NVLAP Lab Code 200087-0

Test Report

FCC CFR47 Part 87

GMN-00946
Market Label: GRA 5500
4250-4350 MHz
Aviation Radar Altimeter
FCC ID: IPH-0181200

For

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

Test Report Number 121030

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

GMN-00946
Market Label: GRA 5500
Aviation Radar Altimeter
Frequency Range: 4250-4350 MHz

FCC ID: IPH-0181200

Test Date: October 30, 2012

Certifying Engineer: Scot D Rogers

Scot D. Rogers
Rogers Labs, Inc.
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Revisions

Revision 1, Issued January 22, 2013

Forward

In accordance with the Federal Communications, Code of Federal Regulations dated October 1, 2011, Part 2 Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.915, 2.925, 2.926, 2.1031 through 2.1057, and Part 87, Subchapter D, Paragraphs 87.131 through 87.147 the following information is submitted for consideration in obtaining grant of certification.

Opinion / Interpretation of Results

Tests Performed	Results
Requirements per CFR47 paragraphs 2 2.1031-2.1057	Complies
Requirements per CFR47 paragraphs 87.131	Complies
Requirements per CFR47 paragraphs 87.133 (d)	Complies
Requirements per CFR47 paragraphs 87.135	Complies
Requirements per CFR47 paragraphs 87.139	Complies
Requirements per CFR47 paragraphs 87.141	Complies

Environmental Conditions

Ambient Temperature	19.4° C
Relative Humidity	33%
Atmospheric Pressure	1017.9 mb

System Description

The GRA 5500 is a Garmin radar altimeter designed to calculate and provide Above Ground Level (AGL) altitude information for both forward-fit and aftermarket stand-alone radar altimeter applications. The design provides operation from -20 to 2500 ft. AGL; accuracy of +/- 1.5 ft. (0 – 100 ft.), +/- 2 % (100 – 2500 ft.); full-featured built in self-test (BIST/BITE) functionality and fault logging; advanced on-ground automated installation calibration; two configurable ARINC 429 data outputs, two proprietary Garmin LSDB RS-422 data interfaces, and a standard USB full-speed interface for unit configuration and code uploads.

Application for Certification

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

(2) Identification: FCC I.D.: IPH-0181200

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

(4) Emission Type: Emissions designator 100MFXN

(5) Frequency Range: 4250-4350 MHz

(6) Operating Power Level: 1 Watt peak

(7) Maximum Power: Maximum power output as determined by appropriate standards during certification per CFR 47 paragraph 87.131.

(8) Power into final amplifying circuitry: Final amplifier circuitry utilizes a single power amplifier biased at +8.0 Volts and peak current of 0.9 Amps (7.2 Watts).

(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: The GRA 5500 utilizes Direct Digital Synthesis (DDS) techniques to digitally generate a direct-IF upsweep and downsweep which is converted to RF using PLLs.

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

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 & Schwarz ESU 40 and/or Hewlett Packard 8591EM was used as the measuring device for emissions testing of frequencies below 1 GHz. A Rohde & Schwarz ESU 40 and/or Hewlett Packard 8562A was used as the measuring device for testing 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.

Emissions at Frequencies below 1000 MHz		
Conducted Emissions		
RBW	AVG. BW	Detector Function
9 kHz	30 kHz	Peak / Quasi Peak
Radiated Emissions		
RBW	AVG. BW	Detector Function
120 kHz	300 kHz	Peak / Quasi Peak
Emissions at Frequencies above 1000 MHz		
RBW	Video BW	Detector Function
1 MHz	1 MHz	Peak / Average

Equipment	Manufacturer	Model	Band	Cal Date	Due
☐ LISN	Comp. Design	FCC-LISN-2-MOD.CD	.15-30MHz	10/12	10/13
☐ Antenna	ARA	BCD-235-B	20-350MHz	10/12	10/13
☐ Antenna	EMCO	3147	200-1000MHz	10/12	10/13
☒ Antenna	Com Power	AH-118	1-18 GHz	10/11	10/13
☒ Antenna	Com Power	AH-840	18-40 GHz	10/12	10/13
☒ Antenna	Standard	FXRY638A	10-18 GHz	3/12	5/13
☒ Antenna	EMCO	6509	.001-30 MHz	2/12	2/13
☐ Antenna	EMCO	3143	20-1200 MHz	5/12	5/13
☒ Antenna	Sunol	JB-6	30-1000 MHz	5/12	5/13
☐ Analyzer	HP	8591EM	9kHz-1.8GHz	5/12	5/13
☐ Analyzer	HP	8562A	9kHz-110GHz	5/12	5/13
☒ Analyzer	Rohde & Schwarz	ESU40	20Hz-40GHz	5/12	5/13
☒ Amplifier	Com-Power	PA-010	100Hz-30MHz	10/12	10/13
☒ Amplifier	Com-Power	CPPA-102	1-1000 MHz	10/12	10/13
☒ Amplifier	Com-Power	PA-122	0.5-22 GHz	10/12	10/13

Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2011, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057 the following is submitted for consideration in obtaining Grant of Certification. 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

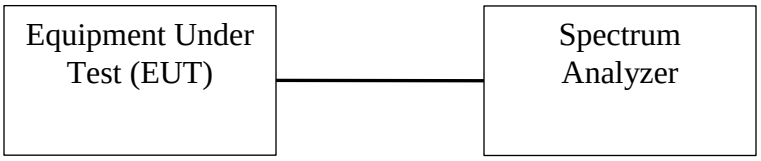
AC Line Conducted Emission Test Procedure

No testing for the AC line-conducted emissions was performed. The EUT operates solely from direct current power supplied from the aircraft and offers no provision for connection to utility power systems.

Antenna Port Conducted Spurious Emission Test Procedure

Testing of the antenna port spurious emissions were performed as directed in TIA/EIA-603.

Diagram 1 Test arrangement for Conducted Spurious Emissions



1. Connect the spectrum analyzer, using the CISPR quasi-peak detector, (through a resistive matching network if required to match the receiver input impedance Rn to the spectrum analyzer) to the antenna terminals.

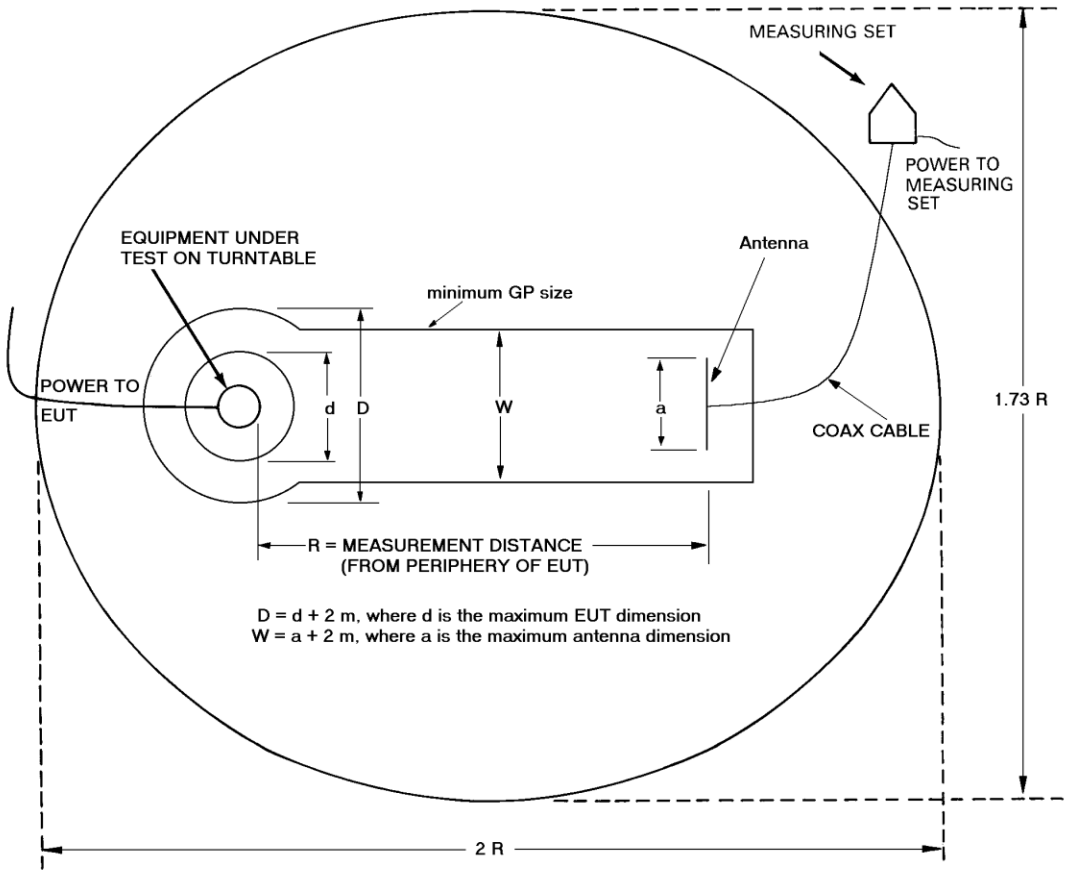
2. Tune the spectrum analyzer to search for spurious outputs from the lowest oscillator or intermediate frequency (whichever is lower) to 1000 MHz or twice the highest fundamental frequency generated in the device (whichever is higher). Record all spurious outputs found.

3. The conducted spurious emission is the largest reading obtained in step 2 above (corrected for any matching network loss, if used).

Radiated Emission Test Procedure

The EUT was placed on a rotating 1 x 1.5-meter table. 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 50,000 MHz was searched for during preliminary investigation. Refer to diagram two showing typical test arrangement and photographs in the test setup exhibits for specific EUT placement during testing.

Diagram 2 Test arrangement for radiated emissions tested on Open Area Test Site (OATS)



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

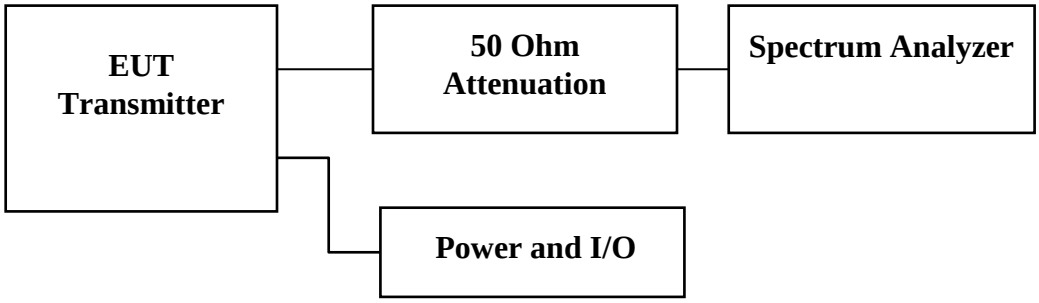
Radio Frequency Power Output

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 designs output power is not adjustable.

Test Arrangement Radio Frequency Power Output



The radio frequency power output was measured at the antenna terminal by placing appropriate attenuation in the antenna line and observing the emission with the spectrum analyzer. The spectrum analyzer had an impedance of 50Ω to match the impedance of the standard antenna. A Rohde Schwarz ESU-40 and/or HP 8562A Spectrum Analyzer was used to measure the radio frequency power at the antenna port. The data was taken in dBm and converted to watts as shown in the following Table. Refer to Figure 1 showing the maximum output power of the transmitter. Data was taken per CFR47 Paragraph 2.1046(a) and applicable paragraphs of Part 87.

P(dBm)	= power in dB above 1 milliwatt.
Milliwatts	= $10^{(PdBm/10)}$
Watts	= (Milliwatts) (0.001)(W/mW)
Milliwatts	= $10^{(30.5/10)}$
	= 1,132 mW
	= 1.1 Watts Peak power

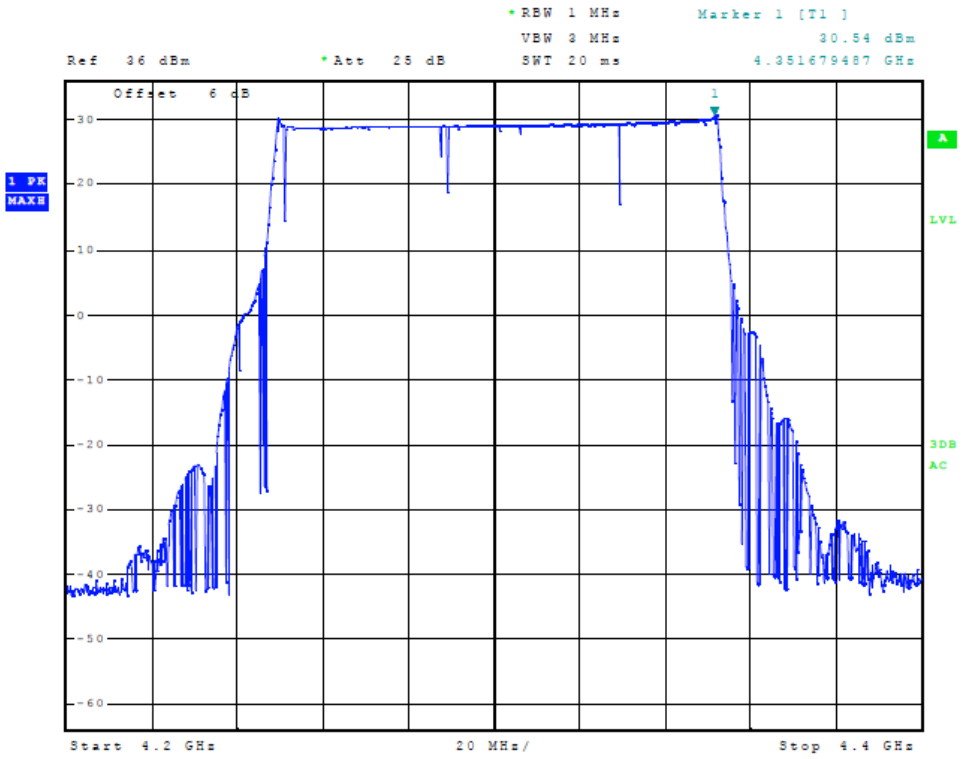


Figure 1 Maximum Power Output

Table 1 Radio Frequency Power Output Results

Frequency (MHz)	P (dBm)	P (mw)	P (Watts)
4300.0	30.54	1,132	1.1

The EUT demonstrated compliance with the specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 87.131. There are no 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.

The EUT transmits no message and utilizes no modulation. Therefore, no modulation curves are available or required.

Modulation Characteristics Results

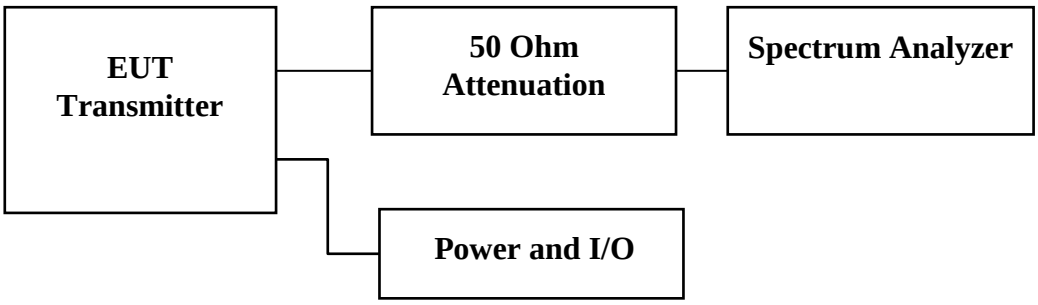
The EUT transmits no message and utilizes no modulation. Therefore, no modulation curves are available or required. The EUT demonstrated compliance with the specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 87.141. There are no deviations to the specifications.

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 0.5 percent of the total mean power radiated by a given emission.

Test Arrangement for Occupied Bandwidth Measurements



A Rohde & Schwarz ESU 40 spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in all normal modes. The EUT was set to transmit in typical mode while measurements were made.

The power ratio in dB representing 99% of the total mean power was recorded from the spectrum analyzer. Refer to figure two showing plot of the 99% power occupied bandwidth.

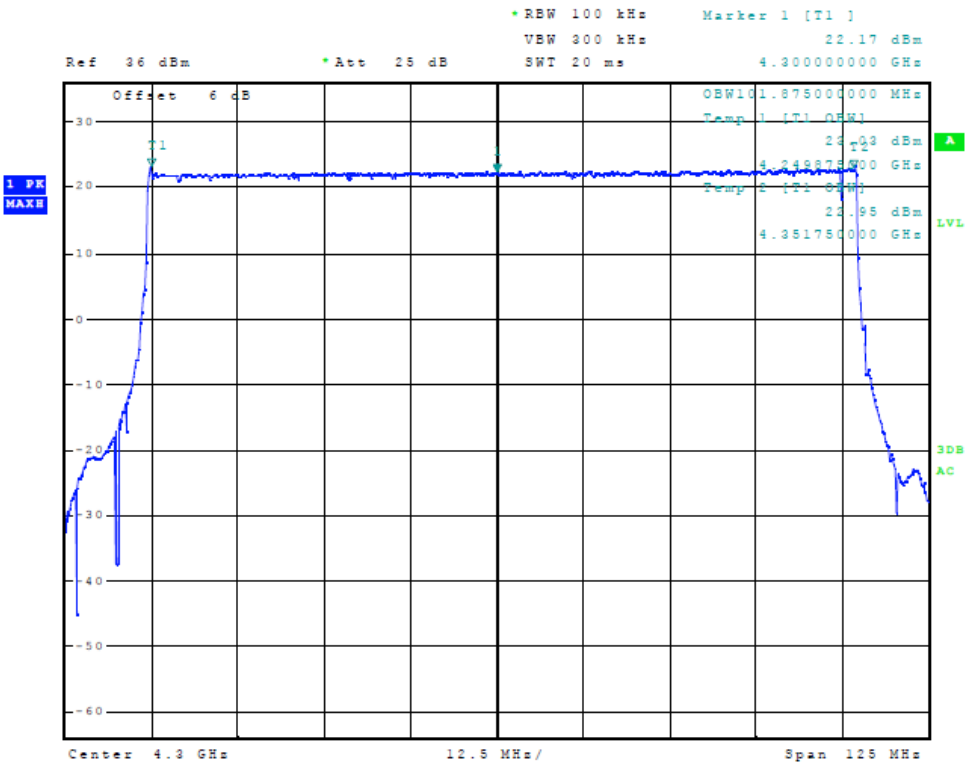


Figure 2 Occupied Band Width

Table 2 Occupied Bandwidth Results

Frequency (MHz)	Occupied bandwidth(MHz)
4300	101.9

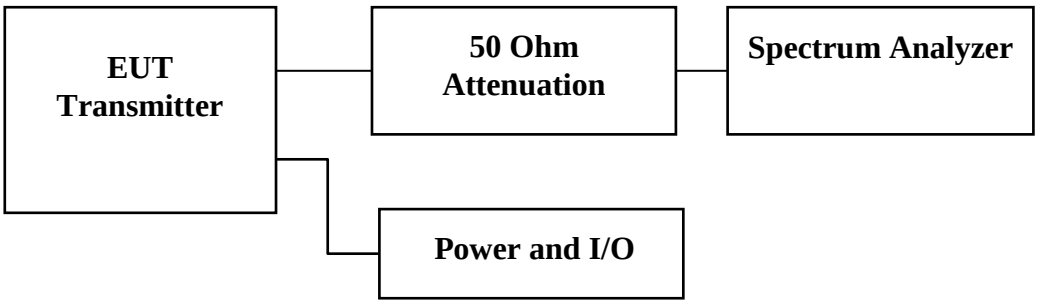
The EUT demonstrated compliance with the specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 87.135. There are no deviations to the specifications.

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.

Test Arrangement Spurious Emissions at Antenna Port



The radio frequency output was coupled to a Rohde & Schwarz ESU 40 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter modulated per section 2.1049 and operated in all normal modes. The frequency spectrum from 30 MHz to 40,000 MHz was observed and plots produced of the frequency spectrum. Figures five through ten represent data for the worst-case antenna spurious emissions of the GMN-00946. Data was taken per CFR47 2.1051, 2.1057, and applicable paragraphs of Part 87.139.

Antenna Port Spurious Emissions Results

The output of the unit was coupled to a Rohde & Schwarz ESU 40 Spectrum Analyzer and the frequency emissions were measured. Data was taken as per CFR47 2.1051 and applicable paragraphs of Part 87. The EUT demonstrated compliance with the specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 87.139. There are no deviations to the specifications.

All spurious emissions must be attenuated at least 43 +10log(P) [P=Average Transmitter power] below the fundamental emission power level. The following equations represent the calculated attenuation levels for the equipment.

Spurious Emissions Limit shall be attenuated at least 49 dB below fundamental carrier

Limit = 43 + 10 Log (P_{ave}) = 43 + 10 Log (1.1)

Limit = 43.5

Table 3 Antenna Port Conducted Data

Channel MHz	Spurious Freq. (MHz)	Measured Level (dBm)	Level Below Carrier (dBc)
4300.0	8600.0	-47.18	-77.7
	12900.0	-48.62	-79.2
	17200.0	-51.21	-81.8
	21500.0	-50.66	-81.2
	25800.0	-49.97	-80.5
	30100.0	-47.82	-78.4
	34400.0	-46.21	-76.8
	38700.0	-45.55	-76.1

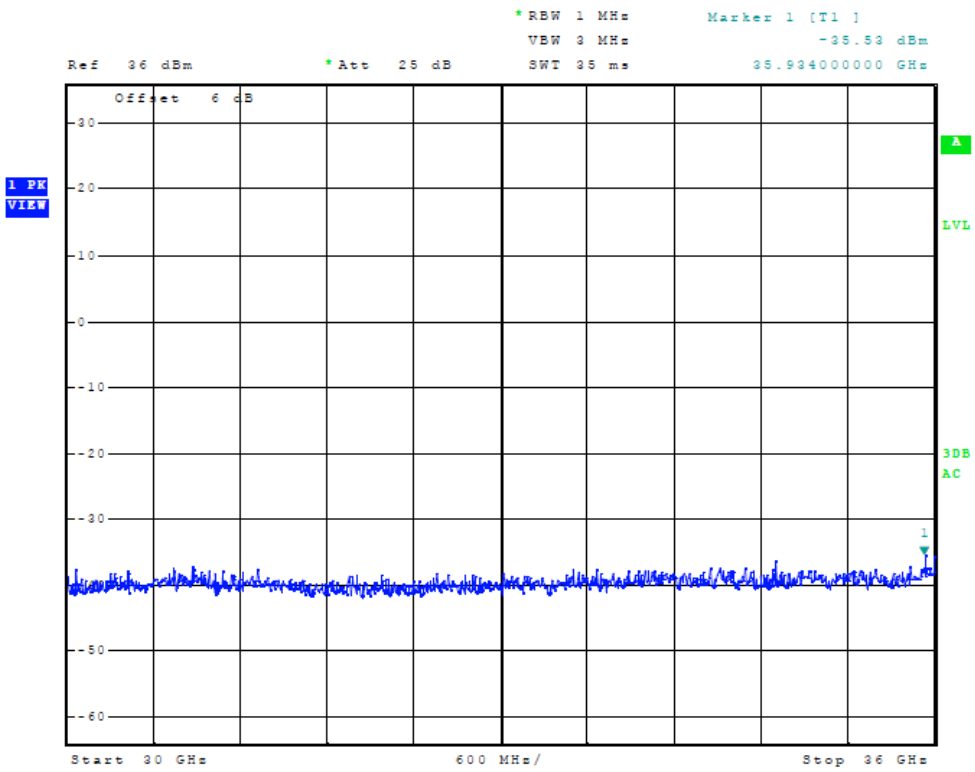


Figure 3 Spurious Emissions at Antenna Terminal

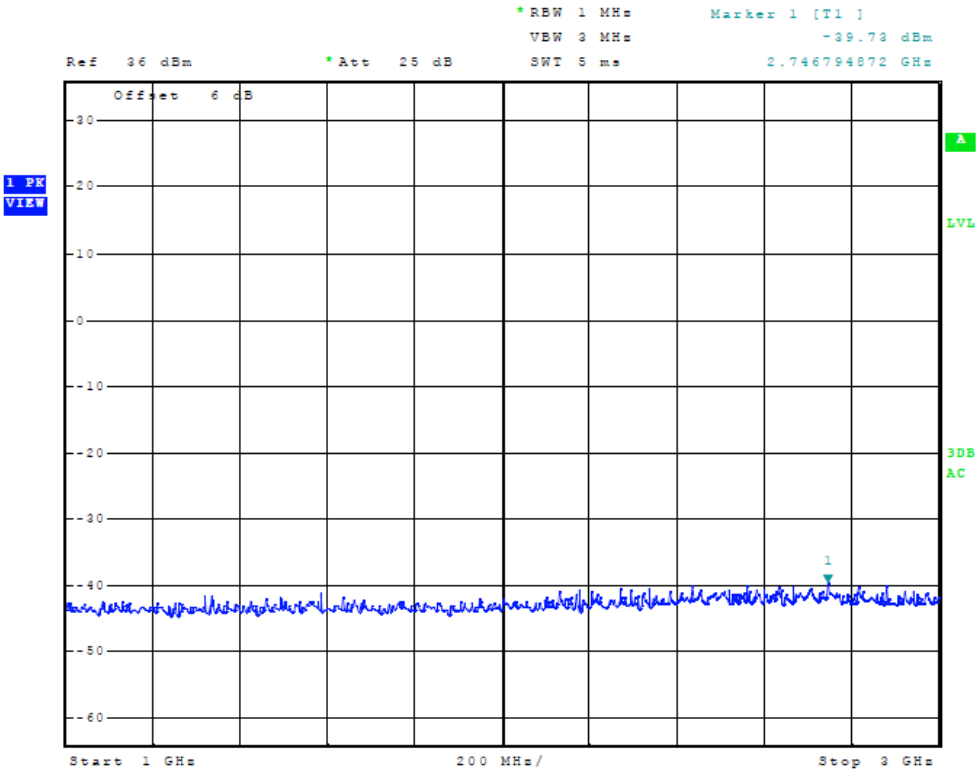


Figure 4 Spurious Emissions at Antenna Terminal

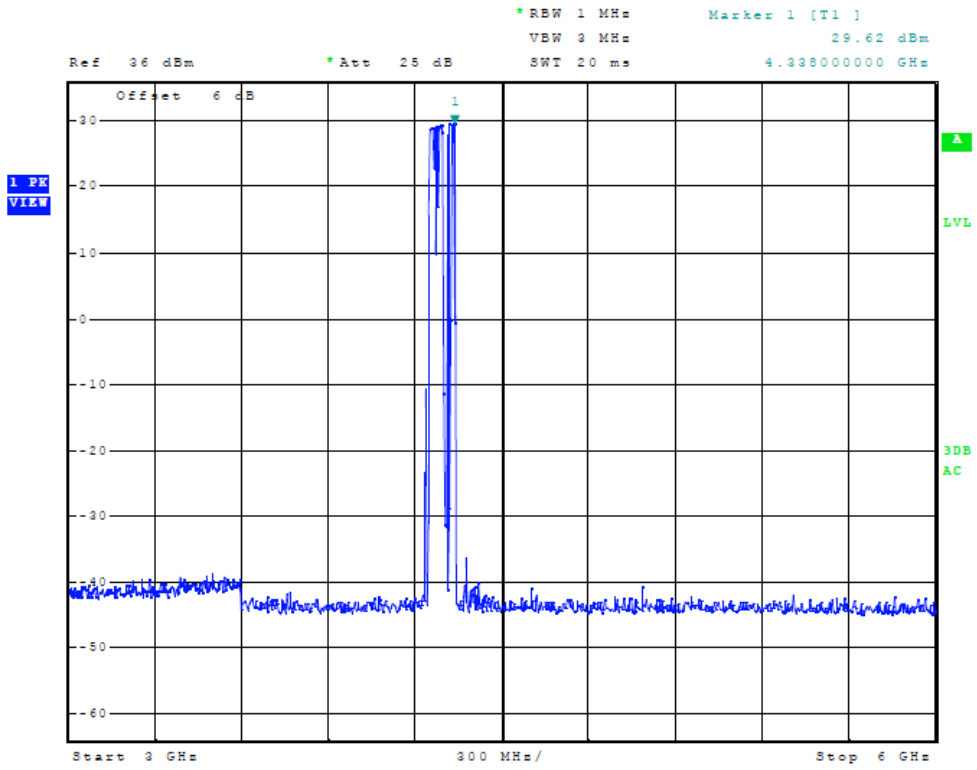


Figure 5 Spurious Emissions at Antenna Terminal

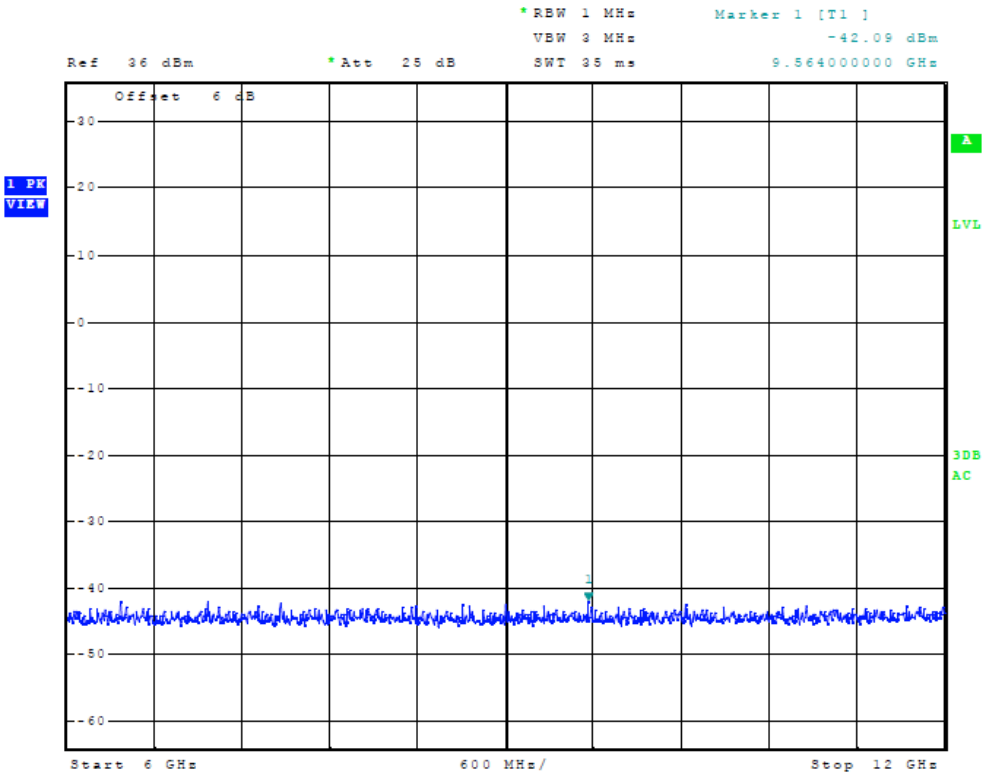


Figure 6 Spurious Emissions at Antenna Terminal

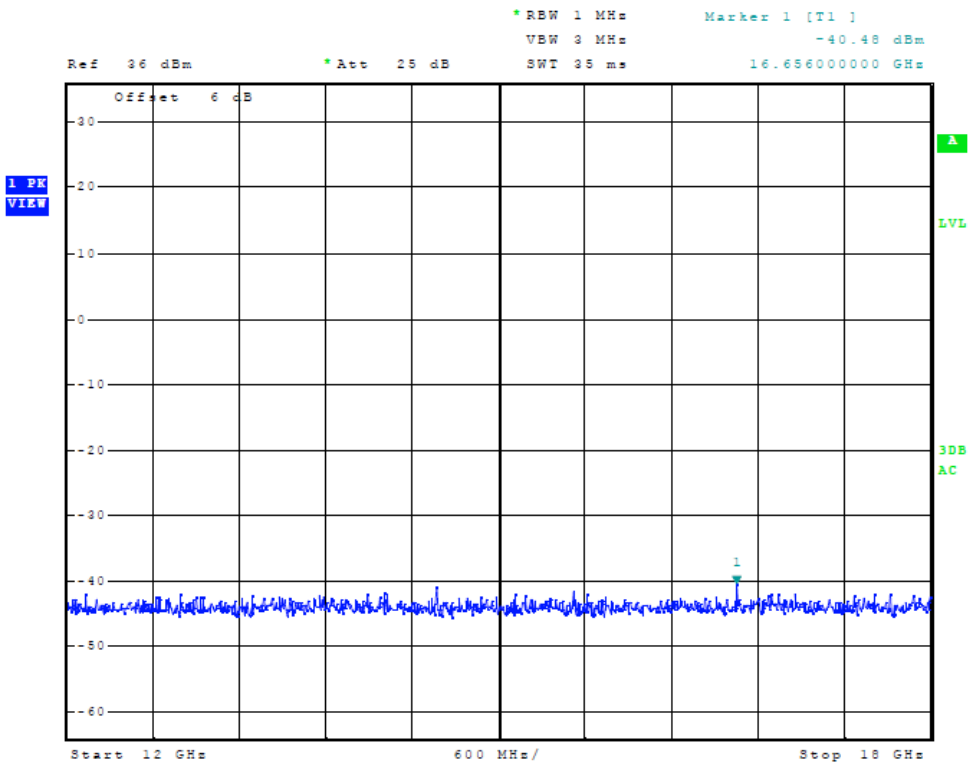


Figure 7 Spurious Emissions at Antenna Terminal

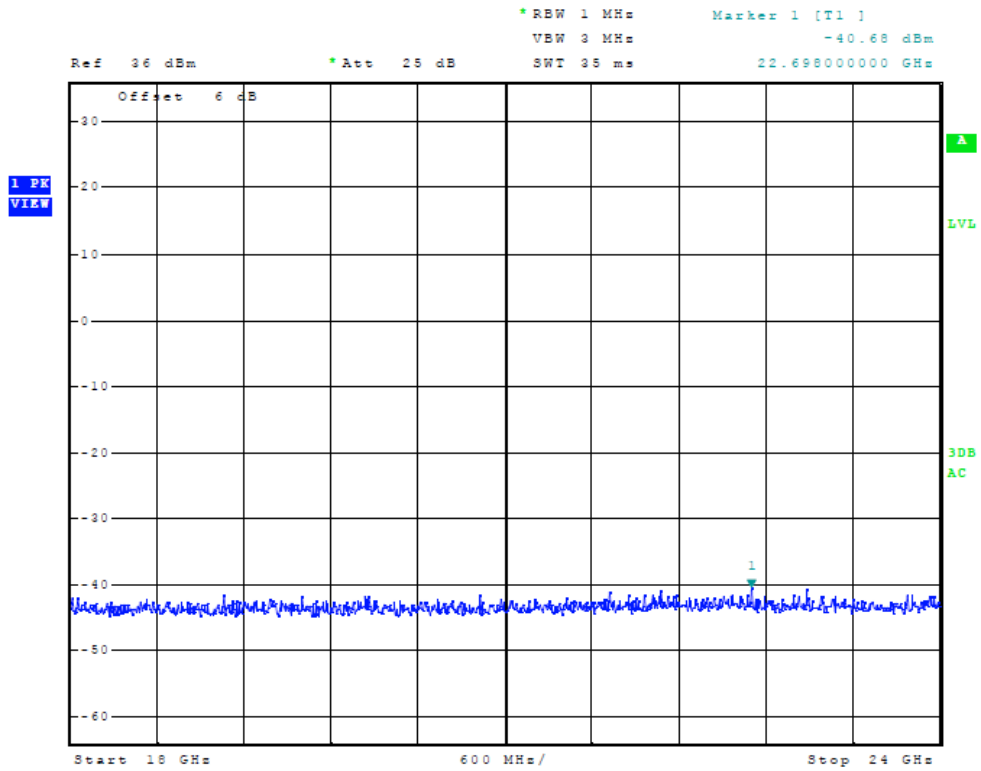


Figure 8 Spurious Emissions at Antenna Terminal

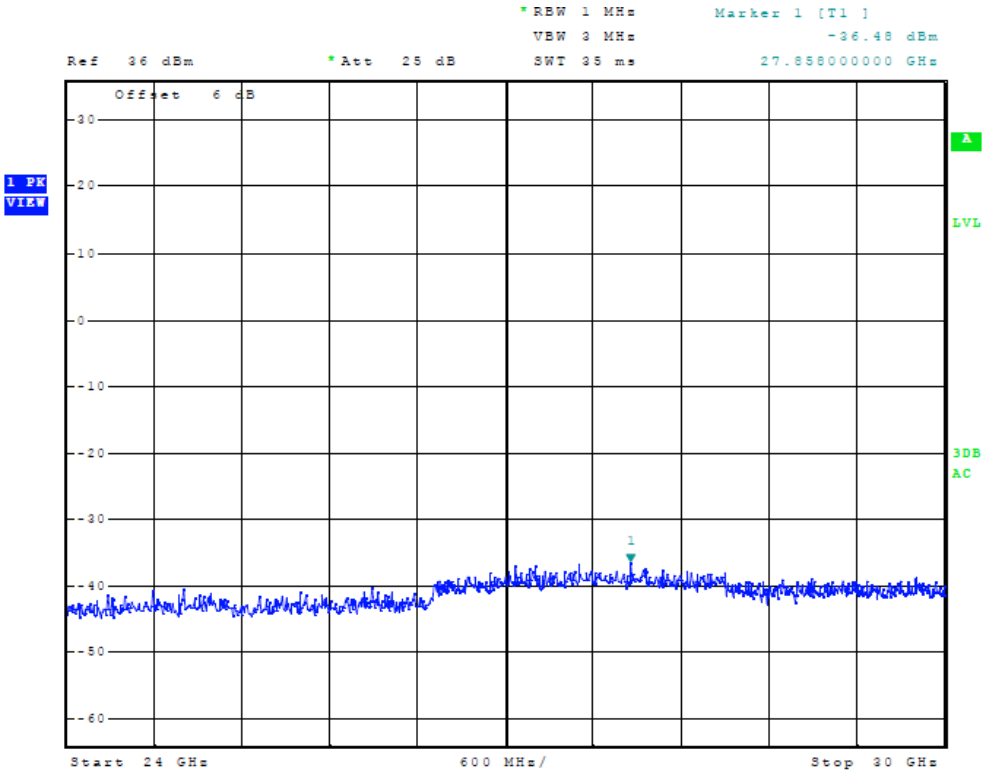


Figure 9 Spurious Emissions at Antenna Terminal

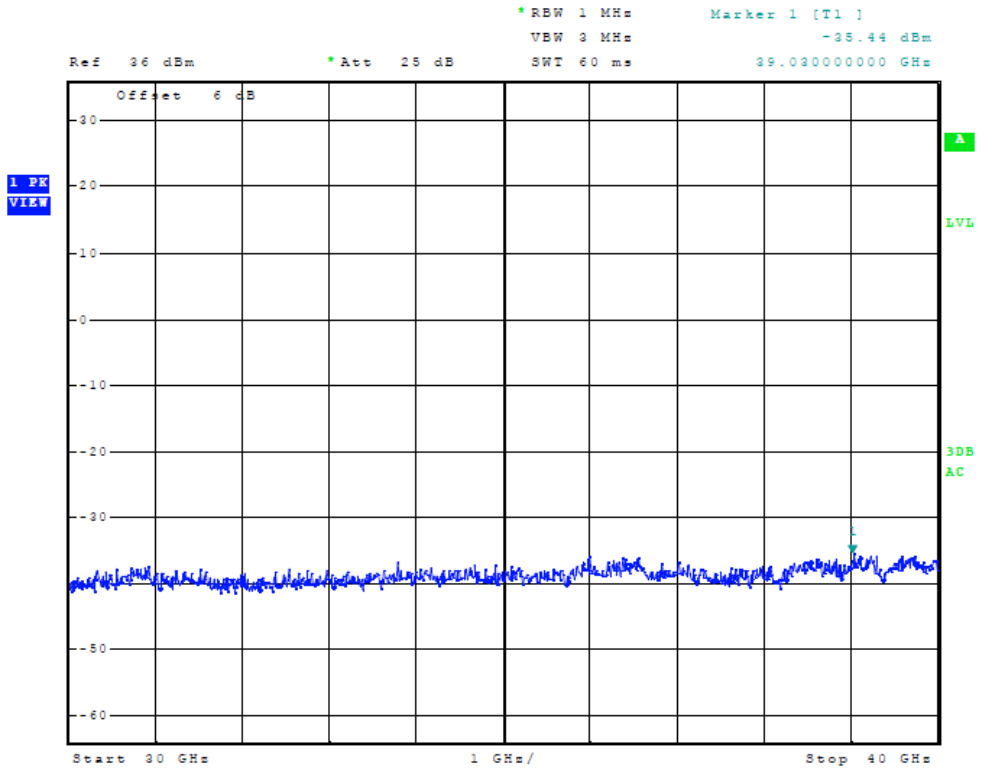


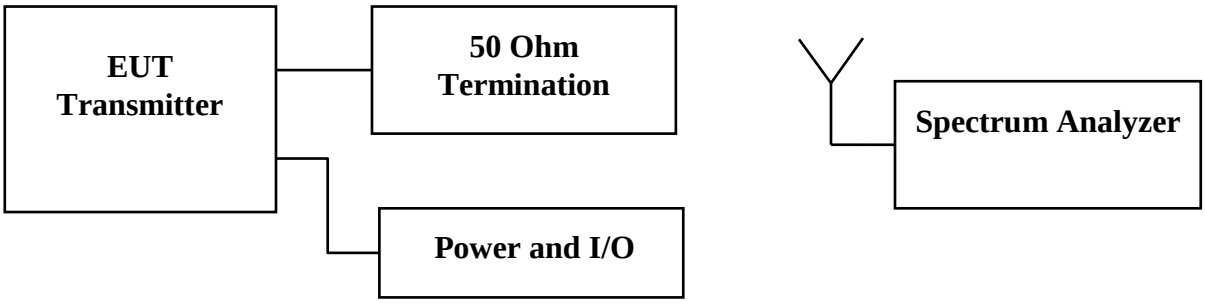
Figure 10 Spurious Emissions at Antenna Terminal

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. This equipment is typically remotely mounted and incorporated into a rack of equipment. Communications with user interface and remotely mounted antennas are connected through appropriate interface cables. Communications for transmitter control during testing was accomplished with use of laptop computer for testing support. The laptop computer offered transmitter control of the unit during testing. 50-ohm loads were connected to the transmitter antenna ports.

Test Arrangement Field Strength of Spurious Radiation



The test setup was assembled in a screen room for preliminary screening. The transmitter was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 1 meter from the receive antenna, plots were made of the radiated emissions. During final radiated emissions, testing the transmitter was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from the Field Strength Measuring (FSM) antenna. With the EUT modulated and radiating into a 50Ω load. The receiving antenna was raised and lowered from 1m to 4m in height to obtain the maximum reading of spurious radiation from the EUT, cabinet, and interface cabling. The turntable 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, interface cabling, and test setup. The amplitude of each spurious emission was maximized by raising and lowering the FSM antenna, and rotating the turntable before final data was recorded. The frequency spectrum from 9 kHz to 44,000 MHz was investigated during radiated emissions testing. A Biconilog antenna

was used for frequency measurements of 30 to 1000 MHz. A double-ridge horn antenna was used for frequencies of 1000 MHz to 44,000 MHz. Emission levels were measured and recorded from the spectrum analyzer in dBµV. Data was taken at the Rogers Labs, Inc. 3 meters open area test site (OATS).

Radiated Spurious Emissions Results

The EUT was connected to power and antenna load as required and operated in all available normal modes while radiated emissions testing were performed. The amplitude of each spurious emission was maximized and amplitude levels recorded while operating at the open area test site at a distance of 3-meters. The EUT demonstrated compliance with the specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 87.139. There are no deviations or exceptions to the specifications.

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 @ 3m (dBµV/m)
175.8	28.0	21.2	N/A	24.9	20.5	N/A	43.5
177.0	27.7	23.5	N/A	26.5	22.7	N/A	43.5
180.5	28.2	25.2	N/A	26.3	22.0	N/A	43.5
181.5	30.0	26.1	N/A	27.5	23.8	N/A	43.5
183.2	29.1	26.0	N/A	26.7	22.9	N/A	43.5
188.0	28.4	24.5	N/A	26.1	22.5	N/A	43.5
188.6	28.6	24.4	N/A	28.6	24.8	N/A	43.5
189.4	29.2	25.2	N/A	25.5	21.6	N/A	43.5
193.4	30.5	27.3	N/A	26.3	22.2	N/A	43.5
316.0	33.9	29.8	N/A	29.4	24.6	N/A	46.0
367.0	36.6	31.8	N/A	32.3	27.0	N/A	46.0

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)
8600.00	14.7	N/A	7.9	19.8	N/A	7.9	54.0
12900.00	19.2	N/A	7.7	21.0	N/A	7.7	54.0
17200.00	21.9	N/A	9.9	22.2	N/A	10.0	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.

Frequency Stability

Frequency Stability Results

CFR47 does not require frequency stability measurement as specified in CFR47 87.133. In compliance with 47CFR paragraph 87.133 (a) (8) radar, stations note (9)

> "Where specific frequencies are not assigned to radar stations, the bandwidth occupied by the emissions of such stations must be maintained within the band allocated to the service and the indicated tolerance does not apply."

The EUT demonstrated compliance with the specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 87.133. There are no deviations or exceptions 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

Equipment	Calibration Date
Spectrum Analyzer: Rohde & Schwarz ESU40	5/12
Spectrum Analyzer: HP 8562A, HP Adapters: 11518, 11519, and 11520 Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	5/12
Spectrum Analyzer: HP 8591EM	5/12
Antenna: EMCO Biconilog Model: 3143	5/12
Antenna: Sunol Biconilog Model: JB6	10/12
Antenna: EMCO Log Periodic Model: 3147	10/12
Antenna: Antenna Research Biconical Model: BCD 235	10/12
LISN: Compliance Design Model: FCC-LISN-2.Mod.cd, 50 µHy/50 ohm/0.1 µf	10/12
R.F. Preamp PA-010	10/12
R.F. Preamp CPPA-102	10/12
R.F. Preamp PA-122	10/12
Cable assembly: (L1) consisting of Belden RG-58, HP11509A, CAT-3	10/12
Cable assembly: (L2) consisting of Belden RG-58, HP11509A, CAT-3	10/12
Cable: (L3) Belden 8268	10/12
Cable: Time Microwave: 4M-750HF290-750	10/12
Cable: Time Microwave: 10M-750HF290-750	10/12
Frequency Counter: Leader LDC825	2/12
Oscilloscope Scope: Tektronix 2230	2/12
Wattmeter: Bird 43 with 50 Ohm Load 8085	2/12
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/12
R.F. Generators: HP 606A, HP 8614A, HP 8640B	2/12
R.F. Power Amp 65W Model: 470-A-1010	2/12
R.F. Power Amp 50W M185- 10-501	2/12
R.F. Power Amp A.R. Model: 10W 1010M7	2/12
R.F. Power Amp EIN Model: A301	2/12
LISN: Compliance Eng. Model 240/20	2/12
LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08	2/12
Antenna: EMCO Dipole Set 3121C	2/12
Antenna: Compliance Design B-101	2/12
Antenna: Solar 9229-1 & 9230-1	2/12
Antenna: EMCO 6509	2/12
Audio Oscillator: HP 201CD	2/12
Peavey Power Amp Model: IPS 801	2/12
ELGAR Model: 1751	2/12
ELGAR Model: TG 704A-3D	2/12
ESD Test Set 2010i	2/12
Fast Transient Burst Generator Model: EFT/B-101	2/12
Field Intensity Meter: EFM-018	2/12
KEYTEK Ecat Surge Generator	2/12
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.

Annex D FCC Test Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

November 01, 2011

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: November 01, 2011

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

May 26, 2010

OUR FILE: 46405-3041
Submission No: 140719

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

Attention: Mr. Scot D. Rogers

Dear Sir/Madame:

The Bureau has received your application for the renewal of a 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 **(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;

- Your primary code is: **3041**

- The company number 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 two 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,

Dalwinder Gill

Dalwinder Gill
For: Wireless Laboratory Manager
Certification and Engineering Bureau
3701 Carling Ave., Building 94
P.O. Box 11490, Station "H"
Ottawa, Ontario K2H 8S2
Email: dalwinder.gill@ic.gc.ca
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