
FCC Test Report

Report No.: AGC03158170503FE05

FCC ID : ZJEK280
APPLICATION PURPOSE : Original Equipment
PRODUCT DESIGNATION : Wireless keyboard
BRAND NAME : N/A
MODEL NAME : IH-K280BB, ST-MKB898W
CLIENT : Shenzhen Star Sources Electronic Technology Co., Ltd.
DATE OF ISSUE : June 09, 2017
STANDARD(S) : FCC Part 15 Rules
TEST PROCEDURE(S)
REPORT VERSION : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd



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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	June 09, 2017	Valid	Original Report

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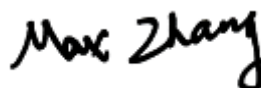
1. VERIFICATION OF CONFORMITY

Applicant	Shenzhen Star Sources Electronic Technology Co., Ltd.
Address	RM2001 MeiLan Business Center, intersection between the road of XiXiang and Qianjin, BaoAn District, Shenzhen, China
Manufacturer	Shenzhen Star Sources Electronic Technology Co., Ltd.
Address	RM2001 MeiLan Business Center, intersection between the road of XiXiang and Qianjin, BaoAn District, Shenzhen, China
Product Designation	Wireless keyboard
Brand Name	N/A
Test Model	IH-K280BB
Serial Model	ST-MKB898W
Difference Description	All the same except the appearance color.
Date of test	June 05, 2017 to June 09, 2017
Deviation	None
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF

We hereby certify that:

The above equipment was tested by Dongguan Precise Testing Service Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.249.

Tested by



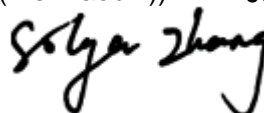
Max Zhang(Zhang Yi) June 09, 2017

Reviewed by



Bart Xie(Xie Xiaobin) June 09, 2017

Approved by



Solger Zhang(Zhang Hongyi)
Authorized Officer June 09, 2017

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

A major technical description of EUT is described as following

Operation Frequency	2.404 GHz to 2.478GHz
Maximum field strength	80.17dBuV/m@3m(AV)
Modulation	GFSK
Number of channels	20
Antenna Gain	0dBi
Antenna Designation	Integrated Antenna (Met 15.203 Antenna requirement)
Hardware Version	QKIE-K8898-V1
Software Version	V1.0
Power Supply	DC 3V by battery

2.2. TABLE OF CARRIER FREQUENCY

Channel Number	Frequency	Channel Number	Frequency
1	2404MHZ	11	2425MHZ
2	2414MHZ	12	2450MHZ
3	2478MHZ	13	2470MHZ
4	2408MHZ	14	2458MHZ
5	2454MHZ	15	2477MHZ
6	2406MHZ	16	2452MHZ
7	2456MHZ	17	2460MHZ
8	2410MHZ	18	2435MHZ
9	2405MHZ	19	2466MHZ
10	2474MHZ	20	2421MHZ

3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Conducted Emission Test	$\pm 3.18\text{dB}$
2	All emissions, radiated	$\pm 3.91\text{dB}$
3	Temperature	$\pm 0.5^\circ\text{C}$
4	Humidity	$\pm 2\%$

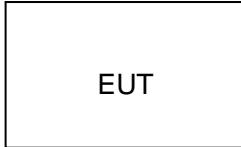
4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX in GFSK modulation
2	Middle channel TX in GFSK modulation
3	High channel TX in GFSK modulation
<p>Note:</p> <ol style="list-style-type: none"> 1. Only the result of the worst case was recorded in the report, if no other cases. 2. For Radiated Emission, 3axis were chosen for testing for each applicable mode. 3. The EUT had been programmed in continuous transmission conditions for the test modes. 	

5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configure 1:



5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	WIRELESS KEYBOARD	IH-K280BB	ZJEK280	EUT

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.249	Radiated Emission	Compliant
§15.249	Band Edges	Compliant
§15.215	20dB bandwidth	Compliant

6. TEST FACILITY

Site	Dongguan Precise Testing Service Co., Ltd.
Location	Building D, Baoding Technology Park, Guangming Road2, Dongcheng District, Dongguan, Guangdong, China.
FCC Registration No.	371540
Description	The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2014.

ALL TEST EQUIPMENT LIST

Radiated Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 3, 2016	July 2, 2017
Trilog Broadband Antenna (25M-1GHz)	SCHWARZBECK	VULB9160	9160-3355	July 3, 2016	July 2, 2017
Signal Amplifier	SCHWARZBECK	BBV 9475	9745-0013	July 3, 2016	July 2, 2017
RF Cable	SCHWARZBECK	AK9515E	96221	July 3, 2016	July 2, 2017
3m Anechoic Chamber	CHENGYU	966	PTS-001	June 2, 2017	June 1, 2018
MULTI-DEVICE Positioning Controller	Max-Full	MF-7802	MF780208339	N/A	N/A
Active loop antenna (9K-30MHz)	Schwarzbeck	FMZB1519	1519-038	June 2, 2017	June 1, 2018
Spectrum analyzer	Agilent	E4407B	MY46185649	June 2, 2017	June 1, 2018
Horn Antenna (1G-18GHz)	SCHWARZBECK	BBHA9120D	9120D-1246	June 2, 2017	June 1, 2018
Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170	9170-181	June 2, 2017	June 1, 2018

7. RADIATED EMISSION

7.1 TEST LIMIT

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

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.

7.2. 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 minimum resolution bandwidth of 1 MHz. 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.

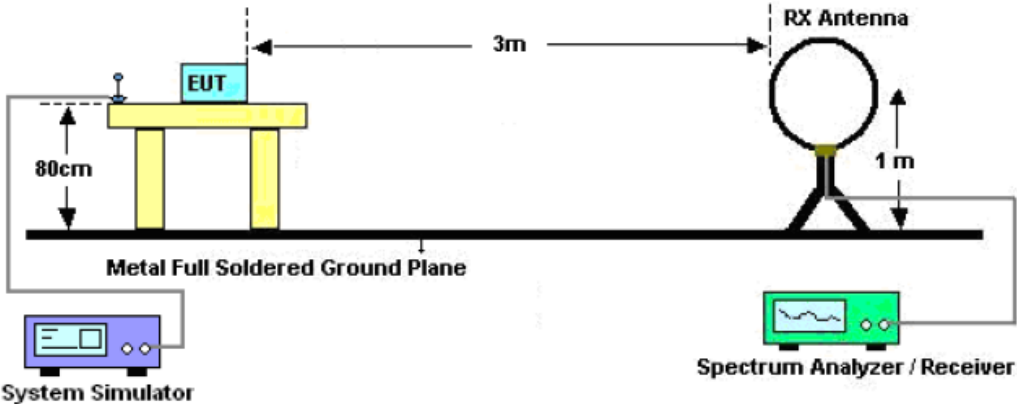
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 2.4MHz/8MHz for Peak, 2.4MHz/10Hz for Average

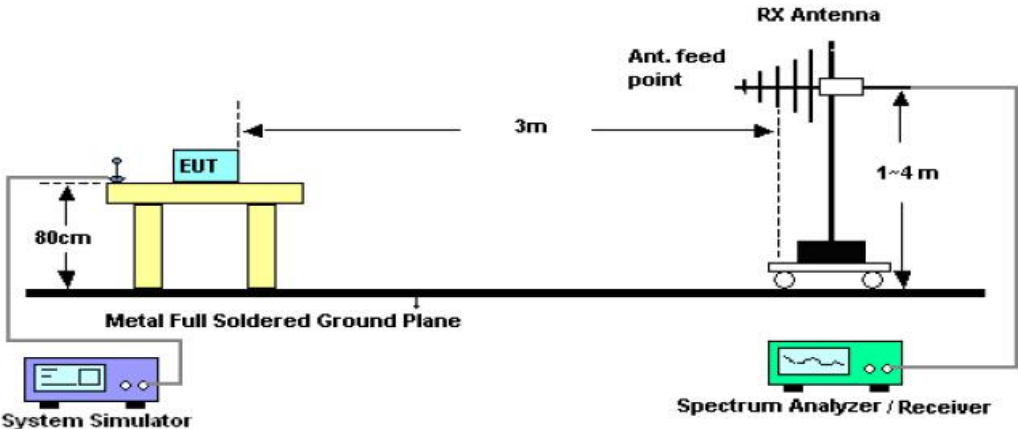
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

7.3. TEST SETUP

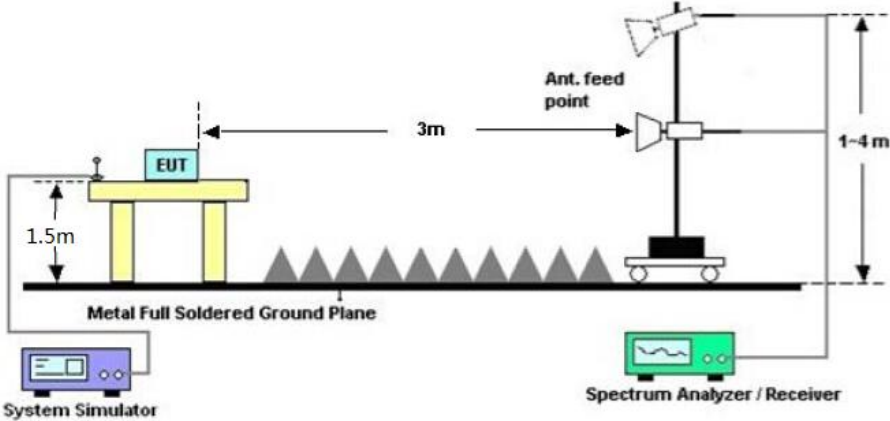
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



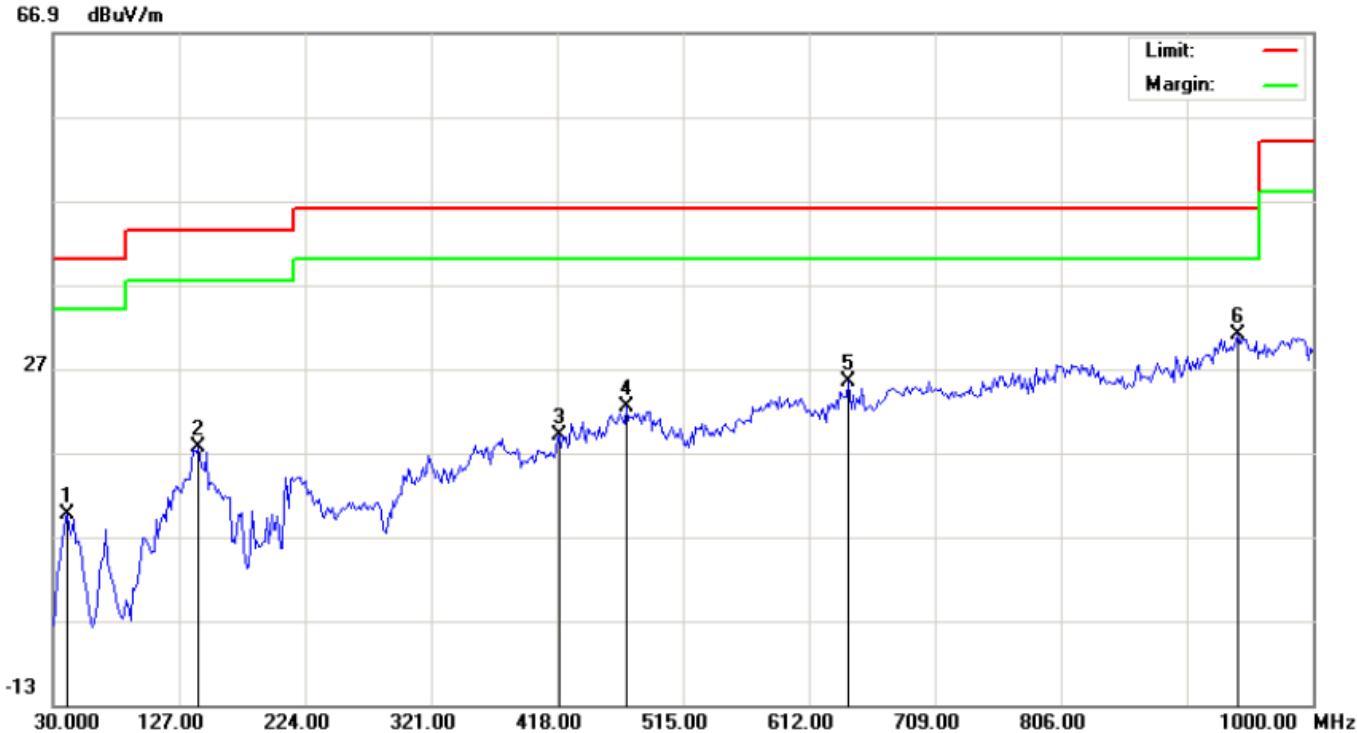
7.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

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

RADIATED EMISSION 30MHz- 1GHZ

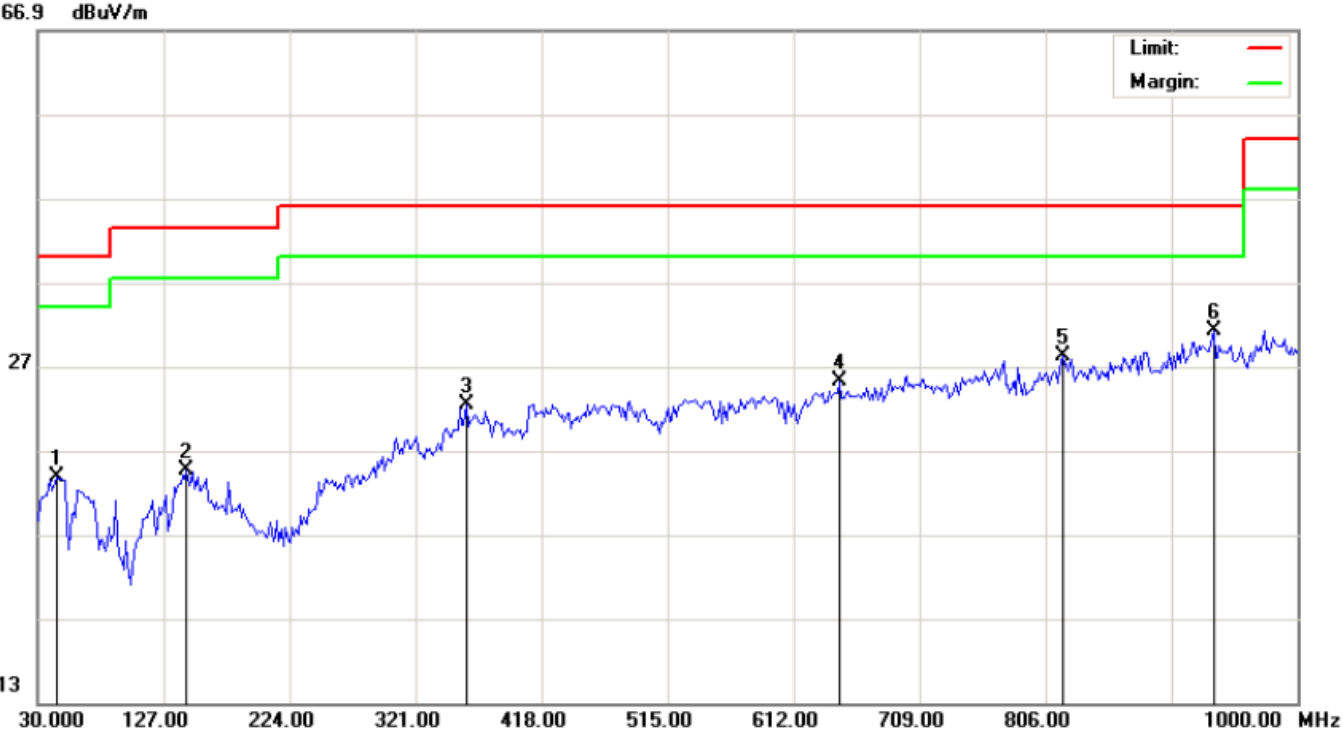
EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Horizontal



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		41.3167	-2.29	11.81	9.52	40.00	-30.48	peak			
2		141.5500	2.81	14.82	17.63	43.50	-25.87	peak			
3		419.6167	-0.74	19.67	18.93	46.00	-27.07	peak			
4		471.3500	1.60	20.82	22.42	46.00	-23.58	peak			
5		642.7167	1.64	23.83	25.47	46.00	-20.53	peak			
6	*	941.8000	1.23	29.77	31.00	46.00	-15.00	peak			

RESULT: PASS

EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		44.5500	5.29	8.60	13.89	40.00	-26.11	peak			
2		144.7833	-0.54	15.23	14.69	43.50	-28.81	peak			
3		359.8000	3.69	18.80	22.49	46.00	-23.51	peak			
4		647.5667	1.46	23.80	25.26	46.00	-20.74	peak			
5		818.9333	0.92	27.32	28.24	46.00	-17.76	peak			
6	*	935.3333	1.58	29.59	31.17	46.00	-14.83	peak			

RESULT: PASS

Note:

Factor=Antenna Factor + Cable loss, Margin=Result-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

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

RADIATED EMISSION ABOVE 1GHZ

EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Value Type
2404.013	92.85	-9.37	83.48	114	-30.52	peak
2404.013	89.54	-9.37	80.17	94	-13.83	AVG
4808.026	42.54	3.74	46.28	74	-27.72	peak
4808.026	39.16	3.74	42.9	54	-11.1	AVG
7212.039	40.02	8.14	48.16	74	-25.84	peak
7212.039	36.87	8.14	45.01	54	-8.99	AVG

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

EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Value Type
2404.013	91.74	-9.37	82.37	114	-31.63	peak
2404.013	89.35	-9.37	79.98	94	-14.02	AVG
4808.026	41.55	3.74	45.29	74	-28.71	peak
4808.026	38.37	3.74	42.11	54	-11.89	AVG
7212.039	39.52	8.14	47.66	74	-26.34	peak
7212.039	36.32	8.14	44.46	54	-9.54	AVG

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

EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 2	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Value Type
2441.016	92.24	-9.63	82.61	114	-31.39	peak
2441.016	89.15	-9.63	79.52	94	-14.48	AVG
4882.032	42.16	3.76	45.92	74	-28.08	peak
4882.032	38.94	3.76	42.7	54	-11.3	AVG
7323.048	38.52	8.17	46.69	74	-27.31	peak
7323.048	35.37	8.17	43.54	54	-10.46	AVG

Remark:

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

EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 2	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBµV)	Factor (dB)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Value Type
2441.016	91.52	-9.63	81.89	114	-32.11	peak
2441.016	88.36	-9.63	78.73	94	-15.27	AVG
4882.032	39.52	3.76	43.28	74	-30.72	peak
4882.032	36.19	3.76	39.95	54	-14.05	AVG
7323.048	40.25	8.17	48.42	74	-25.58	peak
7323.048	37.08	8.17	45.25	54	-8.75	AVG

Remark:

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

EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 3	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2478.021	91.85	-9.61	82.24	114	-31.76	peak
2478.021	88.64	-9.61	79.03	94	-14.97	AVG
4956.042	40.52	3.83	44.35	74	-29.65	peak
4956.042	37.33	3.83	41.16	54	-12.84	AVG
7434.063	39.69	8.21	47.9	74	-26.1	peak
7434.063	36.51	8.21	44.72	54	-9.28	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 3	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2478.021	90.75	-9.61	81.14	114	-32.86	peak
2478.021	87.51	-9.61	77.9	94	-16.1	AVG
4956.042	39.16	3.83	42.99	74	-31.01	peak
4956.042	35.84	3.83	39.67	54	-14.33	AVG
7434.063	40.22	8.21	48.43	74	-25.57	peak
7434.063	37.01	8.21	45.22	54	-8.78	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.

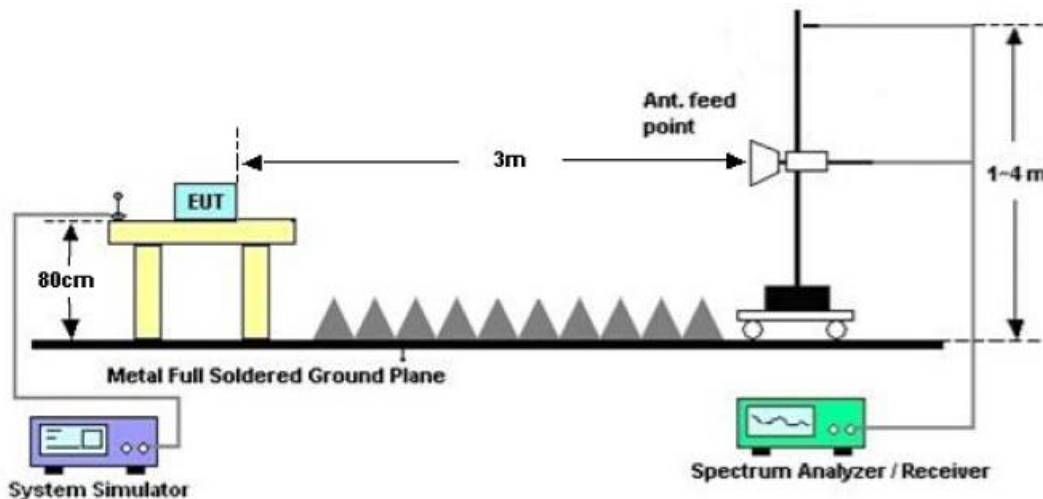
8. BAND EDGE EMISSION

8.1. 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=VBW=1MHz / Sweep=AUTO
(b) AVERAGE: RBW=1MHz ; VBW=1/on time(1KHz) / Sweep=AUTO
3. Other procedures refer to clause 7.2.

8.2 TEST SETUP

RADIATED EMISSION TEST SETUP



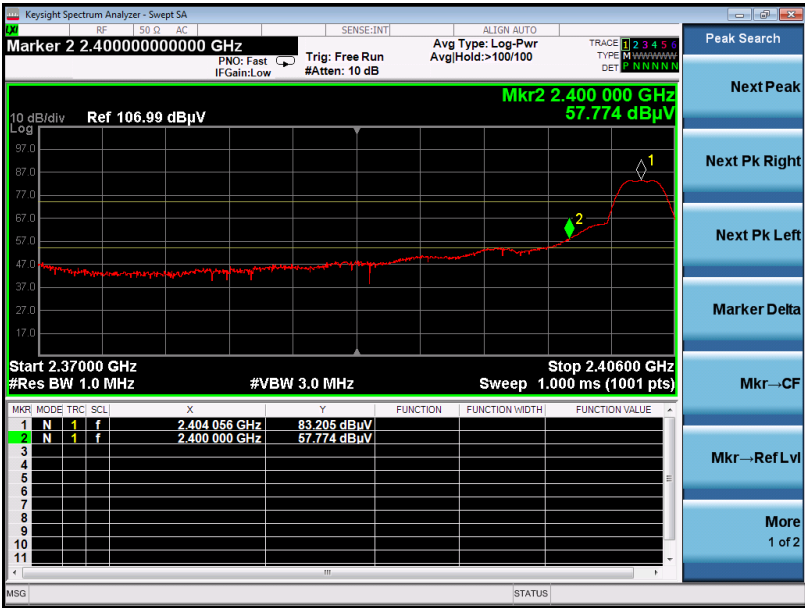
8.3 RADIATED TEST RESULT

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-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Horizontal

PK Value



AV Value



EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 3	Polarization :	Horizontal

PK Value

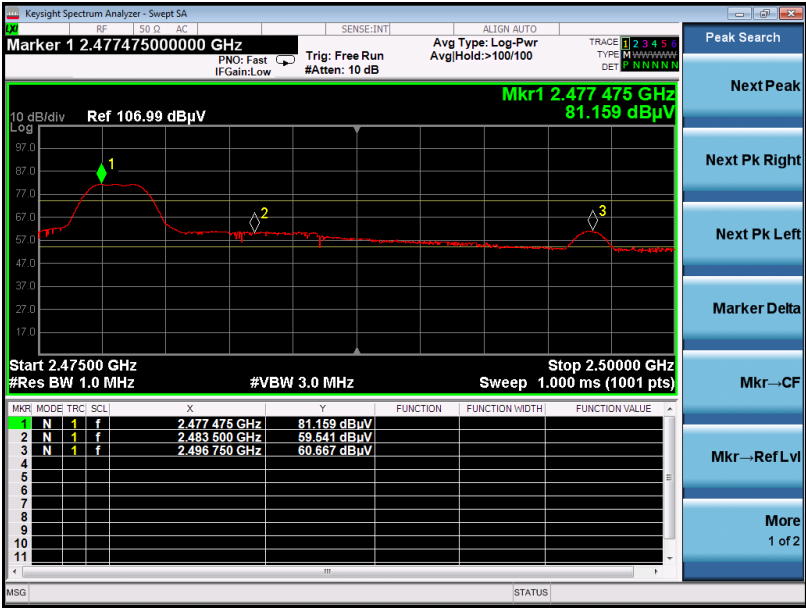


AV Value



EUT :	WIRELESS KEYBOARD	Model Name. :	IH-K280BB
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 3	Polarization :	Vertical

PK Value



AV Value

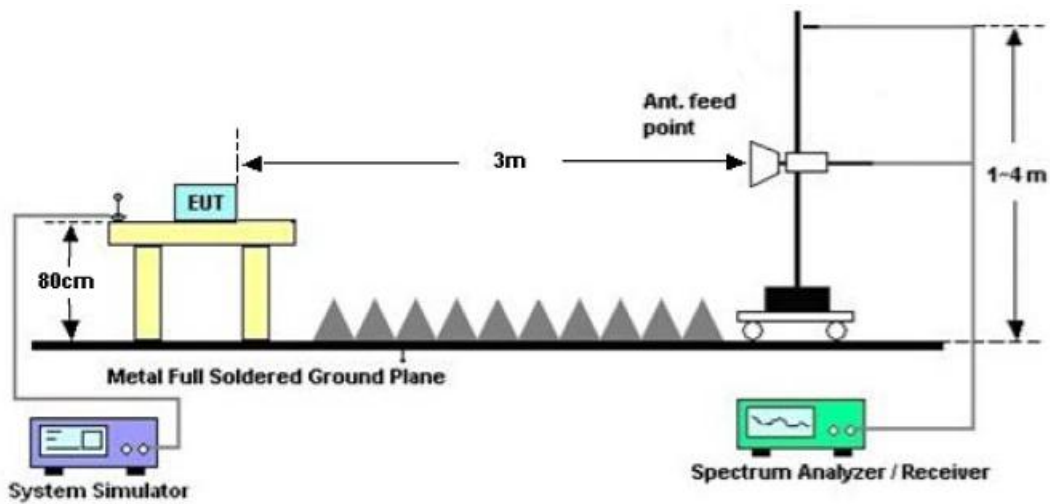


9. 20DB BANDWIDTH

9.1. 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 top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, 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 three times RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

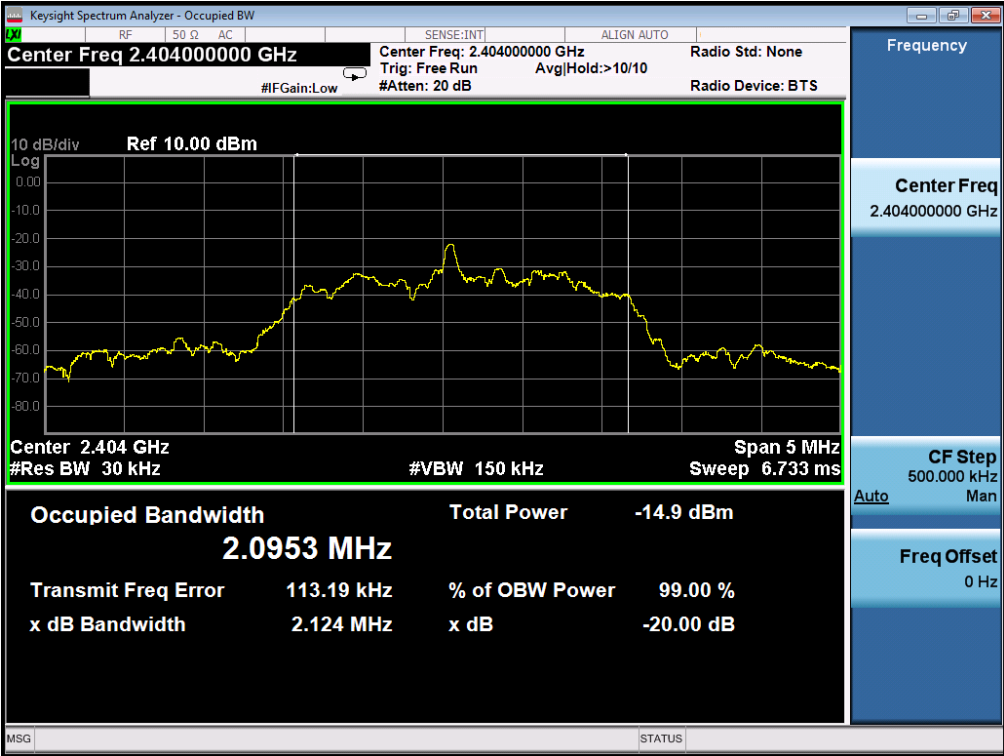


9.3. MEASUREMENT RESULTS

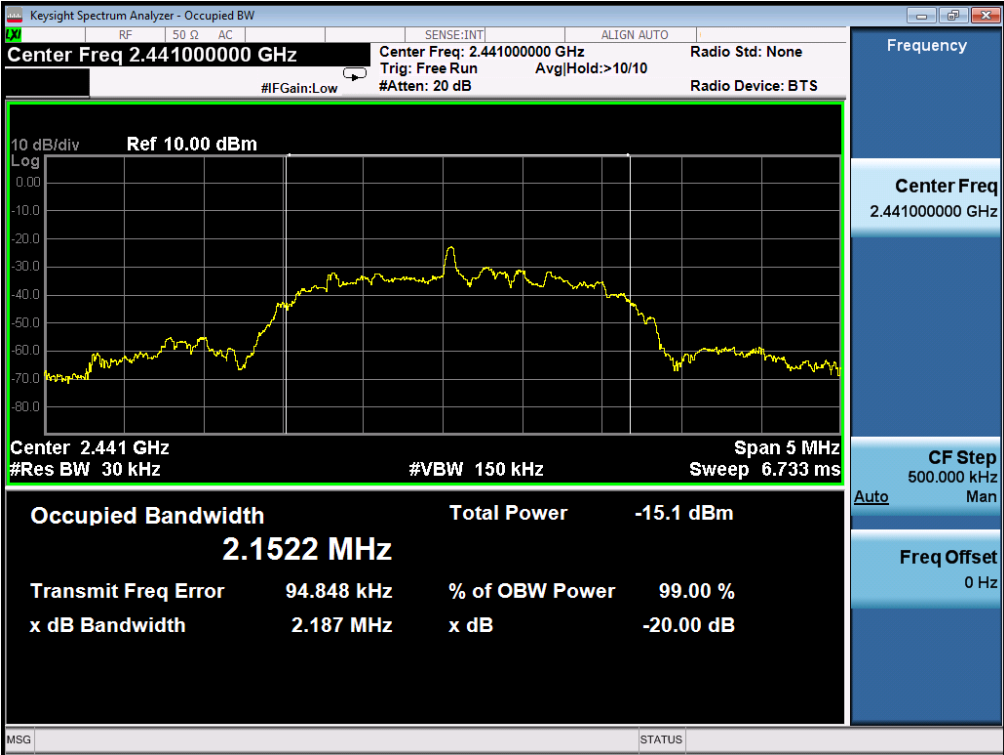
TEST ITEM	20DB BANDWIDTH
TEST MODE	Mode1;Mode2;Mode3

Test Data (MHz)		Criteria
Low Channel	2.124	PASS
Middle Channel	2.187	PASS
High Channel	2.195	PASS

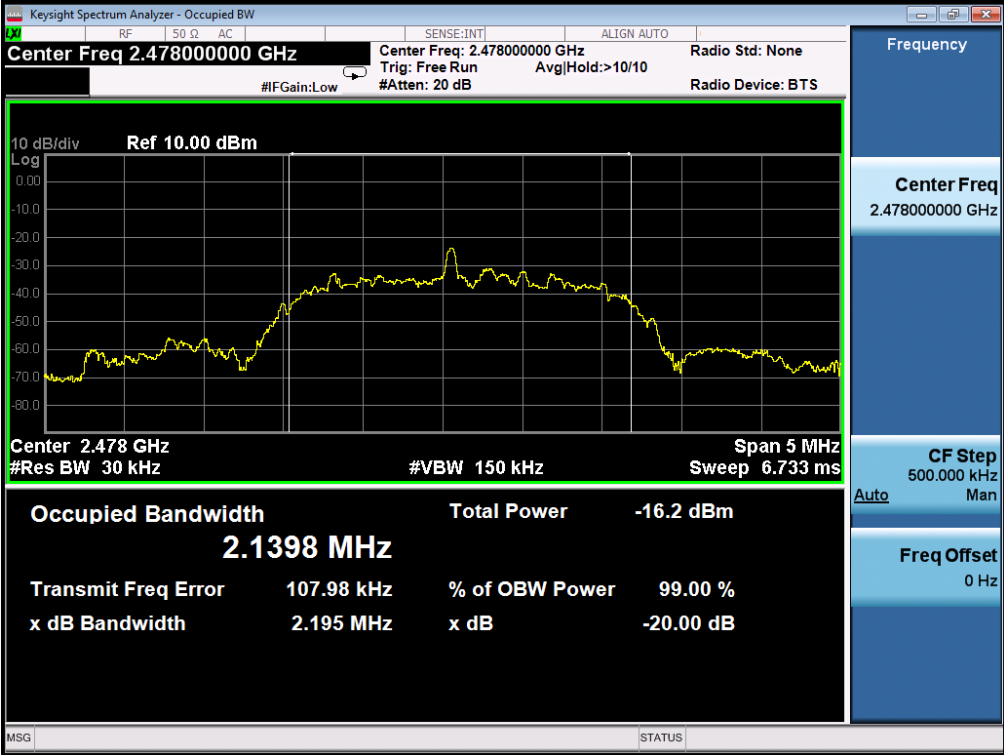
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



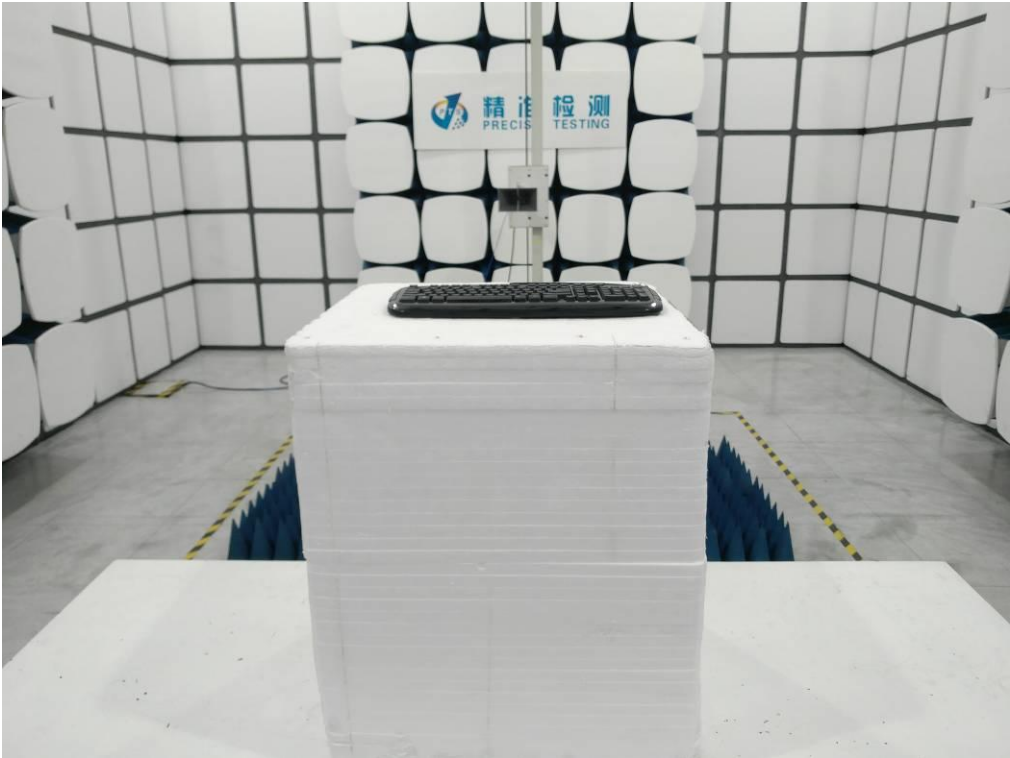
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



APPENDIX A: PHOTOGRAPHS OF TEST SETUP
FCC RADIATED EMISSION TEST SETUP



APPENDIX B: PHOTOGRAPHS OF EUT
TOP VIEW OF EUT



BOTTOM VIEW OF EUT



FRONT VIEW OF EUT



BACK VIEW OF EUT



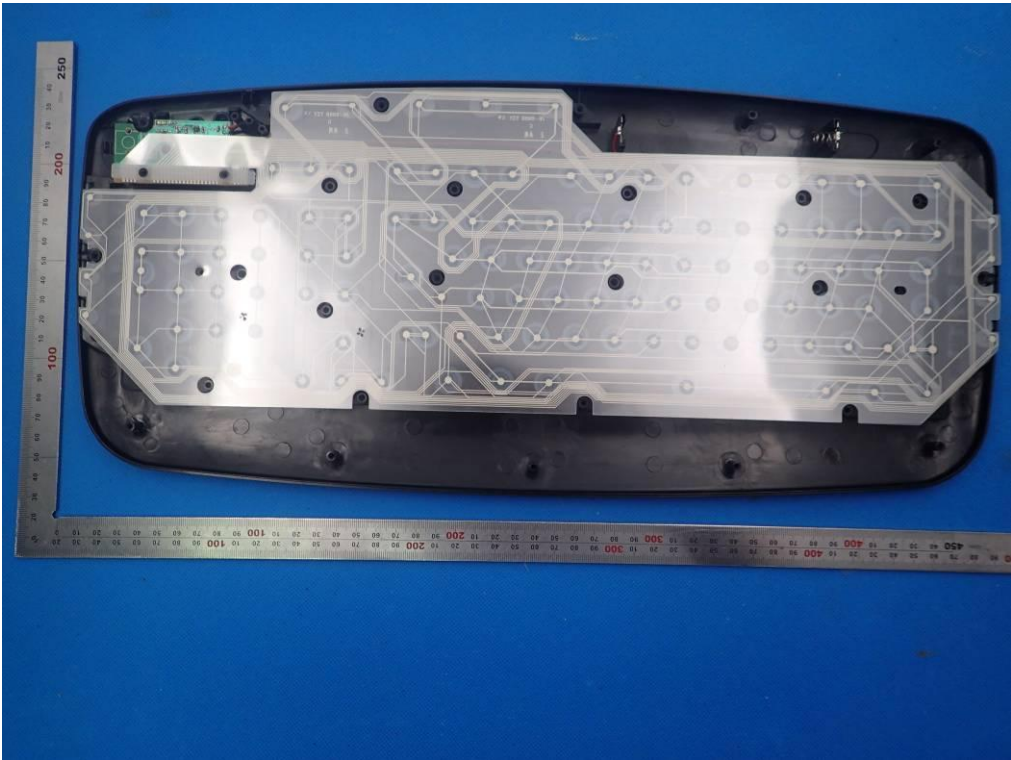
LEFT VIEW OF EUT



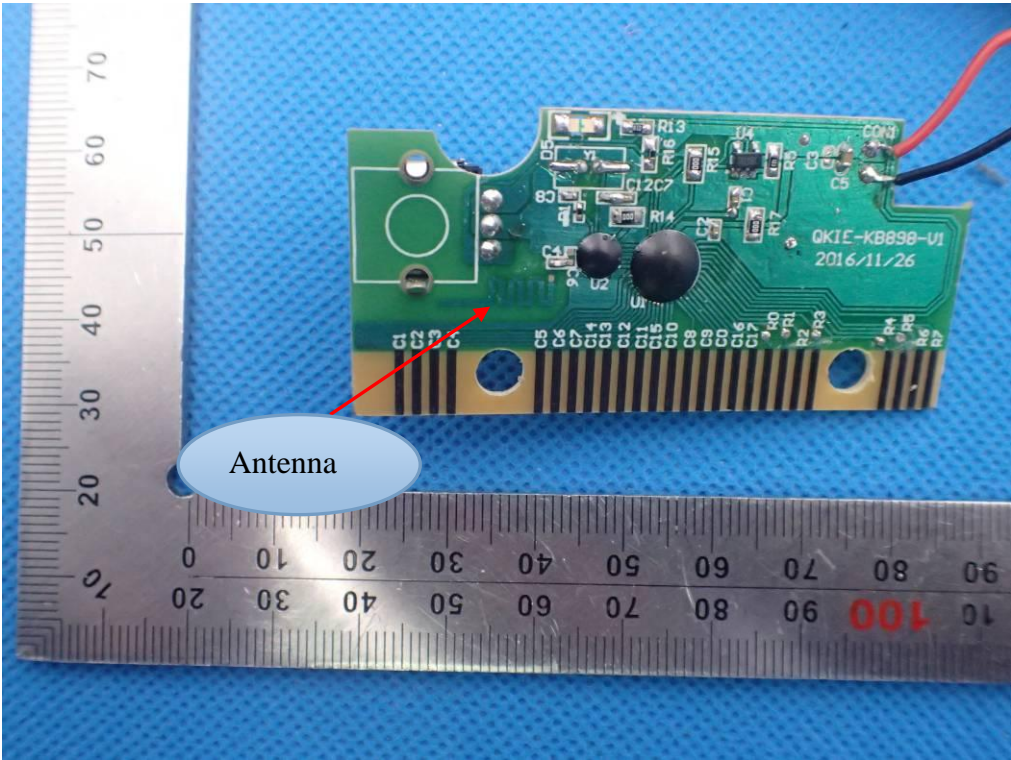
RIGHT VIEW OF EUT



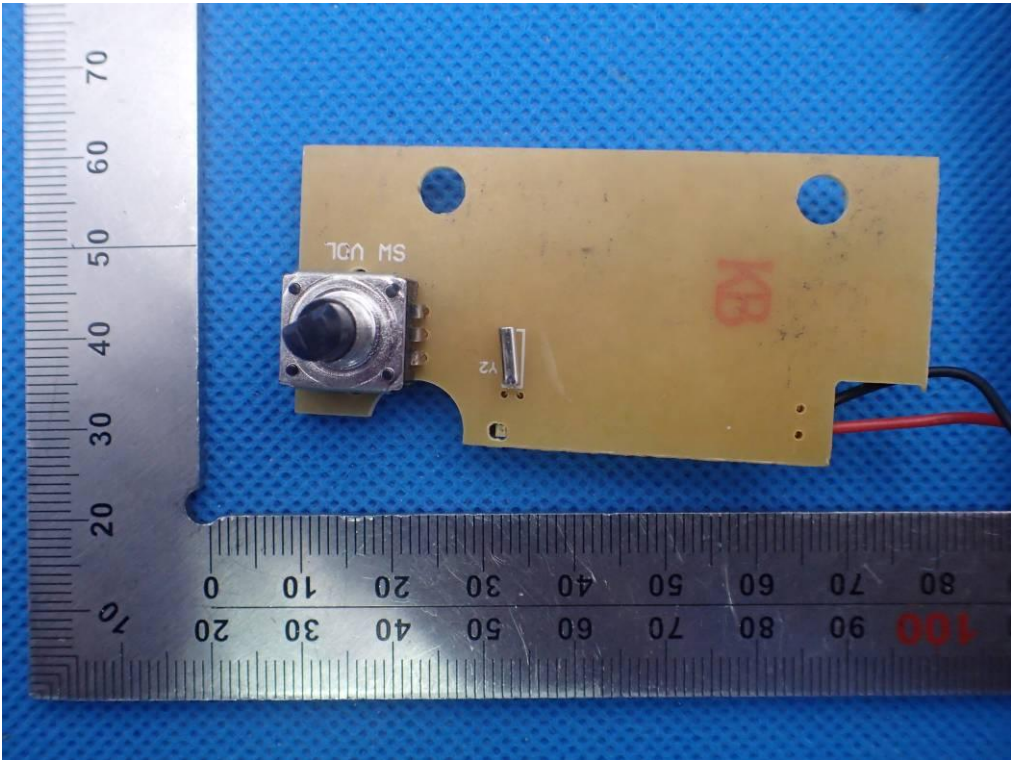
OPEN VIEW OF EUT



INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



----END OF REPORT----