

## EMISSIONS TEST REPORT

**Report Number:** 100415528BOX-001a  
**Project Number:** G100415528

**Report Issue Date:** 05/31/2011

**Product Designation:** 673A01 Echo<sup>®</sup> Receiver

**Standards:** CFR47 FCC Part15, Subpart B:2011  
ICES-003: Issue 4 (2004)  
Industry Canada RSS-210 Issue 8 December 2010  
Industry Canada RSS-Gen Issue 3 December 2010

Tested by:  
Intertek Testing Services NA, Inc.  
70 Codman Hill Road  
Boxborough, MA 01719

Client:  
PCB Piezotronics Inc  
3425 Walden Avenue  
Depew, NY 14043

Report prepared by



Vathana F. Ven/Senior Project Engineer

Report reviewed by



Jeff Goulet/EMC Engineering Team Leader

*This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.*

## 1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

## 2 Test Summary

Section	Test full name	Result
3	Client Information	
4	Description of Equipment Under Test	
5	System Setup and Method	
6	Radiated Emissions (CFR47 FCC Part15, Subpart B:2011 ICES-003: Issue 4 (2004))	Pass
7	AC Mains Conducted Emissions (CFR47 FCC Part15, Subpart B:2011 ICES-003: Issue 4 (2004))	Pass
8	Revision History	

### 3 Client Information

This EUT was tested at the request of:

**Company:** PCB Piezotronics Inc  
3425 Walden Avenue  
Depew, NY 14043

**Contact:** Dave Corelli  
**Telephone:** (716) 684-0002 EXT. 2294  
**Fax:** (716) 684-0978  
**Email:** DCorelli@pcb.com

### 4 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
673A01 Echo <sup>®</sup> Receiver	PCB Piezotronics	673A01 Echo <sup>®</sup>	ENCL-0103-0013

Receive Date:	05/24/2011
Received Condition:	Good
Type:	Production

#### Description of Equipment Under Test (provided by client)

The EUT is an echo receiver.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
100-240VAC	1.6A	47-63Hz	1

#### Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	The EUT was in receiving mode.

## 5 System Setup and Method

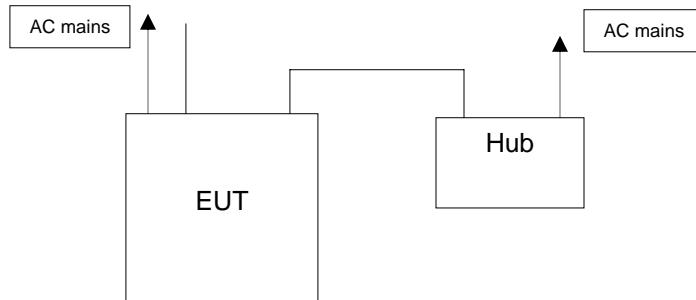
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	AC cable	<3	None	None	AC mains
2	AC adapter cable	<3	None	None	EUT
3	RJ-45 cable	>3	None	None	EUT
4	RS-232	<3	Foil	None	Unterminated

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
AC adapter	MW Mean Well	SPU50-3	05344300
Ethernet Switch	Hawking Technology	HFS5T-P	HCMCFS5035201346

### 5.1 Method:

Configuration as required by ANSI 63.4:2009, RSS-210 Issue 8 December 2010, RSS-Gen Issue 3 December 2010

### 5.2 EUT Block Diagram:



## 6 Radiated Emissions

### 6.1 Method

Tests are performed in accordance with CFR47 FCC Part15, Subpart B:2011  
ICES-003: Issue 4 (2004), RSS-210 Issue 8 December 2010, RSS-Gen Issue 3 December 2010

**TEST SITE:** 10m ALSE

**The 10m ALSE** is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

#### **Measurement Uncertainty**

For radiated emissions,  $U_{lab}$  (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz)  $< U_{CISPR}$  (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

**Sample Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

FS = Field Strength in  $\text{dB}\mu\text{V}/\text{m}$

RA = Receiver Amplitude (including preamplifier) in  $\text{dB}\mu\text{V}$

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0  $\text{dB}\mu\text{V}$  is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32  $\text{dB}\mu\text{V}/\text{m}$ . This value in  $\text{dB}\mu\text{V}/\text{m}$  was converted to its corresponding level in  $\mu\text{V}/\text{m}$ .

RA = 52.0  $\text{dB}\mu\text{V}$

AF = 7.4 dB/m

CF = 1.6 dB

AG = 29.0 dB

FS = 32  $\text{dB}\mu\text{V}/\text{m}$

To convert from  $\text{dB}\mu\text{V}$  to  $\mu\text{V}$  or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in  $\text{dB}\mu\text{V}$

**Example:**

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V}/20)} = 39.8 \mu\text{V}/\text{m}$$

**6.2 Test Equipment Used:**

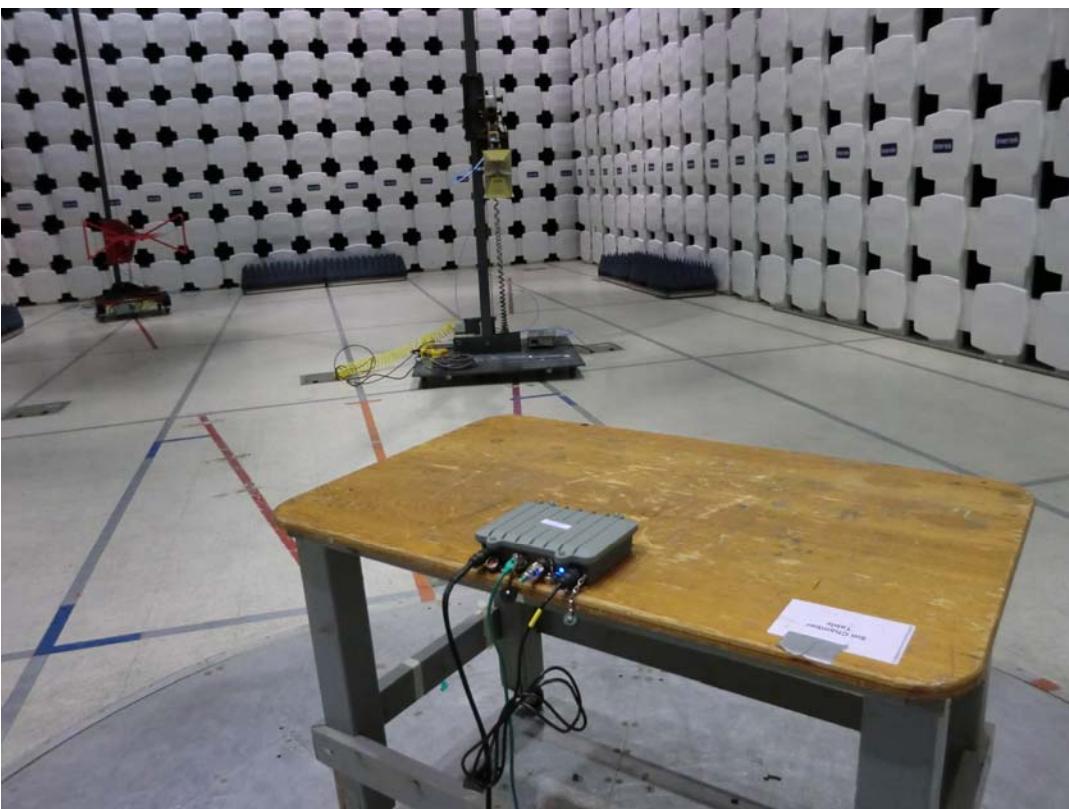
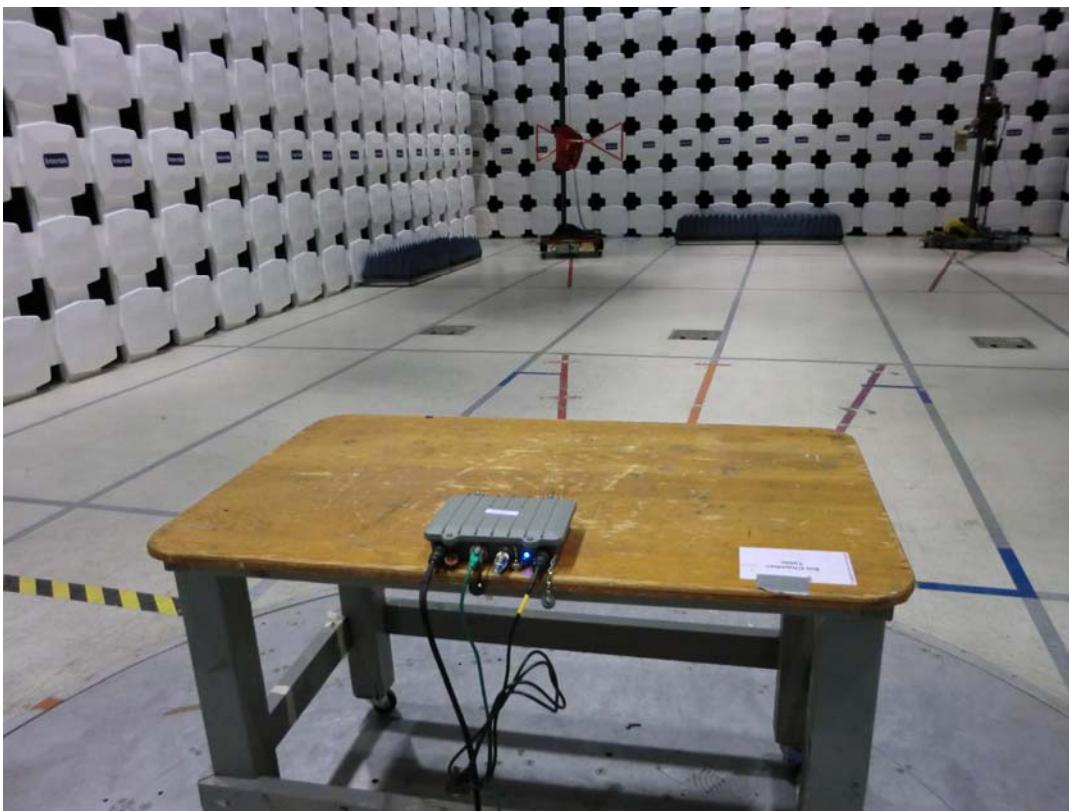
Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
145 106	Bilog Antenna	Sunol Sciences	JB5	A111003	07/20/2010	07/20/2011
145 003	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2443A04077	09/16/2010	09/16/2011
145 128	EMI Test Receiver (20Hz - 40GHz)	Rohde & Schwarz	ESI	837771/027	08/10/2010	08/10/2011
145-410	Cables 145-400 145-406 145-407 145-405 145-403	Huber + Suhner	10m Track A Cables	multiple	08/31/2010	08/31/2011
145-416	Cables 145-400 145-408 145-402 145-404	Huber + Suhner	3m Track B cables	multiple	08/31/2010	08/31/2011
HORN2	HORN ANTENNA	EMCO	3115	9602-4675	10/08/2010	10/08/2011
145 014	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	12/28/2010	12/28/2011
DAV004	Weather Station	Davis Instruments	7400	PE80529A61A	06/11/2010	06/11/2011

**Software Utilized:**

Name	Manufacturer	Version
C5	TESEQ	5.26.00 Build 5.23.00.3

**6.3 Results:**

The sample tested was found to Comply.

**6.4 Setup Photographs:**

## 6.5 Plots/Data:

### Test Information

#### Test Details

Project:

Test Notes:

Temperature:

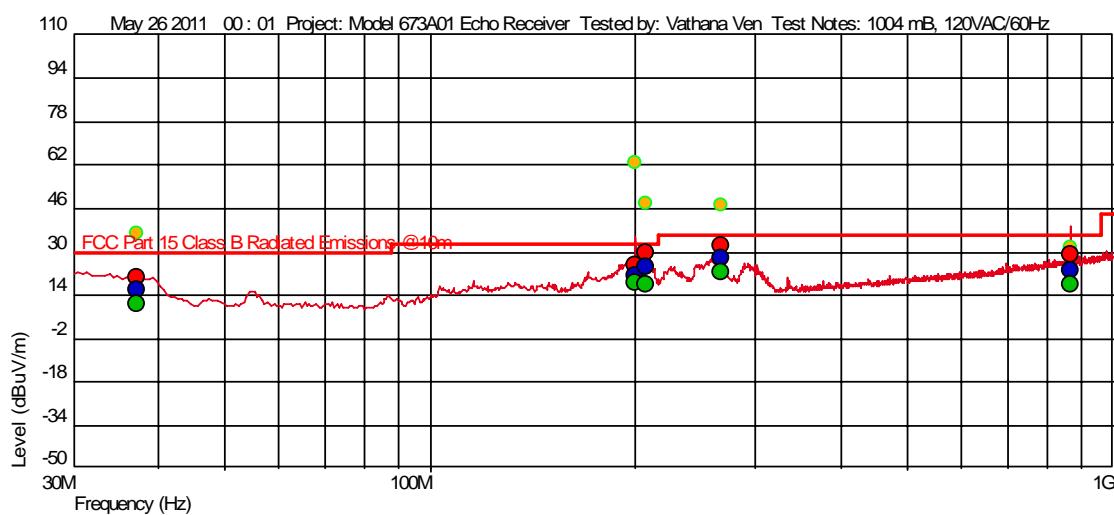
Humidity:

Tested by:

Test Started:

#### User Input

673A01 Echo<sup>®</sup> Receiver  
1004 mB, 120VAC/60Hz  
23 deg C  
46%  
Vathana Ven  
May 26 2011 00 : 01



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable

Level (dBuV/m) = AF + CL + PA + Raw  
AF = Antenna Factor  
CL = Cable Losses  
PA = Pre-Amplifier

Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: QP

Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Ver ( )	Angle (Deg)	Mast Height (m)	RBW (Hz)
37.136829259 M	15.73	15.732	-26.515	30.00	-14.27		39	1.47	120 k
199.968247611 M	21.09	13.093	-24.900	33.00	-11.91		232	3.99	120 k
207.468692844 M	24.44	11.305	-24.888	33.00	-8.56		58	1.52	120 k
266.625829551 M	27.66	12.930	-24.749	36.00	-8.34		276	1.30	120 k
866.602583006 M	23.28	22.000	-23.157	36.00	-12.72		175	4.00	120 k

## Test Information

## Test Details

Project:

Test Notes:

Temperature:

Humidity:

Tested by:

Test Started:

## User Input

673A01 Echo® Receiver

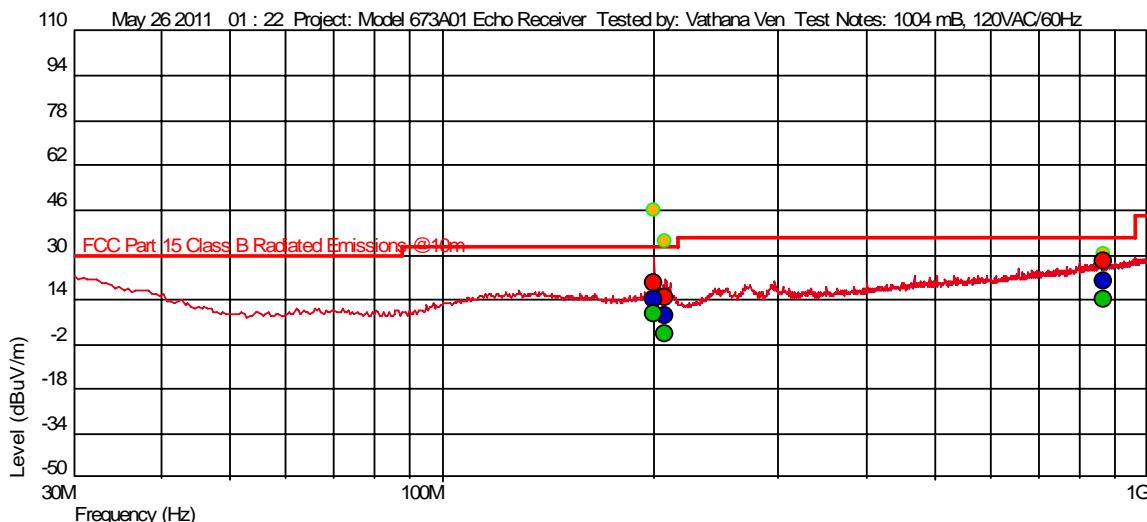
1004 mB, 120VAC/60Hz

23 deg C

46%

Vathana Ven

May 26 2011 01 : 22



Measured Peak Value

Measured Quasi Peak Value

Measured Average Value

Maximum Value of Mast and Turntable

Level (dBuV/m) = AF + CL + PA + Raw

AF = Antenna Factor

CL = Cable Losses

PA = Pre-Amplifier

Raw = Raw Instrument Reading (Not listed on Spot Tables)

## Measured: QP

Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Hor (--)	Angle (Deg)	Mast Height (m)	RBW (Hz)
199.899710627 M	13.76	12.784	-24.901	33.00	-19.24	--	325	1.57	120 k
206.845891906 M	8.31	10.815	-24.889	33.00	-24.69	--	144	1.41	120 k
866.517034186 M	20.81	21.800	-23.158	36.00	-15.19	--	122	3.06	120 k

## Test Information

## Test Details

Project:

Test Notes:

Temperature:

Humidity:

Tested by:

Test Started:

## User Input

673A01 Echo® Receiver

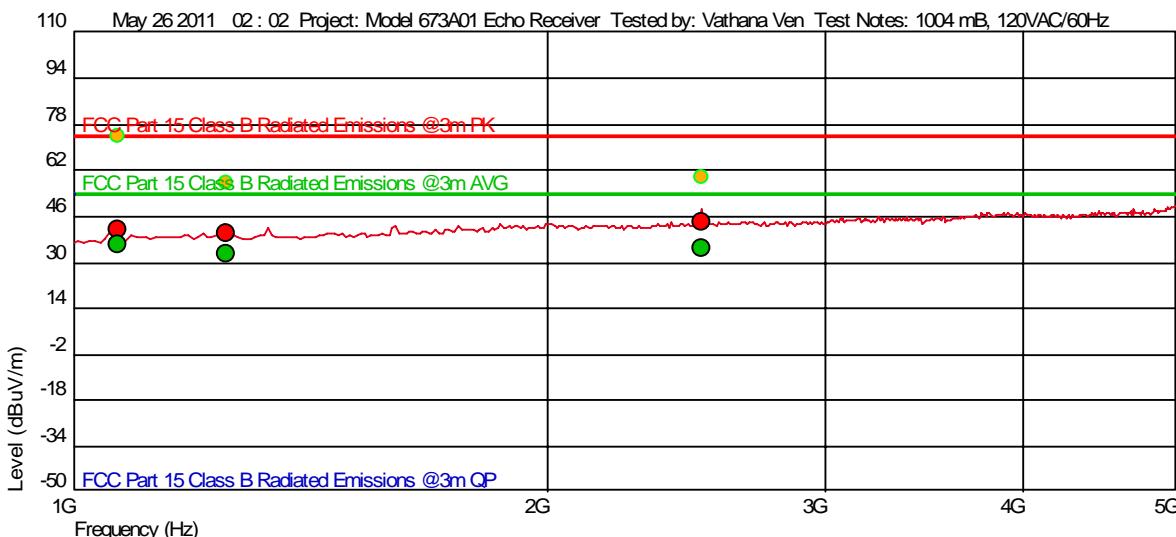
1004 mB, 120VAC/60Hz

23 deg C

46%

Vathana Ven

May 26 2011 02 : 02



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Level (dBuV/m) = AF + CL + PA + Raw
  - AF = Antenna Factor
  - CL = Cable Losses
  - PA = Pre-Amplifier
  - Raw = Raw Instrument Reading (Not listed on Spot Tables)

## Measured: PEAK

Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dBuV/m)	Hor ( -- ) Ver (   )	Angle (Deg)	Mast Height (m)	RBW (Hz)
1.066581162 G	41.31	24.713	-30.283	74.00	-32.69		125	1.36	1 M
1.249889557 G	39.79	25.687	-29.792	74.00	-34.21	--	206	1.68	1 M
2.500160321 G	43.73	28.414	-28.030	74.00	-30.27		242	1.78	1 M

## Measured: AVERAGE

Frequency (Hz)	Level (dBuV/m)	AF	PA+CL	Limit (dBuV/m)	Margin (dB)	Hor ( -- ) Ver (   )	Angle (Deg)	Mast Height (m)	RBW (Hz)
1.066581162 G	36.10	24.713	-30.283	54.00	-17.90		125	1.36	1 M
1.249889557 G	32.94	25.687	-29.792	54.00	-21.06	--	206	1.68	1 M
2.500160321 G	35.07	28.414	-28.030	54.00	-18.93		242	1.78	1 M

Test Personnel: Vathana Ven  
Supervising Engineer:  
(Where Applicable) N/A  
Product Standard: FCC Part 15 Subpart B/ICES  
003, RSS-210, RSS-Gen  
Input Voltage: 120VAC/60Hz  
Pretest Verification w/  
Ambient Signals or  
BB Source: Ambient

Test Date: 05/26/2011  
Test Levels: Class B  
Ambient Temperature: 23 °C  
Relative Humidity: 46 %  
Atmospheric Pressure: 1004 mbars

Deviations, Additions, or Exclusions: None

## 7 AC Mains Conducted Emissions

### 7.1 Method

Tests are performed in accordance with CFR47 FCC Part15, Subpart B:2011 ICES-003: Issue 4 (2004).

#### TEST SITE: AMAP Bump Out

**The EMC Lab** has two Semi-anechoic Chambers and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

**The AMAP Building and Lab** includes general lab space that can be used for testing where a shielded/enclosed environment is not required.

#### Measurement Uncertainty

For conducted emissions,  $U_{lab}$  (3.2 dB in worst case)  $< U_{CISPR}$  (3.6 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

#### Sample Calculations

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB $\mu$ V

RF = Reading from receiver in dB $\mu$ V

LF = LISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB $\mu$ V

#### Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

**7.2 Test Equipment Used:**

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
ROS002	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K0 3	100067	04/15/2011	04/15/2012
LISN12	LISN, 50uH, .01 - 50MHz, 24A	Solar Electronics	9252-50-R- 24-BNC	941714	01/19/2011	01/19/2012
DS27	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS27	04/19/2011	04/19/2012
CBLBNC61	Cable BNC/BNC, 30'	ITS	BNC-30	CBLBNC61	09/15/2010	09/15/2011
DAV004	Weather Station	Davis Instruments	7400	PE80529A61 A	06/11/2010	06/11/2011

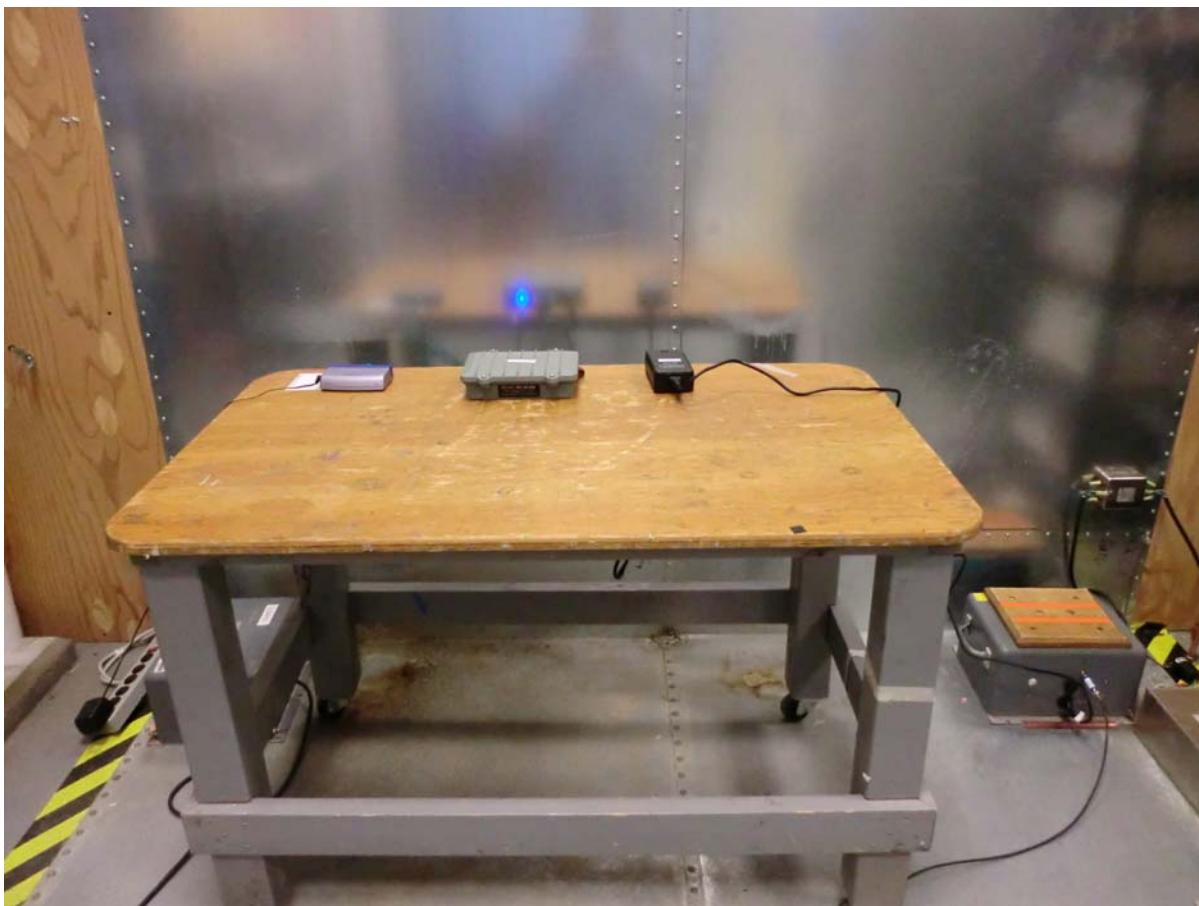
**Software Utilized:**

Name	Manufacturer	Version
Excel 2003	Microsoft	(11.8231.8221) SP3
EMI Boxborough.xls	Intertek	4/17/09

Note: Your Laptop may use a different version of Excel. Record the version you actually used!

**7.3 Results:**

The sample tested was found to Comply.

**7.4 Setup Photographs:**

**7.5 Plots/Data:****Conducted Emissions**

Company: PCB Pieztronics  
 Model #: 673A01 Echo®  
 Serial #: ENCL-0103-0013  
 Engineer(s): Vathana Ven  
 Project #: G100415528  
 Date: 05/26/11  
 Standard: FCC Part 15 Subpart B/ICES 003/RSS-210/RSS-Gen Class B  
 Barometer: DAV004 Temp/Humidity/Pressure: 22 deg C 52% 1002 mb Attenuator: DS27\_4-19-2012.txt  
 Voltage/Frequency: 120VAC/60Hz Frequency Range: 0.150-30MHz

Net is the sum of worst-case lisn, cable, & attenuator losses, and initial reading, factors are not shown

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor; Bandwidth denoted as RBW/VBW

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	QP Limit dB(uV)	Margin dB	Bandwidth
QP	0.206	22.32	21.90			42.60	63.37	-20.77	9/30 kHz
QP	0.308	8.50	8.30			28.77	60.02	-31.25	9/30 kHz
QP	5.460	3.00	5.50			26.06	60.00	-33.94	9/30 kHz
QP	5.874	7.90	9.10			29.68	60.00	-30.32	9/30 kHz
QP	16.229	12.50	12.60			33.49	60.00	-26.51	9/30 kHz
QP	29.237	11.30	11.32			32.80	60.00	-27.20	9/30 kHz

Detector	Frequency	Reading	Reading	Reading	Reading	Net	Average	Margin	Bandwidth
Type	MHz	Line 1	Line 2	Line 3	Line 4	dB(uV)	Limit	dB	
AVG	0.206	10.60	10.60			30.88	53.37	-22.49	9/30 kHz
AVG	0.308	1.00	0.90			21.27	50.02	-28.75	9/30 kHz
AVG	5.460	-2.00	-0.90			19.66	50.00	-30.34	9/30 kHz
AVG	5.874	6.00	7.40			27.98	50.00	-22.02	9/30 kHz
AVG	16.229	11.20	11.30			32.19	50.00	-17.81	9/30 kHz
AVG	29.237	9.00	9.00			30.48	50.00	-19.52	9/30 kHz

Test Personnel: Vathana Ven  
 Supervising Engineer: \_\_\_\_\_  
 (Where Applicable) N/A  
 Product Standard: FCC Part 15 Subpart B/ICES  
003, RSS-210, RSS-Gen  
 Input Voltage: 120VAC/60Hz  
 Pretest Verification w/  
 Ambient Signals or  
 BB Source: Ambient

Test Date: 05/26/2011  
 Test Levels: Class B  
 Ambient Temperature: 22 °C  
 Relative Humidity: 52 %  
 Atmospheric Pressure: 1002 mbars

Deviations, Additions, or Exclusions: None

**8 Revision History**

Revision Level	Date	Report Number	Notes
0	05/31/2011	100415528BOX-001	Original Issue
1	07/15/2011	100415528BOX-001a	Model correction