TEST REPORT

Applicant:	Red Bear Company Limited
Address of Applicant:	1711 Block B, Wah Luen Industrial Centre, 15-21 Wong Chuk Yeung Street, Fo Tan, Hong Kong

Equipment Under Test (EUT)

Product Name:	RedBear IoT pHAT
Model No.:	PHAT-IOT
Applicable standards:	EN 55022:2010/AC:2011 EN 55024:2010/A1:2015 EN 61000-3-2:2014 EN 61000-3-3:2013
Date of sample receipt:	July 06, 2016
Date of Test:	July 07-12, 2016
Date of report issued:	July 13, 2016
Test Result :	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/30/EU are considered.

Robinson Lo
Laboratory Manager

2 Version

Version No.	*Date*	*Description*
00	*July 13, 2016*	*Original*

Prepared By: Edward.Pan ***Date:*** *July 13, 2016*

Project Engineer

Check By: Andy.wu ***Date:*** *July 13, 2016*

Reviewer

3 Contents

4 Test Summary

Test item	Test Requirement	Test Method	Class / Severity	Result
Radiated Emission	EN 55022	EN 55022	Class B	Pass
Conducted Emission	EN 55022	EN 55022	Class B	N/A
Harmonic Emission	EN 61000-3-2	EN 61000-3-2	N/A	N/A
Flicker Emission	EN 61000-3-3	EN 61000-3-3	Clause 5	N/A
Electrostatic discharge	EN 55024	EN 61000-4-2	Contact ±2,±4 kV Air ±2,±4,±8 kV	Pass
Radio-frequency electromagnetic field Amplitude modulated	EN 55024	EN 61000-4-3	3V/m 80%, 1kHz, AM	Pass
Electrical fast transients	EN 55024	EN 61000-4-4	AC ± 1.0kV	N/A
Surges	EN 55024	EN 61000-4-5	±1kV D.M ±2kV C.M	N/A
Radio-frequency continuous conducted	EN 55024	EN 61000-4-6	3Vrms (emf), 80%, 1kHz Amp. Mod.	N/A
Voltage dips and Voltage interruptions	EN 55024	EN 61000-4-11	0 % U_T* for 0.5per 0 % U_T* for 250per 70 % U_T* for 25per	N/A

Remark:

1. *Pass: Comply with the essential requirements in the standard.*
2. *N/A: not applicable*
3. *U_T: the nominal supply voltage; D.M: Differential Mode; C.M: Common Mode.*

5 General Information

5.1 Client Information

Applicant:	Red Bear Company Limited
Address of Applicant:	1711 Block B, Wah Luen Industrial Centre, 15-21 Wong Chuk Yeung Street Fo Tan, Hong Kong
Manufacturer/Factory:	Red Bear Company Limited
Address of Manufacturer/Factory:	1711 Block B, Wah Luen Industrial Centre, 15-21 Wong Chuk Yeung Street Fo Tan, Hong Kong

5.2 General Description of EUT

Product Name:	RedBear IoT pHAT
Model No.:	PHAT-IOT
Power Supply:	DC 5V

5.3 Test mode and Test voltage

Test mode:	
Operation mode	Keep the EUT in normal operation mode
Test voltage:	
AC 230V	

5.4 Description of Support Units

Manufacturer	Description	Model	Serial Number	FCC Approval
Apple	PC	A1278	C1MN99ERDTY3	FCC DoC

5.5 Deviation from Standards

None.

5.6 Abnormalities from Standard Conditions

None.

5.7 Monitoring of EUT for All Immunity Test

Voice and picture

5.8 Test Facility

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

● **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fuly described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 600491, June 22, 2016.

● **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. Has been

Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, June 26, 2013.

5.9 Test Location

RI test was performed at:
China Shenzhen Academy of Metrology and Quality Inspection, Metrology and Quality Inspection building, Central Section of LongZhu Road, Nan Shan, Shenzhen.
All other tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

6 Test Instruments List

Radiated Emission						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.0(L)*6.0(W)* 6.0(H)	GTS250	Mar. 27 2016	Mar. 26 2017
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	ESU EMI Test Receiver	R&S	ESU26	GTS203	June 29 2016	June 28 2017
4	BiConiLog Antenna	SCHWARZBECK	VULB9163	GTS214	Feb. 21 2016	Feb. 20 2017
5	Double -ridged waveguide horn	SCHWARZBECK	9120D	GTS208	June 25 2016	June 24 2017
6	RF Amplifier	HP	8347A	GTS204	June 29 2016	June 28 2017
7	Preamplifier	HP	8349B	GTS206	June 29 2016	June 28 2017
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial cable	GTS	N/A	GTS211	Mar. 27 2016	Mar. 26 2017
10	Coaxial Cable	GTS	N/A	GTS210	Mar. 27 2016	Mar. 26 2017
11	Thermo meter	N/A	N/A	GTS256	Jul. 02 2016	Jul. 01 2017

ESD:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	ESD Simulator	EMPEK	ESD-2030A	GTS242	June 29 2016	June 28 2017
2	Thermo meter	KTJ	TA328	GTS243	July. 06 2016	July. 05 2017

Radio-frequency electromagnetic fields:					
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial NO.**	**Cal.Due Date (mm-dd-yy)**
1	Signal Generator	Rohde & Schwarz	SMT03	100059	Jan. 14 2017
2	Power Amplifier	AR	150W1000	300999	Jan. 14 2017
3	Power Amplifier	AR	25S1G4AM1	305993	Jan. 18 2017
4	Power Amplifier	AR	150A220M6	305965	Mar. 05 2017
5	Broadband antenna	CHASE	CBL6111C	2576	Jan. 14 2017
6	Horn Antenna	AR	AT4002A	#N/A	#N/A
7	Anechoic Chamber	Albatross Projects	MCDC	----	Oct. 06 2016

General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (dd-mm-yy)**	**Cal.Due date (dd-mm-yy)**
1	Barometer	ChangChun	DYM3	GTS257	July 06 2016	July 05 2017

7 Emission Test Results

7.1 Radiated Emission

Test Requirement:	EN 55022
Test Method:	EN 55022
Test Frequency Range:	30MHz to 6GHz
Class / Severity:	Class B
Test site:	Measurement Distance: 3m
Receiver setup:	

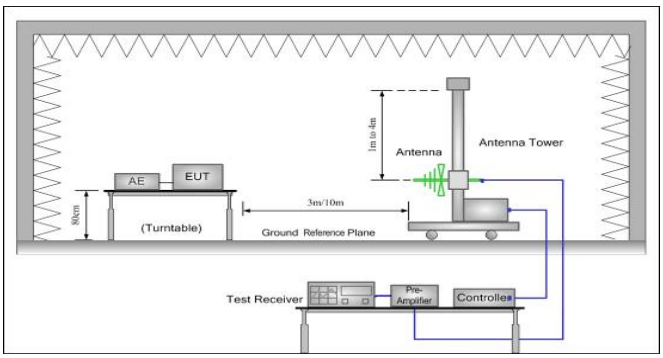
Frequency	Detector	RBW	VBW	Value
30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	AV	1MHz	3MHz	Average

Limit:

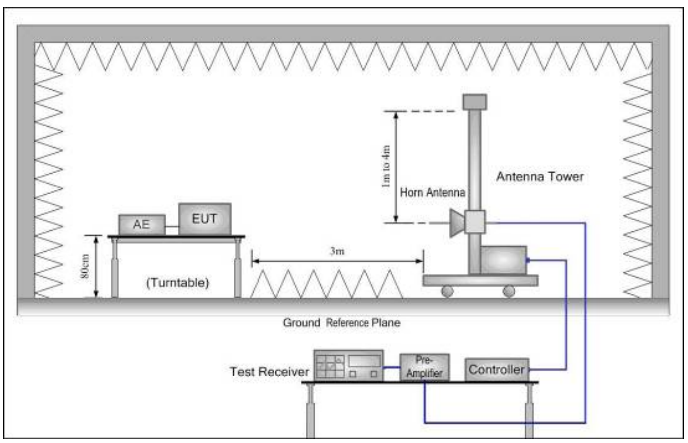
Frequency	Limit (dBμV/m @3m)	Value
30MHz-230MHz	40.00	Quasi-peak
230MHz-1GHz	47.00	Quasi-peak
1GHz-3GHz	70.00	Peak
1GHz-3GHz	50.00	Average
3GHz-6GHz	74.00	Peak
3GHz-6GHz	54.00	Average

Test setup:

Below 1GHz:



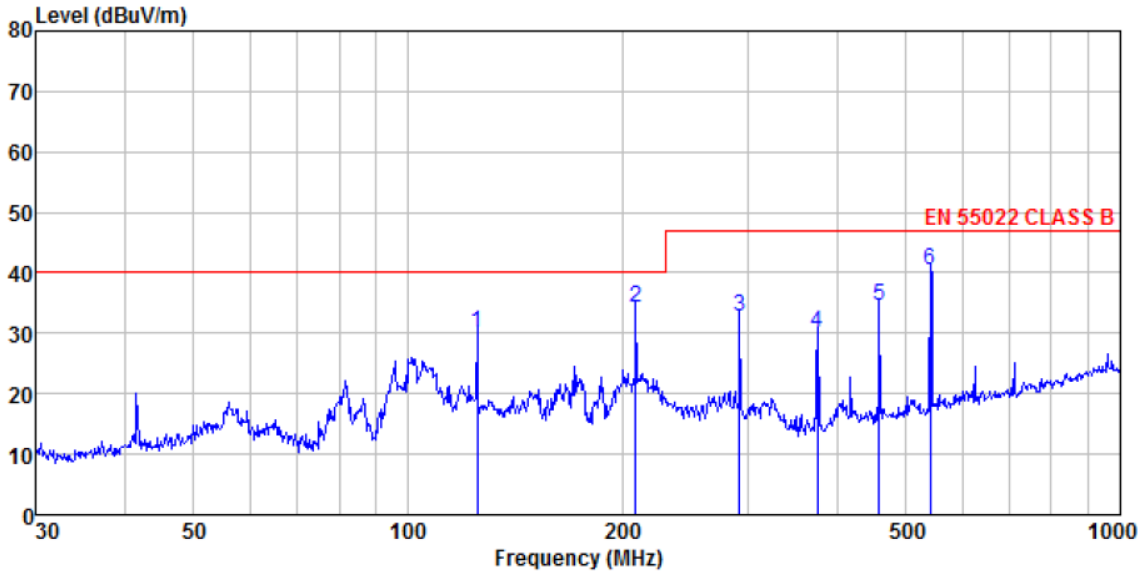
Above 1GHz:



Test Procedure:	**From 30MHz to 1GHz:** 1. The radiated emissions test was conducted in a semi-anechoic chamber. 2. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation. 3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT. 4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization. **Above 1GHz:** 1. The radiated emissions test was conducted in a fully-anechoic chamber. 2. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation. 3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emission spectrum plots of the EUT. 4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.
Test environment:	Temp.: 25 °C | Humid.: 52% | Press.: 1 012mbar
Measurement Record:	Uncertainty: ± 4.50dB
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details. Only the data of worst mode is reported.
Test results:	Pass

Measurement Data

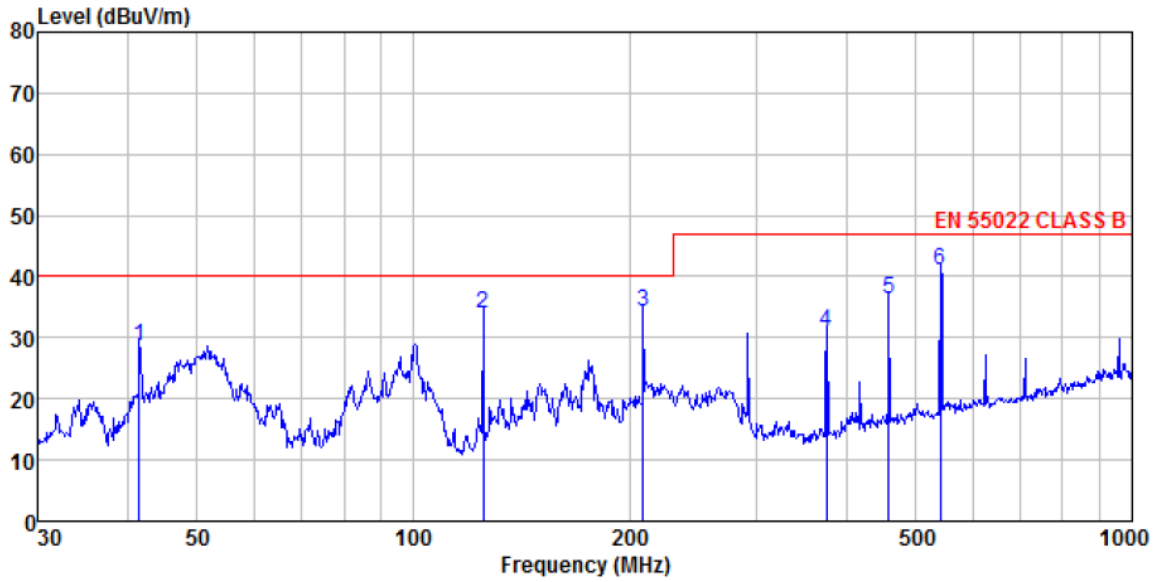
Below 1GHz:
Horizontal:



Site : 3m chamber
Condition : EN 55022 CLASS B VULB9163-2013M HORIZONTAL
Job No. : 0066
Test Mode : Operation mode
Test Engineer: Sky

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	125.007	46.63	11.70	1.40	29.54	30.19	40.00	-9.81	QP
2	208.580	48.71	12.84	1.89	29.29	34.15	40.00	-5.85	QP
3	292.058	45.56	14.89	2.32	29.95	32.82	47.00	-14.18	QP
4	375.939	40.35	16.56	2.75	29.61	30.05	47.00	-16.95	QP
5	459.114	43.13	17.59	3.13	29.38	34.47	47.00	-12.53	QP
6	541.373	46.95	19.41	3.49	29.30	40.55	47.00	-6.45	QP

Vertical:

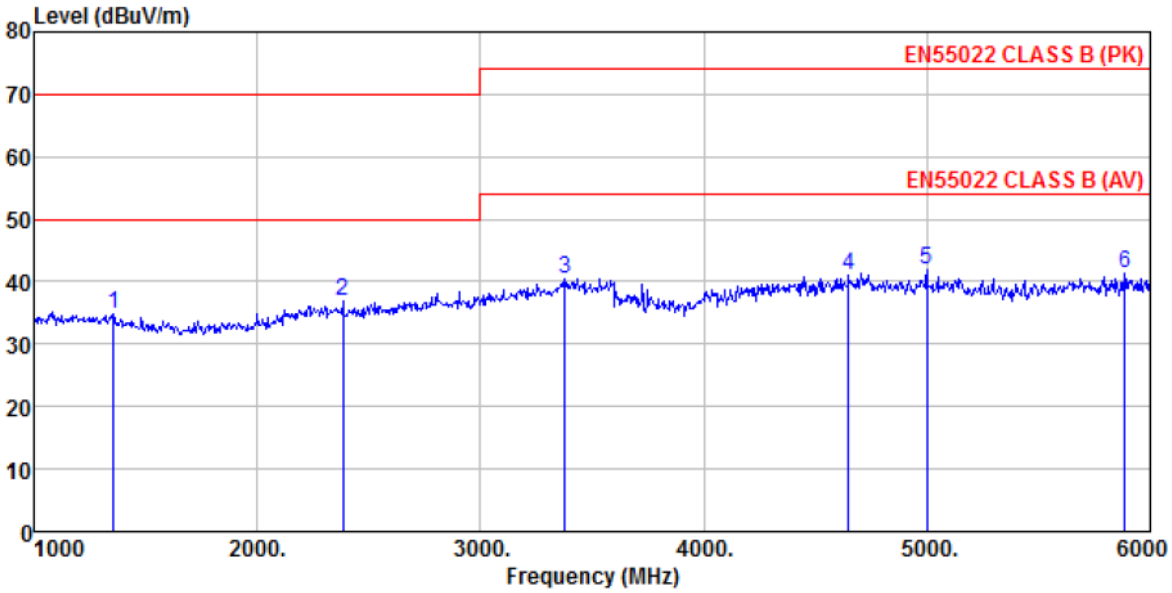


Site : 3m chamber
Condition : EN 55022 CLASS B VULB9163-2013M VERTICAL
Job No. : 0066
Test Mode : Operation mode
Test Engineer: Sky

	Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	41.567	42.52	15.57	0.68	30.04	28.73	40.00	-11.27	QP
2	125.007	50.39	11.70	1.40	29.54	33.95	40.00	-6.05	QP
3	208.580	48.67	12.84	1.89	29.29	34.11	40.00	-5.89	QP
4	375.939	41.31	16.56	2.75	29.61	31.01	47.00	-15.99	QP
5	459.114	45.02	17.59	3.13	29.38	36.36	47.00	-10.64	QP
6	541.373	47.33	19.41	3.49	29.30	40.93	47.00	-6.07	QP

Above 1GHz

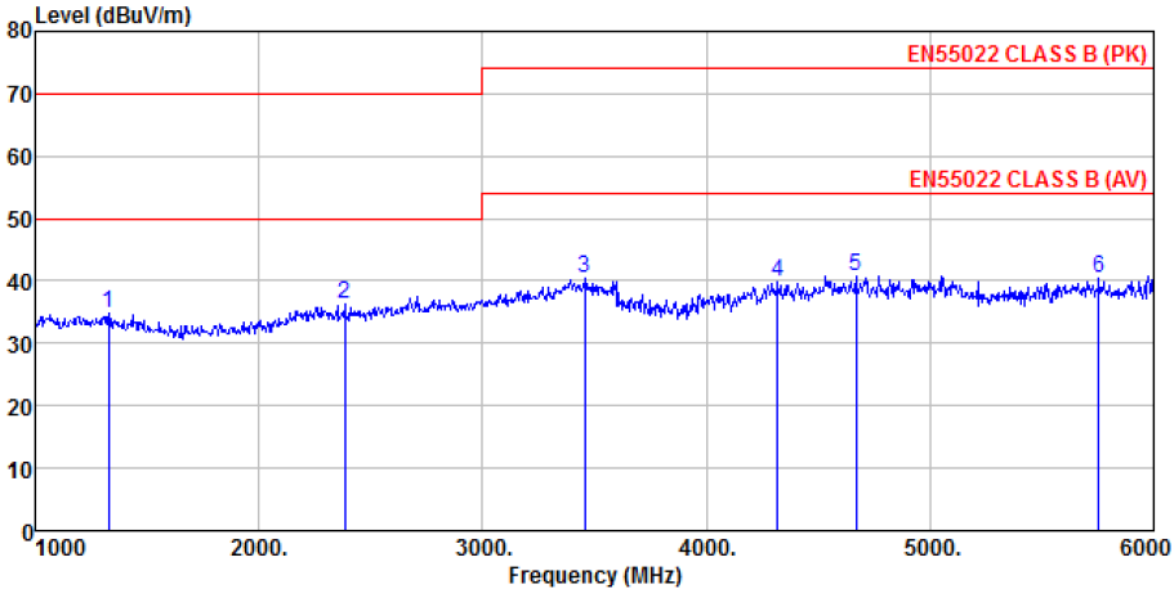
Horizontal:



Site : 3m chamber
Condition : EN55022 CLASS B (PK) BBHA9120D ANT(>1GHZ) HORIZONTAL
Job No. : 0066
Test Mode : Operation mode
Test Engineer: Sky

	Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1355.000	37.87	25.70	4.58	33.36	34.79	70.00	-35.21	Peak
2	2385.000	38.04	27.61	5.38	34.03	37.00	70.00	-33.00	Peak
3	3380.000	38.21	28.54	6.72	32.89	40.58	74.00	-33.42	Peak
4	4650.000	32.94	31.59	8.47	32.01	40.99	74.00	-33.01	Peak
5	5000.000	33.41	31.96	8.76	32.18	41.95	74.00	-32.05	Peak
6	5885.000	30.89	32.74	10.04	32.20	41.47	74.00	-32.53	Peak

Vertical:



Site : 3m chamber
Condition : EN55022 CLASS B (PK) BBHA9120D ANT(>1GHZ) VERTICAL
Job No. : 0066
Test Mode : Operation mode
Test Engineer: Sky

	Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1330.000	38.03	25.68	4.57	33.30	34.98	70.00	-35.02	Peak
2	2385.000	37.27	27.61	5.38	34.03	36.23	70.00	-33.77	Peak
3	3455.000	37.57	28.84	6.88	32.81	40.48	74.00	-33.52	Peak
4	4320.000	32.77	30.77	8.17	31.85	39.86	74.00	-34.14	Peak
5	4670.000	32.69	31.61	8.48	32.02	40.76	74.00	-33.24	Peak
6	5755.000	30.20	32.59	9.86	32.27	40.38	74.00	-33.62	Peak

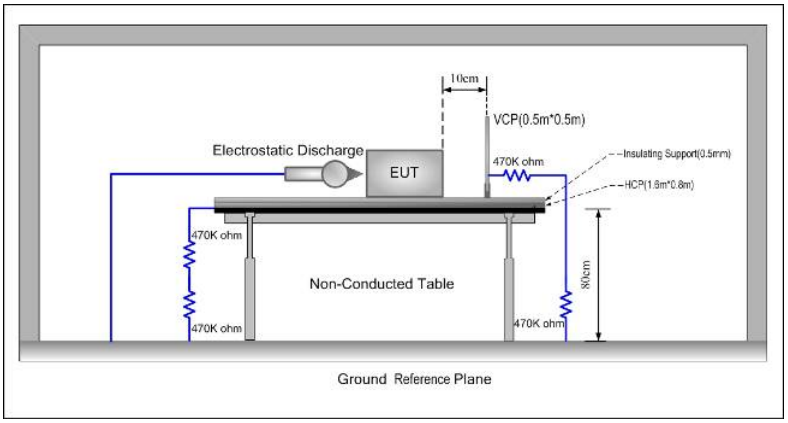
Remark:
1. If the average limit is met when using a Peak detector, the EUT shall be deemed to meet both peak and average limits. And measurement with the average detector is unnecessary.

8 Immunity Test Results

8.1 Performance Criteria Description in Clause 7 of EN 55024

Criterion A:	The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
Criterion B:	After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
Criterion C:	Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

8.2 Electrostatic discharge

Test Requirement:	EN 55024
Test Method:	EN 61000-4-2
Discharge Voltage:	Contact Discharge: ±2kV, ±4kV Air Discharge: ±2kV, ±4kV, ±8kV HCP/VCP: ±2kV, ±4kV
Polarity:	Positive & Negative
Number of Discharge:	Contact Discharge: Minimum 25 times at each test point, Air Discharge: Minimum 10 times at each test point.
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum
Performance Criterion:	Criterion B
Test setup:	
Test Procedure:	**1. Air discharge:** The test was applied on non-conductive surfaces of EUT. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the discharge electrode was removed from the EUT. The generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure was repeated until all the air discharge completed **2. Contact Discharge:** The test was applied on conductive surfaces of EUT. the generator was re-triggered for a new single discharge and repeated 25 times for each pre-selected test point. the tip of the discharge electrode was touch the EUT before the discharge switch was operated. **3. Indirect discharge for horizontal coupling plane** At least 10 single discharges shall be applied at the front edge of each HCP opposite the centre point of each unit of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge. Consideration should be given to exposing all sides of the EUT. **4. Indirect discharge for vertical coupling plane** At least 10 single discharges were applied to the center of one vertical

	edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.					
Test environment:	Temp.:	24 °C	Humid.:	51%	Press.:	1 012mbar
Test mode:	Refer to section 6.0 for details					
Test Instruments:	Refer to section 5.3 for details					
Test results:	Pass					

Measurement Record:

Test points:	I:N/A
	II: N/A

Direct discharge

Discharge Voltage (KV)	Type of discharge	Test points	Observations (Performance Criterion)	Result
± 2, ± 4	Contact	I	N/A	N/A
± 2, ± 4,± 8	Air	II	N/A	N/A

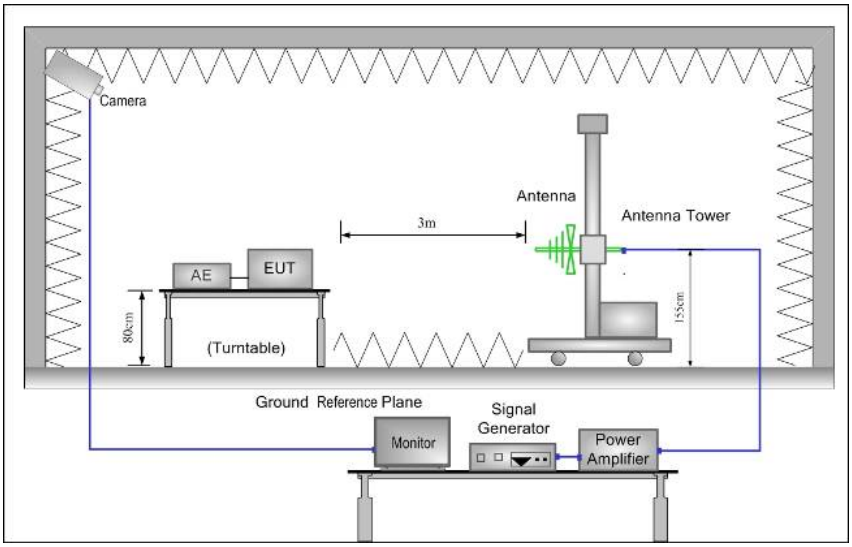
Indirect discharge

Discharge Voltage (KV)	Type of discharge	Test points	Observation Performance	Result
± 2, ± 4	HCP-Bottom/Top/ Front/Back/Left/Right	Edge of the HCP	A	Pass
± 2, ± 4	VCP-Front/Back /Left/Right	Center of the VCP	A	Pass

Remark:

A: Normal performance within the specification limits.

8.3 Radio-frequency electromagnetic field Amplitude modulated

Test Requirement:	EN 55024
Test Method:	EN 61000-4-3
Frequency range:	80MHz to 1GHz
Test Level:	3V/m
Modulation:	80%, 1kHz Amplitude Modulation
Performance Criterion:	Criterion A
Test setup:	
Test Procedure:	1. For table-top equipment, the EUT was placed in the chamber on a non-conductive table 0.8m high. For arrangement of floor-standing equipment, the EUT was mounted on a non-conductive support 0.1m above the supporting plane. For human body-mounted equipment, the EUT may be tested in the same manner as table top items. 2. If possible, a minimum of 1 m of cable is exposed to the electromagnetic field. Excess length of cables interconnecting units of the EUT shall be bundled low-inductively in the approximate center of the cable to form a bundle 30 cm to 40 cm in length. 3. The EUT was initially placed with one face coincident with the calibration plane. The EUT face being illuminated was contained within the UFA (Uniform Field Area). 4. The frequency ranges to be considered were swept with the signal modulated and pausing to adjust the RF signal level or to switch oscillators and antennas as necessary.Where the frequency range was swept incrementally, the step size was not exceed 1 % of the preceding frequency value. 5. The dwell time of the amplitude modulated carrier at each frequency was not be less than the time necessary for the EUT to be exercised and to respond, and was not less than 0,5 s. 6. The test normally was performed with the generating antenna facing each side of the EUT. 7. The polarization of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned

	vertically and again with the antenna positioned horizontally. 8. The EUT was performed in a configuration to actual installation conditions, a video camera and/or a audio monitor were used to monitor the performance of the EUT.					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1 012mbar
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Pass					

Measurement Record:

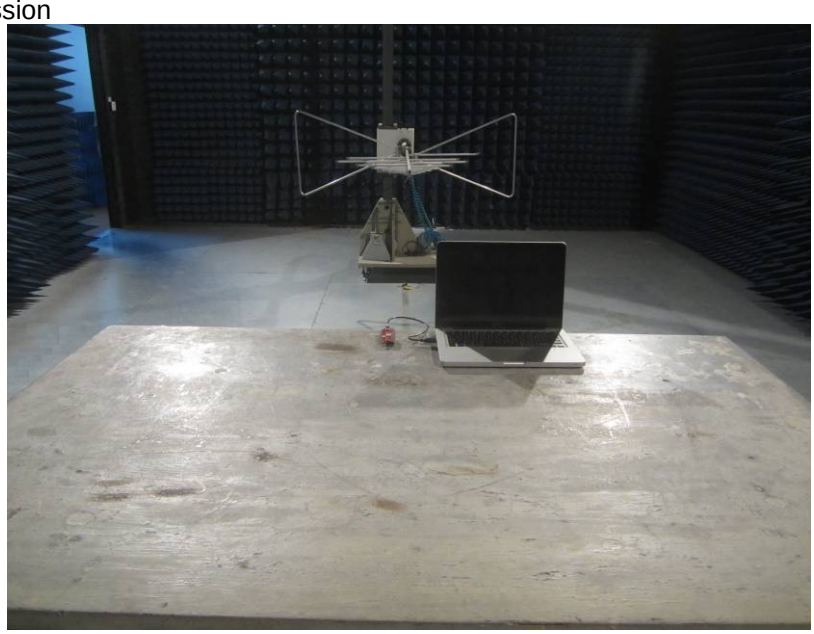
Frequency	Level	Modulation	Antenna Polarization	EUT Face	Observations (Performance Criterion)	Result
80 MHz-1 GHz	3 V/m	1 kHz, 80 % Amp. Mod, 1 % increment, dwell time=3seconds	V	Front	A	Pass
			H		A	Pass
			V	Rear	A	Pass
			H		A	Pass
			V	Left	A	Pass
			H		A	Pass
			V	Right	A	Pass
			H		A	Pass
			V	Top	A	Pass
			H		A	Pass
			V	Bottom	A	Pass
			H		A	Pass

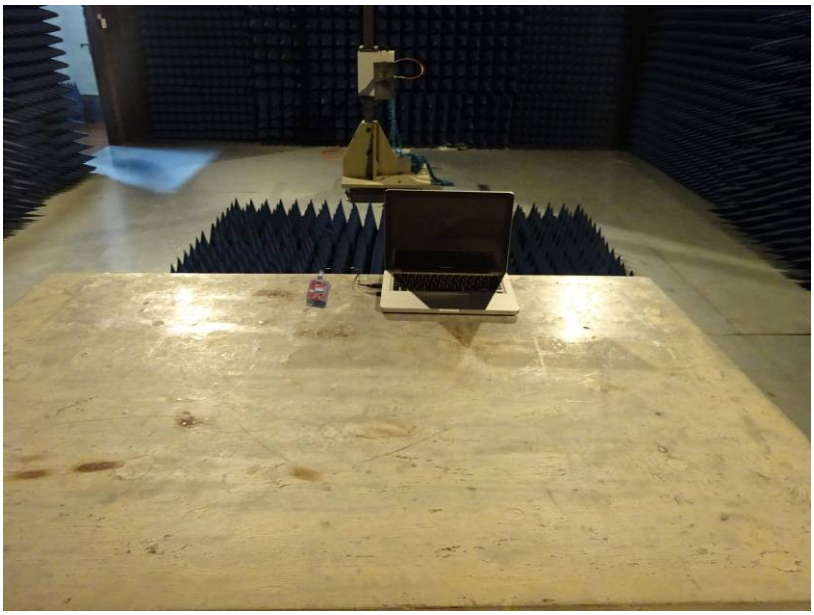
Remark:

A: No degradation in performance of the EUT was observed.

9 Test Setup Photo

Radiated Emission

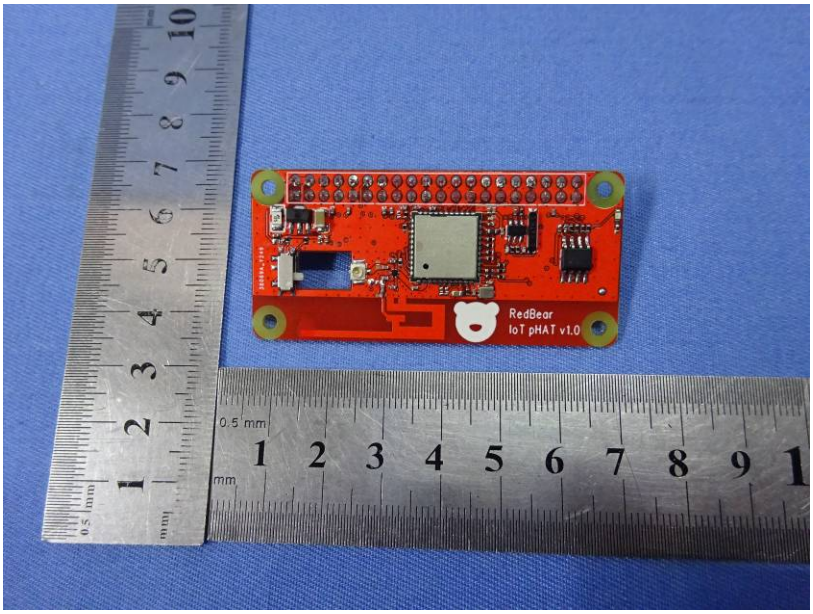


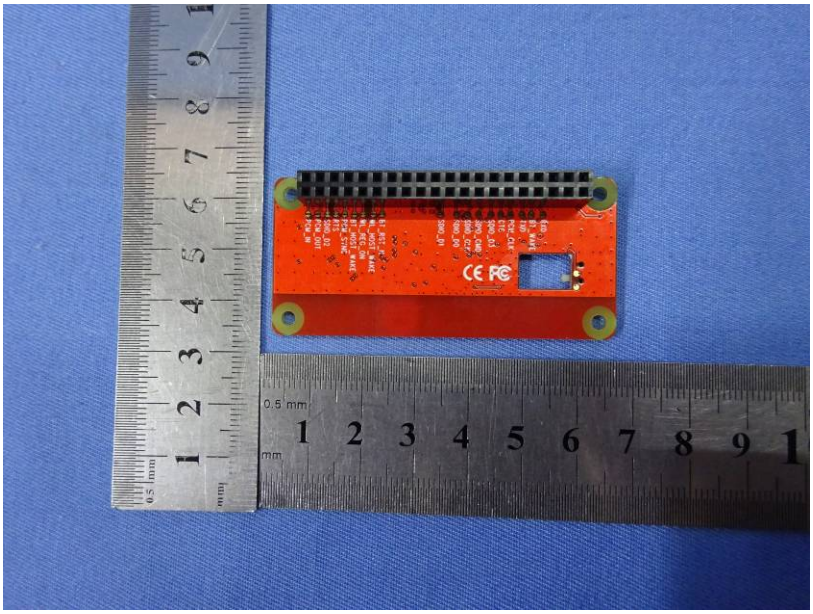


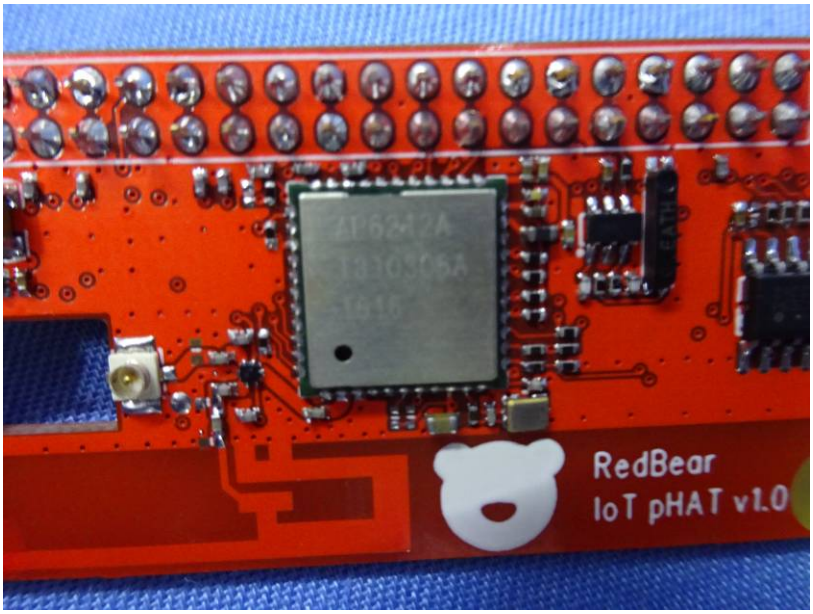
ESD

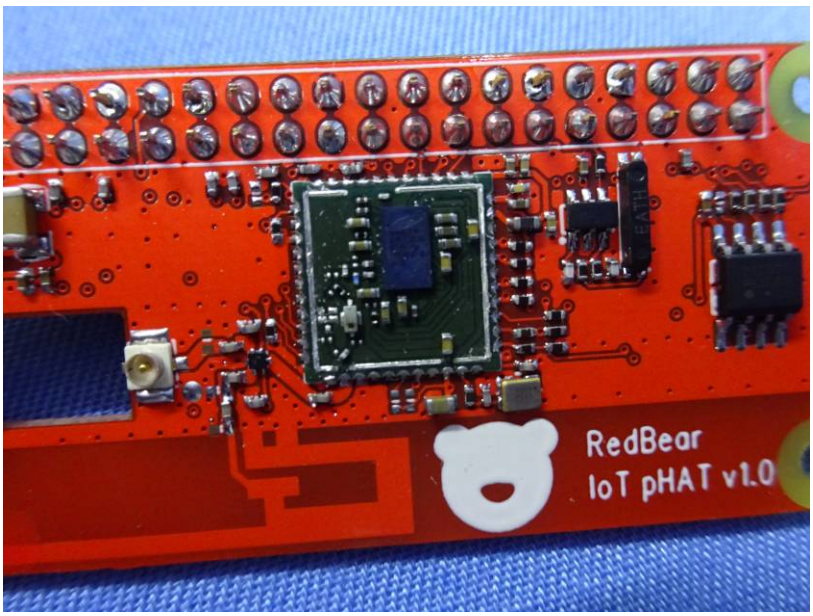
RS

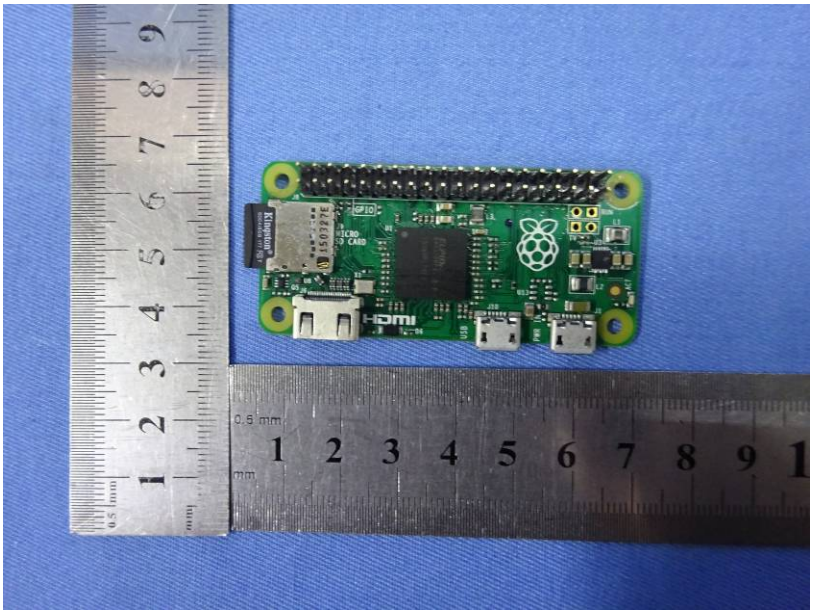
10 EUT Constructional Details

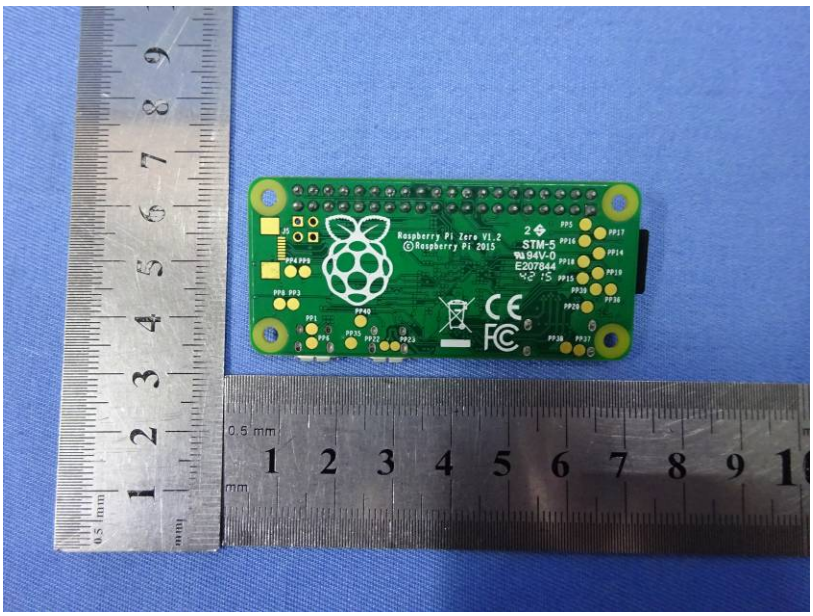





RedBear
IoT pHAT v1.0


RedBear
IoT pHAT v1.0





------End------