

# EMC TEST REPORT

For

Wireless VHF/FM Transmitter

Model Number: CLS725-T   CLS721-T   CLS729-T  
FCC ID: VK7CLS725-T

Report Number :   WT088000927

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## TABLE OF CONTENTS

<b>TEST REPORT DECLARATION .....</b>	<b>4</b>
<b>1. TEST RESULTS SUMMARY .....</b>	<b>5</b>
<b>2. GENERAL INFORMATION .....</b>	<b>6</b>
2.1. Report information .....	6
2.2. Laboratory Accreditation and Relationship to Customer .....	6
2.3. Measurement Uncertainty .....	7
<b>3. PRODUCT DESCRIPTION .....</b>	<b>7</b>
3.1. EUT Description .....	7
3.2. Related Submittal(s) / Grant (s) .....	7
3.3. Block Diagram of EUT Configuration.....	8
3.4. Operating Condition of EUT .....	8
3.5. Special Accessories.....	8
3.6. Equipment Modifications.....	8
3.7. Support Equipment List .....	8
3.8. Test Conditions .....	8
<b>4. TEST EQUIPMENT USED .....</b>	<b>9</b>
4.1. Test Equipment Used to Measure .....	9
<b>5. CONDUCTED DISTURBANCE TEST .....</b>	<b>10</b>
5.1. Test Standard and Limit.....	10
5.2. Test Procedure .....	10
5.3. Test Arrangement.....	10
5.4. Test Data .....	10
<b>6. RADIATED DISTURBANCE TEST .....</b>	<b>15</b>
6.1. Test Standard and Limit.....	15
6.2. Test Procedure .....	15
6.3. Test Arrangement.....	15
6.4. Test Data .....	16
<b>7. OCCUPIED BANDWIDTH .....</b>	<b>21</b>
7.1. Test Standard and Limit.....	21
7.2. Test Procedure .....	21
7.3. Test Arrangement.....	21
7.4. Test Data .....	22
<b>8. BAND EDGE .....</b>	<b>23</b>
8.1. Test Standard and Limit.....	23
8.2. Band Edge FCC 15.237 Limit.....	23
8.3. Test Procedure .....	23
8.4. Test Arrangement.....	23
8.5. Test Data .....	23
<b>9. MODULATION CHARACTERISTICS.....</b>	<b>25</b>
9.1. Test requirement .....	25
9.2. MODULATION CHARACTERISTICS MEASUREMENT METHOD .....	25
9.3. MEASUREMENT RESULT .....	26

<b>10. ANTENNA REQUIREMENT .....</b>	<b>29</b>
<b>APPENDIX I TEST PHOTO.....</b>	<b>30</b>
<b>APPENDIX II EUT PHOTO .....</b>	<b>33</b>

**TEST REPORT DECLARATION**




Applicant : Mainstar Electrical Company Ltd.  
 Address : Room 40, 12/F, Block D, Wah Lok ind'l Centre, Shan Mei Street,  
 Fo Tan, Shatin, N.T. Hong Kong  
 Manufacturer : Mainstar Electrical Company Ltd.  
 Address : Block A5&A6, Chang An Wu Sha International Industrial Park  
 Chang An, Dongguan, Guangdong Province, China  
 EUT Description : Wireless VHF/FM Transmitter  
 Model Number : CLS725-T CLS721-T CLS729-T  
 FCC ID Number : VK7CLS725-T

Test Standards:

**FCC Part 15 15.237**

The EUT described above is tested by Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory to determine the maximum emissions from the EUT. Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory is assumed full responsibility for the accuracy of the test results. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2003) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.237.

The test report is valid for above tested sample only and shall not be reproduced in part without written approval of the laboratory.

Tested by:	 _____ (Louis Lin)	Date:	2008.05.15 _____
Checked by:	 _____ (Dewelly Yang)	Date:	2008.05.15 _____
Approved by:	 _____ (Peter Lin)	Date:	2008.05.15 _____

## 1. TEST RESULTS SUMMARY

Table 1 Test Results Summary

Test Items	FCC Rules	Test Results
Conducted Disturbance	15.207	Pass
Radiated disturbance	15.237 15.35	Pass
Occupied Bandwidth	15.237	Pass
Band Edges	15.237	Pass
MODULATION CHARACTERISTICS	2.1047	Pass
Antenna Requirement	15.203	Pass

## 2. GENERAL INFORMATION

### 2.1. Report information

- 2.1.1. This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that SMQ approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that SMQ in any way guarantees the later performance of the product/equipment.
- 2.1.2. The sample/s mentioned in this report is/are supplied by Applicant, SMQ therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.
- 2.1.3. Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through SMQ, unless the applicant has authorized SMQ in writing to do so.

### 2.2. Laboratory Accreditation and Relationship to Customer

The testing report were performed by the Shenzhen Academy of Metrology and quality Inspection EMC Laboratory (Guangdong EMC compliance testing center), in their facilities located at Bldg. of Metrology & Quality Inspection, Longzhu Road, Nanshan District, Shenzhen, Guangdong, China. At the time of testing, Laboratory is accredited by the following organizations:

China National Accreditation Committee for Laboratories (**CNAL**) accredits the Laboratory for conformance to FCC standards, EMC international standards and EN standards. The Registration Number is L0579.

The Laboratory is listed in the United States of American Federal Communications Commission (**FCC**), and the registration number are **97379**(open area test site) and **274801**(semi anechoic chamber).

The Laboratory is listed in Voluntary Control Council for Interference by Information Technology Equipment (**VCCI**), and the registration number are **R-1974**(open area test site) , **R-1966**(semi anechoic chamber), **C-2117**(mains ports conducted interference measurement) and **T-180**(telecommunication ports conducted interference measurement).

The Laboratory is registered to perform emission tests with Industry Canada (**IC**), and the registration number is **IC4174**.

**TUV Rhineland** accredits the Laboratory for conformance to IEC and EN standards, the registration number is **E2024086Z02**.

Measurement Uncertainty

**2.3. Measurement Uncertainty**

Conducted Disturbance : 9kHz~30MHz 3.5dB

Radiated Disturbance: 30MHz~1000MHz 4.5dB  
1GHz~18GHz 4.6dB

**3. PRODUCT DESCRIPTION****3.1. EUT Description**

Description : Wireless VHF/FM Transmitter

Manufacturer : MAINSTAR ELECTRICAL COMPANY LTD.

Model Number : CLS725-T CLS721-T CLS729-T

Input Power : DC 12V

Model number: DPX411433

Adaptor : Input : AC 120 V, 60 Hz, 9W  
Output : DC 12V 300mA

Operate Frequency : 72.1-72.9MHz

Modulation FM

Antenna Designation : Fixed

CLS725-T working frequency is 72.5MHz  
CLS721-T working frequency is 72.1MHz  
CLS729-T working frequency is 72.9MHz

**3.2. Related Submittal(s) / Grant (s)**

This submittal(s) (test report) is intended for FCC ID: VK7CLS725-T filing to comply with Section 15.237 of the FCC Part 15, Subpart C Rules.

### 3.3. Block Diagram of EUT Configuration

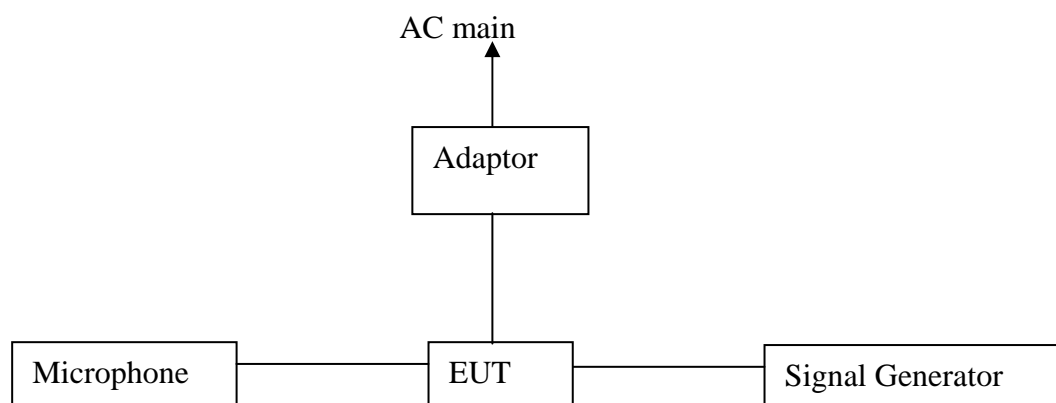


Figure 1 Test Setup 1

### 3.4. Operating Condition of EUT

Mode 1: 72.5MHz TX

### 3.5. Special Accessories

Not available for this EUT intended for grant.

### 3.6. Equipment Modifications

Not available for this EUT intended for grant.

### 3.7. Support Equipment List

Signal Generator  
M/N: CT100  
Manufacture: BEHRINGER  
Microphone  
M/N:---

### 3.8. Test Conditions

Date of test: May.12-16,2008  
Date of EUT Receive: May.9,,2007  
Temperature: 24 °C  
Relative Humidity: 56-58%



## 4. TEST EQUIPMENT USED

### 4.1. Test Equipment Used to Measure

Table 2 Conducted Disturbance Test Equipment

No.	Equipment	Manufacturer	Model No.	Last Cal.	Cal. Interval
SB2603	EMI Test Receiver	Rohde & Schwarz	ESCS30	Jan.24, 2008	1 Year
SB3321	AMN	Rohde & Schwarz	ESH2-Z5	Jan.24, 2008	1 Year
SB2604	AMN	Rohde & Schwarz	ESH3-Z5	Jan.24, 2008	1 Year
SB3612	Audio generator	KENWOOD	AD-203D	Jun.19, 2007	1 Year
SB3436	EMI Test Receiver	Rohde & Schwarz	ESI26	Jan.24, 2008	1 Year
SB3440	Bilog Antenna	Chase	CBL6112B	Jan.24, 2008	1 Year
SB3450/01	3m Semi-anechoic chamber	Albatross Projects	9X6X6	Jan.24, 2008	1 Year
SB2541	RF Communication Tester	HP	8920A	May 22,2007	1 Year

## 5. CONDUCTED DISTURBANCE TEST

### 5.1. Test Standard and Limit

#### 5.1.1. Test Standard

FCC Part 15 15.207

#### 5.1.2. Test Limit

Table 3 Conducted Disturbance Test Limit (Class B)

Frequency	Maximum RF Line Voltage (dB $\mu$ V)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

- Decreasing linearly with logarithm of the frequency
- The lower limit shall apply at the transition frequency.

### 5.2. Test Procedure

The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI test receiver (R&S Test Receiver ESCS30) is used to test the emissions form both sides of AC line. According to the requirements in Section 7 and 13 of ANSI C63.4-2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9kHz.

### 5.3. Test Arrangement

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

### 5.4. Test Data

The test was performed with two model. The worst case is TX mode. the follow was shown the worst data.

Table 4 Conducted Disturbance Test Data

Model: CLS725-T

Mode: 1

Frequency (MHz)	Correction Factor (dB)	Line					
		Quasi-Peak			Average		
		Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V)	Limits (dB $\mu$ V)	Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V)	Limits (dB $\mu$ V)
0.150	10.0	23.1	33.1	66	-1.5	8.5	56
0.222	10.0	21.5	31.5	62.7	-2.2	7.8	52.7
0.544	10.0	18.5	28.5	56	-3.6	6.4	46
2.165	10.1	8.5	18.6	56	-0.4	9.7	46
12.085	10.3	13.9	24.2	60	12.2	22.5	50
24.165	10.3	22.3	32.6	60	22.3	32.6	50

**REMARKS:** 1. Emission level(dBuV)=Read Value(dBuV) + Correction Factor(dB)  
 2. Correction Factor(dB) =LISN Factor (dB) + Cable Factor (dB)+Limiter Factor(dB)  
 3. The other emission levels were very low against the limit.

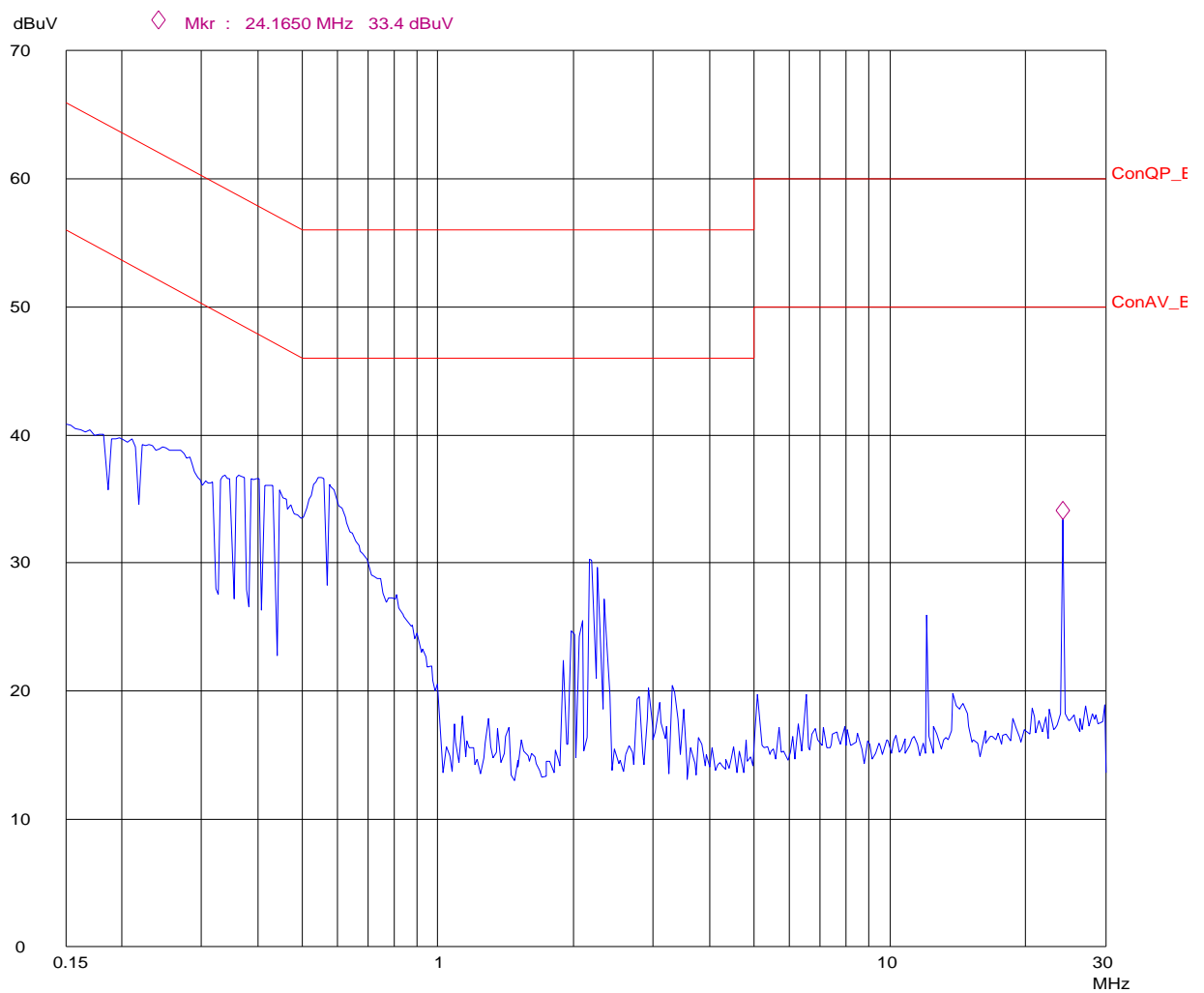
Table 5 Conducted Disturbance Test Data

Model: CLS725-T							
Mode: 1							
Neutral							
Frequency (MHz)	Correction Factor (dB)	Quasi-Peak			Average		
		Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V)	Limits (dB $\mu$ V)	Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V)	Limits (dB $\mu$ V)
0.150	10.0	23.2	33.2	66	-1.6	8.4	56
0.350	10.0	17.5	27.5	58.9	-3.8	6.2	48.9
0.548	10.0	18.6	28.6	56	-3.5	6.5	46
2.820	10.1	2.2	12.3	56	-5.7	4.4	46
12.085	10.3	13.0	23.3	60	11.1	21.4	50
24.165	10.3	23.1	33.4	60	23.1	33.4	50

**REMARKS:** 1. Emission level(dBuV)=Read Value(dBuV) + Correction Factor(dB)  
 2. Correction Factor(dB) =LISN Factor (dB) + Cable Factor (dB)+Limiter Factor(dB)  
 3. The other emission levels were very low against the limit.

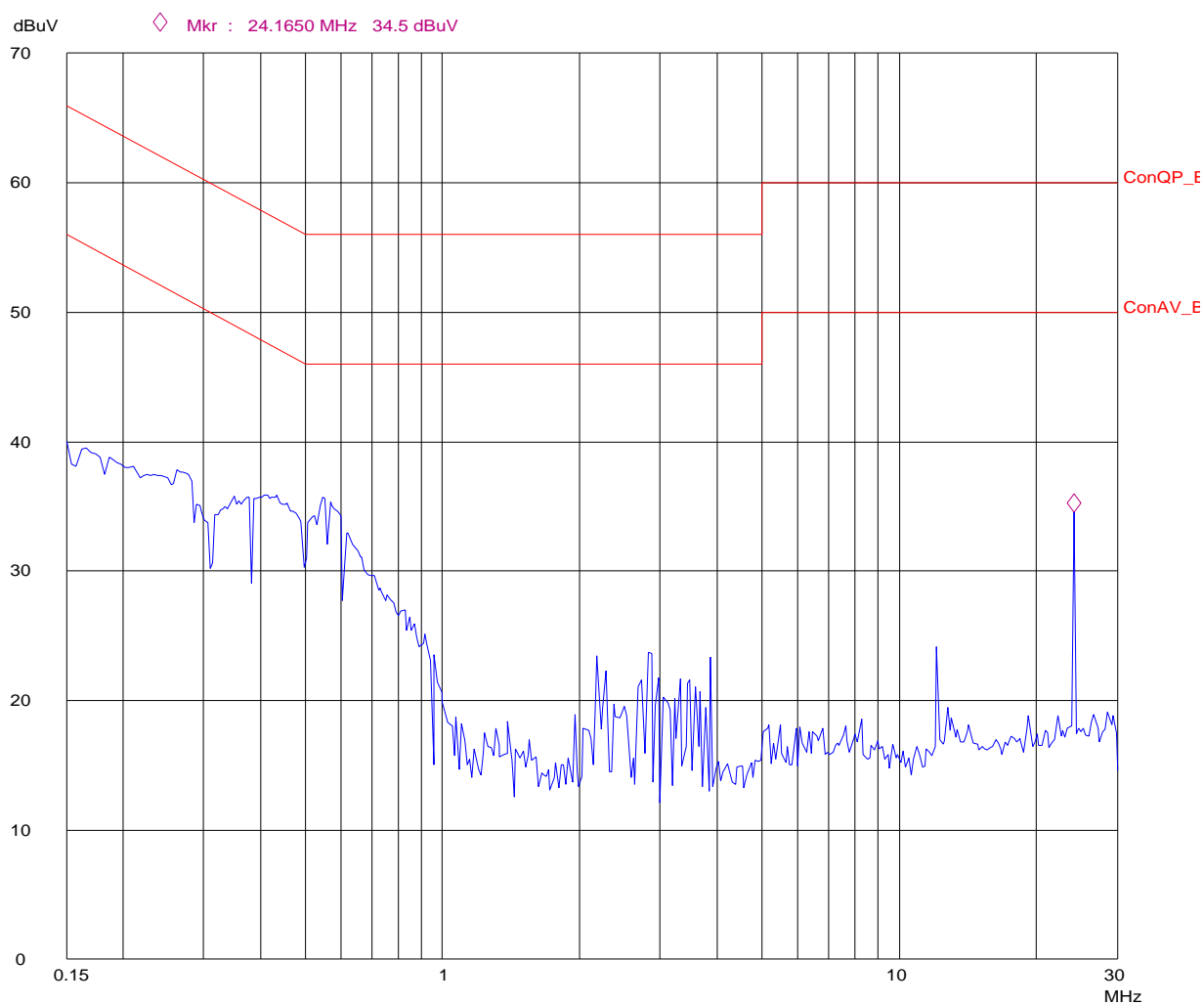
## Conducted Disturbance

EUT: M/N:725-T  
Op Cond: ON  
Test Spec: L  
Comment: AC 120V/60Hz



## Conducted Disturbance

EUT: M/N:725-T  
Op Cond: ON  
Test Spec: N  
Comment: AC 120V/60Hz



## 6. RADIATED DISTURBANCE TEST

### 6.1. Test Standard and Limit

#### 6.1.1. Test Standard

FCC Part 15 15.237

#### 6.1.2. Test Limit

The field strength of any emissions within the permitted 200 kHz band shall not exceed 80 millivolts/meter(98dBuV/m) at 3 meters. The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed 1500 microvolts/meter(63.5dBuV/m) at 3 meters. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

Emissions that fall in the restricted bands (15.205). These emissions must be less than or equal to 100 uV/m (40 dBuV/m). Part 15.35(b) applies in the restricted bands. Emissions not in the restricted band must be below 63.5dBuV/m.

### 6.2. Test Procedure

The EUT is placed on a turntable, which is 0.8 meter above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can move up and down between 1 to 4 meters to find out the maximum emission level. Broadband antenna is used as a receiving antenna. Both horizontal and vertical polarization of the antenna is set on test. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 8 and 13 of ANSI C63.4-2003.

The RBW of the EMI test receiver is :

30~1000MHz	120KHz
1000-18000MHz	1MHz

### 6.3. Test Arrangement

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

**6.4. Test Data**

Table 6 Radiated Disturbance Test Data

Model number: CCS725-T Test Mode:1							
Frequency (MHz)	Polarization	Reading Value (dB $\mu$ V)	Correction Factor (dB)	Antenna Factor (dB/m)	Emission Level dB ( $\mu$ V/m)	Limits dB ( $\mu$ V/m)	Note
60.427	V	41.2	1.4	5.9	48.5	83.5	Spurious PK
60.427	V	40.2	1.4	5.9	47.5	63.5	Spurious AV
72.500	V	78.9	1.4	7.8	88.1	118.0	Fundamental QP
72.500	V	78.1	1.4	7.8	87.3	98.0	Fundamental AV
84.605	V	34.7	1.4	10.1	46.1	83.5	Spurious PK
84.605	V	33.8	1.4	10.1	45.2	63.5	Spurious AV
144.985	V	41.4	2.1	11.7	55.2	83.5	Spurious PK
144.985	V	30.9	2.1	11.7	44.7	63.5	Spurious AV
72.501	H	70.7	1.4	7.8	79.9	118.0	Fundamental QP
72.501	H	70.5	1.4	7.8	79.7	98.0	Fundamental AV
60.427	H	34.7	1.4	5.9	42.0	83.5	Spurious PK
60.427	H	33.3	1.4	5.9	40.6	63.5	Spurious AV
144.995	H	32.5	2.1	11.7	46.3	83.5	Spurious PK
144.995	H	22.5	2.1	11.7	36.3	63.5	Spurious AV
725.013	H	30.7	4.5	20.0	55.2	83.5	Spurious PK
725.013	H	29.0	4.5	20.0	53.5	63.5	Spurious AV

Note: 1. Emission level(dBuV/m)=Reading Value(dBuV) + Correction Factor(dB/m)+ Antenna Factor (dB/m)

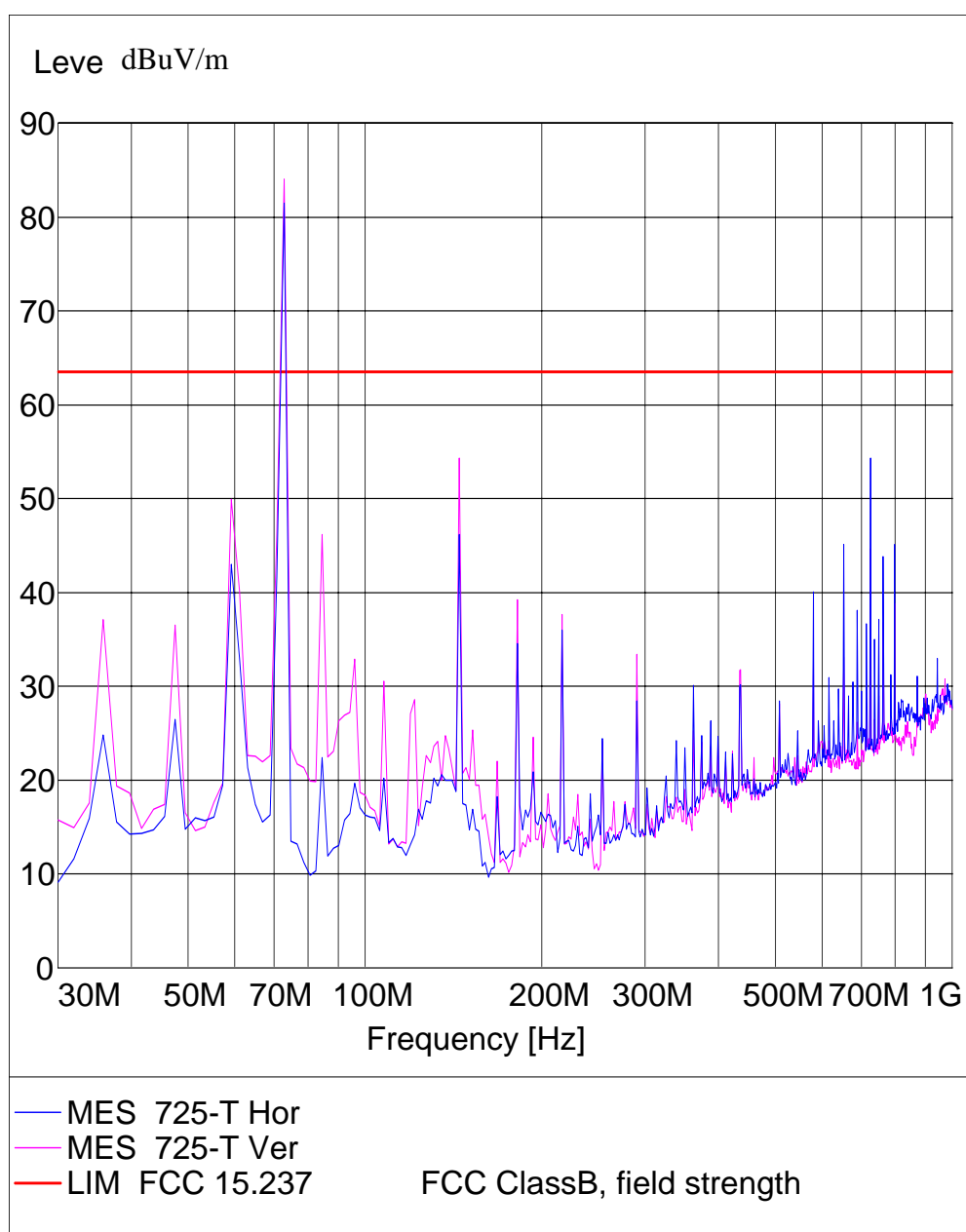
2. Correction Factor(dB/m) = Cable Factor (dB)+Amplifier Factor(dB)

3. The other emission levels were less than the limit 20dB

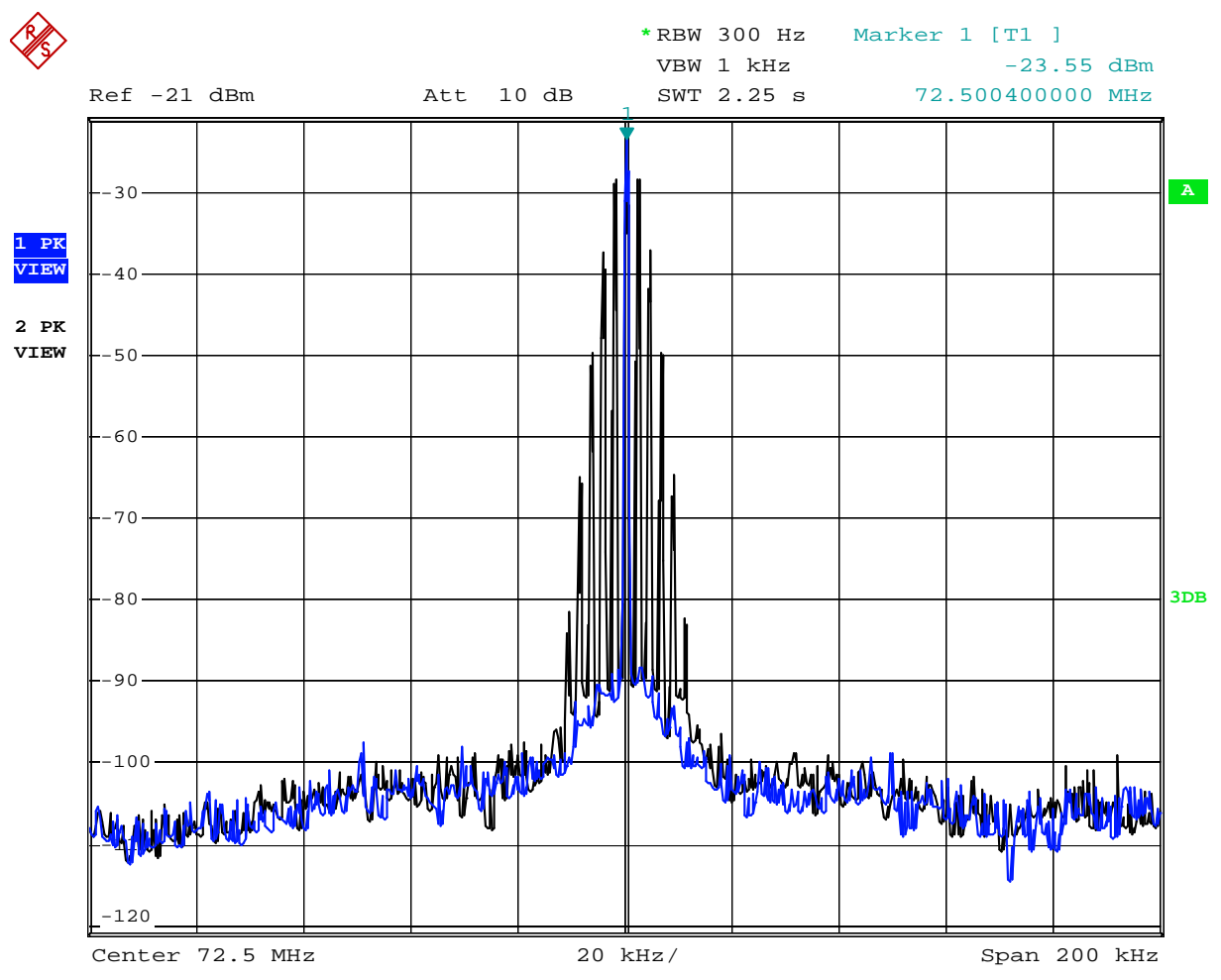
***Radiated Emission***



EUT: CLS725-T  
Manufacturer:  
Operating Condition: TX  
Test Site: SMQ EMC lab SAC  
Operator:  
Test Specification: Horizontal&Vertical  
Comment: AC 120V/60Hz



MEASUREMENT RESULTS NEAR CENTER FREQUENCY



Date: 14.MAY.2008 07:28:24

**Restricted Band Radiated Emission Data (73-74.6MHz 74.8-75.2MHz)**

\*RBW 30 kHz Marker 2 [T1 ]  
 VBW 100 kHz -89.40 dBm  
 SWT 5 ms 73.004800000 MHz

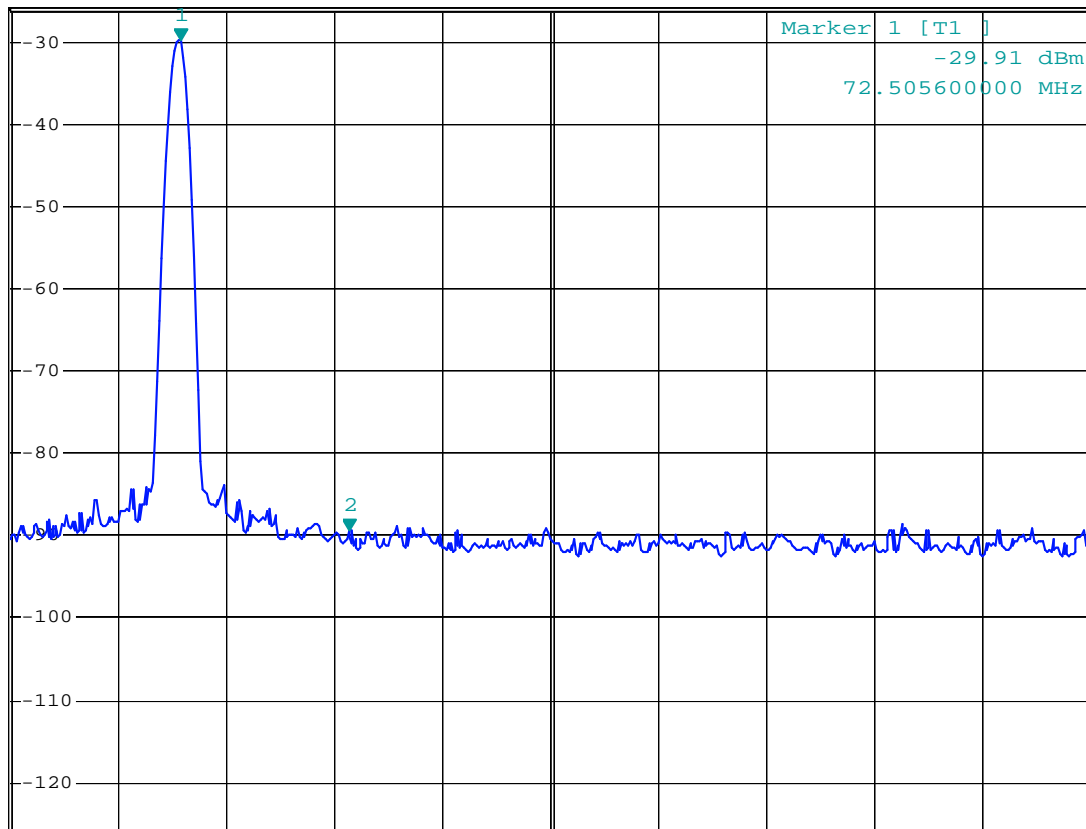
Ref -26 dBm

Att 10 dB

SWT 5 ms

73.004800000 MHz

1 PK  
 VIEW



Start 72 MHz

320 kHz/

Stop 75.2 MHz

Date: 17.MAY.2008 00:22:47

NOTE 1: The emission plot shows 59.5dBc. The emission of carrier strength list in the test result of TX frequency is 88.1dBuV/m (PK), so the maximum field strength in restrict band is  $88.1 - 59.5 = 28.6$  dBuV/m which is under 40.0 dBuV/m limit.

**Table 7 Restricted Band Radiated Emission Data**

MHz	MHz
0.090 - 0.110	16.42 - 16.423
0.495 - 0.505	16.69475 - 16.69525
2.1735 - 2.1905	16.80425 - 16.80475
4.125 - 4.128	25.5 - 25.67
4.17725 - 4.17775	37.5 - 38.25
4.20725 - 4.20775	108 - 121.94
6.215 - 6.218	123 - 138
6.26775 - 6.26825	149.9 - 150.05
6.31175 - 6.31225	156.52475 - 156.52525
8.291 - 8.294	156.7 - 156.9
8.362 - 8.366	162.0125 - 167.17
8.37625 - 8.38675	167.72 - 173.2
8.41425 - 8.41475	240 - 285
12.29 - 12.293	322 - 335.4
12.51975 -	399.9 - 410
12.52025	608 - 614
12.57675 -	960 - 1240
12.57725	
13.36 - 13.41	

All the emission of the above band were less than the limit 20dB.

## **7. OCCUPIED BANDWIDTH**

### **7.1. Test Standard and Limit**

#### 7.1.1. Test Standard

FCC Part 15 15.237

#### 7.1.2 test limit

Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the above specified frequency ranges.

### **7.2. Test Procedure**

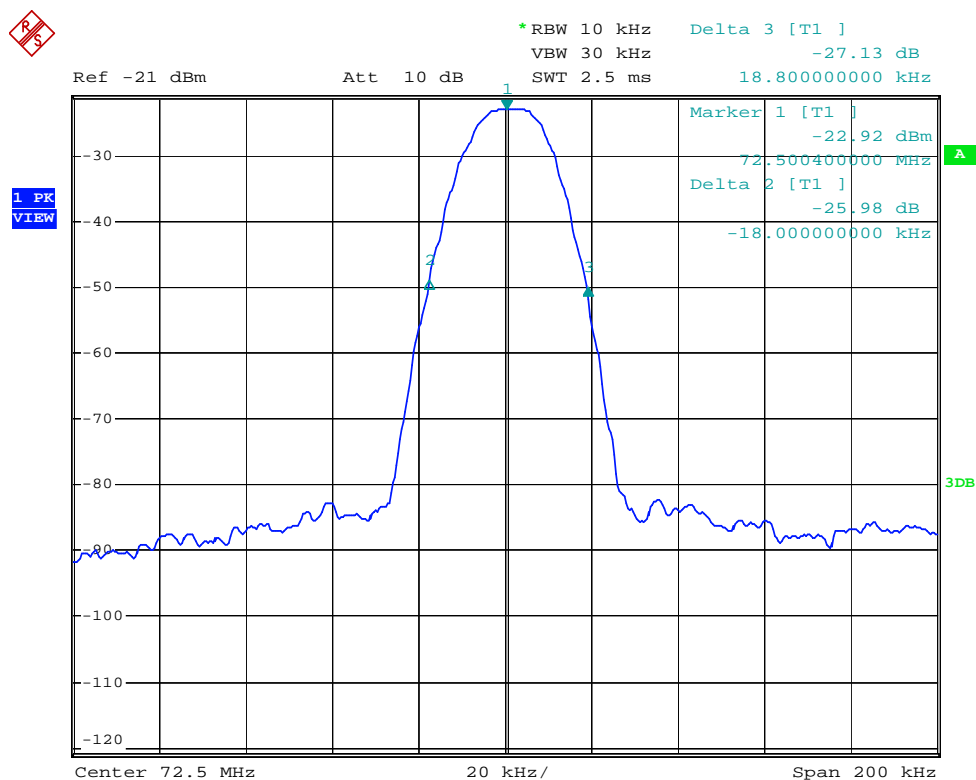
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set EMI test receiver(ESIB26) Center Frequency = fundamental frequency, RBW=10kHz, VBW= 30kHz, Span=200kHz.
4. Set EMI test receiver(ESIB26) Max hold. Mark peak, -26dB.

### **7.3. Test Arrangement**

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

## 7.4. Test Data

The test was performed with CLS725-T.  
26dB bandwidth = 36.8 kHz



Date: 14.MAY.2008 07:27:12

## 8. BAND EDGE

### 8.1. Test Standard and Limit

#### 8.1.1. Test Standard

FCC Part 15 15.237

### 8.2. Band Edge FCC 15.237 Limit

The field strength of any emissions within the permitted 200 kHz band shall not exceed 80 millivolts/meter (98 dBuV/m) at 3 meters. The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed 1500 microvolts/meter (63.5 dBuV/m) at 3 meters. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

### 8.3. Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instruments. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Measure the highest amplitude appearing on spectral display and set it as reference level. Plot the graph with marking the highest point and edge frequency.
4. Repeat above procedures until all measured frequencies were complete.

### 8.4. Test Arrangement

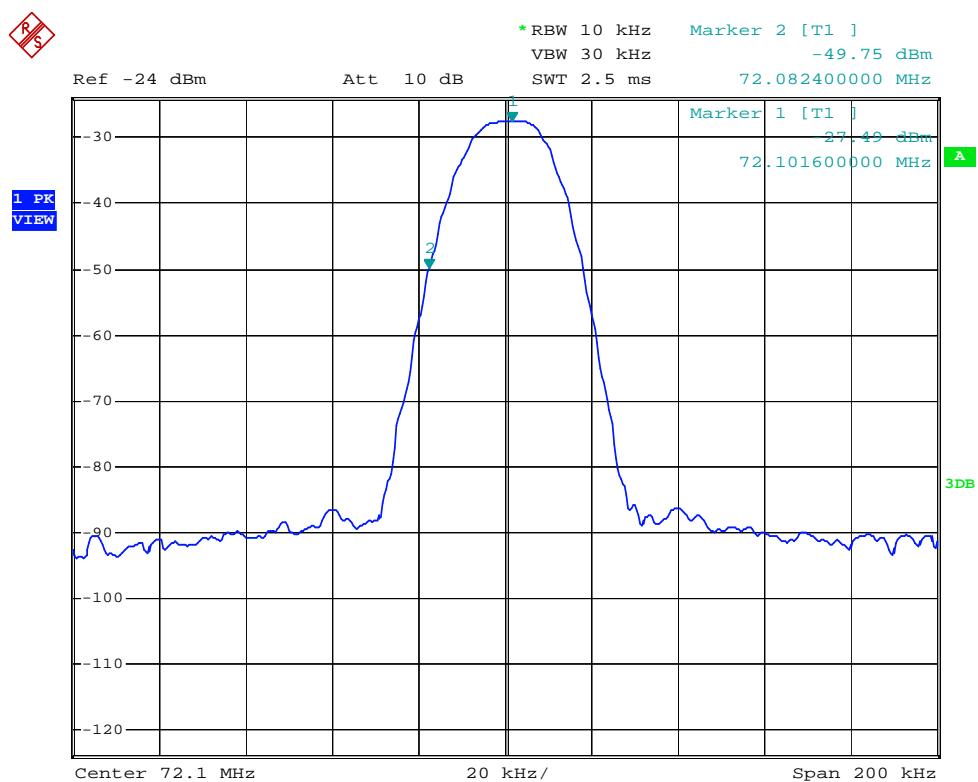
The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

### 8.5. Test Data

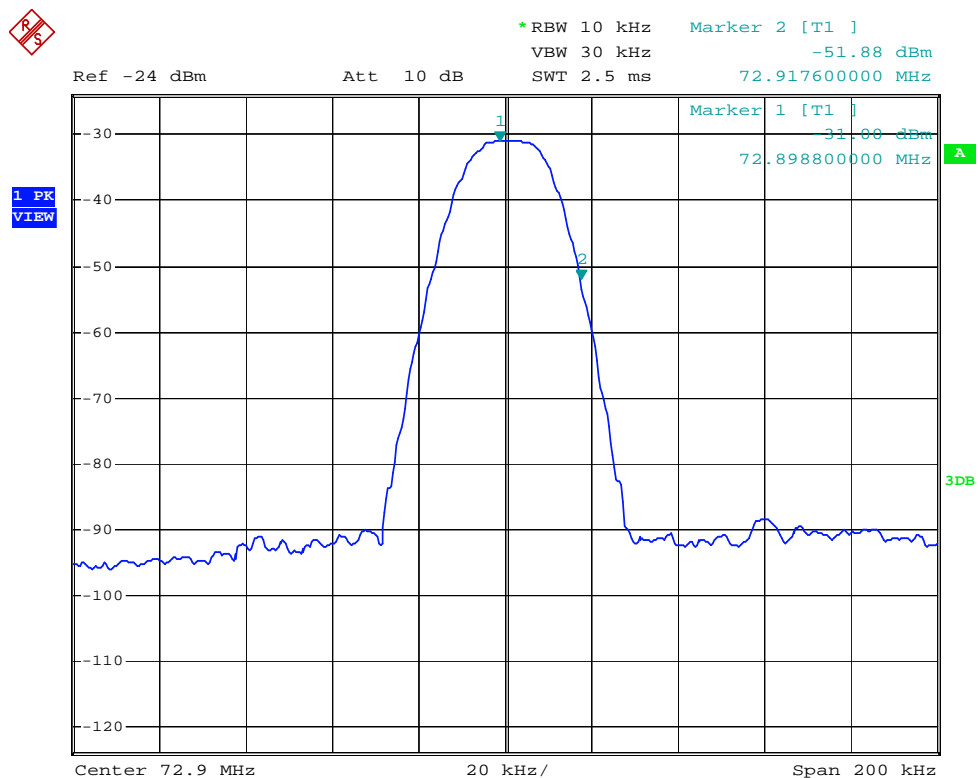
All the emission outside 72.062 to 72.918 is lower than 63.5 dB ( $\mu$  V/m).

NOTE 1: The band edge emission plot of on page 24 low frequency shows 22.3 dBc. The emission of carrier strength list in the test result of low frequency is 84.2 dBuV/m (AV), so the maximum field strength in restrict band is  $84.2 - 22.3 = 62.0$  dBuV/m which is under 63.5 dBuV/m limit.

NOTE 2: The band edge emission plot of on page 24 high frequency shows 20.0 dBc. The emission of carrier strength list in the test result of high frequency is 82.3 dBuV/m (AV), so the maximum field strength in restrict band is  $82.3 - 20.0 = 62.3$  dBuV/m which is under 63.5 dBuV/m limit.



Date: 14.MAY.2008 07:26:15



Date: 14.MAY.2008 07:25:00



## 9. MODULATION CHARACTERISTICS

### 9.1. Test requirement

Part 2 2.1047 (a) & (b)

Requirements: A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted.

### 9.2. MODULATION CHARACTERISTICS MEASUREMENT METHOD

#### 9.2.1 Modulation Limit

- 1). Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1KHz using this level as a reference (0dB) and vary the input level from –20 to +20dB. Record the frequency deviation obtained as a function of the input level.
- 2). Repeat step 1 with input frequency changing to 300,1000,3000, and 14000Hz in sequence.

#### 9.2.2 Audio Frequency Response

- 1). Configure the EUT as shown in figure 1.
- 2). Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0 dB).
- 3). Vary the Audio frequency from 100 Hz to 30 KHz and record the frequency deviation

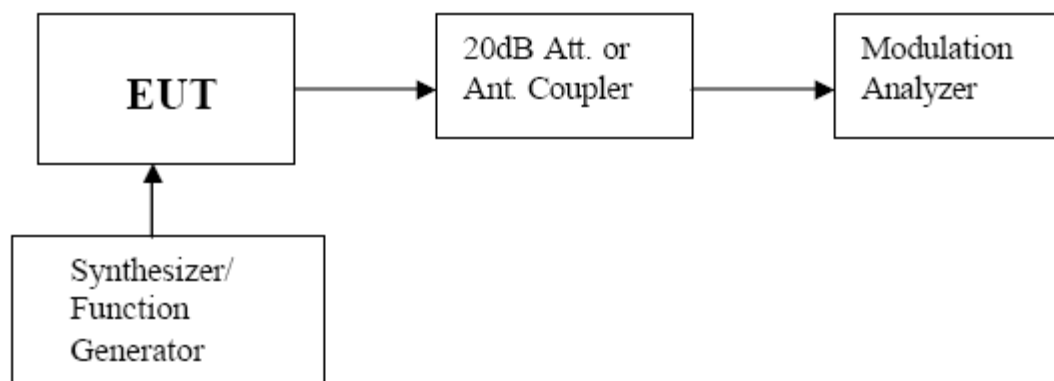


Figure 2 Modulation test setup

### 9.3. MEASUREMENT RESULT

#### 9.3.1 Modulation Limit:

The Max deviation is 5kHz.

Table 8 Modulation Test Results

Test Mode: 1

Modulation Level (dB)	Peak Deviation 300Hz Freq At	Peak Deviation 1000Hz Freq At	Peak Deviation 2500Hz Freq At
-20	0.10	0.33	0.39
-15	0.15	0.69	0.75
-10	0.20	1.00	1.16
-5	0.45	1.89	2.15
0	0.63	3.00	3.53
5	0.75	3.50	3.95
10	0.83	4.02	4.47
15	0.84	4.05	4.48
20	0.85	4.09	4.50

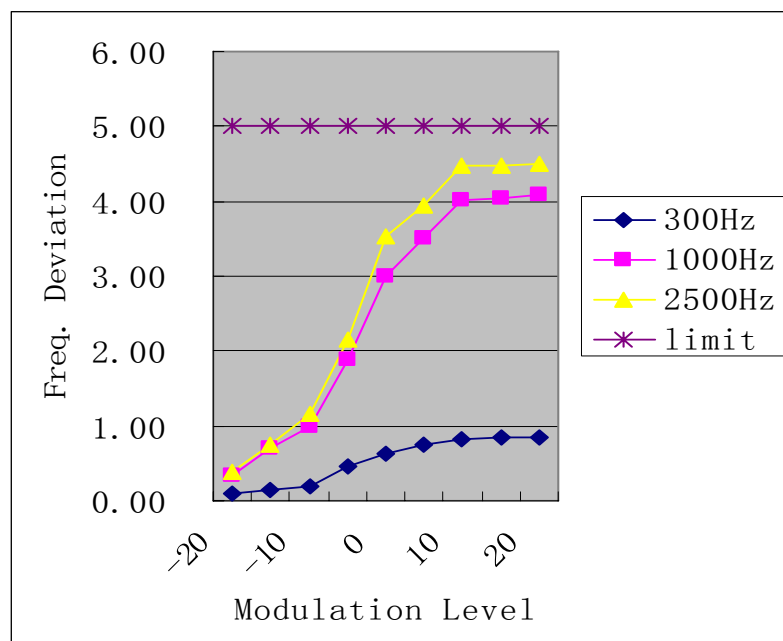


Figure 3 modulation test result

## b). Audio Frequency Response:

Table 9 Modulation Test Results

Frequency (Hz)	Deviation (KHz)
100	--
200	0.08
300	0.25
400	0.40
500	0.54
600	0.65
700	0.84
800	0.93
900	0.99
1000	1.00
1200	1.14
1400	1.14
1600	1.15
1800	1.18
2000	1.20
2200	1.24
2400	1.24
2600	1.25
2800	1.23
3000	1.19
3200	1.18
3400	1.11
3600	0.95
3800	0.85
4000	0.42
4200	0.25
4400	0.17
4600	0.12
4800	0.10
5000	0.04
5500	---
6000	---
6500	---

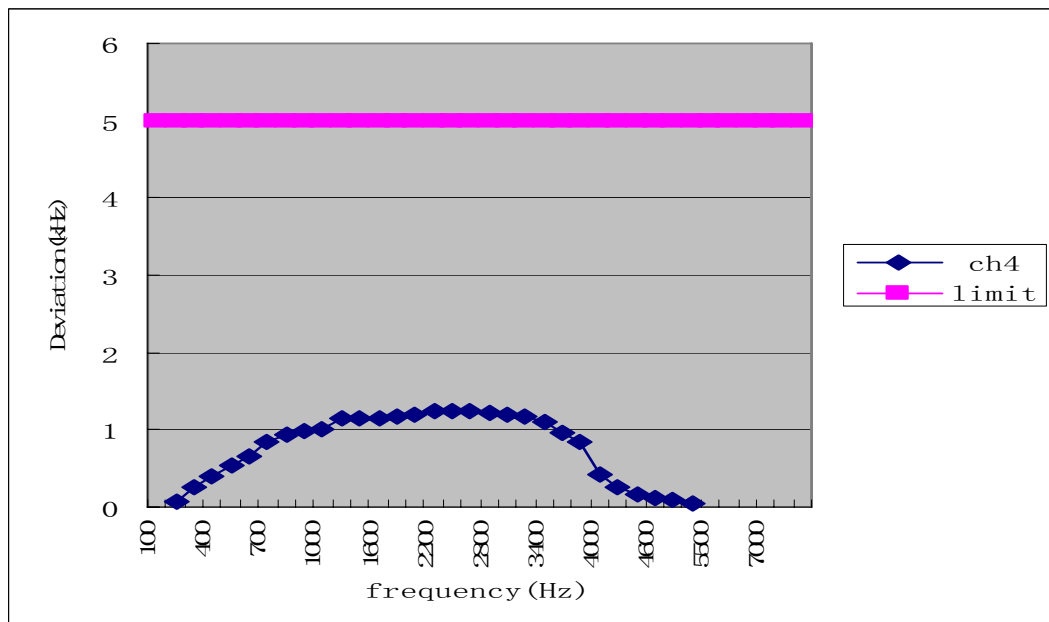


Figure 4 modulation test result

## **10. ANTENNA REQUIREMENT**

According to 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.

The EUT has a fixed antenna which is fixed to the enclosure of the device. this is permanently attached antenna and meets the requirements of this section.

**APPENDIX I TEST PHOTO**

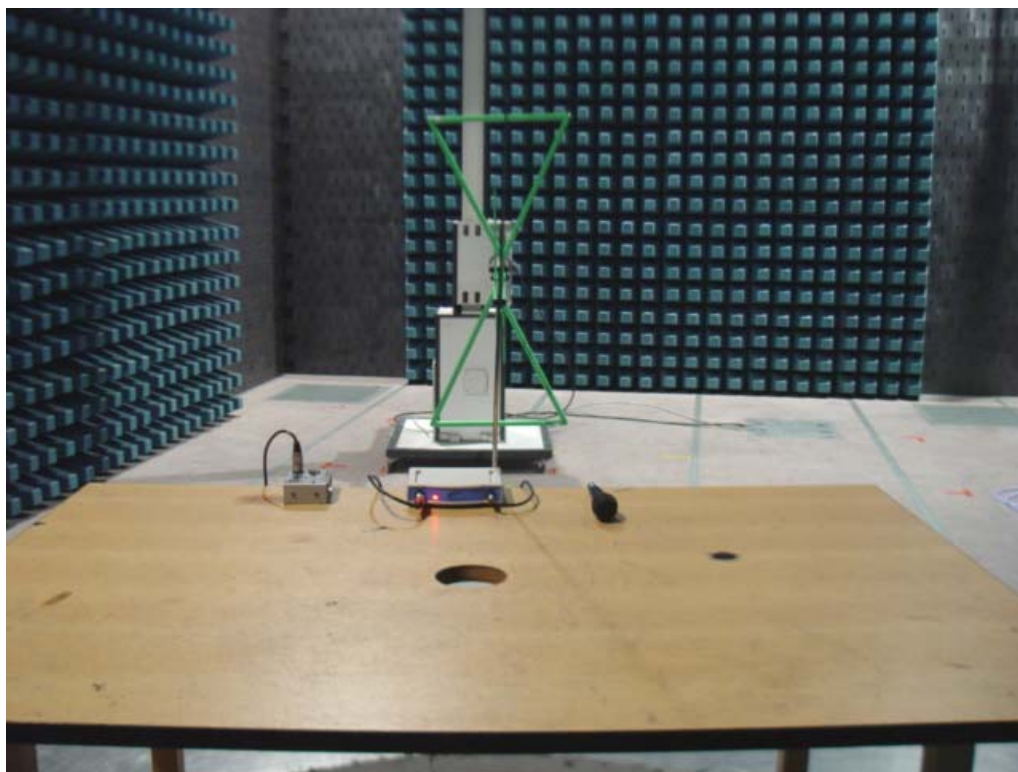
**Photo 1 Conducted Emission Test**



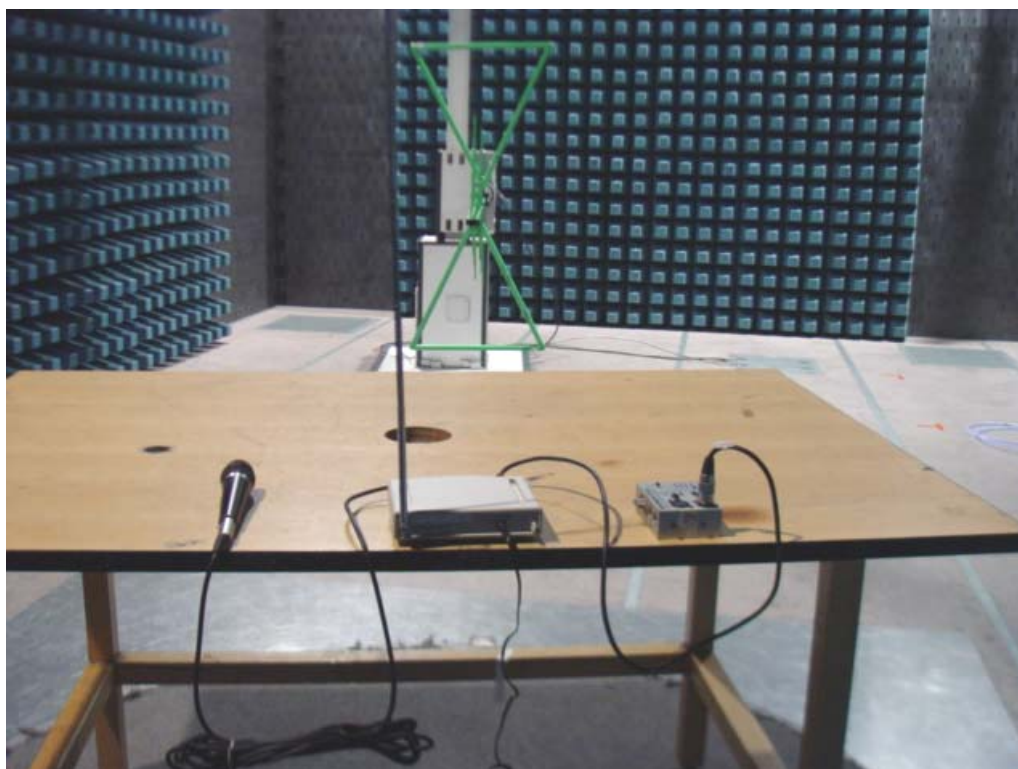
**Photo 2 Conducted Emission Test**



**Photo 3 Radiated Emission Test**



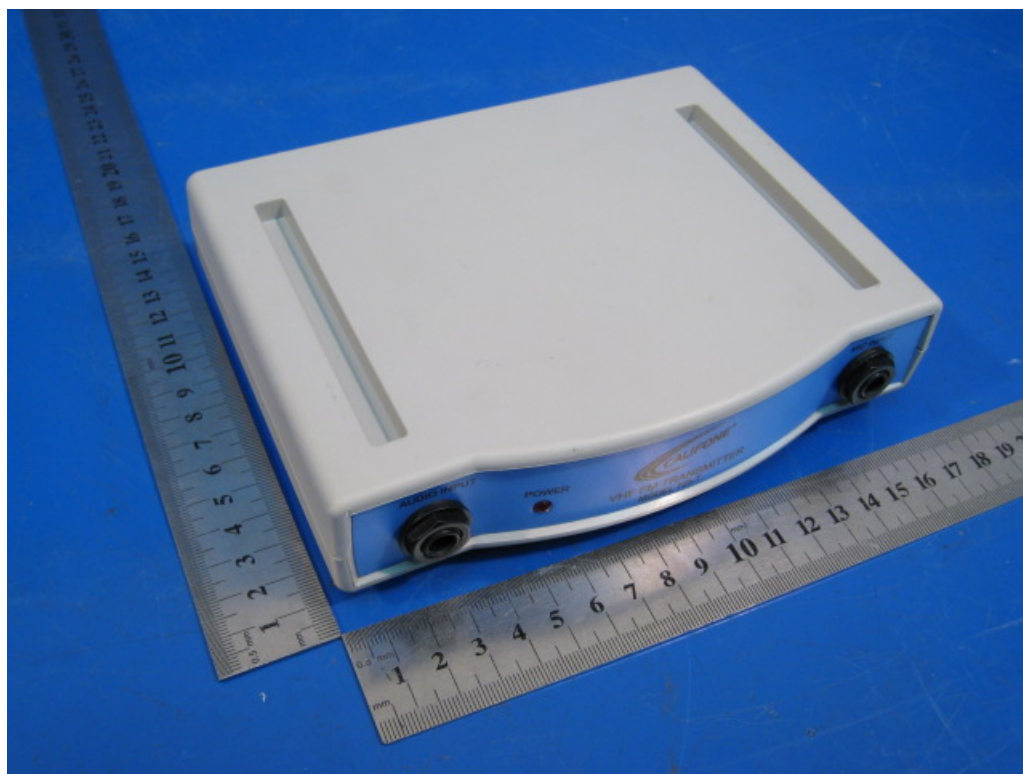
**Photo 4 Radiated Emission Test**



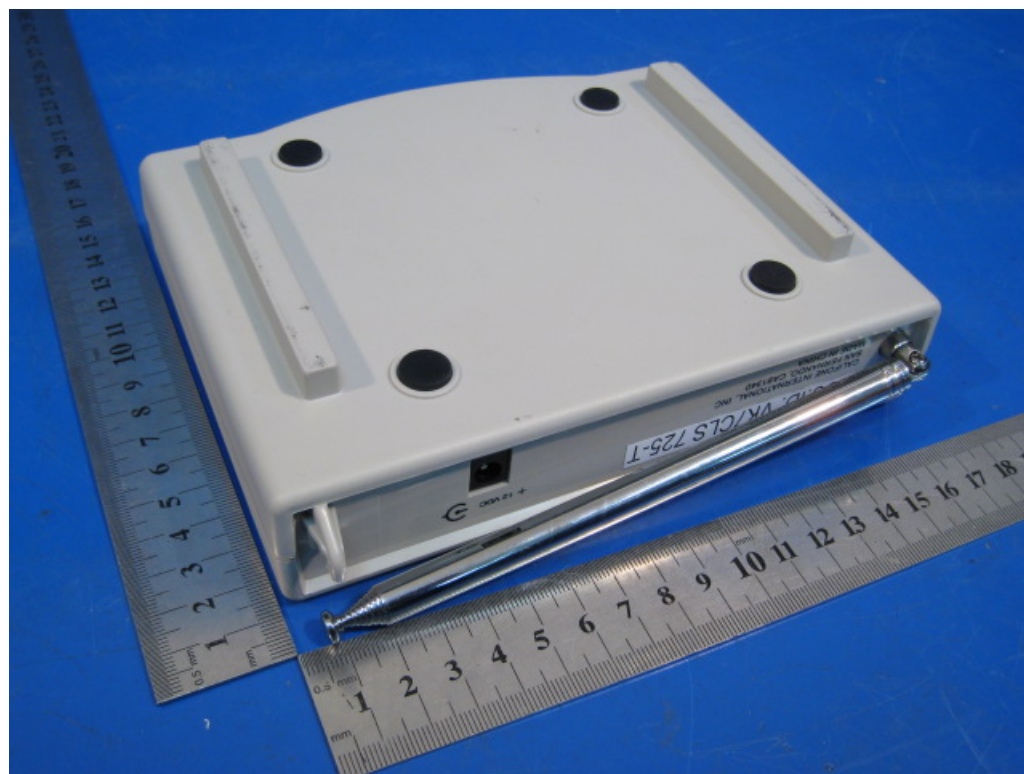


## **APPENDIX II EUT PHOTO**

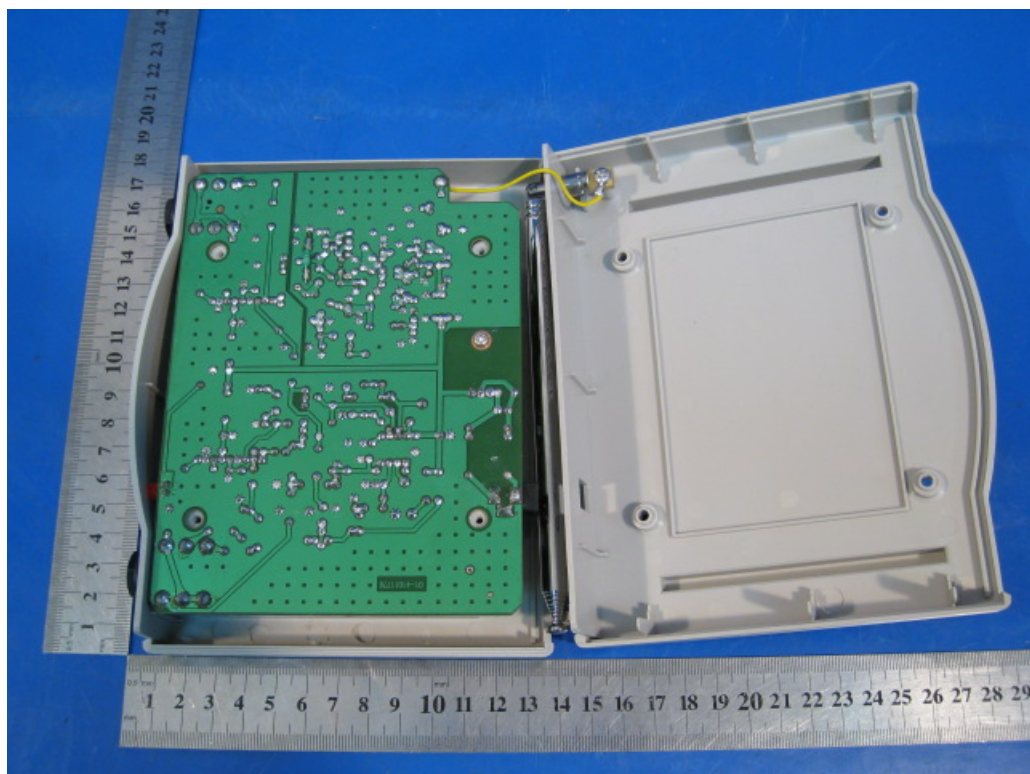
**Photo 1 Appearance of EUT**



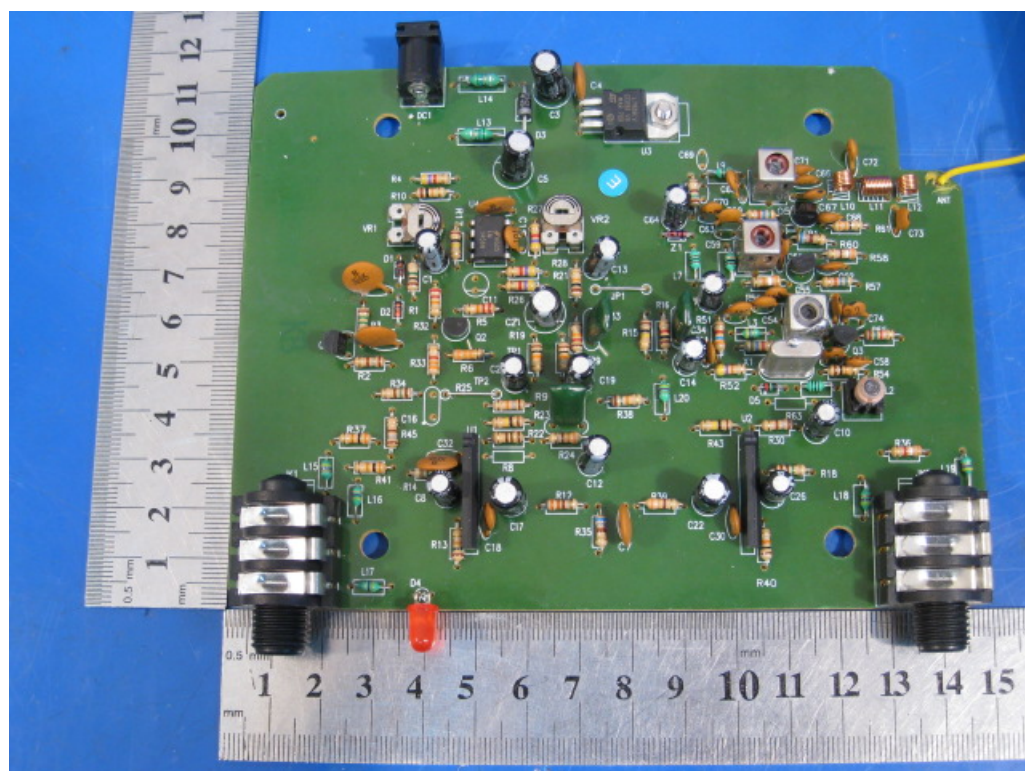
**Photo 2 Appearance of EUT**



**Photo 3 Inside of EUT**

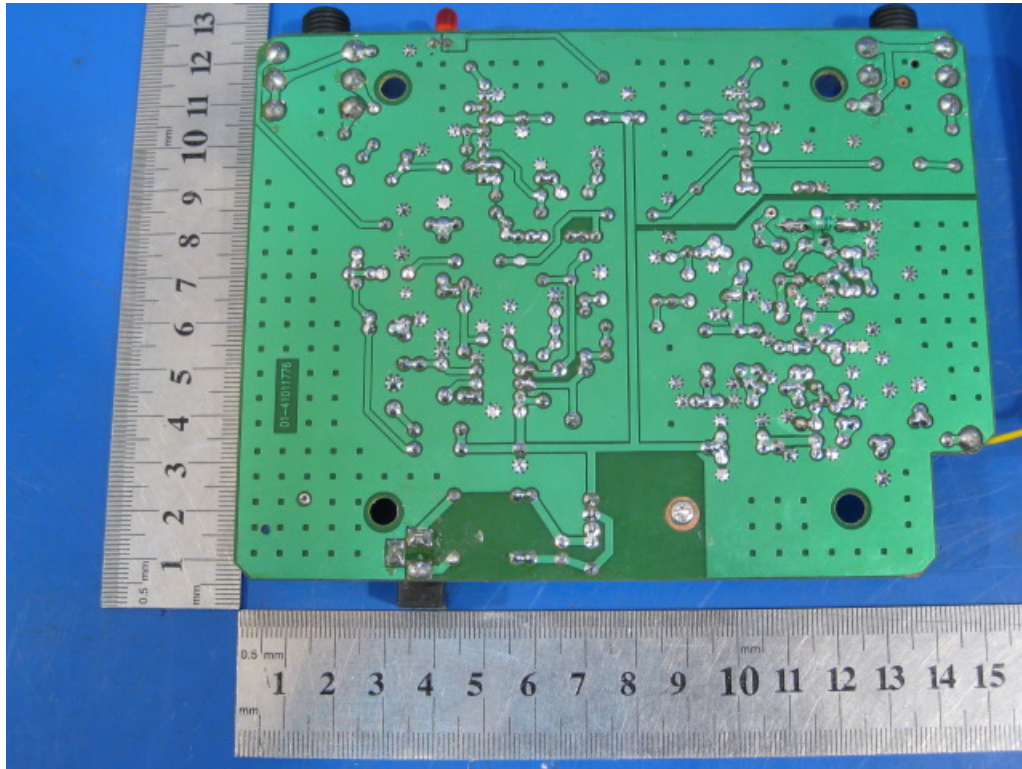


**Photo 4 Inside of EUT**





**Photo 5 Inside of EUT**



**Photo 6 Adaptor**

