	2437	20.90	21.00	20.94	22.00	23.93	24.00
		11	2462	13.93	15.00	14.01	15.00	16.98	18.00
		12	2467	11.05	15.00	10.99	15.00	14.03	15.00
		13	2472	8.03	9.00	8.11	9.00	11.08	13.00
802.11n_HT40 (256-QAM)	27M	3	2422	12.83	15.00	12.79	15.00	15.82	18.00
		6	2437	16.91	17.00	16.87	17.00	19.90	20.00
		9	2452	14.13	15.00	14.18	16.00	17.17	18.00
		10	2457	10.98	11.50	10.88	11.05	13.94	15.00
		11	2462	7.46	8.00	7.36	8.00	10.42	13.00

Band	Date Rate or Sub-test	CH	Frequency (MHz)	ANT-0	ANT-0	ANT-1	ANT-1	ANT-(Total)	ANT-(Total)
				Average power	Tune-up Power	Average power	Tune-up Power	Average power	Tune-up Power
				dBm	dBm	dBm	dBm	dBm	dBm
802.11a	6M	36	5180	18.66	20.00	18.63	20.00	21.66	22.00
		40	5200	18.69	20.00	18.67	20.00	21.69	22.00
		44	5220	18.62	20.00	18.60	20.00	21.62	22.00
		48	5240	18.73	20.00	18.64	20.00	21.70	22.00
		52	5260	18.69	20.00	18.66	20.00	21.69	22.00
		56	5280	18.48	20.00	18.41	20.00	21.46	22.00
		60	5300	18.43	20.00	18.38	20.00	21.42	22.00
		64	5320	18.53	20.00	18.54	20.00	21.55	22.00
		100	5500	17.55	20.00	17.48	20.00	20.53	22.00
		104	5520	18.51	20.00	18.59	20.00	21.56	22.00
		108	5540	18.52	20.00	18.58	20.00	21.56	22.00
		112	5560	18.55	20.00	18.62	20.00	21.60	22.00
		116	5580	18.50	20.00	18.56	20.00	21.54	22.00
		132	5660	18.53	20.00	18.57	20.00	21.56	22.00
		136	5680	18.52	20.00	18.55	20.00	21.55	22.00
		140	5700	17.53	20.00	17.68	20.00	20.62	22.00
		149	5745	21.75	22.00	21.56	22.00	24.67	25.00
		153	5765	21.68	22.00	21.43	22.00	24.57	25.00
		157	5785	21.71	22.00	21.47	22.00	24.60	25.00
		161	5805	21.69	22.00	21.44	22.00	24.58	25.00
		165	5825	21.58	22.00	21.37	22.00	24.49	25.00
802.11n_5G_HT20	13M	36	5180	18.66	20.00	18.64	20.00	21.66	22.00
		40	5200	18.70	20.00	18.68	20.00	21.70	22.00
		44	5220	18.61	20.00	18.64	20.00	21.64	22.00
		48	5240	18.68	20.00	18.66	20.00	21.68	22.00
		52	5260	18.61	20.00	18.49	20.00	21.56	22.00
		56	5280	18.50	20.00	18.43	20.00	21.48	22.00
		60	5300	18.48	20.00	18.41	20.00	21.46	22.00
		64	5320	18.53	20.00	18.66	20.00	21.61	22.00
		100	5500	16.41	18.00	16.57	18.00	19.50	20.00
		104	5520	18.61	20.00	18.37	20.00	21.50	22.00
		108	5540	18.62	20.00	18.41	20.00	21.53	22.00
		112	5560	18.66	20.00	18.49	20.00	21.59	22.00
		116	5580	18.53	20.00	18.40	20.00	21.48	22.00
		132	5660	18.58	20.00	18.36	20.00	21.48	22.00
		136	5680	18.45	20.00	18.32	20.00	21.40	22.00
		140	5700	16.44	18.00	16.57	18.00	19.52	20.00
		149	5745	21.60	22.00	21.26	22.00	24.44	25.00
		153	5765	21.48	22.00	21.20	22.00	24.35	25.00
		157	5785	21.57	22.00	21.30	22.00	24.45	25.00
		161	5805	21.51	22.00	21.21	22.00	24.37	25.00
		165	5825	21.47	22.00	21.68	22.00	24.59	25.00

Band	Date Rate or Sub-test	CH	Frequency (MHz)	ANT-0	ANT-0	ANT-1	ANT-1	ANT-(Total)	ANT-(Total)
				Average power	Tune-up Power	Average power	Tune-up Power	Average power	Tune-up Power
				dBm	dBm	dBm	dBm	dBm	dBm
802.11n_5G_HT40	27M	38	5190	16.24	18.00	16.26	18.00	19.26	20.00
		46	5230	19.84	20.00	19.87	20.00	22.87	24.00
		54	5270	19.69	20.00	19.65	20.00	22.68	24.00
		62	5310	15.63	18.00	15.87	18.00	18.76	20.00
		102	5510	14.80	15.00	14.81	15.00	17.82	20.00
		110	5550	20.19	22.00	20.08	22.00	23.15	24.00
		134	5670	18.78	20.00	18.59	20.00	21.70	24.00
		151	5755	20.14	22.00	19.94	22.00	23.05	24.00
		159	5795	20.07	22.00	19.88	22.00	22.99	24.00
802.11ac_VHT20	13M	36	5180	18.69	20.00	18.74	20.00	21.73	24.00
		40	5200	18.79	20.00	18.78	20.00	21.80	24.00
		44	5220	18.75	20.00	18.72	20.00	21.75	24.00
		48	5240	18.76	20.00	18.69	20.00	21.74	24.00
		52	5260	18.75	20.00	18.62	20.00	21.70	24.00
		56	5280	18.61	20.00	18.53	20.00	21.58	24.00
		60	5300	18.58	20.00	18.49	20.00	21.55	24.00
		64	5320	18.55	20.00	18.67	20.00	21.62	24.00
		100	5500	16.44	18.00	16.58	18.00	19.52	20.00
		104	5520	18.69	20.00	18.48	20.00	21.60	24.00
		108	5540	18.67	20.00	18.46	20.00	21.58	24.00
		112	5560	18.71	20.00	18.51	20.00	21.62	24.00
		116	5580	18.66	20.00	18.49	20.00	21.59	24.00
		132	5660	18.61	20.00	18.40	20.00	21.52	24.00
		136	5680	18.59	20.00	18.41	20.00	21.51	24.00
		140	5700	16.49	18.00	16.62	18.00	19.57	20.00
		149	5745	21.65	22.00	21.27	22.00	24.47	25.00
		153	5765	21.60	22.00	21.28	22.00	24.45	25.00
		157	5785	21.65	22.00	21.31	22.00	24.49	25.00
		161	5805	21.61	22.00	21.26	22.00	24.45	25.00
		165	5825	21.58	22.00	21.74	22.00	24.67	25.00
802.11ac_VHT40	27M	38	5190	16.30	18.00	16.33	18.00	19.33	20.00
		46	5230	19.97	20.00	19.88	20.00	22.94	24.00
		54	5270	19.83	20.00	19.75	20.00	22.80	24.00
		62	5310	15.76	18.00	15.88	18.00	18.83	20.00
		102	5510	14.85	15.00	14.91	15.00	17.89	20.00
		110	5550	20.21	22.00	20.22	22.00	23.23	24.00
		134	5670	18.82	20.00	18.66	20.00	21.75	24.00
		151	5755	20.15	22.00	20.06	22.00	23.12	24.00
		159	5795	20.10	22.00	20.02	22.00	23.07	24.00
802.11ac_VHT80	58.6M	42	5210	14.92	15.00	14.98	15.00	17.96	20.00
		58	5290	14.84	15.00	14.73	15.00	17.80	20.00
		106	5530	13.83	15.00	14.01	15.00	16.93	18.00
		155	5775	17.21	18.00	17.16	18.00	20.20	22.00

Data Rate	Frequency(MHz)	Packet Type	Average Power	Tune-up Power
			dBm	dBm
1Mbps (GFSK)	2402	DH1	6.06	7.00
		DH3	6.08	7.00
		DH5	6.10	7.00
	2441	DH1	5.38	7.00
		DH3	5.42	7.00
		DH5	5.45	7.00
	2480	DH1	5.57	7.00
		DH3	5.58	7.00
		DH5	5.59	7.00
2Mbps (π/4-DQPSK)	2402	DH1	6.67	7.00
		DH3	6.68	7.00
		DH5	6.70	7.00
	2441	DH1	6.06	7.00
		DH3	6.08	7.00
		DH5	6.10	7.00
	2480	DH1	6.28	7.00
		DH3	6.31	7.00
		DH5	6.35	7.00
3Mbps (8DPSK)	2402	DH1	6.70	7.00
		DH3	6.72	7.00
		DH5	6.73	7.00
	2441	DH1	6.09	7.00
		DH3	6.11	7.00
		DH5	6.13	7.00
	2480	DH1	6.35	7.00
		DH3	6.37	7.00
		DH5	6.39	7.00

Bluetooth LE 1 Mbps		
MHz	Average Power	Tune-up Power
	dBm	dBm
2402	5.49	6.00
2440	4.91	6.00
2480	5.09	6.00
Bluetooth LE 2 Mbps		
MHz	Average Power	Tune-up Power
	dBm	dBm
2402	5.56	6.00
2440	4.98	6.00
2480	5.16	6.00
Bluetooth LE 500 Kbps (C2)		
MHz	Average Power	Tune-up Power
	dBm	dBm
2402	5.48	6.00
2440	4.89	6.00
2480	5.08	6.00
Bluetooth LE 125 Kbps (C8)		
MHz	Average Power	Tune-up Power
	dBm	dBm
2402	5.47	6.00
2440	4.87	6.00
2480	5.06	6.00

6. Test Result

Antenna	Band	Frequency (MHz)	Limit (mW)/cm^2	Distance (cm) [R]	Tune-up Power (dBm) [P]	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	Power with Duty cycle (mW) [P]x[G]	Power Density (mW)/cm^2 [S]
Bluetooth Antenna	Bluetooth	2402-2480	1.0	20	7.00	5.00	3.16	1	15.84	0.003
Wi-Fi Antenna 0	2.4 GHz	2412-2462	1.0	20	21.50	5.00	3.16	1	446.36	0.089
	5 GHz	5150-5250	1.0	20	20.00	5.00	3.16	1	316.00	0.063
		5250-5350	1.0	20	20.00	5.00	3.16	1	316.00	0.063
		5470-5725	1.0	20	22.00	5.00	3.16	1	500.83	0.100
		5725-5850	1.0	20	22.00	5.00	3.16	1	500.83	0.100
Wi-Fi Antenna 1	2.4 GHz	2412-2462	1.0	20	22.00	5.00	3.16	1	500.83	0.100
	5 GHz	5150-5250	1.0	20	20.00	5.00	3.16	1	316.00	0.063
		5250-5350	1.0	20	20.00	5.00	3.16	1	316.00	0.063
		5470-5725	1.0	20	22.00	5.00	3.16	1	500.83	0.100
		5725-5850	1.0	20	22.00	5.00	3.16	1	500.83	0.100

Note:

＊ Mobile or fixed location transmitters, minimum separation distance is 20 cm, even if calculations indicate MPE distance is less.

＊ We used the maximum power and gain to provide MPE results.

＊ The Numeric Gain calculated by 10^(ant. Gain(dBi) /10).

＊ The MPE results are evaluated by lowest data rate for WLAN.

Simultaneous Transmitting：

Total MPE = 0.203 (mW)/cm^2 < 1 (mW)/cm^2

---END---