



**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

Email: ee.shenzhen@sgs.com

Report No.: HKES160900181104

Page: 1 of 11

## 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

|                      |              |
|----------------------|--------------|
| <b>Test Result :</b> | <b>PASS*</b> |
|----------------------|--------------|

\* 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.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Documents.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.



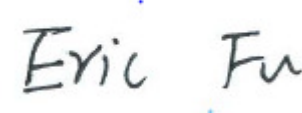
**SGS-CSTC Standards Technical Services Co., Ltd.**  
**Shenzhen Branch**

Report No.: HKES160900181104

Page: 2 of 11

## 2 Version

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

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



### 3 Contents

|                                                       | Page |
|-------------------------------------------------------|------|
| 1 COVER PAGE.....                                     | 1    |
| 2 VERSION .....                                       | 2    |
| 3 CONTENTS .....                                      | 3    |
| 4 GENERAL INFORMATION.....                            | 4    |
| 4.1 CLIENT INFORMATION.....                           | 4    |
| 4.2 GENERAL DESCRIPTION OF EUT .....                  | 4    |
| 4.3 TEST LOCATION .....                               | 6    |
| 4.4 TEST FACILITY .....                               | 6    |
| 4.5 DEVIATION FROM STANDARDS.....                     | 7    |
| 4.6 ABNORMALITIES FROM STANDARD CONDITIONS .....      | 7    |
| 4.7 OTHER INFORMATION REQUESTED BY THE CUSTOMER ..... | 7    |
| 5 RF EXPOSURE EVALUATION .....                        | 8    |
| 5.1 RF EXPOSURE COMPLIANCE REQUIREMENT .....          | 8    |
| 5.1.1 Limits .....                                    | 8    |
| 5.1.2 Test Procedure.....                             | 8    |
| 5.1.3 EUT RF EXPOSURE EVALUATION.....                 | 9-11 |



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

Report No.: HKES160900181104

Page: 4 of 11

## 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<br>POE Model: POE31U-1AT<br>INPUT: 100-240V, 0.8A, 50/60Hz<br>OUTPUT: DC 56V, 0.536A<br>PIN 3,6 DC56V<br>PIN 1,2 RETURN                       |                       |                      |                    |
| For 2.4G WIFI        |                                                                                                                                                              |                       |                      |                    |
| Operating Frequency: | IEEE 802.11b/g/n(HT20): 2412MHz to 2472MHz<br>IEEE 802.n(HT40): 2422MHz to 2462MHz                                                                           |                       |                      |                    |
| Type of Modulation:  | IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE for 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>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)<br>For 802.11n: OFDM(8PSK/QPSK/16QAM/64QAM)                                                                         |                       |                      |                    |



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

Report No.: HKES160900181104

Page: 5 of 11

|                                |                                                                                  |
|--------------------------------|----------------------------------------------------------------------------------|
|                                | For 802.11ac: OFDM(8PSK/QPSK/16QAM/64QAM)                                        |
| Antenna Gain:                  | 4.36dBi                                                                          |
| <b>LTE module:</b>             | Model Number: MC7354                                                             |
|                                | FCC ID: N7NMC7355                                                                |
| <b>Alternative LTE module:</b> | Model Number: MC7455                                                             |
|                                | FCC ID: N7NMC7455                                                                |
| Antenna for LTE module:        | Type: PCB Antenna (One main antenna and a DIV antenna)<br>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<br>(MHz)                                       | Electric field<br>strength<br>(V/m) | Magnetic field<br>strength<br>(A/m) | Power density<br>(mW/cm <sup>2</sup> ) | Averaging time<br>(minutes) |
|----------------------------------------------------------------|-------------------------------------|-------------------------------------|----------------------------------------|-----------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                                     |                                     |                                        |                             |
| 0.3–3.0 .....                                                  | 614                                 | 1.63                                | *(100)                                 | 6                           |
| 3.0–30 .....                                                   | 1842/f                              | 4.89/f                              | *(900/f <sup>2</sup> )                 | 6                           |
| 30–300 .....                                                   | 61.4                                | 0.163                               | 1.0                                    | 6                           |
| 300–1500 .....                                                 | .....                               | .....                               | f/300                                  | 6                           |
| 1500–100,000 .....                                             | .....                               | .....                               | 5                                      | 6                           |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                                     |                                     |                                        |                             |
| 0.3–1.34 .....                                                 | 614                                 | 1.63                                | *(100)                                 | 30                          |
| 1.34–30 .....                                                  | 824/f                               | 2.19/f                              | *(180/f <sup>2</sup> )                 | 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:  $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = 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

$P_d$  is the limit of MPE, 1 mW/cm<sup>2</sup>. 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.



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

Report No.: HKES160900181104

Page: 9 of 11

### 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<br>(MHz) | Max Conducted<br>Peak Output<br>Power (dBm) | Output Power<br>to Antenna<br>(mW) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | Limit | MPE<br>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<br>(MHz) | Max Conducted<br>Peak Output<br>Power (dBm) | Output Power<br>to Antenna<br>(mW) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | Limit | MPE<br>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.



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

Report No.: HKES160900181104

Page: 10 of 11

**Band IV**

| Channel | Frequency<br>(MHz) | Max Conducted<br>Peak Output<br>Power (dBm) | Output Power<br>to Antenna<br>(mW) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | Limit | MPE<br>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<br>(MHz) | Average EIRP<br>(dBm) | Average EIRP<br>(mW) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | Limit | MPE<br>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<br>(MHz) | Average EIRP<br>(dBm) | Average EIRP<br>(mW) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | Limit | MPE<br>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.



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

Report No.: HKES160900181104

Page: 11 of 11

**Exposure conditions for simultaneous transmission operations**

For LTE module MC7354

$\Sigma$  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

$\Sigma$  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   |