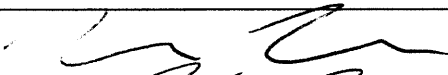
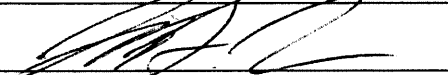


Test Report
for
LoJack Corporation
on the
Remote Locator Unit (Motorcycle Mounting)
Model: ML3
to
FCC Part 90 Emissions for Mobile Radios

Test Report #: 3065972.EMIREV3
Date of Report: October 28, 2004
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Total No of Pages Contained in this Report: 11

	Nicholas Abbondante, Test Engineer
	Michael F. Murphy, Staff Engineer/EMC

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FCC Part 90 Certification



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1.0 Summary of Tests

LoJack Remote Locator Unit (Motorcycle Mounting)
Serial No.: 5RLJ0015US 0389A97
Model No.: ML3

FCC RULE	DESCRIPTION OF TEST	RESULTS	REPORT PAGE
FCC §2.1053, § 90.20(e)(6)	RF Power Output	Passed	7
FCC §2.1053, § 90.210(c)	Field Strength of Spurious Radiation	Passed	8

2.0 General Description

2.1 Product Description

The EUT is a transmitter operating at 173.075 MHz, that is used to locate stolen motorcycles. Once activated, it sends repeated transmissions of an ID code that can be used for radiolocation of and identification of the stolen vehicle. The sample received was configured to test in the worst-case transmission mode, corresponding to the mode where the transmitter has been activated as if it were in a stolen vehicle.

The EUT has been tested at the request of

Company:	LoJack Corporation 780 Dedham Street Canton, MA, 02021
Name of contact:	Mr. Robert White
Telephone:	(781) 302-7128
Fax:	(781) 302-7299

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

Site 2C (Middle Site) is a 3m and 10m sheltered EMI 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 groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets of metal 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 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. A 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 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.

2.4 Test Equipment and Support Equipment

Test Equipment

Description	Manufacturer	Model Number	ITS ID	Serial Number	Cal Due Date
Antenna	EMCO	3142	LOG3	9711-1224	02/09/2005
Spectrum Analyzer	Rohde & Schwarz	FSEK-30	ROS001	100225	06/04/2005
Spectrum Analyzer	Hewlett Packard	8591EM	-	3639A00943	07/07/2005
High Frequency Cable	Megaphase	TM40 K1K1 197	CBL028	CBL028	11/11/2004
High Frequency Cable	Megaphase	TM40 K1K1 80	CBL030	CBL030	11/11/2004
Signal Generator	Hewlett Packard	8648C	HEW63	3847A05291	11/11/2004
Horn Antenna	EMCO	3115	HORN2	9602-4675	9602-4675
Horn Antenna	EMCO	3115	HORN3	9610-4980	09/20/2005
Antenna	Compliance Design	B100	ANT4A	3317	09/13/2005
Antenna	Compliance Design	B200	ANT4B	3245	09/13/2005
Antenna	Compliance Design	B300	ANT4C	3352	09/13/2005

Support Equipment

Description	Manufacturer	Model Number	Serial Number
DC Power Supply	N/L	N/L	N/L

Cables

Quantity	Type	Length (m)	Shielding	Ferrite	Connector Type
1	Power Supply AC Mains	1	None	None	US 120V Plug
2	DC Leads	0.3	None	None	Lead

3.0 RF Power Output

FCC § 90.20(e)(6)

3.1 Test Procedure

The transmitter was placed on a wooden turntable. The measurement antenna was placed at a distance of 10 meters from the EUT. During the tests, the antenna height and polarization were varied, and the EUT was rotated through 360 degrees and manipulated on three orthogonal axes in order to identify the maximum level of emissions from the EUT. A max hold function was used to determine maximum field strength levels.

The Radiated Power was measured by the substitution method using a horn antenna or a biconical antenna connected to a signal generator. Power P (in dBm) was calculated as follows:

$$P = P_{sg} + dB_{adj} - L + G_H$$

Where G_H is the gain of the transmit horn/biconical antenna attached to the signal generator

L is the loss in the cable between the signal generator and the transmit antenna

P_{sg} is the generator output power

dB_{adj} is the adjustment in dB used to correct for the difference between the observed field strengths of the EUT and of the signal generator signal, respectively.

Requirement: The RF Power Output must be below 2.5 Watts (4 dBW).

3.2 Test Results

Results: Passed

Performed 10/29/2003

Equipment: HP 8591EM, CBL030, HEW63, ANT4, LOG3, ROS001

Frequency (MHz)	Description	Value (dBm)	Value (dBW)	Limit (dBW)
173.075	LoJack Remote Locator Unit	32.8	2.8	4

4.0 Field Strength of Spurious Radiation

FCC §2.1053, § 90.210(c)

4.1 Test Procedure

The transmitter was placed on a wooden turntable. The measurement antenna was placed at a distance of 10 meters from the EUT. During the tests, the antenna height and polarization were varied, and the EUT was rotated through 360 degrees and manipulated on three orthogonal axes in order to identify the maximum level of emissions from the EUT. A max hold function was used to determine maximum field strength levels.

The Radiated Power was measured by the substitution method using a horn antenna or a biconical antenna connected to a signal generator. Power P (in dBm) was calculated as follows:

$$P = P_{sg} + dB_{adj} - L + G_H$$

Where G_H is the gain of the transmit horn/biconical antenna attached to the signal generator

L is the loss in the cable between the signal generator and the transmit antenna

P_{sg} is the generator output power

dB_{adj} is the adjustment in dB used to correct for the difference between the observed field strengths of the EUT and of the signal generator signal, respectively.

Requirement: The power into a dipole necessary to duplicate spurious emissions and harmonics must be attenuated below the power of the unmodulated carrier (P) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least $(43 + 10 \log P)$ dB. P is the measured RF output power in Watts. This corresponds to an ERP limit of -13 dBm. A table showing ERP values for the harmonics and spurious is shown.

4.2 Test Results

Results: Pass

Radiated Emissions / Interference

Company: LoJack Corporation Model #: ML3
 Engineer: Nicholas Abbondante Location: Site 2 Serial #: 5RLJ0015US 0389A97
 Project #: 3065972 Pressure: 1010 mB Receiver: R&S FSEK-30 HP 8591EM
 Date: 11/29/04 Temp: 20c Antenna: LOG3 2-9-05 V3.ant LOG3 2-9-05 H3.ant
 Standard: FCC Part 15 Subpart B Humidity: 46% PreAmp: NONE.
 Class: B Group: None Cable(s): Site2, 3M Floor 9-15-05.cbl NONE.
 Limit Distance: 3 meters Test Distance: 3 meters
 Voltage/Frequency: 13.8VDC Frequency Range: 30 MHz - 2 GHz
 Tx Signal Generator: HEW63 Tx Antenna <1GHz: ANT4 Rx Antenna <1GHz: LOG3
 Rx Antenna >1GHz: Horn2 Rx Cable: CBLSHF203 Tx Antenna >1GHz: Horn3 Tx Cable: CBL030
 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/BW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	EUT Reading dB(μV)	Generator Reading dB(μV)	Transmit Cable Loss dB	Transmit Antenna Factor dB	Generator Level dBm	Net dBm	Limit dBm	Margin dB	Bandwidth
PK	H	173.075	118.8	88.0	0.3	2.3	0.0	32.8	34.0	-1.2	100/300 kHz
PK	H	230.800	36.2	84.4	0.3	0.9	0.0	-47.6	-13.0	-34.6	100/300 kHz
PK	H	304.000	30.9	82.9	0.4	0.4	0.0	-52.0	-13.0	-39.0	100/300 kHz
PK	H	346.500	61.5	78.3	0.4	0.0	0.0	-17.2	-13.0	-4.2	100/300 kHz
PK	V	519.500	51.7	73.7	0.5	0.5	0.0	-22.0	-13.0	-9.0	100/300 kHz
PK	H	692.800	32.4	74.8	0.6	3.2	0.0	-39.9	-13.0	-26.9	100/300 kHz
PK	V	865.500	34.0	70.4	0.7	-0.3	0.0	-37.4	-13.0	-24.4	100/300 kHz
PK	V	1038.500	29.7	75.8	0.7	6.0	0.0	-40.9	-13.0	-27.9	1/3 MHz
PK	V	1211.500	28.0	74.7	0.7	6.7	0.0	-40.7	-13.0	-27.7	1/3 MHz
PK	V	1384.600	28.0	69.0	0.7	7.5	0.0	-34.2	-13.0	-21.2	1/3 MHz
PK	V	1557.700	28.9	74.8	0.9	7.8	0.0	-39.1	-13.0	-26.1	1/3 MHz
PK	V	1730.800	30.9	73.6	0.9	7.7	0.0	-35.9	-13.0	-22.9	1/3 MHz

4.3 Configuration Photographs – Radiated Emissions



Spurious Test Setup, Front View



Spurious Test Setup, Back View

REVISIONS

REVISION SUMMARY – The following changes have been made to this Report:

<u>Date</u>	<u>Project No.</u>	<u>Project Handler</u>	<u>Page(s)</u>	<u>Item</u>	Description of Change
11/15/04	3065972	Nicholas Abbondante	1 - 10	EUT M/N's	EUT M/N.'s changed from MLU to ML3 at client request and typo on page 3 referencing RLU3 is now ML3
12/02/04	3065972	Nicholas Abbondante	6 - 7, 9	RF output power and spurious emissions	Re-tested output power and spurious emissions on the EUT with properly configured power output. New data tables for RF output power and spurious emissions have been added. Equipment table was also edited to include the equipment used.