

# **Technical Solutions Inc.**

## **ZRY01**

### **ZPoint Relay Unit**

## **EMC Directive Compliance Test Report**

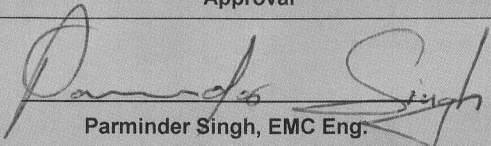
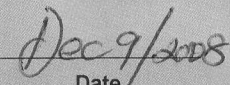
**FCC ID #: WYEZRY01**

**Model #: ZRY01**

### **FCC PT 15.249 Low Power Device Test Report**

Revision 1.0

December 9, 2008

Approval		
Checked By:	 Parminder Singh, EMC Eng:	 Date

Protocol Data Systems Inc, EMC Lab, Abbotsford BC, Canada. SCC ISO/17025 (CAN-P-4E) Accredited Laboratory No. 612  
FCC O.A.T.S. Registration Number 96437 Industry Canada O.A.T.S. Registration Number IC3384

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## Index

Section I:	Report of Measurements Testing Information .....	3
Section II:	Report of Measurements Test Procedure .....	5
Section III:	Report of Measurements to Radiation Interference .....	6
Section IV:	Report of Maximum Permissible Exposure .....	7
Section V:	Report of Measurements to Occupied Bandwidth .....	8
Section VI:	Report of Measurements to Power Line Conducted Interference .....	10
Section VII:	Measurements EUT Photos .....	12

## **Section I: Report of Measurements Testing Information**

### **General Information**

Applicant Company Name	Technical Solutions Inc.
Address	7787 Progress Way
	Delta, BC V4G 1A3
	Phone: 604-946-8324
	Fax 604-946-6445
	Contact Person: Howard Davis
	Email: howard@techsol.ca
Product Name	zPoint Relay Unit
FCC ID#	WYEZRY01
Applicable Standard	FCC Part 15.249, ANSI C63.4:2003; Part 15.207, 15.209
Test Results	Pass
Related Report/s Approval	Technical Solutions RN03344, Rev 0.0.
Statement of Compliance	This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of our knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards. – Signature on Front Cover Page.

### **Equipment Under Test Specification**

Manufacturer	Technical Solutions Inc.
Product Description	zPoint Relay Unit
FCC ID	WYEZRY01
Model Number	zRY01
Name	zPoint Relay Unit
Operating Frequency	2400-2483.5MHz
Emission Designator	DXX
EUT Power Source	120Vac 60Hz
Test Item	Production Unit
Type of Equipment	Mobile
Antennas	Internal PCB
Antenna Connector	Permanently attached
Test Voltage	120Vac 60Hz

### **Test Environment**

Test Facility	Protocol Data Systems Inc.
	28945 McTavish Road
	Abbotsford, BC V4X 2E7
	Phone: 604-607-0012
	Fax: 604-607-0019
	Email: info@protocol-emc.com
	Website: www.protocol-emc.com
Test Facility ID's	SCC ISO/17025 (CAN-P-4E) Accredited Laboratory No. 612
	FCC O.A.T.S. Registration Number 96437
	Industry Canada O.A.T.S. Registration Number IC3384
Date Tested	10July08
Tested By	David Johanson

**Test Setup**

Test Supporting Equipment	120Vac 60Watt Light Bulb
Test Conditions	Temperature and Humidity: 20.7°C, 49%
Test Exercise e.g. software description, test signal, etc.	The EUT was set for continuous transmit mode of operation. It was programmable to transmit on a fixed frequency as selected.
Deviation from Standard/s	No deviation from Standard
Modification to the EUT	No modifications was made.

**Test Equipment List**

<b>EMISSION</b>				
<b>Manufacturer</b>	<b>Model</b>	<b>Equipment Description</b>	<b>Serial No.</b>	<b>Next Cal</b>
HP	85650A	CDN Quasi-Peak Adapter	2043A00240	18/09/09
HP	85662A	Spectrum Analyzer Display	2318A05184	18/09/09
HP	8566B	Spectrum Analyzer RF Section	2241A02102	18/09/09
HP	85685A	RF-Preselector	3107A01222	18/09/09
Solar	8012-50-R-24	LISN	863092	28/09/08
EMCO	CPA-30	Ant Log Periodic 200-1000MHZ	563	05/12/08
EMCO	3110B	Ant Biconical 20-300MHz	9401-1850	05/12/08
EMCO	3115	DGR Horn At. 1-18GHzMHz	3429	15/12/08
AH Systems	SAS-200/550-1	Active Monopole Antenna	631	08/05/09
EMCO	6502	Active Loop Antenna	9002-2489	28/02/09
Rhientech	Custom	Antenna Mast	N/A	N/A
Protocol EMC	Custom	Turntable	N/A	N/A

**Measurement Uncertainty**

<b>Parameter</b>	<b>Uncertainty</b>
Radio Frequency	$\pm 1 \times 10^{-5}$
Total RF power, conducted	$\pm 1,5$ dB
RF power density, conducted	$\pm 3$ dB
Spurious emissions, conducted	$\pm 3$ dB
All emissions, radiated	$\pm 5$ dB
Temperature	$\pm 1^\circ\text{C}$
Humidity	$\pm 5$ %
DC and low frequency voltages	$\pm 3$ %

## **Section II: Report of Measurements Test Procedure**

### **Radiation Interference:**

The measurement was made per ANSI C63.4-2003 using an Agilent model 8566B spectrum analyzer, a model 85685A Preselector, a model 85650A quasi-peak adapter, and the appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100kHz with an appropriate sweep speed and the video bandwidth was 300kHz up to 1GHz and 1MHz with a VBW greater than or equal to the RBW above 1GHz. When an emission was found, the table was rotated to produce the maximum, signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported. The EUT was re-positioned to produce the highest emission level. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

### **Formula of Conversion Factors:**

The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBμV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ACF	+CL	= FS
330	20 dBμV	+10.36 dB	+0.5	= 30.86 dBμV/m @ 3m

Where the field strength was too low to get an accurate reading at the required distance of 3meters, the Antenna was moved closer to 1 meter. The resulting measurement was distance corrected for 3 meters by using the formula:

(1 meter result) – (20Log(measured distance/required distance)) = (3 meter result)

Example:

1 meter result + distance correction = 3 meter result

54.5 dBμV + -9.54dB = 45 dBμV

### **Power Line Conducted Interference:**

The procedure used was ANSI C63.4-2003 using a 50μH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30MHz. The measurement was performed on an Open Air Test Site at 0.8meters above the horizontal groundplane.

### **Occupied Bandwidth:**

A sample of the transmitter output detected by an antenna was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to 10dB per division.

### **ANSI C63.4-2003 Measurement Procedures:**

The EUT was placed in a horizontal orientation, laying flat, on top of a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes. Due to the construction of the EUT, the EUT was also placed in a vertical orientation and rotated on its axis and the emissions were maximized again to identify the highest emission level. Frequencies less than 1GHz were measured using the Quasi-Peak receiver. Frequencies equal to and greater than 1GHz were measured using the Average receiver.

## Section III: Report of Measurements to Radiation Interference

**Rules Part No.:** Pt 15.249, Pt 15.209

Frequency	Limits
<b>Part 15.209</b>	
9 to 490 kHz	2400/F (kHz) $\mu$ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) $\mu$ V/m @ 30 meters
1705 to 30 MHz	29.54 dB $\mu$ V/m @ 30 meters
30 – 88	40.0 dB $\mu$ V/m @ 3 meters
80 – 216	43.5 dB $\mu$ V/m @ 3 meters
216 – 960	46.0 dB $\mu$ V/m @ 3 meters
Above 960	54.0 dB $\mu$ V/m @ 3 meters
<b>Part 15.249</b>	
Fundamental 902-928 MHz	94.0 dB $\mu$ V/m @ 3 meters
Fundamental 2.4-2.4835 MHz	94.0 dB $\mu$ V/m @ 3 meters
Harmonics	54.0 dB $\mu$ V/m @ 3 meters

### **Test Data: Fundamental as per Part 15.249**

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB $\mu$ V at 3m	Antenna Polarity V/H	Coax Loss and Antenna Correction Factor dBm	Field Strength Peak dB $\mu$ V/m	Field Strength Avg dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
2404	2404.8998	41.90	H	39.14	81.04	72.56	94.0	21.4
2440	2439.68763	43.20	H	39.25	82.45	74.41	94.0	19.6
2480	2479.89988	45.00	H	39.38	84.38	76.57	94.0	17.4

### **Test Data: Unintentional Radiated Emissions as per Part 15.209**

Frequency (MHz)	Pol	Hgt (m)	Ang (deg)	Uncor-Pk (dB $\mu$ V)	Tot Corr (dB)	Peak (dB $\mu$ V/m)	QP Lmt (dB $\mu$ V/m)	DelLim-Pk (dB)	QP (dB $\mu$ V/m)	DelLim-QP (dB)
31.99689	Vert	1	350	23.30	14.76	38.06	40.00	-1.94	27.62	-12.38
63.99402	Vert	1	270	23.90	10.41	34.31	40.00	-5.69	29.88	-10.12
79.99295	Vert	1	190	18.30	10.84	29.14	40.00	-10.86	20.40	-19.60
95.99149	Vert	1	200	26.80	11.87	38.67	43.50	-4.83	26.92	-16.58
191.98424	Hor <sub>z</sub>	1	260	7.70	15.94	23.64	43.50	-19.86	18.29	-25.21
223.98020	Hor <sub>z</sub>	2	80	13.30	13.25	26.55	46.00	-19.45	22.81	-23.19

## **Section IV: Report of Maximum Permissible Exposure**

**Rules Part No.:** Pt 1.1310 and 2.1091

**Requirements:** General Population/Uncontrolled Exposure : 1mW/cm<sup>2</sup>

**Calculation:**

$$S = \frac{PG}{4\pi r^2} = \frac{EIRP}{4\pi r^2}$$

S = Power Density

P = Power at Antenna Terminal

G = Gain of the Transmit Antenna

EIRP = Effective Isotropic Radiated power

r = Measurement Distance

EIRP Measurement at 3m at 1MHz RBW (peak) = 84.38 dBuV

Conversion to dBm (dBuV – 107) = -22.62 dBm at 300cm

Conversion to 20cm (-43.2 + (20log (300/20))) = +0.90 dBm at 20 cm

Conversion to mW EIRP ( $10^{(0.9/10)}$ ) = 1.23mW EIRP at 20cm

Power Density =  $\frac{1.23}{4\pi(20)^2}$  = 0.0002447 mW/ cm<sup>2</sup> at 20cm

**Recommendations:**

Based on these worst case calculations the EUT is well below the maximum permissible exposure limit of 1mW/cm<sup>2</sup> at 20cm.

## Section V: Report of Measurements to Occupied Bandwidth

### Rules Part No.:

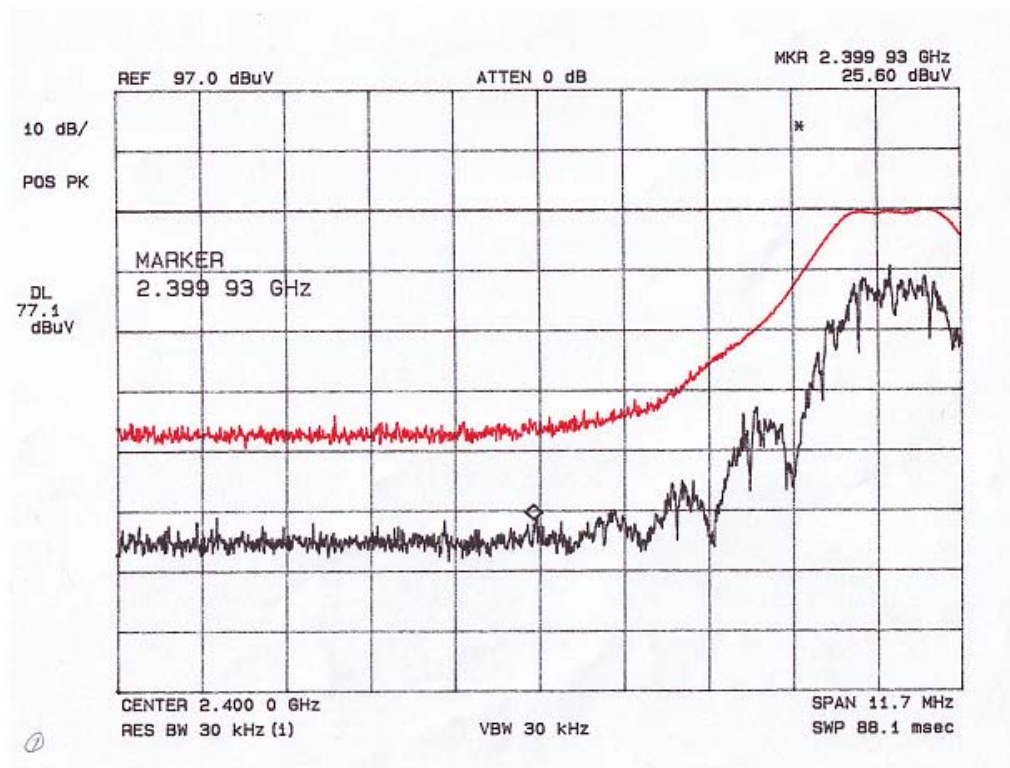
Pt 15.249. (d)

### Requirements:

The field strength of any emissions appearing outside the band edges and up to 10kHz and below the band edges shall be attenuated at least 50dB below the Level of the carrier or to the general limits of 15.209. Which ever is the lesser

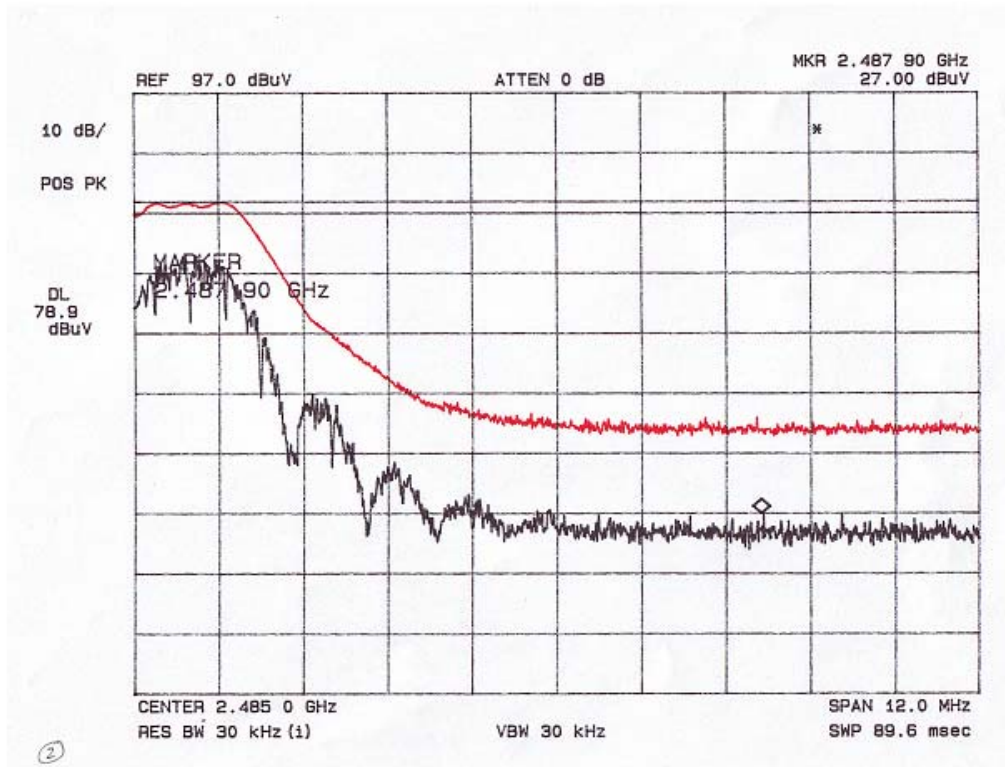
### Test Data:

All emissions at the band edges are below the 15.209 limit line.



**Figure1: Occupied Bandwidth.**



**Figure2: Occupied Bandwidth.**

## Section VI: Report of Measurements to Power Line Conducted Interference

### Rules Part No.:

Pt 15.207

### Requirements:

Frequency MHz	Quasi Peak Limits dB $\mu$ V	Average Limits dB $\mu$ V
0.15 – 0.5	66 – 56	56 -46
0.5 – 5.0	56	46
5.0 – 30	60	50

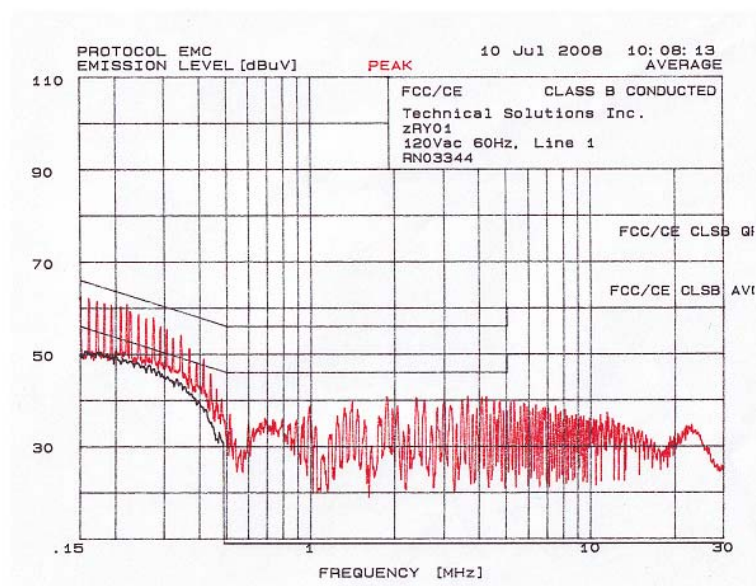
### Test Data:

**Table 1:** Line 1- 120Vac, 60Hz Peak

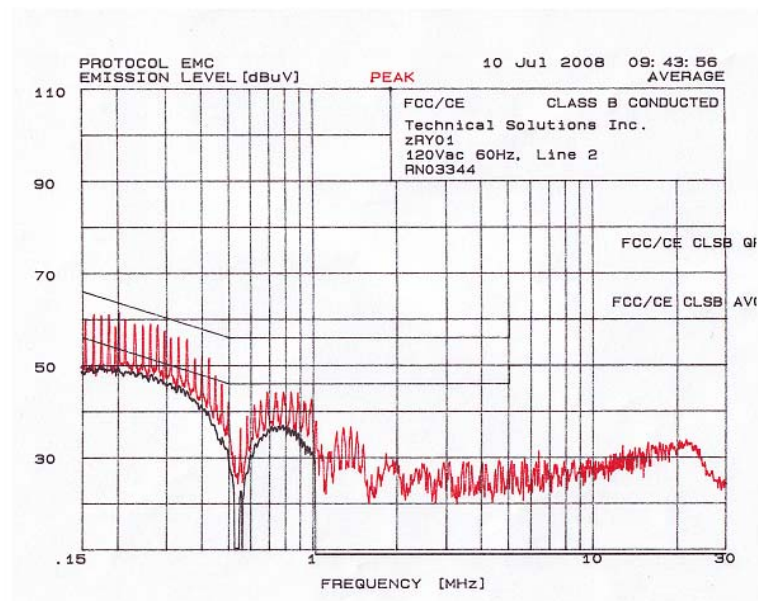
Frequency (MHz)	Limit (dB $\mu$ V)	DelLim-Pk (dB)
0.2352	60.3	+8.1
0.215	60.8	+7.8
0.2039	60.9	+7.5
0.2196	60.2	+7.4
0.2671	58.4	+7.2
0.2507	58.6	+6.9
AVERAGE		
0.2615	47.7	-3.6
0.2007	49.8	-3.7
0.1703	50.5	-4.4
0.3301	44.7	-4.7

**Table 2:** Line 2- 120Vac, 60Hz Peak

Frequency (MHz)	Limit (dB $\mu$ V)	DelLim-Pk (dB)
0.2028	61.5	+8.1
0.2786	58.8	+8.0
0.2629	59.0	+7.7
0.2953	57.5	+7.2
0.1864	61.1	+7.0
0.2467	58.8	+7.0
AVERAGE		
0.2643	48.0	-3.2
0.3318	45.6	-3.8
0.2018	49.5	-4.0
0.1749	49.8	-4.9
0.1582	49.6	-5.9



**Figure 3:** Conducted Emissions Line 1 – 120Vac, 60Hz



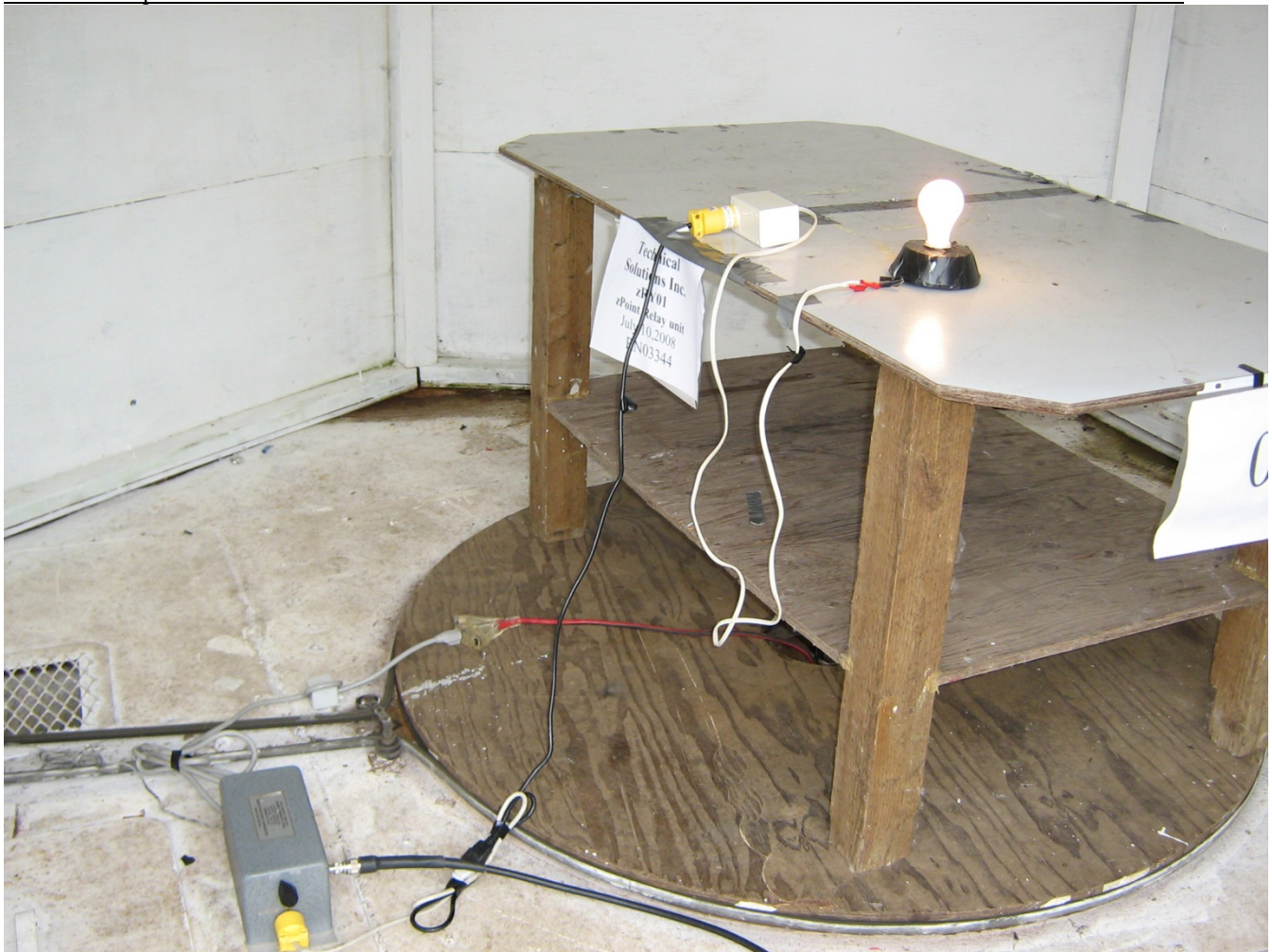
**Figure 4: Conducted Emissions Line 2 – 120Vac, 60Hz**

## Section VII: EUT Measurements Photos



**Test Setup of EUT Front View**





**Test Setup of EUT for AC Mains Conducted Emissions**