NVLAP Lab Code 200087-0

# Submittal Application Report

## For Class 2 Permissible Change
## Grant Of Certification

FOR

## Model: Sextant

## 2x2 MIMO Broadband Digital Transmission System
## 5740-5830 MHz

## FCC ID: TV7RB711UA-5HND

FOR

## MIKROTIKLS SIA

Pernavas 46
Riga, Latvia LV-1009

Test Report Number: 110913

Test Date: September 13, 2011

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

CFR 47, PART 15C - Intentional Radiators
CFR 47 Paragraph 15.247
License Exempt Intentional Radiator

For

# MIKROTIKLS SIA

Pernavas 46
Riga, Latvia LV-1009

2x2 MIMO Broadband Digital Transmission System
Model: Sextant
Frequency Range 5740-5830 MHz
FCC ID#: TV7RB711UA-5HND

Test Date: September 13, 2011

Certifying Engineer: Scot D Rogers

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

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## Forward

This report documents supporting information for requesting Class 2 permissible change to certified equipment. The document offers supporting information and demonstration of compliance for use of addition of antenna and case change to model RB711UA-5HnD. The electromagnetic emissions compatibility testing required for demonstration of compliance with class 2 permissible change as authorized by CFR47 Dated October 1, 2010, Paragraphs 2.1043, 15.247 have been conducted on the Sextant and antenna system. The results have been reviewed and equipment found to demonstrate compliance with all the requirements investigated for this report.

Name of Applicant: Mikrotikls SIA
Pernavas 46
Riga, Latvia LV-1009

Model: Sextant

FCC I.D.: TV7RB711UA-5HND FRN: 0014 43 1100

Frequency Range: 5740-5830 MHz, 5745-5825 MHz, or 5755-5815 MHz

Operating Power: 0.2-Watts total output power 2x2 MIMO chain operation, 0.1 Watts per chain

## Opinion / Interpretation of Results

| Tests Performed | Margin (dB) | Results |
|---|---|---|
| Emissions as per CFR 47 paragraphs 2 and 15.205 | -4.6 | Complies |
| Emissions as per CFR 47 paragraphs 2 and 15.207 | -5.3 | Complies |
| Emissions as per CFR 47 paragraphs 2 and 15.209 | -3.1 | Complies |
| Emissions as per CFR 47 paragraphs 2 and 15.247 | -7.0 | Complies |

## Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 21.6° C |
| Relative Humidity | 36% |
| Atmospheric Pressure | 1027.0 mb |

## Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2010, 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 the following information is submitted.

Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI C63.4-2009 Document, FCC documents KDB 662911 MIMO, DA00-1407 and DA00-705 and/or TIA/EIA 603-1. Testing for the AC line-conducted emissions were performed as defined in sections 7 and 13.1.3, testing of the radiated emissions was performed as defined in sections 8 and 13.1.4 of ANSI C63.4-2009. Testing of the intentional radiated emissions was performed as defined in section 13 of ANSI C63.4-2009.

## List of Test Equipment

A Rohde and Schwarz ESU40 and/or Hewlett Packard 8591EM was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Rohde and Schwarz ESU40 and/or 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.

| AC Line Conducted Emissions (0.150 -30 MHz) | | |
|---|---|---|
| RBW | AVG. BW | Detector Function |
| 9 kHz | 30 kHz | Peak / Quasi Peak |
| Emissions (30-1000 MHz) | | |
| RBW | AVG. BW | Detector Function |
| 120 kHz | 300 kHz | Peak / Quasi Peak |
| Emissions (Above 1000 MHz) | | |
| RBW | Video BW | Detector Function |
| 100 kHz | 100 kHz | Peak |
| 1 MHz | 1 MHz | Peak / Average |

| Equipment | Manufacturer | Model | Calibration Date | Due |
|---|---|---|---|---|
| LISN | Comp. Design | FCC-LISN-2-MOD.CD | 10/10 | 10/11 |
| Antenna | ARA | BCD-235-B | 10/10 | 10/11 |
| Antenna | EMCO | 3147 | 10/10 | 10/11 |
| Antenna | EMCO | 3143 | 5/11 | 5/12 |
| Analyzer | HP | 8591EM | 5/11 | 5/12 |
| Analyzer | HP | 8562A | 5/11 | 5/12 |
| Analyzer | Rohde & Schwarz | ESU40 | 5/11 | 5/12 |

## Test Site Locations

Conducted EMI — The AC power line conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS

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

Site Registration — Refer to Annex for Site Registration Letters

NVLAP Accreditation — Lab code 200087-0

## 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

Sample Calculation:

RFS = Radiated Field Strength, FSM = Field Strength Measured
A.F. = Receive antenna factor, Gain = amplification gains and/or cable losses
RFS (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB) - Gain (dB)

## Application for Certification

(1) Manufacturer: Mikrotikls SIA
Pernavas 46
Riga, Latvia LV-1009

(2) Identification: Model: Sextant

FCC I.D.: TV7RB711UA-5HND

(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) List of Peripheral Equipment Necessary for operation. The equipment operates from power received from authorized AC power adapter or POE (Power Over Ethernet). The EUT offers connection port for network. During testing, the EUT was connected to CPU through network cable and power supplied from external AC adapter and POE.

(9) Transition Provisions of CFR47 15.37 are not 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.

(12) The equipment is not software defined and this section is not applicable.

## Equipment Tested

| Equipment | Model | FCC I.D. |
|---|---|---|
| EUT | Sextant | TV7RB711UA-5HND |
| AC Adapter (POE) | KSAS024240008 | N/A |
| Dell Studio XPS | 921LBN1 | N/A |
| Antenna/Type | Model | Gain |
| Integrated Panel | Sextant | 17dBi |

## Change to Equipment

Reason for Class II permissive change:

1) Change of enclosure to house electronics and antenna
2) Antenna dual polarized 17 dBi panel antenna

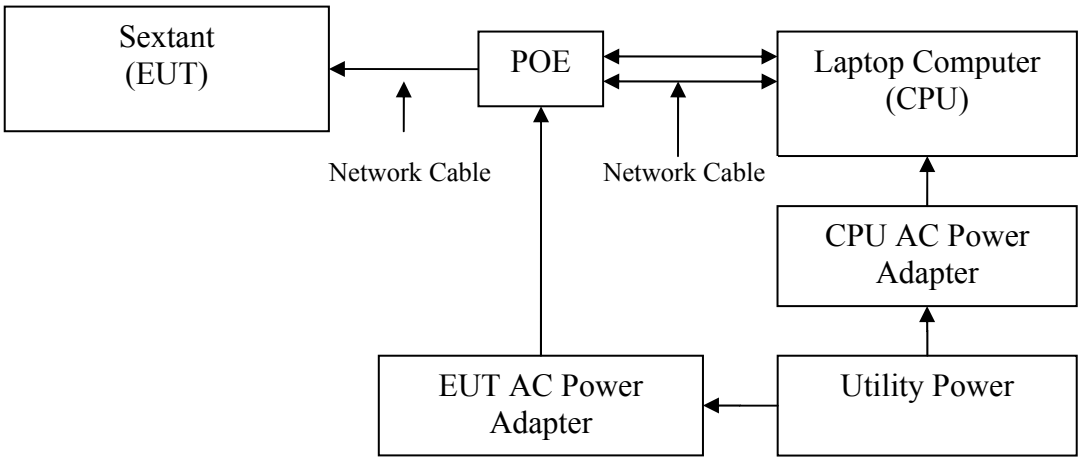
Effect

1) Offers integrated dual polarity antenna system

## Equipment Function and Configuration

The EUT is a 5740-5830 MHz 2x2 Multiple Input Multiple Output (MIMO) Digital Transmission System transmitters used to transmit data in applications offering broadband wireless connectivity. The equipment is marketed for use to incorporate a wireless link to exchange data information from one point to another. For testing purposes, the Sextant transceiver was connected to the manufacturer supplied AC power adapter, POE, and communicating to the laptop computer allowing for operational control of the transmitter and communications over the network interface between the EUT and supporting computer system. The Sextant receives power from the supplied AC power adapter and POE connected to utility power systems. The EUT offers connection port for network only and requires power supplied from external source (AC adapter and POE), no other interfacing options are provided. For testing purposes, the Sextant was powered from the AC power adapter and POE and set to transmit in available data modes. The device is marketed for professional installation and antenna connection and options comply with the unique antenna connection requirements.

### *Equipment Configuration*




## Test Procedures

### *AC Line Conducted Emission Test Procedure*

The EUT operates from DC power only and must be connected to an approved AC adapter/POE for operation. For testing purposes, the manufacturer supplied AC power adapter was used to power the EUT and system. Testing for the AC line-conducted emissions testing was performed as defined in sections 7 and 13.1.3 of ANSI C63.4-2009. The test setup including the EUT was arranged in typical equipment configurations 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. Testing for the radiated emissions was performed as defined in sections 8 and 13.1.4 of ANSI C63.4-2009. 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 test setup exhibits for EUT placement during testing.

## Intentional Radiators

As per CFR47, Subpart C, paragraph 15.247 the following information is submitted.

### *Antenna Requirements*

The EUT utilizes integral antenna system and offers no other provision for alternate antenna connection. The design is marketed for professional installation and use as described in original application documentation. The antenna connection point complies with the unique antenna connection requirements. The requirements of 15.203 are fulfilled; there are no deviations or exceptions to the specification.

### *Restricted Bands of Operation*

Spurious emissions falling in the restricted frequency bands of operation were measured at a distance of three meters on the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were measured 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.

**Radiated Emissions in Restricted Bands Data (worst-case presented)**

| Frequency in MHz | Horizontal Peak (dBµV) | Horizontal Quasi-Peak (dBµV) | Horizontal Average (dBµV) | Vertical Peak (dBµV) | Vertical Quasi-Peak (dBµV) | Vertical Average (dBµV) | Limit @ 3m (dBµV/m) |
|---|---|---|---|---|---|---|---|
| 108.8 | 43.9 | 38.9 | N/A | 40.7 | 34.4 | N/A | 43.5 |
| 246.0 | 37.6 | 27.9 | N/A | 27.3 | 23.9 | N/A | 46.0 |
| 254.0 | 43.2 | 25.4 | N/A | 34.8 | 24.6 | N/A | 46.0 |
| 400.0 | 37.8 | 32.4 | N/A | 41.1 | 36.7 | N/A | 46.0 |
| 11480.0 | 56.5 | N/A | 39.4 | 52.6 | N/A | 40.3 | 54.0 |
| 11570.0 | 61.7 | N/A | 46.2 | 55.2 | N/A | 39.4 | 54.0 |
| 11660.0 | 54.0 | N/A | 16.6 | 16.1 | N/A | 40.9 | 54.0 |
| 22960.0 | 38.3 | N/A | 25.5 | 37.6 | N/A | 25.2 | 54.0 |

Other emissions present had amplitudes at least 20 dB below the limit.
Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz.
Average amplitude emissions are recorded above for frequency range above 1000 MHz.

### *Summary of Results for Radiated Emissions in Restricted Bands*

The EUT demonstrated compliance with the radiated emissions requirements of CFR 47 Part 15C Intentional Radiators. The EUT demonstrated a minimum margin of -4.6 dB below the radiated emissions requirements in restricted frequency bands. Peak, Quasi-peak, and average amplitudes were checked for compliance with the regulations. Worst-case emissions are reported with other emissions found in the restricted frequency bands at least 20 dB below the requirements.

### *AC Line Conducted Emissions Procedure*

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 POE/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 for plots of the EUT powered by AC adapter, AC Power Line conducted emissions.

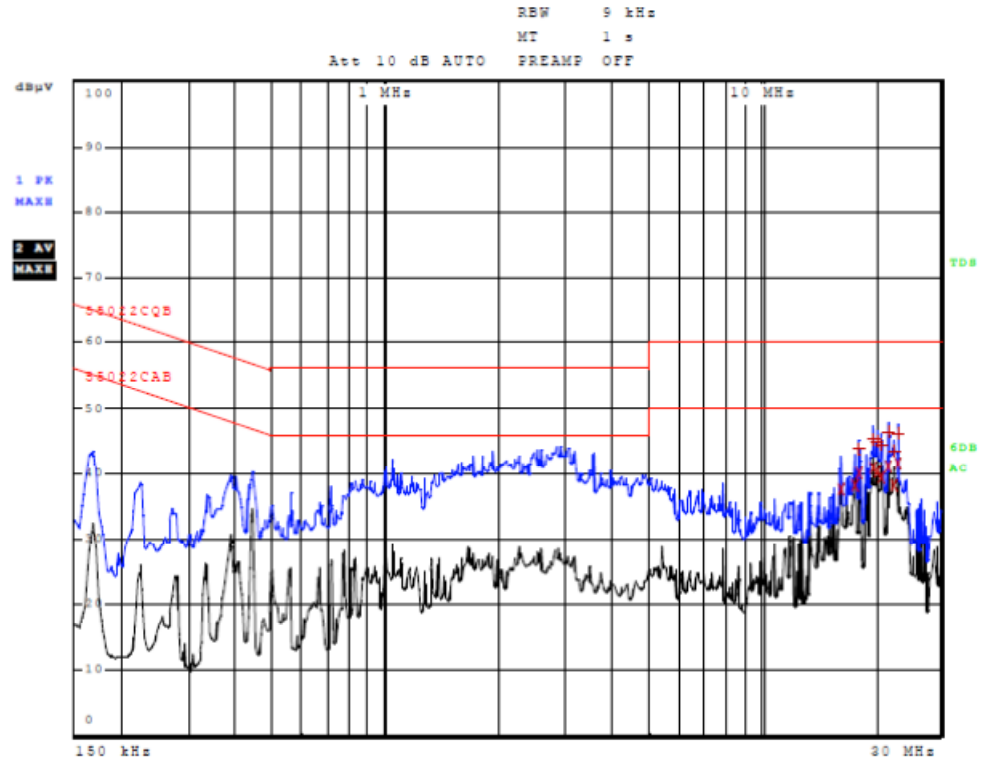



**Figure One AC Line Conducted Emissions Line 1**

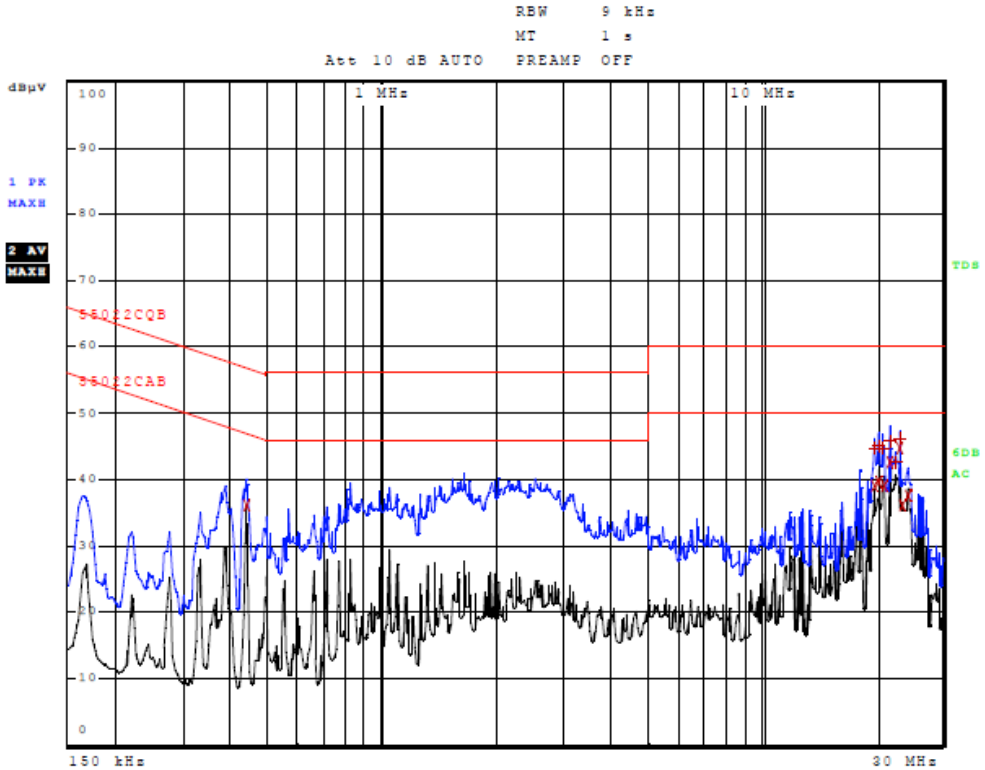



**Figure Two AC Line Conducted Emissions Line 2**

**AC Line Conducted Emissions Data (Highest Emissions)**

Line 1

| Trace | Frequency | Level (dBµV) | Detector | Delta Limit/dB |
|---|---|---|---|---|
| 2 | 16.228000000 MHz | 37.51 | Average | -12.49 |
| 2 | 17.692000000 MHz | 38.04 | Average | -11.96 |
| 1 | 18.244000000 MHz | 43.76 | Quasi Peak | -16.24 |
| 2 | 18.244000000 MHz | 39.92 | Average | -10.08 |
| 1 | 19.708000000 MHz | 45.31 | Quasi Peak | -14.69 |
| 2 | 19.708000000 MHz | 40.82 | Average | -9.18 |
| 2 | 20.260000000 MHz | 40.23 | Average | -9.77 |
| 1 | 20.260000000 MHz | 44.90 | Quasi Peak | -15.10 |
| 2 | 20.808000000 MHz | 39.44 | Average | -10.56 |
| 1 | 20.808000000 MHz | 44.35 | Quasi Peak | -15.65 |
| 2 | 21.664000000 MHz | 41.07 | Average | -8.93 |
| 1 | 21.664000000 MHz | 46.34 | Quasi Peak | -13.66 |
| 2 | 22.456000000 MHz | 38.15 | Average | -11.85 |
| 1 | 22.456000000 MHz | 43.30 | Quasi Peak | -16.70 |
| 2 | 23.128000000 MHz | 41.45 | Average | -8.55 |
| 1 | 23.128000000 MHz | 46.12 | Quasi Peak | -13.88 |

Line 2

| Trace | Frequency | Level (dBµV) | Detector | Delta Limit/dB |
|---|---|---|---|---|
| 2 | 438.000000000 kHz | 36.06 | Average | -11.04 |
| 1 | 19.708000000 MHz | 44.54 | Quasi Peak | -15.46 |
| 2 | 19.708000000 MHz | 38.97 | Average | -11.03 |
| 1 | 20.260000000 MHz | 45.07 | Quasi Peak | -14.93 |
| 2 | 20.260000000 MHz | 39.56 | Average | -10.44 |
| 1 | 20.808000000 MHz | 44.64 | Quasi Peak | -15.36 |
| 2 | 21.052000000 MHz | 38.93 | Average | -11.07 |
| 2 | 21.664000000 MHz | 42.50 | Average | -7.50 |
| 1 | 21.664000000 MHz | 45.76 | Quasi Peak | -14.24 |
| 1 | 22.456000000 MHz | 42.65 | Quasi Peak | -17.35 |
| 2 | 23.128000000 MHz | 44.68 | Average | -5.32 |
| 1 | 23.128000000 MHz | 46.01 | Quasi Peak | -13.99 |
| 2 | 23.432000000 MHz | 36.07 | Average | -13.93 |
| 2 | 24.348000000 MHz | 37.50 | Average | -12.50 |

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

***Summary of Results for AC Line Conducted Emissions***

The EUT demonstrated compliance to the conducted emissions requirements of CFR47 Part 15C equipment. The EUT demonstrated minimum margin of -5.3 dB below the 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.

### *Operation in the Band 5725 – 5850 MHz*

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 40,000 MHz for the preliminary testing. Refer to figures three through eleven for plots of the general radiated emissions spectrum taken in a screen room. Each radiated emission was then 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 1 GHz and or double Ridge or pyramidal horns and mixers from 1 GHz to 60 GHz, notch filters and appropriate amplifiers and external mixers were utilized. The peak and quasi-peak amplitude of the frequencies below 1000 MHz were measured using a spectrum analyzer. The peak and average amplitude of emissions above 1000 MHz including were measured using a spectrum analyzer. Data was recorded from the analyzer measurement result. Measurement data demonstrating compliance is presented in following tables.

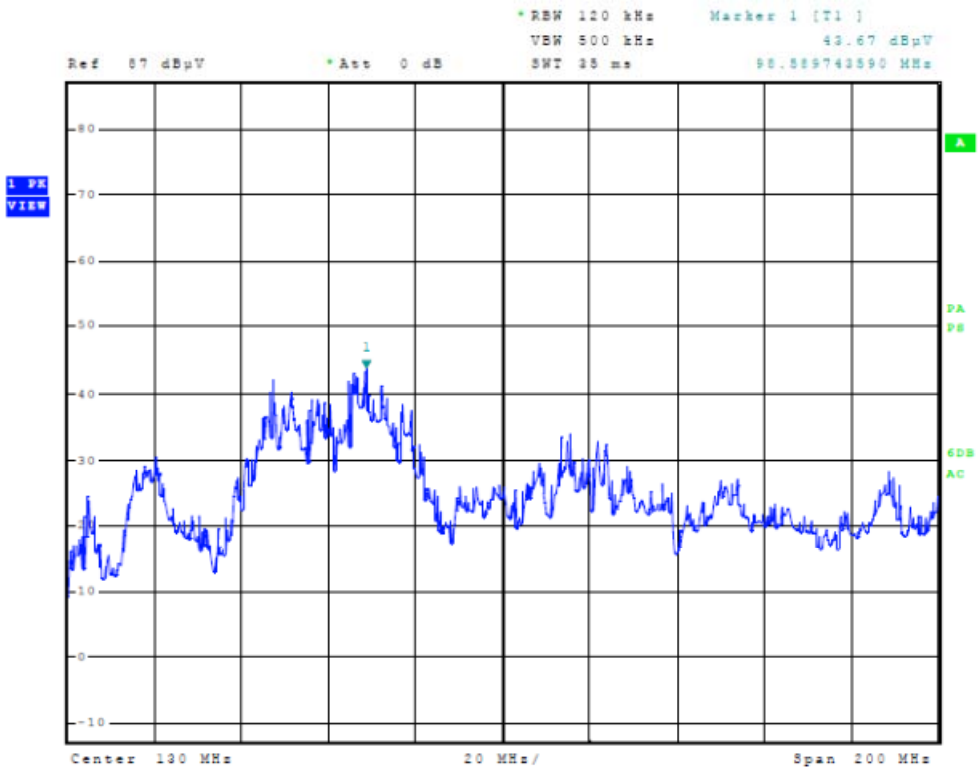



**Figure Three Radiated Emissions taken at 1 meter in screen room**

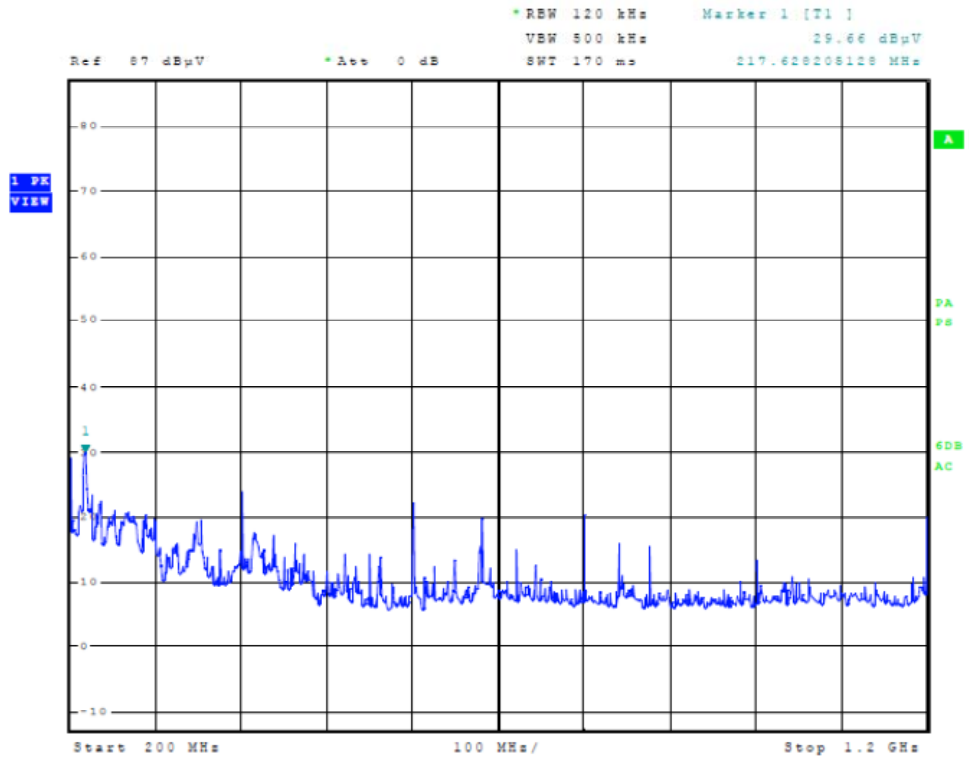



**Figure Four Radiated Emissions taken at 1 meter in screen room**

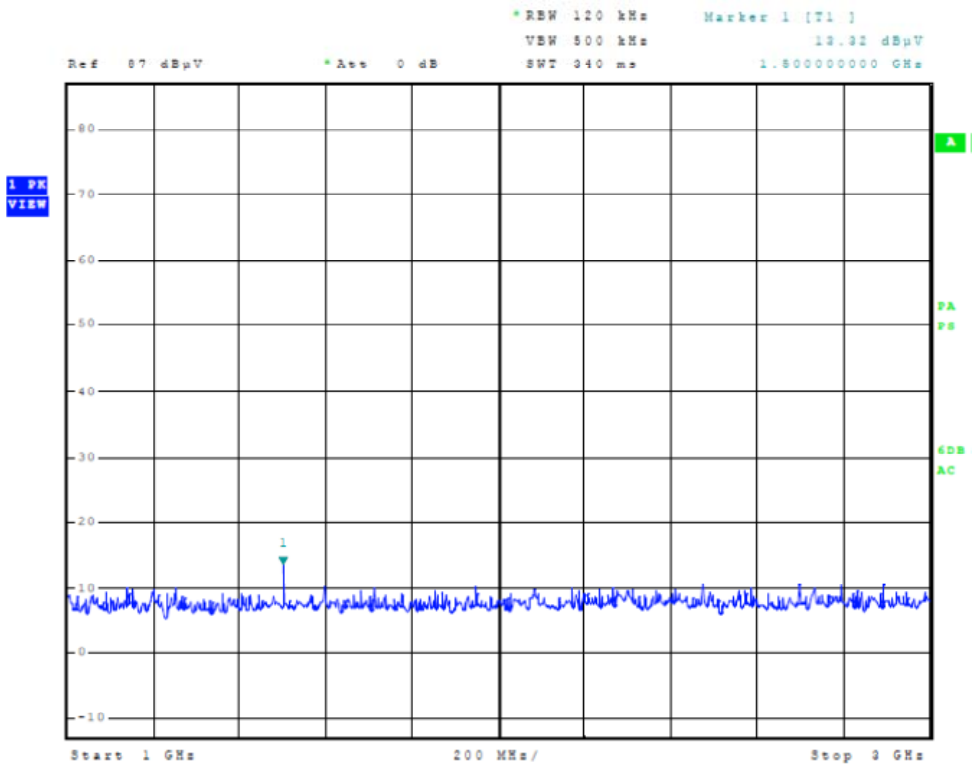



**Figure Five Radiated Emissions taken at 1 meter in screen room**

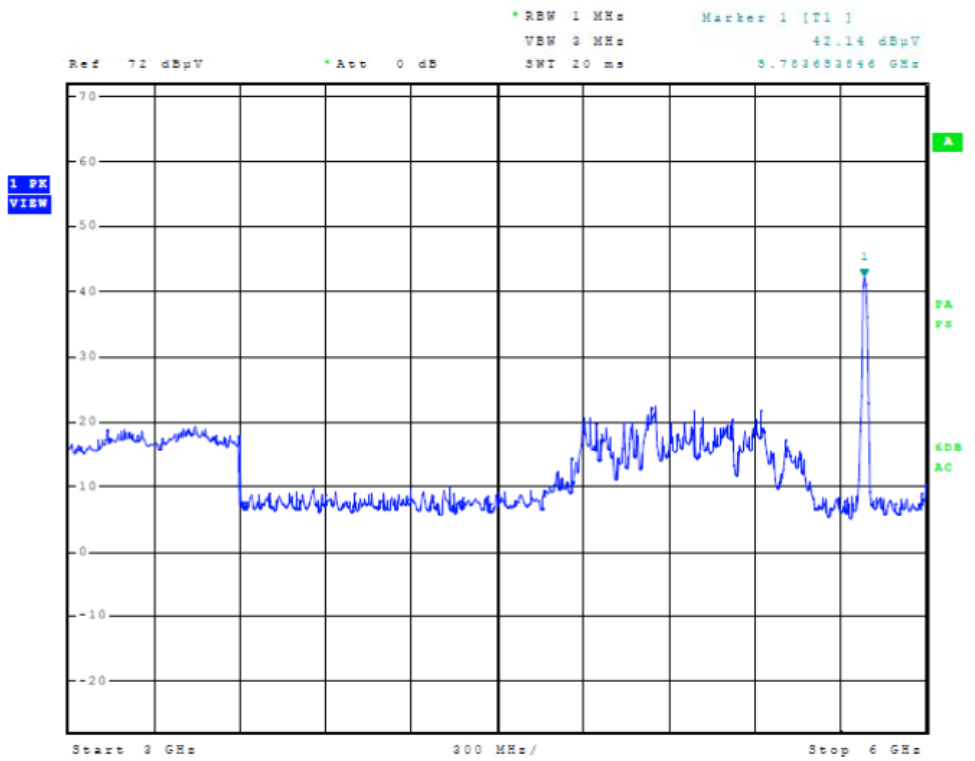



**Figure Six Radiated Emissions taken at 1 meter in screen room**

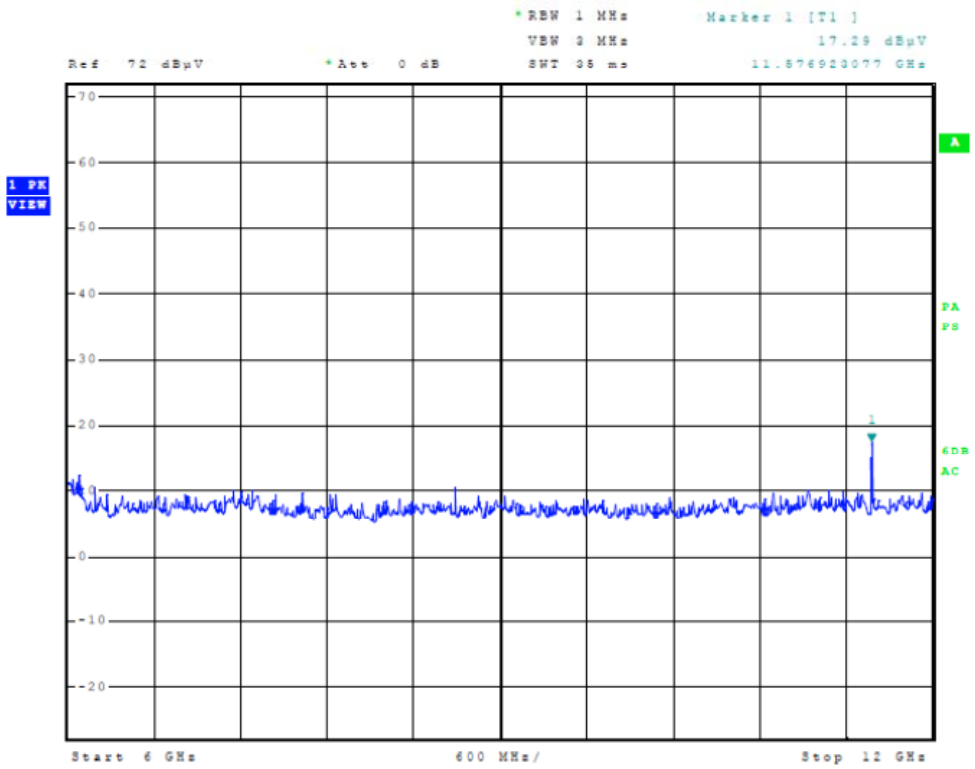



**Figure Seven Radiated Emissions taken at 1 meter in screen room**

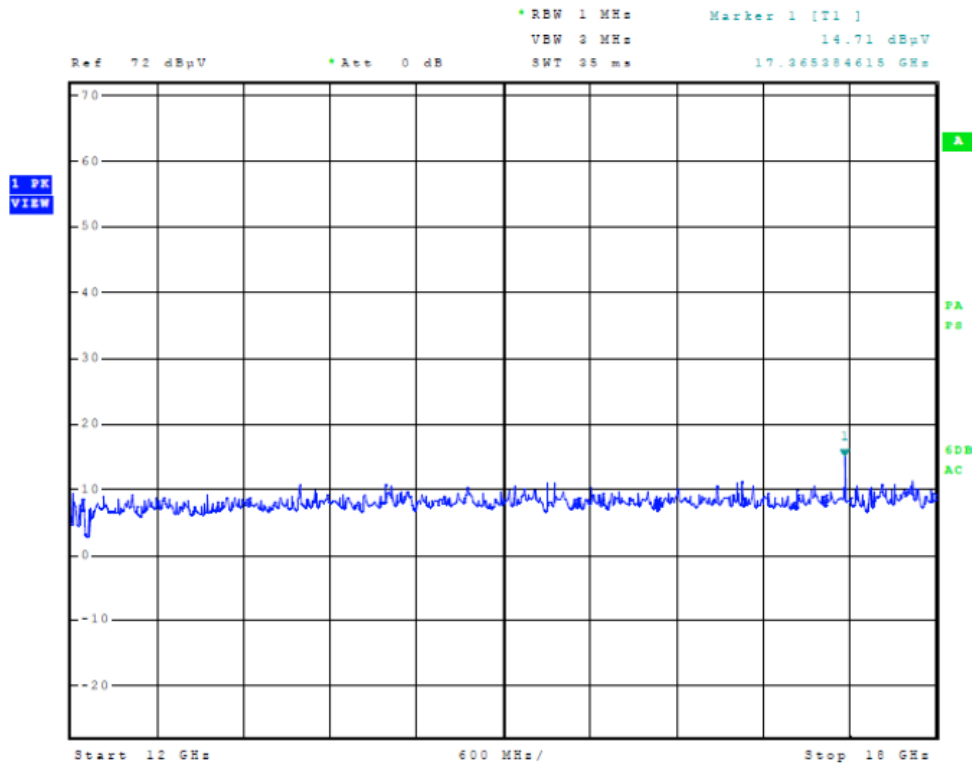



**Figure Eight Radiated Emissions taken at 1 meter in screen room**

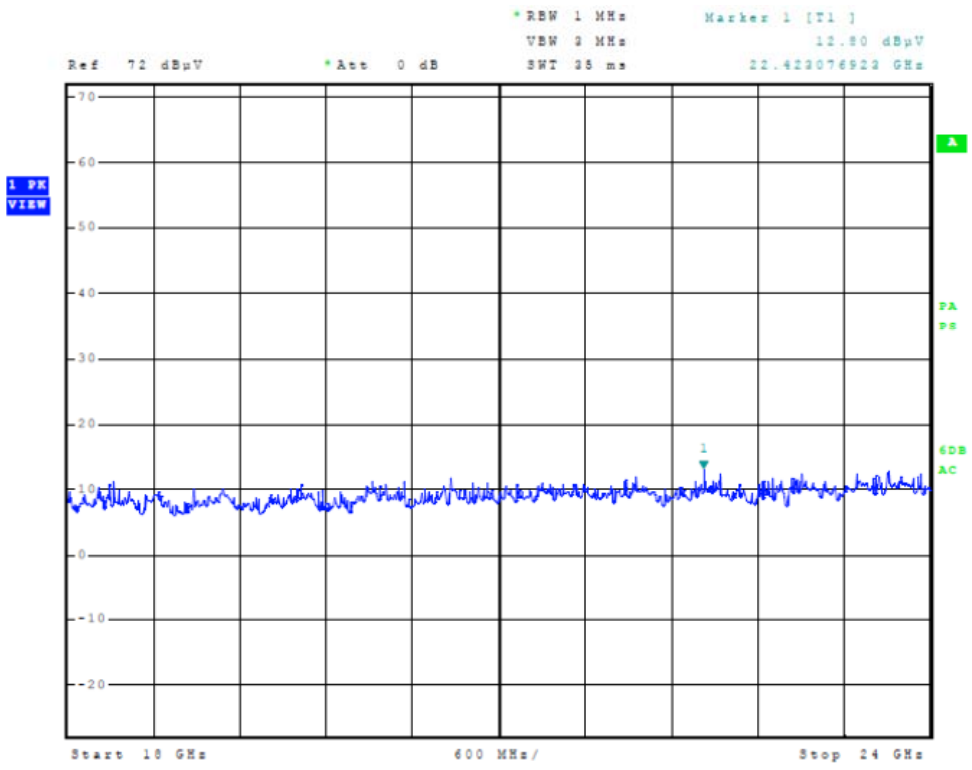



**Figure Nine Radiated Emissions taken at 1 meter in screen room**

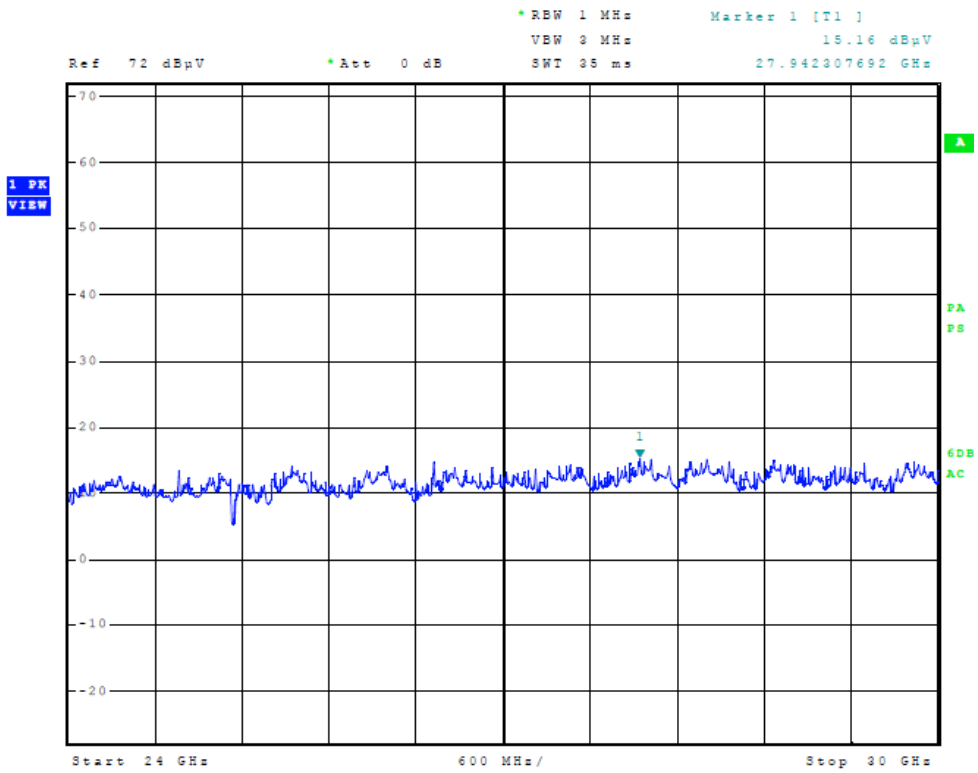



**Figure Ten Radiated Emissions taken at 1 meter in screen room**

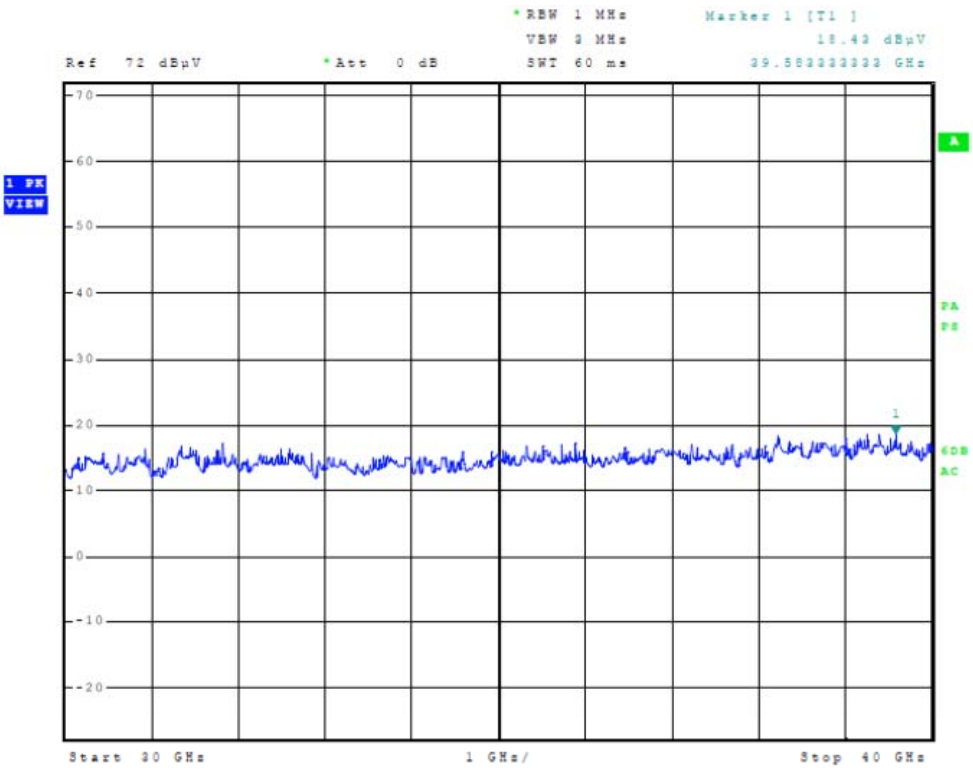



**Figure Eleven Radiated Emissions taken at 1 meter in screen room**

## *Transmitter Emissions Data*

### General Radiated Emissions from EUT Data (Highest Emissions)

| Frequency in MHz | Horizontal Peak (dBµV) | Horizontal Quasi-Peak (dBµV) | Horizontal Average (dBµV) | Vertical Peak (dBµV) | Vertical Quasi-Peak (dBµV) | Vertical Average (dBµV) | Limit @ 3m (dBµV/m) |
|---|---|---|---|---|---|---|---|
| 76.6 | 40.0 | 35.5 | N/A | 37.2 | 33.4 | N/A | 40.0 |
| 77.2 | 39.9 | 36.3 | N/A | 38.1 | 35.6 | N/A | 40.0 |
| 79.2 | 40.1 | 36.9 | N/A | 35.9 | 35.6 | N/A | 40.0 |
| 79.2 | 40.1 | 36.9 | N/A | 35.9 | 32.5 | N/A | 40.0 |
| 81.2 | 40.7 | 36.0 | N/A | 41.3 | 32.8 | N/A | 40.0 |
| 86.0 | 39.3 | 35.2 | N/A | 39.1 | 31.9 | N/A | 40.0 |
| 94.4 | 42.1 | 39.7 | N/A | 43.8 | 40.2 | N/A | 43.5 |
| 95.2 | 44.7 | 39.0 | N/A | 45.2 | 39.9 | N/A | 43.5 |
| 95.8 | 45.5 | 40.2 | N/A | 43.6 | 38.6 | N/A | 43.5 |
| 98.4 | 43.5 | 39.5 | N/A | 45.2 | 40.1 | N/A | 43.5 |
| 101.8 | 37.8 | 36.0 | N/A | 38.7 | 33.8 | N/A | 43.5 |
| 104.7 | 42.5 | 39.2 | N/A | 42.4 | 39.4 | N/A | 43.5 |
| 108.8 | 43.9 | 38.9 | N/A | 40.7 | 34.4 | N/A | 43.5 |
| 212.5 | 36.7 | 32.3 | N/A | 30.8 | 26.2 | N/A | 43.5 |
| 223.4 | 41.2 | 37.9 | N/A | 37.2 | 32.9 | N/A | 46.0 |
| 246.0 | 37.6 | 27.9 | N/A | 27.3 | 23.9 | N/A | 46.0 |
| 254.0 | 43.2 | 25.4 | N/A | 34.8 | 24.6 | N/A | 46.0 |
| 400.0 | 37.8 | 32.4 | N/A | 41.1 | 36.7 | N/A | 46.0 |
| 600.0 | 47.2 | 42.1 | N/A | 38.3 | 33.0 | N/A | 46.0 |
| 800.0 | 45.4 | 40.7 | N/A | 43.5 | 37.1 | N/A | 46.0 |

Other emissions present had amplitudes at least 20 dB below the limit.
Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz.
Average amplitude emissions are recorded above for frequency range above 1000 MHz.

**Transmitter Radiated Emission (17dBi Integral Antenna, Worst-case)**

| Frequency in MHz | Horizontal Peak (dBµV) | Horizontal Average (dBµV) | Vertical Peak (dBµV) | Vertical Average (dBµV) | Limit @ 3m (dBµV/m) |
|---|---|---|---|---|---|
| 5740.0 | 135.6 | 124.7 | 134.7 | 123.2 | -- |
| 11480.0 | 56.5 | 39.4 | 52.6 | 40.3 | 54.0 |
| 17220.0 | 56.0 | 42.6 | 57.3 | 43.9 | 54.0 |
| 22960.0 | 38.3 | 25.5 | 37.6 | 25.2 | 54.0 |
| 28700.0 | 38.2 | 24.9 | 38.2 | 25.2 | 54.0 |
| 5785.0 | 135.3 | 124.4 | 134.2 | 122.9 | -- |
| 11570.0 | 61.7 | 46.2 | 55.2 | 39.4 | 54.0 |
| 17355.0 | 56.1 | 43.0 | 57.7 | 43.5 | 54.0 |
| 23140.0 | 38.7 | 26.0 | 38.8 | 26.0 | 54.0 |
| 28925.0 | 38.9 | 26.1 | 39.6 | 26.4 | 54.0 |
| 5830.0 | 135.8 | 125.0 | 132.9 | 122.0 | -- |
| 11660.0 | 63.1 | 47.0 | 56.2 | 40.9 | 54.0 |
| 17490.0 | 55.2 | 42.6 | 58.4 | 43.5 | 54.0 |
| 23320.0 | 36.2 | 22.2 | 35.1 | 23.3 | 54.0 |
| 29150.0 | 38.0 | 25.0 | 38.2 | 25.3 | 54.0 |

Other emissions present had amplitudes at least 20 dB below the limit.
Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz.
Average amplitude emissions are recorded above for frequency range above 1000 MHz.

### *Summary of Results for Transmitter Radiated Emissions of Intentional Radiator*

The EUT demonstrated compliance with the conducted and radiated emissions requirements of CFR47 Part 15.247. The EUT demonstrated a minimum radiated emission margin of -7.0 dB below the harmonic emission requirements. There are no other significantly 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 requirements. The specifications of 15.247 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 demonstrate compliance with the CFR47 Part 15C emissions standards. There were no deviations to the specifications.

## Annex

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

The test equipment 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 |
|---|---|
| Spectrum Analyzer: Rohde & Schwarz ESU40 | 5/11 |
| Spectrum Analyzer: HP 8562A, HP Adapters: 11518, 11519, and 11520 Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W | 5/11 |
| Spectrum Analyzer: HP 8591EM | 5/11 |
| Antenna: EMCO Biconilog Model: 3143 | 5/11 |
| Antenna: Sunol Biconilog Model: JB6 | 10/10 |
| Antenna: EMCO Log Periodic Model: 3147 | 10/10 |
| Antenna: Antenna Research Biconical Model: BCD 235 | 10/10 |
| LISN: Compliance Design Model: FCC-LISN-2.Mod.cd, 50 µHy/50 ohm/0.1 µf | 10/10 |
| R.F. Preamp CPPA-102 | 10/10 |
| Attenuator: HP Model: HP11509A | 10/10 |
| Attenuator: Mini Circuits Model: CAT-3 | 10/10 |
| Attenuator: Mini Circuits Model: CAT-3 | 10/10 |
| Cable: Belden RG-58 (L1) | 10/10 |
| Cable: Belden RG-58 (L2) | 10/10 |
| Cable: Belden 8268 (L3) | 10/10 |
| Cable: Time Microwave: 4M-750HF290-750 | 10/10 |
| Cable: Time Microwave: 10M-750HF290-750 | 10/10 |
| Frequency Counter: Leader LDC825 | 2/11 |
| Oscilloscope Scope: Tektronix 2230 | 2/11 |
| Wattmeter: Bird 43 with Load Bird 8085 | 2/11 |
| Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140 | 2/11 |
| R.F. Generators: HP 606A, HP 8614A, HP 8640B | 2/11 |
| R.F. Power Amp 65W Model: 470-A-1010 | 2/11 |
| R.F. Power Amp 50W M185- 10-501 | 2/11 |
| R.F. Power Amp A.R. Model: 10W 1010M7 | 2/11 |
| R.F. Power Amp EIN Model: A301 | 2/11 |
| LISN: Compliance Eng. Model 240/20 | 2/11 |
| LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08 | 2/11 |
| Antenna: EMCO Dipole Set 3121C | 2/11 |
| Antenna: C.D. B-101 | 2/11 |
| Antenna: Solar 9229-1 & 9230-1 | 2/11 |
| Antenna: EMCO 6509 | 2/11 |
| Audio Oscillator: H.P. 201CD | 2/11 |
| Peavey Power Amp Model: IPS 801 | 2/11 |
| ELGAR Model: 1751 | 2/11 |
| ELGAR Model: TG 704A-3D | 2/11 |
| ESD Test Set 2010i | 2/11 |
| Fast Transient Burst Generator Model: EFT/B-101 | 2/11 |
| Field Intensity Meter: EFM-018 | 2/11 |
| KEYTEK Ecat Surge Generator | 2/11 |
| 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. Engineering experience includes six years in the automated controls industry and remaining 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

NVLAP Lab Code 200087-0

## *Annex D FCC Site Registration Letter*

# FEDERAL COMMUNICATIONS COMMISSION

**Laboratory Division**
**7435 Oakland Mills Road**
**Columbia, MD 21046**

May 18, 2010

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 18, 2010

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

NVLAP Lab Code 200087-0

## *Annex E Industry Canada Site Registration Letter*

Industry Canada Industrie Canada

May 26, 2010

OUR FILE: 46405-3041
Submission No: 140719

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

***Attention***: Mr. Scot D. Rogers

Dear Sir/Madame:

The Bureau has received your application for the 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 **( 3041A-1 ).** Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please keep for your records the following information;

- Your primary code is: **3041**

- The company number associated to the site(s) located at the above address is: **3041A**

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 or later shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 metre OATS or 3 metre 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;
http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/h_tt00052e.html.

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,

Dalwinder Gill
For: Wireless Laboratory Manager
**Certification and Engineering Bureau**
3701 Carling Ave., Building 94
P.O. Box 11490, Station "H"
Ottawa, Ontario K2H 8S2
Email: dalwinder.gill@ic.gc.ca
Tel. No. (613) 998-8363
Fax. No. (613) 990-4752