NVLAP Lab Code: 200087-0

SUBMITTAL APPLICATION REPORT

FOR
FCC And INDUSTRY CANADA
GRANT OF CERTIFICATION

FOR

MODEL: BB003 Transceiver Module
902 - 928 MHz Transmitter
FCC ID: TJJ-BB003
IC: 6047A-BB003

FOR

HOPKINS MANUFACTURING CORP.

428 Peyton
Emporia, KS 66801

Test Report Number: 070822

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
Spread Spectrum Frequency Hopping Transmitter

For

HOPKINS MANUFACTURING CORP.

428 Peyton

Emporia, KS 66801

Jon Gray,

Model: BB003 Transceiver Module

Frequency 902-928 MHz

FCC ID: TJJ-BB003, IC: 6047A-BB003

Test Date: August 22, 2007

Certifying Engineer: Scot D Rogers

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ROGERS LABS, INC.
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FORWARD

The following information is submitted for consideration in obtaining a Grant of Certification for a spread spectrum frequency hopping intentional radiator operating under CFR47 Paragraph 15.247 and Industry Canada standard RSS-210.

Name of Applicant:
HOPKINS MANUFACTURING CORP.
428 Peyton
Emporia, KS 66801

Model: BB003 Transceiver wireless transceiver module.

FCC I.D.: TJJ-BB003.

Operating Power: 106.9 dBµV/m @ 3-meters (3 meter effective radiated measurement).

Opinion / Interpretation of Results

TESTS PERFORMED	RESULTS
Emissions Tests	
General Radiated Emissions as per CFR47 15C and RSS-210 Standards	Complies

Applicable Standards & Test Procedures

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.

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.

Environmental Conditions

Ambient Temperature	22.2° C
Relative Humidity	58%
Atmospheric Pressure	29.95 in Hg

2.1033(b) Application for Certification

(1) Manufacturer: HOPKINS MANUFACTURING CORP.
428 Peyton
Emporia, KS 66801

(2) Identification: Model: BB003 Transceiver Module
FCC I.D.: TJJ-BB003
IC: 6047A-BB003

(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.

Equipment Tested

Equipment	Model	FCC I.D.	IC
EUT	BB003 Transceiver	TJJ-BB003	6047A-BB003

Equipment Function and Testing Procedures

The EUT is a 902-928 MHz radio transmitter used to transmit information and control functions for use in an installation. The BB003 Transceiver is a wireless link used for transmitting conditions and information in installation environments. The device communicates with other module installations based on functional conditions. Upon power up the EUT enables an identification service, which allows communications with a receiver to shift frequencies in synchronization with the transmitter. The unit is marketed for use to incorporate a wireless link in remote system solutions. Test software was installed in the test samples for testing purposes. The modified software allowed the transmitter to be set to transmit channels dependant on activation of the power switch located on the test system interface board. The unit operates from 3 volt DC power input and is internally regulated. For testing purposes, new batteries were used to power the EUT during testing. The device utilizes a permanently connected antenna system with no provision for user replacement.

Equipment and Cable Configurations

Conducted Emission Test Procedure

The unit operates from direct current power only and has no provision to connect to the public utility power system. Therefore, AC line conducted emission measurements are not required.

Radiated Emission Test Procedure

Testing for the radiated emissions was performed as defined in sections 8.3 and 13.1 of ANSI C63.4 and/or DA-00-705. 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.

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	10/06	10/07
LISN	Comp. Design	1762	2/07	2/08
Antenna	ARA	BCD-235-B	10/06	10/07
Antenna	EMCO	3147	10/06	10/07
Antenna	EMCO	3143	5/07	5/08
Analyzer	HP	8591EM	5/07	5/08
Analyzer	HP	8562A	2/07	2/08

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 tests were performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.

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

Site Approval Refer to Appendix for FCC Site Approval Letter, Reference # 90910, and Industry Canada Site Approval code IC3041-1.

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

Test procedures of ANSI 63.4-2003 paragraphs 13.1 and 8.3.1.2 were used during radiated emissions testing. 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)
= 39.2 + 34.2 - 30
= 43.4

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)
2715.0	39.2	38.8	34.2	30	43.4	43.0	54.0
2745.0	37.7	39.5	34.1	30	41.8	43.6	54.0
2775.4	36.0	39.5	34.2	30	40.2	43.7	54.0
3620.0	34.0	33.8	38.7	30	42.7	42.5	54.0
3660.0	31.5	35.5	39.1	30	40.6	44.6	54.0
3700.6	35.6	33.0	38.6	30	44.2	41.6	54.0
4525.0	32.8	31.5	24.3	30	27.1	25.8	54.0
4575.0	32.7	32.8	44.3	30	47.0	47.1	54.0
4625.7	32.3	32.5	44.0	30	46.3	46.5	54.0
5430.0	31.6	33.6	33.1	30	34.7	36.7	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 6.9 dB (Peak Amplitude) margin below the Average limits. Both average and peak amplitudes were checked for compliance with the regulations. Peak amplitude data presented here demonstrating worst-case emissions. No other emissions where found in the restricted frequency bands. Other emissions were present with amplitudes at least 20 dB below the FCC Limits.

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.

15.209 Radiated Emissions Limits; General Requirements

General Radiated Emissions Test Procedure

Test procedures of ANSI 63.4-2003 paragraphs 13.1 and 8.3.1.2 were used during radiated emissions testing. 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. Refer to figures 1 through 5 showing the worst-case radiated emission spectrum displayed on the spectrum analyzer taken in a screen room. 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 at this location before final radiated emissions measurements were performed. The frequency spectrum from 30 MHz to 10,000 MHz was searched for radiated emissions. Measured emission levels were maximized by EUT placement on the table, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna polarization between horizontal and vertical. Antennas used were Broadband Biconical from 30 MHz to 200 MHz, Biconilog from 30 MHz to 1000 MHz, Log Periodic from 200 MHz to 5 GHz, and/or Pyramidal Horns and Double-Ridge horn from 4 GHz to 10 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)

Note: No emissions above 20 dB below the limit were found emanating from this device other than the fundamental and harmonics. Other emissions present had amplitudes at least 20 dB below the limit.

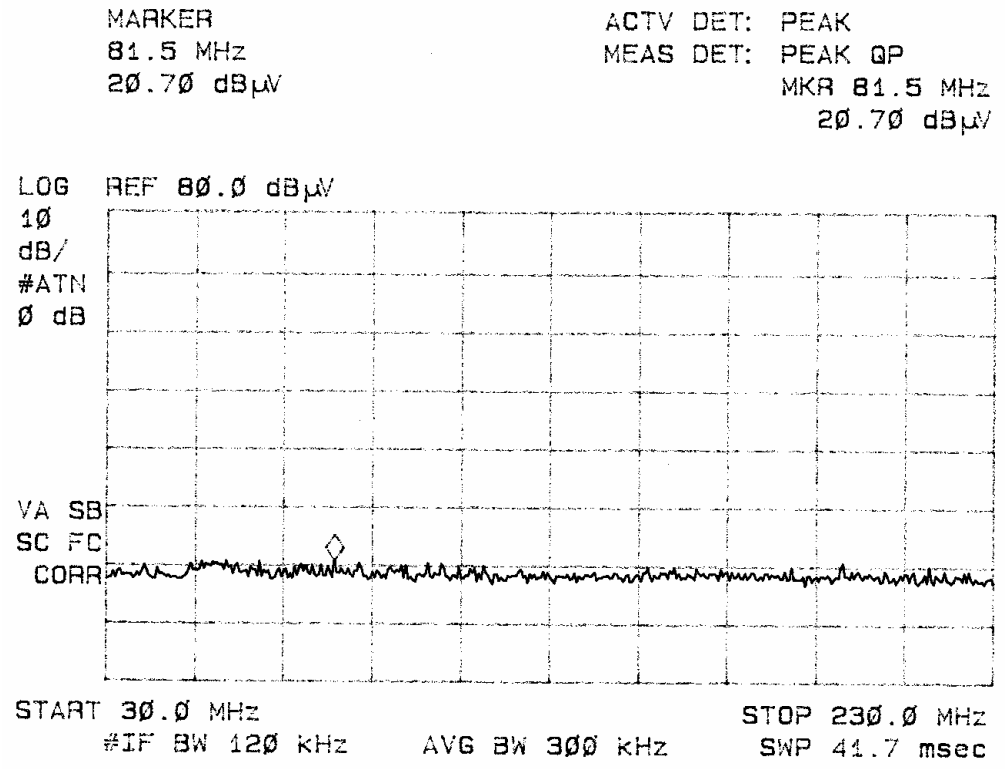

Figure one Radiated Emissions in screen room.

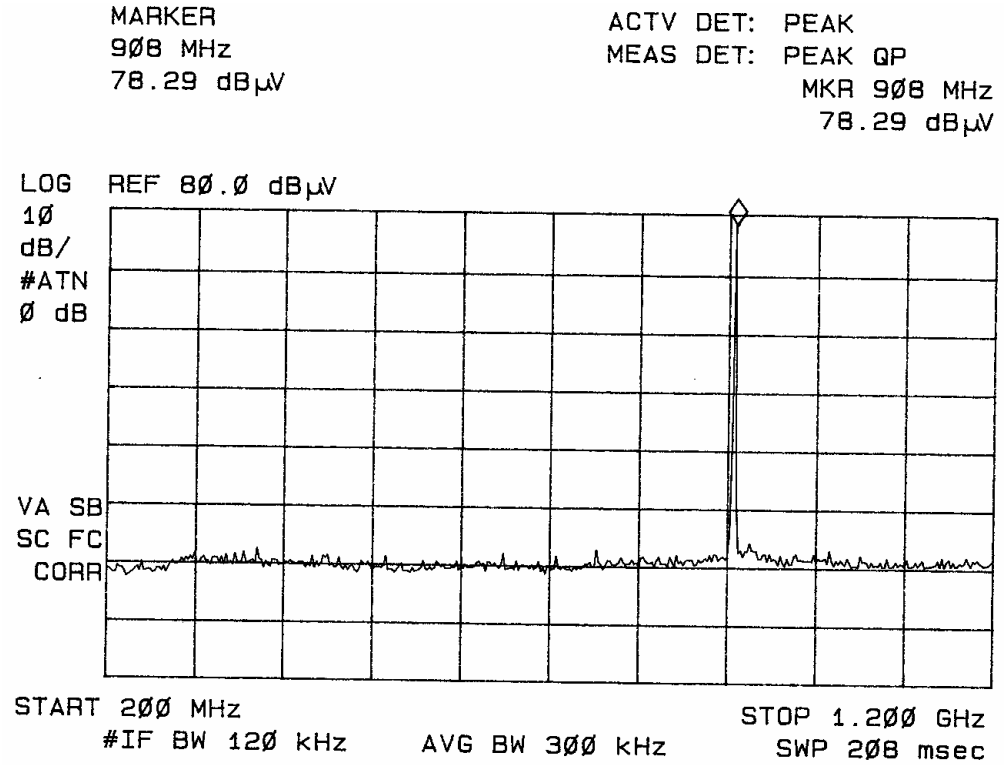

Figure two Radiated Emissions in screen room.

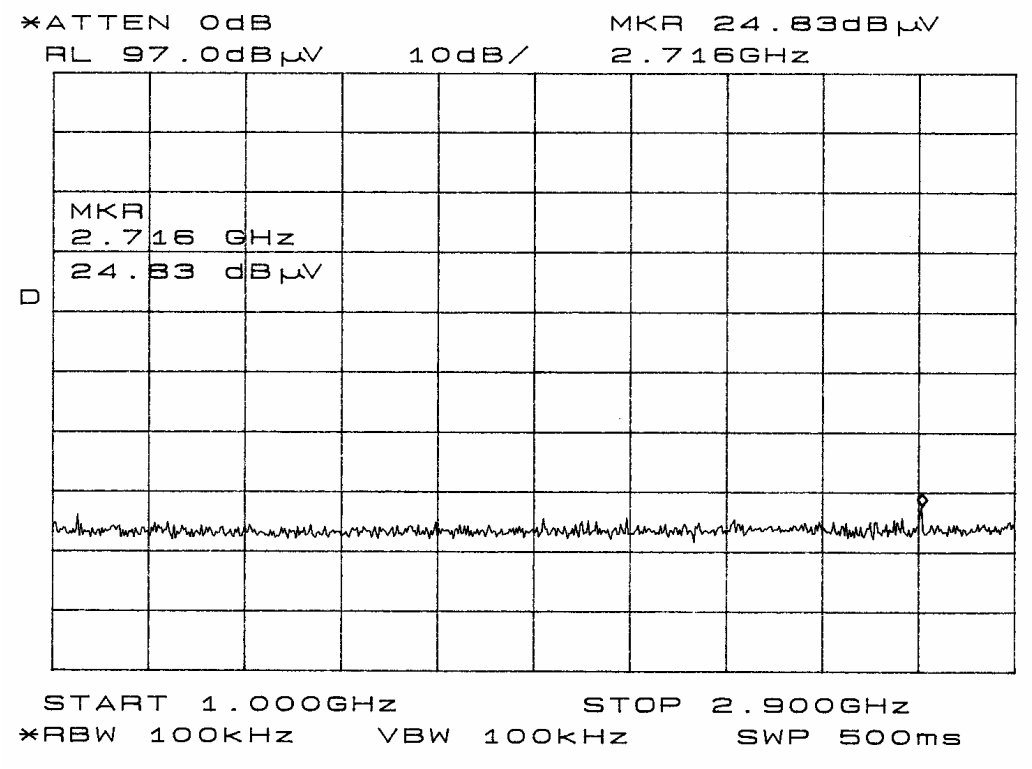

Figure three Radiated Emissions in screen room.

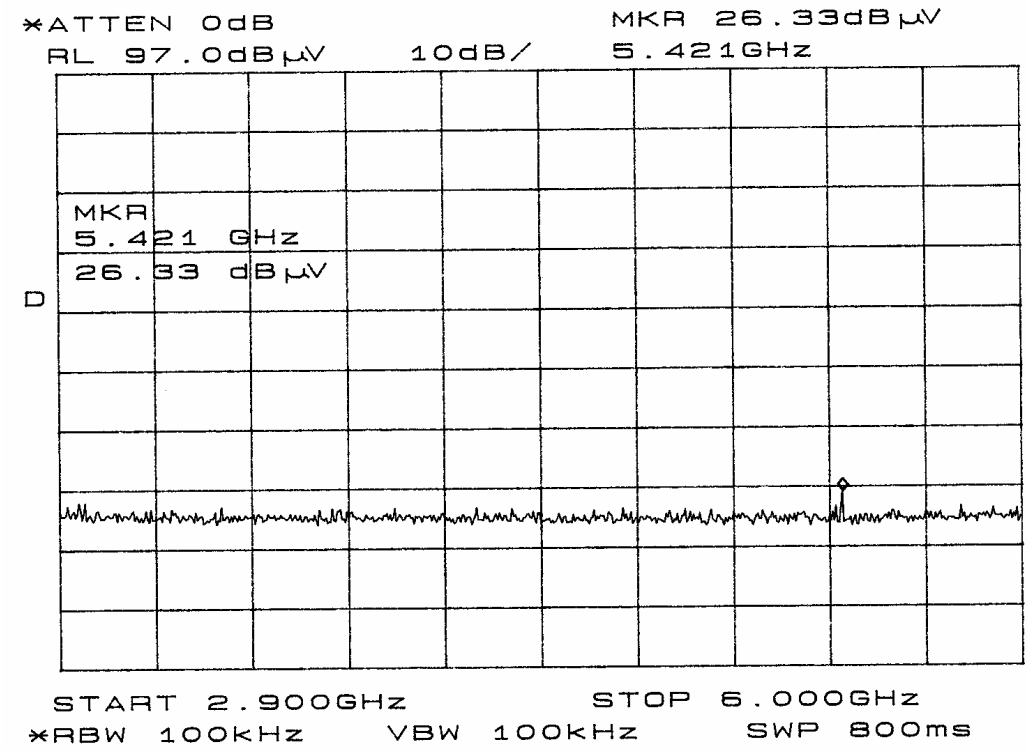

Figure four Radiated Emissions in screen room.

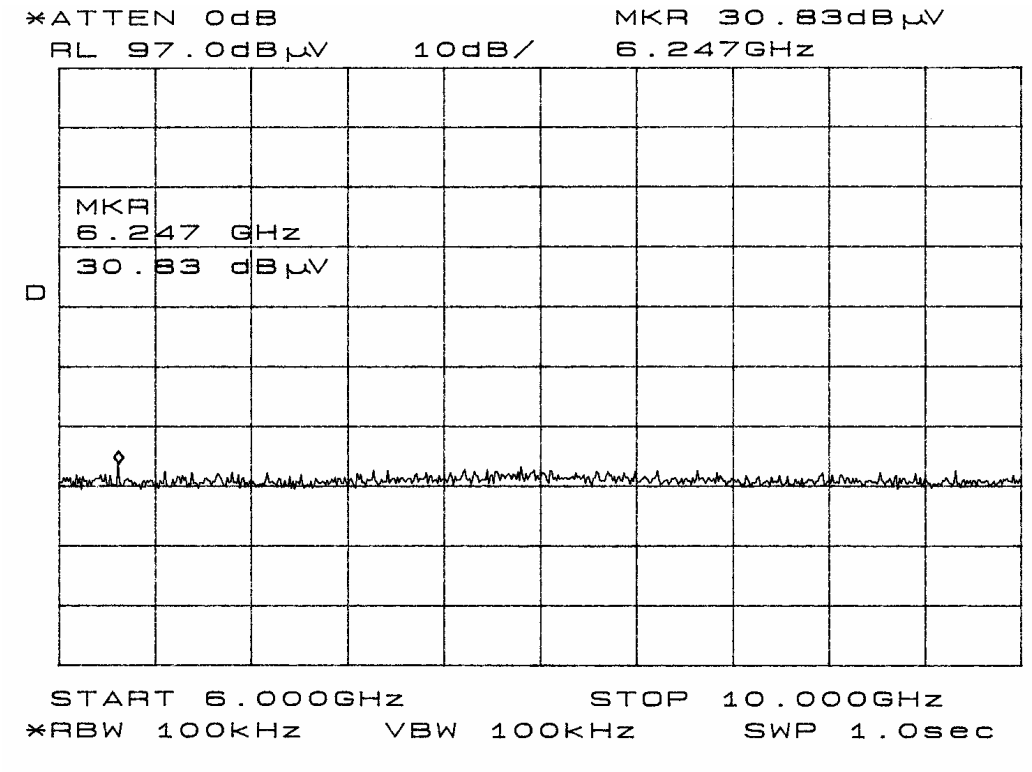

Figure five Radiated Emissions in screen room.

Summary of Results for General 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 dB minimum margin below the quasi-peak 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 CFR47 Part 15C or RSS-210 emissions standards. There were no deviations to the specifications.

15.247 Operation in the Band 902-928 MHz

Test procedures of ANSI 63.4-2003 paragraphs 13.1 and 8.3.1.2, FCC documents DA00-1407 and DA00-705 and/or TIA/EIA 603-1, were used during radiated emissions testing. 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 were measured using a spectrum analyzer then data was recorded from the analyzer display. Refer to figures 6 through 15 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. The 20-dB bandwidth of 138 kHz complies with the requirement of less than 250 kHz wide and utilizing at least 50 hopping frequencies. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a twenty-second-time period. Figure 11 shows the dwell time of occupancy of 31 mS. Information showing compliance for time of channel occupancy and hopping sequence are displayed below.

Channel Assignments

Ch	Frequency (MHz)	Ch	Frequency (MHz)	Ch	Frequency (MHz)	Ch	Frequency (MHz)
0	904.499756	16	909.742920	32	914.986084	48	920.229248
1	904.827454	17	910.070618	33	915.313782	49	920.556946
2	905.155152	18	910.398316	34	915.641480	50	920.884644
3	905.482849	19	910.726013	35	915.969177	51	921.212341
4	905.810547	20	911.053711	36	916.296875	52	921.540039
5	906.138245	21	911.381409	37	916.624573	53	921.867737
6	906.465943	22	911.709107	38	916.952271	54	922.195435
7	906.793640	23	912.036804	39	917.279968	55	922.523132
8	907.121338	24	912.364502	40	917.607666	56	922.850830
9	907.449036	25	912.692200	41	917.935364	57	923.178528
10	907.776734	26	913.019898	42	918.263062	58	923.506226
11	908.104431	27	913.347595	43	918.590759	59	923.833923
12	908.432129	28	913.675293	44	918.918457	60	924.161621
13	908.759827	29	914.002991	45	919.246155	61	924.489319
14	909.087525	30	914.330689	46	919.573853	62	924.817017
15	909.415222	31	914.658386	47	919.901550	63	925.144714

Message Structure/Frequency Hopping

The two BB003 modules in an operational pair—Unit #1 and Unit #2 units which are in a point-to-point communication session with each other—use the same frequency hopping "hop table" and share a factory assigned address and "sync word". In addition, the two modules are time-synchronized so that the Unit #1 is primarily the receiver of the pair, can spend most of its time in a low power sleep mode, and "wake" just in time to receive a message from the Unit #2 unit.

Each matched pair uses a randomly assigned hop table that begins at a randomly assigned channel. The hop table (one-of-eight tables) and the starting channel within the table (one of 64 possible channels) are randomly chosen and programmed at the factory. Each hop table has 64 entries; each channel is used one time until processing all the channels in the table before repeating the sequence. Each hop is at least nine channels from the previous frequency.

Message Structure:

* 4 bytes Preamble (32 bits alternating 1 and 0)
* 4 bytes Sync Word (2 bytes repeated)
* 1 byte Address
* 2 byte Payload
* 2 bytes 16-bit CRC
* 7 bytes Forward Error Correction (FEC)

The transmitting BB003 of a matched pair sends a Sync Word that is a 16-bit pattern used by the receive BB003 to match its timing to the incoming transmission to signify the start of the data. The BB003 requires that 14 of 16 received Sync Word bits match its factory stored pattern. There are 64 possible Sync Words used by BB003s, each with six bits or more (within the 16 bits) that are different from each of the other sync words. By using 64 different Sync Words, six more bits of addressing are effectively added, enabling each pair to be distinguished from another pair by a total of 14 bits that include the conventional 8 address bits.

As described above, there are a total of 20 bytes (160 bits) in each transmitted packet. Each transmitting BB003 transmits a packet 4 times in sequence in order to increase the probability of reception. Therefore, each transmission lasts:

160 bits/packet * 4 packets/transmission / 32.532 kbits/sec = 19.67 msec/transmission

Once time-synchronized with its mated Unit #1 BB003, the Unit #2 BB003 transmits every 100msec – or 10 transmissions/second. It changes channels every transmission per a 64-member hop table that includes each channel one time until processing all the channels in the table before repeating the sequence. Therefore, the percent of time on any channel within a sufficiently long period is:

100% * 19.67 msec/transmission * 10 transmissions/second / 64 = 0.307%

This was designed so that the dwell time in a 20 second period would fall well below the 400msec maximum as specified in Part 15.247.

20 seconds * 0.307% = 61.4msec

The Unit #1 BB003 is primarily in its sleep mode, and enables its receiver every 400msec to catch every fourth transmission. Typically, it will only be in receive for 20msec out of every 400msec—a 5% duty cycle. The low duty cycle offers the Unit #1 unit to strictly conserve energy use and operate from battery power for many weeks. The Unit #2 BB003 transmits at four times what is needed for the normal Unit #1 BB003 receive interval so that the Unit #1 BB003 has the opportunity for more frequent updates should one be missed.

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. The band edges are protected due to the frequency of operation of the EUT. 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. Calculated power was obtained using the formal below and measured emission data of 106.9 dBµ/m @3meters. 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 904.5– 925.1MHz channels used for frequency of operation. Refer to figures 6 through 15 showing plots taken of the EUT performance displaying compliance with the specifications.

Sample Calculation

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

= 73.8 + 23.1 - 0

= 96.9

Sample Calculated Power

Power (Watts) = $[3*10^{((RFS-120)/20)}]^2/30$

Power (Watts) = $[3*10^{((106.9-120)/20)}]^2/30$

Power (Watts) = 14.69 e-3 Watts

Power (mW) = 14.7 mW

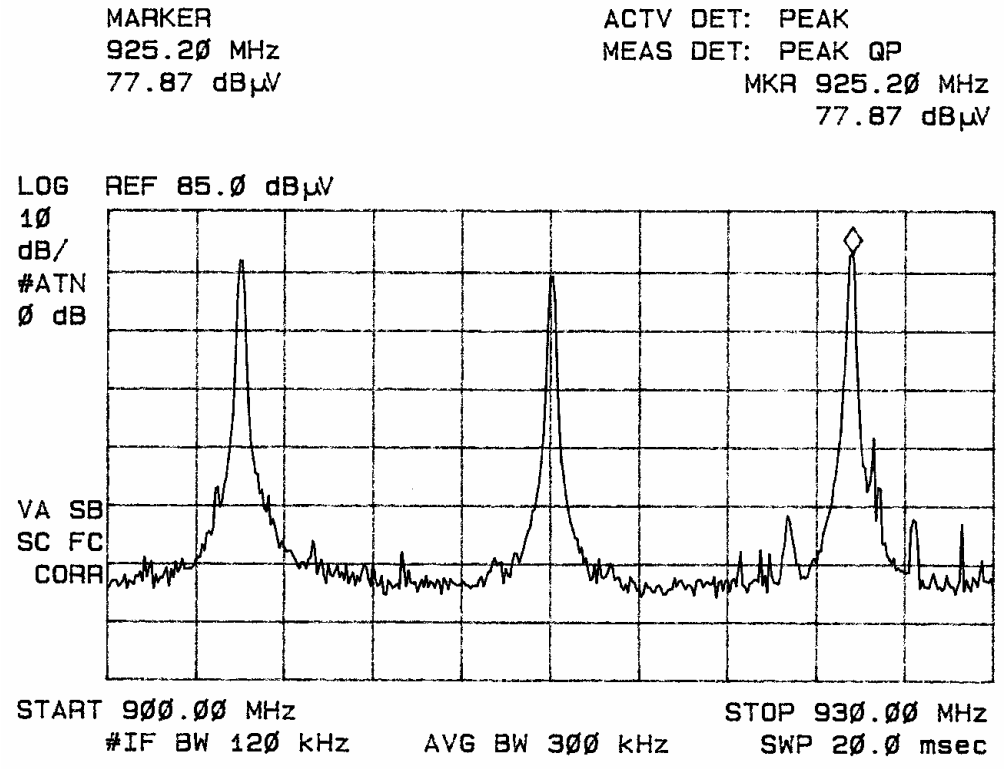

Figure six Band edges

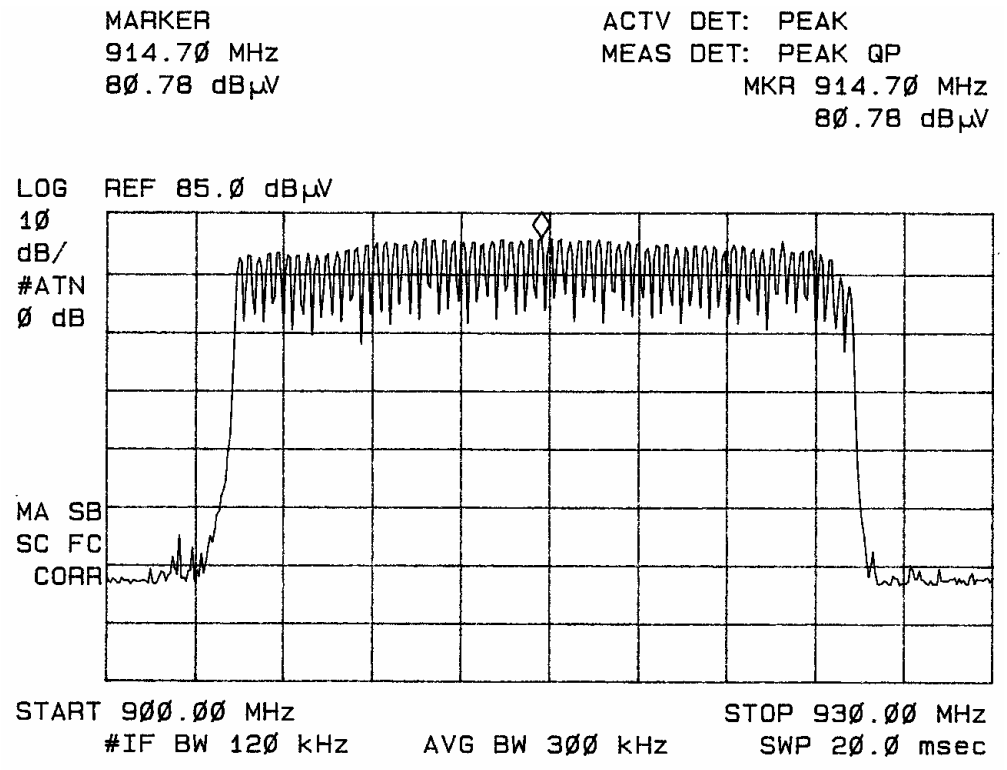

Figure seven Frequencies of operation

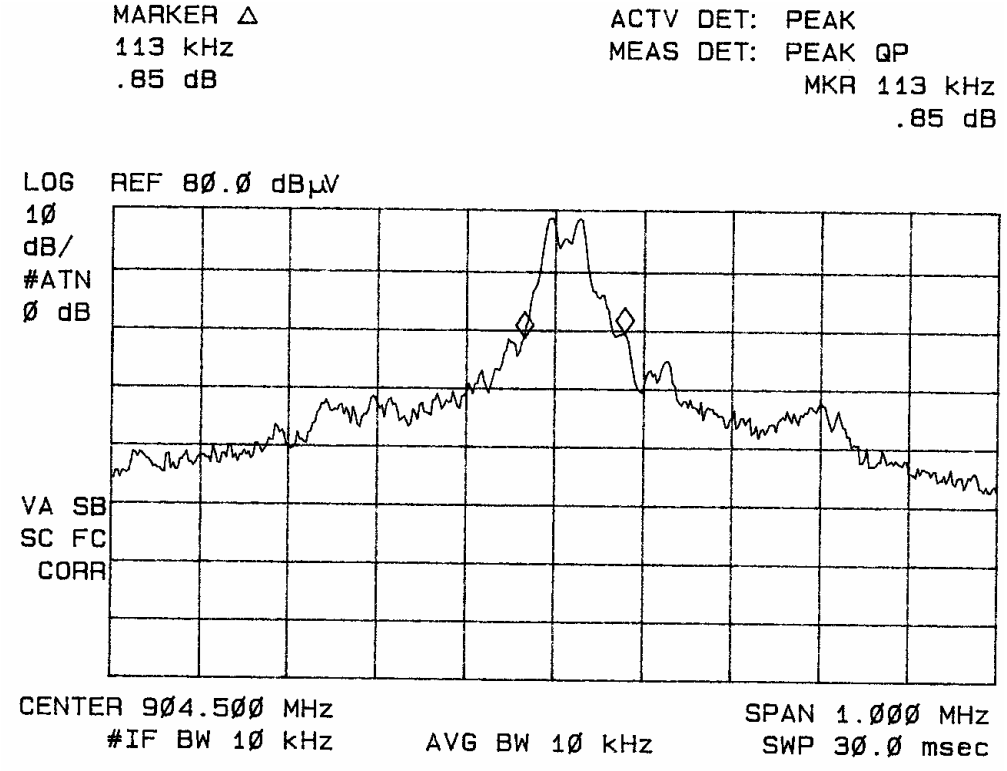

Figure eight Occupied Bandwidth low frequency (20 dB Bandwidth)

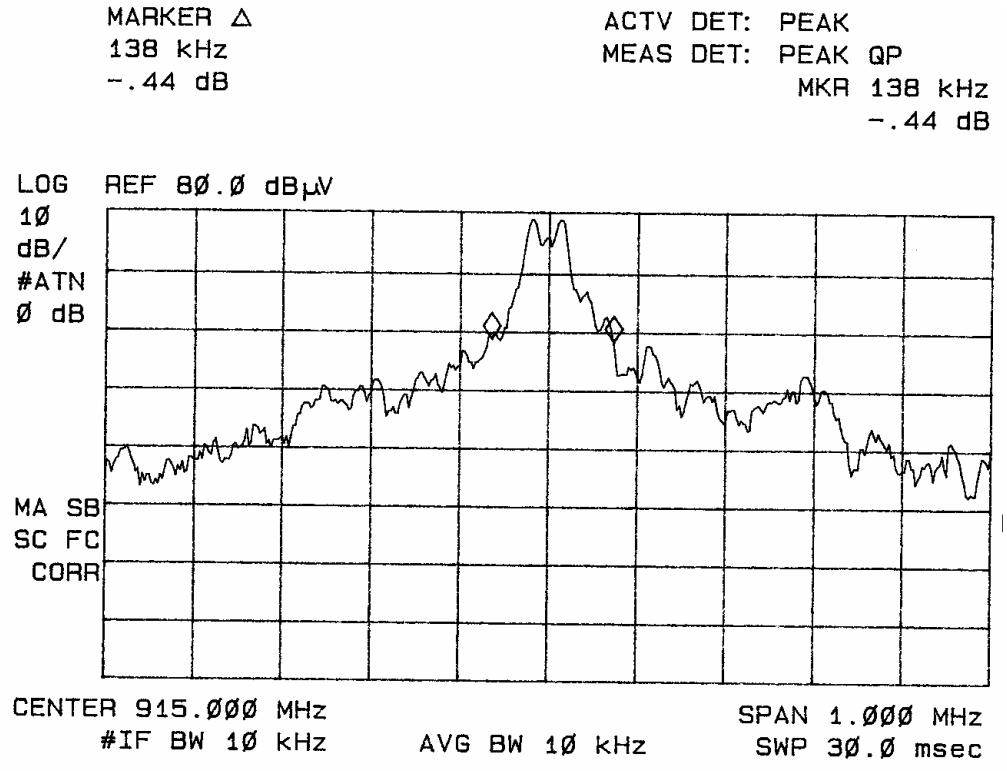

Figure nine Occupied Bandwidth middle frequency (20 dB Bandwidth)

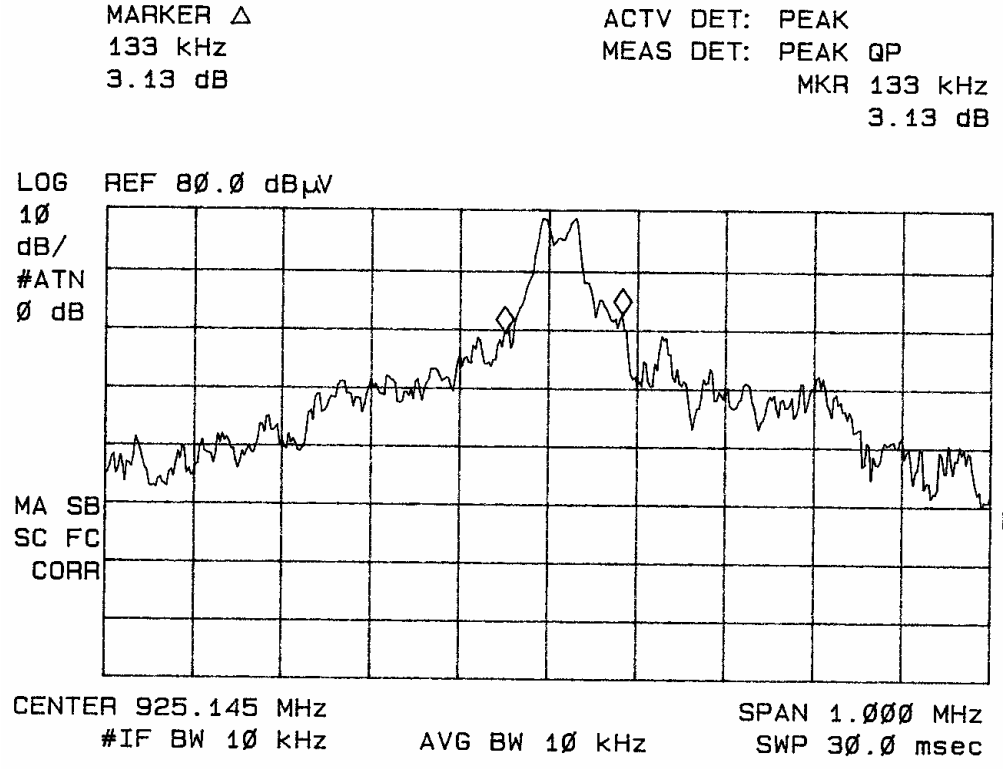

Figure ten Occupied Bandwidth high frequency (20 dB Bandwidth)

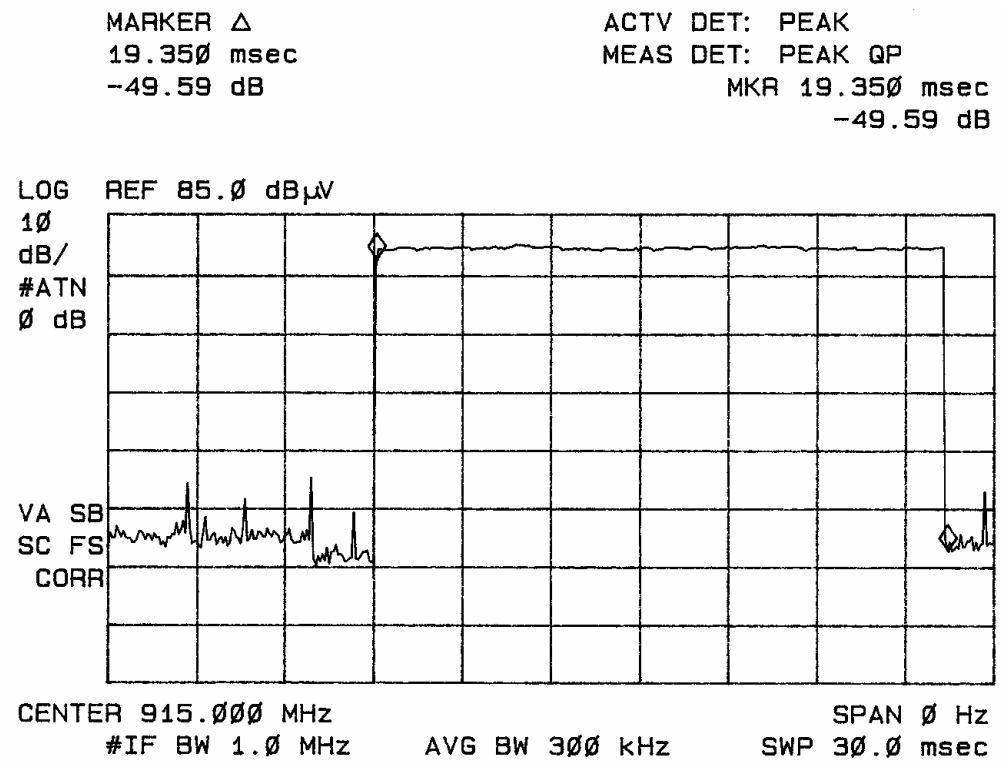

Figure eleven Dwell Time on channel

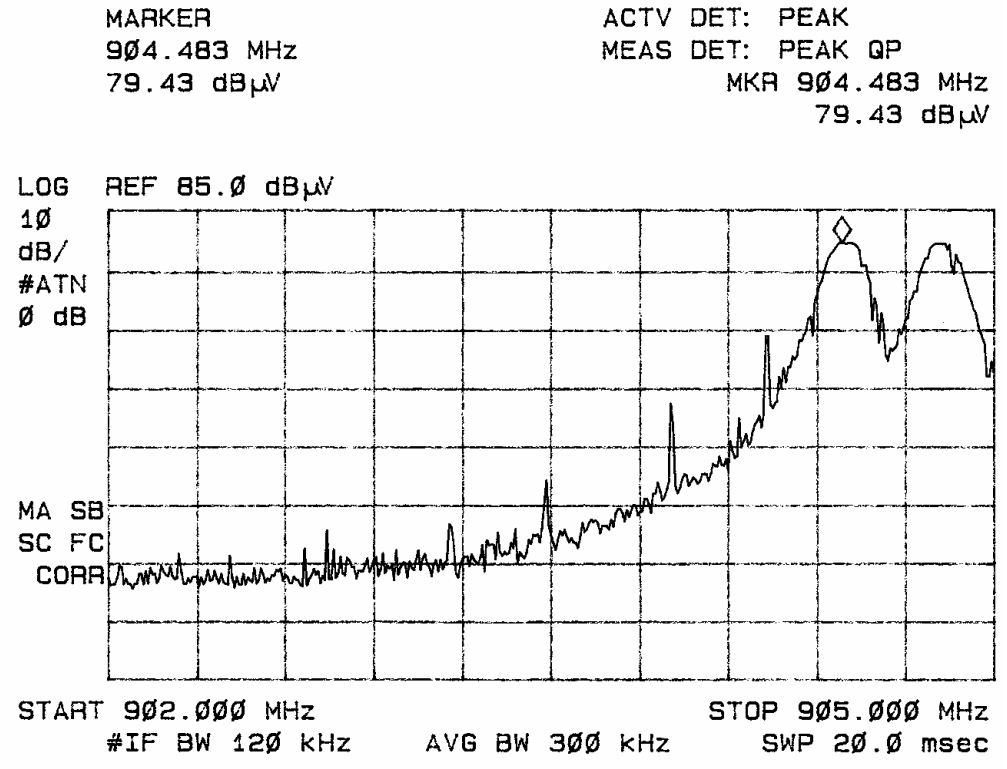

Figure twelve Channel Spacing and low band edge

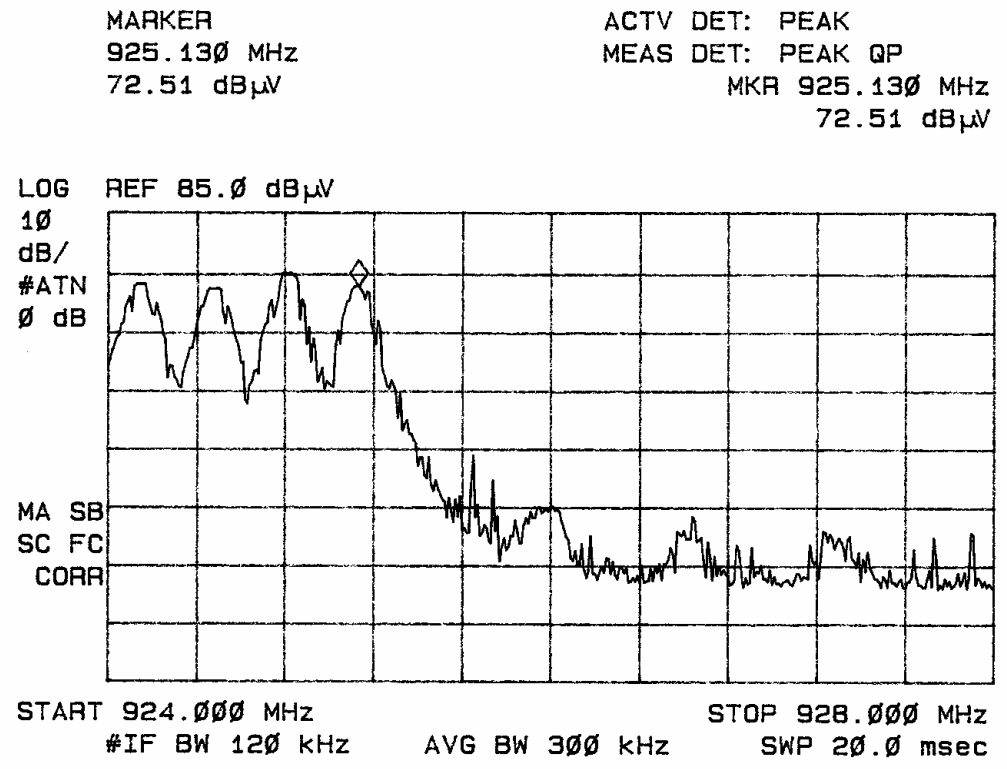

Figure thirteen Channel Spacing and high band edge

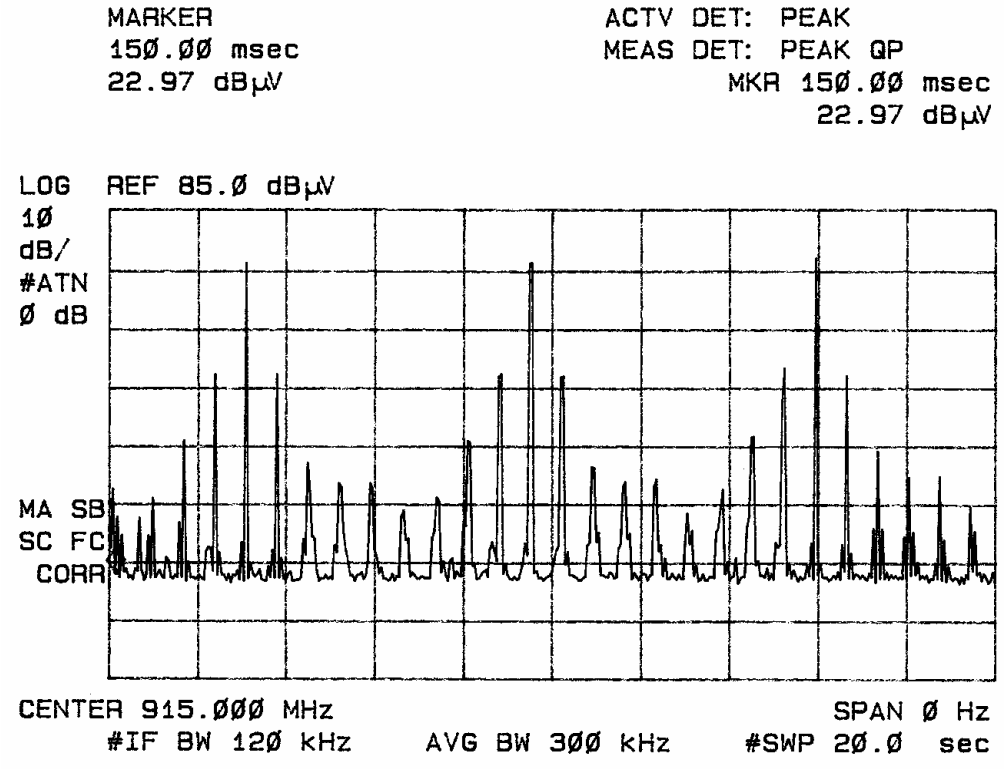

Figure fourteen one, Channel Occupancy over 20-second period

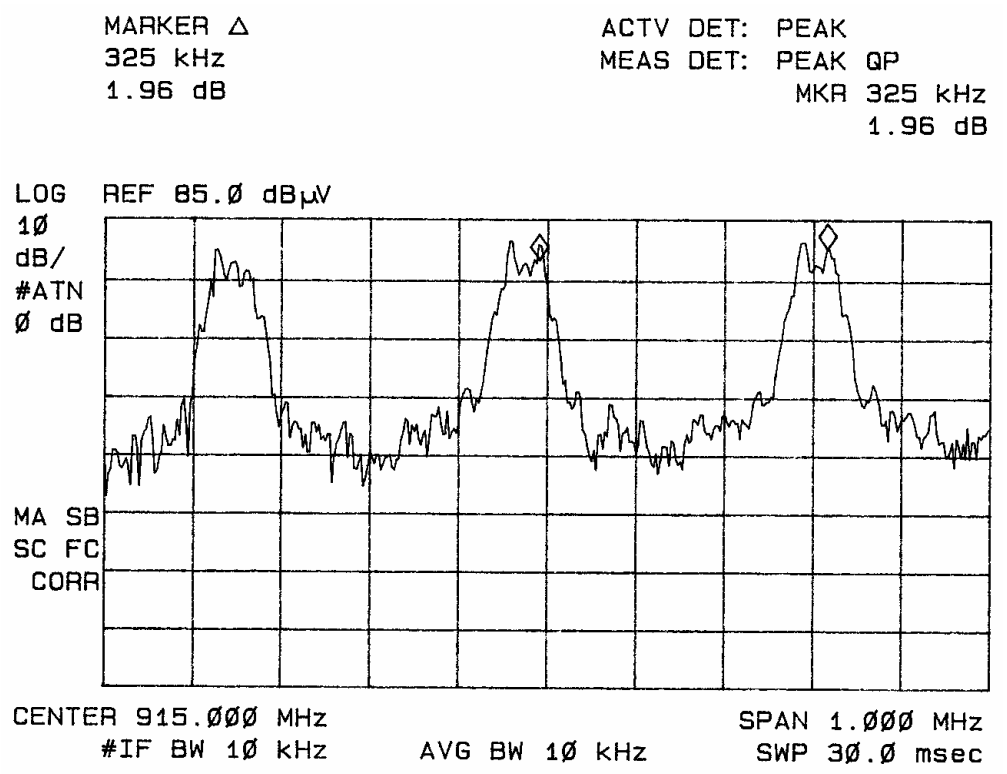

Figure fifteen Channel Spacing

Radiated Emissions Data from EUT (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)
905.0	73.8	82.5	23.1	0	96.9	105.6	
1810.0	32.0	26.3	29.0	30	31.0	25.3	54.0
2715.0	39.2	38.8	34.2	30	43.4	43.0	54.0
3620.0	34.0	33.8	38.7	30	42.7	42.5	54.0
4525.0	32.8	31.5	24.3	30	27.1	25.8	54.0
5430.0	31.6	33.6	33.1	30	34.7	36.7	54.0
915.0	74.5	83.3	23.2	0	97.7	106.5	
1830.0	33.6	32.3	29.0	30	32.6	31.3	54.0
2745.0	37.7	39.5	34.1	30	41.8	43.6	54.0
3660.0	31.5	35.5	39.1	30	40.6	44.6	54.0
4575.0	32.7	32.8	44.3	30	47.0	47.1	54.0
5490.0	30.3	32.6	33.1	30	33.4	35.7	54.0
925.1	73.3	83.7	23.2	0	96.5	106.9	
1850.3	32.2	31.8	29.1	30	31.3	30.9	54.0
2775.4	36.0	39.5	34.2	30	40.2	43.7	54.0
3700.6	35.6	33.0	38.6	30	44.2	41.6	54.0
4625.7	32.3	32.5	44.0	30	46.3	46.5	54.0
5550.9	29.0	32.3	33.1	30	32.1	35.4	54.0

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

Summary of Results for Radiated Emissions of Intentional Radiator

The highest measured emission of the EUT was at 106.9 dBμV/m at 3-meters measured at the fundamental frequency of operation. The EUT had a worst-case of 6.9 dB (Peak Amplitude) margin below the Average 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 Site 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

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

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:

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

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	10/06
Antenna: Antenna Research Biconical Model: BCD 235	10/06
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	10/06
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
Shielded Room 5 M x 3 M x 3.0 M	
5/2/2007	

NVLAP Lab Code: 200087-0

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

August 22, 2007
Date

NVLAP Lab Code: 200087-0

Annex D

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

NVLAP Lab Code: 200087-0

Annex E

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