



FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

PCI-PED V2.0 & ISO/IEC14443 CONTACTLESS READER

MODEL NUMBER: ViVOpay 8600

FCC ID: Q55VIVOPAY8600

REPORT NUMBER: 09U12344-1B

ISSUE DATE: FEBRUARY 02, 2009

*Prepared for*  
ViVOtech, Inc.  
451 EL CAMINO REAL  
SANTA CLARA, CA 95050, USA

*Prepared by*  
COMPLIANCE CERTIFICATION SERVICES  
47173 BENICIA STREET  
FREMONT, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888

NVLAP®

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	01/22/09	Initial Issue	F. Ibrahim
A	01/26/09	Per client's request, revised section 5.5	A. Zaffar
B	02/02/09	Per client's request to remove this sentence "This product will be sold by NCR Corp but manufactured by ViVOtech	A. Zaffar

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS.....</b>	<b>4</b>
<b>2. TEST METHODOLOGY .....</b>	<b>5</b>
<b>3. FACILITIES AND ACCREDITATION.....</b>	<b>5</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>5</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION .....</i>	<i>5</i>
4.2. <i>MEASUREMENT UNCERTAINTY.....</i>	<i>5</i>
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>6</b>
5.1. <i>DESCRIPTION OF EUT.....</i>	<i>6</i>
5.2. <i>DESCRIPTION OF AVAILABLE ANTENNAS.....</i>	<i>6</i>
5.3. <i>SOFTWARE AND FIRMWARE.....</i>	<i>6</i>
5.4. <i>WORST-CASE CONFIGURATION.....</i>	<i>6</i>
5.5. <i>MODIFICATIONS.....</i>	<i>6</i>
5.6. <i>DESCRIPTION OF TEST SETUP.....</i>	<i>7</i>
<b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>9</b>
<b>7. APPLICABLE LIMITS AND TEST RESULTS .....</b>	<b>10</b>
7.1. <i>FREQUENCY STABILITY.....</i>	<i>10</i>
7.2. <i>RADIATED EMISSION.....</i>	<i>12</i>
7.2.1. <i>FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz) .....</i>	<i>14</i>
7.2.2. <i>SPURIOUS EMISSIONS (30 - 1000 MHz).....</i>	<i>15</i>
7.3. <i>AC MAINS LINE CONDUCTED EMISSIONS.....</i>	<i>23</i>
<b>8. SETUP PHOTOS.....</b>	<b>27</b>

## 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** PCI-PED v2.0 & ISO/IEC14443 Contactless Reader

**MODEL:** ViVOpay 8600

**SERIAL NUMBER:** 9

**DATE TESTED:** JANUARY 12-16, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS

Compliance Certification Services, Inc. (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 CCS based on interpretations and/or observations of test results. 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

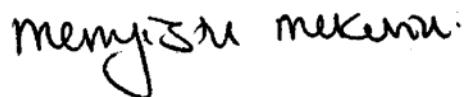
Approved & Released For CCS By:



---

FRANK IBRAHIM  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

Tested By:



---

MENGISTU MEKURIA  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7 Annex 2.

## 3. FACILITIES AND ACCREDITATION

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

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. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT



VIVOpay 8600 is an ISO/IEC 14443 intelligent contactless reader with PCI v2.0 compliant PIN Entry Device.

### 5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna is integrated inside the product around the LCD area invisible from the user.

### 5.3. SOFTWARE AND FIRMWARE

The FW version used for this testing was HG0 AR 1.0.0

### 5.4. WORST-CASE CONFIGURATION

The EUT was laid out and oriented as in normal operation.

### 5.5. MODIFICATIONS

To pass emissions during the digital device tests, the ferrite core made by Fair-Rite part # 0461164181 was used on the USB/Ethernet cable. In addition, a piece of EMI absorber pad was used inside the EUT.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC	GLOBAL POWER	3A-161WP09	GPWAC-15-09-2-VT	N/A

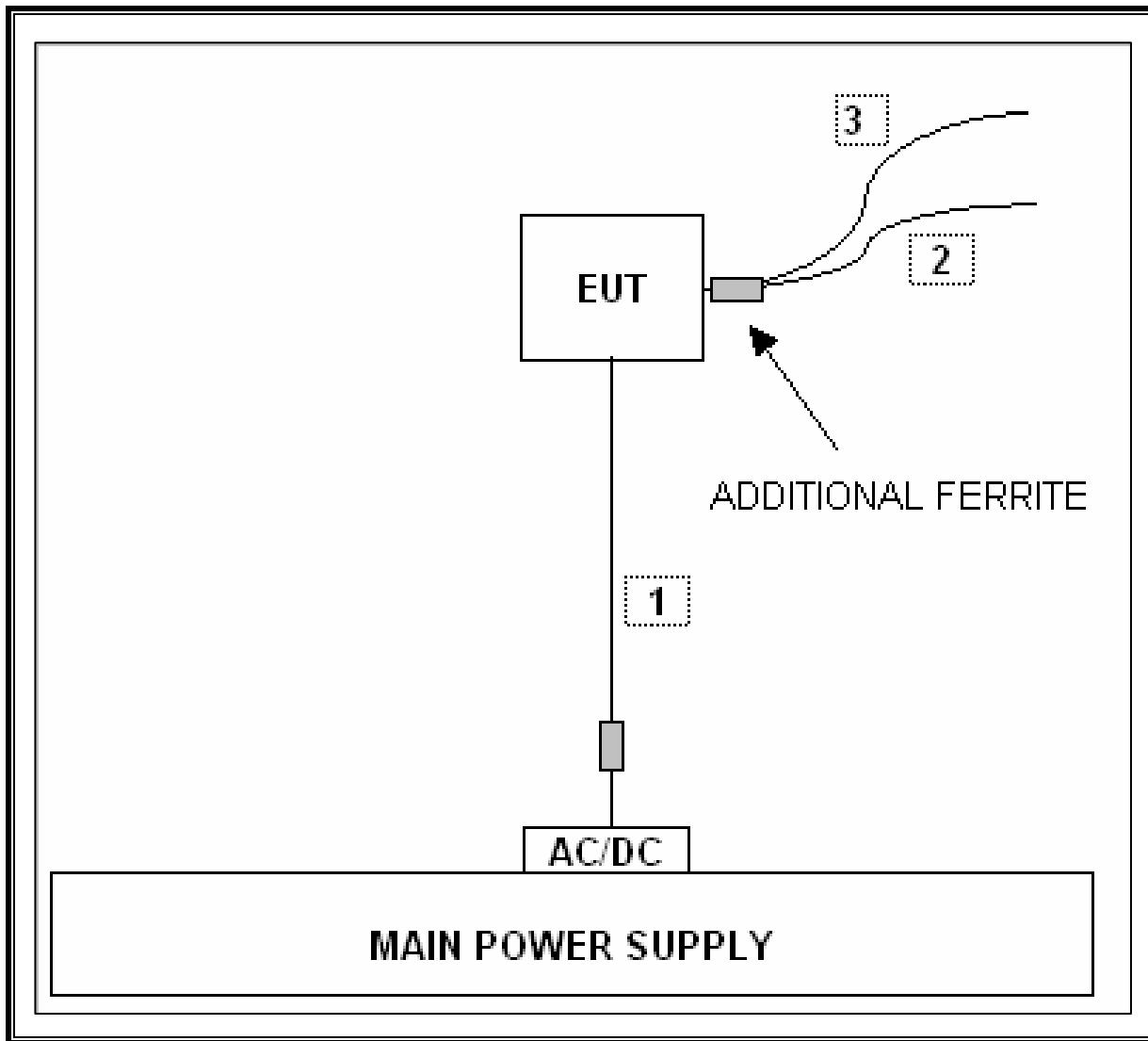
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	DC	1	DC	UN-SHIELDED	2.0 m	FERRITE AT ONE END
2	Ethernet	1	RJ45	UN-SHIELDED	1.2 m	USB/RJ45 SPLITER AT ONE END
3	Ethernet	1	USB	UN-SHIELDED	1.2 m	USB/RJ45 SPLITER AT ONE END

### TEST SETUP

The EUT is a standalone device; the firmware in the EUT make the radio unit work.

SETUP DIAGRAM FOR TESTS



## 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	Serial Number	Cal Due
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	3705A00256	09/19/09
EMI Receiver, 2.9 GHz	Agilent / HP	8542E	3942A00286	09/19/09
Spectrum Analyzer, 40 GHz	Agilent / HP	8564E	3943A01643	06/12/10
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	MY45300064	01/05/10
EMI Test Receiver	R & S	ESHS 20	827129/006	08/06/09
Antenna, Bilog 30MHz ~ 2Ghz	Sunol Sciences	JB1	A0022704	01/14/10
Antenna, Loop, 30 MHz	EMCO	6502	C00593	09/16/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	1937A02062	03/31/09
Environmental Chamber	Thermotron	SE 600-10-10	C00930	05/13/09
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/29/09
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/30/09

## 7. APPLICABLE LIMITS AND TEST RESULTS

### 7.1. FREQUENCY STABILITY

#### LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  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**

Power Supply (Vac)	Environment Temperature (°C)	Limit: 1.356 kHz		
		Frequency Deviation Measured with Time Elapse (MHz)	Delta (kHz)	Margin (kHz)
115.00	50	13.5604206	-0.039	-1.317
115.00	40	13.5603826	-0.077	-1.279
115.00	30	13.5604169	-0.043	-1.313
<b>115.00</b>	<b>20</b>	<b>13.5604601</b>	<b>0.000</b>	<b>-1.356</b>
115.00	10	13.5605028	0.043	-1.313
115.00	0	13.5605474	0.087	-1.269
115.00	-10	13.5606071	0.147	-1.209
115.00	-20	13.5607274	0.267	-1.089
97.15	20	13.5604606	0.001	-1.356
132.25	20	13.5604604	0.000	-1.356

## 7.2. RADIATED EMISSION

### TEST PROCEDURE

ANSI C63.4

The highest clock frequency generated or used in the EUT is 13.56 MHz; therefore the frequency range was investigated from 9 kHz to 1000 MHz.

### LIMIT

§15.225:

- (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 ( $\mu$ V/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.

Formula for converting the filed strength from uV/m to dBuV/m is:

Limit (dBuV/m) = 20 log limit (uV/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.

## **RESULTS**

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

#### **TRANSCEIVER SPURIOUS EMISSIONS BELOW 30 MHz**

<b>FCC Part 15, Subpart B &amp; C</b>											<b>10 Meter Distance Measurement At Open Field</b>				
Frequency (MHz)	PK (dBuV)	AV (dBuV)	AF dB/m	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes				
Loop Antenna Face On:															
13.56	85	N/A	10.56	-19.08	56.47	N/A	84.00	N/A	-27.5	N/A	Fundamental @ 10m Dist				
27.12	16.67	N/A	9.046	-31.12	-5.40	N/A	29.54	N/A	-46.9	N/A	Spurious @ 5m				
Loop Antenna Face Off:															
13.56	60.33	N/A	10.56	-19.08	51.81	N/A	84.00	N/A	-32.2	N/A	Fundamental @ 10m Dist				
27.12	18.86	N/A	9.046	-31.12	-3.21	N/A	29.54	N/A	-44.8	N/A	Spurious @ 5m				

\* 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

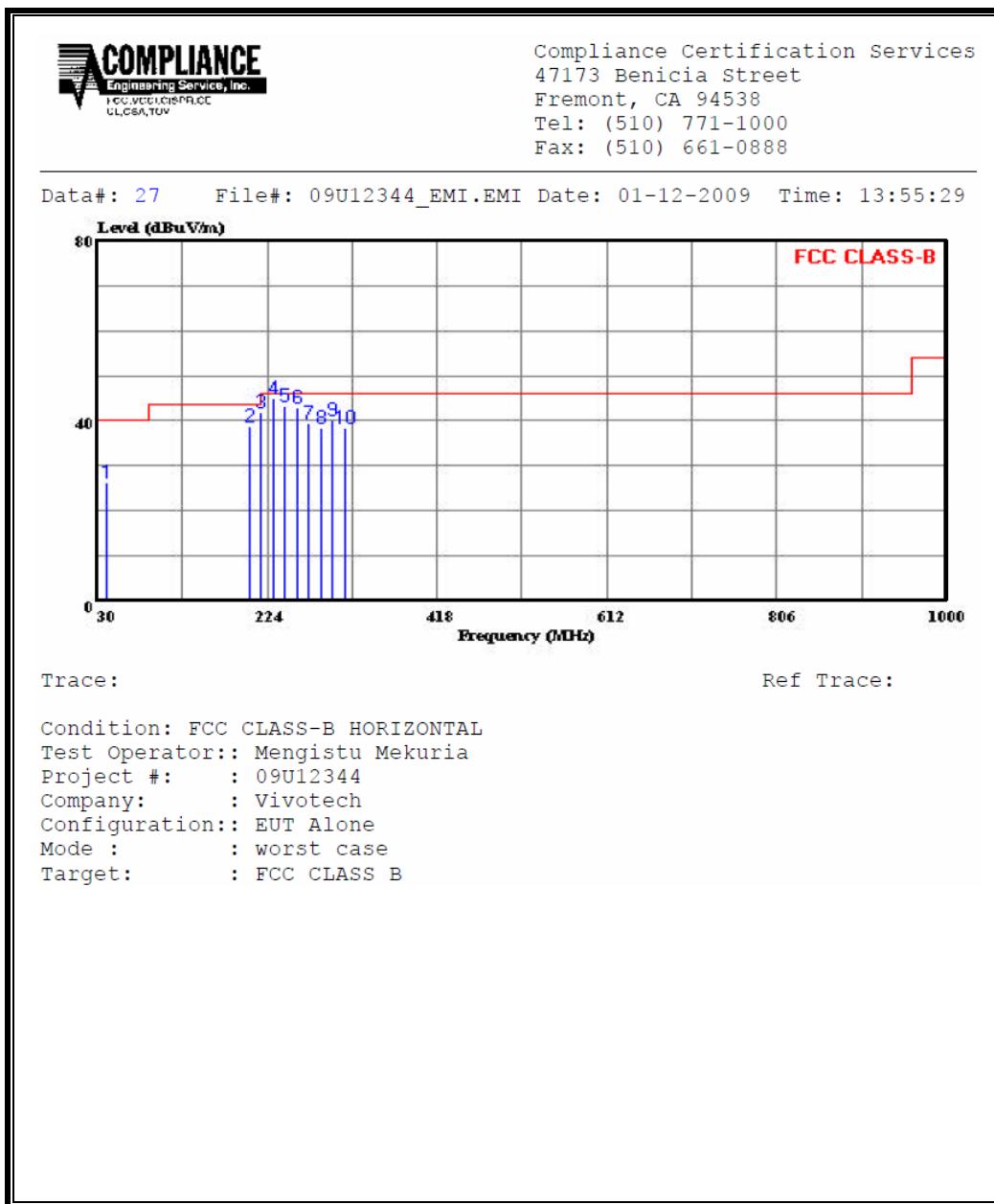
Q.P. = Quasi Peak

A.F. = Antenna factor

## 7.2.2. SPURIOUS EMISSIONS (30 - 1000 MHz)

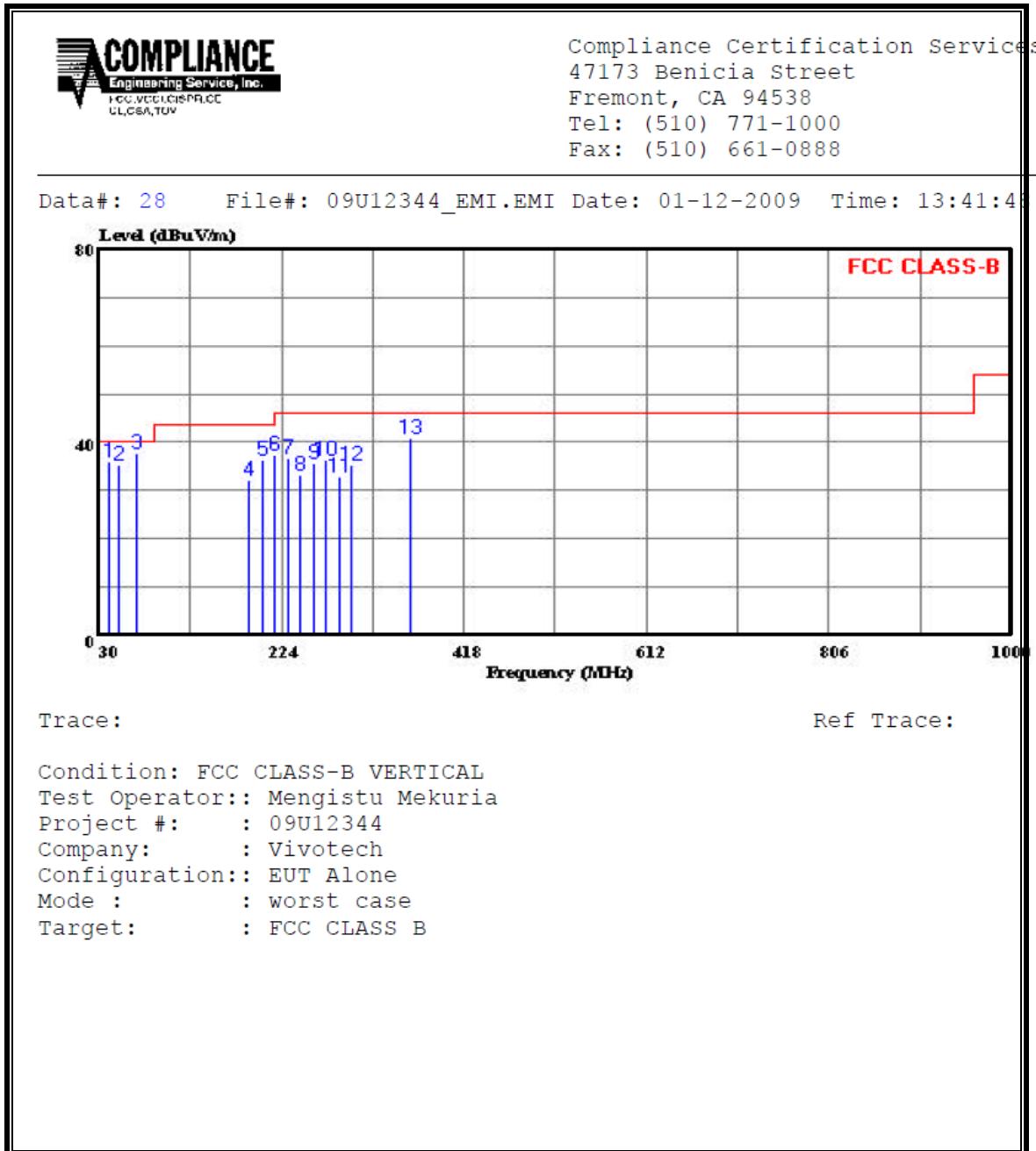
### RADIO PORTION OF EUT:

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



Freq	Read		Level	Limit	Over	Limit	Remark
	Level	Factor					
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	40.670	39.11	-12.83	26.28	40.00	-13.72	Peak
2	204.600	51.67	-13.02	38.64	43.50	-4.86	Peak
3	217.210	55.17	-13.10	42.07	46.00	-3.93	Peak
4	230.790	58.08	-13.17	44.92	46.00	-1.08	Peak
5	244.370	56.67	-13.24	43.42	46.00	-2.58	Peak
6	257.950	55.83	-12.91	42.93	46.00	-3.07	Peak
7	270.560	51.83	-12.37	39.46	46.00	-6.54	Peak
8	285.110	50.22	-11.75	38.47	46.00	-7.53	Peak
9	297.720	51.33	-11.13	40.20	46.00	-5.80	Peak
10	312.270	49.00	-10.67	38.33	46.00	-7.67	Peak

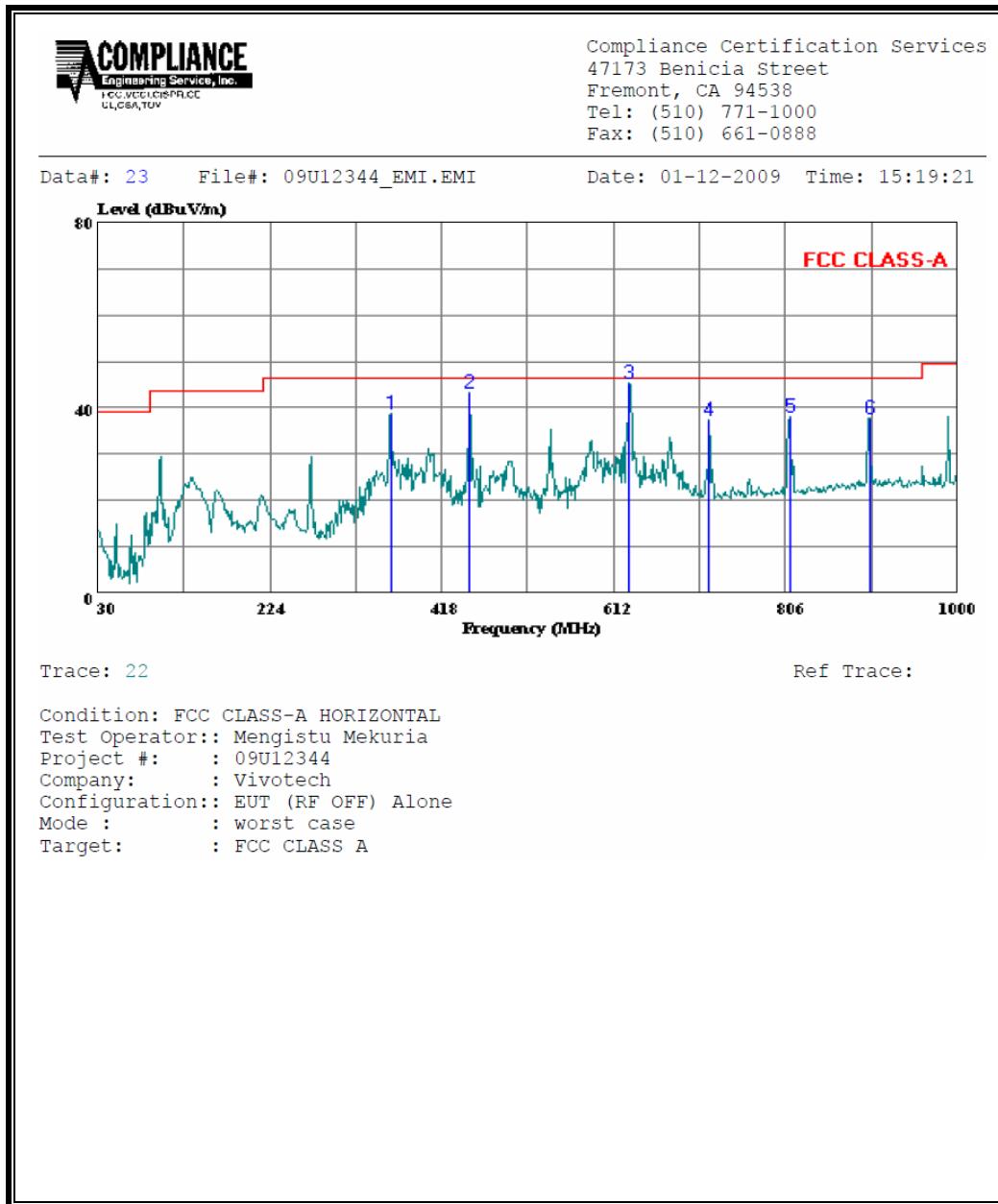
**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**



Freq	Read		Level	Limit	Over	Limit	Remark
	Level	Factor					
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	40.670	48.78	-12.83	35.95	40.00	-4.05	Peak
2	50.370	54.83	-19.64	35.19	40.00	-4.81	Peak
3	68.800	56.83	-19.10	37.73	40.00	-2.27	Peak
4	190.050	46.17	-13.86	32.31	43.50	-11.19	Peak
5	203.630	49.50	-13.02	36.48	43.50	-7.02	Peak
6	217.210	50.67	-13.10	37.57	46.00	-8.43	Peak
7	230.790	49.75	-13.17	36.58	46.00	-9.42	Peak
8	244.370	46.33	-13.24	33.09	46.00	-12.91	Peak
9	257.950	48.50	-12.91	35.59	46.00	-10.41	Peak
10	270.560	48.67	-12.37	36.29	46.00	-9.71	Peak
11	285.110	44.55	-11.75	32.80	46.00	-13.20	Peak
12	297.720	46.33	-11.13	35.20	46.00	-10.80	Peak
13	360.770	50.00	-9.28	40.72	46.00	-5.28	Peak

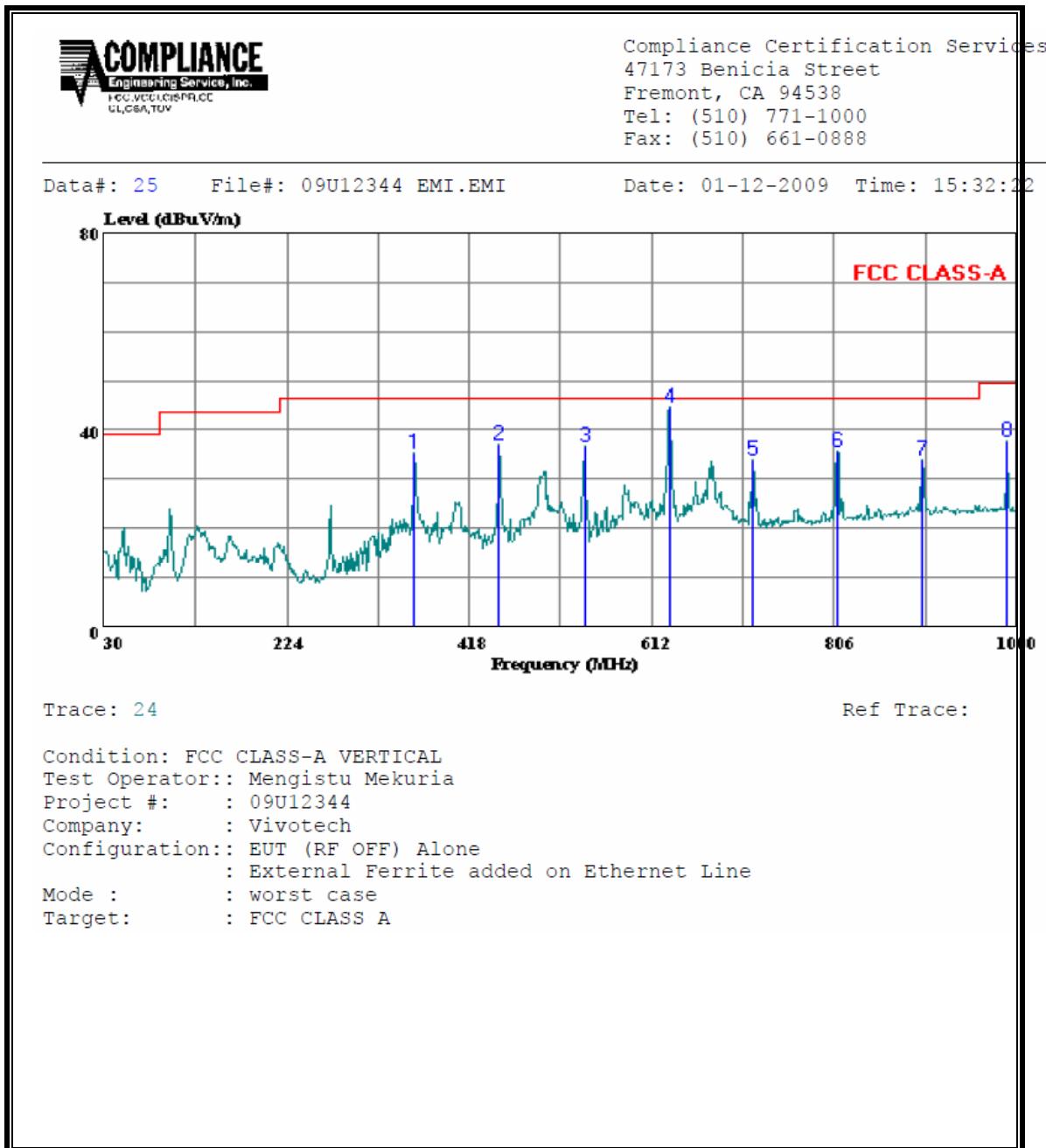
**DIGITAL PORTION OF THE EUT:**

**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)**



Freq	Read		Level	Limit	Over	Limit	Remark
	Level	Factor					
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	360.770	48.00	-9.28	38.72	46.40	-7.68	Peak
2	450.010	49.67	-6.45	43.22	46.40	-3.18	Peak
3	629.460	47.67	-2.14	45.53	46.40	-0.87	Peak
4	719.670	37.67	-0.20	37.47	46.40	-8.93	Peak
5	810.850	37.00	1.00	38.00	46.40	-8.40	Peak
6	901.060	34.83	2.93	37.76	46.40	-8.64	Peak

**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**



Freq	Read		Level	Limit	Over	Limit	Remark
	MHz	dBuV					
1	359.800	44.67	-9.31	35.36	46.40	-11.04	Peak
2	450.010	43.50	-6.45	37.06	46.40	-9.35	Peak
3	540.220	40.87	-4.04	36.83	46.40	-9.57	Peak
4	631.400	46.83	-2.09	44.74	46.40	-1.66	Peak
5	719.670	34.17	-0.20	33.97	46.40	-12.43	Peak
6	808.910	34.50	1.00	35.50	46.40	-10.90	Peak
7	899.120	31.19	2.87	34.06	46.40	-12.34	Peak
8	990.300	34.00	3.58	37.58	49.50	-11.92	Peak

### 7.3. AC MAINS LINE CONDUCTED EMISSIONS

#### TEST PROCEDURE

ANSI C63.4

#### LIMIT

§15.207 (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 50 $\mu$ H/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 (dB $\mu$ V)	
	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:

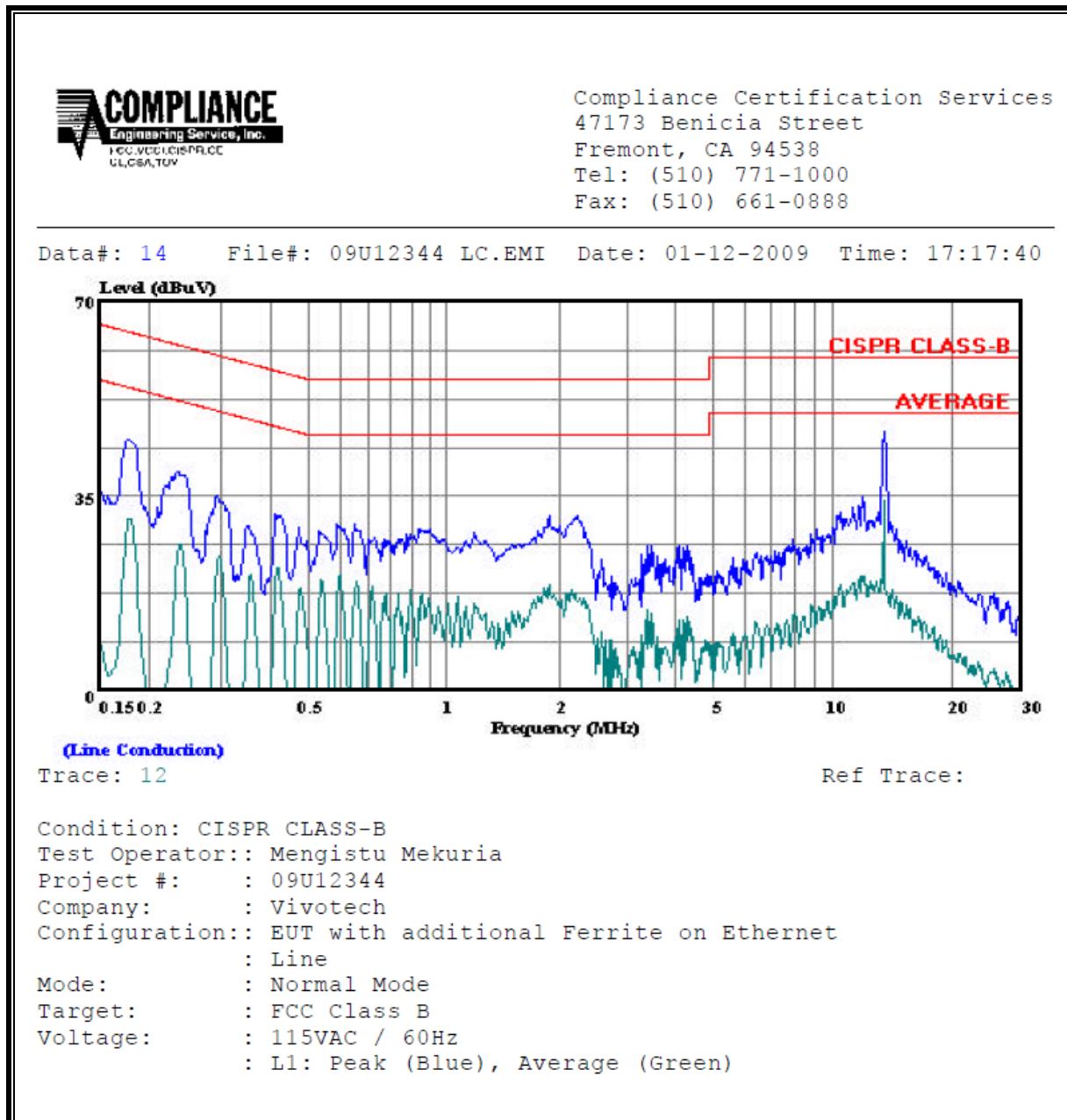
1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

**RESULTS:**

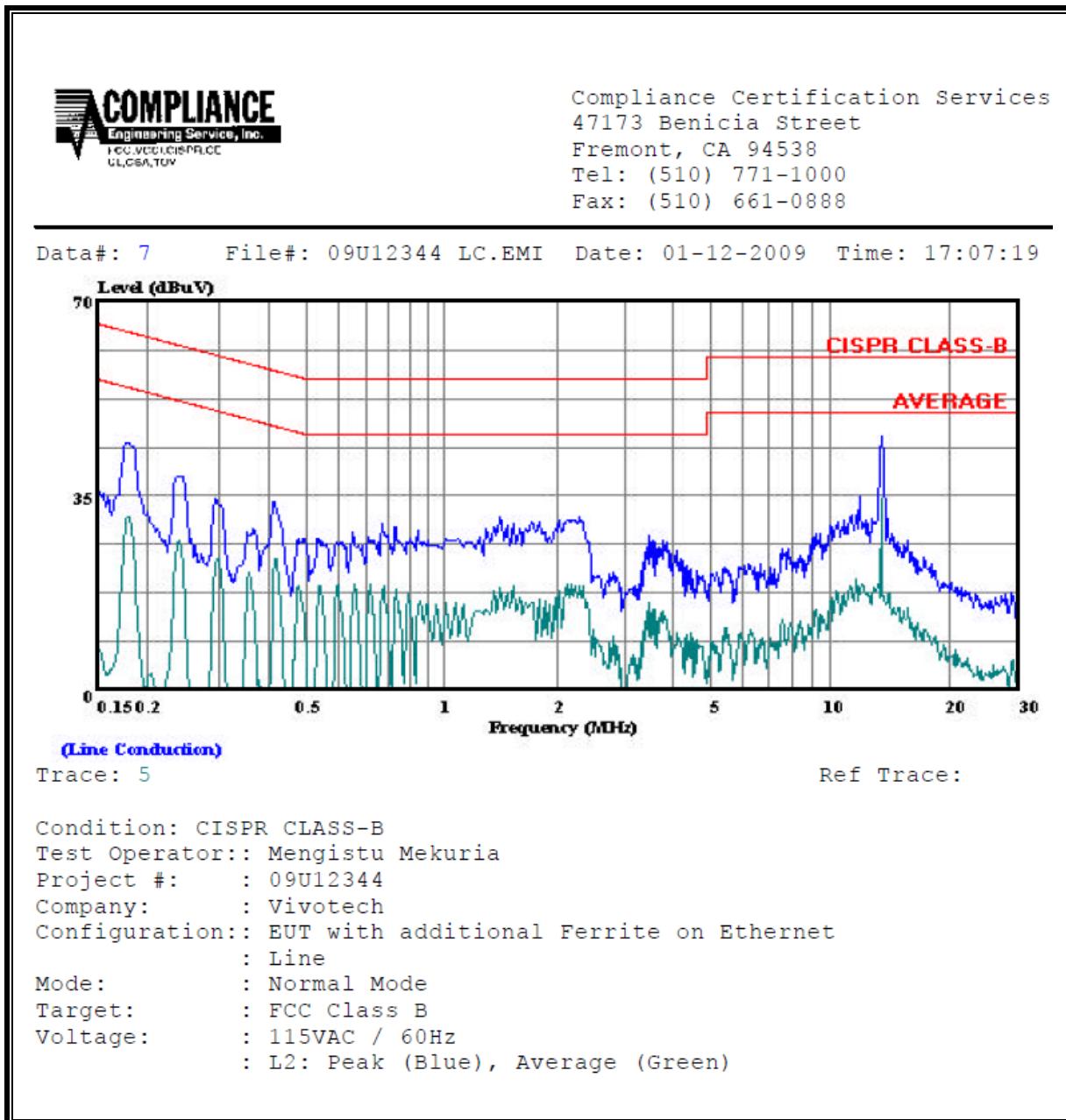
**6 WORST EMISSIONS**

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq. (MHz)	Reading			Closs (dB)	Limit	EN_B	Margin		Remark
	PK (dBuV)	QP (dBuV)	AV (dBuV)				QP	AV	
0.18	45.24	--	31.03	0.00	64.67	54.67	-19.43	-23.64	L1
0.24	39.42	--	26.39	0.00	62.20	52.20	-22.78	-25.81	L1
13.70	46.75	--	34.29	0.00	60.00	50.00	-13.25	-15.71	L1
0.18	44.55	--	31.25	0.00	64.67	54.67	-20.12	-23.42	L2
0.24	38.63	--	37.03	0.00	62.20	52.20	-23.57	-15.17	L2
13.70	45.58	--	34.42	0.00	60.00	50.00	-14.42	-15.58	L2
6 Worst Data									

LINE 1 RESULTS

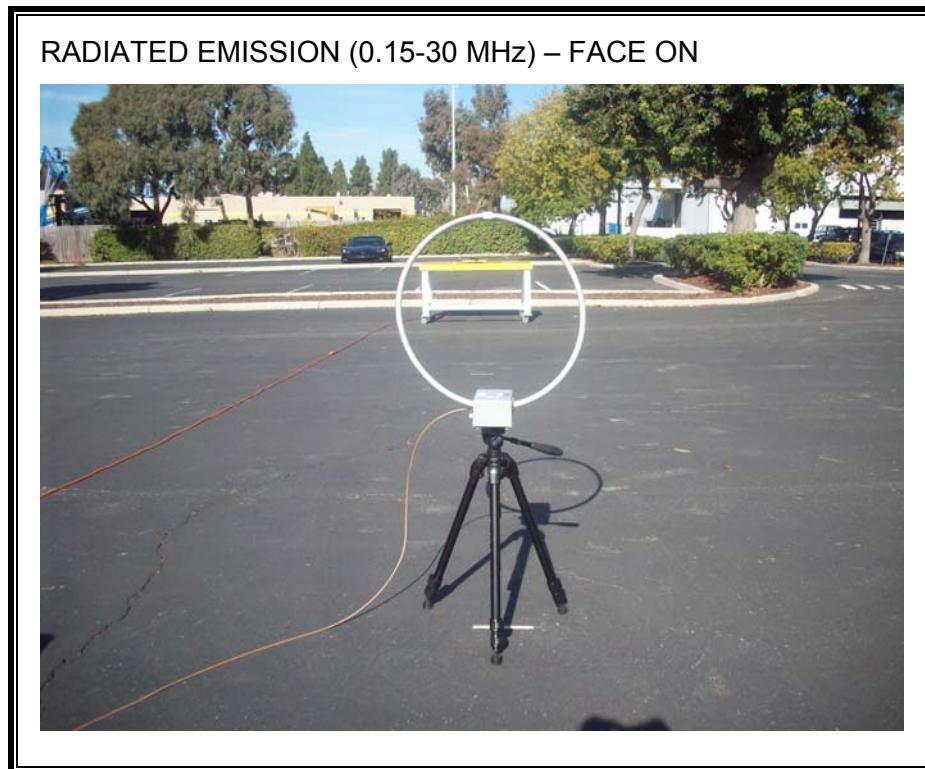


LINE 2 RESULTS



## 8. SETUP PHOTOS

### RADIATED EMISSION (0.15-30 MHz)



RADIATED EMISSION (0.15-30 MHz) – FACE OFF



RADIATED EMISSION (30-1000 MHz)

RADIATED EMISSION (30-1000 MHz) - FRONT



RADIATED EMISSION (30-1000 MHz) - BACK



AC MAINS LINE CONDUCTED EMISSION

LINE CONDUCTED EMISSION (FRONT)



LINE CONDUCTED EMISSION (BACK)



**FREQUENCY TOLERANCE OVER EXTREME CONDITIONS**

**FREQUENCY TOLERANCE OVER EXTREME CONDITIONS**



**END OF REPORT**