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mailed
9/30/05

Intertek ETL SEMKO

9/29/2005

Bob White
LoJack Corporation
780 Dedham Street
Canton, MA 02021

Mr. White,

Enclosed you will find our Emissions Test Report covering testing on your VLU5W EW2 Key Pass.

If there are any questions regarding this report, please contact the undersigned or your account representative.

Sincerely,

Nicholas Abbondante
Project Engineer

Jeff Goulet
Team Leader, EMC

Enclosure

Intertek ETL SEMKO

EMISSIONS TEST REPORT

Report Number: 3082162BOX.006
Project Number: 3082162

Testing performed on the
Model: VLU5W EW2 Key Pass

to

FCC Part 15 Subpart C

For

LoJack Corporation

Test Performed by:
Intertek – ETL SEMKO
70 Codman Hill Road
Boxborough, MA 01719

Test Authorized by:
LoJack Corporation
780 Dedham Street
Canton, MA 02021

Prepared by: _____ Date: 9/29/05
Nicholas Abbondante

Reviewed by: Roland W. Gubisch Date: 9-30-2005
Roland W. Gubisch

1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of

Company:	LoJack Corporation 780 Dedham Street Canton, MA 02021
Contact:	Bob White
Telephone:	781-302-7128
Fax:	781-302-7299

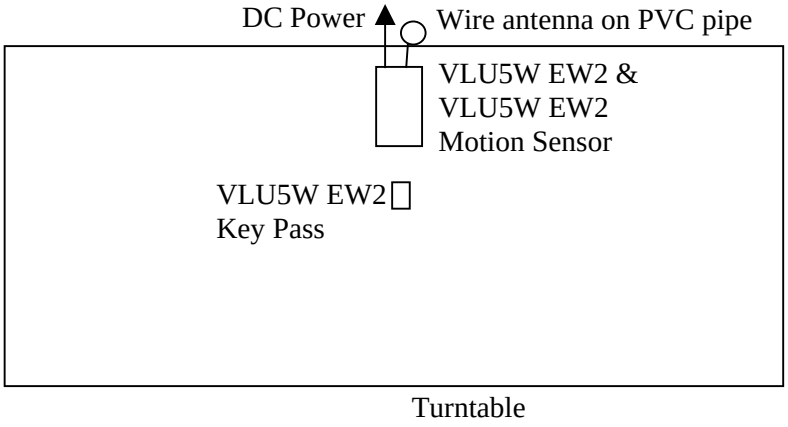
1.2 Equipment Under Test

Equipment Type:	Key Pass
Model Number(s):	VLU5W EW2 Key Pass
Serial number(s):	T6
FCC ID Number:	IDIEW2KP-05
Manufacturer:	LoJack Corporation
EUT receive date:	09/14/2005
EUT received condition:	Good
Test report issue date:	09/29/2005
Test start date:	09/14/2005
Test end date:	09/28/2005

1.3 Test Plan Reference: Tested according to the standards listed and ANSI C63.4:2003.

1.4 Test Configuration

1.4.1 Block Diagram



1.4.2 Cable List:

Cable	Shielding	Connector	Length (m)	Qty.
DC Power	None	Wire	0.8	2

1.4.3 Support Equipment:

Name: Protek Triple DC Power Supply
Model No.: 3040T
Serial No.: AC3518

Name: Vehicle Location Unit
Model No.: VLU5W EW2
Serial No.: 05AA213*

Name: Motion Sensor
Model No.: VLU5W EW2 Motion Sensor
Serial No.: 05AA213*

* - The Vehicle Location Unit and the Motion Sensor are contained in a single composite device

1.5 Mode of Operation:

The Vehicle Location Unit and the Motion Sensor were both powered from a DC power supply and were operating in a manner representative of normal operation during testing. The Key Pass was powered from a fresh battery and was transmitting normally during testing.

2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 15 Subpart C		
SUB-TEST	**TEST PARAMETER**	**COMMENT**
Occupied Bandwidth and Frequency Stability FCC 15.215	The fundamental frequency 20 dB bandwidth must stay within the assigned frequency band.	Pass
Field Strength of Fundamental and Spurious Emissions FCC 15.209, 15.249	Fundamental field strength must not exceed 94 dBuV/m. Spurious emissions must be below the 15.209 limits.	Pass

3.0 Sample Calculations

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 dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
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 dBμV 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 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

Level in μV/m = [10(32 dBμV/m)/20] = 39.8 μV/m

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

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(48.1\ dB\mu V / 20)}$ = 254 μV/m

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.
The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be:

±3.5 dB at 10m, ±3.8 dB at 3m

The expanded uncertainty (k = 2) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

±2.6 dB

The expanded uncertainty (k = 2) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:

±3.2 for ISN and voltage probe measurements
±3.1 for current probe measurements

3.2 Site Description

Test Site(s): 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-1992 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

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 groundplanes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Test Results: Pass

Test Standard: FCC 15.215

Test: Occupied Bandwidth and Frequency Stability

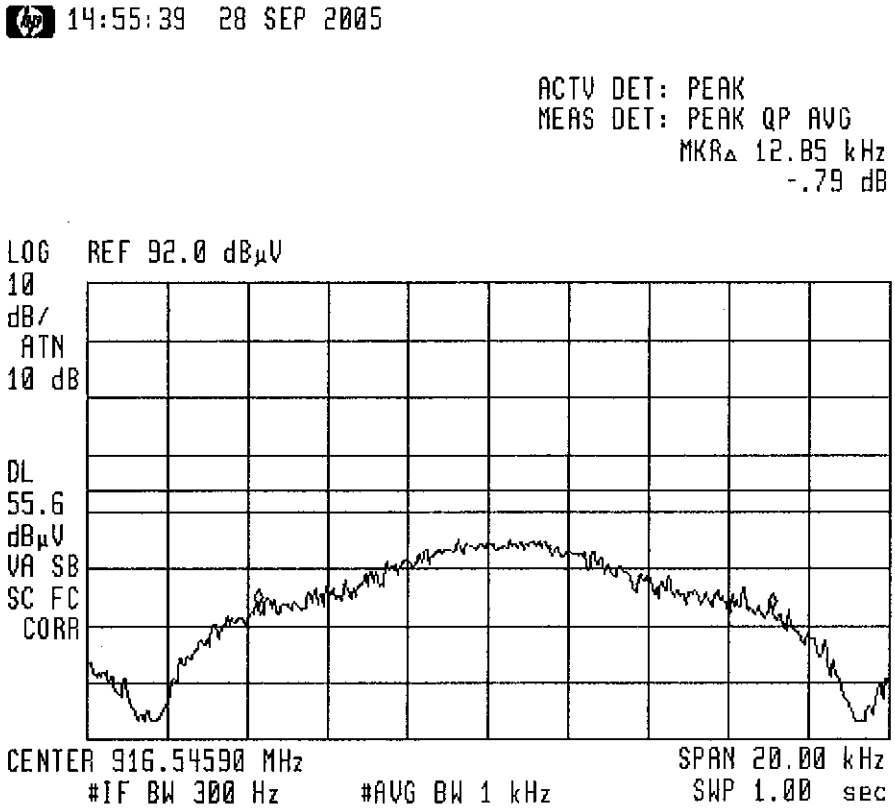
Performance Criterion: The fundamental frequency must stay within the assigned band.

Test Date: 09/28/2005 **Engineer Initials:** NNA **Date:** 9/29/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** RWJ **Date:** 9-30-2005

Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
RECFL2	Hewlett Packard	85420E	3427A00126	02/08/2006
LOG2	EMCO	3142	9711-1223	12/13/2005
S2 3M FLR	ITS	RG214B/U	S2 3M FLR	09/02/2006

Test Details:



Note that the 20 dB points are referenced to the display line which was placed at the fundamental peak when measured with a 100 kHz bandwidth. The field strength was not maximized for this measurement. The 20 dB bandwidth falls within the central 80% of the band, demonstrating compliance to 15.215(c).

Test Results: Pass

Test Standard: FCC 15.209, 15.249

Test: Field Strength of Fundamental and Spurious Emissions

Performance Criterion: Emissions must be below specified limits.

Test Environment:

See Data Tables

Software:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	2/07/05 Revision

Test Date: 09/14-15/2005 **Engineer Initials:** NA **Date:** 9/30/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** RWB **Date:** 9-30-2005

Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
BAR2	Mannix	0ABA116	BAR2	08/02/2006
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
RECFL2	Hewlett Packard	85420E	3427A00126	02/08/2006
ROS001	Rohde & Schwarz	FSEK-30	100225	07/26/2006
LOG2	EMCO	3142	9711-1223	12/13/2005
S2 10M FLR	ITS	RG214B/U	S2 10M FLR	09/02/2006
S2 3M FLR	ITS	RG214B/U	S2 3M FLR	09/02/2006
CBL028	Megaphase	TM40 K1K1 197	CBL028	12/01/2005
CBL030	Megaphase	TM40 K1K1 80	CBL030	12/01/2005
HORN1	EMCO	3115	9512-4632	11/24/2005
PRE8	Miteq	NSP4000-NF	507145	11/16/2005

Test Details:

Radiated Emissions / Interference

Company: LoJack Corporation — Model #: VLU5W EW2 Key Pass
Engineer: Nicholas Abbondante — Barometer: BAR2 — Serial #: T6
Project #: 3082162 — Pressure: 1007mB — Receiver: HP 8542E (REC2/RECFL2)
Date: 09/14/05 09/15/05 — Temp: 22c — Antenna: LOG2 12-13-05 V10.txt LOG2 12-13-05 H10.txt
Standard: FCC Part 15 — Humidity: 65% — PreAmp: NONE.
Class: - — Group: - — Cable(s): S2 3M FLR 9-2-2006.cbl NONE.
Limit Distance: 3 meters — Test Distance: 3 meters — Location: Site 2
Voltage/Frequency: Fresh Battery — Frequency Range: 30 MHz - 1 GHz
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	
PK	V	916.500	61.0	23.6	4.7	0.0	0.0	89.3	94.0	-4.7	120/300 kHz	

Radiated Emissions / Interference

Company: LoJack Corporation — Model #: VLU5W EW2 Key Pass
Engineer: Nicholas Abbondante — Barometer: BAR2 — Serial #: T6
Project #: 3082162 — Pressure: 1007mB — Receiver: HP 8542E (REC2/RECFL2)
Date: 09/14/05 09/15/05 — Temp: 22c — Antenna: LOG2 12-13-05 V10.txt LOG2 12-13-05 H10.txt
Standard: FCC Part 15 — Humidity: 65% — PreAmp: NONE.
Class: - — Group: - — Cable(s): S2 10M FLR 9-2-2006.cbl NONE.
Limit Distance: 3 meters — Test Distance: 10 meters — Location: Site 2
Voltage/Frequency: Fresh Battery — Frequency Range: 30 - 1000 MHz
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	
QP	V	39.860	4.3	11.6	1.5	0.0	-10.5	27.8	40.0	-12.2	120/300 kHz	NF
QP	V	44.030	-0.3	10.3	1.5	0.0	-10.5	21.9	40.0	-18.1	120/300 kHz	NF
QP	V	73.880	7.0	6.6	1.6	0.0	-10.5	25.6	40.0	-14.4	120/300 kHz	NF
QP	V	402.400	0.2	17.3	3.5	0.0	-10.5	31.5	46.0	-14.5	120/300 kHz	NF
QP	V	607.800	3.9	20.3	4.5	0.0	-10.5	39.1	46.0	-6.9	120/300 kHz	NF
QP	V	823.000	0.4	22.6	5.6	0.0	-10.5	39.0	46.0	-7.0	120/300 kHz	NF

Radiated Emissions / Interference

Company:	LoJack Corporation			Model #:	VLU5W EW2 Key Pass
Engineer:	Nicholas Abbondante	Barometer:	BAR2	Serial #:	T6
Project #:	3082162	Pressure:	1007mB	Receiver:	R&S FSEK-30 (ROS001)
Date:	09/14/05 09/15/05	Temp:	22c	Antenna:	HORN1 11-15-05 V3.ant HORN1 11-15-05 H3.ant
Standard:	FCC Part 15	Humidity:	65%	PreAmp:	PRE8 11-16-05.amp
Class:	-	Group:	-	Cable(s):	CBL028 12-1-2005.cbl CBL030 12-1-2005.cbl
Limit Distance:	3 meters			Test Distance:	3 meters Location: Site 2
Voltage/Frequency:	Fresh Battery			Frequency Range:	1 GHz - 10 GHz

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

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	
PK	V	1833.000	31.9	28.1	3.6	19.9	0.0	43.7	74.0	-30.3	1/3 MHz	
AVG	V	1833.000	25.8	28.1	3.6	19.9	0.0	37.6	54.0	-16.4	1/3 MHz	
PK	V	2749.500	35.1	31.0	4.6	20.1	0.0	50.5	74.0	-23.5	1/3 MHz	
AVG	V	2749.500	32.1	31.0	4.6	20.1	0.0	47.5	54.0	-6.5	1/3 MHz	
PK	V	3666.000	31.7	33.2	5.4	20.4	0.0	49.9	74.0	-24.1	1/3 MHz	NF
AVG	V	3666.000	23.1	33.2	5.4	20.4	0.0	41.3	54.0	-12.7	1/3 MHz	NF
PK	V	4582.500	32.3	34.3	6.2	21.1	0.0	51.6	74.0	-22.4	1/3 MHz	NF
AVG	V	4582.500	22.3	34.3	6.2	21.1	0.0	41.6	54.0	-12.4	1/3 MHz	NF
PK	V	5499.000	33.4	36.0	7.0	21.4	0.0	54.9	74.0	-19.1	1/3 MHz	NF
AVG	V	5499.000	24.7	36.0	7.0	21.4	0.0	46.3	54.0	-7.7	1/3 MHz	NF
PK	V	6415.500	33.2	36.2	7.6	21.4	0.0	55.6	74.0	-18.4	1/3 MHz	NF
AVG	V	6415.500	23.6	36.2	7.6	21.4	0.0	46.0	54.0	-8.0	1/3 MHz	NF

NF – This measurement is a measurement of the instrumentation noise floor