NVLAP Lab Code 200087-0

# SUBMITTAL APPLICATION REPORT

For Class 2 Permissible Change

Grant of Certification

FOR

**Model: WMR300**
**908.0 – 923.0 MHz**
**Broadband Wireless Data Transmitter**
**FCC ID: V2U-WMR300**

FOR

## WILIBOX DELIBERANT GROUP

**1440 Dutch Valley Place, Suite 1155**

**Atlanta, GA 30324**

**Test Report Number: 080416**

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
# CLASS 2 PERMISSIVE CHANGE

FOR

## CFR47, PART 15C - INTENTIONAL RADIATORS
## Paragraph 15.247
## Low Power License Exempt Intentional Radiator

For

## WILIBOX DELIBERANT GROUP

1440 Dutch Valley Place, Suite 1155
Atlanta, GA 30324
Mr. Matt Hardy

Model: WMR300
Broadband Wireless Data Transmitter
Frequency Range 908.0 – 923.0 MHz
FCC ID#: V2U-WMR300

Test Date: April 16, 2008

Certifying Engineer: Scot D Rogers


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

## Table of Contents

## Forward

This report documents the supporting information for requesting a Class 2 permissible change. The request offers alternate antenna structures for use with the certified equipment. The electromagnetic emissions compatibility tests required for demonstration of continued compliance with the CFR47 Dated October 1, 2007, Paragraphs 2.1043, and 15.247 have been conducted on the WMR300. The results have been reviewed and found to meet all the requirements investigated for this report.

Name of Applicant:

WILIBOX DELIBERANT GROUP
1440 Dutch Valley Place, Suite 1155
Atlanta, GA 30324

Model: WMR300

FCC I.D.: V2U-WMR300.
Frequency Range: 908.0 – 923.0 MHz.
Operating Power: 0.5834 Watts 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 15.247 | Complies |

## Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 22.8° C |
| Relative Humidity | 30% |
| Atmospheric Pressure | 29.74 in Hg |

## Equipment Tested

| Equipment | Model | FCC I.D.# |
|---|---|---|
| EUT | WMR300 | V2U-WMR500 |
| Interface support board | WDG | DoC |

## 2.1033(b) Application for Certification

(1) Manufacturer: WILIBOX DELIBERANT GROUP
1440 Dutch Valley Place, Suite 1155
Atlanta, GA 30324

(2) Identification: Model: WMR300
FCC I.D.: V2U-WMR300

(3) Instruction Book:
Refer to original submittal Exhibit for Instruction Manual.

(4) Description of Circuit Functions:
Refer to original submittal Exhibit of Operational Description.

(5) Block Diagram with Frequencies:
Refer to original submittal Exhibit of Operational Description.

(6) Report of Measurements:
Report of measurements follows in this Report.

(7) Photographs: Construction, Component Placement, etc.:
Refer to original submittal Exhibit for photographs of equipment.

(8) Peripheral Equipment included interfacing with a computer system.

(9) Transition Provisions of 15.37 are not being requested.

(10) Not Applicable. The unit is not a scanning receiver.

(11) Not Applicable. The EUT does not operate in the 59 – 64 GHz frequency band.

## Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2007, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1043, and applicable parts of paragraph 15, and Part 15C Paragraph 15.247, 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.

## Equipment Function and Testing Procedures

The EUT is a 908 - 923 MHz mini PCI interface radio transmitter module used to transmit data in applications offering broadband wireless connectivity. The unit is marketed for use to incorporate a wireless link to exchange data information from one point to another. For testing purposes the WMR300 transceiver was placed in an interface support board allowing power and communications over the network interface between the EUT and supporting computer system. The support interface board receives power from a Power Over Ethernet (POE) AC adapter. The WMR300 receives power from the support interface board and offers no provision to connect to utility power systems. For testing purposes WMR300 and support interface board was powered from the POE AC power adapter supply and set to transmit in all maximum data modes available. The device is marketed for professionally installed use and the antenna connection complies with the unique antenna connection requirements.

## Change to Equipment

The change to the equipment, in relation to the original equipment submittal, included placement of the transmitter inside an enclosure and increasing the antenna options to include gain to 18 dBi. Testing was performed to verify the equipment continues to meet all the applicable rules and requirements of the CFR47. Testing confirmed the changes made do not degrade the characteristics allowable and acceptable by the Commission. No change to transmitter or other specifications were affected by the antenna change.

# Equipment and Cable Configurations

### *AC Line Conducted Emission Test Procedure*

The unit typically operates from Power Over Ethernet (POE) and required the manufacturer supplied POE AC power adapter. For testing purposes, the manufacturer supplied AC power adapter was used to power the equipment. The test setup including the EUT was arranged in a typical equipment configuration and placed on a 1 x 1.5-meter wooden bench, 0.8 meters high located in a screen room. The power lines of the system were isolated from the power source using a standard LISN with a 50 - µHy choke. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor internal to the LISN. The LISN was positioned on the floor beneath the wooden bench supporting the EUT. The power lines and cables were draped over the back edge of the table.

### *Radiated Emission Test Procedure*

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 | 10/07 | 10/08 |
| LISN | Comp. Design | 1762 | 2/08 | 2/09 |
| 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 | 2/08 | 2/09 |

## 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. 259$^{th}$ 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. |

## Subpart C – Intentional Radiators

### *AC Line Conducted EMI*

The EUT was arranged in a typical equipment configuration and placed on a 1 x 1.5-meter wooden bench 80 cm above the conducting ground plane, floor of a screen room. The bench was positioned 40 cm away from the wall of the screen room. The LISN was positioned on the floor of the screen room 80-cm from the rear of the EUT. The manufacturer supplied AC power adapter for the EUT was connected to the LISN. A second LISN was positioned on the floor of the screen room 80-cm from the rear of the supporting equipment of the EUT. All power cords except the EUT were then powered from the second LISN. EMI was coupled to the spectrum analyzer through a 0.1 μF capacitor, internal to the LISN. Power line conducted emissions testing were carried out individually for each current carrying conductor of the EUT. The excess length of lead between the system and the LISN receptacle was folded back and forth to form a bundle not exceeding 40 cm in length. The screen room, conducting ground plane, analyzer, and LISN were bonded together to the protective earth ground. Preliminary testing was performed to identify the frequency of each radio frequency emission displaying the highest amplitude. The cables were repositioned to obtain maximum amplitude of measured EMI level. Once the worst-case configuration was identified, plots were made of the EMI from 0.15 MHz to 30 MHz then the data was recorded with maximum conducted emissions levels. Refer to figures one and two showing plots of the conducted emissions spectrum as displayed on the spectrum analyzer for the WMR300.

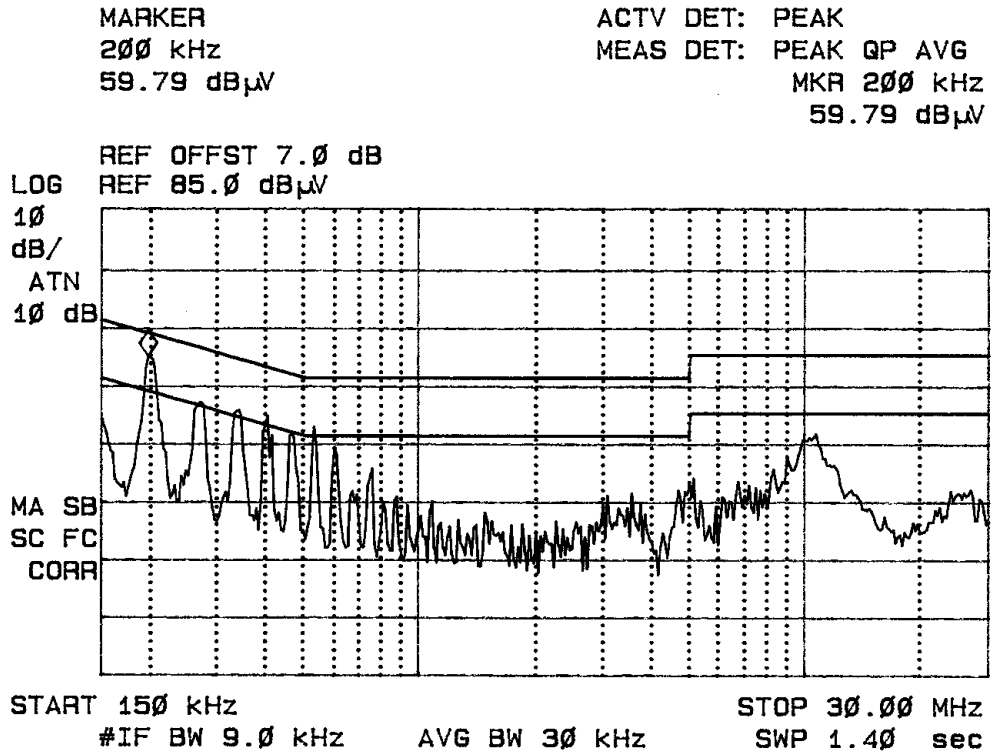


**Figure 1 Conducted Emissions Line 1 (WMR300).**

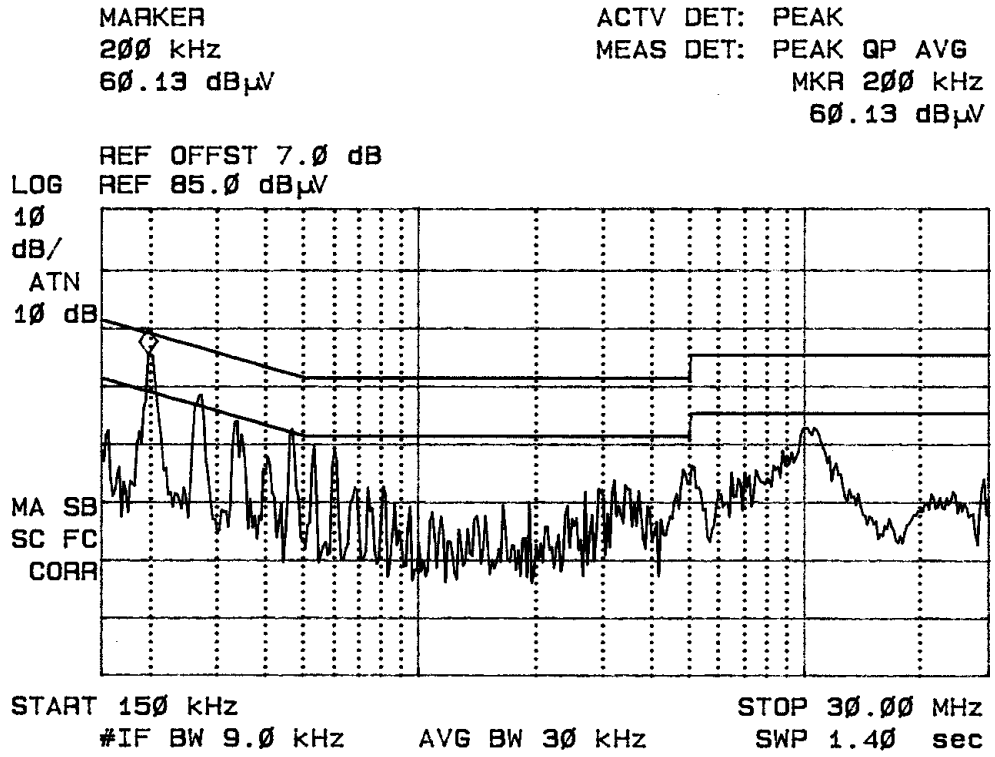


**Figure 2 Conducted Emissions Line 2 (WMR300)**

### *Radiated EMI*

The EUT was arranged in a typical equipment configuration and operated through all available modes with worst-case data recorded. 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 radiated frequency spectrum from 30 MHz to 18,000 MHz for the preliminary testing. Refer to figures three through twelve showing plots of the worst-case radiated emissions spectrum taken in a screen room of the WMR300. The highest radiated mission 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 60,000 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 40 GHz, notch filters and appropriate amplifiers were utilized.

Sample Calculations:

RFS = Radiated Field Strength

dBµV/m @ 3 m = dBµV + A.F. - Amplifier Gain

dBµV/m @ 3 m = 50.2 + 8.3 - 30

= 28.5

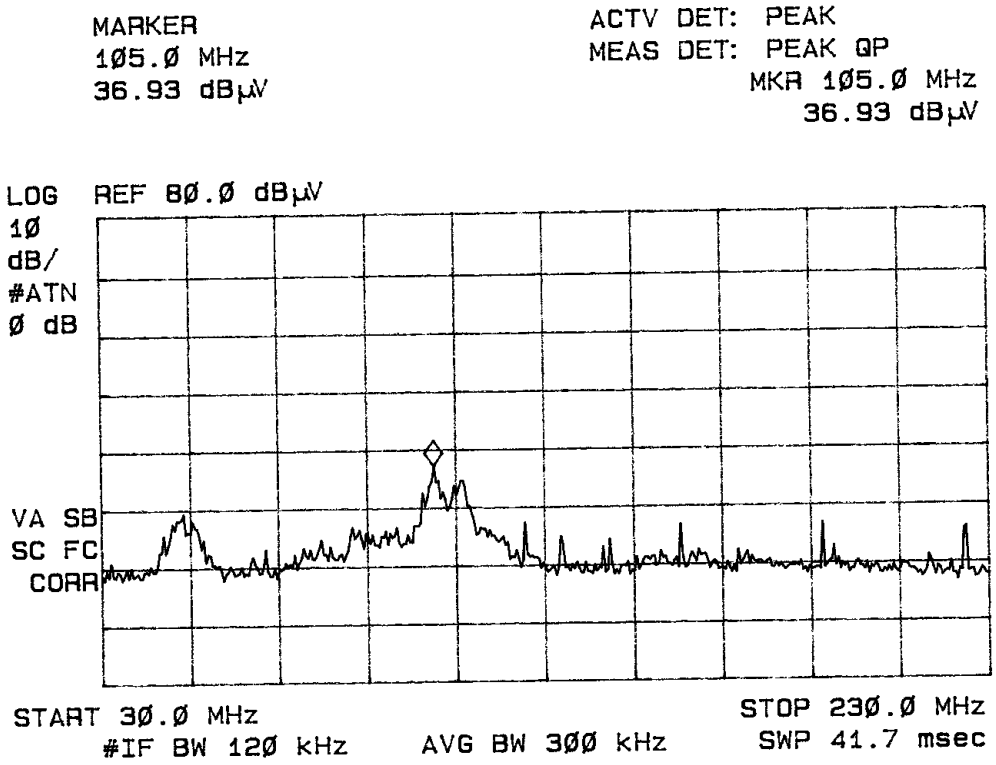


**Figure three Radiated Emissions taken at 1 meter in screen room (WMR300)**

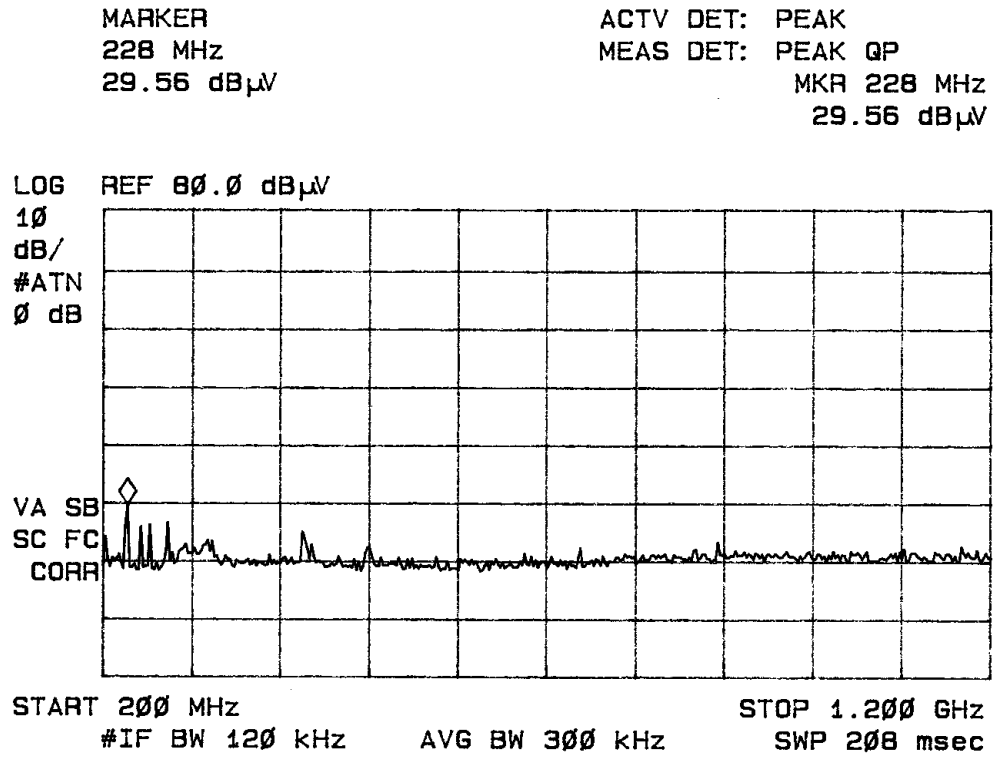


**Figure four Radiated Emissions taken at 1 meter in screen room (WMR300)**

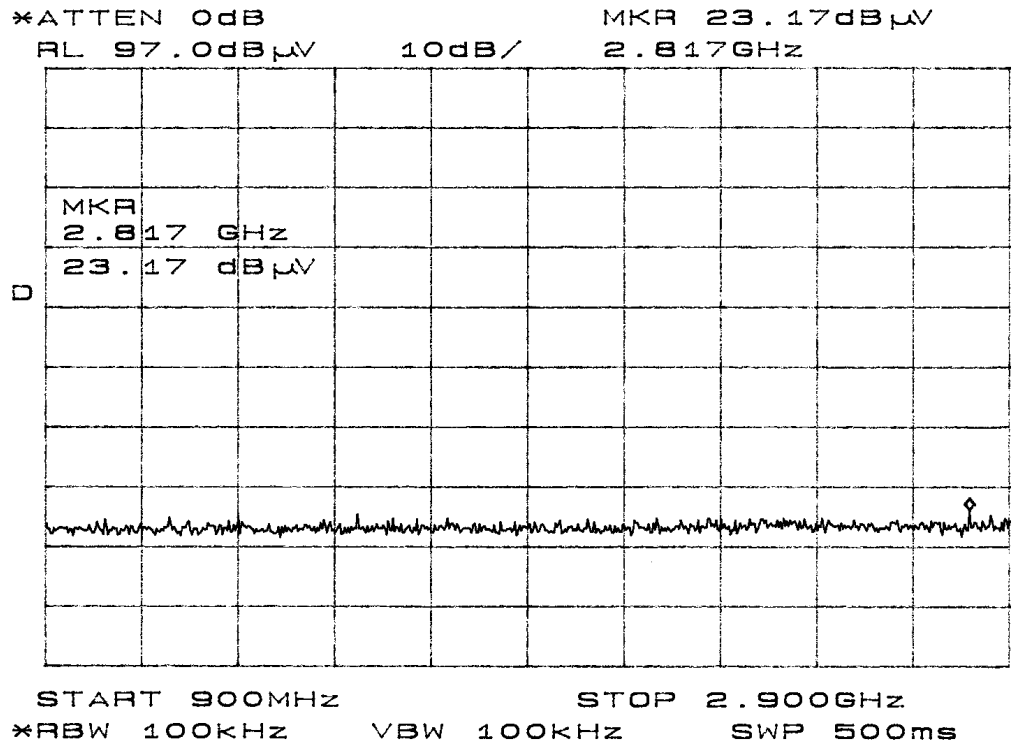


**Figure five Radiated Emissions taken at 1 meter in screen room (WMR300)**

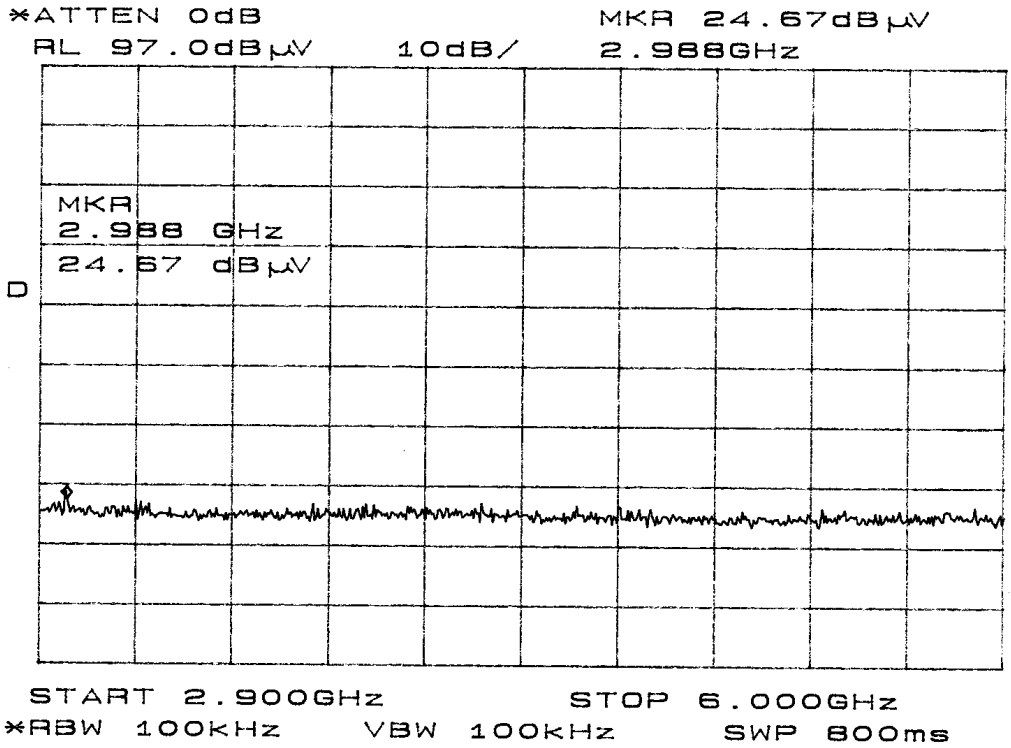


**Figure six Radiated Emissions taken at 1 meter in screen room (WMR300)**

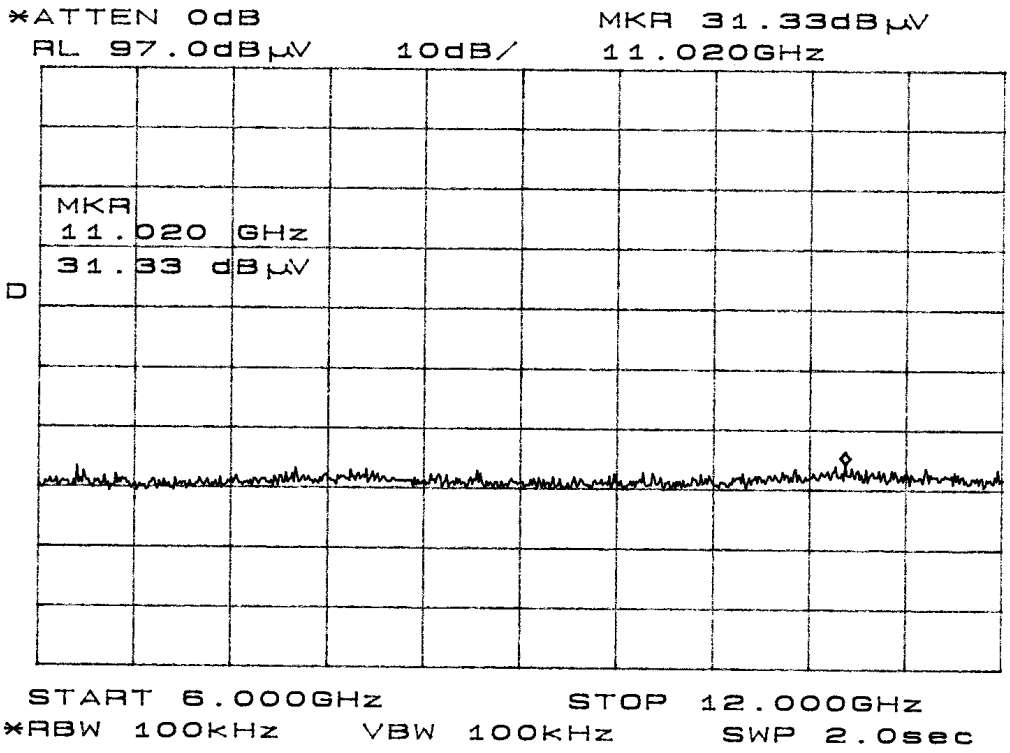


**Figure seven Radiated Emissions taken at 1 meter in screen room (WMR300)**

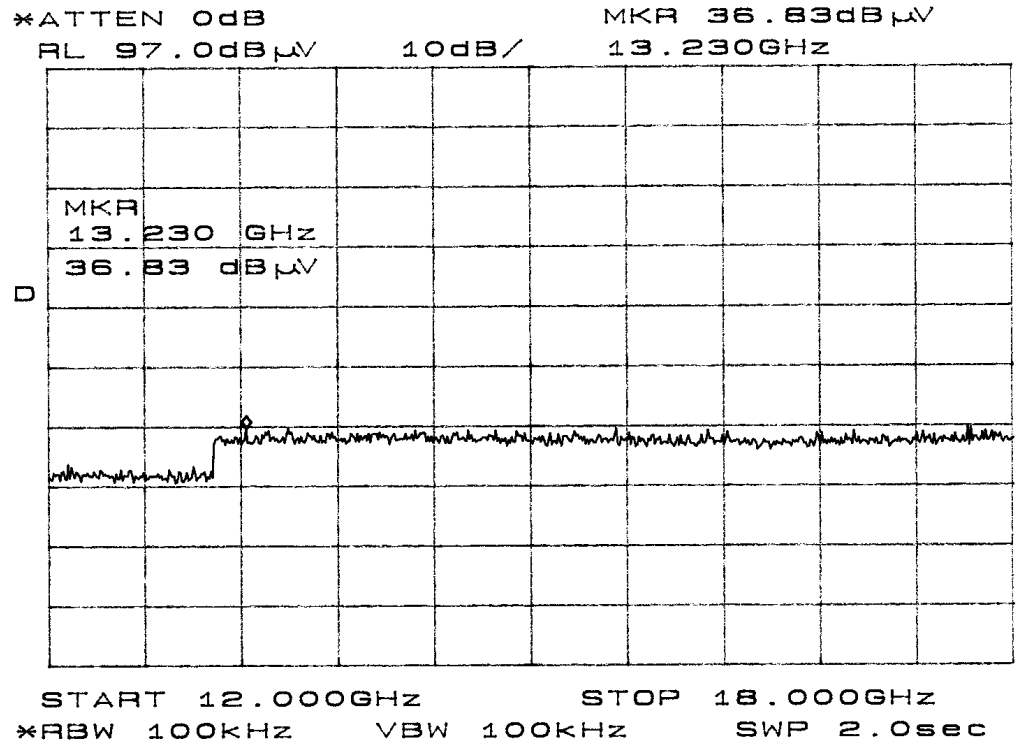


**Figure eight Radiated Emissions taken at 1 meter in screen room (WMR300)**

**Data: Conducted Emissions (7 Highest Emissions)**

| Frequency band (MHz) | L1 Level (dBµV) | | | L2 Level (dBµV) | | | CISPR 22 Limit Q.P. Ave(dBµV) |
|---|---|---|---|---|---|---|---|
| | Peak | Q.P. | AVE | Peak | Q.P. | AVE | |
| 0.15 – 0.5 | 59.8 | 54.3 | 41.8 | 60.1 | 55.0 | 43.4 | 66 / 56 |
| 0.5 – 5 | 44.5 | 39.6 | 34.8 | 48.9 | 43.6 | 37.3 | 56 / 46 |
| 5 – 10 | 46.2 | 42.6 | 34.5 | 49.2 | 46.5 | 39.5 | 60 / 50 |
| 10 – 15 | 46.7 | 43.9 | 35.7 | 49.2 | 45.6 | 39.9 | 60 / 50 |
| 15 – 20 | 29.9 | 25.1 | 18.2 | 33.7 | 29.0 | 21.5 | 60 / 50 |
| 20 – 25 | 33.7 | 30.4 | 32.6 | 36.0 | 31.6 | 23.2 | 60 / 50 |
| 25 – 30 | 37.1 | 32.1 | 24.5 | 35.1 | 30.8 | 22.7 | 60 / 50 |

Other emissions present had amplitudes at least 10 dB below the limit.

**Data: General Radiated Emissions from EUT**

| Frequency in MHz | FSM Horz. (dBµV) | FSM Vert. (dBµV) | A.F. (dB/m) | Amp. Gain (dB) | RFS Horz. @ 3 m (dBµV/m) | RFS Vert. @ 3 m (dBµV/m) | FCC Class B Limit @ 3 m (dBµV/m) |
|---|---|---|---|---|---|---|---|
| 48.0 | 50.2 | 51.0 | 8.3 | 30 | 28.5 | 29.3 | 40.0 |
| 104.8 | 51.1 | 54.8 | 7.0 | 30 | 28.1 | 31.8 | 43.5 |
| 110.8 | 50.3 | 50.4 | 6.8 | 30 | 27.1 | 27.2 | 43.5 |
| 125.0 | 51.7 | 54.9 | 7.6 | 30 | 29.3 | 32.5 | 43.5 |
| 133.0 | 47.2 | 48.0 | 8.5 | 30 | 25.7 | 26.5 | 43.5 |
| 160.0 | 46.2 | 43.4 | 8.9 | 30 | 25.1 | 22.3 | 43.5 |
| 192.0 | 47.9 | 48.4 | 10.7 | 30 | 28.6 | 29.1 | 43.5 |
| 224.0 | 48.0 | 44.0 | 11.2 | 30 | 29.2 | 25.2 | 46.0 |
| 240.0 | 50.5 | 51.8 | 11.7 | 30 | 32.2 | 33.5 | 46.0 |
| 250.0 | 44.5 | 44.6 | 12.3 | 30 | 26.8 | 26.9 | 46.0 |
| 270.0 | 50.5 | 51.8 | 12.8 | 30 | 33.3 | 34.6 | 46.0 |
| 422.2 | 44.5 | 44.6 | 16.9 | 30 | 31.4 | 31.5 | 46.0 |

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

**Data: Transmitter Radiated Emissions 12.5 dBi Panel**

| Frequency in MHz | FSM Horz. (dBµV) | FSM Vert. (dBµV) | A.F. (dB/m) | Amp. Gain (dB) | RFS Horz. @ 3 m (dBµV/m) | RFS Vert. @ 3 m (dBµV/m) | FCC Class B Limit @ 3 m (dBµV/m) |
|---|---|---|---|---|---|---|---|
| 908.0 | 66.7 | 81.7 | 23.4 | 0 | 90.1 | 105.1 | 132.0 |
| 1816.0 | 32.2 | 36.0 | 29.4 | 30 | 31.6 | 35.4 | 54.0 |
| 2724.0 | 29.3 | 29.8 | 34.4 | 30 | 33.7 | 34.2 | 54.0 |
| 3632.0 | 28.7 | 30.5 | 37.8 | 30 | 36.5 | 38.3 | 54.0 |
| 4540.0 | 27.8 | 30.6 | 41.3 | 30 | 39.1 | 41.9 | 54.0 |
| 913.0 | 65.2 | 85.3 | 23.4 | 0 | 88.6 | 108.7 | 132.0 |
| 1826.0 | 33.3 | 33.0 | 29.4 | 30 | 32.7 | 32.4 | 54.0 |
| 2739.0 | 30.0 | 29.5 | 34.4 | 30 | 34.4 | 33.9 | 54.0 |
| 3652.0 | 29.8 | 29.0 | 37.8 | 30 | 37.6 | 36.8 | 54.0 |
| 4565.0 | 31.5 | 30.0 | 41.4 | 30 | 42.9 | 41.4 | 54.0 |
| 923.0 | 61.7 | 86.7 | 23.4 | 0 | 85.1 | 110.1 | 132.0 |
| 1846.0 | 24.8 | 33.7 | 29.3 | 30 | 24.1 | 33.0 | 54.0 |
| 2769.0 | 36.8 | 29.5 | 34.5 | 30 | 41.3 | 34.0 | 54.0 |
| 3692.0 | 30.2 | 30.5 | 38.3 | 30 | 38.5 | 38.8 | 54.0 |
| 4615.0 | 28.3 | 30.3 | 42.0 | 30 | 40.3 | 42.3 | 54.0 |
| Band Edge | | | | | | | |
| 902.0 | 47.3 | 47.0 | 23.3 | 30 | 40.6 | 40.3 | 46.0 |
| 928.0 | 37.7 | 50.8 | 23.5 | 30 | 31.2 | 44.3 | 46.0 |
| Restricted Bands of Operation | | | | | | | |
| 2724.0 | 29.3 | 29.8 | 34.4 | 30 | 33.7 | 34.2 | 54.0 |
| 2739.0 | 30.0 | 29.5 | 34.4 | 30 | 34.4 | 33.9 | 54.0 |
| 2769.0 | 36.8 | 29.5 | 34.5 | 30 | 41.3 | 34.0 | 54.0 |
| 3632.0 | 28.7 | 30.5 | 37.8 | 30 | 36.5 | 38.3 | 54.0 |
| 3652.0 | 29.8 | 29.0 | 37.8 | 30 | 37.6 | 36.8 | 54.0 |
| 3692.0 | 30.2 | 30.5 | 38.3 | 30 | 38.5 | 38.8 | 54.0 |
| 4540.0 | 27.8 | 30.6 | 41.3 | 30 | 39.1 | 41.9 | 54.0 |
| 4565.0 | 31.5 | 30.0 | 41.4 | 30 | 42.9 | 41.4 | 54.0 |
| 4615.0 | 28.3 | 30.3 | 42.0 | 30 | 40.3 | 42.3 | 54.0 |

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

**Data: Transmitter Radiated Emissions 8.0 dBi Omni**

| Frequency in MHz | FSM Horz. (dBµV) | FSM Vert. (dBµV) | A.F. (dB/m) | Amp. Gain (dB) | RFS Horz. @ 3 m (dBµV/m) | RFS Vert. @ 3 m (dBµV/m) | FCC Class B Limit @ 3 m (dBµV/m) |
|---|---|---|---|---|---|---|---|
| 908.0 | 58.8 | 79.0 | 23.4 | 0 | 82.2 | 102.4 | 132.0 |
| 1816.0 | 30.0 | 33.5 | 29.4 | 30 | 29.4 | 32.9 | 54.0 |
| 2724.0 | 29.3 | 27.5 | 34.4 | 30 | 33.7 | 31.9 | 54.0 |
| 3632.0 | 27.5 | 30.5 | 37.8 | 30 | 35.3 | 38.3 | 54.0 |
| 4540.0 | 26.7 | 28.8 | 41.3 | 30 | 38.0 | 40.1 | 54.0 |
| 913.0 | 59.9 | 80.5 | 23.4 | 0 | 83.3 | 103.9 | 132.0 |
| 1826.0 | 31.0 | 32.3 | 29.4 | 30 | 30.4 | 31.7 | 54.0 |
| 2739.0 | 27.7 | 30.3 | 34.4 | 30 | 32.1 | 34.7 | 54.0 |
| 3652.0 | 29.8 | 30.4 | 37.8 | 30 | 37.6 | 38.2 | 54.0 |
| 4565.0 | 29.3 | 29.3 | 41.4 | 30 | 40.7 | 40.7 | 54.0 |
| 923.0 | 55.5 | 77.8 | 23.4 | 0 | 78.9 | 101.2 | 132.0 |
| 1846.0 | 29.6 | 34.8 | 29.3 | 30 | 28.9 | 34.1 | 54.0 |
| 2769.0 | 28.0 | 28.5 | 34.5 | 30 | 32.5 | 33.0 | 54.0 |
| 3692.0 | 27.2 | 28.7 | 38.3 | 30 | 35.5 | 37.0 | 54.0 |
| 4615.0 | 27.2 | 28.2 | 42.0 | 30 | 39.2 | 40.2 | 54.0 |
| Band Edge | | | | | | | |
| 902.0 | 43.2 | 46.9 | 23.3 | 30 | 36.5 | 40.2 | 46.0 |
| 928.0 | 37.3 | 49.3 | 23.5 | 30 | 30.8 | 42.8 | 46.0 |
| Restricted Bands of Operation | | | | | | | |
| 2724.0 | 29.3 | 27.5 | 34.4 | 30 | 33.7 | 31.9 | 54.0 |
| 2739.0 | 27.7 | 30.3 | 34.4 | 30 | 32.1 | 34.7 | 54.0 |
| 2769.0 | 28.0 | 28.5 | 34.5 | 30 | 32.5 | 33.0 | 54.0 |
| 3632.0 | 27.5 | 30.5 | 37.8 | 30 | 35.3 | 38.3 | 54.0 |
| 3652.0 | 29.8 | 30.4 | 37.8 | 30 | 37.6 | 38.2 | 54.0 |
| 3692.0 | 27.2 | 28.7 | 38.3 | 30 | 35.5 | 37.0 | 54.0 |
| 4540.0 | 26.7 | 28.8 | 41.3 | 30 | 38.0 | 40.1 | 54.0 |
| 4565.0 | 29.3 | 29.3 | 41.4 | 30 | 40.7 | 40.7 | 54.0 |
| 4615.0 | 27.2 | 28.2 | 42.0 | 30 | 39.2 | 40.2 | 54.0 |

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

**Data: Transmitter Radiated Emissions 13 dBi Yagi**

| Frequency in MHz | FSM Horz. (dBµV) | FSM Vert. (dBµV) | A.F. (dB/m) | Amp. Gain (dB) | RFS Horz. @ 3 m (dBµV/m) | RFS Vert. @ 3 m (dBµV/m) | FCC Class B Limit @ 3 m (dBµV/m) |
|---|---|---|---|---|---|---|---|
| 908.0 | 66.3 | 88.5 | 23.4 | 0 | 89.7 | 111.9 | 132.0 |
| 1816.0 | 32.3 | 32.3 | 29.4 | 30 | 31.7 | 31.7 | 54.0 |
| 2724.0 | 26.0 | 28.5 | 34.4 | 30 | 30.4 | 32.9 | 54.0 |
| 3632.0 | 27.3 | 28.0 | 37.8 | 30 | 35.1 | 35.8 | 54.0 |
| 4540.0 | 25.2 | 28.5 | 41.3 | 30 | 36.5 | 39.8 | 54.0 |
| 913.0 | 65.5 | 88.3 | 23.4 | 0 | 88.9 | 111.7 | 132.0 |
| 1826.0 | 33.8 | 38.5 | 29.4 | 30 | 33.2 | 37.9 | 54.0 |
| 2739.0 | 29.3 | 29.9 | 34.4 | 30 | 33.7 | 34.3 | 54.0 |
| 3652.0 | 30.8 | 30.5 | 37.8 | 30 | 38.6 | 38.3 | 54.0 |
| 4565.0 | 28.0 | 28.5 | 41.4 | 30 | 39.4 | 39.9 | 54.0 |
| 923.0 | 63.0 | 85.3 | 23.4 | 0 | 86.4 | 108.7 | 132.0 |
| 1846.0 | 31.3 | 34.5 | 29.3 | 30 | 30.6 | 33.8 | 54.0 |
| 2769.0 | 30.0 | 30.0 | 34.5 | 30 | 34.5 | 34.5 | 54.0 |
| 3692.0 | 29.8 | 30.3 | 38.3 | 30 | 38.1 | 38.6 | 54.0 |
| 4615.0 | 27.8 | 28.2 | 42.0 | 30 | 39.8 | 40.2 | 54.0 |
| Band Edge | | | | | | | |
| 902.0 | 50.1 | 49.9 | 23.3 | 30 | 43.4 | 43.2 | 46.0 |
| 928.0 | 49.4 | 48.2 | 23.5 | 30 | 42.9 | 41.7 | 46.0 |
| Restricted Bands of Operation | | | | | | | |
| 2724.0 | 26.0 | 28.5 | 34.4 | 30 | 30.4 | 32.9 | 54.0 |
| 2739.0 | 29.3 | 29.9 | 34.4 | 30 | 33.7 | 34.3 | 54.0 |
| 2769.0 | 30.0 | 30.0 | 34.5 | 30 | 34.5 | 34.5 | 54.0 |
| 3632.0 | 27.3 | 28.0 | 37.8 | 30 | 35.1 | 35.8 | 54.0 |
| 3652.0 | 30.8 | 30.5 | 37.8 | 30 | 38.6 | 38.3 | 54.0 |
| 3692.0 | 29.8 | 30.3 | 38.3 | 30 | 38.1 | 38.6 | 54.0 |
| 4540.0 | 25.2 | 28.5 | 41.3 | 30 | 36.5 | 39.8 | 54.0 |
| 4565.0 | 28.0 | 28.5 | 41.4 | 30 | 39.4 | 39.9 | 54.0 |
| 4615.0 | 27.8 | 28.2 | 42.0 | 30 | 39.8 | 40.2 | 54.0 |

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

**Data: Transmitter Radiated Emissions 18 dBi Grid**

| Frequency in MHz | FSM Horz. (dBµV) | FSM Vert. (dBµV) | A.F. (dB/m) | Amp. Gain (dB) | RFS Horz. @ 3 m (dBµV/m) | RFS Vert. @ 3 m (dBµV/m) | FCC Class B Limit @ 3 m (dBµV/m) |
|---|---|---|---|---|---|---|---|
| 908.0 | 69.7 | 91.7 | 23.4 | 0 | 93.1 | 115.1 | 132.0 |
| 1816.0 | 32.0 | 36.8 | 29.4 | 30 | 31.4 | 36.2 | 54.0 |
| 2724.0 | 28.2 | 28.5 | 34.4 | 30 | 32.6 | 32.9 | 54.0 |
| 3632.0 | 30.8 | 30.3 | 37.8 | 30 | 38.6 | 38.1 | 54.0 |
| 4540.0 | 29.6 | 30.7 | 41.3 | 30 | 40.9 | 42.0 | 54.0 |
| 913.0 | 73.3 | 87.5 | 23.4 | 0 | 96.7 | 110.9 | 132.0 |
| 1826.0 | 33.0 | 32.2 | 29.4 | 30 | 32.4 | 31.6 | 54.0 |
| 2739.0 | 29.2 | 29.3 | 34.4 | 30 | 33.6 | 33.7 | 54.0 |
| 3652.0 | 30.0 | 31.0 | 37.8 | 30 | 37.8 | 38.8 | 54.0 |
| 4565.0 | 30.6 | 28.0 | 41.4 | 30 | 42.0 | 39.4 | 54.0 |
| 923.0 | 82.8 | 91.5 | 23.4 | 0 | 106.2 | 114.9 | 132.0 |
| 1846.0 | 29.6 | 32.3 | 29.3 | 30 | 28.9 | 31.6 | 54.0 |
| 2769.0 | 26.2 | 29.5 | 34.5 | 30 | 30.7 | 34.0 | 54.0 |
| 3692.0 | 28.1 | 30.1 | 38.3 | 30 | 36.4 | 38.4 | 54.0 |
| 4615.0 | 28.5 | 29.3 | 42.0 | 30 | 40.5 | 41.3 | 54.0 |
| Band Edge | | | | | | | |
| 902.0 | 48.7 | 49.0 | 23.3 | 30 | 42.0 | 42.3 | 46.0 |
| 928.0 | 49.1 | 51.0 | 23.5 | 30 | 42.6 | 44.5 | 46.0 |
| Restricted Bands of Operation | | | | | | | |
| 2724.0 | 28.2 | 28.5 | 34.4 | 30 | 32.6 | 32.9 | 54.0 |
| 2739.0 | 29.2 | 29.3 | 34.4 | 30 | 33.6 | 33.7 | 54.0 |
| 2769.0 | 26.2 | 29.5 | 34.5 | 30 | 30.7 | 34.0 | 54.0 |
| 3632.0 | 30.8 | 30.3 | 37.8 | 30 | 38.6 | 38.1 | 54.0 |
| 3652.0 | 30.0 | 31.0 | 37.8 | 30 | 37.8 | 38.8 | 54.0 |
| 3692.0 | 28.1 | 30.1 | 38.3 | 30 | 36.4 | 38.4 | 54.0 |
| 4540.0 | 29.6 | 30.7 | 41.3 | 30 | 40.9 | 42.0 | 54.0 |
| 4565.0 | 30.6 | 28.0 | 41.4 | 30 | 42.0 | 39.4 | 54.0 |
| 4615.0 | 28.5 | 29.3 | 42.0 | 30 | 40.5 | 41.3 | 54.0 |

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

### *Summary of Results for Conducted Emissions*

The conducted emissions for the EUT meet the requirements for CISPR 22 and FCC Part 15B CLASS B Digital Devices. The model WMR300 had an 11.0 dB (Quasi-Peak) minimum margin below the Quasi-Peak limit, and an 8.7 dB minimum margin below the CISPR average limit. Measurements were taken using the peak, quasi peak, and average, measurement function for each emissions amplitude and were below the limits stated in the specification. Other emissions were present with recorded data representing worst-case amplitudes.

### *Summary of Results for Radiated Emissions*

The general radiated emissions for the EUT meet the requirements for CISPR 22 and FCC Part 15B CLASS B Digital Devices. The model WMR300 had a 1.7 dB minimum margin below the quasi-peak limit. The model WMR300 had an 11.1 dB margin for harmonic emissions. 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 or FCC Part 15B Class B general emissions standards or CFR47 15C requirements. There were no deviations or exceptions to the specifications.

## Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Test 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:

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

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

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

## *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 Registration 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 Registration 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