APPLICATION
FOR
GRANT of CERTIFICATION
REPORT
FOR

MODEL: 011-01434-00
GPN 011-01434-00

FOR

GARMIN INTERNATIONAL, INC.

1200 East 151st Street

Olathe, KS 66062

Test Report Number 061213D

Rogers Labs, Inc.
4405 West 259th Terrace
Louisburg, KS 66053
Telephone / 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. Doug Kealey
Compliance Engineer

Model: 011-01434-00
MURS Transmitter
Frequency: 151.820, 151.880, 151.940, 154.570, and 15.600 MHz

Low Power Transmitter
Frequency: 2,400-2,483.5 MHz

FCC ID: IPH-01113

Test Date: December 13, 2006

Certifying Engineer: Scot D Rogers

Scot D. Rogers
ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone: (913) 837-3214
FAX: (913) 837-3214

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FORWARD

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2005, Part 2 Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.915, 2.925, 2.926, 2.1031 through 2.1057, applicable paragraphs of Part 15C and 95, the following report is submitted.

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

Model 011-01434-00

FCC ID IPH-01113

Equipment Function and Configuration

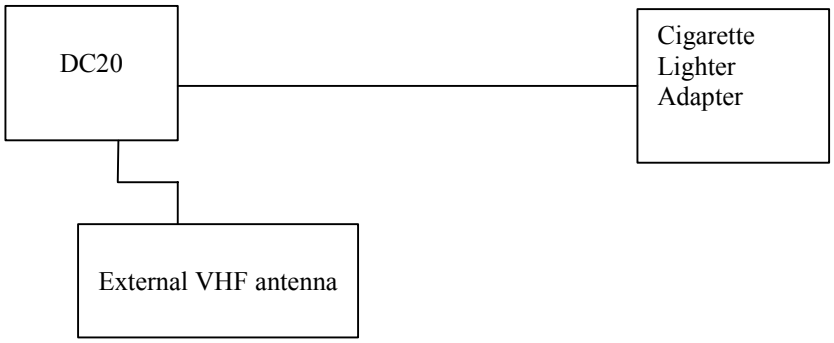
Equipment Function

The EUT incorporates two separate transmitter sections, one operating on the approved MURS frequencies governed by rule of CFR47 95.632. The other operating as a low power license exempt intentional radiator operating between 2.4-2.4835 GHz governed by CFR47 15.249. The low power transmitter allows for channel selection and synchronization of the transmitter and remote receiver. The unit functions while attached to a collar or harness allowing a sports enthusiast to locate and track an animal wearing the harness and transmitter. The MURS transmissions are received on the synchronized receiver carried by the sports enthusiast allowing them to monitor the location of the transmitter.

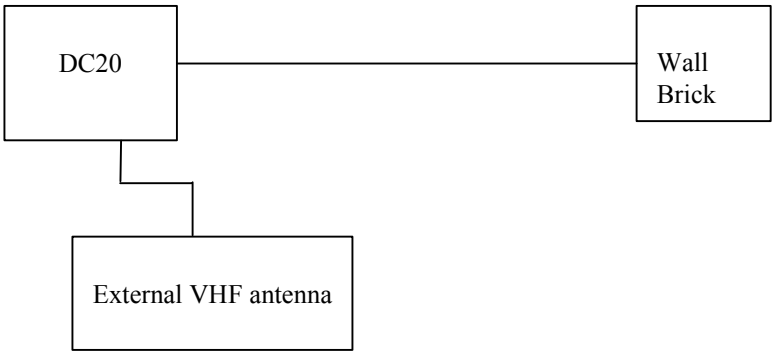
The EUT enclosure is sealed allowing no access inside. This approach hardens the equipment to adverse conditions the tracked animal experience. Channel selection for the MURS transmitter is limited to the approved channels of operation. The EUT offers no transmitter power adjustment to the end user.

Equipment Configuration

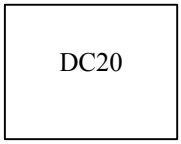
1. DC20 (GPN: 011-01434-00) connected to car cigarette lighter adapter (GPN: 320-00340-00), and external VHF antenna (GPN: 700-00021-00 or 700-00022-00).



2. DC20 Li-Ion battery charged by the AC wall brick power supply (GPN: 362-00045-00).



3. DC20 Operating Transmitter from Li-Ion battery



List of Test Equipment

A Hewlett Packard 8591EM and or 8562A Spectrum Analyzer was used as the measuring device for the emissions testing. The analyzer settings used are described in the following table. Refer to the Appendix for a complete list of Test Equipment.

HP 8591EM SPECTRUM ANALYZER SETTINGS		
CONDUCTED EMISSIONS		
RBW	AVG. BW	DETECTOR FUNCTION
9 kHz	30 kHz	Peak/Quasi Peak
RADIATED EMISSIONS (30 – 1000 MHz)		
RBW	AVG. BW	DETECTOR FUNCTION
120 kHz	300 kHz	Peak/Quasi Peak
HP 8562A SPECTRUM ANALYZER SETTINGS		
RADIATED EMISSIONS (1 – 40 GHz)		
RBW	AVG. BW	DETECTOR FUNCTION
1 MHz	1 MHz	Peak/Average
ANTENNA CONDUCTED EMISSIONS:		
RBW	AVG. BW	DETECTOR FUNCTION
120 kHz	300 kHz	Peak

CFR47 2.1033(c) Application for Certification

(1) Manufacturer: GARMIN INTERNATIONAL, INC.
1200 East 151st Street
Olathe, KS 66062
Phone: (913) 397-8200

(2) FCC Identification: Model: 011-01434-00
FCC ID: IPH-01113 S/N: #18

(3) Copy of the installation and operating manual:
Refer to exhibit for Draft Instruction Manual.

(4) Emission Type: 8k80F2D

(5) Frequency Range: MURS Transmitter, 151 MHz, and 154 MHz

(6) Operating Power Level: 2.0 Watts MURS, 77.4 dBμv/m at three meters distance for the 2.4-2.4835 GHz Low Power License Exempt operation

(7) Max Power allowed as defined in 95.639(h): 2.0 Watts MURS

(8) Power into final amplifier: 2.0 Watt MURS: 6.15 Watts (4.1V @ 1.5A)

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

(10) Circuit Diagrams; description of circuits, frequency stability, spurious suppression, and power and modulation limiting: Refer to Exhibit for Circuit Diagrams. Refer to Exhibit for 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 Information of Components Layout and Chassis Drawings.

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

(14) Data required by 2.1046 through 2.1057 is reported in this document.

(15) Application for certification of an external radio power amplifier operating under part 97 of this chapter. This specification is not applicable to this device.

(16) Application for certification of AM broadcast transmitter. This specification is not applicable to this device.

A single application may be filed for a composite system that incorporates devices subject to certification under multiple rule parts; however, the appropriate fee must be included for each device. The device is governed by CFR47 rule Part 95 subpart E for MURS transmitter and 15.249 for operation of the low power licensed exempt transmitter.

CFR47 2.1046 RF 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 of the MURS transmitter was measured at the antenna terminal by replacing the antenna with a coaxial cable connected to a spectrum analyzer. The spectrum analyzer had an impedance of 50 Ohms to match the impedance of the standard antenna. A HP 8591EM and/or 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 one showing the output power of the MURS transmitter at the antenna terminal. Data was taken per Paragraph 2.1046(a) and applicable parts of Part 95.

33.00 dBm	$= 10^{(33.00/10)}$	32.66 dBm	$= 10^{(32.66/10)}$
	= 1,995.26 mW		= 1,845.02 mW
	= 2.0 Watts		= 1.9 Watts

Results MURS Transmitter Output Power

FREQUENCY	PdBm	Pmw	Pw
151.880	33.00	1,995.3	2.0
154.600	32.66	1,845.0	1.9

Using the substitution method the following data was taken per TIA/EIA-603. Utilizing the available antenna options, the radio frequency output power was measured at a three-meter distance on an approved Open Area Test Site (OATS) using the substitution method. A HP 8591EM Spectrum Analyzer was used to measure the radio frequency power produced by the EUT at a distance of three-meters. The level was recorded and the EUT was removed from the table and replaced by a substitution antenna driven by a frequency generator and amplification stages. The generator output level was then increased until the amplitude level produced by the substitution system measured the same as previously recorded from the EUT. The antenna was removed and replaced by a spectrum analyzer. This allow for accurate recording of the generator-amplifier power output. This power output level was then recorded, as the power required reproducing the measured level. This procedure was repeated for all frequencies of interest with the data taken reported below. The testing procedures used conform to the procedures stated in the TIA/EIA-603 document.

Substitution method radiated power Data using antenna option

Frequency of Emission	Amplitude of emission		Signal level to dipole required to reproduce	
	Horizontal	Vertical	Horizontal	Vertical
(MHz)	dBm	dBm	dBm	dBm
151.880	-1.60	7.40	20.3	29.3
154.600	5.30	9.10	26.1	29.9

P_{dBm} = power in dB above 1 milliwatt.

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

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

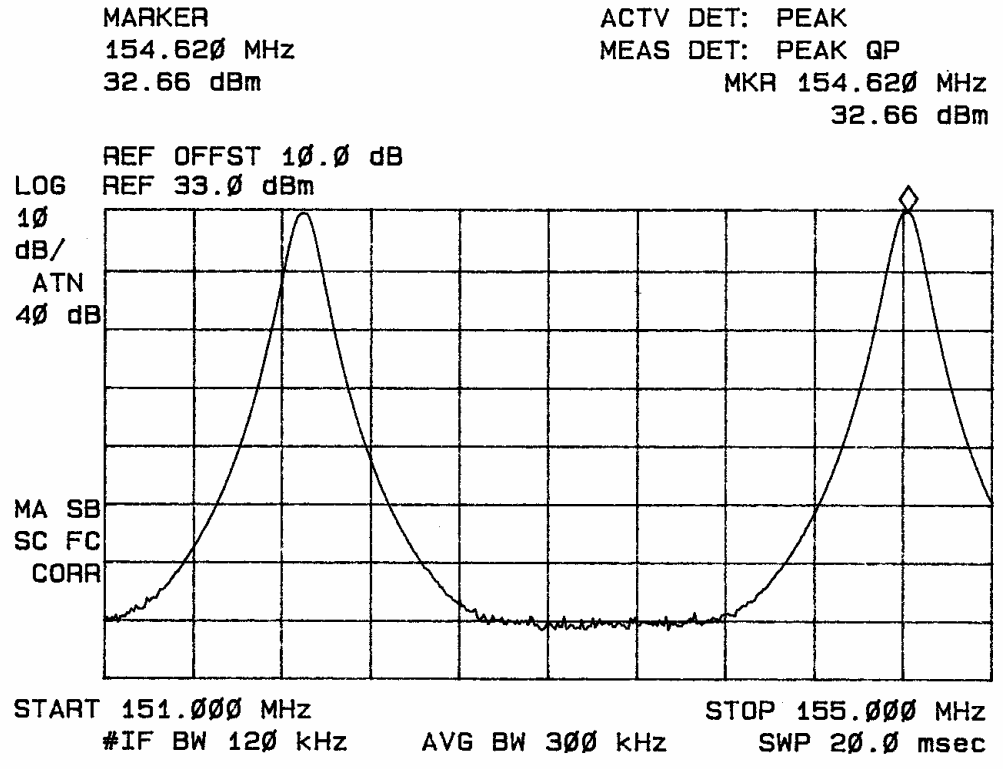


Figure one Power Output at antenna terminal of MURS Transmitter

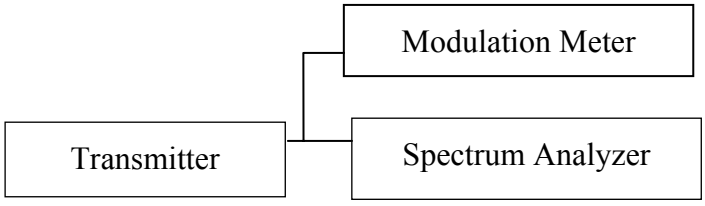
The specifications of Paragraph 2.1046(a) and applicable Parts of 95 are met. There are no deviations to the specifications.

CFR47 2.1047 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.

Test Arrangement



The radio frequency output was coupled to a HP Spectrum Analyzer and a modulation meter. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its various modes. The modulation meter was used to measure the percent modulation or frequency deviation.

Results

The MURS Transmitter broadcasts only digital information and offers no connection for external audio inputs. Therefore, no modulation characteristics were measured or reported.

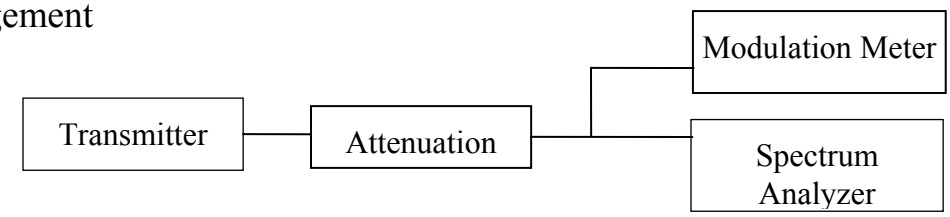
The specifications of Paragraph 2.1047 and applicable parts of 95 are met.

CFR47 2.1049 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. Plots were taken with the unit operating in all normal modes with digital data formats of zeros, ones, and alternating zero-one.

Test Arrangement



Results

fc (MHz)	Occupied Bandwidth (kHz)
151.880	8.75
151.880	8.80
151.880	8.80

A spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in all normal modes. The test sample provided transmit operation streaming either all zero, all ones, or one-zero values. The power ratio in dB representing 99.5% of the total mean power was recorded from the spectrum analyzer. Refer to figures two through four for plots showing the occupied bandwidth of 99.5% power and emission mask.

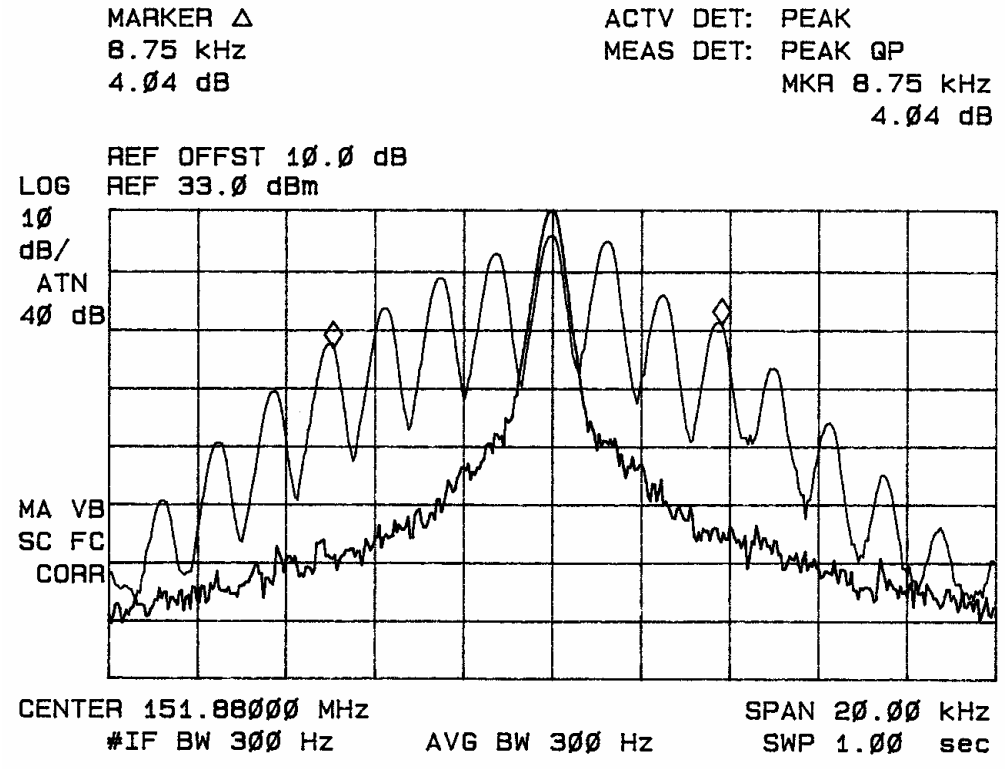


Figure two Occupied Band Width (Data 0000).

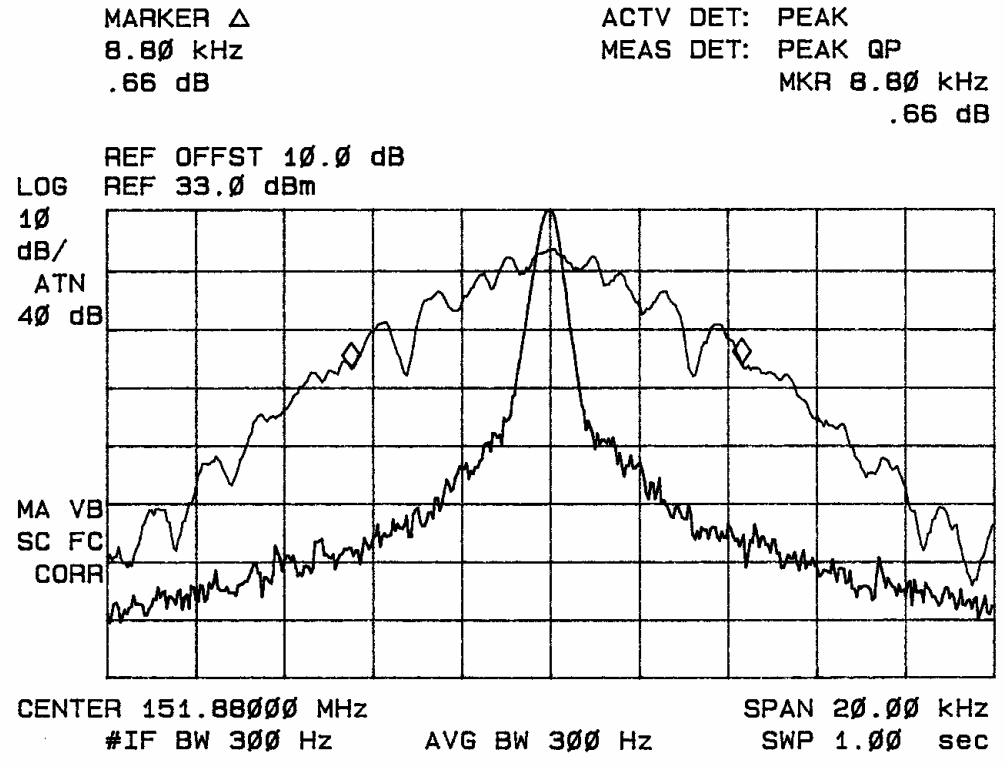


Figure three Occupied Band Width (Data 1111).

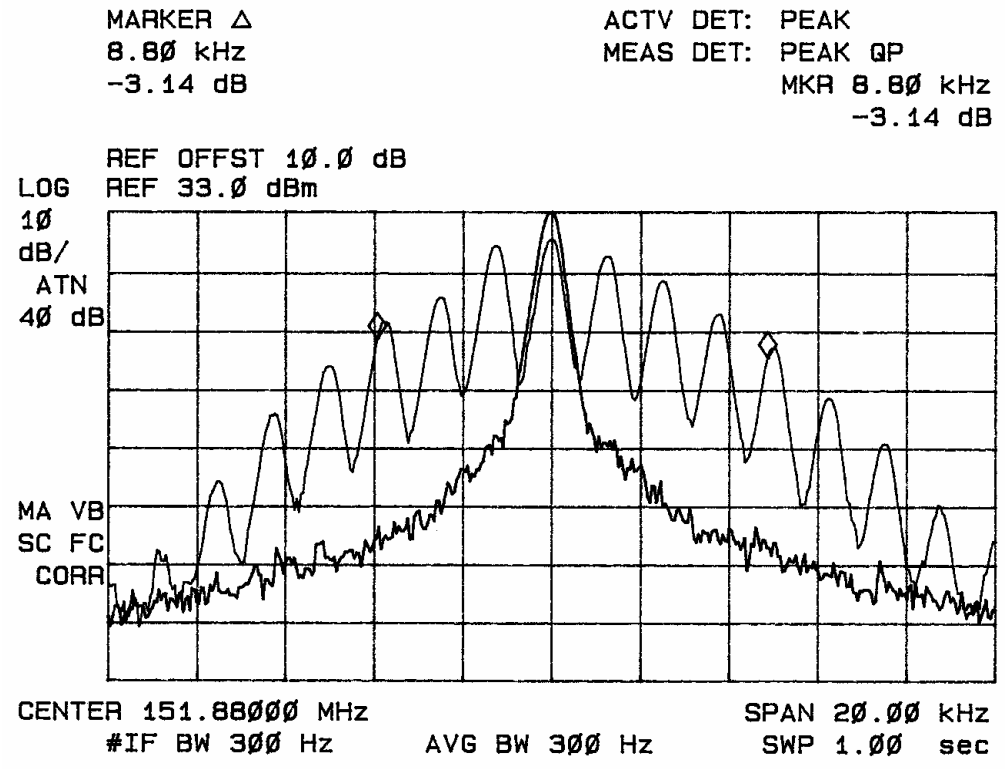


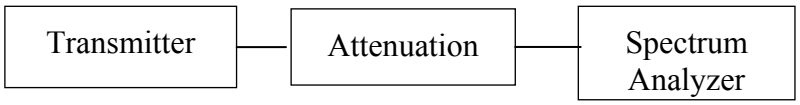
Figure four Occupied Band Width (Data 1010).

CFR47 2.1051 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 HP 8562 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the MURS transmitter operated in a normal mode. The frequency spectrum from 0 MHz to 2.0 GHz was observed and a plot produced of the frequency spectrum. Figure five represents data for the 011-01434-00 operating while transmitting data. Data was taken per 2.1051, 2.1057, and applicable paragraphs of Part and 95.

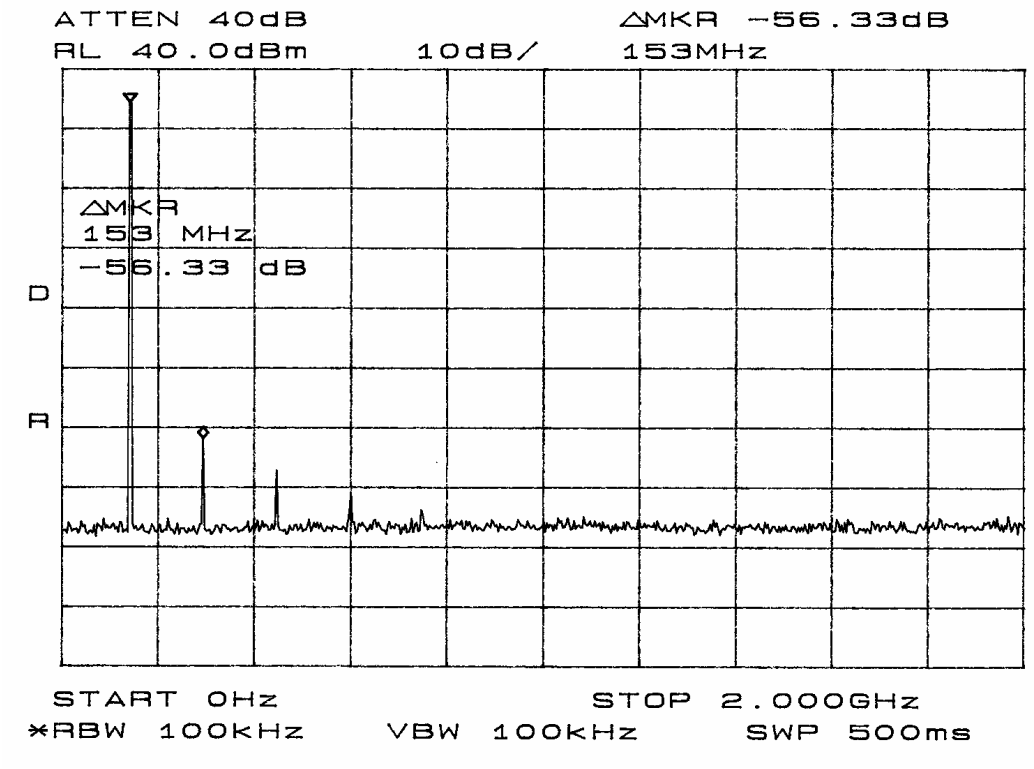


Figure five Spurious Emissions at Antenna Terminal

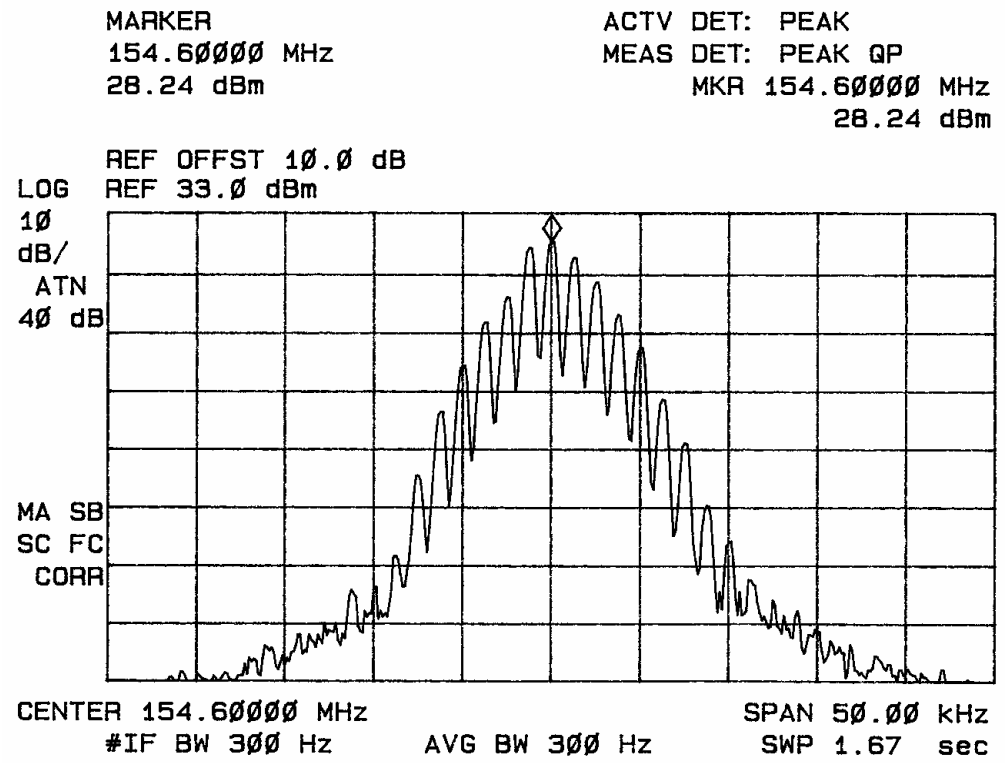


Figure six Spurious Emissions at Antenna Terminal

Results

The output of the MURS transmitter was coupled to a HP Spectrum Analyzer and the frequency emissions were measured. Data was taken as per 2.1051 and applicable paragraphs of Part 95.

FCC Limits:

Spurious emissions removed from the center frequency by more than 12.5 kHz must be attenuated at least $50+10\log(P_o)$.

2.0 Watt $= 50 + 10 \text{ LOG}(P_o)$

$= 50 + 10 \text{ LOG}(2)$

$= 53.0$

CFR47 2.1051 2.0 Watt MURS Spurious Emissions Data

CHANNEL MHz	SPURIOUS FREQ. (MHz)	LEVEL BELOW CARRIER (dB)
151.880	303.72	-54.1
	455.65	-60.8
	607.52	-65.8
	759.40	-71.3
	911.3	-81.1
	1063.2	-79.9
	1215.0	-81.8
	1366.9	-79.7
	1518.8	-78.8

Specifications of Paragraphs 2.1051, 2.1057 and applicable paragraphs of part 95 are met. There are no deviations to the specifications.

CFR47 2.1053 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.

Test Arrangement

The transmitter was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from the FSM antenna. With the MURS transmitter radiating into a standard 50-ohm load attached at the antenna terminal, the receiving antenna was raised and lowered from 1m to 4m to obtain the maximum reading of spurious radiation from the EUT on the spectrum analyzer. 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. The amplitude of each spurious emission was maximized by raising and lowering the FSM antenna, and rotating the turntable before final data was recorded. A Biconilog antenna was used for frequency measurements of 30 to 1000 MHz. A log periodic antenna was used for frequencies of 1000 MHz to 5 GHz and pyramidal horn antennas were used for frequencies of 5 GHz to 40 GHz. Emission levels were measured and recorded from the spectrum analyzer in dBm. The transmitter was then removed and replaced with a substitution antenna and signal generator. The signal from the generator was then adjusted such that the amplitude received was the same as that previously recorded for each frequency. This step was repeated for both horizontal and vertical polarizations. The power in dBm required to produce the desired signal level was then recorded from the signal generator. The power in dBm was then calculated by reducing the previous readings by the power loss in the cable and further corrected for the gain in the substitution antenna. Data was taken at the ROGERS LABS, INC. 3 meters open area test site (OATS). A description of the test facility is on file with the FCC, Reference 90910. The testing procedures used conform to the procedures stated in the TIA/EIA-603 document.

The limits for the spurious radiated emissions are defined by the following equation.

Limit = Amplitude of the spurious emission must be attenuated by this amount below the level of the fundamental. On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth: at least 50 + 10 Log (Po) dB.

2-watt MURS transmitter.

Attenuation = 50 + 10 Log10(Pw)
= 50 + 10 Log10(2)
= 53.0 dB

Limit = spurious emission must be at least 53 dB below the fundamental MURS emission.

Results

The EUT was connected to a 50-ohm load at the antenna terminal and set to transmit at the desired frequency. The amplitude of each spurious emission was then maximized and recorded. The transmitter produces 2.0-watts (MURS) of output power (33 dBm). Then the radiated spurious emission in dB was calculated from the following equation.

Radiated spurious emission (dB) = RSE
Radiated spurious emission (dB) =
10 Log10[Tx power(W)/0.001] – signal level required to reproduce example:
RSE = 10 Log10[2.0/0.001]-(-85.3) = 118.3 dBc

CFR47 2.1053 Spurious Emission Data Channel frequency 151.880

Frequency of Emission	Amplitude of Spurious emission		Signal level to dipole required to reproduce		Emission level below carrier		Limit
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBm	dBm	dBm	dBm	dBc	dBc	dBc
303.77	-97.1	-98.2	-85.3	-86.4	118.3	119.4	53
455.65	-89.4	-87.7	-77.6	-75.9	110.6	108.9	53
607.52	-89.8	-87.4	-78.0	-75.6	111.0	108.6	53
759.40	-75.4	-71.7	-63.6	-59.9	96.6	92.9	53
911.30	-81.0	-87.1	-69.2	-75.3	102.2	108.3	53
1063.20	-83.3	-85.0	-71.5	-73.2	104.5	106.2	53
1215.00	-73.4	-83.8	-61.6	-72.0	94.6	105.0	53
1366.90	-83.6	-73.9	-71.8	-62.1	104.8	95.1	53
1518.80	-88.5	-79.2	-76.7	-67.4	109.7	100.4	53

CFR47 2.1053 Spurious Emission Data Channel frequency 154.600

Frequency of Emission	Amplitude of Spurious emission		Signal level to dipole required to reproduce		Emission level below carrier		Limit
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBm	dBm	dBm	dBm	dBc	dBc	dBc
309.20	-97.6	-97.5	-85.8	-85.7	118.8	118.7	53
463.80	-86.5	-84.8	-74.7	-73.0	107.7	106.0	53
618.40	-88.6	-81.1	-76.8	-69.3	109.8	102.3	53
773.00	-74.6	-69.8	-62.8	-58.0	95.8	91.0	53
927.60	-86.7	-90.5	-74.9	-78.7	107.9	111.7	53
1082.20	-84.4	-78.3	-72.6	-66.5	105.6	99.5	53
1236.80	-74.6	-75.5	-62.8	-63.7	95.8	96.7	53
1391.40	-83.4	-74.8	-71.6	-63.0	104.6	96.0	53
1546.00	-88.7	-82.3	-76.9	-70.5	109.9	103.5	53

CFR47 2.1053 Spurious Emission Data (General)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)

All other measured spurious emissions where 20 db or more below the specified limit.

Specifications of Paragraph 2.1053, 2.1057, applicable paragraphs of part 15 and 95 are met. There are no deviations to the specifications.

2.1055 Frequency Stability

Measurements Required

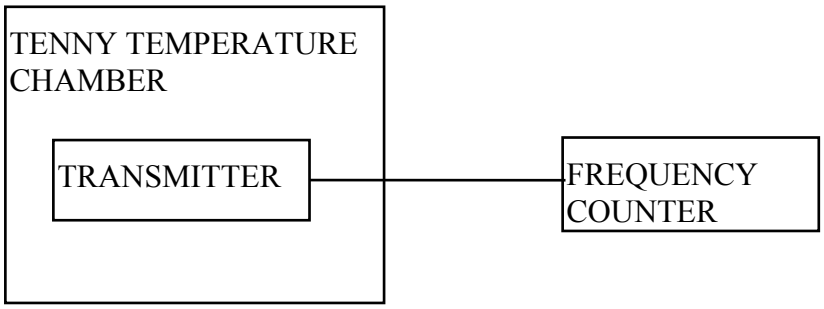
The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components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

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) 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.

Test Arrangement



The measurement procedure outlined below shall be followed:

Steps 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. A Topward 6303A DC Power Supply was used to vary the dc voltage for the power input from 3.15 Vdc to 4.26 Vdc. The frequency was measured and the variation in parts per million was calculated. Data was taken per Paragraphs 2.1055 and applicable paragraphs of part 95.

Results

Frequency	Frequency Stability Vs Temperature In Parts Per Million (Ppm)								
(MHz)	Temperature in °C								
154.6000	-30	-20	-10	0	+10	+20	+30	+40	+50
Δ (Hz)	-50.00	-40.0	-30.0	-20.0	10.0	10.0	310.0	0.0	-360.0
Ppm	-0.323	-0.259	-0.194	-0.129	0.065	0.065	2.005	0.000	-2.329
%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	-0.0002

Frequency In MHz	Frequency Stability Vs Voltage Variation 7.5 Volts Nominal; Results In Ppm Input Voltage		
	3.15 Vdc	3.70 Vdc	4.26 Vdc
154.6000	0.0	0.0	0.0

Frequency In MHz	Frequency Stability Vs Voltage Endpoint 3.70 Volts Nominal; Results In Ppm Battery Endpoint Voltage 3.0 Vdc
154.6000	0.0

Specifications of Paragraphs 2.1055 and applicable paragraphs of parts 2, 15 and 95 are met. There are no deviations to the specifications.

CFR47 15 Subpart C - Intentional Radiators

As per CFR47 Part 15, Subpart C the following information is submitted for consideration in obtaining a grant of certification for unlicensed low power intentional radiators.

CFR47 15.203 Antenna Requirements

The unit is produced with a permanently attached antenna (for part 15C transmitter) inside the sealed plastic case. No provisions for modification or alterations of the antenna configuration are available to the end user. The requirements of 15.203 are met there are no deviations or exceptions to the specification.

CFR47 15.205 Restricted Bands of Operation

Spurious emissions falling in the restricted frequency bands of operation were measured at the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were checked at the OATS, using appropriate antennas or pyramidal horns, amplification stages, and a spectrum analyzer. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. No other significant emission was observed which fell into the restricted bands of operation. Computed emission values take into account the measured radiated field strength, receive antenna correction factor, amplifier gain stage, and test system cable losses.

Sample Calculations:

Computed Peak (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB) - Gain (dB)
= 30.1 + 8.4 - 30
= 8.5

CFR47 15.205 Emissions Data in Restricted Bands

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
136.5	30.1	31.1	8.4	30	8.5	9.5	43.5

Other emissions present presented amplitudes at least 20 dB below the required limits.

CFR47 15.205 Summary of Results for Radiated Emissions in Restricted Bands

The radiated emissions for the EUT meet the requirements for FCC CFR47 Part 15.205 restricted bands of operation. The EUT had a 34.0 dB minimum margin below the limits. No other emissions found in the restricted bands.

CFR47 15.207 Conducted emissions limits; general requirements

CFR47 15.207 AC Line Conducted EMI

The EUT was arranged in a typical equipment battery charging configuration for AC line conducted emissions testing. Testing was performed with the EUT placed on a 1 x 1.5-meter wooden bench 80 cm above the conducting ground plane, floor of a screen room. The bench was positioned 40 cm away from the wall of the screen room. The LISN was positioned on the floor of the screen room 80-cm from the rear of the EUT. Testing for the line-conducted emissions was as follows. The ac adapter for the EUT was connected to the LISN for line-conducted emissions testing. A second LISN was positioned on the floor of the screen room 80-cm from the rear of the supporting equipment of the EUT. All power cords except the EUT were then powered from the second LISN. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor, internal to the LISN. Power line conducted emissions testing was carried out individually for each current carrying conductor of the EUT. The excess length of lead between the system and the LISN receptacle was folded back and forth to form a bundle not exceeding 40 cm in length. The screen room, conducting ground plane, analyzer, and LISN were bonded together to the protective earth ground. Preliminary testing was performed to identify the frequencies of each of the emissions, which had the highest amplitudes. The cables were repositioned to obtain maximum amplitude of measured EMI level. Once the worst-case configuration was identified, plots were made of the EMI from 0.15 MHz to 30 MHz then data was recorded with maximum conducted emissions levels. Refer to Figures seven and eight for plots of the EUT conducted emissions frequency spectrum taken in the screen room.

CFR47 15.207 Data Conducted Emissions (7 Highest Emissions)

Frequency band (MHz)	L1 Level (dBµV) Peak	Q.P.	AVE	L2 Level (dBµV) Peak	Q.P.	AVE	CISPR 22 Limit Q.P. Ave(dBµV)
0.15 – 0.5	40.2	32.7	20.4	40.5	39.5	20.6	66-56 / 56-46
0.5 – 5	43.2	39.0	27.3	42.5	39.8	29.9	56 / 46
5 – 10	26.6	20.9	10.1	26.9	20.0	10.1	60 / 50
10 – 15	24.0	19.0	9.5	24.3	19.2	9.6	60 / 50
15 – 20	19.3	14.9	8.3	19.8	14.6	8.0	60 / 50
20 – 25	19.9	14.5	8.1	20.6	14.6	8.4	60 / 50
25 – 30	19.2	14.5	8.0	19.4	14.5	8.0	60 / 50

Other emissions present had amplitudes at least 20 dB below the limit.

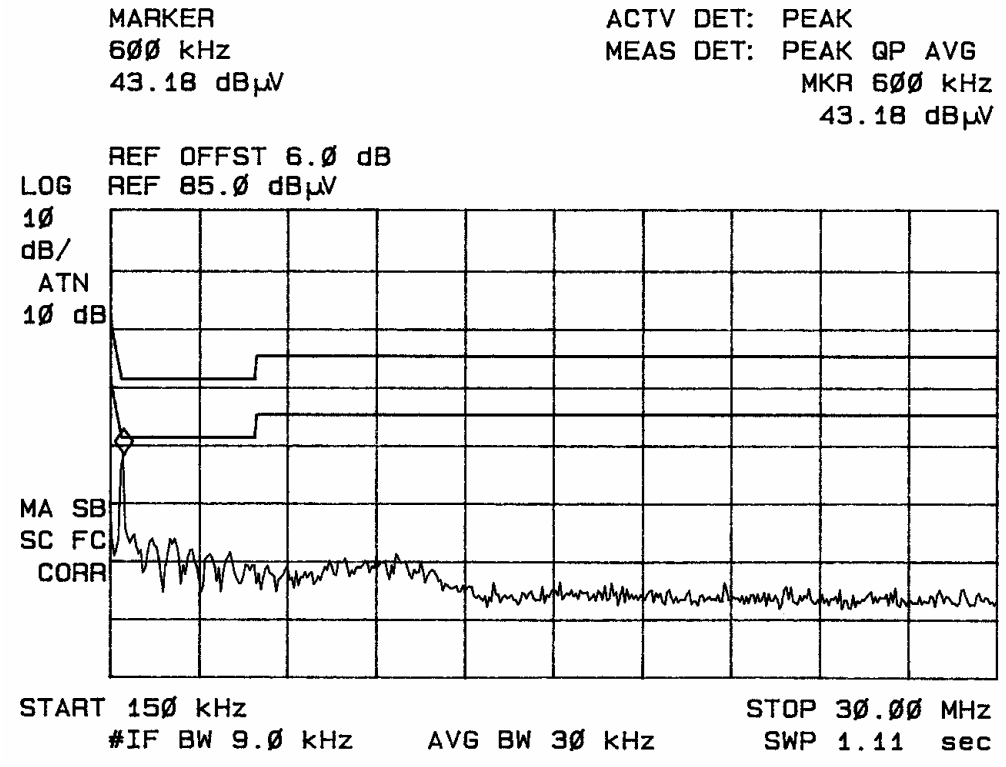


Figure seven Conducted emissions of EUT line 1

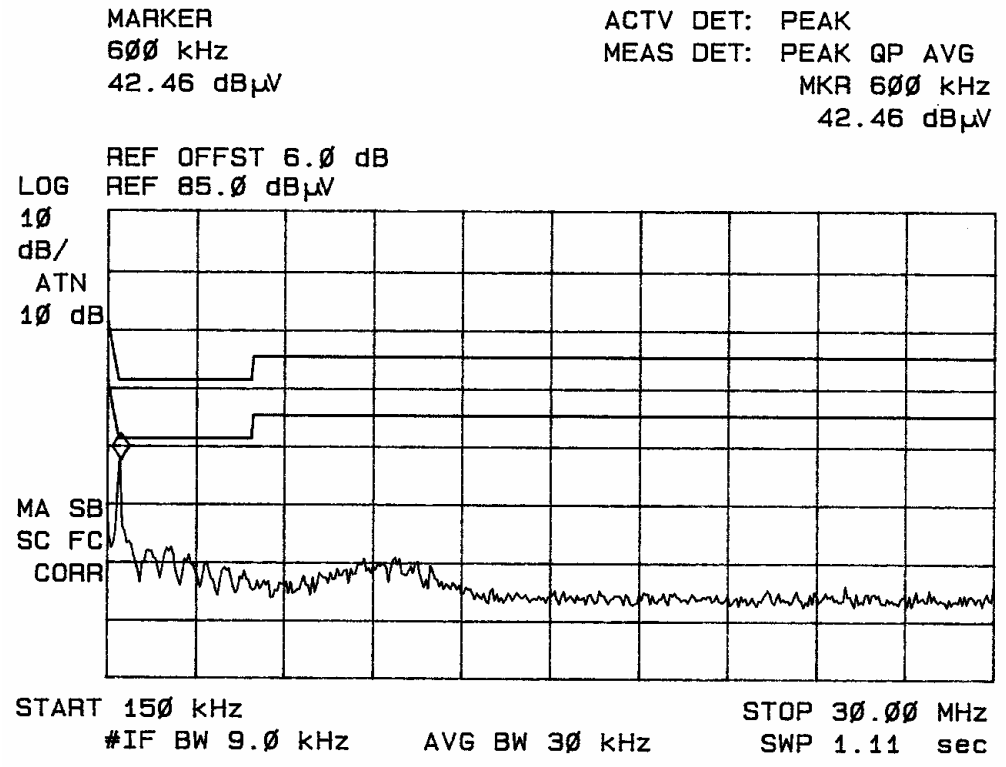


Figure eight Conducted emissions of EUT line 2

CFR47 15.207 Summary of Results for AC Line Conducted General Emissions

The conducted emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT worst-case had a 16.2 dB minimum margin below the FCC/CISPR quasi peak limit, and a 16.1 dB minimum margin below the FCC/CISPR average limit. Other emissions were present with recorded data representing the worst-case amplitudes.

CFR47 15.209 Radiated emissions limits; general requirements

CFR47 15.209 General Radiated EMI

The EUT was arranged in a typical equipment configuration and operated through all of its various modes. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions investigations were performed to identify the frequencies, which produced the highest emissions. Plots were made of the radiated emission frequency spectrum from 30 MHz to 18,000 MHz for the preliminary testing. Refer to figures nine through thirteen showing the worst-case radiated emission spectrum displayed on the spectrum analyzer taken in a screen room. The highest radiated emission was then re-maximized at the OATS site before final radiated emissions measurements were performed. Final data was taken with the EUT located at the open field test site at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 30 MHz to 25,000 MHz was searched for radiated emissions. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. Measured emission levels were maximized by EUT placement on the table, changing cable location, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna polarization between horizontal and vertical. Antennas used were Broadband Biconical from 30 MHz to 200 MHz, Log Periodic from 200 MHz to 5 GHz, and/or Biconilog from 30 MHz to 1000 MHz, Pyramidal Horns from 5 GHz to 25 GHz, and amplification stages.

Sample Calculations:

RFS = Radiated Field Strength
dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain
dBµV/m @ 3m = 30.1 + 8.4 - 30
= 8.5

CFR47 15.209 General Radiated Emissions Data

Emission Freq. (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
136.5	30.1	31.1	8.4	30	8.5	9.5	43.5

Other emissions present presented amplitudes at least 20 dB below limits.

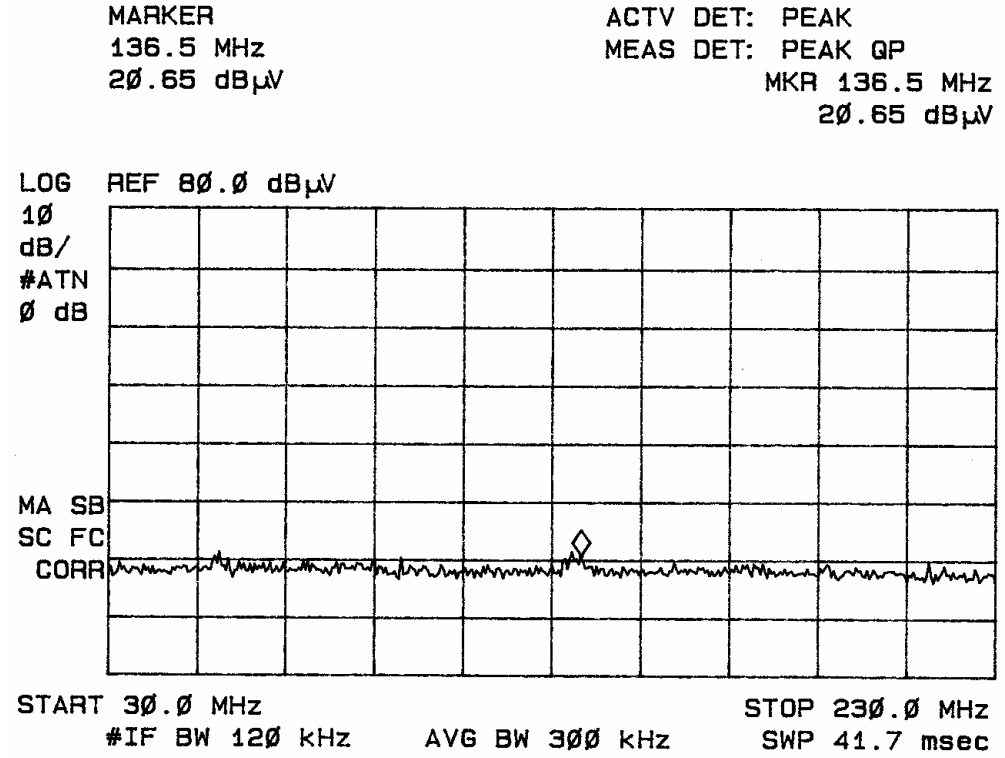


Figure nine Radiated Emissions taken at 1 meter in screen room.

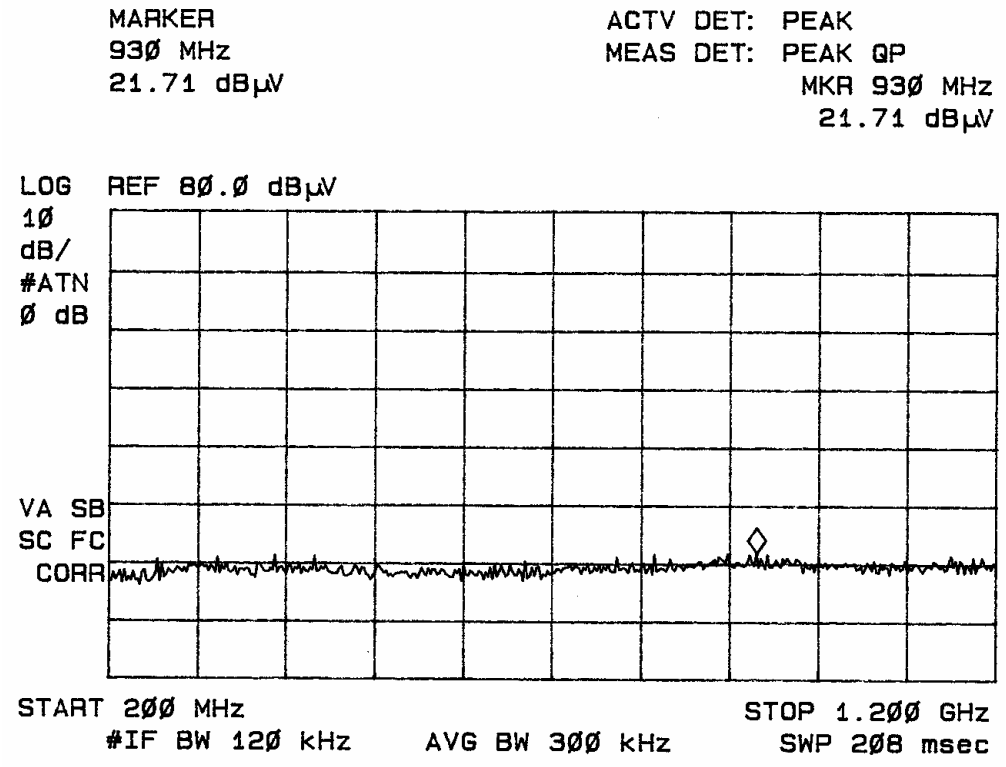


Figure ten Radiated Emissions taken at 1 meter in screen room.

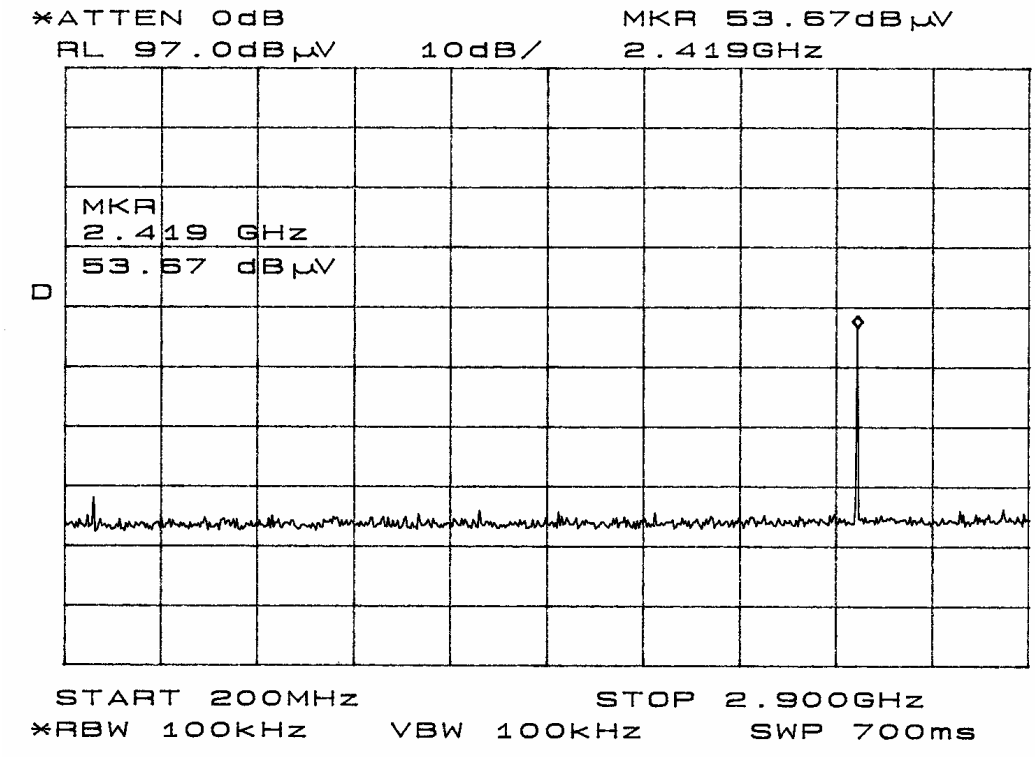


Figure eleven Radiated Emissions taken at 1 meter in screen room.

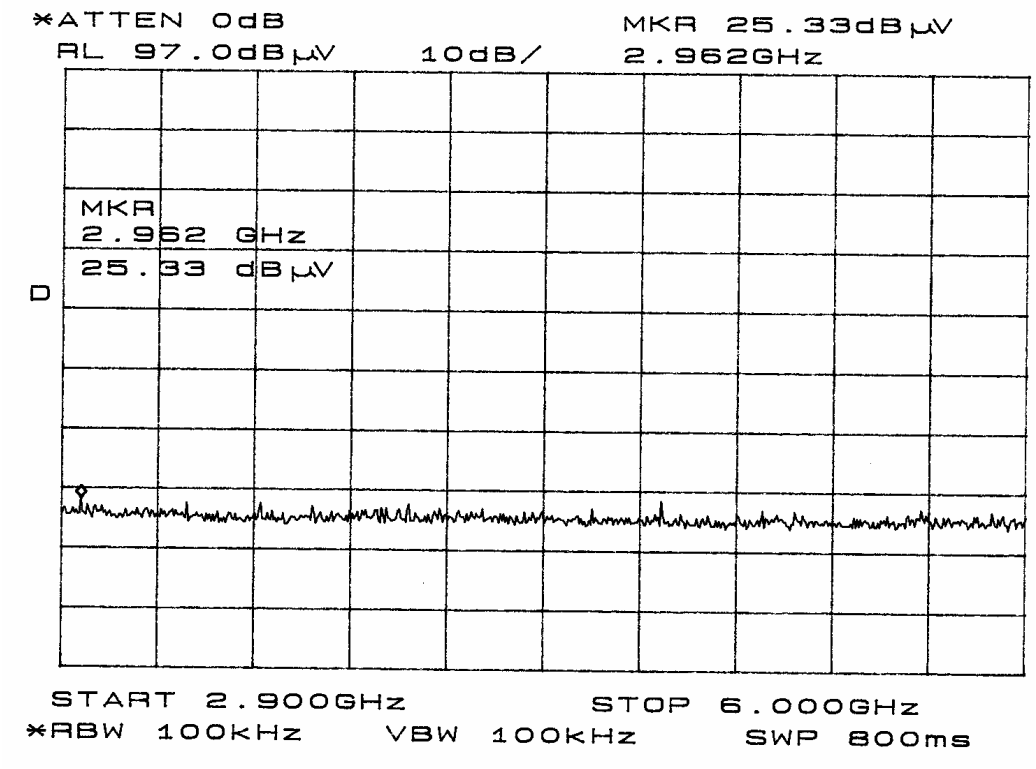


Figure twelve Radiated Emissions taken at 1 meter in screen room.

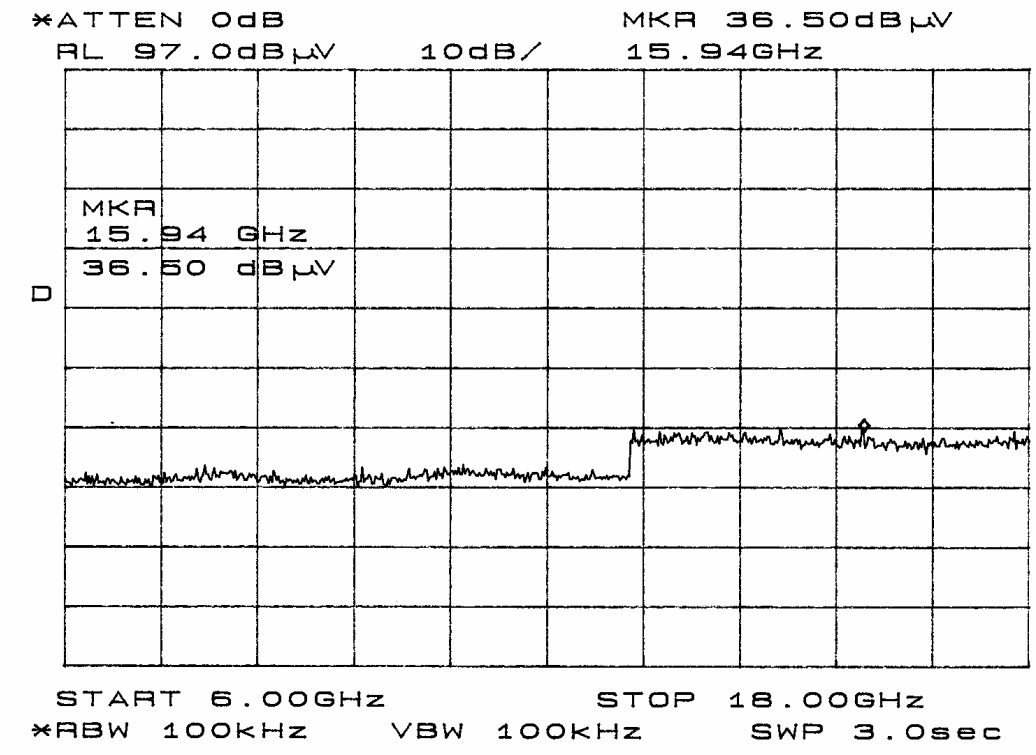


Figure thirteen Radiated Emissions taken at 1 meter in screen room.

CFR47 15.209 Summary of Results for General Radiated Emissions

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had a 34.0 dB minimum margin below the limits. Other emissions were present with amplitudes at least 20 dB below the FCC Limits.

CFR47 15.249 Operation in the Band 2,400-2,483.5 MHz

The power output was measured on an open field test site @ 3 meters. Refer to figures fourteen through seventeen for plots demonstrating compliance to 15.249 operation.

(a) The EUT was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from the FSM antenna. The peak and average amplitude of the carrier frequency was measured using a spectrum analyzer. The peak and average emission amplitude of the emission was then recorded from the analyzer display.

(b) Emissions radiated outside of the specified bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation. The amplitudes of each spurious emission were measured at the OATS at a distance of 3 meters from the FSM antenna. The amplitude of each spurious emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable. A Biconilog Antenna was used for measuring emissions from 30 to 1000 MHz, a Log Periodic Antenna for 200 to 5000 MHz, and Pyramidal Horn Antennas from 4 GHz to 25 GHz. Emissions were measured in dBµV/m @ 3 meters.

Sample calculation

dBµv/m@ 3m = FSM + A.F. + cable loss - amplifier Gain
= 78.0 + 28.1 – 30
= 76.1

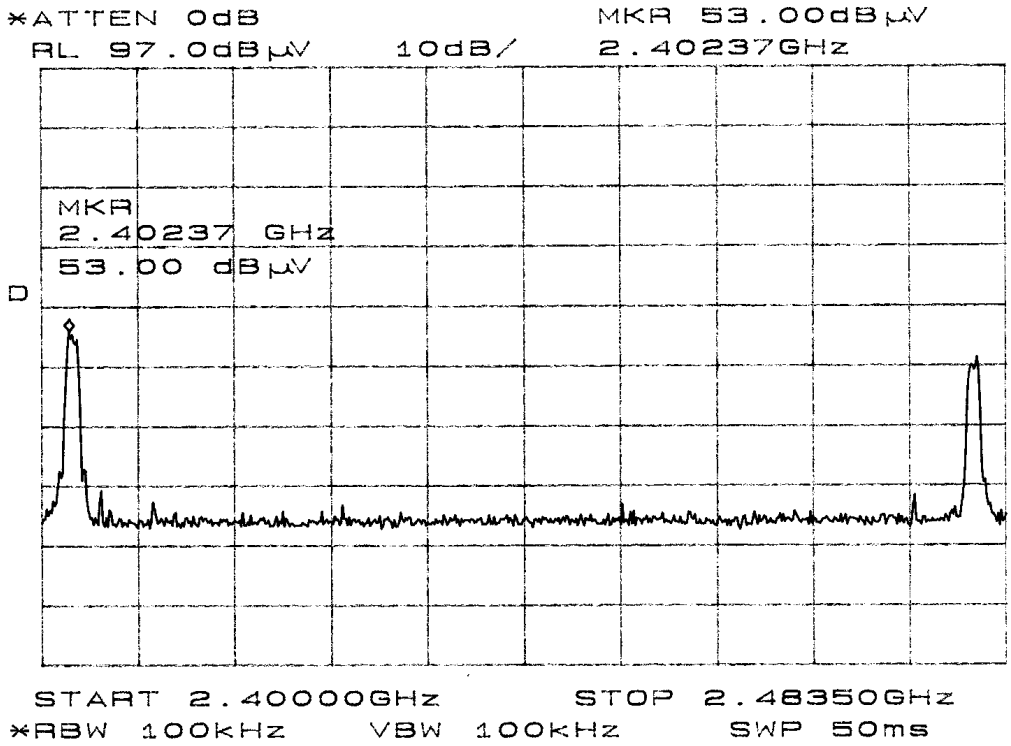


Figure fourteen Radiated Emissions taken at 1 meter in screen room.

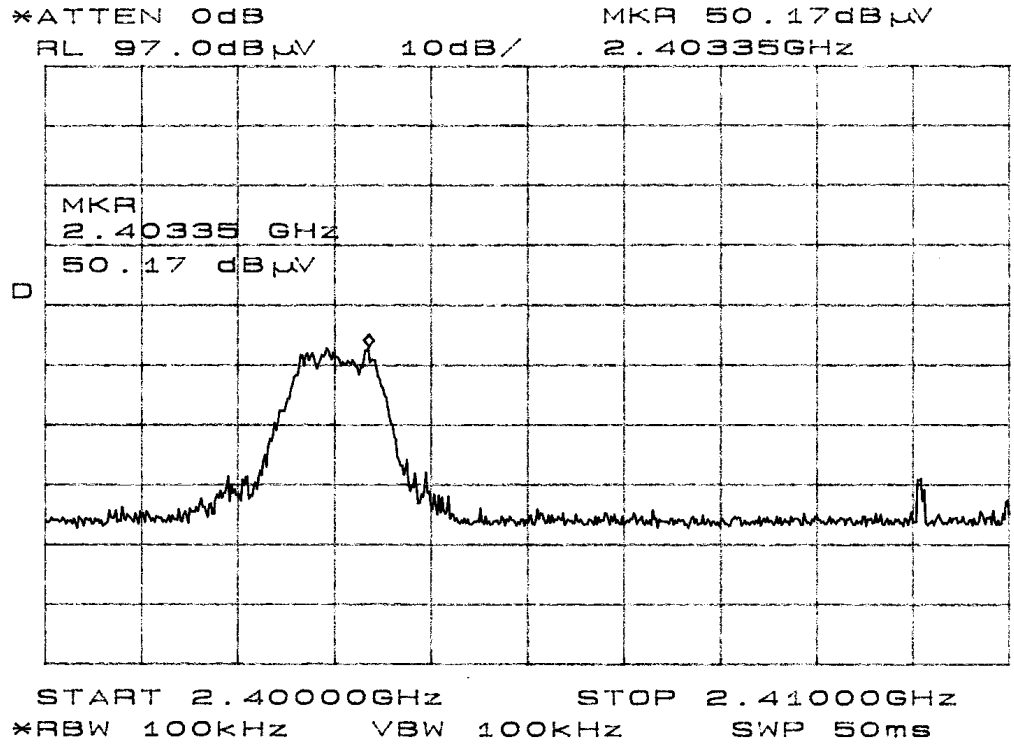


Figure fifteen Radiated Emissions taken at 1 meter in screen room.

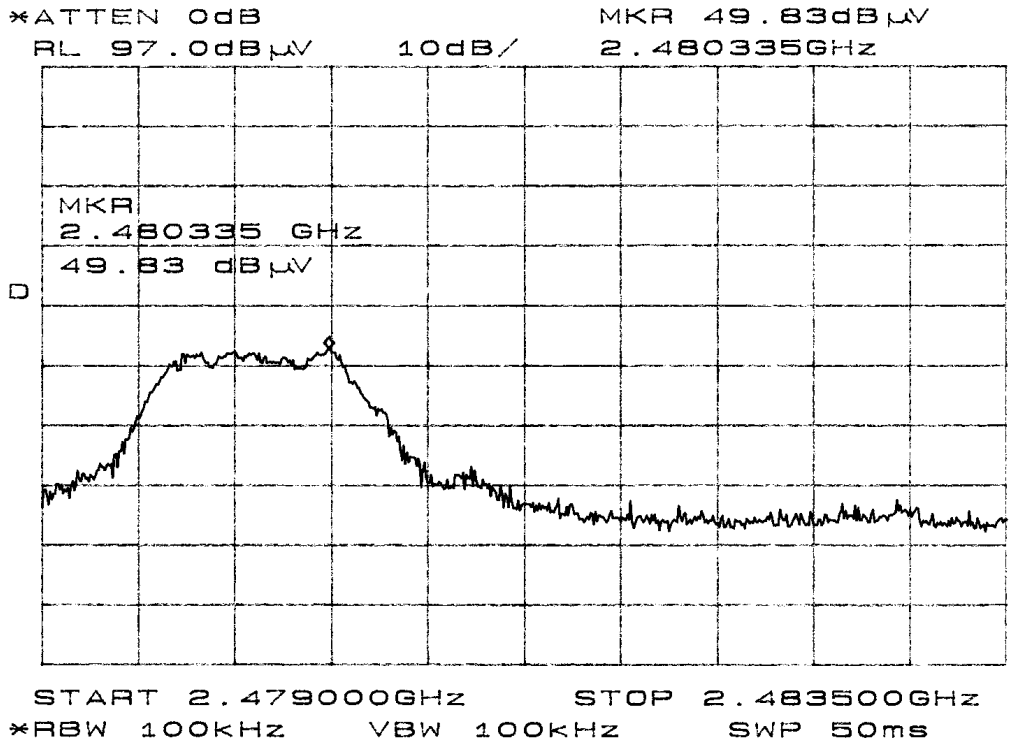


Figure sixteen Radiated Emissions taken at 1 meter in screen room.

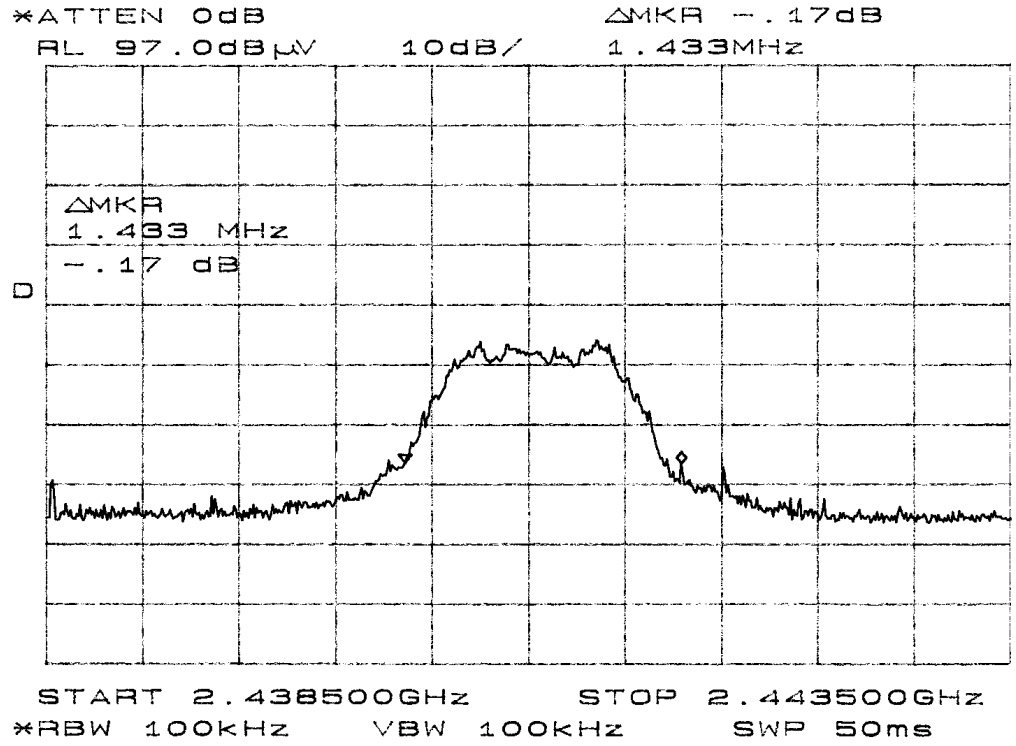


Figure seventeen Radiated Emissions taken at 1 meter in screen room.

CFR47 15.249 Transmitter Radiated Emissions Data

Emission Frequency (MHz) (polarization)	FSM Peak (dBμV)	FSM Average (dBμV)	Ant. Factor (dB)	Amp. Gain (dB)	RFS Peak @ 3m (dBμV/m)	RFS Average @ 3m (dBμV/m)	Limit @ 3m (ave) (dBμV/m)
2403.0 (H)	78.0	59.3	28.1	30	76.1	57.4	94.0
2403.0 (V)	77.8	50.5	28.1	30	75.9	48.6	94.0
4806.0 (H)	40.3	22.3	32.9	30	43.2	26.2	54.0
4806.0 (V)	39.7	23.5	32.9	30	42.6	26.4	54.0
7209.0 (H)	32.7	20.8	36.0	30	38.7	26.8	54.0
7209.0 (V)	33.6	22.1	36.0	30	39.6	28.1	54.0
2441.3 (H)	79.3	59.6	28.1	30	77.4	57.7	94.0
2441.3 (V)	74.3	54.5	28.1	30	72.4	52.6	94.0
4882.6 (H)	35.8	23.0	32.9	30	38.7	25.9	54.0
4882.6 (V)	42.5	21.0	32.9	30	45.4	23.9	54.0
7323.9 (H)	28.0	21.1	36.0	30	34.0	27.1	54.0
7323.9 (V)	27.8	20.8	36.0	30	33.8	26.8	54.0
2480.3 (H)	77.5	56.6	28.1	30	75.6	54.7	94.0
2480.3 (V)	73.5	54.3	28.1	30	71.6	52.4	94.0
4960.6 (H)	33.8	19.3	32.9	30	36.7	22.2	54.0
4960.6 (V)	34.5	21.6	32.9	30	37.4	24.5	54.0
7440.9 (H)	29.3	21.6	36.0	30	35.3	27.6	54.0
7440.9 (V)	26.0	20.1	36.0	30	32.0	26.1	54.0

Note: Levels measured @ 3-meter OATS site.

CFR47 15.249 Power from Antenna Substitution Method Data

Frequency of Emission	Measured Peak Amplitude of EUT emission		Signal level to substitution antenna required to reproduce	
	Horizontal	Vertical	Horizontal	Vertical
(MHz)	dBµV	dBµV	dBm	dBm
2403.0	76.1	75.9	-19.1	-19.3
244130	77.4	72.4	-17.8	-22.8
2480.3	75.6	71.6	-19.6	-23.6

CFR47 15.249 Summary of Results for Transmitter Radiated Emissions

The EUT had a peak amplitude emission of 16.6 dB margin below the average limit of 15.249. The EUT had an average amplitude of harmonic emissions of 45.6 dB margin below the average limit of 15.209 and 15.249. The radiated emissions for the EUT meet the requirements for FCC CFR47 Part 15.249 Intentional Radiators. There are no measurable emissions in the restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the FCC Limits.

APPENDIX

Model: 011-01434-00

Test Equipment List.

Rogers Qualifications.

FCC Site Approval Letter.

TEST EQUIPMENT LIST FOR ROGERS LABS, INC.

The test equipment used is maintained in calibration and good operating condition. Use of this calibrated equipment ensures measurements are traceable to national standards.

List of Test Equipment	Calibration Date
Oscilloscope Scope: Tektronix 2230	2/06
Wattmeter: Bird 43 with Load Bird 8085	2/06
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/06
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/06
R.F. Generator: HP 606A	2/06
R.F. Generator: HP 8614A	2/06
R.F. Generator: HP 8640B	2/06
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	2/06
Spectrum Analyzer: HP 8591EM	5/06
Frequency Counter: Leader LDC825	2/06
Antenna: EMCO Biconilog Model: 3143	5/06
Antenna: EMCO Log Periodic Model: 3147	10/06
Antenna: Antenna Research Biconical Model: BCD 235	10/06
Antenna: EMCO Dipole Set 3121C	2/06
Antenna: C.D. B-101	2/06
Antenna: Solar 9229-1 & 9230-1	2/06
Antenna: EMCO 6509	2/06
Audio Oscillator: H.P. 201CD	2/06
R.F. Power Amp 65W Model: 470-A-1010	2/06
R.F. Power Amp 50W M185- 10-501	2/06
R.F. PreAmp CPPA-102	2/06
LISN 50 µHy/50 ohm/0.1 µf	10/06
LISN Compliance Eng. 240/20	2/06
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	6/05
Peavey Power Amp Model: IPS 801	2/06
Power Amp A.R. Model: 10W 1010M7	2/06
Power Amp EIN Model: A301	2/06
ELGAR Model: 1751	2/06
ELGAR Model: TG 704A-3D	2/06
ESD Test Set 2010i	2/06
Fast Transient Burst Generator Model: EFT/B-101	2/06
Current Probe: Singer CP-105	2/06
Current Probe: Solar 9108-1N	2/06
Field Intensity Meter: EFM-018	2/06
KEYTEK Ecat Surge Generator	2/06
Shielded Room 5 M x 3 M x 3.0 M	

10/18/2006

QUALIFICATIONS

Of

SCOT D. ROGERS, ENGINEER

ROGERS LABS, INC.

Mr. Rogers has approximately 16 years experience in the field of electronics. Six years working in the automated controls industry and 6 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
December 13, 2006
Date

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

May 16, 2006

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: May 16, 2006

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
Information Technician

Industry Canada Industrie Canada

May 23rd, 2006

OUR FILE: 46405-3041
Submission No: 115252

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

Dear Sir/Madame:

The Bureau has received your application for the Alternate Test Site or OATS and the filing is satisfactory to Industry Canada.

Please reference to the file number **(3041-1)** in the body of all test reports containing measurements performed on the site.

In the future, to obtain or renew a unique registration number, you may demonstrate that the site has been accredited to ANSI C63.4-2003 or later.

If the site is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating conformance with the ANSI standard. The Department 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.

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

Yours sincerely,

Robert Corey
Manager Certification
Certification and Engineering Bureau
3701 Carling Ave., Building 94
Ottawa, Ontario K2H 8S2

Canada