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**FCC PART 95 AND IC RSS-210 (i8)
FRS/GMRS TRANSCEIVER
TEST REPORT**

APPLICANT	COBRA ELECTRONICS CORPORATION
	6500 WEST CORTLAND STREET CHICAGO IL 60707 USA
FCC ID	BBO2146A
IC	906A-2146A
MODEL NUMBER	CXT645, CXT645C
PRODUCT DESCRIPTION	FRF/GMRS TRANSCEIVER
FCC STANDARD APPLIED	47 CFR § 95 Personal Radio Service Subpart A – General Mobile Radio Service (GMRS) Subpart B – Family Radio Service (FRS)
IC STANDARD APPLIED	IC Standard RSS-210 (i8), Annex 6
DATE SAMPLE RECEIVED	9/15/2014
DATE TESTED	9/24/2014
TESTED BY	Cory Leverett
APPROVED BY	Sid Sanders
TIMCO REPORT NO.	1643AUT14TestRepRev2.docx
TEST RESULTS	☒ PASS ☐ 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.

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:

Cory Leverett
Engineering Project Manager

Date: 9/24/2014

A handwritten signature in black ink is written over a circular purple stamp. The stamp contains the text "TIMCO ENGINEERING, INC." around its perimeter.

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FCC ID: BBO2146A
IC: 906A-2146A
Report: C:\COBRA\1643AUT14\1643AUT14TestRepRev2.docx

GENERAL INFORMATION

EUT Specification

EUT Description	FRF/GMRS TRANSCEIVER
EUT Application	Portable short range communications
FCC ID	BBO2146A
IC	906A-2146A
Model Number	CXT645, CXT645C
Serial Number	N/A
Operating Frequency	GMRS: 462.5500-462.7250 MHz FRS: 462.5625-467.7125 MHz
Test Frequencies	GMRS: 462.5625 MHz FRS: 467.7250 MHz
No. of Channels	22
Type of Emission	10K5F3E
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
Antenna	Fixed
Test Conditions	The temperature was 26°C 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.

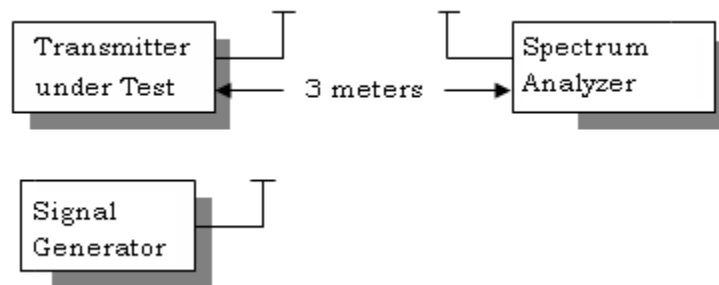
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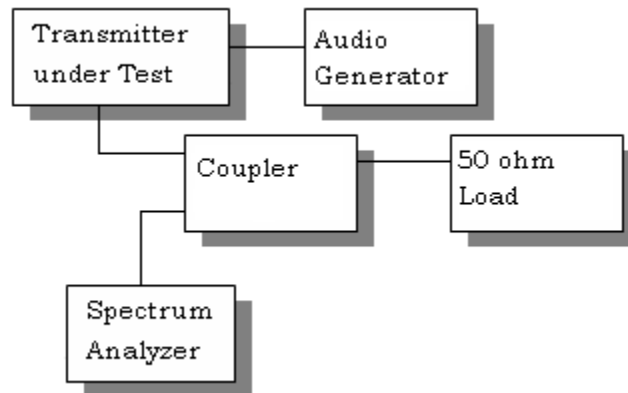
TEST PROCEDURES:

General: The test procedures used are detailed in **ANSI/TIA 603-D:2004**.

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



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.

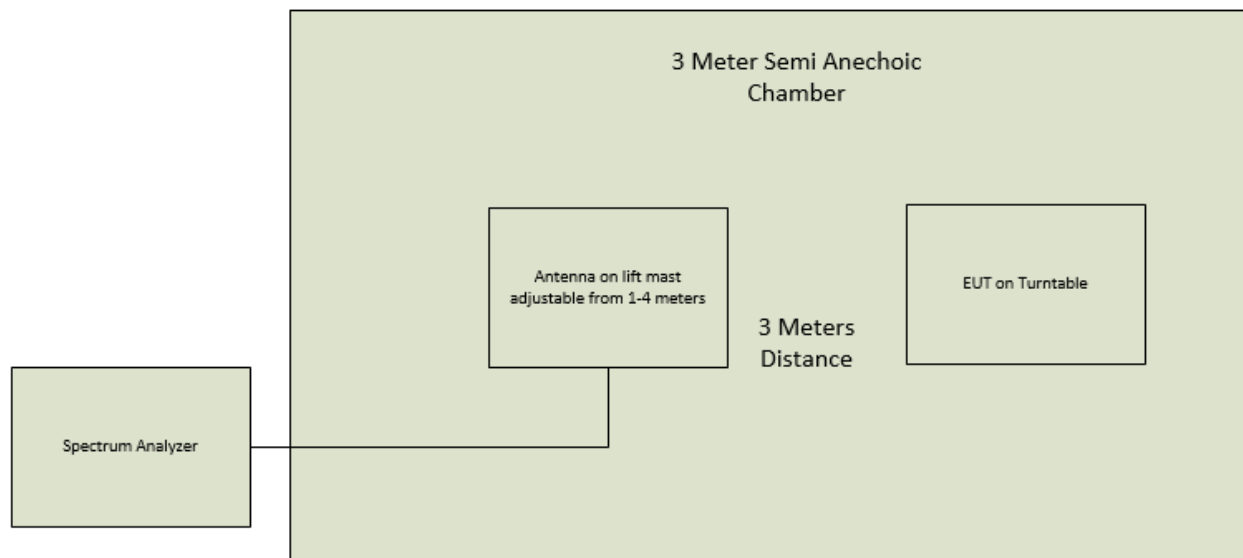


Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

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TEST PROCEDURES:

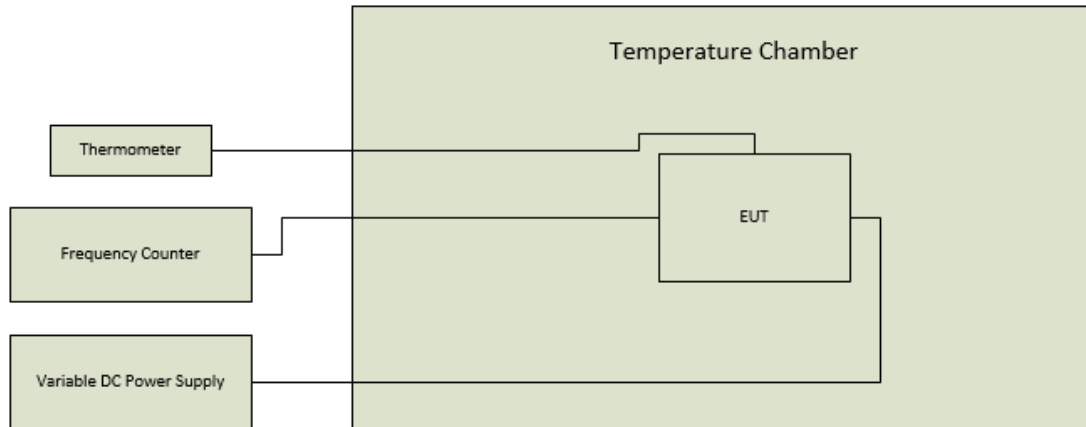
Radiation Interference: The test procedure used was ANSI/TIA 603-C: 2004 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated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



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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.



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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, Part 95 Subpart B, RSS-210	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), IC RSS-210	Field Strength Spurious Emissions	Pass
Part 2.1055 Part 95.621(b), IC RSS-210	Frequency Stability	Pass

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RF POWER OUTPUT

Rule Part No.: [FCC Part 2.1033\(c\)\(6\)\(7\)](#), [FCC Part 2.1046\(a\)](#), [FCC PART 95 Subpart A](#), [FCC Part 95 Subpart B](#), IC [RSS-210](#)

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 as ERP as the antenna is permanently attached. The substitution method was used. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

Test Data:

Output power

GMRS HI POWER CH 22	W 2.0	33dBm
FRS CH 8	W .5	27dBm

* Measurements made conducted using an average power sensor

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

GMRS HI Power Input = 3.6 Watts
FRS Power Input = 6 Watts

GMRS HI Power DC Power Consumption
Vdc = 4.8
Ic = 1.25

FRS HI Power DC Power Consumption
Vdc = 4.8 Volts
Ic = .75 Amps

Results: Pass

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MODULATION CHARACTERISTICS

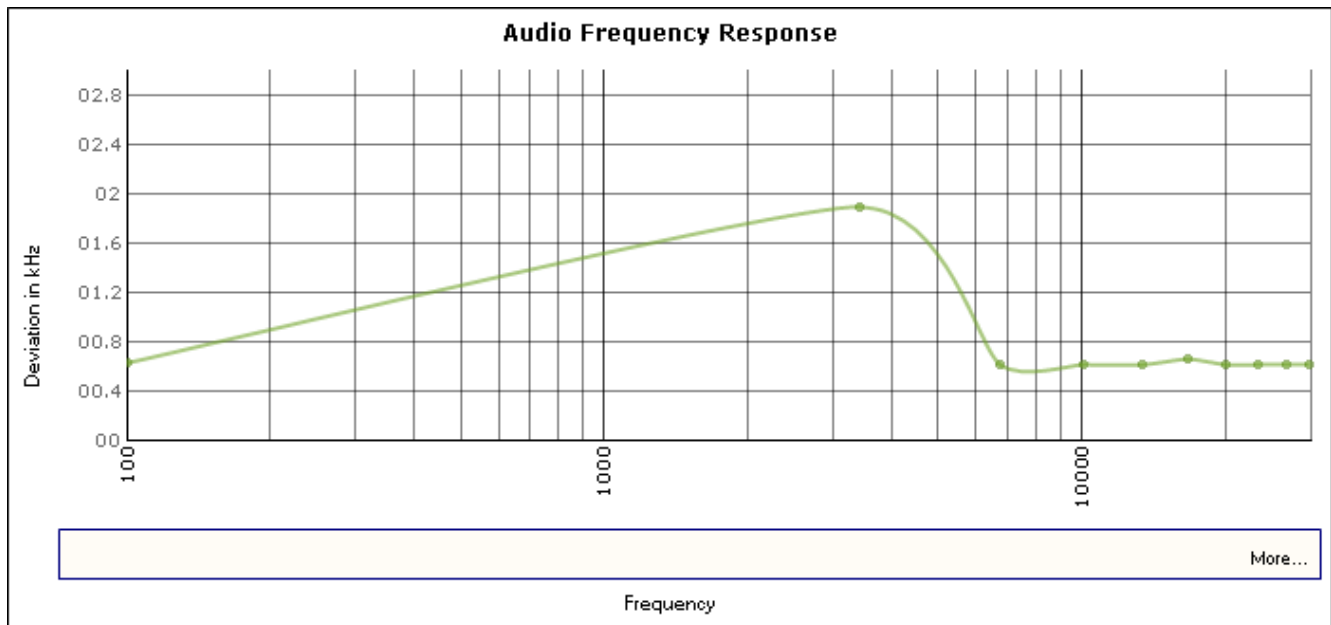
Rule Part No.: Part 2.1047(a)(b)

Test Requirements:

Method of Measurement:

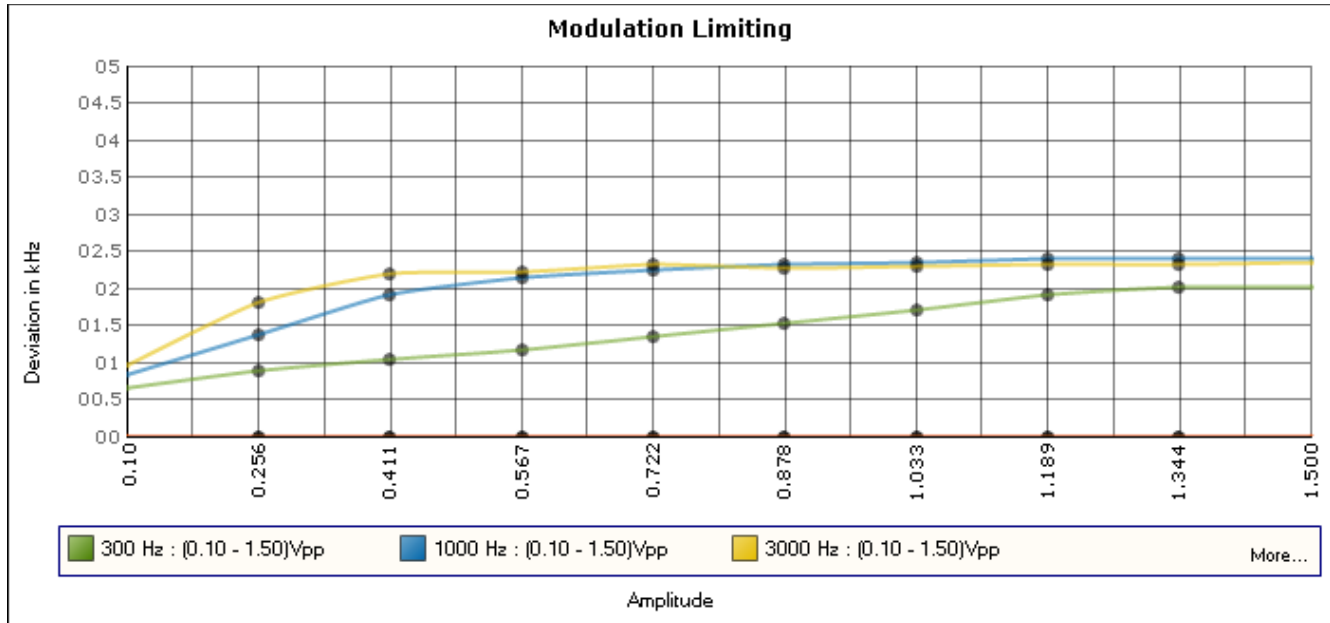
The audio frequency response was measured in accordance with ANSI/TIA 603-C: 2004. The audio frequency response curve is shown below. The audio signal was fed into a dummy microphone circuit and into the microphone connector. The input required to produce 30 percent modulation level was measured.

AUDIO FREQUENCY RESPONSE PLOT



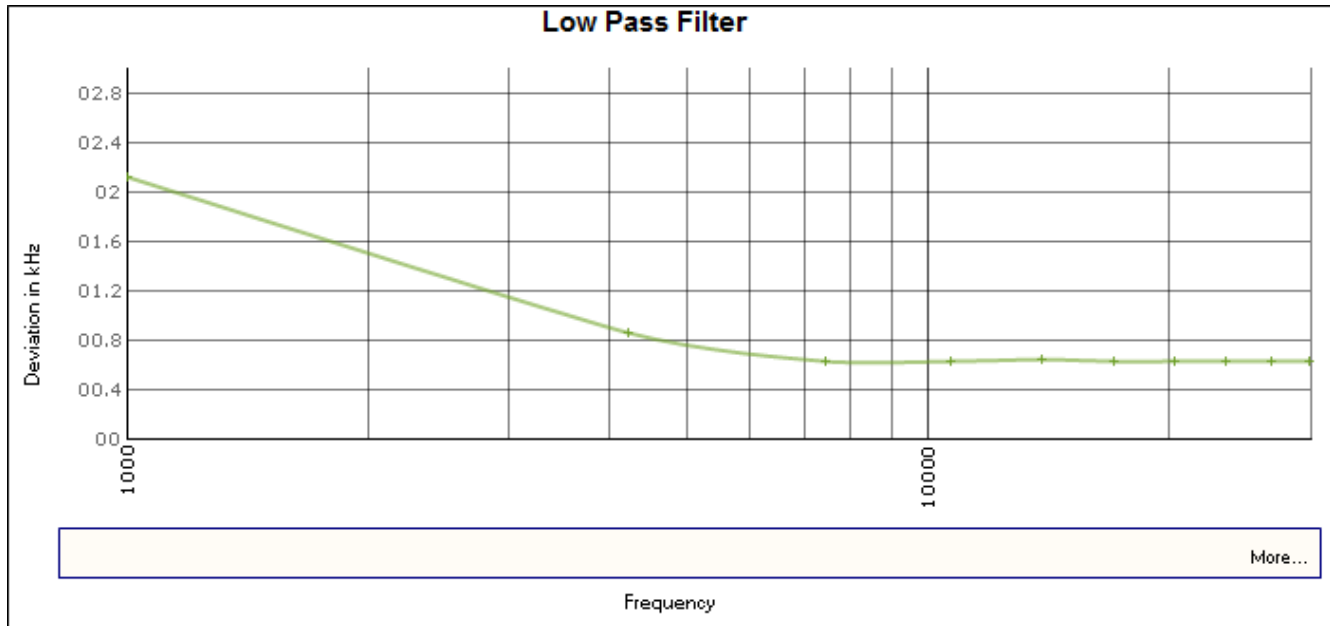
Audio input versus modulation

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 AND FREQUENCIES

[2.1033© \(4\)](#) Type of Emission: 10K5F3E
[95.631](#)

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

GMRS Authorized Bandwidth 20.0 kHz

[2.1033© \(5\)](#) GMRS Allowed Channel frequencies (MHz):
[95.621 \(a\)](#)

1. 462.5500	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	

FRS Authorized Bandwidth 12.5 kHz

[2.1033© \(5\)](#) FRS Allowed Channel frequencies (MHz):
[95.626 \(a\)](#)

1. 462.5625	8. 467.5625
2. 462.5875	9. 467.5875
3. 462.6125	10. 467.6125
4. 462.6375	11. 467.6375
5. 462.6625	12. 467.6625
6. 462.6875	13. 467.6875
7. 462.7125	14. 467.7125 MHz

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OCCUPIED BANDWIDTH

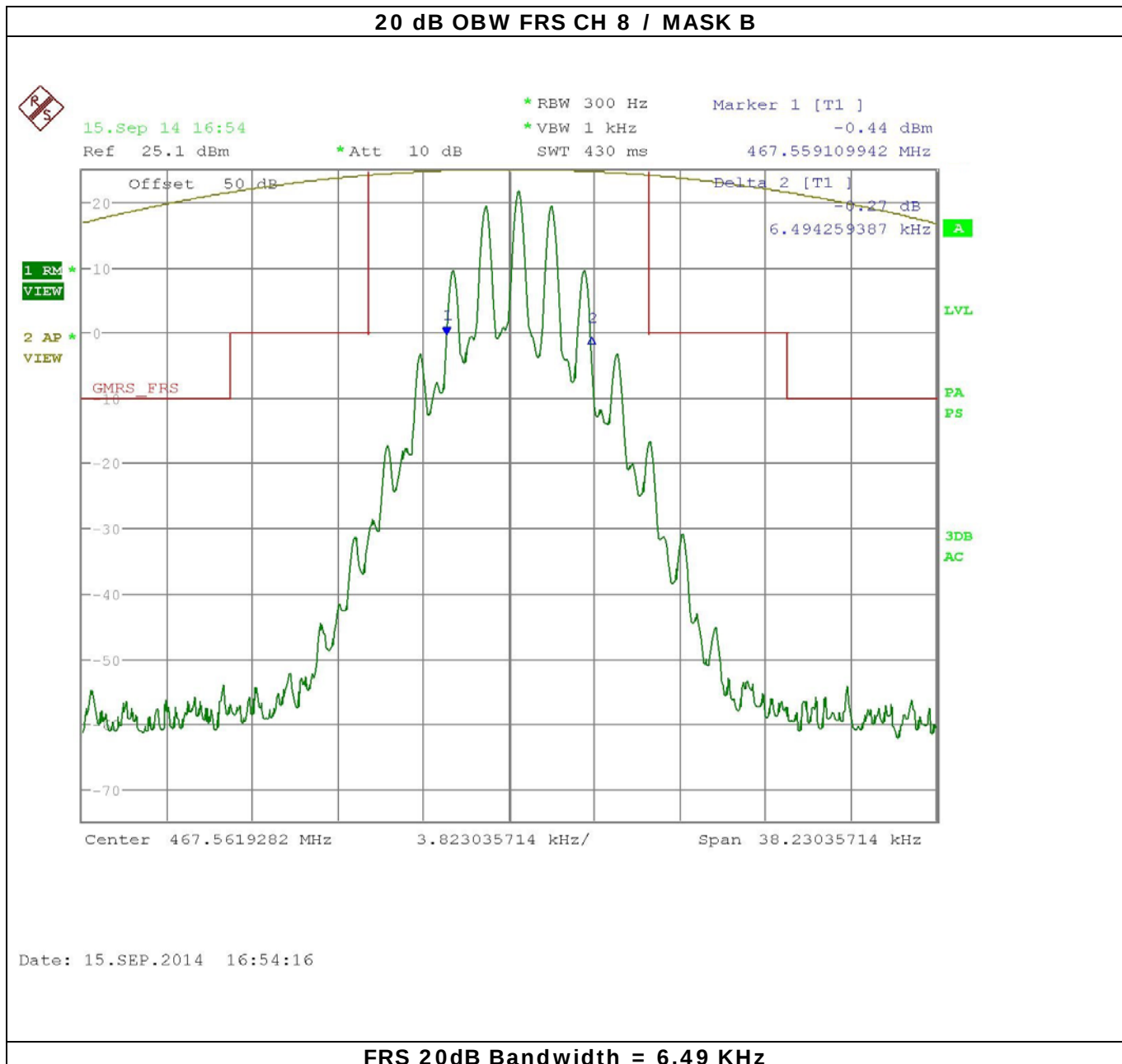
[Part 2.1049©](#) EMISSION BANDWIDTH:
[95.635\(b\)\(1\)\(3\)\(7\)](#)

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.

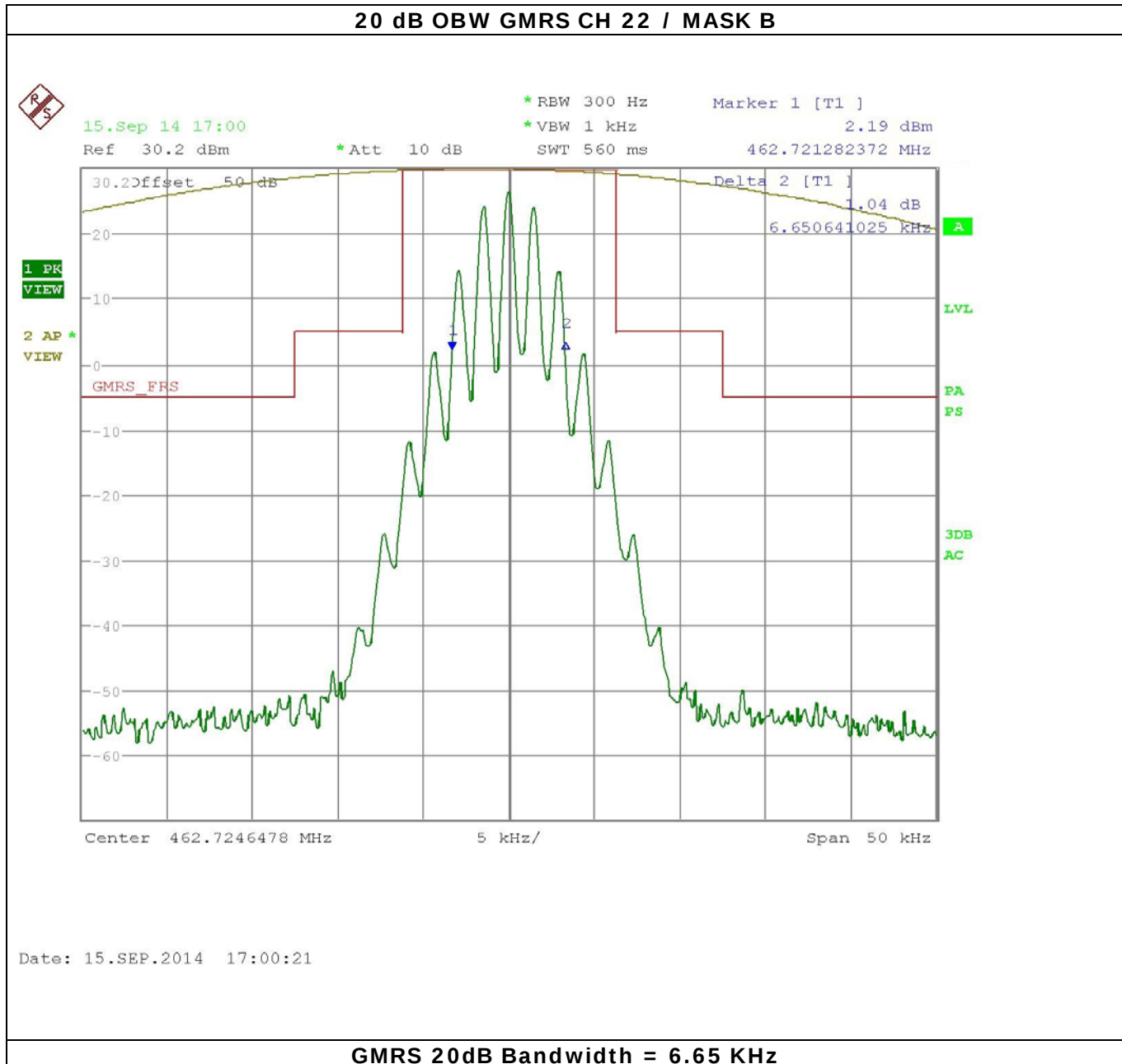
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OCCUPIED BANDWIDTH



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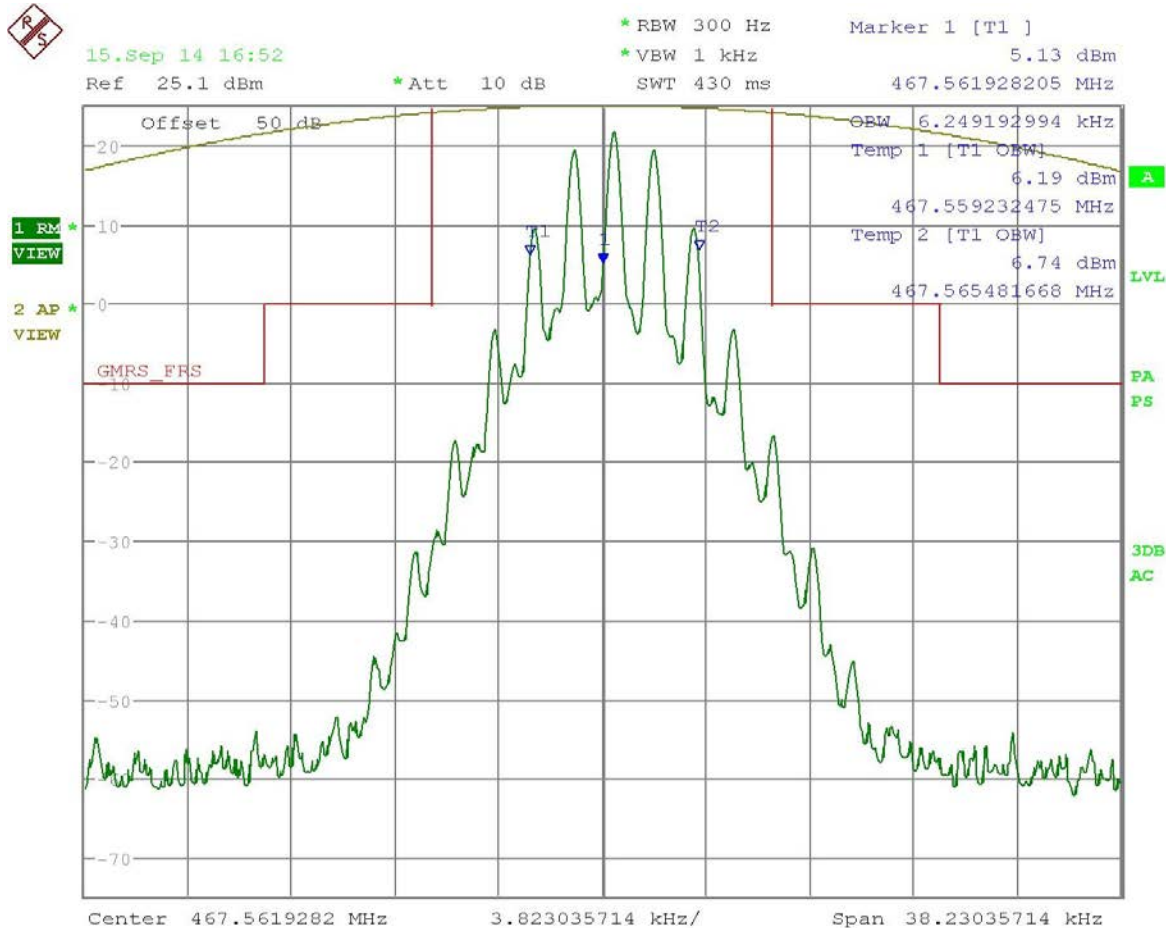
OCCUPIED BANDWIDTH



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OCCUPIED BANDWIDTH

99 % Power OBW FRS CH 8 / MASK B



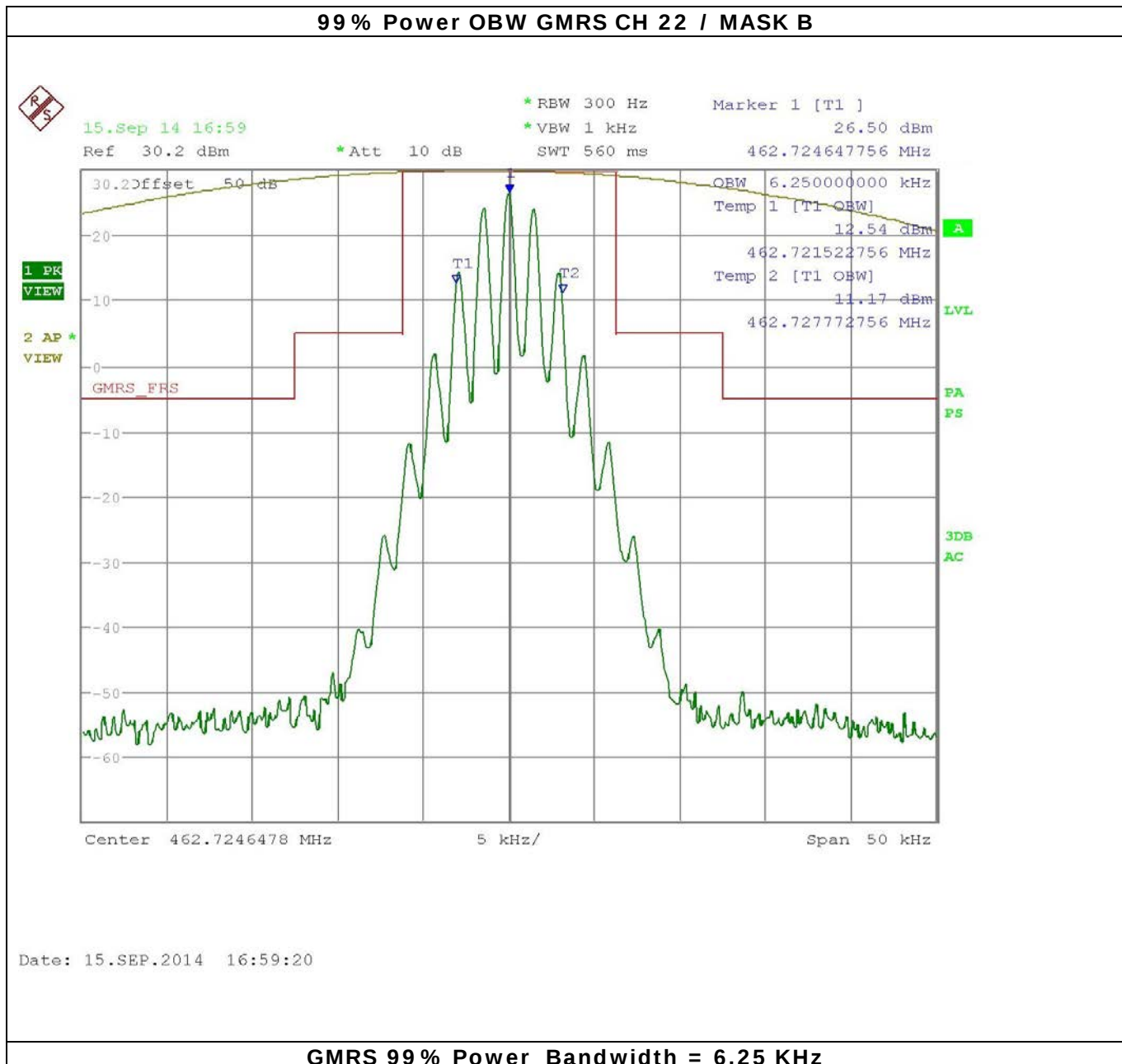
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FRS 99 % Power Bandwidth = 6.24 KHz

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OCCUPIED BANDWIDTH



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FIELD STRENGTH OF SPURIOUS EMISSIONS

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

Requirements: GMRS: $43 + 10\log(2) = 46$ dB

FRS: $43 + 10\log(.5) = 40$ 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.

GMRS Test Data:

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
462.82	Hi	33.0	2.0	46.0	12.5
Emission Frequency (MHz)	Ant. Polarity		Below Carrier (dBc)	Margin	
925.64	V		77.91	31.91	
1,388.46	H		72.20	26.20	
1,851.28	V		78.86	32.86	
2,314.10	V		78.86	32.86	
2,776.92	V		76.10	30.10	
3,239.74	V		74.43	28.43	
3,702.56	V		74.99	28.99	
4,165.38	V		79.78	33.78	
4,628.20	V		86.31	40.31	

Emission Frequency (MHz)	Ant. Polarity	EUT Signal Reading	Signal Generator Reading	Coax Loss (dB)	Filter Insertion Loss	Substitution Antenna	ERP (dBm)	Below Carrier (dBc)	Margin
925.64	H	18.50	75.94	0.20	0.00	-1.43	-59.08	92.08	46.08
925.64	V	31.67	74.94	0.20	0.00	-1.43	-44.91	77.91	31.91
1,388.46	H	31.67	74.73	0.87	0.00	4.72	-39.20	72.20	26.20
1,388.46	V	17.10	74.09	0.87	0.00	4.72	-53.13	86.13	40.13
1,851.28	H	16.80	71.70	0.96	0.00	5.29	-50.56	83.56	37.56
1,851.28	V	21.20	71.39	0.96	0.00	5.29	-45.86	78.86	32.86
2,314.10	H	19.95	72.15	2.23	0.00	6.17	-48.26	81.26	35.26
2,314.10	V	20.71	70.50	2.23	0.00	6.17	-45.86	78.86	32.86
2,776.92	H	20.27	70.70	2.28	0.00	6.96	-45.75	78.75	32.75
2,776.92	V	21.65	69.43	2.28	0.00	6.96	-43.10	76.10	30.10
3,239.74	H	17.59	68.90	1.54	0.00	7.30	-45.55	78.55	32.55
3,239.74	V	20.20	67.39	1.54	0.00	7.30	-41.43	74.43	28.43
3,702.56	H	11.56	67.29	1.61	0.00	7.59	-49.75	82.75	36.75
3,702.56	V	18.13	66.10	1.61	0.00	7.59	-41.99	74.99	28.99
4,165.38	H	10.86	65.19	1.73	0.00	7.72	-48.34	81.34	35.34
4,165.38	V	12.52	65.29	1.73	0.00	7.72	-46.78	79.78	33.78
4,628.20	H	12.68	72.79	1.80	0.00	7.84	-54.07	87.07	41.07
4,628.20	V	12.94	72.29	1.80	0.00	7.84	-53.31	86.31	40.31

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FIELD STRENGTH OF SPURIOUS EMISSIONS

FRS Test Data:

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
467.94	Hi	27.00	0.50	47.00	12.50
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
935.88	V	86.08		39.08	
1,403.82	H	78.83		31.83	
1,871.76	V	73.16		26.16	
2,339.70	V	72.98		25.98	
2,807.64	H	72.22		25.22	
3,275.58	V	67.45		20.45	
3,743.52	H	67.89		20.89	
4,211.46	V	74.55		27.55	
4,679.40	V	77.85		30.85	

Emission Frequency (MHz)	Ant. Polarity	EUT Signal Reading	Signal Generator Reading	Coax Loss (dB)	Filter Insertion Loss	Substitution Antenna	ERP (dBm)	Below Carrier (dBc)	Margin
935.88	H	14.21	74.55	0.20	0.00	-1.18	-61.72	88.72	41.72
935.88	V	15.85	73.55	0.20	0.00	-1.18	-59.08	86.08	39.08
1,403.82	H	19.23	74.98	0.87	0.00	4.80	-51.83	78.83	31.83
1,403.82	V	17.04	74.18	0.87	0.00	4.80	-53.21	80.21	33.21
1,871.76	H	20.20	71.66	0.96	0.00	5.33	-47.09	74.09	27.09
1,871.76	V	20.82	71.35	0.96	0.00	5.33	-46.16	73.16	26.16
2,339.70	H	20.00	72.03	2.24	0.00	6.22	-48.05	75.05	28.05
2,339.70	V	20.42	70.38	2.24	0.00	6.22	-45.98	72.98	25.98
2,807.64	H	20.70	70.62	2.29	0.00	6.99	-45.22	72.22	25.22
2,807.64	V	20.61	69.32	2.29	0.00	6.99	-44.01	71.01	24.01
3,275.58	H	20.62	68.85	1.54	0.00	7.32	-42.45	69.45	22.45
3,275.58	V	21.05	67.28	1.54	0.00	7.32	-40.45	67.45	20.45
3,743.52	H	20.10	66.97	1.62	0.00	7.60	-40.89	67.89	20.89
3,743.52	V	18.56	65.96	1.62	0.00	7.60	-41.42	68.42	21.42
4,211.46	H	11.94	65.95	1.73	0.00	7.73	-48.01	75.01	28.01
4,211.46	V	11.95	65.50	1.73	0.00	7.73	-47.55	74.55	27.55
4,679.40	H	12.33	70.42	1.81	0.00	7.85	-52.04	79.04	32.04
4,679.40	V	12.82	69.72	1.81	0.00	7.85	-50.85	77.85	30.85

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

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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 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 -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-D:2004

Test Data:

Temperature	Frequency MHz	Cycles	PPM
25°C (reference)	462.562319		
-30°C	462.563745	-1426	2.94
-20°C	462.56352	-1201	2.46
-10°C	462.563638	-1319	2.71
0°C	462.563576	-1257	2.58
10°C	462.563201	-882	1.77
20°C	462.562705	-386	0.7
30°C	462.562021	298	-0.78
40°C	462.561773	546	-1.32
50°C	462.561826	493	-1.2
Battery Voltage	Frequency	Cycles	PPM
-15%	462.562359	-40	-0.05
15%	462.562271	48	-0.24

Note: This EUT meets the frequency stability requirement for a FRS: +/- 2.5ppm over temp range of -20 degrees C to +50 degrees C. It also meets the GMRS frequency stability requirements: +/- 5ppm over the temp range -30 degrees C to +50 degrees C.

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EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
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
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	152	NA	NA
Frequency Counter	HP	5352B	2632A00165	06/26/13	06/26/15
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
Digital Multimeter	Fluke	77	35053830	08/22/13	08/22/15
Temperature Chamber Small	Thermotron Corp.	S1.2 Mini Max	25-1420-09	07/03/12	02/03/15
Signal Generator HP 8648C	HP	8648C	3623A02898	08/29/13	08/29/15
Software: Field Strength Program	Timco	N/A	Version 4.0	N/A	N/A
DC Power Supply	HP	6264B	2032A04119	05/06/13	05/06/15
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	10/05/12	10/05/14
*EMI Test Receiver R & S ESU 40	Rhode & Schwarz	ESU 40	100320	03/21/13	03/21/15
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 RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

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