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Report No.: HKES160900181104

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RF Exposure Evaluation Report

Application No: HKES1609001811IT
Applicant: Pismo Labs Technology Limited
Product Name: Peplink/ Pepwave/ Pismo Labs wireless product
Model No.(EUT): MAX Hotspot
FCC ID: U8G-P1AC1DUO
Standards: 47 CFR Part 1.1307(2015)
47 CFR Part 1.1310(2015)
Date of Receipt: 2016-09-07
Date of Test: 2016-09-22 to 2016-09-26
Date of Issue: 2016-10-10

Test Result :	PASS*
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2016-10-10		Original

Authorized for issue by:			
		<i>Hank yan.</i>	2016-09-26
Tested By		(Hank Yan) /Project Engineer	Date
		<i>Eric Fu</i>	2016-10-10
Checked By		(Eric Fu) /Reviewer	Date



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4 General Information

4.1 Client Information

Applicant:	Pismo Labs Technology Limited
Address of Applicant:	Unit A5, 5/F HK SPINNERS IND BLDG PHASE 6, 481 CASTLE PEAK ROAD, CHEUNG SHA WAN, KOWLOON 999077 HONG KONG

4.2 General Description of EUT

Product Name:	Peplink/ Pepwave/ Pismo Labs wireless product			
Model No.:	MAX Hotspot			
Antenna Type:	MIMO*3			
Power Supply:	Powered by POE POE Model: POE31U-1AT INPUT: 100-240V, 0.8A, 50/60Hz OUTPUT: DC 56V, 0.536A PIN 3,6 DC56V PIN 1,2 RETURN			
For 2.4G WIFI				
Operating Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2472MHz IEEE 802.n(HT40): 2422MHz to 2462MHz			
Type of Modulation:	IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n (HT20)&(HT40): OFDM (64QAM, 16QAM,QPSK,BPSK)			
Antenna Gain:	3.8dBi			
For 5G WIFI				
Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	UNII Band I	IEEE 802.11a	5180-5240	4
		IEEE 802.11n/ac 20MHz	5180-5240	4
		IEEE 802.11n/ac 40MHz	5190-5230	2
		IEEE 802.11ac 80MHz	5210	1
	UNII Band III	IEEE 802.11a	5745-5825	5
		IEEE 802.11n/ac 20MHz	5745-5825	5
		IEEE 802.11n/ac 40MHz	5755-5795	2
IEEE 802.11ac 80MHz		5775	1	
Data Modulation:	For 802.11a: OFDM(BPSK/QPSK/16QAM/64QAM) For 802.11n: OFDM(8PSK/QPSK/16QAM/64QAM)			



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	For 802.11ac: OFDM(8PSK/QPSK/16QAM/64QAM)
Antenna Gain:	4.36dBi
LTE module:	Model Number: MC7354
	FCC ID: N7NMC7355
Alternative LTE module:	Model Number: MC7455
	FCC ID: N7NMC7455
Antenna for LTE module:	Type: PCB Antenna (One main antenna and a DIV antenna) Antenna Gain: -2.09dBi



4.3 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

4.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

- **FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

- **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.



4.5 Deviation from Standards

None.

4.6 Abnormalities from Standard Conditions

None.

4.7 Other Information Requested by the Customer

None.



5 RF Exposure Evaluation

5.1 RF Exposure Compliance Requirement

5.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
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

Friis Formula

Friis transmission formula: $Pd = (Pout * G) / (4 * Pi * R^2)$

Where

Pd = power density in mW/cm²

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

Pd is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

5.1.2 Test Procedure

Software provided by client enabled the EUT to transmit data at lowest, middle and highest channel individually.



5.1.3 EUT RF Exposure Evaluation

For 2.4GHz

Antenna Gain: 3.80dBi

According to KDB 662911, the transmit signal is correlated,

So Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi = 3.80 + 4.77 = 8.57

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 7.19 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
Middle	2422	18.41	69.34	0.099	1	0.099	PASS

Note: Refer to report No. HKES160900181102 for EUT test Max Conducted Peak Output Power value.

The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For 5GHz

Antenna Gain: 4.36dBi

According to KDB 662911, the transmit signal is correlated,

So Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi = 4.36 + 4.77 = 9.13

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 8.18 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Band I

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
48	5240	18.39	69.02	0.112	1	0.112	PASS

Note: Refer to report No. HKES160900181103 for EUT test Max Conducted Peak Output Power value.

The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.



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Band IV

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
149	5745	17.45	55.59	0.091	1	0.091	PASS

Note: Refer to report No. HKES160900181103 for EUT test Max Conducted Peak Output Power value.

The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

LTE for MC7354

Antenna Gain: -2.09dBi (One main antenna and a DIV antenna)

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 0.618 in linear scale.

Frequency (MHz)	Average EIRP (dBm)	Average EIRP (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
704	20.91	123.310	0.025	0.469	0.053	PASS

Note: Refer to MPE evaluation report of LTE modular(FCC ID:N7NMC7355) and find the maximum ratio of the measured power density with limit in channel 23755, so only choose the channel to do MPE evaluation.

Alternative LTE for MC7455

Antenna Gain: -2.09dBi (One main antenna and a DIV antenna)

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 0.618 in linear scale.

Frequency (MHz)	Average EIRP (dBm)	Average EIRP (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
699	20.91	123.310	0.025	0.466	0.054	PASS

Note: Refer to MPE evaluation report of LTE modular(FCC ID:N7NMC7455) and find the maximum ratio of the measured power density with limit in channel 23010, so only choose the channel to do MPE evaluation.



Exposure conditions for simultaneous transmission operations

For LTE module MC7354

Σ of ratios simultaneous transmitting= Wi-Fi 2.4G + Wi-Fi 5G + WWAN

Ratio of Power Density of Wi-Fi 2.4G at R = 20cm	Ratio of Power Density of Wi-Fi 5G at R = 20cm	Ratio of Max. Power Density of WWAN 1 at R = 20 cm	Total ratios simultaneous transmitting at R =20cm	Limit	Result
0.099	0.112	0.053	0.264	1.0	PASS

For LTE module MC7455

Σ of ratios simultaneous transmitting= Wi-Fi 2.4G + Wi-Fi 5G + WWAN

Ratio of Power Density of Wi-Fi 2.4G at R = 20cm	Ratio of Power Density of Wi-Fi 5G at R = 20cm	Ratio of Max. Power Density of WWAN 1 at R = 20 cm	Total ratios simultaneous transmitting at R =20cm	Limit	Result
0.099	0.112	0.054	0.265	1.0	PASS