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**FCC PART 95
 GMRS TRANSCEIVER
 TEST REPORT**

Applicant	COBRA ELECTRONICS CORPORATION
	6500 WEST CORTLAND STREET CHICAGO, IL 60707 USA
FCC ID	BBOMRHH450
Model Numbers	MR HH450 DUAL, MR HH450 CAMO
Product Description	HANDHELD MARINE/GMRS RADIO
FCC Standard Applied	47 CFR § 95 Personal Radio Service Subpart A – General Mobile Radio Service (GMRS)
Date Sample Received	1/16/2014
Date Tested	1/17/2014
Date Report Issued	1/20/2014
Tested By	NAM NGUYEN
Approved By	NAM NGUYEN
Timco Report No.	2007CZUT13TestReport.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.**





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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.



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 17, 2014

FCC PART RULES

Applicable Rule(s)	FCC CFR 47 Part 2 & Part 95 Personal Radio Service Subpart A – General Mobile Radio Service (GMRS)
Applicable Standards	TIA 603-C , FCC CFR 47 Part 2 & Part 95

TEST ENVIRONMENT

Test Facility	Timco Engineering, Inc. 849 NW State Road 45 Newberry, FL 32669 USA.
Test Condition in the laboratory	Temperature: 26°C Relative humidity: 50%

TEST SETUP SUMMARY

Test Setup Diagram/ Description	All the test set up diagrams and explanation are provided in each test section of this report for clarification. For the radiated emission test, the DUT was placed on the turntable per setup per ANSI C63.4: 2003.
Deviation from the standard/procedure	No deviation
Modification of DUT	No modification

DUT SPECIFICATIONS

The test results relate only to the items tested.	
DUT Description	HANDHELD MARINE/GMRS RADIO
FCC ID	BBOMRHH450
Model Number	MR HH450 CAMO, MR HH450 DUAL
Operating Frequency	462.5500-462.7250
No. of Channels	15
Type of Emission	11K0F3E
Modulation	FM
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	Fixed
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.
Test Lab Conditions	Temperature: 26 C Humidity: 55% RH
Modifications	None
Test Exercise	The DUT was placed in continuous transmit mode of operation



TEST PROCEDURES

Bandwidth: 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: RF power was conducted per ANSI/TIA 603-C: 2004 using the substitution method.

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/TIA 603-C: 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 microvolt at the output of the antenna.

RF POWER OUTPUT

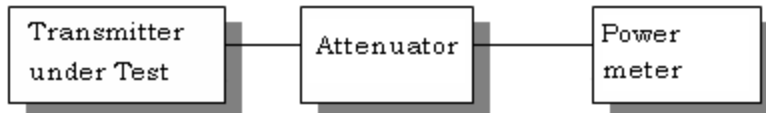
Rule Part No.: 2.1033(c)(6)(7), 2.1046(a), Part 95

Requirements: Power output shall not exceed 0.50 Watts effective radiated power for the FRS channels. There can be no provisions for increasing the power or varying the power. No GMRS channel, under any condition of modulation, shall exceed:

1. 50W Carrier power (average TP during one modulated RF cycle) when transmitting emissions type A1D, F1D, G1D, A3E, F3E, or G3E.
2. 50W peak envelope TP when transmitting emission type H1D, J1D, R1D, H3E, J3E, or R3E.

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

Test Setup Diagram:



The rated output power:

	W	dBm
Hi	2.80	34.5
Low	0.80	29.0

Test Data: RF output power of the EUT can be set to 0.8W or 2.8W.

OUTPUT POWER:

Tuned Frequency MHz	RF POWER (W)	
	HI	LOW
462.65	2.63	0.76

Rule Part No.: 2.1033 (C)(8) DC Input into the final amplifier

FOR LOW POWER SETTING INPUT POWER: (7.4V)(0.65A) = 4.81 Watts
 FOR HIGH POWER SETTING INPUT POWER: (7.4V)(1.10A) = 8.14 Watts

MODULATION CHARACTERISTICS

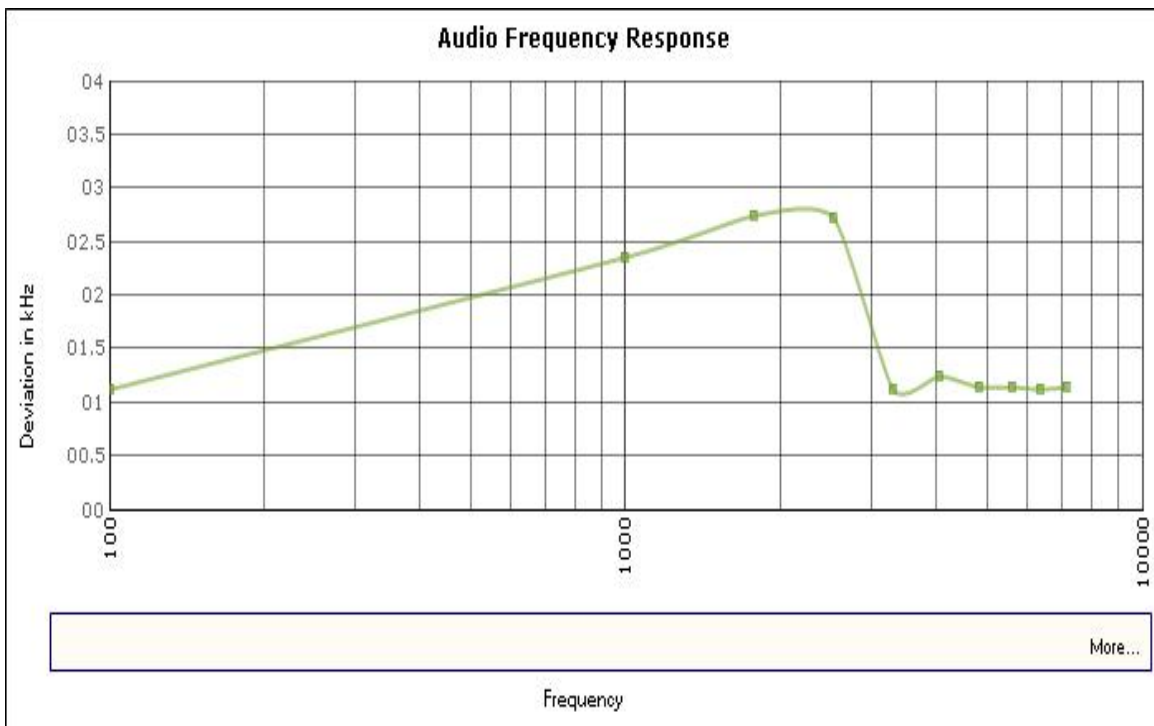
Rule Part No.: Part 2.1047(a)(b)

Test Requirements:

Method of Measurement:

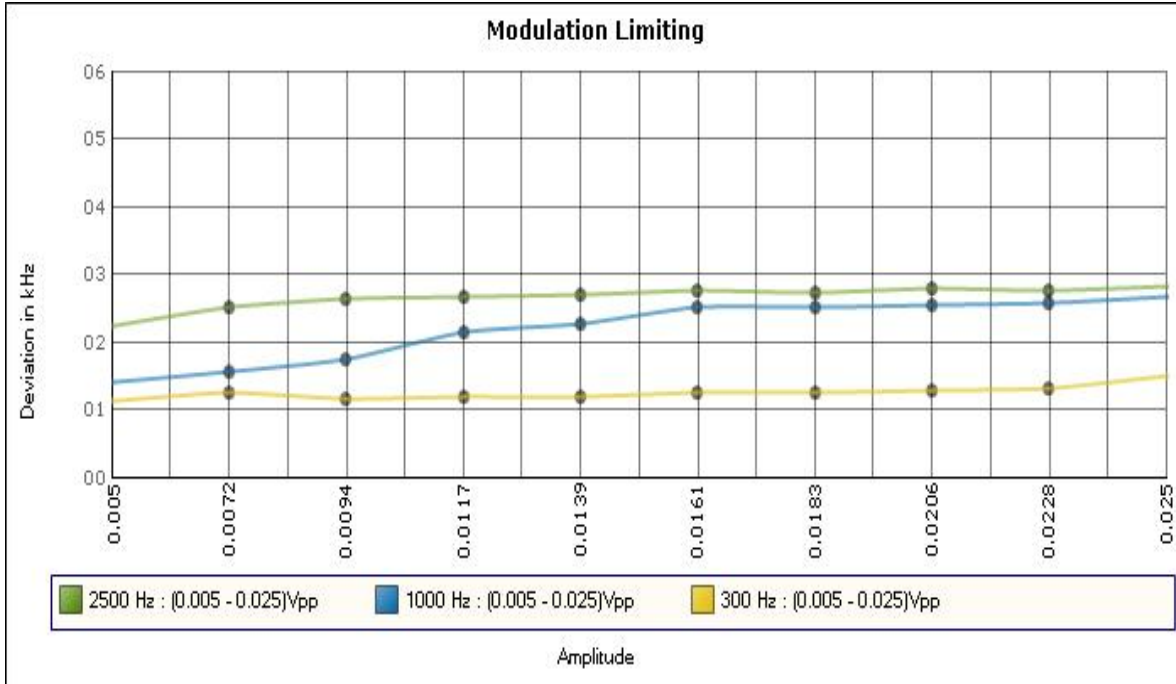
The audio frequency response was measured in accordance with ANSI/TIA 603-C: 2004. The audio frequency response curve is shown below. The audio signal was fed into a dummy microphone circuit and into the microphone connector. The input required to produce 30 percent modulation level was measured.

AUDIO FREQUENCY RESPONSE PLOT



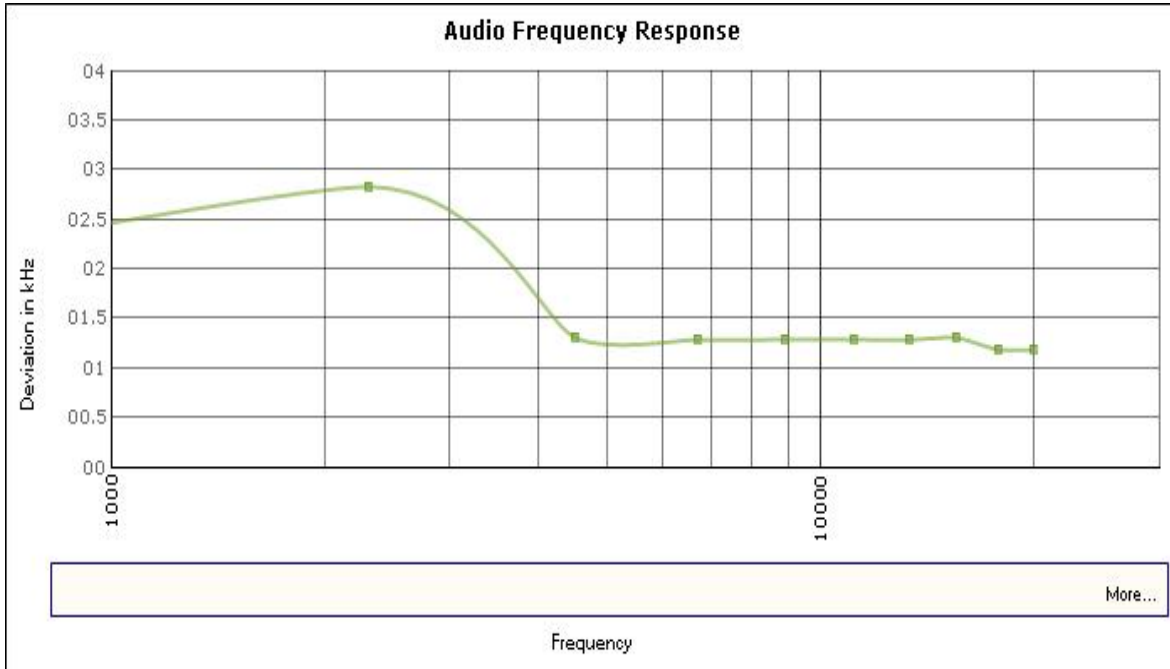
Audio input versus modulation

The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-C: 2004. Curves are provided for audio input frequencies of 300, 1000, and 2500 Hz. See the plot below..



Post Limiter Filter

Each GMRS transmitter, except a mobile station transmitter with a power of 2.5Watts or less, must be equipped with an audio low pass filter. At any frequency between 3 & 20 kHz the filter must have an attenuation of $60\log(f/3)$ greater than the attenuation at 1 kHz. See below.





EMISSION DESIGNATOR

2.1033(c) (4) Type of Emission: 11K0F3E
95.631

$$\begin{aligned} B_n &= 2M + 2DK \\ M &= 3000 \\ D &= 2.50K \\ B_n &= 2(3000) + 2(2500) = 11.0K \end{aligned}$$

GMRS Authorized Bandwidth 11.25 kHz

2.1033(c)(5) GMRS Frequency Range:
95.621

- | | |
|--------------|--------------|
| 1. 462.5500 | 13. 462.7000 |
| 2. 462.5625 | 14. 462.7125 |
| 3. 462.5750 | 15. 462.7250 |
| 4. 462.5875 | |
| 5. 462.6000 | |
| 6. 462.6125 | |
| 7. 462.6250 | |
| 8. 462.6375 | |
| 9. 462.6500 | |
| 10. 462.6625 | |
| 11. 462.6750 | |
| 12. 462.6875 | |

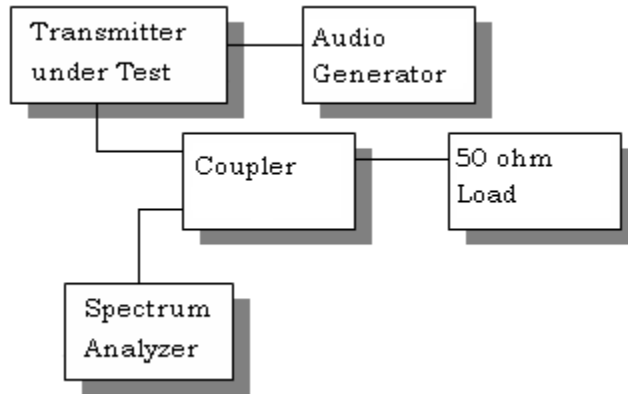
OCCUPIED BANDWIDTH

Part 2.1049(c) EMISSION BANDWIDTH:
95.635(b)(1)(3)(7)

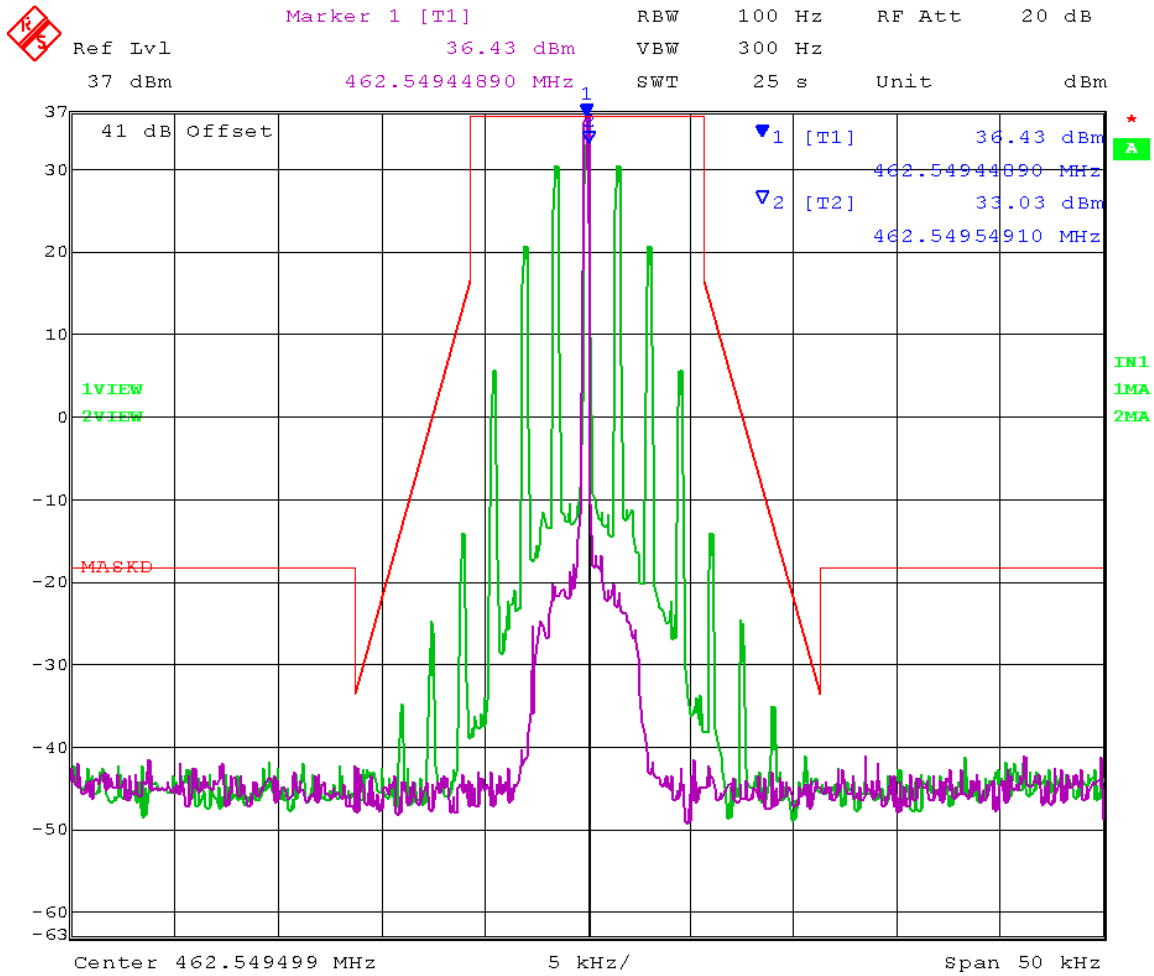
At least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth. At least 35 dB on any frequency removed from the center of the authorized BW by more than 100% up to and including 250% of the authorized BW. At least $43 + \log_{10}(TP)$ dB on any frequency removed from the center of the authorized bandwidth by more than 250%. See the following plot.

Test procedure: ANSI/TIA-603-C: 2004 paragraph 2.2.11.

OCCUPIED BANDWIDTH MEASUREMENT



Occupied bandwidth – Mask D - 462.55 MHz



Date: 9.DEC.2013 11:01:00

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Part 2.1051(a)

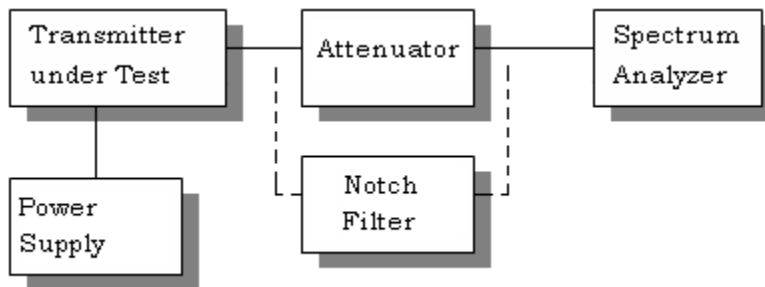
Requirements: Emissions must be $50+10\log(PO)$ dB below the mean power output of the transmitter.
 $50+10\log(2.8) = 54.5\text{dBc}$ (for high power)
 $50+10\log(0.8) = 49.0\text{dBc}$ (for low power)

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
462.65	925.30	69.7		462.65	925.30	65.8
	1387.95	75.7			1387.95	70.3
	1850.60	83.3			1850.60	77.3
	2313.25	66.8			2313.25	66.9
	2775.90	82.1			2775.90	78.5
	3238.55	77.7			3238.55	75.6
	3701.20	84.1			3701.20	79.4
	4163.85	NE			4163.85	NE
	4626.50	NE			4626.50	NE

Method of Measuring Conducted Spurious Emissions



FIELD STRENGTH OF SPURIOUS EMISSIONS - TX

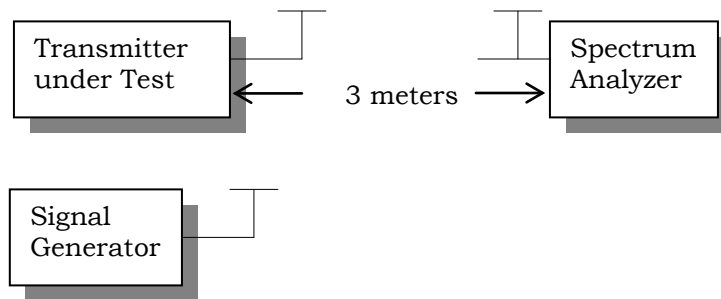
Rule Parts. No.: Part 2.1053
95.635(b)(7)

Requirements:

50+10log (2.8) = 54.5dBc (for high power)
50+10log (0.8) = 49.0dBc (for low power)

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 (GMRS):

High Power

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
462.65		
925.30	H	83.8
1387.95	V	80.1
1850.60	H	78.7
2313.25	H	75.7
2775.90	V	68.9
3238.55	H	70.2
3701.20	H	84.3
4163.85	H	83.7
4626.50	H	81.4

Low Power

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
462.65		
925.30	V	72.9
1387.95	V	72.8
1850.60	H	75.3
2313.25	H	74.2
2775.90	V	70.2
3238.55	H	68.7
3701.20	V	78.0
4163.85	H	75.8
4626.50	V	74.4

FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 95.621(b)

Requirements: Temperature and voltage tests were performed to verify that the frequency remains within the 0.0005%, 5 ppm specification limit. 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 worse case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -30° C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute, and again frequency readings were noted at 15 second 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)		462.650067
Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)
-30	462.649345	-1.56
-20	462.650230	0.35
-10	462.651033	2.09
0	462.651175	2.40
+10	462.650920	1.84
+20	462.650391	0.70
+30	462.649695	-0.80
+40	462.649359	-1.53
+50	462.649086	-2.12

Assigned Frequency (Ref. Frequency) (MHz)		
Battery %	Frequency (MHz)	Frequency Stability (PPM)
-15%	462.650089	0.05
0	462.650067	0.00
+15%	462.650041	-0.06

Note: This EUT meets the frequency stability requirement for a GMRS frequency stability requirements: +/- 5ppm over the temp range -30 degrees C to +50 degrees C.

TEST 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 2	ETS-Lindgren	3117	00041534	10/05/12	10/05/14
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	12/31/13	12/31/15
EMI Test Receiver	Rohde & Schwarz	*ESIB40	100274	3/16/12	3/16/14
EMI Test Receiver	Rohde & Schwarz	*ESU40	100320	3/21/13	3/21/15

***EMI TEST RECEIVER FIRMWARE VERSION USED**

Manufacturer	Model	Receiver Firmware	BIOS Ver
Rohde & Schwarz	ESU40	4.43 SP3	V5.1-24-3
Rohde & Schwarz	ESIB40	4.34.3	3.3