

TEST REPORT

Reference No. : WTS14S0514332E
FCC ID : XBAZW088
Applicant : Aeon Labs LLC.
Address : 1228 NORVELL ST.EL CERRITO, CA 94530 USA
Manufacturer : Fantem Technologies (Shenzhen) Co.,Ltd
Address : North, 3/F, Yitao Technology Industrial Park, Baihua Yuan Rd., The
Second Industrial Area, Guangming Sub-district Office, Guangming
New District, Shenzhen, Guangdong, China
Product Name : Key Fob Gen5
Model No. : ZW088-A
Trademark : AEON LABS/AEOTEC
Standards : FCC CFR47 Part 15 Section 15.249: 2012
Date of Receipt sample : May 27, 2014
Date of Test : May 27~Jun.09, 2014
Date of Issue : Jun.13, 2014
Test Result : Pass *

***Remarks:**

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:

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Testing location: The same as above

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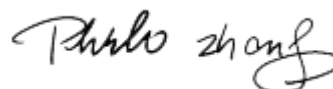
Fax:+86-755-83552400

Compiled by:



Zero Zhou / Project Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

| Test Items | Test Requirement | Result |
|--------------------------|----------------------------------|--------|
| Conducted Emissions | 15.207 | N/A |
| Radiated Emission | 15.249(a) 15.209 15.205(a) | PASS |
| Periodic Operation | 15.35(c) | PASS |
| Outside of Band Emission | 15.249 15.205 15.209 | PASS |
| 20dB Bandwidth | 15:215(c) | PASS |
| Antenna Requirement | 15.203 | PASS |

3 Contents

| | Page |
|---|-----------|
| 1 COVER PAGE | 1 |
| 2 TEST SUMMARY | 2 |
| 3 CONTENTS | 3 |
| 4 GENERAL INFORMATION | 4 |
| 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 MODE | 4 |
| 5 EQUIPMENT USED DURING TEST | 5 |
| 5.1 EQUIPMENTS LIST | 5 |
| 5.2 MEASUREMENT UNCERTAINTY | 5 |
| 5.3 TEST EQUIPMENT CALIBRATION | 5 |
| 6 CONDUCTED EMISSION | 6 |
| 7 RADIATION EMISSION TEST | 7 |
| 7.1 EUT OPERATION | 7 |
| 7.2 TEST SETUP | 8 |
| 7.3 SPECTRUM ANALYZER SETUP | 9 |
| 7.4 TEST PROCEDURE | 10 |
| 7.5 CORRECTED AMPLITUDE & MARGIN CALCULATION | 10 |
| 7.6 TEST RESULT | 11 |
| 8 PERIODIC OPERATION | 12 |
| 9 OUTSIDE OF BAND EMISSION | 13 |
| 9.1 TEST PROCEDURE | 13 |
| 9.2 TEST RESULT | 13 |
| 10 20 DB BANDWIDTH MEASUREMENT | 15 |
| 10.1 TEST PROCEDURE | 15 |
| 10.2 TEST RESULT | 15 |
| 11 ANTENNA REQUIREMENT | 16 |
| 12 PHOTOGRAPHS- MODEL ZW088-A TEST SETUP | 17 |
| 12.1 RADIATION EMISSION FROM 30MHZ-1GHZ | 17 |
| 12.2 RADIATION EMISSION ABOVE 1GHZ | 17 |
| 13 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS | 18 |
| 13.1 MODEL ZW088-A - EXTERNAL VIEW | 18 |
| 13.2 MODEL ZW088-A - INTERNAL VIEW | 22 |
| 13.3 RF MODULE VIEW | 25 |

4 General Information

4.1 General Description of E.U.T.

| | |
|-----------------------|------------------------|
| Product Name | : Key Fob Gen5 |
| Model No. | : ZW088-A |
| Model Differences | : N/A |
| Type of Modulation | : FSK |
| Frequency Range | : 908.40MHz, 908.42MHz |
| The Lowest Oscillator | : 32MHz |
| Antenna installation | : Integrated Antenna |

4.2 Details of E.U.T.

| | |
|----------------|--------------------|
| Technical Data | : DC 3V by Battery |
|----------------|--------------------|

4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **IC – Registration No.:7760A-1**

Waltek Services (Shenzhen) Co., Ltd. EMC Laboratory 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 number 7760A-1, 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, April 29, 2014.

4.4 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 | Low channel | Middle channel | High channel |
|--------------|-------------|----------------|--------------|
| Transmitting | N/A | N/A | 908.42MHz |

5 Equipment Used during Test

5.1 Equipments List

| 3m Semi-anechoic Chamber for Radiation | | | | | | |
|--|-----------------------------|----------------------|---------------|----------------|-----------------------|----------------------|
| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Calibration Date | Calibration Due Date |
| 1 | EMC Analyzer | Agilent | E7405A | MY4511494 3 | Sep.18,2013 | Sep.17,2014 |
| 2 | Trilog Broadband Antenna | SCHWARZBECK | VULB9163 | 336 | Apr.19,2014 | Apr.18,2015 |
| 3 | Coaxial Cable (below 1GHz) | Top | TYPE16(13M) | - | Sep.18,2013 | Sep.17,2014 |
| 4 | Broad-band Horn Antenna | SCHWARZBECK | BBHA 9120 D | 667 | Apr.19,2014 | Apr.18,2015 |
| 5 | Broad-band Horn Antenna | SCHWARZBECK | BBHA 9170 | 335 | Apr.19,2014 | Apr.18,2015 |
| 6 | Broadband Preamplifier | COMPLIANCE DIRECTION | PAP-1G18 | 2004 | Mar.17,2014 | Mar.16,2015 |
| 7 | Coaxial Cable (above 1GHz) | Top | 1GHz-25GHz | EW02014-7 | Apr.10,2014 | Apr.09,2015 |
| RF Conducted Testing | | | | | | |
| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Calibration Date | Calibration Due Date |
| 1. | EMC Analyzer (9k~26.5GHz) | Agilent | E7405A | MY4511494 3 | Sep.18,2013 | Sep.17,2014 |
| 2. | Spectrum Analyzer (9k-6GHz) | R&S | FSL6 | 100959 | Sep.18,2013 | Sep.17,2014 |
| 3. | Humidity Chamber | GF | GTH-225-40-1P | IAA061213 | May 16,2014 | May 15,2015 |

5.2 Measurement Uncertainty

| Parameter | Uncertainty |
|----------------------------------|--|
| Radio Frequency | $\pm 1 \times 10^{-6}$ |
| RF Power | ± 1.0 dB |
| RF Power Density | ± 2.2 dB |
| Radiated Spurious Emissions test | ± 5.03 dB (Bilog antenna 30M~1000MHz) |
| | ± 5.47 dB (Horn antenna 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 Requirement: | FCC CFR 47 Part 15 Section 15.207 |
| Test Method: | ANSI C63.4:2003 |
| Test Result: | N/A |
| Frequency Range: | 150kHz to 30MHz |
| Class/Severity: | Class B |
| Limit: | 66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz |
| Detector: | Peak for pre-scan (9kHz Resolution Bandwidth) |
| Remark | This device powered by battery, this test is not applicable. |

7 Radiation Emission Test

Test Requirement: FCC Part15 Paragraph 15.249

Test Method: ANSI 63.4: 2003

Measurement Distance: 3m

Test Result: PASS

15.249(a)Limit:

| Fundamental frequency | Field strength of fundamental | | Field strength of harmonics | |
|-----------------------|-------------------------------|--------|-----------------------------|--------|
| | mV/m | dBuV/m | uV/m | dBuV/m |
| 902-928 MHz | 50 | 94 | 500 | 54 |
| 2400-2483.5 MHz | 50 | 94 | 500 | 54 |
| 5725-5875 MHz | 50 | 94 | 500 | 54 |
| 24.0-24.25 GHz | 250 | 108 | 2500 | 68 |

15.209 Limit:

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

Note: RF Voltage(dBuV)=20 log₁₀ RF Voltage(uV)

7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

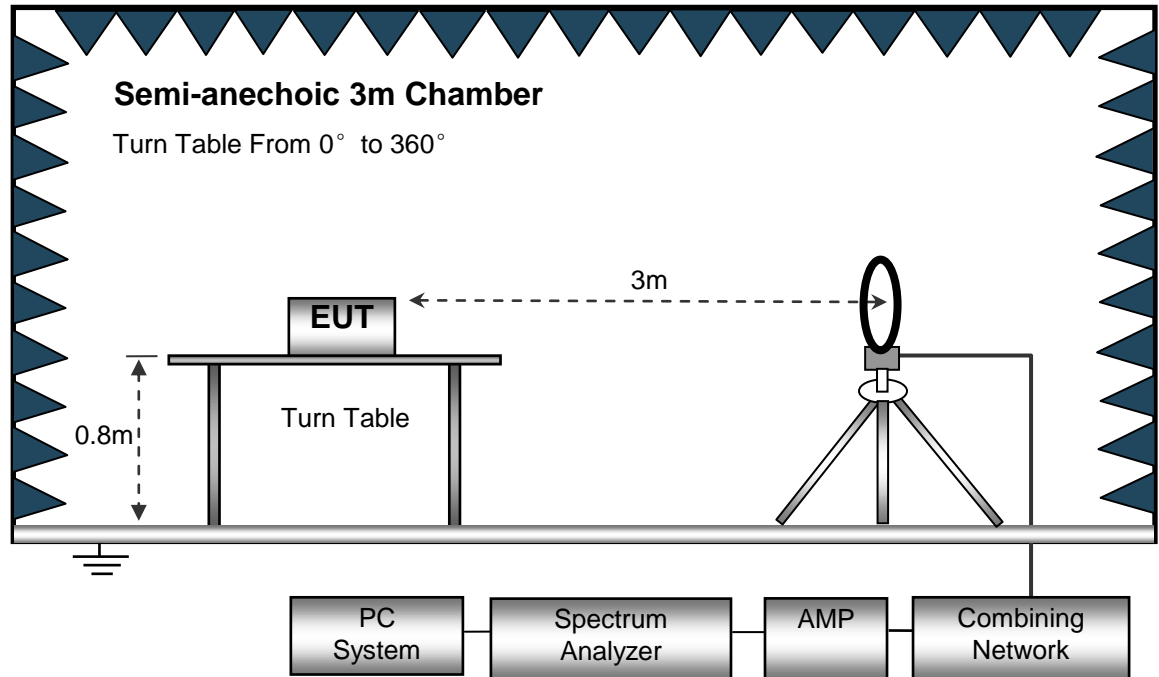
EUT Operation :

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

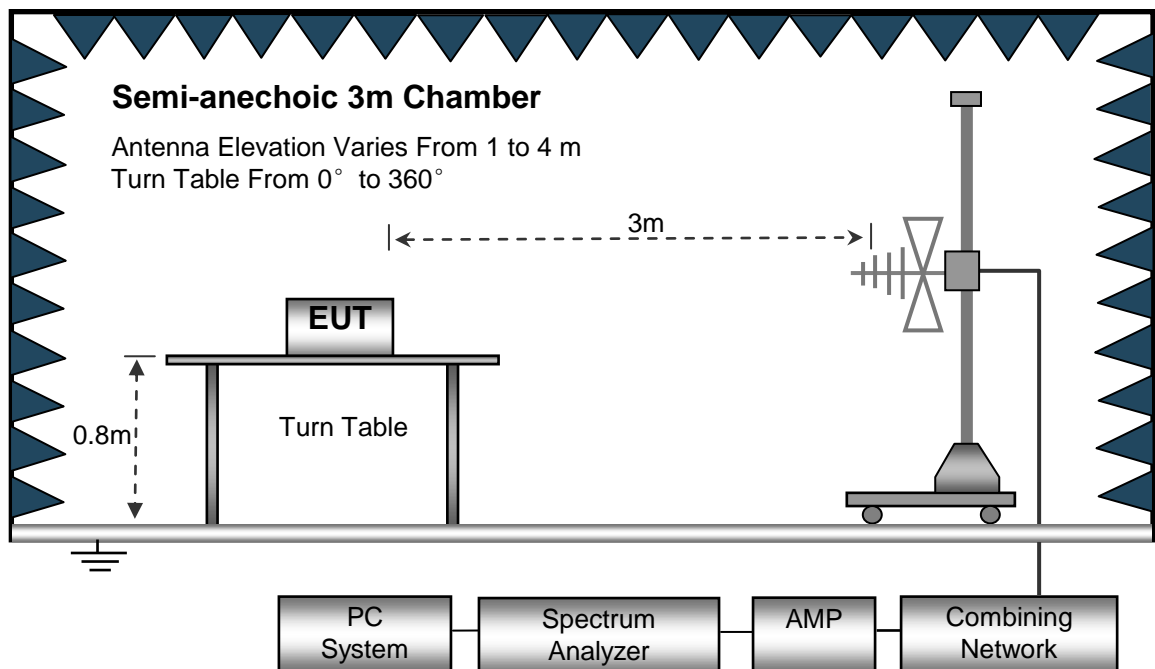
7.2 Test Setup

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

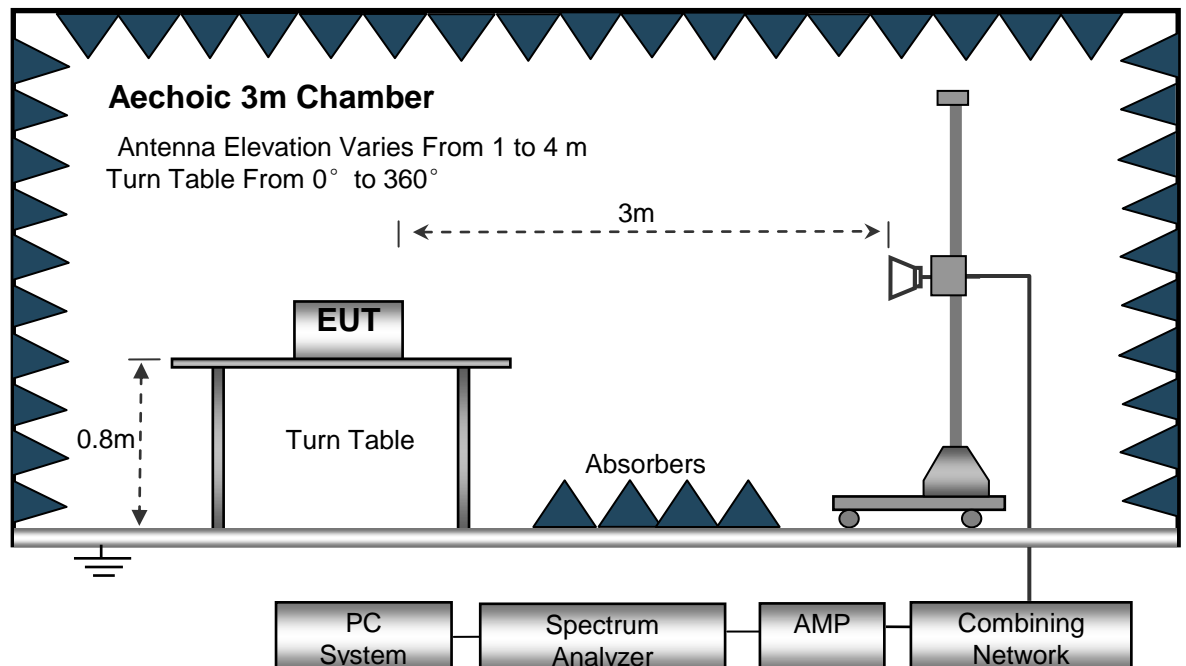
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep SpeedAuto
 IF Bandwidth10kHz
 Video Bandwidth10kHz
 Resolution Bandwidth10kHz

30MHz ~ 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth100kHz
 Video Bandwidth300kHz

Above 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth1MHz
 Video Bandwidth3MHz
 DetectorAve.
 Resolution Bandwidth1MHz
 Video Bandwidth10Hz

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. 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.

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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB μ V means the emission is 7dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

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

7.6 Test Result

$AV = \text{Peak} + 20\log_{10}(\text{duty cycle}) = PK + (-0.30)$ [refer to section 8 for more detail]

Test Frequency: 30MHz ~ 10GHz

Test Mode: Transmitting

| Frequency | Receiver Reading (PK) | Turn table Angle | RX Antenna | | Corrected Factor | Corrected Amplitude (PK) | FCC Part 15.249/209/205 | |
|-----------|-----------------------|------------------|------------|-------|------------------|--------------------------|-------------------------|--------|
| | | | Height | Polar | | | Limit | Margin |
| (MHz) | (dBμV) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 31.17 | 15.22 | 57 | 1.8 | V | 15.14 | 30.36 | 40.00 | -9.64 |
| 172.59 | 22.18 | 25 | 1.3 | V | 10.53 | 32.71 | 46.00 | -13.29 |
| 908.42 | 65.37 | 253 | 1.1 | H | 27.26 | 92.63 | 114.00 | -21.37 |
| 908.42 | 63.64 | 270 | 1.7 | V | 27.26 | 90.90 | 114.00 | -23.10 |
| 1816.84 | 52.34 | 113 | 1.6 | H | -13.21 | 39.13 | 74.00 | -34.87 |
| 1816.84 | 49.31 | 324 | 1.4 | V | -13.21 | 36.10 | 74.00 | -37.90 |
| 2725.26 | 52.33 | 299 | 1.9 | H | -13.08 | 39.25 | 74.00 | -34.75 |
| 2725.26 | 50.89 | 358 | 1.7 | V | -13.08 | 37.81 | 74.00 | -36.19 |
| 3633.68 | 51.39 | 63 | 1.7 | H | -9.08 | 42.31 | 74.00 | -31.69 |
| 3633.68 | 51.27 | 37 | 1.2 | V | -9.08 | 42.19 | 74.00 | -31.81 |

| Frequency | PK | RX Antenna Polar | Duty cycle Factor | Calculated AV | FCC Part 15.249/209/205 | |
|-----------|----------|------------------|-------------------|---------------|-------------------------|--------|
| | | | | | Limit | Margin |
| (MHz) | (dBμV/m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 908.42 | 92.63 | H | -0.30 | 92.33 | 94 | -1.67 |
| 908.42 | 90.90 | V | -0.30 | 90.60 | 94 | -3.40 |
| 1816.84 | 39.13 | H | -0.30 | 38.83 | 54 | -15.17 |
| 1816.84 | 36.10 | V | -0.30 | 35.80 | 54 | -18.20 |
| 2725.26 | 39.25 | H | -0.30 | 38.95 | 54 | -15.05 |
| 2725.26 | 37.81 | V | -0.30 | 37.51 | 54 | -16.49 |
| 3633.68 | 42.31 | H | -0.30 | 42.01 | 54 | -11.99 |
| 3633.68 | 42.19 | V | -0.30 | 41.89 | 54 | -12.11 |

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 * %

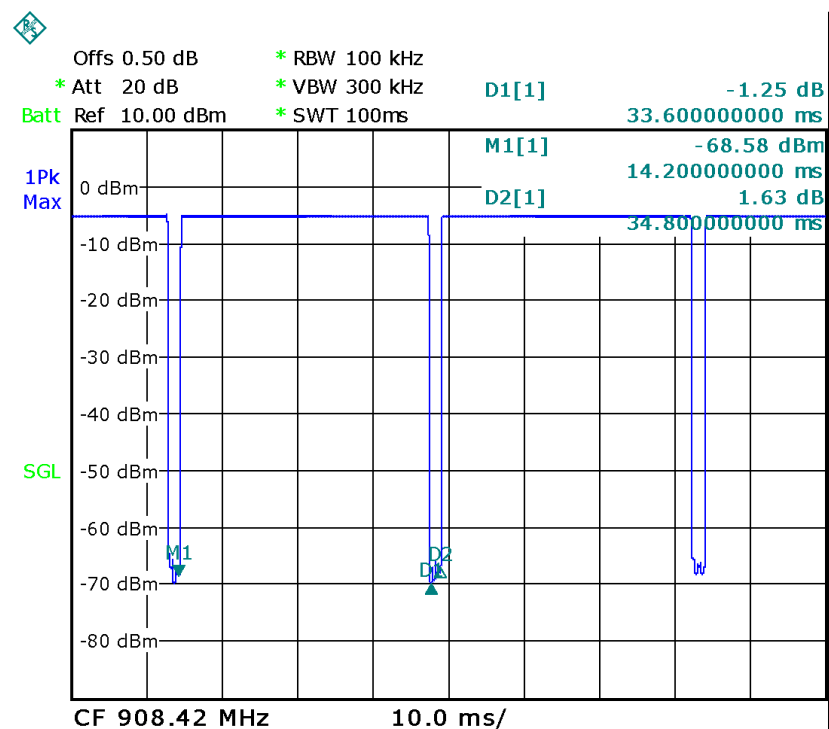
Duty Cycle Correction Factor(dB)=20 * Log₁₀(Duty Cycle(%))

| | |
|--|-------|
| Total transmission time(ms) | 33.6 |
| Length of a complete transmission period(ms) | 34.8 |
| Duty Cycle(%) | 96.55 |
| Duty Cycle Correction Factor(dB) | -0.30 |

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.



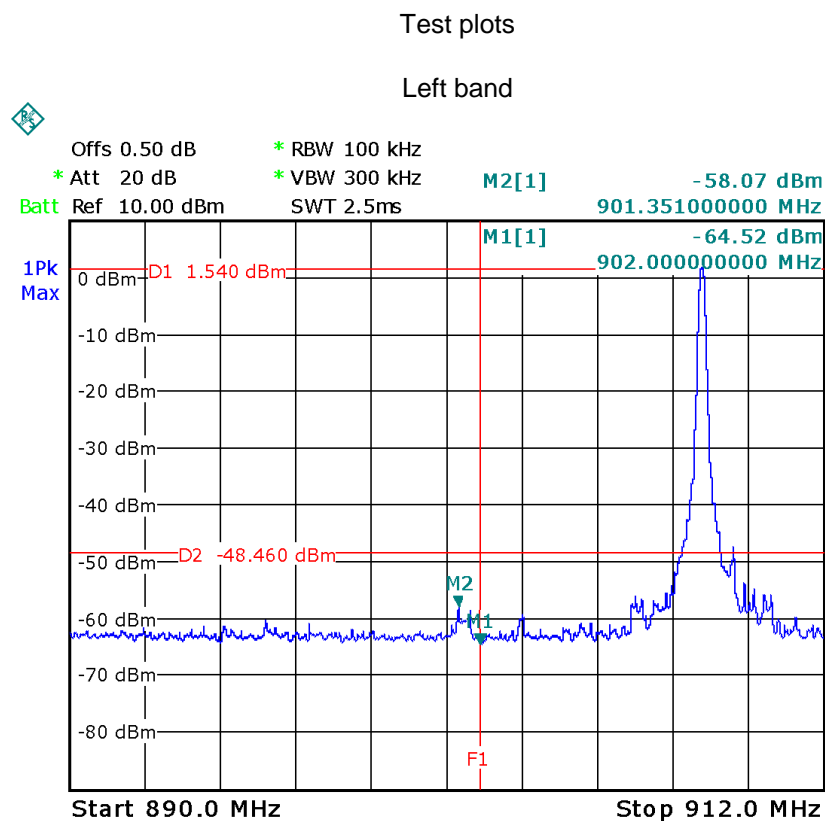
9 Outside of Band Emission

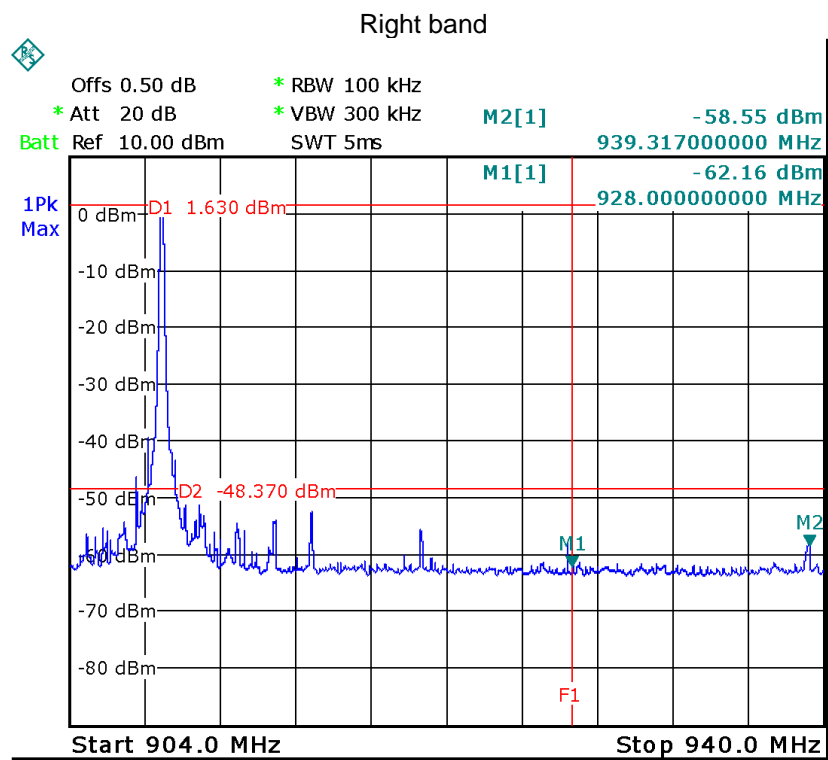
| | |
|-------------------|---|
| Test Requirement: | 15.249(d):Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation. |
| Test Method: | ANSI C63.4:2003 |
| Test Mode: | Transmitting |

9.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

9.2 Test Result





10 20 dB Bandwidth Measurement

Test Requirement:

FCC CFR47 Part 15 Section 15.215(c)

Test Method:

ANSI C63.4:2003

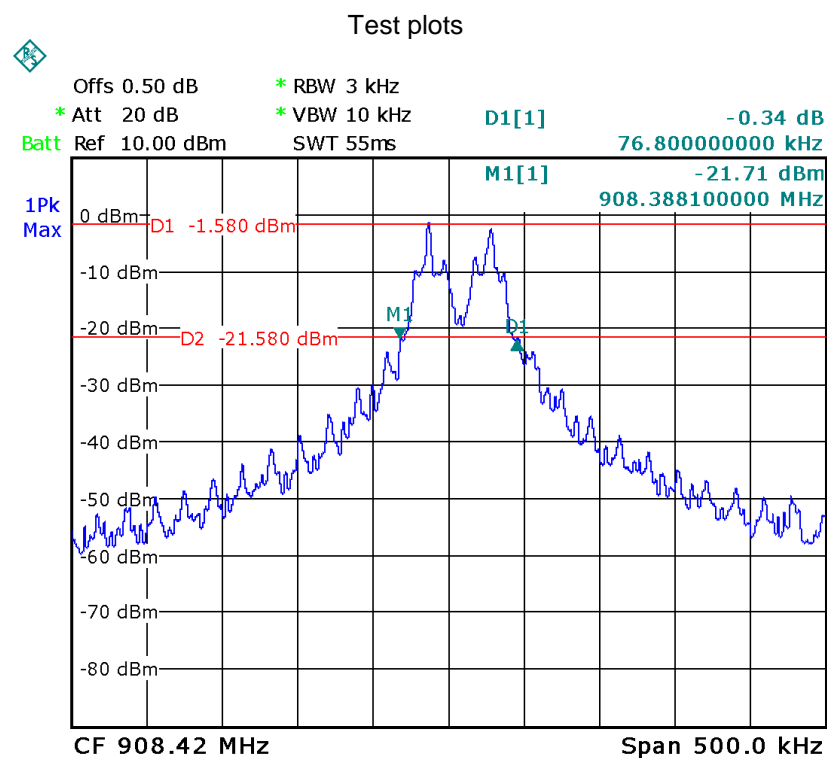
Test Mode:

Transmitting

10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 3kHz, VBW = 10kHz

10.2 Test Result

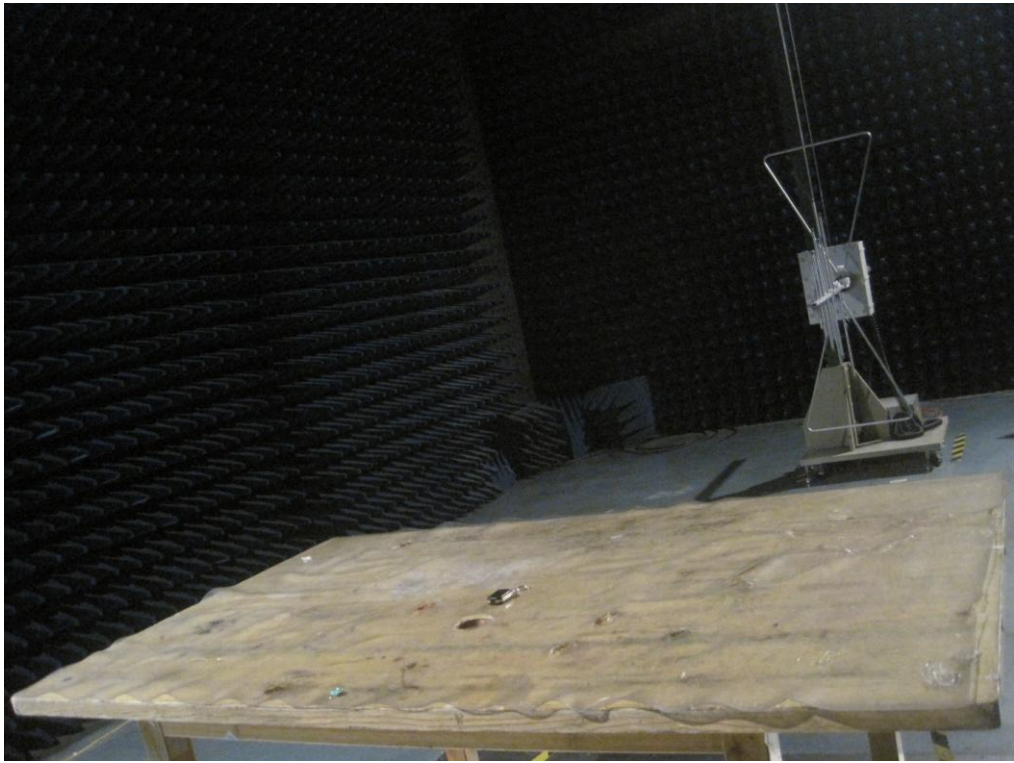


11 Antenna Requirement

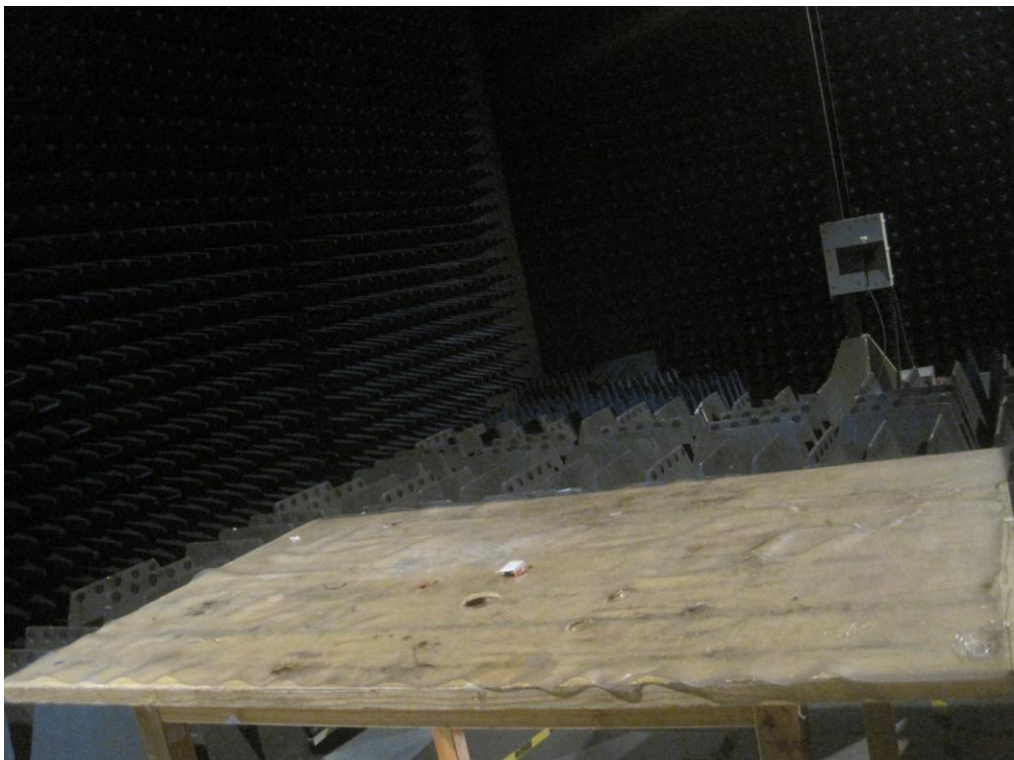
According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has a integrated Antenna, fulfil the requirement of this section.

12 Photographs- Model ZW088-A Test Setup

12.1 Radiation Emission From 30MHz-1GHz



12.2 Radiation Emission Above 1GHz



13 Photographs - Constructional Details

13.1 Model ZW088-A - External View



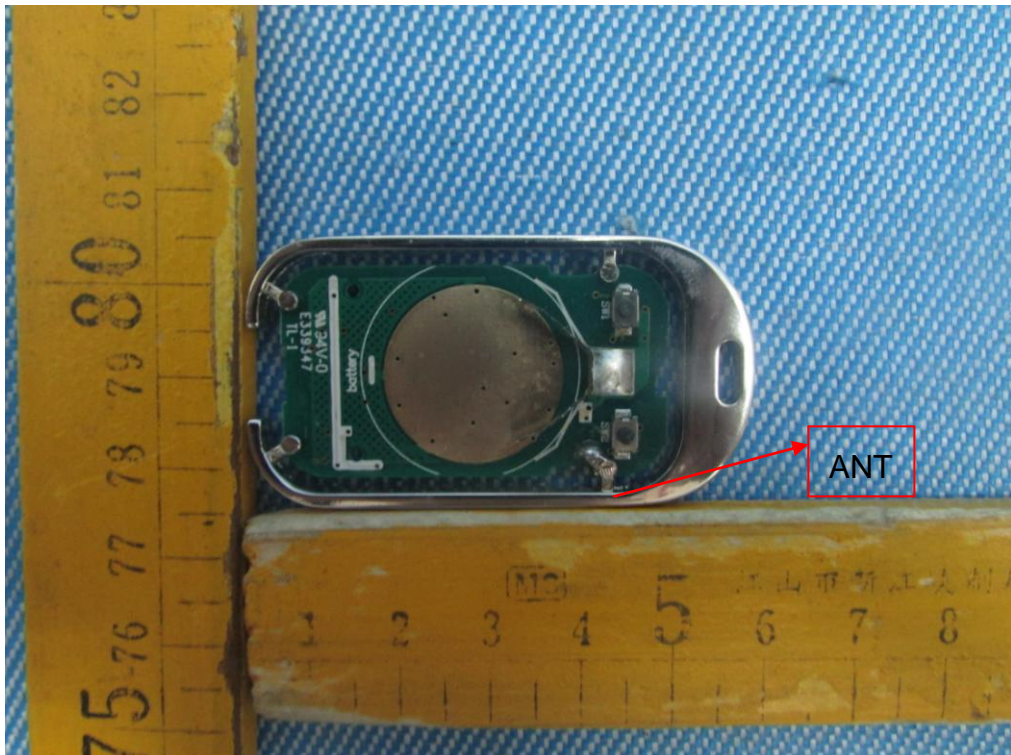


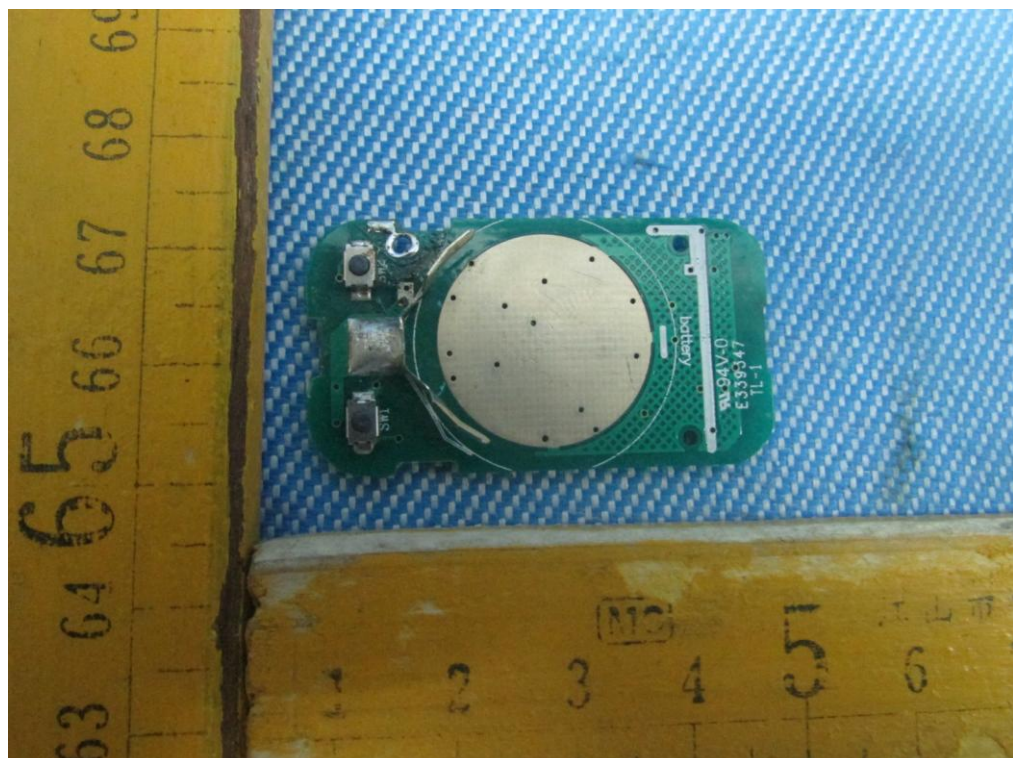
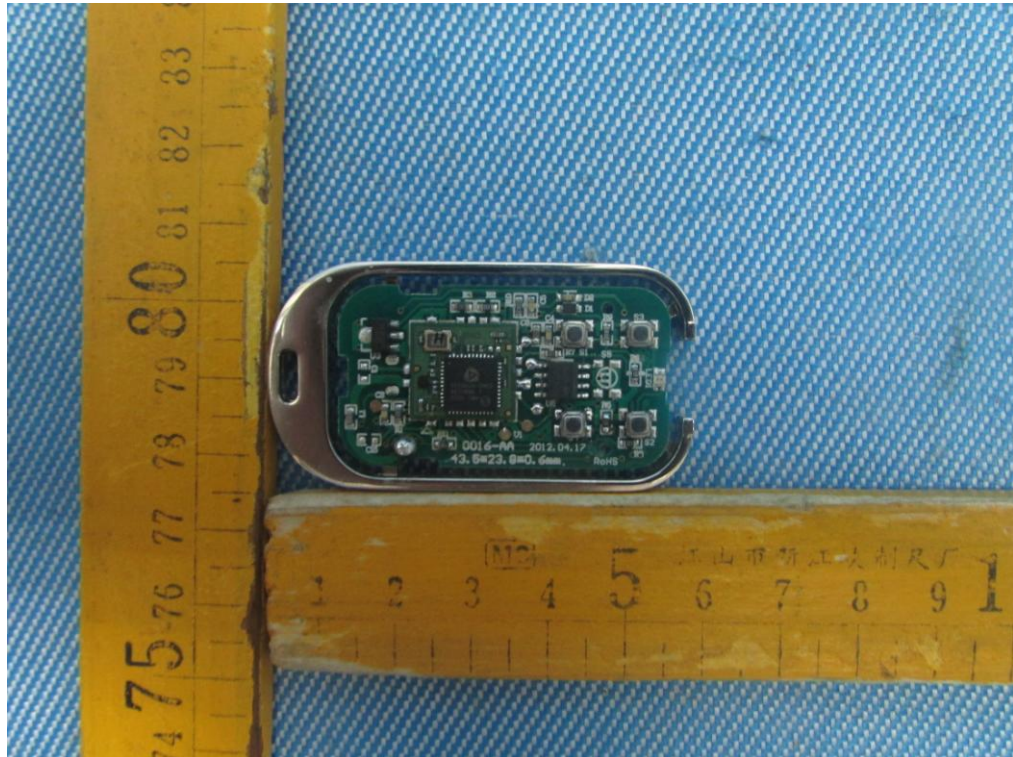


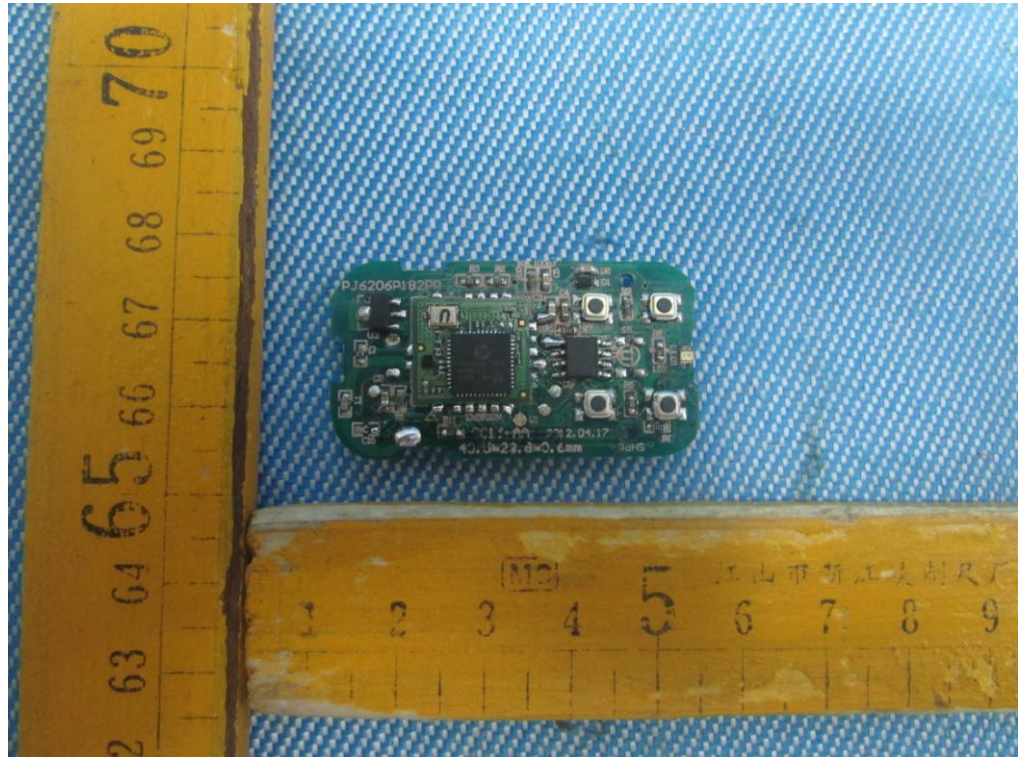


13.2 Model ZW088-A - Internal View

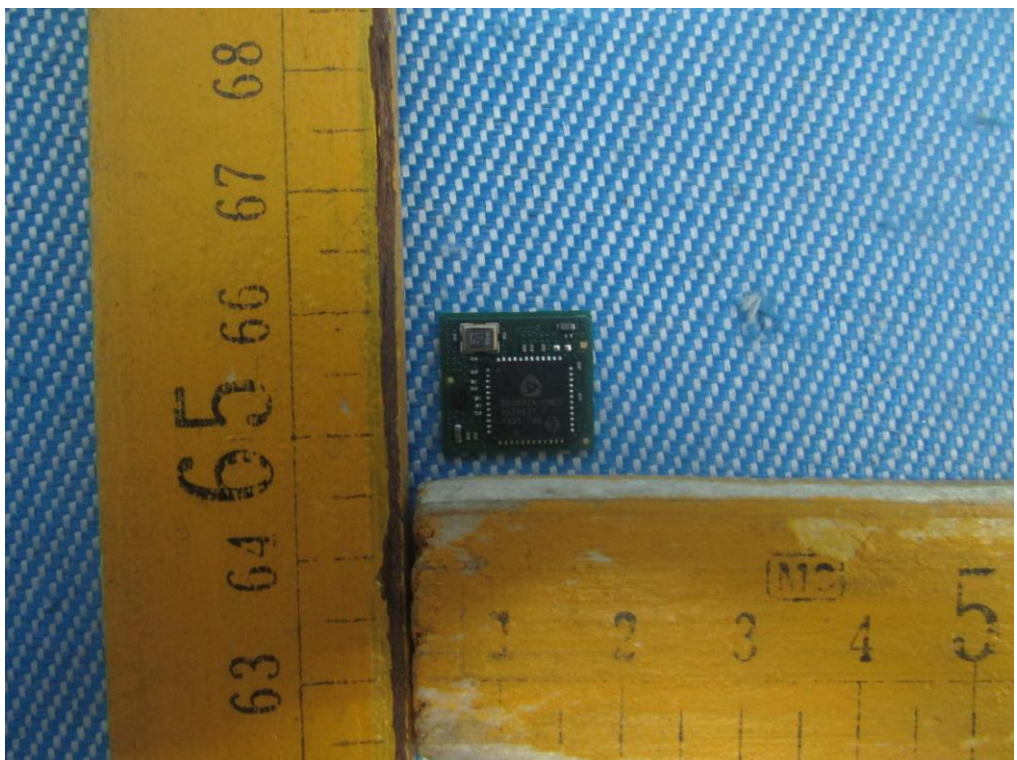


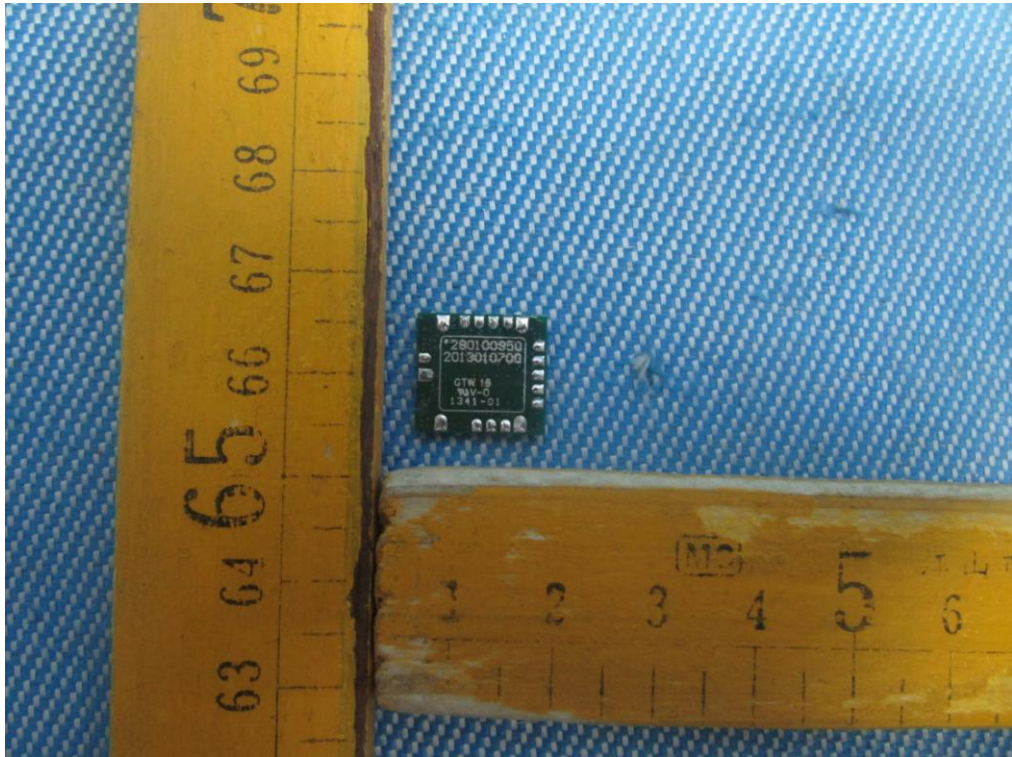






13.3 RF Module View





=====End of Report=====