Re: FCC ID IDILJU-03
731 Confirmation Number: EA94920
Applicant: Lo Jack Corporation

The following four questions from the Commission regarding the above Application for Certification are addressed herein. Photographs of the test arrangements are also provided.

1.) Please provide further details of the modulation process - sufficient to justify the necessary bandwidth and emission classification you have selected.

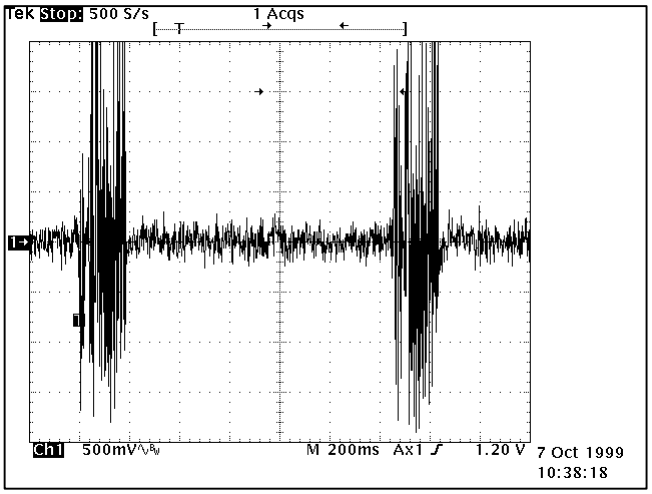
The LoJack III vehicle transponder employs a phase continuous Fast Frequency Shift keyed subcarrier at a 1200 bps data rate. The subcarrier data modulation method complies to the following specifications:

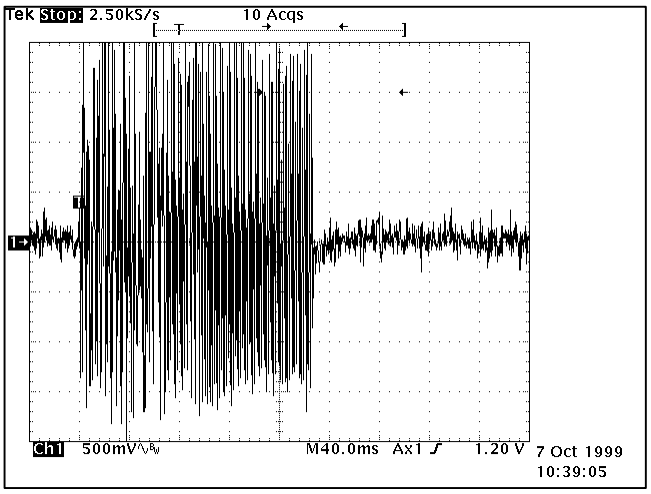
Subcarrier modulation: Phase continuous FSK
Bit rate: 1200 bits per second
Modulation rate: 1200 baud
Binary "0": One and one half cycles of an 1800 Hz sine wave
Binary "1": One cycle of a 1200 Hz sine wave

The LoJack III uses a digital to analog circuit from the microprocessor through a low pass filter to generate the subcarrier signals. Filter characteristics are provided in Appendix B of the Certification Filing.

An emission designator of **13K2F2D** is being requested for the device. The necessary bandwidth was calculated according to the formula B = 2M + 2DK given for frequency modulated digital signals. This calculation was based on the system's rated maximum modulating frequency of 1800 Hz and frequency deviation of 4 kHz. The Certification Filing contains an error in reporting 17.2 KHz Occupied Bandwidth in the table on page 6 (Section 3.3 Test Results and Conclusion). A corrected Section 3.0 is provided herein.

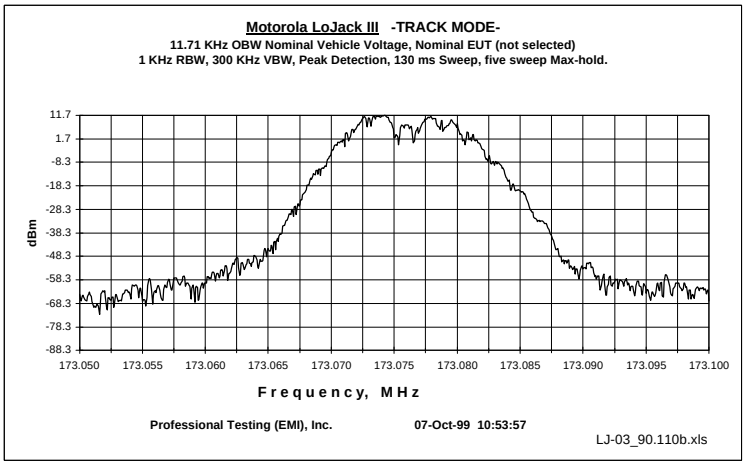
2.) *Please provide measurement data to show compliance with the transmitter timing (duty cycle) requirements under the provisions of Section 90.20(e)(6).*





The above two demodulated audio plots were taken with LJ-03 in the track mode. They show the **EUT**'s transmitter on-times to be consistent with the requirements of 90.20(e)(6). The first graph shows Tx period to be aprox. 1.2 seconds and the second graph shows the individual Tx periods to last aprox. 180 ms, a duty factor of less than 20%.

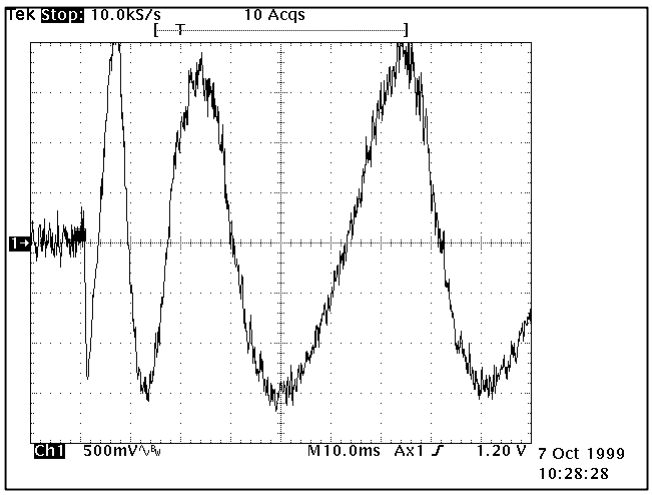
3.) *Please provide occupied bandwidth measurement data for operation in the tracking mode.*

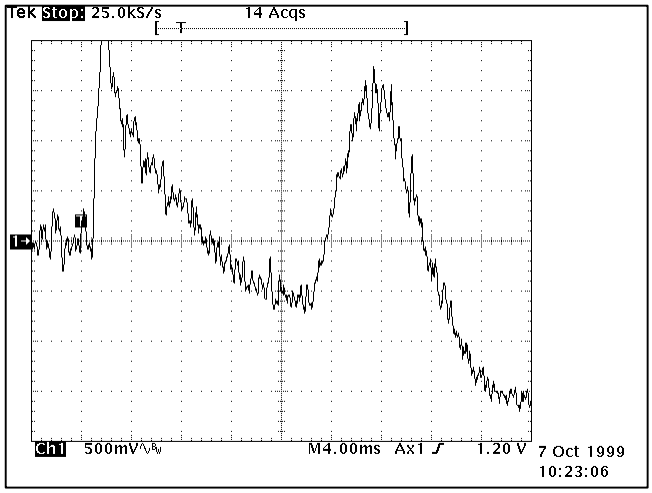


LoJack-03 OBW measurement in the tracking mode.

4.) Please provide actual measurement data, plots, showing the transient frequency behavior performance referenced under Section 90.214.

The direct conversion method was used to measure and document the transient frequency behavior of the LoJack-03. A Watkins Johnson M1 mixer with an HP 8660C LO of 173.075690 MHz was used. The LO was netted to the EUT using an audio monitor. Each port of the mixer contained at least a 6 dB 50 Ohm attenuator. The RF port was driven by the EUT and the DC to 500 MHz IF port hooked to the vertical channel of a 20 MHz VBW Tektronix TDS 680B which was triggered to sweep each time the EUT was caused to transmit.





The 10:28:28 screen shows transmitter coming on at 10 ms, a 1 KHz transient then the **EUT** quickly settles to within 200 Hz during the first 5 ms of transmission and the second screen shows the transient condition to have settled in about 30 ms to better than 100 Hz of the reference LO (173.075690 MHz). Minor **EUT** and LO drift causes the captured transients to be different. The **EUT** clearly meets the requirements of 90.214.

The next page (page three of four) is the corrected Section 3.0 for our Test Report, the last page contains photographs of the test setup used on Thursday 07 October to obtain this data set.

Ben Bibb, Senior Compliance Engineer,
Professional Testing (EMI), Inc.

3.0 Modulation Characteristics, §2.1047 (Revised 07 October, 1999)

A schematic of the low pass filter as well as SPICE data describing the design evaluation is provided in Appendix B. Measurements were made on the **Lojack Corporation 173.075 MHz Vehicle Recovery Transceiver** to verify compliance with the requirements of §90.210(b).

3.1 Test Procedure

All measurements were performed in a controlled laboratory environment. The occupied bandwidth of the **Lojack Corporation 173.075 MHz Vehicle Recovery Transceiver** was measured using an Advantest R3265 Spectrum Analyzer with a transmit command signal provided to the EUT from a Motorola Lojack test control module. The EUT was terminated with an attenuator and the spectrum analyzer. Occupied bandwidth was measured at low and high battery voltages. The worst case occupied bandwidth is reported based on the emission width 26 dB below the peak emission level in a 1 kHz resolution bandwidth and is also shown against the Emission Mask of 90.210(b).

3.3 Test Results and Conclusion

Bandwidth testing results are located in **Appendix B** of this report. The widest (worst case) –26 dB bandwidths for the **Lojack Corporation 173.075 MHz Vehicle Recovery Transceiver** was 13.9 KHz. This OBW was taken with a unit representative of the widest possible (worst case) deviation. Nominal OBW is less than 12 KHz. The EUT clearly meets the requirements of §90.210, emission mask (b).

Service Type	Reference Frequency
13K2F2D	173.075 MHz

General equipment arrangement for FCC requested re-measurement work, LoJack-03.

OBW measurement screen.