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Vibration Testing of Dallas/Maxim iButton Temperature Logger, Model DS1999L, for Flight Qualification on Captive Flight Test Unit-B (CFTU-B)

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Vibration Testing of Dallas/Maxim iButton Temperature
Logger, Model DS1999L, for Flight Qualification on
Captive Flight Test Unit–B (CFTU-B)
Test Number 001

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1. Introduction

This report documents the flight qualification testing of the Dallas/Maxim iButton temperature logger, model DS1922L, for internal mounting to the W80 Air Launched Cruise Missile (ALCM). A single test was performed utilizing a Labworks Inc. LW-140-110 electro-dynamic vibration system in Building 131, Room 2272, at Lawrence Livermore National Laboratory, Livermore, California. Two DS1922L temperature loggers were tested simultaneously, one horizontally and one vertically.

The test consisted of random excitation in the vertical axis for 5-hours. The test spectrum used is a shaped random spectrum defined by the Boeing Company for flight qualification of all modifications flown on ALCM flight tests. The spectrum is defined from 10 to 2000 Hz with a 8.52 g RMS magnitude. The spectrum is given in Table 1 and shown graphically in Figure 1.1

Table 1
Flight Qualification Test Spectrum

Break Point	Frequency (Hz)	PSD (g^2/Hz)
1	10	0.026
2	50	0.026
3	60	0.03
4	600	0.03
5	800	0.03
6	2000	0.03

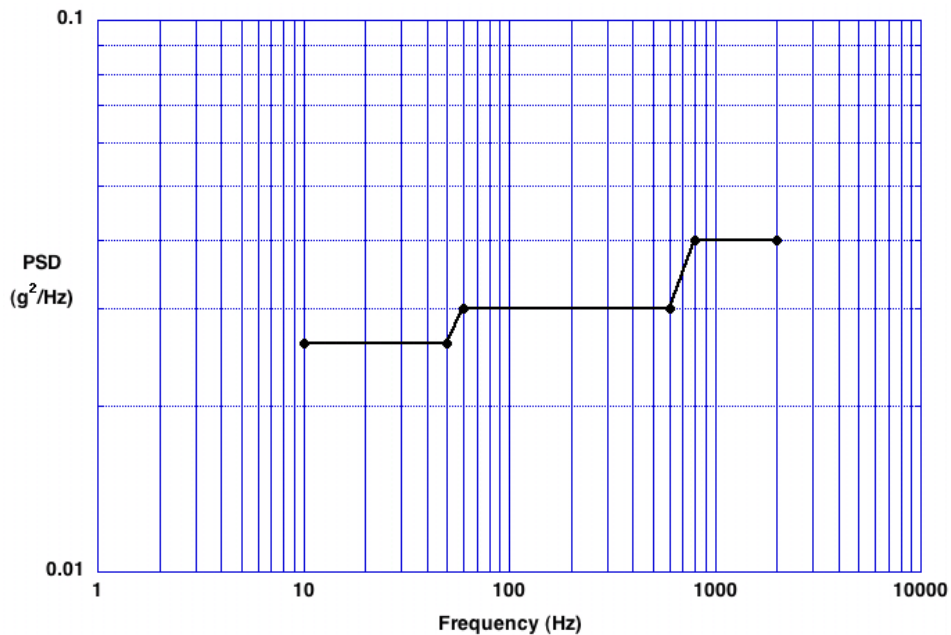


Figure 1.1 ALCM Flight Qualification Test Spectrum

2. Test Setup and Procedure

A Kistler accelerometer, type 8636B50M05, S/N C196770, was attached at the center position of the shaker mounting plate of the shaker head for use as the reference/control accelerometer. An aluminum mounting plate was attached to top of the shaker using four 10-32 x 1" cap head screws, Figure 2.1. The shaker is controlled using VibeLab Pro Digital Sine, Random, and Shock Vibration Controller. It is a pc-based vibration test controller.

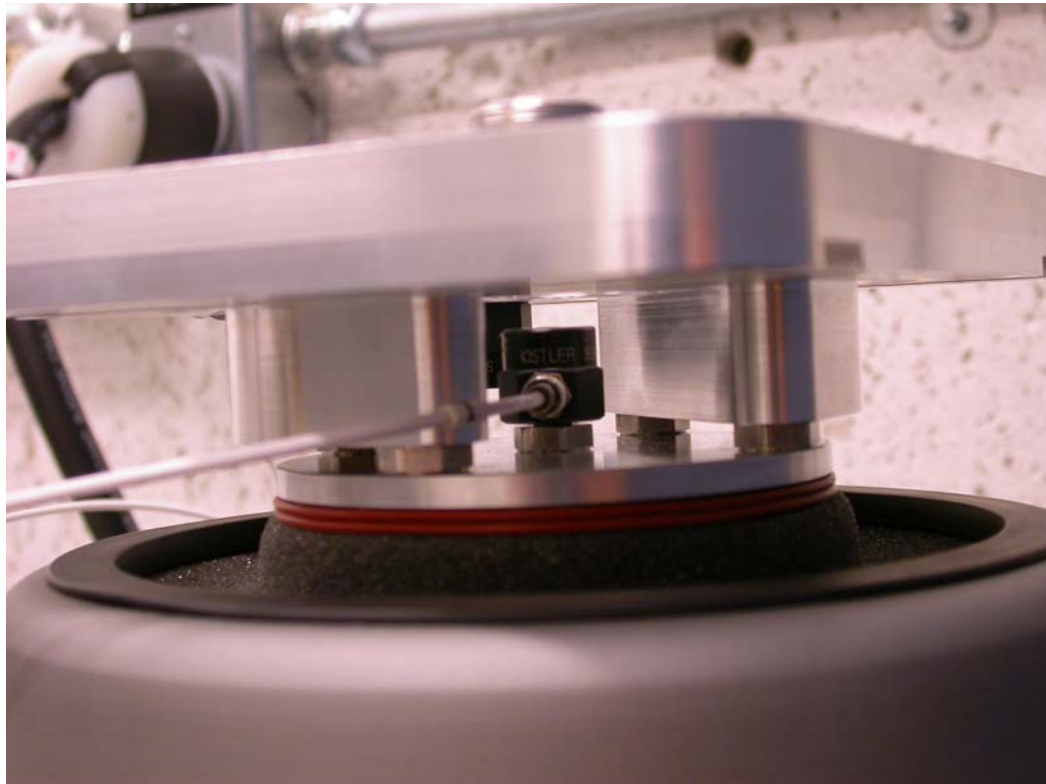


Figure 2.1 - Reference/control accelerometer and mounting plate.

A second Kistler accelerometer, type 8636B50M05, S/N C196961, was attached to the bottom horizontal surface of the mounting plate between the 10 and 11 o'clock positions, Figure 2.2. This accelerometer measured the response of the mounting plate to the test spectrum.



Figure 2.2 - Second accelerometer position.

The top horizontal surface, left side surface of the mounting plate and the bottom the two DS199L temperature loggers were cleaned using IPA. The two DS1922Ls were attached to the plate, one horizontally, S/N 380000001F63541, and the other vertically, S/N 8F000000200F41, using adhesive pads, Dallas/Maxim model DS9096P, Figures 2.3-2.4.

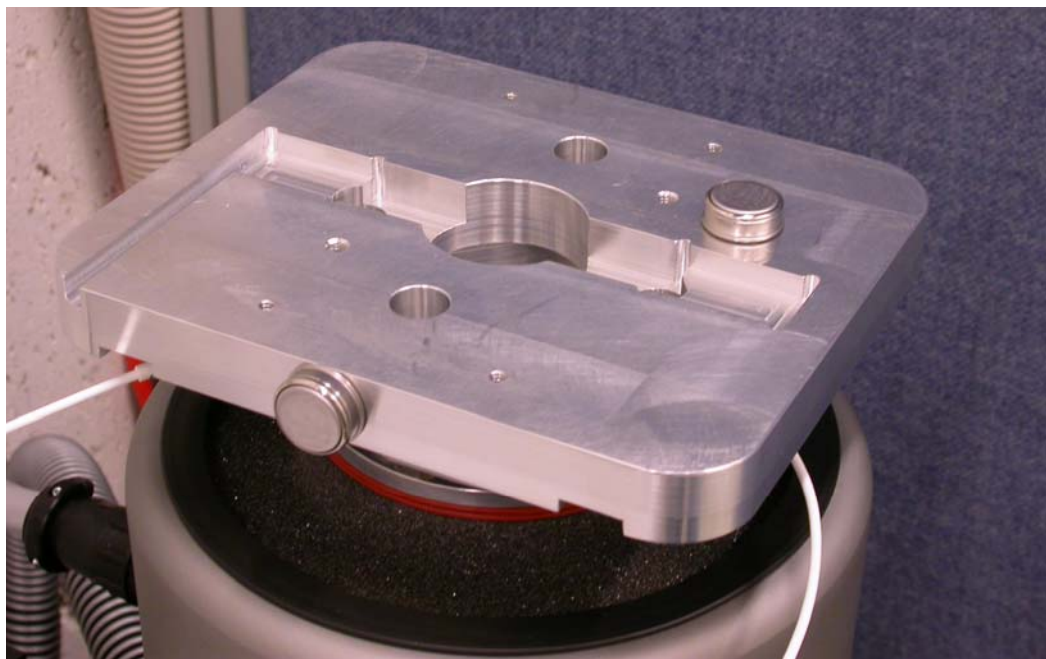


Figure 2.3 - Placement of DS1922L temperature loggers.



Figure 2.4 - DS1922L attached to the mounting plate with an adhesive pad.

The DS1922Ls were configured using ThermoTrack software from Proges-Plus. Parameters of the mission were a start delay of 5 minutes, 0.5° C resolution, and a 3-second sampling rate. The 3-second sampling rate allows the DS1922L to acquire 8129, 8-bit readings for 6 Hours 46 minutes and 27 Seconds. A 5-hour test requires a minimum of 6000 samples, which is easily accommodated by the DS1922L. A status check of the DS1922Ls was performed ~4 minutes after the scheduled start time to verify they were acquiring data.

The VibeLab software was set to the test position with a programmed 5-hour run time. The system performed a pretest at 12 dB below the desired amplitude. When it was determined that the desired spectrum was being achieved, the amplitude was raised to the test level and maintained for the programmed time. The system and test parts were monitored for the first 20-minutes and then checked periodically at 30-minute intervals. The last 10-minutes of the test were monitored with the test ending after 5-hours.

3. Test Results

The reference/control accelerometer is monitored continuously during the testing and provides feedback for the shaker control. Vibration amplitude and the calculated PSD are only saved periodically for tests of this type. For tests with duration of more than a couple of hours, this was done at the beginning and at the end of the test period. The PSDs are shown in Figures 3.1 and 3.2.

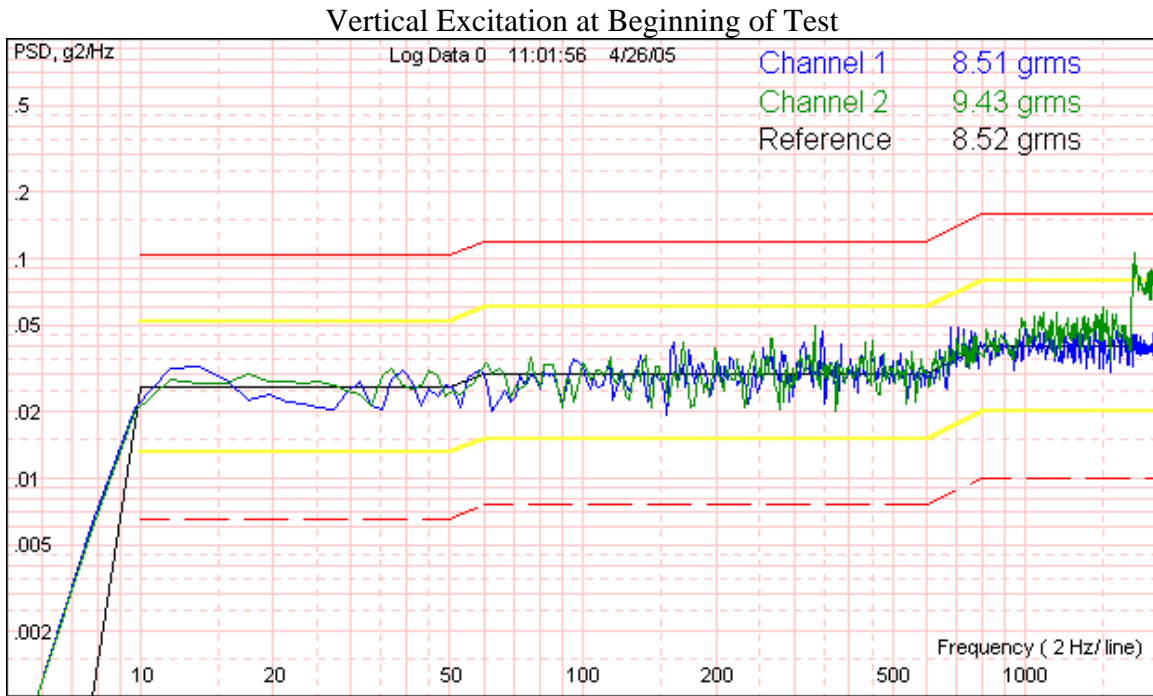


Figure 3.1 – Power Spectral Density plot taken at the beginning of test.

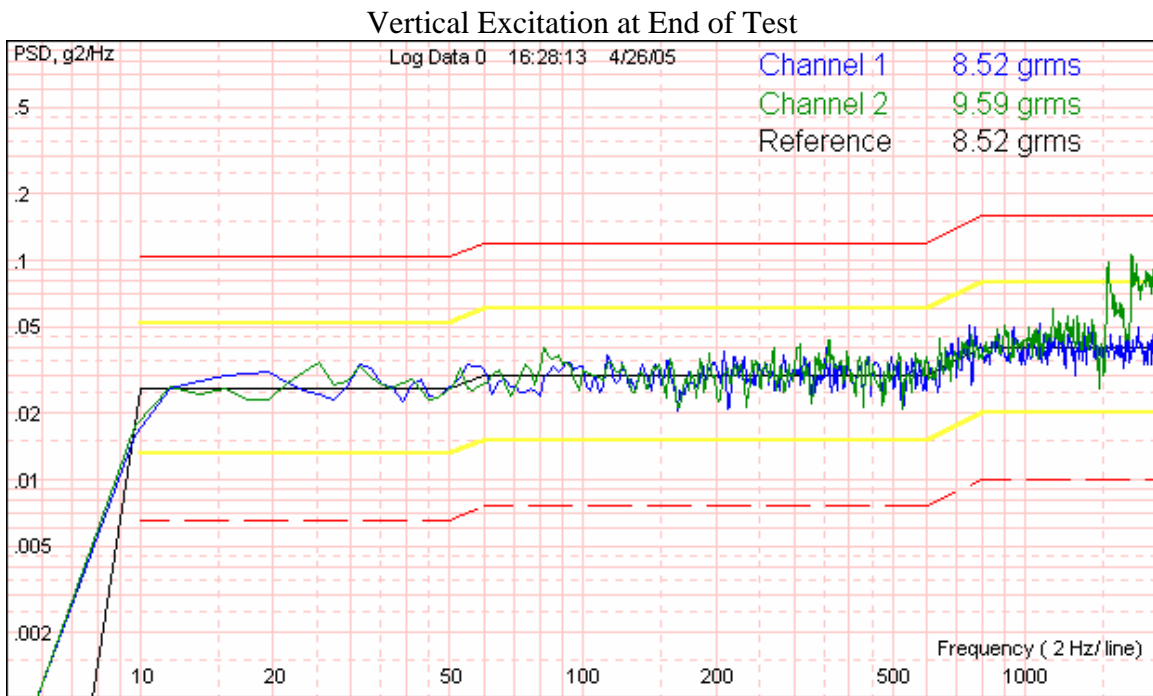


Figure 3.2 – Power Spectral Density plot taken at the end of test.

At the end of the test period, a status check of the DS1922Ls was performed to verify functionality. Data acquisition was then stopped. The data was then downloaded to a laptop, archived and exported to an Excel format file. Figures 3.3 and 3.4 show the data plots from the data downloads. The plots show that data was continuously captured during the length of the test. Ambient room temperature during the test period was maintained at 72° F (22.2° C) \pm 1° F.

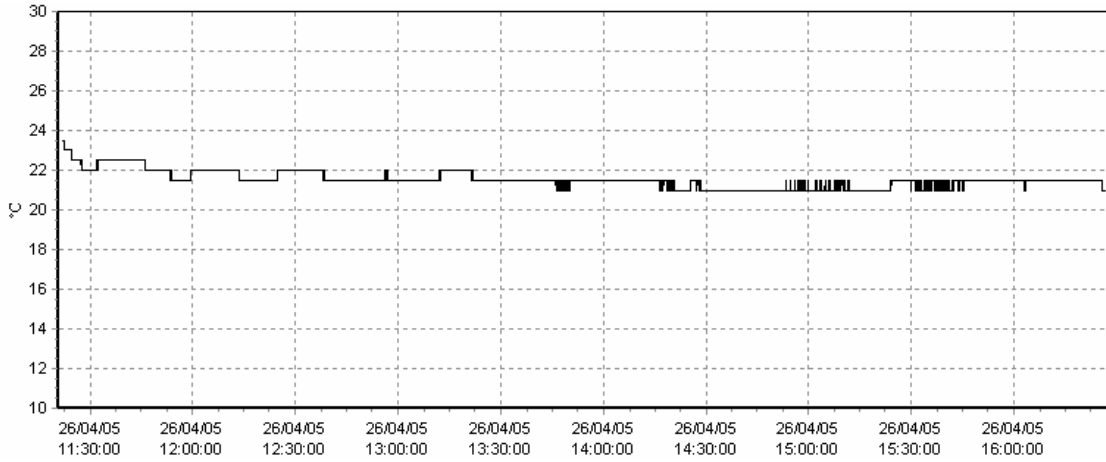


Figure 3.2 – Temperature Graph for Horizontally Mounted DS1922L, S/N 380000001F63541

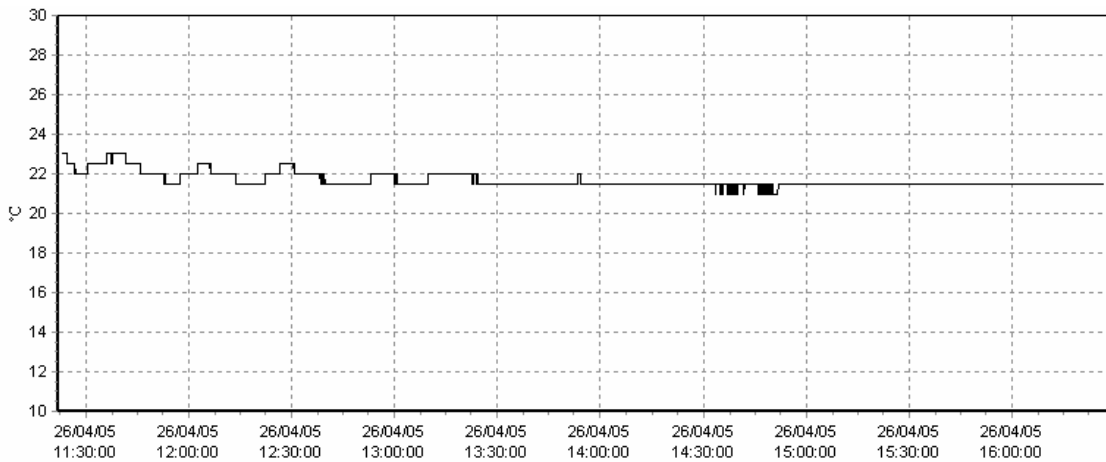


Figure 3.3 – Temperature Graph for Vertically Mounted DS1922L, S/N 8F000000200F41