ENVIRONMENTAL TESTS

ZAURAC 4-30

FINAS
Finnish Accreditation Service
T001 (EN ISO/IEC 17025)

VTT Expert Services Ltd

Requested by: Five Watts Oy

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Requested by

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1.7.2013, Ville Schütt

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Environmental tests for ZAURAC 4-30

Summary

The specimen operated normally during and after the tests.

During the random vibration test the mounting brackets failed. Otherwise no changes were noticed.

Based on the results of the tightness tests ZAURAC 4-30 complies with the requirements stated for the protection class IP68.

Espoo, July 11, 2013

Antti Turtola	Jari Heikkinen
Business Manager	Expert

Appendices 3 pcs., total number of pages 9

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1 General

The test place was VTT Expert Services Ltd and the tests were carried out 1. – 4.7.2013. The specimen consisted of the following ZAURAC 4-30 units:

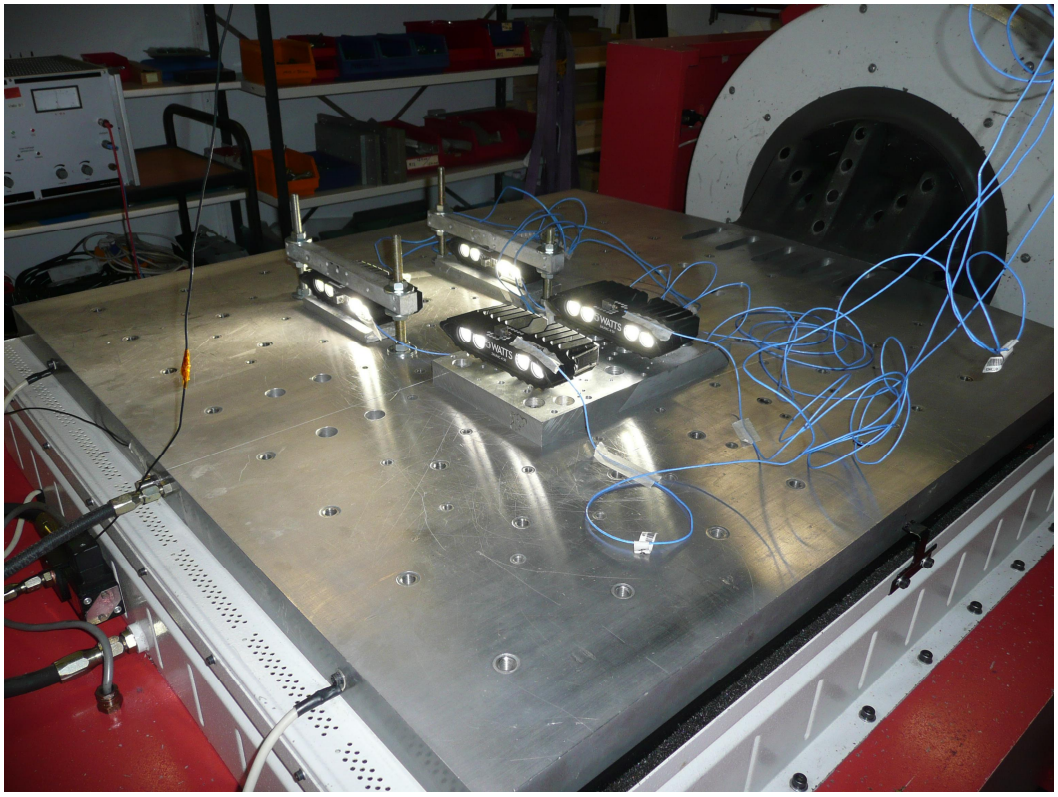
SN: 02, 04, 07 and 09 – Mechanical tests
SN: 03 and 08 – Dry heat
SN: 01 – Tightness tests

The test equipment:

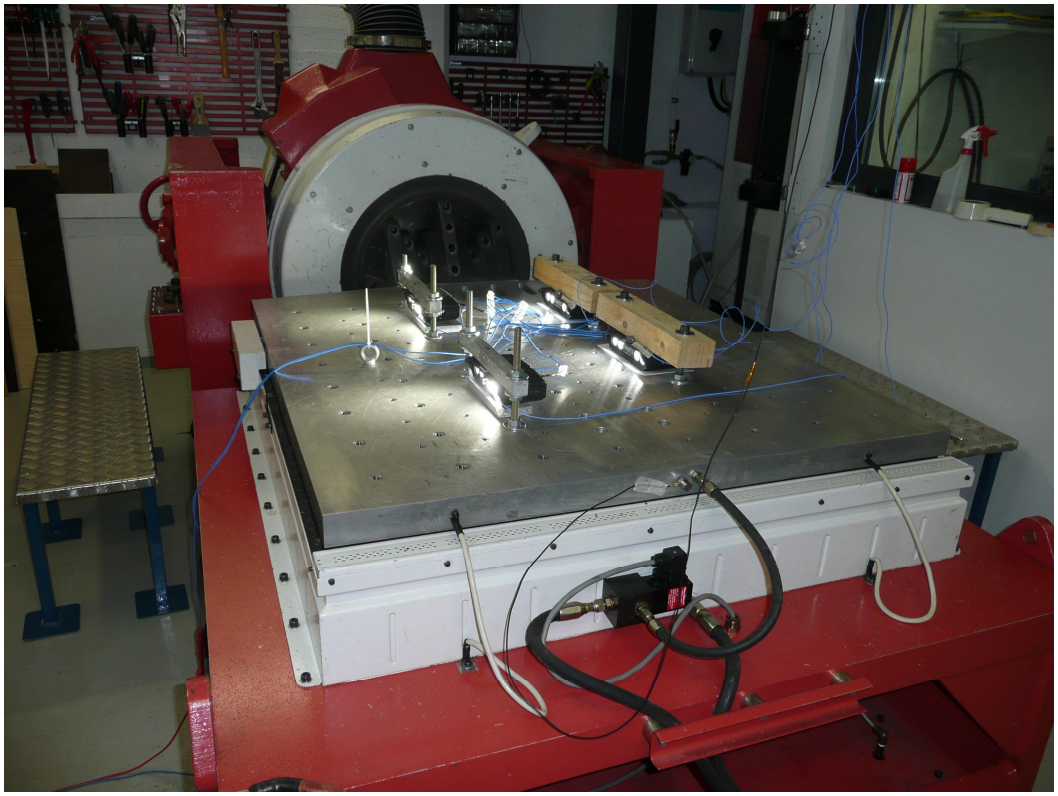
- LDS V875 electrodynamic shaker, IDN TL04033
- VIBPILOT vibration control software, IDN TL13236
- B&K type 4371 accelerometer, IDN TL04022
- PCB type 356B21 accelerometers, IDN TL04069…TL04072
- Dust test chamber, IDN TL04118
- Pressure gauge DPP-4K, IDN TL04117
- Flow meter NP-G21, IDN TL04116
- Water test facility, reg. no. 1274958
- Cold / heat chamber ESPEC ENZ28-15CW, IDN TL04107
- HP 6643A DC power supply, IDN TL04141
- EA-565-10 DC power supply, IDN Valo 91
- Fluke 179 universal meter, IDN EX79

The test severities for the mechanical tests were extracted from the publication ISO 15003 “Agricultural Engineering — Electrical and electronic equipment — Testing resistance to environmental conditions”, 2006-02-15.

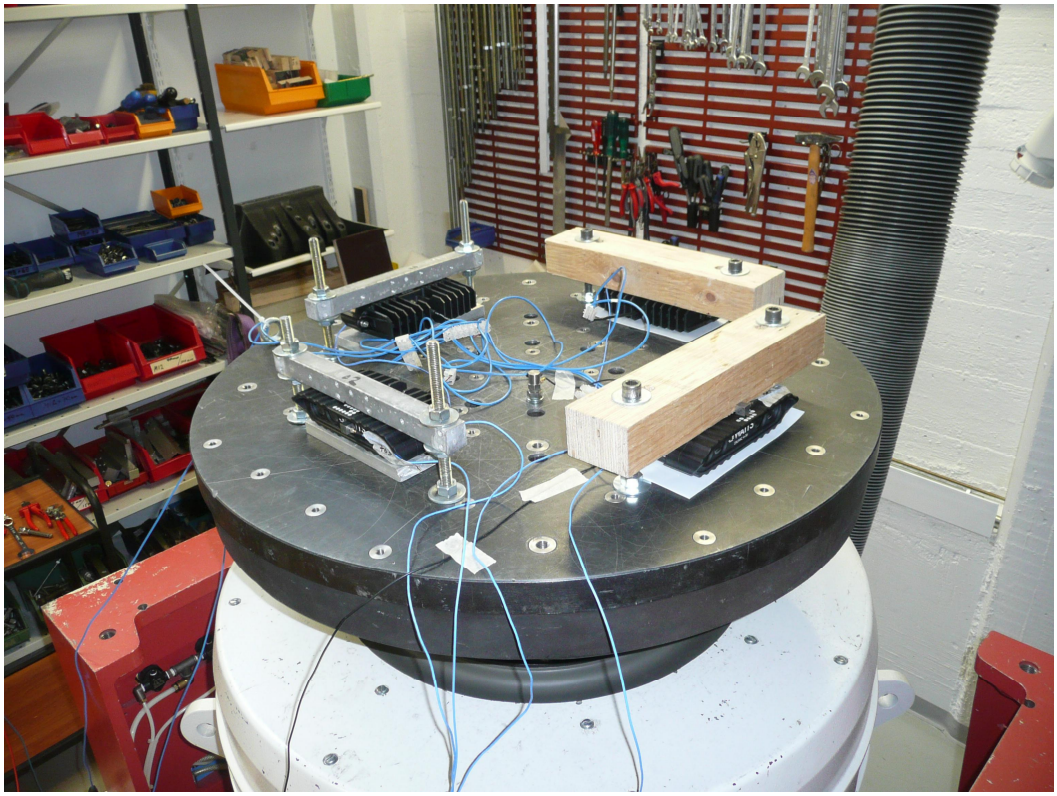
The performance of the specimen was verified on the visual basis. The test setup is presented in the following in the respective order.



Photograph 1. The test setup for the vibration and shock tests, x-axis (P1100342.JPG).



Photograph 2. The test setup for the vibration and shock tests, y-axis (P1100351.JPG).



Photograph 3. The test setup for the vibration and shock tests, z-axis (P1100353.JPG).

2 Mechanical tests

For the tests in x-axis two specimen (SN: 02 and SN: 04) were attached on the shaker table with the mounting bracket and two were clamped. For the tests in y- and z-axes all specimen were clamped.

2.1 Sinusoidal vibration, IEC 60068-2-6, Test Fc (2007-12)

2.1.1 Test procedure

The test was carried out according to the publication IEC 60068-2-6, Test Fc in each of the three perpendicular axes (test severity clause 5.6.2 of ISO 15003). The test consisted of the frequency response measurements and of 30 minutes endurance tests in each axis. The test level was following:

- frequency range 10…2000 Hz
- peak acceleration 20 m/s^2 (2 g_n)
- sweep rate 1 oct/min
- uncertainty of measurements ±5 %

The frequency responses were measured from the body (SN: 07 and SN: 09) and front panel (SN: 02 and SN: 04). The measured control level plots and frequency responses are presented in appendix 1.

The endurance tests (2 g_n / 30 minutes) were carried out as follows:

x-axis – 54,67 Hz
y-axis – 850…1000 Hz
z-axis – 1450 Hz

2.1.2 Test results

The specimen operated normally during and after the test.

2.2 Vibration broad-band random, IEC 60068-2-64, Test Fh (2008-04)

2.2.1 Test procedure

The test was carried out for operational specimen according to the publication IEC 60068-2-64, test Fh, in three mutually perpendicular axes (test severity clause 5.6.1 of ISO 15003). The test level was following:

- frequency range 10...350 Hz
- ASD-level 0,005 g²/Hz (0,5 m^2/s^3), 10 Hz
- ASD-level 0,02 g²/Hz (2,0 m^2/s^3), 200 Hz
- ASD-level 0,01 g²/Hz (1,0 m^2/s^3), 300 Hz
- ASD-level 0,002 g²/Hz (0,2 m^2/s^3), 350 Hz
- total spectral acceleration 2,087 grms
- test duration 8 hours in all three perpendicular axes
- uncertainty of the measurements ±5 %

The test level was controlled with an accelerometer attached on the shaker table. The measured control level plot is presented in appendix 2.

2.2.2 Test results

The specimen operated during and after the test normally. The fixing brackets failed during the test in x-axis (see photo 4). The test in y- and z-axes were continued without the brackets.

Photograph 4. The fixing brackets after the tests in x-axis (P1100349.JPG).

2.3 Shock, IEC 60068-2-27, Test Ea (2008-02)

2.3.1 Test procedure

The shock test was carried out on operational specimens according to the publication IEC 60068-2-27, test Ea (test severity clause 5.5.2 of ISO 15003). The test was performed in the both directions of the three perpendicular axes. The pulse shape was half sine and the number of the pulses was 3 in each direction. The test level was following:

- peak acceleration 300 m/s² (30 g_n)
- pulse duration 18 ms
- uncertainty of the measurements ±5 %

The pulse shape was measured with an accelerometer attached on the shaker table. The pulse shapes are presented in appendix 3.

2.2.2 Test results

The specimen operated during and after the test normally and in the visual examination no changes were detected.

3 Dry heat, IEC 60068-2-2, Test Bd, (2007-07)

3.1 Test procedure

The test was carried out according to the publication IEC 60068-2-2, Test Bd. The test temperature was +70 °C ±2 °C, the testing time was 16 h and the rate of change of

temperature was 1 °C / min during the slopes. The specimen were operational during the test.

The measured temperature curves are presented in figure 1.

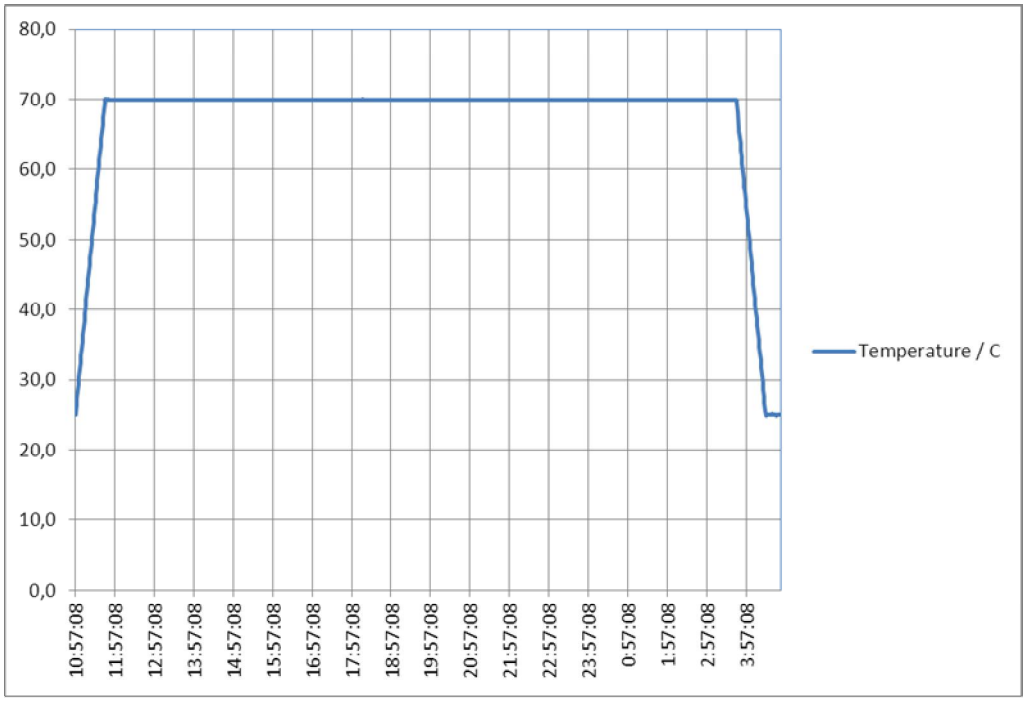


Figure 3. The measured temperatures during the dry heat test.

3.2 Test results

The specimen operated normally during and after the test and in the visual examination no damages were detected.

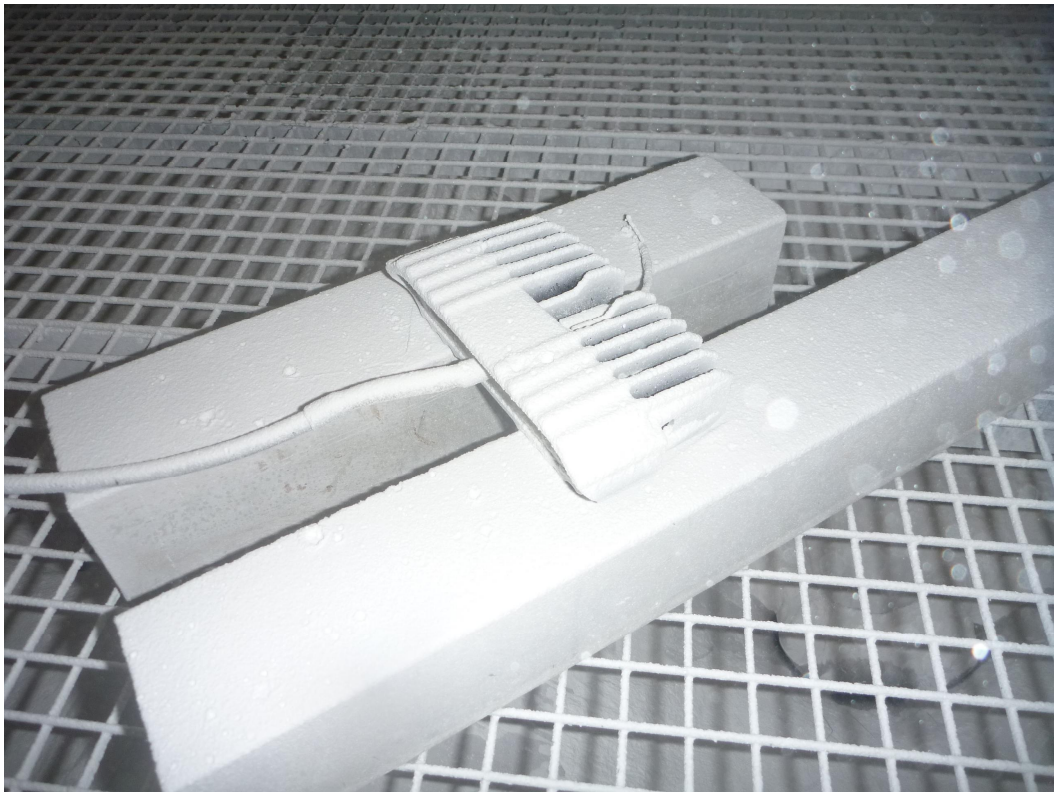
4 Tightness tests for IP67

The tests were performed in accordance with the standard IEC 60529 “Degrees of protection provided by enclosures (IP Code)” (2001-02).

4.1 Dust test for IP6X

4.1.1 Test procedure

For the dust test the specimen was placed in the dust chamber provided with talcum powder circulation. The specimen was exposed to the free settling dust for a period of 8 hours. The under pressure pipe was connected on the bottom of the front panel. The under pressure during the test was 2 kPa and the flow rate of the air was 0,1 l/min.



Photograph 5. The test setup for dust test (P1030275.JPG).

4.1.2 Test results

In the visual examination after the test no deposit of dust was noticed inside the specimen.

Based on the results the dust test the specimen complies with the requirements stated for the protection class IP6X.

4.2 Water test for IPX8

4.2.1 Test procedure

The test was carried out by immersing the specimen for a period of 1 hour. The immersion depth was 1000 mm and the water temperature was +22 °C.

4.2.2 Test results

In the visual examination after the test no ingress of water was noticed inside the specimen.

Based on the results the water test the specimen complies with the requirements stated for the protection class IPX8.

Sinusoidal vibration, IEC 60068-2-6, Tets Fc

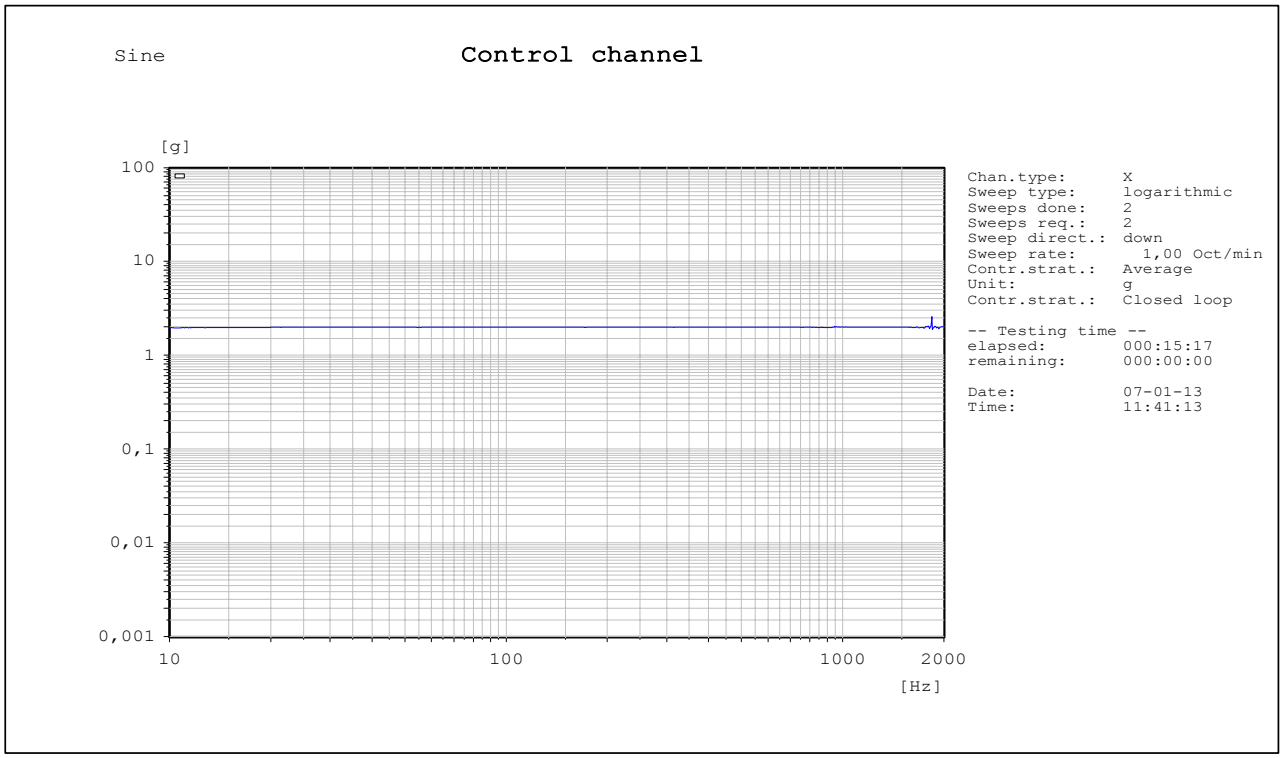


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Figure 1. The measured control level.

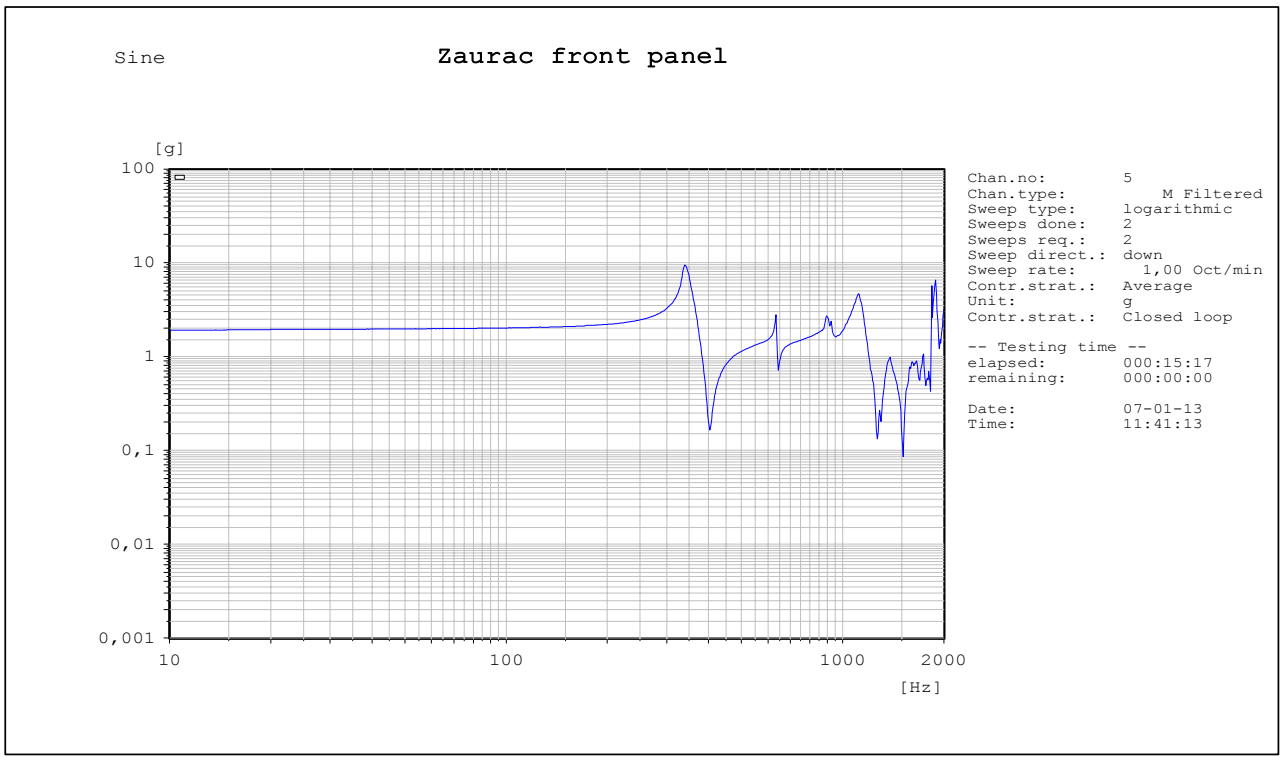

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Figure 2. The measured frequency response, SN: 02, x-axis.

Sinusoidal vibration, IEC 60068-2-6, Tets Fc

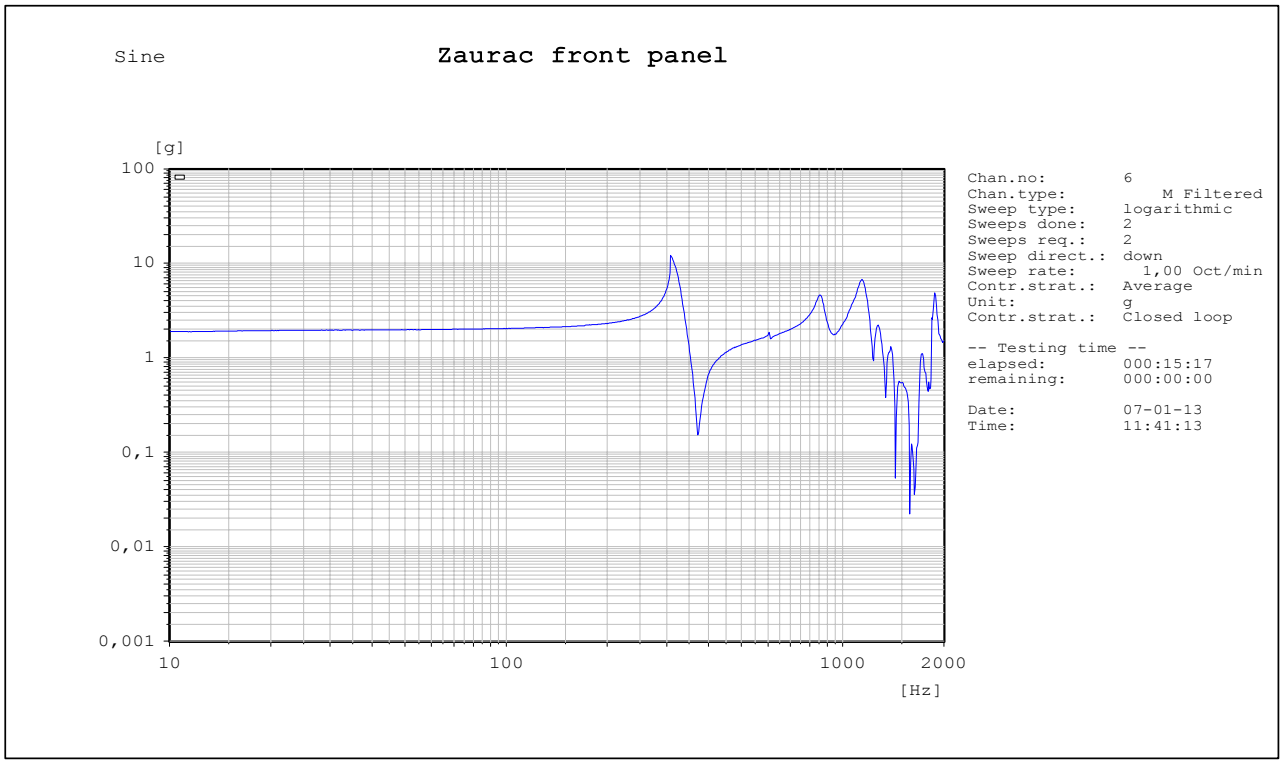

Figure 3. The measured frequency response, SN: 04, x-axis.

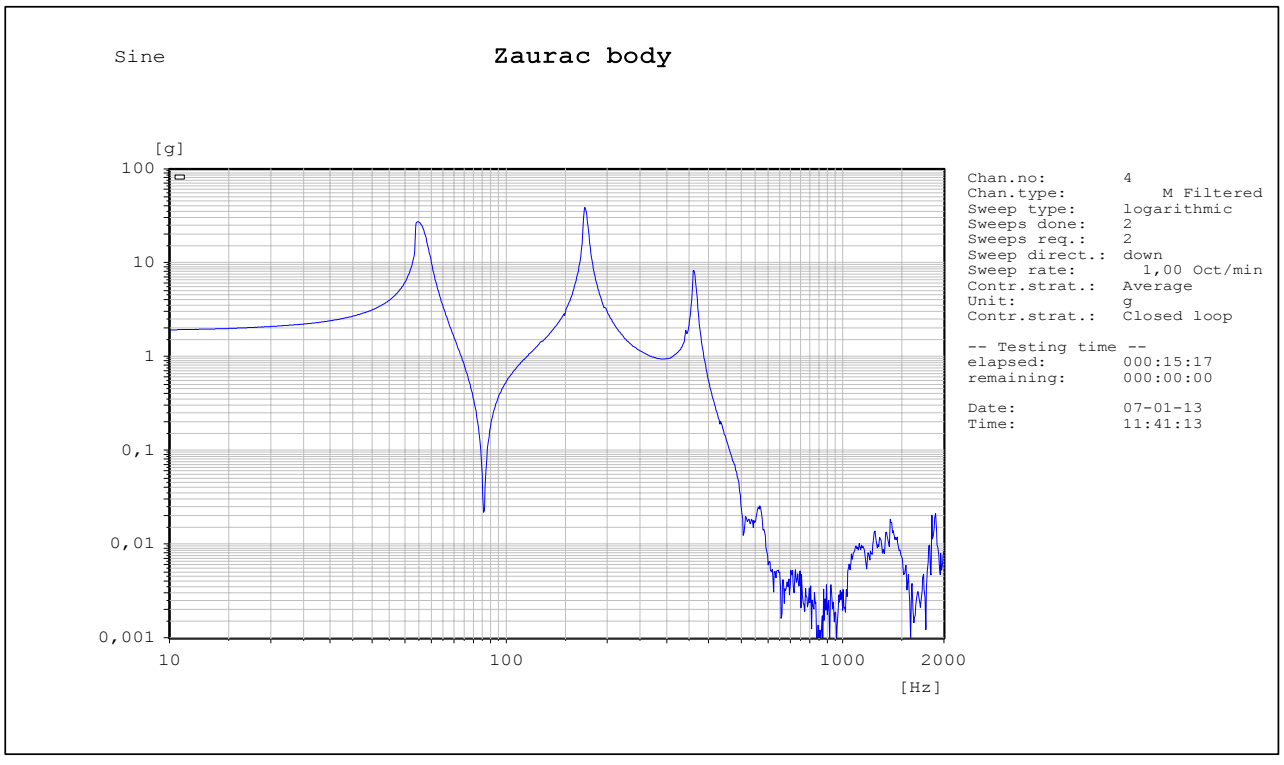

Figure 4. The measured frequency response, SN: 07, x-axis.

Sinusoidal vibration, IEC 60068-2-6, Tets Fc

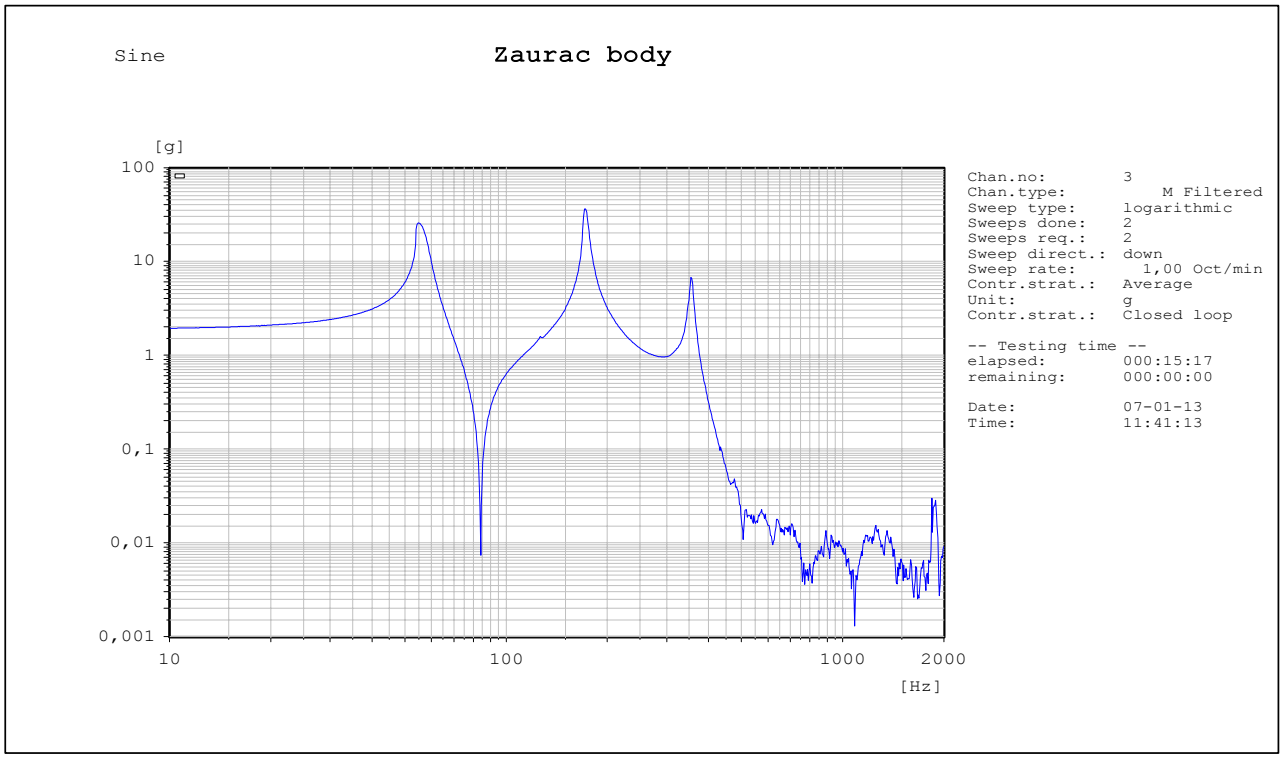

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Figure 5. The measured frequency response, SN: 09, x-axis.

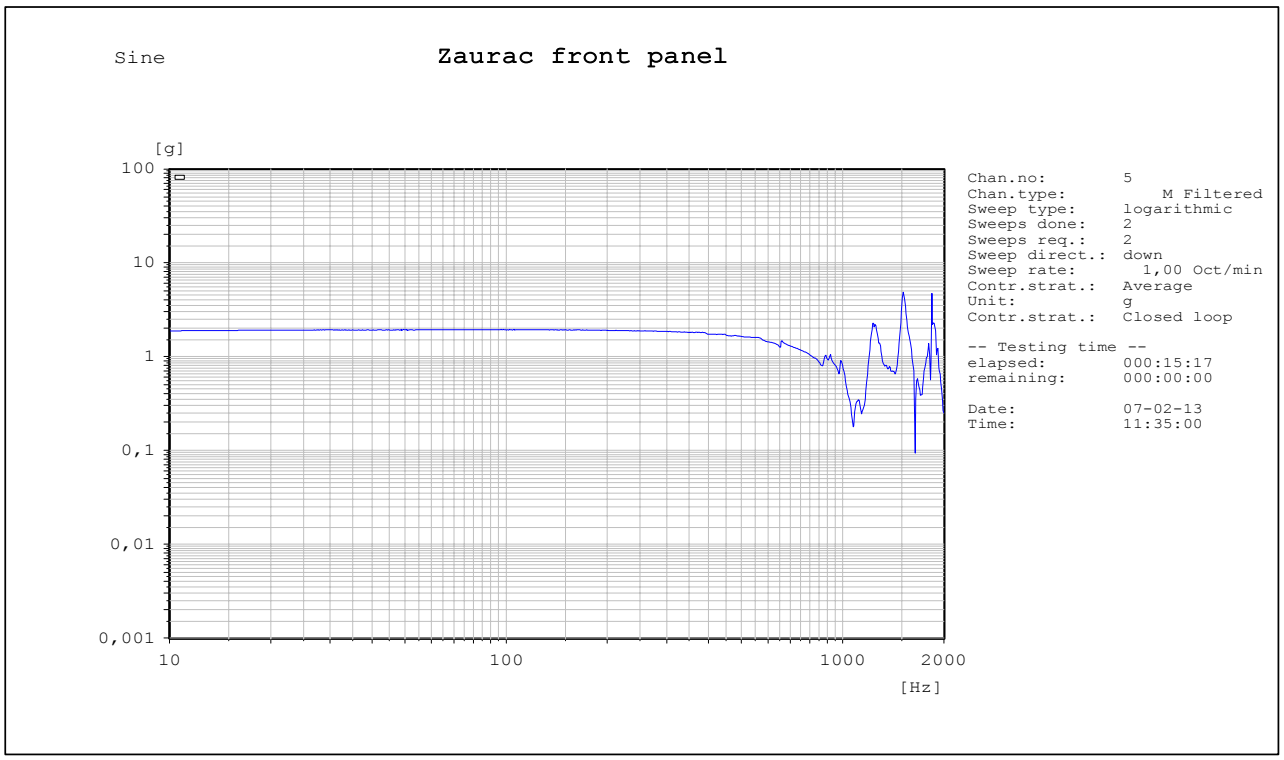

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Figure 6. The measured frequency response, SN: 02, y-axis.

Sinusoidal vibration, IEC 60068-2-6, Tets Fc

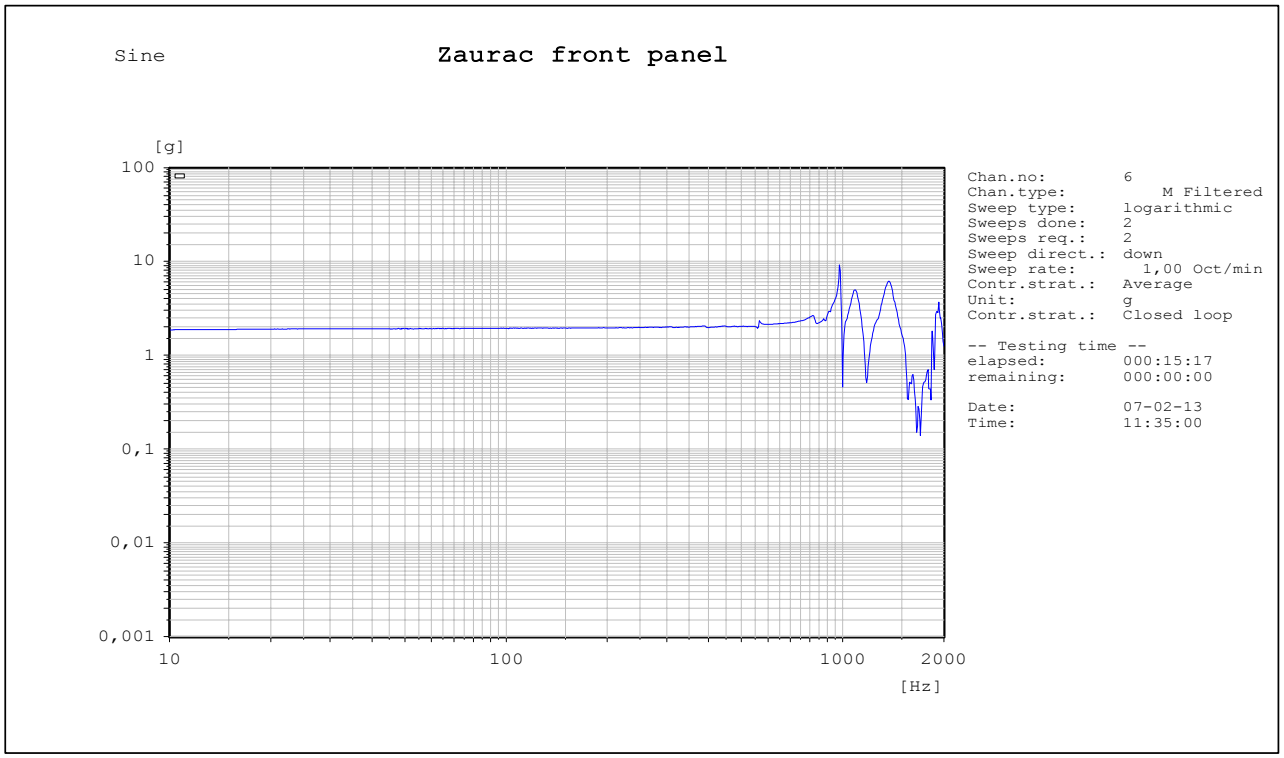

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Figure 7. The measured frequency response, SN: 04, y-axis.

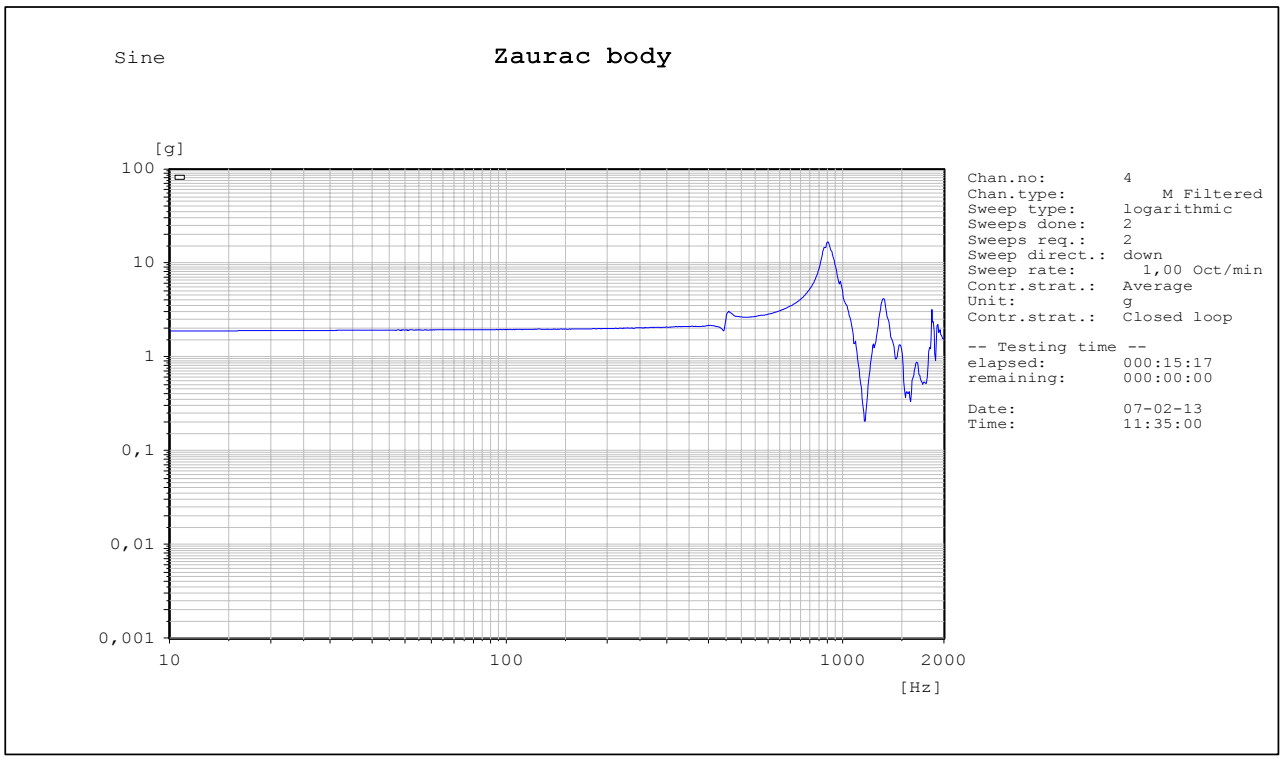

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Figure 8. The measured frequency response, SN: 07, y-axis.

Sinusoidal vibration, IEC 60068-2-6, Tets Fc

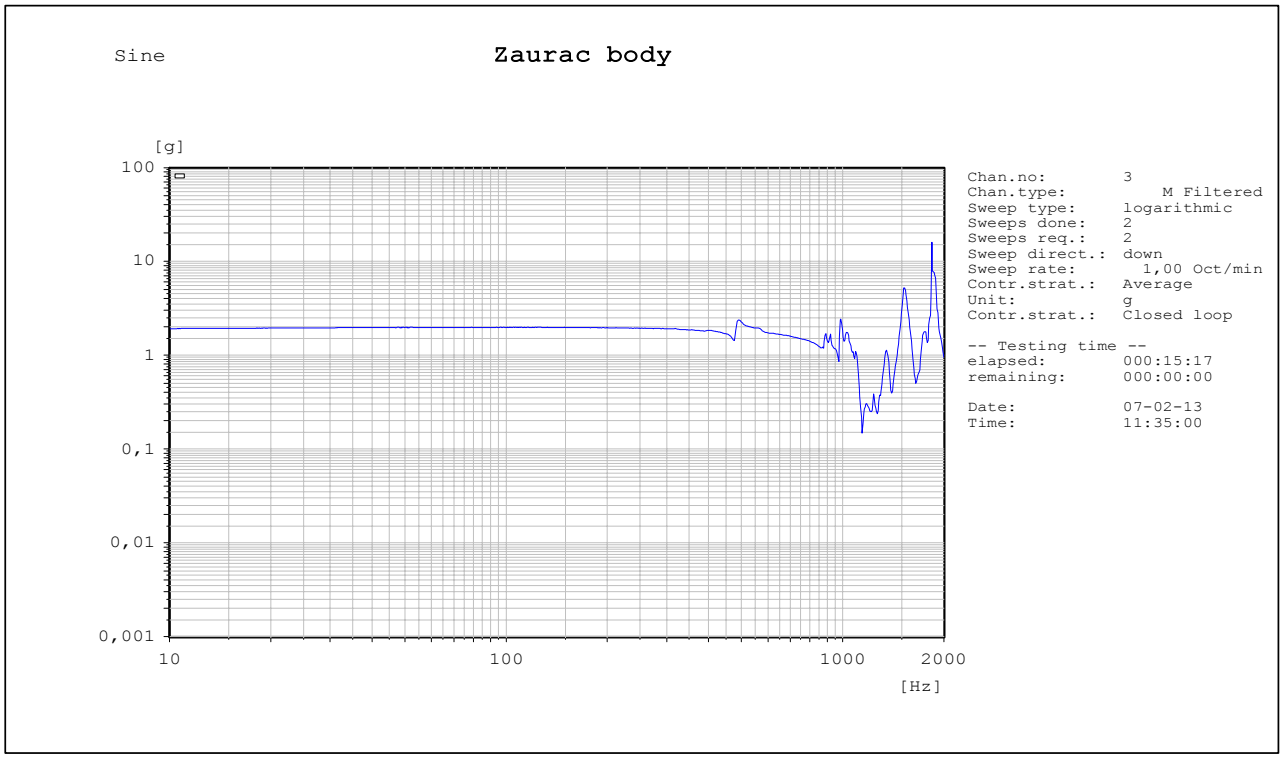

Figure 9. The measured frequency response, SN: 09, y-axis.

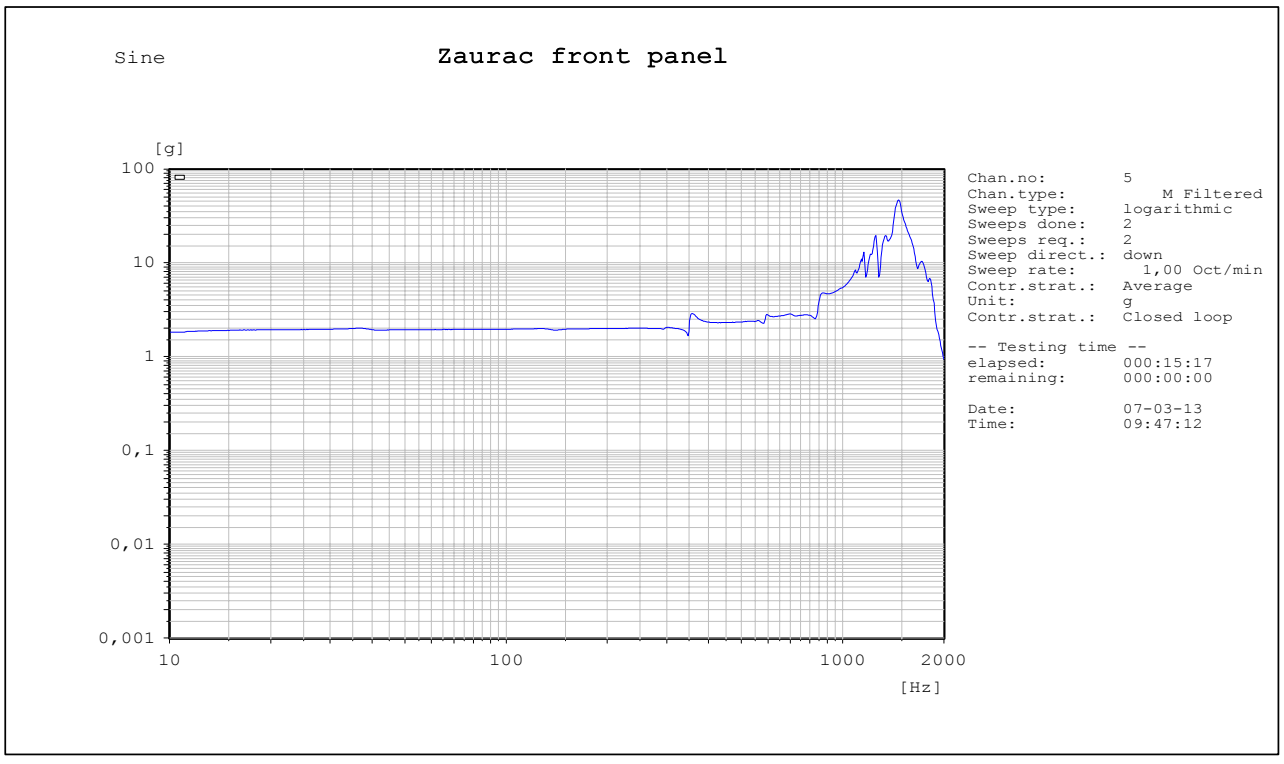

Figure 10. The measured frequency response, SN: 02, z-axis.

Sinusoidal vibration, IEC 60068-2-6, Tets Fc

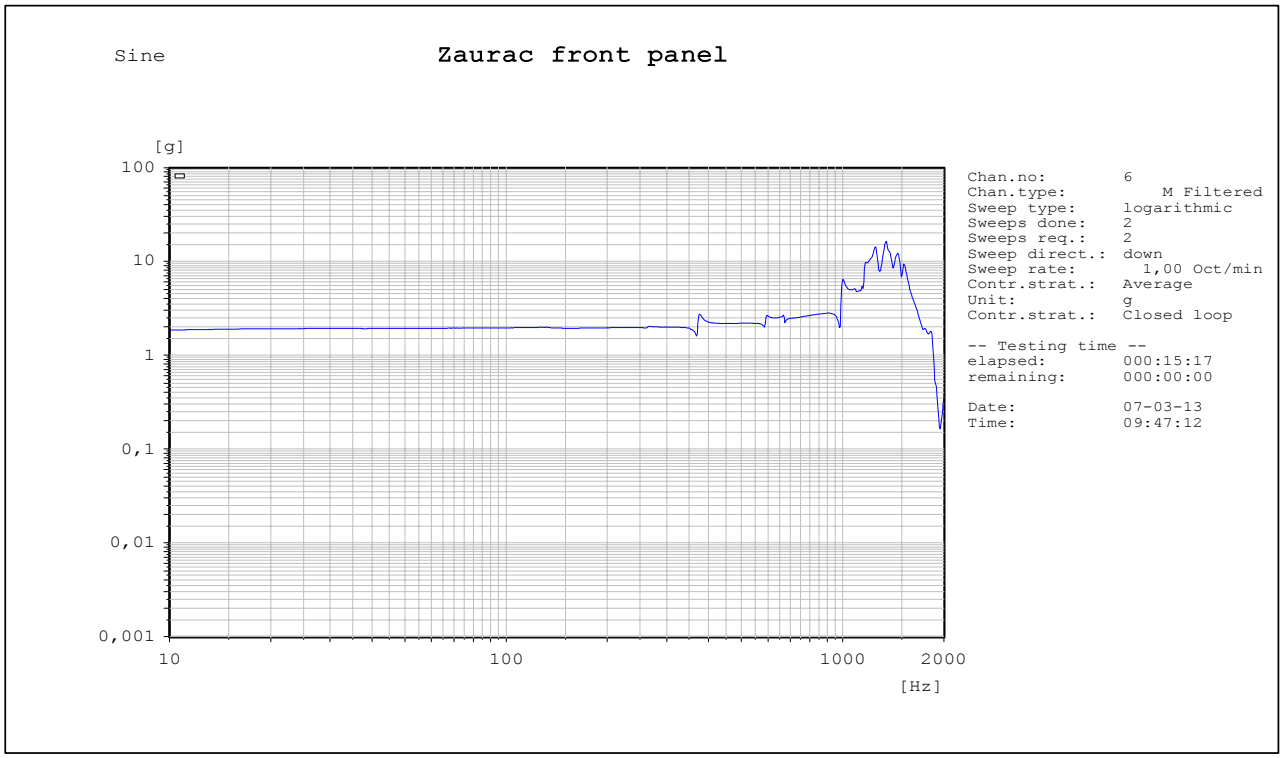

Figure 11. The measured frequency response, SN: 04, z-axis.

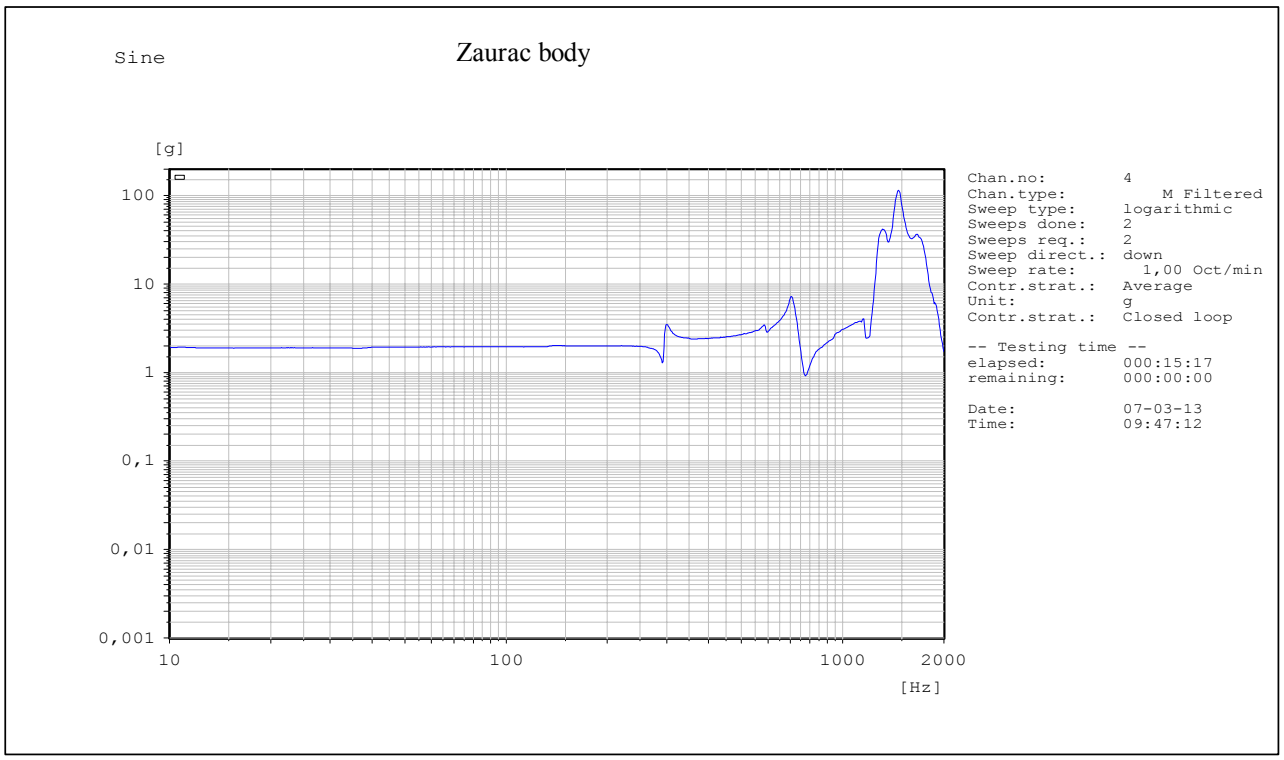

Figure 12. The measured frequency response, SN: 07, z-axis.

Sinusoidal vibration, IEC 60068-2-6, Tets Fc

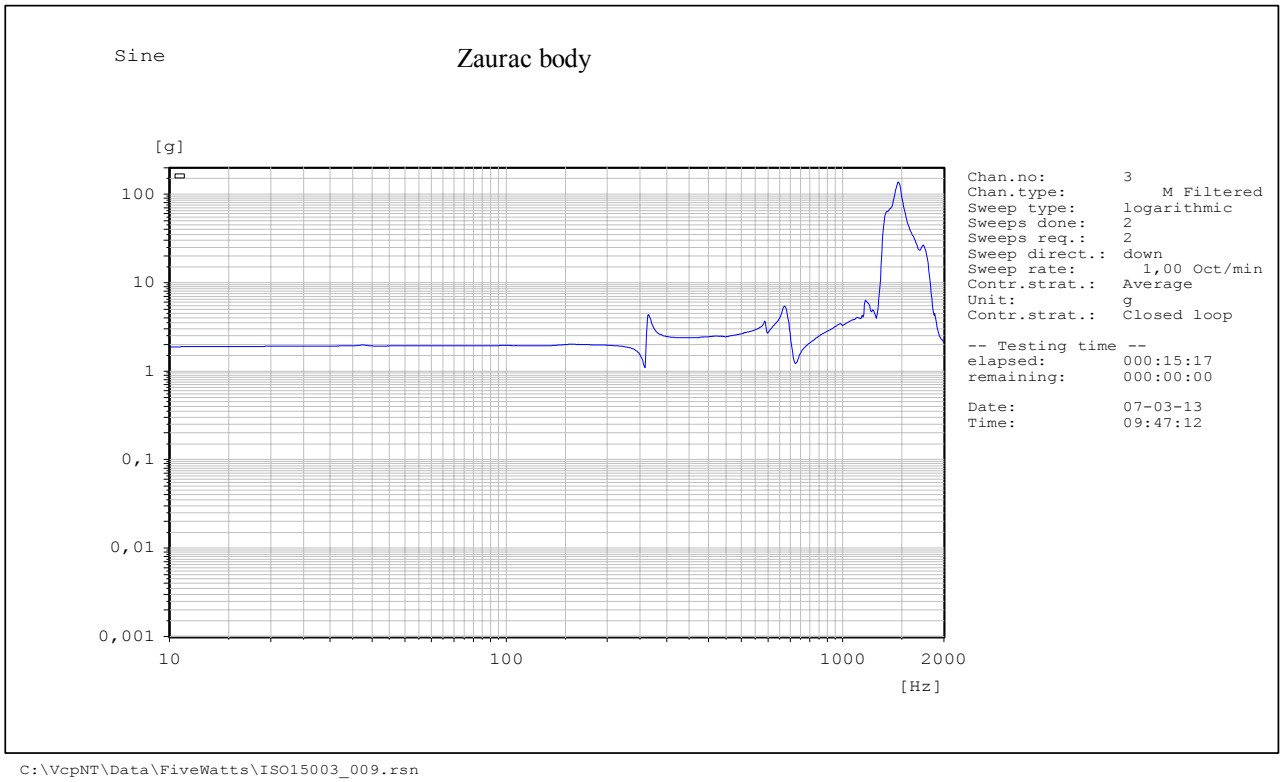

Figure 13. The measured frequency response, SN: 09, z-axis.

Vibration, broad-band random, IEC 60068-2-64, Test Fh

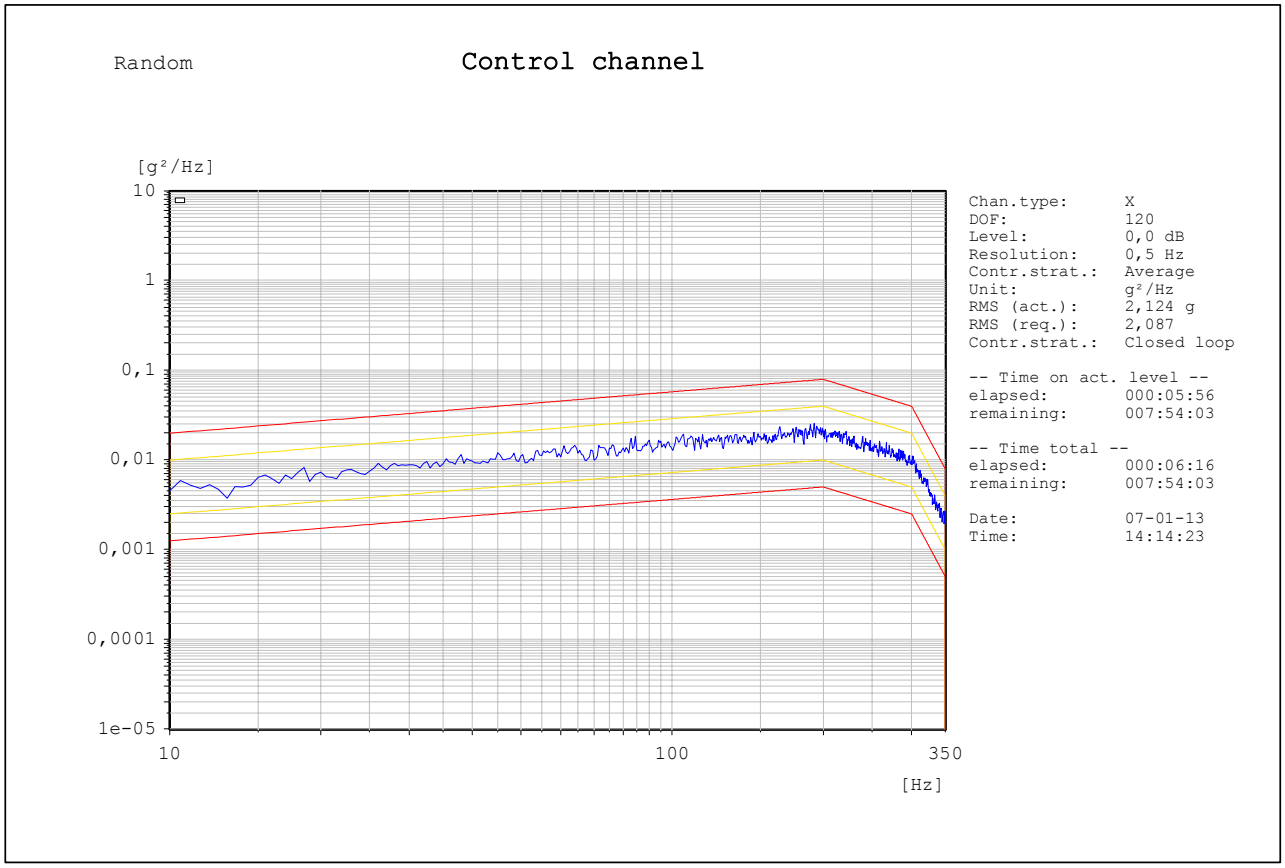

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Figure 14. The measured control level.

Shock, IEC 60068-2-27, Test Ea

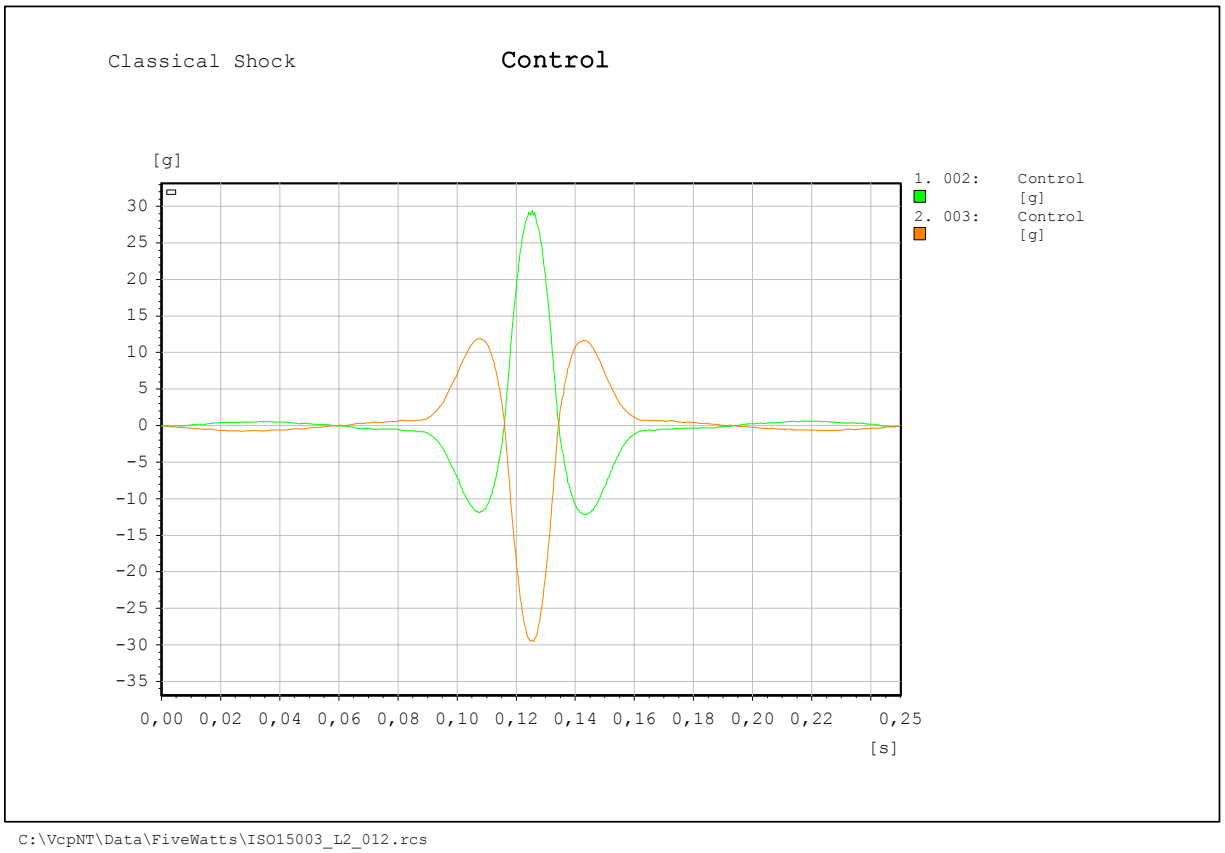

Figure 15. The measured pulse shapes.