

MEASUREMENT REPORT

Prepared for:

LOJACK CORPORATION

I. INTRODUCTION

This measurement report is submitted in support of an Application for Certification in accordance with Part 2, and Part 90.210(e)(6) of the Federal Communications Commission's Rules and Regulations.

The equipment under test (EUT) is a digitally modulated RF transmitter. This transmitter operates at a fixed frequency of 173.075 MHz and is powered by a 12.0 VDC car battery, with a 6. VDC battery backup. It is identified as the *LoJack Stolen Vehicle Recovery System* (FCC ID:IDILJU-03U). The measurements contained in this report demonstrate compliance with the limitations of the FCC Rules.

Note: A waiver of the Part 90.20(e)(6) duty cycle requirements was requested by LoJack and granted by the FCC. A copy of the grant of waiver is included in this application.

II. INFORMATION REQUIRED FOR CERTIFICATION

Paragraph(s)

2.1033(a) This application for certification is filed with TCB, Timco Engineering, FCC Form 731 with all questions answered. An application fee of \$450.00 was payed.

2.1033(b)(1) The full name and mailing address of the manufacturer of the device and applicant for certification is:

LoJack Corporation
333 Elm Street,
Dedham, MA 02026

(2) The FCC Identifier of the device is IDILJU-03U.

- (3) A copy of the installation and operating instructions to be furnished to the user is included in the exhibits section of this application.
- (4) The transmitter is powered by a 12.0 VDC Volt car battery.

It is designed to operate at a fixed frequency of 173.025 MHz.

Complete circuit schematics are provided in the exhibits section of this application.
- (5) A block diagram of the device is included in the exhibits section of this application.
- (6) A report of measurements is included in this report.
- (7) Photographs of this device showing the label placement, chassis assembly, and circuit layout are included in the exhibits section of this application. An Actual label photograph is included.
- (8) This equipment is a stand-alone unit. No peripherals or accessories are involved.
- (9) N/A.
- (10) N/A.

III. GENERAL TEST CONDITIONS AND PROCEDURES

Measurement procedures were used as outlined in ANSI. The open field tests were performed on a three-meter range maintained by Carl T. Jones Corporation at the Springfield facility. Complete description and measurement data for the site have been placed on file with the Commission. Carl T. Jones Corporation is listed by the FCC as a facility available to do measurement work for others on a contract basis. Prior to open-field testing, the equipment was placed in a shielded enclosure and scanned at a close distance to determine its emission characteristics.

IV. RF POWER OUTPUT (2.1046, 90.20(e)(6))

The transmitter is authorized for a maximum output power of 2.5 Watts. However, the EUT has a rated maximum output power of 2.0 Watts. The output power spectral plot, included in this report, demonstrates compliance with the applicable FCC Rules, and the output power of this device measured a peak power output of 2 Watts.

V. MODULATION CHARACTERISTICS (2.1046, 90.20(e)(6))

The modulation characteristics, emission designator, of this transmitter is 13K2F2D. A description of the modulation technique is included in the *operational description* exhibit of this application. Also included in this application are two digital timing plots, in the time domain, used to control the transmitter's *on* and *off* sequences.

VI. OCCUPIED BANDWIDTH (2.1049, 90.210, and 90.20(e)(6))

The LoJack transmitter is authorized an occupied bandwidth of 20 kHz. Included in the exhibits section of this application are spectral plots demonstrating compliance with the occupied bandwidth requirements listed in paragraph 90.20(e)(6) of the Rules. Plots are included using RBW's and VBW's of 100kHz and 300 Hz.

In addition, spectral plots are included to show compliance with the emission mask requirements defined in paragraph 90.210, Emission Mask B.

VII. SPURIOUS EMISSIONS AT ANTENNA TERMINAL (2.1051, 90.210(b))

Included in the exhibits section of this application are spectral plots demonstrating compliance with the

spurious emissions levels defined in paragraph 90.210(b), at the EUT's antenna terminal.

In addition, spectral plots are included to show compliance with the emission mask requirements defined in paragraph 90.210, Mask B.

VIII. FIELD STRENGTH OF SPURIOUS EMISSIONS (2.1053, 90.210(b))

The transmitter was assembled on a rotatable wooden test stand approximately 0.8 meters in height. The transmitter's antenna port was terminated with a 50 ohm dummy-load. The emission spectrum was examined up to 2000 MHz using Hewlett-Packard 8568B and 8592A spectrum analyzers; with Electrometrics Model LPA-25/30, Antenna Corporation of America Model 2203-LI-N, and Electrometrics Model BIA-25 broadband antennas.

At each emission frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB bandwidth was set to 100 kHz. The analyzers were operated in the peak detection mode for measurements of emissions less than 2000 MHz. No post-detector video filters were used. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in Table 1. All emissions not reported were more than 20 dB below the specified limit.

The actual field intensity in decibels above one microvolt per meter (dBuV/m) is determined by algebraically adding the measured level in dBuV, the antenna factor (dB), and the cable loss (dB) at the appropriate frequency.

$$F_{la} \text{ (dBuV/m)} = F_{lm} \text{ (dBuV)} + AF \text{ (dB)} + CL \text{ (dB)}$$

F_{la} = Actual Field Intensity

F_m = Measured Field Intensity

AF = Antenna Factor

CL = Cable Loss

As a *sample calculation*, assume a particular device emits a signal with a frequency of 49.86 MHz.

The maximized received signal level measured as 69.4 dB μ V. The total attenuation factor (antenna factor plus cable loss) for 49.86 MHz is 4.8 dB. The actual radiated field is calculated as follows:

$$69.4 \text{ dB}\mu\text{V} + 4.8 \text{ dB} = 74.2 \text{ dB}\mu\text{V/m or } 5,128.6 \mu\text{V/m (peak)}$$

The EUT was found to meet the radiated field strength requirements defined in paragraph 90.210(b)(1)(2)(3).

IX FREQUENCY STABILITY (2.1055, 90.213)

Data sheets are included in the exhibits section of this application showing the frequency stability measurements. The EUT was measured and complies with 50 ppm.

X TRANSIENT FREQUENCY BEHAVIOR (90.214)

As per Mr. Frank Coperich, FCC engineer, the EUT was not required to be measured for transient frequency behavior.

XI RECEIVER CERTIFICATION APPLICATION

The receiver portion of this LoJack transceiver was tested and found to be compliant with the requirements defined in Part 15 of the rules. A separate measurement report and spectral (scan) plots

demonstrating compliance for the receiver portion of the transceiver are included in this application.