MPE Report

Applicant	:	PISMO LABS TECHNOLOGY LIMITED
Product Type	:	PEPWAVE / peplink Wireless Product
Trade Name	:	PEPWAVE, peplink
Model Number	:	AP One AX, AP One ENT AX, APO-ENT-AX, APO-AX, PRB-11AX, Pepwave AP One AX, Pepwave AP One Enterprise AX, Peplink AP One AX, Peplink AP One Enterprise AX, AP One Enterprise AX
Applicable Standard	:	IEEE Std.C95.1 47 CFR § 2.1091 / 47 CFR § 1.1310
Received Date	:	May 13, 2020
Test Period	:	Jun. 10 ~ Jun. 24, 2020
Issued Date	:	Aug. 12, 2020

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:

1. The test results are valid only for samples provided by customers and under the test conditions described in this report.
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3. The relevant information is provided by customers in this test report. According to the correctness, appropriateness or completeness of the information provided by the customer, if there is any doubt or error in the information which affects the validity of the test results, the laboratory does not take the responsibility.

Revision History

Rev.	Issued Date	Revisions	Revised By
00	Aug. 05, 2020	Initial Issue	Nicole Chu
01	Aug. 12, 2020	P05 Revised Frequency Range	Nicole Chu

Contents

1. Reference Applicable Standard

Standard	Description	Version
ANSI/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	PISMO LABS TECHNOLOGY LIMITED A8, 5/F, HK Spinners Industrial Building, Phase 6, 481 Castle Peak Road, Cheung Sha Wan, Hong Kong			
Manufacturer	PISMO LABS TECHNOLOGY LIMITED A8, 5/F, HK Spinners Industrial Building, Phase 6, 481 Castle Peak Road, Cheung Sha Wan, Hong Kong			
Product Type	PEPWAVE / peplink Wireless Product			
Trade Name	PEPWAVE, peplink			
Model Number	AP One AX, AP One ENT AX, APO-ENT-AX, APO-AX, PRB-11AX, Pepwave AP One AX, Pepwave AP One Enterprise AX, Peplink AP One AX, Peplink AP One Enterprise AX, AP One Enterprise AX			
FCC ID	U8G-P1X02			
Frequency Range	Operate Band			Frequency Range (MHz)
	IEEE 802.11b / 802.11g			2412 - 2462
	IEEE 802 11n 2.4 GHz 20 MHz(256-QAM) IEEE 802 11ax 2.4 GHz 20 MHz			2412 - 2462
	IEEE 802.11n 2.4 GHz 40 MHz (256-QAM) IEEE 802.11ax 2.4 GHz 40 MHz			2422 - 2452
	IEEE 802.11a U-NII Band I			5180 - 5240
	IEEE 802.11a U-NII Band III			5745 - 5825
	IEEE 802.11n 5 GHz 20 MHz U-NII Band I IEEE 802.11ax 20 MHz U-NII Band I			5180 - 5240
	IEEE 802.11n 5 GHz 20 MHz U-NII Band III IEEE 802.11ax 20 MHz U-NII Band III			5745 - 5825
	IEEE 802.11n 5 GHz 40 MHz U-NII Band I IEEE 802.11ax 40 MHz U-NII Band I			5190 - 5230
	IEEE 802.11n 5 GHz 40 MHz U-NII Band III IEEE 802.11ax 40 MHz U-NII Band III			5755 - 5795
	IEEE 802.11ac 80 MHz IEEE 802.11ax 80 MHz			5210
				5775
Antenna Information	Model	Type	Max. Gain (dBi)	
	5718A0514300	PIFA Antenna	2412 - 2472	3.70
	5718A0515300	PIFA Antenna	2412 - 2472	4.08
	5718A0516300	PIFA Antenna	2412 - 2472	4.12
	5718A0517300	PIFA Antenna	2412 - 2472	5.01
	G_{ANT}			4.25
	Directional			10.26

Antenna Information	Model	Type	Max. Gain (dBi)	
	5718A0518300	PIFA Antenna	5150~5250	5.13
			5725~5850	5.19
	5718A0522300	PIFA Antenna	5150~5250	4.26
			5725~5850	3.81
	5718A0520300	PIFA Antenna	5150~5250	4.03
			5725~5850	4.56
	5718A0521300	PIFA Antenna	5150~5250	5.04
			5725~5850	5.04
	G_{ANT}		5150~5250	4.64
			5725~5850	4.68
	Directional		5150~5250	10.65
			5725~5850	10.69
Antenna Delivery	IEEE 802.11b: 1TX / 1RX (Diversity) IEEE 802.11g : 4TX / 4RX (CDD) IEEE 802.11n 2.4 GHz 20 MHz / 40 MHz: 4TX / 4RX (STBC / Beamforming on) IEEE 802.11ax 2.4 GHz 20 MHz / 40 MHz: 4TX / 4RX (STBC / Beamforming on) IEEE 802.11a: 4TX / 4RX (CDD) IEEE 802.11ac 20 MHz / 40 MHz / 80 MHz: 4TX / 4RX (STBC / Beamforming on) IEEE 802.11ax 20 MHz / 40 MHz / 80 MHz: 4TX / 4RX (STBC / Beamforming on)			
RF Evaluation	0.443 mW/cm^2			
Operate Temp. 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.

EUT Modify Description：

Modify Description: (1)The differences between the original EUT and new one (Hardware removal only): a. Remove a USB Port, a Ethernet RJ45 Port, HW Watchdog IC, Scanning Radio and Bluetooth LE function. b. In new one, Flash NOR is 32 MB and DDR4 RAM is 1 GB. (2)Update applicant name, applicant address, manufacture name, manufacture address, product type, model number, trade name, FCC ID, EUT rated voltage and product's appearance. After the verification of worst cast of AC Power Conducted Emission and Transmitter Radiated Emissions, all test data can be referred to the original report and showed in this report.
Original Report : 2007FS16 Rev.01 Modify: 2007FS15 Rev.01

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

4.1 *Conducted Power*

Beamforming on

Band	Date Rate or Sub-test	CH	Frequency (MHz)	Average Conducted power (dBm)		
				ANT-0	ANT-1	All ANT
802.11n_HT20 (256-QAM)	26M	1	2412	10.76	10.84	16.68
		6	2437	13.01	13.04	18.90
		11	2462	10.58	10.39	16.22
802.11n_HT40 (256-QAM)	54M	3	2422	10.42	10.45	16.43
		6	2437	11.14	11.19	17.07
		9	2452	9.06	8.99	14.98

Band	Date Rate or Sub-test	CH	Frequency (MHz)	RU	RU Number	Average Conducted power (dBm)		
						ANT-0	ANT-1	All ANT
802.11ax_HE20	MCS0	1	2412	242	1	10.34	10.32	16.30
		6	2437	242	1	13.04	13.04	19.00
		11	2462	242	1	8.23	8.46	14.27
802.11ax_HE40	MCS0	3	2422	484	1	9.46	9.42	15.42
		6	2437	484	1	10.21	10.28	16.19
		9	2452	484	1	8.06	8.11	14.07

Beamforming off

Band	Date Rate or Sub-test	CH	Frequency (MHz)	Average Conducted power (dBm)		
				ANT-0	ANT-1	All ANT
802.11b	1M	1	2412	19.28	19.42	---
		6	2437	19.21	19.24	---
		11	2462	19.32	19.49	---
802.11g	6M	1	2412	16.66	16.82	22.70
		6	2437	19.24	19.35	25.24
		11	2462	16.74	16.83	22.76
802.11n_HT20 (256-QAM)	26M	1	2412	17.34	17.28	23.09
		6	2437	19.31	19.34	25.18
		11	2462	16.77	16.62	22.61
802.11n_HT40 (256-QAM)	54M	3	2422	16.81	16.84	22.82
		6	2437	17.54	17.57	23.55
		9	2452	15.44	15.52	21.48

Band	Date Rate or Sub-test	CH	Frequency (MHz)	RU	RU Number	Average Conducted power (dBm)		
						ANT-0	ANT-1	All ANT
802.11ax_HE20	MCS0	1	2412	242	1	16.72	16.81	22.68
		6	2437	242	1	19.21	19.32	25.21
		11	2462	242	1	14.74	14.82	20.72
802.11ax_HE40	MCS0	3	2422	484	1	15.82	15.96	21.89
		6	2437	484	1	16.54	16.71	22.68
		9	2452	484	1	14.41	14.58	20.53

Beamforming on

Band	Date Rate or Sub-test	CH	Frequency (MHz)	Average Conducted power (dBm)		
				ANT-0	ANT-1	All ANT
802.11ac_5G_VHT20	26M	36	5180	11.91	12.14	18.11
		40	5200	12.95	13.11	19.06
		44	5220	12.93	13.08	19.03
		48	5240	13.14	13.33	19.24
		149	5745	12.76	12.74	18.98
		153	5765	12.75	12.64	18.91
		157	5785	12.81	12.68	18.96
		161	5805	12.77	12.65	18.92
		165	5825	13.23	12.80	19.19
802.11ac_5G_VHT40	54M	38	5190	10.26	10.42	16.33
		46	5230	13.21	13.41	19.34
		151	5755	12.84	12.85	19.16
		159	5795	13.22	12.78	19.29
802.11ac_5G_VHT80	117.2M	42	5210	10.06	10.09	16.07
		155	5775	12.86	12.67	19.08

Band	Date Rate or Sub-test	CH	Frequency (MHz)	RU	RU Number	Average Conducted power (dBm)		
						ANT-0	ANT-1	All ANT
802.11ax_5G_HE20	MCS 0	36	5180	242	1	11.81	12.04	17.96
		40	5200	242	1	13.25	13.41	19.32
		44	5220	242	1	13.21	13.44	19.29
		48	5240	242	1	13.51	13.57	19.49
		149	5745	242	1	13.02	12.78	19.19
		153	5765	242	1	13.01	12.73	19.16
		157	5785	242	1	13.09	12.82	19.23
		161	5805	242	1	13.06	12.77	19.18
		165	5825	242	1	13.54	13.04	19.46
802.11ax_5G_HE40	MCS 0	38	5190	484	1	10.36	10.46	16.40
		46	5230	484	1	13.24	13.56	19.40
		151	5755	484	1	12.94	13.02	19.32
		159	5795	484	1	13.26	12.97	19.41
802.11ax_5G_HE80	MCS 0	42	5210	968	1	9.68	9.76	15.74
		155	5775	968	1	13.08	12.97	19.35

Beamforming off

Band	Date Rate or Sub-test	CH	Frequency (MHz)	Average Conducted power (dBm)		
				ANT-0	ANT-1	All ANT
802.11a	6M	36	5180	16.51	16.71	22.65
		40	5200	16.48	16.69	22.65
		44	5220	16.46	16.65	22.61
		48	5240	16.61	16.91	22.75
		149	5745	19.24	18.94	25.28
		153	5765	19.28	18.78	25.26
		157	5785	19.31	18.82	25.30
		161	5805	19.25	18.80	25.26
		165	5825	19.52	19.15	25.46
802.11ac_5G_VHT20	26M	36	5180	18.22	18.34	24.34
		40	5200	19.32	19.24	25.28
		44	5220	19.29	19.20	25.24
		48	5240	19.41	19.34	25.35
		149	5745	19.14	18.80	25.13
		153	5765	19.20	18.79	25.18
		157	5785	19.22	18.85	25.24
		161	5805	19.19	18.82	25.21
		165	5825	19.48	18.82	25.29
802.11ac_5G_VHT40	54M	38	5190	16.64	16.74	22.76
		46	5230	19.51	19.68	25.59
		151	5755	19.21	19.18	25.44
		159	5795	19.48	19.12	25.55
802.11ac_5G_VHT80	117.2M	42	5210	16.44	16.48	22.46
		155	5775	19.22	18.94	25.36

Band	Date Rate or Sub-test	CH	Frequency (MHz)	RU	RU Number	Average Conducted power (dBm)		
						ANT-0	ANT-1	All ANT
802.11ax_5G_HE20	MCS 0	36	5180	242	1	18.12	18.21	24.20
		40	5200	242	1	19.61	19.51	25.50
		44	5220	242	1	19.55	19.48	25.45
		48	5240	242	1	19.72	19.61	25.58
		149	5745	242	1	19.14	18.82	25.27
		153	5765	242	1	19.22	19.00	25.32
		157	5785	242	1	19.31	19.02	25.38
		161	5805	242	1	19.29	18.97	25.32
		165	5825	242	1	19.64	19.21	25.55
802.11ax_5G_HE40	MCS 0	38	5190	484	1	16.82	16.88	22.93
		46	5230	484	1	19.64	19.91	25.76
		151	5755	484	1	19.32	19.14	25.54
		159	5795	484	1	19.54	19.24	25.67
802.11ax_5G_HE80	MCS 0	42	5210	968	1	16.14	16.19	22.14
		155	5775	968	1	19.32	19.14	25.51

5. Test Result

Antenna	Band	Frequency (MHz)	Limit (w)/m^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]
Wi-Fi Antenna	2.4GHz	2412-2462	10	20	25.74	4.25	2.66	1	997.76	0.198
	5GHz	5150-5250	10	20	26.26	4.64	2.91	1	1230.01	0.245
		5725-5850	10	20	26.17	4.68	2.94	1	1216.97	0.242
Wi-Fi Antenna (Beamforming)	2.4GHz	2412-2462	10	20	19.50	10.26	10.62	1	947.27	0.188
	5GHz	5150-5250	10	20	19.99	10.65	11.61	1	1158.20	0.230
		5725-5850	10	20	19.96	10.69	11.72	1	1160.98	0.231

Note:

1. Mobile or fixed location transmitters, minimum separation distance is 20 cm, even if calculations indicate MPE distance is less.
2. We used the maximum power and gain to provide MPE results..
3. The Numeric Gain calculated by 10^(ant. Gain(dBi) /10).
4. The MPE results are evaluated by lowest data rate for WLAN.

Simultaneous Transmitting：

Total MPE = 2.4GHz MPE + 5GHz MPE = 0.198 + 0.245 = 0.443 W/m^2 < 10 W/m^2

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