

# FCC TEST REPORT

**FCC ID** : 2AAV8D  
**Applicant** : SHENZHEN QIAOHUA INDUSTRIES LIMITED  
**Address** : Qiaohua Industrial Zone, Luo Tian Forestry Center, Song Gang Town, Bao An District, Shenzhen, China  
**Manufacturer** : The same as above  
**Address** : The same as above

**Equipment Under Test (EUT) :**

Product Name : Wireless Doorbell(Transmitter)

Model No. : D

**Rules** : FCC CFR47 Part 15 Subpart C: 2010**Date of Test** : Jun 21~25, 2013**Date of Issue** : July 22, 2013**Test Result** : **PASS\***

Remark:

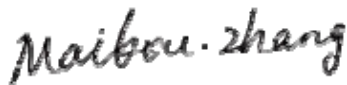
\* The sample described above has been tested to be in compliance with the requirements of ANSI C63.4:2003. The test results have been reviewed and comply with the rules listed above and found to meet their essential requirements.

PERPARED BY:

**Waltek Services (Shenzhen) Co., Ltd.**1/F, Fukangtai Building, West of Baima Road., Songgang Street, Bao'an District,  
Shenzhen, China

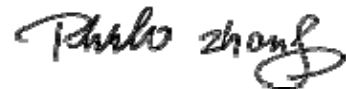
Tel: +86-755-83551033 Fax: +86-755-83552400

Compiled by:



Maikou Zhang / Project Engineer

Approved by:



Philo Zhong / Manager

## 2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	N/A
Radiated Spurious Emissions	15.205(a) 15.209 15.231(b)	PASS
Periodic Operation	15.231(a)	PASS
20dB Bandwidth	15.231(c)	PASS
Antenna Requirement	15.203	PASS

### 3 Contents

	Page
<b>1 COVER PAGE</b> .....	<b>1</b>
<b>2 TEST SUMMARY</b> .....	<b>2</b>
<b>3 CONTENTS</b> .....	<b>3</b>
<b>4 GENERAL INFORMATION</b> .....	<b>4</b>
4.1 GENERAL DESCRIPTION OF E.U.T. ....	4
4.2 DETAILS OF E.U.T. ....	4
4.3 TEST FACILITY .....	4
4.4 TEST LOCATION.....	4
4.5 GENERAL CONDITION .....	4
4.5.1 <i>Environmental condition of test site</i> .....	5
4.5.2 <i>Test Mode</i> .....	5
<b>5 EQUIPMENT USED DURING TEST</b> .....	<b>6</b>
5.1 EQUIPMENTS LIST .....	6
5.2 MEASUREMENT UNCERTAINTY .....	6
5.3 TEST EQUIPMENT CALIBRATION .....	6
<b>6 CONDUCTED EMISSION TEST</b> .....	<b>7</b>
<b>7 RADIATION EMISSION TEST</b> .....	<b>8</b>
7.1 EUT OPERATION: .....	9
7.2 TEST SETUP .....	9
7.3 SPECTRUM ANALYZER SETUP .....	11
7.4 TEST PROCEDURE .....	11
7.5 CORRECTED AMPLITUDE & MARGIN CALCULATION .....	11
7.6 SUMMARY OF TEST RESULTS .....	12
<b>8 PERIODIC OPERATION</b> .....	<b>16</b>
<b>9 20DB BANDWIDTH</b> .....	<b>19</b>
9.1 TEST PROCEDURE .....	19
9.2 TEST RESULT .....	19
<b>10 ANTENNA REQUIREMENT</b> .....	<b>20</b>
<b>11 PHOTOGRAPHS OF TESTING</b> .....	<b>21</b>
11.1 RADIATION EMISSION TEST VIEW .....	21
<b>12 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS</b> .....	<b>23</b>
12.1 EUT - APPEARANCE VIEW .....	23
12.2 EUT- INTERNAL VIEW .....	26

## 4 General Information

### 4.1 General Description of E.U.T.

Product Name	: Wireless Doorbell(Transmitter)
Model No.	: D
Type of Modulation	: FSK
Note	: N/A
Frequency Range	: 433.92 MHz (transmitter)
Oscillator	: 433.92MHz
Antenna installation	: PCB Printed Antenna

### 4.2 Details of E.U.T.

Technical Data	: DC 12V Powered by Battery
Adapter manufacturer	: N/A
M/N	: N/A

### 4.3 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A**

Waltek Services (Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A, July 12, 2012.

- **FCC – Registration No.: 880581**

Waltek Services (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, May 26, 2011.

### 4.4 Test Location

All Emissions tests were performed at:-

Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen 518105, China.

### 4.5 General condition

Ambient Condition: 25.5 °C 58 %RH

#### 4.5.1 Environmental condition of test site

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

The follow condition is not applicable

Test Voltage	Input voltage
Rated voltage-15%	#####
normal	#####
Rated voltage+15%	#####

The follow condition is applicable.

Test voltage	Test Voltage
Rated voltage	New Battery DC 12V

#### 4.5.2 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	MHz	433.92MHz	MHz
Receiving	MHz	MHz	MHz

## 5 Equipment Used during Test

### 5.1 Equipments List

3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Aug. 13,2012	Aug. 12,2013
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2012	Aug. 12,2013
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr. 20,2013	Apr. 19,2014
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr. 20,2013	Apr. 19,2014
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2012	Aug. 12,2013
6.	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07,2013	Apr.06,2014
7.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2012	Aug. 12,2013
8.	Cable	Top	EWO2014-7	-	Apr. 20,2013	Apr. 19,2014
9.	Cable	Top	TYPE16(13M)	-	Aug. 13,2012	Aug. 12,2013

### 5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	$\pm 1.0$ dB
RF Power Density	$\pm 2.2$ dB
Radiated Spurious Emissions test	$\pm 5.03$ dB (30M~1000MHz)
	$\pm 4.74$ dB (1000M~25000MHz)

### 5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

## 6 Conducted Emission Test

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Frequency Range:	150kHz to 30MHz
Class:	Class B
Limit:	66-56 dB $\mu$ V between 0.15MHz & 0.5MHz 56 dB $\mu$ V between 0.5MHz & 5MHz 60 dB $\mu$ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit
Test Result:	N/A
Remark:	This device powered by battery, this test is not applicable.

## 7 Radiation Emission Test

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247  
 Test Method: ANSI C63.4:2003  
 Measurement Distance: 3m  
 Test Result: PASS

15.209 The spurious radiated emissions limit:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 -0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

15.231 (b) Limit: The field strength of emissions

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	1,250 to 3,750**	125 to 375**
174-260	3,750	375
260-470	3,750 to 12,500**	375 to 1,250**
Above 470	12,500	1,250

\*\* linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz,  $\mu\text{V/m}$  at 3 meters =  $56.81818(F) - 6136.3636$ ; for the band 260-470 MHz,  $\mu\text{V/m}$  at 3 meters =  $41.6667(F) - 7083.3333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

- (1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.
- (2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.



- (3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.
- (4) Where F is the frequency in MHz, The formulas for calculating the maximum permitted fundamental field strengths are as follows:

Sample calculation of limit @ 433.92MHz

$41.6667 (433.92) - 7083.3333 = 10996.681 \mu\text{V/m}$

$20\log(10996.681) = 80.82 \text{ dBuV/m(AV) limit @ 433.92MHz}$

## 7.1 EUT Operation:

### Operating Environment:

Temperature: 25.5 °C  
Humidity: 51 % RH  
Atmospheric Pressure: 1010 mbar

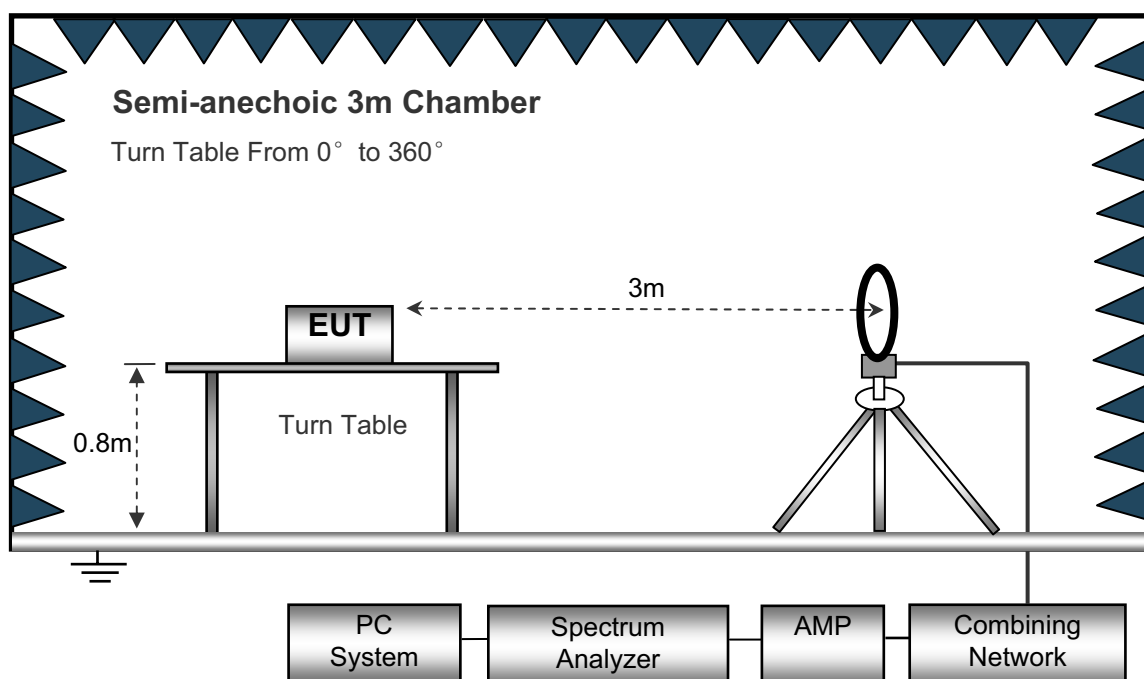
### Operation Mode:

The EUT was tested in working mode. The test data were shown as follow.

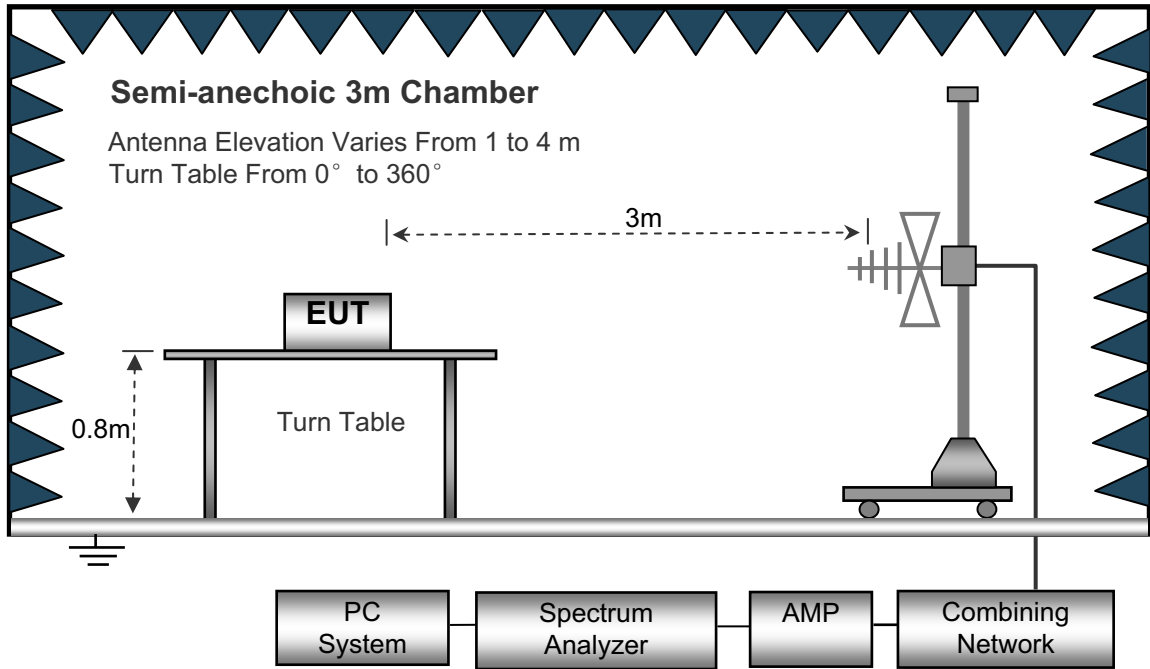
## 7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

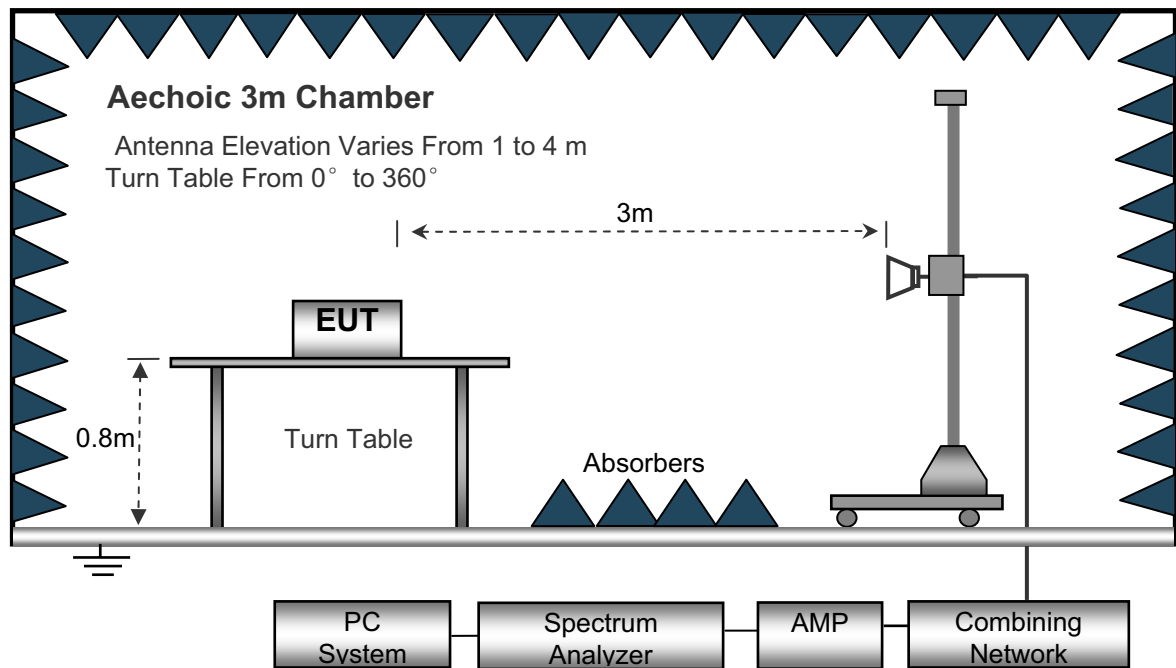
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



### 7.3 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested from 9KHz to 5GHz.

Below 30MHz

Sweep Speed .....Auto  
 IF Bandwidth .....10KHz  
 Video Bandwidth .....10KHz  
 Resolution Bandwidth .....10KHz

30MHz ~ 1GHz

Sweep Speed .....Auto  
 IF Bandwidth .....120 KHz  
 Video Bandwidth .....100KHz  
 Quasi-Peak Adapter Bandwidth .....120 KHz  
 Quasi-Peak Adapter Mode .....Normal  
 Resolution Bandwidth .....100KHz

Above 1GHz

Sweep Speed .....Auto  
 IF Bandwidth .....120 KHz  
 Video Bandwidth .....3MHz  
 Quasi-Peak Adapter Bandwidth .....120 KHz  
 Quasi-Peak Adapter Mode .....Normal  
 Resolution Bandwidth .....1MHz

### 7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X, Y, Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand). After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

### 7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:  
 Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain the **"Margin"** column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

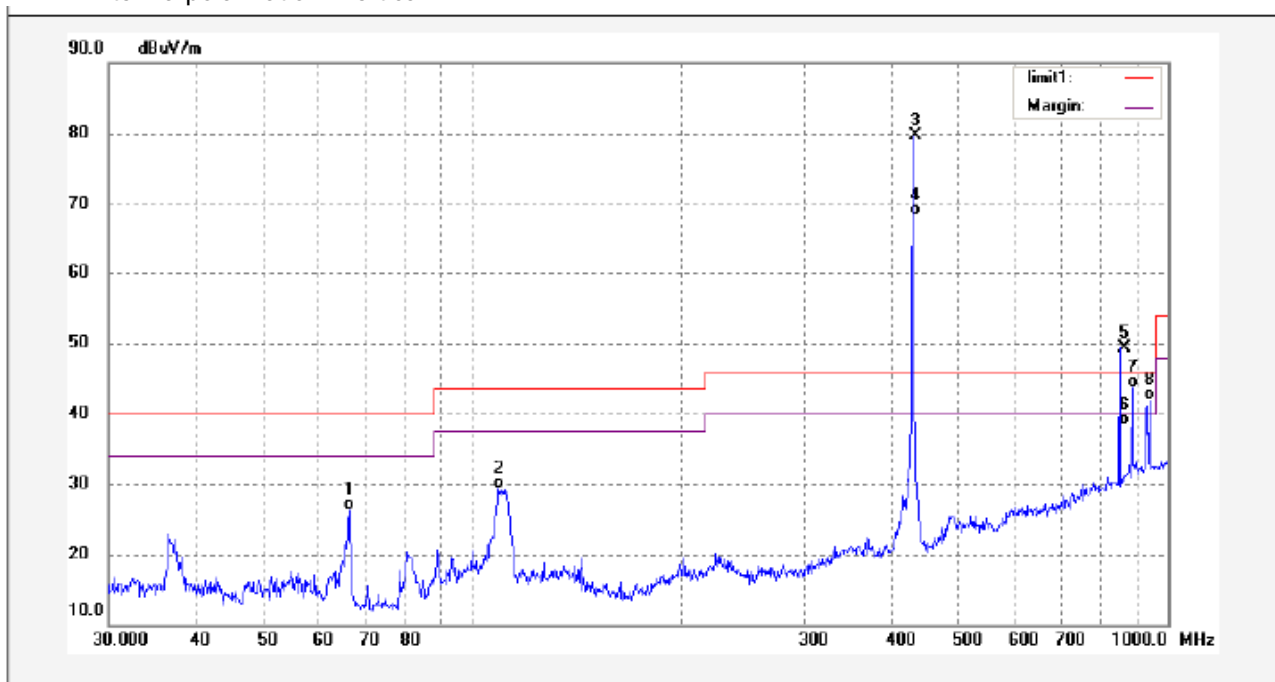
### 7.6 Summary of Test Results

**Test Frequency :Below 30MHz**

The measurements were more than 20 dB below the limit and not reported.

**Test Frequency : 30MHz ~ 1000MHz**

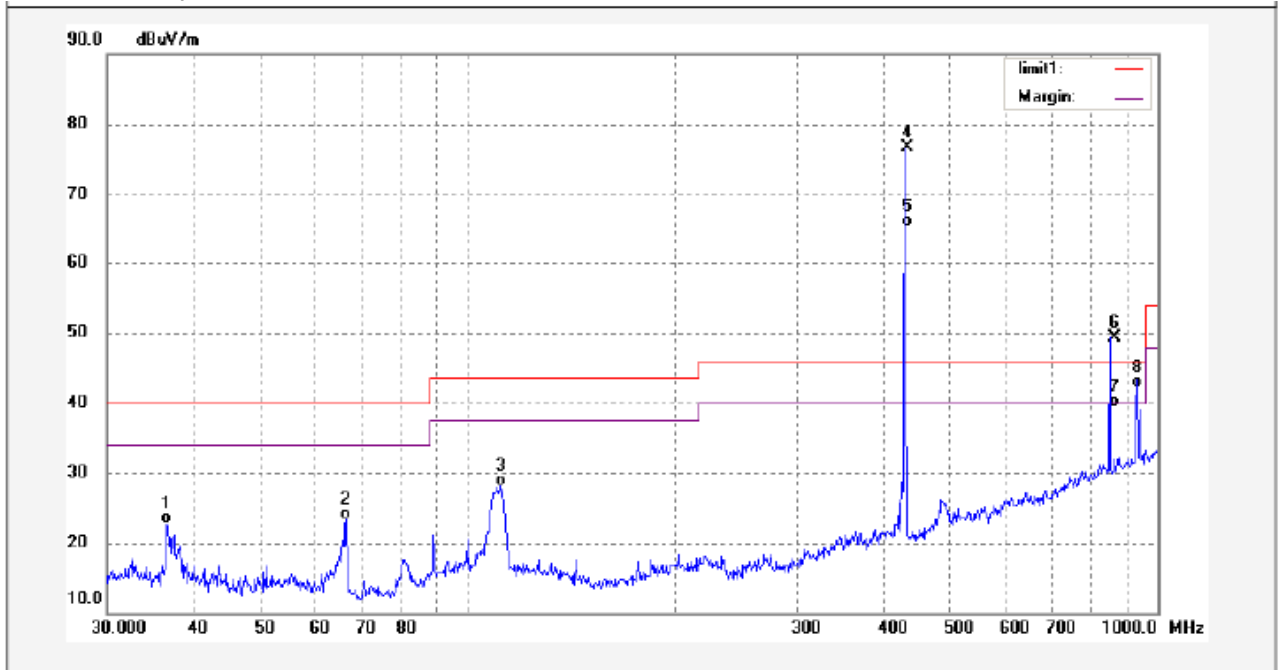
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	66.6051	15.50	10.72	26.22	40.00	-13.78	QP	
2	108.9276	15.50	13.88	29.38	43.50	-14.12	QP	
3	433.9200	59.96	19.68	79.64	100.82	-34.36	peak	
4	433.9200	48.57	19.68	68.25	80.82	-25.75	AVG	
5	867.8400	19.55	29.71	49.26	80.82	-44.74	peak	
6	867.8400	8.56	29.71	38.27	60.82	-35.73	AVG	
7	890.5212	12.82	30.17	42.99	46.00	-3.01	QP	
8	942.0180	10.65	31.26	41.91	46.00	-4.09	QP	

Remark:the marker 3&4 is the fundamental

Antenna polarization: Horizontal



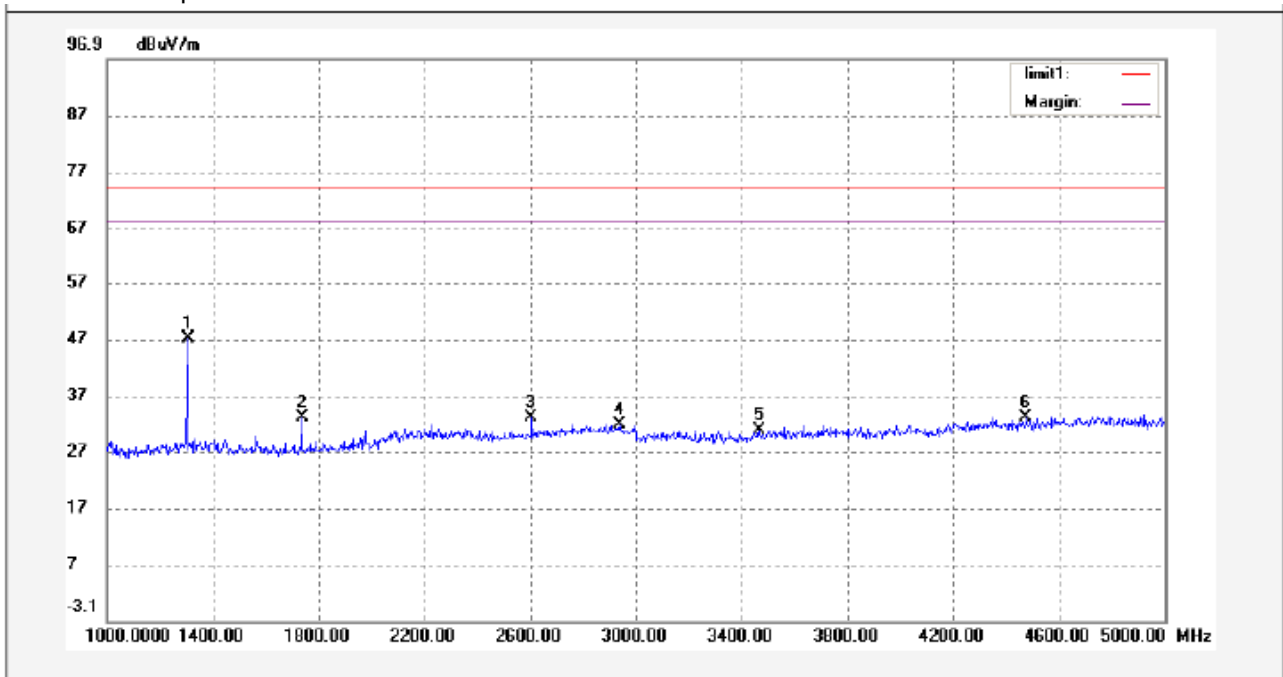
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	36.6521	6.23	16.45	22.68	40.00	-17.32	QP	
2	66.6051	12.58	10.72	23.30	40.00	-16.70	QP	
3	111.2483	14.61	13.48	28.09	43.50	-15.41	QP	
4	433.9200	57.07	19.68	76.75	100.82	-37.25	peak	
5	433.9200	45.58	19.68	65.26	80.82	-28.74	AVG	
6	867.8400	19.63	29.71	49.34	80.82	-44.66	peak	
7	867.8400	9.53	29.71	39.24	60.82	-34.76	AVG	
8	935.4214	10.83	31.37	42.20	46.00	-3.80	QP	

Remark:the marker 4&5 is the fundamental

**Test Frequency: 1GHz ~ 5GHz**

AV = Peak +20Log<sub>10</sub>(duty cycle) =PK+(-18) [refer to section 8 for more detail]

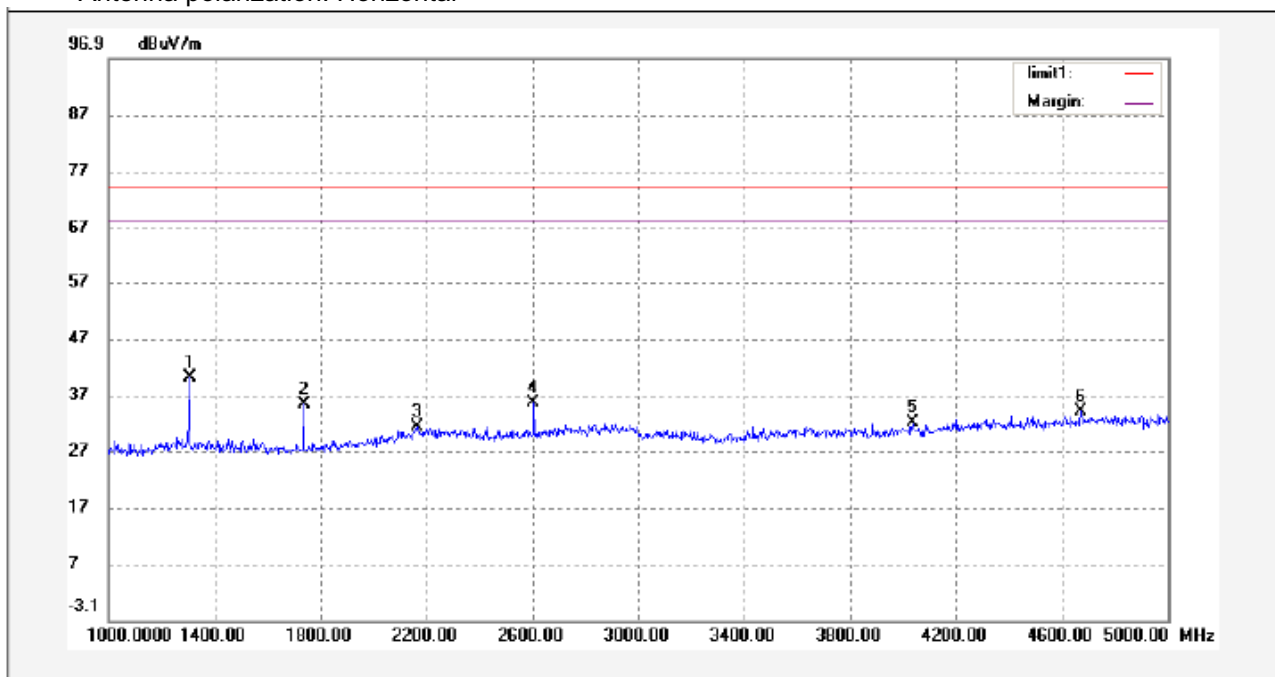
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1304.000	64.28	-17.18	47.10	80.82	-33.72	peak	
2	1736.000	50.86	-17.85	33.01	80.82	-47.81	peak	
3	2604.000	48.41	-15.39	33.02	80.82	-47.80	peak	
4	2940.000	46.50	-14.77	31.73	74.00	-42.27	peak	
5	3464.000	45.27	-14.54	30.73	80.82	-50.09	peak	
6	4476.000	45.92	-12.81	33.11	74.00	-40.89	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1304.000	-18	29.1	60.82	-31.72	AV	
2	1736.000	-18	15.01	60.82	-45.81	AV	
3	2604.000	-18	15.02	60.82	-45.80	AV	
4	2940.000	-18	13.73	54.00	-40.27	AV	
5	3464.000	-18	12.73	60.82	-48.09	AV	
6	4476.000	-18	15.11	54.00	-38.89	AV	

Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1304.000	57.18	-17.18	40.00	80.82	-40.82	peak	
2	1736.000	53.03	-17.85	35.18	80.82	-45.64	peak	
3	2164.000	46.66	-15.34	31.32	80.82	-49.50	peak	
4	2604.000	50.93	-15.39	35.54	80.82	-45.28	peak	
5	4036.000	45.32	-13.39	31.93	74.00	-42.07	peak	
6	4672.000	46.34	-12.26	34.08	74.00	-39.92	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1304.000	-18	22.00	60.82	-38.82	AV	
2	1736.000	-18	17.18	60.82	-43.64	AV	
3	2164.000	-18	13.32	60.82	-47.50	AV	
4	2604.000	-18	17.54	60.82	-43.28	AV	
5	4036.000	-18	13.93	54.00	-40.07	AV	
6	4672.000	-18	16.08	54.00	-37.92	AV	

## 8 Periodic Operation

The duty cycle was determined by the following equation:

To calculate the actual field intensity, The duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

**Duty Cycle(%)=**

**Total On interval in a complete pulse train/ Length of a complete pulse train \* %**

**Duty Cycle Correction Factor(dB)=20 \* Log<sub>10</sub>(Duty Cycle(%))**

Pulse Train	Number of Pulse	T(ms)	Total Time(ms)
Long Pulse	7	1.068	7.476
Short Pulse	11	0.384	4.224

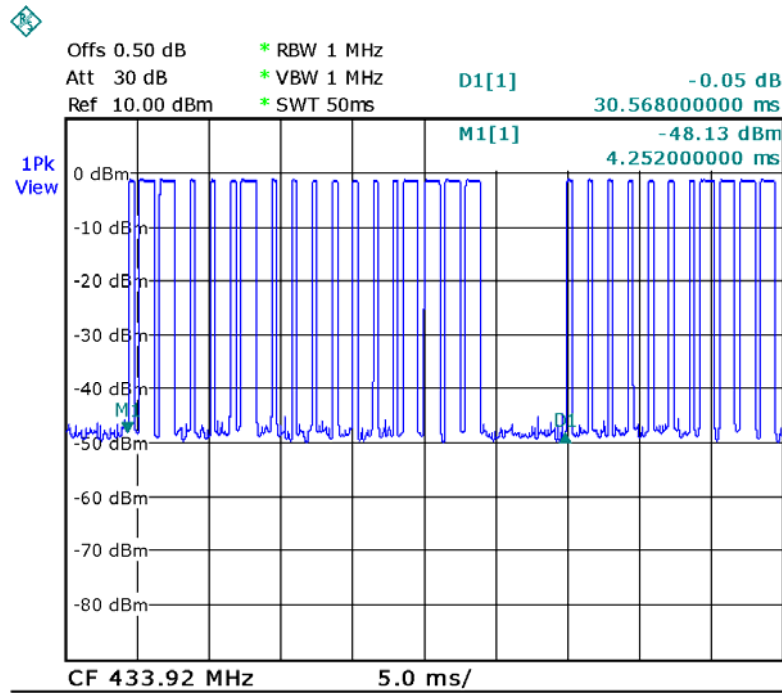
Total On interval in a complete pulse train(ms)	11.7
Length of a complete pulse train(ms)	50
Duty Cycle(%)	11.7
Duty Cycle Correction Factor(dB)	-18



Refer to the duty cycle plot (as below), This device meets the FCC requirement.

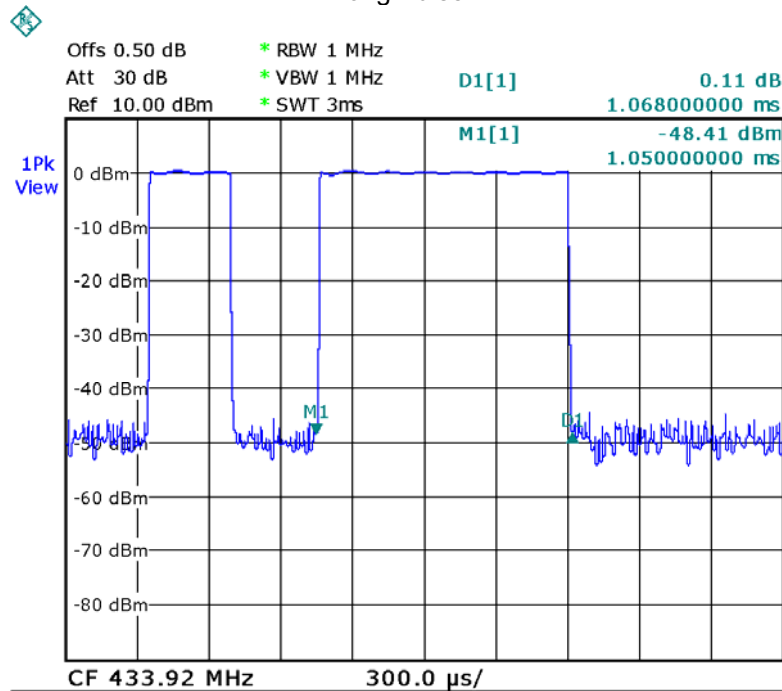
Length of a complete pulse train:

Remark: FCC part 15.35(c) required that a complete pulse train is more than 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 value.



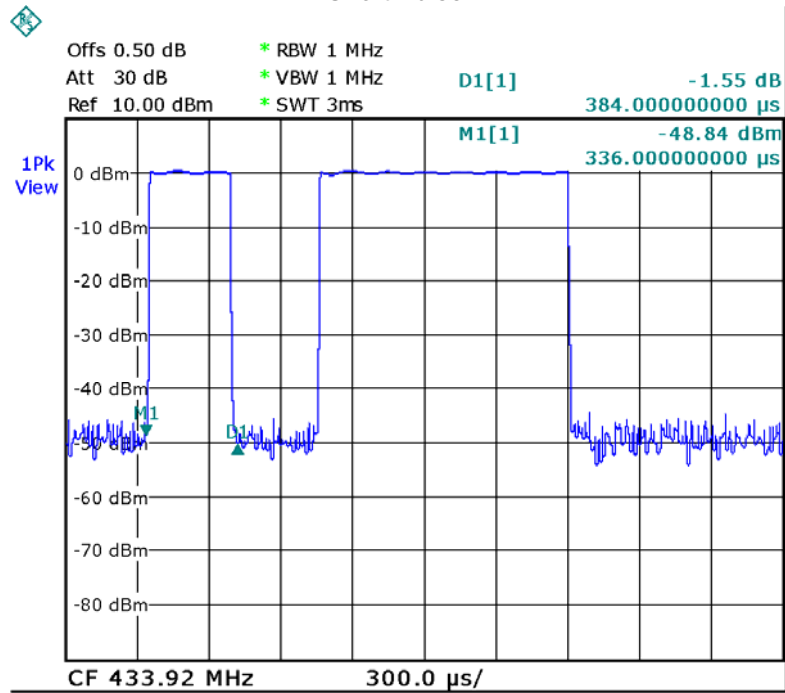
Date: 21.JUN.2013 23:07:59

Long Pulse



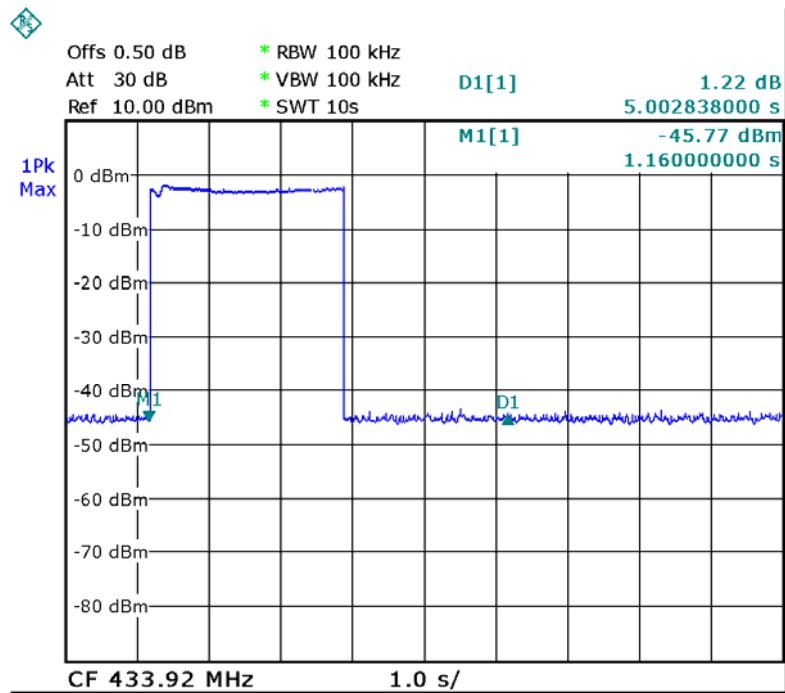
Date: 22.JUN.2013 00:33:07

Short Pulse:



Date: 22.JUN.2013 00:32:46

Refer to the plot (as below), We find a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter immediately, within not more than 5 seconds of being released.



Date: 22.JUN.2013 00:29:34

## 9 20dB Bandwidth

Test Requirement: FCC Part15 C  
 Test Method: FCC Part15 Paragraph 15.231(c)  
 Limit: The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

### 9.1 Test Procedure

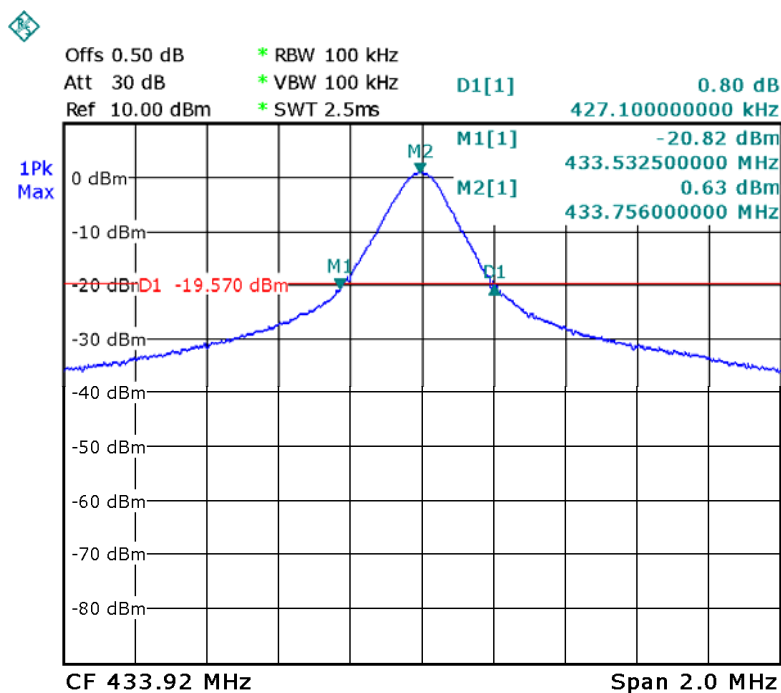
1. The transmitter output (antenna port) was connected to the spectrum analyzer.EUT and its simulators are placed on a table, let EUT working in test mode,then test it.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 100KHz RBW and 100KHz VBW.The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power 20dB.

### 9.2 Test Result

Frequency (MHz)	Bandwidth Emission (KHz)	Limit (KHz)	Result
433.92	427.100	1084.8	Pass

Limit=Center Frequency\*0.25%

Test Plot



Date: 22.JUN.2013 00:34:17

## 10 Antenna Requirement

According to the FCC Part 15 Paragraph 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 use of a permanently attached antenna to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product use a permanent PCB printed antenna, fulfill the requirement of this section

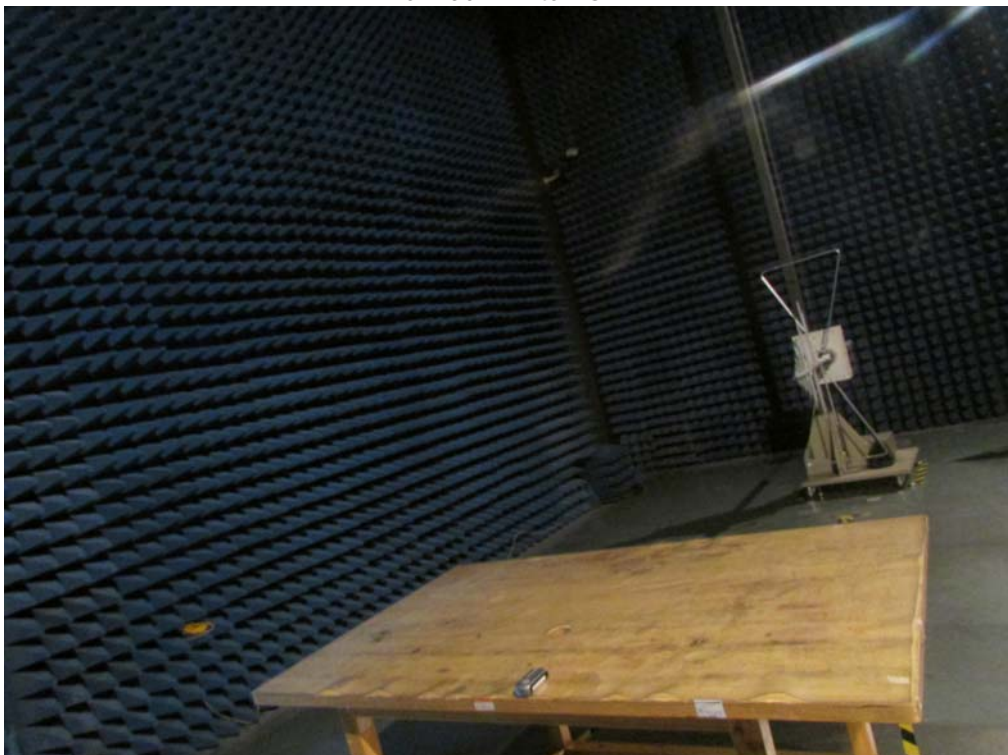
## 11 Photographs of Testing

### 11.1 Radiation Emission Test View

Below 30MHz



From 30MHz to 1GHz



Above 1GHz





## 12 Photographs - Constructional Details

### 12.1 EUT - Appearance View

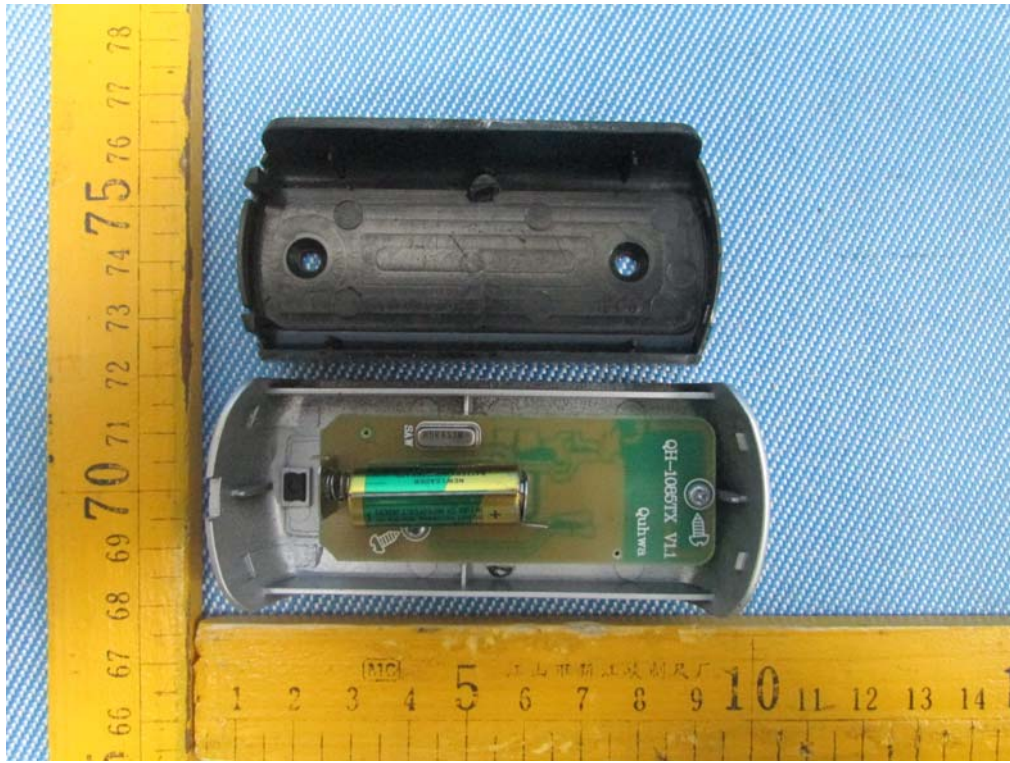




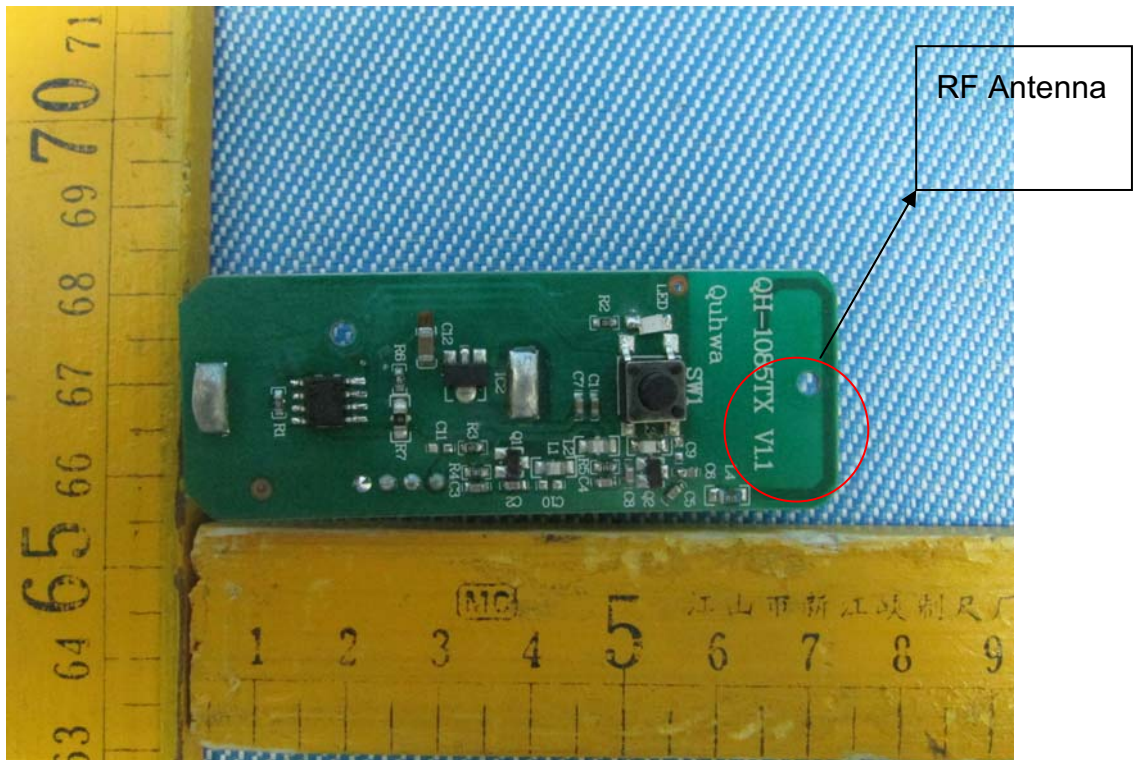
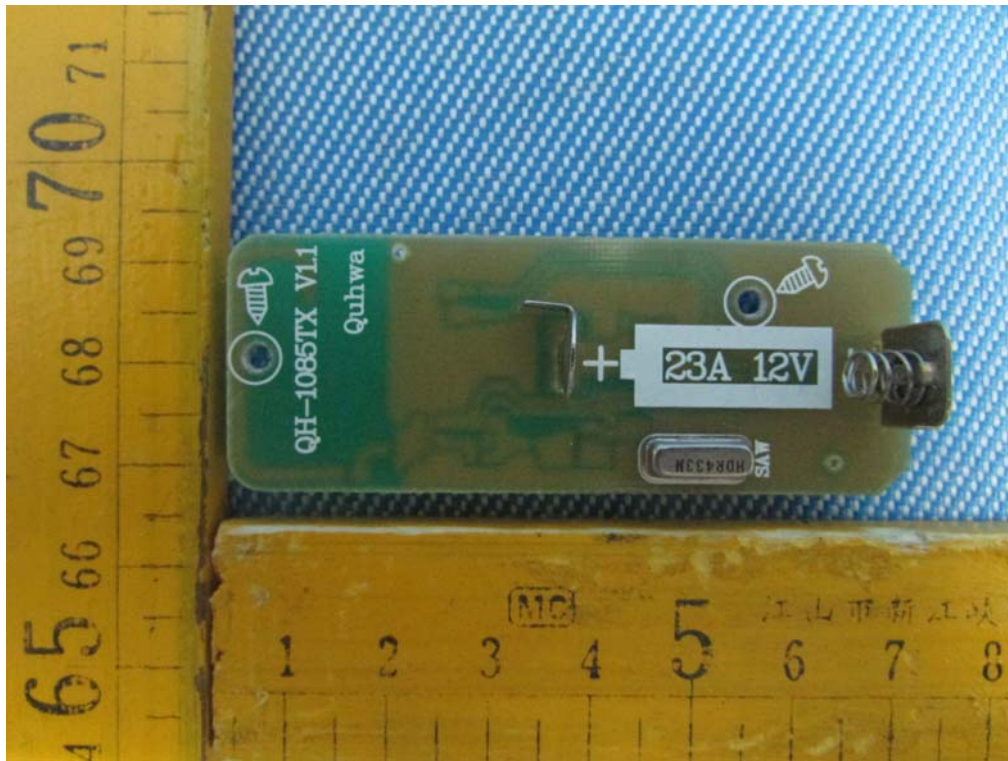




## 12.2 EUT- Internal View







=End of test report==