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FCC PART 95

GMRS TRANSCEIVER

TEST REPORT

APPLICANT	**MIDLAND RADIO CORPORATION**
	5900 PARRETTA DRIVE **KANSAS CITY MISSOURI 64120 USA**
FCC ID	MMAMXT100
PRODUCT DESCRIPTION	MOBILE GMRS
FCC STANDARD APPLIED	47 CFR § 95 Personal Radio Service Subpart A – General Mobile Radio Service (GMRS)
DATE SAMPLE RECEIVED	11/11/2014
DATE TESTED	12/5/2014 -
TESTED BY	Sid Sanders
APPROVED BY	Cory Leverett
TIMCO REPORT NO.	2037AUT14TestReportRev1.docx
TEST RESULTS	☒ PASS ☐ FAIL

CONTENTS

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.

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:

Sid Sanders

Engineering Project Manager

Date: 12/10/14

Table of Contents

GENERAL INFORMATION
EUT Specification

EUT Description	MOBILE GMRS
EUT Application	Short range communications
FCC ID	MMAMXT100
Operating Frequency	GMRS:462.5500-462.7250 MHz
Test Frequencies	GMRS: 462.5625 MHz
No. of Channels	22
Type of Emission	10K5F3E for Channel Spacing of 12.5kHz
EUT Power Source	☐ 110–120Vac/50–60Hz (Optional AC power Adapter)
	☒ DC Power 13.8V
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☐ Fixed
	☒ Mobile
	☐ Portable
Test Conditions	The temperature was 24-26ºC with a relative humidity of 50-60%.
Modification to the EUT	None
Test Exercise	The EUT was placed in continuous transmit mode of operation
Applicable Standards	ANSI/TIA 603-D:2004, FCC CFR 47 Part 25
Test Facility	Timco Engineering Inc. 849 NW State Road 45 Newberry, FL 32669 USA.

Table of Contents

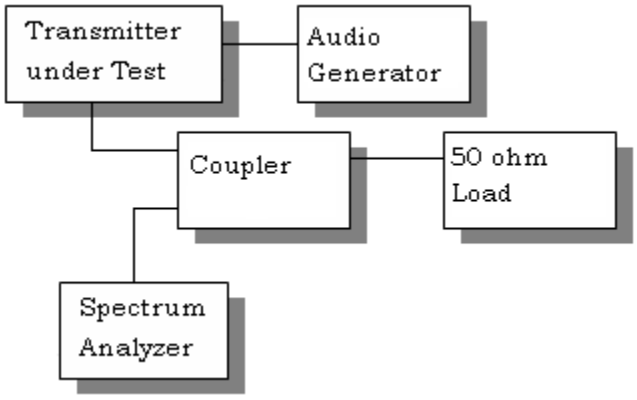
TEST REPORT SUMMARY

Rule Part No.	Scope of Work	Status Pass/Fail/NA
Part 2.1033(c)(6)(7), Part 2.1046(a), PART 95 Subpart A	RF Power Output	PASS
Part 2.1033(a) (b)	Modulation Characteristics	PASS
2.1049(c), 95.635(b)(1)(3)(7)	Emission Mask and Occupied Bandwidths	PASS
2.1051	Antenna Conducted Emissions	PASS
2.1053, 95.635(b)(7)	Field Strength Spurious Emissions	PASS
Part 2.1055 Part 95.621(b)	Frequency Stability	PASS

TEST PROCEDURES:

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-D:2010, using a 50uH LISN. Both lines were observed with the EUT 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. **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.



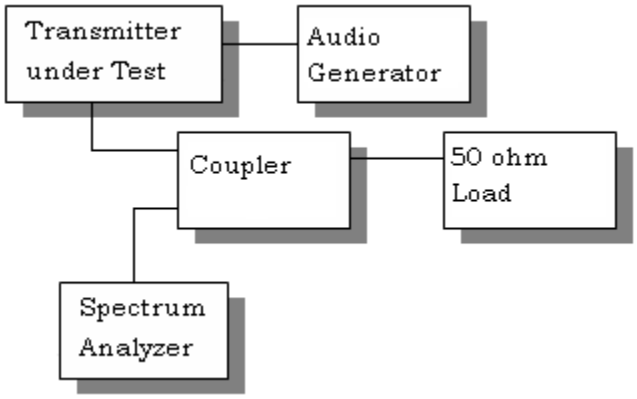
Power Output: The RF power output was measured at the antenna feed point using a peak power meter. The test procedures used are detailed in **ANSI/TIA 603-D:2004.**

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.

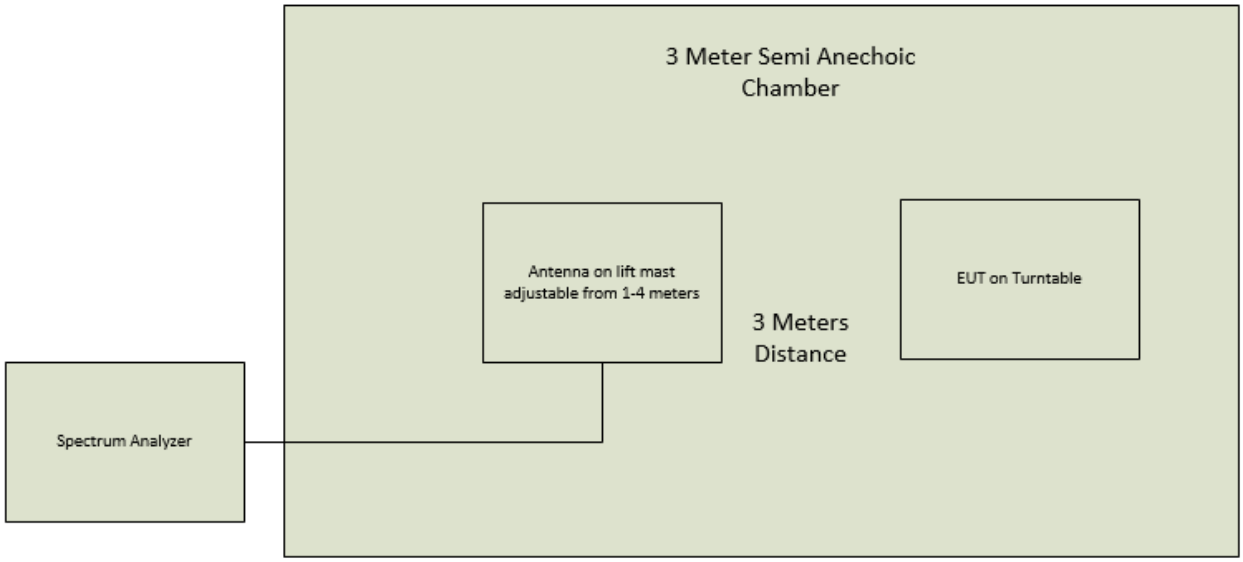
Radiation Interference: The test procedure used was ANSI/TIA 603-D:2010, using an Rohde & Schwarz – EMI test receiver. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

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.

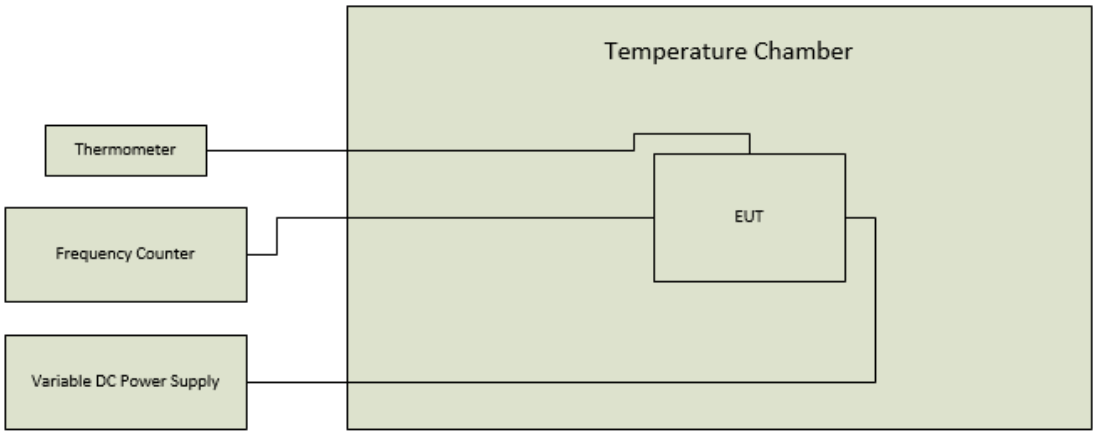


Radiation Interference*:* The test procedure used was ANSI/TIA 603-C: 2004 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.



TEST PROCEDURES:

Frequency Stability: The EUT was placed into a temperature chamber. After a reference frequency is measured at room temperature, The EUT frequency is measured at the required extreme temperatures after a 20 minute soak time at each said temperature. The EUT antenna output port was connected to a frequency counter for the frequency measurement of an unmodulated CW signal. The voltage was also varied + and – 15% with a variable DC power supply and the frequency measured and compared to the reference frequency.



RF POWER OUTPUT

Rule Part No.: FCC Part 2.1033(c)(6)(7), FCC Part 2.1046(a), FCC PART 95 Subpart A,

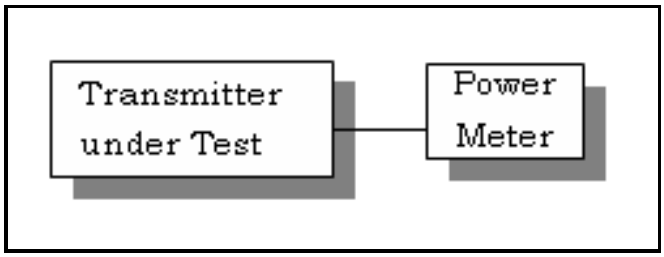
Requirements: There can be no provisions for increasing the power or varying the power. No GMRS channel, under any condition of modulation, shall exceed:

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 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:

For the device with a fixed or integral antenna, the RF power is measured as ERP. The substitution method was used. The RF output measures:

Test Setup Diagram:



Test Data:

Output power

GMRS	dBm	W
462.5625MHz	37.1	5.0

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

Power Input = 11.1Watts

DC Power Consumption
Vdc = 13.6volts
Ic = 0.81 amps

Results: Pass

MODULATION CHARACTERISTICS

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

MODULATION CHARACTERISTICS

AUDIO FREQUENCY RESPONSE

Part 2.1033(a) (b)

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

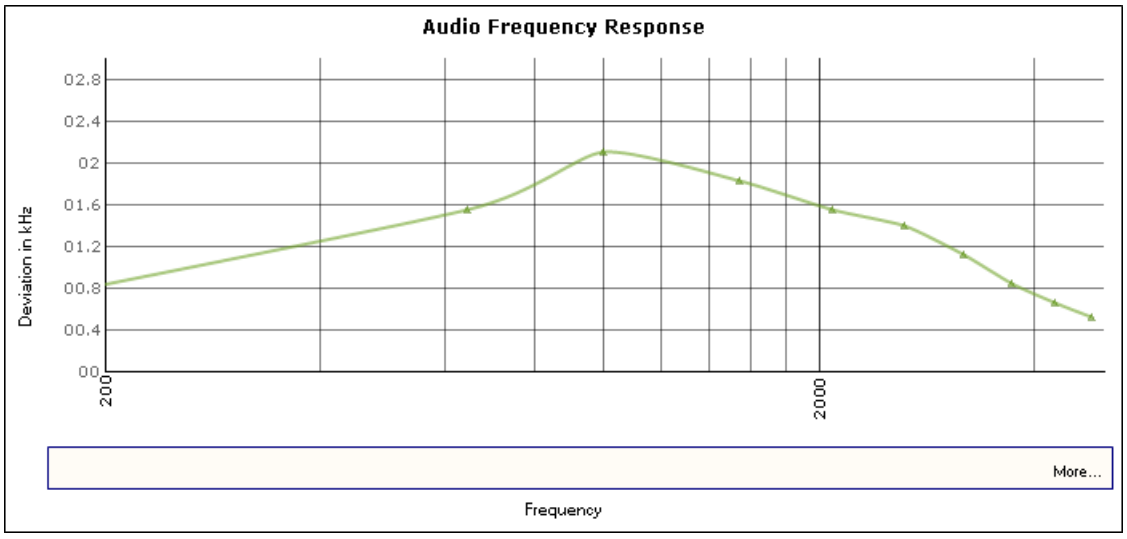
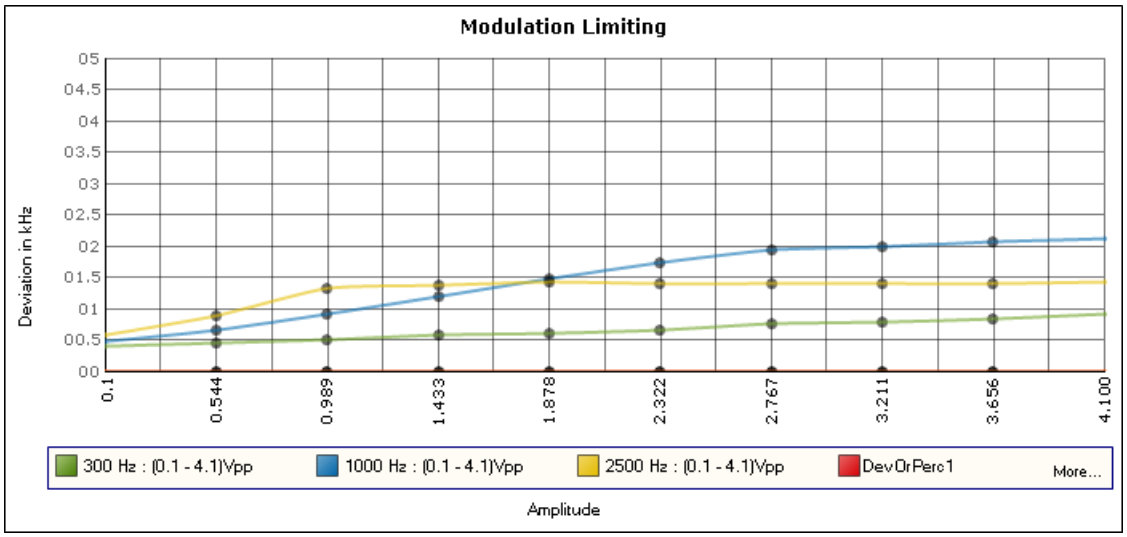


Table of Contents

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.

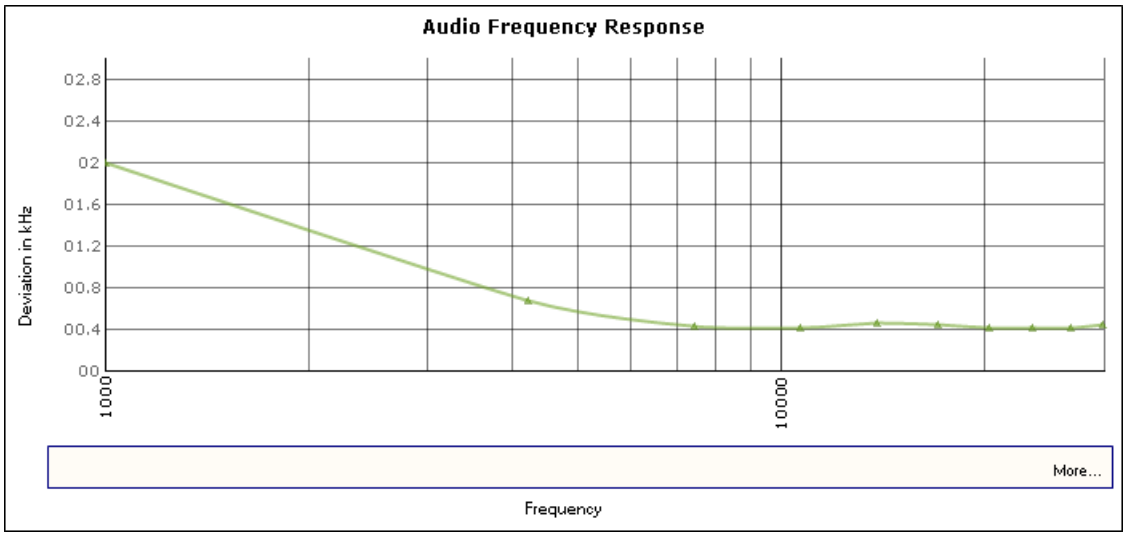


Results: PASS

Table of Contents

POST LIMITER FILTER

Each GMRS transmitter, except a mobile station transmitter with a power output of 2.5 W or less, must automatically prevent a greater than normal audio level from causing overmodulation. The transmitter also must include audio frequency low pass filtering, unless it complies with the applicable paragraphs of §95.631 (without filtering.) The filter must be between the modulation limiter and the modulated stage of the transmitter. At any frequency (f in kHz) between 3 and 20 kHz, the filter must have an attenuation of at least 60 log10 (f/3) dB greater than the attenuation at 1 kHz. Above 20 kHz, it must have an attenuation of at least 50 dB greater than the attenuation at 1 kHz.



Results: PASS

Table of Contents

EMISSION DESIGNATOR AND FREQUENCIES

2.1033© (4) 95.631 Type of Emission: 10K5F3E

Bn = 2M + 2DK
M = 3000
D = 2.25K
Bn = 2(3000) + 2(2250) = 10.5K

GMRS Authorized Bandwidth 20.0 kHz

2.1033© (5) GMRS Allowed Channel frequencies (MHz):
95.621 (a)

1. 462.5500
2. 462.5625
3. 462.5750
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
13. 462.7000
14. 462.7125
15. 462.7250

Table of Contents

OCCUPIED BANDWIDTH

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

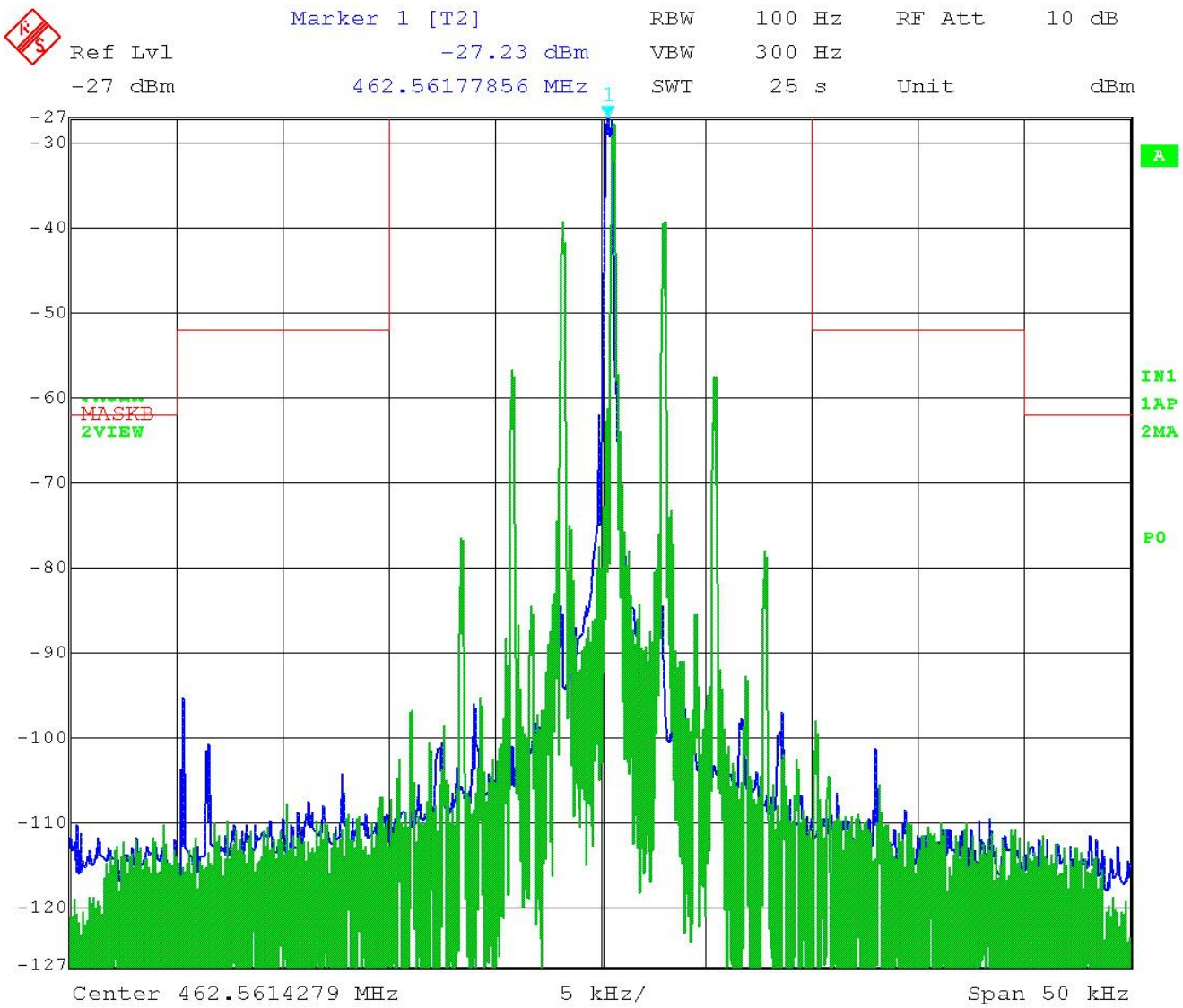
Requirements: At least 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth. At least 35 dB on any frequency removed from the center of the authorized BW by more than 100% up to and including 250% of the authorized BW. At least 43+log10(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.

Table of Contents

OCCUPIED BANDWIDTH

GMRS OCCUPIED BANDWIDTH MASK B



SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

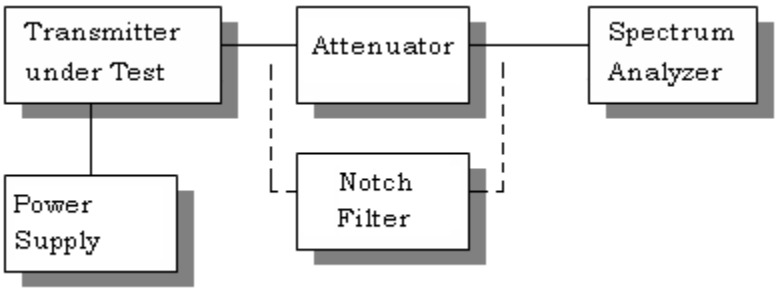
Rule Part No.: Part 2.1051(a)

Requirements:

12.5 kHz Channel Spacing = 50+10 log (5.0) = 57.0 dBc (low power)

Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from the lowest frequency generated to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-D: 2010.

Method of Measuring Conducted Spurious Emissions



Test Data: High Power 462.5625MHz

	dBm	Watts	Margin
Power Output	37	5	dB
LIMIT		60	
	Frequency	dBc	
	462.56	0	
	925.12	71.8	11.8
	1387.68	74.9	14.9
	1850.24	75.2	15.2
	2312.8	68	8
	2775.36	73.9	13.9
	3237.92	77.8	17.8
	3700.48	79.5	19.5
	4163.04	74	14
	4625.6	73.2	13.2

FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 2.1053, 95.635(b)(7), IC RSS-210

Requirements: GMRS: 43 + 10log(.5) =40 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. Only the worst case for each antenna polarity is shown.

Test Data (GMRS):

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
462.56	Hi	37.00	5.01	57.00	12.50

Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin
925.12	V	78.79	18.79
1,387.68	H	68.14	8.14
1,850.24	H	66.22	6.22
2,312.80	H	69.40	9.4
2,775.36	H	74.23	14.23
3,237.92	H	66.40	6.40
3,700.48	H	65.59	5.59
4,163.04	H	64.45	4.45
4,625.60	H	74.16	17.16

NE = No emission found **NF** = Only the noise floor was present

FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055 Part 95.621(b), IC RSS-210

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 25º 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 -30º 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 + 50º C.

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

Test Data:

Reference Frequency			462.7249	MHz					
		Battery (%)		Frequency)			Frequency Stability (ppm)		
		-15		462.7249	MHz		0		
		0		462.7249	MHz		0		
		15		462.7249	MHz		0		
		Temperature(C)		Frequency)			Frequency Stability (ppm)		
		-30		462.725	MHz		0.18		
		-20		462.7247	MHz		-0.32		
		-10		462.7247	MHz		-0.37		
		0		462.7249	MHz		-0.05		
		10		462.725	MHz		0.24		
		20		462.7249	MHz		0.11		
		30		462.7249	MHz		-0.08		
		40		462.7248	MHz		-0.27		

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.

Table of Contents

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical Chamber	Eaton Chamber	94455-1	1057	06/14/13	06/14/15
Antenna: Log-Periodic Chamber	Eaton	96005	1243	05/31/13	05/31/15
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00035923	06/13/14	06/13/16
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/12/14	08/12/16

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

Table of Contents