NVLAP Lab Code 200087-0

Application for Grant of Certification

FCC 47CFR Part 87

FCC ID: IPH-02133

1090 MHz
Aviation Transponder Equipment

For

Garmin International, Inc.

1200 East 151st Street
Olathe, KS 66062

Test Report Number: 151102A
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

Engineering 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

FCC ID: IPH-02133

Aviation Transponder
Frequency Range: 1090 MHz

Test Date: November 2, 2015

Certifying Engineer: Scot D Rogers

Scot D. Rogers
Rogers Labs, Inc.
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Revisions

Revision 1, Issued January 7, 2016

Forward

In accordance with the Federal Communications, Code of Federal Regulations dated October 1, 2014, 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 47CFR paragraphs 2 2.1031-2.1057	Complies
Requirements per 47CFR paragraphs 87.131	Complies
Requirements per 47CFR paragraphs 87.133 (d)	Complies
Requirements per 47CFR paragraphs 87.135	Complies
Requirements per 47CFR paragraphs 87.139	Complies
Requirements per 47CFR paragraphs 87.141	Complies

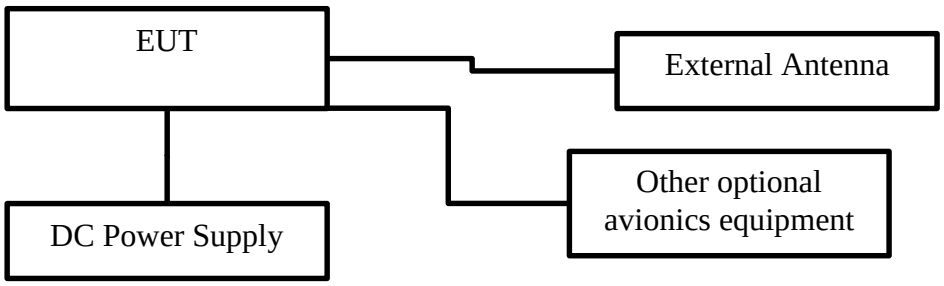
Equipment Tested

Equipment	Serial Number	FCC I.D.#
EUT	3EG400013	IPH-02133
Dc Power Supply	209C131	N/A

Equipment Function and Configuration

The EUT is a panel mount Mode A, C, and S avionics transponder. The design offers addition of altitude reporting, multiple transmit/receive ARINC 429, RS-232, analog, and discrete data ports. The unit operates on aviation-defined frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses back at 1090 MHz.

Equipment Configuration



Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2014, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, and applicable paragraphs of Part 87 the following is submitted for consideration in obtaining Grant of Certification.

Application for Certification

(1) Manufacturer:

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

(2) Identification: FCC I.D.: IPH-02133

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

(4) Emission Type: Emissions designator 8M94M1D

(5) Frequency Range: 1090 MHz

(6) Operating Power Level: 350-Watts peak, 3.3 Watts (Average Power) delivered at antenna port. Average power calculation assumes 0.95% duty cycle. The average power then calculated 350 Watts times 0.95% duty cycle results in 3.3-Watts average power.

(7) Maximum Po: Maximum power output as determined by appropriate standards during certification per CFR 47 paragraph 87.131. Per paragraph 2.2.3.2.d of DO-181E, the maximum RF peak power for all equipment shall be no more than 500 W peak power at the antenna terminals. Assuming 0 dB cable loss, this means the power out of the unit itself shall not exceed 500 W.

(8) Power into final amplifying circuitry: The final amplifier chain operates at nominal 28 volts with current of 20 amps (560 watts peak).

(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 modulation for the transmitted pulses is defined in RTCA DO-181E.

The following specifications apply to Modes A and C operation:

The unit employs pulse modulation prescribed by RTCA/DO-181E and DO-144A. This requires pulses of 0.45 ±0.10 microseconds for Mode A/C transmissions with rise times of 0.100-microsecond maximum and fall-times of 0.200 microseconds maximum for both. Twelve information pulses (binary data) shall be spaced in increments of 1.45 microseconds between two framing pulses spaced 20.3 microseconds apart. In addition, a Special Position Identification pulse shall occur at a pulse interval of 4.35 microseconds following the last framing pulse. The SPI pulse shall not be included when transmitting Mode C replies.

The following specifications apply to Mode-S operation

The unit employs pulse modulation prescribed by RTCA/DO-181E. This requires pulses of 0.500 ±0.050 microseconds for Mode S with rise times of 0.100-microsecond maximum and fall-times of 0.200 microseconds maximum for both. The maximum rated condition, Mode S reply, has a 120 microsecond length with four pulses in the first eight microseconds, which is called the preamble, and pulses of 0.5 or 1.0 microsecond length filling in the next 112 microseconds, which is called the data block. Binary data is coded by the pulse position in the one-microsecond frames.

(14) Data required by 47CFR 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 47CFR 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

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 Approval	Refer to Annex for FCC Site Registration Letter, # 90910, and Industry Canada Site Registration Letter, IC3041A-1.

Environmental Conditions

Ambient Temperature	20.2° C
Relative Humidity	41%
Atmospheric Pressure	1016.5 mb

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.

Emissions (0.009-30 MHz)		
RBW	Video BW	Detector Function
9 kHz	30 kHz	Peak / Quasi Peak
Emissions (30-1000 MHz)		
RBW	Video 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	FCC	FCC-LISN-50-2-10(1PA) (160611)	.15-30MHz	6/15	5/16
☒ Cable	Time Microwave	750HF290-750 (L10M)	9kHz-40 GHz	10/15	10/16
☐ Cable	Belden	RG-58 (L1-CAT3-11509)	9kHz-30 MHz	10/15	10/16
☐ Cable	Belden	RG-58 (L2-CAT3-11509)	9kHz-30 MHz	10/15	10/16
☐ Antenna	ARA	BCD-235-B (169)	20-350MHz	10/15	10/16
☐ Antenna	EMCO	3147 (40582)	200-1000MHz	10/15	10/16
☒ Antenna	ETS-Lindgren	3117 (200389)	1-18 GHz	5/15	5/17
☐ Antenna	Com Power	AH-118 (10110)	1-18 GHz	10/15	10/16
☐ Antenna	Com Power	AH-840 (101046)	18-40 GHz	5/15	5/17
☒ Antenna	EMCO	6509 (9502-1374)	.001-30 MHz	10/15	10/16
☒ Antenna	Sunol	JB-6 (A100709)	30-1000 MHz	10/15	10/16
☐ Antenna	EMCO	3143 (9607-1277)	20-1200 MHz	5/15	5/16
☐ Analyzer	HP	8591EM (3628A00871)	9kHz-1.8GHz	5/15	5/16
☐ Analyzer	HP	8562A (3051A05950)	9kHz-110GHz	5/15	5/16
☐ Analyzer	HP External Mixers	11571, 11970	25GHz-110GHz	5/15	5/16
☒ Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	5/15	5/16
☒ Amplifier	Com-Power	PA-010 (171003)	100Hz-30MHz	10/15	10/16
☒ Amplifier	Com-Power	CPPA-102 (01254)	1-1000 MHz	10/15	10/16
☒ Amplifier	Com-Power	PAM-118A (551014)	0.5-18 GHz	10/15	10/16

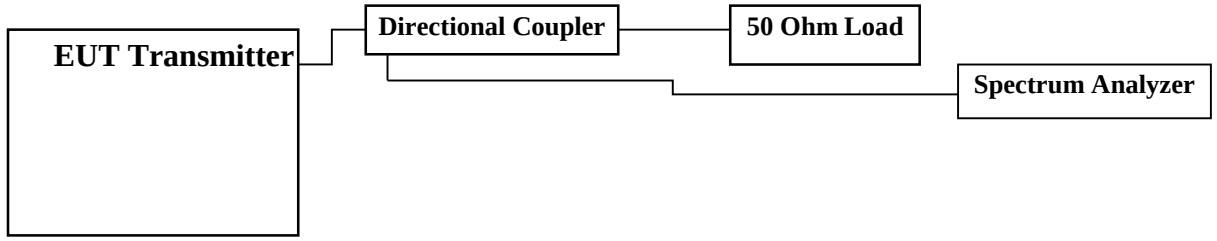
Radio Frequency Power Output

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.

Test Arrangement



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 attenuation and spectrum analyzer had an impedance of 50Ω to match the impedance of the standard antenna. A Rohde Schwarz ESU-40 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 47CFR Paragraph 2.1046(a) and applicable paragraphs of Part 87.

PdBm = power in dB above 1 milliwatt.

Milliwatts $= 10^{(PdBm/10)}$

Watts = (Milliwatts) (0.001) (W/mW)

Milliwatts $= 10^{(55.19/10)}$

= 330,369.5 mW

= 350 Watts Peak power

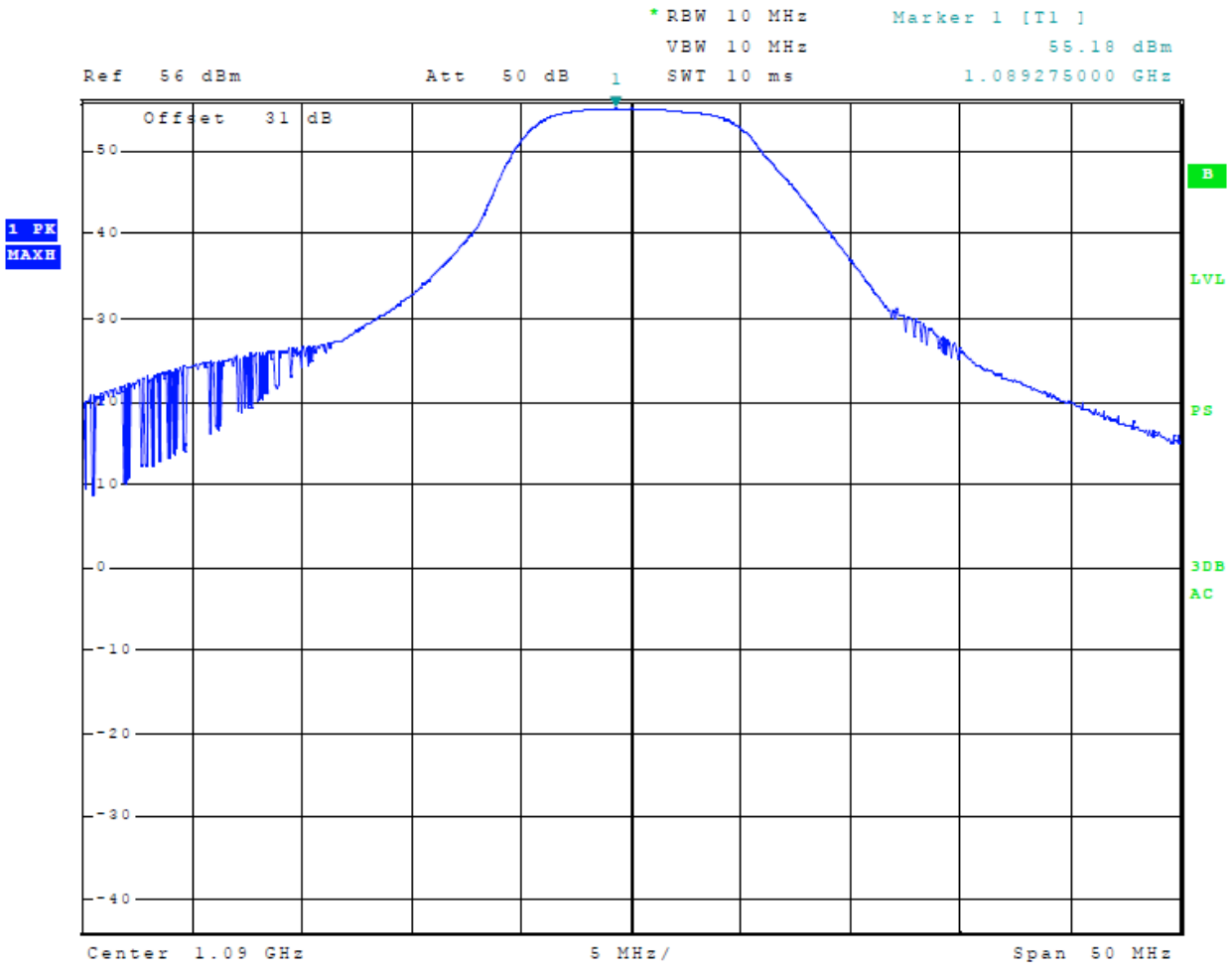


Figure 1 Maximum Power Output

Radio Frequency Power Output Results

Frequency (MHz)	P (dBm)	P (mw)	P (Watts)
1090.0	55.19	330,369.5	350

The specifications of 47CFR Paragraph 2.1046(a) and applicable Parts of 2 and 87.131 are met.

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 modulation specifications are defined by the RTCA DO-181E. The following specifications apply to ATCRBS reply pulses:

Specification	Data	Unit
Rise Time (10%/90%)	50-100	ns
Fall Time (90%/10%)	50-200	ns
Pulse width	450 +/- 100	ns

The following specifications apply to Mode-S reply pulses:

Specification	Data	Unit
Rise Time (10%/90%)	50-100	ns
Fall Time (90%/10%)	50-200	ns
Pulse Width (preamble pulses)	500 +/- 50	ns
Pulse Width (data pulses)	500 +/- 50	ns
Pulse Width (data pulses)	1 +/- 0.05	us

Modulation Characteristics Results

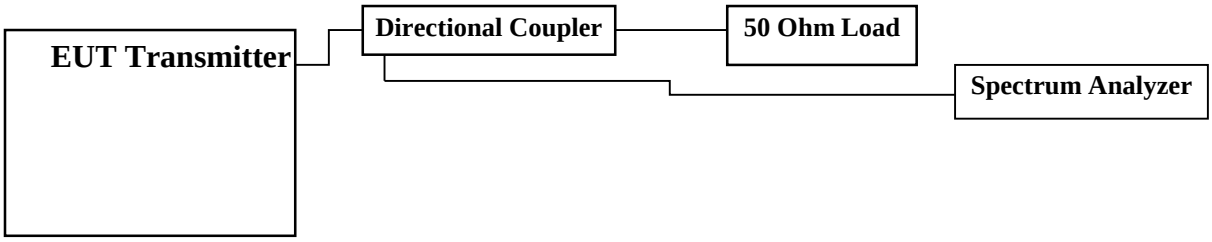
The modulation characteristics are defined in aviation standards and regulations. This equipment complies with the pulse timing requirements as defined above. The requirements of 47CFR 2.1049(c)(1) and applicable paragraphs of Part 87.141 are met. There are no deviations to the specifications.

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

Test Arrangement



A 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 normal modes while measurements were made. The power ratio in dB representing 99.5% of the total mean power was recorded from the spectrum analyzer. Refer to figures 2 and 3 showing the plot of the 99.5% power occupied bandwidth for operational modes.

Occupied Bandwidth Results

Frequency (MHz)	Mode	Occupied bandwidth(MHz)
1090.00	Mode S	7.540
1090.00	Mode A	7.420

The requirements of 47CFR 2.1049(h) and applicable paragraphs of Part 87.135 are met. There are no deviations to the specifications.

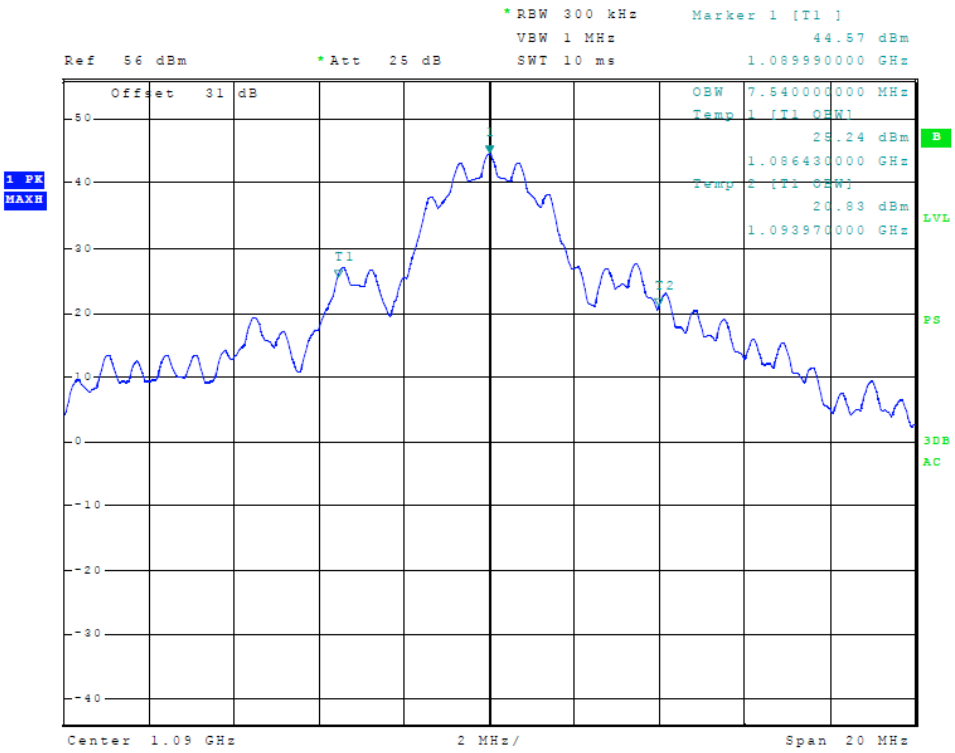


Figure 2 Mode S Occupied Band Width

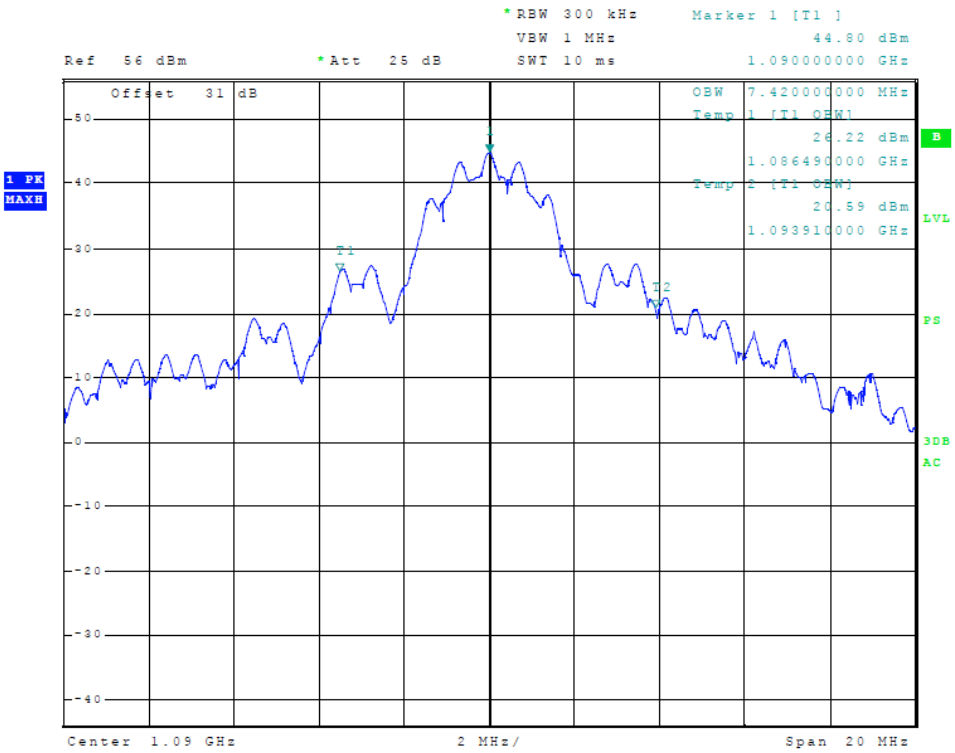


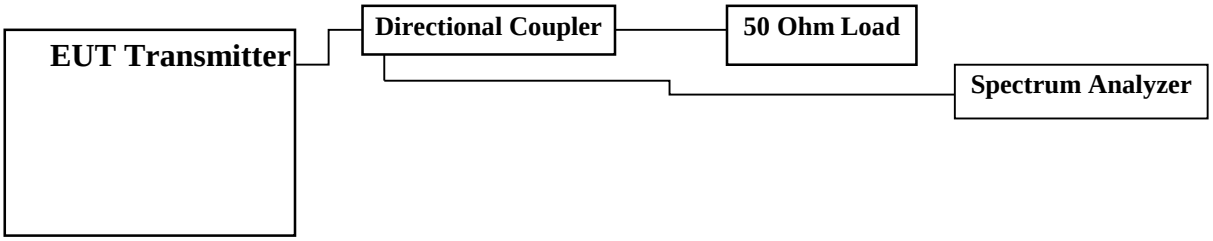
Figure 3 Mode A Occupied Band Width

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



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 12,000 MHz was observed during preliminary investigation. Figures 4 through 10 represent data for the worst-case antenna spurious emissions of the EUT. Data was taken per 47CFR 2.1051, 2.1057, and applicable paragraphs of Part 87.139.

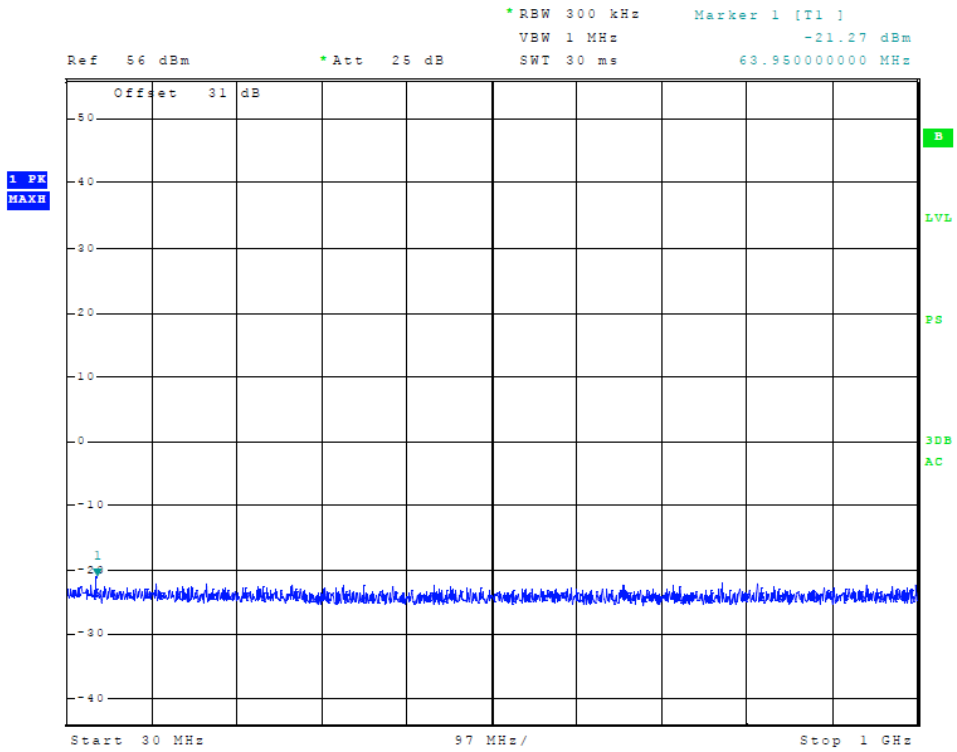


Figure 4 Spurious Emissions at Antenna Terminal

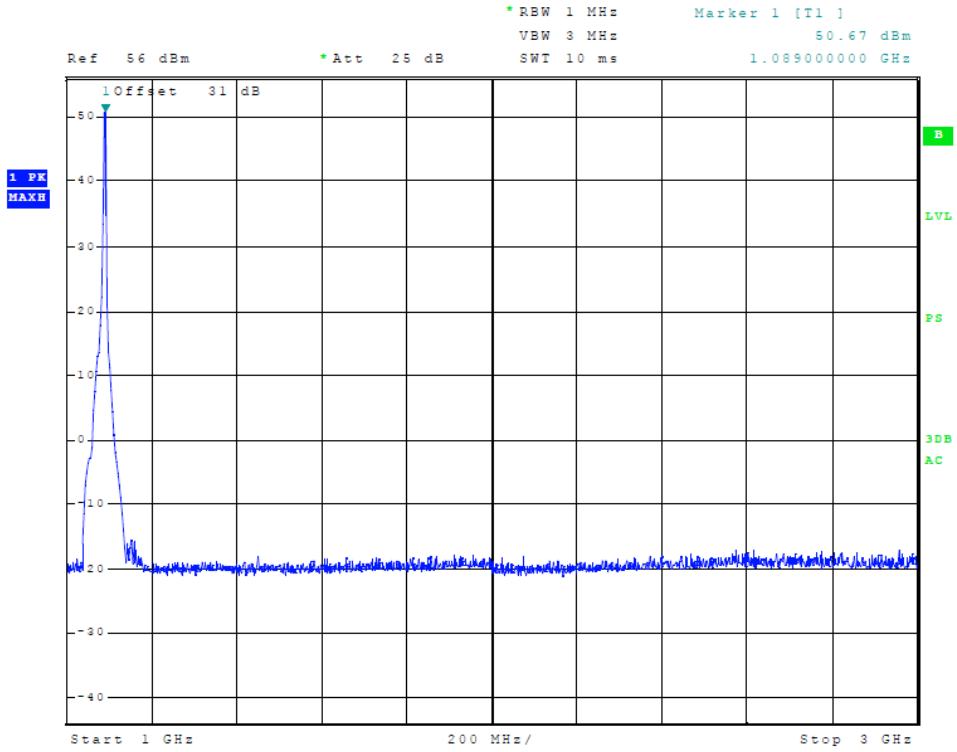


Figure 5 Spurious Emissions at Antenna Terminal

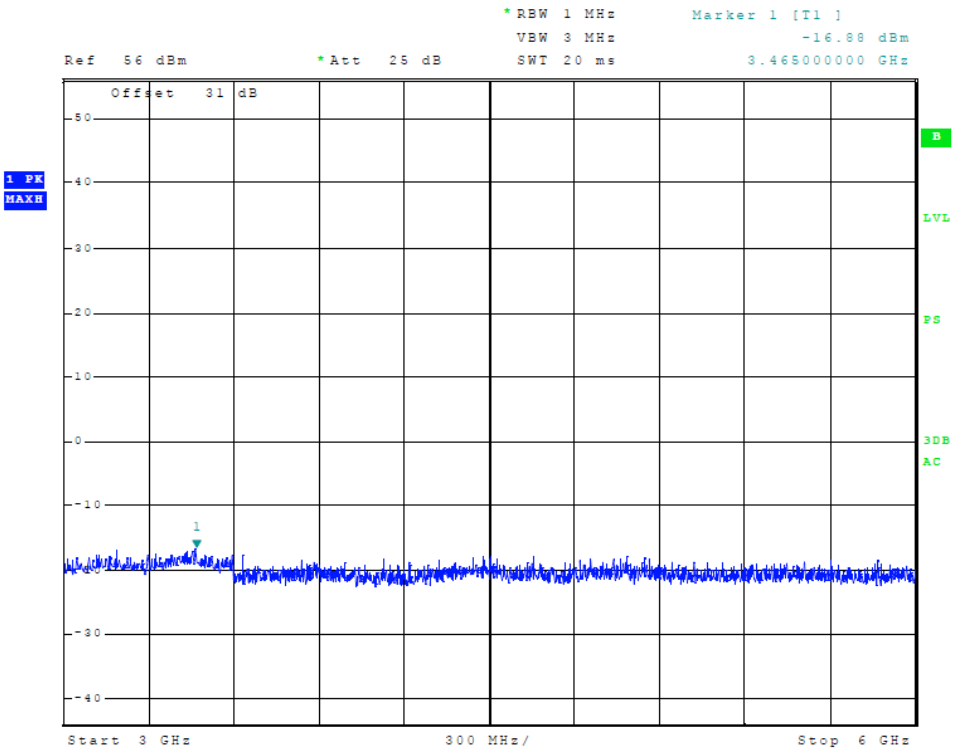


Figure 6 Spurious Emissions at Antenna Terminal

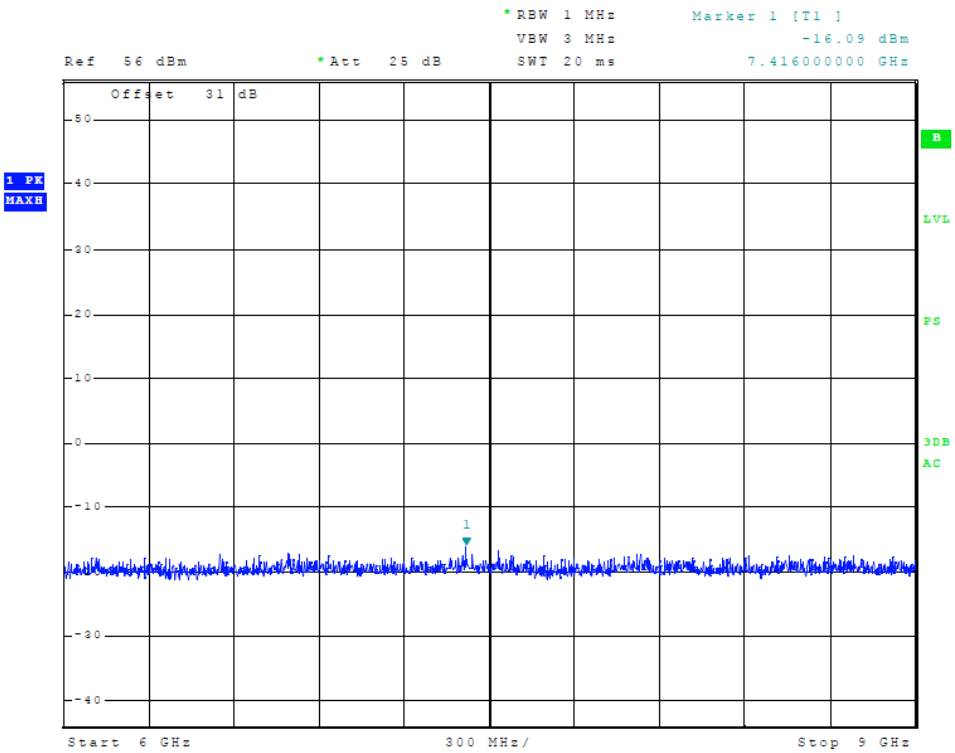


Figure 7 Spurious Emissions at Antenna Terminal

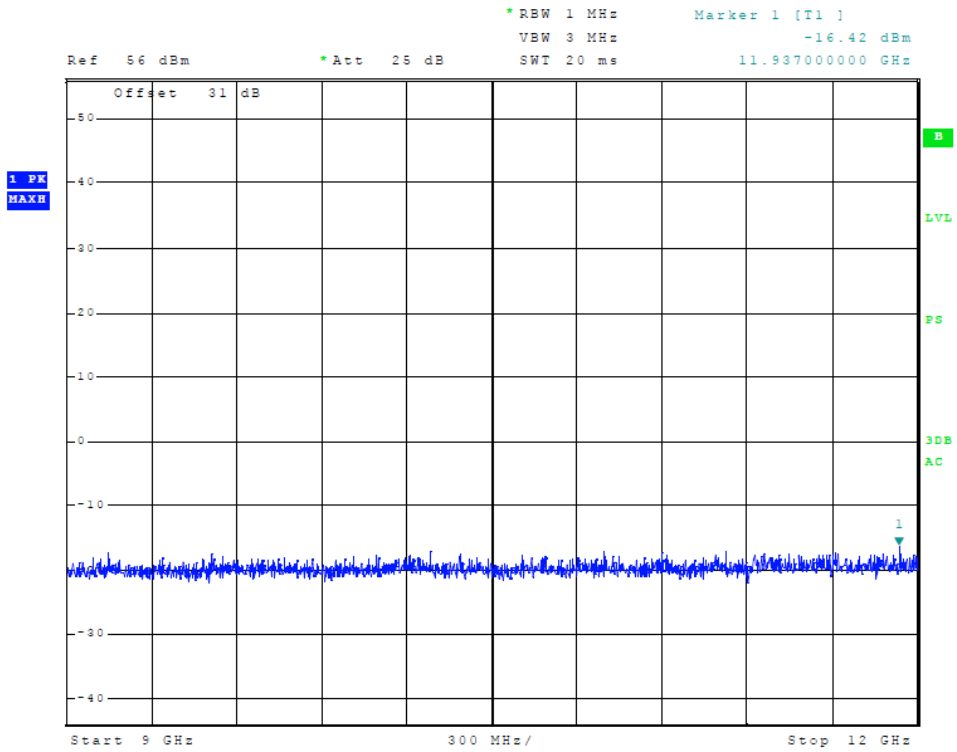


Figure 8 Spurious Emissions at Antenna Terminal

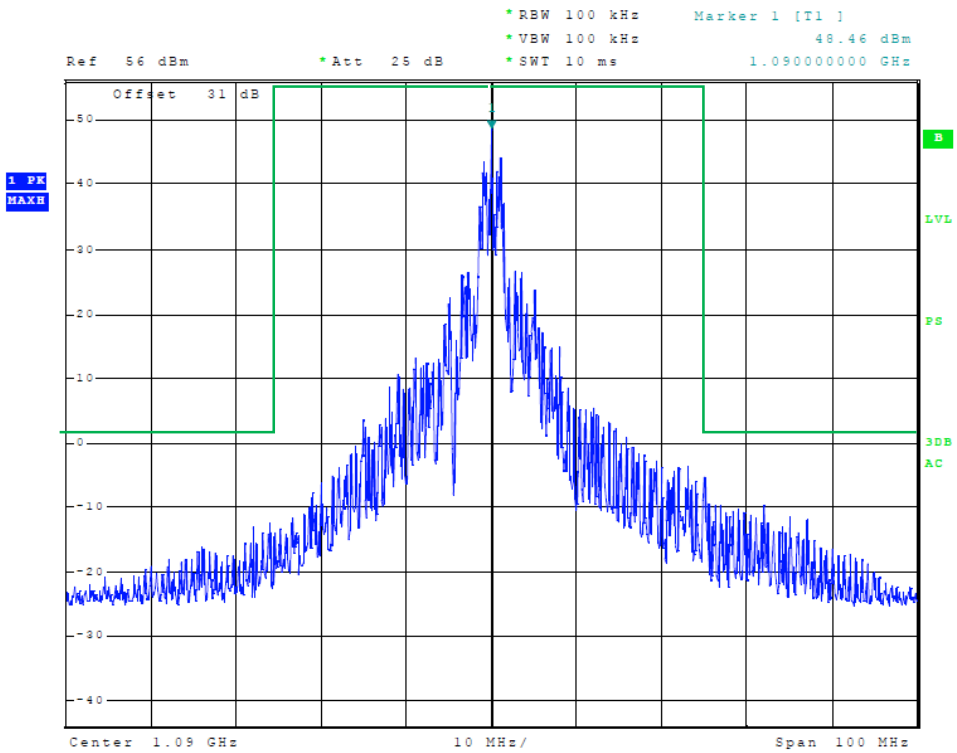


Figure 9 Emissions Mask (Mode-S)

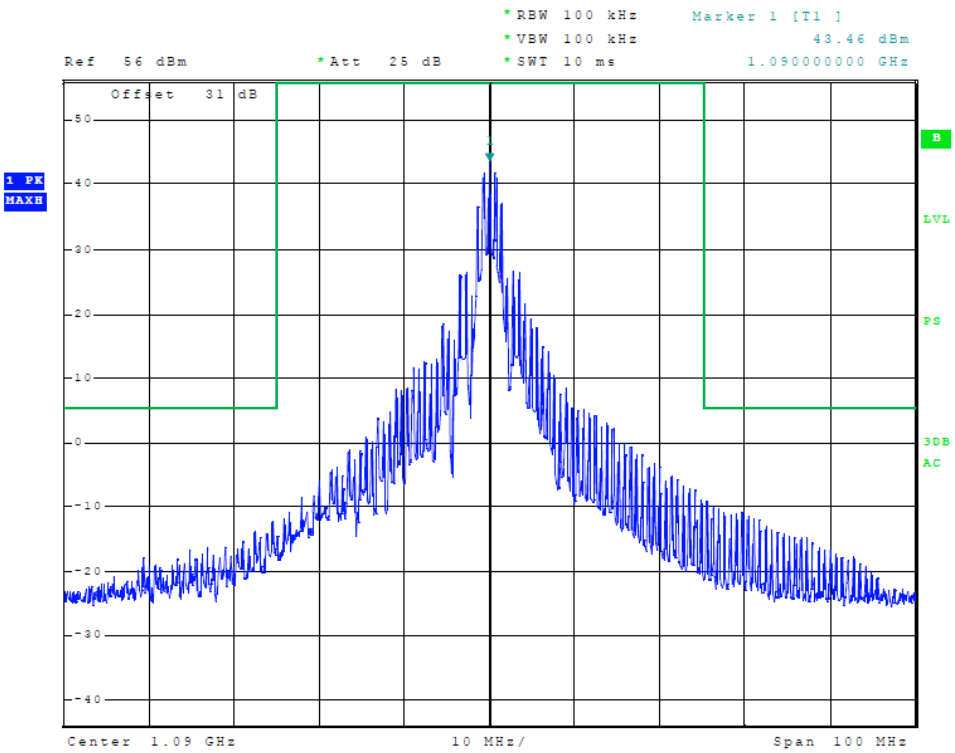


Figure 10 Emissions Mask (Mode-A)

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 47CFR 2.1051 and applicable paragraphs of Part 87. Specifications of Paragraphs 2.1051, 2.1057 and applicable paragraphs of part 87.139 are met. There are no deviations to the specifications.

All spurious emissions must be attenuated at least 43 +10log (pY) [pY=mean 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 48.4 dB below fundamental carrier

= 43 + 10 Log(pY)

= 43 + 10 Log (3.5)

= 48.44

= 48.4 dBc

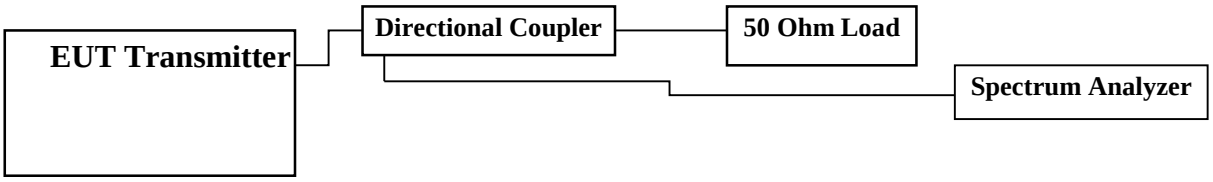
Channel MHz	Spurious Freq. (MHz)	Measured Level (dBm)	Level Below Carrier (dBc)
1090.00	2180.0	-30.70	85.9
	3270.0	-30.14	85.3
	4360.0	-31.50	86.7
	5450.0	-17.50	72.7
	6540.0	-27.26	82.5
	7630.0	-27.25	82.4
	8720.0	-26.91	82.1
	9810.0	-26.30	81.5
	10900.0	-25.98	81.2

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 incorporated into a rack of equipment, cabling attached to the cabinet. A test box was used to interface with the equipment for testing purposes. The test box offered transmitter control and continuously interrogated the unit during testing. The test set supplied the 50-ohm load for the antenna connections.

Test Arrangement



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 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 12,000 MHz was investigated during radiated emissions testing. A Loop antenna was used for measuring emissions from 0.009 to 30 MHz, Biconilog Antenna for 30 to 1000 MHz, Double-Ridge, and/or Pyramidal Horn Antennas from 1 GHz to 25 GHz. Emissions were measured in dBµV/m @ 3 meters. 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.

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)	47CFR General Emissions Limit @ 3m (dBµV/m)
51.6	31.3	25.0	N/A	37.5	28.2	N/A	40.0
96.0	39.2	35.8	N/A	41.6	38.3	N/A	43.5
108.0	38.6	33.8	N/A	37.2	30.1	N/A	43.5
120.1	37.9	34.6	N/A	33.3	28.2	N/A	43.5
132.0	28.6	21.8	N/A	31.1	20.5	N/A	43.5
156.1	39.2	28.6	N/A	29.8	27.5	N/A	43.5
180.1	25.4	23.0	N/A	22.4	19.3	N/A	43.5
204.1	31.0	29.4	N/A	28.8	25.3	N/A	43.5
279.0	28.2	17.3	N/A	29.5	20.4	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.

Channel frequency 1090.00 MHz

Frequency of Emission	Amplitude of EUT Spurious emission		Signal level to substitution antenna required to reproduce		Emission level below carrier		47CFR Limit at least
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBµV/m	dBµV/m	dBm	dBm	dBc	dBc	dBc
2180.0	26.9	26.9	-68.33	-68.33	123.3	123.3	48.4
3270.0	28.9	28.9	-66.33	-66.33	121.3	121.3	48.4
4360.0	30.9	30.8	-64.33	-64.43	119.3	119.4	48.4
5450.0	32.0	32.0	-63.23	-63.23	118.2	118.2	48.4
6540.0	32.1	31.9	-63.13	-63.33	118.1	118.3	48.4
7630.0	32.7	32.7	-62.53	-62.53	117.5	117.5	48.4

Other Emissions present with amplitudes at least 20 dB below limit.

Specifications of 47CFR Paragraph 2.1053, 2.1057, applicable paragraphs of part 87.139 are met. There are no deviations or exceptions to the specifications.

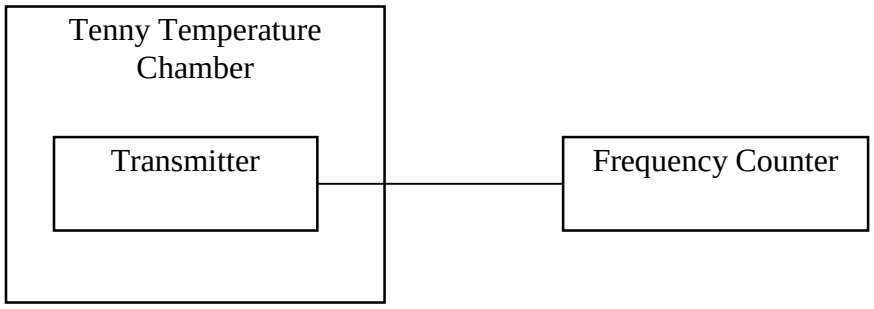
Frequency Stability

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 of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. In addition to temperature stability, the frequency stability shall be measured with variation of primary supply voltage as follows.

Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
For hand carried, batteries powered equipment, reduce primary supply voltage to the battery-operating end point, which shall be specified by the manufacturer.
The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

Frequency Stability 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 unmodulated 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 stability was measured with variations in the power supply voltage from 85 to 115 percent of the nominal value. The frequency was measured and the variation in parts per million calculated. Data was taken per 47CFR Paragraphs 2.1055 and applicable paragraphs of part 87.133. 47CFR 87.133 requires stability maintained at least 1000 ppm.

Frequency Stability Results

Frequency 1089.982585 (MHz)	Frequency Stability Vs Temperature In Parts Per Million (PPM)								
Temperature C	-30	-20	-10	0	+10	+20	+30	+40	+50
Change (kHz)	17.2	-0.3	1.0	-2.4	-1.1	-7.6	5.0	2.3	-9.5
PPM	15.7	-0.3	0.9	-2.2	-1.0	-6.9	4.6	2.1	-8.7
%	0.002	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	-0.001

Frequency 1089.982585 (MHz)	Frequency Stability Vs Voltage Variation 14 or 28 volts nominal; Results In Hz		
Voltage Vdc	11.9	14.0	16.1
Change (Hz)	0	0	0
Voltage Vdc	23.8	28.0	32.2
Change (Hz)	0	0	0

Specifications of 47CFR Paragraphs 2.1055 and applicable paragraphs of part 87.133 are met. There are no deviations or exceptions to the specifications.

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Rogers Labs Test Equipment List
- Annex C Rogers Qualifications
- Annex D FCC Site Registration Letter
- Annex E Industry Canada 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	Due
Spectrum Analyzer: Rohde & Schwarz ESU40	5/15	5/16
Spectrum Analyzer: HP 8562A, HP Adapters: 11518, 11519, and 11520 Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	5/15	5/16
Spectrum Analyzer: HP 8591EM	5/15	5/16
Antenna: EMCO Biconilog Model: 3143	5/15	5/16
Antenna: Sunol Biconilog Model: JB6	10/15	10/16
Antenna: EMCO Log Periodic Model: 3147	10/15	10/16
Antenna: Com Power Model: AH-118	10/15	10/16
Antenna: Com Power Model: AH-840	5/15	5/17
Antenna: Antenna Research Biconical Model: BCD 235	10/15	10/16
Antenna: EMCO 6509	10/15	10/16
LISN: Compliance Design Model: FCC-LISN-2.Mod.cd, 50 µHy/50 ohm/0.1 µf	10/15	10/16
R.F. Preamp CPPA-102	10/15	10/16
Attenuator: HP Model: HP11509A	10/15	10/16
Attenuator: Mini Circuits Model: CAT-3	10/15	10/16
Attenuator: Mini Circuits Model: CAT-3	10/15	10/16
Cable: Belden RG-58 (L1)	10/15	10/16
Cable: Belden RG-58 (L2)	10/15	10/16
Cable: Belden 8268 (L3)	10/15	10/16
Cable: Time Microwave: 4M-750HF290-750	10/15	10/16
Cable: Time Microwave: 10M-750HF290-750	10/15	10/16
Frequency Counter: Leader LDC825	2/15	2/16
Oscilloscope Scope: Tektronix 2230	2/15	2/16
Wattmeter: Bird 43 with Load Bird 8085	2/15	2/16
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/15	2/16
R.F. Generators: HP 606A, HP 8614A, HP 8640B	2/15	2/16
R.F. Power Amp 65W Model: 470-A-1010	2/15	2/16
R.F. Power Amp 50W M185- 10-501	2/15	2/16
R.F. Power Amp A.R. Model: 10W 1010M7	2/15	2/16
R.F. Power Amp EIN Model: A301	2/15	2/16
LISN: Compliance Eng. Model 240/20	2/15	2/16
LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08	2/15	2/16
Antenna: EMCO Dipole Set 3121C	2/15	2/16
Antenna: C.D. B-101	2/15	2/16
Antenna: Solar 9229-1 & 9230-1	2/15	2/16
Audio Oscillator: H.P. 201CD	2/15	2/16
ELGAR Model: 1751	2/15	2/16
ELGAR Model: TG 704A-3D	2/15	2/16
ESD Test Set 2010i	2/15	2/16
Fast Transient Burst Generator Model: EFT/B-101	2/15	2/16
Field Intensity Meter: EFM-018	2/15	2/16
KEYTEK Ecat Surge Generator	2/15	2/16
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.

Scot D Rogers

Scot D. Rogers

NVLAP Lab Code 200087-0

Annex D FCC Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

April 16, 2015

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: April 16, 2015

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 Site Registration Letter

Industry Canada Industrie Canada

June 08, 2015

OUR FILE: 46405-3041
Authorization No: 010277847-001

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 3m 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 C63.4-2009 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2009 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 C63.4-2009 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 AH@
Ottawa, Ontario K2H 8S2
Email: certification.bureau@ic.gc.ca