

EMI TEST REPORT

Report Number: 3075658.EMI2 Project Number: 3075658

Testing performed on the:

Remote Locator Unit

Model: R3H

To: FCC Part 90 Emissions for Stolen Vehicle Recovery Systems

For:

LoJack Corporation

FCC ID: IDILJU-03U

Issue Date: 6/17/2005

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

Prepared by:

Nicholas Abbondante

Reviewed by:

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

Gliplos Date:

6/17/05 Date:

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1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of: Company: LoJack Corporation

Contact:	Bob White
Telephone:	781-302-7128
Fax:	781-302-7299
Email:	rwhite@lojack.com

1.2 Equipment Under Test	
Equipment Type:	Remote Locator Unit
Model Number(s):	R3H
Serial number(s):	04E539F
Manufacturer:	LoJack Corporation
EUT receive date:	05/18/2005
EUT received condition:	Good
Test start date:	05/18/2005
Test end date:	05/19/2005

1.3 Test Plan Reference: Tested according to TIA-603 and FCC Parts 2 and 90

1.4 Test Configuration

1.4.1. Cables:

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

1.4.2. Support Equipment:

Name:	Kepco Programmable DC Power Supply
Model No.:	MBT 75-5M
Serial No.:	F 81015

1.5 Mode(s) of Operation:

The EUT was activated from nominal power via either a fresh battery or a DC power supply and was transmitting normally throughout testing.



2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 90		
SUB-TEST	TEST PARAMETER	COMMENT
Spurious Emissions FCC §2.1051, §2.1053, §90.210(c)	Spurious emissions must not exceed –13 dBm ERP.	Pass
Frequency Stability FCC §2.1055, §90.213	Frequency stability must not exceed 50 PPM.	Pass

The EUT is being tested due to a change in the chassis packaging and the addition of a PCB which accepts 24 volts and provides 12 volts to the transmitter circuitry, which has not changed. Based on the nature of the changes, it is expected that none of the transmitter characteristics have changed, so the EUT was tested for spurious emissions and frequency stability.



- 3.0 Test Results: Pass
- 3.1 Test Standard: FCC §2.1051, §2.1053, §90.210(c)

3.2 Test: Spurious Emissions

The transmitter was operated at nominal power. The field strength of emissions was recorded and converted to ERP by replacing the EUT with a signal generator and transmit antenna and recording the power level required to duplicate each emission. The EUT was investigated in 3 orthogonal axes, and the configuration which generated the highest emissions was tested.

3.3 Maximum Test Disturbance Parameters: Spurious emissions must not exceed -13 dBm ERP.

Test Date: 05/18-19/05 Test Engineer: Nicholas Abbondante Test Engineer Initials: $\mathcal{N}^{\mathcal{N}^{\mathcal{N}^{\mathcal{A}}}}$ Date: 6/17/65Reviewer Initials: D3 Date: 6/17/05

3.4 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
BAR2	Mannix	0ABA116	BAR2	07/02/2005
HEW62	Hewlett Packard	83620A	3213A01244	01/25/2006
CBL028	Megaphase	TM40 K1K1 197	CBL028	12/01/2005
CBL029	Megaphase	TM40 K1K1 80	CBL029	12/01/2005
LOG2	EMCO	3142	9711-1223	12/13/2005
ANT4A	Compliance Design	B100	3317	09/13/2005
ANT4B	Compliance Design	B200	3245	09/13/2005
ANT4C	Compliance Design	B300	3352	09/13/2005
HORN1	EMCO	3115	9512-4632	11/24/2005
HORN2	EMCO	3115	9602-4675	09/20/2005
Site 2 10M FLOOR	ITS	RG214B/U	S2 10M FLR	09/15/2005

3.5 Software Utilized:

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



3.6 Test Results:

Radiated Emissions / Interference

		Company:	LoJack Co	poration			Model #:	R3H			
		Engineer:	Nicholas A	bbondante	Barometer:	BAR2	Serial #:	04E539F			
		Project #:	3075658		Pressure:	1009mB	Receiver:	HP 8542E (RE	EC2/RECFL2)		
		Date:	05/18/05	05/19/05	Temp:	21c	Antenna:	LOG2 12-13	8-05 V10.txt	LOG2 12-13	3-05 H10.txt
		Standard:	FCC Part 9	0	Humidity:	43%	PreAmp:	NONE.			
		Class:	-	Group:	None		Cable(s):	Site2, 10M Flo	or 9-15-05.cbl	NONE.	
		Limi	it Distance:		meters	Tes	t Distance:	10 & 3	meters	Location:	Site 2
		Voltage/	Frequency:	24\	/DC	Frequer	ncy Range:	30 - 18	00 MHz		
		Tx Signal	Generator:	HEW62 T	x Antenna: /	ANT4, HOR	N1 Rx Ant	enna: LOG2	2, HORN2		
	Rx Cal	ole: CBL028	, Site 2 10N	1 Floor Tx	Cable: CBL	.029 10m te	est distance	< 1GHz, 3r	n distance >	> 1 GHz	
	Net	= Generator	r Level (0.00) dBm) + (E	UT reading	- Generato	r reading) -	Cable Loss	+ Antenna	Gain	
		Peak: PK (Quasi-Peak	QP Avera	ige: AVG R	MS: RMS;	Bandwidth	denoted as	RBW/VBW		
	Ant.		EUT	Generator	Transmit	Transmit	Generator				
Detector	Pol.	Frequency	Reading	Reading	Cable	Antenna	Level	Net	Limit	Margin	Bandwidth
Type	(V/H)	MHz	dB(uV)	dB(uV)	Loss dB	Factor dBi	dBm	dBm	dBm	dB	
PK	V	153.880	41.2	59.6	0.3	1.4	-20.0	-37.3	-13.0	-24.3	120/300 kHz
PK	V	192.500	37.0	57.0	0.3	0.6	-20.0	-39.7	-13.0	-26.7	120/300 kHz
PK	V	230.880	29.7	53.6	0.3	0.3	-20.0	-44.0	-13.0	-31.0	120/300 kHz
PK	Н	346.500	55.9	48.6	0.4	-0.4	-20.0	-13.4	-13.0	-0.4	120/300 kHz
PK	Н	519.500	32.3	45.7	0.5	1.2	-20.0	-32.7	-13.0	-19.7	120/300 kHz
PK	Н	692.400	27.2	44.1	0.6	2.4	-20.0	-35.1	-13.0	-22.1	120/300 kHz
PK	Н	1038.500	34.2	46.9	0.7	4.6	-20.0	-28.9	-13.0	-15.9	1/3 MHz
PK	Н	1211.500	35.2	50.8	0.8	5.6	-20.0	-30.9	-13.0	-17.9	1/3 MHz
PK	V	1384.600	32.6	48.1	0.8	6.1	-20.0	-30.3	-13.0	-17.3	1/3 MHz
PK	V	1557.700	29.8	54.9	0.9	7.5	-20.0	-38.4	-13.0	-25.4	1/3 MHz
PK	V	1668.000	22.0	56.1	1.0	7.5	-20.0	-47.6	-13.0	-34.6	1/3 MHz
PK	V	1683.000	22.6	55.7	1.0	7.5	-20.0	-46.6	-13.0	-33.6	1/3 MHz
PK	V	1730.800	29.3	54.5	1.0	7.4	-20.0	-38.8	-13.0	-25.8	1/3 MHz



Spurious emissions setup photos





EMI Report for LoJack Corporation on the Model: R3H Report Number 3075658.EMI2



Emissions Site Description:

Site 2C (Middle Site) is a 3m and 10m sheltered emissions measurement range located in a light commercial environment in Boxborough, Massachusetts. It meets 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 ground plane 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 is provided for floor-standing equipment. A wooden table 80 cm high is used for tabletop 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 ground plane 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 ground plane (2 meter X 2 meter area) is used for line-conducted measurements for tabletop equipment. The vertical ground plane is electrically connected to the reference ground plane.

Measurement Uncertainty:

Note that the measurement uncertainty contained herein is ± 4.0 dB for radiated emissions and ± 2.0 dB for lineconducted emissions.



- 4.0 Test Results: Pass
- 4.1 Test Standard: FCC §2.1055, §90.213
- 4.2 Test: Frequency Stability over Voltage

The EUT was powered by a DC power supply with output voltage verified with a digital multimeter. Readings were taken at the nominal voltage of 24 Volts and at the battery operating endpoint which is 18 Volts.

4.3 Maximum Test Disturbance Parameters: The frequency stability must not exceed 50 PPM (8654 Hz at 173 MHz).

Test Date: 05/19/2005 Test Engineer: Nicholas Abbondante Test Engineer Initials: ^{NNA} Date: 6/17/05 Reviewer Initials: 05 Date: 6/17/05

4.4 Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
RECEL2	Hewlett Packard	85420E	3427A00126	02/08/2006
BAR2	Mannix	0ABA116	BAR2	07/02/2005
LOG2	EMCO	3142	9711-1223	12/13/2005
Site 2 10M FLOOR	ITS	RG214B/U	S2 10M FLR	09/15/2005

4.5 Test Results:

Voltage	Freq MHz	Deviation, Hz	Max Drift, Hz
24V	173.07325	0	8653.7
18V	173.07335	100	8653.7