



ENVIRONMENTAL TEST REPORT No. 6737-A Rev 1

for

Shock Testing

applied to

Valve Actuators KEM, WEM, WE

in accordance with

IEC 60068-2-27

Dated: 2009

Submitted to:

A-T CONTROLS
9955 International Blvd.
Cincinnati, OH 45246

Customer PO#: 48030

Report Date: 7 August 2018

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Approved By:

Kenneth C. Malley, Jr.
CEO
E-LABS, Inc.
www.e-labsinc.com

Reviewed By:

Carl Moran
Lab Manager
E-LABS, Inc.

Prepared by:

Lee Edwards
Test Engineer
E-LABS, Inc.

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REPORT No. 6737-A

7 August 2018

EXECUTIVE SUMMARY

E-LABS Incorporated performed Shock Tests on Valve Actuators KEM, WEM, WE for A-T CONTROLS. The Valve Actuators KEM, WEM, WE which will be known as Equipment Under Test (EUT) throughout this report are identified in *Table ES-1*.

Testing was performed from July 11, 2018 Through July 12, 2018. The sequence of the testing that was performed is listed in *Table ES-2*. All testing was performed at and under the control of E-LABS Laboratory, 5150 Lad Land Drive, Fredericksburg, VA 22407.

A summary of results of testing are presented in *Table ES-3: Test Summary* and in more detail in *Section 5.2*.

Table ES-1: Equipment Under Test

<i>EUT Number</i>	<i>EUT Description</i>	<i>Part Number</i>	<i>Serial Number</i>
1	Electric Actuator	KEM-440XD	n/a
2	Electric Actuator	WEM-690XD	n/a
3	Electric Actuator	WEM-4400	n/a
4	Electric Actuator	WE-1350X-VR	n/a
5	Electric Actuator	WEM-1350E-VR	n/a
6	Electric Actuator	WE-1350HB	n/a
7	Electric Actuator	WE-2640HB	n/a
8	Electric Actuator	WE-10500HC	n/a

Table ES-2: Tests Applied to Equipment Under Test

<i>Test Applied</i>	<i>Procedure</i>
Shock	125 g's, 5 ms, half-sine 6 shocks per valve 1 positive and 1 negative per axis

Table ES-3: Shock Test Summary

Test #	Date	Test	EUT	Results
1	11Jul18	Shock Vertical Axis 1 positive and 1 negative	1 KEM-440XD	No anomalies observed
2	11Jul18	Vertical Axis 1 positive and 1 negative	2 WEM-690XD	No anomalies observed
3	11Jul18	Vertical Axis 1 positive and 1 negative	3 WEM-4400XD	No anomalies observed
4	11Jul18	Vertical Axis 1 positive and 1 negative	4 WE-1350X-VR	No anomalies observed
5	11Jul18	Vertical Axis 1 positive and 1 negative	5 WEM-1350E-VR	No anomalies observed
6	11Jul18	Vertical Axis 1 positive and 1 negative	6 WE-1350HB	No anomalies observed
7	11Jul18	Vertical Axis 1 positive and 1 negative	7 WE-2640HB	No anomalies observed
8	11Jul18	Vertical Shock 1 positive and 1 negative	8 WE-10500HC	No anomalies observed
9	12Jul18	Longitudinal Shock 1 positive and 1 negative	8 WE-10500HC	No anomalies observed
10	12Jul18	Transverse Shock 1 positive and 1 negative	8 WE-10500HC	No anomalies observed
11	12Jul18	Transverse Shock 1 positive and 1 negative	1 KEM-440XD	No anomalies observed
12	12Jul18	Longitudinal Shock 1 positive and 1 negative	1 KEM-440XD	No anomalies observed

13	12Jul18	Longitudinal Shock 1 positive and 1 negative	2 WEM-690XD	No anomalies observed
14	12Jul18	Transverse Shock 1 positive and 1 negative	2 WEM-690XD	No anomalies observed
15	12Jul18	Transverse Shock 1 positive and 1 negative	7 WE-2640HB	No anomalies observed
16	12Jul18	Longitudinal Shock 1 positive and 1 negative	7 WE-2640HB	No anomalies observed
17	12Jul18	Transverse Shock 1 positive and 1 negative	3 WEM-4400	No anomalies observed
18	12Jul18	Longitudinal Shock 1 positive and 1 negative	3 WEM-4400	No anomalies observed
19	12Jul18	Transverse Shock 1 positive and 1 negative	6 WE-1350HB	No anomalies observed
20	12Jul18	Longitudinal Shock 1 positive and 1 negative	6 WE-1350HB	No anomalies observed
21	12Jul18	Transverse Shock 1 positive and 1 negative	4 WEM-1350X-VR	No anomalies observed
22	12Jul18	Longitudinal Shock 1 positive and 1 negative	4 WEM-1350X-VR	No anomalies observed
23	12Jul18	Transverse Shock 1 positive and 1 negative	5 WEM-1350E-VR	No anomalies observed
24	12Jul18	Longitudinal Shock 1 positive and 1 negative	5 WEM-1350E-VR	No anomalies observed

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1. INTRODUCTION

A-T CONTROLS contracted test services for environmental testing with E-Labs. A-T CONTROLS provided the EUT, specifications and personnel for performing operational tests.

This report documents the preparations, set-up, methods, and results for the tests performed.

2. TEST FACILITY

Testing was performed by E-LABS, Inc. [www.e-labsinc.com] at its laboratory facility located at 5150 Lad Land Drive in Fredericksburg, Virginia 22407.

3. EQUIPMENT UNDER TEST

The EUT was received at E-LABS on June 14 2018 in 'No Visual Damage' condition.

4. TEST REQUIREMENTS [Applicable Documents (AD)]

Testing of the EUT was conducted in accordance with:

AD-1: E-Labs Quotation Number 06737-A, dated 12 May 2018

AD-2: IEC 60068-2-27, dated 2009

5. TESTING

5.1 Preparation

The EUT was sequenced for testing as detailed above in Table ES-3.

All equipment used for accuracy and data recording was calibrated with traceability to the National Institute of Standards and Technology reference standards. See Table 5.1-1 for a list of equipment used and calibration dates.

Table 5.1-1: Equipment and Calibration Data

Instrument	Model No.	Serial No.	Manufacturer	Calibration Date	Calibration Due Date
Vibration Controller	VIB Runner 24	B160043	M+P	10-27-17	10-27-18
Signal Conditioner	483B07	608	PCB	4-25-18	4-25-19
Accelerometer	J353B04	34340	PCB	11-19-18	11-19-19

5.2 Description of Testing

5.2.1 Shock

Parameters:

- A) Peak Value: 125 g's
- B) Duration: 5 ms
- C) Pulse shape: Half-sine
- D) Orientation: 3 axes, both positive and negative directions
- E) Number of shocks: 1 positive and 1 negative shock per axis
- F) Total shocks: 6 shocks per test item, 48 total for test series
- G) Units powered on during exposure

Procedures:

- Step 1) The EUT #1 through #8 were received and inspected for any signs of damage that may have occurred during shipping or handling prior to arrival at ELABS. No damage was discovered or observed.
- Step 2) The shock profile was programmed into the controller and verified by an ELABS subject matter expert.
- Step 3) The test fixture was mounted on the drive surface of the electro-dynamic shaker and all bolts were torqued to the industrial shock and vibration standard of 45 foot-pounds.

- Step 4) One (1) control accelerometer was mounted to the shock fixture for control and date records.
- Step 5) The positive and negative shock pulse were ran through the bare fixture; the specified peak value, pulse duration, and pulse shape were observed, validated, and approved for full execution by an ELABS subject matter expert.
- Step 6) The test items were wired for operation during testing by A-T Controls representative.
- Step 7) Each EUT # 1 through #8 was mounted individually to the fixture in the Vertical Z-axis and subjected to one (1) positive and (1) negative shock pulse.
- Step 8) Note: During the first shock pulse on WEM-690XD became loosened. The unit was tightened using shorter mounting bolts and the test resumed with no anomalies.
- Step 9) After the shock pulses, the EUT was visually examined for damage prior to mounting the next EUT.
- Step 10) After completing the Vertical axis, each EUT was mounted to the fixture in the Longitudinal X-axis and subjected to 1 positive and 1 negative shock pulse.
- Step 11) After the shock pulses, the EUT was visually examined for damage prior to mounting the next EUT.
- Step 12) After completing the Longitudinal axis, each EUT was mounted in the Transverse Y-axis and subjected to 1 positive and 1 negative shock pulse.
- Step 13) After the shock pulses, the EUT was visually examined for damage prior to mounting the next EUT.
- Step 14) End of the shock test

Results:

Shock testing was completed in accordance with the referenced guidance. Post-test inspections of EUT #1 through #8 were conducted and no anomalies were observed.

See Photos 5.2.1-1 thru 5.2.1-24 for pictures of the shock setup.

See charts 5.2.1-25 thru 5.2.1-72 Shock plots.

Photo 5.2.1-1: Vertical axis shock on KEM-440XD

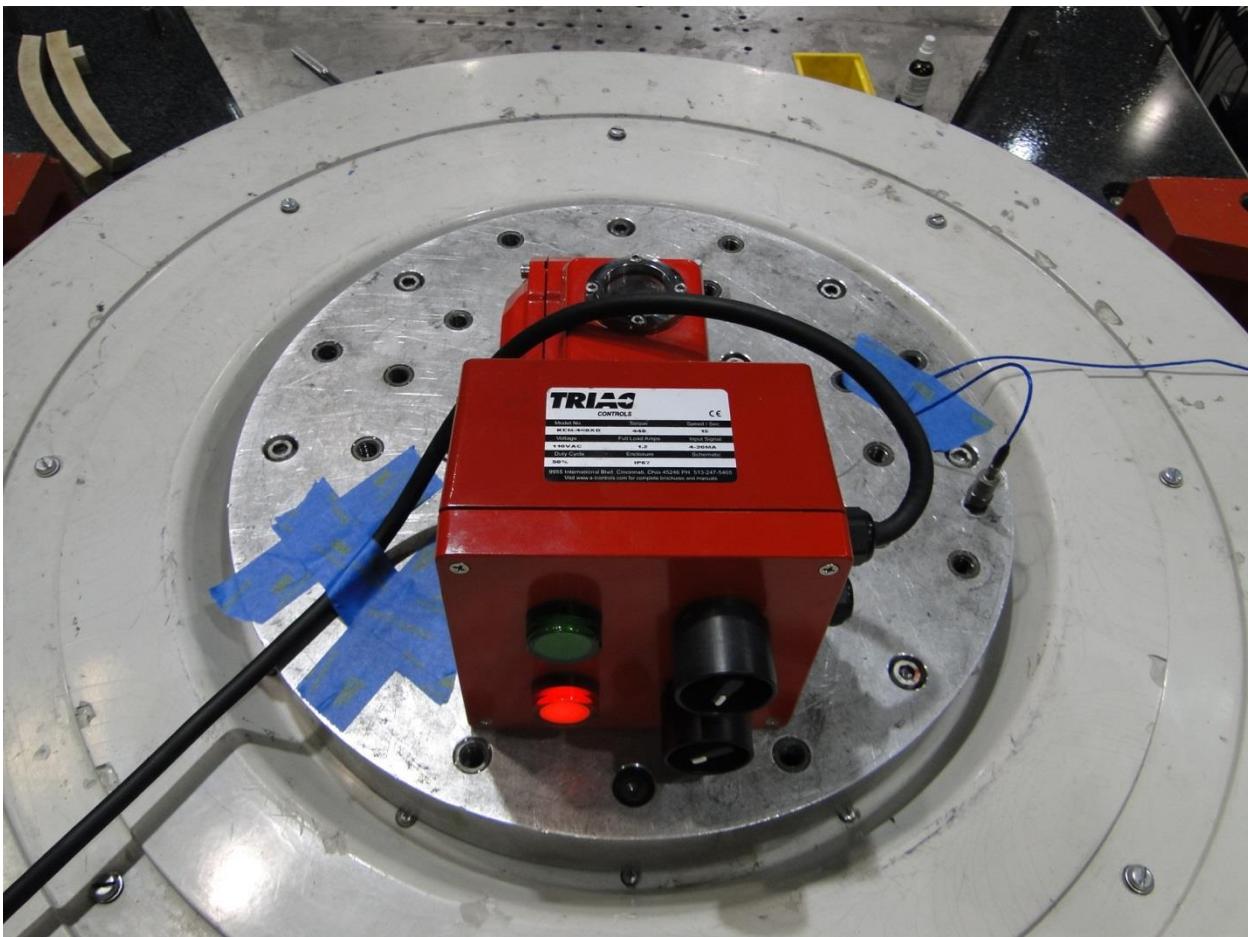


Photo 5.2.1-2: Vertical axis shock on WEM-690XD

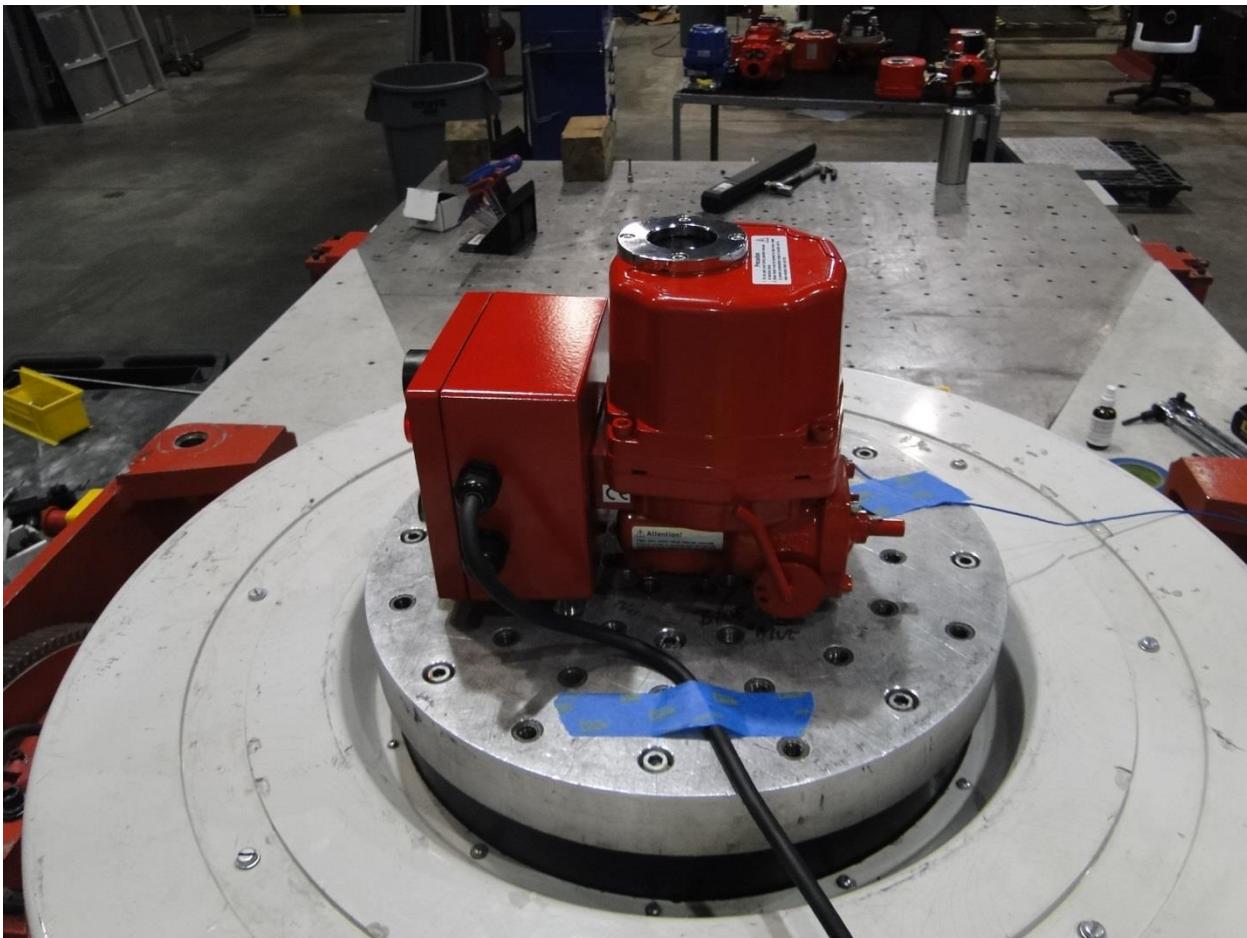


Photo 5.2.1-3: Vertical axis shock on WEM-4400



Photo 5.2.1-4: Vertical axis shock on WE-1350X-VR



Photo 5.2.1-5: Vertical axis shock on WE-1350E-VR



Photo 5.2.1-6: Vertical axis shock on WE-1350HB



Photo 5.2.1-7: Vertical axis shock on WE-2640HB



Photo 5.2.1-8: Vertical axis shock on WE-10500HB



Photo 5.2.1-9 Longitudinal axis shock on WE-10500HB



Photo 5.2.1-10 Transverse axis shock on WE-10500HB



Photo 5.2.1-11 Transverse axis shock on KEM-440XD



Photo 5.2.1-12 Longitudinal axis shock on KEM-440XD

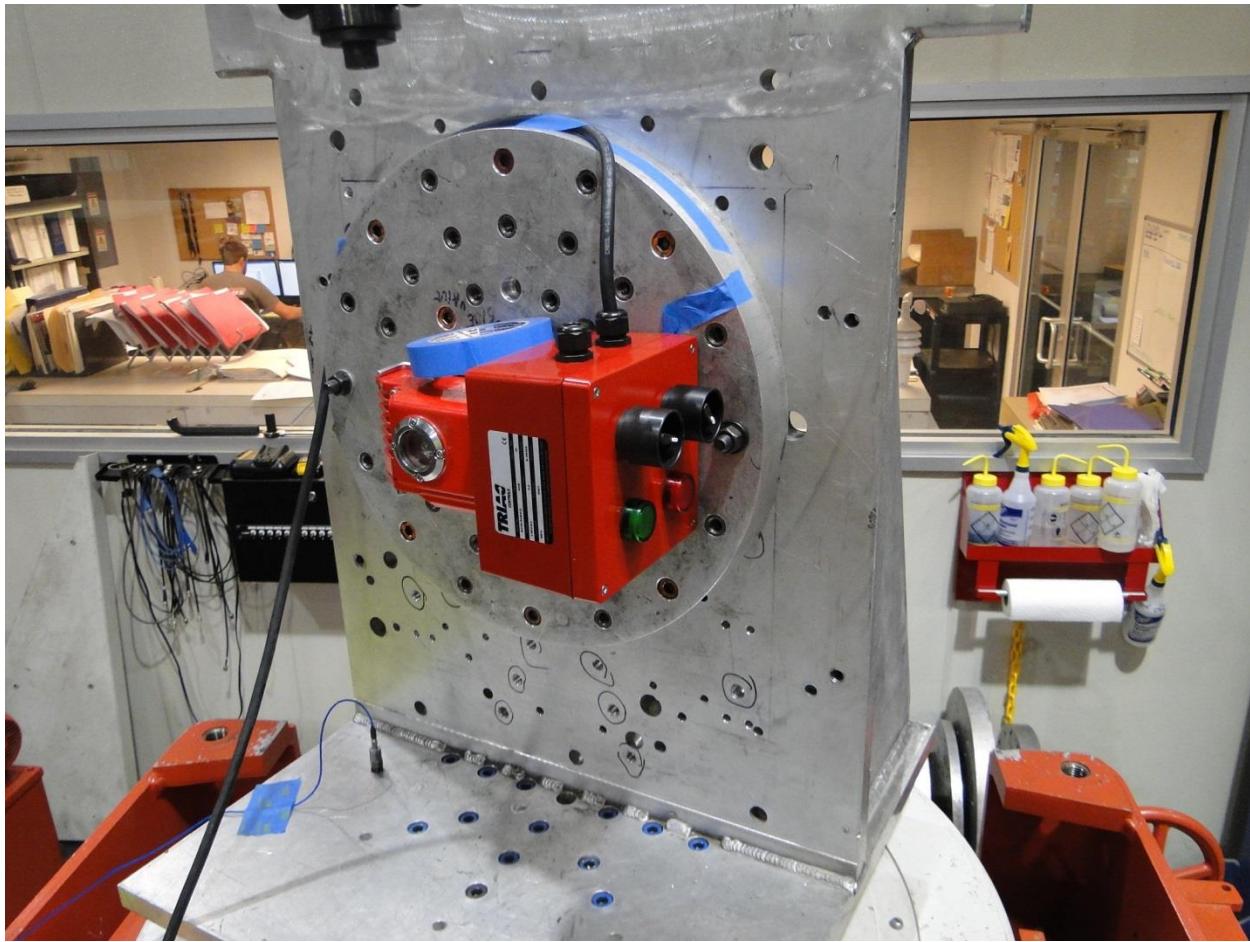


Photo 5.2.1-13 Longitudinal axis shock on WEM-690XD



Photo 5.2.1-14 Transverse axis shock on WEM-690XD



Photo 5.2.1-15 Transverse axis shock on WE-2640HB



Photo 5.2.1-16 Longitudinal axis shock on WE-2640HB



Photo 5.2.1-17 Longitudinal axis shock on WEM-4400



Photo 5.2.1-18 Transverse axis shock on WEM-4400



Photo 5.2.1-19 Transverse axis shock on WE-1350HB

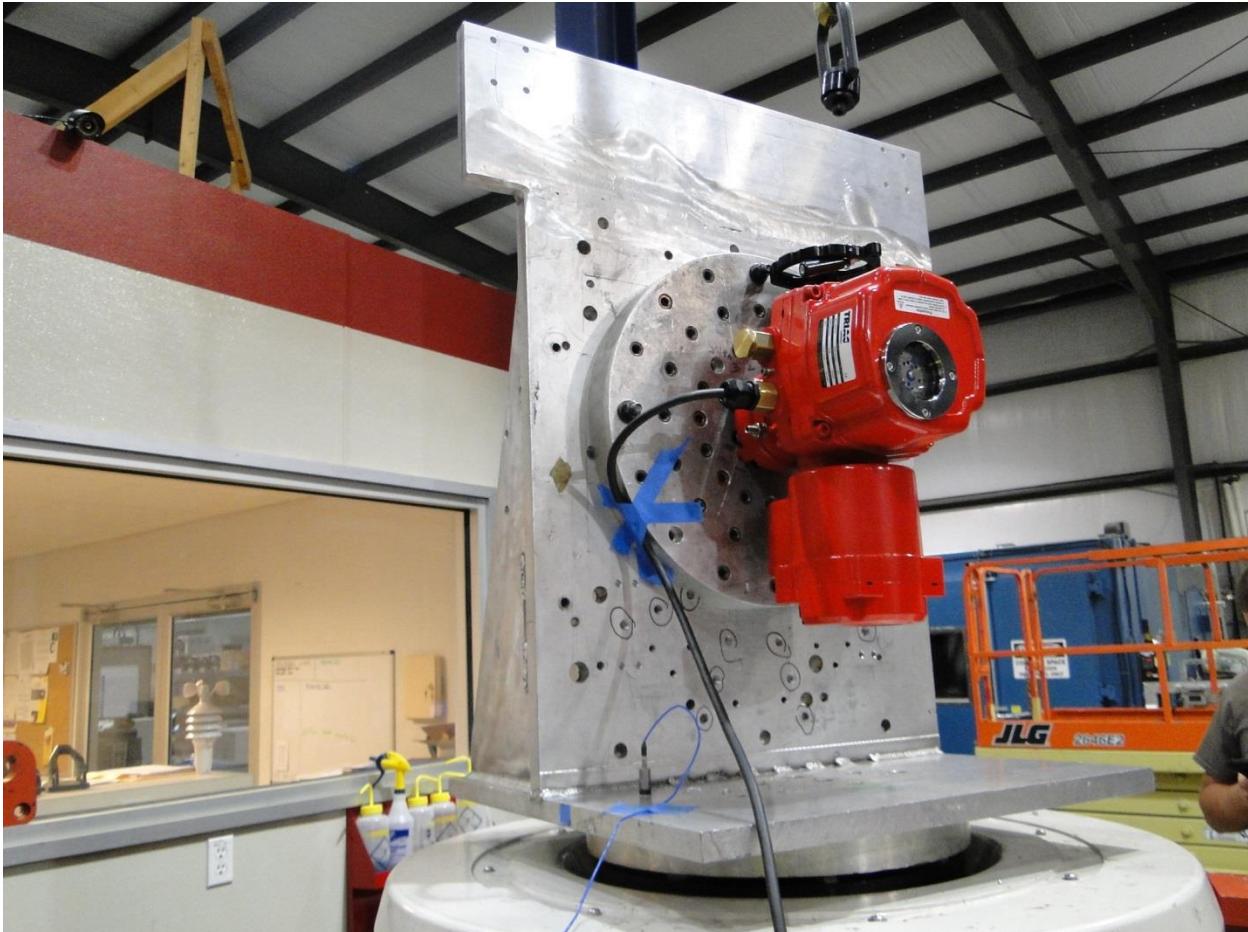


Photo 5.2.1-20 Longitudinal axis shock on WE-1350HB



Photo 5.2.1-21 Transverse axis shock on WE-1350X-VR

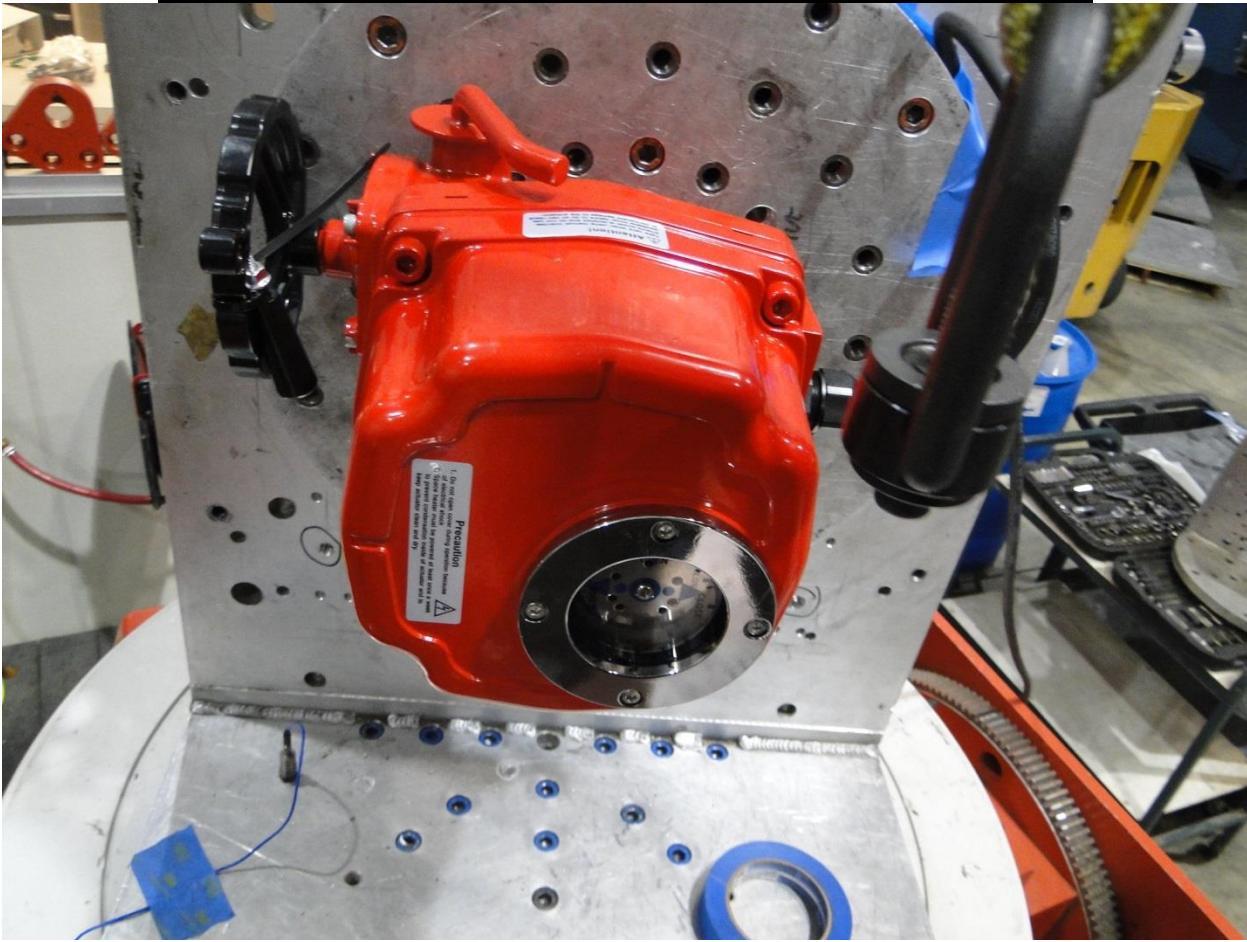


Photo 5.2.1-22 Longitudinal axis shock on WE-1350X-VR



Photo 5.2.1-23 Transverse axis shock on WEM-1350E-VR

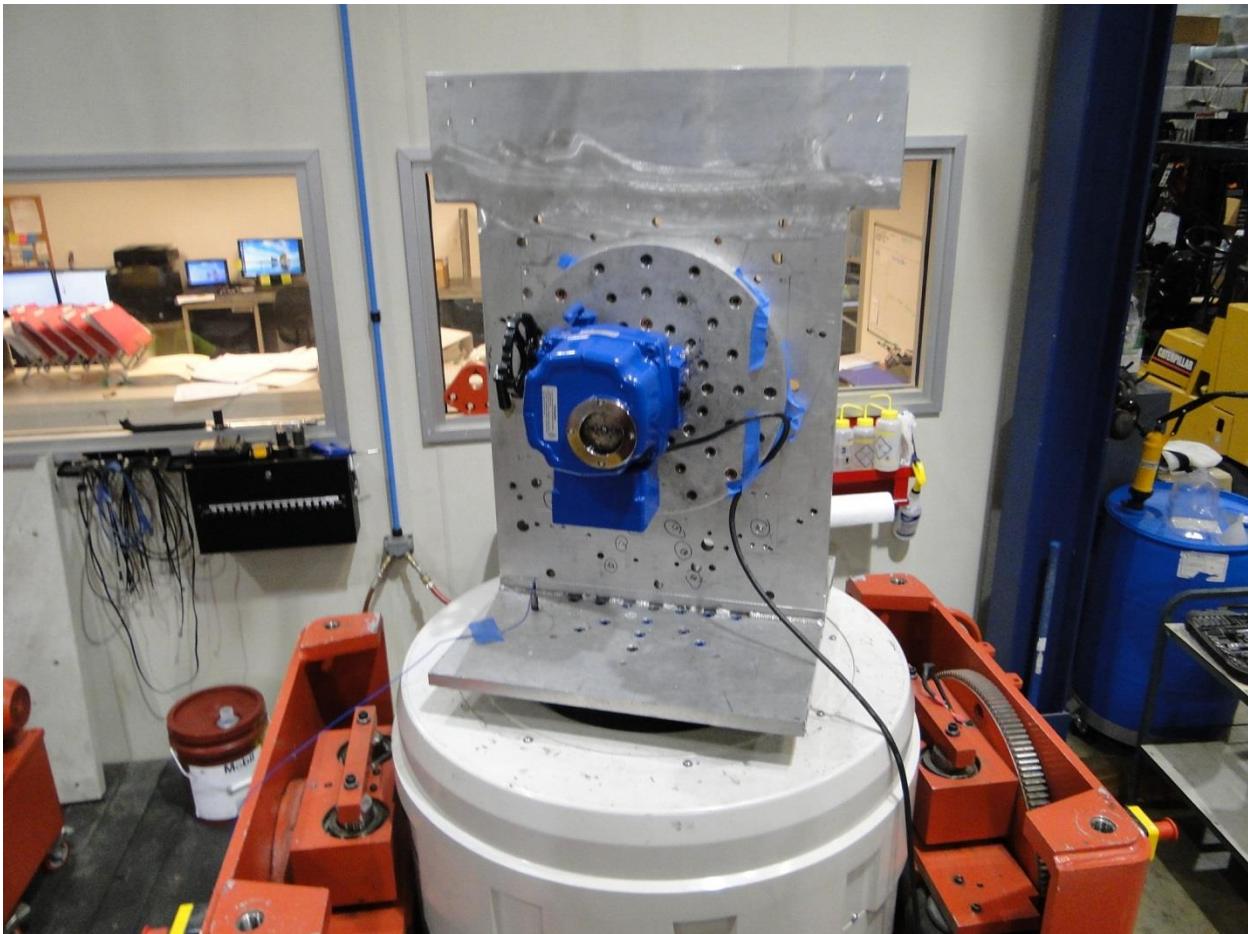


Photo 5.2.1-24 Longitudinal axis shock on WEM-1350E-VR

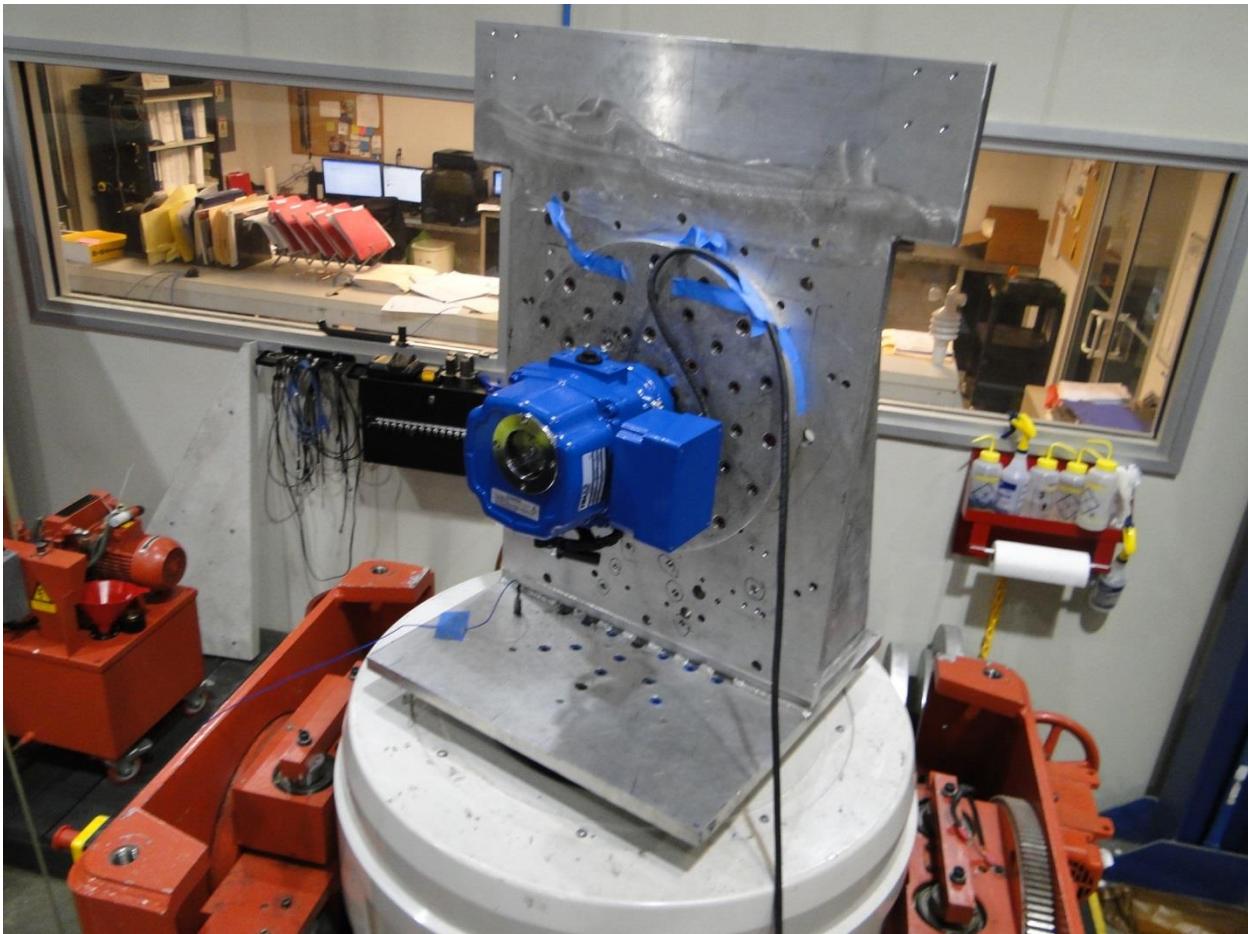


Chart 5.2.1-25: Vertical axis Shock Profile, P/N KEM-440XD, Positive 1

* Due to an interruption during the data saving process this plot is unavailable to report on. This shock pulse was however run and witnessed as completed satisfactory by an ELABS Test Engineer and an A-T Controls on site technical representative.

Chart 5.2.1-26: Vertical axis Shock Profile, P/N KEM-440XD, Negative 1

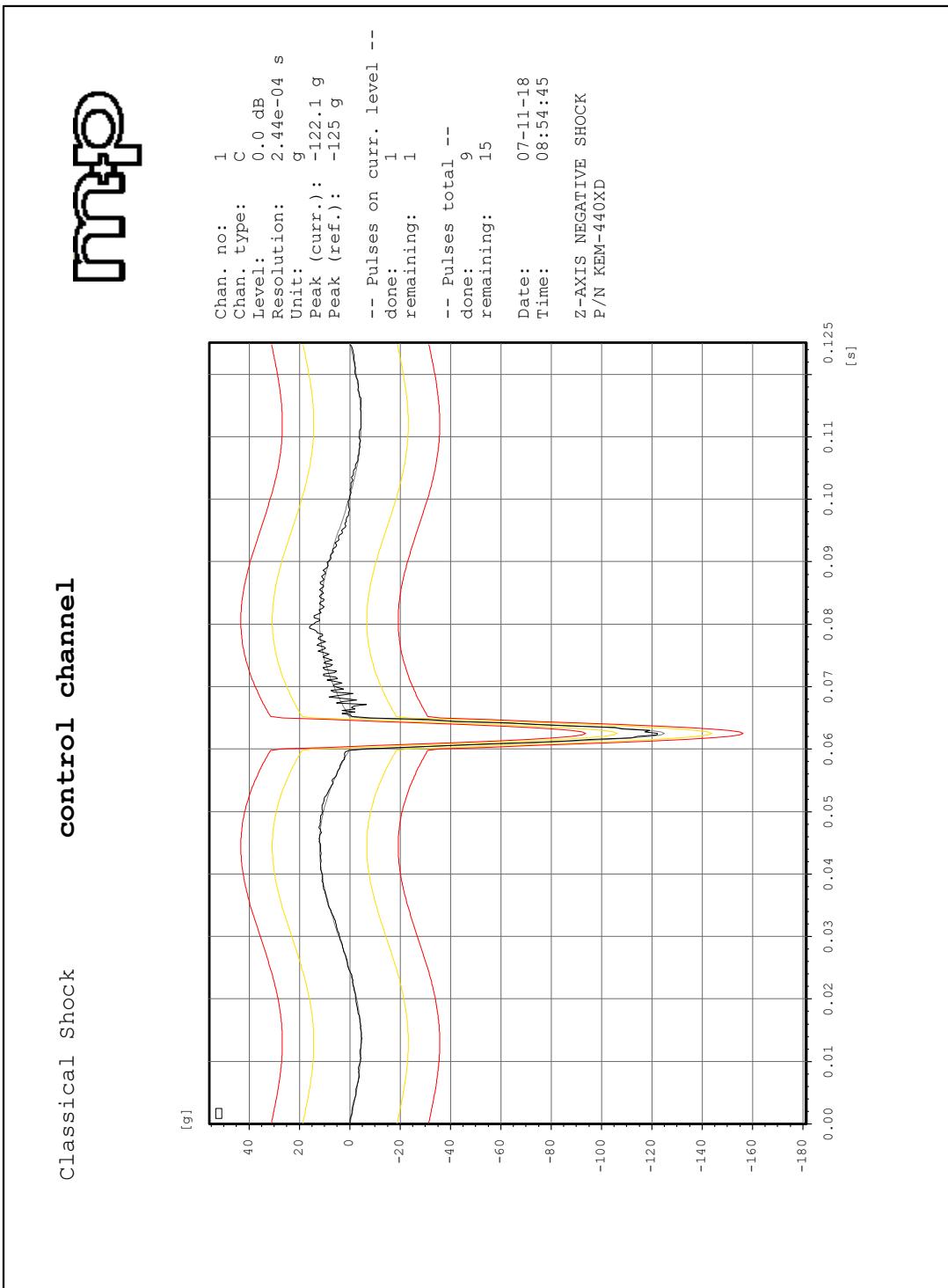
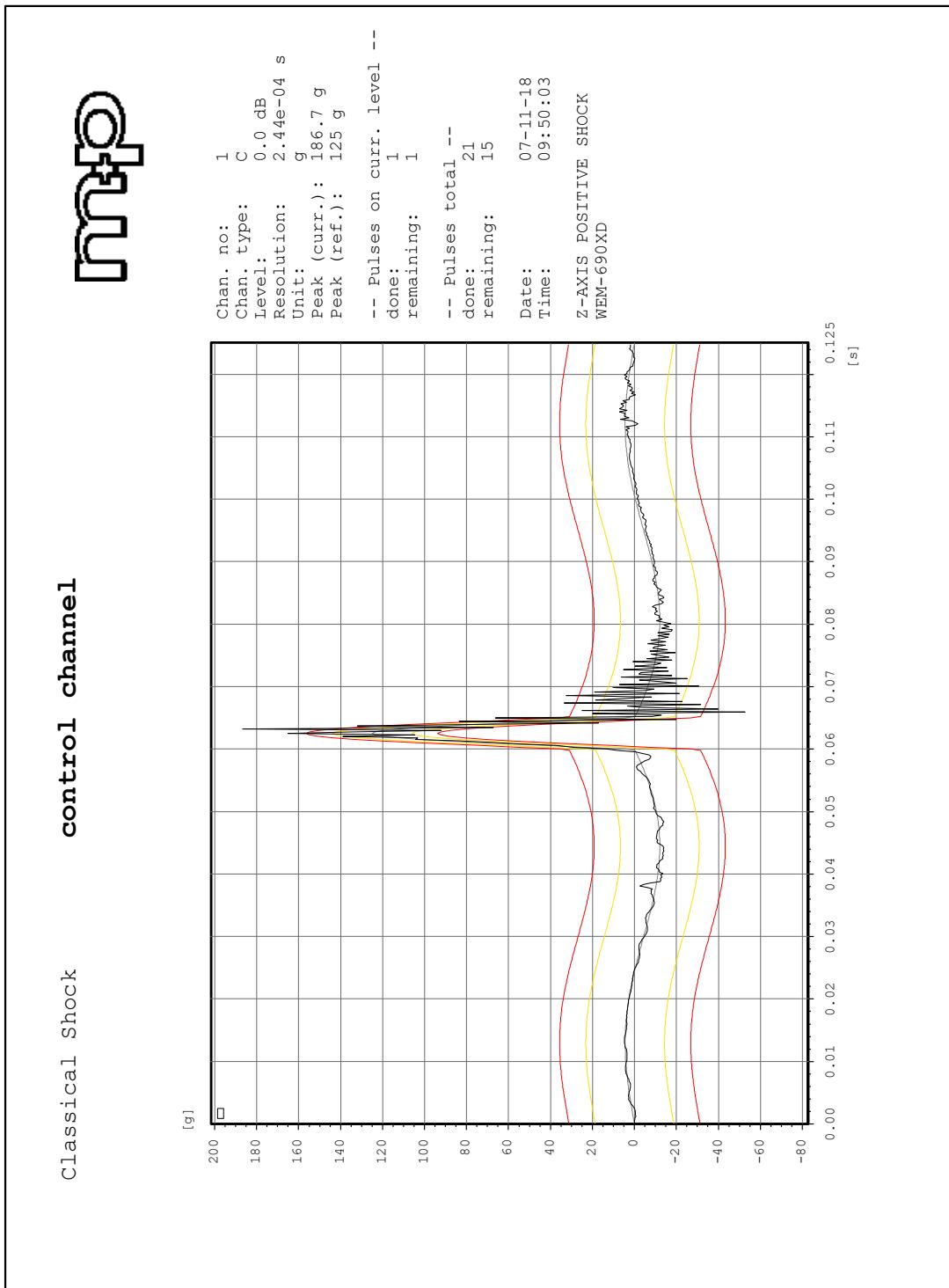


Chart 5.2.1-27: Vertical axis Shock Profile, P/N WEM-690XD, Positive 1



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Chart 5.2.1-28: Vertical axis Shock Profile, P/N WEM-690XD, Negative 1

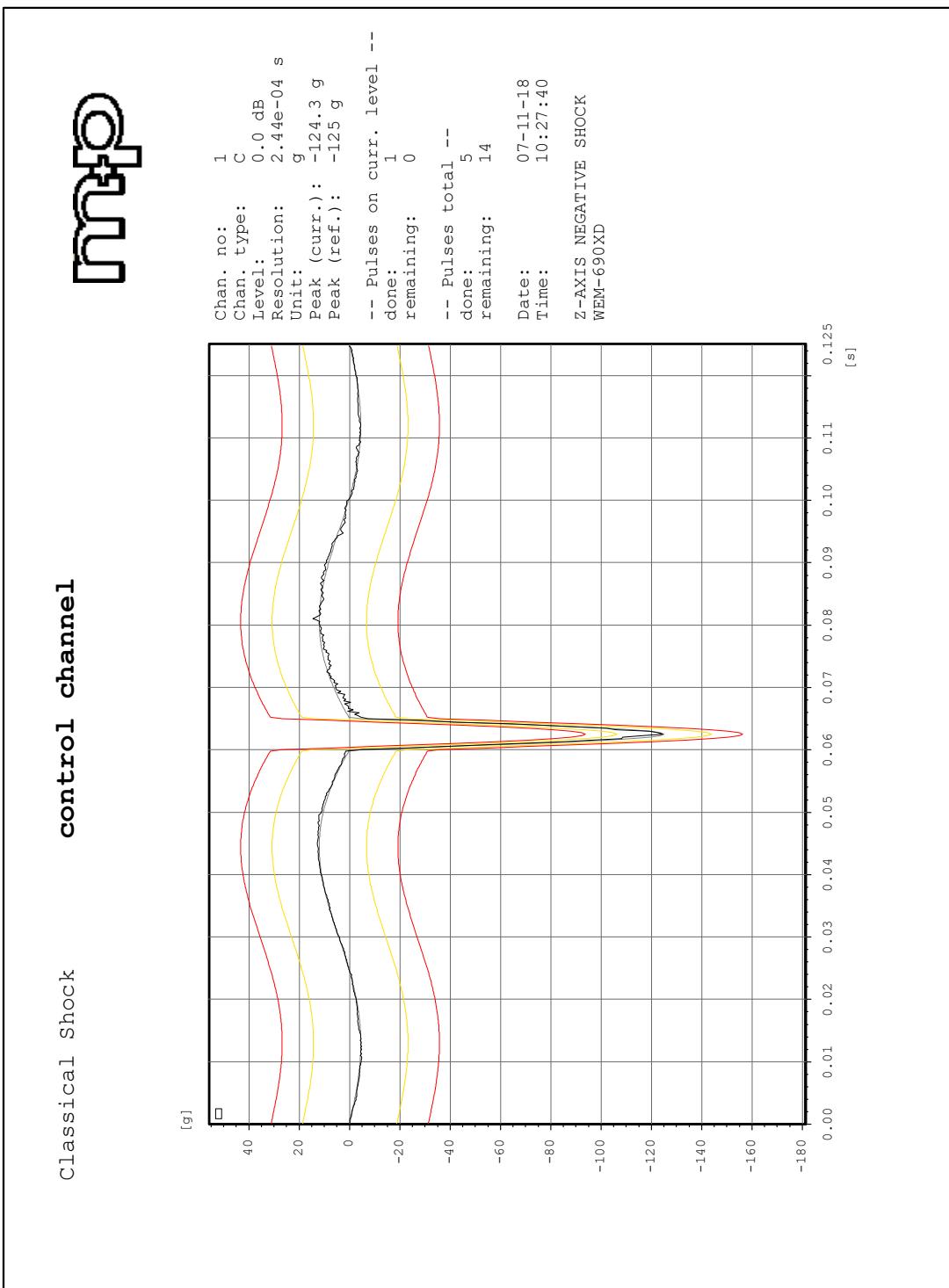


Chart 5.2.1-29: Vertical axis Shock Profile, P/N WEM-4400, Positive 1

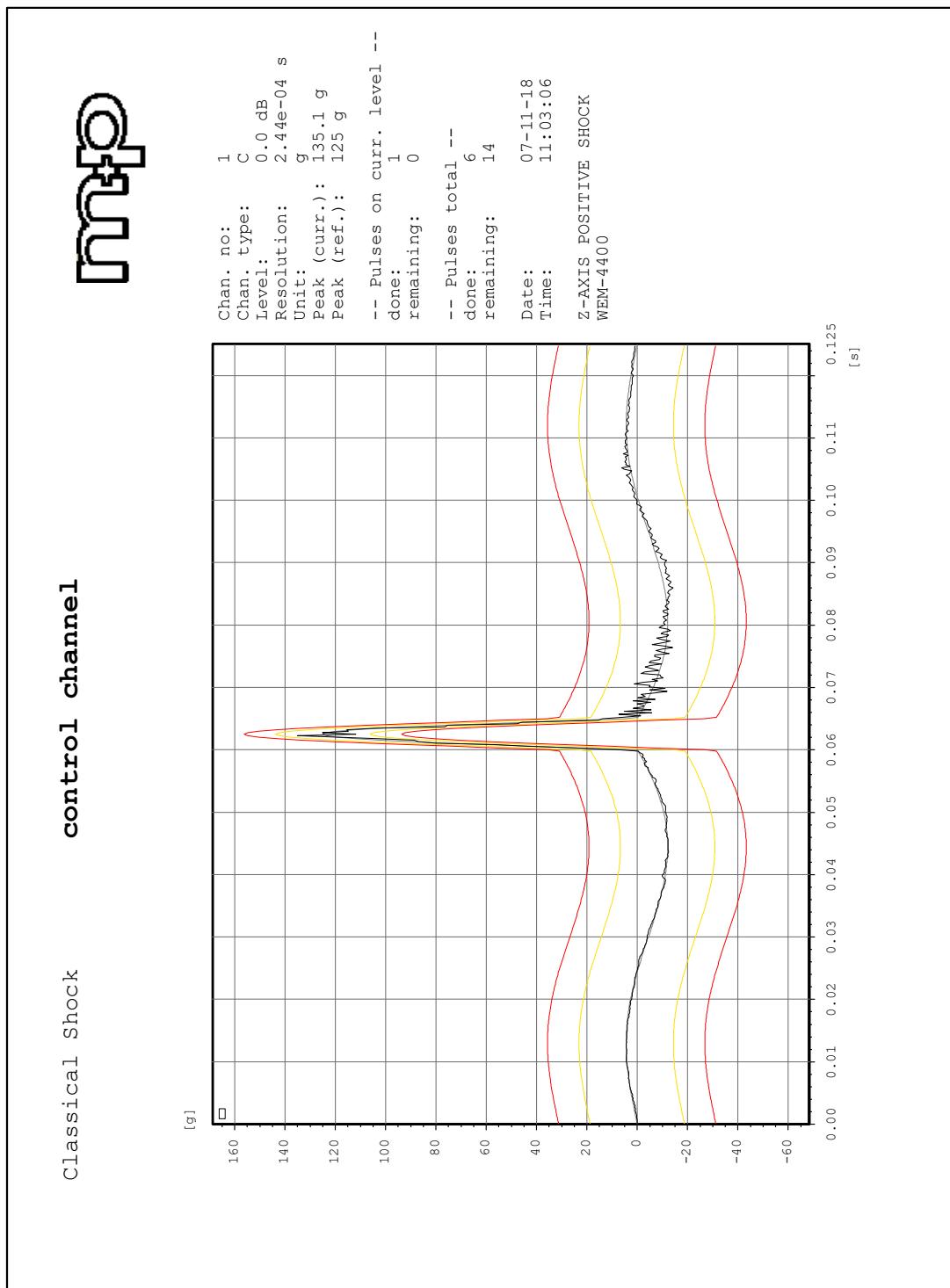


Chart 5.2.1-30: Vertical axis Shock Profile, P/N WEM-4400, Negative 1

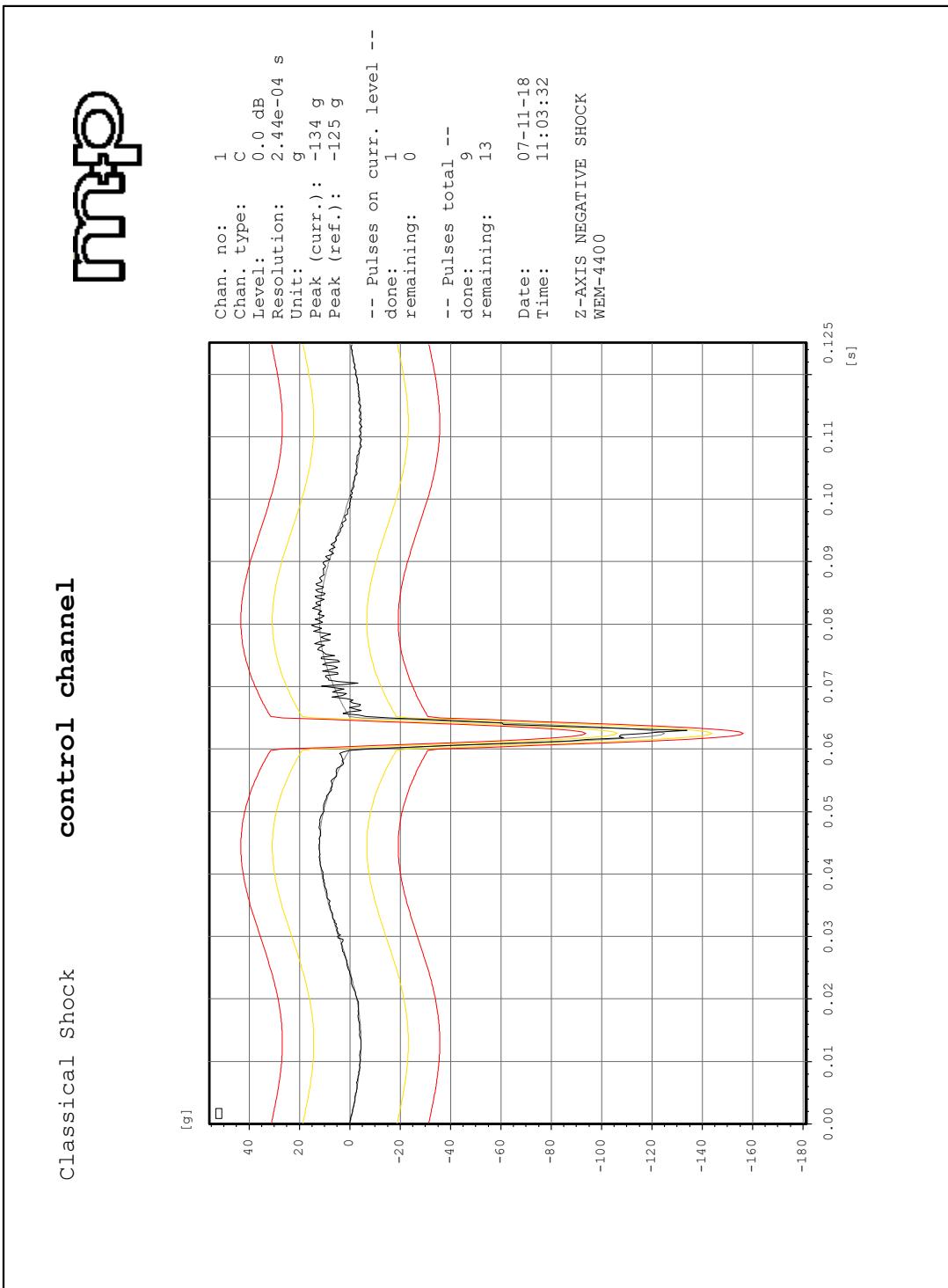


Chart 5.2.1-31: Vertical axis Shock Profile, P/N WE-1350X-VR, Positive 1

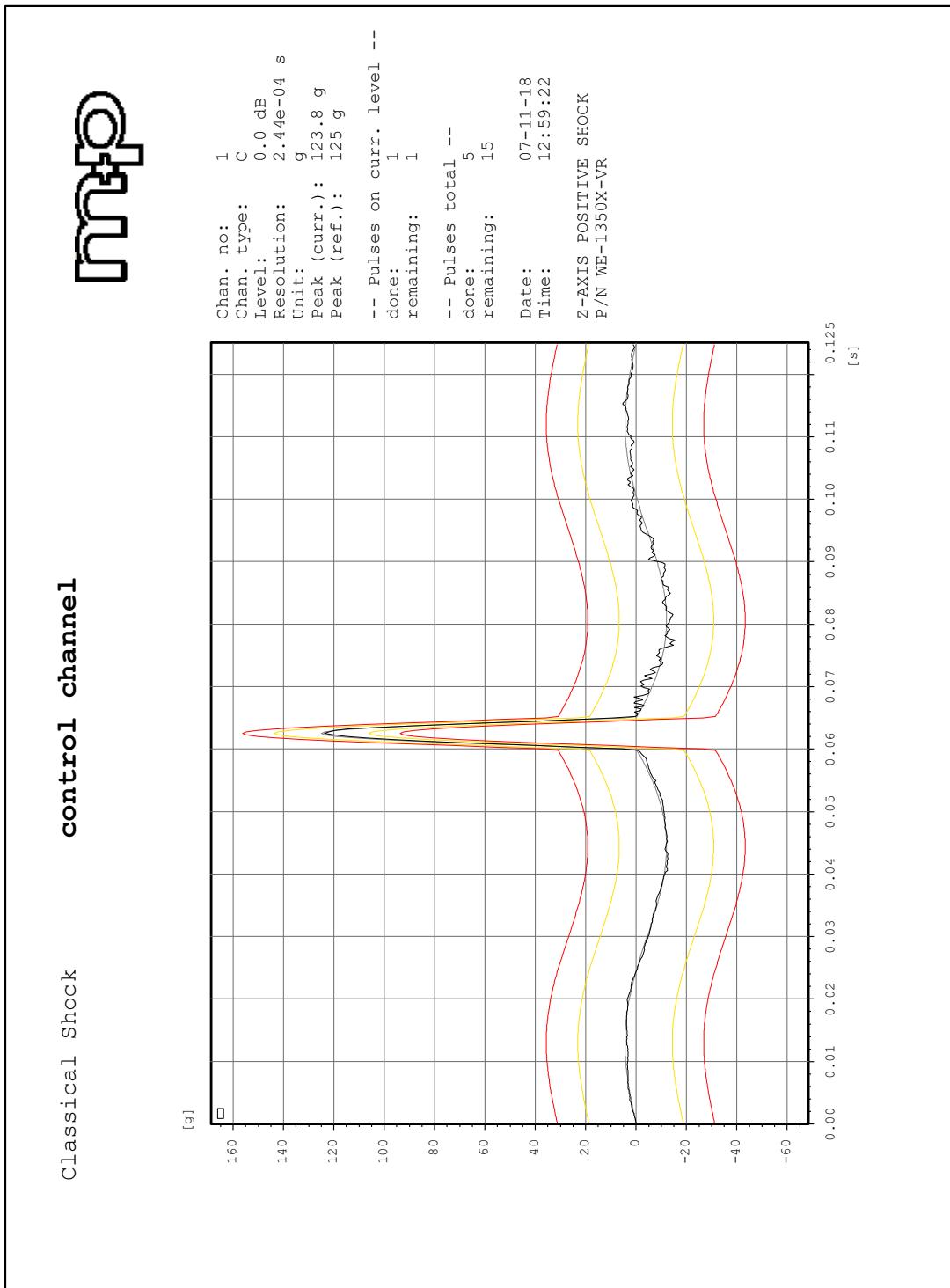


Chart 5.2.1-32: Vertical axis Shock Profile, P/N WE-1350X-VR, Negative 1

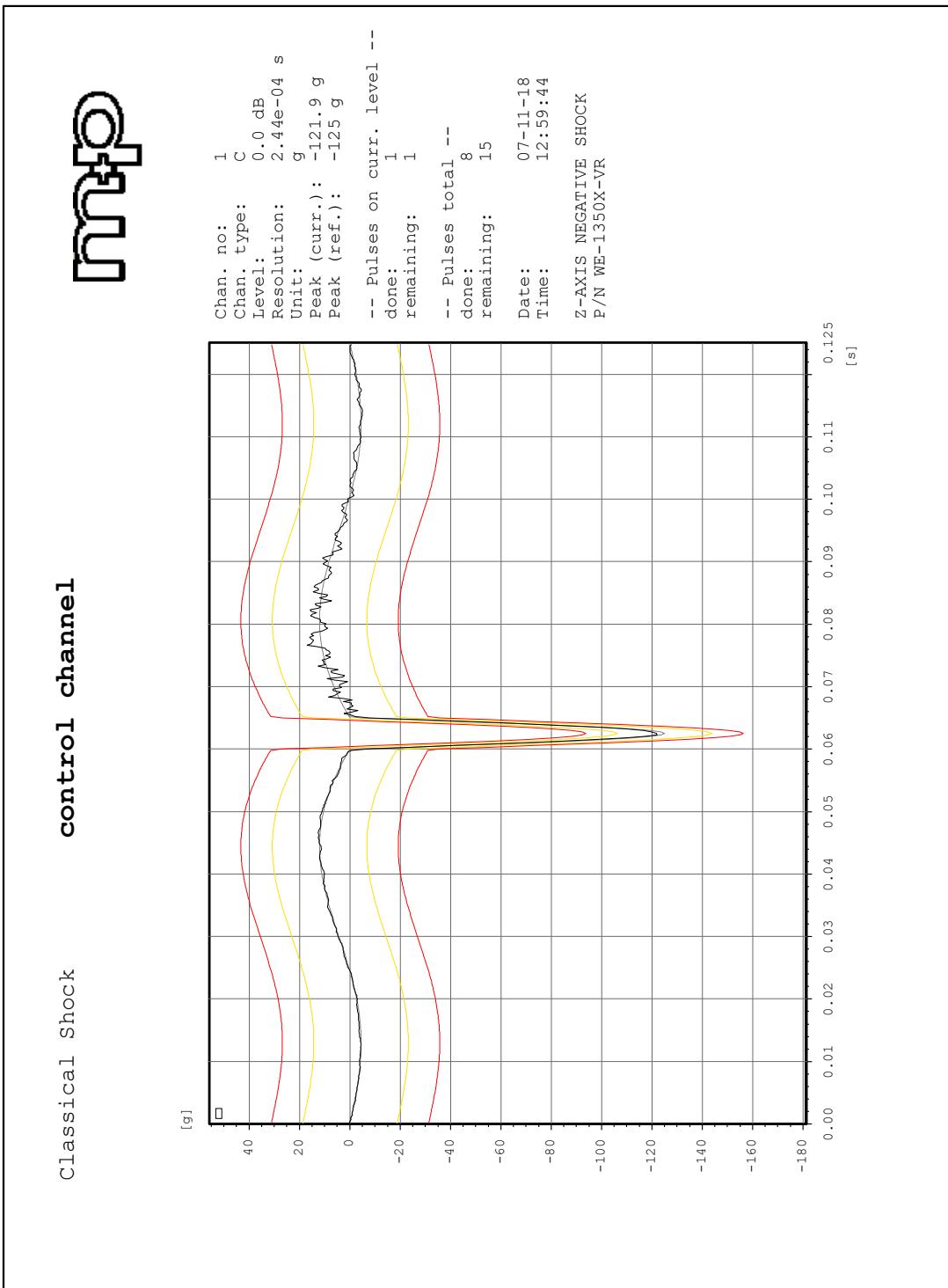
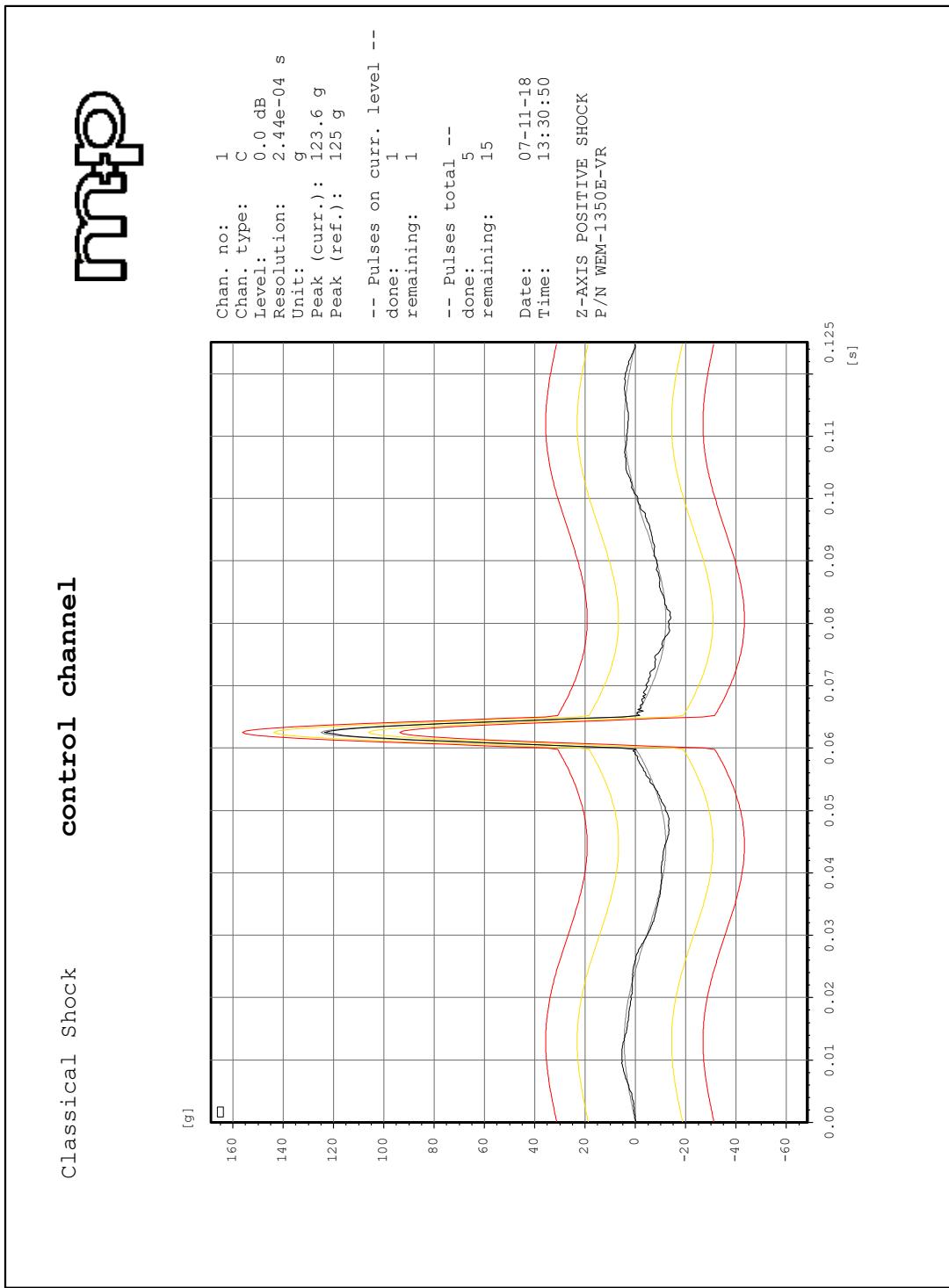
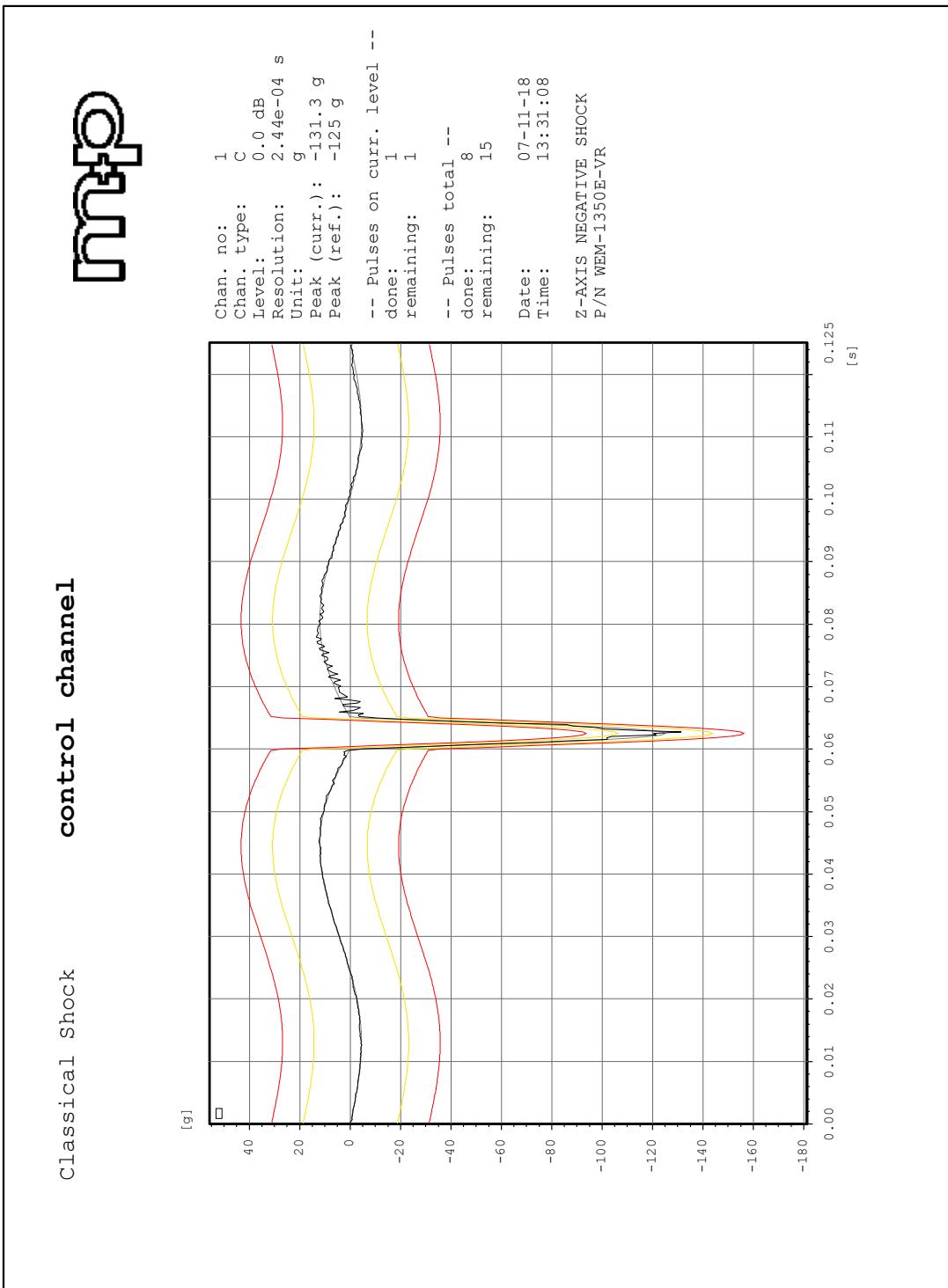


Chart 5.2.1-33: Vertical axis Shock Profile, P/N WEM-1350E-VR, Positive 1



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Chart 5.2.1-34: Vertical axis Shock Profile, P/N WEM-1350E-VR,Negative1



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Chart 5.2.1-35: Vertical axis Shock Profile, P/N WE-1350HB, Positive 1

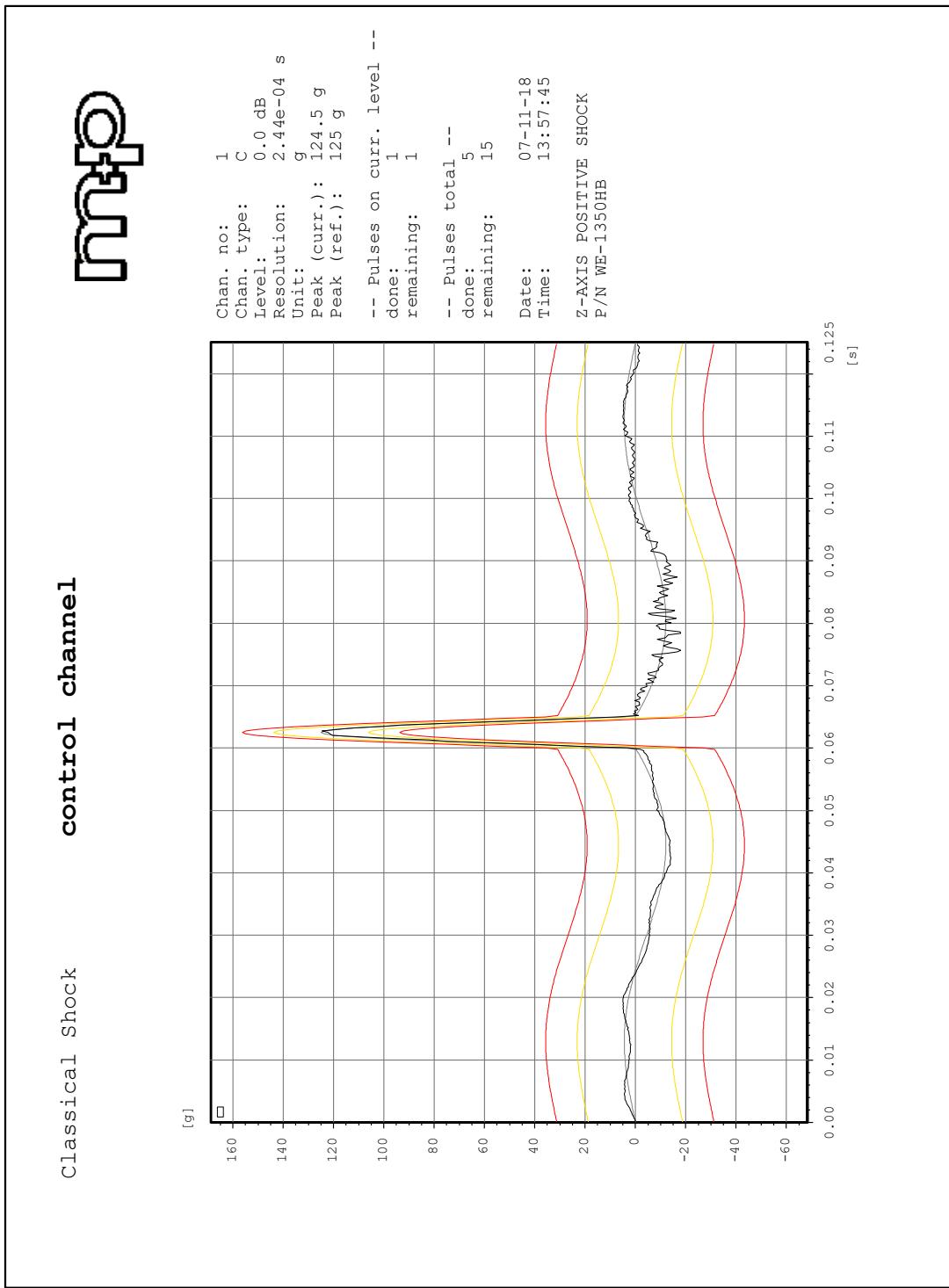


Chart 5.2.1-36: Vertical axis Shock Profile, P/N WE-1350HB, Negative 1

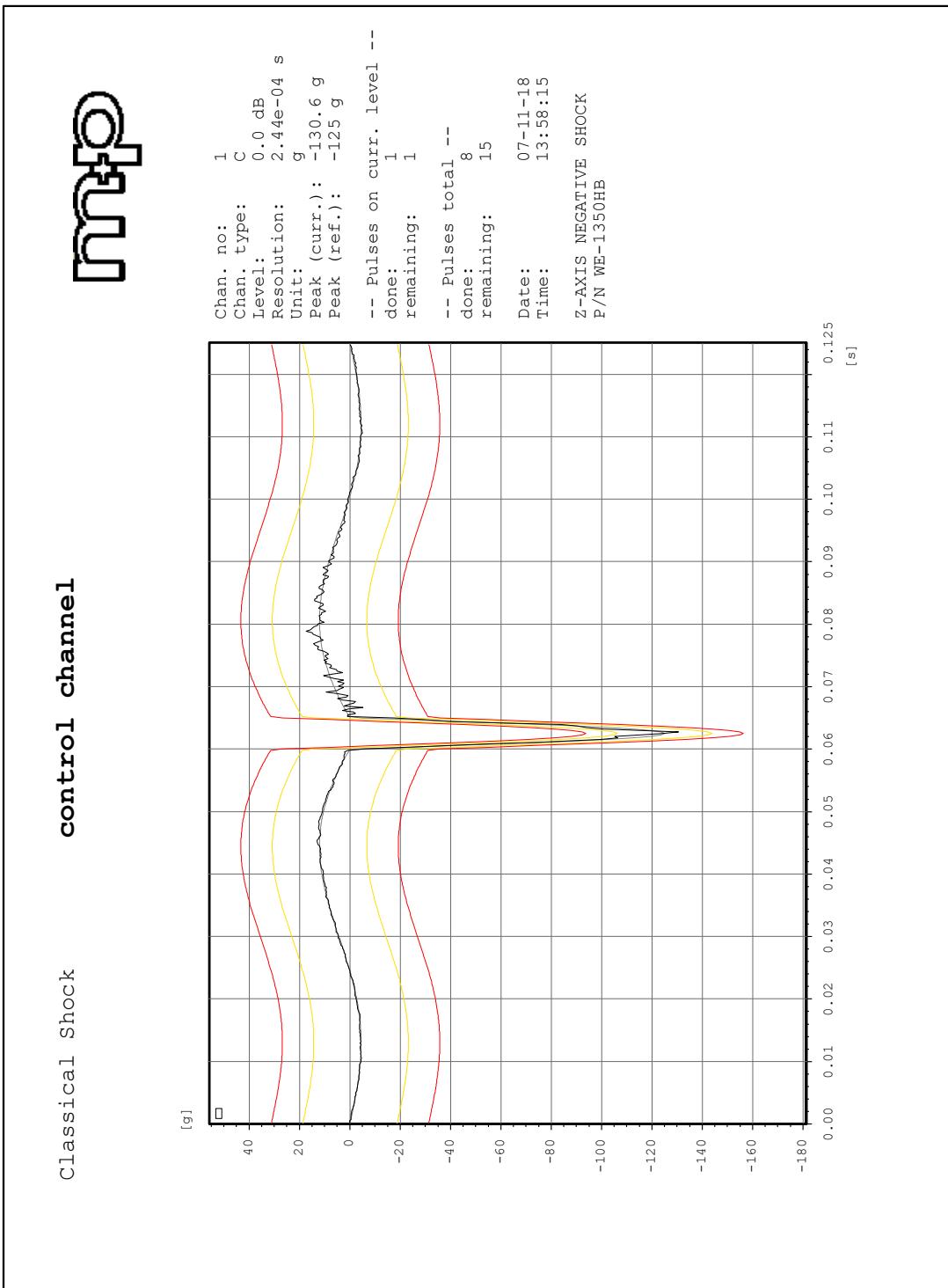
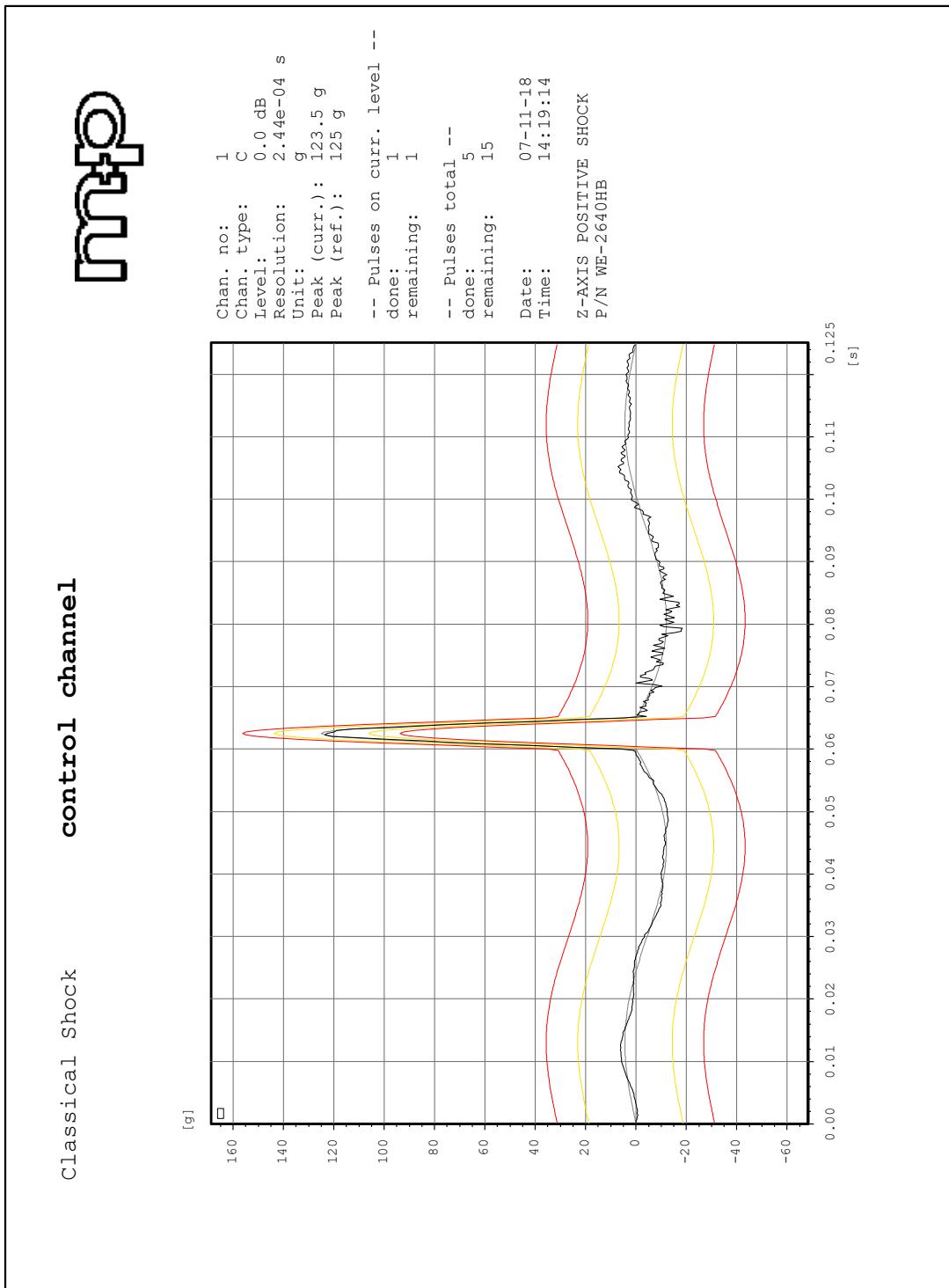


Chart 5.2.1-37: Vertical axis Shock Profile, P/N WE-2640HB, Positive 1



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Chart 5.2.1-38: Vertical axis Shock Profile, P/N WE-2640HB, Negative 1

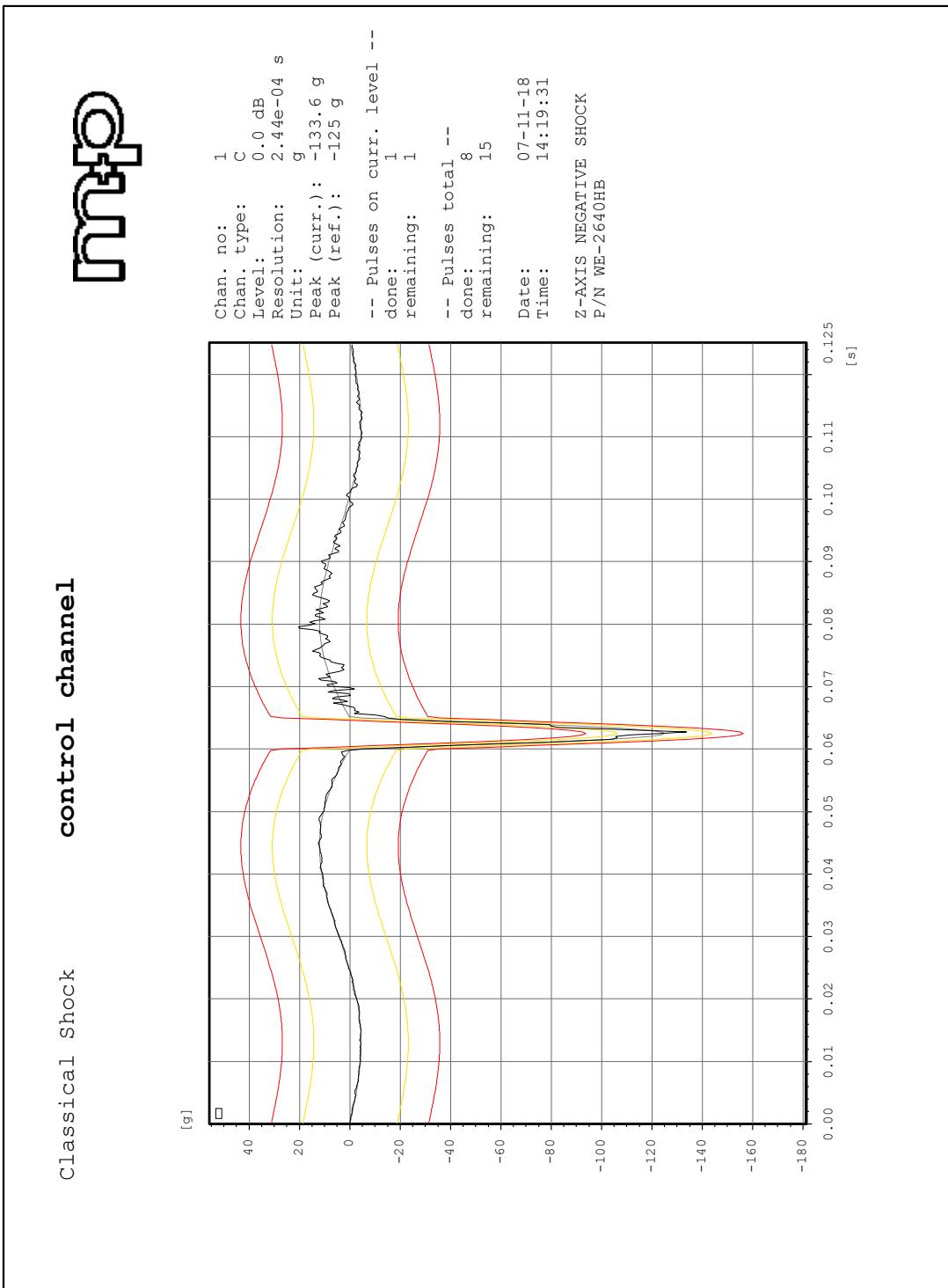


Chart 5.2.1-39: Vertical axis Shock Profile, P/N WE-10500HC, Positive 1

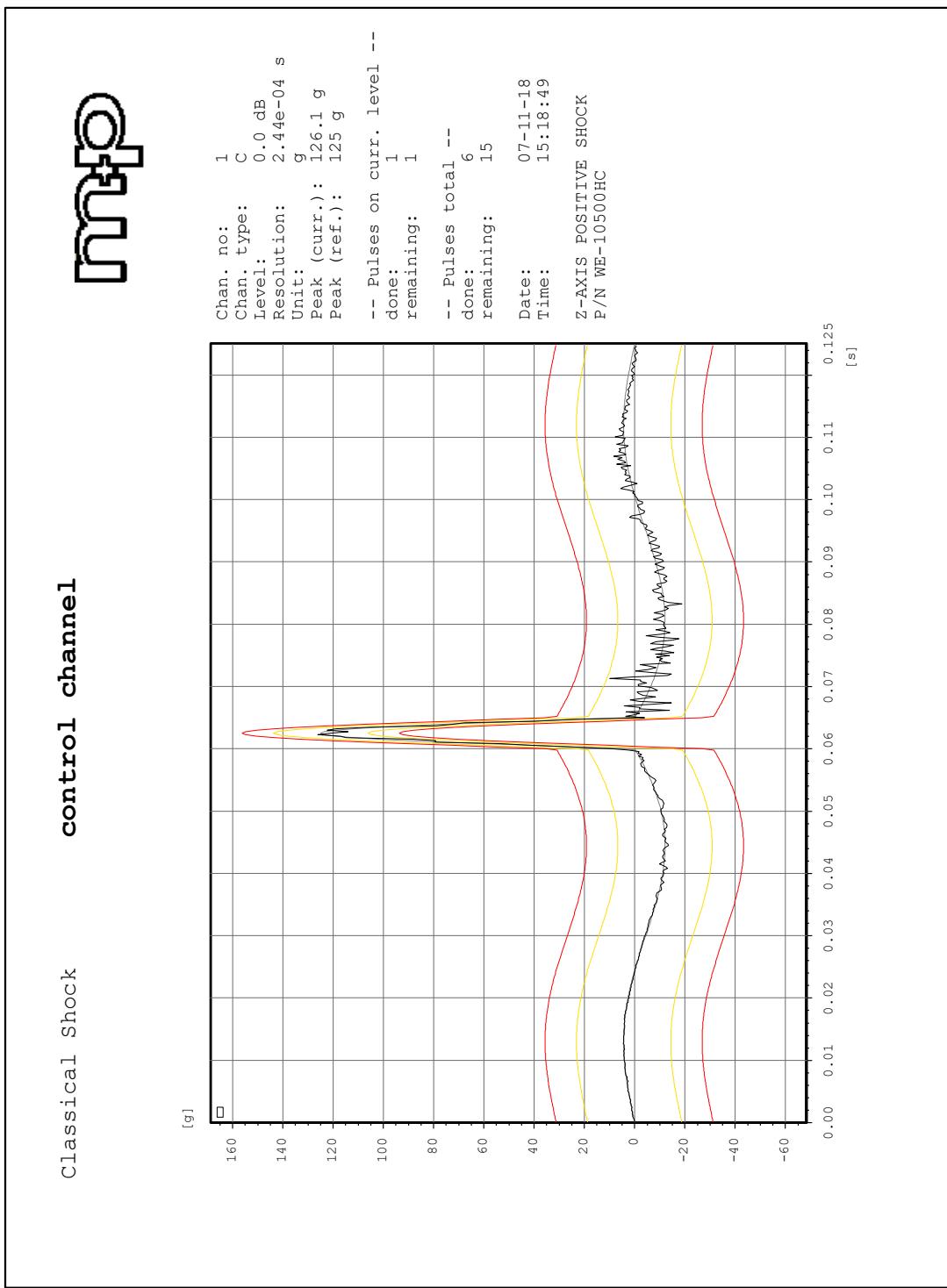
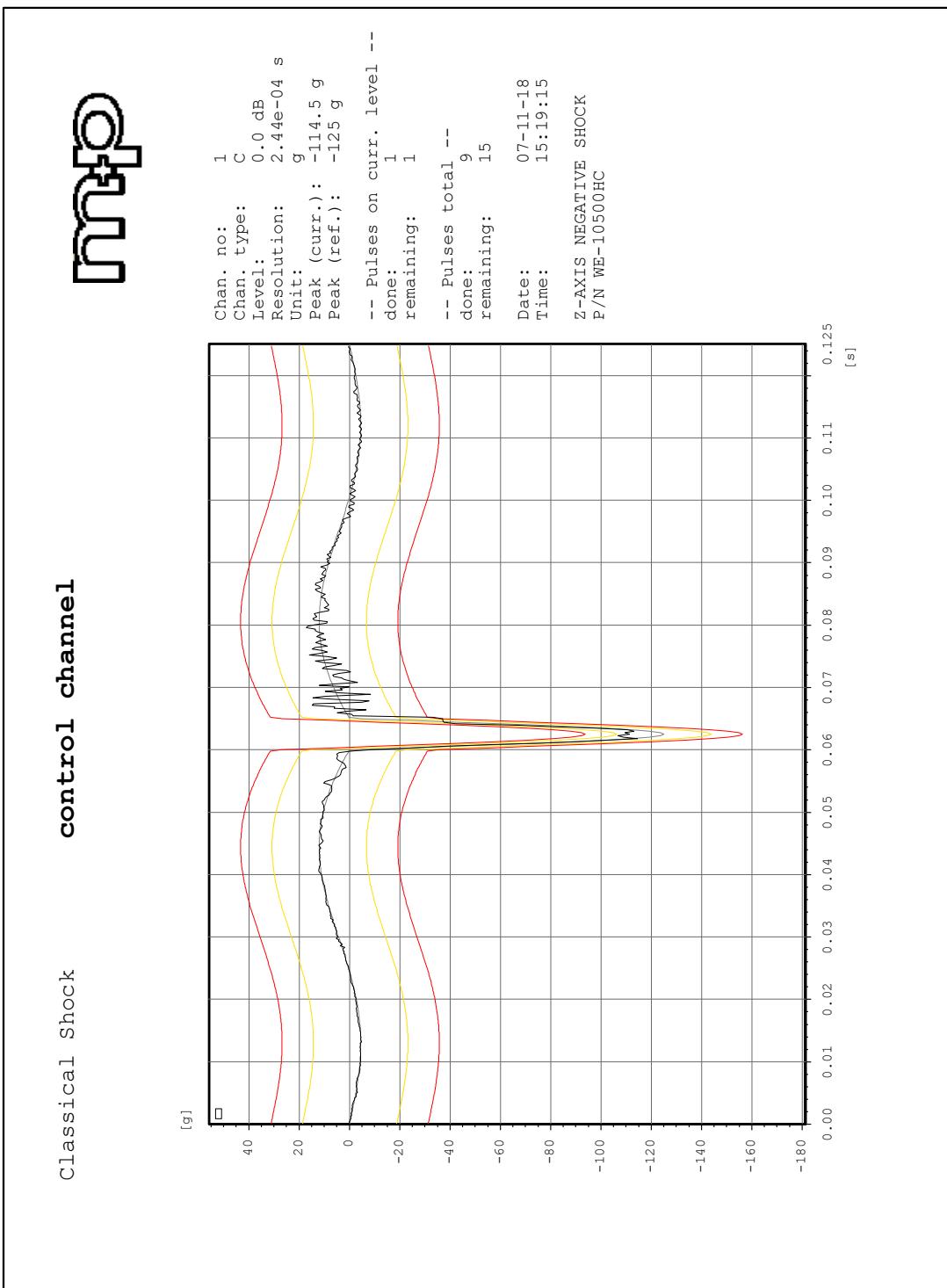
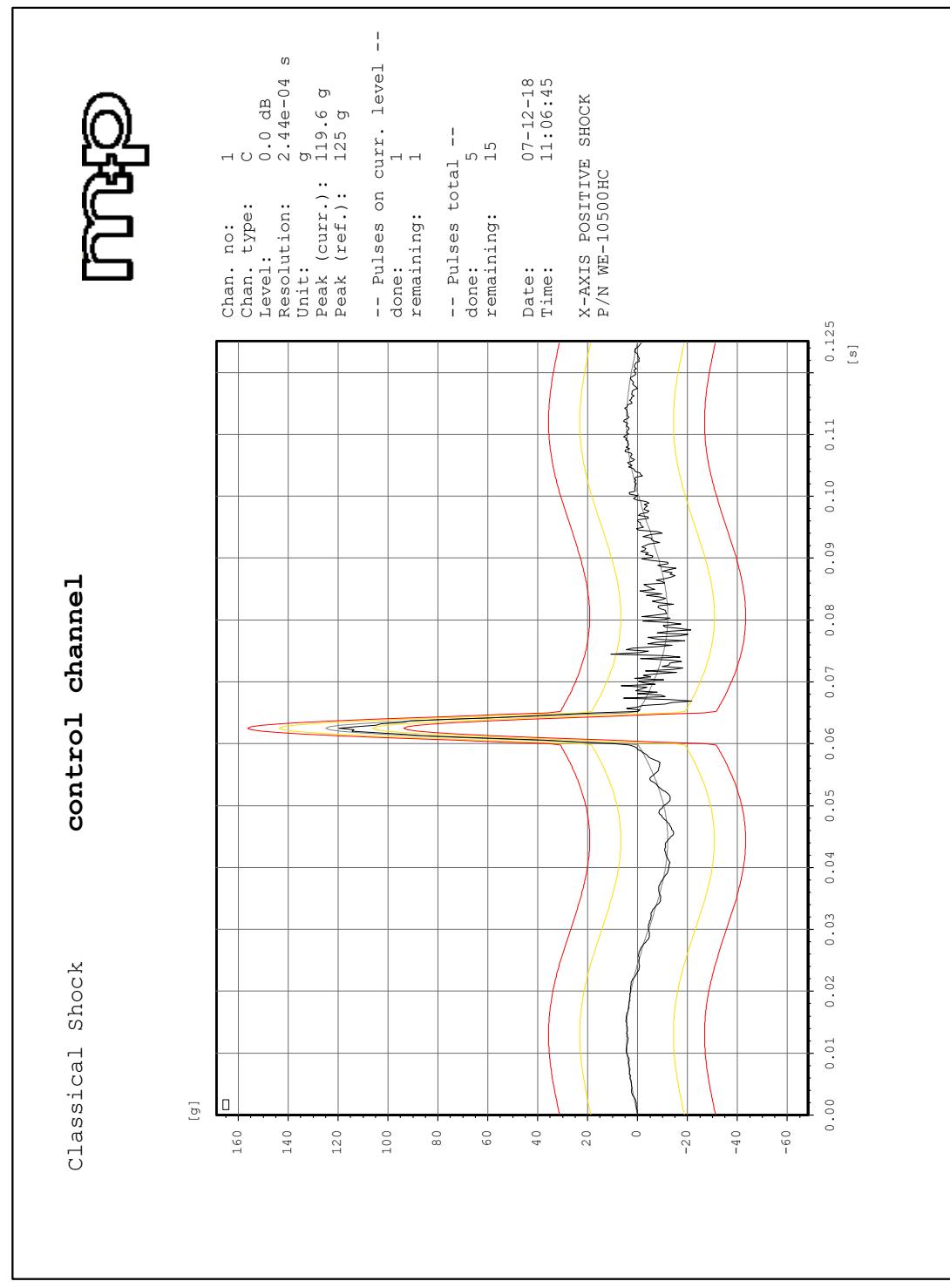


Chart 5.2.1-40: Vertical axis Shock Profile, P/N WE-10500HC, Negative 1



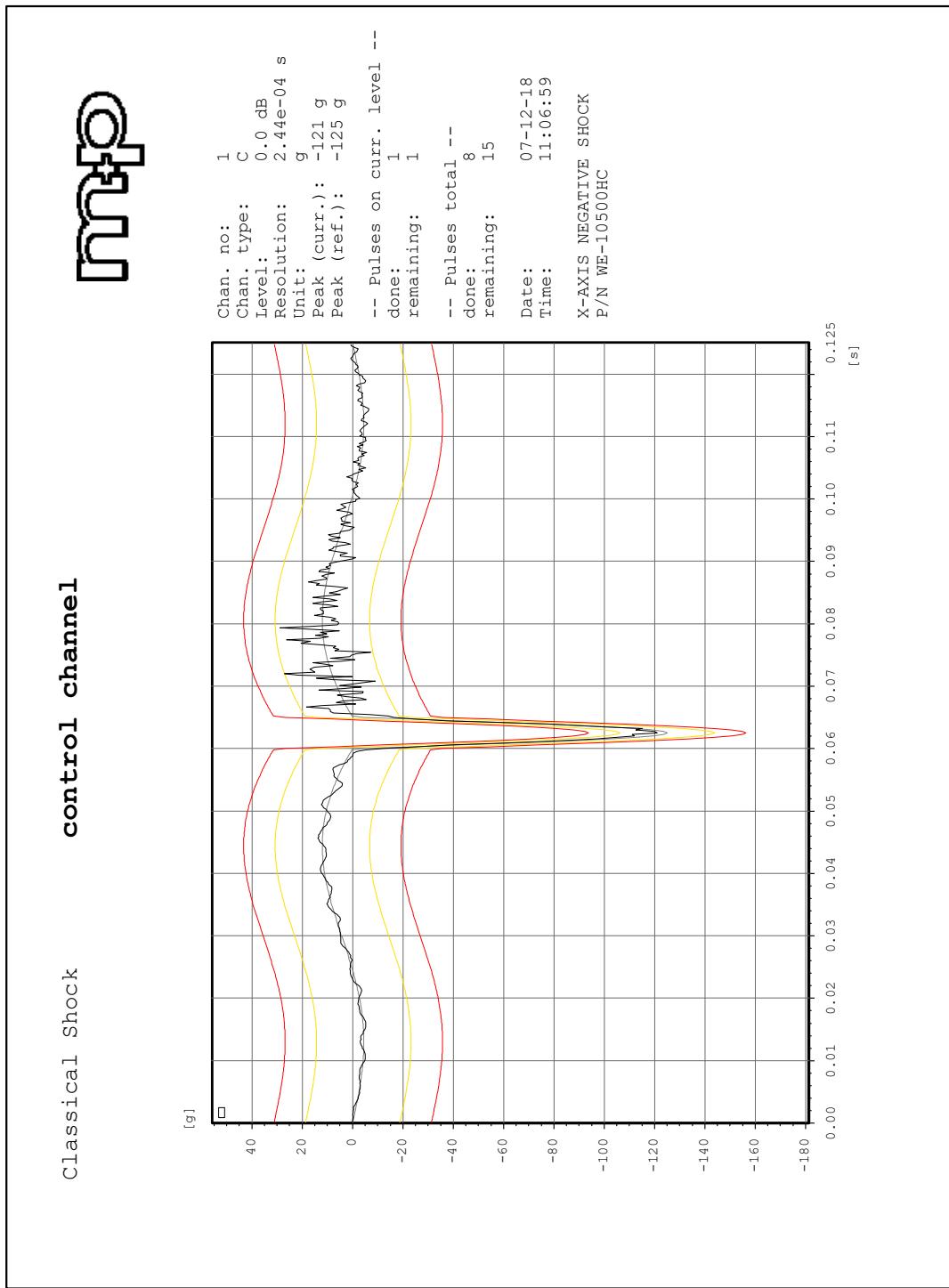
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Chart 5.2.1-41:Longitudinal axis Shock Profile, P/N WE-10500HC,Positive



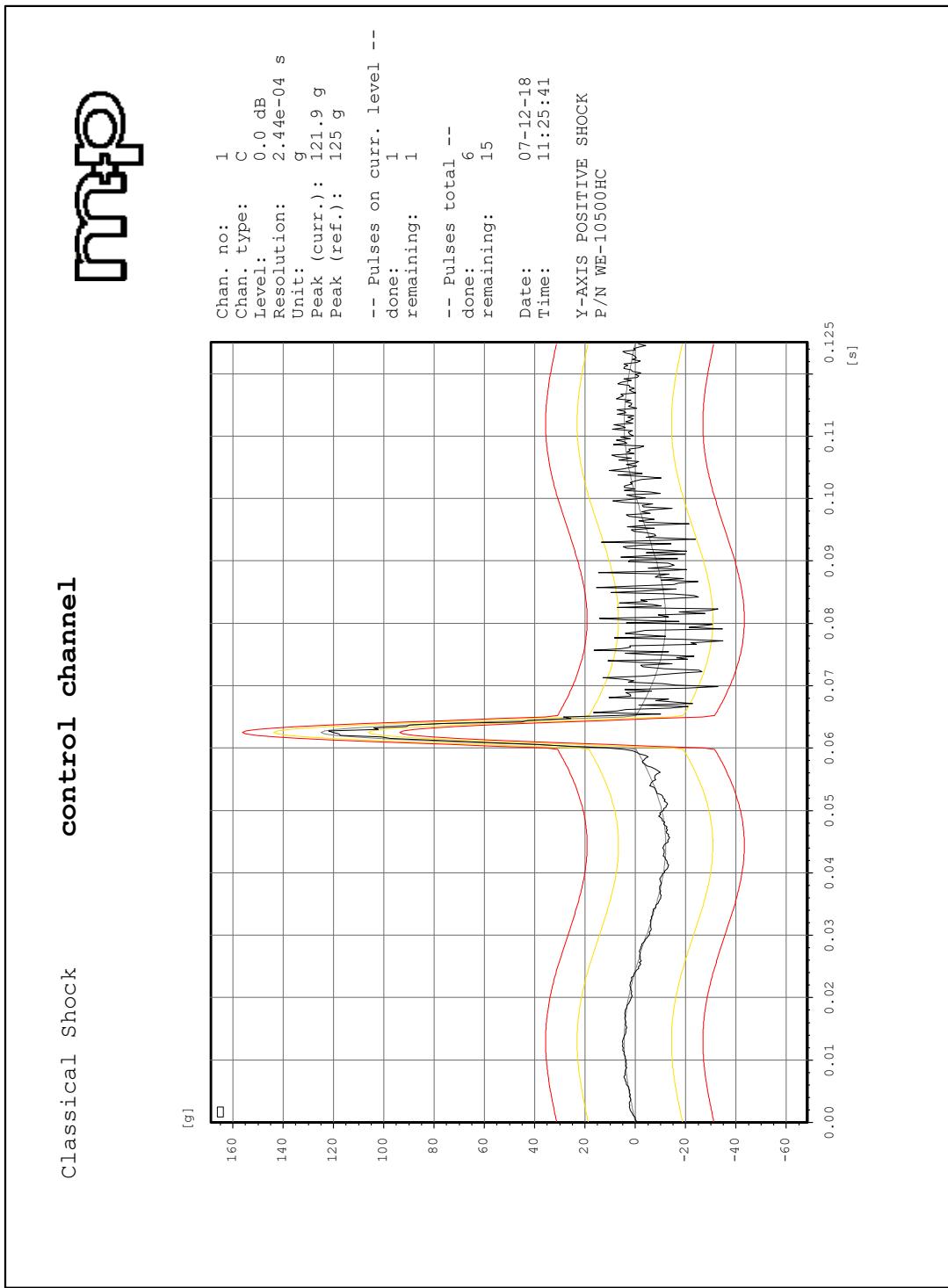
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Chart 5.2.1-42:Longitudinal axis Shock Profile, P/N WE-10500HC,Negative1



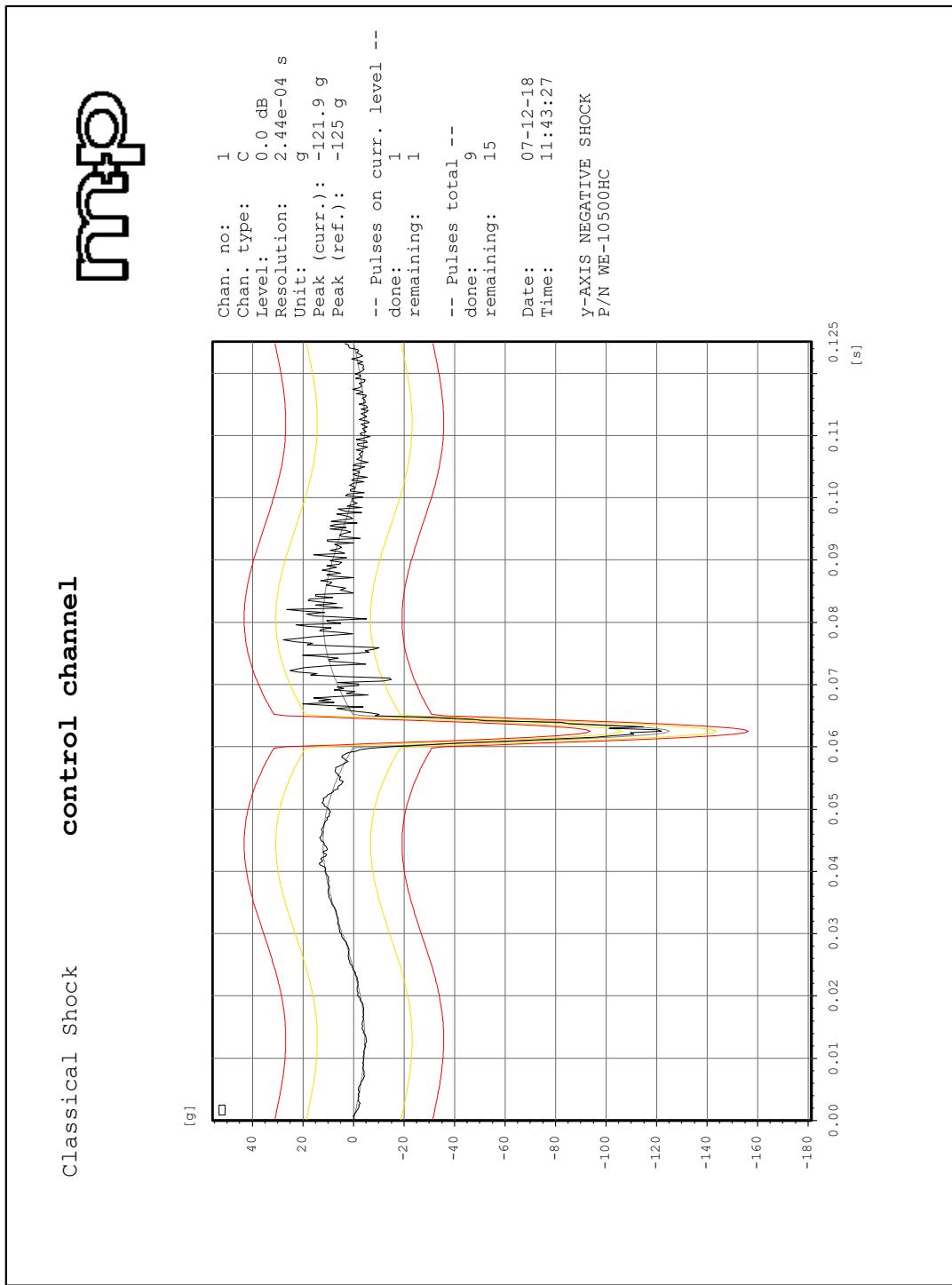
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Chart 5.2.1-43:Transverse axis Shock Profile, P/N WE-10500HC,Positive 1



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**Chart 5.2.1-44:Transverse axis Shock Profile, P/N WE-
10500h=HC,Negative 1**



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Chart 5.2.1-45:Transverse axis Shock Profile, P/N KEM-440XD,Positive 1

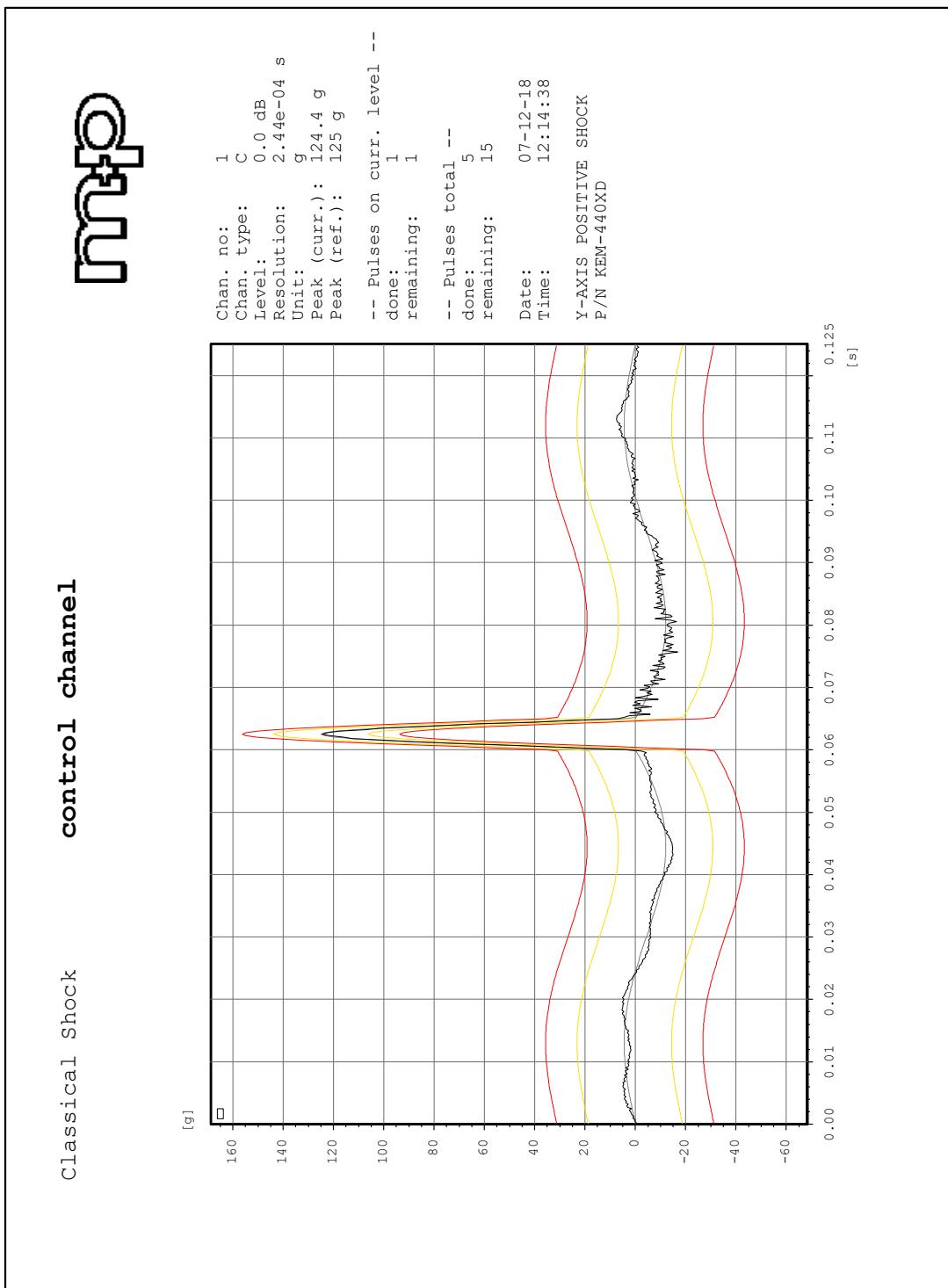


Chart 5.2.1-46:Transverse axis Shock Profile, P/N KEM-440XD,Negative 1

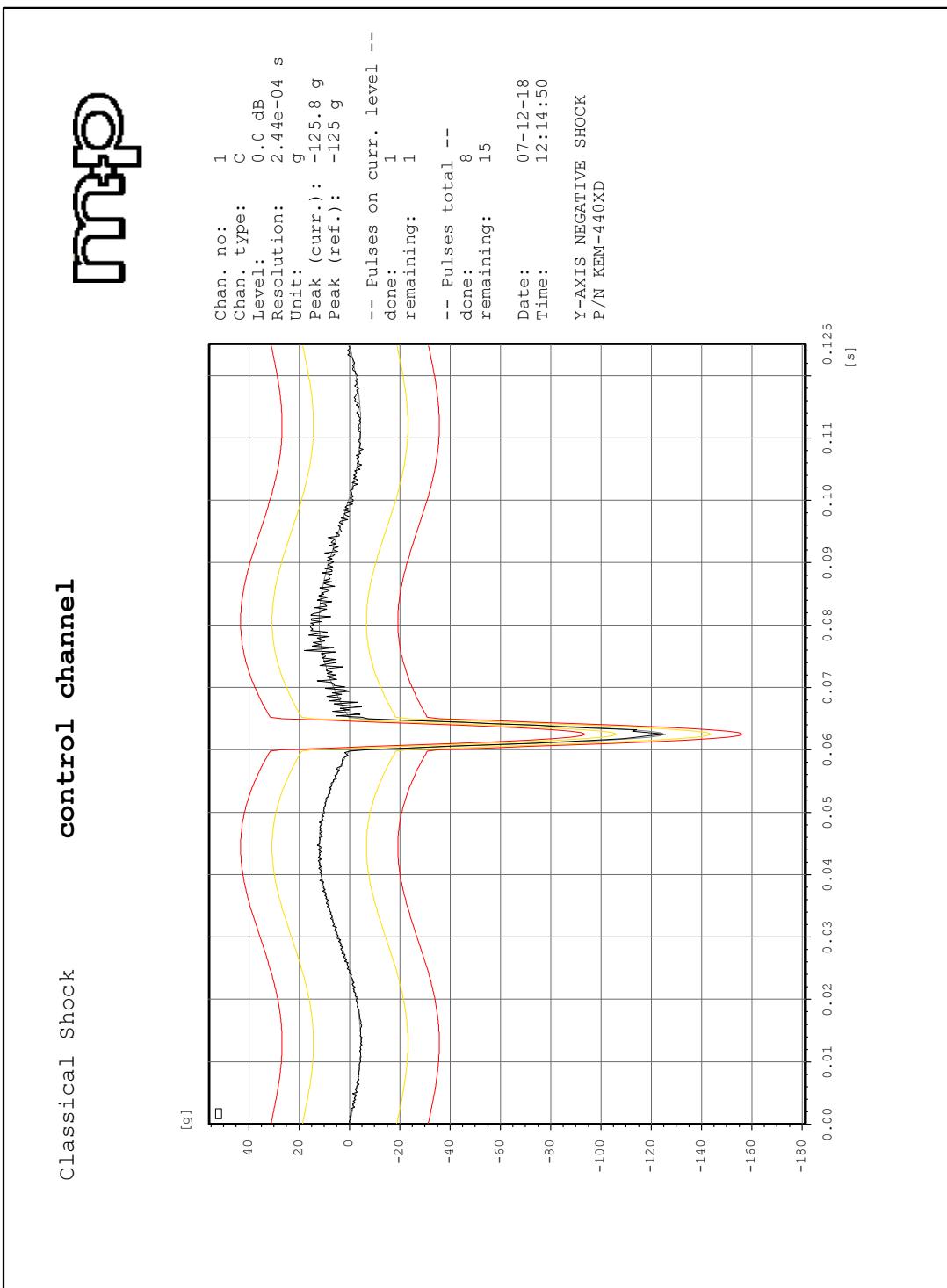
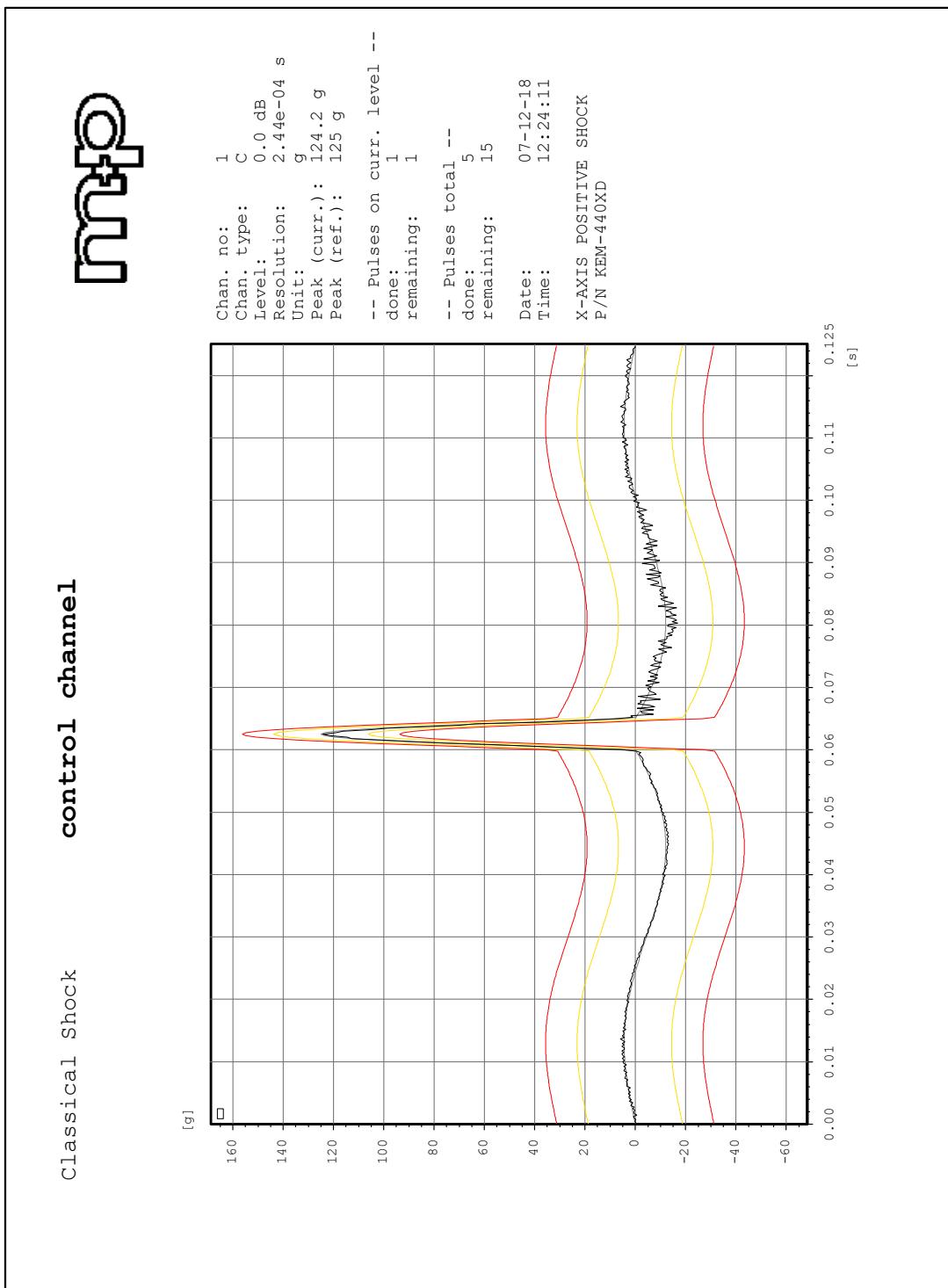


Chart 5.2.1-47:Longitudinal axis Shock Profile, P/N KEM-440XD,Positive 1



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Chart 5.2.1-48:Longitudinal axis Shock Profile, P/N KEM-440XD,Negative 1

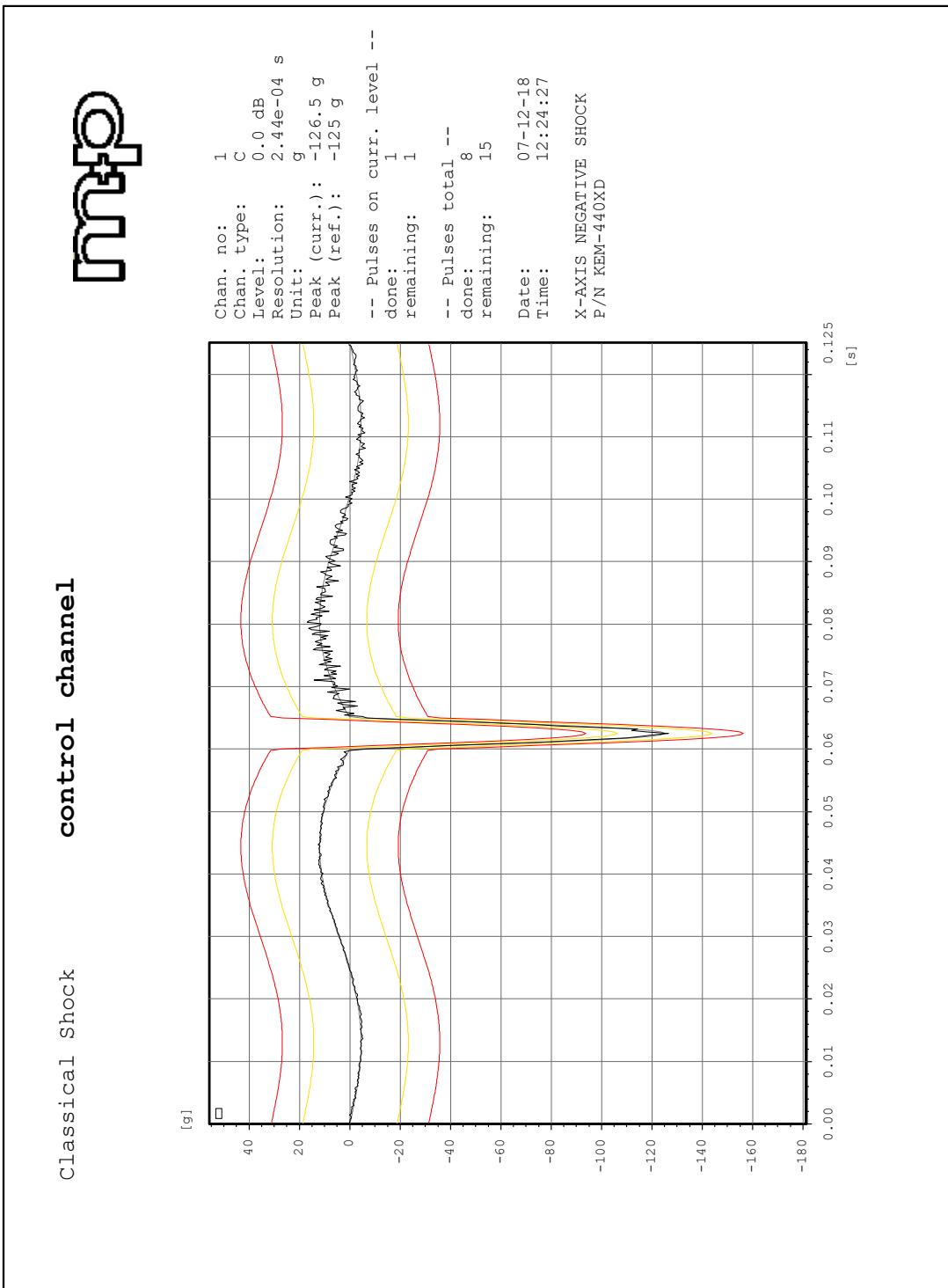
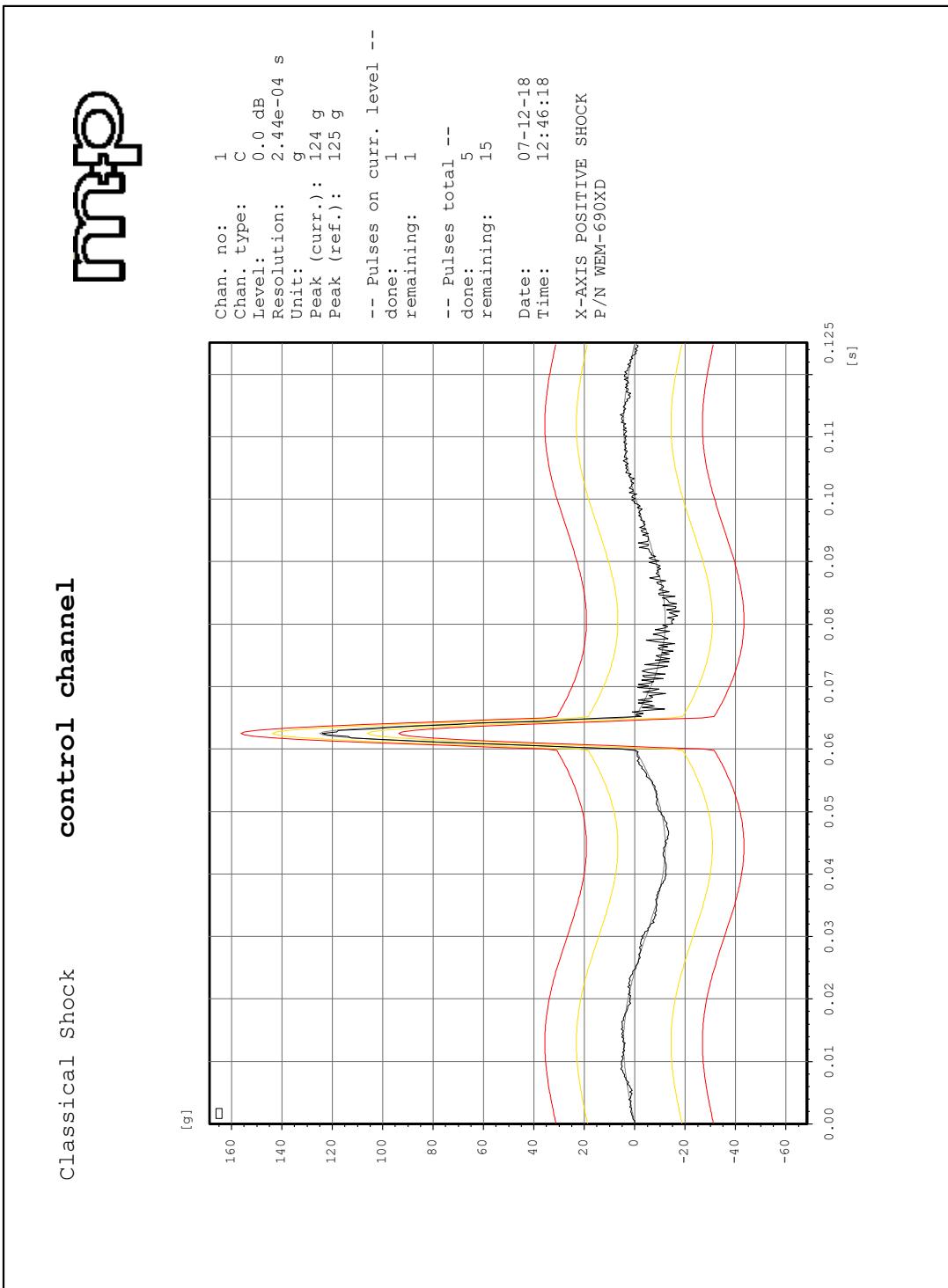
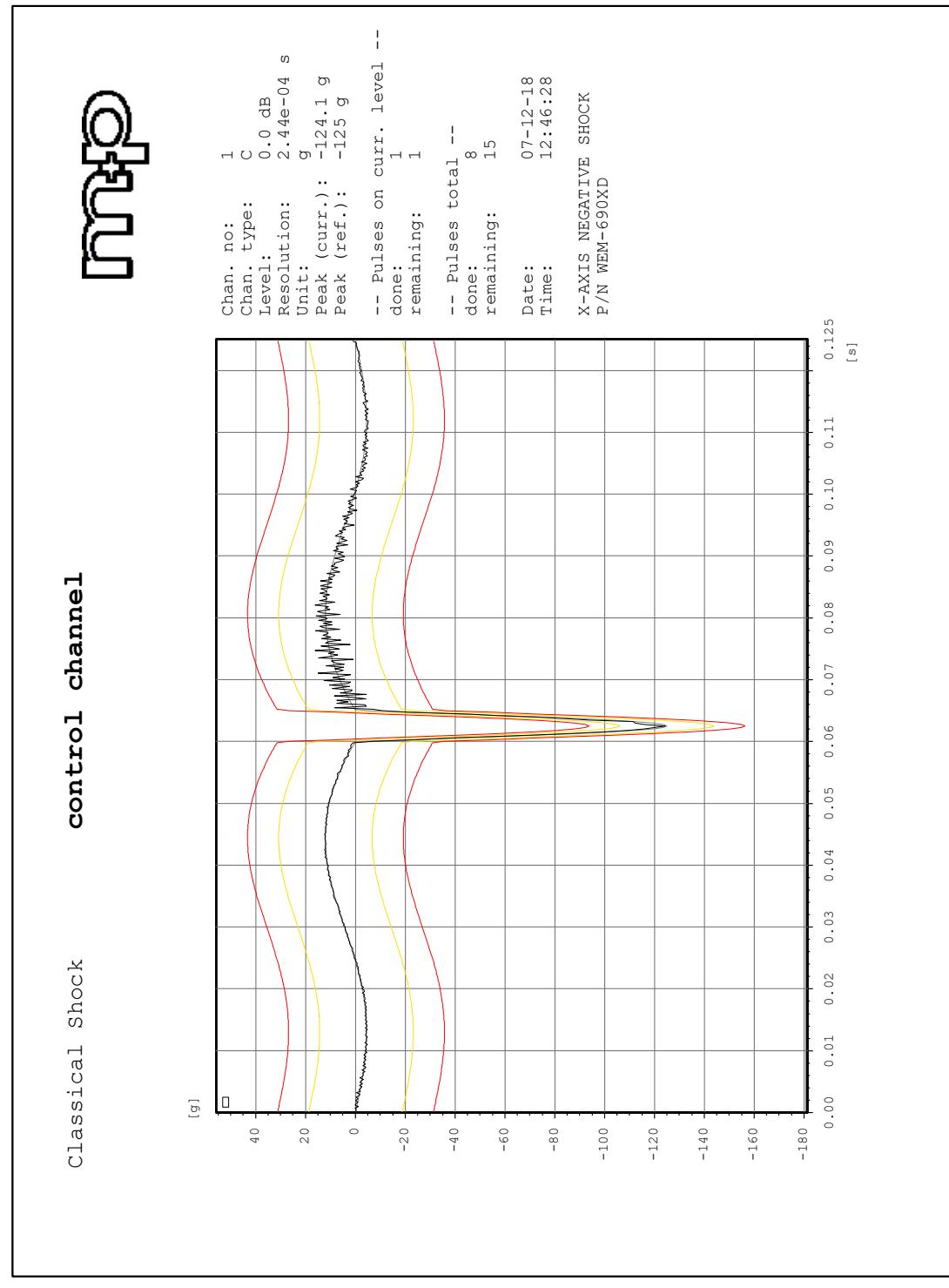


Chart 5.2.1-49:Longitudinal axis Shock Profile, P/N WEM-690XD,Positive 1



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Chart 5.2.1-50:Longitudinal axis Shock Profile, P/N WEM-690XD,Negative



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Chart 5.2.1-51:Transverse axis Shock Profile, P/N WEM-690XD,Positive 1

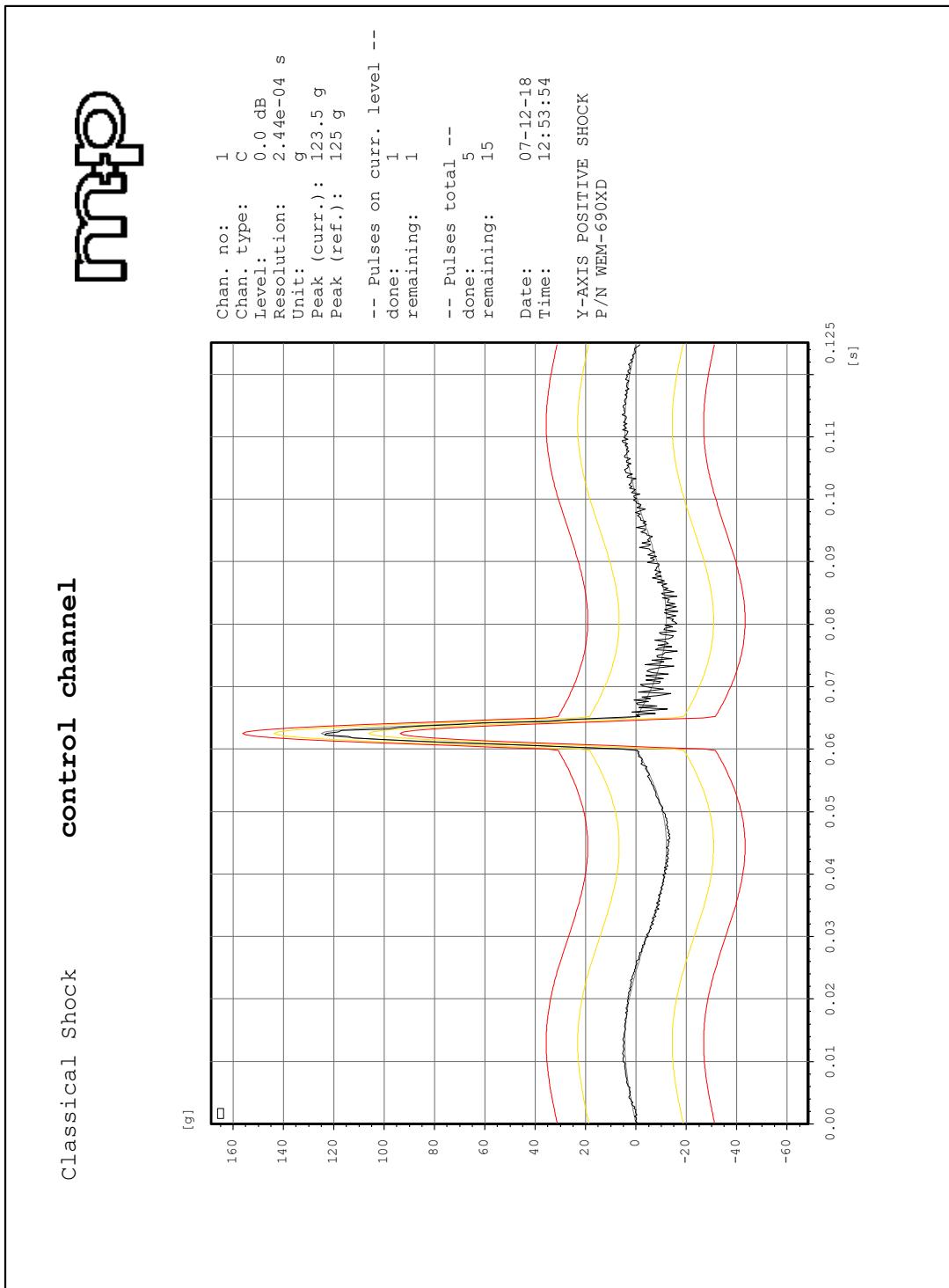


Chart 5.2.1-52: Transverse axis Shock Profile, P/N WEM-690XD, Negative 1

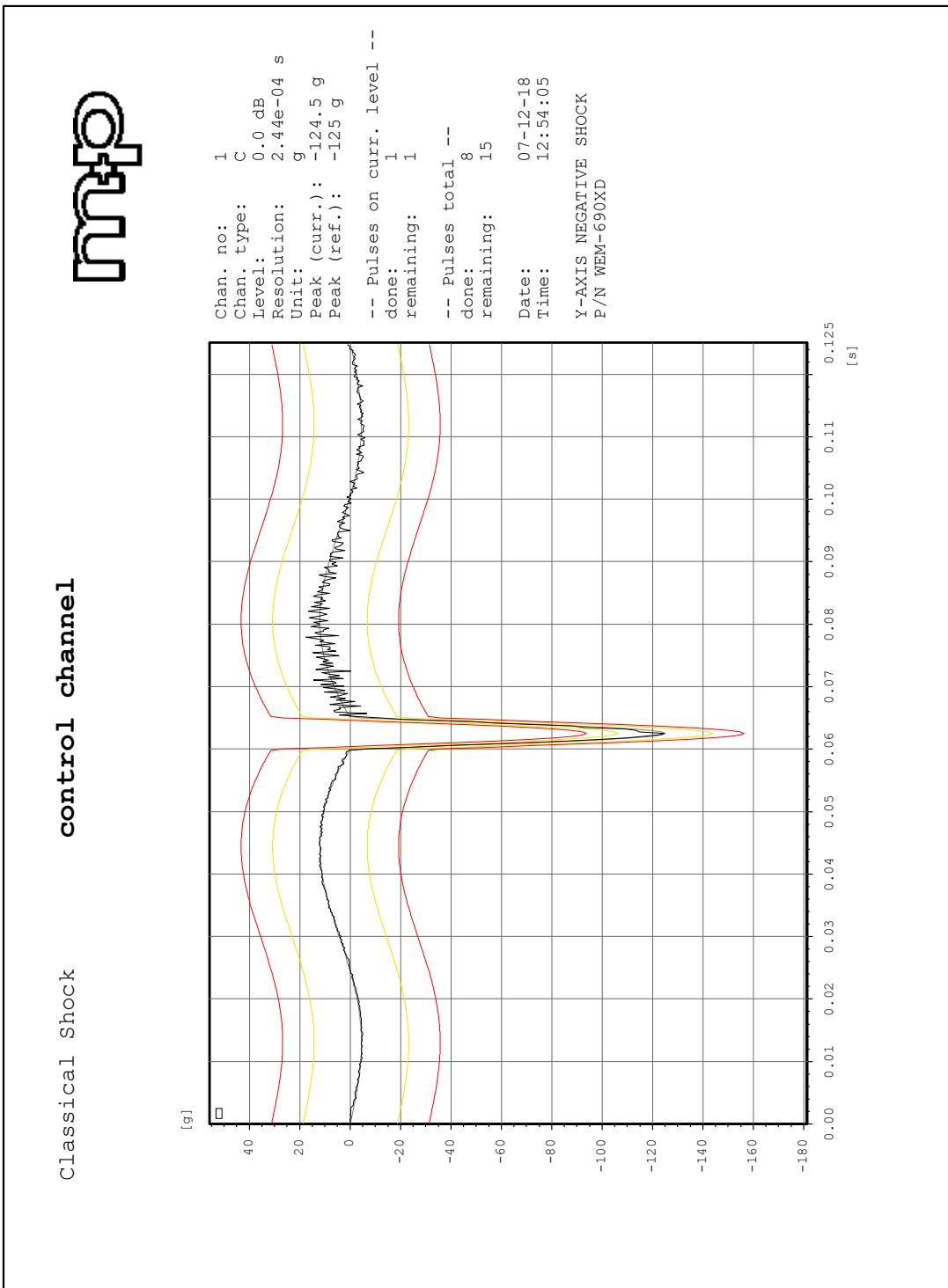


Chart 5.2.1-53:Transverse axis Shock Profile, P/N WE-2640HB,Positive 1

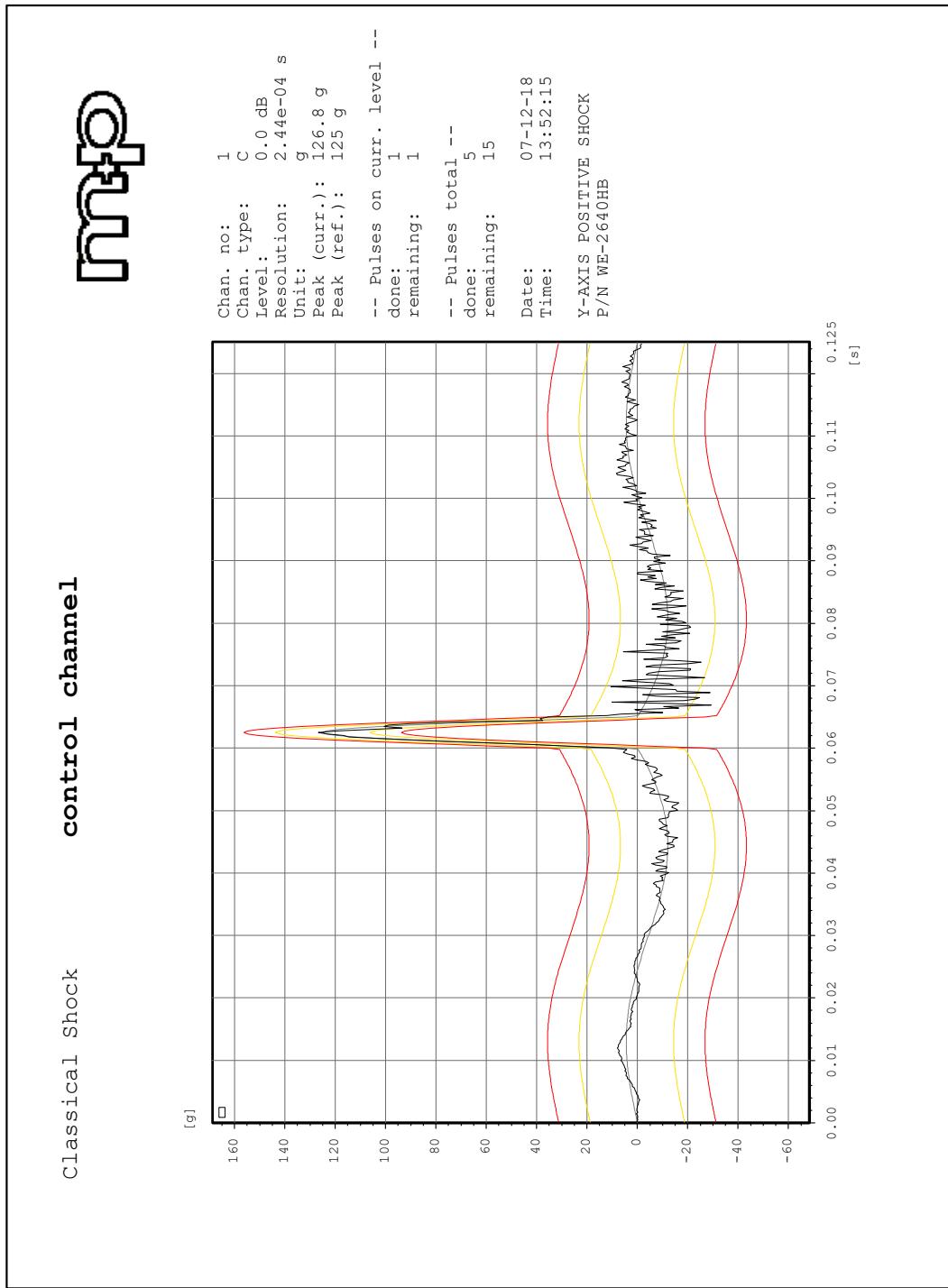


Chart 5.2.1-54:Transverse axis Shock Profile, P/N WE-2640HB,Negative 1

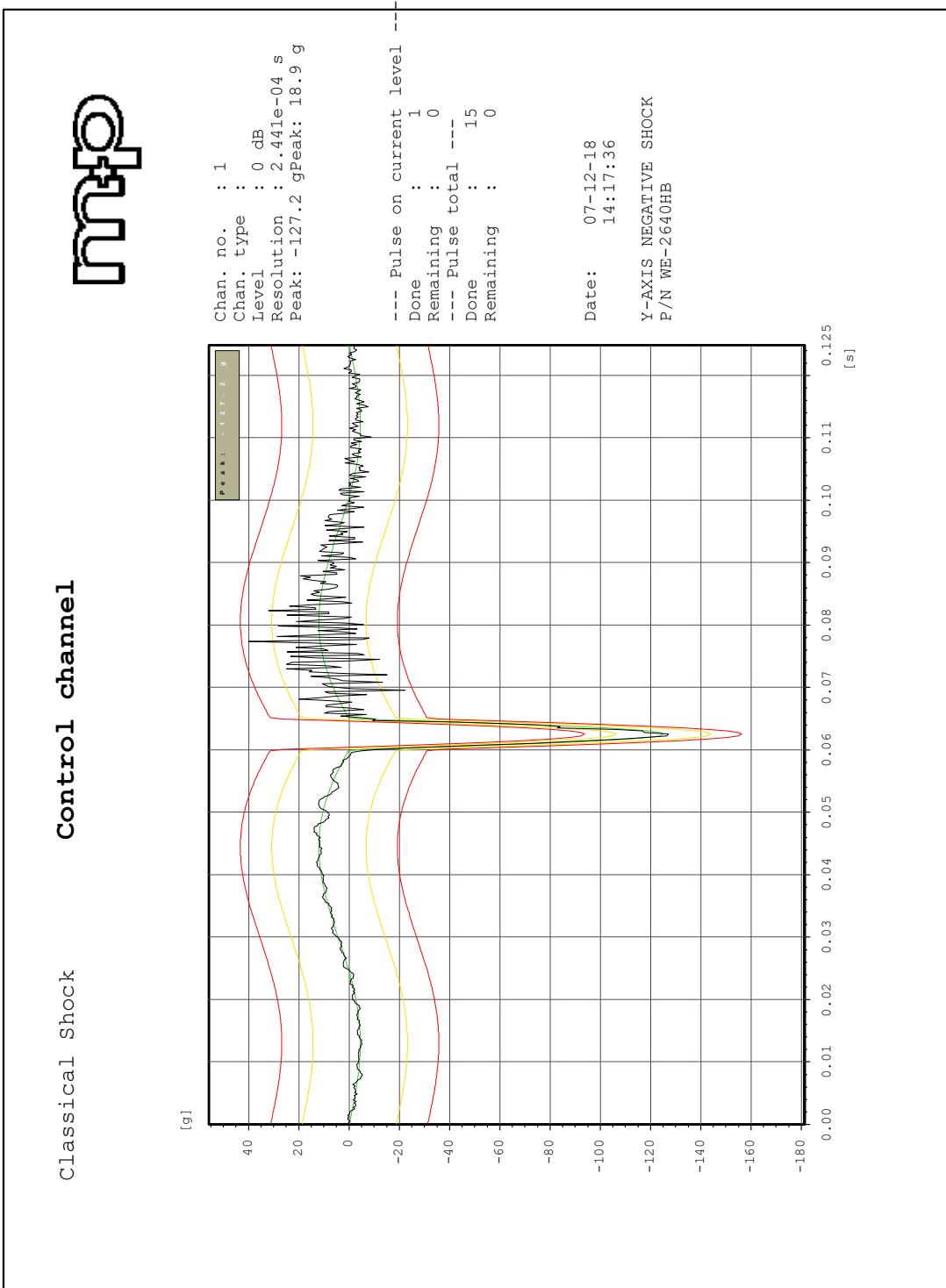


Chart 5.2.1-55:Longitudinal axis Shock Profile, P/N WE-2640HB,Positive 1

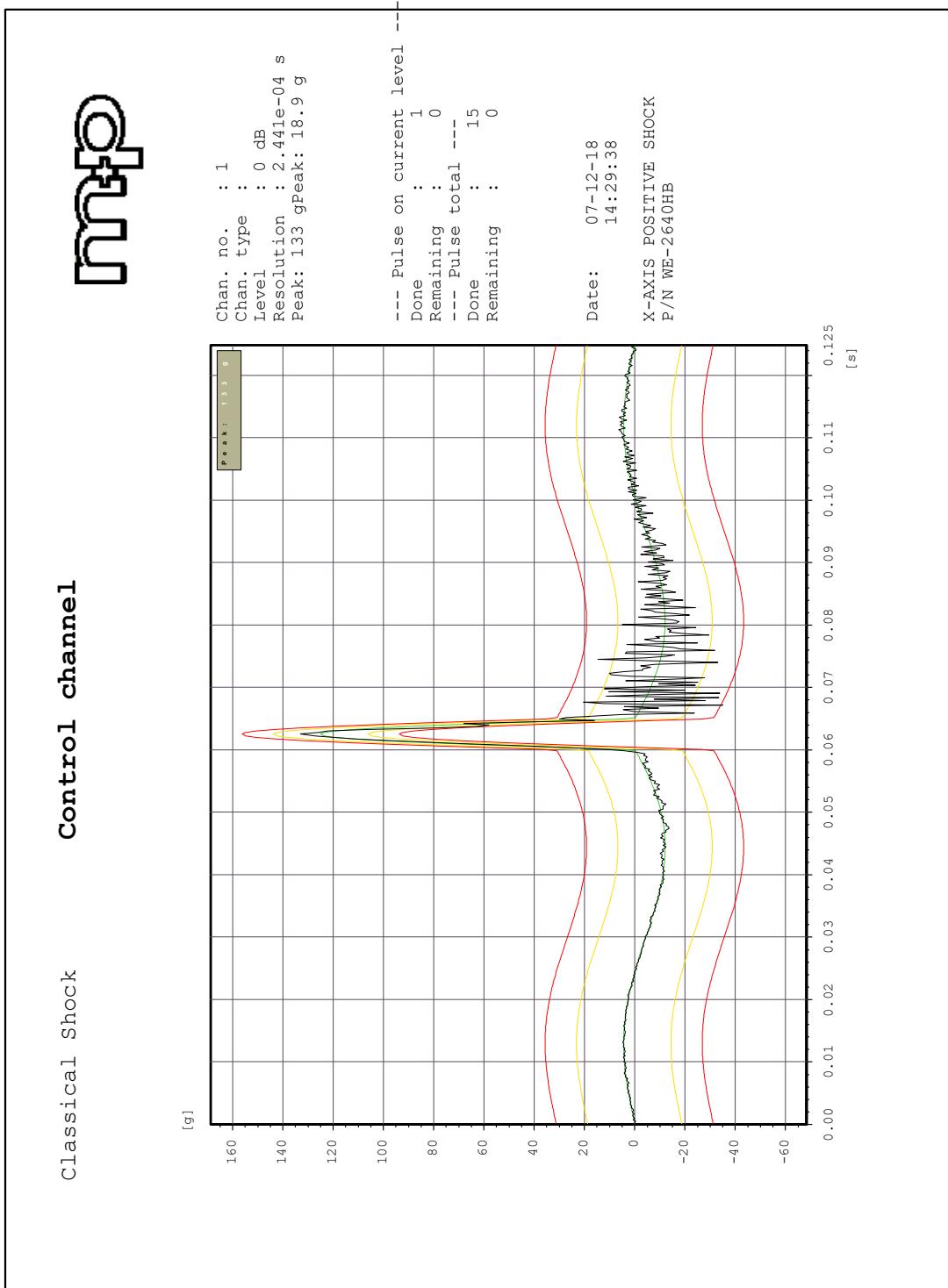


Chart 5.2.1-56:Longitudinal axis Shock Profile, P/N WE-2640HB,Negative 1

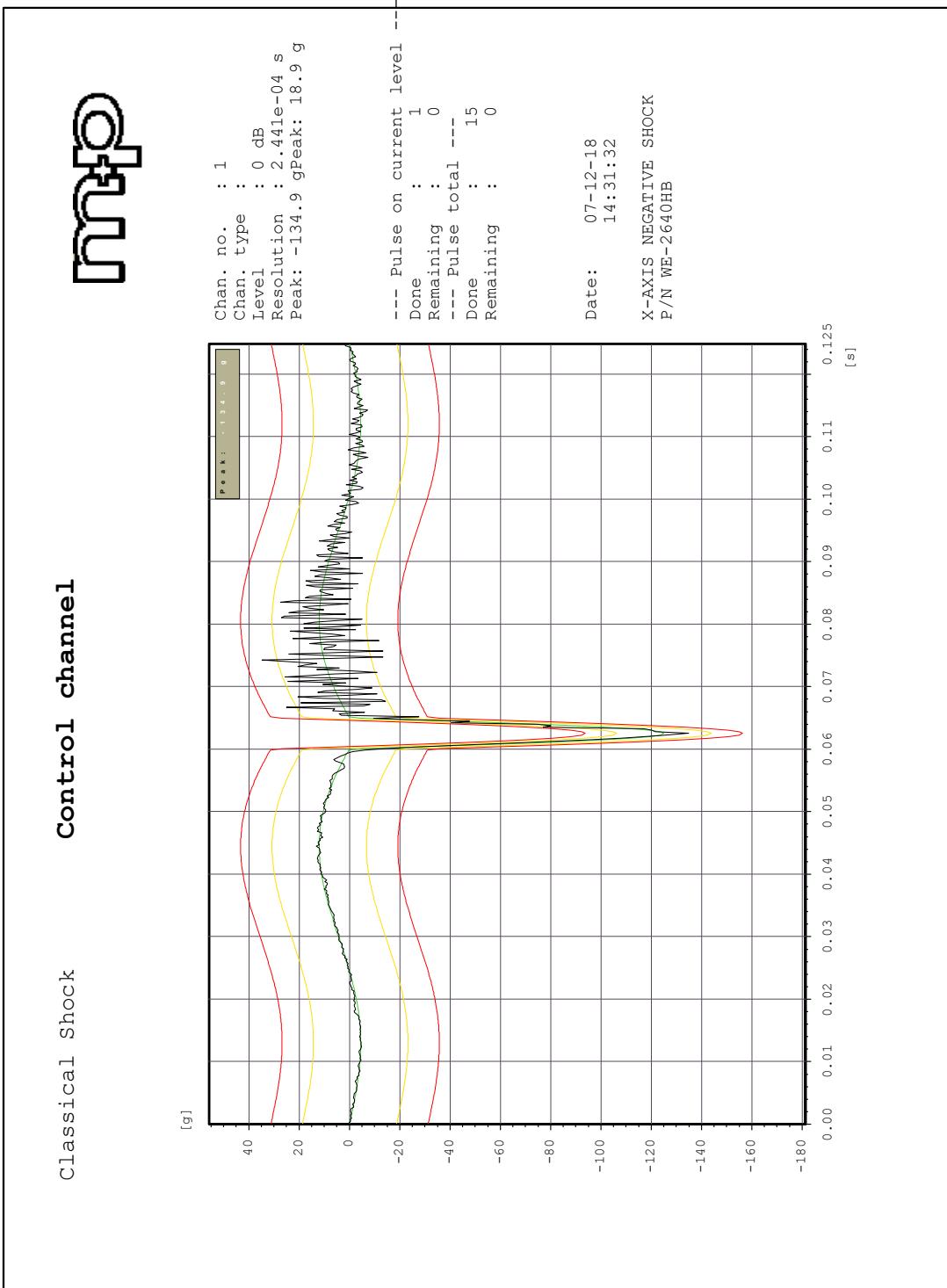
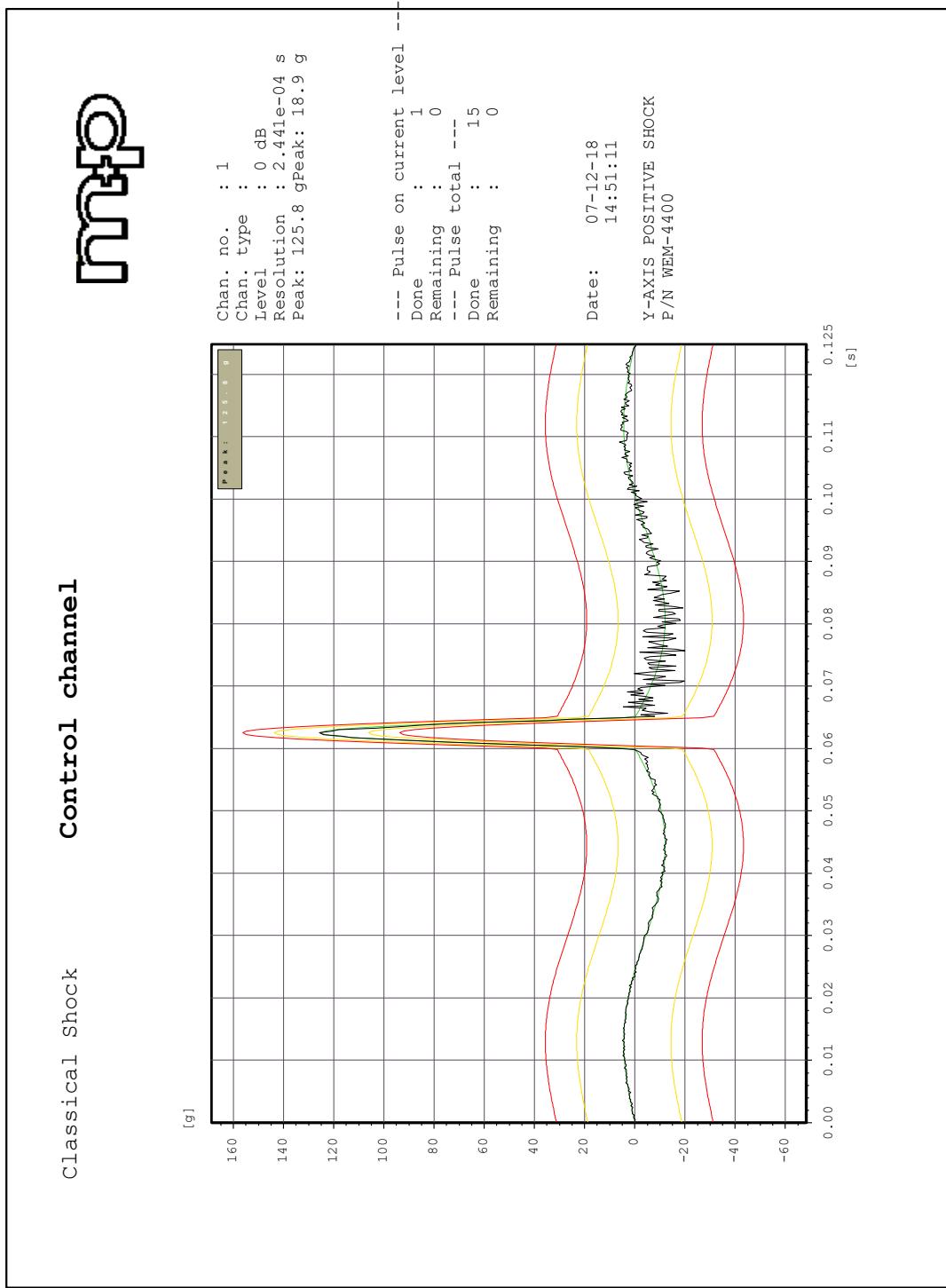


Chart 5.2.1-57:Transverse axis Shock Profile, P/N WEM-4400,Positive 1



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Chart 5.2.1-58:Transverse axis Shock Profile, P/N WEM-4400,Negative 1

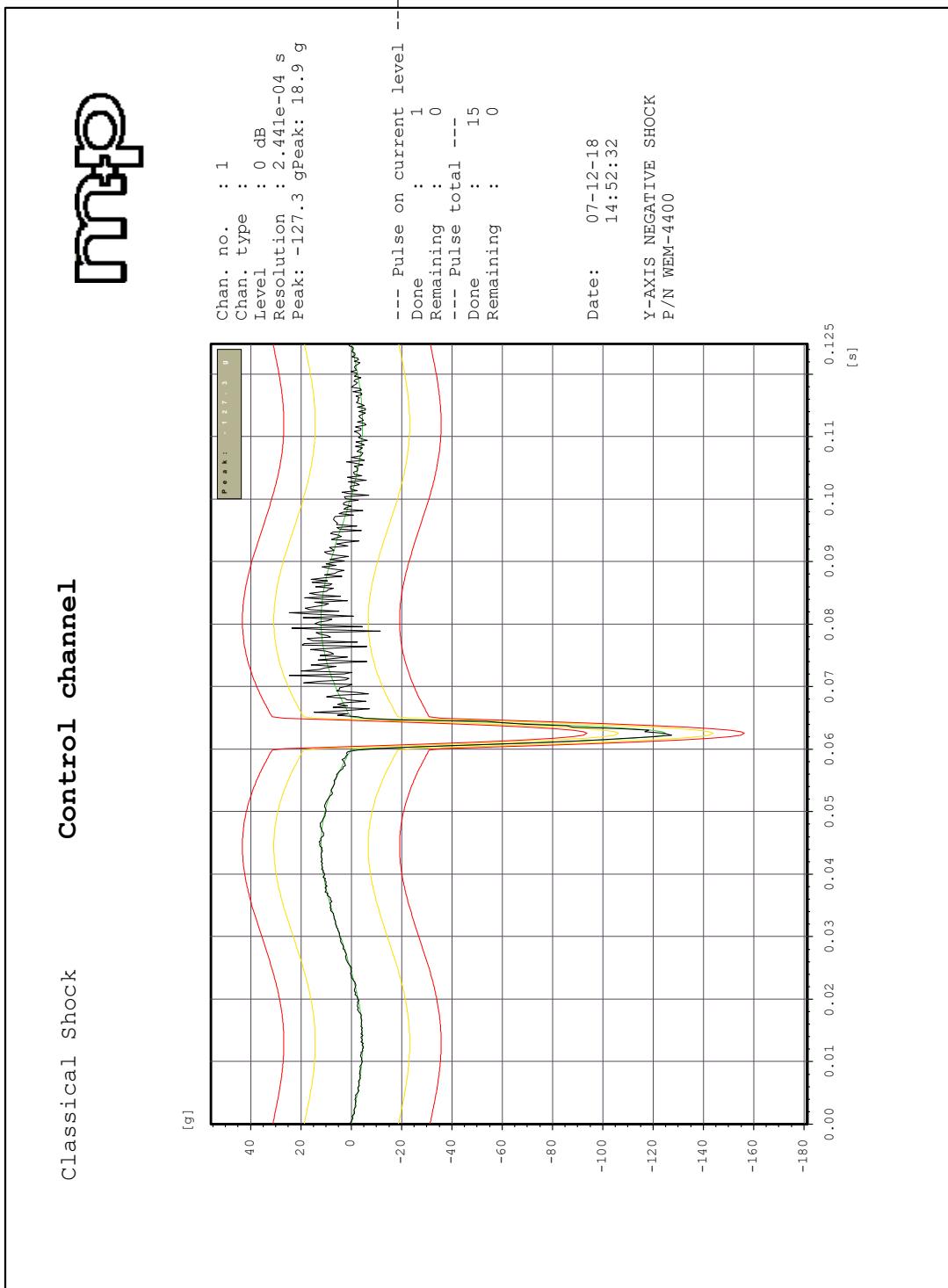


Chart 5.2.1-59:Longitudinal axis Shock Profile, P/N WEM-4400,Positive 1

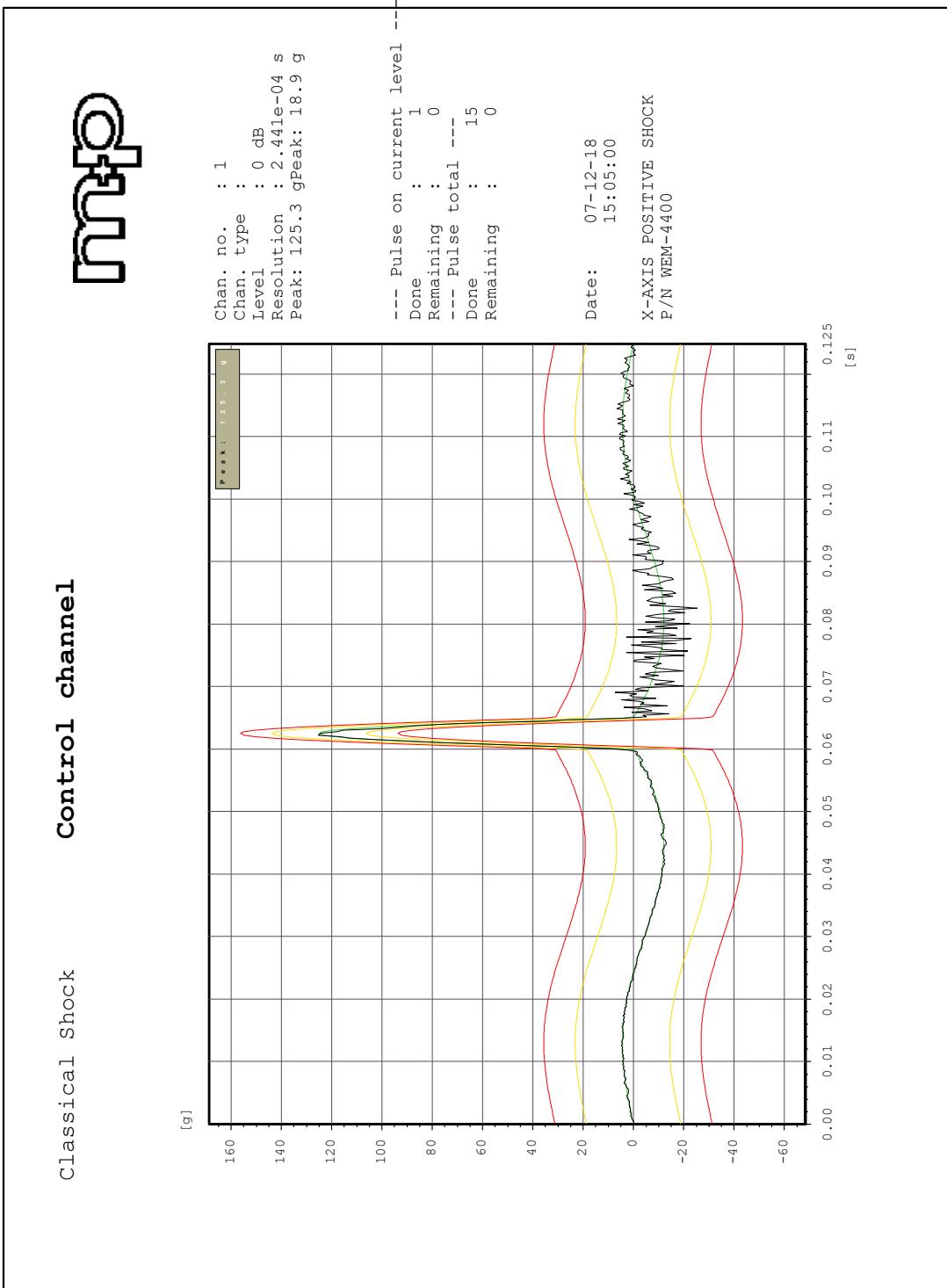


Chart 5.2.1-60:Longitudinal axis Shock Profile, P/N WEM-4400,Negative 1

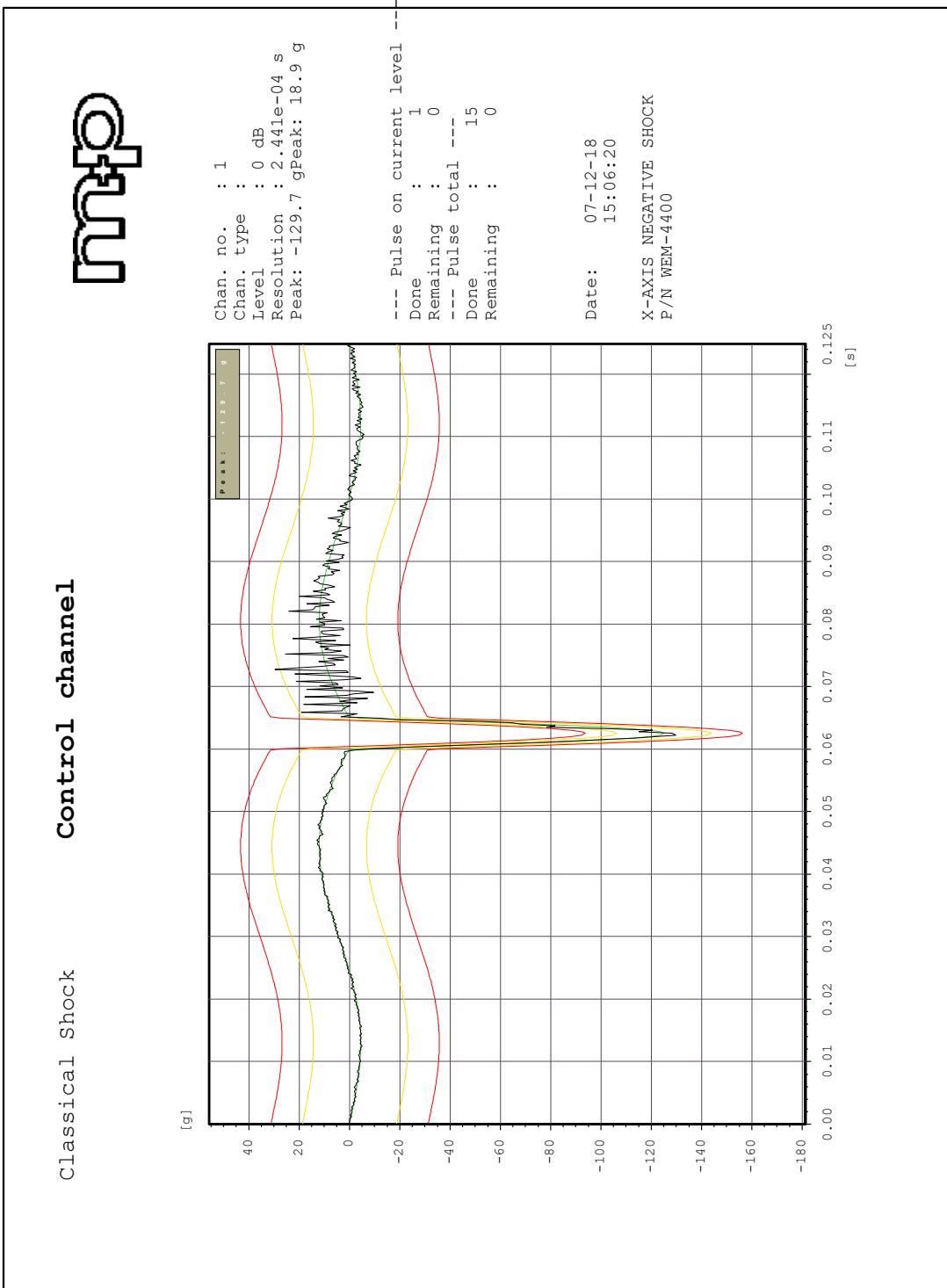


Chart 5.2.1-61:Transverse axis Shock Profile, P/N WE-1350HB,Positive 1

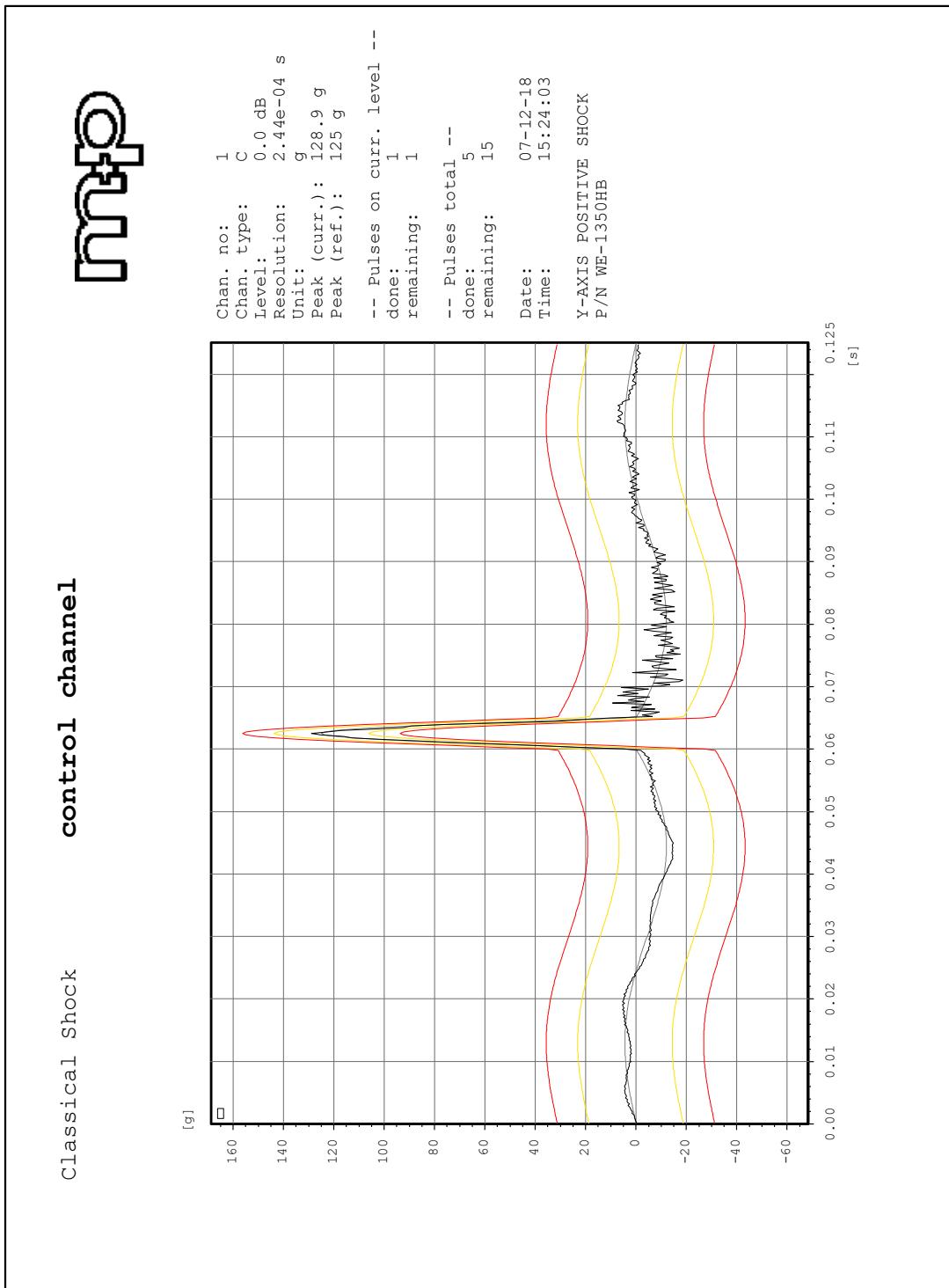


Chart 5.2.1-62:Transverse axis Shock Profile, P/N WE-1350HB,Negative 1

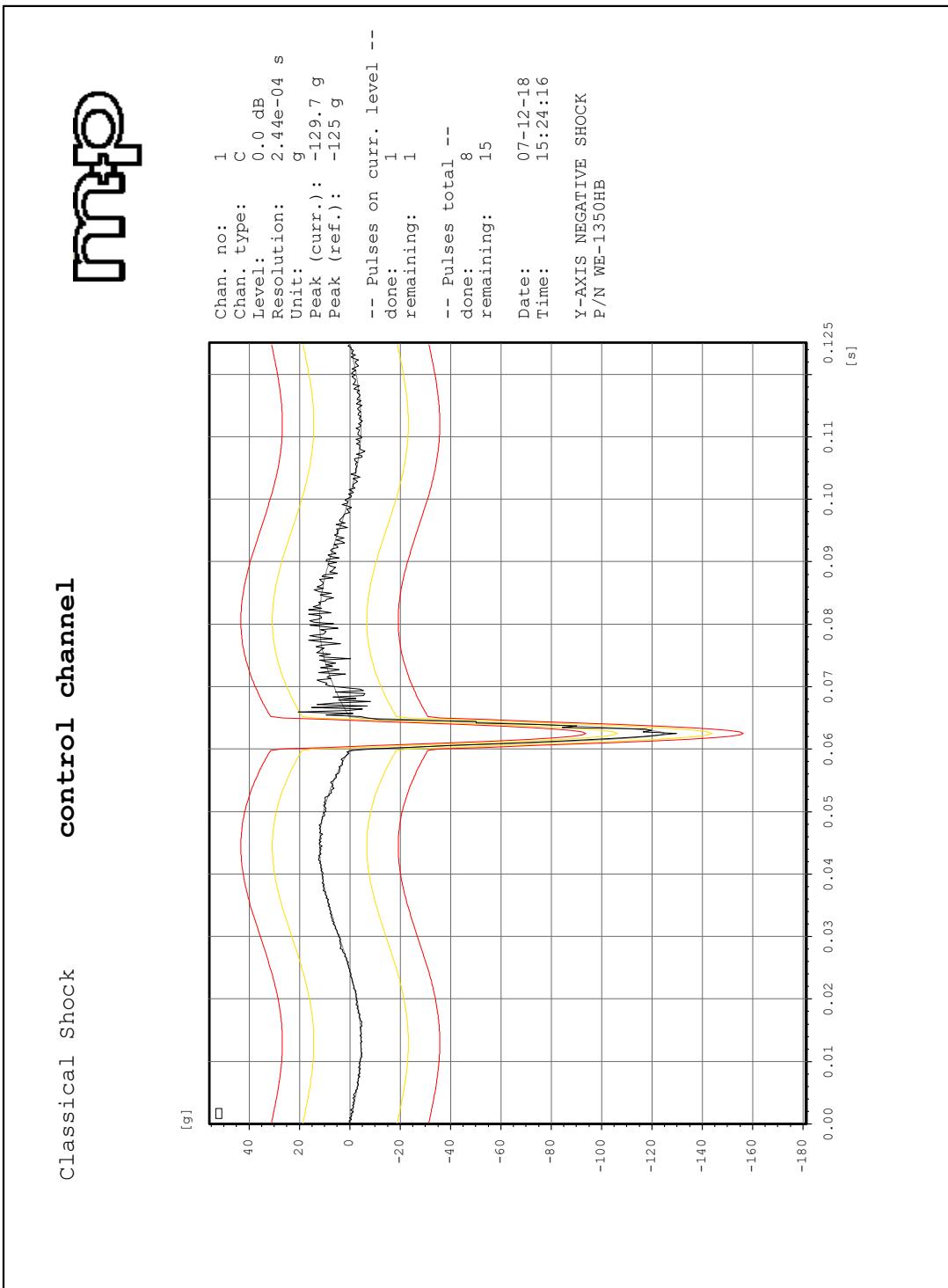


Chart 5.2.1-63:Longitudinal axis Shock Profile, P/N WE-1350HB,Positive 1

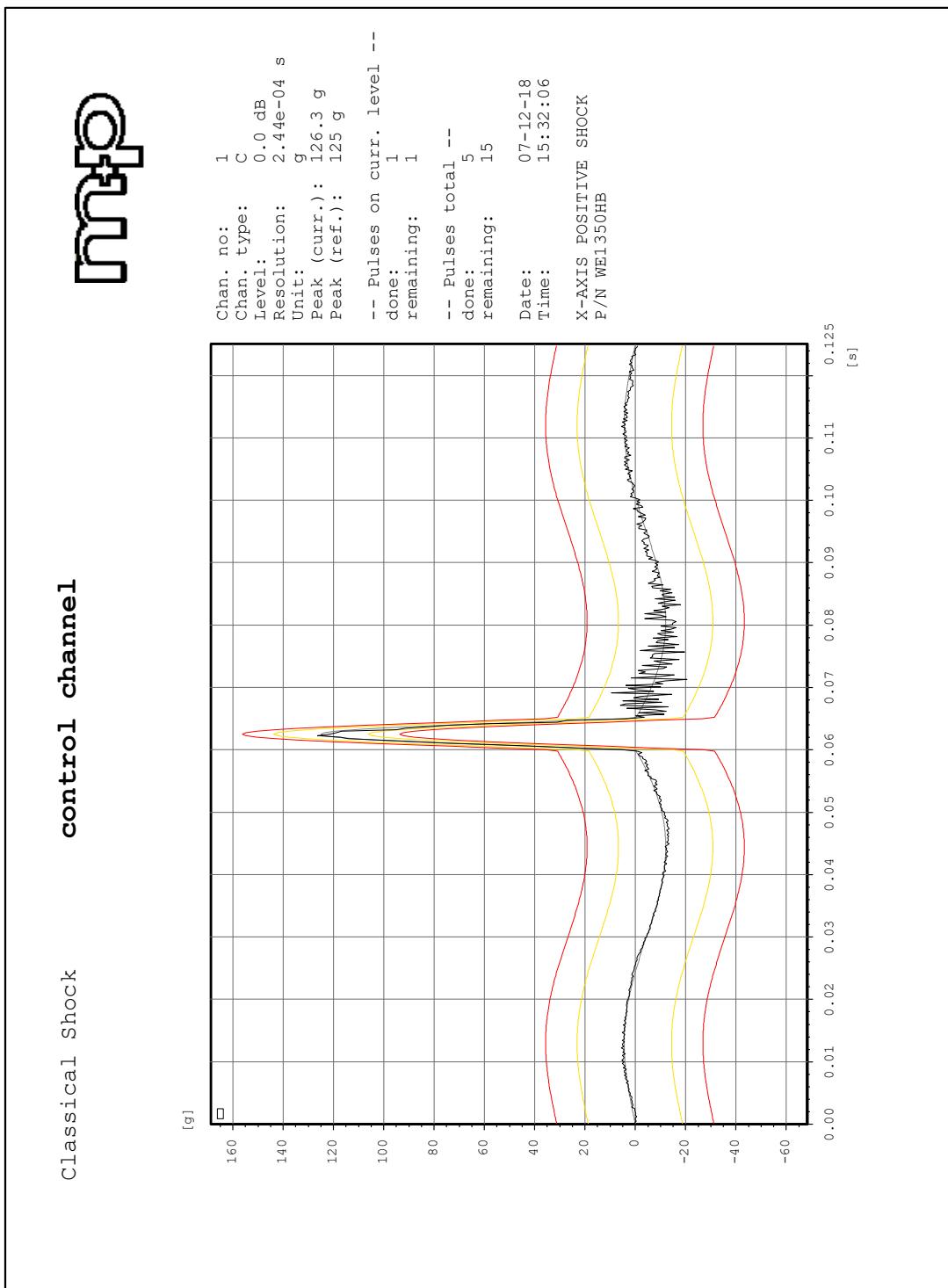


Chart 5.2.1-64:Longitudinal axis Shock Profile, P/N WE-1350HB,Negative 1

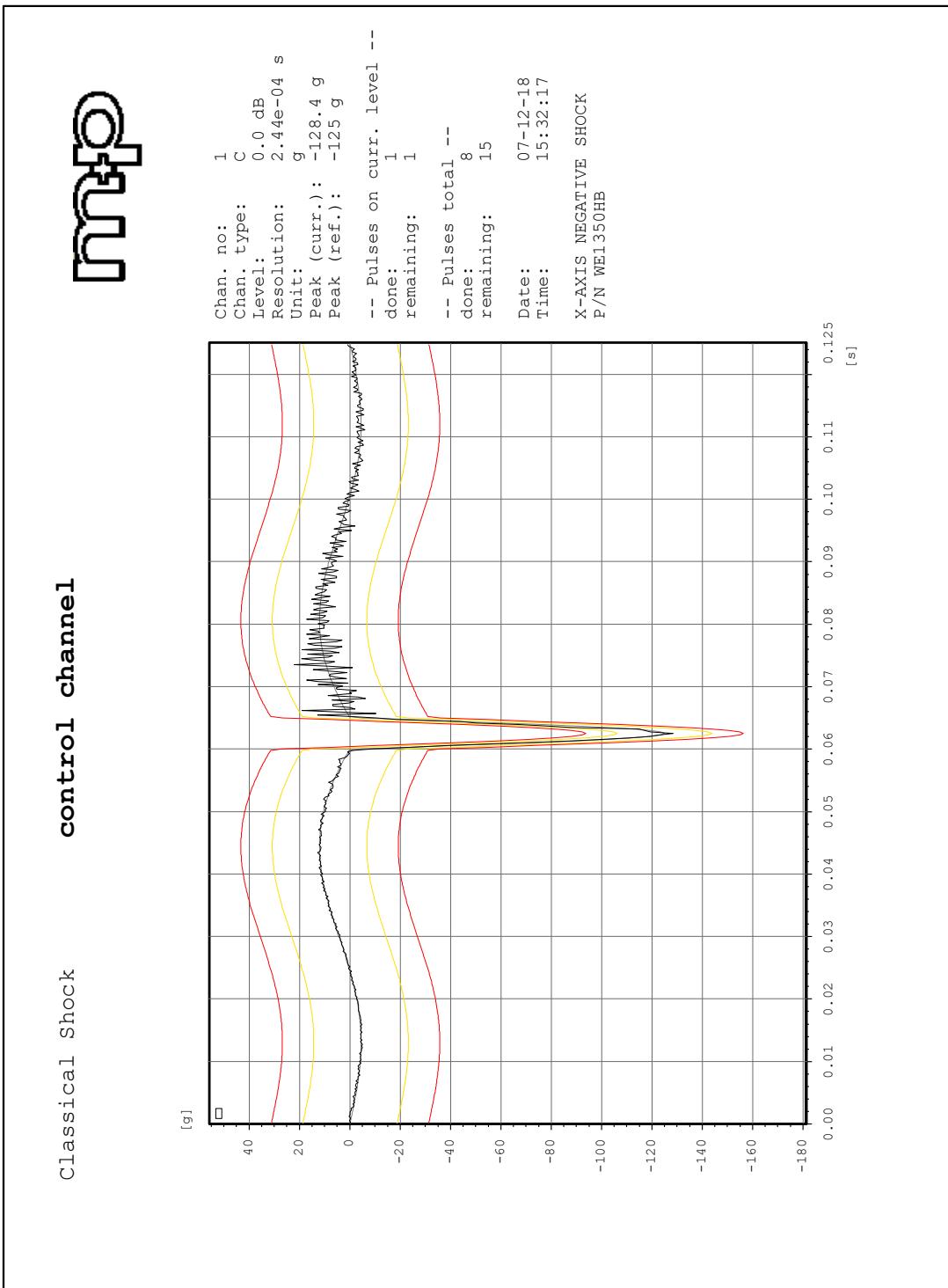
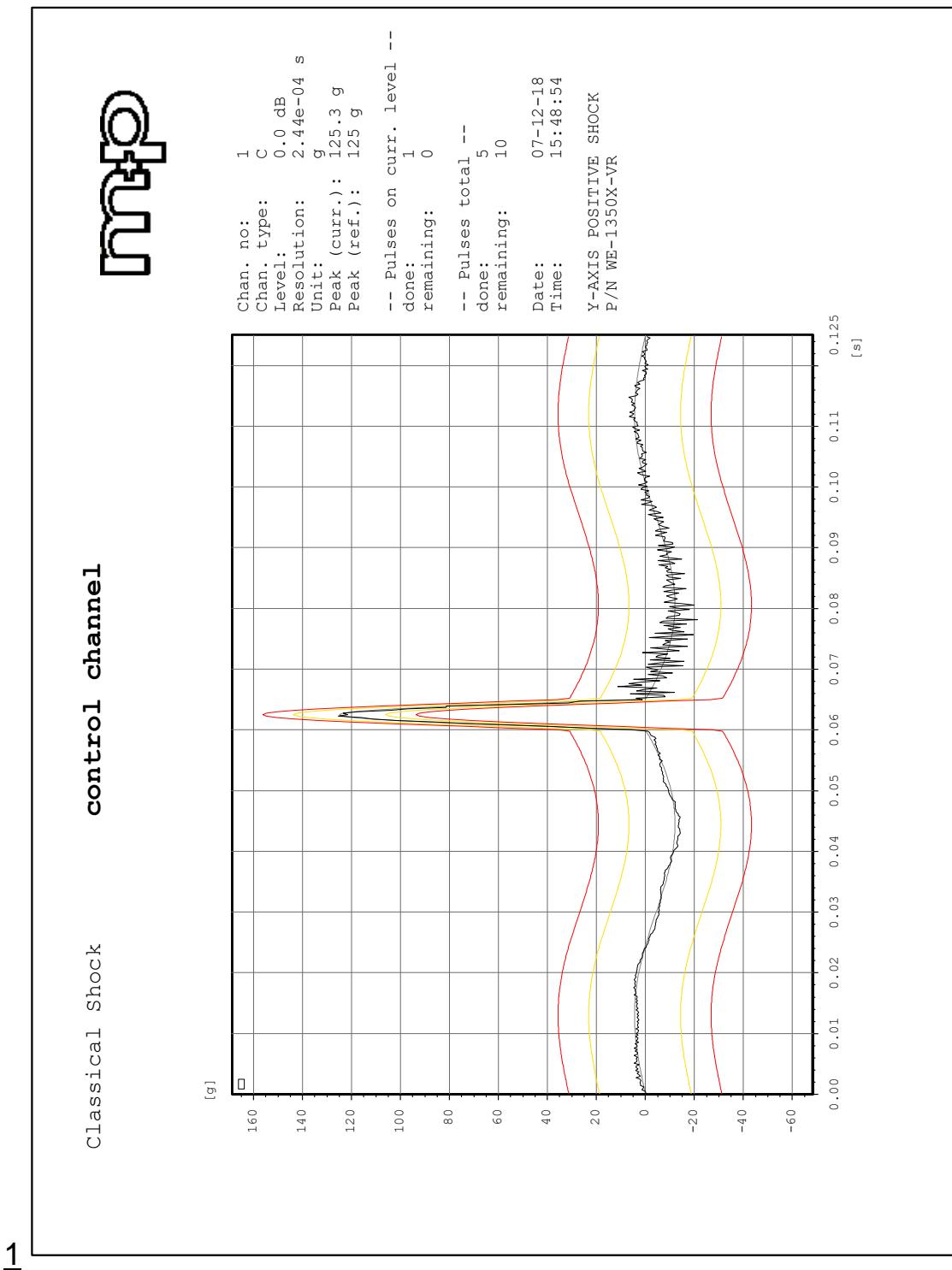
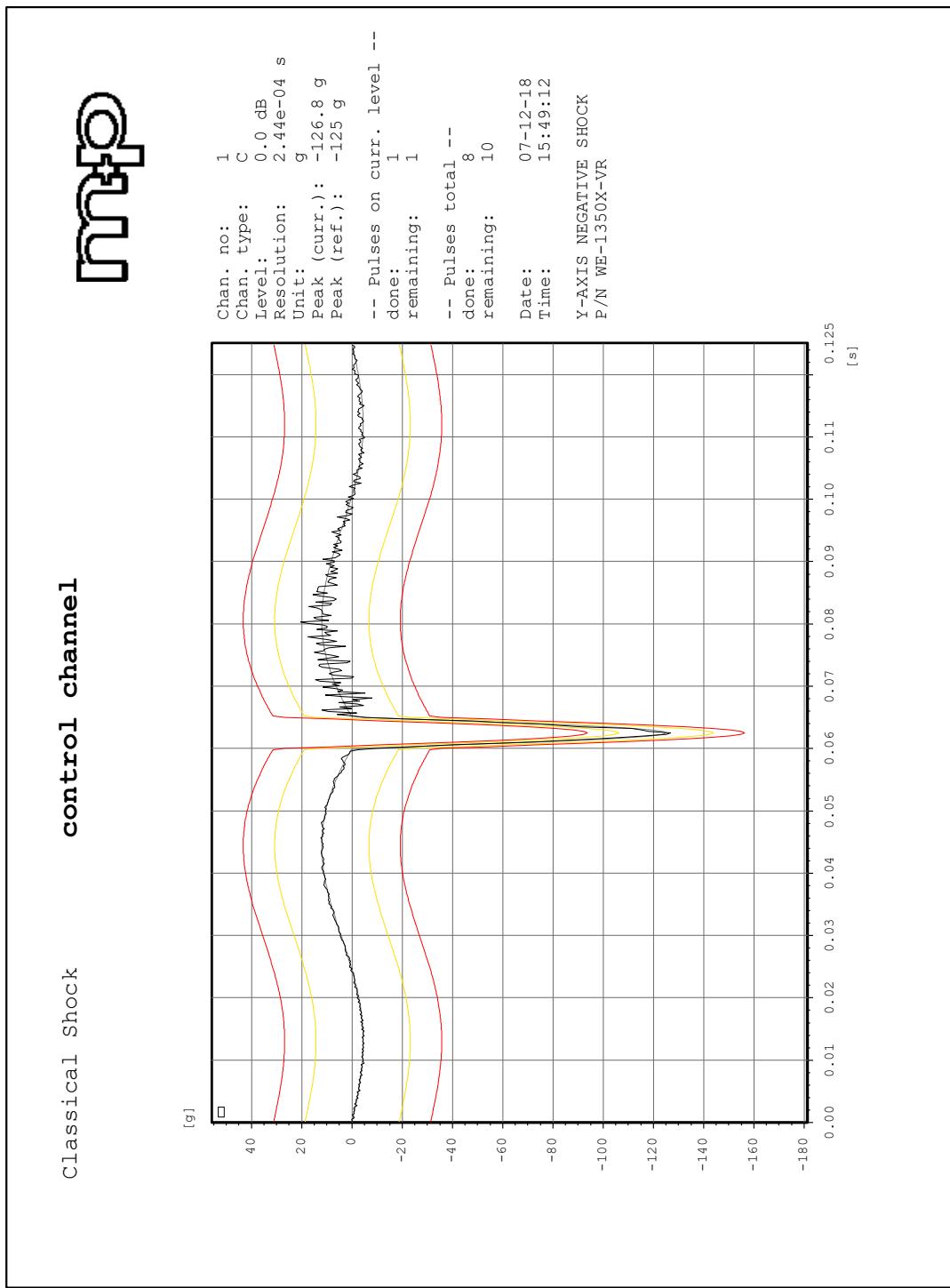


Chart 5.2.1-65:Transverse axis Shock Profile, P/N WE-1350X-VR,Positive



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Chart 5.2.1-66:Transverse axis, P/N WE-1350X-VR,Negative1



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Chart 5.2.1-67:Longitudinal axis Shock Profile, P/N WE-1350X-VR,Positive

1

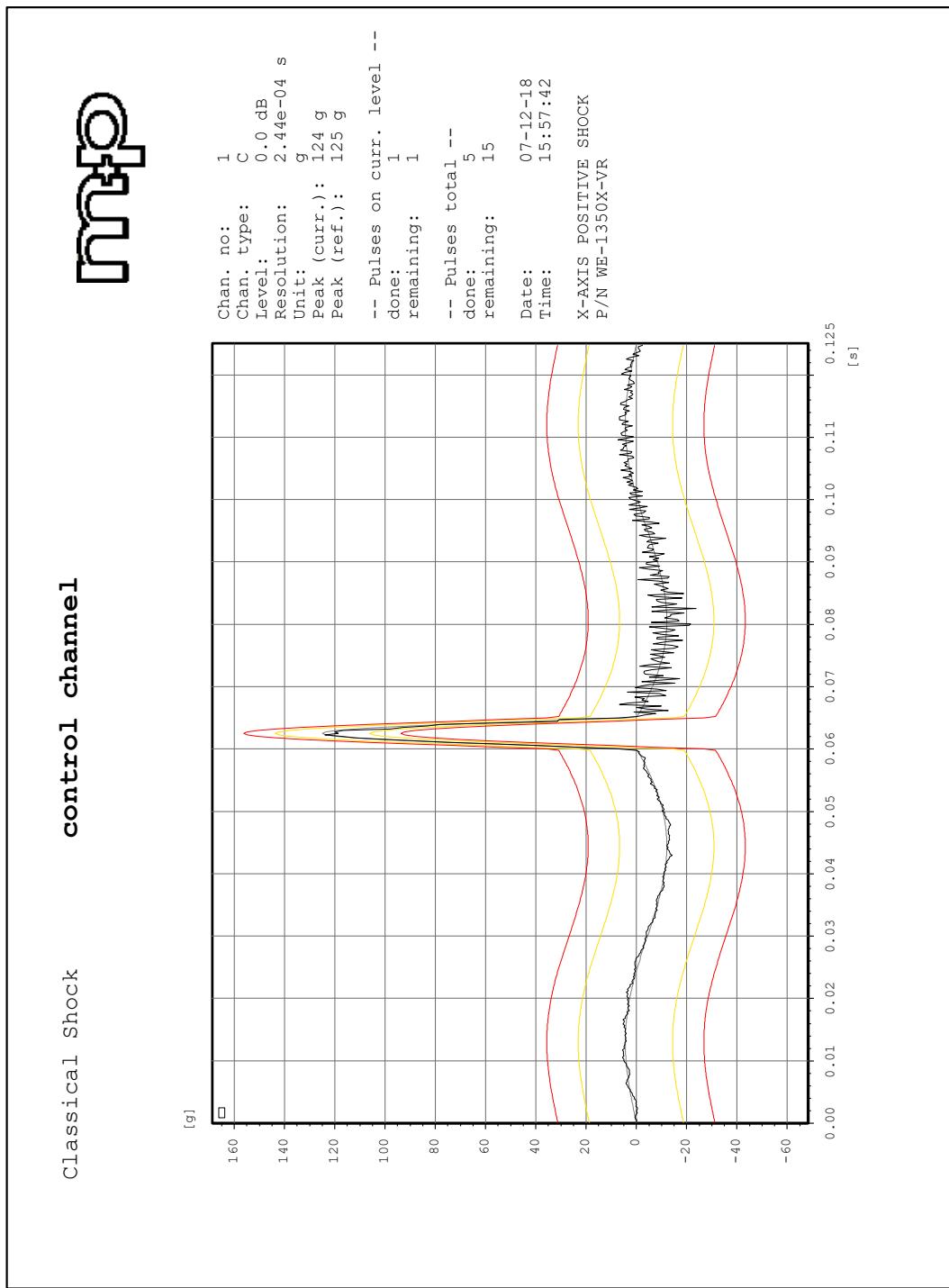
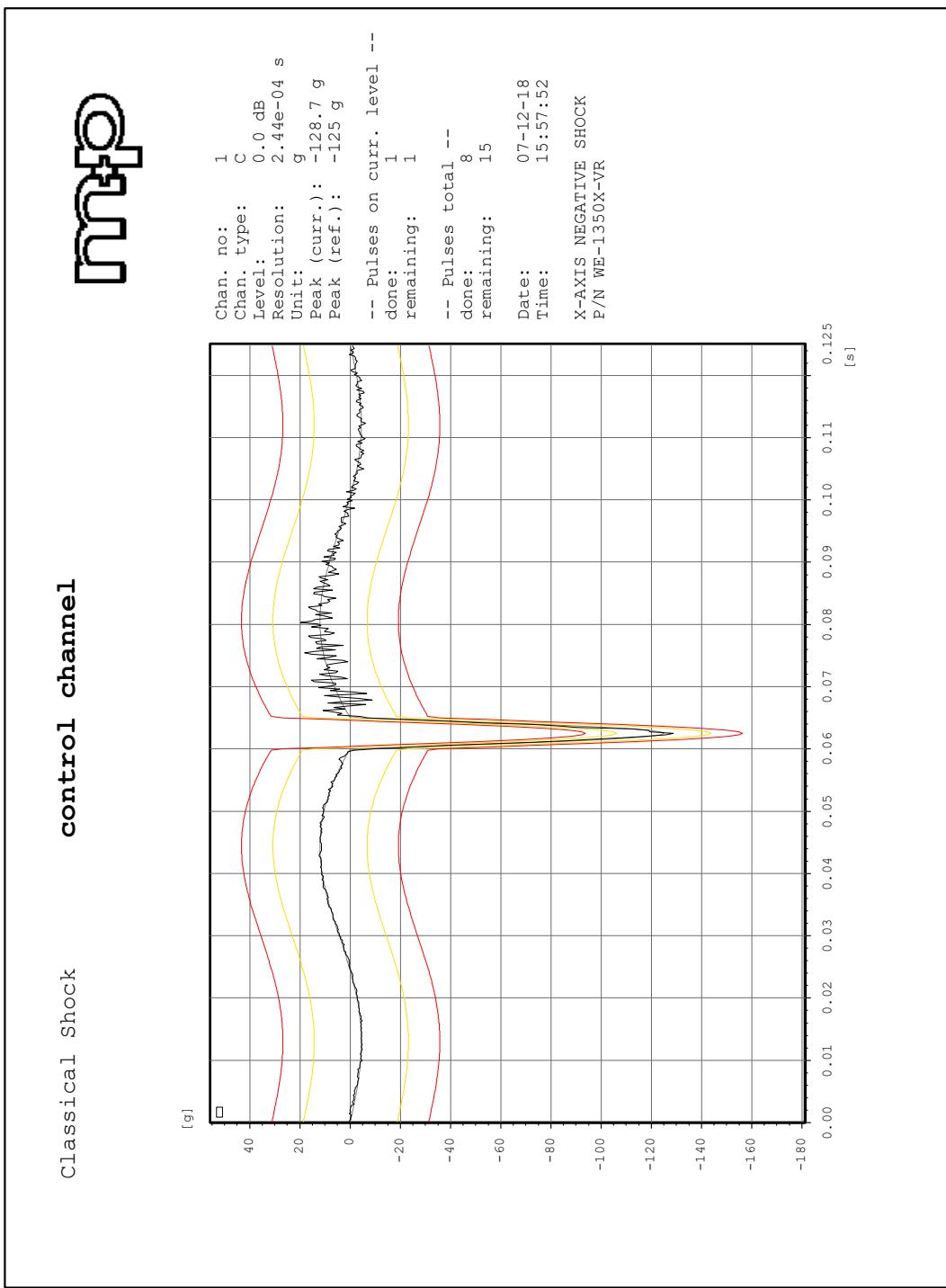


Chart 5.2.1-68:Longitudinal Axis, P/N WE-1350X-VR,Negative 1



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Chart 5.2.1-69:Transverse axis, P/N WEM-1350E-VR,Positive 1

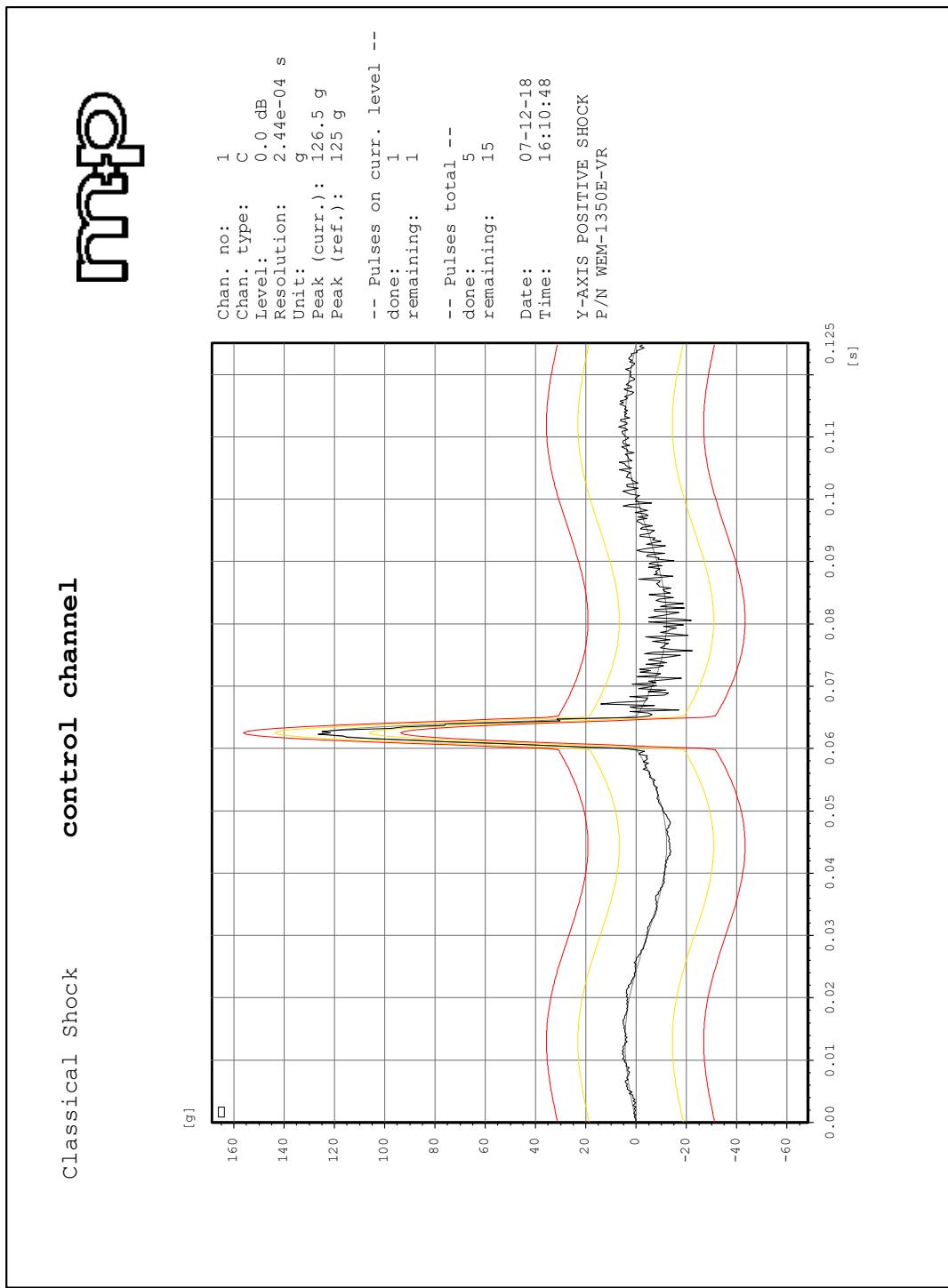


Chart 5.2.1-70:Transverse axis, P/N WEM-1350E-VR,Negative 1

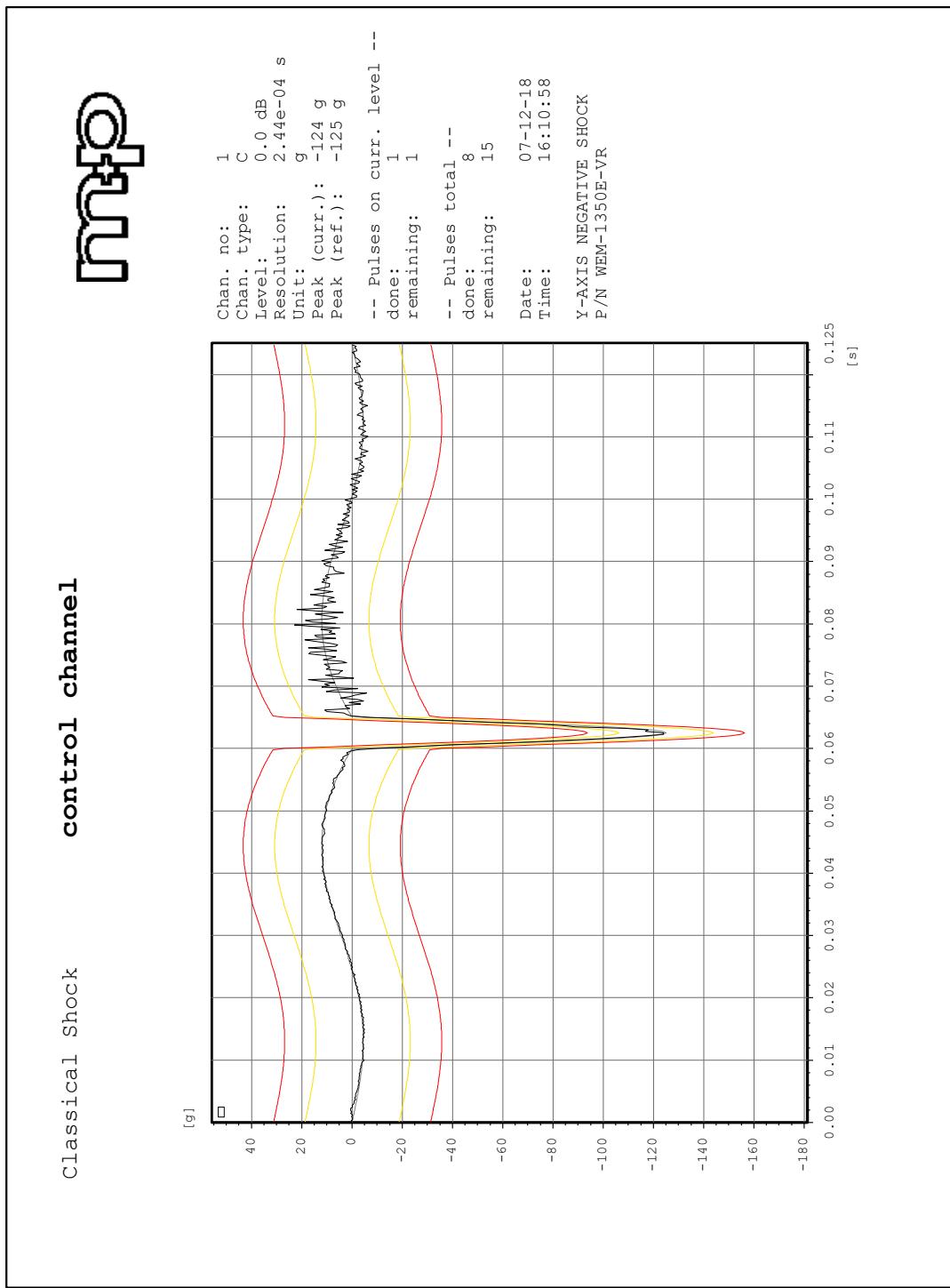
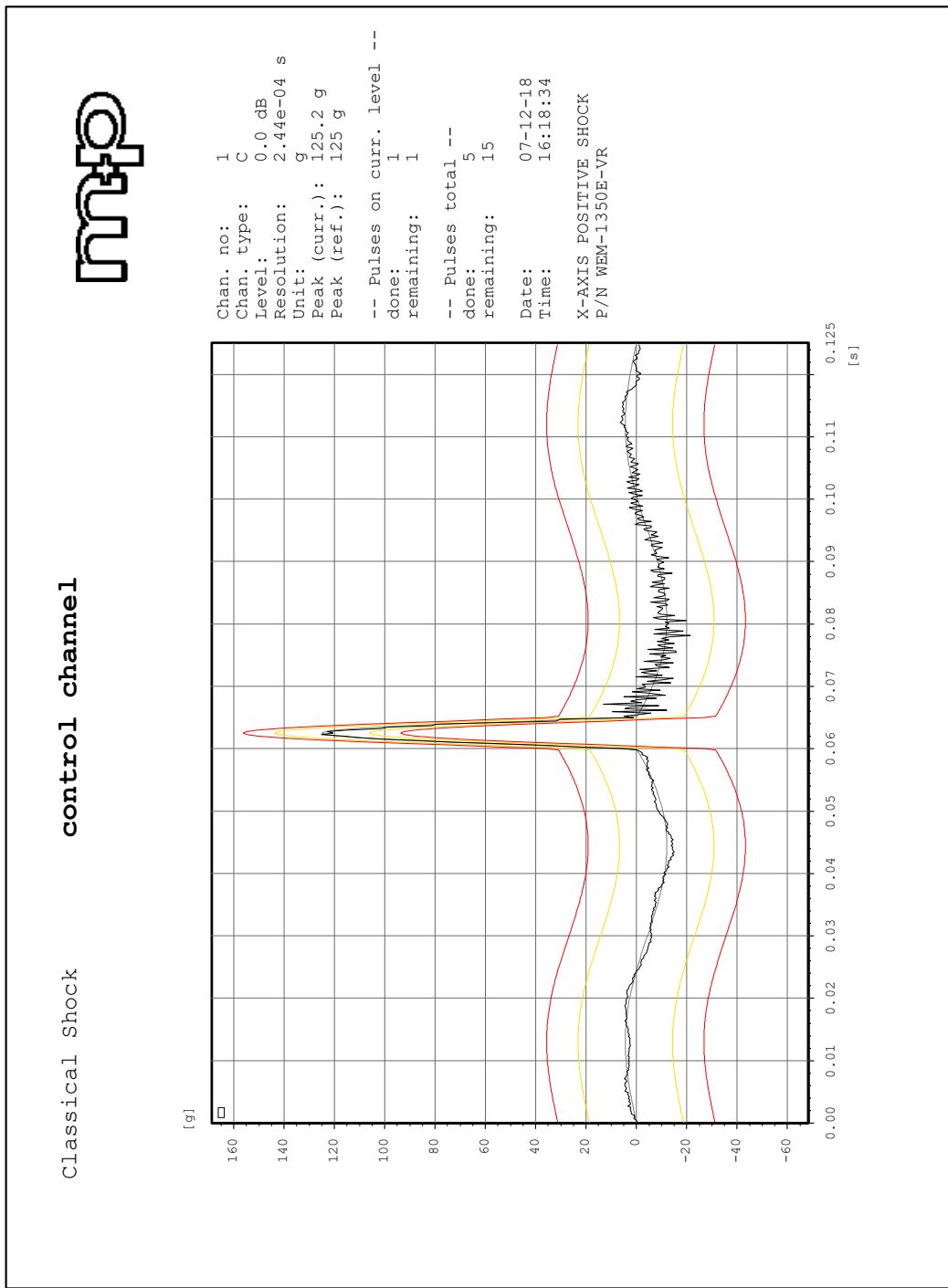
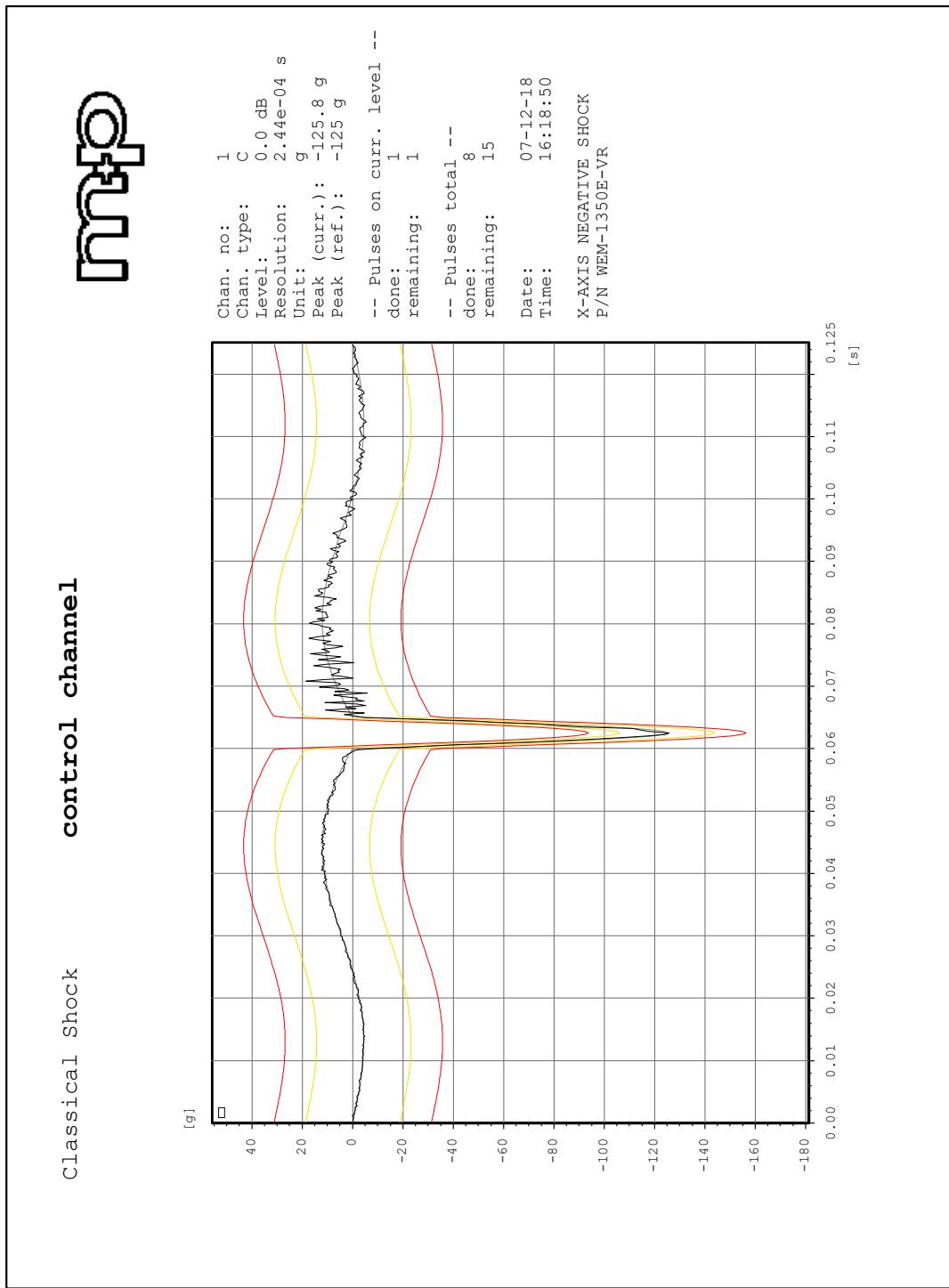


Chart 5.2.1-71:Longitudinal axis Shock Profile, P/N WEM-1350E-VR,Positive 1



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Chart 5.2.1-72:Longitudinal axis Shock Profile, P/N WEM-1350E-VR,Negative 1



6. ACCEPTANCE CRITERIA

Acceptability will be contingent upon the ability of the EUT to perform its function before, during and after the test.

7. TEST RESULTS

See table ES-3 and section 5.2 for test results.

8. TEST MODIFICATIONS

None

9. TEST ITEM DISPOSITION

The EUT was returned to A-T CONTROLS.

10. PERSONNEL

Zachary Miller
Josh Tomarchio

11. REPORT DISTRIBUTION

A. A-T CONTROLS
9955 International Blvd.
Cincinnati, OH 45246
Attention: Tim Malinak Email: tmalinak@atcontrols.com

B. E-LABS Job Number 6737-A

END OF REPORT