EMISSIONS TEST REPORT

Report Number: 100277723BOX-001
Project Number: G100277723

Report Issue Date: 12/21/10

Product Designation: **VTU3**

Standards: **Industry Canada RSS-Gen Issue 3 December 2010 "General Requirements and Information for the Certification of Radio Apparatus"**

Industry Canada ICES-003 Issue 4 February 2004 "Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard Digital Apparatus"

Industry Canada RSS-119 Issue 10 April 2010, "Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41-960 MHz"

FCC Title 47 CFR Part 15:2010 Subpart B Unintentional Radiator Class B

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

Client:
LoJack Corporation
780 Dedham Street
Canton, MA 02021

Report prepared by

Kouma Sinn/Senior Project Engineer

Report reviewed by

Michael F. Murphy / Staff Engineer, EMC

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	Receiver Spurious Emissions IC RSS-119 Section 5.11, IC RSS-Gen Sections 4.10, 6.0) FCC Part 15.109(a)	Pass
7	AC Mains Conducted Emissions IC RSS-Gen Section 7.2.4, FCC Part 15.107(a)	Pass
8	Revision History	--

3 Client Information

This EUT was tested at the request of:

Company: LoJack Corporation
780 Dedham Street
Canton, MA 02021

Contact: Vincent Ricci
Telephone: (781) 302-7148
Fax: Not provided
Email: vricci@lojack.com

4 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Receiver	LoJack Corporation	VTU3	0932A3E

Receive Date:	12/14/10
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The equipment under test is a receiver used with vehicle recovery system.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
11-16VDC	1A Max	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	The receiver was continuously receiving signal from the support transmitter during all testing

5 System Setup and Method

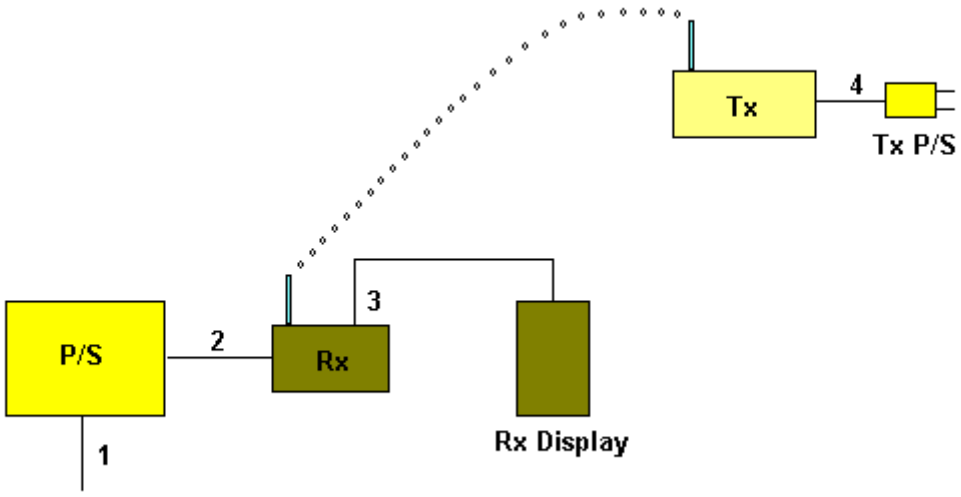
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	AC Power Cable	2	None	None	Power
2	DC Leads	5	None	None	P/S
3	Display Cable	5	None	None	Display
4	AC Adapter	2	None	None	Power

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Transmitter	LoJack Corporation	09502 472	5RLJ00M3US 032A11C 1.4B
Transmitter p/s	Xicon	419-11210-3	604-0653075
DC Lab p/s	GW	GPS-1830D	EF863599

5.1 Method:

Configuration as required by RSS-Gen Issue 3 December 2010 and ANSI C63.4:2003.

5.2 EUT Block Diagram:



6 Receiver Spurious Emissions

6.1 Method

Tests are performed in accordance with ANSI C 63.4:2003.

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.

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004	Weather Station	Davis Instruments	7400	PE80529A61A	06/11/2010	06/11/2011
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
145106	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	07/20/2010	07/20/2011
145003	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2443A04077	09/24/2010	09/24/2011
145128	EMI Receiver 40 GHz (20 Hz - 40 Ghz)	Rohde & Schwarz	ESI	8392831001	08/10/2010	08/10/2011
145-416	Cables 145-400 145-408 145-402 145-404	Huber + Suhner	3m Track B cables	multiple	08/31/2010	08/31/2011
145014	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	01/05/2010	01/05/2011
HORN3	HORN ANTENNA	EMCO	3115	9610-4980	03/22/2010	03/22/2011
145128	EMI Receiver 40 GHz (20 Hz - 40 Ghz)	Rohde & Schwarz	ESI	8392831001	08/10/2010	08/10/2011

Software Utilized:

Name	Manufacturer	Version
C5	Teseq	Build 5.26.00.3

6.3 Results:

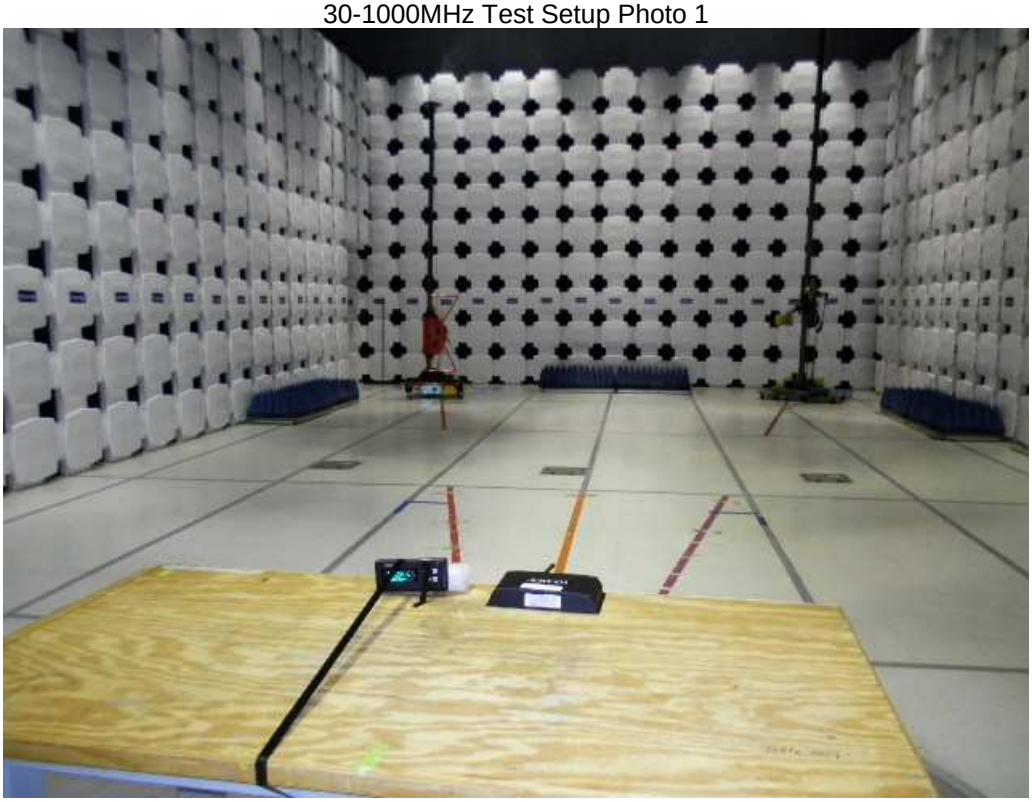
The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength (microvolts/meter)
30–88	100
88–216	150
216–960	200
Above 960	500

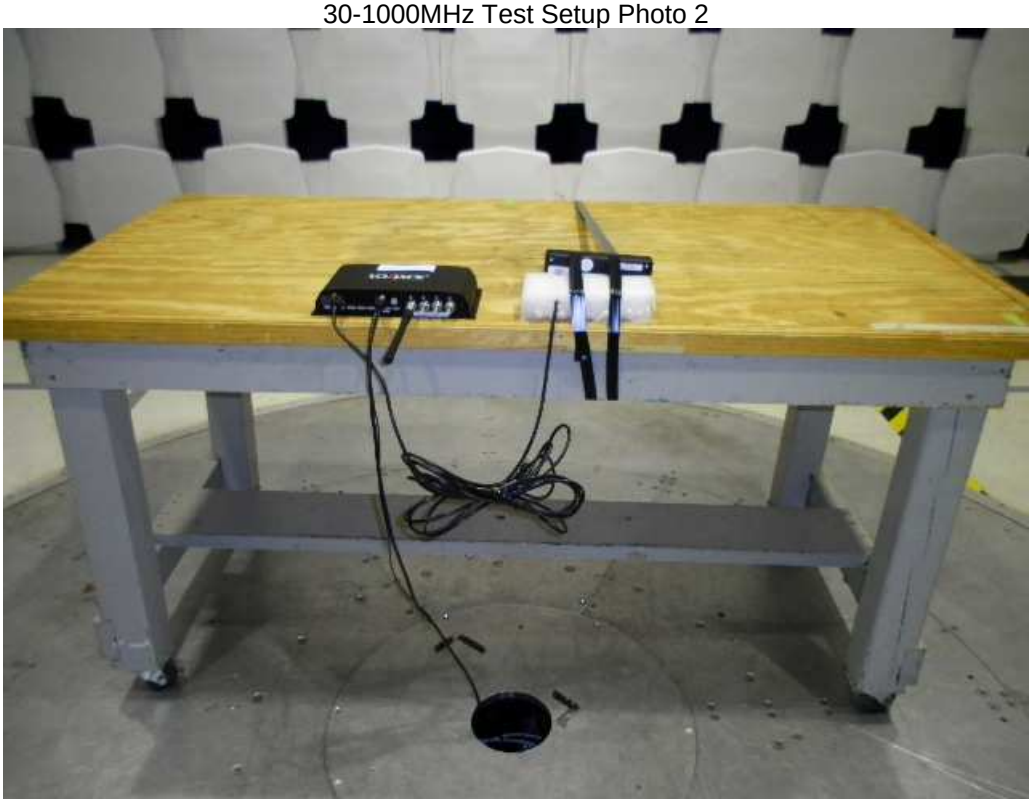
The sample tested was found to comply.

6.4 Setup Photographs:

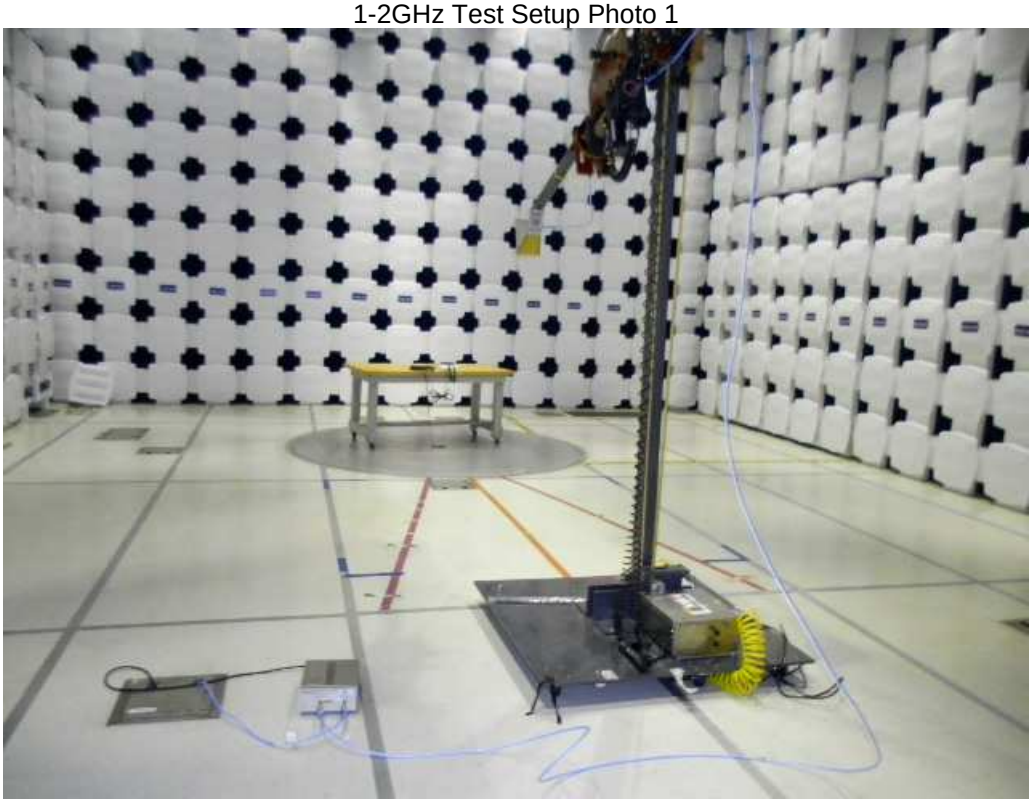
30-1000MHz Test Setup Photo 1



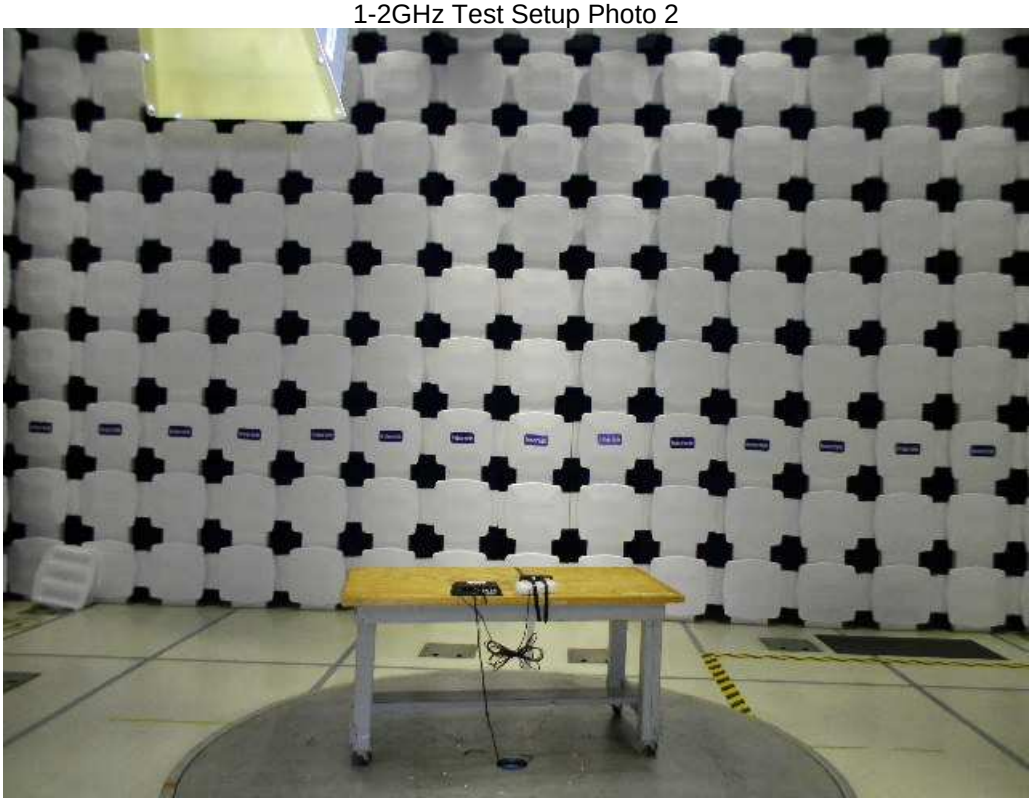
30-1000MHz Test Setup Photo 2



1-2GHz Test Setup Photo 1

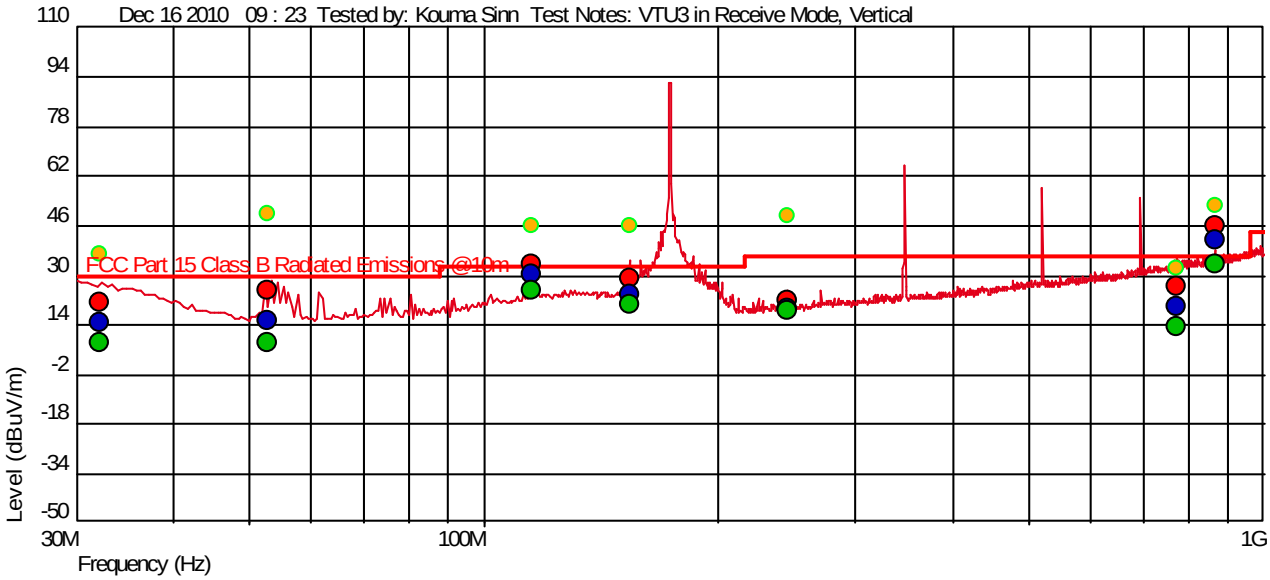


1-2GHz Test Setup Photo 2



6.5 Test Data:

30-1000MHz Radiated Emissions @ 10m, Vertical Polarity



"PORTRAIT"

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

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

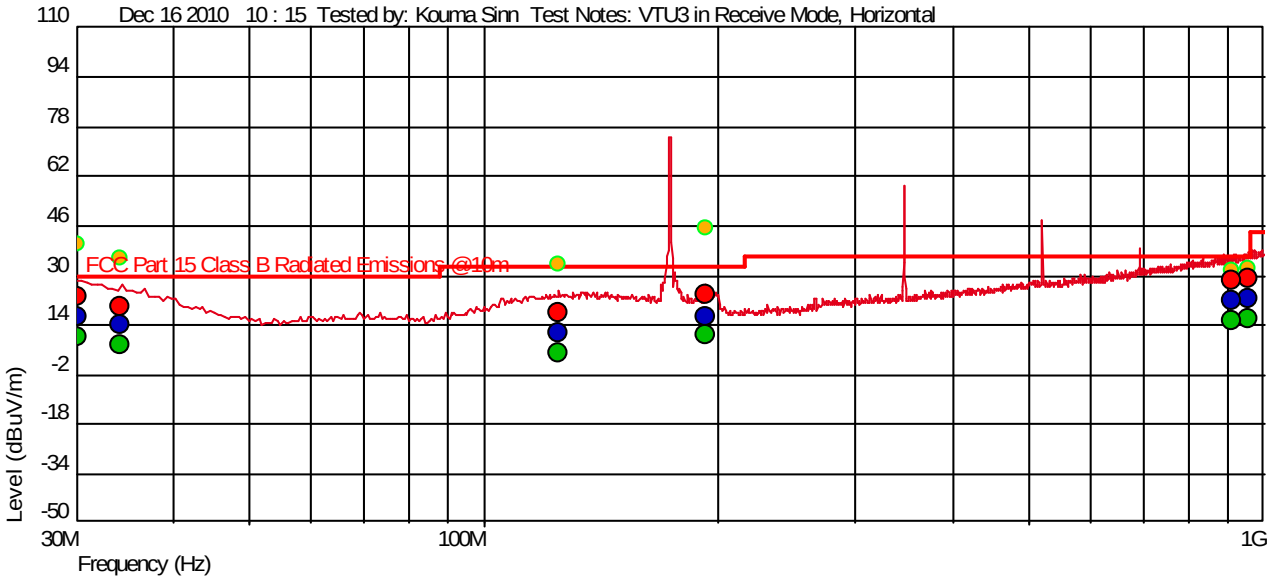
AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: Quasi-Peak

Frequency (Hz)	Level (dBuV/m)	Ant. Fact. (dB)	Other Fact. (dB)	Limit (dBuV/m)	Margin (dB)	Vert (|)	Angle (Deg)	Mast Height (m)	RBW (Hz)
32.228M	14.81	19.063	-26.306	30.00	-15.19	|	101	3.18	120k
52.842M	15.38	7.116	-26.001	30.00	-14.62	|	201	1.94	120k
115.378M	30.01	13.308	-25.370	33.00	-2.99	|	235	2.16	120k
153.801M	24.06	12.548	-24.901	33.00	-8.94	|	66	1.30	120k
245.776M	19.51	11.900	-24.539	36.00	-16.49	|	67	1.18	120k
772.589M	19.73	21.052	-23.489	36.00	-16.27	|	8	3.39	120k
865.310M	--	--	--	--	--	|	--	--	--

Notes: All the peaks that are exceed the limit as shown in the plot above including 865.310MHz are harmonics of 173.05MHz transmitter used to support the receiver testing.

30-1000MHz Radiated Emissions @ 10m, Horizontal Polarity



"PORTRAIT"

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

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

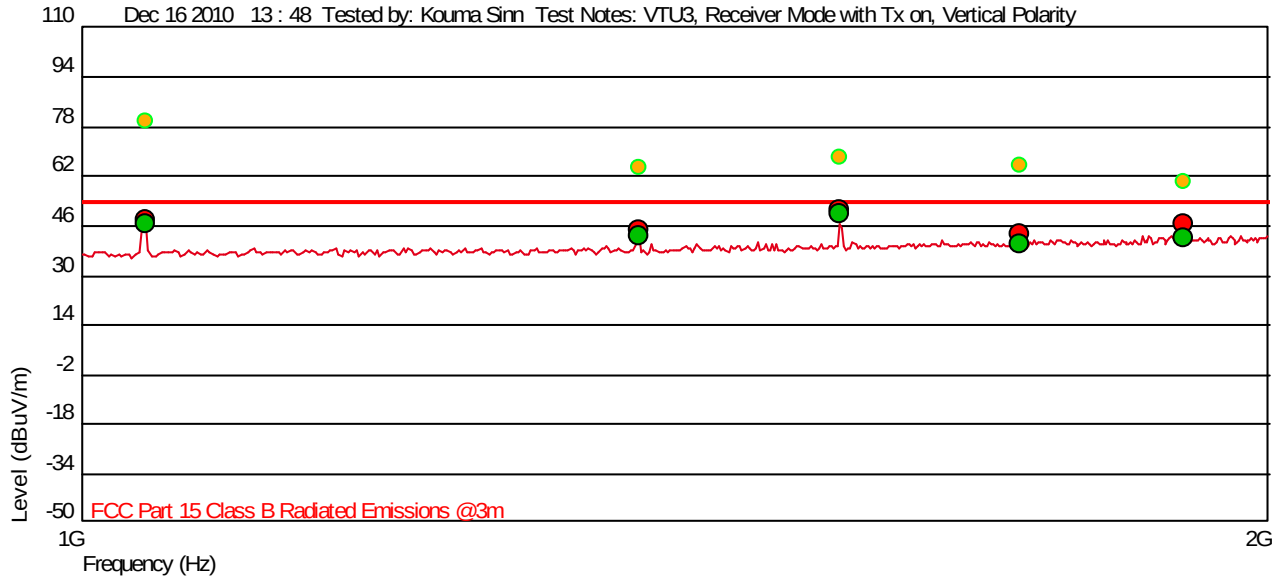
AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: Quasi-Peak

Frequency (Hz)	Level (dBuV/m)	Ant. Fact. (dB)	Other Fact. (dB)	Limit (dBuV/m)	Margin (dB)	Hor (--)	Angle (Deg)	Mast Height (m)	RBW (Hz)
30.172M	16.87	21.045	-26.339	30.00	-13.13	--	193	2.53	120k
34.186M	13.81	18.270	-26.277	30.00	-16.19	--	39	2.51	120k
124.461M	11.55	13.978	-25.249	33.00	-21.45	--	45	2.40	120k
192.197M	16.91	11.608	-24.476	33.00	-16.09	--	87	4.00	120k
913.071M	21.82	22.161	-22.504	36.00	-14.18	--	189	3.67	120k
955.248M	22.79	22.695	-22.403	36.00	-13.21	--	36	2.93	120k

Notes: All the peaks that are exceed the limit as shown in the plot above are harmonics of 173.05MHz transmitter used to support the receiver testing.

1-2GHz Radiated Emissions @ 10m, Vertical Polarity



"PORTRAIT"

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

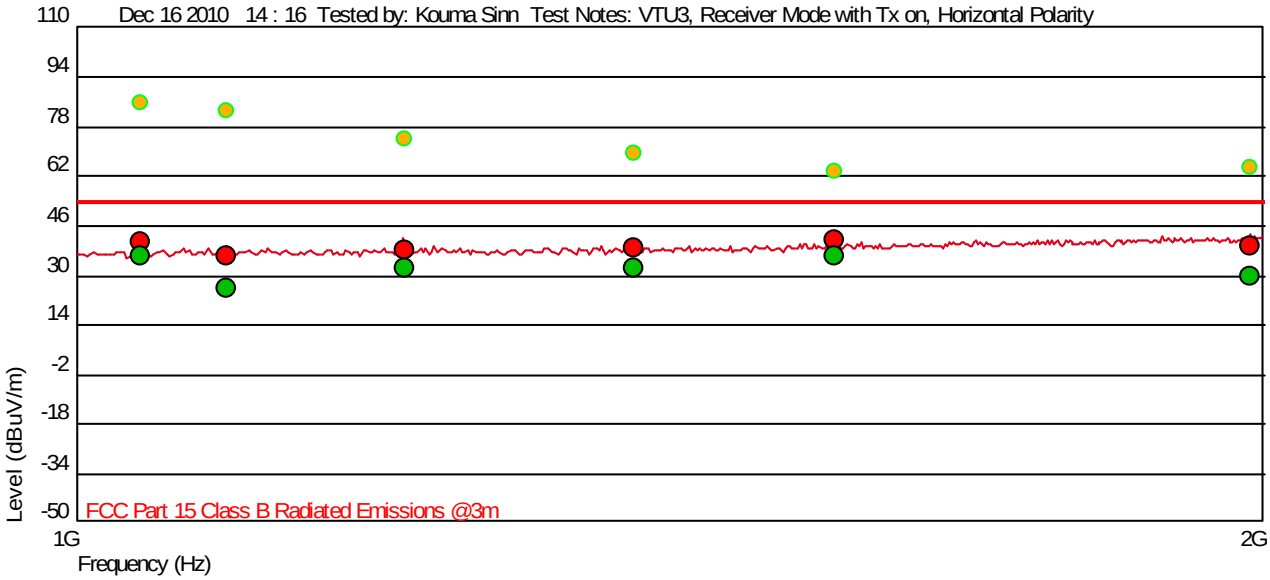
Level (dBuV/m) = AF + CL + PA + Raw

AF = Antenna Factor
CL = Cable Losses
PA = Pre-Amplifier
Raw = Raw Instrument Reading (Not listed on Spot Tables)

Measured: Average

Frequency (Hz)	Level (dBuV/m)	Ant. Fact. (dB)	Other Fact. (dB)	Limit (dBuV/m)	Margin (dB)	Vert (|)	Angle (Deg)	Mast Height (m)	RBW (Hz)
1.038G	46.37	24.225	-30.640	54	-7.63	|	10	1.33	1/3M
1.385G	42.47	25.146	-29.736	54	-11.53	|	4	1.34	1/3M
1.558G	49.53	25.378	-29.277	54	-4.47	|	158	1.05	1/3M
1.731G	40.01	26.187	-29.080	54	-13.99	|	182	1.08	1/3M
1.904G	42.35	27.006	-28.919	54	-11.65	|	157	1.09	1/3M

1-2GHz Radiated Emissions @ 10m, Horizontal Polarity



"PORTRAIT"

- 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: Quasi-Peak

Frequency (Hz)	Level (dBuV/m)	Ant. Fact. (dB)	Other Fact. (dB)	Limit (dBuV/m)	Margin (dB)	Hor (--)	Angle (Deg)	Mast Height (m)	RBW (Hz)
1.038G	35.95	24.128	-30.640	54	-18.05	--	35	2.04	1/3M
1.091G	25.52	24.303	-30.482	54	-28.48	--	346	2.04	1/3M
1.211G	32.46	24.702	-30.140	54	-21.54	--	343	2.23	1/3M
1.385G	32.38	25.200	-29.736	54	-21.62	--	65	2.33	1/3M
1.558G	36.28	25.412	-29.277	54	-17.72	--	20	2.13	1/3M
1.983G	29.63	27.235	-28.937	54	-24.37	--	317	2.44	1/3M

Test Personnel: Kouma Sinn KPS
Test Date: 12/16/10

Product Standard: RSS-Gen, ICES-003, IC RSS-119
FCC Title 47 CFR Part 15:2010
Subpart B
Test Levels: Class B

Input Voltage:

Pretest Verification w/ BB Source: **No**

Ambient Temperature: 22 ºC
Relative Humidity: 14 %
Atmospheric Pressure: 998 mbars

Deviations, Additions, or Exclusions: None

7 AC Mains Conducted Emissions

7.1 Method

Tests are performed in accordance with ANSI C 63.4:2003.

TEST SITE: EMC Lab

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.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1*	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	08/11/2010	08/11/2011
ROS002*	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	03/26/2010	03/26/2011
145005*	LISN: 50 Ohm/50 microHenry	Solar Electronics	9252-50-R-24-BNC	941725	01/27/2010	01/27/2011
DS26A*	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS26A	09/15/2010	09/15/2011
CBLBNC61*	Cable BNC/BNC, 30'	ITS	BNC-30	CBLBNC61	09/15/2010	09/15/2011

Software Utilized:

Name	Manufacturer	Version
Excel 2003	Microsoft	(11.8231.8221) SP3
EMI Boxborough.xls	Intertek	08/27/10

7.3 Results:

The equipment 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. The lower limit applies at the band edges.

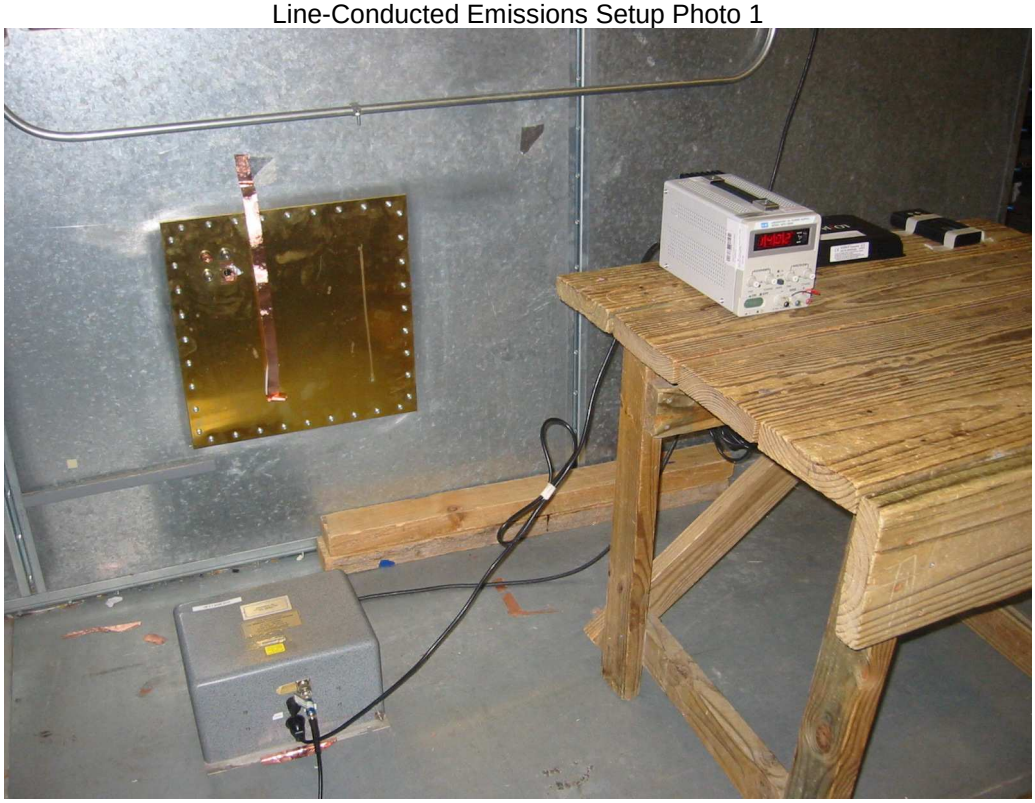
Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

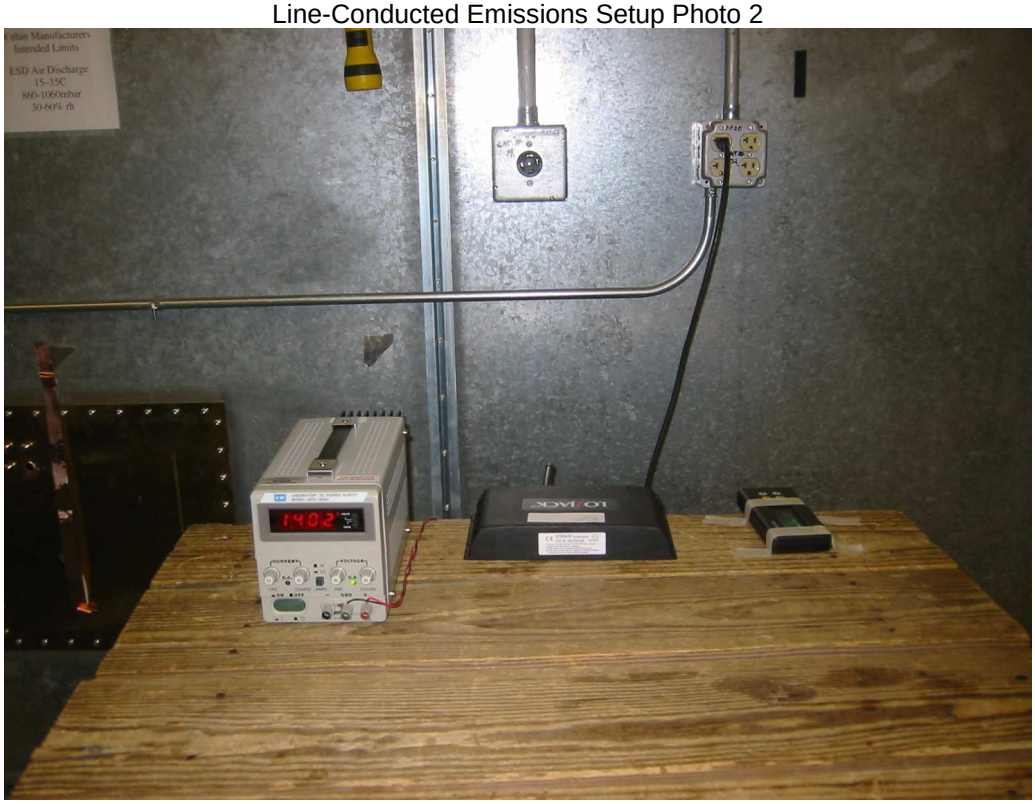
The sample tested was found to comply.

7.4 Setup Photographs:

Line-Conducted Emissions Setup Photo 1



Line-Conducted Emissions Setup Photo 2



7.5 Test Data:

Conducted Emissions

Company: LoJack
Model #: VTU3
Serial #: 0932A3E
Engineer(s): Kouma Sinn
Project #: G100277723
Standard: FCC Part 15/Cispr22 Class B
Barometer: BAR1
Date: 12/16/10
Location: EMC Lab
Temp/Humidity/Pressure: 22C 24% 999mbar
Voltage/Frequency: 120VAC/60Hz
Frequency Range: 150kHz-30MHz

Receiver: R&S ESCI (ROS002) 03-26-2011
Cable: CBLBNC61_9-15-2011.txt
LISN 1: LISN145005_[1]_1-27-2011.txt
LISN 2: LISN145005_[2]_1-27-2011.txt
LISN 3: NONE.
LISN 4: NONE.
Attenuator: DS26A_9-15-2011.txt

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	0.150	28.00	28.60			49.65	66.00	-16.35	9/30 kHz	
QP	0.491	17.80	16.50			38.76	56.15	-17.39	9/30 kHz	
QP	1.330	1.69	1.40			22.67	56.00	-33.33	9/30 kHz	
QP	2.108	2.26	2.16			23.27	56.00	-32.73	9/30 kHz	
QP	6.910	-10.90	-11.00			10.27	60.00	-49.73	9/30 kHz	NF
QP	9.409	7.00	7.17			28.48	60.00	-31.52	9/30 kHz	

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)	Average Limit dB(uV)	Margin dB	Bandwidth	
AVG	0.150	3.10	3.20			24.25	56.00	-31.75	9/30 kHz	
AVG	0.491	-7.80	-8.60			13.16	46.15	-32.99	9/30 kHz	
AVG	1.330	-13.30	-13.34			7.68	46.00	-38.32	9/30 kHz	
AVG	2.108	-14.10	-14.00			7.03	46.00	-38.97	9/30 kHz	
AVG	6.910	-15.50	-15.33			5.91	50.00	-44.09	9/30 kHz	NF
AVG	9.409	2.80	2.90			24.21	50.00	-25.79	9/30 kHz	

Test Personnel: Kouma Sinn KPS
Test Date: 12/16/10

Product Standard: RSS-Gen, ICES-003, IC RSS-119
FCC Title 47 CFR Part 15:2010
Subpart B
Test Levels: Class B

Input Voltage: DC Powered

Pretest Verification w/ BB Source: **No**

Ambient Temperature: 22 ºC
Relative Humidity: 24 %
Atmospheric Pressure: 999 mbars

Deviations, Additions, or Exclusions: None

8 Revision History

Revision Level	Date	Report Number	Notes
0	12/17/10	100277723BOX-001	Original Issue