NVLAP Lab Code 200087-0

Test Report

CFR47 part 80(E), RSS-238

Market Label: M4AONR00

9300-9500 MHz

Marine Radar Equipment

FCC ID: IPH-02552

IC: 1792A-02552

For

Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062

Test Report Number: 140819

IC Test Site Registration: 3041A-1

Authorized Signatory: Scot D Rogers
Scot D. Rogers

NVLAP Lab Code 200087-0

Rogers Labs, Inc.

4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

Test Report For Application of Certification For

Garmin International, Inc.

1200 East 151st Street
Olathe, KS 66062
Phone: (913) 397-8200

Mr. Van Ruggles
Director of Quality Assurance

Market Label: M4AONR00
Marine Radar Equipment
Frequency Range: 9300-9500 MHz

FCC ID: IPH-02552

IC: 1792A-02552

Test Date: August 19, 2014

Certifying Engineer: Scot D Rogers

Scot D. Rogers
Rogers Labs, Inc.
4405 West 259th Terrace
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Revisions

Revision 1, Issued October 23, 2014

Forward

In accordance with the Federal Communications, Code of Federal Regulations dated October 1, 2013, Part 2 Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.915, 2.925, 2.926, 2.1031 through 2.1057, and Part 80, Subchapter E, and RSS-238 issue 1, the following information is submitted for consideration in obtaining grant of certification.

Name of Applicant: Garmin International, Inc., 1200 East 151st Street, Olathe, KS 66062

Model: M4AONR00

FCC ID: IPH-02552 Industry Canada ID: 1792A-02552

Frequency Range: 9300-9500 MHz

Emissions Designator: 37MP0N (40-dB 126M9P0N)

Opinion / Interpretation of Results

Tests Performed	Results
Requirements per CFR47 paragraphs 2 2.1031-2.1057	Complies
Requirements per CFR47 paragraphs 80.205 Bandwidths (RSS-238 3.2)	Complies
Requirements per CFR47 paragraphs 80.209 Frequency Tolerances (RSS-238 4.1)	Complies
Requirements per CFR47 paragraphs 80.211 Emission Limitations (RSS-238 4.3)	Complies
Requirements per CFR47 paragraphs 80.213 Modulation	Complies
Requirements per CFR47 paragraphs 80.215 Transmitter Power (RSS-238 4.2)	Complies

Equipment Tested

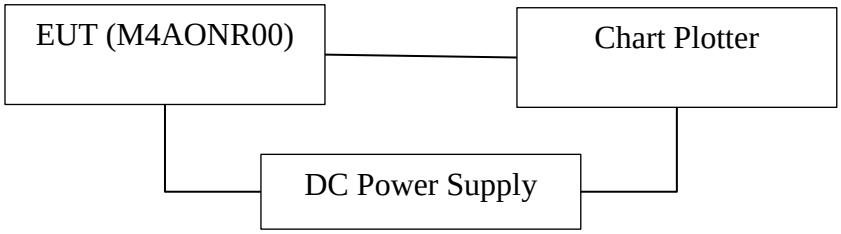
Equipment	Serial Number	FCC I.D.#
EUT M4AONR00	FCC #3	IPH-02552
Chart Plotter (GPSMap 4012)	Cert Test	N/A

Equipment Function and Configuration

The M4AONR00 is a ship borne marine radar designed to provide bearing and distance of ships and land targets near the ship (unit). The radar unit must be integrated into a full Marine system installation, including chart plotter for display and control purposes. As the radar sweeps through 360°, reflected signals are displayed on the chart plotter as indications of potential above surface hazards.

The design is offered in three (3) power options 4kW, 6kW, and 12kW. All design options contain identical transmitter electronics with output power determined by selection and configuration and cavity magnetron.

Equipment Configuration



Application for Certification

(1) Manufacturer: Garmin International, Inc. 1200 East 151st Street, Olathe, KS 66062

(2) Identification: Model: M4AONR00 FCC ID: IPH-02552 IC: 1792A-02552

(3) Instruction Book: Refer to exhibit for Draft Manual

(4) Emission Type: Emissions designator 126M9PON

(5) Frequency Range: 9300-9500 MHz, 9400 MHz ± 30 MHz (typical)

(6) Operating Power Level: 12000 Watt peak power, Maximum average power = 11.1Watts EIRP
6000 Watt peak power, Maximum average power = 5.5 Watts EIRP
4000 Watt peak power, Maximum average power = 3.7 Watts EIRP

(7) Maximum Power: 80.215, 20.0 Watts EIRP as listed on license

(8) Power into final amplifier(Peak magnetron anode):
12 kW - 5845 Vdc @ 5.28 A maximum = 30,861.6 watts peak power at magnetron
6 kW - 4200 Vdc @ 3.40 A maximum = 14,280 watts peak power at magnetron
4 kW - 3800 Vdc @ 3.90 A maximum = 14,820 watts peak power at magnetron
Calculated average power

Pulse Width (nS)	12 kW Magnetron	6 kW Magnetron	4 kW Magnetron
70	3.9	1.94	1.3
150	8.3	4.2	2.8
350	9.7	4.8	3.2
800	11.1	5.5	3.7
1000	6.9	3.5	2.3

(9) Tune Up Procedure for Output Power: Refer to Exhibit for Alignment Procedure.

(10) Circuit Diagrams: description of circuits, frequency stability, spurious suppression, and power and modulation limiting: Refer to Exhibit for Circuit Diagrams and theory of Operation.

(11) Photograph or drawing of the Identification Plate: Refer to Exhibit for Photograph or Drawing.

(12) Drawings of Construction and Layout: Refer to Exhibit for Drawings of Components Layout and Chassis Drawings.

(13) Detail Description of Digital Modulation: Refer to Operational Description exhibit for description of modulation.

(14) Data required by CFR47 paragraphs 2.1046 through 2.1057 are contained in this report.

(15) External power amplifier requirements do not apply to this device or application.

(16) AM broadcast requirements do not apply to this device or application.

(17) Requirements of CFR47 paragraph 25.129 do not apply to this device or application.

(18) The device is not a software-defined radio and requirements of 2.944 do not apply to this application.

(19) Requirements of CFR47 paragraph 27 do not apply to this device or application.

Environmental Conditions

Ambient Temperature	23.8° C
Relative Humidity	42%
Atmospheric Pressure	1016.8 mb

Units of Measurements

AC Line Conducted EMI	Data is in dBµV; dB referenced to one microvolt.
Radiated EMI	Data is in dBµV/m; dB/m referenced to one microvolt per meter
Antenna Conducted	Data is in dBm, dB referenced to one milliwatt

Test Site Locations

Conducted EMI	The conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.
Radiated EMI	The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.
Site Registration	Refer to Annex for FCC Site Registration Letter, # 90910, and Industry Canada Site Registration Letter, IC3041A-1.

List of Test Equipment

A Rohde and Schwarz ESU40 and/or Hewlett Packard 8591EM was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Rohde and Schwarz ESU40 and/or Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The analyzer settings used are described in the following table. Refer to the appendix for a complete list of test equipment.

AC Line Conducted Emissions (0.150 -30 MHz)		
RBW	AVG. BW	Detector Function
9 kHz	30 kHz	Peak / Quasi Peak
Emissions (30-1000 MHz)		
RBW	AVG. BW	Detector Function
120 kHz	300 kHz	Peak / Quasi Peak
Emissions (Above 1000 MHz)		
RBW	Video BW	Detector Function
100 kHz	100 kHz	Peak
1 MHz	1 MHz	Peak / Average

Equipment	Manufacturer	Model (SN)	Band	Cal Date	Due
☐ LISN	Comp. Design	FCC-LISN-2-MOD.CD(126).	15-30MHz	10/13	10/14
☒ Cable	Time Microwave	750HF290-750 (L10M)	9kHz-40 GHz	10/13	10/14
☒ Cable	Belden	RG-58 (L1-CAT3-11509)	9kHz-30 MHz	10/13	10/14
☒ Cable	Belden	RG-58 (L2-CAT3-11509)	9kHz-30 MHz	10/13	10/14
☐ Antenna	ARA	BCD-235-B (169)	20-350MHz	10/13	10/14
☐ Antenna	EMCO	3147 (40582)	200-1000MHz	10/13	10/14
☒ Antenna	Com Power	AH-118 (10110)	1-18 GHz	10/13	10/14
☒ Antenna	Com Power	AH-840 (101046)	18-40 GHz	5/14	5/15
☒ Antenna	EMCO	6509 (9502-1374)	.001-30 MHz	10/13	10/14
☒ Antenna	Sunol	JB-6 (A100709)	30-1000 MHz	10/13	10/14
☒ Antenna	Standard	FXRY638A (621786)	10-18 GHz	5/14	5/15
☐ Antenna	EMCO	3143 (9607-1277)	20-1200 MHz	5/14	5/15
☐ Analyzer	HP	8591EM (3628A00871)	9kHz-1.8GHz	5/14	5/15
☐ Analyzer	HP	8562A (3051A05950)	9kHz-110GHz	5/14	5/15
☒ Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	5/14	5/15
☒ Amplifier	Com-Power	PA-010 (171003)	100Hz-30MHz	10/13	10/14
☒ Amplifier	Com-Power	CPPA-102 (01254)	1-1000 MHz	10/13	10/14
☒ Amplifier	Com-Power	PAM-118A (551014)	0.5-18 GHz	10/13	10/14

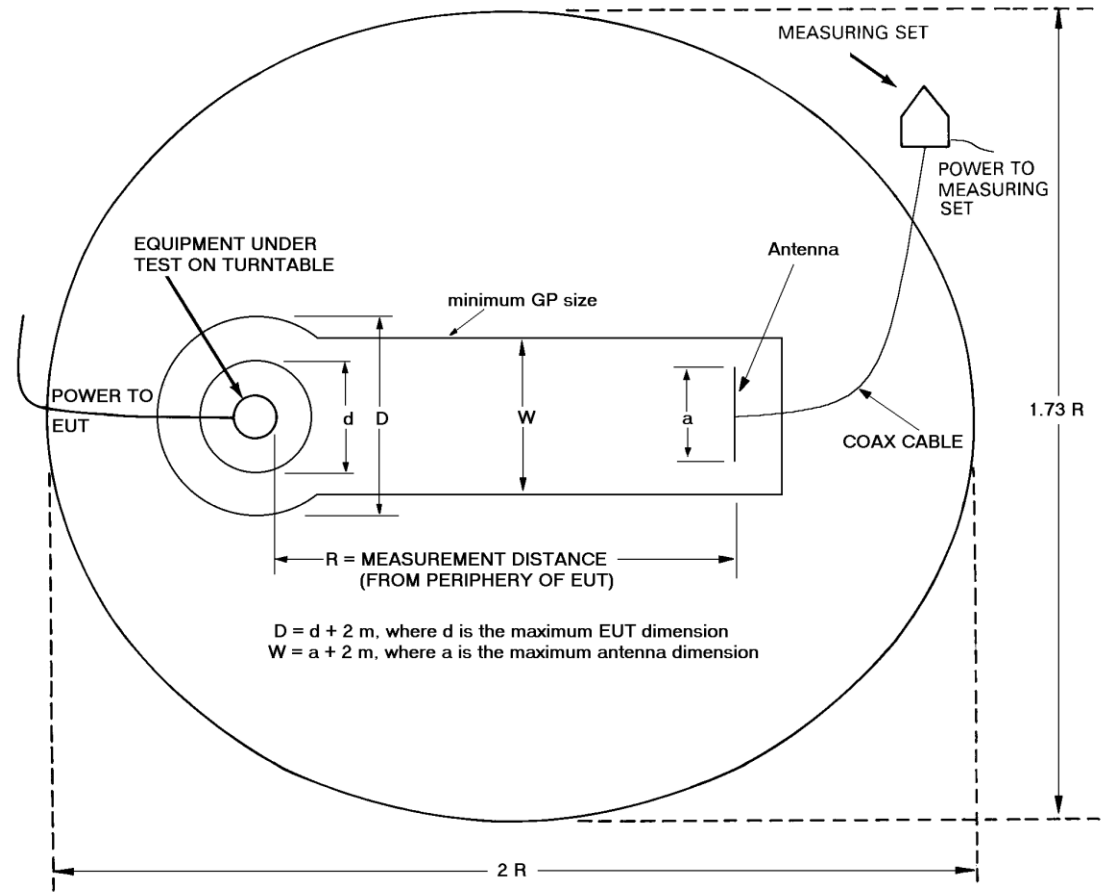
Applicable Standards & Test Procedures

In In accordance with the Federal Communications Commission, Code of Federal Regulations 47CFR, dated October 1, 2013, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, applicable parts of paragraph Parts 2, 80(E), and Industry Canada RSS-238 issue 1, the following information is submitted. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in ANSI C63.4-2009 and/or TIA/EIA 603-C.

Test Procedures

Radiated Emission Test Procedure

The EUT was placed on a rotating 1 x 1.5-meter wooden platform, 0.8 meters above the ground plane at a distance of 3 meters from the FSM antenna. EMI energy was maximized by equipment placement, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken using a spectrum analyzer. The frequency spectrum from 9 kHz to 100,000 MHz was searched during preliminary investigation. Refer to diagram one sowing typical OATS range configuration and diagram two showing typical test arrangement and photographs in the test setup exhibits for specific EUT placement during testing.



AREA DIMENSIONS =	R = 3m	R = 10 m	R = 30 m
	6 m x 5.2 m	20 m x 17.3 m	60 m x 52 m

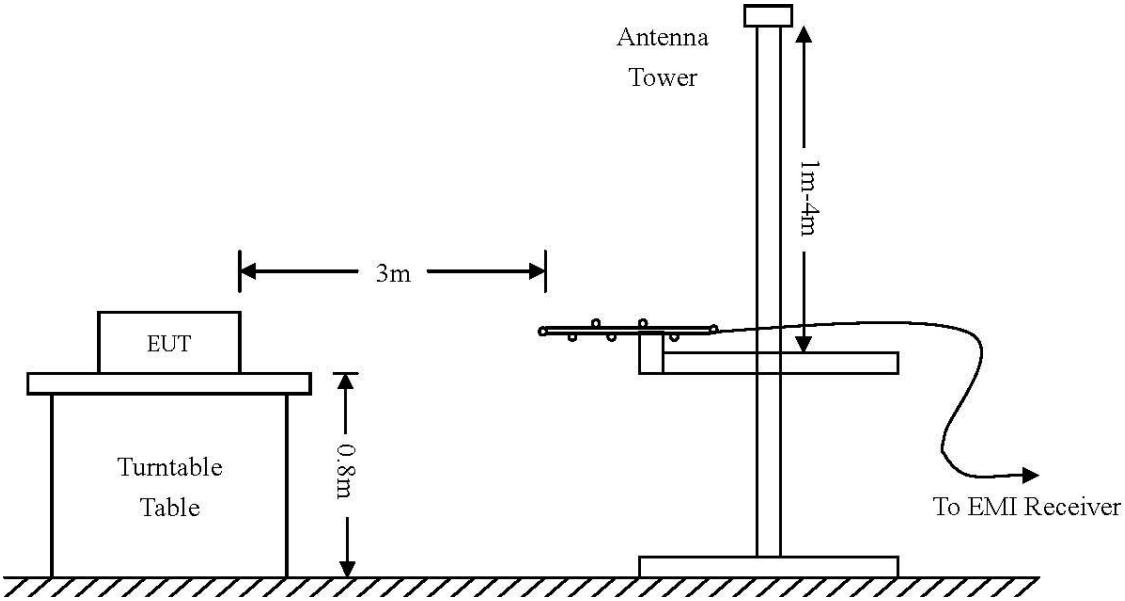


Diagram 1 Test arrangement for radiated emissions tested on Open Area Test Site (OATS)

Radio Frequency Power Output

Measurements Required

Measurements shall be made to establish the radio frequency power delivered by the transmitter into the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun except as noted below:

If the power output is adjustable, measurements shall be made for the highest and lowest power levels. Note design output power is not adjustable but defined by selection of cavity Magnetron .

Test Arrangement Radio Frequency Power Output

The design's peak output power is a function controlled strictly by the cavity magnetron. The peak output power of the design is either 4kW, 6kW, or 12kW depending on manufacturer installed Magnetron. The radio frequency power output was measured at the open area test site with the transmitter operating in a normal mode through all available transmission states. The EUT was separated from the receiving system by a distance of three meters during measurements. The spectrum analyzer had an impedance of 50Ω to match the impedance of the receiving antenna. A Rohde and Schwarz ESU40 and/or HP 8562A Spectrum Analyzer and appropriate mixers were used to measure the radio frequency power at a three-meter distance. During testing data was taken in dBµV/m.

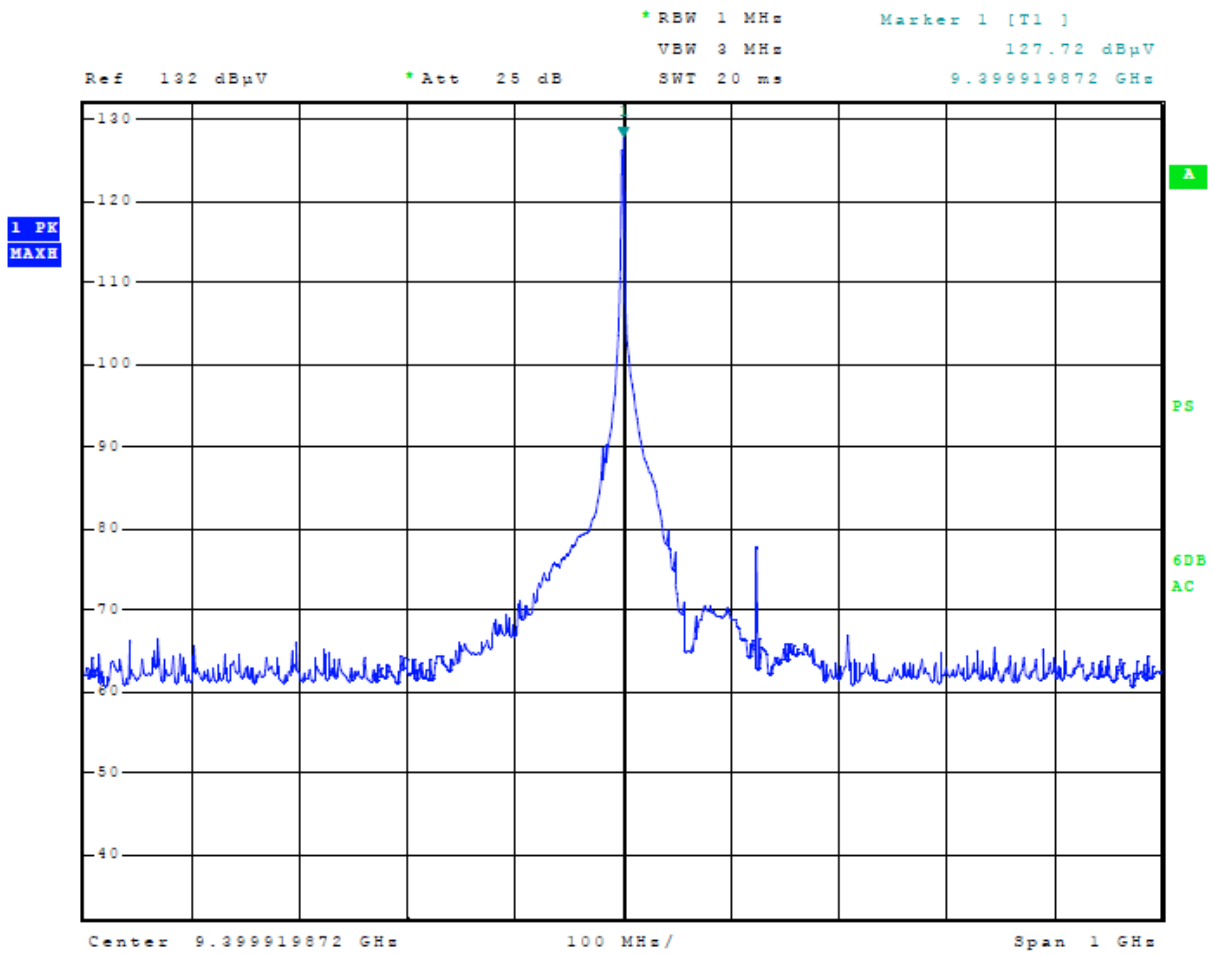


Figure 1 Maximum Power Output

Table 1 Radio Frequency Power Output Results

Transmitter Range Setting	Peak Measured emission dBµV/m @ 3 m	Average Measured emission dBµV/m @ 3 m
3 NM	189.5	132.2
1/8 NM	192.8	135.6

The average power output was also calculated using the pulse width and pulse repetition frequency, which define the duty cycle.

P(ave) = Peak Power (W) x Pulse width (s) (PW) x Pulse repetition (Hz) (PRF)
P(ave) = Po multiplied by duty factor, Duty factor = Pulse width (PW) x Pulse repetition (PRF)
Example: P(ave) = 12,000 watts x 800nS (PW) x 1152 (PRF)
P(ave) = 11.06 watts

Table 2 Calculated average power Radio

Range [nm]	Pulse Width (ns)	Pulse Repetition Frequency (Hz)	Calculated Average Power (Watts)
0.125 NM	70	4608	3.87
0.25 NM	70	4608	3.87
0.5 NM	80	4608	4.42
0.75 NM	90	4608	4.98
1.0 NM	150	4608	8.29
1.5 NM	200	3456	8.29
2.0 NM	250	2304	6.91
3.0 NM	350	2304	9.68
4.0 NM	400	1152	5.53
6.0 NM	700	1152	9.68
8.0 NM	700	1152	9.68
12 NM	800	1152	11.06
16 NM	1000	576	6.91
24 NM	1000	576	6.91
36 NM	1000	576	6.91
48 NM	1000	576	6.91
64 NM	1000	576	6.91
72 NM	1000	576	6.91

Data was taken per Paragraph 2.1046(a) and applicable parts of Part 80 and RSS-238. The equipment demonstrated compliance with specifications of Paragraph 2.1046(a) and applicable Parts of 80.215 and RSS-238. There were no modifications or deviations to the specifications.

Modulation Characteristics

Measurements Required

A curve or equivalent data, which shows that the equipment will meet the modulation requirements of the rules, under which the equipment is to be licensed, shall be submitted.

Modulation Characteristics Test Arrangement

The EUT transmits no message and uses no modulation. Therefore, no curves are supplied.

Modulation Characteristics Results

The EUT transmits no message and uses no modulation. Therefore, no curves are supplied. The equipment demonstrated compliance with specifications of Paragraph 2.1046(a) and applicable Parts of 80.215 and RSS-238.

Occupied Bandwidth

Measurements Required

The occupied bandwidth, that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are each equal to (23 dB and 40-db down) of the total peak power radiated by a given emission.

Table 3 Occupied Bandwidth Results

f_c (MHz)	Observed 40 dB Bandwidth (MHz)	Observed 23dB Bandwidth (MHz)
9400	126.923	37.821

A spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in a normal mode. The power ratio in dB representing the 23-dB and 40-dB bandwidth was recorded from the spectrum analyzer. Data for the occupied bandwidth was observed at the RLI OATS using appropriate antennas. Refer to figures three and four showing the analyzer display screen with the analyzer connected to the receiving antenna. The equipment demonstrated compliance with specifications of Paragraph 2.1046(a) and applicable Parts of 80.215 and RSS-238.

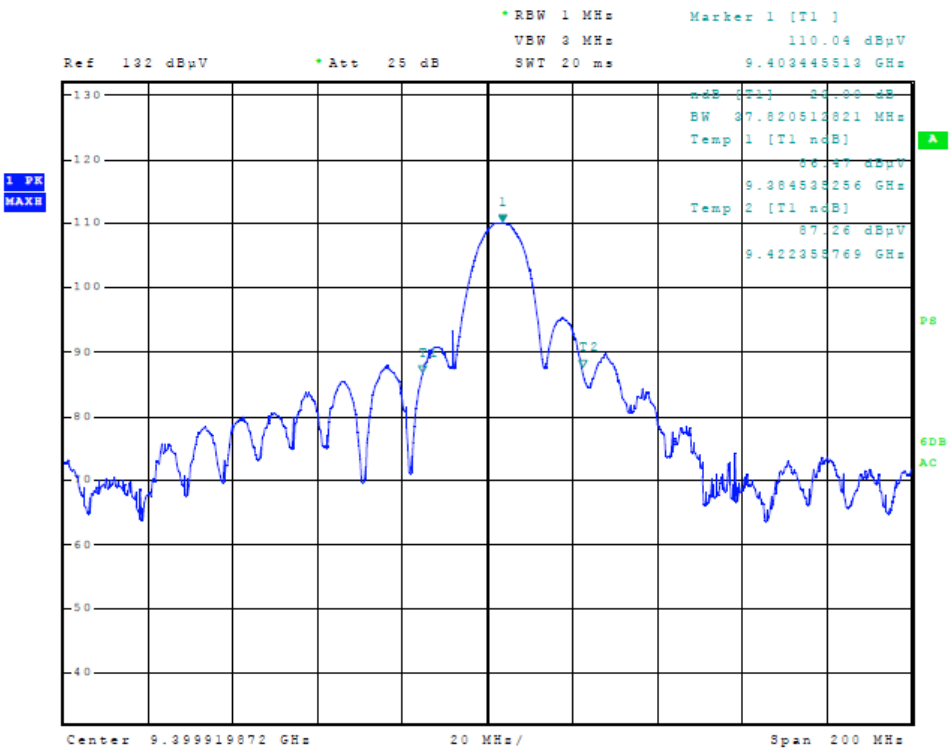


Figure 2 Plot of analyzer screen showing 23-dB occupied bandwidth (1/2 nm)

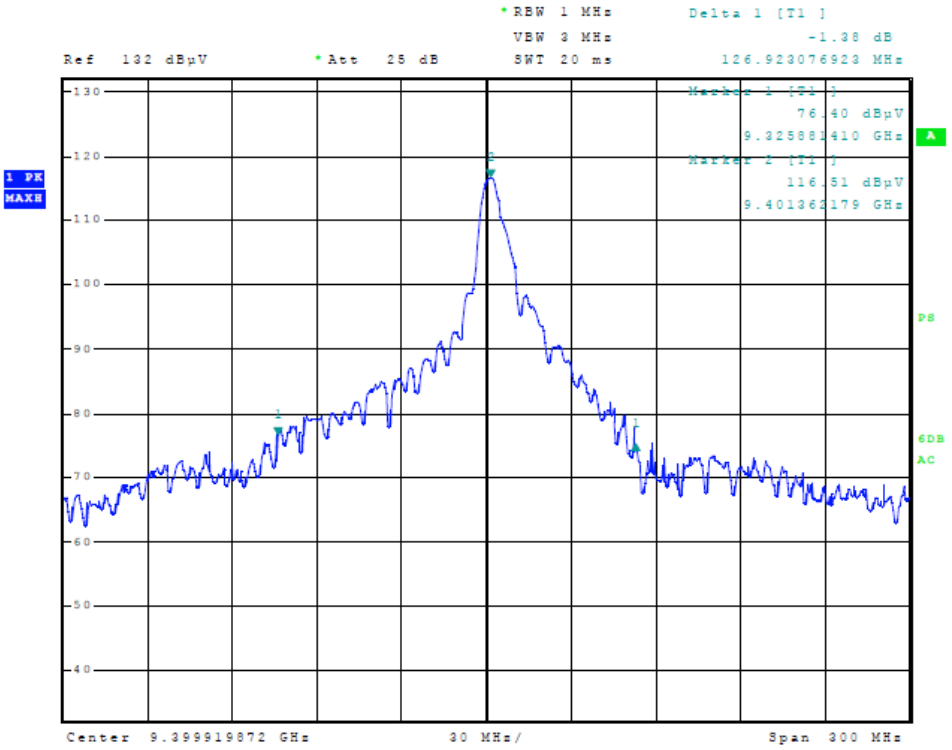


Figure 3 Plot of analyzer screen showing 40-dB occupied bandwidth (1/2 nm)

Spurious Emissions at Antenna Terminals

Measurements Required

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna.

Spurious Emission at Antenna Test Arrangement

Spurious Emission at Antenna Results

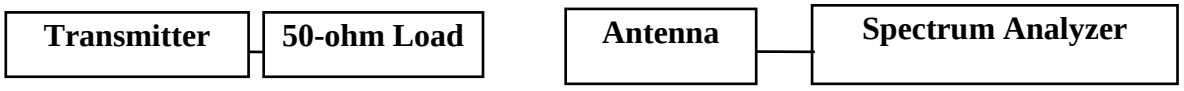
The EUT has no provision to connect directly to the output of the transmitter. Therefore, compliance to the specifications is shown in this and other data presented with this report. The equipment demonstrated compliance with specifications of Paragraph 2.1046(a) and applicable Parts of 80.215 and RSS-238.

Field Strength of Spurious Radiation

Measurements Required

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

Field Strength of Spurious Radiation Test Arrangement



The transmitter was placed on a platform at a distance of 3 meters from the FSM antenna. With the EUT radiating into a 50-ohm load attached to the antenna port, the receiving antenna was raised and lowered to obtain the maximum reading of spurious radiation from the EUT on the spectrum analyzer. The platform was rotated though 360 degrees to locate the position registering the highest amplitude of

emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter and support circuitry. The transmitter was also placed on a platform at a distance of 10 meters from the FSM antenna for power and spurious emissions testing. The amplitude of each spurious emission was maximized by raising and lowering the FSM antenna, and rotating the EUT before final data was recorded. Data presented below demonstrates the general and harmonic spur emissions from the EUT and support equipment taken at 3 meters. Plots were made of the spectrum analyzer display showing emission levels recorded at a one-meter distance in a screen room. Refer to figures five through sixteen showing general radiated emission levels taken in the screen room.

Field Strength of Spurious Results

The EUT was connected to the standard antenna(s) and set to transmit in a normal test mode of operation (with antenna rotation disabled during test). The amplitude of each spurious emission was then maximized and recorded. Measurements were made at a distance of ten meters at the RLI OATS. All other measured spurious emissions where 20-dB or more below the specified limit. The equipment demonstrated compliance with specifications of Paragraph 2.1046(a) and applicable Parts of 80.215 and RSS-238. There are no deviations to the specifications.

RSS-238 requires out of band emissions be at least 60 dB below fundamental emission. Using measured fundamental emissions power of 189.5 dBµV/m at 3-meters, the limit would be 129.5 dBµV/m.

Calculations made are as follows:
CFS = Calculated Field Strength
FSM = Field Strength Measurement
CFS = FSM + Antenna Factor – amplifier gain
Example:
CFS = 50.6 +8.9 - 30
CFS = 29.5

Table 4 General Radiated Emissions

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	General Emissions Limit CFR47 15.109 @ 3m (dBµV/m)
137.3	43.8	39.1	N/A	49.1	42.2	N/A	43.5
140.5	43.8	39.3	N/A	47.9	40.5	N/A	43.5
141.2	42.3	38.7	N/A	49.1	37.8	N/A	43.5
142.8	43.2	38.7	N/A	49.5	41.4	N/A	43.5
144.4	43.4	38.4	N/A	47.9	42.8	N/A	43.5
145.3	41.8	37.3	N/A	44.5	41.8	N/A	43.5
146.3	43.0	39.2	N/A	48.2	41.0	N/A	43.5
151.5	39.3	35.0	N/A	45.1	37.8	N/A	43.5
200.0	38.3	36.7	N/A	44.4	40.3	N/A	43.5
200.5	35.9	32.6	N/A	42.9	39.6	N/A	43.5
250.0	39.7	35.2	N/A	44.6	37.7	N/A	46.0
298.8	37.5	32.7	N/A	37.9	33.7	N/A	46.0
333.0	48.1	40.5	N/A	49.2	41.1	N/A	46.0
348.0	50.4	41.3	N/A	47.8	38.9	N/A	46.0
362.4	53.6	43.7	N/A	52.9	44.4	N/A	46.0
374.6	48.8	43.8	N/A	50.7	42.9	N/A	46.0
400.9	46.0	43.1	N/A	43.0	40.7	N/A	46.0
402.1	46.2	43.9	N/A	42.7	40.3	N/A	46.0
416.1	44.2	42.3	N/A	42.8	39.7	N/A	46.0
422.7	46.7	44.6	N/A	45.5	43.0	N/A	46.0
437.5	45.1	42.5	N/A	45.0	42.5	N/A	46.0
452.0	45.1	42.9	N/A	46.6	44.3	N/A	46.0
453.0	46.6	44.7	N/A	46.9	44.7	N/A	46.0
460.6	47.4	45.0	N/A	46.5	44.3	N/A	46.0
468.0	46.5	44.3	N/A	40.5	37.9	N/A	46.0
475.0	46.0	43.9	N/A	48.0	45.8	N/A	46.0
490.4	43.5	41.1	N/A	38.1	35.7	N/A	46.0
518.1	43.8	41.5	N/A	39.5	37.7	N/A	46.0
541.2	48.3	44.4	N/A	42.4	40.6	N/A	46.0
1116.8	52.1	40.0	N/A	52.2	40.2	N/A	54.0
1190.0	50.1	38.7	N/A	47.7	35.9	N/A	54.0
1726.7	50.5	40.5	N/A	51.9	40.3	N/A	54.0
1842.6	54.0	41.0	N/A	51.1	40.0	N/A	54.0

Other emissions present had amplitudes at least 20 dB below the limit.
Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz.
Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Table 5 Harmonic Radiated Emissions

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	General Average Emissions Limit @ 3m (dBµV/m)
18800.0	89.3	N/A	79.9	88.4	N/A	69.7	129.5
28200.0	61.0	N/A	47.7	60.6	N/A	47.7	129.5
37600.0	68.0	N/A	55.8	69.1	N/A	55.8	129.5

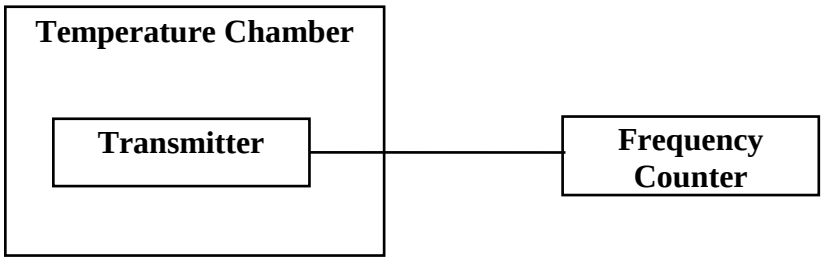
Other emissions present had amplitudes at least 20 dB below the limit.
Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz.
Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Frequency Stability

Measurements Required

The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.

Test Arrangement



The measurement procedure outlined below shall be followed.

Step 1: The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.

Step 2: With the transmitter inoperative (power switched "OFF"), the temperature of the test chamber shall be adjusted to +25°C. After a temperature stabilization period of one hour at +25°C, the transmitter shall be switched "ON" with standard test voltage applied.

Step 3: The carrier shall be keyed "ON", and the transmitter shall be operated at full radio frequency power output at the duty cycle, for which it is rated, for duration of at least 5 minutes. The radio frequency carrier frequency shall be monitored and measurements shall be recorded.

Step 4: The test procedures outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified, -30°C to +50°C in 10-degree increments.

The frequency was measured and the variation in parts per million calculated. Data was taken per CFR47 Paragraphs 2.1055 and applicable paragraphs of part 80 and RSS-238.

Table 6 Frequency Stability vs. Temperature Results

Frequency 9413.3000 (MHz)	Frequency Stability Vs. Temperature Ambient Frequency (9413.3000)								
Temperature °C	-30	-20	-10	0	+10	+20	+30	+40	+50
PPM	-482	-467	-318	-293	-172	0	148	307	476
%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Limit (PPM)	1250	1250	1250	1250	1250	1250	1250	1250	1250

Frequency Stability Results

The temperature stability of the unit is determined by the Magnetron. There are no deviations or exceptions to the specifications. The equipment demonstrated compliance with specifications of Paragraph 2.1046(a) and applicable Parts of 80.215 and RSS-238. There are no deviations to the specifications.

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Test Equipment List
- Annex C Rogers Qualifications
- Annex D FCC Site Registration Letter
- Annex E Industry Canada Site Registration Letter

Annex A Measurement Uncertainty Calculations

Measurement uncertainty calculations were made for the laboratory. Result of measurement uncertainty calculations are recorded below for AC line conducted and radiated emission measurements.

Measurement Uncertainty	$U_{(E)}$	$U_{(lab)}$
3 Meter Horizontal 30-200 MHz Measurements	2.08	4.16
3 Meter Vertical 30-200 MHz Measurements	2.16	4.33
3 Meter Vertical Measurements 200-1000 MHz	2.99	5.97
10 Meter Horizontal Measurements 30-200 MHz	2.07	4.15
10 Meter Vertical Measurements 30-200 MHz	2.06	4.13
10 Meter Horizontal Measurements 200-1000 MHz	2.32	4.64
10 Meter Vertical Measurements 200-1000 MHz	2.33	4.66
3 Meter Measurements 1-6 GHz	2.57	5.14
3 Meter Measurements 6-18 GHz	2.58	5.16
AC Line Conducted	1.72	3.43

Annex B Rogers Labs Test Equipment List

List of Test Equipment	Calibration Date
Spectrum Analyzer: Rohde & Schwarz ESU40	5/14
Spectrum Analyzer: HP 8562A, HP Adapters: 11518, 11519, and 11520 Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	5/14
Spectrum Analyzer: HP 8591EM	5/14
Antenna: EMCO Biconilog Model: 3143	5/14
Antenna: Sunol Biconilog Model: JB6	10/13
Antenna: EMCO Log Periodic Model: 3147	10/13
Antenna: Com Power Model: AH-118	10/13
Antenna: Com Power Model: AH-840	10/13
Antenna: Antenna Research Biconical Model: BCD 235	10/13
Antenna: EMCO 6509	10/13
LISN: Compliance Design Model: FCC-LISN-2.Mod.cd, 50 µHy/50 ohm/0.1 µf	10/13
R.F. Preamp CPPA-102	10/13
Attenuator: HP Model: HP11509A	10/13
Attenuator: Mini Circuits Model: CAT-3	10/13
Attenuator: Mini Circuits Model: CAT-3	10/13
Cable: Belden RG-58 (L1)	10/13
Cable: Belden RG-58 (L2)	10/13
Cable: Belden 8268 (L3)	10/13
Cable: Time Microwave: 4M-750HF290-750	10/13
Cable: Time Microwave: 10M-750HF290-750	10/13
Frequency Counter: Leader LDC825	2/14
Oscilloscope Scope: Tektronix 2230	2/14
Wattmeter: Bird 43 with Load Bird 8085	2/14
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/14
R.F. Generators: HP 606A, HP 8614A, HP 8640B	2/14
R.F. Power Amp 65W Model: 470-A-1010	2/14
R.F. Power Amp 50W M185- 10-501	2/14
R.F. Power Amp A.R. Model: 10W 1010M7	2/14
R.F. Power Amp EIN Model: A301	2/14
LISN: Compliance Eng. Model 240/20	2/14
LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08	2/14
Antenna: EMCO Dipole Set 3121C	2/14
Antenna: C.D. B-101	2/14
Antenna: Solar 9229-1 & 9230-1	2/14
Audio Oscillator: H.P. 201CD	2/14
ELGAR Model: 1751	2/14
ELGAR Model: TG 704A-3D	2/14
ESD Test Set 2010i	2/14
Fast Transient Burst Generator Model: EFT/B-101	2/14
Field Intensity Meter: EFM-018	2/14
KEYTEK Ecat Surge Generator	2/14
Shielded Room 5 M x 3 M x 3.0 M	

Annex C Rogers Qualifications

Scot D. Rogers, Engineer

Rogers Labs, Inc.

Mr. Rogers has approximately 17 years experience in the field of electronics. Engineering experience includes six years in the automated controls industry and remaining years working with the design, development and testing of radio communications and electronic equipment.

Positions Held:

Systems Engineer:	A/C Controls Mfg. Co., Inc.	6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc.	5 Years
Electrical Engineer:	Rogers Labs, Inc.	Current

Educational Background:

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University

2) Bachelor of Science Degree in Business Administration Kansas State University

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

NVLAP Lab Code 200087-0

Annex D FCC Test Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

June 28, 2013

Registration Number: 90910

Rogers Labs, Inc.
4405 West 259th Terrace,
Louisburg, KS 66053

Attention: Scot Rogers,

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: June 28, 2013

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst

NVLAP Lab Code 200087-0

Annex E Industry Canada Test Site Registration Letter

Industry Canada Industrie Canada

June 19, 2013

OUR FILE: 46405-3041
Submission No: 168037

Rogers Labs Inc.
4405 West 259th Terrace
Louisburg
KS, USA
66053

Attention: Mr. Scot D. Rogers

Dear Sir:

The Bureau has received your application for the renewal of 3/10m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought **(Site# 3041A-1).** Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please keep for your records the following information;

- The company address code associated to the site(s) located at the above address is: **3041A**

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 or later shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 metre OATS or 3 metre chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to **exceed three years**. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL;
http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/h_tt00052e.html.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca Please reference our file and submission number above for all correspondence.

Yours sincerely,

Bill Payn
For: Wireless Laboratory Manager
Certification and Engineering Bureau
3701 Carling Ave., Building 94
P.O. Box 11490, Station "H"
Ottawa, Ontario K2H 8S2
Email: Bill.Payn@ic.gc.ca
Tel. No. (613) 990-3639
Fax. No. (613) 990-4752