

**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

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

Prepared by:

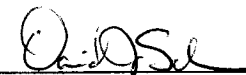


Nicholas Abbondante

Date:

6/17/05

Reviewed by:



David Schramm

Date:

6/17/05

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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) | 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<br>FCC §2.1051, §2.1053, §90.210(c) | Spurious emissions must not exceed –13 dBm ERP. | Pass    |
| Frequency Stability<br>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:** NNA **Date:** 6/17/05

**Reviewer Initials:** DJS **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:

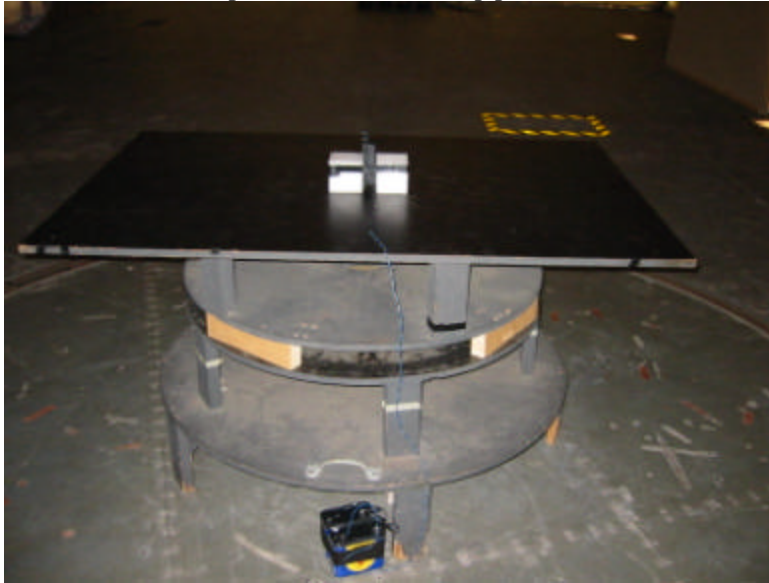
#### Radiated Emissions / Interference

Company: LoJack Corporation  
 Engineer: Nicholas Abbondante  
 Project #: 3075658  
 Date: 05/18/05 05/19/05  
 Standard: FCC Part 90  
 Class: -  
 Limit Distance: - meters  
 Voltage/Frequency: 24VDC  
 Tx Signal Generator: HEW62  
 Rx Cable: CBL028, Site 2 10M Floor  
 Tx Cable: CBL029 10m test distance < 1GHz, 3m distance > 1 GHz  
 Net = Generator Level (0.00 dBm) + (EUT reading - Generator reading) - Cable Loss + Antenna Gain  
 Peak: PK, Quasi-Peak: QP, Average: AVG, RMS: RMS, Bandwidth denoted as RBW/VBW

Model #: R3H  
 Serial #: 04E539F  
 Receiver: HP 8542E (REC2/RECFL2)  
 Antenna: LOG2 12-13-05 V10.txt LOG2 12-13-05 H10.txt  
 PreAmp: NONE.  
 Cable(s): Site2, 10M Floor 9-15-05.cbl NONE.  
 Test Distance: 10 & 3 meters  
 Frequency Range: 30 - 1800 MHz  
 Rx Antenna: ANT4, HORN1  
 Rx Antenna: LOG2, HORN2  
 Location: Site 2

| Detector Type | Ant. Pol. (V/H) | Frequency MHz | EUT Reading dB(uV) | Generator Reading dB(uV) | Transmit Cable Loss dB | Transmit Antenna Factor dBi | Generator Level dBm | Net dBm | Limit dBm | Margin dB | Bandwidth   |
|---------------|-----------------|---------------|--------------------|--------------------------|------------------------|-----------------------------|---------------------|---------|-----------|-----------|-------------|
| 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            | H               | 346.500       | 55.9               | 48.6                     | 0.4                    | -0.4                        | -20.0               | -13.4   | -13.0     | -0.4      | 120/300 kHz |
| PK            | H               | 519.500       | 32.3               | 45.7                     | 0.5                    | 1.2                         | -20.0               | -32.7   | -13.0     | -19.7     | 120/300 kHz |
| PK            | H               | 692.400       | 27.2               | 44.1                     | 0.6                    | 2.4                         | -20.0               | -35.1   | -13.0     | -22.1     | 120/300 kHz |
| PK            | H               | 1038.500      | 34.2               | 46.9                     | 0.7                    | 4.6                         | -20.0               | -28.9   | -13.0     | -15.9     | 1/3 MHz     |
| PK            | H               | 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



**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  $\pm 4.0$  dB for radiated emissions and  $\pm 2.0$  dB for line-conducted 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:** DS **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 |
| RECFL2           | 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        |