



SENTON

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September 29,
2011

Prüfbericht / Test Report

Nr. / No. 11383-02592-1 (Edition 1)

| | |
|---|--|
| Auftraggeber <i>Applicant</i> | Kontron Embedded Computers GmbH |
| Geräteart <i>Type of equipment</i> | Industrial PC for use in Military Applications |
| Typenbezeichnung <i>Type designation</i> | KISS 4U MIL 760-A |
| Auftragsnummer / <i>Order No.</i> | 45236395 |
| Prüfgrundlage <i>Test standards</i> | MIL 810 G ENVIRONMENTAL ENGINEERING CONSIDERATIONS AND LABORATORY TESTS Vibration, method 514.4, procedure I, cat. 4 Vibration, method 514.4, procedure I, cat. 7 Vibration, method 514.5, procedure IV Shock, method 516.5, Procedure I EN 60068-2-6:2008-10 Vibration (sinusoidal) EN 60068-2-27:2010-02 Shock EN 60068-2-31:2009-04 Drop and Topple EN 60068-2-64:2009-04 Vibration, broad-band random |



Summary

| | |
|--------------------------------------|---|
| Prüfergebnisse / Test Results | Auftragsnummer / Order No. 45236395 |
|--------------------------------------|---|

Die Prüfungen wurden nach folgenden Vorschriften durchgeführt:
Tests were performed according to:

**MIL 810 G ENVIRONMENTAL ENGINEERING CONSIDERATIONS
 AND LABORATORY TESTS**

Vibration, method 514.4, procedure I, cat. 4

Vibration, method 514.4, procedure I, cat. 7

Vibration, method 514.5, procedure IV

Shock, method 516.5, Procedure I

EN 60068-2-6:2008-10 Vibration (sinusoidal)

EN 60068-2-27:2010-02 Shock

EN 60068-2-31:2009-04 Drop and Topple

EN 60068-2-64:2009-04 Vibration, broad-band random

| Durchgeführte Prüfung <i>Test performed</i> | Betriebsart <i>Operation mode</i> | | Prüfergebnis <i>Testresult</i> | |
|--|--------------------------------------|---|-------------------------------------|------------------------------------|
| | Betrieb <i>Operating</i> | ohne Betrieb / <i>non Operating</i> | Erfüllt <i>Passed</i> | Nicht erfüllt <i>Not Passed</i> |
| Vibration, method 514.5, procedure IV | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Shock EN 60068-2-27 Halbsine | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Shock, method 516.5, Procedure I, sawtooth | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Vibration, method 514.4, procedure I, cat. 4 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Vibration, method 514.4, procedure I, cat. 7 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Drop Test EN 60068-2-31 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Bemerkungen / Remarks:

Eine abschließende Funktionskontrolle obliegt dem Auftraggeber.

The final evaluation will be performed by the applicant.

Die Prüfergebnisse beziehen sich ausschließlich auf das zur Prüfung vorgestellte Prüfmuster. Ohne schriftliche Genehmigung des Prüflabors darf der Prüfbericht auszugsweise nicht vervielfältigt werden. *The test results relate only to the individual item which has been tested. Without the written approval of the test laboratory this report may not be reproduced in extracts.*

| | | | |
|-----------------------|---|--|--|
| Datum / Date | Geprüft von / Tested by | Freigabe durch / Checked by | Prüfergebnis / Test Result <input checked="" type="checkbox"/> Erfüllt / Passed <input type="checkbox"/> Nicht erfüllt / Not passed |
| September 29, 2011 | Reinhold Markl Responsible for testing | Johann Roidt Laboratory manager | |

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1 Administrative Data

Application details

| | |
|------------------------------|---|
| Applicant: | Kontron Embedded Computers GmbH Oskar-von-Miller-Straße 1 85386 Eching Germany |
| Contact person: | Mr. Ferit Durgut |
| Order number: | 45236395 / 05.08.2010 |
| Receipt of EUT: | November 10, 2010 |
| Return of EUT: | September 27, 2011 |
| Date(s) of test: | November 10, 2010 to September 20, 2011 |
| Note(s): | The final evaluation will be performed by the applicant. |
| Responsible for testing: | Mr. Reinhold Markl |
| Responsible for test report: | Mr. Reinhold Markl (kbr) |
| Test report checked by: | Mr. Johann Roidt |

Report details

| | |
|----------------|--------------------|
| Report number: | 11383-02592-1 |
| Edition: | 1 |
| Issue date: | September 29, 2011 |



2 Details about the Test Laboratory

Details about the Test Laboratory

| | |
|---------------------------|--|
| Company name: | TÜV SÜD SENTON GmbH |
| Address: | Äußere Frühlingstraße 45 D-94315 Straubing Germany |
| Laboratory accreditation: | DAR-Registration No. DAT-PL-171/94-03 |
| Contact: | Mr. Johann Roidt |
| | Phone: +49 9421 5522-0 Fax: +49 9421 5522-99 |

3 Description of the Equipment Under Test

| Equipment characteristics | |
|---------------------------|---|
| Type designation: | KISS 4U MIL 760-A |
| Parts of the system: | see Table 1. |
| Options and accessories: | -- |
| Type of equipment: | Industrial PC for use in Military Applications |
| Serial number: | see Table 1. |
| Manufacturer: | Kontron Embedded Computers GmbH |
| Power supply: | AC supply Nominal: 230 V Nominal frequency: 50 Hz |
| Version of EUT: | see photo and Table 1. |



Table 1. Configuration:

| <i>Components</i> | <i>Name / Manufacturer</i> | <i>Article-Number</i> | <i>Serial-Nr. / Version</i> | <i>Remark</i> |
|--------------------------|---|-----------------------|-----------------------------|------------------|
| MB / Baseboard | LF PCI-760 PICMG1.3 Q35 Full Version | 9-1501-3600 | 148276024 R15B | |
| BP | LF KISS 4U PCIE Backplane xBP13E9P3 | 9-1201-3606 | 146498010 R12A | |
| CPU | ICMP Core2 Duo E6400/2,13GHz/2MB LGA775 | 0-0044-1830 | XXXX | |
| Memory | DIMM DDR2 1GB PC2-6400 Samsung | 1031-8876 | XXXX 2x | |
| . Harddisk SSD | Samsung MZ-SP/71280/000 | MZ SPA 128 HMCD | S0MJNEAZB00271 | PN |
| Harddisk | HDD_SATA300_3,5" 250G B_DESKSTAR7K1000. | 1035-8459 | XXXX | |
| Harddisk | HDD_SATA300_3,5" 500G B_WD RE3 24/7 | 1036-5378 | XXXX | |
| Wechselrahmen | 1-fach SATA 3,5" HDD Rack 1x 5,25" | 1037-8452 | XXXX | |
| Power Supply | BGNT ATX, PS2 -Netzteil 400W BEA-640-B5 | 1022-9353 | 20080904P600-584 | T93305204 |
| Lan | NET PCIe(x4) INTEL PRO SRV 2x1000PT | 0-0074-3993 | XXXX | |
| Mechanics-Rev. | | 1035-7344 | 10063-001-00 D | |
| Firmware: | <input type="checkbox"/> | BIOS: 08.00.06 | <input type="checkbox"/> | |
| Operating System: XP SP3 | <input type="checkbox"/> | ID : 3B600016 | <input type="checkbox"/> | |

3.1 Photos of the Testsample





4 Operation Mode and Configuration of EUT

Operation Mode(s)

Operating:

- PC powered with 230 VAC / 50 Hz
- Windows running
- Burn In Test operating

Non Operating:

- PC not powered (cables connected)
- Functional test before and after each single test

Drop Test:

- PC packaged in serial packaging
- Functional test before and after test

List of ports and cables

| No. | Description | Classification ¹ | Cable type | Cable length |
|-----|-----------------------|-----------------------------|------------|--------------|
| A1 | Power Supply | ac power | Unshielded | 2 m |
| S1 | VGA to Display | signal/control port | Shielded | 2 m |
| S1 | USB to Keyboard/Mouse | signal/control port | Shielded | 1,5 m |

EUT mounting

| No. | Description | Type designation | Serial no. or ID | Weight |
|-----|--|-----------------------------------|------------------|--------|
| 1 | clamped down to headexpander/sliptable | 4 M8 bolts and steel pipe 40x40x4 | -- | -- |
| 2 | 4 side blocks | each 1 M8 screw | -- | -- |

List of devices connected to EUT

| No. | Description | Type designation | Serial no. or ID | Manufacturer |
|-----|--------------|------------------|------------------|--------------|
| 1 | Display | VGA | -- | -- |
| 1 | USB Keyboard | USB | -- | -- |
| 2 | USB Mouse | USB | -- | -- |

¹ Ports shall be classified as ac power, dc power or signal/control port.

List of support devices

| No. | Description | Type designation | Serial no. or ID | Weight |
|-----|-----------------------------------|------------------|------------------|------------|
| 1 | steel pipe 40 x 40 x 4 l = 500 | stainless steel | | appr. 5 kg |
| 2 | side blocks | steel | -- | -- |

5 Performance Criteria and Methods of Observation

| Methods of Observation | | | |
|--|----------------------|--------------------------|---------------------------|
| <i>Function</i> | <i>Observed size</i> | <i>Permissible range</i> | <i>Observation method</i> |
| mechanical | constitution | -- | visual |
| functional test | -- | -- | Burn In Testprogram |
| <i>The final evaluation will be done by the applicant.</i> | | | |

6 Referenced Regulations

| <i>Publikation</i> | <i>Titel</i> |
|---|--|
| EN 60068-2-6:2008-10 | Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal) (IEC 60068-2-6:2007); German version EN 60068-2-6:2008 |
| EN 60068-2-27:2010-02 | Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock (IEC 60068-2-27:2008); German version EN 60068-2-27:2009 |
| EN 60068-2-31:2009-04 | Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens (IEC 60068-2-31:2008); German version EN 60068-2-31:2008 |
| EN 60068-2-64:2009-04 | Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance (IEC 60068-2-64:2008); German version EN 60068-2-64:2008 |
| MIL-STD-810G 31 October 2008 SUPERSEDING MIL-STD-810F 1 January 2000 | DEPARTMENT OF DEFENSE TEST METHOD STANDARD ENVIRONMENTAL ENGINEERING CONSIDERATIONS AND LABORATORY TESTS |

7 Test Results

Mechanical Tests

| Method 514.5, procedure IV EN 60068-2-6 Sine Vibration | | | |
|---|----------------------------|--------------------|------------------|
| <i>Operation Mode</i> | OPERATION | | |
| <i>Test performed</i> | | <i>Test Result</i> | <i>Note</i> |
| frequency range | 10..500 Hz | Test passed | X / Y / Z tested |
| constant amplitude | 3,5 mm | | |
| cross-over-frequency | 8,4 Hz | | |
| acceleration | 10 m/s ² (~1 g) | | |
| duration | 45 min | | |
| sweep | 1 octave / minute | | |

| Method 514.5, procedure IV EN 60068-2-6 Sine Vibration | | | |
|---|----------------------------|--------------------|------------------|
| <i>Operation Mode</i> | NON OPERATION | | |
| <i>Test performed</i> | | <i>Test Result</i> | <i>Note</i> |
| frequency range | 10..500 Hz | Test passed | X / Y / Z tested |
| constant amplitude | 7,5 mm | | |
| cross-over-frequency | 8,1 Hz | | |
| acceleration | 20 m/s ² (~2 g) | | |
| duration | 45 min | | |
| sweep | 1 octave / minute | | |



| Method 514.4, procedure I, cat. 4 | | | |
|-----------------------------------|-----------------|-------------|------------------|
| EN 60068-2-64 Random Vibration | | | |
| Operation Mode | OPERATION | | |
| Test performed | | Test Result | Note |
| constant asd | see table below | Test passed | X / Y / Z tested |
| slope | see table below | | |
| RMS level | see table below | | |
| duration | 40 min | | |
| standard deviation σ | 3 | | |

| vertical | | transverse | | longitudinal | |
|----------|----------|------------|----------|--------------|----------|
| Hz | g^2/Hz | Hz | g^2/Hz | Hz | g^2/Hz |
| 5 | 0.2252 | 5 | 0.0474 | 5 | 0.0563 |
| 8 | 0.5508 | 6 | 0.0303 | 6 | 0.0563 |
| 10 | 0.0437 | 7 | 0.0761 | 8 | 0.1102 |
| 13 | 0.0253 | 13 | 0.0130 | 13 | 0.0140 |
| 15 | 0.0735 | 15 | 0.0335 | 16 | 0.0303 |
| 19 | 0.0143 | 16 | 0.0137 | 20 | 0.0130 |
| 23 | 0.0358 | 21 | 0.0120 | 23 | 0.0378 |
| 27 | 0.0123 | 23 | 0.0268 | 27 | 0.0079 |
| 30 | 0.0286 | 25 | 0.0090 | 30 | 0.0200 |
| 34 | 0.0133 | 28 | 0.0090 | 33 | 0.0068 |
| 36 | 0.0416 | 30 | 0.0137 | 95 | 0.0019 |
| 41 | 0.0103 | 34 | 0.0055 | 121 | 0.0214 |
| 45 | 0.0241 | 37 | 0.0081 | 146 | 0.0450 |
| 51 | 0.0114 | 46 | 0.0039 | 153 | 0.0236 |
| 95 | 0.0266 | 51 | 0.0068 | 158 | 0.0549 |
| 111 | 0.0166 | 55 | 0.0042 | 164 | 0.0261 |
| 136 | 0.0683 | 158 | 0.0029 | 185 | 0.0577 |
| 147 | 0.0266 | 235 | 0.0013 | 314 | 0.0015 |
| 185 | 0.0603 | 257 | 0.0027 | 353 | 0.0096 |
| 262 | 0.0634 | 317 | 0.0016 | 398 | 0.0009 |
| 330 | 0.0083 | 326 | 0.0057 | 444 | 0.0027 |
| 360 | 0.0253 | 343 | 0.0009 | 500 | 0.0014 |
| 500 | 0.0017 | 384 | 0.0018 | 2.40 | g rms |
| 3.85 | g rms | 410 | 0.0008 | | |
| | | 462 | 0.0020 | | |
| | | 500 | 0.0007 | | |
| | | 1.28 | g rms | | |

| Method 514.4, procedure I, cat. 7 | | | |
|--|-----------------|--------------------|------------------|
| EN 60068-2-64 Random Vibration | | | |
| <i>Operation Mode</i> | OPERATION | | |
| <i>Test performed</i> | | <i>Test Result</i> | <i>Note</i> |
| constant asd | see table below | Test passed | X / Y / Z tested |
| slope | see table below | | |
| RMS level | see table below | | |
| duration | 30 min | | |
| standard deviation σ | 3 | | |

| General Exposure | | |
|-------------------------|----------|--------|
| Hz | g^2/Hz | dB/Oct |
| 15 | | |
| 105.94 | 0.01 | |
| | | 6 |
| 150 | 0.02 | |
| 500 | 0.02 | |
| | | -6 |
| 2000 | 1.3E-3 | |
| rms = 3.54 g | | |

| EN 60068-2-27 Single Shock | | | |
|-----------------------------------|----------------------------|--------------------|------------------|
| <i>Operation Mode</i> | OPERATION | | |
| <i>Test performed</i> | | <i>Test Result</i> | <i>Note</i> |
| shock acceleration | 150 m/s ² ~15 g | Test passed | X / Y / Z tested |
| shock duration | 11 ms | | |
| count of shocks | 3 per axis and direction | | |
| pulse shape | half-sine pulse | | |

| EN 60068-2-27 Single Shock | | | |
|-----------------------------------|----------------------------|--------------------|------------------|
| <i>Operation Mode</i> | NON OPERATION | | |
| <i>Test performed</i> | | <i>Test Result</i> | <i>Note</i> |
| shock acceleration | 200 m/s ² ~20 g | Test passed | X / Y / Z tested |
| shock duration | 11 ms | | |
| count of shocks | 3 per axis and direction | | |
| pulse shape | half-sine pulse | | |

| Method 516.5, procedure I EN 60068-2-27 Single Shock | | | |
|---|----------------------------|--------------------|------------------|
| <i>Operation Mode</i> | NON OPERATION | | |
| <i>Test performed</i> | | <i>Test Result</i> | <i>Note</i> |
| shock acceleration | 400 m/s ² ~40 g | Test passed | X / Y / Z tested |
| shock duration | 11 ms | | |
| count of shocks | 3 per axis and direction | | |
| pulse shape | final-peak saw-tooth pulse | | |



| EN 60068-2-32 Drop Test | | | |
|--------------------------------|--|--------------------|-------------|
| <i>Operation Mode</i> | TRANSPORT / PACKAGING | | |
| <i>Test performed</i> | | <i>Test Result</i> | <i>Note</i> |
| drop height | 800 mm | Test passed | --- |
| count of shocks | 1 per defined point | | |
| faces | 2/3/5 3/5 2/5 2/3 5 6 2 4 1 3 | | |
| drop Surface | concrete | | |
| Pass-Fail Criteria | no visual damage; must operate after test | | |

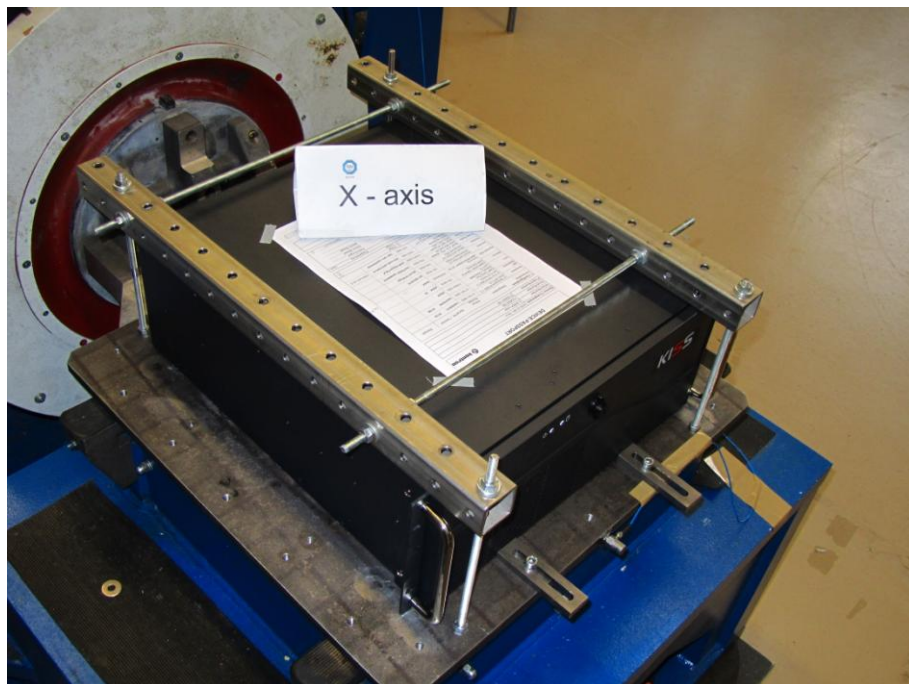
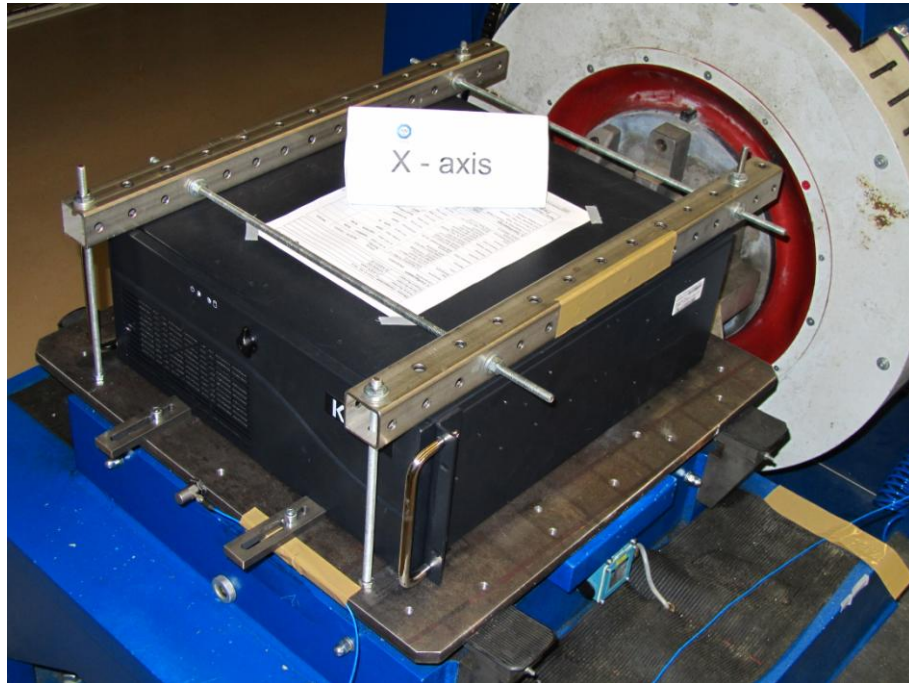
7.1 Mechanical Tests

7.1.1 Test Equipment List

| <i>Type</i> | <i>Designation</i> | <i>Inv.-no.</i> | <i>Manufacturer</i> |
|--|-----------------------------|-----------------|----------------------|
| <input checked="" type="checkbox"/> Shakersystem | | | TIRA GmbH |
| Shaker | S597/AIT-340 | 1923 | TIRA GmbH |
| Power amplifier | A 54342 | 1923 | TIRA GmbH |
| Sliptable | TGT MO 20 XL | 1923 | TIRA GmbH |
| 4-channel - controlsystem | VR 8500-4 | 1924 | Vibration Research |
| Software | Vibration View | 1925 | Vibration Research |
| Accelerometer | M320 C 03 | 1927 | ICP |
| Accelerometer | M320 C 33 | 2049 | ICP |
| Triaxial Accelerometer | M356A02 | 2046 | ICP |
| Triaxial Accelerometer | M356A15 | 1930 | ICP |
| Accelerometer | M352 C 22 | 2047 | ICP |
| Accelerometer | M352 C 22 | 2048 | ICP |
| Accelerometer | M352 C 22 | 2050 | ICP |
| <input type="checkbox"/> Vibration- and temperature- /climatic test chamber | TIRAvibro TTV 7120 ES VH | 1934 | TIRA GmbH |
| Software | WINKRATOS | 1935 | TIRA GmbH |
| <input type="checkbox"/> Data Aquisition Switch Unit | 34970A | 1967 | Agilent Technologies |
| 20 channel multiplexer | 34901A | 1968 | Agilent Technologies |

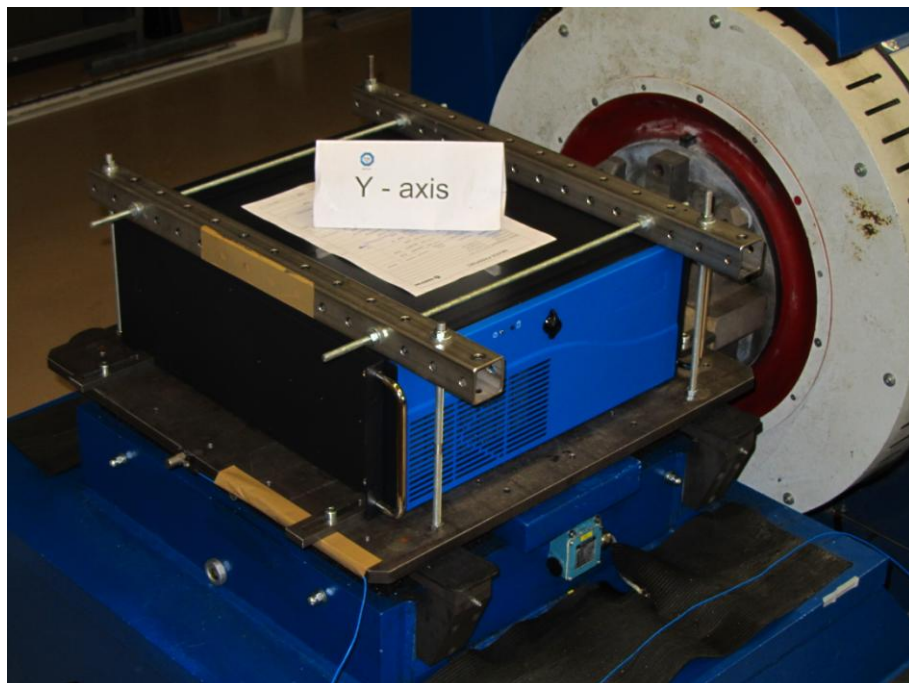
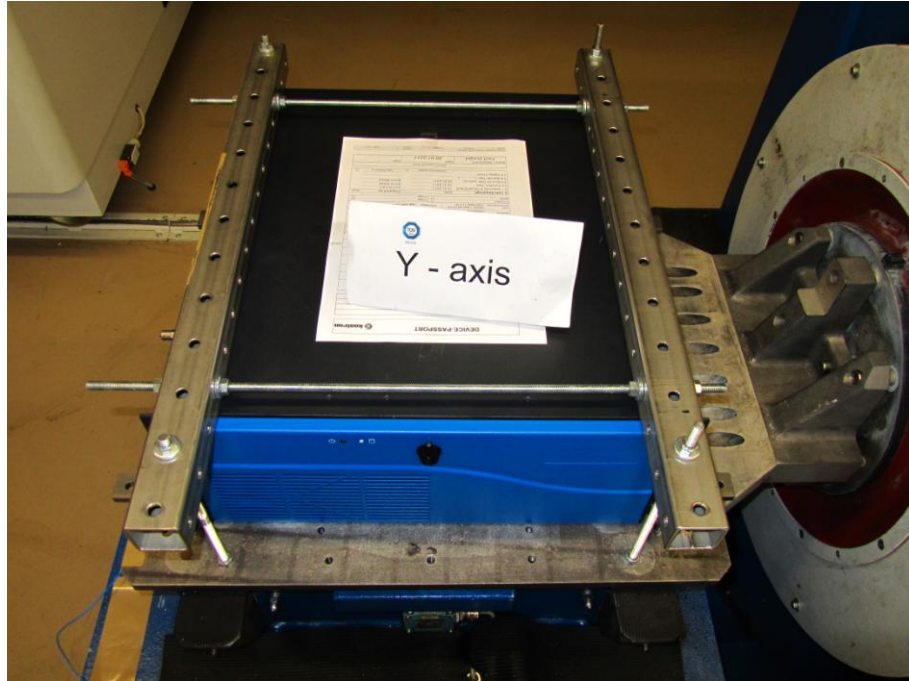
7.1.2 Testsetup

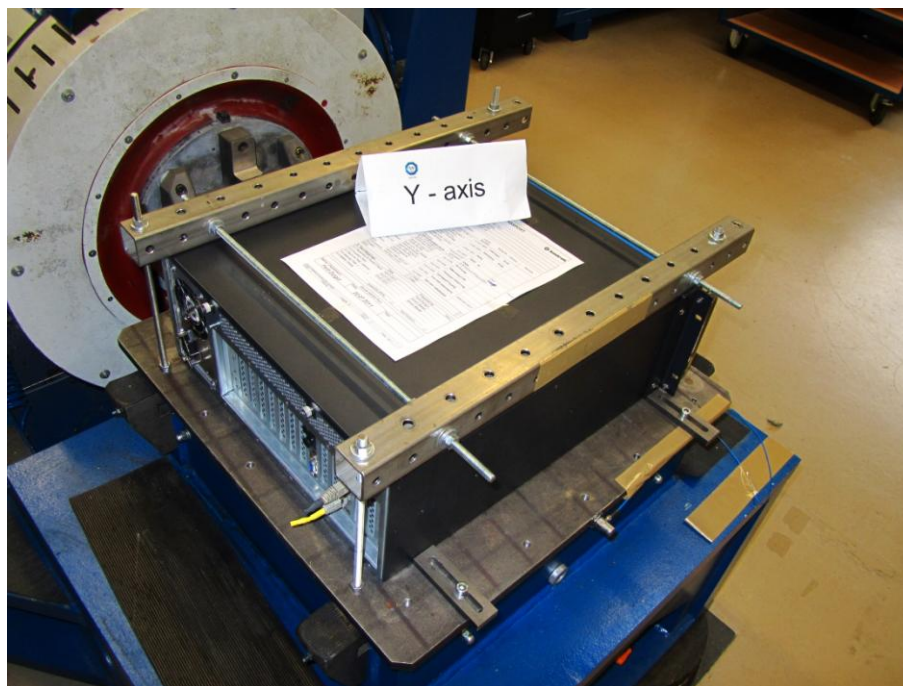
Testsetup X-Axis



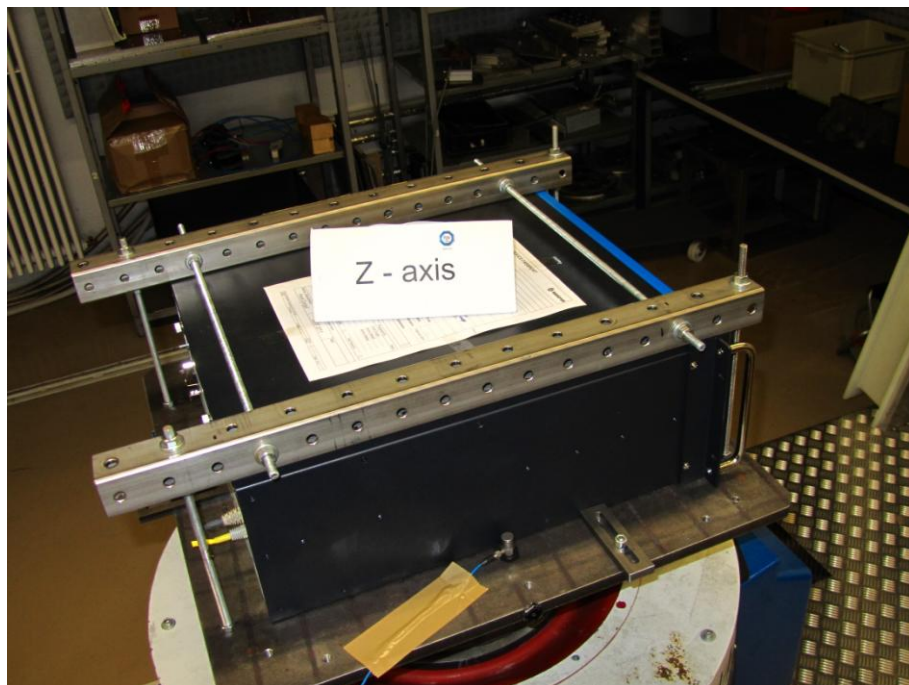
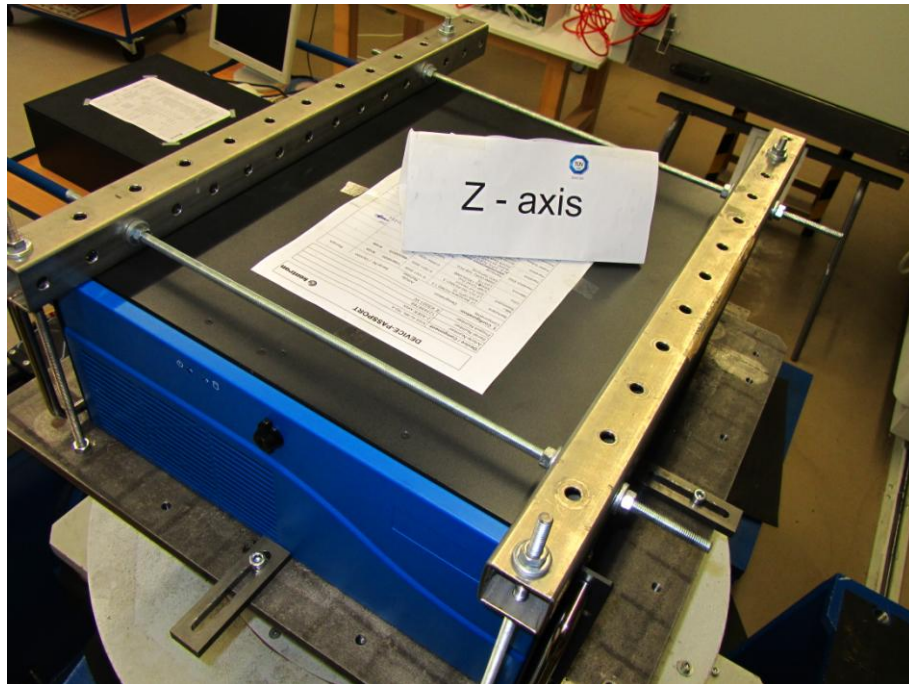


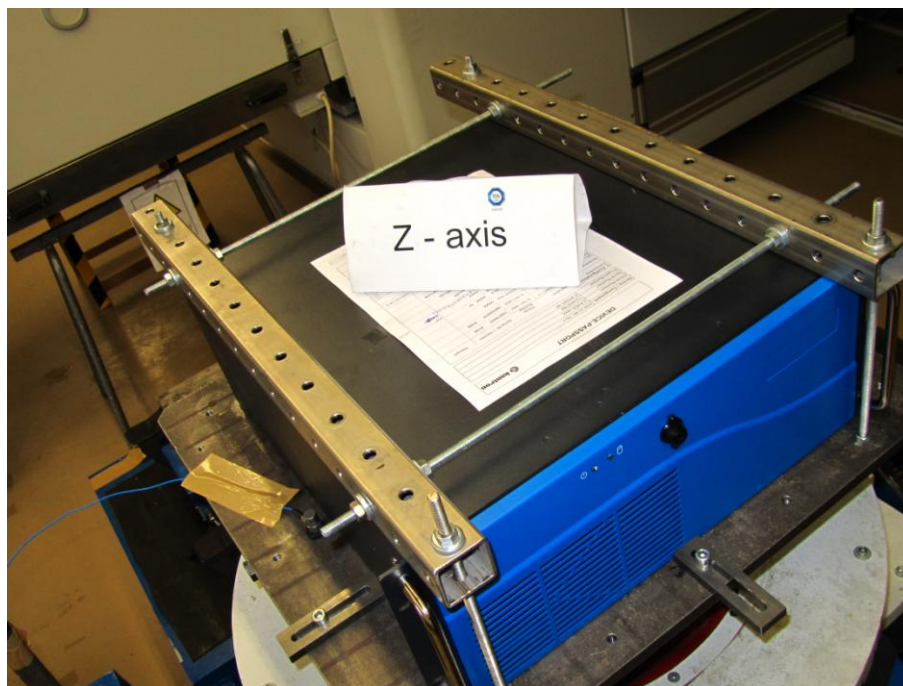
Testsetup Y-Axis





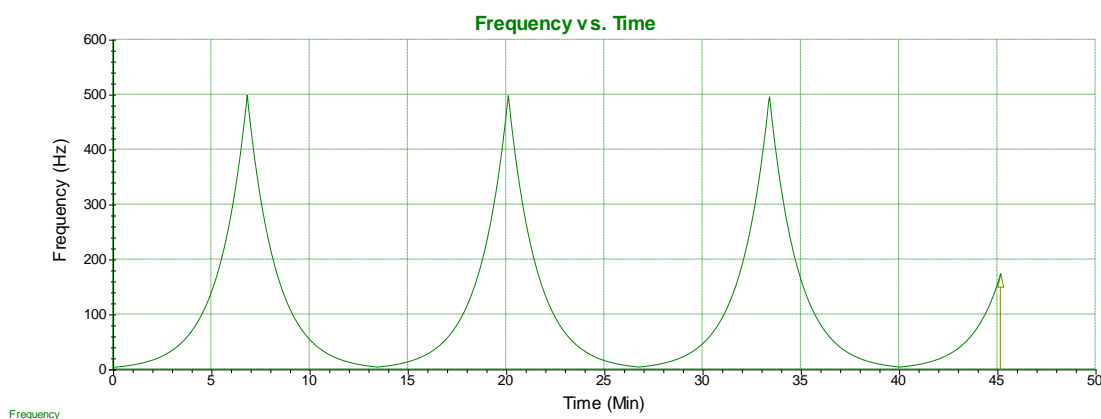
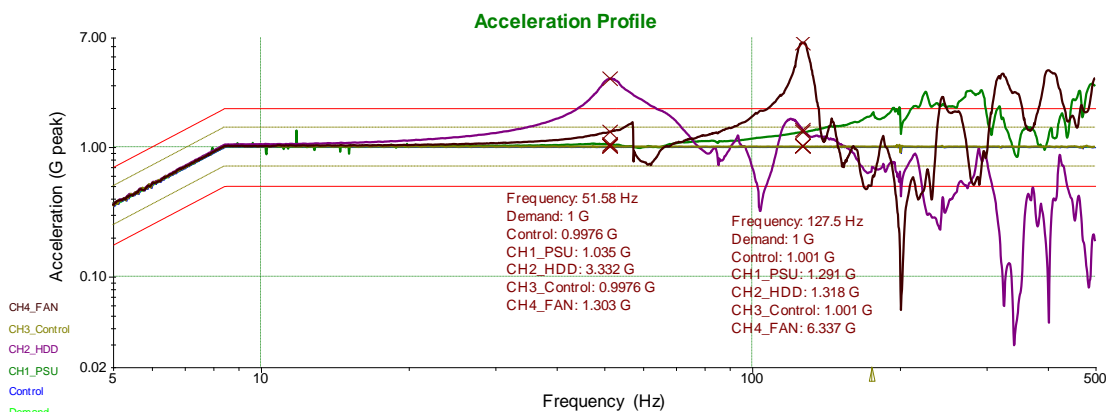
Testsetup Z-Axis





7.1.3 Sine Vibration – Method 514.5, procedure IV – Operating

X-Axis



Breakpoint table:

| Start Freq. | Amplitude | End Freq. | Amplitude |
|-------------|-----------|------------|-----------|
| 5 Hz | 3.5 mm | 8.42454 Hz | 3.5 mm |
| 8.42454 Hz | 1 G | 500 Hz | 1 G |

Sweep rate:

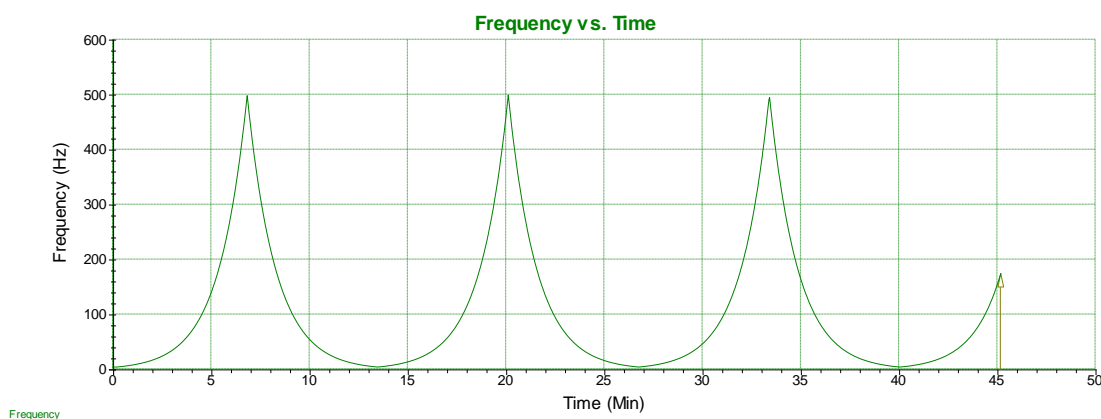
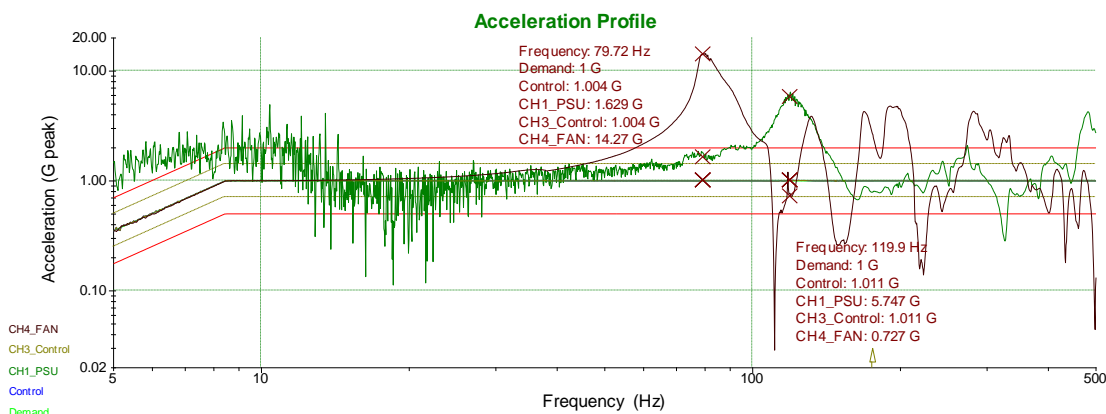
Sweep between 5 Hz and 500 Hz at 1 Oct/min

Test level schedule:

| Duration | Level |
|------------|-------|
| 1) 0:45:00 | 100 % |

** Test started Jul 20, 2011 13:34:48, running for 0:45:09
 ** Current level: 1, running at 100 %, 0:45:00 of 0:45:00 complete

Y-Axis



Breakpoint table:

| Start Freq. | Amplitude | End Freq. | Amplitude |
|-------------|-----------|------------|-----------|
| 5 Hz | 3.5 mm | 8.42454 Hz | 3.5 mm |
| 8.42454 Hz | 1 G | 500 Hz | 1 G |

Sweep rate:

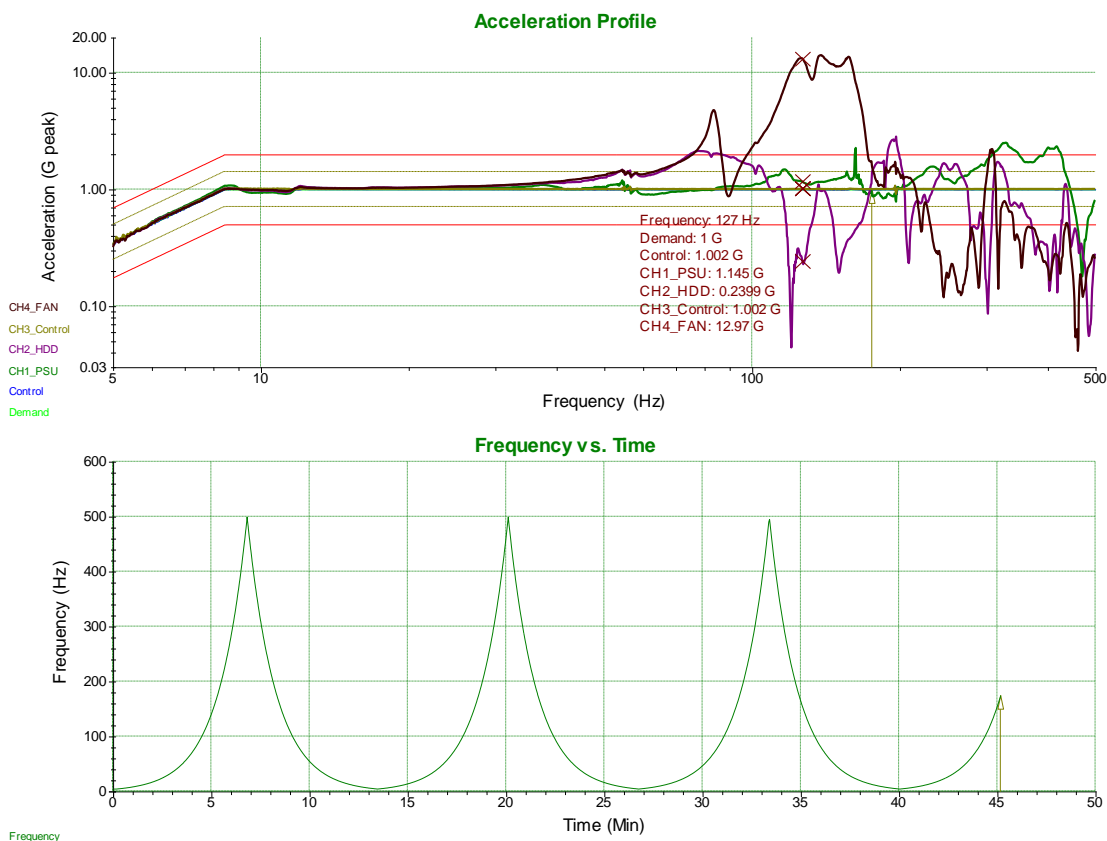
Sweep between 5 Hz and 500 Hz at 1 Oct/min

Test level schedule:

| Duration | Level |
|------------|-------|
| 1) 0:45:00 | 100 % |

** Test started Jul 20, 2011 10:18:01, running for 0:45:09
 ** Current level: 1, running at 100 %, 0:45:00 of 0:45:00 complete

Z-Axis



Breakpoint table:

| Start Freq. | Amplitude | End Freq. | Amplitude |
|-------------|-----------|------------|-----------|
| 5 Hz | 3.5 mm | 8.42454 Hz | 3.5 mm |
| 8.42454 Hz | 1 G | 500 Hz | 1 G |

Sweep rate:

Sweep between 5 Hz and 500 Hz at 1 Oct/min

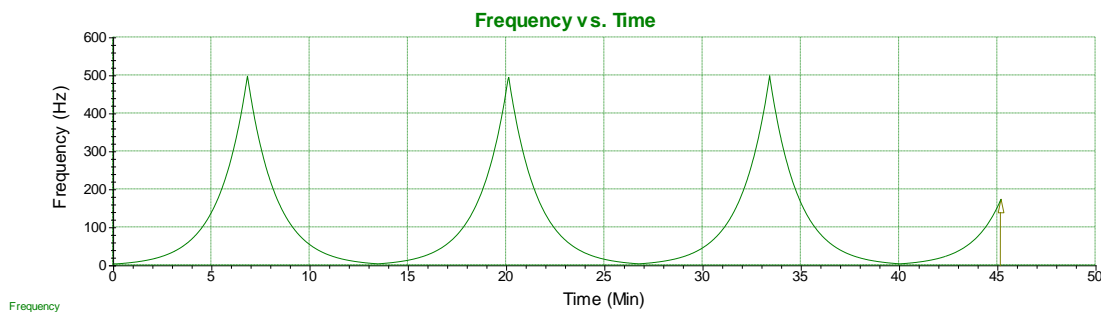
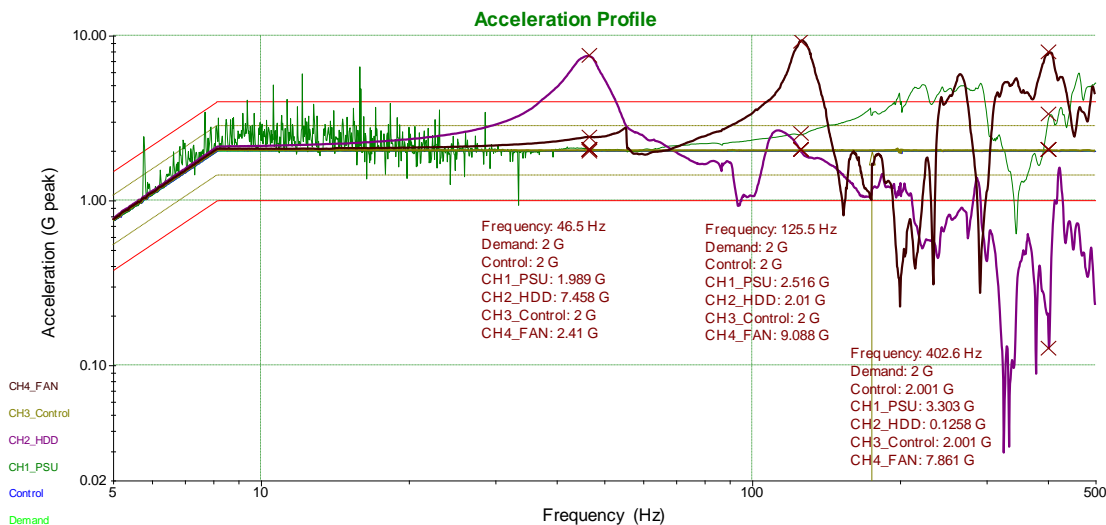
Test level schedule:

| | Duration | Level |
|----|----------|-------|
| 1) | 0:45:00 | 100 % |

** Test started Jul 20, 2011 15:45:40, running for 0:45:09
 ** Current level: 1, running at 100 %, 0:45:00 of 0:45:00 complete

7.1.4 Sine Vibration – Method 514.5, procedure IV – Non Operating

X-Axis



Breakpoint table:

| Start Freq. | Amplitude | End Freq. | Amplitude |
|-------------|-----------|------------|-----------|
| 5 Hz | 7.5 mm | 8.13888 Hz | 7.5 mm |
| 8.13888 Hz | 2 G | 500 Hz | 2 G |

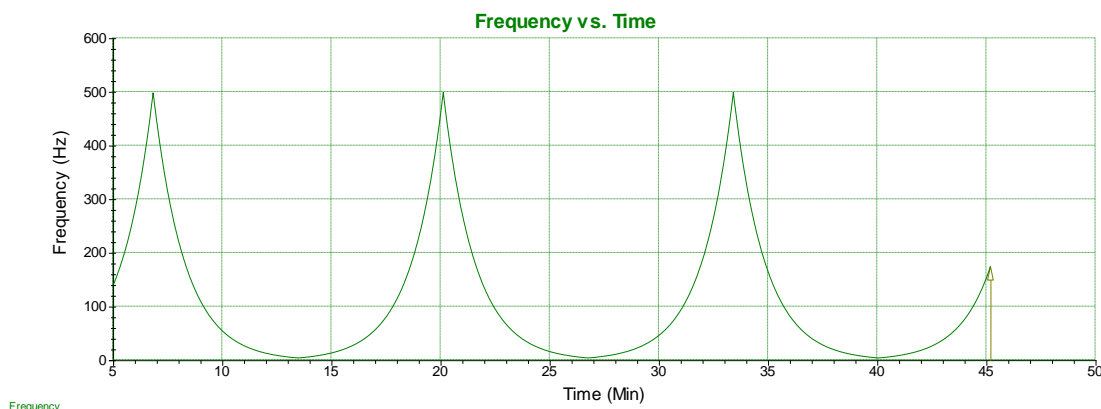
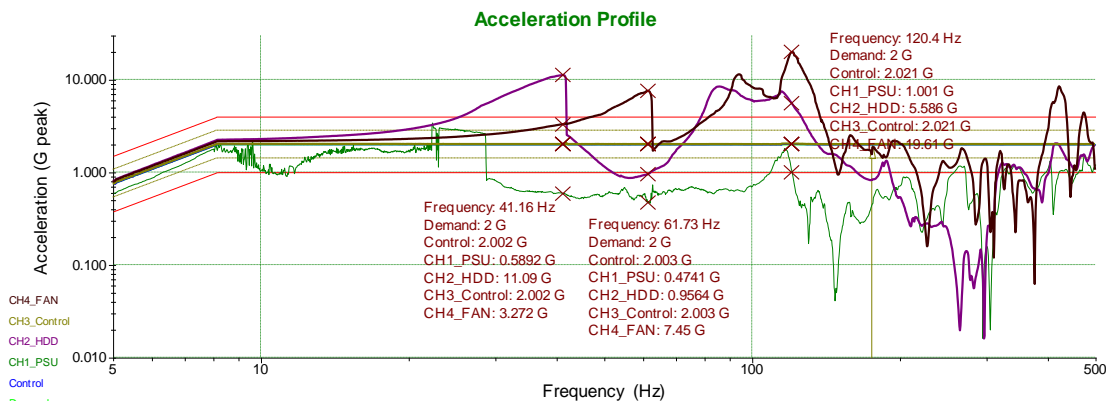
Sweep rate:

Sweep between 5 Hz and 500 Hz at 1 Oct/min

Test level schedule:

| | Duration | Level |
|--|----------|-------|
| 1) | 0:45:00 | 100 % |
| ** Test started Jul 20, 2011 14:22:49, running for 0:45:10 | | |
| ** Current level: 1, running at 100 %, 0:45:00 of 0:45:00 complete | | |

Y-Axis



Breakpoint table:

| Start Freq. | Amplitude | End Freq. | Amplitude |
|-------------|-----------|------------|-----------|
| 5 Hz | 7.5 mm | 8.13888 Hz | 7.5 mm |
| 8.13888 Hz | 2 G | 500 Hz | 2 G |

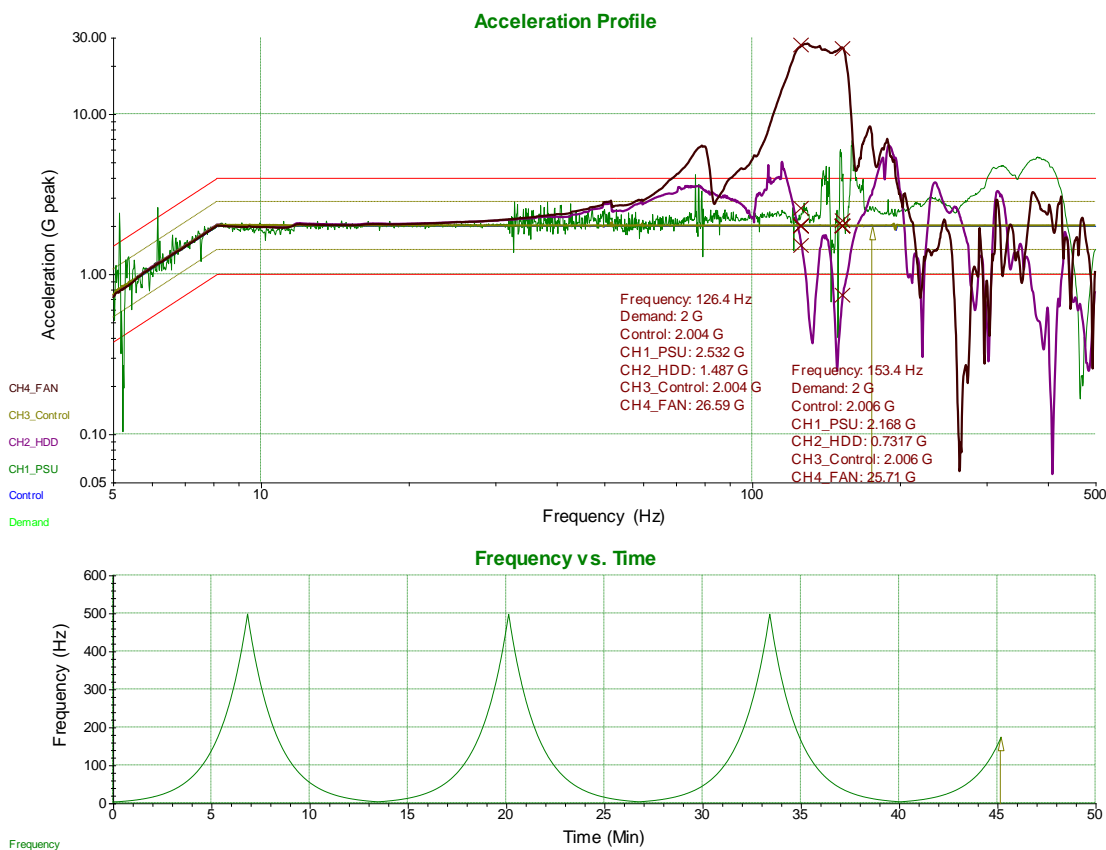
Sweep rate:

Sweep between 5 Hz and 500 Hz at 1 Oct/min

Test level schedule:

| | Duration | Level |
|--|----------|-------|
| 1) | 0:45:00 | 100 % |
| ** Test started Jul 20, 2011 11:41:40, running for 0:45:10 | | |
| ** Current level: 1, running at 100 %, 0:45:00 of 0:45:00 complete | | |

Z-Axis



Breakpoint table:

| Start Freq. | Amplitude | End Freq. | Amplitude |
|-------------|-----------|------------|-----------|
| 5 Hz | 7.5 mm | 8.13888 Hz | 7.5 mm |
| 8.13888 Hz | 2 G | 500 Hz | 2 G |

Sweep rate:

Sweep between 5 Hz and 500 Hz at 1 Oct/min

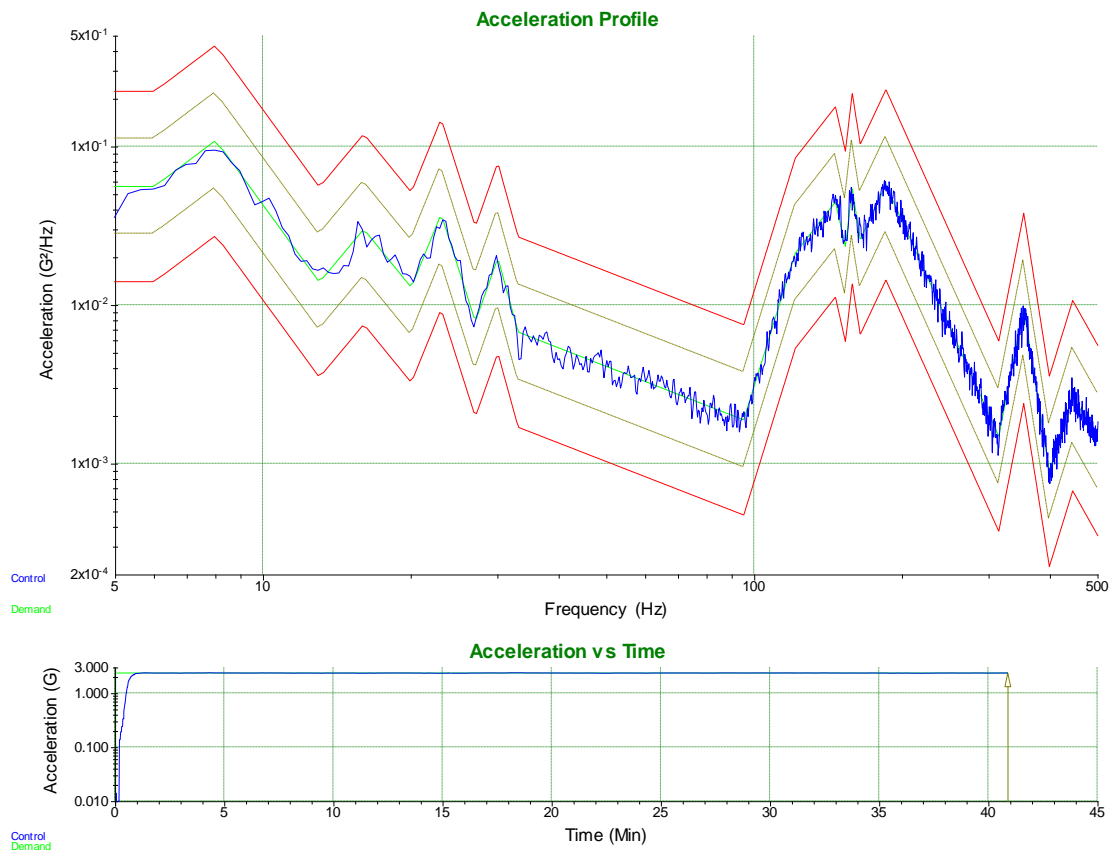
Test level schedule:

| | Duration | Level |
|----|----------|-------|
| 1) | 0:45:00 | 100 % |

** Test started Jul 20, 2011 16:35:05, running for 0:45:10
 ** Current level: 1, running at 100 %, 0:45:00 of 0:45:00 complete

7.1.5 Random Vibration – Method 514.4, procedure I, cat. 4 – Operating

X-Axis



Breakpoint table:

| Frequency | G²/Hz | dB/Octave |
|-----------|--------|-----------|
| 5 Hz | 0.0563 | 0 |
| 6 Hz | 0.0563 | 7.028 |
| 8 Hz | 0.1102 | -12.79 |
| 13 Hz | 0.014 | 11.19 |
| 16 Hz | 0.0303 | -11.42 |
| 20 Hz | 0.013 | 22.99 |
| 23 Hz | 0.0378 | -29.39 |
| 27 Hz | 0.0079 | 26.54 |
| 30 Hz | 0.02 | -34.07 |
| 33 Hz | 0.0068 | -3.63 |
| 95 Hz | 0.0019 | 30.13 |
| 121 Hz | 0.0214 | 11.91 |
| 146 Hz | 0.045 | -41.49 |
| 153 Hz | 0.0236 | 79.03 |
| 158 Hz | 0.0549 | -60.06 |
| 164 Hz | 0.0261 | 19.82 |
| 185 Hz | 0.0577 | -20.77 |
| 314 Hz | 0.0015 | 47.73 |
| 353 Hz | 0.0096 | -59.39 |
| 398 Hz | 0.0009 | 30.24 |
| 444 Hz | 0.0027 | -16.64 |
| 500 Hz | 0.0014 | |



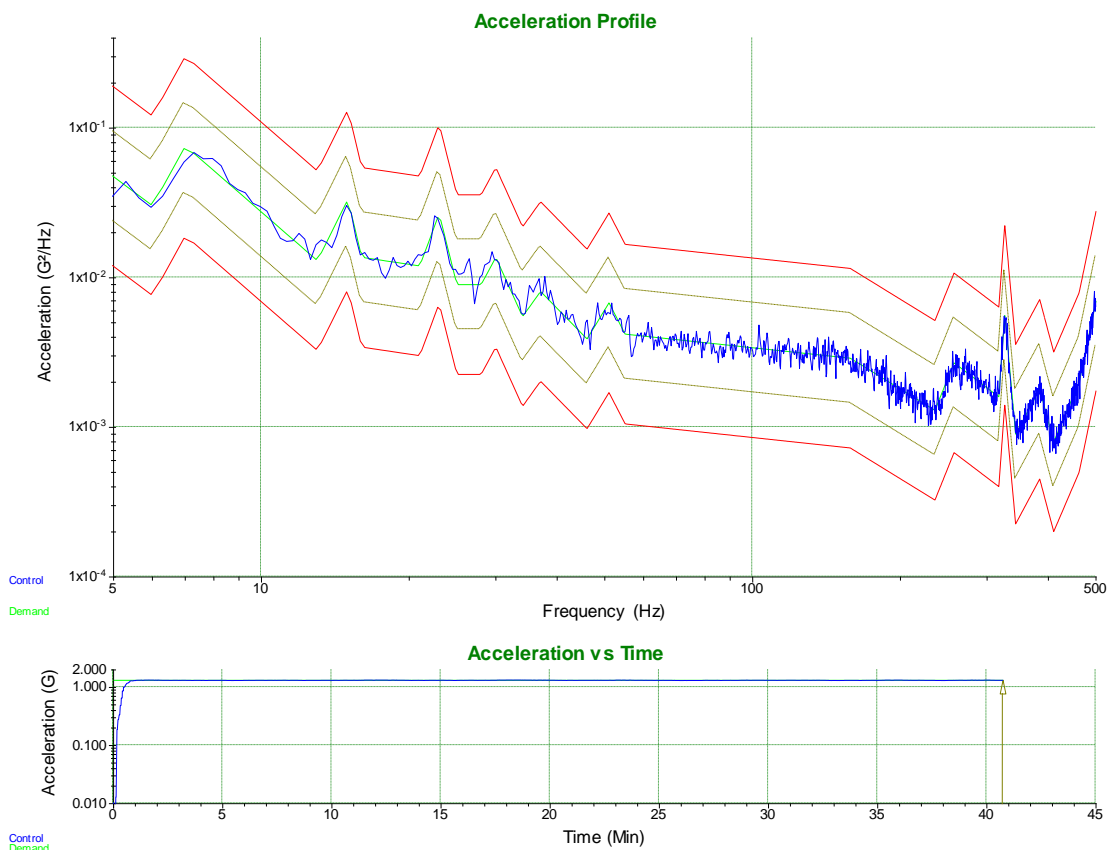
Test level schedule:

| | Duration | Level |
|--|-----------------|--------------|
| 1) | 0:40:00 | 100 % |
| ** Test started Aug 01, 2011 14:13:00, running for 0:40:53 | | |
| ** Current level: 1, running at 100 % for 0:40:00 of 0:40:00 | | |

Measurements:

| | |
|----------------------|----------------|
| Demand: 2.406 G RMS | 20.12 mm pk-pk |
| Control: 2.406 G RMS | 18.49 mm pk-pk |

Y-Axis



Breakpoint table:

| Frequency | G ² /Hz | dB/Octave |
|-----------|--------------------|-----------|
| 5 Hz | 0.0474 | -7.388 |
| 6 Hz | 0.0303 | 17.98 |
| 7 Hz | 0.0761 | -8.593 |
| 13 Hz | 0.013 | 19.91 |
| 15 Hz | 0.0335 | -41.71 |
| 16 Hz | 0.0137 | -1.467 |
| 21 Hz | 0.012 | 26.59 |
| 23 Hz | 0.0268 | -39.39 |
| 25 Hz | 0.009 | 0 |
| 28 Hz | 0.009 | 18.33 |
| 30 Hz | 0.0137 | -21.95 |
| 34 Hz | 0.0055 | 13.78 |
| 37 Hz | 0.0081 | -10.11 |
| 46 Hz | 0.0039 | 16.22 |
| 51 Hz | 0.0068 | -19.21 |
| 55 Hz | 0.0042 | -1.057 |
| 158 Hz | 0.0029 | -6.084 |
| 235 Hz | 0.0013 | 24.59 |
| 257 Hz | 0.0027 | -7.507 |
| 317 Hz | 0.0016 | 136.6 |
| 326 Hz | 0.0057 | -109.3 |
| 343 Hz | 0.0009 | 18.48 |
| 384 Hz | 0.0018 | -37.26 |



| | | |
|--------|--------|-------|
| 410 Hz | 0.0008 | 23.1 |
| 462 Hz | 0.002 | 47.71 |
| 500 Hz | 0.007 | |

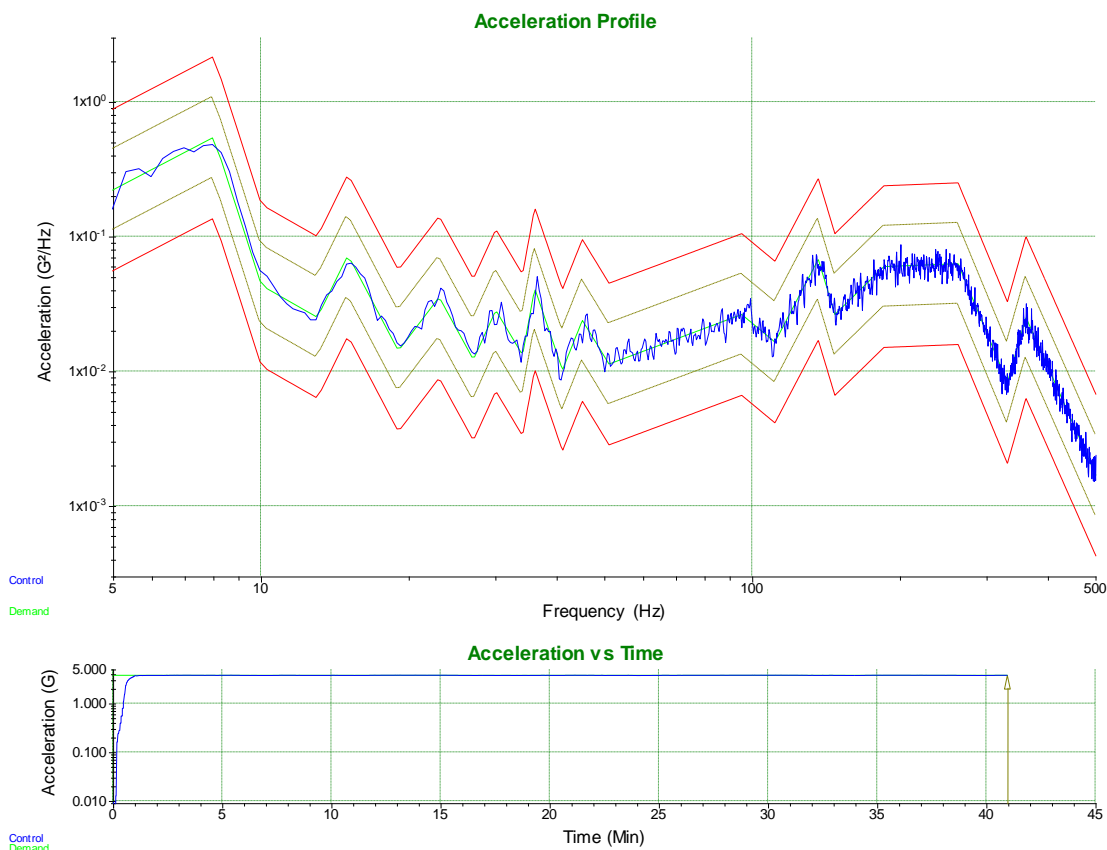
Test level schedule:

| | Duration | Level |
|--|-----------------|--------------|
| 1) | 0:40:00 | 100 % |
| ** Test started Aug 01, 2011 15:49:33, running for 0:40:45 | | |
| ** Current level: 1, running at 100 % for 0:40:00 of 0:40:00 | | |

Measurements:

| | |
|----------------------|----------------|
| Demand: 1.321 G RMS | 16.81 mm pk-pk |
| Control: 1.324 G RMS | 15.91 mm pk-pk |

Z-Axis



Breakpoint table:

| Frequency | G ² /Hz | dB/Octave |
|-----------|--------------------|-----------|
| 5 Hz | 0.2252 | 5.728 |
| 8 Hz | 0.5508 | -34.19 |
| 10 Hz | 0.0437 | -6.271 |
| 13 Hz | 0.0253 | 22.43 |
| 15 Hz | 0.0735 | -20.85 |
| 19 Hz | 0.0143 | 14.46 |
| 23 Hz | 0.0358 | -20.06 |
| 27 Hz | 0.0123 | 24.11 |
| 30 Hz | 0.0286 | -18.41 |
| 34 Hz | 0.0133 | 60.06 |
| 36 Hz | 0.0416 | -32.31 |
| 41 Hz | 0.0103 | 27.49 |
| 45 Hz | 0.0241 | -18 |
| 51 Hz | 0.0114 | 4.1 |
| 95 Hz | 0.0266 | -9.119 |
| 111 Hz | 0.0166 | 20.96 |
| 136 Hz | 0.0683 | -36.5 |
| 147 Hz | 0.0266 | 10.72 |
| 185 Hz | 0.0603 | 0.4337 |
| 262 Hz | 0.0634 | -26.52 |
| 330 Hz | 0.0083 | 38.56 |
| 360 Hz | 0.0253 | -24.74 |
| 500 Hz | 0.0017 | |



Test level schedule:

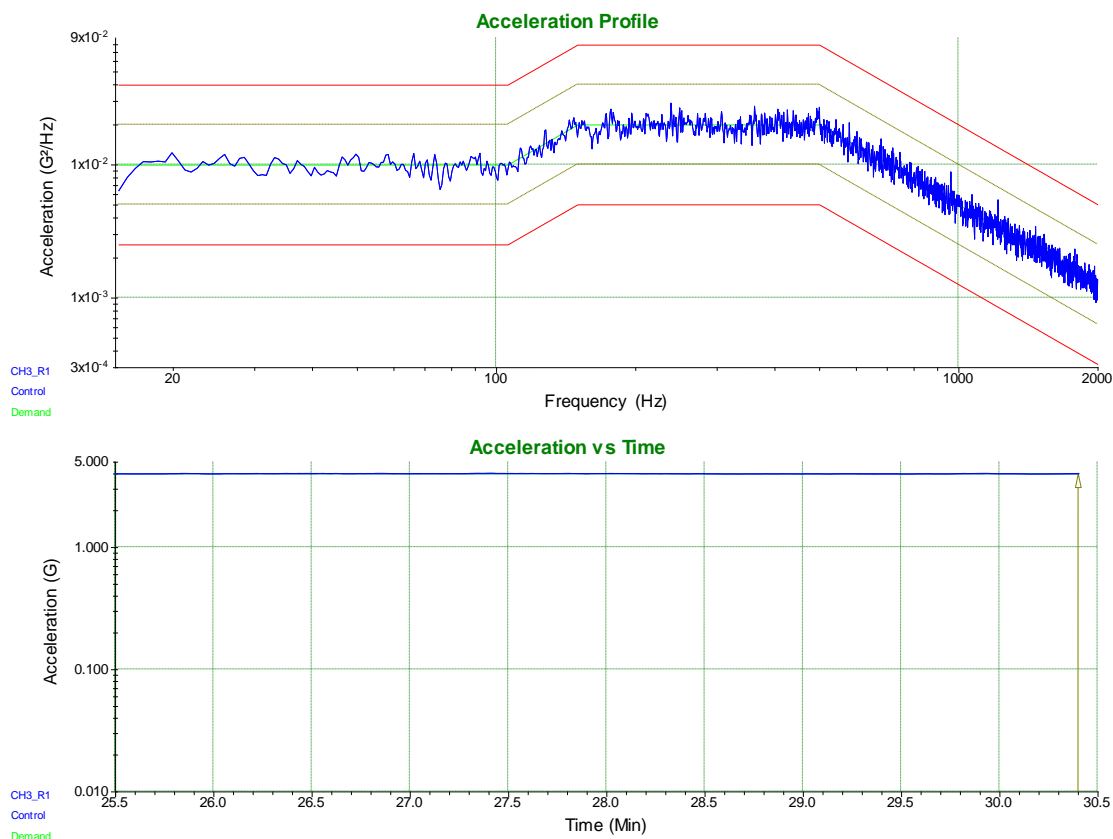
| | Duration | Level |
|--|-----------------|--------------|
| 1) | 0:40:00 | 100 % |
| ** Test started Aug 01, 2011 12:43:21, running for 0:40:57 | | |
| ** Current level: 1, running at 100 % for 0:40:00 of 0:40:00 | | |

Measurements:

| | |
|----------------------|----------------|
| Demand: 3.854 G RMS | 42.67 mm pk-pk |
| Control: 3.853 G RMS | 41.42 mm pk-pk |

7.1.6 Random Vibration – Method 514.4, procedure I, cat. 7 – Operating

X-Axis



Breakpoint table:

| Frequency | G ² /Hz | dB/Octave |
|-----------|--------------------|-----------|
| 15 Hz | 0.01 | 0 |
| 105.9 Hz | 0.01 | 6 |
| 150 Hz | 0.02 | 0 |
| 500 Hz | 0.02 | -6 |
| 2000 Hz | 0.001262 | |

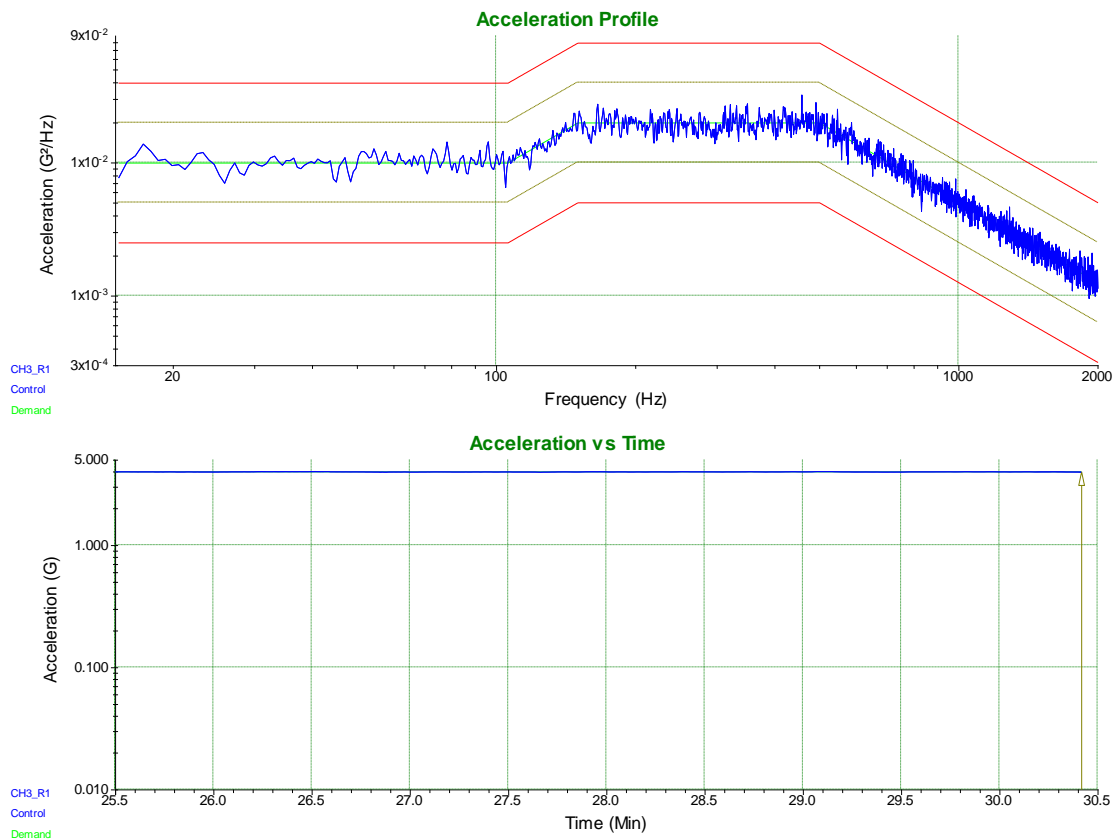
Test level schedule:

| | Duration | Level |
|--|----------|-------|
| 1) | 0:30:00 | 100 % |
| ** Test started Jul 29, 2011 14:11:17, running for 0:30:24 | | |
| ** Current level: 1, running at 100 % for 0:30:00 of 0:30:00 | | |

Measurements:

| | |
|----------------------|----------------|
| Demand: 4.011 G RMS | 1.496 mm pk-pk |
| Control: 3.998 G RMS | 1.396 mm pk-pk |

Y-Axis



Breakpoint table:

| Frequency | G ² /Hz | dB/Octave |
|-----------|--------------------|-----------|
| 15 Hz | 0.01 | 0 |
| 105.9 Hz | 0.01 | 6 |
| 150 Hz | 0.02 | 0 |
| 500 Hz | 0.02 | -6 |
| 2000 Hz | 0.001262 | |

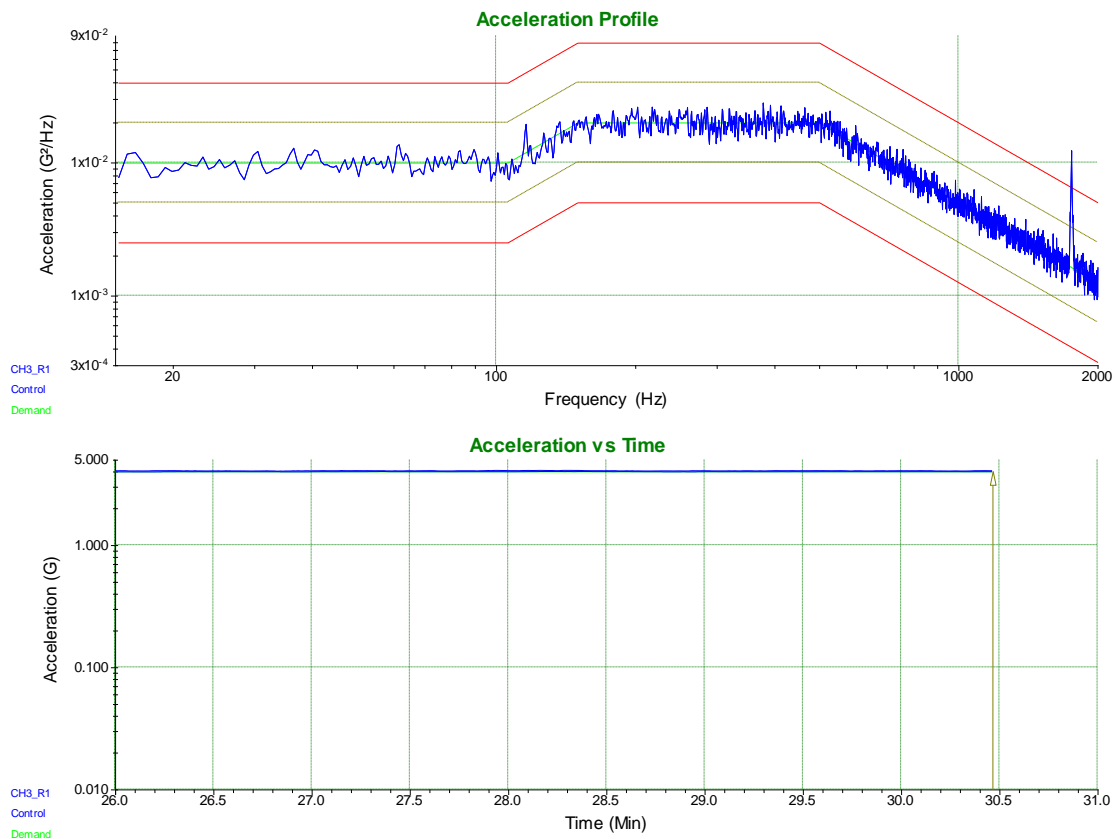
Test level schedule:

| | Duration | Level |
|--|----------|-------|
| 1) | 0:30:00 | 100 % |
| ** Test started Jul 29, 2011 13:27:46, running for 0:30:25 | | |
| ** Current level: 1, running at 100 % for 0:30:00 of 0:30:00 | | |

Measurements:

| | |
|----------------------|----------------|
| Demand: 4.011 G RMS | 1.496 mm pk-pk |
| Control: 4.012 G RMS | 1.44 mm pk-pk |

Z-Axis



Breakpoint table:

| Frequency | G ² /Hz | dB/Octave |
|-----------|--------------------|-----------|
| 15 Hz | 0.01 | 0 |
| 105.9 Hz | 0.01 | 6 |
| 150 Hz | 0.02 | 0 |
| 500 Hz | 0.02 | -6 |
| 2000 Hz | 0.001262 | |

Test level schedule:

| | Duration | Level |
|--|----------|-------|
| 1) | 0:30:00 | 100 % |
| ** Test started Aug 01, 2011 10:55:40, running for 0:30:28 | | |
| ** Current level: 1, running at 100 % for 0:30:00 of 0:30:00 | | |

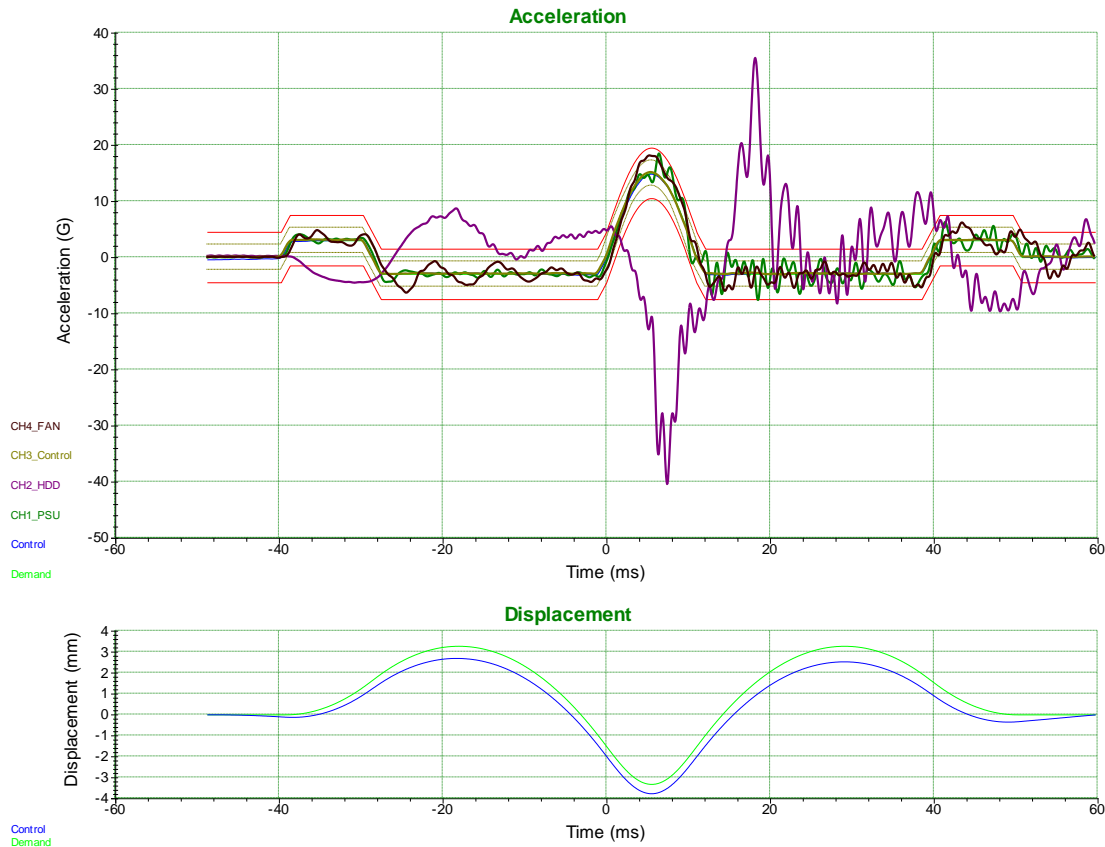
Measurements:

| | |
|----------------------|----------------|
| Demand: 4.011 G RMS | 1.496 mm pk-pk |
| Control: 4.022 G RMS | 1.405 mm pk-pk |



7.1.7 Shock – Operating

X-Axis positive



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 15:11:14
** Current level: 1, running at 100 % for 3 of 3 pulses

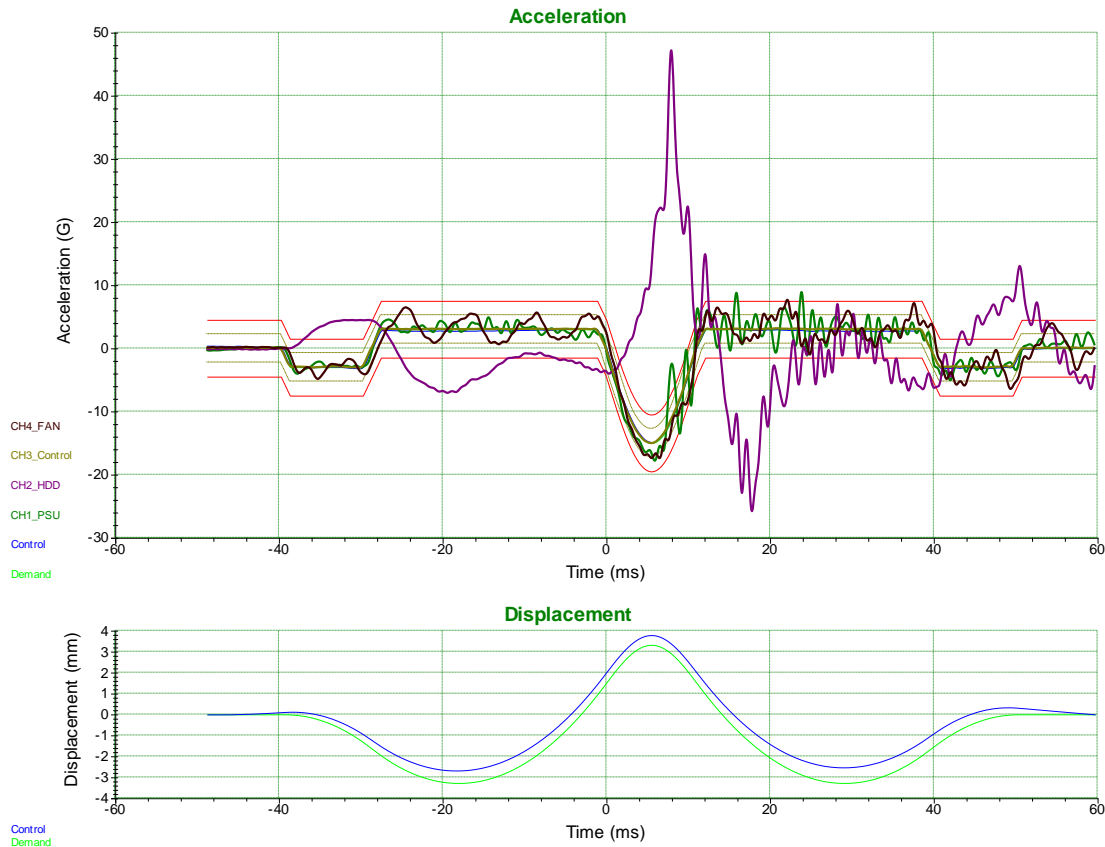
Test Profile:

11 ms Half Sine Pulse with amplitude 15 G (Positive)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 14.86 G
Output voltage: 2.129 Volts peak

X-Axis negative



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 15:12:15
** Current level: 1, running at 100 % for 3 of 3 pulses

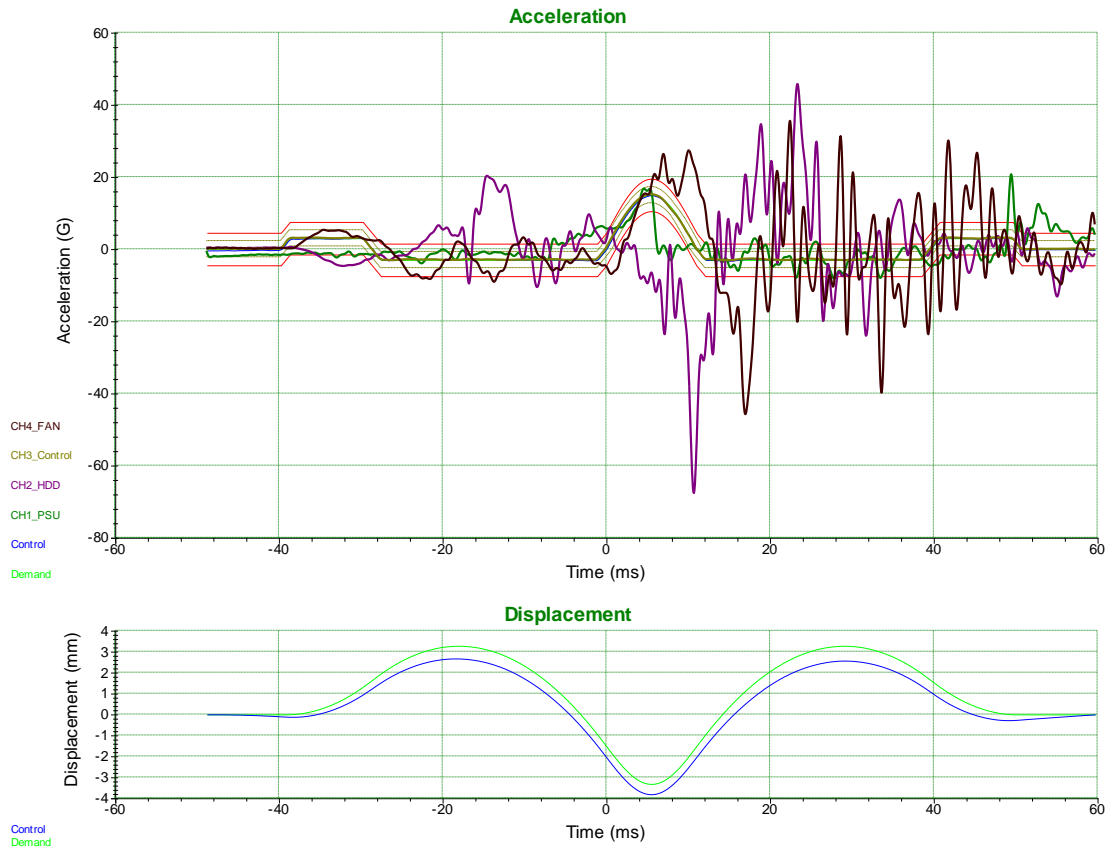
Test Profile:

11 ms Half Sine Pulse with amplitude 15 G (Negative)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 14.86 G
Output voltage: 2.167 Volts peak

Y-Axis positive



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 13:00:55
** Current level: 1, running at 100 % for 3 of 3 pulses

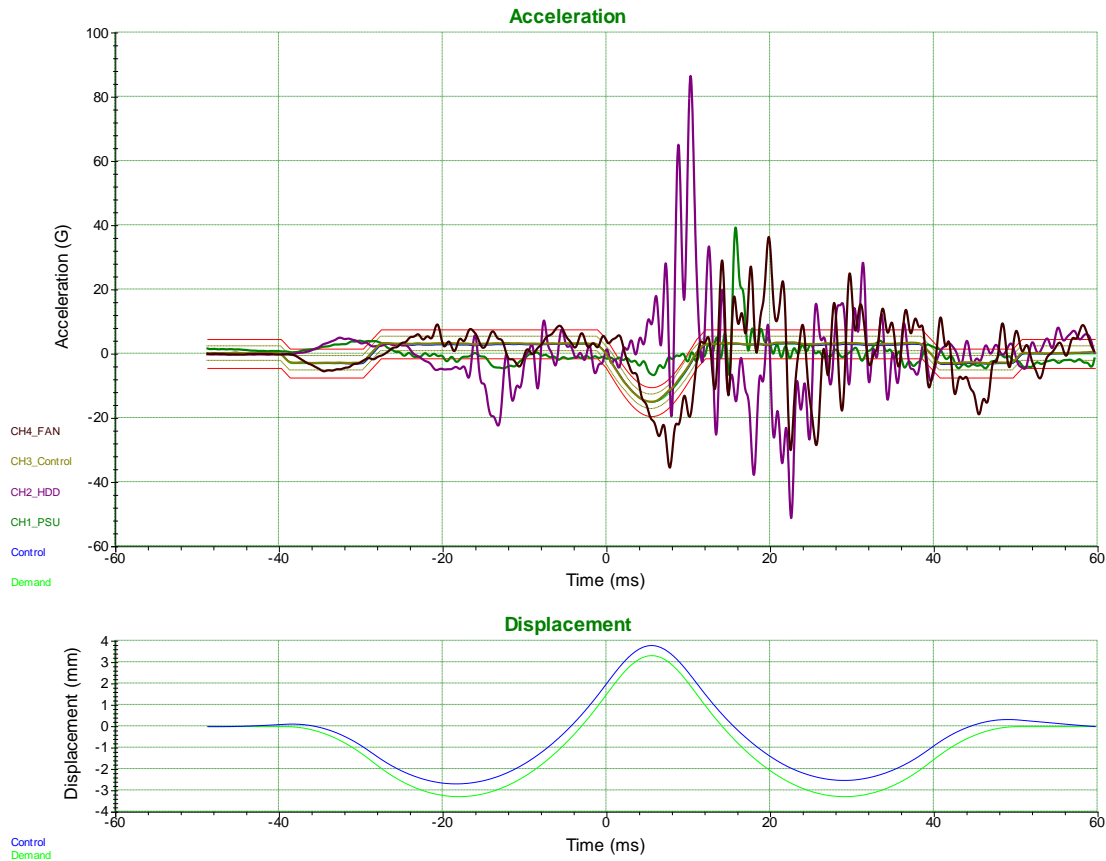
Test Profile:

11 ms Half Sine Pulse with amplitude 15 G (Positive)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 14.95 G
Output voltage: 2.285 Volts peak

Y-Axis negative



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 13:04:25
 ** Current level: 1, running at 100 % for 3 of 3 pulses

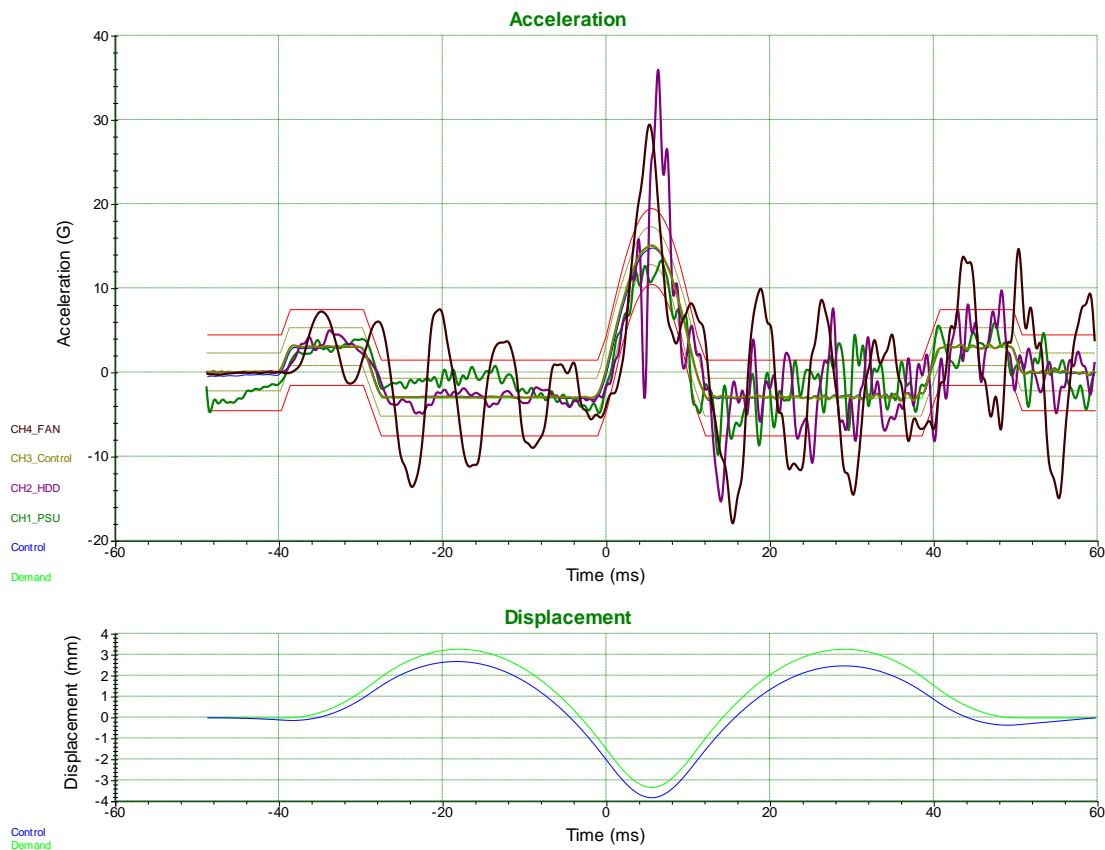
Test Profile:

11 ms Half Sine Pulse with amplitude 15 G (Negative)
 Pre-pulse amplitude: 20 % of the peak acceleration
 Post-pulse amplitude: 20 % of the peak acceleration
 Normal limits used
 Control channels: CH3_Control

Measurements:

Control amplitude: 14.93 G
 Output voltage: 1.972 Volts peak

Z-Axis positive



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 17:27:09
** Current level: 1, running at 100 % for 3 of 3 pulses

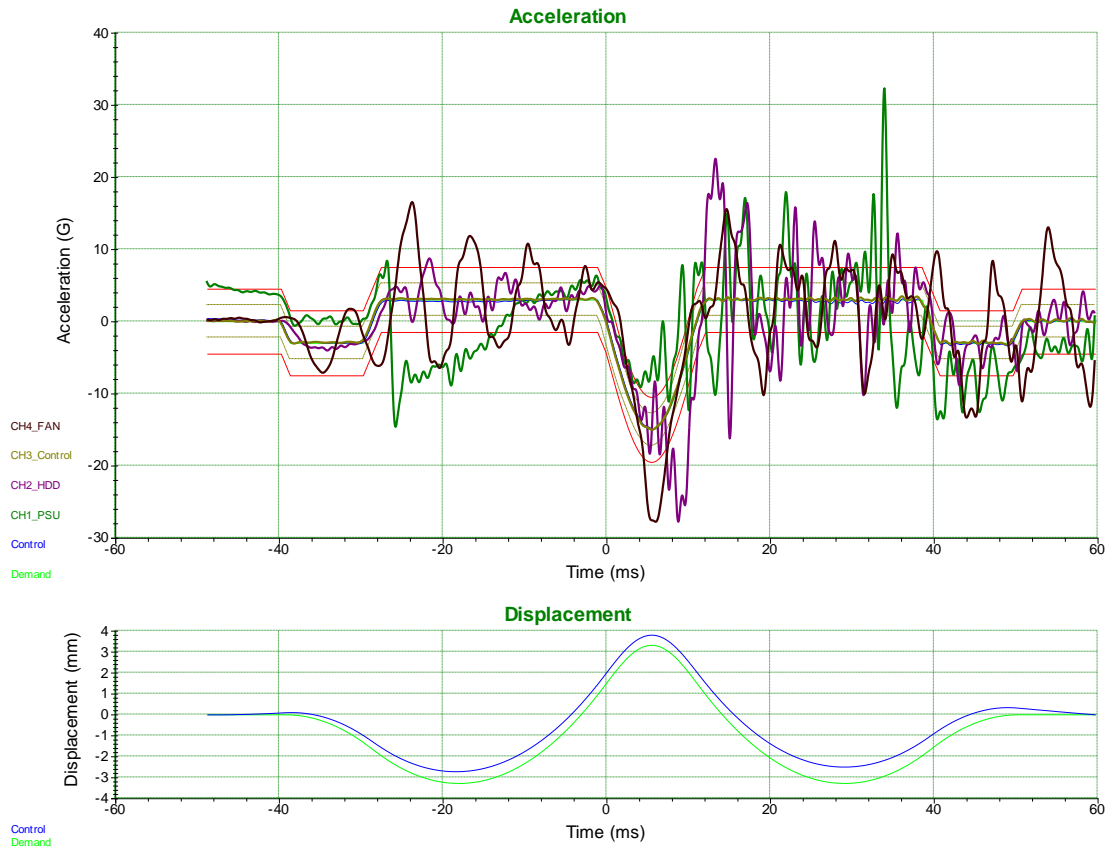
Test Profile:

11 ms Half Sine Pulse with amplitude 15 G (Positive)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 14.82 G
Output voltage: 2.562 Volts peak

Z-Axis negative



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 17:26:25
** Current level: 1, running at 100 % for 3 of 3 pulses

Test Profile:

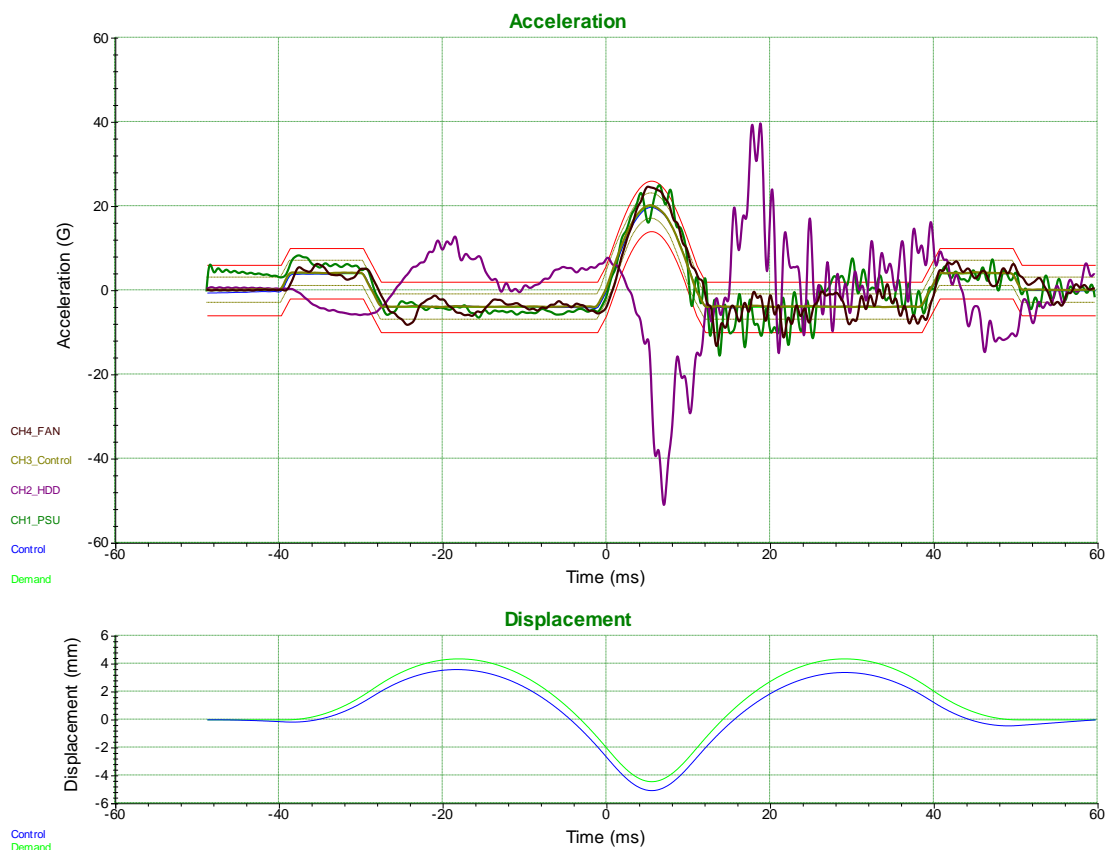
11 ms Half Sine Pulse with amplitude 15 G (Negative)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 14.88 G
Output voltage: 2.558 Volts peak

7.1.8 Shock – Non Operating

X-Axis positive



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 15:13:19
** Current level: 1, running at 100 % for 3 of 3 pulses

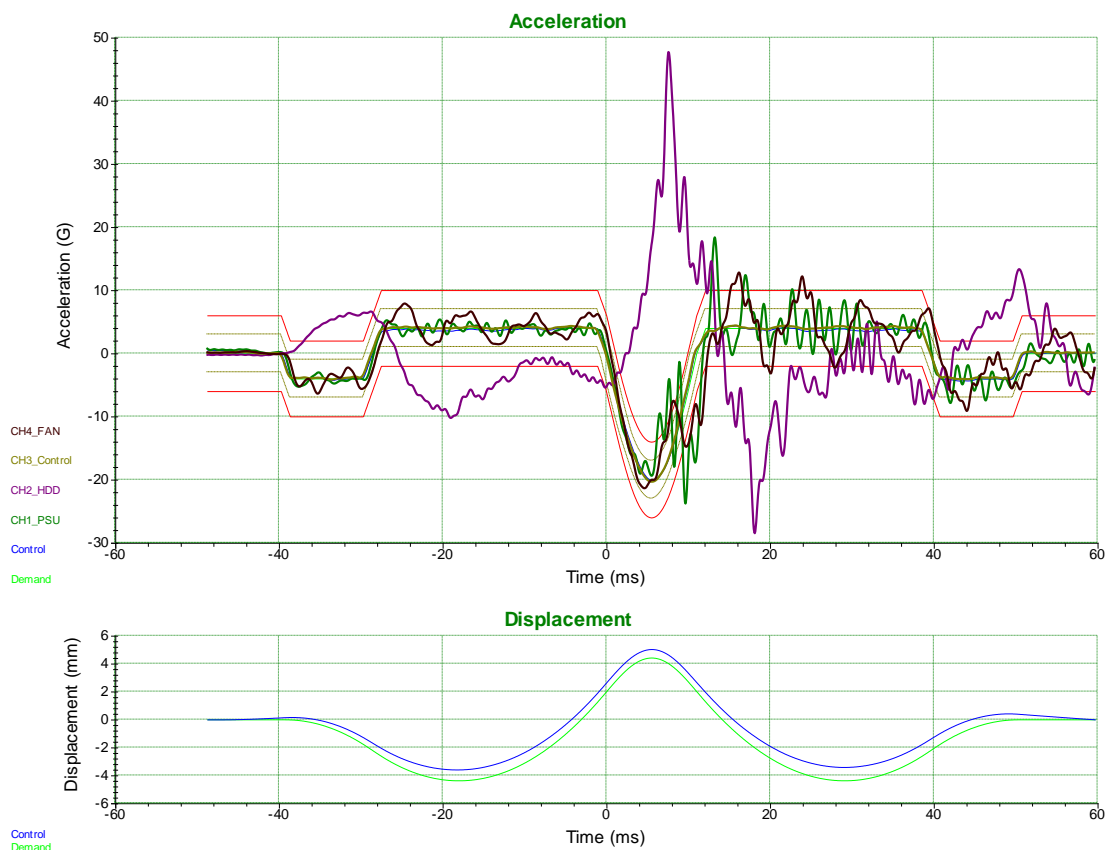
Test Profile:

11 ms Half Sine Pulse with amplitude 20 G (Positive)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 19.78 G
Output voltage: 2.867 Volts peak

X-Axis negative



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 15:13:59
** Current level: 1, running at 100 % for 3 of 3 pulses

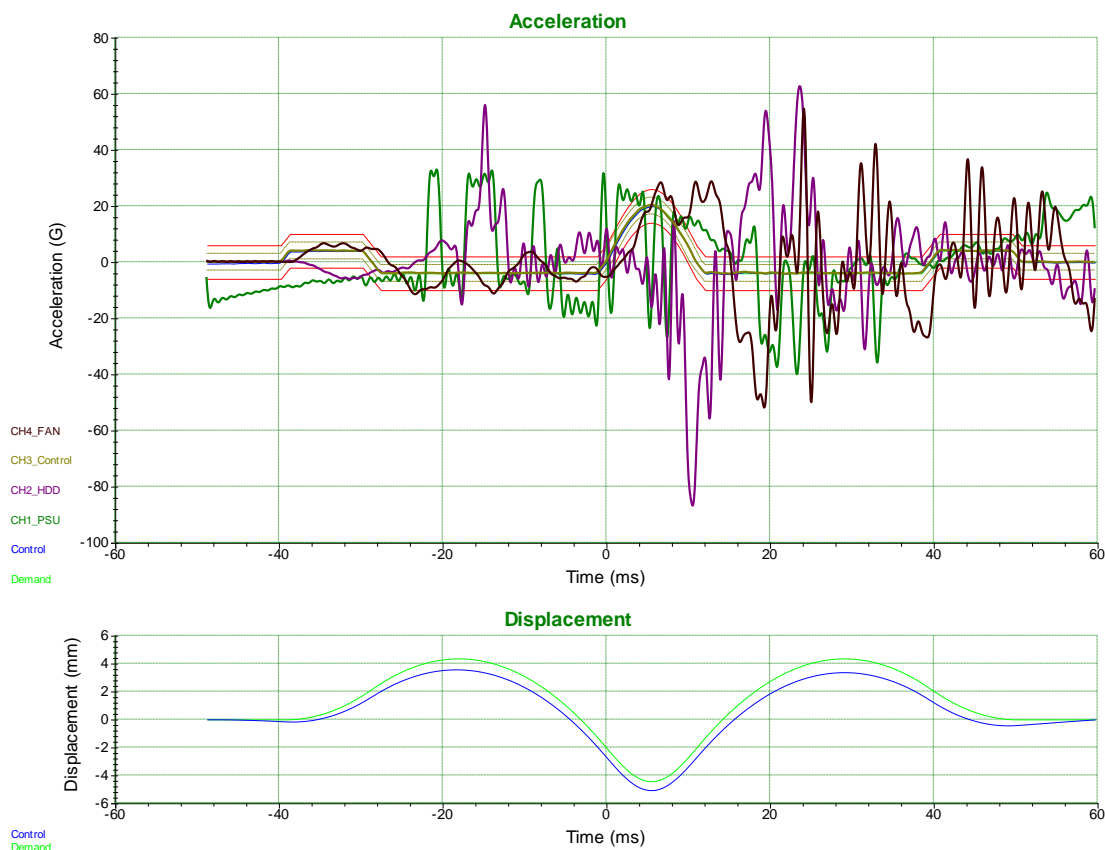
Test Profile:

11 ms Half Sine Pulse with amplitude 20 G (Negative)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 20.12 G
Output voltage: 2.771 Volts peak

Y-Axis positive



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 13:08:58
** Current level: 1, running at 100 % for 3 of 3 pulses

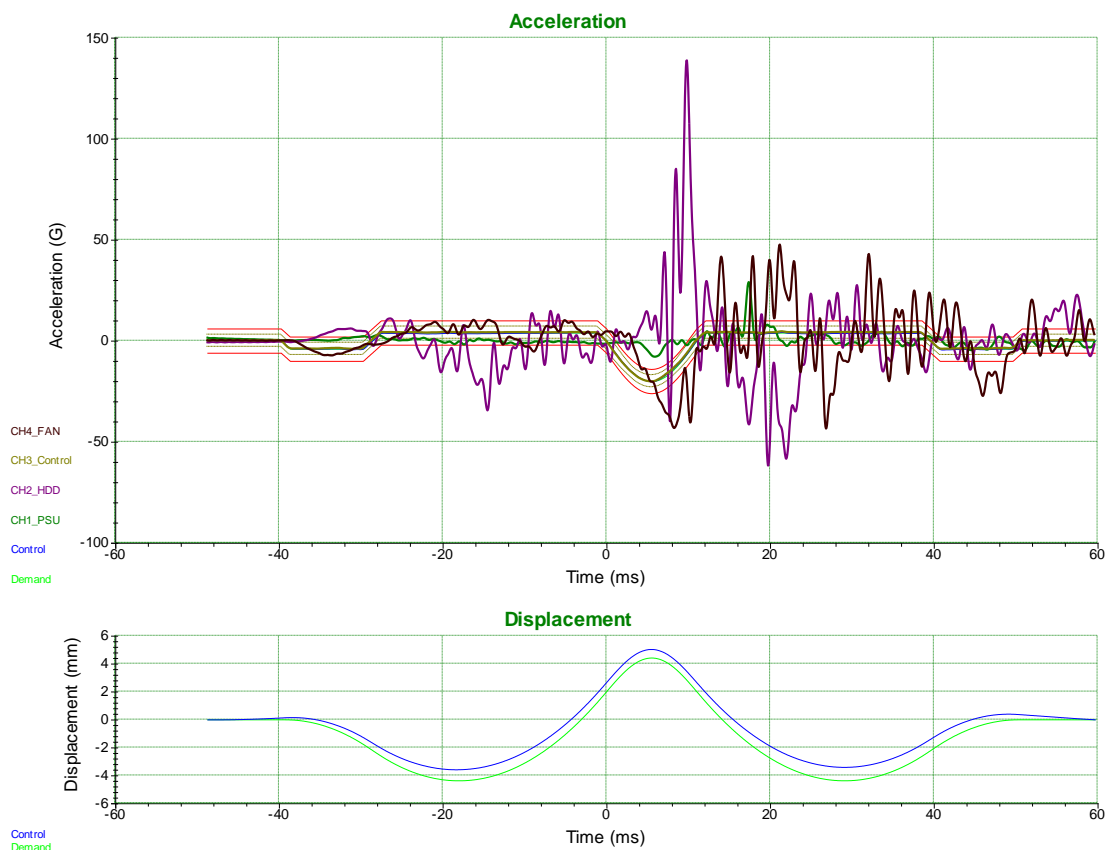
Test Profile:

11 ms Half Sine Pulse with amplitude 20 G (Positive)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 19.92 G
Output voltage: 2.491 Volts peak

Y-Axis negative



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 13:08:02
** Current level: 1, running at 100 % for 3 of 3 pulses

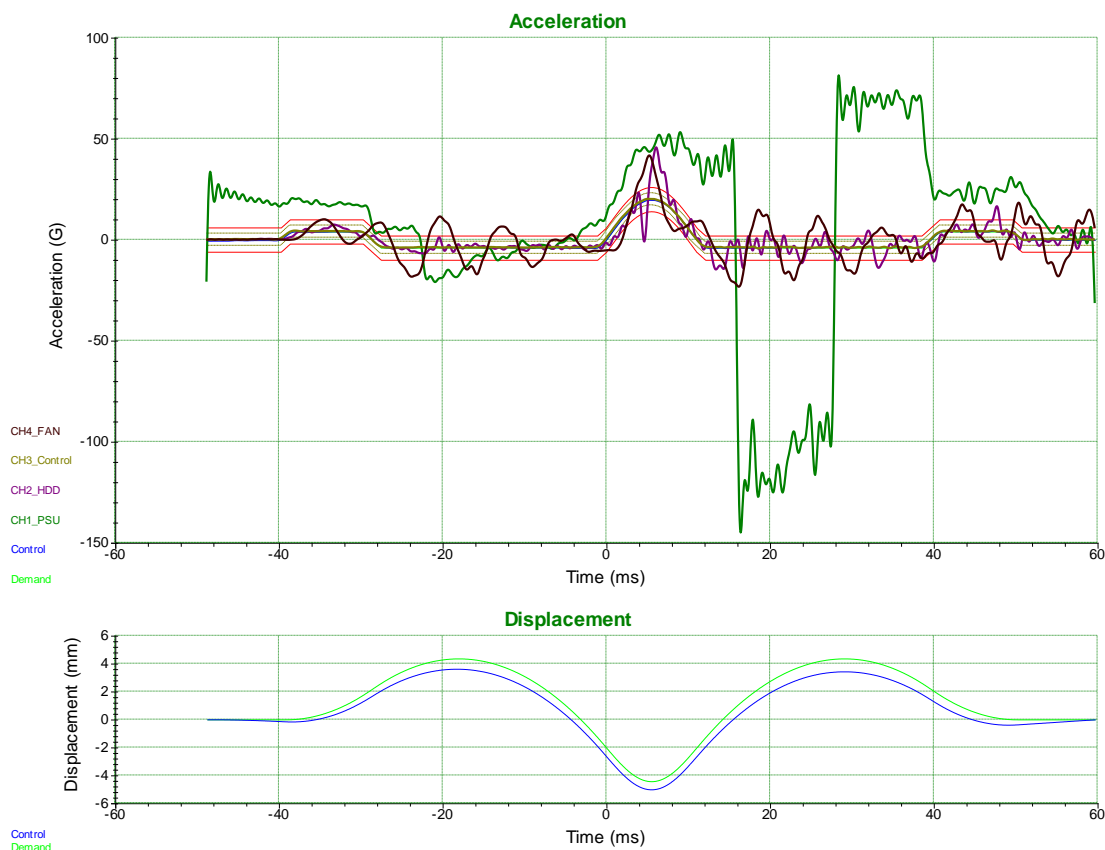
Test Profile:

11 ms Half Sine Pulse with amplitude 20 G (Negative)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 20.06 G
Output voltage: 2.562 Volts peak

Z-Axis positive



Test level schedule:

- | | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |
- ** Test started Jul 20, 2011 17:29:35
** Current level: 1, running at 100 % for 3 of 3 pulses

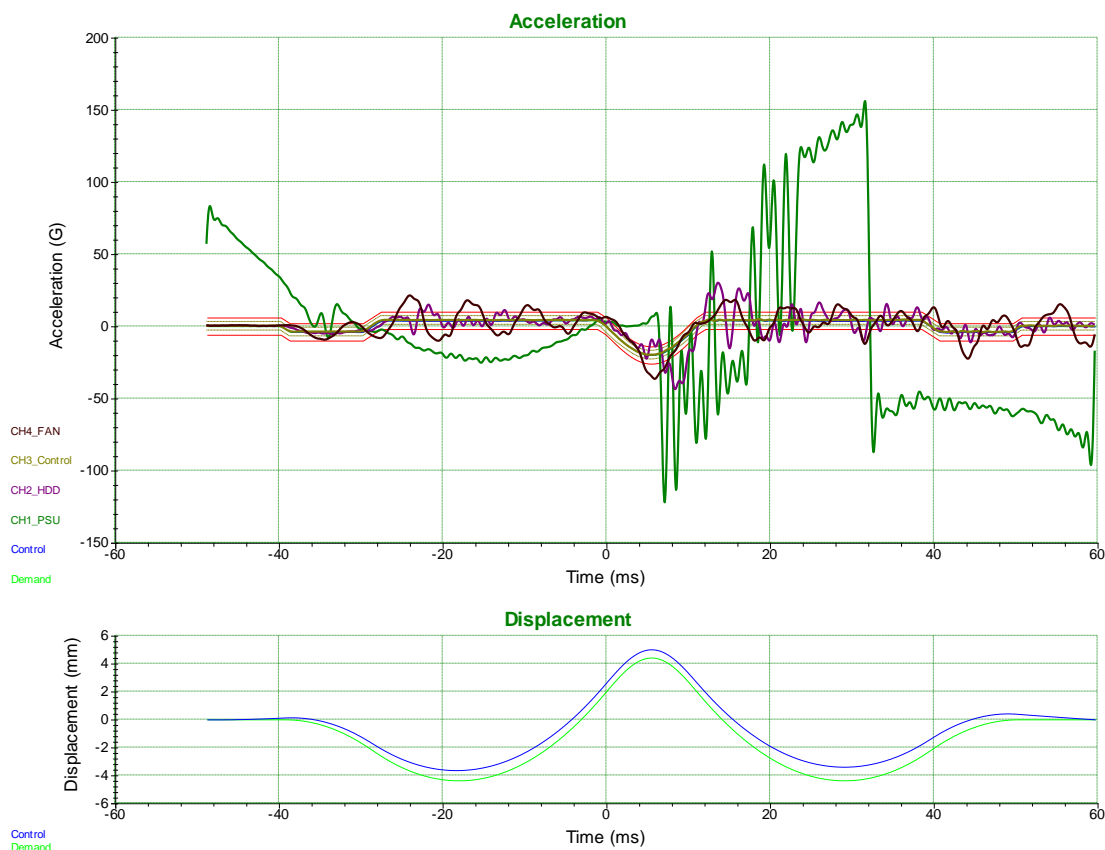
Test Profile:

11 ms Half Sine Pulse with amplitude 20 G (Positive)
Pre-pulse amplitude: 20 % of the peak acceleration
Post-pulse amplitude: 20 % of the peak acceleration
Normal limits used
Control channels: CH3_Control

Measurements:

Control amplitude: 19.66 G
Output voltage: 3.418 Volts peak

Z-Axis negative



Test level schedule:

| | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 100 % |

** Test started Jul 20, 2011 17:28:44

** Current level: 1, running at 100 % for 3 of 3 pulses

Test Profile:

11 ms Half Sine Pulse with amplitude 20 G (Negative)

Pre-pulse amplitude: 20 % of the peak acceleration

Post-pulse amplitude: 20 % of the peak acceleration

Normal limits used

Control channels: CH3_Control

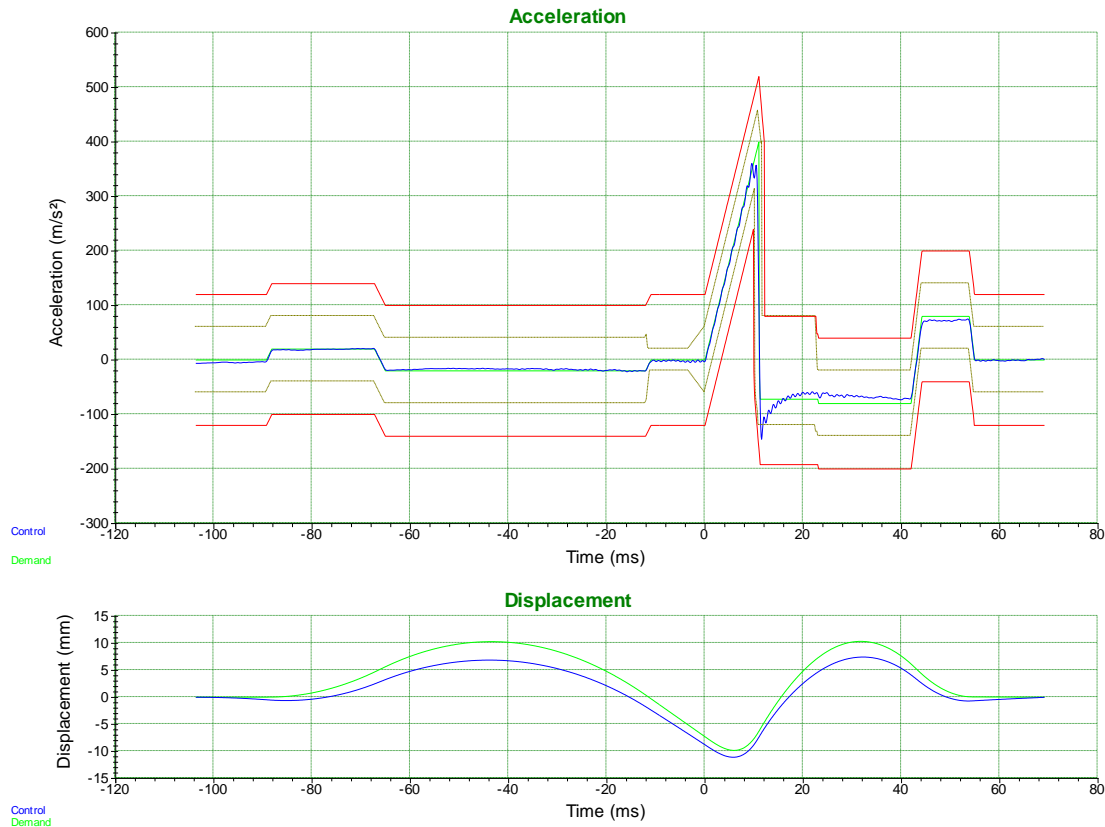
Measurements:

Control amplitude: 19.7 G

Output voltage: 3.447 Volts peak

7.1.9 Shock – Method 516.5, procedure I – Non Operating

X-Axis positive



Test level schedule:

| | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 60 % |
| 2) | 3 | 80 % |
| 3) | 3 | 100 % |

** Test started Sep 14, 2011 11:46:33

** Current level: 3, running at 100 % for 3 of 3 pulses

Test Profile:

11 ms Terminal Peak Sawtooth Pulse with amplitude 400 m/s² (Positive)

Pre-pulse amplitude: 5 % of the peak acceleration

Post-pulse amplitude: 20 % of the peak acceleration

MIL-STD limits enabled

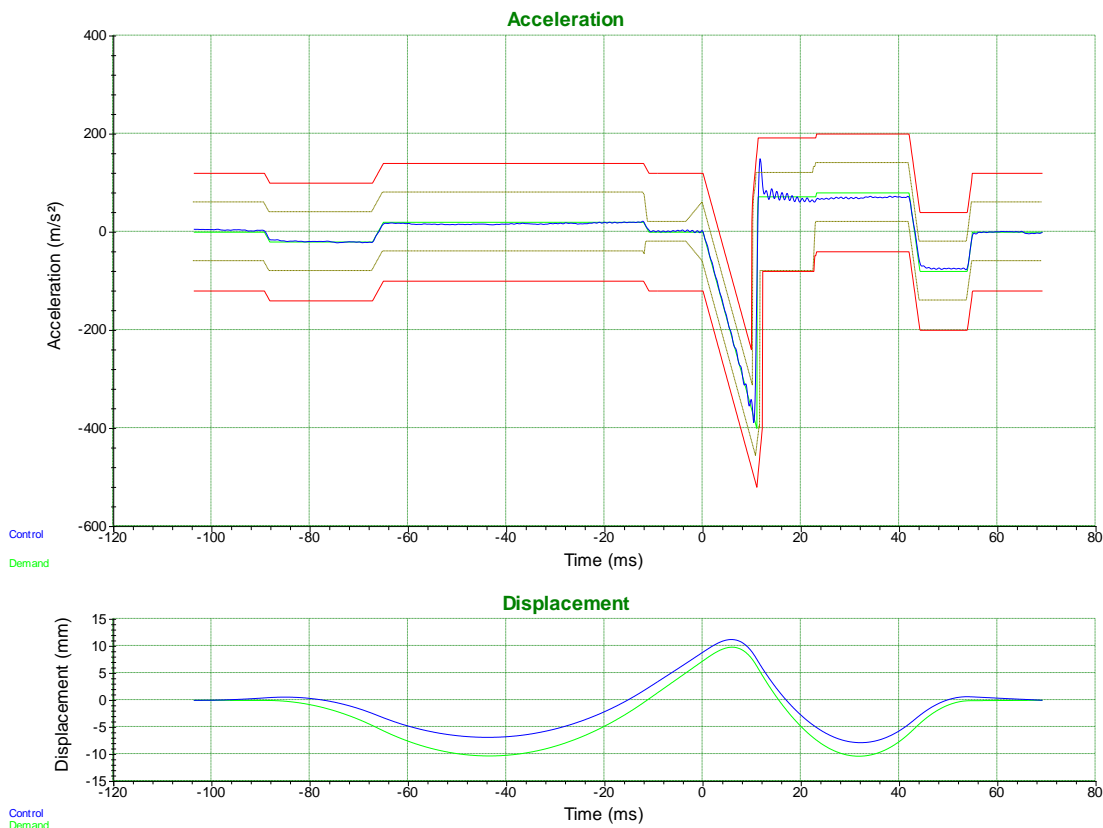
Control channels: CH1_R1

Measurements:

Control amplitude: 360.4 m/s²

Output voltage: 5.642 Volts peak

X-Axis negative



Test level schedule:

| | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 60 % |
| 2) | 3 | 80 % |
| 3) | 3 | 100 % |

** Test started Sep 14, 2011 11:54:36

** Current level: 3, running at 100 % for 3 of 3 pulses

Test Profile:

11 ms Terminal Peak Sawtooth Pulse with amplitude 400 m/s² (Negative)

Pre-pulse amplitude: 5 % of the peak acceleration

Post-pulse amplitude: 20 % of the peak acceleration

MIL-STD limits enabled

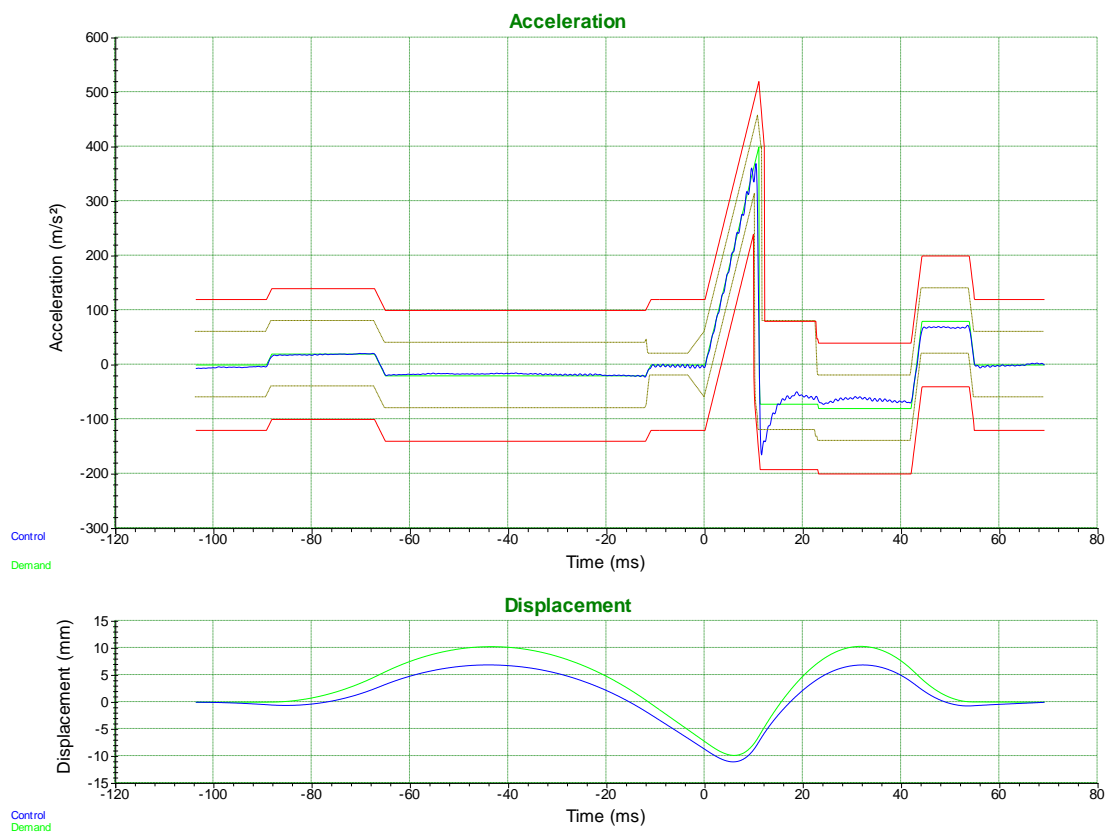
Control channels: CH1_R1

Measurements:

Control amplitude: 388.1 m/s²

Output voltage: 5.375 Volts peak

Y-Axis positive



Test level schedule:

| | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 60 % |
| 2) | 3 | 80 % |
| 3) | 3 | 100 % |

** Test started Sep 14, 2011 11:32:58

** Current level: 3, running at 100 % for 3 of 3 pulses

Test Profile:

11 ms Terminal Peak Sawtooth Pulse with amplitude 400 m/s² (Positive)

Pre-pulse amplitude: 5 % of the peak acceleration

Post-pulse amplitude: 20 % of the peak acceleration

MIL-STD limits enabled

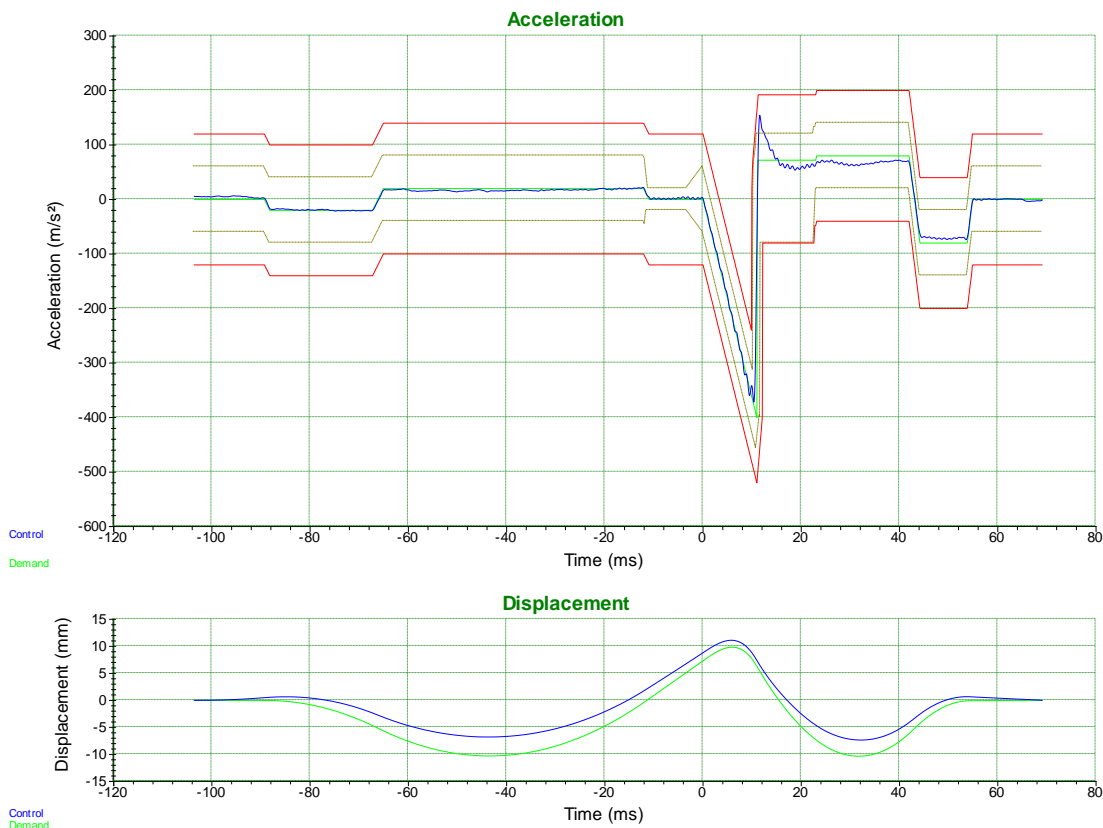
Control channels: CH1_R1

Measurements:

Control amplitude: 369.4 m/s²

Output voltage: 5.723 Volts peak

Y-Axis negative



Test level schedule:

| | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 60 % |
| 2) | 3 | 80 % |
| 3) | 3 | 100 % |

** Test started Sep 14, 2011 11:28:32

** Current level: 3, running at 100 % for 3 of 3 pulses

Test Profile:

11 ms Terminal Peak Sawtooth Pulse with amplitude 400 m/s² (Negative)

Pre-pulse amplitude: 5 % of the peak acceleration

Post-pulse amplitude: 20 % of the peak acceleration

MIL-STD limits enabled

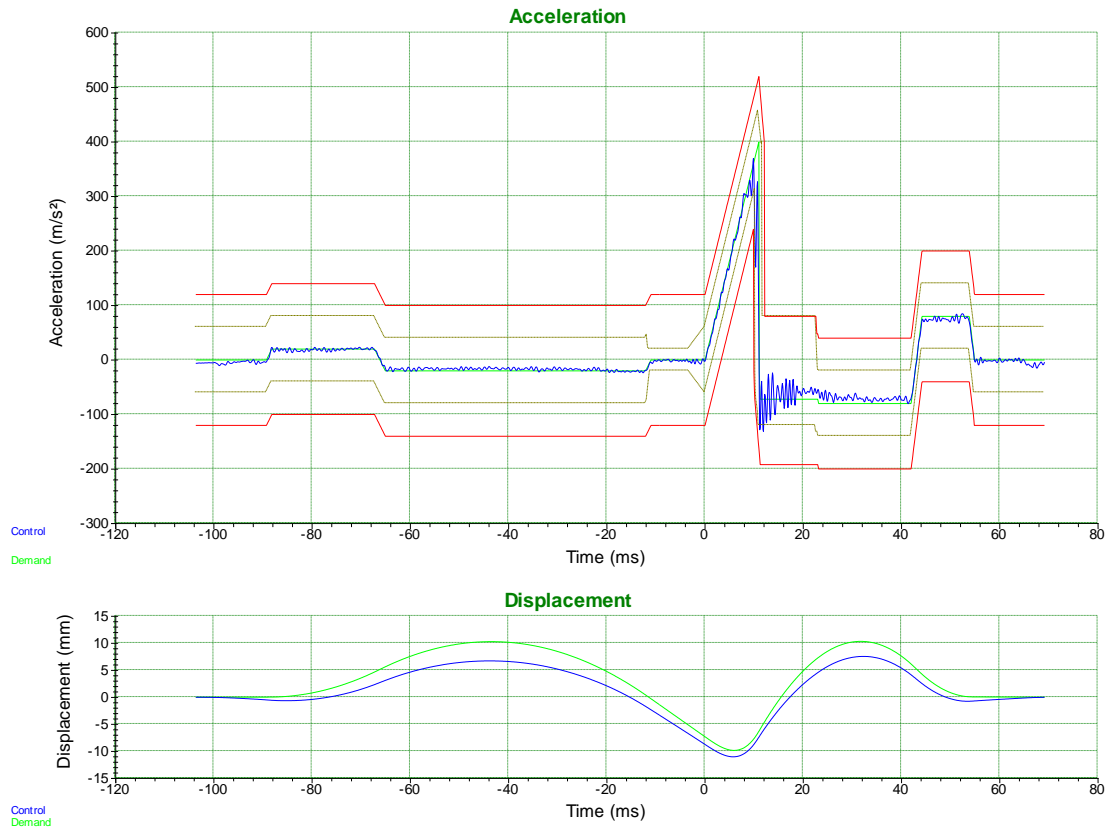
Control channels: CH1_R1

Measurements:

Control amplitude: 371.8 m/s²

Output voltage: 5.693 Volts peak

Z-Axis positive



Test level schedule:

| | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 60 % |
| 2) | 3 | 80 % |
| 3) | 3 | 100 % |

** Test started Sep 14, 2011 10:27:15

** Current level: 3, running at 100 % for 3 of 3 pulses

Test Profile:

11 ms Terminal Peak Sawtooth Pulse with amplitude 400 m/s² (Positive)

Pre-pulse amplitude: 5 % of the peak acceleration

Post-pulse amplitude: 20 % of the peak acceleration

MIL-STD limits enabled

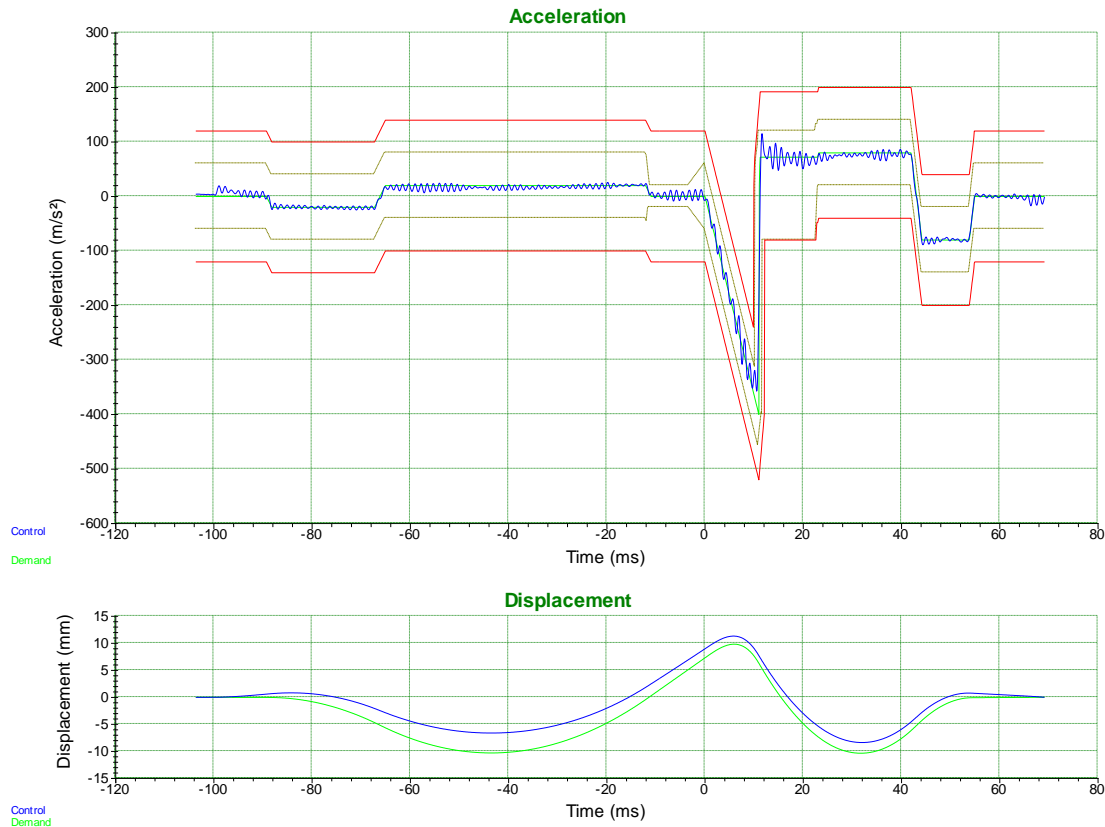
Control channels: CH3_R

Measurements:

Control amplitude: 369.8 m/s²

Output voltage: 5.875 Volts peak

Z-Axis negative



Test level schedule:

| | Pulses | Level |
|----|--------|-------|
| 1) | 3 | 60 % |
| 2) | 3 | 80 % |
| 3) | 3 | 100 % |

** Test started Sep 14, 2011 10:33:33

** Current level: 3, running at 100 % for 3 of 3 pulses

Test Profile:

11 ms Terminal Peak Sawtooth Pulse with amplitude 400 m/s² (Negative)

Pre-pulse amplitude: 5 % of the peak acceleration

Post-pulse amplitude: 20 % of the peak acceleration

MIL-STD limits enabled

Control channels: CH3_R

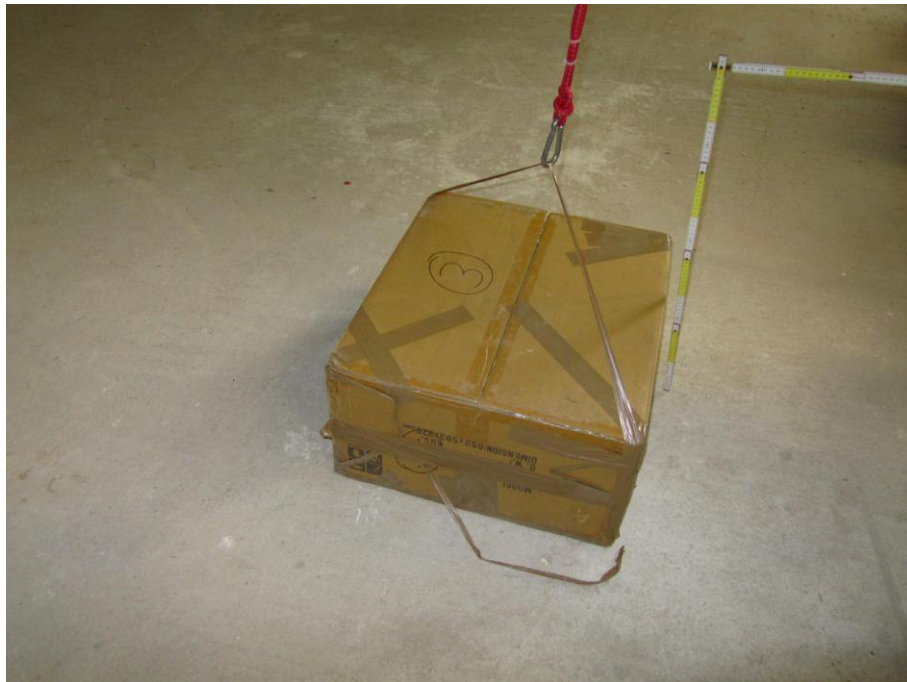
Measurements:

Control amplitude: 357.2 m/s²

Output voltage: 4.937 Volts peak

7.1.10 Drop Test – Shipping Package













8 Revision History

| Revision History | | | |
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