



## **FCC 47 CFR PART 15 SUBPART C 15.247**

### **TEST REPORT**

### **FOR**

**Waterproof Wireless Earphones**

**Model : BTH202**

**Trade Name : Topmore**

**Issued to**

**Topmore Technology Inc.**

**No.1-1, Taiyuan 2nd St., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)**

**Issued by**

**WH Technology Corp.**



|  |                                 |   |
|--|---------------------------------|---|
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## 1. General Information

**Applicant** : Topmore Technology Inc.  
**Address** : No.1-1, Taiyuan 2nd St., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)  
**Manufacturer** : Dongguan goldfinger electronic technology limited company  
**Address** : 3F, No.6, Qingping Rd., Qingping Town, Qinghutoucun, Tangxia Town, Dongguan, Guangdong, China  
**EUT** : Waterproof Wireless Earphones  
**Model Name** : BTH202  
**Model Differences** : N/A

Is here with confirmed to comply with the requirements set out in the FCC Rules and Regulations Part 15 Subpart C and the measurement procedures were according to ANSI C63.10:2013. The said equipment in the configuration described in this report shows the maximum emission levels emanating from equipment are within the compliance requirements.

## FCC part 15 subpart C

Receipt Date : 11/08/2017

Final Test Date : 12/25/2017

**Tested By:****Reviewed by:**

Dec. 26, 2017

**Date**

Bell Wei/ Engineer

Dec. 26, 2017

**Date**Mike Lee / Manager  
Designation Number: TW2954



## 2. Report of Measurements and Examinations

### 2.1 List of Measurements and Examinations

| FCC Rule                             | Description of Test                        | Result |
|--------------------------------------|--|--------|
| 15.203                               | . Antenna Requirement                      | Pass   |
| 15.207                               | . Conducted Emission                       | Pass   |
| 15.209<br>15.247(d)                  | . Radiated Emission                        | Pass   |
| 15.247(a)(2)                         | . 6dB Bandwidth                            | Pass   |
| 15.247(b)                            | . Maximum Peak Output Power                | Pass   |
| 15.247(d)                            | . 100kHz Bandwidth of Frequency Band Edges | Pass   |
| 15.247(e)                            | . Power Spectral Density                   | Pass   |
| 1.1307<br>1.1310<br>2.1091<br>2.1093 | . RF Exposure Compliance                   | Pass   |



### **3. Test Configuration of Equipment under Test**

#### **3.1 Description of the tested samples**

EUT Name : Waterproof Wireless Earphones

Model Number : BTH202

FCCID : 2ANH6-BTH202

Receipt Date : 11/08/2017

Input Voltage :: 5Vdc

Power From : ☐Inside ☐Outside  
☐Adaptor ☐Battery ☐AC Power Source ☒DC Power Source  
☐Support Unit PC or NB

Operate Frequency : Refer to the channel list as described below (2.402 ~2.480 GHz)

Modulation Technique : GFSK

Number of Channels : 40

Channel spacing : ☐N/A ☒ 2 MHz

Operating Mode : ☐Simplex ☒ Half Duplex

Antenna Type : SMD Antenna

Channel bandwidth : 2 MHz

Antenna gain : 3.4 dBi



### 3.2 Carrier Frequency of Channels

BLE

| Channel | Frequency(MHz) | Channel | Frequency(MHz) |
|---------|----------------|---------|----------------|
| 00      | 2402           | 20      | 2442           |
| 01      | 2404           | 21      | 2444           |
| 02      | 2406           | 22      | 2446           |
| 03      | 2408           | 23      | 2448           |
| 04      | 2410           | 24      | 2450           |
| 05      | 2412           | 25      | 2452           |
| 06      | 2414           | 26      | 2454           |
| 07      | 2416           | 27      | 2456           |
| 08      | 2418           | 28      | 2458           |
| 09      | 2420           | 29      | 2460           |
| 10      | 2422           | 30      | 2462           |
| 11      | 2424           | 31      | 2464           |
| 12      | 2426           | 32      | 2466           |
| 13      | 2428           | 33      | 2468           |
| 14      | 2430           | 34      | 2470           |
| 15      | 2432           | 35      | 2472           |
| 16      | 2434           | 36      | 2474           |
| 17      | 2436           | 37      | 2476           |
| 18      | 2438           | 38      | 2478           |
| 19      | 2440           | 39      | 2480           |



### **3.3 Test Mode and Test Software**

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.4.
- b. The complete test system included Notebook and EUT for RF test.
- c. Test Software: N/A
- d. New Battery was used for all testing and the worst radiated emission case from X,Y and Z axis evaluation was selected for testing.
- e. The following test modes were performed for test:
  - BLE: CH00: 2402MHz, CH19: 2440MHz, CH39: 2480MHz





### **3.4 TEST Methodology & General Test Procedures**

All testing as described bellowed were performed in accordance with ANSI C63.4:2014 and FCC CFR 47 Part 15 Subpart C.

#### **Conducted Emissions**

The EUT is placed on a wood table, which is at 0.8 m above ground plane acceding to clause 15.207 and requirements of ANSI C63.4:2014. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz are using CISPR Quasi-Peak / Average detectors.

#### **Radiated Emissions**

The EUT is a placed on a turn table, which is 0.8 m above ground plane. The turntable was rotated through 360 degrees to determine the position of maximum emission level. The EUT is placed at 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

- 1) Putting the EUT on the platform and turning on the EUT (on/off button on the bottom of the EUT).
- 2) Setting test channel described as "Channel setting and operating condition", and testing channel by channel.
- 3) For the maximum output power measurement, we followed the method of measurement KDB558074 D01.
- 4) For the spurious emission test based on ANSI(2014), at the frequency where below 1GHz used quasi-peak detector mode; where above 1GHz used the peak and average detector mode. IF the peak value may be under average limit, the average mode will not be performed.



### 3.5 Measurement Uncertainty

| Measurement Item             | Uncertainty         |
|------------------------------|---------------------|
| Radiated emission            | $\pm 4.11\text{dB}$ |
| Peak Output Power(conducted) | $\pm 1.38\text{dB}$ |
| Peak Output Power(Radiated)  | $\pm 1.70\text{dB}$ |
| Power Spectral Density       | $\pm 1.39\text{dB}$ |
| Radiated emission(3m)        | $\pm 4.11\text{dB}$ |
| Radiated emission(10m)       | $\pm 3.89\text{dB}$ |



## 3.6 Description of the Support Equipments

### Setup Diagram

See test photographs attached in appendix 1 for the actual connections between EUT and support equipment.

### Support Equipment

Peripherals Devices:

| OUTSIDE SUPPORT EQUIPMENT |           |           |  |                    |               |                        |                    |
|---------------------------|-----------|-----------|--|--------------------|---------------|------------------------|--------------------|
| No.                       | Equipment | Model     | Serial No.                             | FCC ID/<br>BSMI ID | Trade<br>name | Data Cable             | Power Cord         |
| 1.                        | PC        | D19M      | CYY7Y A00<br>DC4                       | R33002             | DELL          | N/A                    | Unshielded<br>1.8m |
| 2.                        | Monitor   | UZ2315Hf  | CN-0NJ1C5-72<br>872-473-AF2S<br>REVA02 | R43002             | DELL          | Shielded<br>1.8m       | Unshielded<br>1.8m |
| 3.                        | Printer   | C9079A    | TH6BG16249                             | R33001             | HP            | Shielded<br>1.8m / USB | Unshielded<br>1.8m |
| 4.                        | USB 3.0   | TC100-001 | NA                                     | D43606             | TCELL         | Shielded<br>1m / USB   | N/A                |
| 5.                        | Mouse     | MS111-L   | CN-09RRC7-48<br>729-43M-070D           | T41126             | DELL          | Shielded<br>1.8m / USB | N/A                |
| 6.                        | Keyboard  | D13M      | 2P4BR12                                | R41108             | DELL          | Shielded<br>1.8m / USB | N/A                |
| 7.                        | PC        | D320MT    | NA                                     | R31018             | ASUS          | N/A                    | Unshielded<br>1.8m |
| INSIDE SUPPORT EQUIPMENT  |           |           |  |                    |               |                        |                    |
| No.                       | Equipment | Model     | Serial No.                             | FCC ID/<br>BSMI ID | Trade<br>name | Data Cable             | Power Cord         |
| 1.                        | N/A       | N/A       | N/A                                    | N/A                | N/A           | N/A                    | N/A                |

**Note:** All the above equipment /cable were placed in worse case position to maximize emission signals during emission test

**Grounding:** Grounding was in accordance with the manufacturer's requirement and conditions for the intended use.



## **4. Test and measurement equipment**

### **4.1 calibration**

The measuring equipment utilized to perform the tests documented in the report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### **4.2 equipment**

The following list contains measurement equipment used for testing. The equipment conforms to the requirement of CISPR 16-1, ANSI C63.2 and. Other required standards.

Calibration of all test and measurement, including any accessories that may effect such calibration, is checked frequently to ensure the accuracy. Adjustments are made and correction factors are applied in accordance with the instructions contained in the respective.

**TABLELIST OF TEST AND MEASUREMENT EQUIPMENT**

| Test Site  | Instrument                               | Manufacturer                      | Model No.          | S/N                  | Next Cal. Date |
|------------|--|-----------------------------------|--------------------|----------------------|----------------|
| Conduction | Spectrum (9K--3GHz)                      | R&S                               | FSP3               | 833387/010           | 2018/12/07     |
|            | EMI Receiver                             | R&S                               | ESHS10             | 830223/008           | 2018/06/06     |
|            | LISN                                     | Rolf Heine<br>Hochfrequenztechnik | NNB-2/16z          | 98062                | 2018/06/11     |
|            | ISN                                      | Schwarzbeck                       | 8-Wire ISN CAT5    | CAT5-8158-0094       | 2018/10/19     |
|            | RF Cable                                 | N/A                               | N/A                | EMI-3                | 2018/10/17     |
| Radiation  | Bilog antenna(30M-1G)                    | ETC                               | MCTD2786B          | BLB16M04004/JB-5-004 | 2018/05/18     |
|            | Double Ridged Guide Horn antenna(1G-18G) | ETC                               | MCTD 1209          | DRH15N02009          | 2018/11/28     |
|            | Horn antenna (18G-26G)                   | com-power                         | AH-826             | 81000                | 2018/08/16     |
|            | LOOP Antenna (Below 30M)                 | com-power                         | AL-130             | 17117                | 2018/11/12     |
|            | Pre amplifier (30M-1G)                   | EMC INSTRUMENT                    | EMC9135            | 980334               | 2018/05/03     |
|            | Microwave Preamplifier (1G-18G)          | EMC INSTRUMENT                    | EMC051845          | 980108&AT-18001      | 2018/11/27     |
|            | Pre amplifier (18G~26G)                  | MITEQ                             | JS4-18002600-30-5A | 808329               | 2018/08/09     |
|            | EMI Test                                 | R&S                               | ESVS30             | 826006/002           | 2018/11/07     |



|          |                                    |                       |                                       |                |            |
|----------|------------------------------------|-----------------------|---------------------------------------|----------------|------------|
|          | Receiver                           |                       | (20M-1000MHz)                         |                |            |
|          | RF Cable<br>(open site)            | EMCI                  | N male on end of<br>both sides (EMI4) | 30m            | 2018/11/09 |
|          | RF CABLE<br>(1~26G)                | HARBOUT<br>INDUSTRIES | LL142MI(4M+4M)                        | NA             | 2017/04/17 |
|          | RF CABLE<br>(1~26G)                | HARBOUR<br>INDUSTRIES | LL142MI(7M)                           | NA             | 2018/08/09 |
|          | Spectrum<br>(9K--7GHz)             | R&S                   | FSP7                                  | 830180/006     | 2018/04/14 |
|          | Spectrum<br>(9K--40GHz)            | AGILENT               | 8564EC                                | 4046A0032      | 2018/03/01 |
| Software | e3                                 | AUDIX                 | N/A                                   | N/A            | N/A        |
| SG       | SINGAL<br>GENERATOR<br>(100k-1GHz) | HP                    | 8648A                                 | 3619U0042<br>6 | N/A        |

**\*CALIBRATION INTERVAL OF INSTRUMENTS LISTED ABOVE IS ONE YEAR**



## **5. Antenna Requirements**

### **5.1 Standard Applicable**

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### **5.2 Antenna Construction and Directional Gain**

**BLE:**

Antenna Type: SMD Antenna

Antenna Gain: 3.4 dBi



## 6. Test of Conducted Emission

### 6.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz on the 120 VAC power and return leads of the EUT according to the methods defined in ANSI C63.4-2014 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane as shown in section 2.2. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

| Frequency (MHz) | Quasi Peak (dB $\mu$ V) | Average (dB $\mu$ V) |
|-----------------|-------------------------|----------------------|
| 0.15 – 0.5      | 66-56*                  | 56-46*               |
| 0.5 – 5.0       | 56                      | 46                   |
| 5.0 – 30.0      | 60                      | 50                   |

\*Decreases with the logarithm of the frequency.

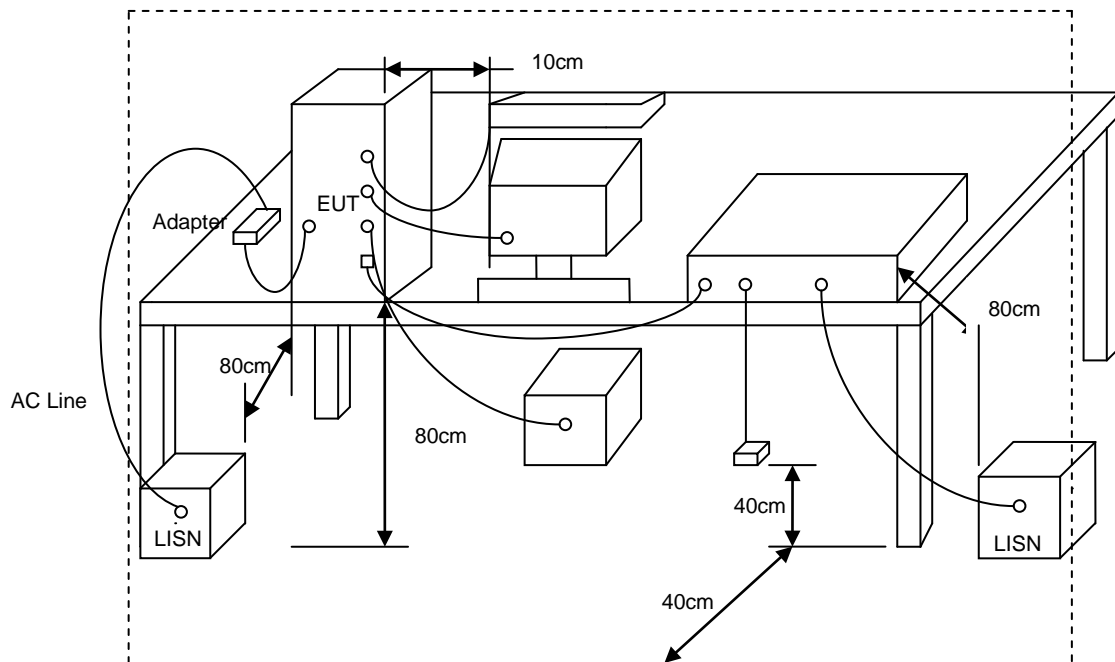
### 6.2 Test Procedures

- The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connecting to the other LISN.
- The LISN provides 50 ohm coupling impedance for the measuring instrument.
- The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.





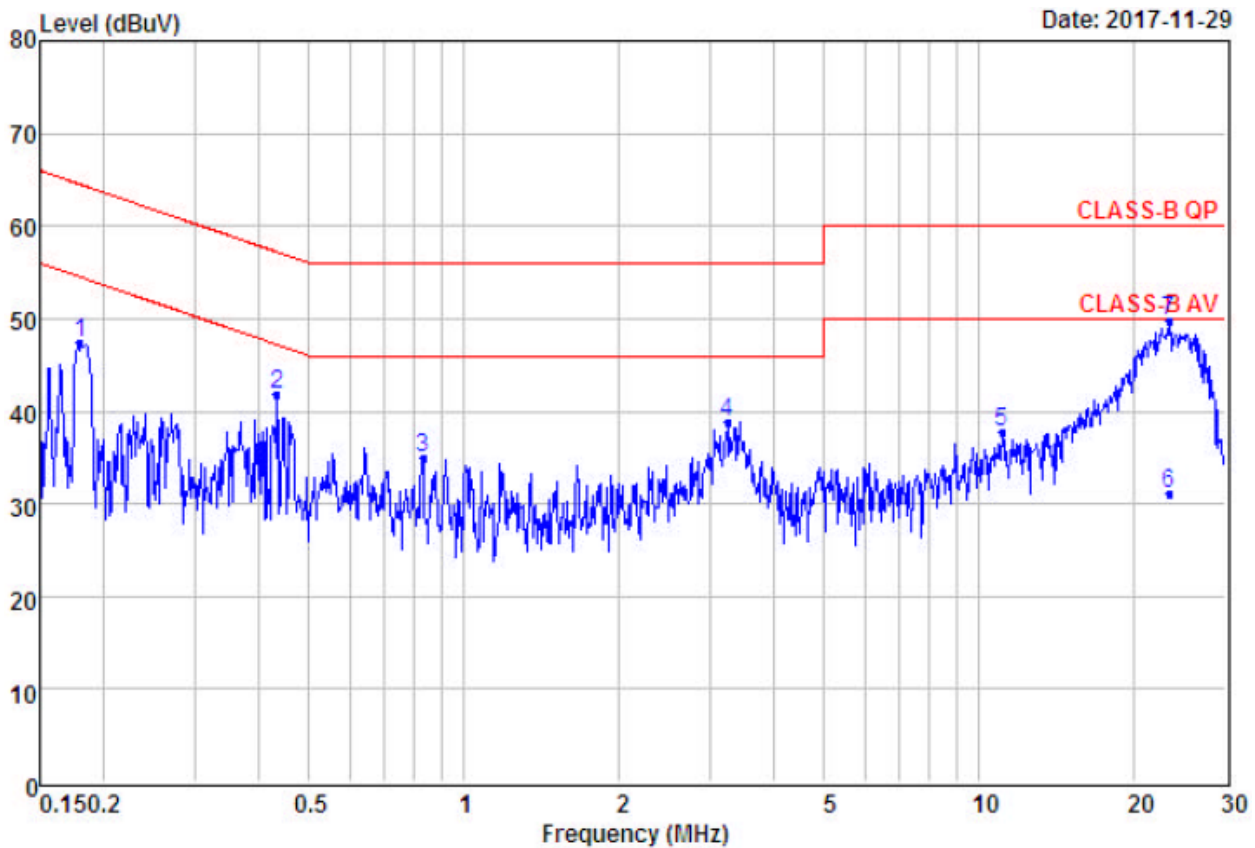
### 6.3 Typical Test Setup





## 6.4 Test Result and Data

|             |          |             |           |
|-------------|----------|-------------|-----------|
| Power       | : DC 5V  | Pol/Phase   | : LINE    |
| Test Mode 1 | : TX CH0 | Temperature | : 25.6 °C |
| Memo        | :        | Humidity    | : 58 %    |

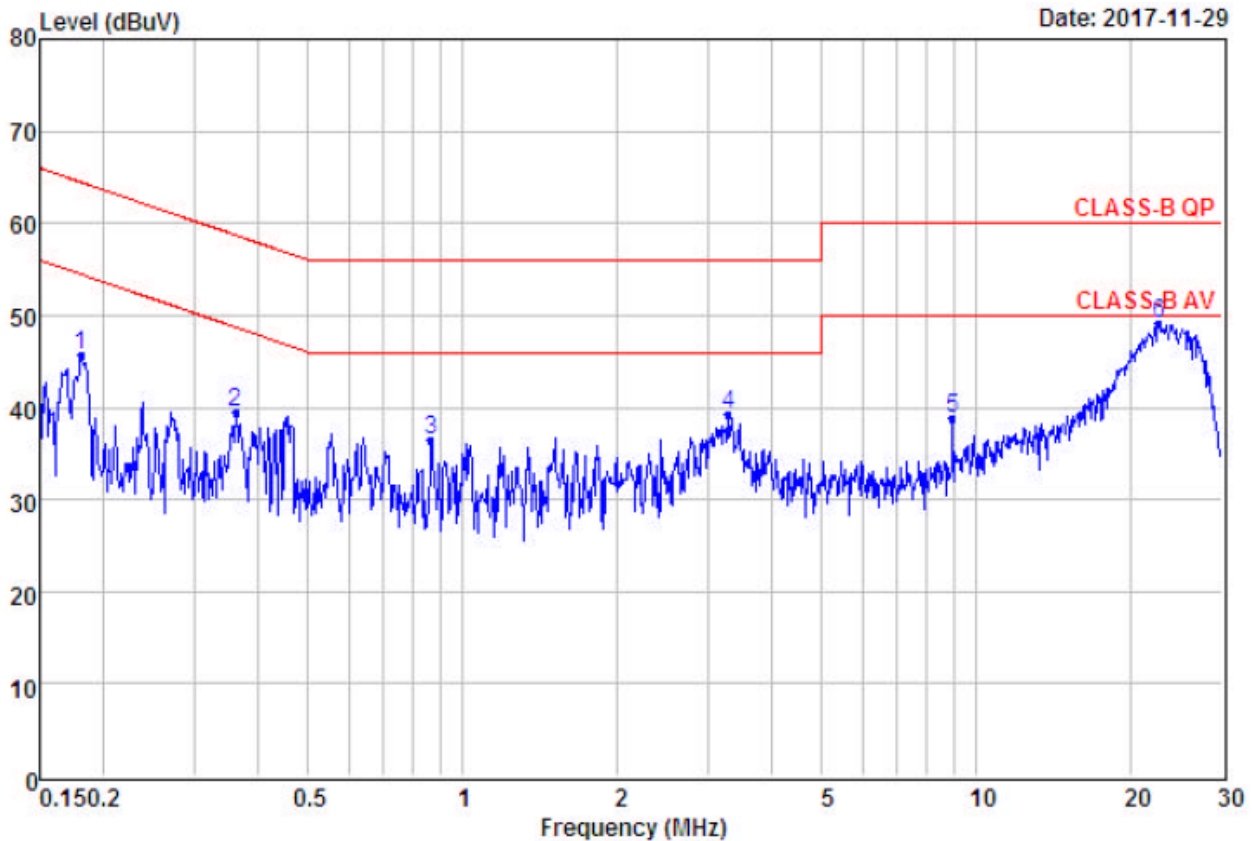


Remarks: : Factor=Insertion loss+Cable loss

|   | Freq  | Read Level | Level | Factor | Over Limit | Limit Line | Remark  |
|---|-------|------------|-------|--------|------------|------------|---------|
|   | MHz   | dBuV       | dBuV  | dB     | dB         | dBuV       |         |
| 1 | 0.18  | 37.27      | 47.36 | 10.09  | -17.14     | 64.50      | Peak    |
| 2 | 0.43  | 31.62      | 41.72 | 10.10  | -15.48     | 57.20      | Peak    |
| 3 | 0.83  | 24.75      | 34.87 | 10.12  | -21.13     | 56.00      | Peak    |
| 4 | 3.24  | 28.69      | 38.86 | 10.17  | -17.14     | 56.00      | Peak    |
| 5 | 11.08 | 27.49      | 37.78 | 10.29  | -22.22     | 60.00      | Peak    |
| 6 | 23.39 | 20.60      | 31.08 | 10.48  | -18.92     | 50.00      | Average |
| 7 | 23.39 | 39.25      | 49.73 | 10.48  | -10.27     | 60.00      | Peak    |



|             |          |             |           |
|-------------|----------|-------------|-----------|
| Power       | : DC 5V  | Pol/Phase   | : NEUTRAL |
| Test Mode 1 | : TX CH0 | Temperature | : 25.6 °C |
| Memo        | :        | Humidity    | : 58 %    |



Remarks: : Factor=Insertion loss+Cable loss

|     | Freq  | Read Level | Level | Factor | Over Limit | Limit | Remark |
|-----|-------|------------|-------|--------|------------|-------|--------|
|     | MHz   | dBuV       | dBuV  | dB     | dB         | dBuV  |        |
| 1   | 0.18  | 35.43      | 45.60 | 10.17  | -18.86     | 64.46 | Peak   |
| 2   | 0.36  | 29.36      | 39.55 | 10.19  | -19.14     | 58.69 | Peak   |
| 3   | 0.87  | 26.32      | 36.53 | 10.21  | -19.47     | 56.00 | Peak   |
| 4   | 3.29  | 28.93      | 39.23 | 10.30  | -16.77     | 56.00 | Peak   |
| 5   | 8.96  | 28.50      | 38.91 | 10.41  | -21.09     | 60.00 | Peak   |
| 6 @ | 22.66 | 38.51      | 49.01 | 10.50  | -10.99     | 60.00 | Peak   |



## 7. Test of Radiated Emission

### 7.1 Test Limit

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter measurement is based on the maximum conducted output power, the attenuation required under this paragraph shall be 30dB instead of 20dB. In addition, radiated emissions which fall in section 15.205(a) the restricted bands must also comply with the radiated emission limit specified in section 15.209(a).

| Frequency (MHz) | Field Strength (microvolt/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                             |

### 7.2 Test Procedures

- The EUT was placed on a rotatable table top 0.8 meter above ground.
- The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- The table was rotated 360 degrees to determine the position of the highest radiation.
- The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in



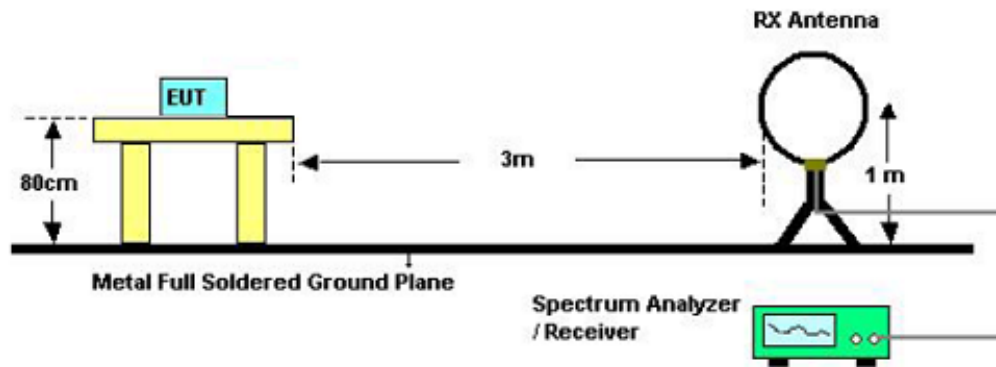
average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

- i. "Cone of radiation" has been considered to be 3dB bandwidth of the measurement antenna.

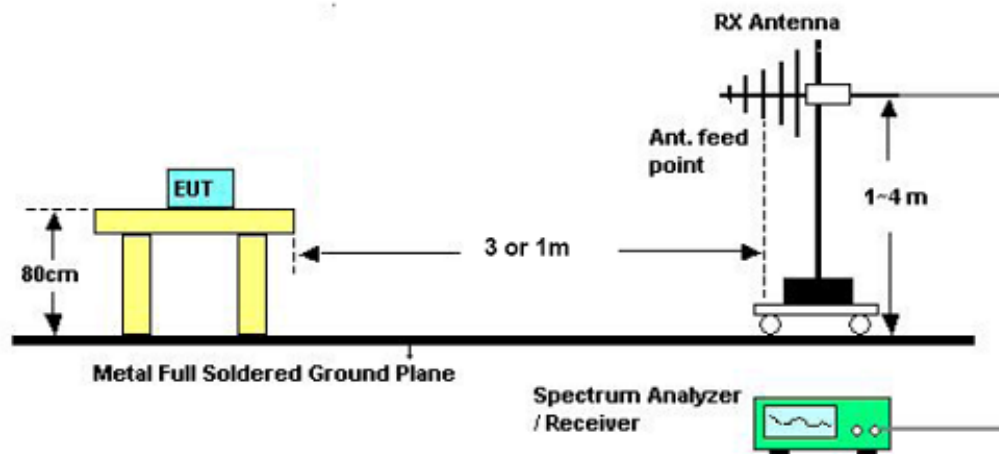


### 7.3 Typical Test Setup

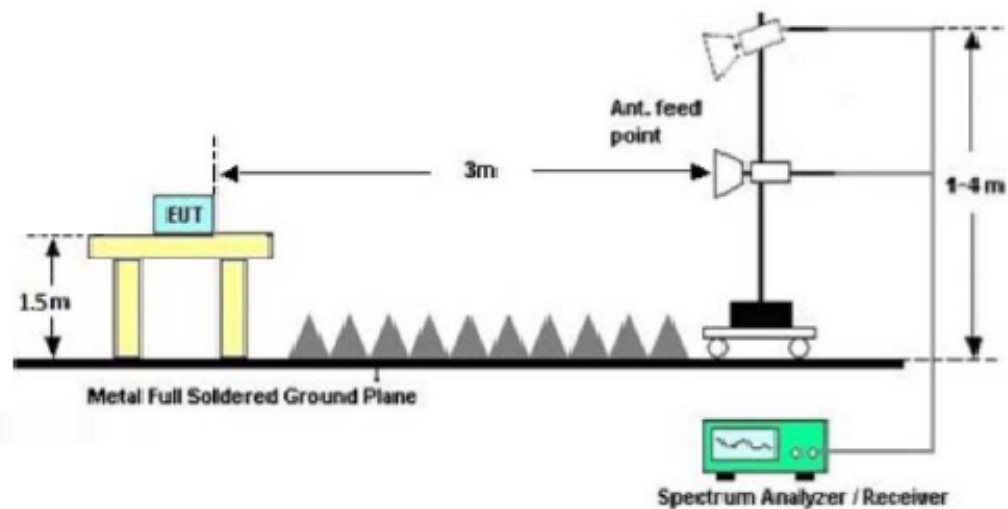
For radiated emissions below 30MHz



For radiated emissions above 30MHz



For radiated emissions above 1GHz



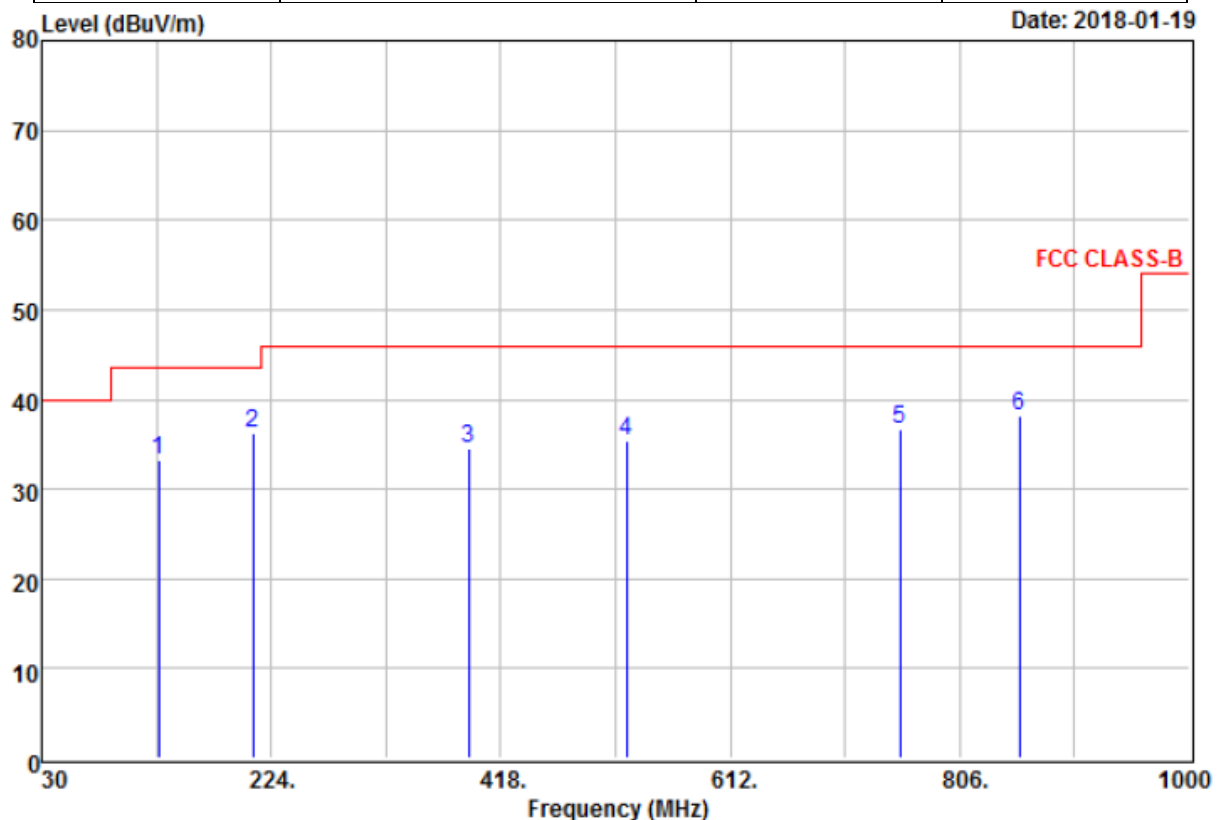


#### 7.4 Test Result and Data (9kHz ~ 30MHz)

The 9kHz - 30MHz spurious emission is under limit 20dB more.

#### 7.5 Test Result and Data (30MHz ~ 1GHz, worst emissions found)

|             |          |             |              |
|-------------|----------|-------------|--------------|
| Power       | : DC 5V  | Pol/Phase   | : HORIZONTAL |
| Test Mode 1 | : TX CH0 | Temperature | : 21 °C      |
| Memo        | :        | Humidity    | : 68 %       |

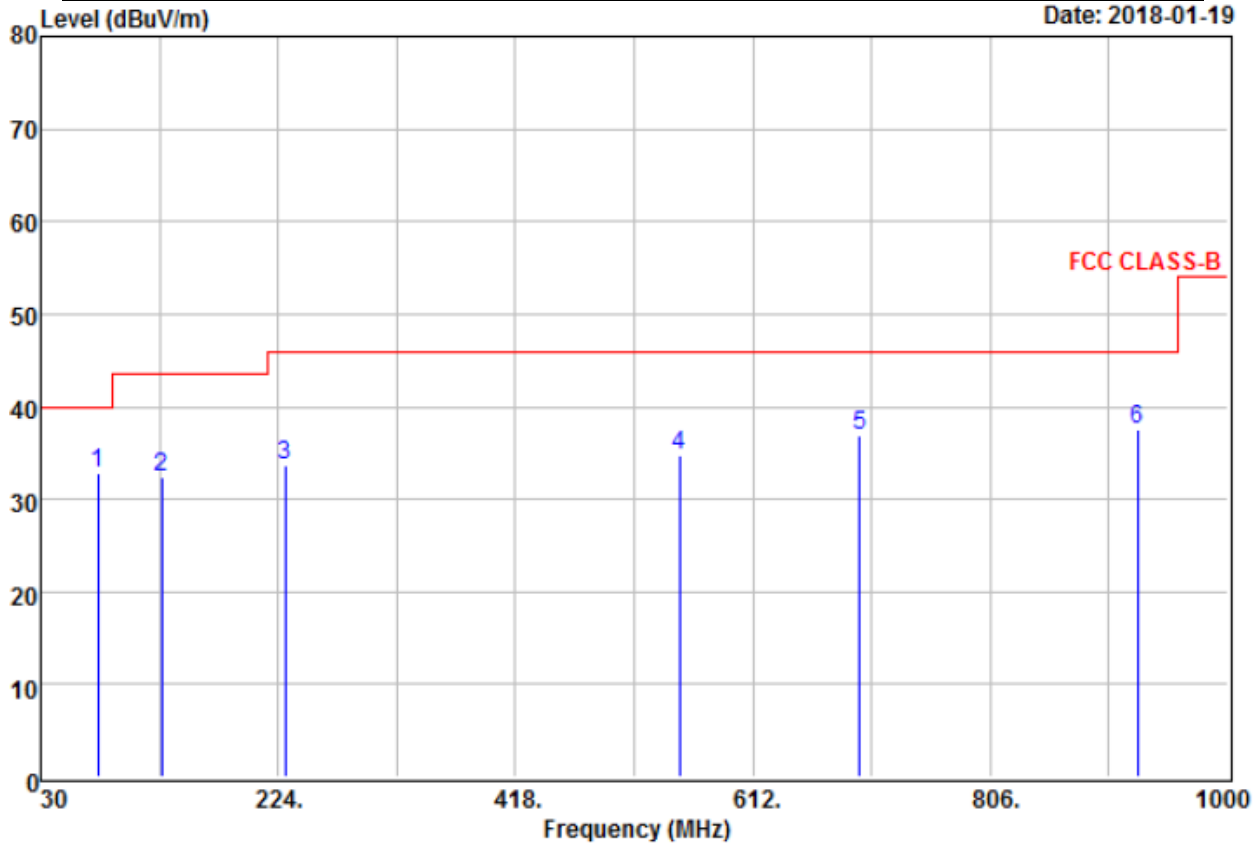


Remarks: : 1.Result=Read Value+Factor  
: 2.Factor=Antenna Factor+Cable loss-  
: Amplifier Factor

|     | Freq    | Read Level | Factor | Level  | Limit Line | Over Limit | Remark |
|-----|---------|------------|--------|--------|------------|------------|--------|
|     | MHz     | dBuV       | dB/m   | dBuV/m | dBuV/m     | dB         |        |
| 1   | 128.750 | 48.25      | -14.99 | 33.26  | 43.50      | -10.24     | QP     |
| 2 @ | 208.510 | 54.60      | -18.46 | 36.14  | 43.50      | -7.36      | QP     |
| 3   | 390.550 | 45.83      | -11.27 | 34.56  | 46.00      | -11.44     | QP     |
| 4   | 524.680 | 44.70      | -9.25  | 35.45  | 46.00      | -10.55     | QP     |
| 5   | 755.560 | 42.97      | -6.24  | 36.73  | 46.00      | -9.27      | QP     |
| 6   | 856.420 | 42.36      | -4.15  | 38.21  | 46.00      | -7.79      | QP     |



|             |          |             |            |
|-------------|----------|-------------|------------|
| Power       | : DC 5V  | Pol/Phase   | : VERTICAL |
| Test Mode 1 | : TX CH0 | Temperature | : 21 °C    |
| Memo        | :        | Humidity    | : 68 %     |



Remarks: : 1.Result=Read Value+Factor  
: 2.Factor=Antenna Factor+Cable loss-  
: Amplifier Factor

|     | Freq    | Read Level | Factor | Level  | Limit Line | Over Limit | Remark |
|-----|---------|------------|--------|--------|------------|------------|--------|
|     | MHz     | dBuV       | dB/m   | dBuV/m | dBuV/m     | dB         |        |
| 1 @ | 76.660  | 55.48      | -22.76 | 32.72  | 40.00      | -7.28      | QP     |
| 2   | 128.940 | 47.44      | -14.99 | 32.45  | 43.50      | -11.05     | QP     |
| 3   | 229.790 | 50.83      | -17.15 | 33.68  | 46.00      | -12.32     | QP     |
| 4   | 551.790 | 43.59      | -8.95  | 34.64  | 46.00      | -11.36     | QP     |
| 5   | 699.480 | 43.97      | -7.18  | 36.79  | 46.00      | -9.21      | QP     |
| 6   | 926.270 | 40.42      | -2.84  | 37.58  | 46.00      | -8.42      | QP     |





## 7.6 Test Result and Data (Above 1GHz)

|             |   |       |           |   |            |
|-------------|---|-------|-----------|---|------------|
| Power       | : | DC 5V | Test Date | : | 2018/01/19 |
| Temperature | : | 21 °C | Humidity  | : | 68 %       |

| Channel 0       |             |                      |                       |                 |        | Fundamental Frequency: 2402 MHz |     |             |
|-----------------|-------------|----------------------|-----------------------|-----------------|--------|---------------------------------|-----|-------------|
| Frequency (MHz) | Ant-Pol H/V | Meter Reading (dBuV) | Corrected Factor (dB) | Result (dBuV/m) | Remark | Limit (dBuV/m)                  |     | Margin (dB) |
|                 |             |                      |                       |                 |        | Peak                            | Ave |             |
| 4804.00         | H           | 59.29                | -6.42                 | 52.87           | Peak   | 74                              | 54  | -21.13      |
| ---             | H           | ---                  | ---                   | ---             | Ave    | 74                              | 54  | ---         |
| 4804.00         | V           | 56.74                | -6.42                 | 50.32           | Peak   | 74                              | 54  | -23.68      |
| ---             | V           | ---                  | ---                   | ---             | Ave    | 74                              | 54  | ---         |
| Channel 19      |             |                      |                       |                 |        | Fundamental Frequency: 2440 MHz |     |             |
| Frequency (MHz) | Ant-Pol H/V | Meter Reading (dBuV) | Corrected Factor (dB) | Result (dBuV/m) | Remark | Limit (dBuV/m)                  |     | Margin (dB) |
|                 |             |                      |                       |                 |        | Peak                            | Ave |             |
| 4880.00         | H           | 58.96                | -6.20                 | 52.76           | Peak   | 74                              | 54  | -21.24      |
| ---             | H           | ---                  | ---                   | ---             | Ave    | 74                              | 54  | ---         |
| 4880.00         | V           | 55.49                | -6.20                 | 49.29           | Peak   | 74                              | 54  | -24.71      |
| ---             | V           | ---                  | ---                   | ---             | Ave    | 74                              | 54  | ---         |
| Channel 39      |             |                      |                       |                 |        | Fundamental Frequency: 2480 MHz |     |             |
| Frequency (MHz) | Ant-Pol H/V | Meter Reading (dBuV) | Corrected Factor (dB) | Result (dBuV/m) | Remark | Limit (dBuV/m)                  |     | Margin (dB) |
|                 |             |                      |                       |                 |        | Peak                            | Ave |             |
| 4960.00         | H           | 57.65                | -5.96                 | 51.69           | Peak   | 74                              | 54  | -22.31      |
| ---             | H           | ---                  | ---                   | ---             | Ave    | 74                              | 54  | ---         |
| 4960.00         | V           | 54.49                | -5.96                 | 48.53           | Peak   | 74                              | 54  | -25.47      |
| ---             | V           | ---                  | ---                   | ---             | Ave    | 74                              | 54  | ---         |

### Note:

1. Emission level = Reading level + Correction factor
2. Correction factor : Antenna factor, Cable loss, Pre-Amp, etc.
3. Measurements above 1000 MHz, Peak detector setting:  
1 MHz RBW with 1 MHz VBW.
4. Measurements above 1000 MHz, Average detector setting:  
1 MHz RBW with 10Hz VBW.
5. Peak detector measurement data will represent the worst case results.
6. Where limits are specified for both average and peak detector functions, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
7. The other emission levels were 20dB below the limit.



## **8. 6dB Bandwidth Measurement Data**

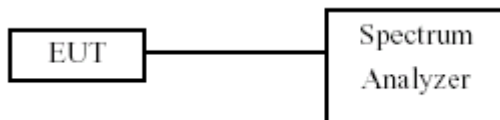
### **8.1 Test Limit**

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

### **8.2 Test Procedures**

- a. The transmitter output was connected to the spectrum analyzer.
- b. Set RBW of spectrum analyzer to 1~5% of the emission bandwidth and  $VBW \geq 3x RBW$ .
- c. The 6 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.
- d. The 6dB Bandwidth was measured and recorded.

### **8.3 Test Setup Layout**





## 8.4 Test Result and Data

Test Date: 2017.12.25

Temperature: 22°C

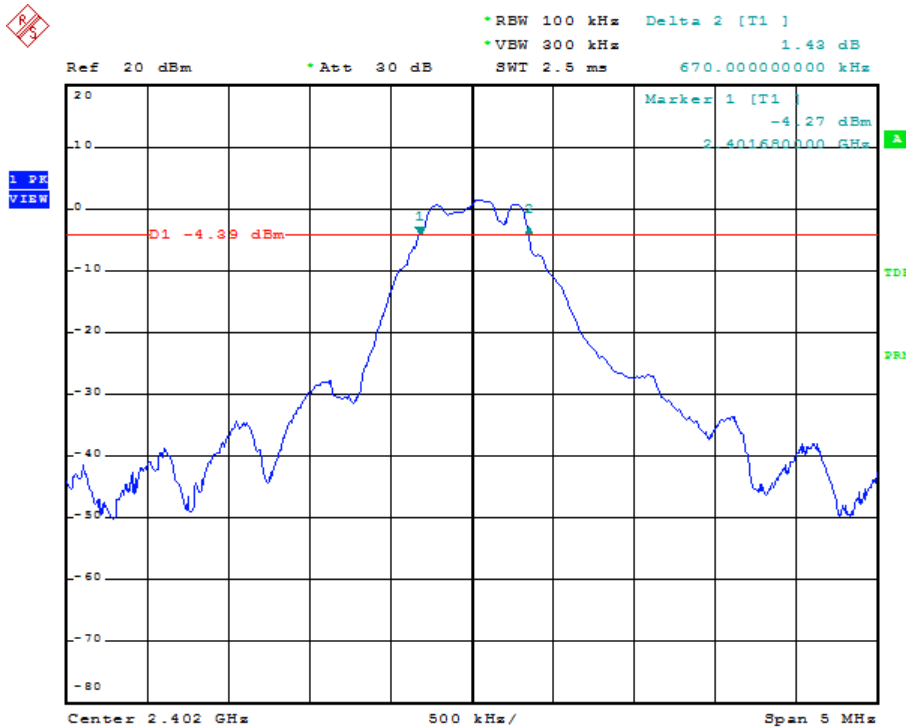
Atmospheric pressure: 1006 pha

Humidity: 61%

| Modulation Standard | Channel | Frequency (MHz) | 6dB Bandwidth (MHz) |
|---------------------|---------|-----------------|---------------------|
| GFSK (1Mbps)        | 0       | 2402            | 0.67                |
|                     | 19      | 2440            | 0.66                |
|                     | 39      | 2480            | 0.67                |

Modulation Standard: GFSK (1Mbps)

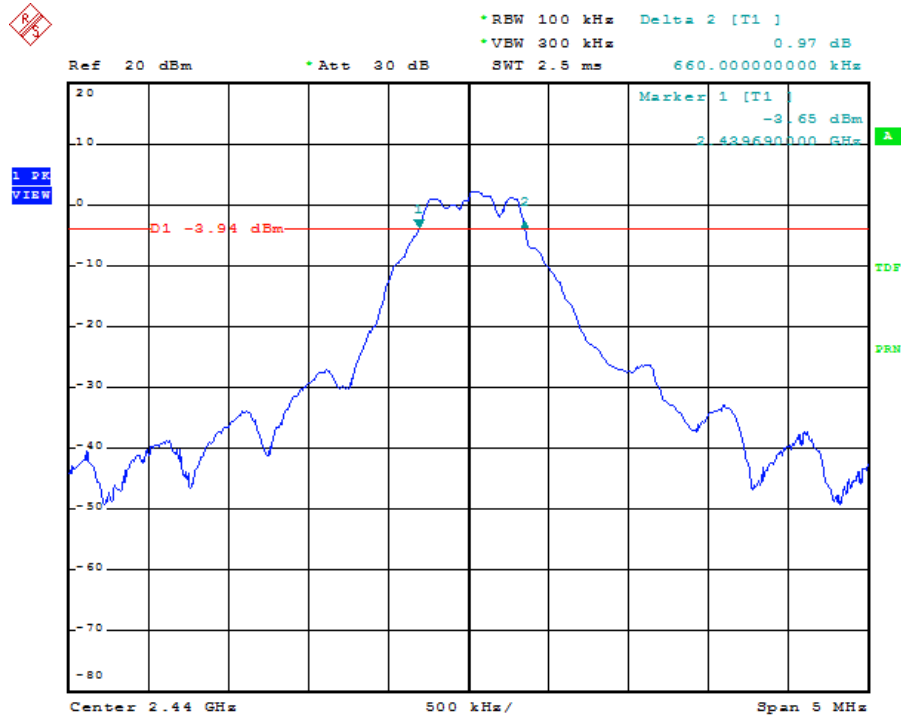
Channel: 0





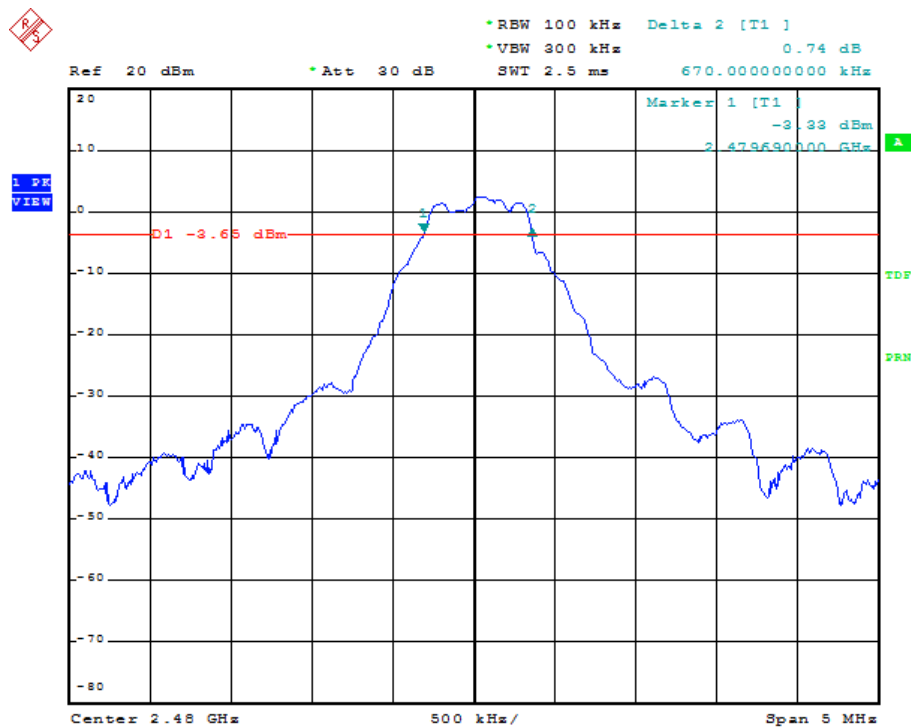
Modulation Standard: GFSK (1Mbps)

Channel: 19



Modulation Standard: GFSK (1Mbps)

Channel: 39





## **9. Maximum Peak and Average Output Power**

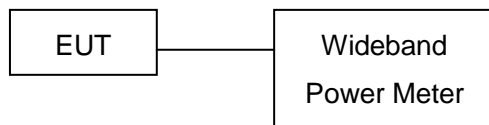
### **9.1 Test Limit**

The Maximum Peak Output Power Measurement is 30dBm.

### **9.2 Test Procedures**

- a. Peak power is measured using the wideband power meter.
- b. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.
- c. The Peak and Average Output Power was measured and recorded.

### **9.3 Test Setup Layout**





## 9.4 Test Result and Data

Test Date: 2017.12.25

Temperature: 22°C

Atmospheric pressure: 1006 pha

Humidity: 61%

| Modulation Standard | Channel | Frequency (MHz) | Peak Power Output (dBm) | Peak Power Output (mW) |
|---------------------|---------|-----------------|-------------------------|------------------------|
| GFSK (1Mbps)        | 0       | 2402            | 6.26                    | 4.23                   |
|                     | 19      | 2440            | 6.03                    | 4.01                   |
|                     | 39      | 2480            | 6.18                    | 4.15                   |

| Modulation Standard | Channel | Frequency (MHz) | Average Power Output (dBm) | Average Power Output (mW) |
|---------------------|---------|-----------------|----------------------------|---------------------------|
| GFSK (1Mbps)        | 0       | 2402            | 2.85                       | 1.93                      |
|                     | 19      | 2440            | 2.32                       | 1.71                      |
|                     | 39      | 2480            | 2.69                       | 1.86                      |



## **10. Power Spectral Density**

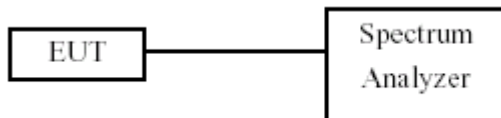
### **10.1 Test Limit**

The Maximum of Power Spectral Density Measurement is 8dBm

### **10.2 Test Procedures**

- a. The transmitter output was connected to spectrum analyzer.
- b. The spectrum analyzer's resolution bandwidth were set at 3KHz RBW and 30KHz VBW as that of the fundamental frequency. Set the sweep time=auto couple.
- c. The power spectral density was measured and recorded.

### **10.3 Test Setup Layout**





## 10.4 Test Result and Data

Test Date: 2017.12.25

Temperature: 22°C

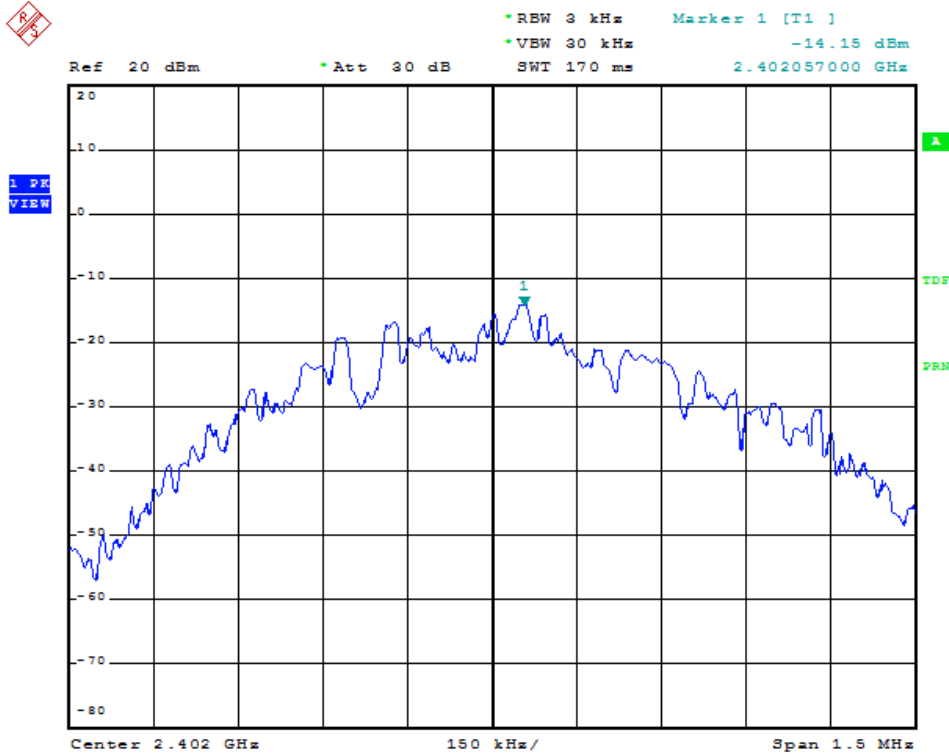
Atmospheric pressure: 1006 pha

Humidity: 61%

| Modulation Standard | Channel | Frequency (MHz) | Measured Power Density (dBm) |
|---------------------|---------|-----------------|------------------------------|
| GFSK (1Mbps)        | 0       | 2402            | -14.15                       |
|                     | 19      | 2440            | -13.48                       |
|                     | 39      | 2480            | -12.44                       |

Modulation Standard: GFSK (1Mbps)

Channel: 0

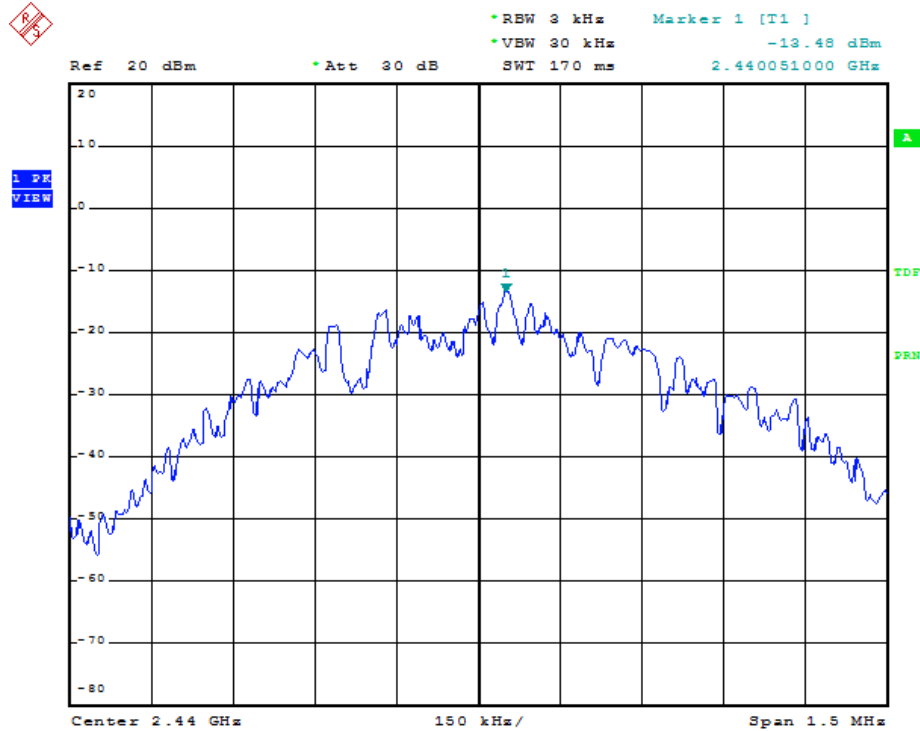






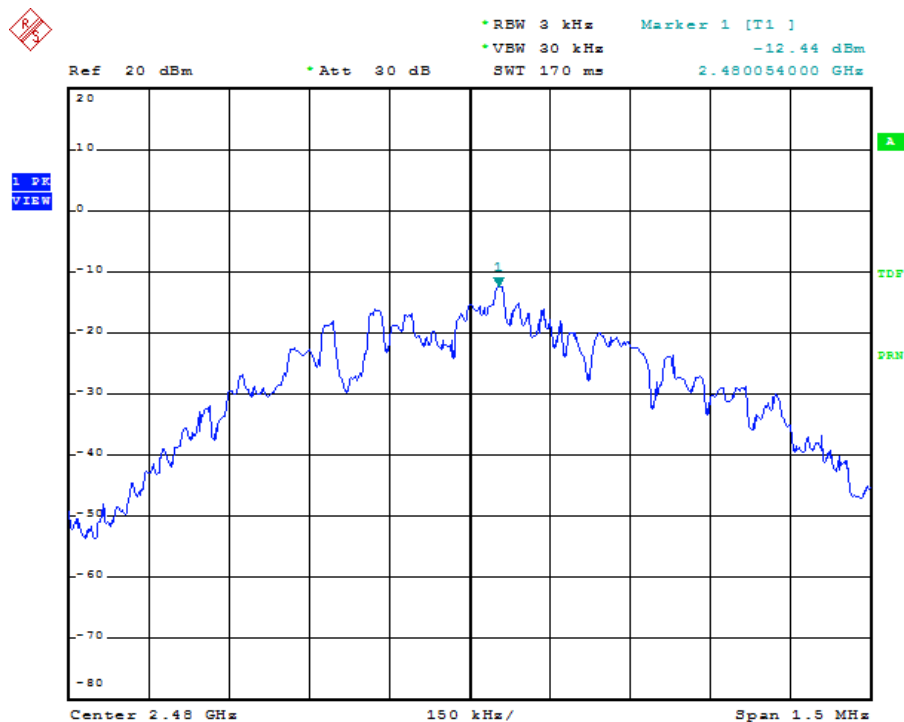
Modulation Standard: GFSK (1Mbps)

Channel: 19



Modulation Standard: GFSK (1Mbps)

Channel: 39





## **11. Band Edges Measurement**

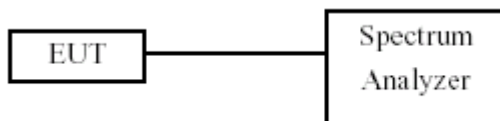
### **11.1 Test Limit**

Below -20dB of the highest emission level of operating band (In 100 kHz Resolution Bandwidth)

### **11.2 Test Procedure**

- a. The transmitter output was connected to the spectrum analyzer via a low lose cable.
- b. Set RBW of spectrum analyzer to 100 KHz and VBW of spectrum analyzer to 300 KHz with convenient frequency span including 100 KHz bandwidth from band edge.
- c. Peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20dB relative to the maximum measured in-band peak PSD level.
- d. The band edges was measured and recorded.

### **11.3 Test Setup Layout**





## 11.4 Test Result and Data

Test Date: 2017.12.25

Temperature: 22°C

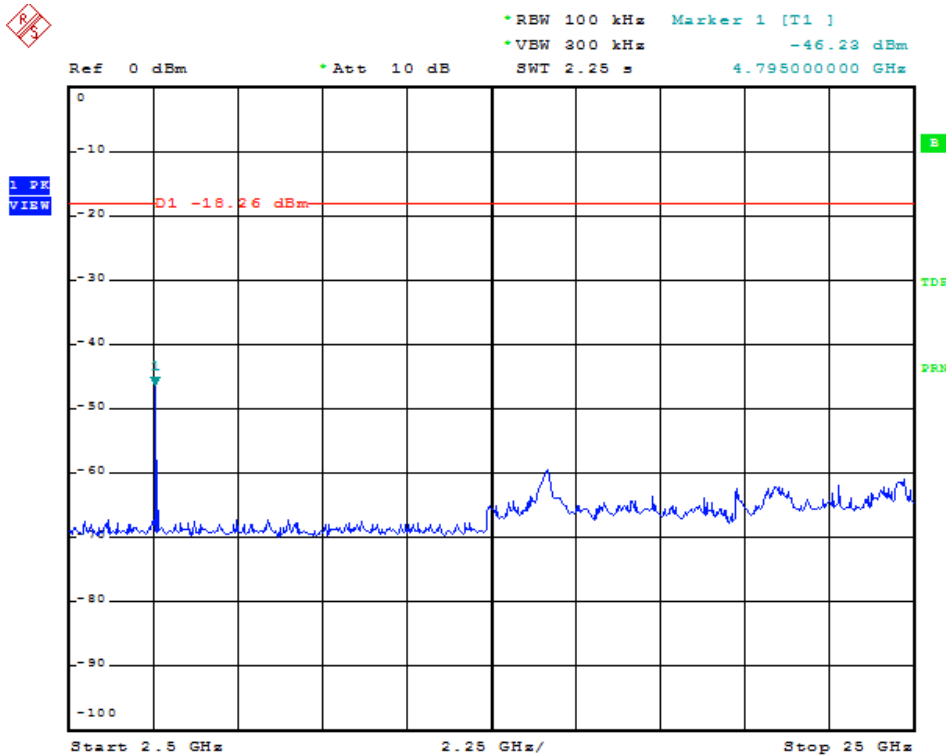
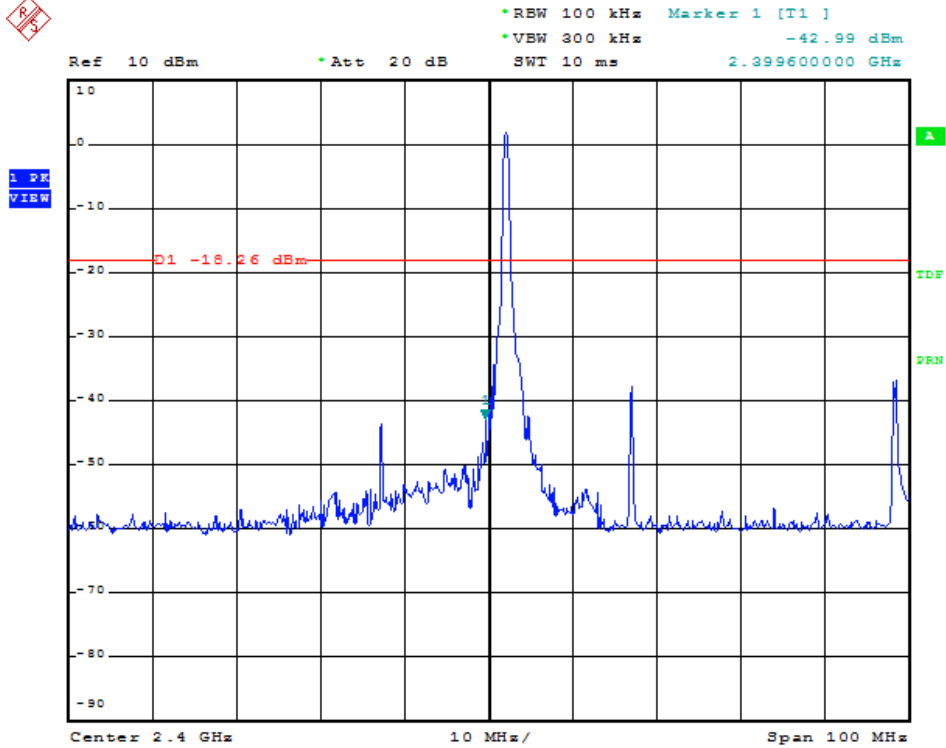
Atmospheric pressure: 1006 pha

Humidity: 61%

| Modulation Standard | Channel | Frequency (MHz) | maximum value in frequency (MHz) | maximum value (dBm) |
|---------------------|---------|-----------------|----------------------------------|---------------------|
| GFSK (1Mbps)        | 0       | 2402            | 2399.60                          | -42.99              |
|                     | 39      | 2480            | 2545.00                          | -40.81              |

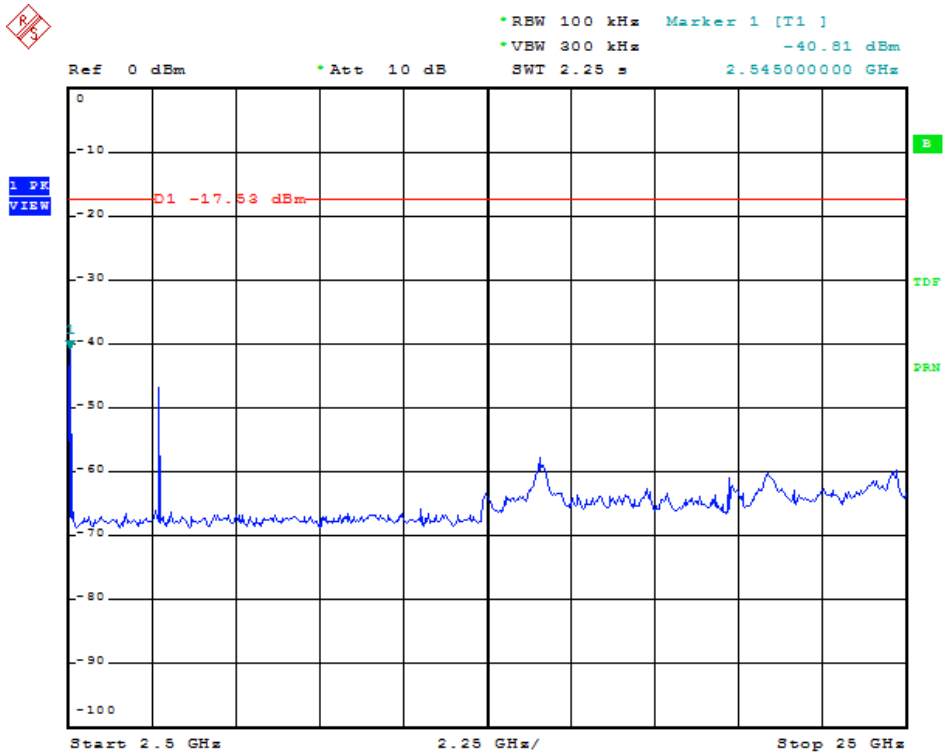
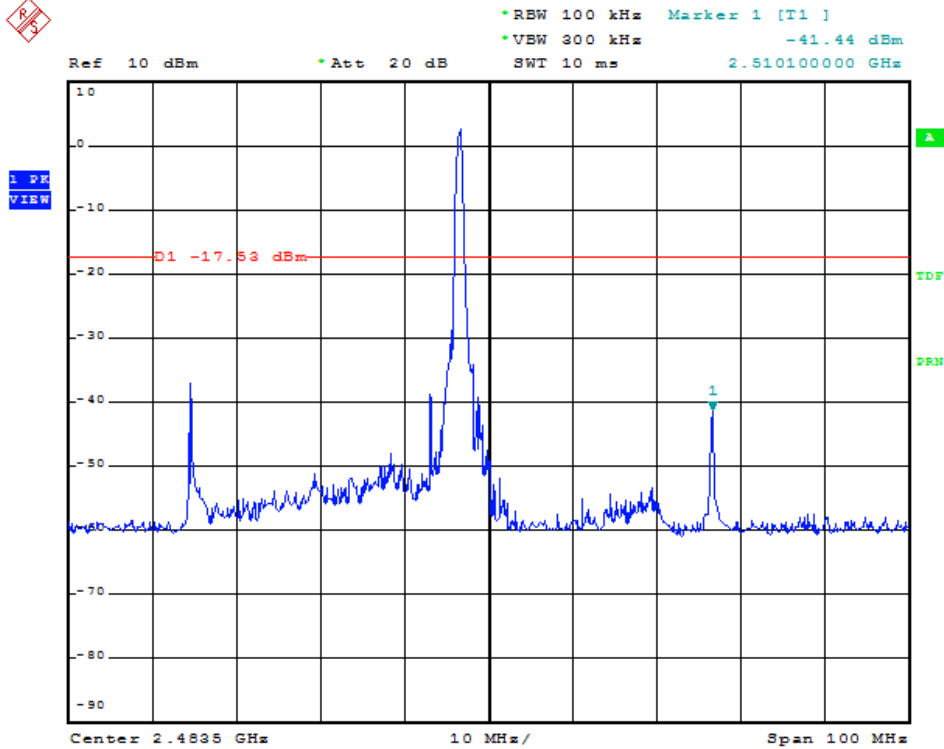


Modulation Standard: GFSK (1Mbps)  
Channel: 0





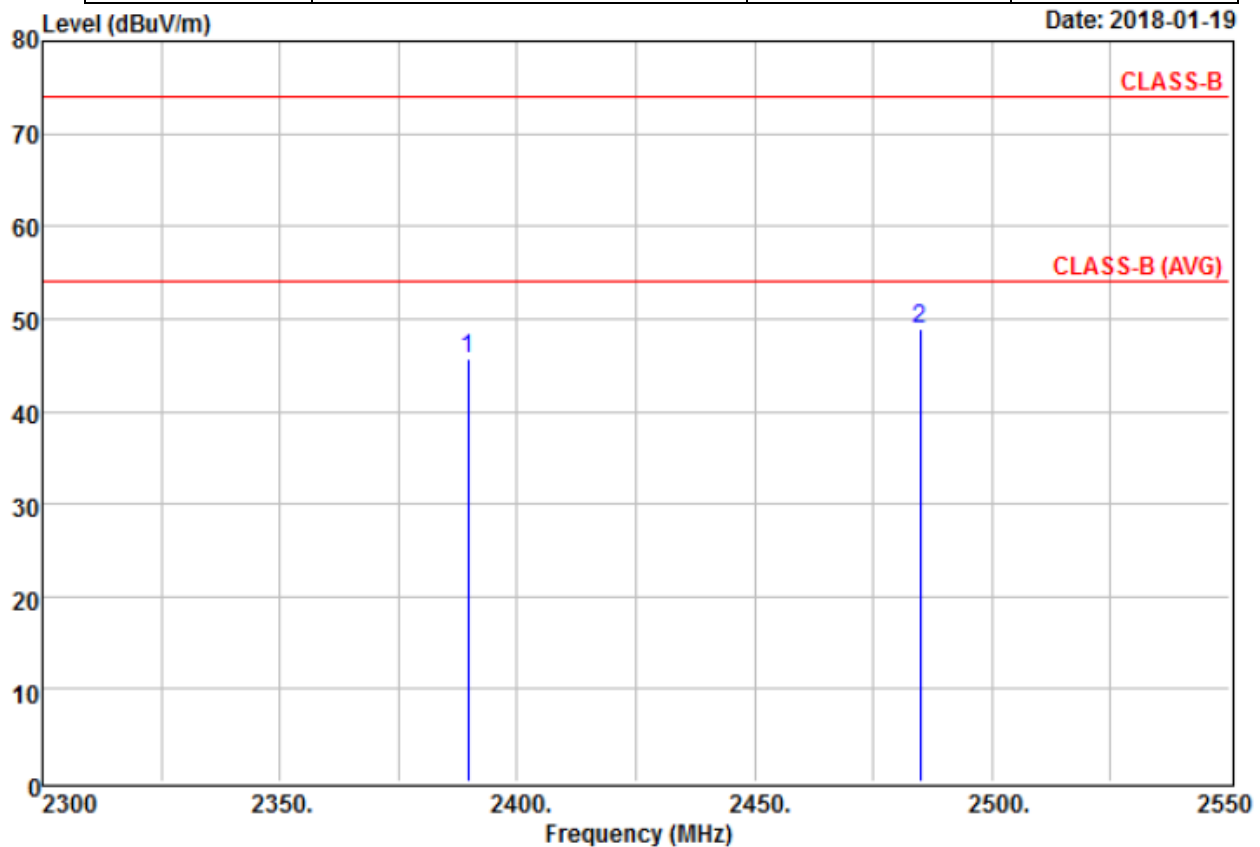
Modulation Standard: GFSK (1Mbps)  
Channel: 39





## 11.5 Restrict Band Emission Measurement Data

|             |                                 |             |              |
|-------------|---------------------------------|-------------|--------------|
| Power       | : DC 5V                         | Pol/Phase   | : HORIZONTAL |
| Test Mode 1 | : CH LO & HI – Restricted Bands | Temperature | : 21 °C      |
| Memo        | :                               | Humidity    | : 68 %       |

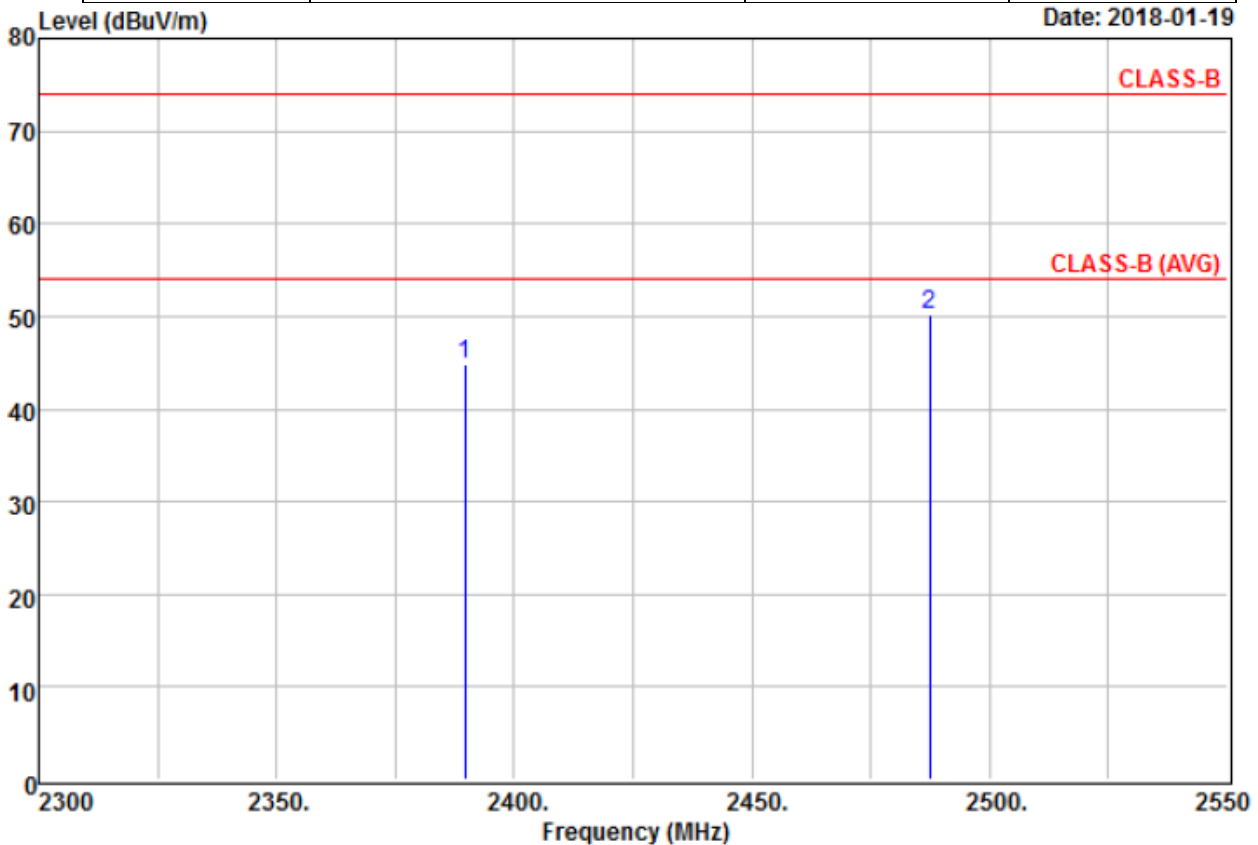


Remarks: : 1.Result=Read Value+Factor  
: 2.Factor=Antenna Factor+Cable loss-  
: Amplifier Factor

|     | Freq     | Read Level | Factor | Level  | Limit Line | Over Limit | Remark |
|-----|----------|------------|--------|--------|------------|------------|--------|
|     | MHz      | dBuV       | dB/m   | dBuV/m | dBuV/m     | dB         |        |
| 1   | 2389.600 | 59.61      | -14.00 | 45.61  | 74.00      | -28.39     | Peak   |
| 2 @ | 2484.900 | 62.51      | -13.69 | 48.82  | 74.00      | -25.18     | Peak   |



|             |                                 |             |            |
|-------------|---------------------------------|-------------|------------|
| Power       | : DC 5V                         | Pol/Phase   | : VERTICAL |
| Test Mode 1 | : CH LO & HI – Restricted Bands | Temperature | : 21 °C    |
| Memo        | :                               | Humidity    | : 68 %     |



Remarks: : 1.Result=Read Value+Factor  
: 2.Factor=Antenna Factor+Cable loss-  
: Amplifier Factor

|     | Freq     | Read Level | Factor | Level  | Limit Line | Over Limit | Remark |
|-----|----------|------------|--------|--------|------------|------------|--------|
|     | MHz      | dBuV       | dB/m   | dBuV/m | dBuV/m     | dB         |        |
| 1   | 2389.700 | 58.75      | -14.00 | 44.75  | 74.00      | -29.25     | Peak   |
| 2 @ | 2487.500 | 63.93      | -13.67 | 50.26  | 74.00      | -23.74     | Peak   |



Note:

8. Emission level = Reading level + Correction factor
9. Correction factor : Antenna factor, Cable loss, Pre-Amp, etc.
10. Measurements above 1000 MHz, Peak detector setting:  
1 MHz RBW with 1 MHz VBW.
11. Measurements above 1000 MHz, Average detector setting:  
1 MHz RBW with 10Hz VBW.
12. Peak detector measurement data will represent the worst case results.
13. Where limits are specified for both average and peak detector functions, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
14. The other emission levels were 20dB below the limit.





## 12. Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                 | MHz                   | MHz             | GHz             |
|---------------------|-----------------------|-----------------|-----------------|
| 0.09000 – 0.11000   | 16.42000 – 16.42300   | 399.9 – 410.0   | 4.500 – 5.150   |
| 0.49500 – 0.505**   | 16.69475 – 16.69525   | 608.0 – 614.0   | 5.350 – 5.460   |
| 2.17350 – 2.19050   | 16.80425 – 16.80475   | 960.0 – 1240.0  | 7.250 – 7.750   |
| 4.12500 – 4.12800   | 25.50000 – 25.67000   | 1300.0 – 1427.0 | 8.025 – 8.500   |
| 4.17725 – 4.17775   | 37.50000 – 38.25000   | 1435.0 – 1626.5 | 9.000 – 9.200   |
| 4.20725 – 4.20775   | 73.00000 – 74.60000   | 1645.5 – 1646.5 | 9.300 – 9.500   |
| 6.21500 – 6.21800   | 74.80000 – 75.20000   | 1660.0 – 1710.0 | 10.600 – 12.700 |
| 6.26775 – 6.26825   | 108.00000 – 121.94000 | 1718.8 – 1722.2 | 13.250 – 13.400 |
| 6.31175 – 6.31225   | 123.00000 – 138.00000 | 2200.0 – 2300.0 | 14.470 – 14.500 |
| 8.29100 – 8.29400   | 149.90000 – 150.05000 | 2310.0 – 2390.0 | 15.350 – 16.200 |
| 8.36200 – 8.36600   | 156.52475 – 156.52525 | 2483.5 – 2500.0 | 17.700 – 21.400 |
| 8.37625 – 8.38675   | 156.70000 – 156.90000 | 2655.0 – 2900.0 | 22.010 – 23.120 |
| 8.41425 – 8.41475   | 162.01250 – 167.17000 | 3260.0 – 3267.0 | 23.600 – 24.000 |
| 12.29000 – 12.29300 | 167.72000 – 173.20000 | 3332.0 – 3339.0 | 31.200 – 31.800 |
| 12.51975 – 12.52025 | 240.00000 – 285.00000 | 3345.8 – 3358.0 | 36.430 – 36.500 |
| 12.57675 – 12.57725 | 322.00000 – 335.40000 | 3600.0 – 4400.0 | Above 38.6      |
| 13.36000 – 13.41000 |                       |                 |                 |

\*\* : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

### 12.1 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.