

# SUBMITTAL APPLICATION REPORT

FOR  
FCC And INDUSTRY CANADA  
GRANT OF CERTIFICATION

FOR

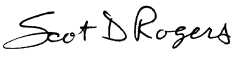
Model: D4T  
907.7 – 921.6 MHz Digitally Modulated  
Transmitter

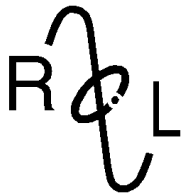
FCC ID: DBZD4T  
IC: 8024A-D4T

FOR

**LECTROSONICS, INC.**  
581 Laser Road  
Rio Rancho, NM 87124

Test Report Number: 090122T

Authorized Signatory:   
Scot D. Rogers



**ROGERS LABS, INC.**

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

**Engineering Test Report For  
 Application of  
 Grant of Certification**

FOR  
**CFR47, PART 15C - Intentional Radiators  
 Paragraph 15.247 and Industry Canada, RSS-210  
 Digitally Modulated Transmitter**

For

**LECTROSONICS, INC.**

581 Laser Road  
 Rio Rancho, NM 87124  
 Larry Fisher  
 President

**Model: D4T**

Frequency 907.7-921.6 MHz  
 FCC ID#: DBZD4T, IC: 8024A-D4T

Test Date: January 22, 2009

Certifying Engineer: *Scot D. Rogers*

Scot D. Rogers  
 Rogers Labs, Inc.  
 4405 West 259<sup>th</sup> Terrace  
 Louisburg, KS 66053  
 Telephone/Fax: (913) 837-3214

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### Forward

The following information is submitted for consideration in obtaining Grant of Certification for license exempt digitally modulated intentional radiator operating under CFR47 Paragraph 15.247 and Industry Canada standard RSS-210.

Name of Applicant:

LECTROSONICS, INC.  
581 Laser Road  
Rio Rancho, NM 87124

Model: D4T

FCC I.D.: DBZD4T                      IC: 8024A-D4T

Frequency Range: 907.7-921.6MHz

Operating Power: 0.82 watts antenna conducted, Peak radiated measured 115.0 dBµV/m @ 3-meters (3- meter radiated measurement)

### Opinion / Interpretation of Results

Tests Performed	Results
Emissions Tests	
Emissions as per CFR47 paragraphs 2 and 15.205	Complies
Emissions as per CFR47 paragraphs 2 and 15.207	Complies
Emissions as per CFR47 paragraphs 2 and 15.209	Complies
Emissions as per CFR47 paragraphs 2 and 15.247, and RSS-210	Complies

### Environmental Conditions

Ambient Temperature	20.1° C
Relative Humidity	19%
Atmospheric Pressure	1038.7 mb

### 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.

## 2.1033(b) Application for Certification

- (1) Manufacturer: LECTROSONICS, INC.  
581 Laser Road  
Rio Rancho, NM 87124
- (2) Identification: Model: D4T  
FCC I.D.: DBZD4T  
IC: 8024A-D4T
- (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) Equipment is not a scanning receiver and this section is not applicable.
- (11) The equipment does not operate in the 59 – 64 GHz frequency band and this section is not applicable.
- (12) The equipment is not software defined and this section is not applicable.

## Test Site Locations

- Conducted EMI**      The AC power line conducted emissions testing was performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259<sup>th</sup> 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. 259<sup>th</sup> Terrace, Louisburg, KS.
- Site Approval**      Refer to Annex for FCC and Industry Canada Site Registration Letters

NVLAP Accreditation 200087-0

## 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



<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Calibration Date</u>	<u>Due</u>
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/08	10/09
LISN	Comp. Design	1762	2/08	2/09
Antenna	ARA	BCD-235-B	10/08	10/09
Antenna	EMCO	3147	10/08	10/09
Antenna	EMCO	3143	5/08	5/09
Analyzer	HP	8591EM	5/08	5/09
Analyzer	HP	8562A	5/08	5/09

### **Applicable Standards & Test Procedures**

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2008, 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, and Industry Canada standard RSS-210 the following information is submitted. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-2003 Document FCC, documents DA00-1407 and DA00-705 and/or TIA/EIA 603-1.

#### ***AC Line Conducted Emission Test Procedure***

Testing for the AC line-conducted emissions testing was performed as defined in sections 7 and 13.1.3 of ANSI C63.4. 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***

Testing for the unintentional radiated emissions was performed as defined in section 8 and 13.1.4 of ANSI C63.4. 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.



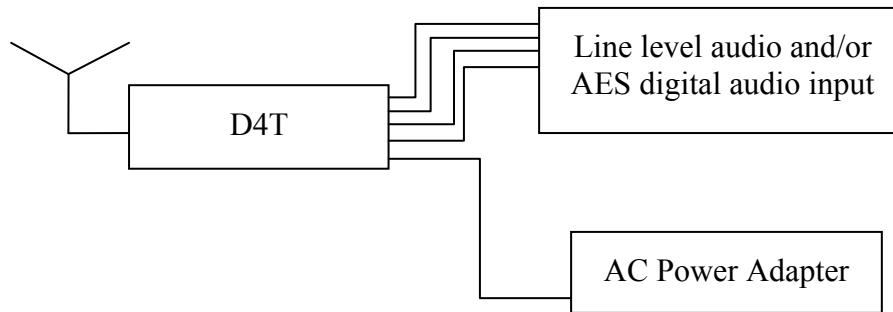
## Equipment Tested

<u>Equipment</u>	<u>Model</u>	<u>FCC ID</u>	<u>IC</u>
EUT	D4T	DBZD4T	8024A-D4T
AC Charger	DCR15/2AU	N/A	

## Equipment Function

The EUT is a 907.7-921.6 MHz radio transmitter used to provide high quality monaural audio for communications. The D4T is the transmitter portion for remote audio communications. The inputs are for either AES digital audio or line level audio. The equipment was tested for compliance while operating through all normal modes available. These configurations represented the worst-case emissions profile for the equipment and results are recorded in this report. The equipment operates from external AC power supplied from the manufacturer supplied AC power adapter.

## Equipment Configuration



## **Subpart B – Unintentional Radiators**

### ***AC Line 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 adapter option 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  $\mu$ F capacitor, internal to the LISN. Power line conducted emissions testing were 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 the AC Line conducted emissions.

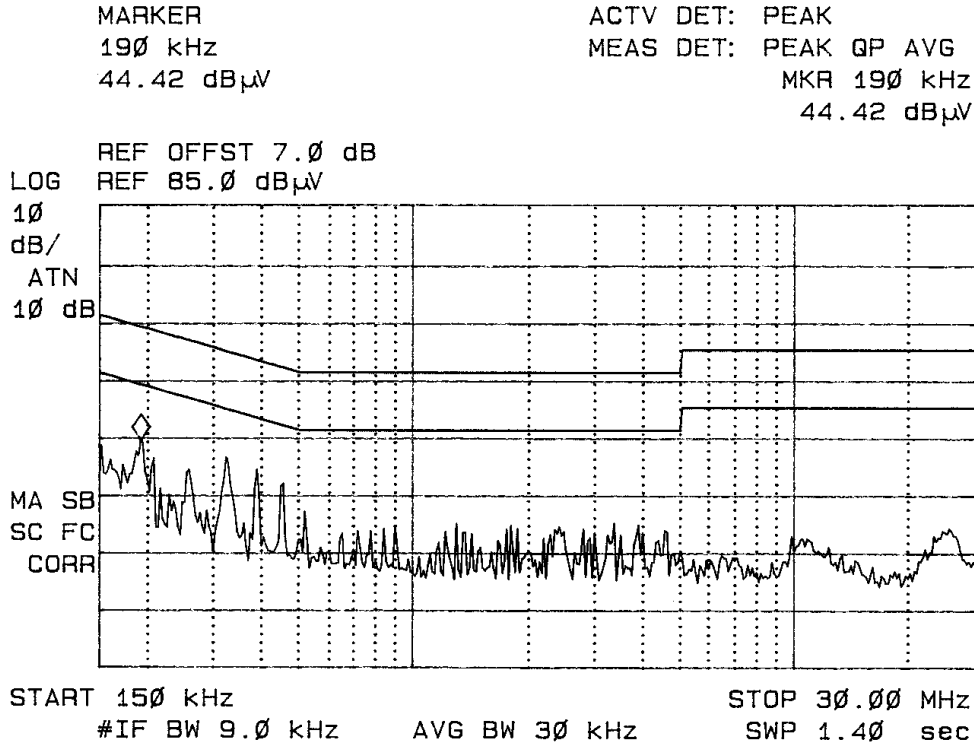


Figure One AC Line Conducted Emissions Line 1

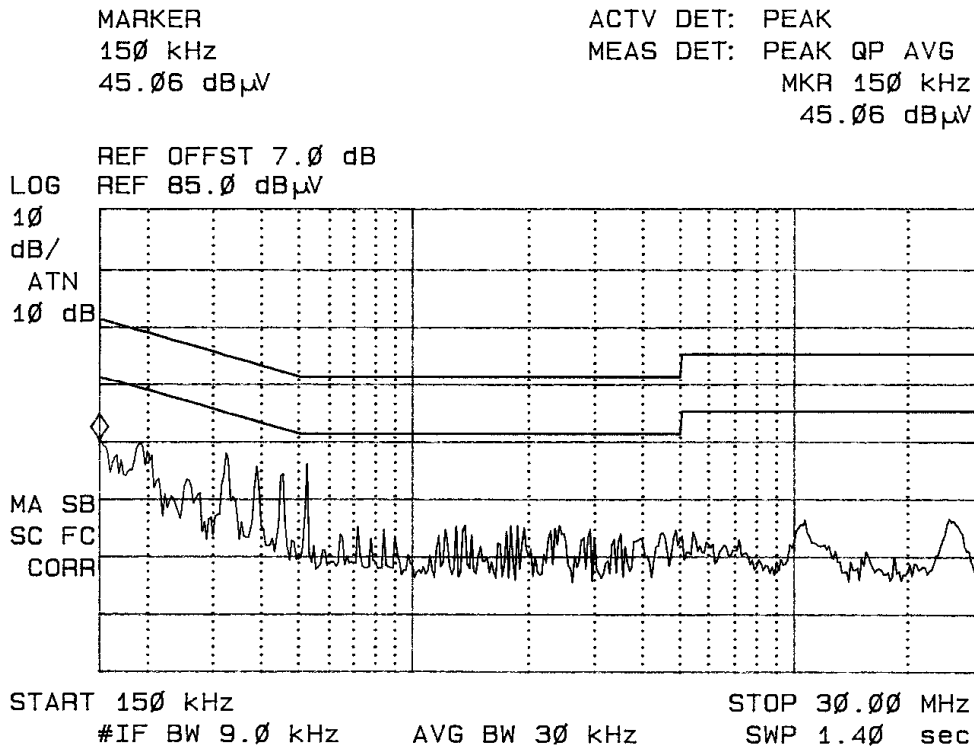


Figure Two AC Line Conducted Emissions Line 2

***Radiated EMI***

The EUT was arranged 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. 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 12,000 MHz for the preliminary testing. Refer to figures three through seven showing plots of the radiated emissions spectrum taken in a screen room. 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 12,000 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, double ridge or pyramidal horns and mixers from 4 GHz to 40 GHz, notch filters and appropriate amplifiers were utilized.

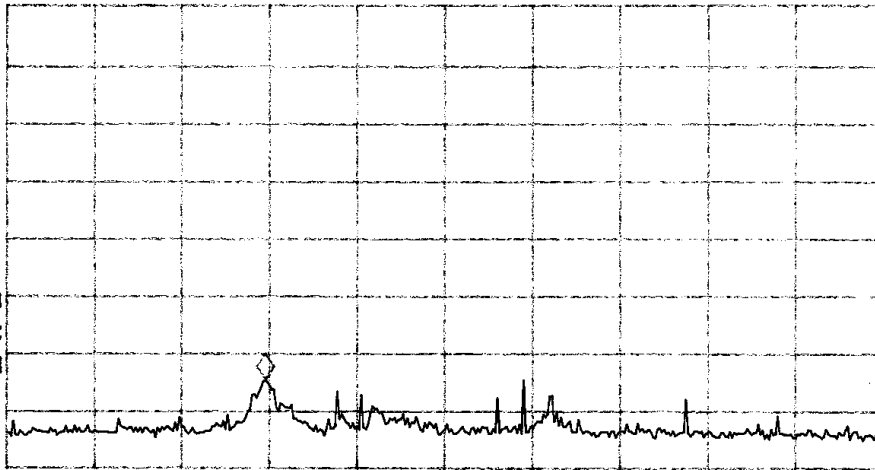
MARKER  
89.0 MHz  
32.40 dB $\mu$ V

ACTV DET: PEAK  
MEAS DET: PEAK QP  
MKR 89.0 MHz  
32.40 dB $\mu$ V

LOG REF 97.0 dB $\mu$ V

10  
dB/  
#ATN  
0 dB

MA SB  
SC FC  
CORR



START 30.0 MHz STOP 230.0 MHz  
#IF BW 120 kHz AVG BW 300 kHz SWP 41.7 msec

Figure Three Plot of General Radiated Emissions

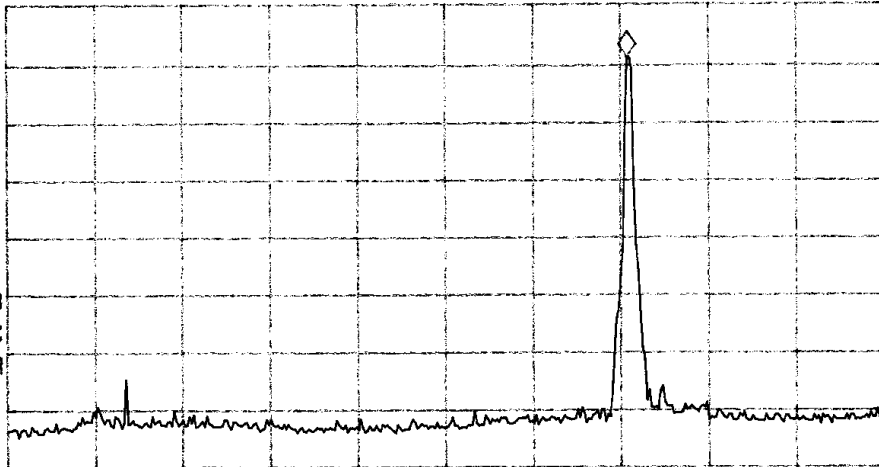
MARKER  
908 MHz  
87.83 dB $\mu$ V

ACTV DET: PEAK  
MEAS DET: PEAK QP  
MKR 908 MHz  
87.83 dB $\mu$ V

LOG REF 97.0 dB $\mu$ V

10  
dB/  
#ATN  
0 dB

VA SB  
SC FC  
CORR



START 200 MHz STOP 1.200 GHz  
#IF BW 120 kHz AVG BW 300 kHz SWP 208 msec

Figure four Plot of General Radiated Emissions

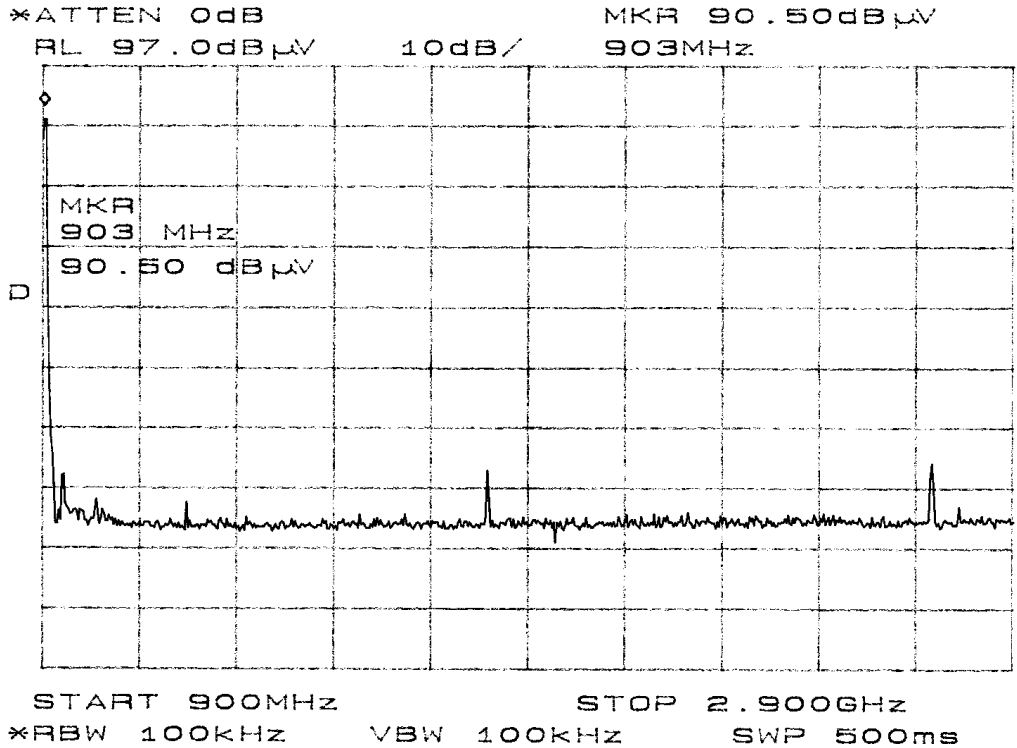


Figure Five Plot of General Radiated Emissions

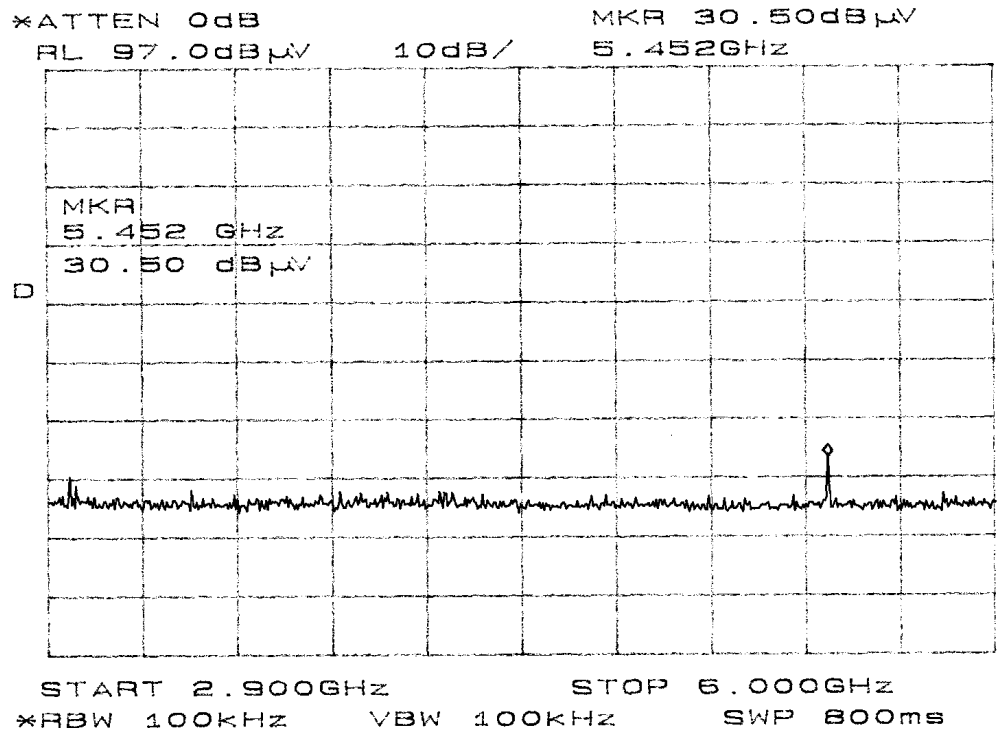
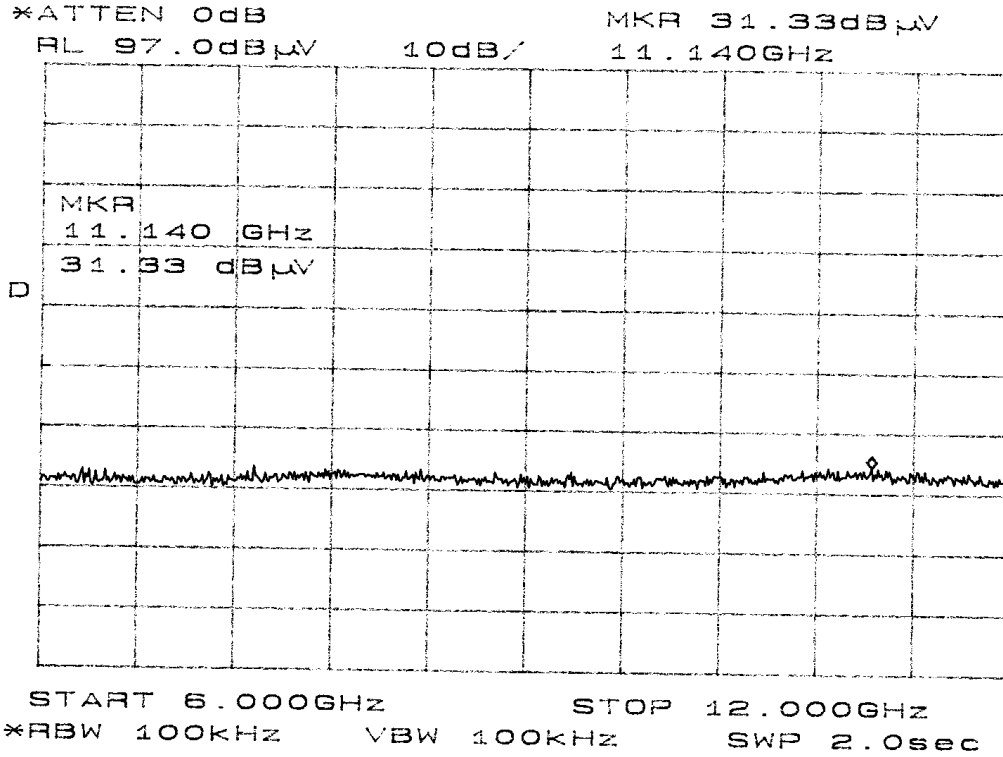


Figure Six Plot of General Radiated Emissions



**Figure Seven Plot of General Radiated Emissions**

**AC Line Conducted Emissions Data (7 Highest Emissions)**

Frequency band (MHz)	L1 Level (dBµV)			L2 Level (dBµV)			CISPR 22 Limit Q.P. / Ave(dBµV)
	Peak	Q.P.	AVE	Peak	Q.P.	AVE	
0.15 – 0.5	44.4	43.0	35.3	45.1	43.9	32.5	66 / 56
0.5 – 5	36.6	34.9	30.4	36.6	34.9	30.4	56 / 46
5 – 10	26.3	22.6	17.1	29.5	26.7	21.8	60 / 50
10 – 15	28.3	25.5	20.9	30.2	27.6	23.5	60 / 50
15 – 20	23.9	19.0	11.1	25.6	21.1	12.5	60 / 50
20 – 25	29.5	26.6	23.7	29.6	26.2	22.7	60 / 50
25 – 30	29.4	26.7	23.1	30.6	27.9	23.6	60 / 50

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

**General Radiated Emissions Data from EUT**

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)	Class B Limit @ 3m (dBµV/m)
85.3	34.8	35.3	7.6	30	12.4	12.9	40.0
110.6	48.2	43.5	6.7	30	24.9	20.2	43.5
147.5	54.9	48.5	12.5	30	37.4	31.0	43.5
153.6	43.4	47.2	9.2	30	22.6	26.4	43.5
184.4	47.8	50.8	11.8	30	29.6	32.6	43.5
294.9	51.1	47.7	13.7	30	34.8	31.4	46.0
331.6	49.4	43.2	15.0	30	34.4	28.2	46.0

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

**Summary of Results for AC Line Conducted Emissions**

The conducted emissions for the EUT meet the requirements for CFR47 and RSS-210. The EUT demonstrated a 21.1dB minimum margin below the Quasi-Peak limit, and 15.6 dB minimum margins below the average limit. Measurements were taken using the peak, quasi peak, and average, measurement function for each emissions amplitude and were below the limits stated in the specification. Other emissions were present with recorded data representing worst-case amplitudes.

**Summary of Results for General Radiated Emissions**

The radiated emissions of the EUT comply with requirements for CFR47, and Industry Canada. The EUT demonstrated 6.1 dB minimum margins below the limit. Other emissions were present with amplitudes at least 20 dB below the limit.

**Statement of Modifications and Deviations**

No modifications to the EUT were required for demonstration of compliance with the CISPR 22, CFR47, and Industry Canada requirements. There were no modifications, deviations or exceptions to the specifications.



## Subpart C - Intentional Radiators

As per CFR47 Part 15, Subpart C, paragraphs 15.203, 15.205, 15.209, 15.247 and RSS-210 the following information is submitted.

### **15.203 Antenna Requirements**

The equipment utilizes a compliant reverse SMA antenna port connection for use with approved antennas. The system is supplied with a center fed ½ wave 4” long dipole antenna. The requirements of 15.203 are fulfilled and there are no deviations or exceptions to the specification.

### **15.205 Restricted Bands of Operation**

Spurious emissions falling in the restricted frequency bands of operation were measured at a distance of three meters 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:

$$\begin{aligned} \text{RFS (dB}\mu\text{V/m @ 3m)} &= \text{FSM(dB}\mu\text{V)} + \text{A.F.(dB)} - \text{Gain(dB)} \\ &= 48.2 + 6.7 - 30 \\ &= 24.9 \end{aligned}$$

**Radiated Emissions Data in Restricted Bands (Worst-case)**

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)	Class B Limit @ 3m (dBµV/m)
110.6	48.2	43.5	6.7	30	24.9	20.2	43.5
153.6	43.4	47.2	9.2	30	22.6	26.4	43.5
331.6	49.4	43.2	15.0	30	34.4	28.2	46.0
2723.3	29.2	28.8	34.5	30	33.7	33.3	54.0
2737.2	32.0	41.2	34.5	30	36.5	45.7	54.0
2764.8	27.8	26.5	34.4	30	32.2	30.9	54.0
3631.1	25.0	24.7	38.0	30	33.0	32.7	54.0
3649.5	21.8	23.6	39.0	30	30.8	32.6	54.0
3686.4	25.3	25.0	39.0	30	34.3	34.0	54.0
4538.9	23.8	23.8	41.6	30	35.4	35.4	54.0
4561.9	22.3	24.5	41.8	30	34.1	36.3	54.0
4608.0	24.5	23.8	41.7	30	36.2	35.5	54.0
5446.7	24.1	23.2	33.1	30	27.2	26.3	54.0

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

**Summary of Results for Radiated Emissions in Restricted Bands**

The radiated emissions in restricted bands comply with requirements of CFR47 and RSS-210. The EUT demonstrated 8.3 dB minimum margins below the limits for restricted bands of operation. Both average and peak amplitudes above 1000 MHz were checked for compliance with the regulations. No other emissions were found in the restricted frequency bands. Other emissions were present with amplitudes at least 20 dB below the 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 12,000 MHz and plots were made of the frequency spectrum from 30 MHz to 12,000 MHz for the preliminary testing. Final data was taken with the EUT located at the open area test site at a distance of 3 meters between the EUT and the receiving antenna. The highest radiated emission was then re-maximized on the OATS before final radiated emissions measurements were performed. The frequency spectrum from 30 MHz to 12,000 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 40 GHz.

#### General Radiated Emissions Data from EUT (15.209)

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)	Class B Limit @ 3m (dBμV/m)
85.3	34.8	35.3	7.6	30	12.4	12.9	40.0
110.6	48.2	43.5	6.7	30	24.9	20.2	43.5
147.5	54.9	48.5	12.5	30	37.4	31.0	43.5
153.6	43.4	47.2	9.2	30	22.6	26.4	43.5
184.4	47.8	50.8	11.8	30	29.6	32.6	43.5
294.9	51.1	47.7	13.7	30	34.8	31.4	46.0
331.6	49.4	43.2	15.0	30	34.4	28.2	46.0

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

**Summary of Results for Radiated Emissions**

The radiated emissions for the EUT meet the requirements for CFR47 Part 15C, and Industry Canada. The EUT demonstrated 6.1 dB minimum margins below the required emissions limit. Other emissions were present with amplitudes at least 20 dB below the limit.

**15.247 Operation in the Band 907.7-921.6 MHz**

The power output and harmonics were measured on an Open Area Test Site at a 3 meters distance. The EUT and test fixture was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from the FSM antenna. The peak and quasi-peak amplitude of the carrier frequency was measured using a spectrum analyzer. The peak and average amplitude of the spurious emissions above 1000 MHz were measured using a spectrum analyzer then data was recorded from the analyzer display. Refer to figures eight through eleven for plots of the transmitter antenna conducted emissions taken in the screen room. Refer to figures twelve through nineteen for plots of the spectrum analyzer display demonstrating compliance to the specifications. The EUT is a digitally modulated intentional radiator utilizing occupied bandwidth greater than 500 kHz as required. Figures twelve and thirteen demonstrate number of channels used in 907.7-921.6 MHz frequency maximum output power. Figures fourteen through nineteen demonstrate occupied bandwidth and power spectral density of channels in the 907.7-921.6 MHz band. The 20-dB bandwidth of 4.23 MHz complies with the requirement of greater than 500 kHz. The 902 and 928 MHz band edges are protected due to the 902.9– 927 MHz channels used for frequency of operation. The maximum peak output power of the unit was measured at the antenna port and again at a distance of three meters while tested on the OATS with the available antenna option. The amplitudes of each emission and spurious emission were measured at a distance of 3 meters from the FSM antenna on the OATS. The amplitude of each emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable. Emissions were measured in dBµV/m at three meters. The amplitude of each measured emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable. A Biconilog Antenna was used for measuring emissions from 30 to 1000 MHz, a Log Periodic Antenna for 200 to 5000 MHz, and Double Ridge and/or Pyramidal Horn Antennas from 4 GHz to 40 GHz. Data was taken per Paragraph 2.1046(a), 15.247 and RSS-210.

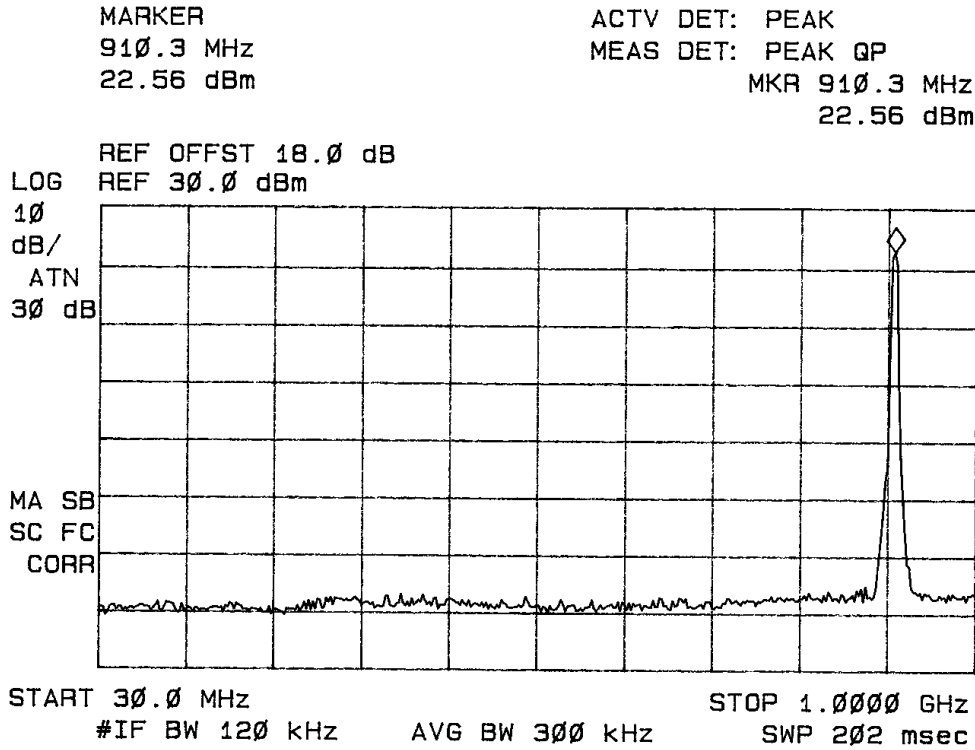


Figure Eight Plot of Antenna Conducted Emissions

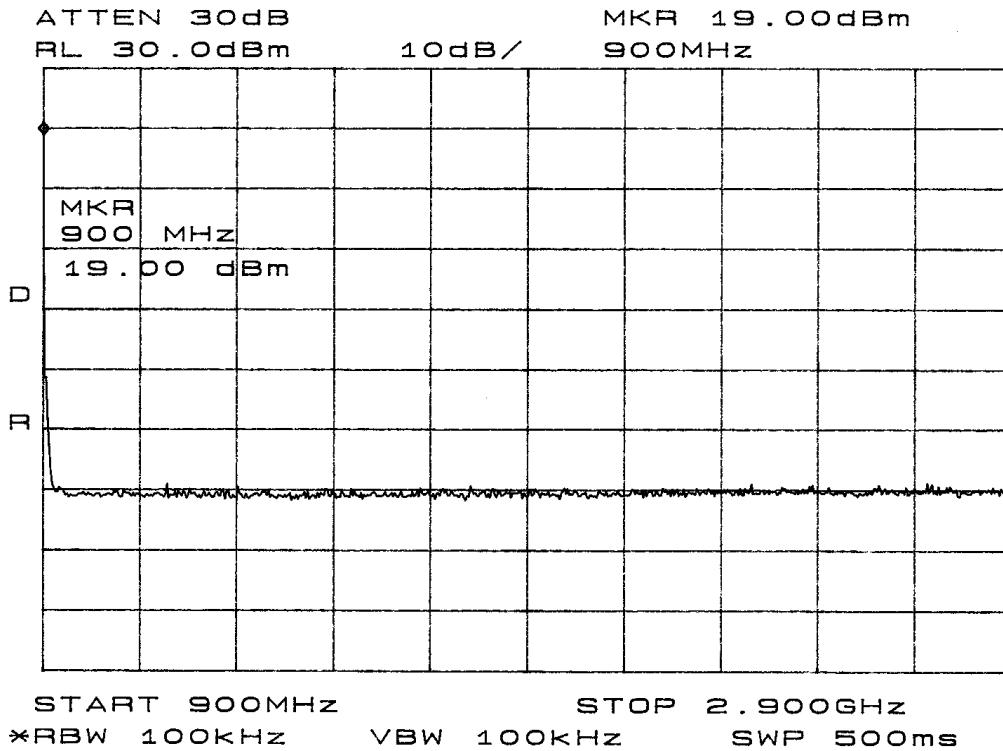
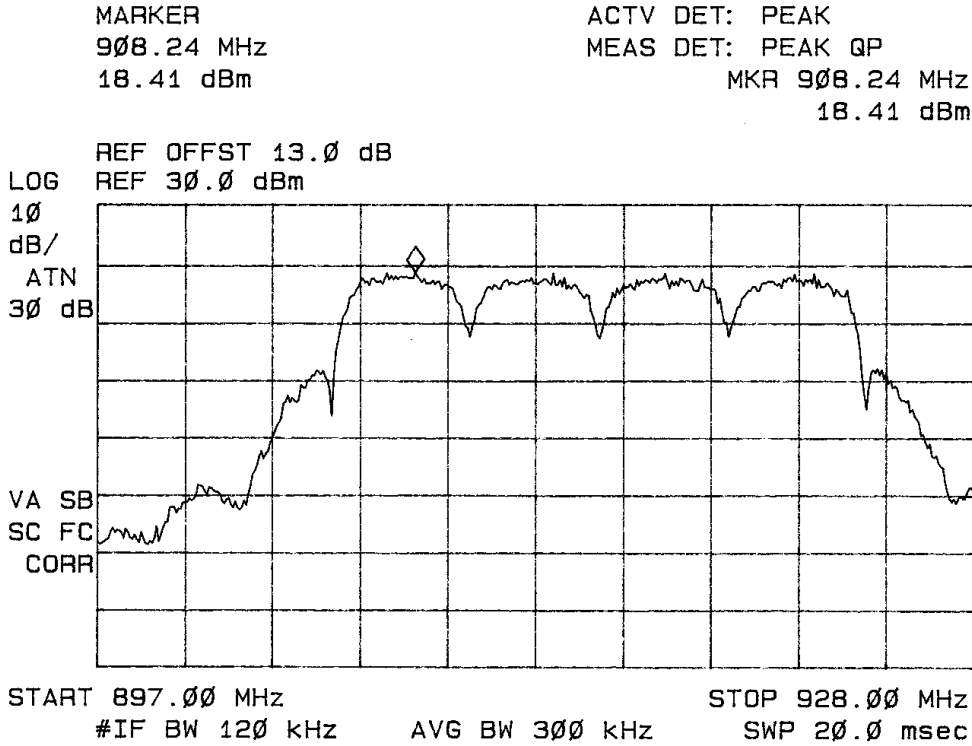
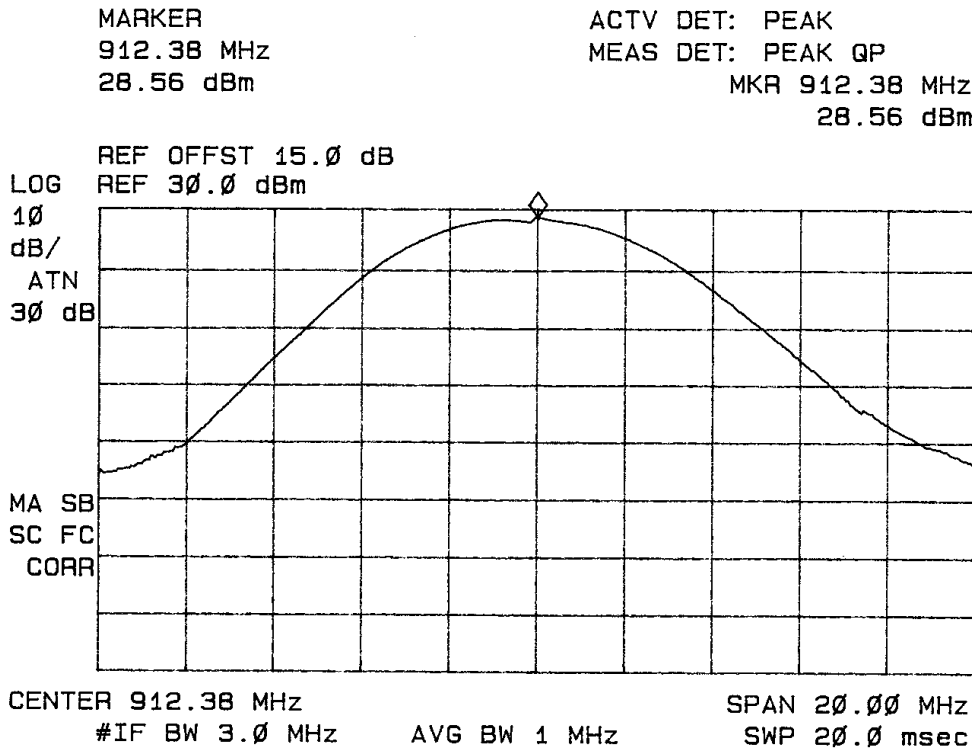


Figure Nine Plot of Antenna Conducted Emissions





**Figure Twelve Plot of Antenna Conducted Emissions Channels of Operation**



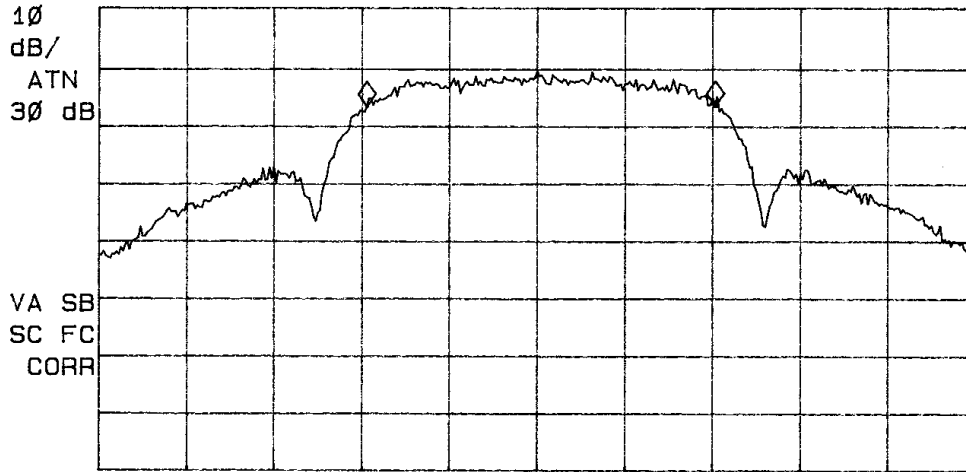
**Figure Thirteen Plot of Radiated Emissions Maximum Output Power**

MARKER  $\Delta$   
3.98 MHz  
.20 dB

ACTV DET: PEAK  
MEAS DET: PEAK QP  
MKR 3.98 MHz  
.20 dB

REF OFFST 15.0 dB

LOG REF 30.0 dBm



CENTER 907.78 MHz SPAN 10.00 MHz  
#IF BW 100 kHz AVG BW 30 kHz SWP 20.0 msec

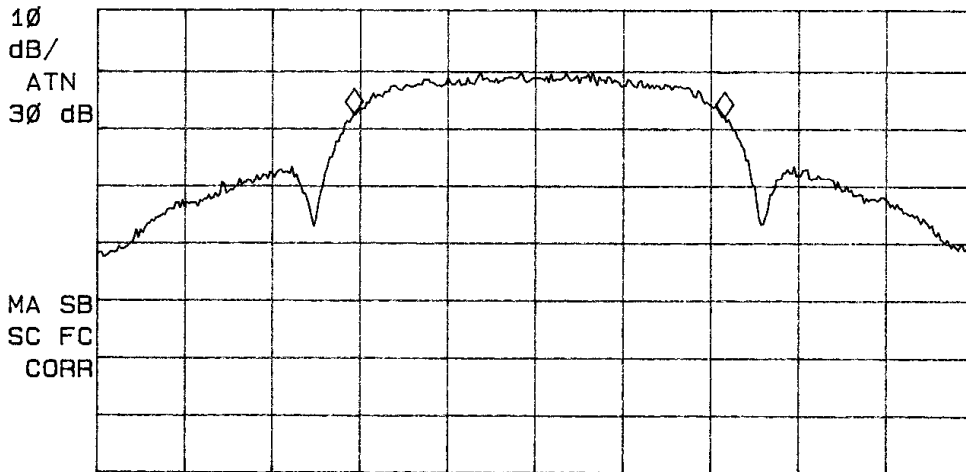
**Figure Fourteen Plot of Radiated Emissions 6 dB Occupied Bandwidth**

MARKER  $\Delta$   
4.23 MHz  
-.44 dB

ACTV DET: PEAK  
MEAS DET: PEAK QP  
MKR 4.23 MHz  
-.44 dB

REF OFFST 15.0 dB

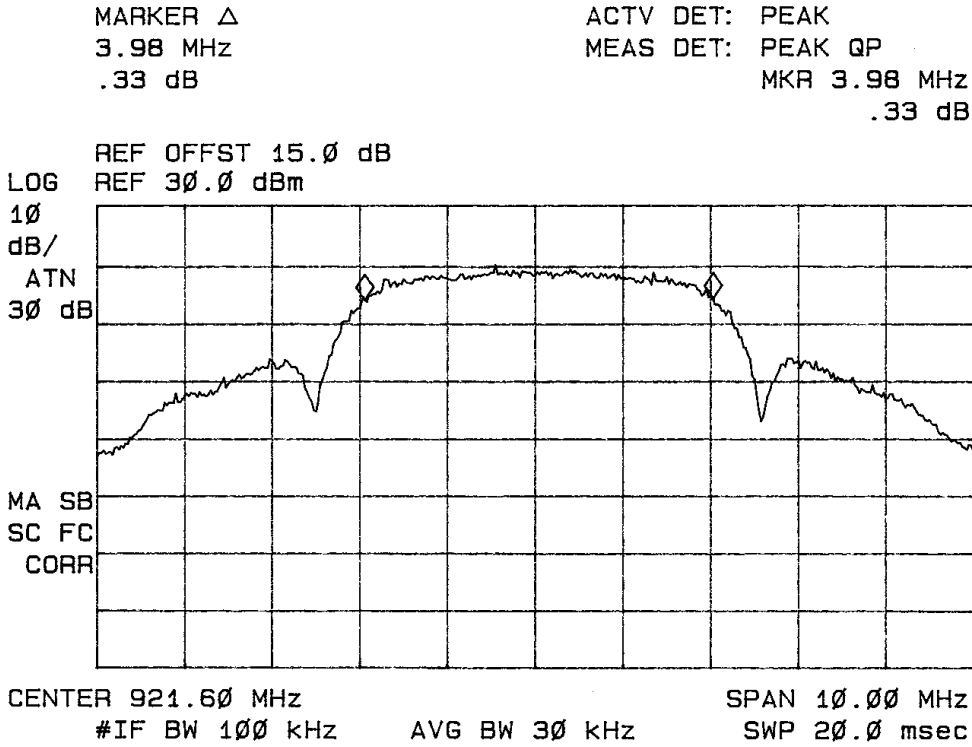
LOG REF 30.0 dBm



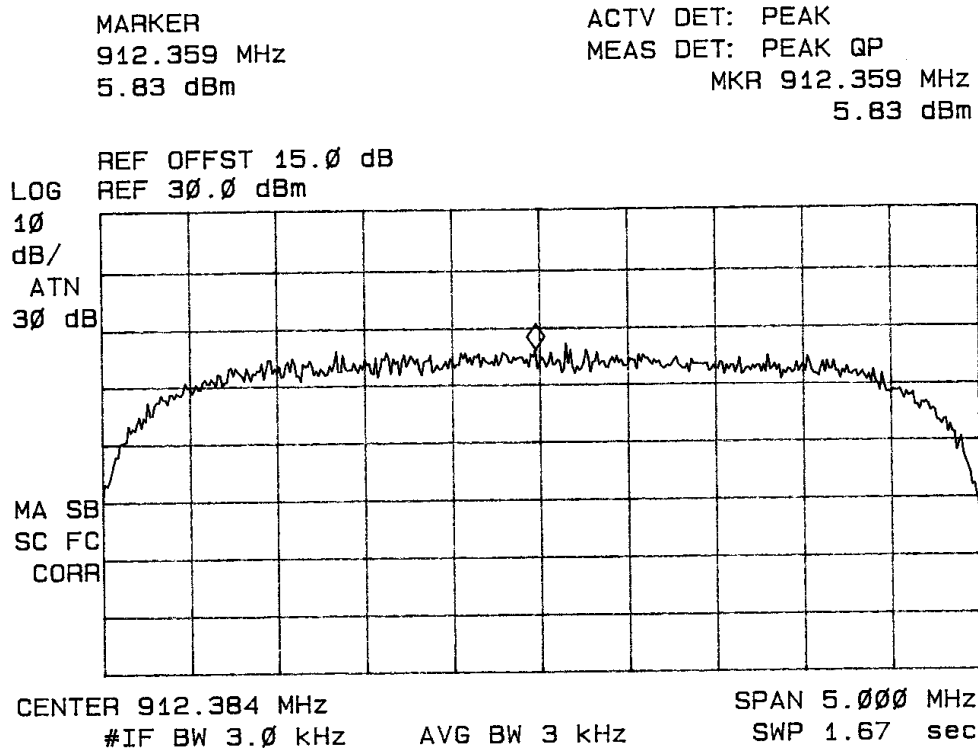
CENTER 912.38 MHz SPAN 10.00 MHz  
#IF BW 100 kHz AVG BW 30 kHz SWP 20.0 msec

**Figure Fifteen Plot of Radiated Emissions 6 dB Occupied Bandwidth**

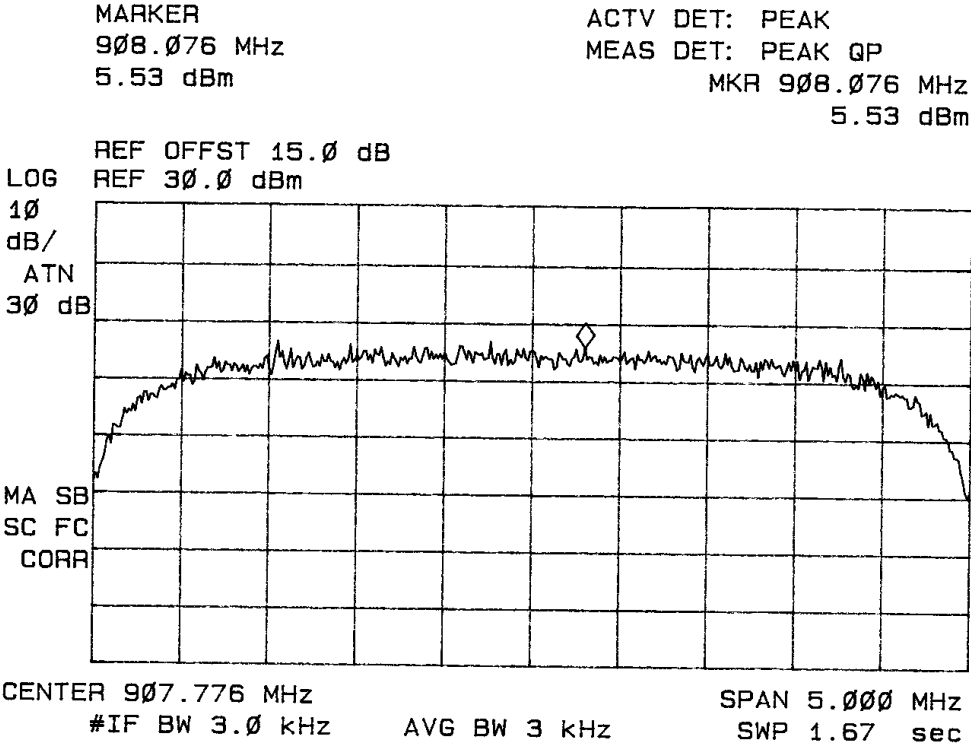




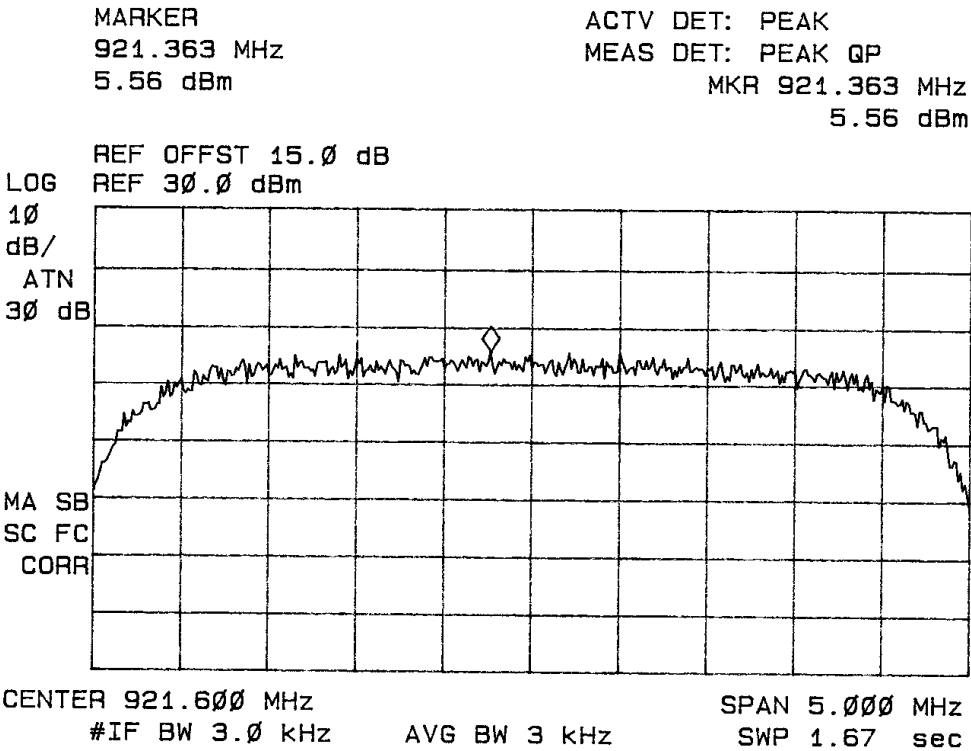
**Figure Sixteen Plot of Radiated Emissions 6 dB Occupied Bandwidth**



**Figure Seventeen Plot of Power Spectral Density**



**Figure Eighteen Plot of Power Spectral Density**



**Figure Nineteen Plot of Power Spectral Density**

Sample Calculation

$$\begin{aligned}
 \text{RFS (dB}\mu\text{V/m @ 3m)} &= \text{FSM(dB}\mu\text{V)} + \text{A.F.(dB)} - \text{Gain(dB)} \\
 &= 114.0 + 23.4 - 30 \\
 &= 107.4
 \end{aligned}$$

**Radiated Emissions Data per CFR47 15.247 and RSS-210**

Emission Frequency (MHz)	FSM Horz. (dBμV)	FSM Vert. (dBμV)	Ant. Factor (dB)	Amp Gain (dB)	RFS Horz. @ 3m (dBμV/m)	RFS Vert. @ 3m (dBμV/m)	Limit @ 3m (dBμV/m)
907.8(Peak)	114.0	118.9	23.4	30	107.4	112.3	--
1815.6	49.3	48.8	29.3	30	48.6	48.1	54.0
2723.3	29.2	28.8	34.5	30	33.7	33.3	54.0
3631.1	25.0	24.7	38.0	30	33.0	32.7	54.0
4538.9	23.8	23.8	41.6	30	35.4	35.4	54.0
5446.7	24.1	23.2	33.1	30	22.7	23.9	54.0
912.4(Peak)	115.6	121.6	23.4	30	109.0	115.0	--
1824.8	49.5	48.3	29.4	30	48.9	47.7	54.0
2737.2	32.0	41.2	34.5	30	36.5	45.7	54.0
3649.5	21.8	23.6	39.0	30	30.8	32.6	54.0
4561.9	22.3	24.5	41.8	30	34.1	36.3	54.0
5474.3	22.0	24.5	33.1	30	25.1	27.6	54.0
921.6(Peak)	120.2	121.5	23.3	30	113.5	114.8	--
1843.2	48.5	43.0	29.3	30	47.8	42.3	54.0
2764.8	27.8	26.5	34.4	30	32.2	30.9	54.0
3686.4	25.3	25.0	39.0	30	34.3	34.0	54.0
4608.0	24.5	23.8	41.7	30	36.2	35.5	54.0
5529.6	25.0	27.5	33.1	30	28.1	30.6	54.0

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

**Peak Conducted Output Power**

Frequency (MHz)	Output Power (dBm)	Output Power (Watts)
907.776	28.83	0.764
912.384	29.13	0.818
921.600	28.68	0.738

**Summary of Results for Radiated Emissions of Intentional Radiator**

The EUT fundamental frequency of operation demonstrated the highest peak emission measurement at 3 meters distance of 115.0 dBµV/m. The EUT demonstrated worst-case harmonic emissions of 5.1 dB margin below the limit. The radiated emissions for the EUT demonstrated compliance with the requirements for CFR47 Part 15.247 Intentional Radiators and RSS-210. There are no measurable emissions in the restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the limits. The specifications of 15.247 and RSS-210 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 demonstrate compliance with CFR47 Part 15C or RSS-210 emissions standards. There were no modifications, deviations or exceptions to the specifications.



NVLAP Lab Code 200087-0

## Annex

- Annex A, Measurement Uncertainty Calculations
- Annex B, Test Equipment List.
- Annex C, Rogers Qualifications.
- Annex D, FCC Site Registration Letter.
- Annex E, Industry Canada Site Registration Letter.

## Annex A Measurement Uncertainty Calculations

### Radiated Emissions Measurement Uncertainty Calculation

Measurement of vertically polarized radiated field strength over the frequency range 30 MHz to 1 GHz on an open area test site at 3m and 10m includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Antenna factor calibration	normal (k = 2)	±0.58
Cable loss calibration	normal (k = 2)	±0.2
Receiver specification	rectangular	±1.0
Antenna directivity	rectangular	±0.1
Antenna factor variation with height	rectangular	±2.0
Antenna factor frequency interpolation	rectangular	±0.1
Measurement distance variation	rectangular	±0.2
Site Imperfections	rectangular	±1.5

Combined standard uncertainty  $u_c(y)$  is

$$U_c(y) = \pm \sqrt{\left[\frac{1.0}{2}\right]^2 + \left[\frac{0.2}{2}\right]^2 + \left[\frac{1.0^2 + 0.1^2 + 2.0^2 + 0.1^2 + 0.2^2 + 1.5^2}{3}\right]}$$

$$U_c(y) = \pm 1.6 \text{ dB}$$

It is probable that  $u_c(y) / s(q_k) > 3$ , where  $s(q_k)$  is estimated standard deviation from a sample of  $n$  readings unless the repeatability of the EUT is particularly poor, and a coverage factor of  $k = 2$  will ensure that the level of confidence will be approximately 95%, therefore:

$$s(q_k) = \sqrt{\frac{1}{(n-1)} \sum_{k=1}^n (q_k - \bar{q})^2}$$

$$U = 2 U_c(y) = 2 \times \pm 1.6 \text{ dB} = \pm 3.2 \text{ dB}$$

Notes:

- 1.1 Uncertainties for the antenna and cable were estimated, based on a normal probability distribution with  $k = 2$ .
- 1.2 The receiver uncertainty was obtained from the manufacturer's specification for which a rectangular distribution was assumed.
- 1.3 The antenna factor uncertainty does not take account of antenna directivity.
- 1.4 The antenna factor varies with height and since the height was not always the same in use as when the antenna was calibrated an additional uncertainty is added.
- 1.5 The uncertainty in the measurement distance is relatively small but has some effect on the received signal strength. The increase in measurement distance as the antenna height is increased is an inevitable consequence of the test method and is therefore not considered a contribution to uncertainty.
- 1.6 Site imperfections are difficult to quantify but may include the following contributions:
  - Unwanted reflections from adjacent objects.
  - Ground plane imperfections: reflection coefficient, flatness, and edge effects.
  - Losses or reflections from "transparent" cabins for the EUT or site coverings.
  - Earth currents in antenna cable (mainly effect biconical antennas).

The specified limits for the difference between measured site attenuation and the theoretical

value ( $\pm 4$  dB) were not included in total since the measurement of site attenuation includes uncertainty contributions already allowed for in this budget, such as antenna factor.

*Conducted Measurements Uncertainty Calculation*

Measurement of conducted emissions over the frequency range 9 kHz to 30 MHz includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Receiver specification	rectangular	$\pm 1.5$
LISN coupling specification	rectangular	$\pm 1.5$
Cable and input attenuator calibration	normal (k=2)	$\pm 0.5$

Combined standard uncertainty  $u_c(y)$  is

$$U_c(y) = \pm \sqrt{\left[\frac{0.5}{2}\right]^2 + \frac{1.5^2 + 1.5^2}{3}}$$

$$U_c(y) = \pm 1.2 \text{ dB}$$

As with radiated field strength uncertainty, it is probable that  $u_c(y) / s(q_k) > 3$  and a coverage factor of  $k = 2$  will suffice, therefore:

$$U = 2 U_c(y) = 2 \times \pm 1.2 \text{ dB} = \pm 2.4 \text{ dB}$$



**Annex B Test Equipment List For Rogers Labs, Inc.**

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

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





## **Annex C Rogers Qualifications**

**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



NVLAP Lab Code 200087-0

**Annex D FCC Site Registration Letter**

**FEDERAL COMMUNICATIONS COMMISSION**

**Laboratory Division  
7435 Oakland Mills Road  
Columbia, MD 21046**

June 18, 2008

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: June 18, 2008

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](http://www.fcc.gov) under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish  
Industry Analyst

Rogers Labs, Inc.  
4405 W. 259th Terrace  
Louisburg, KS 66053  
Phone/Fax: (913) 837-3214  
Revision 1

Lectrosonics, Inc.  
Model: D4T  
Test #: 090122T  
Test to: FCC 15c (15.247), IC RSS-210  
File: Lectrosonics D4T TstRpt 090122T

SN 005  
FCC ID: DBZD4T  
IC: 8024A-D4T  
Page 34 of 35  
Date: February 17, 2009

## Annex E Industry Canada Site Registration Letter

July 29th, 2008

OUR FILE: 46405-3041  
Submission No: 127059

Rogers Labs Inc.  
4405 West 259<sup>th</sup> Terrace  
Louisburg KY 66053  
USA

**Attention:** Scot D. Rogers

Dear Sir/Madame:

The Bureau has received your application for the registration / renewal of a 3/10m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought (**3040A-1**). Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please be informed that the Bureau is now utilizing a **new site numbering scheme** in order to simplify the electronic filing process. Our goal is to reduce the number of secondary codes associated to one particular company. The following changes have been made to your records.

Your primary code is: **3041**

The company number associated to the site(s) located at the above address is: **3041A**

The table below is a summary of the changes made to the unique site registration number(s):

New Site Number	Obsolete Site Number	Description of Site	Expiry Date (YYYY-MM-DD)
3041A-1	3041-1	3 / 10m OATS	2010-07-29

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 meter OATS or 3 meter chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to exceed two years. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL;

If you have any questions, you may contact the Bureau by e-mail at [certification.bureau@ic.gc.ca](mailto:certification.bureau@ic.gc.ca)

Please reference our file and submission number above for all correspondence.

Yours sincerely,

S. Proulx Wireless Laboratory  
Manager Certification and  
Engineering Bureau Industry Canada  
3701 Carling Ave., Building 94  
Ottawa, Ontario K2H 8S2  
Canada

