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Report No.: HKES160900181103
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FCC 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 15, Subpart E (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 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



3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15 Section 15.203	ANSI C63.10: 2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15 Section 15.407(b)	ANSI C63.10: 2013	PASS
Conducted Output Power	47 CFR Part 15 Section 15.407(a)	ANSI C63.10: 2013	PASS
6dB Occupied Bandwidth	47 CFR Part 15 Section 15.407(e)	ANSI C63.10: 2013	PASS
26 dB Emission Bandwidth & 99% Occupied Bandwidth	47 CFR Part 15 Section 15.407(a)	ANSI C63.10: 2013	PASS
Power Spectral Density	47 CFR Part 15 Section 15.407(a)	ANSI C63.10: 2013	PASS
Radiated Spurious Emissions	47 CFR Part 15 Section 15.407(b)	ANSI C63.10: 2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15 Section 15.407(b)	ANSI C63.10: 2013	PASS
Frequency Stability	47 CFR Part 15 Section 15.407(g)	ANSI C63.10: 2013	PASS
Automatically Discontinue Transmission Requirement	47 CFR Part 15 Section 15.407 (c)	ANSI C63.10: 2013	PASS

Remark:

This report is based on a granted product (FCC ID:U8G-P1AC1DUO, Date of Grant: 05/27/2016). Relative to the original product, the new one adds a granted LTE module, which is inserted to the mini PCI-E socket. The electrical circuit design, layout, components used and internal wiring are exactly same to the original one. In this case, only the Radiated spurious emissions of were retested.



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5 General Information

5.1 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

5.2 General Description of EUT

Product Name:	Peplink / Pepwave / Pismo Labs wireless product			
Model No.:	MAX Hotspot			
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	
	* The 5600-5650MHz can not be used.			
Type of Modulation:	IEEE 802.11a: OFDM(BPSK/QPSK/16QAM/64QAM) IEEE 802.11n: OFDM(BPSK/QPSK/16QAM/64QAM) IEEE 802.11ac: OFDM (BPSK/QPSK/16QAM/64QAM/256QAM)			
Antenna Type:	MIMO*3			
Antenna Gain:	Max. 4.36dBi			
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			
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			



Note:

In FCC 15.31, for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table, and the selected channel to perform the test as below:

Frequency Range of Operation Operating Frequency Range (in each Band)	Number of Measurement Frequencies Required	Location of Measurement Frequency in Band of Operation
1 MHz or less	1	centre
1 MHz to 10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near centre

For UNII Band I:

Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5180
	The Middle channel	5220
	The Highest channel	5240
IEEE 802.11n/ac 40MHz	The Lowest channel	5190
	The Highest channel	5230
IEEE 802.11ac 80MHz	One channel	5210

For UNII Band III:

Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5745
	The Middle channel	5785
	The Highest channel	5825
IEEE 802.11n/ac 40MHz	The Lowest channel	5755
	The Highest channel	5795
IEEE 802.11ac 80MHz	One channel	5775



5.3 Test Environment and Mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	55% RH
Atmospheric Pressure:	1020 mbar
Test mode:	
Transmitting mode:	Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate.

5.4 Description of Support Units

The EUT has been tested independent unit.

5.5 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.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.



5.6 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.

5.7 Deviation from Standards

None.

5.8 Abnormalities from Standard Conditions

None.

5.9 Other Information Requested by the Customer

None.



5.10 Equipment List

RE in Chamber						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2016-05-13	2017-05-13
2	EMI Test Receiver	Agilent Technologies	N9038A	SEM004-05	2015-10-09	2016-10-09
3	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2014-11-01	2017-11-01
4	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEM003-11	2015-10-17	2018-10-17
5	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEM003-12	2014-11-24	2017-11-24
6	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2016-04-25	2017-04-25
7	Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A
8	DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2015-10-09	2016-10-09
9	Loop Antenna	Beijing Daze	ZN30401	SEM003-09	2015-05-13	2018-05-13



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RE in Chamber						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2016-05-13	2017-05-13
2	EMI Test Receiver	Rohde & Schwarz	ESIB26	SEM004-04	2016-04-25	2017-04-25
3	BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-02	2014-11-15	2017-11-15
4	Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2015-10-09	2016-10-09
5	Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2015-06-14	2018-06-14
6	Horn Antenna (18-26GHz)	ETS-Lindgren	3160	SEM003-12	2014-11-24	2017-11-24
7	Horn Antenna(26GHz-40GHz)	A.H.Systems, inc.	SAS-573	SEM003-13	2015-02-12	2018-02-12
8	Low Noise Amplifier	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2015-10-09	2016-10-09
9	Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A

RF connected test						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
1	DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2015-10-09	2016-10-09
2	Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2015-10-09	2016-10-09
3	Signal Generator	Rohde & Schwarz	SML03	SEM006-02	2016-04-25	2017-04-25
4	Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2015-10-09	2016-10-09



6 Test results and Measurement Data

6.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p>	
EUT Antenna:	<p>The image shows the internal antenna layout of a device. Two long, thin antennas are labeled LTE-1 and LTE-2, enclosed in red dashed boxes. Three smaller antennas are labeled 5G-1, 5G-2, and 5G-3, enclosed in green dashed boxes. Three other antennas are labeled 2G-1, 2G-2, and 2G-3, enclosed in blue dashed boxes. A green arrow points to a component near the 5G-3 antenna.</p>
<p>The antenna is integrated and no consideration of replacement. The best case gain of the antenna is 4.36dBi, directional gain is 9.13 dBi.</p>	

6.2 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15 Section 15.407(b)
Test Method:	ANSI C63.10: 2013, section 12.7.5, 12.7.6, 12.7.7.3
Test Site:	Below 1GHz: Measurement Distance: 10m (Semi-Anechoic Chamber) Above 1GHz: Measurement Distance: 3m (Full-Anechoic Chamber)
Test Setup:	

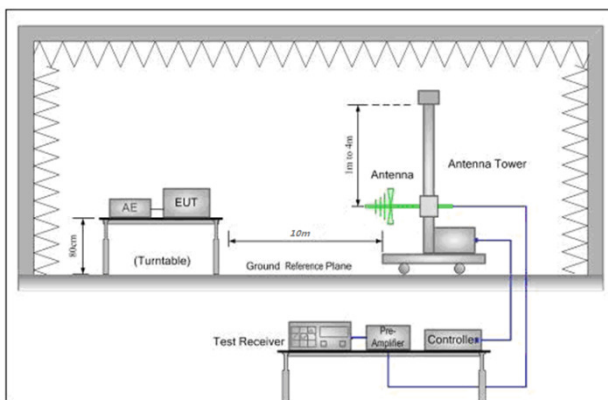


Figure 1. 30MHz to 1GHz

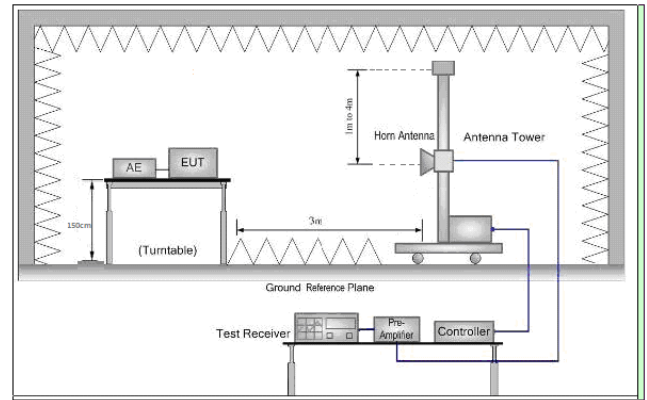


Figure 2. Above 1 GHz

Test Procedure:	<ol style="list-style-type: none"> For below 1GHz test, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. For above 1GHz test, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter full-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. Test the EUT in the outermost channels.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates.
Final Test Mode:	Through Pre-scan, find the 6Mbps of rate is the worst case of 802.11a; MCS0 of rate is the worst case of 802.11n(HT20); MCS0 of rate is the worst case of 802.11n(HT40); 1SS0 of rate is the worst case of 802.11ac(HT20); 1SS0 of rate is the worst case of 802.11ac(HT40); 1SS0 of rate is the worst case of 802.11ac(HT80) For below 1GHz, after Pre-scan, find the 1Mbps of rate of 802.11a at lowest

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	channel is the worst case for 5G WIFI and 1Mbps of rate of 802.11b at lowest channel is the worst case for 2.4G WIFI, so the final test was carried out at simultaneous transmission operations under the worst case of 2.4G & 5G WIFI.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

For frequencies below 1GHz, the test was performed at a 10m test site. According to below formulate and the test data at 10m test distance,

$$L_3 / L_{10} = D_{10} / D_3$$

Note:

L₃: Level @ 3m distance. Unit: uV/m;

L₁₀: Level @ 10m distance. Unit: uV/m;

D₃: 3m distance. Unit: m

D₁₀: 10m distance. Unit: m

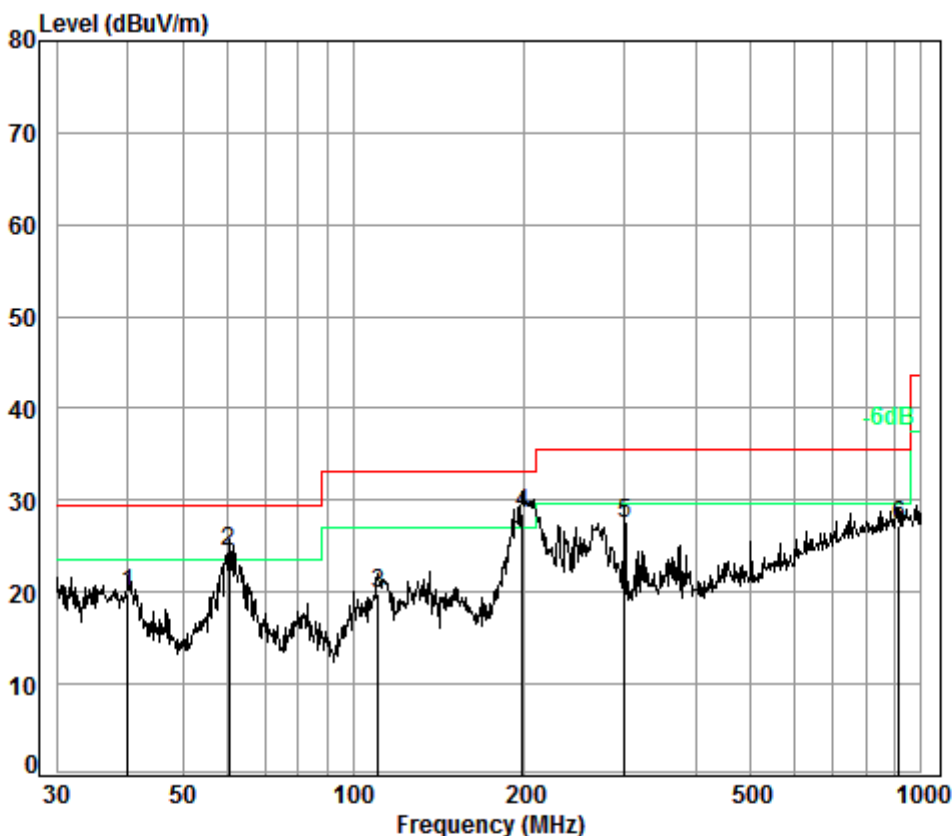
The level at 3m test distance is below:

Frequency (MHz)	Level @ 10m (dBuV/m)	Level @ 10m (uV/m)	Level @ 3m (uV/m)	Level @ 3m (dBuV/m)	Limit @ 3m (dBuV/m)	Margin (dB)	Ant. Polarization
39.99	19.81	9.78	32.61	30.27	40.00	-9.73	V
60.28	24.50	16.79	55.96	34.96	40.00	-5.04	V
110.57	19.92	9.91	33.03	30.38	43.50	-13.12	V
198.59	28.55	26.76	89.20	39.01	43.50	-4.49	V
300.37	27.42	23.50	78.32	37.88	46.00	-8.12	V
912.86	27.31	23.20	77.34	37.77	46.00	-8.23	V
52.95	15.43	5.91	19.70	25.89	40.00	-14.11	H
152.66	18.59	8.50	28.34	29.05	43.50	-14.45	H
204.24	26.91	22.16	73.85	37.37	43.50	-6.13	H
300.37	29.02	28.25	94.16	39.48	46.00	-6.52	H
501.18	26.22	20.46	68.21	36.68	46.00	-9.32	H
801.79	31.60	38.02	126.73	42.06	46.00	-3.94	H



6.2.1 Radiated emission below 1GHz

30MHz~1GHz (QP)		
Test mode:	Transmitting	Vertical

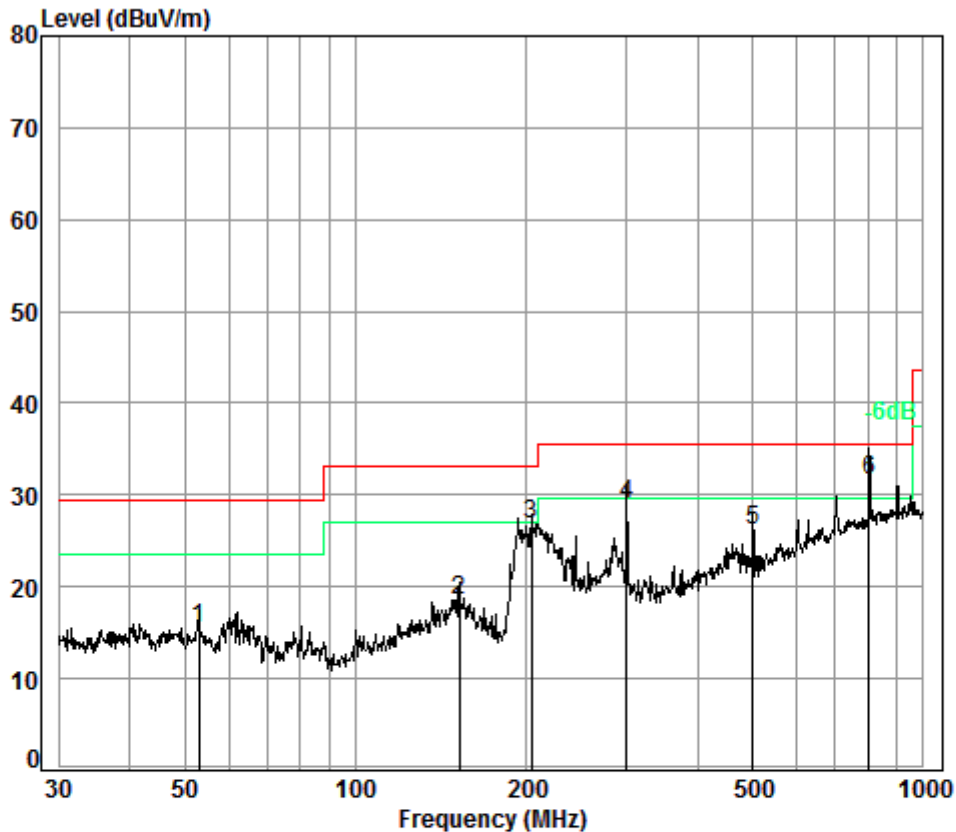


Condition: 10m VERTICAL
Job No. : 1811IT
Test Mode: TX mode

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	39.99	6.80	13.32	32.99	32.68	19.81	29.50	-9.69
2	60.28	7.00	11.94	32.95	38.51	24.50	29.50	-5.00
3	110.57	7.26	10.44	32.79	35.01	19.92	33.10	-13.18
4 pp	198.59	7.59	9.36	32.70	44.30	28.55	33.10	-4.55
5	300.37	8.05	12.67	32.60	39.30	27.42	35.60	-8.18
6	912.86	9.50	22.40	32.50	27.91	27.31	35.60	-8.29



Test mode:	Transmitting	Horizontal
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Condition: 10m HORIZONTAL

Job No. : 1811IT

Test Mode: TX mode

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	52.95	6.96	12.54	32.98	28.91	15.43	29.50	-14.07
2	152.66	7.46	13.40	32.74	30.47	18.59	33.10	-14.51
3	204.24	7.62	9.39	32.69	42.59	26.91	33.10	-6.19
4	300.37	8.05	12.67	32.60	40.90	29.02	35.60	-6.58
5	501.18	8.61	16.81	32.60	33.40	26.22	35.60	-9.38
6 pp	801.79	9.30	21.24	32.60	33.66	31.60	35.60	-4.00



6.2.2 Transmitter emission above 1GHz

Note:

Refer to the original report (HKES160300051103), the worst case of radiated spurious emission is the highest channel of 802.11n20 mode. So the retest is only performed at this mode.

Test data as follows:

Test mode:		802.11 n20		Frequency(MHz):		5825		Remark:		Peak
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
7093.172	35.49	10.64	37.69	41.29	49.73	74	-24.27	Vertical		
8990.716	37.00	11.79	37.19	35.55	47.15	74	-26.85	Vertical		
11650.000	37.50	14.18	36.83	30.47	45.32	74	-28.68	Vertical		
13192.440	38.29	15.60	38.42	33.43	48.90	74	-25.10	Vertical		
15157.260	40.66	16.70	39.53	33.39	51.22	74	-22.78	Vertical		
17475.000	43.45	20.33	36.99	23.92	50.71	74	-23.29	Vertical		
7678.832	36.04	10.89	37.44	39.40	48.89	74	-25.11	Horizontal		
8990.716	37.00	11.79	37.19	36.19	47.79	74	-26.21	Horizontal		
11650.000	37.50	14.18	36.83	32.03	46.88	74	-27.12	Horizontal		
13192.440	38.29	15.60	38.42	34.38	49.85	74	-24.15	Horizontal		
15800.410	41.20	17.31	38.51	31.71	51.71	74	-22.29	Horizontal		
17475.000	43.45	20.33	36.99	24.20	50.99	74	-23.01	Horizontal		

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

$$\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Preamplifier Factor}$$

2) Scan from 9kHz to 25GHz, The disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported .

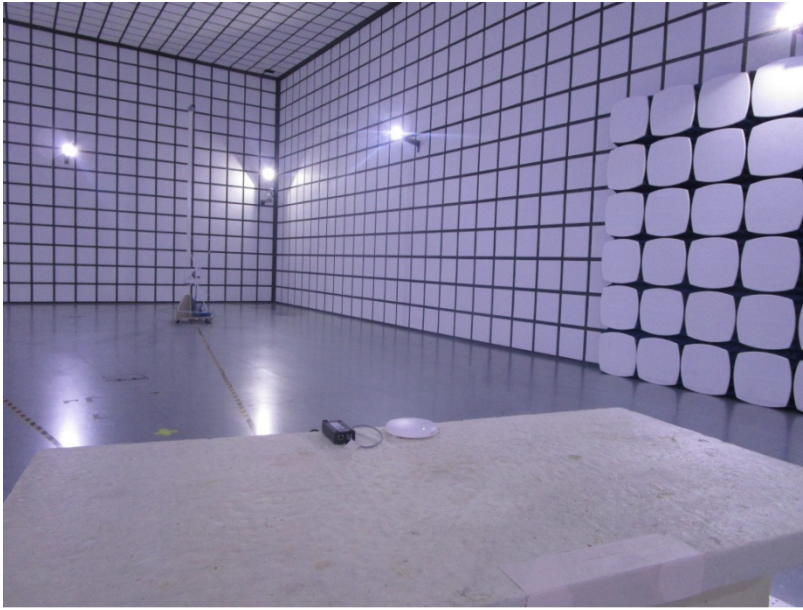
3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.



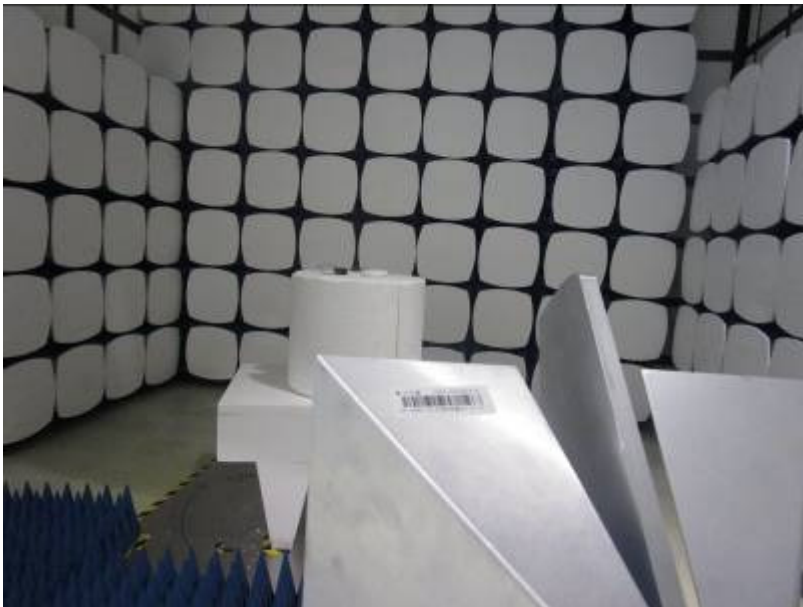
7 Photographs - EUT Test Setup

Test model No.: MAX Hotspot

7.1 Radiated Emission



7.2 Radiated Spurious Emission



8 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for HKES1609001811IT.