



FCC TEST REPORT

Prepared For :	Calford Technology Ltd.
Product Name:	4 channel FM wireless intercom
Model :	AF411
Prepared By :	Shenzhen BATT Testing Technology Co., Ltd. 11F, Bldg.B, Xinbaoyuan, Xinnanhu Commercial city, Bao'an District, Shenzhen, Guangdong, China. Tel: 86-755-27753991 Fax: 86-755-27754182
Test Date:	Jan 2, 2014 to Jan 14, 2014
Date of Report :	Jan 15, 2014
Report No.:	BATT201401013FCC

Note: This report shall not be reproduced except in full, without the written approval of Shenzhen BATT Testing Technology Co., Ltd. This document may be altered or revised by Shenzhen BATT Testing Technology Co., Ltd. personnel only, and shall be noted in the revision section of the document. The test results in the report only apply to the tested sample



TABLE OF CONTENTS

1.0	TEST CERTIFICATION.....	3
2.0	Test Equipment.....	5
3.0	Technical Details.....	6
4.0	Test Lab Details.....	6
5.0	Power Line Conducted Emission Test.....	7
6.0	Frequency Tolerance.....	11
7.0	Emission Bandwidth and Mask.....	14
8.0	Unwanted Radiation.....	22
9.0	Modulation Characteristics.....	25
10.0	Maximum transmitter Power (Conducted Output Power).....	29
11.0	Radiated Emission on Receiving Mode.....	30
12.0	FCC ID Label.....	33
13.0	Photo of Test Setup and EUT View.....	34



1 TEST CERTIFICATION

Product:	4 channel FM wireless intercom
Model:	AF411
Applicant:	Calford Technology Ltd. Room 14, 3 FLR., Sing Win Fty. Building, 15 – 17 Shing Yip St., Kowloon, Hong Kong.
Manufacturer:	Guangdong Samzuk Technology Development Co., Ltd High-Tech Zone Xingdong Avenue East Heyuan City (2/F of Minghuang Electrical Engineering Company Building)
Trade Mark:	N/A
Tested:	Jan 02, 2014 to Jan 14, 2014
Test Voltage:	DC6V Powered by power supply
Operational Frequency Range:	462.5625MHz, 462.6125MHz, 462.6375MHz, 462.6875MHz
Modulation Type:	FM
Frequency Selection	By Key button
Channel Number	4 Channel provided to the EUT
Antenna:	Integral antenna with Gain 2.0 dBi
Power Supply:	Model No.: NLA080060W1A1 Input: 100-240V, 50/60Hz, 0.2A Max; Output: 6V, 800mA
FCC ID:	2AAYF-AF411
Applicable Standards:	FCC Part 95, Subpart B and Subpart E;

The test report was prepared by Shenzhen BATT Testing Technology Co., Ltd. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.



Prepared by :

Hellen Xiao

Hellen Xiao Assistant

Reviewer :

Mike Yong

Mike Yong/Supervisor

Approved & Authorized Signer :

Jones Song

Jones Song/ Manager



2.0	Test Equipments				
Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	ROHDE&SCHWA RZ	ESPI 3	100379	2013-05-27	2014-05-26
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	2013-05-27	2014-05-26
Impuls-Begrenzer	ROHDE&SCHWA RZ	ESH3-Z2	100281	2013-05-27	2014-05-26
Loop Antenna	EMCO	6502	00042960	2013-05-27	2014-05-26
ESPI Test Receiver	ROHDE&SCHWA RZ	ESI26	838786/013	2013-05-27	2014-05-26
3m OATS	--	--	N/A	2013-05-27	2014-05-26
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170399	2013-05-27	2014-05-26
Horn Antenna	SCHWARZBECK	BBHA 9120	D143	2013-05-27	2014-05-26
Power meter	Anritsu	ML2487A	6K00003613	2013-05-27	2014-05-26
Power sensor	Anritsu	MA2491A	32263	2013-05-27	2014-05-26
Bilog Antenna	Schwarebeck	VULB916 3	9163/142	2013-05-27	2014-05-26
LISN (Three Phase)	Schwarebeck	NSLK 8126	8126453	2013-05-27	2014-05-26
9*6*6 Anechoic	--	--	N/A	2013-05-27	2014-05-26
EMI Test Receiver	RS	ESCS30	100139	2013-05-27	2014-05-26
LISN	RS	ESH2-Z5	100225	2013-05-27	2014-05-26
LISN (Three Phase)	Schwarebeck	NSLK 8126	8126453	2013-05-27	2014-05-26
Pre-Amplifier	A.H.	PAM-0126	1415261	2013-05-27	2014-05-26
Modulation Analyzer	HP	8901B	3104A03367	2013-06-16	2014-06-15



3.0 Technical Details

3.1 Summary of test results

The EUT has been tested according to the following specifications:

Standard	Test Type	Result	Notes
FCC Part 15.207	Conducted Emission	Pass	Complies
FCC Part 95.639	Maximum Transmitter Power	Pass	Complies
FCC Part 95.637	Modulation Characteristic	Pass	Complies
FCC Part 95.633	Occupied Bandwidth	Pass	Complies
FCC Part 95.633	Emission Mask	Pass	Complies
FCC Part 95.626	Frequency Tolerance	Pass	Complies
FCC Part 95.635	Spurious Radiated Emissions	Pass	Complies

4.0 Test LAB Details

All Tests Performed at

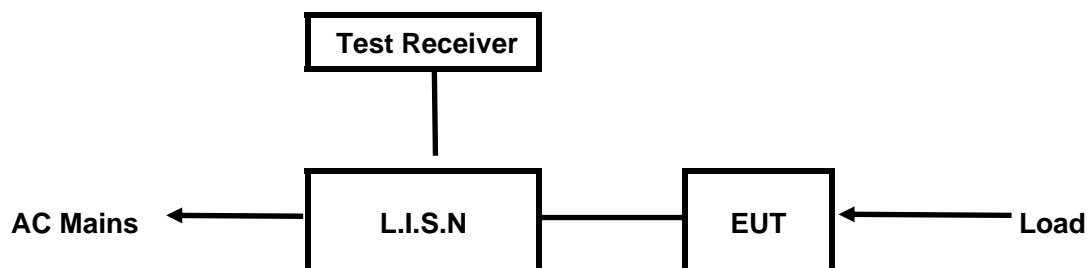
Name: Shenzhen Emtex Co., Ltd.

Address: Bldg. 69, Majialong Industry Zone,,Nanshan District,Shenzhen, Guangdong, 518052China

FCC Registration Number: 406365

5. Power Line Conducted Emission Test

5.1 Schematics of the test



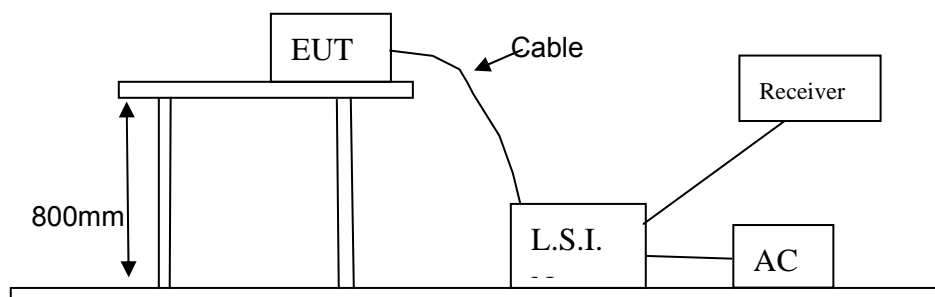
EUT: Equipment Under Test

5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.4-2003. The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.4 –2003.

Test Voltage: 120V~, 60Hz

Block diagram of Test setup



5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.4-2003. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

One channels are provided to the EUT

A. EUT

Device	Manufacturer	Model	FCC ID
4 channel FM wireless intercom	Guangdong Samzuk Technology Development Co., Ltd.	AF411	2AAYF-AF411



B. Internal Device

Device	Manufacturer	Model	FCC ID/DOC
N/A			

C. Peripherals

Device	Manufacturer	Model	FCC ID/DOC	Cable
N/A				

5.4 EUT Operating Condition

Operating condition is according to ANSI C63.4 -2003

A Setup the EUT and simulators as shown on follow

B Enable AF signal and confirm EUT active to normal condition

5.5 Power line conducted Emission Limit according to Paragraph 15.207

Frequency(MHz)	Class A Limits (dB μ V)		Class B Limits (dB μ V)	
	Quasi-peak Level	Average Level	Quasi-peak Level	Average Level
0.15 ~ 0.50	79.0	66.0	66.0~56.0*	56.0~46.0*
0.50 ~ 5.00	73.0	60.0	56.0	46.0
5.00 ~ 30.00	73.0	60.0	60.0	50.0

- Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The tighter limit shall apply at the transition frequencies

5.6 Test Results

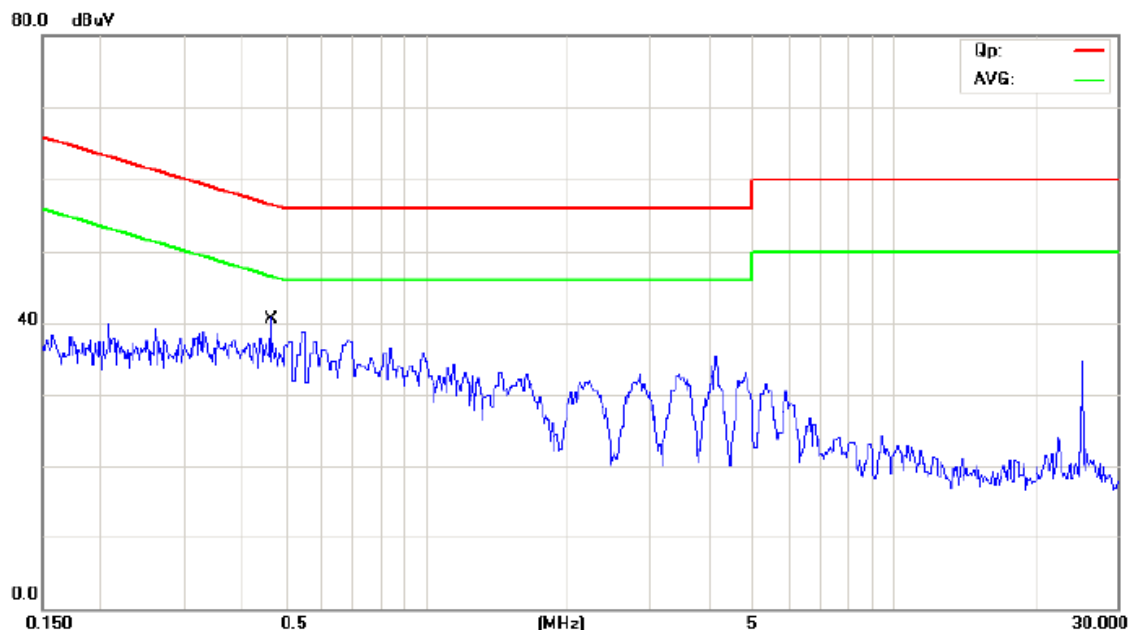
The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.

A Conducted Emission on Line Terminal of the power line (150kHz to 30MHz)

EUT set Condition: Charging

Results: Pass

Please refer to following diagram for individual



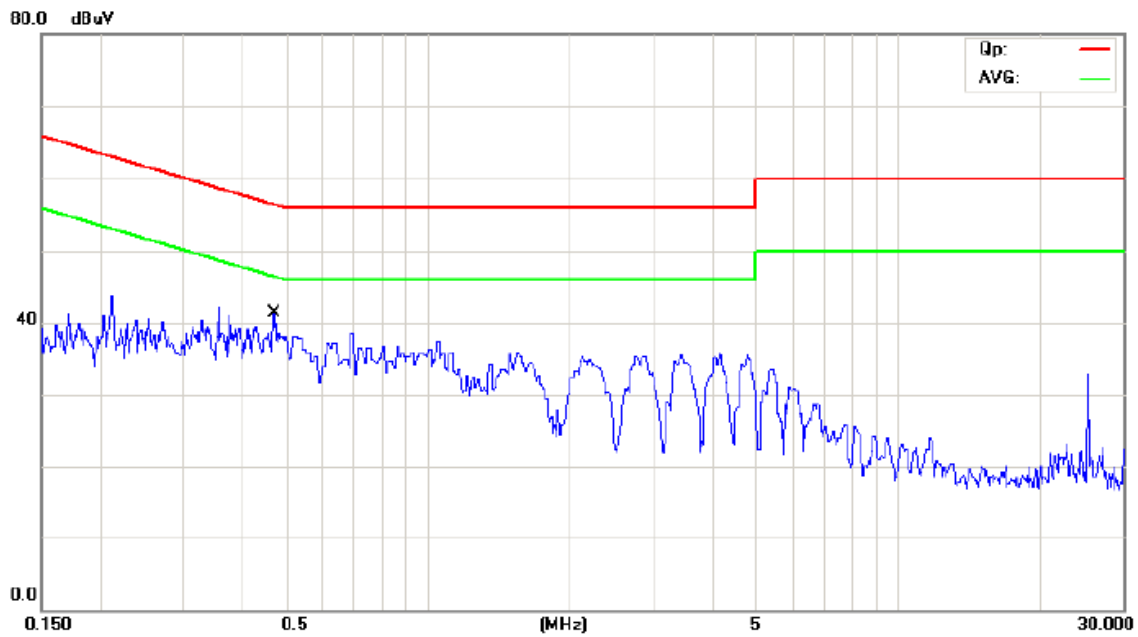
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.4614	9.70	11.33	21.03	56.67	-35.64	QP	
2		0.4614	-7.50	11.33	3.83	46.67	-42.84	AVG	

B Conducted Emission on Neutral Terminal of the power line (150kHz to 30MHz)

EUT set Condition: Charging

Results: Pass

Please refer to following diagram for individual



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.4671	11.70	11.34	23.04	56.57	-33.53	QP	
2		0.4671	-6.30	11.34	5.04	46.57	-41.53	AVG	

6. Frequency Tolerance

6.1 Applicable standard

According to FCC §2.1055(a) (1), the frequency stability shall be measured with variation of ambient temperature from -30°C to $+50^{\circ}\text{C}$, and according to FCC 2.1055(d) (2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

According to FCC §95.626(b), Each FRS Unit must be maintained within a frequency tolerance of 0.00025 % (2.5 ppm).

6.2 Measurement Procedure

6.2.1 Frequency stability versus environmental temperature

1. Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.
2. Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1KHz and Video Resolution Bandwidth to 1KHz and Frequency Span to 50KHz. Record this frequency as reference frequency.
3. Set the temperature of chamber to 50°C . Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10°C decreased per stage until the lowest temperature -30°C is measured, record all measured frequencies on each temperature step.

6.2.2 Frequency stability versus input voltage

1. Setup the configuration per figure 1 for frequencies measured at temperature if it is within 15°C to 25°C . Otherwise, an environment chamber set for a temperature of 20°C shall be used.
2. Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz and Video Resolution Bandwidth to 1KHz. Record this frequency as reference frequency.
3. Supply the EUT primary voltage at the operating end point which is specified by manufacturer and record the frequency.

6.3 TEST SETUP BLOCK DIAGRAM

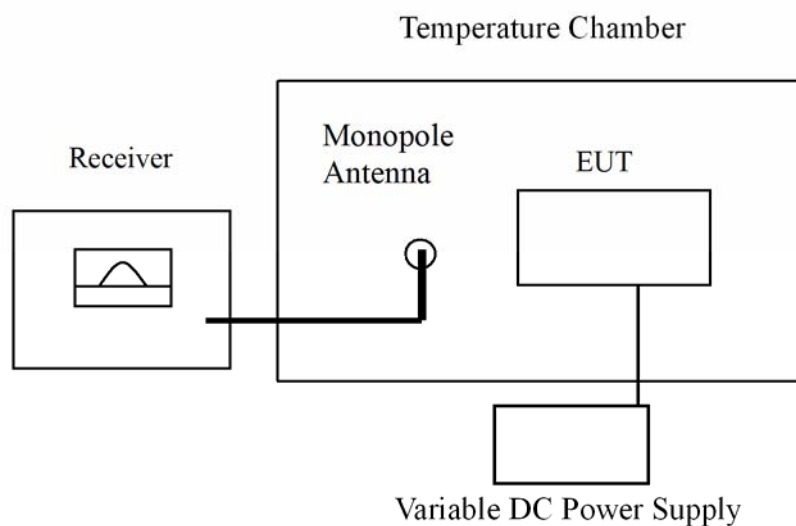


Figure 1

6.5 TEST RESULT

(1) Frequency stability versus input voltage (The end point voltage is 4.5V)

Channel	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Deviation (ppm)	Nominal Frequency	Limit (ppm)
CH1	4.5V	462.562286	-0.46	462.5625MHz	±2.5



(2) Frequency stability versus ambient temperature

Test Results

CH1

Environment Temperature(°C)	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Deviation (ppm)	Nominal Frequency	Limit(ppm)
50	6.0	462.562278	-0.48	462.5625MHz	±2.5
40	6.0	462.562234	-0.58	462.5625MHz	±2.5
30	6.0	462.562309	-0.41	462.5625MHz	±2.5
20	6.0	462.562323	-0.38	462.5625MHz	±2.5
10	6.0	462.562266	-0.51	462.5625MHz	±2.5
0	6.0	462.562272	-0.49	462.5625MHz	±2.5
-10	6.0	462.562238	-0.57	462.5625MHz	±2.5
-20	6.0	462.562219	-0.61	462.5625MHz	±2.5
-30	6.0	462.562265	-0.51	462.5625MHz	±2.5

7. EMISSION BANDWIDTH and Mask

7.1 PROVISIONS APPLICABLE

Per FCC §2.1049 and FCC §95.633(a) (c), the authorized bandwidth for emission type F3E or F2D transmitted by an FRS Unit is 12.5 kHz.

(1) At least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.

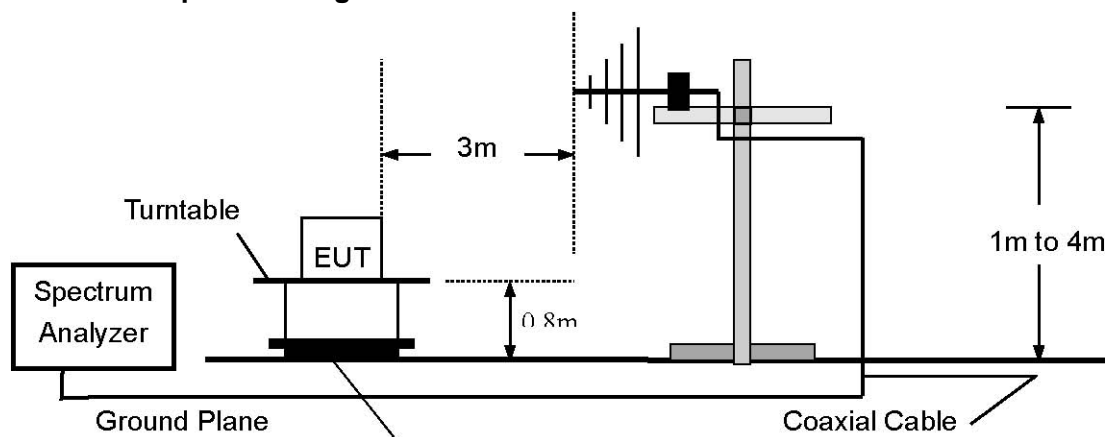
(3) At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.

(7) At least $43 + 10 \log_{10} (T)$ dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

7.2 MEASUREMENT PROCEDURE

TIA-603-C, section 2.2.11

7.3 Test Setup Block Diagram



7.4 Measurement Result:

Bandwidth			
Operating Frequency	Test Data	Limits	Result
462.5625MHz	6.8kHz	12.5kHz	Pass

Emission Designator:

Bn=2M + 2DK

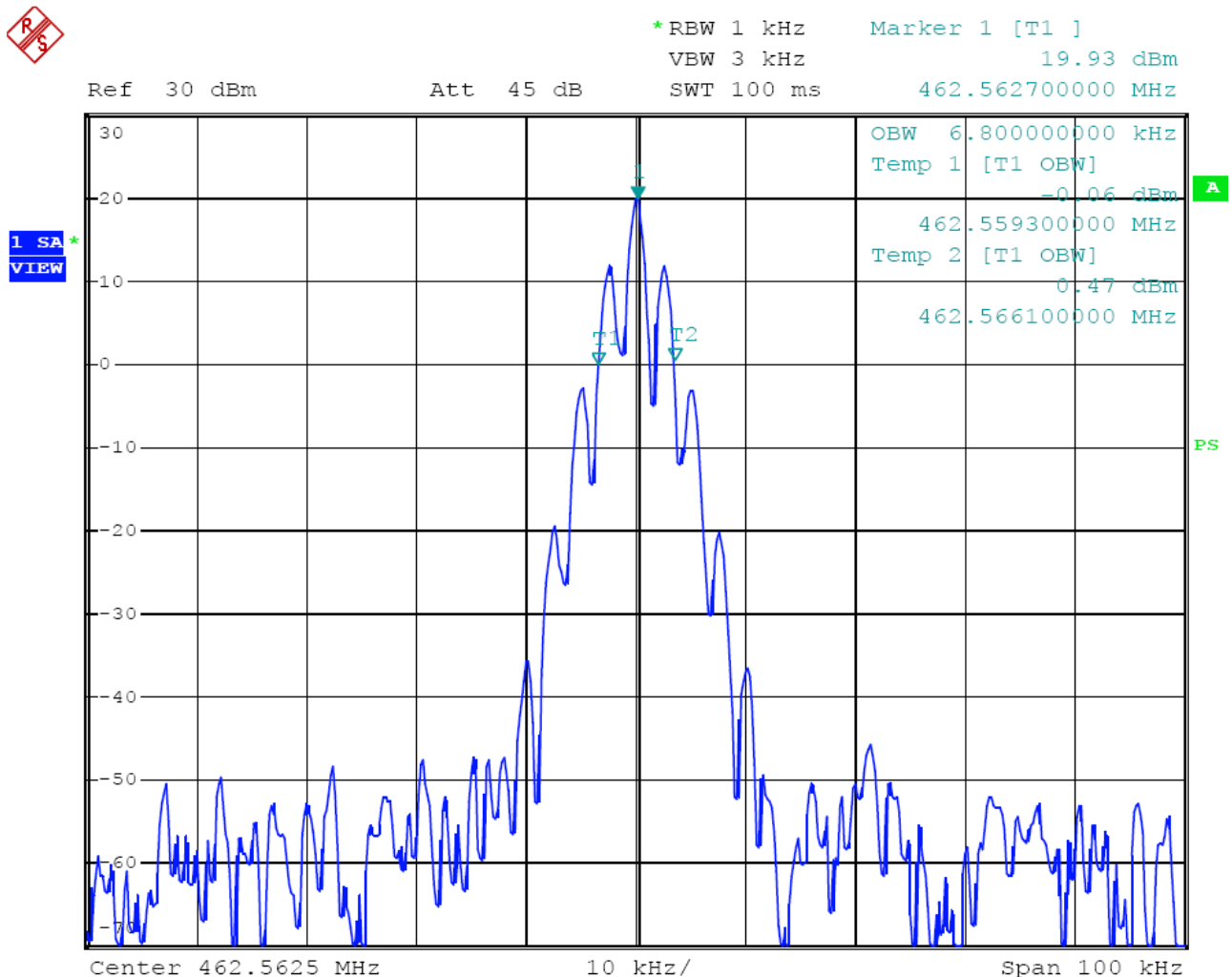
Where M = 3 KHz, D = 2.5 KHz, K = 1

Bn =2*3 + 2*2.5 = 11KHz

Type of emission: 11K0F3E

7.5 Test Plots:

For channel 462.5625MHz





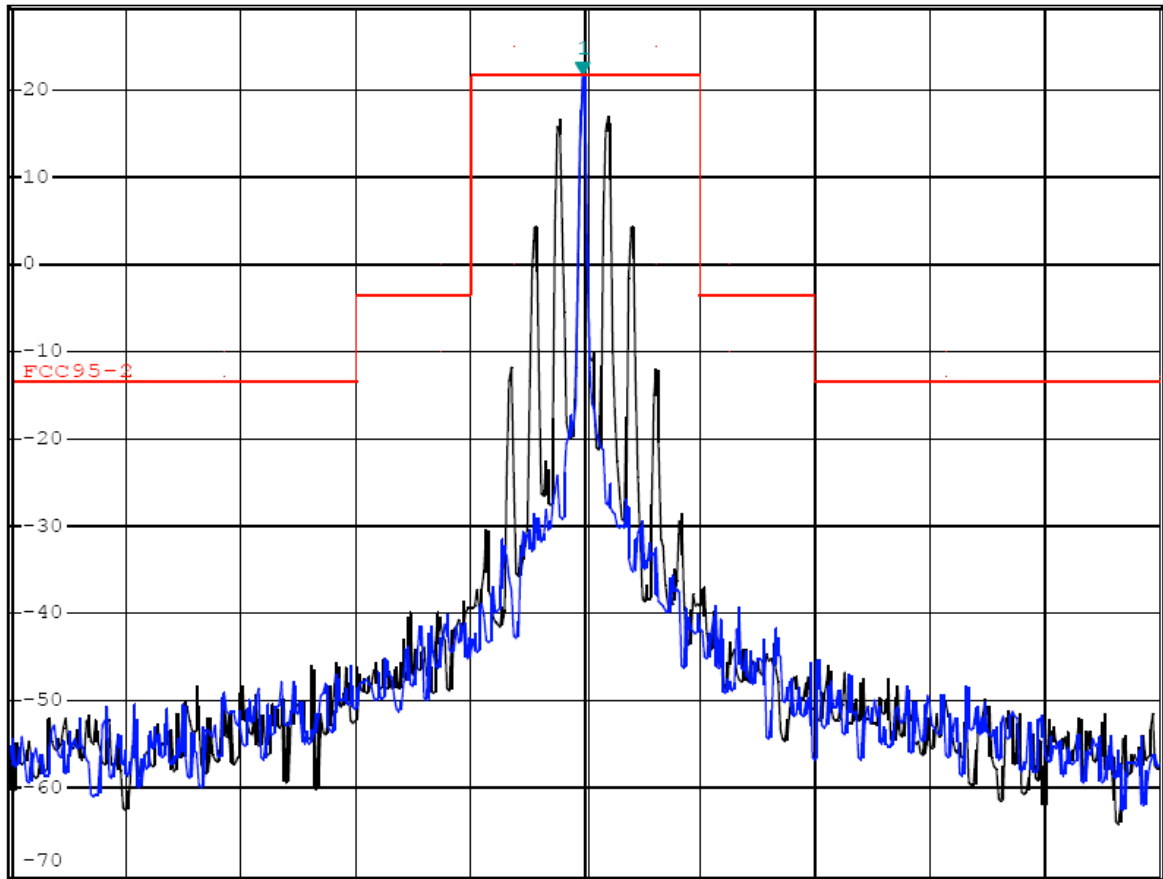
*RBW 300 Hz Marker 1 [T1]
VBW 1 kHz 21.85 dBm
SWT 1.15 s 462.562300000 MHz

Ref 29.5 dBm

*Att 50 dB

1 PK
VIEW

2 PK
VIEW



A

LVL

PS

Conducted emission test



*RBW 100 kHz

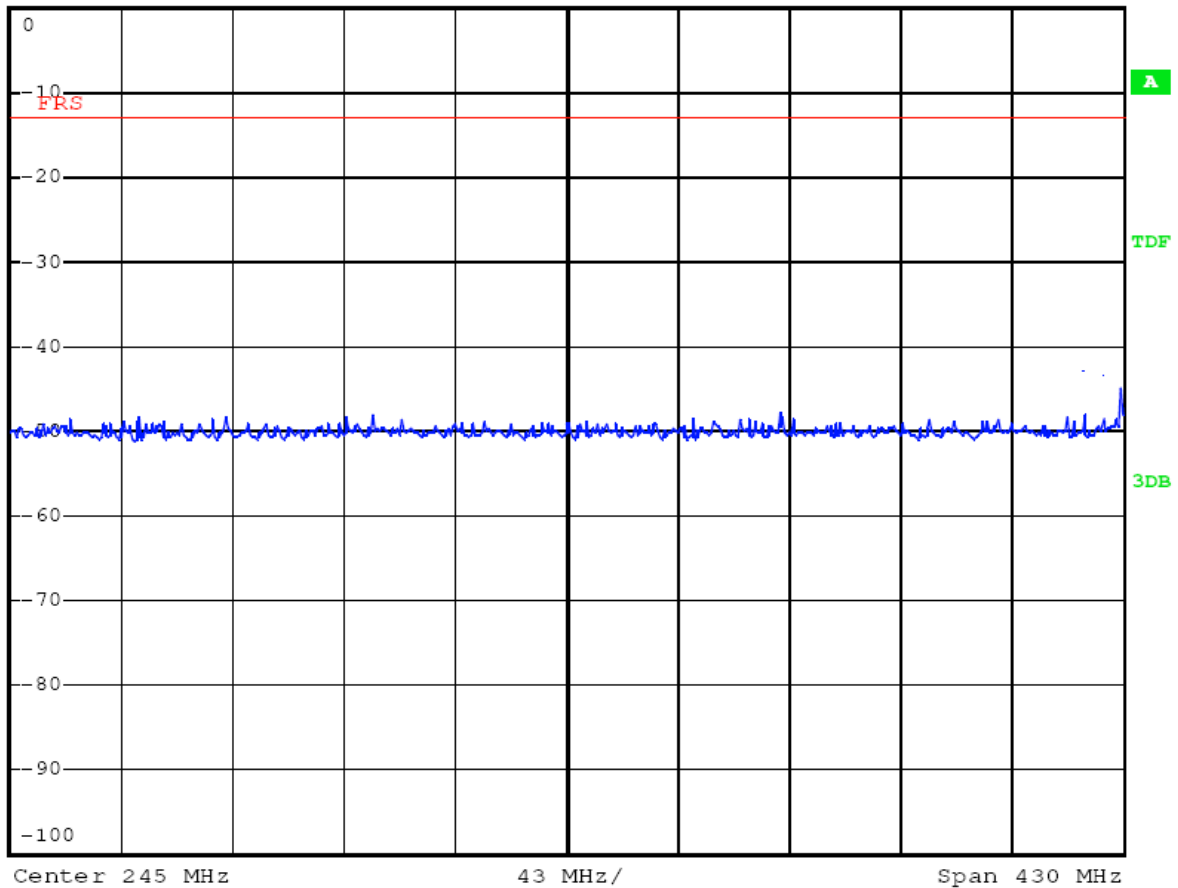
*VBW 100 kHz

Ref 0 dBm

*Att 10 dB

SWT 45 ms

1 PK
VIEW





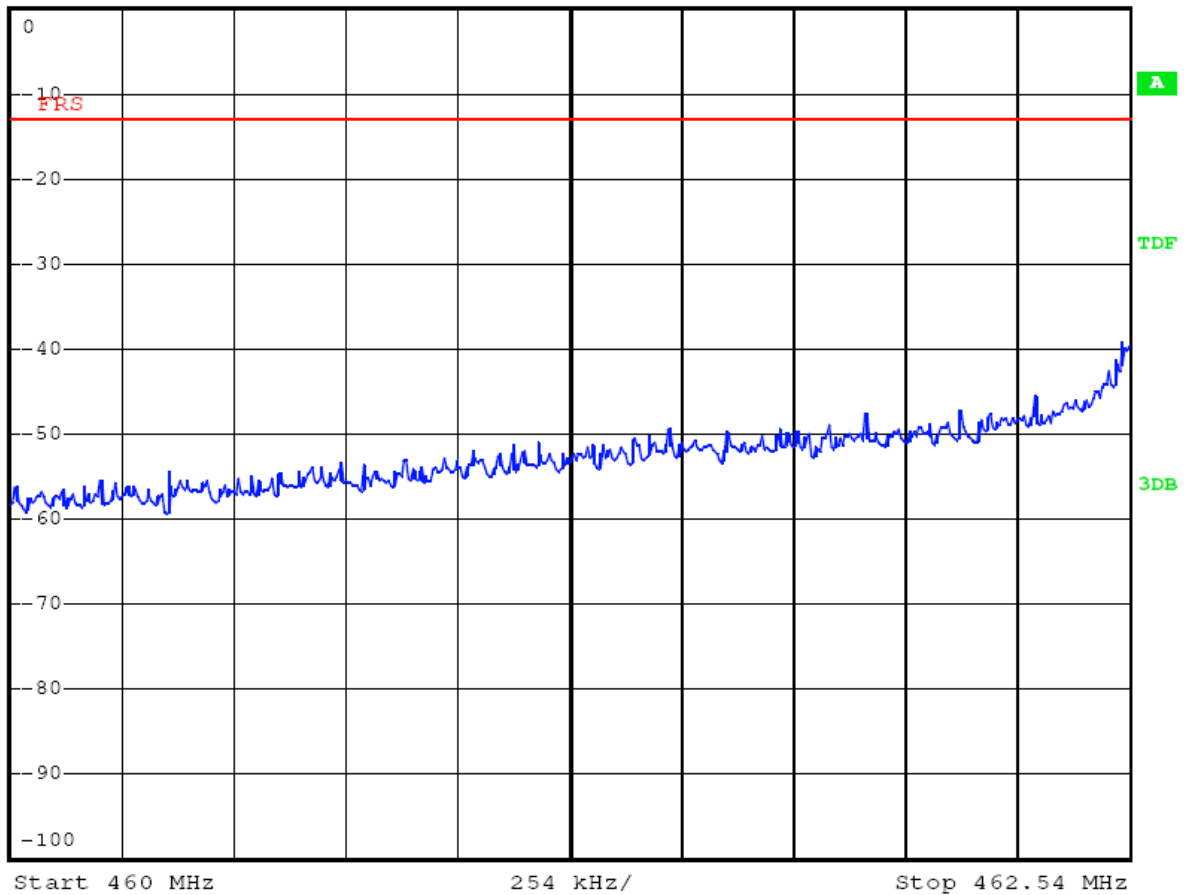
* RBW 10 kHz
* VBW 100 kHz

Ref 0 dBm

* Att 10 dB

SWT 30 ms

1 PK
MAXH





* RBW 10 kHz

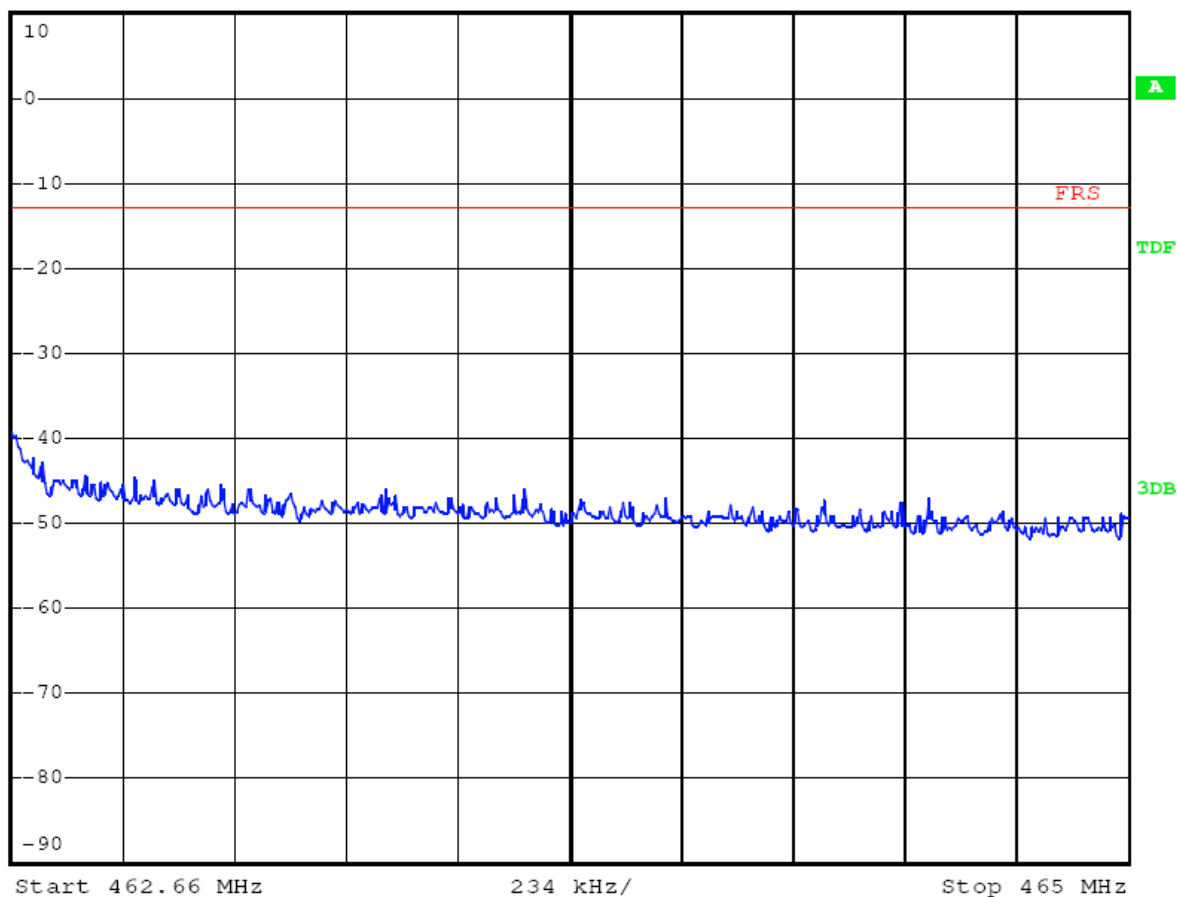
VBW 30 kHz

SWT 25 ms

Ref 10 dBm

* Att 20 dB

1 PR
VIEW





* RBW 100 kHz

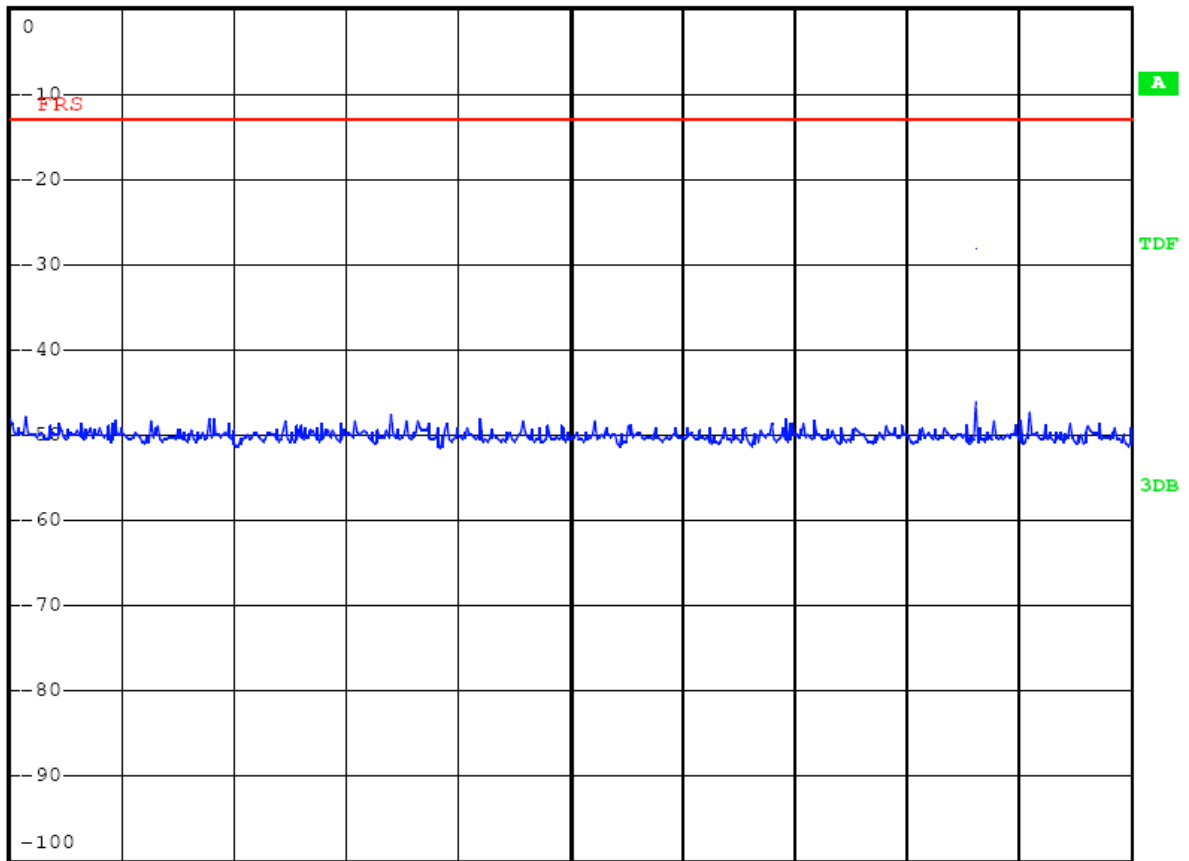
VBW 300 kHz

SWT 55 ms

Ref 0 dBm

* Att 10 dB

1 PK
VIEW



Start 465 MHz

53.5 MHz/

Stop 1 GHz



* RBW 1 MHz

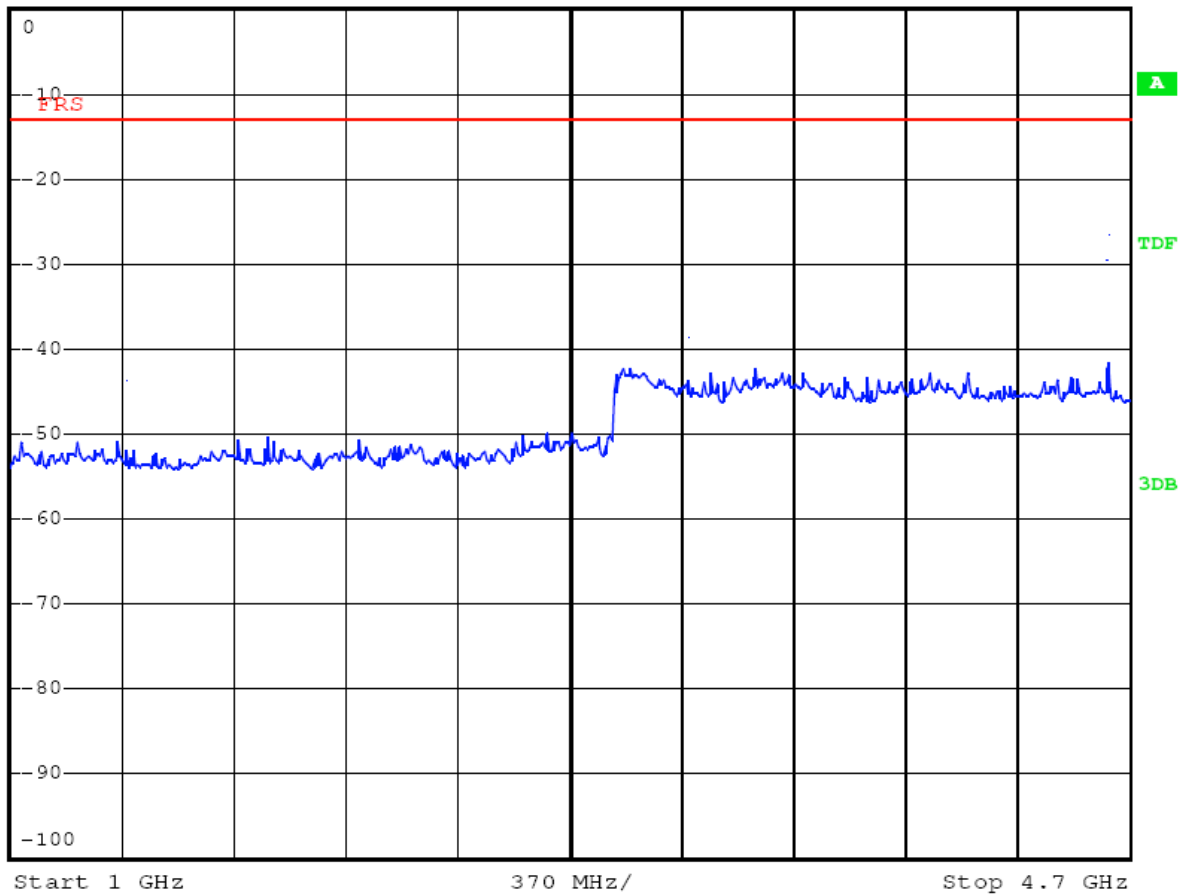
VBW 3 MHz

SWT 75 ms

Ref 0 dBm

* Att 10 dB

1 PK
VIEW





8. UNWANTED RADIATION

8.1 PROVISIONS APPLICABLE

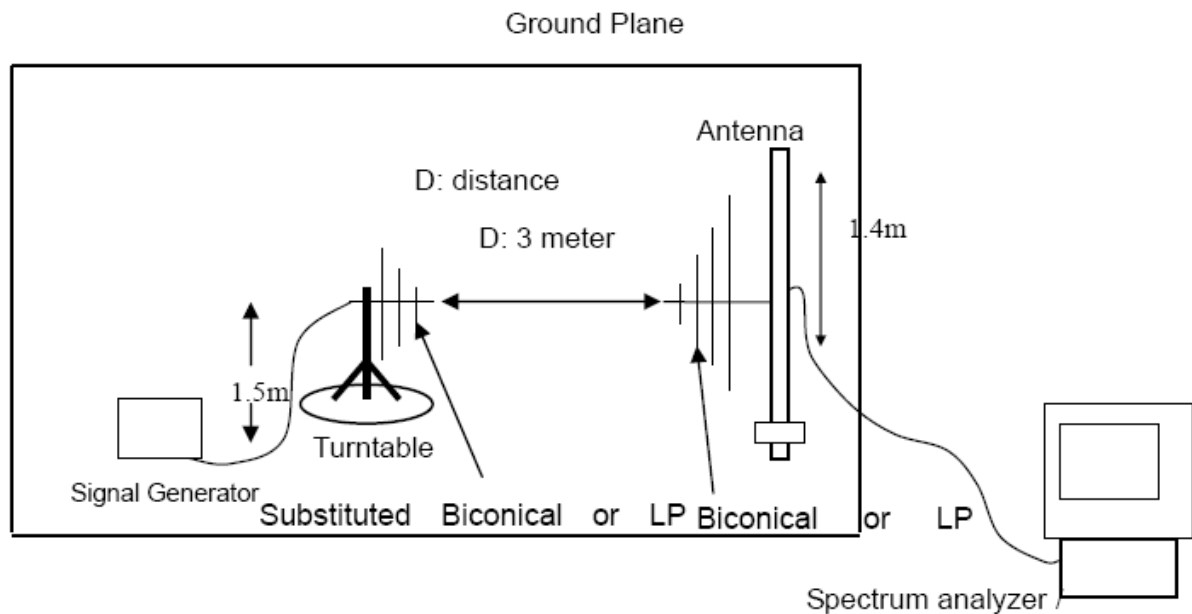
FCC §2.1053 and §95.635

8.2 MEASUREMENT PROCEDURE (Radiated Emissions)

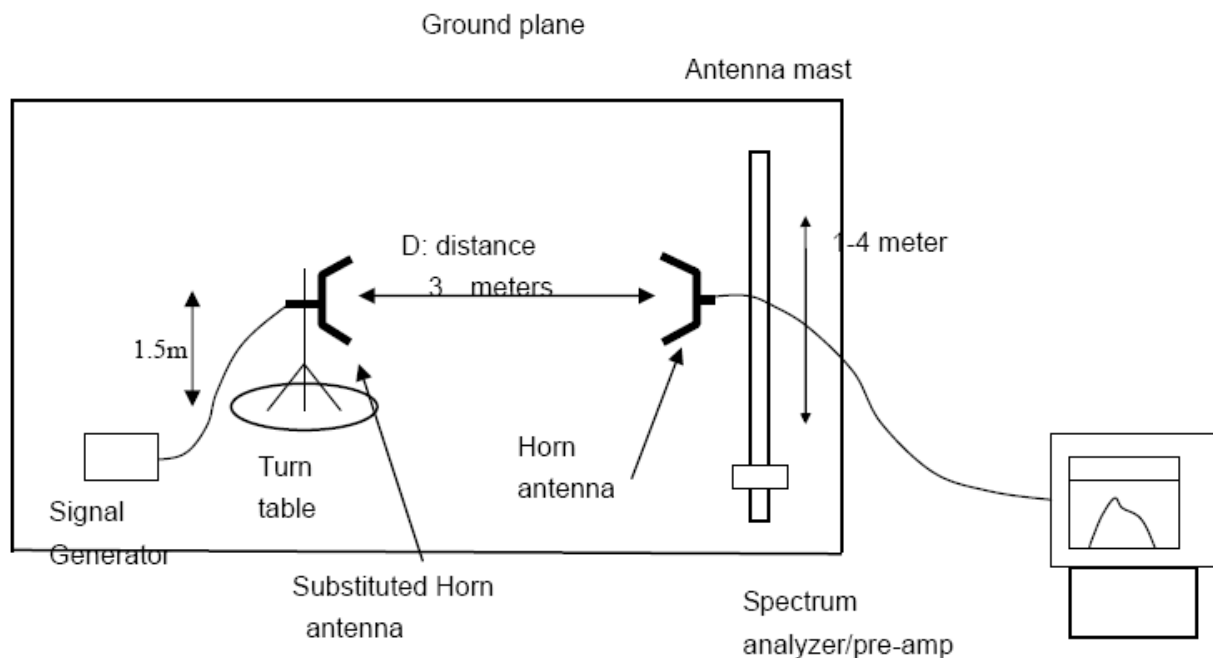
- (1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- (2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
- (3). The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- (4). The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- (5). The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
- (6). The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- (7). The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
- (8). The maximum signal level detected by the measuring receiver shall be noted.
- (9). The measurement shall be repeated with the test antenna set to horizontal polarization.
- (10). Replace the antenna with a proper Antenna (substitution antenna).
- (11). The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
- (12). The substitution antenna shall be connected to a calibrated signal generator.
- (13). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- (14). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- (15). The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- (16). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- (17). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

8.3 Substitution Method: (Radiated Emissions)

Radiated Below 1GHz



Radiated Above 1 GHz



**8.4 MEASUREMENT RESULTS:**

Calculation: Limit (dBm)= EL-43-10log10 (T)=-13dBm

Notes: EL is the emission level of the Output Power expressed in dBm, in this application, the EL is 27 dBm

CH1

Frequency (MHz)	Antennal Polarity	Emission (dBm)	Limit (dBm)
925.125	Vertical	-37.53	-13
1387.6875	Vertical	-43.75	-13
1850.25	Vertical	-46.38	-13
925.125	Horizontal	-41.25	-13
1387.6875	Horizontal	-45.09	-13

Note: ERP was recorded.

9. Modulation Characteristics

9.1 PROVISIONS APPLICABLE

According to CFR 47 section 2.1047(a), for Voice Modulation Communication Equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000Hz shall be measured.

Part95.637: A FRS unit that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 2.5 kHz, and the audio frequency response must not exceed 3.125 kHz

9.2 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, 1500 and 3000Hz in sequence.

9.2.2 Audio Frequency Response

- (1). The EUT and test equipment were set up as shown in figure 2.
- (2). Adjust the Modulation Analyzer for the following setting:
 - a) High-pass filter : off
 - b) Low-pass filter : 15 kHz
 - c) Detector : positive peak
 - d) Function : FM
- (3). The audio signal input was adjusted to obtain 20 % modulation at 1 kHz, and this point was taken as the 0 dB reference level.
- (4). With input levels held constant and below limiting at all frequencies, the audio signal generator was varied from 300 Hz to 5 kHz.
- (5). The response in dB relative to 1 kHz was then measured, using the Modulation Analyzer.

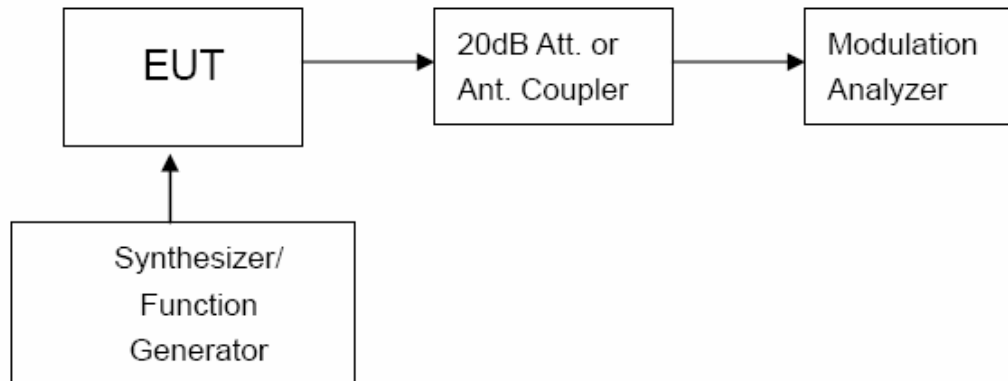


Figure 1: Modulation characteristic measurement configuration

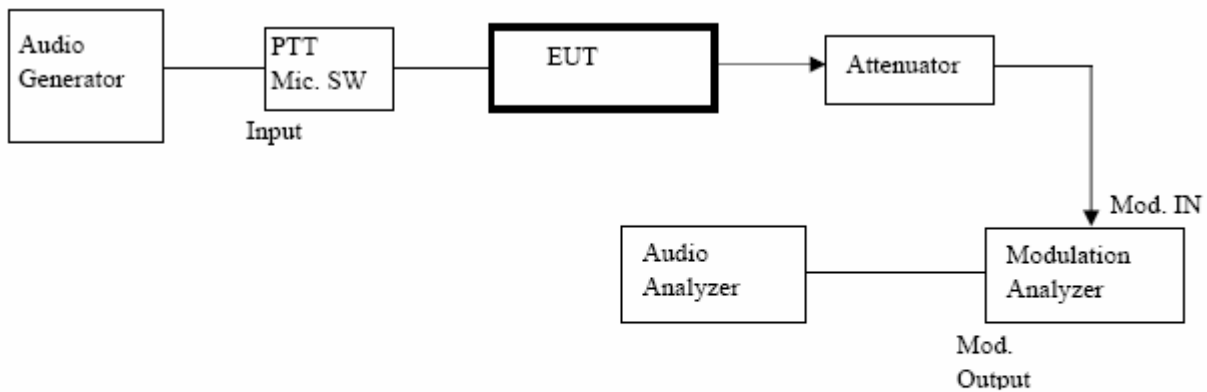


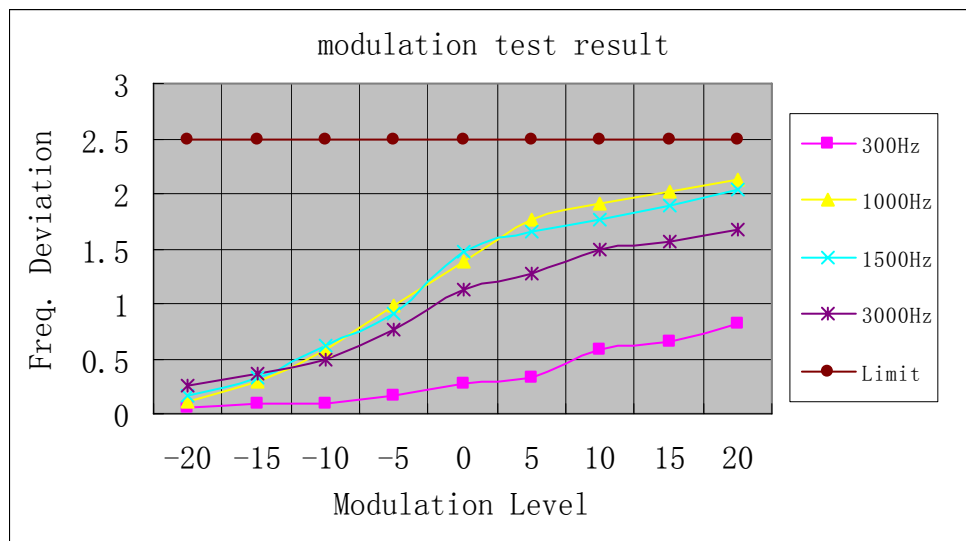
Figure 2: Audio Frequency Response Measurement Configure

9.4 MEASUREMENT RESULT

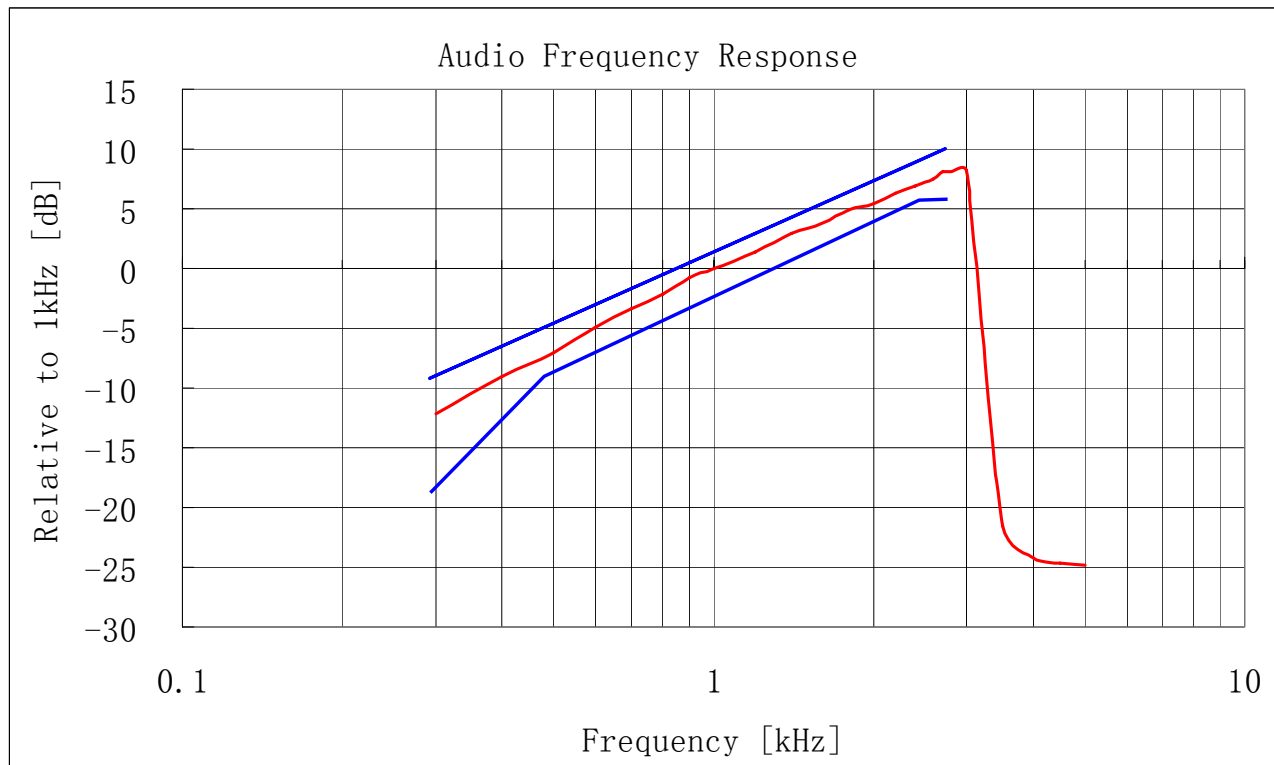
(a). Modulation Limit:

CH1

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz	Peak Freq. Deviation At 1000 Hz	Peak Freq. Deviation At 1500 Hz	Peak Freq. Deviation At 3000 Hz
-20	0.06	0.11	0.17	0.25
-15	0.09	0.3	0.33	0.37
-10	0.1	0.59	0.62	0.49
-5	0.16	0.99	0.91	0.76
0	0.28	1.38	1.47	1.12
5	0.33	1.76	1.65	1.27
10	0.58	1.91	1.77	1.5
15	0.66	2.01	1.89	1.56
20	0.82	2.12	2.03	1.68



(b). Audio Frequency Response:



**10. MAXIMUM TRANSMITTER POWER****10.1 PROVISIONS APPLICABLE**

Per FCC §2.1046 and §95.639(d), No FRS Unit, under any condition of modulation, shall exceed a 0.5 W effective radiated power (ERP).

10.2 TEST PROCEDURE

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the emissions were measured by the substitution.

10.3 TEST RESULT

Power Measurement Results	
Channel	Measurement Result (dBm)
CH1 (462.5625MHz)	23.50

Note: ERP was recorded.



11. Radiated Emission on Receiving Mode

11.1 Provisions Applicable

FCC Part 15 Subpart B Section 15.109

11.2 TEST METHOD

ANSI C 63.4: 2003

11.4 MEASURE RESULT (MEASURED AT 3M USING FCC PART15 B LIMITS)

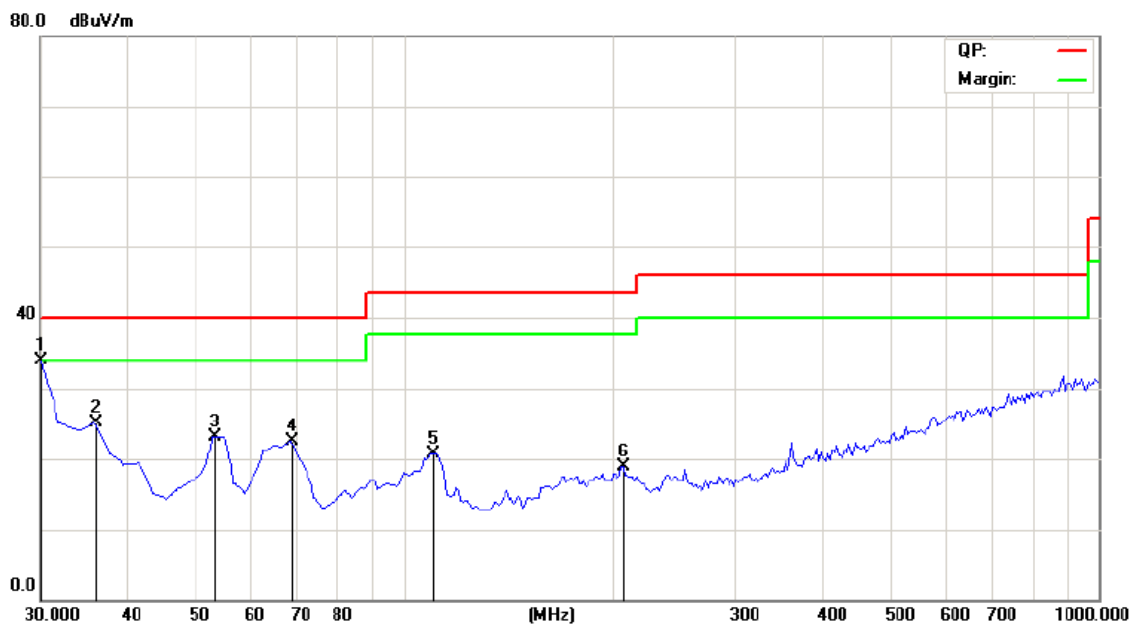
A Radiated Disturbance In Vertical (30MHz----1000MHz)

EUT set Condition: Receiving

Level: Class B

Results: PASS

Please refer to following diagram for individual



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	30.0000	46.81	-12.92	33.89	40.00	-6.11	peak	0	
2		35.8316	37.88	-12.81	25.07	40.00	-14.93	peak	0	
3		53.3267	35.00	-11.83	23.17	40.00	-16.83	peak	0	
4		68.8777	38.14	-15.55	22.59	40.00	-17.41	peak	0	
5		109.6994	32.73	-11.97	20.76	43.50	-22.74	peak	0	
6		206.8938	30.82	-11.89	18.93	43.50	-24.57	peak	0	

B Radiated Disturbance In Horizontal (30MHz----1000MHz)

EUT set Condition: Receiving
Level: Class B
Results: PASS

Please refer to following diagram for individual



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree degree	Comment
1	*	35.8316	32.06	-12.81	19.25	40.00	-20.75	peak		0	
2		31.9438	31.49	-12.97	18.52	40.00	-21.48	peak		0	
3		64.9900	31.02	-14.04	16.98	40.00	-23.02	peak		0	
4		103.8676	28.79	-11.46	17.33	43.50	-26.17	peak		0	
5		362.4048	28.61	-6.15	22.46	46.00	-23.54	peak		0	
6		199.1182	30.08	-12.35	17.73	43.50	-25.77	peak		0	

12.0 FCC ID Label

FCC ID: 2AAYF-AF411

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Mark Location:

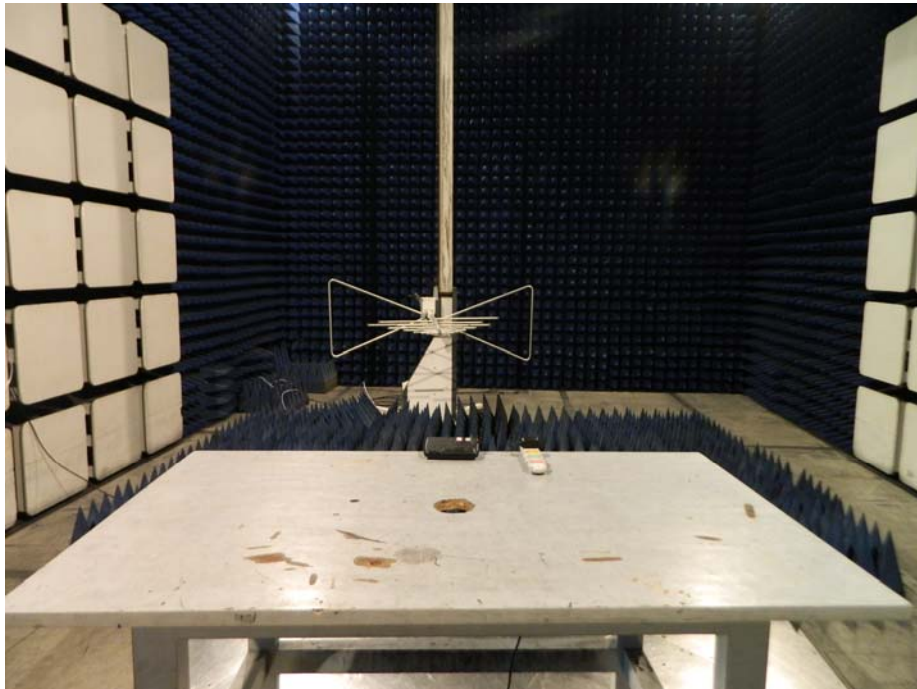
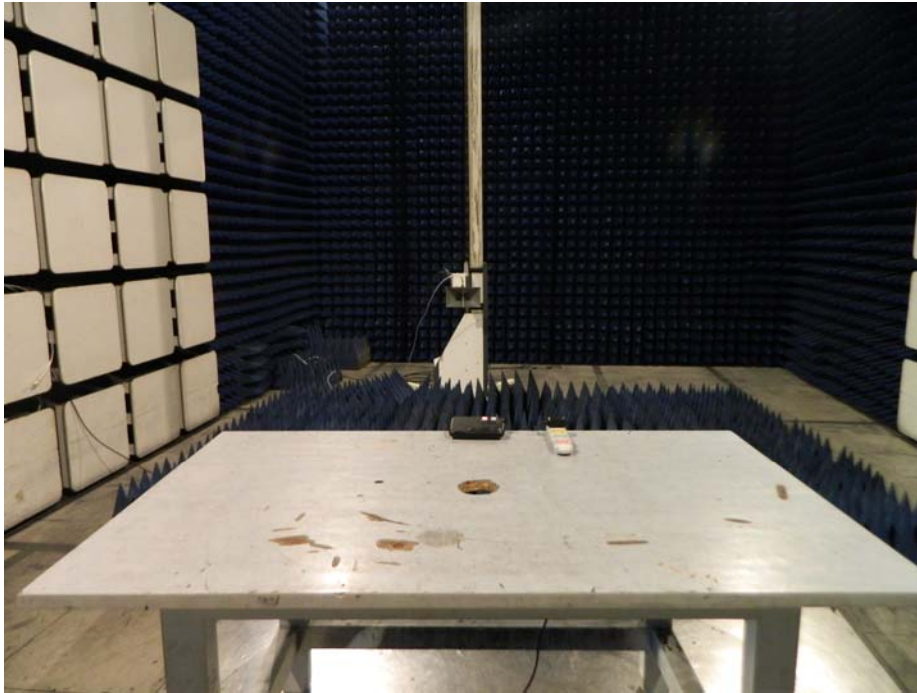


13.0 Photo of testing

13.1 Conducted test View--



13.2 Radiated emission test view



Outside View



Outside View



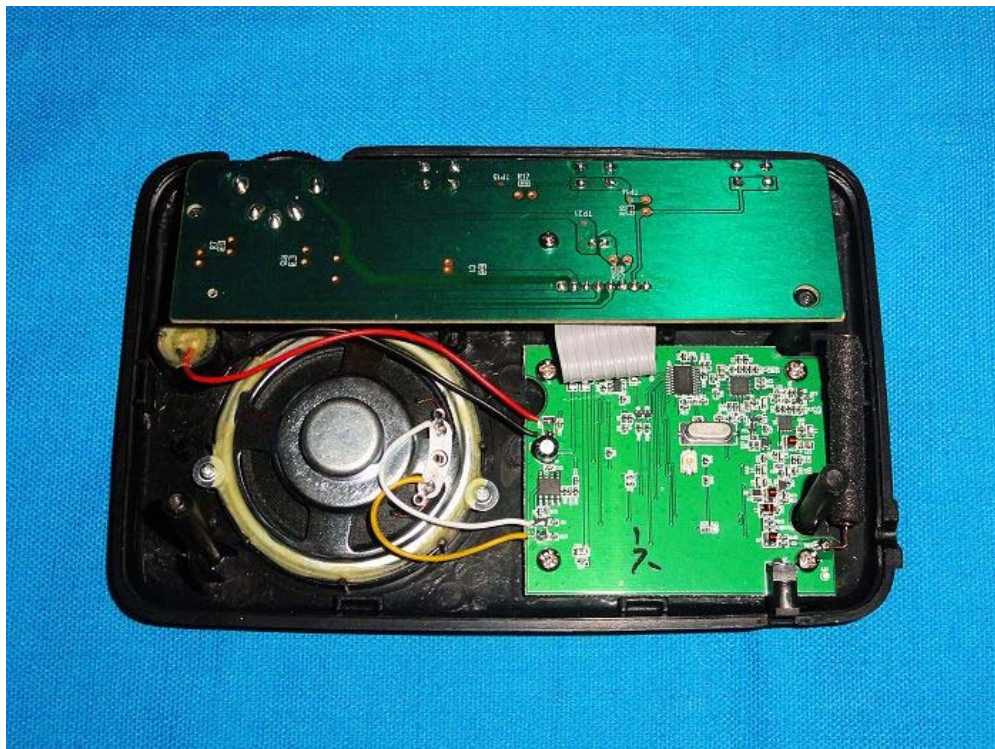
Outside View



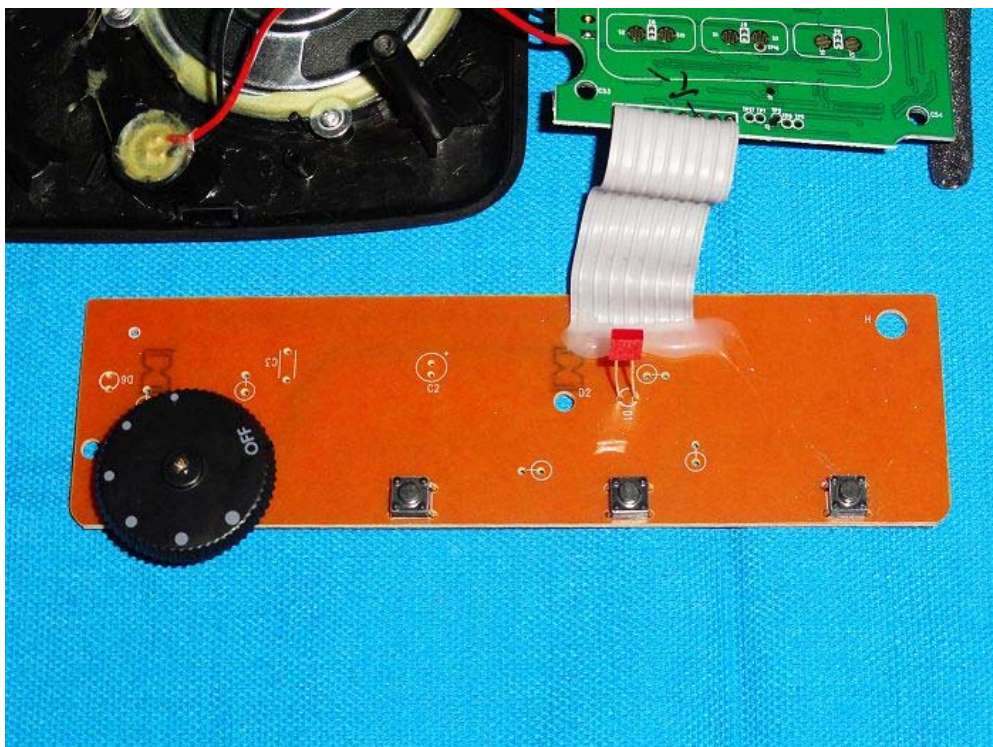
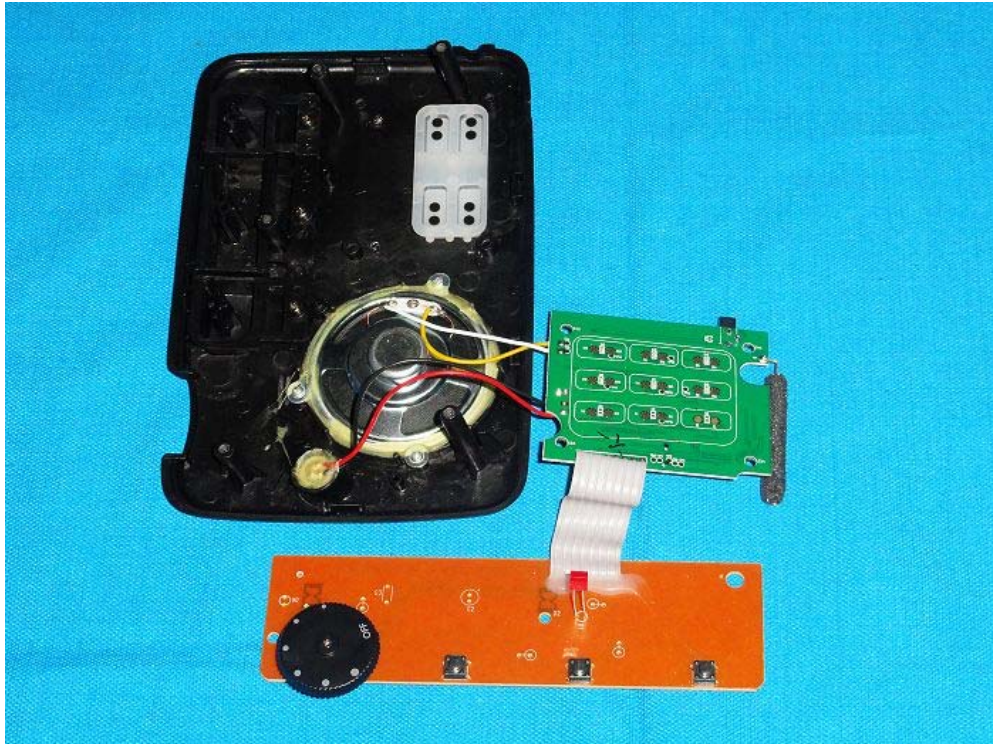
Outside View



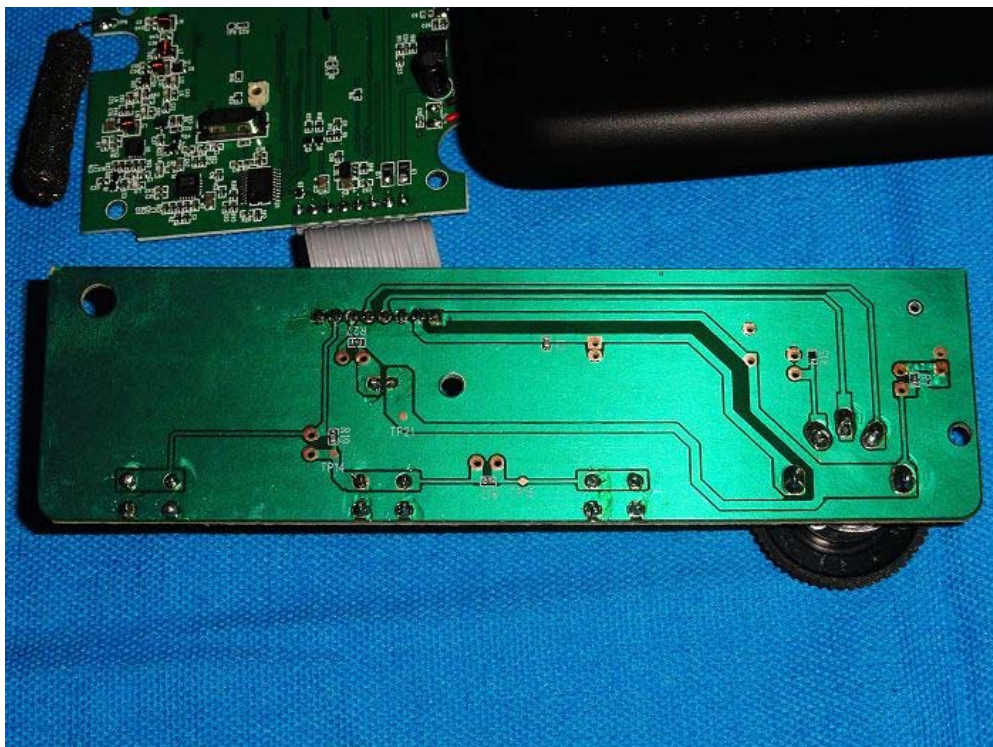
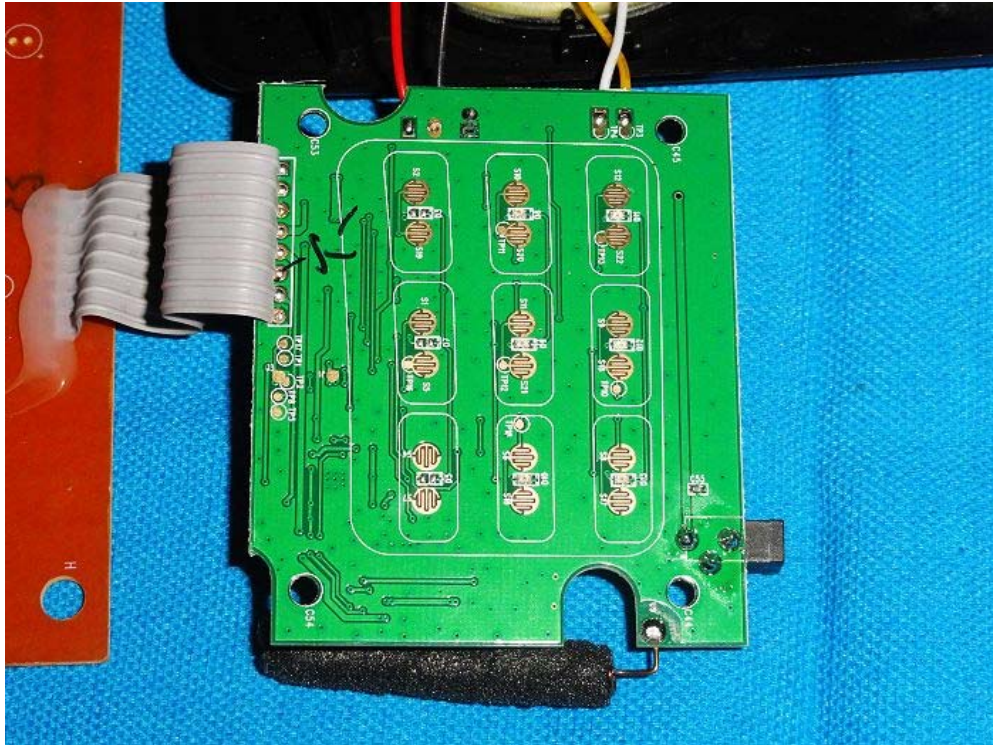
Interior View



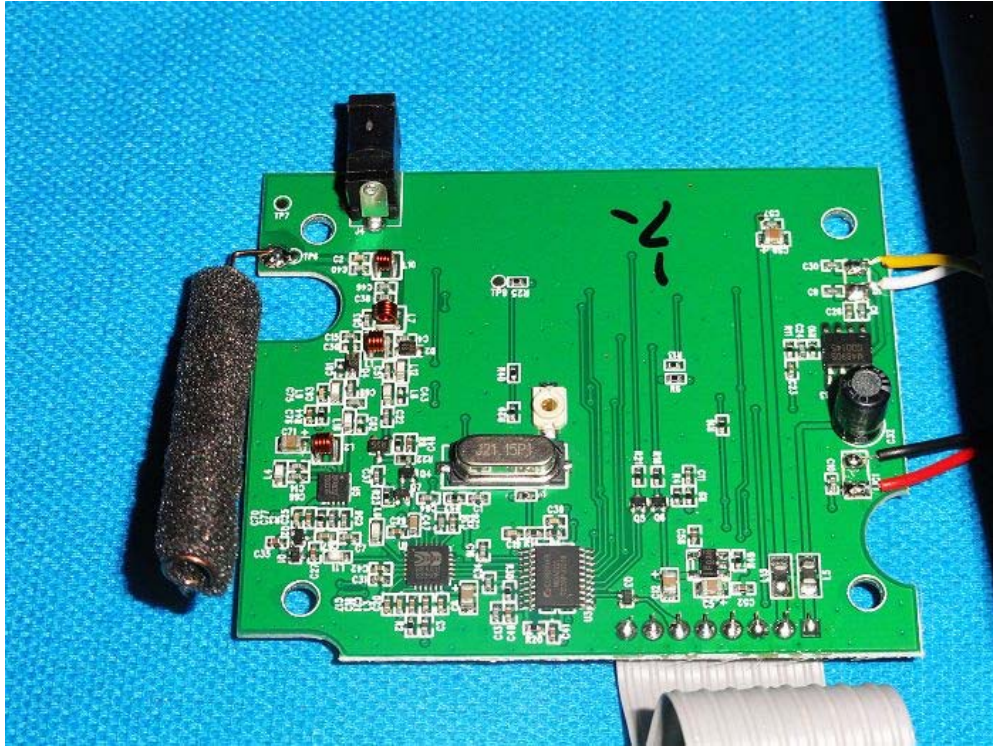
Interior View



Interior View



Interior View



The Report End