

# FCC RADIO TEST REPORT

## FCC 47 CFR PART 15 SUBPART C

|                        |   |
|------------------------|---|
| <b>Test Standard</b>   | <b>FCC Part 15.231</b>                        |
| <b>FCC ID</b>          | <b>KR5180528</b>                              |
| <b>Trade name</b>      | <b>Continental</b>                            |
| <b>Product name</b>    | <b>PAG Transmitter (Car Key)</b>              |
| <b>Model No.</b>       | <b>PAG-KEY-433-180528, PAG-KEY-434-180528</b> |
| <b>Operation Freq.</b> | <b>433.92 MHz &amp; 434.42 MHz</b>            |
| <b>Test Result</b>     | <b>Pass</b>                                   |

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.

The test Report of full or partial shall not copy. Without written approval of SGS Compliance Certification Services Inc.(Wugu Laboratory)



Approved by:

Reviewed by:




Sam Chuang  
Manager

Jerry Chuang  
Engineer

## **Revision History**

| Rev. | Issue Date       | Revisions            | Revised By   |
|------|------------------|----------------------|--------------|
| 00   | January 22, 2018 | Initial Issue        | Allison Chen |
| 01   | March 26, 2018   | Modify section 4.2.2 | Angel Cheng  |

## Table of contents

|   |           |
|---|-----------|
| <b>1. GENERAL INFORMATION .....</b>                     | <b>4</b>  |
| <b>1.1 EUT INFORMATION .....</b>                        | <b>4</b>  |
| <b>1.2 EUT CHANNEL INFORMATION .....</b>                | <b>5</b>  |
| <b>1.3 ANTENNA INFORMATION .....</b>                    | <b>5</b>  |
| <b>1.4 MEASUREMENT UNCERTAINTY .....</b>                | <b>6</b>  |
| <b>1.5 FACILITIES AND TEST LOCATION .....</b>           | <b>7</b>  |
| <b>1.6 INSTRUMENT CALIBRATION .....</b>                 | <b>7</b>  |
| <b>1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT .....</b>  | <b>8</b>  |
| <b>1.8 TEST METHODOLOGY AND APPLIED STANDARDS .....</b> | <b>8</b>  |
| <b>2. TEST SUMMERY .....</b>                            | <b>9</b>  |
| <b>3. DESCRIPTION OF TEST MODES .....</b>               | <b>10</b> |
| <b>3.1 THE WORST MODE OF OPERATING CONDITION .....</b>  | <b>10</b> |
| <b>3.2 THE WORST MODE OF MEASUREMENT .....</b>          | <b>10</b> |
| <b>3.3 EUT DUTY CYCLE .....</b>                         | <b>11</b> |
| <b>4. TEST RESULT .....</b>                             | <b>13</b> |
| <b>4.1 AC POWER LINE CONDUCTED EMISSION .....</b>       | <b>13</b> |
| <b>4.2 EMISSION BANDWIDTH .....</b>                     | <b>14</b> |
| <b>4.3 FIELD STRENGTH OF FUNDAMENTAL .....</b>          | <b>17</b> |
| <b>4.4 RADIATION UNWANTED EMISSION .....</b>            | <b>21</b> |
| <b>4.5 OPERATION RESTRICTION .....</b>                  | <b>33</b> |
| <b>APPENDIX 1 – PHOTOGRAPHS OF EUT</b>                  |           |

# 1. GENERAL INFORMATION

## 1.1 EUT INFORMATION

|                    |  |
|--------------------|--|
| Applicant          | Continental Automotive GmbH<br>Siemensstrasse 12 SV C TS RBG EMC-Laboratory<br>Regensburg, 93055<br>Germany  |
| Manufacturer       | Huf Hülsbeck & Fürst GmbH & Co. KG<br>Steeger Straße 17, 42551 Velbert, Germany  |
| Equipment          | PAG Transmitter (Car Key)  |
| Model Name         | PAG-KEY-433-180528, PAG-KEY-434-180528   |
| Model Discrepancy  | Different from operation frequency see as below:<br>PAG-KEY-433-180528 → TX 433.92MHz / RX 125kHz<br>PAG-KEY-434-180528 → TX 434.42MHz / RX 125kHz   |
| Received Date      | January 5, 2018  |
| Date of Test       | January 11 ~ January 22, 2018  |
| Periodic operation | <input checked="" type="checkbox"/> (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.<br><input type="checkbox"/> (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation<br><input type="checkbox"/> (3) Periodic transmissions at regular predetermined intervals are not permitted.<br><input type="checkbox"/> (4) Periodic transmissions (lower field strength): each transmission is not greater than 1 sec and the silent period between transmissions is at least 30 times the duration of the transmission but in no case less than 10 sec. |
| Power Operation    | Battery 1 x CR2032 (Lithium Standard-Battery: 3V)  |

## 1.2 EUT CHANNEL INFORMATION

|                    |                        |
|--------------------|------------------------|
| Frequency Range    | 433.92 MHz, 434.42 MHz |
| Modulation Type    | ASK                    |
| Bandwidth          | 110.2749 KHz           |
| Number of Channels | 1 channel              |

**Remark:**

Refer as ANSI 63.10:2013 clause 5.6.1 Table 4 for test channels

| Number of frequencies to be tested                |                       |  |
|---|-----------------------|--|
| Frequency range in which device operates          | Number of frequencies | Location in frequency range of operation     |
| <input checked="" type="checkbox"/> 1 MHz or less | 1                     | Middle                                       |
| <input type="checkbox"/> 1 MHz to 10 MHz          | 2                     | 1 near top and 1 near bottom                 |
| <input type="checkbox"/> More than 10 MHz         | 3                     | 1 near top, 1 near middle, and 1 near bottom |

## 1.3 ANTENNA INFORMATION

|              |                                   |
|--------------|-----------------------------------|
| Antenna Type | Loop antenna (PCB routed antenna) |
| Antenna Gain | -20.01dBi                         |

## 1.4 MEASUREMENT UNCERTAINTY

| PARAMETER                                | UNCERTAINTY |
|--|-------------|
| AC Powerline Conducted Emission          | +/- 1.2575  |
| Emission bandwidth, 20dB bandwidth       | +/- 1.4003  |
| RF output power, conducted               | +/- 1.1372  |
| Power density, conducted                 | +/- 1.4003  |
| 3M Semi Anechoic Chamber / 30M~200M      | +/- 4.0138  |
| 3M Semi Anechoic Chamber / 200M~1000M    | +/- 3.9483  |
| 3M Semi Anechoic Chamber / 1GHz~8GHz     | +/- 2.5975  |
| 3M Semi Anechoic Chamber / 8GHz~18GHz    | +/- 2.6112  |
| 3M Semi Anechoic Chamber / 18GHz~26GHz   | +/- 2.7389  |
| 3M Semi Anechoic Chamber / 26GHz~40GHz   | +/- 2.9683  |
| 3M Semi Anechoic Chamber / 40GHz~60GHz   | +/- 1.8509  |
| 3M Semi Anechoic Chamber / 60GHz~75GHz   | +/- 1.9869  |
| 3M Semi Anechoic Chamber / 75GHz~110GHz  | +/- 2.9651  |
| 3M Semi Anechoic Chamber / 110GHz~170GHz | +/- 2.7807  |
| 3M Semi Anechoic Chamber / 170GHz~220GHz | +/- 3.6437  |
| 3M Semi Anechoic Chamber / 220GHz~325GHz | +/- 4.2982  |

**Remark:**

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

## 1.5 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at

No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)

| Test site          | Test Engineer | Remark         |
|--------------------|---------------|----------------|
| AC Conduction Room | N/A           | Not applicable |
| Radiation          | Jerry Chuang  | -              |
| RF Conducted       | Jerry Chuang  | -              |

**Remark:** The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

## 1.6 INSTRUMENT CALIBRATION

| RF Conducted Test Site |              |        |        |            |            |
|------------------------|--------------|--------|--------|------------|------------|
| Equipment              | Manufacturer | Model  | S/N    | Cal Date   | Cal Due    |
| Spectrum Analyzer      | R&S          | FSV 40 | 101073 | 10/02/2017 | 10/01/2018 |

| 3M 966 Chamber Test Site |                |                 |            |            |            |
|--------------------------|----------------|-----------------|------------|------------|------------|
| Equipment                | Manufacturer   | Model           | S/N        | Cal Date   | Cal Due    |
| Bilog Antenna            | Sunol Sciences | JB3             | A030105    | 06/20/2017 | 06/19/2018 |
| Pre-Amplifier            | EMEC           | EM330           | 60609      | 06/07/2017 | 06/06/2018 |
| Spectrum Analyzer        | Agilent        | E4446A          | US42510252 | 11/27/2017 | 11/26/2018 |
| Antenna Tower            | CCS            | CC-A-1F         | N/A        | N.C.R      | N.C.R      |
| Controller               | CCS            | CC-C-1F         | N/A        | N.C.R      | N.C.R      |
| Turn Table               | CCS            | CC-T-1F         | N/A        | N.C.R      | N.C.R      |
| Pre-Amplifier            | HP             | 8449B           | 3008A00965 | 06/27/2017 | 06/26/2018 |
| Filter                   | N/A            | 580-6000        | N/A        | N/A        | N/A        |
| Cable                    | HUBER SUHNER   | SUCOFLEX 104PEA | 25157      | 07/31/2017 | 07/30/2018 |
| Cable                    | HUBER SUHNER   | SUCOFLEX 104PEA | 20995      | 07/31/2017 | 07/30/2018 |
| Horn Antenna             | EMCO           | 3117            | 55165      | 02/20/2017 | 02/19/2018 |

**Remark:** Each piece of equipment is scheduled for calibration once a year.

## 1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

There are no accessories and support equipment be used during the test.

| EUT Accessories Equipment |           |       |       |            |        |
|---------------------------|-----------|-------|-------|------------|--------|
| No.                       | Equipment | Brand | Model | Series No. | FCC ID |
|                           | N/A       |       |       |            |        |

| Support Equipment |           |       |       |            |        |
|-------------------|-----------|-------|-------|------------|--------|
| No.               | Equipment | Brand | Model | Series No. | FCC ID |
|                   | N/A       |       |       |            |        |

## 1.8 TEST METHODOLOGY AND APPLIED STANDARDS

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC 15.231 Rules.



## 2. TEST SUMMERY

| Standard Sec. | Chapter | Test Item                        | Result         |
|---------------|---------|----------------------------------|----------------|
| 15.203        | 1.2     | Antenna Requirement              | Pass           |
| 15.207        | 4.1     | AC Power-line Conducted Emission | Not applicable |
| 15.231(c)     | 4.2     | Emission Bandwidth               | Pass           |
| 15.231(b)     | 4.3     | Fundamental Emission             | Pass           |
| 15.209(b)     | 4.4     | Transmitter Radiated Emission    | Pass           |
| 15.231(a)(1)  | 4.5     | Operation Restriction            | Pass           |

### 3. DESCRIPTION OF TEST MODES

#### 3.1 THE WORST MODE OF OPERATING CONDITION

|                   |  |
|-------------------|--|
| Operation mode    | 433.92 MHz   |
| RF Filed strength | <u>Peak: 78.91 dBuv/m</u><br><u>Average : 72.29 dBuv/m</u> |

|                   |  |
|-------------------|--|
| Operation mode    | 434.42 MHz   |
| RF Filed strength | <u>Peak: 78.67 dBuv/m</u><br><u>Average : 70.81 dBuv/m</u> |

Remark: Field strength performed Average level at 3m.

#### 3.2 THE WORST MODE OF MEASUREMENT

| Radiated Emission Measurement Above 1G |   |
|--|---|
| Test Condition                         | Band edge, Emission for Unwanted and Fundamental  |
| DC Voltage                             | DC 3V   |
| Test Mode                              | Mode 1:EUT power by Battery.  |
| Worst Mode                             | <input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4  |
| Worst Position                         | <input type="checkbox"/> Placed in fixed position.<br><input checked="" type="checkbox"/> Placed in fixed position at X-Plane (E2-Plane)<br><input type="checkbox"/> Placed in fixed position at Y-Plane (E1-Plane)<br><input type="checkbox"/> Placed in fixed position at Z-Plane (H-Plane) |
| Worst Polarity                         | <input checked="" type="checkbox"/> Horizontal <input type="checkbox"/> Vertical  |

| Radiated Emission Measurement Below 1G |  |
|--|--|
| Test Condition                         | Radiated Emission Below 1G   |
| DC Voltage                             | DC 3V  |
| Test Mode                              | Mode 1:EUT power by Battery.   |
| Worst Mode                             | <input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4 |

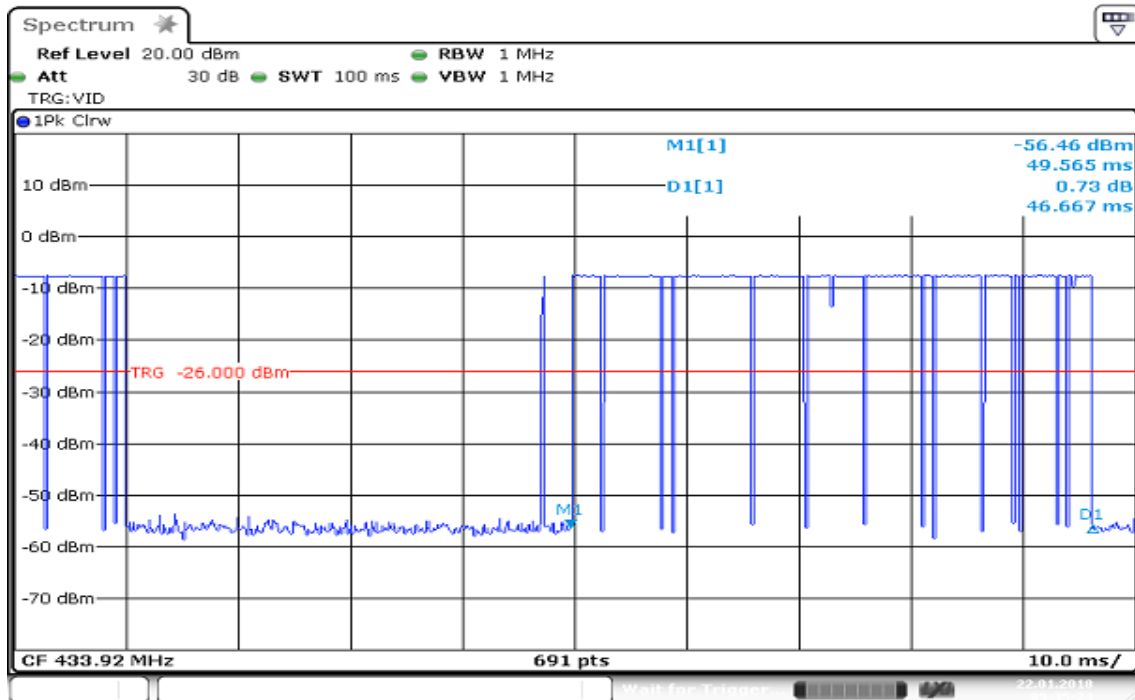
Remark:

1. The worst mode was record in this test report.
2. EUT pre-scanned in three axis ,X,Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case(X-Plane and Horizontal) were recorded in this report
3. For below 1G, Radiation emission were performed the EUT transmit at the highest output power channel as worse case.

### 3.3 EUT DUTY CYCLE

**433.92MHz**

| Duty Cycle |                 |
|------------|-----------------|
| TX ON (ms) | Duty Factor(dB) |
| 46.667     | -6.62           |



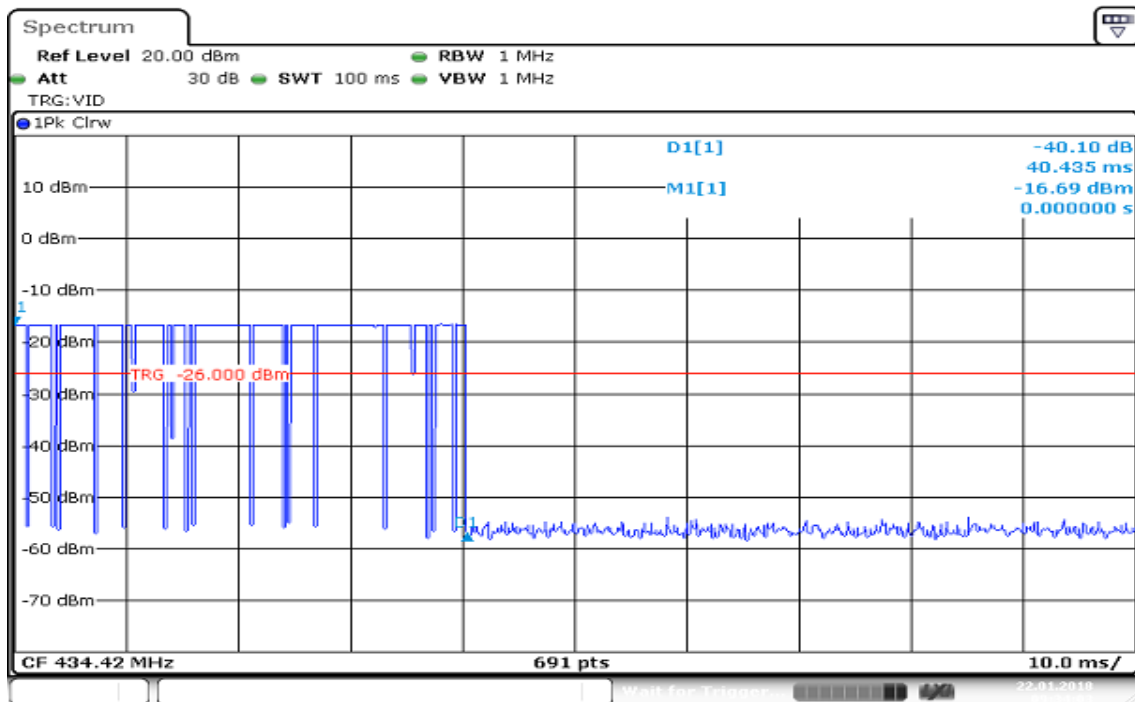
Date: 22.JAN.2018 09:35:24

#### Notes:

- The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by  $20 \log(\text{Time}_{\text{on}} / [\text{Period or 100 ms whichever is the lesser}])$
- The EUT transmits for a  $\text{Time}_{\text{on}}$  of 46.667 milliseconds within the specified 100ms period.  
 $20 \log(\text{Time}_{\text{on}} / [\text{Period or 100 ms whichever is the lesser}])$ .  
 $20 \log(46.667/100) = -6.62\text{dB}$

## 434.42 MHz

| Duty Cycle |                 |
|------------|-----------------|
| TX ON (ms) | Duty Factor(dB) |
| 40.435     | -7.86           |



Date: 22.JAN.2018 09:34:03

### Notes:

1. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by  $20 \log(\text{Time}_{\text{on}} / [\text{Period or } 100 \text{ ms whichever is the lesser}])$
2. The EUT transmits for a  $\text{Time}_{\text{on}}$  of 40.435 milliseconds within the specified 100ms period.

$$20 \log (\text{Time}_{\text{on}}) / [\text{Period or } 100 \text{ ms whichever is the lesser}].$$

$$20 \log (40.435/100) = -7.86\text{dB}$$

## 4. TEST RESULT

### 4.1 AC POWER LINE CONDUCTED EMISSION

#### 4.1.1 Test Limit

According to §15.207(a) ,

| Frequency Range<br>(MHz) | Limits(dBμV) |           |
|--------------------------|--------------|-----------|
|                          | Quasi-peak   | Average   |
| 0.15 to 0.50             | 66 to 56*    | 56 to 46* |
| 0.50 to 5                | 56           | 46        |
| 5 to 30                  | 60           | 50        |

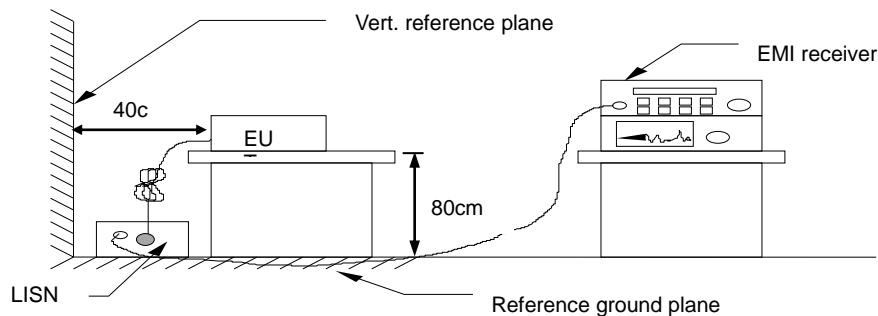
\* Decreases with the logarithm of the frequency.

#### 4.1.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 6.2,

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete

#### 4.1.3 Test Setup



#### 4.1.4 Test Result

**Not applicable**

## 4.2 EMISSION BANDWIDTH

### 4.2.1 Test Limit

According to §15.231© ,

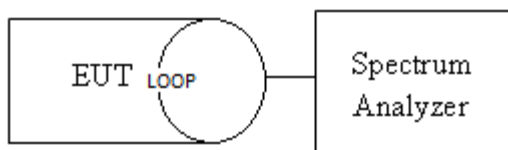
|       |   |
|-------|---|
| Limit | <input checked="" type="checkbox"/> 70 MHz – 900 MHz : $F_c * 0.25 \%$<br><input type="checkbox"/> Above 900 MHz : $F_c * 0.5 \%$ |
|-------|---|

### 4.2.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 6.9.2,

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. RBW=10KHz, VBW  $\geq 3 \times$  RBW, Detector = Peak, Trace mode = Max hold, Sweep = Auto., to measurement 20dB Bandwidth
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth
5. Measure and record the result of 20 dB Bandwidth and 99% Bandwidth. in the test report.

### 4.2.3 Test Setup



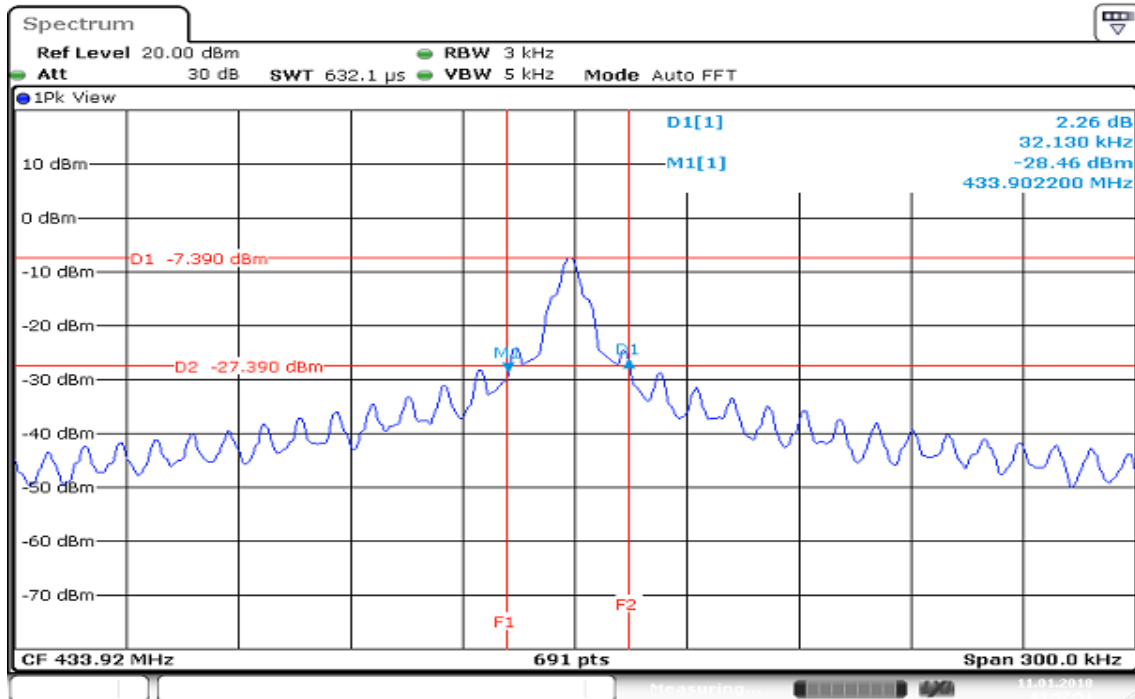
### 4.2.4 Test Result

| Spectrum Bandwidth |                       |                      |                             |
|--------------------|-----------------------|----------------------|-----------------------------|
| Frequency (MHz)    | 99% Occupied BW (KHz) | 20dB Bandwidth (KHz) | 20dB Bandwidth Limits (MHz) |
| 433.92             | 110.2749              | 32.130               | 1.0848                      |
| 434.42             | 110.2749              | 32.130               | 1.0860                      |

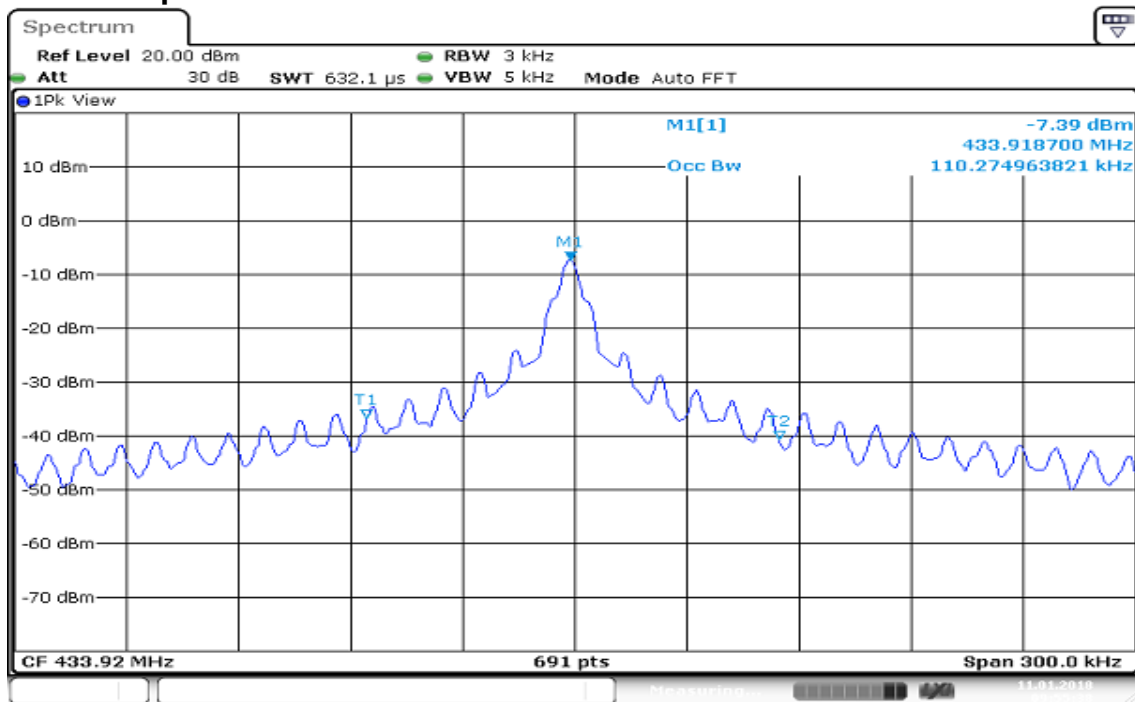
## Test Data

433.92 MHz

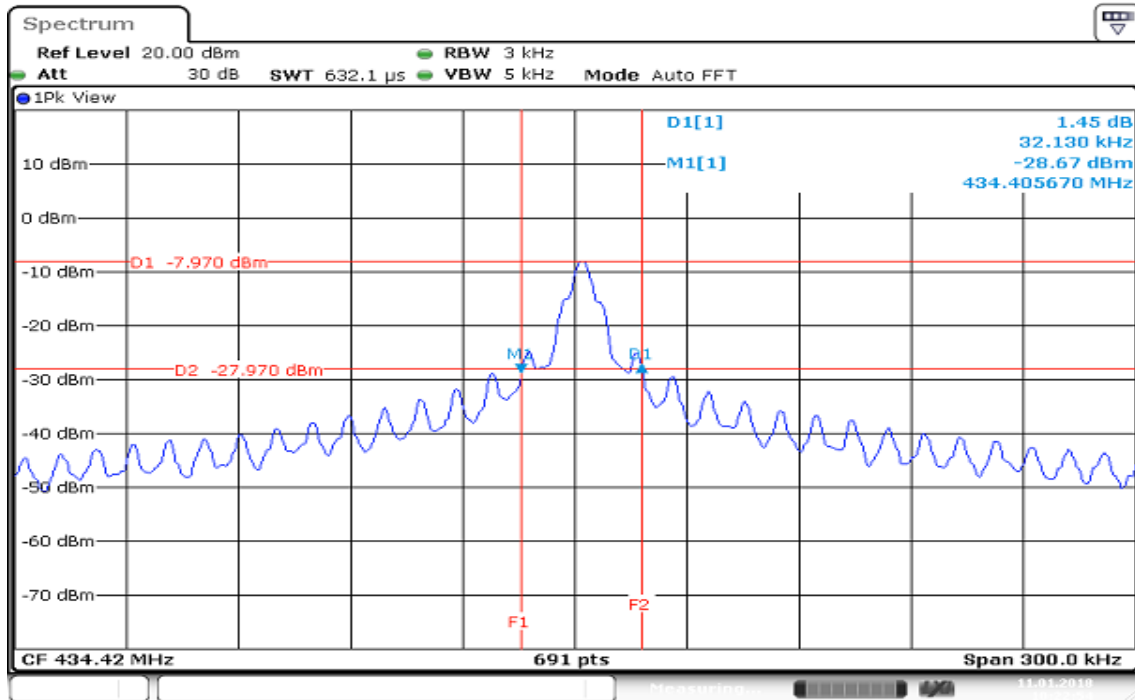
20dB Bandwidth



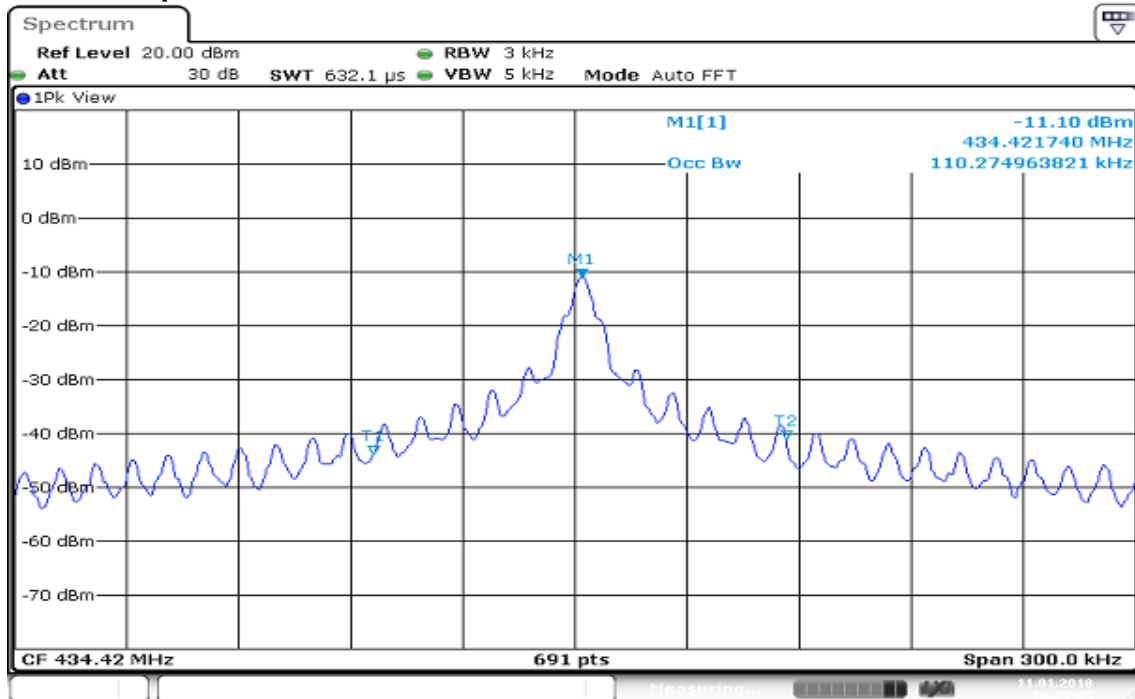
## 99% Occupied BW



## 434.42 MHz 20dB Bandwidth



## 99% Occupied BW





## 4.3 FIELD STRENGTH OF FUNDAMENTAL

### 4.3.1 Test Limit

According to §15.231(b)

| Fundamental frequency (MHz) | Field strength of fundamental (uv/m) at 3m | Field strength of fundamental (dBuv/m) at 3m |
|-----------------------------|--|--|
| 40.66-40.70                 | 2,250                                      | 67   |
| 70-130                      | 1,250                                      | 61.9   |
| *130-174                    | *1,250 to 3,750                            | 61.9-71.5                                    |
| 174-260                     | 3,750                                      | 71.5   |
| *260-470                    | *3,750 to 12,500                           | 71.5-81.9                                    |
| Above 470                   | 12,500                                     | 81.9   |

**REMARK:**

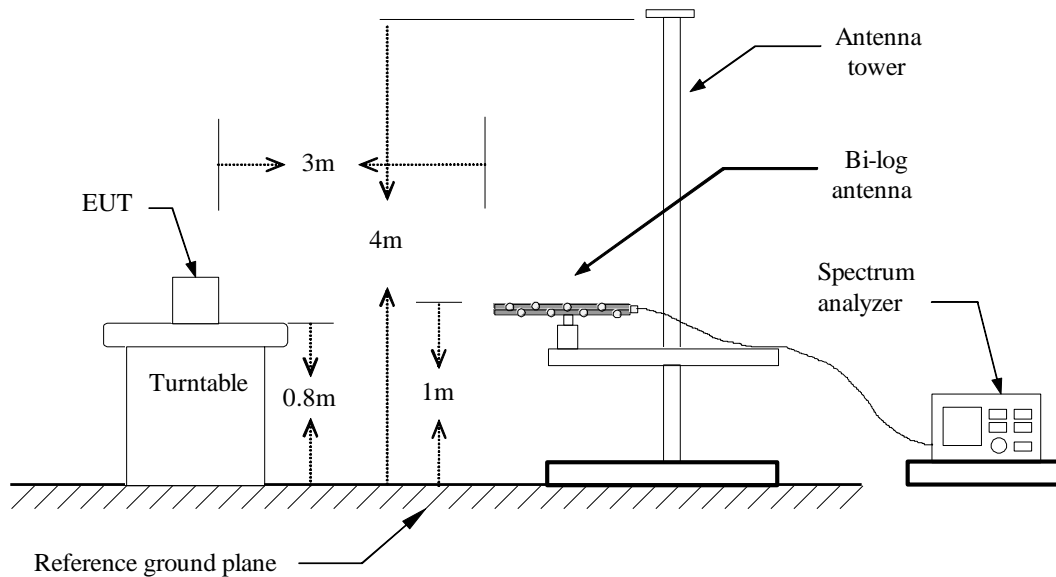
1. Linear interpolations
2. Based on the average value of the measured Field strength of fundamental.

### 4.3.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 4.1.4 and clause 6.5

|              |  |
|--------------|--|
| clause 4.1.4 | <input checked="" type="checkbox"/> 4.1.4.2.2: Measurement Peak value.<br><input type="checkbox"/> 4.1.4.2.3: Duty cycle $\geq$ 100%.<br><input checked="" type="checkbox"/> 4.1.4.2.4: Measurement Average value. |
|--------------|--|

### 4.3.3 Test Setup



### 4.3.4 Test Result

#### 433.92 MHz

| Field Strength  |                            |                      |             |           |        |
|-----------------|----------------------------|----------------------|-------------|-----------|--------|
| Frequency (MHz) | Fundamental (dBuV/m) at 3m | Limit (dBuV/m) at 3m | Margin (dB) | Axis/Pol. | Remark |
| 433.9180        | 72.29                      | 80.82                | -8.53       | X/H       | AVG    |

**Remark:**

1. Fundamental measured method setting on spectrum, RBW=100 kHz, VBW=100kHz and Detector=Peak.
2. Average result = Peak result + Duty factor = 78.91 dBuV/m – 6.62 = 72.29 dBuV/m
3. 260MHz ~ 470MHz limit is  $41.6667 * (\text{Frequency, MHz}) - 7083.3333$   
 $\text{Limit} = 41.6667 * (433.9180 \text{ MHz}) - 7083.3333$   
 $= 10996.59783 \text{ (uV/m)}$   
 $\text{dBuV/m} = 20 \text{ Log (uV/m)} = 20 \text{ Log (10996.59783 uV/m)} = 80.82 \text{ dBuV/m}$

#### 434.42 MHz

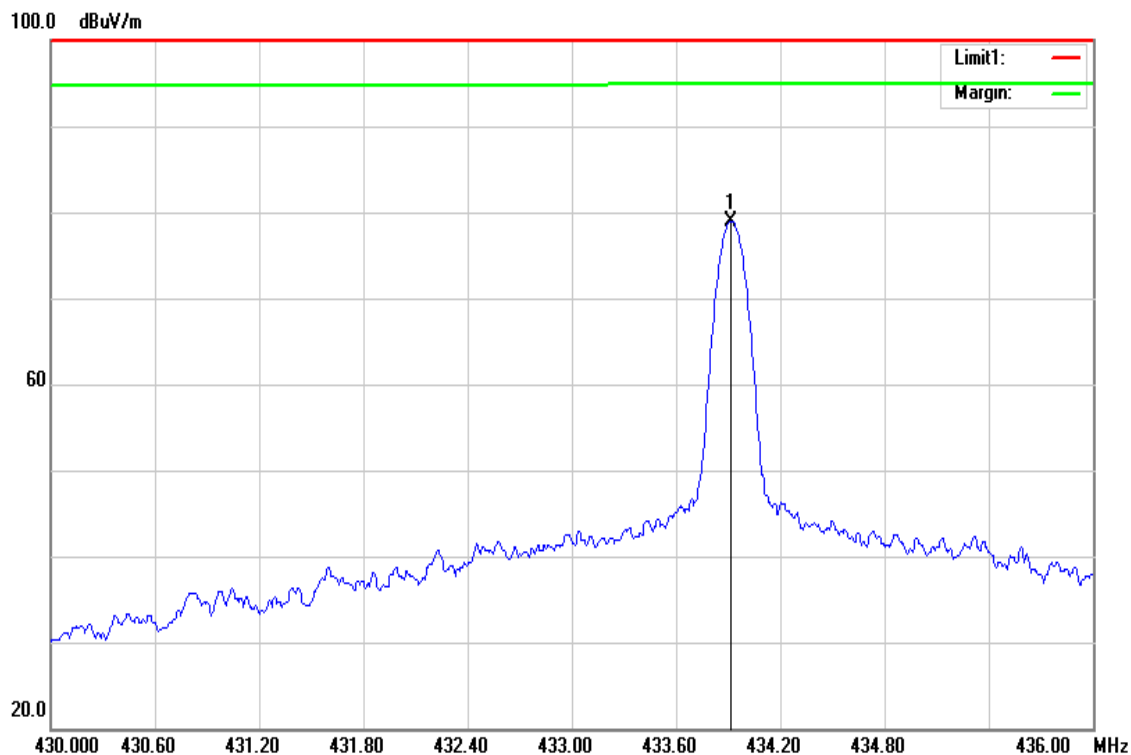
| Field Strength  |                            |                      |             |           |        |
|-----------------|----------------------------|----------------------|-------------|-----------|--------|
| Frequency (MHz) | Fundamental (dBuV/m) at 3m | Limit (dBuV/m) at 3m | Margin (dB) | Axis/Pol. | Remark |
| 434.4220        | 70.81                      | 80.84                | -10.03      | X/H       | AVG    |

**Remark:**

1. Fundamental measured method setting on spectrum, RBW=100 kHz, VBW=100kHz and Detector=Peak.
2. Average result = Peak result + Duty factor = 78.67 dBuV/m – 7.86 = 70.81 dBuV/m
3. 260MHz ~ 470MHz limit is  $41.6667 * (\text{Frequency, MHz}) - 7083.3333$   
 $\text{Limit} = 41.6667 * (434.4220 \text{ MHz}) - 7083.3333$   
 $= 11017.59785 \text{ (uV/m)}$   
 $\text{dBuV/m} = 20 \text{ Log (uV/m)} = 20 \text{ Log (11017.59785 uV/m)} = 80.84 \text{ dBuV/m}$

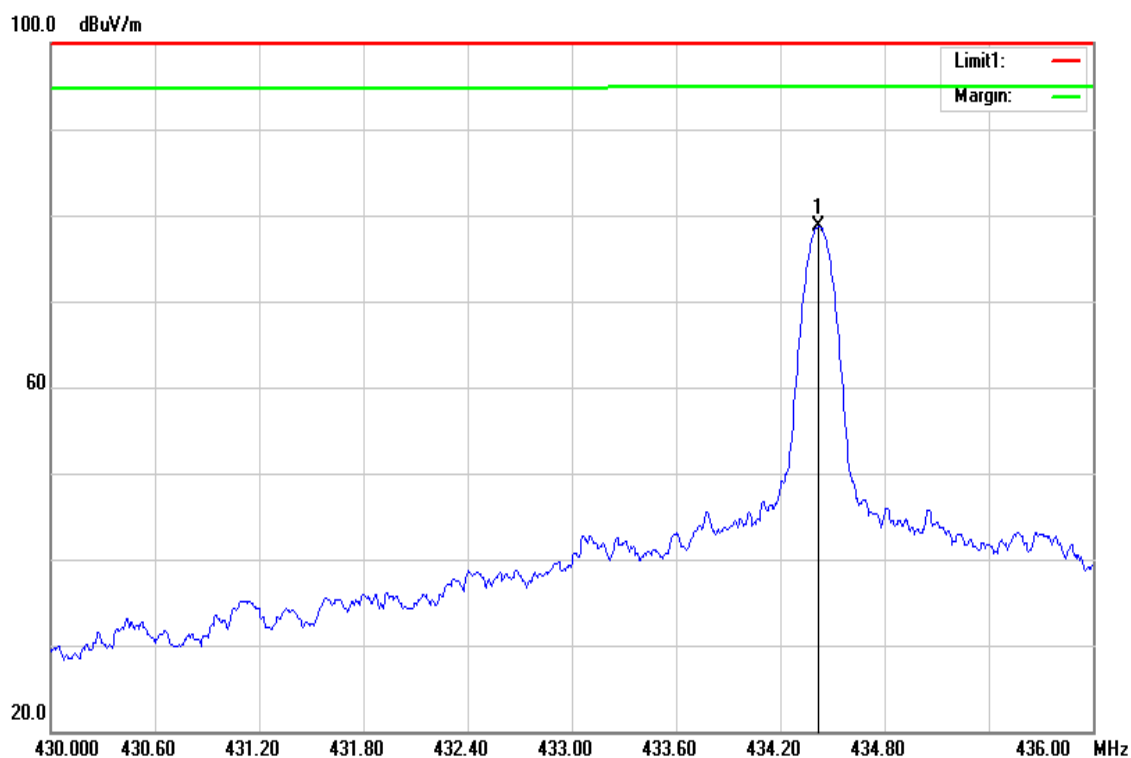
## Test Data

|               |              |               |               |
|---------------|--------------|---------------|---------------|
| Test Mode:    | TX-433.92MHz | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item     | Fundamental  | Test Date     | 2018/01/10    |
| Axis/Polarize | X-Plane/Hor. | Test Engineer | Jerry Chuang  |
| Detector      | Peak         | Test Voltage: | 3Vdc          |



| No | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>Factor(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1  | 433.9180           | 89.08             | -10.17                  | 78.91              | 100.82            | -21.91         | peak   |

|               |              |               |               |
|---------------|--------------|---------------|---------------|
| Test Mode:    | TX-434.42MHz | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item     | Fundamental  | Test Date     | 2018/01/10    |
| Axis/Polarize | X-Plane/Hor. | Test Engineer | Jerry Chuang  |
| Detector      | Peak         | Test Voltage: | 3Vdc          |



| No | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>Factor(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1  | 434.4220           | 88.83             | -10.16                  | 78.67              | 100.84            | -22.17         | peak   |

## 4.4 RADIATION UNWANTED EMISSION

### 4.4.1 Test Limit

According to §15.231(e) and §15.209

Unwanted emissions limit follow the table or the FCC Part 15.209, whichever limit permits higher field strength.

According to §15.231(b)

| Fundamental frequency (MHz) | Field strength of Spurious emission (uv/m) at 3m | Field strength of Spurious emission (dBuv/m) at 3m |
|-----------------------------|--|--|
| 40.66-40.70                 | 225  | 47   |
| 70-130                      | 125  | 41.9   |
| *130-174                    | *125-375   | 41.9-51.5  |
| 174-260                     | 375  | 51.5   |
| *260-470                    | *375-1250  | 51.5-61.9  |
| Above 470                   | 1250   | 61.9   |

**REMARK:**

1. Linear interpolations
2. Based on the average value of the measured Field strength of fundamental.

### Below 30MHz

| Frequency (MHz) | Field Strength |               |                              |               |                              |
|-----------------|----------------|---------------|------------------------------|---------------|------------------------------|
|                 | (μV/m)         | (dBμV/m)      | Measurement Distance (meter) | (dBμV/m)      | Measurement Distance (meter) |
| 0.009 - 0.490   | 2400/F(kHz)    | 48.52 – 13.80 | 300                          | 128.52–104.84 | 3                            |
| 0.490 - 1.705   | 24000/F(kHz)   | 33.80 – 22.97 | 30                           | 73.80– 62.97  | 3                            |
| 1.705 – 30.0    | 30             | 29.54         | 30                           | 69.54         | 3                            |

### Above 30MHz

| Frequency (MHz) | Field Strength |          | Measurement Distance (meter) |
|-----------------|----------------|----------|------------------------------|
|                 | (μV/m)         | (dBμV/m) |                              |
| 30-88           | 100            | 40.0     | 3                            |
| 88-216          | 150            | 43.5     | 3                            |
| 216-960         | 200            | 46.0     | 3                            |
| Above 960       | 500            | 54.0     | 3                            |

## 4.4.2 Test Procedure

Test method Refer as ANSI 63.10:2013

|   |  |
|---|--|
| <input checked="" type="checkbox"/> Unwanted Emission | <input checked="" type="checkbox"/> clause 4.1.4.2.2: Measurement Peak value.<br><input type="checkbox"/> clause 4.1.4.2.3: Duty cycle $\geq 100\%$ .<br><input checked="" type="checkbox"/> clause 4.1.4.2.4: Measurement Average value.                                      |
| <input checked="" type="checkbox"/> Radiated Emission | <input checked="" type="checkbox"/> clause 6.4: below 30 MHz and test distance is 3m.<br><input checked="" type="checkbox"/> clause 6.5: below 30 MHz -1 GHz and test distance is 3m.<br><input checked="" type="checkbox"/> clause 6.6: Above 30 MHz and test distance is 3m. |

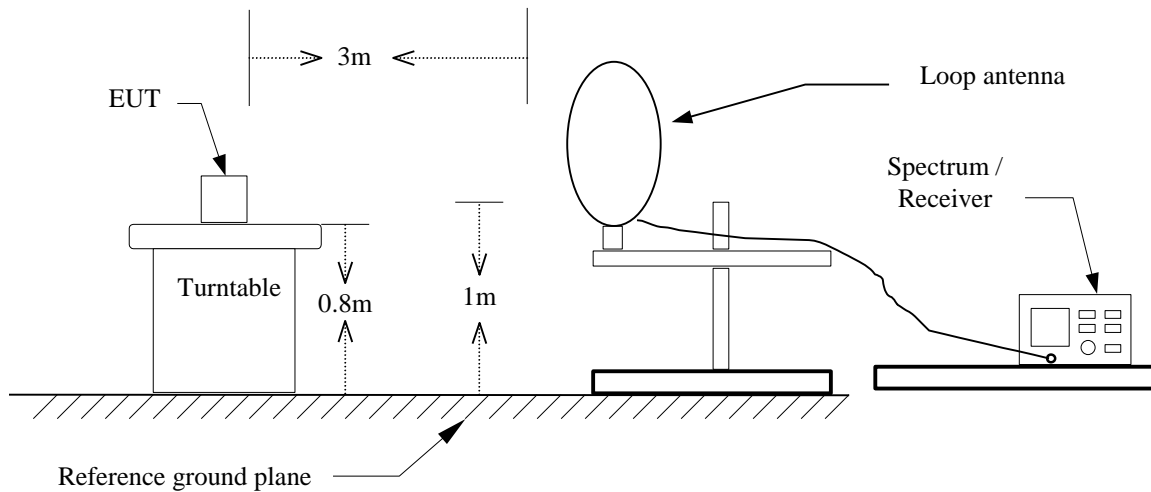
- The EUT is placed on a turntable, which is 0.8m for test below 1GHz and 1.5m for test above 1GHz, above ground plane.
- The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- Set the spectrum analyzer in the following setting as:  
Below 1GHz:  
RBW=100kHz / VBW=300kHz / Sweep=AUTO  
Above 1GHz:  
(a)PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO  
(b)AVERAGE: RBW=1MHz,
- Repeat above procedures until the measurements for all frequencies are complete.

### Remark.

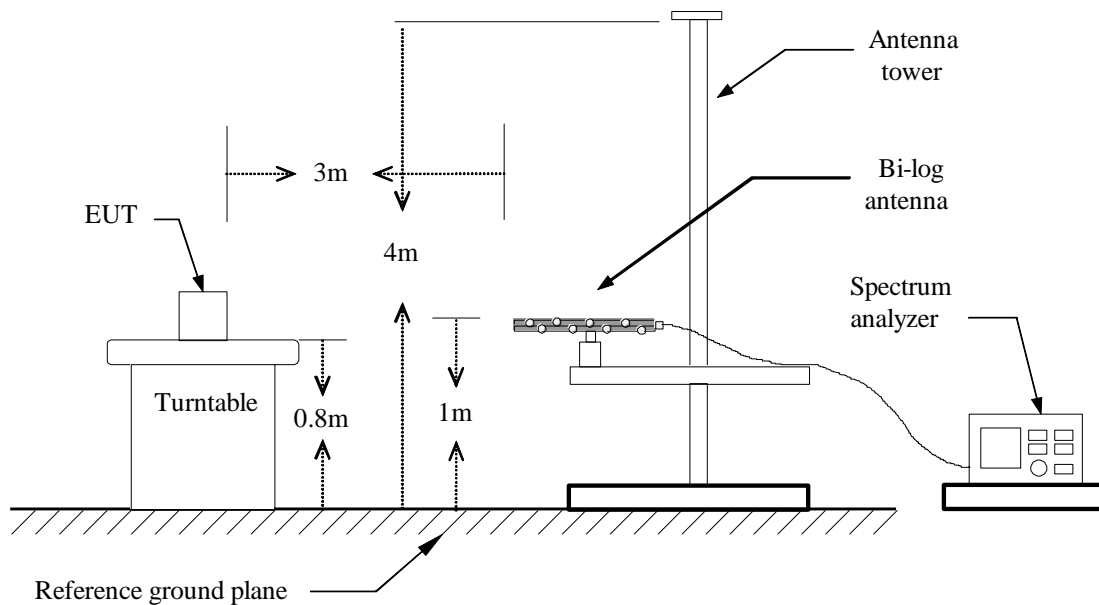
- The EUT has a oscillator operating at 27.6 MHz, harmonic/spurious was verified. And didn't catch any emission at 27.6MHz.
- Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.
- No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

### 4.4.3 Test Setup

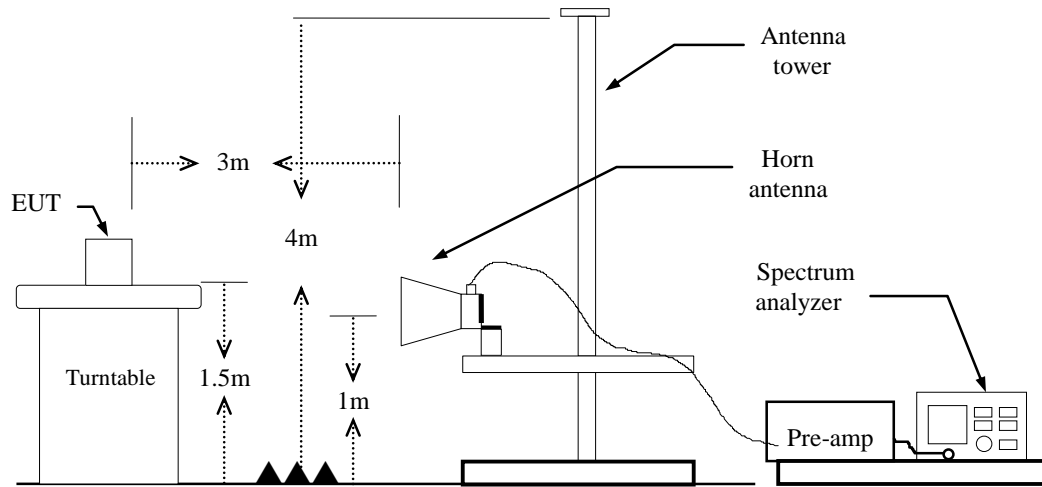
#### 9kHz ~ 30MHz



#### 30MHz ~ 1 GHz



### Above 1 GHz



### 4.4.4 Test Result

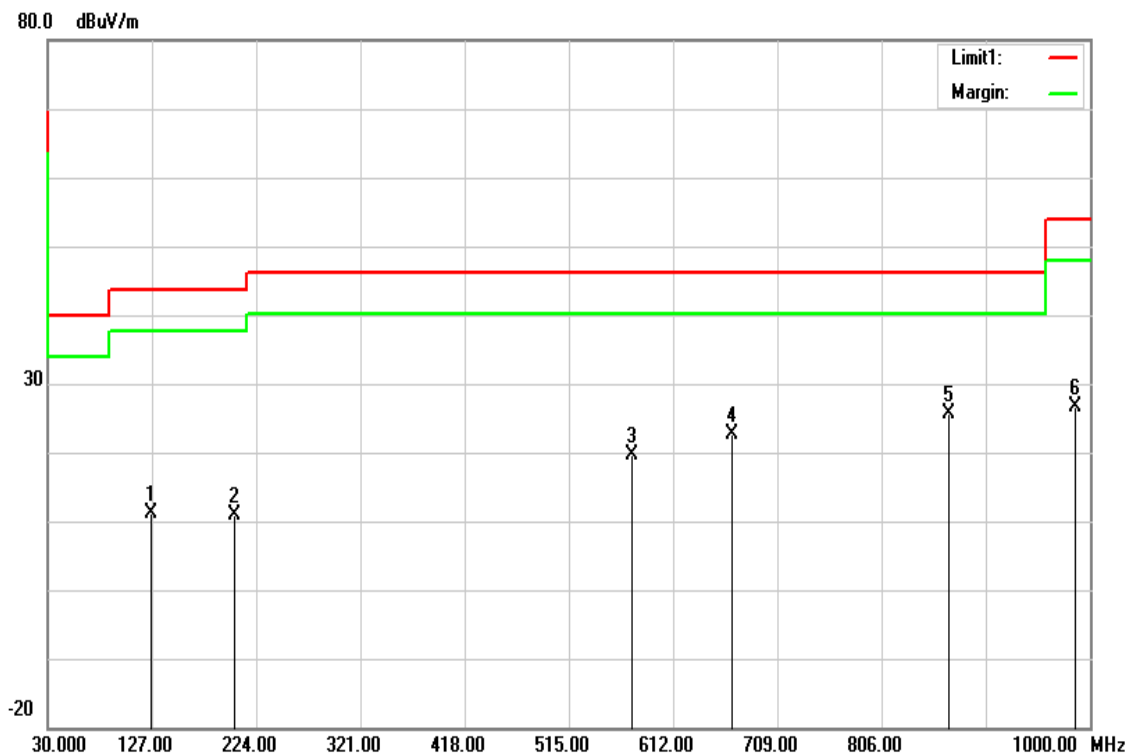
Pass.



## Test Data

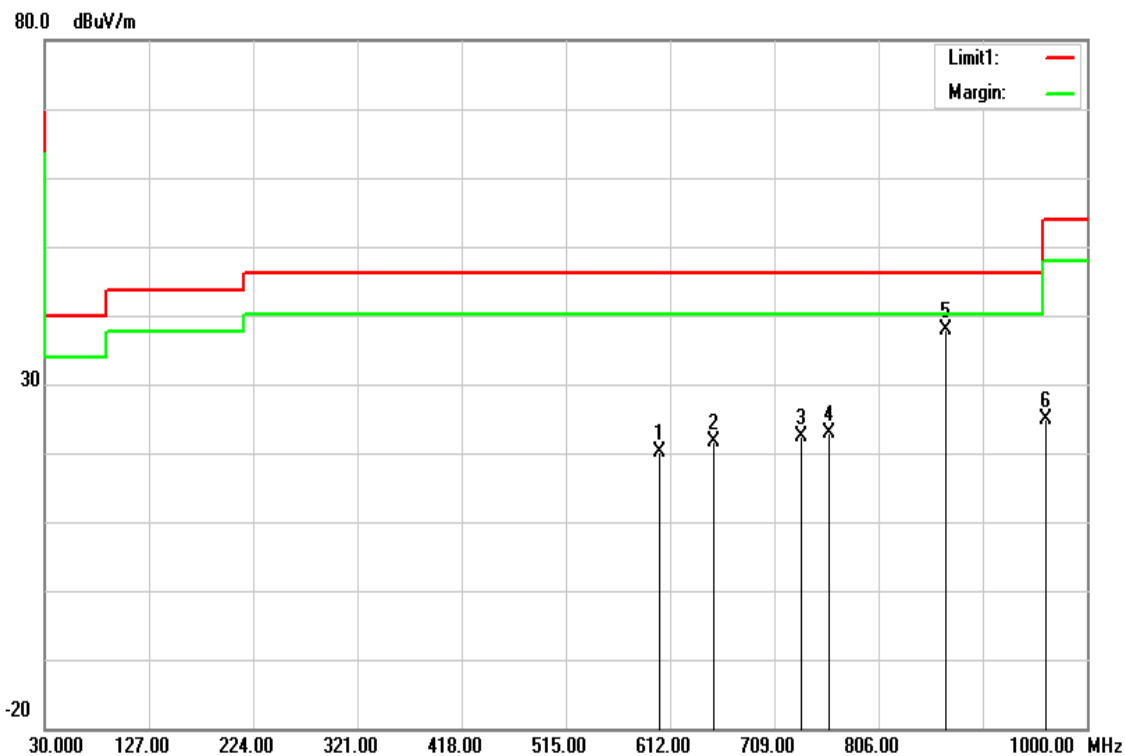
### Below 1GHz

|            |              |               |               |
|------------|--------------|---------------|---------------|
| Test Mode: | TX-433.92MHz | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item  | Below 1GHz   | Test Date     | 2018/01/10    |
| Polarize   | Vertical     | Test Engineer | Jerry Chuang  |
| Detector   | Peak         | Test Voltage: | 3Vdc          |



| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 126.0300        | 26.29          | -15.16                   | 11.13           | 43.52          | -32.39      | peak   |
| 203.6300        | 26.49          | -15.67                   | 10.82           | 43.52          | -32.70      | peak   |
| 573.2000        | 26.89          | -7.26                    | 19.63           | 46.02          | -26.39      | peak   |
| 667.2900        | 28.05          | -5.32                    | 22.73           | 46.02          | -23.29      | peak   |
| 868.0800        | 28.21          | -2.55                    | 25.66           | 46.02          | -20.36      | peak   |
| 986.4200        | 27.44          | -0.80                    | 26.64           | 54.00          | -27.36      | peak   |

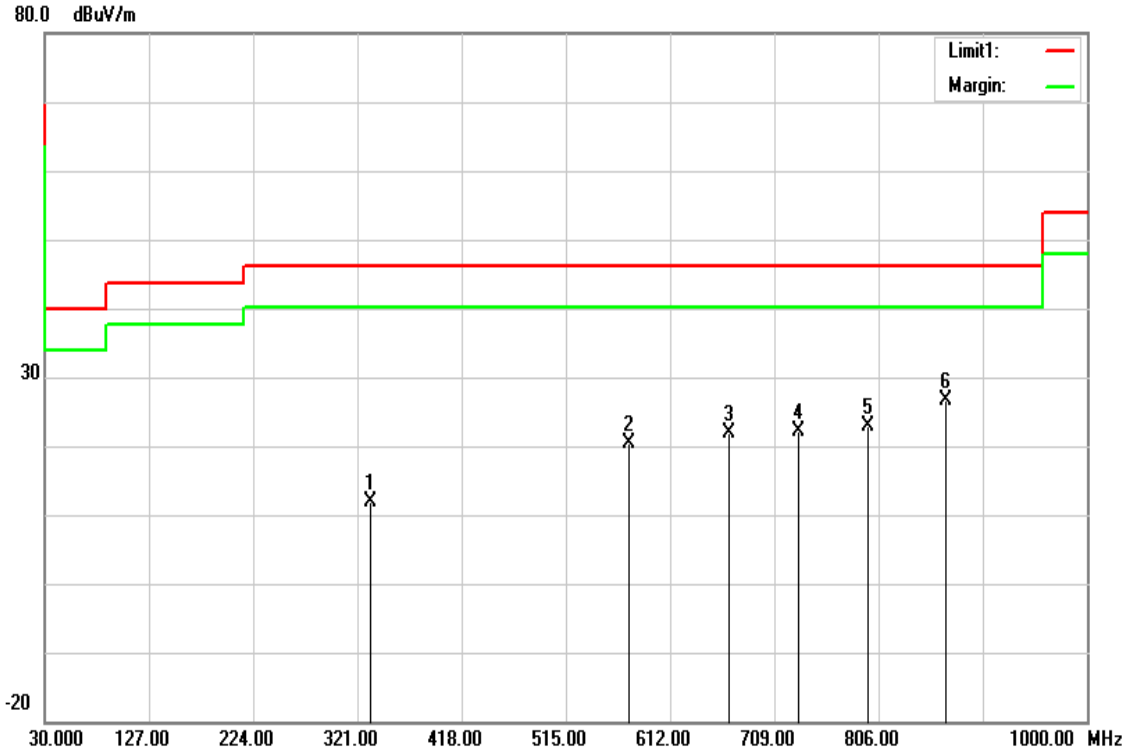
|            |              |               |               |
|------------|--------------|---------------|---------------|
| Test Mode: | TX-433.92MHz | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item  | Below 1GHz   | Test Date     | 2018/01/10    |
| Polarize   | Horizontal   | Test Engineer | Jerry Chuang  |
| Detector   | Peak         | Test Voltage: | 3Vdc          |



| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 602.3000        | 27.00          | -6.87                    | 20.13           | 46.02          | -25.89      | peak   |
| 652.7400        | 27.17          | -5.51                    | 21.66           | 46.02          | -24.36      | peak   |
| 734.2200        | 26.93          | -4.48                    | 22.45           | 46.02          | -23.57      | peak   |
| 760.4100        | 26.87          | -4.11                    | 22.76           | 46.02          | -23.26      | peak   |
| 868.0800        | 40.32          | -2.55                    | 37.77           | 46.02          | -8.25       | peak   |
| 961.2000        | 25.87          | -1.07                    | 24.80           | 54.00          | -29.20      | peak   |

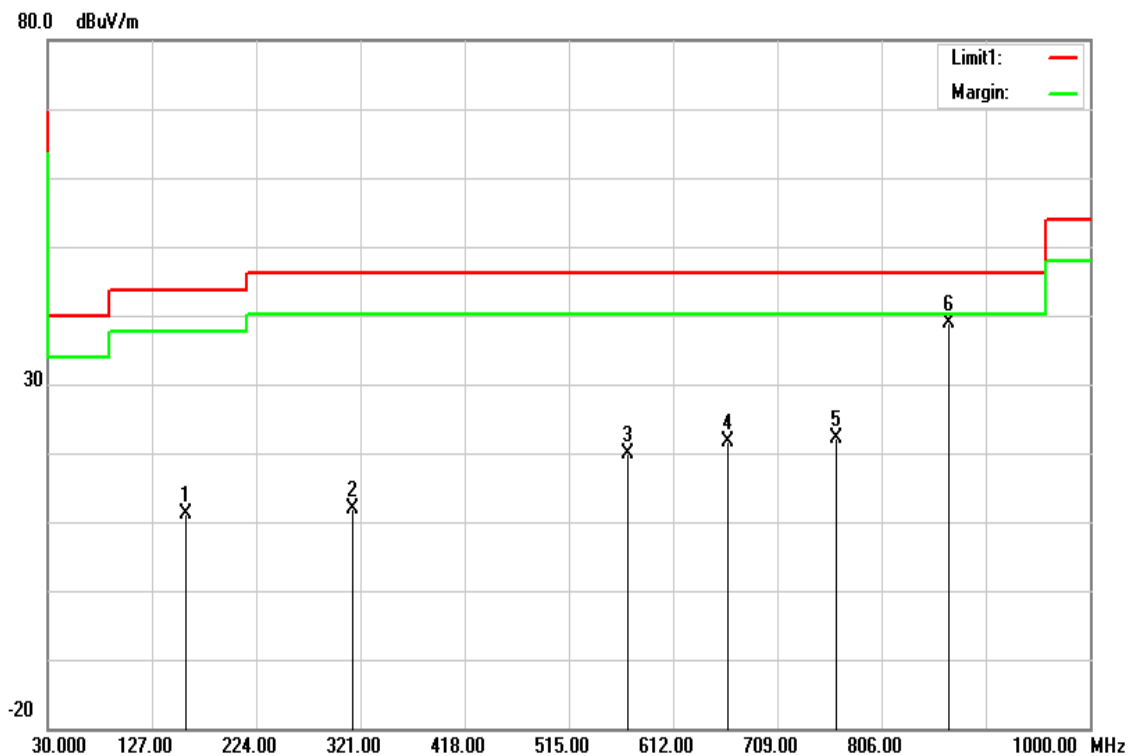
### Below 1GHz

|            |              |               |               |
|------------|--------------|---------------|---------------|
| Test Mode: | TX-434.42MHz | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item  | Below 1GHz   | Test Date     | 2018/01/10    |
| Polarize   | Vertical     | Test Engineer | Jerry Chuang  |
| Detector   | Peak         | Test Voltage: | 3Vdc          |



| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 332.6400        | 25.36          | -13.36                   | 12.00           | 46.02          | -34.02      | peak   |
| 573.2000        | 27.56          | -7.26                    | 20.30           | 46.02          | -25.72      | peak   |
| 667.2900        | 27.27          | -5.32                    | 21.95           | 46.02          | -24.07      | peak   |
| 731.3100        | 26.62          | -4.51                    | 22.11           | 46.02          | -23.91      | peak   |
| 796.3000        | 26.23          | -3.44                    | 22.79           | 46.02          | -23.23      | peak   |
| 869.0500        | 29.10          | -2.53                    | 26.57           | 46.02          | -19.45      | peak   |

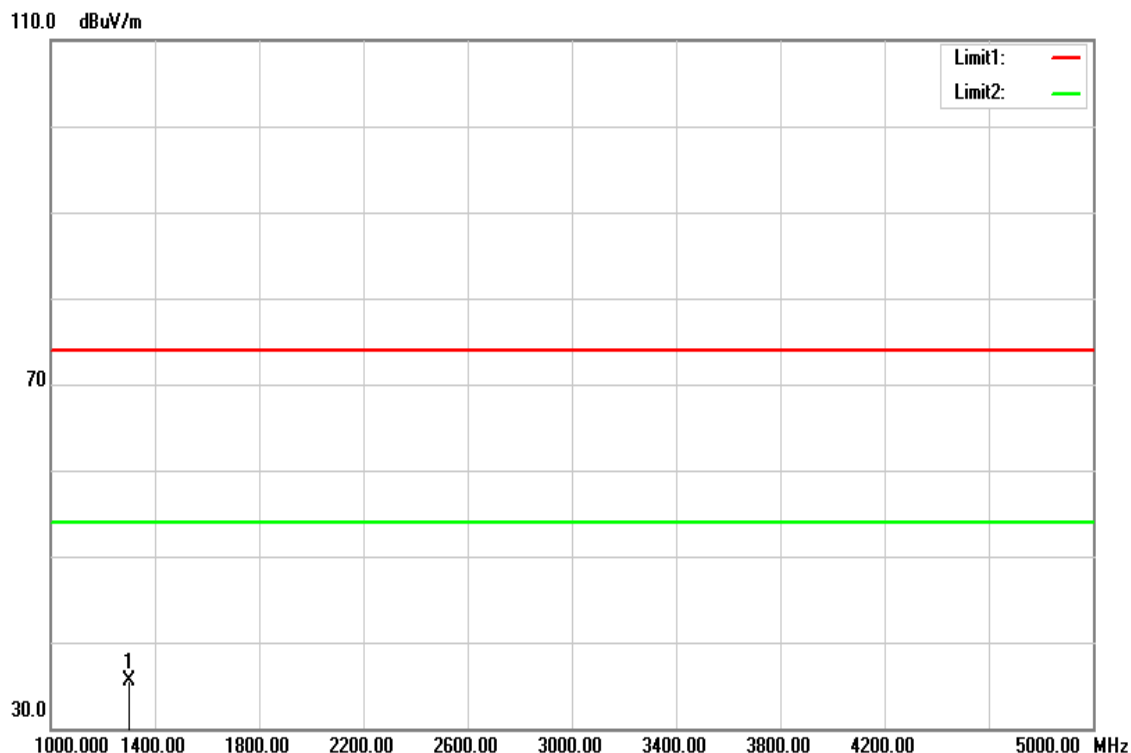
|            |            |               |               |
|------------|------------|---------------|---------------|
| Test Mode: | TX         | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item  | Below 1GHz | Test Date     | 2018/01/10    |
| Polarize   | Horizontal | Test Engineer | Jerry Chuang  |
| Detector   | Peak       | Test Voltage: | 3Vdc          |



| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 158.0400        | 26.95          | -15.91                   | 11.04           | 43.52          | -32.48      | peak   |
| 314.2100        | 25.74          | -13.75                   | 11.99           | 46.02          | -34.03      | peak   |
| 570.2900        | 27.07          | -7.30                    | 19.77           | 46.02          | -26.25      | peak   |
| 663.4100        | 26.95          | -5.37                    | 21.58           | 46.02          | -24.44      | peak   |
| 763.3200        | 26.18          | -4.05                    | 22.13           | 46.02          | -23.89      | peak   |
| 869.0500        | 41.40          | -2.53                    | 38.87           | 46.02          | -7.15       | peak   |

**Above 1GHz**

|            |              |               |               |
|------------|--------------|---------------|---------------|
| Test Mode: | TX-433.92MHz | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item  | Above 1GHz   | Test Date     | 2018/01/10    |
| Polarize   | Vertical     | Test Engineer | Jerry Chuang  |
| Detector   | Peak         | Test Voltage: | 3Vdc          |

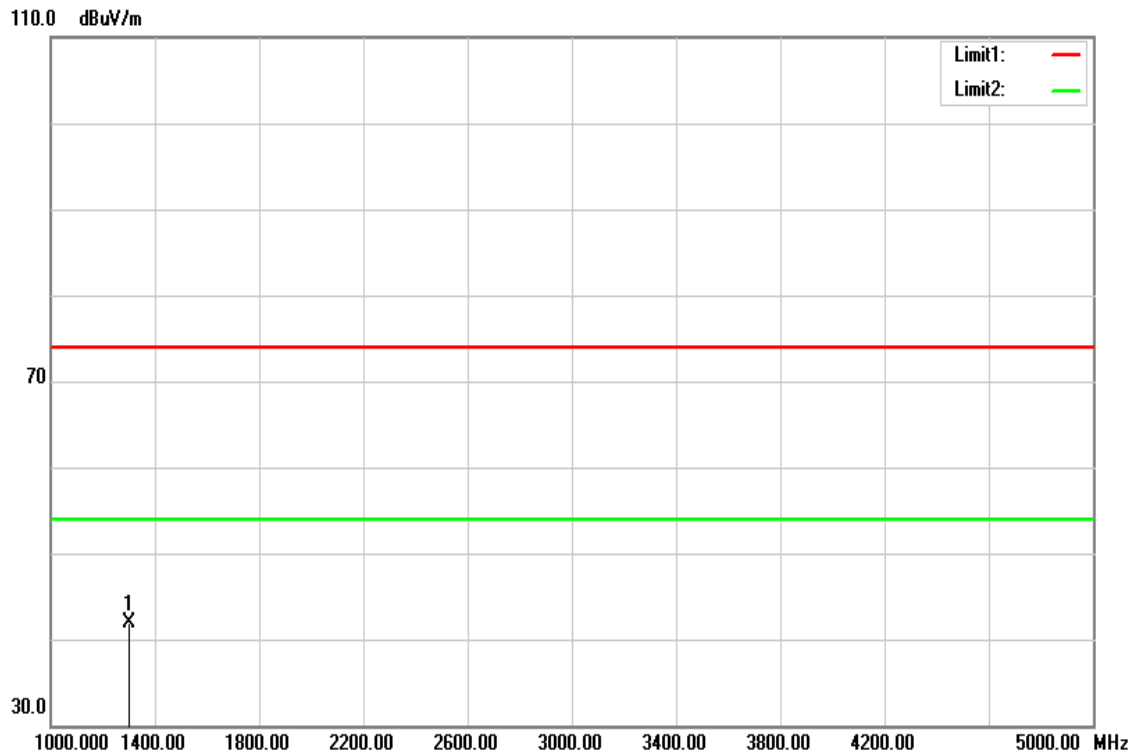


| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 1300.000        | 44.13          | -8.66                    | 35.47           | 74.00          | -38.53      | peak   |
| N/A             |                |                          |                 |                |             |        |
|                 |                |                          |                 |                |             |        |

**Remark:**

- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

|            |              |               |               |
|------------|--------------|---------------|---------------|
| Test Mode: | TX-433.92MHz | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item  | Above 1GHz   | Test Date     | 2018/01/10    |
| Polarize   | Horizontal   | Test Engineer | Jerry Chuang  |
| Detector   | Peak         | Test Voltage: | 3Vdc          |



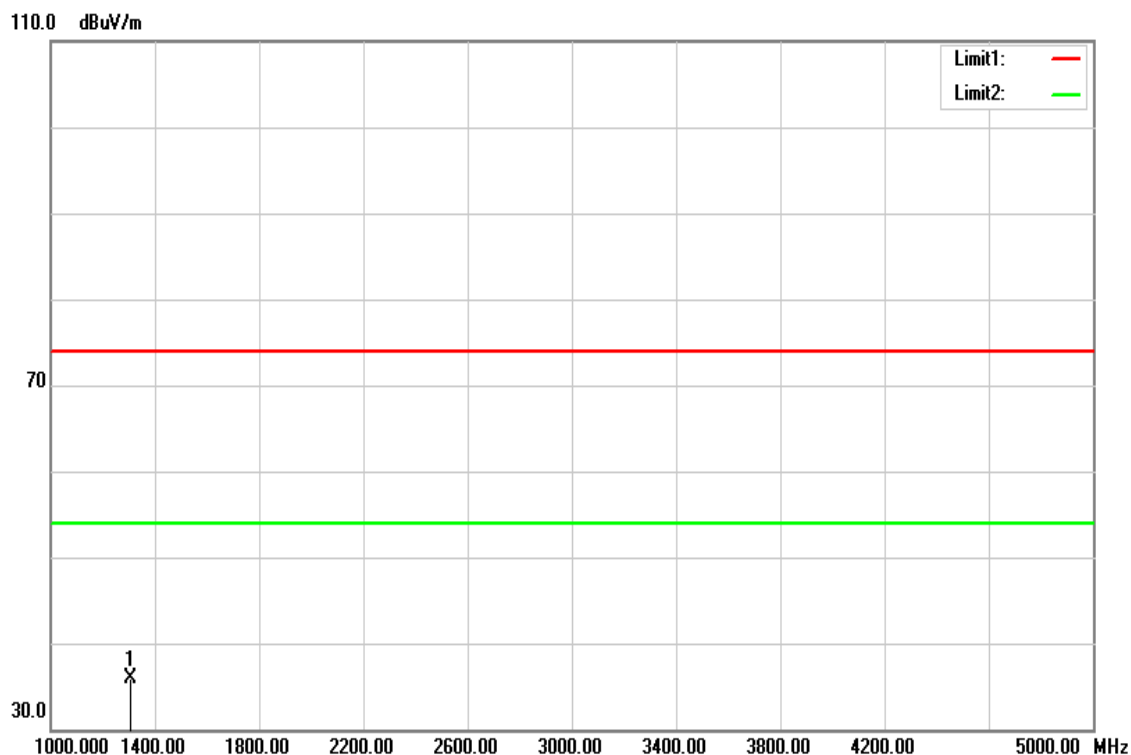
| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 1300.000        | 50.57          | -8.66                    | 41.91           | 74.00          | -32.09      | peak   |
| N/A             |                |                          |                 |                |             |        |
|                 |                |                          |                 |                |             |        |

**Remark:**

- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

**Above 1GHz**

|            |              |               |               |
|------------|--------------|---------------|---------------|
| Test Mode: | TX-434.42MHz | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item  | Above 1GHz   | Test Date     | 2018/01/10    |
| Polarize   | Vertical     | Test Engineer | Jerry Chuang  |
| Detector   | Peak         | Test Voltage: | 3Vdc          |

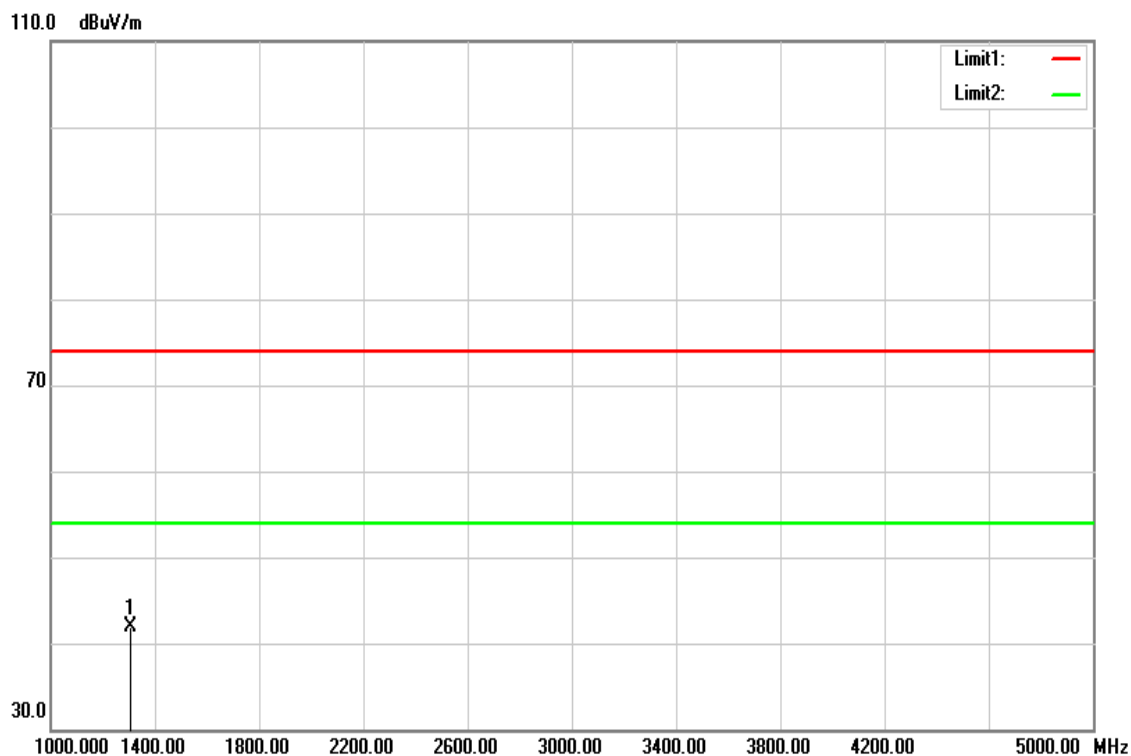


| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 1304.000        | 44.59          | -8.65                    | 35.94           | 74.00          | -38.06      | peak   |
| N/A             |                |                          |                 |                |             |        |
|                 |                |                          |                 |                |             |        |

**Remark:**

- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

|            |              |               |               |
|------------|--------------|---------------|---------------|
| Test Mode: | TX-434.42MHz | Temp/Hum      | 24(°C)/ 33%RH |
| Test Item  | Above 1GHz   | Test Date     | 2018/01/10    |
| Polarize   | Horizontal   | Test Engineer | Jerry Chuang  |
| Detector   | Peak         | Test Voltage: | 3Vdc          |



| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 1304.000        | 50.63          | -8.65                    | 41.98           | 74.00          | -32.02      | peak   |
| N/A             |                |                          |                 |                |             |        |
|                 |                |                          |                 |                |             |        |

**Remark:**

- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.



## 4.5 OPERATION RESTRICTION

### 4.5.1 Test Limit

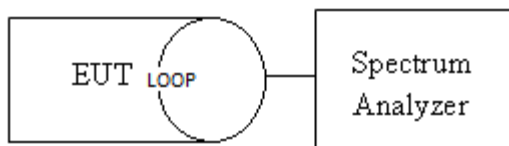
15.231(a)(1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

### 4.5.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 7.4

The Loop antenna connected to the spectrum analyzer, was touching to the transmitter antenna. Set the RBW=1MHz, VBW  $\geq 3 \times$  RBW, Detector = Peak, Trace mode = Max hold, Sweep = 200s.Measure

### 4.5.3 Test Setup



### 4.5.4 Test Result

| Dwell Time (433.92MHz) |                |        |
|------------------------|----------------|--------|
| Operation condition    | Burst Duration | Limits |
| Automatically Operated | 231.9 ms       | 5 sec  |

| Dwell Time (434.42MHz) |                |        |
|------------------------|----------------|--------|
| Operation condition    | Burst Duration | Limits |
| Automatically Operated | 289.9 ms       | 5 sec  |

## Test Data

