# FCC Part 15C
# Measurement and Test Report

**For**

**Acrox Technologies Co., Ltd.**

**4F., No.89, Minshan St., Neihu Dist.,Taipei City 114, Taiwan, R.O.C**

**FCC ID: PRDMQQ**

| | |
|---|---|
| **FCC Rule(s):** | FCC Part 15.249 |
| **Product Description:** | USB RECEIVEER |
| **Tested Model:** | MQQ |
| **Report No.:** | WTX20X01004047W |
| **Sample Receipt Date:** | Jan.19, 2020 |
| **Tested Date:** | Jan.19, 2020 to Apr.07, 2020 |
| **Issued Date:** | Apr.07, 2020 |
| **Tested By:** | Mike Shi / Engineer |
| **Reviewed By:** | Lion Cai / RF Manager |
| **Approved & Authorized By:** | Silin Chen / Manager |

**Prepared By:**

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## Report version

| Version No. | Date of issue | Description |
|---|---|---|
| Rev.00 | Apr.07, 2020 | Original |
| / | / | / |

# 1. GENERAL INFORMATION

## 1.1 Product Description for Equipment Under Test (EUT)

**Client Information**

| | |
|---|---|
| Applicant: | Acrox Technologies Co., Ltd. |
| Address of applicant: | 4F., No.89, Minshan St., Neihu Dist.,Taipei City 114, Taiwan, R.O.C |
| Manufacturer: | Acrox Technologies Co., Ltd. |
| Address of manufacturer: | Hsinmin Industria,Changan Town,Dongguan City, Guangdong,China |

| **General Description of EUT** | |
|---|---|
| Product Name: | USB RECEIVEER |
| Trade Name: | / |
| Model No.: | MQQ |
| Adding Model(s): | / |
| Rated Voltage: | DC5V |
| Power Adapter Model: | / |
| Firmware Version: | V107 |
| Hardware Version: | V1.0 |
| | |
| *Note: The test data is gathered from a production sample, provided by the manufacturer.* | |

| **Technical Characteristics of EUT** | |
|---|---|
| Frequency Range: | 2402MHz-2480MHz |
| Max. Field Strength: | 95.98dBuV/m |
| Modulation: | GFSK |
| Antenna Type: | PCB Antenna |
| Antenna Gain: | -5dBi |

➢ Center Frequency of Each of Channel:

| Channel | Frequency (MHz) |
|---|---|
| 00 | 2402 |
| 01 | 2403 |
| ⋮ | ⋮ |
| 33 | 2435 |
| 34 | 2436 |
| ⋮ | ⋮ |
| 78 | 2480 |

## 1.2 Test Standards

The tests were performed according to following standards:

**FCC Rules Part 15.249:** Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz.

**ANSI C63.10-2013:** American National Standard for Testing Unlicensed Wireless Devices.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013,
The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

## 1.4 Test Facility

**Address of the test laboratory**

Laboratory: Shenzhen SEM Test Technology Co., Ltd.

Address: 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C. (518101）

**FCC – Registration No.: 125990**

Shenzhen SEM Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintain ed in our files. The Designation Number is CN5010, and Test Firm Registration Number is 125990.

**Industry Canada (IC) Registration No.: 11464A**

The 3m Semi-anechoic chamber of Shenzhen SEM Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

## 1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

| **Test Mode List** | | |
|---|---|---|
| Test Mode | Description | Remark |
| TM1 | Low Channel | 2402MHz |
| TM2 | Middle Channel | 2441MHz |
| TM3 | High Channel | 2480MHz |

| **Test Conditions** | |
|---|---|
| Temperature: | 22~25 °C |
| Relative Humidity: | 50~55 %. |
| ATM Pressure: | 1019 mbar |

| **EUT Cable List and Details** | | | |
|---|---|---|---|
| Cable Description | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| / | / | / | / |

| **Special Cable List and Details** | | | |
|---|---|---|---|
| Cable Description | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| / | / | / | / |

| **Auxiliary Equipment List and Details** | | | |
|---|---|---|---|
| Description | Manufacturer | Model | Serial Number |
| Computer | Lenovo | ThinkPad Edge E445 | / |

## 1.6 Measurement Uncertainty

| **Measurement uncertainty** | | |
|---|---|---|
| Parameter | Conditions | Uncertainty |
| RF Output Power | Conducted | ±0.42dB |
| Occupied Bandwidth | Conducted | ±1.5% |
| Conducted Spurious Emission | Conducted | ±2.17dB |
| Conducted Emissions | Conducted | 9-150kHz ±3.74dB |
| | | 0.15-30MHz ±3.34dB |
| Transmitter Spurious Emissions | Radiated | 30-200MHz ±4.52dB |
| | | 0.2-1GHz ±5.56dB |
| | | 1-6GHz ±3.84dB |
| | | 6-18GHz ±3.92dB |

## 1.7 Test Equipment List and Details

| No. | Description | Manufacturer | Model | Serial No. | Cal Date | Due Date |
|---|---|---|---|---|---|---|
| SEMT-1072 | Spectrum Analyzer | Agilent | E4407B | MY41440400 | 2019-04-30 | 2020-04-29 |
| SEMT-1031 | Spectrum Analyzer | Rohde & Schwarz | FSP30 | 836079/035 | 2019-04-30 | 2020-04-29 |
| SEMT-1007 | EMI Test Receiver | Rohde & Schwarz | ESVB | 825471/005 | 2019-04-30 | 2020-04-29 |
| SEMT-1008 | Amplifier | Agilent | 8447F | 3113A06717 | 2019-04-30 | 2020-04-29 |
| SEMT-1043 | Amplifier | C&D | PAP-1G18 | 2002 | 2019-04-30 | 2020-04-29 |
| SEMT-1011 | Broadband Antenna | Schwarz beck | VULB9163 | 9163-333 | 2019-05-05 | 2021-05-04 |
| SEMT-1042 | Horn Antenna | ETS | 3117 | 00086197 | 2019-05-05 | 2021-05-04 |
| SEMT-1121 | Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170582 | 2019-05-05 | 2021-05-04 |
| SEMT-1069 | Loop Antenna | Schwarz beck | FMZB 1516 | 9773 | 2019-05-05 | 2021-05-04 |
| SEMT-1001 | EMI Test Receiver | Rohde & Schwarz | ESPI | 101611 | 2019-04-30 | 2020-04-29 |
| SEMT-1003 | L.I.S.N | Schwarz beck | NSLK8126 | 8126-224 | 2019-04-30 | 2020-04-29 |
| SEMT-1002 | Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100911 | 2019-04-30 | 2020-04-29 |
| SEMT-1168 | Pre-amplifier | Direction Systems Inc. | PAP-0126 | 14141-12838 | 2019-04-30 | 2020-04-29 |
| SEMT-1169 | Pre-amplifier | Direction Systems Inc. | PAP-2640 | 14145-14153 | 2019-04-30 | 2020-04-29 |
| SEMT-1163 | Spectrum Analyzer | Rohde & Schwarz | FSP40 | 100612 | 2019-04-30 | 2020-04-29 |
| SEMT-1170 | DRG Horn Antenna | A.H. SYSTEMS | SAS-574 | 571 | 2019-05-05 | 2021-05-04 |
| SEMT-1166 | Power Limiter | Agilent | N9356B | MY45450376 | 2019-04-30 | 2020-04-29 |
| SEMT-1048 | RF Limiter | ATTEN | AT-BSF-2400~2500 | / | 2019-04-30 | 2020-04-29 |
| SEMT-1076 | RF Switcher | Top Precision | RCS03-A2 | / | 2019-04-30 | 2020-04-29 |
| SEMT-C001 | Cable | Zheng DI | LL142-07-07-10M(A) | / | 2020-03-17 | 2021-03-16 |
| SEMT-C002 | Cable | Zheng DI | ZT40-2.92J-2.92J-6M | / | 2020-03-17 | 2021-03-16 |
| SEMT-C003 | Cable | Zheng DI | ZT40-2.92J-2.92J-2.5M | / | 2020-03-17 | 2021-03-16 |
| SEMT-C004 | Cable | Zheng DI | 2M0RFC | / | 2020-03-17 | 2021-03-16 |
| SEMT-C005 | Cable | Zheng DI | 1M0RFC | / | 2020-03-17 | 2021-03-16 |
| SEMT-C006 | Cable | Zheng DI | 1M0RFC | / | 2020-03-17 | 2021-03-16 |

| Software List | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Version** |
| EMI Test Software (Radiated Emission)* | Farad | EZ-EMC | RA-03A1 |
| EMI Test Software (Conducted Emission)* | Farad | EZ-EMC | RA-03A1 |

*Remark: indicates software version used in the compliance certification testing

# 2. SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test Item | Result |
|---|---|---|
| §15.203 | Antenna Requirement | Compliant |
| §15.205 | Restricted Band of Operation | Compliant |
| §15.207(a) | Conducted Emission | Compliant |
| §15.209(a)(f) | Radiated Spurious Emissions | Compliant |
| §15.249(a) | Field Strength of Emissions | Compliant |
| §15.249(d) | Out of Band Emission | Compliant |
| §15.215(c) | Emission Bandwidth | Compliant |

# 3. Antenna Requirements

## 3.1 Standard Applicable

According to FCC Part 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

## 3.2 Test Result

This product has a PCB antenna, fulfill the requirement of this section.

# 4. Radiated Emissions

## 4.1 Standard Applicable

According to §15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

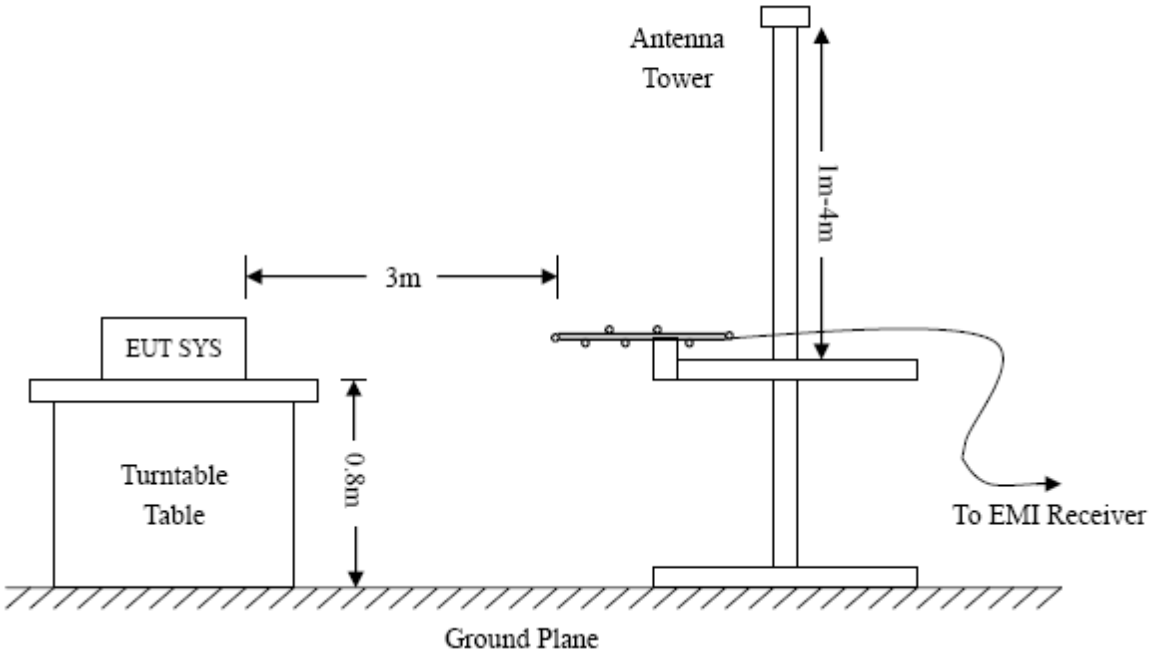
| Fundamental Frequency | Field strength of fundamental (milli-volts/meter) | Field strength of Harmonics (micro-volts/meter) |
|---|---|---|
| 902-928 MHz | 50 | 500 |
| 2400-2483.5 MHz | 50 | 500 |
| 5725-5875 MHz | 50 | 500 |
| 24.0-24.25 GHz | 250 | 2500 |

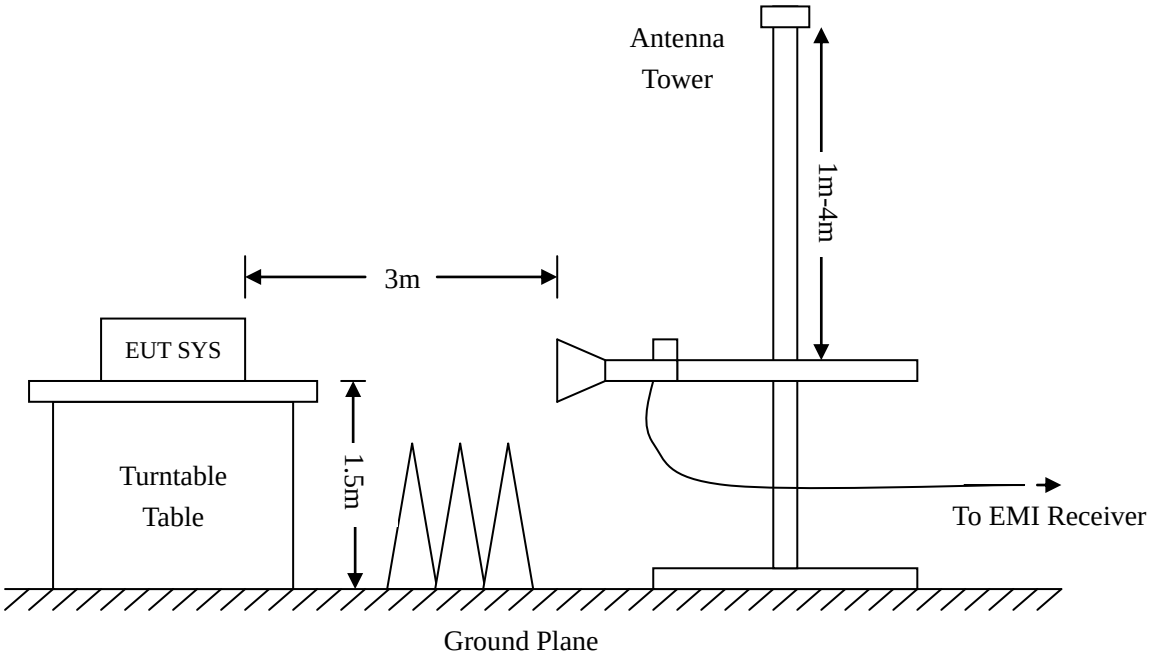
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

## 4.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.249(a) and FCC Part 15.209 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.




| | | |
|---|---|---|
| Frequency :9kHz-30MHz | Frequency :30MHz-1GHz | Frequency :Above 1GHz |
| RBW=10KHz, | RBW=120KHz, | RBW=1MHz, |
| VBW =30KHz | VBW=300KHz | VBW=3MHz(Peak), 10Hz(AV) |
| Sweep time= Auto | Sweep time= Auto | Sweep time= Auto |
| Trace = max hold | Trace = max hold | Trace = max hold |
| Detector function = peak | Detector function = peak, QP | Detector function = peak, AV |

## 4.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

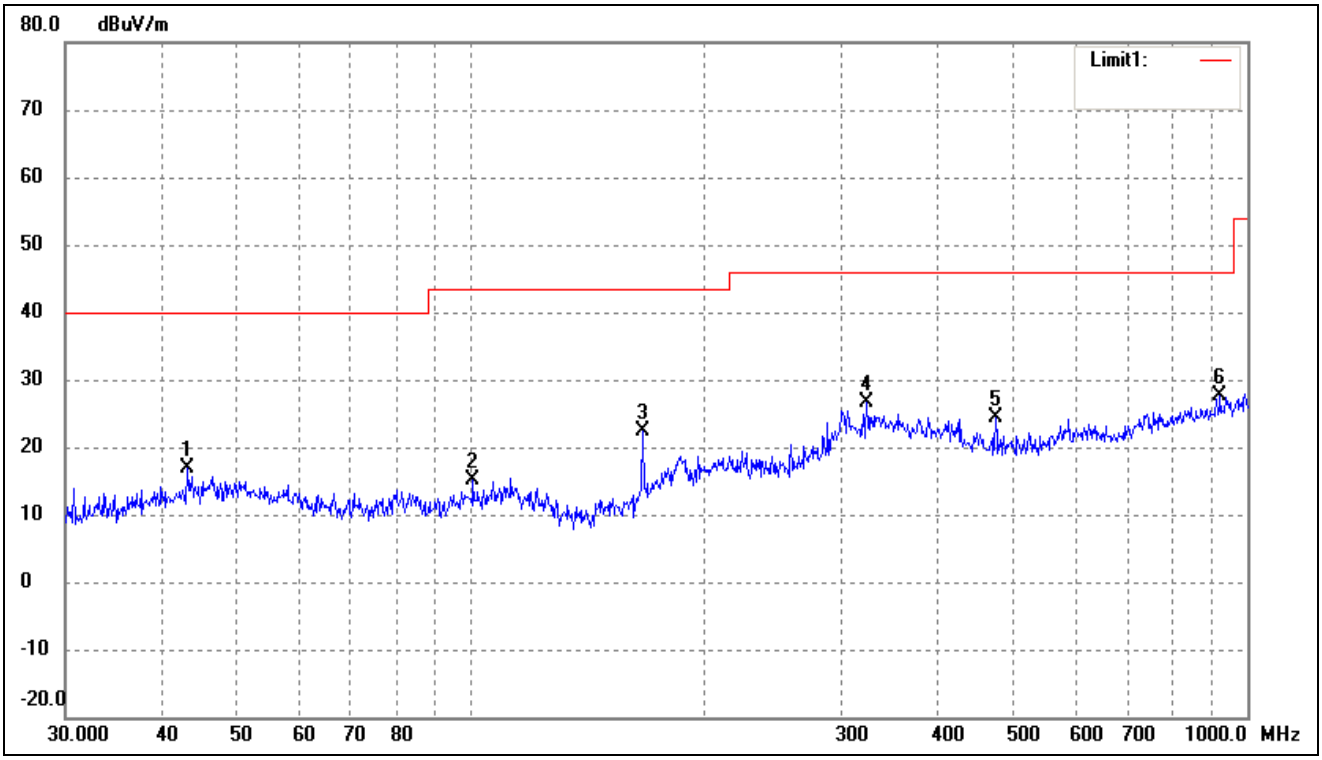
Margin = Corr. Ampl. – FCC Part 15C Limit

## 4.4 Summary of Test Results/Plots

*Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*

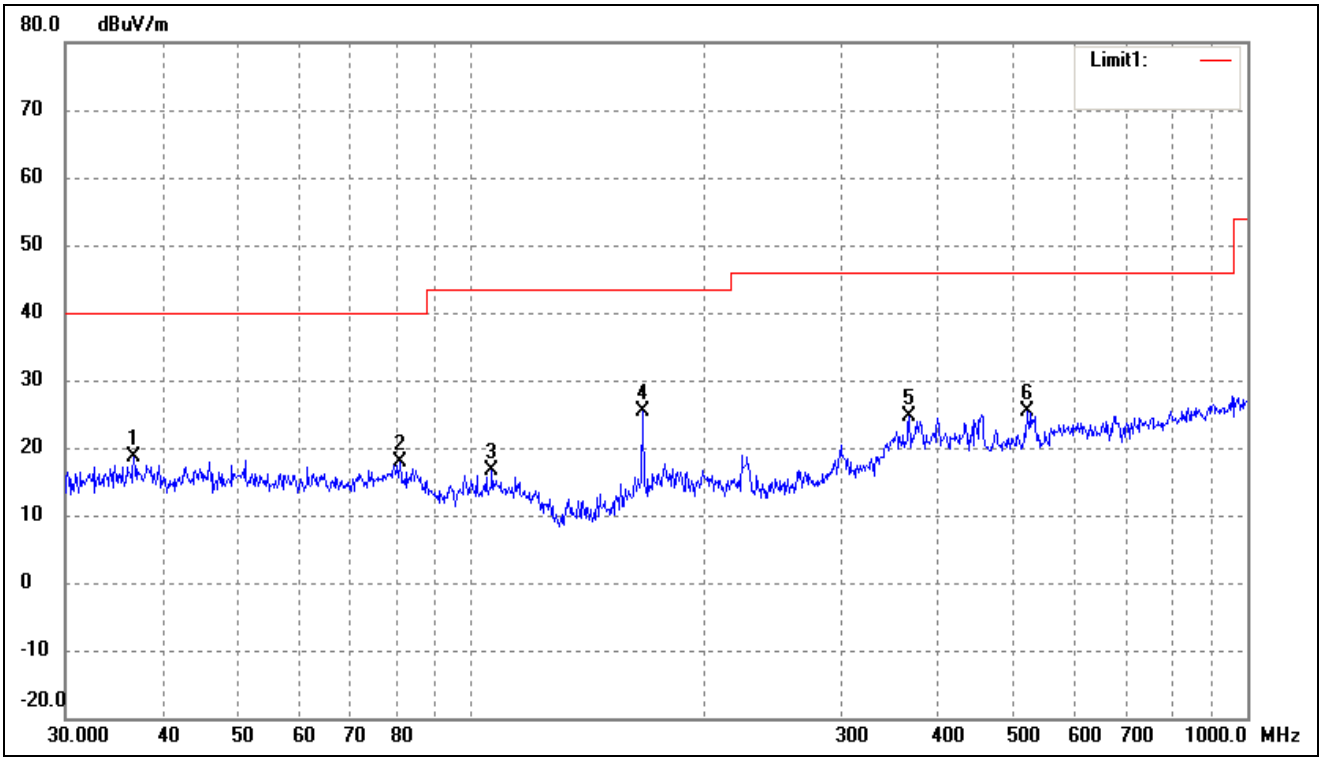
➢ Spurious Emissions Below 1GHz

| Test Channel | Low | Polarity: | Horizontal |
|---|---|---|---|



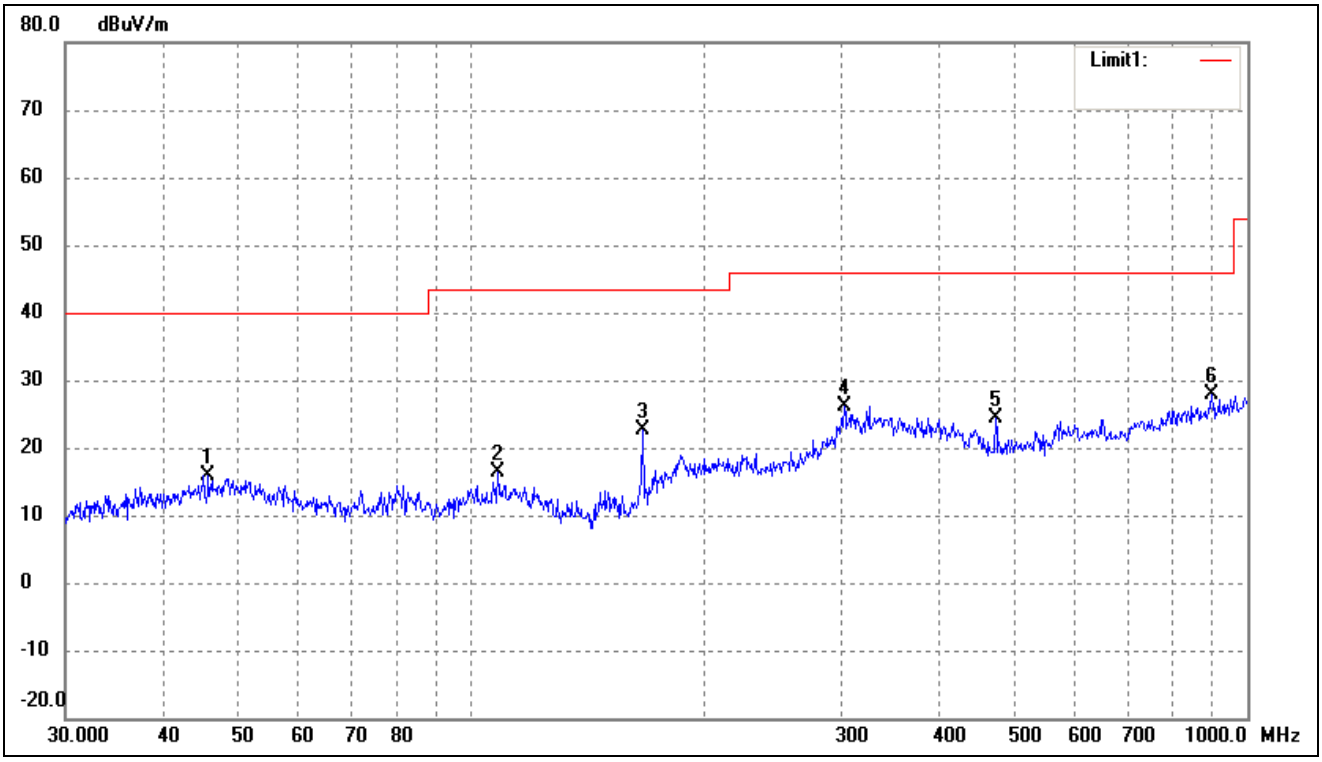

| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ) | (cm) | |
| 1 | 43.0505 | 28.68 | -11.80 | 16.88 | 40.00 | -23.12 | 228 | 100 | peak |
| 2 | 100.5806 | 28.22 | -13.17 | 15.05 | 43.50 | -28.45 | 179 | 100 | peak |
| 3 | 166.0680 | 37.53 | -15.12 | 22.41 | 43.50 | -21.09 | 64 | 100 | peak |
| 4 | 323.3204 | 35.94 | -9.36 | 26.58 | 46.00 | -19.42 | 326 | 100 | peak |
| 5 | 473.8347 | 30.86 | -6.60 | 24.26 | 46.00 | -21.74 | 176 | 100 | peak |
| 6 | 922.5157 | 27.96 | -0.23 | 27.73 | 46.00 | -18.27 | 193 | 100 | peak |

| Test Channel | Low | Polarity: | Vertical |
|---|---|---|---|



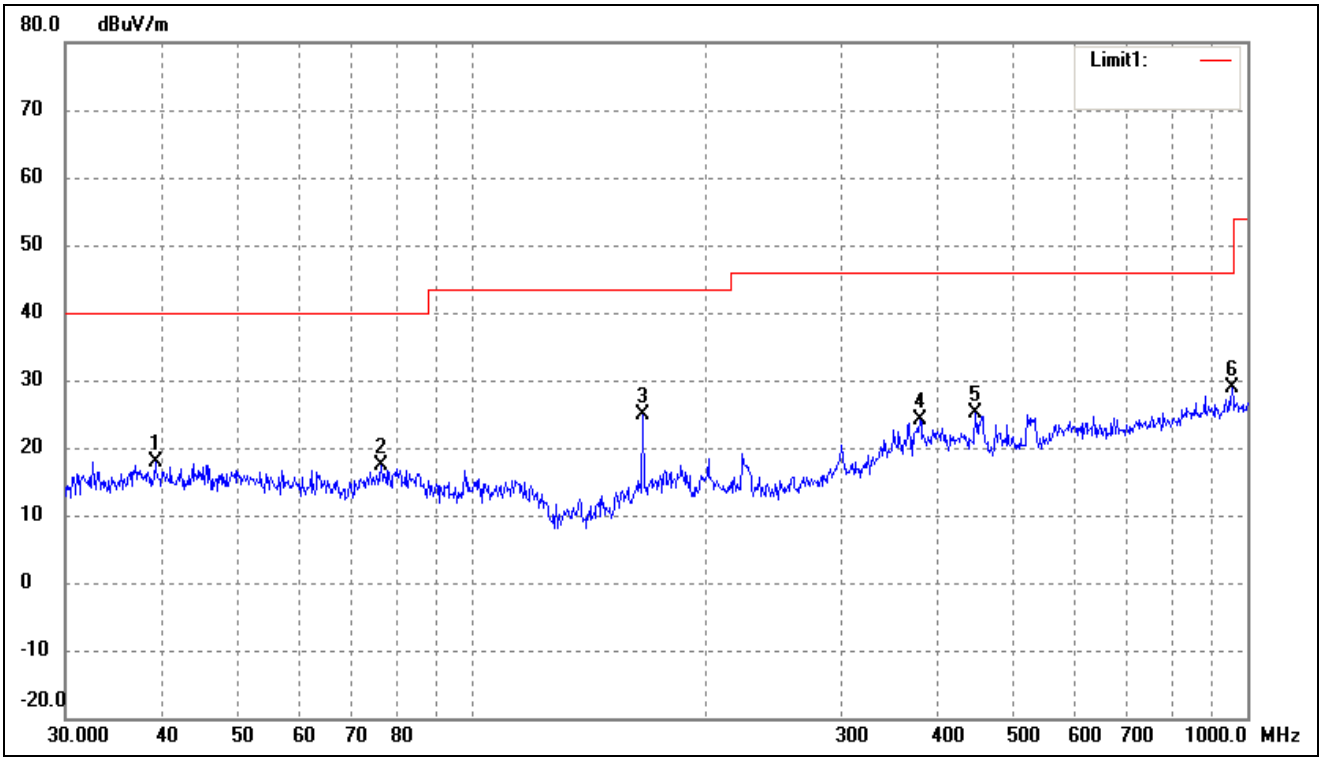

| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ) | (cm) | |
| 1 | 36.7662 | 31.75 | -13.05 | 18.70 | 40.00 | -21.30 | 199 | 100 | peak |
| 2 | 80.9275 | 33.35 | -15.50 | 17.85 | 40.00 | -22.15 | 206 | 100 | peak |
| 3 | 106.3850 | 29.60 | -13.08 | 16.52 | 43.50 | -26.98 | 84 | 100 | peak |
| 4 | 166.0680 | 40.49 | -15.12 | 25.37 | 43.50 | -18.13 | 334 | 100 | peak |
| 5 | 366.8231 | 32.38 | -7.74 | 24.64 | 46.00 | -21.36 | 198 | 100 | peak |
| 6 | 520.8882 | 31.52 | -6.14 | 25.38 | 46.00 | -20.62 | 282 | 100 | peak |

| Test Channel | Middle | Polarity: | Horizontal |
|---|---|---|---|



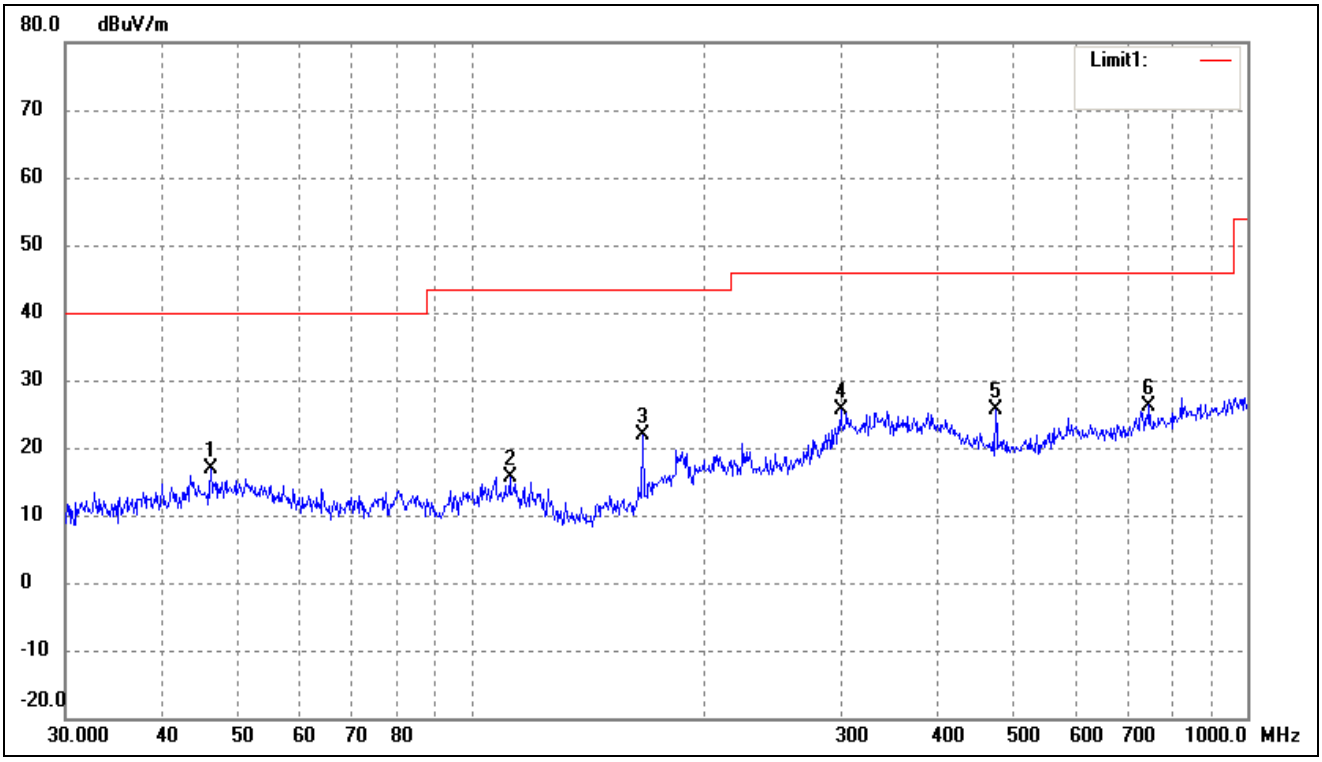

| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ) | (cm) | |
| 1 | 45.8553 | 27.14 | -11.28 | 15.86 | 40.00 | -24.14 | 93 | 100 | peak |
| 2 | 108.2667 | 29.52 | -13.05 | 16.47 | 43.50 | -27.03 | 136 | 100 | peak |
| 3 | 166.0680 | 37.77 | -15.12 | 22.65 | 43.50 | -20.85 | 143 | 100 | peak |
| 4 | 302.4812 | 35.34 | -9.24 | 26.10 | 46.00 | -19.90 | 147 | 100 | peak |
| 5 | 473.8347 | 31.07 | -6.60 | 24.47 | 46.00 | -21.53 | 151 | 100 | peak |
| 6 | 900.1474 | 28.55 | -0.57 | 27.98 | 46.00 | -18.02 | 117 | 100 | peak |

| Test Channel | Middle | Polarity: | Vertical |
|---|---|---|---|



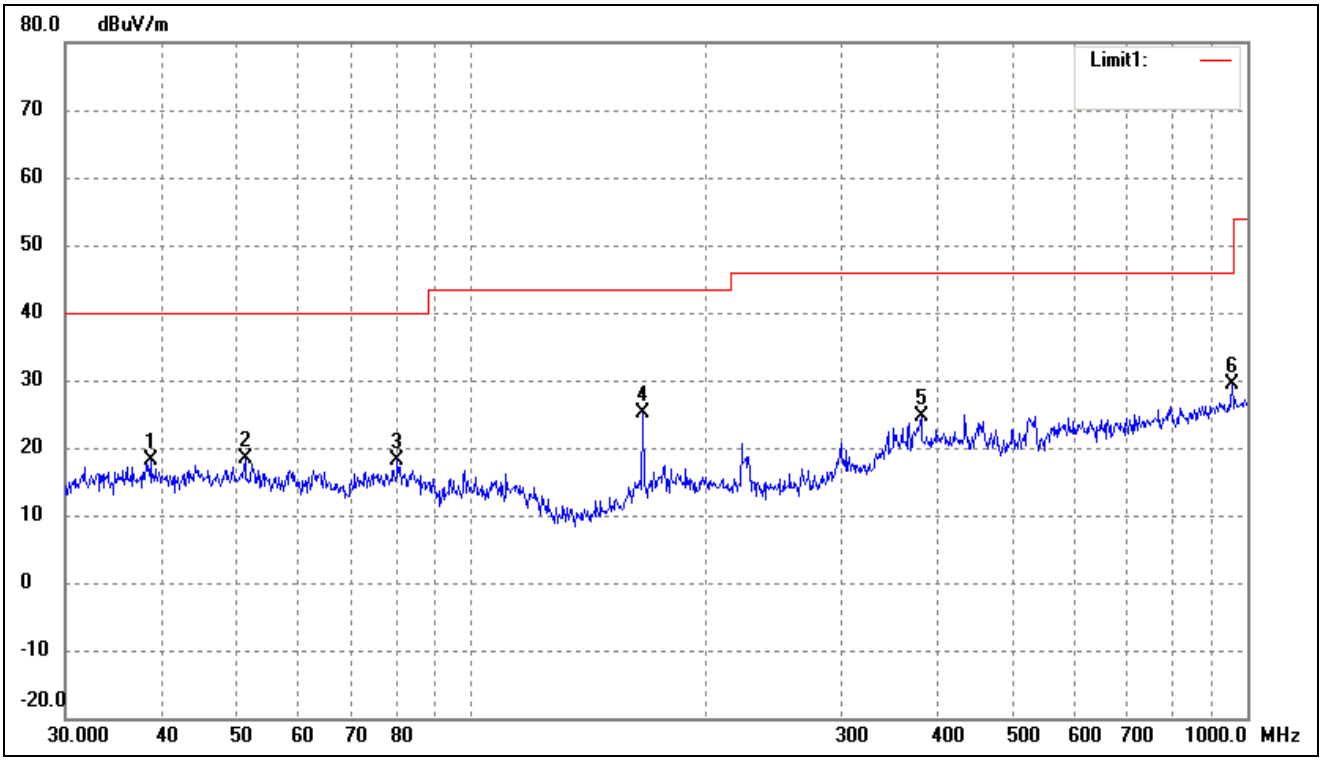

| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ) | (cm) | |
| 1 | 39.1616 | 30.52 | -12.65 | 17.87 | 40.00 | -22.13 | 302 | 100 | peak |
| 2 | 76.5121 | 32.73 | -15.25 | 17.48 | 40.00 | -22.52 | 93 | 100 | peak |
| 3 | 166.0680 | 40.05 | -15.12 | 24.93 | 43.50 | -18.57 | 332 | 100 | peak |
| 4 | 378.5843 | 31.66 | -7.56 | 24.10 | 46.00 | -21.90 | 109 | 100 | peak |
| 5 | 446.4141 | 31.40 | -6.31 | 25.09 | 46.00 | -20.91 | 172 | 100 | peak |
| 6 | 955.4381 | 28.76 | 0.13 | 28.89 | 46.00 | -17.11 | 113 | 100 | peak |

| Test Channel | High | Polarity: | Horizontal |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ) | (cm) | |
| 1 | 46.1780 | 28.12 | -11.26 | 16.86 | 40.00 | -23.14 | 285 | 100 | peak |
| 2 | 112.1305 | 28.94 | -13.26 | 15.68 | 43.50 | -27.82 | 96 | 100 | peak |
| 3 | 166.0680 | 36.98 | -15.12 | 21.86 | 43.50 | -21.64 | 238 | 100 | peak |
| 4 | 299.3158 | 34.88 | -9.26 | 25.62 | 46.00 | -20.38 | 104 | 100 | peak |
| 5 | 473.8347 | 32.20 | -6.60 | 25.60 | 46.00 | -20.40 | 174 | 100 | peak |
| 6 | 747.4826 | 28.94 | -2.69 | 26.25 | 46.00 | -19.75 | 141 | 100 | peak |

| Test Channel | High | Polarity: | Vertical |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ) | (cm) | |
| 1 | 38.6161 | 30.77 | -12.73 | 18.04 | 40.00 | -21.96 | 140 | 100 | peak |
| 2 | 51.1209 | 29.75 | -11.25 | 18.50 | 40.00 | -21.50 | 244 | 100 | peak |
| 3 | 80.3619 | 33.58 | -15.48 | 18.10 | 40.00 | -21.90 | 87 | 100 | peak |
| 4 | 166.0680 | 40.32 | -15.12 | 25.20 | 43.50 | -18.30 | 165 | 100 | peak |
| 5 | 379.9141 | 32.13 | -7.56 | 24.57 | 46.00 | -21.43 | 256 | 100 | peak |
| 6 | 955.4381 | 29.20 | 0.13 | 29.33 | 46.00 | -16.67 | 276 | 100 | peak |

*Spurious Emissions Above 1GHz*

| Frequency | Reading | Correct | Result | Limit | Margin | Polar | Detector |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | H/V | |
| Low Channel-2402MHz | | | | | | | |
| 2402 | 105.45 | -9.47 | 95.98 | 114 | -18.02 | H | PK |
| 2402 | 101.36 | -9.47 | 91.89 | 94 | -2.11 | H | AV |
| 4804 | 63.09 | -5.87 | 57.22 | 74 | -16.78 | H | PK |
| 4804 | 45.78 | -5.87 | 39.91 | 54 | -14.09 | H | AV |
| 7206 | 50.68 | -0.54 | 50.14 | 74 | -23.86 | H | PK |
| 7206 | 40.51 | -0.54 | 39.97 | 54 | -14.03 | H | AV |
| 2402 | 91.95 | -9.47 | 82.48 | 114 | -31.52 | V | PK |
| 2402 | 85.31 | -9.47 | 75.84 | 94 | -18.16 | V | AV |
| 4804 | 62.45 | -5.87 | 56.58 | 74 | -17.42 | V | PK |
| 4804 | 44.31 | -5.87 | 38.44 | 54 | -15.56 | V | AV |
| 7206 | 47.39 | -0.54 | 46.85 | 74 | -27.15 | V | PK |
| 7206 | 40.78 | -0.54 | 40.24 | 54 | -13.76 | V | AV |
| Middle Channel-2441MHz | | | | | | | |
| 2441 | 103.95 | -9.41 | 94.54 | 114 | -19.46 | H | PK |
| 2441 | 100.83 | -9.41 | 91.42 | 94 | -2.58 | H | AV |
| 4882 | 64.38 | -5.48 | 58.90 | 74 | -15.10 | H | PK |
| 4882 | 43.22 | -5.48 | 37.74 | 54 | -16.26 | H | AV |
| 7323 | 50.70 | -0.64 | 50.06 | 74 | -23.94 | H | PK |
| 7323 | 38.29 | -0.64 | 37.65 | 54 | -16.35 | H | AV |
| 2441 | 86.98 | -9.41 | 77.57 | 114 | -36.43 | V | PK |
| 2441 | 86.13 | -9.41 | 76.72 | 94 | -17.28 | V | AV |
| 4882 | 61.61 | -5.48 | 56.13 | 74 | -17.87 | V | PK |
| 4882 | 46.44 | -5.48 | 40.96 | 54 | -13.04 | V | AV |
| 7323 | 50.00 | -0.64 | 49.36 | 74 | -24.64 | V | PK |
| 7323 | 39.47 | -0.64 | 38.83 | 54 | -15.17 | V | AV |

| Frequency | Reading | Correct | Result | Limit | Margin | Polar | Detector |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | H/V | |
| Low Channel-2480MHz | | | | | | | |
| 2480 | 104.99 | -9.32 | 95.67 | 114 | -18.33 | H | PK |
| 2480 | 100.19 | -9.32 | 90.87 | 94 | -3.13 | H | AV |
| 4960 | 64.41 | -5.52 | 58.89 | 74 | -15.11 | H | PK |
| 4960 | 46.83 | -5.52 | 41.31 | 54 | -12.69 | H | AV |
| 7440 | 52.25 | -0.68 | 51.57 | 74 | -22.43 | H | PK |
| 7440 | 40.09 | -0.68 | 39.41 | 54 | -14.59 | H | AV |
| 2480 | 89.33 | -9.32 | 80.01 | 114 | -33.99 | V | PK |
| 2480 | 86.08 | -9.32 | 76.76 | 94 | -17.24 | V | AV |
| 4960 | 62.82 | -5.52 | 57.30 | 74 | -16.70 | V | PK |
| 4960 | 43.24 | -5.52 | 37.72 | 54 | -16.28 | V | AV |
| 7440 | 49.48 | -0.68 | 48.80 | 74 | -25.20 | V | PK |
| 7440 | 41.55 | -0.68 | 40.87 | 54 | -13.13 | V | AV |

*Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5$^{th}$ Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
*The measurements greater than 20dB below the limit from 9kHz to 30MHz..*

# 5. Out of Band Emissions

## 5.1 Standard Applicable

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, whichever is the lesser attenuation.

## 5.2 Test Procedure

As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2483.5MHz, than mark the higher-level emission for comparing with the FCC rules.

## 5.3 Summary of Test Results/Plots

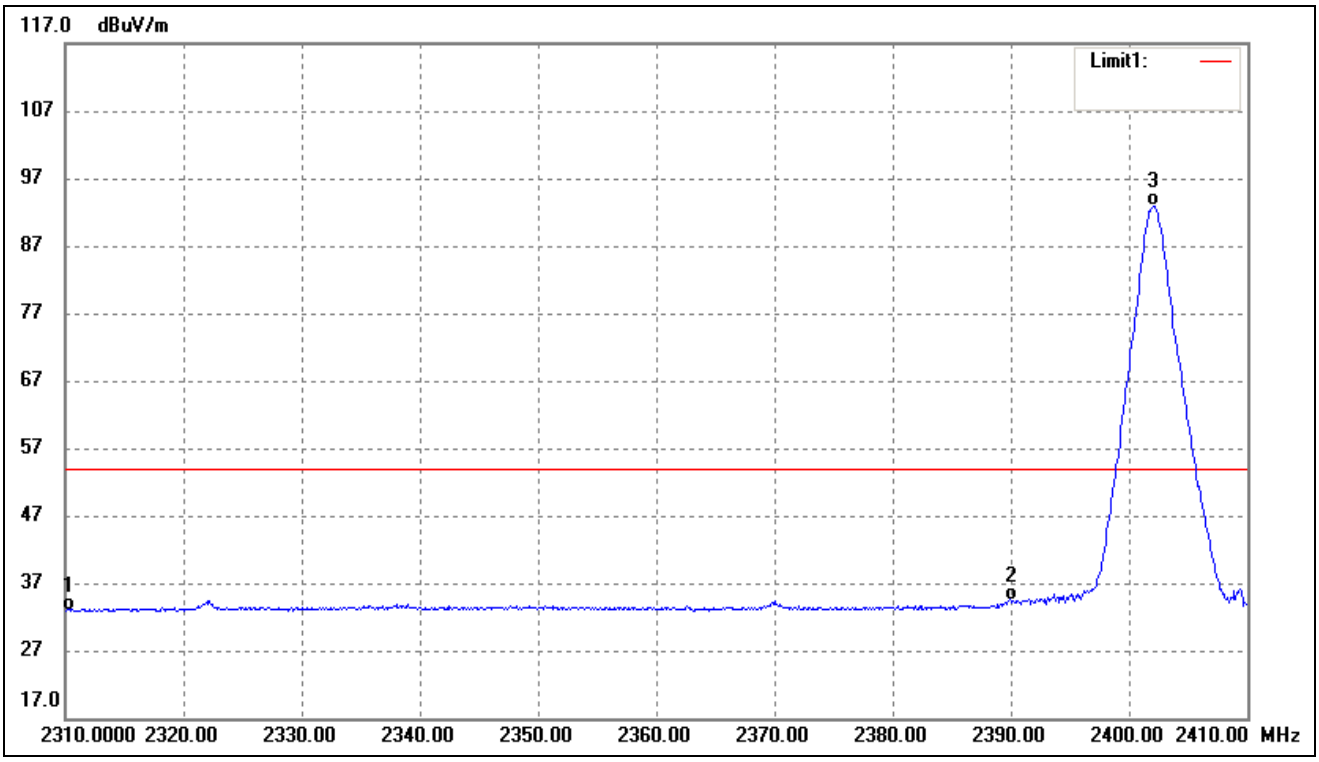
| Test mode | Frequency | Limit | Result |
|---|---|---|---|
| | MHz | dBuV / dBc | |
| Lowest | 2310.00 | <54 dBuV | Pass |
| | 2390.00 | <54 dBuV | Pass |
| | 2400.00 | <54 dBuV | Pass |
| Highest | 2483.50 | <54 dBuV | Pass |
| | 2500.00 | <54 dBuV | Pass |

The edge emissions are below the FCC 15.209 Limits or complies with the 15.249 requirements.

Please refer to the test plots as below.

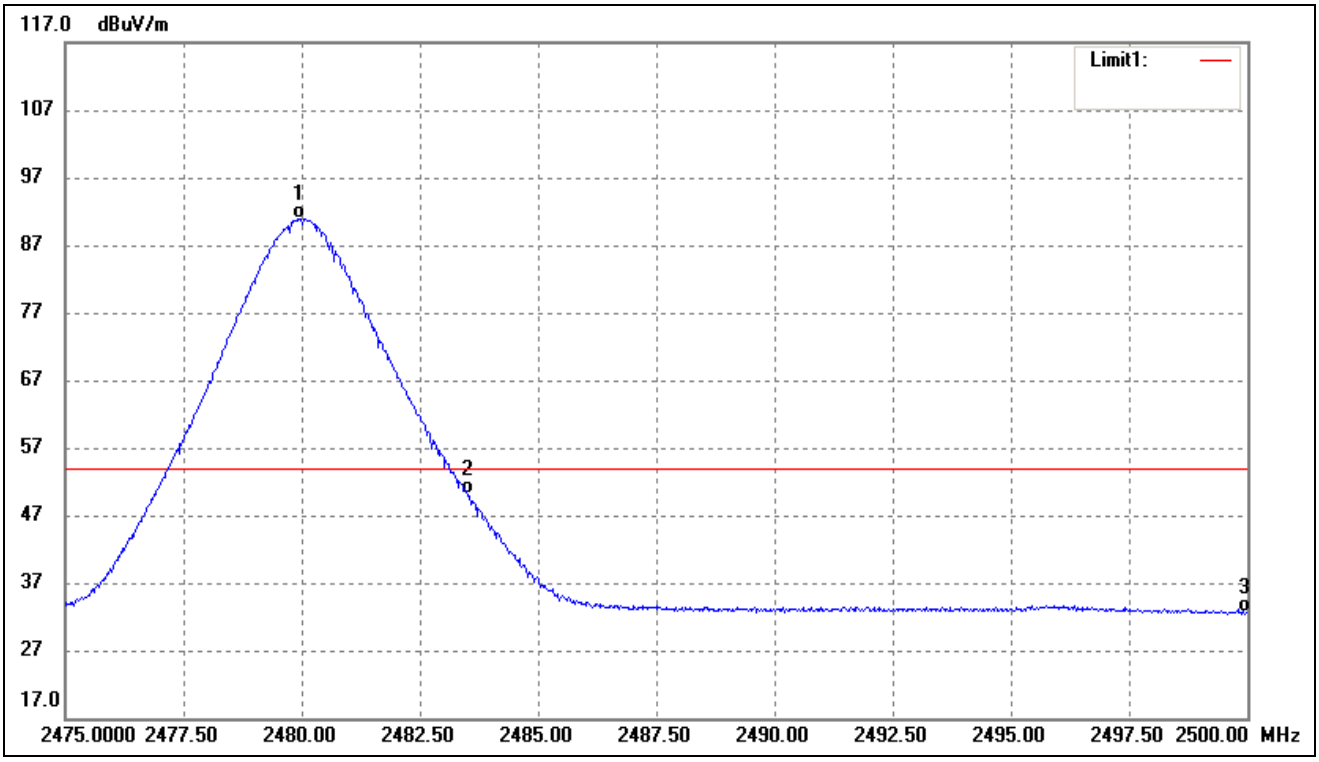
➢ Restricted Band

| Test Channel | Low | Polarity: | Horizontal (worst case) |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2310.000 | 42.63 | -9.66 | 32.97 | 54.00 | -21.03 | Ave Detector |
| | 2310.000 | 54.56 | -9.66 | 44.90 | 74.00 | -29.10 | Peak Detector |
| 2 | 2390.000 | 43.77 | -9.50 | 34.27 | 54.00 | -19.73 | Ave Detector |
| | 2390.000 | 71.88 | -9.50 | 62.38 | 74.00 | -11.62 | Peak Detector |
| 3 | 2402.100 | 101.36 | -9.47 | 91.89 | / | / | Ave Detector |
| | 2402.300 | 105.45 | -9.47 | 95.98 | / | / | Peak Detector |

| Test Channel | High | Polarity: | Horizontal (worst case) |
|---|---|---|---|

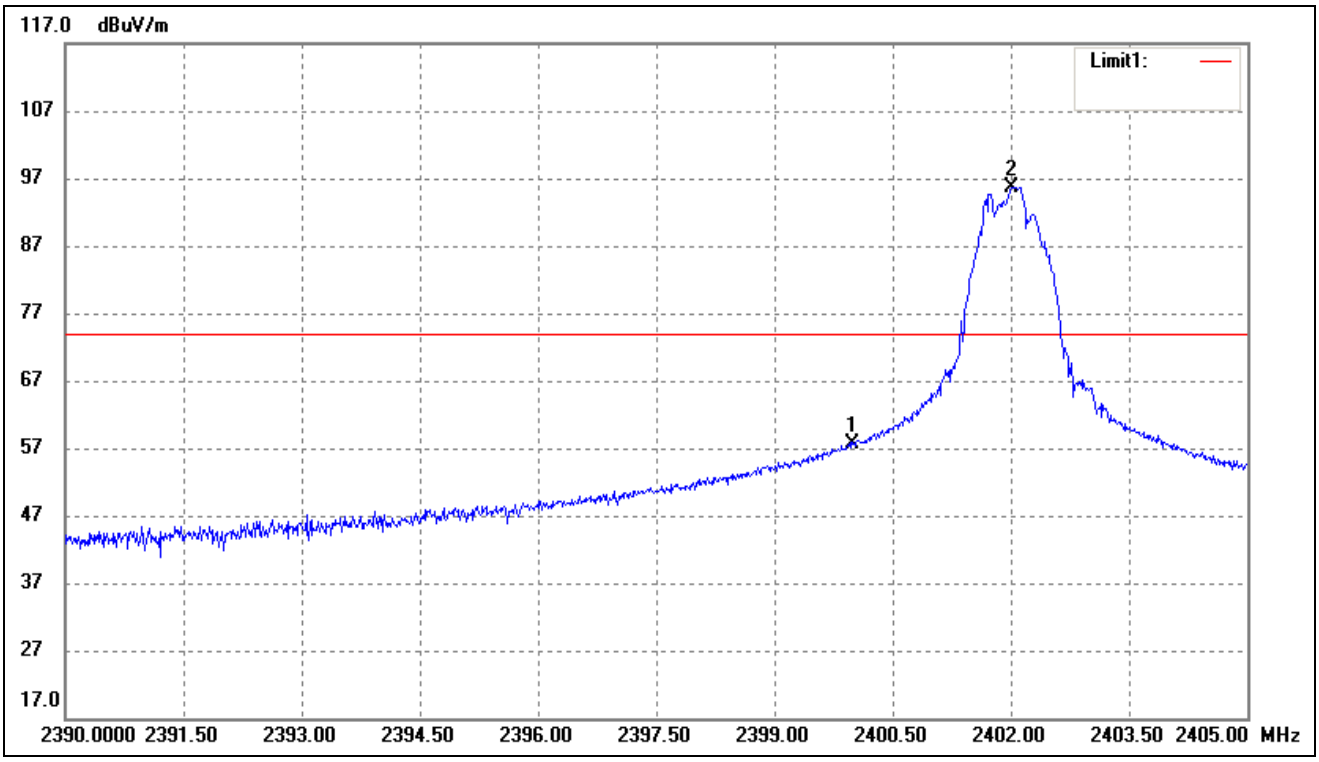



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2479.950 | 100.19 | -9.32 | 90.87 | / | / | Ave Detector |
| | 2480.450 | 104.99 | -9.32 | 95.67 | / | / | Peak Detector |
| 2 | 2483.500 | 59.50 | -9.31 | 50.19 | 54.00 | -3.81 | Ave Detector |
| | 2483.500 | 82.26 | -9.31 | 72.95 | 74.00 | -1.05 | Peak Detector |
| 3 | 2500.000 | 41.86 | -9.28 | 32.58 | 54.00 | -21.42 | Ave Detector |
| | 2500.000 | 67.23 | -9.28 | 57.95 | 74.00 | -16.05 | Peak Detector |

➢ Band edge

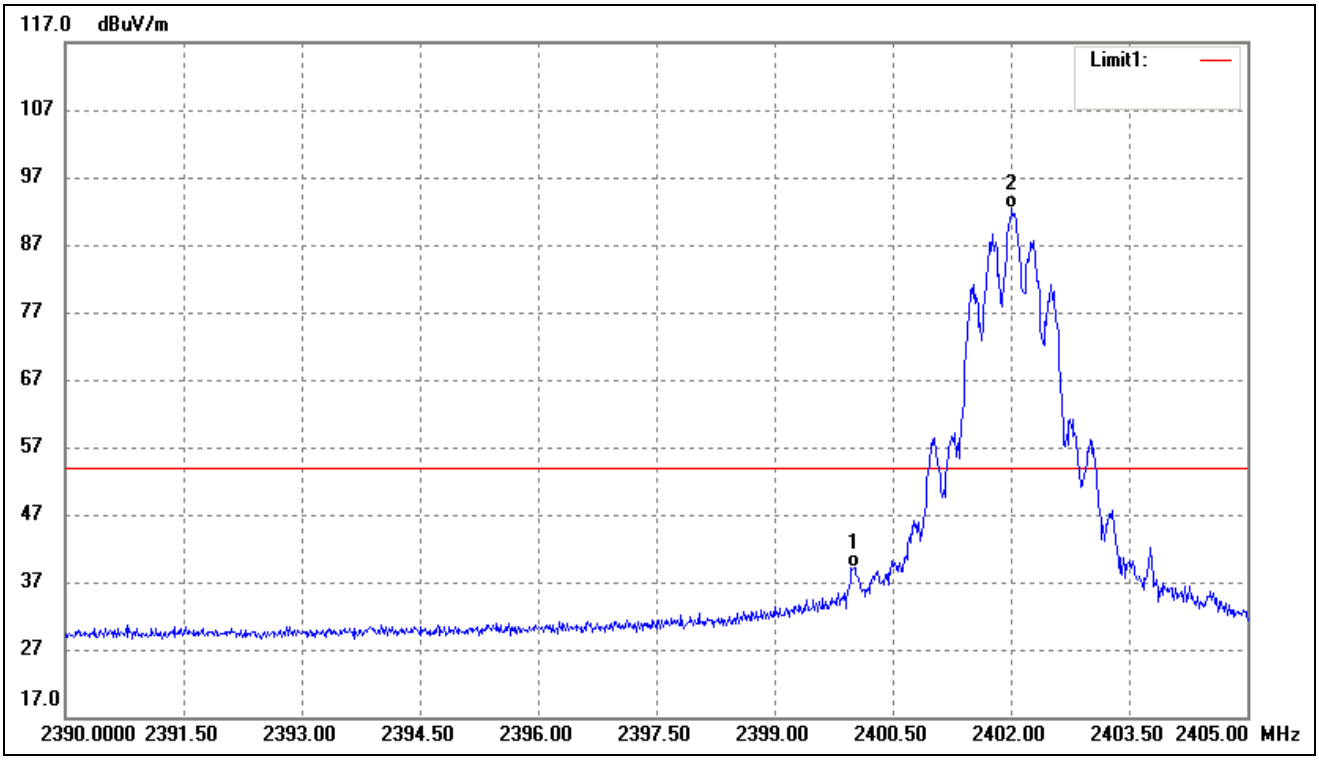
RBW:100kHz VBW:300kHz

| Test Channel | Low | Polarity: | Horizontal (worst case) |
|---|---|---|---|



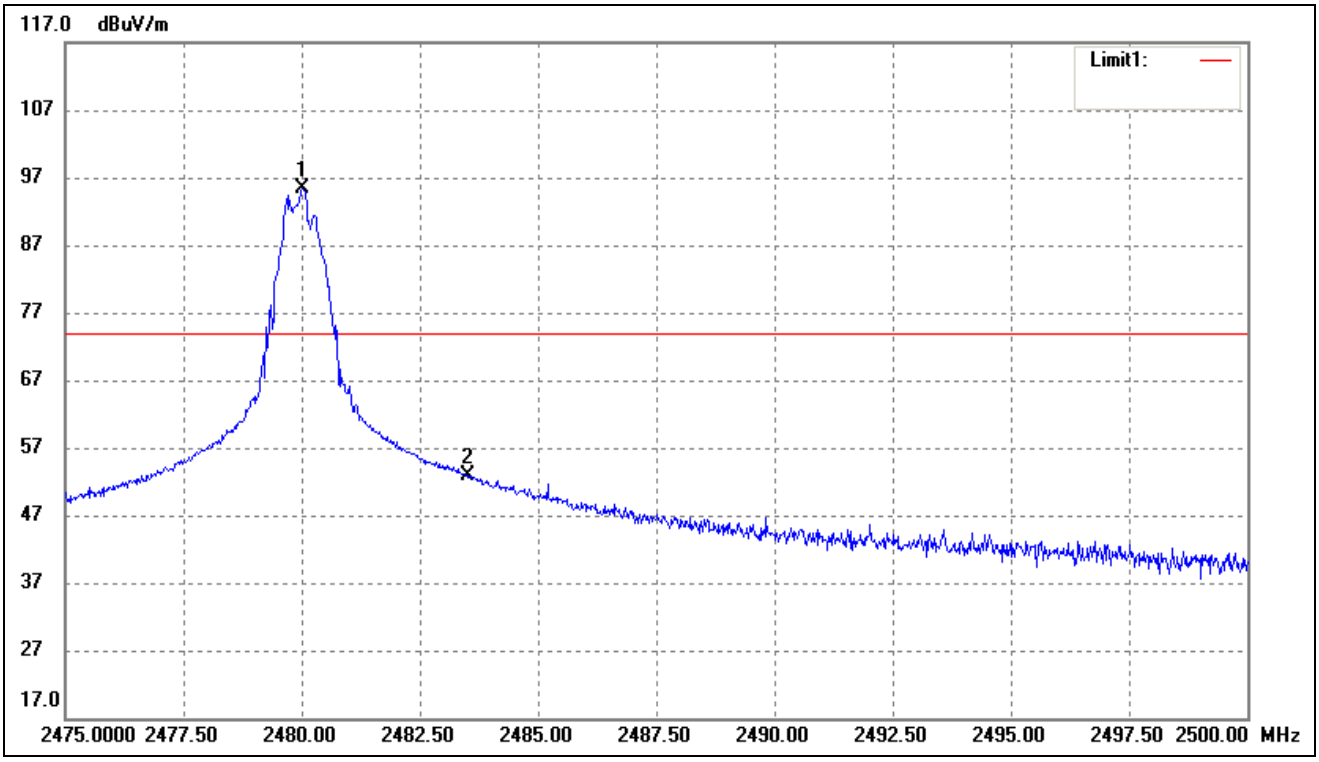

| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2400.000 | 67.08 | -9.48 | 57.60 | 74.00 | -16.40 | Peak Detector |
| 2 | 2402.015 | 105.17 | -9.47 | 95.70 | / | / | Peak Detector |

| Test Channel | Low | Polarity: | Horizontal (worst case) |
|---|---|---|---|



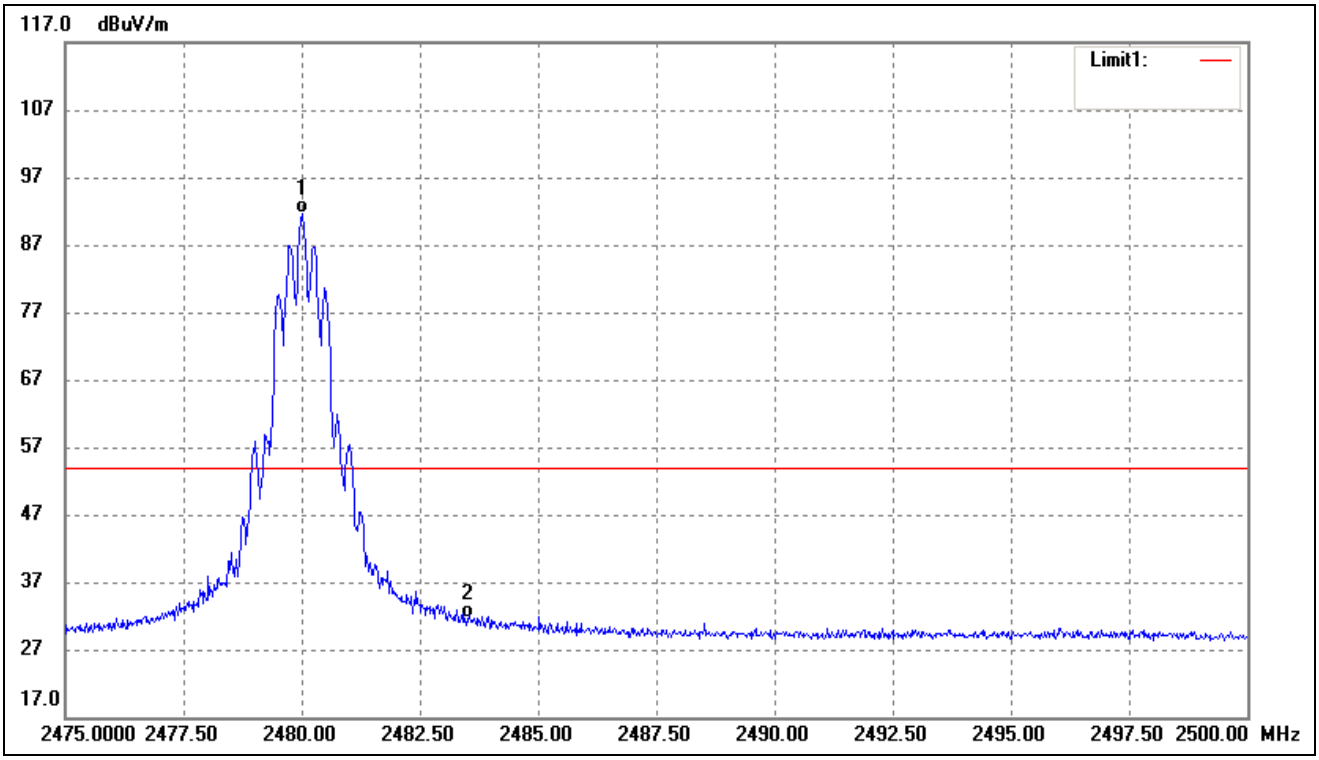

| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2400.000 | 48.63 | -9.48 | 39.15 | 54.00 | -14.85 | Ave Detector |
| 2 | 2402.015 | 100.73 | -9.47 | 91.26 | / | / | Ave Detector |

| Test Channel | High | Polarity: | Horizontal (worst case) |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2480.000 | 104.61 | -9.32 | 95.29 | / | / | Peak Detector |
| 2 | 2483.500 | 62.20 | -9.31 | 52.89 | 74.00 | -21.11 | Peak Detector |

| Test Channel | High | Polarity: | Horizontal (worst case) |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2480.000 | 100.93 | -9.32 | 91.61 | / | / | Ave Detector |
| 2 | 2483.500 | 40.93 | -9.31 | 31.62 | 54.00 | -22.38 | Ave Detector |

# 6. Emission Bandwidth

## 6.1 Standard Applicable

According to 15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

## 6.2 Test Procedure

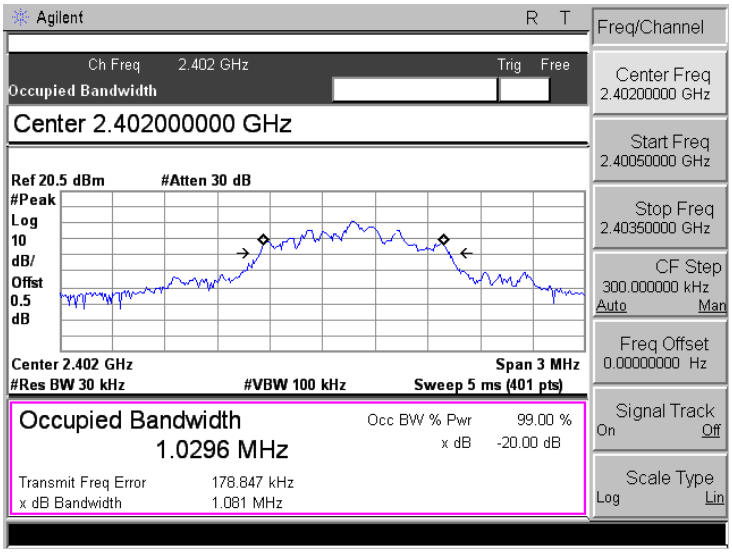
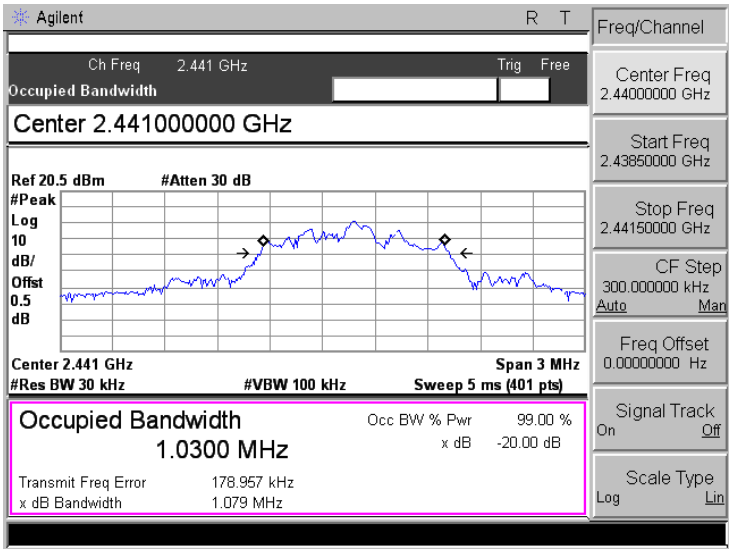
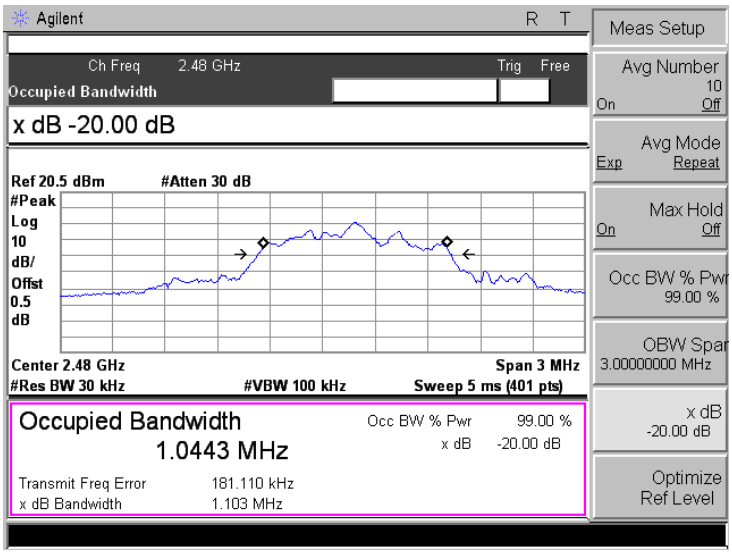
According to the ANSI 63.10-2013, the emission bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Set span = 1MHz, centered on a transmitting channel
RBW ≥1% 20dB Bandwidth, VBW ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold
All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down and 99% bandwidth of the emission.

## 6.3 Summary of Test Results/Plots

| Test Channel | 20dB Bandwidth(MHz) |
|---|---|
| Low Channel | 1.081 |
| Middle Channel | 1.079 |
| High Channel | 1.103 |

*Please refer to the following test plots*

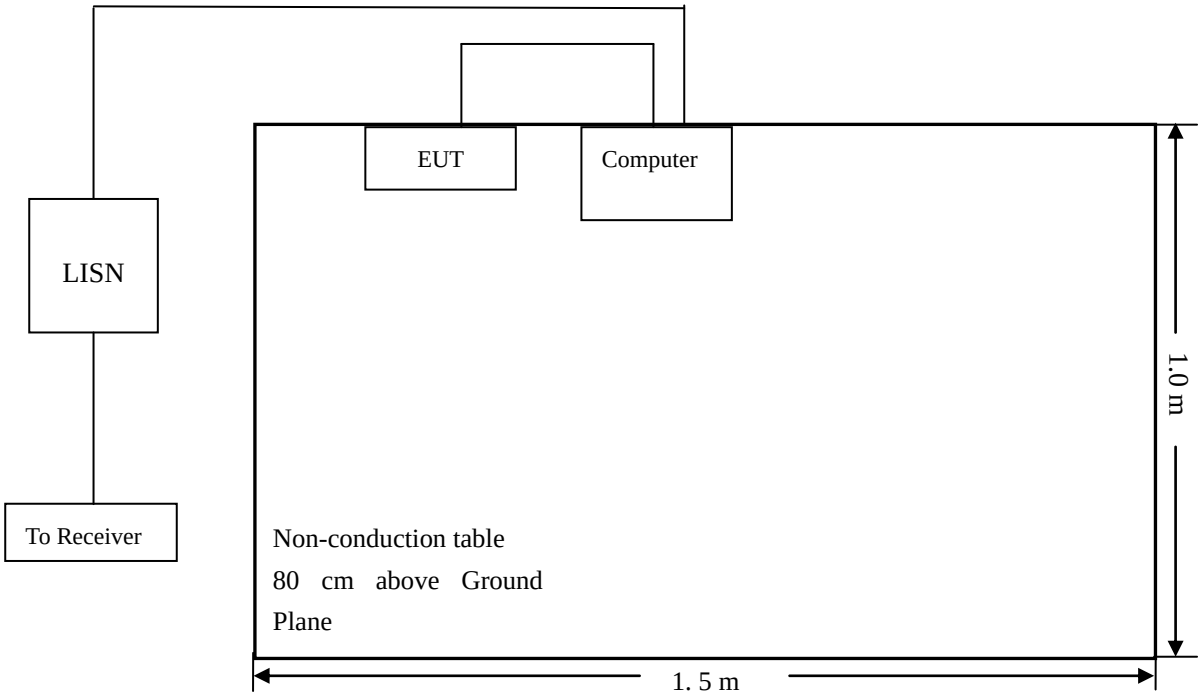
| | |
|---|---|
| Low Channel |  |
| Middle Channel |  |
| High Channel |  |

# 7. Conducted Emissions

## 7.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

## 7.2 Basic Test Setup Block Diagram



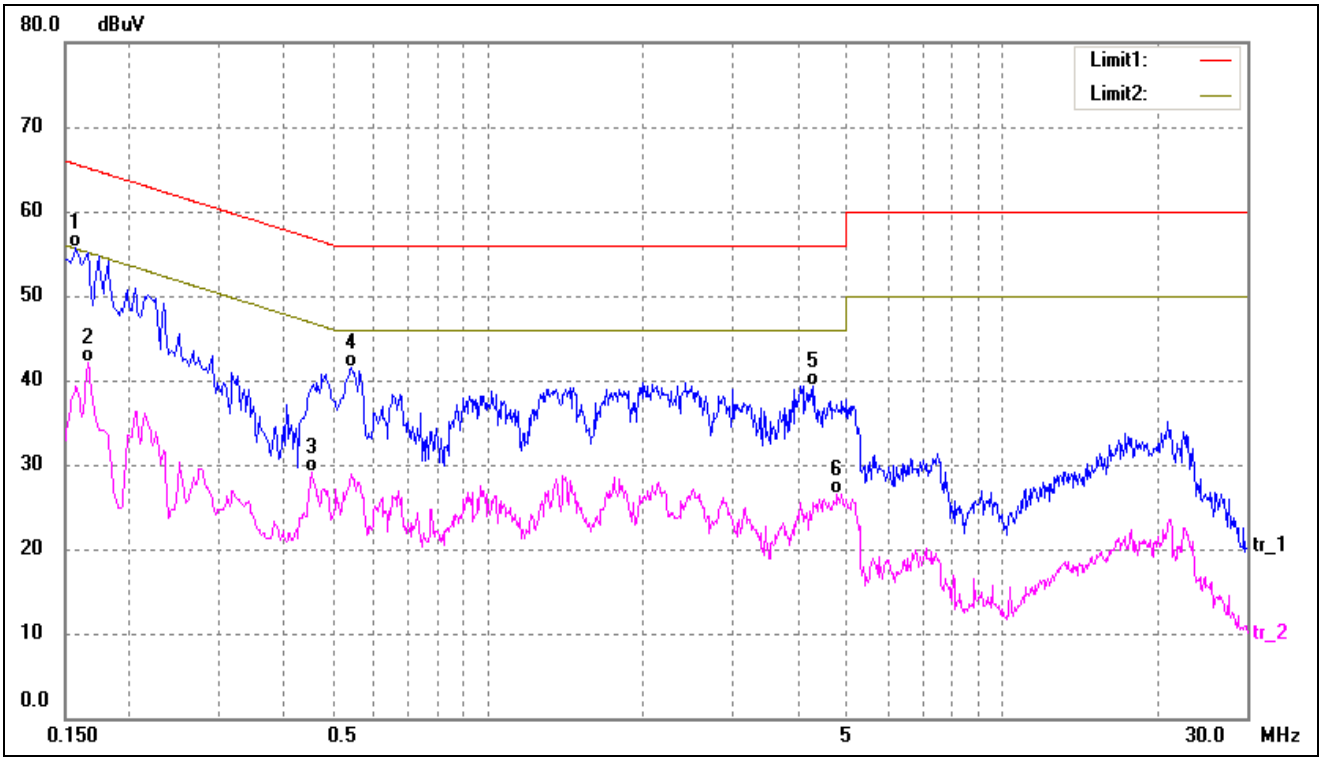

## 7.3 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency ..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz
Quasi-Peak Adapter Mode ..... Normal

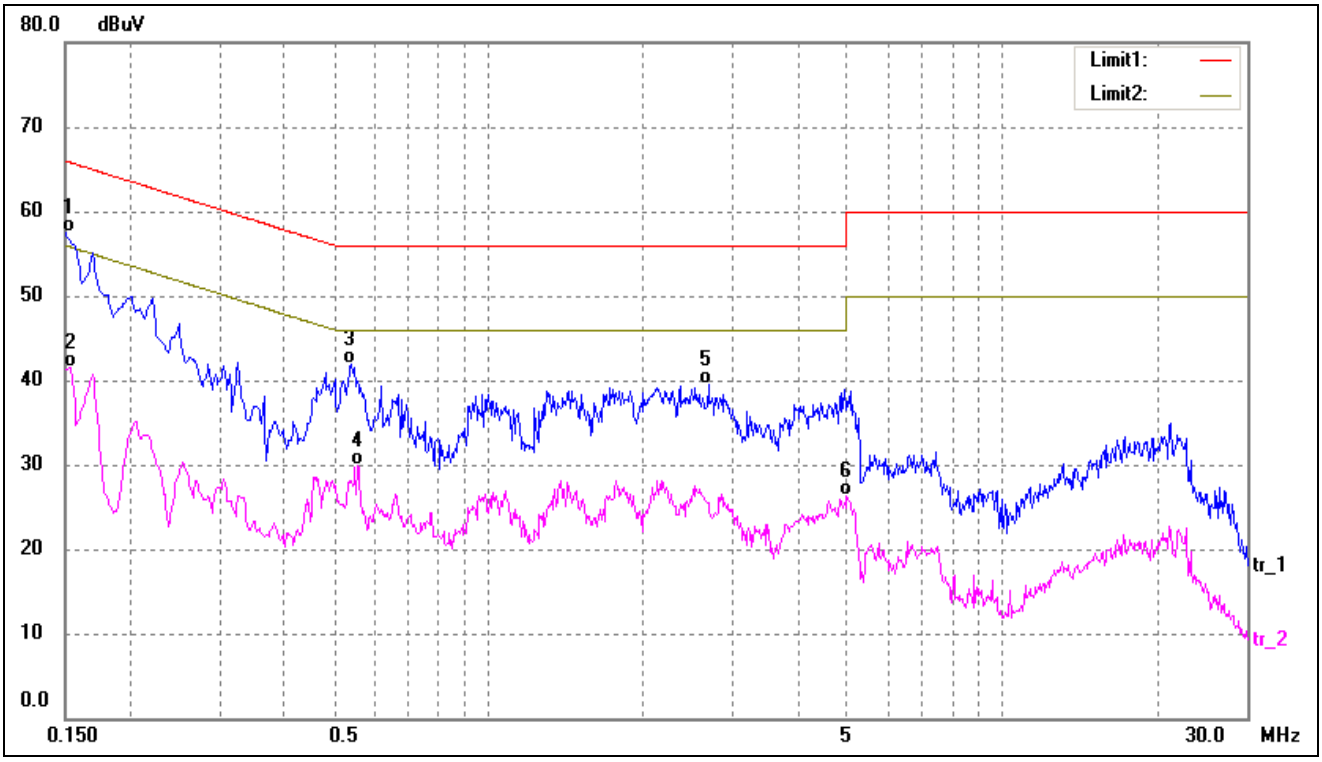
## 7.4 Summary of Test Results/Plots

| Test Mode | Communication | AC120V 60Hz | Polarity: | Neutral |
|---|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Detector |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dB/m) | (dBuV) | (dBuV) | (dB) | |
| 1* | 0.1580 | 45.76 | 9.95 | 55.71 | 65.57 | -9.86 | QP |
| 2 | 0.1660 | 32.25 | 9.95 | 42.20 | 55.16 | -12.96 | AVG |
| 3 | 0.4540 | 19.15 | 10.02 | 29.17 | 46.80 | -17.63 | AVG |
| 4 | 0.5420 | 31.44 | 10.03 | 41.47 | 56.00 | -14.53 | QP |
| 5 | 4.2940 | 29.01 | 10.33 | 39.34 | 56.00 | -16.66 | QP |
| 6 | 4.7900 | 16.21 | 10.37 | 26.58 | 46.00 | -19.42 | AVG |

| Test Mode | Communication | AC120V 60Hz | Polarity: | Line |
|---|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Detector |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dB/m) | (dBuV) | (dBuV) | (dB) | |
| 1* | 0.1500 | 47.49 | 9.96 | 57.45 | 66.00 | -8.55 | QP |
| 2 | 0.1540 | 31.58 | 9.95 | 41.53 | 55.78 | -14.25 | AVG |
| 3 | 0.5420 | 31.82 | 10.03 | 41.85 | 56.00 | -14.15 | QP |
| 4 | 0.5580 | 19.77 | 10.04 | 29.81 | 46.00 | -16.19 | AVG |
| 5 | 2.6900 | 29.09 | 10.37 | 39.46 | 56.00 | -16.54 | QP |
| 6 | 4.9900 | 15.84 | 10.38 | 26.22 | 46.00 | -19.78 | AVG |

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