TIMCO ENGINEERING, Inc.

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# FCC PART 90 & RSS-119 (i12)

# VHF BASE STATION

# TEST REPORT

| | |
|---|---|
| **APPLICANT** | **COMTRONIX COMMUNICATIONS INC.** |
| **ADDRESS** | **42327 RIO NEDO, SUITE A TEMECULA CA 92590 USA** |
| **FCC ID** | **2AHIALBR100C** |
| **IC CERT** | **21255-LBR100C** |
| **MODEL NUMBER** | **LBR-100** |
| PRODUCT DESCRIPTION | VHF LOW BAND REPEATER |
| DATE SAMPLE RECEIVED | 3/16/2016 |
| FINAL TEST DATE | 3/28/2016 |
| TESTED BY | Cory Leverett |
| APPROVED BY | Tim Royer |
| TEST RESULTS | ☒ PASS ☐ FAIL |

| Report Number | Version Number | Description | Issue Date |
|---|---|---|---|
| 514AUT16TestReport_ | Rev1 | Initial Issue | 4/7/2016 |

# Table of Contents

## 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.

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:

**Authorized Signatory Name:** _____

Cory Leverett
Project Manager/Testing Technician

Date: 3/31/2016

## GENERAL INFORMATION

### EUT Specification

| | |
|---|---|
| **EUT Description** | **VHF LOW BAND REPEATER** |
| **FCC ID** | **2AHIALBR100C** |
| **IC CERT** | **21255-LBR100C** |
| **Model Number** | **LBR-100** |
| Operating Frequency | 39.05 – 49.95 MHz |
| Test Frequencies | 39.45, 44.09, 49.55 MHz |
| Type of Emission | 16K0F3E |
| Modulation | FM Analog Voice |
| EUT Power Source | ☐ 110–120Vac/50– 60Hz |
| | ☒ DC Power 13.8 VDC Nominal |
| | ☐ Battery Operated Exclusively |
| Test Item | ☐ Prototype |
| | ☐ Pre-Production |
| | ☒ Production |
| Type of Equipment | ☒ Fixed |
| | ☐ Mobile |
| | ☐ Portable |
| Test Conditions | Temperature: 24-26ºC<br>Relative Humidity: 50 - 65%. |
| Modification to the EUT | None |
| Test Exercise | The EUT was modulated as required by standard. |
| Regulatory Standard | FCC CFR 47 Part 90, 22 |
| Measurement Standard | ANSI/TIA 603-D:2010<br>ANSI C63.4 – 2014<br>RSS-GEN ISSUE 4<br>RSS-119 ISSUE 12 |
| Test Facility | **Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.** |

## TEST RESULTS SUMMARY

| TEST DESCRIPTION | FCC RULE PART NO. | IC RSS 119 | RESULT |
|---|---|---|---|
| RF Power Output | 2.1046(a), 90.205 | Sec 5.4 | Pass |
| Modulation Characteristics | 2.1047(a)(b), 90.207 | Sec 5.5 | Pass |
| Occupied Bandwidth | 2.1049(c)(h), 90.210 (b) | Sec 5.5 | Pass |
| Spurious Emissions at Antenna Terminal | 2.1051(a), 90.210(b) | Sec 5.8 | Pass |
| Field Strength of Spurious Radiation | 2.1053, 90.210 (b) | Sec 5.8 | Pass |
| Frequency Stability | 2.1055, 90.213 | Sec 5.3 | Pass |

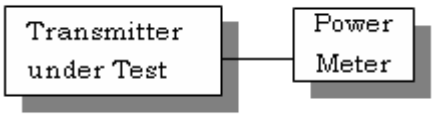
## RF POWER OUTPUT

**Specification:** FCC Part 2.1046(a) & 90.205
IC RSS-119 sec 5.4

**Limits:** Limit on power is geographically dependent. The Rf power is measured and reported only

**Procedure:** RF power is measured by using a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage (if battery operated), or a properly adjusted power supply (if not battery operated), and the transmitter properly adjusted the RF output measures:

**Diagram:**




**Test Data:** **Conducted Power Output Table**

| | RF POWER | |
|---|---|---|
| Tuned Frequency (MHz) | (W) | (dBm) |
| 39.45 | 122.74 | 50.89 |
| 44.09 | 123.02 | 50.90 |
| 49.55 | 118.85 | 50.75 |

Part 2.1033 (C) (8) DC Input into the final amplifier

INPUT POWER: (13.8V) (16.2A) = 223.56 Watts

## MODULATION CHARACTERISTICS

**Requirements:** FCC Part 2.1033(c), 2.1033(c) (4), 2.1047(a)(b), 90.209, & 90.207
IC RSS-119 sec 5.5

## BANDWIDTH CALCUATION

Type of Emission: 16K0F3E

Bn = 2M + 2DK
M = 3000
D = 5000
K=1
Bn = 2(3000) +2(5000) = 16.0k

## MODULATION CHARACTERISTICS

### AUDIO FREQUENCY RESPONSE

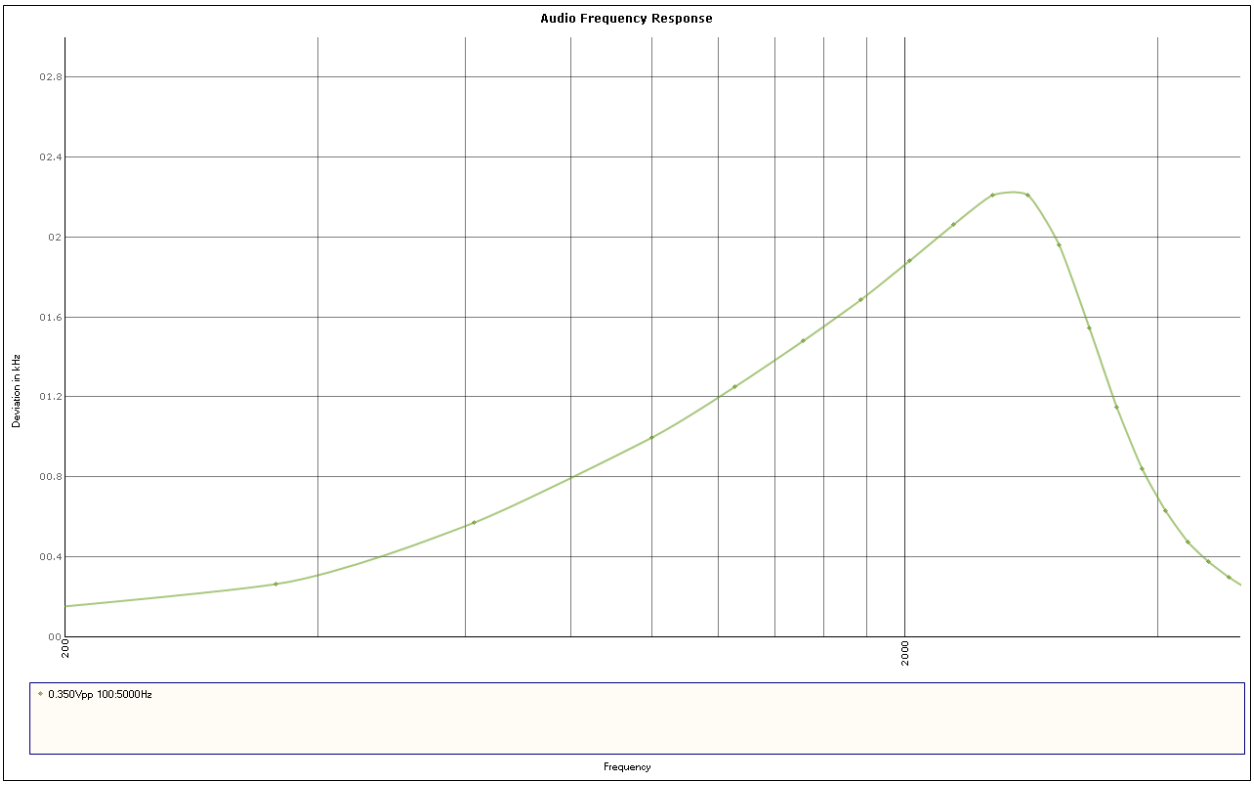
**Rule Part No.:** Part 2.1047(a) (b)

**Test Requirements:** Reporting Only

**Method of Measurement:** ANSI/TIA-603 § 2.2.6 Audio Frequency Response

**TEST DATA:**

**AUDIO FREQUENCY RESPONSE – 25 kHz**



## MODULATION CHARACTERISTICS

### AUDIO LOW PASS FILTER

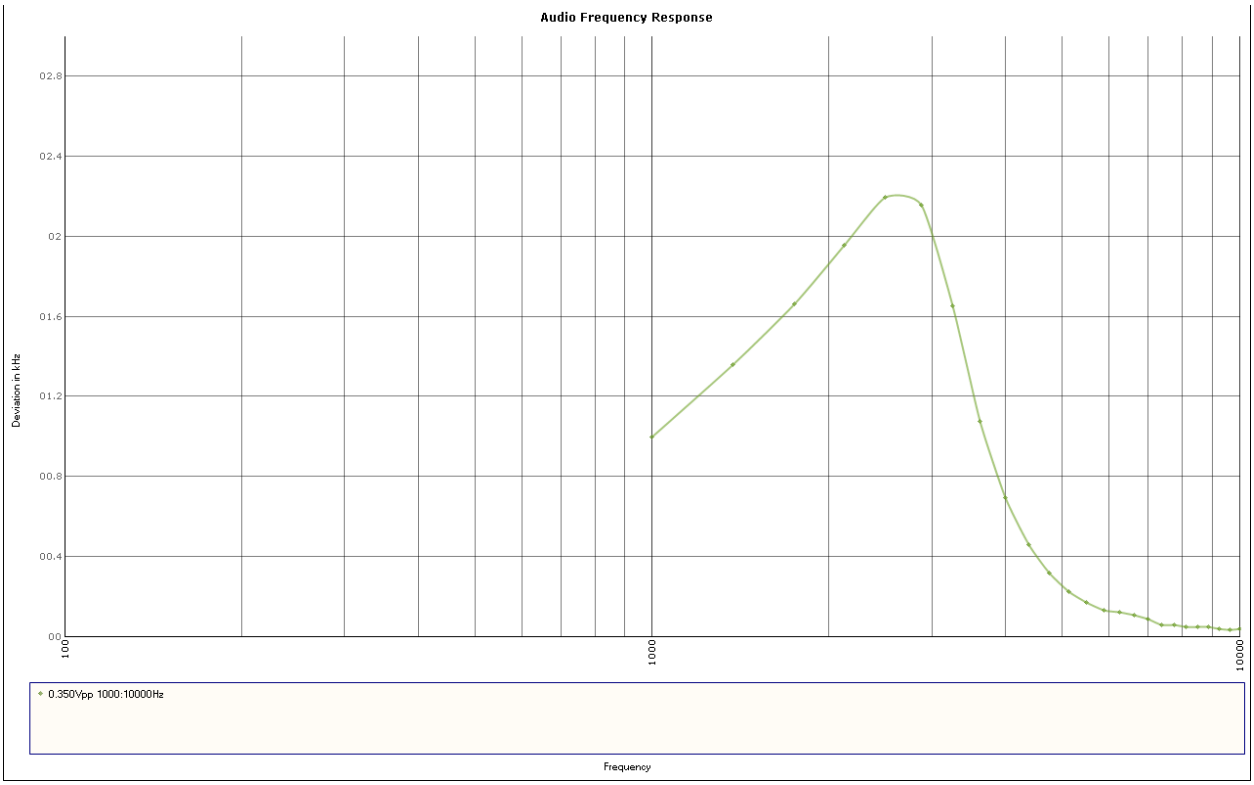
**Rule Part No.:** Part 2.1047(a) (b)

**Test Requirements:** For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all the circuitry installed between the modulation limiter and the modulated stage shall be submitted.

**Method of Measurement:** ANSI/TIA-603 § 2.2.15 Audio Low pass filter Response

**TEST DATA:**

**AUDIO LOW PASS FILTER 25 kHz**



## MODULATION CHARACTERISTICS –

### AUDIO INPUT VERSUS MODULATION

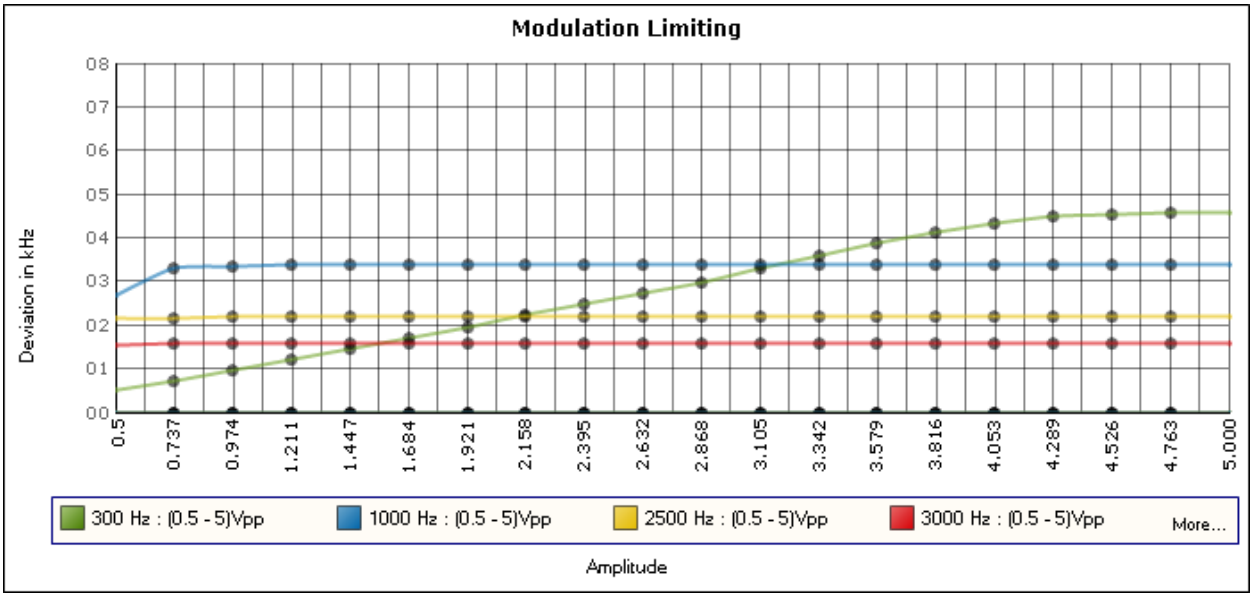
**RULE PART NO:** **Part 2.1047(b)**

**REQUIREMENT** Modulation cannot exceed 100% of the rated FM deviation.

**Method of Measurement:** ANSI/TIA-603 § 2.2.3

**Test data:**

**MODULATION LIMITING 25 kHz**



## OCCUPIED BANDWIDTH

**Specification.:** FCC Rule Part 2.1049(c) & 90.210 (b)
IC RSS-119 sec 5.5

**Limits:**

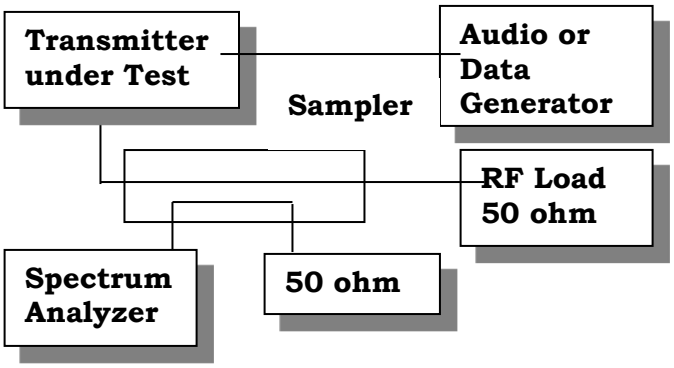
Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

**Procedure:** ANSI/TIA-603 § 2.2.11 Sideband Spectrum

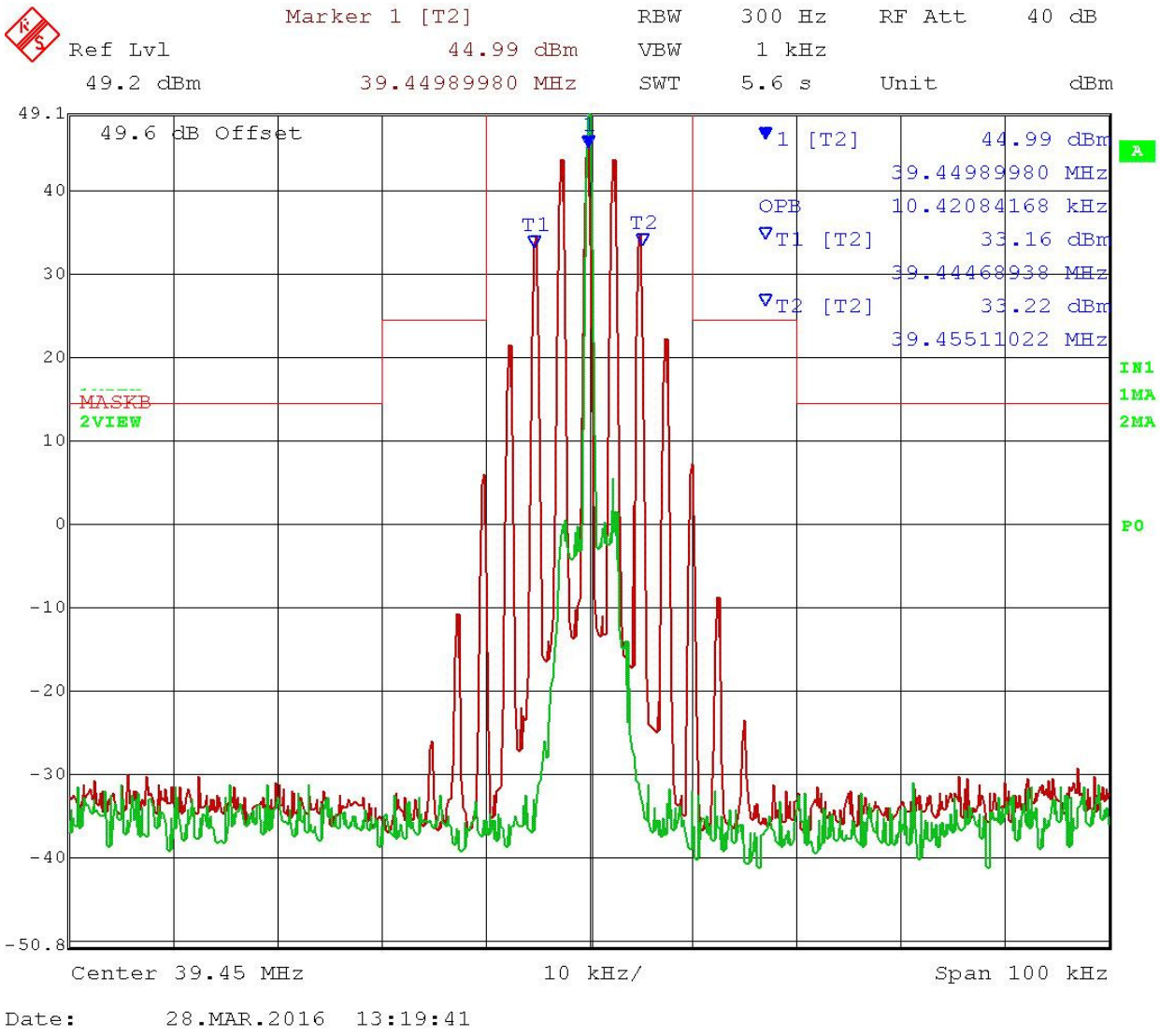
**Diagram:**



## OCCUPIED BANDWIDTH

## TEST FREQ. 39.45 MHz

Part 90.210(b) Emission Mask B – Equipment with audio Low pass filter

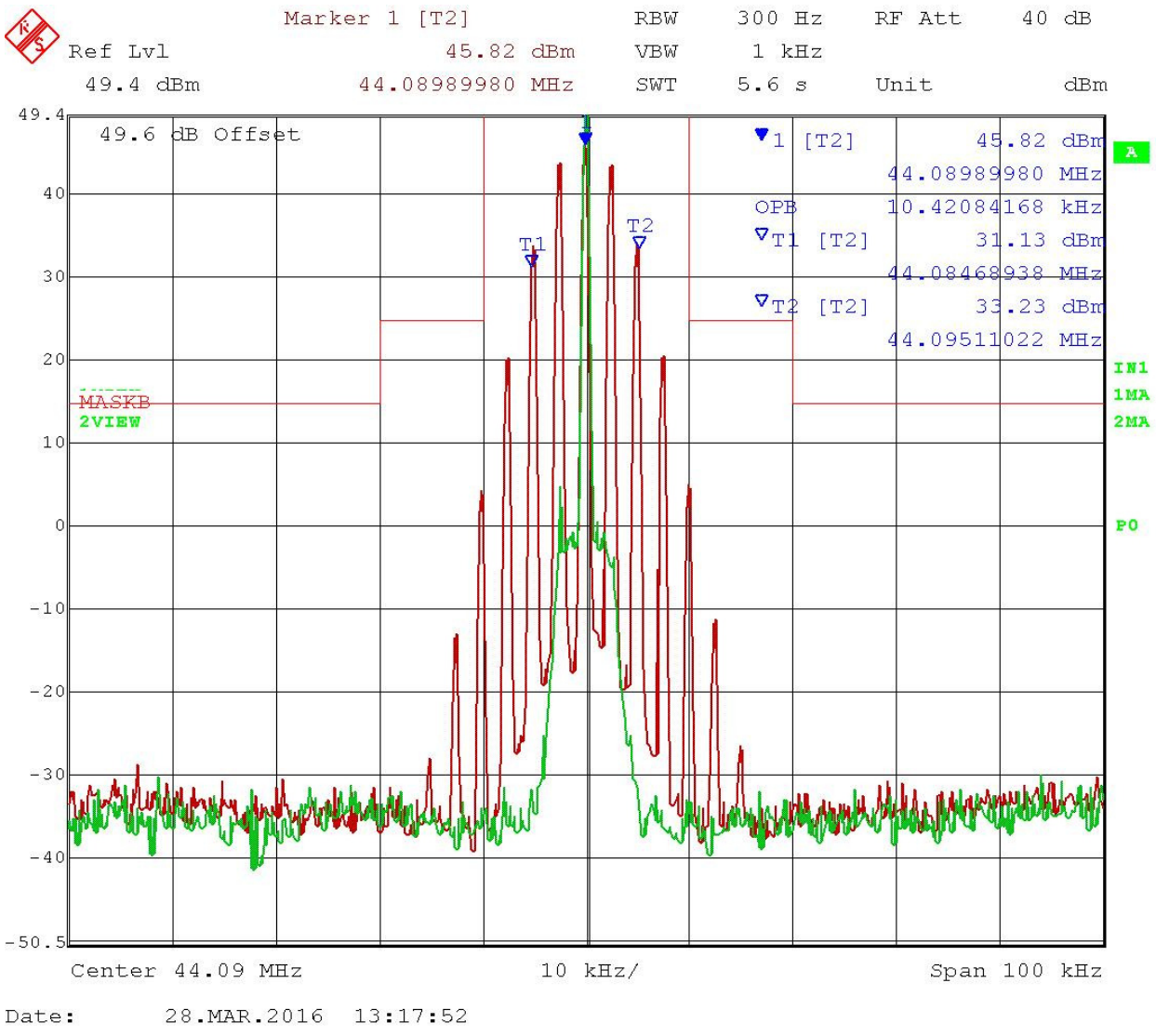



Date: 28.MAR.2016 13:19:41

## OCCUPIED BANDWIDTH

## TEST FREQ. 44.09 MHz

Part 90.210(b) Emission Mask B – Equipment with audio Low pass filter

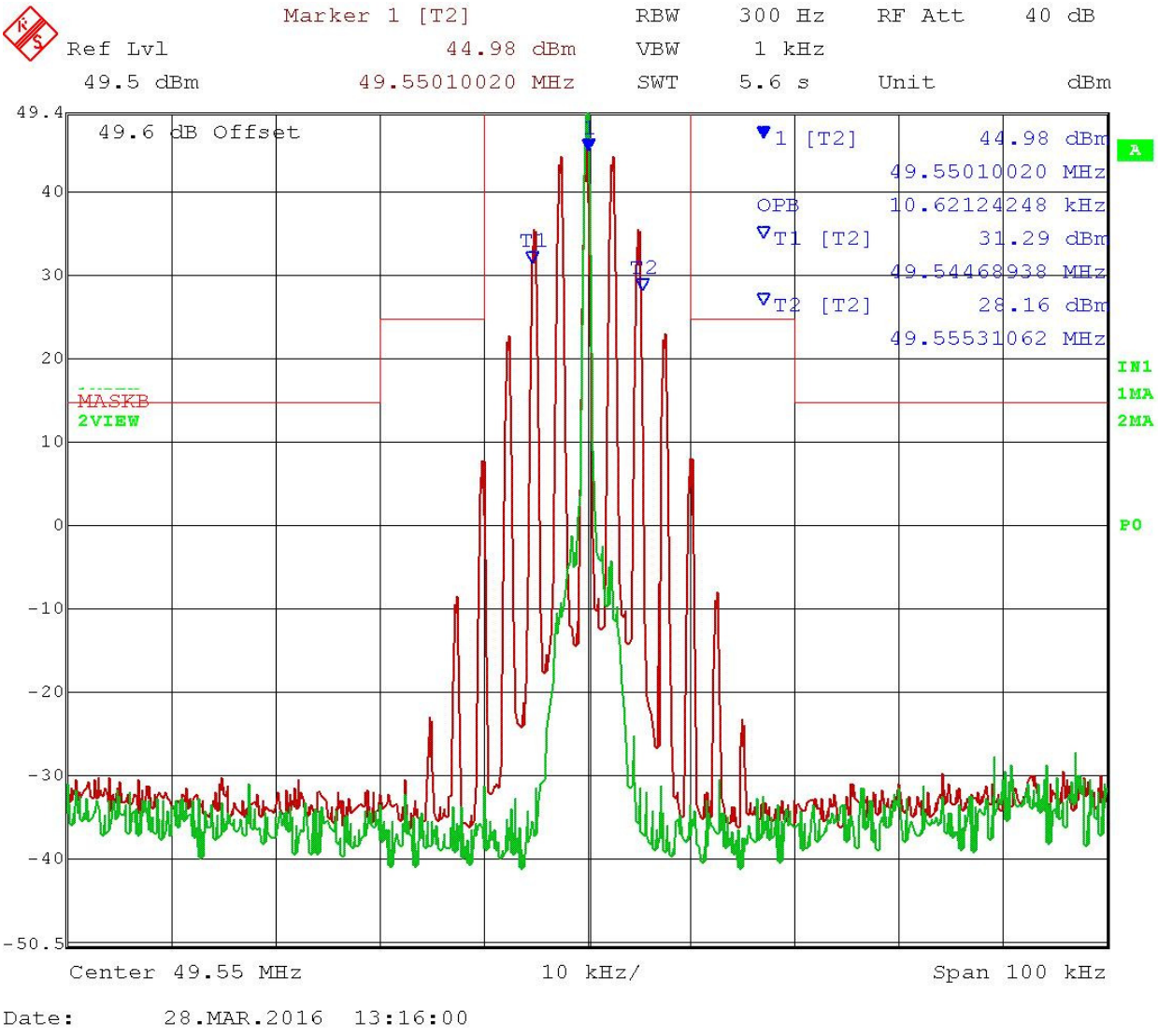



Date: 28.MAR.2016 13:17:52

## OCCUPIED BANDWIDTH

## TEST FREQ. 49.55 MHz

Part 90.210(b) Emission Mask B – Equipment with audio Low pass filter



## SPURIOUS EMISSIONS AT ANTENNA TERMINALS

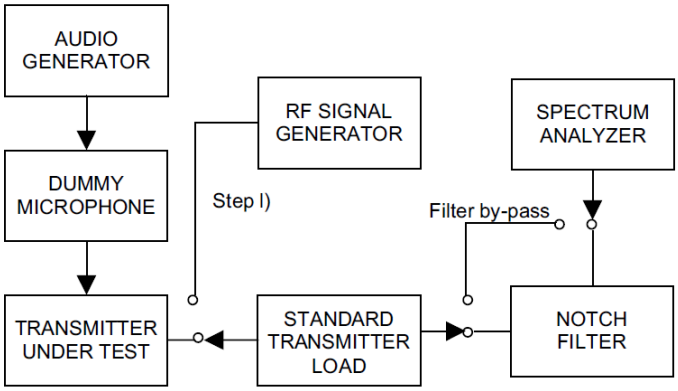
**Specification:** FCC Rule Part 2.1051(a), 90.210, 22.359 (a)
IC RSS-119 sec 5.8

**Limits:**

| Rule Part | Requirement |
|---|---|
| 90.210 (b), 22.359 (a) | 43 + 10log (P) dB |

**Procedure:** ANSI/TIA-603 § 2.2.13 Unwanted Emissions: Conducted Spurious

**Diagram:**




**TEST FREQ. 39.45 MHz**

| | dBm | Watts | Limit |
|---|---|---|---|
| Power Output | 50.74 | 118.58 | 63.74 |
| | | | |
| | Frequency | dBc | Margin |
| | 39.45 | 0 | 0.0 |
| | 78.90 | 84.9 | 21.2 |
| | 118.35 | 71.6 | 7.9 |
| | 157.80 | 81.8 | 18.1 |
| | 197.25 | 82.5 | 18.7 |
| | 236.70 | 81.7 | 18.0 |
| | 276.15 | 96.4 | 32.7 |
| | 315.60 | 94.6 | 30.9 |
| | 355.05 | 98.9 | 35.2 |
| * | 394.50 | 102.7 | 39.0 |
| | | | |

* Indicates only the noise floor was present

## SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### TEST FREQ. 44.09 MHz

| | dBm | Watts | Limit |
|---|---|---|---|
| Power Output | 50.904 | 123.14 | 63.90 |
| | | | |
| | Frequency | dBc | Margin |
| | 44.09 | 0 | 0.0 |
| | 88.18 | 84.4 | 20.5 |
| | 132.27 | 68.6 | 4.7 |
| | 176.36 | 84.5 | 20.6 |
| | 220.45 | 96.3 | 32.4 |
| | 264.54 | 94.7 | 30.8 |
| | 308.63 | 92.2 | 28.3 |
| | 352.72 | 93.4 | 29.5 |
| | 396.81 | 99.3 | 35.4 |
| * | 440.90 | 113.5 | 49.6 |
| | | | |

* Indicates only the noise floor was present

### TEST FREQ. 49.55 MHz

| | dBm | Watts | Limit |
|---|---|---|---|
| Power Output | 50.893 | 122.83 | 63.893 |
| | | | |
| | Frequency | dBc | Margin |
| | 49.55 | 0 | 0.0 |
| | 99.10 | 88.0 | 24.1 |
| | 148.65 | 72.1 | 8.2 |
| | 198.20 | 90.0 | 26.1 |
| | 247.75 | 96.0 | 32.1 |
| | 297.30 | 86.8 | 22.9 |
| | 346.85 | 91.6 | 27.7 |
| | 396.40 | 94.6 | 30.7 |
| | 445.95 | 99.5 | 35.6 |
| * | 495.50 | 118.6 | 54.7 |
| | | | |

* Indicates only the noise floor was present

**Result: Meets Requirement**

## FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS

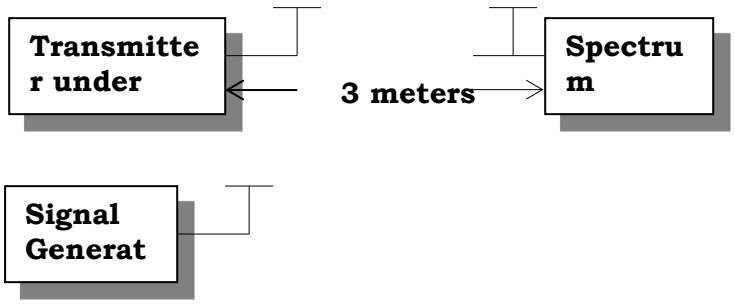
**Specification** FCC Rule Part 2.1053, 90.210, 22.359
IC RSS-119 sec 5.8

**Limits:** Out of Band Emission Limits

| Rule Part | Requirement |
|---|---|
| 90.210 (b), 22.359 (a) | 43 + 10log (P) dB |

**Procedure** : ANSI/TIA-603 § 2.2.12 Unwanted Emissions: Radiated Spurious

**Diagram**:




**TEST FREQ. 39.45 MHz**

| Emission Frequency (MHz) | Power Mode | ERP Power Output (dBm) | ERP Power Output (Watts) | FCC Requirement dB | Bandwidth - BW - kHz |
|---|---|---|---|---|---|
| 39.45 | Hi | 50.89 | 122.74 | 63.89 | 25.00 |

| Emission Frequency (MHz) | Ant. Polarity | Below Carrier (dBc) | Margin |
|---|---|---|---|
| 78.90 | V | 113.76 | 49.87 |
| 118.35 | V | 86.92 | 23.03 |
| 157.80 | H | 94.35 | 30.46 |
| 197.25 | H | 86.45 | 22.56 |
| 236.70 | H | 99.21 | 35.32 |
| 276.15 | H | 109.77 | 45.88 |
| 315.60 | H | 104.45 | 40.56 |
| 355.05 | H | 104.57 | 40.68 |
| 394.50 | H | 114.47 | 50.58 |

## FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS

### TEST FREQ. 44.09 MHz

| Emission Frequency (MHz) | Power Mode | ERP Power Output (dBm) | ERP Power Output (Watts) | FCC Requirement dB | Bandwidth - BW - kHz |
|---|---|---|---|---|---|
| 44.09 | Hi | 50.90 | 123.03 | 63.90 | 25.00 |

| Emission Frequency (MHz) | Ant. Polarity | Below Carrier (dBc) | Margin |
|---|---|---|---|
| 88.18 | H | 115.52 | 51.62 |
| 132.27 | H | 81.56 | 17.66 |
| 176.36 | V | 74.62 | 10.72 |
| 220.45 | H | 94.10 | 30.20 |
| 264.54 | V | 106.26 | 42.36 |
| 308.63 | H | 101.68 | 37.78 |
| 352.72 | H | 96.90 | 33.00 |
| 396.81 | H | 103.91 | 40.01 |
| 440.90 | H | 114.02 | 50.12 |

### TEST FREQ. 49.55 MHz

| Emission Frequency (MHz) | Power Mode | ERP Power Output (dBm) | ERP Power Output (Watts) | FCC Requirement dB | Bandwidth - BW - kHz |
|---|---|---|---|---|---|
| 49.55 | Hi | 50.75 | 118.85 | 63.75 | 25.00 |

| Emission Frequency (MHz) | Ant. Polarity | Below Carrier (dBc) | Margin |
|---|---|---|---|
| 99.10 | V | 100.46 | 36.71 |
| 148.65 | H | 88.58 | 24.83 |
| 198.20 | H | 99.63 | 35.88 |
| 247.75 | V | 104.18 | 40.43 |
| 297.30 | H | 111.70 | 47.95 |
| 346.85 | H | 100.18 | 36.43 |
| 396.40 | V | 115.05 | 51.30 |
| 445.95 | V | 110.22 | 46.47 |
| 495.50 | H | 113.99 | 50.24 |

**Results meet requirements**

## FREQUENCY STABILITY

**Rule Parts. No.:** FCC Rule Part 2.1055, Part 90.213
IC RSS-119 sec 5.3

**Requirements:** Temperature range requirements: -30 to +50º C.
Voltage Variation +, -15%
For Rated Power > 2 Watts is ±20 PPM

**Method of Measurements:** ANSI/TIA 603-D: 2.2.2

**TEST FREQ: 49.55 MHz**

| Temperature | Frequency MHz | Cycles | PPM |
|---|---|---|---|
| 25°C (reference) | 49.549961 | | |
| -30°C | 49.549847 | -114 | -2.301 |
| -20°C | 49.550016 | 55 | 1.110 |
| -10°C | 49.550032 | 71 | 1.433 |
| 0°C | 49.550026 | 65 | 1.312 |
| 10°C | 49.550008 | 47 | 0.949 |
| 20°C | 49.549994 | 33 | 0.666 |
| 30°C | 49.549962 | 1 | 0.020 |
| 40°C | 49.549958 | -3 | -0.061 |
| 50°C | 49.549968 | 7 | 0.141 |
| | | | |
| Battery Voltage (VDC) | Frequency | Cycles | PPM |
| 11.73 | 49.549960 | -1 | -0.020 |
| 13.80 | 49.549961 | | |
| 15.87 | 49.549963 | 2 | 0.040 |

## EQUIPMENT LIST

| Device | Manufacturer | Model | Serial Number | Cal/ Char Date | Due Date |
|---|---|---|---|---|---|
| 12 Volt Power Supply | Astron | VS-50M | 9001191 | NA | NA |
| Antenna: Biconnical | Eaton | 94455-1 | 1057 | 11/18/15 | 11/18/17 |
| Antenna: Log-Periodic | Eaton | 96005 | 1243 | 02/09/16 | 02/09/18 |
| Digital Multimeter | Fluke | 77 | 35053830 | 10/21/15 | 10/21/17 |
| CHAMBER | Panashield | 3M | N/A | 01/05/16 | 01/05/19 |
| Antenna: Double-Ridged Horn/ETS Horn 1 | ETS-Lindgren | 3117 | 00035923 | 06/13/14 | 06/13/16 |
| EMI Test Receiver R & S ESIB 40 | Rohde & Schwarz | ESIB 40 | 100274 | 08/12/14 | 08/12/16 |
| Software: Field Strength Program | Timco | N/A | Version 4.0 | N/A | N/A |
| Antenna: Active Loop | ETS-Lindgren | 6502 | 00062529 | 11/18/15 | 11/18/17 |
| Hygro-Thermometer | Extech | 445703 | 0602 | 06/30/15 | 06/30/17 |
| Attenuator N 30dB 150W DC-6G | Narda | 769-30 | 10267 | 06/26/15 | 06/26/17 |
| EMI Test Receiver R & S ESU 40 | Rohde & Schwarz | ESU 40 | 100320 | 12/15/14 | 12/15/17 |
| Temp Chamber | Tenney Engineering | TTRC | 11717-7 | 08/20/14 | 08/20/16 |
| Frequency Counter | HP | 5352B | 2632A00165 | 07/01/15 | 07/01/17 |
| Type K J Thermometer | Martel | 303 | 080504494 | 10/26/15 | 10/26/17 |
| Modulation Analyzer | HP | 8901A | 3050A05856 | 04/16/15 | 04/16/17 |
| Function Generator | Stanford | DS340 | 25200 | 02/02/16 | 02/02/18 |
| AC Volt Meter | HP | 400FL | 2213A14499 | 07/01/15 | 07/01/17 |

* EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

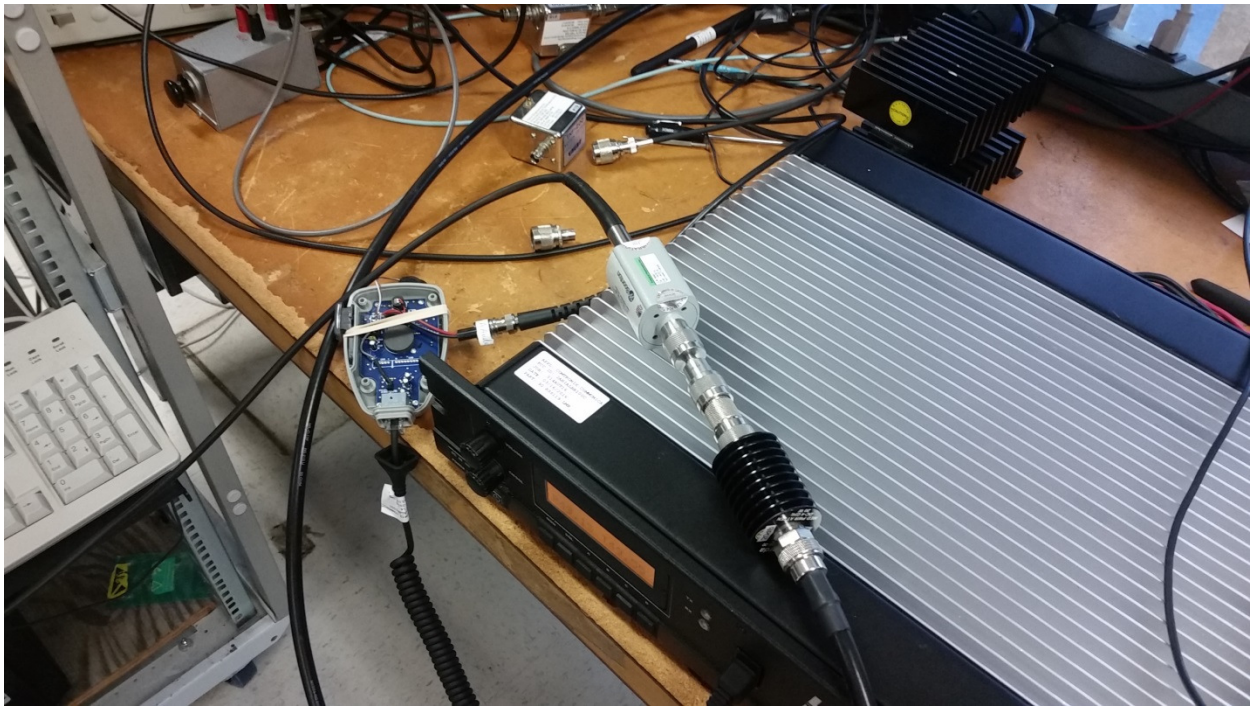
**Applicant: COMTRONIX COMMUNICATIONS INC.**

**FCC ID: 2AHIALBR100C**

**IC CERT: 21255-LBR100C**

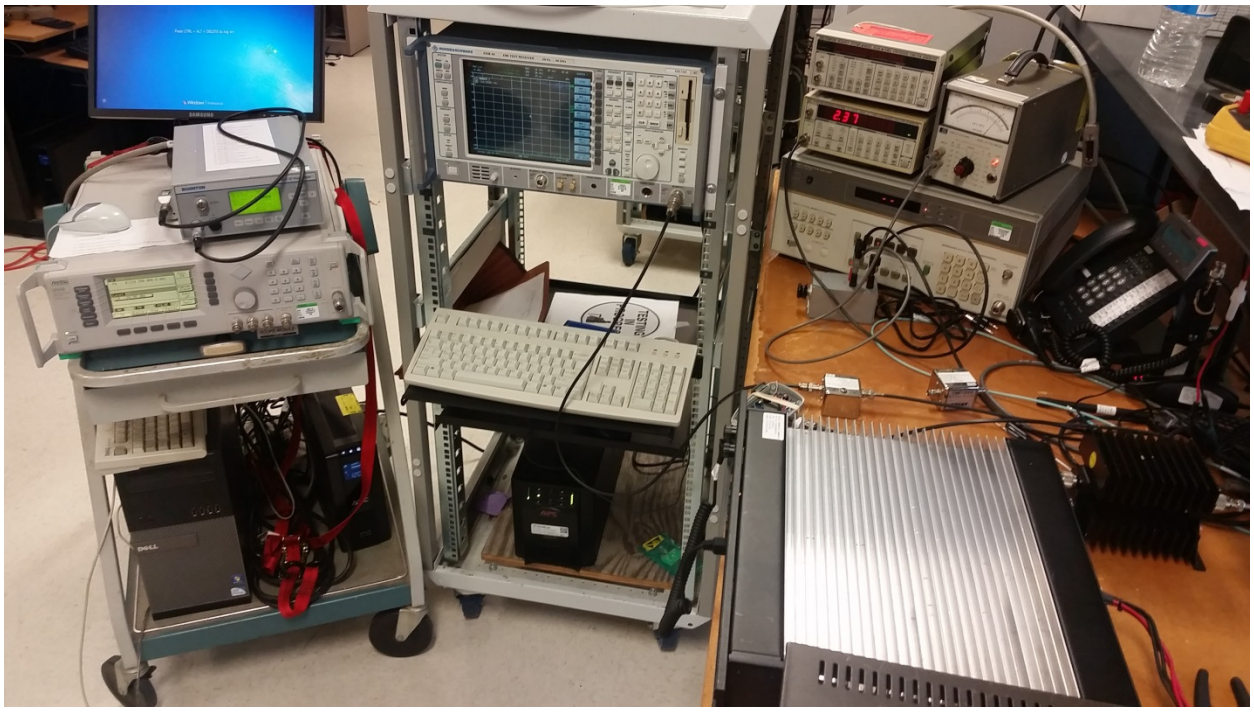
**TEST SET UP PHOTOS**

## OUTPUT POWER



## MODULATION CHARACTERISTICS

## ANT CONDUCTED EMISSIONS



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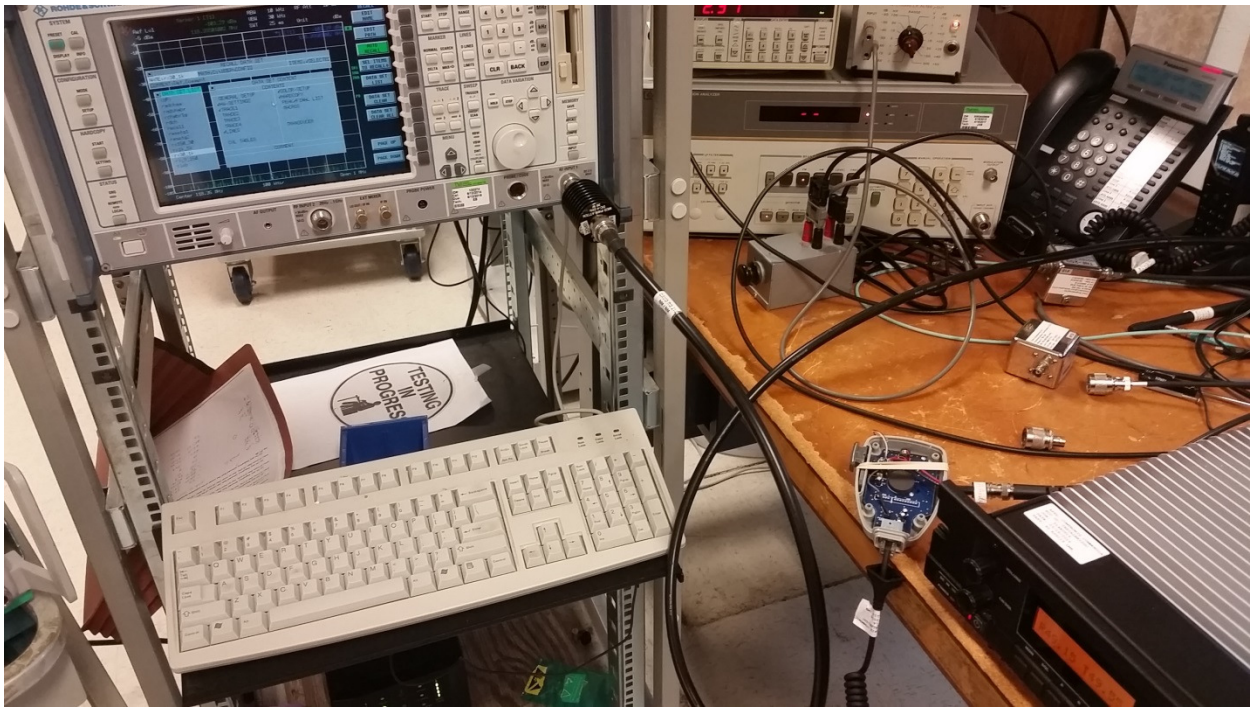
## OCCUPIED BANDWIDTH



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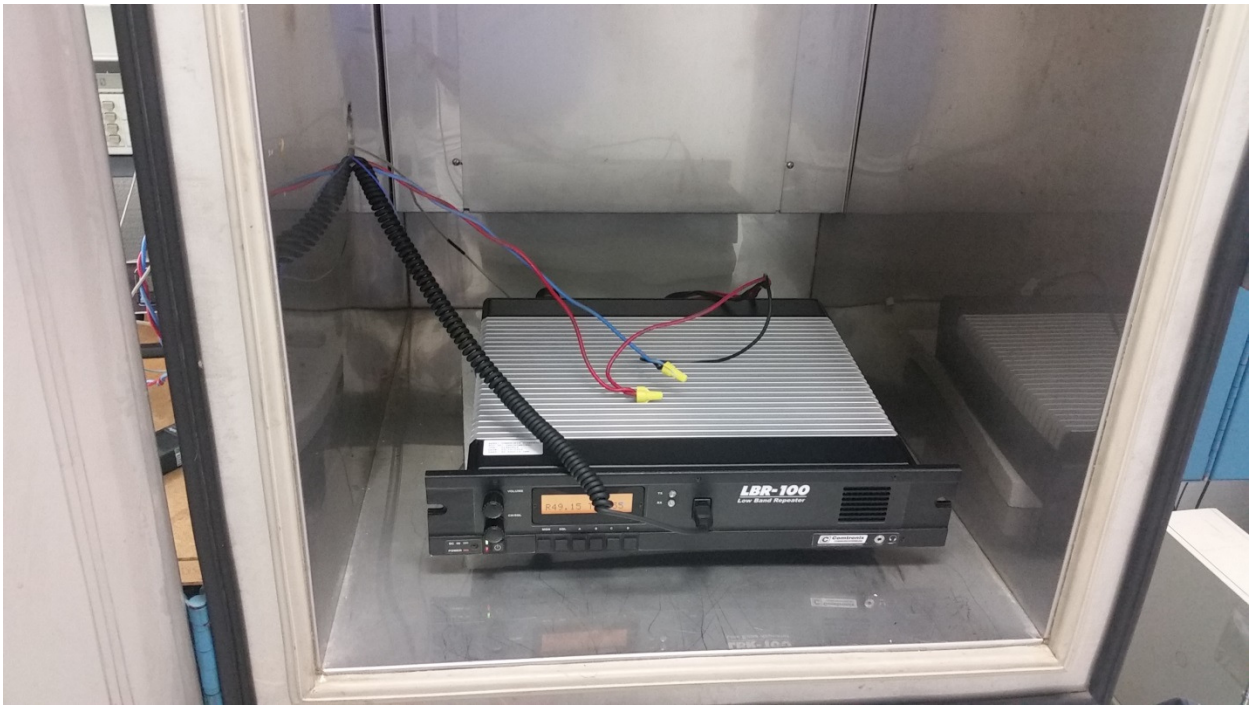
## TEMPERATURE STABILITY



## FIELD STRENGTH SPURIOUS EMISSIONS