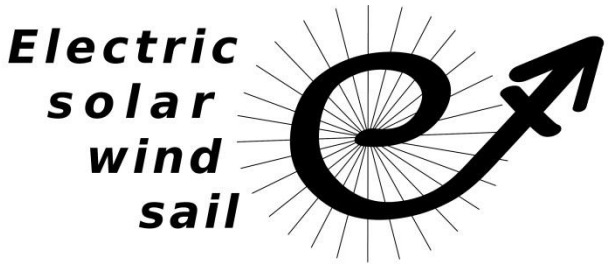

ESAIL D3.3.4
Auxiliary tether reel test report

Work Package: **WP 3.3**

Version: **Version 1.0**

Prepared by: DLR German Aerospace Center, Roland Rosta

Time: Bremen, June 18th, 2013

Coordinating person: Pekka Janhunen, Pekka.Janhunen@fmi.fi

Document Change Record

Issue	Rev.	Date	Pages, Tables, Figures affected	Modification	Name
1	0	18 June 2013	All	Initial issue	Rosta

Table of Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

DLR	German Aerospace Center (Deutsches Zentrum für Luft und Raumfahrt)
ESAIL	Electric solar wind sail
TLR	Technical readiness level

Reference Documents

[RD01]	ESAIL Proposal - Part B: Description of Work
[RD02]	Auxiliary tether reel test plan, D3.3.3, Version 1.0
[RD03]	Design description auxiliary tether reel, D3.3.2, Version 1.0

Applicable Documents

[AD01]	ECSS System engineering general requirements, ECSS-E-ST-10C, 06. March 2009
[AD02]	ECSS Standard Testing, ECSS-E-10-03A, 15. February 2002

1. Scope of this Document

This document presents the test results for the auxiliary tether reel tests in the framework of the Esail Project [RD01]. The tests have been accomplished according to the test plan [RD02].
The tests verified the design of the auxiliary tether reels as well as the functionality of same.
The following tests have been accomplished:

- Vibration
- Shock
- Thermal vacuum

It has to be considered that the tests do not present qualification tests but have been done in the course of development toward TLR 4-5.

2. Test Item Description

2.1. *Auxiliary Tether Reel*

For the tests the auxiliary tether reel mechanism has been used. The manufactured hardware is show in Figure 1. The detailed concept as well as the detailed design is given in [RD03].

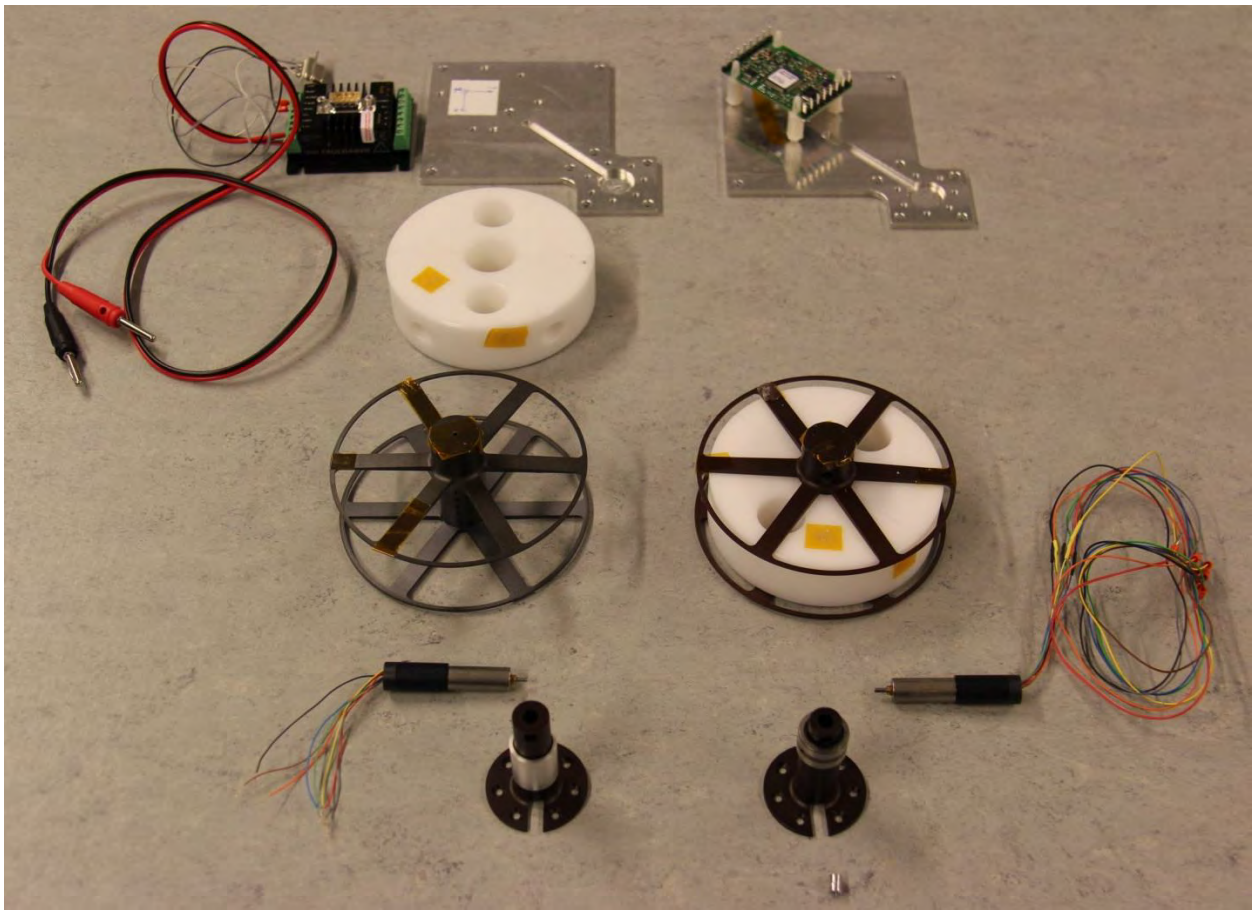

Figure 1: Auxiliary tether reel parts for both configurations. On the left hand side, the parts of the sliding bearing are disassembled (from top to bottom): Motor controller (with housing and electrical interface), base plate, tether mass dummy, tether reel, motor and motor holder equipped with a thin aluminum cylinder for the sliding bearing. On the right hand side the parts of the roller bearing configuration are shown. From top to bottom: Motor controller (without housing) mounted on the base plate, tether reel equipped with the tether dummy mass, motor and motor holder equipped with the roller bearing.

3. Test Results

3.1. *Shock and Vibration Tests*

The purpose of this test is to demonstrate the ability of the mechanism to withstand the random vibration during the launch [AD02].

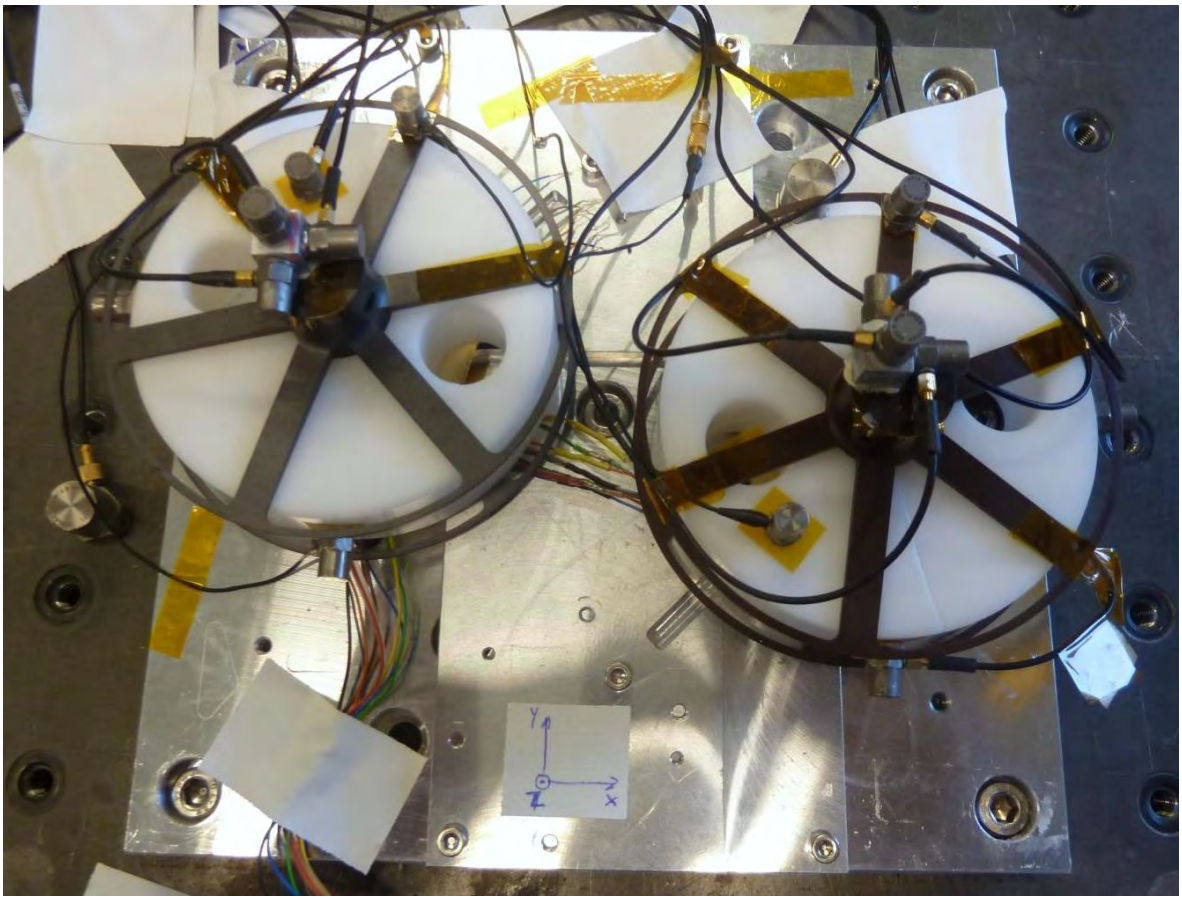

Figure 2: The manufactured auxiliary tether reels in both configurations, on the left hand side the sliding bearing and on the right hand side the roller bearing. Both are equipped with the auxiliary tether dummy mass as well as with force sensors and mounted on the shaker at the DLR test facility.

This test run can be divided in two test sections, the first was the sine vibration (“resonance sweep”), the second the random vibration test run, see table 1.

For the test runs both of the tether reels were equipped on the shaker, see Figure 2, and equipped with acceleration sensors. The detailed list of the sensors is specified in Appendix 4.2 “Test report vibration tests”.
Prior to every test run a resonance frequency search has been performed. The first resonance frequency of the setup should be higher than 140 Hz. The resonance search will be done to determine the dynamic properties before the load test and to inspect the mechanical integrity after the load tests.

The accomplished search shows that the first resonance frequency is above 140 Hz.

Duration	Frequency [Hz]	Qualification
Vertical[b] 2,5 min/axis	20-100	+3 dB/octave
	100-300	PSD(M)[c] = 1,78 g²/Hz
	300-2000	-5 dB/octave
	Overall	31,93 g_{rms}
Lateral[b] 2,5 min/axis	20-100	+3 dB/octave
	100-300	PSD(M)[c] = (2/3)² × 1,78 g²/Hz = 0,79
	300-2000	-5 dB/octave
	Overall	21,27 g_{rms}
[b] Equipment vertical axis = perpendicular to fixation plane. Equipment lateral axis = parallel to fixation plane. [c] M = equipment mass in kg, PSD = Power Spectral Density in g²/Hz.		

Table 1: Random vibration levels [RD02]

Parameter	Value
Frequency range	5…2000…5 Hz
Acceleration	0.5 g
Amplitude (5…22 Hz)	0.5 mm … ± 1 mm
Sweep rate	± 1 oct/min
Axis	Axial and lateral
Recorded Data	Main resonance of each axis

Table 2: Resonance search test specification [RD02]

The first test was a sine vibration test in z-axis direction and accomplished successfully.

The second test was the random vibration in z-axis direction. After 1:15 minutes the tether reel with the roller bearing shows an undefined movement, but no displacement of the tether reel. Due to this unacceptable movement the test was aborted. The disassembly of this tether reel shows the reason of the movement. The pin which locks the tether reel to the motor holder broke a small part out of the motor holder, see Figure 3. Hence this test failed.
Not that the maximum value for random vibration is 31.93 g_{RMS} was acting directly on the test object. This shows the worst case load on the auxiliary tether reels. For a real test case the transfer function is necessary, which define the load in dependence of the position on the remote unit as well as on the launch system.

Figure 3: Damaged motor holder, the broken part is placed on top of the motor holder.

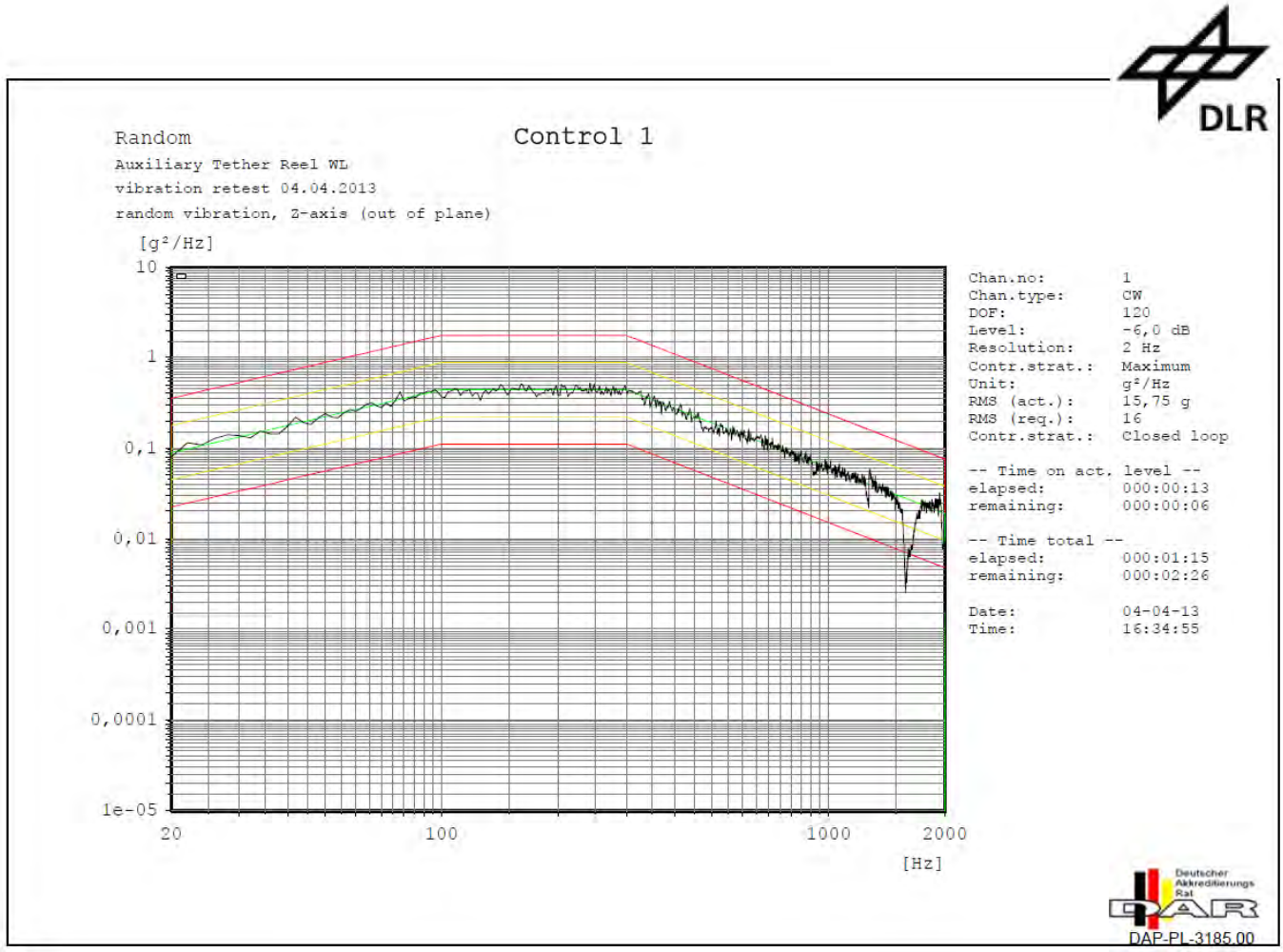

Figure 4: Test curve, random vibration test z-axis. Shows the random vibration test run until the motor holder damage

For the random test it can be concluded that the RMS level of the vibration was too high. Hence the test will be repeated with new manufactured components. Additionally, for the next test the RMS-level should be at maximum 15 g_{RMS}

Test Number	Damages	Functionality	Success/Fail Criteria
Si-1	Non Visual damage	Full functionality given	Success
Ra-1	Visual Damage	Part of the motor holder is broken, functionality	Fail

Table 3: Success/Fail Criteria for the shock and vibration tests

3.2. *Thermal Vacuum Tests*

The TV test was accomplished in the calorimetric chamber of the DLR test facility. This test was performed with the auxiliary tether reel in the sliding bearing configuration. As the test plan [RD02] required the test has a non-operation as well as an operation test mode with different temperature ranges. During the operation mode the tether reel turns with one revolution per minute.

Qualification Temperature Min [°C]	Qualification Temperature Max [°C]	Pressure [mbar]
-60	60	10^{-5} or less

Table 4: Temperature range for the non-operating thermal vacuum test [RD02]

Qualification Temperature Min [°C]	Qualification Temperature Max [°C]	Pressure [mbar]
-60	60	10^{-5} or less

Table 5: Temperature range for the operating thermal vacuum test [RD02]

The entire test run was successful accomplished. During the tests the functionality of the motor was verified.

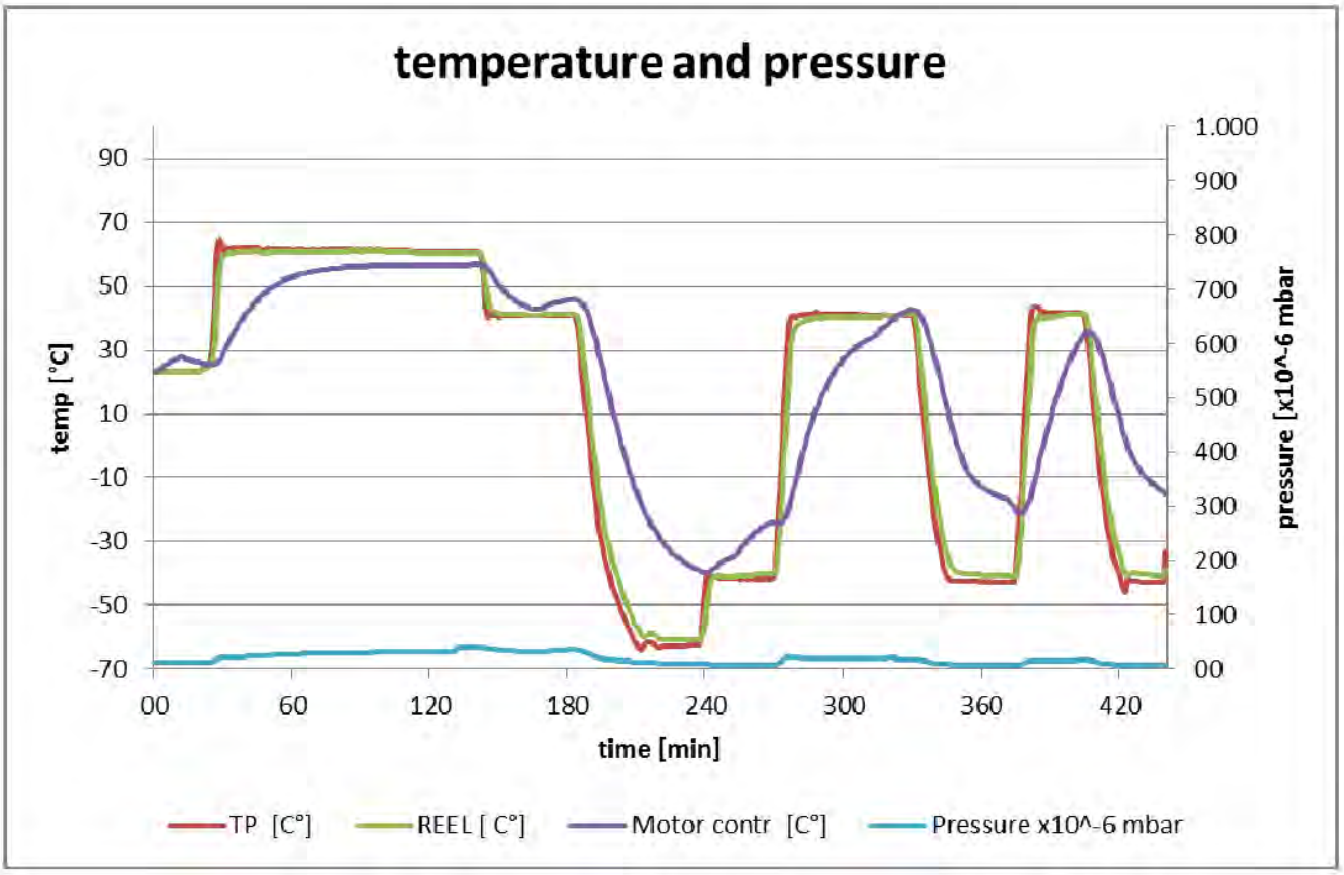

Figure 5: Test curve, thermal vacuum tests. The tests started with the non-operating mode followed by the operating mode with shorter change intervals.

Note that due to the tight schedule of the test facility and the planed auxiliary pull test yield to the fact that only the auxiliary tether reel in sliding bearing configuration has been tested.
The detailed test report is described in the appendix thermal vacuum test.

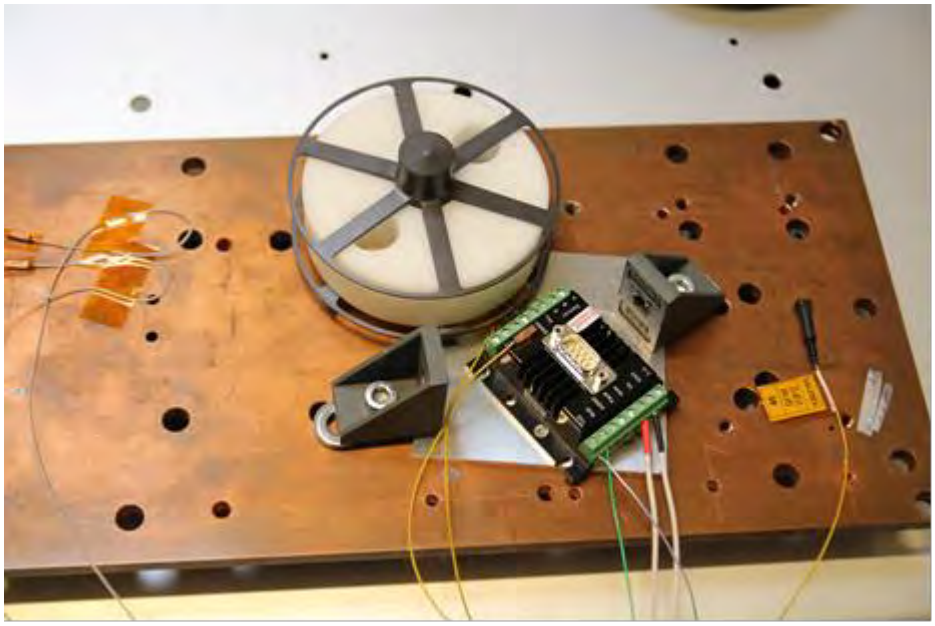

Figure 6: Auxiliary tether reel in the sliding bearing configuration connected to the motor controller equipped on the temperature support plate.

Test Number	Damages	Functionality	Success/Fail Criteria
TV-1	Non visual damage	Full functionality given during and after the test run	Success

Table 6: Success/Fail Criteria for the thermal vacuum tests

4. Appendix

4.1. *Thermal Vacuum Test*

4.2. *Shaker Test*

DLR
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Institute of Space Systems

Section System Conditioning

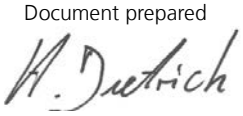
Test Report

Thermal Vacuum Test

ESAIL/REEL

ESAIL/REEL

Test Item:	Test Item Identification No. (TIIN):	Report No.:
ESAIL/REEL		**DLR-STV-019-2013**
Test Facility **Calorimetric Chamber**		Model Status
Test Division **Institute of Space Systems** **System Conditioning**		Test Level
Type of Test **Thermal Vacuum Test**	Test Personal Holger Dietrich	

Customer / Project Leader (Responsible for test item and functional tests - Name and Location) **Roland Rosta** **DLR RY-EXS**	Confirmation of Customer Signature
Facility Engineer (Responsible for facility performance) **H. Dietrich**	Document prepared  Signature
Test Responsible (Responsible for the professional accuracy of measurement results) **H. Dietrich**	Document prepared  Signature
Test manager (Responsible for objective and correctly execution of test according to test procedure) **N. Melnik**	Document checked  Signature
Section Head **T. Spröwitz**	Document released  Signature

ESAIL/REEL

Distribution List

No.	Name	Company Institute
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2.	Nauka Melnik	DLR–RY–SEK HB Archives

Document Change Record

Issue/ Rev.	Date	Affected Page(s) Paragraph(s)	Remarks/Change(s)
1	18.06.13	all	First Edition

ESAIL/REEL

Table of Contents

List of Figures

List of Tables

1. Document Specific Abbreviations

DL	Demonstration Level
DT	Dwell Time
EGSE	Electrical Ground Support Equipment
EM	Engineering Model
FFC	Full Function Check
FL	Flight Level
FM	Flight Model
FSM	Flight Spare Model
h	Hour
n. a.	not available
NCR	Non-Conformance Report.
PFL	Proto flight Level
QM	Qualification Model
QL	Qualification Level
SFC	Short Function Check
STV	Solar Thermal Vacuum
TEM	Thermal Engineering Model
TO	Temperature Operational
TNO	Temperature Non Operational
TSO	Temperature Switch On
TSP	Temperature Support Plate
TV	Thermal Vacuum
TVC	Thermal Vacuum Cycling
UUT	Unit under Test

2. Test objectives

The objective of these tests is to demonstrate the function of the *reel motor* under thermally controlled vacuum environment.

3. Test Requirements

3.1 Environment

The environmental conditions for handling the test specimen shall be as follows:

- Temperature 22 ±5°C
- Relative humidity 30 – 65%
- Atmospheric pressure Ambient
- Cleanliness Visible clean, dust from 100 000 or better (US Fed. Std. 209 E)

3.2 Test Facility

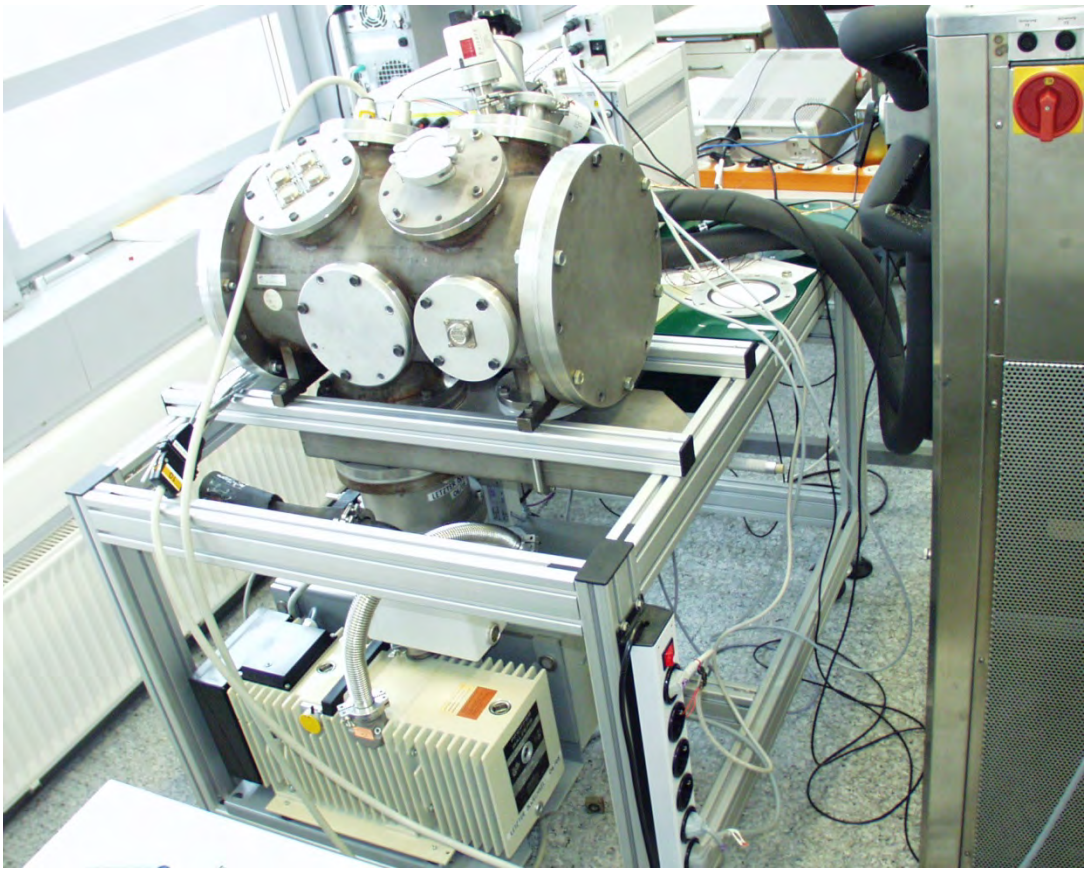

Figure 1: **Calorimetric Chamber**

Volume:	0.025 m^3 (Ø 0.25 m x 0.5 m)
Vacuum:	$1.33*10^{-5}$ mbar at Q_{gas}=0.013 mbar l s^{-1}
Temperature:	-60°C – 100°C
Temper with:	Thermostat

The chamber TSP shall operate at requested temperatures between 210 K and 380 K.
The chamber shall be capable of reaching a pressure of 10^{-5} mbar or less. The facility shall comprise all the required equipment for data acquisition incl. the temperature sensors and EGSE harness through the test chamber wall. The test facility shall provide at least 20 recording channels for temperature and current.

Figure 2: **Data Acquisition System Yokogawa DC100**

Table 1: Data Sheet of Yokogawa DC100

Input	Type	Measurement (digital display)		Maximum resolution
		Measurement range	Measurement accuracy	
DC Voltage	20 mV 60 mV 200 mV 2 V 6 V 20 V 50 V	-20,0 bis 20,0 mV -60,0 bis 60,0 mV -200,0 bis 200,0 mV -2000,0 bis 2000,0 mV -6,0 bis 6,0 V -20,0 bis 20,0 V -50,0bis 50,0 V	± (0,05% + 5 digits) ± (0,05% + 2 digits) ± (0,05% + 2 digits) ± (0,05% + 2 digits) ± (0,05% + 2 digits) ± (0,05% + 2 digits) ± (0,05% + 2 digits)	1 µV 10 µV 10 µV 100 µV 1 mV 1 mV 10 mV
TC	E	-200,0 bis 800,0 °C	± (0,05% + 0,5 °C)	0,1 °C
RTD	Pt100(1mA)	-200,0 bis 500,0 °C	± (0,05% + 0,3 °C)	0,1 °C

Table 2: **Calorimetric Chamber: Revision data sheet**

Instrumentation and test equipment				
Instrument/ Equipment	**Description/ Name**	**S/ N**	**Accuracy**	**Calibration Valid to**
Space environmental simulation facility	Calorimetric Chamber DLR/RY-SK-HB	n.a.	n.a.	n.a.
Temp. Data collector	Yokogawa DC 100	SK-901-015-1/KL	± (0,05% + 0,3°C)	07-2014
Vacuum Display	TPG 252	SK 101-0051/STV	see calibration	06-2014
Vacuum Gauge	Full Range PKR 250	SK-102-012-1/STV	see calibration	06-2014
Thermostat	HUBER "unistat 385 H1/2"	n.a	n.a	n.a

Table 3: **List of used thermo couples**

Type	Measurement equipment/ registration no.	Calibration no.	Calibration Valid to	Accuracy
Pt 100	RY-SK-1663 /1/STV	1643	09-2013	Pt 100 1/3 DIN B (0°C) according to DIN EN 60751
Pt 100	RY-SK-1664 /1/STV	1664	09-2013	--"--
Pt 100	RY-SK-45 /1/STV	45	09-2013	--"--
Pt 100	RY-SK-46 /1/STV	46	09-2013	--"--

Figure 3: **Thermostat Huber unistat 385**

Measurement range: -85…150°C
Temperature accuracy at -10°C in 20 l container: 0.02 K
Refrigerating capacity of ethanol:

- - 0°C 2.3 KW
- -20°C 2.3 KW
- -40°C 2.0 KW
- -60°C 1.2 KW
- -80°C 0.3 KW

4. Test Conditions

4.1 Thermal Vacuum Conditions

The equipment shall be tested in a thermal vacuum environment, having a pressure of $5*10^{-5}$ mbar or less. The thermal vacuum test shall start with pump-down. The temperature shall be increased up to max. non-operational level.

4.2 Constraints

Table 4: Test constrains

	Non operational		**Operational**		**Switch on**	
Unit	Min.	Max.	Min.	Max.	Min.	Max.
(TSP Temp.)	-60°C	60°C	-40°C	40°C	n.a.	n.a.
Equipment ref. point (REEL)	-60°C	60°C	-40°C	40°C	n.a.	n.a.

4.3 Measurements and Tolerances

4.3.1 Recorded Data

The following data shall be measured and recorded:

- **Test Set- Up**
  - Photo of test set-up
  - Photo of test specimen
  - Photo of test sensors
- **Temperature recording**
  - Record of temperature versus time. The measurements shall be in an acceptable time interval and at a minimum rate of one measurement per minute in all cycles.

4.3.2 Test Condition Tolerances

All instruments and test equipment used in the conduction of the tests shall have an accuracy of less than 25% of the tolerance given for the variable to be measured according to Table 3.

Table 5: Allowable tolerances for test parameters

Test Parameters	**Tolerances**
Relative humidity	± 5%
Temperature condition tolerances for temperature range -50°C to +100°C -200°C to -50°C > +100°C	Min. temperature: -3/ 0 K (Sensor accuracy included) Max. temperature: 0/ +3 K -5/ 0 K 0/ +5 K
Pressure	>1 mbar ± 15% 1E-1 to 1 mbar ± 30% <1E-1 mbar ± 80%
Test Duration	0/ +10%

5. Test flow

No.	Test step	Remarks
Test date: 15.03.2013 Description: Thermal Vacuum		
Functional test		
1	Short Function test	✓
Preparation of test facility		
2	Check T Sensors	✓
3	Connecting liquid tubes	✓
4	Check leak tightness	✓
Preparation of test sample		
5	Integration T Sensors	✓
6	Integration on thermal interface	✓
7	Assembly thermal interface on temp. support plate	✓
8	Check isolation resistance	✓
9	Integration of Multi-Layer Insulation (MLI)	✓
10	Photo of test assembly	✓
11	Photo of all visible T sensors	✓
Function test		DLR-STV-019-2013
12	SFC at T Ambient / Pressure Ambient	✓
13	T - Sensors	✓
14	Vacuum gauge	✓
Test steps thermal vacuum		
15	T Ambient / Pressure Ambient	✓
16	Pressure < 10^{-4} mbar	✓
17	TNO MAX	60°C
18	dwelltime	15 min
19	TO MAX	40°C
20	dwelltime	15 min
21	Function test	✓
22	TNO MIN	-60°C
23	dwelltime	15 min
24	TO MIN	-40°C
25	dwelltime	15 min
26	Funktion test	✓
27	TO MAX	40°C
28	dwelltime	15 min
29	Funktion test	✓
30	TO MIN	-40°C
31	dwelltime	15 min
32	Funktion test	✓
33	Repeat nr. 27-32	✓
34	End of test	✓

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6. Test chart

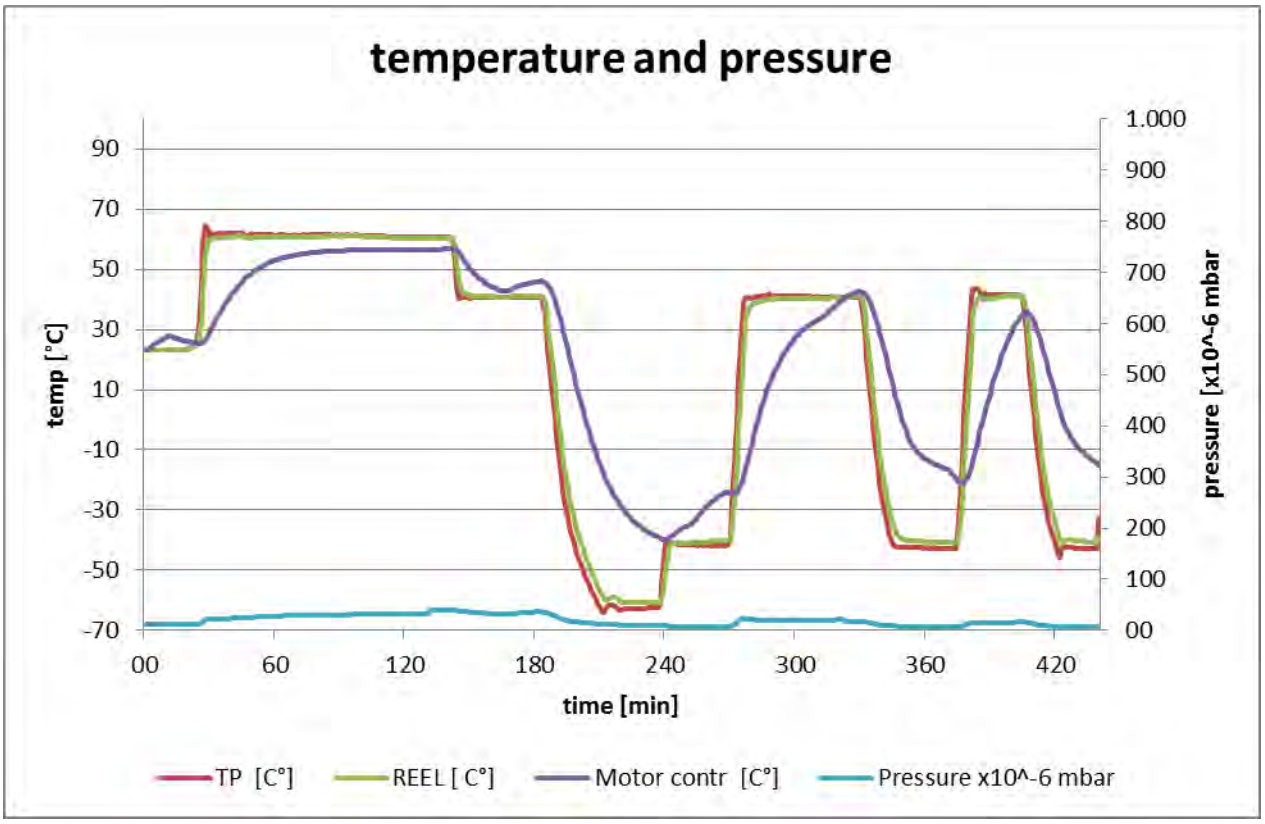

Figure 4: **Test chart**

7. Test Assembly

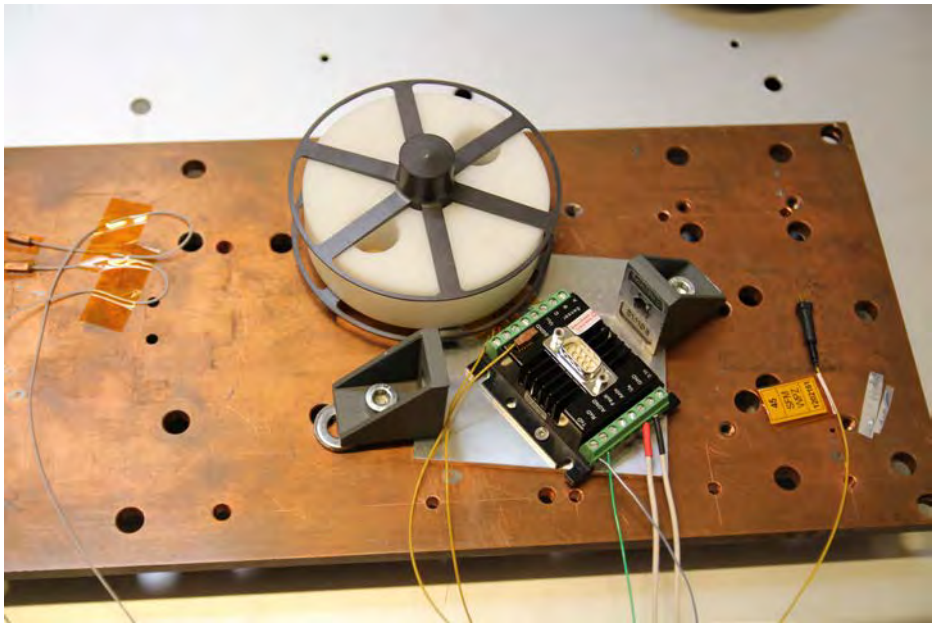

Figure 5: Test setup

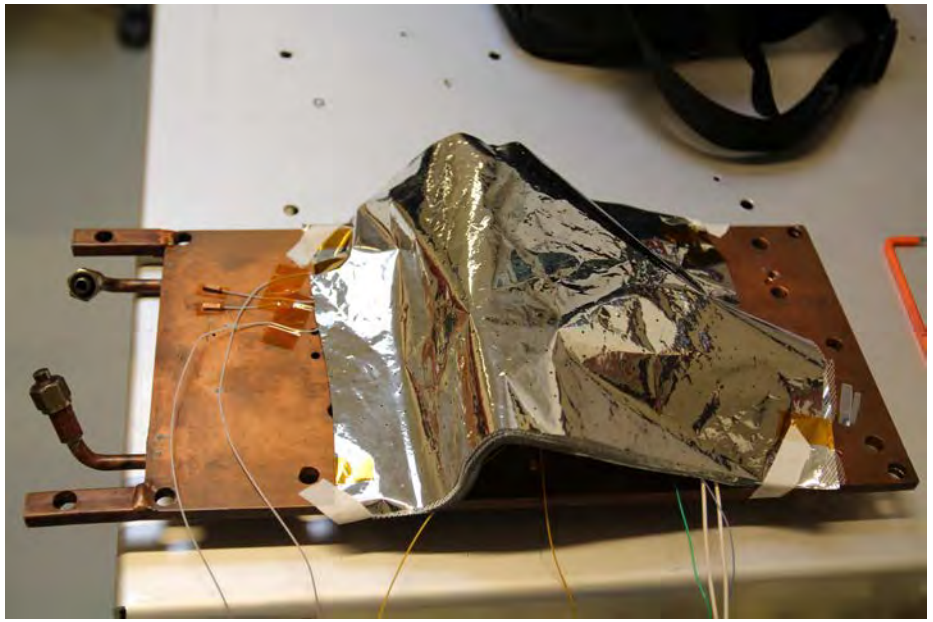

Figure 6: Test setup with MLI

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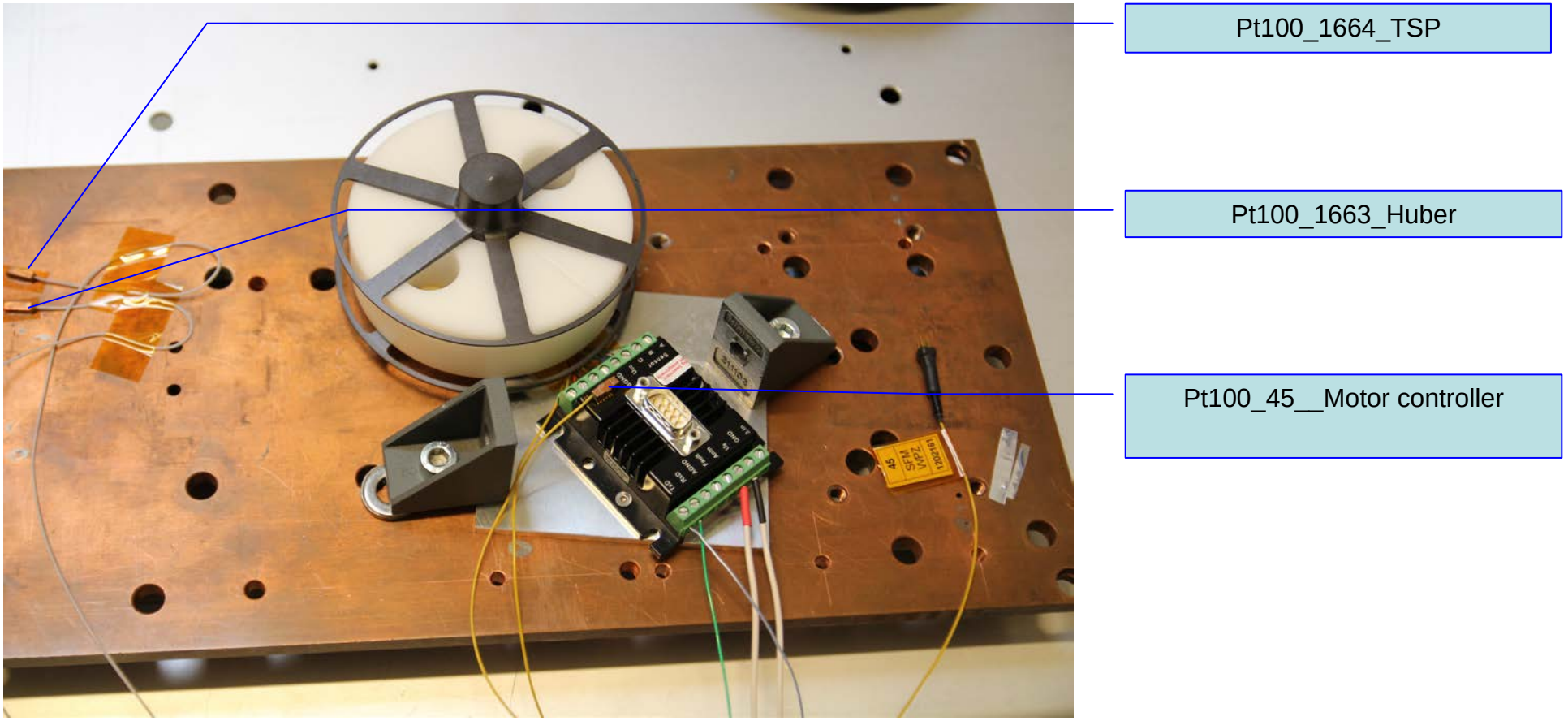

Figure 7: Test Setup with temperature sensors

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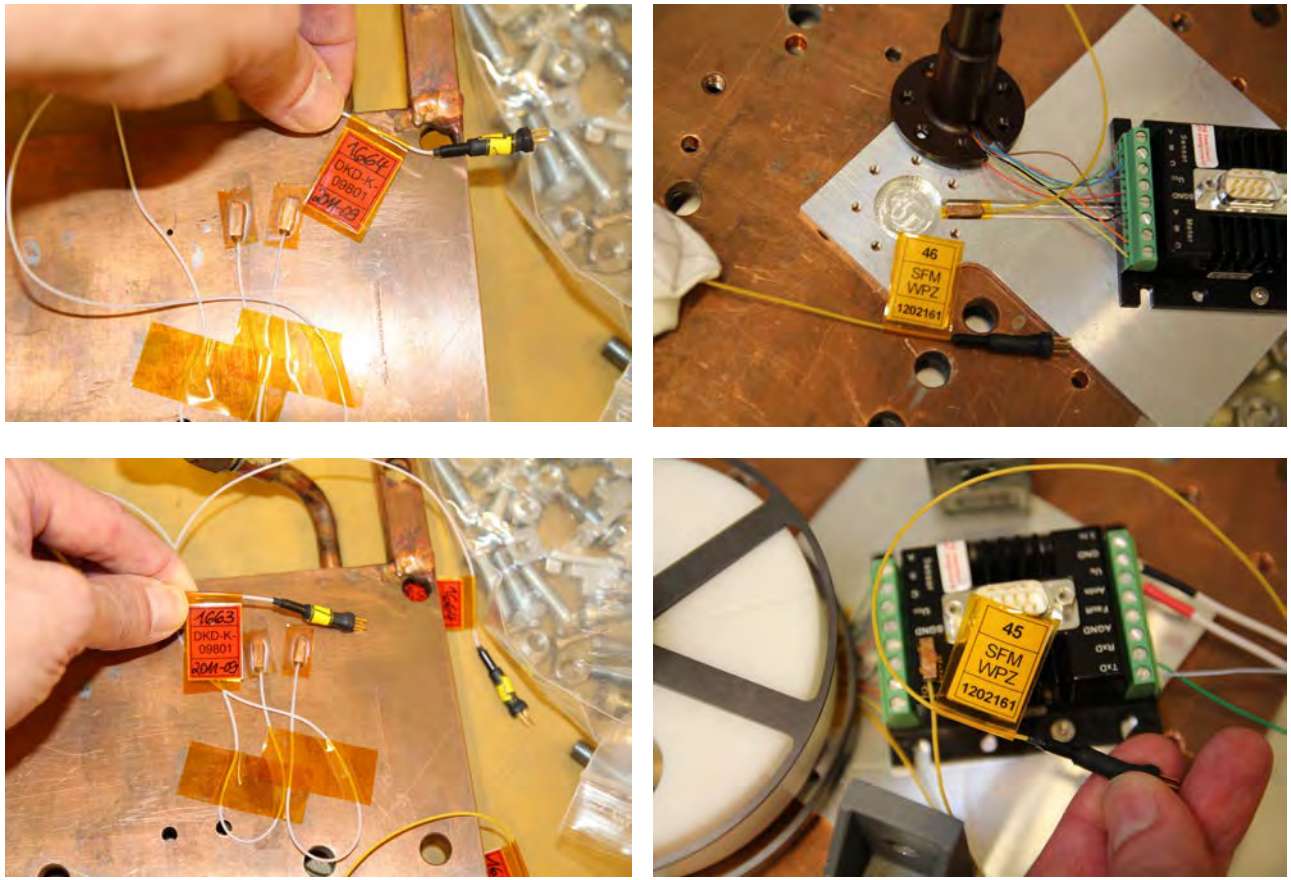


Figure 8: Test Setup with temperature sensors

8. Test Personal

H. Dietrich RY-SEK HB

9. Summary

The visual inspections and functional tests were performed by the customer Roland Rosta. The test was successful.

10. Appendix

- **Test steps (DLR-STV-019-2013-REEL-Protokoll.xls)**
- **Test record (DLR-STV-019-REEL-20130314-0000.xls)**
- **Pictures**

Institute of Space Systems

Section System Conditioning

Test Report

Vibration Test

Auxiliary Tether Reels

Project: ESAIL

DLR e.V.

Test item	Test Item Identification No. (TIN)	Report No.:
Tether Reel GL **Tether Reel WL**	**EM**	**DLR-MDT-012-2013**

Test Facility	Model Status
TIRAVIB 51010 **m+p international - Vibco NT**	**EM**

Test Division	Test Level
System Conditioning	**Qualification**

Type of Test	Test Personnel
Mechanical Test ***Vibration***	Jahnke DLR Rosta DLR

Customer / Project Leader (Responsible for test item and functional tests – Name and Location)

R. Rosta

DLR e.V. RY-EXS
Robert-Hooke-Str. 7
D - 28359 Bremen

Test Responsible / Facility Engineer (Responsible for correct test flow and facility performance)

A. Bäger **DLR e.V.**

(Document prepared)

Signature

Test Manager

N. Melnik **DLR e.V.**

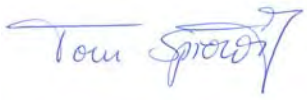
(Document checked)

Signature

Section Head

T. Spröwitz **DLR e.V.**

(Document released)



Signature

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1	Rosta	DLR/ RY-EXS
2	Melnik	DLR Archive

Revision Status Sheet

changed Rev.	Date	Sheet	Revision Notice	Signature

List of Contents

List of Figures

List of Tables

1. Test objectives

The objective of these tests was the evaluation of the design quality under mechanical loading of the Tether Reels GL and WL according to the ESAIL project test requirements.

2. Applicable Documents

The Vibration tests were performed according to the test specifications in the document titled “ESAIL D3.3.3 Auxiliary tether reel test plan” manifested in the ESAIL Work Package WP 3.3 Version 1.0 dated 2012-08-10.

3. Test Method

The vibration test was performed on the basis of test standard “Space Engineering – Testing” No ECSS-E-10-03A issue 2002-02-15.

4. Test requirements

4.1 Low level sine sweep

This test was performed before and after high level vibration tests to examine resonance behaviour.

- frequency: 5 – 2000 Hz
- acceleration: 0.5 g
- sweep rate: 2 oct/min (one upsweep)

4.2 Sine vibration

Table 1: Sine vibration test levels

Axis	Frequency	Level
Z out of plane	5 Hz 21 Hz 60 Hz 100 Hz	11 mm 20 g 20 g 6 g
sweep rate	2 oct/min	
duration	130 s	

4.3 Random vibration

Table 2: Random vibration test levels

Axis	Frequency	Level
Z out of plane	20-100 Hz 100 Hz 300 Hz 300-2000 Hz	3 dB/oct 1.78 g²/Hz 1.78 g²/Hz -5 dB/oct
overall level	32 g_{RMS}	
duration	120 s	

4.4 Test tolerances

Table 3: Test parameter tolerances

TEST PARAMETERS	TOLERANCES
Vibration frequency:	± 2% (or 1 Hz whichever is greater)
Random vibration acceleration: PSD Random overall g_{RMS}	 -1 / +3 dB, 20-500 Hz (Qualification) -3.0/+1.5 dB, 500-2000 Hz (Acceptance) ±10%

4.5 Pass / fail criteria

a) general: no visible structural damages or cracks, no loosened parts,
no changes in resonance frequencies behaviour greater than 10%
first resonance frequency greater than 140 Hz

b) specific to test item: N/A

5. Test results and summary

During the first sinusoidal vibration test got loosened Tether Reel WL and GL because they weren't locked on the motor holder. For the further tests was only used the Reel WL as representative Reel.

The tested Tether Reel WL passed the sine vibration in Z-axis and failed the random vibration test performed on 3rd/4th of April 2013.

With respect to section 4.5:

a) During the random vibration test, -6dB of full level in Z-direction, the WL showed tilting movement. The lock pin which locks the Reel on the motor holder damaged this holder, see figure 1.
The first resonance frequency is greater than 140 Hz.

b) N/A

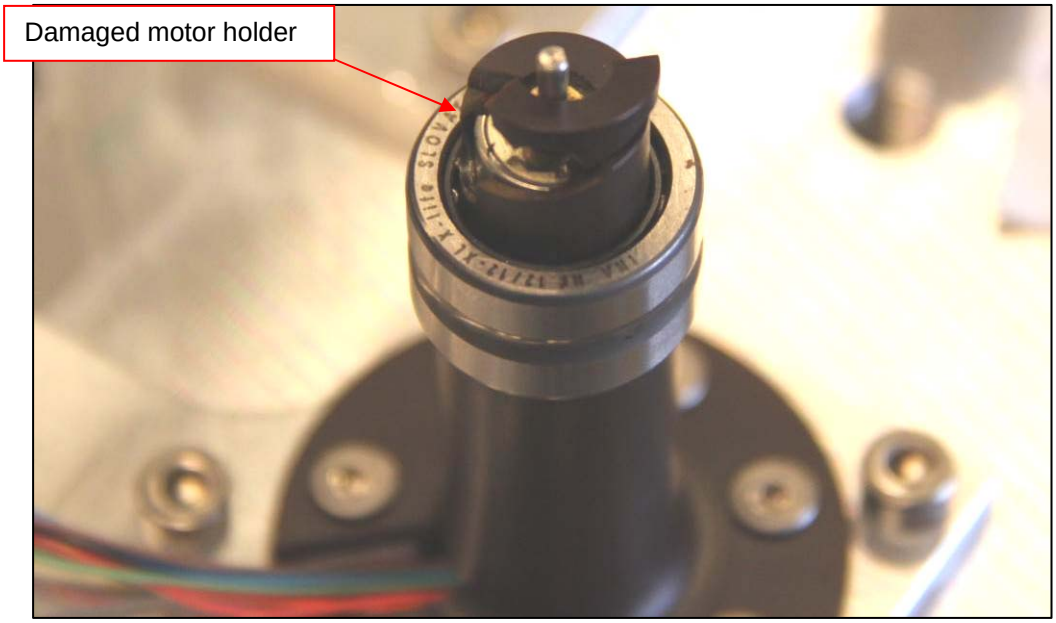


Figure 1: Damaged motor holder

5.1 Resonance survey

Table 4: Resonance survey results

Assembly/ Axis		MP	before sine	before random
WL -Z	1	WL-Reel-Center-Z	1583 Hz; Q=4	1583 Hz; Q=4
	2	WL-Side-Z	no significant resonance	no significant resonance

6. Test personnel

Test Engineer / Test Facility

R.Jahnke DLR e.V.
A. Bäger DLR e.V.

Hardware responsible (Test item / functional tests)

R. Rosta DLR e.V.

7. Test assemblies and Instrumentations

7.1 Test assembly Z-axis - Tether Reels WL and GL

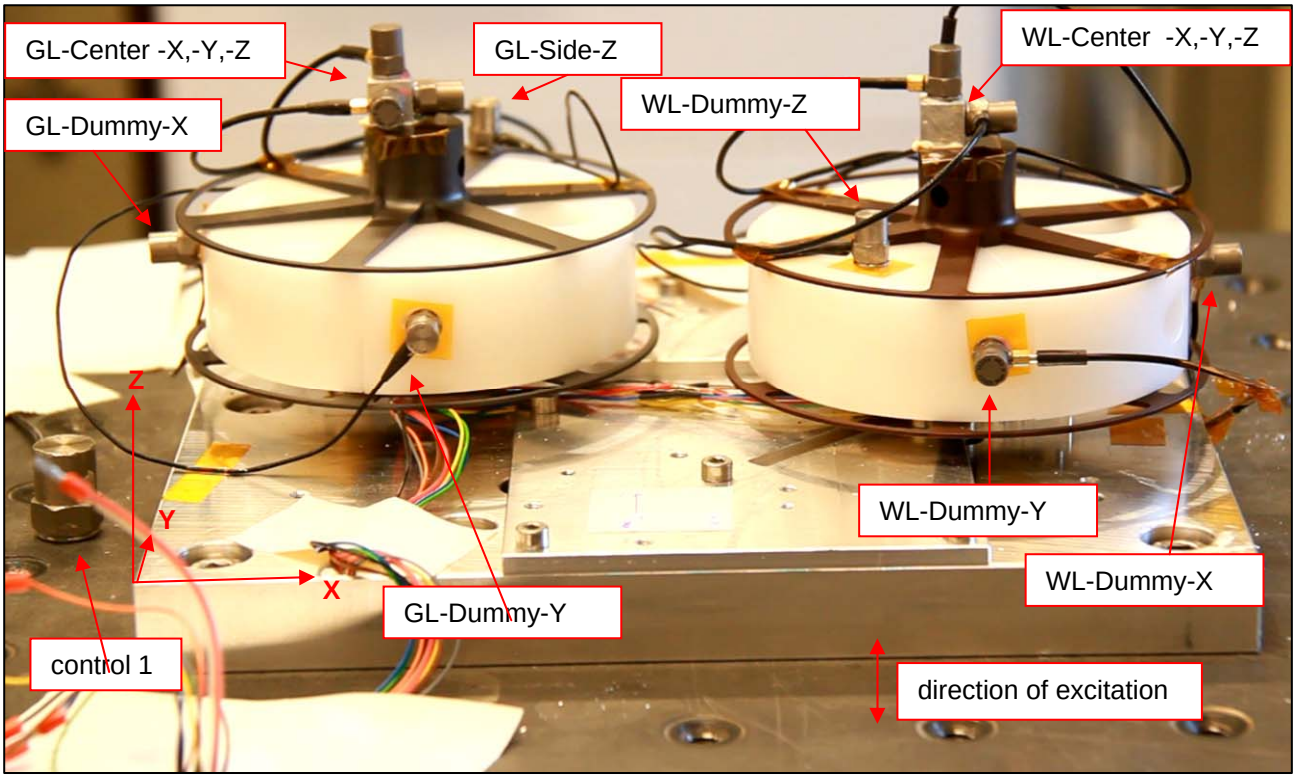


Figure 2: Vibration test setup for testing WL and GL in Z-direction

Table 5: Accelerometers for vibration testing of WL and GL in Z-direction

channel	measurement point	Sensor Type / S/N
channel 1	control 1	B&K 4371 / 1720484
channel 2	control 2	B&K 4371 / 1731225
channel 3	WL-Reel-Center-X	B&K 4393V / 14370
channel 4	WL-Reel-Center-Y	B&K 4393V / 14397
channel 5	WL-Reel-Center-Z	B&K 4393V / 14369
channel 6	GL-Reel-Center-X	B&K 4393V / 14399
channel 7	GL-Reel-Center-Y	B&K 4393V / 13964
channel 8	GL-Reel-Center-Z	B&K 4393V / 14403
channel 9	WL-Dummy-Center-X	B&K 4393V / 13958
channel 10	WL-Dummy-Center-Y	B&K 4393V / 14395
channel 11	WL-Dummy-Center-Z	B&K 4375V / 2107950
channel 12	GL-Dummy-Center-X	B&K 4375V / 2107955
channel 13	GL-Dummy-Center-Y	B&K 4375V / 2107951
channel 14	GL-Dummy-Center-Z	B&K 4393V / 14001
channel 15	WL-Side-Z	B&K 4393V / 12916
channel 16	GL-Side-Z	B&K 4375V / 2107948

Temperature: 21°C, Humidity: 40%

7.2 Test assembly Z-axis - Tether Reel WL

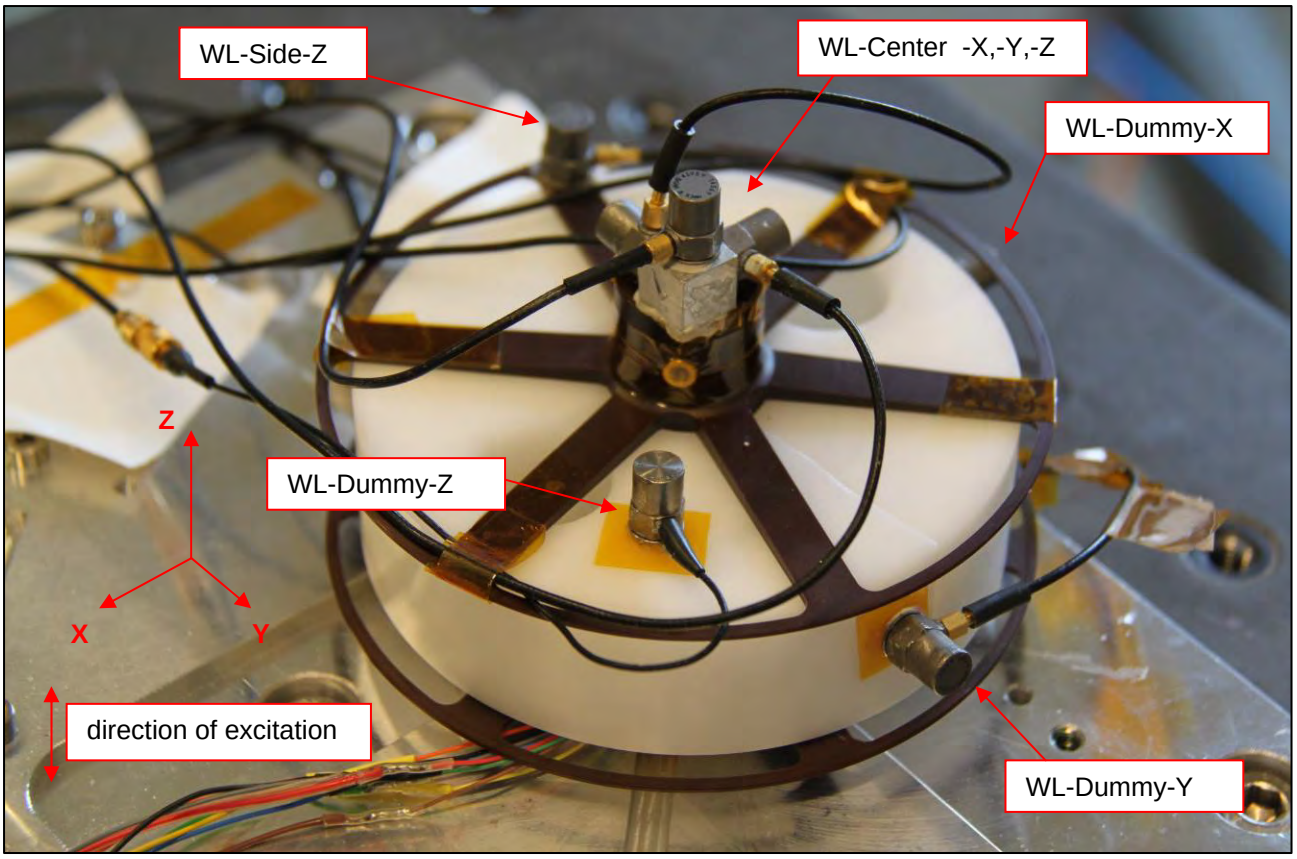


Figure 3: Vibration test setup for testing WL in Z-direction

Table 6: Accelerometers for vibration testing of WL in Z-direction

channel	measurement point	Sensor Type / S/N
channel 1	control 1	B&K 4371 / 1720484
channel 2	control 2	B&K 4371 / 1731225
channel 3	WL-Reel-Center-X	B&K 4393V / 14370
channel 4	WL-Reel-Center-Y	B&K 4393V / 14397
channel 5	WL-Reel-Center-Z	B&K 4393V / 14369
channel 9	WL-Dummy-Center-X	B&K 4393V / 13958
channel 10	WL-Dummy-Center-Y	B&K 4393V / 14395
channel 11	WL-Dummy-Center-Z	B&K 4375V / 2107950
channel 15	WL-Side-Z	B&K 4393V / 12916

Temperature: 21°C
Humidity: 40%

8. Test flow

No.	Test step	Remarks
Test date: 2013-04-03/ 2013-04-04 description: Vibration test Tether Reels GL and WL, EM		
functional testing		
1.	function test	by customer
preparation of test facility		
2.	check calibration of accelerometers	✓
3.	check shaker	✓
integration on test facility		
4.	mounting Tether Reels GL and WL on test adapter on shaker in Z-direction	✓
5.	integration of accelerometers	✓
6.	configure test setup for testing in Z-axis	✓
7.	check of the test assembly, the control and measurement channel connections and setup on the PC by another Person	✓
8.	photo of test assembly	✓
test flow Tether Reels GL/WL , Z-axis		
9.	resonance survey 1 Z	ATR-WL-GL_Reso_Z1.pdf
10.	sine vibration test Z	ATR-WL-GL_Sine_Z.pdf Tether Reels GL and WL got loosened at 15 Hz/ 10g peak, test was stopped
next test, only with Reel WL		
11.	mounting Tether Reel WL locked on the motor axle on test adapter on shaker in Z-direction	✓
12.	integration of accelerometers	✓
13.	configure test setup for Z-axis	✓
14.	check of the test assembly, the control and measurement channel connections and setup on the PC by another Person	✓
15.	photo of test assembly	✓
test flow Tether Reel WL, Z-axis		
16.	resonance survey 1 Z	ATR-WL_Reso_Z1.pdf
17.	sine vibration test Z	ATR-WL_Sine_Z.pdf
18.	resonance survey 2 Z	ATR-WL_Reso_Z2.pdf
19.	random vibration test Z	ATR-WL_Random_Z.pdf The lock pin of Tether Reel WL cracked the motor holder apart, full test level of 32g RMS was not reached, test was stopped at -6dB
end of tests		

9. Calibration and Test Equipment

9.1 Shaker TIRAVIB 51010 / LS with slip table

Manufacturer TIRA Maschinenbau GmbH Rauhenstein
Poststrasse 1-3
96528 Rauhenstein
Germany

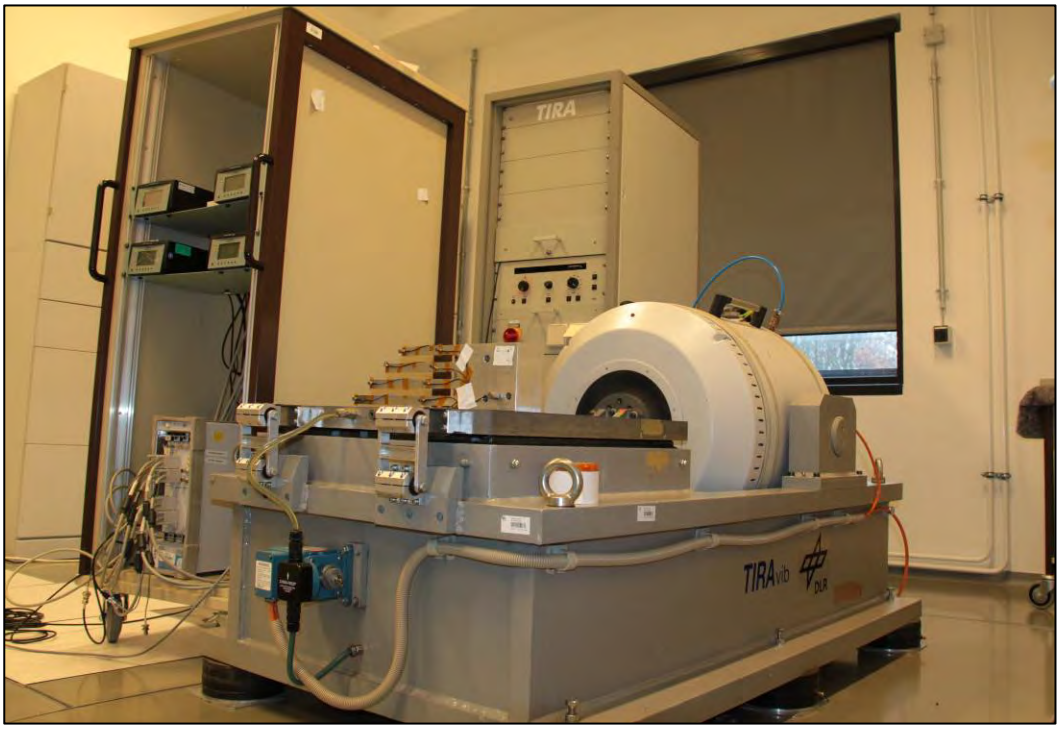


Figure 4: TIRAvib 51010 test facility with slip table

max. force in sinusoidal mode:	11 000 N
max. force in random mode:	11 000 N
max. displacement:	51 mm (peak-to-peak)
max. velocity:	1.8 m/sec
max. acceleration:	957 m/sec² (without mass)
frequency range:	2 … 5000 Hz

Safety features power amplifier

- supervision of current, input overload, displacement, velocity and temperature
- test abort in case of overcurrent, overtravel, exceeding of maximum velocity or temperature

Technical characteristics

shaker

- guidance of moving equipment by rolling elements (PP) and damping elements
- mass of moving equipment: 11.5 kg
- maximum mass load: 150 kg
- stiffness of suspension:

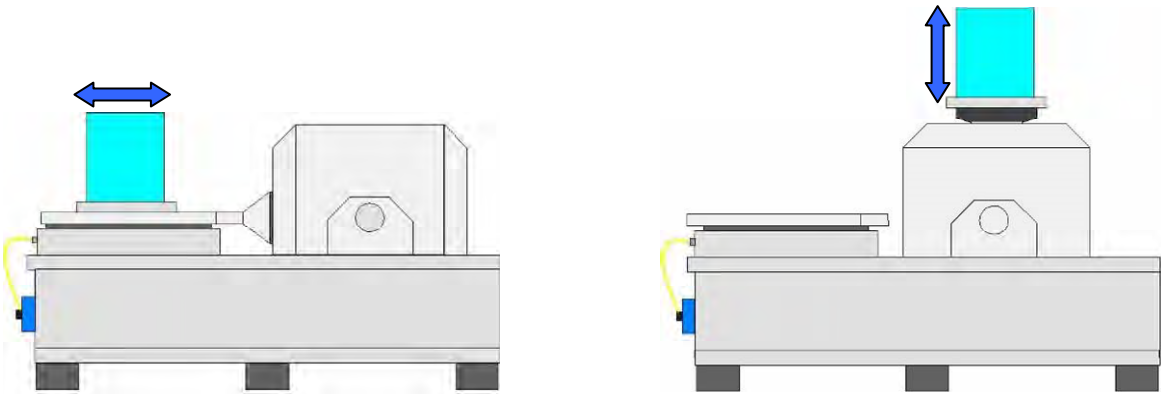
axial	80 kN/m
orthogonal to axis	3 kN/m
rotating stiffness	50 kN/rad

auxiliary table TGT MO 24

- dimension of table: 1665 · 940 · 925 mm
- frequency range: 0 … 2000 Hz
- material: magnesium
- mass of table: 30 kg
- maximum displacement: 70 mm
- maximum mass load: 500 kg

power amplifier TIRAVIB 50010 / LS

- power: 14 kVA
- power frequency range: 2 … 6000 Hz
- safety control for power overload, input overload and temperature



shaker excitation in horizontal direction *shaker excitation in vertical direction*

Figure 5: Shaker setup for horizontal and vertical excitation

9.2 Control unit VibControl NT m+p international

Manufacturer m+p international
Mess- und Rechentechnik GmbH
Freundallee 17
30173 Hannover
Germany

Safety features Control Unit

- safety for disconnection of control accelerometer
- acceleration control with 2 or more channels
- maximum limit over all channels in test setup
- abort and warn limits for control signal in test setup
- quick stop button to standby
- soft stop (soft shutdown within 3 seconds) in case of loss of control channel or exceeding of abort limits
- software version 2.11

9.3 Acceleration Measurement - Charge Amplifier

- **4 four-channel charge amplifier NEXUS**

Manufacturer **Brüel & Kjær** Danmark A/S
Skodsborgvej 307
2850 Nærum
Danmark

9.4 Acceleration Measurement - Transducer

Manufacturer **Brüel & Kjær** Danmark A/S
Skodsborgvej 307
2850 Nærum
Danmark

Accelerometer Type 4371
Accelerometer type 4371 is a DeltaShear®, UniGain® type with side connector. The 4371 has a wide frequency and dynamic range and is especially suitable for high-level measurements.

Miniature Accelerometer Type 4393V
Miniature accelerometer type 4393V is a miniature DeltaShear® charge accelerometer for high-level, high-frequency vibration measurements and for measurements in confined spaces or on delicate structures.

For further information on the used equipment refer to paragraph 9.5.

9.5 List of used facilities and equipment

Table 7: Used facilities and equipment

x	Device	Type	S/N	Manufacturer	Next calibration
X	Shaker	TiraVib 51010/LS		Tira	
	Pyroshock table			Astro	
X	Control Unit V 2.11	VXI-Bus	US40052598	M+P international	20.05.2013
	SO Analyzer V 3.3	VibPilot	B080085 B080088	M+P international	20.05.2013
X	Accelerometer	4371	1720484	Brüel & Kjær	11.10.2013
X	Accelerometer	4371	1731225	Brüel & Kjær	11.10.2013
	Accelerometer	4371	1796090	Brüel & Kjær	11.10.2013
	Accelerometer	4371	1942352	Brüel & Kjær	11.10.2013
	Accelerometer	4371	1942353	Brüel & Kjær	11.10.2013
	Accelerometer	4375V	2107943	Brüel & Kjær	26.04.2013
X	Accelerometer	4375V	2107948	Brüel & Kjær	26.04.2013
	Accelerometer	4375V	2107949	Brüel & Kjær	26.04.2013
X	Accelerometer	4375V	2107950	Brüel & Kjær	26.04.2013
X	Accelerometer	4375V	2107951	Brüel & Kjær	26.04.2013
X	Accelerometer	4375V	2107955	Brüel & Kjær	26.04.2013
X	Accelerometer	4393V	12916	Brüel & Kjær	04.05.2013
	Accelerometer	4393V	12917	Brüel & Kjær	24.06.2013
	Accelerometer	4393V	13881	Brüel & Kjær	04.05.2013
X	Accelerometer	4393V	13958	Brüel & Kjær	04.05.2013
X	Accelerometer	4393V	13964	Brüel & Kjær	04.05.2013
	Accelerometer	4393V	13984	Brüel & Kjær	04.05.2013
X	Accelerometer	4393V	14001	Brüel & Kjær	04.05.2013
	Accelerometer	4393V	14368	Brüel & Kjær	04.05.2013
X	Accelerometer	4393V	14369	Brüel & Kjær	24.06.2013
X	Accelerometer	4393V	14370	Brüel & Kjær	04.05.2013
X	Accelerometer	4393V	14395	Brüel & Kjær	04.05.2013
X	Accelerometer	4393V	14397	Brüel & Kjær	04.05.2013
X	Accelerometer	4393V	14399	Brüel & Kjær	04.05.2013
X	Accelerometer	4393V	14403	Brüel & Kjær	24.06.2013
	Accelerometer	M353B15	104348	PCB	24.06.2013
	Accelerometer	M353B15	104349	PCB	13.10.2013
	Accelerometer	M353B15	104350	PCB	13.10.2013
	Accelerometer	M353B15	104351	PCB	24.06.2013
	Accelerometer	M353B15	104352	PCB	13.10.2013
	Accelerometer	M353B15	103906	PCB	13.10.2013
	Accelerometer	M353B15	104172	PCB	13.10.2013
	Accelerometer	M353B15	104173	PCB	13.10.2013
	Accelerometer	M353B16	103775	PCB	13.10.2013
	Accelerometer	M353B16	103776	PCB	13.10.2013

x	Device	Type	S/N	Manufacturer	Next calibration
	Accelerometer	M353B16	104268	PCB	13.10.2013
	Accelerometer	M353B16	104269	PCB	13.10.2013
	Accelerometer	M353B16	104270	PCB	13.10.2013
	Accelerometer	M353B16	104271	PCB	13.10.2013
	Accelerometer	M353B16	99089	PCB	13.10.2013
	Accelerometer	M353B16	99088	PCB	14.10.2013
	Force Gauge	9067	507281	Kistler	14.07.2013
	Force Gauge	9067	497036	Kistler	14.07.2013
	Force Gauge	9067	507271	Kistler	14.07.2013
	Force Gauge	9067	497034	Kistler	14.07.2013
X	Charge Amplifier	Nexus	2236649	Brüel & Kjær	28.07.2013
X	Charge Amplifier	Nexus	2236720	Brüel & Kjær	28.07.2013
X	Charge Amplifier	Nexus	2236647	Brüel & Kjær	11.08.2013
X	Charge Amplifier	Nexus	2236648	Brüel & Kjær	11.08.2013
	Accelerometer	8339	55715	Brüel & Kjær	11.08.2013
	Accelerometer	8339	55716	Brüel & Kjær	11.08.2013
	Accelerometer	8339	55718	Brüel & Kjær	11.08.2013
	Accelerometer	8339	55719	Brüel & Kjær	11.08.2013
	Accelerometer	8339	55720	Brüel & Kjær	11.08.2013
	Accelerometer	8339	55721	Brüel & Kjær	11.08.2013
	Accelerometer	8743A20	2066503	Kistler	21.11.2012
	Accelerometer	8743A20	2090780	Kistler	08.12.2012
	Accelerometer	8743A20	2090781	Kistler	08.12.2012
	Accelerometer	352A25	104654	PCB	27.06.2013
	Accelerometer	352A25	104655	PCB	27.06.2013
	Accelerometer	352A25	104657	PCB	27.06.2013
	Accelerometer	352A25	104658	PCB	27.06.2013
	Accelerometer	352A25	104688	PCB	27.06.2013
	Accelerometer	356A01	113155	PCB	20.05.2013
	Accelerometer	356A01	113156	PCB	20.05.2013

APPENDIX
Test curves

Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

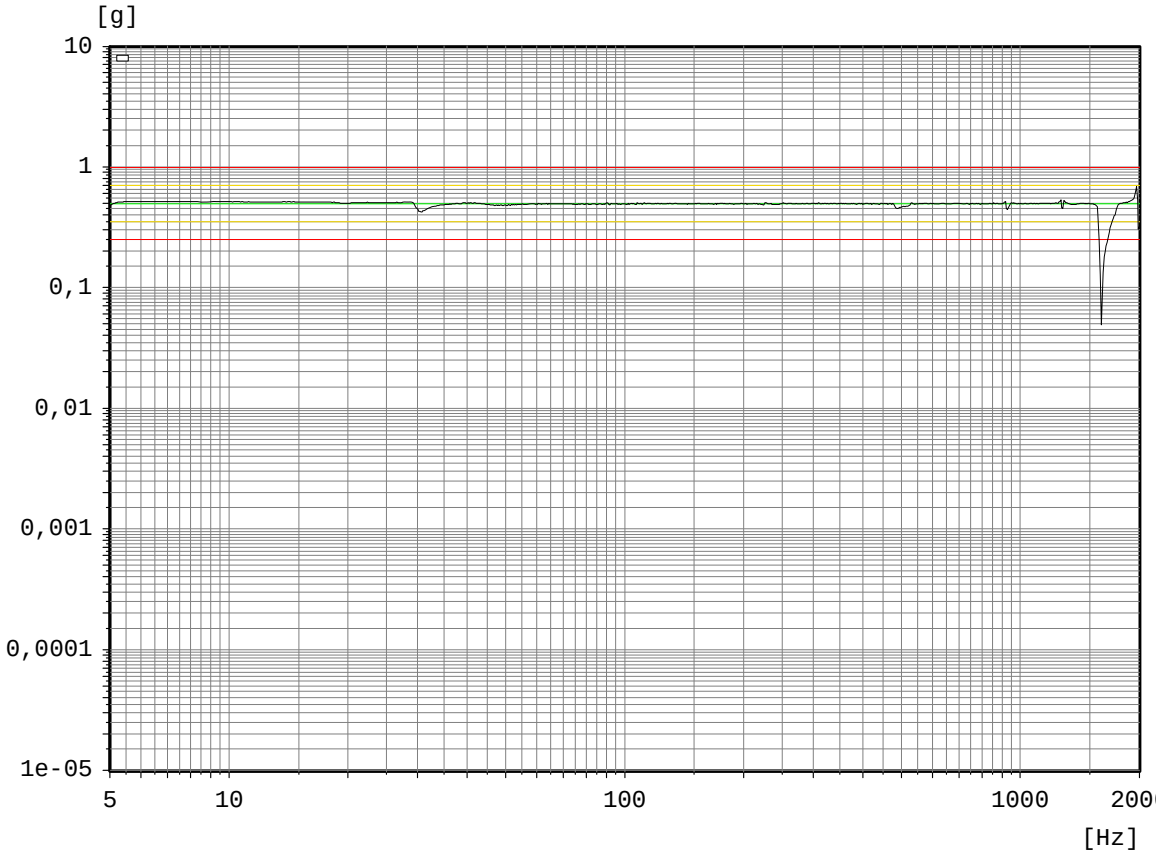
Sine

Control 1

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



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Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_1.rsn

Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

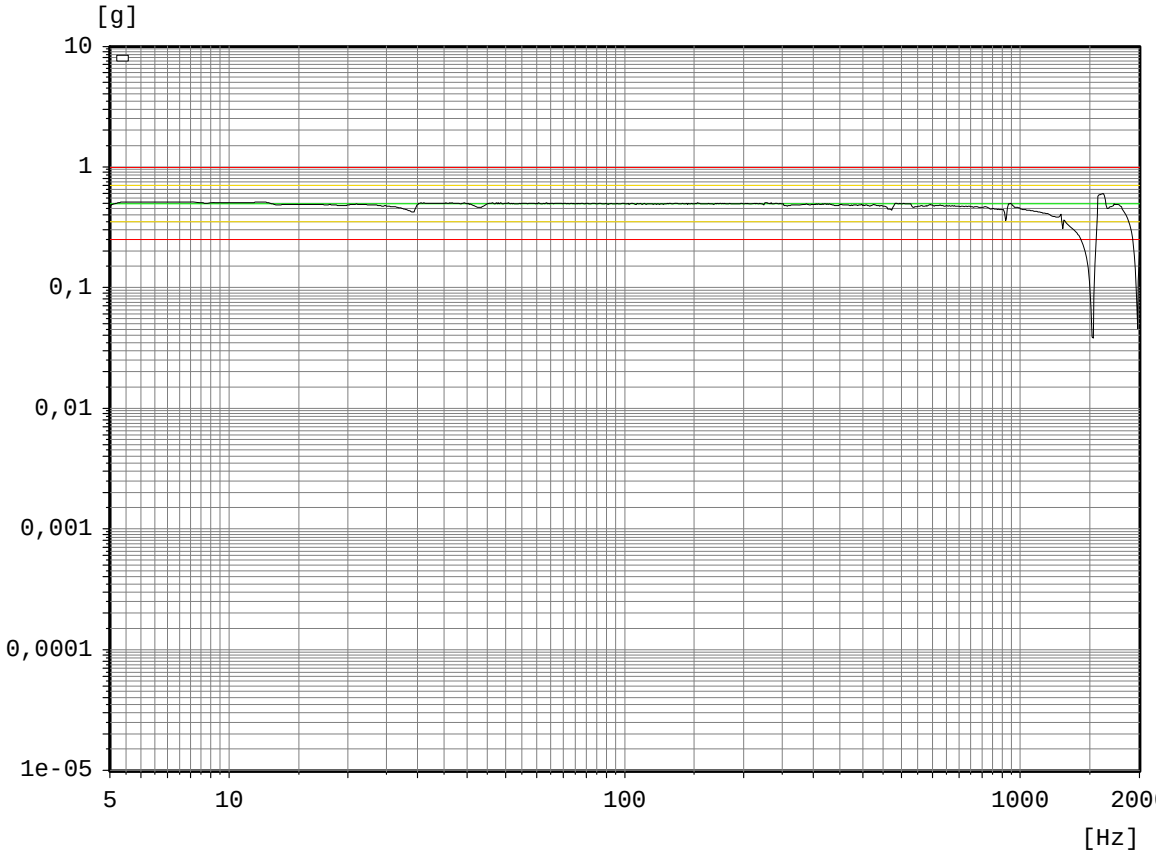
Sine

Control 2

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



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Unit:	g
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Time:	18:42:44

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

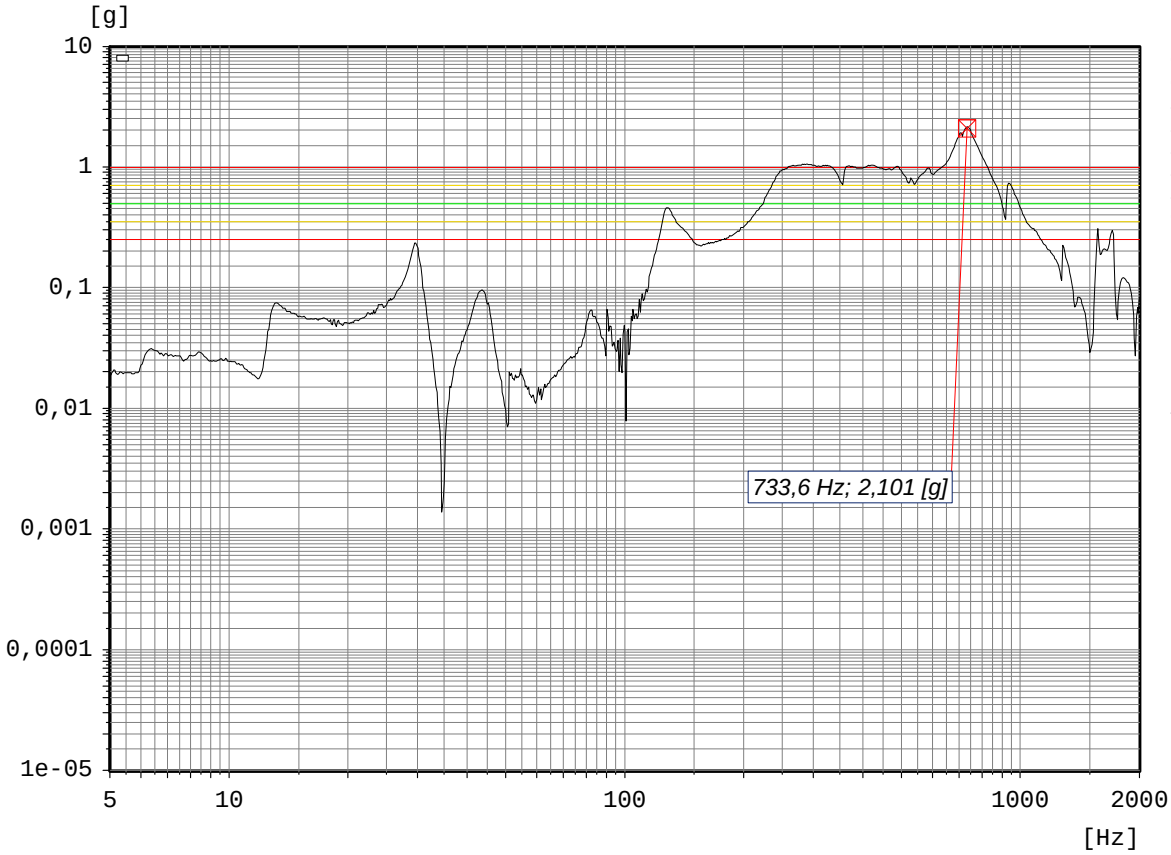
Sine

WL-Reel-Center-X

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



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Unit:	g
Contr.strat.:	Closed loop
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remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

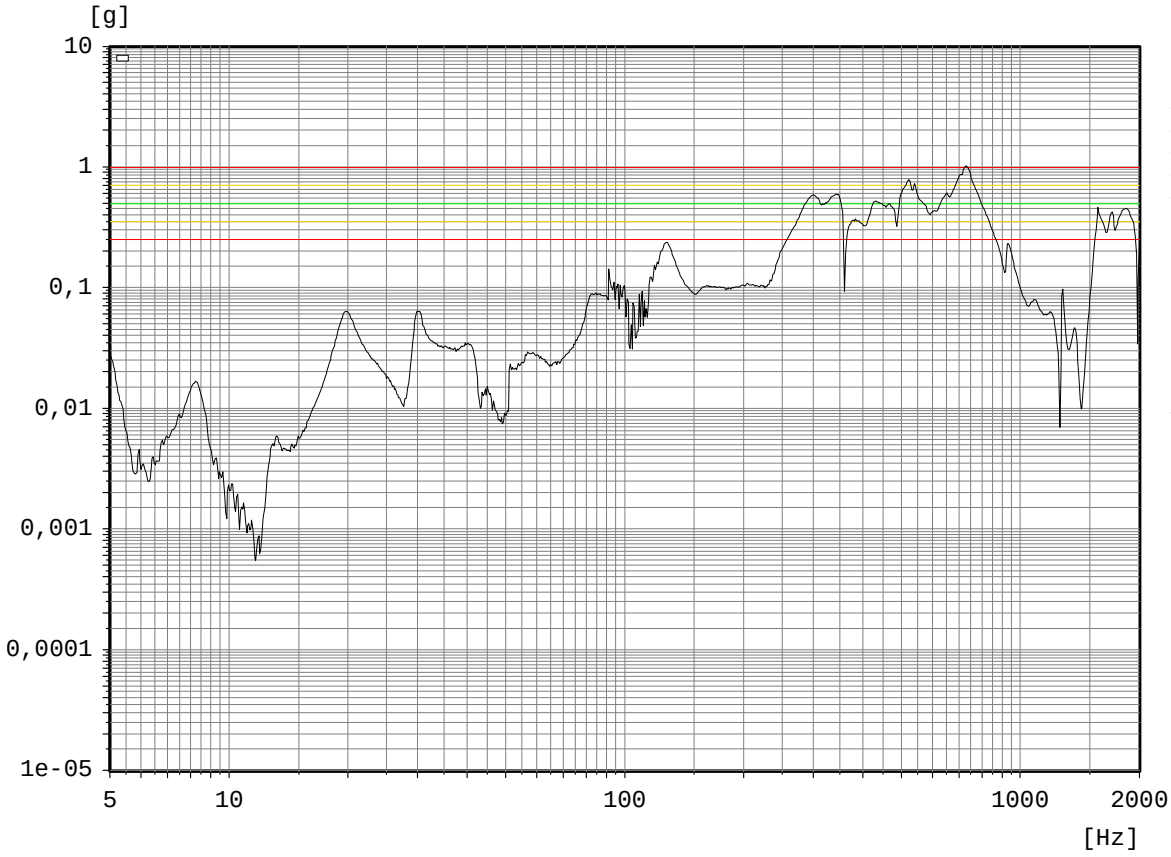
Sine

WL-Reel-Center-Y

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



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Unit:	g
Contr.strat.:	Closed loop
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remaining:	000:00:00
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Time:	18:42:44

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL / GL

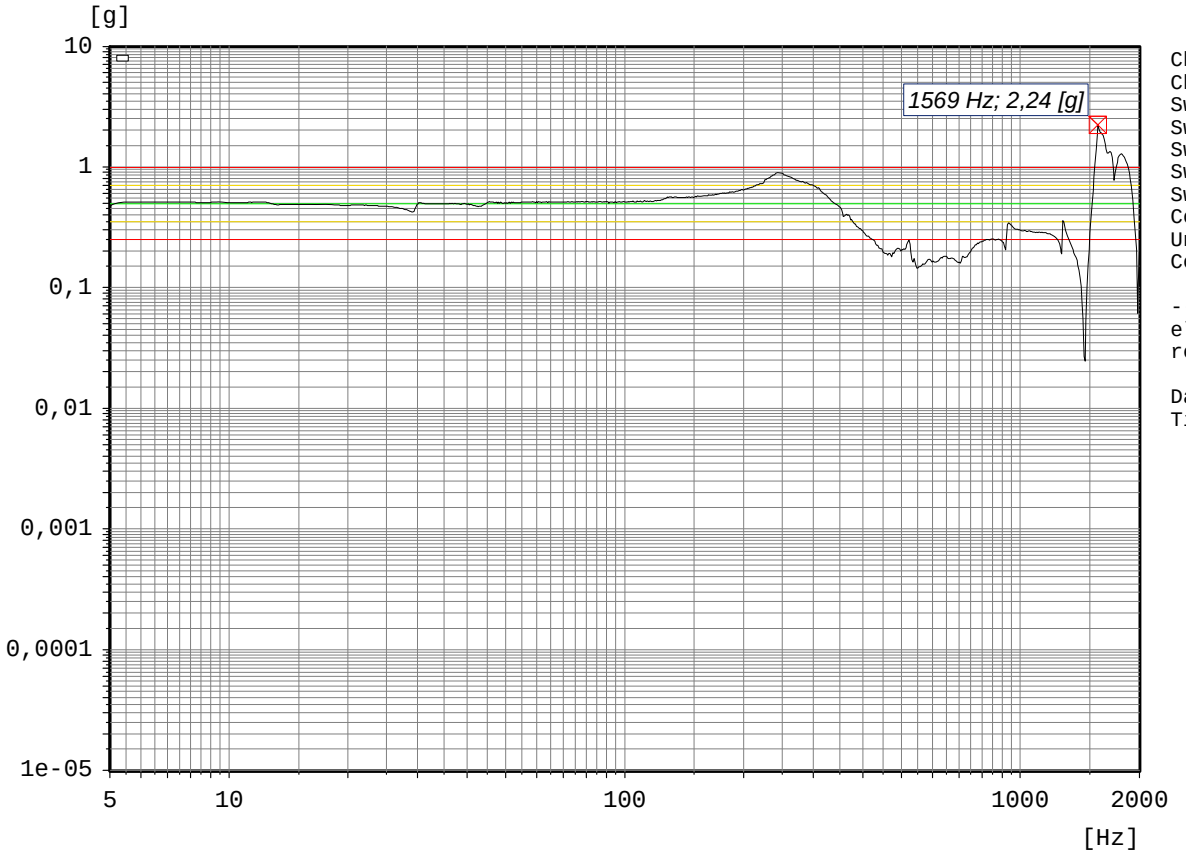
Sine

WL-Reel-Center-Z

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



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Unit:	g
Contr.strat.:	Closed loop
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Date:	04-03-13
Time:	18:42:44

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL / GL

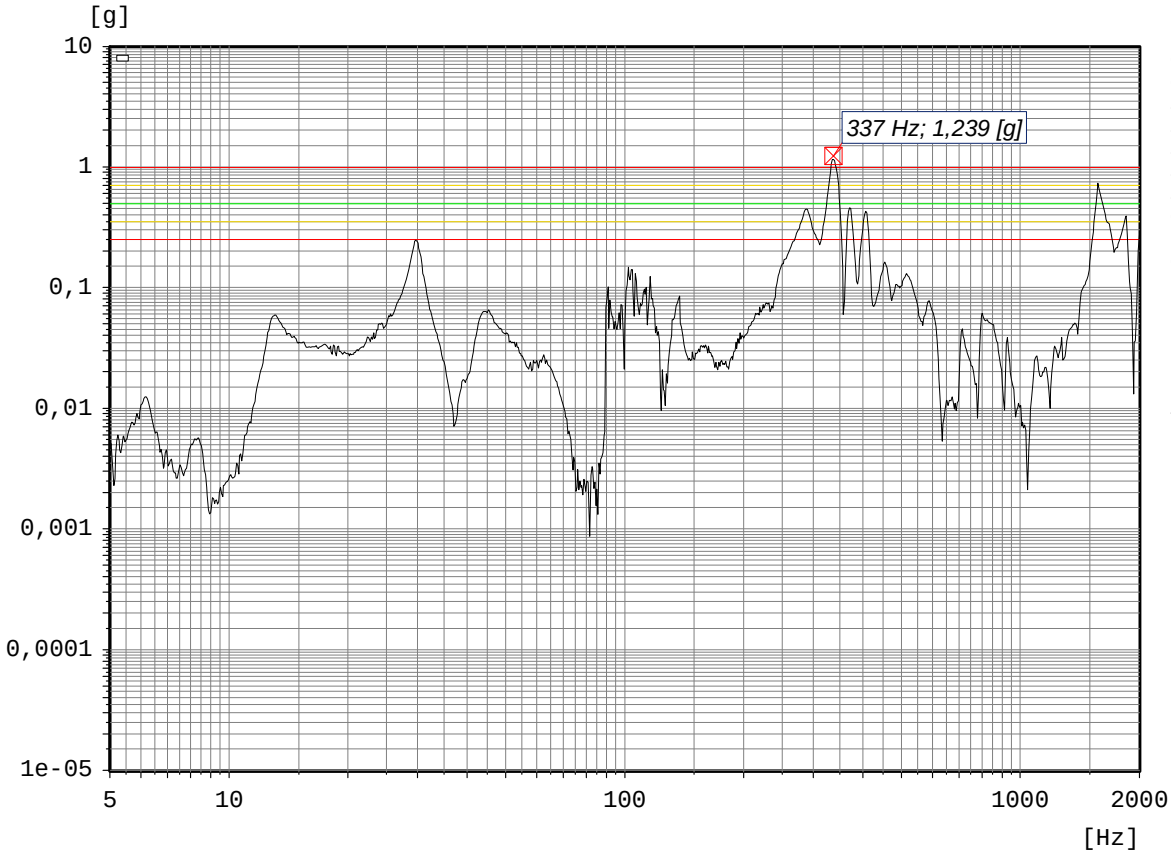
Sine

GL-Reel-Center-X

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



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Unit:	g
Contr.strat.:	Closed loop
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Time:	18:42:44

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL / GL

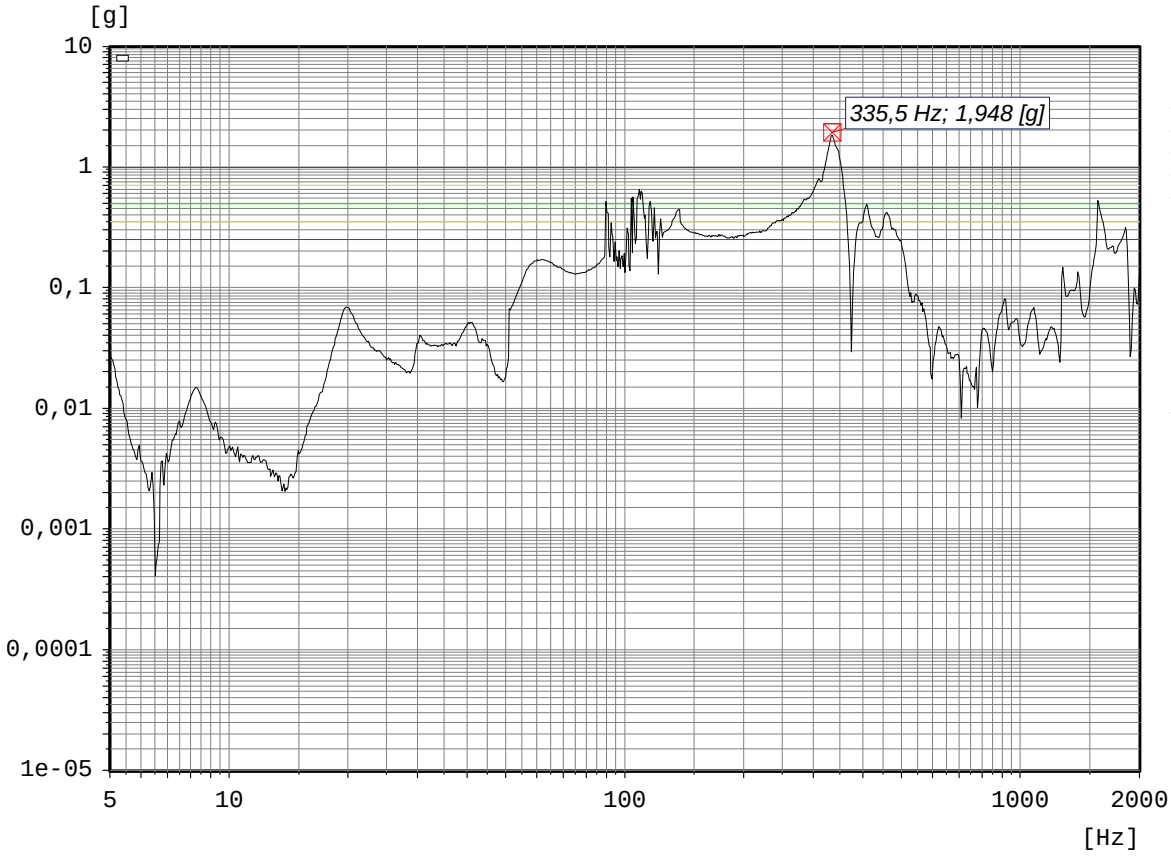
Sine

GL-Reel-Center-Y

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



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Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL / GL

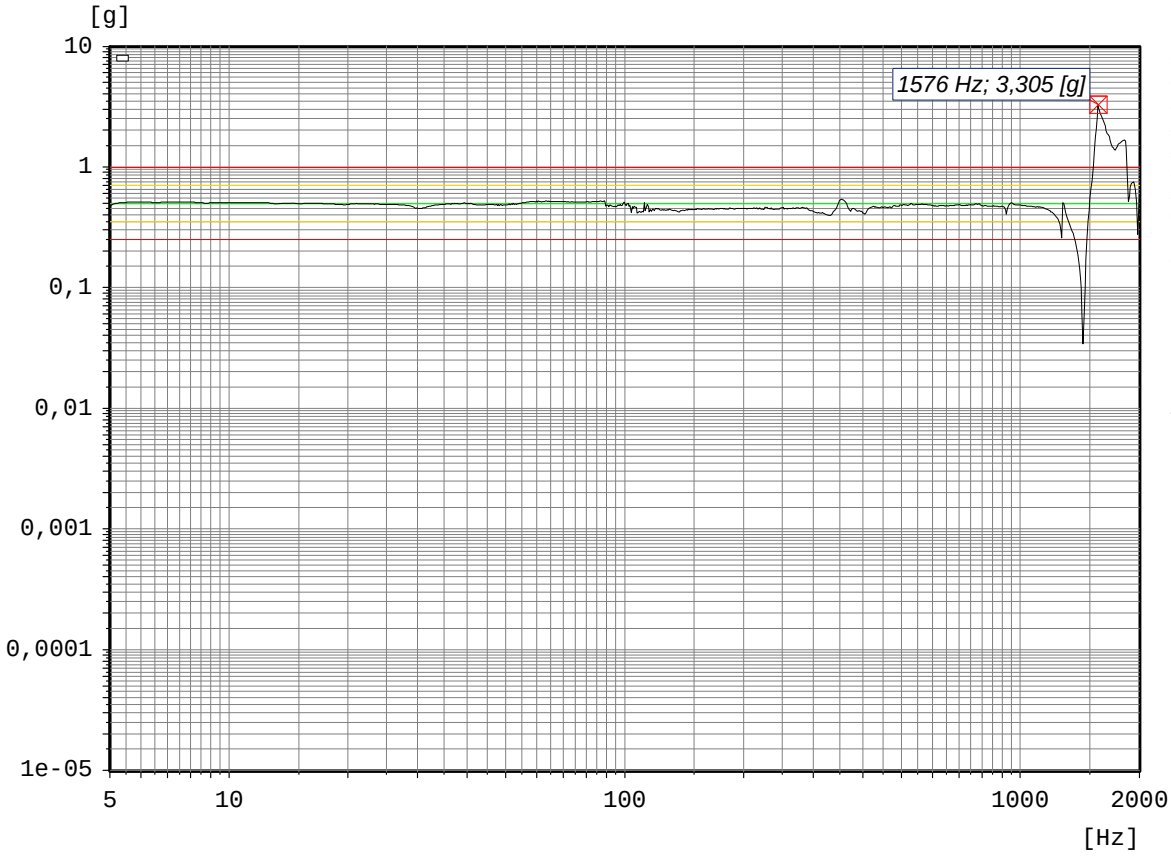
Sine

GL-Reel-Center-Z

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



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Time:	18:42:44

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

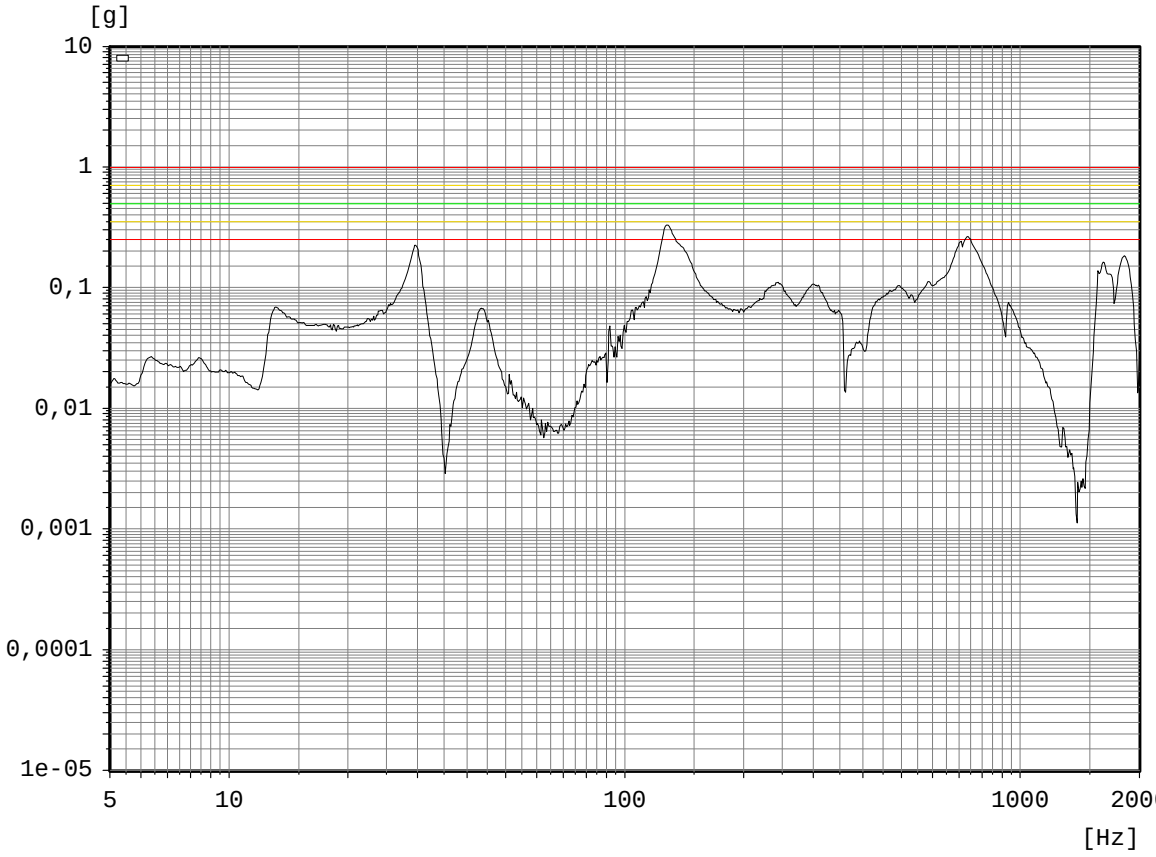
Sine

WL-Dummy-X

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



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Time:	18:42:44

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

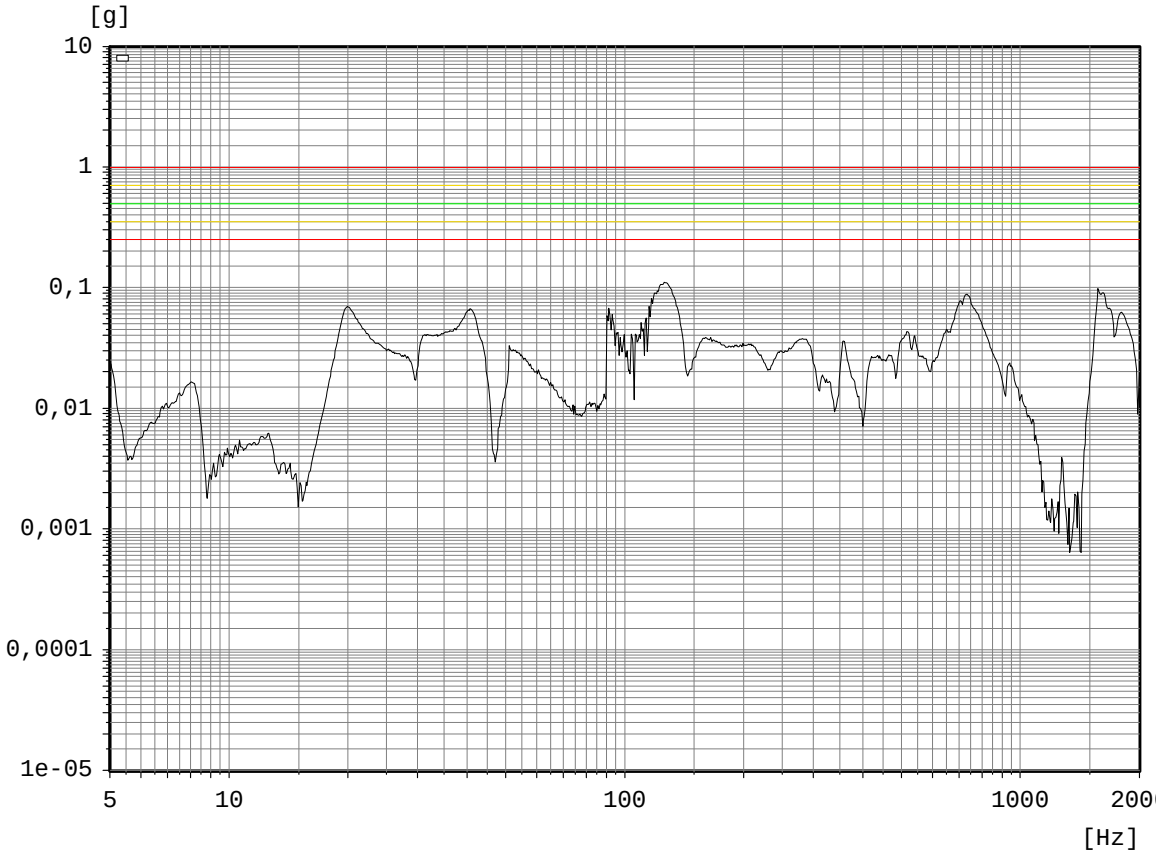
Sine

WL-Dummy-Y

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	10
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_1.rsn

Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

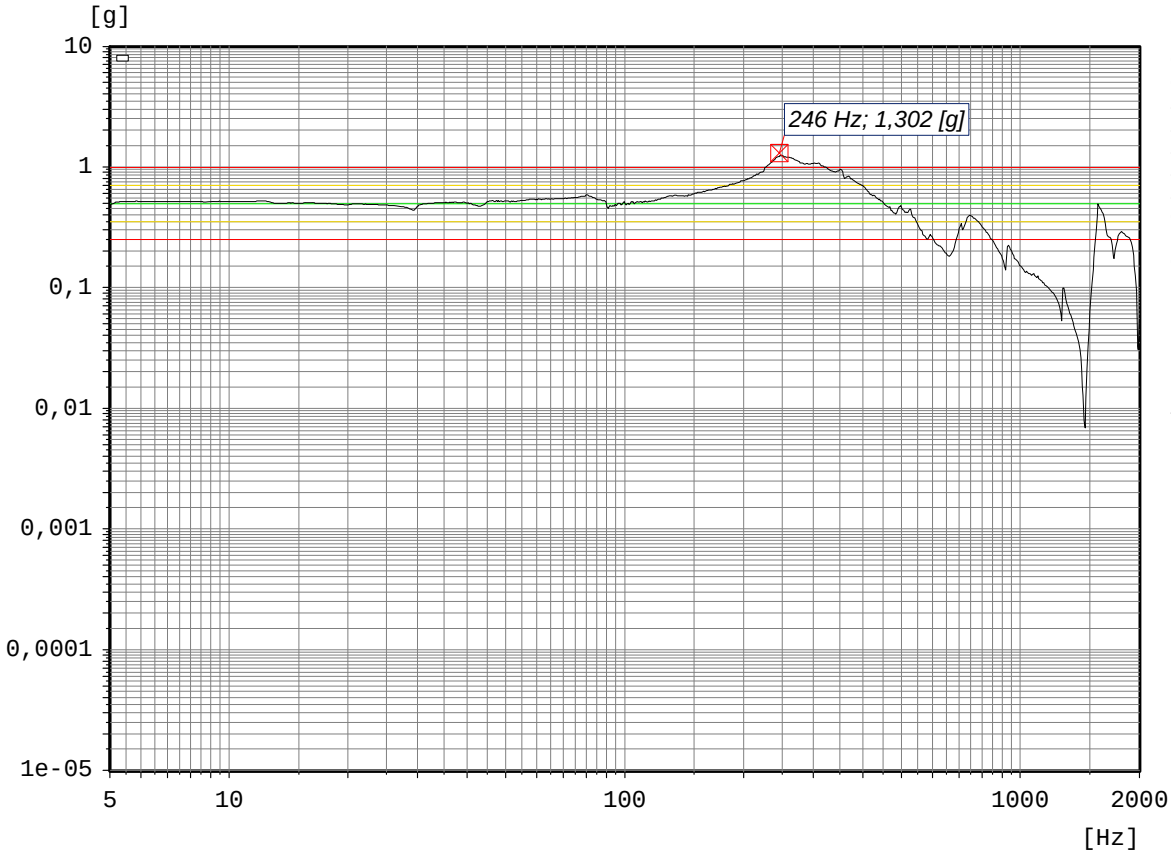
Sine

WL-Dummy-Z

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	11
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

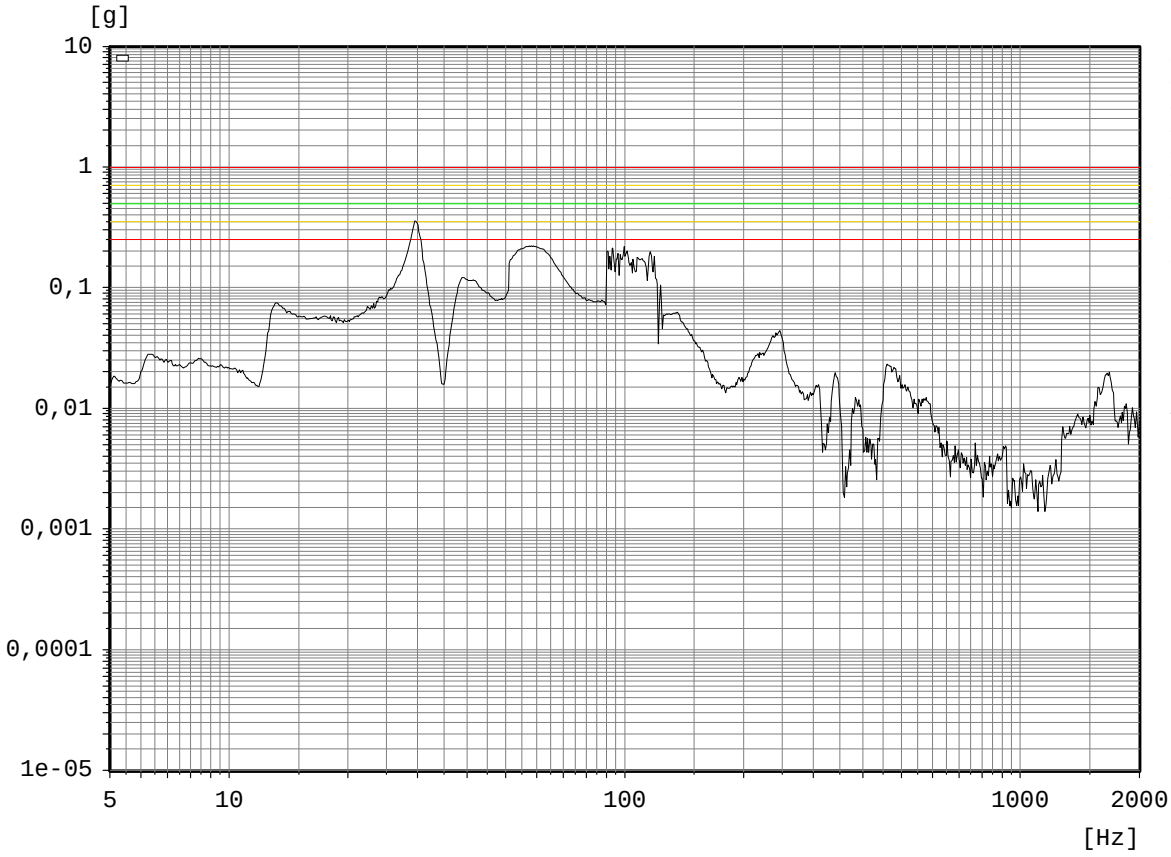
Sine

GL-Dummy-X

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	12
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

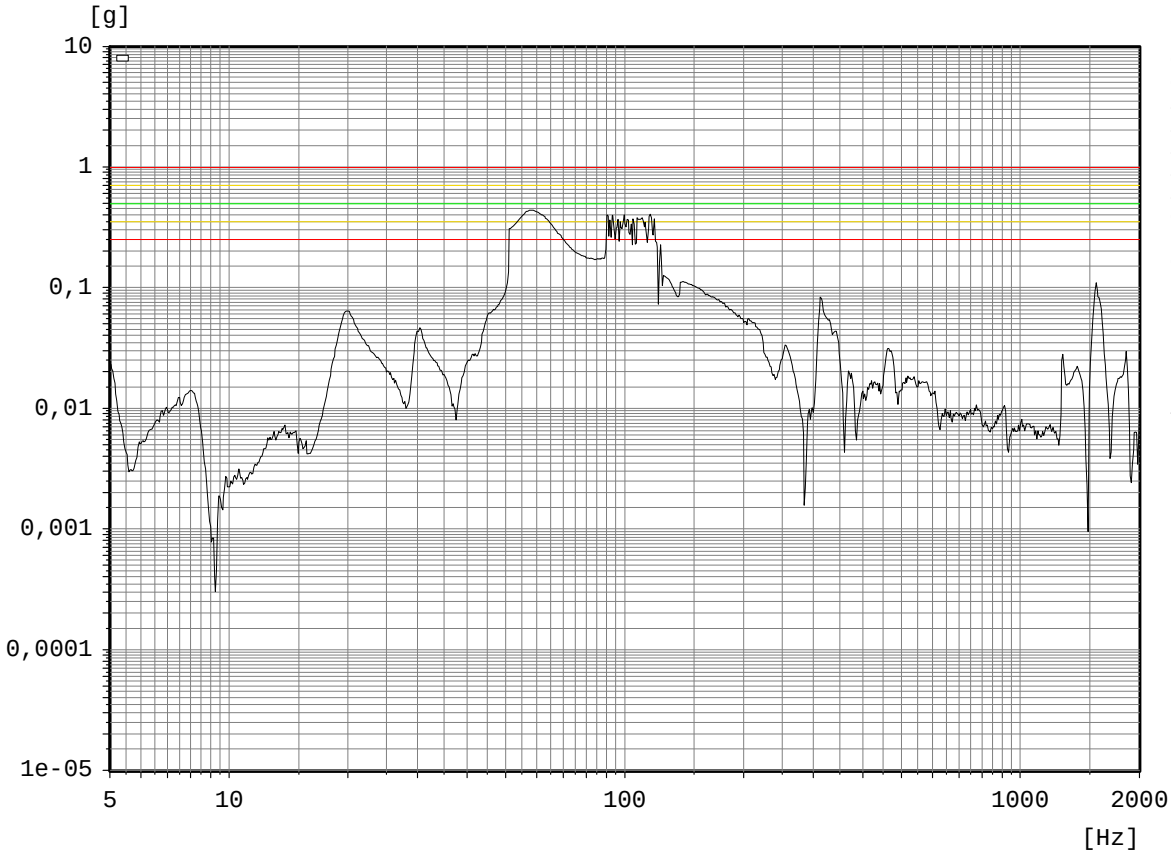
Sine

GL-Dummy-Y

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	13
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

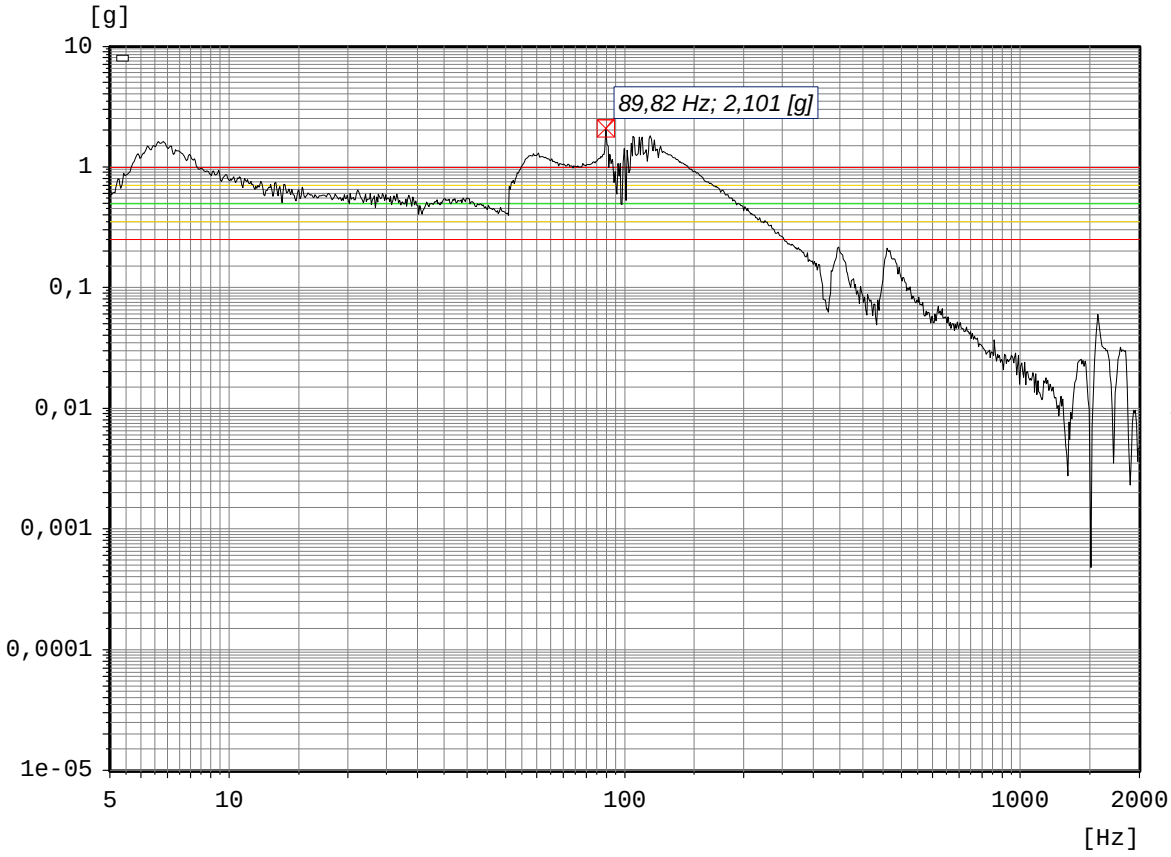
Sine

GL-Dummy-Z

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	14
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL

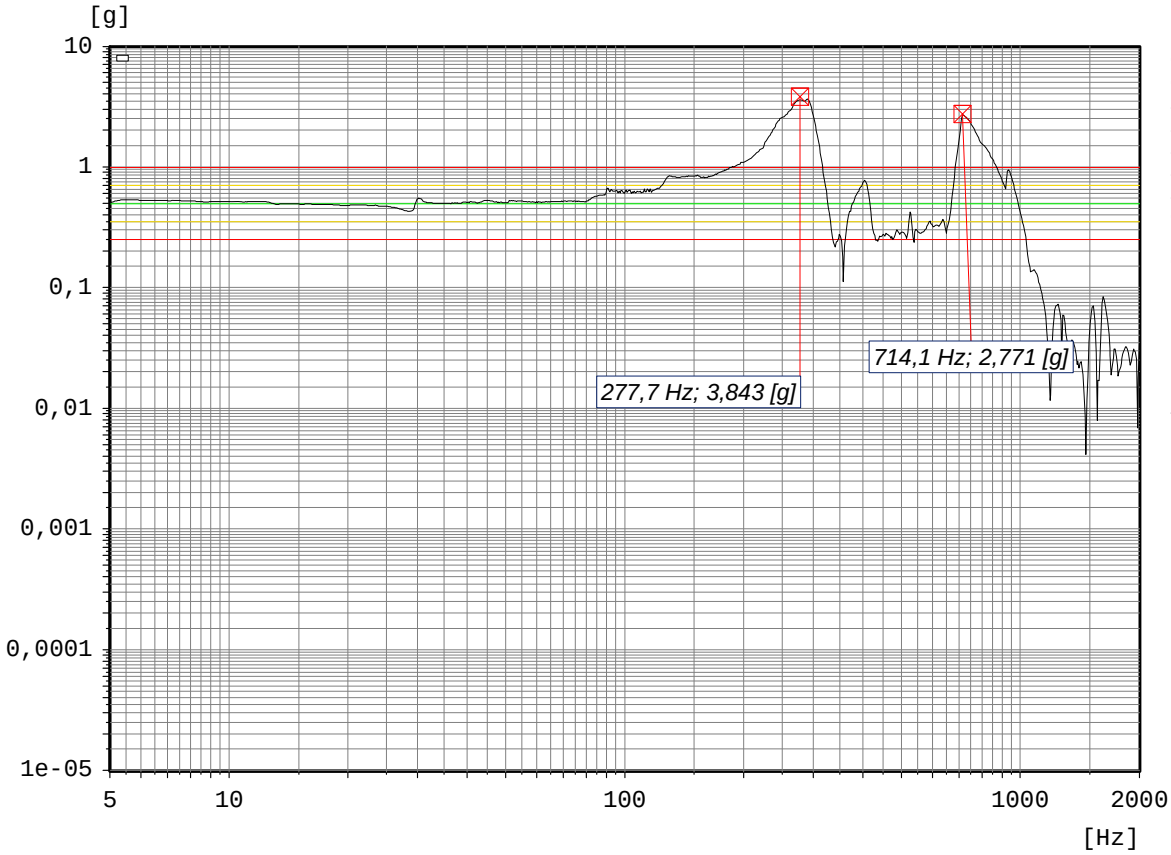
Sine

WL-Side-Z

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	15
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_1.rsn

Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL / GL

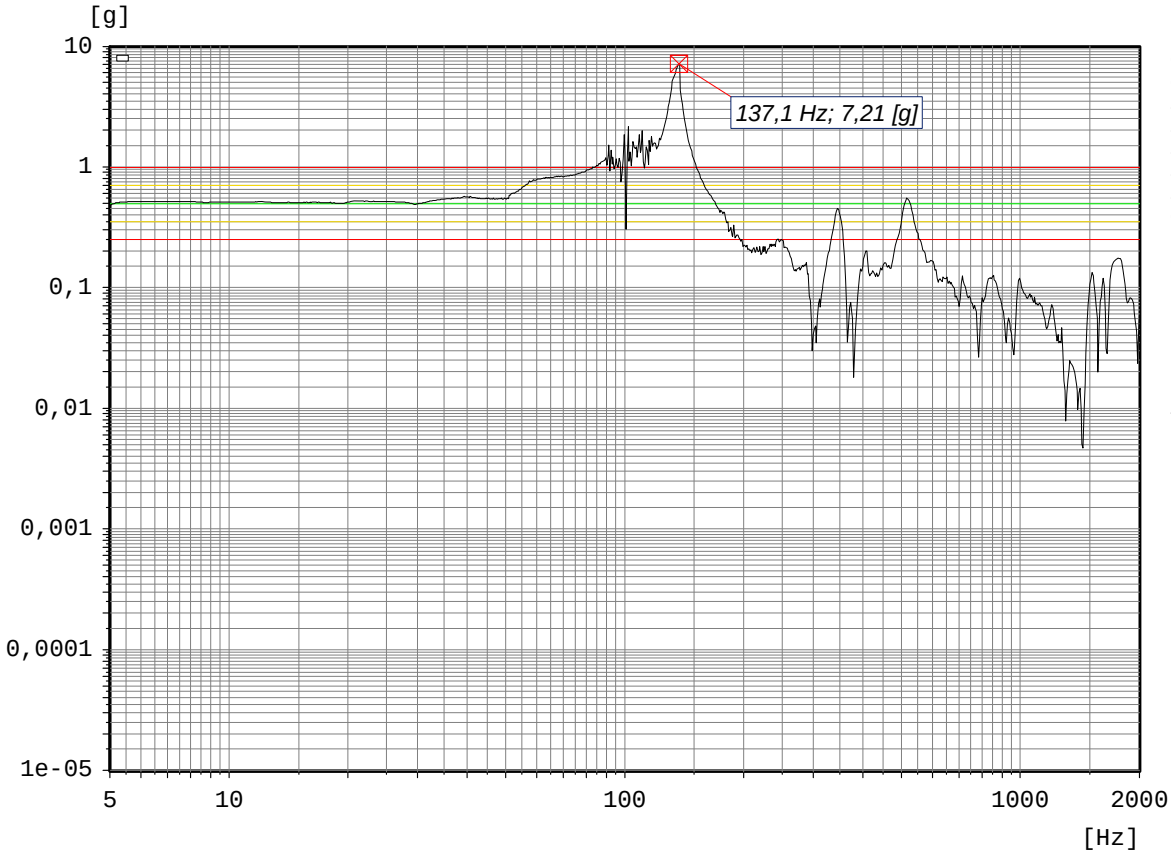
Sine

GL-Side-Z

Auxiliary Tether Reel

vibration test 03.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	16
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-03-13
Time:	18:42:44

DAP-PL-3185.00

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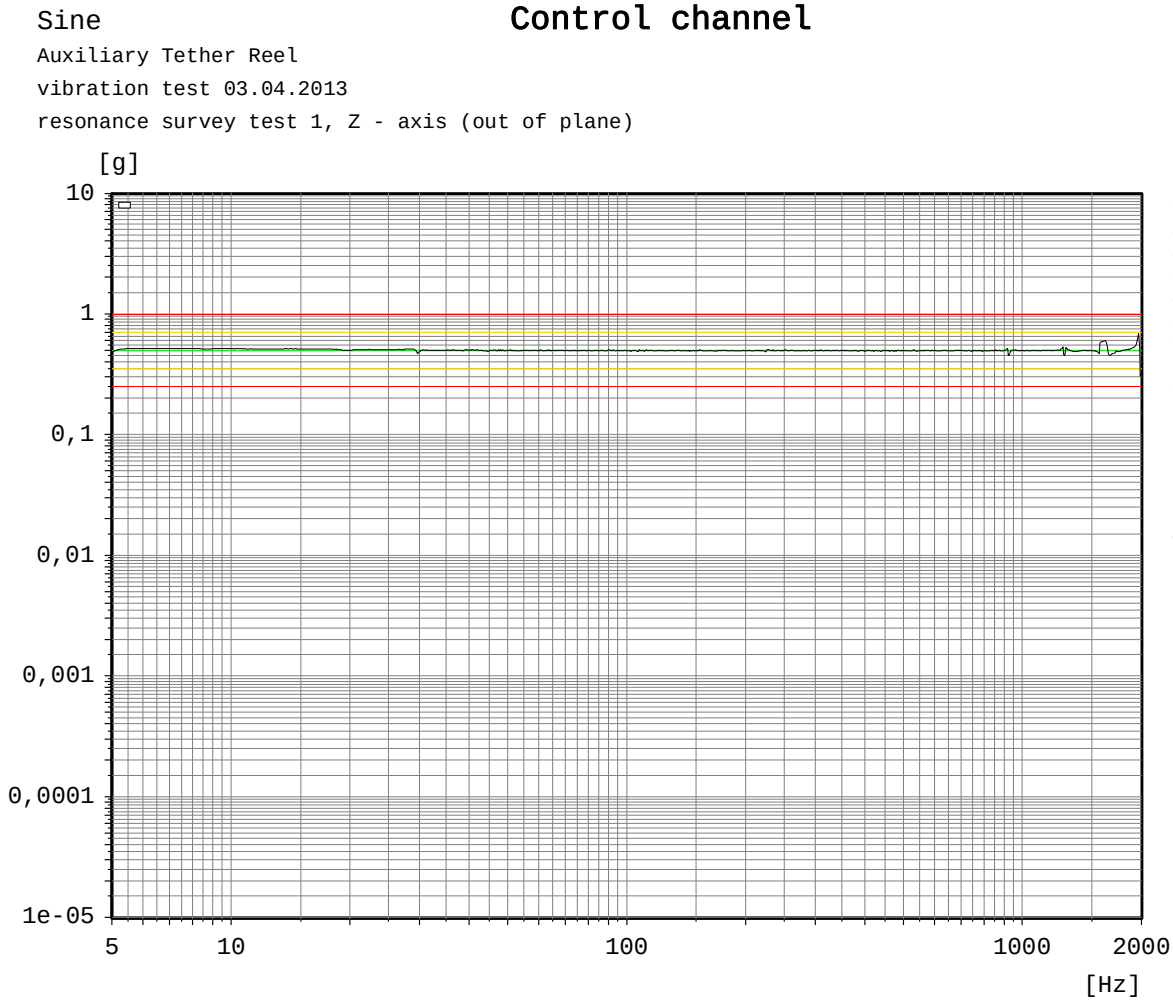
Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL/GL



DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

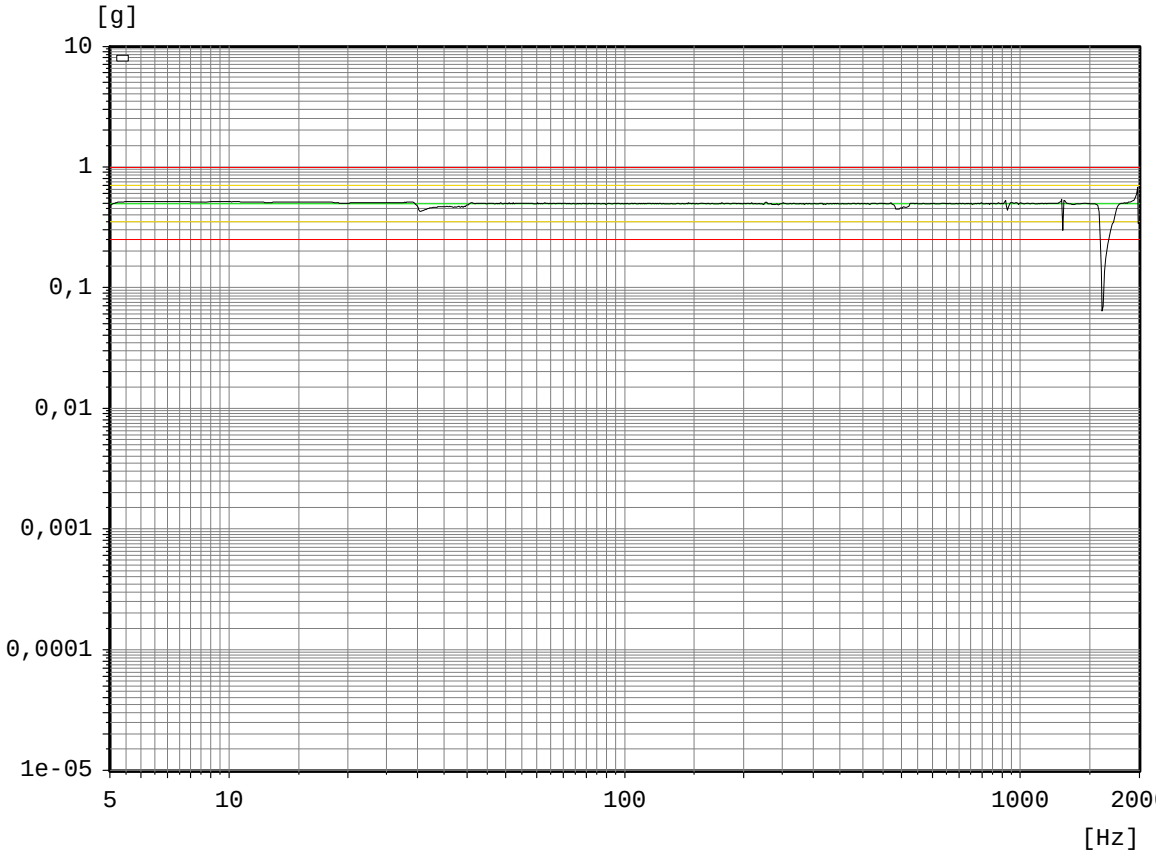
Sine

Control 1

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	1
Chan.type:	CW Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

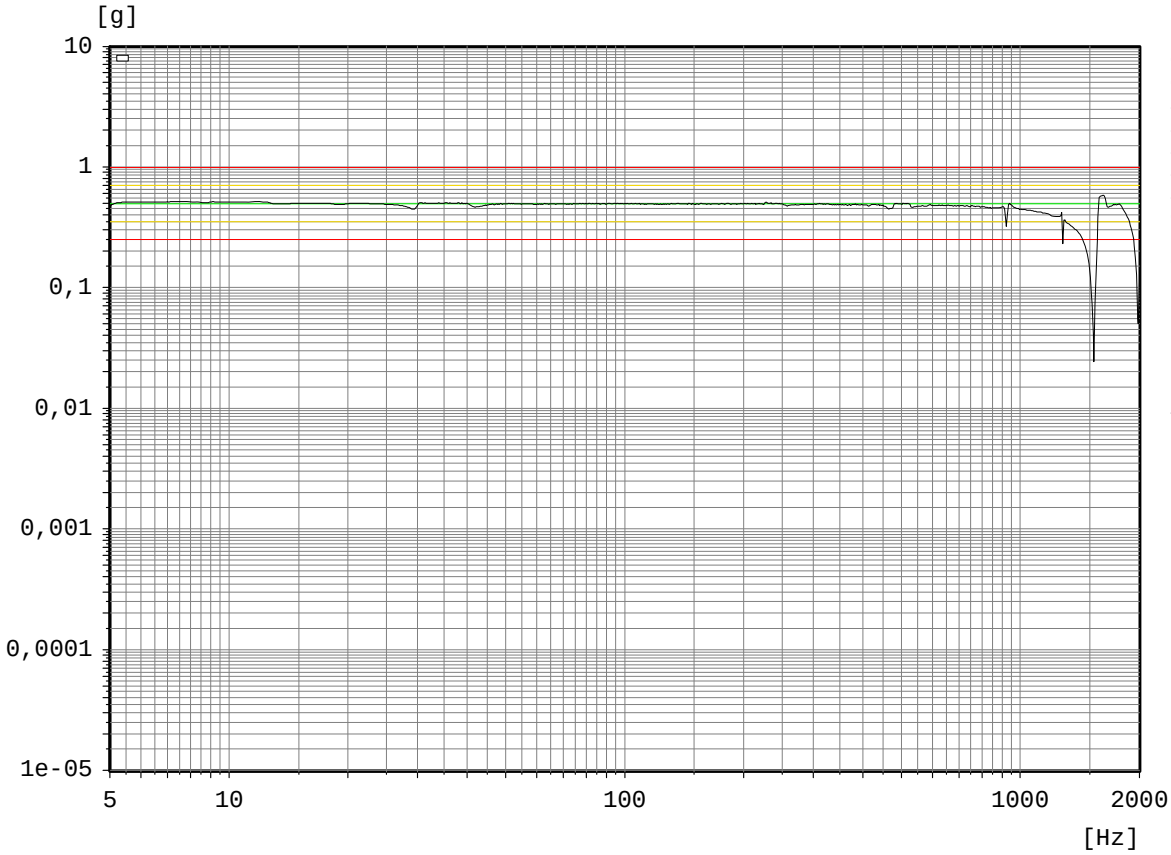
Sine

Control 2

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	2
Chan.type:	CW Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

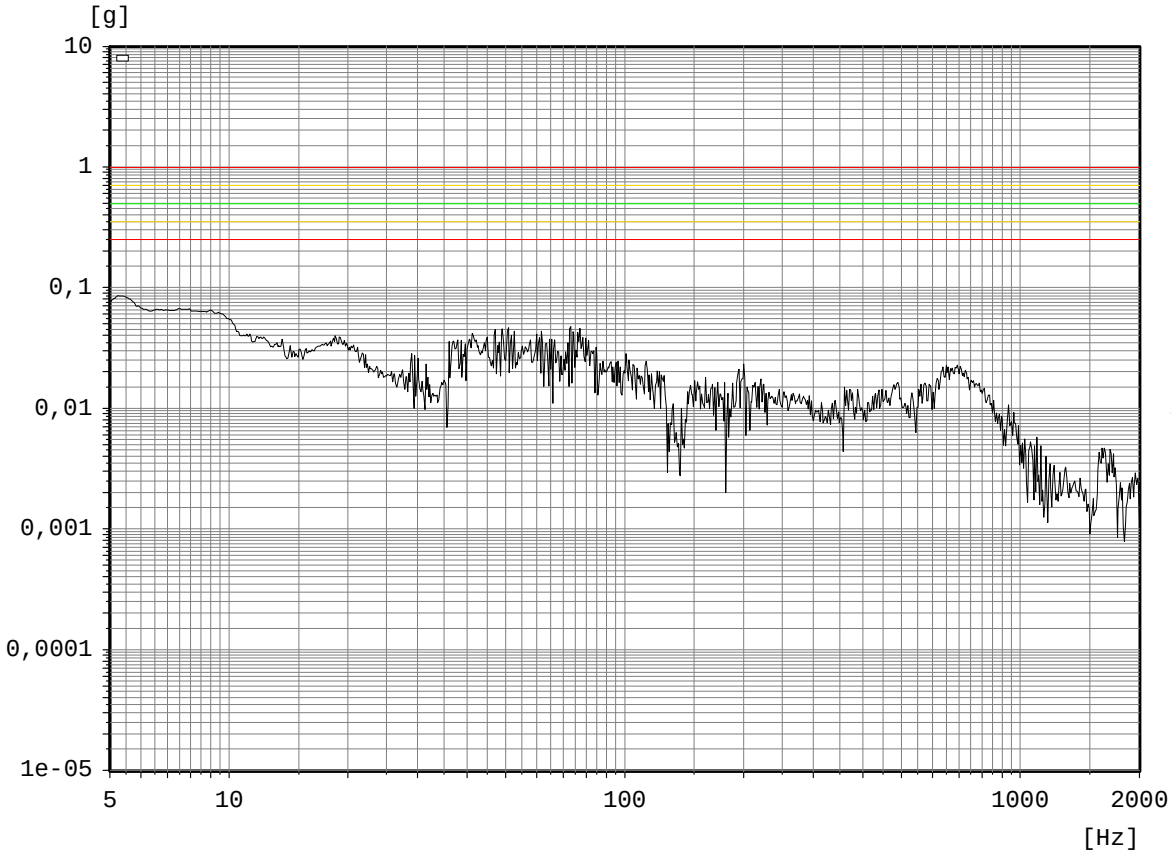
Sine

WL-Reel-Center-X

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	3
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

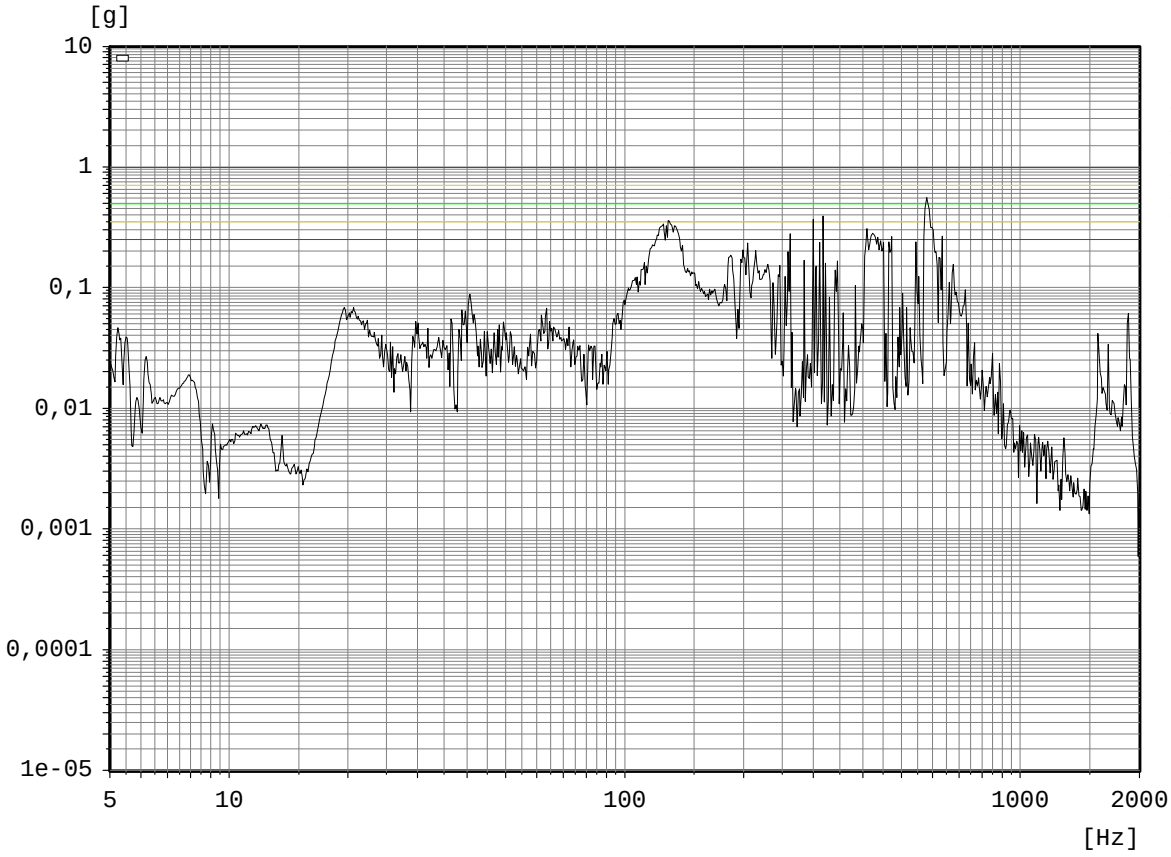
Sine

WL-Reel-Center-Y

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	4
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

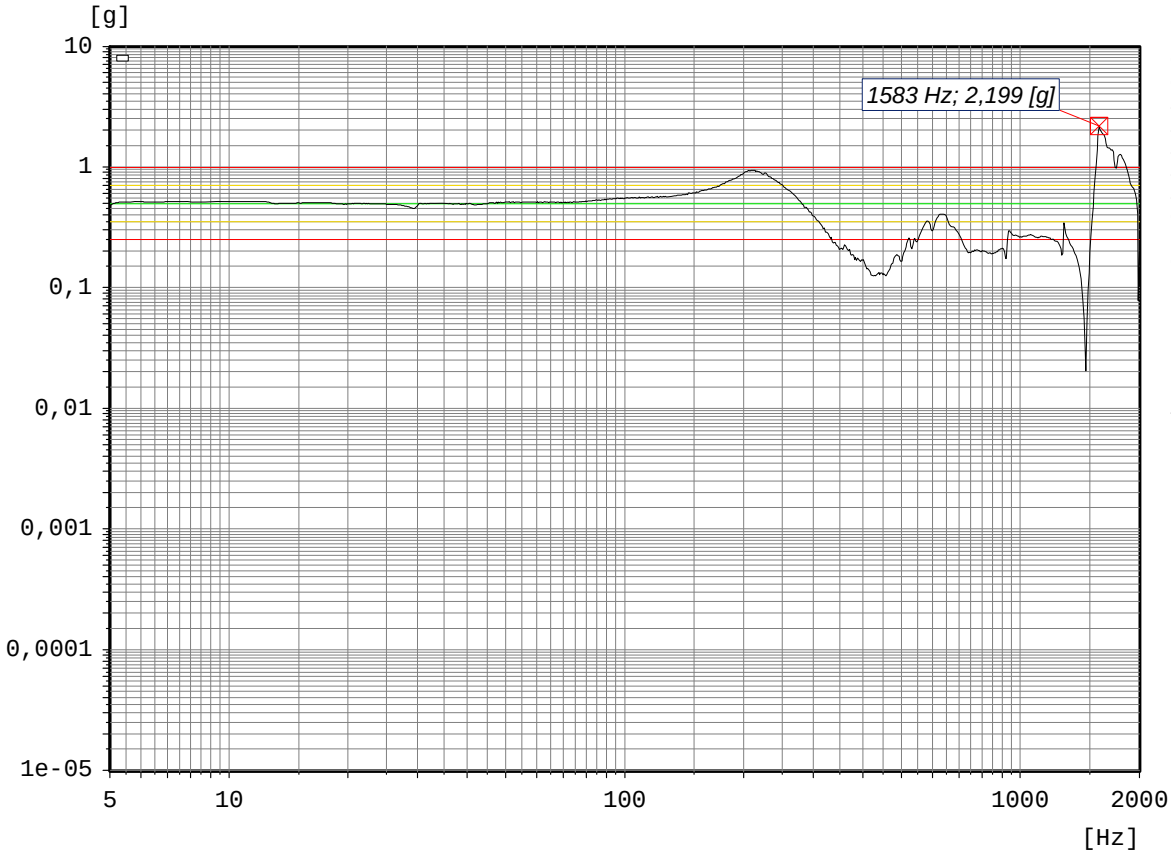
Sine

WL-Reel-Center-Z

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	5
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\ATR-WL-Reso_Z_1.rsn

Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

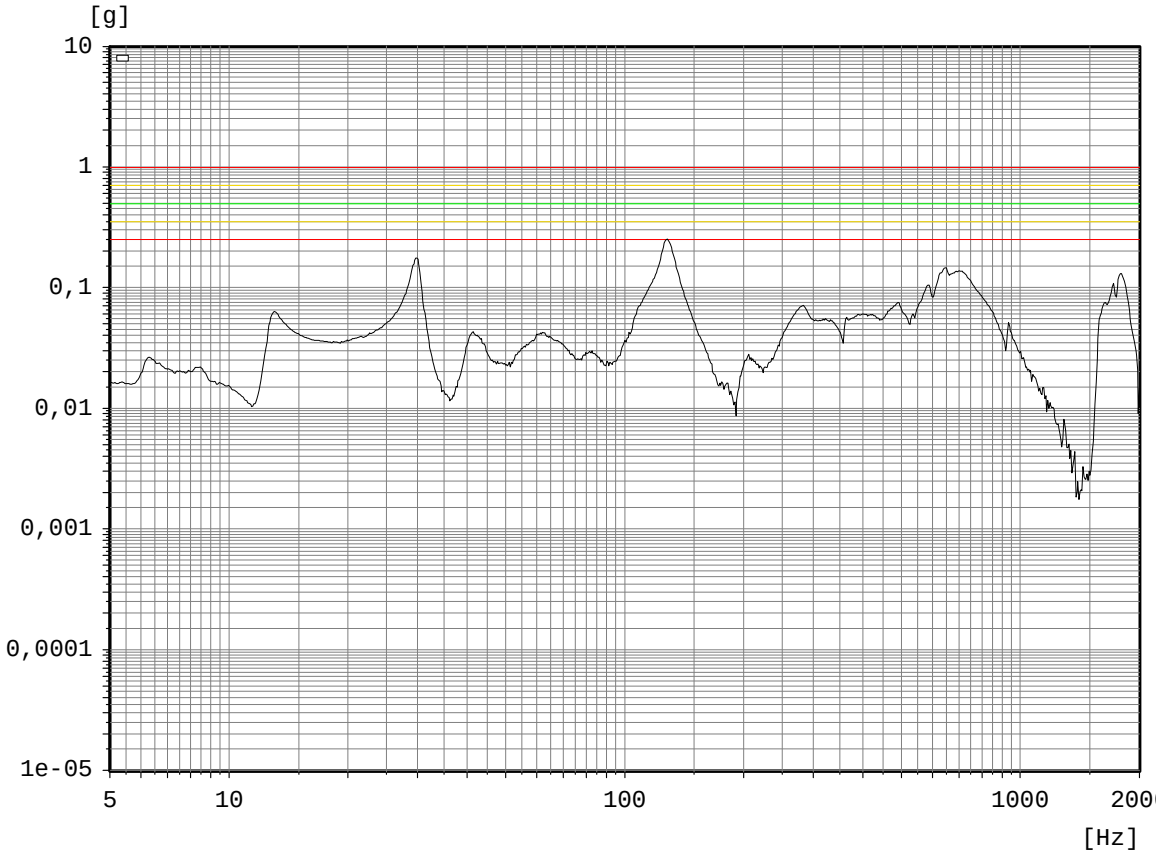
Sine

WL-Dummy-X

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	9
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\ATR-WL-Reso_Z_1.rsn

Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

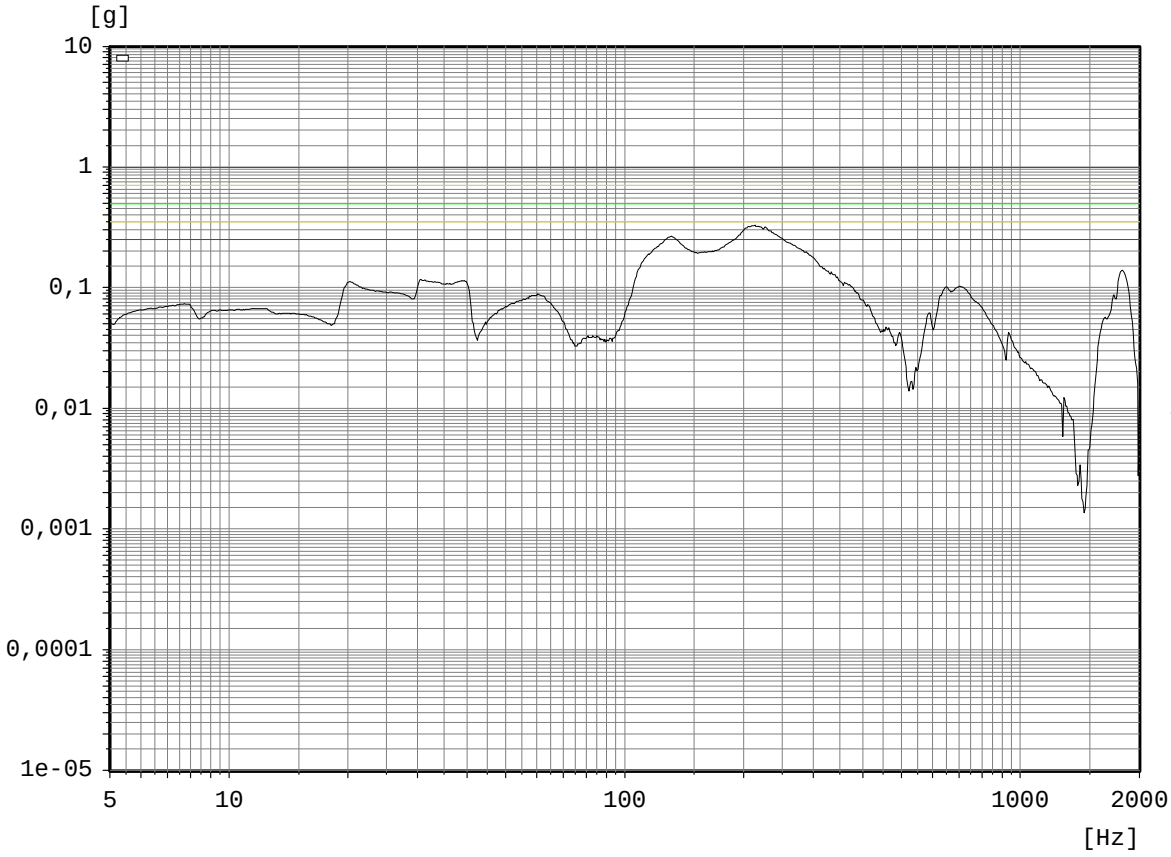
Sine

WL-Dummy-Y

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	10
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

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Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

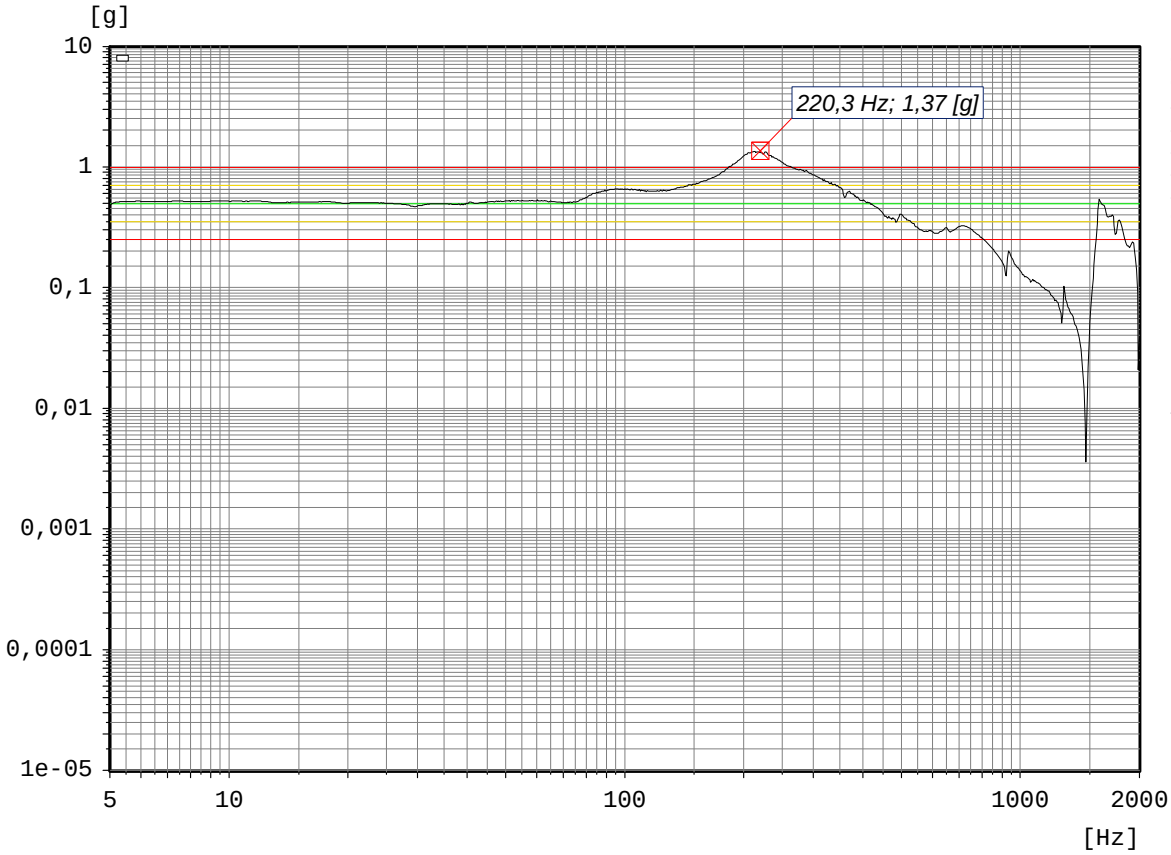
Sine

WL-Dummy-Z

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	11
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\ATR-WL-Reso_Z_1.rsn

Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

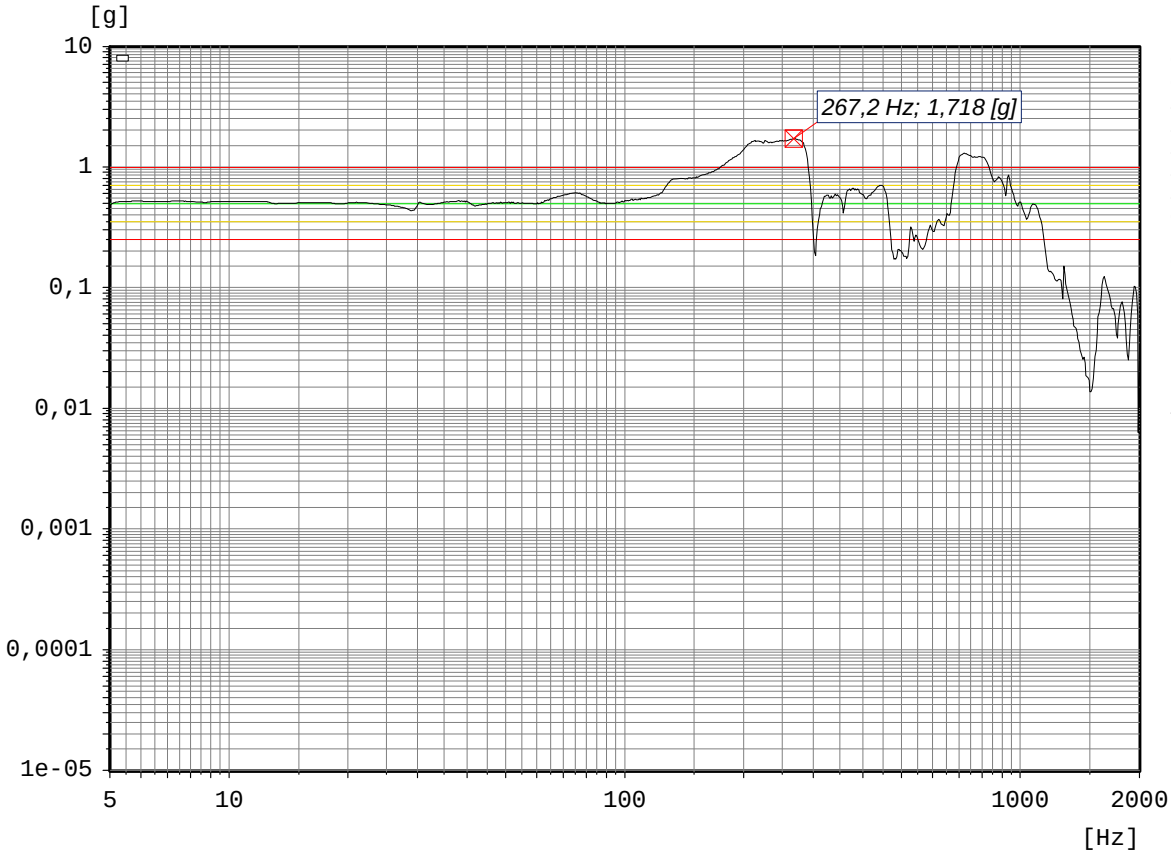
Sine

WL-Side-Z

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.no:	15
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\ATR-WL-Reso_Z_1.rsn

Test curve – resonance survey test 1 Z-axis, Auxiliary Tether Reel WL

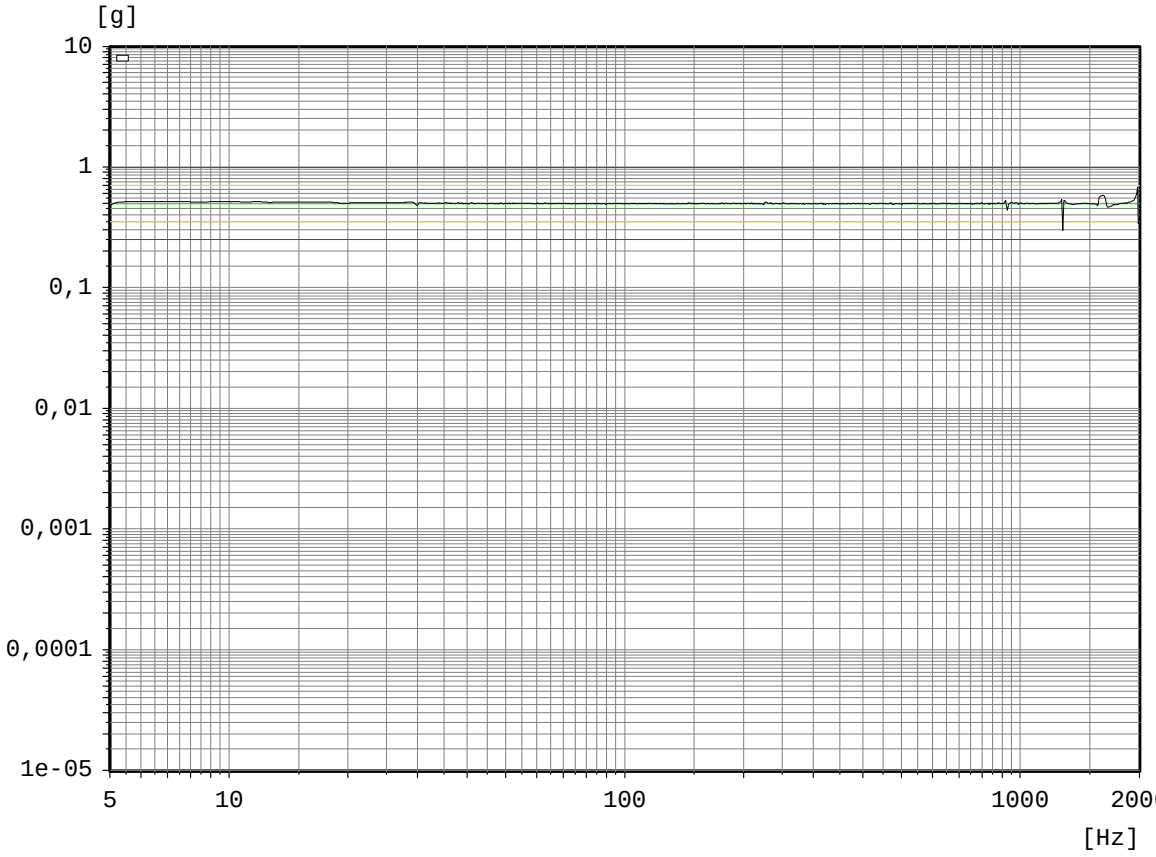
Sine

Control channel

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 1, Z - axis (out of plane)



Chan.type:	X
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	15:36:26

DAP-PL-3185.00

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Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

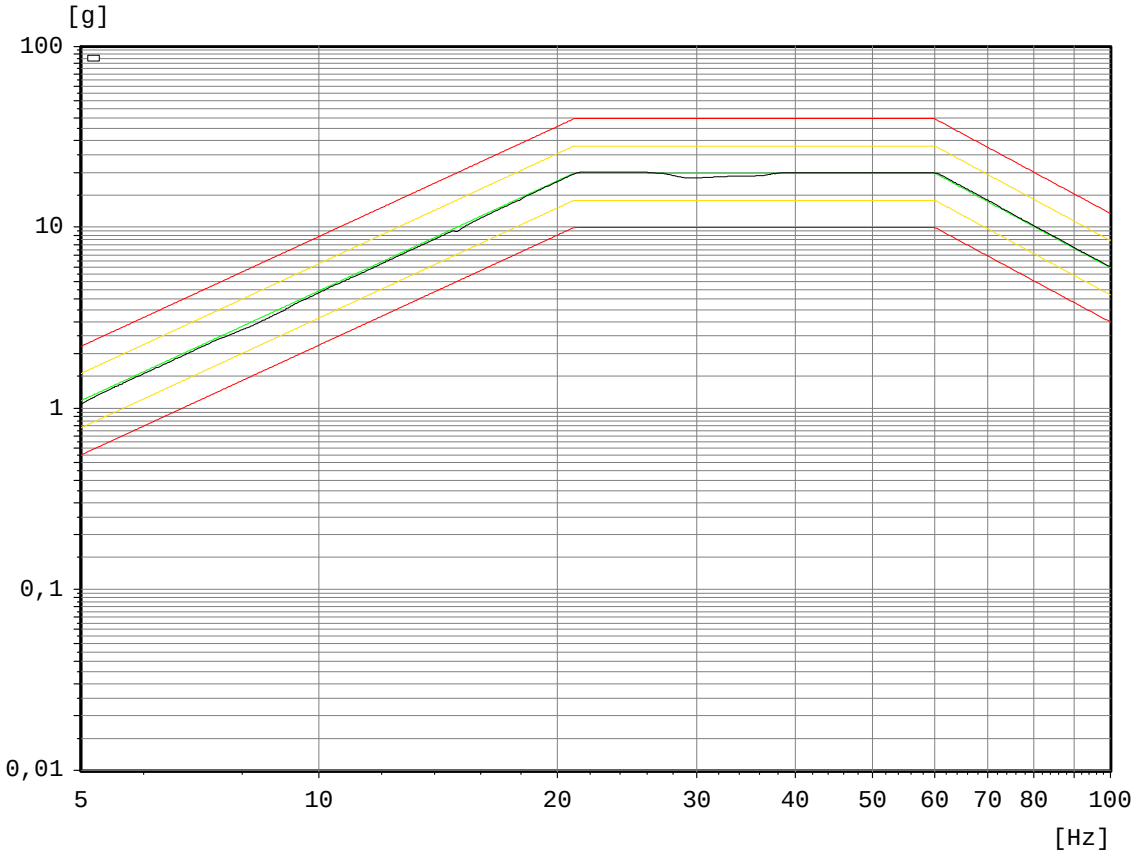
Sine

Control 1

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.no:	1
Chan.type:	CW Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:02:09
remaining:	000:00:00
Date:	04-04-13
Time:	15:51:32

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\ATR-WL-Sine_Z.rsn

Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

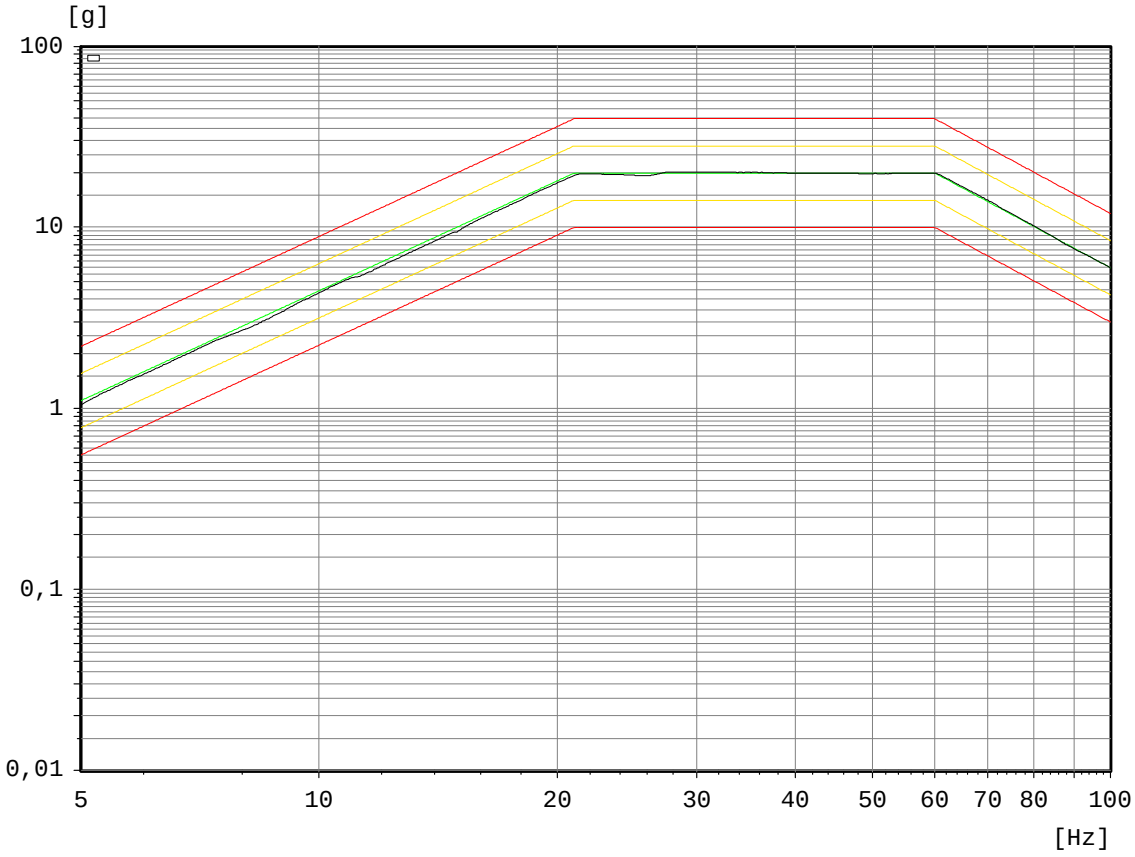
Sine

Control 2

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.no:	2
Chan.type:	CW Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:02:09
remaining:	000:00:00
Date:	04-04-13
Time:	15:51:32

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\ATR-WL-Sine_Z.rsn

Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

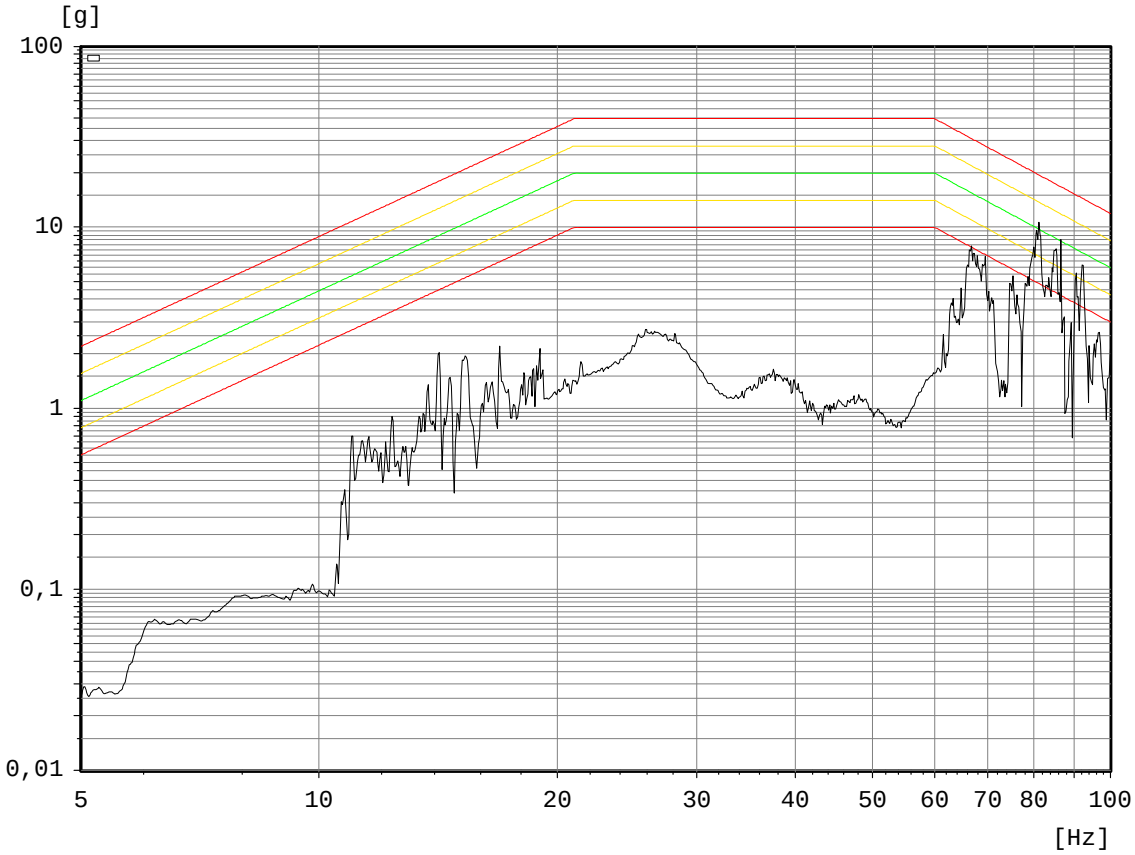
Sine

WL-Reel-Center-X

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.no:	3
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:02:09
remaining:	000:00:00
Date:	04-04-13
Time:	15:51:32

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\ATR-WL-Sine_Z.rsn

Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

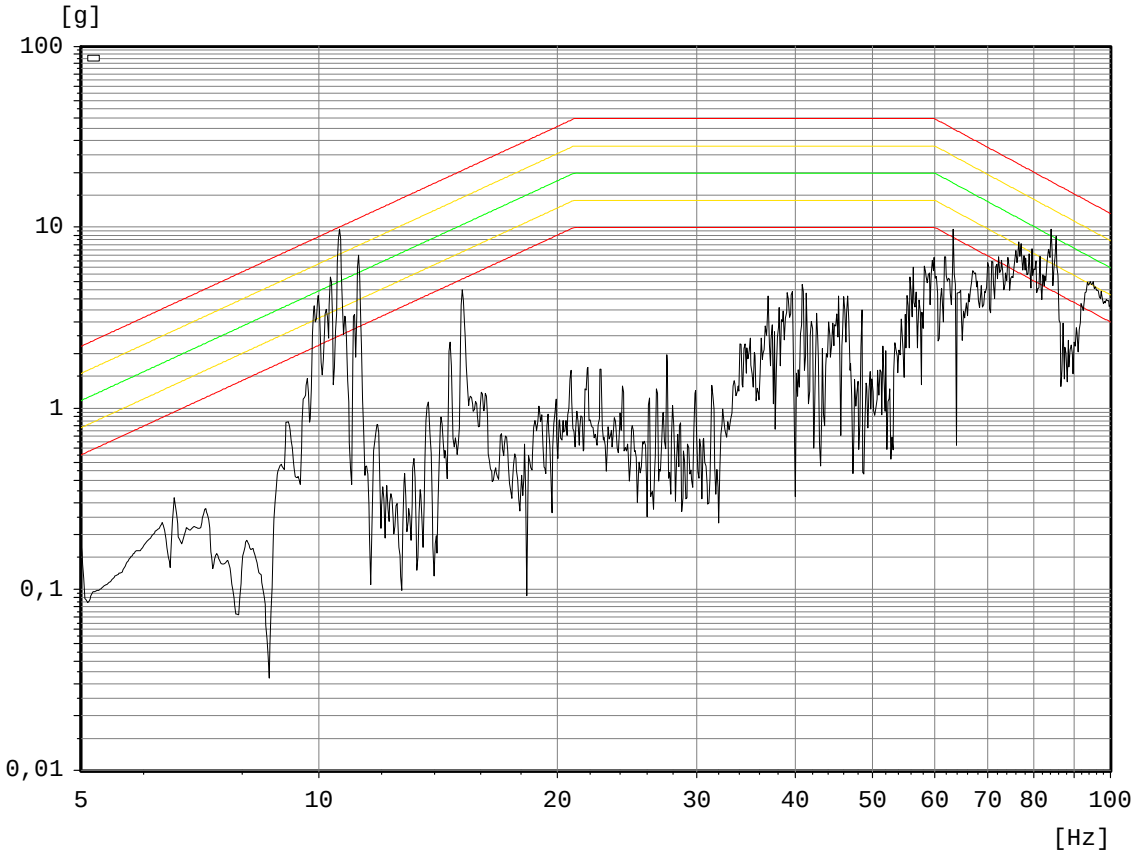
Sine

WL-Reel-Center-Y

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.no:	4
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:02:09
remaining:	000:00:00
Date:	04-04-13
Time:	15:51:32

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\ATR-WL-Sine_Z.rsn

Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

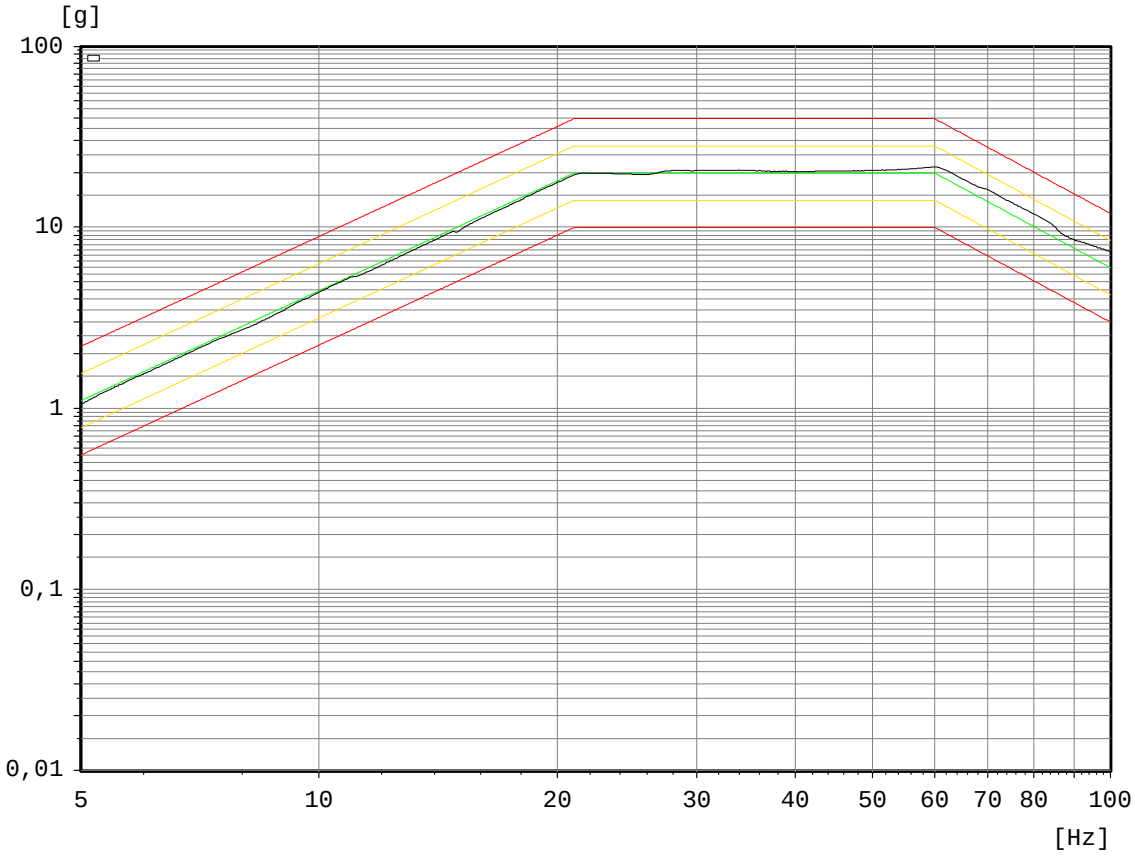
Sine

WL-Reel-Center-Z

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.no:	5
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:02:09
remaining:	000:00:00
Date:	04-04-13
Time:	15:51:32

DAP-PL-3185.00

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Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

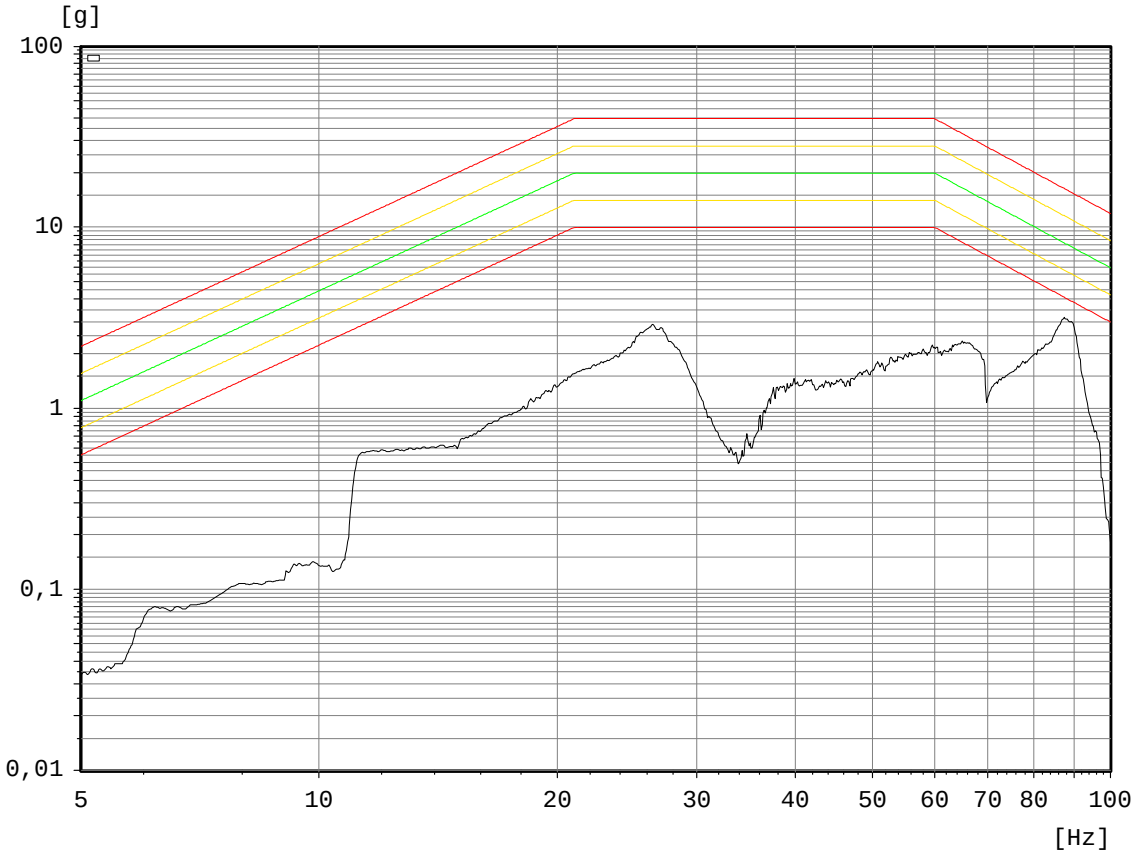
Sine

WL-Dummy-X

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.no:	9
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop

-- Testing time --

elapsed:	000:02:09
remaining:	000:00:00

Date:	04-04-13
Time:	15:51:32

DAP-PL-3185.00

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Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

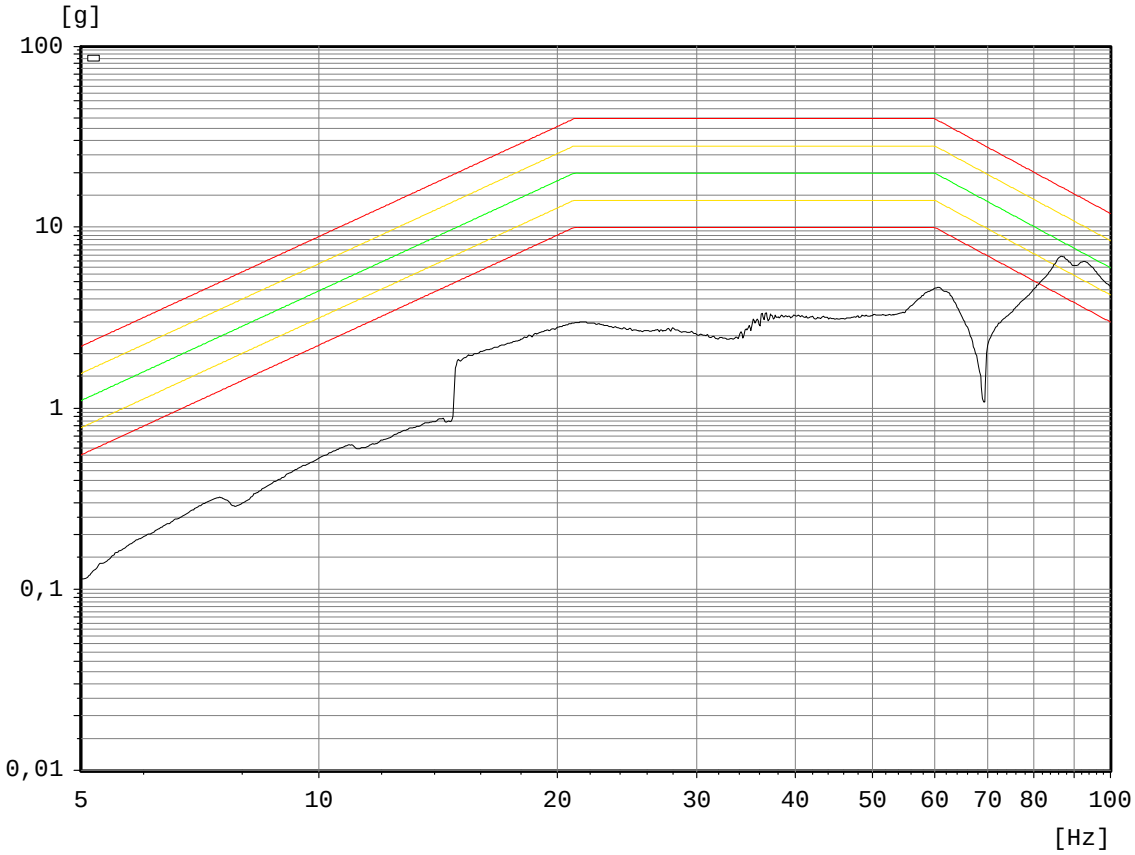
Sine

WL-Dummy-Y

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.no:	10
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:02:09
remaining:	000:00:00
Date:	04-04-13
Time:	15:51:32

DAP-PL-3185.00

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Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

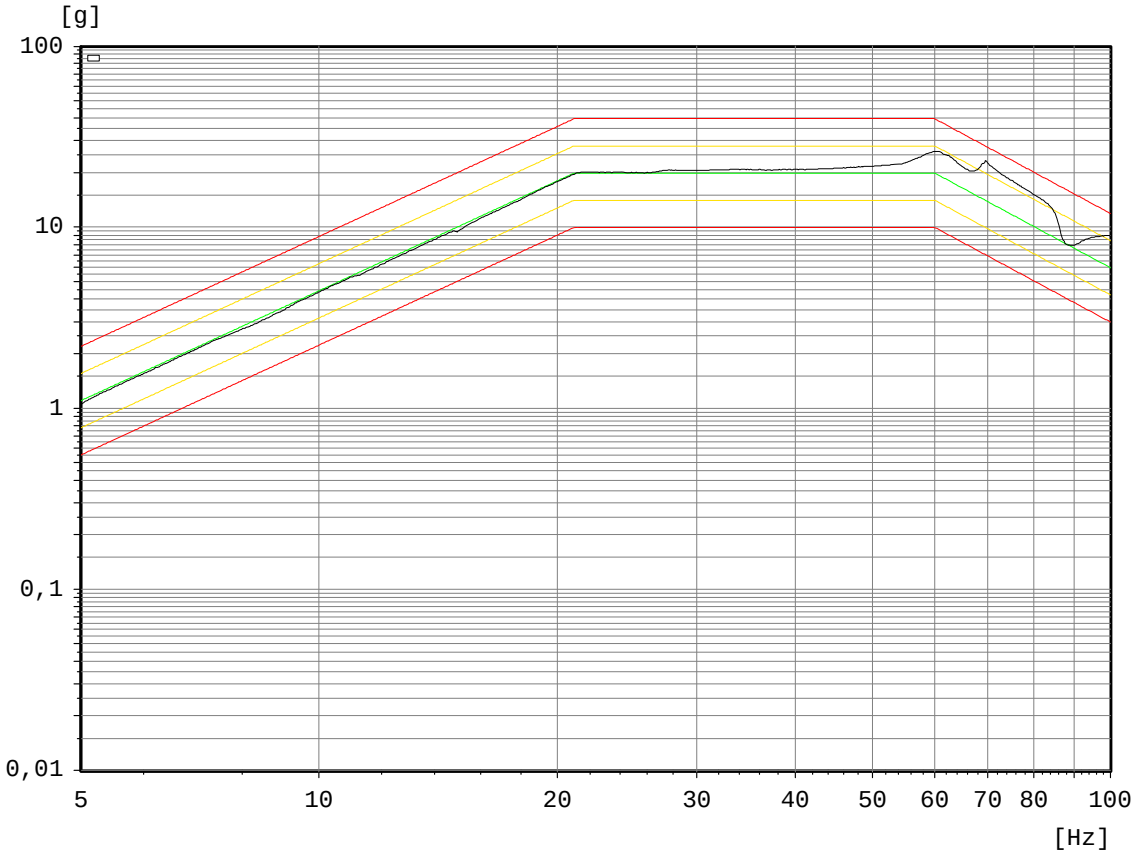
Sine

WL-Dummy-Z

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.no:	11
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop

-- Testing time --

elapsed:	000:02:09
remaining:	000:00:00

Date:	04-04-13
Time:	15:51:32

Deutscher Akkreditierungs Rat DAR

DAP-PL-3185.00

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Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

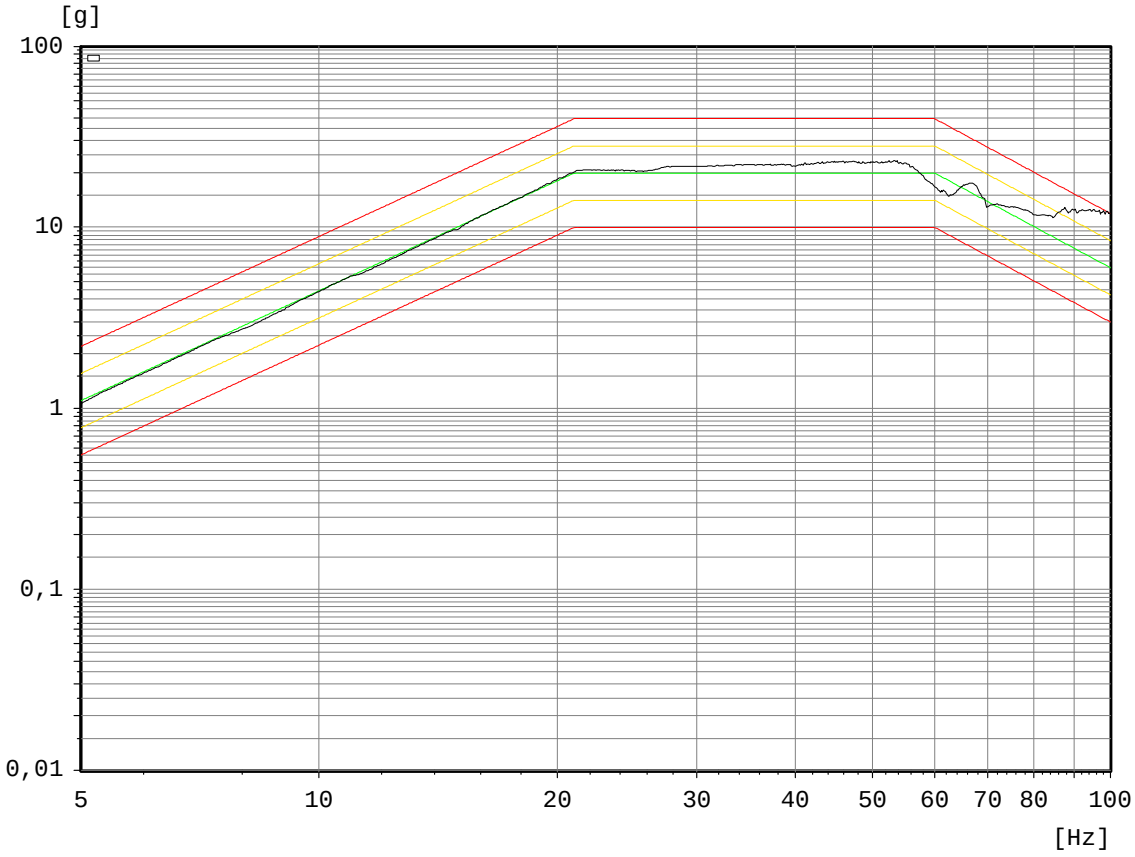
Sine

WL-Side-Z

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.no:	15
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop

-- Testing time --

elapsed:	000:02:09
remaining:	000:00:00

Date:	04-04-13
Time:	15:51:32

Deutscher Akkreditierungs Rat DAR

DAP-PL-3185.00

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Test curve – sinusoidal vibration test Z-axis, Auxiliary Tether Reel WL

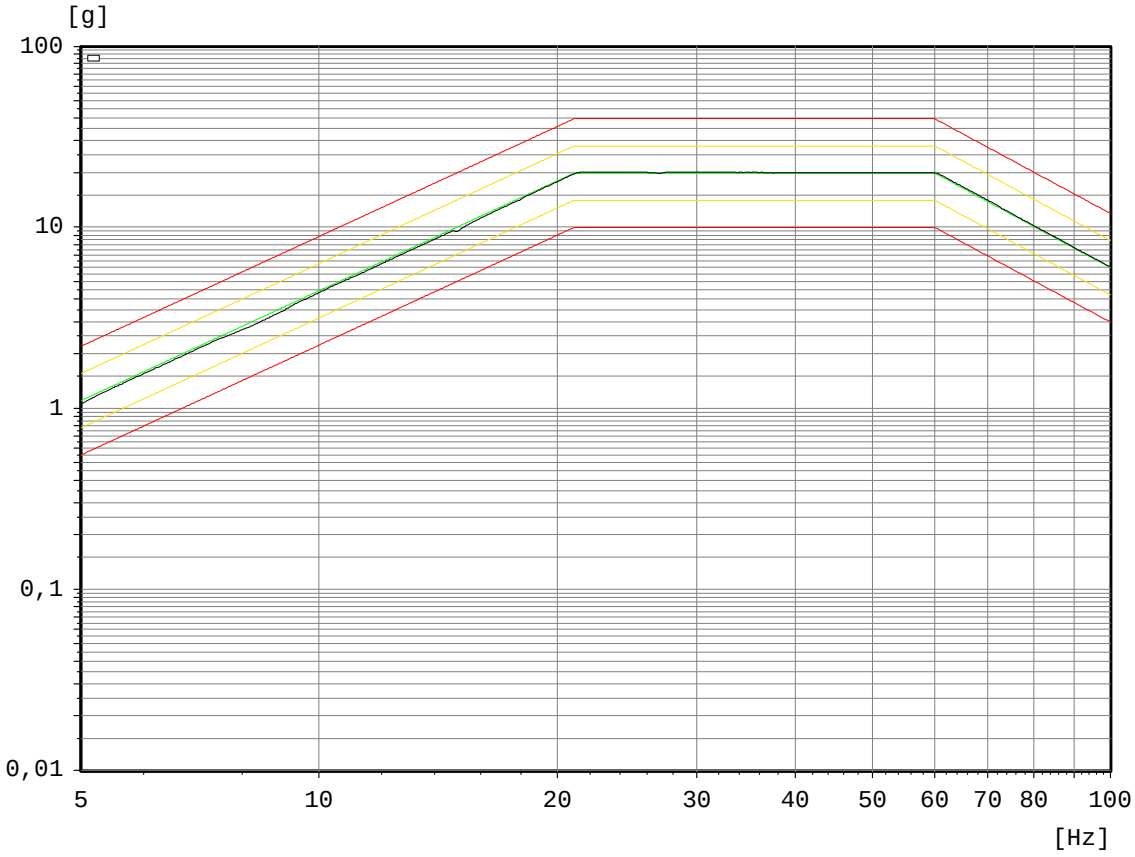
Sine

Control channel

Auxiliary Tether Reel WL

vibration test 04.04.2013

sinusoidal vibration test, Z - axis (out of plane)



Chan.type:	X
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:02:09
remaining:	000:00:00
Date:	04-04-13
Time:	15:51:32

DAP-PL-3185.00

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Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

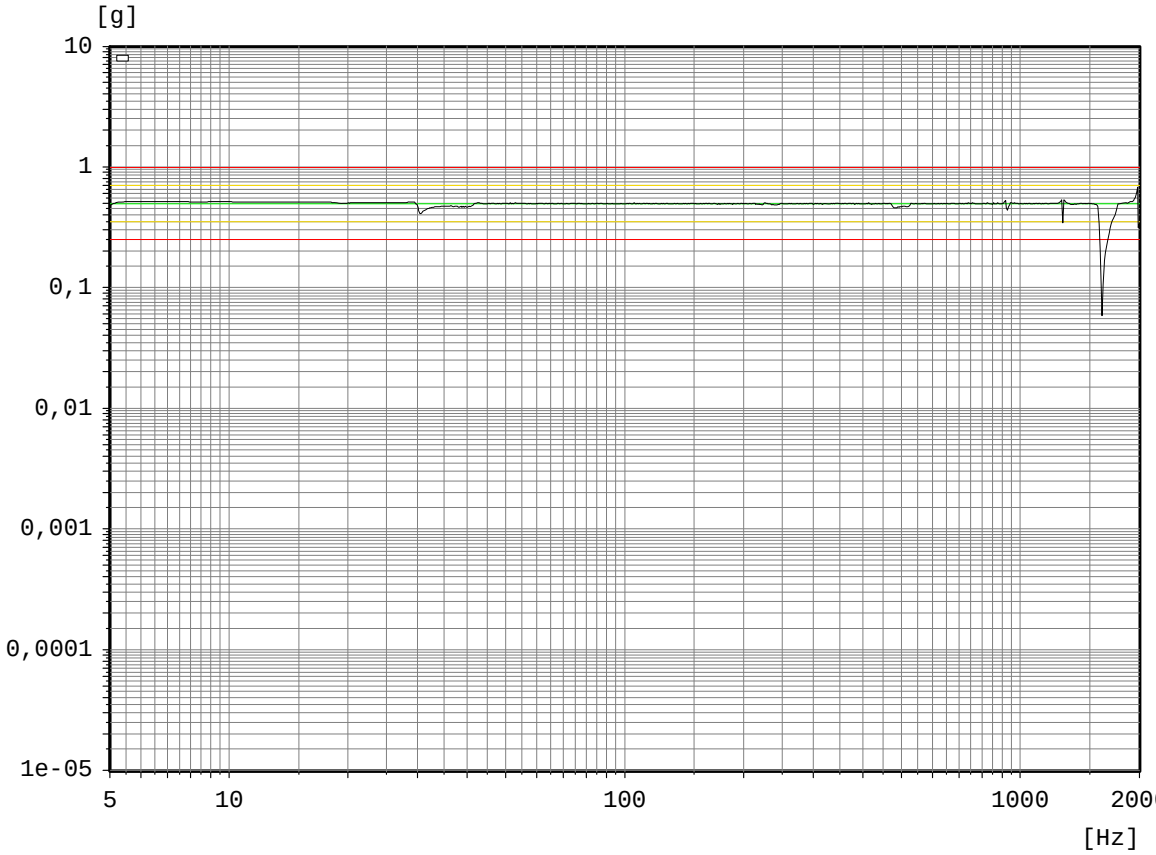
Sine

Control 1

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.no:	1
Chan.type:	CW Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_2.rsn

Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

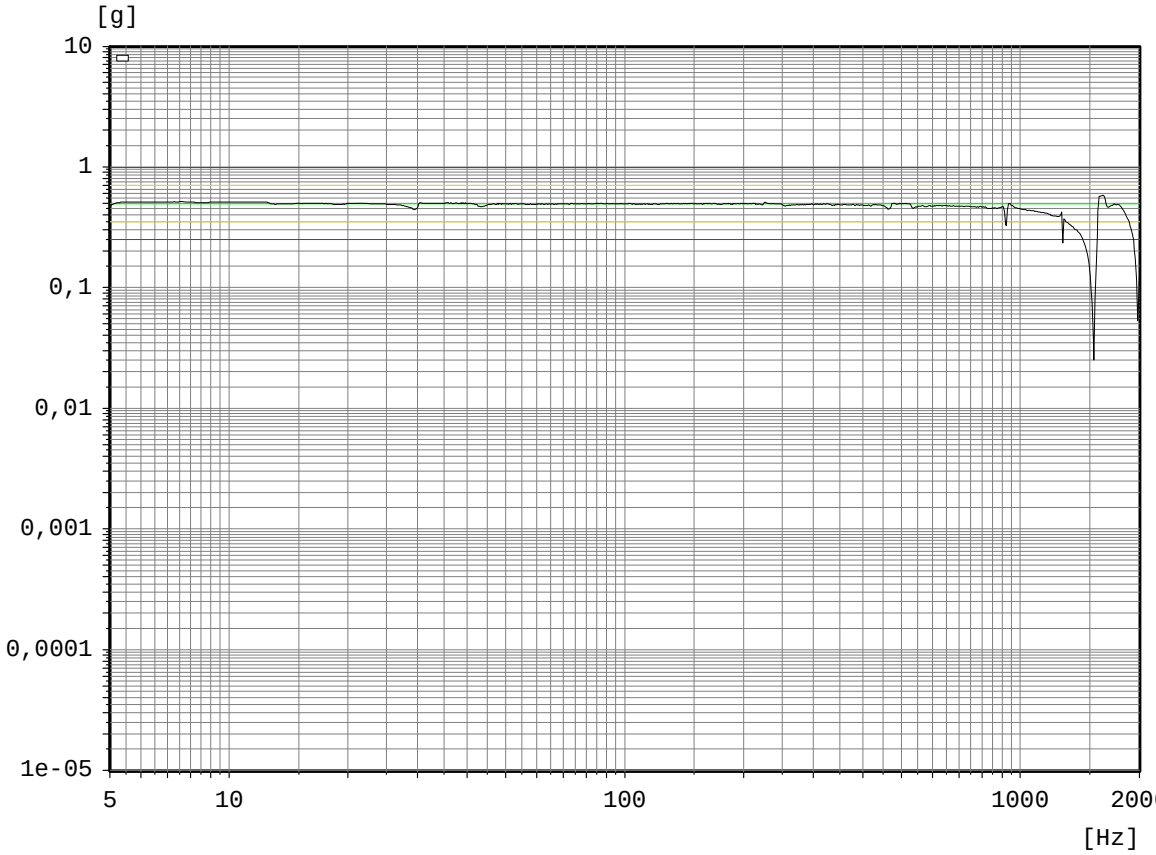
Sine

Control 2

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.no:	2
Chan.type:	CW Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

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Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

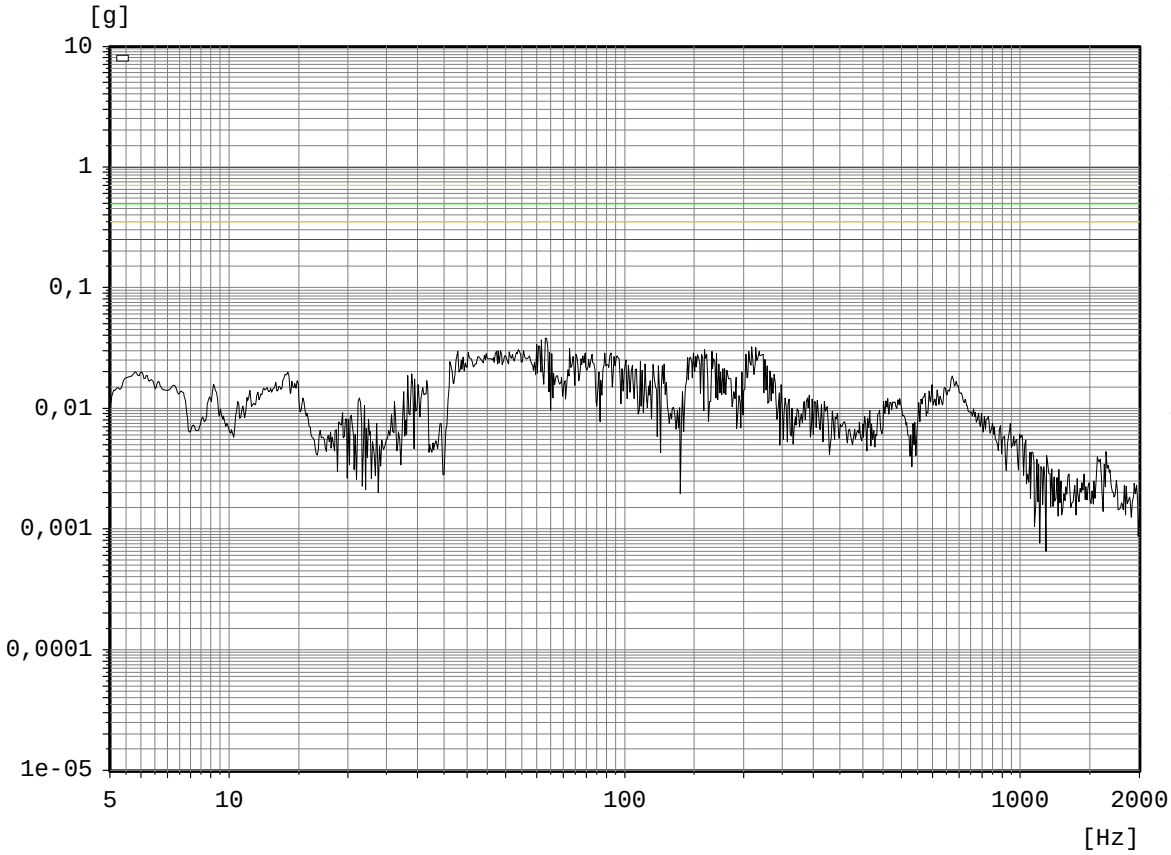
Sine

WL-Reel-Center-X

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.no:	3
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

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Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

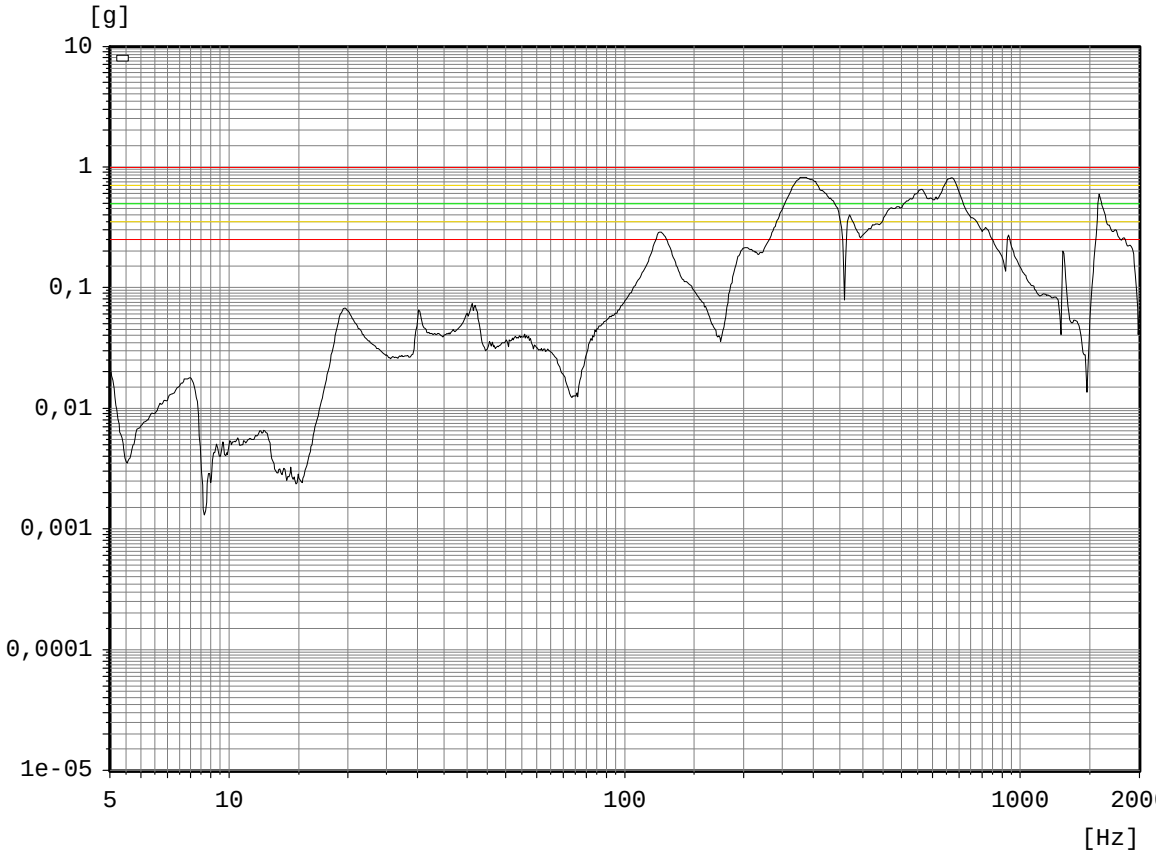
Sine

WL-Reel-Center-Y

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.no:	4
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_2.rsn

Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

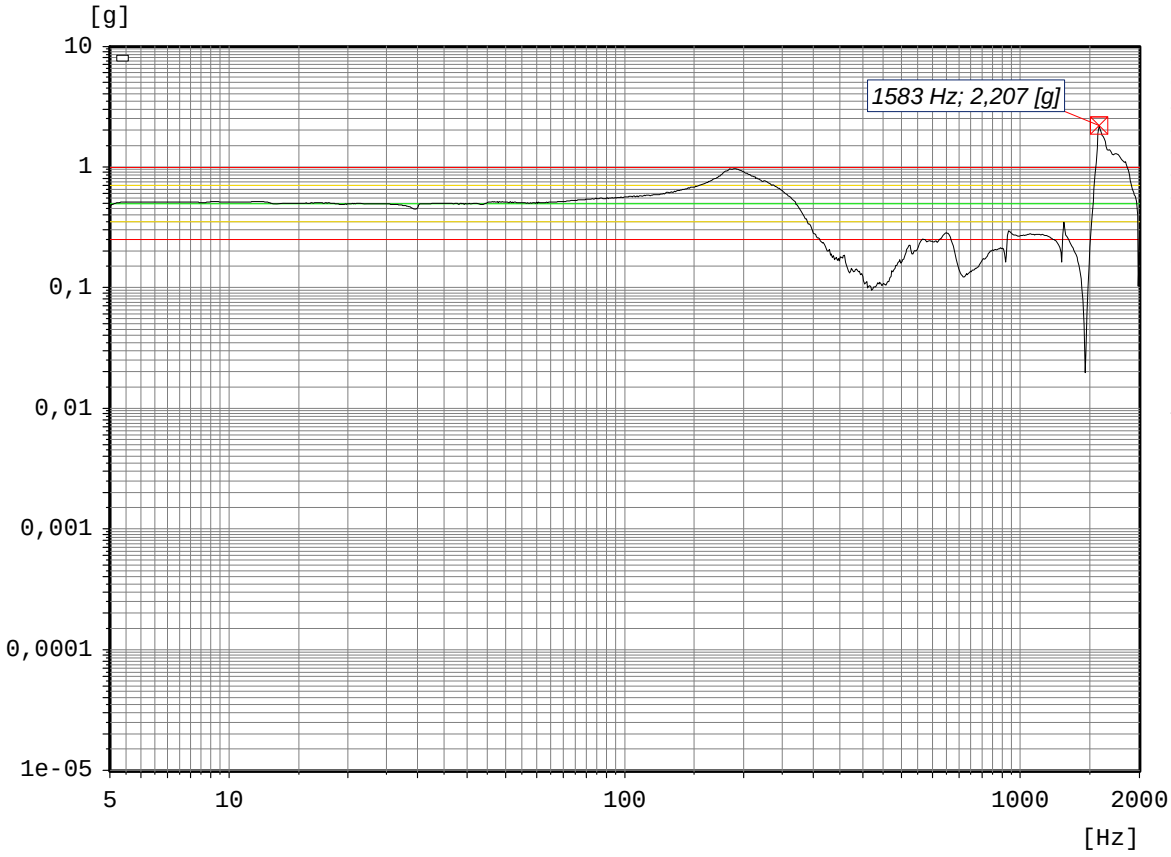
Sine

WL-Reel-Center-Z

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.no:	5
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_2.rsn

Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

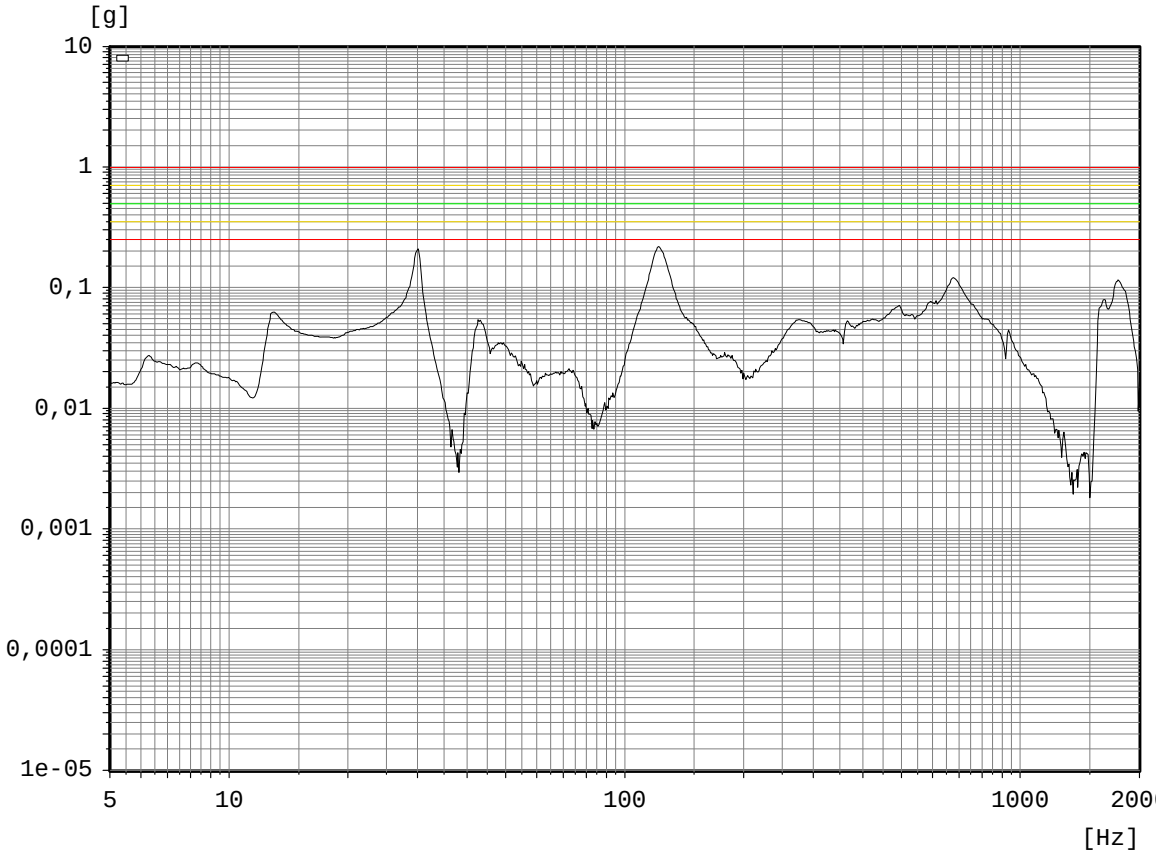
Sine

WL-Dummy-X

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.no:	9
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_2.rsn

Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

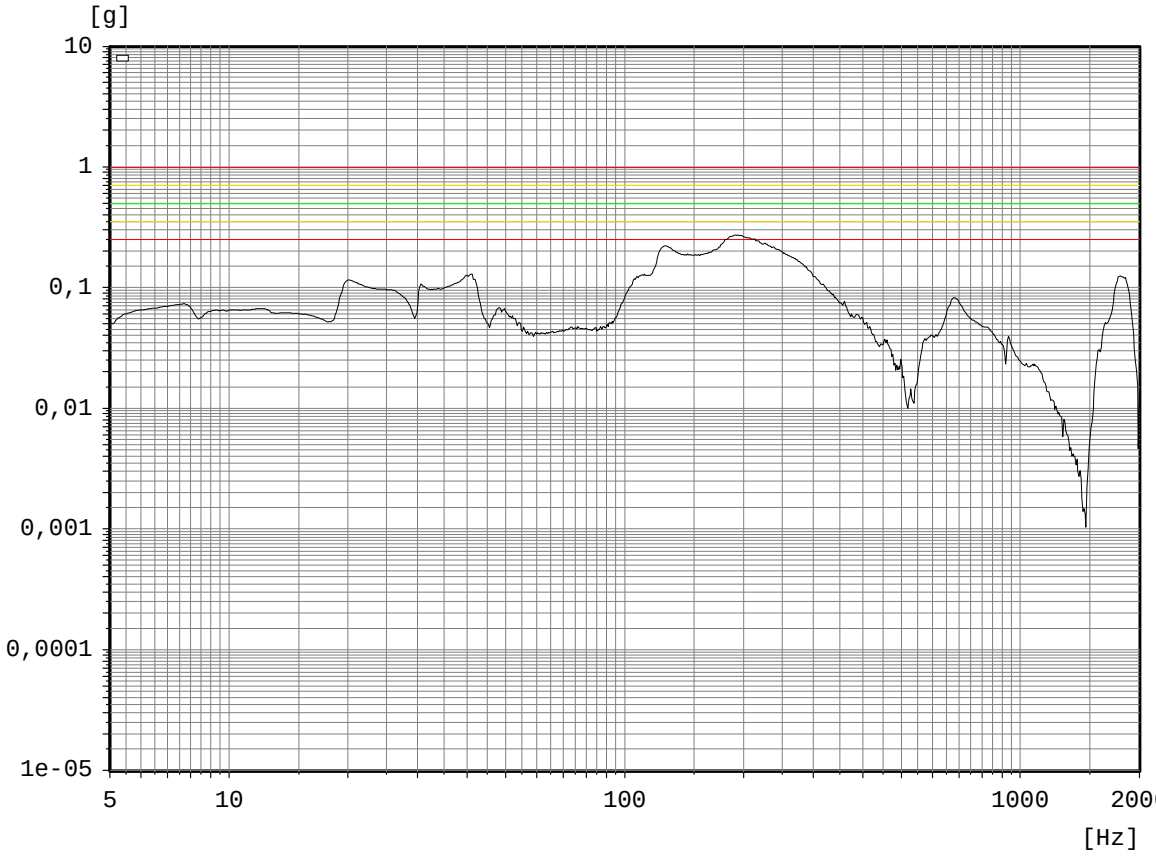
Sine

WL-Dummy-Y

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.no:	10
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_2.rsn

Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

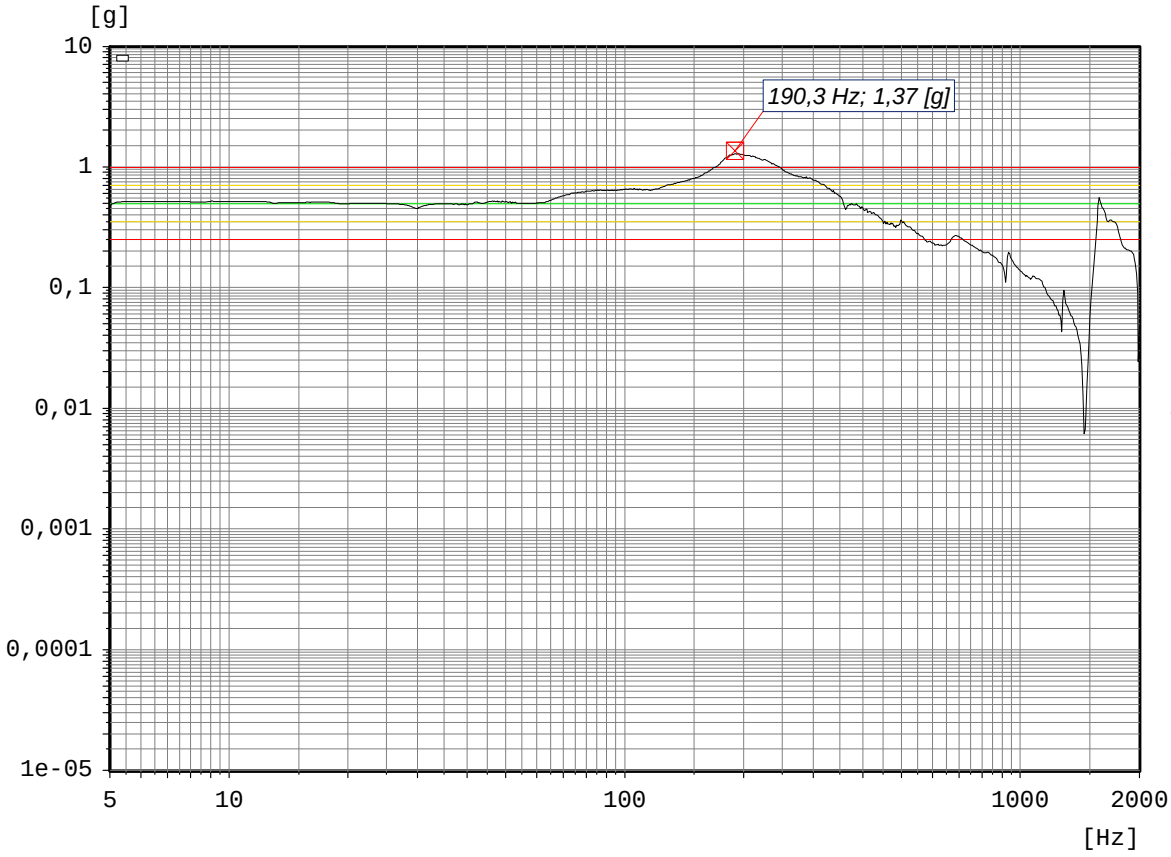
Sine

WL-Dummy-Z

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.no:	11
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_2.rsn

Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

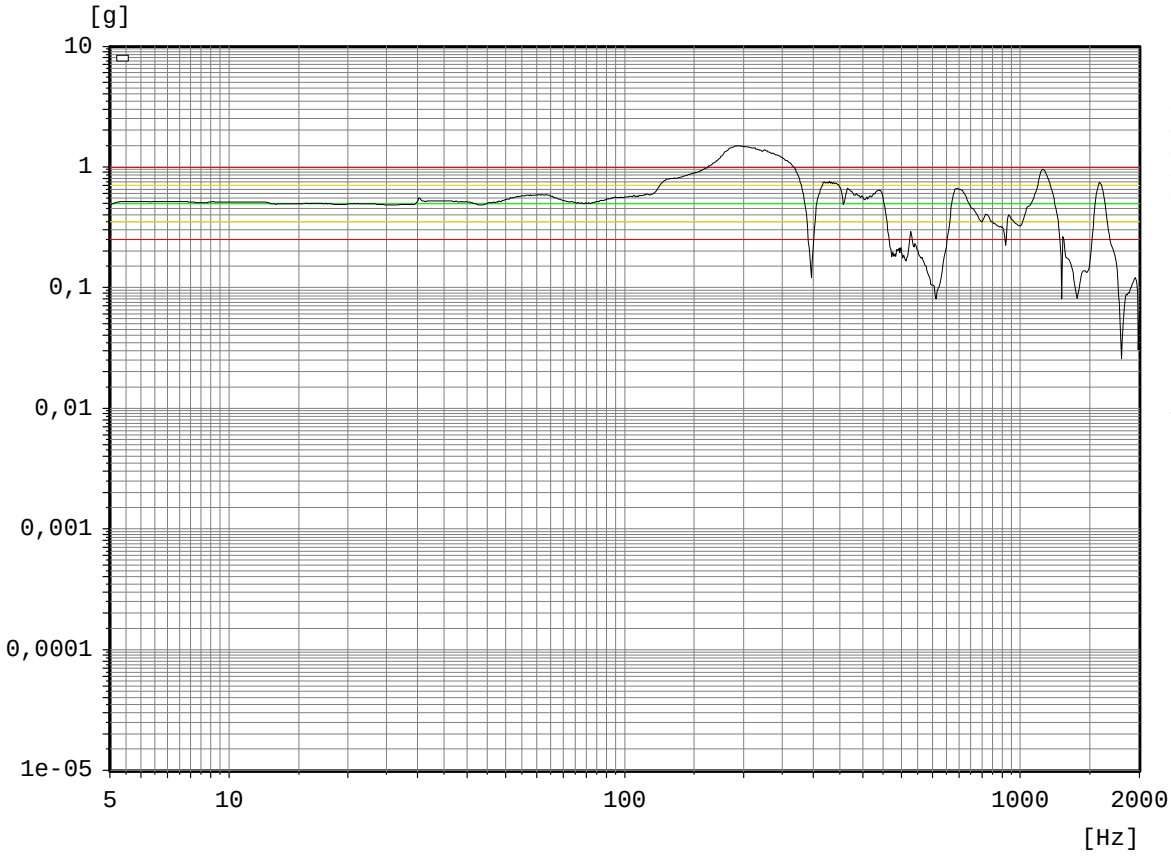
Sine

WL-Side-Z

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.no:	15
Chan.type:	M Filtered
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_2.rsn

Test curve – resonance survey test 2 Z-axis, Auxiliary Tether Reel WL

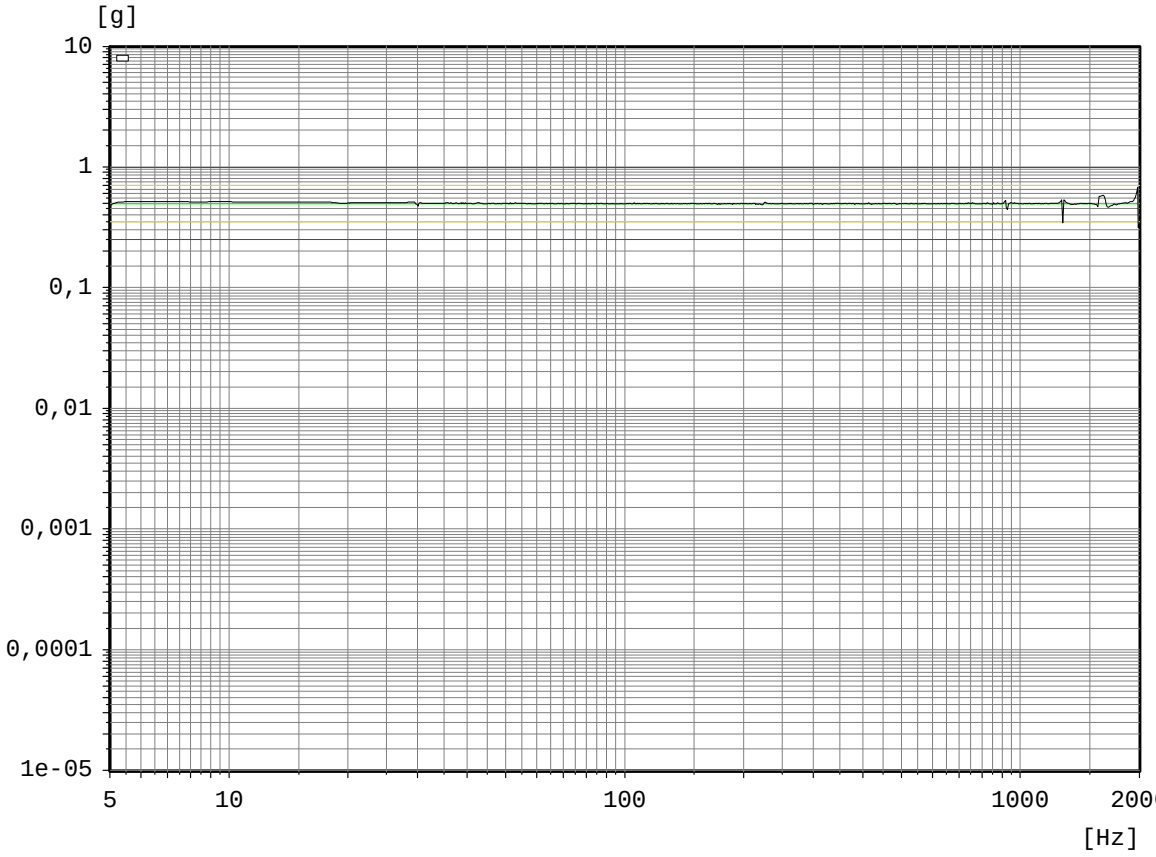
Sine

Control channel

Auxiliary Tether Reel WL

vibration test 04.04.2013

resonance survey test 2, Z - axis (out of plane)



Chan.type:	X
Sweep type:	logarithmic
Sweeps done:	1
Sweeps req.:	1
Sweep direct.:	up
Sweep rate:	2,00 Oct/min
Contr.strat.:	Maximum
Unit:	g
Contr.strat.:	Closed loop
-- Testing time --	
elapsed:	000:04:18
remaining:	000:00:00
Date:	04-04-13
Time:	16:07:42

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\Auxiliary_Tether_Reel_Reso_Z_2.rsn

Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

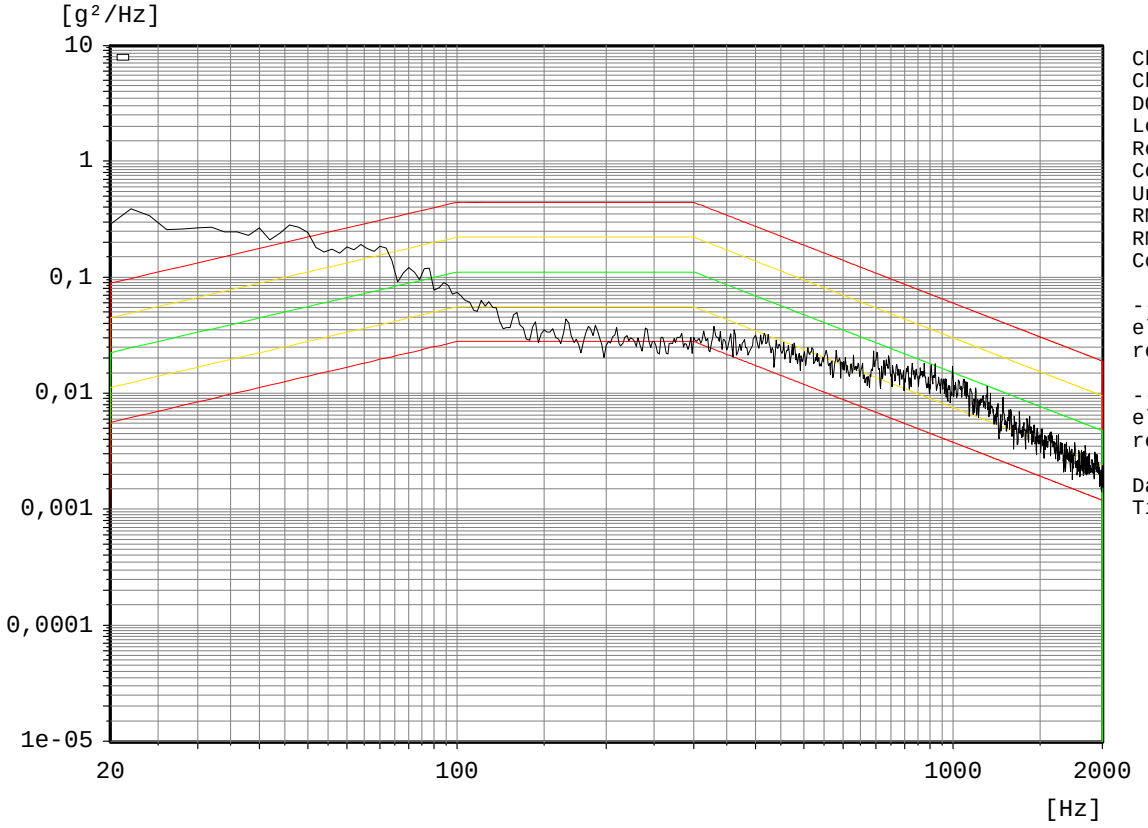
Random

WL-Reel-Center-X

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	3
Chan.type:	M
DOF:	100
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	6,332 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\WL_Random_Z_broken.rrn

Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

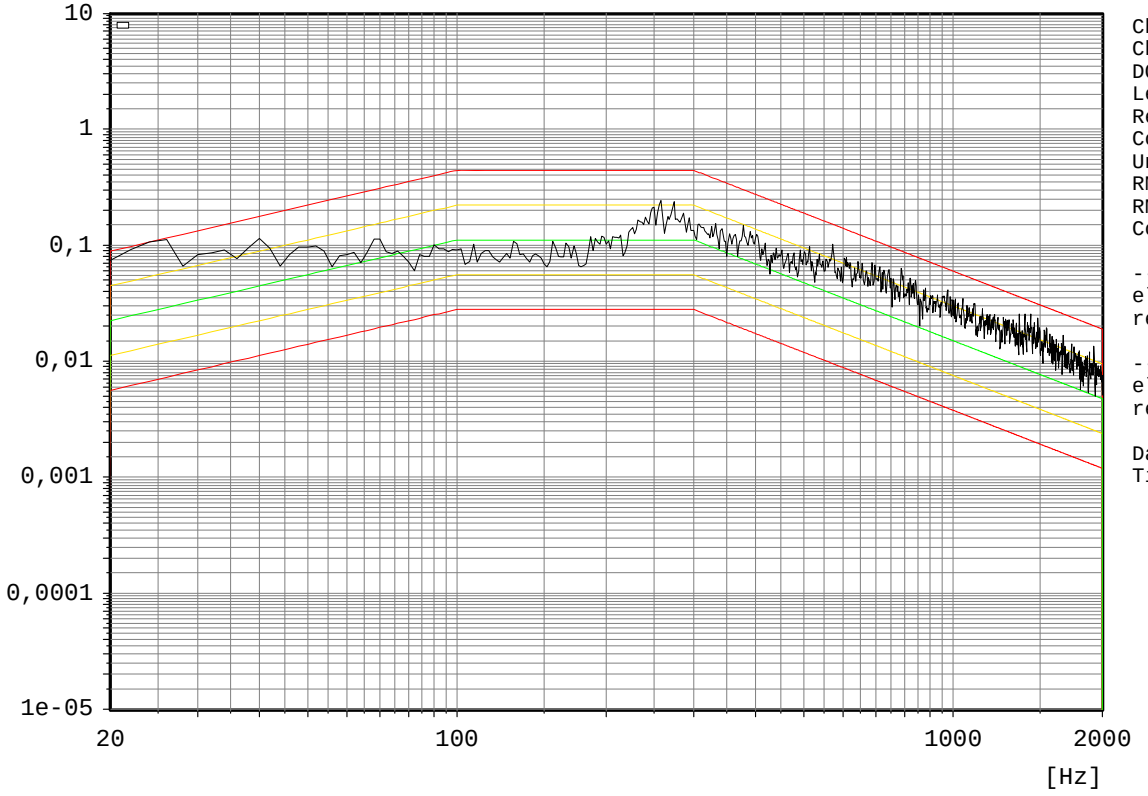
Random

WL-Reel-Center-Y

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	4
Chan.type:	M
DOF:	100
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	9,577 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\WL_Random_Z_broken.rrn

Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

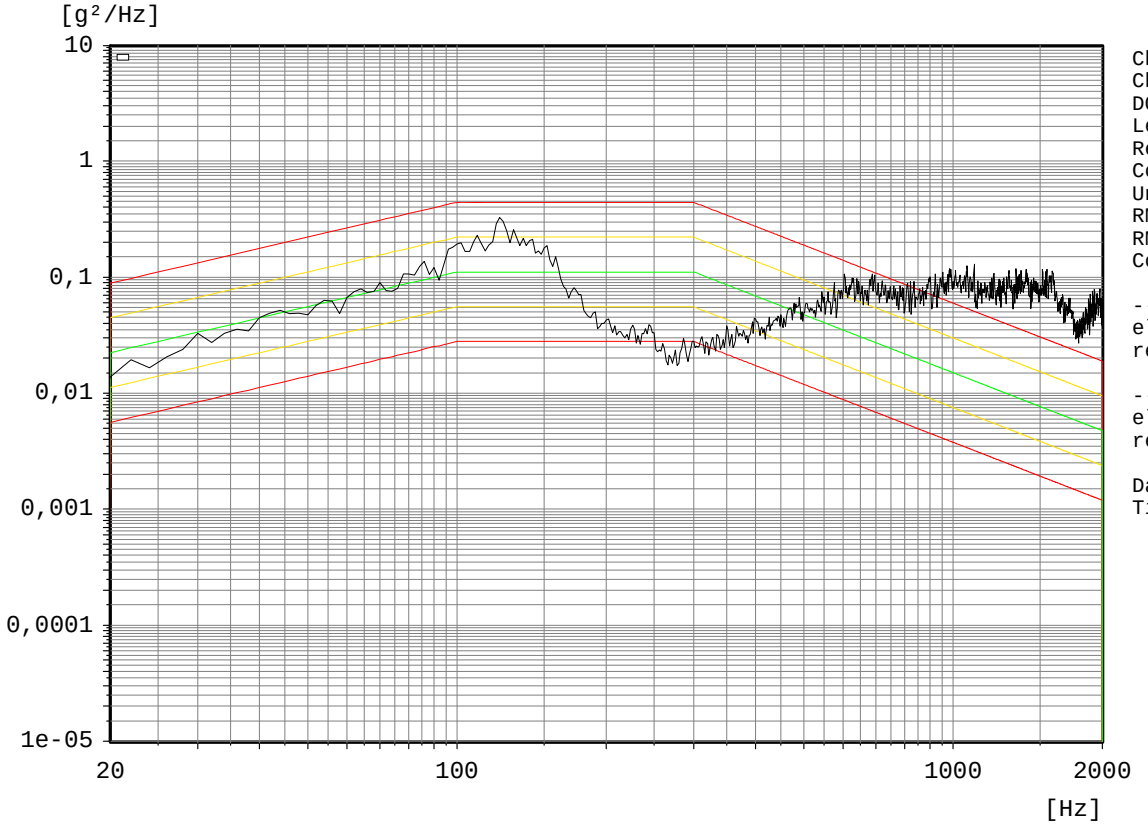
Random

WL-Reel-Center-Z

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	5
Chan.type:	M
DOF:	100
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	11,83 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

DAP-PL-3185.00

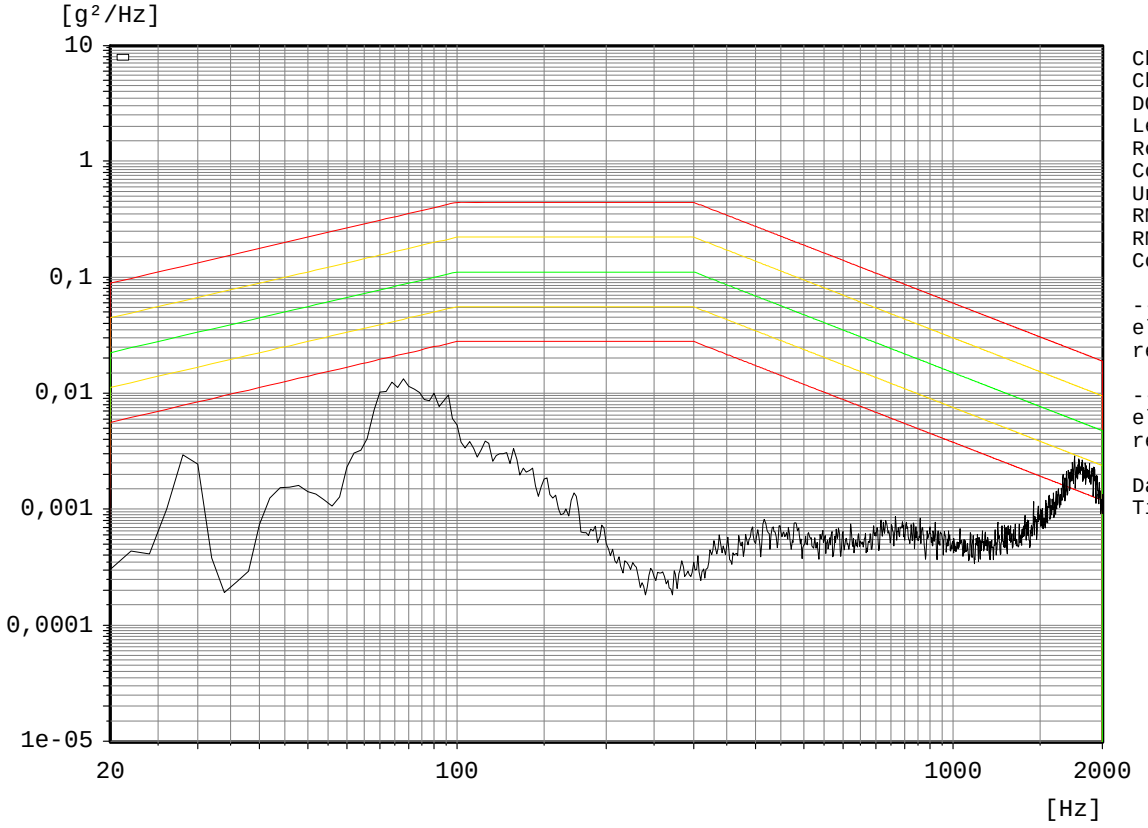
D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\WL_Random_Z_broken.rrn

Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

WL-Dummy-X

Auxiliary Tether Reel WL
vibration retest 04.04.2013
random vibration, Z-axis (out of plane)



Chan.no:	9
Chan.type:	M
DOF:	100
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	1,452 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\WL_Random_Z_broken.rrn

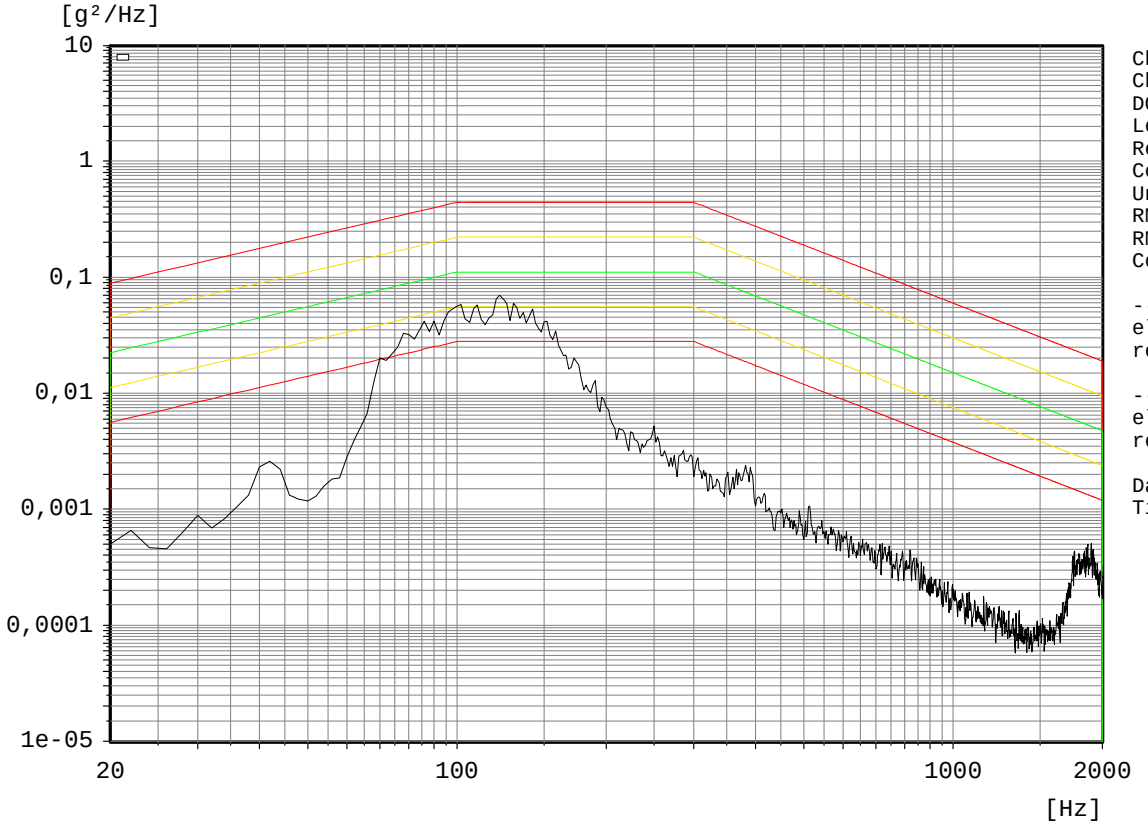
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	10
Chan.type:	M
DOF:	100
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	2,376 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

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Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

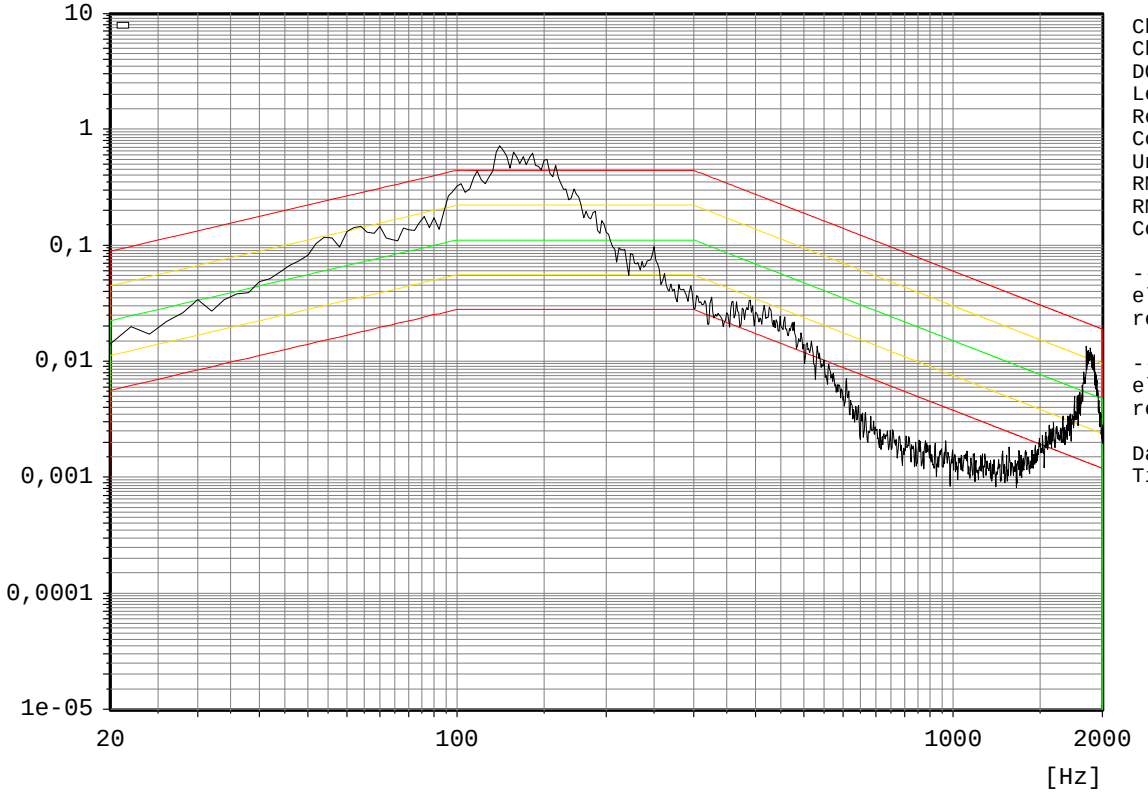
Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)

WL-Dummy-Z



Chan.no:	11
Chan.type:	M
DOF:	100
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	7,94 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

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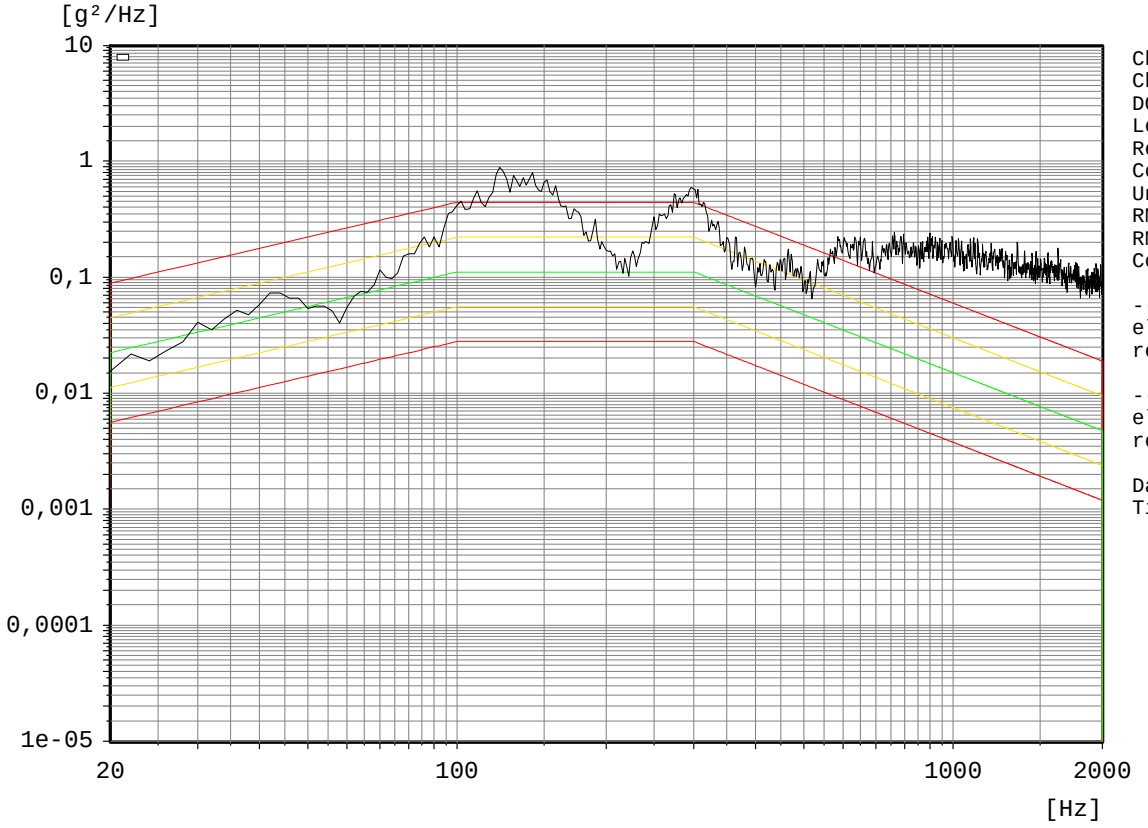
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	15
Chan.type:	M
DOF:	100
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	18,13 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

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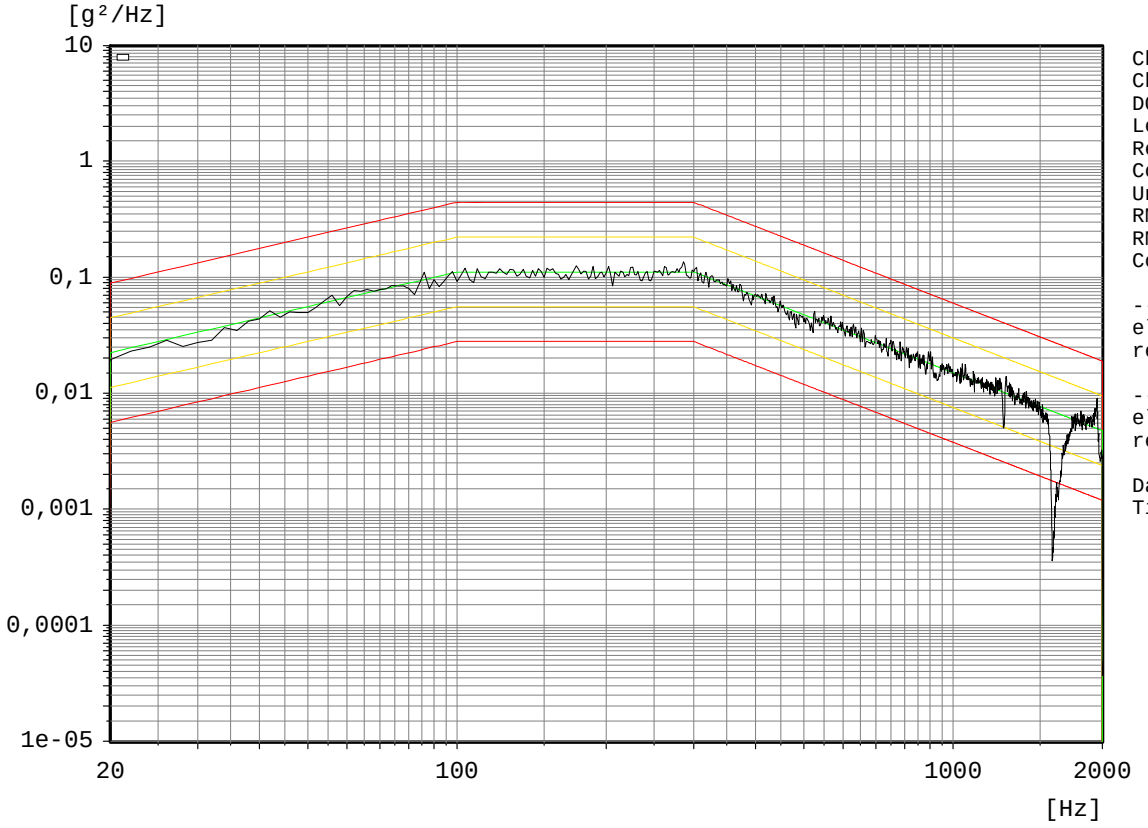
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	1
Chan.type:	CW
DOF:	120
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	7,911 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

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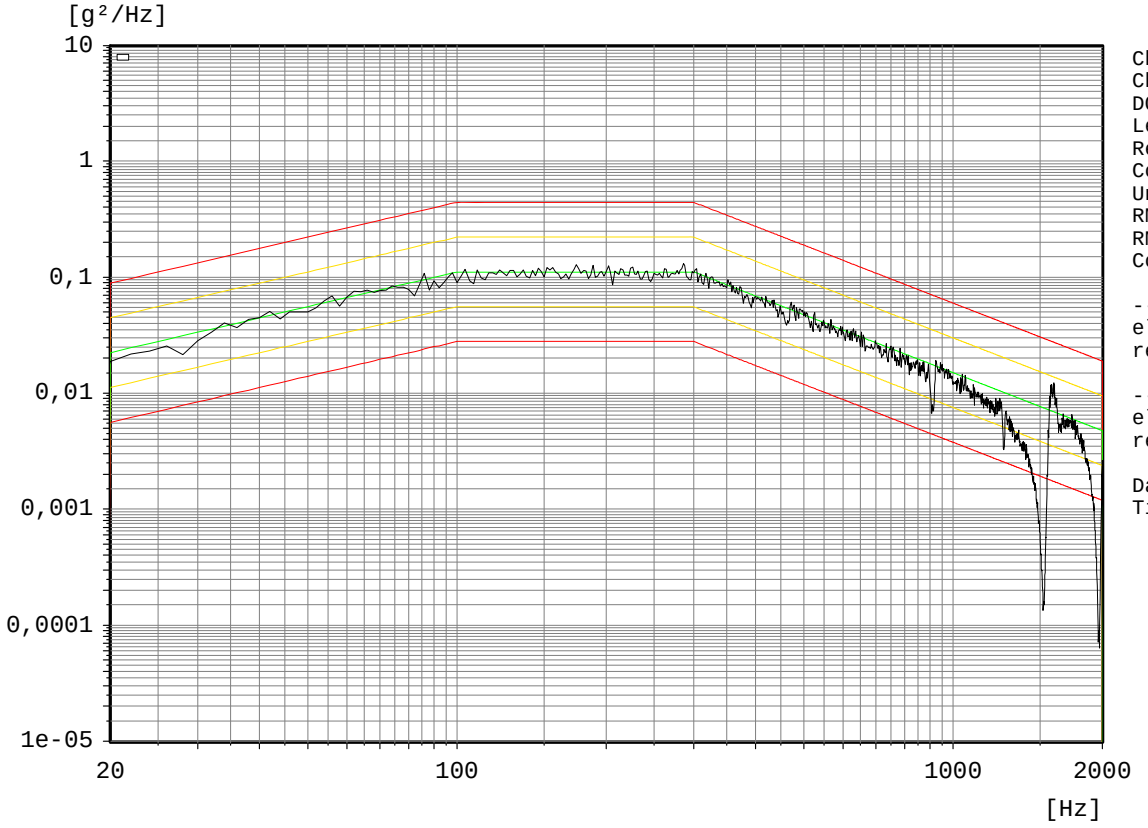
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	2
Chan.type:	CW
DOF:	120
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	7,635 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

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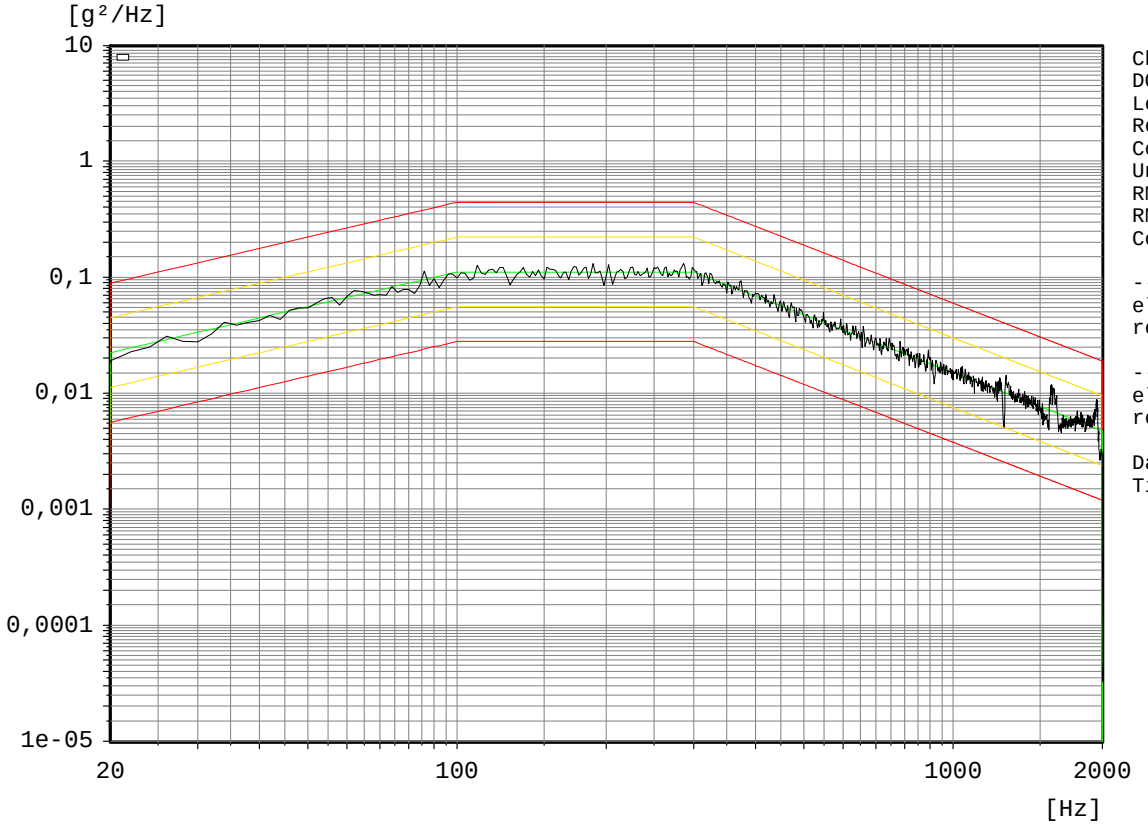
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

Control channel

Auxiliary Tether Reel WL
vibration retest 04.04.2013
random vibration, Z-axis (out of plane)



Chan.type:	X
DOF:	240
Level:	-12,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	7,987 g
RMS (req.):	8,02
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:17
remaining:	000:00:02
-- Time total --	
elapsed:	000:00:38
remaining:	000:03:02
Date:	04-04-13
Time:	16:34:22

DAP-PL-3185.00

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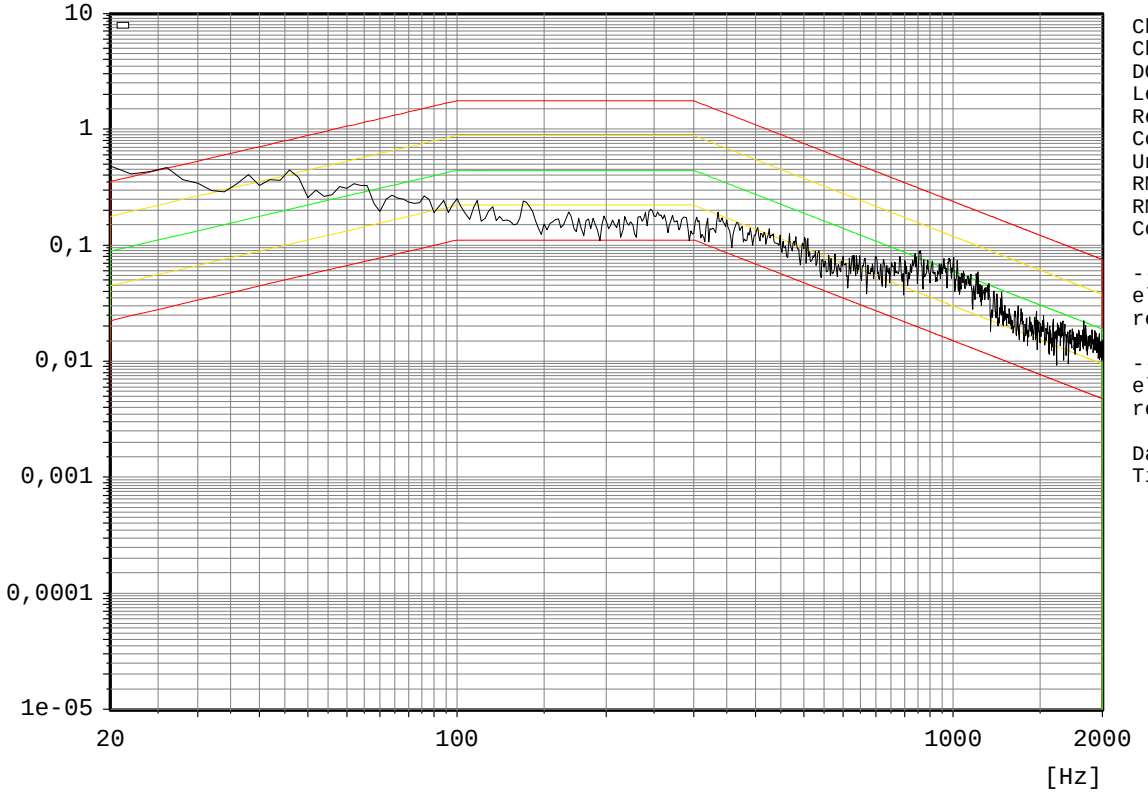
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

WL-Reel-Center-X

Auxiliary Tether Reel WL
vibration retest 04.04.2013
random vibration, Z-axis (out of plane)



Chan.no:	3
Chan.type:	M
DOF:	100
Level:	-6,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	11,8 g
RMS (req.):	16
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:13
remaining:	000:00:06
-- Time total --	
elapsed:	000:01:15
remaining:	000:02:26
Date:	04-04-13
Time:	16:34:55

DAP-PL-3185.00

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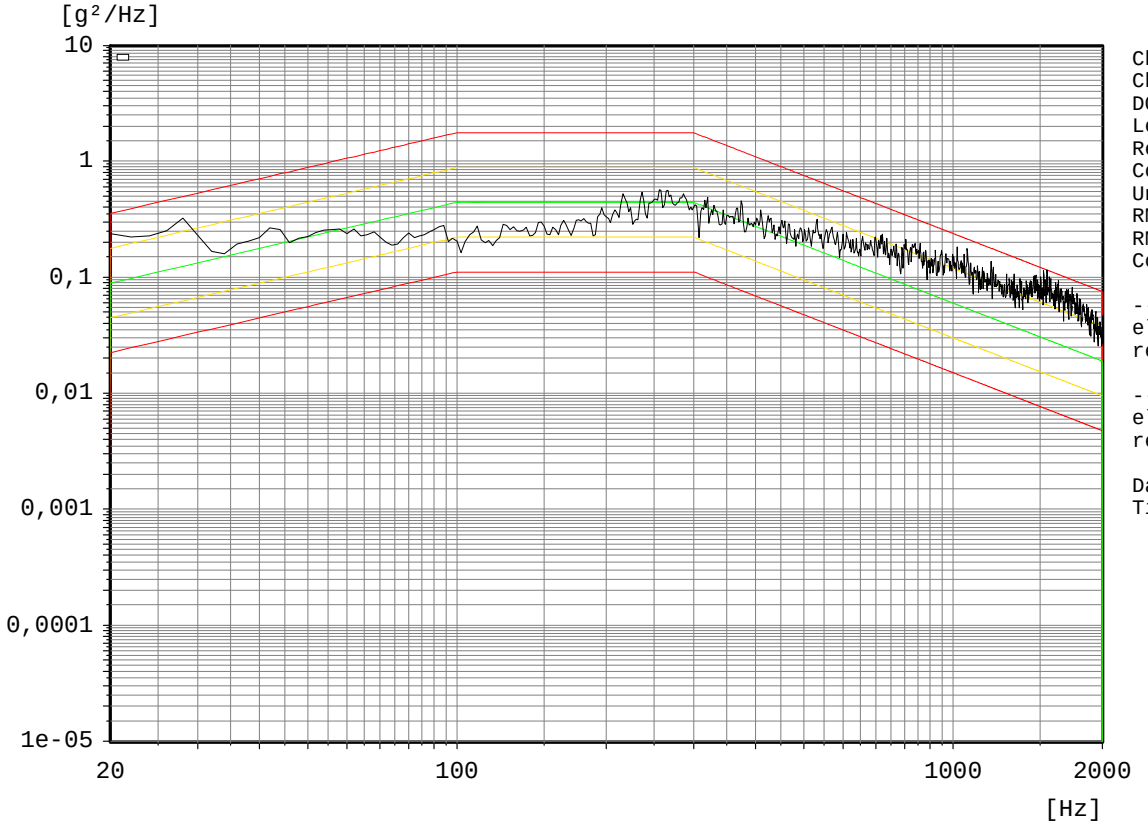
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

WL-Reel-Center-Y

Auxiliary Tether Reel WL
vibration retest 04.04.2013
random vibration, Z-axis (out of plane)



Chan.no:	4
Chan.type:	M
DOF:	100
Level:	-6,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	17,7 g
RMS (req.):	16
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:13
remaining:	000:00:06
-- Time total --	
elapsed:	000:01:15
remaining:	000:02:26
Date:	04-04-13
Time:	16:34:55

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Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

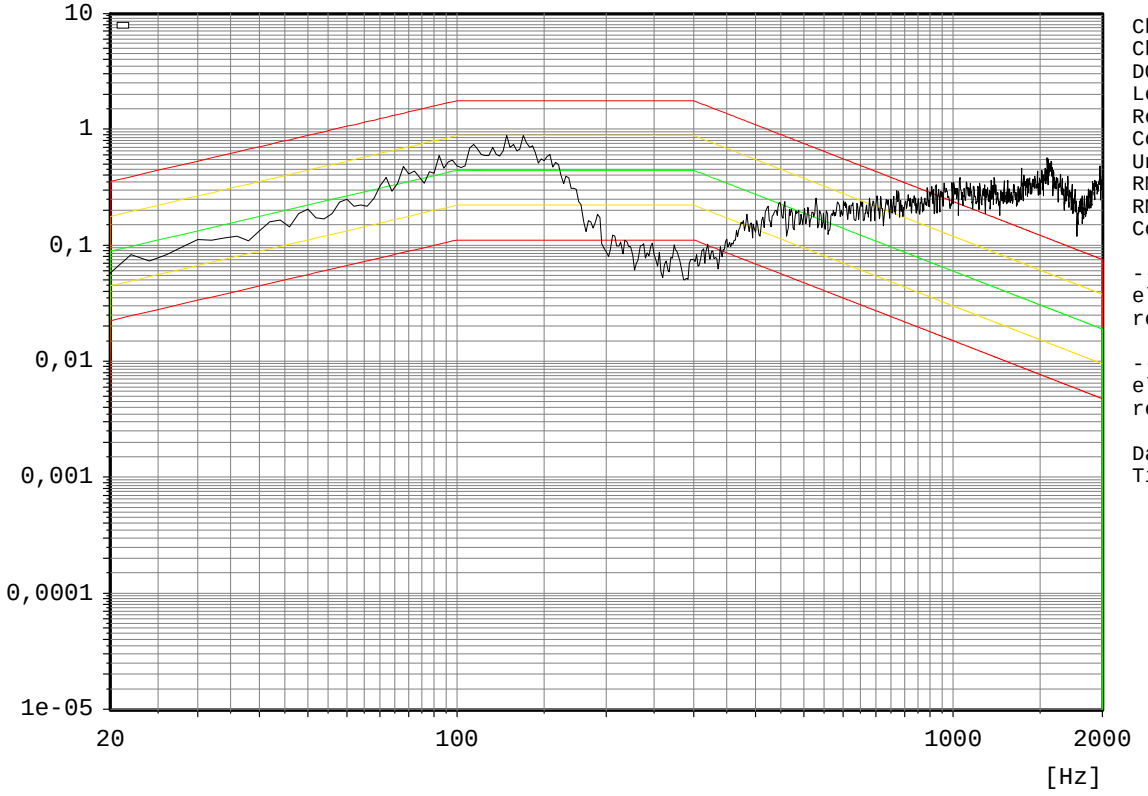
Random

WL-Reel-Center-Z

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	5
Chan.type:	M
DOF:	100
Level:	-6,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	22,72 g
RMS (req.):	16
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:13
remaining:	000:00:06
-- Time total --	
elapsed:	000:01:15
remaining:	000:02:26
Date:	04-04-13
Time:	16:34:55

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Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

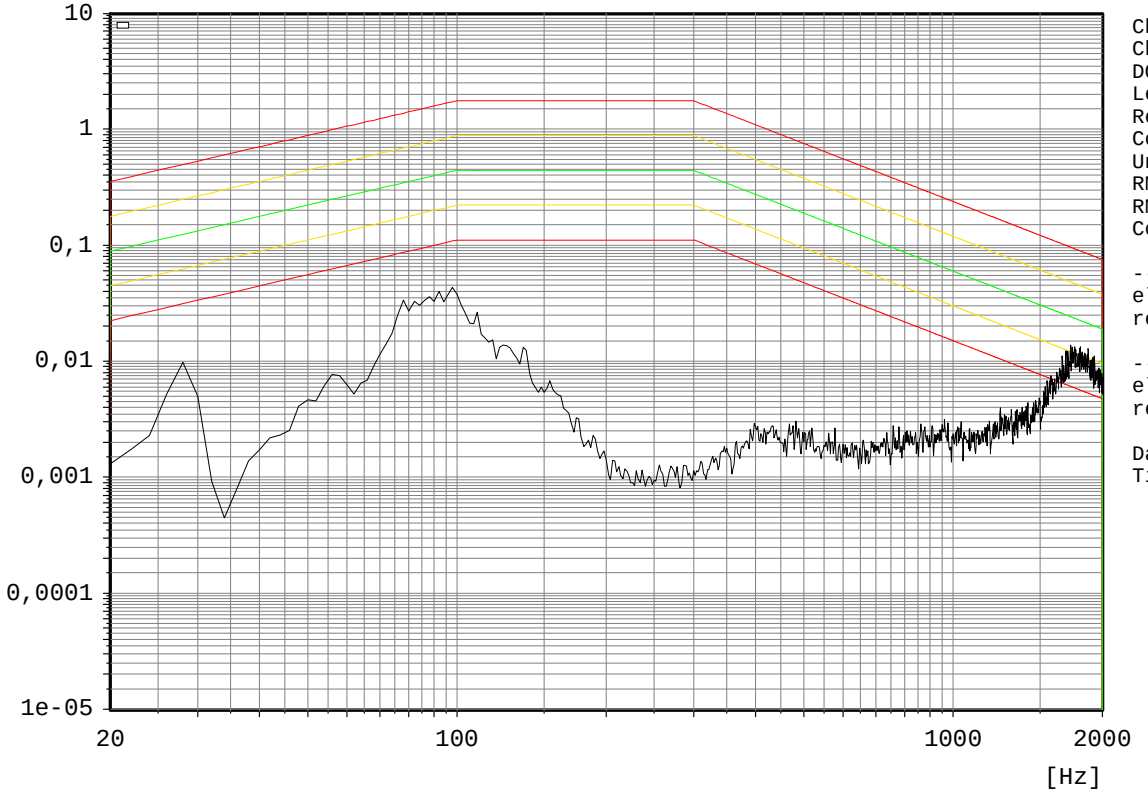
Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)

WL-Dummy-X



Chan.no:	9
Chan.type:	M
DOF:	100
Level:	-6,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	3,012 g
RMS (req.):	16
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:13
remaining:	000:00:06
-- Time total --	
elapsed:	000:01:15
remaining:	000:02:26
Date:	04-04-13
Time:	16:34:55

DAP-PL-3185.00

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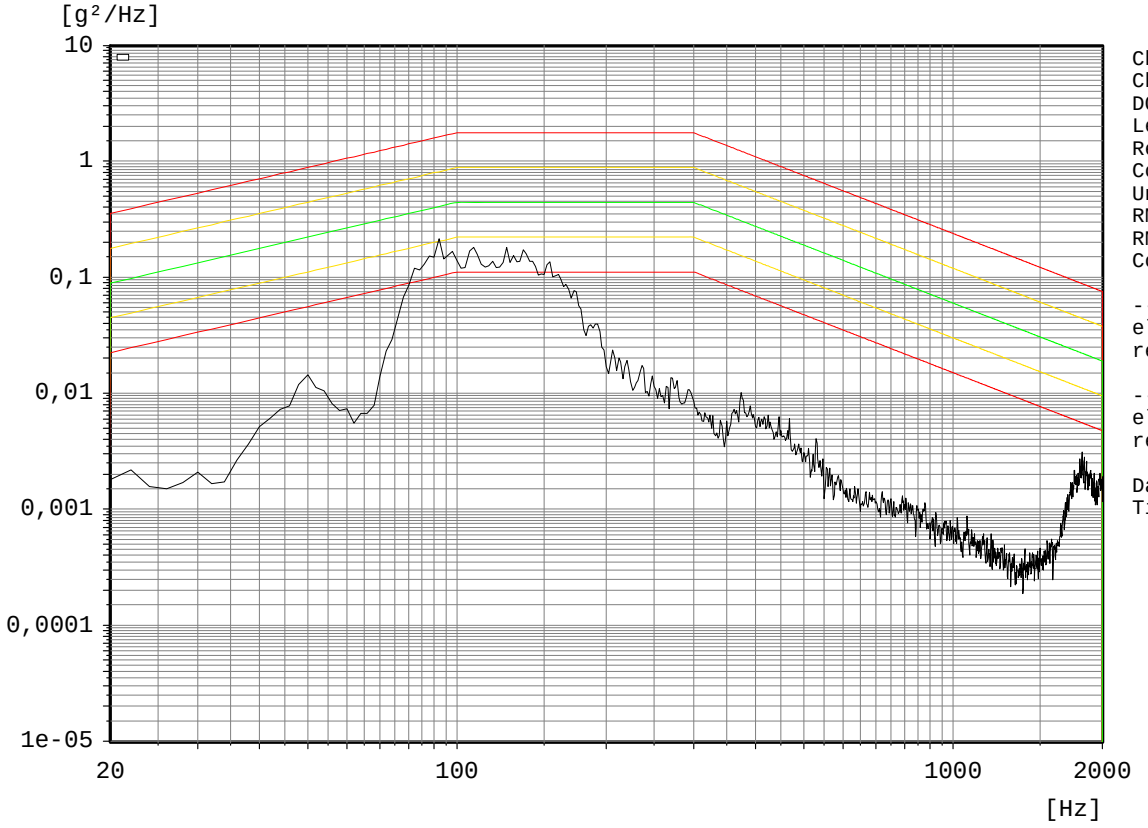
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	10
Chan.type:	M
DOF:	100
Level:	-6,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	4,217 g
RMS (req.):	16
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:13
remaining:	000:00:06
-- Time total --	
elapsed:	000:01:15
remaining:	000:02:26
Date:	04-04-13
Time:	16:34:55

DAP-PL-3185.00

D:\Daten\2013_04_03_Auxiliary_Tether_Reel\2013_04_04\WL_Random_Z_broken.rrn

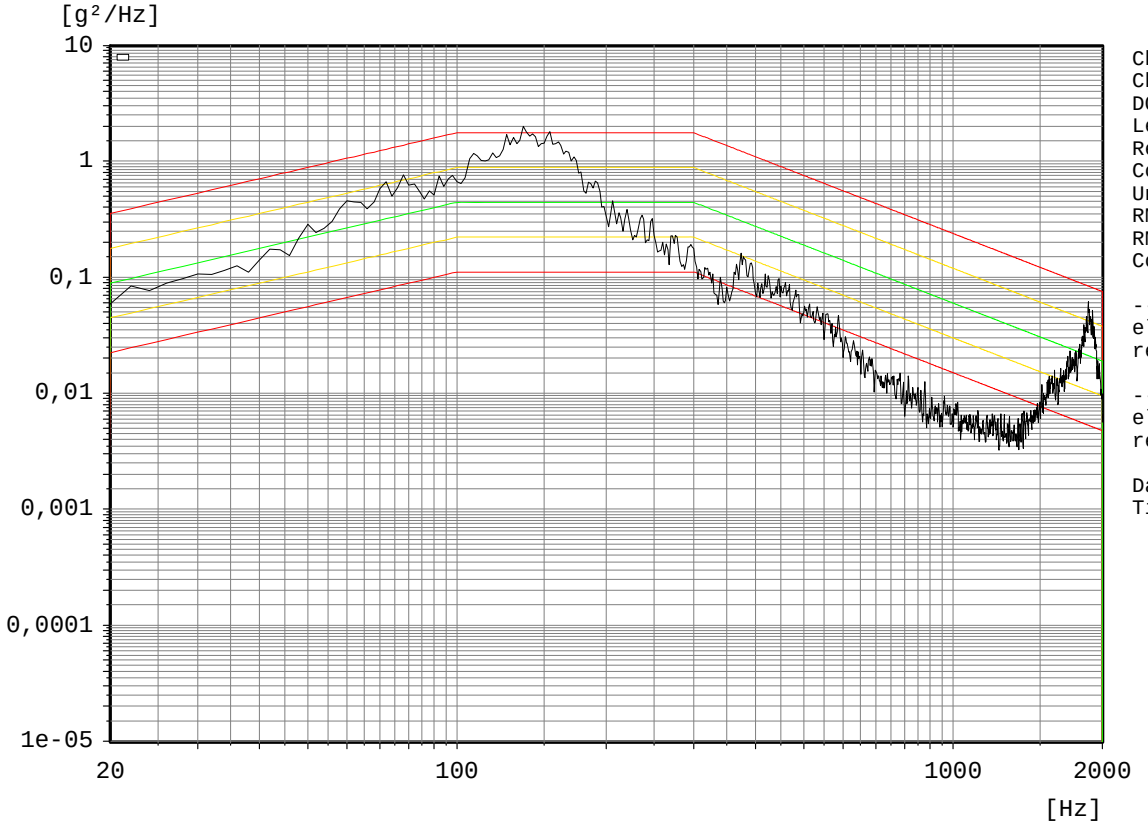
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	11
Chan.type:	M
DOF:	100
Level:	-6,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	14,42 g
RMS (req.):	16
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:13
remaining:	000:00:06
-- Time total --	
elapsed:	000:01:15
remaining:	000:02:26
Date:	04-04-13
Time:	16:34:55

DAP-PL-3185.00

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Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

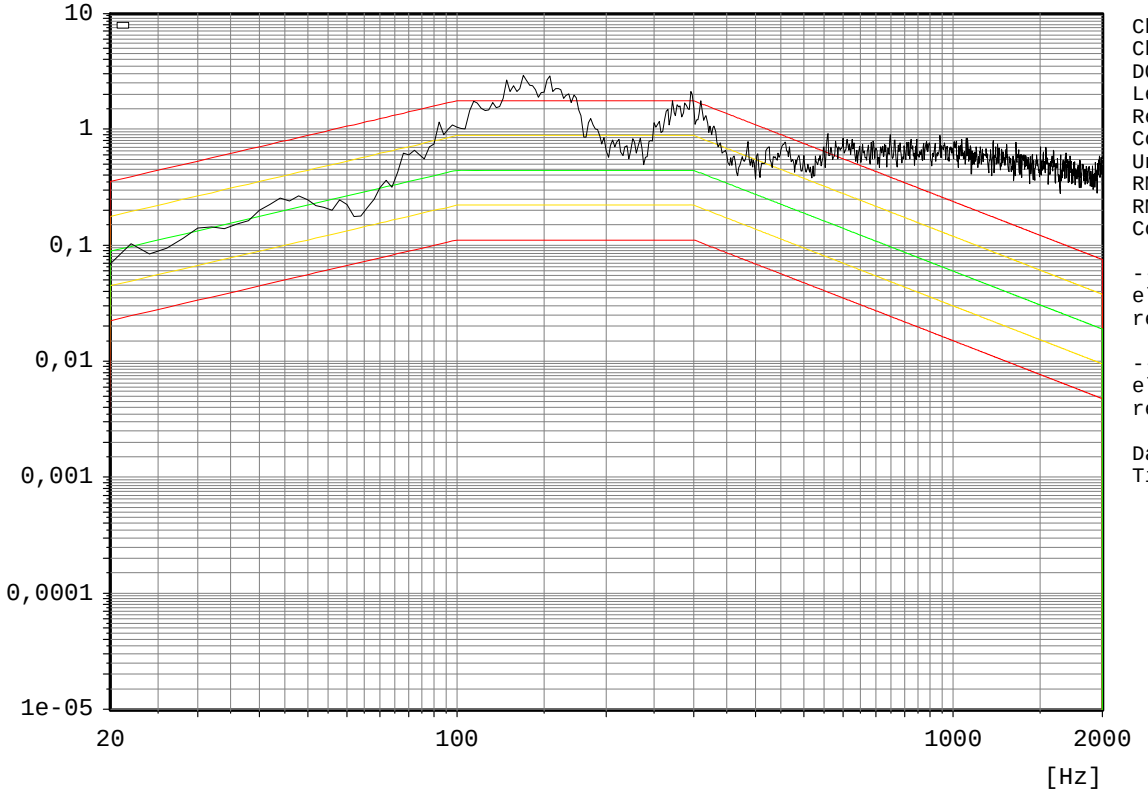
Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)

WL-Side-Z



Chan.no:	15
Chan.type:	M
DOF:	100
Level:	-6,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	35,79 g
RMS (req.):	16
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:13
remaining:	000:00:06
-- Time total --	
elapsed:	000:01:15
remaining:	000:02:26
Date:	04-04-13
Time:	16:34:55

DAP-PL-3185.00

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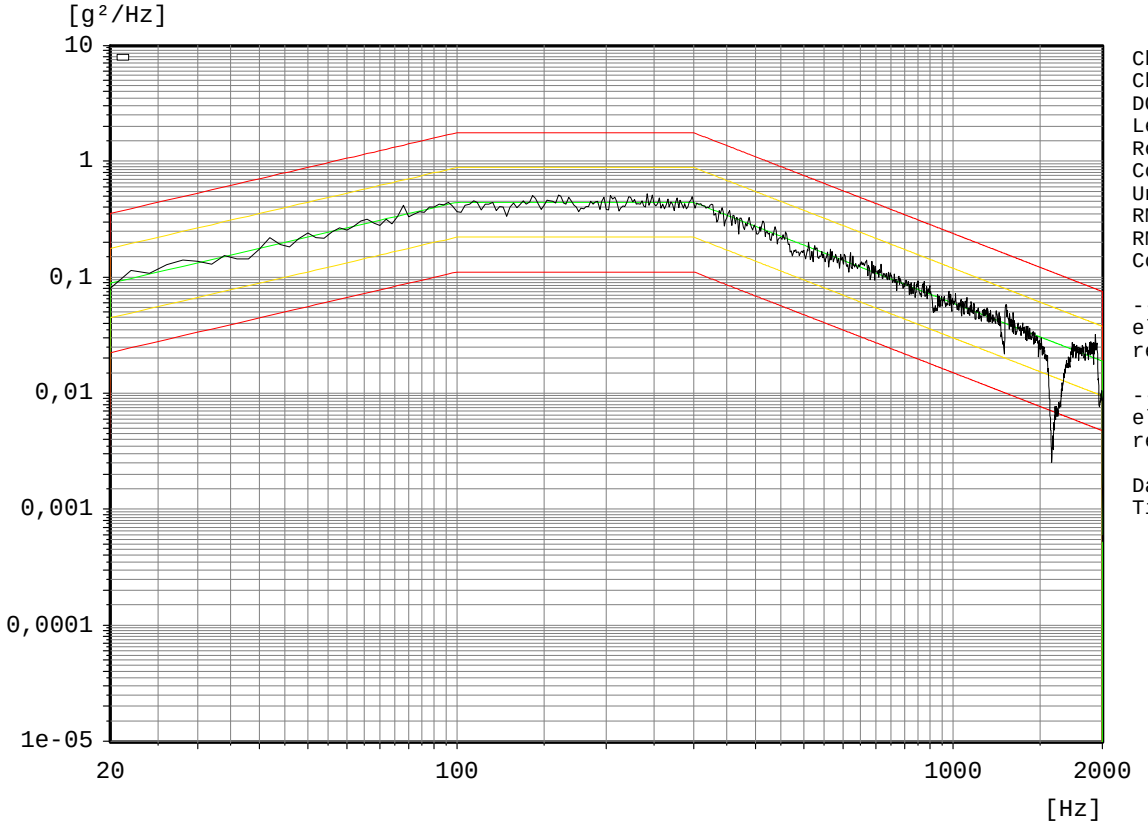
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	1
Chan.type:	CW
DOF:	120
Level:	-6,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	15,75 g
RMS (req.):	16
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:13
remaining:	000:00:06
-- Time total --	
elapsed:	000:01:15
remaining:	000:02:26
Date:	04-04-13
Time:	16:34:55

DAP-PL-3185.00

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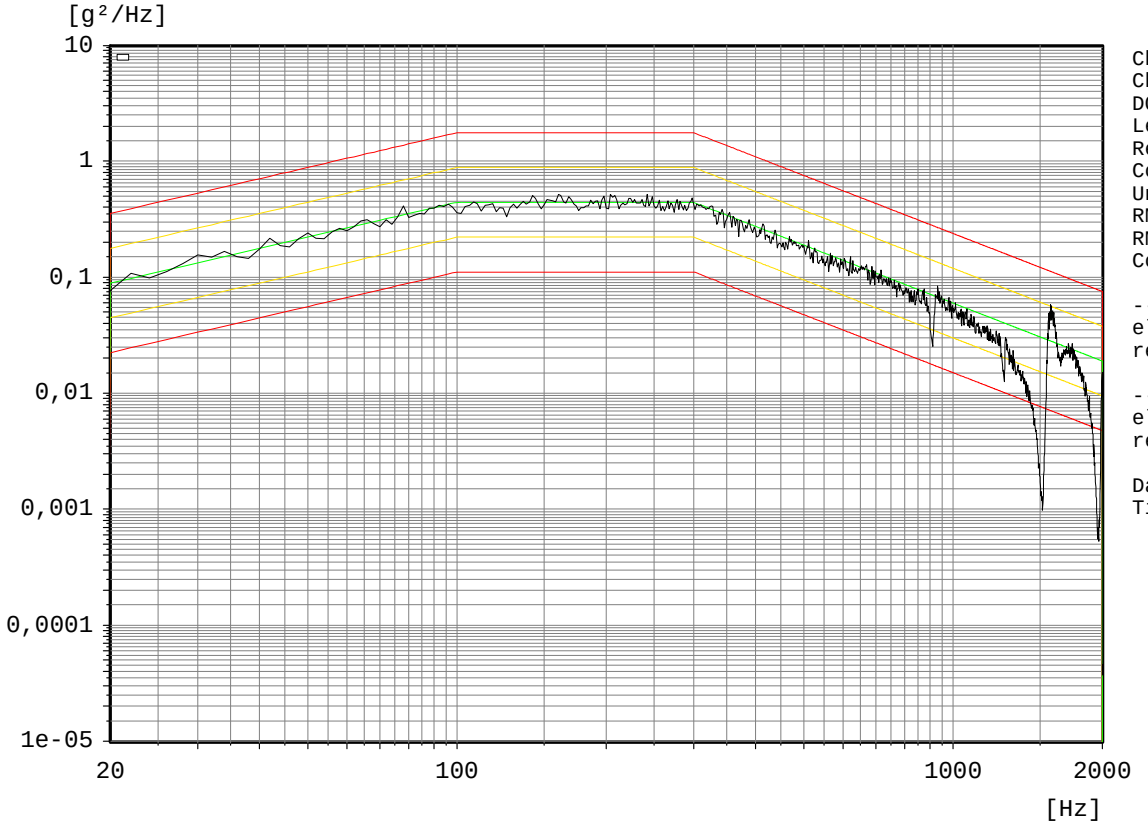
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL

Random

Auxiliary Tether Reel WL

vibration retest 04.04.2013

random vibration, Z-axis (out of plane)



Chan.no:	2
Chan.type:	CW
DOF:	120
Level:	-6,0 dB
Resolution:	2 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	15,23 g
RMS (req.):	16
Contr.strat.:	Closed loop
-- Time on act. level --	
elapsed:	000:00:13
remaining:	000:00:06
-- Time total --	
elapsed:	000:01:15
remaining:	000:02:26
Date:	04-04-13
Time:	16:34:55

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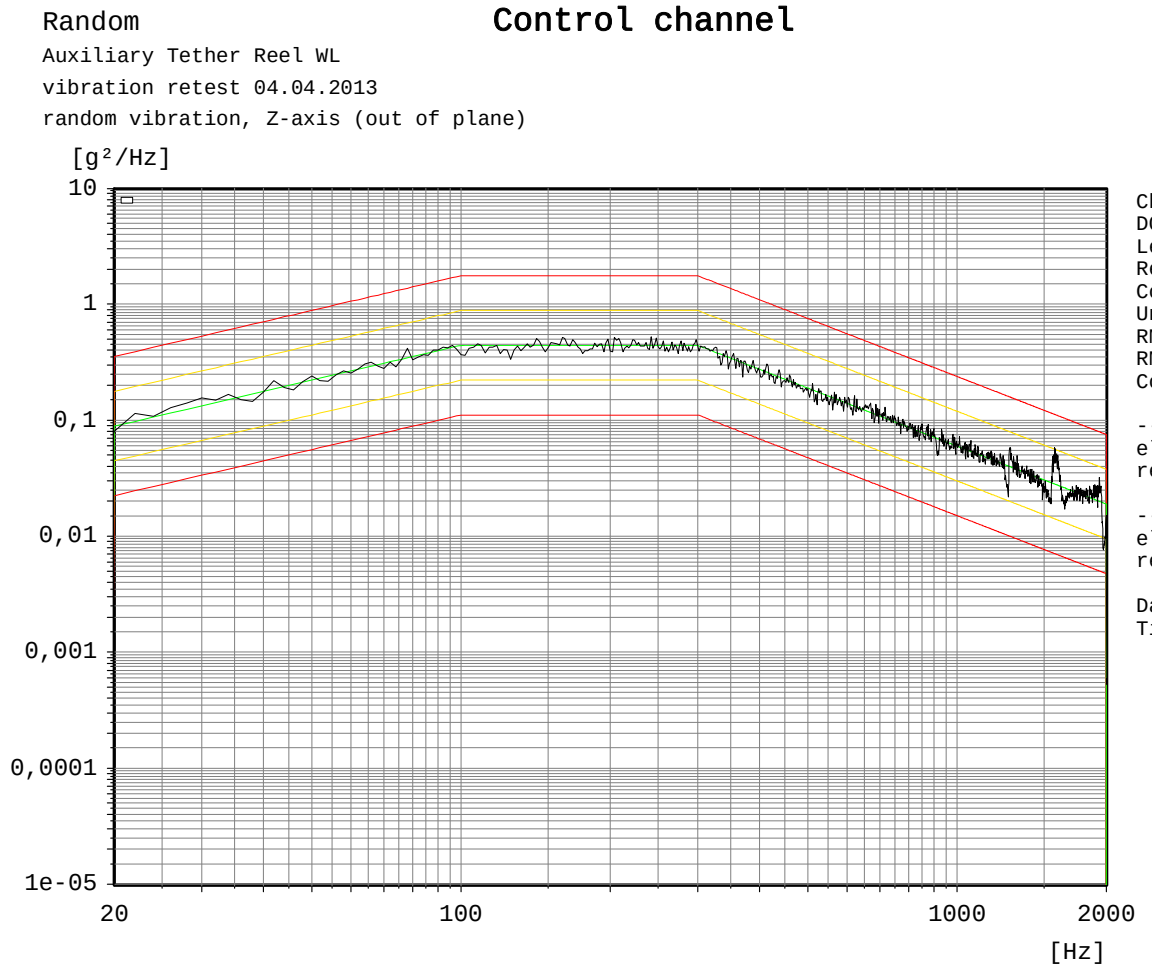
Test curve – random vibration test Z-axis, Auxiliary Tether Reel WL



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