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MPE Report

Applicant	: Control4
Product Type	: 802.11ac 2x2 Wave 2 Access Point
Trade Name	: pakedge
Model Number	: WA-2200-1, WA-2200, WA-2200-C, WA-2200-C-1
Received Date	: Feb. 18, 2019
Test Period	: Mar. 18, 2019
Issue Date	: May 29, 2019
Test Specification	: ANSI / IEEE Std.C95.1-1992 / IEEE Std. 1528-2013 47 CFR § 2.1091 47 CFR § 1.1310
Test Firm MRA designation number	: TW0010

1. The test operations have to be performed with cautious behavior, the test results are as attached.
2. The test results are under chamber environment of A Test Lab Techno Corp. A Test Lab Techno Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples.
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4. This document may be altered or revised by A Test Lab Techno. Corp. personnel only, and shall be noted in the revision section of the document.

Approved By : Edison Hu Tested By : Kris Pan
(Edison Hu) (Kris Pan)



Revision History

Rev.	Issue Date	Revisions	Revised By
00	May 15, 2019	Initial Issue	Shelly Chen
01	May 29, 2019	Page 9 Added description of simultaneous transmitting.	Shelly Chen



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1. Description of Equipment under Test (EUT)

Applicant	Control4 11734 S. Election Road, Draper, Utah, 84020, United States				
Manufacturer	Control4 11734 S. Election Road, Draper, Utah, 84020, United States				
Product Type	802.11ac 2x2 Wave 2 Access Point				
Trade Name	pakedge				
Model Number	WA-2200-1, WA-2200, WA-2200-C, WA-2200-C-1 (*Those model numbers differ from each other in selling region.)				
FCC ID	R33WA2200				
Class II Permissive Change	Add U-NII Band II function by software control.				
Frequency Range	Operate Band			Frequency Range (MHz)	
	IEEE 802.11a U-NII Band II-A			5260 - 5320	
	IEEE 802.11a U-NII Band II-C			5500 - 5700	
	IEEE 802.11n 5 GHz / 802.11ac 20 MHz U-NII Band II-A			5260 - 5320	
	IEEE 802.11n 5 GHz / 802.11ac 20 MHz U-NII Band II-C			5500 - 5700	
	IEEE 802.11n 5 GHz / 802.11ac 40 MHz U-NII Band II-A			5270 - 5310	
	IEEE 802.11n 5 GHz / 802.11ac 40 MHz U-NII Band II-C			5510 - 5670	
	IEEE 802.11ac 80 MHz U-NII Band II-A			5290	
	IEEE 802.11ac 80 MHz U-NII Band II-C			5530	
Antenna Information	ANT	Model	Type	Max. Gain (dBi)	
	ANT-0	5718A0289300	Metal PIFA Antenna	5260 - 5320	3.98
				5500 - 5700	5.30
	ANT-1	5718A0289300	Metal PIFA Antenna	5260 - 5320	5.38
				5500 - 5700	4.88
	G_{ANT}			5260 - 5320	4.74
				5500 - 5700	5.10
	Directional Gain			5260 - 5320	7.72
5500 - 5700				8.10	
Antenna Delivery	IEEE 802.11a: 2TX (CDD) IEEE 802.11ac 20 MHz / 40 MHz / 80 MHz: 2TX (CDD/Beamforming on)				
Temperature Range	0 ~ +40°C				

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



2. 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

$$S = \frac{PG}{4\pi R^2}$$

Where

S: power density

P: power input to the antenna

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.



3. RF Output Power

The conducted power turn-up tolerance reference manufacturer specification.

Band	Data Rate (Mbps)	Frequency (MHz)	Average Conducted power (dBm)		
			ANT-0	ANT-1	ANT-0+1
IEEE 802.11a	6	5260.0	16.85	16.76	19.82
		5280.0	17.15	16.99	20.08
		5300.0	17.18	17.14	20.17
		5320.0	16.77	16.93	19.86
		5500.0	16.30	16.17	19.25
		5520.0	15.80	15.95	18.89
		5540.0	15.79	16.05	18.93
		5560.0	15.66	16.30	19.00
		5580.0	15.74	16.28	19.03
		5660.0	16.05	15.63	18.86
		5680.0	15.92	15.48	18.72
		5700.0	17.70	17.10	20.42
IEEE 802.11ac 20 MHz	13	5260.0	17.35	16.74	20.07
		5280.0	17.43	17.05	20.25
		5300.0	17.19	17.33	20.27
		5320.0	17.05	17.56	20.32
		5500.0	16.20	17.28	19.78
		5520.0	15.61	16.43	19.05
		5540.0	15.90	16.54	19.24
		5560.0	16.33	16.72	19.54
		5580.0	16.74	16.70	19.73
		5660.0	17.26	15.73	19.57
		5680.0	17.20	15.61	19.49
		5700.0	18.29	16.62	20.55
IEEE 802.11ac 40 MHz	27	5270.0	18.43	18.39	21.42
		5310.0	16.39	16.52	19.47
		5510.0	16.40	16.30	19.36
		5550.0	18.67	18.78	21.74
		5670.0	18.92	18.50	21.73
IEEE 802.11ac 80 MHz	58.6	5290.0	16.36	16.69	19.54
		5530.0	16.21	16.50	19.37

Note: The relevant measured result has the offset with cable loss already.



Beamforming on

Band	Date Rate (Mbps)	Frequency (MHz)	Average Conducted power (dBm)		
			ANT-0	ANT-1	ANT-0+1
IEEE 802.11ac 20 MHz	13	5260.0	14.14	13.55	16.87
		5280.0	13.68	13.52	16.61
		5300.0	13.73	13.84	16.80
		5320.0	13.51	14.21	16.88
		5500.0	13.03	13.97	16.54
		5520.0	12.35	13.10	15.75
		5540.0	12.70	13.12	15.93
		5560.0	13.15	13.30	16.24
		5580.0	13.40	13.24	16.33
		5660.0	14.01	12.45	16.31
		5680.0	13.97	12.40	16.27
IEEE 802.11ac 40 MHz	27	5700.0	14.70	13.16	17.01
		5270.0	15.05	15.00	18.04
		5310.0	13.12	13.29	16.22
		5510.0	13.15	12.94	16.06
		5550.0	15.45	15.74	18.61
IEEE 802.11ac 80 MHz	58.6	5670.0	15.83	15.43	18.64
		5290.0	13.17	13.14	16.17
		5530.0	12.99	13.22	16.12

Note: The relevant measured result has the offset with cable loss already.



4. Test Results

WLAN Antenna_CDD										
Band	Data Rate (Mbps)	Frequency (MHz)	Limit (mw)	Distance [R] (cm)	Max tune-up Power (upper limit) [P] (dBm)	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	Power with Duty cycle [TP] (mW)	Power Density [S] (mw/cm ²)
IEEE 802.11a	6	5260.0	1	20	20.5	4.74	2.98	1	334.36	0.067
		5280.0	1	20	20.5	4.74	2.98	1	334.36	0.067
		5300.0	1	20	20.5	4.74	2.98	1	334.36	0.067
		5320.0	1	20	20.5	4.74	2.98	1	334.36	0.067
		5500.0	1	20	20.5	5.10	3.24	1	363.53	0.072
		5520.0	1	20	20.5	5.10	3.24	1	363.53	0.072
		5540.0	1	20	20.5	5.10	3.24	1	363.53	0.072
		5560.0	1	20	20.5	5.10	3.24	1	363.53	0.072
		5580.0	1	20	20.5	5.10	3.24	1	363.53	0.072
		5660.0	1	20	20.5	5.10	3.24	1	363.53	0.072
		5680.0	1	20	20.5	5.10	3.24	1	363.53	0.072
		5700.0	1	20	20.5	5.10	3.24	1	363.53	0.072
IEEE 802.11ac 20 MHz	13	5260.0	1	20	20.5	4.74	2.98	1	334.36	0.067
		5280.0	1	20	20.5	4.74	2.98	1	334.36	0.067
		5300.0	1	20	20.5	4.74	2.98	1	334.36	0.067
		5320.0	1	20	20.5	4.74	2.98	1	334.36	0.067
		5500.0	1	20	21.0	5.10	3.24	1	407.89	0.081
		5520.0	1	20	21.0	5.10	3.24	1	407.89	0.081
		5540.0	1	20	21.0	5.10	3.24	1	407.89	0.081
		5560.0	1	20	21.0	5.10	3.24	1	407.89	0.081
		5580.0	1	20	21.0	5.10	3.24	1	407.89	0.081
		5660.0	1	20	21.0	5.10	3.24	1	407.89	0.081
		5680.0	1	20	21.0	5.10	3.24	1	407.89	0.081
		5700.0	1	20	21.0	5.10	3.24	1	407.89	0.081
IEEE 802.11ac 40 MHz	27	5270.0	1	20	21.5	4.74	2.98	1	420.94	0.084
		5310.0	1	20	20.0	4.74	2.98	1	298	0.059
		5510.0	1	20	19.5	5.10	3.24	1	288.77	0.057
		5550.0	1	20	22.0	5.10	3.24	1	513.51	0.102
		5670.0	1	20	22.0	5.10	3.24	1	513.51	0.102
IEEE 802.11ac 80 MHz	58.6	5290.0	1	20	20.0	4.74	2.98	1	298	0.059
		5530.0	1	20	20.0	5.10	3.24	1	324	0.064



WLAN Antenna_Beamforming on										
Band	Data Rate (Mbps)	Frequency (MHz)	Limit (mw)	Distance [R] (cm)	Max tune-up Power (upper limit) [P] (dBm)	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	Power with Duty cycle [TP] (mW)	Power Density [S] (mw/cm ²)
IEEE 802.11ac 20 MHz	13	5260.0	1	20	17.0	7.72	5.92	1	296.7	0.059
		5280.0	1	20	17.0	7.72	5.92	1	296.7	0.059
		5300.0	1	20	17.0	7.72	5.92	1	296.7	0.059
		5320.0	1	20	17.0	7.72	5.92	1	296.7	0.059
		5500.0	1	20	17.5	8.10	6.46	1	363.27	0.072
		5520.0	1	20	17.5	8.10	6.46	1	363.27	0.072
		5540.0	1	20	17.5	8.10	6.46	1	363.27	0.072
		5560.0	1	20	17.5	8.10	6.46	1	363.27	0.072
		5580.0	1	20	17.5	8.10	6.46	1	363.27	0.072
		5660.0	1	20	17.5	8.10	6.46	1	363.27	0.072
		5680.0	1	20	17.5	8.10	6.46	1	363.27	0.072
IEEE 802.11ac 40 MHz	27	5270.0	1	20	18.5	7.72	5.92	1	419.1	0.083
		5310.0	1	20	16.5	7.72	5.92	1	264.44	0.053
		5510.0	1	20	16.5	8.10	6.46	1	288.56	0.057
		5550.0	1	20	19.0	8.10	6.46	1	513.14	0.102
		5670.0	1	20	19.0	8.10	6.46	1	513.14	0.102
IEEE 802.11ac 80 MHz	58.6	5290.0	1	20	16.5	7.72	5.92	1	264.44	0.053
		5530.0	1	20	16.5	8.10	6.46	1	288.56	0.057

Note:

1. Mobile or fixed location transmitters, minimum separation distance is 20 cm, even if calculations indicate MPE distance is less.
2. The Numeric Gain calculated by $10^{(\text{ant. Gain(dBi)} / 10)}$.
3. Each band max power which perform MPE of any configurations.
4. The MPE results are evaluated by lowest data rate for WLAN.
5. The device operating IEEE 802.11 b/g/n/a/ac mode is 2TX (CDD/MIMO).
6. The device support simultaneous transmission.
7. The simultaneous transmission result is same as the original data, please refer test report number: 1812FS11.

Simultaneous Transmitting :

$$\text{Total MPE} = 2.4 \text{ GHz MPE} + 5 \text{ GHz MPE} = 0.215 + 0.237 = 0.452 \text{ (mw)/cm}^2 < 10 \text{ (mw)/cm}^2$$