NVLAP Lab Code 200087-0

SUBMITTAL APPLICATION REPORT

Class 2 Permissive Change

Test Report For

MODEL: MPI6000

FCC ID: FIHMPI6000

IC ID: 1584A-MPI6000

FOR

TRANSCORE

AMTECH TECHNOLOGY CENTER

8600 Jefferson Street, NE

Albuquerque, NM 87113

Test Report Number: 090806

NVLAP Lab Code 200087-0

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

Class 2 Permissive Change

Test Report

For

Transcore

Amtech Technology Center

8600 Jefferson Street, NE
Albuquerque, NM 87113
Phone: (505) 856-8101

Model: MPI6000

LMS Transmitter

Frequency Range
911.75 – 919.75 MHz

FCC ID: FIHMPI6000
IC: 1584A-MPI6000

Test Date: August 6, 2009

Certifying Engineer: Scot D Rogers

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

Table Of Contents

Executive Summary

The electromagnetic emissions compatibility tests required for demonstration of compliance with CFR47 Part 90 and Industry Canada RSS-137 have been conducted on the MPI6000 in compliance with the rules for Class two permissible changes. The results have been reviewed and found in compliance with the requirements investigated for this report.

Forward

In accordance with Federal Communications Code of Federal Regulations, dated October 1, 2008, Part 2 Subpart J, Paragraphs 2.907, 2.925, 2.926, 2.1041, 2.1043, applicable paragraphs of Parts 15, 90, and Industry Canada RSS-137 the following information is submitted.

Opinion / Interpretation of Results

Tests Performed	Results
Emissions Tests	
Occupied Band Width Emissions	Complies
Emissions Mask	Complies

Environmental Conditions

Ambient Temperature	25.7° C
Relative Humidity	44%
Atmospheric Pressure	1016.7 mb

Equipment Tested

Equipment	Model	FCC ID	IC I.D.#
EUT	MPI6000	FIHMPI6000	1584A-MPI6000

List of Test Equipment

A Rohde and Schwarz ESU40, Hewlett Packard 8591EM and or 8562A Spectrum Analyzer was used as the measuring device for the emissions testing. The analyzer settings used are described in the following table. Refer to the appendix for a complete list of Test Equipment.

Spectrum Analyzer Settings		
AC Line Conducted Emissions		
RBW	AVG. BW	Detector Function
9 kHz	30 kHz	Peak/Quasi Peak
Radiated Emissions (30 - 1000 MHz)		
RBW	AVG. BW	Detector Function
120 kHz	300 kHz	Peak/Quasi Peak
Spectrum Analyzer Settings		
Radiated Emissions (1 - 40 GHz)		
RBW	AVG. BW	Detector Function
1 MHz	1 MHz	Peak/Average
Antenna Conducted Emissions		
RBW	AVG. BW	Detector Function
100 kHz	300 kHz	Peak

Equipment	Manufacturer	Model	Calibration Date	Due
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/08	10/09
LISN	Comp. Design	1762	2/09	2/10
Antenna	ARA	BCD-235-B	10/08	10/09
Antenna	EMCO	3147	10/08	10/09
Antenna	EMCO	3143	5/09	5/10
Analyzer	Rohde & Schwarz	ESU40	2/09	2/10
Analyzer	HP	8591EM	5/09	5/10
Analyzer	HP	8562A	2/09	2/10

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 Registration	Refer to Annex for FCC Site registration Letter, Reference # 90910, and Industry Canada registration IC3041A-1

Change to Equipment

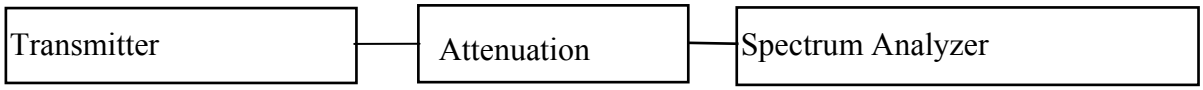
The change to the unit, in relation to the original equipment, included software modifications to the design to enable the equipment to process other modulation schemes and RFID tags. The software modification required the unit produce a wider occupied bandwidth than the original equipment authorization for this frequency range. Testing was performed to verify the equipment continues to meet all the applicable rules and requirements of the Code of Federal regulation 47 and RSS-137. Testing confirmed the changes made do not degrade the characteristics allowable and acceptable by the Commission. The frequency range of operation allowed using the modification will be software limited to a center frequency of 911.75 MHz to 919.75 MHz. No change to operating output power or other specifications were affected by the change.

RF Power Output

Measurements Required

Measurements shall be made to establish the radio frequency power delivered by the transmitter into the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted below: If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

Test Arrangement



The radio frequency power output was measured at the antenna terminals by replacing the antenna with a spectrum analyzer, 10dB Attenuator, and 2dB cable/connector losses. The spectrum analyzer had impedance of 50Ω to match the impedance of the standard antenna. A HP 8591EM Spectrum Analyzer was used to measure the radio frequency power at the antenna port. The data was taken in dBm and converted to watts as shown in the following Table. Refer to Figure one showing the output power of the transmitter. Data was taken per Paragraph 2.1046(a) and applicable parts of Part 90 and RSS-137. The specifications of Paragraph 2.1046(a), 90.205, and RSS-137 are met. There are no deviations to the specifications.

P_{dBm} = power in dB above 1 milliwatt.

Milliwatts = $10^{(PdBm/10)}$

Watts = (Milliwatts)(0.001)(W/mW)

Results of RF Power

Frequency	P_{dBm}	P_{mw}	P_w
911.75	32.88	1940.89	1.9
919.75	32.95	1972.42	2.0

The specifications of Paragraph 2.1046(a), 90.205 and RSS-137are met. There are no deviations to the specifications.

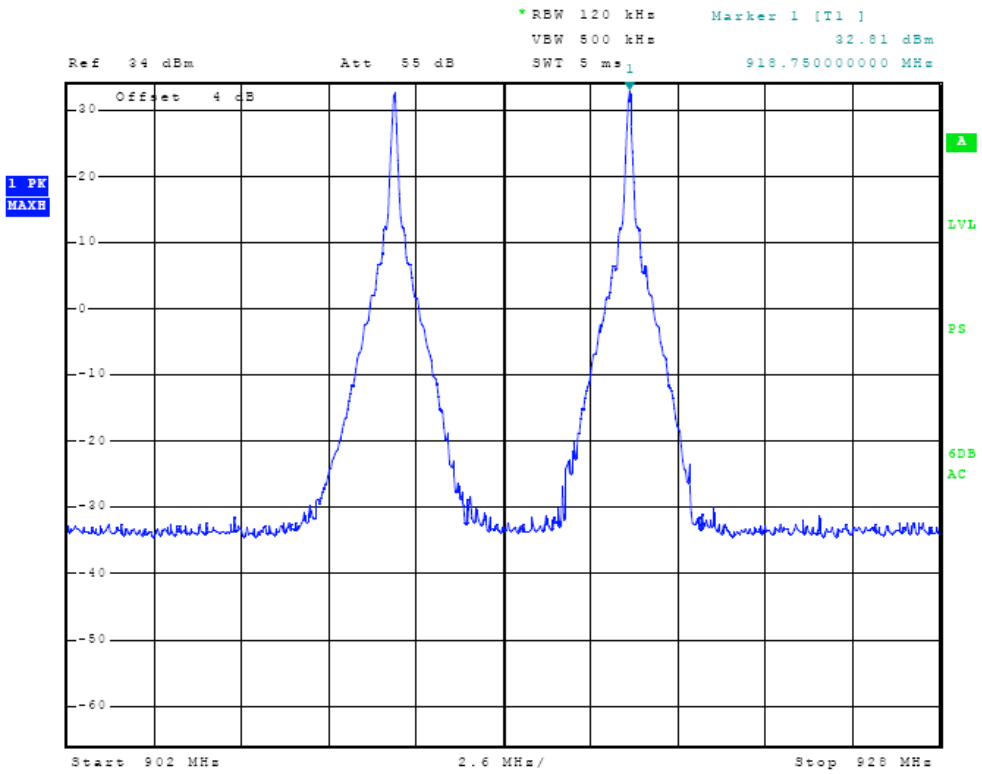


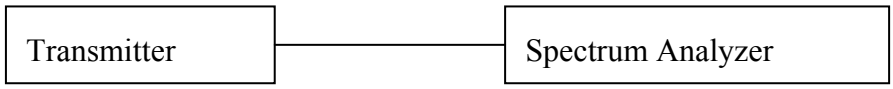
Figure 1 Output Power

Modulation Characteristics

Measurements Required

A curve or equivalent data that shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed shall be submitted.

Test Arrangement



The radio frequency output was coupled to a HP 8591EM Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its normal mode.

Results for Modulation

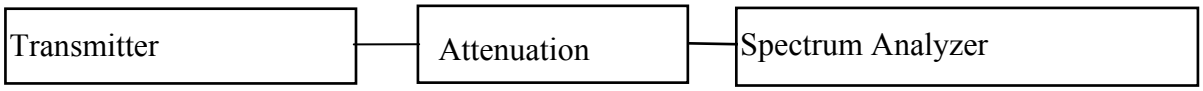
The transmitter operates in two modes, continuous wave (CW), and data transmitted using signals modulated in amplitude/width/duration. Specifications of Paragraphs 2.1047, 90.211, and RSS-137 are met. There are no deviations to the specifications.

Occupied Bandwidth

Measurements Required

The occupied bandwidth, that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5 percent of the total mean power radiated by a given emission. Refer to figure two showing a plot of the occupied bandwidth measurement made of the worst-case data.

Test Arrangement



Results of Occupied Bandwidth Measurements

Modulation	Frequency (MHz)	OBW (kHz)
Mode 88	911.72	616.987
Mode 88	919.75	616.987

The equipment transmits and receives data using signals modulated in amplitude/width/duration. The increased data rate and depth of modulation required increases the occupied bandwidth required to process the data. Requirements of 2.1049 and applicable parts of Paragraph 90 and RSS-137 are met. There are no deviations to the specifications.

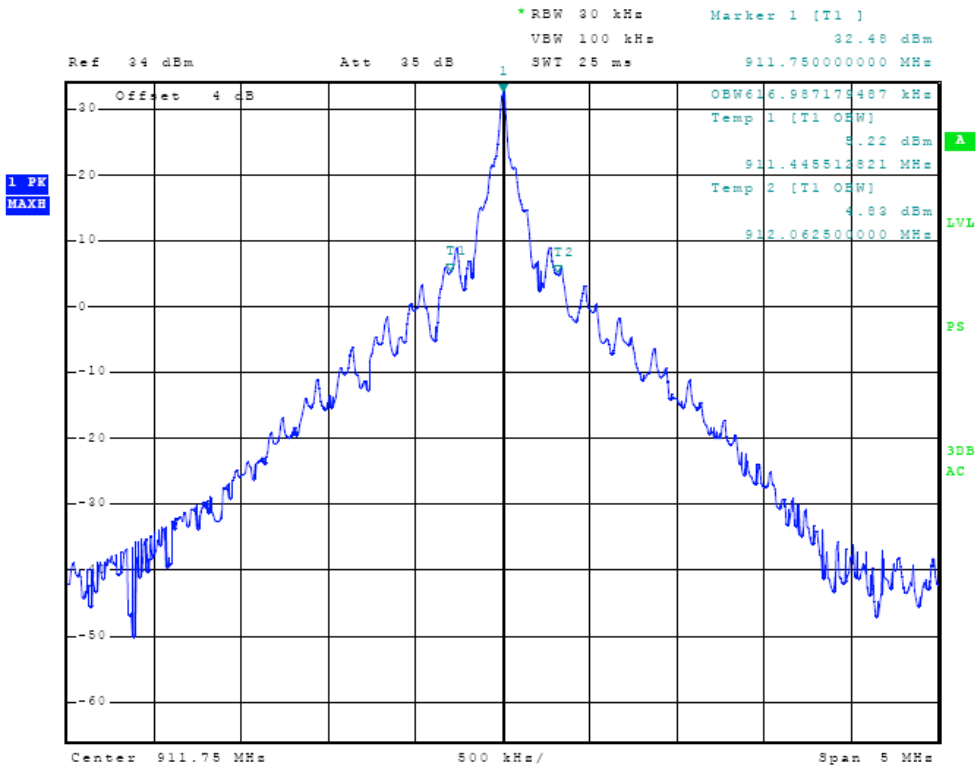


Figure 2 Occupied Bandwidth

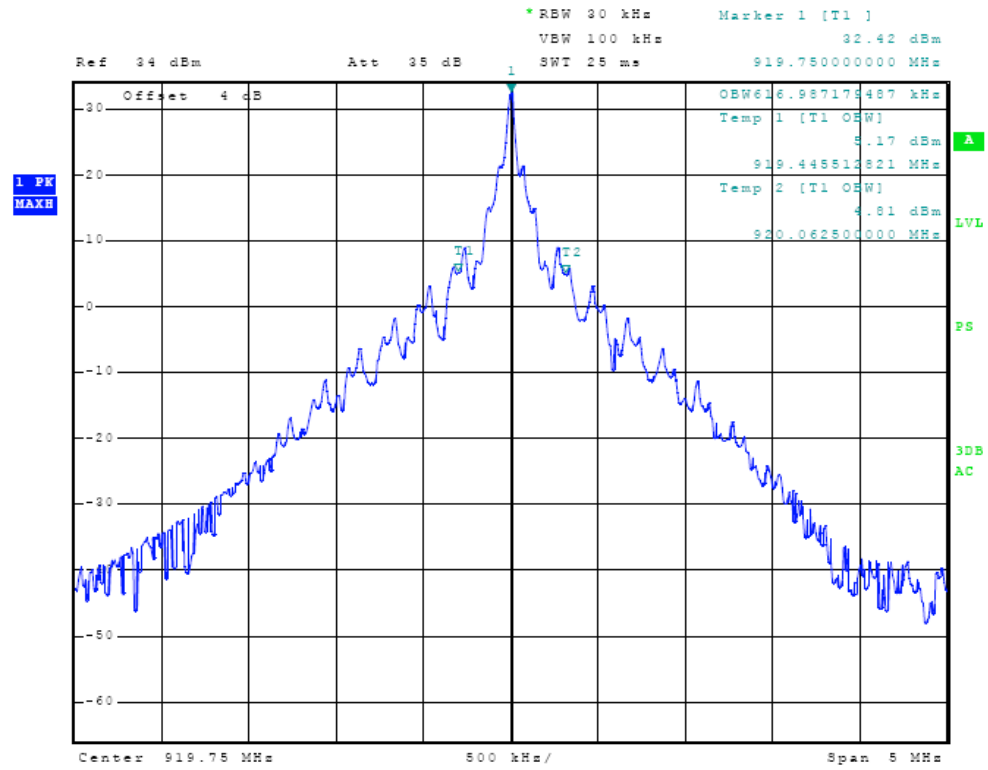


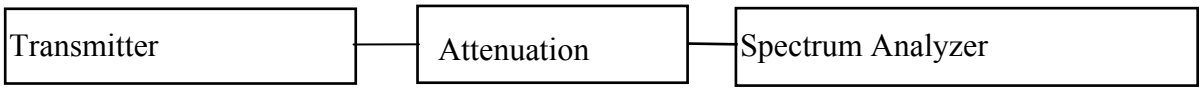
Figure 3 Occupied Bandwidth

Spurious Emissions at Antenna Terminals

Measurements Required

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna.

Test Arrangement



The radio frequency output was coupled to a HP 8562A Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its normal mode. The frequency spectrum from 30 MHz to 12.9 GHz was observed and plots produced of the frequency spectrum. Figures 3 through 5 represent plots of the antenna conducted emissions spectrum for the EUT. Data was taken per 2.1051 and applicable parts of Part 90 and RSS-137. Spurious emissions must be attenuated below the peak output power by the at least 55 + 10 Log (P_o) dB.

2.0-watt transmitter limit specifies the level below the carrier must be suppressed more than this amount.

$$\text{Attenuation} = 55 + 10\ \text{Log}_{10}(P_w)$$
$$= 55 + 10\ \text{Log}_{10}(2.0)$$
$$= 58.0\ \text{dB}$$

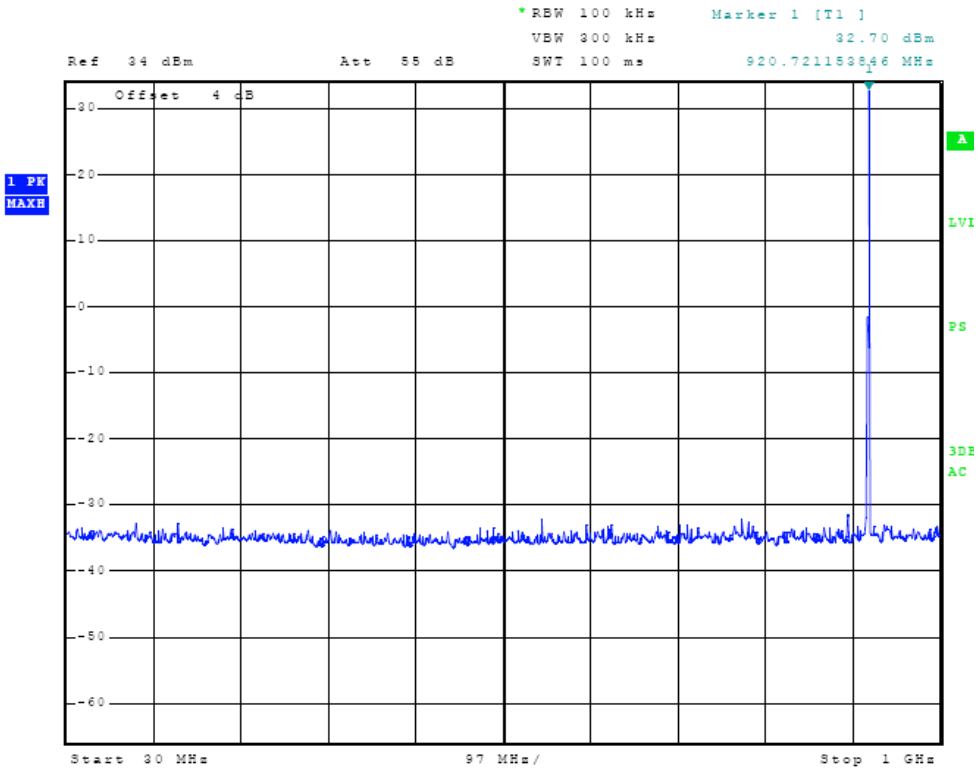


Figure 4 Spurious Emissions at Antenna Terminal

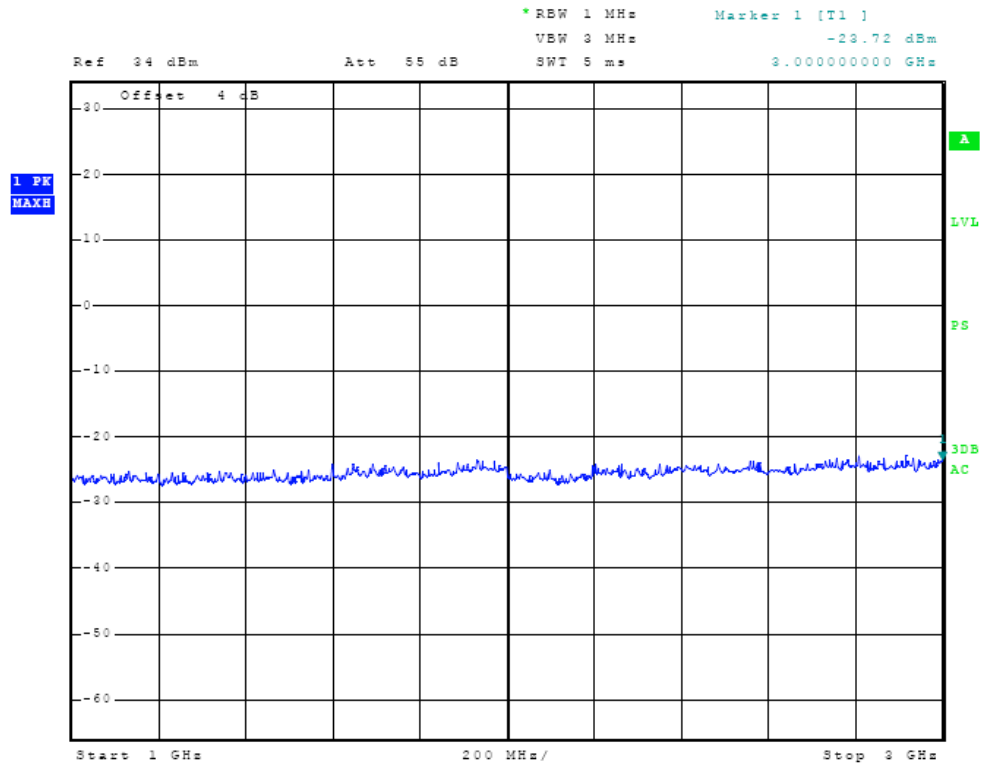


Figure 5 Spurious Emissions at Antenna Terminal

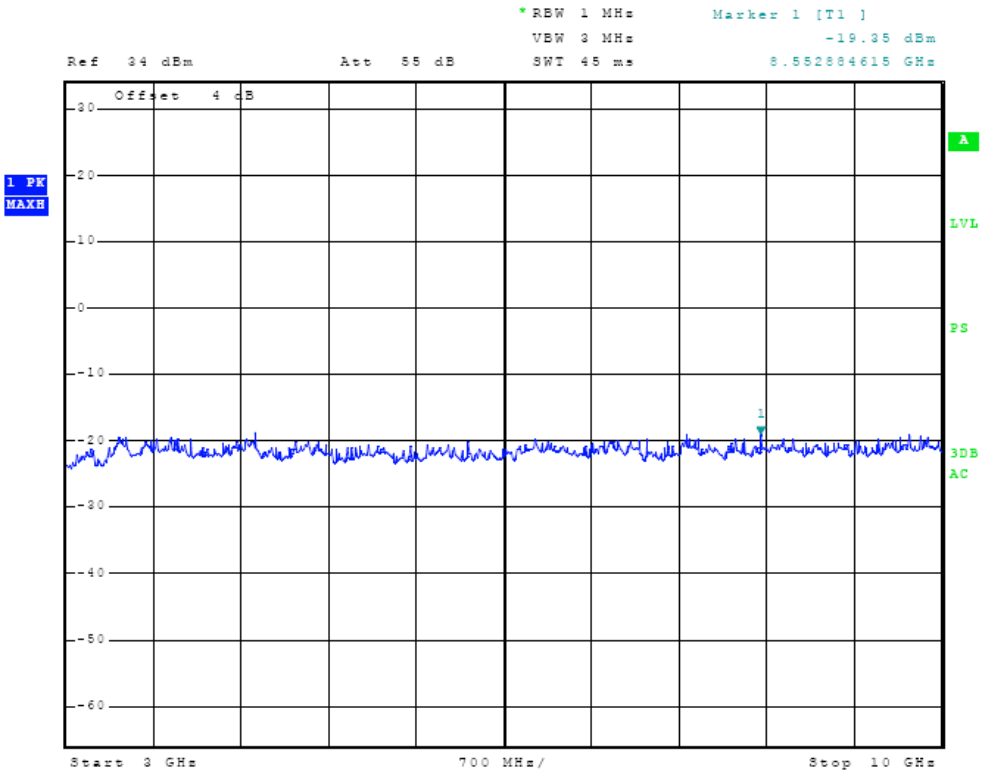


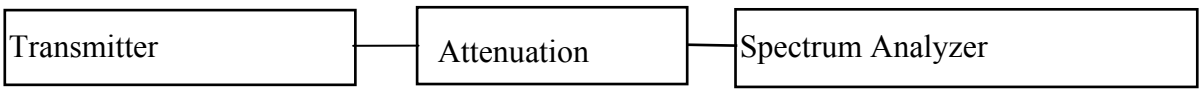
Figure 6 Spurious Emissions at Antenna Terminal

Emission Mask

Measurements Required

Transmitters used in the radio services governed by CFR47 part 90 and RSS-137 must comply with the emission masks outlined in the standards. The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Paragraph 90.210(K) specifies the out of band emission limitations for this equipment. The spurious emissions at the antenna terminal for the device were measured at the maximum power output condition. The antenna port of the EUT was connected to the spectrum analyzer through coaxial cables and attenuation pads.

Test Arrangement



The radio frequency output was coupled to the Spectrum Analyzer and appropriate attenuation. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in all of its normal modes of operation. The frequency spectrum from 30 MHz to 10 GHz was observed and plots produced of the frequency spectrum. Figures three through five represent plots of the antenna emissions measurements for the EUT. Figure 7 shows the plot of emissions mask compliance. Data was taken per Part 90.210 and RSS-137. Specifications of Paragraphs 90.210(k)(3) and RSS-137 are met. There are no deviations to the specifications.

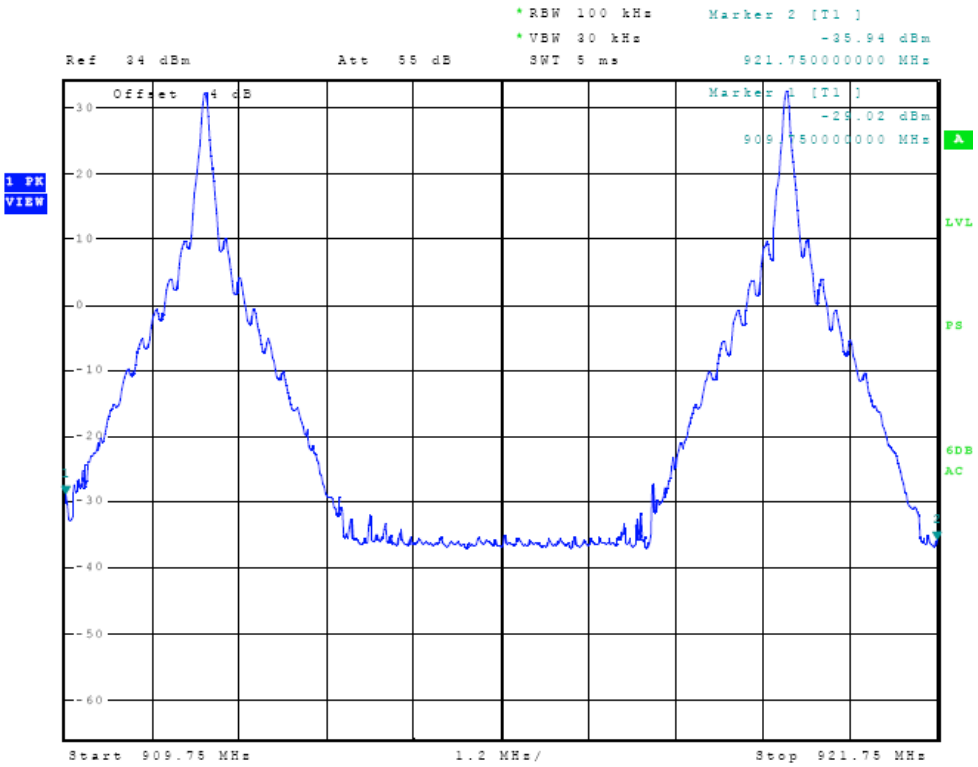


Figure 7 Emissions Mask

Annex

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

Annex A Measurement Uncertainty Calculations

Radiated Emissions Measurement Uncertainty Calculation

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

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

Combined standard uncertainty $u_c(y)$ is

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

$U_c(y) = \pm 1.6$ 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:

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

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

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

$U_c(y) = \pm 1.2$ 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:

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

Annex B Rogers Labs, Inc. Equipment List

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	2/09
Wattmeter: Bird 43 with Load Bird 8085	2/09
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/09
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/09
R.F. Generator: HP 606A	2/09
R.F. Generator: HP 8614A	2/09
R.F. Generator: HP 8640B	2/09
Spectrum Analyzer: Rohde & Schwarz ESU40,	2/09
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	5/09
Spectrum Analyzer: HP 8591EM	5/09
Frequency Counter: Leader LDC825	2/09
Antenna: EMCO Biconilog Model: 3143	5/09
Antenna: EMCO Log Periodic Model: 3147	10/08
Antenna: Antenna Research Biconical Model: BCD 235	10/08
Antenna: EMCO Dipole Set 3121C	2/09
Antenna: C.D. B-101	2/09
Antenna: Solar 9229-1 & 9230-1	2/09
Antenna: EMCO 6509	2/09
Audio Oscillator: H.P. 201CD	2/09
R.F. Power Amp 65W Model: 470-A-1010	2/09
R.F. Power Amp 50W M185- 10-501	2/09
R.F. PreAmp CPPA-102	2/09
LISN 50 µHy/50 ohm/0.1 µf	10/08
LISN Compliance Eng. 240/20	2/09
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	2/09
Peavey Power Amp Model: IPS 801	2/09
Power Amp A.R. Model: 10W 1010M7	2/09
Power Amp EIN Model: A301	2/09
ELGAR Model: 1751	2/09
ELGAR Model: TG 704A-3D	2/09
ESD Test Set 2010i	2/09
Fast Transient Burst Generator Model: EFT/B-101	2/09
Current Probe: Singer CP-105	2/09
Current Probe: Solar 9108-1N	2/09
Field Intensity Meter: EFM-018	2/09
KEYTEK Ecat Surge Generator	2/09
Shielded Room 5 M x 3 M x 3.0 M	

Annex C Rogers Qualifications

Scot D. Rogers, Engineer

Rogers Labs, Inc.

Mr. Rogers has approximately 17 years experience in the field of electronics. Six years working in the automated controls industry and 6 years working with the design, development and testing of radio communications and electronic equipment.

Positions Held:

Systems Engineer:	A/C Controls Mfg. Co., Inc.	6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc.	5 Years
Electrical Engineer:	Rogers Labs, Inc.	Current

Educational Background:

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University.

2) Bachelor of Science Degree in Business Administration Kansas State University.

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

Scot D Rogers

Scot D. Rogers

Annex D FCC Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

June 18, 2008

Registration Number: 90910

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

Attention: Scot Rogers

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: June 18, 2008

Dear Sir or Madam:

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

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

Sincerely,

Phyllis Parrish
Industry Analyst

Annex E Industry Canada Site Registration Letter

Industry Canada Industrie Canada

July 29th, 2008

OUR FILE: 46405-3041
Submission No: 127059

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

Attention: Scot D. Rogers

Dear Sir/Madame:

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

Your primary code is: **3041**
The company number associated to the site(s) located at the above address is: **3041A**
The table below is a summary of the changes made to the unique site registration number(s):

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

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

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

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

Yours sincerely,

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

Canada