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

TEST REPORT
For
APPLICATION of CERTIFICATION

For

JCAIR INCORPORATED

400 New Century Parkway
New Century, KS 66031-0009

Contact Person
Byron J. Dill
Senior Project Engineer
Product Compliance

MODELS: KDR 510 RT
FREQUENCY: 136.450 and 136.475 MHz

FCC ID: GKX KDR510

Test Date: September 25, 2002

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, 2001, Part 2 Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.915, 2.925, 2.926, 2.1031 through 2.1057, Part 87, Subchapter D, Paragraphs 87.131 through 87.147, the following information is submitted.

Equipment Tested:

Equipment	Model/Part#	FCC ID#
EUT	KDR 510 RT	GKX KDR510

The KDR 510 Ramp Tester is a transmitter designed to ground test the functionality of an aircraft mounted KMD540/KDR510 FIS-B avionics display system. The unit transmits a known message at a given frequency for interpretation by the receiver. The ground crew then verifies the message and confirms the operation of the aircraft mounted receiver. The test results in this report relate only to the items tested.

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

2.1033(c) Application for Certification

(1) Manufacturer: JcAIR Incorporated
400 New Century Parkway
New Century, KS 66031-0009

(2) FCC Identification: Model: KDR 510 RT
FCC I.D.: GKX KDR510

(3) Refer to Exhibit for Installation and Operating Manuals:

(4) Emission Type: 16K0G1D

(5) Frequency Range: 136.450 or 136.475 MHz.

(6) Operating Power Level: -39 dBm (125.9E-9 Watts)

(7) Max Power allowed by part 87.131: 60 Watts

(8) Power into final amplifier: 65.9 milliwatts (4.96V @ 13.3mA).

(9) Tune Up Procedure for Output Power:

Refer to Exhibit for Alignment and test Procedure.

(10) Description of the Circuitry and Devices Provided for Determining and Stabilizing Frequency:

Refer to the KDR 510RT schematic diagrams exhibit for the transmitter.

(11) Photograph or drawing of the Identification Plate:

Refer to Exhibit for Drawing of Identification Plate.

(12) Drawings of Construction and Layout:

Refer to exhibit for pictures of Component Layout and Chassis Assembly.

(13) Detail Description of Digital Modulation:

The modulator circuit starts with 2 digital pulse strings produced by the microprocessor. Those 2 signals are each routed through an active low pass filter circuit, which consists of 2 sections of MAX4129 OP-AMPS, and associated passive components which round off the square edges of the signals. Those signals represent I and Q and are then routed into U23, (RF2412) a quadrature modulator. The oscillator (carrier) is introduced in this same chip and is processed with the I and Q signals to produce the RF OUTPUT on pin 20 of the chip. This signal then goes through additional pad circuits to set the output level to no more than -39dBm at the antenna output connector.

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 replacing the antenna with a spectrum analyzer, and cable. The spectrum analyzer had an impedance of 50W 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 output power of the transmitter. Data was taken per Paragraph 2.1046(a) and applicable parts of Part 87.

P_{dBm} = power in dB above 1 milliwatt.
Milliwatts = $10^{(PdBm/10)}$
Watts = (Milliwatts)(0.001)(W/mW)

-39.7 dBm = $10^{(-39/10)}$
= 125.9E-6 mW
= 125E-9 Watts

Results:

FREQUENCY	P_{dBm}	P_{mw}	P_{w}
136.450	-39.7	125E-6	125E-9

The following data was taken per TIA/EIA-603. The testing procedures used conform to the procedures stated in the TIA/EIA-603 document.

Frequency	FSM horizontal	FSM vertical	antenna factor – amplifier gain	CFS horizontal	CFS vertical
136.450	70.5	78.1	-21.6	48.9	56.5

Using the substitution method the following data was taken.

Radiated emission of fundamental using substitution method.

Frequency of Emission	Amplitude of emission		Signal level to dipole required to reproduce	
	Horizontal	Vertical	Horizontal	Vertical
(MHz)	dBµV	dBµV	dBm	dBm
136.450	70.5	78.1	-60	-44

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

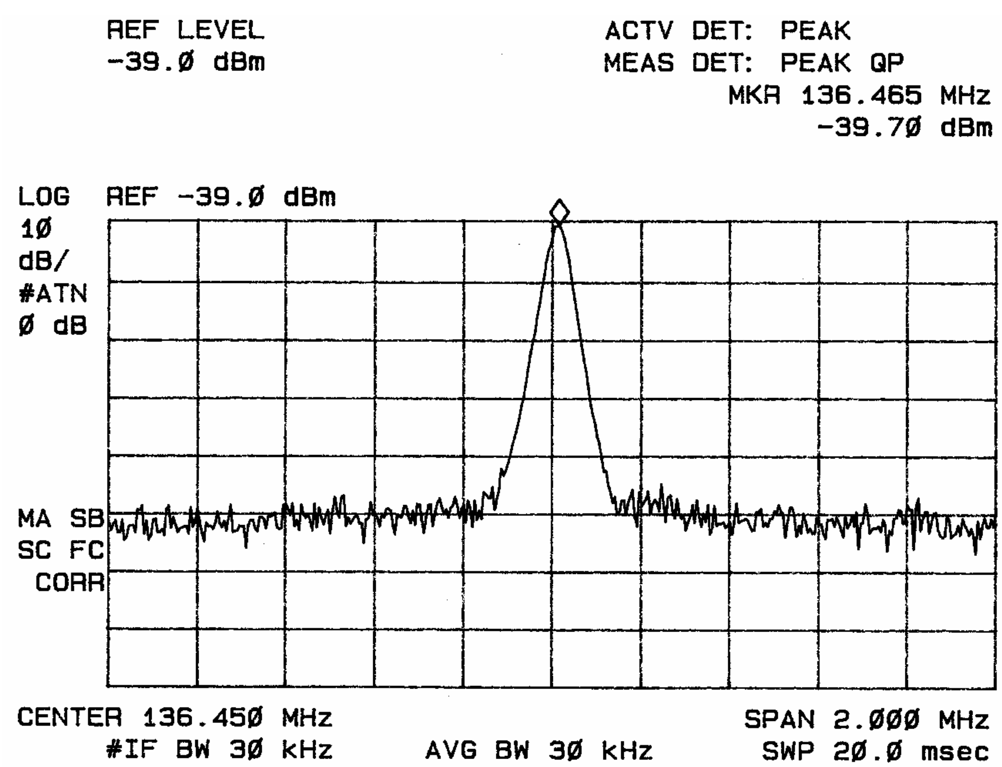


Figure one Output power at antenna terminal.

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. The radio frequency output was coupled to a HP Spectrum Analyzer for observation. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its sole mode of operation.

Results:

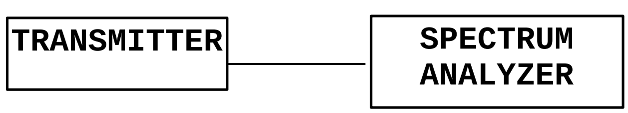
The unit has no input device and broadcasts a predefined message only. The specifications of Paragraph 2.987(b) and applicable parts of 87 are met.

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:



Results:

f_c	O.B. kHz
136.450	16.5

A spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in a normal mode, modulated with the standard test message. The power ratio in dB representing 99.5% of the total mean power was recorded from the spectrum analyzer. Refer to Figure 2 for a plot of the spectrum analyzer screen.

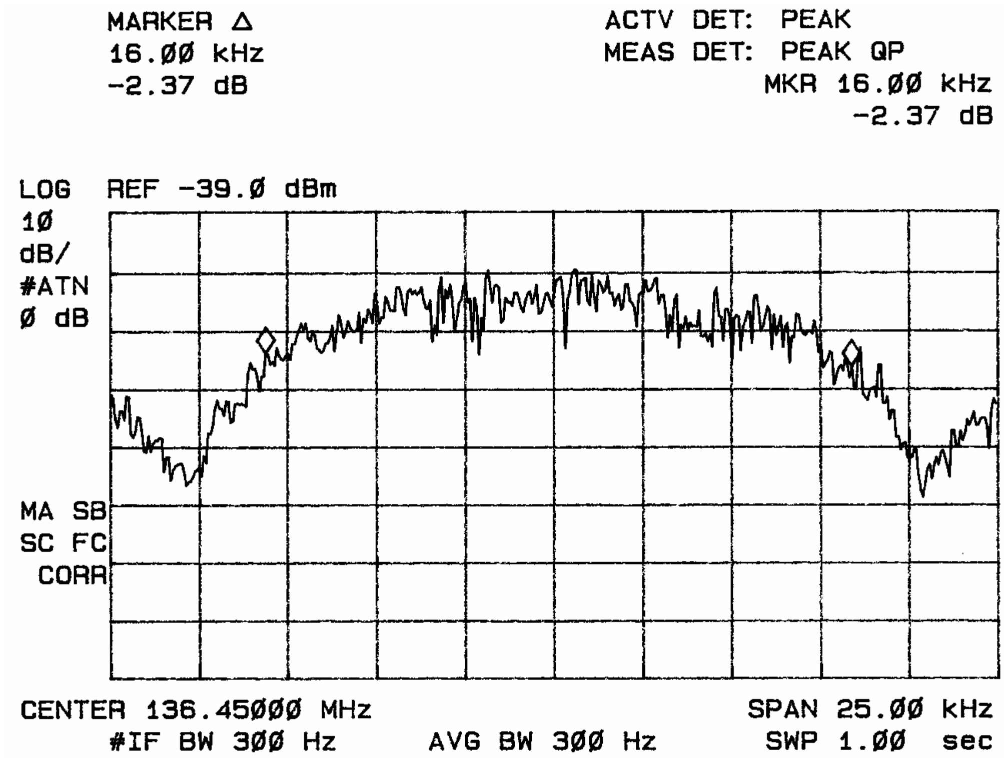


Figure 2 99.5% occupied bandwidth plot.

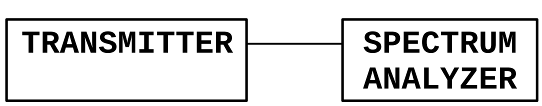
Requirements of 2.1049(c)(1) and applicable paragraphs of Part 87 are met. There are no deviations to the specifications.

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 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operated in a normal mode. The frequency spectrum from 10 MHz to 1.5 GHz was observed and a plot produced of the frequency spectrum. Figure 3 represents emissions data for the KDR 510 RT. Data was taken per 2.1051, 2.1057, and applicable paragraphs of Part 87.

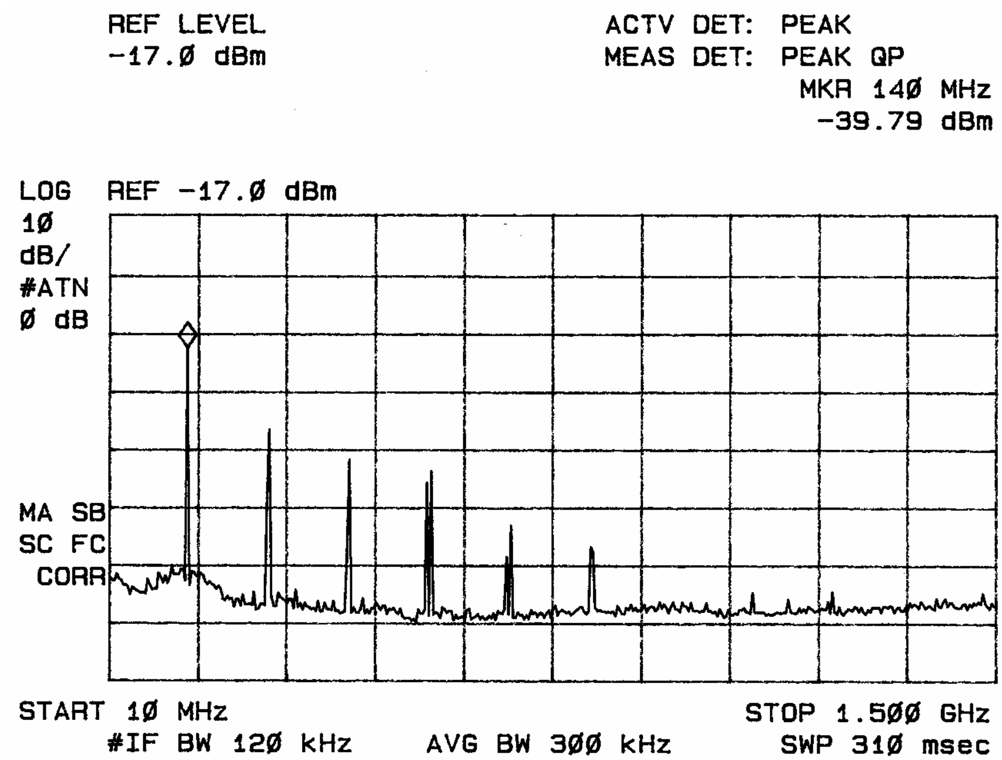


Figure three Emissions at Antenna Terminal.

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.

FCC Limit:

Harmonic attenuation limit $= 43 + 10\ \mathrm{LOG}(P_o)$

$= 43 + 10\ \mathrm{LOG}(10^{(-3.6)})$

$= 4$ dB

Level below carrier:

Amplitude of carrier less amplitude of harmonic

$= -39.7 - (-51.5)$

$= 11.8$

CHANNEL MHz	SPURIOUS FREQ. (MHz)	SPURIOUS AMPLITUDE (dBm)	LEVEL BELOW CARRIER (dB)
136.450 power output -39 dBm	272.9	-51.5	11.8
	409.4	-54.7	15.0
	545.8	-61.2	21.5
	682.3	-72.0	32.3
	818.7	-81.2	41.5
	955.2	-80.2	40.5

Specifications of Paragraphs 2.1051, 2.1057 and applicable parts of 87 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 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. The amplitude of each spurious emission was maximized by raising and lowering the FSM antenna and rotating the turntable before data was recorded. 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. Emission levels were measured and recorded from the spectrum analyzer in dBµV. This level was then added to the antenna factor to calculate the field strength at 3 meters. 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 December 8, 2000. 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.

Results:

The EUT was connected to the standard transmitting antenna and set to transmit at the desired frequency. The amplitude of each spurious emission was then maximized and recorded. The transmitter produces -39 dBm of output power. 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}[125E-9/0.001]-(-70) = 31.0 dBc

Channel frequency 136.450 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
272.9	39.1	38.8	-70.0	-64.0	31.0	25.0	4
409.4	25.2	25.5	-80.3	-72.4	41.3	33.4	4
545.8	26.2	29.0	-79.3	-76.1	40.3	37.1	4
682.3	24.9	25.9	-80.6	-73.2	41.6	34.2	4
818.7	25.1	27.2	-80.4	-77.9	41.4	38.9	4
955.2	28.7	30.9	-78.8	-77.2	39.8	38.2	4

Specifications of Paragraph 2.1053, 2.1057 and 87.139 are met. There are no deviations to the specifications.

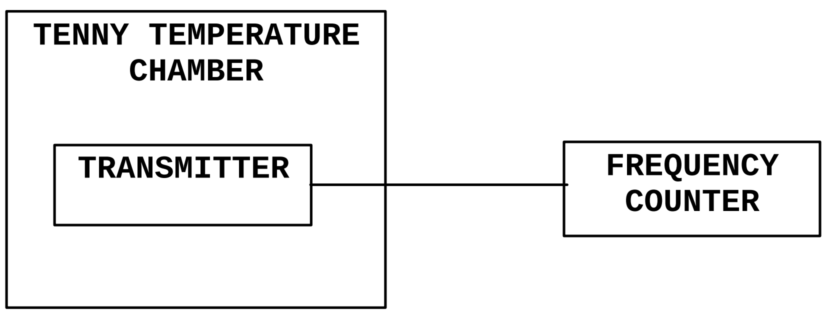
2.1055 Frequency Stability

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.

<u>Test Arrangement:</u>



The measurement procedure outlined below shall be followed:

<u>Steps 1: </u> 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.
<u>Step 2:</u> 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.
<u>Step 3:</u> 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 Sorenson DC Power Supply was used to vary the dc voltage for the power input from 5.1 Vdc to 6.9 Vdc. The frequency was measured and the variation in parts per million was calculated. The limit as specified in part 87 is 20 ppm and all values observed where lower than this requirement. Data was taken per Paragraphs 2.1055 and 87.133.

Results:

Frequency (MHz)	FREQUENCY STABILITY VS TEMPERATURE IN PARTS PER MILLION (PPM)								
	Temperature in °C -30	-20	-10	0	+10	+20	+30	+40	+50
136.450	9.5	19.2	10.9	8.0	0.9	0	3.9	8.2	7.4

FREQUENCY IN MHz	STABILITY VS VOLTAGE VARIATION (±15%) IN PPM INPUT VOLTAGE		
	5.1 V_{dc}	6.0 V_{dc}	6.9 V_{dc}
136.450	0	0	0

FREQUENCY IN MHz	STABILITY AT BATTERY ENDPOINT 4.8 V_{dc}
136.450	0

Specifications of Paragraphs 2.1055 and applicable parts of 87 are met. There are no deviations to the specifications.

APPENDIX

Model: KDR 510 RT

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	2/02
Wattmeter: Bird 43 with Load Bird 8085	2/02
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/02
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/02
R.F. Generator: HP 606A	2/02
R.F. Generator: HP 8614A	2/02
R.F. Generator: HP 8640B	2/02
Spectrum Analyzer: HP 8562A,	7/02
Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	
HP Adapters: 11518, 11519, 11520	
Spectrum Analyzer: HP 8591 EM	7/02
Frequency Counter: Leader LDC 825	2/02
Antenna: EMCO Biconilog Model: 3143	5/02
Antenna: EMCO Log Periodic Model: 3147	10/01
Antenna: Antenna Research Biconical Model: BCD 235	7/02
Antenna: EMCO Dipole Set 3121C	2/02
Antenna: C.D. B-101	2/02
Antenna: Solar 9229-1 & 9230-1	2/02
Antenna: EMCO 6509	2/02
Audio Oscillator: H.P. 201CD	2/02
R.F. Power Amp 65W Model: 470-A-1010	2/02
R.F. Power Amp 50W M185- 10-501	2/02
R.F. PreAmp CPPA-102	2/02
Shielded Room 5 M x 3 M x 3.0 M (101 dB Integrity)	
LISN 50 µHy/50 ohm/0.1 µf	10/01
LISN Compliance Eng. 240/20	2/02
Peavey Power Amp Model: IPS 801	2/02
Power Amp A.R. Model: 10W 1010M7	2/02
Power Amp EIN Model: A301	2/02
ELGAR Model: 1751	2/02
ELGAR Model: TG 704A-3D	2/02
ESD Test Set 2010i	2/02
Fast Transient Burst Generator Model: EFT/B-101	2/02
Current Probe: Singer CP-105	2/02
Current Probe: Solar 9108-1N	2/02
Field Intensity Meter: EFM-018	2/02
KEYTEK Ecat Surge Generator	2/02

07/20/2002

QUALIFICATIONS

Of

SCOT D. ROGERS, ENGINEER

ROGERS LABS, INC.

Mr. Rogers has approximately 13 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

Scot D. Rogers

September 25, 2002
Date

1/11/00

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FEDERAL COMMUNICATIONS COMMISSION
Laboratory Division
7435 Oakland Mills Road
Columbia, MD. 21046

December 08, 2000

Registration Number: 90910

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

Attention: Scot D. Rogers

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Listing: December 08, 2000

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's 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 this filing must be updated for any changes made to the facility, and at least every three years from the date of listing the data on file must be certified as current.

If requested, the above mentioned facility has been added to our list of those who perform these measurement services for the public on a fee basis. An up-to-date list of such public test facilities is available on the Internet on the FCC Website at WWW.FCC.GOV, E-Filing, OET Equipment Authorization Electronic Filing.

Sincerely,

Thomas W Phillips
Electronics Engineer