

# FCC TEST REPORT

Client Name : Smart Devices Ltd.

Address : room 10, floor 2, ul. 1905 goda, b. 10Ac1,  
Moscow, 123022 Russian Federation

Product Name : Z-Uno 2 - Z-Wave prototyping board

Date : Nov. 05, 2021

**Shenzhen Anbotech Compliance Laboratory Limited**



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# TEST REPORT

Applicant : Smart Devices Ltd.  
Manufacturer : Smart Devices Ltd.  
Product Name : Z-Uno 2 - Z-Wave prototyping board  
Model No. : ZME\_ZUNO2  
Trade Mark : Z-Wave.Me  
Rating(s) : Input: DC 3V or DC 5V or DC 7-12V  
The current consumption is 15 mA in receiving mode and 45-50 mA in transmission mode.

**Test Standard(s) : FCC Part15 Subpart C, Paragraph 15.249**

**Test Method(s) : ANSI C63.10: 2020**

The device described above is tested by Shenzhen Anbotech Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotech Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotech Compliance Laboratory Limited.

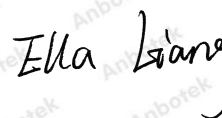
Date of Receipt

Aug. 26, 2021

Date of Test

Aug. 26~Sept. 23, 2021

Prepared by



(Ella Liang)

Approved & Authorized Signer



(Kingkong Jin)

## 1. General Information

### 1.1. Client Information

|              |   |                                                                              |
|--------------|---|------------------------------------------------------------------------------|
| Applicant    | : | Smart Devices Ltd.                                                           |
| Address      | : | room 10, floor 2, ul. 1905 goda, b. 10Ac1, Moscow, 123022 Russian Federation |
| Manufacturer | : | Smart Devices Ltd.                                                           |
| Address      | : | room 10, floor 2, ul. 1905 goda, b. 10Ac1, Moscow, 123022 Russian Federation |
| Factory      | : | Smart Devices Ltd.                                                           |
| Address      | : | room 10, floor 2, ul. 1905 goda, b. 10Ac1, Moscow, 123022 Russian Federation |

### 1.2. Description of Device (EUT)

|                                                                                                                                     |                      |                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------|
| Product Name                                                                                                                        | :                    | Z-Uno 2 - Z-Wave prototyping board                          |
| Model No.                                                                                                                           | :                    | ZME_ZUNO2                                                   |
| Trade Mark                                                                                                                          | :                    | Z-Wave.Me                                                   |
| Test Power Supply                                                                                                                   | :                    | DC 5V via MacBook Air                                       |
| Test Sample No.                                                                                                                     | :                    | 1-2-1(Normal Sample), 1-2-2(Engineering Sample)             |
| Product Description                                                                                                                 | Operation Frequency: | 908 MHz, 912 MHz, 916 MHz, 920 MHz                          |
|                                                                                                                                     | Number of Channel:   | 4 Channel                                                   |
|                                                                                                                                     | Antenna Type:        | Monopole Antenna                                            |
|                                                                                                                                     | Modulation Type:     | FSK on 908MHz and 916MHz<br>DSSS OQPSK on 912MHz and 920MHz |
|                                                                                                                                     | Antenna Gain(Peak):  | 1.4dBi                                                      |
|                                                                                                                                     | Adapter:             | N.A.                                                        |
| <b>Remark:</b> 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual. |                      |                                                             |

### 1.3. Auxiliary Equipment Used During Test

|             |   |                                                               |
|-------------|---|---------------------------------------------------------------|
| MacBook Air | : | Model: A1466<br>Input: 14.85V/3.05A<br>CMIIT ID: C02HXB48DRVC |
| Adapter     | : | Input: AC 100-240V, 1A, 50-60Hz<br>Output: 14.85V/3.05A       |

### 1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

| Pretest Mode | Description |
|--------------|-------------|
| Mode 1       | CH01        |
| Mode 2       | CH02        |
| Mode 3       | CH03        |
| Mode 4       | CH04        |

| For Radiated Emission |             |
|-----------------------|-------------|
| Final Test Mode       | Description |
| Mode 1                | CH01        |
| Mode 2                | CH02        |
| Mode 3                | CH03        |
| Mode 4                | CH04        |

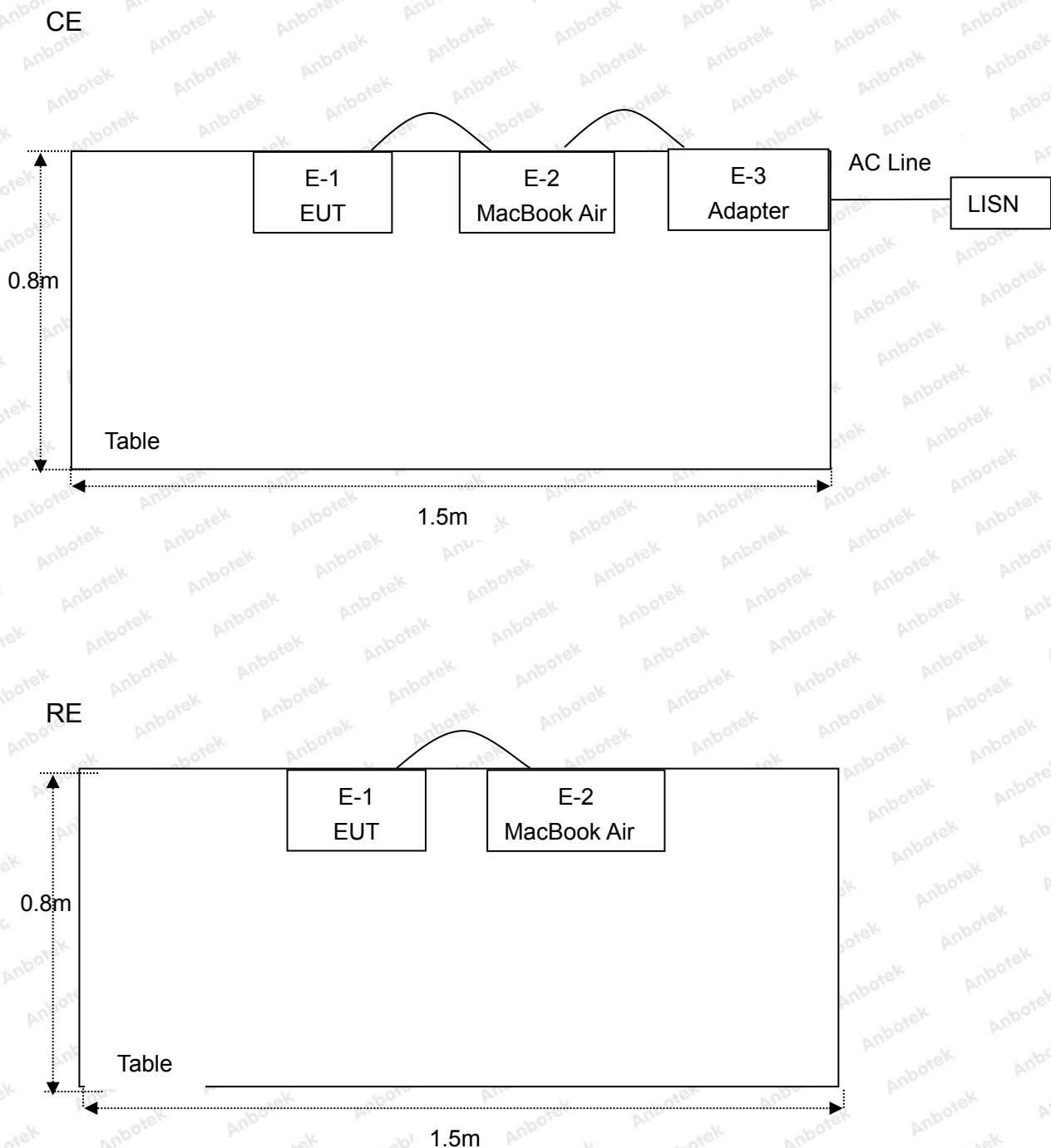
Note:

1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

### 1.5. List of Channels

| Channel | Freq.<br>(MHz) | Channel | Freq.<br>(MHz) | Channel | Freq.<br>(MHz) | Channel | Freq.<br>(MHz) |
|---------|----------------|---------|----------------|---------|----------------|---------|----------------|
| 1       | 908            | /       | /              | /       | /              | /       | /              |
| 2       | 912            | /       | /              | /       | /              | /       | /              |
| 3       | 916            | /       | /              | /       | /              | /       | /              |
| 4       | 920            | /       | /              | /       | /              | /       | /              |

## 1.6. Description of Test Setup



## 1.7. Test Equipment List

| Item | Equipment                                         | Manufacturer               | Model No.        | Serial No.    | Last Cal.     | Cal. Interval |
|------|---------------------------------------------------|----------------------------|------------------|---------------|---------------|---------------|
| 1.   | L.I.S.N.<br>Artificial Mains<br>Network           | Rohde & Schwarz            | ENV216           | 100055        | Oct. 26, 2020 | 1 Year        |
| 2.   | Three Phase V-type<br>Artificial Power<br>Network | CYBERTEK                   | EM5040DT         | E215040DT001  | Jul 05, 2021  | 1 Year        |
| 3.   | EMI Test Receiver                                 | Rohde & Schwarz            | ESCI             | 100627        | Oct. 26, 2020 | 1 Year        |
| 4.   | EMI Test Receiver                                 | Rohde & Schwarz            | ESR26            | 101481        | Oct. 26, 2020 | 1 Year        |
| 5.   | RF Switching Unit                                 | Compliance<br>Direction    | RSU-M2           | 38303         | Oct. 26, 2020 | 1 Year        |
| 6.   | MAX Spectrum<br>Analysis                          | Agilent                    | N9020A           | MY51170037    | Oct. 26, 2020 | 1 Year        |
| 7.   | Preamplifier                                      | SKET Electronic            | BK1G18G30D       | KD17503       | Oct. 26, 2020 | 1 Year        |
| 8.   | Double Ridged Horn<br>Antenna                     | Instruments<br>corporation | GTH-0118         | 351600        | Nov. 02, 2020 | 2 Year        |
| 9.   | Bilog Broadband<br>Antenna                        | Schwarzbeck                | VULB9163         | VULB 9163-289 | Nov. 02, 2020 | 2 Year        |
| 10.  | Loop Antenna                                      | Schwarzbeck                | FMZB1519B        | 00053         | Nov. 02, 2020 | 2 Year        |
| 11.  | Horn Antenna                                      | A-INFO                     | LB-180400-K<br>F | J211060628    | Nov. 02, 2020 | 2 Year        |
| 12.  | Pre-amplifier                                     | SONOMA                     | 310N             | 186860        | Oct. 26, 2020 | 1 Year        |
| 13.  | EMI Test Software<br>EZ-EMC                       | SHURPLE                    | N/A              | N/A           | N/A           | N/A           |
| 14.  | RF Test Control<br>System                         | YIHENG                     | YH3000           | 2017430       | Oct. 26, 2020 | 1 Year        |
| 15.  | Power Sensor                                      | DAER                       | RPR3006W         | 15I00041SN045 | Oct. 26, 2020 | 1 Year        |
| 16.  | Power Sensor                                      | DAER                       | RPR3006W         | 15I00041SN046 | Oct. 26, 2020 | 1 Year        |
| 17.  | MXA Spectrum<br>Analysis                          | Agilent                    | N9020A           | MY51170037    | Oct. 26, 2020 | 1 Year        |
| 18.  | MXG RF Vector<br>Signal Generator                 | Agilent                    | N5182A           | MY48180656    | Oct. 26, 2020 | 1 Year        |
| 19.  | Signal Generator                                  | Agilent                    | E4421B           | MY41000743    | Oct. 26, 2020 | 1 Year        |
| 20.  | DC Power Supply                                   | IVYTECH                    | IV3605           | 1804D360510   | Oct. 26, 2020 | 1 Year        |
| 21.  | Constant<br>Temperature<br>Humidity Chamber       | ZHONGJIAN                  | ZJ-KHWS80B       | N/A           | Oct. 26, 2020 | 1 Year        |



**1.8. Measurement Uncertainty**

|                        |   |                          |
|------------------------|---|--------------------------|
| Radiation Uncertainty  | : | Ur = 3.9 dB (Horizontal) |
|                        |   | Ur = 3.8 dB (Vertical)   |
| Conduction Uncertainty | : | Uc = 3.4 dB              |

**1.9. Description of Test Facility**

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

**FCC-Registration No.: 184111**

Shenzhen Anbotech Compliance Laboratory Limited, 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 No. 184111.

**ISED-Registration No.: 8058A**

Shenzhen Anbotech Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

**Test Location**

Shenzhen Anbotech Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102



## 2. Summary of Test Results

| Standard Section                                     | Test Item           | Result |
|------------------------------------------------------|---------------------|--------|
| 15.203                                               | Antenna Requirement | PASS   |
| 15.207                                               | Conducted Emission  | PASS   |
| 15.249                                               | Radiated Emission   | PASS   |
| 15.215(c)                                            | 20dB Bandwidth      | PASS   |
| 15.249(c)                                            | Band Edge           | PASS   |
| Remark: "N/A" is an abbreviation for Not Applicable. |                     |        |

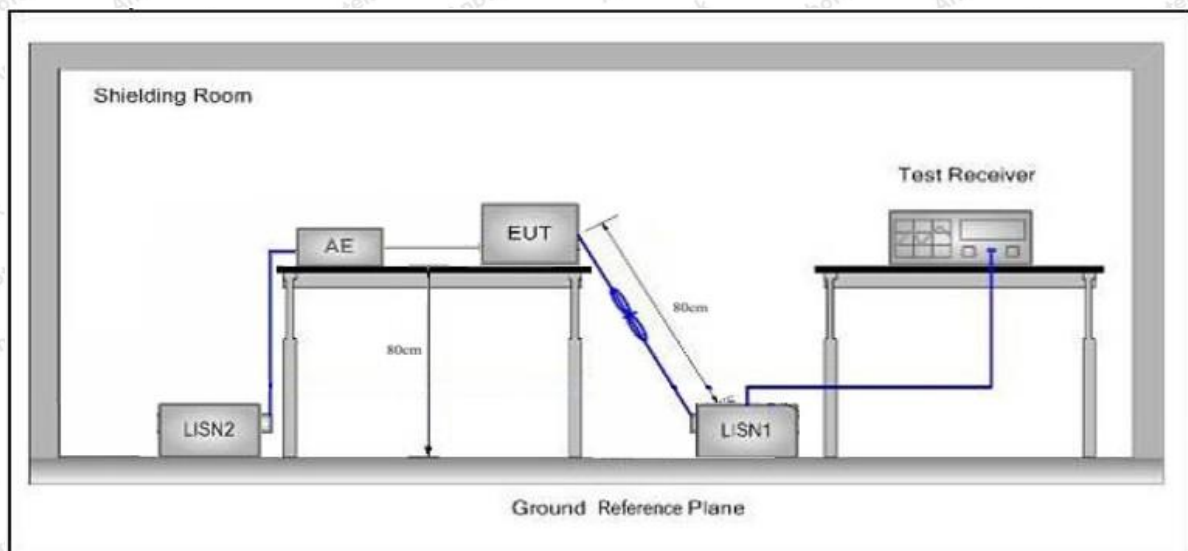


### 3. Conducted Emission Test

### 3.1. Test Standard and Limit

|                                                                                                                                          |                           |                                |               |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------|---------------|
| Test Standard                                                                                                                            | FCC Part15 Section 15.207 |                                |               |
| Test Limit                                                                                                                               | Frequency                 | Maximum RF Line Voltage (dBuV) |               |
|                                                                                                                                          |                           | Quasi-peak Level               | Average Level |
|                                                                                                                                          | 150kHz~500kHz             | 66 ~ 56 *                      | 56 ~ 46 *     |
|                                                                                                                                          | 500kHz~5MHz               | 56                             | 46            |
|                                                                                                                                          | 5MHz~30MHz                | 60                             | 50            |
| <b>Remark:</b> (1) *Decreasing linearly with logarithm of the frequency.<br>(2) The lower limit shall apply at the transition frequency. |                           |                                |               |

### 3.2. Test Setup



### 3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2020 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

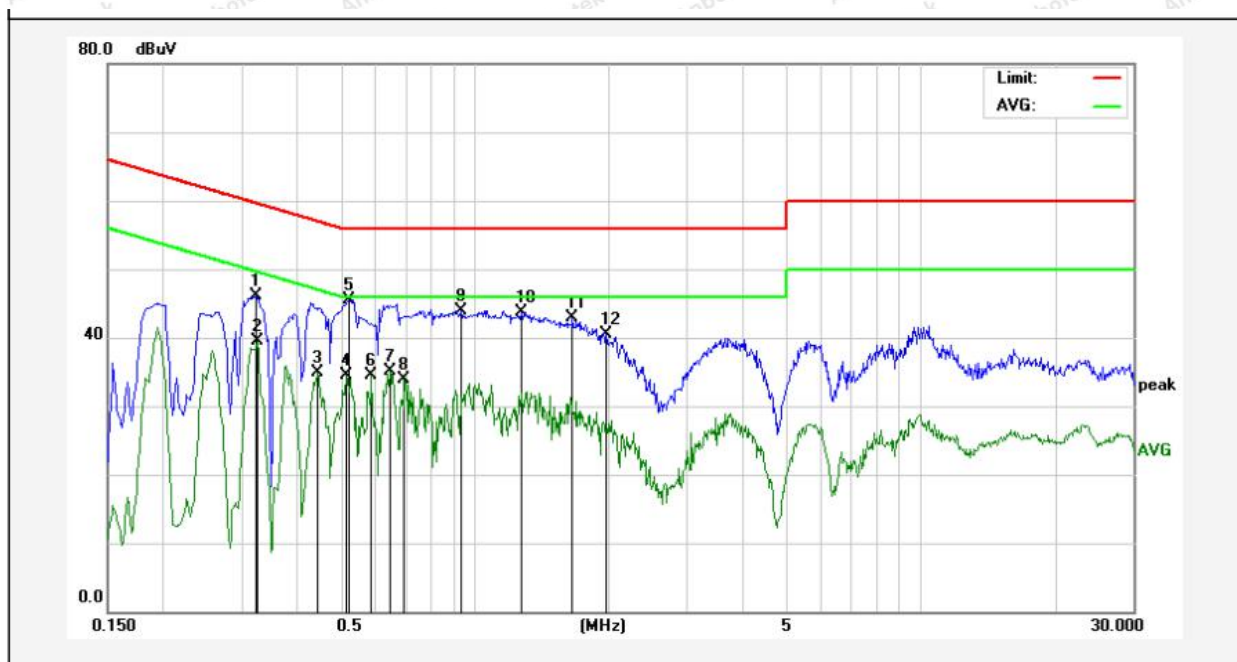
The frequency range from 150kHz to 30MHz is checked.

### 3.4. Test Data

During the test, pre-scan all modes, and found the CH01 of which is the worst case, only the worst case is recorded in the report.

#### Conducted Emission Test Data

Test Site: 1# Shielded Room  
Operating Condition: CH01  
Test Specification: DC 5V via MacBook Air  
Comment: Live Line  
Tem.: 24.2°C Hum.: 48%

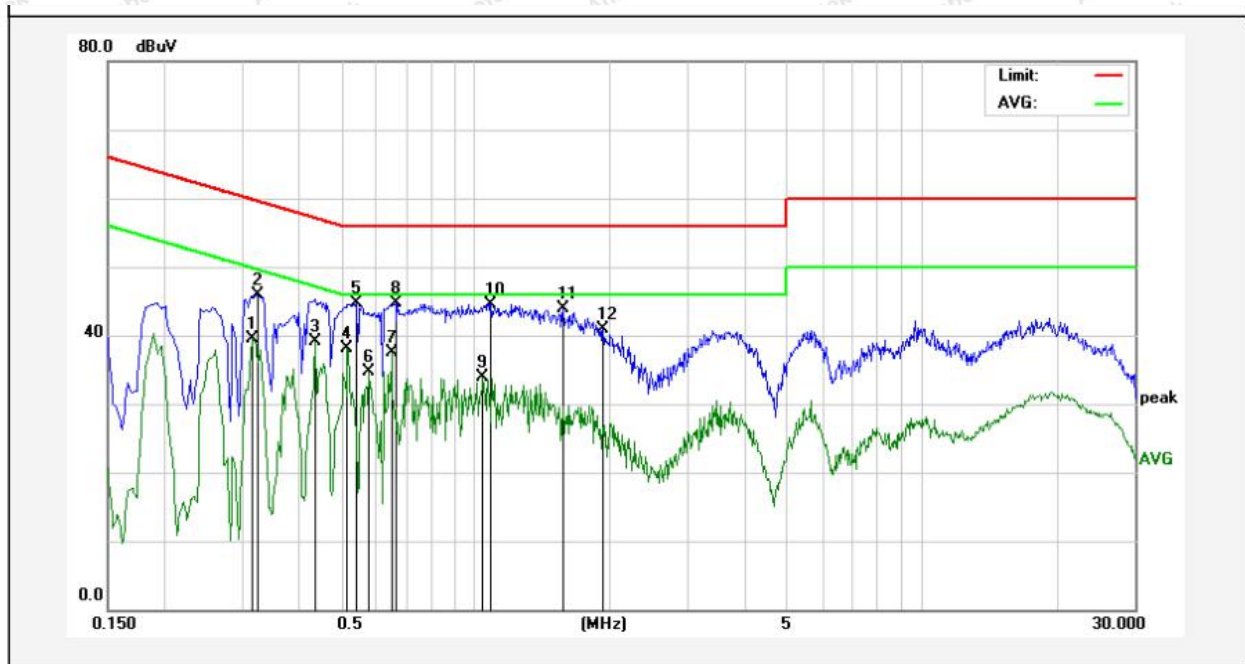


| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Over Limit (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|--------------|-----------------|----------|--------|
| 1   | 0.3220      | 35.89          | 10.13       | 46.02         | 59.65        | -13.63          | QP       |        |
| 2   | 0.3260      | 29.34          | 10.12       | 39.46         | 49.55        | -10.09          | AVG      |        |
| 3   | 0.4460      | 24.84          | 10.13       | 34.97         | 46.95        | -11.98          | AVG      |        |
| 4   | 0.5140      | 24.37          | 10.15       | 34.52         | 46.00        | -11.48          | AVG      |        |
| 5   | 0.5220      | 35.37          | 10.15       | 45.52         | 56.00        | -10.48          | QP       |        |
| 6   | 0.5860      | 24.30          | 10.15       | 34.45         | 46.00        | -11.55          | AVG      |        |
| 7   | 0.6460      | 24.95          | 10.15       | 35.10         | 46.00        | -10.90          | AVG      |        |
| 8   | 0.6940      | 23.82          | 10.15       | 33.97         | 46.00        | -12.03          | AVG      |        |
| 9   | 0.9380      | 33.85          | 10.15       | 44.00         | 56.00        | -12.00          | QP       |        |
| 10  | 1.2700      | 33.57          | 10.14       | 43.71         | 56.00        | -12.29          | QP       |        |
| 11  | 1.6580      | 32.68          | 10.13       | 42.81         | 56.00        | -13.19          | QP       |        |
| 12  | 1.9780      | 30.45          | 10.12       | 40.57         | 56.00        | -15.43          | QP       |        |



**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
 Operating Condition: CH01  
 Test Specification: DC 5V via MacBook Air  
 Comment: Neutral Line  
 Tem.: 24.2°C Hum.: 48%



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Over Limit (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|--------------|-----------------|----------|--------|
| 1   | 0.3180      | 29.43          | 10.13       | 39.56         | 49.76        | -10.20          | AVG      |        |
| 2   | 0.3260      | 35.73          | 10.12       | 45.85         | 59.55        | -13.70          | QP       |        |
| 3   | 0.4380      | 28.98          | 10.13       | 39.11         | 47.10        | -7.99           | AVG      |        |
| 4   | 0.5180      | 27.94          | 10.15       | 38.09         | 46.00        | -7.91           | AVG      |        |
| 5   | 0.5420      | 34.58          | 10.15       | 44.73         | 56.00        | -11.27          | QP       |        |
| 6   | 0.5780      | 24.52          | 10.15       | 34.67         | 46.00        | -11.33          | AVG      |        |
| 7   | 0.6500      | 27.41          | 10.15       | 37.56         | 46.00        | -8.44           | AVG      |        |
| 8   | 0.6620      | 34.63          | 10.15       | 44.78         | 56.00        | -11.22          | QP       |        |
| 9   | 1.0420      | 23.74          | 10.15       | 33.89         | 46.00        | -12.11          | AVG      |        |
| 10  | 1.0859      | 34.45          | 10.15       | 44.60         | 56.00        | -11.40          | QP       |        |
| 11  | 1.5700      | 33.76          | 10.13       | 43.89         | 56.00        | -12.11          | QP       |        |
| 12  | 1.9340      | 30.80          | 10.12       | 40.92         | 56.00        | -15.08          | QP       |        |



## 4. Radiated Emission and Band Edge

### 4.1. Test Standard and Limit

| Test Standard | FCC Part15 C Section 15.209 and 15.205 |                                  |                |            |                          |
|---------------|----------------------------------------|----------------------------------|----------------|------------|--------------------------|
| Test Limit    | Frequency (MHz)                        | Field strength (microvolt/meter) | Limit (dBuV/m) | Remark     | Measurement distance (m) |
|               | 0.009MHz~0.490MHz                      | 2400/F(kHz)                      | -              | -          | 300                      |
|               | 0.490MHz-1.705MHz                      | 24000/F(kHz)                     | -              | -          | 30                       |
|               | 1.705MHz-30MHz                         | 30                               | -              | -          | 30                       |
|               | 30MHz~88MHz                            | 100                              | 40.0           | Quasi-peak | 3                        |
|               | 88MHz~216MHz                           | 150                              | 43.5           | Quasi-peak | 3                        |
|               | 216MHz~960MHz                          | 200                              | 46.0           | Quasi-peak | 3                        |
|               | 960MHz~1000MHz                         | 500                              | 54.0           | Quasi-peak | 3                        |
|               | Above 1000MHz                          | 500                              | 54.0           | Average    | 3                        |
|               |                                        | -                                | 74.0           | Peak       | 3                        |

**Remark:**

(1)The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

| Test Standard | FCC Part15 C Section 15.249 |                                                    |                                                |                |         |                          |
|---------------|-----------------------------|----------------------------------------------------|------------------------------------------------|----------------|---------|--------------------------|
| Test Limit    | Frequency (MHz)             | Field Strength of fundamental ((millivolts /meter) | Field Strength of Harmonics (microvolts/meter) | Limit (dBuV/m) | Remark  | Measurement distance (m) |
|               | 2400~2483.5                 | 50                                                 | -                                              | 114.0          | Peak    | 3                        |
|               | 2400~2483.5                 | 50                                                 | -                                              | 94.0           | Average | 3                        |
|               | 2400~2483.5                 | -                                                  | 500                                            | 74.0           | Peak    | 3                        |
|               | 2400~2483.5                 | -                                                  | 500                                            | 54.0           | Average | 3                        |

**Remark:**

(1) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

## 4.2. Test Setup

Figure 1. Below 30MHz

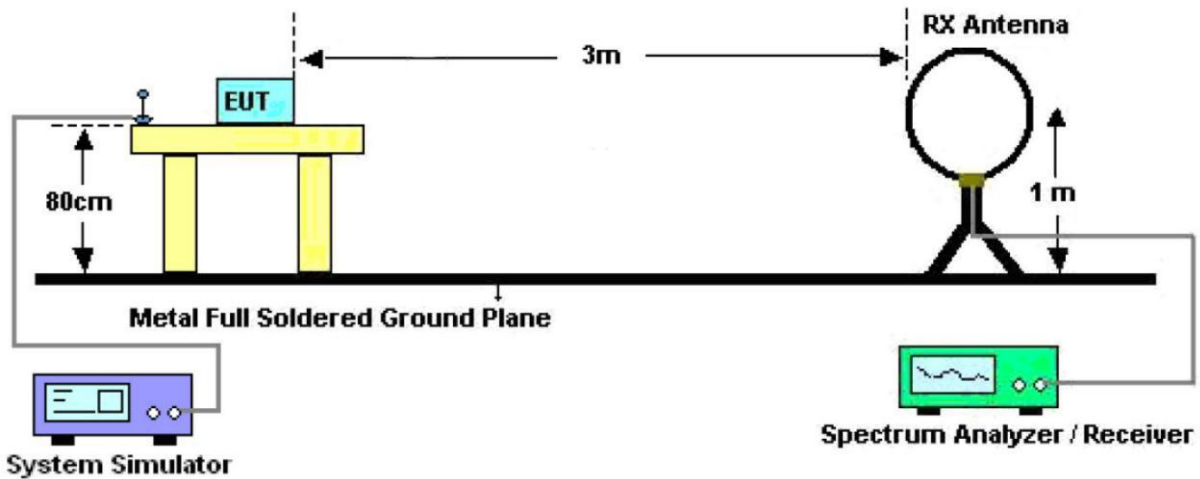


Figure 2. 30MHz to 1GHz

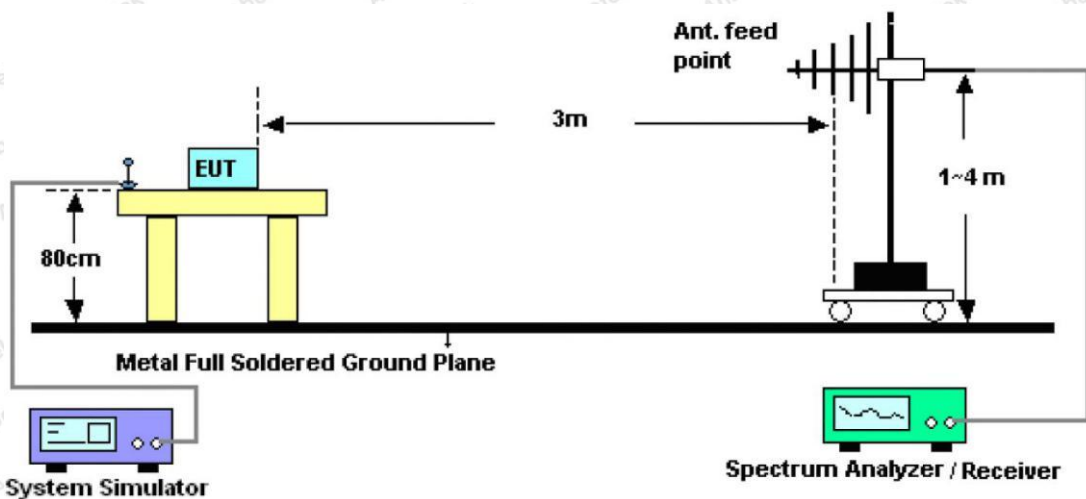
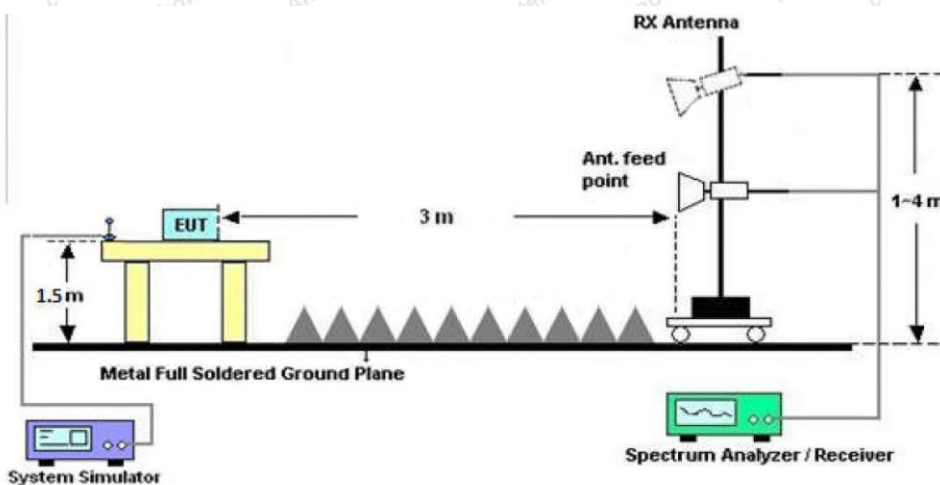


Figure 3. Above 1 GHz



### 4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9\*6\*6 Chamber. The device is evaluated in xyz orientation.

For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW = 1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9KHz, VBW = 30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW = 300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz, Set the spectrum analyzer as:

RBW = 1MHz, VBW = 1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

RBW = 1MHz, VBW = 10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

### 4.4. Test Data

#### PASS

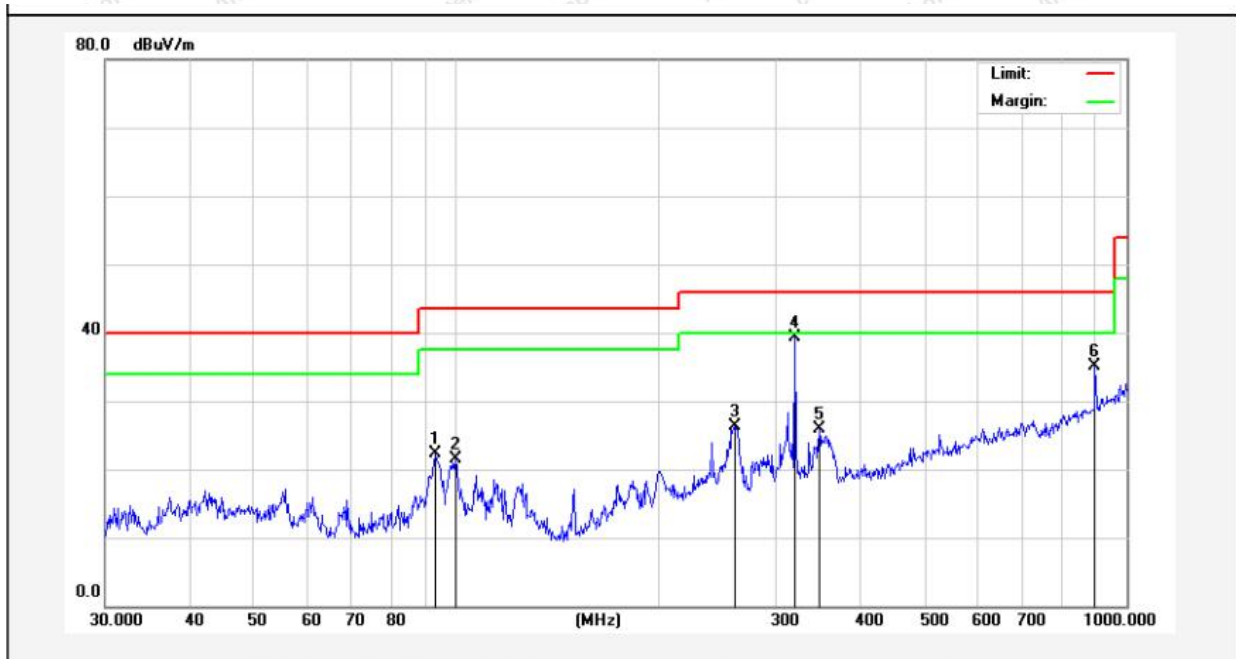
During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.



## Test Results (30~1000MHz)

Test Mode: CH01  
Power Source: DC 5V via MacBook Air  
Polarization: Vertical  
Temp.(°C)/Hum.(%RH): 22.9°C/49%RH

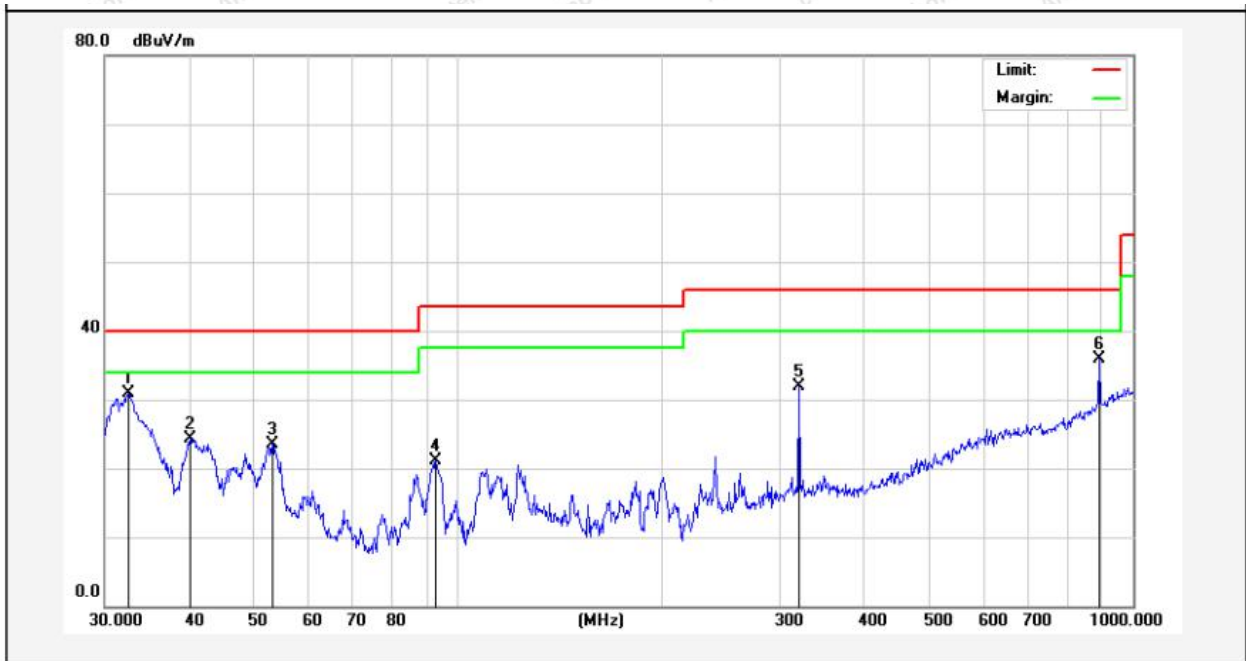


| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|-----|-------------|----------------|---------------|-----------------|----------------|-----------------|----------|-------------|--------------|--------|
| 1   | 93.1132     | 42.56          | -20.17        | 22.39           | 43.50          | -21.11          | QP       | 100         | 0            |        |
| 2   | 99.8777     | 40.92          | -19.39        | 21.53           | 43.50          | -21.97          | QP       | 100         | 360          |        |
| 3   | 260.1444    | 44.25          | -17.92        | 26.33           | 46.00          | -19.67          | QP       | 100         | 0            |        |
| 4   | 319.9370    | 53.04          | -13.78        | 39.26           | 46.00          | -6.74           | QP       | 100         | 360          |        |
| 5   | 348.0274    | 38.95          | -13.05        | 25.90           | 46.00          | -20.10          | QP       | 100         | 0            |        |
| 6   | 896.9963    | 36.80          | -1.78         | 35.02           | 46.00          | -10.98          | QP       | 100         | 360          |        |



**Test Results (30~1000MHz)**

Test Mode: CH01  
Power Source: DC 5V via MacBook Air  
Polarization: Horizontal  
Temp.(°C)/Hum.(%RH): 22.9°C/49%RH



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|-----|-------------|----------------|---------------|-----------------|----------------|-----------------|----------|-------------|--------------|--------|
| 1   | 32.5197     | 47.72          | -16.73        | 30.99           | 40.00          | -9.01           | QP       | 100         | 0            |        |
| 2   | 40.1347     | 37.93          | -13.59        | 24.34           | 40.00          | -15.66          | QP       | 100         | 360          |        |
| 3   | 53.1313     | 39.40          | -15.90        | 23.50           | 40.00          | -16.50          | QP       | 100         | 0            |        |
| 4   | 92.7870     | 36.57          | -15.54        | 21.03           | 43.50          | -22.47          | QP       | 100         | 360          |        |
| 5   | 319.9370    | 44.72          | -12.84        | 31.88           | 46.00          | -14.12          | QP       | 100         | 0            |        |
| 6   | 890.7278    | 37.82          | -1.98         | 35.84           | 46.00          | -10.16          | QP       | 100         | 360          |        |

**Fundamental**

| Frequency (MHz) | Antenna Pol. | Reading (dBuV/m) | Factor (dB) | Results (dBuV/m) | Limits (dBuV/m) | Det. Mode |
|-----------------|--------------|------------------|-------------|------------------|-----------------|-----------|
| 908             | H            | 93.64            | -1.57       | 92.07            | 94              | QP        |
| 908             | V            | 92.15            | -1.57       | 90.58            | 94              | QP        |
| 912             | H            | 90.33            | -1.49       | 88.84            | 94              | QP        |
| 912             | V            | 88.76            | -1.49       | 87.27            | 94              | QP        |
| 916             | H            | 94.26            | -1.43       | 92.83            | 94              | QP        |
| 916             | V            | 93.57            | -1.43       | 92.14            | 94              | QP        |
| 920             | H            | 92.88            | -1.34       | 91.54            | 94              | QP        |
| 920             | V            | 92.06            | -1.34       | 90.72            | 94              | QP        |

**Note:**

1. Level = Receiver Read level + Factor

**Test Results (1GHz-25GHz)**

| Test Mode: 908MHz |                   |                       |                 |                    |                |                |                 |      |          |
|-------------------|-------------------|-----------------------|-----------------|--------------------|----------------|----------------|-----------------|------|----------|
| Frequency (MHz)   | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. | Detector |
| 1816.8000         | 50.97             | 7.39                  | 28.73           | 26.31              | 60.78          | 74             | -13.22          | H    | Peak     |
| 1816.8000         | 40.11             | 7.39                  | 28.73           | 26.31              | 49.92          | 54             | -4.08           | H    | AVG      |
| 2725.2000         | 48.40             | 8.10                  | 29.71           | 27.01              | 59.20          | 74             | -14.80          | H    | Peak     |
| 2725.2000         | 37.63             | 8.10                  | 29.71           | 27.01              | 48.43          | 54             | -5.57           | H    | AVG      |
| 3633.6000         | --                | --                    | --              | --                 | --             | --             | --              | H    | Peak     |
| 3633.6000         | --                | --                    | --              | --                 | --             | --             | --              | H    | AVG      |
| 1816.8000         | 45.32             | 7.39                  | 28.73           | 26.31              | 55.13          | 74             | -18.87          | V    | Peak     |
| 1816.8000         | 37.88             | 7.39                  | 28.73           | 26.31              | 47.69          | 54             | -6.31           | V    | AVG      |
| 2725.2000         | 46.44             | 8.10                  | 29.71           | 27.01              | 57.24          | 74             | -16.76          | V    | Peak     |
| 2725.2000         | 38.32             | 8.10                  | 29.71           | 27.01              | 49.12          | 54             | -4.88           | V    | AVG      |
| 3633.6000         | --                | --                    | --              | --                 | --             | --             | --              | V    | Peak     |
| 3633.6000         | --                | --                    | --              | --                 | --             | --             | --              | V    | AVG      |



| Test Mode: 912MHz |                   |                       |                 |                          |                |                |                 |      |          |
|-------------------|-------------------|-----------------------|-----------------|--------------------------|----------------|----------------|-----------------|------|----------|
| Frequency (MHz)   | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. | Detector |
| 1824.0000         | 50.67             | 7.39                  | 28.73           | 26.31                    | 60.48          | 74             | -13.52          | H    | Peak     |
| 1824.0000         | 40.51             | 7.39                  | 28.73           | 26.31                    | 50.32          | 54             | -3.68           | H    | AVG      |
| 2736.0000         | 47.89             | 8.10                  | 29.71           | 27.01                    | 58.69          | 74             | -15.31          | H    | Peak     |
| 2736.0000         | 38.01             | 8.10                  | 29.71           | 27.01                    | 48.81          | 54             | -5.19           | H    | AVG      |
| 3648.0000         | --                | --                    | --              | --                       |                | --             | --              | H    | Peak     |
| 3648.0000         | --                | --                    | --              | --                       |                | --             | --              | H    | AVG      |
| 1824.0000         | 45.28             | 7.39                  | 28.73           | 26.31                    | 55.09          | 74             | -18.91          | V    | Peak     |
| 1824.0000         | 38.02             | 7.39                  | 28.73           | 26.31                    | 47.83          | 54             | -6.17           | V    | AVG      |
| 2736.0000         | 46.36             | 8.10                  | 29.71           | 27.01                    | 57.16          | 74             | -16.84          | V    | Peak     |
| 2736.0000         | 38.93             | 8.10                  | 29.71           | 27.01                    | 49.73          | 54             | -4.27           | V    | AVG      |
| 3648.0000         | --                | --                    | --              | --                       |                | --             | --              | V    | Peak     |
| 3648.0000         | --                | --                    | --              | --                       |                | --             | --              | V    | AVG      |

| Test Mode: 916MHz |                   |                       |                 |                          |                |                |                 |      |          |
|-------------------|-------------------|-----------------------|-----------------|--------------------------|----------------|----------------|-----------------|------|----------|
| Frequency (MHz)   | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. | Detector |
| 1832.0000         | 50.77             | 7.39                  | 28.73           | 26.31                    | 60.58          | 74             | -13.42          | H    | Peak     |
| 1832.0000         | 40.27             | 7.39                  | 28.73           | 26.31                    | 50.08          | 54             | -3.92           | H    | AVG      |
| 2748.0000         | 48.68             | 8.10                  | 29.71           | 27.01                    | 59.48          | 74             | -14.52          | H    | Peak     |
| 2748.0000         | 38.07             | 8.10                  | 29.71           | 27.01                    | 48.87          | 54             | -5.13           | H    | AVG      |
| 3664.0000         | --                | --                    | --              | --                       |                | --             | --              | H    | Peak     |
| 3664.0000         | --                | --                    | --              | --                       |                | --             | --              | H    | AVG      |
| 1832.0000         | 45.54             | 7.39                  | 28.73           | 26.31                    | 55.35          | 74             | -18.65          | V    | Peak     |
| 1832.0000         | 38.40             | 7.39                  | 28.73           | 26.31                    | 48.21          | 54             | -5.79           | V    | AVG      |
| 2748.0000         | 46.58             | 8.10                  | 29.71           | 27.01                    | 57.38          | 74             | -16.62          | V    | Peak     |
| 2748.0000         | 38.78             | 8.10                  | 29.71           | 27.01                    | 49.58          | 54             | -4.42           | V    | AVG      |
| 3664.0000         | --                | --                    | --              | --                       |                | --             | --              | V    | Peak     |
| 3664.0000         | --                | --                    | --              | --                       |                | --             | --              | V    | AVG      |



| Test Mode: 920MHz |                   |                       |                 |                     |                |                |                 |      |          |
|-------------------|-------------------|-----------------------|-----------------|---------------------|----------------|----------------|-----------------|------|----------|
| Frequency (MHz)   | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preampl Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. | Detector |
| 1840.0000         | 50.25             | 7.39                  | 28.73           | 26.31               | 60.06          | 74             | -13.94          | H    | Peak     |
| 1840.0000         | 39.66             | 7.39                  | 28.73           | 26.31               | 49.47          | 54             | -4.53           | H    | AVG      |
| 2760.0000         | 48.04             | 8.10                  | 29.71           | 27.01               | 58.84          | 74             | -15.16          | H    | Peak     |
| 2760.0000         | 37.32             | 8.10                  | 29.71           | 27.01               | 48.12          | 54             | -5.88           | H    | AVG      |
| 3680.0000         | --                | --                    | --              | --                  |                | --             | --              | H    | Peak     |
| 3680.0000         | --                | --                    | --              | --                  |                | --             | --              | H    | AVG      |
| 1840.0000         | 45.32             | 7.39                  | 28.73           | 26.31               | 55.13          | 74             | -18.87          | V    | Peak     |
| 1840.0000         | 38.54             | 7.39                  | 28.73           | 26.31               | 48.35          | 54             | -5.65           | V    | AVG      |
| 2760.0000         | 46.72             | 8.10                  | 29.71           | 27.01               | 57.52          | 74             | -16.48          | V    | Peak     |
| 2760.0000         | 38.65             | 8.10                  | 29.71           | 27.01               | 49.45          | 54             | -4.55           | V    | AVG      |
| 3680.0000         | --                | --                    | --              | --                  |                | --             | --              | V    | Peak     |
| 3680.0000         | --                | --                    | --              | --                  |                | --             | --              | V    | AVG      |

**Note:**

1. Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “--” means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

**Radiated Band Edge:**

| Frequency (MHz) | Read Level (dBuV/m) | Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. | Det. |
|-----------------|---------------------|-------------|----------------|----------------|-----------------|------|------|
| 902.0000        | 36.96               | -1.67       | 35.29          | 46.00          | -10.71          | H    | QP   |
| 928.0000        | 37.45               | -1.22       | 36.23          | 46.00          | -9.77           | H    | QP   |
| 902.0000        | 40.17               | -1.67       | 38.50          | 46.00          | -7.50           | V    | QP   |
| 928.0000        | 40.45               | -1.22       | 39.23          | 46.00          | -6.77           | V    | QP   |

**Remark:**

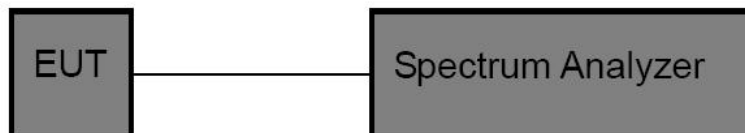
1. Level = Receiver Read level + Factor

## 5. 20dB Bandwidth Test

### 5.1. Test Standard and Limit

|               |                             |
|---------------|-----------------------------|
| Test Standard | FCC Part15 C Section 15.249 |
|---------------|-----------------------------|

### 5.2. Test Setup



### 5.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:  
RBW = 30kHz, VBW $\geq$ 3\*RBW =100kHz,  
Detector= Average  
Trace mode= Max hold.  
Sweep- auto couple.
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

### 5.4. Test Data

Test Item : 20dB Bandwidth

Test Voltage : DC 5V via MacBook Air

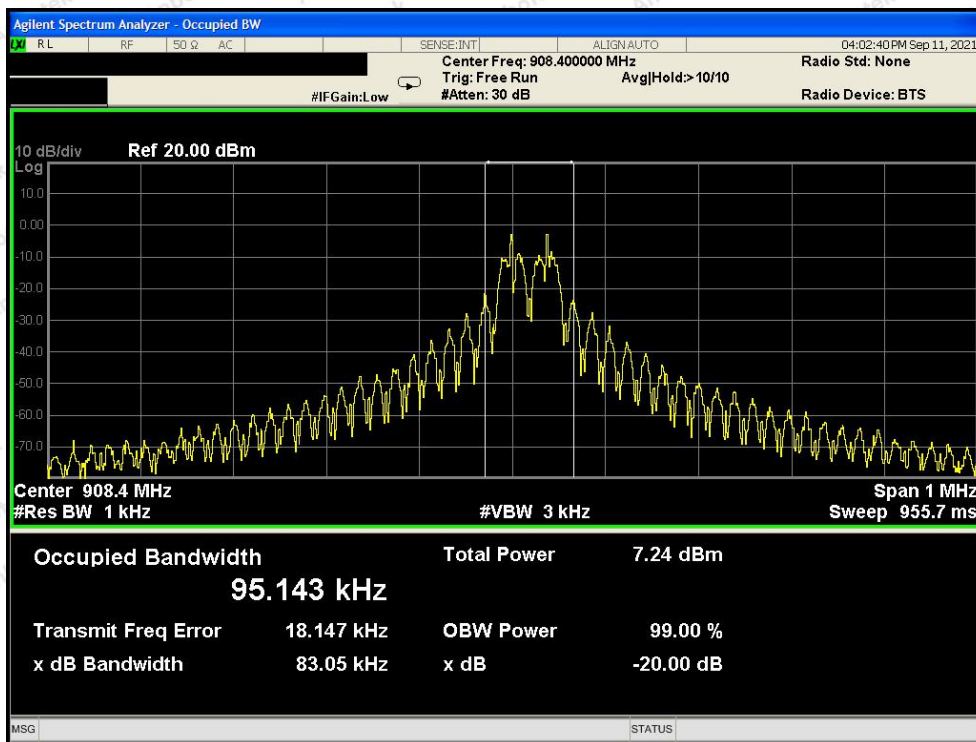
Test Result : PASS

Test Mode : Mode 1

Temperature : 22.4℃

Humidity : 55%RH

| Frequency (MHz) | Bandwidth (kHz) | Result |
|-----------------|-----------------|--------|
| 908             | 83.05           | PASS   |
| 912             | 1049            | PASS   |
| 916             | 120.4           | PASS   |
| 920             | 1049            | PASS   |

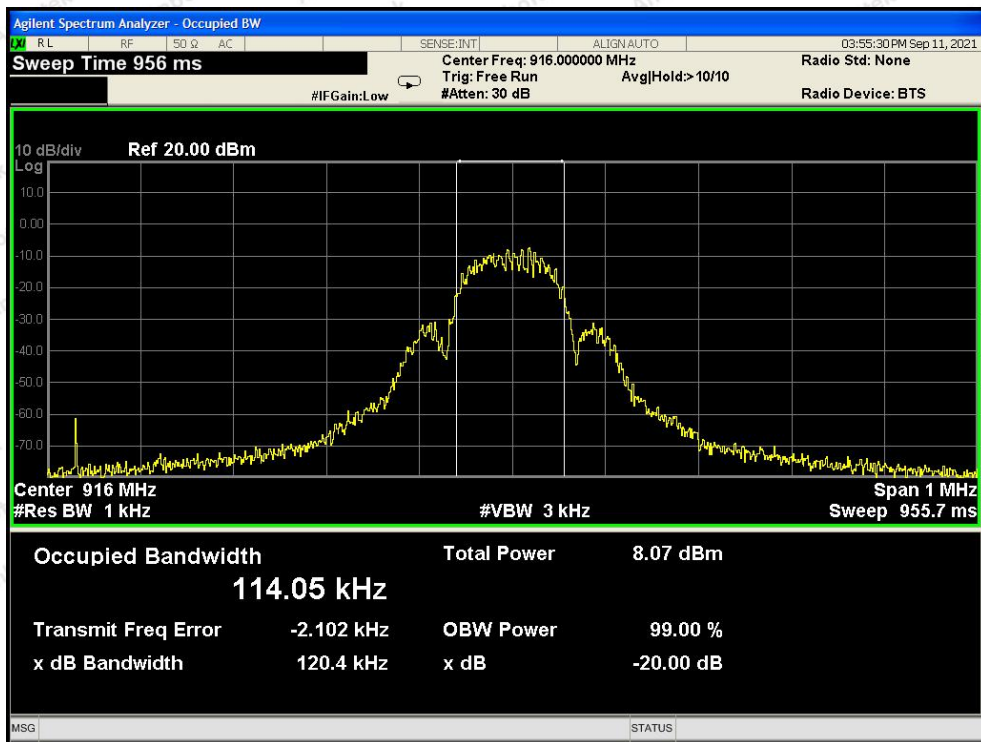


908MHz

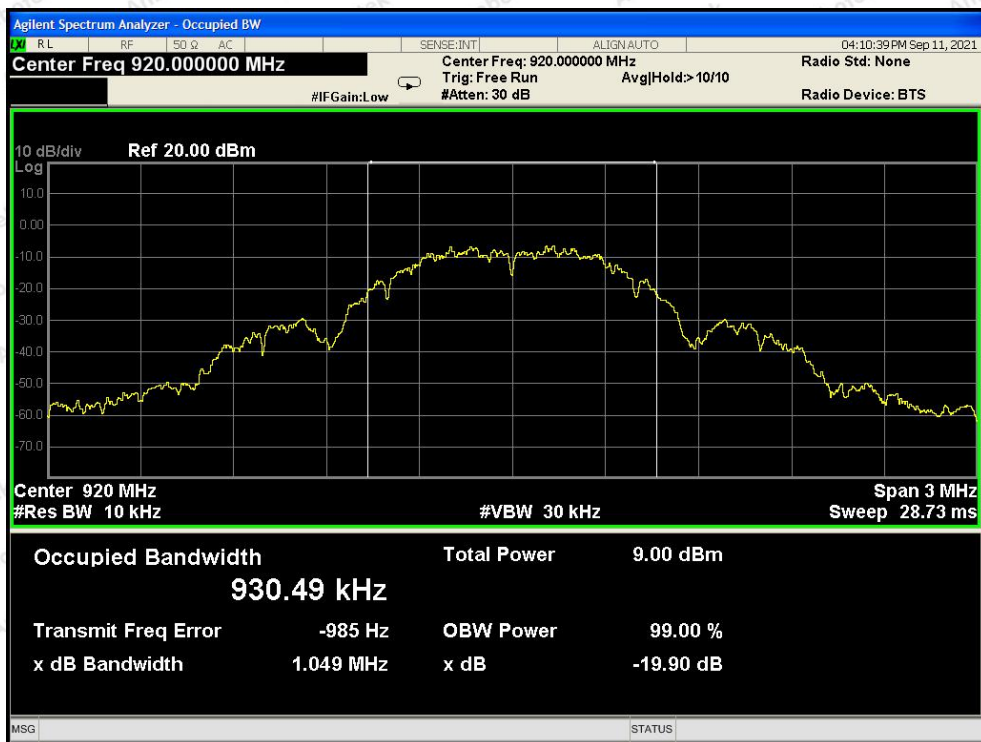


912MHz





916MHz



920MHz



## 6. Antenna Requirement

### 6.1. Test Standard and Requirement

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Standard | FCC Part15 Section 15.203                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Requirement   | 1) 15.203 requirement:<br>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 or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. |

### 6.2. Antenna Connected Construction

The antenna is a Monopole Antenna which permanently attached, and the best case gain of the antenna is 1.4 dBi. It complies with the standard requirement.

## APPENDIX I -- TEST SETUP PHOTOGRAPH

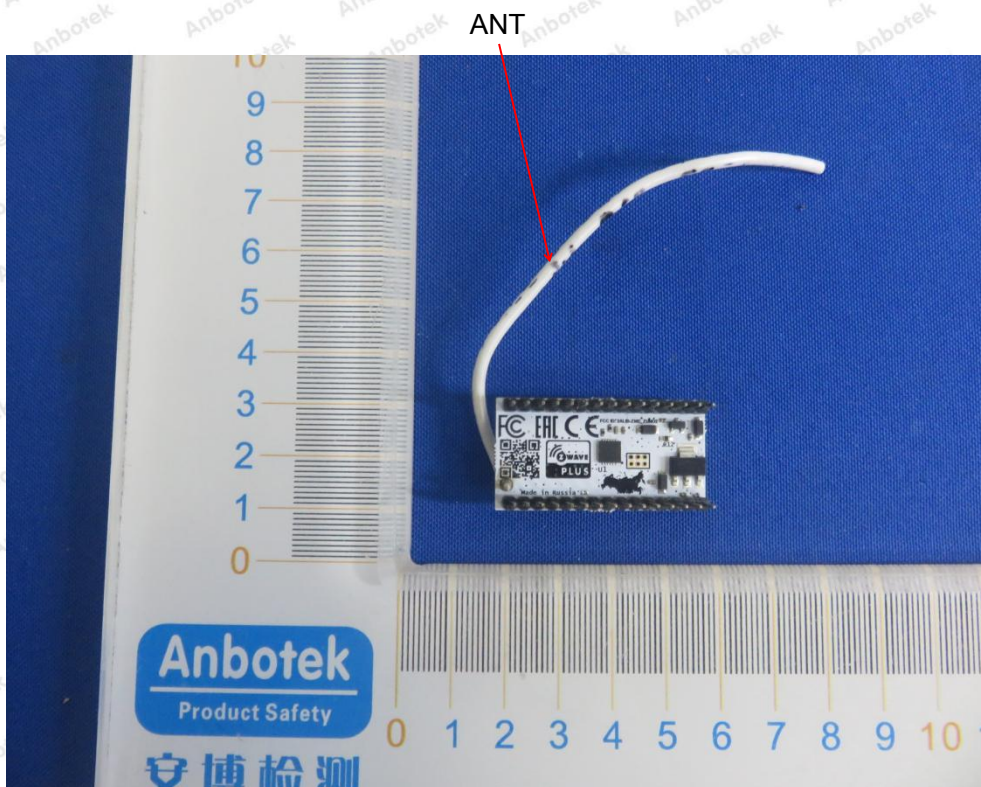
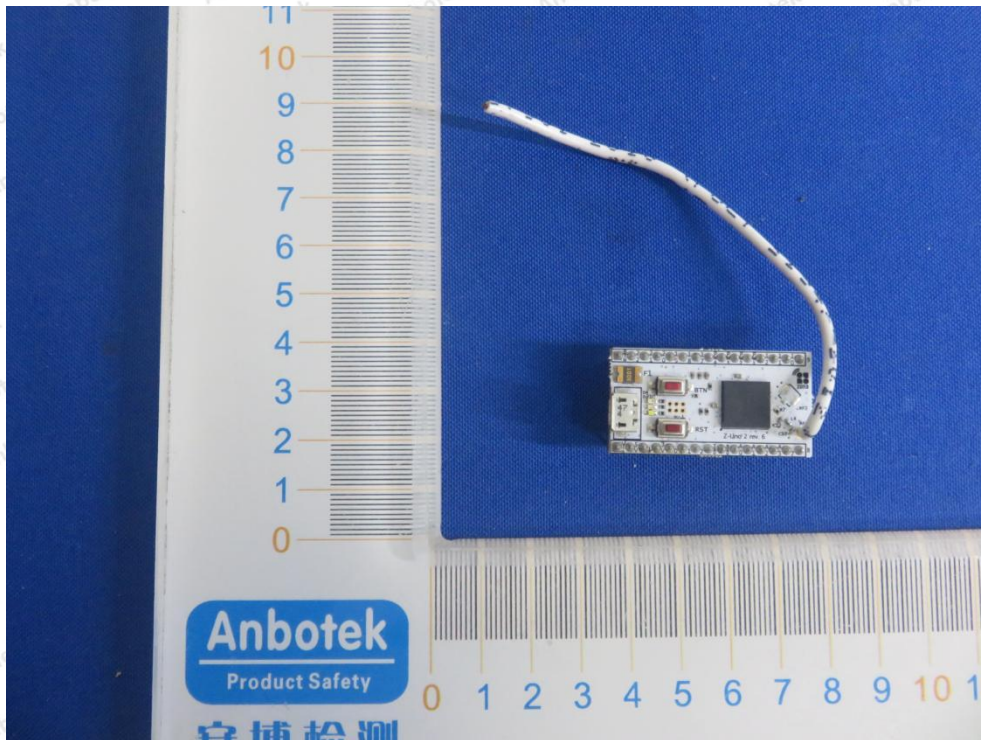
Photo of Power Line Conducted Emission Test

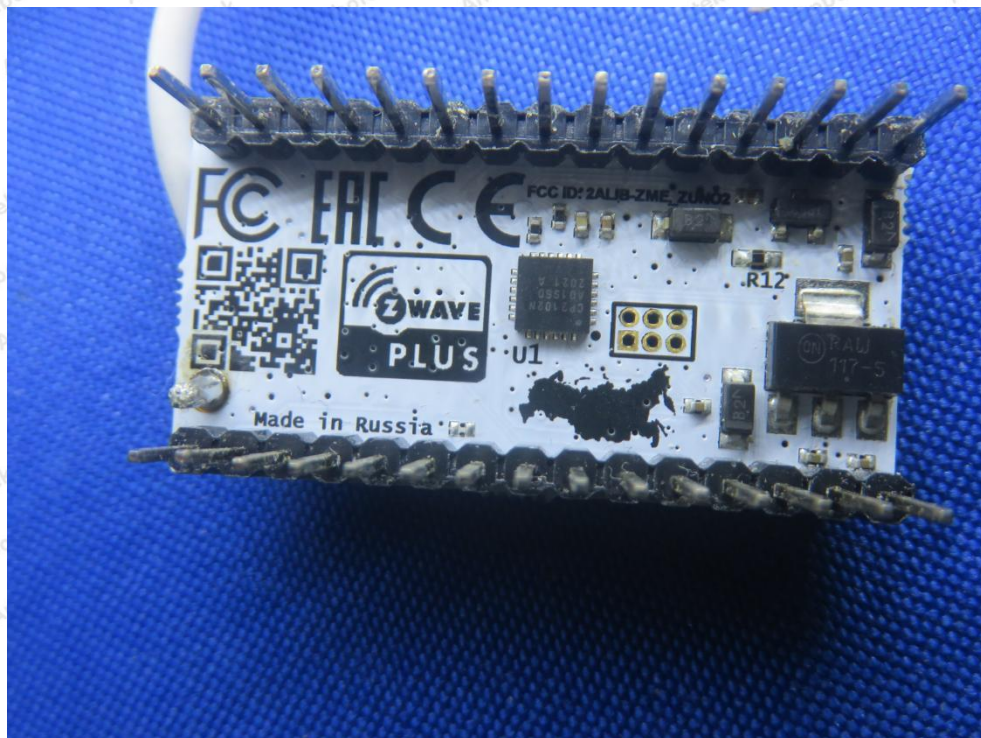
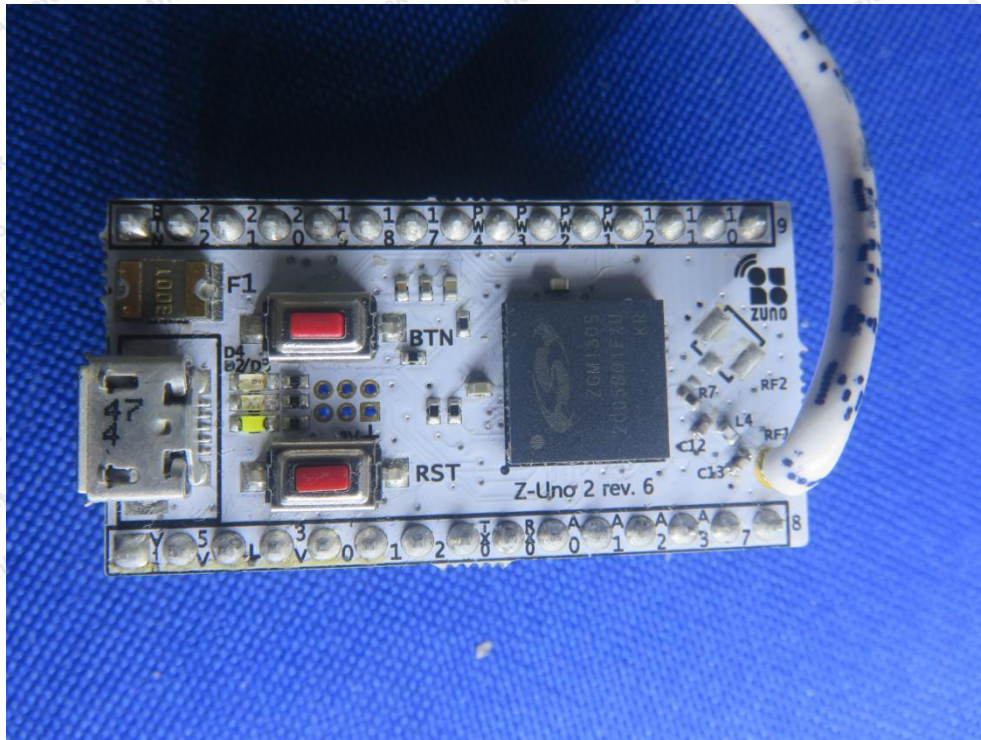


Photo of Radiation Emission Test





**APPENDIX II -- EUT PHOTOGRAPH**



----- End of Report -----