

**FCC 47 CFR PART 15 SUBPART C****TEST REPORT****For****Bicycle Power Meter****Model Number: Power Pro-R, Power Pro-L****Trade Name: GIANT***Issued to*

**Giant Manufacturing Co., Ltd.**  
**No.19, Shunfan Rd., Dajia Dist., Taichung City 437, Taiwan (R.O.C.)**

*Issued by*

**Compliance Certification Services Inc.**  
**Wugu Laboratory**  
**No.11, Wugong 6th Rd., Wugu Dist.,**  
**New Taipei City 24891, Taiwan. (R.O.C.)**  
<http://www.ccsrf.com>  
**Issued Date: March 21, 2018**



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**Revision History**

| Rev. | Issue Date     | Revisions                                     | Effect Page | Revised By |
|------|----------------|---|-------------|------------|
| 00   | March 21, 2018 | Initial Issue                                 | ALL         | Doris Chu  |
| 01   | May 7, 2018    | 1. Add loop antenna.<br>2. Remove KDB 558074. | P.11, P.15  | Doris Chu  |

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## 1. TEST RESULT CERTIFICATION

**Applicant:** Giant Manufacturing Co., Ltd.  
No.19, Shunfan Rd., Dajia Dist., Taichung City 437, Taiwan  
(R.O.C.)

**Manufacturer:** Giant Manufacturing Co., Ltd.  
No.19, Shunfan Rd., Dajia Dist., Taichung City 437, Taiwan  
(R.O.C.)

**Equipment Under Test:** Bicycle Power Meter

**Trade Name:** GIANT

**Model Number:** Power Pro-R, Power Pro-L

**Date of Test:** March 1 ~ 16, 2018

| APPLICABLE STANDARDS         |                         |
|------------------------------|-------------------------|
| STANDARD                     | TEST RESULT             |
| FCC 47 CFR Part 15 Subpart C | No non-compliance noted |

### We hereby certify that:

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 CCS. Inc. The sample selected for test was production product and was provided by manufacturer.

Approved by:



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Sam Chuang  
Manager  
Compliance Certification Services Inc.

Tested by:



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Jerry Chuang  
Engineer  
Compliance Certification Services Inc.

## 2. TEST SUMMERY

| FCC Standard Section | Report Section | Test Item                             | Result |
|----------------------|----------------|---------------------------------------|--------|
| 15.203               | 3              | Antenna Requirement                   | Pass   |
| 2.1049               | 8.1            | 20 dB Bandwidth                       | Pass   |
| -                    | 8.1            | Occupied Bandwidth (99%)              | Pass   |
| 15.209               |                | Band Edge and Fundamental measurement |        |
| 15.249(a)            | 8.2            |                                       | Pass   |
| 15.249(a)            | 8.3            | Radiation Spurious Emission           | Pass   |
| 15.207(a)            | 8.4            | Powerline Conducted Emission          | N/A    |

### 3. EUT DESCRIPTION

|                          |   |
|--------------------------|---|
| <b>Product</b>           | Bicycle Power Meter   |
| <b>Trade Name</b>        | GIANT   |
| <b>Model Number</b>      | Power Pro-R, Power Pro-L  |
| <b>Model Discrepancy</b> | The two models use the same module, the difference for the fix location |
| <b>Received Date</b>     | December 22, 2017   |
| <b>Power Supply</b>      | Power from DC Battery (DC3.7V)  |

| Frequency Range      | 2401 ~ 2480MHz     |                 |         |                 |
|----------------------|--------------------|-----------------|---------|-----------------|
|                      | Channel            | Frequency (MHz) | Channel | Frequency (MHz) |
| 1                    | 2401               | 41              | 2441    |                 |
| 2                    | 2402               | 42              | 2442    |                 |
| 3                    | 2403               | 43              | 2443    |                 |
| 4                    | 2404               | 44              | 2444    |                 |
| 5                    | 2405               | 45              | 2445    |                 |
| 6                    | 2406               | 46              | 2446    |                 |
| 7                    | 2407               | 47              | 2447    |                 |
| 8                    | 2408               | 48              | 2448    |                 |
| 9                    | 2409               | 49              | 2449    |                 |
| 10                   | 2410               | 50              | 2450    |                 |
| 11                   | 2411               | 51              | 2451    |                 |
| 12                   | 2412               | 52              | 2452    |                 |
| 13                   | 2413               | 53              | 2453    |                 |
| 14                   | 2414               | 54              | 2454    |                 |
| 15                   | 2415               | 55              | 2455    |                 |
| 16                   | 2416               | 56              | 2456    |                 |
| 17                   | 2417               | 57              | 2457    |                 |
| 18                   | 2418               | 58              | 2458    |                 |
| 19                   | 2419               | 59              | 2459    |                 |
| 20                   | 2420               | 60              | 2460    |                 |
| 21                   | 2421               | 61              | 2461    |                 |
| 22                   | 2422               | 62              | 2462    |                 |
| 23                   | 2423               | 63              | 2463    |                 |
| 24                   | 2424               | 64              | 2464    |                 |
| 25                   | 2425               | 65              | 2465    |                 |
| 26                   | 2426               | 66              | 2466    |                 |
| 27                   | 2427               | 67              | 2467    |                 |
| 28                   | 2428               | 68              | 2468    |                 |
| 29                   | 2429               | 69              | 2469    |                 |
| 30                   | 2430               | 70              | 2470    |                 |
| 31                   | 2431               | 71              | 2471    |                 |
| 32                   | 2432               | 72              | 2472    |                 |
| 33                   | 2433               | 73              | 2473    |                 |
| 34                   | 2434               | 74              | 2474    |                 |
| 35                   | 2435               | 75              | 2475    |                 |
| 36                   | 2436               | 76              | 2476    |                 |
| 37                   | 2437               | 77              | 2477    |                 |
| 38                   | 2438               | 78              | 2478    |                 |
| 39                   | 2439               | 79              | 2479    |                 |
| 40                   | 2440               | 80              | 2480    |                 |
| Modulation Technique | GFSK               |                 |         |                 |
| Antenna Gain         | Gain: 0 dBi        |                 |         |                 |
| Antenna Designation  | PCB Antenna        |                 |         |                 |
| Antenna Brand        | WUSA               |                 |         |                 |
| Antenna Model        | PCB Layout printed |                 |         |                 |

**Remark:**

1. The sample selected for test was production product and was provided by manufacturer.

## **4. TEST METHODOLOGY**

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 2, FCC Part 15.249.

### **4.1 EUT CONFIGURATION**

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

### **4.2 DESCRIPTION OF TEST MODES**

The EUT (model: Power Pro-L) had been tested under operating condition.

Channel Low (2401MHz), Channel Mid (2440MHz) and Channel High (2480MHz) were chosen for the final testing.

### 4.3 THE WORST MODE OF MEASUREMENT

| AC Power Line Conducted Emission |  |
|----------------------------------|--|
| <b>Test Condition</b>            | <b>AC Power line conducted emission for line and neutral</b>   |
| <b>Voltage/Hz</b>                | <b>DC 3.7V</b>   |
| <b>Test Mode</b>                 | <b>Mode 1:EUT power by host system.</b>  |
| <b>Worst Mode</b>                | <input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4 |

| Radiated Emission Measurement Above 1G |   |
|--|---|
| <b>Test Condition</b>                  | <b>Band edge, Emission for Unwanted and Fundamental</b>   |
| <b>Voltage/Hz</b>                      | <b>DC 3.7V</b>  |
| <b>Test Mode</b>                       | <b>Mode 1:EUT power by host system.</b>   |
| <b>Worst Mode</b>                      | <input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4  |
| <b>Worst Position</b>                  | <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) |
| <b>Worst Polarity</b>                  | <input checked="" type="checkbox"/> Horizontal <input type="checkbox"/> Vertical  |

| Radiated Emission Measurement Below 1G |  |
|--|--|
| <b>Test Condition</b>                  | <b>Radiated Emission Below 1G</b>  |
| <b>Voltage/Hz</b>                      | <b>DC 3.7V</b>   |
| <b>Test Mode</b>                       | <b>Mode 1:EUT power by host system.</b>  |
| <b>Worst Mode</b>                      | <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, AC power line conducted emission and radiation emission were performed the EUT transmit at the highest output power channel as worse case.

#### 4.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                        | MHz                 | MHz             | GHz              |
|----------------------------|---------------------|-----------------|------------------|
| 0.090 - 0.110              | 16.42 - 16.423      | 399.9 - 410     | 4.5 - 5.15       |
| <sup>1</sup> 0.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614       | 5.35 - 5.46      |
| 2.1735 - 2.1905            | 16.80425 - 16.80475 | 960 - 1240      | 7.25 - 7.75      |
| 4.125 - 4.128              | 25.5 - 25.67        | 1300 - 1427     | 8.025 - 8.5      |
| 4.17725 - 4.17775          | 37.5 - 38.25        | 1435 - 1626.5   | 9.0 - 9.2        |
| 4.20725 - 4.20775          | 73 - 74.6           | 1645.5 - 1646.5 | 9.3 - 9.5        |
| 6.215 - 6.218              | 74.8 - 75.2         | 1660 - 1710     | 10.6 - 12.7      |
| 6.26775 - 6.26825          | 108 - 121.94        | 1718.8 - 1722.2 | 13.25 - 13.4     |
| 6.31175 - 6.31225          | 123 - 138           | 2200 - 2300     | 14.47 - 14.5     |
| 8.291 - 8.294              | 149.9 - 150.05      | 2310 - 2390     | 15.35 - 16.2     |
| 8.362 - 8.366              | 156.52475 -         | 2483.5 - 2500   | 17.7 - 21.4      |
| 8.37625 - 8.38675          | 156.52525           | 2655 - 2900     | 22.01 - 23.12    |
| 8.41425 - 8.41475          | 156.7 - 156.9       | 3260 - 3267     | 23.6 - 24.0      |
| 12.29 - 12.293             | 162.0125 - 167.17   | 3332 - 3339     | 31.2 - 31.8      |
| 12.51975 - 12.52025        | 167.72 - 173.2      | 3345.8 - 3358   | 36.43 - 36.5     |
| 12.57675 - 12.57725        | 240 - 285           | 3600 - 4400     | ( <sup>2</sup> ) |
| 13.36 - 13.41              | 322 - 335.4         |                 |                  |

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

## 5. INSTRUMENT CALIBRATION

### 5.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

### 5.2 MEASUREMENT EQUIPMENT USED

#### Equipment Used for Emissions Measurement

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

| Wugu 966 Chamber A |                |                 |               |                  |                 |
|--------------------|----------------|-----------------|---------------|------------------|-----------------|
| Name of Equipment  | Manufacturer   | Model           | Serial Number | Calibration Date | Calibration Due |
| Bilog Antenna      | Sunol Sciences | JB3             | A030105       | 06/20/2017       | 06/19/2018      |
| Horn Antenna       | ETC            | MCTD 1209       | DRH13M02003   | 08/25/2017       | 08/24/2018      |
| Pre-Amplifier      | EMEC           | EM330           | 60609         | 06/07/2017       | 06/06/2018      |
| Spectrum Analyzer  | Agilent        | E4446A          | US42510252    | 11/27/2017       | 11/26/2018      |
| Loop Ant           | COM-POWER      | AL-130          | 121051        | 03/21/2018       | 03/20/2019      |
| 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            | 2400-2500       | 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      |

| RF Conducted Test Site |                    |                 |               |                  |                 |
|------------------------|--------------------|-----------------|---------------|------------------|-----------------|
| Name of Equipment      | Manufacturer       | Model           | Serial Number | Calibration Date | Calibration Due |
| Power Meter            | Anritsu            | ML2495A         | 1012009       | 07/03/2017       | 07/02/2018      |
| Power Sensor           | Anritsu            | MA2411B         | 917072        | 07/03/2017       | 07/02/2018      |
| Spectrum Analyzer      | R&S                | FSV 40          | 101073        | 10/02/2017       | 10/01/2018      |
| Directional Coupler    | Agilent            | 87301D          | MY44350252    | 07/25/2017       | 07/24/2018      |
| SUCOFLEX Cable         | HUBER SUHNER       | SUCOFLEX 104PEA | 25157         | 07/31/2017       | 07/30/2018      |
| Divider                | Solvang Technology | 2-18GHz 4Way    | STI08-0015    | 07/26/2017       | 07/25/2018      |

| Conducted Emission Room #B |              |       |               |                  |                 |
|----------------------------|--------------|-------|---------------|------------------|-----------------|
| Name of Equipment          | Manufacturer | Model | Serial Number | Calibration Date | Calibration Due |
| N/A                        |              |       |               |                  |                 |

**Remark:**

1. Each piece of equipment is scheduled for calibration once a year and Precision Dipole is scheduled for calibration once three years.
2. N.C.R. = No Calibration Request.

### 5.3 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 / 1G~8G      | +/- 2.5975  |
| 3M Semi Anechoic Chamber / 8G~18G     | +/- 2.6112  |
| 3M Semi Anechoic Chamber / 18G~26G    | +/- 2.7389  |
| 3M Semi Anechoic Chamber / 26G~40G    | +/- 2.9683  |
| 3M Semi Anechoic Chamber / 40G~60G    | +/- 1.8509  |
| 3M Semi Anechoic Chamber / 60G~75G    | +/- 1.9869  |
| 3M Semi Anechoic Chamber / 75G~110G   | +/- 2.9651  |
| 3M Semi Anechoic Chamber / 110G~170G  | +/- 2.7807  |
| 3M Semi Anechoic Chamber / 170G~220G  | +/- 3.6437  |
| 3M Semi Anechoic Chamber / 220G~325G  | +/- 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.

## 6. FACILITIES AND ACCREDITATIONS

### 6.1 FACILITIES

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

No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

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

Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

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

### 6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

## 7. SETUP OF EQUIPMENT UNDER TEST

### 7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix I for the actual connections between EUT and support equipment.

### 7.2 SUPPORT EQUIPMENT

| No | Device Type | Brand   | Model   | Series No. | FCC ID |
|----|-------------|---------|---------|------------|--------|
| 1  | NB(K)       | Toshiba | voyager | ZD 154034s | N/A    |

**Remark:**

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

## 8. FCC PART 15.249 REQUIREMENTS

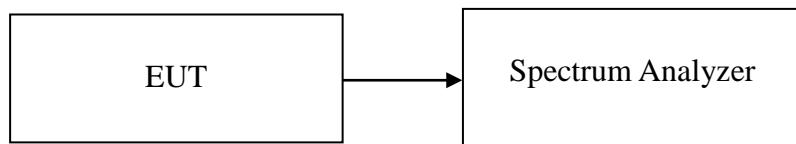
### 8.1 20DB BANDWIDTH AND OCCUPIED BANDWIDTH(99%)

#### LIMIT

**20 dB Bandwidth** : For reporting purposes only.

**Occupied Bandwidth(99%)** : For reporting purposes only.

#### Test Configuration



## TEST PROCEDURE

Test method Refer as ANSI 63.10:2013 clause 6.9.2

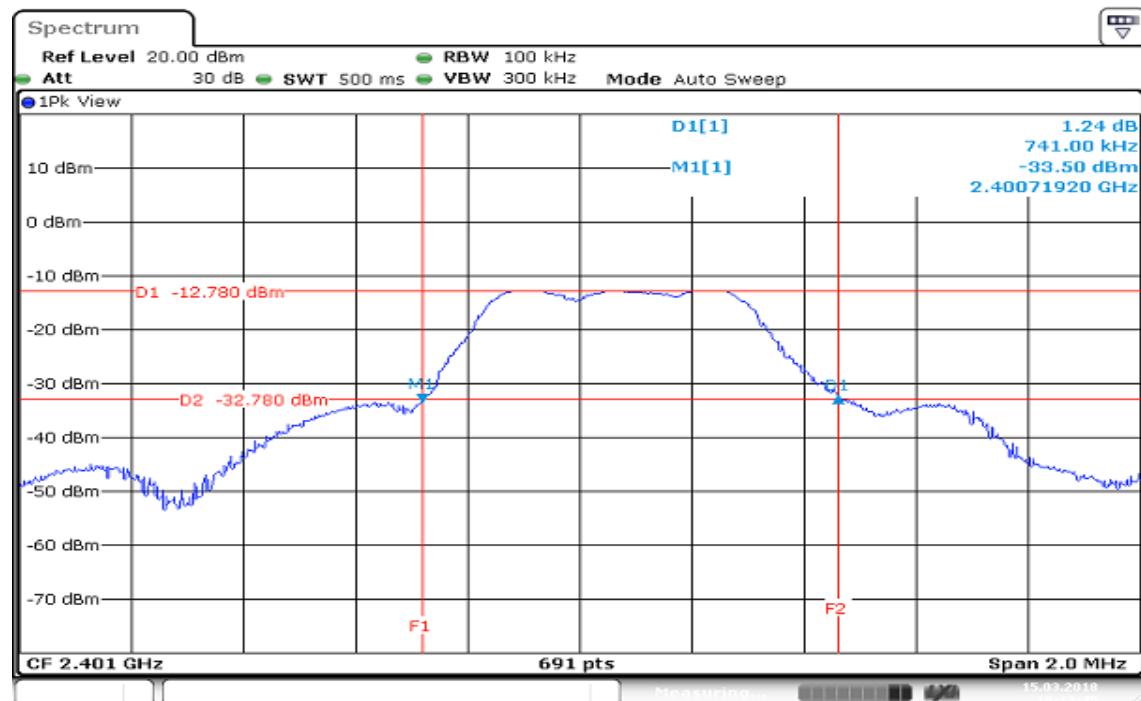
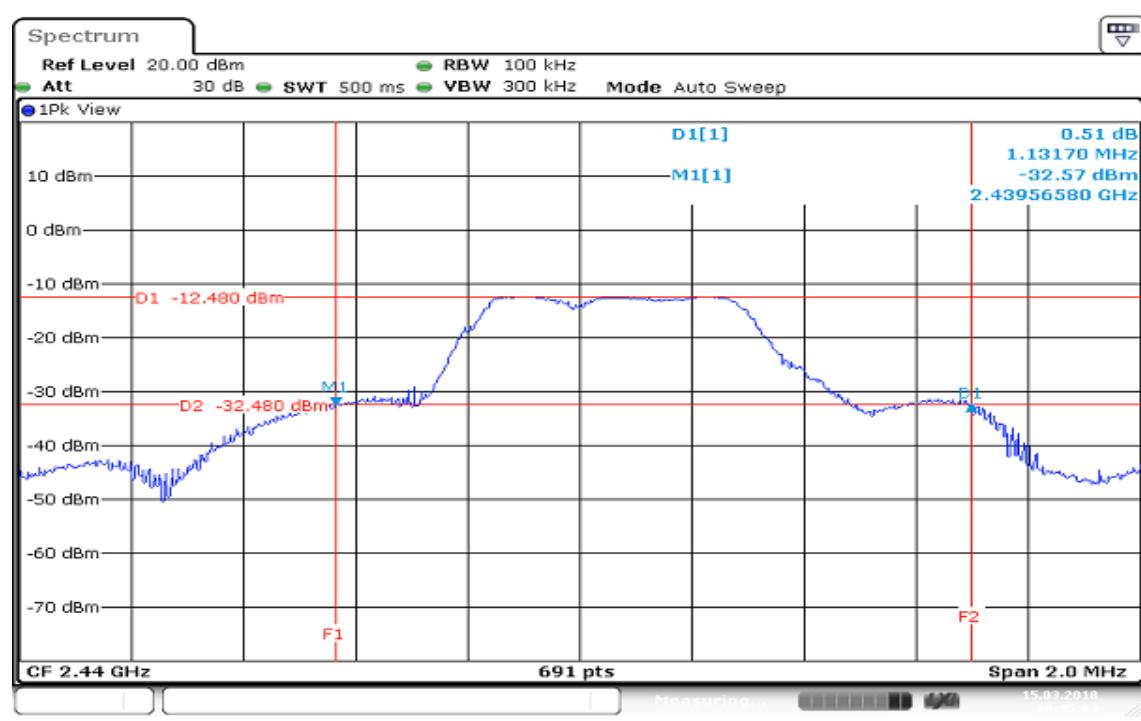
1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 100kHz, VBW = 300kHz and Detector = Peak, to measurement 20 dB Bandwidth.
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth
5. Measure and record the result of 20 dB Bandwidth and 99% Bandwidth. in the test report.

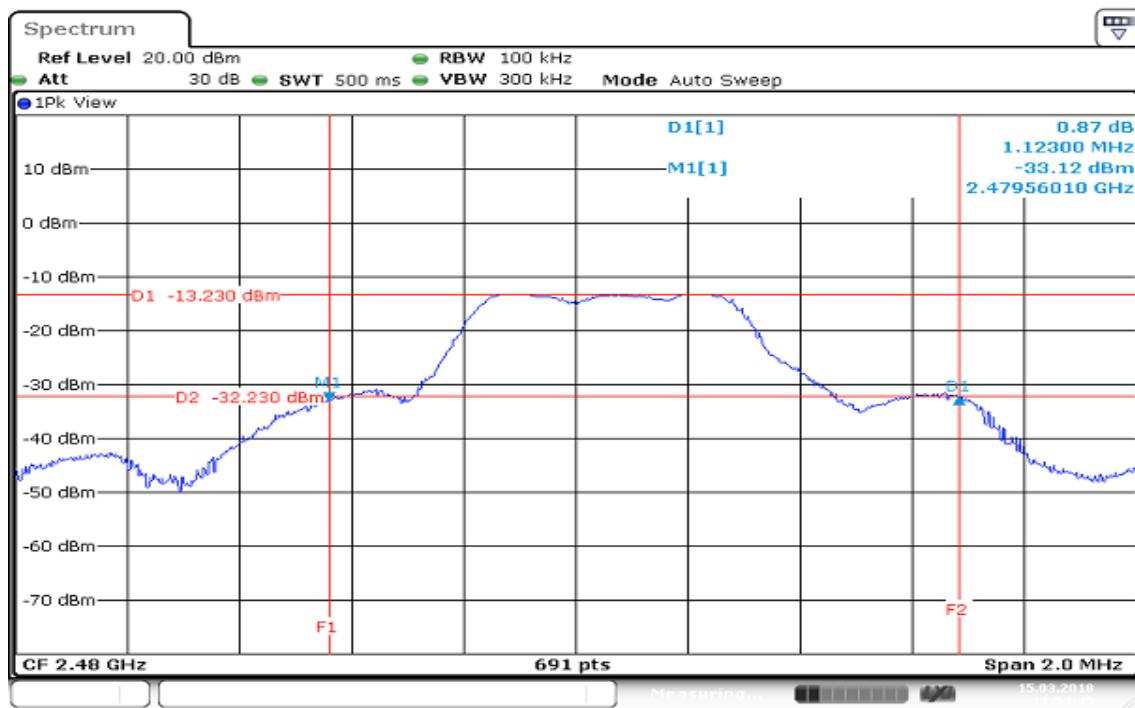
## TEST RESULTS

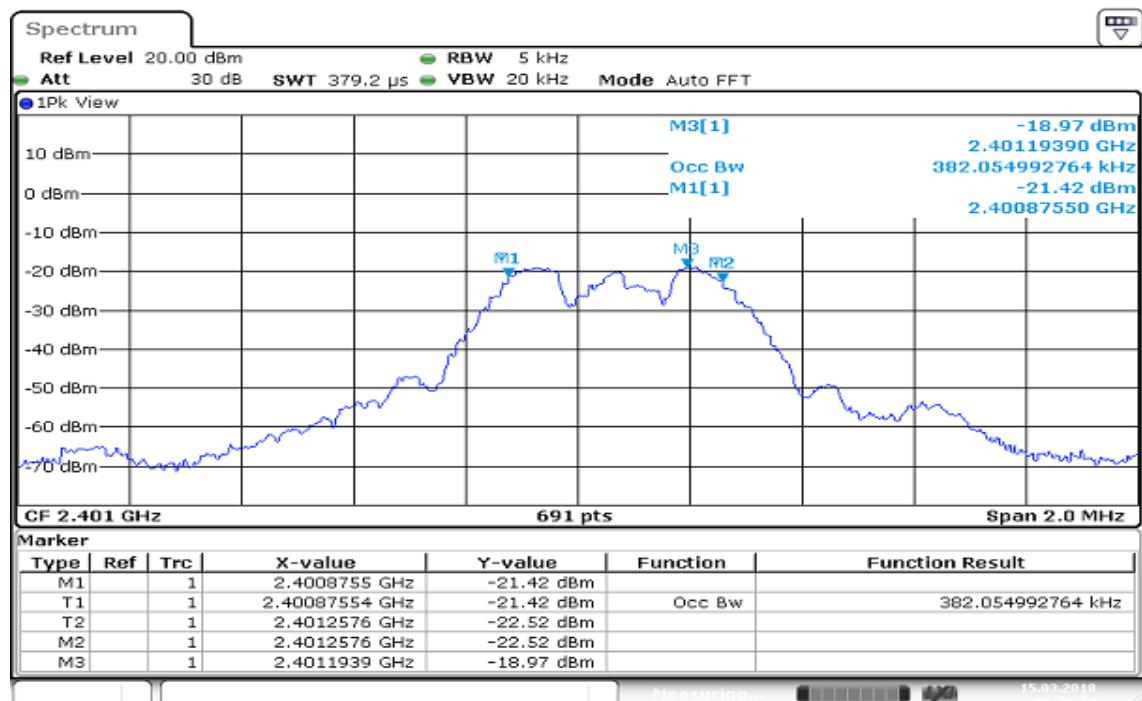
*No non-compliance noted*

#### Test Data

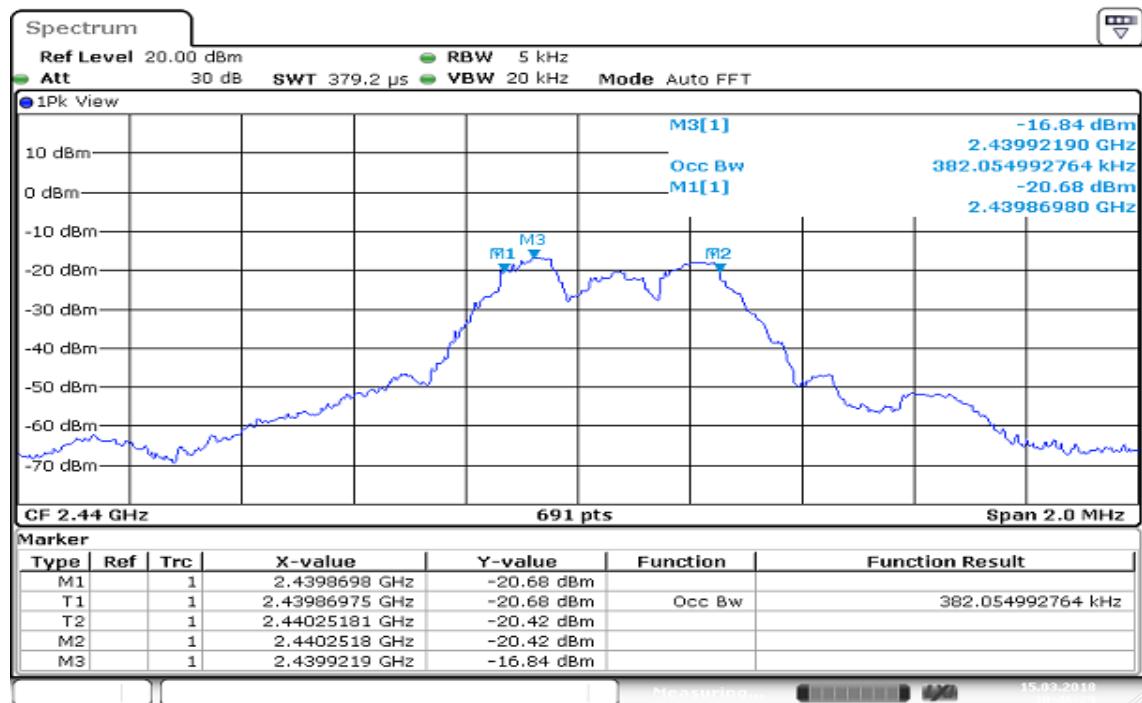
| Test mode: ANT+ mode / 2401 ~ 2480MHz |                 |                |               |
|---------------------------------------|-----------------|----------------|---------------|
| Channel                               | Frequency (MHz) | OBW(99%) (MHz) | 20dB BW (MHz) |
| Low                                   | 2401            | 0.3820         | 0.7410        |
| Mid                                   | 2440            | 0.3820         | 1.1317        |
| High                                  | 2480            | 0.3936         | 1.1230        |

**Test Plot****20dB BW(MHz)****CH Low****CH Mid**

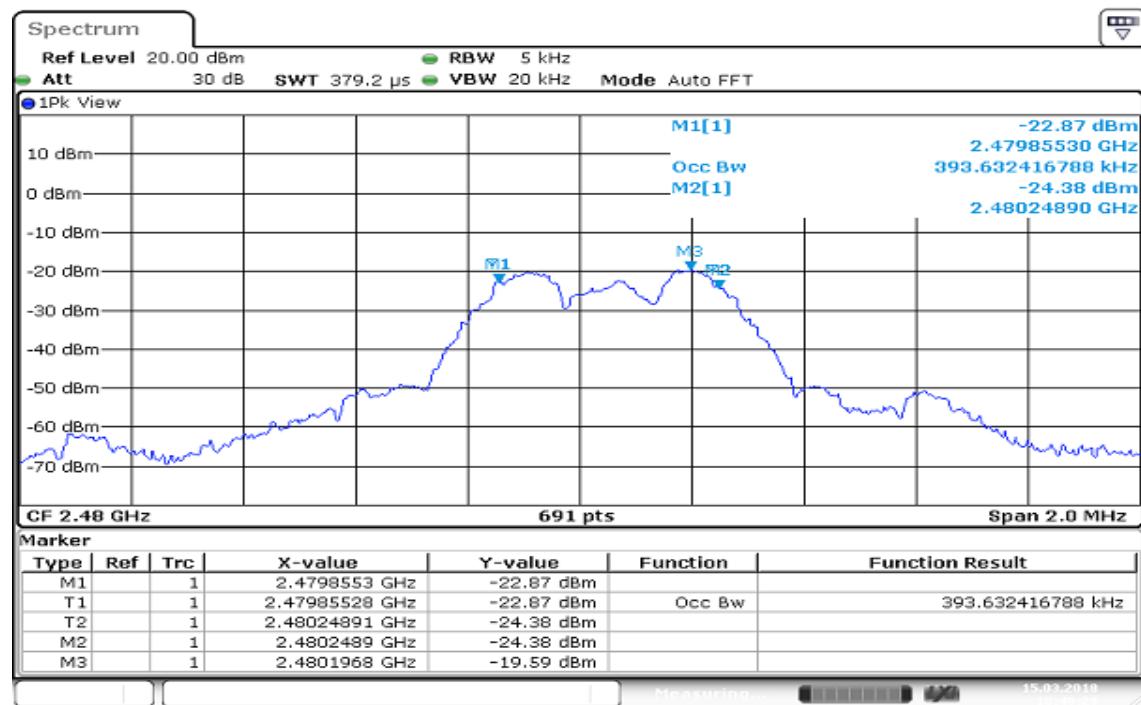
**CH High**

**OBW(99%) (MHz)****CH Low**

Date: 15 MAR 2018 10:29:23

**CH Mid**

Date: 15 MAR 2018 10:46:30

**CH High**

## 8.2 BAND EDGES AND FUNDAMENTAL MEASUREMENT

### LIMIT

According to §15.209, §15.249(a)

(1) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency (MHz) | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) |
|-----------------------------|--|--|
| 2400-2483.5                 | 50   | 500  |
| 5725-5875                   | 50   | 500  |
| 24000-24250                 | 250  | 2500   |

\* Field strength limits are specified at a distance of 3 meters

| Fundamental Limit Conversion |                        |                     |
|------------------------------|------------------------|---------------------|
| Average (mV/m) at 3M         | Average (dBuV/m) at 3M | Peak (dBuV/m) at 3M |
| 50                           | 93.98                  | 113.98              |

| Harmonic Limit Conversion |                        |                     |
|---------------------------|------------------------|---------------------|
| Average (uV/m) at 3M      | Average (dBuV/m) at 3M | Peak (dBuV/m) at 1M |
| 500                       | 53.97                  | 73.97               |

\*(Limit=20LOG(500)=53.79 dBuV/m)

(2) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209(follow the table), whichever is the lesser attenuation

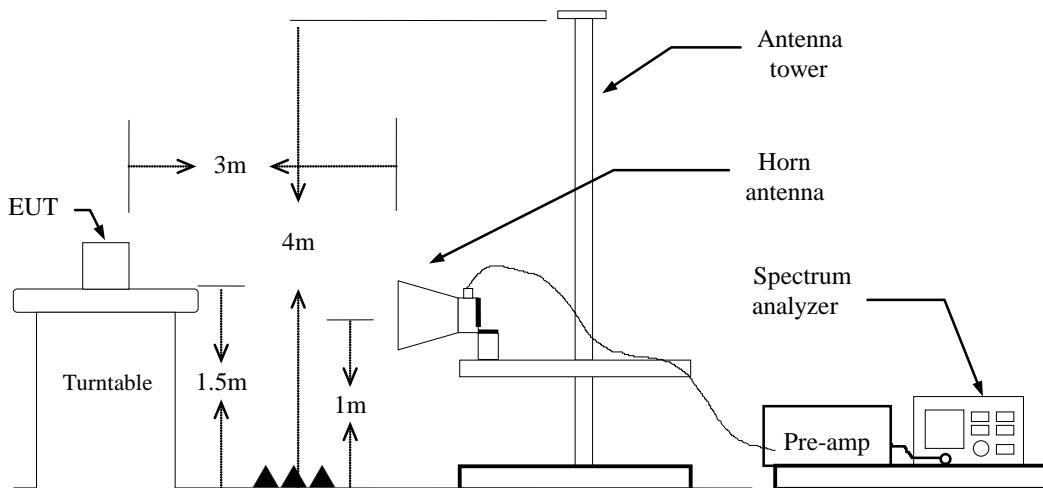
### Below 30 MHz

| Frequency     | Field Strength (microvolts/m) | Measurement Distance (metres) |
|---------------|-------------------------------|-------------------------------|
| 9-490 kHz     | 2,400/F (F in kHz)            | 300                           |
| 490-1,705 kHz | 24,000/F (F in kHz)           | 30                            |
| 1.705-30 MHz  | 30                            | 30                            |

### Above 30 MHz

| Frequency | Field Strength (microvolts/m) | Measurement Distance (metres) |
|-----------|-------------------------------|-------------------------------|
| 30-88     | 100                           | 3                             |
| 88-216    | 150                           | 3                             |
| 216-960   | 200                           | 3                             |
| Above 960 | 500                           | 3                             |

### Test Configuration



## TEST PROCEDURE

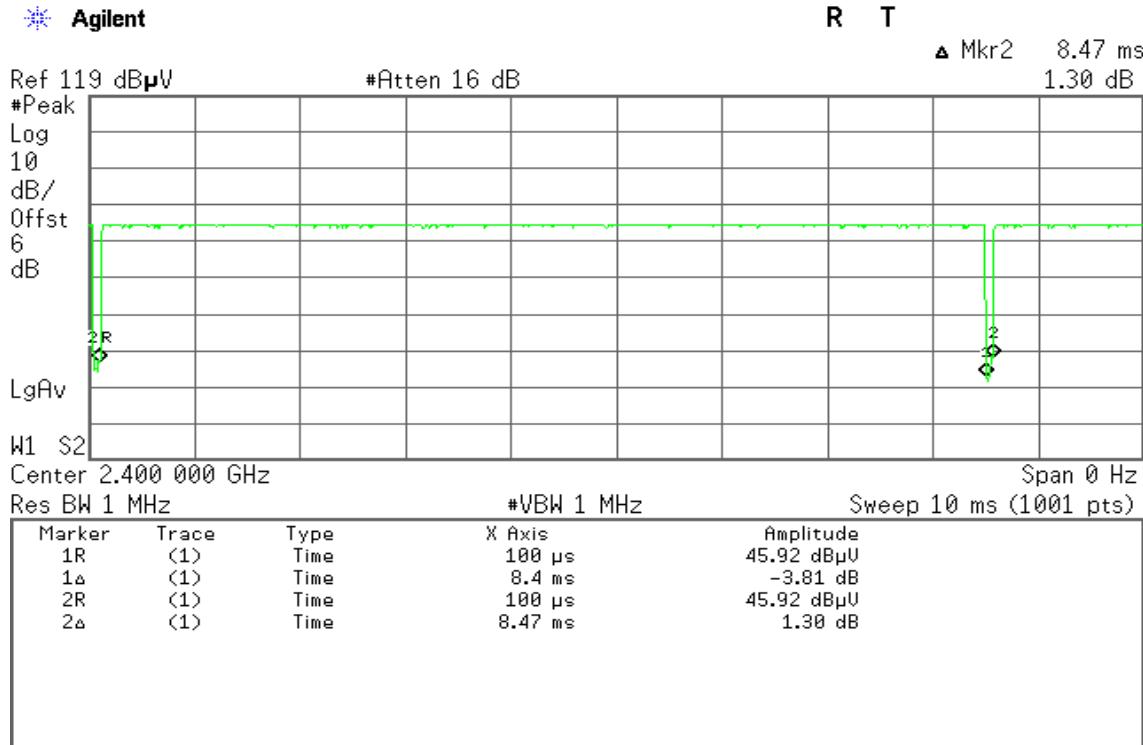
1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
  - (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
  - (b) AVERAGE: RBW=1MHz,  
if duty cycle $\geq$ 98%, VBW=10Hz.  
if duty cycle<98% VBW=1/T.

About Test :

**ANT+:** = 99%, VBW= 10Hz

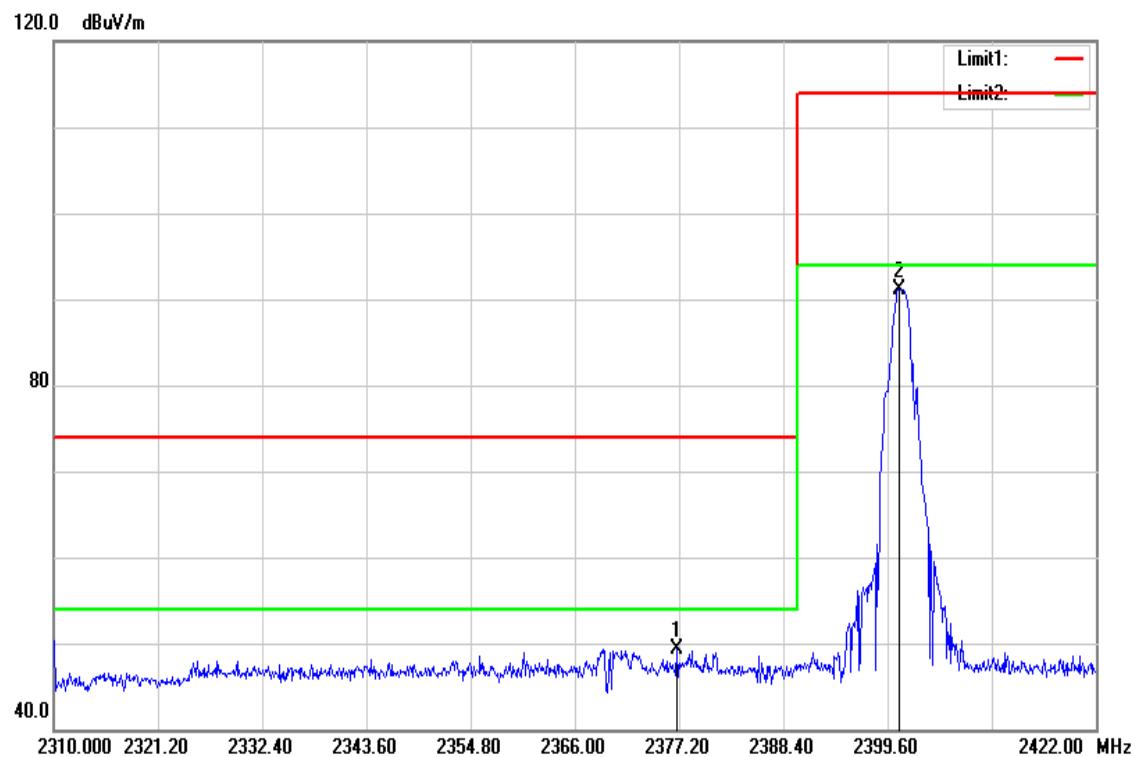
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.
6. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant

## DUTY CYCLE



## TEST RESULTS

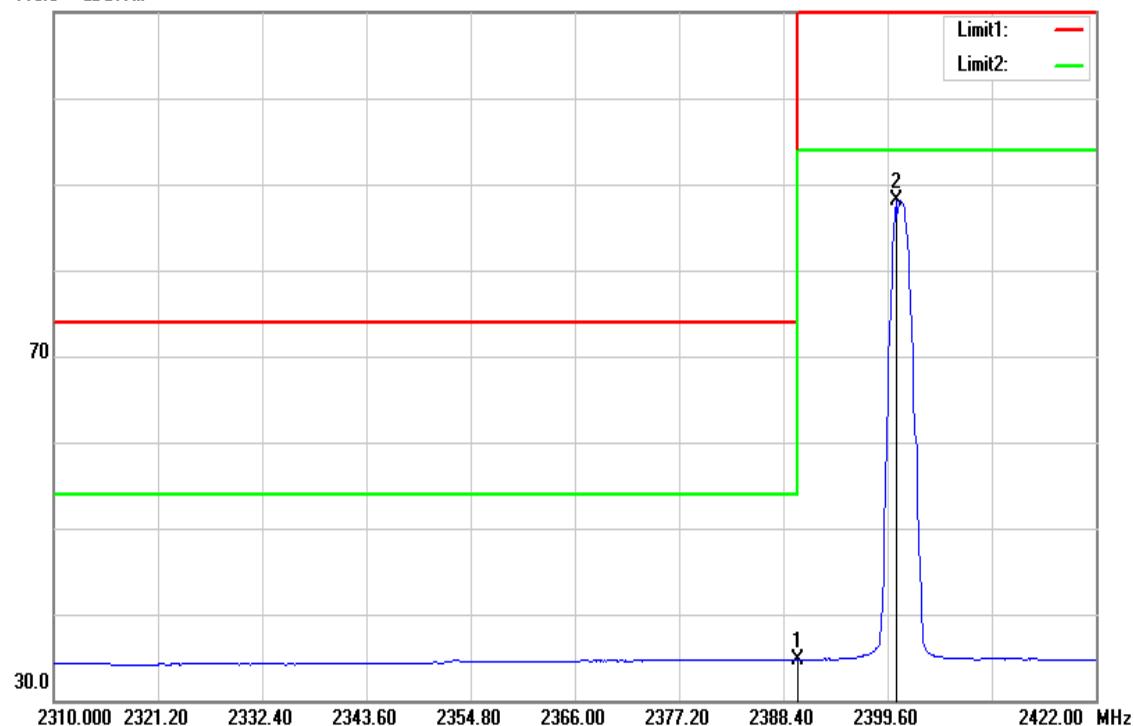
Refer to attach spectrum analyzer data chart.

**Band Edges (CH Low)****Detector mode: Peak**

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|--------|
| 1   | 2376.976        | 52.41          | -3.02                | 49.39           | 74.00          | -24.61      | peak   |
| 2   | 2400.832        | 94.14          | -2.95                | 91.19           | 114.00         | -22.81      | peak   |

**Detector mode: Average**

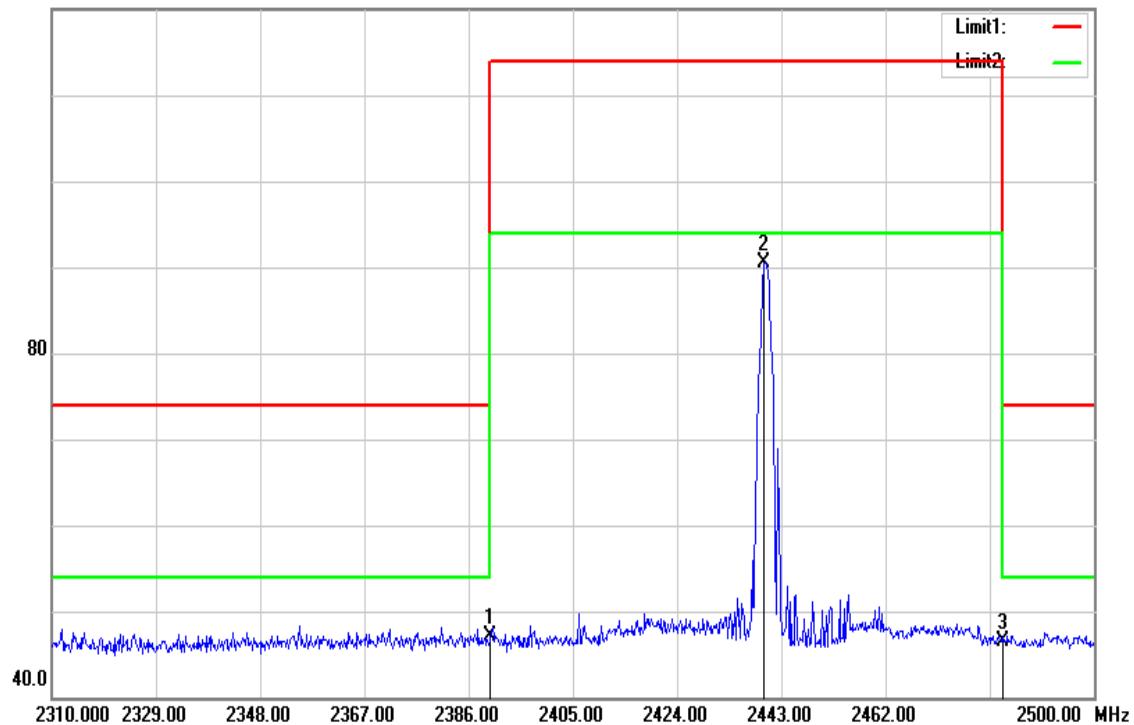
110.0 dBuV/m



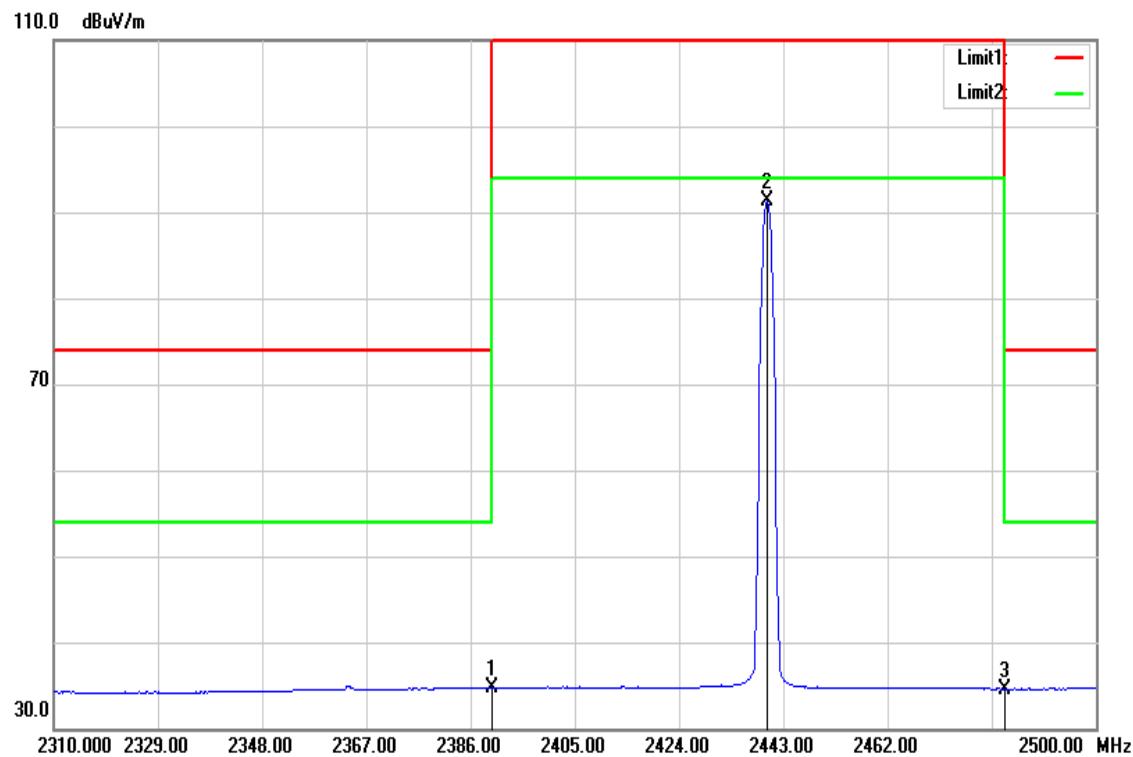
| No. | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>Factor(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|-----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1   | 2390.000           | 37.68             | -2.98                   | 34.70              | 54.00             | -19.30         | AVG    |
| 2   | 2400.552           | 91.13             | -2.95                   | 88.18              | 94.00             | -5.82          | AVG    |

**Band Edges (CH Mid)****Detector mode: Peak**

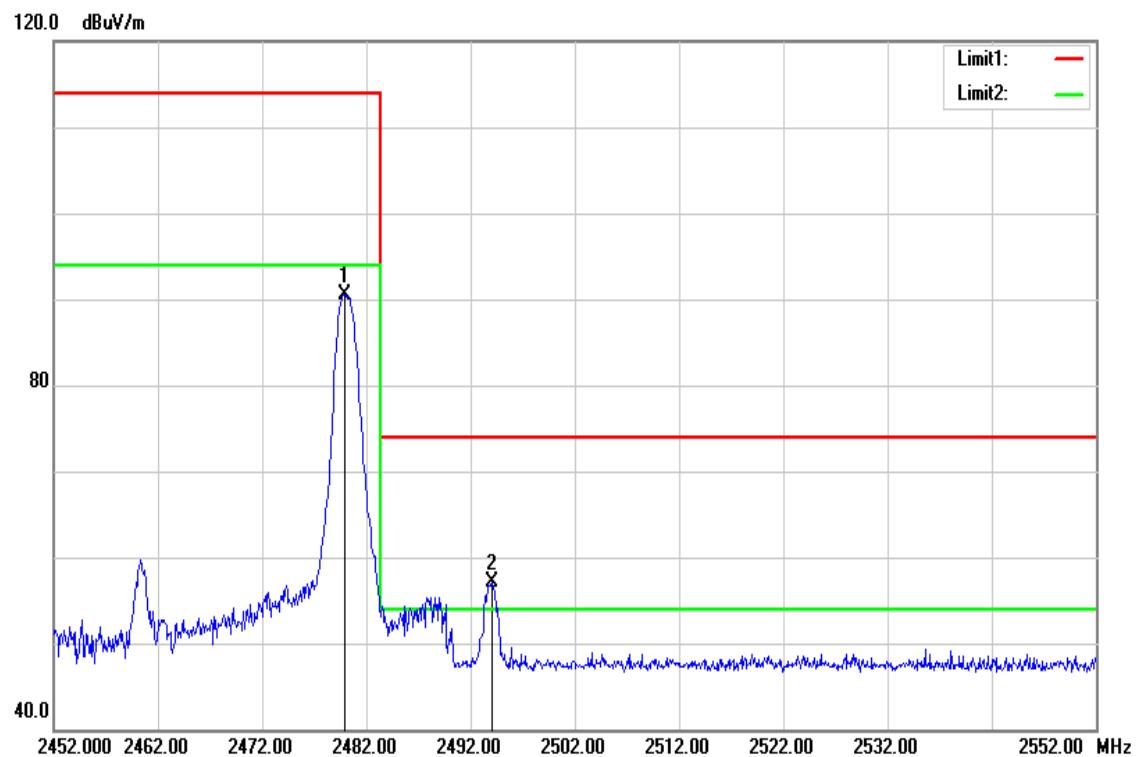
120.0 dBuV/m



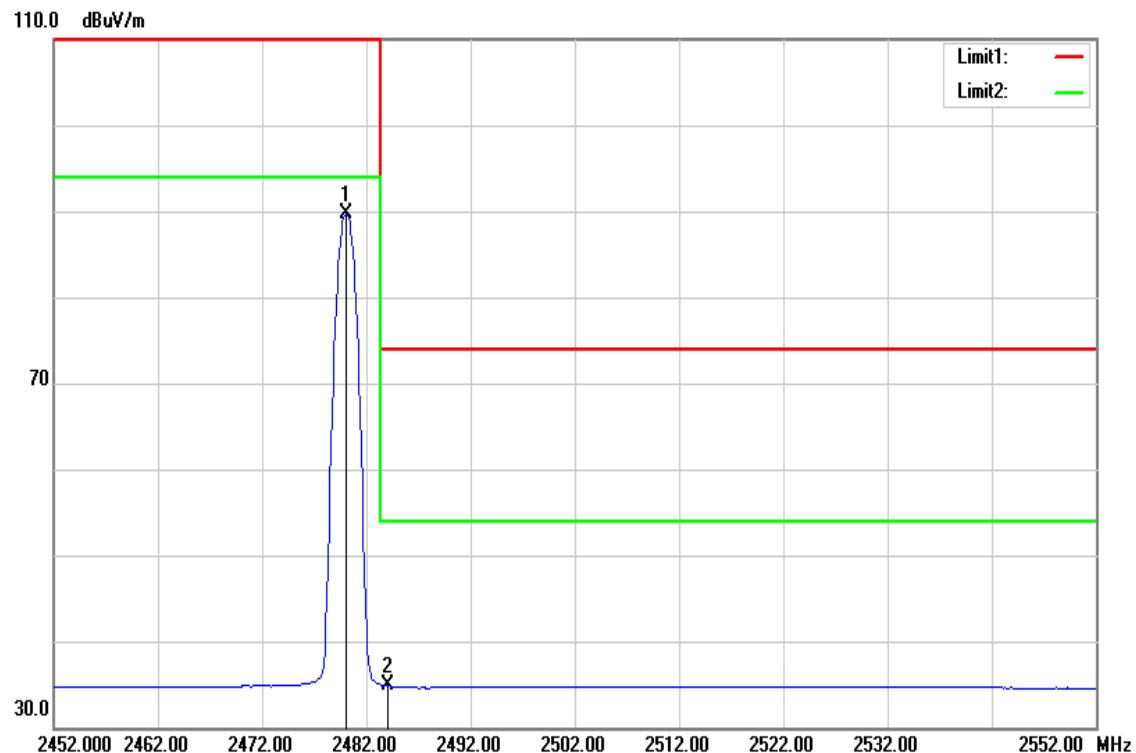
| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|--------|
| 1   | 2390.000        | 50.08          | -2.98                | 47.10           | 74.00          | -26.90      | peak   |
| 2   | 2439.865        | 93.26          | -2.82                | 90.44           | 114.00         | -23.56      | peak   |
| 3   | 2483.500        | 49.22          | -2.69                | 46.53           | 74.00          | -27.47      | peak   |

**Detector mode: Average**

| 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   | 2390.000           | 37.64             | -2.98                   | 34.66              | 54.00             | -19.34         | AVG    |
| 2   | 2440.055           | 94.17             | -2.82                   | 91.35              | 94.00             | -2.65          | AVG    |
| 3   | 2483.500           | 37.27             | -2.69                   | 34.58              | 54.00             | -19.42         | AVG    |

**Band Edges (CH High)****Detector mode: Peak**

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|--------|
| 1   | 2479.900        | 93.14          | -2.70                | 90.44           | 114.00         | -23.56      | peak   |
| 2   | 2494.000        | 59.75          | -2.66                | 57.09           | 74.00          | -16.91      | peak   |

**Detector mode: Average**

| 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   | 2480.050           | 92.44             | -2.70                   | 89.74              | 94.00             | -4.26          | AVG    |
| 2   | 2484.000           | 37.55             | -2.69                   | 34.86              | 54.00             | -19.14         | AVG    |

## 8.3 SPURIOUS EMISSION

### LIMIT

According to §15.209, §15.249(a)

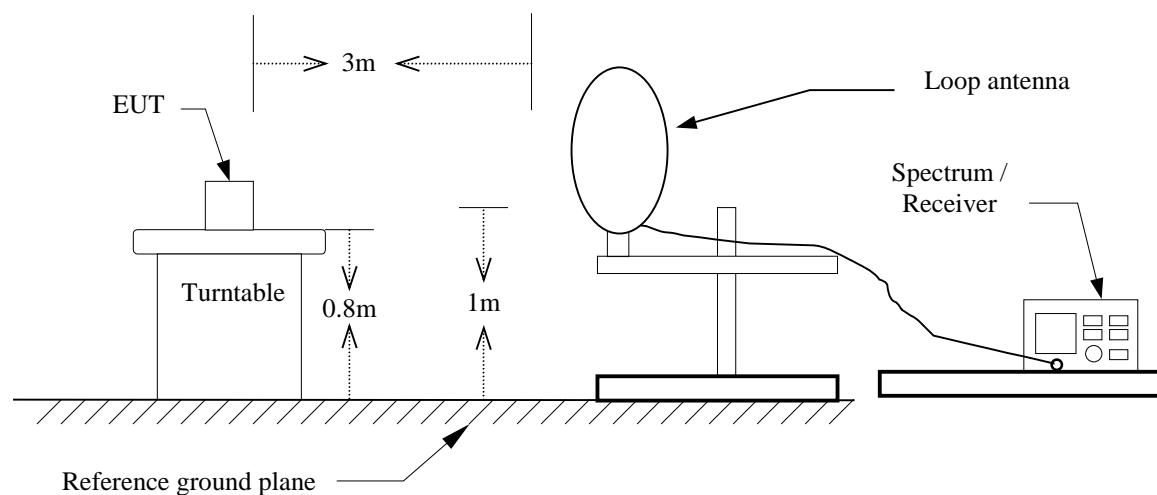
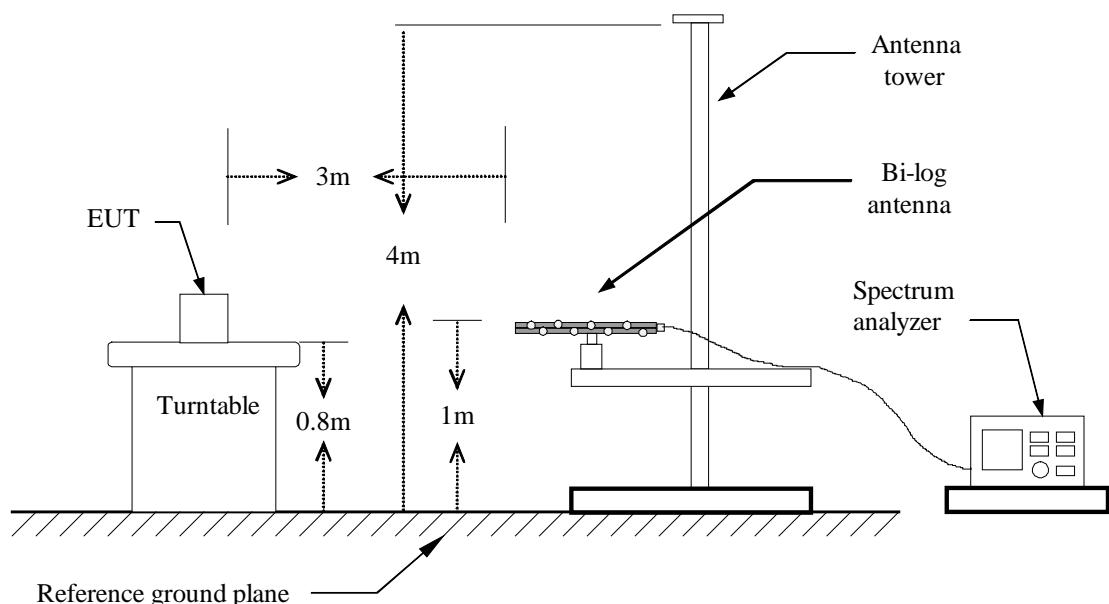
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209(follow the table), whichever is the lesser attenuation

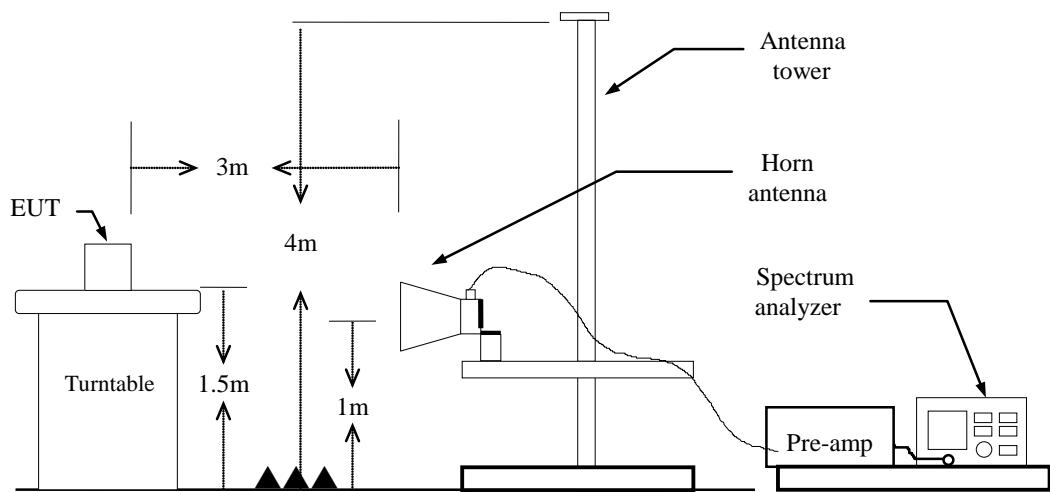
#### Below 30 MHz

| Frequency     | Field Strength<br>(microvolts/m) | Measurement<br>Distance<br>(metres) |
|---------------|----------------------------------|-------------------------------------|
| 9-490 kHz     | 2,400/F (F in kHz)               | 300                                 |
| 490-1,705 kHz | 24,000/F (F in kHz)              | 30                                  |
| 1.705-30 MHz  | 30                               | 30                                  |

#### Above 30 MHz

| Frequency | Field Strength<br>(microvolts/m) | Measurement<br>Distance<br>(metres) |
|-----------|----------------------------------|-------------------------------------|
| 30-88     | 100                              | 3                                   |
| 88-216    | 150                              | 3                                   |
| 216-960   | 200                              | 3                                   |
| Above 960 | 500                              | 3                                   |

**Test Configuration****9kHz ~ 30MHz****30MHz ~ 1GHz**

**Above 1 GHz**

## **TEST PROCEDURE**

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m high and below 1 GHz is 0.8m high above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. 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,

if duty cycle $\geq$ 98%, VBW=10Hz.

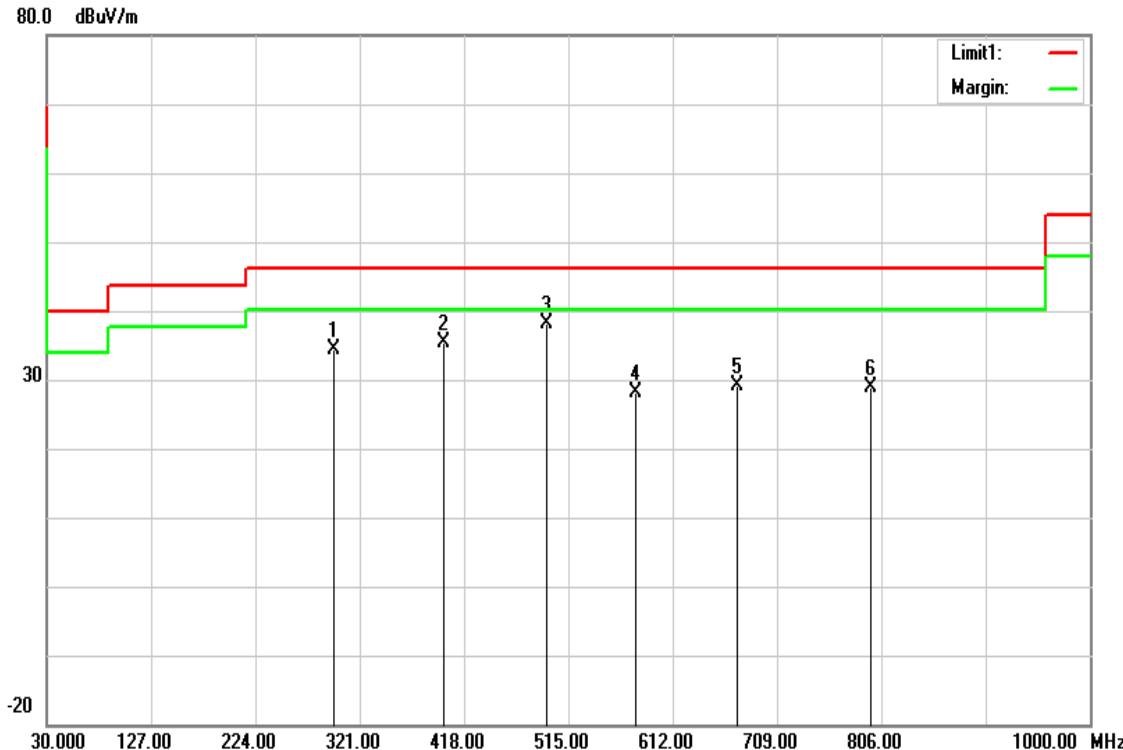
if duty cycle<98% VBW=1/T.

About test

**ANT+:** = 99%, VBW= 10Hz

7. Repeat above procedures until the measurements for all frequencies are complete.
8. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant

**Note:** We checked every harmonics frequencies from Fundamental frequencies with reduced VBW, and we mark a point to prove pass or not if we find any emission. For this case, there are no emissions hidden in the noise floor.

**Below 1 GHz****Operation Mode:** Normal Link**Test Date:** March 1, 2018**Temperature:** 22°C**Tested by:** Jerry Chuang**Humidity:** 34% RH**Polarity:** Ver.

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant. Pol. (H/V) |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|-----------------|
| 297.2350        | 48.59          | -14.09                   | 34.50           | 46.02          | -11.52      | peak   | V               |
| 399.5700        | 46.77          | -11.40                   | 35.37           | 46.02          | -10.65      | peak   | V               |
| 494.6300        | 46.85          | -8.61                    | 38.24           | 46.02          | -7.78       | peak   | V               |
| 578.5350        | 35.31          | -7.19                    | 28.12           | 46.02          | -17.90      | peak   | V               |
| 672.6250        | 34.39          | -5.25                    | 29.14           | 46.02          | -16.88      | peak   | V               |
| 796.7850        | 32.30          | -3.44                    | 28.86           | 46.02          | -17.16      | peak   | V               |

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

Operation Mode: Normal Link

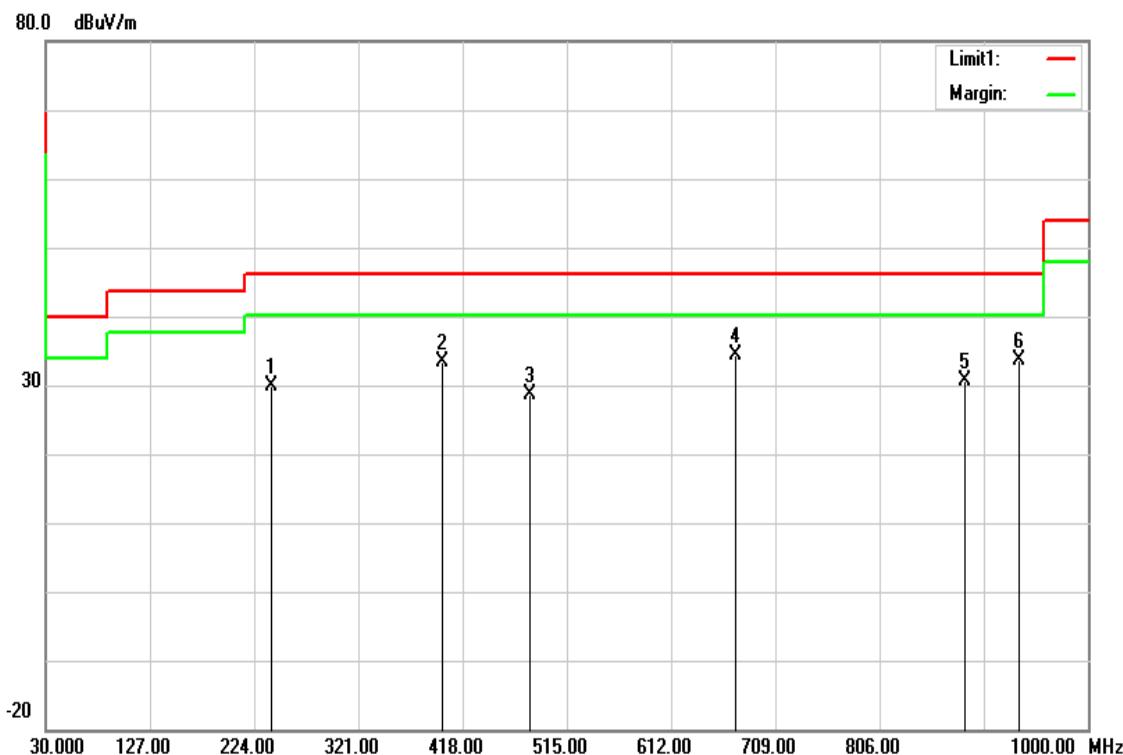
Test Date: March 1, 2018

Temperature: 22°C

Tested by: Jerry Chuang

Humidity: 34% RH

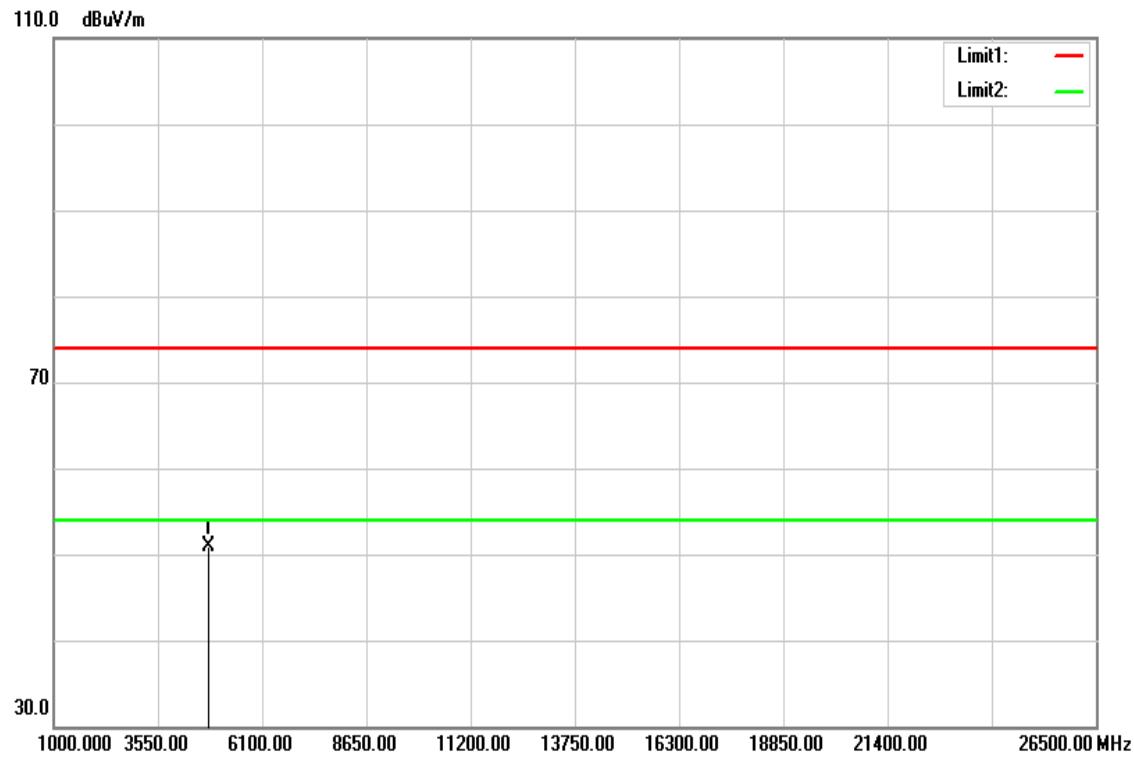
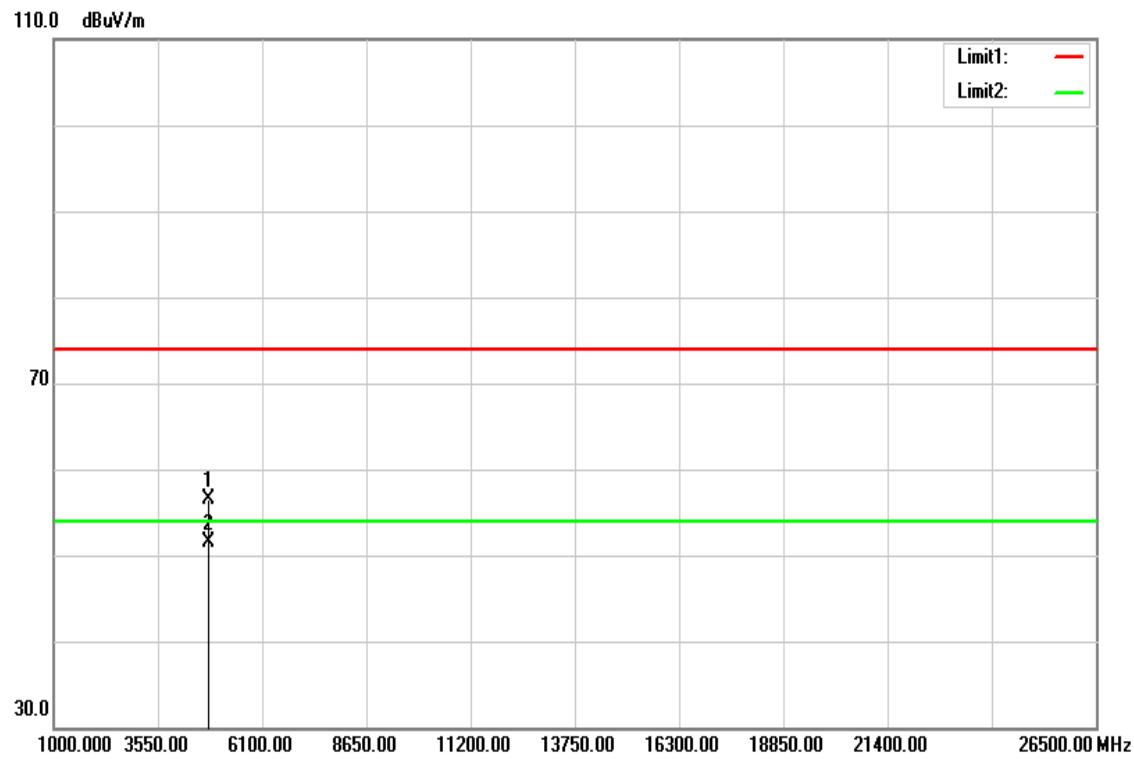
Polarity: Hor.



| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant. Pol. (H/V) |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|-----------------|
| 240.0050        | 45.99          | -16.13                   | 29.86           | 46.02          | -16.16      | peak   | H               |
| 399.0850        | 44.68          | -11.41                   | 33.27           | 46.02          | -12.75      | peak   | H               |
| 480.0800        | 37.47          | -8.94                    | 28.53           | 46.02          | -17.49      | peak   | H               |
| 672.6250        | 39.71          | -5.25                    | 34.46           | 46.02          | -11.56      | peak   | H               |
| 886.0250        | 32.81          | -2.25                    | 30.56           | 46.02          | -15.46      | peak   | H               |
| 935.9800        | 35.07          | -1.42                    | 33.65           | 46.02          | -12.37      | peak   | H               |

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

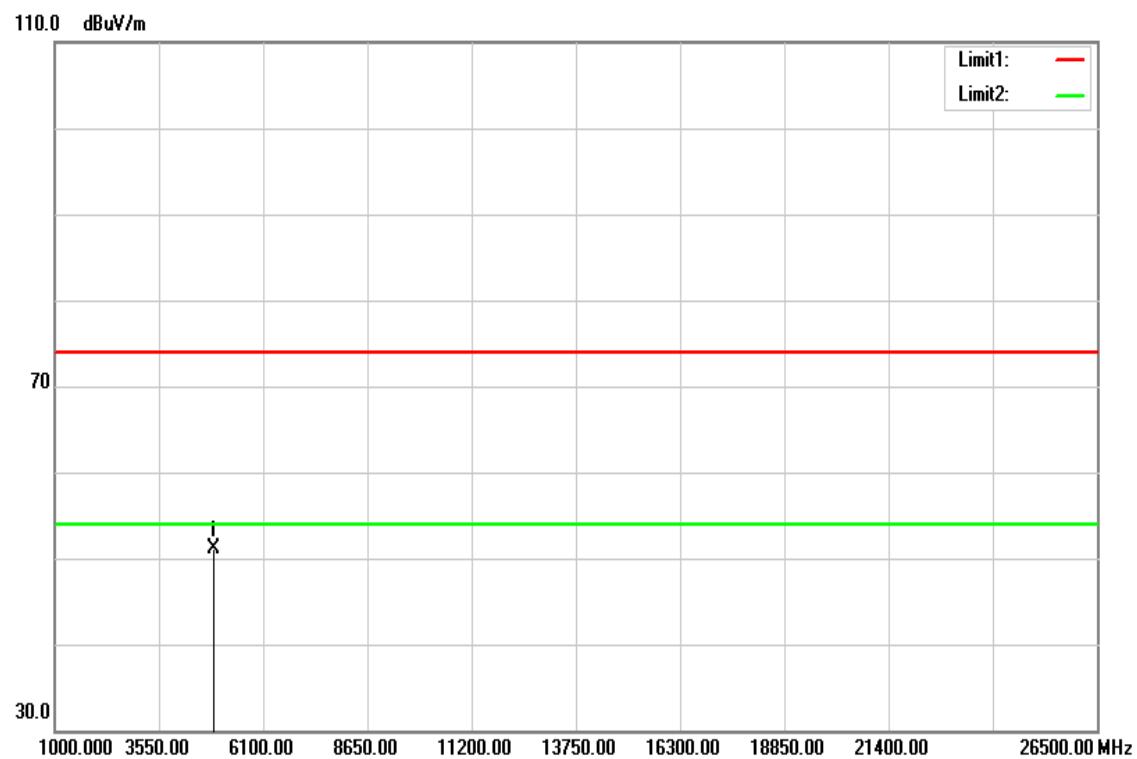
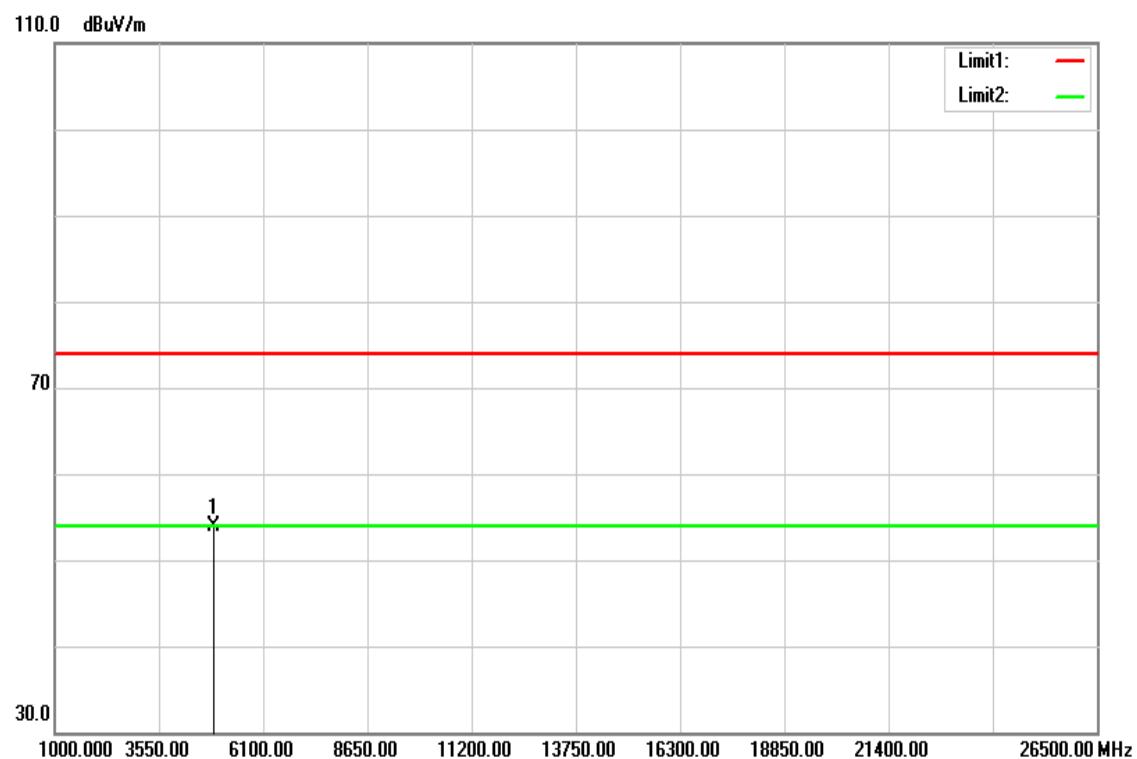
**Above 1 GHz****TX / CH Low****Polarity: Vertical****Polarity: Horizontal**

**Above 1 GHz****Operation Mode:** Tx / CH Low      **Test Date:** March 16, 2018**Temperature:** 22°C      **Tested by:** Jerry Chuang**Humidity:** 34% RH      **Polarity:** Ver. / Hor.

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|----------------|
| 4802.500        | 46.63          | 4.33                     | 50.96           | 74.00          | -23.04      | peak   | V              |
| N/A             |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
| 4802.500        | 52.22          | 4.33                     | 56.55           | 74.00          | -17.45      | peak   | H              |
| 4802.500        | 47.25          | 4.33                     | 51.58           | 54.00          | -2.42       | AVG    | H              |
| N/A             |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Result (dBuV/m) – limit (dBuV/m).

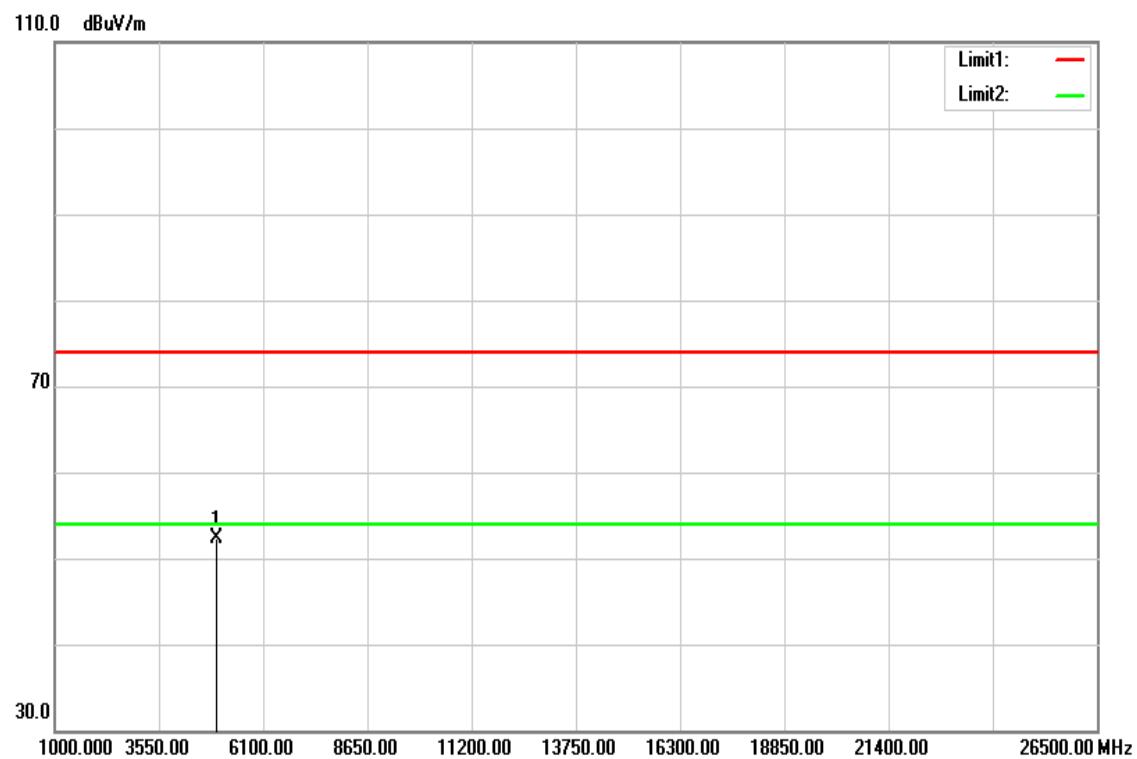
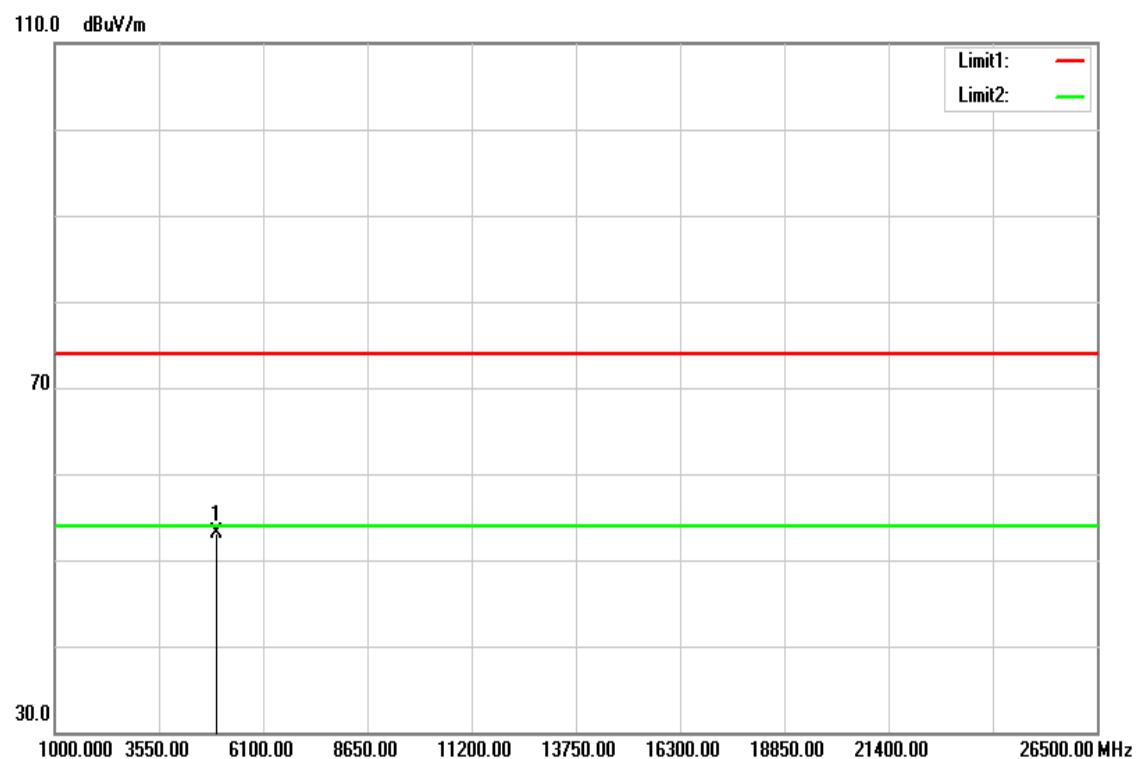
**TX / CH Mid****Polarity: Vertical****Polarity: Horizontal**

**Operation Mode:** Tx / CH Mid      **Test Date:** March 1, 2018  
**Temperature:** 22°C      **Tested by:** Jerry Chuang  
**Humidity:** 34% RH      **Polarity:** Ver. / Hor.

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|----------------|
| 4879.500        | 46.71          | 4.48                     | 51.19           | 74.00          | -22.81      | peak   | V              |
| N/A             |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
| 4879.500        | 49.49          | 4.48                     | 53.97           | 74.00          | -20.03      | peak   | H              |
| N/A             |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Result (dBuV/m) – limit (dBuV/m).

**TX / CH High****Polarity: Vertical****Polarity: Horizontal**

**Operation Mode:** Tx / CH High      **Test Date:** March 1, 2018  
**Temperature:** 22°C      **Tested by:** Jerry Chuang  
**Humidity:** 34% RH      **Polarity:** Ver. / Hor.

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|----------------|
| 4960.000        | 47.77          | 4.61                     | 52.38           | 74.00          | -21.62      | peak   | V              |
| N/A             |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
| 4960.000        | 48.45          | 4.61                     | 53.06           | 74.00          | -20.94      | peak   | H              |
| N/A             |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |
|                 |                |                          |                 |                |             |        |                |

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Result (dBuV/m) – limit (dBuV/m).

## 8.4 POWERLINE CONDUCTED EMISSIONS

### LIMIT

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency Range<br>(MHz) | Limits<br>(dB $\mu$ V) |           |
|--------------------------|------------------------|-----------|
|                          | 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        |

### Test Configuration

See test photographs attached in Appendix I for the actual connections between EUT and support equipment.

### TEST PROCEDURE

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.

## **TEST RESULTS**

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

### **Test Data**

**Not applicable, because EUT not connect to AC Main Source direct.**