

Test Report

EN 50155: 2007

(EMC, Characteristic, Environmental...Test)

Product : **DC/DC Converter**

Trade Name : 

Model Number : Please refer to section 1.2

Prepared for

Traco Electronic AG

Sihlbruggstrasse 111, 6340 Baar Switzerland

Prepared by

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Remark:

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The test result in this report is only subjected to the test sample.

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Statement of Compliance

Applicant: Traco Electronic AG
Product: DC/DC Converter
Model No.: Please refer to section 1.2
Tested Power Supply: DC 48V; DC 72V; DC 96V; DC 110V
Date of Final Test: Aug. 03, 2013
Revision of Report: Rev. 02

Measurement Procedures and Standards Used :

- ☒ EN 50155: 2007 for EMC, Characteristic and Environmental
 - ☒ EN 50121-3-2: 2006 for EMC
 - ☒ EN 60068-2-1: 2007 for Environmental
 - ☒ EN 60068-2-2: 2007 for Environmental
 - ☒ EN 60068-2-30: 2005 for Environmental
 - ☒ EN 61373: 2010 for Environmental

The device described above was performed by Interocean EMC Technology Corporation to determine the EMC & Environmental & Characteristic compliance with the requirement of above standards. The results contained in this report are subjected to the tested sample only.

Report Issued : 2016/04/25

Project Engineer : Vin Chou Approved: Roy Chiang
Vin Chou Roy Chiang

1 General Information

1.1 Description of Equipment Under Test

- Product** : DC/DC Converter
- Model Number** : Please refer to section 1.2
- Applicant** : **Traco Electronic AG**
Sihlbruggstrasse 111, 6340 Baar Switzerland
- Date of Test** : Jul. 19 ~ Aug. 03, 2013
- Additional Description** :
1. The test model is “**TEN 40-7225WIRz1z1z1z1z1z1z1**” and included in this report.
 2. The difference for all models include in this report, please see “**Model Type List**” as below page.
 3. For more detail specification about EUT, please refer to the user’s manual.
 4. The test model meets EN 50155 with external components.

The BOM of external components are listed as below. BOM of external components		
Components	Specifications	Quantity(PCS)
Aluminum electrolytic capacitor	68μF/200V	3
TVS	90A, 90V, 3000W	2
SMD capacitor	105P/250V/ 1812	5
	102P/2KV/ 1206	2
SMD inductor	22μH/ 1.5A	1
DIP inductor	1.38 mH	1
The list is only suitable for this test mode TEN 40-7225WIRz1z1z1z1z1z1z1		

1.2 Model Type List

Model Number	Input Range (VDC)	Full load Input current (A)	Output Voltage (VDC)	Full Load (mA)
TEN 40-2410WIRz1z1z1z1z1z1z1	9 ~ 36	4.074	3.3	10000
TEN 40-2411WIRz1z1z1z1z1z1z1	9 ~ 36	4.884	5	8000
TEN 40-2412WIRz1z1z1z1z1z1z1	9 ~ 36	4.883	12	3333
TEN 40-2413WIRz1z1z1z1z1z1z1	9 ~ 36	4.882	15	2666
TEN 40-2415WIRz1z1z1z1z1z1z1	9 ~ 36	4.882	24	1666
TEN 40-2422WIRz1z1z1z1z1z1z1	9 ~ 36	4.936	±12	±1666
TEN 40-2423WIRz1z1z1z1z1z1z1	9 ~ 36	4.937	±15	±1333
TEN 40-2425WIRz1z1z1z1z1z1z1	9 ~ 36	4.883	±24	±833
TEN 40-4810WIRz1z1z1z1z1z1z1	18 ~ 75	2.037	3.3	10000
TEN 40-4811WIRz1z1z1z1z1z1z1	18 ~ 75	2.442	5	8000
TEN 40-4812WIRz1z1z1z1z1z1z1	18 ~ 75	2.415	12	3333
TEN 40-4813WIRz1z1z1z1z1z1z1	18 ~ 75	2.414	15	2666
TEN 40-4815WIRz1z1z1z1z1z1z1	18 ~ 75	2.441	24	1666
TEN 40-4822WIRz1z1z1z1z1z1z1	18 ~ 75	2.468	±12	±1666
TEN 40-4823WIRz1z1z1z1z1z1z1	18 ~ 75	2.468	±15	±1333
TEN 40-4825WIRz1z1z1z1z1z1z1	18 ~ 75	2.441	±24	±833
TEN 40-7210WIRz1z1z1z1z1z1z1	43~160	0.872	3.3	10000
TEN 40-7211WIRz1z1z1z1z1z1z1	43~160	1.045	5	8000
TEN 40-7212WIRz1z1z1z1z1z1z1	43~160	1.027	12	3333
TEN 40-7213WIRz1z1z1z1z1z1z1	43~160	1.033	15	2666
TEN 40-7215WIRz1z1z1z1z1z1z1	43~160	1.033	24	1666
TEN 40-7222WIRz1z1z1z1z1z1z1	43~160	1.044	±12	±1666
TEN 40-7223WIRz1z1z1z1z1z1z1	43~160	1.044	±15	±1333
TEN 40-7225WIRz1z1z1z1z1z1z1	43~160	1.021	±24	±833

1.3 Details of Tested Supporting System

1.3.1 Test Cable

Power Cord : ☒Non-shielded ☒Detachable, 1.8 m ☒w/o core

1.3.2 Load

FULL LOAD : 19.992W (+24Vdc, 833mA)

FULL LOAD : 19.992W (-24Vdc, 833mA)

1.4 Test Facility

Site Description	:	<input checked="" type="checkbox"/> Conducted 1 <input checked="" type="checkbox"/> OATS 1 <input checked="" type="checkbox"/> EMS Site
Name of Firm	:	Interocean EMC Technology Corp.
Company web	:	http://www.ietc.com.tw
Location	:	No. 5-2, Lin 1, Tin-Fu, Lin-Kou Dist., New Taipei City, Taiwan 244, R.O.C.
Site Filing	:	<ul style="list-style-type: none"> ● Federal Communication Commissions – USA Registration No.: 96399 (OATS 1 & 2) Registration No.: 518958 (OATS 3) Designation No.: TW1020 ● Voluntary Control Council for Interference by Information Technology Equipment (VCCI) – Japan Member No.: 1349 Registration No. (Conducted Room): C-1094 Registration No. (Conducted Room): T-1562 Registration No. (OATS 1): R-1040; G-274 Registration No. (OATS 2): R-1041 ● Industry Canada (IC) OUR FILE: 46405-4437 Submission: 145171 Registration No. (OATS 1): Site# 4437A-1 Registration No. (OATS 2): Site# 4437A-2 Registration No. (OATS 3): Site# 4437A-3
Site Accreditation	:	<ul style="list-style-type: none"> ● Bureau of Standards and Metrology and Inspection (BSMI) – Taiwan, R.O.C. Accreditation No.: SL2-IN-E-0026 for CNS13438 / CISPR22 SL2-R1-E-0026 for CNS13439 / CISPR13 SL2-R2-E-0026 for CNS13439 / CISPR13 SL2-A1-E-0026 for CNS13783-1 / CISPR14-1 SL2-L1-E-0026 for CNS 14115 / CISPR 15 ● Taiwan Accreditation Foundation (TAF) Accreditation No.: 1113 ● TÜV NORD Certificate No: TNTW0801R-04

1.5 Summary of Test Results

Report Clause	Phenomenon	EN 50155 Reference Clause(s)	Reference standard	Result
2	Characteristic Test			
2.1	Visual Inspection	12.2.1	-	Applicable
2.2	Performance (Supply variations)	12.2.2 5.1.1.1	-	Applicable
2.3	Performance (Supply interruption)	12.2.2 5.1.1.2 5.1.3	-	Applicable
2.4	Performance (Supply over change)	12.2.2 5.1.3	-	Applicable
2.5	Insulation Test	12.2.9	-	Applicable
2.6	Supply Overvoltages	12.2.6	-	Applicable
3	Electromagnetic Compatibility (EMC)			
3.1	Surges Test	12.2.7.1	EN 50121-3-2 EN 61000-4-5	Applicable
3.2	Electrostatic Discharge Test	12.2.7.2	EN 50121-3-2 EN 61000-4-2	Applicable
3.3	Transient Burst Susceptibility Test	12.2.7.3	EN 50121-3-2 EN 61000-4-4	Applicable
3.4	Radio- Frequency, Electromagnetic Field Immunity Test	12.2.8.1	EN 50121-3-2 EN 61000-4-3	Applicable
3.5	Radio- Frequency, Conducted Disturbances Immunity Test	12.2.8.1	EN 50121-3-2 EN 61000-4-6	Applicable
3.6	Power Line Conducted Emission Measurement	12.2.8.2	EN 50121-3-2 EN 55011	Applicable
3.7	Radiated Emission Measurement	12.2.8.2	EN 50121-3-2 EN 55011	Applicable
4	Environmental Tests			
4.1	Low Temperature Test	12.2.3	EN 60068-2-1	Applicable
4.2	Dry Heat Test	12.2.4	EN 60068-2-2	Applicable
4.3	Damp Heat Test	12.2.5	EN 60068-2-30	Applicable
4.4	Random Vibration Test	12.2.11	EN 61373	Applicable
4.5	Increased Vibration Test	12.2.11	EN 61373	Applicable
4.6	Shock Test	12.2.11	EN 61373	Applicable

1.6 Measurement Uncertainty

Item	Value
Conduction 1:	
Power Line Conducted Emission (9kHz~30MHz)	2.4 dB
Telecom. Port Conducted Emission / ISN-T4 (150kHz~30MHz)	2.6 dB
Telecom. Port Conducted Emission / ISN-T8 (150kHz~30MHz)	2.6 dB
Telecom. Port Conducted Emission / Current Probe (150kHz~30MHz)	2.8 dB
Radiated Electromagnetic disturbance / Loop Antenna (9kHz~30MHz)	4.8 dB
Conduction 2:	
Power Line Conducted Emission (9kHz~30MHz)	2.4 dB
Telecom. Port Conducted Emission / ISN-T4 (150kHz~30MHz)	2.6 dB
Telecom. Port Conducted Emission / ISN-T8 (150kHz~30MHz)	2.6 dB
Telecom. Port Conducted Emission / Current Probe (150kHz~30MHz)	2.8 dB
Disturbance Power Emission (30MHz~300MHz)	3.1 dB
Click disturbances Emission (150kHz~30MHz)	2.4 dB
OATS 1:	
Radiated Emission Test (30MHz~1GHz)	4.2 dB
Radiated Emission Test (1GHz~6GHz)	3.2 dB
OATS 2:	
Radiated Emission Test (30MHz~1GHz)	4.2 dB
Radiated Emission Test (1GHz~6GHz)	3.2 dB
OATS 3:	
Radiated Emission Test (30MHz~1GHz)	4.2 dB
Radiated Emission Test (1GHz~6GHz)	3.2 dB
OATS 5:	
Radiated Emission Test (30MHz~1GHz)	4.2 dB
Radiated Emission Test (1GHz~6GHz)	3.2 dB
Chamber 3:	
Radiated Emission Test (30MHz~1GHz)	4.2 dB
Radiated Emission Test (1GHz~6GHz)	3.2 dB
Conducted Immunity Room:	
Conducted Immunity Test / CDN-M2	1.3 dB
Conducted Immunity Test / CDN-M3	1.3 dB
Conducted Immunity Test / EM Clamp	3.2 dB

1.7 Measured Mode

1.7.1 The test modes for preliminary test are as following:

- Mode 1: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 48V)
- Mode 2: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 72V)
- Mode 3: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 96V)
- Mode 4: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 110V)

1.7.2 After preliminary test, EUT was selected the worst-case for the final testing.

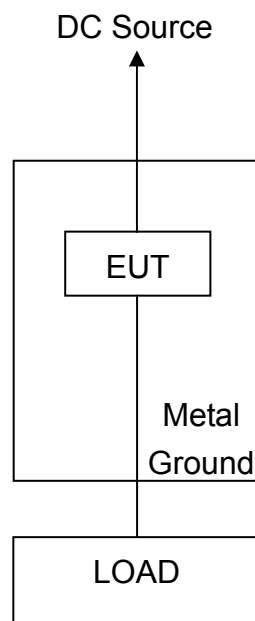
The test modes are:

- For Emission: Mode 1 ~ 4
- For Immunity: Mode 4

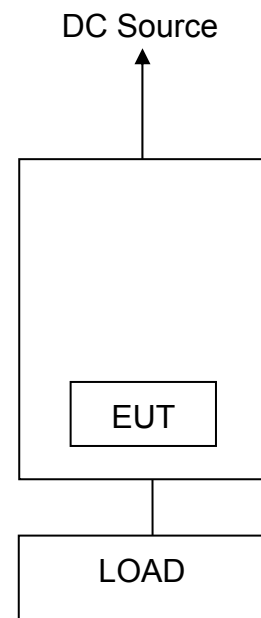
1.8 Configuration of EUT Setup

- The EUT contains DC/DC converter and external components.

(For Surges Test)



(For Other Test)



1.9 Test Step of EUT

1.9.1 Setup the EUT and peripheral as above.

1.9.2 Connected the EUT with DC Source and Load.

1.9.3 Turn on the EUT power to start the test.

2 Characteristic Test

2.1 Visual Inspection

2.1.1 Inspection Requirement

2.1.2 The visual inspection shall be carrier out to ensure that the equipment construction meets it's specified requirements.

2.1.3 Test Procedures

2.1.4 Test Procedures were referred to EN 50155 sub-clause 12.2.1

2.1.5 Inspection Result
Pass.

2.2 Performance (Supply variations)

2.2.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Digital Multimeter	HOLA	DM-1220	729075	2014/01/28
DC Power Supply	GW instek	GPC-6030D	EK890619	N.C.R.
DC Power Supply	GW instek	GPC-6030D	EK890653	N.C.R.
Voltage Regulators	Interocean	IETC-VR	IETC-VR-001	N.C.R.

Note: The above equipments are within the valid calibration period.

2.2.2 Test Requirement

☒ D.C. supplied equipment:

Test performed to prove correct functioning at nominal supply voltage and at the upper and lower limits of specified voltage as defined below.

- Minimum voltage: $0.7 U_n$
- Nominal voltage: U_n
- Rated voltage: $1.15 U_n$
- Maximum voltage: $1.25 U_n$

Voltage fluctuations (e.g. during start-up of auxiliary equipment or voltage oscillations of battery chargers) lying between $0,6 U_n$ and $1,4 U_n$ and not exceeding 0,1 s shall not cause deviation of function.

Voltage fluctuations lying between $1,25 U_n$ and $1,4 U_n$ and not exceeding 1 s shall not cause damage: equipment may not be fully functioning during these fluctuations.

☐ A.C. supplied equipment:

Test performed to prove correct functioning at:

- Nominal voltage and frequency;
- The upper and lower limits of voltage and frequency in all combinations.

2.2.3 Test Procedures

Test Procedures were referred to EN 50155 sub-clause 12.2.2 & 5.1.1.1

2.2.4 Test Result

Temperature: 29.6 °C ; Humidity: 37 % ; Atm pres: 101 Kpa ; Test Engineer: Victor

(Nominal: DC 110V)

Test Voltage		Test Time	Result / Observation
$0.7 U_n$	77VDC	10 min.	No deviation
U_n	110VDC	10 min.	No deviation
$1.15 U_n$	126.5VDC	10 min.	No deviation
$1.25 U_n$	137.5VDC	10 min.	No deviation
$1.25 U_n$	137.5VDC	1 sec.	No deviation
$1.4 U_n$	154VDC	1 sec.	No deviation
$0.6 U_n$	66VDC	0.1 sec.	No deviation
$1.4 U_n$	154VDC	0.1 sec.	No deviation

2.3 Performance (Supply interruption)

2.3.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Digital Multimeter	HOLA	DM-1220	729075	2014/01/28
DC Power Supply	GW instek	GPC-6030D	EK890619	N.C.R.
DC Power Supply	GW instek	GPC-6030D	EK890653	N.C.R.
Voltage Regulators	Interocean	IETC-VR	IETC-VR-001	N.C.R.

Note: The above equipments are within the valid calibration period.

2.3.2 Test Requirement

Interruptions of input voltage as defined below:

- Class S1: no interruptions
- Class S2: 10 ms interruptions

Test acceptance requirements:

The equipment continues to function and indicate correctly without intervention or need for resetting by the operator.

2.3.3 Test Procedures

Test Procedures were referred to EN 50155 sub-clause 12.2.2 & 5.1.1.2

2.3.4 Test Result

Temperature: 29.6 °C ; Humidity: 37 % ; Atm pres: 101 Kpa ; Test Engineer: Victor

Supply Interruption	Class	Interruption Time	Result / Observation
100%	S1	0 ms	No deviation
100%	S2	10 ms	No deviation

2.4 Performance (Supply change over)

2.4.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Digital Multimeter	HOLA	DM-1220	729075	2014/01/28
DC Power Supply	GW instek	GPC-6030D	EK890619	N.C.R.
DC Power Supply	GW instek	GPC-6030D	EK890653	N.C.R.
Voltage Regulators	Interocean	IETC-VR	IETC-VR-001	N.C.R.

Note: The above equipments are within the valid calibration period.

2.4.2 Test Requirement

- Class C1 at 0.6 Un during 100ms (without interruptions)
- Class C2 during a supply break of 30ms

Test acceptance requirements:

The equipment continues to function and indicate correctly without intervention or need for resetting by the operator.

2.4.3 Test Procedures

Test Procedures were referred to EN 50155 sub-clause 12.2.2 & 5.1.3

2.4.4 Test Result

Temperature: 29.6 °C ; Humidity: 37 % ; Atm pres: 101 Kpa ; Test Engineer: Victor

Supply Voltage		Class	Repeated time	Result / Observation
Dips	40%	C1	100 ms	No deviation

2.5 Insulation Test

2.5.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Withstand Voltage/insulation tester	EXTECH	7142	1344529	2013/09/19

Note: The above equipments are within the valid calibration period.

2.5.2 Test Requirement

(1) Insulation measurement Test: 500VDC

- The insulation resistance test carried out at 500 VDC and the values recorded.
- The test repeated after the voltage withstand test.

Test acceptance requirements:

There shall be no fundamental deterioration from the initial measurement.

(2) Voltage withstand test:

- 500 VAC or 700 VDC for nominal battery voltages below 72 V (or 50 VAC)
- 1000 VAC or 1400 VDC for nominal battery voltages from 72 V up to 125 V, (or from 50 to 90 VAC), and
- 1500 VAC or 2100 VDC for nominal battery voltages above 125 V and up to 315 V, (or from 90 to 225 VAC)

Test acceptance requirements:

Neither disruptive discharge nor flashover shall occur.

2.5.3 Test Procedures

Test Procedures were referred to EN 50155 sub-clause 12.2.9

2.5.4 Test Result

Temperature: 31.4 °C ; Humidity: 34 % ; Atm pres: 101 Kpa ; Test Engineer: Vin

1. Initial Insulation measurement Test: 500VDC

Test Item	Insulation measurement test (Before)	Resistance	Insulation measurement test (After)	Resistance
Input TO Output (1 2 PIN) TO (4 5 6 PIN)	>10G	Ω	>10G	Ω
Output TO CTRL(3 PIN)	>10G	Ω	>10G	Ω

2. Voltage withstand test: 1400VDC

Test was performed after initial insulation measurement

Test Item	Current	Result
Input TO Output	0.0 uA	PASS

3. Voltage withstand test: 700VDC

Test was performed after initial insulation measurement

Test Item	Current	Result
Output TO CTRL	0.0 uA	PASS

2.6 Supply Overvoltages

2.6.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Arbitrary Waveforms Test System	SCHAFFNER	NSG5600	560-0030	2013/09/18
Module Test System	SCHAFFNER	NSG5500	550-0030	2013/09/18
Power Amplifier	SCHAFFNER	PA5840-75	581-0010	2013/09/18

Note: The above equipments are within the valid calibration period.

2.6.2 Test Requirement

☒ D.C. supplied equipment:

Voltage Level min.	Duration d max.	Duration D max.	Series Resistor (Tol. $\pm 10\%$)
1.4 Un	0.1 s	1.0 s	1 Ω

Test acceptance requirements: No failure shall occur

☐ A.C. supplied equipment:

Voltage Level min.	Duration D min.	Series Resistor ^a (Tol. $\pm 10\%$)
1.4 Un	1.0 s	1 Ω

^a Inclusive of power supply impedance.

Test acceptance requirements: No failure shall occur

2.6.3 Test Procedures

Test Procedures were referred to EN 50155 sub-clause 12.2.6

2.6.4 Test Result

Temperature: 29.6 °C ; Humidity: 37 % ; Atm pres: 101 Kpa ; Test Engineer: Victor

Voltage level (minimum)	Duration d (maximum)	Duration D (maximum)	Series resistor Rs (Tol. $\pm 10\%$)	Result / Observation
154VDC	0.1s	1.0s	1 Ω	No deviation

3 Electromagnetic compatibility (EMC)

3.1 Surges Test

3.1.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
EMC Pro Systems	KeyTek	EMC Pro	0003234	2014/04/16

Note: The above equipments are within the valid calibration period.

3.1.2 Test Requirement

Reference to EN 50155 clause 12.2.7.1 and EN 50121-3-2 table 7

☐ Auxiliary AC power input ports:

☐ Line to line: $\pm 1.0\text{kV}$ ($42\ \Omega$, $0.5\ \mu\text{F}$), $1.2/50$ (8/20) Tr/Th μs

☐ Line to earth (ground): $\pm 2.0\text{kV}$ ($42\ \Omega$, $0.5\ \mu\text{F}$), $1.2/50$ (8/20) Tr/Th μs

☒ Battery referenced ports.

☒ Line to line: $\pm 1.0\text{kV}$ ($42\ \Omega$, $0.5\ \mu\text{F}$), $1.2/50$ (8/20) Tr/Th μs

☒ Line to earth (ground): $\pm 2.0\text{kV}$ ($42\ \Omega$, $0.5\ \mu\text{F}$), $1.2/50$ (8/20) Tr/Th μs

Performance criterion: B

3.1.3 Test Procedures

Test Procedures were referred to IEC 61000-4-5 sub-clause 8

3.1.4 Test Result

Temperature: 29.5 °C ; Humidity: 37 % ; Atm pres: 101 Kpa ; Test Engineer: Vin

PASS.

☒ $\pm 0.5\text{kV}$, Battery referenced port: Line to line

Performance criterion: ☒ A ☐ B ☐ C

☒ $\pm 1.0\text{kV}$, Battery referenced port: Line to line

Performance criterion: ☒ A ☐ B ☐ C

☒ $\pm 0.5\text{kV}$, Battery referenced port: Line to earth (ground)

Performance criterion: ☒ A ☐ B ☐ C

☒ $\pm 1.0\text{kV}$, Battery referenced port: Line to earth (ground)

Performance criterion: ☒ A ☐ B ☐ C

☒ $\pm 2.0\text{kV}$, Battery referenced port: Line to earth (ground)

Performance criterion: ☒ A ☐ B ☐ C

* "A": The apparatus shall continue to operate as intended during and after the test, no degradation of performance or loss of function.

3.2 Electrostatic Discharge Test

3.2.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
ESD Simulator	EMC PARTNER	ESD3000	276	2014/03/04

Note: The above equipments are within the valid calibration period.

3.2.2 Test Requirement

Reference to EN 50155 clause 12.2.7.2 and EN 50121-3-2 table 9

☒ Air discharge: ± 8 kV

☒ Contact discharge: ± 6 kV

Performance criterion: B

3.2.3 Test Procedures

Test Procedures were referred to EN 61000-4-2 sub-clause 8

3.2.4 Test Result

Temperature: 28.9 °C ; Humidity: 40 % ; Atm pres: 101 Kpa ; Test Engineer: Vin

PASS.

Air discharge ± 2 kV, ± 4 kV, ± 8 kV:

☒ A ☐ B ☐ C

Contact discharge ± 2 kV, ± 4 kV, ± 6 kV:

☒ A ☐ B ☐ C

Indirect discharge (HCP) ± 2 kV, ± 4 kV, ± 6 kV:

☒ A ☐ B ☐ C

Indirect discharge (VCP Front, Left, Back, Right) ± 2 kV, ± 4 kV, ± 6 kV:

☒ A ☐ B ☐ C

* "A": The apparatus shall continue to operate as intended during and after the test, no degradation of performance or loss of function.

3.3 Transient Burst Susceptibility Test

3.3.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
EMC Test System	EMC PARTNER	TRANSIENT-2000	812	2013/08/27
Injection Clamp	EMC PARTNER	CN-EFT1000	497	N. C. R.

Note: The above equipments are within the valid calibration period.

3.3.2 Test Requirement

Reference to EN 50155 clause 12.2.7.3 and EN 50121-3-2 table 7 & 8

5 kHz Repetition frequency

☐ ± 2.0 kV Auxiliary AC power input ports.

☒ ± 2.0 kV Battery referenced ports.

☐ ± 2.0 kV Signal & communication, process measurement & control ports.

Performance criterion: A

3.3.3 Test Procedures

Test Procedures were referred to EN 61000-4-4 sub-clause 8

3.3.4 Test Result

Temperature: 27.9 °C ; Humidity: 48 % ; Atm pres: 101 Kpa ; Test Engineer: Vin

PASS.

☒ ± 2.0 kV Battery referenced port: Line + Neutral

Performance criterion: ☒ **A** ☐ **B** ☐ **C**

* "A": The apparatus shall continue to operate as intended during and after the test, no degradation of performance or loss of function.

3.4 Radio- Frequency, Electromagnetic Field Immunity Test

3.4.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Signal Generator	R&S	SM300	101279	2013/08/29
RF Power Amplifier	Frankonia	FLG-200B	1038	2014/02/18
RF Power Amplifier	Frankonia	FLG-50C	1013	2014/02/18
Bilog Antenna	Frankonia	BTA-M	06012M	2014/02/18

Note: The above equipments are within the valid calibration period.

3.4.2 Test Requirement

Reference to EN 50155 clause 12.2.8.1 and EN 50121-3-2 table 9

The frequency steps: 1%, Log sweep, Dwell time: 3.0 sec.

- ☒ Frequency range: 80 to 1000 MHz, Field strength: 20 V/m, 80% AM (1kHz),
 - ☒ Frequency range: 1400 to 2100 MHz, Field strength: 10 V/m, 80% AM (1kHz),
 - ☒ Frequency range: 2100 to 2500 MHz, Field strength: 5 V/m, 80% AM (1kHz),
- Performance criterion: A

3.4.3 Test Procedures

Test Procedures were referred to EN 61000-4-3 sub-clause 8

3.4.4 Test Result

Temperature: 22.4 °C ; Humidity: 51 % ; Atm pres: 101 Kpa ; Test Engineer: Mark
PASS.

- ☒ Frequency range: **80 to 1000** MHz, Field strength: **20** V/m, 80% AM (1kHz),
Performance criterion: ☒ **A** ☐ **B** ☐ **C**
- ☒ Frequency range: **1400 to 2100** MHz, Field strength: **10** V/m, 80% AM (1kHz),
Performance criterion: ☒ **A** ☐ **B** ☐ **C**
- ☒ Frequency range: **2100 to 2500** MHz, Field strength: **5** V/m, 80% AM (1kHz),
Performance criterion: ☒ **A** ☐ **B** ☐ **C**

* "A": The apparatus shall continue to operate as intended during and after the test, no degradation of performance or loss of function.

3.5 Radio- Frequency, Conducted Disturbances Immunity Test

3.5.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Signal Generator	R&S	SMY02	829846/013	2014/04/07
Power Amplifier	Frankonia	CIT-10	162D1278	2014/02/08
Attenuator	SCHAFFNER	ATN6075	22300	2014/02/08
C.D.N	FCC	FCC-801-M3-25A	2045	2014/02/08
C.D.N	SCHAFFNER	M216	16394	2014/02/08

Note: The above equipments are within the valid calibration period.

3.5.2 Test Requirement

Reference to EN 50155 clause 12.2.8.1 and EN 50121-3-2 table 7 & 8

Frequency range: **0.15** to **80** MHz, Field strength: **10** V, 80% AM (1kHz)

☐ Auxiliary AC power input ports.

☒ Battery referenced ports.

☐ Signal & communication, process measurement & control ports.

Performance criterion: A

3.5.3 Test Procedures

Test Procedures were referred to EN 61000-4-6 sub-clause 8

3.5.4 Test Result

Temperature: 27.4 °C ; Humidity: 44 % ; Atm pres: 101 Kpa ; Test Engineer: Vin
PASS.

Frequency range: **0.15** to **80** MHz, Field strength: **10** V, 80% AM (1kHz),

☒ Battery referenced port.

Performance criterion: ☒ **A** ☐ **B** ☐ **C**

* "A": The apparatus shall continue to operate as intended during and after the test, no degradation of performance or loss of function.

3.6 Power Line Conducted Emission

3.6.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESCS 30	830245/027	2013/10/10
RF Cable	HARBOUR	RG58/U	CBL48	2013/07/30
L.I.S.N.	Schwarzbeck	NNLK8121	8121417	2013/08/07
L.I.S.N.	Schaffner	MN2050D	1596	2013/07/22

Note: The above equipments are within the valid calibration period.

3.6.2 Test Requirement

Reference to EN 50155 clause 12.2.8.2 and EN 50121-3-2 table 5

Frequency (MHz)	Q.P. (Quasi-Peak)
0.15 ~ 0.50	99
0.50 ~ 30	93

3.6.3 Test Procedures

Test Procedures were referred to EN 55011 sub-clause 7

3.6.4 Test Result

PASS.

The final test data is shown as following pages.

Factor = Insertion Loss + Cable Loss

Level = Reading + Factor

Margin = Level - Limit

Power Line Conducted Test Data

CLIENT: Traco Electronic AG

OPERATOR: Vin

EUT: DC/DC Converter

TEST SITE: Conducted 1

MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1

POLARIZATION: Line

RATING: DC 48V

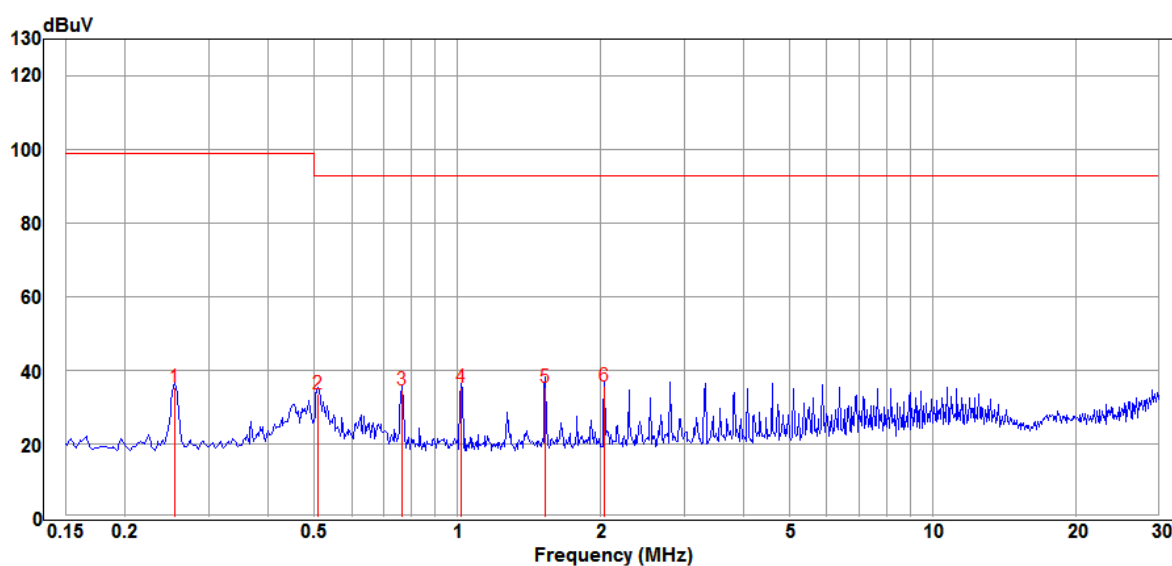
TEMP/HUM: 26.3°C / 60%

COMMENT: Test Mode: Mode 1: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 48V)

Data: 16

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2013-07-19



Item Mark	Freq. MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Remark
1	0.255	35.33	0.14	35.47	99.00	-63.53	QP
2	0.510	33.47	0.14	33.61	93.00	-59.39	QP
3	0.767	34.45	0.15	34.60	93.00	-58.40	QP
4	1.021	35.36	0.15	35.51	93.00	-57.49	QP
5	1.535	35.12	0.14	35.26	93.00	-57.74	QP
6	2.044	35.56	0.13	35.69	93.00	-57.31	QP

Power Line Conducted Test Data

CLIENT: Traco Electronic AG

OPERATOR: Vin

EUT: DC/DC Converter

TEST SITE: Conducted 1

MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1

POLARIZATION: Neutral

RATING: DC 48V

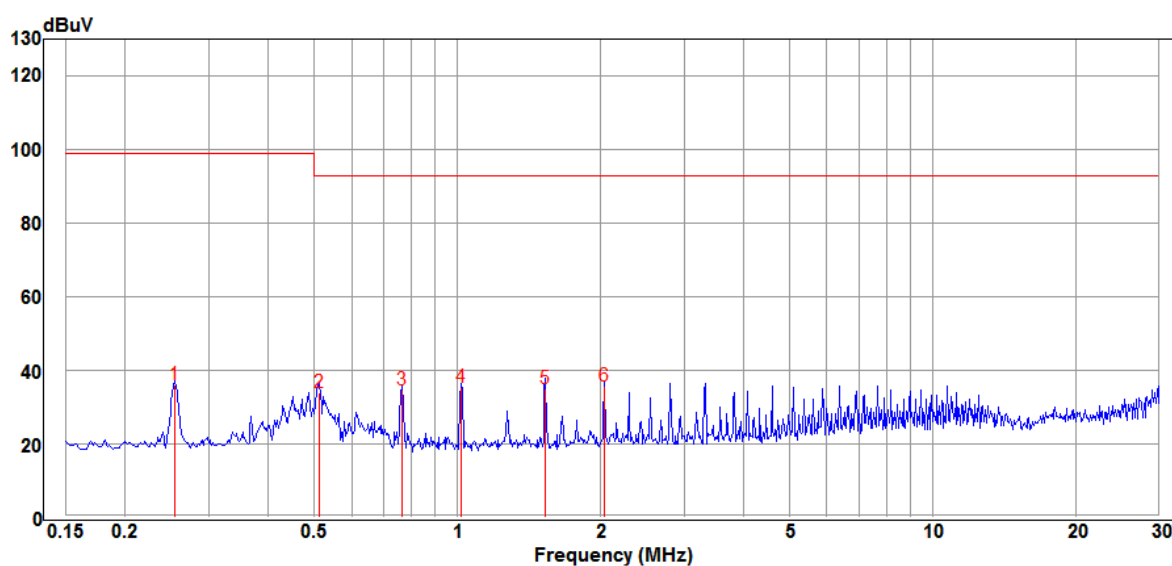
TEMP/HUM: 26.3°C / 60%

COMMENT: Test Mode: Mode 1: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 48V)

Data: 15

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2013-07-19



Item Mark	Freq. MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Remark
1	0.255	35.85	0.13	35.98	99.00	-63.02	QP
2	0.513	33.81	0.13	33.94	93.00	-59.06	QP
3	0.767	34.43	0.14	34.57	93.00	-58.43	QP
4	1.021	35.40	0.14	35.54	93.00	-57.46	QP
5	1.535	35.06	0.13	35.19	93.00	-57.81	QP
6	2.044	35.50	0.12	35.62	93.00	-57.38	QP

Power Line Conducted Test Data

CLIENT: Traco Electronic AG

OPERATOR: Vin

EUT: DC/DC Converter

TEST SITE: Conducted 1

MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1

POLARIZATION: Line

RATING: DC 72V

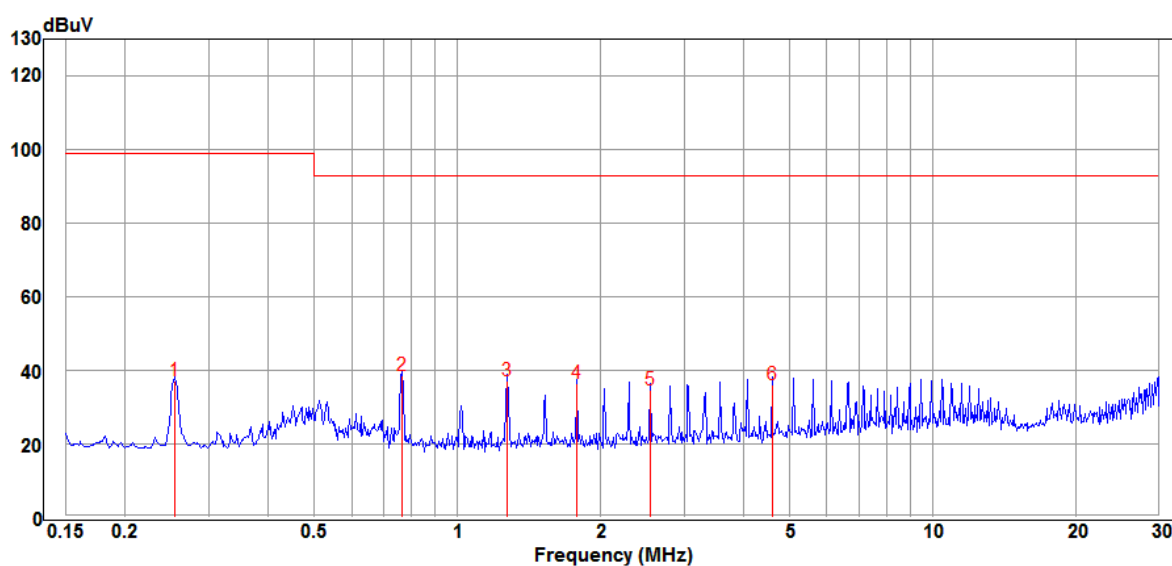
TEMP/HUM: 26.3°C / 60%

COMMENT: Test Mode: Mode 2: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 72V)

Data: 13

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2013-07-19



Item Mark	Freq. MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Remark
1	0.255	37.10	0.14	37.24	99.00	-61.76	QP
2	0.767	38.59	0.15	38.74	93.00	-54.26	QP
3	1.276	37.06	0.15	37.21	93.00	-55.79	QP
4	1.790	36.23	0.14	36.37	93.00	-56.63	QP
5	2.554	34.35	0.13	34.48	93.00	-58.52	QP
6	4.598	35.78	0.24	36.02	93.00	-56.98	QP

Power Line Conducted Test Data

CLIENT: Traco Electronic AG

OPERATOR: Vin

EUT: DC/DC Converter

TEST SITE: Conducted 1

MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1

POLARIZATION: Neutral

RATING: DC 72V

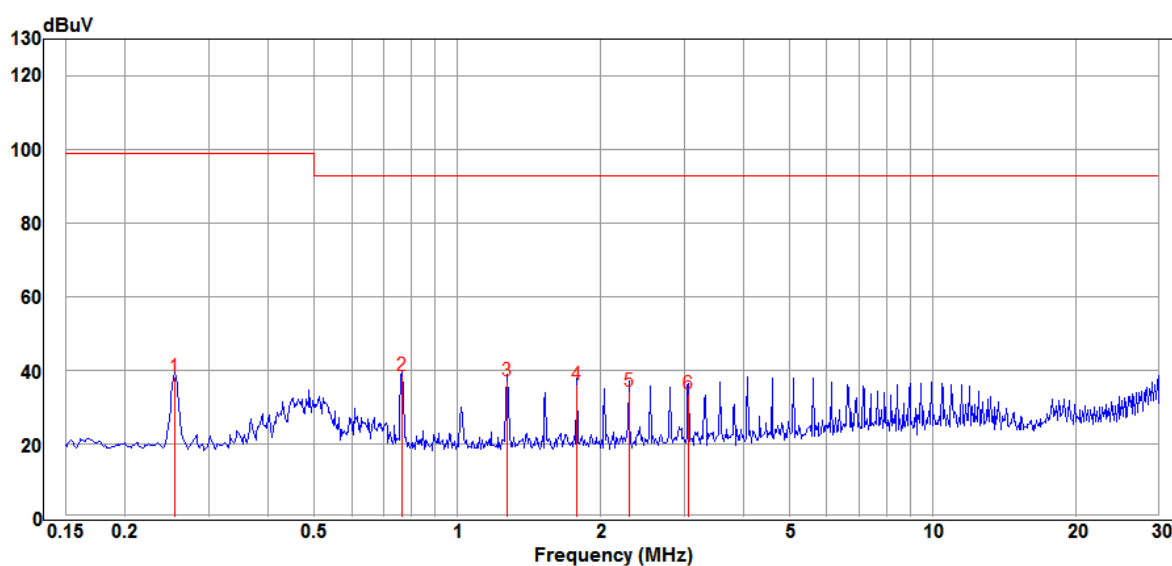
TEMP/HUM: 26.3°C / 60%

COMMENT: Test Mode: Mode 2: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 72V)

Data: 14

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2013-07-19



Item Mark	Freq. MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Remark
1	0.255	38.00	0.13	38.13	99.00	-60.87	QP
2	0.767	38.61	0.14	38.75	93.00	-54.25	QP
3	1.276	37.14	0.14	37.28	93.00	-55.72	QP
4	1.790	35.93	0.13	36.06	93.00	-56.94	QP
5	2.297	34.27	0.12	34.39	93.00	-58.61	QP
6	3.074	33.50	0.15	33.65	93.00	-59.35	QP

Power Line Conducted Test Data

CLIENT: Traco Electronic AG

OPERATOR: Vin

EUT: DC/DC Converter

TEST SITE: Conducted 1

MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1

POLARIZATION: Line

RATING: DC 96V

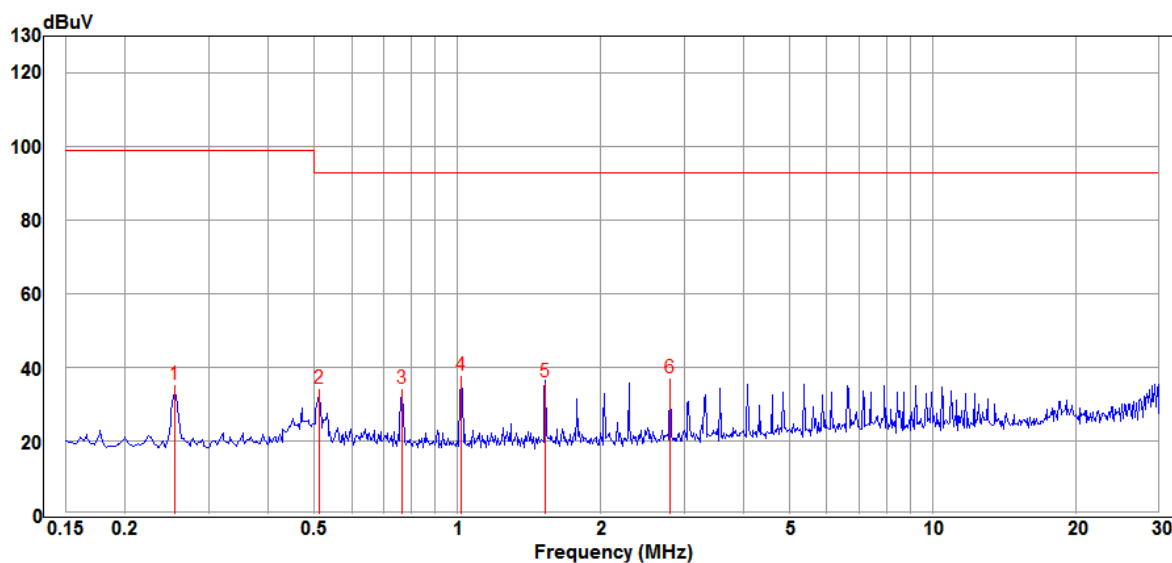
TEMP/HUM: 26.3°C / 60%

COMMENT: Test Mode: Mode 3: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 96V)

Data: 12

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2013-07-19



Item Mark	Freq. MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Remark
1	0.255	35.23	0.14	35.37	99.00	-63.63	QP
2	0.513	34.09	0.14	34.23	93.00	-58.77	QP
3	0.767	34.10	0.15	34.25	93.00	-58.75	QP
4	1.021	37.71	0.15	37.86	93.00	-55.14	QP
5	1.535	35.92	0.14	36.06	93.00	-56.94	QP
6	2.809	37.07	0.14	37.21	93.00	-55.79	QP

Power Line Conducted Test Data

CLIENT: Traco Electronic AG

OPERATOR: Vin

EUT: DC/DC Converter

TEST SITE: Conducted 1

MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1

POLARIZATION: Neutral

RATING: DC 96V

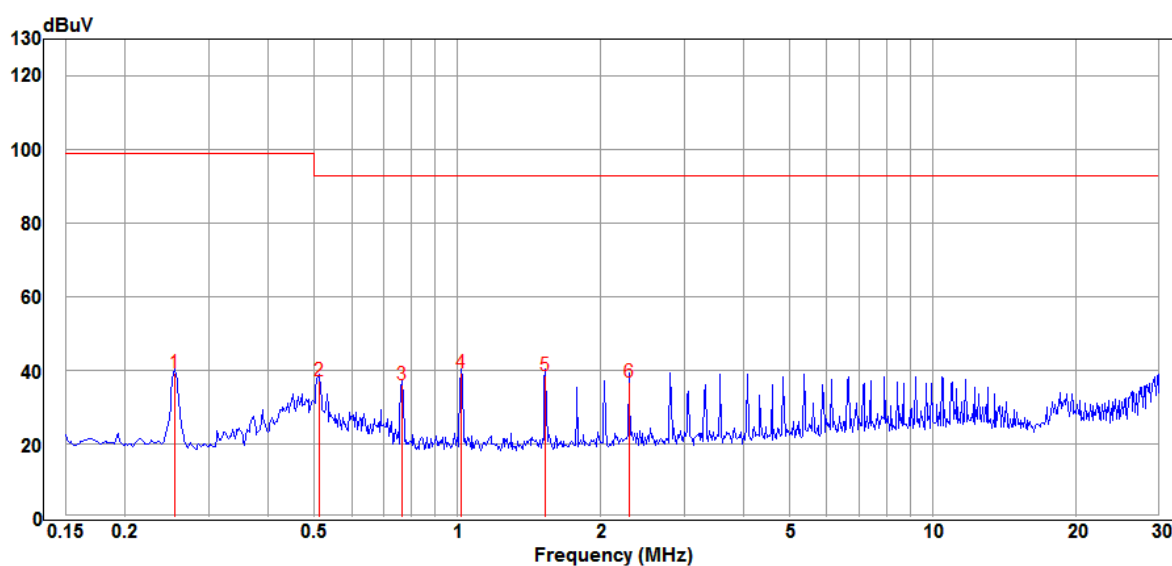
TEMP/HUM: 26.3°C / 60%

COMMENT: Test Mode: Mode 3: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 96V)

Data:11

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2013-07-19



Item Mark	Freq. MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Remark
1	0.255	39.07	0.13	39.20	99.00	-59.80	QP
2	0.513	36.85	0.13	36.98	93.00	-56.02	QP
3	0.767	35.97	0.14	36.11	93.00	-56.89	QP
4	1.021	39.22	0.14	39.36	93.00	-53.64	QP
5	1.535	38.36	0.13	38.49	93.00	-54.51	QP
6	2.297	36.75	0.12	36.87	93.00	-56.13	QP

Power Line Conducted Test Data

CLIENT: Traco Electronic AG

OPERATOR: Vin

EUT: DC/DC Converter

TEST SITE: Conducted 1

MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1

POLARIZATION: Line

RATING: DC 110V

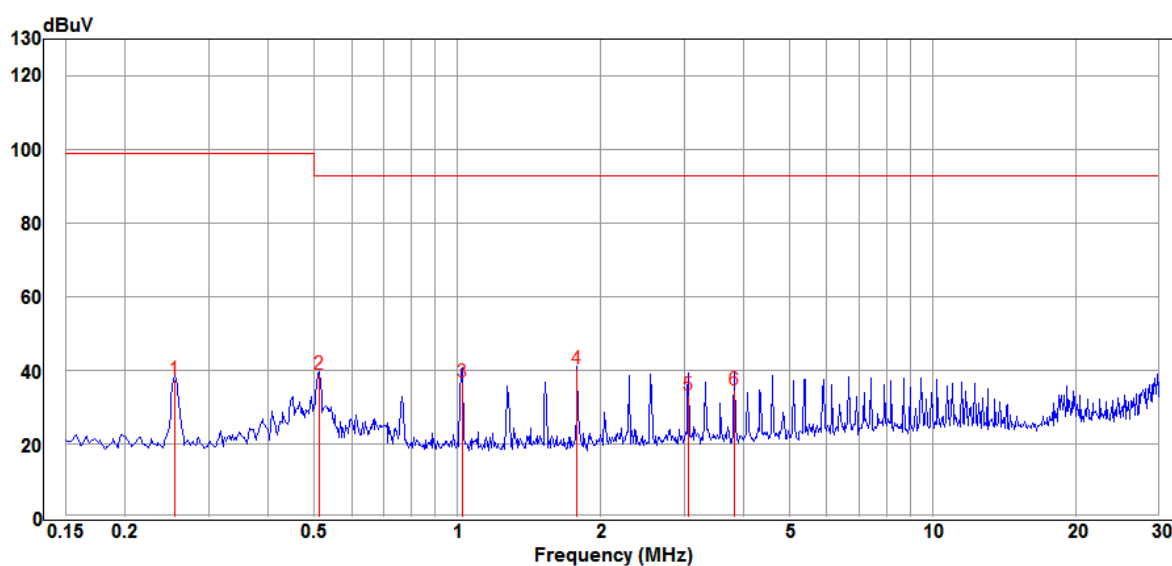
TEMP/HUM: 26.3°C / 60%

COMMENT: Test Mode: Mode 4: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 110V)

Data:9

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2013-07-19



Item Mark	Freq. MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Remark
1	0.255	37.54	0.14	37.68	99.00	-61.32	QP
2	0.513	38.90	0.14	39.04	93.00	-53.96	QP
3	1.027	36.57	0.15	36.72	93.00	-56.28	QP
4	1.790	40.37	0.14	40.51	93.00	-52.49	QP
5	3.074	33.00	0.15	33.15	93.00	-59.85	QP
6	3.840	34.60	0.19	34.79	93.00	-58.21	QP

Power Line Conducted Test Data

CLIENT: Traco Electronic AG

OPERATOR: Vin

EUT: DC/DC Converter

TEST SITE: Conducted 1

MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1

POLARIZATION: Neutral

RATING: DC 110V

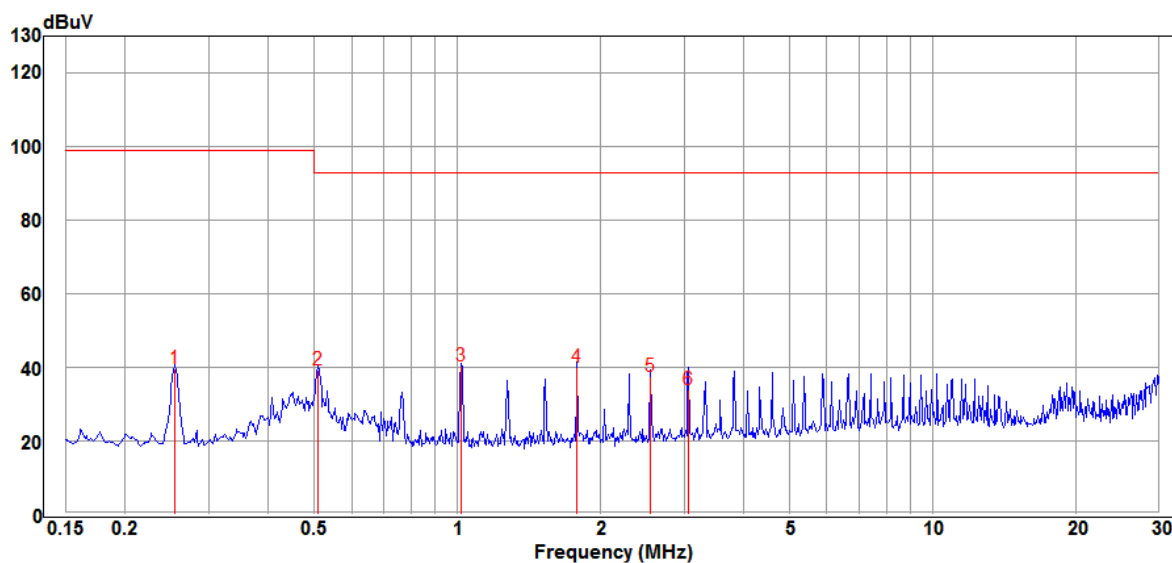
TEMP/HUM: 26.3°C / 60%

COMMENT: Test Mode: Mode 4: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1) (DC 110V)

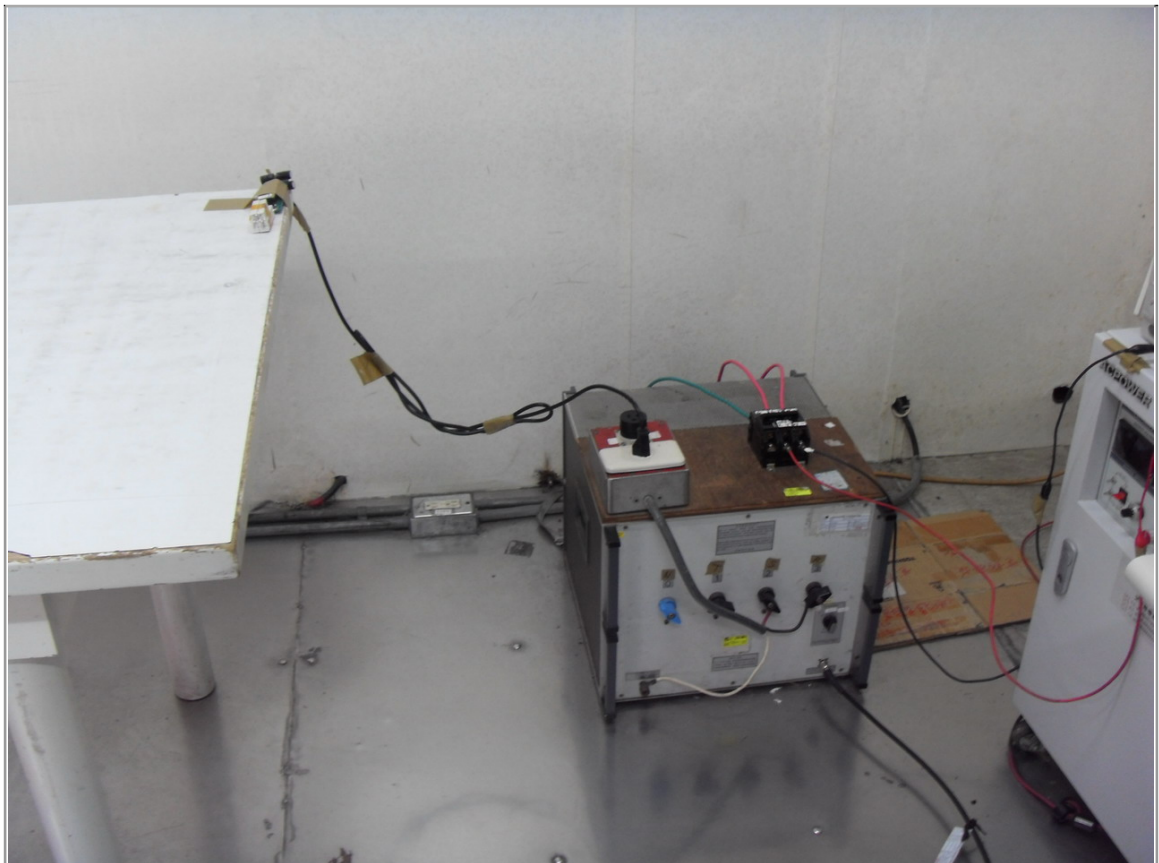
Data:10

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2013-07-19



Item Mark	Freq. MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Remark
1	0.255	39.62	0.13	39.75	99.00	-59.25	QP
2	0.510	39.32	0.13	39.45	93.00	-53.55	QP
3	1.021	40.22	0.14	40.36	93.00	-52.64	QP
4	1.790	39.76	0.13	39.89	93.00	-53.11	QP
5	2.554	37.23	0.12	37.35	93.00	-55.65	QP
6	3.074	33.67	0.15	33.82	93.00	-59.18	QP



Front View



Rear View

3.7 Radiated emission

3.7.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESVS10	826148/011	2013/10/16
Biconical Antenna	Schwarzbeck	BBA 9106	VHA 9103-2418	2014/03/27
Log Antenna	Schwarzbeck	UHALP 9108 A	0738	2014/03/27
Pre-Amplifier	Agilent	8447D	2944A09703	2014/04/30
RF Cable	PACIFIC	CBL41	CBL41	2013/11/16
RF Cable	Mini-Circuits	CBL-3FL-NMNM	CBL56	2013/08/31
RF Cable	Insulated Wire	CBL59	CBL59	2014/01/23

Note: The above equipments are within the valid calibration period.

3.7.2 Test Requirement

Reference to EN 50155 clause 12.2.8.2 and EN 50121-3-2 table 6

Frequency (MHz)	Quasi-Peak dB(μV/m)
30 ~ 230	40.0
230 ~ 1000	47.0

3.7.3 Test Procedures

Test Procedures were referred to EN 55011 sub-clause 7

3.7.4 Test Result

PASS.

The final test data is shown as following pages.

Factor = Antenna Factor + Cable Loss - Preamplifier Gain

Level = Reading + Factor

Margin = Level - Limit

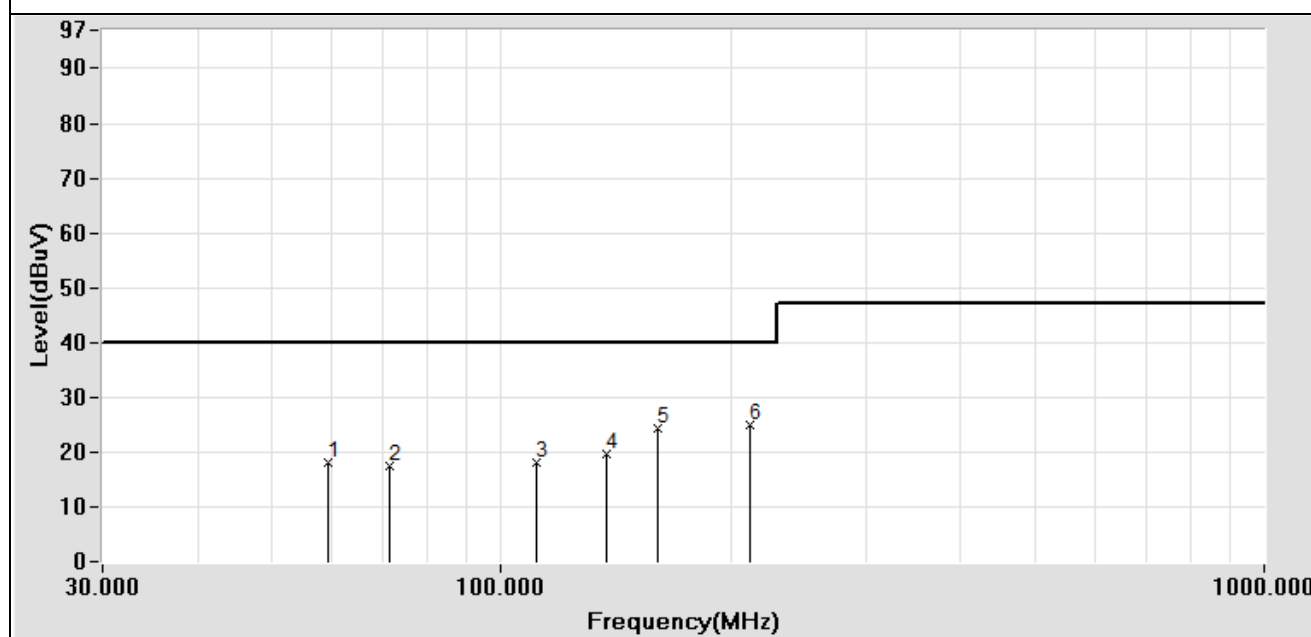
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Horizontal
CLIENT: Traco Electronic AG	DISTANCE: 10 m
MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1	Serial No.:
RATING: DC 48V	FILE/DATA#: Traco.emi/64
Temperature: 24.6 °C	OPERATOR: Bill
Humidity: 54 %	TEST SITE: OATS 1

Frequency	Factor	Meter Reading	Emission Level	Limits	Margin
(MHz)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)
59.130 **	-19.05	37.00	17.95	40.00	-22.05
71.270 **	-21.43	39.00	17.57	40.00	-22.43
111.100 **	-14.86	33.00	18.14	40.00	-21.86
137.400 **	-12.23	31.80	19.57	40.00	-20.43
160.600 **	-10.55	35.00	24.45	40.00	-15.55
212.300 **	-9.18	34.00	24.82	40.00	-15.18

Remark:

1. " * " Mark means readings are Peak Values.
2. " ** " Mark means readings are Quasi-Peak values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Test Mode: Mode 1: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1)(DC 48V)

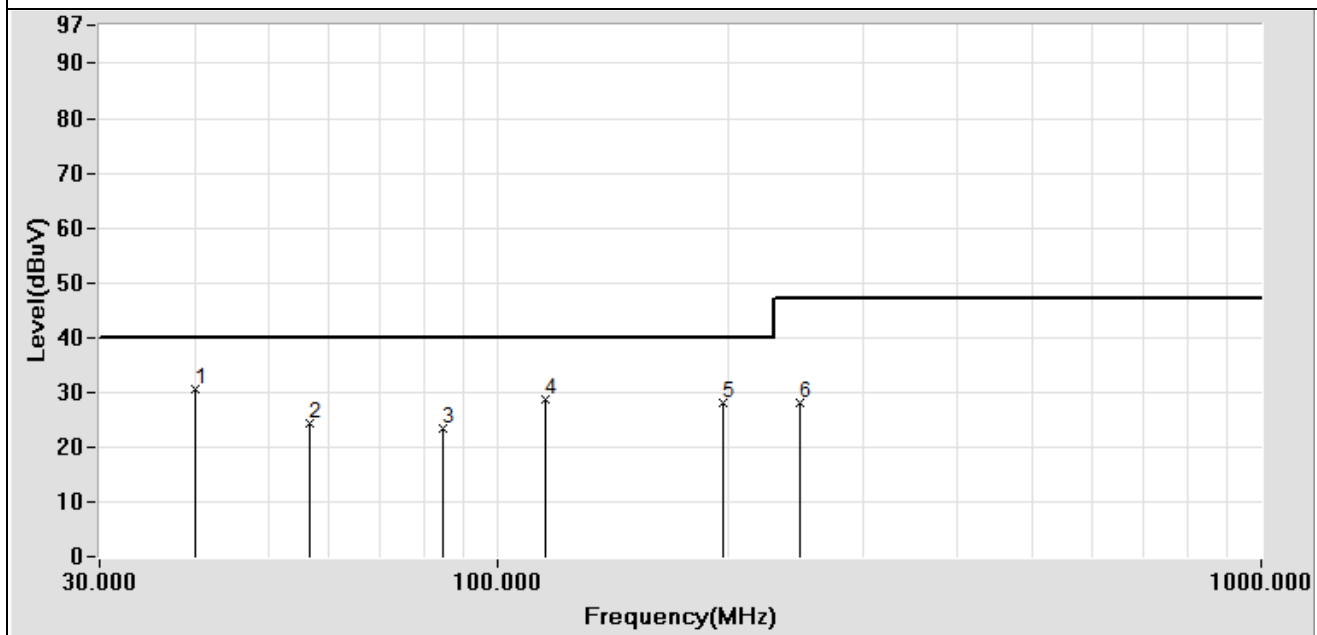
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Vertical
CLIENT: Traco Electronic AG	DISTANCE: 10 m
MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1	Serial No.:
RATING: DC 48V	FILE/DATA#: Traco.emi/65
Temperature: 24.6 °C	OPERATOR: Bill
Humidity: 54 %	TEST SITE: OATS 1

Frequency	Factor	Meter Reading	Emission Level	Limits	Margin
(MHz)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)
39.980 **	-13.40	44.00	30.60	40.00	-9.40
56.680 **	-18.57	42.80	24.23	40.00	-15.77
84.380 **	-19.52	43.00	23.48	40.00	-16.52
115.100 **	-14.77	43.50	28.73	40.00	-11.27
196.700 **	-9.45	37.50	28.05	40.00	-11.95
249.100 **	-8.05	36.00	27.95	47.00	-19.05

Remark:

1. " * " Mark means readings are Peak Values.
2. " ** " Mark means readings are Quasi-Peak values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Test Mode: Mode 1: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1)(DC 48V)

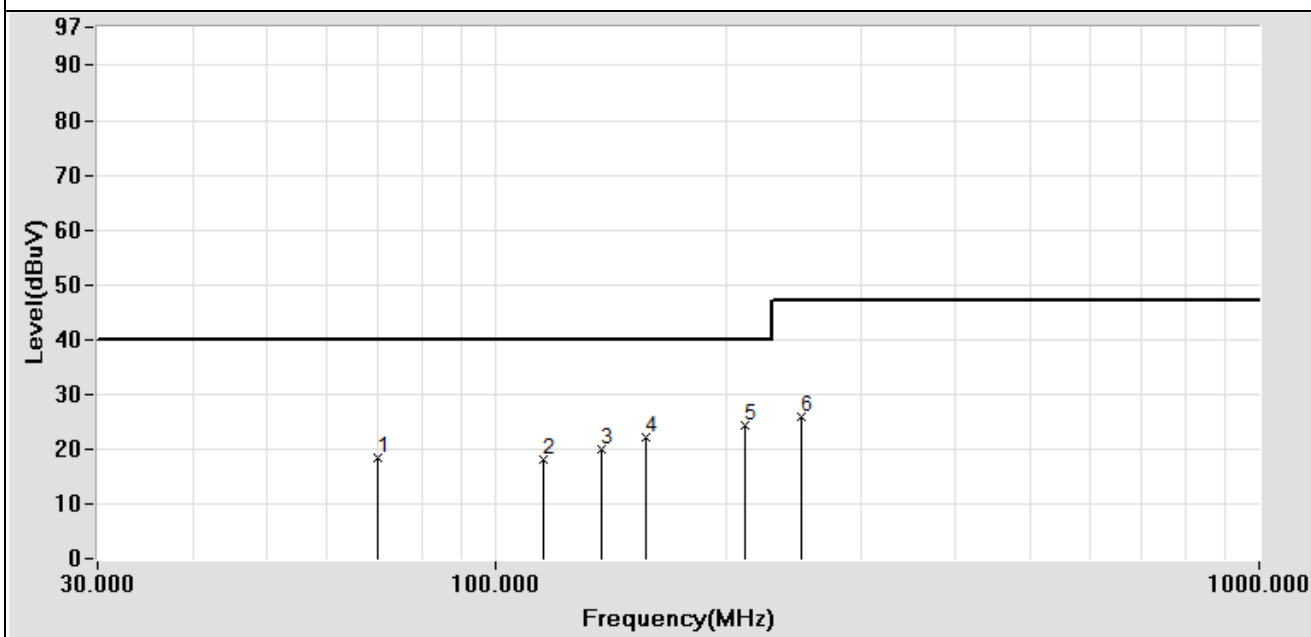
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Horizontal
CLIENT: Traco Electronic AG	DISTANCE: 10 m
MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1	Serial No.:
RATING: DC 72V	FILE/DATA#: Traco.emi/63
Temperature: 24.6 °C	OPERATOR: Bill
Humidity: 54 %	TEST SITE: OATS 1

Frequency	Factor	Meter Reading	Emission Level	Limits	Margin
(MHz)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)
69.960 **	-21.57	39.90	18.33	40.00	-21.67
115.100 **	-14.77	33.00	18.23	40.00	-21.77
137.400 **	-12.23	32.30	20.07	40.00	-19.93
157.000 **	-10.81	32.80	21.99	40.00	-18.01
211.700 **	-9.19	33.50	24.31	40.00	-15.69
250.700 **	-7.99	33.80	25.81	47.00	-21.19

Remark:

1. " * " Mark means readings are Peak Values.
2. " ** " Mark means readings are Quasi-Peak values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Test Mode: Mode 2: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1)(DC 72V)

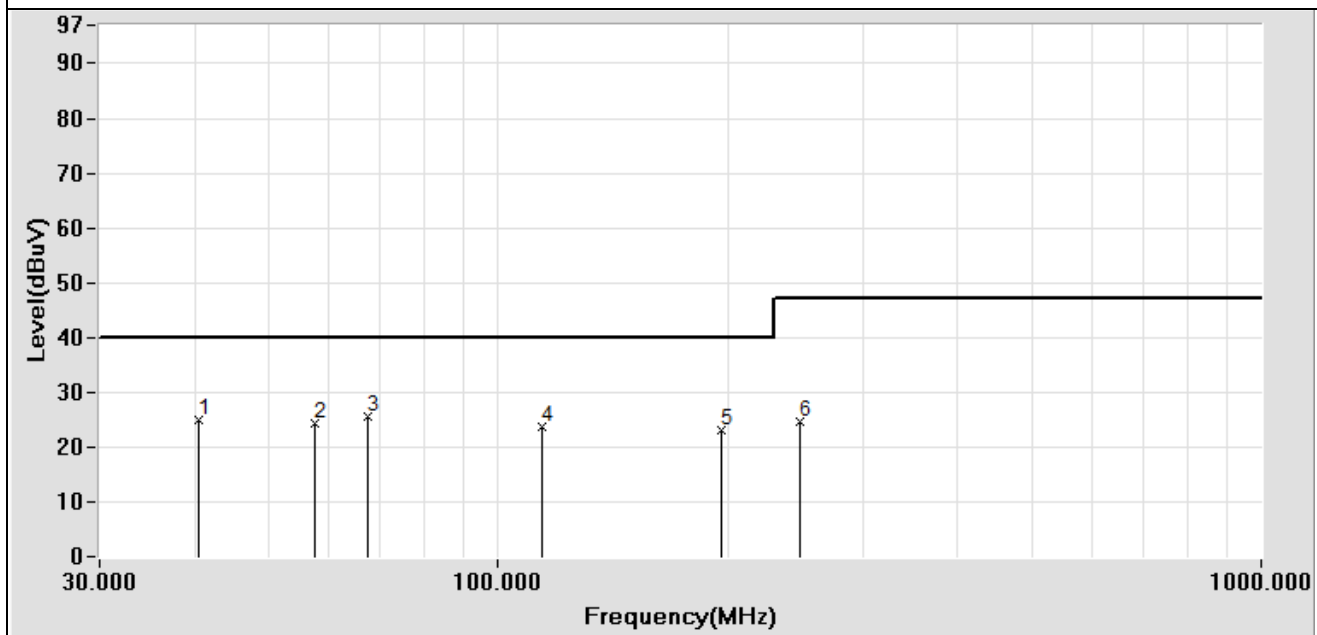
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Vertical
CLIENT: Traco Electronic AG	DISTANCE: 10 m
MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1	Serial No.:
RATING: DC 72V	FILE/DATA#: Traco.emi/62
Temperature: 24.6 °C	OPERATOR: Bill
Humidity: 54 %	TEST SITE: OATS 1

Frequency	Factor	Meter Reading	Emission Level	Limits	Margin
(MHz)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)
40.430 **	-13.59	38.60	25.01	40.00	-14.99
57.360 **	-18.70	43.00	24.30	40.00	-15.70
67.450 **	-21.32	47.00	25.68	40.00	-14.32
114.100 **	-14.79	38.50	23.71	40.00	-16.29
195.600 **	-9.46	32.60	23.14	40.00	-16.86
248.700 **	-8.05	32.60	24.55	47.00	-22.45

Remark:

1. " * " Mark means readings are Peak Values.
2. " ** " Mark means readings are Quasi-Peak values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Test Mode: Mode 2: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1)(DC 72V)

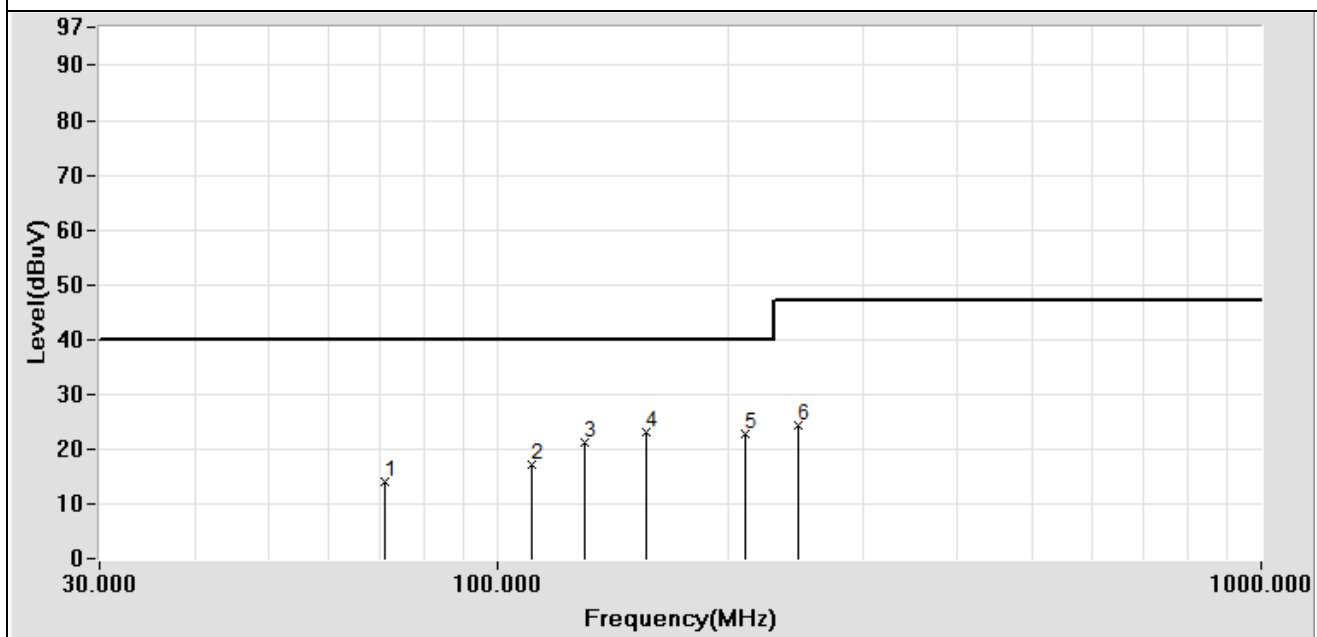
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Horizontal
CLIENT: Traco Electronic AG	DISTANCE: 10 m
MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1	Serial No.:
RATING: DC 96V	FILE/DATA#: Traco.emi/60
Temperature: 24.6 °C	OPERATOR: Bill
Humidity: 54 %	TEST SITE: OATS 1

Frequency	Factor	Meter Reading	Emission Level	Limits	Margin
(MHz)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)
70.810 **	-21.48	35.50	14.02	40.00	-25.98
110.700 **	-14.87	32.00	17.13	40.00	-22.87
129.500 **	-12.65	34.00	21.35	40.00	-18.65
156.600 **	-10.83	34.00	23.17	40.00	-16.83
211.100 **	-9.21	32.00	22.79	40.00	-17.21
247.200 **	-8.07	32.50	24.43	47.00	-22.57

Remark:

1. " * " Mark means readings are Peak Values.
2. " ** " Mark means readings are Quasi-Peak values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Test Mode: Mode 3: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1)(DC 96V)

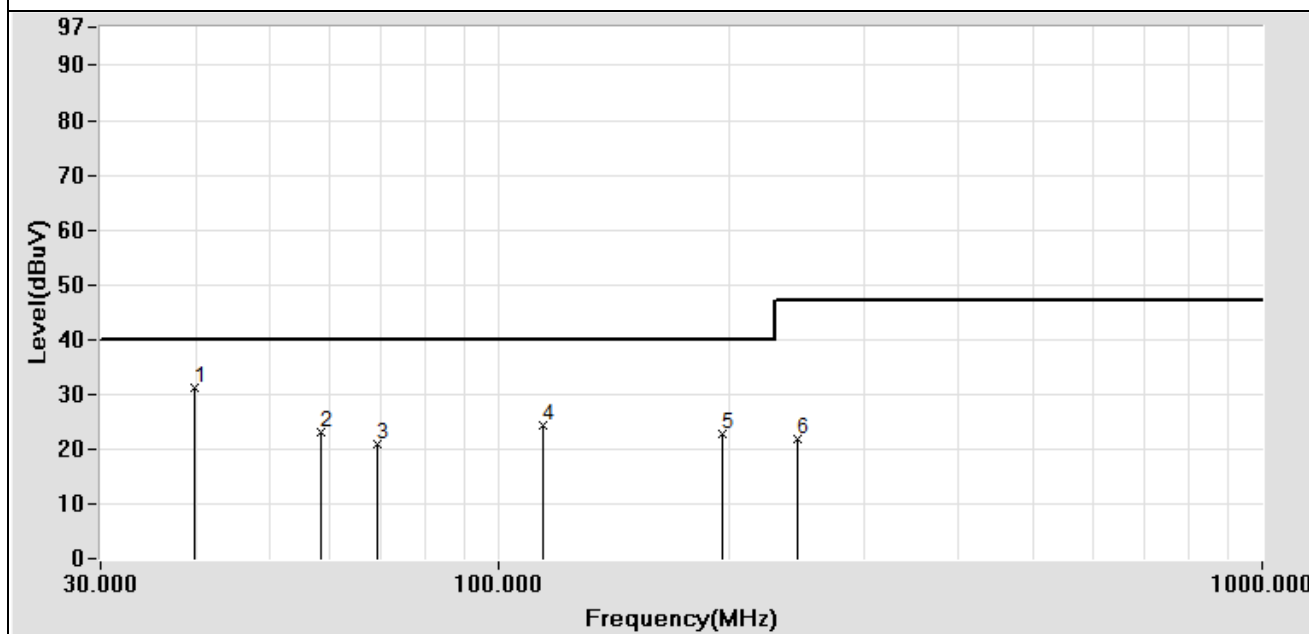
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Vertical
CLIENT: Traco Electronic AG	DISTANCE: 10 m
MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1	Serial No.:
RATING: DC 96V	FILE/DATA#: Traco.emi/61
Temperature: 24.6 °C	OPERATOR: Bill
Humidity: 54 %	TEST SITE: OATS 1

Frequency	Factor	Meter Reading	Emission Level	Limits	Margin
(MHz)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)
39.800 **	-13.34	44.50	31.16	40.00	-8.84
58.220 **	-18.86	41.90	23.04	40.00	-16.96
69.270 **	-21.50	42.50	21.00	40.00	-19.00
114.000 **	-14.79	39.00	24.21	40.00	-15.79
195.900 **	-9.46	32.20	22.74	40.00	-17.26
246.200 **	-8.07	30.00	21.93	47.00	-25.07

Remark:

1. " * " Mark means readings are Peak Values.
2. " ** " Mark means readings are Quasi-Peak values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Test Mode: Mode 3: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1)(DC 96V)

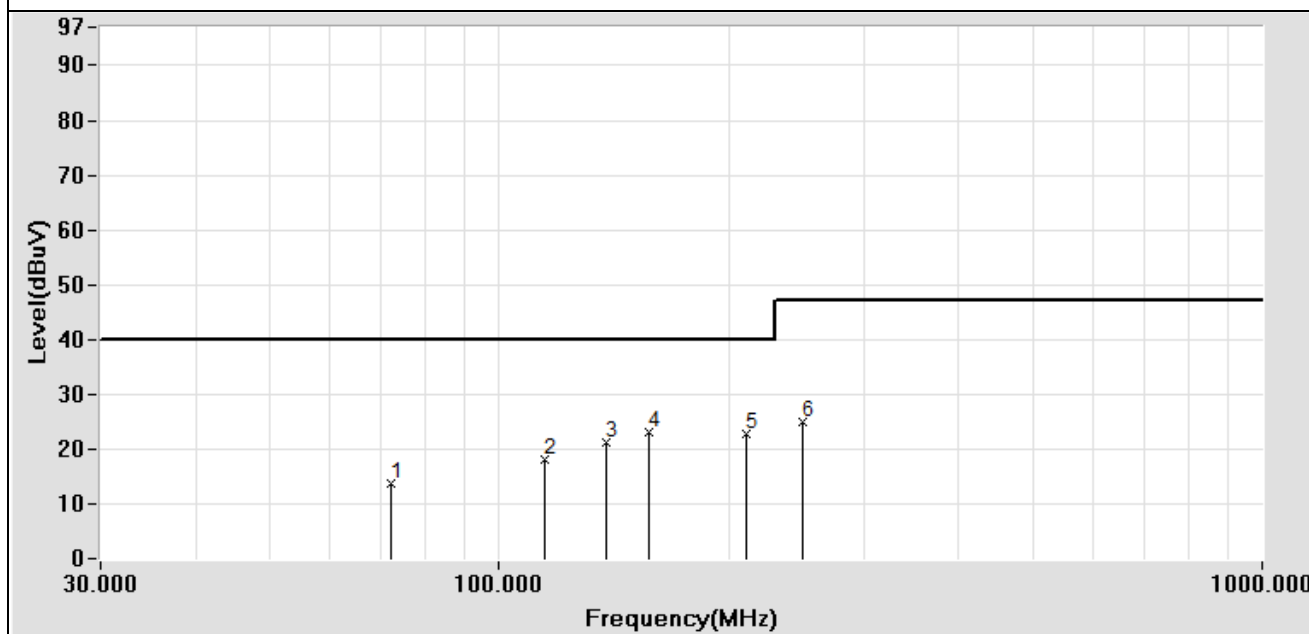
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Horizontal
CLIENT: Traco Electronic AG	DISTANCE: 10 m
MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1	Serial No.:
RATING: DC 110V	FILE/DATA#: Traco.emi/59
Temperature: 24.6 °C	OPERATOR: Bill
Humidity: 54 %	TEST SITE: OATS 1

Frequency	Factor	Meter Reading	Emission Level	Limits	Margin
(MHz)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)
72.120 **	-21.33	35.00	13.67	40.00	-26.33
114.500 **	-14.78	32.80	18.02	40.00	-21.98
138.000 **	-12.20	33.50	21.30	40.00	-18.70
157.000 **	-10.81	34.00	23.19	40.00	-16.81
211.100 **	-9.21	32.00	22.79	40.00	-17.21
250.300 **	-8.02	33.00	24.98	47.00	-22.02

Remark:

1. " * " Mark means readings are Peak Values.
2. " ** " Mark means readings are Quasi-Peak values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Test Mode: Mode 4: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1)(DC 110V)

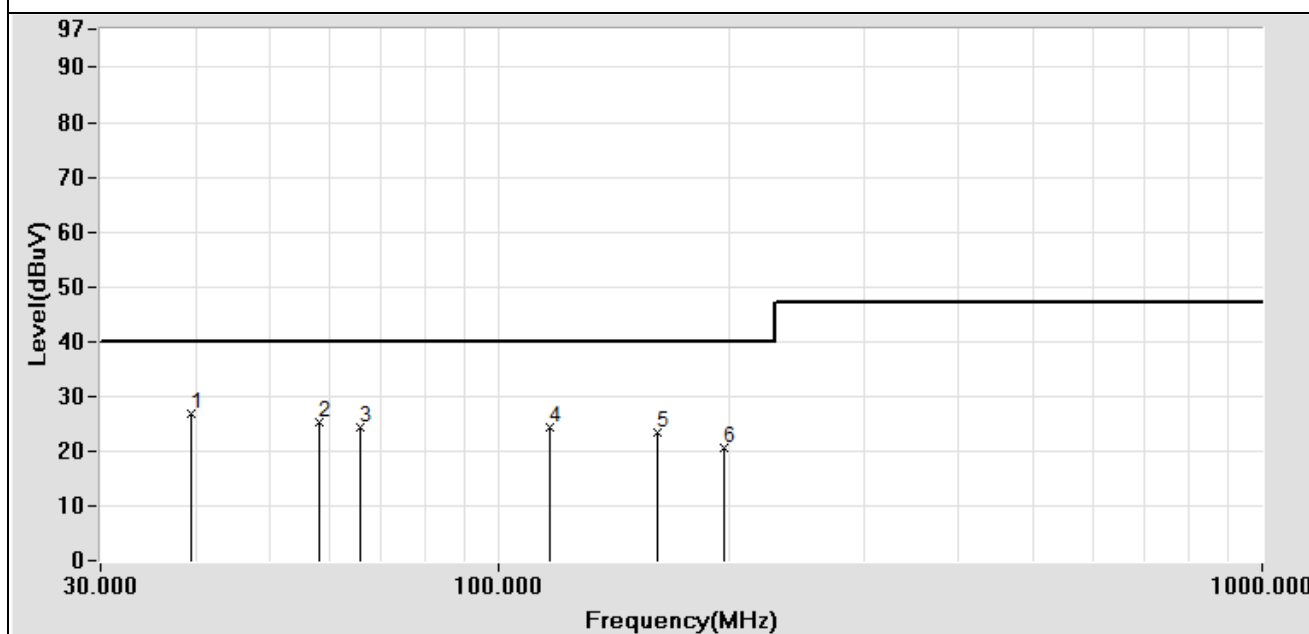
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Vertical
CLIENT: Traco Electronic AG	DISTANCE: 10 m
MODEL: TEN 40-7225WIRz1z1z1z1z1z1z1	Serial No.:
RATING: DC 110V	FILE/DATA#: Traco.emi/58
Temperature: 24.6 °C	OPERATOR: Bill
Humidity: 54 %	TEST SITE: OATS 1

Frequency	Factor	Meter Reading	Emission Level	Limits	Margin
(MHz)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)
39.520 **	-13.23	40.00	26.77	40.00	-13.23
58.100 **	-18.85	44.00	25.15	40.00	-14.85
65.570 **	-21.14	45.50	24.36	40.00	-15.64
116.300 **	-14.75	39.00	24.25	40.00	-15.75
161.400 **	-10.53	34.00	23.47	40.00	-16.53
197.100 **	-9.45	30.00	20.55	40.00	-19.45

Remark:

1. " * " Mark means readings are Peak Values.
2. " ** " Mark means readings are Quasi-Peak values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Test Mode: Mode 4: FULL LOAD (TEN 40-7225WIRz1z1z1z1z1z1z1)(DC 110V)



Front View



Rear View

4 Environmental Tests

4.1 Low Temperature Test

4.1.1 Instrument

Instrument	Manufacturer	Model	Serial No.
MALLIER Temperature Humidity Testing Chamber	N/A	MHT-4YP	N/A
YOKOGAWA	N/A	4516	49YD1165/TW-9

4.1.2 Test Ambience

Temperature : 30°C ± 3°C

Humidity : 60% ± 5%(RH)

4.1.3 Specimen & Model Quantity:

Specimen : DC/DC Converter

Model : TEN 40-7225WIRz1z1z1z1z1z1z1 (Serial models were shown as in page 5)

Quantity : 1 set

4.1.4 Test Condition

Temperature : Storage -40°C, 16 hours,

Operating -40°C, at last 2 hours.

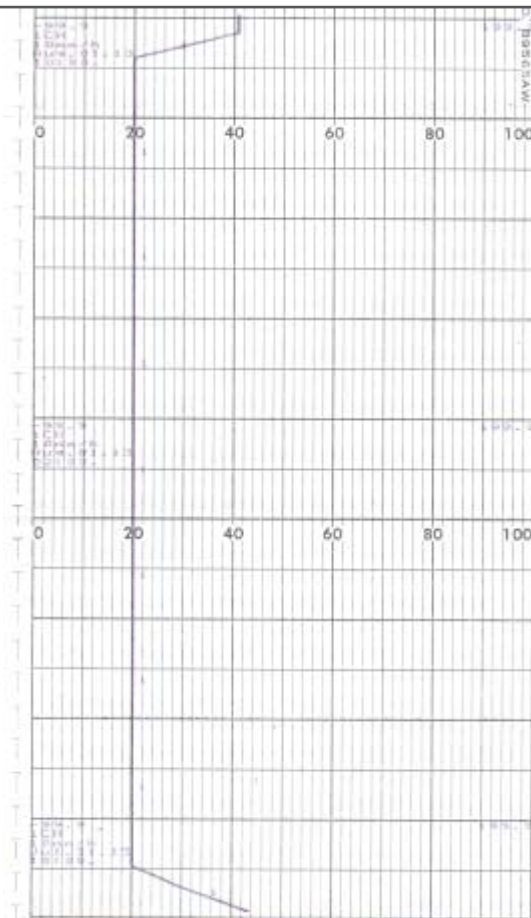
Performance Check: The performance check was carried out before, during and after the low temperature storage/operating test.

4.1.5 Test results

1. Test configuration was shown in Fig.1.
2. The testing data were shown in Fig.2.
3. Test specimen was visually inspected after test. No external physical damage was noted.
4. The function of specimen was normal during and after the Low Temperature Test.
5. According Test Result, the DC/DC Converter pass EN 50155 Class TX Low Temperature Test.



Fig. 1: Temperature and Damp Heat Test



Temperature span: $-99.9^{\circ}\text{C} \sim +199.9^{\circ}\text{C}$, Temperature scale: $6^{\circ}\text{C}/\text{div.}$

Chart speed : 10 mm/hr

Fig. 2: Low Temperature Storage/Operating Test Record

4.2 Dry Heat Test

4.2.1 Instrument

Instrument	Manufacturer	Model	Serial No.
MALLIER Temperature Humidity Testing Chamber	N/A	MHT-4YP	N/A
YOKOGAWA	N/A	4516	49YD1165/TW-9

4.2.2 Test Ambience

Temperature : 30°C ± 3°C

Humidity : 60% ± 5%(RH)

4.2.3 Specimen & Model Quantity:

Specimen : DC/DC Converter

Model : TEN 40-7225WIRz1z1z1z1z1z1z1 (Serial models were shown as in page 5)

Quantity : 1 set

4.2.4 Test Condition:

Temperature : 85°C, 6 hours,

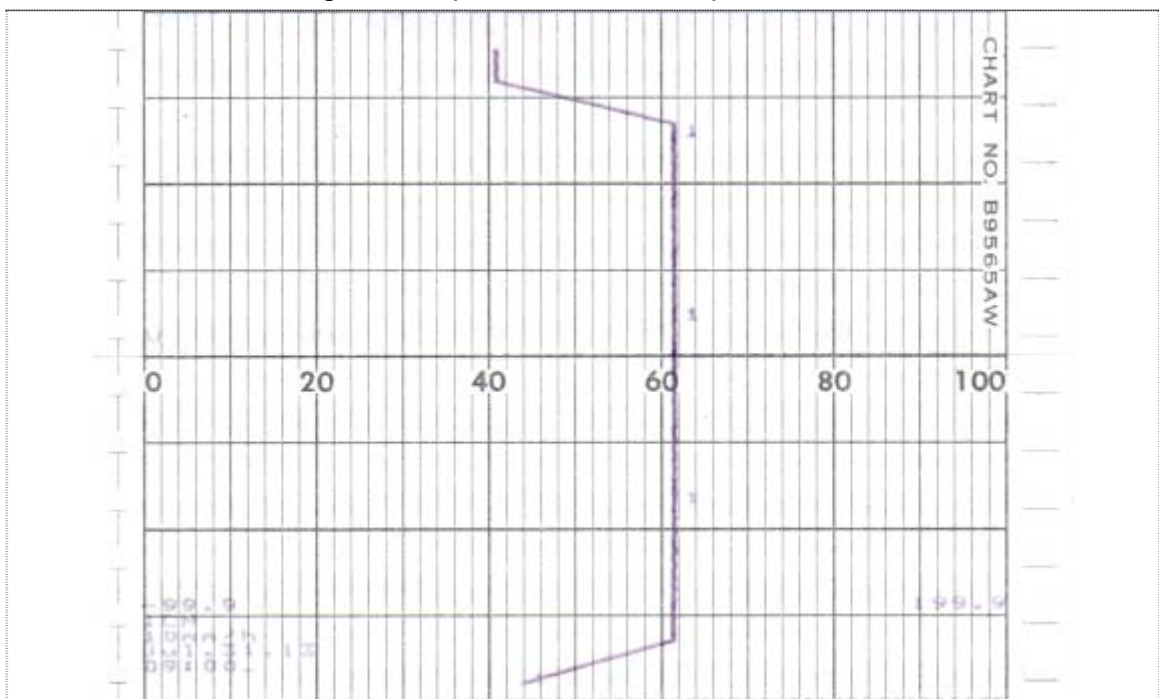
Performance Check: The performance check was carried out before, during and after the Dry Heat Test.

4.2.5 Test Result

1. Test configuration was shown in Fig.1.
2. The testing data were shown in Fig.3.
3. Test specimen was visually inspected after test. No external physical damage was noted.
4. The function of specimen was normal during and after the Dry Heat Test.
5. According Test Result, the DC/DC Converter pass EN 50155 Class TX Dry Heat Test.



Fig. 1: Temperature and Damp Heat Test



Temperature span : -99.9°C~+199.9°C, Temperature scale:6°C/div.

Chart speed : 10 mm/hr

Fig. 3: Dry Heat Test Record

4.3 Damp Heat Test

4.3.1 Instrument

Instrument	Manufacturer	Model	Serial No.
MALLIER Temperature Humidity Testing Chamber	N/A	MHT-4YP	N/A
YOKOGAWA	N/A	4516	49YD1165/TW-9

4.3.2 Test Ambience

Temperature : 30°C ± 3°C

Humidity : 60% ± 5%(RH)

4.3.3 Specimen & Model Quantity:

Specimen : DC/DC Converter

Model : TEN 40-7225WIRz1z1z1z1z1z1z1 (Serial models were shown as in page 5)

Quantity : 1 set

4.3.4 Test Condition:

Temperature / Humidity :

25°C~55°C, 95%±5%RH without condensation, 48 hours.

Performance Check: The performance check was carried out before, during and after the Dump Heat test.

4.3.5 Test results:

1. Test configuration was shown in Fig.1.
2. The testing data were shown in Fig.4.
3. Test specimen was visually inspected after test. No external physical damage was noted.
4. The function of specimen was normal during and after Dump Heat test.
5. According Test Result, the DC/DC Converter pass EN 50155 Class TX Dump Heat Test.



Fig. 1: Temperature and Damp Heat Test



Temperature span : $-99.9^{\circ}\text{C} \sim +199.9^{\circ}\text{C}$, Temperature scale: $6^{\circ}\text{C}/\text{div}$.

Humidity span : $0\% \sim 100\%(\text{RH})$, Humidity scale : $2\%(\text{RH})/\text{div}$.

Chart speed : 10 mm/hr .

Fig. 4: Damp Heat Test Record

4.4 Random Vibration Test

4.4.1 Instrument

Instrument	Manufacturer	Model	Serial No.
U-D vibration machine	N/A	TA240D-208/CSTA.	N/A
Control System	LDS DACTRON CONTROLLER.	N/A	N/A
Accelerometer	DYTRAN	3055B2, sensitivity: 99.01 mv/g.	N/A

4.4.2 Test Ambience

Temperature : $29^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Humidity : $65\% \pm 5\%(\text{RH})$

4.4.3 Specimen & Model Quantity

Specimen : DC/DC Converter

Model : TEN 40-7225WIRz1z1z1z1z1z1z1 (Serial models were shown as in page 5)

Quantity : 1 set

4.4.4 Test Condition

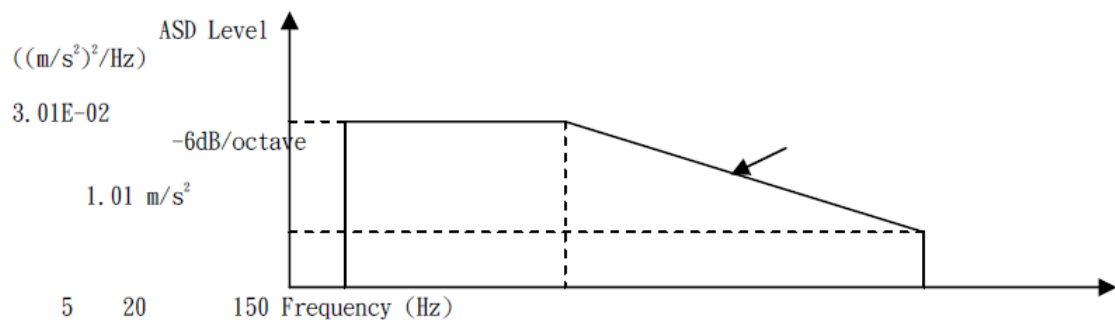
Frequency Range : 5Hz~150Hz.

G_{rms} value : Vertical (Z-Axis) 1.01 m/s^2 ($0.103 G_{\text{rms}}$),

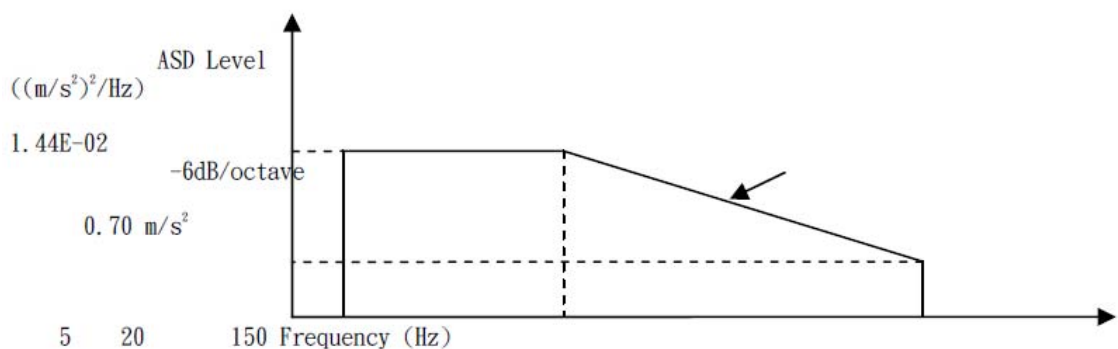
Transverse (Y-Axis) and Longitudinal (X-Axis) 0.70 m/s^2 ($0.0714 G_{\text{rms}}$).

Duration : 10 min/axis ◦

Power Spectrum Density shown as follow :



PSD of Vertical (Z) Axis



PSD of Transverse (Y Axis) and Longitudinal (X Axis)

4.4.5 Test Result

1. Test configurations were shown in Fig.5~Fig.7.
2. The testing data were shown in Fig.8~Fig.10.
3. Test specimen was visually inspected after test. No external physical damage was noted.
4. The function of specimen was normal during and after the Random vibration test.
5. According Test Result, the DC/DC Converter pass EN 50155 (refer to EN 61373:2010 Category 1 Class B) Random Vibration Test.



Fig.5: Vibration and Shock Test in X Axis

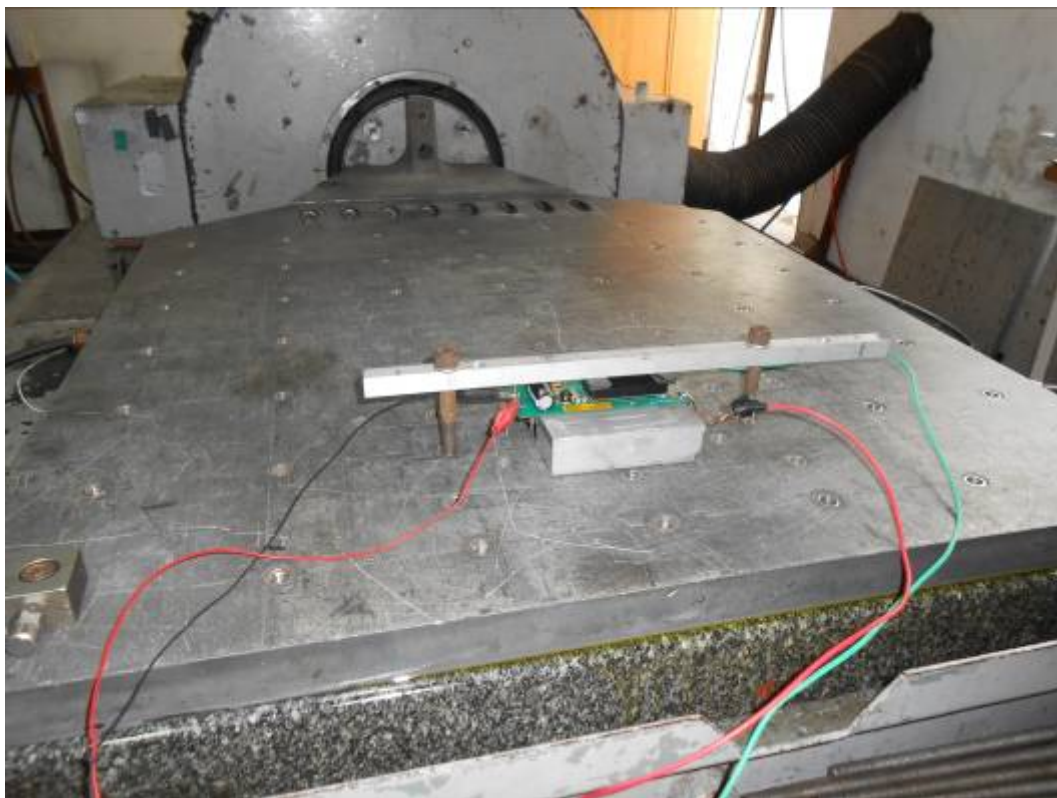


Fig. 6: Vibration and Shock Test in Y Axis

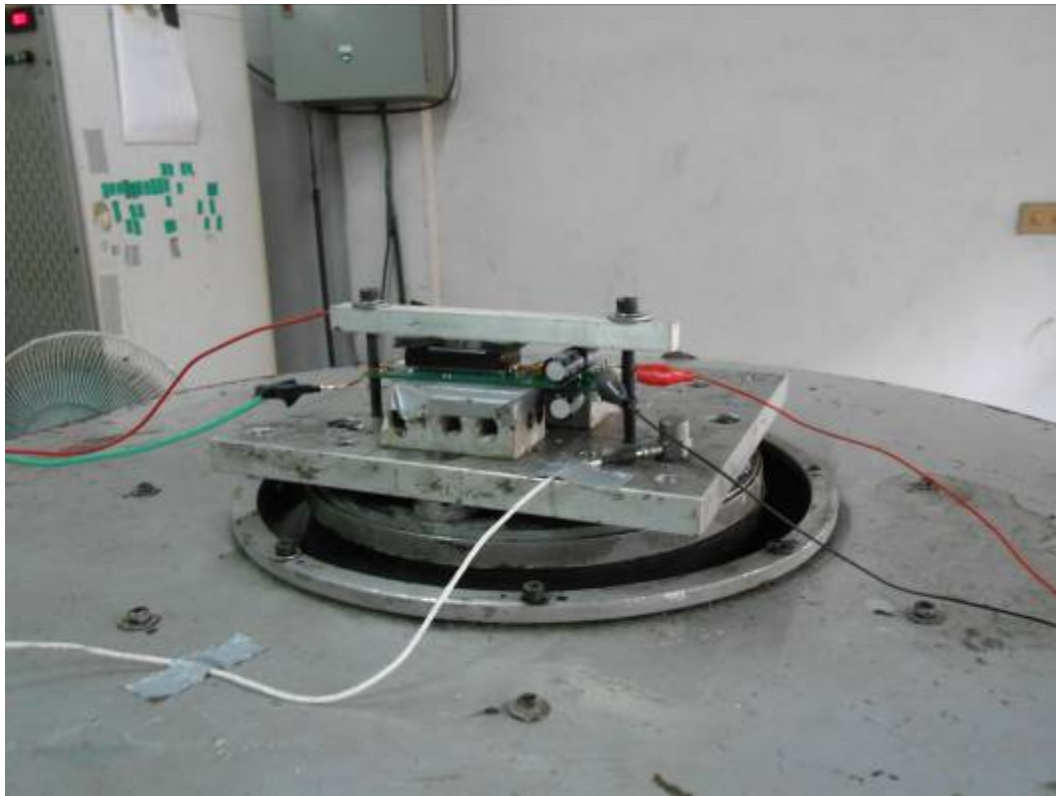
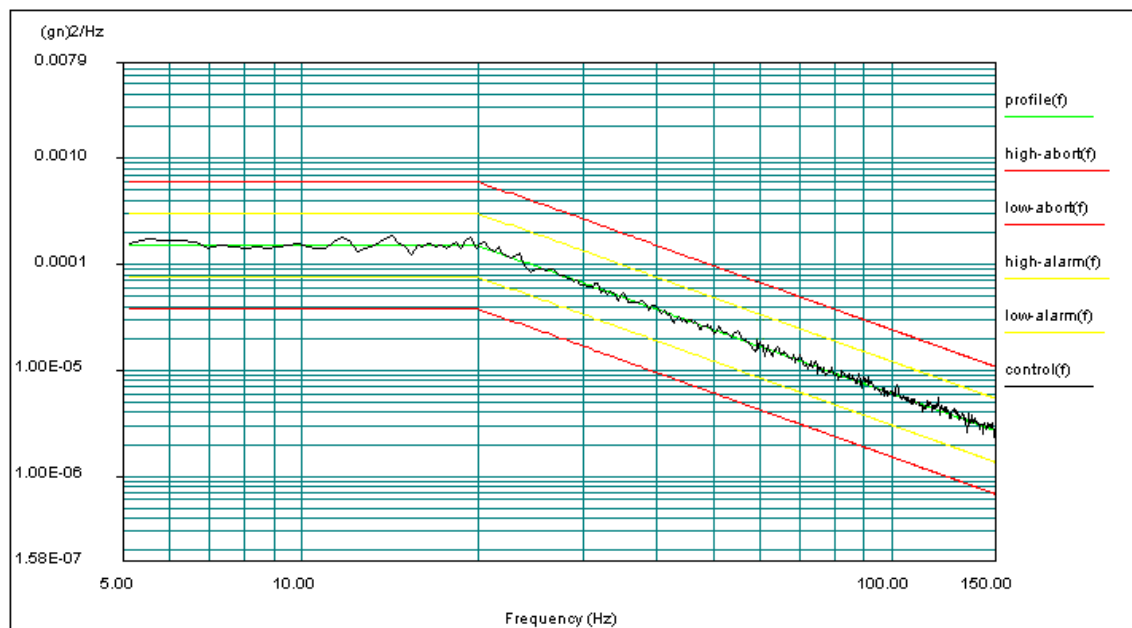


Fig. 7: Vibration and Shock Test in Z Axis

DC/DC Converter

Project File Name: IEC61373X-op.prj

Profile Name: X-Axis Test Type: Random Run Folder: .\RunDefault Jul 29, 2013 10-00-18



Level: 100 %

Control RMS: 0.073732 gn Full Level Elapsed Time: 00:10:00 Lines: 400 Frame Time: 2.730667 Seconds

Demand RMS: 0.071482 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

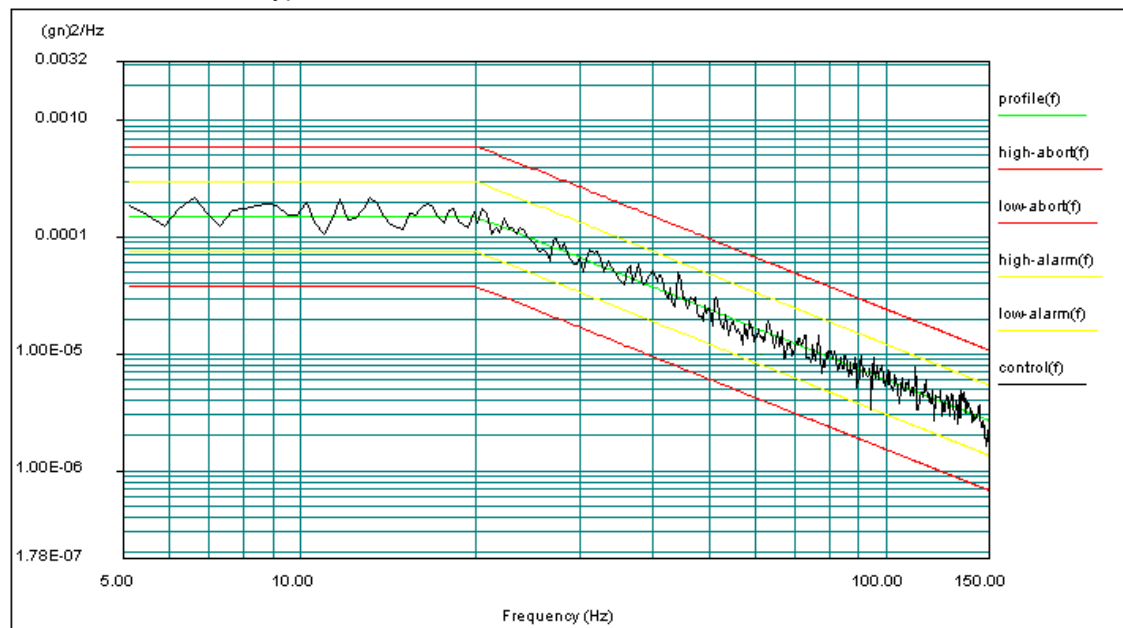
Data saved at 10:11:35 AM, Monday, July 29, 2013

Fig. 8: Random Vibration Testing data of X Axis

DC/DC Converter

Project File Name: IEC61373X-op.prj

Profile Name: Y-Axis Test Type: Random Run Folder: .\RunDefault Jul 30, 2013 08-31-07



Level: 100 %

Control RMS: 0.0072651 gn Full Level Elapsed Time: 00:10:00 Lines: 400 Frame Time: 2.730667 Seconds

Demand RMS: 0.071482 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

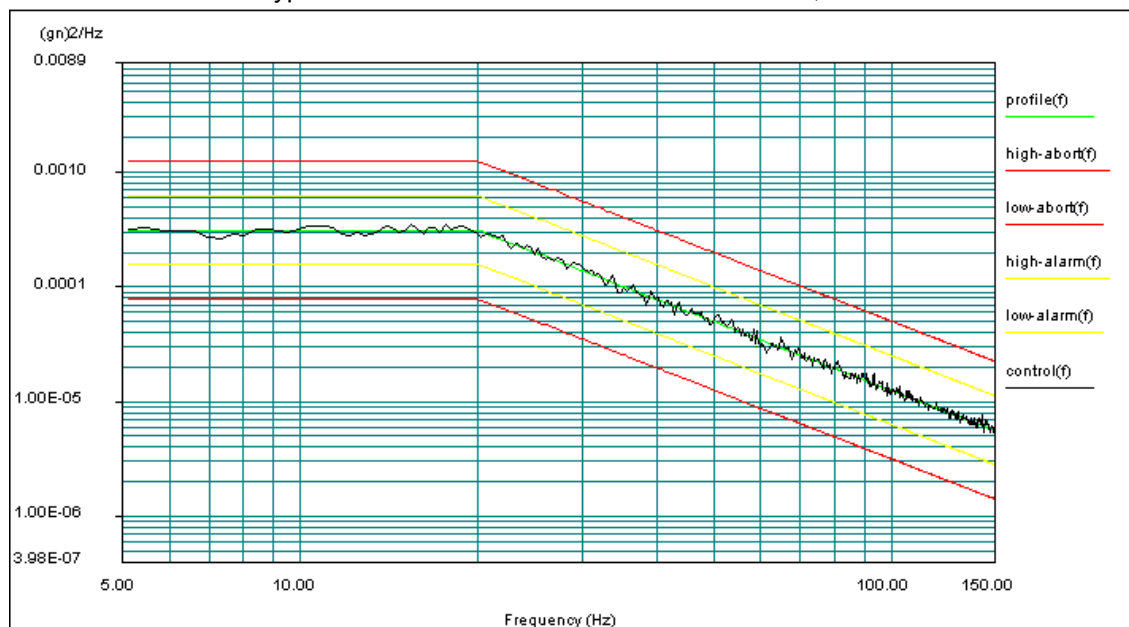
Data saved at 08:42:30 AM, Tuesday, July 30, 2013

Fig. 09: Random Vibration Testing data of Y Axis

DC/DC Converter

Project File Name: IEC61373Z-op.prj

Profile Name: Z-Axis Test Type: Random Run Folder: .\RunDefault Jul 26, 2013 09-43-30



Level: 100 %

Control RMS: 0.109799 gn Full Level Elapsed Time: 00:10:00 Lines: 400 Frame Time: 2.730667 Seconds

Demand RMS: 0.100526 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

Data saved at 09:57:01 AM, Friday, July 26, 2013

Fig. 10: Random Vibration Testing data of Z Axis

4.5 Increased Vibration Test

4.5.1 Instrument

Instrument	Manufacturer	Model	Serial No.
U-D vibration machine	N/A	TA240D-208/CSTA.	N/A
Control System	LDS DACTRON ONTROLLER.	N/A	N/A
Control Accelerometer	DYTRAN	3055B2, sensitivity: 99.01 mv/g.	N/A

4.5.2 Test Ambience

Temperature : $29^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Humidity : $65\% \pm 5\%(\text{RH})$

4.5.3 Specimen & Model Quantity

Specimen : DC/DC Converter

Model : TEN 40-7225WIRz1z1z1z1z1z1z1z1 (Serial models were shown as in page 5)

Quantity : 1 set

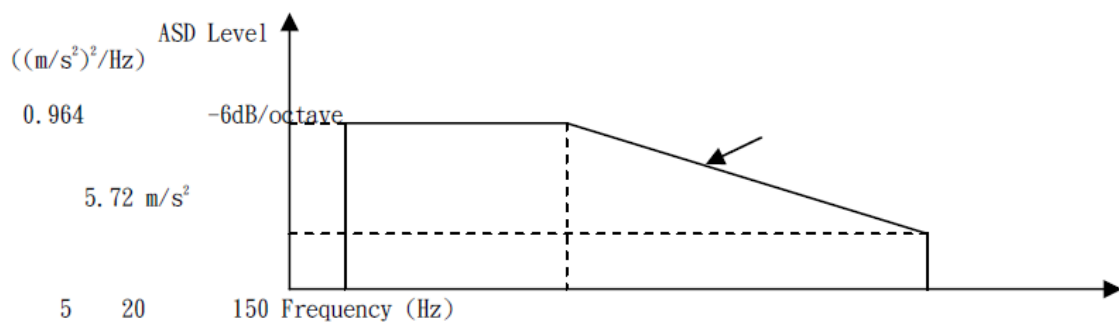
4.5.4 Test Condition

Frequency Range : 5Hz~150Hz,

G_{rms} value : Vertical (Z-Axis), Transverse (Y-Axis) and Longitudinal 5.72 m/s^2 ($0.584 G_{\text{rms}}$),

Duration : 5 hours/axis .

Power Spectrum Density shown as follow:



PSD of Vertical (Z-Axis)

4.5.5 Test Result

PASS.

1. Test configurations were shown in Fig.5~Fig.7.
2. The testing data were shown in Fig.11~Fig.13.
3. Test specimen was visually inspected after test. No external physical damage was noted.
4. The function of specimen was normal after the Increased Random Vibration Test.
5. According Test Result, the DC/DC Converter pass EN 50155 (refer to EN 61373:2010 Category 1 Class B) Increased Random Vibration Test.



Fig.5: Vibration and Shock Test in X Axis



Fig. 6: Vibration and Shock Test in Y Axis

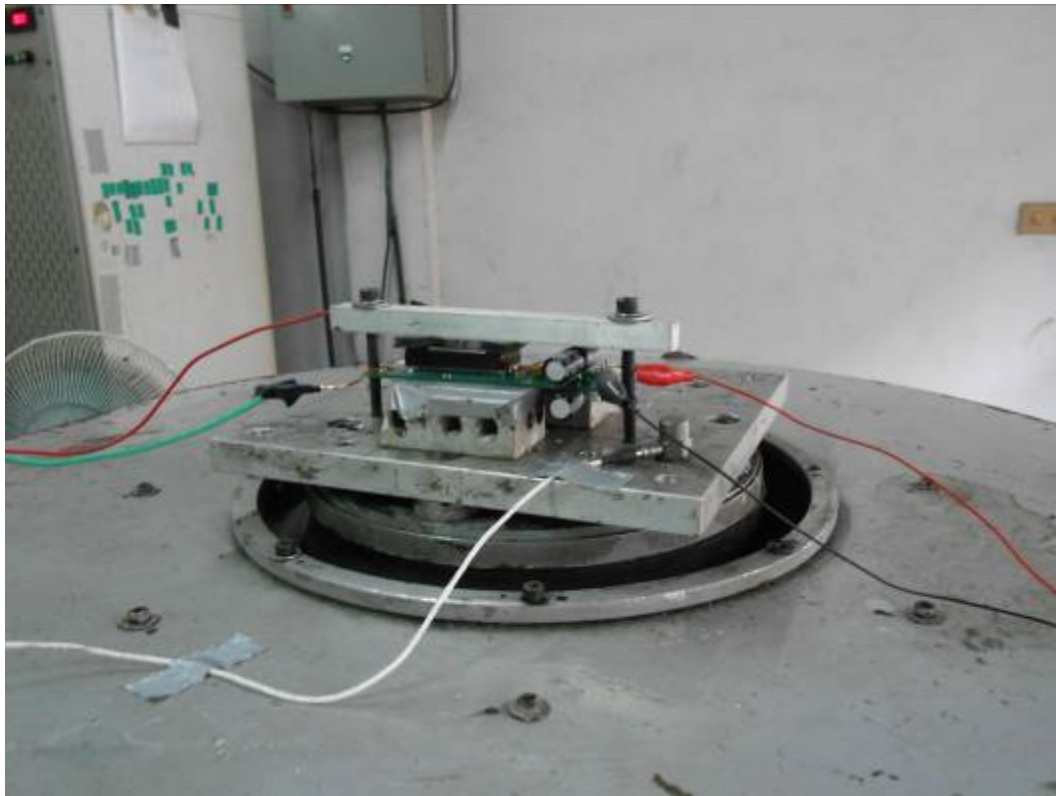
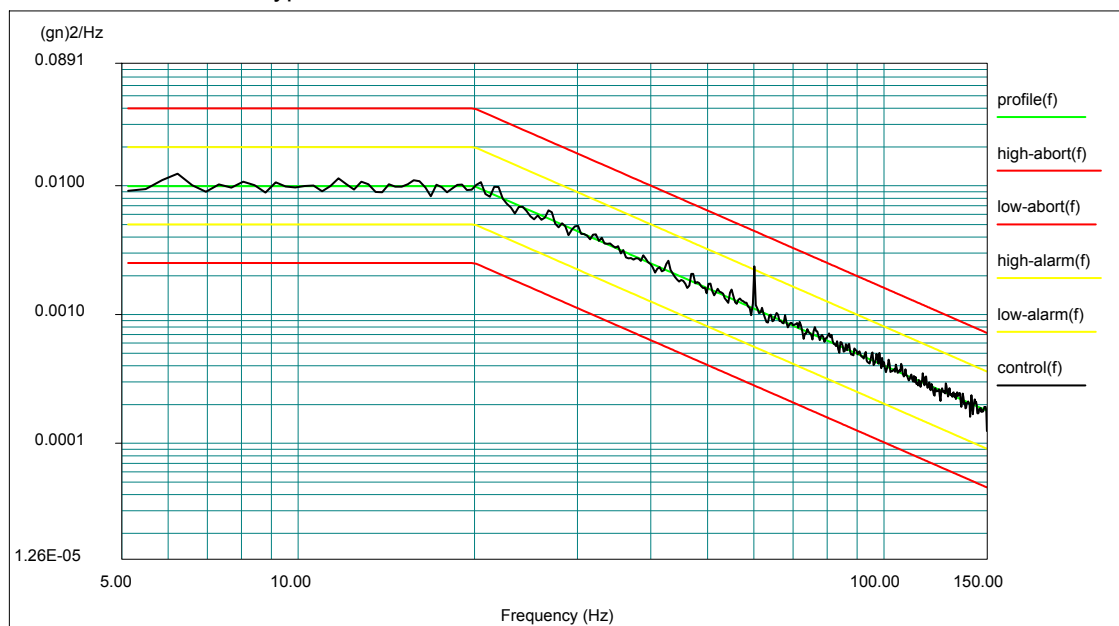


Fig. 7: Vibration and Shock Test in Z Axis

DC/DC Converter

Project File Name: IEC61373X-nop(2010-1B)(RANDOM).prj

Profile Name: X-Axis Test Type: Random Run Folder: .\RunDefault Jul 29, 2013 13-19-38



Level: 100 %

Control RMS: 0.571043 gn Full Level Elapsed Time: 05:00:00 Lines: 200 Frame Time: 2.730667 Seconds

Demand RMS: 0.570746 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

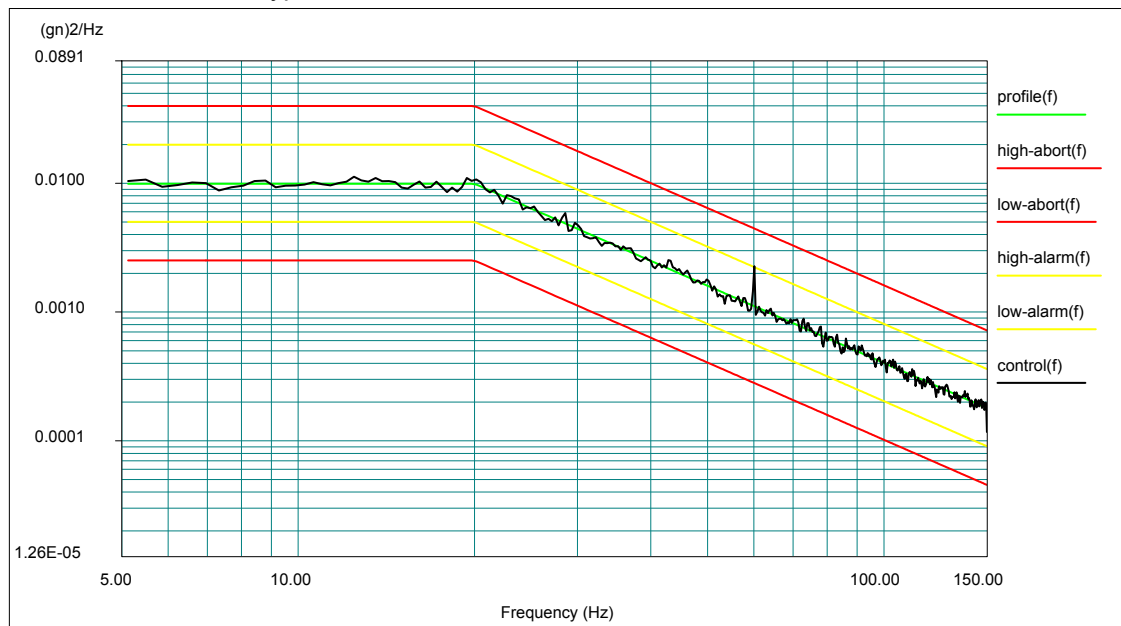
Data saved at 06:22:34 PM, Monday, July 29, 2013

Fig. 11: Increased Random Vibration Testing data of X Axis

DC/DC Converter

Project File Name: IEC61373X-nop(2010-1B)(RANDOM).prj

Profile Name: Y-Axis Test Type: Random Run Folder: .\RunDefault Jul 30, 2013 08-46-44



Level: 100 %

Control RMS: 0.570366 gn Full Level Elapsed Time: 05:00:00 Lines: 200 Frame Time: 2.730667 Seconds

Demand RMS: 0.570746gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

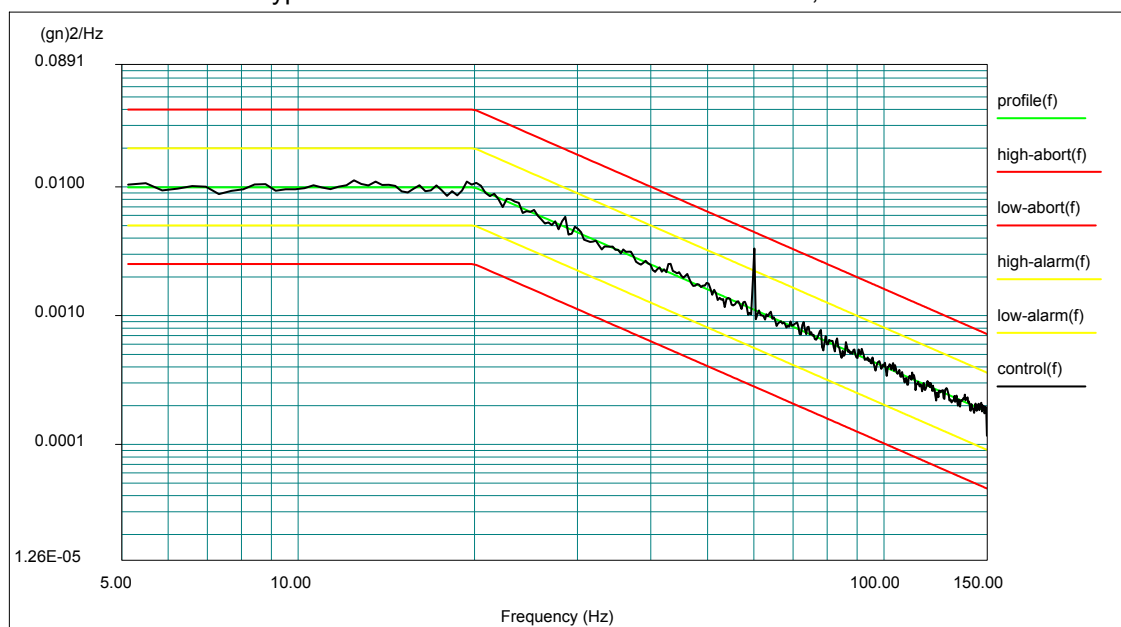
Data saved at 01:54:15 PM, Tuesday, July 30, 2013

Fig. 12: Increased Random Vibration Testing data of Y Axis

DC/DC Converter

Project File Name: IEC61373Z-nop(2010-1B).prj

Profile Name: Z-Axis Test Type: Random Run Folder: .\RunDefault Jul 26, 2013 10-03-55



Level: 100 %

Control RMS: 0.570907 gn Full Level Elapsed Time: 05:00:00 Lines: 400 Frame Time: 2.730667 Seconds

Demand RMS: 0.570746 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

Data saved at 03:06:05 PM, Friday, July 26, 2013

Fig. 13: Increased Random Vibration Testing data of Z Axis

4.6 Shock Test

4.6.1 Instrument

Instrument	Manufacturer	Model	Serial No.
U-D vibration machine	N/A	TA240D-208/CSTA.	N/A
Control System	LDS DACTRON CONTROLLER.	N/A	N/A
Accelerometer	DYTRAN	3055B2, sensitivity:99.01 mv/g.	N/A

4.6.2 Test Ambience

Temperature : 29°C ± 3°C

Humidity : 65% ± 5%(RH)

4.6.3 Specimen & Model Quantity

Specimen : DC/DC Converter

Model : TEN 40-7225WIRz1z1z1z1z1z1z1 (Serial models were shown as in page 5)

Quantity : 1 set

4.6.4 Test Condition

Wave Form : Half Sine Wave

Acceleration Peak : Vertical(Z), Transverse(Y) and Longitudinal(X), 50m/s² (5.1020 G).

Duration : 30ms

Shock Times : 3 times for each direction, 6 directions, 18 times in total.

4.6.5 Test Result

1. Test configurations were shown in Fig.5~Fig.7.
2. The testing data were shown in Fig.14~Fig.19.
3. Test specimen was visually inspected after test. No external physical damage was noted.
4. The function of specimen was normal during and after the shock test.
5. According Test Result, the DC/DC Converter pass EN 50155 (refer to EN 61373:2010 Category 1 Class B) Shock Test.



Fig.5: Vibration and Shock Test in X Axis

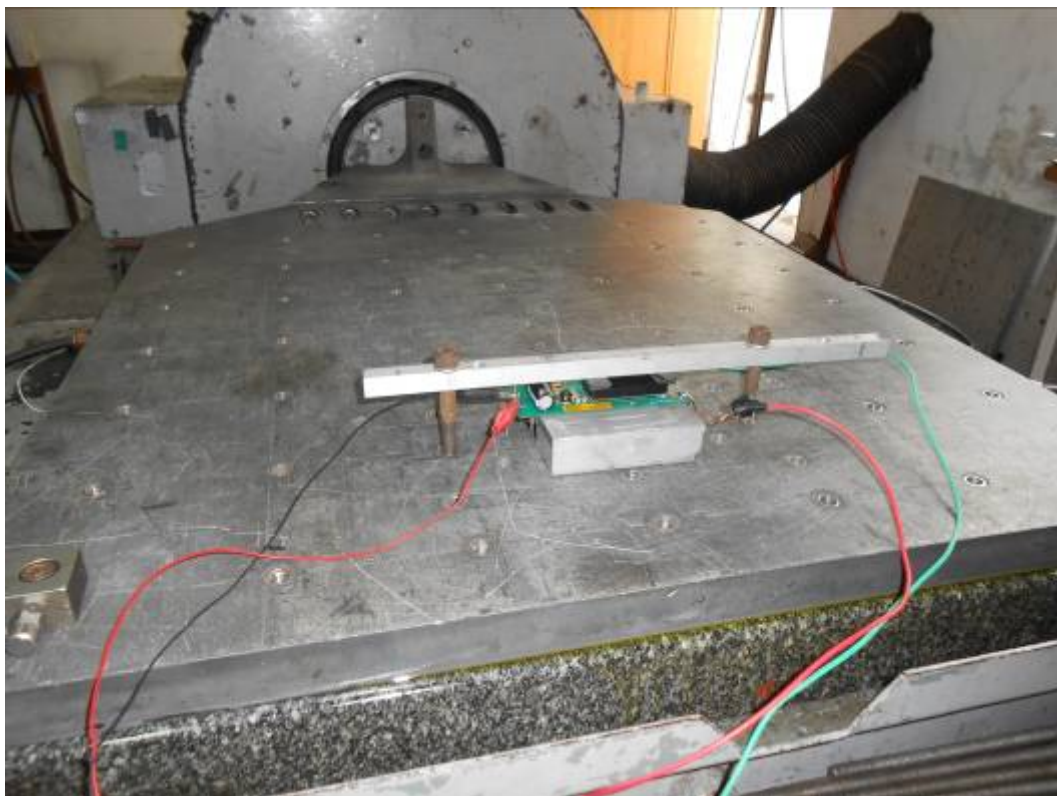


Fig. 6: Vibration and Shock Test in Y Axis

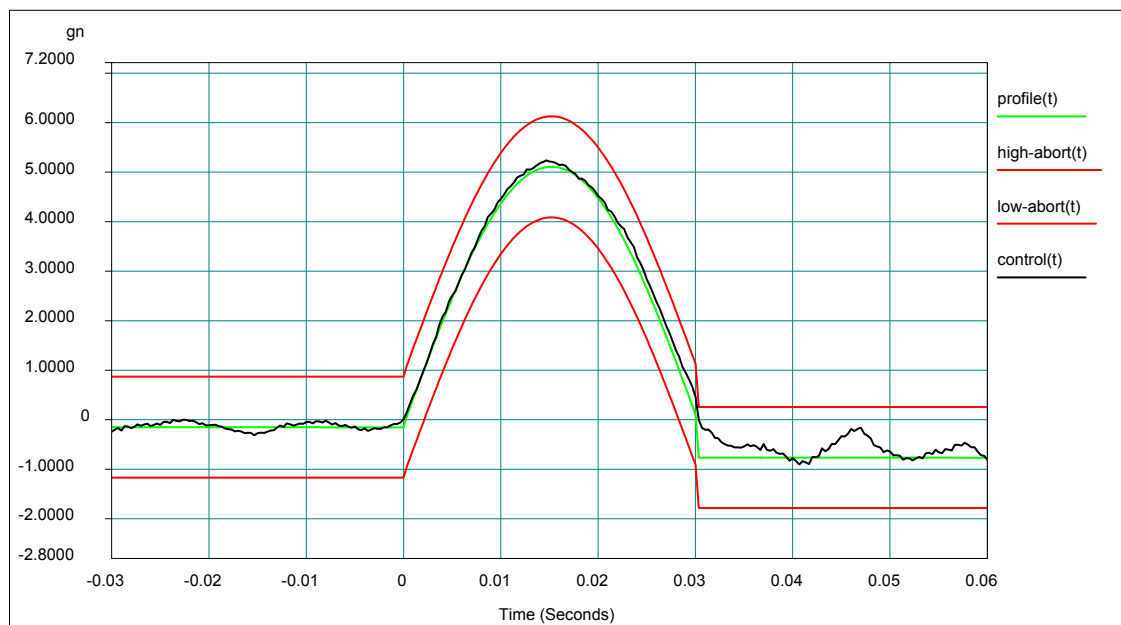


Fig. 7: Vibration and Shock Test in Z Axis

DC/DC Converter

Project File Name: IEC61373Sk(X).prj

Profile Name: +X-Axis Test Type: Classical Shock Run Folder: .\RunDefault Jul 29, 2013 10-13-01



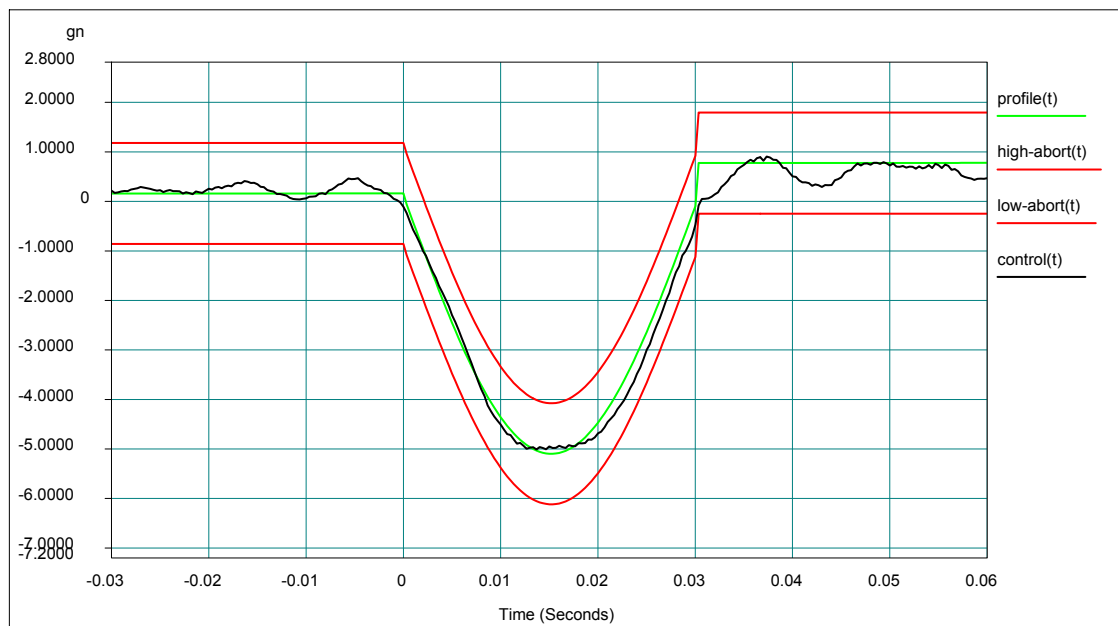
Level: 100 % Block Size: 4096 Elapsed Pulses: 15
Frame Time: 1.365333 Seconds Control Peak: 5.227770 gn Full Level Elapsed Pulses: 3
dT: 0.000333 Seconds Demand Peak: 5.100000 gn Remaining Pulses: 0
Pulse Type: Half Sine Amplitude: 5.100000 gn
Data saved at 10:13:38 AM, Monday, July 29, 2013

Fig. 14: Shock Testing Data of +X Axis

DC/DC Converter

Project File Name: IEC61373Sk(X).prj

Profile Name: -X-Axis Test Type: Classical Shock Run Folder: .\RunDefault Jul 29, 2013 10-14-24



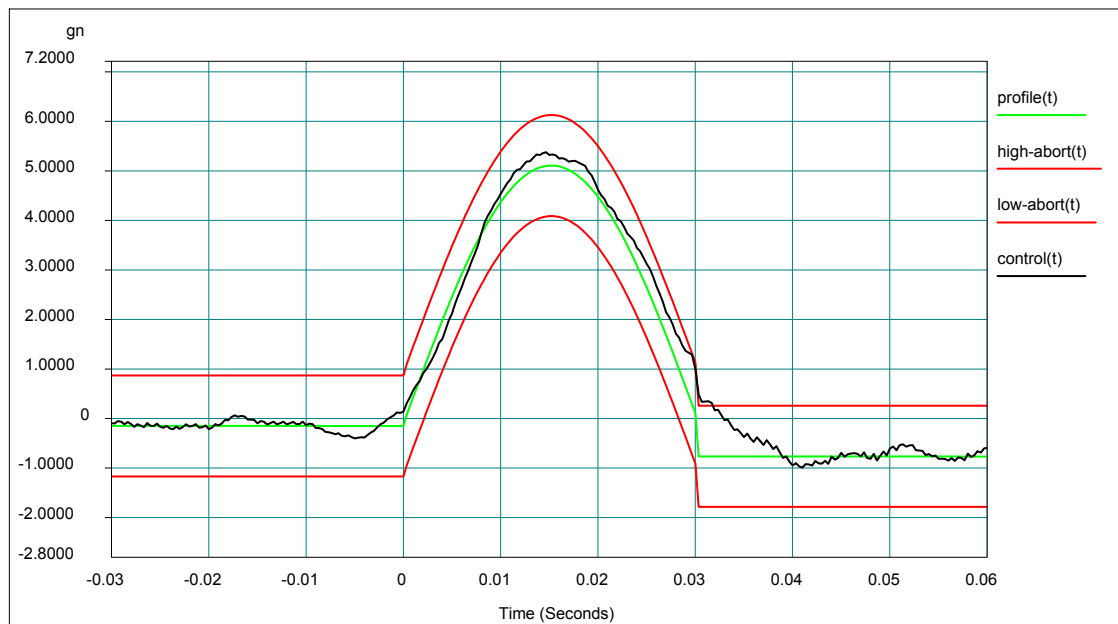
Level: 100 % Block Size: 4096 Elapsed Pulses: 15
Frame Time: 1.365333 Seconds Control Peak: 5.012075 gn Full Level Elapsed Pulses: 3
dT: 0.000333 Seconds Demand Peak: 5.100000 gn Remaining Pulses: 0
Pulse Type: Half Sine Amplitude: 5.100000 gn
Data saved at 10:14:58 AM, Monday, July 29, 2013

Fig. 15: Shock Testing Data of -X Axis

DC/DC Converter

Project File Name: IEC61373Sk(X).prj

Profile Name: +Y-Axis Test Type: Classical Shock Run Folder: .\RunDefault Jul 30, 2013 08-44-00



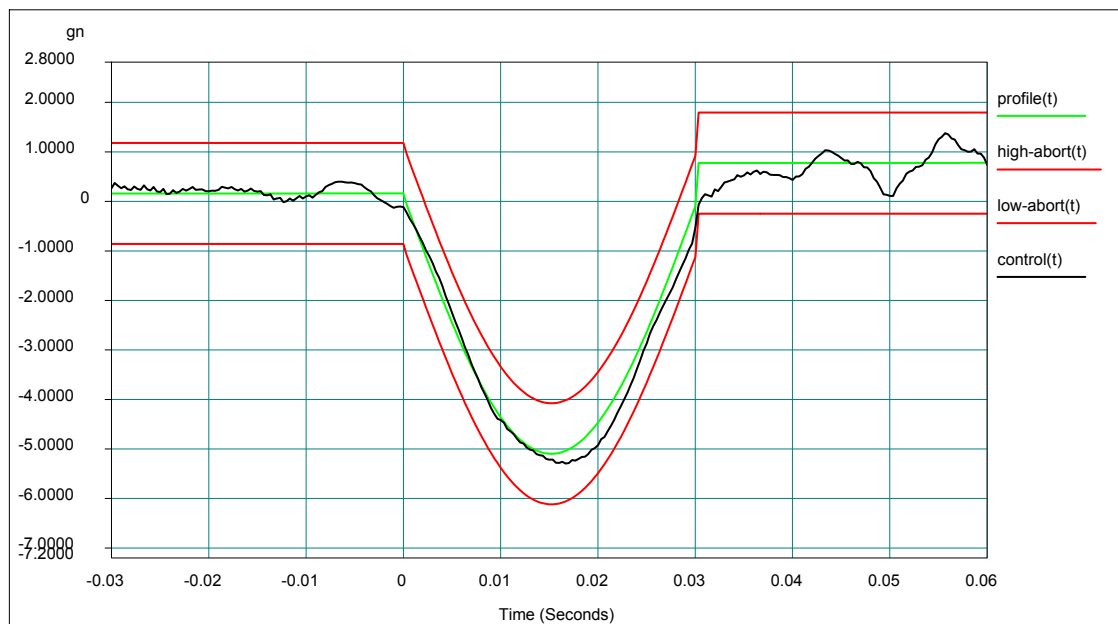
Level: 100 % Block Size: 4096 Elapsed Pulses: 15
Frame Time: 1.365333 Seconds Control Peak: 5.367365 gn Full Level Elapsed Pulses: 3
dT: 0.000333 Seconds Demand Peak: 5.100000 gn Remaining Pulses: 0
Pulse Type: Half Sine Amplitude: 5.100000 gn
Data saved at 08:44:36 AM, Tuesday, July 30, 2013

Fig. 16: Shock Testing Data of +Y Axis

DC/DC Converter

Project File Name: IEC61373Sk(X).prj

Profile Name: -Y-Axis Test Type: Classical Shock Run Folder: .\RunDefault Jul 30, 2013 08-45-10



Level: 100 % Block Size: 4096 Elapsed Pulses: 15

Frame Time: 1.365333 Seconds Control Peak: 5.296674 gn Full Level Elapsed Pulses: 3

dT: 0.000333 Seconds Demand Peak: 5.100000 gn Remaining Pulses: 0

Pulse Type: Half Sine Amplitude: 5.100000 gn

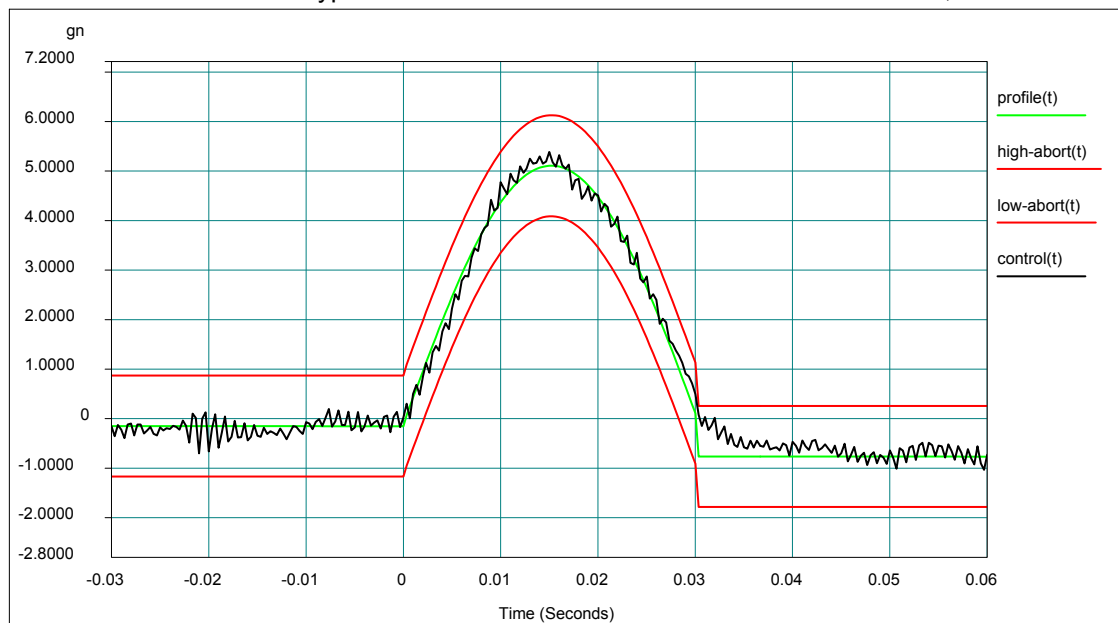
Data saved at 08:45:45 AM, Tuesday, July 30, 2013

Fig. 17: Shock Testing Data of -Y Axis

DC/DC Converter

Project File Name: IEC61373Sk(X)(SHOCK).prj

Profile Name: +Z-Axis Test Type: Classical Shock Run Folder: .\RunDefault Jul 26, 2013 15-08-12



Level: 100 % Block Size: 4096 Elapsed Pulses: 15

Frame Time: 1.365333 Seconds Control Peak: 5.378696gn Full Level Elapsed Pulses: 3

dT: 0.000333 Seconds Demand Peak: 5.100000 gn Remaining Pulses: 0

Pulse Type: Half Sine Amplitude: 5.100000 gn

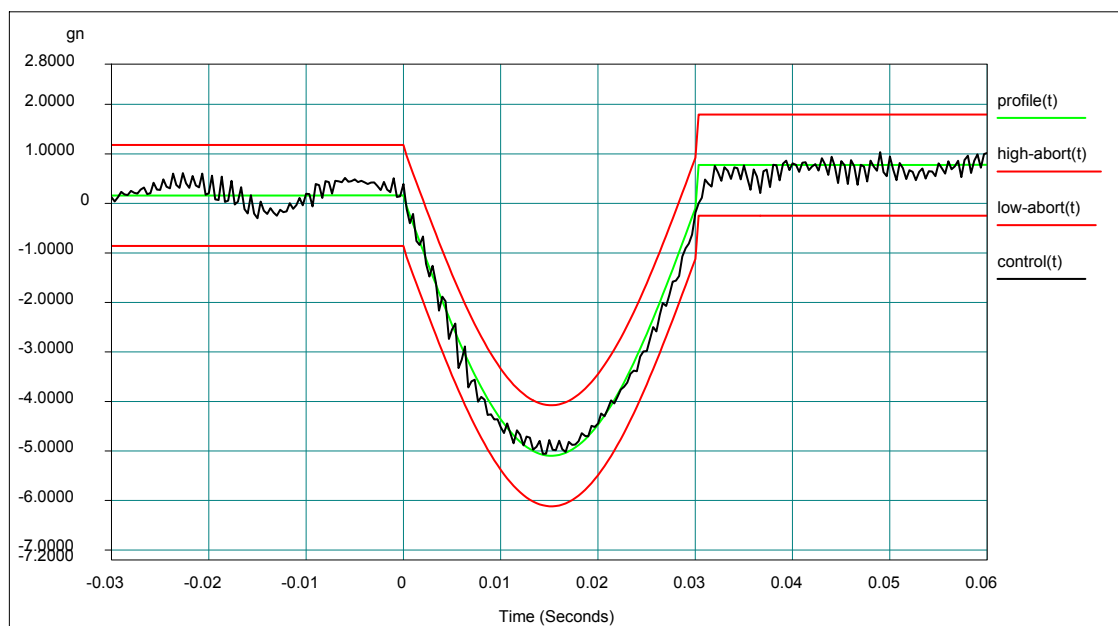
Data saved at 03:08:48 PM, Friday, July 26, 2013

Fig. 18: Shock Testing Data of +Z Axis

DC/DC Converter

Project File Name: IEC61373Sk(X)(SHOCK).prj

Profile Name: -Z-Axis Test Type: Classical Shock Run Folder: .\RunDefault Jul 26, 2013 15-09-24



Level: 100 % Block Size: 4096 Elapsed Pulses: 15

Frame Time: 1.365333 Seconds Control Peak: 5.060715 gn Full Level Elapsed Pulses: 3

dT: 0.000333 Seconds Demand Peak: 5.100000 gn Remaining Pulses: 0

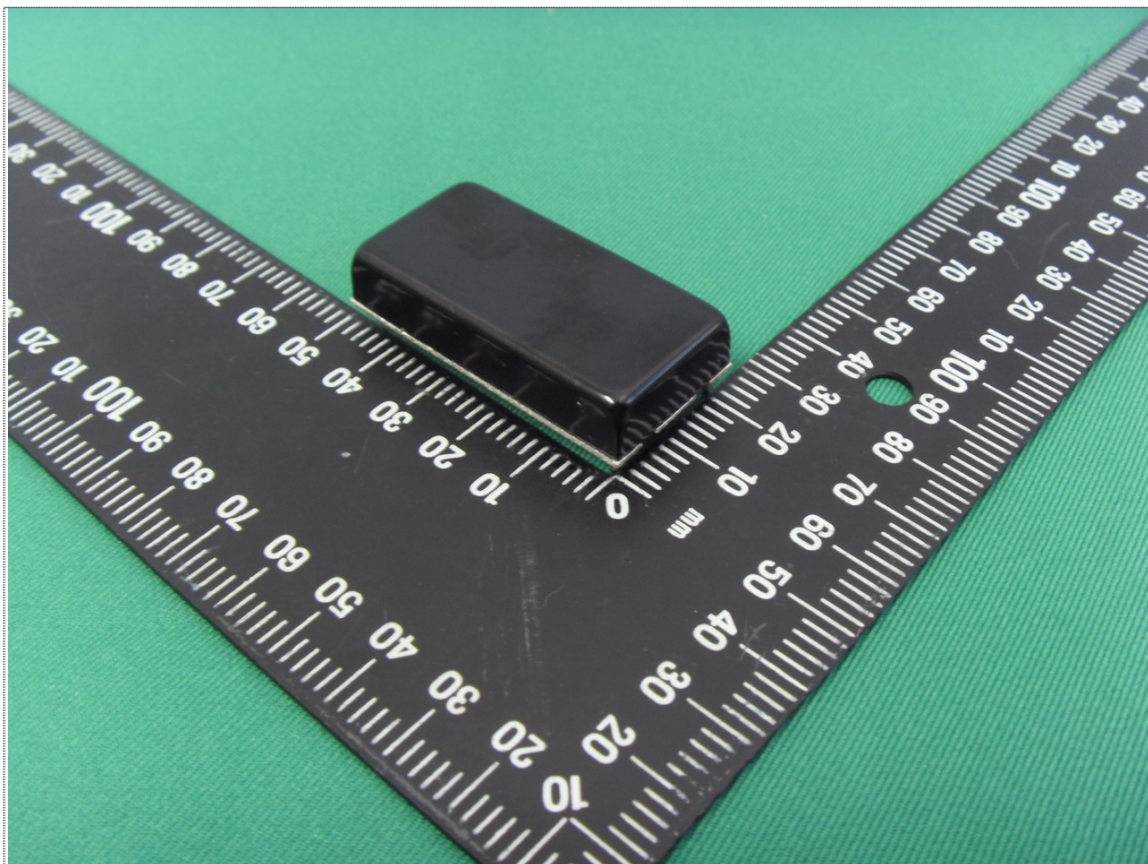
Pulse Type: Half Sine Amplitude: 5.100000 gn

Data saved at 03:10:00 PM, Friday, July 26, 2013

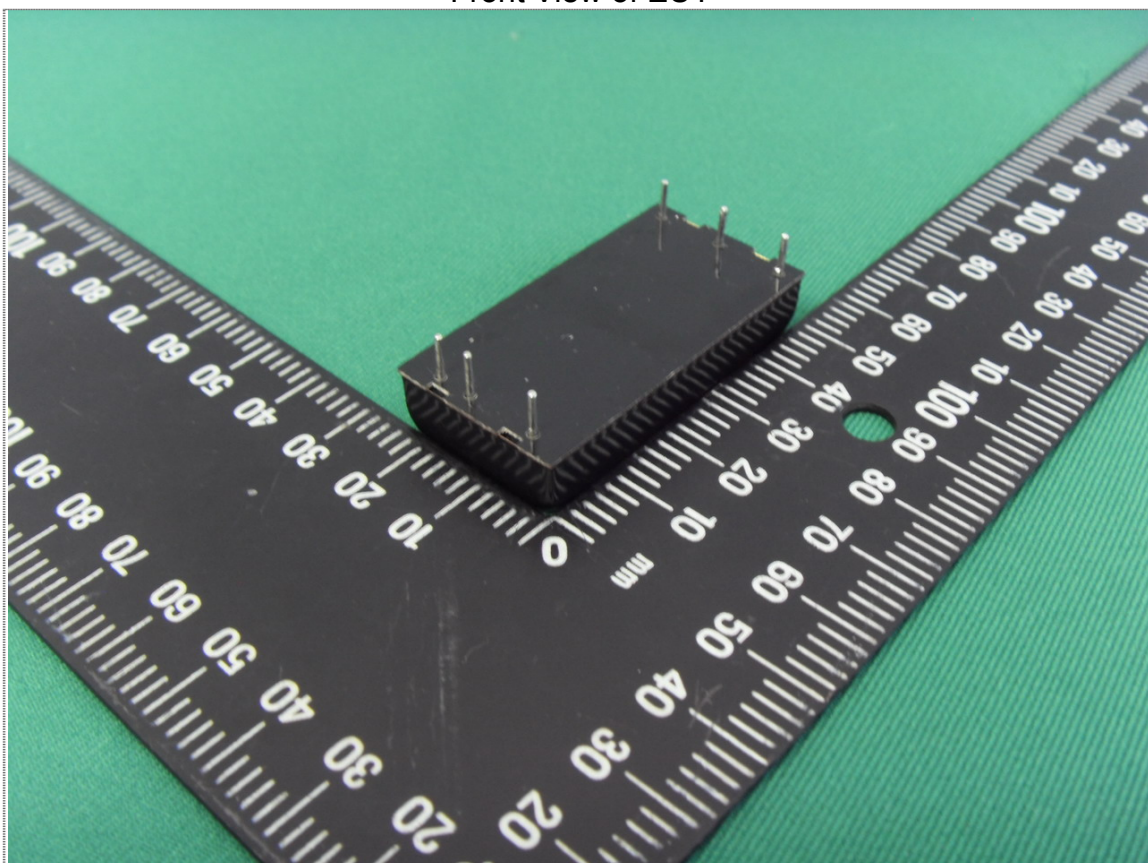
Fig. 19: Shock Testing Data of -Z Axis

5 Photographs of EUT

5.1 Model Number: TEN 40-7225WIRz1z1z1z1z1z1z1



Front View of EUT



Rear View of EUT