Opticom Technologies Inc.
SAE J1455 and MIL-STD-810F
Vibration Testing of
Model CC-02-4.3
CCTV Camera

Prepared by: Weir-Jones Engineering Consultants Ltd.
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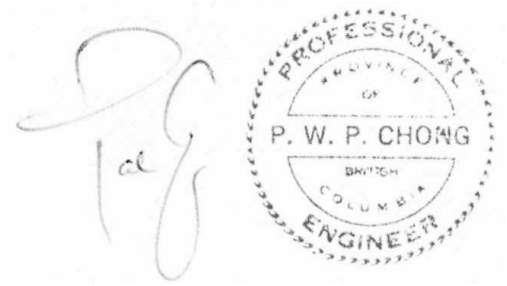
ISO 9001:2000 Registered

June 17th, 2005

AUTHORIZATION

The work described in this report was authorized by David Boyd of Opticom Technologies Inc. on June10th, 2005. The report was prepared by Paul Chong, P.Eng.



Paul Chong, P.Eng.
Project Engineer

Dated at Vancouver, June 17th, 2005.

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1.0 INTRODUCTION

On June 10th, 2005 Weir-Jones Engineering Consultants Ltd. (WJEC) was retained by Opticom Technologies Inc. to perform a set of vibration tests on its Model CC-02-4.3 CCTV camera. The primary objective in testing the camera was to verify its structural integrity. This was done by subjecting the unit to the worst-case vibrational stresses expected in its application environment.

The testing consisted of vibrating the Model CC-02-4.3 CCTV camera in the two mutually perpendicular axes in accordance with the profiles defined in Sections 4.9 of the SAE J1455 (August 1994) Standard and Method 514.5 of the MIL-STD-810F (January 2000) Standard. The testing of the camera was performed on June 14th and 15th, 2005.

2.0 VIBRATION PROFILES

The vibration testing of the Model CC-02-4.3 CCTV camera comprised of subjecting the unit to the Sinusoidal profile as defined in Section 4.9 of the SAE J1455 (August 1994) Standard and to the Random profile as defined in Method 514.5 of the MIL-STD-810F (January 2000) Standard. The parameters of the Sinusoidal and Random profiles are summarized below with the graphical representation of the Sinusoidal profile shown in Figure 1 and that of the Random profile shown in Figure 2.

Sinusoidal (truck chassis-mounted)

Amplitude* - 2 G's from 10 to 12 Hz
2.5 G's from 12 to 14 Hz
3 G's from 14 to 16 Hz
3.5 G's from 16 to 18 Hz
4 G's from 18 to 2,000 Hz

Sweep rate - 0.5 octave per minute

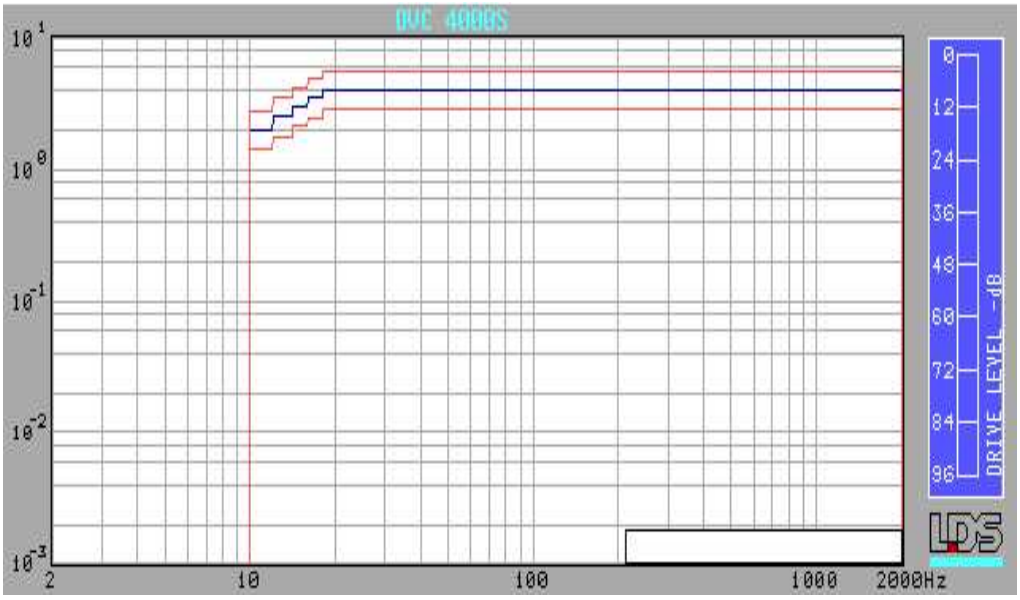
Duration - 180 minutes per axis for each axis. Unit to be operational as intended during testing.

* the step function is intended to simulate the ramp-up from 10 to 20 Hz.

Random (Basic Transportation for U.S. Highway Truck)

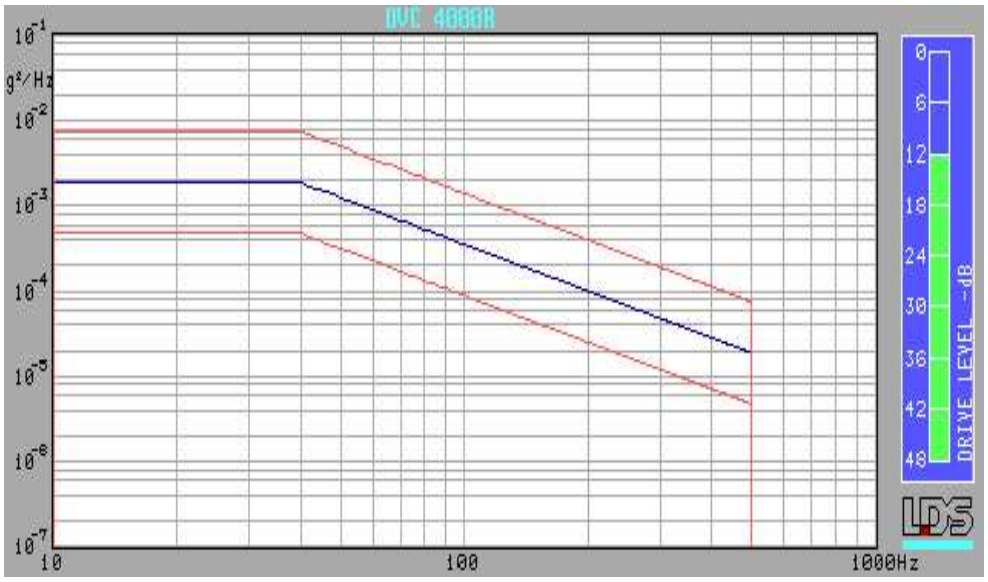
Breakpoints - as per Figure 514.5C-1
10 Hz → 0.015 G^2/Hz
40 Hz → 0.015 G^2/Hz
500 Hz → 0.00015 G^2/Hz
Overall G_{RMS} level of 1.04

Duration - 60 minutes is equivalent to 1,000 miles of travel. Unit is recommended to be operational as intended during testing.



Blue - Vibration profile
Red - Upper and lower limits of frequency and acceleration (equivalent to ±3dB)

Figure 1: Graphical plot of the SAE J1455 Sinusoidal vibration profile intended for equipment to be mounted on truck chassis.



Blue - Vibration profile
Red - Upper and lower limits of frequency and amplitude (equivalent to ±6dB)

Figure 2: Graphical plot of the MIL-STD-801F Random vibration profile (U.S. Highway Truck). It should be noted that the amplitude shown in the plot has been reduced by -9dB.

3.0 VIBRATION TEST EQUIPMENT

The equipment required for the vibration tests was a shaker, a vibration controller and two feedback accelerometers (*see Figure 3*). The specifications of the equipment used are as follows.

Shaker:	Manufacturer:	Ling Dynamic Systems (LDS)
	Model:	V722
	Rated Force:	750 lbf. rms (Random)
	Frequency:	5 Hz - 4000 Hz
	Maximum Displacement:	1 inch peak-to-peak
	Maximum Velocity:	40 inch/sec peak
	Maximum Acceleration:	50g rms (Random)
	Maximum Payload:	220 lbs (total weight)
	Driven by:	LDS PA2000 2kW power amplifier
	Controlled by:	LDS DVC 4000 Mk3
Accelerometer:	Manufacturer:	PCB
	Model:	J357B01 (charge capacitance type)
	Serial:	8968, 8969
	Range:	±1800 g

The vibration controller and feedback accelerometers were calibrated on March 21st, 2005 by Ralco Inc. in North Haven, Connecticut, in compliance with ANSI/NCSL Z540-1 and traceable to NIST. The calibration certificates of the controller and accelerometers are provided in Appendix 1.

Figure 3: Weir-Jones Engineering Consultants Ltd. vibration testing equipment. Note that the direction of shaker movement is vertical.

As the vibration shaker was designed to translate in the vertical direction only, a set of Aluminum mounting fixtures were used to position the CCTV camera in its two mutually perpendicular axes (Vertical and Transverse) as shown in Figures 4A and 4B.

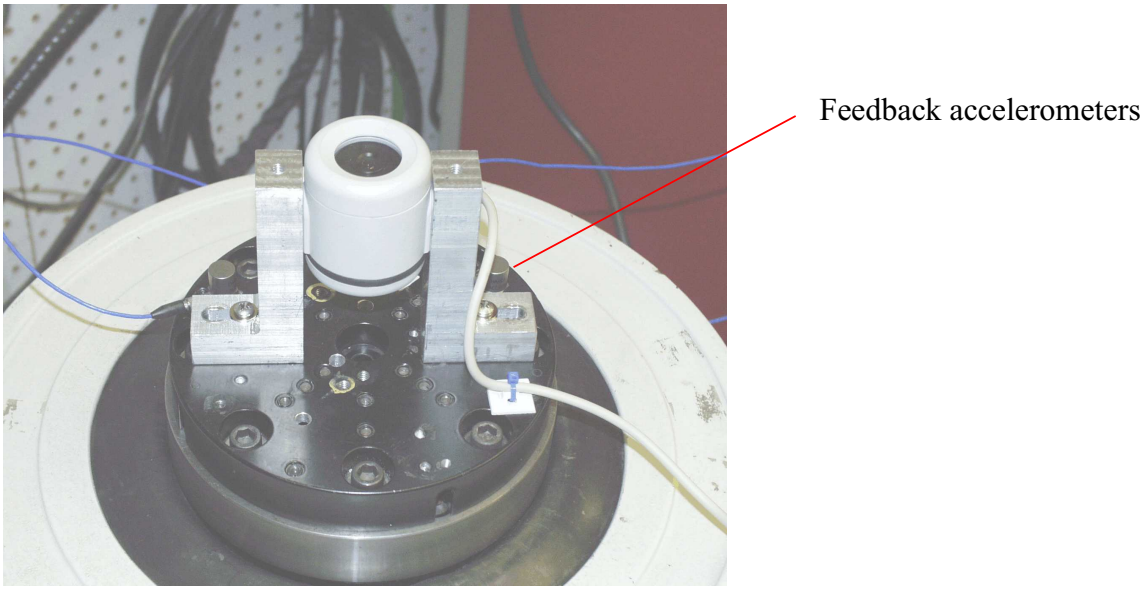


Figure 4A: Vertical orientation mounting of the CCTV camera.

Figure 4B: Transverse orientation mounting of the CCTV camera.

4.0 RESULTS

4.1 Sinusoidal Vibration Test

The graphical results of the Sinusoidal vibration tests for the Model CC-02-4.3 CCTV camera are shown in Appendix 2 located in the back of this report. The interpretation of the lines on each graphical result is as follows:

Line Colour	Description
Red	Frequency limits and Upper and lower limits of acceleration.
Dark Blue	Vibration profile.
Light Blue	Shaker output as measured by the feedback accelerometers.

Based on the graphical results, it can be seen that the shaker outputs as measured by the feedback accelerometers corresponded with the defined Sinusoidal vibration profiles within the allowable tolerance specified by the SAE J1455 (August 1994) Standard. Because the Model CC-02-4.3 CCTV camera was rigidly mounted onto the mounting fixtures during the various Sinusoidal vibration tests, the camera was therefore subjected to the same vibration profiles as those generated by the shaker.

The following observations with respect to the CCTV camera were made during and after the tests:

- No physical damage to the housing of the camera was noticeable during or after the tests.
- No loose components within the camera were noticeable during or after the tests.
- No degradation in the quality of the video produced by the camera was noticeable during or after the tests.

Therefore the Model CC-02-4.3 CCTV camera has passed the chassis-mounted Sinusoidal vibration test in accordance with Section 4.9 of the SAE J1455 (August 1994) Standard.

4.2 Random Vibration Test

The graphical results of the Random vibration tests for the Model CC-02-4.3 CCTV camera are shown in Appendix 3 located in the back of this report. The interpretation of the lines on each graphical result is as follows:

Line Colour	Description
Red	Frequency limits and Upper and lower limits of acceleration.
Dark Blue	Vibration profile.
Light Blue	Shaker output as measured by the feedback accelerometers.

Based on the graphical results, it can be seen that the shaker outputs as measured by the feedback accelerometers corresponded with the defined Random vibration profile within the allowable tolerance specified by Method 514.5 of the MIL-STD-810F (January 2000) Standard. Because the Model CC-02-4.3 CCTV camera was rigidly mounted onto the mounting fixtures during the testing, the camera was therefore subjected to the same vibration profiles as those generated by the shaker.

The following observations with respect to the CCTV camera were made during and after the tests:

- No physical damage to the housing of the camera was noticeable during or after the tests.
- No loose components within the camera were noticeable during or after the tests.
- No degradation in the quality of the video produced by the camera was noticeable during or after the tests.

Therefore the Model CC-02-4.3 CCTV camera has passed the U.S. Highway Truck Random vibration test in accordance with Method 514.5 of the MIL-STD-810F (January 2000) Standard.

APPENDIX 1: Calibration Certificates

AN A2LA ACCREDITED CALIBRATION LABORATORY

RALCO, INC.

81 STATE STREET NORTH HAVEN CT 06473
TEL: 203-239-6558 FAX: 203-239-6625

802.01

Certificate of Calibration

CUSTOMER: WEIR JONES ENGINEERING CONSULTANTS LTD P.O.# LS-000059
ADDRESS: 2040 WEST 10TH AVE
CITY, STATE: VANCOUVER, B.C. V6J 2B3 CANADA TEST # 68377

[ ] CUSTOMER FACILITY [X] RALCO TEST DATE: 3/28/05

DESCRIPTION: DIGITAL VIBRATION CONTROLLER,LDS,MODEL#DVC4000

SERIAL NO: 209 I.D. #

RATED ACCURACY: Per Mfr's Manual

THE SUBJECT ITEM WAS CALIBRATED USING THE FOLLOWING CALIBRATION PROCEDURE:
[X] MANUFACTURER'S MANUAL
[ ] ANSI/ASME PROCEDURE (SEE DATA SHEET)

This is to certify that the calibration of the above has been performed in compliance with the calibration systems requirements of ANSI / NCSL Z540-1-1994 and is traceable to N.I.S.T. and S.I. Units.

Test were conducted at an ambient temperature of 17.2 deg.C - 22.8 deg.C and R.H. range of 33 -55%

RALCO, INC.

BY Richard A. Lewis
Laboratory Manager

CONDITION OF EQUIPMENT RECEIVED:

[X] IN TOLERANCE [ ] OUT OF TOLERANCE [ ] INOPERABLE
CALIBRATION PROCEDURE HAS BEEN MODIFIED [ ] SEE REPORT
[ ] *LIMITED CALIBRATION

AN A2LA ACCREDITED CALIBRATION LABORATORY

ACCREDITED

802.01

RALCO, INC.

81 STATE STREET NORTH HAVEN CT 06473

TEL: 203-239-6558 FAX: 203-239-6625

Certificate of Calibration

CUSTOMER: WEIR JONES ENGINEERING CONSULTANTS LTD P.O.# LS-000059

ADDRESS: 2040 WEST 10TH AVE

CITY, STATE: VANCOUVER, B.C. V6J 2B3 CANADA TEST # 68377

[ ] CUSTOMER FACILITY [X] RALCO TEST DATE: 3/28/05

DESCRIPTION: CHARGE AMP, LDS,MOD#CA4

SERIAL NO: 915 I.D. #

RATED ACCURACY: Per Mfr's Manual

THE SUBJECT ITEM WAS CALIBRATED USING THE FOLLOWING CALIBRATION PROCEDURE:

[X] MANUFACTURER'S MANUAL

[ ] ANSI/ASME PROCEDURE (SEE DATA SHEET)

This is to certify that the calibration of the above has been performed in compliance with the calibration systems requirements of ANSI / NCSL Z540-1-1994 and is traceable to N.I.S.T. and S.I. Units.

Test were conducted at an ambient temperature of 17.2 deg.C - 22.8 deg.C and R.H. range of 33 -55%

RALCO, INC.

Richard A. Lewis

BY _____

Laboratory Manager

CONDITION OF EQUIPMENT RECEIVED:

[X] IN TOLERANCE [ ] OUT OF TOLERANCE [ ] INOPERABLE

CALIBRATION PROCEDURE HAS BEEN MODIFIED [ ] SEE REPORT

[ ] *LIMITED CALIBRATION

NOTE: THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT WRITTEN APPROVAL BY RALCO, INC.
MEASUREMENT UNCERTAINTY IS EXPRESSED AT A CONFIDENCE LEVEL OF 95% (COVERAGE FACTOR k=2)
BEST UNCERTAINTY, SEE SCOPE
THIS CERTIFICATE OF CALIBRATION AND ALL ASSOCIATED RESULTS APPLY ONLY TO THE ABOVE NAMED ITEM.

ACCREDITED

802.01

RALCO,INC.

81 STATE STREET, NORTH HAVEN, CT. 06473
Tel. (203) 239-6558 Fax. (203) 239-6625

Test # 68377

Accelerometer Calibration Certificate

Page 1 of 1

Customer: LDS Test & Measurement/Weir Jones Engineering
Purchase Order # LS000055
Model # J357B01
Serial # 8968
Control #
Mfg: PCB
Temp. = 19.53 Deg.C / RH = 27.56 %
Calibration Date: 3/21/05

Reference Sensitivity 15.18 **Pc/G [X] or MV/G [ ]**

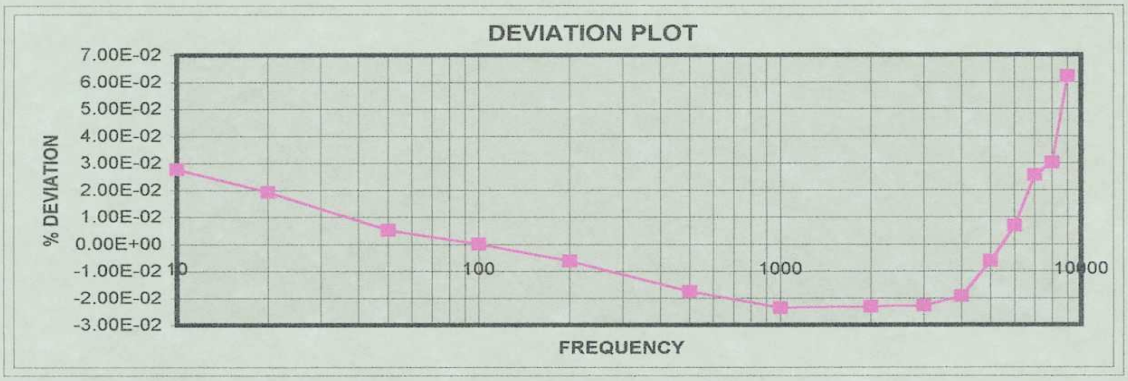
Point #	Frequency (Hz.)	Sensitivity	% Deviation
1	10	15.60	2.77E-02
2	20	15.47	1.93E-02
3	50	15.26	5.25E-03
4	100	15.18	0.00E+00
5	200	15.08	-6.19E-03
6	500	14.91	-1.76E-02
7	1000	14.82	-2.36E-02
8	2000	14.83	-2.31E-02
9	3000	14.83	-2.28E-02
10	4000	14.89	-1.93E-02
11	5000	15.08	-6.21E-03
12	6000	15.28	6.86E-03
13	7000	15.57	2.56E-02
14	8000	15.64	3.02E-02
15	9000	16.12	6.22E-02
16	10000	17	1.07E-01

(1) This calibration was performed in accordance with ANSI / NCSL Z540-1-1994 using the back to back comparison method per ISA RP37.2 and is tracable to the NIST through Test # 822/267400 Due:04/24/2005

(2) Reference Sensitivity measured at 100 HZ and 1 Grms.
(3) Measurement of uncertainty + / - 2%
(4) Range = + / - ___G M/S^2 = 0.102 * G

Test Cable = 100 Pf.
Notes:
Sensitivity: Multiply by 0.1 [ ] 1 [X] 10 [ ]

Calibration technician : Joseph Morra
Q.C.Mgr: Richard A. Lucia



CONDITION OF EQUIPMENT RECEIVED: [X]IN TOLERANCE [ ]OUT OF TOLERANCE [ ]INOPERABLE

Measurement uncertainty is expressed at a confidence level of 95% (coverage factor k = 2)

This certificate of calibration and all associated results apply only to the above named item.
This Certificate shall not be reproduced, except in full without written approval by RALCO, INC.

RALCO,INC.
81 STATE STREET, NORTH HAVEN, CT. 06473
Tel. (203) 239-6558 Fax. (203) 239-6625

ACCREDITED # 802.01

Accelerometer Calibration Certificate

Test # 68377

Page 1 of 1

Customer: LDS Test & Measurement/Weir Jones Engineering
Purchase Order # LS-000059
Model # J357B01
Serial # 8969
Control #
Mfg: PCB
Temp. = 19.417 Deg.C / RH = 27.53 %
Calibration Date: 3/21/05

Reference Sensitivity 15.13 **Pc/G [X] or MV/G [ ]**

Point #	Frequency (Hz.)	Sensitivity	% Deviation
1	10	15.14	8.59E-04
2	20	15.21	5.54E-03
3	50	15.26	9.01E-03
4	100	15.13	0.00E+00
5	200	15.05	-5.31E-03
6	500	14.79	-2.25E-02
7	1000	14.73	-2.65E-02
8	2000	14.70	-2.81E-02
9	3000	14.71	-2.78E-02
10	4000	14.77	-2.34E-02
11	5000	14.92	-1.38E-02
12	6000	15.07	-3.37E-03
13	7000	15.29	1.06E-02
14	8000	15.52	2.60E-02
15	9000	15.93	5.31E-02
16	10000	17	9.13E-02

(1) This calibration was performed in accordance with ANSI / NCSL Z540-1-1994 using the back to back comparison method per ISA RP37.2 and is tracable to the NIST through Test # 822/267400 Due:04/24/2005

(2) Reference Sensitivity measured at 100 HZ and 1 Grms.

(3) Measurement of uncertainty + / - 2%

(4) Range = + / - ___G M/S^2 = 0.102 * G

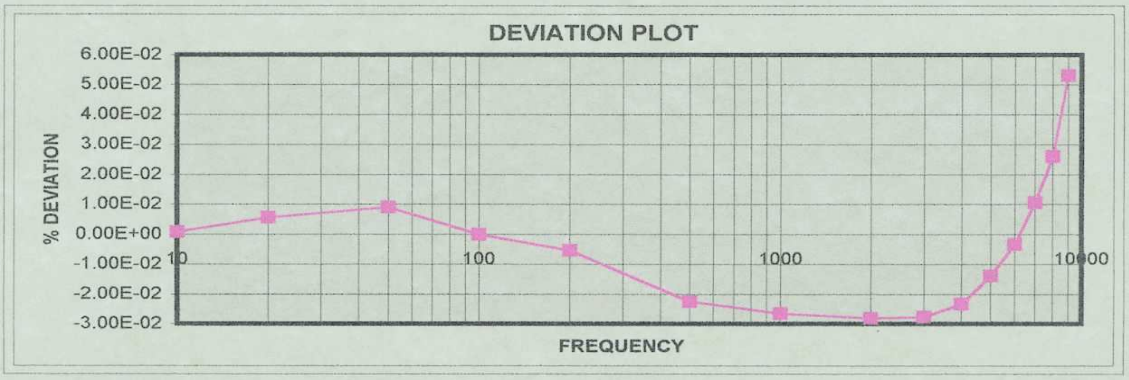
Calibration technician : Joseph Morra

Test Cable = 100 Pf.

Notes:

Sensitivity: Multiply by 0.1 [ ] 1 [X] 10 [ ]

Q.C.Mgr: Robert A. Lewis



CONDITION OF EQUIPMENT RECEIVED: [X]IN TOLERANCE [ ]OUT OF TOLERANCE [ ]INOPERABLE

Measurement uncertainty is expressed at a confidence level of 95% (coverage factor k = 2)

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APPENDIX 2: Sinusoidal Test Results

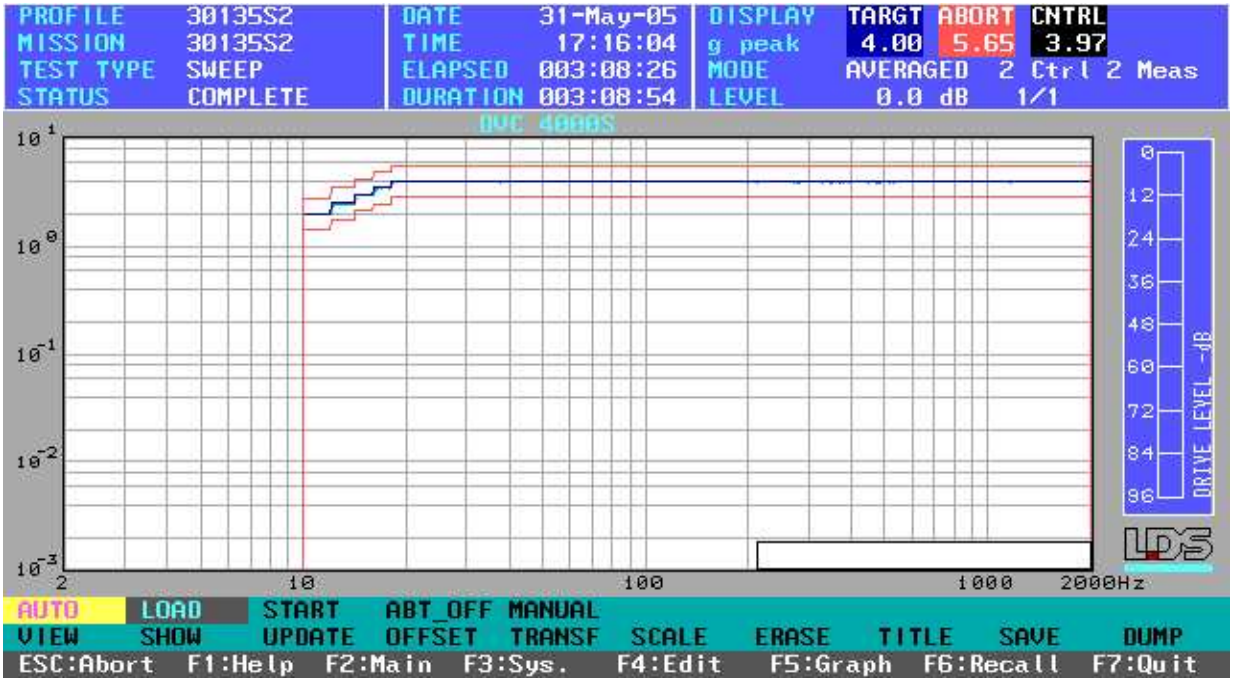

Figure A2-1: Graphical profiles of the Sinusoidal vibration test for the Model CC-02-4.3 CCTV camera mounted in the **Vertical orientation**.

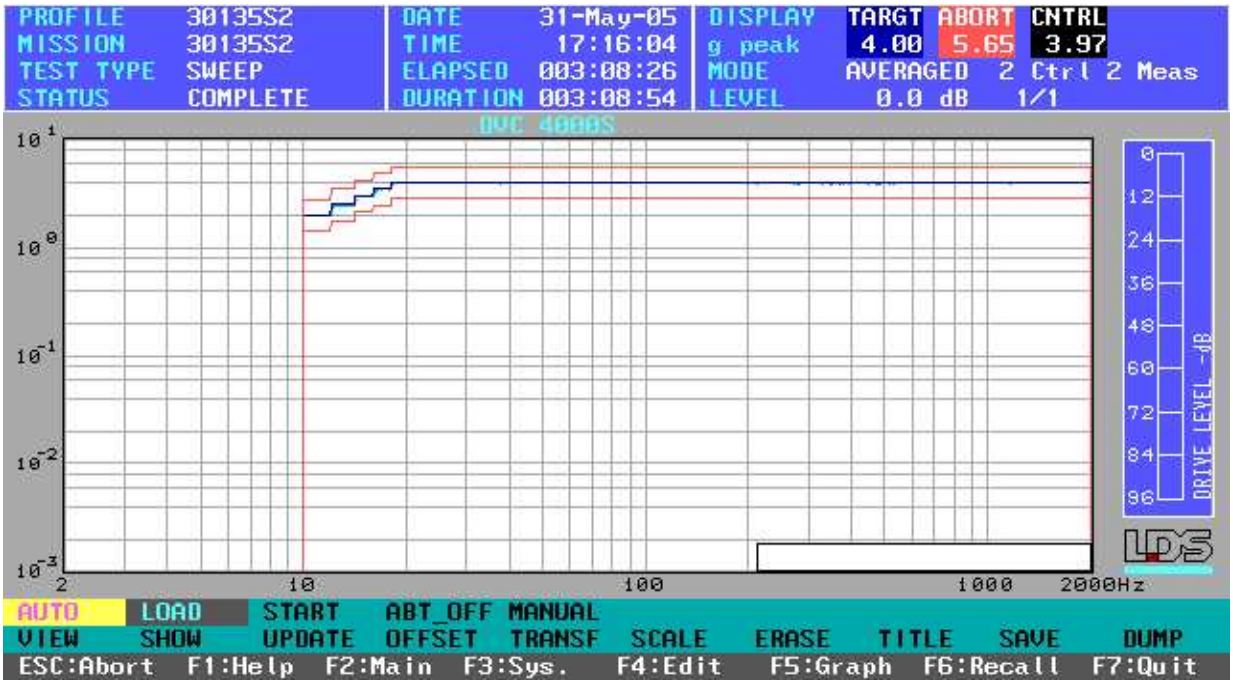

Figure A2-2: Graphical profiles of the Sinusoidal vibration test for the Model CC-02-4.3 CCTV camera mounted in the **Transverse orientation**.

APPENDIX 3: Random Test Results

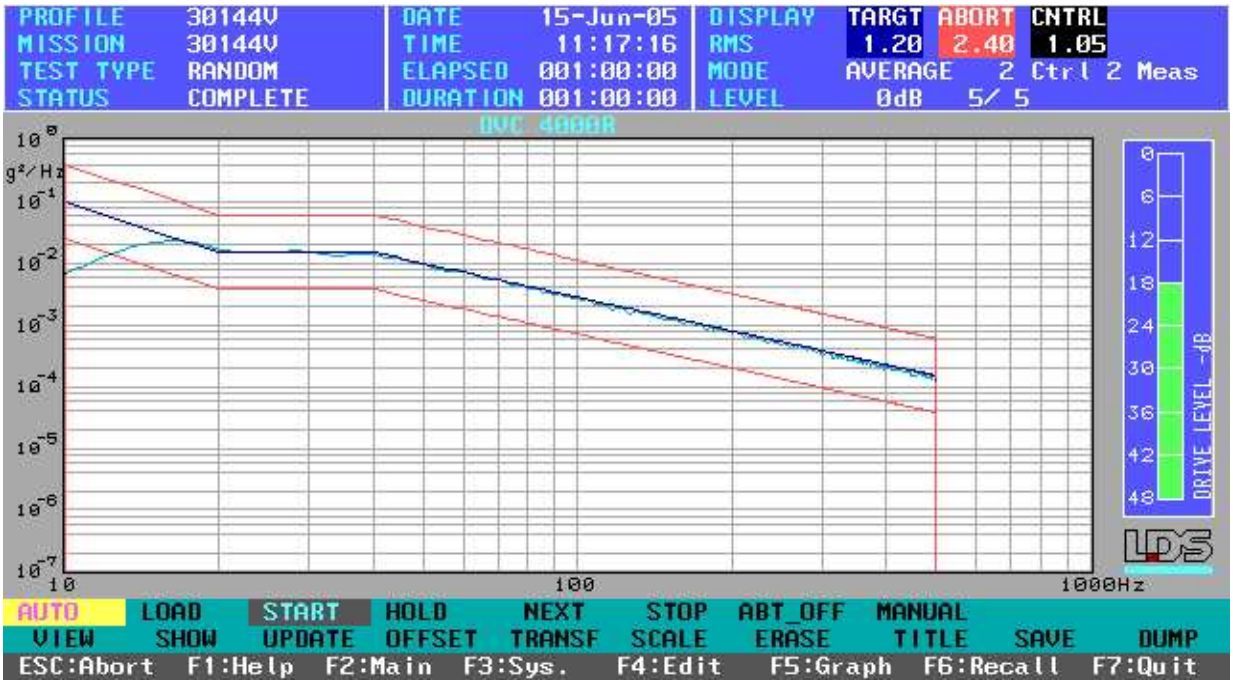

Figure A3-1: Graphical profiles of the Random vibration test for the Model CC-02-4.3 CCTV camera mounted in the **Vertical orientation**.

It should be noted that the amplitude between 10 and 20 Hz had been increased slightly in order to compensate for the lighter weight aluminum fixture. The resultant shaker output however still matches with the required profile as defined by the MIL standard.

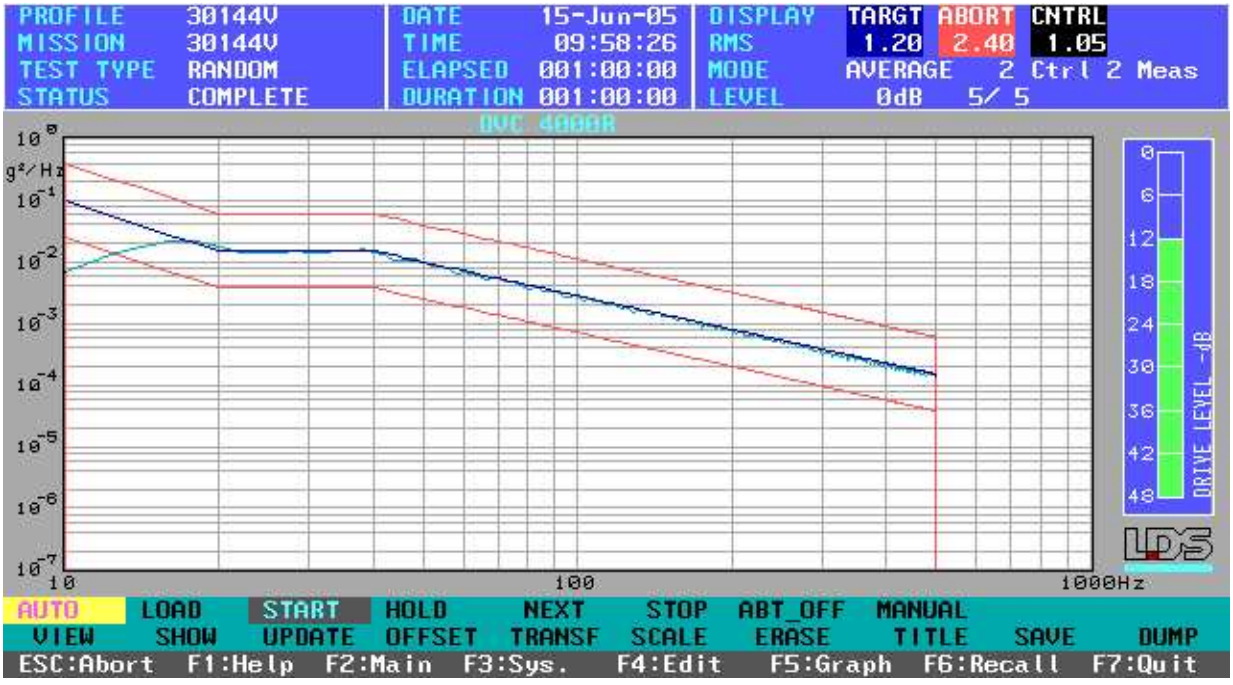

Figure A3-2: Graphical profiles of the Random vibration test for the Model CC-02-4.3 CCTV camera mounted in the **Transverse orientation**.