APPLICATION SUBMITTAL

FOR
FCC GRANT OF CERTIFICATION
Per Part 87

FOR

MODEL: MCX-1000A
128.825-132.000, 136.500-136.975 MHz
VHF Aviation Data Transmitter
FCC ID: ASY MCX-1000A

FOR

Honeywell International Inc.

Business and General Aviation
Division One Technology Center,
23500 West 105th Street
Olathe, KS 66061

ROGERS LABS, INC.

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

TEST REPORT

For

APPLICATION of CERTIFICATION

For

HONEYWELL INTERNATIONAL INC.

Business and General Aviation Division One Technology Center
23500 West 105th Street
OLATHE, KS 66061
Phone: (913) 712-2352

Jack Glecier
FCC Coordinator

VHF AVIATION DATA TRANSCEIVER
Model: MCX-1000A
Part Number: 42455-1
Frequency Range: 128.825-132.000, 136.500-136.975 MHz

FCC ID: ASY MCX-1000A

Test Date: December 12, 2005

Certifying Engineer: Scot D Rogers

Scot D. Rogers
ROGERS LABS, INC.
4405 West 259th Terrace
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FORWARD

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2004, 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, and applicable paragraphs of Part 15, the following is submitted:

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	100 kHz	Peak

2.1033(c) Application for Certification

(1) Manufacturer: HONEYWELL INTERNATIONAL INC.
Business and General Aviation Division
One Technology Center
23500 West 105th Street
OLATHE, KS 66061

(2) Identification: FCC I.D.: ASY MCX-1000A

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

(4) Emission Type: Emissions designator 13k0A2D. Double-sideband amplitude modulated single channel, data transmission.

(5) Frequency Range: 128.825–132.000, 136.500-136.975 MHz

(6) Operating Power Level: 20 Watts (Maximum Power) delivered from the EUT.

(7) Maximum P_o: 20 Watts delivered from the EUT. Maximum power output of 55 Watts allowed in CFR 47, paragraph 87.131.

(8) Power into final amplifying circuitry: Final amplifier 10.27 volts @ 2.50 amps, Driver 11.77 volts @ 0.68 amps

(9) Tune Up Procedure for Output Power: Refer to Exhibit for Transceiver 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 Drawings of Components Layout and Chassis Drawings.

(13) Detail Description of Digital Modulation: Not applicable.

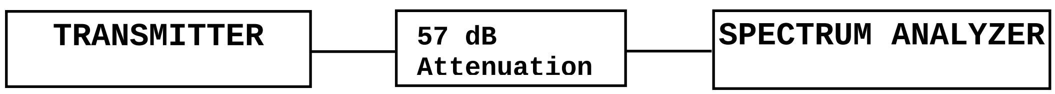
2.1046 RF Power Output

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 was measured at the antenna terminal by placing of 57 dB attenuation in the antenna line and observing the emission with the spectrum analyzer. The spectrum analyzer had an impedance of 50Ω to match the impedance of the standard antenna. A 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. Refer to Figure 1 showing the maximum output power of the transmitter. Data was taken per Paragraph 2.1046(a) and applicable paragraphs of Part 87.

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

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

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

milliwatts = $10^{(42.88/10)}$

= 19,410 mW

= 19.4 Watts

milliwatts = $10^{(43.00/10)}$

= 19,953 mW

= 20 Watts

Results

FREQUENCY	P_{dBm}	P_{mw}	P_w
129.000	42.88	19,410	19.4
132.000	43.00	19,953	20.0
136.975	42.88	19,410	19.4

The specifications of Paragraph 2.1046(a) and applicable Parts of 2 and 87 are met. There are no deviations to the specifications.

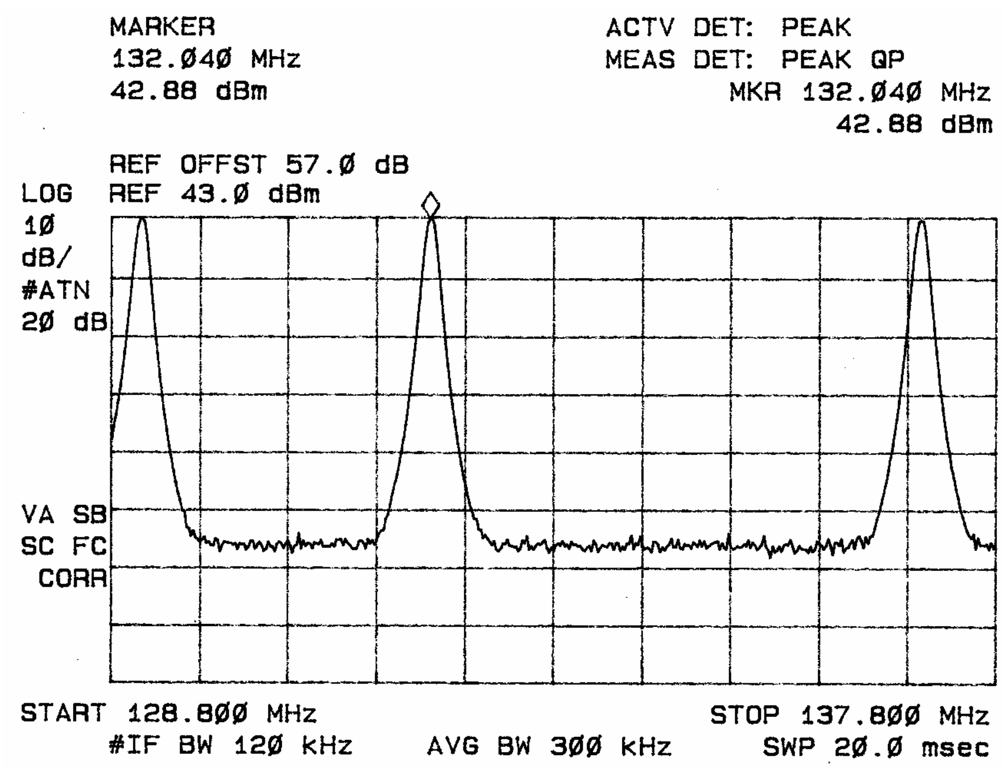


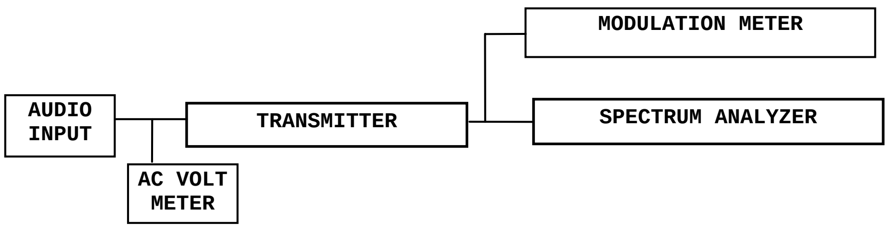
Figure 1 Maximum Power Output

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.

Results

Figure 2 displays the graph made showing the audio frequency response of the modulator. The frequency generator was set to 1 kHz frequency 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 output voltage level was adjusted to maintain the 50% modulation. The output level required for 50% modulation was then recorded. This level was normalized to the level required for 50% modulation at 1000 Hz.

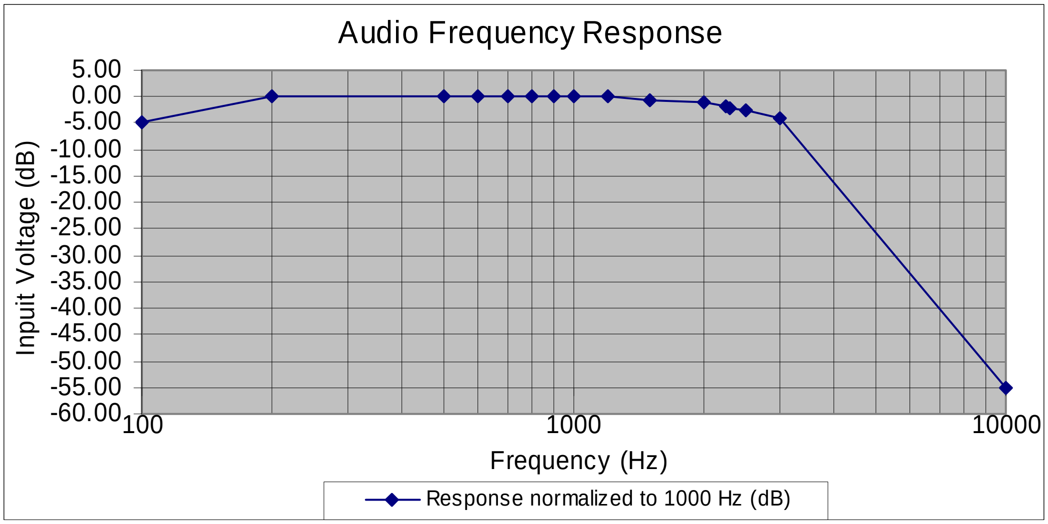


Figure 2 Audio Frequency Response Characteristics

Figure 3 shows the modulation characteristics each of five frequencies while the input voltage was varied. The frequency is held constant and the percent modulation is read from the modulation meter.

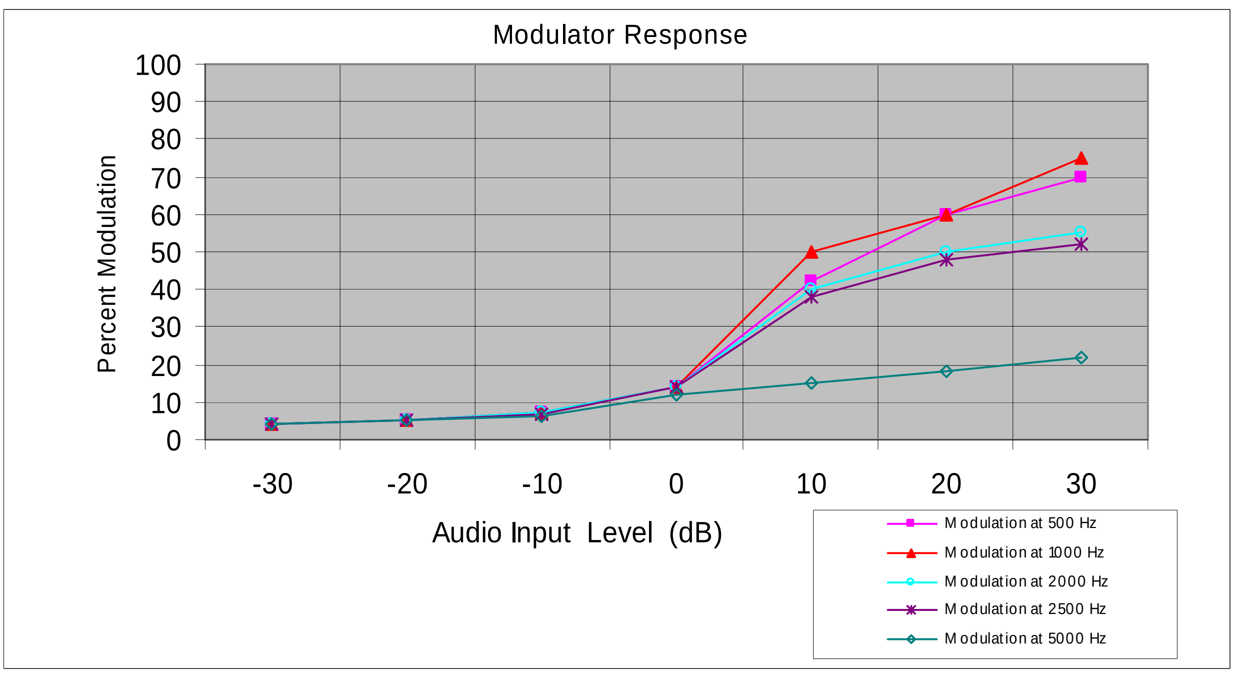


Figure 3 Modulation characteristics

Figure 4 shows the frequency response of the audio lowpass filter. The specifications of Paragraph 2.1047 and applicable parts of paragraph 87 are met.

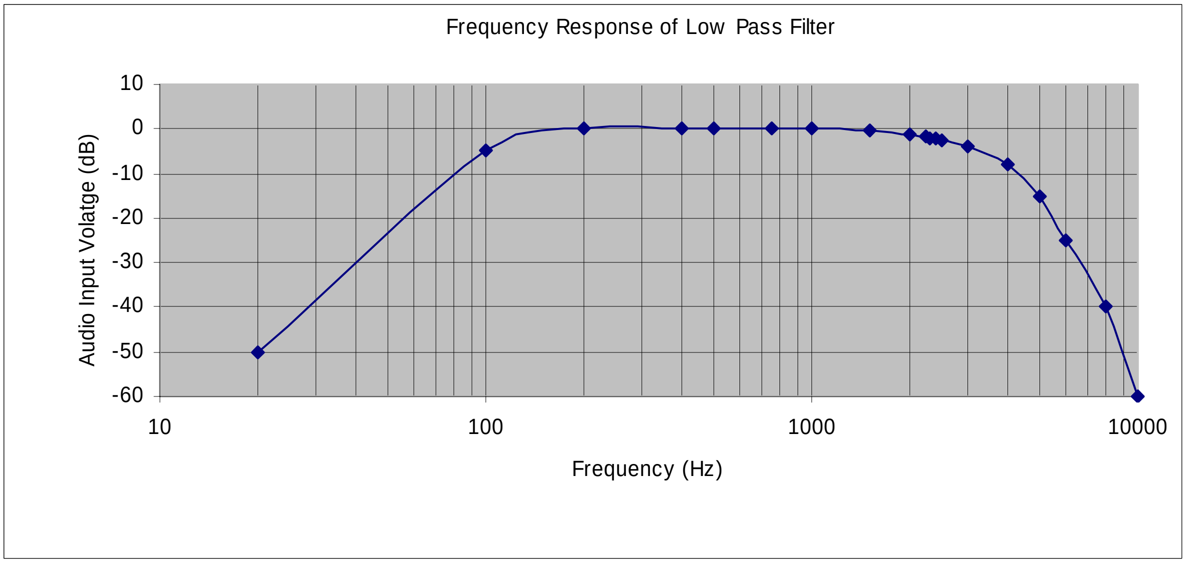


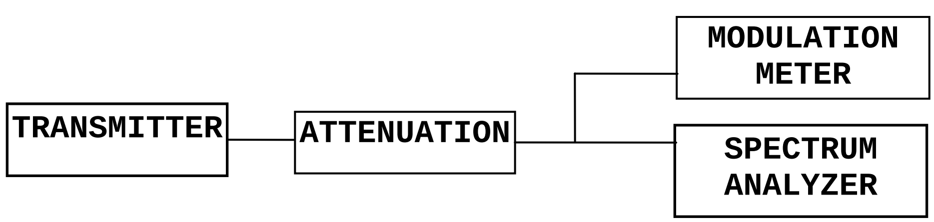
Figure 4 Frequency Response of Audio Lowpass Filter

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



Results

Frequency (MHz)	Occupied bandwidth(kHz)
132.000	13.00

A spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in a normal mode, modulated by a captured MFK signal at a level 16 dB above 50% modulation. The power ratio in dB representing 99.5% of the total mean power was recorded from the spectrum analyzer. Refer to figure 5 showing a plot of the occupied bandwidth of the 99.5% power.

The requirements of 2.1049(c)(1) and applicable paragraphs of Part 87 are met. There are no deviations to the specifications.

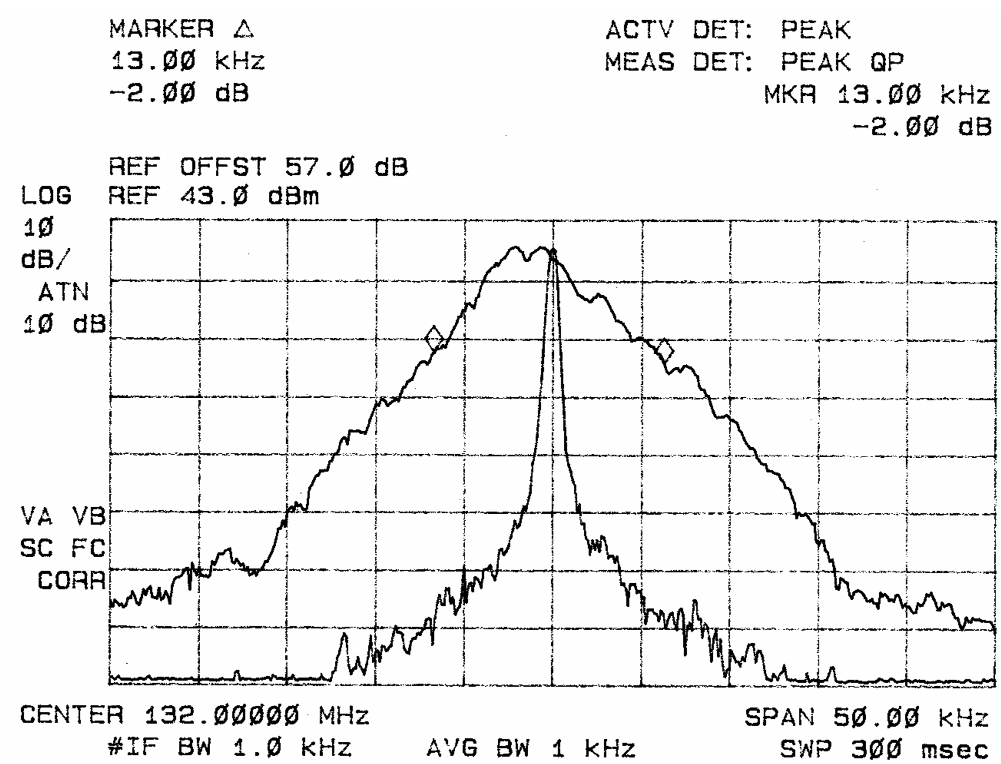


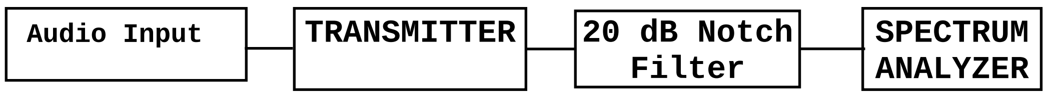
Figure 5 Occupied Band Width, Carrier frequency 132.00 MHz

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 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 1000 MHz was observed and a plot produced of the frequency spectrum. Figure 6 represents data for the spurious emissions of the MCX-1000A. Data was taken per 2.1051, 2.1057, and applicable paragraphs of Part 87.

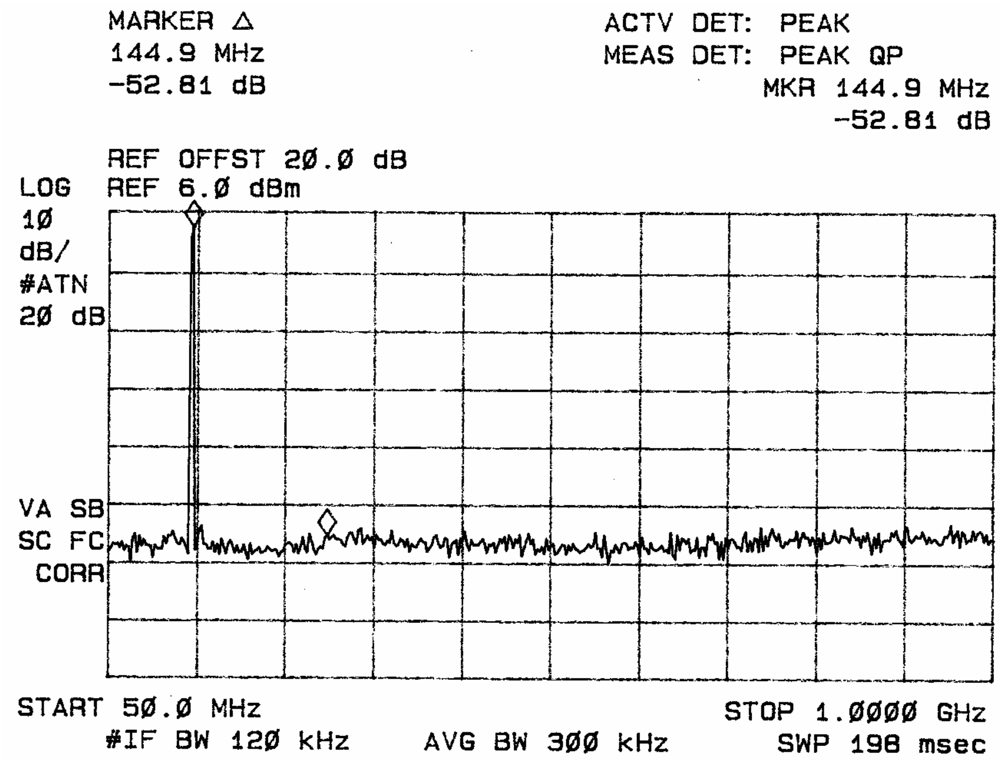


Figure 6 Spurious Emissions at Antenna Terminal.

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

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

20 Watt = 43 + 10 LOG(P_o)
= 43 + 10 LOG(20)
Limit = 56.0 dB below carrier
Limit = 56 - 43 dBm (-13 dBm limit)

CHANNEL MHz	SPURIOUS FREQ. (MHz)	MEASURED LEVEL (dBm)	LEVEL BELOW CARRIER (dB)
129.00	258.0	-46.5	89.5
	387.0	-48.7	91.7
	516.0	-54.3	97.3
	645.0	-53.7	96.7
	774.0	-52.8	95.8
132.00	264.0	-45.0	88.0
	396.0	-51.5	94.5
	528.0	-54.7	97.7
	660.0	-53.8	96.8
	792.0	-53.5	96.5
136.975	274.0	-45.5	88.5
	410.9	-50.0	93.0
	547.9	-50.6	93.6
	684.9	-53.0	96.0
	821.9	-53.5	96.5

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. This equipment is typically incorporated into a rack of equipment, which offers no external wiring attached directly to the unit. A test box was constructed to interface with the equipment for testing purposes. The test box received transmitter control signals over a serial communications line from a laptop computer. The computer and test box were included in the open area test setup for radiated emissions testing.

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 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 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 5000 MHz. Emission levels were measured and recorded from the spectrum analyzer in dBμV. The transmitter was then removed and replaced with a substitution antenna powered from a signal generator. The output power 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. 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, and dated August 15, 2003. 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.

Spurious limit = 43 + 10 $Log_{10}(P_w)$
= 43 + 10 $Log_{10}(20)$
= 56.0 dB below the carrier frequency amplitude

Results

The EUT was connected to a dummy load and set to transmit at the desired frequency. The amplitude of each spurious emission was then maximized and recorded. The transmitter produces 20 watts of output power (43 dBm). Then the radiated spurious emission in dB is calculated from the following equation:

Radiated spurious emission (dB) = RSE
Radiated spurious emission (dB) =
10 Log_{10}[Tx power(W)/0.001] – signal level required to reproduce
example:
RSE = 10 Log_{10}[20/0.001]-(-66.0) = 108.0 dBc

Channel frequency 129.00 MHz

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)	dBµV	dBµV	dBm	dBm	dBc	dBc	dBc
258.0	55.8	59.7	-66.0	-51.2	109.0	94.2	56
387.0	60.3	67.2	-50.1	-45.3	93.1	88.3	56
516.0	56.2	57.3	-61.3	-53.1	104.3	96.1	56
645.0	52.8	51.0	-59.1	-60.4	102.1	103.4	56
774.0	52.9	53.2	-49.8	-50.5	92.8	93.5	56

Channel frequency 132.00 MHz

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)	dBμV	dBμV	dBm	dBm	dBc	dBc	dBc
264.0	56.9	66.6	-67.3	-46.7	110.3	89.7	56
396.0	64.7	63.5	-48.2	-49.8	91.2	92.8	56
528.0	61.1	62.5	-56.5	-49.1	99.5	92.1	56
660.0	55.2	53.4	-61.3	-62.8	104.3	105.8	56
792.0	53.8	51.8	-50.5	-51.36	93.5	94.3	56

Channel frequency 136.975 MHz

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)	dBμV	dBμV	dBm	dBm	dBc	dBc	dBc
274.0	55.9	59.0	-66.9	-51.8	109.9	94.8	56
410.9	61.5	58.7	-51.3	-53.5	94.3	96.5	56
547.9	57.7	59.7	-58.7	-50.3	101.7	93.3	56
684.9	51.8	49.0	-60.2	-61.3	103.2	104.3	56
821.9	50.9	49.9	-53.5	-52.2	96.5	95.2	56

Specifications of Paragraph 2.1053, 2.1057, applicable paragraphs of part 87 are met. There are no deviations or exceptions to the specifications.

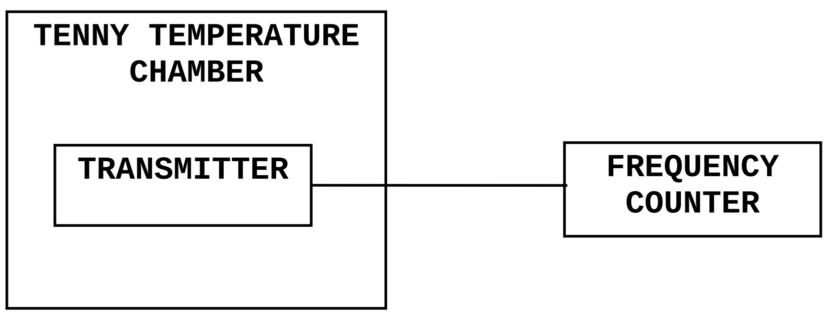
2.1055 Frequency Stability

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 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.

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 Sorensen DC Power Supply was used to vary the dc voltage for the power input from 23.80 Vdc to 32.20 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 87.

Results

Frequency 132.0000 (MHz)	FREQUENCY STABILITY VS TEMPERATURE IN PARTS PER MILLION (PPM)								
	Temperature in °C								
	-30	-20	-10	0	+10	+20	+30	+40	+50
	-150	-140	100	40	-70	-100	-130	-150	-220
PPM	-1.14	-1.06	0.76	0.30	-0.53	-0.76	-0.99	-1.14	-1.67
%	-0.0001	-0.0001	0.0001	0.0000	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002

FREQUENCY IN MHz	FREQUENCY STABILITY VS VOLTAGE VARIATION 28.0 volts nominal; RESULTS IN PPM INPUT VOLTAGE		
	23.80 V_{dc}	28.00 V_{dc}	32.20 V_{dc}
132.0000	0.0	0.0	0.0

Specifications of Paragraphs 2.1055 and applicable paragraphs of part 87 are met. There are no deviations or exceptions to the specifications.

APPENDIX

Model: MCX-1000A

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	2/05
Wattmeter: Bird 43 with Load Bird 8085	2/05
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/05
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/05
R.F. Generator: HP 606A	2/05
R.F. Generator: HP 8614A	2/05
R.F. Generator: HP 8640B	2/05
Spectrum Analyzer: HP 8562A,	2/05
Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	
HP Adapters: 11518, 11519, 11520	
Spectrum Analyzer: HP 8591 EM	5/05
Frequency Counter: Leader LDC 825	2/05
Antenna: EMCO Biconilog Model: 3143	5/05
Antenna: EMCO Log Periodic Model: 3147	10/05
Antenna: Antenna Research Biconical Model: BCD 235	10/05
Antenna: EMCO Dipole Set 3121C	2/05
Antenna: C.D. B-101	2/05
Antenna: Solar 9229-1 & 9230-1	2/05
Antenna: EMCO 6509	2/05
Audio Oscillator: H.P. 201CD	2/05
R.F. Power Amp 65W Model: 470-A-1010	2/05
R.F. Power Amp 50W M185- 10-501	2/05
R.F. PreAmp CPPA-102	2/05
LISN 50 μHy/50 ohm/0.1 μf	10/05
LISN Compliance Eng. 240/20	2/05
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	6/05
Peavey Power Amp Model: IPS 801	2/05
Power Amp A.R. Model: 10W 1010M7	2/05
Power Amp EIN Model: A301	2/05
ELGAR Model: 1751	2/05
ELGAR Model: TG 704A-3D	2/05
ESD Test Set 2010i	2/05
Fast Transient Burst Generator Model: EFT/B-101	2/05
Current Probe: Singer CP-105	2/05
Current Probe: Solar 9108-1N	2/05
Field Intensity Meter: EFM-018	2/05
KEYTEK Ecat Surge Generator	2/05
Shielded Room 5 M x 3 M x 3.0 M (101 dB Integrity)	

10/20/2005

QUALIFICATIONS

Of

SCOT D. ROGERS, ENGINEER

ROGERS LABS, INC.

Mr. Rogers has approximately 17 years experience in the field of electronics. Mr. Rogers has worked for six years in the automated controls industry and the 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

December 12, 2005
Date

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

August 15, 2003

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: August 15, 2003

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,

Ms. Phyllis Parrish
Information Technician