849 NW State Road 45
Newberry, FL 32669 USA
Ph: 888.472.2424 or 352.472.5500
Fax: 352.472.2030
Email: info@timcoengr.com
Website: www.timcoengr.com

# FCC PART 15.247 AND IC RSS-210

# TEST REPORT

# DIGITAL SPREAD SPECTRUM

| | |
|---|---|
| **Applicant** | Osborne Coinage Co. |
| **Address** | 2851 Massachusetts Avenue |
| | Cincinnati OH 45225-2225 |
| **FCC ID** | ZOD-RF24A1 |
| **IC** | 9750A-RF24A1 |
| **Model Number** | RF24A1 |
| **Product Description** | GAME ALERT RADIO MODULE |
| **Date Sample Received** | 10/10/2012 |
| **Date Tested** | 10/18/2012 |
| **Tested By** | Joe Scoglio |
| **Approved By** | Mario R. de Aranzeta |
| **Report Number** | 2666AUT12TestReport.doc |
| **Test Results** | ☒ PASS ☐ FAIL |



ACCREDITED
**Testing Certificate # 0955-01**

## TABLE OF CONTENT

**GENERAL REMARKS**

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

**Summary**

The device under test does:
☒ fulfill the general approval requirements as identified in this test report
☐ not fulfill the general approval requirements as identified in this test report

**Attestations**

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025: 2005 requirements.

Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, Fl 32669

**Authorized Signatory Name:**

Mario de Aranzeta C.E.T.
Compliance Engineer/ Lab. Supervisor

**Date:** November 1, 2012

## GENERAL INFORMATION

### DUT Specification

| | | | |
|---|---|---|---|
| Applicable Standard | Part 15.247 | | |
| DUT Description | GAME ALERT RADIO MODULE | | |
| FCC ID | ZOD-RF24A1 | | |
| IC | 9750A-RF24A1 | | |
| Model | RF24A1 | | |
| Operating Frequency | TX: 2405-2480 MHz | | |
| Number of channels | 16 | | |
| | | | |
| DUT Power Source | ☐ 110–120Vac/50– 60Hz | | |
| | ☒ DC Power with AC Wall Supply | | |
| | ☐ Battery Operated Exclusively | | |
| Test Item | ☐ Prototype | ☒ Pre-Production | ☐ Production |
| Type of Equipment | ☒ Fixed | ☐ Mobile | ☐ Portable |
| Antenna Connector | | | |
| Antenna | PC board | | |
| Test Facility | Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA. | | |
| Test Conditions | Temperature: 26ºC<br>Relative humidity: 50% | | |
| Test Exercise | The DUT was placed in continuous transmit mode of operation. | | |

### Test Supporting Equipment

| Supporting Device | Manufacturer | Model / FCC ID | Serial Number |
|---|---|---|---|
| N/A | | | |

**EMC EQUIPMENT LIST**

| Device | Manufacturer | Model | Serial Number | Cal/Char Date | Due Date |
|---|---|---|---|---|---|
| 3-Meter Semi-Anechoic Chamber | Panashield | N/A | N/A | 12/31/11 | 12/31/13 |
| Analyzer Open-Frame Tower Preamplifier | HP | 8449B | 3008A01075 | 07/22/09 | 09/15/13 |
| Analyzer Open-Frame Tower Quasi-Peak Adapter | HP | 85650A | 2043A00305 | 10/26/09 | 09/15/13 |
| Analyzer Open-Frame Tower RF Preselector | HP | 85685A | 3107A01282 | 07/22/09 | 09/15/13 |
| Analyzer Open-Frame Tower Spectrum Analyzer | HP | 8566B/ 85662A | 2627A03154/ 2648A14276 | 07/22/09 | 09/15/13 |
| Analyzer Silver Tower Quasi-Peak Adapter | HP | 85650A | 3303A01844 | 11/23/10 | 11/23/12 |
| Analyzer Silver Tower RF Preselector | HP | 85685A | 2926A00983 | 11/10/10 | 11/10/12 |
| Analyzer Silver Tower Spectrum Analyzer | HP | 8566B Opt 462 | 3552A22064 3638A08608 | 11/10/10 | 11/10/12 |
| Analyzer Tan Tower Preamplifier | HP | 8449B-H02 | 3008A00372 | 11/21/09 | 10/28/13 |
| Analyzer Tan Tower Quasi-Peak Adapter | HP | 85650A | 3303A01690 | 11/22/09 | 10/28/13 |
| Analyzer Tan Tower RF Preselector | HP | 85685A | 3221A01400 | 11/21/09 | 10/28/13 |
| Analyzer Tan Tower Spectrum Analyzer | HP | 8566B Opt 462 | 3138A07786 3144A20661 | 11/24/09 | 10/28/13 |
| Antenna: Biconnical | Eaton | 94455-1 | 1057 | 05/31/11 | 05/31/13 |
| Antenna: Biconnical | Eaton | 94455-1 | 1096 | 05/04/11 | 05/04/13 |
| Antenna: Double-Ridged Horn | Electro-Metrics | RGA-180 | 2319 | 06/19/12 | 06/19/14 |
| Antenna: Log-Periodic | Electro-Metrics | LPA-25 | 1122 | 05/04/11 | 05/04/13 |
| Power Line Coupling/Decoupling Network | Fischer Custom Communications | FCC-801-M2-16A | 01048 | 01/04/11 | 01/04/13 |
| Power Line Coupling/Decoupling Network | Fischer Custom Communications | FCC-801-M3-16A | 01060 | 01/04/11 | 01/04/13 |

## TEST PROCEDURES

**Radiation Interference:** ANSI C63.4-2003 using a spectrum analyzer, a preselector, a quasi-peak adapter, and an appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz with an appropriate sweep speed and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3 MHz above 1 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

**Formula Of Conversion Factors:** The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBμV) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

| Example: | | | |
|---|---|---|---|
| Freq (MHz) | Meter Reading | + ACF | + CL = FS |
| 33 | 20 dBμV | + 10.36 dB | + 0.5 = 30.86 dBμV/m @ 3m |

**Power Line Conducted Interference:** The procedure used was ANSI C63.4-2003 using a 50uH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30 MHz.

**Occupied Bandwidth**: A small sample of the transmitter output was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to -10 dBm per division.

**Bandwidth 6.0dB:** The measurements were made with the spectrum analyzer's resolution bandwidth (RBW)=1 MHz and the video bandwidth (VBW) =3 MHz and the span set as shown on plot.

**Power Output:** The RF power output was measured at the antenna feed point using a peak power meter.

**Antenna Conducted Emissions:** The RBW=100 kHz, VBW=300 kHz and the span set to 10 MHz and the spectrum was scanned from 30 MHz to the 10th Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

**ANSI C63.4-2003 10.1 Measurement Procedures:** The DUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The DUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes. Emissions attenuated more than 20 dB below the permissible value are not reported.

## RADIATION INTERFERENCE

**Rules Part No.:** 15.247, 15.209, RSS-210

**Requirements:**

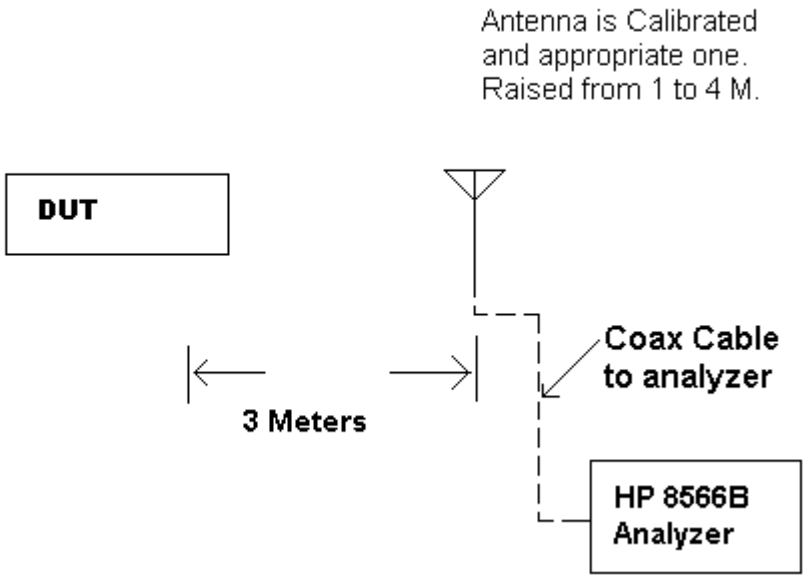
| Frequency | Limits |
|---|---|
| Part 15.209 | |
| 9 to 490 kHz | 2400/F (kHz) µV/m @ 300 meters |
| 490 to 1705 kHz | 24000/F (kHz) µV/m @ 30 meters |
| 1705 kHz to 30 MHz | 29.54 dBµV/m @ 30 meters |
| 30 – 88 | 40.0 dBµV/m @ 3 meters |
| 80 – 216 | 43.5 dBµV/m @ 3 meters |
| 216 – 960 | 46.0 dBµV/m @ 3 meters |
| Above 960 | 54.0 dBµV/m @ 3 meters |
| Part 15.247 | |
| Fundamental 902 – 928 MHz | 127.37 dBµV/m @ 3 meters |
| Fundamental 2.4 – 2.4835 MHz | 127.37 dBµV/m @ 3 meters |
| Harmonics | 54.0 dBµV/m @ 3 meters |

Any emissions that fall in the restricted bands (15.205) must be less than or equal to 54 dBµV/m. Spurious emissions not in a restricted band must be 20 dBc. Harmonics were checked from the lowest frequency generated to the 10th harmonic.

**Test Data:** All values are peak unless noted.
Items mark with an * designate a frequency in a restricted band.

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBuV | Ant. Pol | Coax Loss dB | Correction Factor dB/m | Field Strength dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 2,405.0 | 2,405.00 | 61.9 | V | 3.18 | 32.41 | 97.49 | 29.89 |
| 2,405.0 | 2,405.00 | 69.6 | H | 3.18 | 32.41 | 105.19 | 22.19 |
| 2,405.0 | 4,810.00R | 13.3 | V | 4.91 | 34.39 | 52.60 | 32.59 |
| 2,405.0 | 4,810.00R | 13.7 | H | 4.91 | 34.39 | 53.00 | 32.19 |
| 2,440.0 | 2,440.00 | 65.5 | V | 3.21 | 32.48 | 101.19 | 26.19 |
| 2,440.0 | 2,440.00 | 69.4 | H | 3.21 | 32.48 | 105.09 | 22.29 |
| 2,440.0 | 4,880.00R | 13.6 | V | 4.94 | 34.43 | 52.97 | 32.12 |
| 2,440.0 | 4,880.00R | 13.5 | H | 4.94 | 34.43 | 52.87 | 32.22 |
| 2,475.0 | 2,475.00 | 63.8 | V | 3.24 | 32.56 | 99.60 | 27.78 |
| 2,475.0 | 2,475.00 | 68.9 | H | 3.24 | 32.56 | 104.70 | 22.68 |
| 2,475.0 | 4,950.00R | 13.2 | V | 4.98 | 34.48 | 52.66 | 32.04 |
| 2,475.0 | 4,950.00R | 13.5 | H | 4.98 | 34.48 | 52.96 | 31.74 |

**Method of Measuring Radiated Spurious Emissions**




METHOD OF MEASUREMENT: The procedure used was ANSI standard C63.4-2003 & the FCC/OET Guidance on Measurements for Spread Spectrum Systems – KDB 558074 dated March 23, 2005.

**POWER LINE CONDUCTED INTERFERENCE**

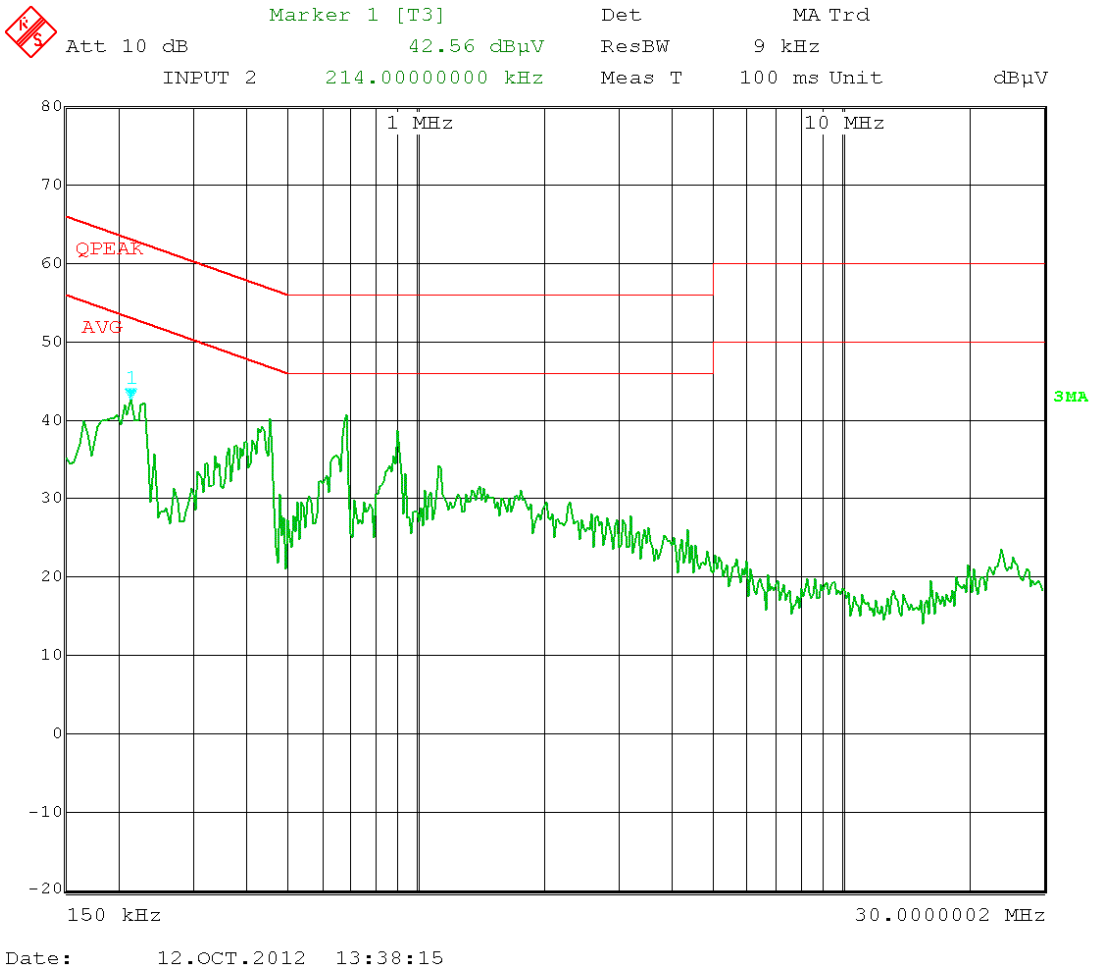
**Rules Part No.:** Part 15.207

**Requirements:**

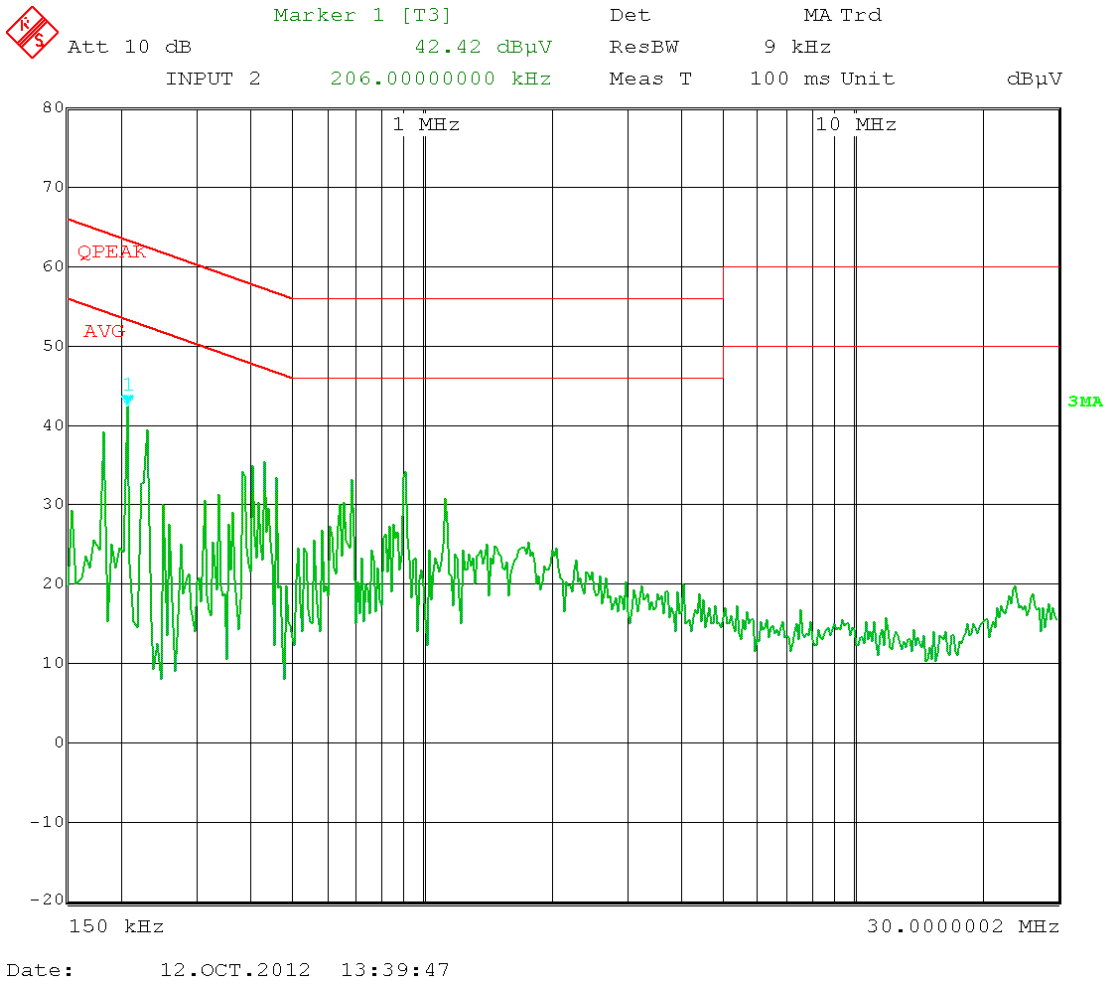
| Frequency (MHz) | Quasi Peak Limits (dBµV) | Average Limits (dBµV) |
|---|---|---|
| 0.15 – 0.5 | 66 – 56 * | 56 – 46 * |
| 0.5 – 5.0 | 56 | 46 |
| 5.0 – 30 | 60 | 50 |
| * Decrease with logarithm of frequency | | |

**Test Data:** The following plots represent the emissions read for power line conducted. Both lines were observed.

## POWERLINE CONDUCTED PLOT – LINE 1



# POWERLINE CONDUCTED PLOT – LINE 2




APPLICANT: Osborne Coinage Co.
FCC ID: ZOD-RF24A1
IC: 9750A-RF24A1
REPORT: O\Osborne\2666AUT12\2666AUT12TestReport.doc

## OCCUPIED BANDWIDTH

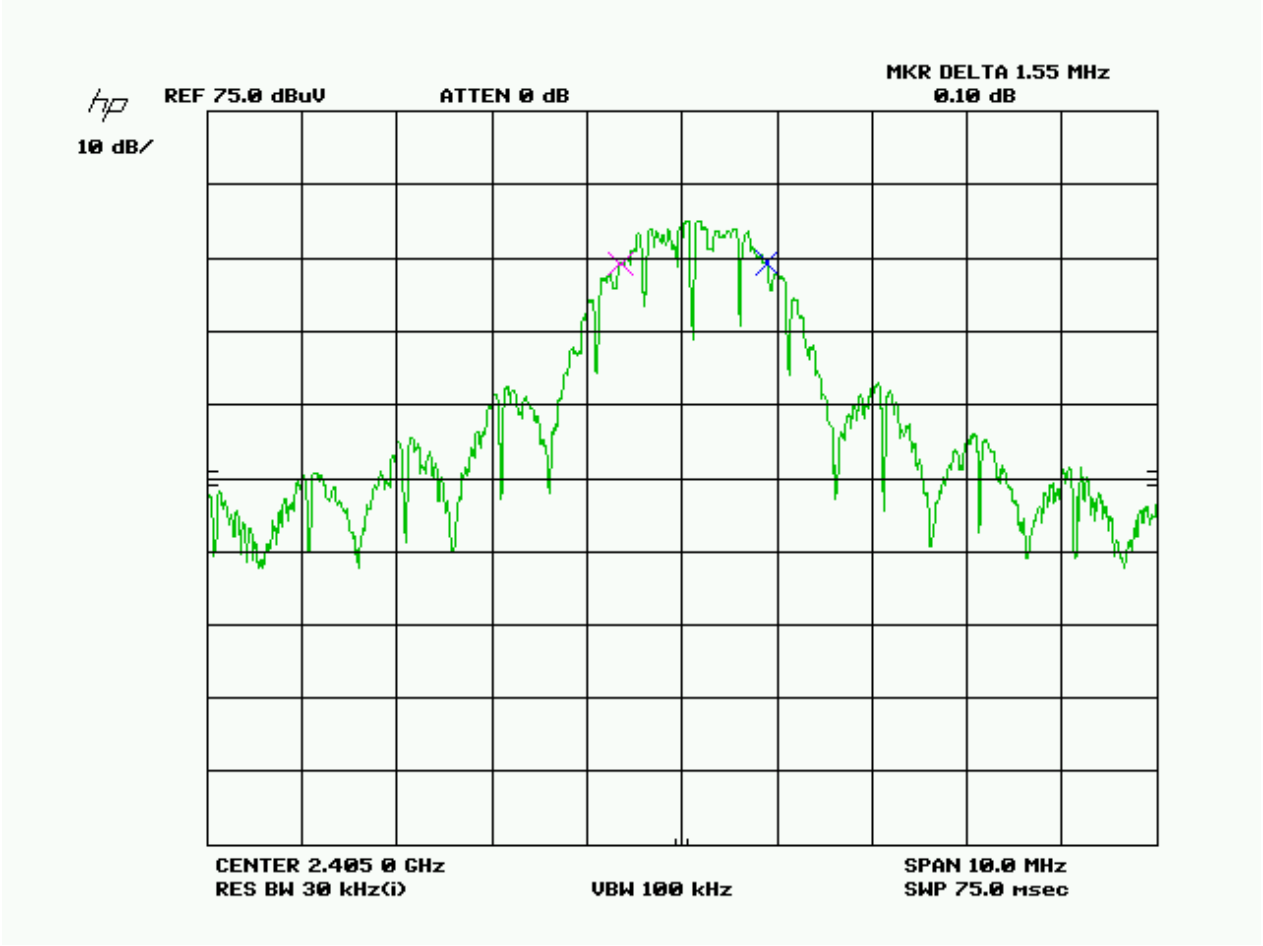
**Rules Part No.:** 15.247(a)(2

**Requirements:** The 6 dB bandwidth must be greater than 500 kHz.

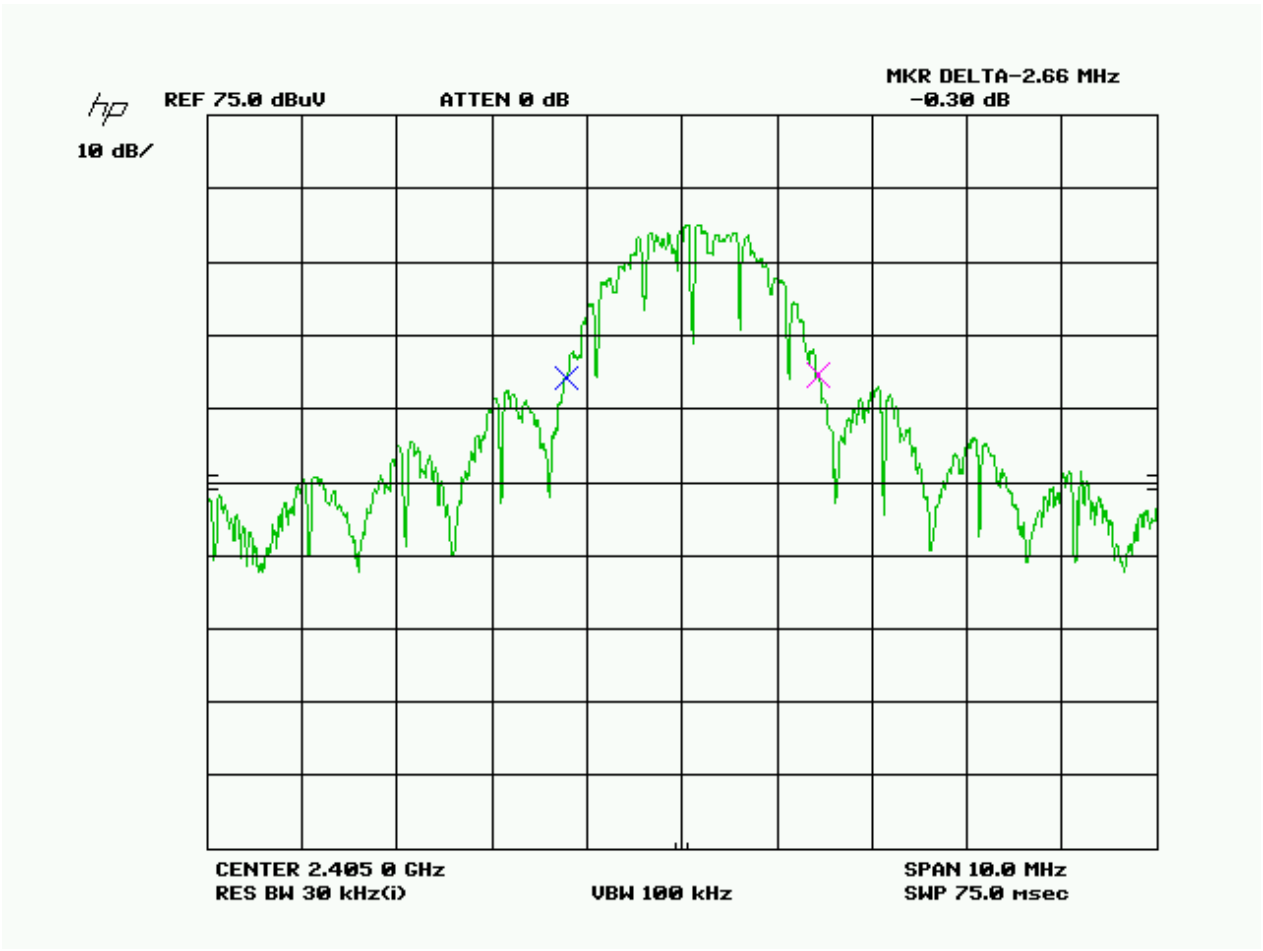
**Test Data:**

Three places in the band were measured and the worst case reported.

**6 dB Bandwidth Plot**



**20 dB Bandwidth Plot**



**POWER OUTPUT**

**Rules Part #:** 15.247(b) 1 Watt conducted, 4W EIRP

Power was measured radiated as the antennas are integral.

**Radiated EIRP**

**Test Results:**

| Frequency MHz | Po dBm | Po mW |
|---|---|---|
| 2405 | 10 | 9.9 |
| 2440 | 9.9 | 9.7 |
| 2475 | 9.5 | 8.8 |

Using the EIRP to conducted power equation of eirp = pt*gt = (E*d)^2/30
Where: pt transmitter power
Gt is transmitter gain (linear)
E is electric field strength
We get a conducted power worst case of 6 mW.

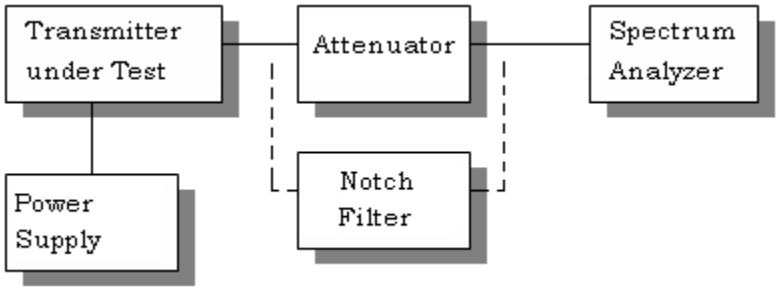
## SPURIOUS EMISSIONS AT ANTENNA TERMINALS

**Requirements:** Emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

**Test Data:**

**N/A, Device has permanently attached antenna and no antenna connector.**

15.247(c) Method of Measuring RF Conducted Spurious Emissions

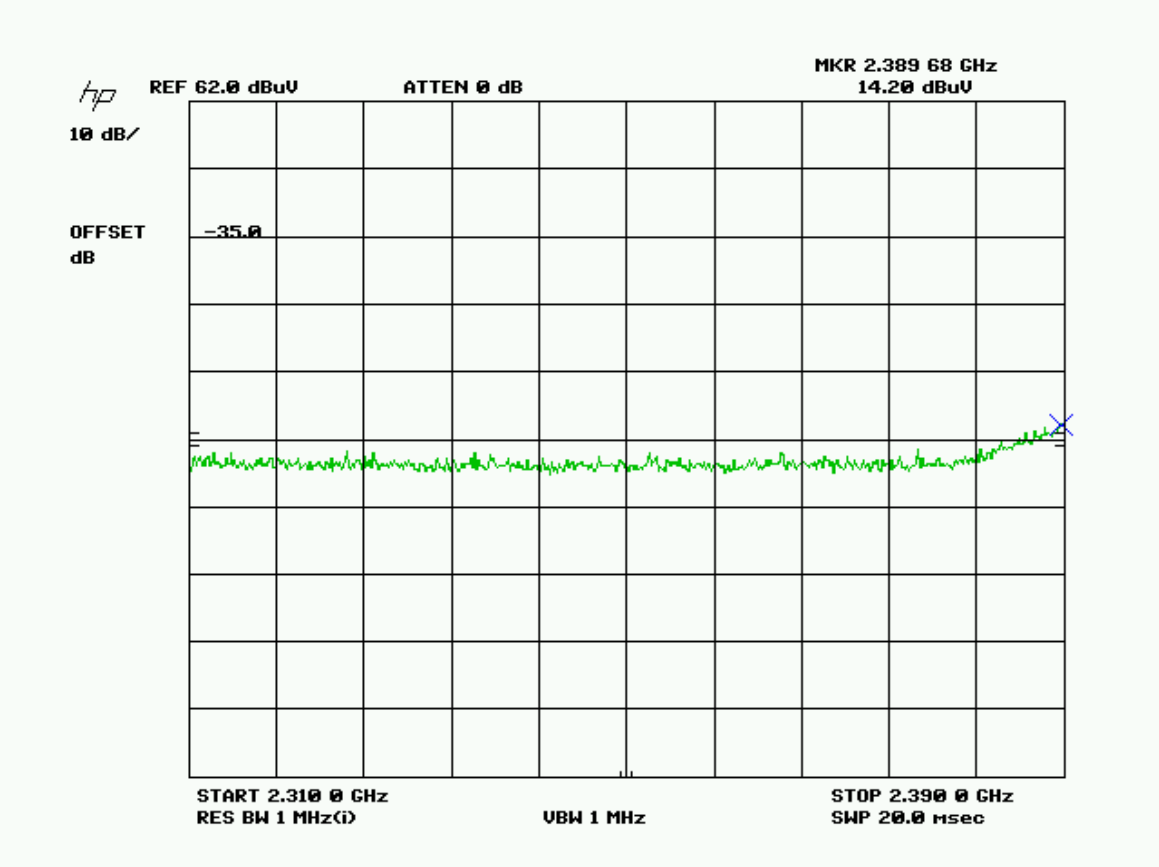


## RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

**Requirements**: Emissions that fall in the restricted bands (15.205). These emissions must be less than or equal to 500 µV/m (54 dBµV/m).

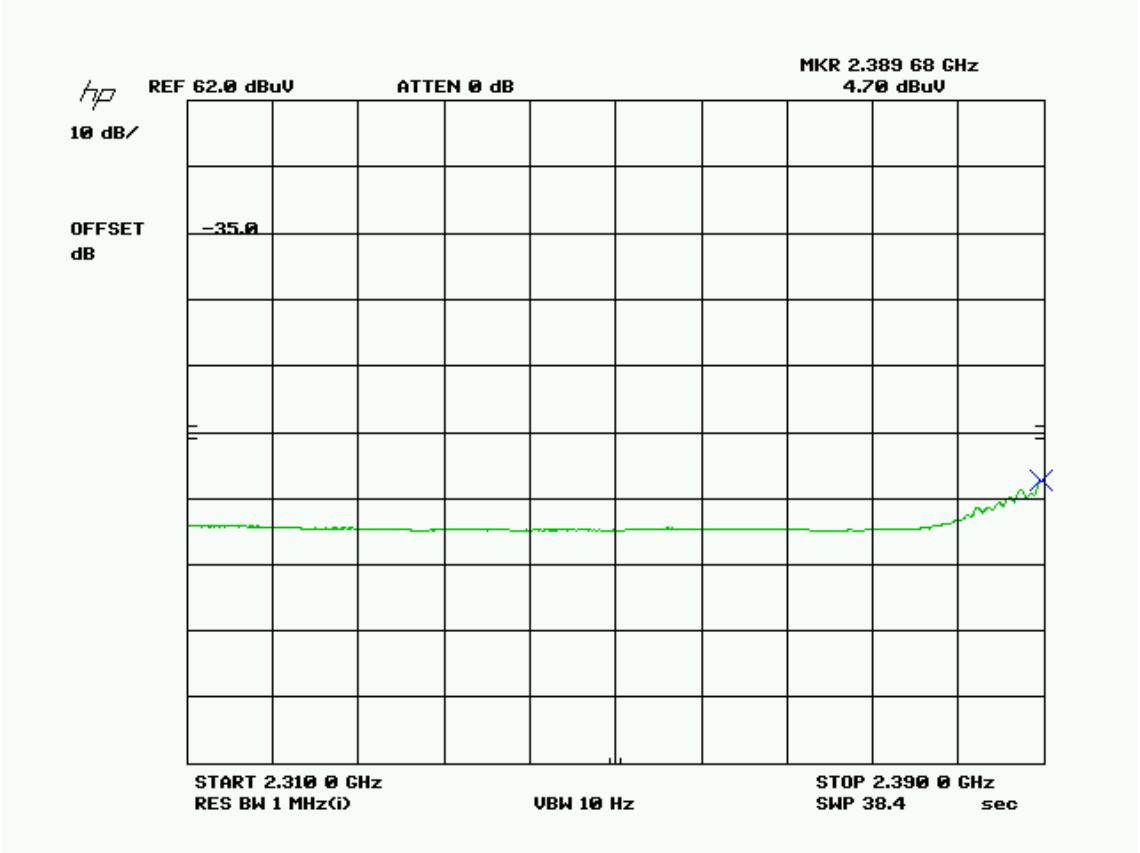
**Test Procedure:** An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Lower adjacent restricted band – ch 2405 Peak Horiz.



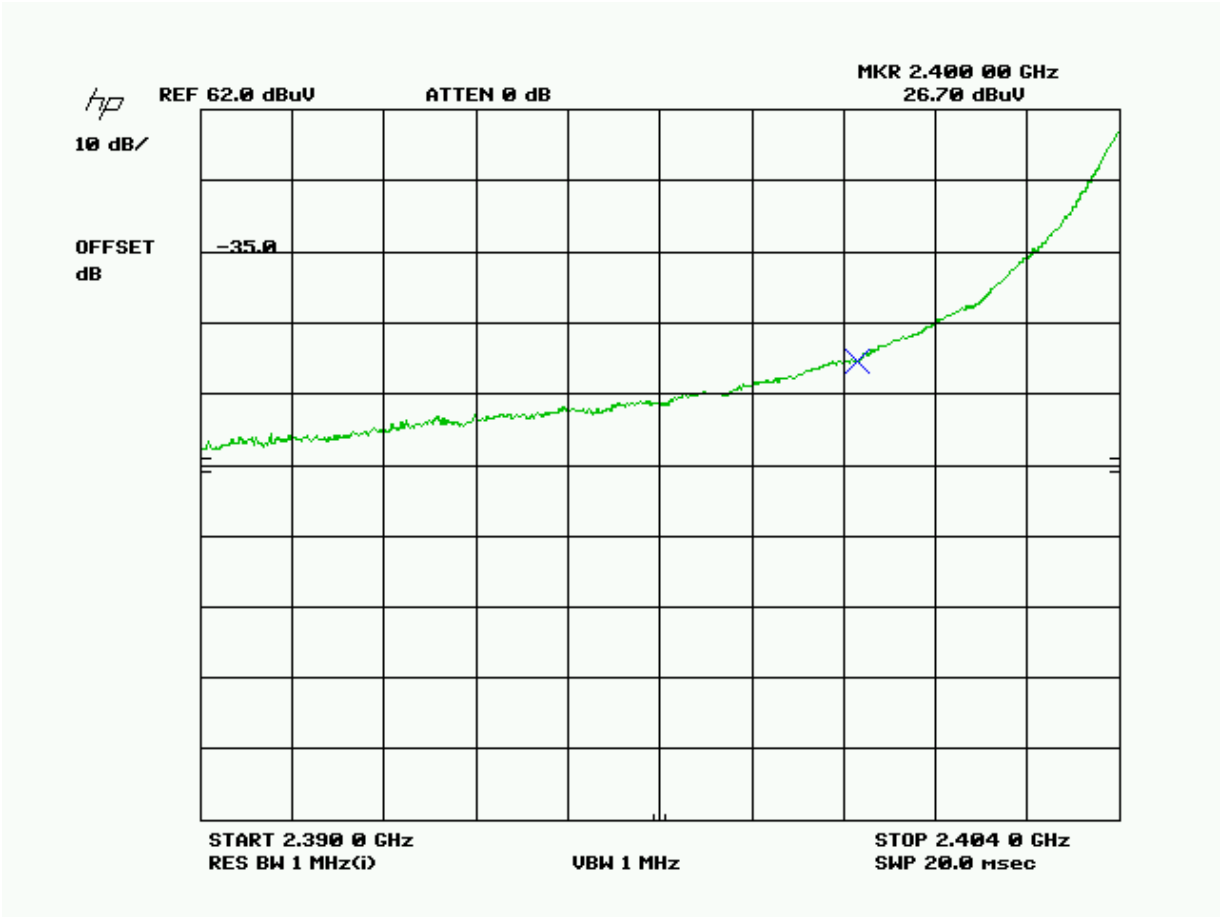

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBµV | Ant. Pol | Coax Loss dB | Correction Factor dB/m | Field Strength dBµV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 2,405.0 | 2,389.60 | 14.2 | H | 1.86 | 32.38 | 48.44 | |

Lower adjacent restricted band – ch 2405 Average Horiz.



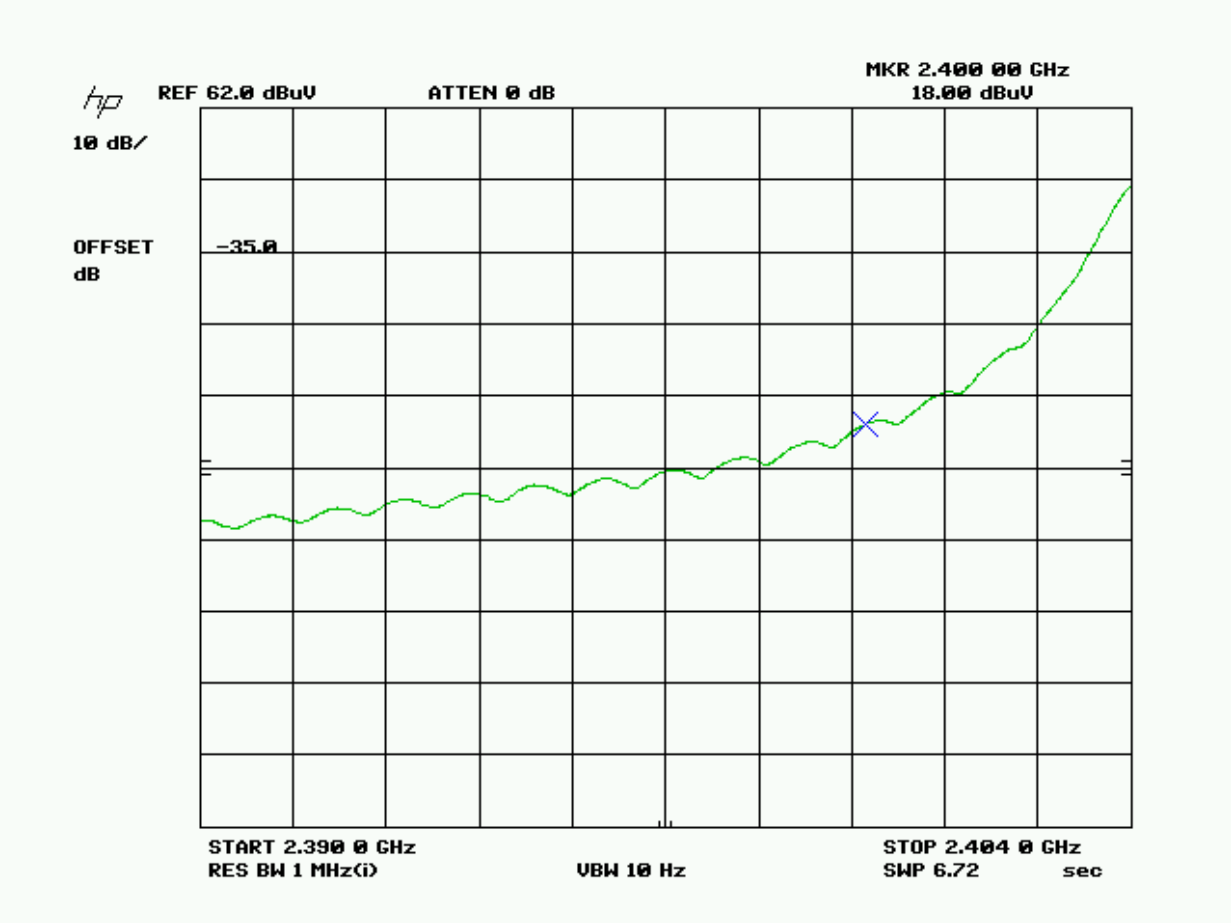

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBµV | Ant. Pol | Coax Loss dB | Correction Factor dB/m | Field Strength dBµV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 2,405.0 | 2,389.60 | 4.7 | H | 1.86 | 32.38 | 38.94 | |

Lower Bandedge – ch 2405 Peak Horiz.



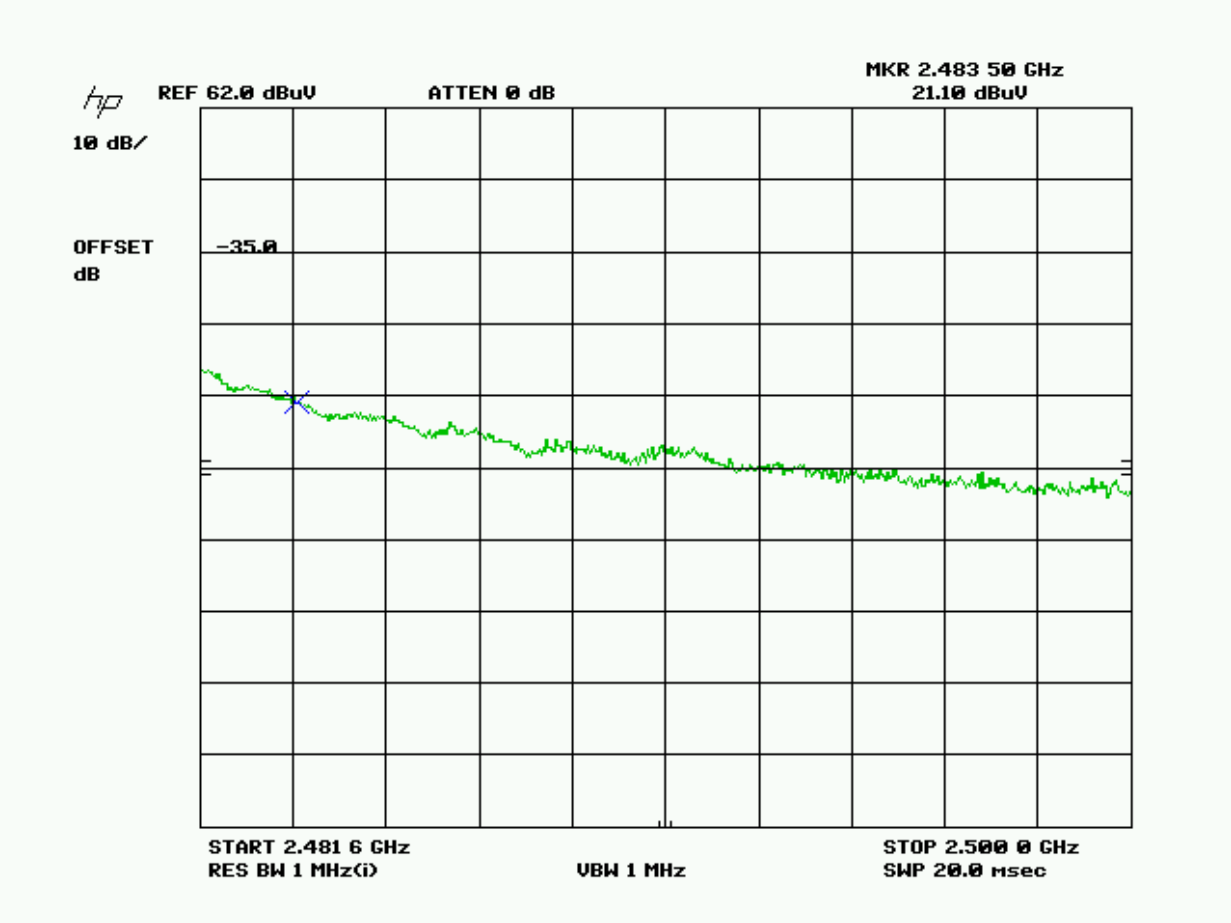

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBµV | Ant. Pol | Coax Loss dB | Correction Factor dB/m | Field Strength dBµV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 2,405.0 | 2,400.00 | 26.7 | H | 3.18 | 32.40 | 62.28 | 11.72 |

Lower Bandedge – ch 2405 Average Horiz.



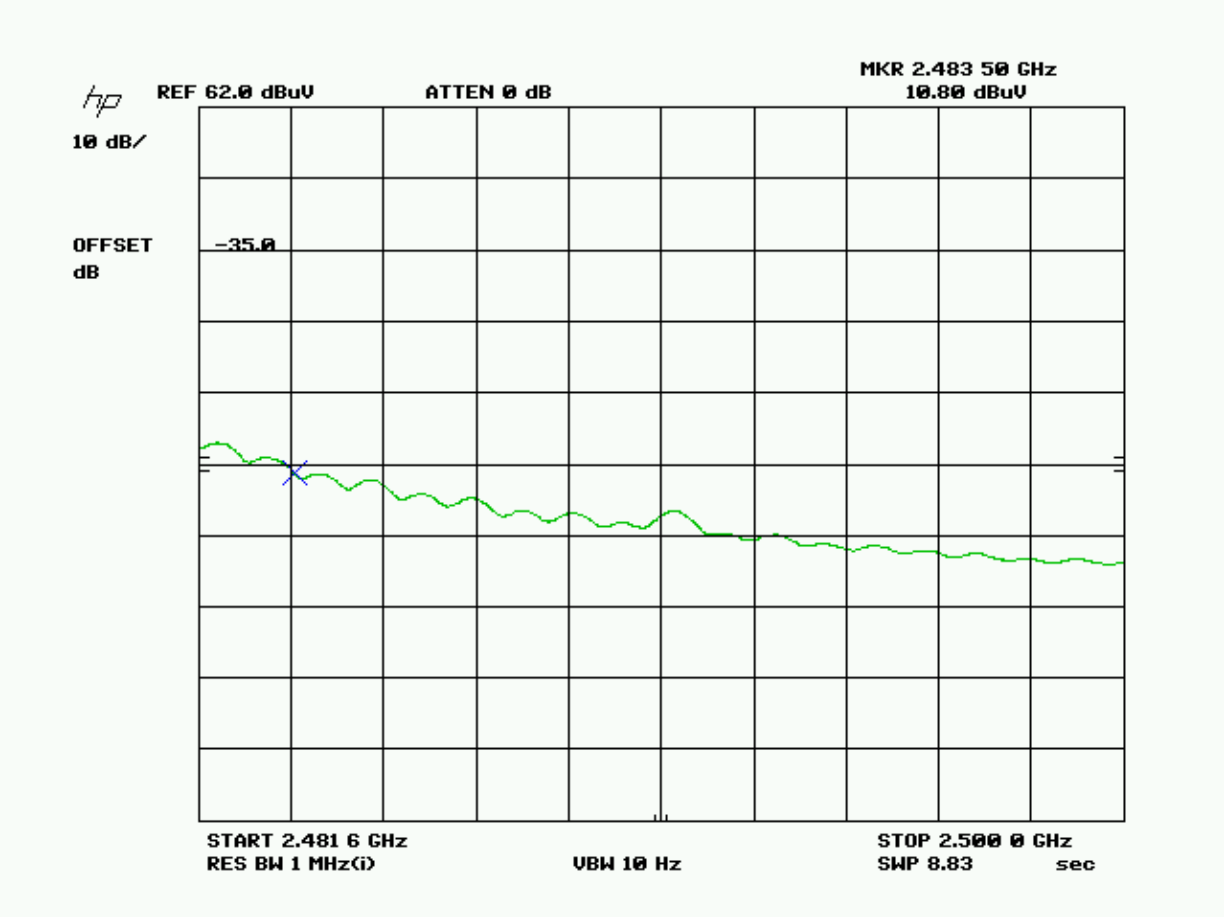

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBµV | Ant. Pol | Coax Loss dB | Correction Factor dB/m | Field Strength dBµV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 2,405.0 | 2,400.00 | 18.0 | H | 3.18 | 32.40 | 53.58 | 0.42 |

Upper  bandedge ch 2475 Peak Horiz




| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBµV | Ant. Pol | Coax Loss dB | Correction Factor dB/m | Field Strength dBµV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 2,475.0 | 2,483.50 | 21.1 | H | 3.24 | 32.57 | 56.91 | 17.09 |

Upper bandedge 2475 average – Horiz.




| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBµV | Ant. Pol | Coax Loss dB | Correction Factor dB/m | Field Strength dBµV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 2,475.0 | 2,483.50 | 10.8 | H | 3.24 | 32.57 | 46.61 | 7.39 |

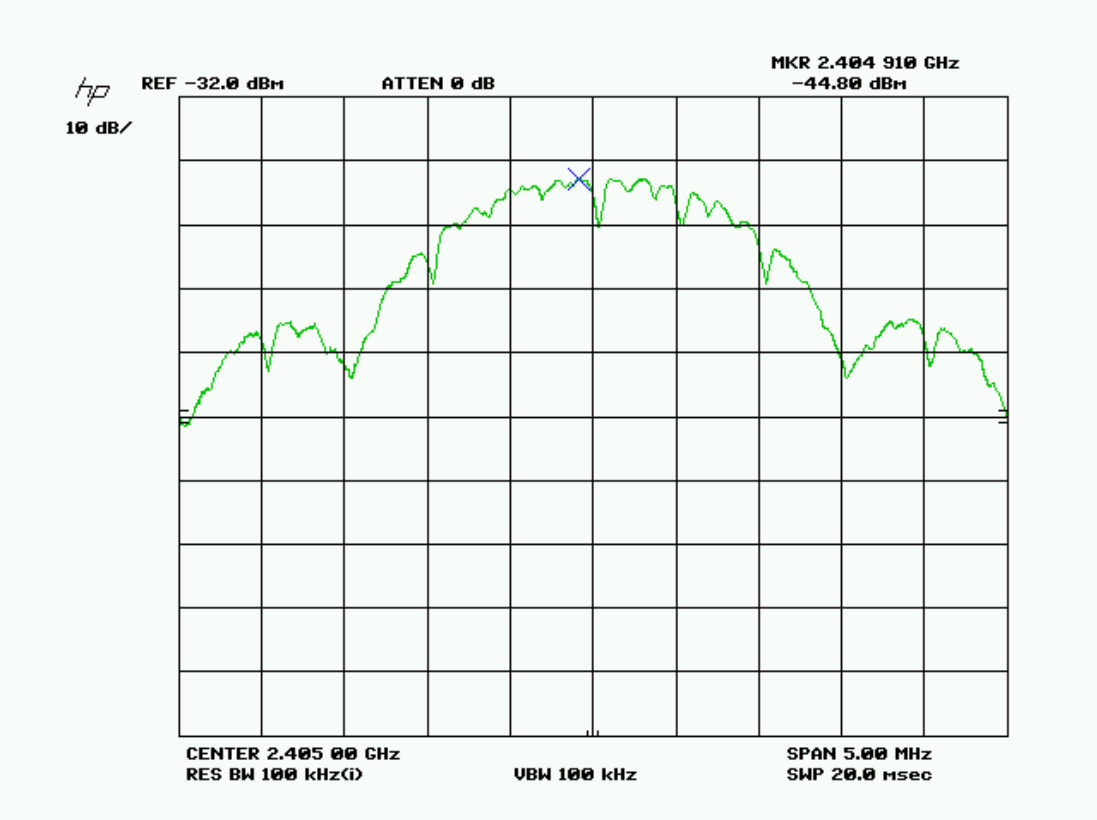
## POWER SPECTRAL DENSITY

**Rules Part No.**: 15.247(d)

**Requirements:** The peak level measured must be less than +8.0 dBm.

**Test Data:** SEE THE FOLLOWING PLOT

Three places in the band were measured and the worst case reported.




| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBµV | Ant. Pol | Coax Loss dB | Correction Factor dB/m | Field Strength dBµV/m |
|---|---|---|---|---|---|---|
| 2,405.0 | 2,405.00 | 62.1 | H | 3.18 | 32.41 | 97.69 |

97.69 dBµV/m
0.3 dBm conducted
-15.2 dB conversion factor to 3 kHz
.3 -15.2 -14.9dBm power spectral density