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FCC PART 80 AND IC RSS-182 (i5) TEST REPORT

| | |
|-----------------------------|--|
| APPLICANT | COBRA ELECTRONICS CORPORATION |
| | 6500 WEST CORTLAND STREET CHICAGO IL 60707 USA |
| FCC ID | BBOMRHH350 |
| IC CERTIFICATION | 906A-MRHH350 |
| MODEL NUMBER | MR HH350 |
| PRODUCT DESCRIPTION | MARINE TRANSCEIVER |
| DATE SAMPLE RECEIVED | 11/20/2012 |
| DATE TESTED | 12/6/2012 |
| TESTED BY | Sushant Kadimdivan |
| APPROVED BY | Mario de Aranzeta |
| TIMCO REPORT NO. | 3002AUT12TestReport.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.

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: 12/21/2012

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GENERAL INFORMATION

DUT Specification

| | |
|--------------------------------|---|
| DUT Description | MARINE TRANSCIEVER |
| FCC ID | BBOMRHH350 |
| IC Certification | 906A-MRHHH350 |
| Model Number | MR HH350 |
| Operating Frequency | 156.025-157.425 MHz |
| Test Frequencies | 156.4 MHz, 157.475 MHz |
| Type of Emission | 16K0G3E |
| 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 | SMA male |
| 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, IC RSS-182 issue 5 and RSS-GEN issue 3 |
| Test Facility | Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. |

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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.

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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.
- 80.203 (c) Five minutes continuous transmission test: The antenna was connected to a dummy load and the radio was locked in a transmit PTT mode. An external timer digital clock was used to observe the duration of the un-modulated transmission. The transmitter turned off and the radio went to receive mode at **4** minutes, **40** seconds as displayed by the external digital clock.
- 80.203 (n) DSC capability: This requirement does not apply to transmitters used with AMTS or hand-held portable transmitters.
The product is a hand-held transmitter and does not have DSC capability.
- 80.873; 80.956 Transmitter G3E emission capability: The transmitter was connected to 50 ohm resistive wattmeter and the frequency was set to 156.300 and to 156.800 MHz.

With normal modulation, the output power displayed was **5** Watts at the high power setting and **0.9** watt at low power setting, consistent with previous measurements.
The transmitter is a handheld device.
- 80.911 (a) 80.956 G3E Transmissions: This radio is capable of G3E emission on 156.300 and 156.800 MHz

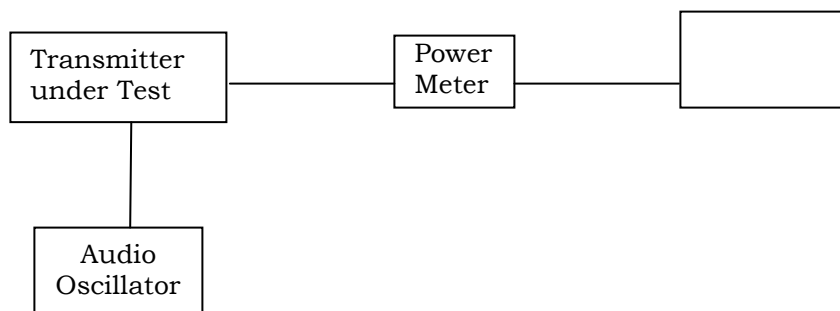
RF POWER OUTPUT

Rule Part No.: FCC Part 2.1046(a), 80.215(e)(1), IC RSS-182 issue 5

Test Requirements:

Method of Measurement: RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage and the transmitter properly adjusted the RF output measures:

Test Setup Diagram:



Test Data:

OUTPUT POWER: HIGH – 5.0 W
LOW - 0.9 W

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

FOR LOW POWER SETTING INPUT POWER: (7.4 V) (0.8 A) = 5.92 Watts
FOR HIGH POWER SETTING INPUT POWER: (7.4 V) (1.41 A) = 10.4 Watts

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MODULATION CHARACTERISTICS

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

FCC Part 80.205(a)

RSS-182, RSS-GEN issue 3

$$B_n = 2M + 2DK$$

$$M = 3000$$

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

$$K = 1$$

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

80.205(a) ALLOWED AUTHORIZED BANDWIDTH – 20.00 kHz

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AUDIO FREQUENCY RESPONSE

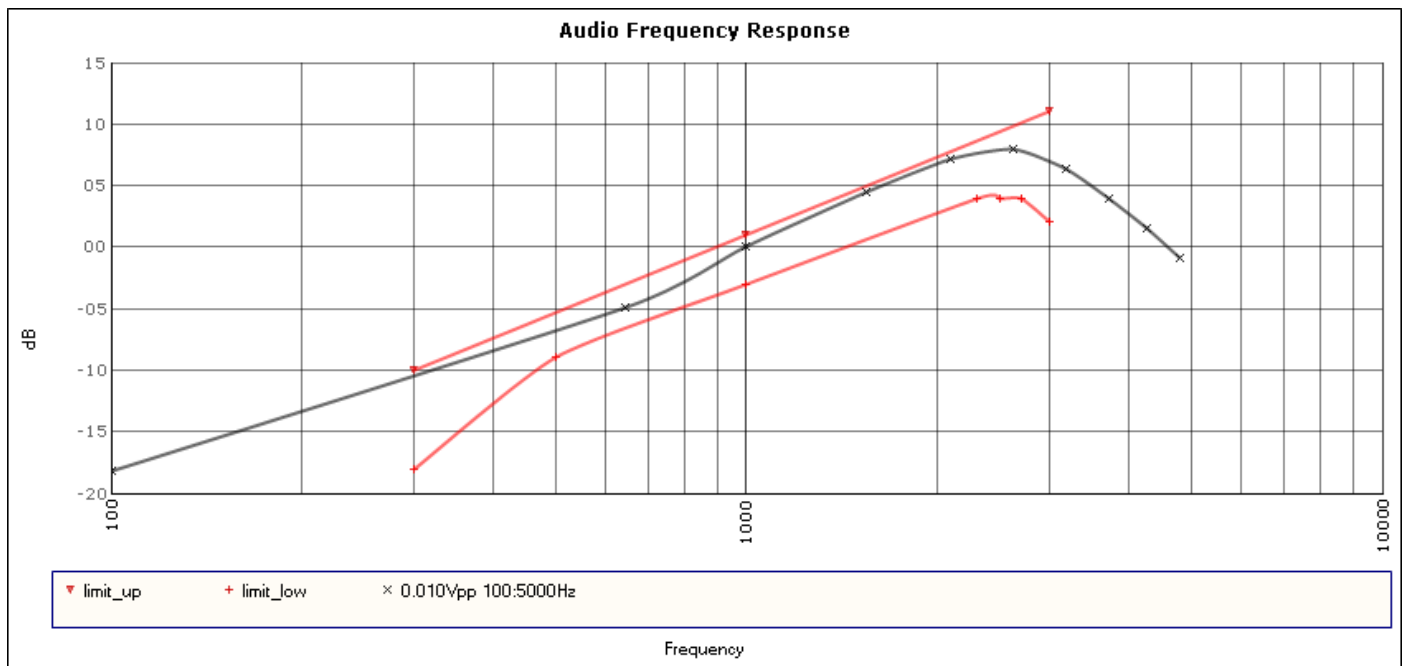
Rule Part No.: FCC Part 2.1047(a)(b), IC RSS-182 issue 5

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 – 5000 Hz shall be submitted. The audio frequency response curve is shown below.

AUDIO FREQUENCY RESPONSE PLOT



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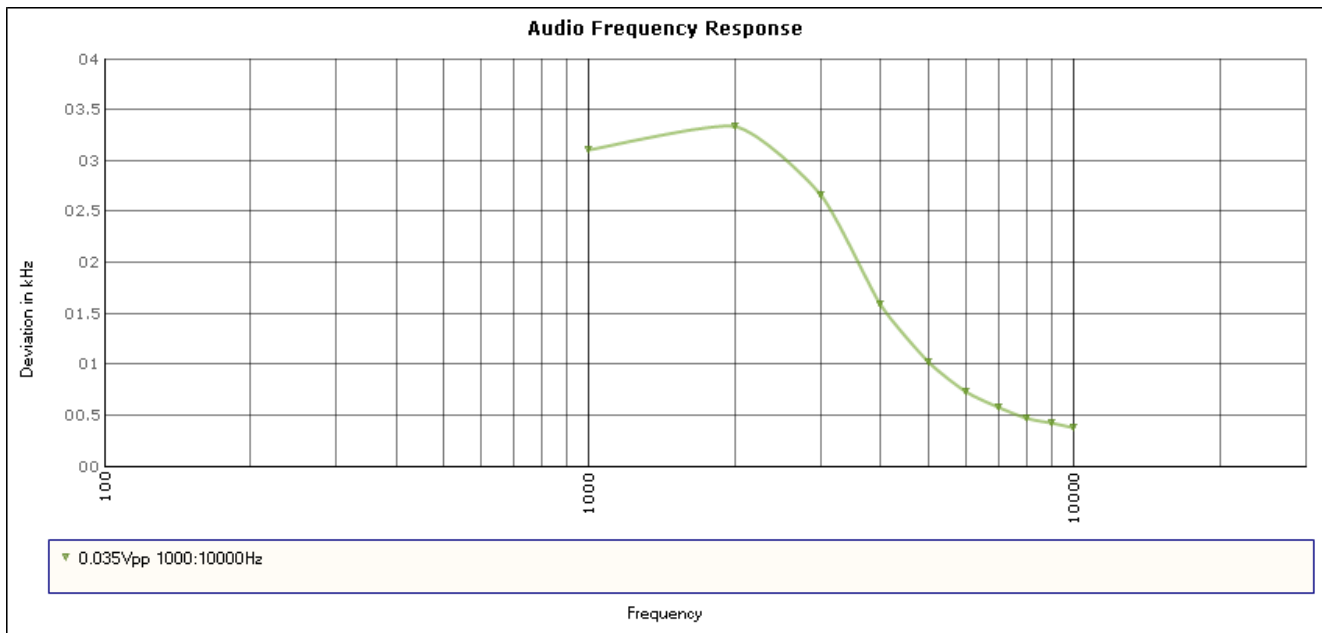
AUDIO LOW PASS FILTER

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



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AUDIO INPUT VERSUS MODULATION

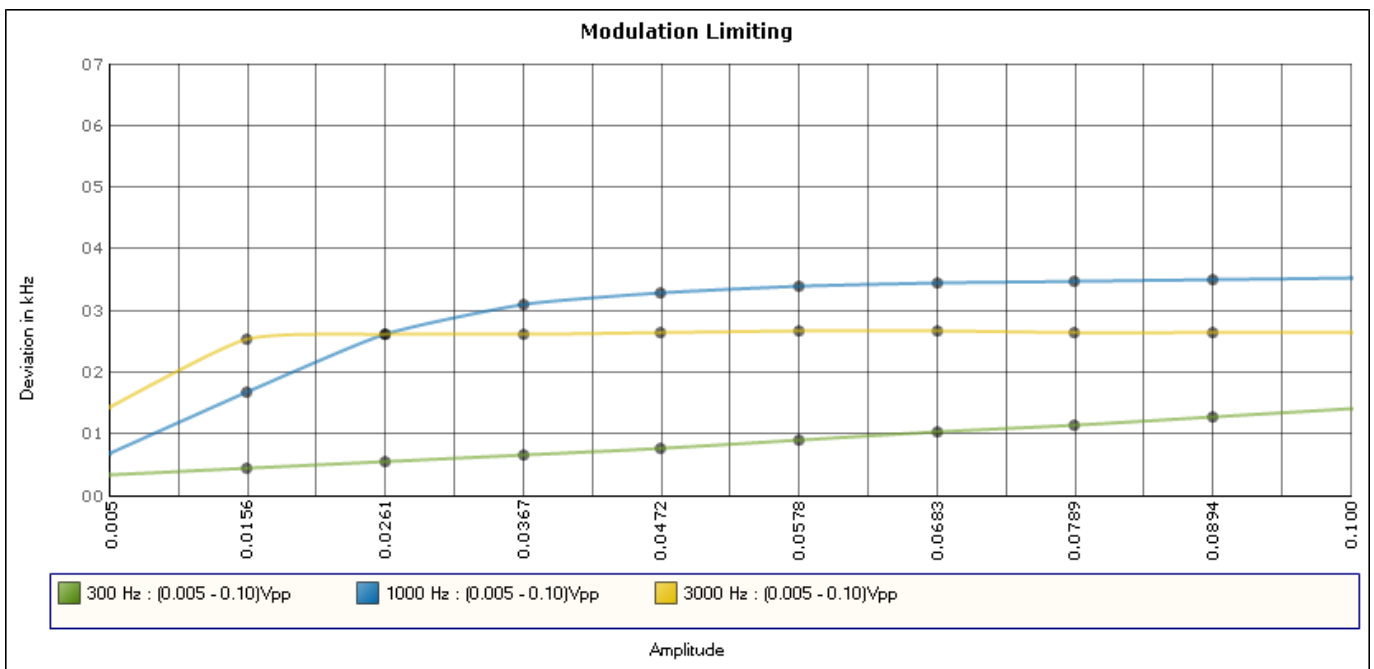
Rule Part No.: FCC Part 2.1047(b) & 80, IC RSS-182 issue 5

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



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OCCUPIED BANDWIDTH

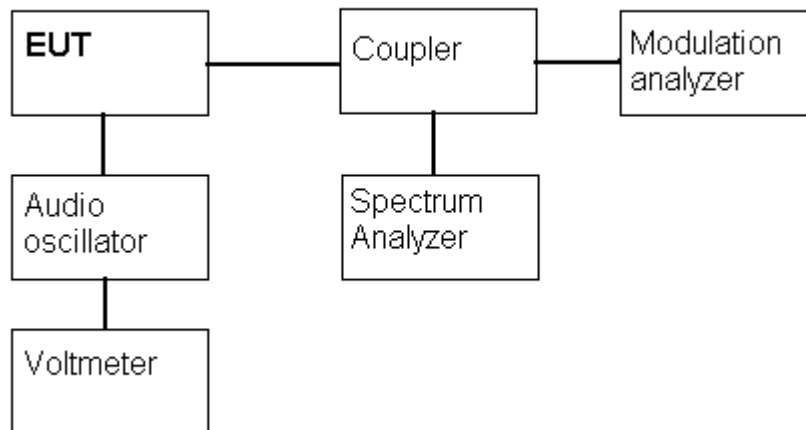
**FCC Part 2.1049(c), RSS-GEN 4.6 EMISSION BANDWIDTH
 FCC Part 80.213(b) RSS-182 issue 5**

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 + 10log(P)dB.

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

Test Setup Diagram:

OCCUPIED BANDWIDTH MEASUREMENT



Test Data: See the plot below

NOTES:

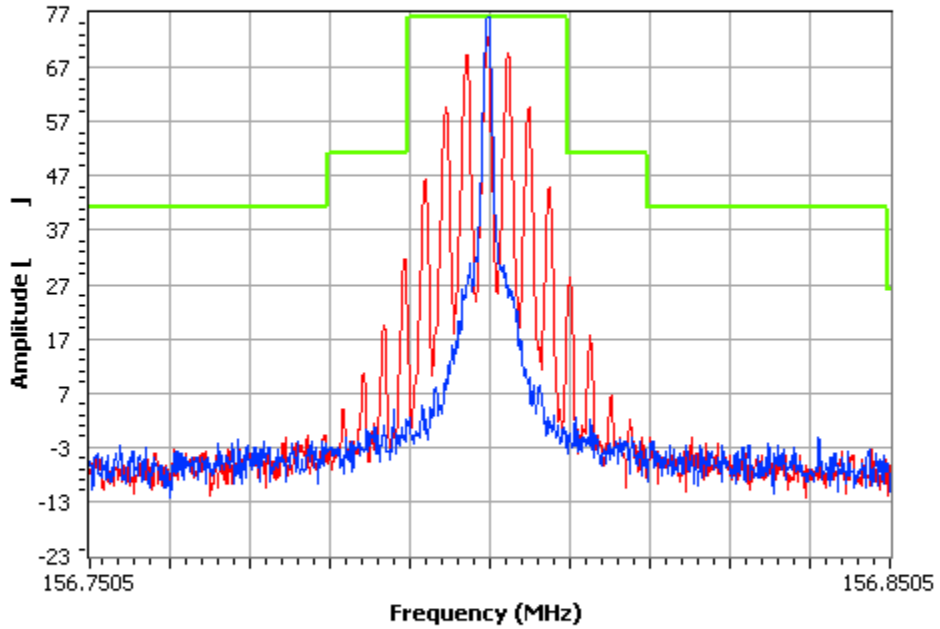
OCCUPIED BANDWIDTH - 2500 Hz

FCC 90.210 Mask B

REF dBuV/m 77.00

SPAN (Hz) 100.00k

Timco Engineering, Inc.



| RBW | VBW | ST (sec) | Peak | 156.80(76.20) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------------|--------|----------|------|----------------|-------------------------------------|--------------------------|--------------------------|
| 300 Hz | 300 Hz | 2 | MKR2 | 156.79: -2.30 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Center Frequency (Hz) 156.801M | | | MKR3 | 156.75(-6.50) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Marker Delta (Hz) 0.00 | | | HWMK | 23.076 6.27 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Part 2.1051(a), 80.211, RSS-182

Requirements: Emissions must be 43+10 log (PO) dB below the mean power output of the transmitter.
 43+10 log (5) = 50 dB
 43+10 log (0.9) = 42.5 dB

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.

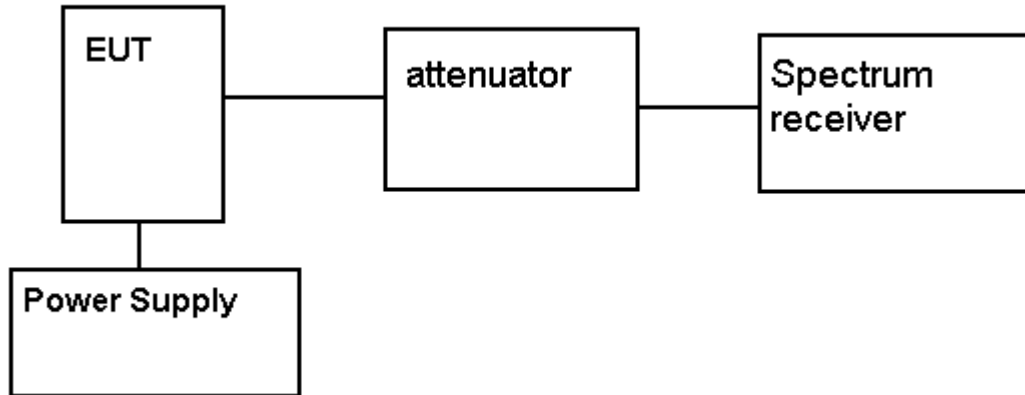
Test Data:

| TF HIGH POWER | EF MHz | dB below carrier | | TF LOW POWER | EF MHz | dB below carrier |
|---------------|--------|------------------|--|--------------|--------|------------------|
| 156.4 MHz | | 0 | | 156.4 MHz | | 0 |
| | 118 | 88.4 | | | 118 | 73.6 |
| | 135.5 | 87.3 | | | 135.5 | 65.6 |
| | 312.8 | 82.2 | | | 312.8 | 67.4 |
| | 469.2 | 89.6 | | | 469.2 | 90 |
| | 625.6 | 99.6 | | | 625.6 | 93 |
| | 782 | 100.8 | | | 782 | 97 |
| | 938.4 | 102.4 | | | 938.4 | 93 |
| | 1094.8 | 102.5 | | | 1094.8 | 93.4 |
| | 1251.2 | 102.2 | | | 1251.2 | 93.2 |
| | 1407.6 | 100.7 | | | 1407.6 | 93.6 |
| | 1564 | 103.8 | | | 1564 | 93 |

| TF HIGH POWER | EF MHz | dB below carrier | | TF LOW POWER | EF MHz | dB below carrier |
|---------------|--------|------------------|--|--------------|--------|------------------|
| 157.4 MHz | | 0 | | 157.4 MHz | | 0 |
| | 118.1 | 88.5 | | | 118.1 | 73.6 |
| | 136.5 | 86.8 | | | 136.5 | 66.7 |
| | 314.8 | 80.9 | | | 314.8 | 67.9 |
| | 472.2 | 92.3 | | | 472.2 | 88.9 |
| | 629.6 | 101.1 | | | 629.6 | 94.2 |
| | 787 | 101.6 | | | 787 | 93.2 |
| | 944.4 | 102.3 | | | 944.4 | 92.7 |
| | 1101.8 | 100.9 | | | 1101.8 | 93.4 |
| | 1259.2 | 101.8 | | | 1259.2 | 93.1 |
| | 1416.6 | 99.9 | | | 1416.6 | 93.2 |
| | 1574 | 100.8 | | | 1574 | 92.9 |

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Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI/TIA 603-C: 2004 without any exceptions. The measurements were made at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

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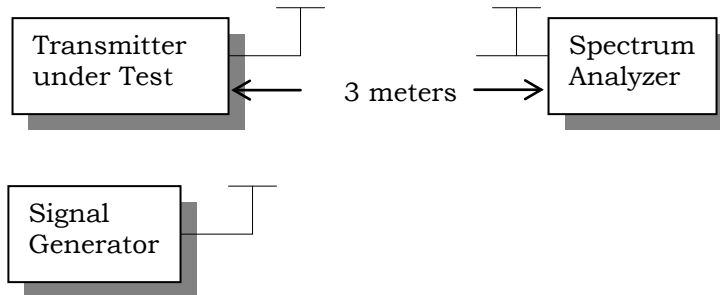
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 2.1053, RSS-182

Requirements: Emissions must be $43+10\log(PO)$ dB below the mean power output of the transmitter.
 $43+10 \log (5) = 50 \text{ dB}$
 $43+10 \log (0.9) = 42.5 \text{ dB}$

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:

156.4 MHz - HIGH POWER

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 156.40 | 0 | 0 |
| 312.80 | H | 91.5 |
| 469.20 | V | 79.0 |
| 625.60 | H | 85.7 |
| 782.00 | H | 95.4 |
| 938.40 | V | 91.8 |
| 1094.80 | V | 90.0 |
| 1251.20 | V | 82.9 |
| 1407.60 | V | 80.5 |
| 1564.00 | V | 90.7 |

156.4 MHz - LOW POWER

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 156.40 | 0 | 0 |
| 312.80 | H | 81.1 |
| 469.20 | H | 86.7 |
| 625.60 | H | 87.1 |
| 782.00 | H | 93.1 |
| 938.40 | H | 93.7 |
| 1094.80 | V | 89.2 |
| 1251.20 | V | 87.2 |
| 1407.60 | V | 87.4 |
| 1564.00 | V | 88.6 |

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157.425 MHz – HIGH POWER

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 157.43 | | 0 |
| 314.85 | H | 90.6 |
| 472.28 | V | 80.5 |
| 629.70 | H | 86.6 |
| 787.13 | H | 95.9 |
| 944.55 | V | 91.1 |
| 1101.98 | V | 90.9 |
| 1259.40 | V | 81.8 |
| 1416.83 | V | 81.2 |
| 1574.25 | V | 91.4 |

157.425 MHz – LOW POWER

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 157.43 | | 0 |
| 314.85 | H | 81.3 |
| 472.28 | H | 89.1 |
| 629.70 | H | 88.8 |
| 787.13 | H | 94.3 |
| 944.55 | H | 94.5 |
| 1101.98 | V | 91.3 |
| 1259.40 | V | 87.0 |
| 1416.83 | V | 87.1 |
| 1574.25 | V | 89.0 |

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FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 80.209(a), RSS-182 issue 5, RSS-GEN issue 3

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) | | |
|--|------------------------|----------------------------------|
| Temperature (°C) | Frequency (MHz) | Frequency Stability (PPM) |
| -30 | 156.79863 | -9.31 |
| -20 | 156.79935 | -4.72 |
| -10 | 156.79981 | -1.79 |
| 0 | 156.80001 | -0.51 |
| +10 | 156.80003 | -0.38 |
| +20 | 156.79994 | -0.96 |
| +30 | 156.80020 | 0.70 |
| +40 | 156.80007 | -0.13 |
| +50 | 156.80008 | -0.06 |

| Assigned Frequency (Ref. Frequency) (MHz) | | |
|--|------------------------|----------------------------------|
| % Battery (%) | Frequency (MHz) | Frequency Stability (PPM) |
| -15% | 156.80009 | 0 |
| 0 | 156.80009 | 0 |
| +15% | 156.80009 | 0 |

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EMC EQUIPMENT LIST

| Device | Manufacturer | Model | Serial Number | Cal/Char Date | Due Date |
|---------------------------------------|--------------------|---------------|--------------------------|---------------|----------|
| Analyzer Tan Tower Spectrum Analyzer | HP | 8566B Opt 462 | 3138A07786 3144A20661 | 10/28/11 | 10/28/13 |
| Analyzer Tan Tower Preamplifier | HP | 8449B-H02 | 3008A00372 | 10/28/11 | 10/28/13 |
| Antenna: Biconnical | Electro-Metrics | BIA-25 | 1171 | 06/13/12 | 06/13/14 |
| Antenna: Biconnical | Eaton | 94455-1 | 1096 | 05/04/11 | 05/04/13 |
| Antenna: Log-Periodic | Electro-Metrics | LPA-25 | 1122 | 05/04/11 | 05/04/13 |
| Frequency Counter | HP | 5352B | 2632A00165 | 06/22/11 | 06/22/13 |
| Frequency Counter | HP | 5385A | 2730A03025 | 08/17/11 | 08/17/13 |
| Signal Generator | HP | 8640B | 2308A21464 | 02/23/12 | 02/23/14 |
| Hygro-Thermometer | Extech | 445703 | 0602 | 06/15/11 | 06/15/13 |
| Digital Multimeter | Fluke | 77 | 35053830 | 09/09/11 | 09/09/13 |
| Analyzer Tan Tower RF Preselector | HP | 85685A | 3221A01400 | 10/28/11 | 10/28/13 |
| Antenna: Passive Loop | EMC Test Systems | EMCO 6512 | 9706-1211 | 06/14/12 | 06/14/14 |
| Analyzer Tan Tower Quasi-Peak Adapter | HP | 85650A | 3303A01690 | 10/28/11 | 10/28/13 |
| Temperature Chamber | Tenney Engineering | TTRC | 11717-7 | 07/03/12 | 07/03/14 |
| Frequency Counter | HP | 5385A | 3242A07460 | 06/22/11 | 06/22/13 |
| 3-Meter Semi-Anechoic Chamber | Panashield | N/A | N/A | 12/31/11 | 12/31/13 |

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