



FCC TEST REPORT

FCC PART 15 SUBPART C 15.249

Test report
On Behalf of
Star Technology Industrial Co., Ltd
For
Wireless Keyboard

Model No.: IH-K2050PAN, IH-K2050PAE, IH-K2050PAU,
IH-K2050PAP, IH-K2050PAG

FCC ID: ZJEST-WK821

Prepared for : **Star Technology Industrial Co., Ltd**
Room 1102, Block 1 st, Yi Luan Building, Xixiang Road 230, BaoAn District,
Shenzhen, China

Prepared By : **Shenzhen HUAKE Testing Technology Co., Ltd.**
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Date of Test: **Jan. 19, 2019 ~ Jan. 25, 2019**
Date of Report: **Jan. 25, 2019**
Report Number: **HK1901240230E**



TEST RESULT CERTIFICATION

Applicant's name Star Technology Industrial Co., Ltd
Address Room 1102, Block 1 st, Yi Luan Building, Xixiang Road 230, BaoAn District, Shenzhen, China

Manufacture's Name Star Technology Industrial Co., Ltd
Address Room 1102, Block 1 st, Yi Luan Building, Xixiang Road 230, BaoAn District, Shenzhen, China

Factory's Name Star Technology Industrial Co., Ltd
Address Room 1102, Block 1 st, Yi Luan Building, Xixiang Road 230, BaoAn District, Shenzhen, China

Product description
Trade Mark: iHome
Product name Wireless Keyboard
Model and/or type reference .. IH-K2050PAN
Series Models IH-K2050PAE, IH-K2050PAU, IH-K2050PAP, IH-K2050PAG
Declaration of Difference All the same except for the model name and front appearance color

Standards FCC Rules and Regulations Part 15 Subpart C Section 15.249
ANSI C63.10: 2013

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Date of Test :
Date (s) of performance of tests : Jan. 19, 2019 to Jan. 25, 2019
Date of Issue : Jan. 25, 2019
Test Result : **Pass**

Testing Engineer :

(Gary Qian)

Technical Manager :

(Eden Hu)

Authorized Signatory :

(Jason Zhou)



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1. TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.249&15.209	Radiated Emission	Compliant
§15.249&15.209	Band Edges Emission	Compliant
§15.215	20dB bandwidth	Compliant
§15.207	Conducted Emission	N/A

1.2 TEST FACILITY

Test Firm : Shenzhen HUAKE Testing Technology Co., Ltd.

Address : 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping
Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Designation Number: : CN1229

Test Firm Registration Number : 616276

1.3 MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty = 2.23dB, k=2

Radiated emission expanded uncertainty(9kHz-30MHz) = 3.08dB, k=2

Radiated emission expanded uncertainty(30MHz-1000MHz) = 4.42dB, k=2

Radiated emission expanded uncertainty(Above 1GHz) = 4.06dB, k=2



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Operation Frequency	2408-2474MHz
Field Strength(3m)	81.42dBuV/m(Peak)@3m
Modulation	GFSK
Number of channels	34(Channel Spacing is 2MHz)
Test Channels	2408MHz, 2440MHz, 2474MHz
Hardware Version	V1.0
Software Version	V1.0
Antenna Designation	PCB antenna
Antenna Gain	0dBi
Power Supply	DC 1.5V by battery



2.2 OPERATION OF EUT DURING TESTING

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
Note: 1. Only the data of the worst case recorded in the test report. 2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.	

2.3 DESCRIPTION OF TEST SETUP

Operation of EUT during Radiation and Above1GHz Radiation testing:





2.4 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Receiver	R&S	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
2.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 27, 2018	1 Year
3.	Horn Antenna	Schwarzbeck	BBHA 9170	HKE-090	Dec. 27, 2018	1 Year
4.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
5.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 27, 2018	1 Year
6.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 27, 2018	1 Year
7.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 27, 2018	1 Year
8.	Horn Antenna	Schwarzbeck	9120D	HKE-013	Dec. 27, 2018	1 Year
9.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 27, 2018	1 Year
10.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 27, 2018	1 Year
11.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 27, 2018	N/A
12.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 27, 2018	3 Year



3. RADIATED EMISSION

3.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.



The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RBW 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RBW 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RBW 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 3MHz/10MHz for Peak, 3MHz/10Hz for Average

Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RBW 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RBW 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RBW 120KHz for QP

Test limit for Standard FCC15.249

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
900-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

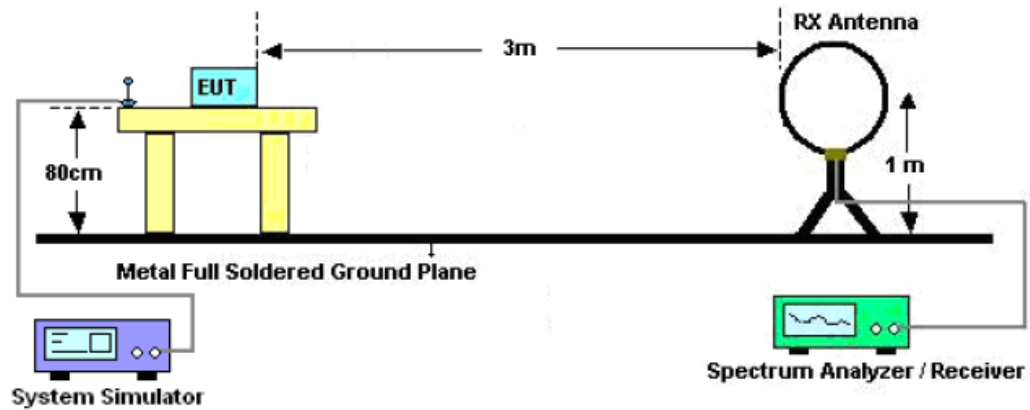
Test limit for Standard FCC 15.209

Frequency (MHz)	Distance Meters	Field Strengths Limit	
		μ V/m	dB(μ V)/m
0.009 ~ 0.490	300	2400/F(kHz)	---
0.490 ~ 1.705	30	24000/F(kHz)	---
1.705 ~ 30	30	30	---
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	Other: 74.0 dB(μ V)/m (Peak) 54.0 dB(μ V)/m (Average)	

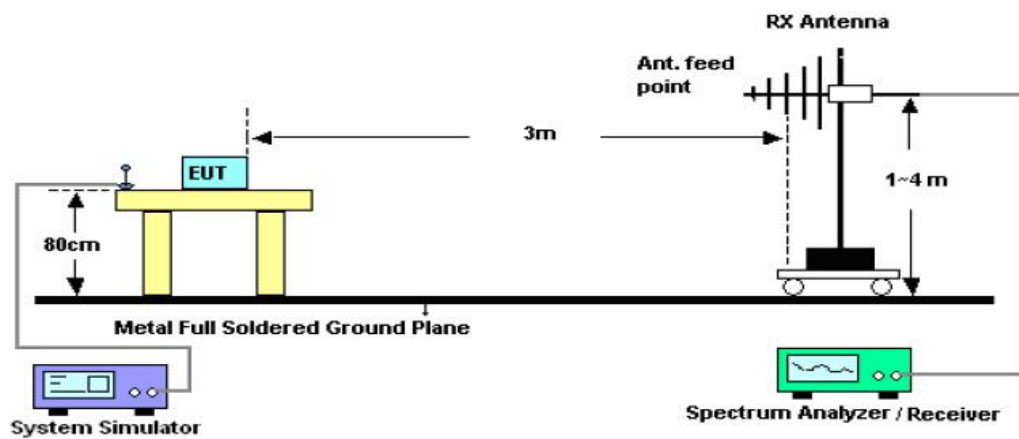
Remark: (1) Emission level dB μ V = 20 log Emission level μ V/m
 (2) The smaller limit shall apply at the cross point between two frequency bands.
 (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

3.2. TEST SETUP

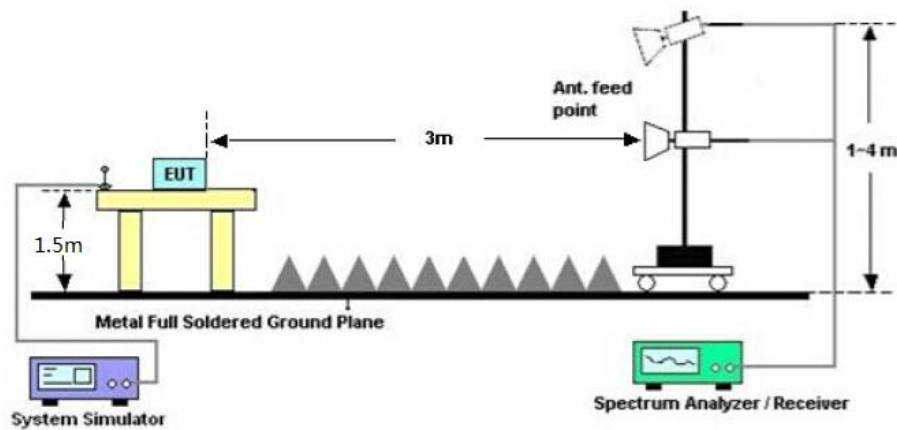
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



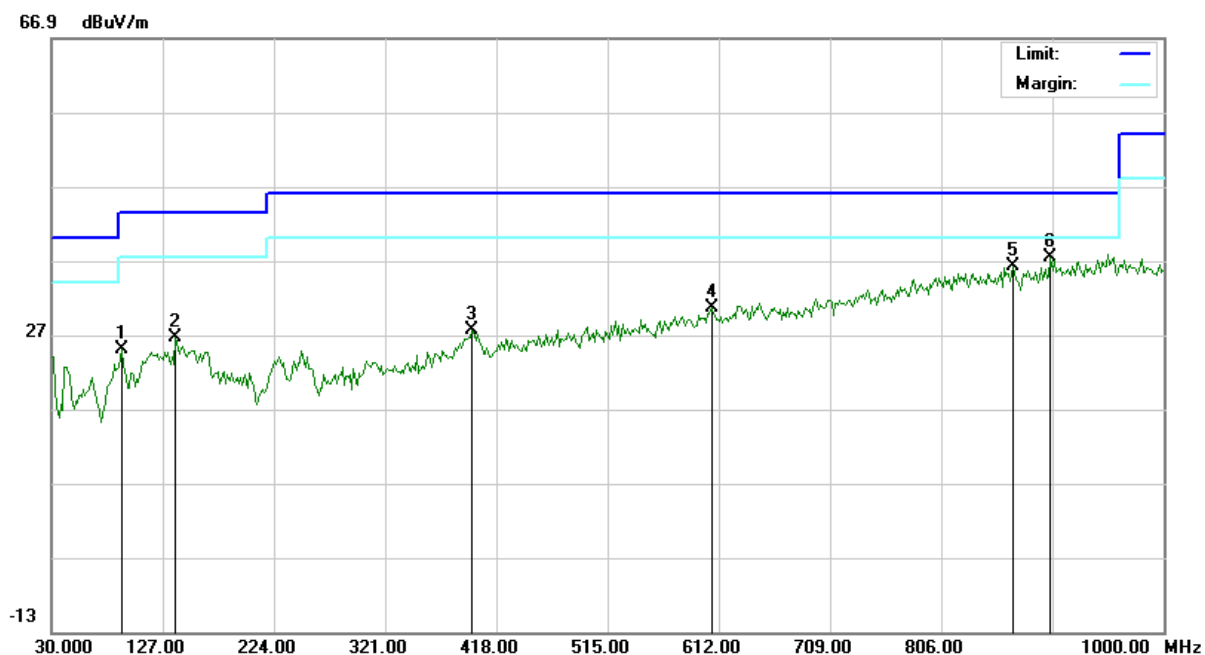


3.3. TEST RESULT

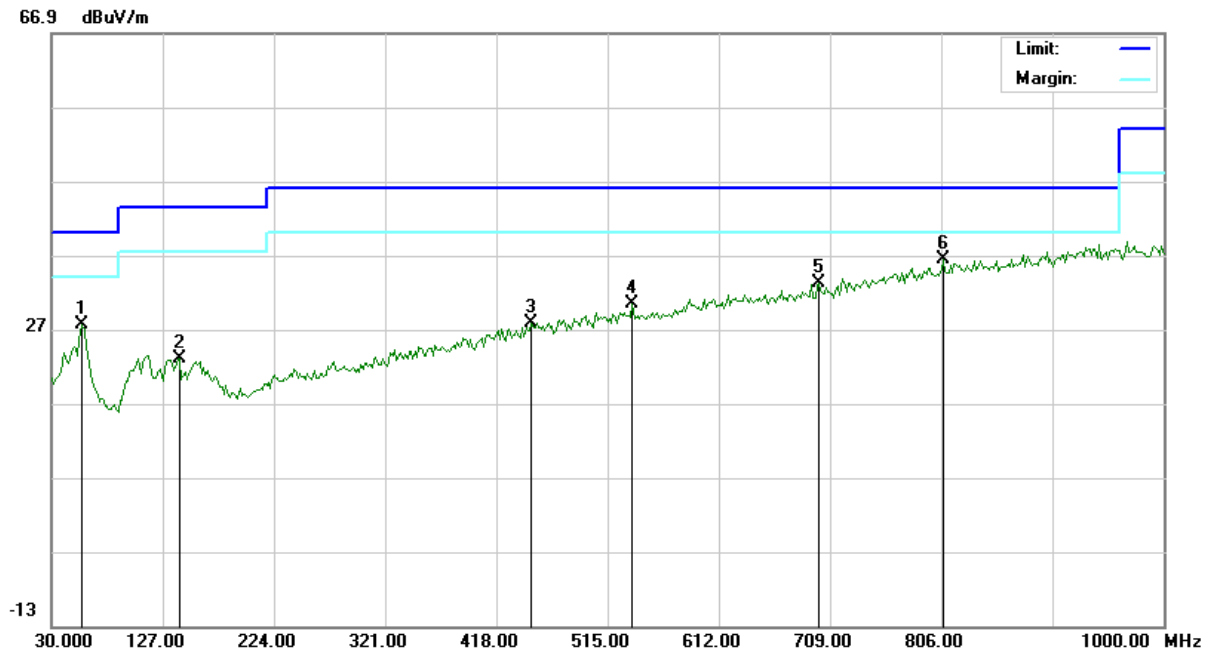
RADIATED EMISSION BELOW 30MHz

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHZ-Horizontal



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB		cm	degree	
1		91.4332	8.61	16.41	25.02	43.50	-18.48	peak			
2		138.3166	6.62	19.94	26.56	43.50	-16.94	peak			
3		396.9833	2.90	24.73	27.63	46.00	-18.37	peak			
4		605.5333	1.29	29.30	30.59	46.00	-15.41	peak			
5		869.0499	1.92	34.21	36.13	46.00	-9.87	peak			
6	*	901.3833	2.63	34.68	37.31	46.00	-8.69	peak			

**RADIATED EMISSION BELOW 1GHZ-Vertical**

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB		cm	degree	
1		55.8667	6.63	20.89	27.52	40.00	-12.48	peak			
2		141.5500	2.80	20.22	23.02	43.50	-20.48	peak			
3		448.7167	1.91	25.96	27.87	46.00	-18.13	peak			
4		536.0167	2.49	27.89	30.38	46.00	-15.62	peak			
5		699.2999	2.49	30.74	33.23	46.00	-12.77	peak			
6	*	807.6165	3.12	33.28	36.40	46.00	-9.60	peak			

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

3. The mode 1 is the worst case, and only the data of the worst case recorded in this test report.

RADIATED EMISSION ABOVE 1GHZ

Field strength of fundamental emission

EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 1/2/3	Polarization :	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2408.031	90.03	-9.61	80.42	114.00	-33.58	peak
2408.031	85.13	-9.61	75.52	94.00	-18.48	AVG
2440.031	89.84	-9.61	80.23	114.00	-33.77	peak
2440.031	84.13	-9.61	74.52	94.00	-19.48	AVG
2474.031	91.03	-9.61	81.42	114.00	-32.58	peak
2474.031	86.18	-9.61	76.57	94.00	-17.43	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 1/2/3	Polarization :	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2408.031	89.03	-9.61	79.42	114.00	-34.58	peak
2408.031	84.22	-9.61	74.61	94.00	-19.39	AVG
2440.031	89.49	-9.61	79.88	114.00	-34.12	peak
2440.031	84.55	-9.61	74.94	94.00	-19.06	AVG
2474.031	89.84	-9.61	80.23	114.00	-33.77	peak
2474.031	84.94	-9.61	75.33	94.00	-18.67	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

**Field strength of spurious emission**

EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 1	Polarization :	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4816.062	48.68	3.76	52.44	74.00	-21.56	peak
4816.062	44.35	3.76	48.11	54.00	-5.89	AVG
7224.093	43.16	8.17	51.33	74.00	-22.67	peak
7224.093	39.08	8.17	47.25	54.00	-6.75	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 1	Polarization :	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4816.062	48.12	3.76	51.88	74.00	-22.12	peak
4816.062	44.76	3.76	48.52	54.00	-5.48	AVG
7224.093	42.19	8.17	50.36	74.00	-23.64	peak
7224.093	36.52	8.17	44.69	54.00	-9.31	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 2	Polarization :	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4880.062	48.58	3.78	52.36	74.00	-21.64	peak
4880.062	44.63	3.78	48.41	54.00	-5.59	AVG
7320.093	43.02	8.23	51.25	74.00	-22.75	peak
7320.093	39.39	8.23	47.62	54.00	-6.38	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 2	Polarization :	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4880.062	46.64	3.78	50.42	74.00	-23.58	peak
4880.062	42.00	3.78	45.78	54.00	-8.22	AVG
7320.093	43.02	8.23	51.25	74.00	-22.75	peak
7320.093	38.10	8.23	46.33	54.00	-7.67	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						



EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 3	Polarization :	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4948.062	47.61	3.81	51.42	74.00	-22.58	peak
4948.062	44.44	3.81	48.25	54.00	-5.75	AVG
7422.093	42.15	8.27	50.42	74.00	-23.58	peak
7422.093	38.09	8.27	46.36	54.00	-7.64	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 3	Polarization :	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4948.062	47.44	3.81	51.25	74.00	-22.75	peak
4948.062	43.31	3.81	47.12	54.00	-6.88	AVG
7422.093	41.95	8.27	50.22	74.00	-23.78	peak
7422.093	38.45	8.27	46.72	54.00	-7.28	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Note: Other emissions from 8G to 25 GHz are considered as ambient noise. No recording in the test report.
Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.
The “Factor” value can be calculated automatically by software of measurement system.

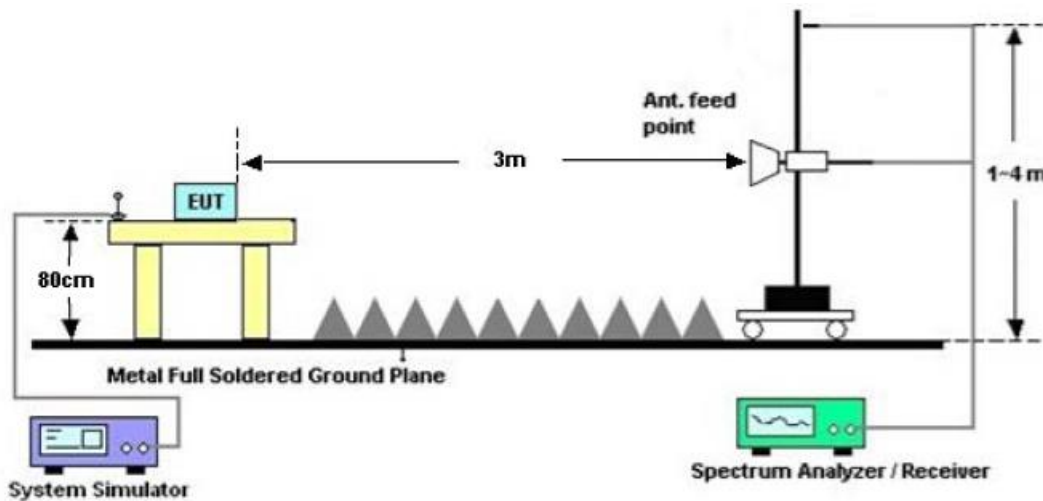
4. BAND EDGE EMISSION

4.1. MEASUREMENT PROCEDURE

1. The EUT operates at transmitting mode. The operate channel is tested to verify the largest transmission and spurious emissions power at the continuous transmission mode.
2. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission: (a) PEAK: RBW=1MHz, VBW=3MHz , Sweep=AUTO
(b) AVERAGE: RBW=1MHz ; VBW=1/on time(1kHz), Sweep=AUTO
3. Other procedures refer to clause 3.1.

4.2 TEST SETUP

RADIATED EMISSION TEST SETUP



4.3 RADIATED TEST RESULT

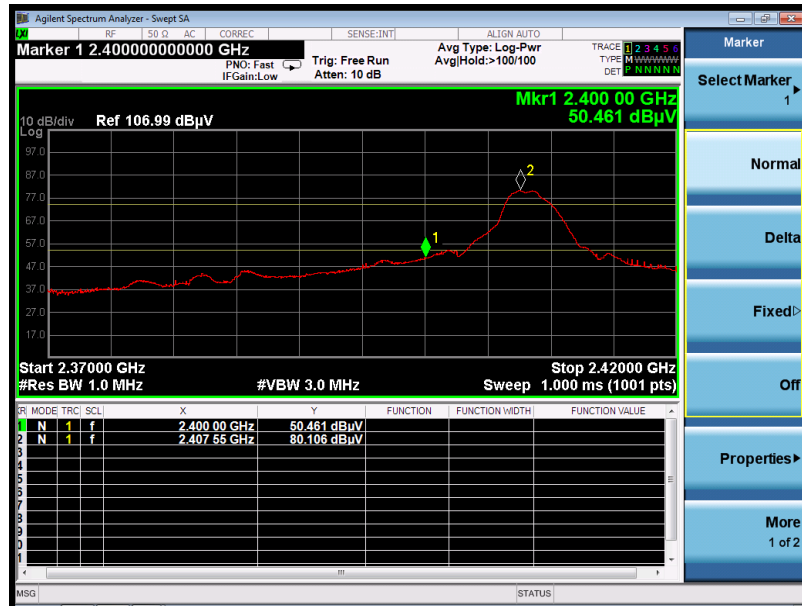
Note:

1. Factor=Antenna Factor + Cable loss - Amplifier gain. Field Strength=Factor + Reading level
2. The factor had been edited in the "Input Correction" of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB(μ V) to represent the Amplitude. Use the F dB(μ V/m) to represent the Field Strength. So A=F.



EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 1	Polarization :	Horizontal

PK Value



EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 1	Polarization :	Vertical

PK Value





EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 3	Polarization :	Horizontal

PK Value



EUT :	Wireless Keyboard	Model Name. :	IH-K2050PAN
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 5V
Test Mode :	Mode 3	Polarization :	Vertical

PK Value



Note: The peak level of the emission is less than the average limit, so the average level should comply with the average limit without test.

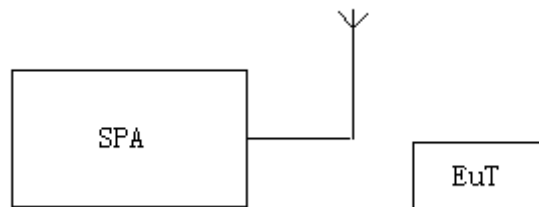


5. BANDWIDTH

5.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Set the EUT Work on the operation frequency individually.
3. Set Span = approximately 2 to 5 times the OBW, centered on a hopping channel
The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately 3* RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

5.2. TEST SETUP



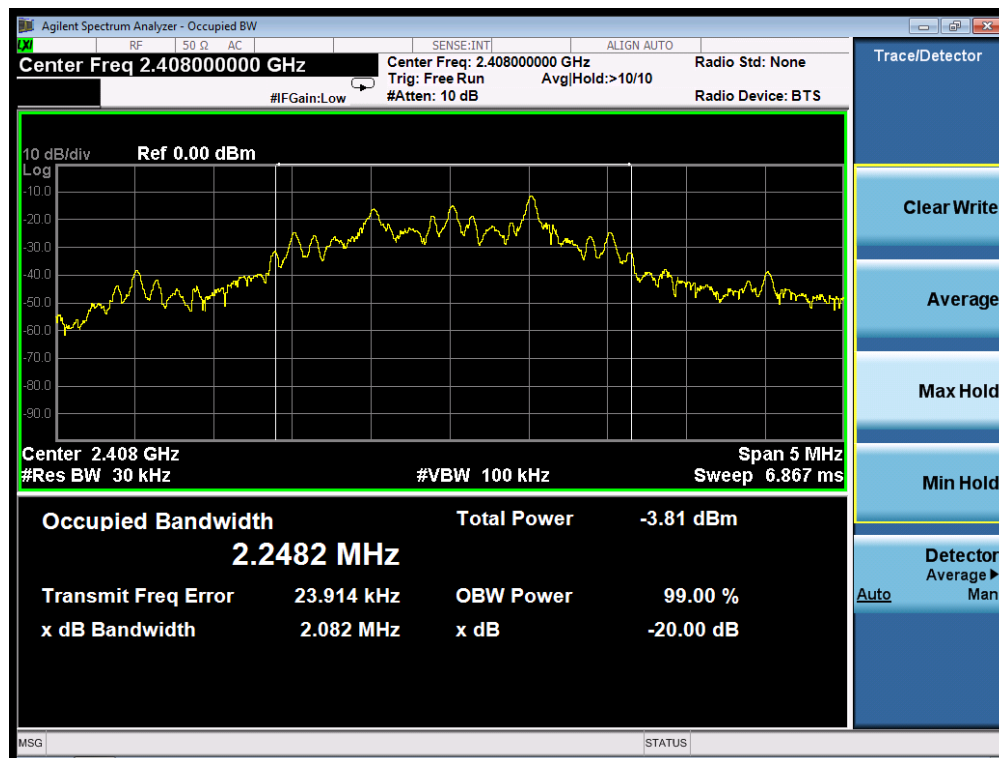


5.3. TEST RESULT

TEST ITEM	-20dB BANDWIDTH
TEST MODE	Mode1, Mode 2, Mode 3

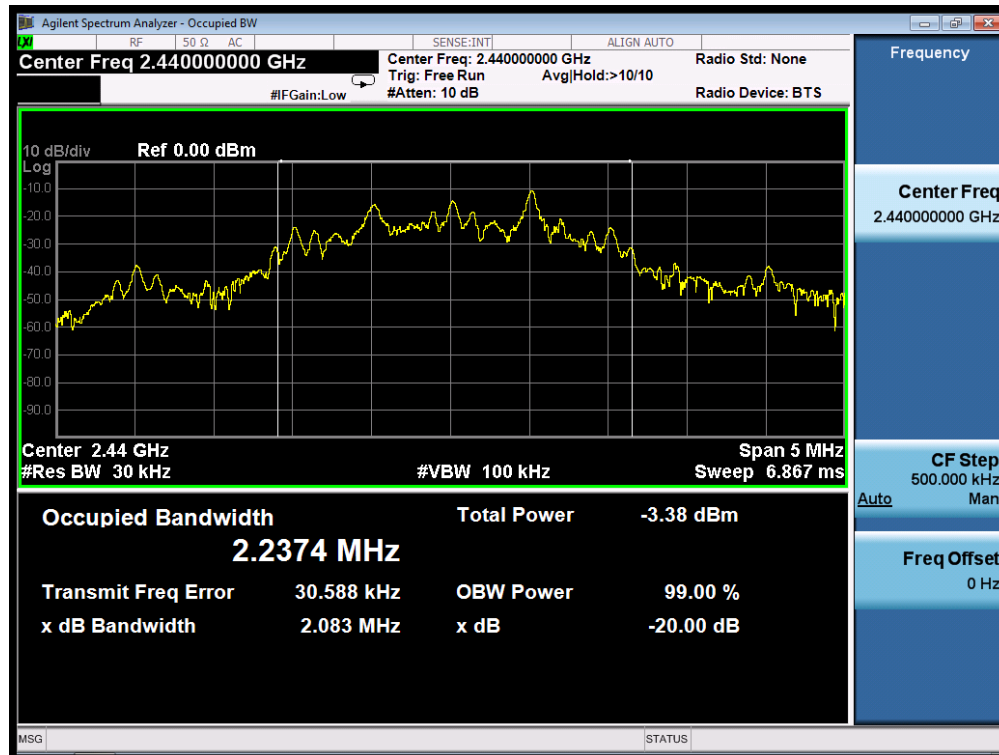
Channel	MHz	Criteria
Low Channel	2.082	PASS
Middle Channel	2.083	PASS
High Channel	2.721	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

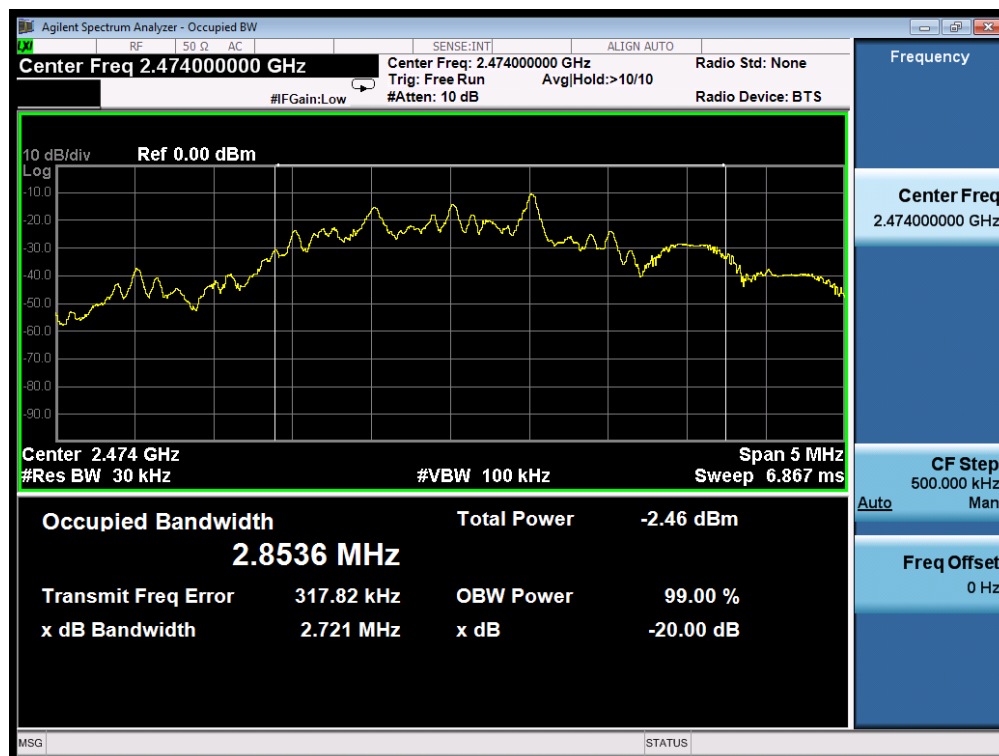




TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

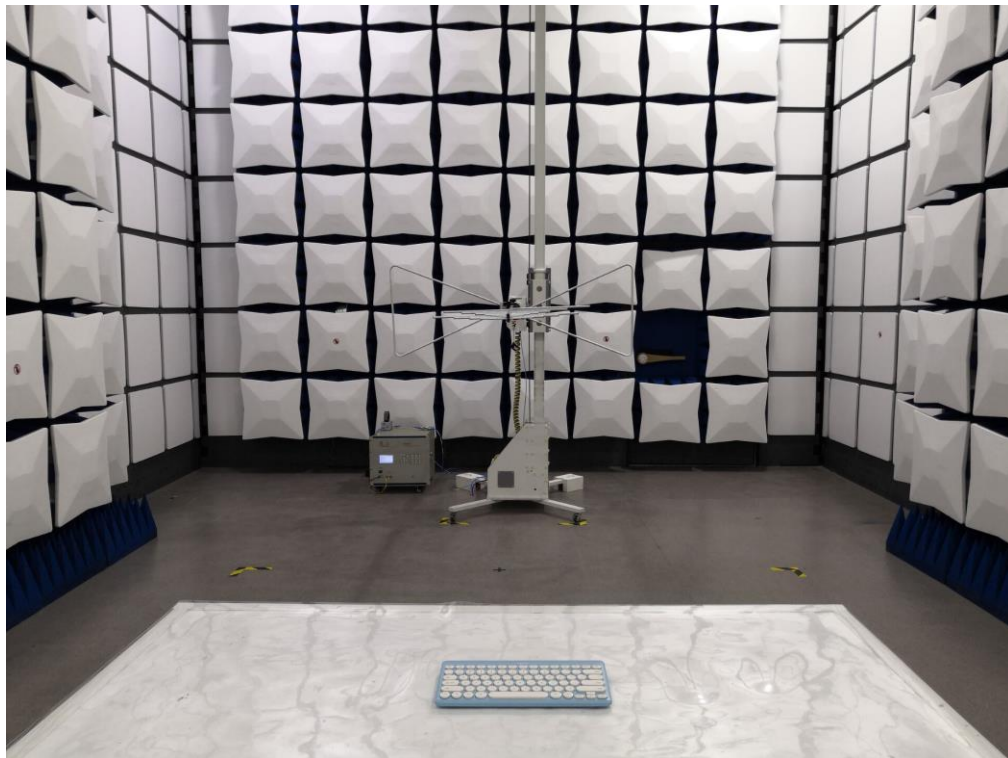


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



6. PHOTOGRAPH OF TEST

Radiated Emission





7. PHOTOGRAPH OF EUT

ALL VIEW OF EUT





TOP VIEW OF EUT



BOTTOM VIEW OF EUT





FRONT VIEW OF EUT



BACK VIEW OF EUT





LEFT VIEW OF EUT



RIGHT VIEW OF EUT

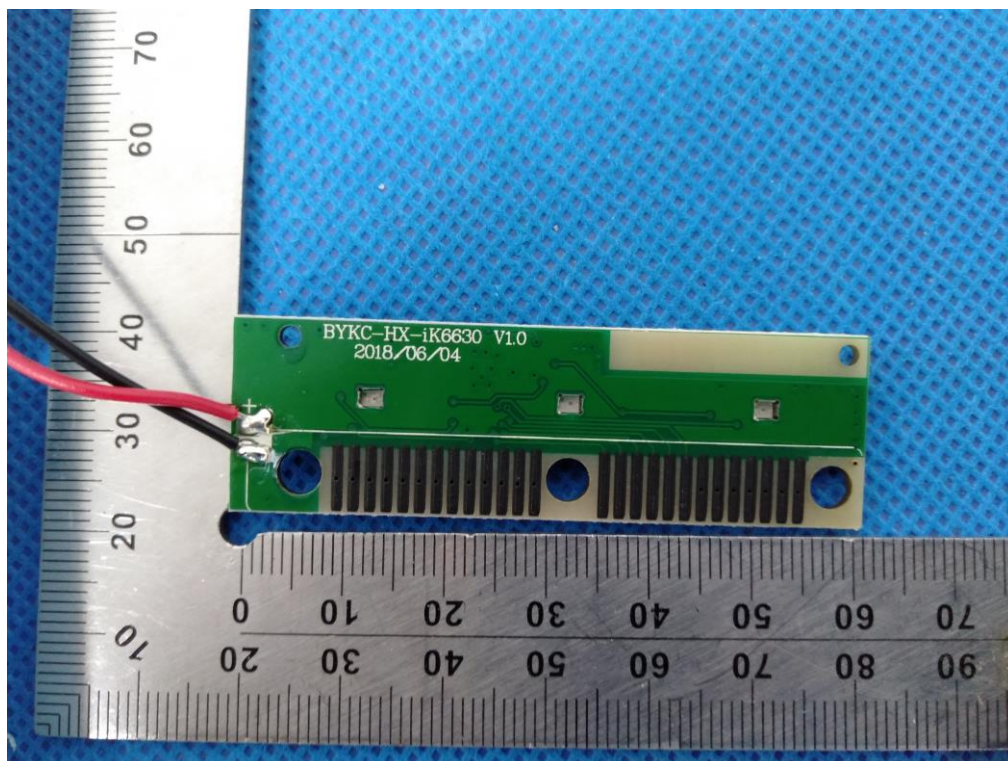




OPEN VIEW OF EUT

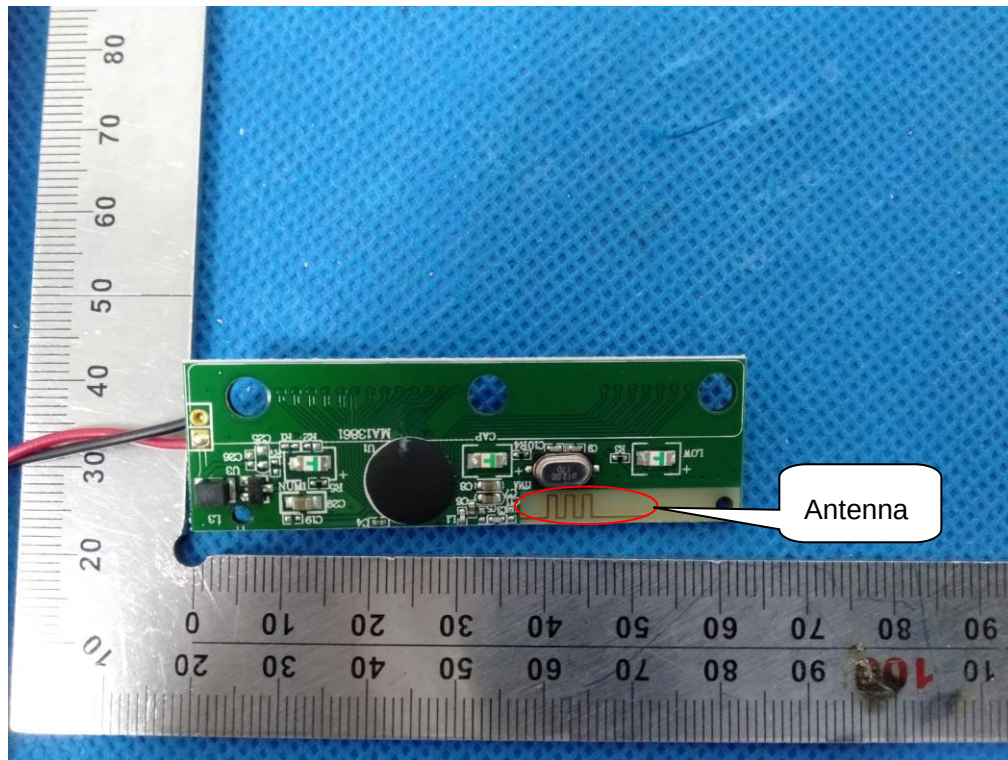


INTERNAL VIEW OF EUT-1





INTERNAL VIEW OF EUT-2



-----END OF REPORT-----