

# FCC Part 15C Test Report

## FCC ID:2ATBW-T700

|                  |  |
|------------------|--|
| Product Name:    | Dog Training Collar  |
| Trademark:       | N/A  |
| Model Name :     | T700<br>T701, T702, T703, T704, T705, T706, T707, T708, T709, T710,<br>T711, T712, T713, T714, T715  |
| Prepared For :   | Shenzhen Kaishenghui Industrial Co., Ltd.  |
| Address :        | 5th Floor, Building D, Pioneer Park, Fenghuang Third Industrial Zone,<br>Fuyong, Bao'an District, Shenzhen, China  |
| Prepared By :    | Shenzhen BCTC Testing Co., Ltd.  |
| Address :        | BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st<br>Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen,<br>China |
| Test Date:       | Apr. 30, 21019 to May 09, 2019   |
| Date of Report : | May 09, 2019   |
| Report No.:      | BCTC-FY190402276E  |

## VERIFICATION OF COMPLIANCE

**Applicant's name** ..... Shenzhen Kaishenghui Industrial Co., Ltd.

**Address** ..... 5th Floor, Building D, Pioneer Park, Fenghuang Third Industrial Zone, Fuyong, Bao'an District, Shenzhen, China

**Manufacture's Name**... Shenzhen Kaishenghui Industrial Co., Ltd.

**Address** ..... 5th Floor, Building D, Pioneer Park, Fenghuang Third Industrial Zone, Fuyong, Bao'an District, Shenzhen, China

### Product description

**Product name** ..... Dog Training Collar

**Trademark:** N/A

T700

**Model Name:** T701, T702, T703, T704, T705, T706, T707, T708, T709, T710, T711, T712, T713, T714, T715

FCC Part15.231

**Test Standards:** ANSI C63.10-2013

This device described above has been tested by BCTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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**Test Result**..... **Pass**

**Prepared by(Engineer):** Leke Xie

*Leke Xie*

**Reviewer(Supervisor):** Eric Yang

*Eric Yang*

**Approved(Manager):** Zero Zhou

*Zero Zhou*



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## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

| FCC Part15 (15.231) , Subpart C |   |          |        |
|---------------------------------|---|----------|--------|
| Standard Section                | Test Item   | Judgment | Remark |
| 15.207                          | Conducted Emission                                  | PASS     |        |
| 15.209,15.231b                  | Fundamental &Radiated Spurious Emission Measurement | PASS     |        |
| 15.231c                         | Occupy Bandwidth                                    | PASS     |        |
| 15.231a                         | Dwell time  | PASS     |        |
| 15.203                          | Antenna Requirement                                 | PASS     |        |

NOTE:

(1) "N/A" denotes test is not applicable in this Test Report

## 1.1 TEST FACILITY

Shenzhen BCTC Testing Co., Ltd.

Add.: BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China

FCC Test Firm Registration Number: 712850

IC Registered No.: 23583

## 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95 %.

| No. | Item   | Uncertainty |
|-----|--|-------------|
| 1   | 3m chamber Radiated spurious emission(30MHz-1GHz)  | U=4.3dB     |
| 2   | 3m chamber Radiated spurious emission(1GHz-18GHz)  | U=4.5dB     |
| 3   | 3m chamber Radiated spurious emission(18GHz-40GHz) | U=3.34dB    |
| 4   | Conducted Adjacent channel power                   | U=1.38dB    |
| 5   | Conducted output power uncertainty Above 1G        | U=1.576dB   |
| 6   | Conducted output power uncertainty below 1G        | U=1.28dB    |
| 7   | humidity uncertainty                               | U=5.3%      |
| 8   | Temperature uncertainty                            | U=0.59℃     |

## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

|                        |  |                |
|------------------------|--|----------------|
| Equipment              | Dog Training Collar  |                |
| Trade Name             | N/A  |                |
| Model Name             | T700   |                |
| Serial Model           | T701, T702, T703, T704, T705, T706, T707, T708, T709, T710, T711, T712, T713, T714, T715   |                |
| Model Difference       | The product is different for model number and outlook color.   |                |
| Product Description    | Operation Frequency:   | 433.92MHz      |
|                        | Modulation Type:   | ASK            |
|                        | Antenna Type:  | Spring Antenna |
|                        | Antenna Gain:  | 1dBi           |
|                        | Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual. |                |
| Ratings                | DC 3.7V or DC 5V form Adapter  |                |
| Connecting I/O Port(s) | Please refer to the User's Manual  |                |
| hardware version       | N/A  |                |
| Software version       | N/A  |                |
| Serial number          | N/A  |                |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

## 2.2 DESCRIPTION OF TEST MODES

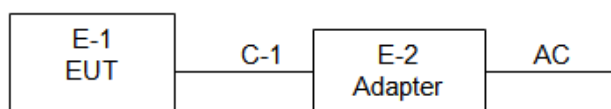
| For All Emission |             |
|------------------|-------------|
| Final Test Mode  | Description |
| Mode 1           | TX Mode     |

Note:

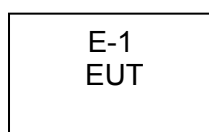
(1) Fully-charged battery is used during the test

## 2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Conducted Emission Test



Spurious emissions



## 2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment           | Mfr/Brand | Model/Type No. | Series No. | Note      |
|------|---------------------|-----------|----------------|------------|-----------|
| E-1  | Dog Training Collar | N/A       | T700           | N/A        | EUT       |
| E-2  | Adapter             | N/A       | BCTC005        | N/A        | Auxiliary |

| Item | Shielded Type | Ferrite Core | Length | Note                 |
|------|---------------|--------------|--------|----------------------|
| C-1  | NO            | NO           | 1.0M   | USB cable unshielded |

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.



## 2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

### Radiation Test equipment

| Item | Equipment                        | Manufacturer | Type No.      | Serial No.    | Last calibration | Calibrated until |
|------|----------------------------------|--------------|---------------|---------------|------------------|------------------|
| 1    | Spectrum Analyzer (9kHz-26.5GHz) | Agilent      | E4407B        | MY45109572    | 2018.06.20       | 2019.06.20       |
| 2    | Test Receiver (9kHz-7GHz)        | R&S          | ESR7          | 101154        | 2018.06.20       | 2019.06.20       |
| 3    | Bilog Antenna (30MHz-3GHz)       | SCHWARZBECK  | VULB9163      | VULB9163-942  | 2018.06.23       | 2019.06.23       |
| 4    | Horn Antenna (1GHz-18GHz)        | SCHWARZBECK  | BBHA9120D     | 1541          | 2018.06.23       | 2021.06.22       |
| 5    | Horn Antenna (18GHz-40GHz)       | SCHWARZBECK  | BBHA9170      | 822           | 2018.08.06       | 2019.08.06       |
| 6    | Amplifier (9KHz-6GHz)            | SCHWARZBECK  | BBV9744       | 9744-0037     | 2018.06.20       | 2019.06.20       |
| 7    | Amplifier (0.5GHz-18GHz)         | SCHWARZBECK  | BBV9718       | 9718-309      | 2018.06.20       | 2019.06.20       |
| 8    | Amplifier (18GHz-40GHz)          | MITEQ        | TTA1840-35-HG | 2034381       | 2018.08.06       | 2019.08.06       |
| 9    | Loop Antenna (9KHz-30MHz)        | SCHWARZBECK  | FMZB1519B     | 014           | 2018.06.23       | 2019.06.23       |
| 10   | RF cables1 (9kHz-30MHz)          | Huber+Suhnar | 9kHz-30MHz    | B1702988-0008 | 2019.02.12       | 2020.02.12       |
| 11   | RF cables2 (30MHz-1GHz)          | Huber+Suhnar | 30MHz-1GHz    | 1486150       | 2019.03.27       | 2020.03.27       |
| 12   | RF cables3 (1GHz-40GHz)          | Huber+Suhnar | 1GHz-40GHz    | 1607106       | 2018.06.19       | 2019.06.19       |
| 13   | Power Metter                     | Keysight     | E4419         | \             | 2018.06.15       | 2019.06.15       |
| 14   | Power Sensor (AV)                | Keysight     | E9 300A       | \             | 2018.06.15       | 2019.06.15       |
| 15   | Signal Analyzer 20kHz-26.5GHz    | KEYSIGHT     | N9020A        | MY49100060    | 2018.08.14       | 2019.08.13       |
| 16   | Test Receiver 9kHz-40GHz         | R&S          | FSP40         | 100550        | 2018.06.13       | 2019.06.12       |
| 17   | D.C. Power Supply                | LongWei      | TPR-6405D     | \             | \                | \                |
| 18   | Software                         | Frad         | EZ-EMC        | FA-03A2 RE    | \                | \                |

### Conduction Test equipment

| Item | Equipment     | Manufacturer | Type No.   | Serial No.    | Last calibration | Calibrated until |
|------|---------------|--------------|------------|---------------|------------------|------------------|
| 1    | Test Receiver | R&S          | ESR3       | 102075        | 2018.06.20       | 2019.06.20       |
| 2    | LISN          | SCHWARZBECK  | NSLK8127   | 8127739       | 2018.06.19       | 2019.06.19       |
| 3    | LISN          | R&S          | ENV216     | 101375        | 2018.06.20       | 2019.06.20       |
| 4    | RF cables     | Huber+Suhnar | 9kHz-30MHz | B1702988-0008 | 2019.02.12       | 2020.02.12       |
| 5    | Software      | Frad         | EZ-EMC     | EMC-CON 3A1   | \                | \                |

### 3. EMC EMISSION TEST

#### 3.1 CONDUCTED EMISSION MEASUREMENT

##### 3.1.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

| FREQUENCY (MHz) | Limit (dBuV) |           | Standard |
|-----------------|--------------|-----------|----------|
|                 | Quasi-peak   | Average   |          |
| 0.15 -0.5       | 66 - 56 *    | 56 - 46 * | FCC      |
| 0.50 -5.0       | 56.00        | 46.00     | FCC      |
| 5.0 -30.0       | 60.00        | 50.00     | FCC      |

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " \* " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

| Receiver Parameters | Setting  |
|---------------------|----------|
| Attenuation         | 10 dB    |
| Start Frequency     | 0.15 MHz |
| Stop Frequency      | 30 MHz   |
| IF Bandwidth        | 9 kHz    |

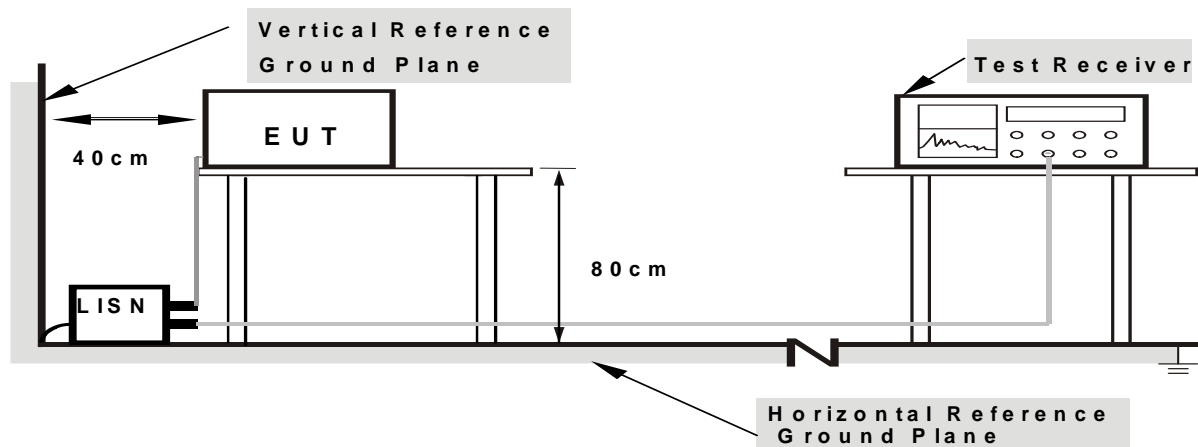
### 3.1.2 TEST PROCEDURE

- The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

### 3.1.3 DEVIATION FROM TEST STANDARD

No deviation

### 3.1.4 TEST SETUP



Note: 1.Support units were connected to second LISN.  
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

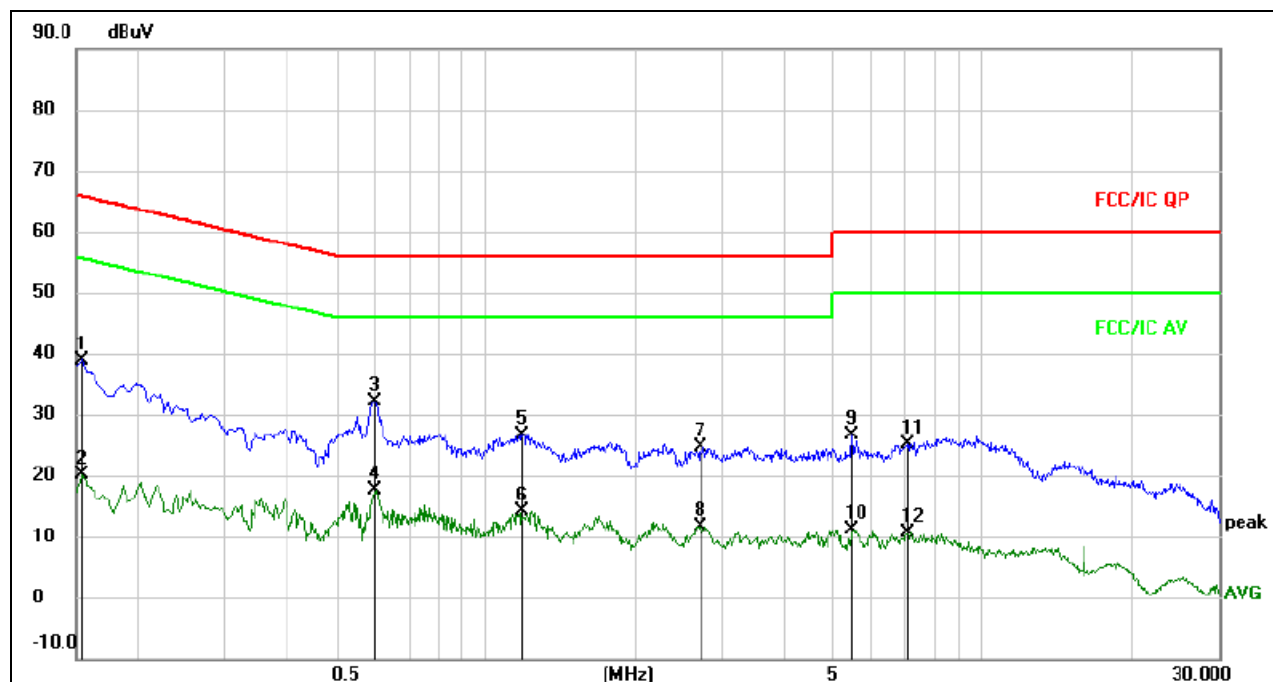
### 3.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

### 3.1.6 TEST RESULTS



|                |              |                     |        |
|----------------|--------------|---------------------|--------|
| Temperature :  | 26 °C        | Relative Humidity : | 54%    |
| Pressure :     | 101kPa       | Phase :             | L      |
| Test Voltage : | AC 120V/60Hz | Test Mode :         | Mode 1 |

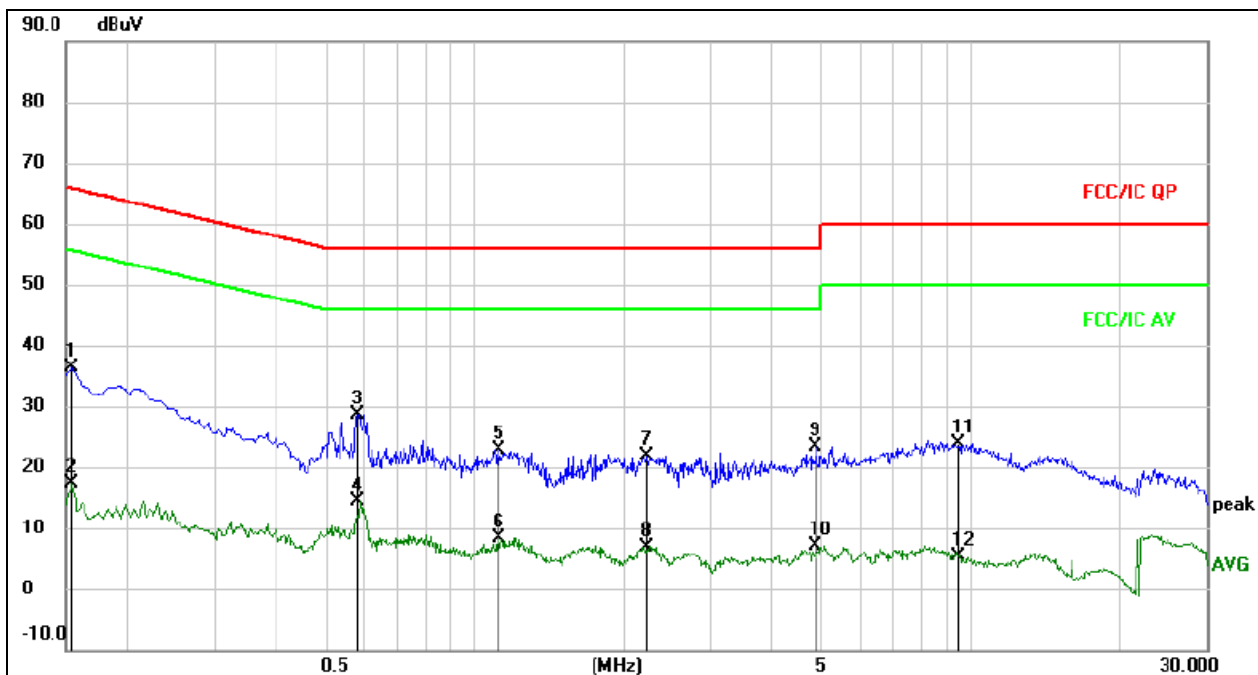


Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------|--------------------------|---------------|------------|----------|---------|
| 1   |     | 0.1539       | 29.48                    | 9.52              | 39.00                    | 65.79         | -26.79     | QP       |         |
| 2   |     | 0.1539       | 10.63                    | 9.52              | 20.15                    | 55.79         | -35.64     | AVG      |         |
| 3   | *   | 0.5980       | 22.20                    | 9.99              | 32.19                    | 56.00         | -23.81     | QP       |         |
| 4   |     | 0.5980       | 7.59                     | 9.99              | 17.58                    | 46.00         | -28.42     | AVG      |         |
| 5   |     | 1.1900       | 17.17                    | 9.57              | 26.74                    | 56.00         | -29.26     | QP       |         |
| 6   |     | 1.1900       | 4.58                     | 9.57              | 14.15                    | 46.00         | -31.85     | AVG      |         |
| 7   |     | 2.7180       | 14.94                    | 9.64              | 24.58                    | 56.00         | -31.42     | QP       |         |
| 8   |     | 2.7180       | 2.00                     | 9.64              | 11.64                    | 46.00         | -34.36     | AVG      |         |
| 9   |     | 5.4660       | 16.95                    | 9.78              | 26.73                    | 60.00         | -33.27     | QP       |         |
| 10  |     | 5.4660       | 1.45                     | 9.78              | 11.23                    | 50.00         | -38.77     | AVG      |         |
| 11  |     | 7.0780       | 15.38                    | 9.72              | 25.10                    | 60.00         | -34.90     | QP       |         |
| 12  |     | 7.0780       | 0.83                     | 9.72              | 10.55                    | 50.00         | -39.45     | AVG      |         |

|                |              |                     |        |
|----------------|--------------|---------------------|--------|
| Temperature :  | 26 °C        | Relative Humidity : | 54%    |
| Pressure :     | 101kPa       | Phase :             | N      |
| Test Voltage : | AC 120V/60Hz | Test Mode :         | Mode 1 |



Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------|--------------------------|---------------|------------|----------|---------|
| 1   |     | 0.1539       | 26.86                    | 9.52              | 36.38                    | 65.79         | -29.41     | QP       |         |
| 2   |     | 0.1539       | 7.75                     | 9.52              | 17.27                    | 55.79         | -38.52     | AVG      |         |
| 3   | *   | 0.5820       | 18.80                    | 9.93              | 28.73                    | 56.00         | -27.27     | QP       |         |
| 4   |     | 0.5820       | 4.51                     | 9.93              | 14.44                    | 46.00         | -31.56     | AVG      |         |
| 5   |     | 1.1220       | 13.42                    | 9.57              | 22.99                    | 56.00         | -33.01     | QP       |         |
| 6   |     | 1.1220       | -1.12                    | 9.57              | 8.45                     | 46.00         | -37.55     | AVG      |         |
| 7   |     | 2.2340       | 12.20                    | 9.61              | 21.81                    | 56.00         | -34.19     | QP       |         |
| 8   |     | 2.2340       | -2.61                    | 9.61              | 7.00                     | 46.00         | -39.00     | AVG      |         |
| 9   |     | 4.8980       | 13.60                    | 9.79              | 23.39                    | 56.00         | -32.61     | QP       |         |
| 10  |     | 4.8980       | -2.68                    | 9.79              | 7.11                     | 46.00         | -38.89     | AVG      |         |
| 11  |     | 9.4780       | 14.31                    | 9.69              | 24.00                    | 60.00         | -36.00     | QP       |         |
| 12  |     | 9.4780       | -4.19                    | 9.69              | 5.50                     | 50.00         | -44.50     | AVG      |         |

## 3.2 RADIATED EMISSION MEASUREMENT

### 3.2.1 RADIATED EMISSION LIMITS (Frequency Range 9kHz-1000MHz)

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.231(b) limit in the table below has to be followed.

| Frequencies(MHz) | Field Strength(microrvolts/meter) | Measurement Distance(meters) |
|------------------|-----------------------------------|------------------------------|
| 0.009~0.490      | 2400/F(KHz)                       | 300                          |
| 0.490~1.705      | 24000/F(KHz)                      | 30                           |
| 1.705~30.0       | 30                                | 30                           |
| 30~88            | 100                               | 3                            |
| 88~216           | 150                               | 3                            |
| 216~960          | 200                               | 3                            |
| Above 960        | 500                               | 3                            |

### LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

| FREQUENCY (MHz) | Limit (dBuV/m) (at 3M) |         |
|-----------------|------------------------|---------|
|                 | PEAK                   | AVERAGE |
| Above 1000      | 74                     | 54      |

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

### FUNDAMENTAL AND HARMONICS EMISSION LIMITS

| Fundamental Frequency (MHz) | Field Strength of Fundamental (microvolts/meter) | Field Strength of Spurious Emissions (microvolts/meter) |
|-----------------------------|--|---|
| 40.66 - 40.70               | 2,250  | 225   |
| 70 - 130                    | 1,250  | 125   |
| 130 - 174                   | 1,250 to 3,750 **                                | 125 to 375 **   |
| 174 - 260                   | 3,750  | 375   |
| 260 - 470                   | 3,750 to 12,500 **                               | 375 to 1,250 **   |
| Above 470                   | 12,500   | 1,250   |

\*\* linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz,  $\mu\text{V/m}$  at 3 meters =  $56.81818(F) - 6136.3636$ ; for the band 260-470 MHz,  $\mu\text{V/m}$  at 3 meters =  $41.6667(F) - 7083.3333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

### FREQUENCY RANGE OF RADIATED MEASUREMENT (For unintentional radiators)

| Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz) | Range (MHz)   |
|---|---|
| Below 1.705   | 30  |
| 1.705 – 108   | 1000  |
| 108 – 500   | 2000  |
| 500 – 1000  | 5000  |
| Above 1000  | 5 <sup>th</sup> harmonic of the highest frequency or 40 GHz, whichever is lower |

| Spectrum Parameter | Setting  |
|--------------------|--|
| Attenuation        | Auto   |
| Start Frequency    | 1000 MHz   |
| Stop Frequency     | 10th carrier harmonic                            |
| RBW / VBW setting  | 1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average |

| Receiver Parameter     | Setting                          |
|------------------------|----------------------------------|
| Attenuation            | Auto                             |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP    |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP    |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |

### 3.2.2 TEST PROCEDURE

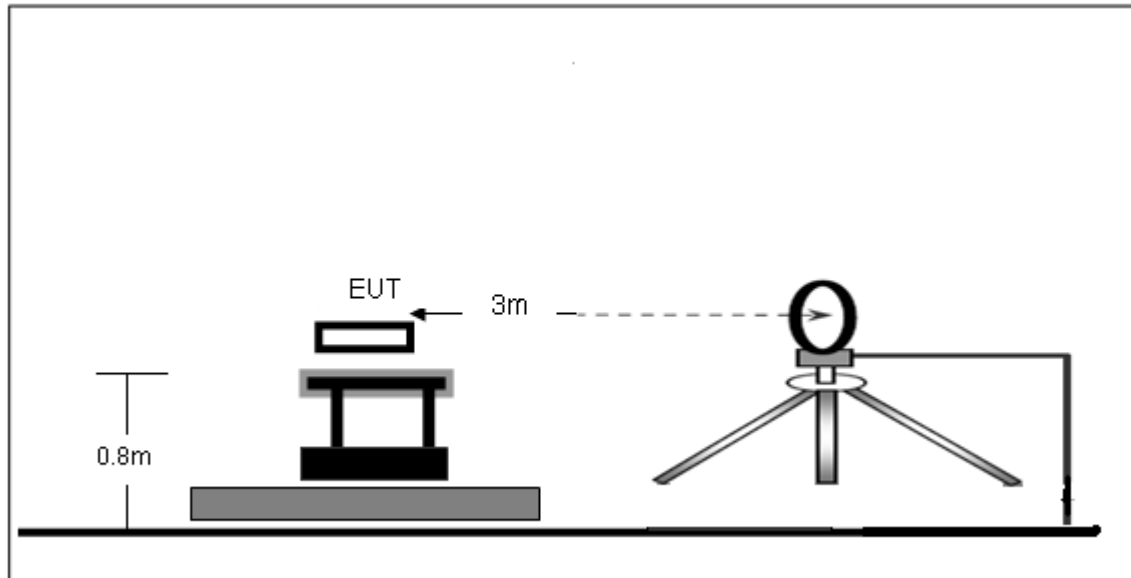
- The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8 m; above 1GHz, the height was 1.5m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

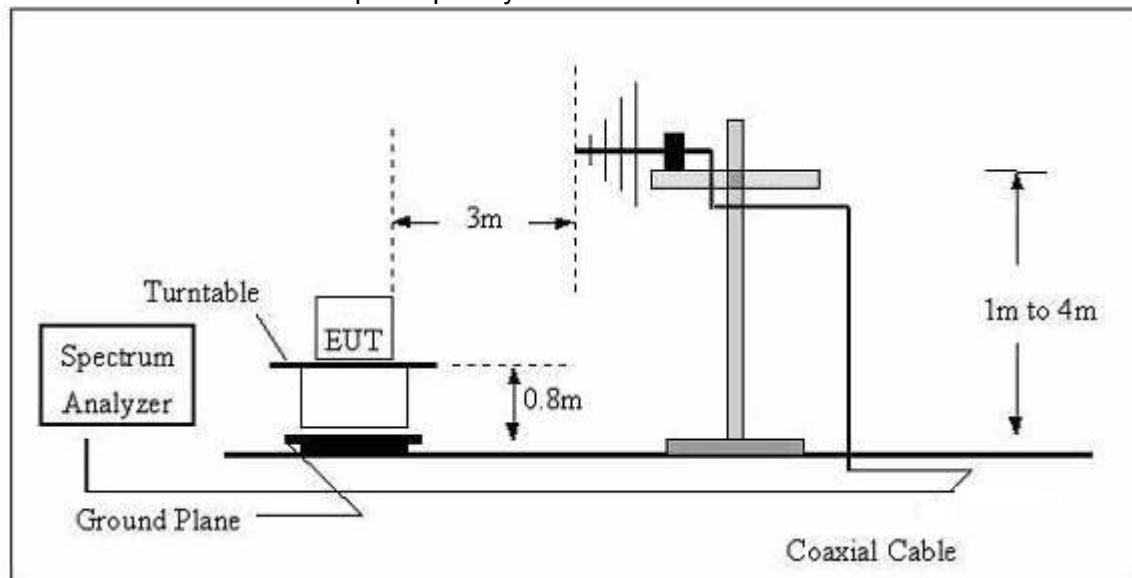
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case was X axis and the emissions were reported

### 3.2.3 TEST SETUP

#### (A) Radiated Emission Test-Up Frequency Below 30MHz

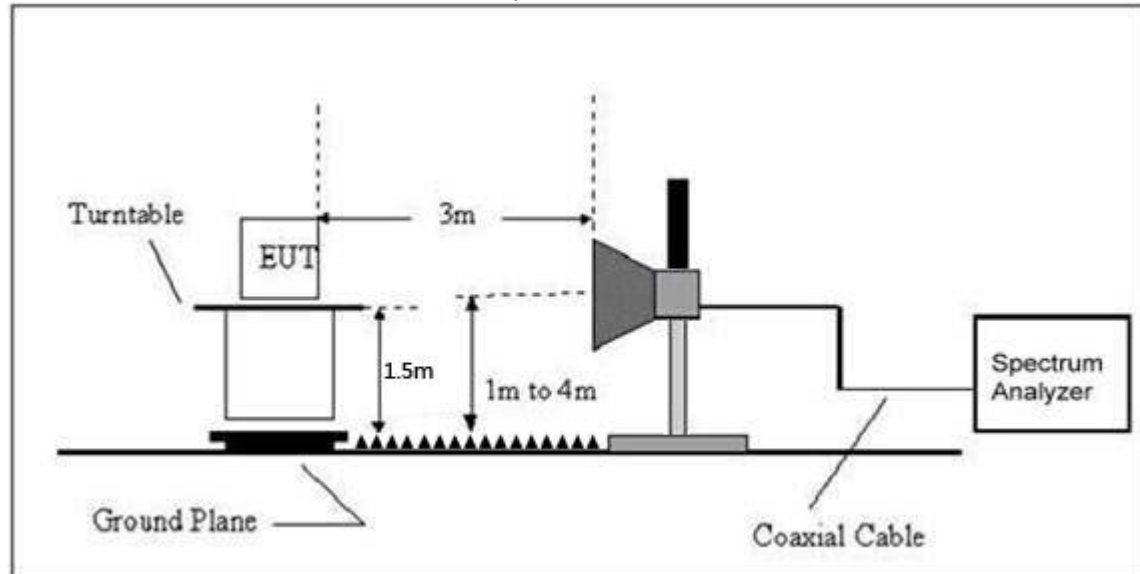


#### (B) Radiated Emission Test-Up Frequency 30MHz~1GHz





(C) Radiated Emission Test-Up Frequency Above 1GHz



### 3.2.4 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

### 3.2.5 TEST RESULTS

Radiated Spurious Emission (Below 9KHz – 30MHz )

|                |         |                     |     |
|----------------|---------|---------------------|-----|
| Temperature :  | 26 °C   | Relative Humidity : | 54% |
| Pressure :     | 101 kPa | Polarization :      | --- |
| Test Voltage : | DC 3.7V |                     |     |
| Test Mode :    | TX Mode |                     |     |

| Freq. | Reading  | Limit    | Margin | State |
|-------|----------|----------|--------|-------|
| (MHz) | (dBuV/m) | (dBuV/m) | (dB)   | P/F   |
| --    | --       | --       | --     | PASS  |
| --    | --       | --       | --     | PASS  |

**NOTE:**

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance/test distance})(\text{dB})$ ;

Limit line = specific limits(dBuv) + distance extrapolation factor.

## Radiated Spurious Emission (Between 30MHz – 1GHz)

|                |         |                     |            |
|----------------|---------|---------------------|------------|
| Temperature :  | 26 °C   | Relative Humidity : | 54%        |
| Pressure :     | 101 kPa | Polarization :      | Horizontal |
| Test Voltage : | DC 3.7V |                     |            |
| Test Mode :    | TX Mode |                     |            |

| Frequency<br>(MHz) | Meter Reading<br>(dBμV) | Factor<br>(dB) | Emission Level<br>(dBμV/m) | Limits<br>(dBμV/m) | Margin<br>(dB) | Detector Type |
|--------------------|-------------------------|----------------|----------------------------|--------------------|----------------|---------------|
| 67.9128            | 39.49                   | -17.71         | 21.78                      | 40.00              | -18.22         | QP            |
| 108.6470           | 40.57                   | -16.84         | 23.73                      | 43.50              | -19.77         | QP            |
| 216.7828           | 47.84                   | -15.91         | 31.93                      | 46.00              | -14.07         | QP            |
| 325.5958           | 49.85                   | -12.90         | 36.95                      | 46.00              | -9.05          | QP            |
| 433.9202           | 102.48                  | -10.33         | 84.35                      | 100.80             | -16.45         | peak          |
| 543.2742           | 49.16                   | -7.85          | 41.31                      | 46.00              | -4.69          | QP            |
| 651.9417           | 45.02                   | -6.75          | 38.27                      | 46.00              | -7.73          | QP            |
| 867.8408           | 58.64                   | -2.13          | 56.51                      | 80.80              | -24.29         | peak          |

## Remark:

Factor = Antenna Factor + Correct Factor.  
Correct Factor= Cable Loss – Pre-amplifier

|                |         |                     |          |
|----------------|---------|---------------------|----------|
| Temperature :  | 26 °C   | Relative Humidity : | 54%      |
| Pressure :     | 101 kPa | Polarization :      | Vertical |
| Test Voltage : | DC 3.7V |                     |          |
| Test Mode :    | TX Mode |                     |          |

| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 67.9128   | 31.20         | -17.71 | 13.49          | 40.00    | -26.51 | QP            |
| 97.7982   | 32.84         | -16.68 | 16.16          | 43.50    | -27.34 | QP            |
| 216.7828  | 41.65         | -15.91 | 25.74          | 46.00    | -20.26 | QP            |
| 325.5958  | 41.33         | -12.90 | 28.43          | 46.00    | -17.57 | QP            |
| 433.9206  | 100.78        | -10.33 | 82.54          | 100.80   | -18.26 | peak          |
| 543.2742  | 46.44         | -7.85  | 38.59          | 46.00    | -7.41  | QP            |
| 651.9417  | 37.06         | -6.75  | 30.31          | 46.00    | -15.69 | QP            |
| 867.8409  | 50.19         | -2.13  | 48.06          | 80.80    | -32.74 | peak          |

Remark:

Factor = Antenna Factor + Correct Factor.

Correct Factor= Cable Loss – Pre-amplifier

For average Emission

| Frequency<br>MHz | Peak<br>Level<br>dBuV/m | Duty<br>cycle<br>factor | AverageLevel<br>dBuV/m | Limit<br>AV | Margin | Polarization |
|------------------|-------------------------|-------------------------|------------------------|-------------|--------|--------------|
| 433.92           | 84.35                   | -6.56                   | 77.79                  | 80.8        | -3.01  | Horizontal   |
| 867.84           | 56.51                   | -6.56                   | 49.95                  | 60.8        | -10.85 | Horizontal   |

Notes: 1. Average emission Level = Peak Level + Duty cycle factor  
2. Duty cycle level please see clause 5.

| Frequency<br>MHz | Peak<br>Level<br>dBuV/m | Duty<br>cycle<br>factor | AverageLevel<br>dBuV/m | Limit<br>AV | Margin | Polarization |
|------------------|-------------------------|-------------------------|------------------------|-------------|--------|--------------|
| 433.92           | 82.54                   | -6.56                   | 75.98                  | 80.8        | -4.82  | Vertical     |
| 867.84           | 48.06                   | -6.56                   | 41.50                  | 60.8        | -19.30 | Vertical     |

Notes: 1. Average emission Level = Peak Level + Duty cycle factor  
2. Duty cycle level please see clause 5.

Radiated Spurious Emission ( 1GHz to 10<sup>th</sup> harmonics)

| Frequency<br>MHz | Peak<br>Level<br>dBuV/m | Duty<br>cycle<br>factor | Average<br>Level<br>dBuV/m | Limit |      | Margin dB |        | Polarization |
|------------------|-------------------------|-------------------------|----------------------------|-------|------|-----------|--------|--------------|
|                  |                         |                         |                            | PK    | AV   | PK        | AV     |              |
| 1301.71          | 51.61                   | -6.56                   | 45.05                      | 80.8  | 60.8 | -29.19    | -15.75 | Vertical     |
| 1735.24          | 52.06                   | -6.56                   | 45.50                      | 80.8  | 60.8 | -28.74    | -15.30 | Vertical     |
| 2603.57          | 50.45                   | -6.56                   | 43.89                      | 80.8  | 60.8 | -30.35    | -16.91 | Vertical     |
| 3037.43          | 50.87                   | -6.56                   | 44.31                      | 80.8  | 60.8 | -29.93    | -16.49 | Vertical     |
| 3471.34          | 50.01                   | -6.56                   | 43.45                      | 80.8  | 60.8 | -30.79    | -17.35 | Vertical     |
| 3905.28          | 47.77                   | -6.56                   | 41.21                      | 80.8  | 60.8 | -33.03    | -19.59 | Vertical     |
| 1301.71          | 47.33                   | -6.56                   | 40.77                      | 80.8  | 60.8 | -33.47    | -20.03 | Horizontal   |
| 1735.24          | 47.22                   | -6.56                   | 40.66                      | 80.8  | 60.8 | -33.58    | -20.14 | Horizontal   |
| 2603.57          | 49.87                   | -6.56                   | 43.31                      | 80.8  | 60.8 | -30.93    | -17.49 | Horizontal   |
| 3037.43          | 49.11                   | -6.56                   | 42.55                      | 80.8  | 60.8 | -31.69    | -18.25 | Horizontal   |
| 3471.34          | 47.28                   | -6.56                   | 40.72                      | 80.8  | 60.8 | -33.52    | -20.08 | Horizontal   |
| 3905.28          | 48.36                   | -6.56                   | 41.80                      | 80.8  | 60.8 | -32.44    | -19.00 | Horizontal   |

Notes: 1.Average emission Level = Peak Level + Duty cycle factor

2.Duty cycle level please see clause 5.

3. Pulse Desensitization Correction Factor

Pulse Width (PW) = 42.00ms

$2/PW = 2/42.00\text{ms} = 0.047\text{ kHz}$

$RBW (100\text{ kHz}) > 2/PW (0.047\text{kHz})$

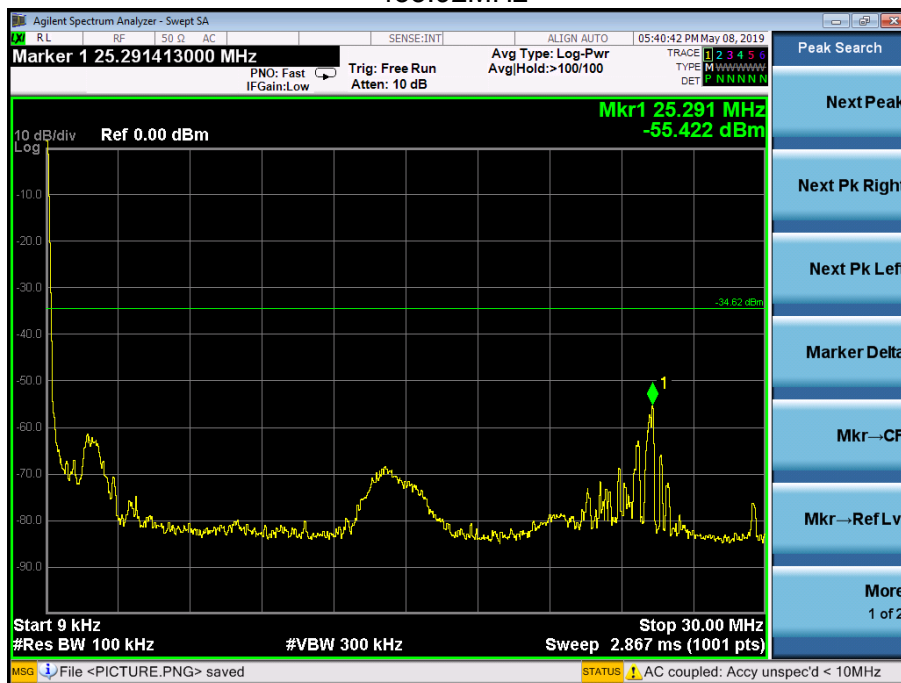
Therefore PDCF is not needed

4.Other harmonics emissions are lower than 20dB below the allowable limit.

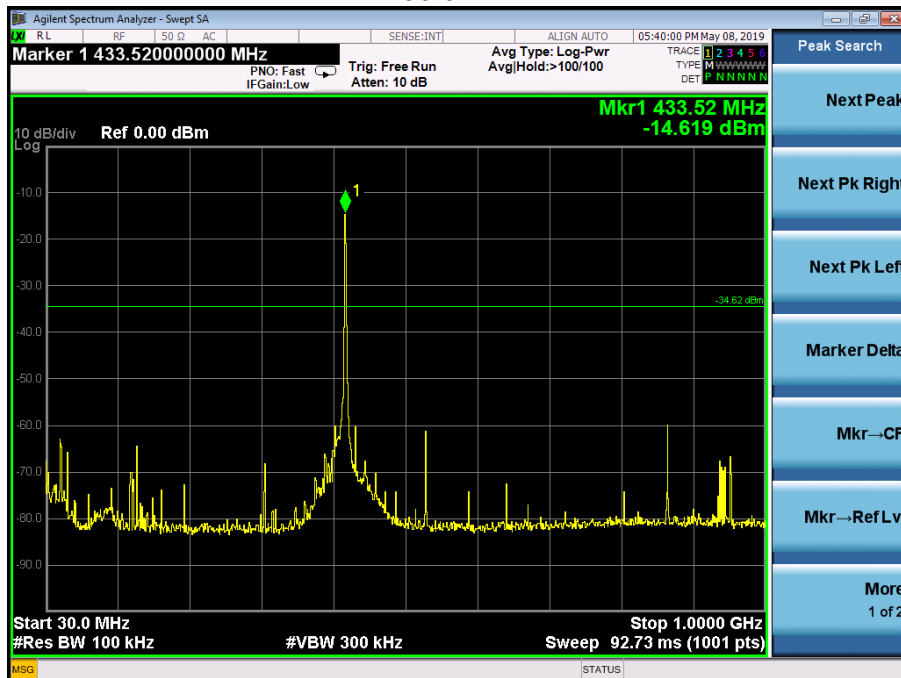


## CONDUCTED EMISSION MEASUREMENT

433.92MHz

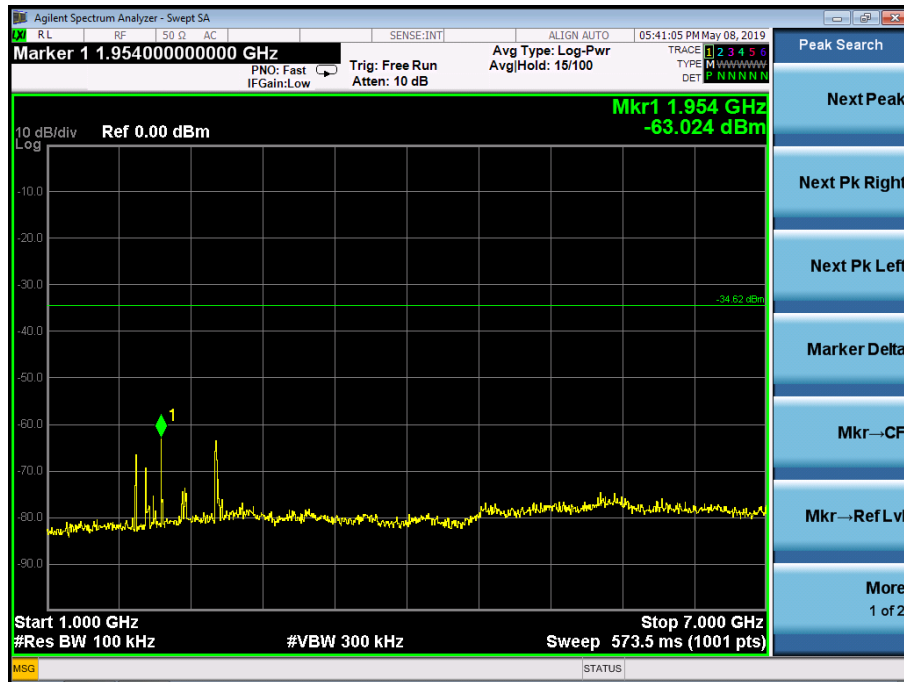


433.92MHz





433.92MHz





## 4. BANDWIDTH TEST

### 4.1 APPLIED PROCEDURES / LIMIT

According to FCC 15.231(c) requirement:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz to 900 MHz. Those devices operating above 900 MHz, the emission spurious shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

B.W (20dBc) Limit =  $0.25\% * f(\text{MHz}) = 0.25\% * 433.92\text{MHz} = 1.0848\text{MHz}$

| Spectrum Parameter | Setting                                       |
|--------------------|---|
| Attenuation        | Auto  |
| Span Frequency     | > Measurement Bandwidth or Channel Separation |
| RB                 | 30kHz   |
| VB                 | $\geq \text{RBW}$                             |
| Detector           | Peak  |
| Trace              | Max Hold                                      |
| Sweep Time         | Auto  |

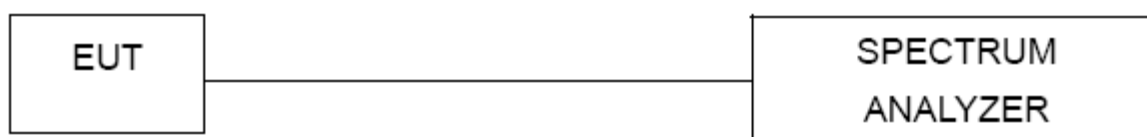
#### 4.1.1 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting : RBW= 30kHz, VBW $\geq$  RBW, Sweep time = Auto.

#### 4.1.2 DEVIATION FROM STANDARD

No deviation.

#### 4.1.3 TEST SETUP



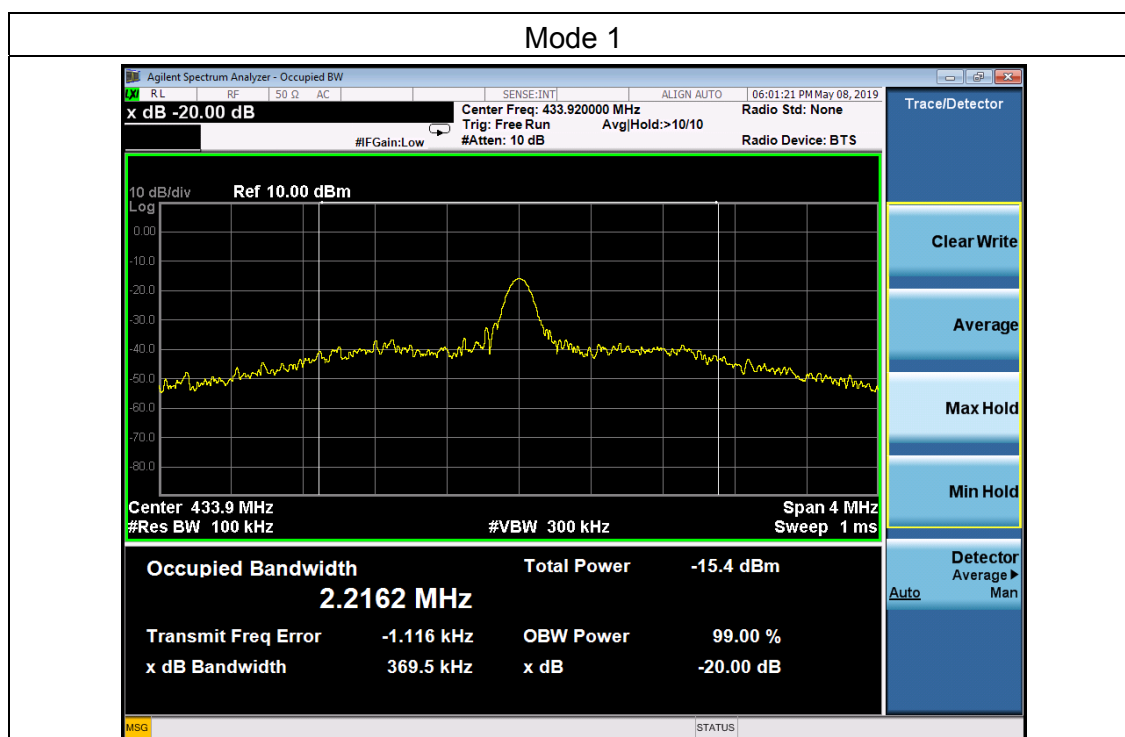
#### 4.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

#### 4.1.5 TEST RESULTS

|               |         |                     |         |
|---------------|---------|---------------------|---------|
| Temperature : | 26 °C   | Relative Humidity : | 54%     |
| Pressure :    | 101kPa  | Test Voltage :      | DC 3.7V |
| Test Mode :   | TX Mode |                     |         |

| Frequency | 20dB Bandwidth (kHz) | Limit (MHz) | Result |
|-----------|----------------------|-------------|--------|
| 433.9MHz  | 369.5                | 1.0848      | PASS   |



## 5. CALCULATION OF AVERAGE FACTOR

The output field strengths of specification in accordance with the FCC rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The duty cycle is measured in 100 ms or the repetition cycle period, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer to set zero span at 100kHz resolution bandwidth.

Averaging factor in dB =  $20\log(\text{duty cycle})$

The duration of one cycle = 42.00ms

The duty cycle is simply the on-time divided the duration of one cycle

Duty Cycle =  $(0.760\text{ms} \times 15 + 0.270\text{ms} \times 25 + 1.510\text{ms} \times 1) / 42.00$

=  $19.66\text{ms} / 42.00\text{ms}$

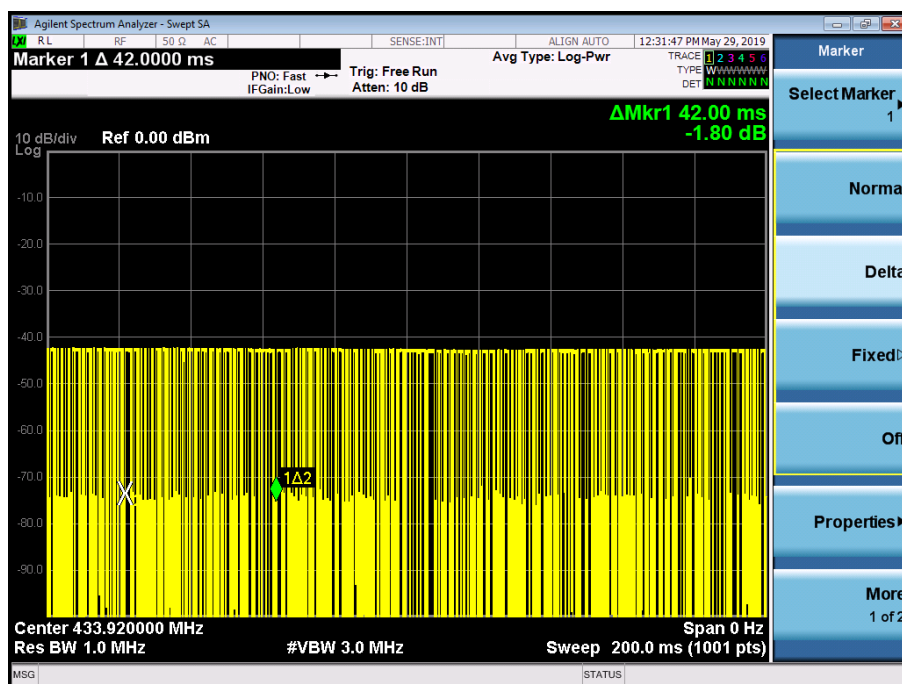
= 0.47

Therefore, the averaging factor is found by  $20\log 0.47 = -6.56\text{dB}$

Test plot as follows:

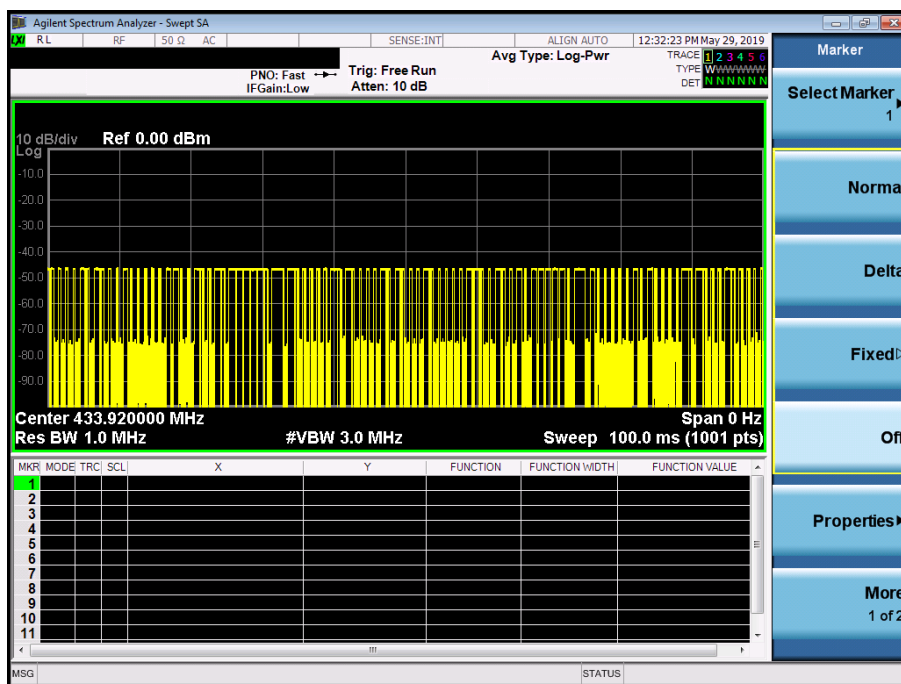
Note: During the 100ms, the amount of pulse and on-time of pulse are the same for every pulse train.

### Cycle

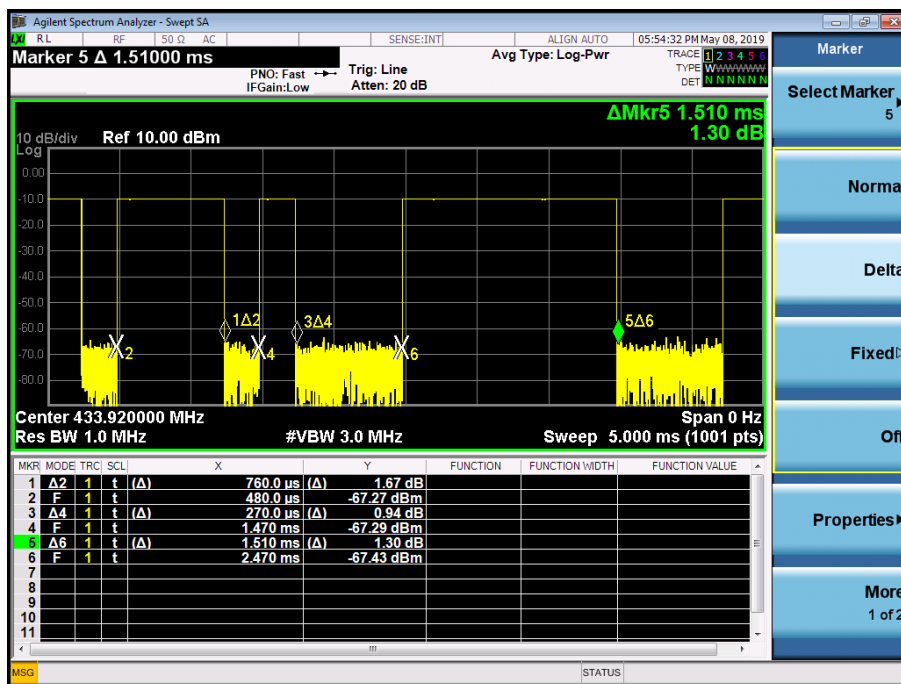




## Pulse



## On-time



## 6. DWELL TIME

### APPLICABLE STANDARD

According to FCC 15.231(a) requirement:

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

### TEST PROCEDURE

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- Repeat above procedures until all measured frequencies were complete.

### 6.1 DEVIATION FROM STANDARD

No deviation.

### 6.2 TEST SETUP



### 6.3 EUT OPERATION CONDITIONS

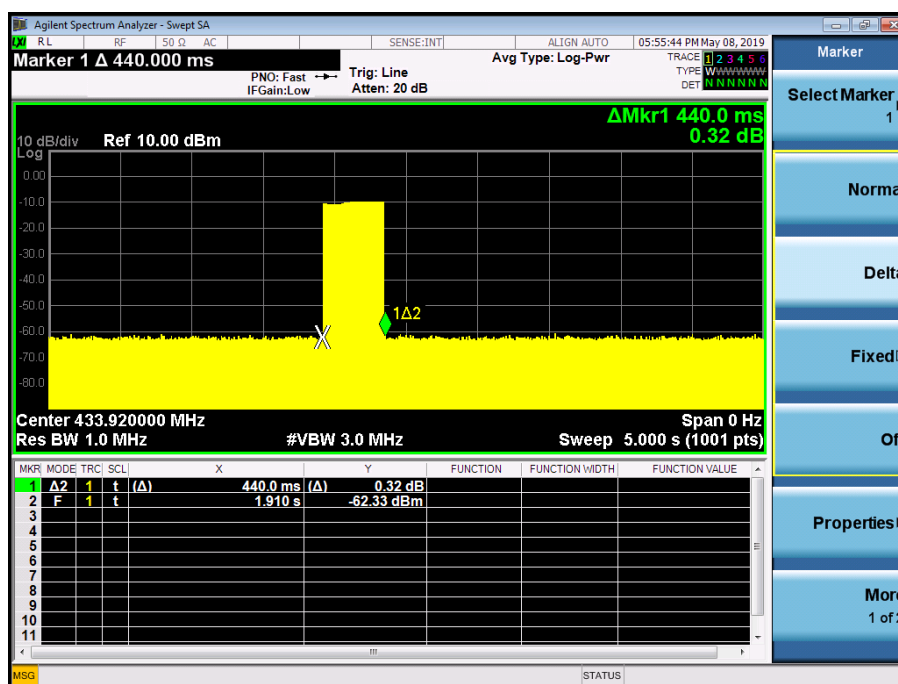
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



## 6.4 TEST RESULTS

| Dwell time (second) | Limit (second) | Result |
|---------------------|----------------|--------|
| 440.0ms             | <5s            | Pass   |

Test plot as follows:





## 7. ANTENNA REQUIREMENT

### 7.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### 7.2 EUT ANTENNA

The EUT antenna is the Spring Antenna. It comply with the standard requirement.



## 8. EUT TEST PHOTO

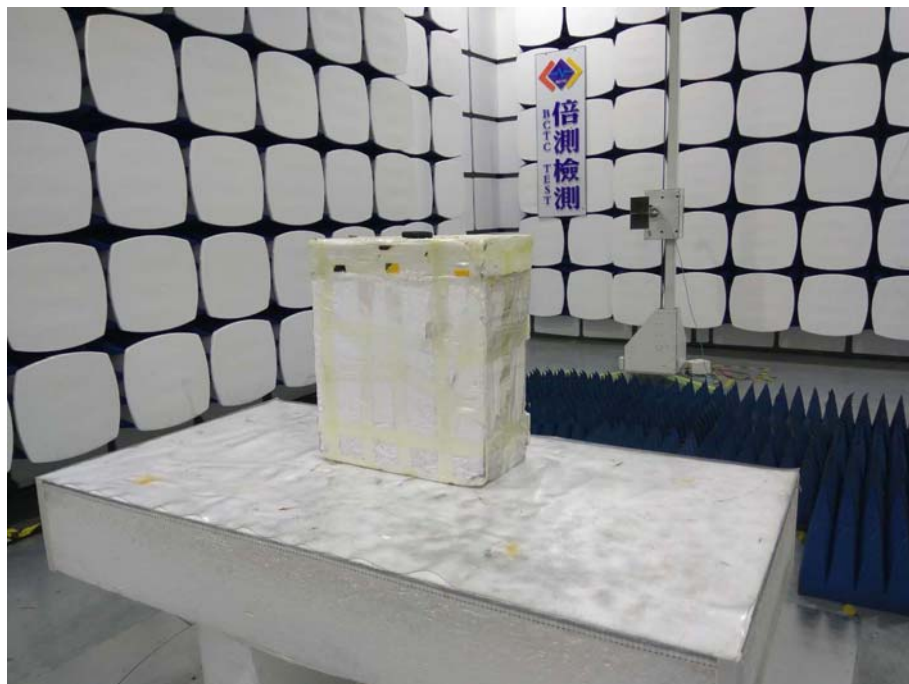
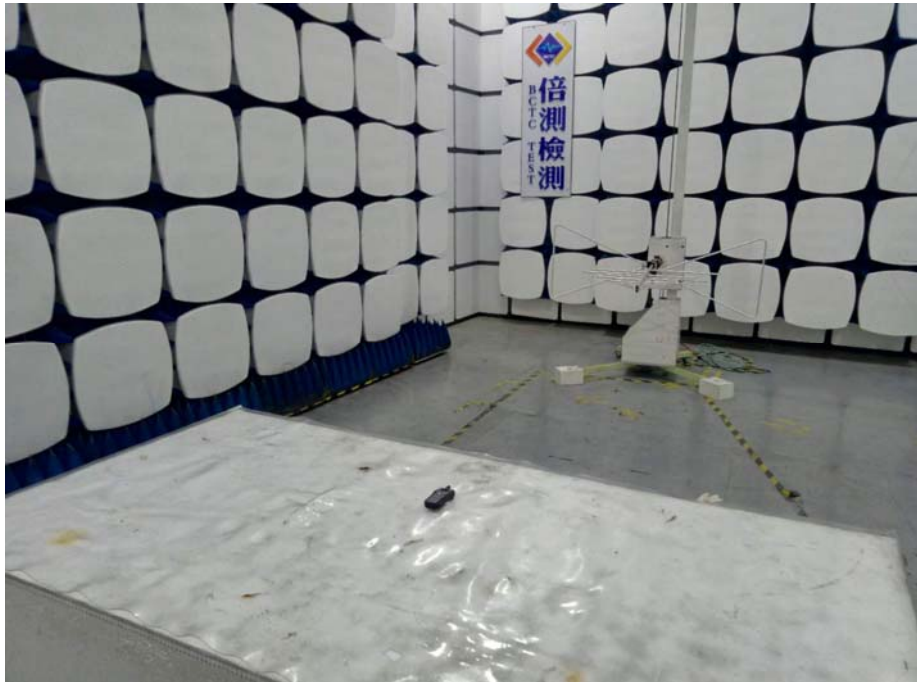
### Conducted Measurement Photos







### Radiated Measurement Photos





## 9. EUT PHOTO





\*\*\*\*\* END OF REPORT \*\*\*\*\*