**FCC CFR47 PART 15 SUBPART C**
**FCC CFR47 PART 15 SUBPART B**
**INDUSTRY CANADA RSS-210 ISSUE 8**
**INDUSTRY CANADA RSS-GEN ISSUE 3**

# CERTIFICATION TEST REPORT

**FOR**

**Wireless Card Reader**

**MODEL NUMBER: ViVOpay 8850**

**FCC ID: Q55VP8850**
**IC: 5141A-VP8850**

**REPORT NUMBER: 11U14111-1**

**ISSUE DATE: NOVEMBER 18, 2011**

*Prepared for*
**ViVOtech, Inc.**
**451 EL CAMINO REAL**
**SANTA CLARA, CA 95050, U.S.A.**

*Prepared by*
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NVLAP LAB CODE 200065-0

Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| -- | 11/18/11 | Initial Issue | S. Leitner |

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** ViVOtech, Inc.
451 EL CAMINO REAL
SANTA CLARA, CA 95050, U.S.A.

**EUT DESCRIPTION:** Wireless Card Reader

**MODEL:** ViVOpay 8850

**SERIAL NUMBER:** 540-2801-02

**DATE TESTED:** NOVEMBER 8-15, 2011

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| FCC PART 15 SUBPART C | Pass |
| FCC PART 15 SUBPART B | Pass |
| INDUSTRY CANADA RSS-210 Issue 8 | Pass |
| INDUSTRY CANADA RSS-GEN Issue 3 | Pass |

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:

STEVE LEITNER
EMC SUPERVISOR
UL CCS

Tested By:

TOM CHEN
EMC ENGINEER
UL CCS

# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

# 4. CALIBRATION AND UNCERTAINTY

## 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

## 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER | UNCERTAINTY |
|---|---|
| Conducted Disturbance, 0.15 to 30 MHz | 3.52 dB |
| Radiated Disturbance, 30 to 1000 MHz | 4.94 dB |

Uncertainty figures are valid to a confidence level of 95%.

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

ViVOpay 8850 is a Wireless Card Reader, operating at 13.56 MHz, intended for tabletop mounting. The EUT has an RJ-45 port labeled for connection to a cable terminated with either an RS-232 connector or a USB connector. The EUT also has an RJ-45 Ethernet port that the manufacturer states is currently not active or supported. Internally generated frequencies include 12 MHz, 24 MHz, and 27.12 MHz.

## 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum E field as follows:

| Frequency (MHz) | Mode | Fundamental E field @ 10m distance (dBuv/m) |
|---|---|---|
| 13.56 | Normal TX mode | 55.49 |

The transmitter has a maximum E-field at 10m distance as follows:
EIRP = E field at 3m distance – 95.2
E field at 3m distance = E field at 10m distance + 20 = 55.49 + 20 = 75.49 dBµV/m
EIRP = 75.49 - 95.2 = **-19.71 dBm**

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The 13.56 MHz antenna is integrated inside the product, around the LCD area invisible to the user.

## 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was version HG1AR-2.1.1 C04.

## 5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was powered by the AC adapter and connected to laptop PC. A demo credit card together with proprietary software on the laptop was used to confirm normal operation.

## 5.6. MODIFICATIONS

A ferrite bead, Fair-Rite part number 0431164951, was added at the EUT end on the USB and RS-232 cables, as well as at the EUT end of the power supply cable. For the USB radiated emissions test, one turn was required on the ferrite added to the power supply cable.

## 5.7. DESCRIPTION OF TEST SETUP

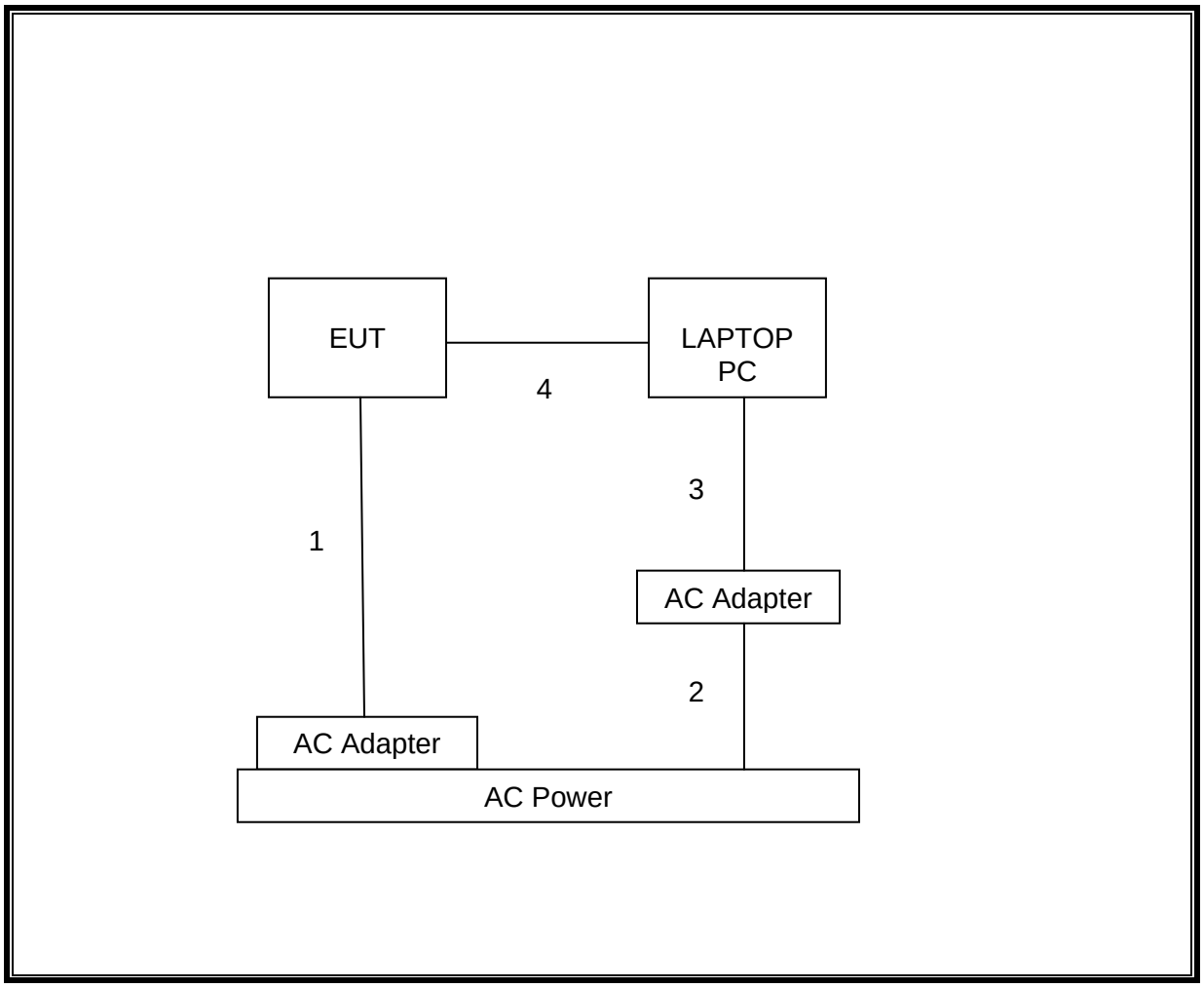
**SUPPORT EQUIPMENT**

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number / Part Number** | **FCC ID** |
| AC/DC adapter | Global Power | 3A-161WP09 | GPWAC-15-09-VT | N/A |
| Laptop PC | DELL | Latitude D610 | CN-0U8082-48643-5CE-5546 | DoC |
| AC/DC adapter | DELL | HA65NS1-00 | CN-0HN662-47890-79I-C03L | N/A |

**I/O CABLES**

| I/O CABLE LIST | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No.** | **Port** | **# of Identical Ports** | **Connector Type** | **Cable Type** | **Cable Length** | **Remarks** |
| 1 | DC | 1 | Barrel | Unshielded | 2 m | Ferrite at both ends. At EUT end, one turn was applied. |
| 2 | AC | 1 | 2-blade | Unshielded | 1 m | N/A |
| 3 | DC | 1 | Barrel | Unshielded | 2 m | N/A |
| 4 | Serial/USB | 1 | RJ-45 | Unshielded | USB 1.8 m RS232 1 m | Can be either RS-232 or USB connector at opposite end. Ferrite at EUT end. |

**TEST SETUP DIAGRAM**



# 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| TEST EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Asset** | **Cal Due** |
| Spectrum Analyzer, 44 GHz | Agilent / HP | E4446A | C01012 | 09/02/12 |
| Preamplifier, 1300 MHz | Agilent / HP | 8447D | C00558 | 01/27/12 |
| Antenna, Horn, 18 GHz | EMCO | 3115 | C00872 | 09/20/12 |
| Antenna, Bilog, 2 GHz | Sunol Sciences | JB1 | C01171 | 07/16/12 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | E4446A | C01159 | 08/11/12 |
| EMI Test Receiver, 9 kHz-7 GHz | R & S | ESCI 7 | 1000741 | 07/06/12 |
| LISN, 30 MHz | FCC | LISN-50/250-25-2 | N02625 | 11/14/12 |
| Antenna, Loop, 30 MHz | EMCO | 6502 | C00593 | 02/10/13 |
| Temperature / Humidity Chamber | Thermotron | SE 600-10-10 | C00930 | 04/20/12 |

# 7. RADIATED EMISSION TEST RESULTS

## 7.1. LIMITS AND PROCEDURE

**LIMIT**

§15.225
IC RSS-210, Section 2.6 (Transmitter)
IC RSS-GEN, Section 6 (Receiver)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Limits for radiated disturbance of an intentional radiator | | |
|---|---|---|
| Frequency range (MHz) | Limits (µV/m) | Measurement Distance (m) |
| 0.009 – 0.490 | 2400 / F (kHz) | 300 |
| 0.490 – 1.705 | 24000 / F (kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100** | 3 |
| 88 - 216 | 150** | 3 |
| 216 – 960 | 200** | 3 |
| Above 960 | 500 | 3 |

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

The formula for converting the field strength from µV/m to dBµV/m is:
Limit (dBµV/m) = 20 log limit (µV/m)

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

**TEST PROCEDURE**

ANSI C63.4

§15.209 specifies that spurious emission are to be measured up to the tenth harmonic of the transmitter fundamental frequency. Thus, for this EUT spurious emissions were measured to 136 MHz (10 × the 13.56 MHz fundamental).

§15.209 also specifies that emissions that must be measured above the tenth harmonic applicable to an incorporated digital device are to comply with the general radiated emission limits in §15.109. As a digital device, with a highest frequency generated or used of 27.12 MHz (according to the manufacturer), radiated emissions were measured between 30 MHz and 1000 MHz.

The plots for spurious emissions show §15.209 limits applied to the range 30 MHz to 1000 MHz (equivalent to FCC Class B). The subsequent summary tables provide data for spurious emissions per §15.209 as wells as interpolated results applied to the limits for a Class A digital device per §15.109.

**RESULTS**

# 7.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)

**FCC Part 15, Subpart B & C** **10 Meter Distance Measurement At Open Field**

**Company: Vivotech**
**Project #: 11U14111**
**Model #: ViVOpay 8850**
**Tester: Tom Chen**
**Date: 11/9/2011**

| Frequency | PK | QP | AV | AF | Distance | PK Corrected | AV Corrected | QP Limit | AV Limit | PK Margin | AV Margin | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBu/V) | (dBu/V) | (dBuV) | dB/m | Correction (dB) | Reading (dBuV/m) | Reading (dBuV/m) | (dBuV/m) | (dBuV/m) | (dB) | (dB) | |
| Loop Antenna Face On: | | | | | | | | | | | | |
| 13.56 | 44.9 | | N/A | 10.56 | -19.08 | 36.37 | N/A | 84.00 | N/A | -47.6 | N/A | Fundamental @ 10m Dist |
| 13.41 | 20.52 | | N/A | 10.54 | -19.08 | 11.98 | N/A | 50.48 | N/A | -38.5 | N/A | 13.41-13.553MHz Spurious @ 10m |
| 13.553 | 19.12 | | N/A | 10.56 | -19.08 | 10.59 | N/A | 50.48 | N/A | -39.9 | N/A | 13.41-13.553MHz Spurious @ 10m |
| 13.567 | 42.32 | | N/A | 10.56 | -19.08 | 33.79 | N/A | 50.48 | N/A | -16.7 | N/A | 13.567-13.710MHz Spurious @ 10m |
| 13.71 | 20.31 | | N/A | 10.57 | -19.08 | 11.80 | N/A | 50.48 | N/A | -38.7 | N/A | 13.567-13.710MHz Spurious @ 10m |
| 13.11 | 15.36 | | N/A | 10.51 | -19.08 | 6.79 | N/A | 40.51 | N/A | -33.7 | N/A | 13.110-13.410MHz Spurious @ 10m |
| 13.41 | 20.52 | | N/A | 10.54 | -19.08 | 11.98 | N/A | 40.51 | N/A | -28.5 | N/A | 13.110-13.410MHz Spurious @ 10m |
| 13.71 | 20.31 | | N/A | 10.57 | -19.08 | 11.80 | N/A | 40.51 | N/A | -28.7 | N/A | 13.710-14.010MHz Spurious @ 10m |
| 14.01 | 16.7 | | N/A | 10.6 | -19.08 | 8.22 | N/A | 40.51 | N/A | -32.3 | N/A | 13.710-14.010MHz Spurious @ 10m |
| 27.145 | 30.06 | | N/A | 9.043 | -19.08 | 20.02 | N/A | 29.54 | N/A | -9.5 | N/A | 14.010-30MHz Spurious @ 10m |
| Loop Antenna Face Off: | | | | | | | | | | | | |
| 13.56 | 64.02 | | N/A | 10.56 | -19.08 | 55.49 | N/A | 84.00 | N/A | -28.5 | N/A | Fundamental @ 10m Dist |
| 13.41 | 32.51 | | N/A | 10.54 | -19.08 | 23.97 | N/A | 50.48 | N/A | -26.5 | N/A | 13.41-13.553MHz Sprious @ 10m |
| 13.553 | 48.94 | | N/A | 10.56 | -19.08 | 40.41 | N/A | 50.48 | N/A | -10.1 | N/A | 13.41-13.553MHz Sprious @ 10m |
| 13.567 | 48.28 | | N/A | 10.56 | -19.08 | 39.75 | N/A | 50.48 | N/A | -10.7 | N/A | 13.567-13.710MHz Spurious @ 10m |
| 13.71 | 31.35 | | N/A | 10.57 | -19.08 | 22.84 | N/A | 50.48 | N/A | -27.6 | N/A | 13.567-13.710MHz Spurious @ 10m |
| 13.11 | 15.5 | | N/A | 10.51 | -19.08 | 6.93 | N/A | 40.51 | N/A | -33.6 | N/A | 13.110-13.410MHz Spurious @ 10m |
| 13.41 | 32.51 | | N/A | 10.54 | -19.08 | 23.97 | N/A | 40.51 | N/A | -16.5 | N/A | 13.110-13.410MHz Spurious @ 10m |
| 13.71 | 31.35 | | N/A | 10.57 | -19.08 | 22.84 | N/A | 40.51 | N/A | -17.7 | N/A | 13.710-14.010MHz Spurious @ 10m |
| 14.01 | 17.17 | | N/A | 10.6 | -19.08 | 8.69 | N/A | 40.51 | N/A | -31.8 | N/A | 13.710-14.010MHz Spurious @ 10m |
| 27.145 | 30.14 | | N/A | 9.043 | -19.08 | 20.10 | N/A | 29.54 | N/A | -9.4 | N/A | 14.010-30MHz Spurious @ 10m |

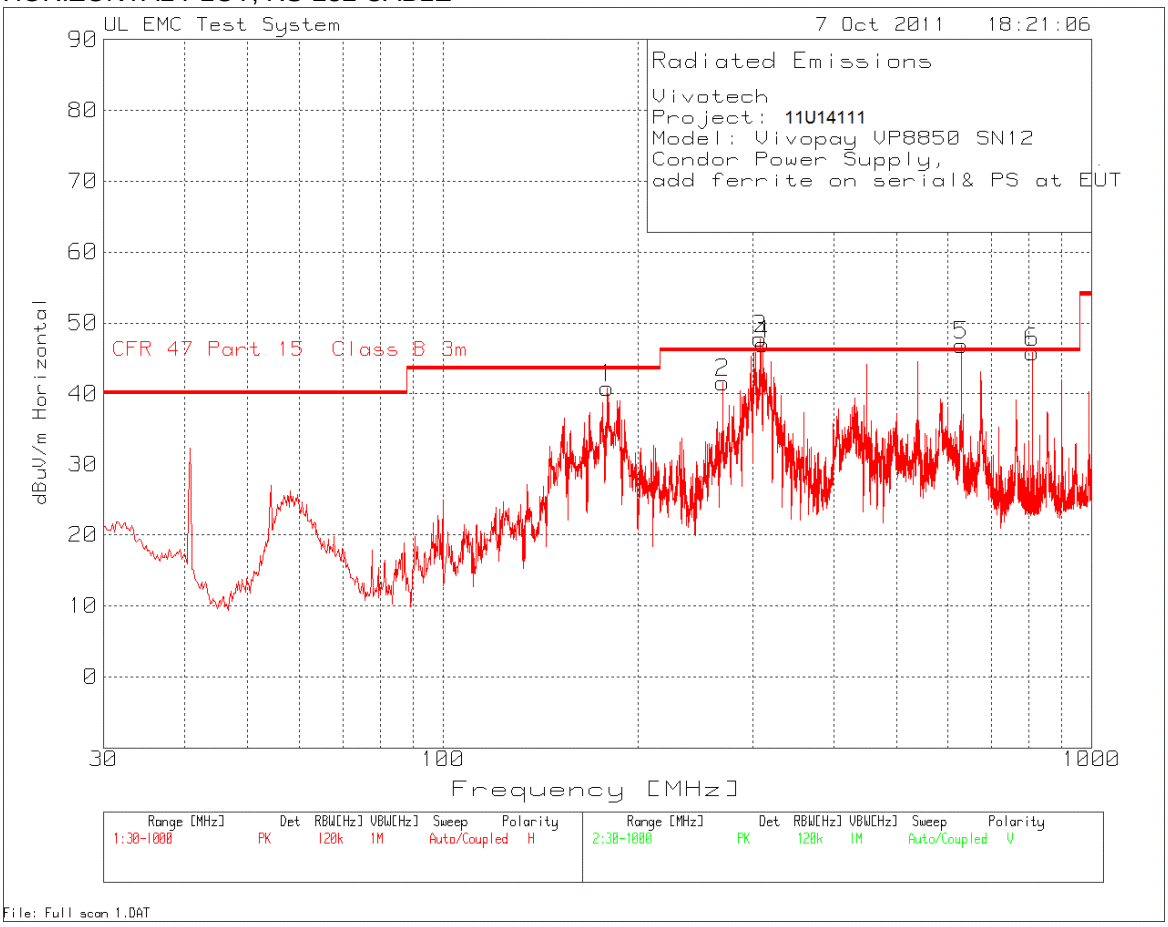
* No more emissions were found up to 30MHz

Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector.

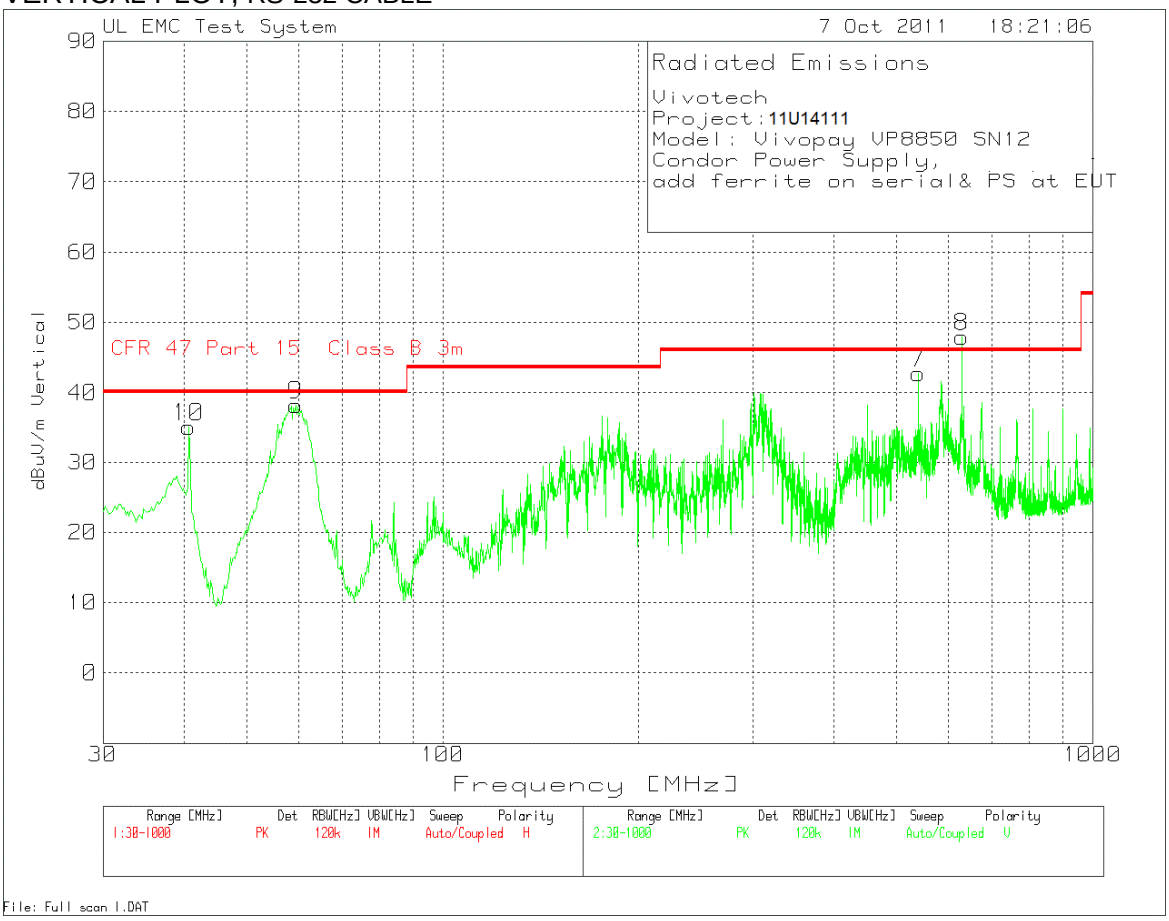
P.K. = Peak
Q.P. = Quasi Peak Readings
A.F. = Antenna factor

## 7.3. TX SPURIOUS AND RADIATED EMISSIONS 30 TO 1000 MHz

HORIZONTAL PLOT, RS-232 CABLE



VERTICAL PLOT, RS-232 CABLE



## HORIZONTAL AND VERTICAL DATA, RS-232 CABLE

Vivotech
Project: 11U14111
Model: Vivopay VP8850 SN12
Condor Power Supply,
add ferrite on serial& PS at EUT
T. Nguyen

TX SPURIOUS EMISSIONS 30 MHz TO TENTH HARMONIC

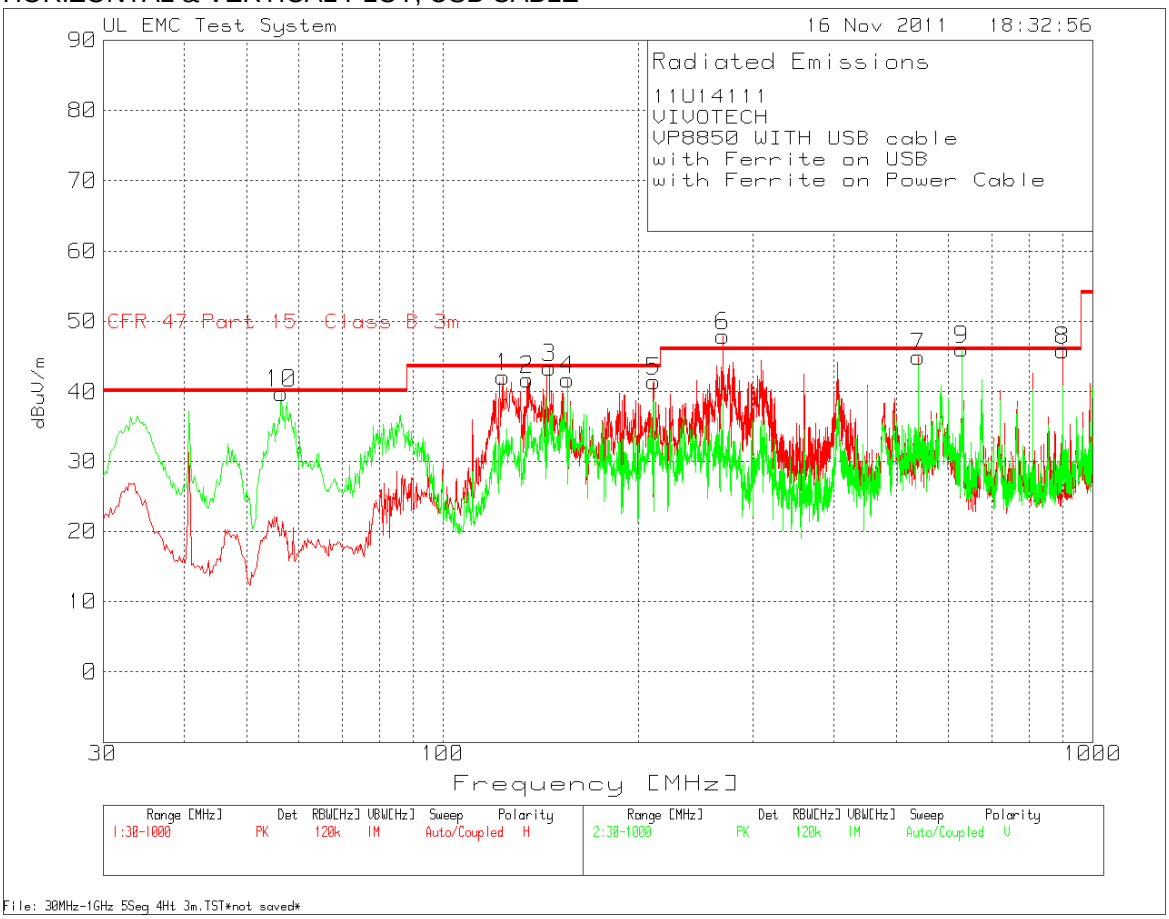
| Test Frequency | Meter Reading | Detector | Chamber 5B Cable [dB] | T10 PreAmp [dB] | T130 Bilog [dB] | Corrected dBuV/m | 15.209 3m limit | 15.209 QP Margin | Height [cm] | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|
| 40.6615 | 49.87 | PK | 0.9 | -29.4 | 13.7 | 35.07 | 40 | -4.93 | 100 | Vert |
| 59.4644 | 58.49 | PK | 1.2 | -29.4 | 7.9 | 38.19 | 40 | -1.81 | 100 | Vert |

RADIATED EMISSIONS 30 MHz TO 1000 MHz (CLASS A DIGITAL DEVICE)

| Test Frequency | Meter Reading | Detector | Chamber 5B Cable [dB] | T10 PreAmp [dB] | T130 Bilog [dB] | 10m to 3m Conversion | Corrected dBuV/m | Class A QP 10m limit | Class A QP Margin | Height [cm] | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 179.2606 | 57.25 | PK | 1.8 | -29 | 10.8 | -10.5 | 30.35 | 43.5 | -13.15 | 200 | Horz |
| 269.98 | 55.45 | PK | 2.3 | -28.6 | 12.4 | -10.5 | 31.05 | 46 | -14.95 | 100 | Horz |
| 308.5552 | 60.47 | PK | 2.5 | -28.6 | 13.4 | -10.5 | 37.27 | 46 | -8.73 | 100 | Horz |
| 810.2258 | 49.68 | PK | 4 | -28.9 | 21.1 | -10.5 | 35.38 | 46 | -10.62 | 100 | Horz |
| | | | | | | | | | | | |
| 40.6615 | 49.87 | PK | 0.9 | -29.4 | 13.7 | -10.5 | 24.57 | 39 | -14.43 | 100 | Vert |
| 59.4644 | 58.49 | PK | 1.2 | -29.4 | 7.9 | -10.5 | 27.69 | 39 | -11.31 | 100 | Vert |
| 540.006 | 51.56 | PK | 3.2 | -29.4 | 17.4 | -10.5 | 32.26 | 46 | -13.74 | 100 | Vert |
| 630.1439 | 55.25 | PK | 3.5 | -29.3 | 18.5 | -10.5 | 37.45 | 46 | -8.55 | 100 | Vert |

PK - Peak detector
QP - Quasi-Peak detector

HORIZONTAL & VERTICAL PLOT, USB CABLE



HORIZONTAL AND VERTICAL DATA, USB CABLE

11U14111
VIVOTECH
VP8850 WITH USB cable
with Ferrite on USB
with Ferrite on Power Cable
D. Cieplik

TX SPURIOUS EMISSIONS 30 MHz TO TENTH HARMONIC

| Test Frequency | Meter Reading | Detector | Preamp and cable [dB] | 5m A T122 Bilog [dB] | Corrected dBuV/m | FCC 15.209 3m limit | QP Margin | Height [cm] | Polarity |
|---|---|---|---|---|---|---|---|---|---|
| 123.8209 | 55.15 | PK | -26.7 | 13.7 | 42.15 | 43.5 | -1.35 | 200 | Horz |
| 134.8701 | 55.06 | PK | -26.7 | 13.4 | 41.76 | 43.5 | -1.74 | 200 | Horz |
| 134.9164 | 50.59 | QP | -26.7 | 13.4 | 37.29 | 43.5 | -6.21 | 216 | Horz |
| | | | | | | | | | |
| 56.3629 | 58.95 | PK | -27.3 | 8.1 | 39.75 | 40 | -0.25 | 200 | Vert |
| 56.2219 | 48.17 | QP | -27.3 | 8.1 | 28.97 | 40 | -11.03 | 107 | Vert |

RADIATED EMISSIONS 30 MHz TO 1000 MHz (CLASS A DIGITAL DEVICE)

| Test Frequency | Meter Reading | Detector | Preamp and cable [dB] | 5m A T122 Bilog [dB] | 10m to 3m Conversion | Corrected dBuV/m | Class A QP 10m limit | Class A QP Margin | Height [cm] | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|
| 123.8209 | 55.15 | PK | -26.7 | 13.7 | -10.5 | 31.65 | 43.5 | -11.85 | 200 | Horz |
| 134.8701 | 55.06 | PK | -26.7 | 13.4 | -10.5 | 31.26 | 43.5 | -12.24 | 200 | Horz |
| 134.9164 | 50.59 | QP | -26.7 | 13.4 | -10.5 | 26.79 | 43.5 | -16.71 | 216 | Horz |
| 145.9193 | 57.1 | PK | -26.6 | 12.9 | -10.5 | 32.9 | 43.5 | -10.6 | 200 | Horz |
| 155.4177 | 56.16 | PK | -26.5 | 12.1 | -10.5 | 31.26 | 43.5 | -12.24 | 200 | Horz |
| 211.0512 | 55.52 | PK | -26.1 | 12 | -10.5 | 30.92 | 43.5 | -12.58 | 100 | Horz |
| 263.3896 | 50.96 | PK | -25.9 | 12.2 | -10.5 | 26.76 | 46 | -19.24 | 216 | Horz |
| 269.98 | 61.22 | PK | -25.7 | 12.4 | -10.5 | 37.42 | 46 | -8.58 | 100 | Horz |
| 540.006 | 52 | PK | -24.5 | 17.4 | -10.5 | 34.4 | 46 | -11.6 | 200 | Horz |
| 900.1699 | 47.36 | PK | -23.4 | 21.9 | -10.5 | 35.36 | 46 | -10.64 | 100 | Horz |
| 900.0085 | 42.42 | QP | -23.4 | 21.9 | -10.5 | 30.42 | 46 | -15.58 | 219 | Horz |
| 630.1439 | 51.05 | PK | -23.8 | 18.8 | -10.5 | 35.55 | 46 | -10.45 | 100 | Horz |
| | | | | | | | | | | |
| 56.3629 | 58.95 | PK | -27.3 | 8.1 | -10.5 | 29.25 | 39 | -9.75 | 200 | Vert |

PK - Peak detector
QP - Quasi-Peak detector
Av - Average detector

# 8. AC MAINS LINE CONDUCTED EMISSIONS

**LIMITS**

§15.207
IC RSS-GEN, Section 7.2.2

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

| Frequency range (MHz) | Limits (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |
| Notes:<br>1. The lower limit shall apply at the transition frequencies<br>2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. | | |

**TEST PROCEDURE**

ANSI C63.4

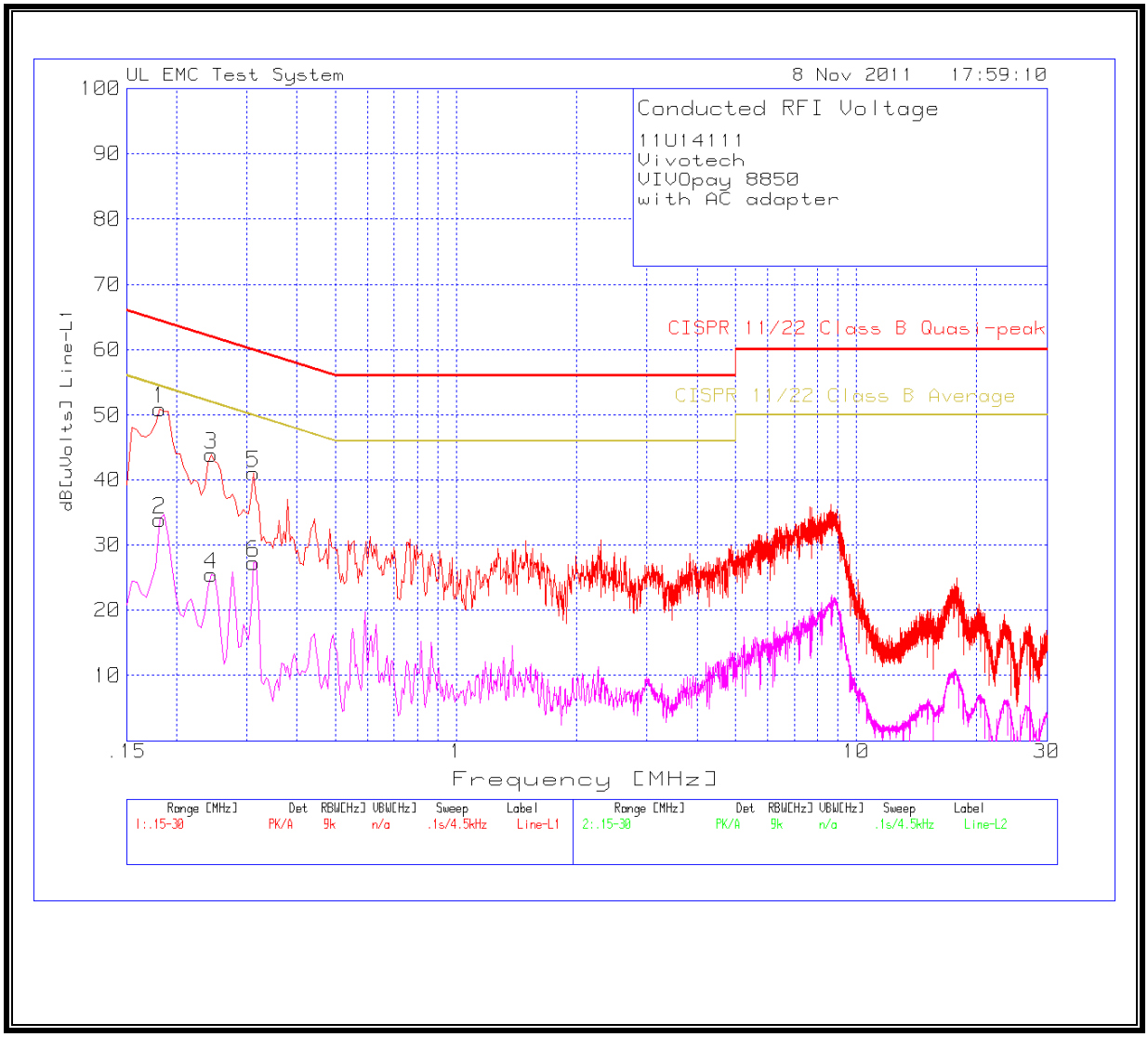
In accordance with ANSI C63.4, the antenna was detached from the EUT and replaced by a 50 Ω load (the load was specified by the manufacturer).

## RESULTS

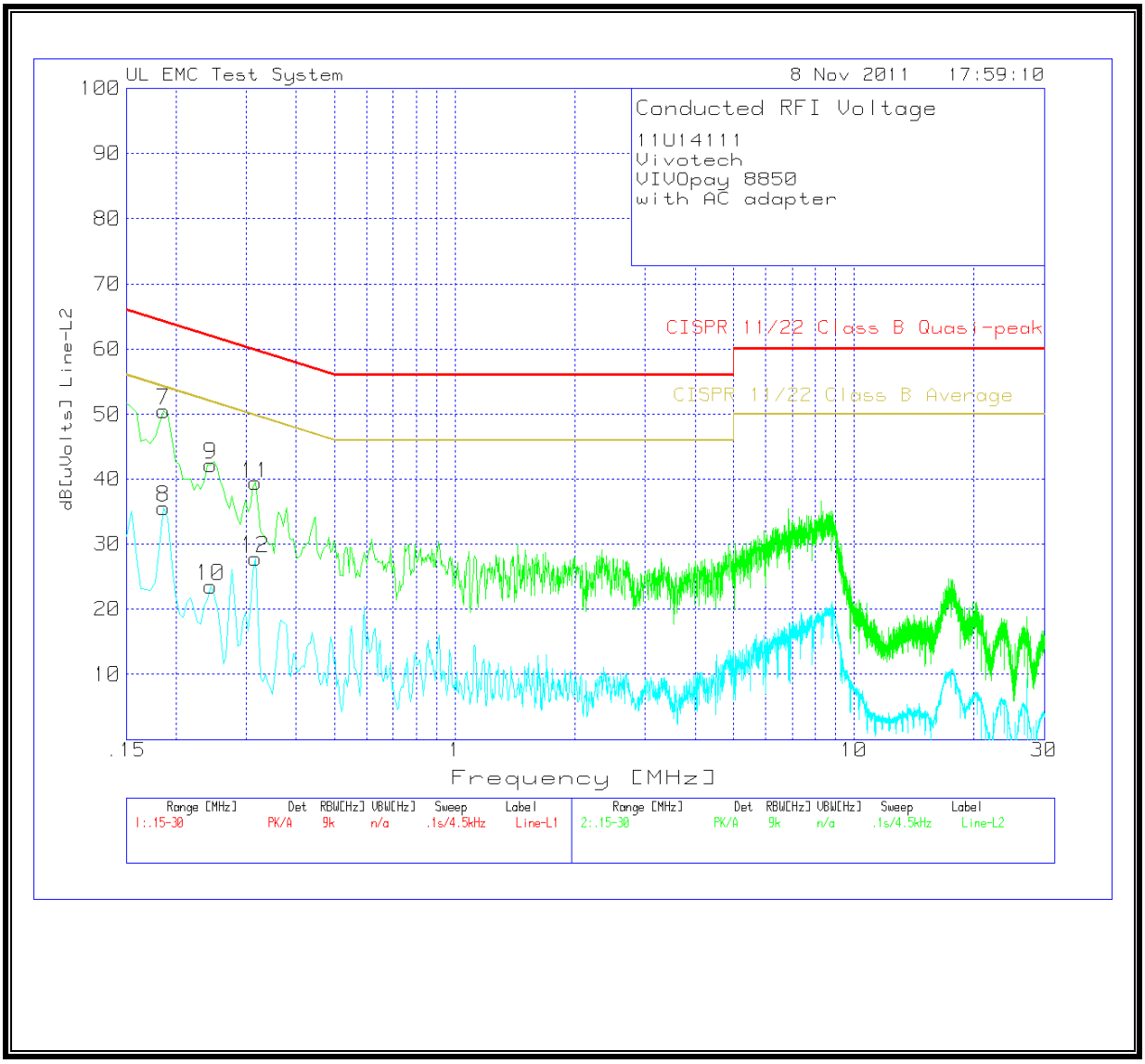
## 6 WORST EMISSIONS – RS-232 CABLE

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 11U14111 | | | | | | | |
| Vivotech | | | | | | | |
| VIVOpay 8850 | | | | | | | |
| with RS-232 Cable | | | | | | | |
| | | | | | | | |
| Line-L1 .15 - 30MHz | | | | | | | |
| **Test Frequency** | **Meter Reading** | **Detector** | **dB[uVolts]** | **CISPR Class B QP Limit** | **QP Margin** | **CISPR Class B Av Limit** | **Av Margin** |
| 0.1815 | 50.96 | PK | 50.96 | 64.4 | -13.44 | 54.4 | -3.44 |
| 0.1815 | 33.84 | Av | 33.84 | | | 54.4 | -20.56 |
| 0.2445 | 43.95 | PK | 43.95 | 61.9 | -17.95 | 51.9 | -7.95 |
| 0.2445 | 25.5 | Av | 25.5 | | | 51.9 | -26.4 |
| 0.312 | 41.16 | PK | 41.16 | 59.9 | -18.74 | 49.9 | -8.74 |
| 0.312 | 27.29 | Av | 27.29 | | | 49.9 | -22.61 |
| Line-L2 .15 - 30MHz | | | | | | | |
| 0.186 | 50.51 | PK | 50.51 | 64.2 | -13.69 | 54.2 | -3.69 |
| 0.186 | 35.5 | Av | 35.5 | | | 54.2 | -18.7 |
| 0.2445 | 42.26 | PK | 42.26 | 61.9 | -19.64 | 51.9 | -9.64 |
| 0.2445 | 23.45 | Av | 23.45 | | | 51.9 | -28.45 |
| 0.3165 | 39.36 | PK | 39.36 | 59.8 | -20.44 | 49.8 | -10.44 |
| 0.3165 | 27.82 | Av | 27.82 | | | 49.8 | -21.98 |
| | | | | | | | |
| PK - Peak detector | | | | | | | |
| QP - Quasi-Peak detector | | | | | | | |
| Av - Average detector | | | | | | | |

**LINE 1 RESULTS– RS-232 CABLE**



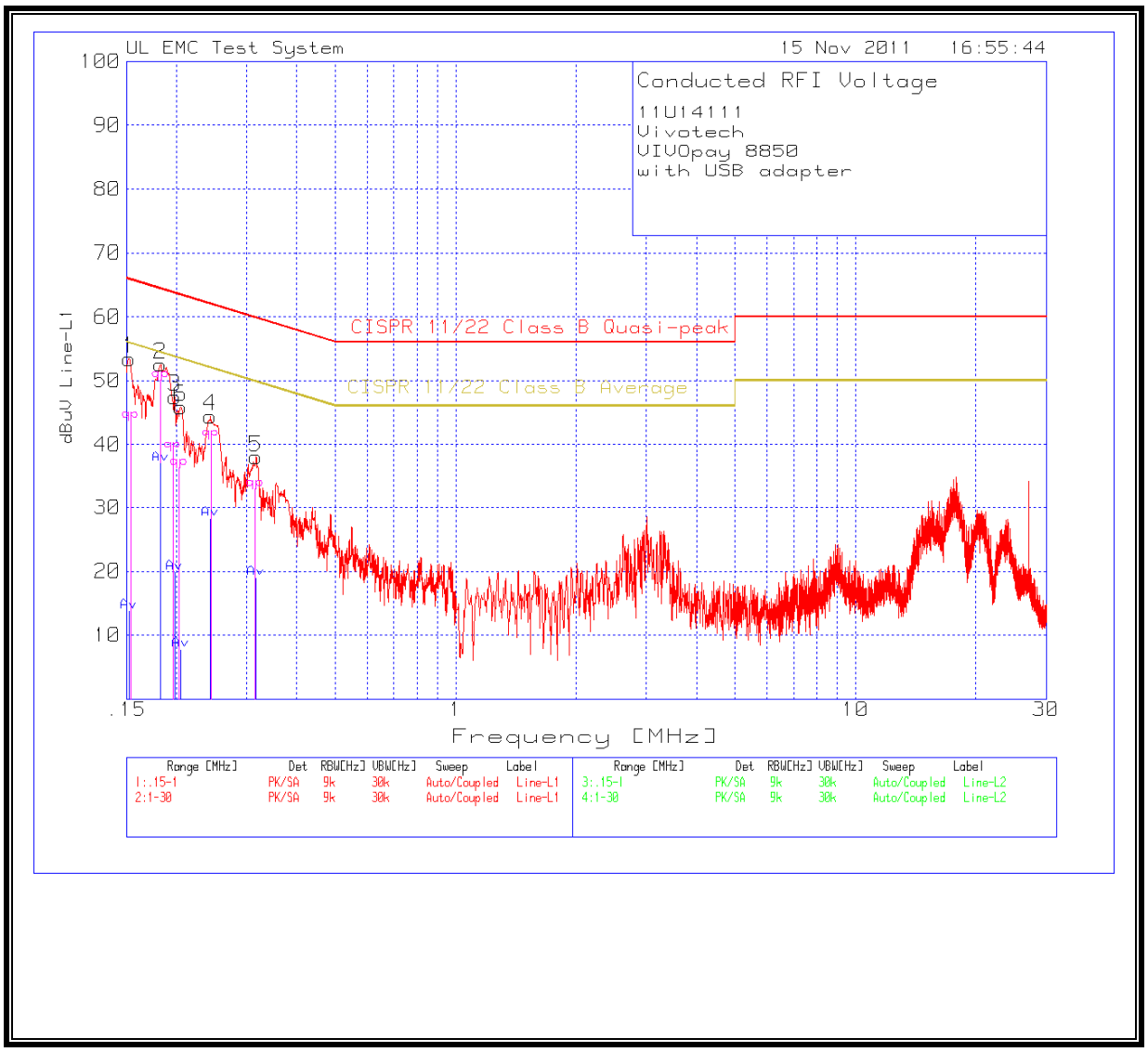
**LINE 2 RESULTS– RS-232 CABLE**



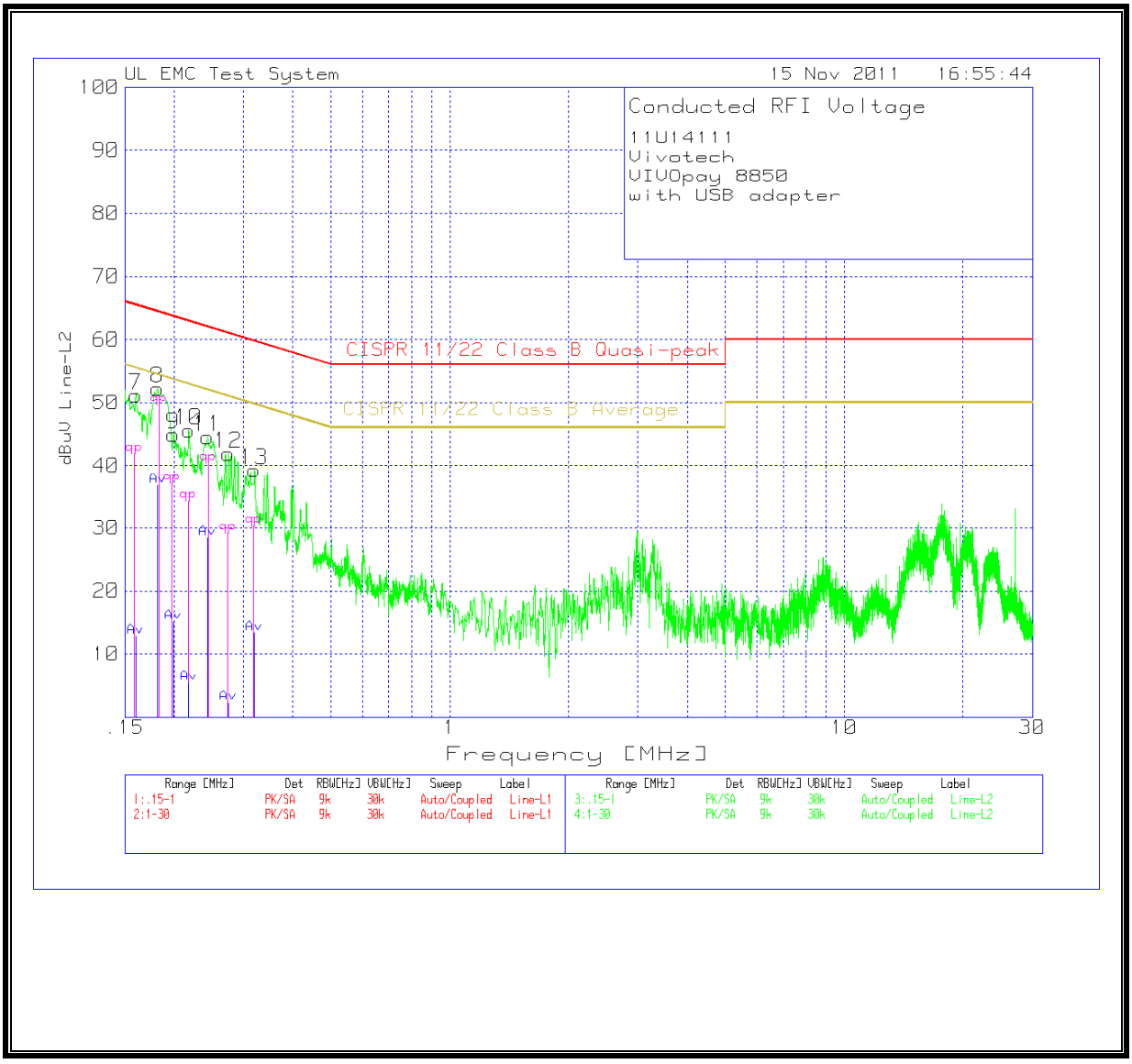
## 6 WORST EMISSIONS – USB CABLE

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11U14111 | | | | | | | | |
| Vivotech | | | | | | | | |
| VIVOpay 8850 | | | | | | | | |
| with USB adapter | | | | | | | | |
| D. Cieplik | | | | | | | | |
| Line-L1 .15 - 1MHz | | | | | | | | |
| Test Frequency | Meter Reading | Detector | Lisn T25 Path Loss [dB] | Corrected dBuV | CISPR Class B QP Limit | QP Margin | CISPR Class B Av Limit | Av Margin |
| 0.15212 | 51.64 | PK | 1.8 | 53.44 | 65.9 | -12.46 | 55.9 | -2.46 |
| 0.18285 | 51.15 | PK | 1.4 | 52.55 | 64.4 | -11.85 | 54.4 | -1.85 |
| 0.19785 | 46.3 | PK | 1.2 | 47.5 | 63.7 | -16.2 | 53.7 | -6.2 |
| 0.24316 | 43.48 | PK | 0.9 | 44.38 | 62 | -17.62 | 52 | -7.62 |
| 0.31649 | 37.27 | PK | 0.7 | 37.97 | 59.8 | -21.83 | 49.8 | -11.83 |
| 0.20507 | 44.66 | PK | 1.2 | 45.86 | 63.4 | -17.54 | 53.4 | -7.54 |
| Line-L2 .15 - 1MHz | | | | | | | | |
| 0.15991 | 49.32 | PK | 1.8 | 51.12 | 65.5 | -14.38 | 55.5 | -4.38 |
| 0.182 | 50.7 | PK | 1.5 | 52.2 | 64.4 | -12.2 | 54.4 | -2.2 |
| 0.19955 | 43.66 | PK | 1.3 | 44.96 | 63.6 | -18.64 | 53.6 | -8.64 |
| 0.21796 | 44.46 | PK | 1.2 | 45.66 | 62.9 | -17.24 | 52.9 | -7.24 |
| 0.2433 | 43.55 | PK | 1 | 44.55 | 62 | -17.45 | 52 | -7.45 |
| 0.27487 | 41.06 | PK | 0.9 | 41.96 | 61 | -19.04 | 51 | -9.04 |
| 0.31989 | 38.51 | PK | 0.7 | 39.21 | 59.7 | -20.49 | 49.7 | -10.49 |
| | | | | | | | | |
| PK - Peak detector | | | | | | | | |
| QP - Quasi-Peak detector | | | | | | | | |
| Av - Average detector | | | | | | | | |

**LINE 1 RESULTS – USB CABLE**



**LINE 2 RESULTS – USB CABLE**



# 9. FREQUENCY STABILITY

**LIMIT**

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

**TEST PROCEDURE**

ANSI / TIA / EIA 603 Clause 2.3.1 and 2.3.2

**RESULTS**

No non-compliance noted.

| **Reference Frequency: EUT Channel 13.56 MHz @ 20ºC**<br>**Limit: ± 100 ppm = 135.600 kHz** | | | | |
|---|---|---|---|---|
| **Power Supply (Vac)** | **Environment Temperature (ºC)** | **Frequency Deviation Measureed with Time Elapse** | | |
| | | **(MHz)** | **Delta (ppm)** | **Limit (ppm)** |
| 115.00 | 50 | 13.5600000 | 0.000 | ± 100 |
| 115.00 | 40 | 13.5600000 | 0.000 | ± 100 |
| 115.00 | 30 | 13.5600000 | 0.000 | ± 100 |
| ***115.00*** | ***20*** | ***13.5600000*** | ***0.000*** | ***± 100*** |
| 115.00 | 10 | 13.5600000 | 0.000 | ± 100 |
| 115.00 | 0 | 13.5600000 | 0.000 | ± 100 |
| 115.00 | -10 | 13.5603000 | -0.221 | ± 100 |
| 115.00 | -20 | 13.5603000 | -0.221 | ± 100 |
| 97.15 | 20 | 13.5600000 | 0.000 | ± 100 |
| 132.25 | 20 | 13.5600000 | 0.000 | ± 100 |

# 10. 99% BANDWIDTH

## LIMITS

None; for reporting purposes only.

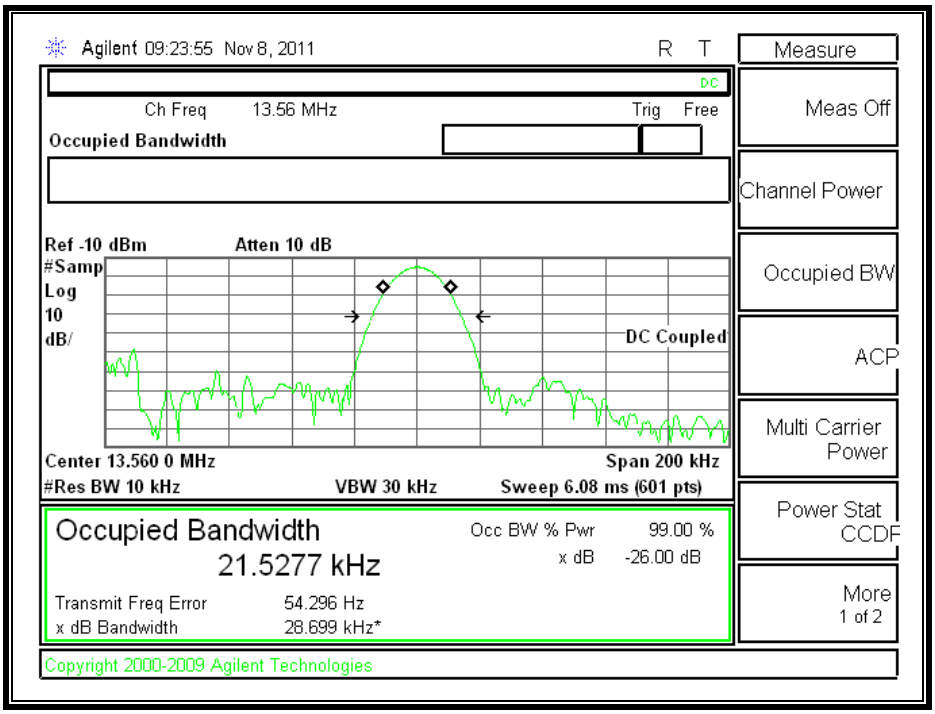
## TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

## RESULTS

| Frequency (MHz) | 99% Bandwidth (kHz) |
|---|---|
| 13.56 | 21.5277 |

## 99% BANDWIDTH



# 11. MAXIMUM PERMISSIBLE EXPOSURE

**FCC RULES**

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density ($mW/cm^2$) | Averaging time (minutes) |
|---|---|---|---|---|
| (A) Limits for Occupational/Controlled Exposures | | | | |
| 0.3–3.0 | 614 | 1.63 | *(100) | 6 |
| 3.0–30 | 1842/f | 4.89/f | *($900/f^2$) | 6 |
| 30–300 | 61.4 | 0.163 | 1.0 | 6 |
| 300–1500 | ..... | ..... | f/300 | 6 |
| 1500–100,000 | ..... | ..... | 5 | 6 |
| (B) Limits for General Population/Uncontrolled Exposure | | | | |
| 0.3–1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34–30 | 824/f | 2.19/f | *($180/f^2$) | 30 |

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density ($mW/cm^2$) | Averaging time (minutes) |
|---|---|---|---|---|
| 30–300 | 27.5 | 0.073 | 0.2 | 30 |
| 300–1500 | ..... | ..... | f/1500 | 30 |
| 1500–100,000 | ..... | ..... | 1.0 | 30 |

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

**IC RULES**

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

**Table 5**
**Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)**

| 1 Frequency (MHz) | 2 Electric Field Strength; rms (V/m) | 3 Magnetic Field Strength; rms (A/m) | 4 Power Density ($W/m^2$) | 5 Averaging Time (min) |
|---|---|---|---|---|
| 0.003–1 | 280 | 2.19 | | 6 |
| 1–10 | $280/f$ | $2.19/f$ | | 6 |
| 10–30 | 28 | $2.19/f$ | | 6 |
| 30–300 | 28 | 0.073 | 2* | 6 |
| 300–1 500 | $1.585f^{0.5}$ | $0.0042f^{0.5}$ | $f/150$ | 6 |
| 1 500–15 000 | 61.4 | 0.163 | 10 | 6 |
| 15 000–150 000 | 61.4 | 0.163 | 10 | $616\,000/f^{1.2}$ |
| 150 000–300 000 | $0.158f^{0.5}$ | $4.21 \times 10^{-4}f^{0.5}$ | $6.67 \times 10^{-5}f$ | $616\,000/f^{1.2}$ |

* Power density limit is applicable at frequencies greater than 100 MHz.

**Notes:** 1. Frequency, $f$, is in MHz.
2. A power density of 10 $W/m^2$ is equivalent to 1 $mW/cm^2$.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

**EQUATIONS**

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

**LIMITS**

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

**RESULTS**

The transmitter has a maximum E-field at 10 m distance as follows:
EIRP = E field at 3m distance – 95.2
E field at 3m distance = E field at 10m distance + 20 = 55.49 + 20 = 75.49 dBµV/m
EIRP = 75.49 - 95.2 = **-19.71 dBm = 0.00001 W,** which is less than 2.5 W based on section 2.2 of RSS 210; therefore this test is not applicable.

# 12. SETUP PHOTOS

**RADIATED EMISSION BELOW 30 MHz**

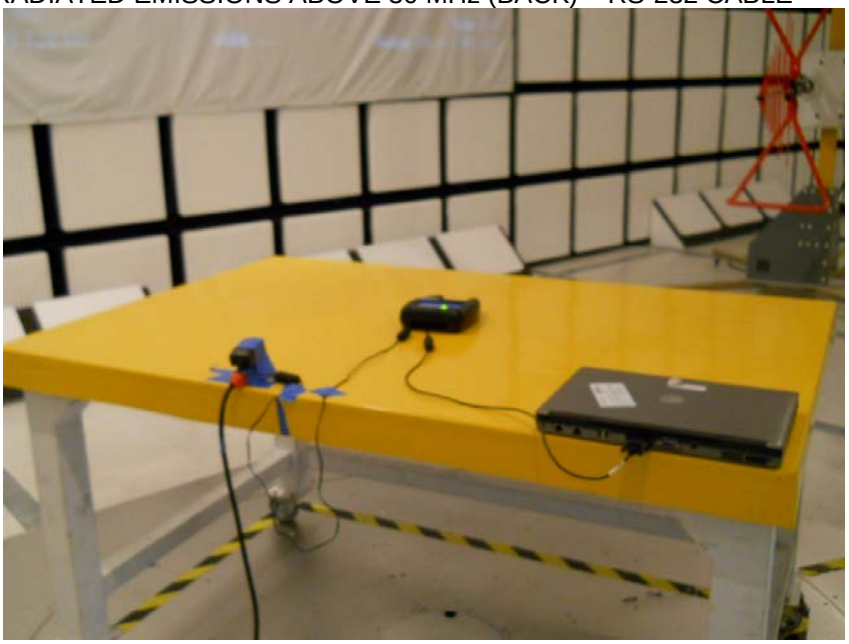
RADIATED EMISSIONS BELOW 30MHz (FRONT)

RADIATED EMISSIONS BELOW 30MHz (BACK)

**RADIATED EMISSION ABOVE 30 MHz**

RADIATED EMISSIONS ABOVE 30 MHz (FRONT) – RS-232 CABLE

RADIATED EMISSIONS ABOVE 30 MHz (BACK) – RS-232 CABLE



**RADIATED EMISSION ABOVE 30 MHz**

RADIATED EMISSIONS ABOVE 30 MHz (FRONT) – USB CABLE

RADIATED EMISSIONS ABOVE 30 MHz (BACK) – USB CABLE

**AC MAINS LINE CONDUCTED EMISSION**

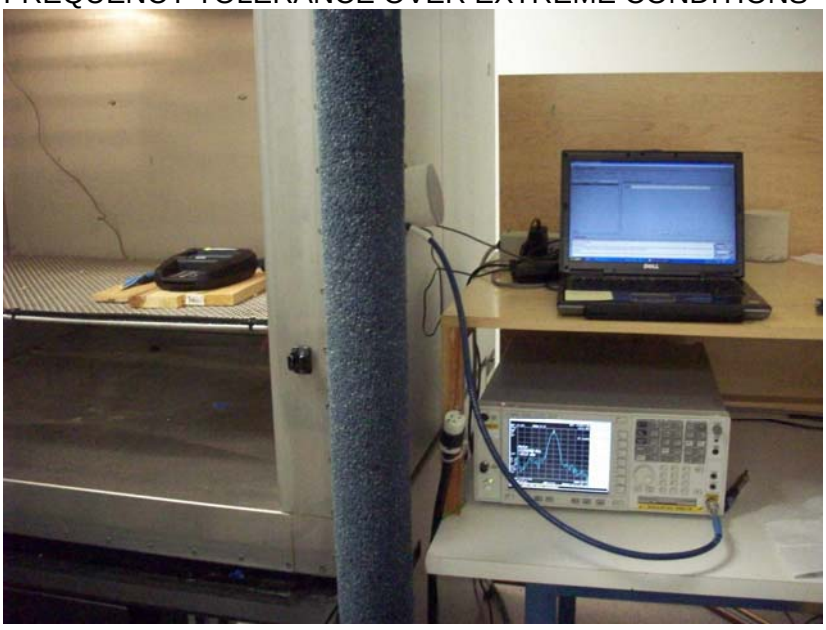
LINE CONDUCTED EMISSION (FRONT)

LINE CONDUCTED EMISSION (BACK) RS-232 CABLE

LINE CONDUCTED EMISSION (BACK) USB CABLE

**FREQUENCY TOLERANCE OVER EXTREME CONDITIONS**

FREQUENCY TOLERANCE OVER EXTREME CONDITIONS



## END OF REPORT