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FCC PART 80 TEST REPORT

| | |
|-----------------------------|--|
| APPLICANT | COBRA ELECTRONICS CORPORATION |
| | 6500 WEST CORTLAND STREET CHICAGO IL 60707 USA |
| FCC ID | BBOMRHH450 |
| MODEL NUMBER | MR HH450 DUAL MR HH450 CAMO |
| PRODUCT DESCRIPTION | HANDHELD MARINE/GMRS RADIO |
| DATE SAMPLE RECEIVED | 11/22/2013 |
| DATE TESTED | 11/26/2013 |
| TESTED BY | NAM NGUYEN |
| APPROVED BY | NAM NGUYEN |
| TIMCO REPORT NO. | 2007AUT13TestReport.docx |
| 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.**



Testing 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.

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:

Nam Nguyen
Project Manager/Testing Technician

Date: January 14, 20143

Applicant: COBRA ELECTRONICS CORPORATION
FCC ID: BBOMRHH450
Report: V\COBRA\2007AUT13\2007AUT13TestReport.docx

GENERAL INFORMATION

DUT Specification

| | |
|--------------------------------|---|
| DUT Description | HANDHELD MARINE/GMRS RADIO |
| FCC ID | BBOMRHH450 |
| Model Number | MR HH450 DUAL, MR HH450 CAMO |
| Operating Frequency | 156.025-157.425 MHz |
| Test Frequencies | 156.025 and 157.425 MHz |
| No. of Channels | |
| Type of Emission | 16K0G3E, 16K0G2B |
| Modulation | FM |
| DUT Power Source | <input type="checkbox"/> 110-120Vac/50- 60Hz |
| | <input type="checkbox"/> DC Power 12V |
| | <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 | SO-239 |
| Test Conditions | The temperature was 26°C Relative humidity of 50%. |
| Modification to the DUT | None |
| Test Exercise | The DUT was placed in continuous transmit mode. |
| Applicable Standards | ANSI/TIA 603-C:2004, FCC CFR 47 Part 80 |
| Test Facility | Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. |

TEST PROCEDURES

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-C: 2004 using a 50uH LISN. Both lines were observed with the DUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Bandwidth 20 dB: 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 10.0 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.

Radiation Interference: The test procedure used was ANSI C63.4-2004 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a micro volt at the output of the antenna.

TECHNICAL DATA

80.203 (b)

External Controls: The transmitter is capable of changing frequency between 156.05 – 157.425 MHz by external control. The available channels are shown in the User Manual description Channel List. These channels are preprogrammed by the manufacturer and change of frequency is inaccessible to the station operator.

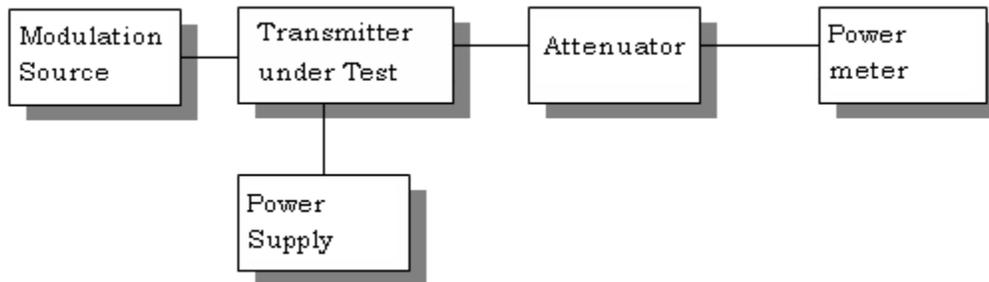
RF POWER OUTPUT

Rule Part No.: FCC Part 2.1046(a), 80.215(e)(1)

Test Requirements:

Method of Measurement: RF power is measured by connecting as per setup diagram. With a nominal voltage, and the transmitter properly adjusted the RF output measures:

Test Setup Diagram:



The rated output power:

| | W | dBm |
|-----|-----|------|
| Hi | 6.0 | 37.8 |
| Low | 1.0 | 30.0 |

Test Data: RF output power of the EUT can be set at 1W, 3W, and 6W.

OUTPUT POWER:

| Tuned Frequency MHz | RF POWER (W) | |
|---------------------|--------------|-----|
| | HI | LOW |
| 156.025 | 6.2 | 1.0 |
| 157.425 | 6.0 | 1.0 |

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

FOR LOW POWER SETTING INPUT POWER: $(7.4V)(0.53A) = 3.92$ Watts
 FOR HIGH POWER SETTING INPUT POWER: $(7.4V)(1.24A) = 9.18$ Watts

MODULATION CHARACTERISTICS

Part 2.1033(c) (4) Type of Emission: 16K0G3E, 16K0F3E
FCC Part 80.205(a)

$$B_n = 2M + 2DK$$

$$M = 3000$$

$$D = 4.6\text{kHz (Peak Deviation)}$$

$$K = 1$$

$$B_n = 2(3000) + 2(4.6\text{K})(1) = 16.0\text{K}$$

80.205(a) ALLOWED AUTHORIZED BANDWIDTH – 20.00 kHz

AUDIO FREQUENCY RESPONSE

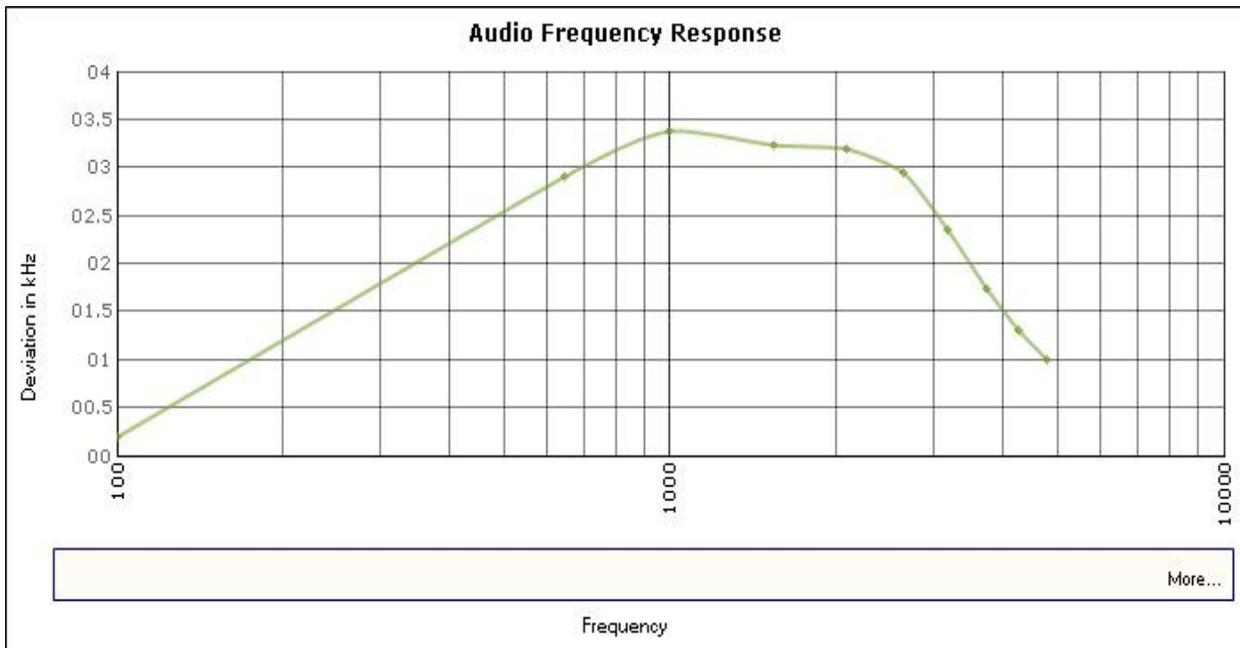
Rule Part No.: FCC Part 2.1047(a)(b)

Test Requirements:

Method of Measurement:

The audio frequency response was measured in accordance with ANSI/TIA 603-C: 2004. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted. The audio frequency response curve is shown below.

AUDIO FREQUENCY RESPONSE PLOT



Applicant: COBRA ELECTRONICS CORPORATION
 FCC ID: BBOMRHH450
 Report: V\COBRA\2007AUT13\2007AUT13TestReport.docx

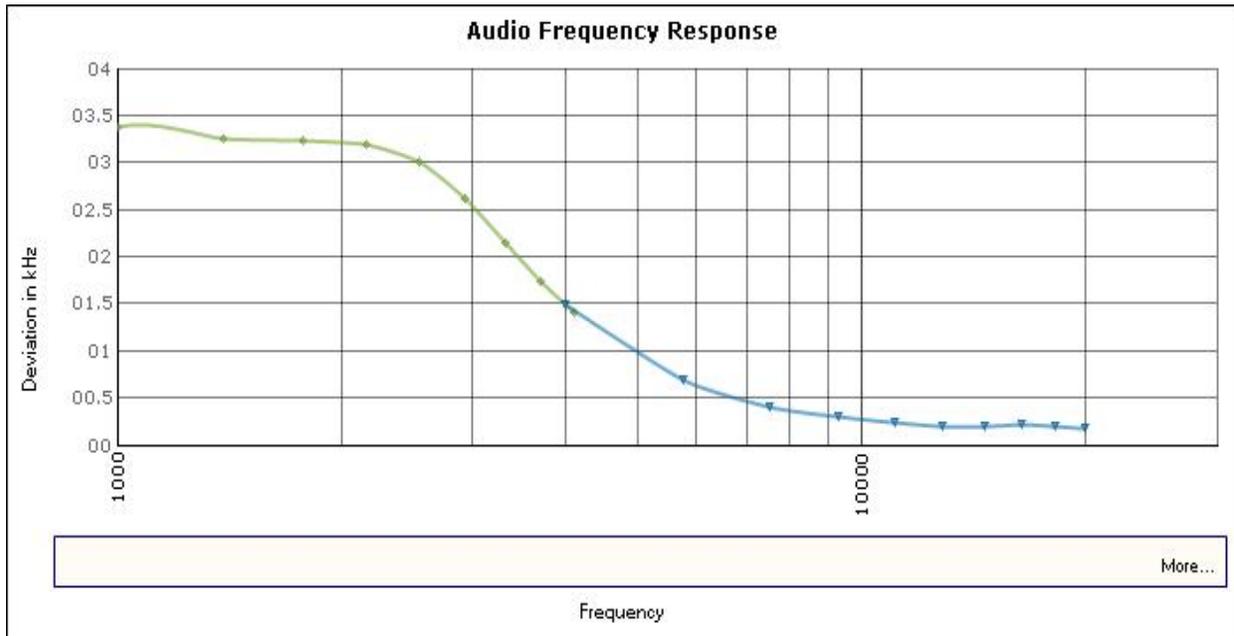
AUDIO LOW PASS FILTER

VOICE MODULATED COMMUNICATION EQUIPMENT

Rule Part No.: 2.1047(a)

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.

AUDIO LOW PASS FILTER



AUDIO INPUT VERSUS MODULATION

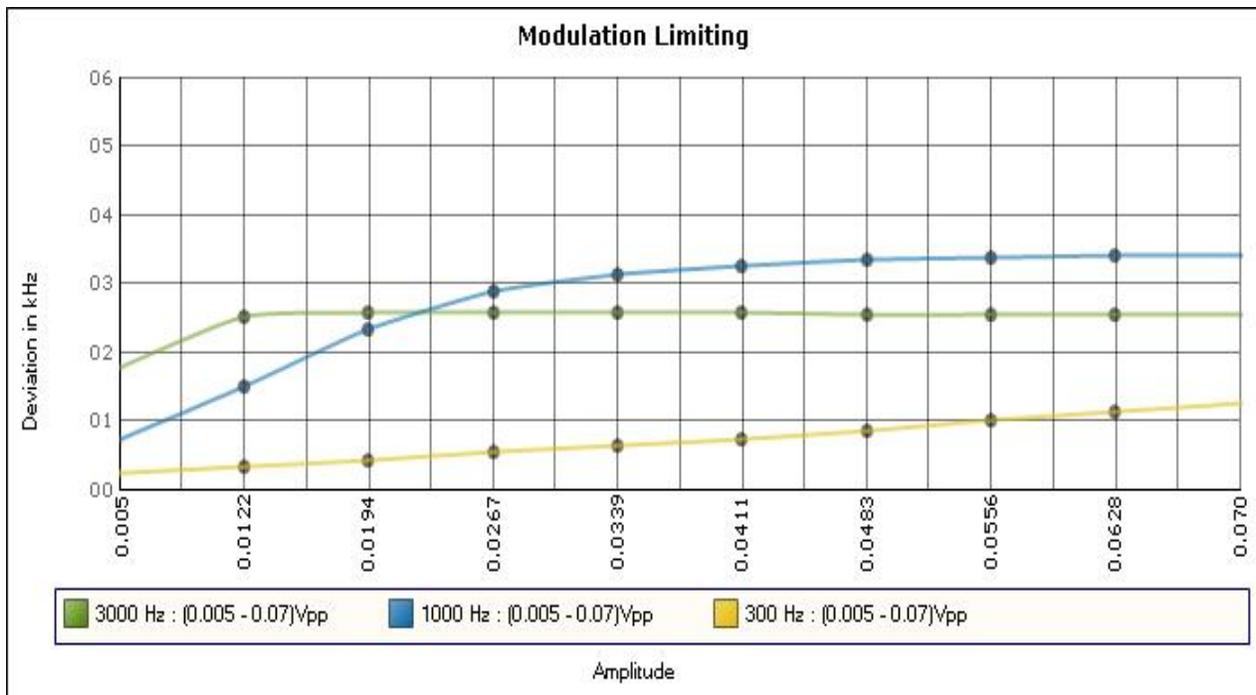
Rule Part No.: FCC Part 2.1047(b) & 80

Test Requirements: Modulation cannot exceed 100%.

Method of Measurement: The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-C: 2004. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

Test data:

Modulation Limiting Plot



OCCUPIED BANDWIDTH

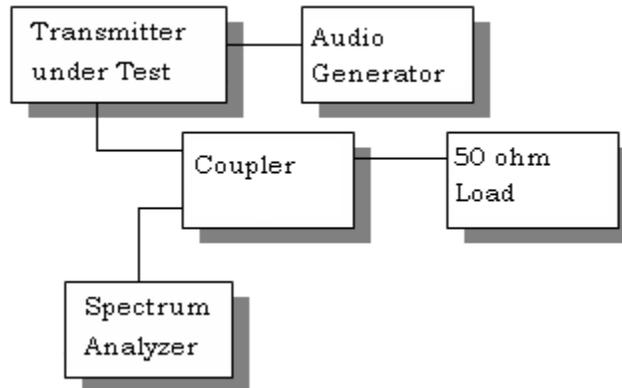
FCC Part 2.1049(c)
FCC Part 80.213(b)

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least $43 + 10\log(P)$ dB.

Method of Measurement: ANSI/TIA-603-C: 2004

Test Setup Diagram:

OCCUPIED BANDWIDTH MEASUREMENT

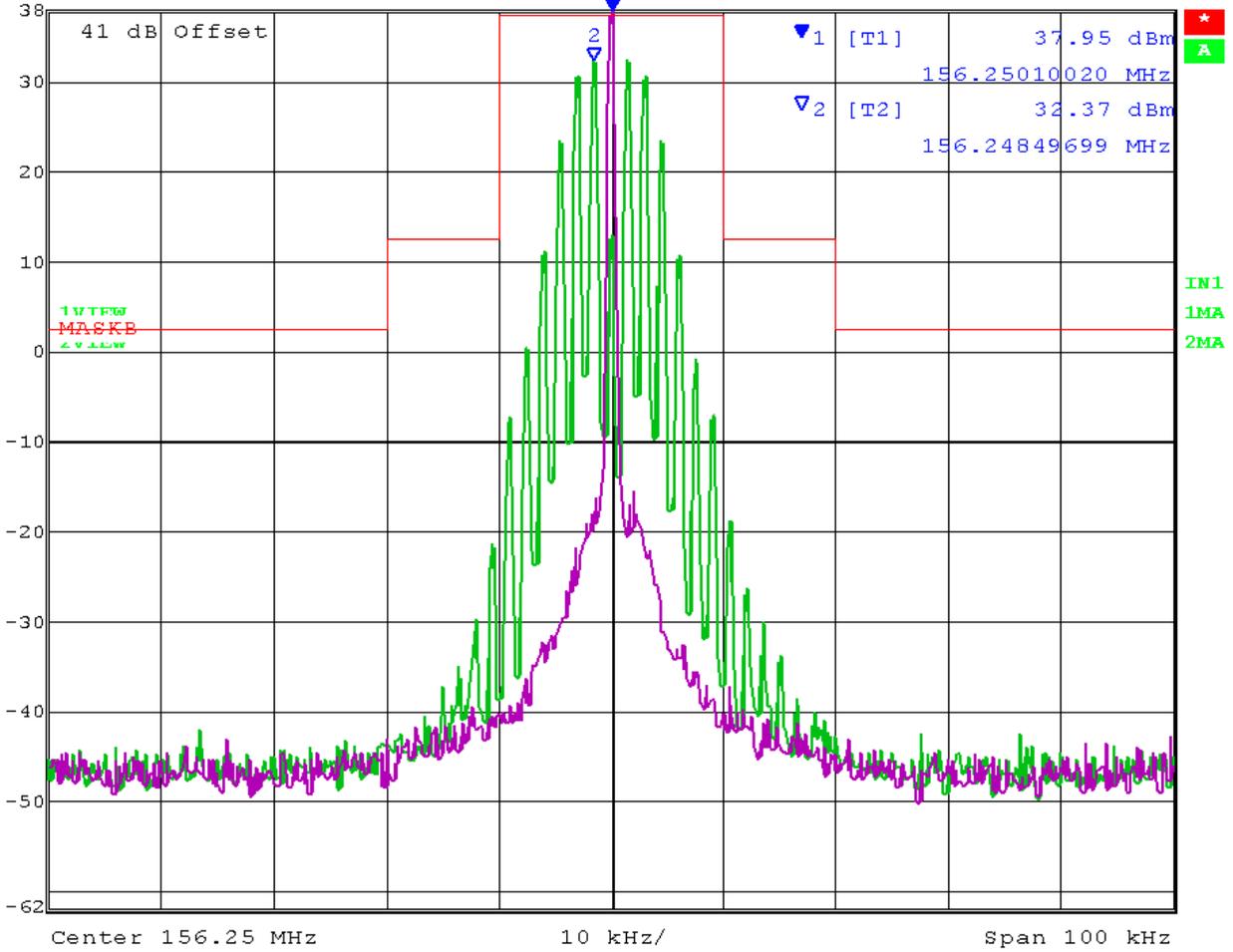


Test Data: See the plot below

Occupied bandwidth - Mask B - 156.025 MHz



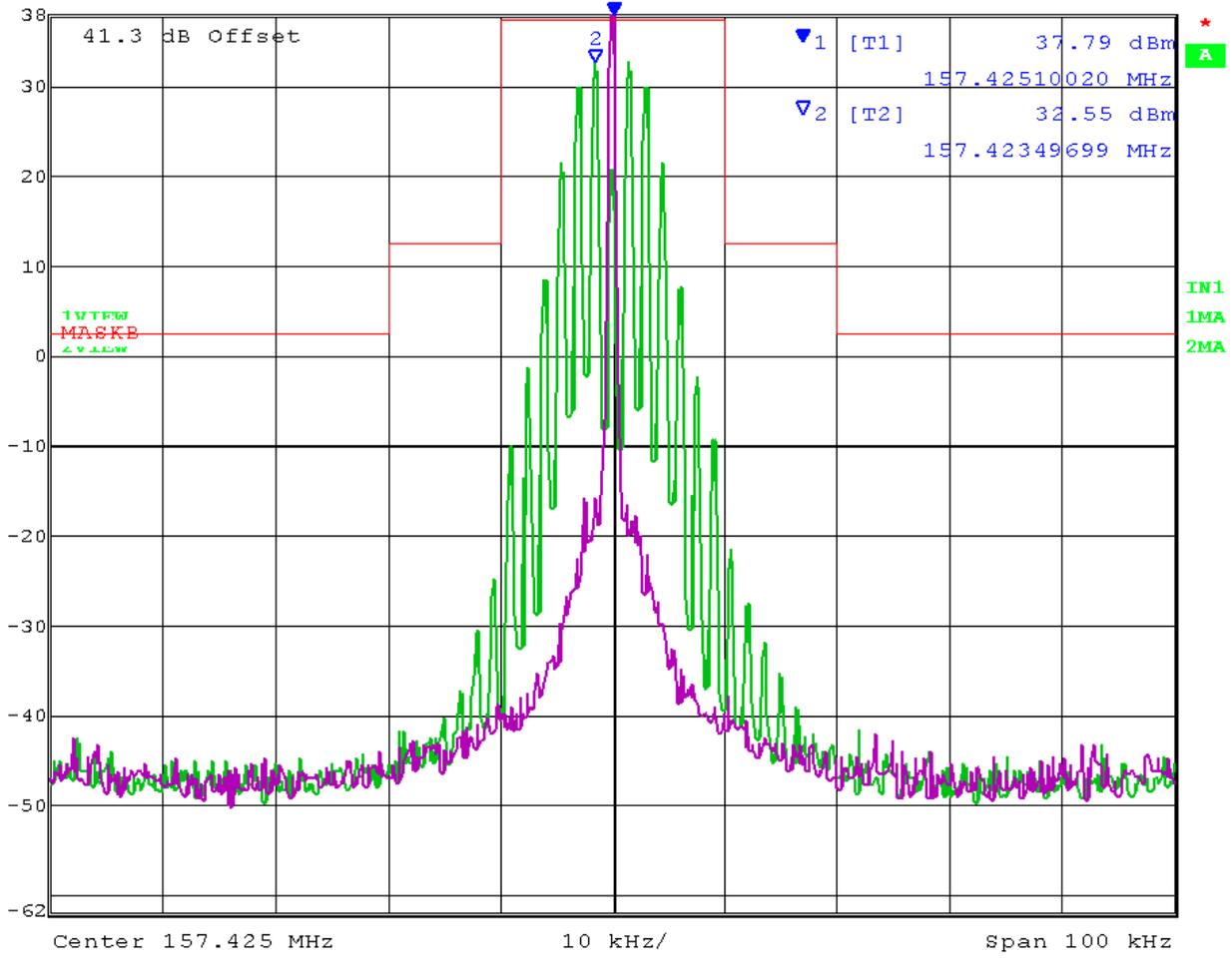
Marker 1 [T1] RBW 300 Hz RF Att 20 dB
 Ref Lvl 37.95 dBm VBW 1 kHz
 38 dBm 156.25010020 MHz SWT 5.6 s Unit dBm



Date: 9.DEC.2013 13:39:12

Occupied bandwidth -mask B – 157.425 MHz


 Marker 1 [T1] RBW 300 Hz RF Att 20 dB
 Ref Lvl 37.79 dBm VBW 1 kHz
 38 dBm 157.42510020 MHz SWT 5.6 s Unit dBm



Date: 9.DEC.2013 13:33:29

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Part 2.1051(a), 80.211

Requirements: Emissions must be $43+10\log(PO)$ dB below the mean power output of the transmitter.

$43+10\log(6.0) = 50.8\text{dBc}$ (for 6 Watts)

$43+10\log(1.0) = 43.0\text{dBc}$ (for 1 Watts)

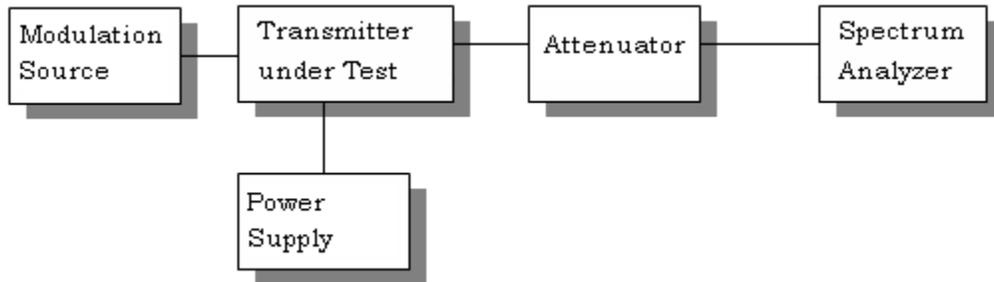
Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-C: 2004.

Test Data:

| TF HIGH POWER | EF | dB below carrier | | TF LOW POWER | EF | dB below carrier |
|---------------|---------|------------------|--|--------------|---------|------------------|
| 156.03 | 312.05 | 87.3 | | 156.03 | 312.05 | 80.4 |
| | 468.08 | 81.3 | | | 468.08 | 70.9 |
| | 624.10 | 61.4 | | | 624.10 | 56.7 |
| | 780.13 | 90.1 | | | 780.13 | 94.7 |
| | 936.15 | 91.7 | | | 936.15 | 95.7 |
| | 1092.18 | 91.5 | | | 1092.18 | NE |
| | 1248.20 | 95.1 | | | 1248.20 | NE |
| | 1404.23 | 97.0 | | | 1404.23 | NE |
| | 1560.25 | 96.9 | | | 1560.25 | NE |
| | | | | | | |

| TF HIGH POWER | EF | dB below carrier | | TF LOW POWER | EF | dB below carrier |
|---------------|---------|------------------|--|--------------|---------|------------------|
| 157.43 | 314.85 | 84.0 | | 157.43 | 314.85 | 88.5 |
| | 472.28 | 71.1 | | | 472.28 | 69.7 |
| | 629.70 | 59.5 | | | 629.70 | 64.3 |
| | 787.13 | 88.3 | | | 787.13 | 87.8 |
| | 944.55 | 87.2 | | | 944.55 | 88.6 |
| | 1101.98 | 92.4 | | | 1101.98 | NE |
| | 1259.40 | 95.9 | | | 1259.40 | NE |
| | 1416.83 | 97.4 | | | 1416.83 | NE |
| | 1574.25 | 95.2 | | | 1574.25 | NE |
| | | | | | | |

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI/TIA 603-C: 2004.

FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 2.1053

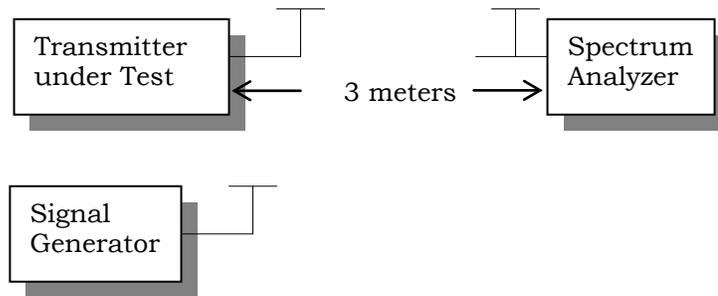
Requirements: Emissions must be $43+10\log(PO)$ dB below the mean power output of the transmitter.

$$43+10\log(6.0) = 50.8\text{dBc (for 6 Watts)}$$

$$43+10\log(1.0) = 43.0\text{dBc (for 1 Watts)}$$

METHOD OF MEASUREMENT: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603-C: 2004 using the substitution method. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

Test Setup Diagram:



Test Data:

High Power

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 156.03 | 0 | 0 |
| 312.05 | H | 88.9 |
| 468.08 | V | 84.4 |
| 624.10 | V | 75.8 |
| 780.13 | V | 77.8 |
| 936.15 | V | 81.9 |
| 1092.18 | V | 86.0 |
| 1248.20 | H/V | NE |
| 1404.23 | H/V | NE |
| 1560.25 | H/V | NE |

Low Power

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 156.03 | 0 | 0 |
| 312.05 | H | 95.3 |
| 468.08 | H | 86.7 |
| 624.10 | V | 70.9 |
| 780.13 | V | 83.2 |
| 936.15 | V | 82.4 |
| 1092.18 | V | 82.8 |
| 1248.20 | H/V | NE |
| 1404.23 | H/V | NE |
| 1560.25 | H/V | NE |

High Power

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 157.43 | 0 | 0 |
| 314.85 | H | 88.8 |
| 472.28 | V | 85.4 |
| 629.70 | V | 76.0 |
| 787.13 | V | 75.8 |
| 944.55 | V | 83.2 |
| 1101.98 | V | 87.7 |
| 1259.40 | V | 88.6 |
| 1416.83 | H/V | NE |
| 1574.25 | V | 88.2 |

Low Power

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 157.43 | 0 | 0 |
| 314.85 | H | 97.6 |
| 472.28 | H | 87.3 |
| 629.70 | V | 71.2 |
| 787.13 | V | 81.6 |
| 944.55 | V | 83.3 |
| 1101.98 | H/V | NE |
| 1259.40 | H/V | NE |
| 1416.83 | H/V | NE |
| 1574.25 | H/V | NE |

FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 80.209(a)

Requirements: Temperature and voltage tests were performed to verify that the frequency remains within the .0010%, 10.0 ppm, specification limit, for 20 kHz spacing. The test was conducted as follows: The transmitter was placed in the temperature chamber at 25°C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15 second intervals. The worst-case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -20°C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute and was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute and again frequency readings were noted at 15 sec intervals. The worst-case number was recorded for temperature plotting. This procedure was repeated in 10-degree increments up to +50°C.

Method of Measurements: ANSI/TIA 603-C: 2004

Test Data:

| Assigned Frequency (Ref. Frequency) (MHz) | | 157.425010 |
|--|------------------------|----------------------------------|
| Temperature (°C) | Frequency (MHz) | Frequency Stability (PPM) |
| -30 | 157.423951 | -4.73 |
| -20 | 157.424384 | -3.98 |
| -10 | 157.424852 | -1.00 |
| 0 | 157.425156 | 0.93 |
| +10 | 157.425175 | 1.05 |
| +20 | 157.425075 | 0.41 |
| +30 | 157.424930 | -0.51 |
| +40 | 157.424856 | -0.98 |
| +50 | 157.424556 | -2.88 |

| Assigned Frequency (Ref. Frequency) (MHz) | | |
|--|------------------------|----------------------------------|
| % Battery (%) | Frequency (MHz) | Frequency Stability (PPM) |
| -15% | 157.425017 | 0.04 |
| 0 | 157.425010 | 0.0 |
| +15% | 157.425001 | -0.06 |

EMC EQUIPMENT LIST

| Device | Manufacturer | Model | Serial Number | Cal/Char Date | Due Date |
|--|--------------------|---------------|--------------------------|---------------|----------|
| Analyzer Silver Tower Spectrum Analyzer | HP | 8566B Opt 462 | 3552A22064 3638A08608 | 06/05/13 | 06/05/15 |
| Antenna: Biconnical | Eaton | 94455-1 | 1096 | 05/10/13 | 05/10/15 |
| Antenna: Log-Periodic | Electro-Metrics | LPA-25 | 1122 | 05/09/13 | 05/09/15 |
| Frequency Counter | HP | 5352B | 2632A00165 | 06/26/13 | 06/26/15 |
| Frequency Counter | HP | 5385A | 2730A03025 | 08/22/13 | 08/22/15 |
| Signal Generator | HP | 8640B | 2308A21464 | 02/23/12 | 02/23/14 |
| Hygro-Thermometer | Extech | 445703 | 0602 | 06/20/13 | 06/20/15 |
| Digital Multimeter | Fluke | 77 | 35053830 | 08/22/13 | 08/22/15 |
| Temperature Chamber | Thermotron Corp. | S1.2 Mini Max | 25-1420-09 | 07/03/12 | 07/03/14 |
| Antenna: Double-Ridged Horn/ETS Horn 1 | ETS-Lindgren | 3117 | 00035923 | 12/07/11 | 12/07/13 |
| Antenna: Double-Ridged Horn | Electro-Metrics | RGA-180 | 2319 | 06/19/12 | 06/19/14 |
| Analyzer Silver Tower RF Preselector | HP | 85685A | 2926A00983 | 06/05/13 | 06/05/15 |
| Analyzer Silver Tower Quasi-Peak Adapter | HP | 85650A | 2811A01175 | 06/05/13 | 06/05/15 |
| Temperature Chamber | Tenney Engineering | TTRC | 11717-7 | 07/03/12 | 07/03/14 |
| Frequency Counter | HP | 5385A | 3242A07460 | 06/16/13 | 06/16/15 |
| 3-Meter Semi-Anechoic Chamber | Panashield | N/A | N/A | 12/31/11 | 12/31/13 |
| EMI Receiver | Rohde & Schwarz | ESIB40 | 100274 | 3/16/12 | 3/16/14 |
| EMI Receiver | Rohde & Schwarz | ESU40 | 100320 | 3/21/13 | 3/21/15 |