# Class 2 Permissive Change Test Report

## FOR

## MODEL: MPI6000 (Title 21)
## FCC ID: FIHMPI6000

FOR

## TRANSCORE
## AMTECH TECHNOLOGY CENTER

8600 Jefferson Street, NE
Albuquerque, NM 87113

Test Report Number: 060801

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 (title 21)
LMS Transmitter

FREQUENCY RANGE
912.75 – 918.75 MHz

FCC ID: FIHMPI6000

Test Date: August 1, 2006

Certifying Engineer: Scot D Rogers
Scot D. Rogers
ROGERS LABS, INC.
4405 W. 259th Terrace
Louisburg, KS 66053
Phone: (913) 837-3214
FAX: (913) 837-3214

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## EXECUTIVE SUMMARY

The electromagnetic emissions compatibility tests required for compliance with the FCC CFR Part 47 Dated October 1, 2005, Paragraphs 2, 15, and 90 have been conducted on the MPI6000 in compliance with the FCC rules for a Class two permissible change. The results have been reviewed and found to meet all the requirements investigated for this report.

## FORWARD

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2005, Part 2 Subpart J, Paragraphs 2.907, 2.925, 2.926, 2.1041, 2.1043, applicable paragraphs of Parts 15, and 90, the following information is submitted.

## List of Test Equipment

A 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.

| **HP 8591EM SPECTRUM ANALYZER SETTINGS** | | |
|---|---|---|
| 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 |
| **HP 8562A 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 | MFG. | MODEL | CAL. DATE | DUE. |
|---|---|---|---|---|
| LISN | Comp. Design | FCC-LISN-2-MOD.CD | 10/05 | 10/06 |
| LISN | Comp. Design | 1762 | 2/06 | 2/07 |
| Antenna | ARA | BCD-235-B | 10/05 | 10/06 |
| Antenna | EMCO | 3147 | 10/05 | 10/06 |
| Antenna | EMCO | 3143 | 5/06 | 5/07 |
| Analyzer | HP | 8591EM | 5/06 | 5/07 |
| Analyzer | HP | 8562A | 2/06 | 2/07 |

## 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 manufacturers RFID tags. The software modification required the unit produce a wider occupied bandwidth than the original equipment authorization allowed. Testing was performed to verify the equipment continues to meet all the applicable rules and requirements of the Code of Federal regulation 47. 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 912.75 MHZ to 918.75 MHz. No change to operating output power or other specifications were affected by the change but results recorded in this report for completeness.

## 2.1046 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. The specifications of Paragraph 2.1046(a) and 90.205 are met. There are no deviations to the specifications.

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

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

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

***Results of RF Power***

| FREQUENCY | $P_{dBm}$ | $P_{mw}$ | $P_{w}$ |
|---|---|---|---|
| 902.25 | 32.67 | 1,849.3 | 1.9 |
| 914.75 | 28.33 | 680.8 | 0.7 |

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

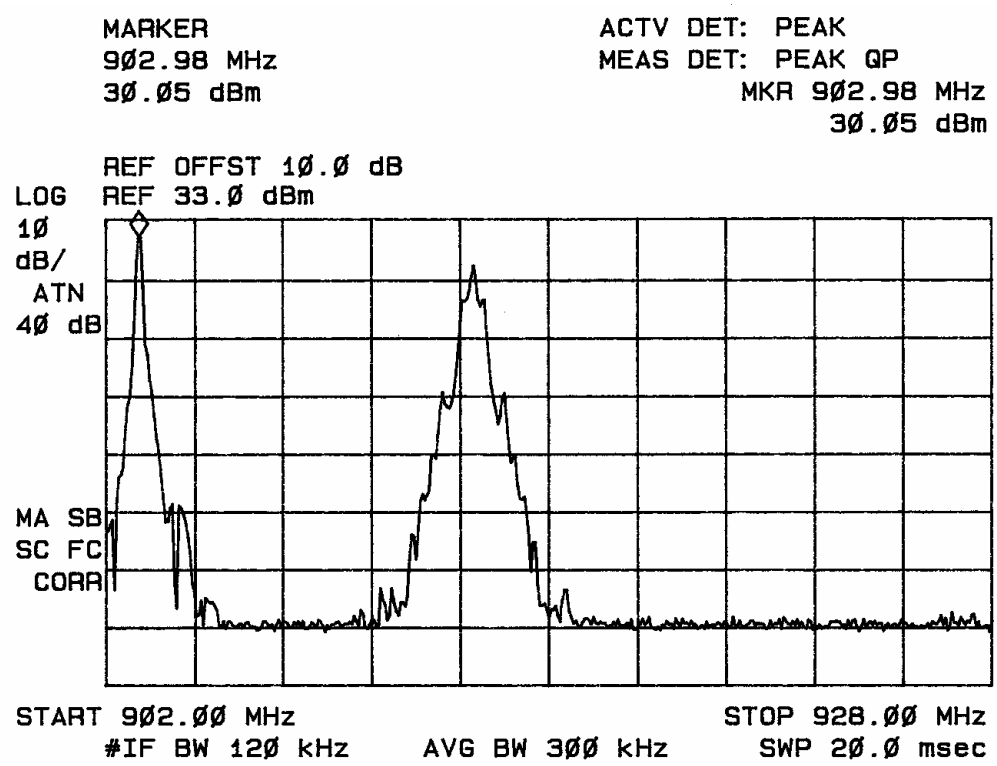


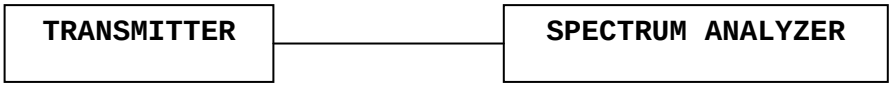

Figure one output power taken in screen room.

## 2.1047 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***

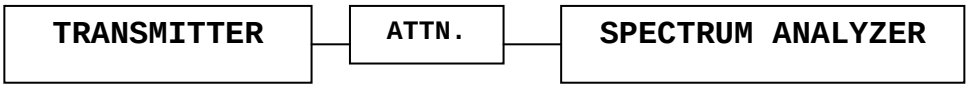
The transmitter operates in a two modes, continuous wave (CW), and data transmitted using signals modulated in amplitude/width/duration. Specifications of Paragraphs 2.1047 and 90.211 are met. There are no deviations to the specifications.

## 2.1049 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 | $f_c$ | O.B.W. |
|---|---|---|
| Title 21 | 914.750 | 1.825 MHz |

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 are met. There are no deviations to the specifications.

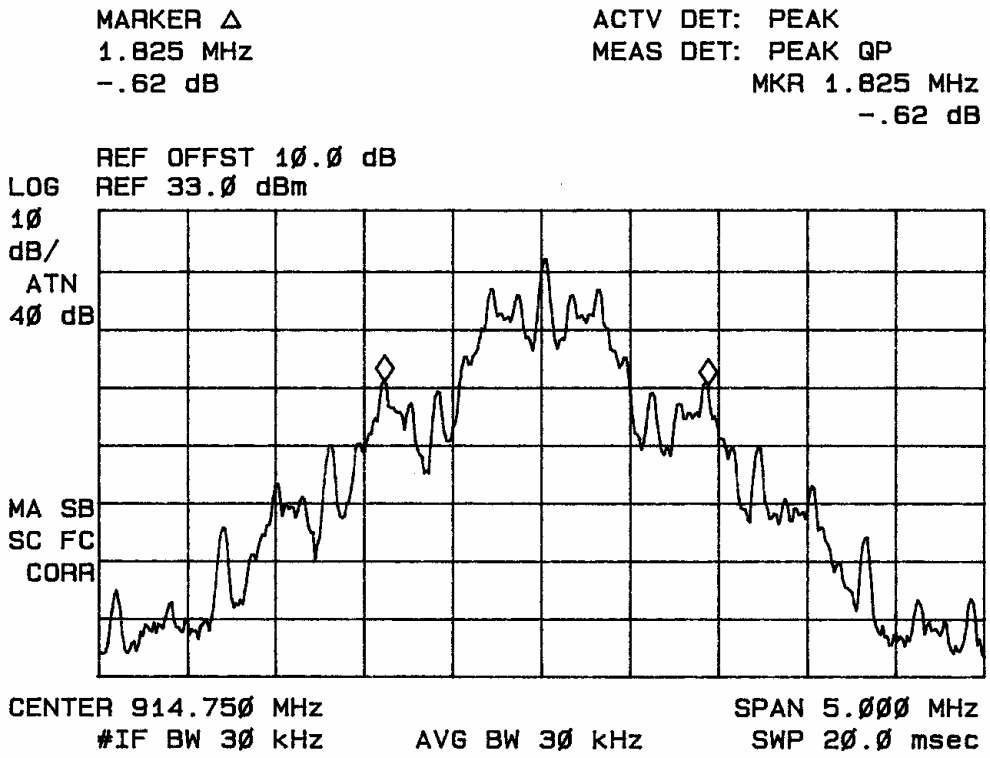



Figure two Occupied Bandwidth Title 21 Mode.

## 2.1051 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. 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.

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

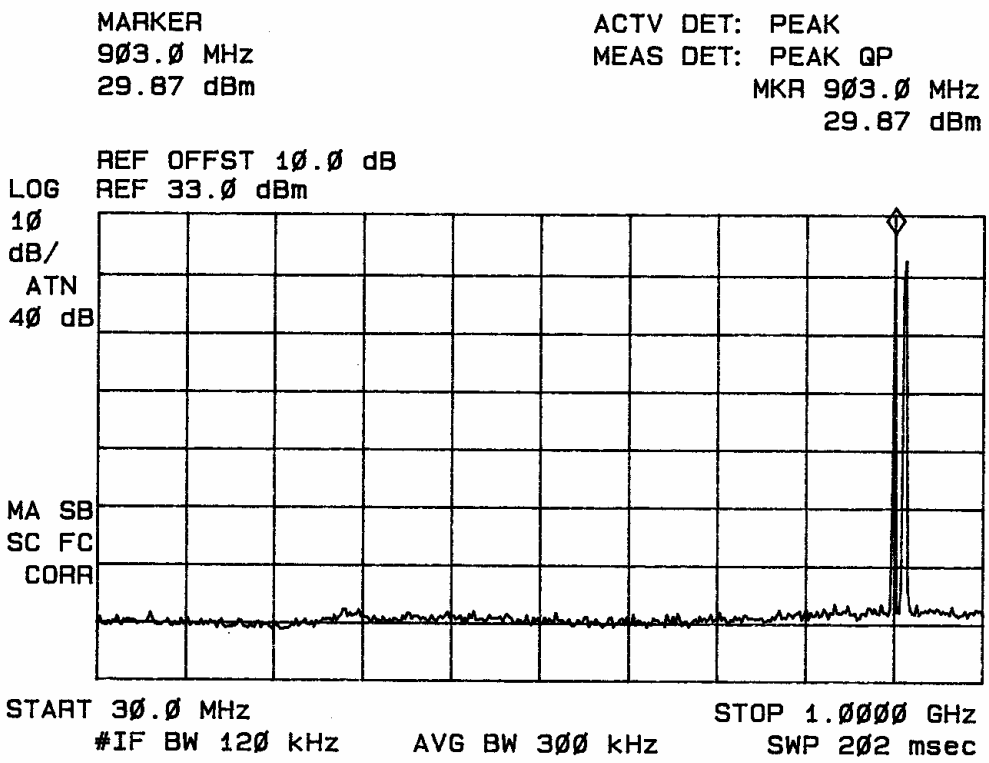



Figure 3 Spurious Emissions at Antenna Terminal

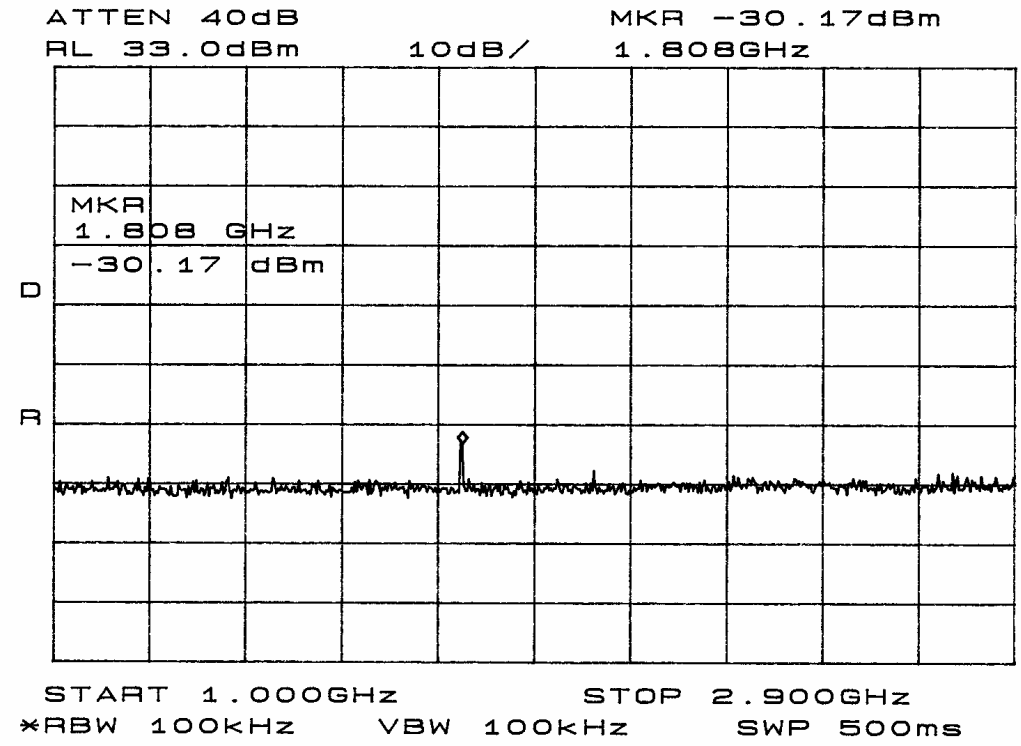



Figure 4 Spurious Emissions at Antenna Terminal

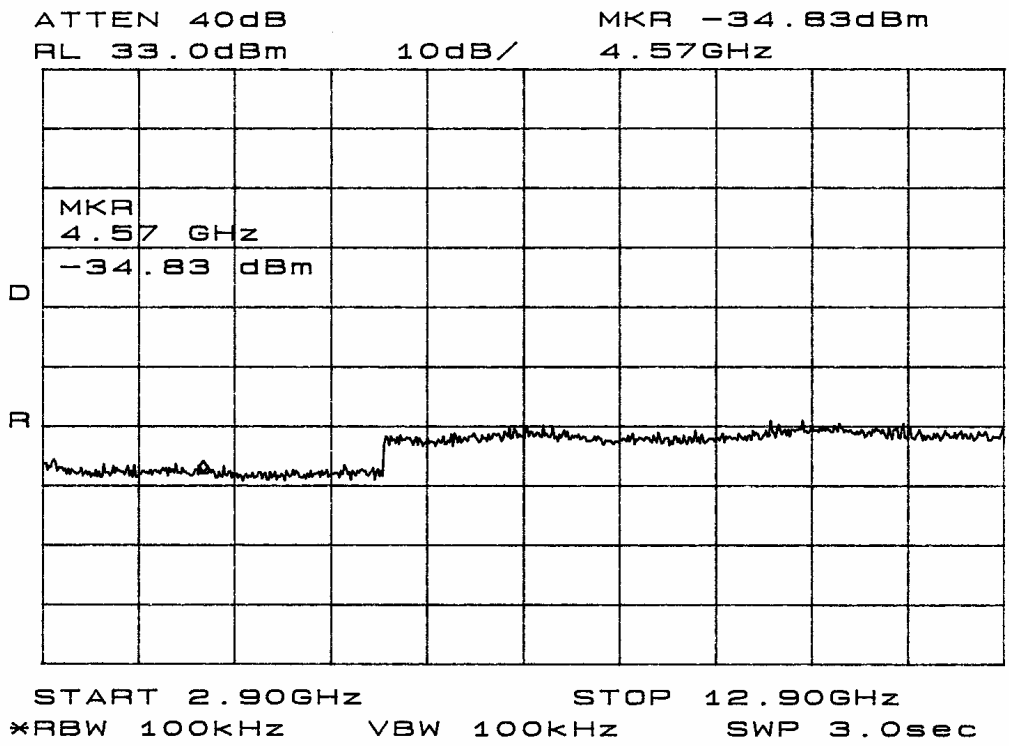



Figure 5 Spurious Emissions at Antenna Terminal

***Results***

| FREQUENCY | SPURIOUS FREQ. (GHz) | LEVEL BELOW CARRIER (dB) |
|---|---|---|
| 914.75 | 1829.5 | -68.9 |
| | 2744.3 | -76.5 |
| | 3659.0 | -78.9 |
| | 4573.8 | -77.0 |
| | 5488.5 | -77.4 |
| | 6403.3 | -78.9 |
| | 7318.0 | -70.0 |
| | 8232.8 | -72.9 |
| | 9147.5 | -70.2 |

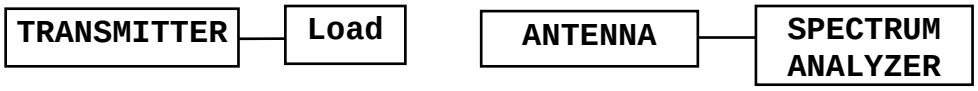
Data was taken per 2.1051 and applicable parts of Part 90. Specifications of Paragraphs 2.1051, 2.1057 and 90.210(k)(3) are met. There are no deviations to the specifications.

## 2.1053 Field Strength of Spurious Radiation

***Measurements Required***

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

***Test Arrangement***




The transmitter antenna port was connected to a 50-ohm load and placed on a wooden turntable 0.8 meters above the ground plane at a distance of 3 meters from the FSM antenna. The turntable was rotated though 360 degrees to locate the position registering the highest amplitude emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter. Raising and lowering the FSM antenna and rotating the turntable to maximize the emission. Data was measured and recorded for the maximum amplitude of each spurious emission. A log periodic antenna was used for frequencies of 200 MHz to 5 GHz and pyramidal horn antennas were used for frequencies of 5 GHz to 10 GHz. The limits for the spurious radiated emissions are defined by the following equation.

Limit = Amplitude of the spurious emission must be attenuated by this amount below the level of the fundamental. On any frequency removed from the assigned frequency outside the assigned sub-band edges: at least 55 + 10 Log ($P_o$) dB.

The 2.0-watt transmitter limit specifies the spurious emission level must be suppressed more than this 58.0 dB below the emission level at the fundamental frequency of operation.

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

### *Field Strength Spurious Radiation*

| Frequency of Emission | Amplitude of EUT Spurious emission observed | | Signal level to substitution antenna required to reproduce | | Emission level below carrier | | Limit per 90.210 |
|---|---|---|---|---|---|---|---|
| | Horizontal | Vertical | Horizontal | Vertical | Horizontal | Vertical | |
| (MHz) | dBm | dBm | dBm | dBm | dBc | dBc | dBc |
| 1829.5 | -80.5 | -81.1 | -69.5 | -70.1 | 97.9 | 98.5 | 58.0 |
| 2744.3 | -81.1 | -81.5 | -64.5 | -64.9 | 92.9 | 93.3 | 58.0 |
| 3659.0 | -81.8 | -80.0 | -69.5 | -67.7 | 97.9 | 96.1 | 58.0 |
| 4573.8 | -80.3 | -79.7 | -66.0 | -65.4 | 94.4 | 93.8 | 58.0 |
| 5488.5 | -79.6 | -80.5 | -64.7 | -65.6 | 93.1 | 94.0 | 58.0 |
| 6403.3 | -82.6 | -81.0 | -66.6 | -65.0 | 95.0 | 93.4 | 58.0 |
| 7318.0 | -78.5 | -78.0 | -60.0 | -59.5 | 88.4 | 87.9 | 58.0 |

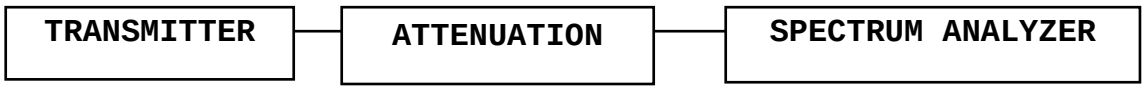
Specifications of Paragraph 2.1053, 2.1057 and 90.211 are met. There are no deviations to the specifications.

## 90.210 Emission Mask

***Measurements Required***

Transmitters used in the radio services governed by part 90 must comply with the emission masks outlined in this section. 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 a HP 8562A 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 in the screen room. Figures three through five represent plots of the antenna emissions measurements for the EUT. Figure six represents the plot at band edges. Figure 7 shows the emissions mask. Data was taken per Part 90.210. Specifications of Paragraphs 90.210(k)(3) are met. There are no deviations to the specifications.

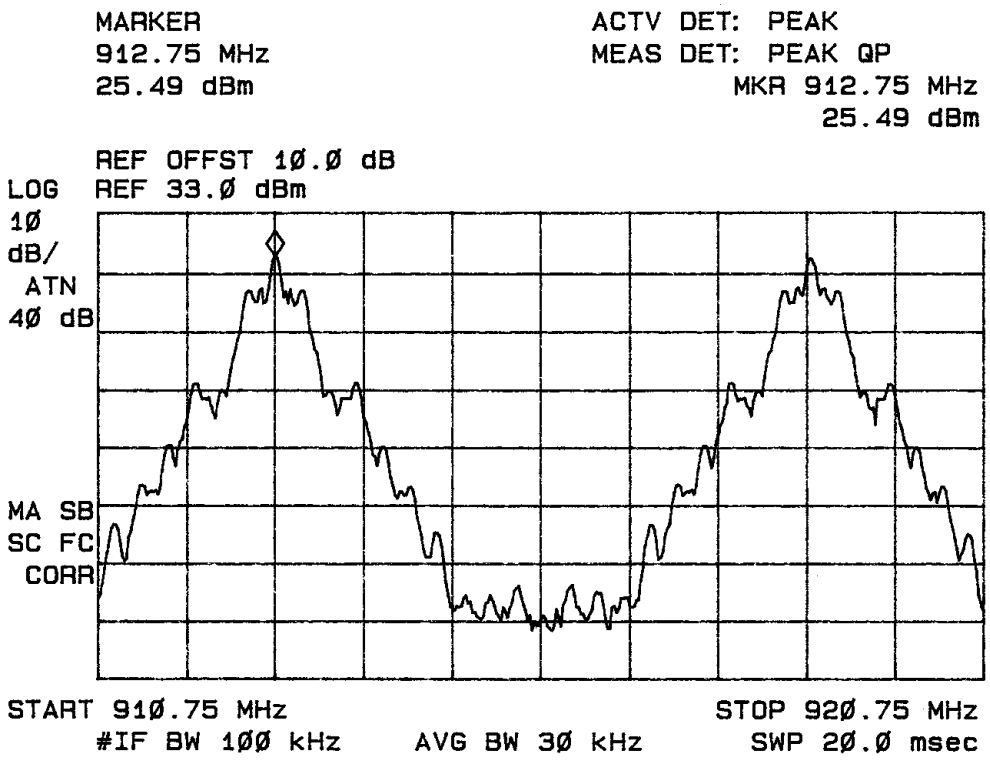



Figure 6 Spurious Emissions at Band Edges

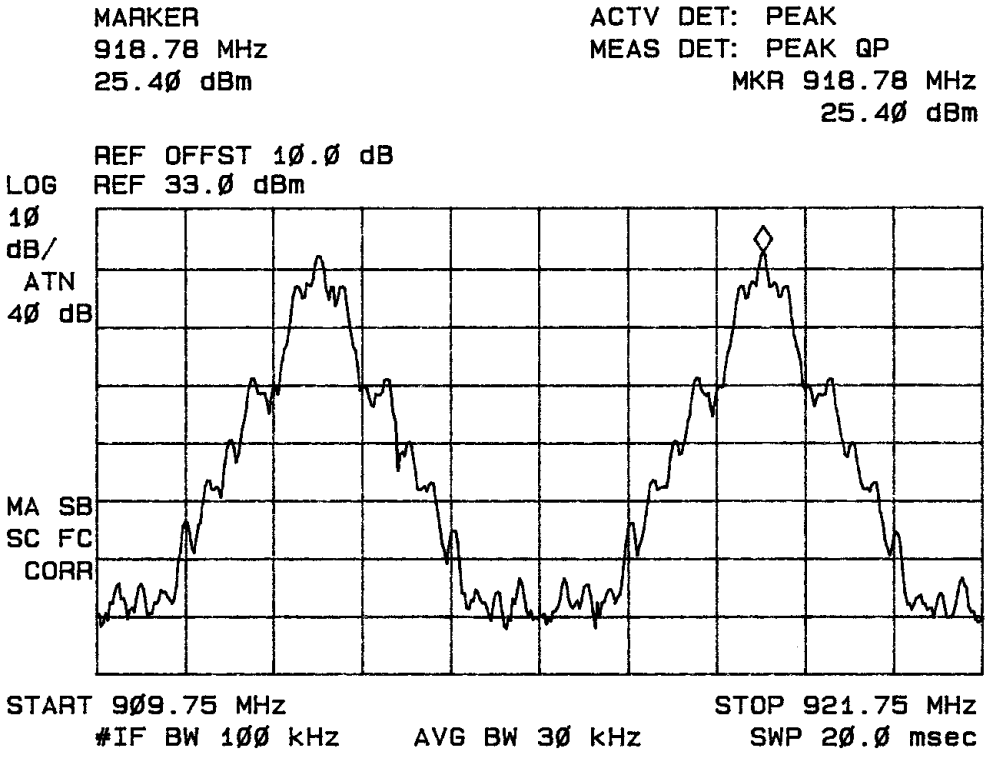



Figure 7 Emissions Mask

# APPENDIX

Model: MPI6000

1. Test Equipment List
2. Rogers Qualifications
3. FCC Site Approval Letter

# 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: |
|---|---|
| Scope: Tektronix 2230 | 2/06 |
| Wattmeter: Bird 43 with Load Bird 8085 | 2/06 |
| Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140 | 2/06 |
| H/V Power Supply: Fluke Model: 408B (SN: 573) | 2/06 |
| R.F. Generator: HP 606A | 2/06 |
| R.F. Generator: HP 8614A | 2/06 |
| R.F. Generator: HP 8640B | 2/06 |
| Spectrum Analyzer: HP 8562A, | 2/06 |
| Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W | |
| HP Adapters: 11518, 11519, 11520 | |
| Spectrum Analyzer: HP 8591 EM | 5/06 |
| Frequency Counter: Leader LDC 825 | 2/06 |
| Antenna: EMCO Biconilog Model: 3143 | 5/06 |
| Antenna: EMCO Log Periodic Model: 3147 | 10/05 |
| Antenna: Antenna Research Biconical Model: BCD 235 | 10/05 |
| Antenna: EMCO Dipole Set 3121C | 2/06 |
| Antenna: C.D. B-101 | 2/06 |
| Antenna: Solar 9229-1 & 9230-1 | 2/06 |
| Antenna: EMCO 6509 | 2/06 |
| Audio Oscillator: H.P. 201CD | 2/06 |
| R.F. Power Amp 65W Model: 470-A-1010 | 2/06 |
| R.F. Power Amp 50W M185- 10-501 | 2/06 |
| R.F. PreAmp CPPA-102 | 2/06 |
| LISN 50 µHy/50 ohm/0.1 µf | 10/05 |
| LISN Compliance Eng. 240/20 | 2/06 |
| LISN Fischer Custom Communications FCC-LISN-50-16-2-08 | 6/05 |
| Peavey Power Amp Model: IPS 801 | 2/06 |
| Power Amp A.R. Model: 10W 1010M7 | 2/06 |
| Power Amp EIN Model: A301 | 2/06 |
| ELGAR Model: 1751 | 2/06 |
| ELGAR Model: TG 704A-3D | 2/06 |
| ESD Test Set 2010i | 2/06 |
| Fast Transient Burst Generator Model: EFT/B-101 | 2/06 |
| Current Probe: Singer CP-105 | 2/06 |
| Current Probe: Solar 9108-1N | 2/06 |
| Field Intensity Meter: EFM-018 | 2/06 |
| KEYTEK Ecat Surge Generator | 2/06 |
| Shielded Room 5 M x 3 M x 3.0 M (101 dB Integrity) | |

5/2/2006

# QUALIFICATIONS

Of

## *SCOT D. ROGERS, ENGINEER*

**ROGERS LABS, INC.**

Mr. Rogers has approximately 16 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.<br>6 Years |
| Electrical Engineer: | Rogers Consulting Labs, Inc.<br>5 Years |
| Electrical Engineer: | Rogers Labs, Inc.<br>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 1, 2006
Date

1/11/03

# 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