



## 2 Test Summary

| Test Items                  | Test Requirement                 | Result |
|-----------------------------|----------------------------------|--------|
| Conducted Emissions         | 15.207                           | PASS   |
| Radiated Spurious Emissions | 15.205(a)<br>15.209<br>15.231(a) | PASS   |
| Periodic Operation          | 15.231(a)                        | PASS   |
| 20dB Bandwidth              | 15.231(c)                        | PASS   |
| Antenna Requirement         | 15.203                           | PASS   |

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## 4 General Information

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

|                       |                      |
|-----------------------|----------------------|
| Product Name          | : FSK Transmitter    |
| Model No.             | : HM-FSK01T          |
| Model Difference      | : N/A                |
| Type of Modulation    | : FSK                |
| Frequency Range       | : 433.36 MHz         |
| The Lowest Oscillator | : 433.36 MHz         |
| Antenna installation  | : Integrated Antenna |

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

|                |                            |
|----------------|----------------------------|
| Technical Data | : Batteries DC 3V CR2032*2 |
|----------------|----------------------------|

### 4.3 Test Facility

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

- **IC – Registration No.: 7760A-1**

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-1, July 12, 2012.

- **FCC Test Site 1#– 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, April 29, 2014.

- **FCC Test Site 2#– Registration No.: 328995**

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 328995, December 3, 2014.

## 5 Equipment Used during Test

### 5.1 Equipments List

| 3m Semi-anechoic Chamber for Radiated Spurious Emissions |                            |                      |             |            |                       |                      |
|--|----------------------------|----------------------|-------------|------------|-----------------------|----------------------|
| Item   | Equipment                  | Manufacturer         | Model No.   | Serial No. | Last Calibration Date | Calibration Due Date |
| 1  | EMC Analyzer               | Agilent              | E7405A      | MY45114943 | Sep.15,2014           | Sep.14,2015          |
| 2  | Active Loop Antenna        | Beijing Dazhi        | ZN30900A    | -          | Sep.15,2014           | Sep.14,2015          |
| 3  | Trilog Broadband Antenna   | SCHWARZBECK          | VULB9163    | 336        | Apr.19,2015           | Apr.18,2016          |
| 4  | Coaxial Cable (below 1GHz) | Top                  | TYPE16(13M) | -          | Sep.15,2014           | Sep.14,2015          |
| 5  | Broad-band Horn Antenna    | SCHWARZBECK          | BBHA 9120 D | 667        | Apr.19,2015           | Apr.18,2016          |
| 6  | Broad-band Horn Antenna    | SCHWARZBECK          | BBHA 9170   | 335        | Apr.19,2015           | Apr.18,2016          |
| 7  | Broadband Preamplicifier   | COMPLIANCE DIRECTION | PAP-1G18    | 2004       | Mar.17,2015           | Mar.16,2016          |
| 8  | Coaxial Cable (above 1GHz) | Top                  | 1GHz-25GHz  | EW02014-7  | Apr.10,2015           | Apr.09,2016          |

### 5.2 Measurement Uncertainty

| Test Item                   | Frequency Range | Uncertainty | Note |
|-----------------------------|-----------------|-------------|------|
| Conducted Emissions         | 150kHz~30MHz    | ±3.64dB     | (1)  |
| Radiated Spurious Emissions | 30MHz~1000MHz   | ±5.03dB     | (1)  |
|                             | 1000M~5000MHz   | ± 5.47 dB   | (1)  |

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

### 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 Radiated Spurious Emissions

Test Requirement: FCC Part15 Paragraph 15.231(a)

Test Method: ANSI C63.4:2003

Test Result: PASS

Measurement Distance: 3m

Limit:

| Fundamental Frequency (MHz) | Field Strength of Fundamental (uV/m) | Field Strength of Fundamental (dBuV/m) | Field Strength of Spurious Emission (uV/m) | Field Strength of Spurious Emission (dBuV/m) |
|-----------------------------|--------------------------------------|--|--|--|
| 44.66-40.70                 | 2250                                 | 67                                     | 225  | 47   |
| 70-130                      | 1250                                 | 62                                     | 125  | 42   |
| 130-174                     | 1250 to 3750                         | 62 to 71.48                            | 125 to 375                                 | 42 to 51.48                                  |
| 174-260                     | 3750                                 | 71.48                                  | 375  | 51.48  |
| 260-470                     | 3750 to 12500                        | 71.48 to 81.94                         | 375 to 1250                                | 51.48 to 61.94                               |
| Above 470                   | 12500                                | 81.94                                  | 1250                                       | 61.94  |
| ** linear interpolations    |                                      |  |  |  |

### 6.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

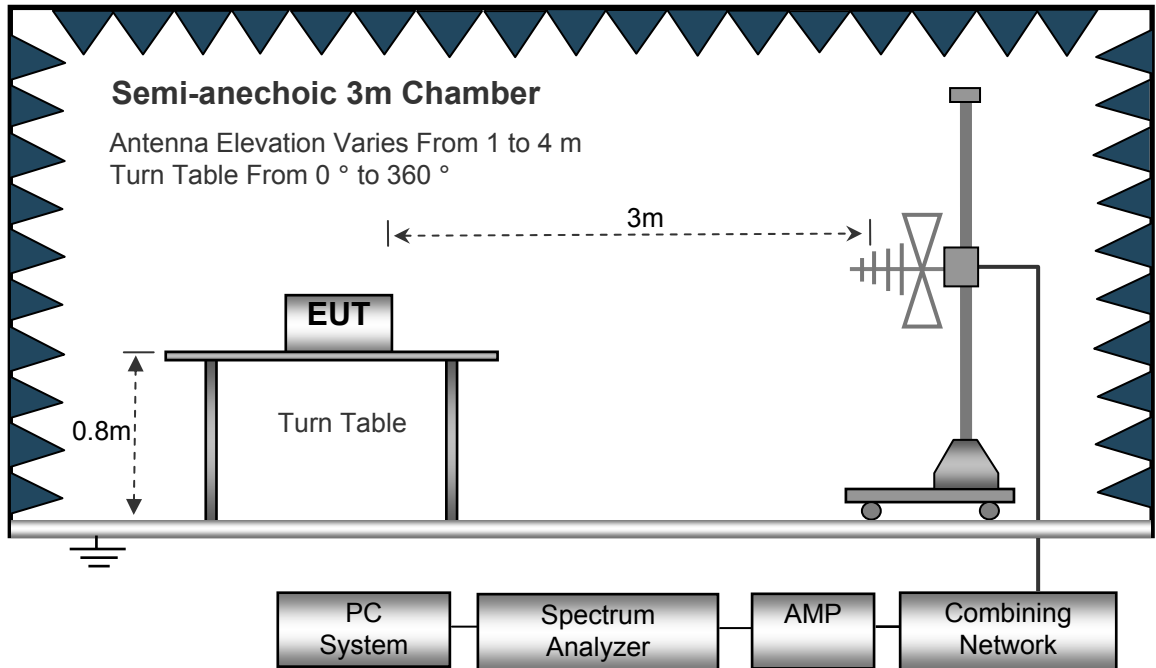
EUT Operation :

The test was performed in transmitting mode, the test data were shown in the report.

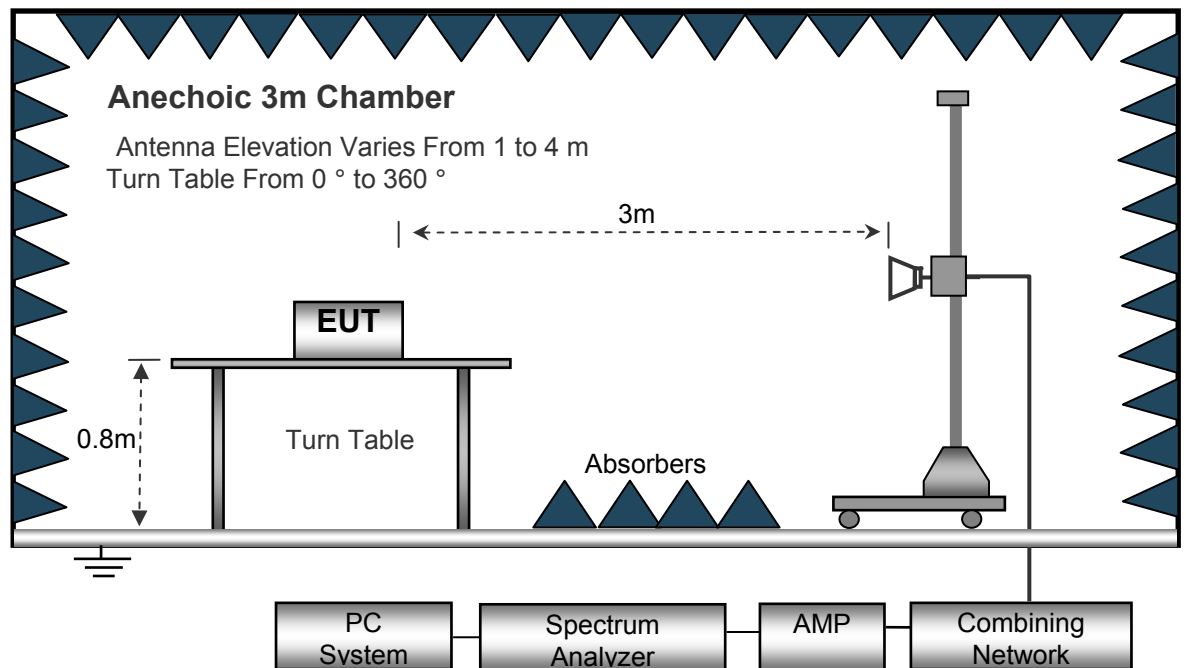
## 6.2 Test Setup

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 from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



### 6.3 Spectrum Analyzer Setup

Below 30MHz

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

30MHz ~ 1GHz

Sweep Speed .....Auto  
Detector .....PK  
Resolution Bandwidth..... 100kHz  
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed .....Auto  
Detector .....PK  
Resolution Bandwidth..... 1MHz  
Video Bandwidth..... 3MHz



## 6.4 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. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
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.

## 6.5 Summary of Test Results

$AV = \text{Peak} + 20\text{Log}_{10}(\text{duty cycle}) = \text{PK} + (-1.61)$  [refer to section 8 for more detail]

Test Frequency : 30MHz ~ 5GHz

| Frequency | Receiver Reading (PK) | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude (PK) | FCC Part 15.231/15.209/205 |        |
|-----------|-----------------------|------------------|------------|-------|------------------|--------------------------|----------------------------|--------|
|           |                       |                  | Height     | Polar |                  |                          | Limit                      | Margin |
| (MHz)     | (dBμV)                | Degree           | (m)        | (H/V) | (dB/m)           | (dBμV/m)                 | (dBμV/m)                   | (dB)   |
| 433.36    | 59.33                 | 221              | 1.2        | H     | 19.68            | 79.01                    | 100.82                     | -21.81 |
| 433.36    | 67.01                 | 161              | 1.8        | V     | 19.68            | 86.69                    | 100.82                     | -14.13 |
| 866.72    | 15.65                 | 5                | 1.6        | H     | 29.72            | 45.37                    | 80.82                      | -35.45 |
| 866.72    | 18.36                 | 354              | 1.9        | V     | 29.72            | 48.08                    | 80.82                      | -32.74 |
| 1300.08   | 54.22                 | 160              | 1.4        | H     | -16.38           | 37.84                    | 74.00                      | -36.16 |
| 1300.08   | 50.88                 | 175              | 1.5        | V     | -16.38           | 34.50                    | 74.00                      | -39.50 |
| 1733.44   | 53.01                 | 311              | 1.5        | H     | -14.89           | 38.12                    | 74.00                      | -35.88 |
| 1733.44   | 51.26                 | 265              | 1.5        | V     | -14.89           | 36.37                    | 74.00                      | -37.63 |

| Frequency | PK       | Turn table Angle | RX Antenna |       | Duty cycle Factor | AV       | FCC Part 15.231/209/205 |        |
|-----------|----------|------------------|------------|-------|-------------------|----------|-------------------------|--------|
|           |          |                  | Height     | Polar |                   |          | Limit                   | Margin |
| (MHz)     | (dBμV/m) | Degree           | (m)        | (H/V) | (dB)              | (dBμV/m) | (dBμV/m)                | (dB)   |
| 433.36    | 79.01    | 317              | 1.8        | H     | -1.61             | 77.40    | 80.82                   | -3.42  |
| 433.36    | 86.69    | 147              | 1.5        | V     | -1.61             | 85.08    | 80.82                   | 4.26   |
| 866.72    | 45.37    | 71               | 1.4        | H     | -1.61             | 43.76    | 60.82                   | -17.06 |
| 866.72    | 48.08    | 76               | 1.6        | V     | -1.61             | 46.47    | 60.82                   | -14.35 |
| 1300.08   | 37.84    | 79               | 1.9        | H     | -1.61             | 36.23    | 54.00                   | -17.77 |
| 1300.08   | 34.50    | 316              | 1.8        | V     | -1.61             | 32.89    | 54.00                   | -21.11 |
| 1733.44   | 38.12    | 325              | 1.8        | H     | -1.61             | 36.51    | 54.00                   | -17.49 |
| 1733.44   | 36.37    | 159              | 1.8        | V     | -1.61             | 34.76    | 54.00                   | -19.24 |

## 7 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

$$\text{Duty Cycle(\%)} = \frac{\text{Total On interval in a complete pulse train}}{\text{Length of a complete pulse train}} * 100\%$$

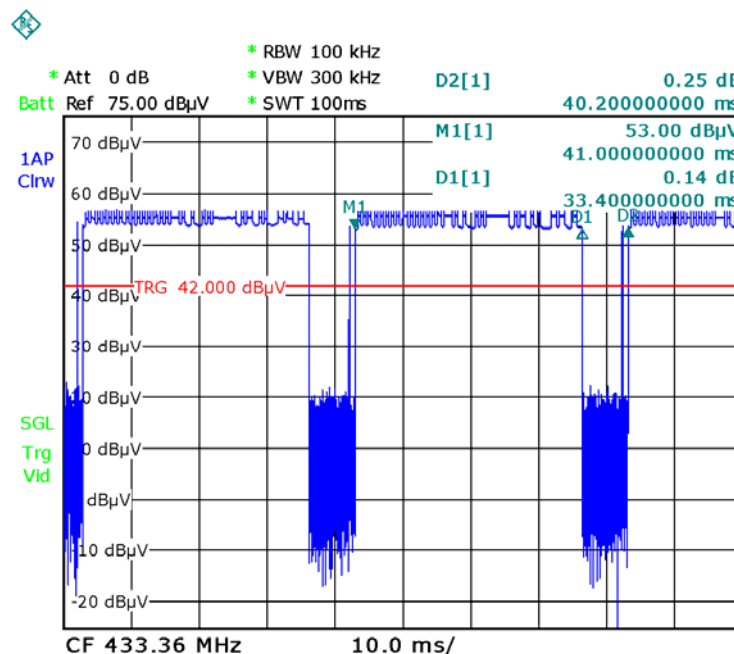
$$\text{Duty Cycle Correction Factor(dB)} = 20 * \text{Log}_{10}(\text{Duty Cycle(\%)})$$

|  |       |
|--|-------|
| Total transmission time(ms)                  | 33.40 |
| Length of a complete transmission period(ms) | 40.20 |
| Duty Cycle(%)                                | 83.08 |
| Duty Cycle Correction Factor(dB)             | -1.61 |

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

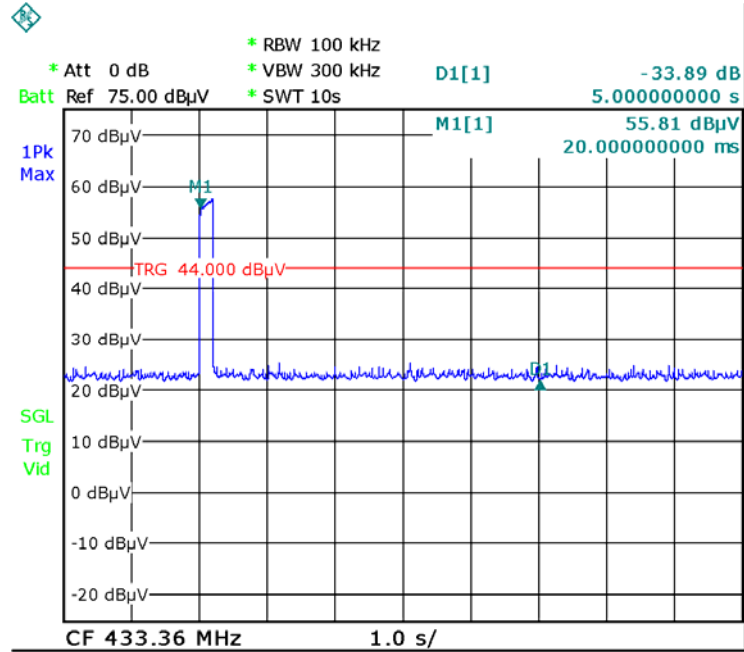
Length of a complete pulse train:

Remark: FCC part15.35(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.



FCC Part15.231(a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2)A transmitter activated automatically shall cease transmission within 5 seconds after activation.



## 8 20dB Bandwidth

Test Requirement: FCC Part15.231(c)  
 Test Method: FCC Part15.231(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.

### 8.1 Test Procedure

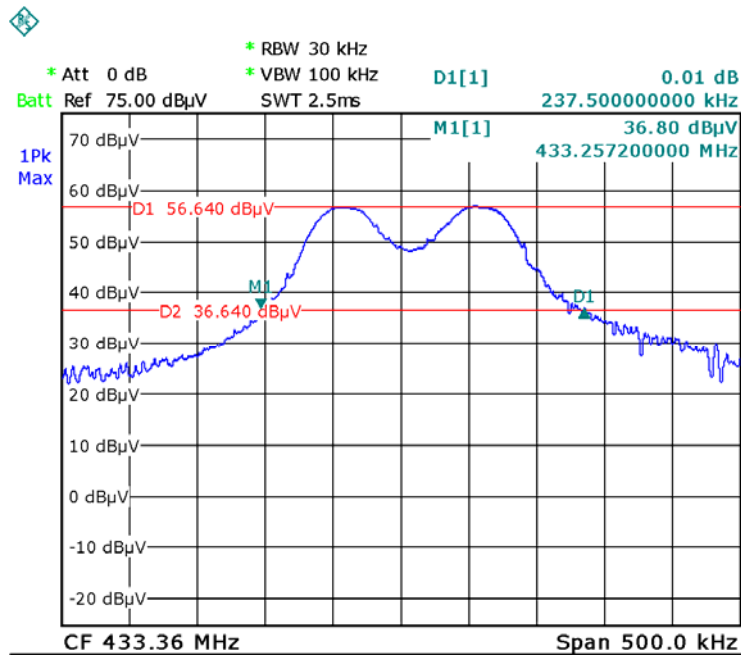
1. The transmitter output (antenna port) was connected to the spectrum analyzer.EUT and its simulators are placed on a table, let EUT working in test mode, then test it.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 3kHz RBW and 10kHz VBW.The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power 20dB.

### 8.2 Test Result

| Frequency (MHz) | Bandwidth Emission (kHz) | Limit (kHz) | Result |
|-----------------|--------------------------|-------------|--------|
| 433.36          | 237.50                   | 1083.75     | Pass   |

Limit=Center Frequency\*0.25%

Test Plot



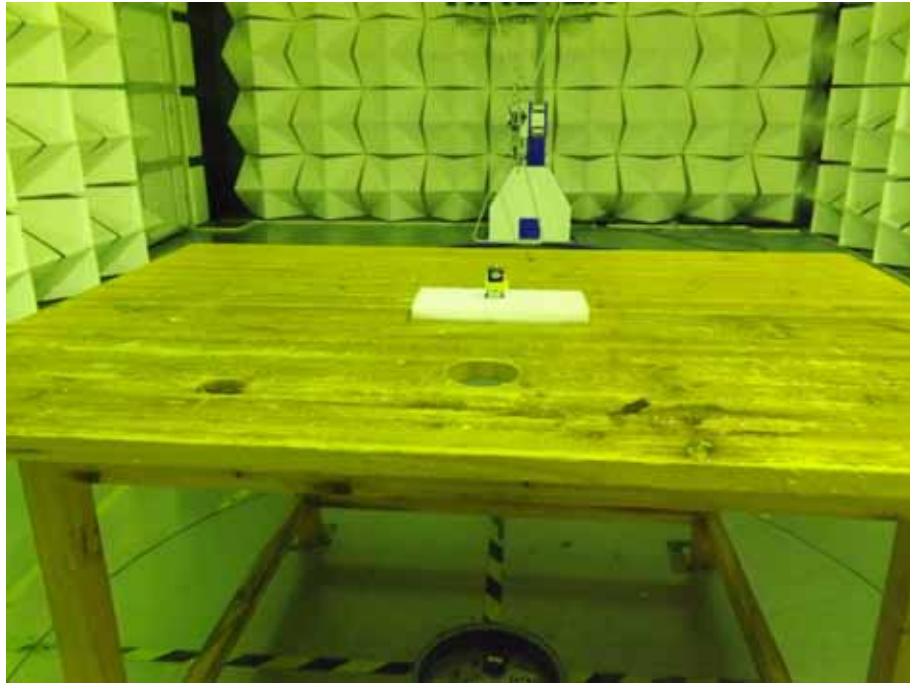
## **9 Antenna Requirement**

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 integrated antenna, fulfill the requirement of this section

## 10 Model HM-FSK01T Photographs of Testing

### 10.1 Radiation Emission Test Setup

From 30MHz to 1GHz



Above 1GHz



## 11 Photographs - Constructional Details

### 11.1 Model HM-FSK01T - Appearance View

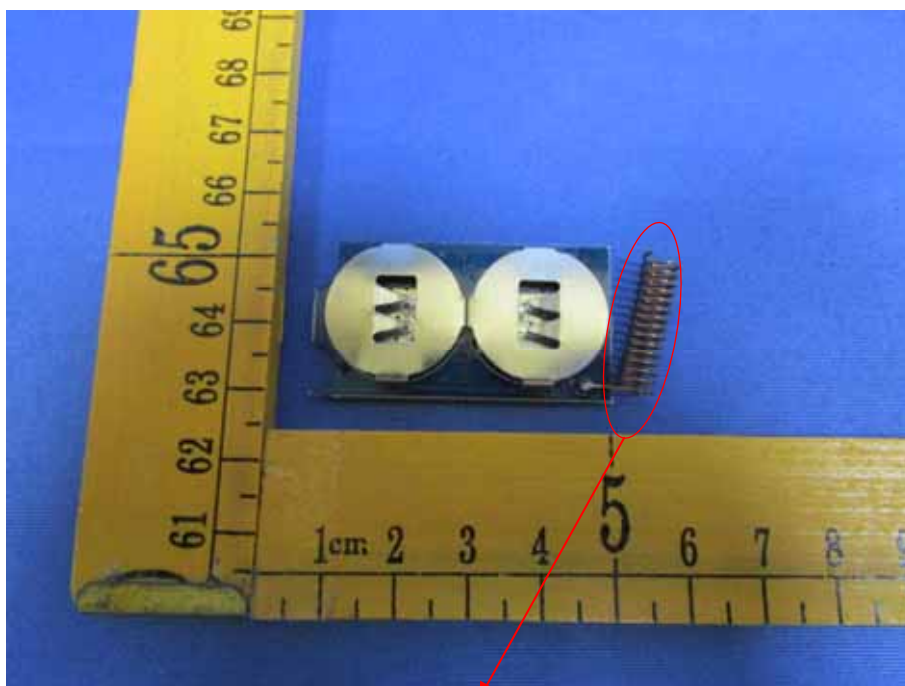




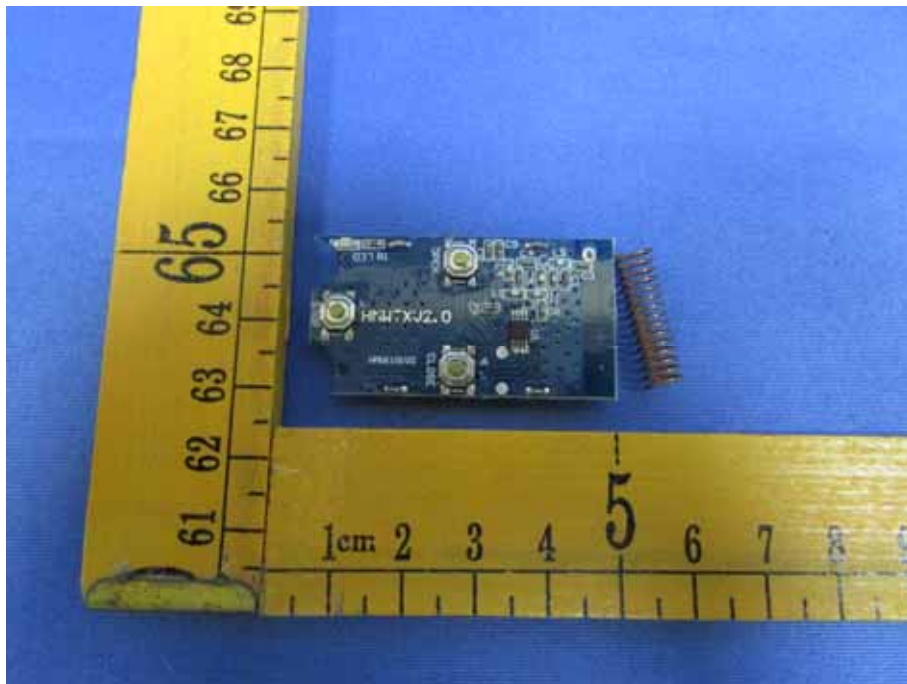




### 11.2 Model HM-FSK01T - Internal View



ANT.





====End of Report====