SUBMITTAL APPLICATION REPORT

FOR GRANT OF CERTIFICATION

MODEL: SMQ
WIRELESS MICROPHONE TRANSMITTER

FCC ID: DBZSMQH

Operating under rule of CFR Part 74, Subpart H

FOR

LECTROSONICS, INC.

581 Laser Road
Rio Rancho, NM 87124

Test Report Number 060815H

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

ENGINEERING TEST REPORT
FOR
APPLICATION of
GRANT of CERTIFICATION

for

LECTROSONICS, INC.

581 Laser Road
Rio Rancho, NM 87124

Larry Fisher
Vice President of Engineering

MODEL: SMQ TRANSMITTER
Wireless Microphone Transmitter

FCC ID: DBZSMQH

FREQUENCY: 691.2-767.9 MHz

Test Date: August 15, 2006

Certifying Engineer:

Scot D. Rogers
ROGERS LABS, INC.
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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, 2.925, 2.926, 2.1031 through 2.1057 and; Part 74 Subpart H; Paragraphs 74.801 through 74.861 the following report is submitted.

Applicable Standards & Test Procedures

a) 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, 2.925, 2.926, 2.1031 through 2.1057, and applicable paragraphs of Part 74 the following is submitted for consideration in obtaining a Grant of Certification.

b) Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in ANSI 63.4-2003 and TIA/EIA 603.

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
100 kHz	300 kHz	Peak

EQUIPMENT	MFG.	MODEL	CAL. DATE	DUE.
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/05	10/06
LISN	Comp. Design	1762	2/06	2/07
Antenna	ARA	BCD-235-B	10/05	10/06
Antenna	EMCO	3147	10/05	10/06
Antenna	EMCO	3143	5/06	5/07
Analyzer	HP	8591EM	5/06	5/07
Analyzer	HP	8562A	2/06	2/07

2.1033(C) Application for Certification

(1) The full name and mailing address of the manufacturer of the device and the applicant for certification.

Lectrosonics, Inc.
581 Laser Road
Rio Rancho, NM 87124

(2) FCC identifier. DBZSMQH

(3) A copy of the installation and operating instructions to be furnished the user. Refer to the instruction manual furnished with this application for details.

(4) Type or types of emission. 180KF3E

(5) Frequency range of operation: 691.2-767.9 MHz

(6) Range of operating power values or specific operating power levels, and description of any means provided for variation of operating power. The output power is factory set to 250 mW. The EUT has no provision for operator variation of the output power.

(7) Maximum power rating as defined in the applicable part(s) of the rules. As stated in CFR 47, 74.861(e)(ii), the maximum permissible output power allowed is 250 mW.

(8) The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range. The SMQ model final amplification stage runs at 3.86 volts with 58 mA current for a power requirement of 424.6 mW.

(9) Tune-up procedure over the power range, or at specific operating power levels. Refer to the tune-up procedure furnished with this application for details.

(10) A schematic diagram and a description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power. Refer to the schematics furnished with this application for details.

(11) A photograph or drawing of the equipment identification plate or label shows the information to be placed thereon. Refer to

the FCC identification label information furnished with this application for details.

(12) Photographs (8'' x 10'') of the equipment of sufficient clarity to reveal equipment construction and layout, including meters, if any, and labels for controls and meters and sufficient views of the internal construction to define component placement and chassis assembly. Insofar as these requirements are met by photographs or drawings contained in instruction manuals supplied with the certification request, additional photographs are necessary only to complete the required showing. Refer to the exhibits of this report and or additional information furnished with the application for details.

(13) For equipment employing digital modulation techniques, a detailed description of the modulation system to be used, including the response characteristics (frequency, phase, and amplitude) of any filters provided, and a description of the modulating wave train, shall be submitted for the maximum rated conditions under which the equipment will be operated. The unit does not use digital modulation. It uses digital processing go get the audio ready for transmission, and then converts it back to audio before transmission.

(14) The data required by Sections 2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in Section 2.1041.

(15) The application for certification of an external radio frequency power amplifier under Part 97 of this chapter need not be accompanied by the data required by Paragraph (b)(14) of this section. In lieu thereof, measurements shall be submitted to show compliance with the technical specifications in Subpart C of Part 97 of this chapter and such information as required by Section 2.1060 of this part. This paragraph does not apply to this equipment.

(16) An application for certification of an AM broadcast stereophonic exciter-generator intended for interfacing with existing certified, or formerly type accepted or notified transmitters must include measurements made on a complete stereophonic transmitter. The instruction book must include complete specifications and circuit requirements for interconnecting with existing transmitters. The instruction book must also provide a full description of the equipment and measurement procedures to monitor modulation and to verify that the combination of stereo exciter-generator and transmitter meets the emission limitations of section 73.44. This paragraph does not apply to this equipment.

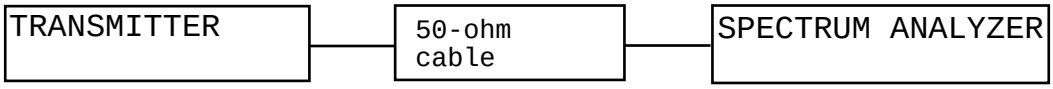
(17) A single application may be filed for a composite system that incorporates devices subject to certification under multiple rule parts; however, the appropriate fee must be included for each device. Separate applications must be filed if different FCC Identifiers will be used for each device.

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 output power was measured at the antenna terminal by placing the coaxial cable 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 HP 8591EM 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. Data was taken per Paragraph 2.1046(a) and applicable paragraphs of Part 74.

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

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

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

$\text{milliwatts} = 10^{(23.87/10)}$
= 243.8 mW
= 0.25 Watts

Results

FREQUENCY	P_{dBm}	P_{mw}	P_w
743.0	23.87	243.8	0.25
755.0	23.67	232.8	0.25
767.5	23.50	223.9	0.25

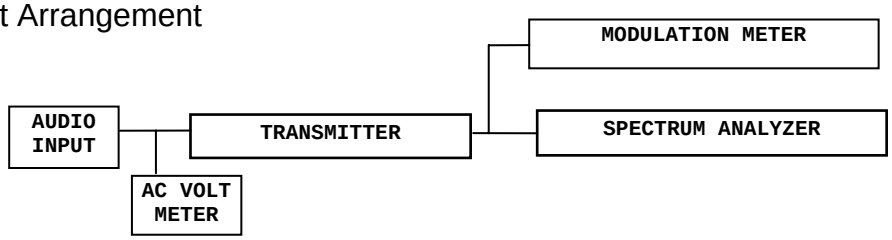
The specifications of Paragraph 2.1046(a) and applicable paragraphs of Part 74 are met. There are no deviations to the specifications.

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 standard mode. The modulation meter was used to measure the percent modulation or frequency deviation.

Results

Figure 1 displays the graph made showing the audio frequency response of the modulator. The frequency generator was set to 1 kHz and injected into the audio input port of the EUT. The input voltage amplitude was adjusted to obtain 50% modulation at 1000 Hz. This level was then taken as the 0-dB reference. The frequency of the generator was then varied and the voltage input level recorded while holding the output modulation level constant.

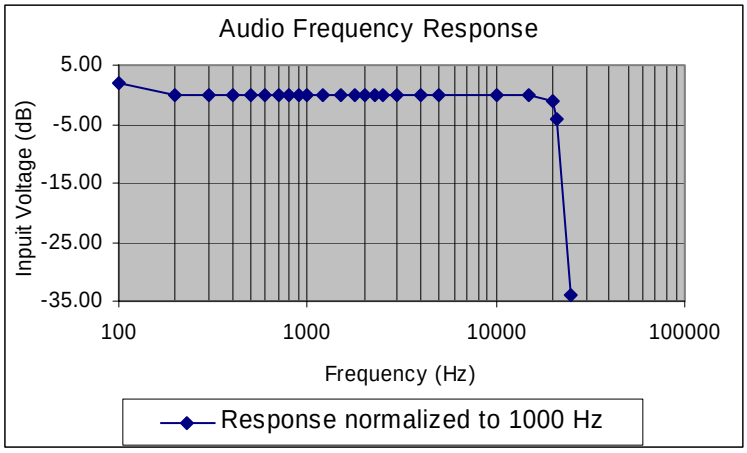


Figure one Audio Frequency Response Characteristics.

Figure 2 shows the frequency deviation response for each of eight frequencies while the input voltage was varied. The frequency was held constant and the frequency deviation was read from the deviation meter.

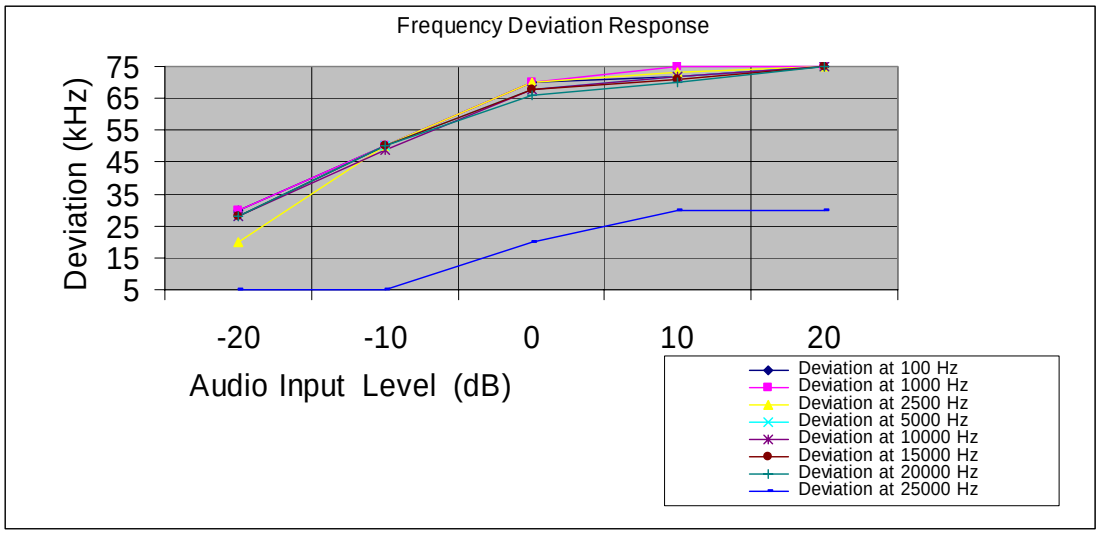


Figure two Deviation Characteristics.

Figure 3 shows the frequency response of the audio low pass filter.

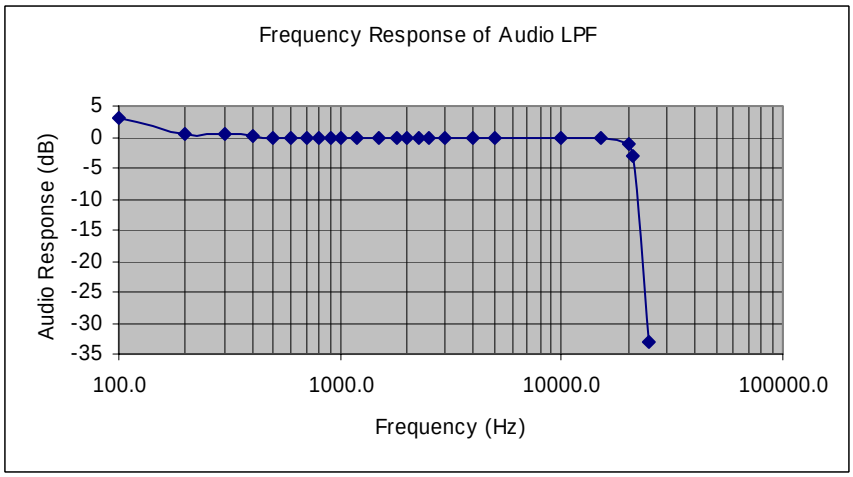


Figure three Frequency Response of Audio low Pass Filter.

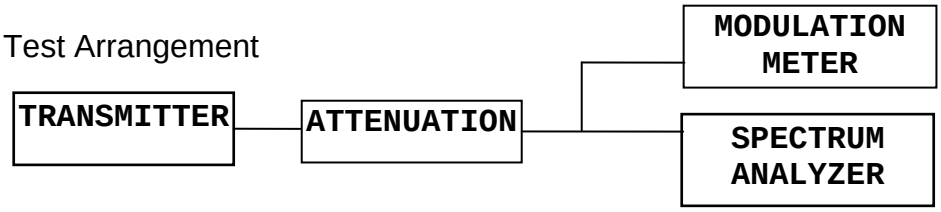
The specifications of Paragraph 2.1047 and applicable parts of 74 are met.

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.

Test Arrangement



A spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in a normal mode, modulated by a frequency of 2,500 Hz and again at 15,000 Hz. The power ratio in dB representing 99.5% of the total mean power was recorded from the spectrum analyzer. Refer to figures four through nine showing plots of the 99.5% power and spectral emissions mask.

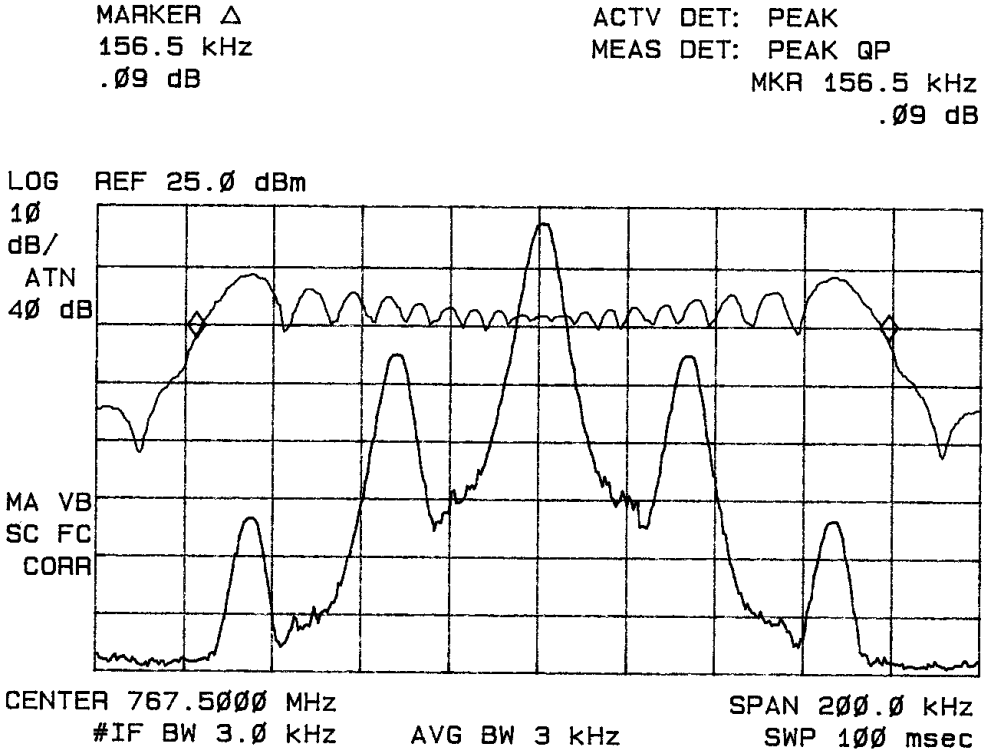


Figure four Occupied Bandwidth Measurement with 2500 Hz input

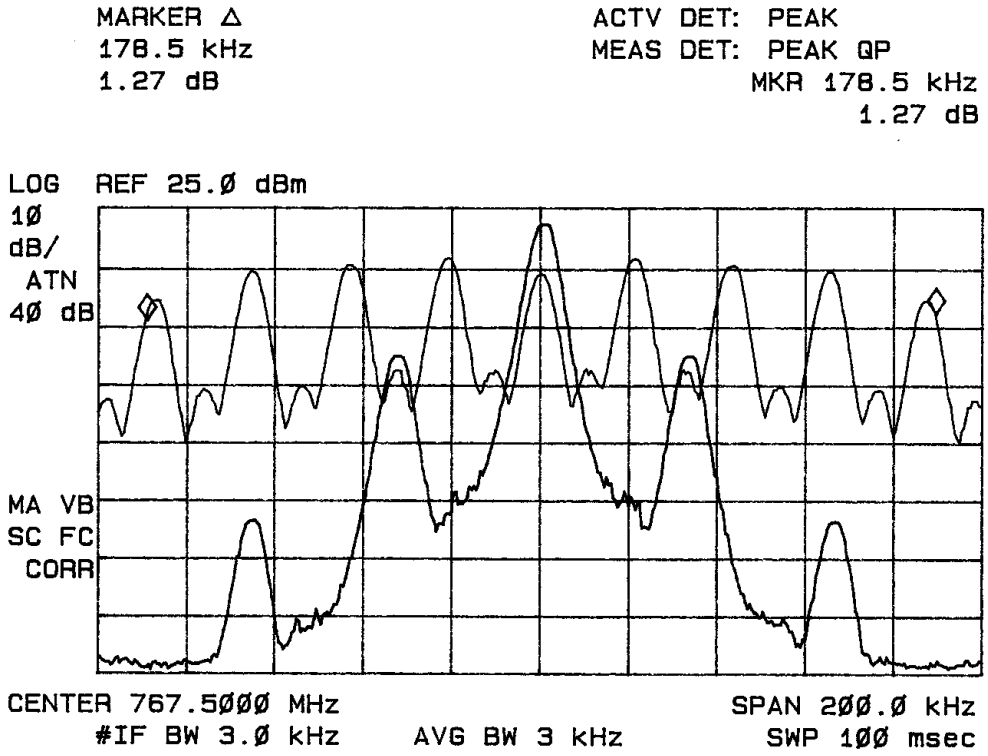


Figure five Occupied Bandwidth Measurement with 21,000 Hz input

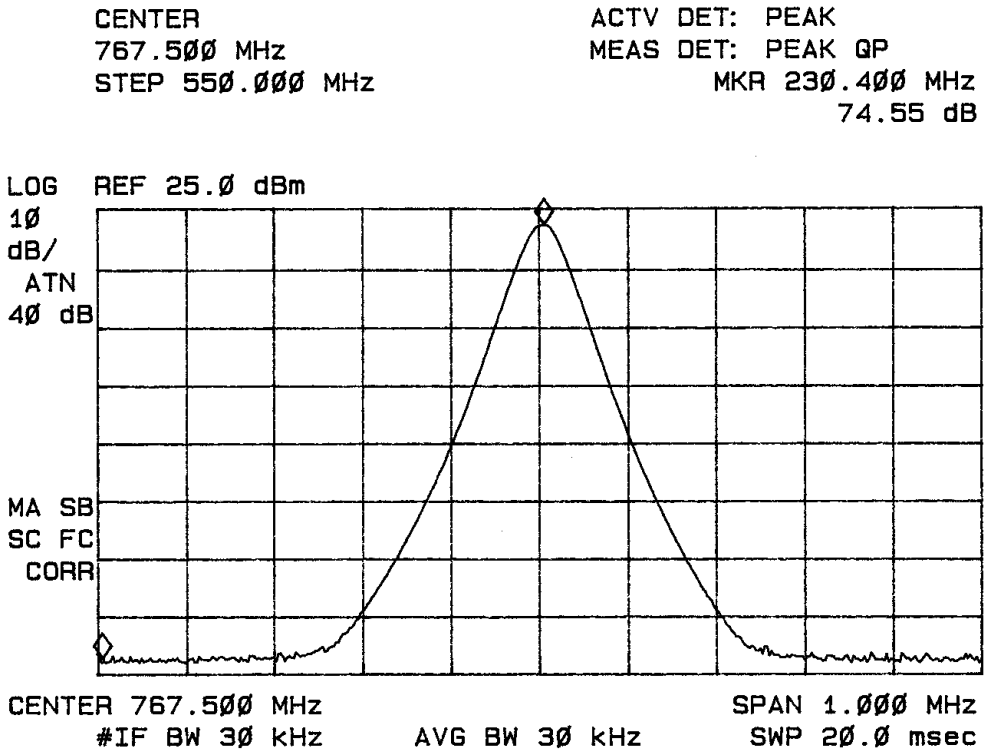


Figure six emissions mask

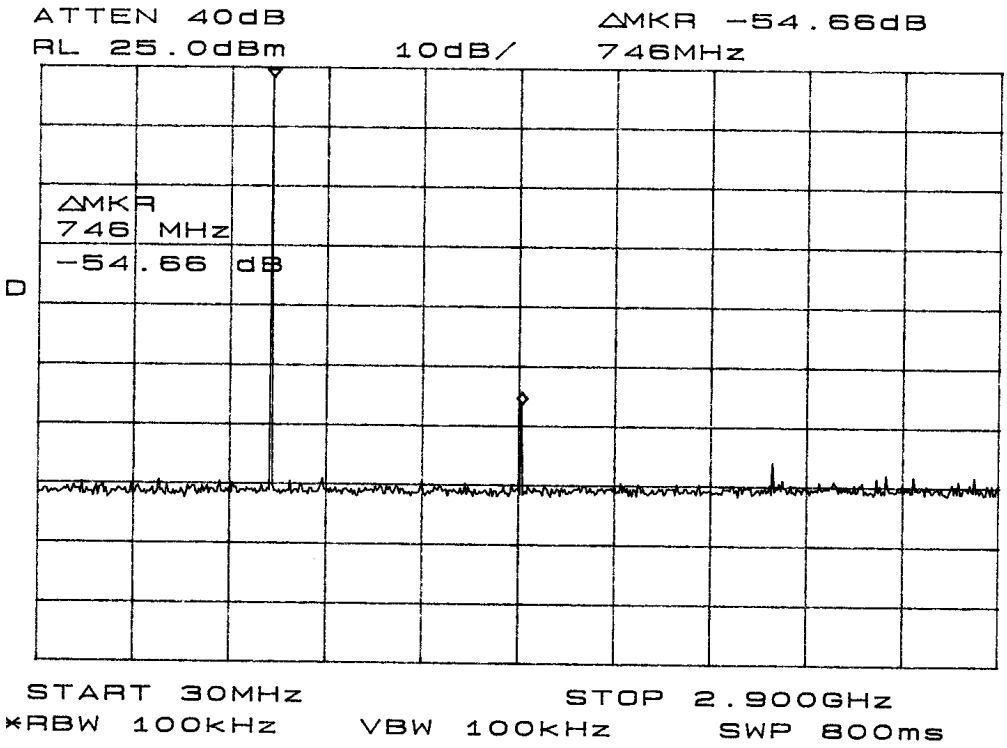


Figure seven emissions mask

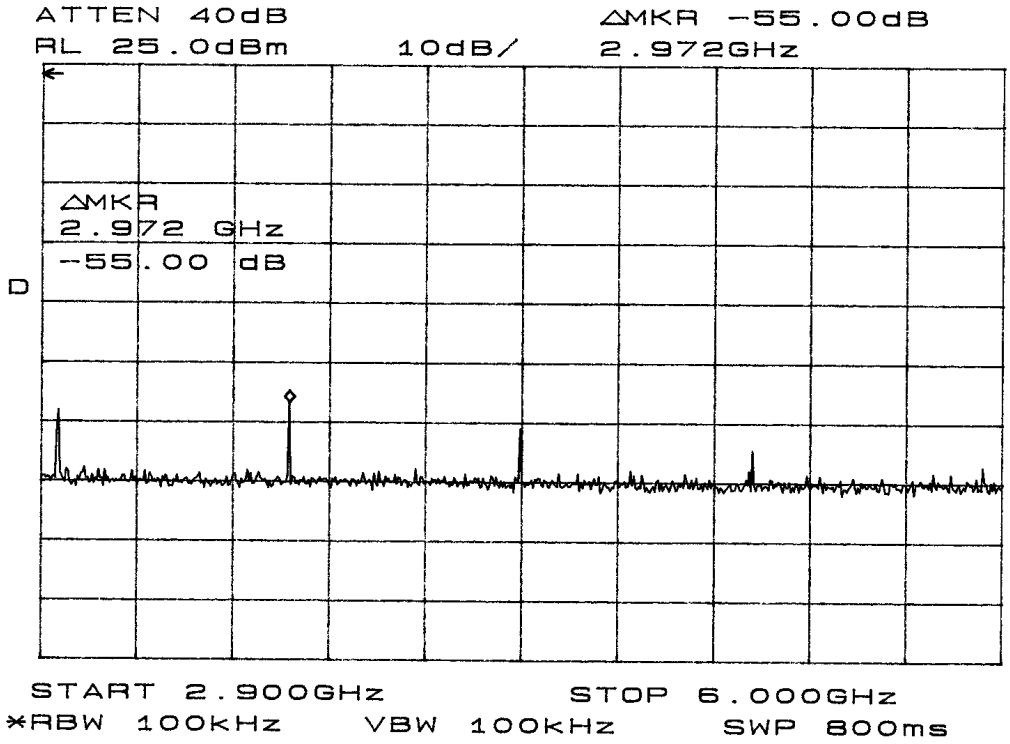


Figure eight emissions mask

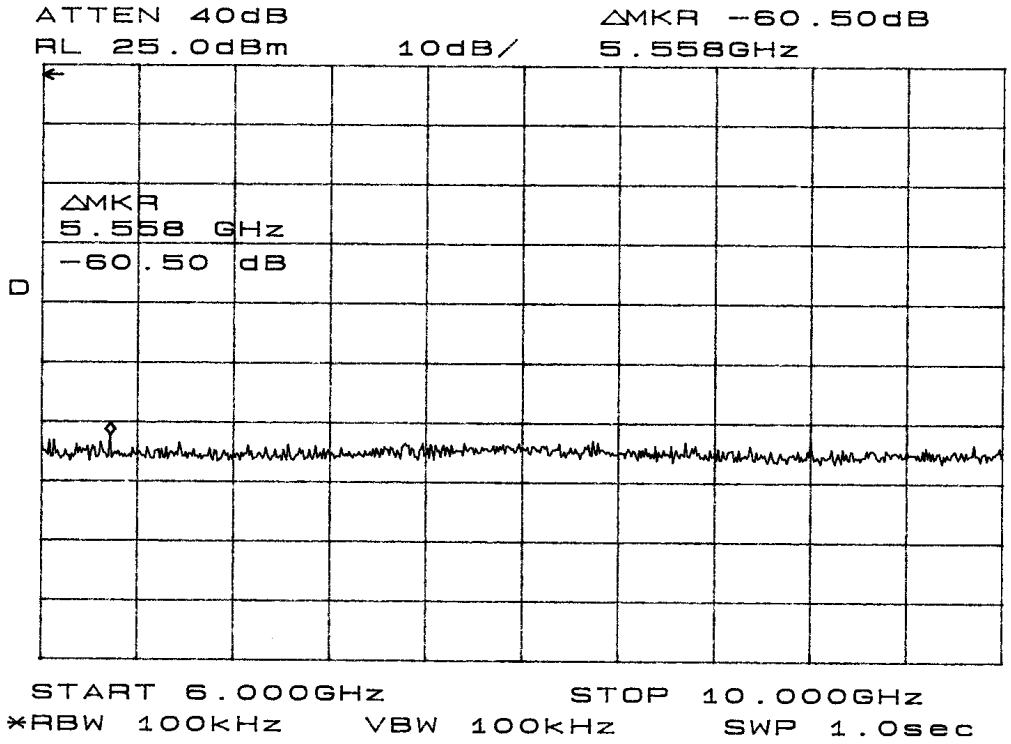


Figure nine emissions mask

Results

The necessary bandwidth for this sound broadcasting class of equipment is calculated from the equation B_n=2M+2DK (k=1, M=15,000 and D=75,000). This equates to a necessary bandwidth of 180 kHz. The limiting circuitry of the device reduces the measured bandwidth due to the constant frequency signal wave used as the input.

f_c (MHz)	Occupied Bandwidth(kHz)
767.500	178.5 (measured)

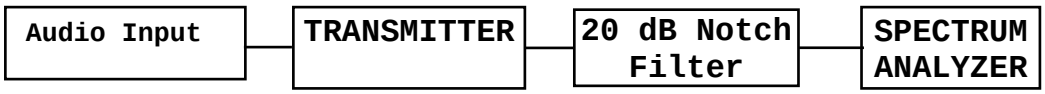
Requirements of 2.1049(c)(1) and applicable paragraphs of Parts 2, 22, and 74 are met. There are no deviations to the specifications.

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 8591EM and/or 8562A Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter modulated per section 2.1049 and operated in a normal mode. The frequency spectrum from 50 MHz to 10,000 MHz was observed and plots produced of the frequency spectrum. Figures seven through nine represents data for the spurious emissions of the UM450. Data was taken per 2.1051, 2.1057, and applicable paragraphs of Part 74.

Results

The output of the unit 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 74.

FCC Limit: The spurious emissions must be reduced in power by at least 43 + 10 LOG(P_o) below the carrier output power.

Limit for 0.25W = 43 + 10 LOG(P_o)
Limit = 43 + 10 LOG(0.250)
Limit = 37.0 dB below carrier
Limit = 24 – 37 dBm (-13 dBm limit)

CHANNEL MHz	SPURIOUS FREQ. (MHz)	MEASURED LEVEL (dBm)	LEVEL BELOW CARRIER (dB)
743.00	1486.0	-32.1	56.0
	2229.0	-43.0	66.9
	2972.0	-33.8	57.7
	3715.0	-32.0	55.9
	4458.0	-37.3	61.2
	5201.0	-42.1	66.0
	5944.0	-48.6	72.5
	6687.0	-46.6	70.5
	7430.0	-48.1	72.0
755.00	1510.0	-32.0	55.7
	2265.0	-47.7	71.4
	3020.0	-33.8	57.5
	3775.0	-37.5	61.2
	4530.0	-40.7	64.4
	5285.0	-44.5	68.2
	6040.0	-47.0	70.7
	6795.0	-48.8	72.5
	7550.0	-50.5	74.2
767.50	1535.0	-36.7	60.2
	2302.5	-38.8	62.3
	3070.0	-42.5	66.0
	3837.5	-35.3	58.8
	4605.0	-38.0	61.5
	5372.5	-42.8	66.3
	6140.0	-51.5	75.0
	6907.5	-42.8	66.3
	7675.0	-42.6	66.1

Specifications of Paragraphs 2.1051, 2.1057 and applicable paragraphs of part 74 are met. There are no deviations to the specifications.

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, with the 50-ohm load placed on the antenna terminal, 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 turntable was rotated though 360 degrees to locate the position registering the highest amplitude emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter. Raising and lowering the FSM antenna and rotating the turntable before final data was recorded maximized the measured amplitude of each spurious emission. A log periodic antenna was used for frequencies of 200 MHz to 5 GHz and pyramidal horn antennas were used for frequencies of 5 GHz to 40 GHz. The substitution method was used to measure the spurious emission levels. Emission levels from the EUT were measured and amplitude levels were recorded. The EUT 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 gain in the substitution antenna. 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 43 + 10 Log (P_o) dB.
0.250-watt transmitter.

$$\text{Attenuation} = 43 + 10\ \text{Log}_{10}(P_w)$$
$$= 43 + 10\ \text{Log}_{10}(0.250)$$
$$= 37\ \text{dB}$$

Results

Frequency of Emission	Amplitude of EUT Spurious emission		Signal level to substitution antenna required to reproduce		Emission level below carrier		Limit At Least
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBµV/m	dBµV/m	dBm	dBm	dBc	dBc	dBc
1486.0	30.2	37.3	-67.93	-60.83	91.8	84.7	37
2229.0	29.5	32.1	-64.43	-61.83	88.3	85.7	37
2972.0	30.1	31.0	-58.83	-57.93	35.0	81.8	37
3715.0	29.9	31.4	-56.03	-54.53	79.9	78.4	37
4458.0	27.3	29.8	-54.53	-52.03	78.4	75.9	37
1510.0	30.5	38.3	-67.83	-60.03	91.5	83.7	37
2265.0	29.8	32.5	-63.83	-61.13	87.5	84.8	37
3020.0	30.6	31.6	-59.13	-58.13	35.5	81.8	37
3775.0	29.3	30.1	-57.13	-56.33	80.8	80.0	37
4530.0	27.5	28.3	-51.83	-51.03	75.5	74.7	37
1534.0	31.0	37.5	-67.13	-60.63	90.6	84.1	37
2301.0	31.0	31.7	-62.53	-61.83	86.0	85.3	37
3068.0	29.5	31.2	-60.13	-58.43	36.6	81.9	37
3835.0	28.3	29.9	-57.83	-56.23	81.3	79.7	37
4602.0	26.8	31.0	-53.83	-49.63	77.3	73.1	37

Specifications of Paragraph 2.1053, 2.1057, applicable paragraphs of part 74 are met. There are no deviations to the specifications.

2.1055 Frequency Stability

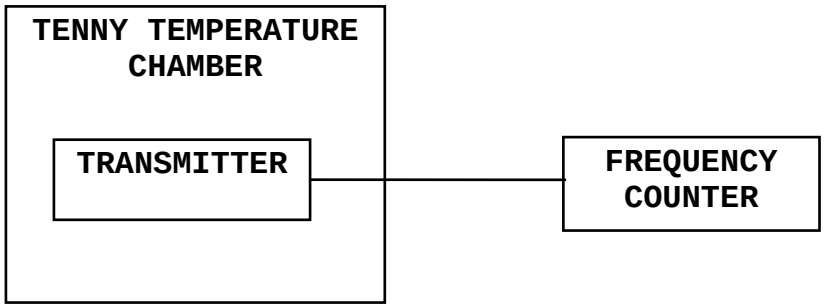
Measurements Required

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.

(3) 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:

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 a 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 1.27 Vdc to 1.72 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 parts 2, 22, and 74.861.

Results

Nominal frequency 743.00036 MHz	FREQUENCY STABILITY VS TEMPERATURE IN PARTS PER MILLION (PPM) and percent (limit=0.005%)								
	Temperature in °C								
	-30	-20	-10	0	+10	+20	+30	+40	+50
Change (Hz)	-2340.00	-1110.0	-3360.0	-2020.0	-1670.0	-320.0	-1250.0	2590.0	3020.0
PPM	-3.15	-1.49	-4.52	-2.72	-2.25	-0.43	-1.68	3.49	4.06
%	-0.0003	-0.0001	-0.0005	-0.0003	-0.0002	0.0000	-0.0002	0.0003	0.0004

FREQUENCY 743.00036 MHz	FREQUENCY STABILITY VS VOLTAGE VARIATION 1.5 volts nominal; RESULTS IN PPM INPUT VOLTAGE		
	1.27 V_{dc}	1.50 V_{dc}	1.72 V_{dc}
Change (Hz)	0.0	0.0	0.0

FREQUENCY 743.00036 MHz	FREQUENCY STABILITY VS VOLTAGE VARIATION 1.50 volts nominal; RESULTS IN PPM BATTERY ENDPOINT VOLTAGE 0.8 V_{dc}
Change (Hz)	0.0

Specifications of Paragraphs 2.1055 and applicable paragraphs of part 74 are met. There are no deviations to the specifications.

APPENDIX

1. Test Equipment List
2. Rogers Qualifications
3. 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:
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 8591 EM	5/06
Frequency Counter: Leader LDC 825	2/06
Antenna: EMCO Biconilog Model: 3143	5/06
Antenna: EMCO Log Periodic Model: 3147	10/05
Antenna: Antenna Research Biconical Model: BCD 235	10/05
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	10/05
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 (101 dB Integrity)	

5/2/2006

QUALIFICATIONS

Of

SCOT D. ROGERS, ENGINEER

ROGERS LABS, INC.

Mr. Rogers has approximately 17 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

August 9, 2006
Date

1/08/2003

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