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4405 West 259th Terrace
Louisburg, KS 66053
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ENGINEERING TEST REPORT
FOR
APLLICATION of
GRANT of CERTIFICATION

FOR

CFR 47, PART 15C - INTENTIONAL RADIATORS
Paragraph 15.247
Spread Spectrum Frequency Hopping Module

For

Coyote DataCom, Inc.
12721 Benson
Overland Park, KS 66213
Keith Hollcroft,

DATA TRANSMITTER
Model: CDR-9150
Frequency 902-928 MHz
FCC ID#: PHO-CDR9150

Test Date: August 26, 2002

Certifying Engineer: Scot D Rogers

Scot D. Rogers
ROGERS LABS, INC.
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FORWARD:

The following is submitted for consideration in obtaining a Grant of Certification for frequency hopping spread spectrum intentional radiators operating under CFR Paragraph 15.247.

Name of Applicant:

Coyote DataCom, Inc.
12721 Benson
Overland Park, KS 66213

Model: CDR-9150 Spread Spectrum Frequency Hopping Module.

FCC I.D.: PHO-CDR9150.

Frequency Range: 902-928 MHz.

Operating Power: 1.0 W (antenna-conducted measurement).

1) Applicable Standards & Test Procedures

a) 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, 2.925, 2.926, 2.1031 through 2.1057, and applicable parts of paragraph 15, Part 15C Paragraph 15.247 the following is submitted:

b) Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-1992 Document FCC, documents DA00-1407 and DA00-705 and/or TIA/EIA 603-1.

2.1033(b) Application for Certification

(1) Manufacturer: COYOTE DATACOM, INC.
12721 Benson
Overland Park, KS 66213

(2) Identification: Model: CDR-9150
FCC I.D.: PHO-CDR9150

(3) Instruction Book:

Refer to Exhibit for Instruction Manual.

(4) Description of Circuit Functions:

Refer to Exhibit of Operational Description.

(5) Block Diagram with Frequencies:

Refer to Exhibit of Operational Description.

(6) Report of Measurements:

Report of measurements follows in this Report.

(7) Photographs: Construction, Component Placement, etc.:

Refer to Exhibit for photographs of equipment.

(8) No Peripheral Equipment was Necessary.

(9) Transition Provisions of 15.37 are not being requested.

(10) Frequency hopping Spread Spectrum transmitters:

Compliance with 15.247(a)(1) and the receiver bandwidth requirement are demonstrated in this report and exhibits.

(11) Not Applicable. The EUT is not a scanning receiver.

(12) Not Applicable. The EUT does not operate in the 59 – 64 GHz frequency band.

2) Equipment Tested

Equipment	Model	FCC I.D.#
EUT	CDR-9150	PHO-CDR9150
CPU	Sharp PC9000	FKG PC9000
Printer	2168A	B94C2121X

3) Equipment Function and Testing Procedures

The EUT is a 902-928 MHz radio transmitter used to transmit data for use in the industrial market place. The CDR-9150 DATA TRANSMITTER is a wireless link used for transmitting information from one remote location to another. The unit is marketed for developers wishing to incorporate a wireless link in a system solution. This product can reduce the development time for system engineers by utilizing the pre-developed transceiver into their system needs. The unit typically operates from a direct current voltage source supplied at the system level. For testing purposes, a twelve-volt wall transformer was used to power the unit. The device utilizes a reverse SMA connection at the antenna for use with one of eight antenna configurations. The antenna options tested included a ¼ wave whip, ¼ wave right angle rubber whip, open coil, zero dB gain dome, 3 dB gain fiberglass omni directional, 3 dB stub, 5 dB center load and 6 dB gain 4-element Yagi, all of which were tested for this report. The unit has provision to connect to a computer for data and command information. The EUT was tested with and without computer communications through the RS232 serial port.

4) Equipment and Cable Configurations

Conducted Emission Test Procedure

The unit typically operates from a supplied voltage in the range of 8-32 volts from the host device and has internal power regulation circuitry. For testing purposes, a twelve-volt wall transformer was used to power the unit. The test setup, including the EUT, was arranged in a typical equipment configuration and placed on a 1 x 1.5-meter wooden bench, 0.8 meters high located in a screen room. The power lines of the system were isolated from the power source using a standard LISN with a 50-µHy choke. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor internal to the LISN. The LISN was positioned on the floor beneath the wooden bench supporting the EUT. The power lines and cables were draped over the back edge of the table.

Radiated Emission Test Procedure:

The EUT was placed on a rotating 1 x 1.5-meter wooden platform, 0.8 meters above the ground plane at a distance of 3 meters from the FSM antenna. EMI energy was maximized by equipment placement, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken using a spectrum analyzer. Refer to photographs in the exhibits for EUT placement.

5) List of Test Equipment

A Hewlett Packard 8591EM Spectrum Analyzer was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The

analyzer settings used are described in the following table. Refer to the appendix for a complete list of test equipment.

HP 8591 EM ANALYZER SETTINGS		
CONDUCTED EMISSIONS:		
RBW	AVG. BW	DETECTOR FUNCTION
9 kHz	30 kHz	Peak / Quasi Peak
RADIATED EMISSIONS:		
RBW	AVG. BW	DETECTOR FUNCTION
120 kHz	300 kHz	Peak / Quasi Peak
HP 8562A ANALYZER SETTINGS		
RBW	VIDEO BW	DETECTOR FUNCTION
100 kHz	100 kHz	PEAK
1 MHz	1 MHz	Peak / Average

EQUIPMENT MFG.	MODEL	CAL. DATES	DUE.
LISN Comp. Design	1762	10/01	10/02
Antenna ARA	BCD-235-B	7/02	7/03
Antenna EMCO	3147	10/01	10/02
Antenna EMCO	3143	5/02	5/03
Analyzer HP	8591EM	7/02	7/03
Analyzer HP	8562A	7/02	7/03

6) Units of Measurements

Conducted EMI: Data is in dBµV; dB referenced to one microvolt.

Radiated EMI: Data is in dBµV/m; dB/m referenced to one microvolt per meter.

7) Test Site Locations

Conducted EMI: The AC power line conducted emissions tests were performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.

Radiated EMI: The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.

Site Approval: Refer to Appendix for FCC Site Approval Letter, Reference # 90910.

8) SUBPART B – UNINTENTIONAL RADIATORS

Conducted EMI

The EUT was arranged in a typical equipment configuration and 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. The manufacturer supplied AC power wall adapter for the EUT was connected to the LISN. 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 frequency of each radio frequency emission displaying the highest amplitude. 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 the data was recorded with maximum conducted emissions levels. Refer to figures one and two for plots of conducted emissions.

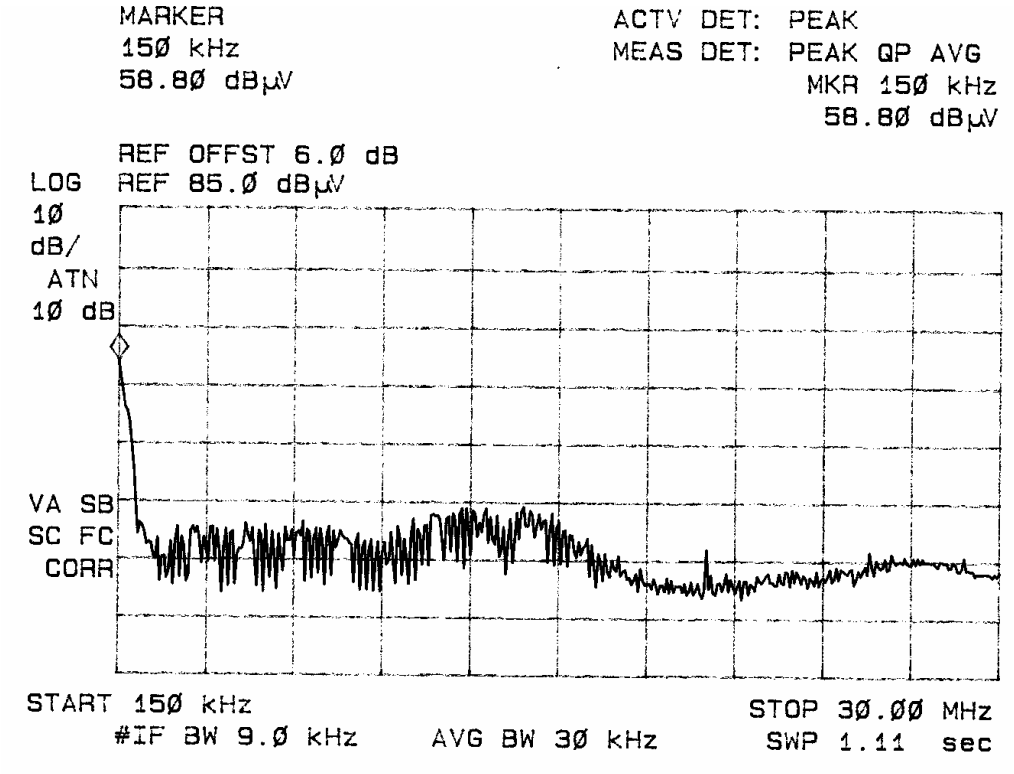

Figure one Line Conducted Emissions Line 1.

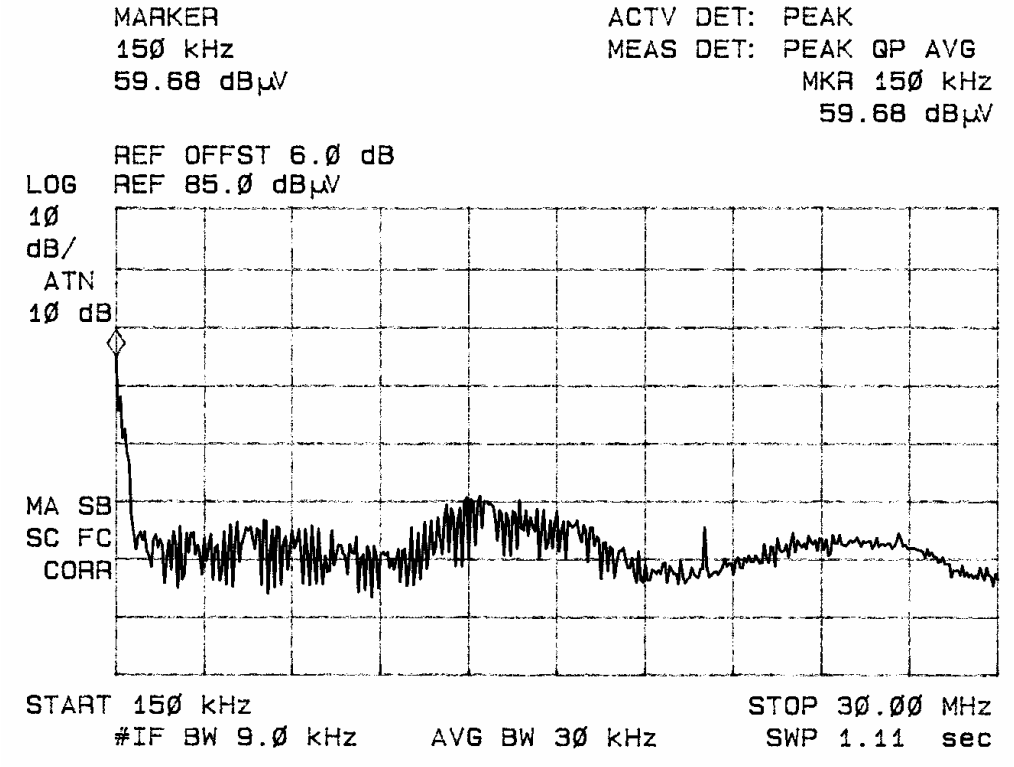

Figure two Line Conducted Emissions Line 2.

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 measurements were performed to identify the frequencies, which produced the highest emissions. Plots were made of the frequency spectrum from 30 MHz to 10,000 MHz for the preliminary testing. Refer to figures three and four for plots of the radiated emissions spectrum taken in a screen room and figures five and six for antenna conducted emissions of the EUT. The highest radiated emission was then re-maximized at the OATS location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the OATS at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 30 MHz to 10,000 MHz was searched for radiated emissions. Measured

emission levels were maximized by EUT placement on the table, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna position between horizontal and vertical polarization. Antennas used were Broadband Biconical from 30 to 200 MHz, Biconilog from 30 to 1000 MHz, Log Periodic from 200 MHz to 5 GHz and or, pyramidal horns and mixers from 4 GHz to 10 GHz, notch filters and appropriate amplifiers were utilized.

Sample Calculations:

RFS = Radiated Field Strength
dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain
dBµV/m @ 3m = 42.7 + 7.7 - 35
= 15.4

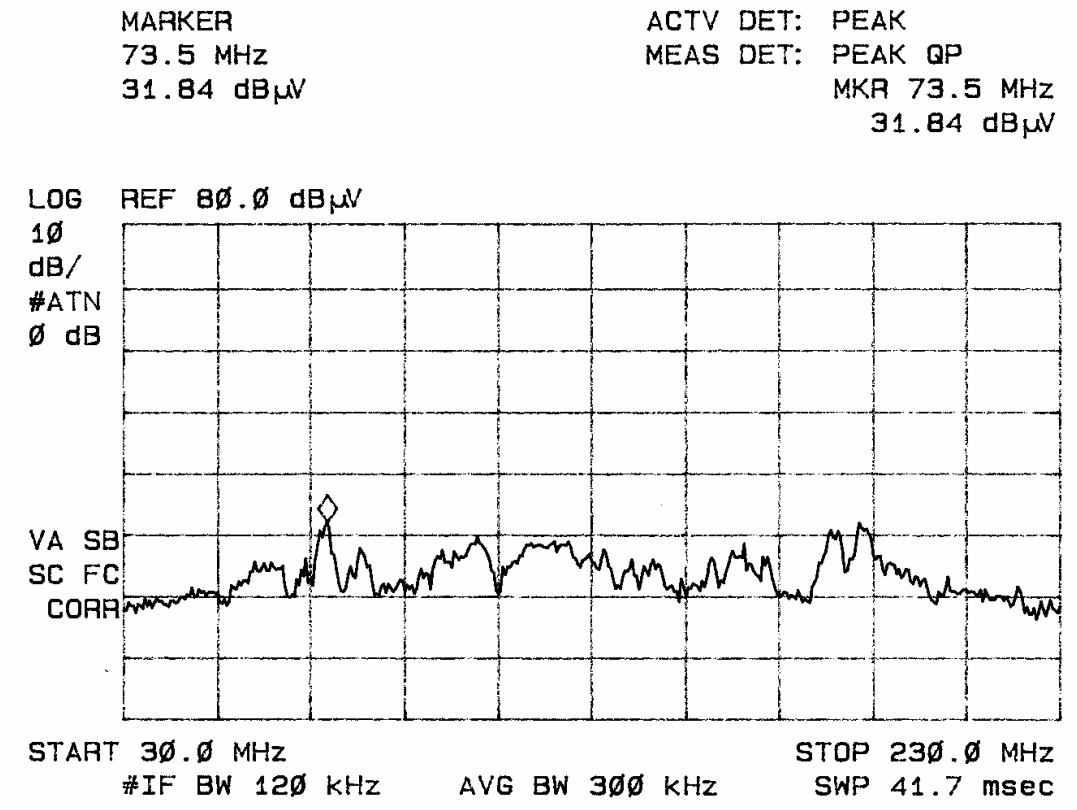

Figure three Radiated Emissions taken at 1 meter in screen room.

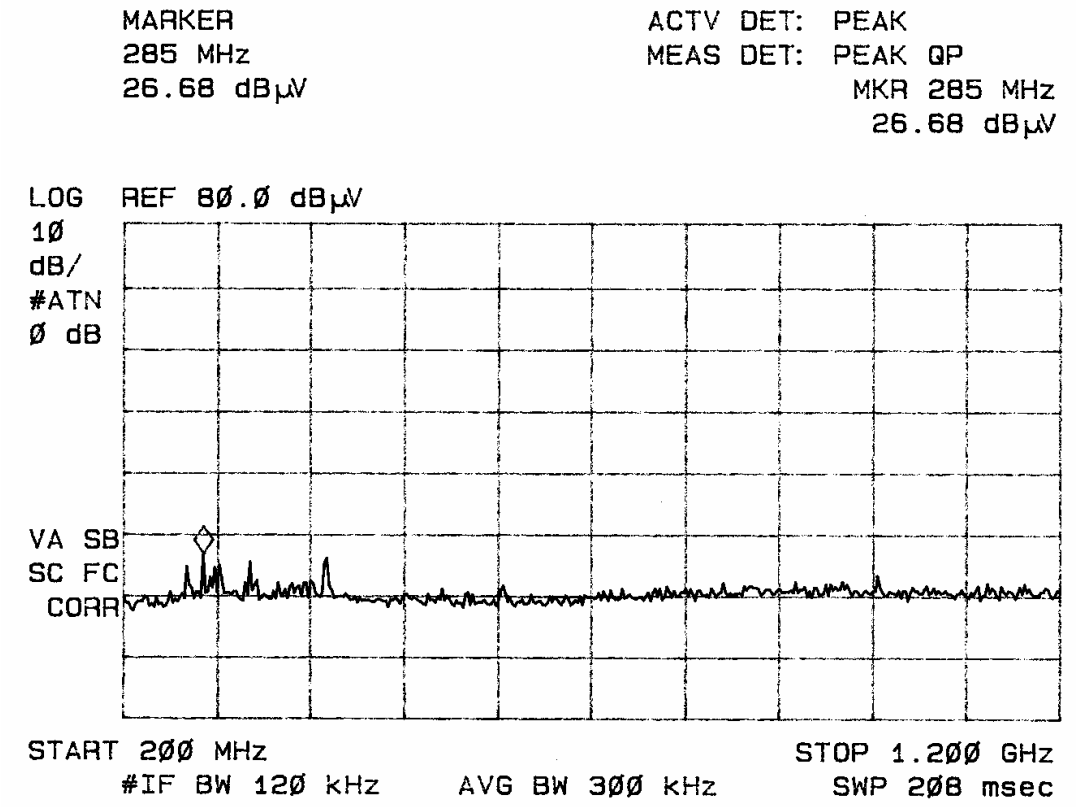

Figure four Radiated Emissions taken at 1 meter in screen room.

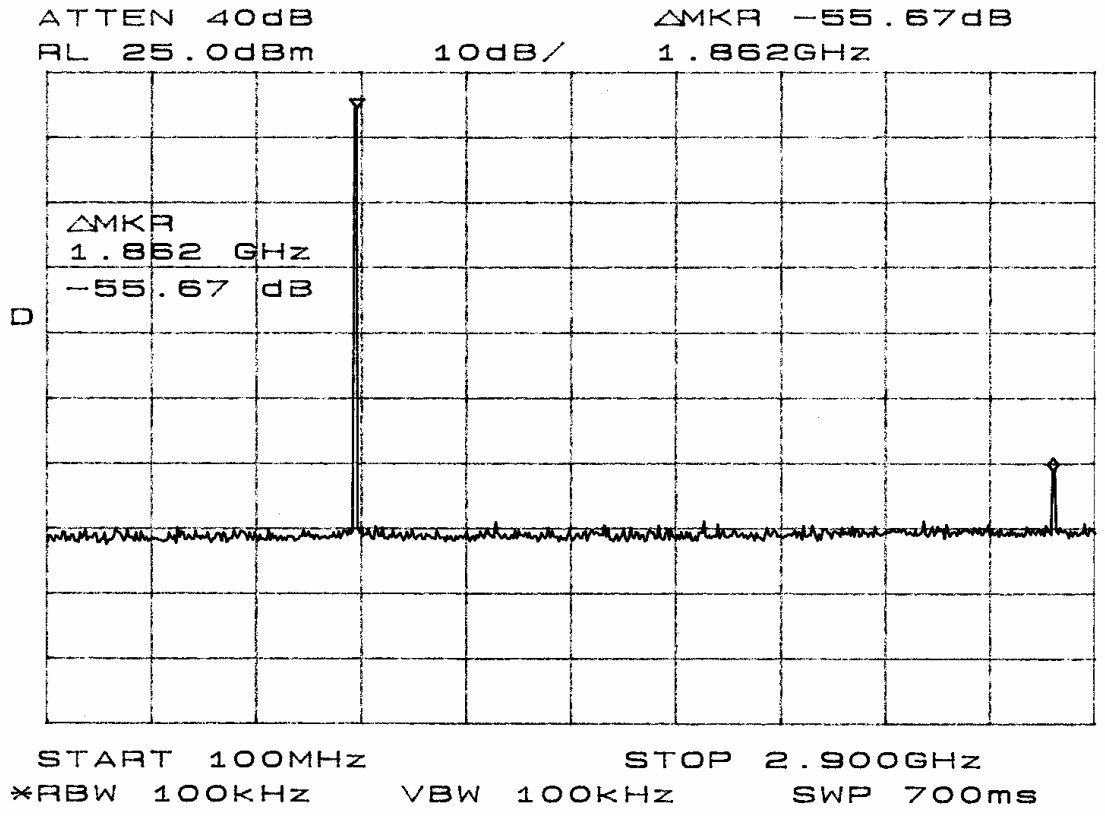

Figure five Antenna Conducted Emissions taken in the screen room.

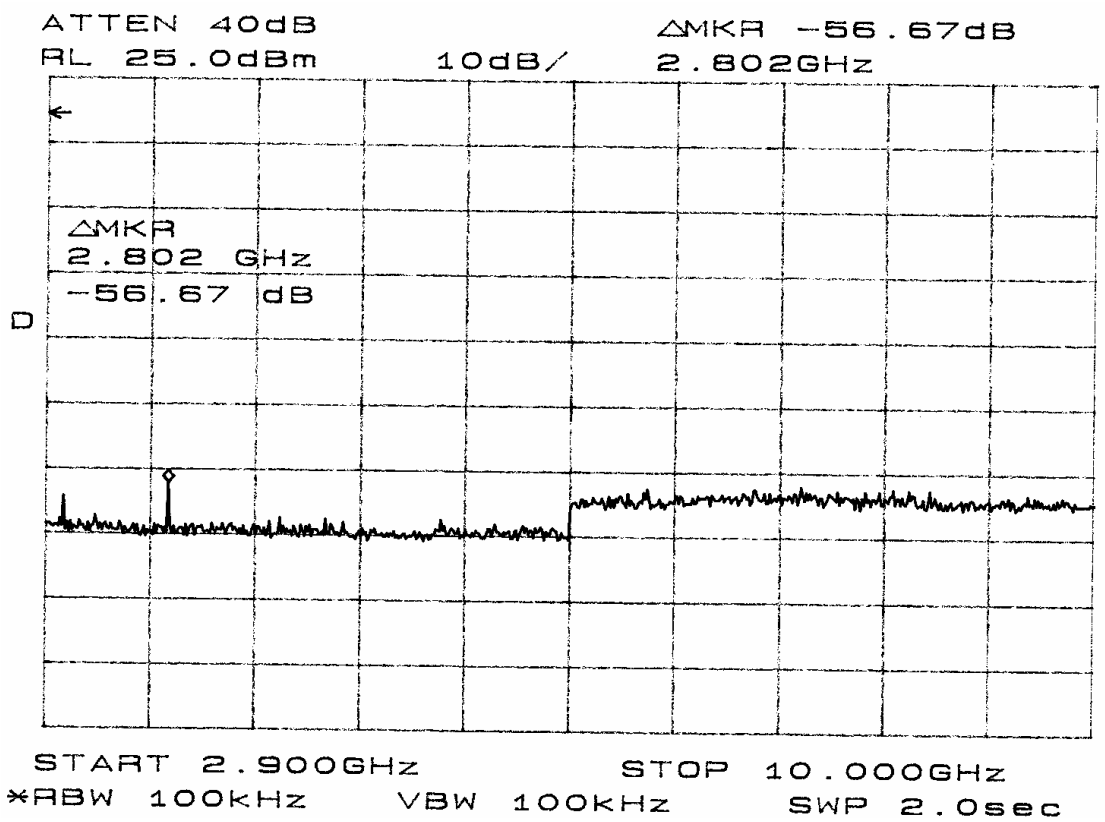

Figure six Antenna Conducted Emissions taken in the screen room.

Conducted (7 Highest Emissions)

Frequency band (MHz)	L1 Level (dBµV) Peak	Q.P.	AVE	L2 Level (dBµV) Peak	Q.P.	AVE	CISPR 22 Q.P./AVE Limit(dBµV)
0.15 - 0.5	58.7	51.1	28.4	58.9	51.2	24.7	66 / 56
0.5 – 5	52.1	44.4	13.7	48.6	41.1	10.2	56 / 46
5 – 10	22.5	17.2	10.0	22.1	18.0	9.8	60 / 50
10 – 15	22.6	17.0	11.3	22.3	17.2	10.7	60 / 50
15 – 20	21.9	16.2	10.2	24.6	20.4	14.3	60 / 50
20 – 25	24.2	19.7	13.1	29.5	25.0	18.5	60 / 50
25 - 30	28.6	23.5	17.0	32.6	28.6	21.8	60 / 50

Other emissions present had amplitudes at least 10 dB below the limit.

Data: General Radiated Emissions from EUT (6 Highest Emissions)

Frequency in MHz	FSM Horz. (dBµV)	FSM Vert. (dBµV)	A.F. (dB/m)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	FCC Class B Limit @ 3m (dBµV/m)
73.0	42.7	41.2	7.7	35	15.4	13.9	40.0
123.3	44.2	47.3	7.5	35	16.7	19.8	43.5
128.1	42.3	45.5	8.1	35	15.4	18.6	43.5
161.2	44.2	41.3	9.0	35	18.2	15.3	43.5
180.2	47.4	37.6	9.0	35	21.4	11.6	43.5
270.3	49.7	34.9	13.0	35	27.7	12.9	46.0

Other emissions present had amplitudes at least 10 dB below the limit.

Summary of Results for Conducted Emissions

The conducted emissions for the EUT meet the requirements for CISPR 22 and FCC Part 15B CLASS B Digital Devices. The EUT had an 11.6 dB minimum margin below the quasi-peak limit and a 27.6 dB margin below the average limit. Other emissions were present with recorded data representing worst-case amplitudes.

Summary of Results for Radiated Emissions

The radiated emissions for the EUT meet the requirements for CISPR 22 and FCC Part 15B CLASS B Digital Devices. The EUT had an 18.3 dB minimum margin below the limit. Other emissions were present with amplitudes at least 10 dB below the limit.

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to meet the CISPR 22 or FCC Part 15B CLASS B emissions standards. There were no deviations to the specifications.

9) Subpart C - Intentional Radiators

As per CFR Part 15, Subpart C, paragraph 15.247 the following information is submitted.

15.203 Antenna Requirements

The unit is produced with a reverse SMA antenna connector to be used with the approved and authorized antennas. The requirements of 15.203 are fulfilled and there are no deviations or exceptions to the specification.

15.204External radio frequency power and antenna modifications

The unit was tested and approved for the use with the following list of antennas.

1. Model AX-B8965C 5dB Base Loaded Closed Collinear Antenna (Antenex)
2. Model AX-TRA9023 3DB Phantom Antenna (Antenex) (the little stub)
3. Model MX-MUF9000 1/4 wave (Max-Rad)
4. Model CCPC904N 4 element welded Yagi (Cushcraft)
5. Model AX-FG8963 Fiberglass Base Stateion (Antennex)
6. Model NP-NMO-9000 Radome (Antennex)
7. Model RCL-915 Right Angle Rubber (Antenna Factor)
8. MX-MUF8963 3dB Open Coil Mobile (Antennex)

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. No other significant emission was observed which fell into the restricted bands of operation.

Sample Calculations:
RFS (dBµV/m @ 3m) = FSM(dBµV) + A.F.(dB) - Gain(dB)
= 42.7 + 7.7 - 35
= 15.4

Data: Emissions in Restricted Bands

Frequency in MHz	FSM Horz. (dBµV)	FSM Vert. (dBµV)	A.F. (dB/m)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	FCC Class B Limit @ 3m (dBµV/m)
73.0	42.7	41.2	7.7	35	15.4	13.9	40.0
123.3	44.2	47.3	7.5	35	16.7	19.8	43.5
128.1	42.3	45.5	8.1	35	15.4	14.8	43.5
166.2	41.2	41.0	8.8	35	15.0	14.8	43.5
270.3	49.7	34.9	13.0	35	27.7	12.9	46.0
331.7	27.8	25.6	15.0	35	7.8	5.6	46.0
2707.6	34.0	36.6	32.5	26.5	40.0	42.6	54.0
2745.6	32.0	32.6	32.5	26.5	38.0	38.6	54.0
2782.8	33.1	34.6	32.5	26.5	39.1	40.6	54.0
3609.6	32.8	33.0	38.6	26.5	44.9	45.1	54.0
3660.8	32.8	33.8	38.6	26.5	44.9	45.9	54.0
3710.4	32.3	34.1	38.6	26.5	44.4	46.2	54.0

Summary of Results for Radiated Emissions in Restricted Bands:

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had a 7.8-dB minimum margin below the limits. Both average and peak amplitudes were checked for compliance with the regulations. No other emissions where found in the restricted frequency bands. Other emissions were present with amplitudes at least 10 dB below the FCC Limits.

15.209 Radiated Emissions Limits; General Requirements

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 measurements were performed to

identify the frequencies, which produced the highest emissions. Emissions were checked in the screen room from 30 to 10,000 MHz and plots were made of the frequency spectrum from 30 MHz to 10,000 MHz for the preliminary testing. The highest radiated emission was then re-maximized at this location 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 10,000 MHz was searched for radiated emissions. Measured emission levels were maximized by EUT placement on the table, 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, Biconilog from 30 MHz to 1000 MHz, Log Periodic from 200 MHz to 5 GHz, and/or Pyramidal Horns from 4 GHz to 10 GHz.

Sample Calculations:

RFS = Radiated Field Strength

dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain

dBµV/m @ 3m = 42.7 + 7.7 - 35

= 15.4

Data: General Radiated Emissions from EUT (6 Highest Emissions)

Frequency in MHz	FSM Horz. (dBµV)	FSM Vert. (dBµV)	A.F. (dB/m)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	FCC Class B Limit @ 3m (dBµV/m)
73.0	42.7	41.2	7.7	35	15.4	13.9	40.0
123.3	44.2	47.3	7.5	35	16.7	19.8	43.5
128.1	42.3	45.5	8.1	35	15.4	18.6	43.5
161.2	44.2	41.3	9.0	35	18.2	15.3	43.5
180.2	47.4	37.6	9.0	35	21.4	11.6	43.5
270.3	49.7	34.9	13.0	35	27.7	12.9	46.0

Other emissions present had amplitudes at least 10 dB below the limit.

Summary of Results for Radiated Emissions:

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had an 18.3 dB minimum margin below the limits. Other emissions were present with amplitudes at least 10 dB below the FCC Limits.

15.247 Operation in the Band 902-928 MHz

The power output was measured both at the antenna terminal and on an open field test site at a three-meter distance. Data was taken per Paragraph 2.1046(a) and 15.247. The 902 and 928 MHz band edges are protected due to the 902.4 – 927.6 MHz channels used for frequency of operation. Refer to figures seven through twelve showing plots taken for the EUT displaying compliance with the specifications.

(a) The EUT is a frequency hopping spread spectrum intentional radiator utilizing at least 50 hopping channels. The 20-dB bandwidth of 275 kHz meets the requirements of greater than 250 and less than 500 kHz wide with the average time of occupancy on any frequency not greater than 0.4 seconds within a ten-second-time period. Figure 8 shows

the dwell time of occupancy of 135 mS. The pseudo random lookup table goes through the 50 channels taking a calculated 6.75 seconds (50 x 135 mS = 6.75 S). The table will repeat after completion of one full cycle thus allowing the channel to be occupied only twice in any ten second period therefore allowing only 270 mS of channel occupancy in any ten second interval.

Information showing compliance for time of occupancy and hopping sequence are displayed below.

THIS IS THE PSEUDO RANDOM CHANNEL LOOKUP TABLE…

```
flash const unsigned char TX_TABLE[] = { 0, 26, 4, 10, 46, 34, 14, 40, 6,
20, 36, 16, 22, 12, 24, 44, 18, 28, 32, 8, 38 30, 42, 2, 48,
1, 27, 5, 11, 47, 35, 15, 41, 7, 21, 37, 17, 23, 13, 25, 45, 19, 29, 33,
9, 39, 31, 43, 3, 49};
```

This routine initiates the channel change for the next TX channel. The routine sequentially goes through the channels in the randomized table above. This guarantees that all channels are used equally.

```
void GotoNextTxChannel (void)
{
tx_channel++;
if ( tx_channel > 49 )
{
tx_channel = 0; //start at beginning of table
while (scan_timer); //check for FCC time limit
scan_timer = FCC_TIME; //reset10 second timer
}
```

The Data Radio utilizes two methods for limiting channel occupancy to 400 mS per channel in a 10 second interval. When the radio is streaming data, packet transmissions are set at 150 mS. By guaranteeing that each channel is used equally there is no possibility of any channel transmitting more than 400 mS in any 10 second period/

The second limitation is imposed using a simple software driven timer. Each time the transmitter uses channel 1 in the transmit hop table a 10 second timer is started. In the event the radio goes through the entire

table and back to channel 1 before the 10 seconds has elapsed, the radio is forced to wait in receive mode the remainder of the 10 second period.

These two tests applied together guarantee that the CDR-9150 will not, in any case, exceed the channel occupancy limitations set forth by the FCC part 15 rules for frequency hopping transmitters.

(b) The maximum peak output power of the unit was measured at the antenna port with a ten dB pad and shown in figure 7. The amplitudes of each emission and spurious emission were measured at a distance of 3 meters from the FSM antenna at the OATS. The amplitude of each 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, Log Periodic Antenna for 200 to 5000 MHz, and Pyramidal Horn Antennas from 4 GHz to 10 GHz. Emissions were measured in dBµV/m at three-meters.

Sample calculation.

dBµv/m@ 3m = FSM + A.F. + cable loss

= 95.3 + 23.8 – 2.5

= 121.6

(c) The band edges are protected due to the frequency of operation of the EUT. Figures 7, 11, and 12 show band edge protection of the EUT with both the hopping sequence disabled and operational.

(g) The unit employs 50 hopping channels with a defined packet length regardless of the message sent. This forces the unit to occupy a channel for 135 mS each time the system runs through the lookup table.

(h) The does not incorporate any intelligence in avoiding other systems in operation. It selects the channel from the pseudo random lookup table sequentially and runs the entire table before starting over. This complies with the requirements of this section.

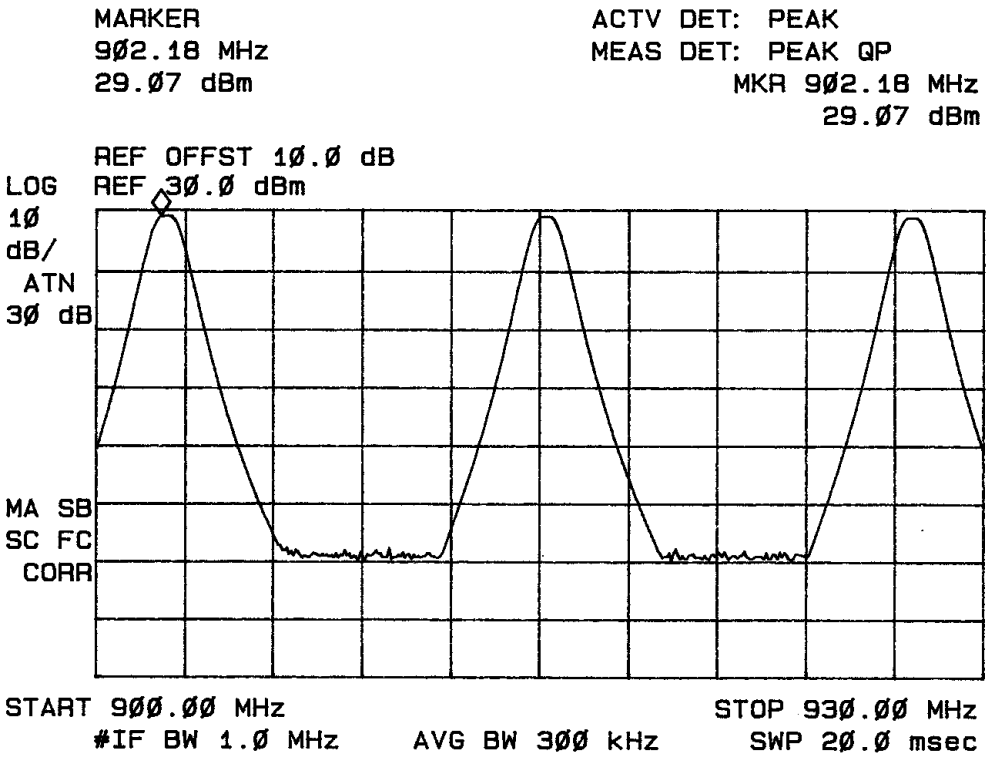

Figure seven Maximum Power output taken with ten dB attenuator.

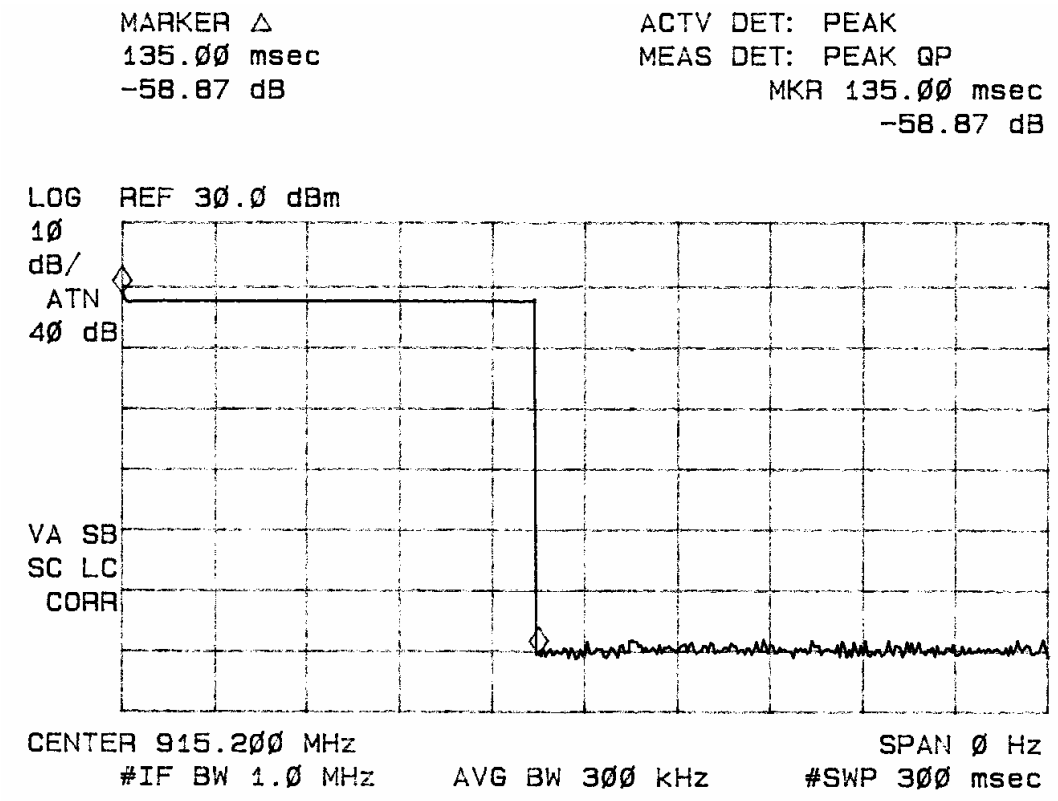

Figure eight Dwell Time of Occupancy.

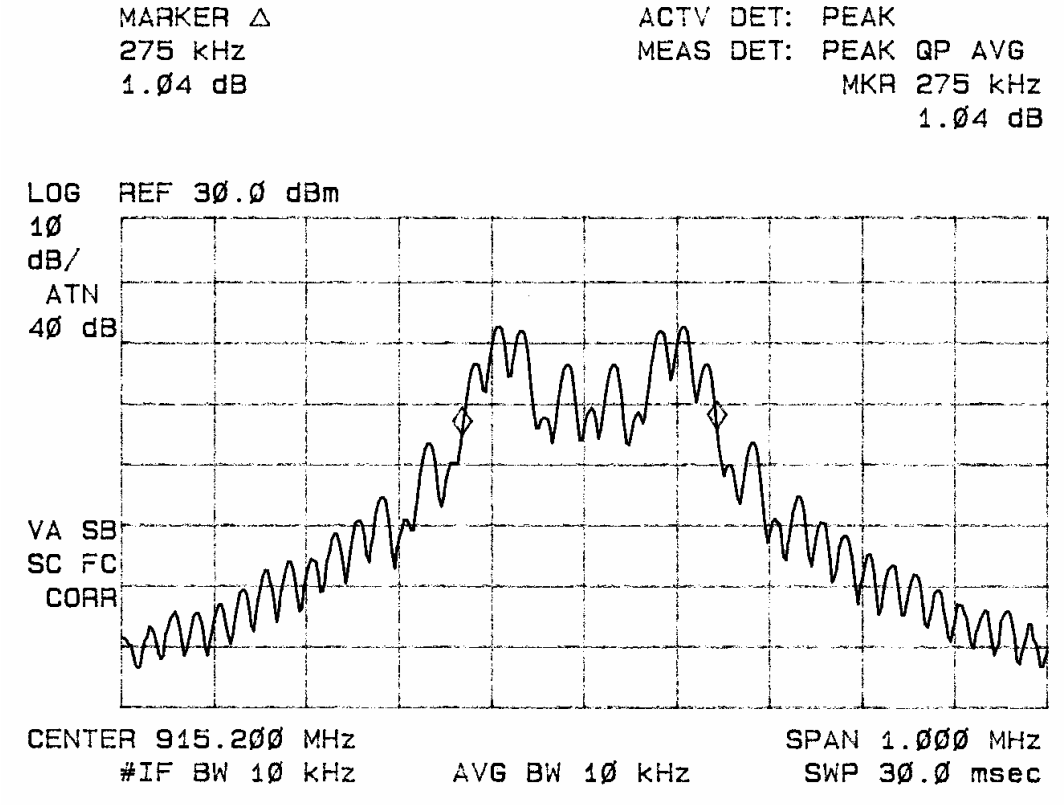

Figure nine 20-dB bandwidth.

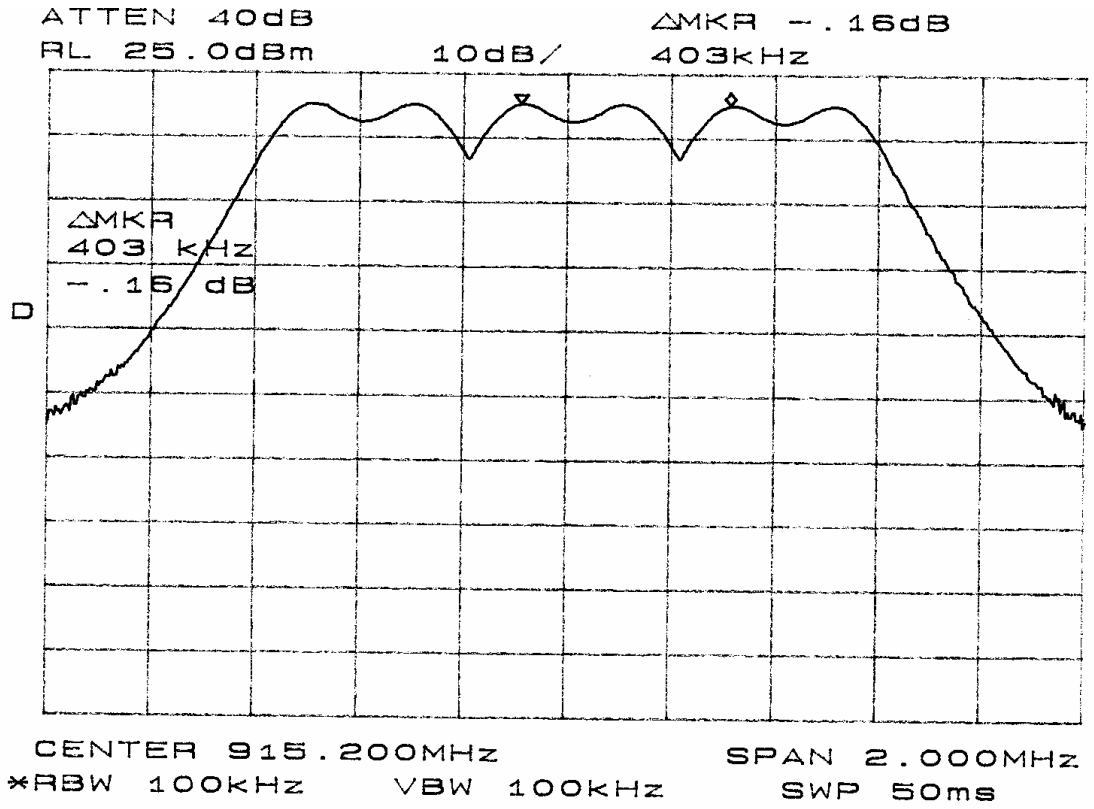

Figure ten Channel Spacing.

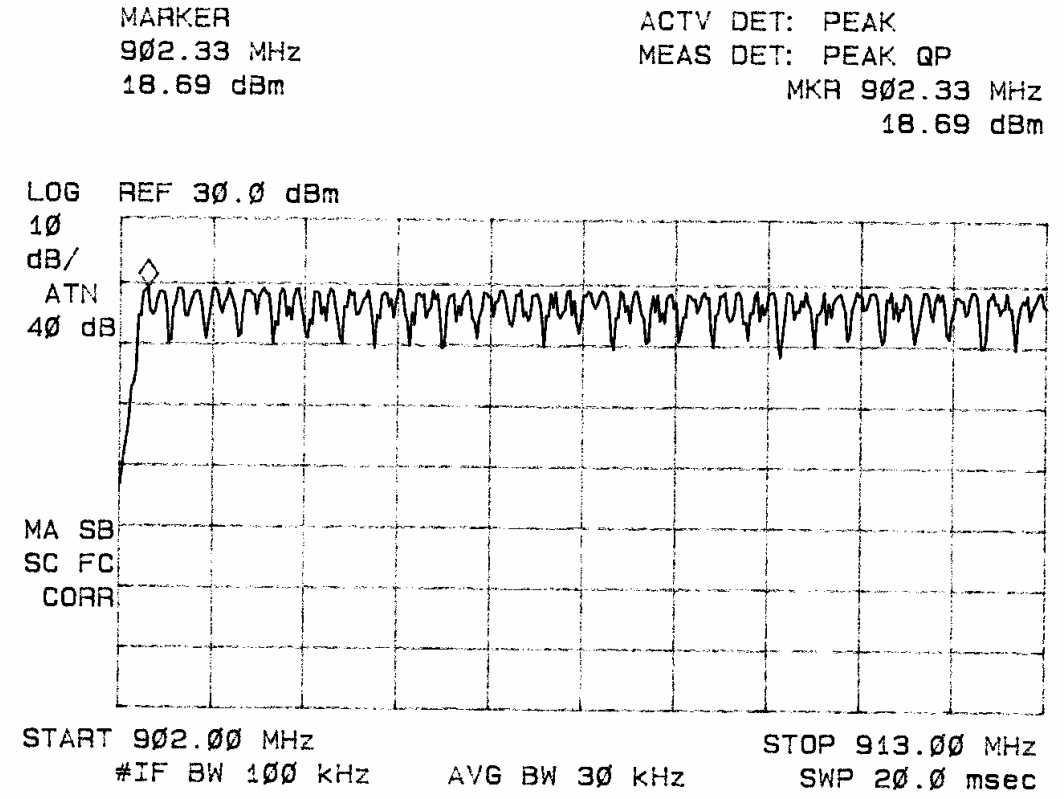

Figure eleven plot showing at least 25 hopping channels.

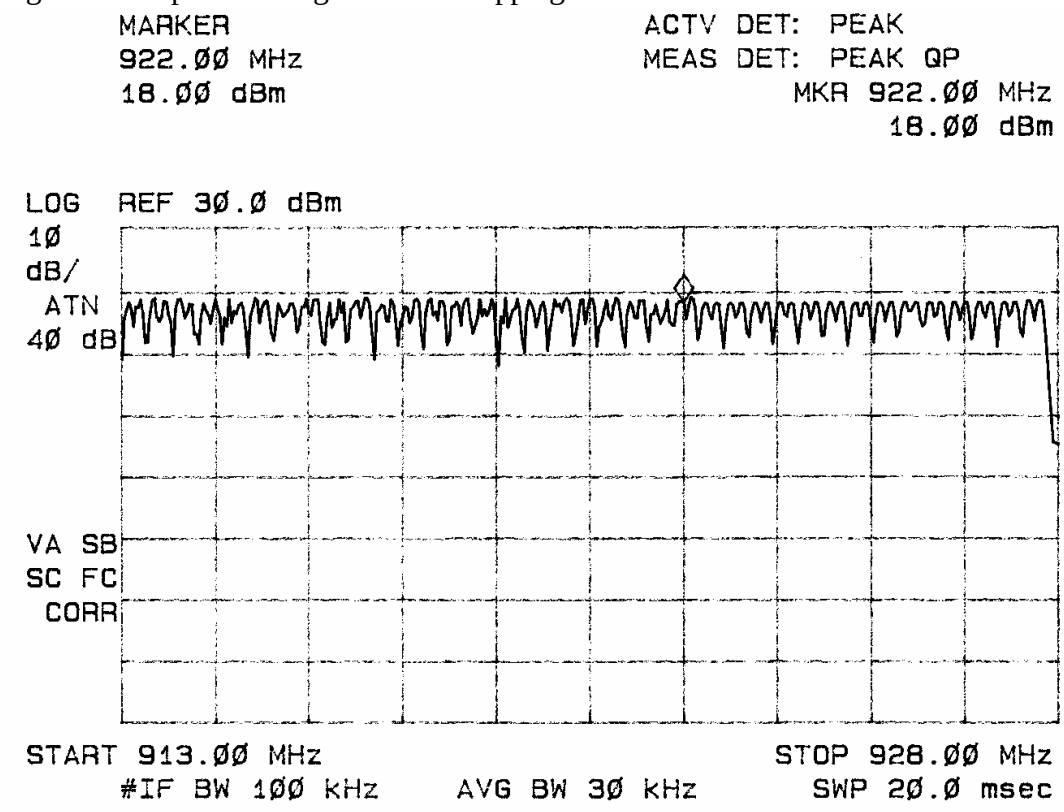

Figure twelve plot showing at least another 25 hopping channels.

Data: Radiated Emissions from EUT (1/4 Wave)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	Cable Loss (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
902.4	95.3	100.0	23.8	0	2.5	121.6	126.3	
1804.8	30.1	32.5	29.9	30	3.5	33.5	35.9	54.0
2707.6	31.5	34.1	32.5	30	3.5	37.5	40.1	54.0
3609.6	32.0	32.8	38.6	30	3.5	44.1	44.9	54.0
4512.0	31.6	32.0	40.6	30	3.5	45.7	46.1	54.0
915.2	95.5	100.5	23.8	0	2.5	121.8	126.8	
1830.4	31.3	36.3	29.9	30	3.5	34.7	39.7	54.0
2745.6	30.8	32.0	32.5	30	3.5	36.8	38.0	54.0
3660.8	31.0	31.6	38.6	30	3.5	43.1	43.7	54.0
4576.0	31.5	32.0	40.6	30	3.5	45.6	46.1	54.0
927.6	95.0	100.8	23.8	0	2.5	121.3	127.1	
1855.2	30.8	35.3	29.9	30	3.5	34.2	38.7	54.0
2782.8	31.5	32.5	32.5	30	3.5	37.5	38.5	54.0
3710.4	32.6	33.2	38.6	30	3.5	44.7	45.3	54.0
4638.0	31.3	31.6	40.6	30	3.5	45.4	45.7	54.0

Data: Radiated Emissions from EUT (1/4 Wave Right Angle Rubber Whip)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	Cable Loss (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
902.4	95.3	100.3	23.8	0	2.5	121.6	126.6	
1804.8	32.1	32.0	29.9	30	3.5	35.5	35.4	54.0
2707.6	30.1	30.0	32.5	30	3.5	36.1	36.0	54.0
3609.6	24.8	25.0	38.6	30	3.5	36.9	37.1	54.0
4512.0	24.5	25.5	40.6	30	3.5	38.6	39.6	54.0
915.2	90.7	100.8	23.8	0	2.5	117.0	127.1	
1830.4	32.1	33.8	29.9	30	3.5	35.5	37.2	54.0
2745.6	30.1	30.6	32.5	30	3.5	36.1	36.6	54.0
3660.8	32.8	34.6	38.6	30	3.5	44.9	46.7	54.0
4576.0	31.1	31.1	40.6	30	3.5	45.2	45.2	54.0
927.6	93.6	99.8	23.8	0	2.5	119.9	126.1	
1855.2	34.1	35.2	29.9	30	3.5	37.5	38.6	54.0
2782.8	30.6	30.6	32.5	30	3.5	36.6	36.6	54.0
3710.4	33.5	33.5	38.6	30	3.5	45.6	45.6	54.0
4638.0	31.8	31.8	40.6	30	3.5	45.9	45.9	54.0

Data: Radiated Emissions from EUT (0 dBi gain Dome)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	Cable Loss (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
902.4	94.5	100.2	23.8	0	2.5	120.8	126.5	
1804.8	32.5	31.0	29.9	30	3.5	35.9	34.4	54.0
2707.6	32.8	33.6	32.5	30	3.5	38.8	39.6	54.0
3609.6	31.5	32.0	38.6	30	3.5	43.6	44.1	54.0
4512.0	31.5	31.8	40.6	30	3.5	45.6	45.9	54.0
915.2	93.7	99.0	23.8	0	2.5	120.0	125.3	
1830.4	31.6	37.0	29.9	30	3.5	35.0	40.4	54.0
2745.6	30.5	30.5	32.5	30	3.5	36.5	36.5	54.0
3660.8	32.0	32.1	38.6	30	3.5	44.1	44.2	54.0
4576.0	31.1	31.1	40.6	30	3.5	45.2	45.2	54.0
927.6	93.2	100.5	23.8	0	2.5	119.5	126.8	
1855.2	30.3	32.0	29.9	30	3.5	33.7	35.4	54.0
2782.8	31.6	31.7	32.5	30	3.5	37.6	37.7	54.0
3710.4	31.8	32.6	38.6	30	3.5	43.9	44.7	54.0
4638.0	31.3	31.4	40.6	30	3.5	45.4	45.5	54.0

Data: Radiated Emissions from EUT (5/8 Open Coil)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	Cable Loss (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
902.4	92.7	100.6	23.8	0	2.5	119.0	126.9	
1804.8	30.8	33.6	29.9	30	3.5	34.2	37.0	54.0
2707.6	34.0	36.6	32.5	30	3.5	40.0	42.6	54.0
3609.6	32.8	33.0	38.6	30	3.5	44.9	45.1	54.0
4512.0	31.5	31.6	40.6	30	3.5	45.6	45.7	54.0
915.2	92.5	101.0	23.8	0	2.5	118.8	127.3	
1830.4	31.8	31.5	29.9	30	3.5	35.2	34.9	54.0
2745.6	32.0	32.6	32.5	30	3.5	38.0	38.6	54.0
3660.8	32.8	33.8	38.6	30	3.5	44.9	45.9	54.0
4576.0	31.3	31.6	40.6	30	3.5	45.4	45.7	54.0
927.6	94.3	100.6	23.8	0	2.5	120.6	126.9	
1855.2	30.8	33.1	29.9	30	3.5	34.2	36.5	54.0
2782.8	33.1	34.6	32.5	30	3.5	39.1	40.6	54.0
3710.4	32.3	34.1	38.6	30	3.5	44.4	46.2	54.0
4638.0	31.3	31.6	40.6	30	3.5	45.4	45.7	54.0

Data: Radiated Emissions from EUT (3 dBi gain Stub)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	Cable Loss (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
902.4	94.2	101.2	23.8	0	2.5	120.5	127.5	
1804.8	31.0	31.6	29.9	30	3.5	34.4	35.0	54.0
2707.6	30.8	32.0	32.5	30	3.5	36.8	38.0	54.0
3609.6	31.5	33.0	38.6	30	3.5	43.6	45.1	54.0
4512.0	31.0	31.6	40.6	30	3.5	45.1	45.7	54.0
915.2	94.8	101.0	23.8	0	2.5	121.1	127.3	
1830.4	32.5	32.0	29.9	30	3.5	35.9	35.4	54.0
2745.6	31.5	31.8	32.5	30	3.5	37.5	37.8	54.0
3660.8	33.6	32.0	38.6	30	3.5	45.7	44.1	54.0
4576.0	31.0	31.1	40.6	30	3.5	45.1	45.2	54.0
927.6	94.3	101.2	23.8	0	2.5	120.6	127.5	
1855.2	34.8	38.3	29.9	30	3.5	38.2	41.7	54.0
2782.8	31.3	32.3	32.5	30	3.5	37.3	38.3	54.0
3710.4	31.6	34.6	38.6	30	3.5	43.7	46.7	54.0
4638.0	30.3	31.1	40.6	30	3.5	44.4	45.2	54.0

Data: Radiated Emissions from EUT (3 dBi gain Fiberglass Omni Directional)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	Cable Loss (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
902.4	93.3	104.4	23.8	0	2.5	119.6	130.7	
1804.8	30.6	30.5	29.9	30	3.5	34.0	33.9	54.0
2707.6	32.3	31.3	32.5	30	3.5	38.3	37.3	54.0
3609.6	31.8	32.3	38.6	30	3.5	43.9	44.4	54.0
4512.0	30.1	30.3	40.6	30	3.5	44.2	44.4	54.0
915.2	94.1	103.8	23.8	0	2.5	120.4	130.1	
1830.4	29.5	30.0	29.9	30	3.5	32.9	33.4	54.0
2745.6	29.3	29.8	32.5	30	3.5	35.3	35.8	54.0
3660.8	31.5	32.0	38.6	30	3.5	43.6	44.1	54.0
4576.0	30.8	31.1	40.6	30	3.5	44.9	45.2	54.0
927.6	94.0	104.3	23.8	0	2.5	120.3	130.6	
1855.2	30.3	30.3	29.9	30	3.5	33.7	33.7	54.0
2782.8	31.6	33.0	32.5	30	3.5	37.6	39.0	54.0
3710.4	31.1	32.6	38.6	30	3.5	43.2	44.7	54.0
4638.0	31.0	31.3	40.6	30	3.5	45.1	45.4	54.0

Data: Radiated Emissions from EUT (5/8 Wave Center loaded 5 dBi gain)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	Cable Loss (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
902.4	92.0	104.0	23.8	0	2.5	118.3	130.3	
1804.8	31.1	35.8	29.9	30	3.5	34.5	39.2	54.0
2707.6	32.5	30.8	32.5	30	3.5	38.5	36.8	54.0
3609.6	32.5	32.3	38.6	30	3.5	44.6	44.4	54.0
4512.0	31.5	32.0	40.6	30	3.5	45.6	46.1	54.0
915.2	91.0	103.0	23.8	0	2.5	117.3	129.3	
1830.4	32.6	30.0	29.9	30	3.5	36.0	33.4	54.0
2745.6	30.5	30.0	32.5	30	3.5	36.5	36.0	54.0
3660.8	30.8	31.3	38.6	30	3.5	42.9	43.4	54.0
4576.0	30.1	30.3	40.6	30	3.5	44.2	44.4	54.0
927.6	91.0	103.3	23.8	0	2.5	117.3	129.6	
1855.2	31.1	32.8	29.9	30	3.5	34.5	36.2	54.0
2782.8	30.8	31.0	32.5	30	3.5	36.8	37.0	54.0
3710.4	32.5	31.6	38.6	30	3.5	44.6	43.7	54.0
4638.0	31.6	31.5	40.6	30	3.5	45.7	45.6	54.0

Data: Radiated Emissions from EUT (4 Element 6 dBi gain Yagi)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	Cable Loss (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
902.4	106.2	93.5	23.8	0	2.5	132.5	119.8	
1804.8	26.3	26.7	29.9	30	3.5	29.7	30.1	54.0
2707.6	23.3	23.6	32.5	30	3.5	29.3	29.6	54.0
3609.6	24.3	26.3	38.6	30	3.5	36.4	38.4	54.0
4512.0	24.3	24.3	40.6	30	3.5	38.4	38.4	54.0
915.2	105.8	94.8	23.8	0	2.5	132.1	121.1	
1830.4	24.0	24.8	29.9	30	3.5	27.4	28.2	54.0
2745.6	24.5	23.0	32.5	30	3.5	30.5	29.0	54.0
3660.8	25.5	24.7	38.6	30	3.5	37.6	36.8	54.0
4576.0	23.5	23.8	40.6	30	3.5	37.6	37.9	54.0
927.6	104.3	92.6	23.8	0	2.5	130.6	118.9	
1855.2	32.0	24.1	29.9	30	3.5	35.4	27.5	54.0
2782.8	30.8	23.8	32.5	30	3.5	36.8	29.8	54.0
3710.4	27.8	27.3	38.6	30	3.5	39.9	39.4	54.0
4638.0	31.0	22.5	40.6	30	3.5	45.1	36.6	54.0

Summary of Results for Radiated Emissions of Intentional Radiator

The EUT had a worst-case of 0.9 dB margin below the limit at the fundamental frequency of operation using the ¼-wave right angle rubber whip. The EUT had a worst-case of 7.31 dB margin below the limit for the harmonic emissions. The radiated emissions for the EUT meet the requirements for FCC Part 15.247 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 10 dB below the FCC Limits. The worst-case data for all antenna configurations was presented in the report. The specifications of 15.247 were met; there are no deviations or exceptions to the requirements.

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to meet the FCC Part 15C emissions standards. There were no deviations to the specifications.

APPENDIX

Model: CDR-9150 DATA TRANSMITTER

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:

Scot D Rogers

Scot D. Rogers

August 26, 2002
Date

1/11/00

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

Thomas W Phillips
Electronics Engineer