REPORT
issued by an Accredited Testing Laboratory

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1002
ISO/IEC 17025

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# Mechanical test on Netbiter EC350

(1 appendix)

## Summary

This report comprises Mechanical tests performed on two modules of Netbiter EC350, prototype 11 and 22.

The test objects have been tested at SP according to IEC standards and with severities stated by the Client.

The functional test equipment was provided by the Client. The Client is responsible for that the functional test method is relevant and controlling necessary functions of the test objects.

The functional test and the visual inspection, during and after each test axis, were performed by the Client´s representatives and without any remarks according to the them.

The mechanical tests were performed without any remarks.

# 1 Client

HMS Industrial Networks AB, Stationsgatan 37, SE-302 45 Halmstad, Sweden.

# 2 Test object

Two modules of Netbiter EC350, prototype 11 and 22.

# 3 Commission

## 3.1 Functional test

The functional test equipment shall be provide by the Client. The Client is responsible for that the functional test method is relevant and controlling necessary functions of the test objects.

Functional test shall be performed during the test and after each test axis. Visual inspection shall be performed after each test axis. The functional test will be performed by the Client´s representatives.

## 3.2 Sinusoidal vibration test

Sinusoidal vibration test in accordance with IEC 60068-2-6, test Fc as reference and with severities stated by the Client.

Severities

| | |
|---|---|
| Frequency range | 10 - 500 Hz |
| Number of axes | 3 mutually perpendicular axes |
| Sweep rate | 1 octave per minute |
| Number of sweep | 10 sweep cycles per axis |
| Mode | in operation |

**Table 3.2.1 – Frequency and displacement/acceleration**

| Frequency [Hz] | Displacement/Acceleration |
|---|---|
| 10 – 58 | 0,35 mm |
| 58 – 500 | 5 g |

## 3.3 Shock test A

Shock tests in accordance with IEC 60068-2-27, test Ea as reference and with the severities stated by the Client.

Severities

| | |
|---|---|
| Wave shape | half sine |
| Number of shocks | 3 positive and 3 negative shocks in each of 3 mutually perpendicular axes |
| Mode | in operation |

**Table 3.3.1 – Axes, acceleration and duration**

| Axes | Acceleration [m/s²] | Duration [ms] |
|---|---|---|
| ±X, ±Y, ±Z | 30 | 11 |

### 3.4 Shock test B

Shock tests in accordance with IEC 60068-2-27, test Ea as reference and with the severities stated by the client.

Severities

| | |
|---|---|
| Wave shape | half sine |
| Number of shocks | 3 positive and 3 negative shocks in each of 3 mutually perpendicular axes |
| Mode | in operation |

**Table 3.4.1 – Axes, acceleration and duration**

| Axes | Acceleration [g] | Duration [ms] |
|---|---|---|
| ±X, ±Y, ±Z | 50 | 11 |

## 4 Performance and results

### 4.1 Performance

Netbiter EC350 prototype 11was mounted directly to an aluminium fixture with four m4 screws. Netbiter EC350 prototype 22 was mounted on a DIN-rail which was mounted to the same aluminium fixture as mentioned before. The DIN-rail was mounted to the fixture with three m5 screws.

Mounting pictures, control accelerometer positions and control signal with upper and lower abort limits are shown in appendix 1.

#### 4.1.1 Functional test

Functional test was performed during the test and after each test axis by the client´s representatives. Visual control was performed after each test axis.

The Device under Test was during the vibration & shock sending data on all ports.

- The Ethernet ports were verified by sending data individually to two auxiliary equipment (AE). The two AE then returned the data and this was in turn verified by the Netbiter EC350. If any errors occurred, these would be displayed on a computer running PuTTY connected to the module's RS232 port.
- The RS485 port was verified by sending 2 bytes via Modbus RTU (switching from AA, BB, 55 and 66) to a computer running Modsim32. The data was then returned to the Netbiter EC350 which verified the data and any errors would be displayed in the same manner as the Ethernet test described above.
- The modem was tested by continuously pinging an external server (in this case, www.google.com). If any errors occurred, these would be displayed as in the tests above.
- The Analog inputs were tested by having a PT100 sensor attached to the module which continuously measured the temperature in the room. If any errors occurred, these would be displayed as faulty values. All values were read at the end of each test.
- The digital inputs/outputs and relay were tested by having the relay switching and the inputs and outputs controlling that the correct data came through. If any errors occurred, these would be displayed as mentioned in the Ethernet test above.

### 4.1.2 Sinusoidal vibration test

Sinusoidal vibration test was performed by Ms Rebecca Hultman on Mars 6, 2014.

The sinusoidal vibration test was performed according to IEC 60068-2-6, test Fc as reference and with severities stated in Commission, chapter 3.2.

Weighted average control was used with two accelerometers.

Acceleration measurements were performed with two accelerometers on locations selected by the client representative Mr Jon Larsson and Mr Richard Andersson.

### 4.1.3 Shock test A

Shock test A was performed by Ms Rebecca Hultman on March 6, 2014.

The shock test A test was performed according to IEC 60068-2-27, test Ea as reference and with severities stated in Commission, chapter 3.3.

### 4.1.4 Shock test B

Shock test B was performed by Ms Rebecca Hultman on March 6, 2014.

The shock test B was performed according to IEC 60068-2-27, test Ea as reference and with severities stated in Commission, chapter 3.4. Due to limitations of the vibrator system, the acceleration was reduced to 48 g and the duration was reduced to 10 ms.

## 4.2 Result

**Table 4.2.1 – Test sequence**

| Date | Test | Result/Comment |
|---|---|---|
| 2014-03-06 | Functional test | Ok |
| 2014-03-06 | Sinusoidal vibration test | Z-axis |
| 2014-03-06 | Functional test | Ok |
| 2014-03-06 | Sinusoidal vibration test | Y-axis |
| 2014-03-06 | Functional test | Ok |
| 2014-03-06 | Sinusoidal vibration test | X-axis |
| 2014-03-06 | Functional test | Ok |
| 2014-03-06 | Shock test A | Y-axis |
| 2014-03-06 | Functional test | Ok |
| 2014-03-06 | Shock test B | Y-axis* |
| 2014-03-06 | Functional test | Ok |
| 2014-03-06 | Shock test A | X-axis |
| 2014-03-06 | Functional test | Ok |
| 2014-03-06 | Shock test B | X-axis* |
| 2014-03-06 | Functional test | Ok |
| 2014-03-06 | Shock test A | Z-axis |
| 2014-03-06 | Functional test | Ok |
| 2014-03-06 | Shock test B | Z-axis* |
| 2014-03-06 | Functional test | Ok |

**Due to limitations of the vibrator system, the acceleration was reduced to 48 g and the duration was reduced to 10 ms.*

The results of the functional tests was performed without any remarks, according to the Client.

The Mechanical tests were performed without any remarks.

The result of the acceleration measurements are shown in appendix 1.

The test results relates only to the tested object.

## 5 Measuring uncertainties

Acceleration ± 3,2 %
Frequency 5-100 Hz ± 0,5 Hz
Frequency >100 Hz ± 0,5 %
(The values are evident from SP-METHOD 1606, rev.7)

## 6 Test equipment

**Table 6.1 – Test equipment**

| Description | Serial No. |
|---|---|
| Vibrator system, ETS | SP No. 902209 |
| Controller, VXI | SP No. 503665 |
| Accelerometer, Dytran | S/N 2009 |
| Accelerometer, Dytran | S/N 431 |
| Accelerometer, Kistler | S/N C132758 |
| Accelerometer, Kistler | S/N C132764 |
| Scale, JuniScale/200/10 | S/N 40828 |

**SP Technical Research Institute of Sweden**
**Electronics - Environmental Durability**

Performed by

Rebecca Hultman

Examined by

Mats Lindgren

**Appendix**

*Mounting pictures, control accelerometer positions, control signal and measuring signal with upper and lower abort limits*

Appendix 1

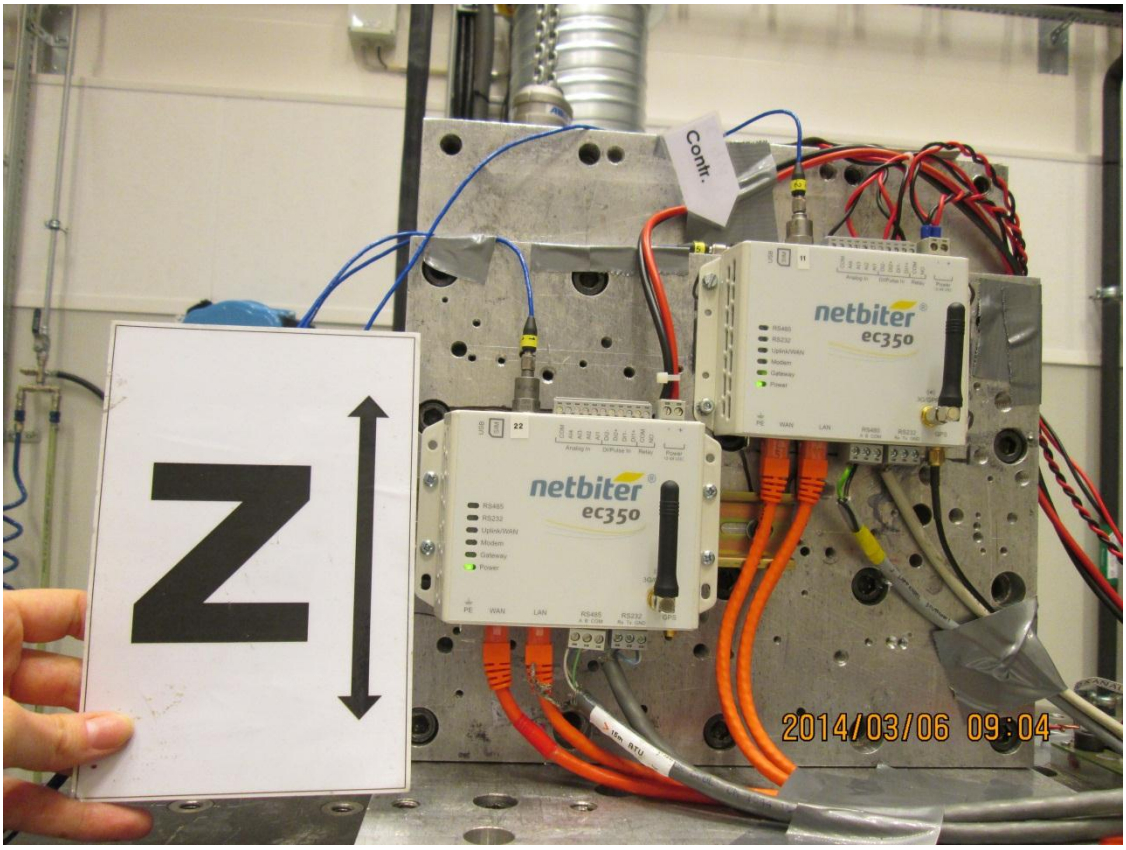



**Image 1. Test setup for Sinusoidal vibration test, Z-axis**

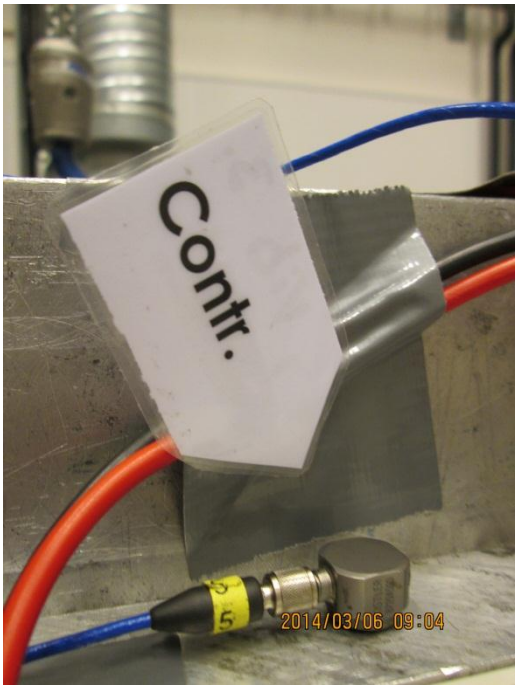



**Image 2. One of the control accelerometer positions for Sinusoidal vibration test, Z-axis**

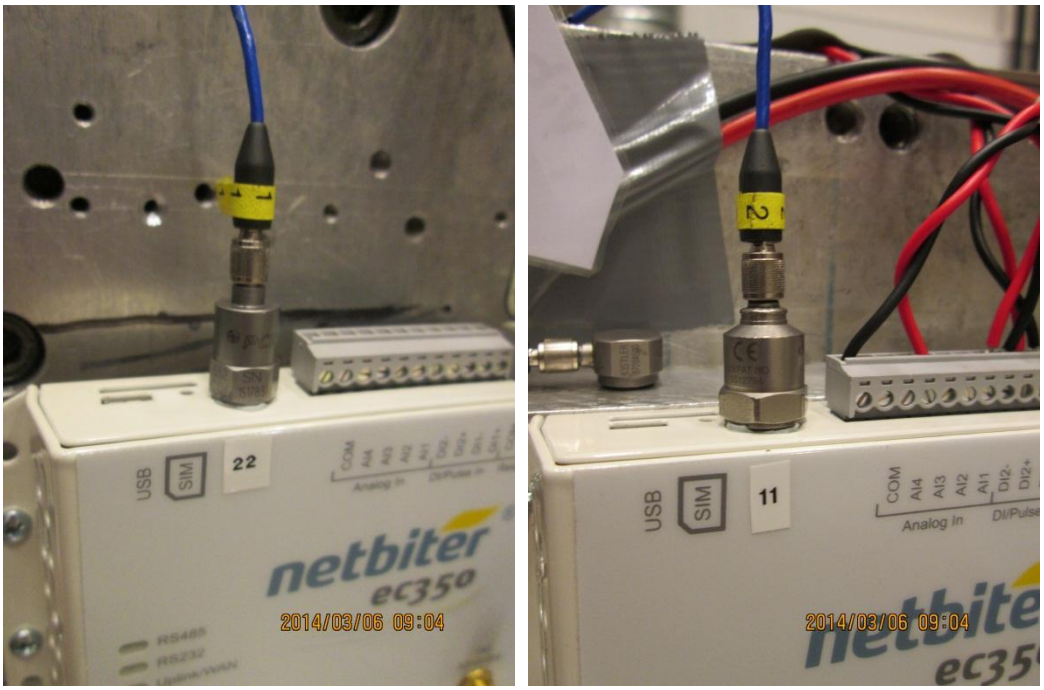
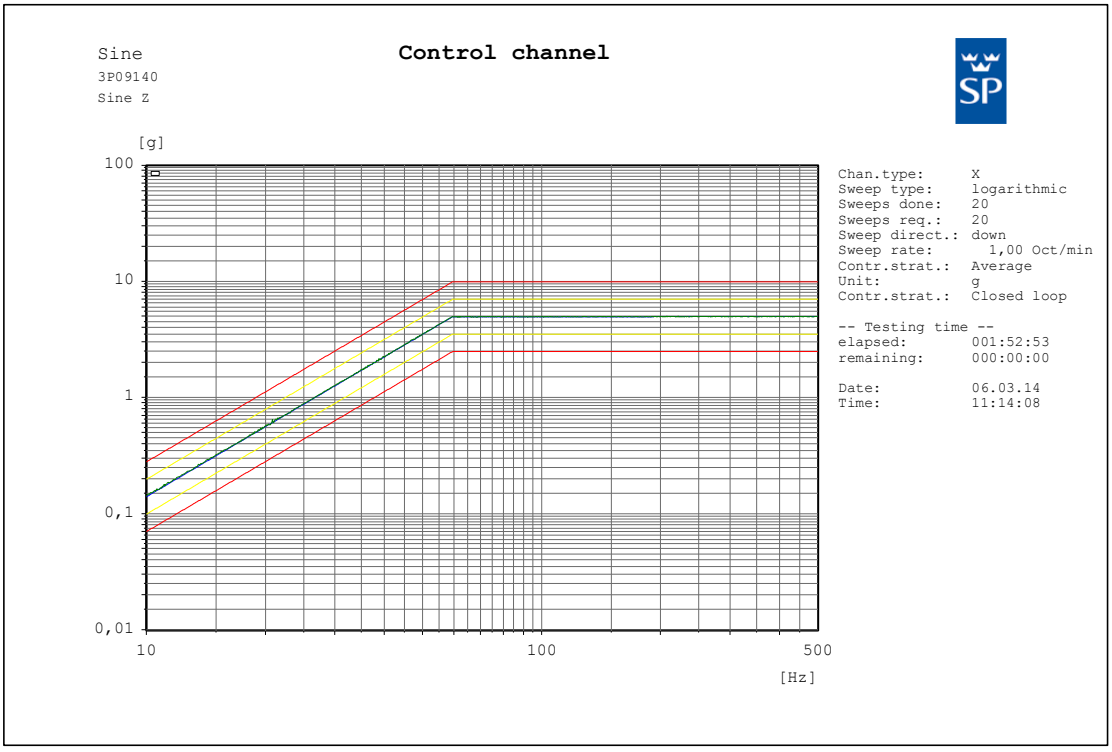
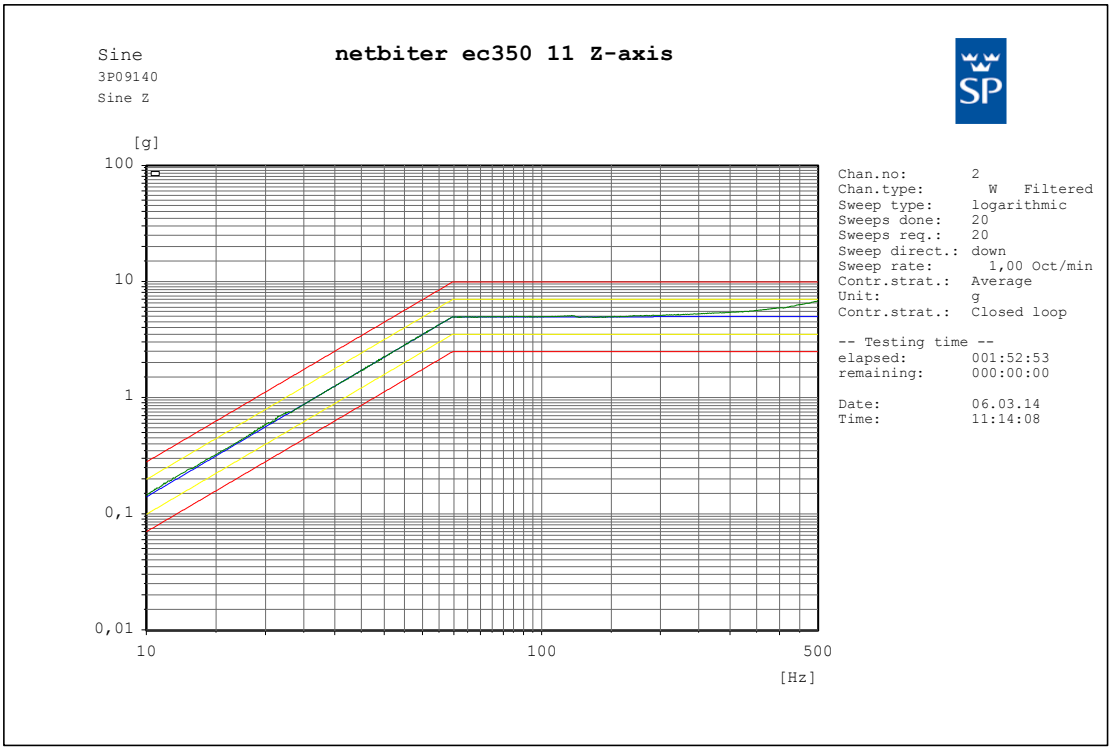



**Image 3 and image 4. Measuring accelerometer positions for Sinusoidal vibration test, Z-axis**




**Graph 1. Sinusoidal vibration frequency plot, Z-axis**

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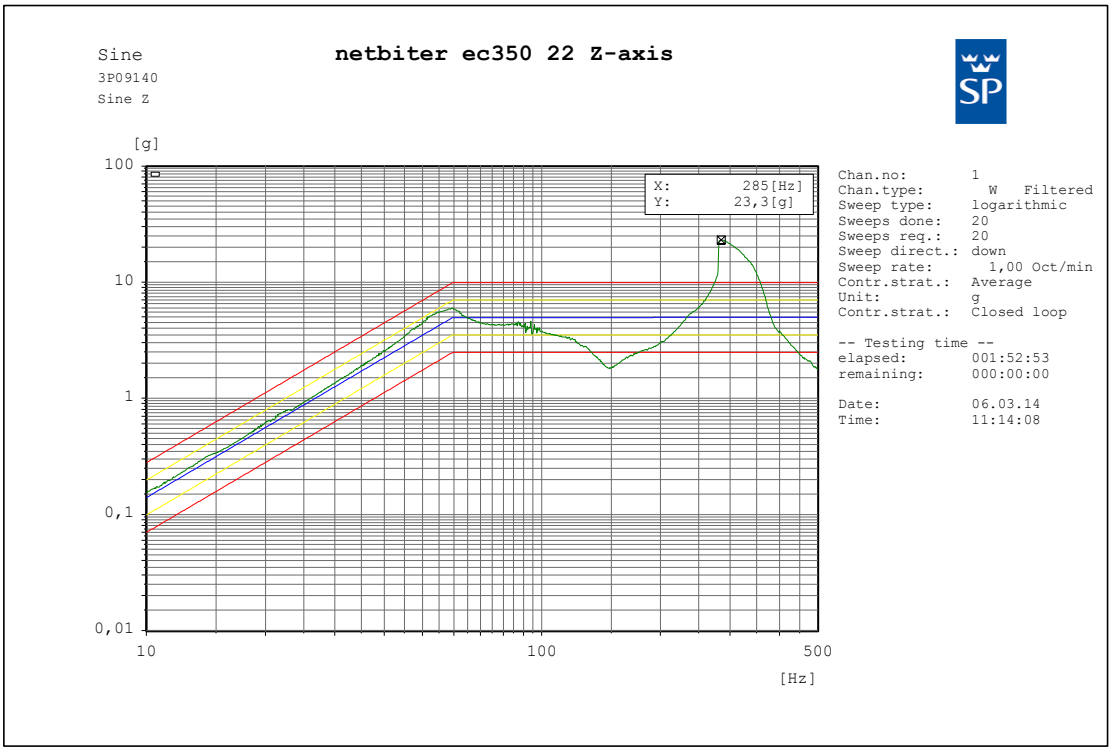
**Graph 2. Sinusoidal vibration frequency plot, Z-axis**

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**Graph 3. Sinusoidal vibration frequency plot, Z-axis**

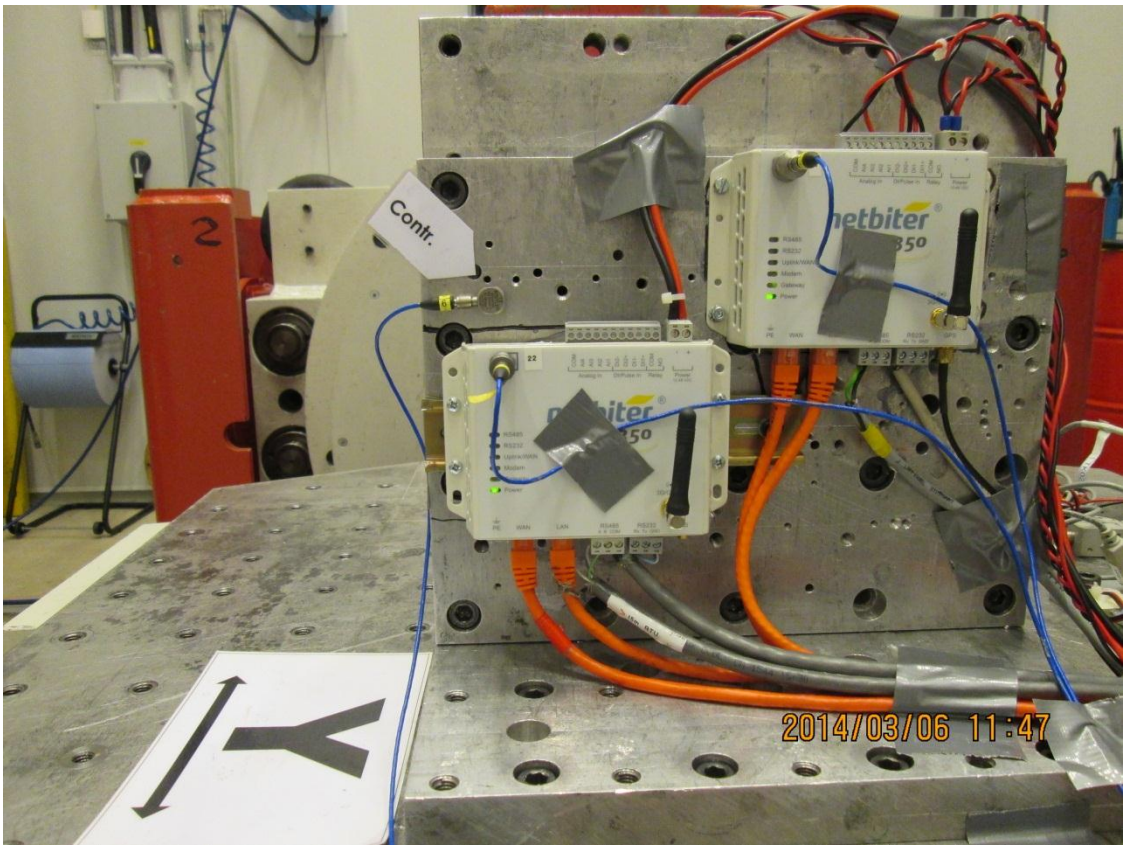
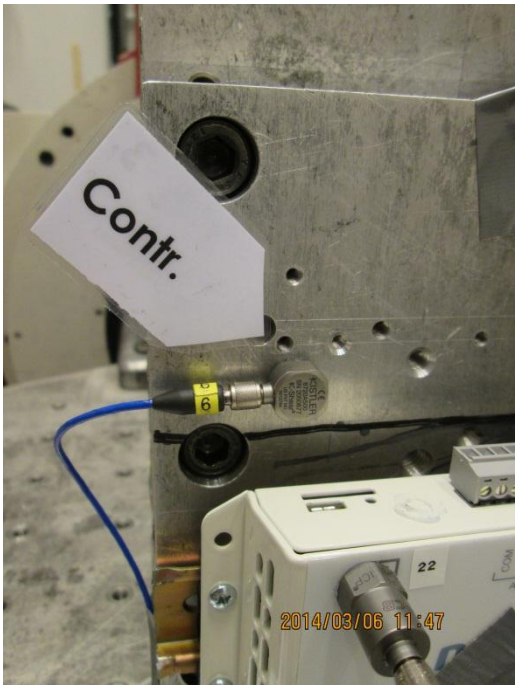



**Image 5. Test setup for Sinusoidal vibration test, Y-axis**



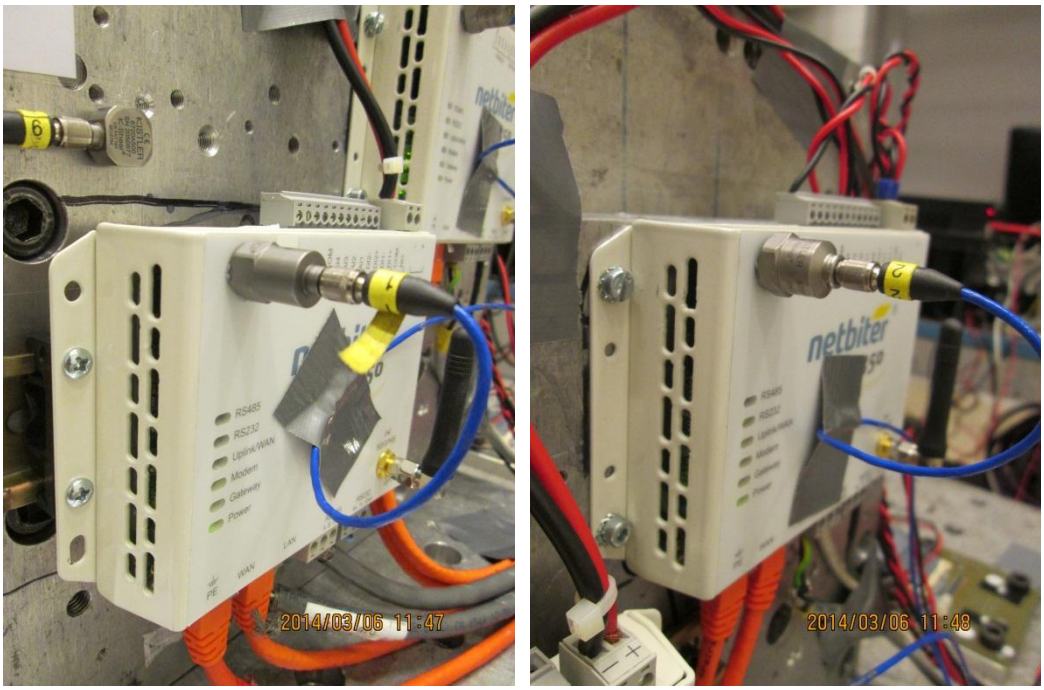
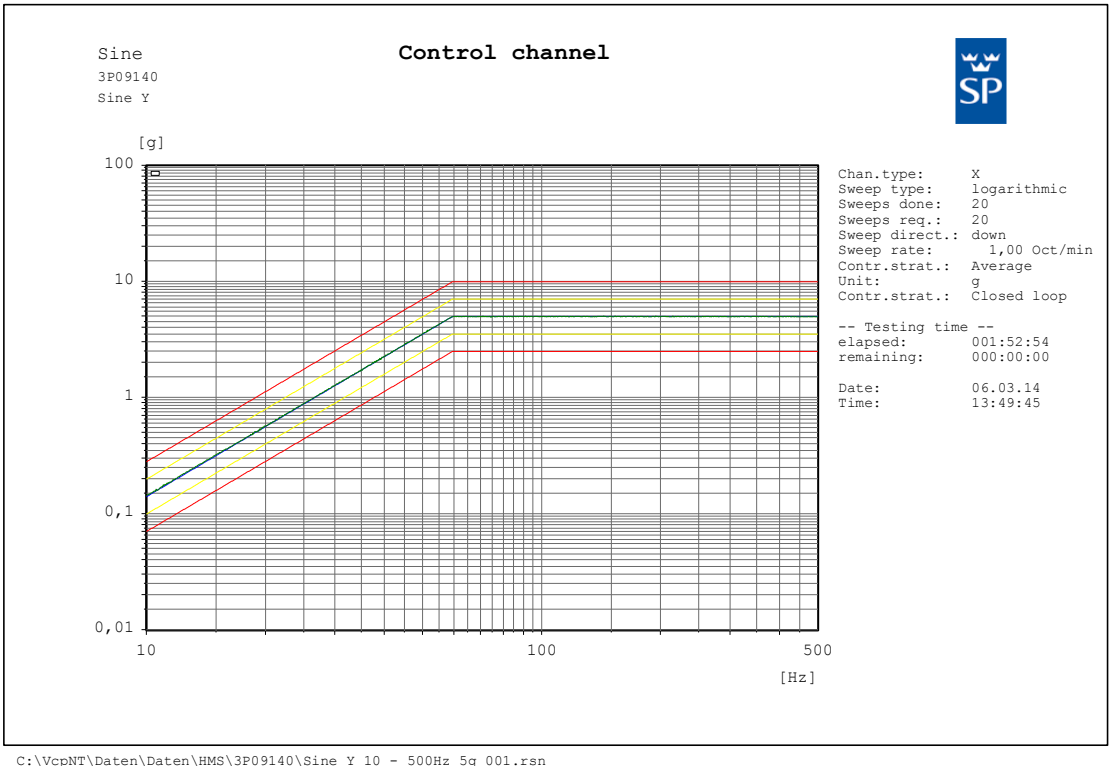
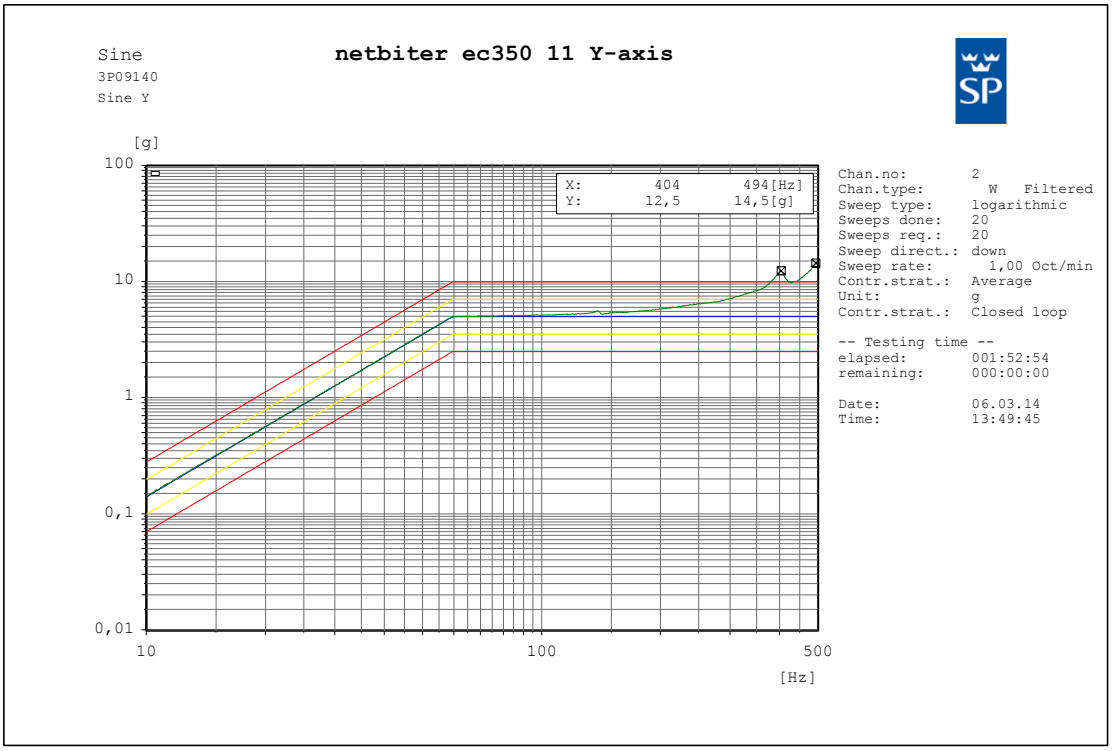



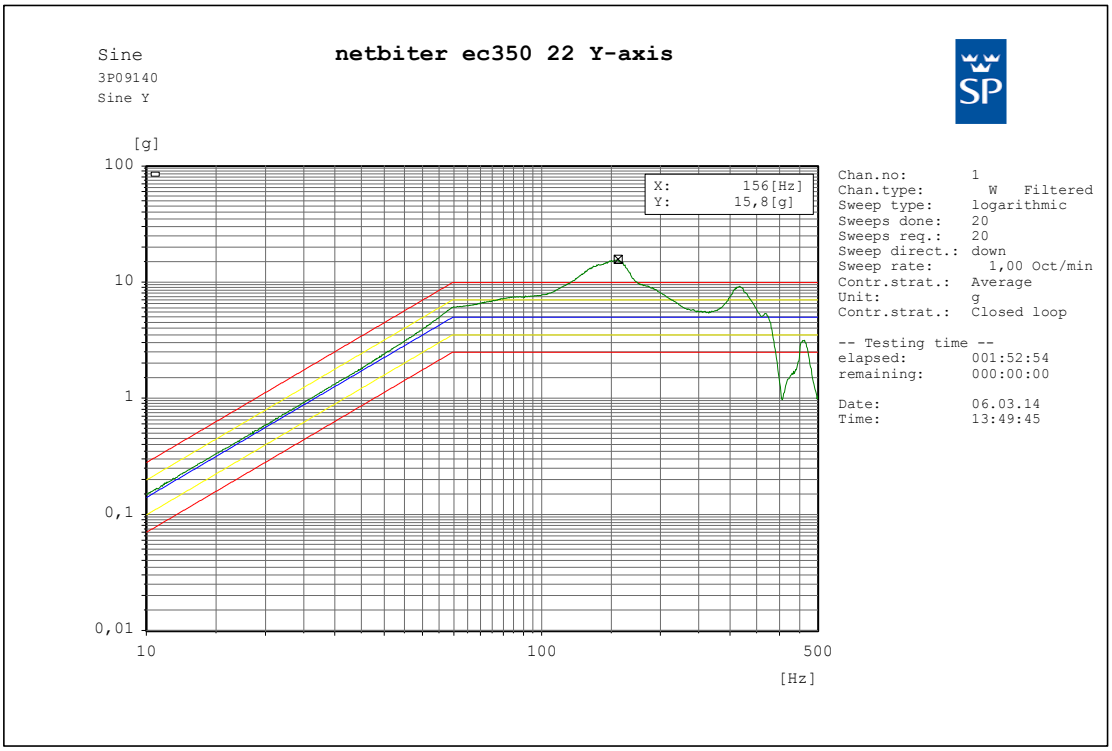

**Image 8 and image 9. Measuring accelerometer positions for Sinusoidal vibration test, Y-axis**




**Graph 4. Sinusoidal vibration frequency plot, Y-axis**




**Graph 5. Sinusoidal vibration frequency plot, Y-axis**




**Graph 6. Sinusoidal vibration frequency plot, Y-axis**

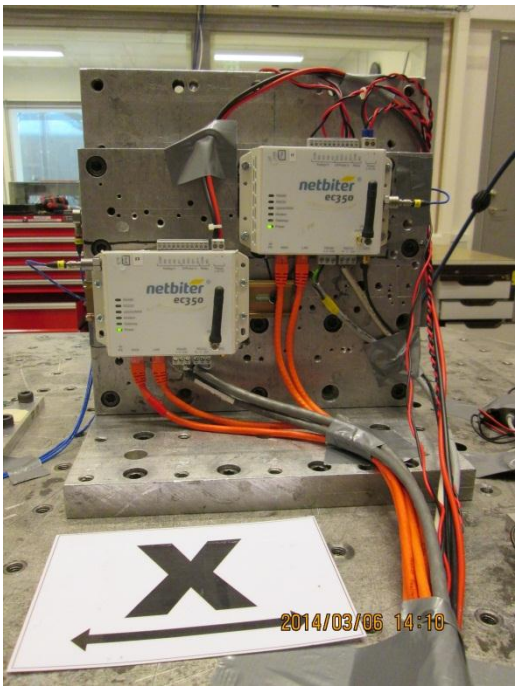



**Image 10. Test setup for Sinusoidal vibration test, X-axis**



**Image 11 and image 12. Control accelerometer positions for Sinusoidal vibration test, X-axis**

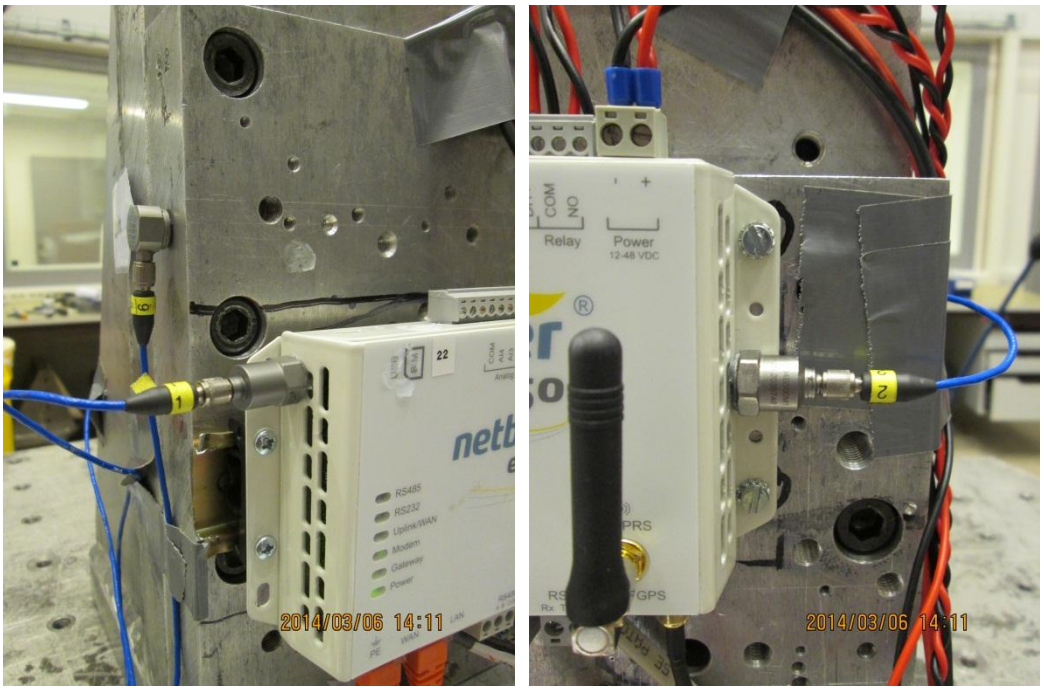
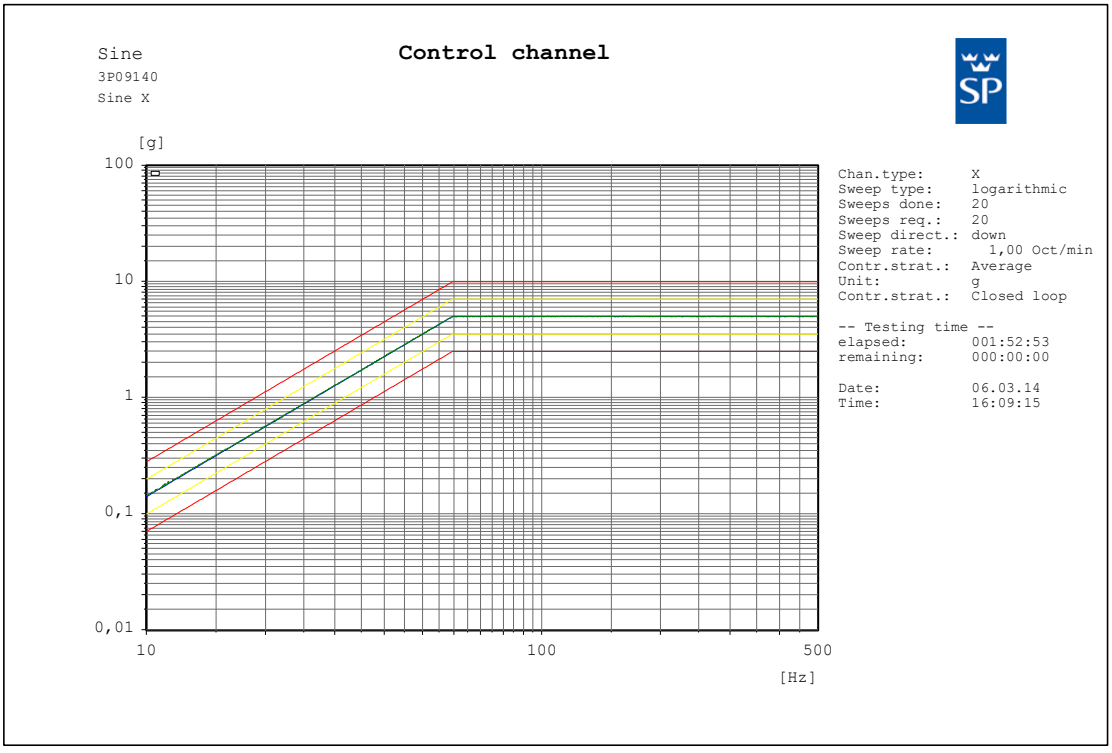
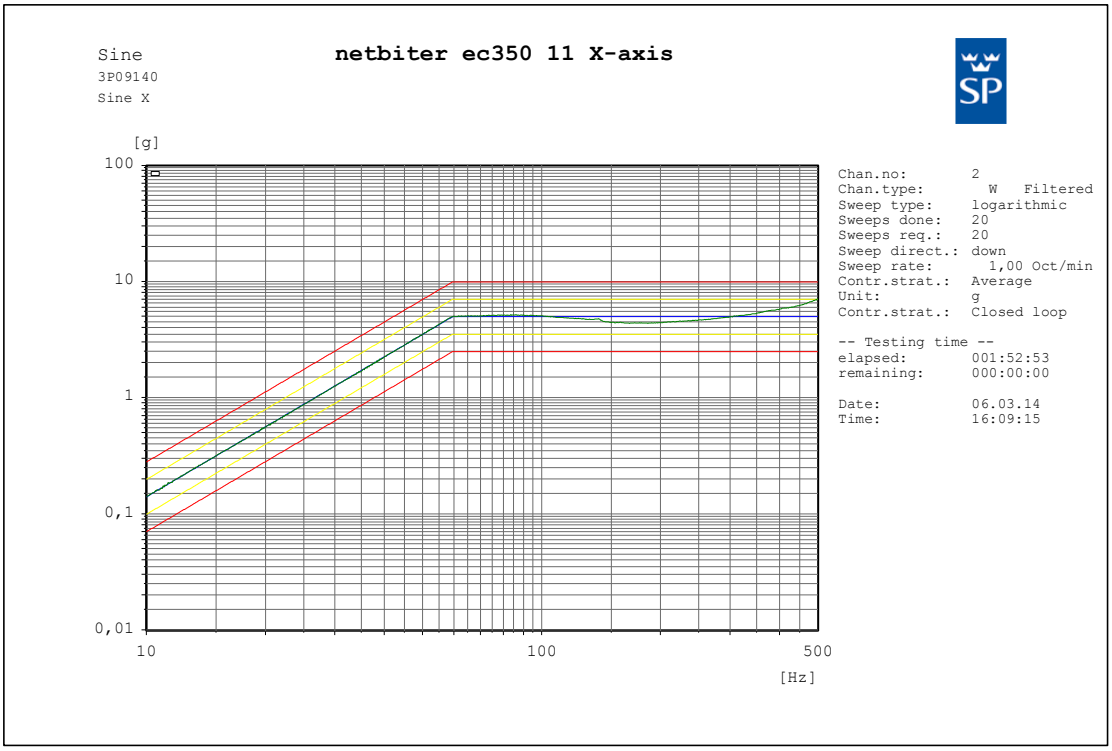



**Image 13 and image 14. Measuring accelerometer positions for Sinusoidal vibration test, X-axis**




**Graph 7. Sinusoidal vibration frequency plot, X-axis**

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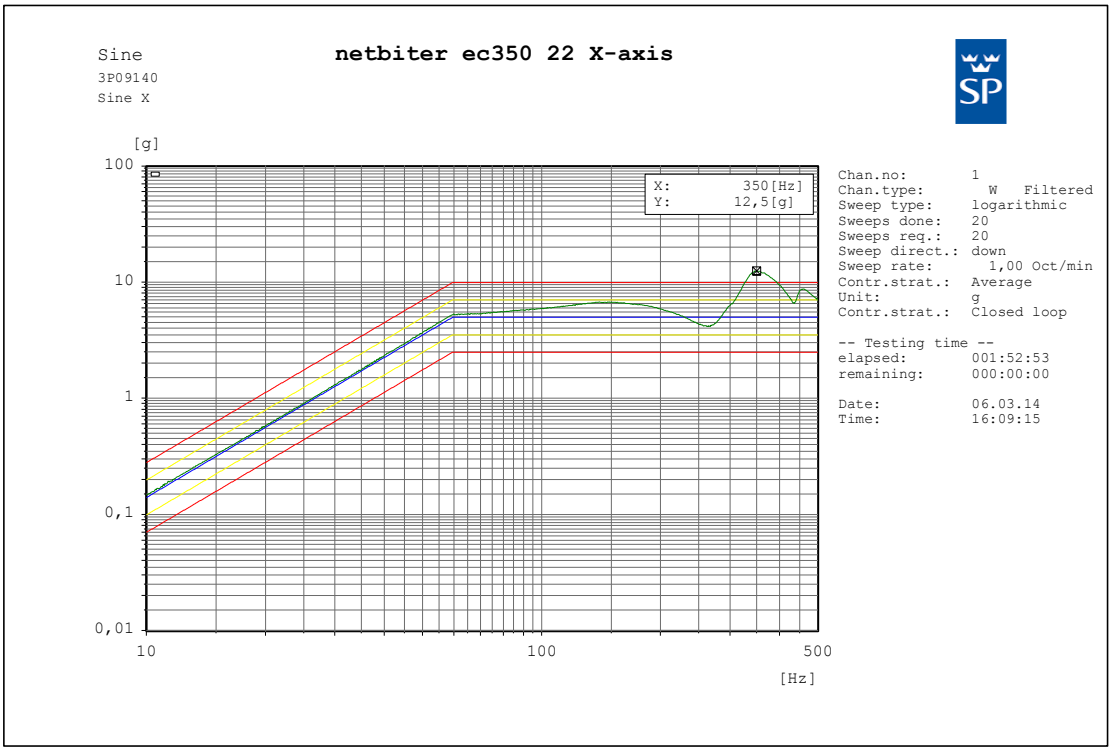
**Graph 8. Sinusoidal vibration frequency plot, X-axis**

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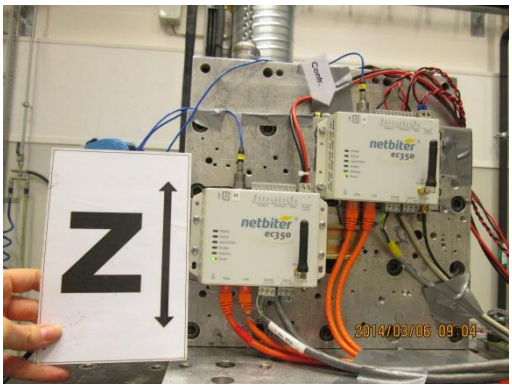
**Graph 9. Sinusoidal vibration frequency plot, X-axis**



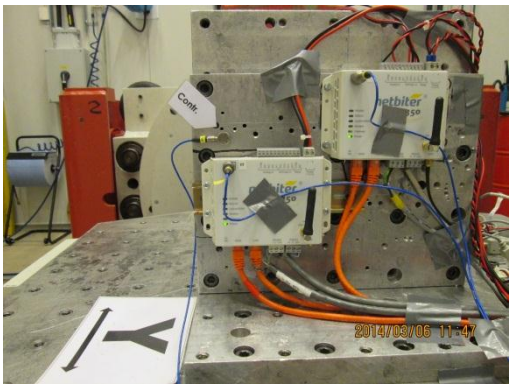




**Image 15 and image 16. Test setup for Shock test A and B, Z-axis and Y-axis**

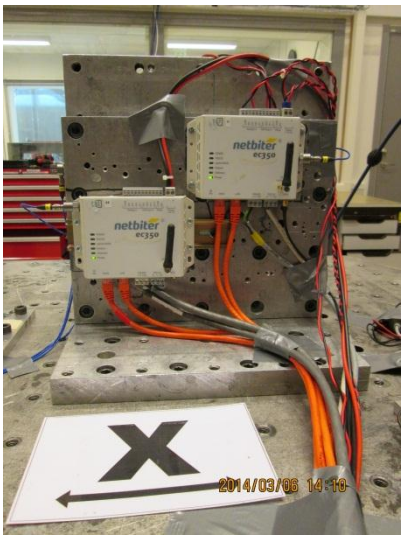
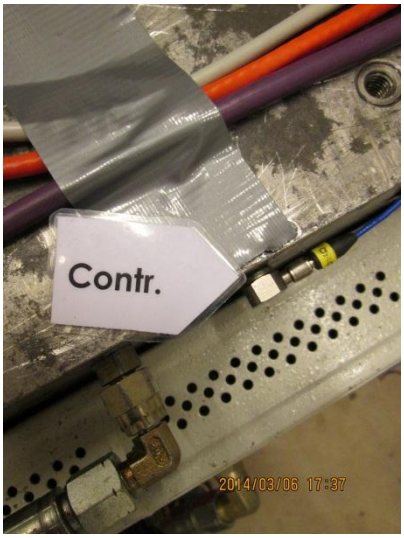



**Image 17. Test setup for Shock test A and B, X-axis**



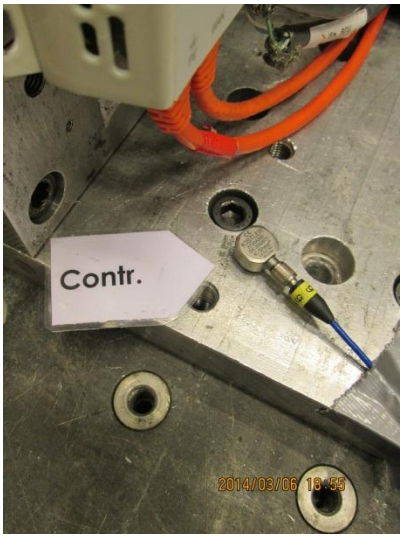




**Image 18 and image 19. Control accelerometer position for Shock test A and B, X-axis and Y-axis, Z-axis**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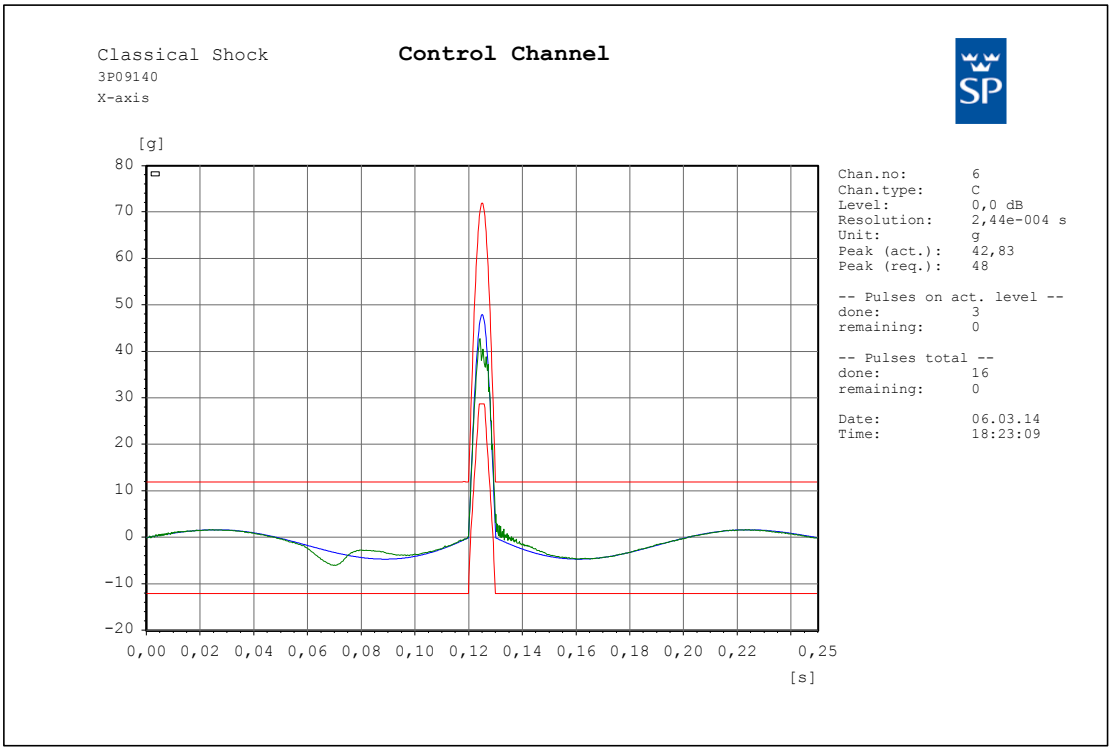
**Graph 10. Typical Shock test A plot, X-axis**

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**Graph 11. Typical Shock test B plot, X-axis**

Appendix 1


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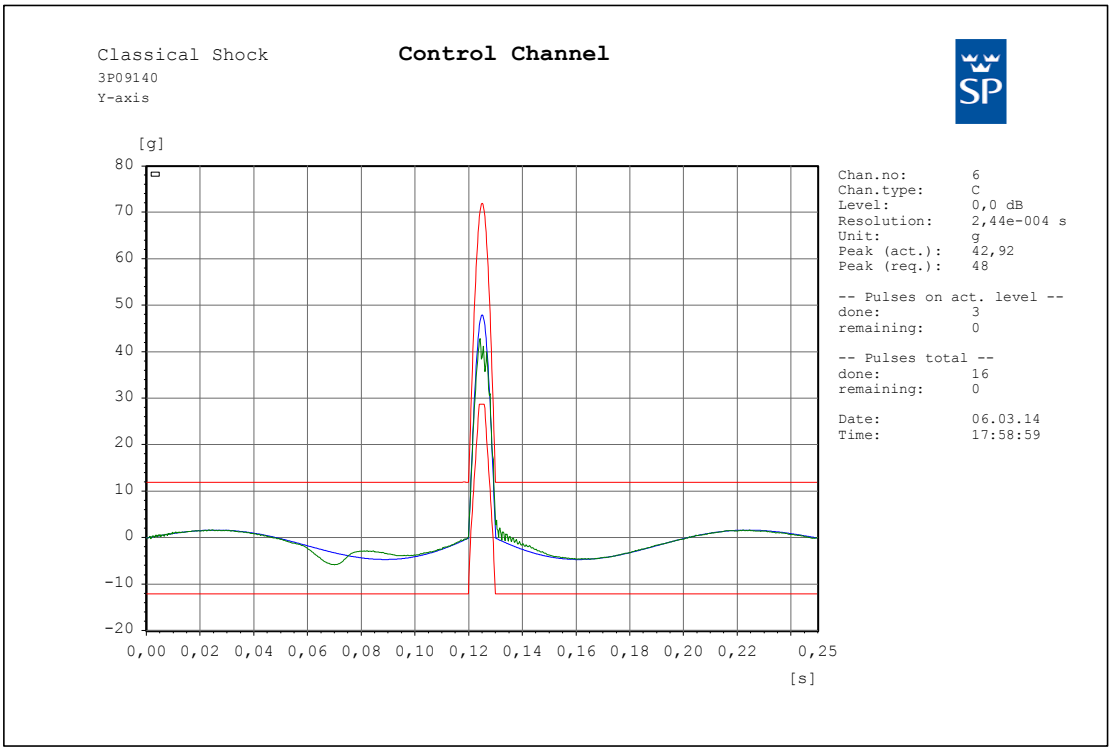
**Graph 12. Typical Shock test A plot, Y-axis**

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**Graph 13. Typical Shock test B plot, Y-axis**

Appendix 1


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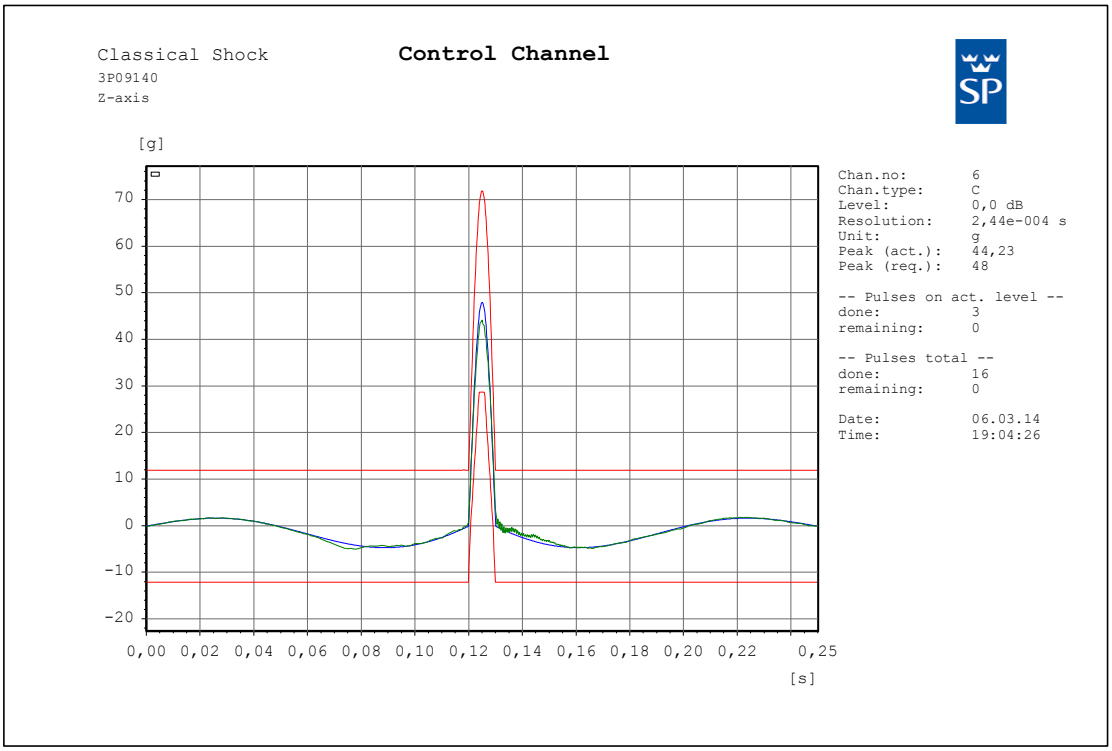
**Graph 14. Typical Shock test A plot, Z-axis**

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**Graph 15. Typical Shock test B plot, Z-axis**