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Shenzhen Branch

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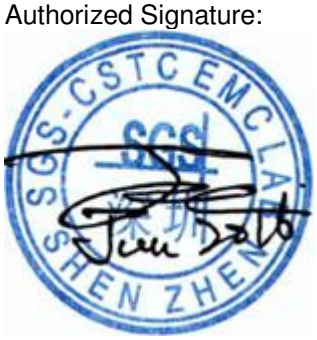
RF Exposure Evaluation Report

Application No:	HKES1605000840IT
Applicant:	Pismo Labs Technology Limited
Product Name:	Peplink/ Pepwave/ Pismo Labs wireless product
Model No.(EUT):	Balance One
Add Model No.:	Balance One AC, Balance One Core, Pismo805AC
FCC ID:	U8G-P1805AC
Standards:	47 CFR Part 1.1307(2014)
	47 CFR Part 1.1310(2014)
Date of Receipt:	2016-05-11
Date of Test:	2016-05-13 to 2016-05-19
Date of Issue:	2016-05-30
Test Result :	**PASS***

* In the configuration tested, the EUTdetailed 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.

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2016-06-02		*Original*

Authorized for issue by:				
Tested By		Hank yan. (Hank Yan) /Project Engineer		2016-05-19 **Date**
Prepared By		Joyce Shi (Joyce Shi) /Clerk		2016-06-02 **Date**
Checked By		Eric Fu (Eric Fu) /Reviewer		2016-06-02 **Date**

3 Contents

4 General Information

4.1 Client Information

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

4.2 General Description of EUT

Product Name:	Peplink/ Pepwave/ Pismo Labs wireless product			
Model No.:	Balance One			
Antenna Type:	MIMO*3			
Power Supply:	SWITCH POWER SUPPLY Model: MU24-Y120200-A1 Input: AC 100-240V, 50/60Hz, 0.7A. Output: DC 12V, 2A			
For 2.4G WIFI				
Operating Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.n(HT40): 2422MHz to 2452MHz			
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:	Ant: Ant1: 4.47dBi; Ant2:4.42dBi; Ant3:4.35dBi			
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) For 802.11ac: OFDM(8PSK/QPSK/16QAM/64QAM)			
Antenna Gain:	Ant1:5.45dBi; Ant2:5.72dBi; Ant3:6.03dBi			

Remark:

Model No.: Balance One, Balance One AC, Balance One Core, Pismo805AC

Only the model Balance One was tested, since the circuit design, PCB layout, electrical components used, internal wiring and functions were identical for the above models, only different on model names for the marketing requirement.

4.3 Test Location

All tests were performed at:

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

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

F= Frequency in MHz

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 id 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 and receive data at lowest, middle and highest channel individually.

5.1.3 EUT RF Exposure Evaluation

For 2.4GHz

Antenna Gain 1: 4.47dBi, Antenna Gain 2: 4.42dBi, Antenna Gain 3: 4.35dBi

According to KDB 662911, the transmit signal is correlated,

So Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}$] dBi= 9.17dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 8.26 in linear scale.

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	2437MHz	24.00	251.19	0.41	1.0	0.41	PASS

Note: Refer to report No. HKES160500084002 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 1 Gain : 5.45dBi, Antenna 2 Gain: 5.72dBi, Antenna 3 Gain: 6.03dBi

According to KDB 662911, the transmit signal is correlated,

So Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}$] dBi= 10.5dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 11.22 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 MHz	23.34	215.77	0.48	1.0	0.48	PASS

Note: Refer to report No. HKES160500084003 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.

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 MHz	21.26	133.66	0.30	1.0	0.30	PASS

Note: Refer to report No. HKES160500084005 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.

1）. exposure conditions for simultaneous transmission operations

Simultaneous transmission MPE test is not required, because the Max. sum of the MPE ratios for 2.4G WIFI and 5G WIFI is 0.41+0.48=0.89＜1