NVLAP Lab Code 200087-0

SUBMITTAL APPLICATION REPORT

FOR
FCC And INDUSTRY CANADA GRANT OF CERTIFICATION

FOR

Model: 1100R Series Transceiver
902 - 928 MHz FHSS Transmitter

FCC ID: CCKPC0110
IC: 5251A-PC0110

FOR

DIGITAL MONITORING PRODUCTS, INC.

2500 North Partnership Boulevard
Springfield, MO 65802-6310

Test Report Number: 080205

Authorized Signatory: Scot D Rogers
Scot D. Rogers

NVLAP Lab Code 200087-0

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

ENGINEERING TEST REPORT
FOR
APPLICATION of
GRANT of CERTIFICATION

FOR

CFR47, PART 15C - INTENTIONAL RADIATORS
Paragraph 15.247 and Industry Canada, RSS-210
Frequency Hopping Spread Spectrum Transmitter

For

DIGITAL MONITORING PRODUCTS, INC.
2500 North Partnership Boulevard
Springfield, MO 65802-6310
Terry Shelton,

Model: 1100R Series Transceiver

Frequency 902-928 MHz
FCC ID#: CCKPC0110, IC: 5251A-PC0110

Test Date: February 5, 2008

Certifying Engineer:

Scot D. Rogers
ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone: (913) 837-3214
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The following information is submitted for consideration in obtaining a Grant of Certification for a frequency hopping spread spectrum intentional radiator operating under CFR47 Paragraph 15.247 and Industry Canada standard RSS-210.

Name of Applicant:

Digital Monitoring Products, Inc.

2500 North Partnership Boulevard

Springfield, MO 65802-6310

Model: 1100R Series Transceiver wireless transceiver.

FCC I.D.: CCKPC0110 IC: 5251A-PC0110

Frequency Range: 902-928 MHz.

Operating Power: 105.6 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 15.209	Complies
Emissions as per CFR47 paragraphs 2 and 15.247	Complies

Environmental Conditions

Ambient Temperature	21.7° C
Relative Humidity	26%
Atmospheric Pressure	29.93 in Hg

2.1033(b) Application for Certification

(1) Manufacturer: Digital Monitoring Products, Inc.
2500 North Partnership Boulevard
Springfield, MO 65802-6310

(2) Identification: Model: 1100R Series Wireless Transceiver
FCC I.D.: CCKPC0110
IC: 5251A-PC0110

(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.

Applicable Standards & Test Procedures

a) In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2006, 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.

b) 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.

Equipment Tested

Equipment	Model	FCC I.D.	IC
EUT	1100R	CCKPC0110	5251A-PC0110

Equipment Function and Testing Procedures

The EUT is a 902-928 MHz radio transmitter used to transmit alarm conditions for use in an alarm panel installation. The 1100R Series Transceiver wireless transmitter is a wireless link used for transmitting alarm conditions in installation environments. The device signals the alarm panel or initiates a contact point based on operational conditions. The unit is marketed for use to incorporate a wireless link in an alarm system solution. Test software was installed in the test sample allowing for special testing purposes. The modified software allowed the transmitter to be set to transmit channels dependant on activation of a temporary switch attached to the relay point contact. The unit operates from external AC power supplied from the manufacturer supplied AC power adapter. The unit has provision to connect to external auxiliary equipment through a relay point contact.

Equipment and Cable Configurations

Conducted Emission Test Procedure

The unit typically operates from the supplied AC power adapter offering provision to connect to utility power. 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 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.

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.

Test Site Locations

Conducted EMI — The AC power line conducted emissions testing 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 Annex for FCC Site Registration Letter, # 90910, and Industry Canada Site Registration Letter, IC3041-1.

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. DATE	DUE.
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/07	10/08
LISN	Comp. Design	1762	2/07	2/08
Antenna	ARA	BCD-235-B	10/07	10/08
Antenna	EMCO	3147	10/07	10/08
Antenna	EMCO	3143	5/07	5/08
Analyzer	HP	8591EM	5/07	5/08
Analyzer	HP	8562A	2/07	2/08

Subpart B – Unintentional Radiators

The unit typically receives power from the supplied AC power adapter offering provision to connect to utility power during operation. 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 and test system. Testing for the line-conducted emissions testing was as follows. The power line for the EUT was connected to the LISN for line-conducted emissions testing. 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. Plots were made of the frequency spectrum from 0.15 MHz to 30 MHz for the preliminary testing. Refer to figures one and two for plots of the EUT AC line conducted emissions frequency spectrum taken in the screen room.

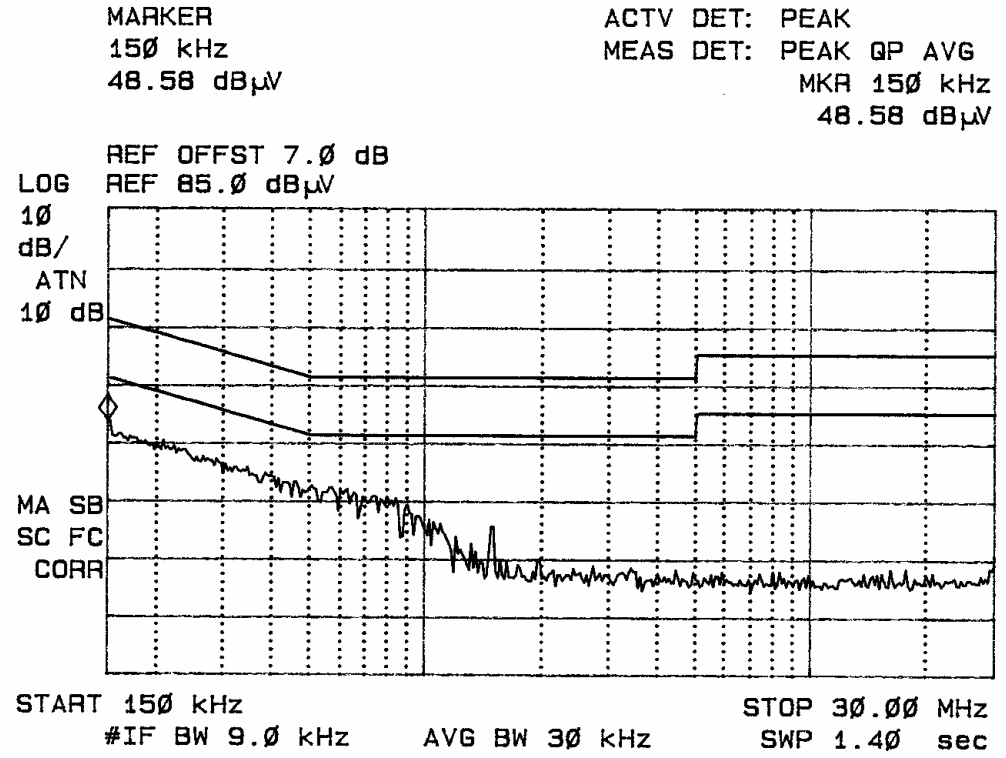

Figure one Conducted Emissions of Line 1 Taken in the Screen Room

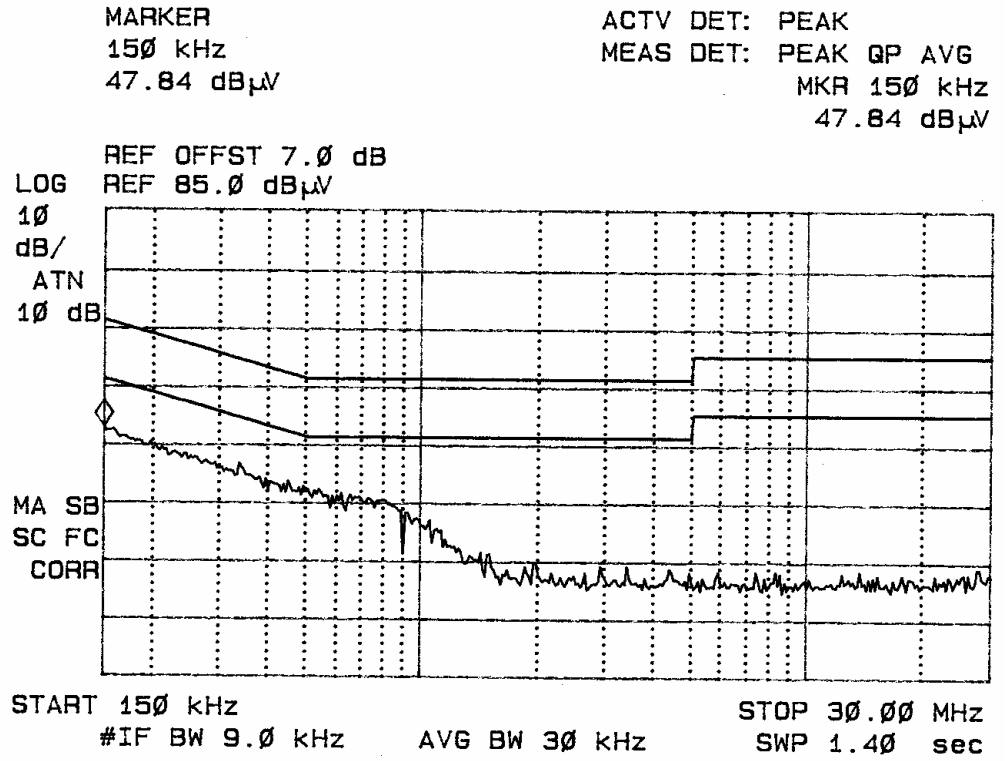

Figure two Conducted Emissions of Line 2 Taken in the Screen Room

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 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, pyramidal horns and mixers from 4 GHz to 12 GHz, notch filters and appropriate amplifiers were utilized.

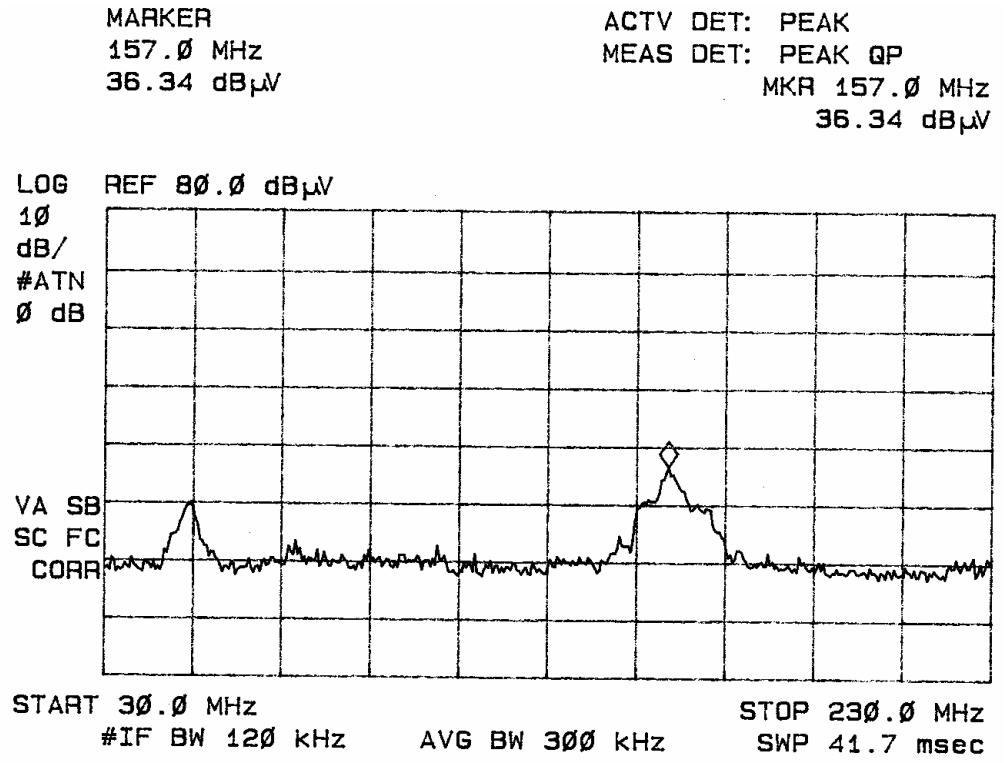

Figure three Plot of General Radiated Emissions

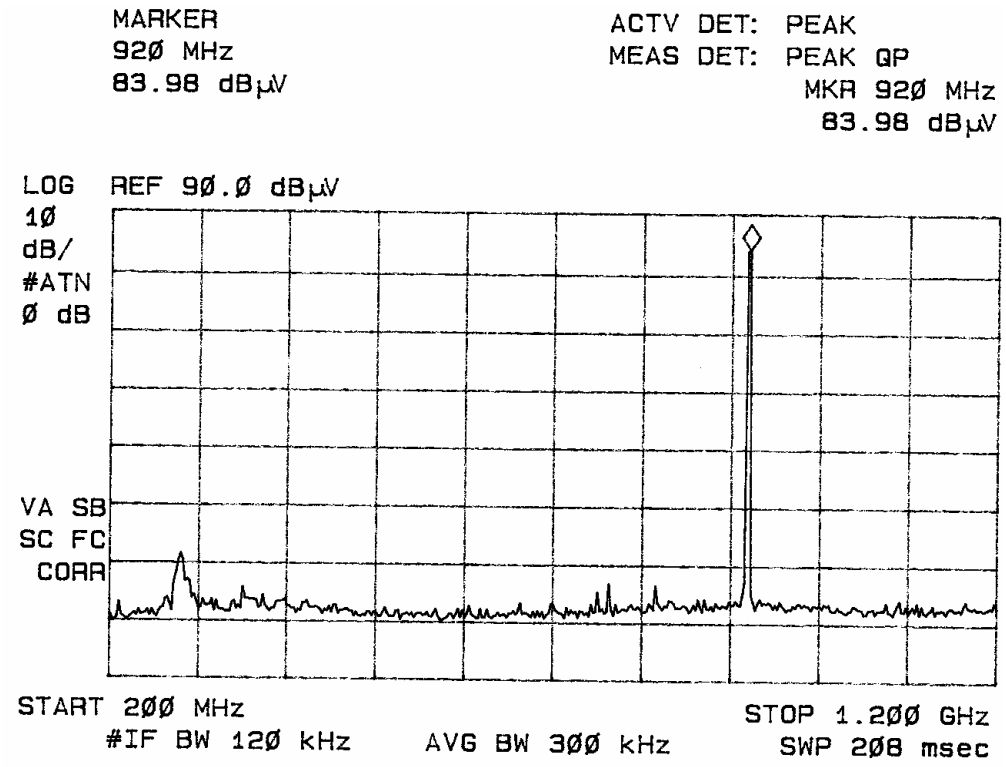

Figure four Plot of General Radiated Emissions

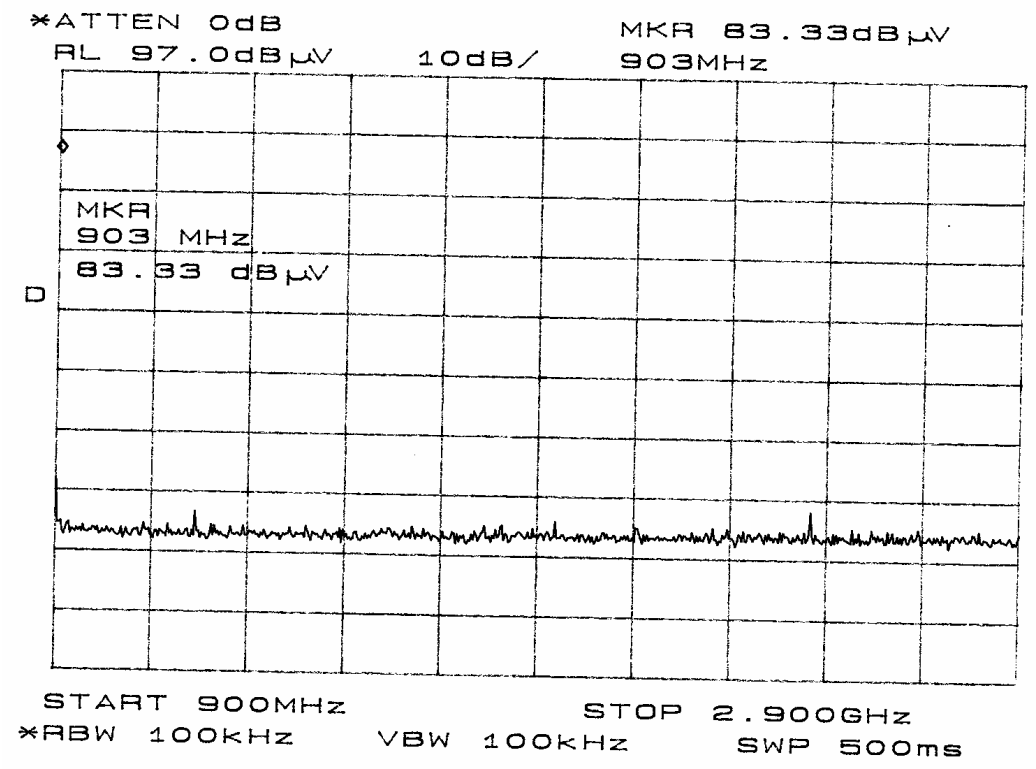

Figure five Plot of General Radiated Emissions

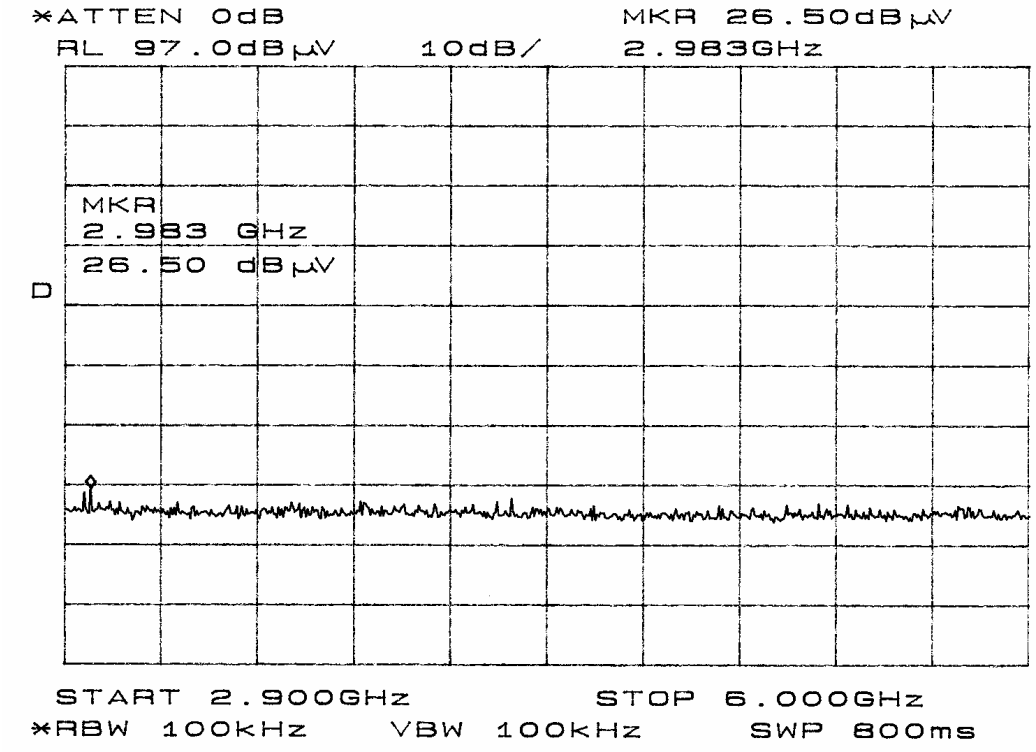

Figure six Plot of General Radiated Emissions

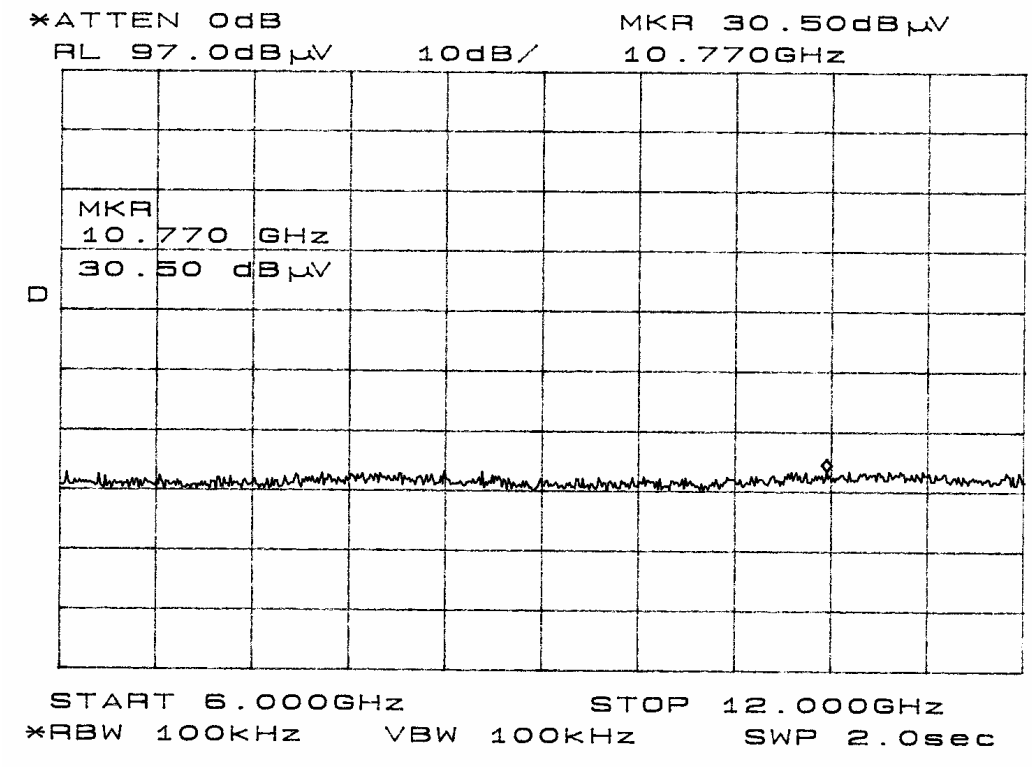

Figure seven Plot of General Radiated Emissions

Conducted Emissions Data (7 Highest Emissions)

Frequency band (MHz)	L1 Level (dBµV)			L2 Level (dBµV)			CISPR 22 Q.P./AVE Limit(dBµV)
	Peak	Q.P.	AVE	Peak	Q.P.	AVE	
0.15 - 0.5	48.6	39.6	20.8	47.8	39.5	19.7	66 / 56
0.5 – 5	36.4	29.3	12.5	36.2	28.8	12.6	56 / 46
5 – 10	24.6	21.6	17.8	25.8	22.2	18.6	60 / 50
10 – 15	24.0	20.1	15.5	24.7	21.6	17.8	60 / 50
15 – 20	23.9	20.2	14.7	22.3	16.0	9.8	60 / 50
20 – 25	20.5	16.0	9.6	24.4	20.1	15.6	60 / 50
25 - 30	23.5	19.5	14.0	24.2	20.6	16.1	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)	FCC Class B Limit @ 3m (dBµV/m)
49.0	49.4	41.5	6.6	30	26.0	18.1	40.0
49.5	49.6	41.5	6.6	30	26.2	18.1	40.0
50.0	50.5	45.3	6.6	30	27.1	21.9	40.0
155.2	50.2	43.8	9.2	30	29.4	23.0	43.5
155.5	50.3	46.8	9.2	30	29.5	26.0	43.5
156.2	50.4	49.4	9.2	30	29.6	28.6	43.5
156.7	50.5	47.2	9.2	30	29.7	26.4	43.5
157.3	50.7	45.0	9.2	30	29.9	24.2	43.5
157.7	50.8	46.8	9.2	30	30.0	26.0	43.5
158.2	49.8	44.8	9.2	30	29.0	24.0	43.5
759.0	43.2	48.1	22.0	30	35.2	40.1	46.0
810.0	26.3	41.8	22.1	30	18.4	33.9	46.0

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

Summary of Results for Conducted Emissions

The conducted emissions for the EUT meet the requirements for CISPR 22, CFR47, and Industry Canada requirements. The 1100R test configuration had a 26.4 dB minimum margin below the CISPR quasi peak limit, and a 29.2 dB minimum margin below the CISPR average limit. Other emissions were present with recorded data representing the worst-case amplitudes.

Summary of Results for Radiated Emissions

The radiated emissions for the EUT meet the requirements for CISPR 22, CFR47, and Industry Canada requirements. The EUT had at least a 5.9 dB minimum margin 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 the unit to meet the CISPR 22, CFR47, and Industry Canada requirements. There were no 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 unit is produced with a permanently attached antenna and has no provision for user service, replacement, or antenna modification. 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:

RFS (dBµV/m @ 3m) = FSM(dBµV) + A.F.(dB) - Gain(dB)
= 50.5 + 9.2 - 30
= 29.7

Radiated Emissions Data in Restricted Bands (15.205)

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)
156.7	50.5	47.2	9.2	30	29.7	26.4	43.5
2710.0	23.3	22.8	34.3	30	27.6	27.1	54.0
2745.0	23.0	21.1	34.3	30	27.3	25.4	54.0
2781.6	23.1	22.5	34.3	30	27.4	26.8	54.0
3613.4	21.6	24.5	37.5	30	29.1	32.0	54.0
3660.0	24.5	24.5	38.0	30	32.5	32.5	54.0
3708.6	22.1	23.8	38.4	30	30.5	32.2	54.0
4516.5	21.8	23.3	41.1	30	32.9	34.4	54.0
4575.0	23.6	23.6	41.7	30	35.3	35.3	54.0
4635.7	23.0	22.8	41.9	30	34.9	34.7	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 for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had a 13.8 dB minimum margin below the limits. Both average and peak amplitudes above 1000 MHz 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 20 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 12,000 MHz and plots were made of the frequency spectrum from 30 MHz to 12,000 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 area test site 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 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 12 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)	FCC Class B Limit @ 3m (dBµV/m)
49.0	49.4	41.5	6.6	30	26.0	18.1	40.0
49.5	49.6	41.5	6.6	30	26.2	18.1	40.0
50.0	50.5	45.3	6.6	30	27.1	21.9	40.0
155.2	50.2	43.8	9.2	30	29.4	23.0	43.5
155.5	50.3	46.8	9.2	30	29.5	26.0	43.5
156.2	50.4	49.4	9.2	30	29.6	28.6	43.5
156.7	50.5	47.2	9.2	30	29.7	26.4	43.5
157.3	50.7	45.0	9.2	30	29.9	24.2	43.5
157.7	50.8	46.8	9.2	30	30.0	26.0	43.5
158.2	49.8	44.8	9.2	30	29.0	24.0	43.5
759.0	43.2	48.1	22.0	30	35.2	40.1	46.0
810.0	26.3	41.8	22.1	30	18.4	33.9	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 requirements. The EUT had at least a 5.9 dB minimum margin below the limit. Other emissions were present with amplitudes at least 20 dB below the limit.

15.247 Operation in the Band 902-928 MHz

The power output was measured on an Open Area Test Site at a 3 meters distance. The EUT 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 sixteen for plots of the spectrum analyzer display demonstrating compliance to the specifications. The EUT is a frequency hopping spread spectrum intentional radiator utilizing at least 50 hopping channels. Figure eight demonstrates power output and number of channels used in 902-928 MHz. Figures nine through eleven demonstrate occupied bandwidth at three frequencies in the 902-928 MHz band. The 20-dB bandwidth of 83 kHz complies with the requirement of less than 250 kHz wide and utilizing at least 50 hopping frequencies. Figure twelve demonstrates the 450 kHz channel spacing in the 902-928 MHz band. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a twenty-second-time period. Figures thirteen and fourteen demonstrate dwell time on channel and number of times on channel in a 20-second period. These plots demonstrate the 30.1 mS dwell time and twelve times on channel in a 20-second period. The dwell time on channel in a 20-second period may then be calculated as 361 mS (30.10 ms x 12 = 361 mS). Alternatively, the pseudo random lookup table moves through the 53 channels taking a calculated 1.75 seconds (53 x 31 mS = 1.643 S). The table will repeat after completion of one full cycle thus allowing the channel to be occupied 12.173 times in any twenty second period (20/1.75). This allows a channel to be occupied a maximum of 366 mS in any twenty second time interval. Information showing compliance for time of channel occupancy and hopping sequence are displayed below.

Pseudorandom hopping sequence

The system uses 53 hop channels. They are evenly spaced between 902.9729 MHz and 927.0271 MHz. They are listed, in order, below:

0	903.3257	18	911.4079	36	919.4901
1	903.7747	19	911.8569	37	919.9391
2	904.2237	20	912.3059	38	920.3881
3	904.6727	21	912.7549	39	920.8372
4	905.1217	22	913.2040	40	921.2862
5	905.5707	23	913.6530	41	921.7352
6	906.0198	24	914.1020	42	922.1842
7	906.4688	25	914.5510	43	922.6332
8	906.9178	26	915.0000	44	923.0822
9	907.3668	27	915.4490	45	923.5312
10	907.8158	28	915.8980	46	923.9802
11	908.2648	29	916.3470	47	924.4293
12	908.7138	30	916.7960	48	924.8783
13	909.1628	31	917.2451	49	925.3273
14	909.6119	32	917.6941	50	925.7763
15	910.0609	33	918.1431	51	926.2253
16	910.5099	34	918.5921	52	926.6743
17	910.9589	35	919.0411		

The order is determined by cycling through the numbers 0-60 in order, and generating a channel number to use with the following equation:

Channel # = Hop XOR (Hop * 8) AND 0x3F
If Channel > 52, try again

Where Hop is the sequence 0,1,2,3,4,5,6,7,8,9,10,11…5,52,0,1…

This generates the channel numbers 0, 9, 18, 27, 36, 45, 6, 7, 8, 1, 26, 19…

A complete cycle is as follows:

0	903.3257	2	904.2237	4	905.1217
9	907.3668	11	908.2648	13	909.1628
18	911.4079	52	926.6743	22	913.204
27	915.449	21	912.7549	31	917.2451
36	919.4901	38	920.3881	40	921.2862
45	923.5312	47	924.4293	33	918.1431
6	906.0198	24	914.102	42	922.1842
7	906.4688	17	910.9589	51	926.2253
8	906.9178	10	907.8158	12	908.7138
1	903.7747	3	904.6727	5	905.5707
26	915	28	915.898	30	916.796
19	911.8569	29	916.347	23	913.653
44	923.0822	46	923.9802	48	924.8783
37	919.9391	39	920.8372	49	925.3273
14	909.6119	32	917.6941	34	918.5921
15	910.0609	41	921.7352	43	922.6332
16	910.5099	50	925.7763	20	912.3059
25	914.551	35	919.0411		

The maximum peak output power of the unit was measured at the OATS at a distance of three meters. 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 12 GHz. Emissions were measured in dBµV/m at three-meters. For multiple systems to coexist properly, each system within range of another is assigned a unique number between 1 and 52. That number is multiplied by the hop sequence is modified by multiplying each hop number by a system number (1-52) and using that value modulo 61 as the hop number. For example, rather than hopping 0,1,2,3,4, a system with a system number of 3 would use hop sequence 0,3,6,9,12…, which would lead to the channel sequence 0, 27, 6, 1, 44… This allows up to 52 systems to coexist because of the unique hopping sequence of each. 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 25 GHz. Emissions were measured in dBµV/m @ 3 meters. The power output was measured at the open area test site at a three-meter distance. Data was taken per Paragraph 2.1046(a), 15.247 and RSS-210. The 902 and 928 MHz band edges are protected due to the 903 – 927 MHz channels used for frequency of operation. Figures fifteen and sixteen demonstrate band edge compliance.

Sample Calculation

RFS (dBµV/m @ 3m) = FSM(dBµV) + A.F.(dB) - Gain(dB)

= 73.0 + 23.3 - 0

= 96.3

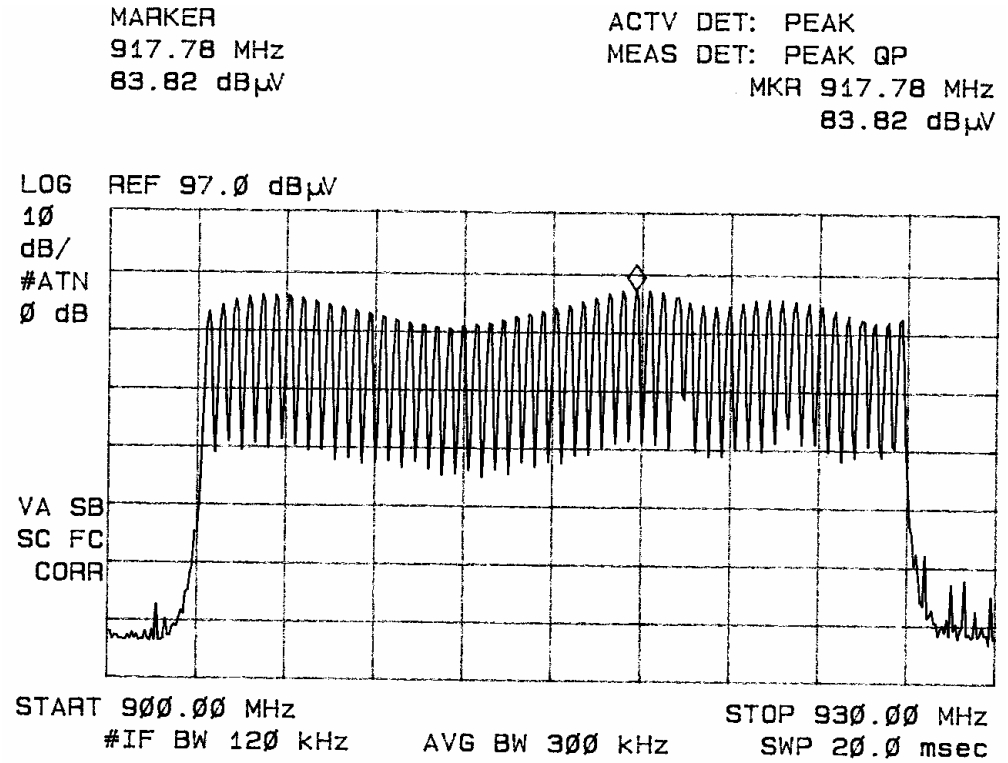

Figure eight Plot of output Power and number of channels in band

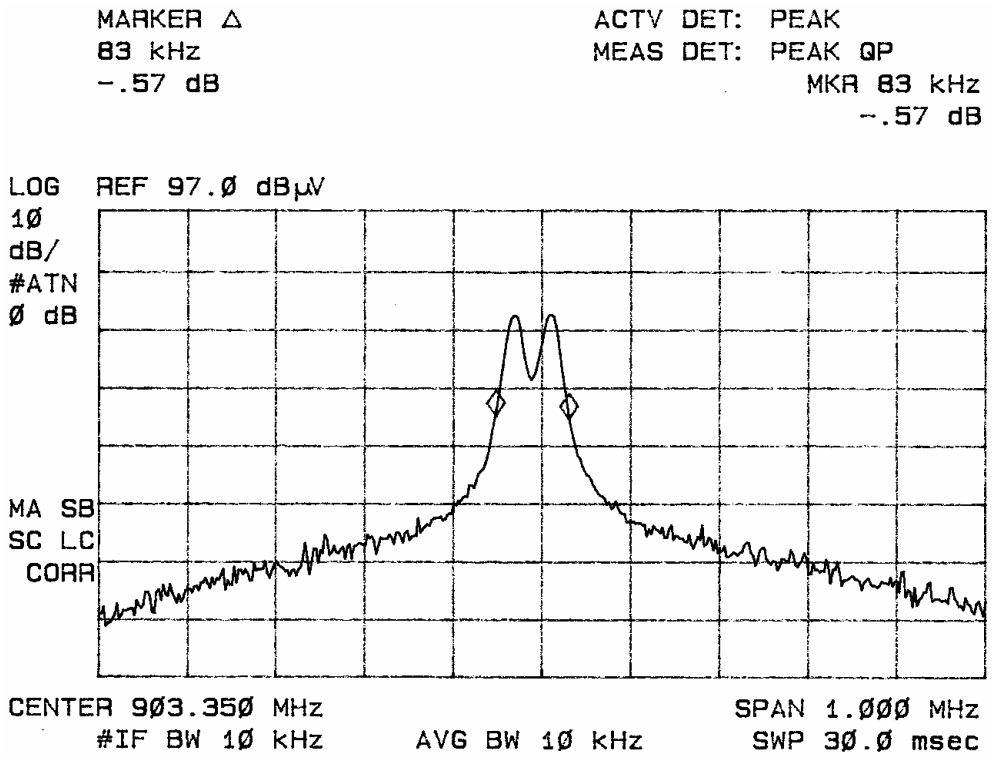

Figure nine Plot of Occupied Bandwidth low frequency

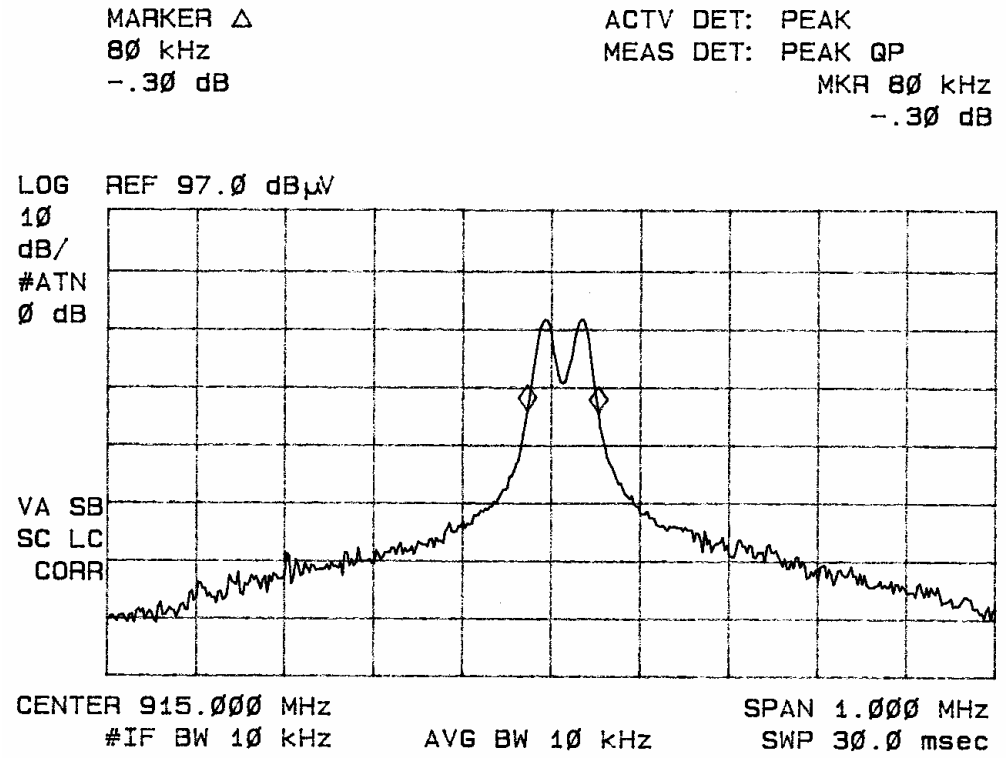

Figure ten Plot of Occupied Bandwidth middle frequency

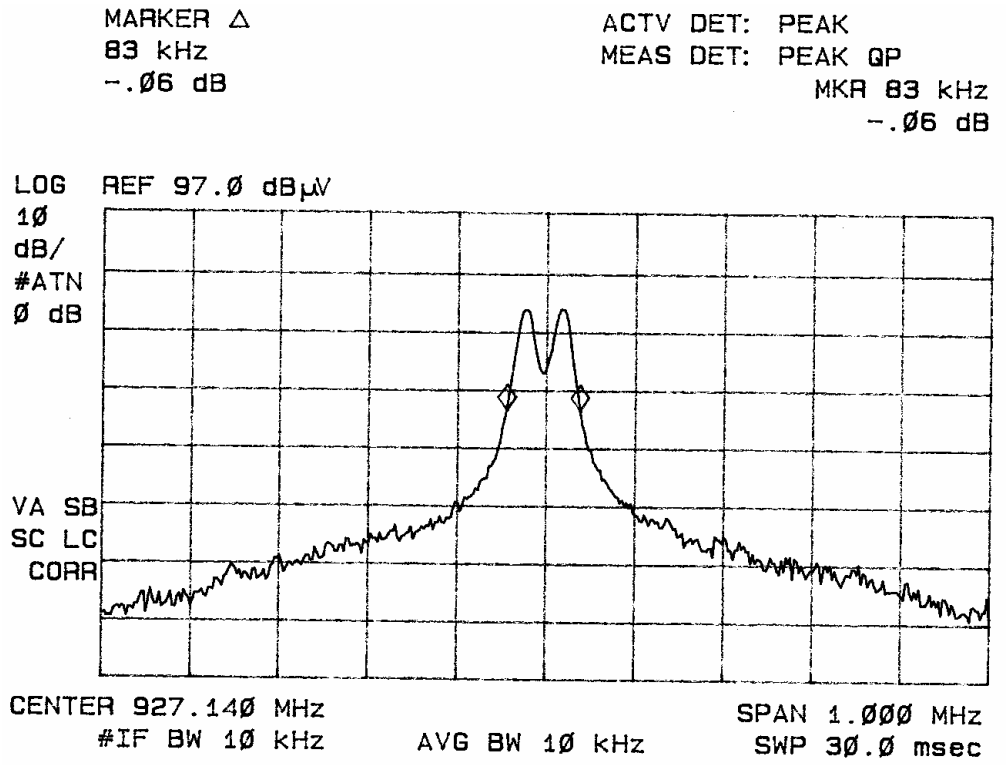

Figure eleven Plot of Occupied Bandwidth high frequency

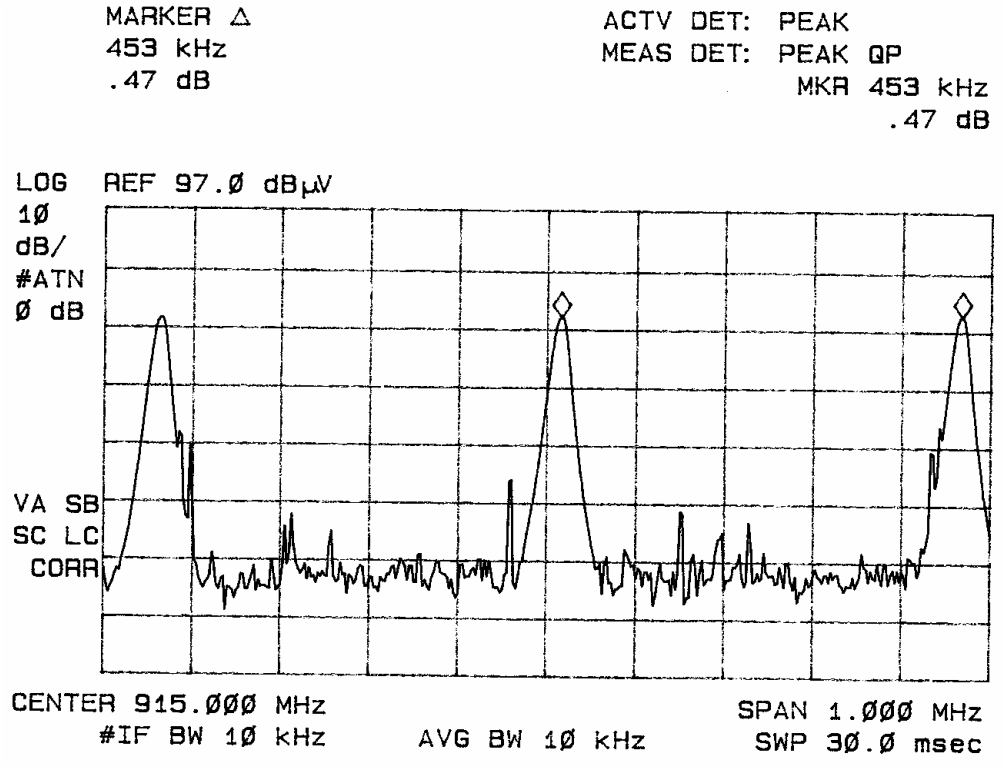

Figure twelve Plot of Channel Spacing

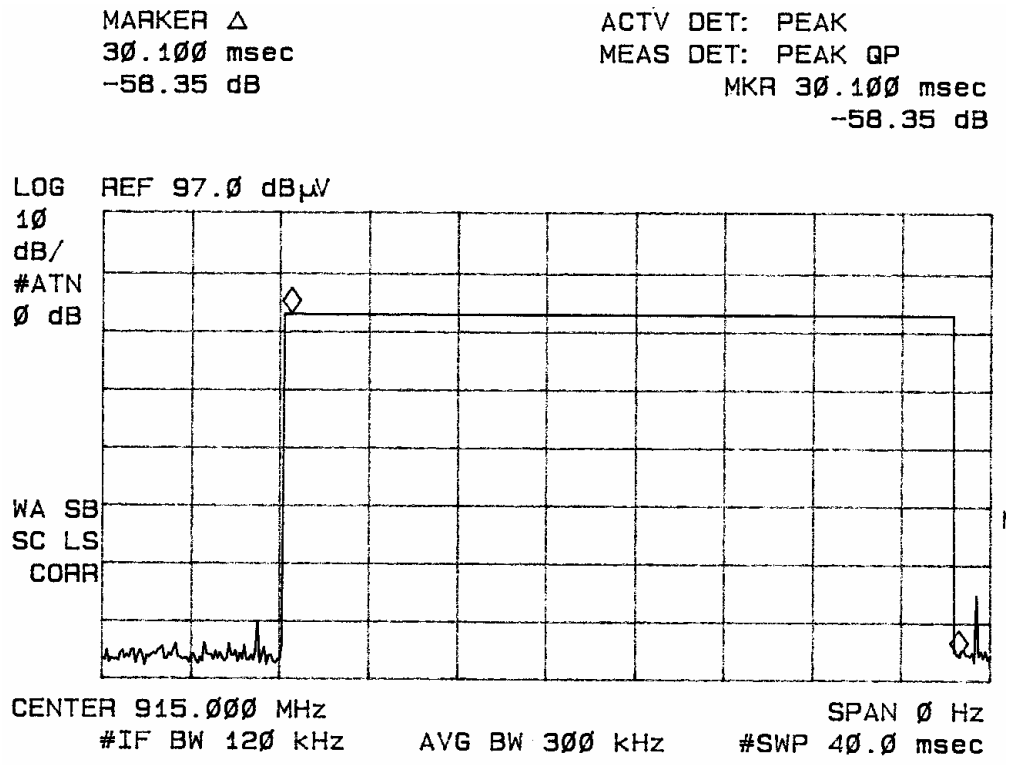

Figure thirteen Plot of Dwell Time on channel

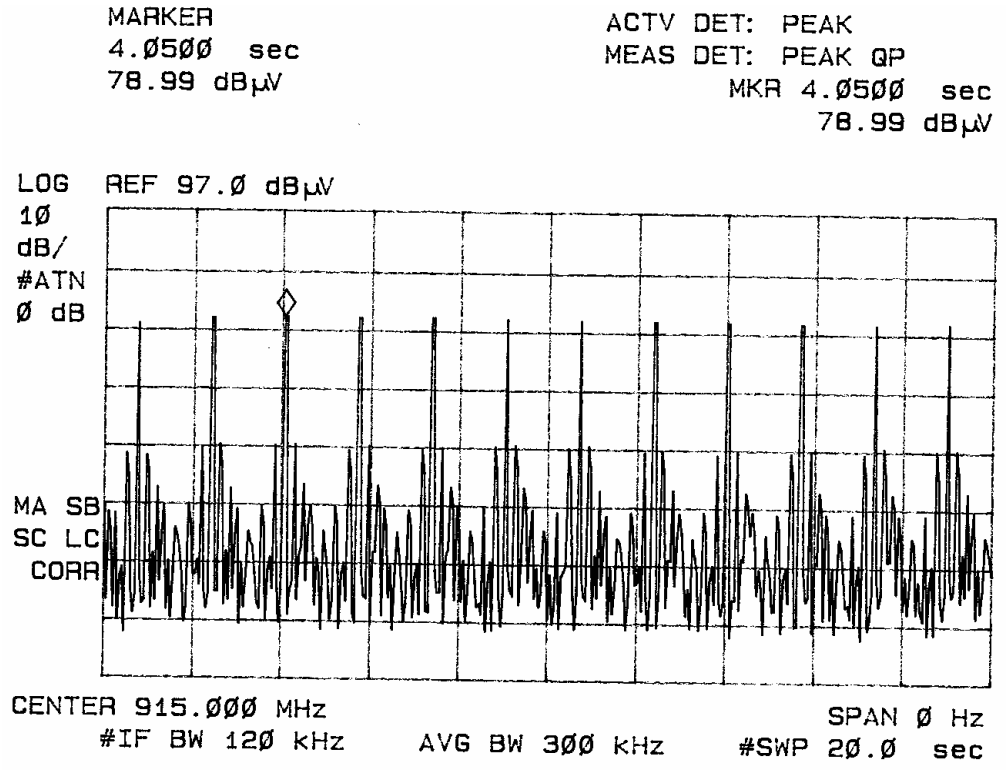

Figure fourteen Plot of Channel Occupancy over 20-second period

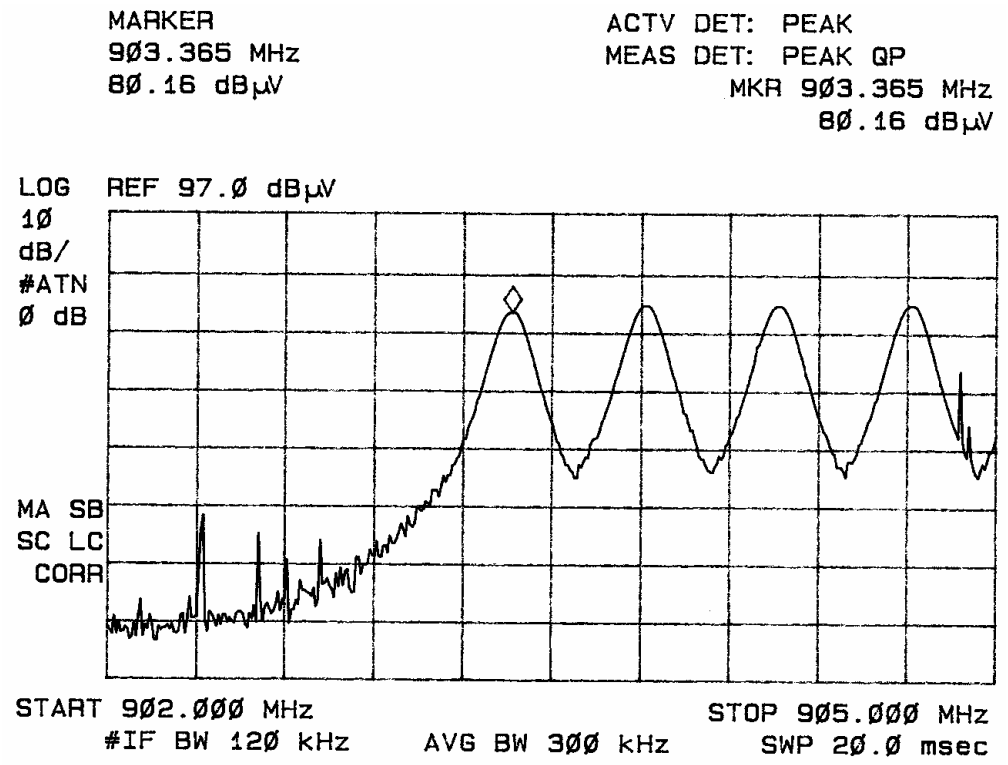

Figure fifteen Plot of lower frequency band edge

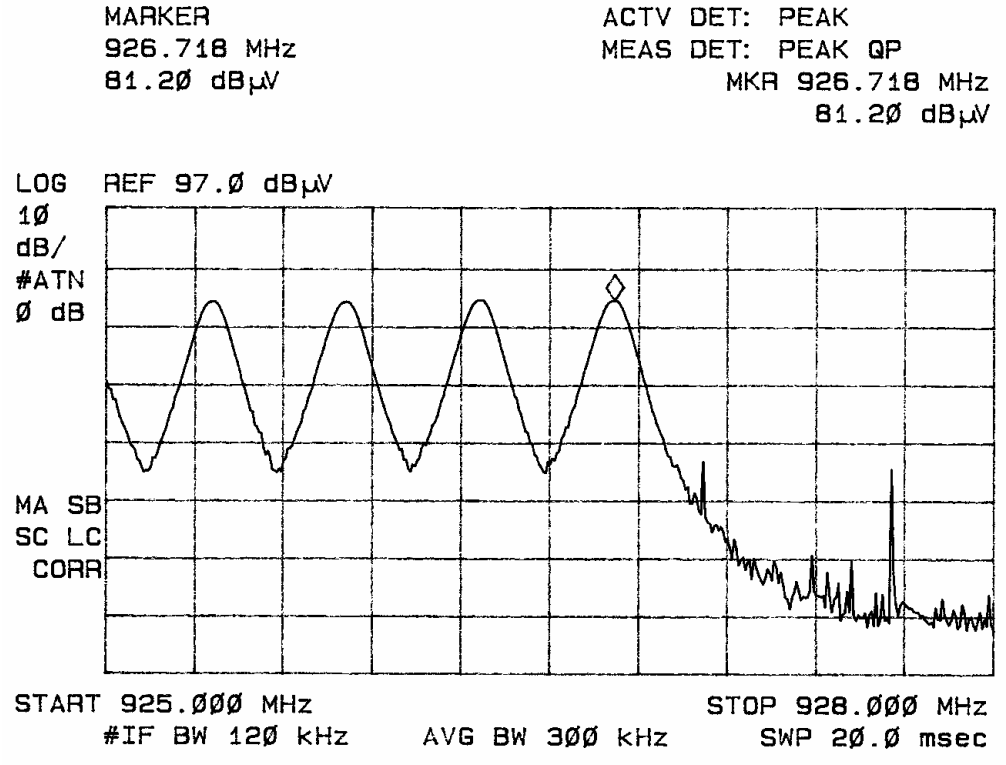

Figure sixteen Plot of higher frequency band edge

Radiated Emissions Data per 15.247

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)
903.3	73.0	82.3	23.3	0	96.3	105.6	
1806.7	22.0	22.3	29.3	30	21.3	21.6	54
2710.0	23.3	22.8	34.3	30	27.6	27.1	54
3613.4	21.6	24.5	37.5	30	29.1	32.0	54
4516.8	21.8	23.3	41.1	30	32.9	34.4	54
915.0	73.2	80.2	23.3	0	96.5	103.5	
1830.0	22.1	21.7	29.5	30	21.6	21.2	54
2745.0	23.0	21.1	34.3	30	27.3	25.4	54
3660.0	24.5	24.5	38.0	30	32.5	32.5	54
4575.0	23.6	23.6	41.7	30	35.3	35.3	54
927.2	71.8	80.0	23.5	0	95.3	103.5	
1854.4	22.0	20.7	29.3	30	21.3	20.0	54
2781.6	23.1	22.5	34.3	30	27.4	26.8	54
3708.8	22.1	23.8	38.4	30	30.5	32.2	54
4636.0	23.0	22.8	41.9	30	34.9	34.7	54

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

Summary of Results for Radiated Emissions of Intentional Radiator

The EUT had the highest emission of 105.6 dBμV/m at 3 meters at the fundamental frequency of operation. The EUT had a worst-case of 18.7 dB margin below the limit for the harmonic emissions. The radiated emissions for the EUT meet 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 meet the CFR47 Part 15C or RSS-210 emissions standards. There were no deviations to the specifications.

Annex

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

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

$U_c(y) = \pm 1.6$ 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 (± 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	±1.5
LISN coupling specification	rectangular	±1.5
Cable and input attenuator calibration	normal (k=2)	±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	2/07
Wattmeter: Bird 43 with Load Bird 8085	2/07
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/07
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/07
R.F. Generator: HP 606A	2/07
R.F. Generator: HP 8614A	2/07
R.F. Generator: HP 8640B	2/07
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	2/07
Spectrum Analyzer: HP 8591EM	5/07
Frequency Counter: Leader LDC825	2/07
Antenna: EMCO Biconilog Model: 3143	5/07
Antenna: EMCO Log Periodic Model: 3147	10/07
Antenna: Antenna Research Biconical Model: BCD 235	10/07
Antenna: EMCO Dipole Set 3121C	2/07
Antenna: C.D. B-101	2/07
Antenna: Solar 9229-1 & 9230-1	2/07
Antenna: EMCO 6509	2/07
Audio Oscillator: H.P. 201CD	2/07
R.F. Power Amp 65W Model: 470-A-1010	2/07
R.F. Power Amp 50W M185- 10-501	2/07
R.F. PreAmp CPPA-102	2/07
LISN 50 µHy/50 ohm/0.1 µf	10/07
LISN Compliance Eng. 240/20	2/07
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	2/07
Peavey Power Amp Model: IPS 801	2/07
Power Amp A.R. Model: 10W 1010M7	2/07
Power Amp EIN Model: A301	2/07
ELGAR Model: 1751	2/07
ELGAR Model: TG 704A-3D	2/07
ESD Test Set 2010i	2/07
Fast Transient Burst Generator Model: EFT/B-101	2/07
Current Probe: Singer CP-105	2/07
Current Probe: Solar 9108-1N	2/07
Field Intensity Meter: EFM-018	2/07
KEYTEK Ecat Surge Generator	2/07

Annex C 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

Scot D. Rogers

Annex D FCC Site Approval Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

May 16, 2006

Registration Number: 90910

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

Attention: Scot Rogers

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: May 16, 2006

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Information Technician

Annex E Industry Canada Site Approval Letter

Industry Canada / Industrie Canada

May 23rd, 2006

OUR FILE: 46405-3041
Submission No: 115252

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

Dear Sir/Madame:

The Bureau has received your application for the Alternate Test Site or OATS and the filing is satisfactory to Industry Canada.

Please reference to the file number (**3041-1**) in the body of all test reports containing measurements performed on the site.

In the future, to obtain or renew a unique registration number, you may demonstrate that the site has been accredited to ANSI C63.4-2003 or later.

If the site is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating conformance with the ANSI standard. The Department 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.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca
Please reference our file number above for all correspondence.

Yours sincerely,

Robert Corey
Manager Certification
Certification and Engineering Bureau
3701 Carling Ave., Building 94
Ottawa, Ontario K2H 8S2

Canada