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## FCC PART 15.249 TEST REPORT

### UNLICENSED INTENTIONAL RADIATOR

|                      |  |                               |
|----------------------|--|-------------------------------|
| Applicant            | RADIOS INC.                              |                               |
| Address              | 1408 CENTER AVENUE                       |                               |
|                      | OOSTBURG WISCONSIN 53070 USA             |                               |
| FCC ID               | W4C-MXR-EM50D-W                          |                               |
| Product Description  | RADIO COMMUNICATION MODULE               |                               |
| Date Sample Received | 2/9/2009                                 |                               |
| Date Tested          | 2/18/2009                                |                               |
| Tested By            | Richard Block                            |                               |
| Approved By          | Mario de Aranzeta                        |                               |
| Report Number        | 277AUT9TestReport.doc                    |                               |
| Test Results         | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |

THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL  
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.



Certificate # 0955-01

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## GENERAL REMARKS

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

### 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 requirements.



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:** 2/25/2009

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## GENERAL INFORMATION

### DUT Specification

|   |   |  |
|---|---|--|
| The test results relate only to the items tested. |   |  |
| Applicable Standard                               | Part 15.249   |  |
| DUT Description                                   | RADIO COMMUNICATION MODULE  |  |
| FCC ID  | W4C-MXR-EM50D-W   |  |
| Operating Frequency                               | TX: 2.405 – 2.480 GHz   | RX: Same   |
| No. of Channels                                   | 16  |  |
| Modulations                                       | GFSK  |  |
| DUT Power Source                                  | <input type="checkbox"/> 110–120Vac/50– 60Hz                                      |  |
|   | <input type="checkbox"/> DC Power   |  |
|   | <input checked="" type="checkbox"/> Battery Operated Exclusively                  |  |
| Test Item   | <input type="checkbox"/> Prototype  | <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Production |
| Type of Equipment                                 | <input type="checkbox"/> Fixed  | <input type="checkbox"/> Mobile <input checked="" type="checkbox"/> Portable           |
| Antenna Connector                                 | FCC Rules require that the antenna connector be unique.                           |  |
| Test Facility                                     | Timco Engineering Inc. located at 849 NW State Road 45<br>Newberry, FL 32669 USA. |  |
| Test Conditions                                   | Temperature: 26°C<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               |              |                |               |

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**EMC EQUIPMENT LIST**

| <b>Device</b>                         | <b>Manufacturer</b> | <b>Model</b>  | <b>Serial Number</b>     | <b>Cal/Char Date</b> | <b>Due Date</b> |
|---------------------------------------|---------------------|---------------|--------------------------|----------------------|-----------------|
| 3/10-Meter OATS                       | TEI                 | N/A           | N/A                      | Listed 3/20/07       | 3/19/10         |
| 3-Meter OATS                          | TEI                 | N/A           | N/A                      | Listed 2/5/09        | 2/5/12          |
| 3-Meter Semi-Anechoic Chamber         | Panashield          | N/A           | N/A                      | Listed 5/11/07       | 5/11/10         |
| AC Voltmeter                          | HP                  | 400FL         | 2213A14261               | CAL 5/14/07          | 5/14/09         |
| Analyzer Tan Tower Quasi-Peak Adapter | HP                  | 85650A        | 3303A01690               | CAL 11/30/07         | 11/30/09        |
| Analyzer Tan Tower RF Preselector     | HP                  | 85685A        | 3221A01400               | CAL 11/30/07         | 11/30/09        |
| Analyzer Tan Tower Spectrum Analyzer  | HP                  | 8566B Opt 462 | 3138A07786<br>3144A20661 | CAL 11/30/07         | 11/30/09        |
| Analyzer Tan Tower Preamplifier       | HP                  | 8449B-H02     | 3008A00372               | CAL 11/30/07         | 11/30/09        |
| Coaxial Cable #64                     | Semflex Inc.        | 60637         | Timco #64                | CHAR 3/30/07         | 3/30/09         |
| Antenna: Dipole Kit                   | Electro-Metrics     | TDA-30/1-4    | 152                      | CAL 3/3/06           | 3/3/09          |
| Antenna: Dipole Kit                   | Electro-Metrics     | TDA-30/1-4    | 153                      | CHAR 4/5/06          | 4/5/09          |
| Frequency Counter                     | HP                  | 5385A         | 2730A03025               | CAL 7/6/07           | 7/6/09          |
| Hygro-Thermometer                     | Extech              | 445703        | 0602                     | CAL 11/15/07         | 11/15/09        |
| Antenna: Log-Periodic                 | Electro-Metrics     | LPA-30        | 409                      | CAL 7/18/07          | 7/18/09         |
| Measuring Tape-7.5M                   | Kraftixx            | 7.5M PROFI    |                          | CHAR 11/13/07        | 11/13/09        |
| Modulation Analyzer                   | HP                  | 8901A         | 3435A06868               | CAL 5/9/07           | 5/9/09          |
| Digital Multimeter                    | Fluke               | FLUKE-77-3    | 79510405                 | CAL 5/14/07          | 5/14/09         |
| System One                            | Audio Precision     | System One    | SYS1-45868               | CHAR 2/27/08         | 2/27/10         |
| Temperature Chamber                   | Tenney Engineering  | TTRC          | 11717-7                  | CHAR 4/25/08         | 4/25/10         |

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## 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 dBuV) to the antenna correction factor supplied by the antenna manufacturer. 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:

$$\begin{array}{llll}
 \text{Freq (MHz)} & \text{Meter Reading} & + \text{ACF} & + \text{CL} = \text{FS} \\
 33 & 20 \text{ dBuV} & + 10.36 \text{ dB} & + 0.5 = 30.86 \text{ dBuV/m @ 3m}
 \end{array}$$

**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.

**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.

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## RADIATION INTERFERENCE

**Rules Part No.:** 15.249, 15.209

**Requirements:**

| Frequency                    | Limits                              |
|------------------------------|-------------------------------------|
| Part 15.209                  |                                     |
| 9 to 490 kHz                 | 2400/F (kHz) $\mu$ V/m @ 300 meters |
| 490 to 1705 kHz              | 24000/F (kHz) $\mu$ V/m @ 30 meters |
| 1705 kHz to 30 MHz           | 29.54 dB $\mu$ V/m @ 30 meters      |
| 30 – 88                      | 40.0 dB $\mu$ V/m @ 3 meters        |
| 80 – 216                     | 43.5 dB $\mu$ V/m @ 3 meters        |
| 216 – 960                    | 46.0 dB $\mu$ V/m @ 3 meters        |
| Above 960                    | 54.0 dB $\mu$ V/m @ 3 meters        |
| Part 15.249                  |                                     |
| Fundamental 902 – 928 MHz    | 94.0 dB $\mu$ V/m @ 3 meters        |
| Fundamental 2.4 – 2.4835 MHz | 94.0 dB $\mu$ V/m @ 3 meters        |
| Harmonics                    | 54.0 dB $\mu$ V/m @ 3 meters        |

**Test Data:**

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBuV | Ant. Polarity | Coax Loss dB | Correction Factor dB | Field Strength dBuV/m | Margin dB |         |
|---------------------|------------------------|--------------------|---------------|--------------|----------------------|-----------------------|-----------|---------|
| 2,405.0             | 2,405.00               | 56.3               | H             | 3.18         | 32.25                | 91.73                 | 2.27      |         |
| 2,405.0             | 2,405.00               | 57.8               | V             | 3.18         | 32.25                | 93.23                 | 0.77      |         |
| 2,405.0             | 4,810.00               | 15.5               | V             | 4.91         | 34.10                | 54.51                 | 19.49     | PEAK    |
| 2,405.0             | 4,810.00               | 7.9                | V             | 4.91         | 34.10                | 46.91                 | 7.10      | AVERAGE |
| 2,405.0             | 4,810.00               | 13.1               | H             | 4.91         | 34.10                | 52.11                 | 1.90      |         |
| 2,405.0             | 7,215.00               | 5.9                | H             | 5.73         | 36.04                | 47.67                 | 6.33      |         |
| 2,405.0             | 7,215.00               | 6.2                | V             | 5.73         | 36.04                | 47.97                 | 6.03      |         |
| 2,405.0             | 9,620.00               | 4.4                | V             | 6.79         | 36.72                | 47.91                 | 6.09      |         |
| 2,405.0             | 9,620.00               | 5.3                | H             | 6.79         | 36.72                | 48.81                 | 5.19      |         |
| 2,405.0             | 12,025.00              | 2.8                | V             | 7.82         | 38.72                | 49.34                 | 4.66      |         |
| 2,405.0             | 12,025.00              | 2.9                | H             | 7.82         | 38.72                | 49.44                 | 4.56      |         |
| 2,440.0             | 2,440.00               | 55.7               | H             | 3.21         | 32.34                | 91.25                 | 2.75      |         |
| 2,440.0             | 2,440.00               | 57.7               | V             | 3.21         | 32.34                | 93.25                 | 0.75      |         |
| 2,440.0             | 4,880.00               | 16.3               | V             | 4.94         | 34.10                | 55.34                 | 18.66     | PEAK    |
| 2,440.0             | 4,880.00               | 8.7                | V             | 4.94         | 34.10                | 47.74                 | 6.26      | AVERAGE |
| 2,440.0             | 4,880.00               | 14.2               | H             | 4.94         | 34.10                | 53.24                 | 0.76      |         |
| 2,440.0             | 7,320.00               | 5.2                | V             | 5.79         | 36.06                | 47.05                 | 6.95      |         |
| 2,440.0             | 7,320.00               | 5.4                | H             | 5.79         | 36.06                | 47.25                 | 6.75      |         |
| 2,440.0             | 9,760.00               | 4.0                | H             | 6.83         | 36.86                | 47.69                 | 6.31      |         |
| 2,440.0             | 9,760.00               | 5.1                | V             | 6.83         | 36.86                | 48.79                 | 5.21      |         |

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**TEST DATA CONTD.**

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBuV | Ant. Polarity | Coax Loss dB | Correction Factor dB | Field Strength dBuV/m | Margin dB |         |
|---------------------|------------------------|--------------------|---------------|--------------|----------------------|-----------------------|-----------|---------|
| 2,440.0             | 12,200.00              | 2.2                | V             | 7.94         | 38.86                | 49.00                 | 5.00      |         |
| 2,440.0             | 12,200.00              | 3.2                | H             | 7.94         | 38.86                | 50.00                 | 4.00      |         |
| 2,480.0             | 2,480.00               | 59.2               | H             | 3.24         | 32.45                | 94.89                 | 19.11     | PEAK    |
| 2,480.0             | 2,480.00               | 55.9               | H             | 3.24         | 32.45                | 91.59                 | 2.41      | AVERAGE |
| 2,480.0             | 2,480.00               | 61.3               | V             | 3.24         | 32.45                | 96.99                 | 17.01     | PEAK    |
| 2,480.0             | 2,480.00               | 58.1               | V             | 3.24         | 32.45                | 93.79                 | 0.21      | AVERAGE |
| 2,480.0             | 4,960.00               | 14.3               | V             | 4.98         | 34.10                | 53.38                 | 0.62      | PEAK    |
| 2,480.0             | 4,960.00               | 6.3                | V             | 4.98         | 34.10                | 45.38                 | 8.62      | AVERAGE |
| 2,480.0             | 4,960.00               | 14.9               | H             | 4.98         | 34.10                | 53.98                 | 0.02      | PEAK    |
| 2,480.0             | 4,960.00               | 6.7                | H             | 4.98         | 34.10                | 45.78                 | 8.22      | AVERAGE |
| 2,480.0             | 7,440.00               | 6.4                | H             | 5.86         | 36.09                | 48.35                 | 5.65      |         |
| 2,480.0             | 7,440.00               | 7.1                | V             | 5.86         | 36.09                | 49.05                 | 4.95      |         |
| 2,480.0             | 9,920.00               | 5.1                | V             | 6.88         | 37.02                | 49.00                 | 5.00      |         |
| 2,480.0             | 9,920.00               | 5.3                | H             | 6.88         | 37.02                | 49.20                 | 4.80      |         |
| 2,480.0             | 12,400.00              | 3.7                | H             | 8.08         | 39.02                | 50.80                 | 3.20      |         |
| 2,480.0             | 12,400.00              | 4.9                | V             | 8.08         | 39.02                | 52.00                 | 2.00      |         |

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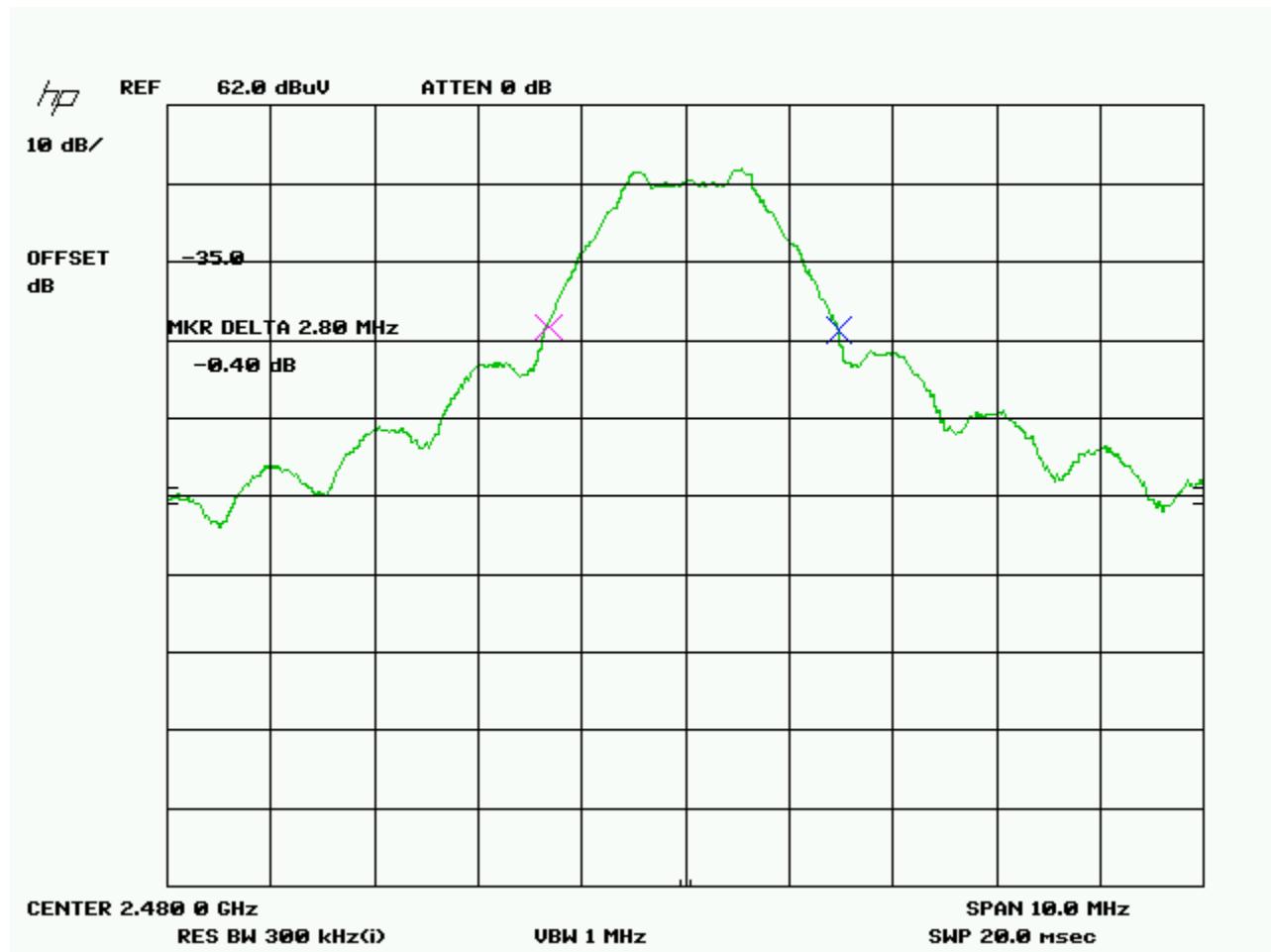
 REPORT #: Y:\R\RADIOS\_W4C\277AUT9\277AUT9TestReport.doc
 

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## 20 dB OCCUPIED BANDWIDTH

**Rules Part No.:** 15.249 (d)

**Test Data:**




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## BAND EDGE COMPLIANCE

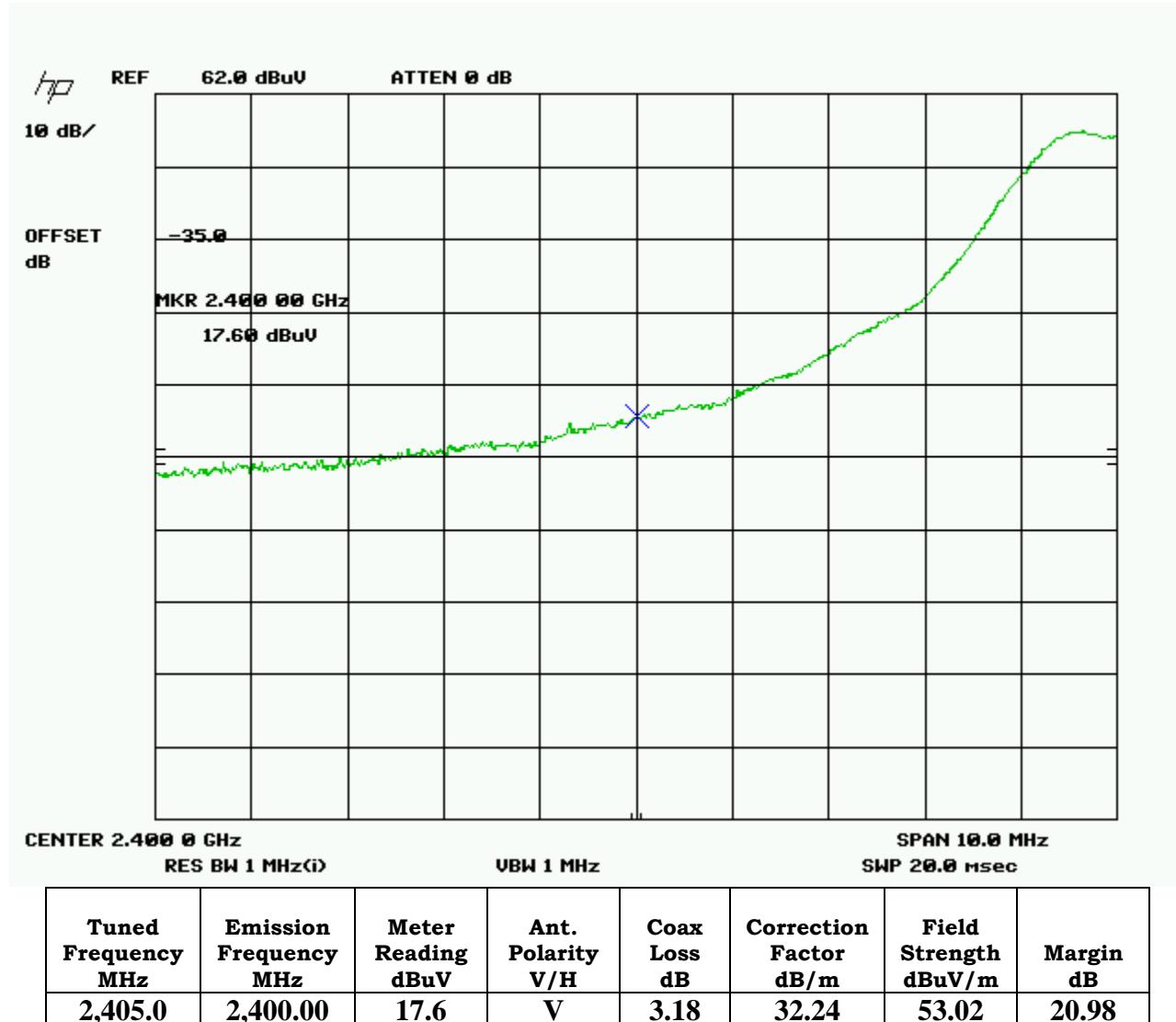
**Rules Part No.:** 15.249 (d)

**Requirements:** 40 dBc or in the case of restricted bands 54 dBuV/m.

### Test Data:

Lower band edge

Peak Plot

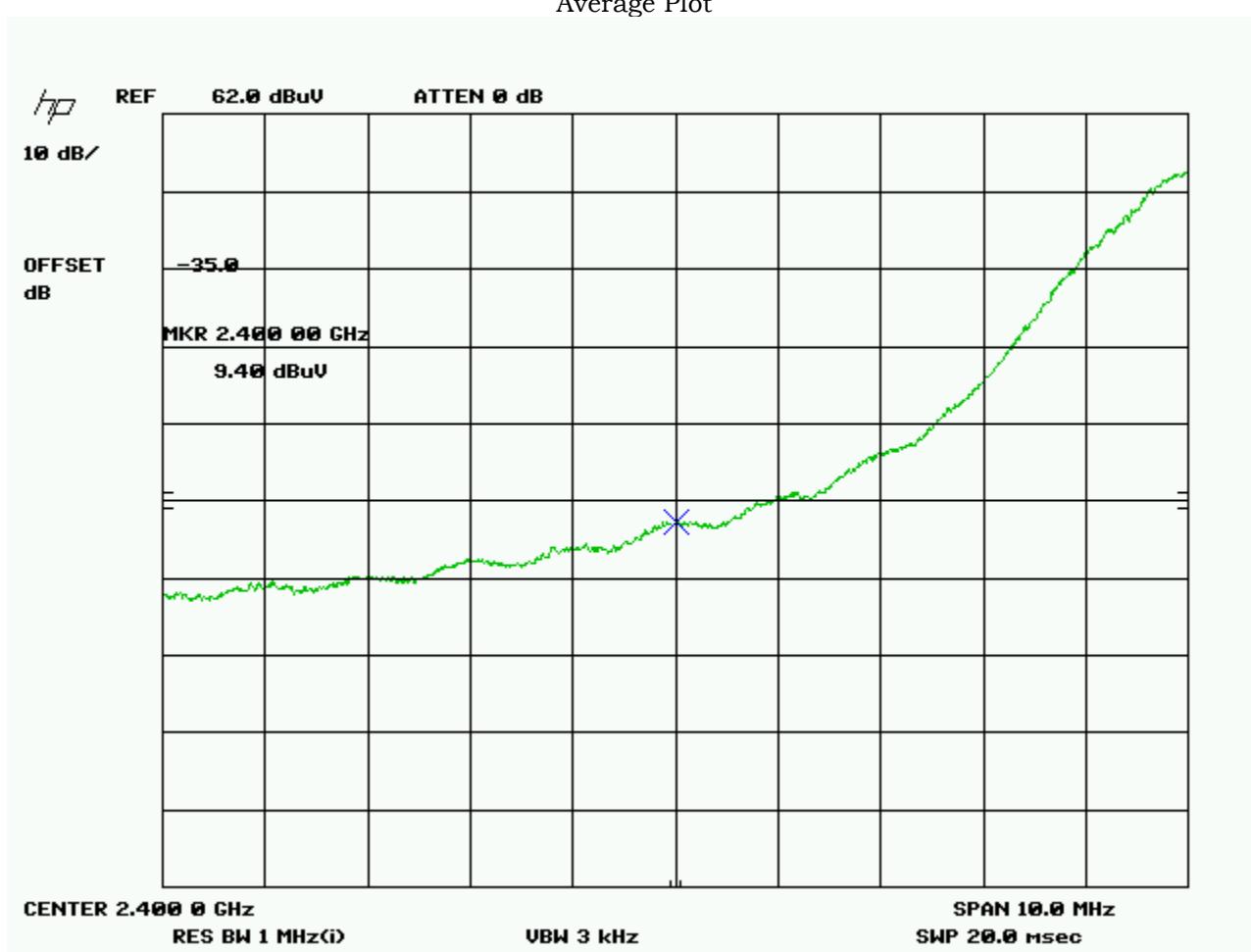


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## Average Plot



| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBuV | Ant. Polarity V/H | Coax Loss dB | Correction Factor dB/m | Field Strength dBuV/m | Margin dB |
|---------------------|------------------------|--------------------|-------------------|--------------|------------------------|-----------------------|-----------|
| 2,405.0             | 2,400.00               | 9.4                | V                 | 3.18         | 32.24                  | 44.82                 | 9.18      |

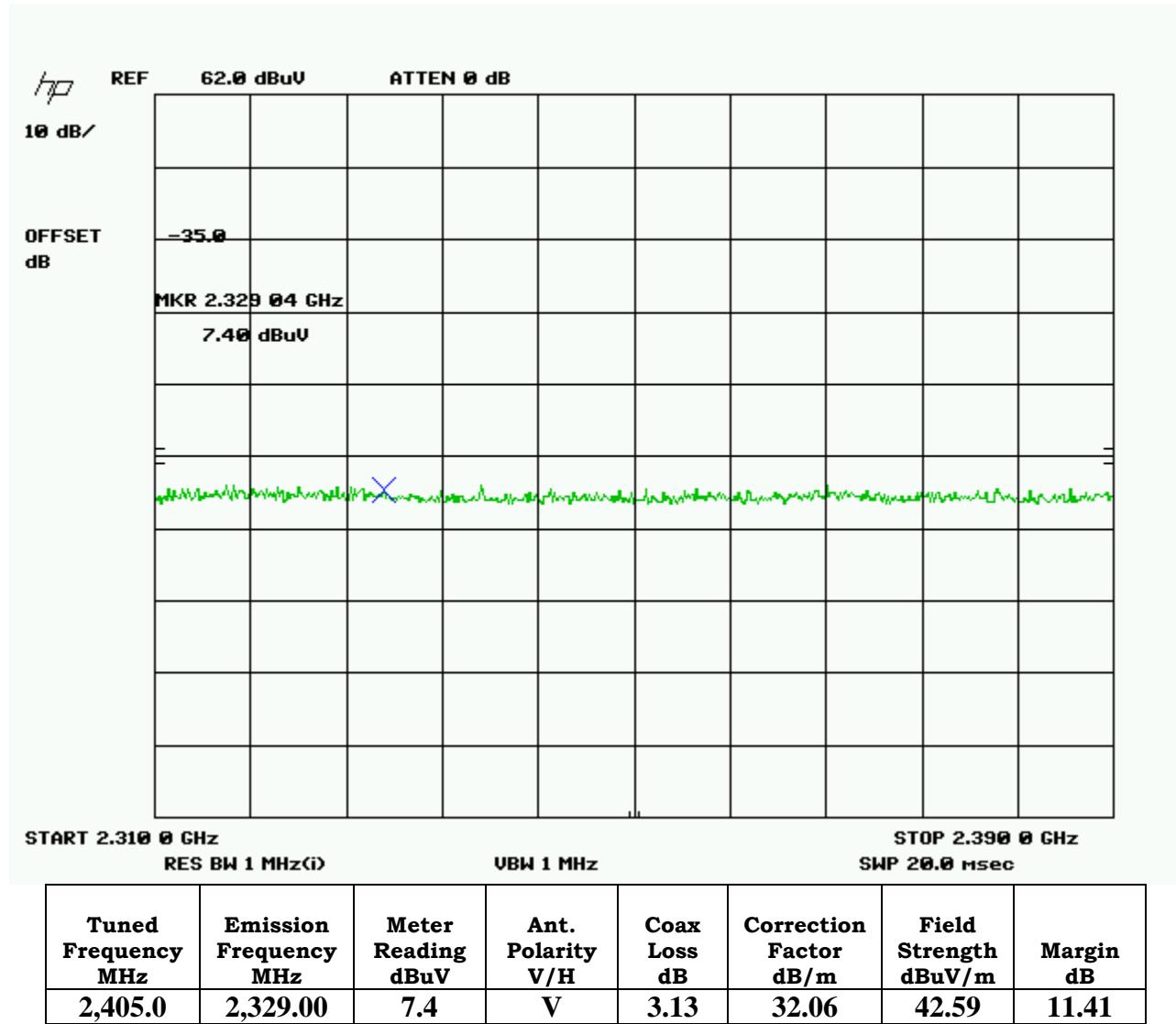
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Lower non-adjacent restricted band

Peak Plot



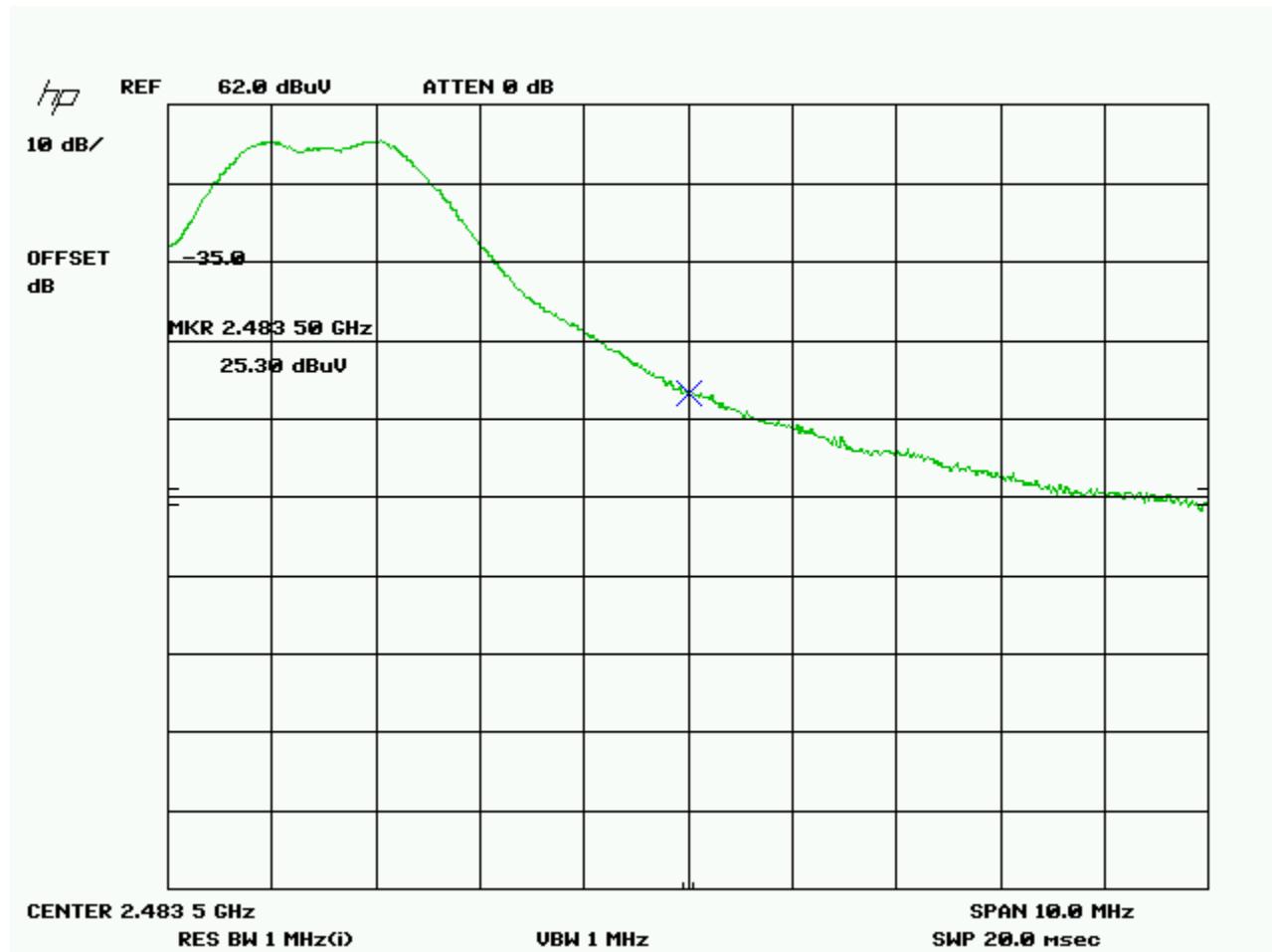

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Upper band edge

Peak Plot

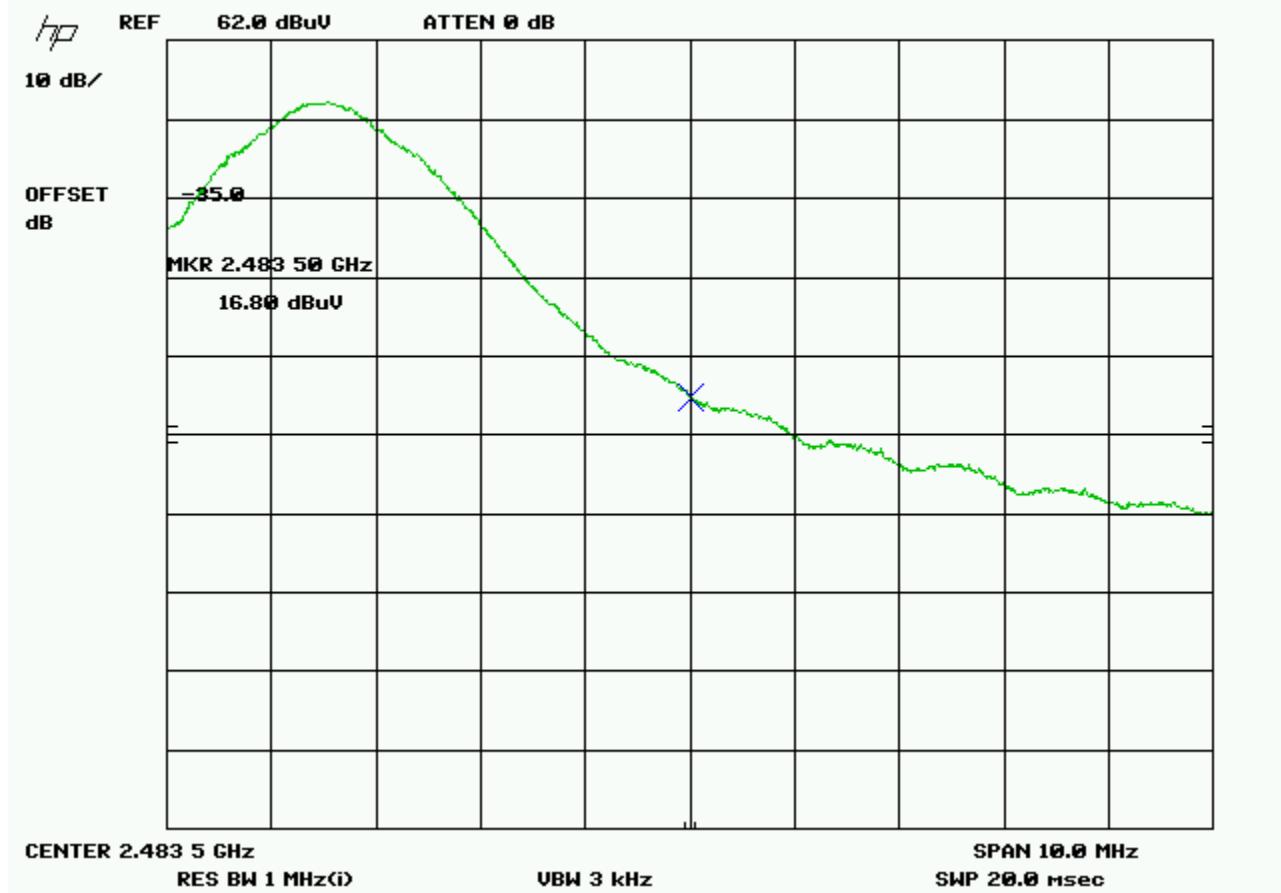


| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dBuV | Ant. Polarity V/H | Coax Loss dB | Correction Factor dB/m | Field Strength dBuV/m | Margin dB |
|---------------------|------------------------|--------------------|-------------------|--------------|------------------------|-----------------------|-----------|
| 2,480.0             | 2,483.50               | 25.3               | V                 | 3.24         | 32.46                  | 61.00 P               | 13.00     |
| 2,480.0             | 2,483.50               | 16.8               | V                 | 3.24         | 32.46                  | 52.50 A               | 1.50      |

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## Average Plot




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## POWER LINE CONDUCTED INTERFERENCE

**Rules Part No.:** 15.207

**Requirements:**

| Frequency<br>(MHz) | Quasi Peak Limits<br>(dB $\mu$ V) | Average Limits<br>(dB $\mu$ V) |
|--------------------|-----------------------------------|--------------------------------|
| 0.15 – 0.5         | 66 – 56                           | 56 – 46                        |
| 0.5 – 5.0          | 56                                | 46                             |
| 5.0 – 30           | 60                                | 50                             |

**Test Data:** The attached graphs represent the emissions read for power line conducted for this device. Both lines were observed.

N/A  
 Battery or vehicle powered DUT.

**RADIATED EMISSIONS TEST SET UP PHOTO**



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