

# FCC TEST REPORT

for

Guoguang Electric Co.,Ltd.

2.1 Sound Bar System(wireless)

Model Number: ESB206

FCC ID: 2AAP8ESB206

Prepared for : Guoguang Electric Co.,Ltd.  
Address : No.8 Jinghu Road, Xinhua Street, Huadu Reg,  
Guanzhou, China  
Prepared by : Keyway Testing Technology Co., Ltd.  
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Report No. : 15KWE103124F  
Date of Test : Oct. 19~22, 2015  
Date of Report : Oct. 23, 2015

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## Keyway Testing Technology Co., Ltd.

<b>Applicant:</b>	Guoguang Electric Co.,Ltd.		
<b>Address:</b>	No.8 Jinghu Road, Xinhua Street, Huadu Reg, Guangzhou, China		
<b>Manufacturer:</b>	Guoguang Electric Co.,Ltd.		
<b>Address:</b>	No.8 Jinghu Road, Xinhua Street, Huadu Reg, Guangzhou, China		
<b>E.U.T:</b>	2.1 Sound Bar System(wireless)		
<b>Model Number:</b>	ESB206		
<b>Trade Name:</b>	element	<b>Serial No.:</b>	-----
<b>Date of Receipt:</b>	Oct. 19, 2015	<b>Date of Test:</b>	Oct.19~22, 2015
<b>Test Specification:</b>	FCC Part 15, Subpart C Section 15.249: 2015 ANSI C63.10:2013		
<b>Test Result:</b>	The equipment under test was found to be compliance with the requirements of the standards applied.		
		<b>Issue Date: Oct. 23, 2015</b>	
<b>Tested by:</b>	<b>Reviewed by:</b>	<b>Approved by:</b>	
			
_____ Keven Wu / Engineer	_____ Mike Xu / Supervisor	_____ Andy Gao / Supervisor	
<b>Other Aspects:</b>	None.		
<i>Abbreviations: OK/P=passed    fail/F=failed    n.a/N=not applicable    E.U.T=equipment under tested</i>			
<i>This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.</i>			

## 1. TEST SUMMARY

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emissions	15.205(a)/15.209/15.249(d)	PASS
20dB Bandwidth	15.249	PASS
Emissions from out of band	15.249	PASS
Antenna Requirement	15.203	PASS

## 2. GENERAL PRODUCT INFORMATION

### 2.1. Product Function

Refer to Technical Construction Form and User Manual.

### 2.2. Description of Device (EUT)

Product Name:	2.1 Sound Bar System(wireless)
Model No.:	ESB206
Operation Frequency:	2404~2479MHz
Channel numbers:	16 Channels
Channel separation:	5M
Modulation technology:	GFSK
Antenna Type:	PCB Antenna
Antenna gain:	0dBi
Power supply:	AC 120V/60Hz
HW:	M2-SB206-MAIN902051A0
SW:	M2-SB206-MAIN902051A0

### 2.3. Difference between Model Numbers

None.

### 2.4. Independent Operation Modes

1	TX Mode	Channel	Frequency
		Low	2404MHz
		Middle	2439MHz
		High	2479MHz

### 2.5. Test Supporting System

None.

### 2.6. Channel list

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2404MHz	5	2424MHz	9	2444MHz	13	2464MHz
2	2409MHz	6	2429MHz	10	2449MHz	14	2469MHz
3	2414MHz	7	2434MHz	11	2454MHz	15	2474MHz
4	2419MHz	8	2439MHz	12	2459MHz	16	2479MHz

## 2.7. Test Facilities

Lab Qualifications : 944 Shielded Room built by ETS-Lindgren, USA  
Date of completion: March 28, 2011

966 Chamber built by ETS-Lindgren, USA  
Date of completion: March 28, 2011

Certificated by TUV Rheinland, Germany.  
Registration No.: UA 50207153  
Date of registration: July 13, 2011

Certificated by UL, USA  
Registration No.: 100567-237  
Date of registration: September 1, 2011

Certificated by Intertek  
Registration No.: 2011-RTL-L1-31  
Date of registration: October 11, 2011

Certificated by Industry Canada  
Registration No.: 9868A  
Date of registration: December 8, 2011

Certificated by FCC, USA  
Registration No.: 370994  
Date of registration: February 21, 2012

Certificated by CNAS China  
Registration No.: CNAS L5783  
Date of registration: August 8, 2012

Name of Firm : Keyway Testing Technology Co., Ltd.

Site Location : Building1, Baishun Industrial Zone, Zhangmutou  
Town, Dongguan, Guangdong, China

## 2.8. List of Test and Measurement Instruments

### 2.8.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,15	Apr. 27,16
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 27,15	Apr. 27,16
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 27,15	Apr. 27,16
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 27,15	Apr. 27,16
temporary antenna connector	ATM	R-00	3567	Oct. 08,15	Nov. 07,15

### 2.8.2. For radiated emission, 20dB bandwidth, band edge test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,15	Apr. 27,16
Bilog Antenna	ETS-LINDGREN	3142D	00135452	Apr. 27,15	Apr. 27,16
Loop Antenna	ARA	PLA-1030/B	1029	Apr. 22,15	Apr. 22,16
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 27,15	Apr. 27,16
3m Semi-anechoic Chamber	ETS-LINDGREN	966	KW01	Apr. 27,15	Apr. 27,16
Signal Amplifier	SONOMA	310	187303	Apr. 27,15	Apr. 27,16
RF Cable below 1G	IMRO	IMRO-400	966 Cable 1#	Apr. 27,15	Apr. 27,16
MULTI-DEVICE Controller	ETS-LINDGREN	2090	126913	Apr. 27,15	Apr. 27,16
Antenna Holder	ETS-LINDGREN	2070B	00109601	Apr. 27,15	Apr. 27,16
Horn Antenna	DAZE	ZN30701	11003	N/A	N/A
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 27,15	Apr. 27,16
RF Cable above 1G	IMRO	IMRO-401	966 Cable 1#	Apr. 27,15	Apr. 27,16
MULTI-DEVICE Controller	ETS-LINDGREN	2090	126913	Apr. 27,15	Apr. 27,16
Antenna Holder	ETS-LINDGREN	2070B	00109601	Apr. 27,15	Apr. 27,16
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 27,15	Apr. 27,16

Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list

### 3. TEST SET-UP AND OPERATION MODES

#### 3.1. Principle of Configuration Selection

**Emission:** The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

#### 3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



*(EUT: 2.1 Sound Bar System(wireless))*

#### 3.3. Test Operation Mode and Test Software

None.

#### 3.4. Special Accessories and Auxiliary Equipment

None.

#### 3.5. Countermeasures to Achieve EMC Compliance

None.

#### 3.6. Test Environment:

Ambient conditions in the test laboratory:

Items	Actual
Temperature (°C)	21~23
Humidity (%RH)	50~65

## 4. EMISSION TEST RESULTS

### 4.1. Conducted Emission at the Mains Terminals Test

#### 4.1.1. Limit 15.207 limits

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

#### 4.1.2. Test Setup

The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the centre so as to form a bundle no longer than 0.4 m.

The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

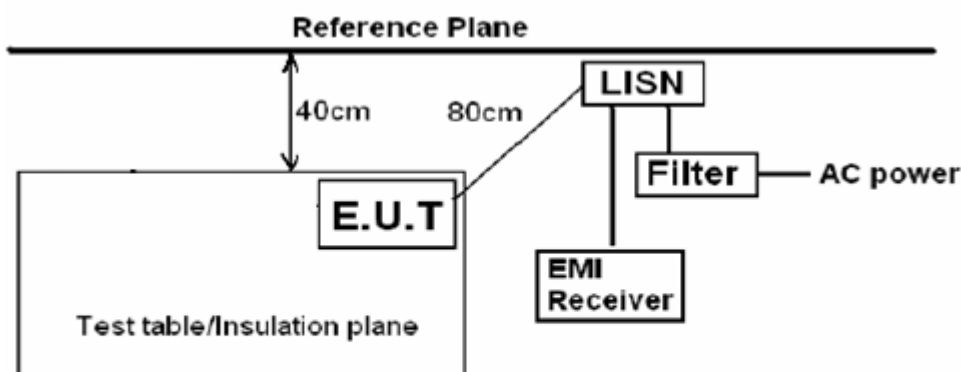
The frequency range from 150 kHz to 30 MHz was investigated.

The bandwidth of the test receiver was set at 9 kHz.

Measurement Uncertainty:  $\pm 2.6$  dB at a level of confidence of 95%.

Pretest for all mode, the worst case was GFSK low channel and the data was reported on the following page.

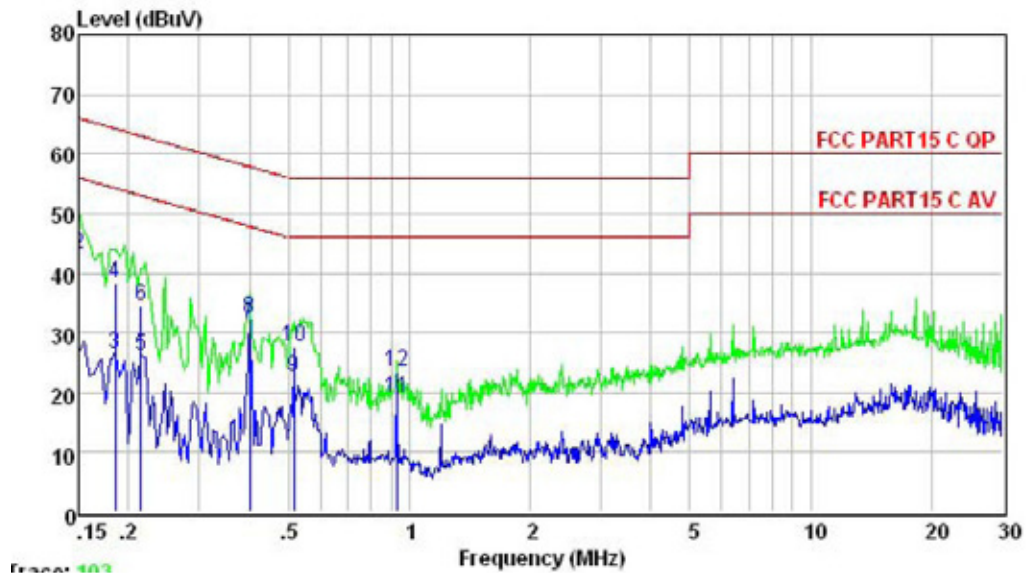
Test voltage was AC 120V/60Hz.



*Remark*  
 E.U.T: Equipment Under Test  
 LISN: Line Impedance Stabilization Network  
 Test table height=0.8m

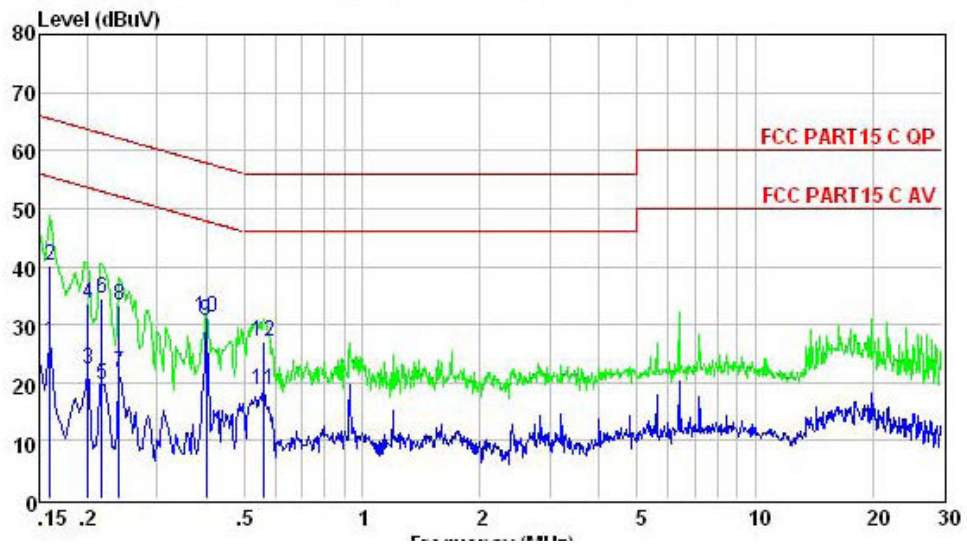


Line



	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.150	26.75	56.00	-29.25	Average
2	0.150	43.20	66.00	-22.80	QP
3	0.185	26.57	54.24	-27.67	Average
4	0.185	38.50	64.24	-25.74	QP
5	0.215	26.20	53.01	-26.81	Average
6	0.215	34.60	63.01	-28.41	QP
7	0.400	31.40	47.86	-16.46	Average
8	0.400	32.40	57.86	-25.46	QP
9	0.516	22.64	46.00	-23.36	Average
10	0.516	27.80	56.00	-28.20	QP
11	0.928	19.09	46.00	-26.91	Average
12	0.928	23.50	56.00	-32.50	QP

Neutral



	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.160	27.19	55.47	-28.28	Average
2	0.160	40.10	65.47	-25.37	QP
3	0.200	22.21	53.62	-31.41	Average
4	0.200	33.70	63.62	-29.92	QP
5	0.216	19.65	52.96	-33.31	Average
6	0.216	34.60	62.96	-28.36	QP
7	0.240	21.71	52.08	-30.37	Average
8	0.240	33.20	62.08	-28.88	QP
9	0.400	30.54	47.86	-17.32	Average
10	0.400	31.20	57.86	-26.66	QP
11	0.561	18.82	46.00	-27.18	Average
12	0.561	27.10	56.00	-28.90	QP

## 4.2. Radiated Emission Test

### 4.2.1. Limit 15.209 limits

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Fundamental Frequency	Field Strength of Fundamental		Field Strength of Harmonics	
	mV/m	dB $\mu$ V/m	$\mu$ V/m	dB $\mu$ V/m
902- 928 MHz	50	94	500	54
2400- 2483.5 MHz	50	94	500	54
5725- 5875 MHz	50	94	500	54
24.0- 24.25GHz	250	108	2500	68

### 4.2.2. Test setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10:2013

The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)

The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)

The height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

For all test, used peak detector. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.

For test above 1GHz:

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.

The bandwidth of the EMI test receiver is set at 10kHz for frequency range from 9kHz to 30 MHz, 120kHz for frequency range from 30MHz to 1000MHz. The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz.

The frequency range from 9kHz to 10<sup>th</sup> harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

2. Measurement Uncertainty:  $\pm 3.2$  dB at a level of confidence of 95%.

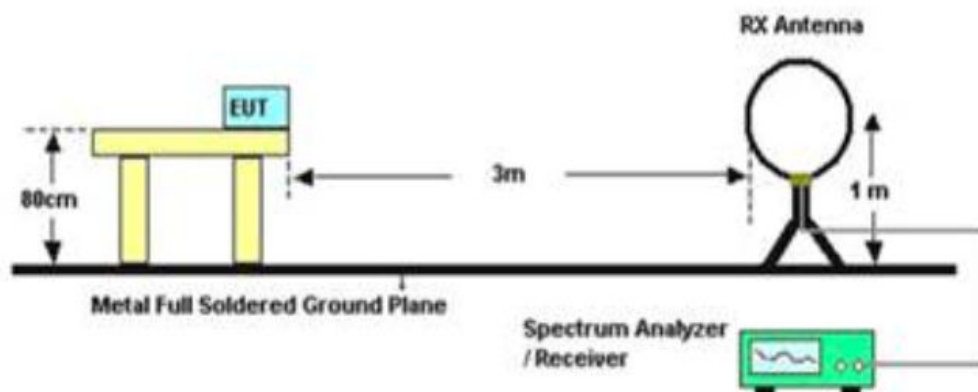
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

4. For emissions below 1GHz, the worst case was GFSK 2404MHz and the data was reported on the following page.

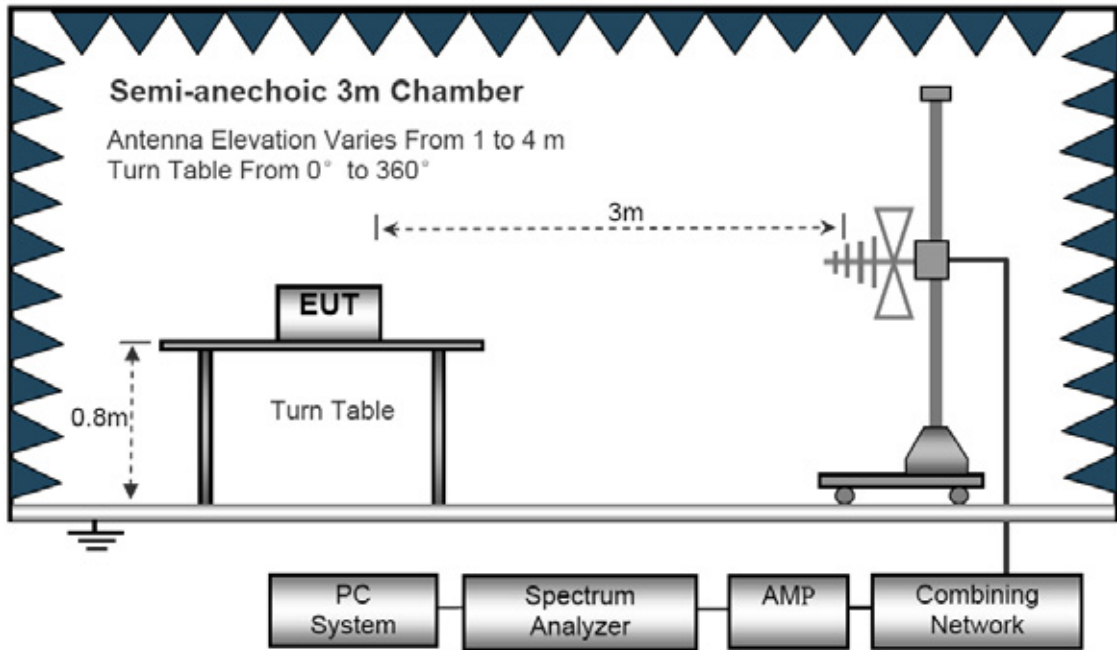
5. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

6. The emission below 30MHz was background noise and met the limit, so no data show it.

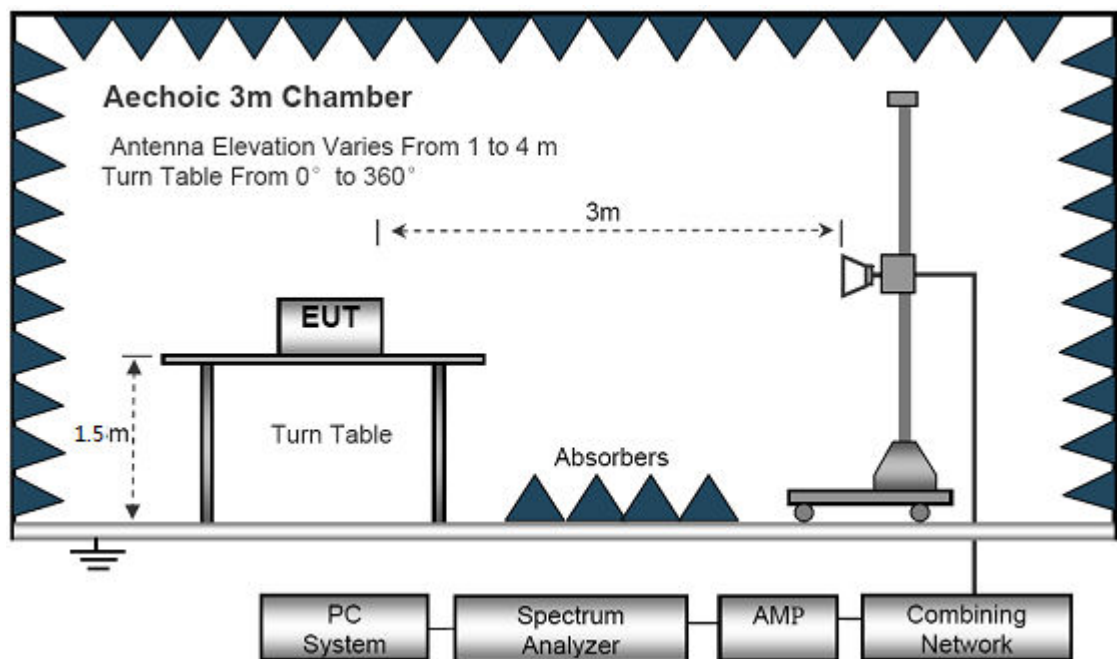
### Below 30MHz



30MHz~1GHz



Above 1GHz



**Below 30MHz**

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

**Note:**

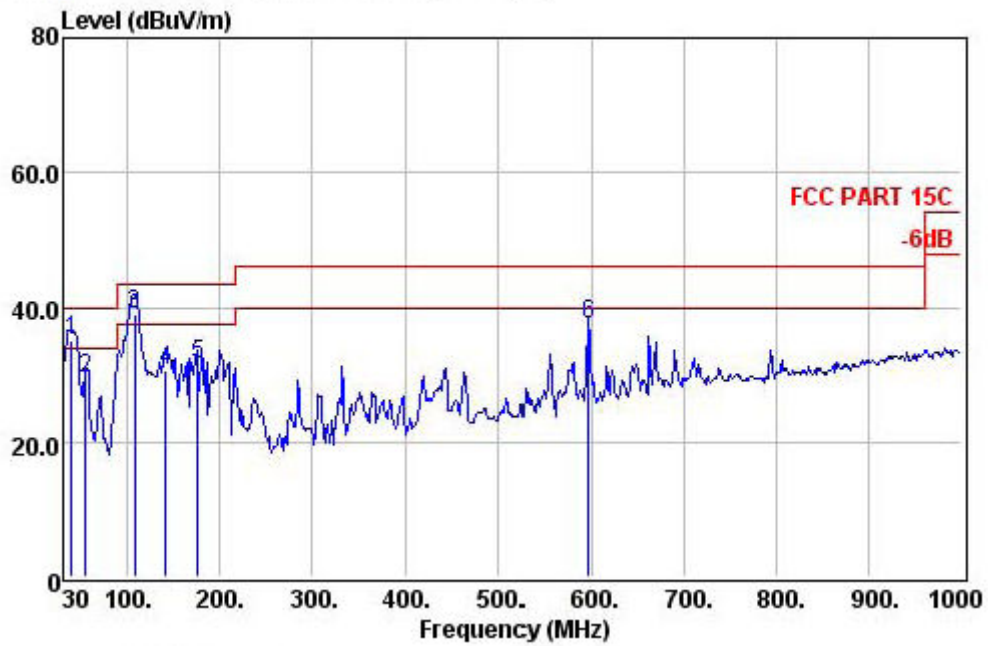
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

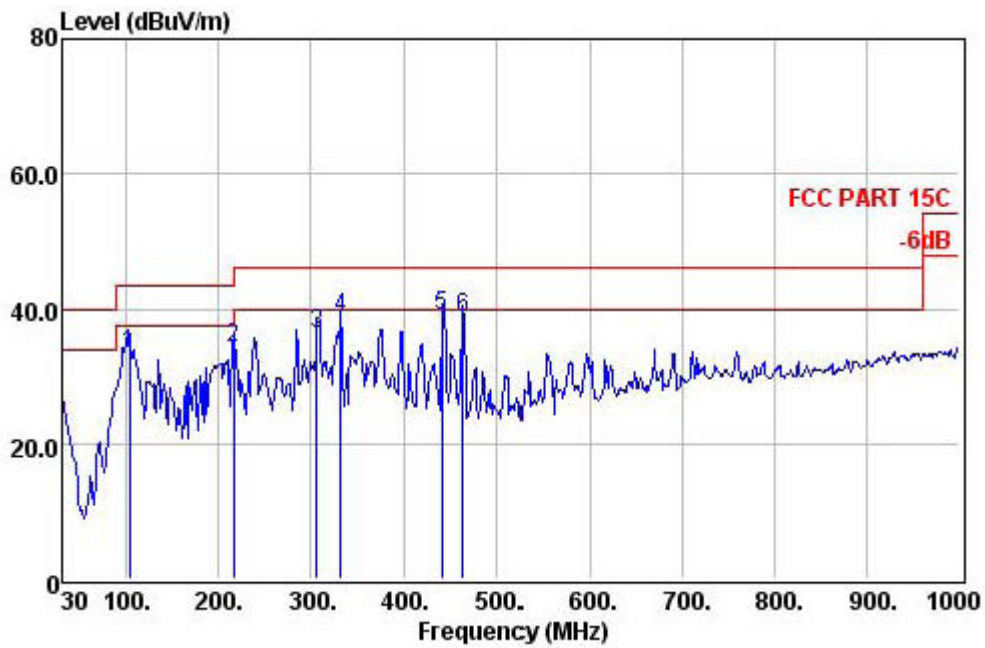
Below 1GHz (AC 120V/60Hz)

Vertical



	Freq	Preamp	Read	Cable	Level	Limit	Over	Remark
	MHz	Factor	Level	Loss	dBuV/m	dBuV/m	dB	
		dB	dBuV	dB				
1 !	39.70	31.37	52.80	0.56	35.07	40.00	-4.93	QP
2	54.25	31.37	51.79	0.75	29.33	40.00	-10.67	QP
3 !	107.60	31.32	59.95	1.03	39.03	43.50	-4.47	QP
4	141.55	31.22	52.03	1.22	30.52	43.50	-12.98	QP
5	175.50	31.17	51.07	1.39	31.56	43.50	-11.94	QP
6	597.45	30.64	44.29	3.29	37.46	46.00	-8.54	QP

Horizontal



	Preamp	Read	Cable	Limit	Over			
Freq	Factor	Level	Loss	Line	Limit	Remark		
MHz	dB	dBuV	dB	dBuV/m	dBuV/m	dB		
1	102.75	31.35	54.03	1.03	33.23	43.50	-10.27	QP
2	216.24	31.02	51.88	1.53	34.17	46.00	-11.83	QP
3	306.45	30.92	51.26	1.94	36.26	46.00	-9.74	QP
4	332.64	30.76	52.61	2.02	38.68	46.00	-7.32	QP
5	442.25	30.62	49.49	2.55	38.86	46.00	-7.14	QP
6	464.56	30.60	48.47	2.69	38.57	46.00	-7.43	QP



## ABOVE 1G

	Frequency (MHz)	Reading (dB $\mu$ V)	Factor (dB)	Corrected Amplitude (dB $\mu$ V/m)	Limit(dB $\mu$ V/m)	Margin (dB)	Remark	Polar (H/V)
2404MHz	2404.000	98.90	8.86	107.76	114	-6.24	Pk	Vertical
	2404.000	52.46	8.86	61.32	94	-32.68	AV	Vertical
	4808.000	44.98	10.07	55.05	74	-18.95	Pk	Vertical
	4808.000	34.43	10.07	44.50	54	-9.50	AV	Vertical
	7212.000	43.73	11.84	55.57	74	-18.43	Pk	Vertical
	7212.000	32.32	11.84	44.16	54	-9.84	AV	Vertical
	2404.000	97.89	8.86	106.75	114	-7.25	Pk	Horizontal
	2404.000	51.50	8.86	60.36	94	-33.64	AV	Horizontal
	4808.000	46.39	10.07	56.46	74	-17.54	Pk	Horizontal
	4808.000	34.41	10.07	44.48	54	-9.52	AV	Horizontal
	7212.000	46.38	11.84	58.22	74	-15.78	Pk	Horizontal
	7212.000	33.52	11.84	45.36	54	-8.64	AV	Horizontal
2439MHz	2439.000	98.32	9.05	107.37	114	-6.63	Pk	Vertical
	2439.000	50.50	9.05	59.55	94	-34.45	AV	Vertical
	4878.000	52.55	10.34	62.89	74	-11.11	Pk	Vertical
	4878.000	36.25	10.37	46.62	54	-7.38	AV	Vertical
	7317.000	45.48	12.56	58.04	74	-15.96	Pk	Vertical
	7317.000	33.33	12.56	45.89	54	-8.11	AV	Vertical
	2439.000	97.63	9.05	106.68	114	-7.32	Pk	Horizontal
	2439.000	50.21	9.05	59.26	94	-34.74	AV	Horizontal
	4878.000	54.82	10.34	65.16	74	-8.84	Pk	Horizontal
	4878.000	35.72	10.37	46.09	54	-7.91	AV	Horizontal
	7317.000	48.69	12.56	61.25	74	-12.75	Pk	Horizontal
	7317.000	34.33	12.56	46.89	54	-7.11	AV	Horizontal
2479MHz	2479.000	98.22	9.52	107.74	114	-6.26	Pk	Vertical
	2479.000	50.10	9.52	59.62	94	-34.38	AV	Vertical
	4958.000	46.26	10.48	56.74	74	-17.26	Pk	Vertical
	4958.000	35.51	10.48	45.99	54	-8.01	AV	Vertical
	7437.000	46.68	12.87	59.55	74	-14.45	Pk	Vertical
	7437.000	35.46	12.87	48.33	54	-5.67	AV	Vertical
	2479.000	98.54	9.52	108.06	114	-5.94	Pk	Horizontal
	2479.000	50.33	9.52	59.85	94	-34.15	AV	Horizontal
	4958.000	45.33	10.48	55.81	74	-18.19	Pk	Horizontal
	4958.000	36.35	10.48	46.83	54	-7.17	AV	Horizontal
	7437.000	43.28	12.87	56.15	74	-17.85	Pk	Horizontal
	7437.000	35.57	12.87	48.44	54	-5.56	AV	Horizontal

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

## 5. 20DB OCCUPY BANDWIDTH

### 5.1. Limits

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### 5.2. Test setup

1. Set the RBW =30kHz.
2. Set the VBW = 300kHz
3. Span=3MHz
4. Detector = peak.
5. Sweep time = auto couple.
6. Allow trace to fully stabilize, and view the plot.
7. Measure and record the result in the test report.

Measurement Uncertainty:  $\pm 500\text{kHz}$  at a level of confidence of 95%..

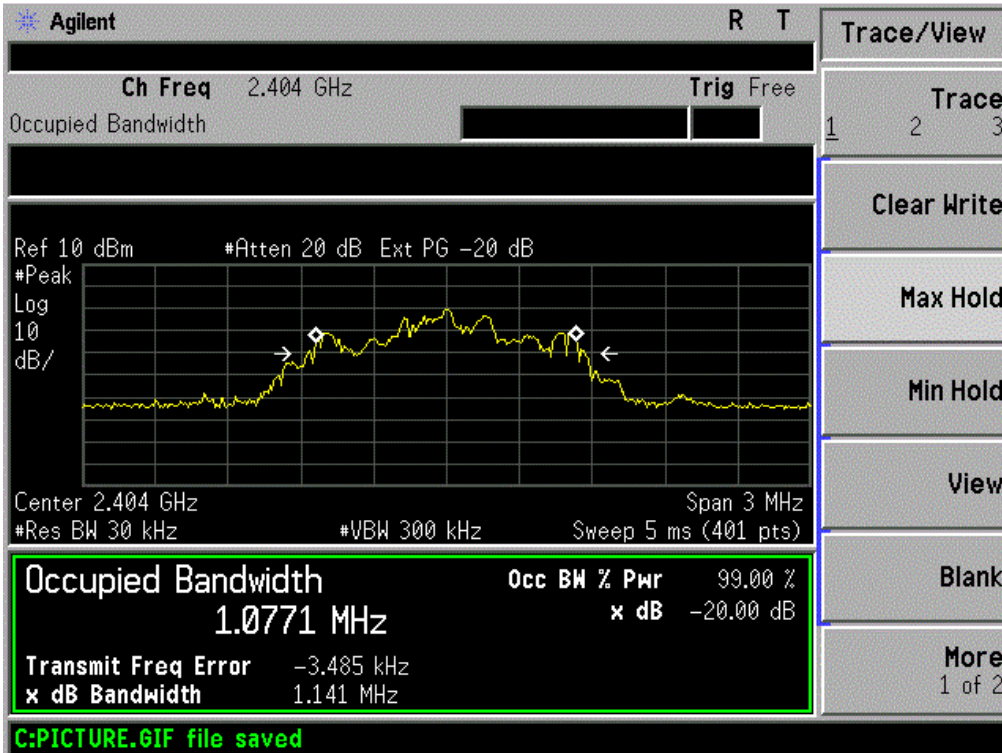
Test data:

	Channel Frequency (MHz)	20dB Bandwidth (MHz)	Result
GFSK	2404	1.141	Pass
	2439	1.137	Pass
	2479	1.140	Pass

Test plot as follows:

The data only show the worst mode

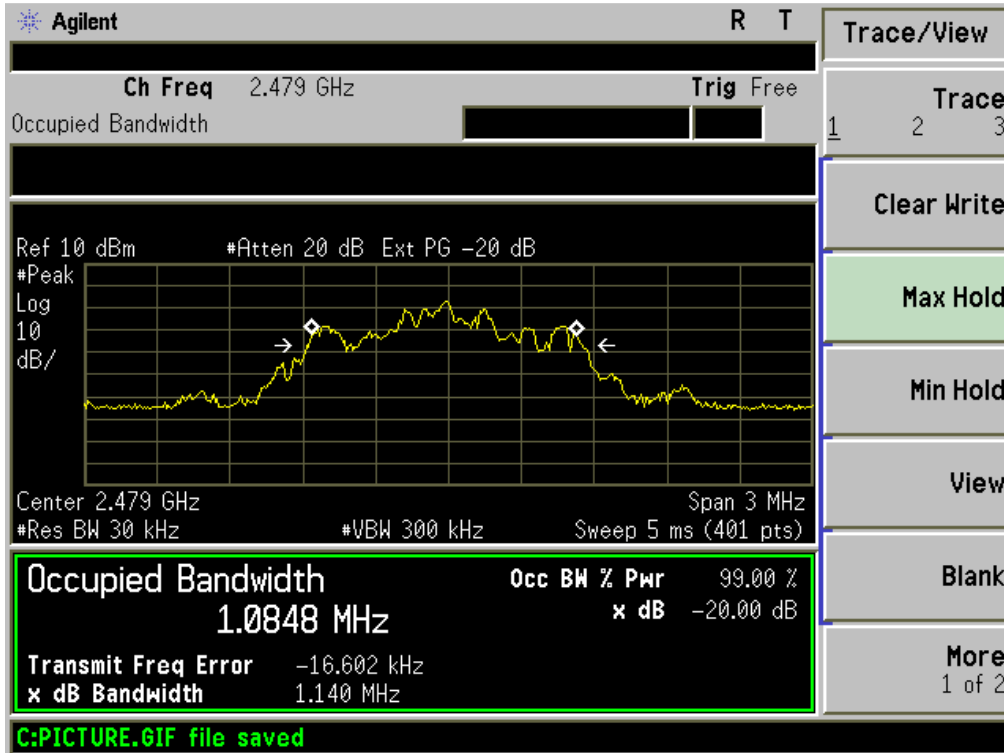
### 2404MHz



### 2439MHz



### 2479 MHz



## 6. BAND EDGE COMPLIANCE TEST

### 6.1. Limits

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

### 6.2. Test setup

The EUT was placed on a turn table which was 1.5 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The bandwidth of the Spectrum's setting.

For the radiated test of band-edge above 1GHz:

Restricted band: RBW=1MHz, VBW=3MHz

Non-restricted band: RBW=100kHz, VBW=300kHz

For all tests, it used peak detector.

Measurement Uncertainty:  $\pm 3.2$  dB at a level of confidence of 95%.

Test data as follows:

Frequency (MHz)	Antenna polarization (H/V)	Test Frequency (MHz)	Emission (dBuV/m)	Band edge Limit (dBuV/m)		Result
			PK	PK	AV	
<2400	H	2397.94	50.24	74.00	54.00	Pass
<2400	V	2398.06	50.08	74.00	54.00	Pass
>2483.5	H	2487.62	50.11	74.00	54.00	Pass
>2483.5	V	2488.06	50.27	74.00	54.00	Pass

If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

## 7. ANTENNA REQUIREMENTS

### 7.1. Limits

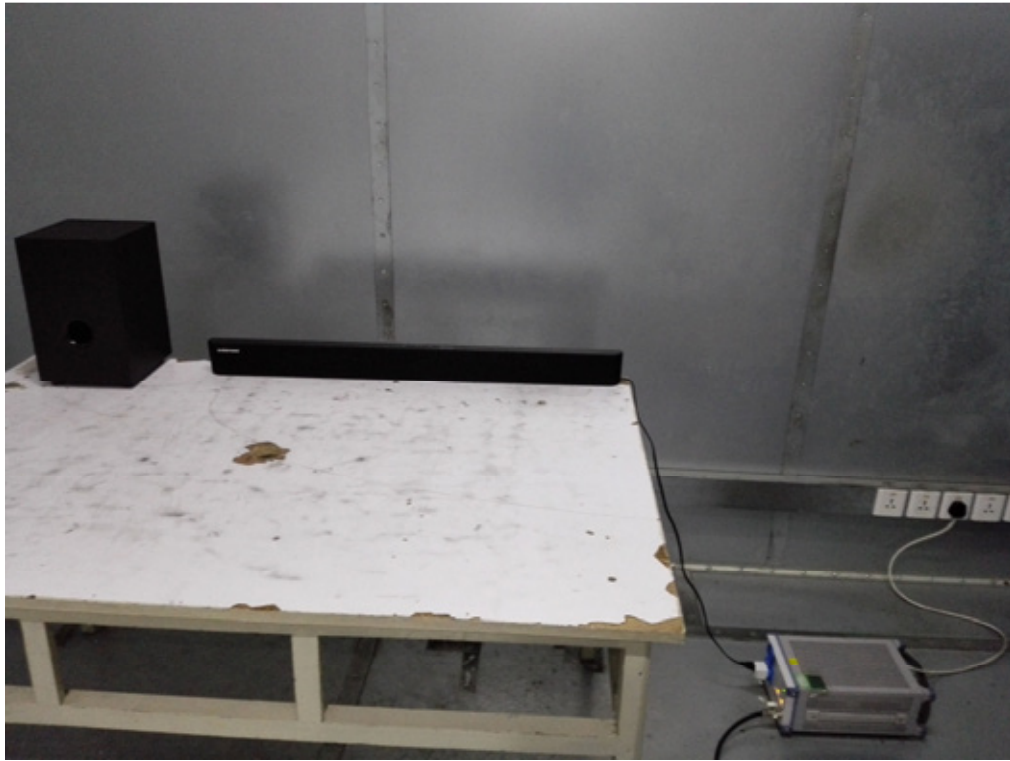
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### 7.2. Result

The antennas used for this product is PCB antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0dBi.

## 8. PHOTOGRAPHS OF TEST SET-UP

Conducted Emission Test



### Radiated Emission Test

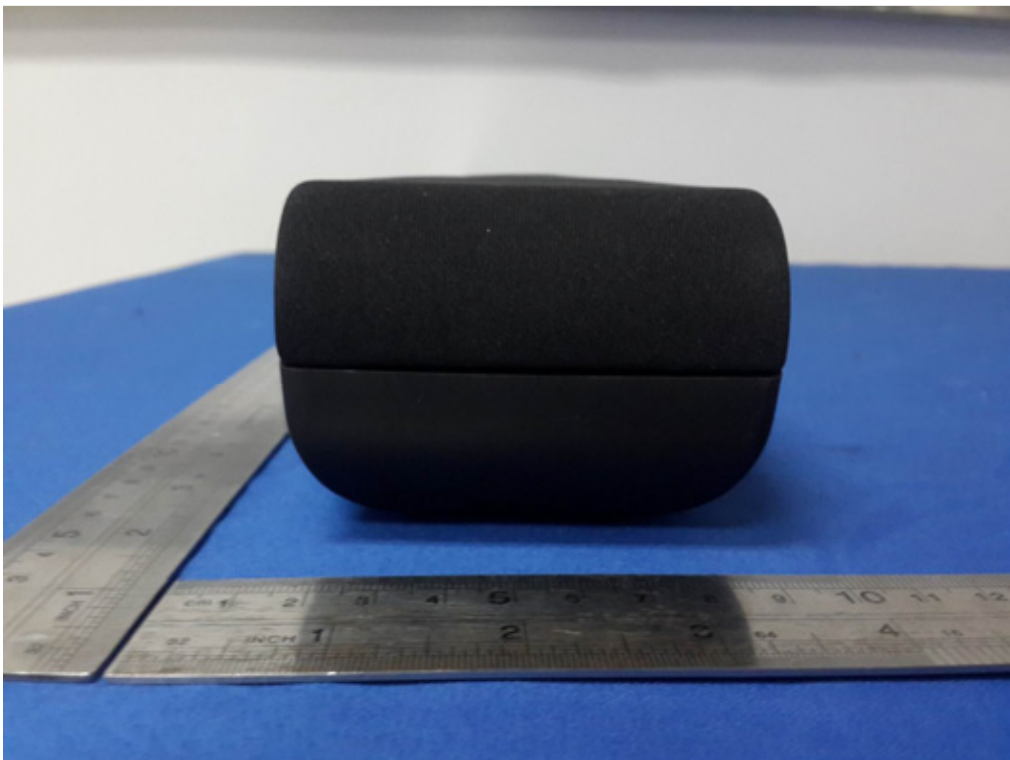


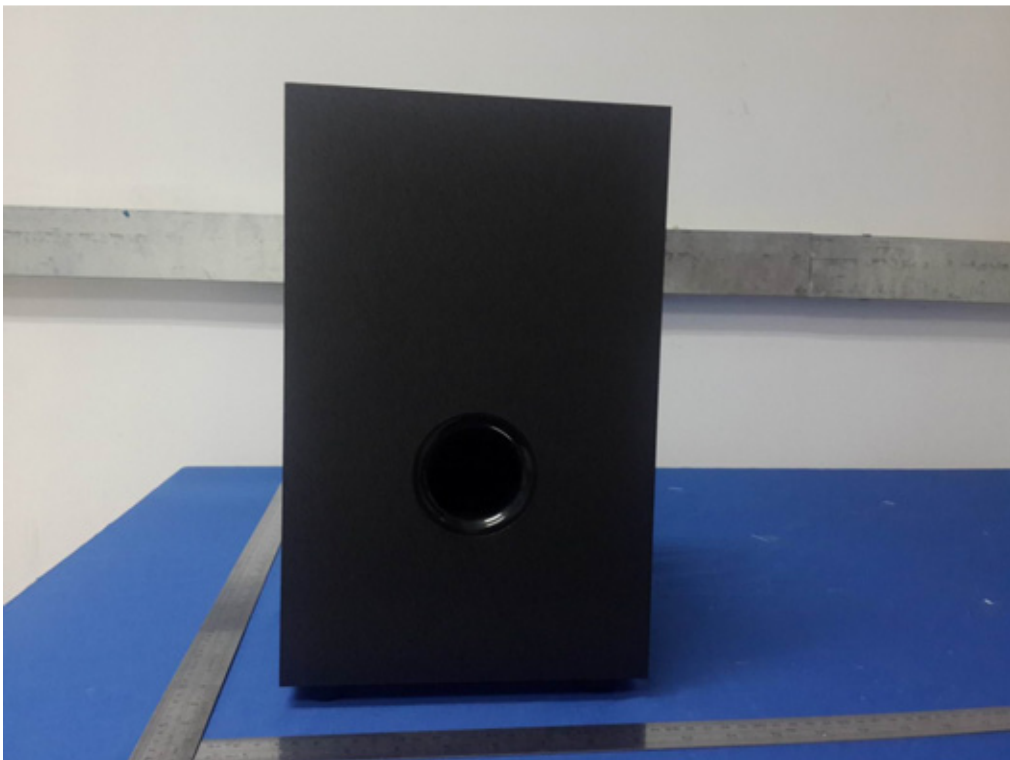
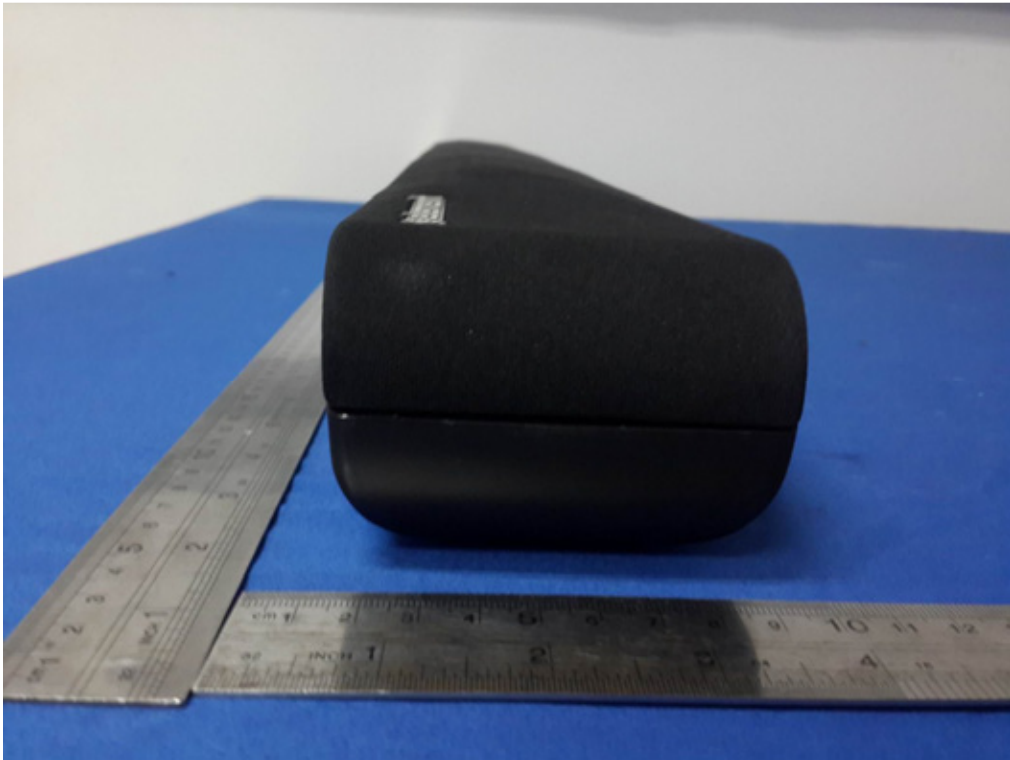


## 9. PHOTOGRAPHS OF THE EUT

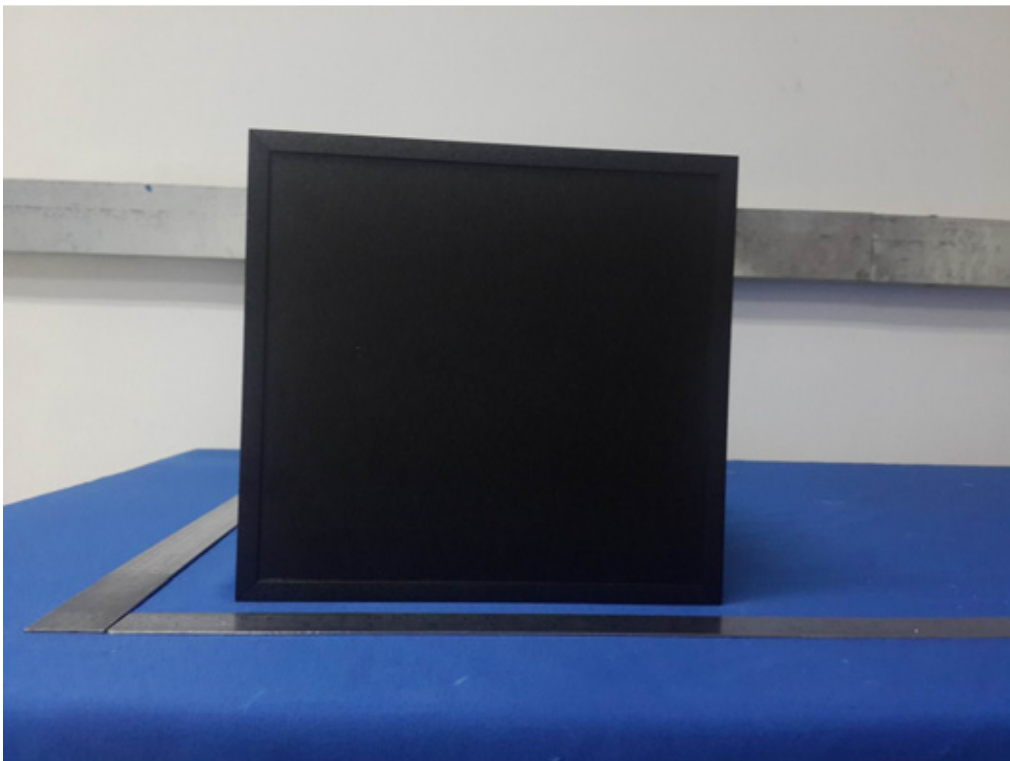


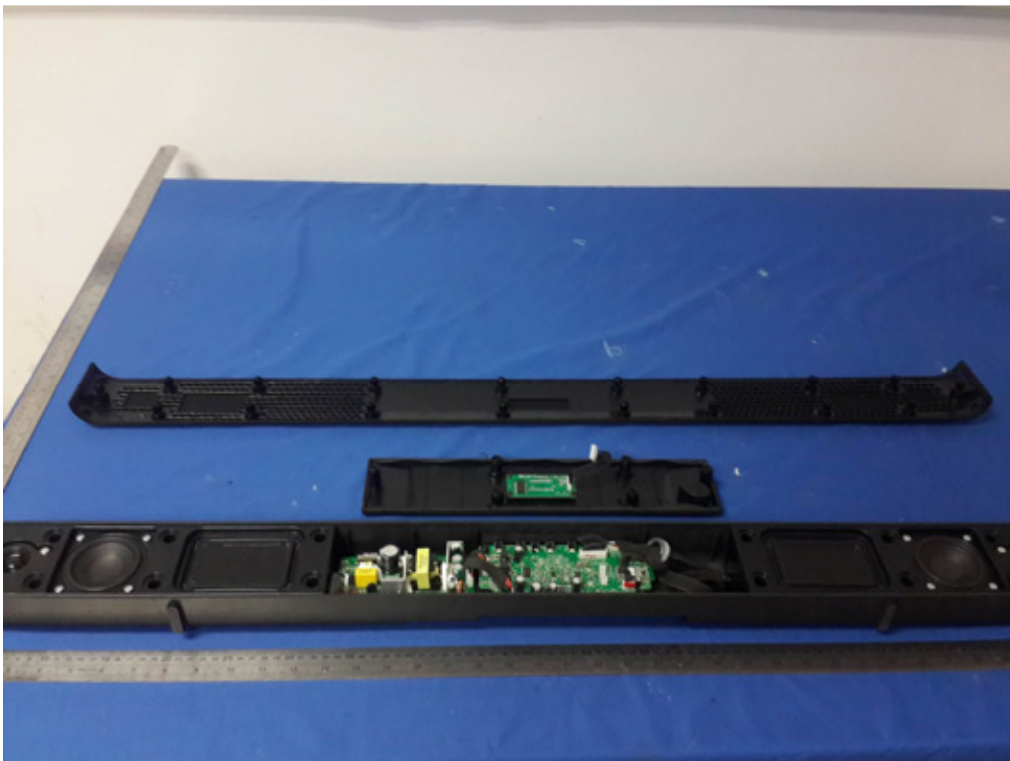


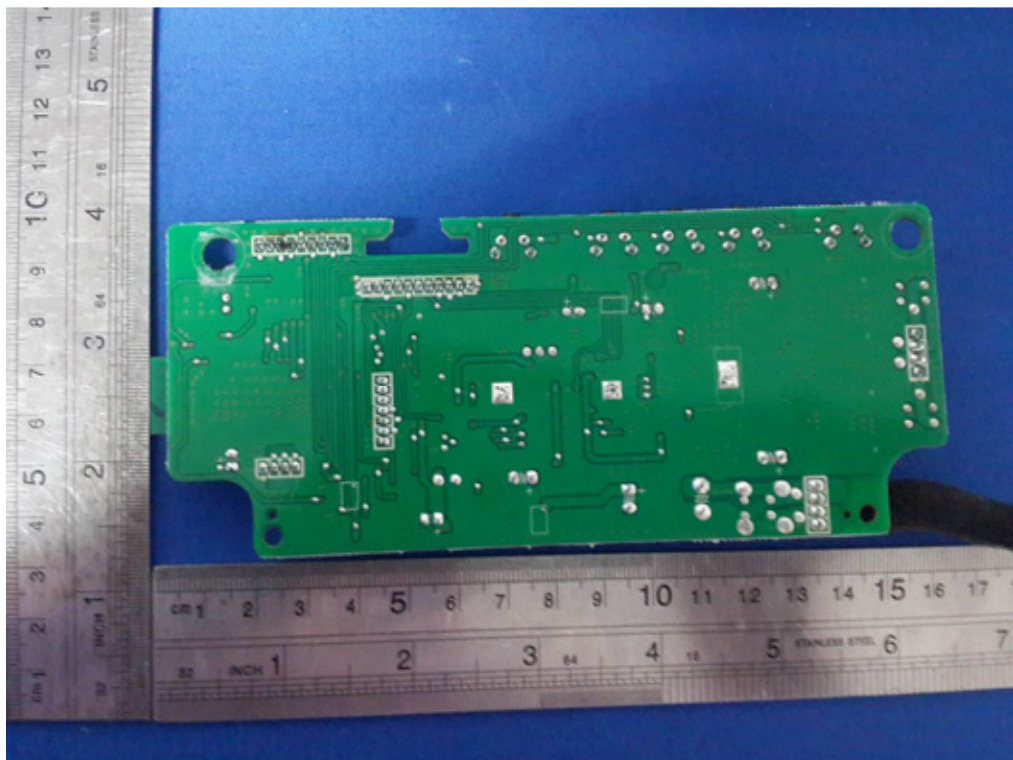
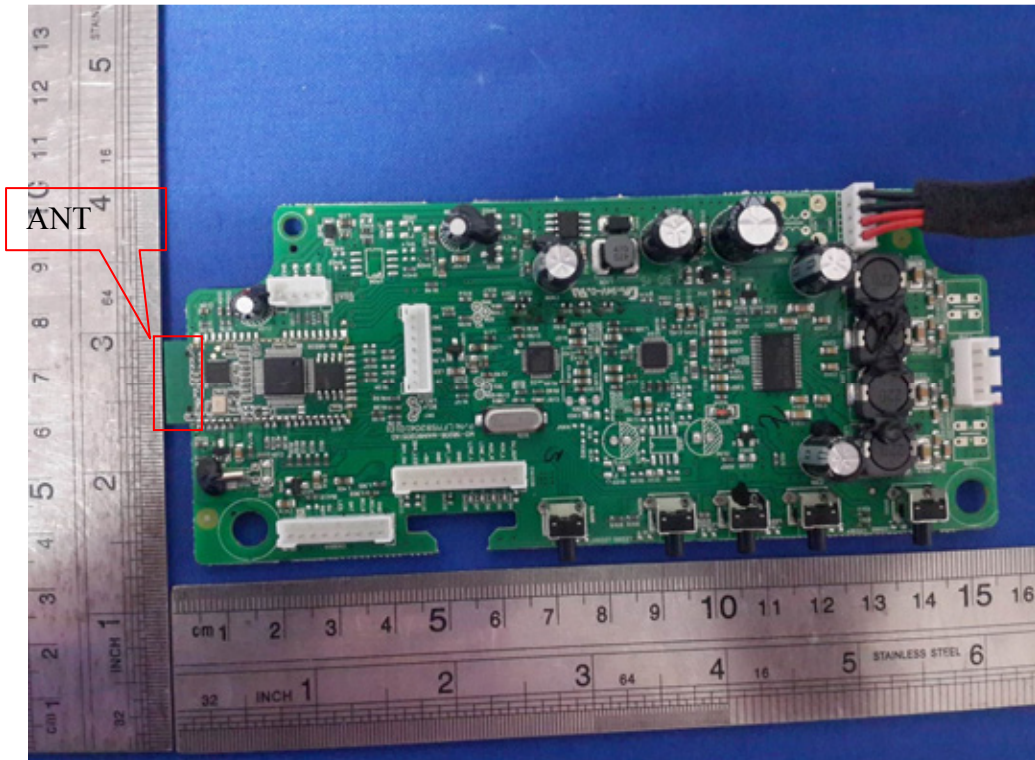




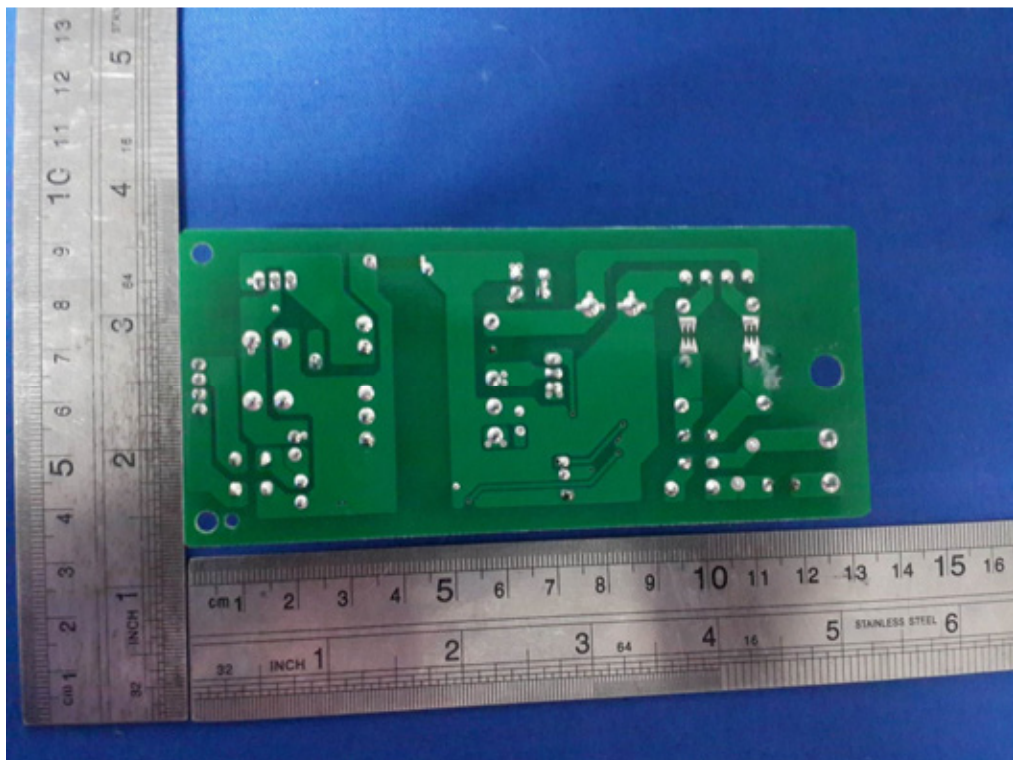
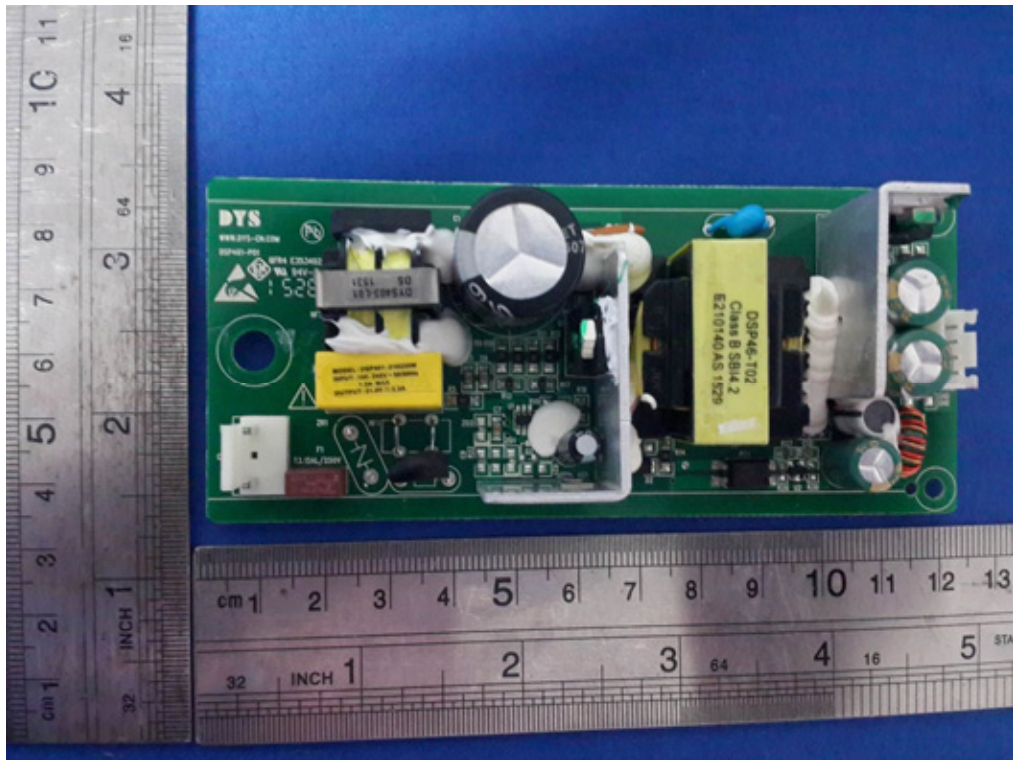


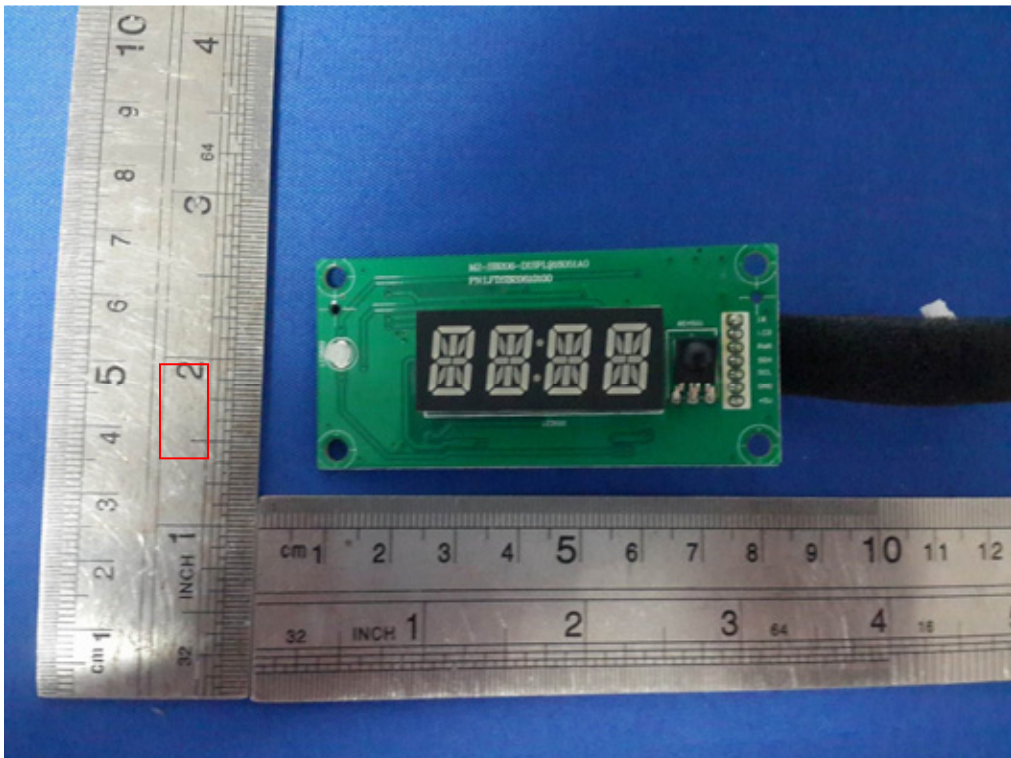
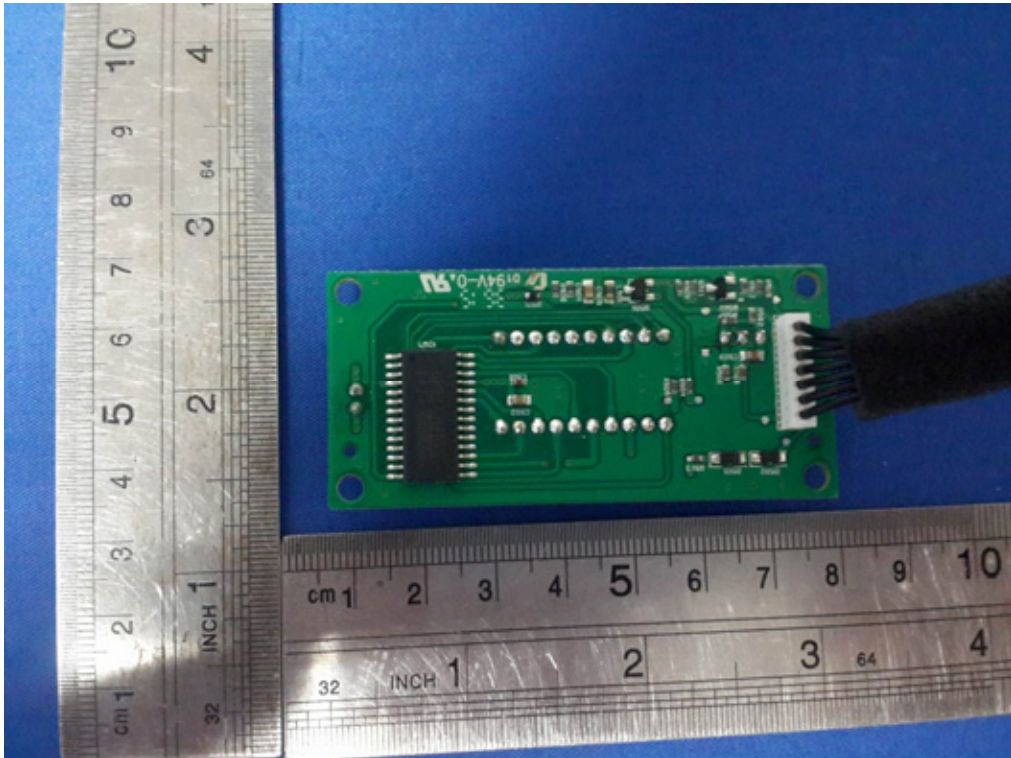


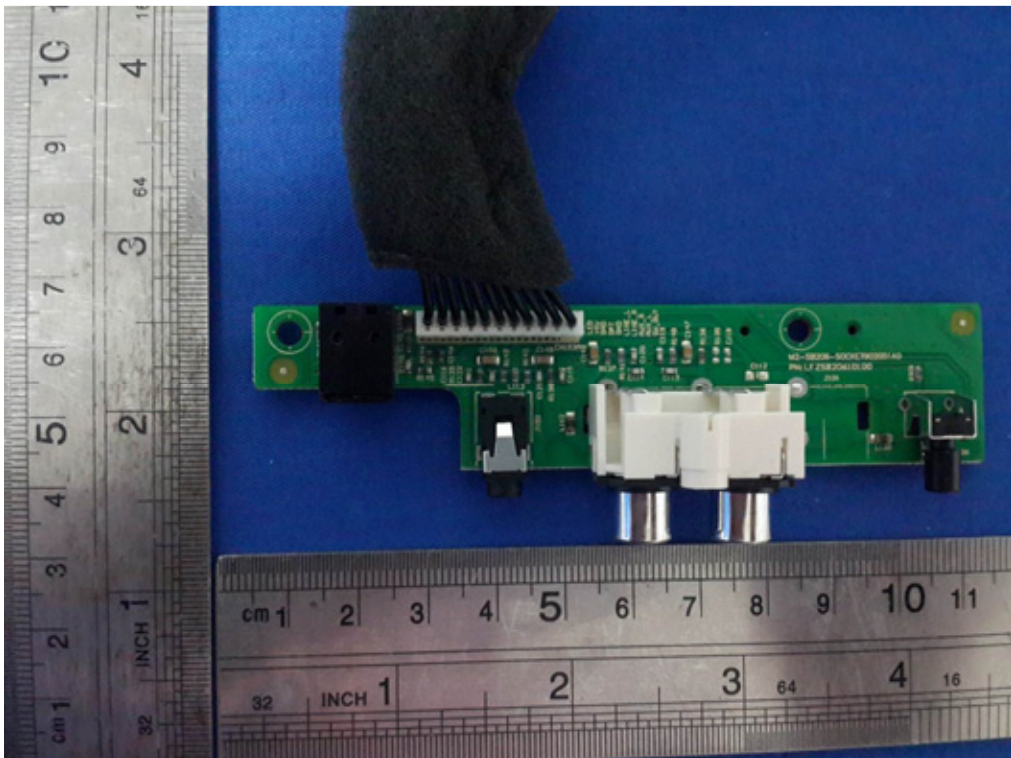
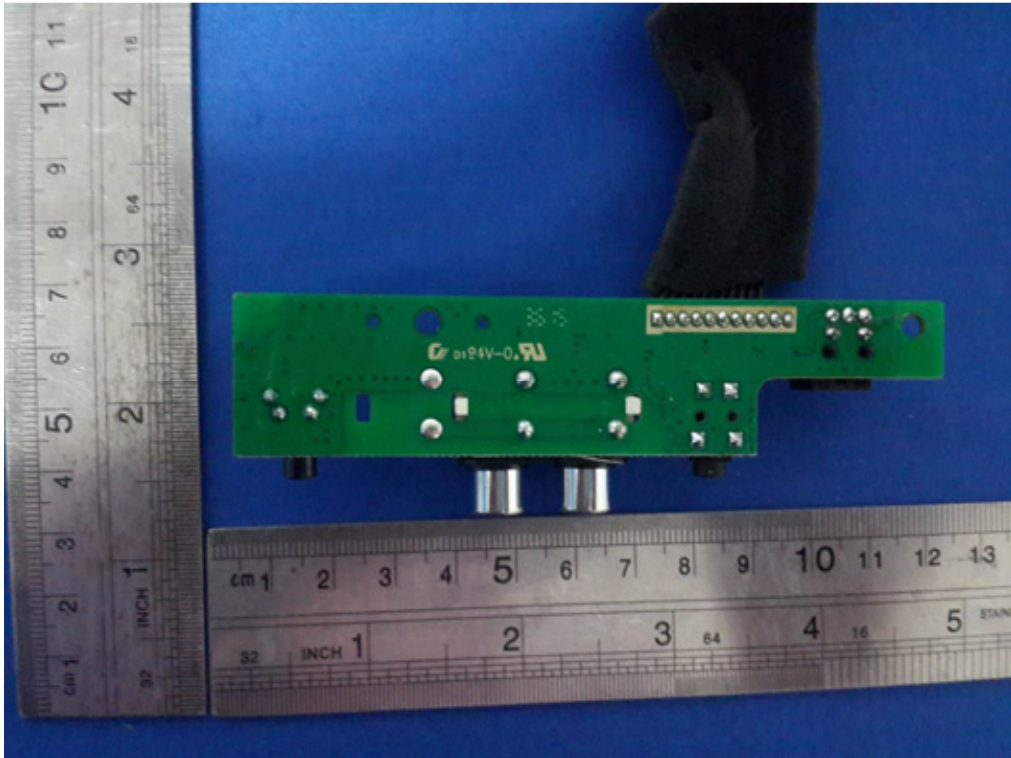


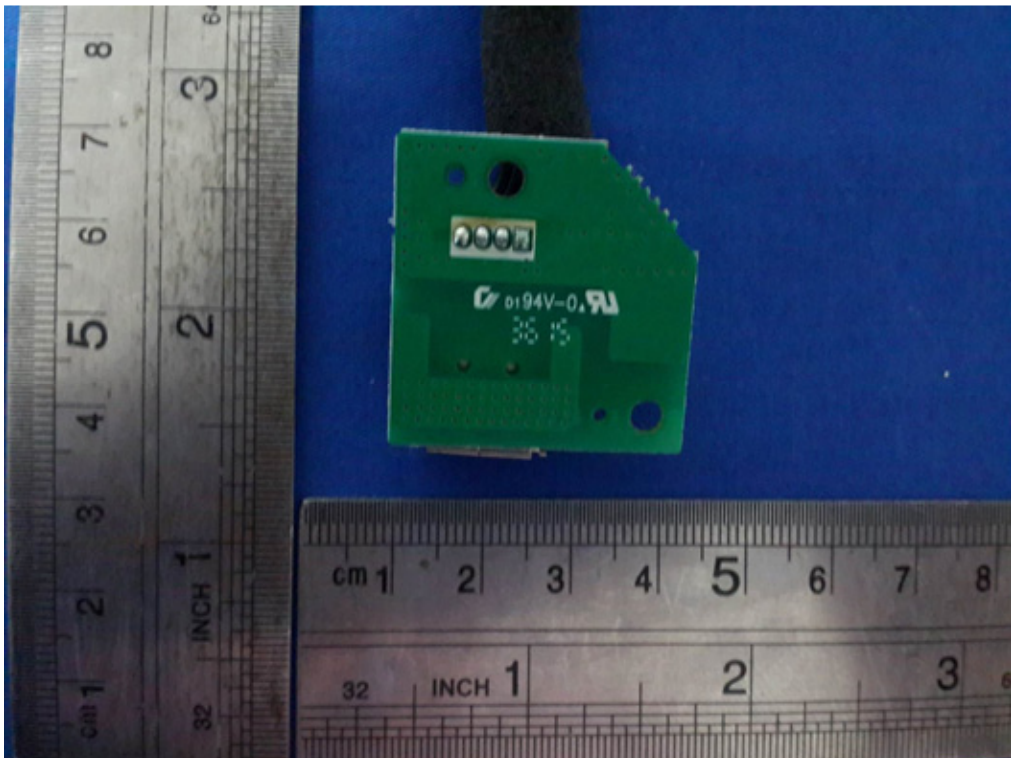
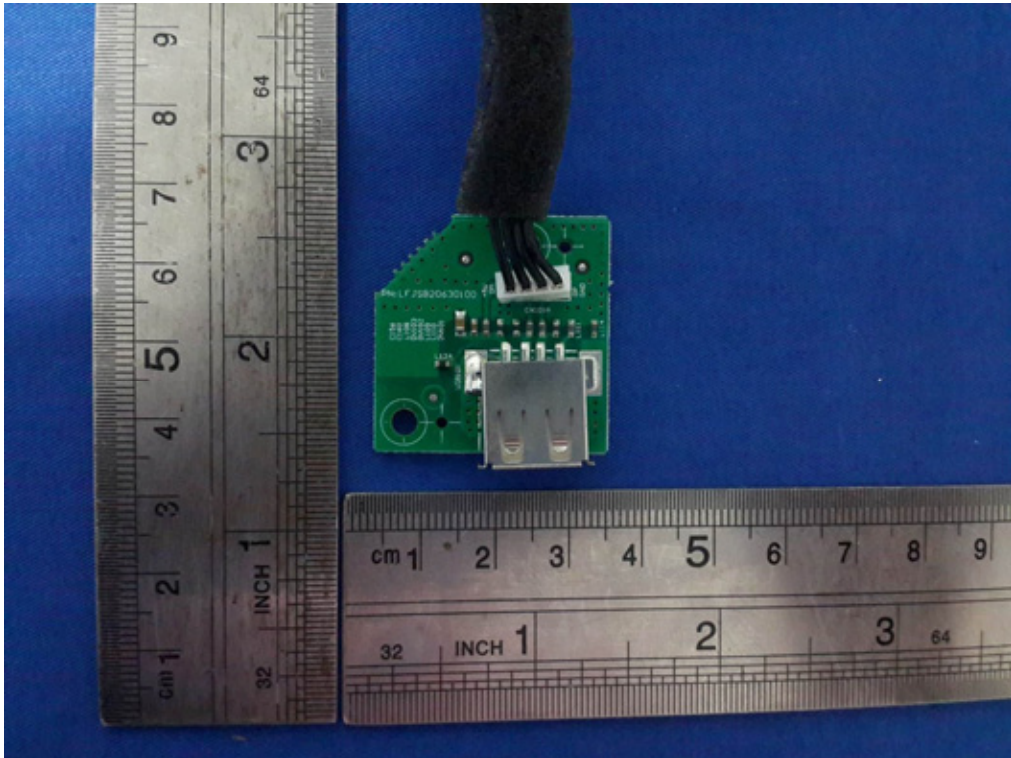


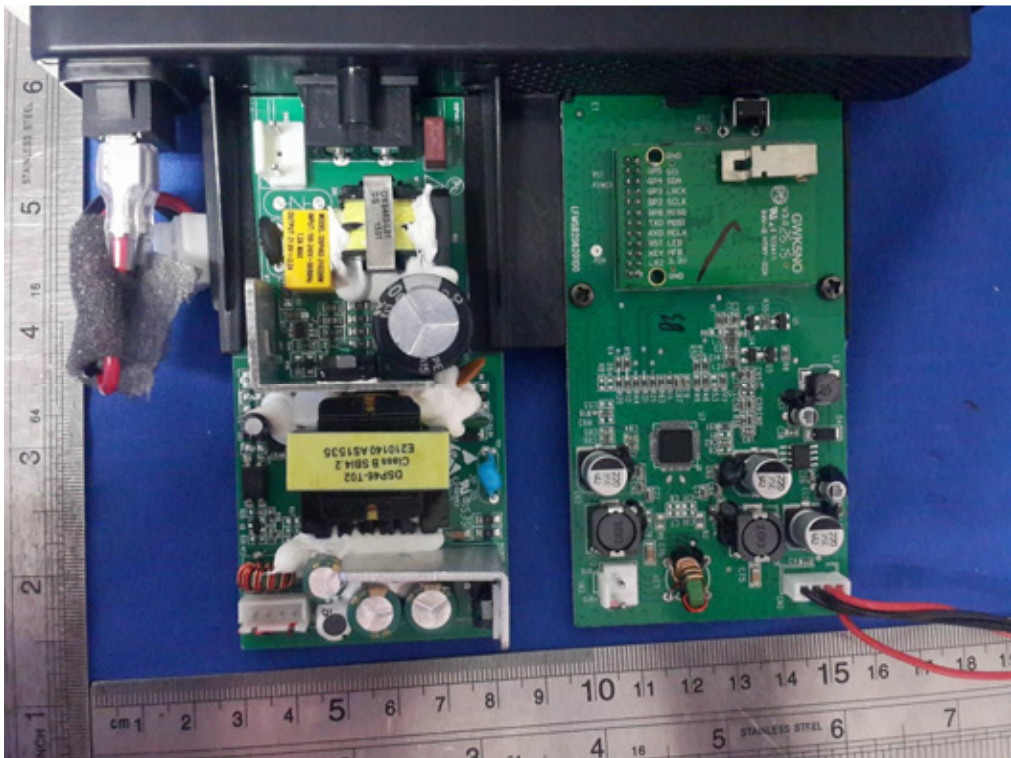
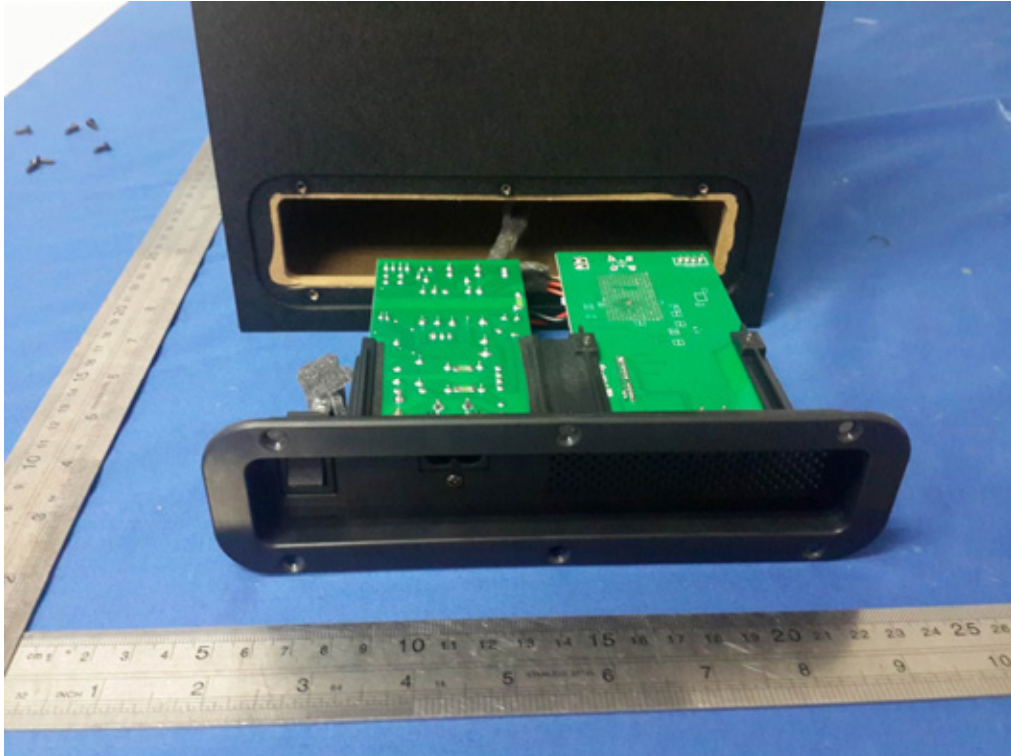


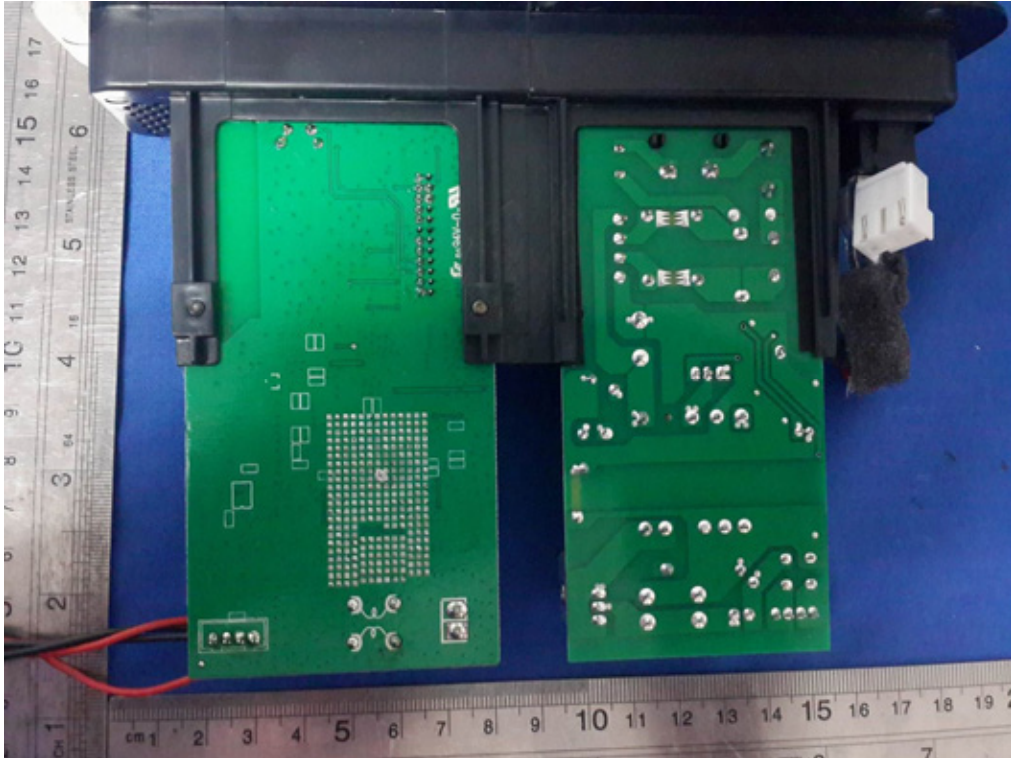












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