NVLAP Lab Code 200087-0

# SUBMITTAL APPLICATION REPORT

## FOR
## FCC And INDUSTRY CANADA
## GRANT OF CERTIFICATION

FOR

## Model: 1100xH and 1100dH Series Transceiver
## 902 - 928 MHz FHSS Transmitter

## FCC ID: CCKPC0114
## IC: 5251A-PC0114

FOR

## **DIGITAL MONITORING PRODUCTS, INC.**

2500 North Partnership Boulevard
Springfield, MO 65802-6310

Test Report Number: 080110

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
# APLLICATION 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: 1100xH and 1100dH Series Transceiver

Frequency 902-928 MHz
FCC ID#: CCKPC0114, IC: 5251A-PC0114

Test Date: January 10, 2008

Certifying Engineer:


Scot D. Rogers
ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone: (913) 837-3214
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## Forward

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: 1100xH and 1100dH Series Transceiver wireless transceiver.

FCC I.D.: CCKPC0114 IC: 5251A-PC0114

Frequency Range: 902-928 MHz.

Operating Power: 123.8 dBµV/m @ 3-meters (3 meter radiated measurement). Designed as 720 mW antenna conducted power.

## 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 | 22.8° C |
| Relative Humidity | 56% |
| Atmospheric Pressure | 29.99 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: 1100xH and 1100dH Series Wireless Transceiver

FCC I.D.: CCKPC0114

IC: 5251A-PC0114

(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 | 1100xH and 1100dH | CCKPC0114 | 5251A-PC0114 |

## 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 1100xH and 1100dH 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 switch attached to the relay point contact. The unit operates from external DC battery power only and has no other power options available. For testing purposes a battery, supplied by the manufacturer, was used to power the EUT during testing. The Equipment offers two configurations depending on software functions required at the installation. 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 operates solely from direct current battery power and has no provision to connect to utility AC power system. Therefore, no AC line conducted emissions testing was performed or required.

### *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

### *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 one through five 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 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.

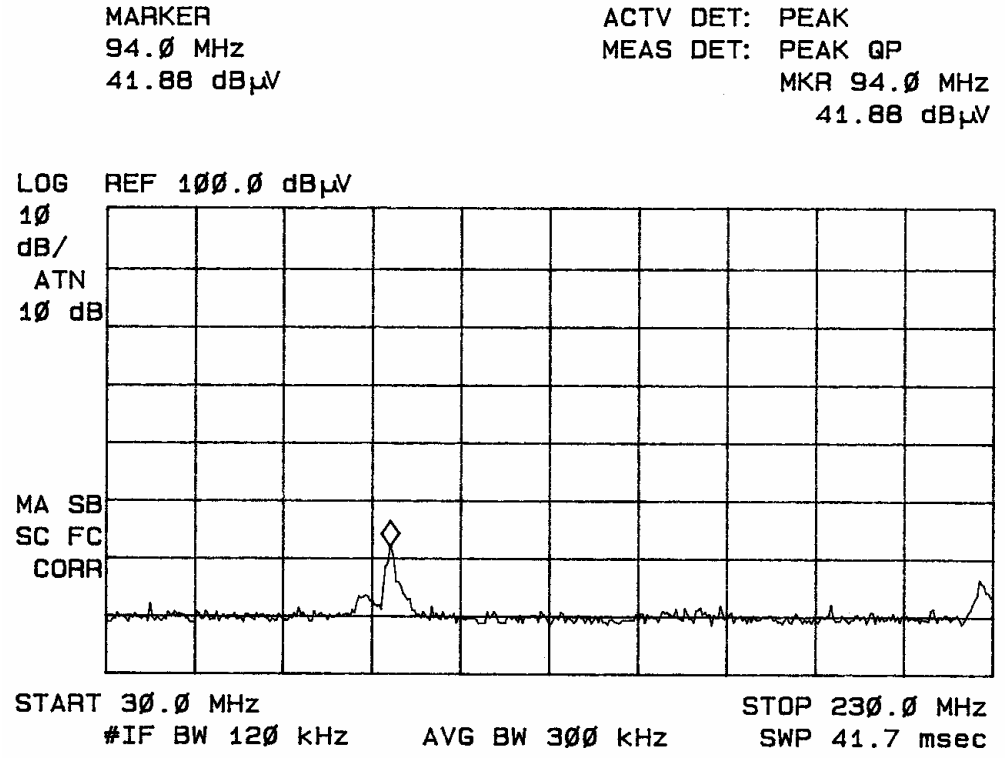


**Figure one Plot of General Radiated Emissions**

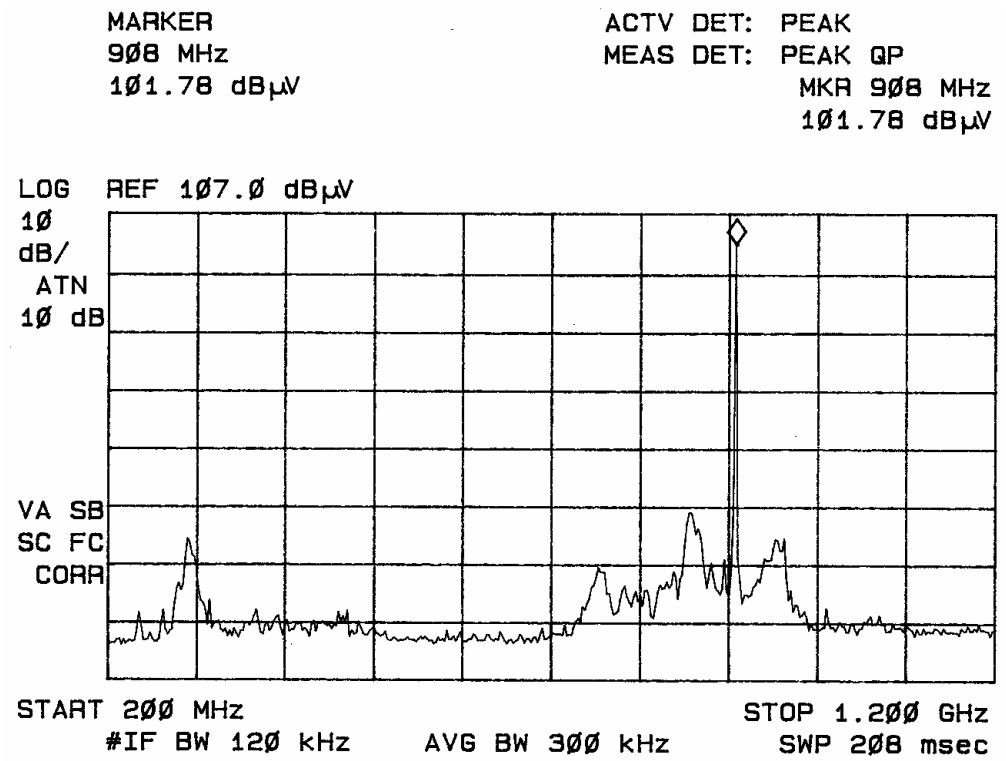


**Figure two Plot of General Radiated Emissions**

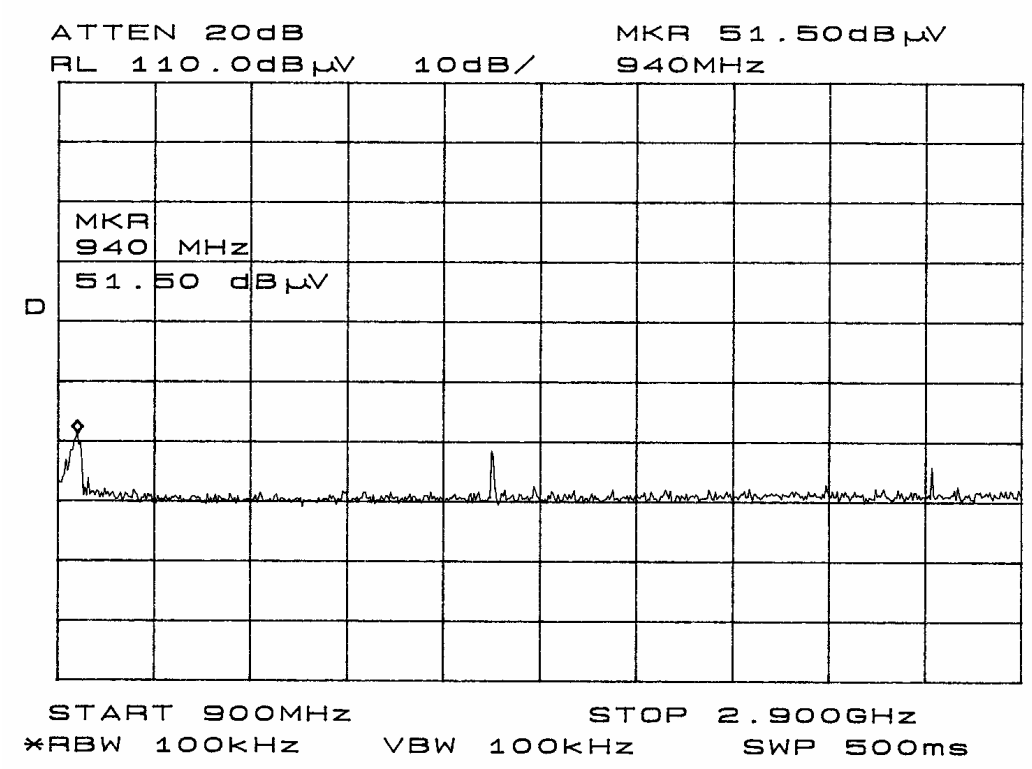


**Figure three Plot of General Radiated Emissions**

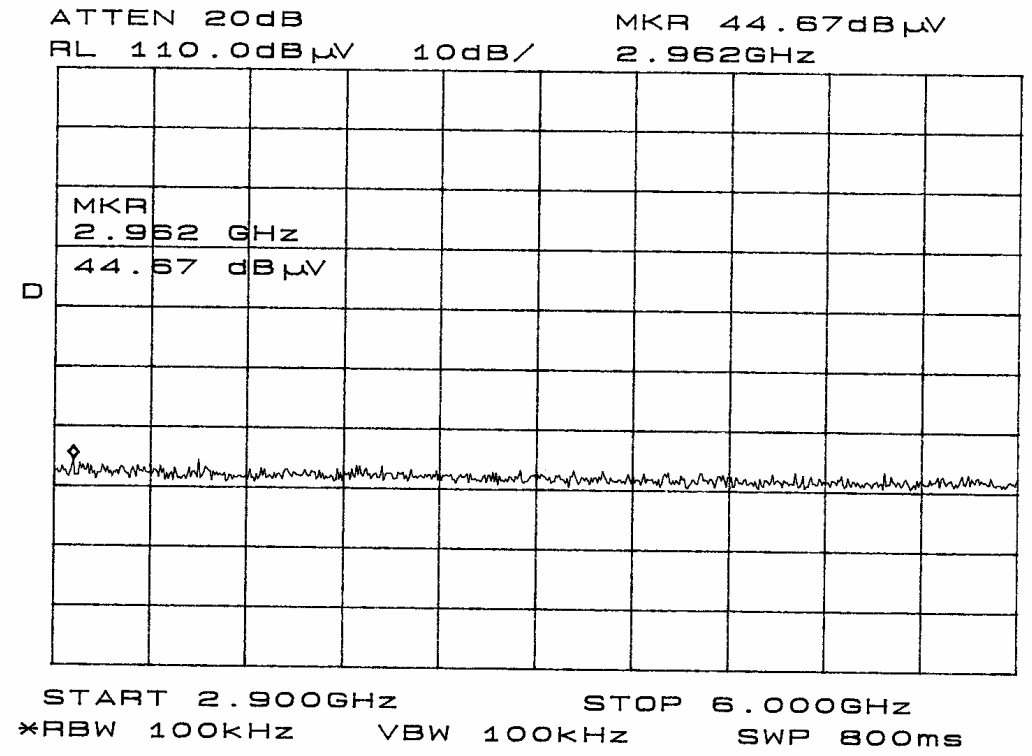


**Figure four Plot of General Radiated Emissions**

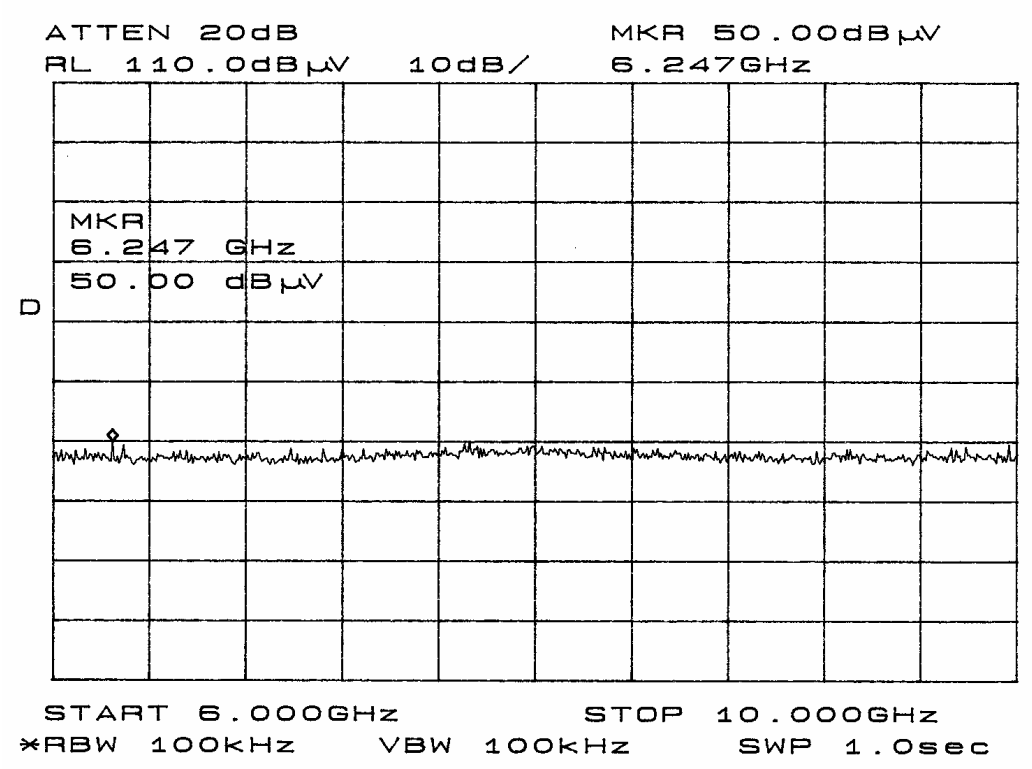


**Figure five Plot of General Radiated Emissions**

## 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) |
|---|---|---|---|---|---|---|---|
| 93.1 | 43.7 | 45.9 | 7.5 | 30 | 21.2 | 23.4 | 43.5 |
| 93.5 | 38.1 | 42.2 | 7.5 | 30 | 15.6 | 19.7 | 43.5 |
| 860.0 | 25.5 | 31.2 | 22.6 | 30 | 18.1 | 23.8 | 46.0 |
| 877.4 | 28.7 | 35.3 | 23.0 | 30 | 21.7 | 28.3 | 46.0 |

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

### *Summary of Results for Conducted Emissions*

The unit operates solely from direct current battery power and has no provision to connect to utility power system. Therefore, no AC line conducted emissions testing was performed or required. The conducted emissions for the EUT meet the requirements for CISPR 22, CFR47, and Industry Canada requirements.

### *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 20.1 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, paragraph 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)

= 40.0 + 34.4 - 30

= 44.1

**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) |
|---|---|---|---|---|---|---|---|
| 2710.0 | 40.0 | 46.8 | 34.4 | 30 | 44.1 | 51.2 | 54.0 |
| 2745.0 | 41.1 | 47.1 | 34.3 | 30 | 45.4 | 51.4 | 54.0 |
| 2781.6 | 40.2 | 41.2 | 34.3 | 30 | 44.5 | 45.5 | 54.0 |
| 3613.4 | 30.5 | 31.0 | 37.5 | 30 | 38.0 | 38.5 | 54.0 |
| 3660.0 | 31.8 | 37.2 | 38.0 | 30 | 39.8 | 45.2 | 54.0 |
| 3708.6 | 33.3 | 38.6 | 30.5 | 30 | 33.8 | 39.1 | 54.0 |
| 4516.5 | 35.0 | 35.3 | 41.1 | 30 | 46.1 | 46.4 | 54.0 |
| 4575.0 | 36.5 | 35.0 | 41.7 | 30 | 48.2 | 46.7 | 54.0 |
| 4635.7 | 36.3 | 33.1 | 41.9 | 30 | 48.2 | 45.0 | 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 2.6 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 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 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 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) |
|---|---|---|---|---|---|---|---|
| 93.1 | 43.7 | 45.9 | 7.5 | 30 | 21.2 | 23.4 | 43.5 |
| 93.5 | 38.1 | 42.2 | 7.5 | 30 | 15.6 | 19.7 | 43.5 |
| 860.0 | 25.5 | 31.2 | 22.6 | 30 | 18.1 | 23.8 | 46.0 |
| 877.4 | 28.7 | 35.3 | 23.0 | 30 | 21.7 | 28.3 | 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 20.1 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 six through fourteen 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 six demonstrates power output and number of channels used in 902-928 MHz. Figures seven through nine demonstrate occupied bandwidth at three frequencies in the 902-928 MHz band. The 20-dB bandwidth of 93 kHz complies with the requirement of less than 250 kHz wide and utilizing at least 50 hopping frequencies. Figure ten 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 eleven and twelve demonstrate dwell time

on channel and number of times on channel in a 20-second period. These plots demonstrate the 30.25 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 363 mS (30.25ms x 12 = 363 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 377 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 10 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 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. The band edges are protected due to the frequency of operation of the EUT. Figures thirteen and fourteen demonstrate band edge compliance.

Sample Calculation

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

= 100.5 + 23.3 - 0

= 123.8

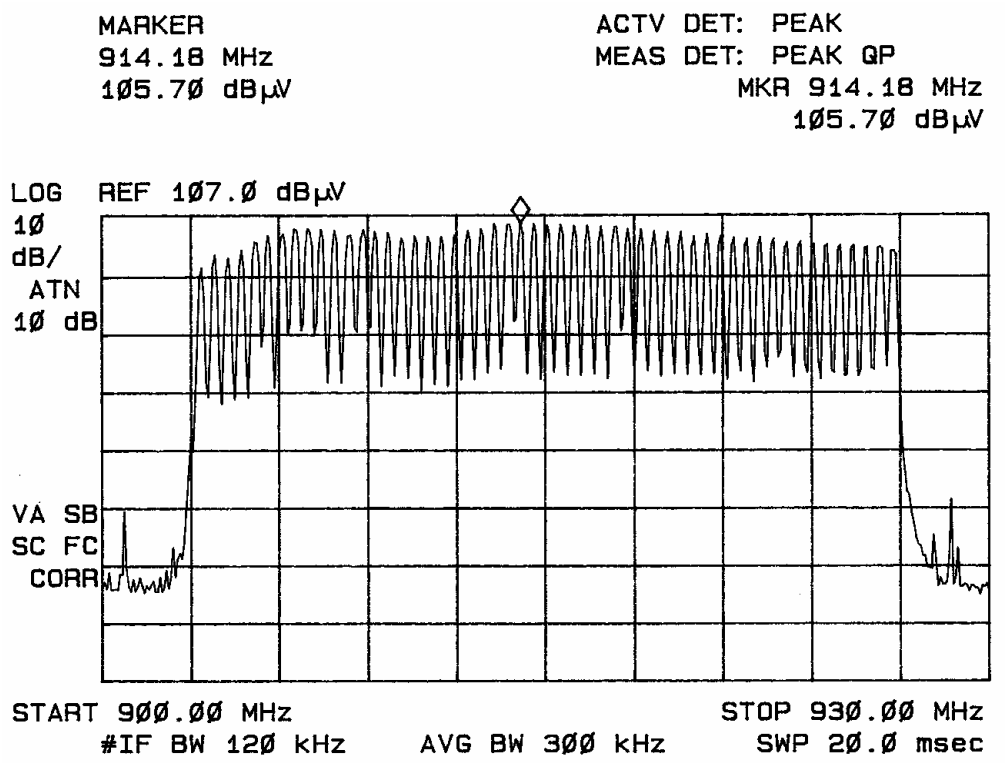


**Figure six Plot of output Power and number of channels in band**

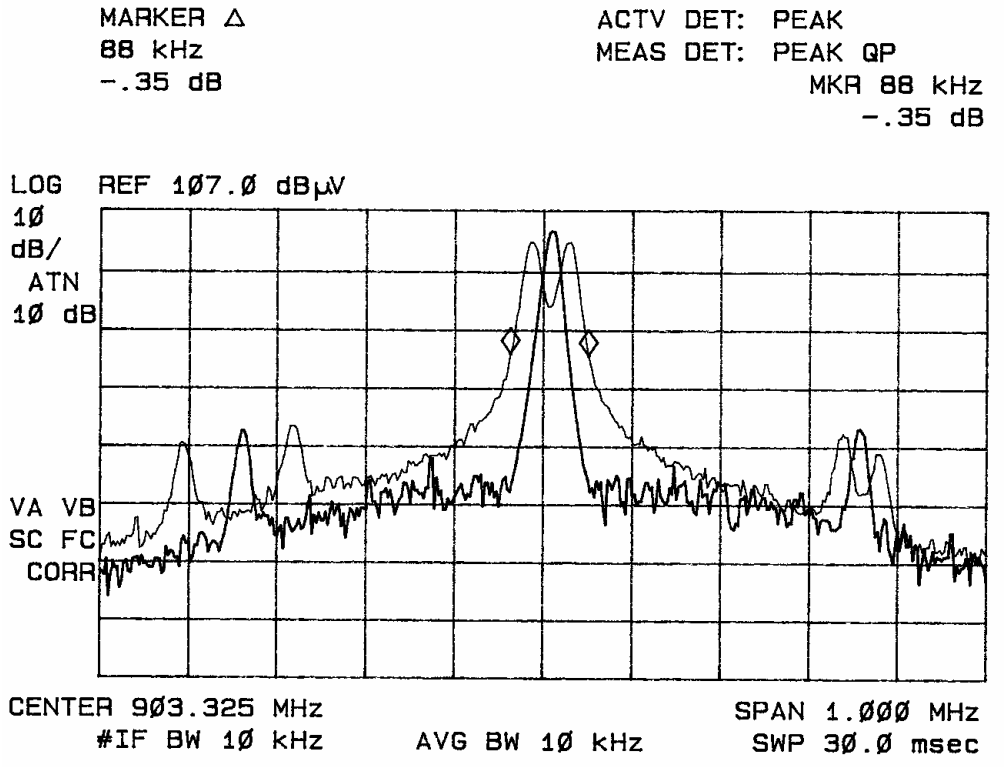


**Figure seven Plot of Occupied Bandwidth low frequency**

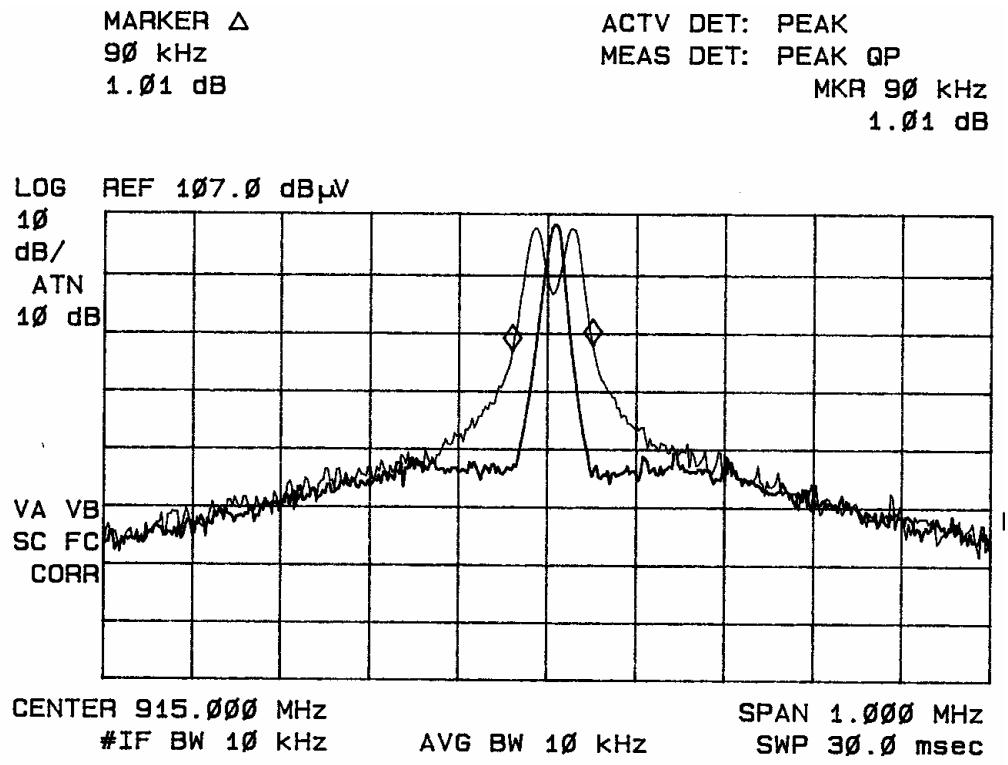


**Figure eight Plot of Occupied Bandwidth middle frequency**

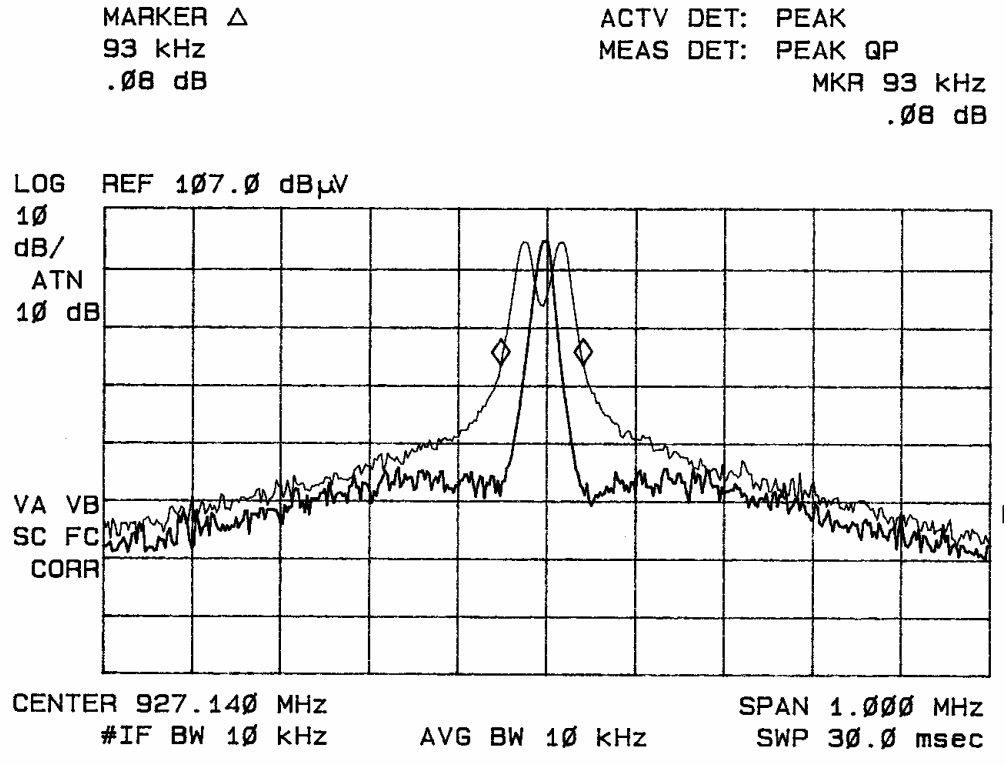


**Figure nine Plot of Occupied Bandwidth high frequency**

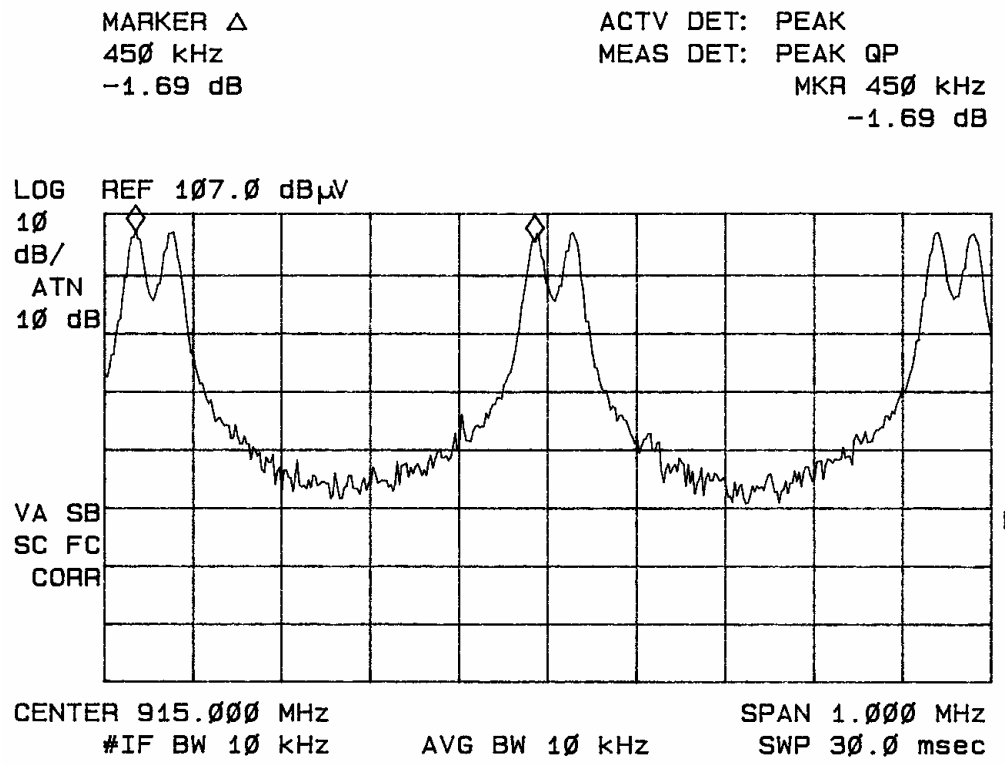


**Figure ten Plot of Channel Spacing**

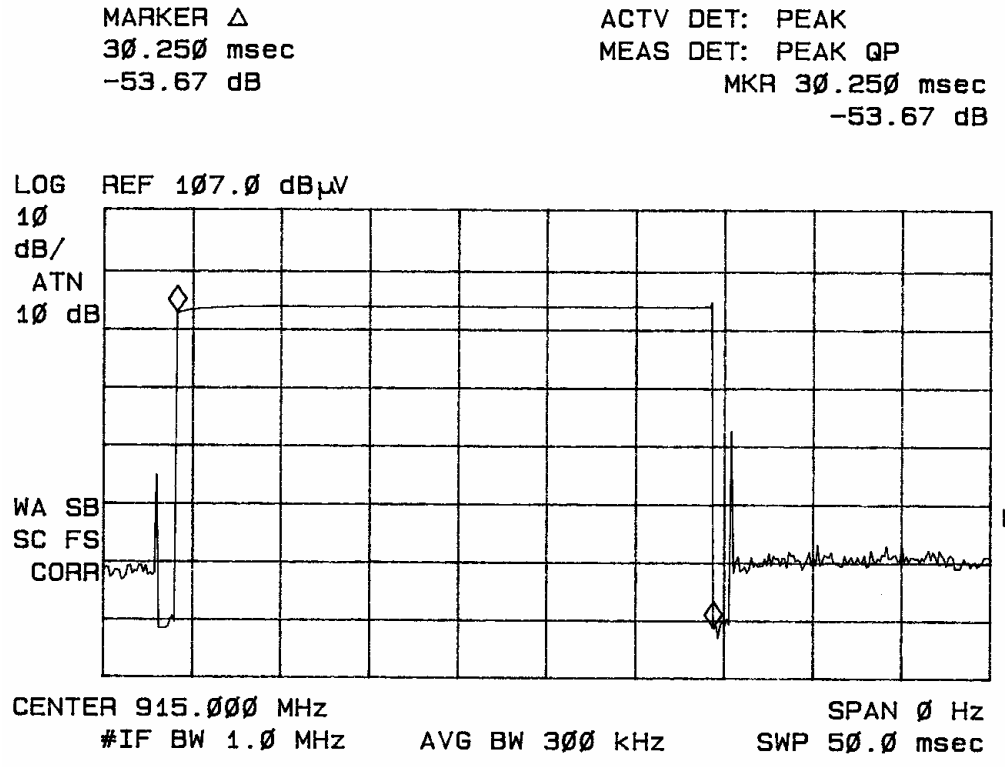


**Figure eleven Plot of Dwell Time on channel**

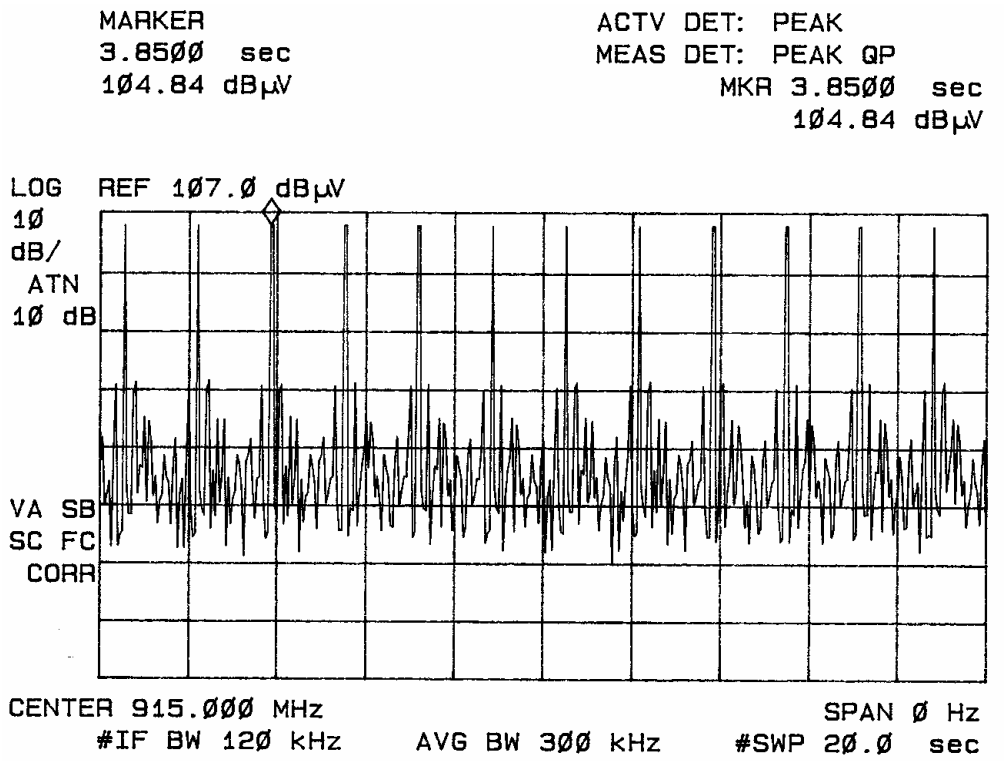


**Figure twelve Plot of Channel Occupancy over 20-second period**

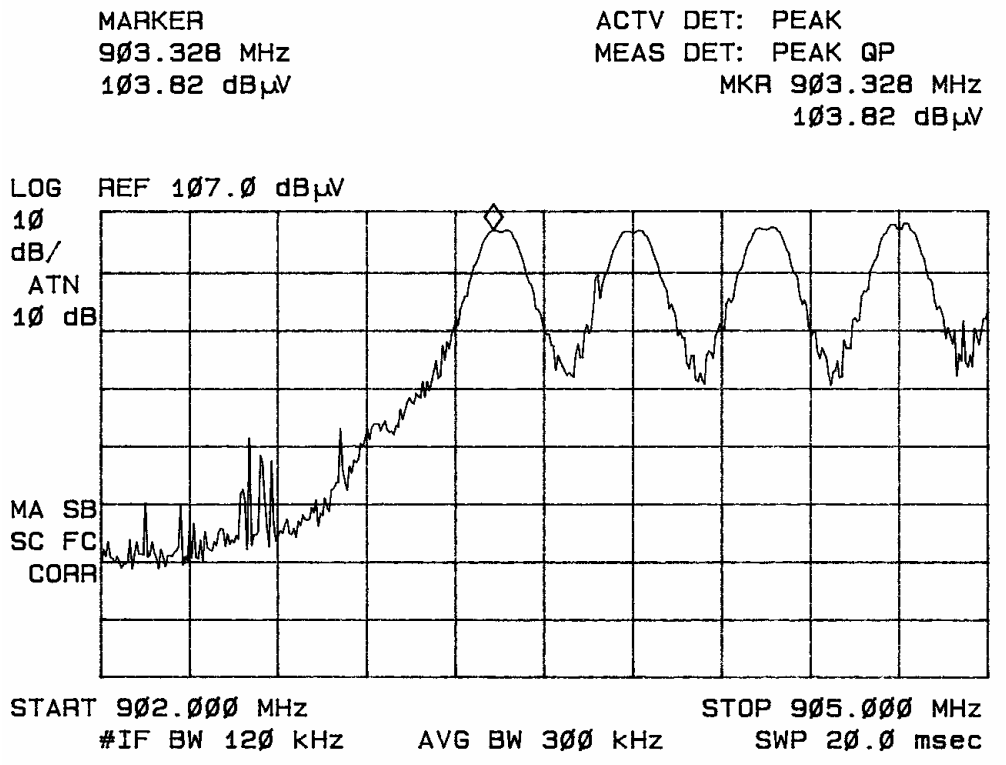


**Figure thirteen Plot of lower frequency band edge**

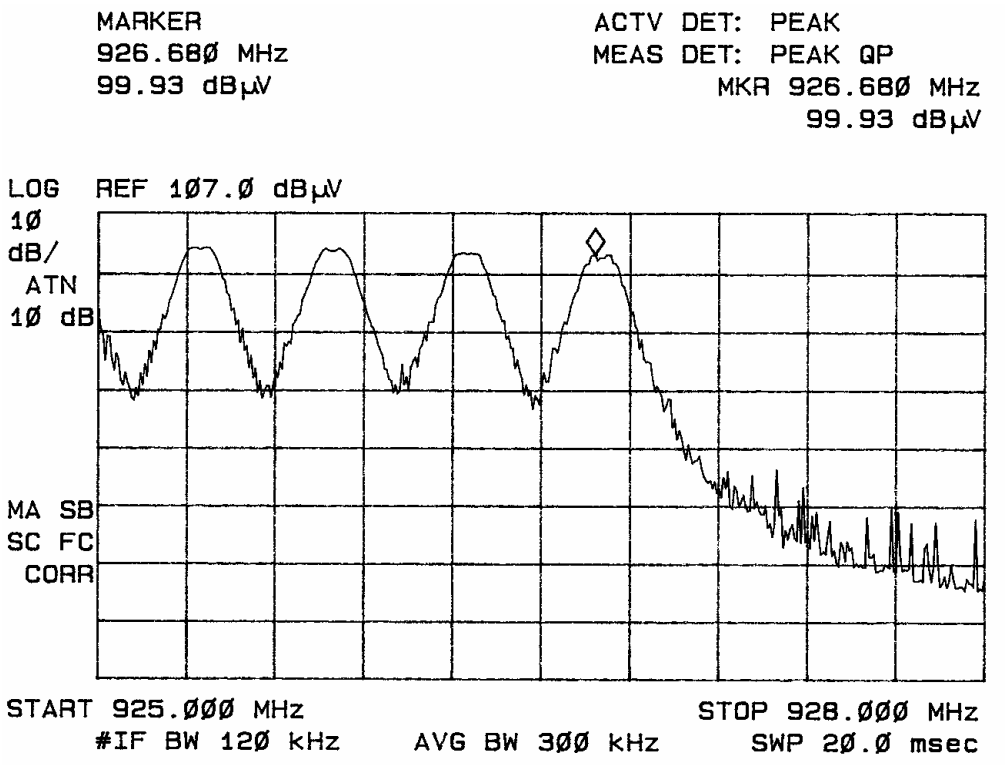


**Figure fourteen Plot of higher frequency band edge**

## 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 | 100.5 | 97.8 | 23.3 | 0 | 123.8 | 121.1 | |
| 1806.7 | 33.8 | 42.0 | 29.3 | 30 | 33.1 | 41.3 | 54 |
| 2710.0 | 40.0 | 46.8 | 34.4 | 30 | 44.4 | 51.2 | 54 |
| 3613.4 | 30.5 | 31.0 | 37.5 | 30 | 38.0 | 38.5 | 54 |
| 4516.8 | 35.0 | 35.3 | 41.1 | 30 | 46.1 | 46.4 | 54 |
| 915.0 | 99.5 | 96.8 | 23.3 | 0 | 122.8 | 120.1 | |
| 1830.0 | 31.8 | 41.5 | 29.5 | 30 | 31.3 | 41.0 | 54 |
| 2745.0 | 41.1 | 47.1 | 34.3 | 30 | 45.4 | 51.4 | 54 |
| 3660.0 | 31.8 | 37.2 | 38.0 | 30 | 39.8 | 45.2 | 54 |
| 4575.0 | 36.5 | 35.0 | 41.7 | 30 | 48.2 | 46.7 | 54 |
| 927.2 | 97.7 | 95.2 | 23.4 | 0 | 121.1 | 118.6 | |
| 1854.4 | 34.0 | 35.8 | 29.3 | 30 | 33.3 | 35.1 | 54 |
| 2781.6 | 40.2 | 41.2 | 34.3 | 30 | 44.5 | 45.5 | 54 |
| 3708.8 | 33.3 | 38.6 | 30.5 | 30 | 33.8 | 39.1 | 54 |
| 4636.0 | 36.3 | 33.1 | 41.9 | 30 | 48.2 | 45.0 | 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 123.8 dBμV/m at 3 meters at the fundamental frequency of operation. The EUT had a worst-case of 2.6 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,<br>Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W<br>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