Deutsche Akkreditierungsstelle D-PL-11130-01-00

TEST REPORT

Project-No.:	17-8981	
Test Specimen:	Shipping Unit - Outdoorcase -	
Client:	B&W International GmbH Junkendiek 5 49479 Ibbenbühren	
Responsible Persons:	Waldemar Masur Johannes Frick	(B&W International GmbH) (PAConsult GmbH)

Purpose:

By means of a transport simulation an outdoorcase - Type 4000 - is tested to climatic-, vibration- and shock strains. Furthermore a water resistance test is performed. The transport simulation is performed according to the specification of the client: MIL-STD-810G w/Change 1 [1].

Summary:

The tests are performed successfully; visible changes are observed.

During the pre-conditioned drop test on face 3, the closure (buckle) opened halfway. The case opened at the drop on face 1. During the unconditioned drop on face 1 and 3, one closure (buckle) opened halfway. No damages could be detected. The immersion test showed no ingress of water.

The evaluation of the result is performed by the client.

Date of Delivery:	May 11, 2017		
Testing Period:	May 17 to 23, 2017		
Page:	1 of 25		
Revision:	0		
Written:	Johannes Frick (Project Leader)	Signature	June 14, 2017
Reviewed:	Dr. Karim Esfahlani (Managing Director)	Signature	June 14, 2017

List of Revision:

Revision	Date	Reason
0	2017-06-12	Original Document

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3 Specimen

For the tests three similar outdoorcases (see Fig. 1) are provided by the client. Tab. 1 specifies the shipping units. In the following designation the specimens are abbreviated by EUT (**E**quipment **U**nder **T**est).

Tab. 1: Specimen

EUT No	Specimen	Content	Dimensions in mm			Weight in kg	Shipping Unit Construction
			Length	Width	Height		
1	Shipping Unit	Empty Case Type 4000	420	330	180	2159	Black Synthetic Case with Closure and Carrying Handle
2	Shipping Unit	Empty Case Type 4000	420	330	180	2154	
3	Shipping Unit	Empty Case Type 4000 with Splint	420	330	180	2161	
Note: The specified dimensions are client identification values and not measurement results.							

The incoming goods control showed no visible damages at the packaging.

Fig. 1: EUT

4 Test and Equipment

The test standards and parameters were given by the client. Tab. 2 describes the tests according to the specification.

Tab. 2: Test Parameters

Test / EUT	Test Parameter	Test Level	Reference
Temperature Shock EUT 1	3 Cycles Basic Hot (Day): + 63 ° C Basic Cold (Night): - 33° C	Stabilization 1h per Temperature Temperature Change Rate < 1 min	MIL-STD 810 G Change 1 Method 503.6 Procedure I-D Shocks from Controlled Ambient
Drop Test Conditioned EUT 1	Drop Height: 1.220 mm	All Faces (6) All Edges (12) All Corners (8)	MIL-STD 810 G Change 1 Method 516.7 Procedure IV Logistic Transit Drop
Immersion Test EUT 2	Specimen conditioned (Water Temperature + 10° C) Depth: 1 m	Duration: 30 min	MIL-STD 810 G Change 1 Method 512.6 Procedure I
Shock Test EUT 1	Half Sine Acceleration: 40 g Duration: 11 ms Specimen fixed on the Shaker	± 3 Shocks 3 Axes	MIL-STD 810 G Change 1 Method 514.7 Category 5 Procedure II Loose Cargo
Random Vibration EUT 1	Vertical: Frequency: 10 - 500 Hz G_{rms}: 1.04 Longitudinal **and** transversal: Frequency: 10 - 500 Hz G_{rms}: 0.74 Specimen fixed on the Shaker	Duration: 1.5 h per Axis 3 Axes	MIL-STD 810 G Change 1 Method 514.7 Category 4 Procedure I Common Carrier Figure 514.7C-2 Secured Cargo
Loose Load Vibration Test EUT 1	Amplitude: 25.4 mm Frequenz: 5 Hz Specimen loose	Duration: 20 min (~ 240 km) Axes: 1 Axis, most stable, Transport orientation)	MIL-STD 810 G Change 1 Method 514.7 Category 5 Procedure II Loose Cargo

Additional Tests:

Test / EUT	Test Parameter	Test Level	Reference
Drop Test (Unconditioned with Splint) EUT 3	Drop Height: 1.220 mm	All Faces (6) All Edges (12) All Corners (8)	MIL-STD 810 G Change 1 Method 516.7 Procedure IV Logistic Transit Drop
Drop Test (Unconditioned) EUT 2	Drop Height: 1.220 mm	Face 1 Face 3	Based on MIL-STD 810 G Change 1 Method 516.7 Procedure IV Logistic Transit Drop

4.1 Test Facility

The tests were performed in the laboratory of:

PAConsult GmbH
Site Hamburg
Birkenau 3
D-22087 Hamburg
info@paconsult.de
ISTA Member ID: ST-9678

4.2 Laboratory Conditions

All tests are performed under the conditions listed in Tab. 3, if not stated otherwise in the test report.

Tab. 3: Environmental Conditions

Temperature	15 °C-35 °C
Relative Humidity	< 85 %
Air Pressure	860 hPa – 1060 hPa

4.3 Equipment used for Test

The test equipment used in the laboratory of PAConsult GmbH is listed in Tab. 4 .

Tab. 4: Test Equipment

Devices	Manufacturer	Type	Serial number / Version	Date of last calibration
Vibrating Table	Lansmont	MS-400	M-13091	2016/12
Drop Table	Lansmont	PDT-56ED	M-15943	2016/09
Shaker RMS 8130	RMS	SW 8130	11382	2017/01
Test Manager 1 (Lab. 0)	LDS	Laser USB	9364940	2017/01
Accelerometer Lab. 0/ Ch. 1	PCB	M353B03	91672	2017/01
Stop Watch	Atech	SW 328	12307036	2016/11
Climatic Cabinet 2 (5K)	Weiss Umwelttechnik	WK 340-70-5	58226073510010	2017/01
Climatic Cabinet 7 (CTS)	CTS	CS 70/350-5	123074	2016/10
Temperature Sensor C5	Ahlborn	ZA 9020-FS Thermo E4	C5	2016/10
Data Logger	Testo	174H	36946057	2016/06
The calibration of the laboratory test equipment is performed annually (± 2 months).				

5 Test Procedures

5.1 Temperature Shock

With the EUT in its appropriate logistic configuration, stabilize the EUT at controlled ambient conditions. Transfer the EUT in no more than one minute to an atmosphere at temperature T2 that will produce the thermal shock and stabilize the temperature. Transfer the EUT back to controlled ambient conditions (T1) in no more than one minute, and stabilize the temperature. Repeat this procedure 2 times (3 cycles in total).

T1 = -33°C

T1 = +63°C

Stabilization time: 1 hour per temperature

The test is performed with EUT 1.

Fig. 2 and 3 show the setup in the two different chambers.

Fig. 2: Cold Chamber

Fig. 3: Hot Chamber

5.2 Drop Test

The EUT is dropped immediately after the end of the third temperature cycle with a temperature of + 63°C. The EUT is dropped from a height of 1.220 mm. It is dropped on all faces (6 drops), all edges (12 drops) and all corners (8 drops.). Fig. 4 shows the setup exemplarily.

The test is performed with EUT 1.

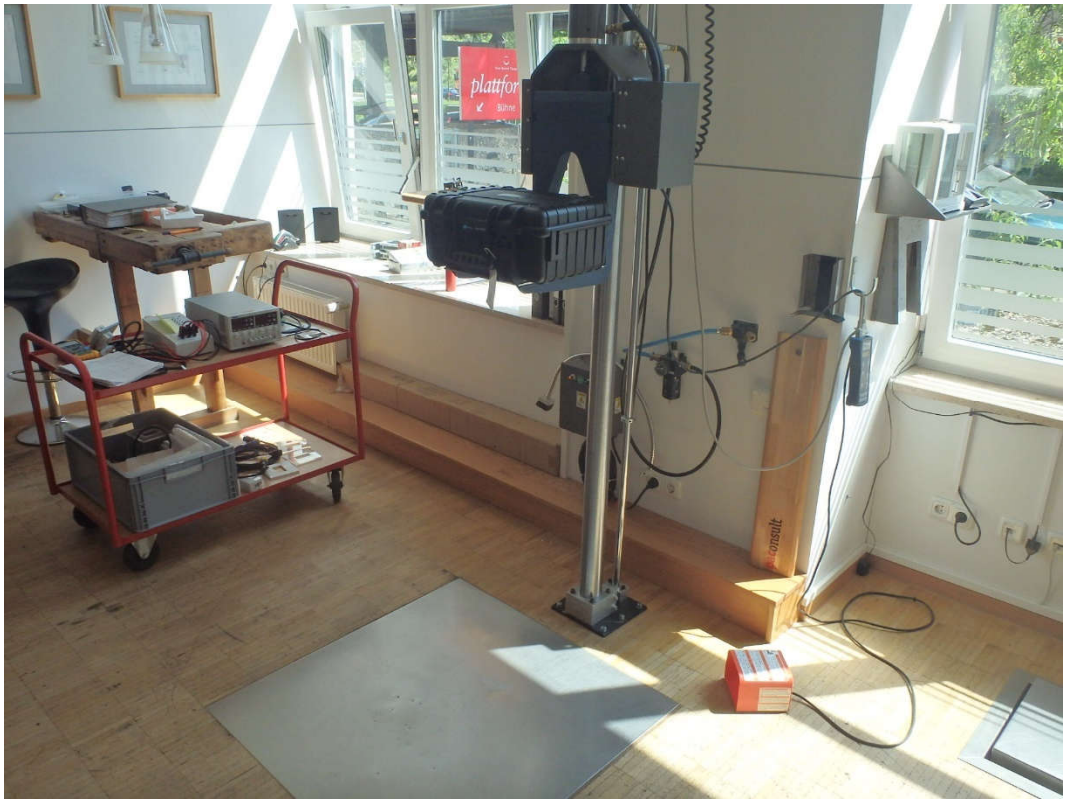

Fig. 4: Setup

5.3 Immersion Test

Measure and record the immersion water temperature. Condition the EUT at a temperature 10°C higher than the water temperature. Close all sealed areas and valves; assemble the EUT in its test configuration and, as quickly as possible, immerse the EUT in water so that the uppermost point of the EUT is 1 m below the surface of the water. The orientation of the EUT should represent that of its expected in-service orientation. If several orientations are possible, select that which is most severe. Following a 30-minute immersion period, remove the EUT from the water, wipe the exterior surfaces dry (giving special attention to areas around seals and relief valves) and, if applicable, equalize the air pressure inside by activating any manual valves. Be careful to not allow water to enter the EUT while activating the manual valves. Open the EUT and examine the interior and contents for evidence of, and quantity of any leakage and, if leakage occurred, for probable areas of entry.

The test is performed with EUT 2.

Fig. 5 shows the ambient (EUT) temperature. Fig. 6 shows the water temperature.

Fig. 5: Ambient (EUT) Temperature

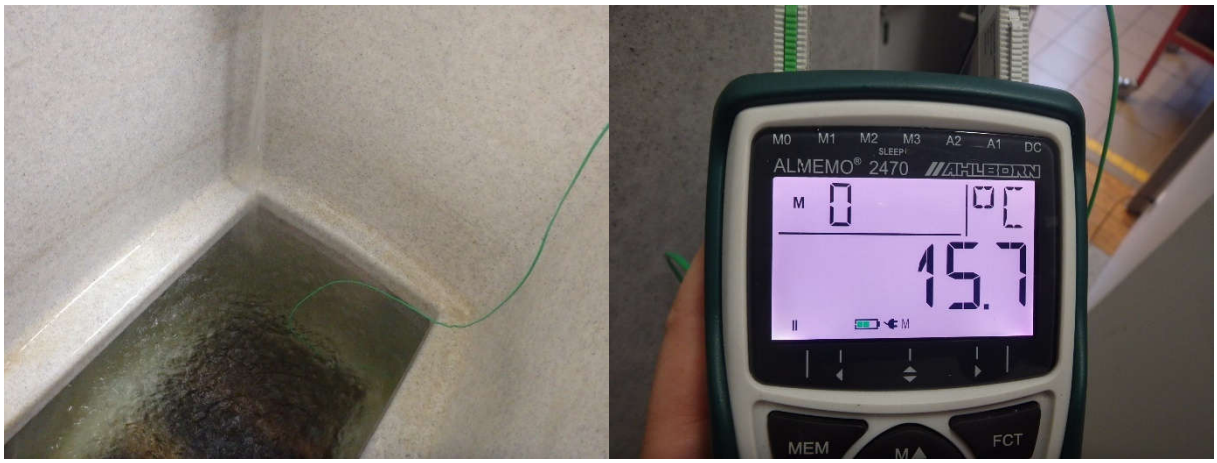

Fig. 6: Water Temperature

Fig. 7: Water Filling and EUT Fixation (Wood Restraints)

Fig. 8: Immersion Depth

5.4 Shock Test

The EUT is fixed on the shaker with fixation devices (tension belts). With the shaker in vertical direction, the EUT is fixed in three different (mutual perpendicular) axes. Fig. 9 to 11 show the position and fixation on the shaker.

The shock pulse is a half sine pulse with a duration of 11 ms and a peak acceleration of 40 g. Three positive and three negative shocks are applied.

The test is performed with EUT 1.

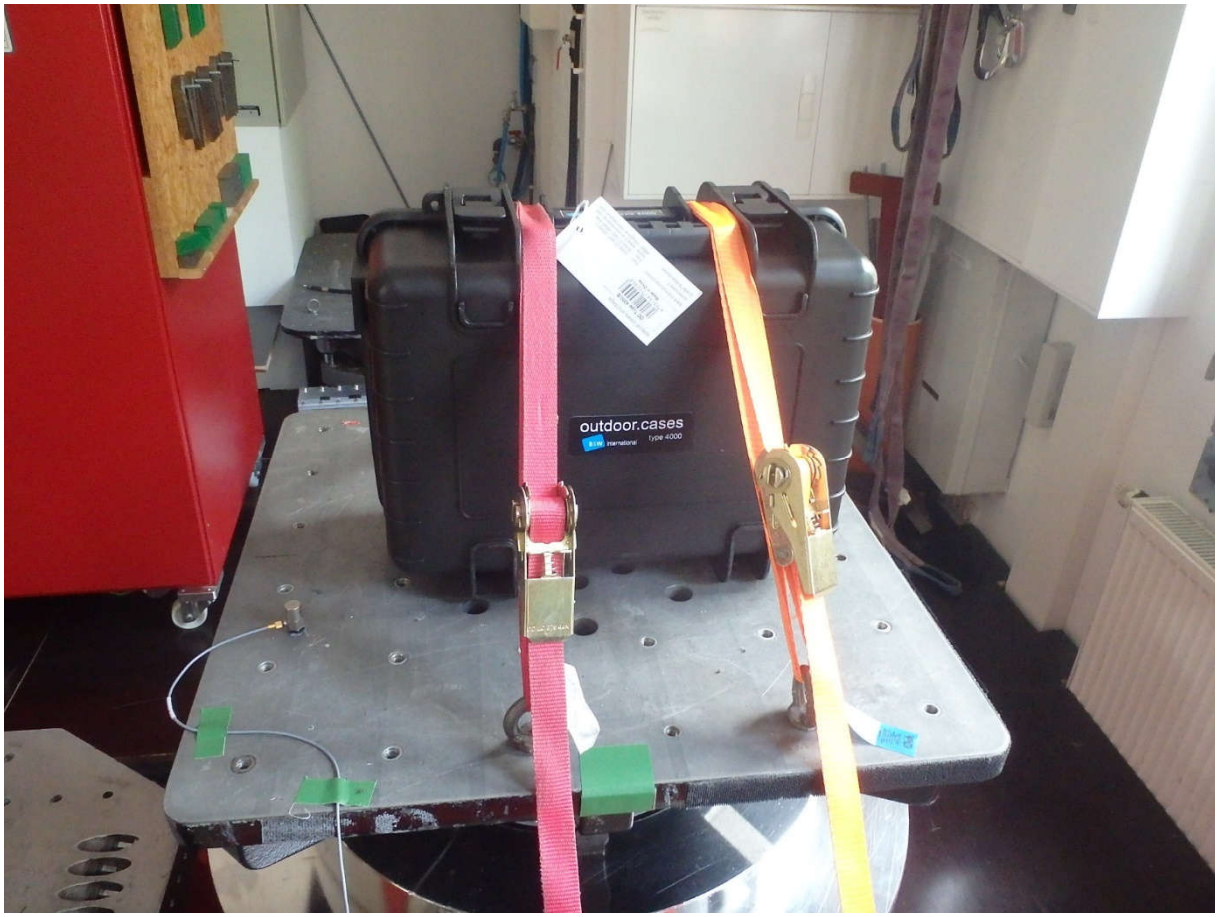

Fig. 9: Setup x-Axis (Transversal)

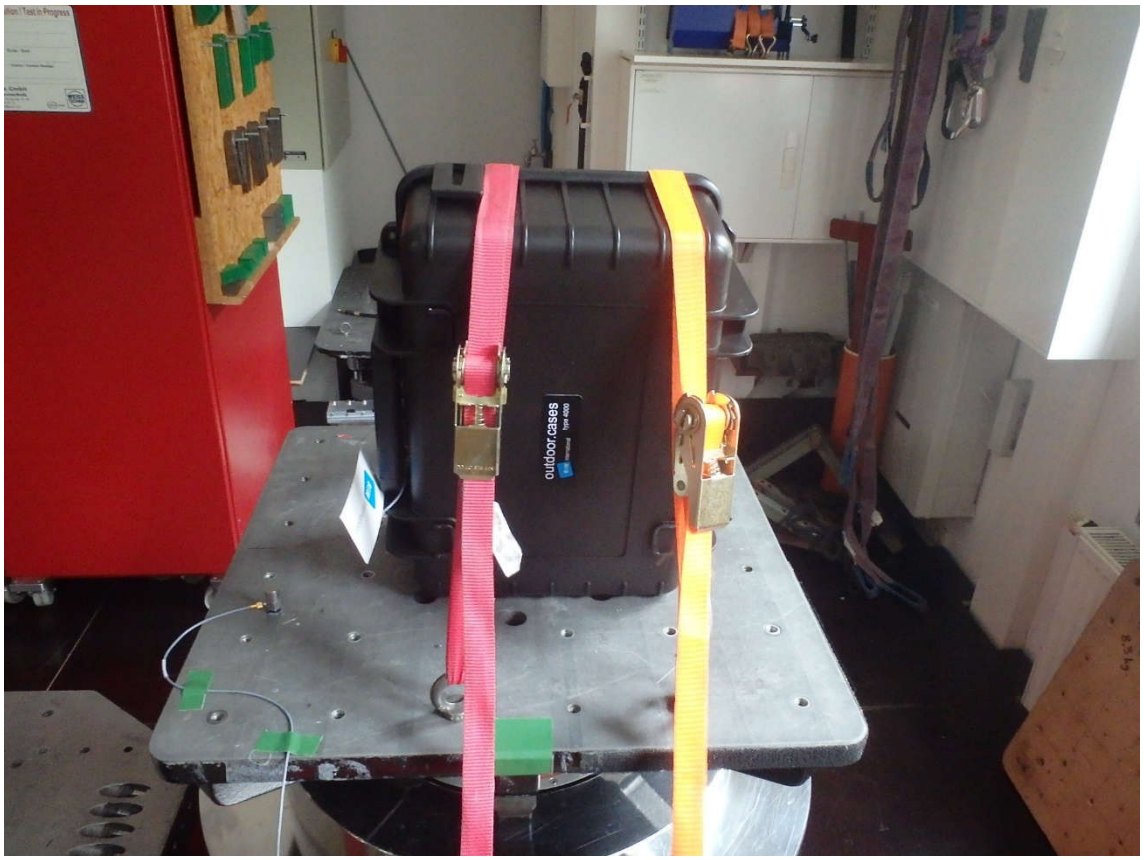

Fig. 10: Setup y-Axis (Longitudinal)

Fig. 11: Setup z-Axis (Vertical)

5.5 Random Vibration Test

The EUT is fixed on the shaker with fixation devices (tension belts). The EUT is fixed on the shaker in three different (mutual perpendicular) axes / positions. Fig. 9 to 11 show the position and fixation on the shaker.

There are three different levels of vibration exposure:

Vertical: 10 -500 Hz; g_{rms} Level 1.04

Longitudinal: 10 -500 Hz; g_{rms} Level 0.20

Transversal: 10 -500 Hz; g_{rms} Level 0.74

The vertical level is applied in vertical axis (z-Axis), the transversal level is applied in x-Axis transversal and y-Axis (longitudinal).

The exposure duration is 1.5h per axis, representing a transportation distance of approximately 2.500 km.

The test is performed with EUT 1.

5.6 Loose Load Vibration Test

The cargo has freedom to bounce, scuff and collide with other cargo and with the sides of the vehicle. The loose cargo environment includes conditions experienced by cargo transported in a vehicle traversing irregular surfaces. This test replicates the repetitive random shock environment incurred by cargo transported under these conditions.

A duration of 20 minutes represents 240 km (150 miles) of transportation (encompassing truck, two-wheeled trailer, and tracked vehicle), over the various road profiles found in the transport scenario from the Corps Staging Area to a Using Unit.

Two methodology studies (paragraph 6.1, references g and h) determined that a standard package tester (300 rpm, circular synchronous mode), provides a reasonable simulation of the loose cargo transportation environment. The movement of the package tester bed is a 2.54 cm (1.0 inch) diameter orbital path at 5 Hz (each point on the bed moves in a circular path in a plane perpendicular to the horizontal plane). The test item is allowed to collide with established test setup restraints.

Fig. 11 shows the setup on the loose load vibration teable (package tester).

The test is performed with EUT 1.

Fig. 12: Setup Loose Load Vibration Test

6 Test and Results

6.1 Temperature Shock

The test is performed with the specified parameters (see Tab. 2). During the test no visible changes were observed.

6.2 Drop Test

The test is performed with the specified parameters (see Tab. 2). During the test visible changes were observed. During the drop on face 3, the closing devices (buckles) opened halfway (see Fig. 13); They were closed and the drop test continued. During the drop on face 1, the case opened completely (see Fig. 14).

Fig. 13: Opening Halfway

Fig. 14: Opened Case

6.3 Immersion Test

The test was performed with the specified parameters (see Tab. 2). During and after the test no visible changes could be observed. No ingress of water could be detected.

Fig. 15: Dry Case

6.4 Shock Test

The test is performed with the specified parameters (see Tab. 2). During the test no visible changes were observed. Fig. 16 to 21 show the shock proceeding.

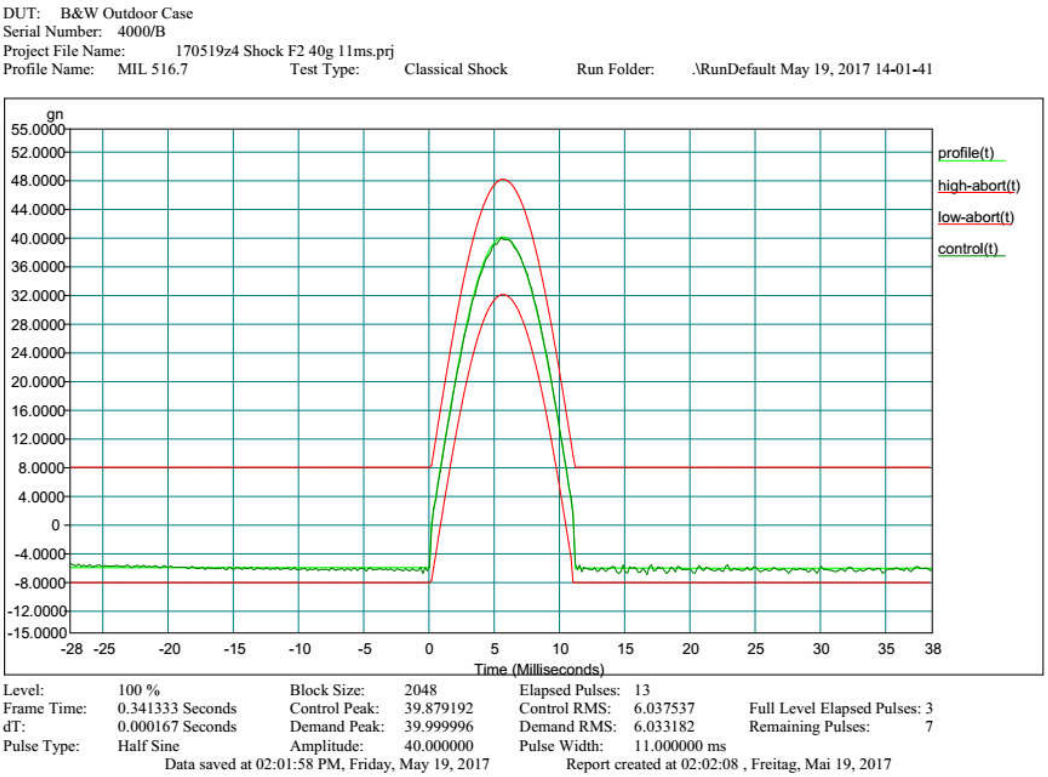

Fig. 16: Positive Shock x-Axis

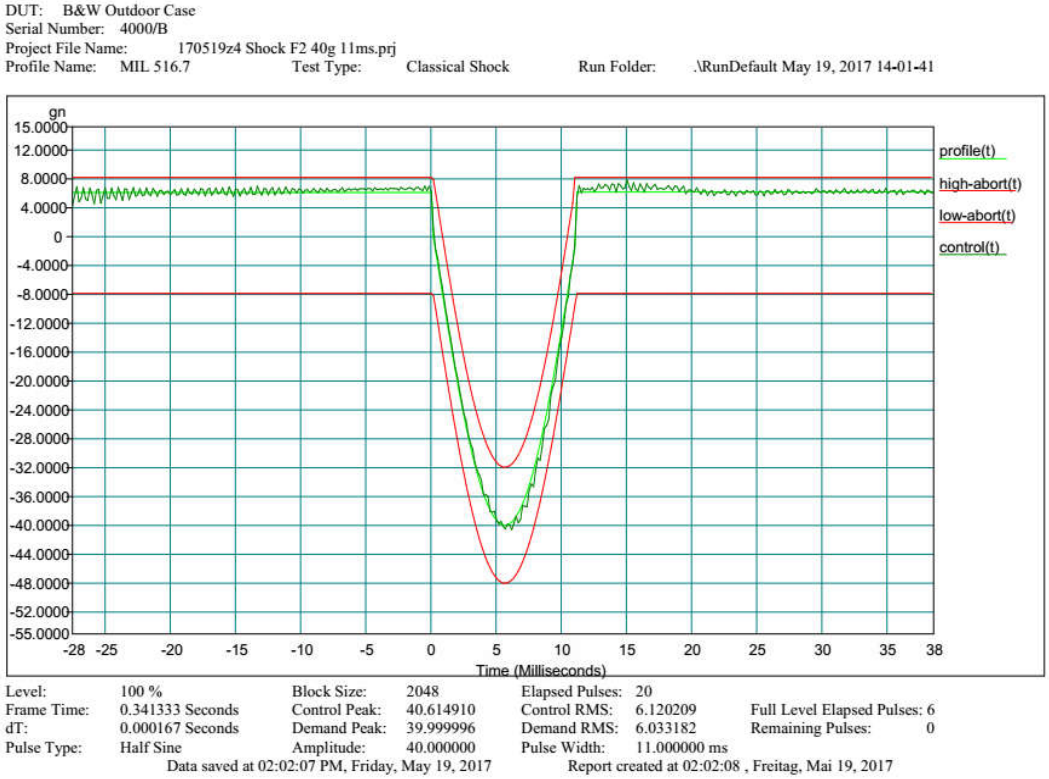

Fig. 17: Negative Shock x-Axis

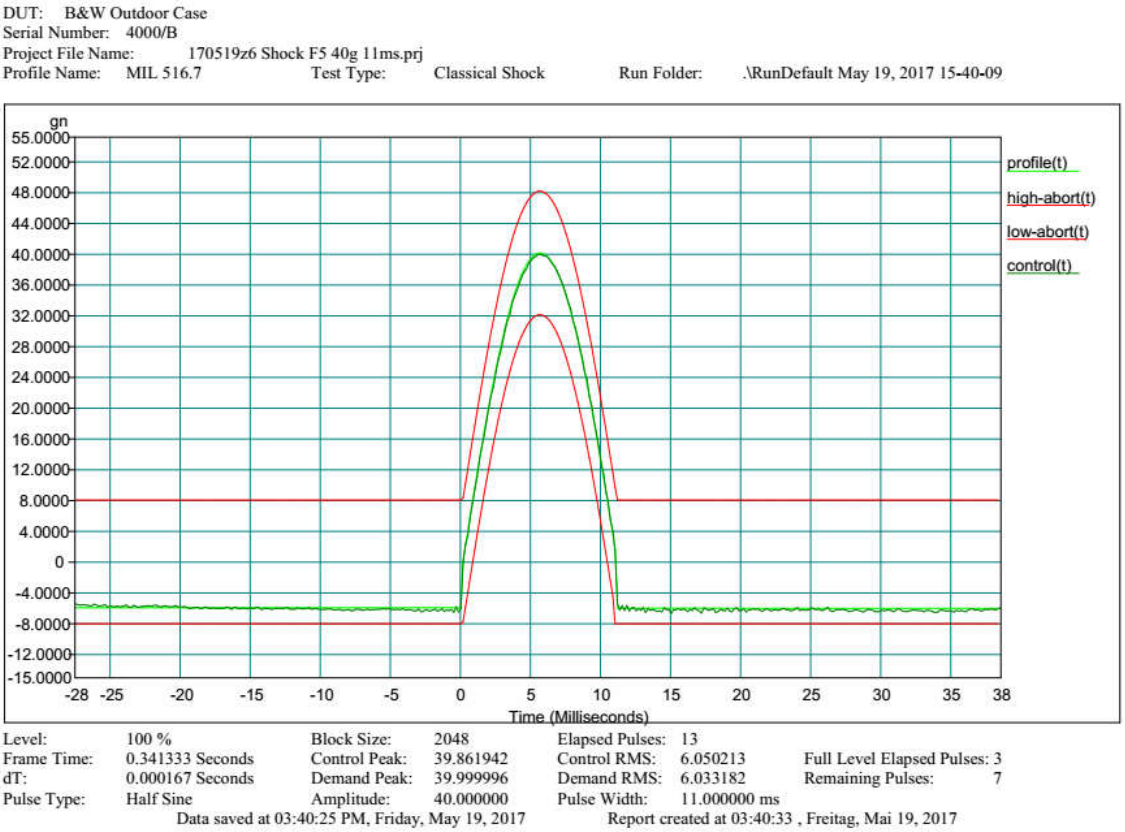

Fig. 18: Positive Shock y-Axis

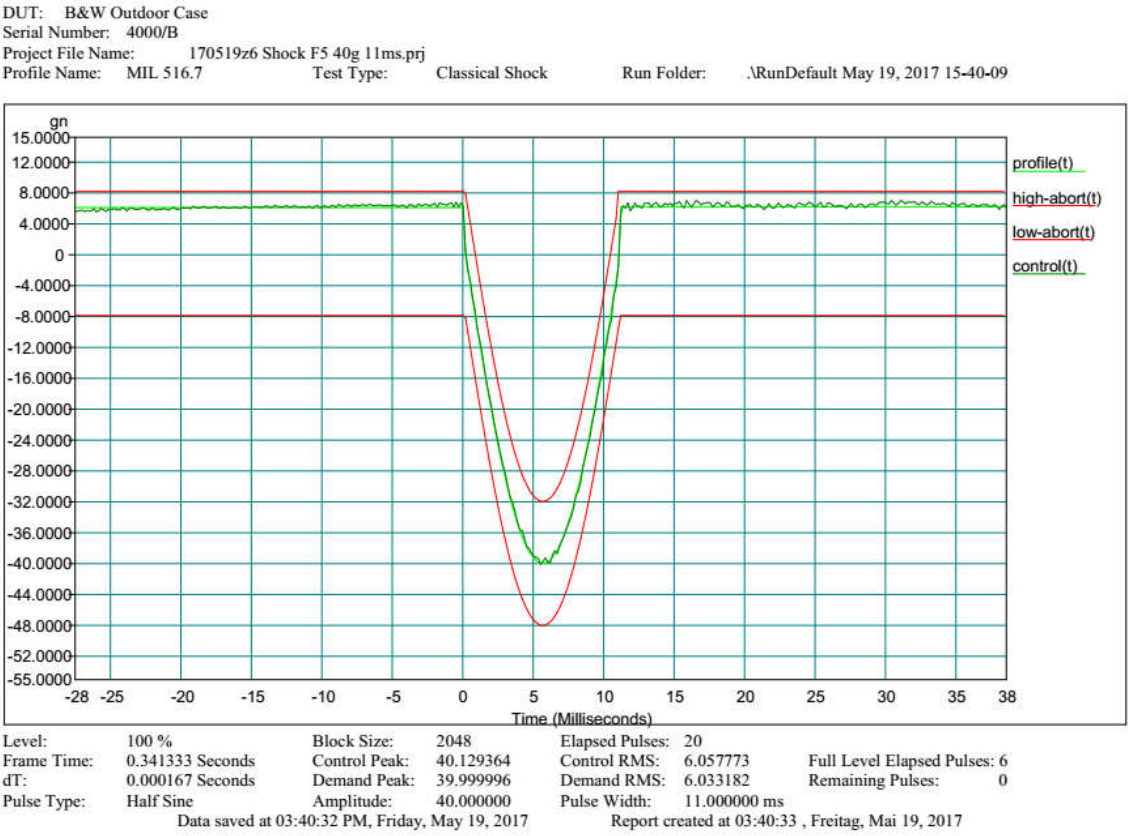

Fig. 19: Negative Shock y-Axis

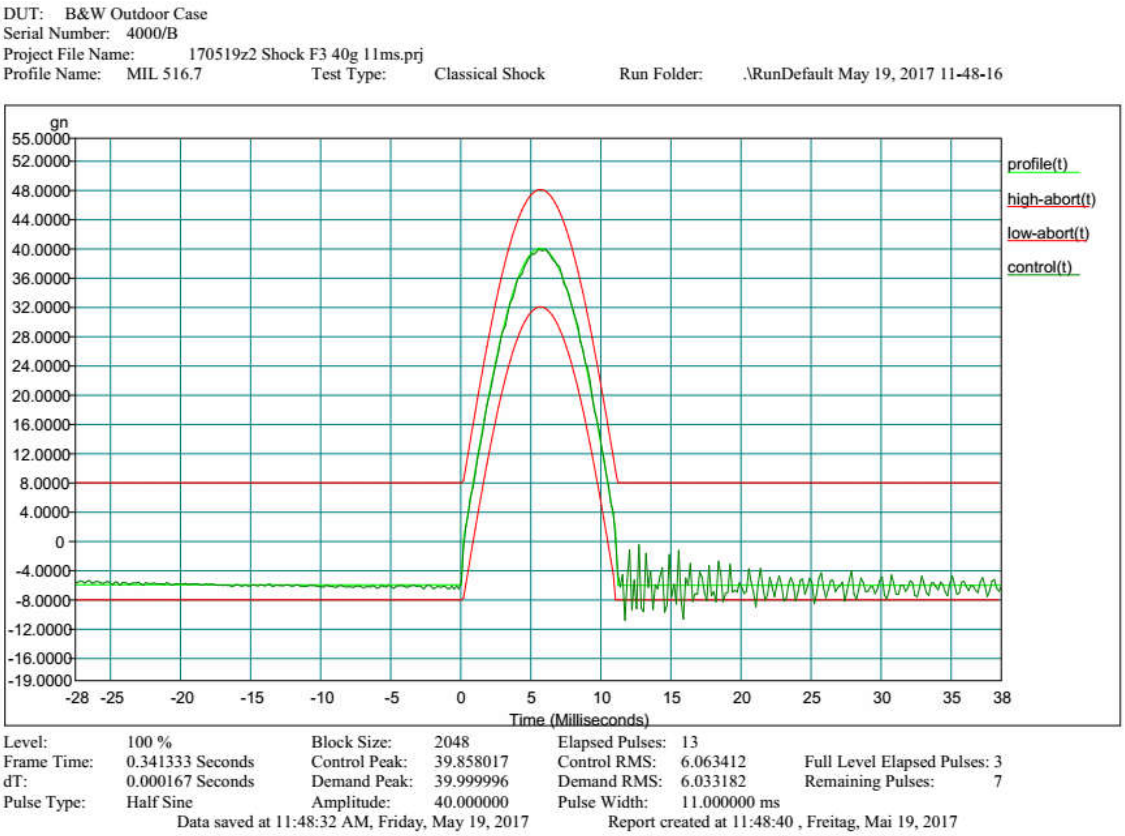

Fig. 20: Positive Shock z-Axis

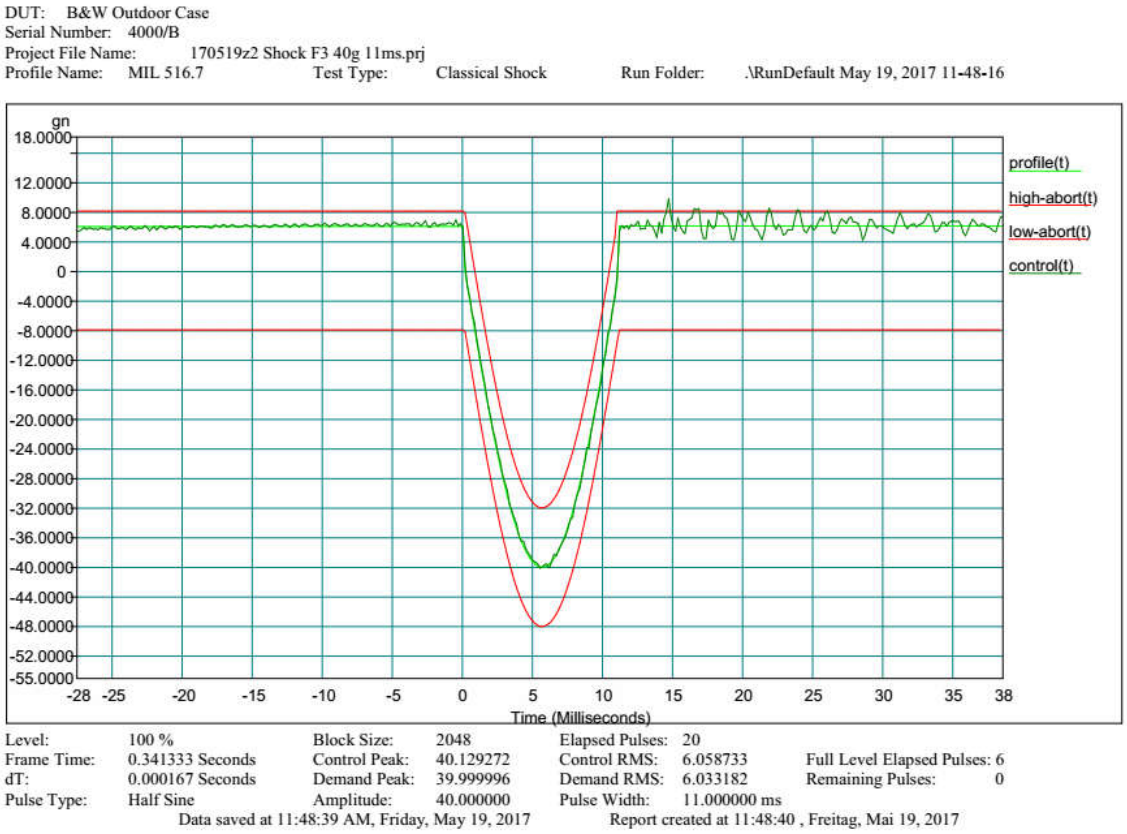

Fig. 21: Negative Shock z-Axis

6.5 Random Vibration Test

The test is performed with the specified parameters (see Tab. 2). During the test no visible changes were observed. Fig. 22 to 24 show the vibration proceeding.

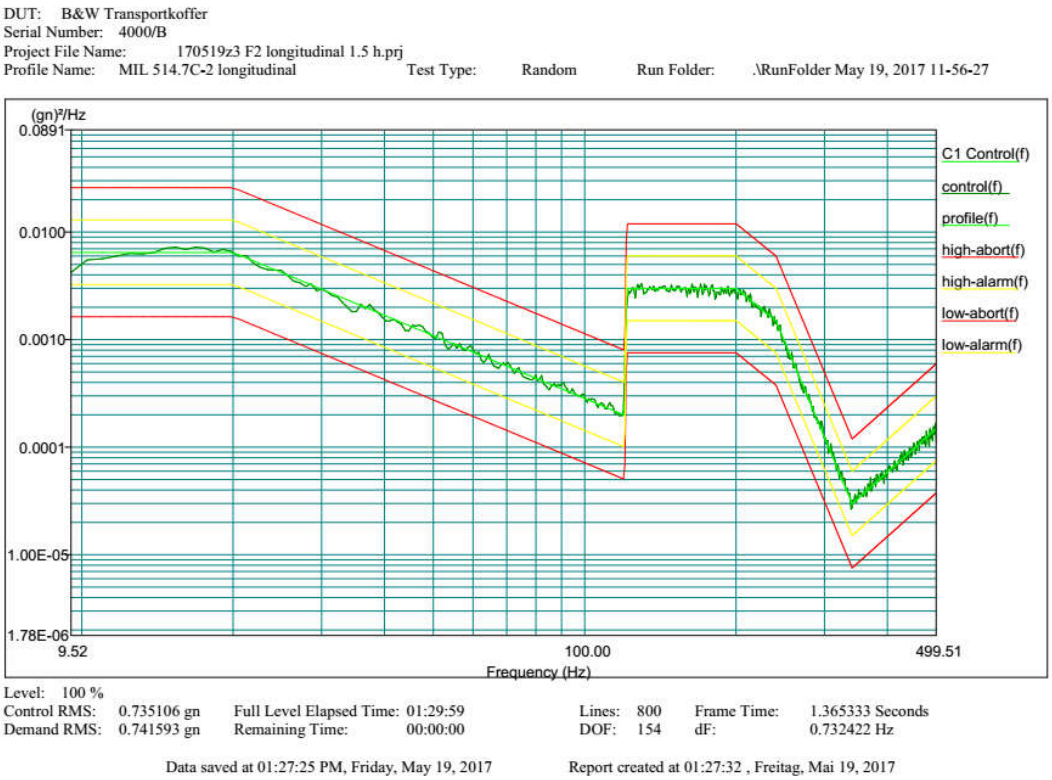

Fig. 22: Random Vibration x-Axis

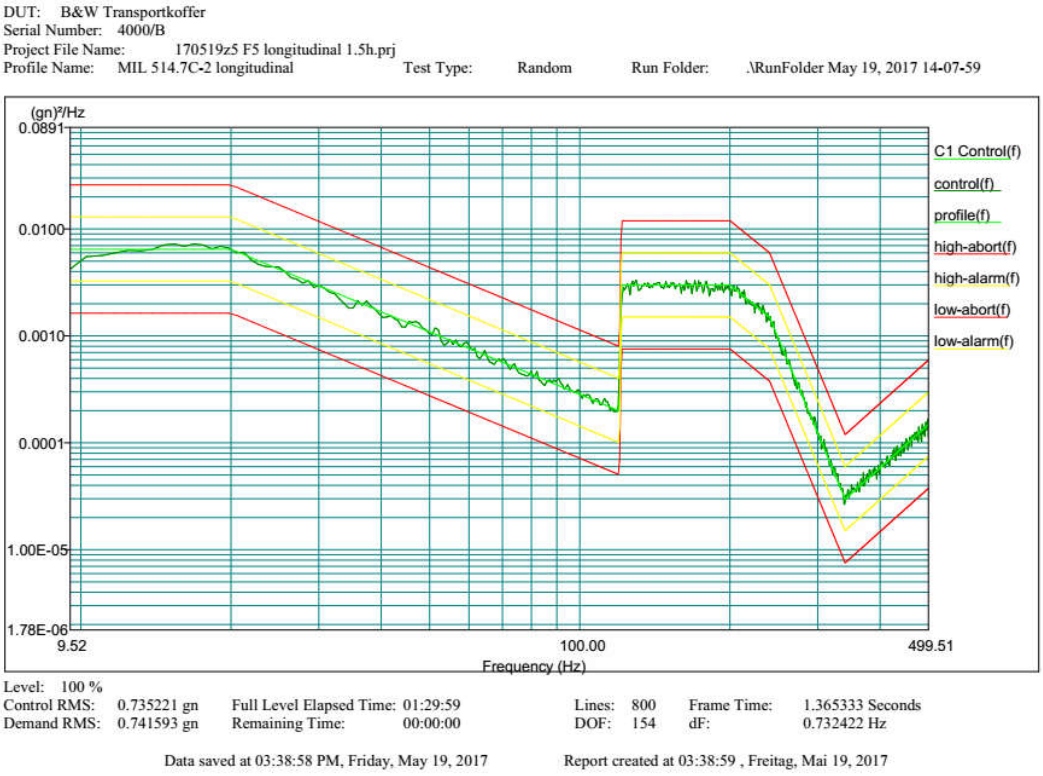

Fig. 23: Random Vibration y- Axis

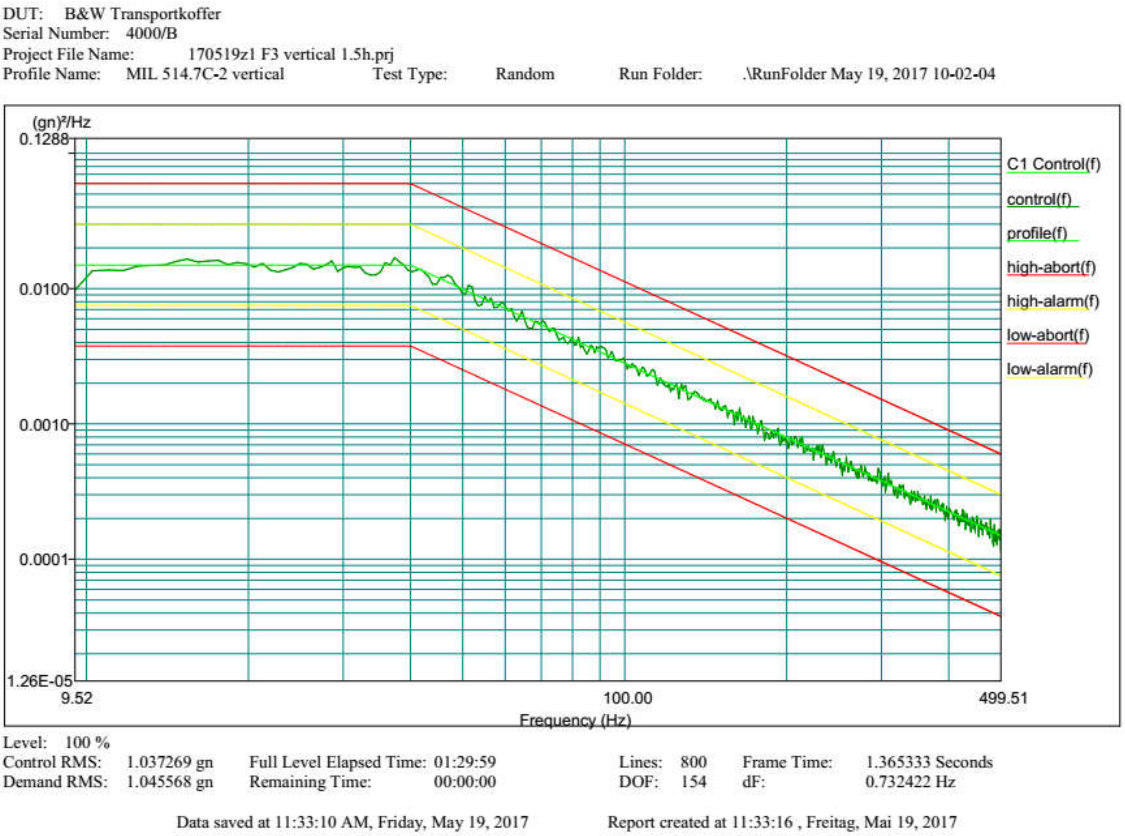

Fig. 24: Random Vibration z-Axis

6.6 Loose Load Vibration Test

The test is performed with the specified parameters (see Tab. 2). During the test no visible changes were observed.

7 Additional Tests

7.1 Drop test with Splint

A complete drop test (see chapter 5.2) was performed with EUT 3 (outdoor case with splints).

Result:

No damages could be detected, no opening of the case or the closing devices could be detected.

7.2 Drop Test Unconditioned

A drop test on face 1 and 3 was performed with EUT 2. This test was performed unconditioned (first drop test: EUT temperature: +63°C). The drops were performed from a height of 1.220 mm.

Result:

One closure (buckle) opened halfway on both drops.

Fig. 25: Opened Buckle

8 Summary

The tests were finished successfully. During the tests visible changes were observed. Tab. 5 summarizes the results of all tests.

Tab. 5: Summary Results

Test Result Transport Simulation with Outdoorcase according to MIL-STD 810G				
Seq.	**Test Type**	**EUT 1**	**EUT 2**	**EUT 3**
1	Temperature Shock	**No changes or damages**	Not performed	Not performed
2	Drop Test	**Halfway opening of buckle (drop on face 3; Fig. 13)** **Opening of case (drop on face 1; Fig .14)**	Not performed	Not performed
3	Immersion Test	Not performed	**No ingress of water detected**	Not performed
4	Shock Test	**No changes or damages**	Not performed	Not performed
5	Random Vibration Test	**No changes or damages**	Not performed	Not performed
Additional Tests				
6	Drop Test with Splint (unconditioned)	Not performed	Not performed	**No changes or damages**
7	Drop Test on Face 1 and 3 (unconditioned)	Not performed	**Halfway opening of one buckle (both drops; Fig. 25)**	Not performed

9 References

[1] MIL-STD-810G w/Change 1: Department of Defense Test Method Standard; Environmental Engineering Considerations and Laboratory Tests. 15 April 2014

Johannes Frick
(Project Leader)

Note

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