

# FCC Test Report

Client Name : FERMAX ELECTRONICA, S.A.U.

Address : AV. TRES CRUCES, 133, VALENCIA Spain 46017

Product Name : RESISTANT KEYPAD AND PROX READER

Date : Jan. 13, 2021

**Shenzhen Anbotek Compliance Laboratory Limited**



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# TEST REPORT

Applicant : FERMAX ELECTRONICA, S.A.U.  
Manufacturer : Secukey Technology Co., Ltd.  
Product Name : RESISTANT KEYPAD AND PROX READER  
Model No. : 5293, 5296  
Trade Mark : FERMAX  
Rating(s) : Input: AC 12-28V /DC 12-28V

**Test Standard(s) : FCC Part15 Subpart C 2018, Section 15.225**

**Test Method(s) : ANSI C63.10: 2013**

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

Dec. 02, 2020

Date of Test

Dec. 02~23, 2020

Prepared By

*Yilia Zhong*

(Engineer / Yilia Zhong)

Reviewer

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(Supervisor / Bibo Zhang)

Approved & Authorized Signer

*Kingkong Jin*

(Manager / Kingkong Jin)

## 1. General Information

### 1.1. Client Information

|              |   |                                                                                                                  |
|--------------|---|------------------------------------------------------------------------------------------------------------------|
| Applicant    | : | FERMAX ELECTRONICA, S.A.U.                                                                                       |
| Address      | : | AV. TRES CRUCES, 133, VALENCIA Spain 46017                                                                       |
| Manufacturer | : | Secukey Technology Co., Ltd.                                                                                     |
| Address      | : | Floor 5, Building 13, Longbi Industrial Park, Dafa Road, Bantian Subdistrict, Longgang District, Shenzhen, China |
| Factory      | : | Secukey Technology Co., Ltd.                                                                                     |
| Address      | : | Floor 5, Building 13, Longbi Industrial Park, Dafa Road, Bantian Subdistrict, Longgang District, Shenzhen, China |

### 1.2. Description of Device (EUT)

|                                                                                                                                                                        |                      |                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------|
| Product Name                                                                                                                                                           | :                    | RESISTANT KEYPAD AND PROX READER                                                                            |
| Model No.                                                                                                                                                              | :                    | 5293, 5296<br>(Note: All samples are the same except the model number, so we prepare "5293" for test only.) |
| Trade Mark                                                                                                                                                             | :                    | FERMAX                                                                                                      |
| Test Power Supply                                                                                                                                                      | :                    | DC 12V /AC12V                                                                                               |
| Product Description                                                                                                                                                    | Operation Frequency: | 13.56MHz                                                                                                    |
|                                                                                                                                                                        | Number of Channel:   | 1 Channels                                                                                                  |
|                                                                                                                                                                        | Modulation Type:     | BPSK                                                                                                        |
|                                                                                                                                                                        | Antenna Type:        | PCB Antenna                                                                                                 |
|                                                                                                                                                                        | Antenna Gain(Peak):  | 0 dBi                                                                                                       |
| Remark: 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.<br>2) This report is for 13.56MHz module. |                      |                                                                                                             |

### 1.3. Auxiliary Equipment Used During Test

|     |   |  |
|-----|---|--|
| N/A | : |  |
|-----|---|--|

#### 1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible 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       | TX Mode     |

| For Conduction Emission |             |
|-------------------------|-------------|
| Final Test Mode         | Description |
| Mode 1                  | TX Mode     |

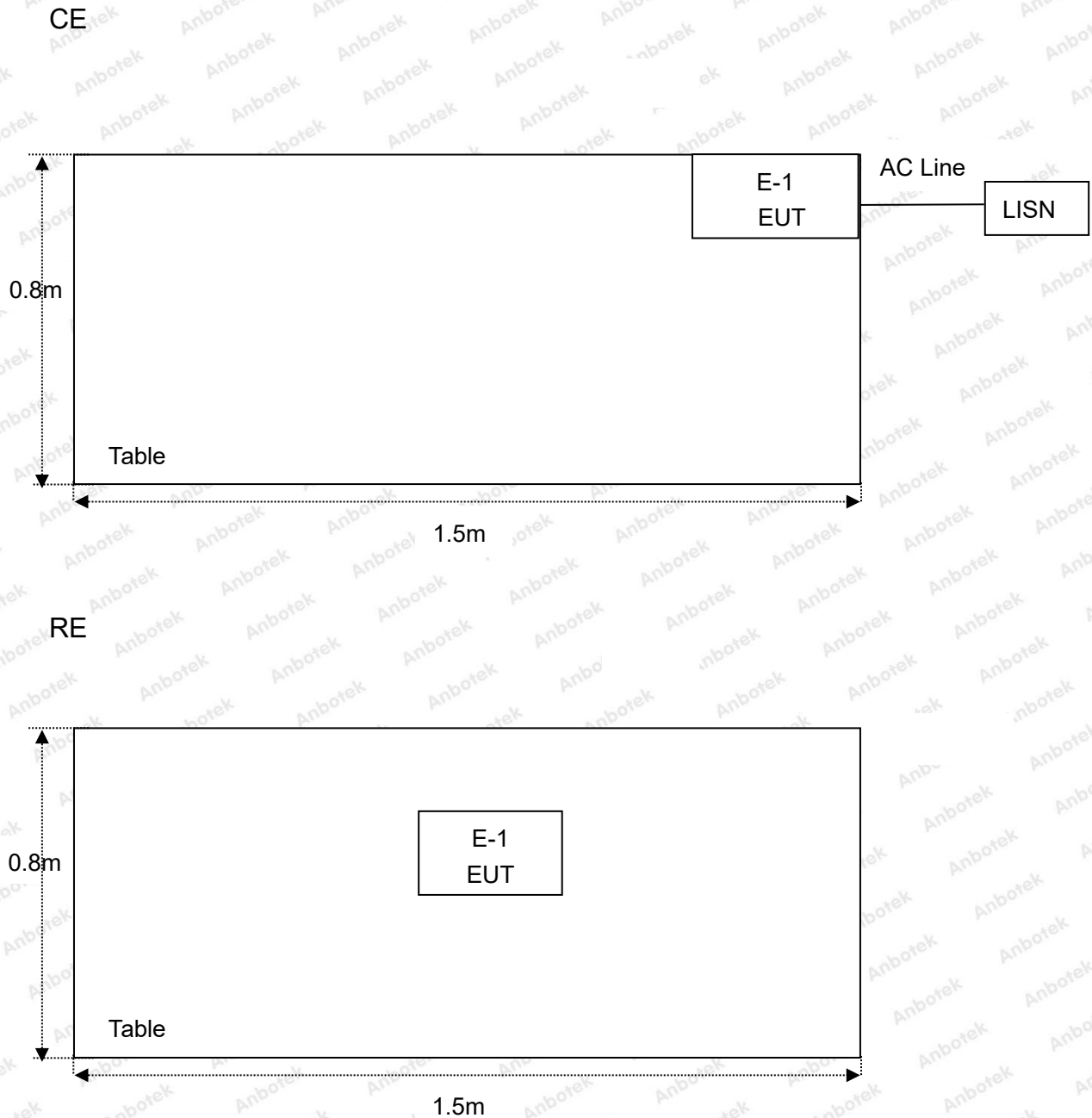
| For Radiated Emission |             |
|-----------------------|-------------|
| Final Test Mode       | Description |
| Mode 1                | TX Mode     |

Note: During the test, the EUT was keeping continuous transmission.

#### 1.5. List of channels

| Channel | Freq.<br>(MHz) | Note<br>(Modulation Type) |
|---------|----------------|---------------------------|
| 01      | 13.56          | BPSK                      |

## 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.   | EMI Test Receiver                           | Rohde & Schwarz            | ESCI             | 100627        | Oct. 26, 2020 | 1 Year        |
| 3.   | EMI Test Receiver                           | Rohde & Schwarz            | ESR26            | 101481        | Oct. 26, 2020 | 1 Year        |
| 4.   | RF Switching Unit                           | Compliance<br>Direction    | RSU-M2           | 38303         | Oct. 26, 2020 | 1 Year        |
| 5.   | MAX Spectrum<br>Analysis                    | Agilent                    | N9020A           | MY51170037    | Oct. 26, 2020 | 1 Year        |
| 6.   | Preamplifier                                | SKET Electronic            | BK1G18G30<br>D   | KD17503       | Oct. 26, 2020 | 1 Year        |
| 7.   | Double Ridged Horn<br>Antenna               | Instruments<br>corporation | GTH-0118         | 351600        | Nov. 02, 2020 | 2 Year        |
| 8.   | Bilog Broadband<br>Antenna                  | Schwarzbeck                | VULB9163         | VULB 9163-289 | Nov. 02, 2020 | 2 Year        |
| 9.   | Loop Antenna                                | Schwarzbeck                | FMZB1519B        | 00053         | Nov. 02, 2020 | 2 Year        |
| 10.  | Horn Antenna                                | A-INFO                     | LB-180400-<br>KF | J211060628    | Nov. 02, 2020 | 2 Year        |
| 11.  | Pre-amplifier                               | SONOMA                     | 310N             | 186860        | Oct. 26, 2020 | 1 Year        |
| 12.  | EMI Test Software<br>EZ-EMC                 | SHURPLE                    | N/A              | N/A           | N/A           | N/A           |
| 13.  | RF Test Control<br>System                   | YIHENG                     | YH3000           | 2017430       | Oct. 26, 2020 | 1 Year        |
| 14.  | Power Sensor                                | DAER                       | RPR3006W         | 15I00041SN045 | Oct. 26, 2020 | 1 Year        |
| 15.  | Power Sensor                                | DAER                       | RPR3006W         | 15I00041SN046 | Oct. 26, 2020 | 1 Year        |
| 16.  | MXA Spectrum<br>Analysis                    | Agilent                    | N9020A           | MY51170037    | Oct. 26, 2020 | 1 Year        |
| 17.  | MXG RF Vector<br>Signal Generator           | Agilent                    | N5182A           | MY48180656    | Oct. 26, 2020 | 1 Year        |
| 18.  | Signal Generator                            | Agilent                    | E4421B           | MY41000743    | Oct. 26, 2020 | 1 Year        |
| 19.  | DC Power Supply                             | IVYTECH                    | IV3605           | 1804D360510   | Oct. 26, 2020 | 1 Year        |
| 20.  | Constant<br>Temperature<br>Humidity Chamber | ZHONGJIAN                  | ZJ-KHWS80<br>B   | 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, September 30, 2020.

#### 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, September 30, 2020.

#### 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   |
| 15.205/15.209/15.225(b)                                     | Spurious Emission       | PASS   |
| 15.225(c)                                                   | 20dB Occupied Bandwidth | PASS   |
| 15.225                                                      | Frequency Tolerance     | PASS   |
| <b>Remark:</b> "N/A" is an abbreviation for Not Applicable. |                         |        |

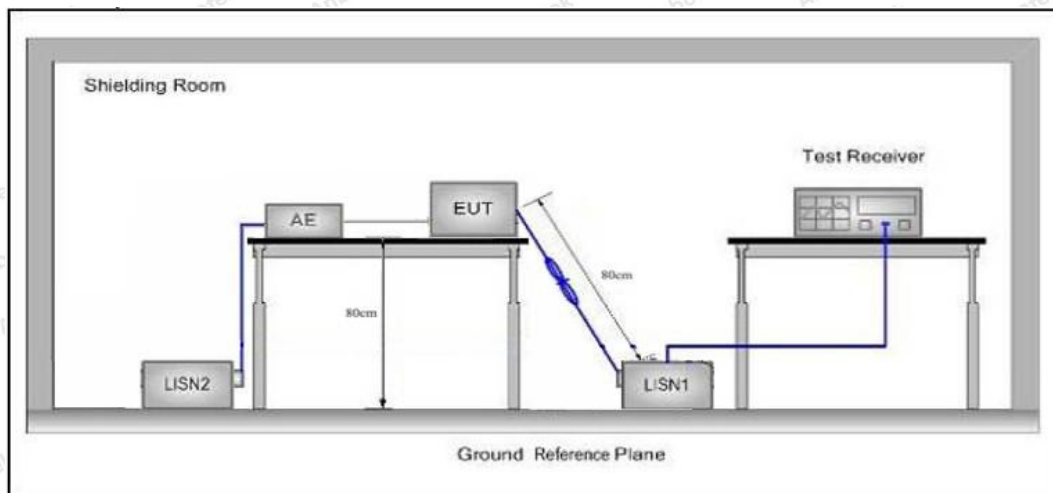
### 3. Conducted Emission Test

#### 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            |

**Remark:** (1) \*Decreasing linearly with logarithm of the frequency.  
(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 C63.10-2013 on Conducted Emission Measurement.

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

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

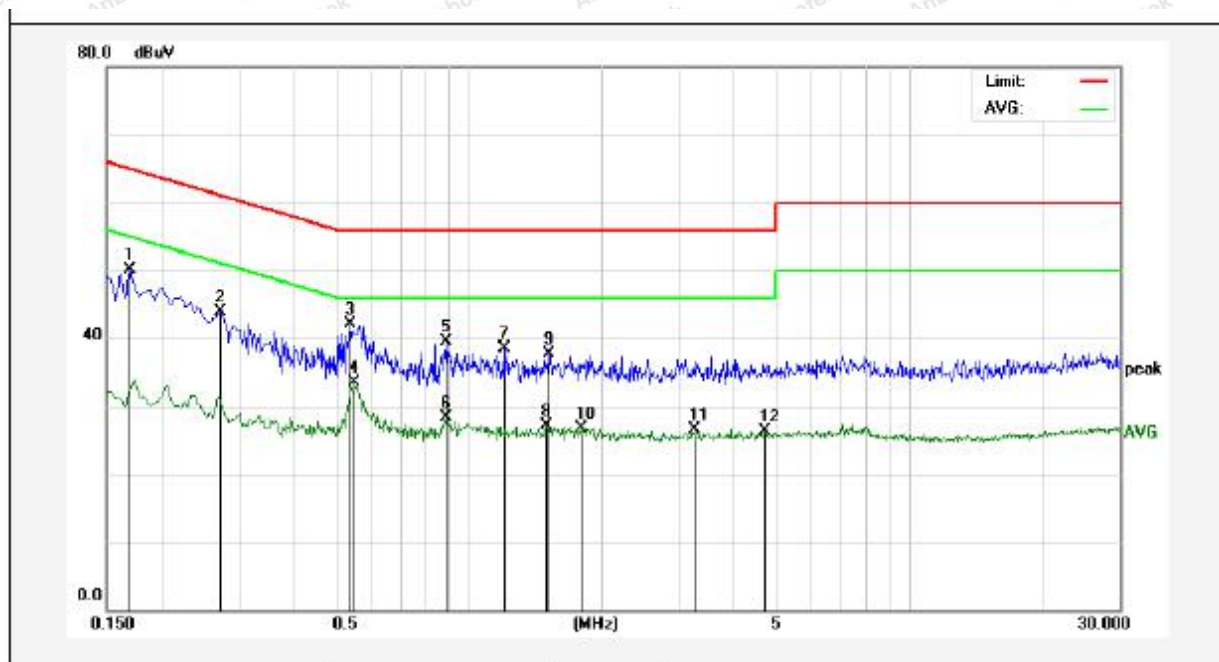
#### 3.4. Test Data

PASS

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

**Conducted Emission Test Data**

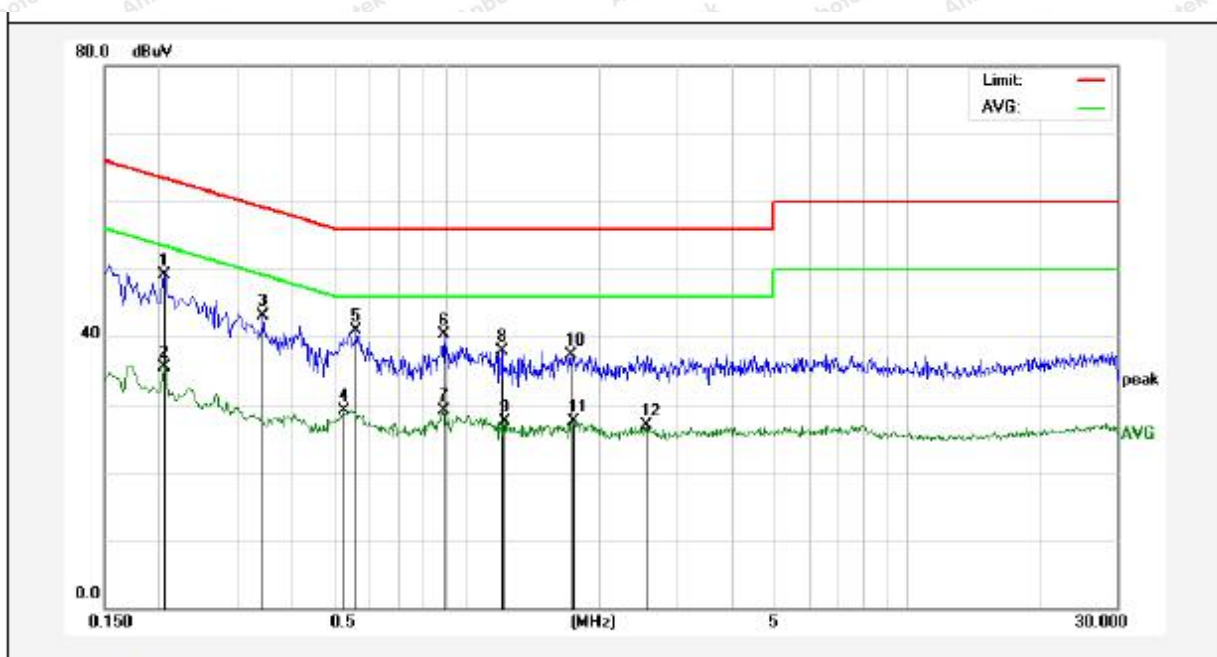
Test Site: 1# Shielded Room  
Operating Condition: Mode 1  
Test Specification: AC 12V  
Comment: Live Line  
Tem.: 24.0°C Hum.: 53%



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Over Limit (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|--------------|-----------------|----------|--------|
| 1   | 0.1700      | 20.65          | 29.46       | 50.11         | 64.96        | -14.85          | QP       |        |
| 2   | 0.2740      | 14.41          | 29.43       | 43.84         | 60.99        | -17.15          | QP       |        |
| 3   | 0.5380      | 12.61          | 29.52       | 42.13         | 56.00        | -13.87          | QP       |        |
| 4   | 0.5500      | 3.97           | 29.52       | 33.49         | 46.00        | -12.51          | AVG      |        |
| 5   | 0.8860      | 9.88           | 29.61       | 39.49         | 56.00        | -16.51          | QP       |        |
| 6   | 0.8860      | -1.29          | 29.61       | 28.32         | 46.00        | -17.68          | AVG      |        |
| 7   | 1.1980      | 8.77           | 29.64       | 38.41         | 56.00        | -17.59          | QP       |        |
| 8   | 1.4980      | -2.61          | 29.64       | 27.03         | 46.00        | -18.97          | AVG      |        |
| 9   | 1.5180      | 8.01           | 29.64       | 37.65         | 56.00        | -18.35          | QP       |        |
| 10  | 1.8060      | -2.85          | 29.65       | 26.80         | 46.00        | -19.20          | AVG      |        |
| 11  | 3.2420      | -3.12          | 29.67       | 26.55         | 46.00        | -19.45          | AVG      |        |
| 12  | 4.7060      | -3.48          | 29.72       | 26.24         | 46.00        | -19.76          | AVG      |        |

**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
 Operating Condition: Mode 1  
 Test Specification: AC 12V  
 Comment: Neutral Line  
 Tem.: 24.0°C Hum.: 53%



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Over Limit (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|--------------|-----------------|----------|--------|
| 1   | 0.2060      | 19.68          | 29.45       | 49.13         | 63.36        | -14.23          | QP       |        |
| 2   | 0.2060      | 6.14           | 29.45       | 35.59         | 53.36        | -17.77          | AVG      |        |
| 3   | 0.3460      | 13.67          | 29.45       | 43.12         | 59.06        | -15.94          | QP       |        |
| 4   | 0.5260      | -0.37          | 29.52       | 29.15         | 46.00        | -16.85          | AVG      |        |
| 5   | 0.5620      | 11.28          | 29.53       | 40.81         | 56.00        | -15.19          | QP       |        |
| 6   | 0.8860      | 10.69          | 29.61       | 40.30         | 56.00        | -15.70          | QP       |        |
| 7   | 0.8860      | -0.59          | 29.61       | 29.02         | 46.00        | -16.98          | AVG      |        |
| 8   | 1.1980      | 8.31           | 29.64       | 37.95         | 56.00        | -18.05          | QP       |        |
| 9   | 1.2220      | -2.21          | 29.64       | 27.43         | 46.00        | -18.57          | AVG      |        |
| 10  | 1.7180      | 7.76           | 29.64       | 37.40         | 56.00        | -18.60          | QP       |        |
| 11  | 1.7420      | -2.19          | 29.64       | 27.45         | 46.00        | -18.55          | AVG      |        |
| 12  | 2.5620      | -2.77          | 29.66       | 26.89         | 46.00        | -19.11          | AVG      |        |

## 4. Radiation Spurious Emission and Band Edge

### 4.1. Test Standard and Limit

| Test Standard                                                                                                                                                                                                                                                                                                                                              | FCC Part15 C Section 15.209, 15.205 and 15.225(a) |                                  |                |            |                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------|----------------|------------|--------------------------|
| 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                        |
| <b>Remark:</b><br>(1)The lower limit shall apply at the transition frequency.<br>(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. |                                                   |                                  |                |            |                          |

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

#### Note:

(1) The tighter limit shall apply at the boundary between two frequency range.

(2) Limitation expressed in dBuV/m is calculated by  $20\log$  Emission Level (uV/m).

(3) If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula of  $Ld1 = Ld2 * (d2/d1)^2$ .

#### Example:

F.S Limit at 30m distance is 30uV/m , then F.S Limitation at 3m distance is adjusted as  $Ld1 = L1 = 30uV/m * (10)^2 = 100 * 30 uV/m$

## 4.2. Test Setup

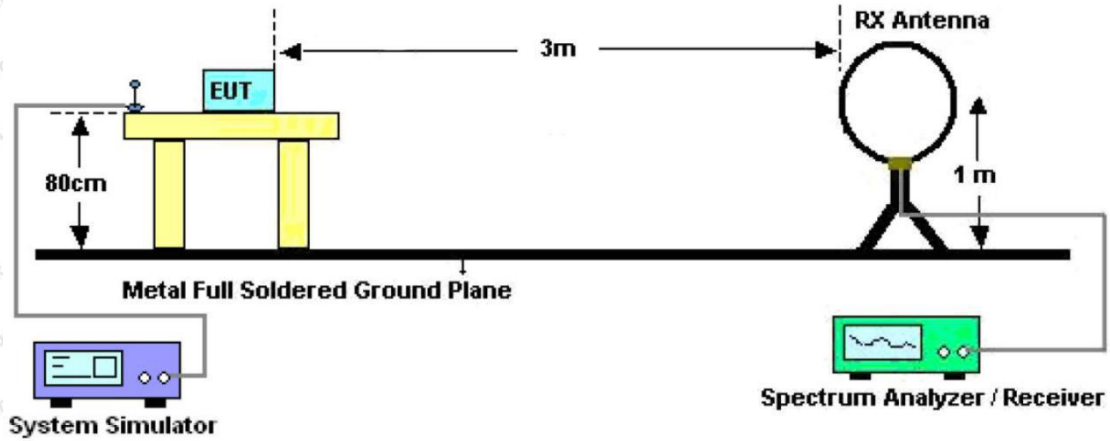


Figure 1. Below 30MHz

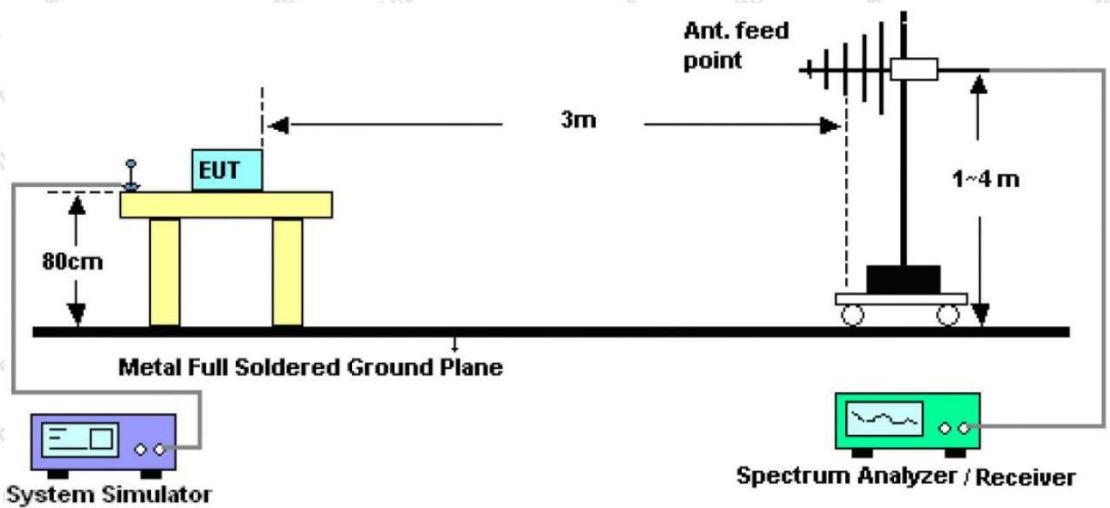


Figure 2. 30MHz to 1GHz

### 4.3. Test Procedure

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

## Test Results (9KHz~30MHz)

| Indicated   |                                  | Table Angle Degree | Antenna Height (m) | Detector | Correction Factor |                 |                    | Corrected Amplitude (dBuV/m) @3m | FCC part 15.225    |        |
|-------------|----------------------------------|--------------------|--------------------|----------|-------------------|-----------------|--------------------|----------------------------------|--------------------|--------|
| Freq. (MHz) | Corrected Amplitude (dBuV/m) @3m |                    |                    |          | Ant. Factor (dB)  | Cable Loss (dB) | Pre-Amp. Gain (dB) |                                  | Limit (dBuV/m) @3m | Result |
| 0.050       | 2.47                             | 67                 | 1.0                | QP       | 73.1              | 0.1             | 30                 | 45.67                            | 113.62             | PASS   |
| 0.690       | 25.57                            | 162                | 1.0                | QP       | 50.2              | 0.1             | 30                 | 45.87                            | 70.83              | PASS   |
| 27.12       | 17.69                            | 73                 | 1.0                | QP       | 31.0              | 0.2             | 30                 | 18.89                            | 69.54              | PASS   |

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## Test Results (30~1000MHz)

Job No.: 18220WC00180004

Temp.(°C)/Hum.(%RH): 24.6°C/50%RH

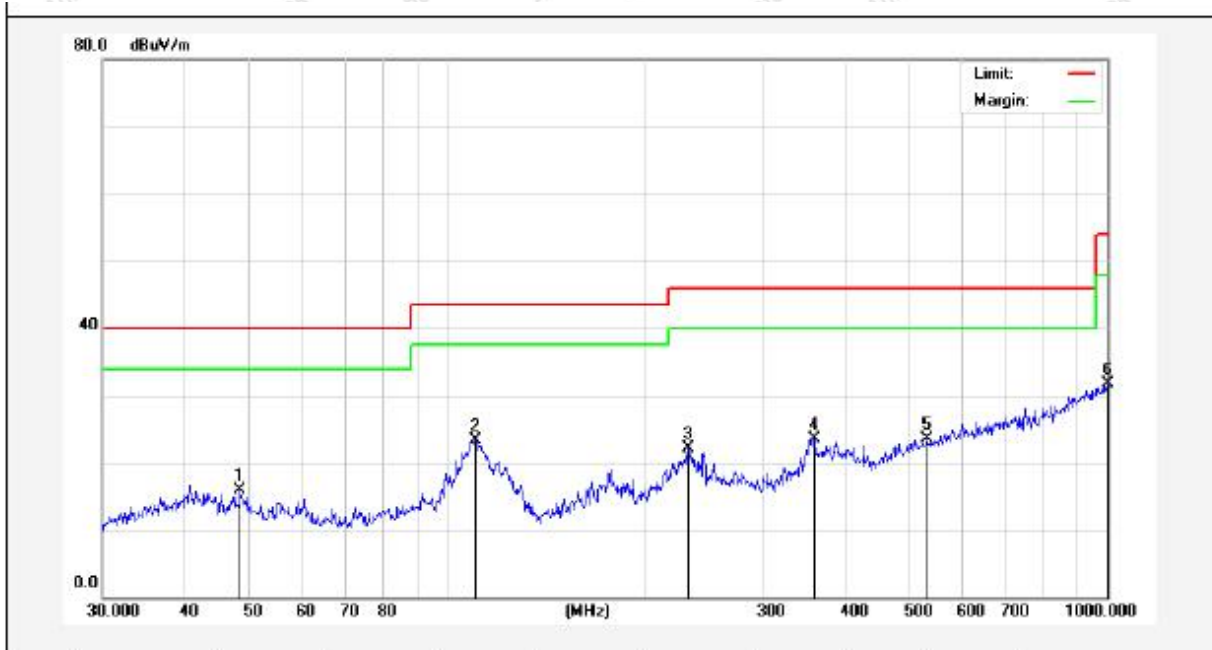
Standard: FCC PART 15C

Power Source: DC 12V

Test Mode: TX Mode

Polarization: Horizontal

Note:



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|-----|-------------|----------------|---------------|-----------------|----------------|-----------------|----------|-------------|--------------|--------|
| 1   | 48.5016     | 30.52          | -14.67        | 15.85           | 40.00          | -24.15          | QP       | 100         | 0            |        |
| 2   | 110.1816    | 44.47          | -21.25        | 23.22           | 43.50          | -20.28          | QP       | 100         | 360          |        |
| 3   | 231.7179    | 41.24          | -19.21        | 22.03           | 46.00          | -23.97          | QP       | 100         | 0            |        |
| 4   | 359.1860    | 36.51          | -12.99        | 23.52           | 46.00          | -22.48          | QP       | 100         | 360          |        |
| 5   | 531.9635    | 32.25          | -8.77         | 23.48           | 46.00          | -22.52          | QP       | 100         | 0            |        |
| 6   | 1000.0000   | 31.35          | 0.32          | 31.67           | 54.00          | -22.33          | QP       | 100         | 360          |        |

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## Test Results (30~1000MHz)

Job No.: 18220WC00180004

Temp.(°C)/Hum.(%RH): 24.6°C/50%RH

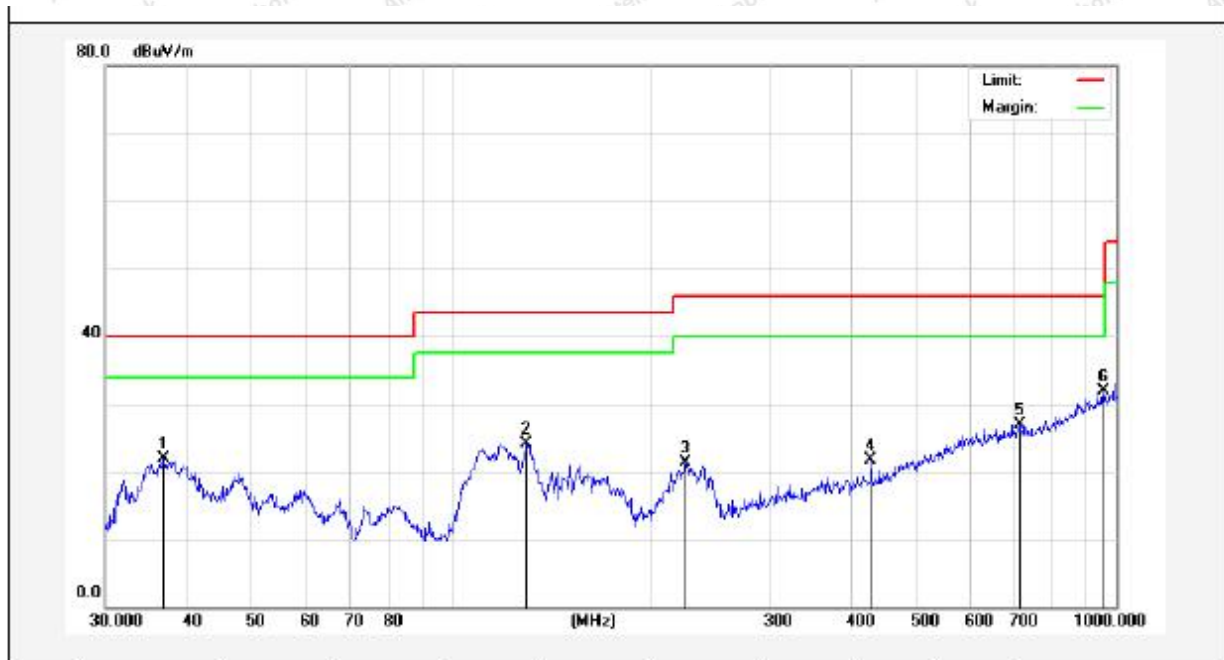
Standard: FCC PART 15C

Power Source: DC 12V

Test Mode: TX Mode

Polarization: Vertical

Note:



| No. | Freq.<br>(MHz) | Reading<br>(dBuV) | Factor<br>(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Over Limit<br>(dB) | Detector | Height<br>(cm) | degree<br>(deg) | Remark |
|-----|----------------|-------------------|------------------|--------------------|-------------------|--------------------|----------|----------------|-----------------|--------|
| 1   | 36.7661        | 37.16             | -15.32           | 21.84              | 40.00             | -18.16             | QP       | 100            | 0               |        |
| 2   | 129.4677       | 43.49             | -19.32           | 24.17              | 43.50             | -19.33             | QP       | 100            | 360             |        |
| 3   | 224.5192       | 37.50             | -16.25           | 21.25              | 46.00             | -24.75             | QP       | 100            | 0               |        |
| 4   | 426.5210       | 32.34             | -10.73           | 21.61              | 46.00             | -24.39             | QP       | 100            | 360             |        |
| 5   | 714.1734       | 32.75             | -5.78            | 26.97              | 46.00             | -19.03             | QP       | 100            | 0               |        |
| 6   | 955.4380       | 32.58             | -0.72            | 31.86              | 46.00             | -14.14             | QP       | 100            | 360             |        |

Remark:

1. Results = Reading + Cable Loss +Ant Factor –Amplifier

## Test Results (Inband)

| Indicated                   |                        |                                           | Table<br>Angle<br>Degree | Antenna<br>Height<br>(m) | Detector | Correction Factor      |                       |                              | Corrected<br>Amplitude<br>(dBuV/m)<br>@3m | FCC part 15.225          |        |
|-----------------------------|------------------------|-------------------------------------------|--------------------------|--------------------------|----------|------------------------|-----------------------|------------------------------|-------------------------------------------|--------------------------|--------|
| Frequency<br>Range<br>(MHz) | Mark<br>Point<br>(MHz) | Corrected<br>Amplitude<br>(dBuV/m)<br>@3m |                          |                          |          | Ant.<br>Factor<br>(dB) | Cable<br>Loss<br>(dB) | Pre-<br>Amp.<br>Gain<br>(dB) |                                           | Limit<br>(dBuV/m)<br>@3m | Result |
| 13.110~13.410               | 13.389                 | 74.05                                     | 0                        | 1.0                      | QP       | 20.8                   | 0.2                   | 30.2                         | 64.85                                     | 80.5                     | PASS   |
| 13.410~13.553               | 13.543                 | 71.91                                     | 0                        | 1.0                      | QP       | 20.9                   | 0.2                   | 30.2                         | 62.81                                     | 90.5                     | PASS   |
| 13.553~13.567               | 13.557                 | 94.23                                     | 0                        | 1.0                      | QP       | 20.9                   | 0.2                   | 30.2                         | 85.13                                     | 124                      | PASS   |
| 13.567~13.710               | 13.578                 | 70.72                                     | 0                        | 1.0                      | QP       | 21.1                   | 0.2                   | 30.2                         | 61.82                                     | 90.5                     | PASS   |
| 13.710~14.010               | 13.883                 | 71.54                                     | 0                        | 1.0                      | QP       | 21.2                   | 0.2                   | 30.2                         | 62.74                                     | 80.5                     | PASS   |

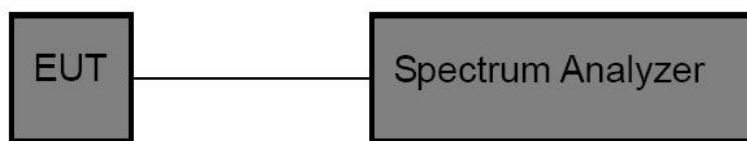


## 5. Frequency Tolerance

### 5.1. Test Requirement

According to FCC section 15.225, the devices operating in the 13.553~13.567 MHz shall maintain the carrier frequency within 0.01% of the operating frequency over the temperature variation of -20°C to +50°C using an environmental chamber. The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

### 5.2. Test Setup



### 5.3. Test Procedure

Let the EUT works on temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 5.4. Test Data

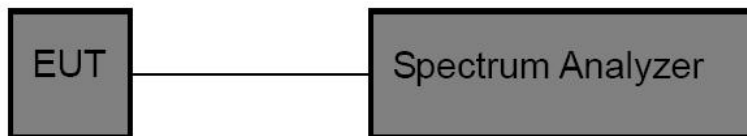
| Test Condition    |             |                  |                  |            |
|-------------------|-------------|------------------|------------------|------------|
|                   | Voltage (V) | Temperature (°C) | Test Result (Hz) | Limit (Hz) |
| Normal Condition  | DC 12V      | -20              | 36               | 1356       |
|                   |             | +20              | 32               | 1356       |
|                   |             | +50              | 43               | 1356       |
| Extreme Condition | DC 10.2V    | +20              | 39               | 1356       |
|                   | DC 13.8V    | +20              | 46               | 1356       |

## 6. 20DB Occupy Bandwidth Test

### 6.1. Test Standard and Limit

According to FCC section 15.215(c), the 20dB bandwidth should be contained within the frequency band designated in the rule section under which the EUT is operated, it was measured with a spectrum analyzer connected the EUT while the EUT is operating in transmission mode.

### 6.2. Test Setup



### 6.3. Test Procedure

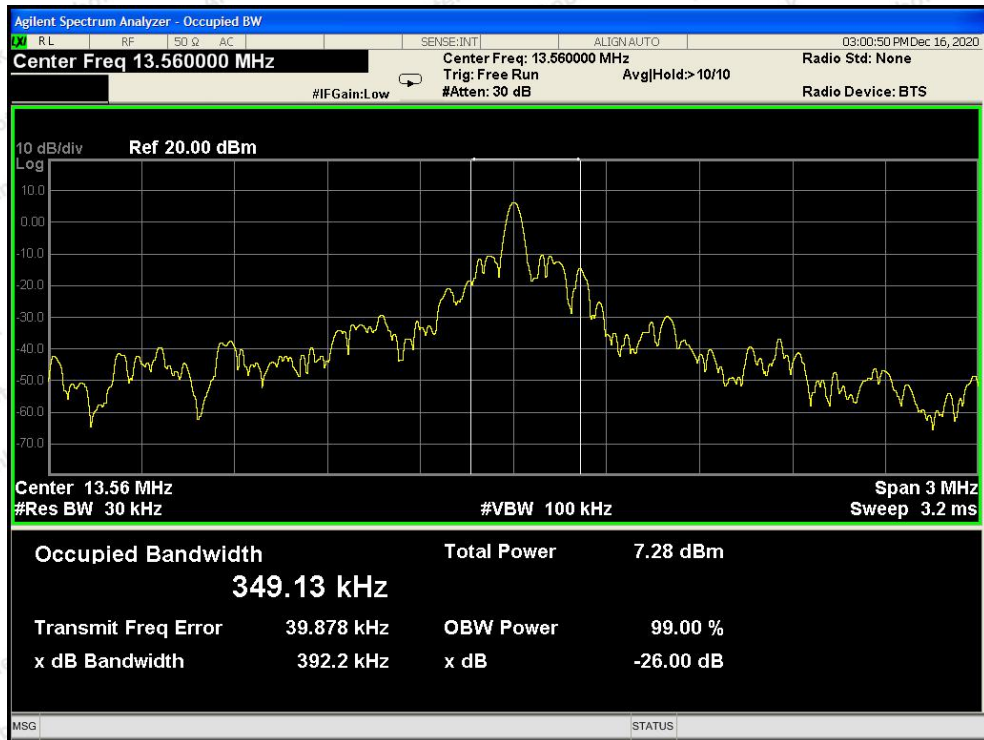
The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

### 6.4. Test Data

|              |                  |
|--------------|------------------|
| Test Item    | : 20dB Bandwidth |
| Test Voltage | : DC 12V         |
| Test Result  | : PASS           |

|             |                             |
|-------------|-----------------------------|
| Test Mode   | : Continuously transmitting |
| Temperature | : 24℃                       |
| Humidity    | : 55%RH                     |

| Freq.<br>(MHz) | Modulation Type | Bandwidth (kHz) | Results |
|----------------|-----------------|-----------------|---------|
| 13.56          | BPSK            | 392.2           | PASS    |



13.56MHz



## 7. Antenna Requirement

### 7.1. Test Standard and Requirement

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Standard | FCC Part15 Section 15.203                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Requirement   | <p>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.<br/>Antenna requirement must meet at least one of the following:</p> <p>1) Antenna must be permanently attached to device.<br/>2) The antenna must use a unique type of connector to attach to the device.<br/>3) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.</p> |

### 7.2. Antenna Connected Construction

The antenna is a PCB antenna which permanently attached, and the best case gain of the antenna is 0 dBi. It complies with the standard requirement.



## **APPENDIX I -- TEST SETUP PHOTOGRAPH**

Please refer to separated files for Test Setup Photos of the EUT.

## **APPENDIX II -- EXTERNAL PHOTOGRAPH**

Please refer to separated files for External Photos of the EUT.

## **APPENDIX III -- INTERNAL PHOTOGRAPH**

Please refer to separated files for Internal Photos of the EUT.

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

