

Test Report

EN 50155: 2007

(EMC, Characteristic, Environmental...Test)

Product: **DC/DC Converter**

Trade Name:

**TRACO[®]
POWER**

Model Number: TEN 20-2410WIR; TEN 20-2411WIR; TEN 20-2412WIR;
TEN 20-2413WIR; TEN 20-2422WIR; TEN 20-2423WIR;
TEN 20-4810WIR; TEN 20-4811WIR; TEN 20-4812WIR;
TEN 20-4813WIR; TEN 20-4822WIR; TEN 20-4823WIR;
TEN 20-7210WIR; TEN 20-7211WIR; TEN 20-7212WIR;
TEN 20-7213WIR; TEN 20-7222WIR; TEN 20-7223WIR

Prepared for

TRACO ELECTRONIC Co. Ltd

Jenatschstrasse 1, CH-8002 Zurich, 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 Co. Ltd
Manufacturer: TRACO ELECTRONIC Co. Ltd
Product: DC/DC Converter
Model No.: TEN 20-2410WIR; TEN 20-2411WIR; TEN 20-2412WIR;
TEN 20-2413WIR; TEN 20-2422WIR; TEN 20-2423WIR;
TEN 20-4810WIR; TEN 20-4811WIR; TEN 20-4812WIR;
TEN 20-4813WIR; TEN 20-4822WIR; TEN 20-4823WIR;
TEN 20-7210WIR; TEN 20-7211WIR; TEN 20-7212WIR;
TEN 20-7213WIR; TEN 20-7222WIR; TEN 20-7223WIR
Tested Power Supply: DC 24V; DC 48V; DC 110V
Date of Final Test: Apr. 03, 2012
Revision of Report: Rev. 03

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: 1999 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 subject to the test sample only.

Report Issued : 2015/03/06

Project Engineer : Victor chen
Victor Chen

Approved : Gimmy Tsai
Gimmy Tsai

1 General Information

1.1 Ordering Product Information

Product	: DC/DC Converter
Model Number	: TEN 20-2410WIR; TEN 20-2411WIR; TEN 20-2412WIR; TEN 20-2413WIR; TEN 20-2422WIR; TEN 20-2423WIR; TEN 20-4810WIR; TEN 20-4811WIR; TEN 20-4812WIR; TEN 20-4813WIR; TEN 20-4822WIR; TEN 20-4823WIR; TEN 20-7210WIR; TEN 20-7211WIR; TEN 20-7212WIR; TEN 20-7213WIR; TEN 20-7222WIR; TEN 20-7223WIR
Applicant	: TRACO ELECTRONIC Co. Ltd Jenatschstrasse 1, CH-8002 Zurich, Switzerland
Manufacturer	: TRACO ELECTRONIC Co. Ltd Jenatschstrasse 1, CH-8002 Zurich, Switzerland
Date of Test	: Sep. 19 ~ Sep. 28, 2011 (For EMC Test) Apr. 02 ~ 03, 2012 (For Environmental Test)
Additional Description	: 1) The Model Numbers " TEN 20-2423WIR; TEN 20-4822WIR; TEN 20-7210WIR; TEN 20-7223WIR " are represented and selected for the test that included in this report. 2) The difference for all models include in this report are only Model No. and Specifications, the rest parts are identical. The detail specification, please see "Specifications Description" as below page.

1.2 Specifications Description

Model Number	Input Range (VDC)	Full load Input current (A)	Output Voltage (VDC)	Full Load (mA)
TEN 20-2410WIR	9 - 36	1.94	3.3	4500
TEN 20-2411WIR	9 - 36	2.53	5	4000
TEN 20-2412WIR	9 - 36	2.50	12	1670
TEN 20-2413WIR	9 - 36	2.52	15	1330
TEN 20-2422WIR	9 - 36	2.52	± 12	± 833
TEN 20-2423WIR	9 - 36	2.50	± 15	± 667
TEN 20-4810WIR	18 - 75	0.97	3.3	4500
TEN 20-4811WIR	18 - 75	1.26	5	4000
TEN 20-4812WIR	18 - 75	1.25	12	1670
TEN 20-4813WIR	18 - 75	1.25	15	1330
TEN 20-4822WIR	18 - 75	1.26	± 12	± 833
TEN 20-4823WIR	18 - 75	1.25	± 15	± 667
TEN 20-7210WIR	43 - 160	0.41	3.3	4500
TEN 20-7211WIR	43 - 160	0.53	5	4000
TEN 20-7212WIR	43 - 160	0.53	12	1670
TEN 20-7213WIR	43 - 160	0.52	15	1330
TEN 20-7222WIR	43 - 160	0.53	± 12	± 833
TEN 20-7223WIR	43 - 160	0.52	± 15	± 667

1.3 Summary of Test Results

Item	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	-	Applicable
2.4	Performance (Supply Change Over)	12.2.2 5.1.3	-	Applicable
2.5	Insulation Test	12.2.9	-	Applicable
3	Electromagnetic Compatibility (EMC)			
3.1	Supply Overvoltages	12.2.6	-	Applicable
3.2	Surges Test	12.2.7.1	EN 50121-3-2 EN 61000-4-5	Applicable
3.3	Electrostatic Discharge Test	12.2.7.2	EN 50121-3-2 EN 61000-4-2	Applicable
3.4	Transient Burst Susceptibility Test	12.2.7.3	EN 50121-3-2 EN 61000-4-4	Applicable
3.5	Radio- Frequency, Electromagnetic Field Immunity Test	12.2.8.1	EN 50121-3-2 EN 61000-4-3	Applicable
3.6	Radio- Frequency, Conducted Disturbances Immunity Test	12.2.8.1	EN 50121-3-2 EN 61000-4-6	Applicable
3.7	Power Line Conducted Emission Measurement	12.2.8.2	EN 50121-3-2 EN 55011	Applicable
3.8	Radiated Emission Measurement	12.2.8.2	EN 50121-3-2 EN 55011	Applicable
4	Environmental Tests			
4.1	Cooling 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, Cyclic	12.2.5	EN 60068-2-30	Applicable
4.4	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

1.4 Details of Tested Supporting System

1.4.1 Test Cable

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

1.5 Test Facility

- Site Description** : ☑Conducted 2 ☑OATS 1 ☑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** :
- Federal Communication Commissions – USA
Registration No.: 96399 (OATS 1, 2, 3 & Chamber 3)
Designation No.: TW1020
 - Industry Canada (IC)
OUR FILE: 46405-4437
Registration No. (OATS 1): Site# 4437A-1
Registration No. (OATS 3): Site# 4437A-3
Registration No. (Chamber 3): Site# 4437A-5
Registration No. (OATS 5): Site# 4437A-6
 - 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
- Site Accreditation** :
- Bureau of Standards and Metrology and Inspection (BSMI) – Taiwan, R.O.C.
Accreditation No.:
SL2-IN-E-0026 for CNS13438 / CISPR 22
SL2-IN-E-0026 for CNS14757-2 / IEC 62040-2
SL2-R1-E-0026 for CNS13439 / CISPR 13
SL2-R2-E-0026 for CNS13439 / CISPR 13
SL2-A1-E-0026 for CNS13783-1 / CISPR 14-1
SL2-L1-E-0026 for CNS 14115 / CISPR 15
 - Taiwan Accreditation Foundation (TAF)
Accreditation No.: 1113
 - Vehicle Safety Certification Center (VSCC)
Approval No.: TW16-11-0
 - TÜV NORD
Certificate No: TNTW0801R-04
 - Nemko
Authorisation No: ELA 181

1.6 Measurement Uncertainty

No.	Item	Value
1	Power Line Conducted Emission (Conduction 1)	2.4 dB
2	Power Line Conducted Emission (Conduction 2)	2.4 dB
3	Disturbance Power Emission (Conduction 2)	3.1 dB
4	Click disturbances Emission (Conduction 2)	2.4 dB
5	Radiated Electromagnetic disturbance (Loop Antenna)	4.8 dB
6	Radiated Emission Test (OATS 1)	4.2 dB
7	Radiated Emission Test (OATS 2)	4.2 dB
8	Radiated Emission Test (OATS 3)	4.2 dB
9	Radiated Emission Test (OATS 4)	4.2 dB
10	Radiated Emission Test (1GHz to 18GHz)	3.2 dB
11	Radiated Emission Test (18GHz to 40GHz)	3.4 dB
12	Conducted Immunity Test (CDN-M2)	1.3 dB
13	Conducted Immunity Test (CDN-M3)	1.3 dB
14	Conducted Immunity Test (EM Clamp)	3.2 dB

1.7 Measured Mode

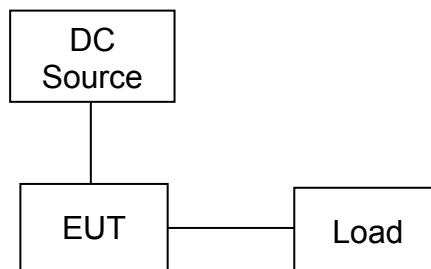
1.7.1 The test modes for preliminary test are as following:

- Mode 1: FULL LOAD (TEN 20-2423WIR) (DC 24V)
- Mode 2: FULL LOAD (TEN 20-4822WIR) (DC 48V)
- Mode 3: FULL LOAD (TEN 20-7210WIR) (DC 110V)
- Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

1.7.2 After preliminary test, EUT was selected the worse case for the final testing:

- Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

1.8 Configuration of EUT Setup



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

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

2.1.2 Test Procedure

Test Procedures were referred to EN 50155 sub-clause 12.2.1

2.1.3 Inspection Result

Pass.

2.2 Performance (Supply Variations)

2.2.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Arbitrary Waveforms Test System	SCHAFFNER	NSG5600	560-0030	2011/11/30
Module Test System	SCHAFFNER	NSG5500	550-0030	2011/11/30
Power Amplifier	SCHAFFNER	PA5840-75	581-0010	2011/11/30

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 Procedure

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

2.2.4 Test Result

Temperature: 24.6 °C ; Humidity: 53 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

Mode 4: FULL LOAD (TEN 20-7223WIR) (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
Arbitrary Waveforms Test System	SCHAFFNER	NSG5600	560-0030	2011/11/30
Module Test System	SCHAFFNER	NSG5500	550-0030	2011/11/30
Power Amplifier	SCHAFFNER	PA5840-75	581-0010	2011/11/30

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 Procedure

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

2.3.4 Test Result

Temperature: 24.6 °C ; Humidity: 53 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

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
Arbitrary Waveforms Test System	SCHAFFNER	NSG5600	560-0030	2011/11/30
Module Test System	SCHAFFNER	NSG5500	550-0030	2011/11/30
Power Amplifier	SCHAFFNER	PA5840-75	581-0010	2011/11/30

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 Procedure

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

2.4.4 Test Result

Temperature: 24.6 °C ; Humidity: 53 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

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	2012/12/22

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 Procedure

Test Procedures were referred to EN 50155 sub-clause 12.2.9

2.5.4 Test Result

Temperature: 28.5 °C ; Humidity: 44 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

1. Initial Insulation measurement Test: 500VDC

Test Item	Insulation measurement test (Before)	Resistance	Insulation measurement test (After)	Resistance
Input(+) to Input(-)	>1M	Ω	>1M	Ω

2. Voltage withstand test: 1400VDC

Test was performed after initial insulation measurement

Test Item	Current	Result
Input(+) to Input(-)	>7.5 mA	PASS

3 Electromagnetic Compatibility (EMC)

3.1 Supply Overvoltages

3.1.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Arbitrary Waveforms Test System	SCHAFFNER	NSG5600	560-0030	2011/11/30
Module Test System	SCHAFFNER	NSG5500	550-0030	2011/11/30
Power Amplifier	SCHAFFNER	PA5840-75	581-0010	2011/11/30

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

3.1.2 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

3.1.3 Test Procedure

Test Procedures were referred to EN 50155 sub-clause 12.2.6

3.1.4 Test Result

Temperature: 24.6 °C ; Humidity: 53 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

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

3.2 Surges Test

3.2.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
EMC Pro Systems	KeyTek	EMC Pro	0003234	2012/03/20

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

3.2.2 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: $\pm 1.0\text{kV}$ (42Ω , $0.5\mu\text{F}$), $1.2/50$ (8/20) Tr/Th μs

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

☒ Battery referenced ports.

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

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

Performance criterion: **B**

3.2.3 Test Procedure

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

3.2.4 Test Result

Temperature: 24.6 °C ; Humidity: 53 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

PASS.

Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

☒ $\pm 0.5\text{kV}$ (peak) Input DC power port: Line to line

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

☒ $\pm 1.0\text{kV}$ (peak) Input DC power port: Line to line

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

☒ $\pm 0.5\text{kV}$ (peak) Input DC power port: Line to earth (ground)

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

☒ $\pm 1.0\text{kV}$ (peak) Input DC power port: Line to earth (ground)

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

☒ $\pm 2.0\text{kV}$ (peak) Input DC power 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.

3.3 Electrostatic Discharge Test

3.3.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
ESD Simulator	EMC PARTNER	ESD3000	276	2012/02/15

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

3.3.2 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**

3.3.3 Test Procedure

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

3.3.4 Test Result

Temperature: 24.6 °C ; Humidity: 53 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

PASS.

Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

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) ± 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.

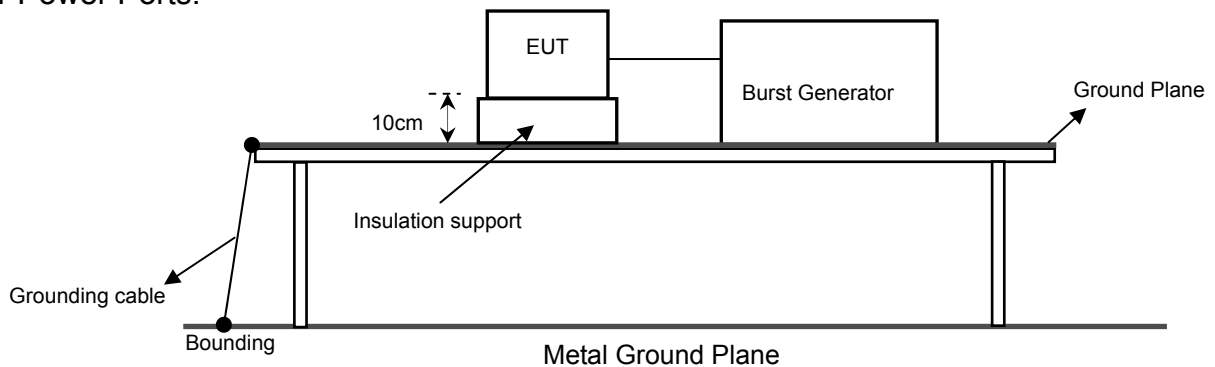
3.4 Transient Burst Susceptibility Test

3.4.1 Instrument

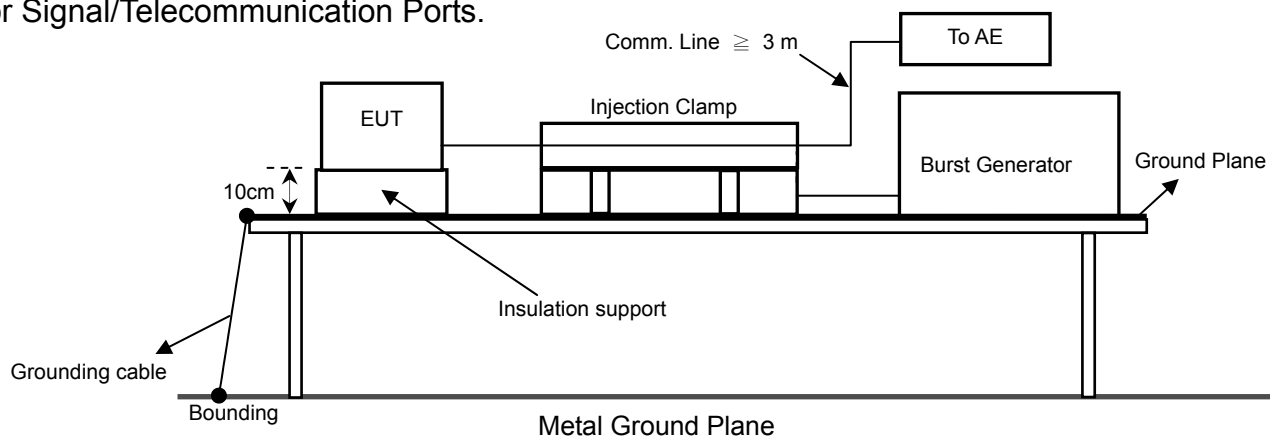
Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
EMC Pro System	KeyTek	EMC Pro	0003231	2012/04/14
Injection Clamp	KeyTek	PRO-CCL-C	0003198	N. C. R.

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

3.4.2 Block Diagram of Test Configuration For Power Ports.



For Signal/Telecommunication Ports.



3.4.3 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 ports.

☒ ± 2.0 kV Battery referenced ports.

☒ ± 2.0 kV Signal and control ports .

Performance criterion: **A**

3.4.4 Configuration of Measurement

3.4.5 The EUT and the auxiliary equipment were placed on a wooden table of 0.8 meters height. The size of ground plane is greater than 1m×1m and project beyond the EUT by at least 0.1m on all sides. The ground plane is connected to the protective earth.

3.4.6 The EUT was connected to the power mains through a coupling device that directly couples the EFT interference signal. Each of the Line, Neutral and Protective Earth (PE) conductors was impressed with burst noise for 1 minute. Both the voltage polarities were applied for each test level. The length of the signal and power lines between the coupling device and the EUT shall be 0,5m ± 0,05m.

3.4.7 Test Result

Temperature: 25.1 °C ; Humidity: 43 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

PASS.

Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

☒ ±2.0 kV Battery referenced port: Line + Neutral + PE

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, Electromagnetic Field Immunity Test

3.5.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Signal Generator	R&S	SM300	101279	2012/10/18
RF Power Amplifier	Frankonia	FLG-200B	1038	2012/02/20
RF Power Amplifier	Frankonia	FLG-50C	1013	2012/02/20
Bilog Antenna	Frankonia	BTA-M	06012M	2012/02/20

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 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**

3.5.3 Test Procedure

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

3.5.4 Test Result

Temperature: 23.9 °C ; Humidity: 48 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

PASS.

Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

- ☒ 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.

3.6 Radio- Frequency, Conducted Disturbances Immunity Test

3.6.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Signal Generator	R&S	SMY02	829846/013	2012/08/25
Power Amplifier	Frankonia	CIT-10	162D1278	2012/02/10
Attenuator	SCHAFFNER	ATN6075	22300	2012/02/10
C.D.N	FCC	FCC-801-M3-25A	2045	2012/02/10
C.D.N	SCHAFFNER	M216	16394	2012/02/10

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

3.6.2 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

3.6.3 Test Procedure

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

3.6.4 Test Result

Temperature: 25.9 °C ; Humidity: 49 % ; Atm pres: 101 Kpa ; Test Engineer: Bill

PASS.

Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

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.

3.7 Power Line Conducted Emission

3.7.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESCS30	100134	2012/08/16
RF Cable	HARBOUR	RG-58/U	CBL40	2011/11/10
L.I.S.N.	Schaffner	MN2050D	1597	2013/06/20
L.I.S.N.	Rohde & Schwarz	ESH3-Z5	829996/016	2013/01/02

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 5

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

3.7.3 Test Procedure

Test Procedures were referred to EN 55011 sub-clause 7

3.7.4 Test Result

PASS.

The final test data is shown on as following pages.

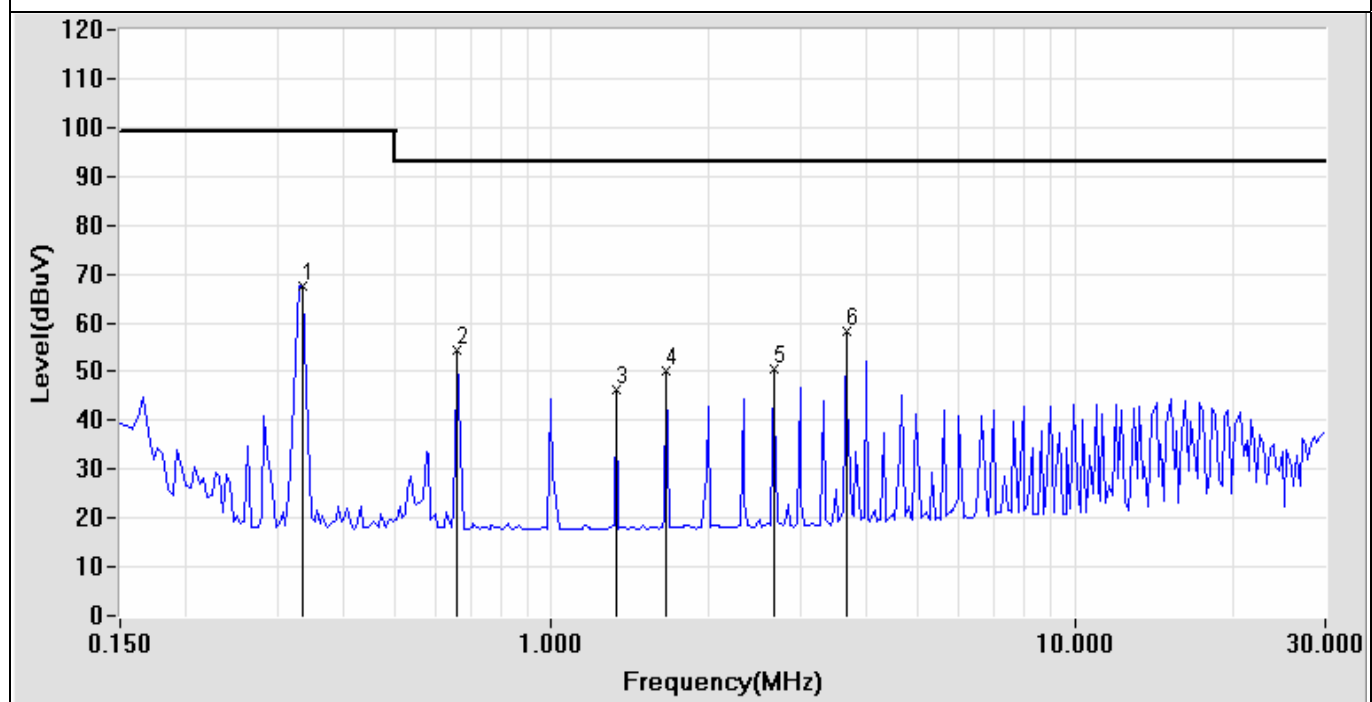
Power Line Conducted Test Data

EUT: DC/DC Converter	POLARITY: Line
CLIENT: TRACO ELECTRONIC Co. Ltd	DISTANCE:
MODEL: TEN 20-7223WIR	Serial No.:
RATING: DC 110V	FILE/DATA#: TRACO ELECTRONIC.emi/41
Temperature: 25.1 °C	OPERATOR: Alex
Humidity: 49 %	TEST SITE: Conduction 2

Frequency (MHz)	Factor (dB)	Meter Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)
		Quasi-Peak	Quasi-Peak	Quasi-Peak	Quasi-Peak
0.334	0.17	67.90	68.07	99.00	-30.93
0.662	0.17	53.16	53.33	93.00	-39.67
1.326	0.16	46.30	46.46	93.00	-46.54
1.658	0.15	48.57	48.72	93.00	-44.28
2.654	0.13	49.07	49.20	93.00	-43.80
3.646	0.19	58.50	58.69	93.00	-34.31

Remark:

1. All readings are Quasi-Peak values.
2. Factor = Insertion Loss + Cable Loss.



Test Mode: Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)

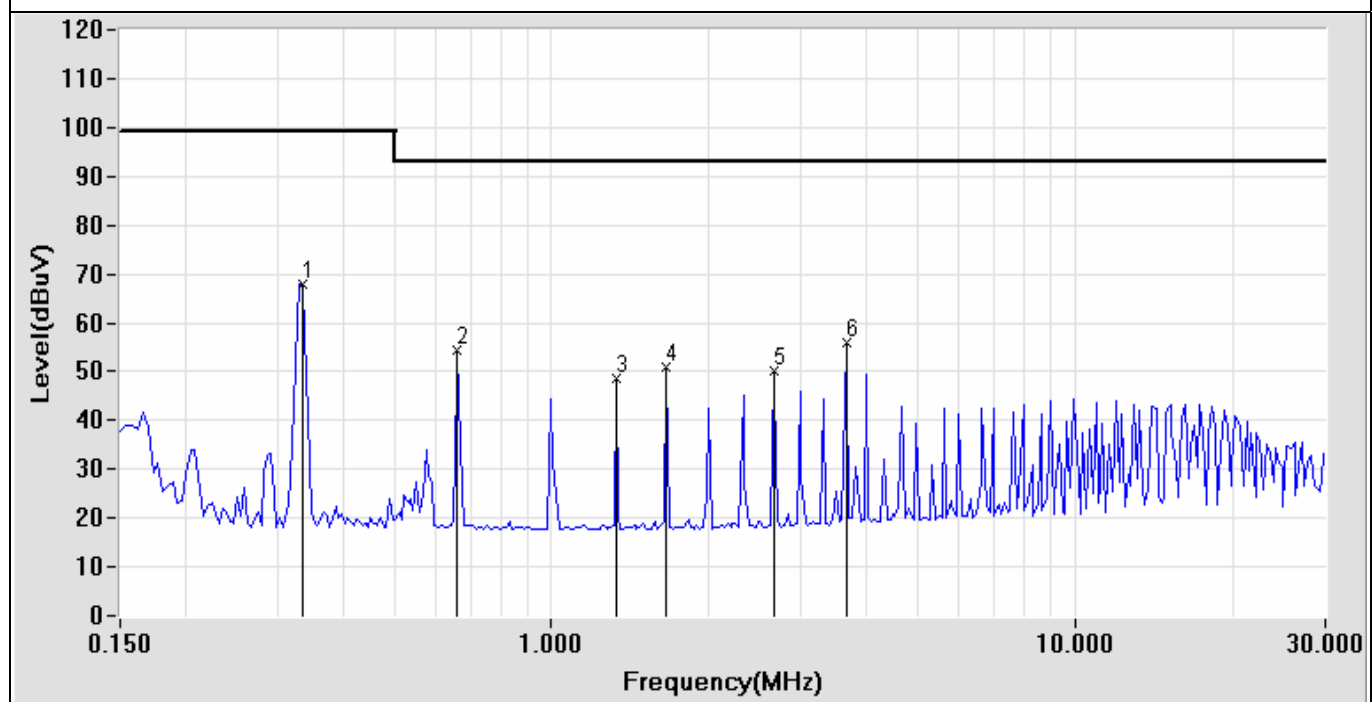
Power Line Conducted Test Data

EUT: DC/DC Converter	POLARITY: Neutral
CLIENT: TRACO ELECTRONIC Co. Ltd	DISTANCE:
MODEL: TEN 20-7223WIR	Serial No.:
RATING: DC 110V	FILE/DATA#: TRACO ELECTRONIC.emi/42
Temperature: 25.1 °C	OPERATOR: Alex
Humidity: 49 %	TEST SITE: Conduction 2

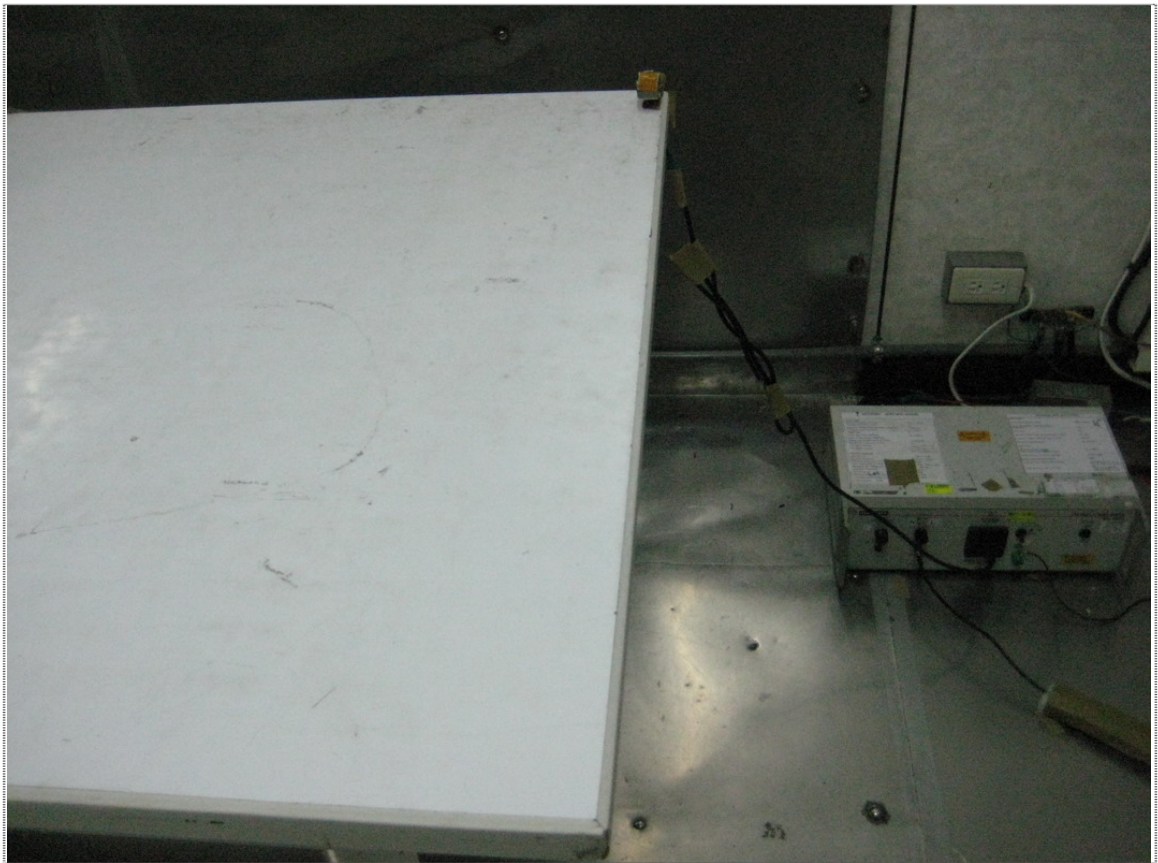
Frequency (MHz)	Factor (dB)	Meter Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)
		Quasi-Peak	Quasi-Peak	Quasi-Peak	Quasi-Peak
0.334	0.21	66.42	66.63	99.00	-32.37
0.662	0.21	53.10	53.31	93.00	-39.69
1.326	0.21	47.15	47.36	93.00	-45.64
1.658	0.19	49.34	49.53	93.00	-43.47
2.654	0.16	48.74	48.90	93.00	-44.10
3.650	0.22	55.80	56.02	93.00	-36.98

Remark:

1. All readings are Quasi-Peak values.
2. Factor = Insertion Loss + Cable Loss.



Test Mode: Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)



Front View



Rear View

3.8 Radiated emission

3.8.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESCS30	100135	2011/11/24
Biconical Antenna	Schwarzbeck	BBA 9106	VHA 9103-2418	2012/03/29
Log Antenna	Schwarzbeck	UHALP 9108 A	0738	2012/03/29
Pre-Amplifier	Agilent	8447D	1937A01903	2011/12/06
RF Cable	PACIFIC	CBL41	CBL41	2011/11/18

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

3.8.2 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

3.8.3 Test Procedure

Test Procedures were referred to EN 55011 sub-clause 7

3.8.4 Test Result

PASS.

The final test data is shown on as following pages.

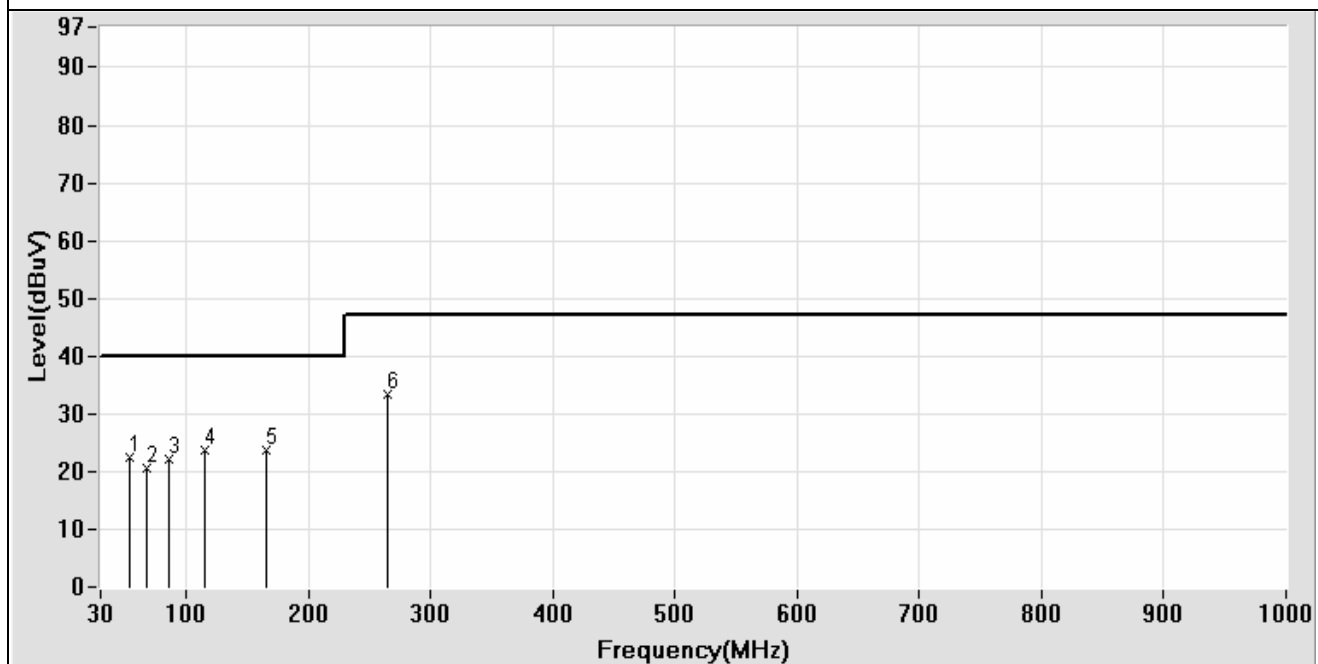
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Horizontal
CLIENT: TRACO ELECTRONIC Co. Ltd	DISTANCE: 10 m
MODEL: TEN 20-7223WIR	Serial No.:
RATING: DC110V	FILE/DATA#: TRACO ELECTRONIC.emi/55
Temperature: 28.5 °C	OPERATOR: Roy
Humidity: 41 %	TEST SITE: OATS 1

Frequency	Factor	Meter Reading	Emission Level	Limits	Margin
(MHz)	(dB)	(dBμV)	(dBμV/m)	(dBμV/m)	(dB)
53.200 **	-18.75	41.20	22.45	40.00	-17.55
68.300 **	-21.58	42.10	20.52	40.00	-19.48
86.000 **	-20.94	43.10	22.16	40.00	-17.84
115.400 **	-15.70	39.50	23.80	40.00	-16.20
165.400 **	-11.99	35.80	23.81	40.00	-16.19
265.500 **	-9.05	42.50	33.45	47.00	-13.55

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 20-7223WIR) (DC 110V)

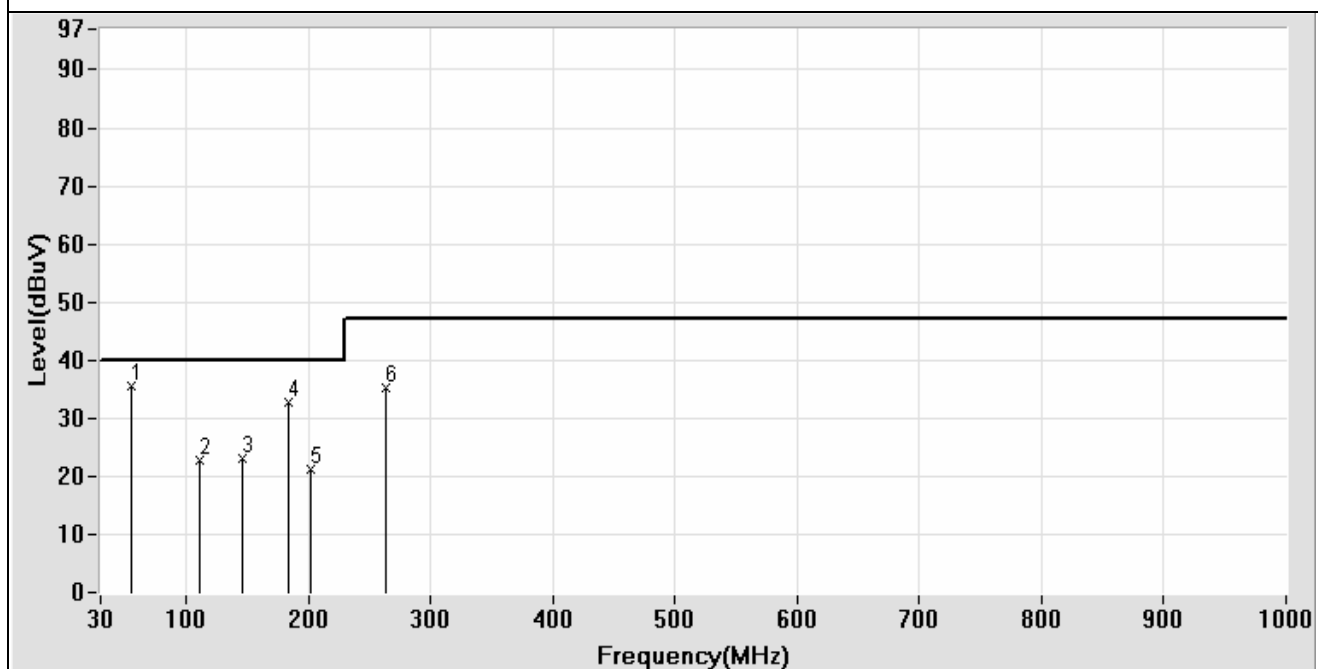
Radiated Emission Measurement Data

EUT: DC/DC Converter	POLARITY: Vertical
CLIENT: TRACO ELECTRONIC Co. Ltd	DISTANCE: 10 m
MODEL: TEN 20-7223WIR	Serial No.:
RATING: DC110V	FILE/DATA#: TRACO ELECTRONIC.emi/54
Temperature: 28.5 °C	OPERATOR: Roy
Humidity: 41 %	TEST SITE: OATS 1

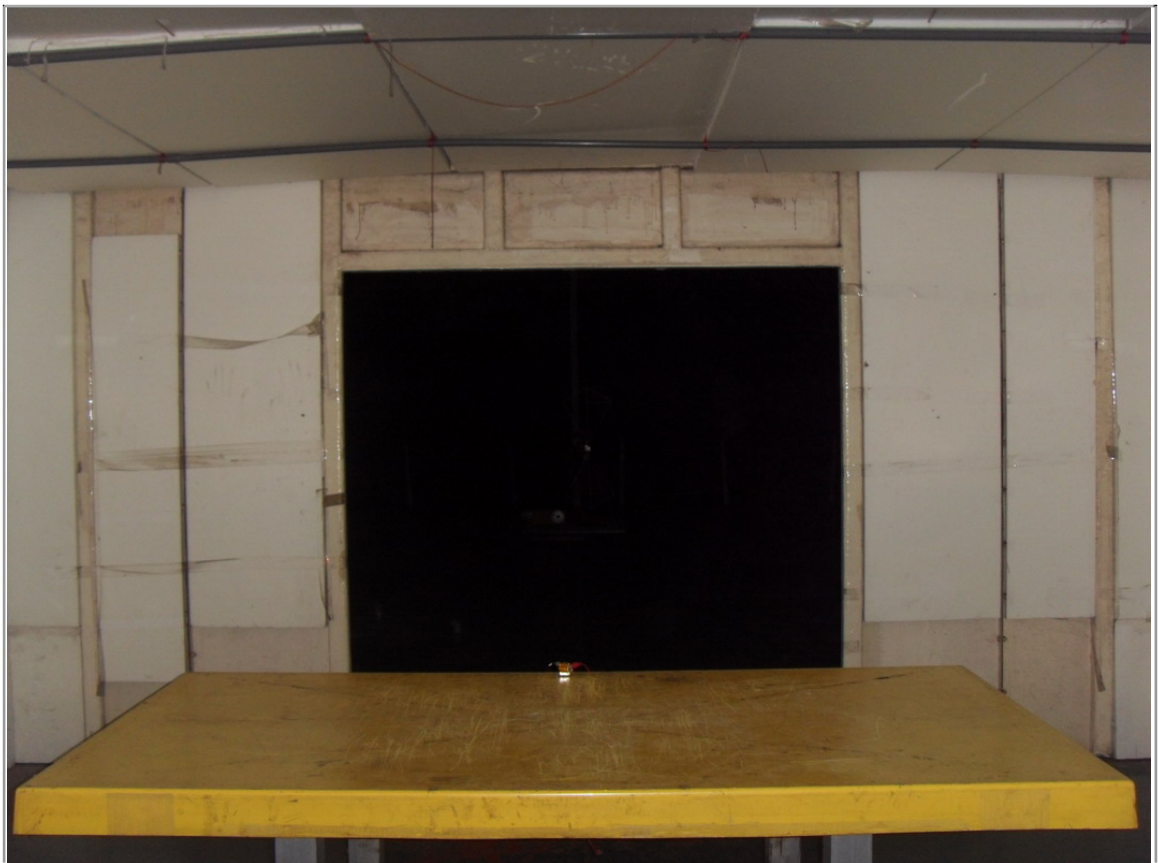
Frequency (MHz)	Factor (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
55.000 **	-19.30	55.00	35.70	40.00	-4.30
110.500 **	-16.62	39.50	22.88	40.00	-17.12
145.500 **	-13.81	36.80	22.99	40.00	-17.01
183.600 **	-10.76	43.50	32.74	40.00	-7.26
201.500 **	-10.04	31.40	21.36	40.00	-18.64
264.100 **	-7.80	43.00	35.20	47.00	-11.80

Remark:

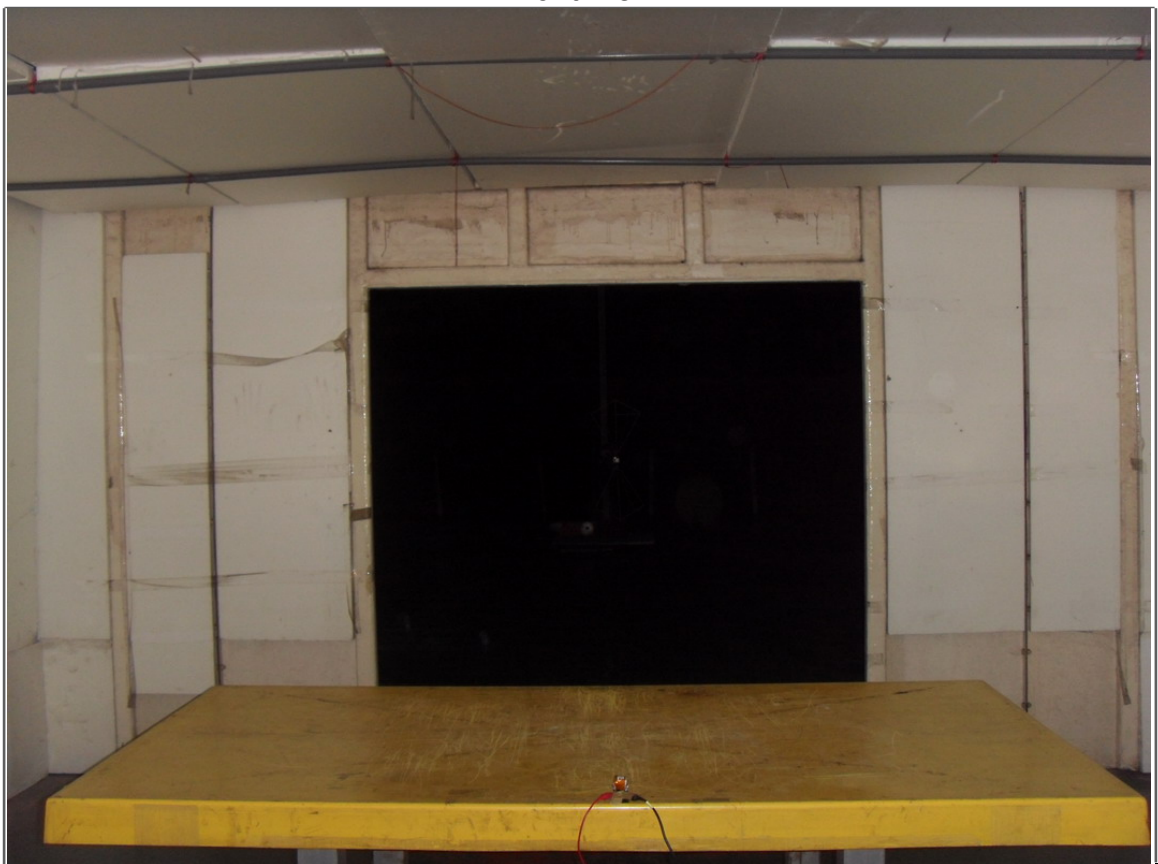
1. " * " Mark means readings are Peak Values.
2. " ** " Mark means readings are Quasi-Peak values.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Test Mode: Mode 4: FULL LOAD (TEN 20-7223WIR) (DC 110V)



Front View



Rear View

4 Environmental Tests

4.1 Cooling Test

4.1.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Temp & Humidity chamber	GIAN FORCE	GTH-150-40-2P-U	MAA0305-012	2013/05/24

4.1.2 Test ambience

Temperature: 21.8°C

Humidity: 54%

4.1.3 Test Requirement

Reference to EN 50155 section 12.2.3 (Column 4, Class TX).

Temperature: -40°C

Dwell Time: 2 hours

Performance Check: At first the specimens was power off, then at the end of dwell period the specimens was power on and a performance check was carried out. A further performance check was carried out after the specimens temperature was recovery to ambient temperature.

4.1.4 Test Procedure

Test Procedures were referred to EN 60068-2-1

4.1.5 Test Result

PASS.

1. Test configurations was show in Fig. 1.
2. The testing data were shown in Fig. 2.
3. Test specimens were visually inspected after test. No external physical damage was noted.
4. The functions of specimens was normal during and after Cooling Test.



Fig. 1 Cooling Test Photo

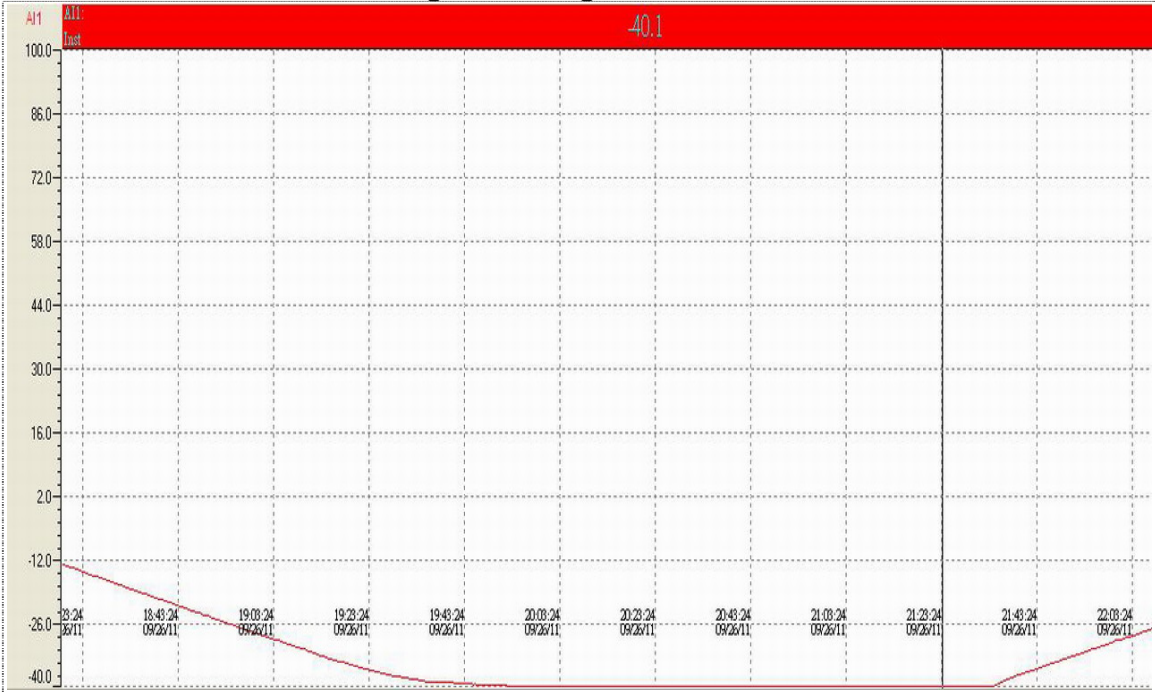


Fig. 2 Cooling Test Record

4.2 Dry Heat Test

4.2.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Temp & Humidity chamber	GIAN FORCE	GTH-150-40-2P-U	MAA0305-012	2013/05/24

4.2.2 Test ambience

Temperature: 22.6°C

Humidity: 56% (RH)

4.2.3 Test Requirement

Reference to EN 50155 section 12.2.4 (Column 4, Class TX).

Temperature: 85°C

Dwell Time: 6 hours

Performance Check: At first the specimens was power off, then at the end of dwell period the specimen was power on and a performance check was carried out. A further performance check was carried out after the specimen temperature was recovery to ambient temperature.

4.2.4 Test Procedure

Test Procedures were referred to EN 60068-2-2

4.2.5 Test Result

PASS.

1. Test configurations was show in Fig. 1.
2. The testing data were shown in Fig. 2.
3. Test specimens were visually inspected after test. No external physical damage was noted.
4. The functions of specimens was normal during and after Dry Heat Test.



Fig. 1 Dry Heat Test Photo



Fig. 2 Dry Heat Test Record

4.3 Damp Heat Test, Cyclic

4.3.1 Instrument

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Temp & Humidity chamber	GIAN FORCE	GTH-150-40-2P-U	MAA0305-012	2013/05/24

4.3.2 Test ambience

Temperature: 21.7°C

Humidity: 53%

4.3.3 Test Requirement

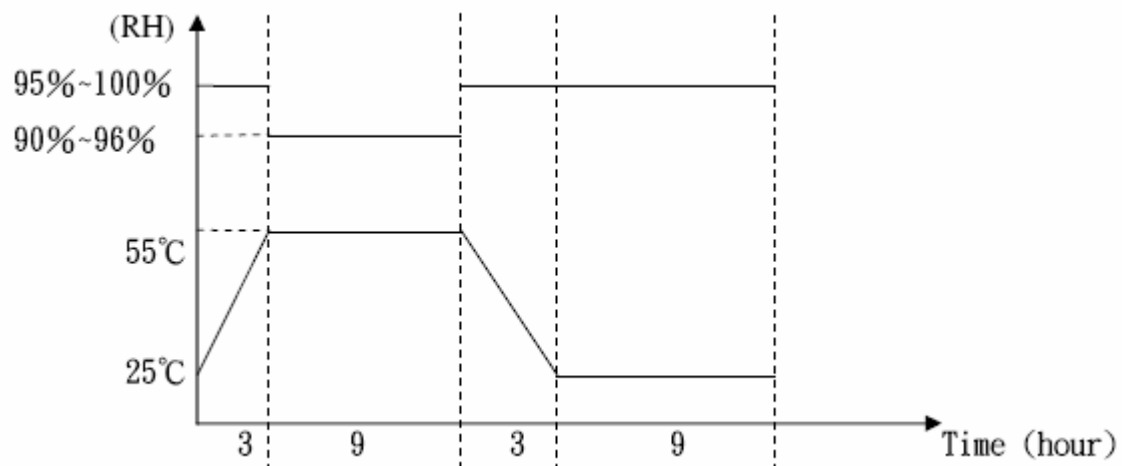
Reference to EN 50155 section 12.2.5

Temperature/Humidity 25°C~55°C/90%~100%RH

Test duration: 24 hours/cycle, 2 cycles, total 48 hours.

Speed of temperature variation: 1°C/min., and with a maintained relative humidity.

Test Profile: Shown as in bellow.



Performance Check: At first the specimens was power off, then at each cycle of the end of dwell under 55°C and 90%~96%(RH) period the specimen was power on and a performance check was carried out. A further performance check was carried out after the specimen temperature was recovery to ambient temperature.

4.3.4 Test Procedure

Test Procedures were referred to EN 60068-2-30

4.3.5 Test Result

1. Test configurations was show in Fig. 1.
2. The testing data were shown in Fig. 2.

Performance checks should be pass before the test (Damp Heat Test, Cyclic), then the test result refer to report clause 2.2, 2.3 and 2.4

Equipment under test return to ambient temperature is carried out under controlled recovery conditions.

Check and final measurements:

(1) Insulation test (Insulation measurement Test: 500VDC) Test was performed before Voltage withstand test				
Test Item		Resistance	Result	
Input(+) to Input(-)		> 1MΩ	PASS	
(2) Insulation test (Voltage withstand test: 1400VDC)				
Test Item		Current	Result	
Input(+) to Input(-)		>7.5 mA	PASS	
(3) Insulation test (Insulation measurement Test: 500VDC) Test was performed after Voltage withstand test				
Test Item		Resistance	Result	
Input(+) to Input(-)		> 1MΩ	PASS	
(4) Performance (Supply variations)				
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	
(5) Performance (Supply interruption)				
Supply interruption	Class	Interruption time	Result / Observation	
100%	S1	0 ms	No deviation	
100%	S2	10 ms	No deviation	
(6) Performance (Supply change over)				
Supply Voltage		Class	Repeated time	Result / Observation
Dips	40%	C1	100 ms	No deviation
(7) Visual inspection				
Inspection Result: PASS				



Fig. 1 Damp Heat Test, Cyclic Photo

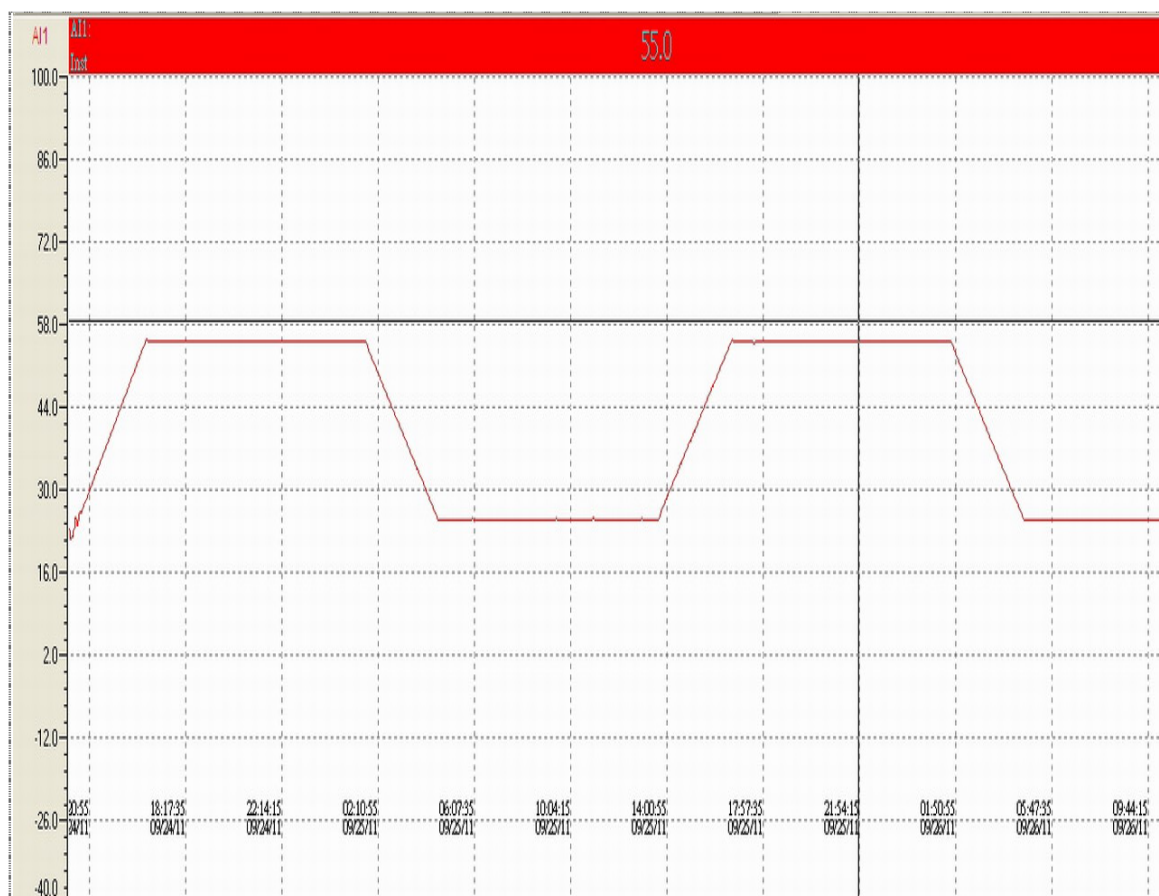


Fig. 2 Damp Heat Test, Cyclic Record

4.4 Vibration Test (Operating)

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	N/A

4.4.2 Test Ambience

Temperature: $21 \pm 3^{\circ}\text{C}$

Humidity: $65\% \pm 5\%$ (RH)

4.4.3 Specimen & Model Quantity

Specimen : DC/DC Converter

Model : TEN 20-7223WIR

Quantity : 1 set

4.4.4 Test condition

Frequency Range : 5Hz~150Hz.

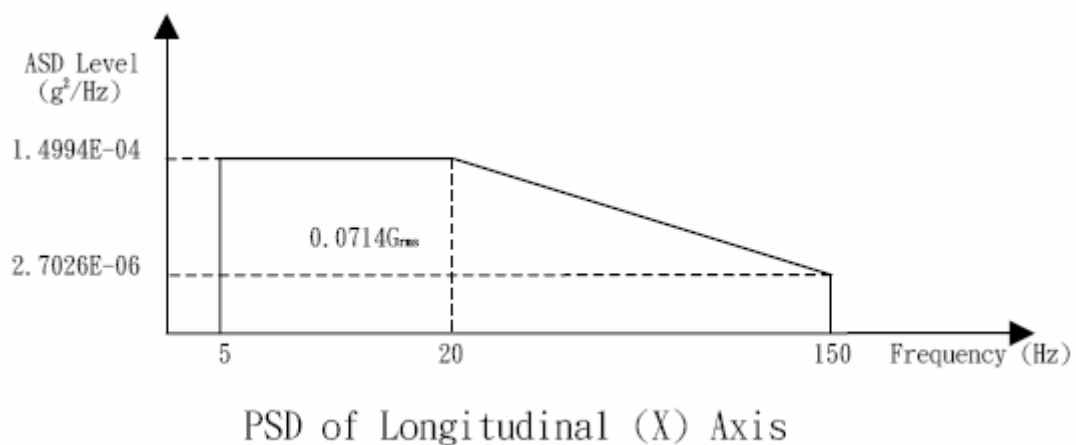
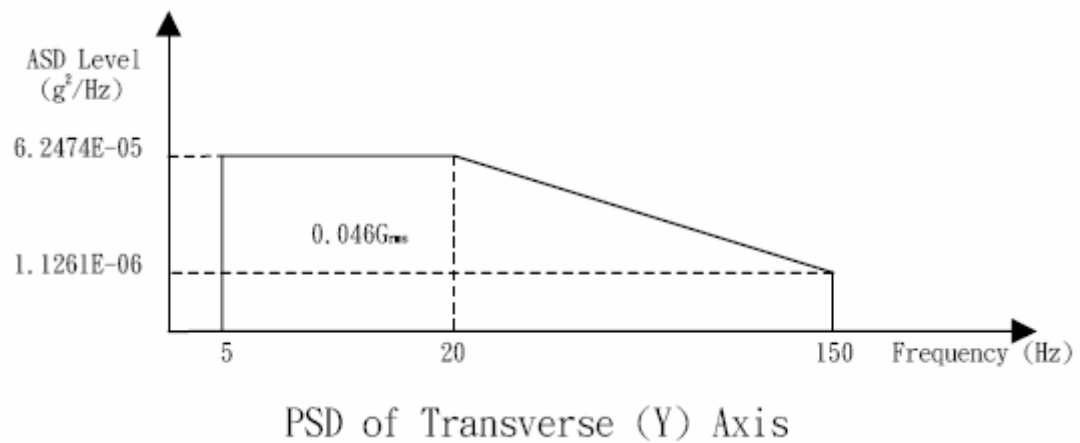
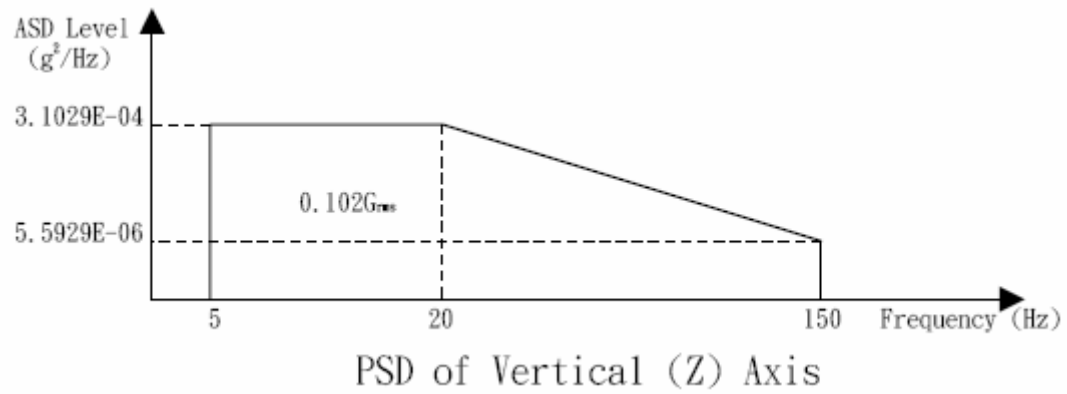
G_{rms} value: Vertical (Z-Axis) 0.102 G_{rms} (1.00m/s²),

Transverse (Y-Axis) 0.046 G_{rms} (0.45m/s²),

Longitudinal (X-Axis) 0.0714 G_{rms} (0.70m/s²).

Duration: 10 min/axis.

Power Spectrum Density shown as follow:



4.4.5 Test Procedures

Reference to EN 61373

4.4.6 Test Result

PASS.

1. Test configurations were shown in Fig.1~Fig.3.
2. The testing data were shown in Fig.4~Fig.6.
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 vibration test.

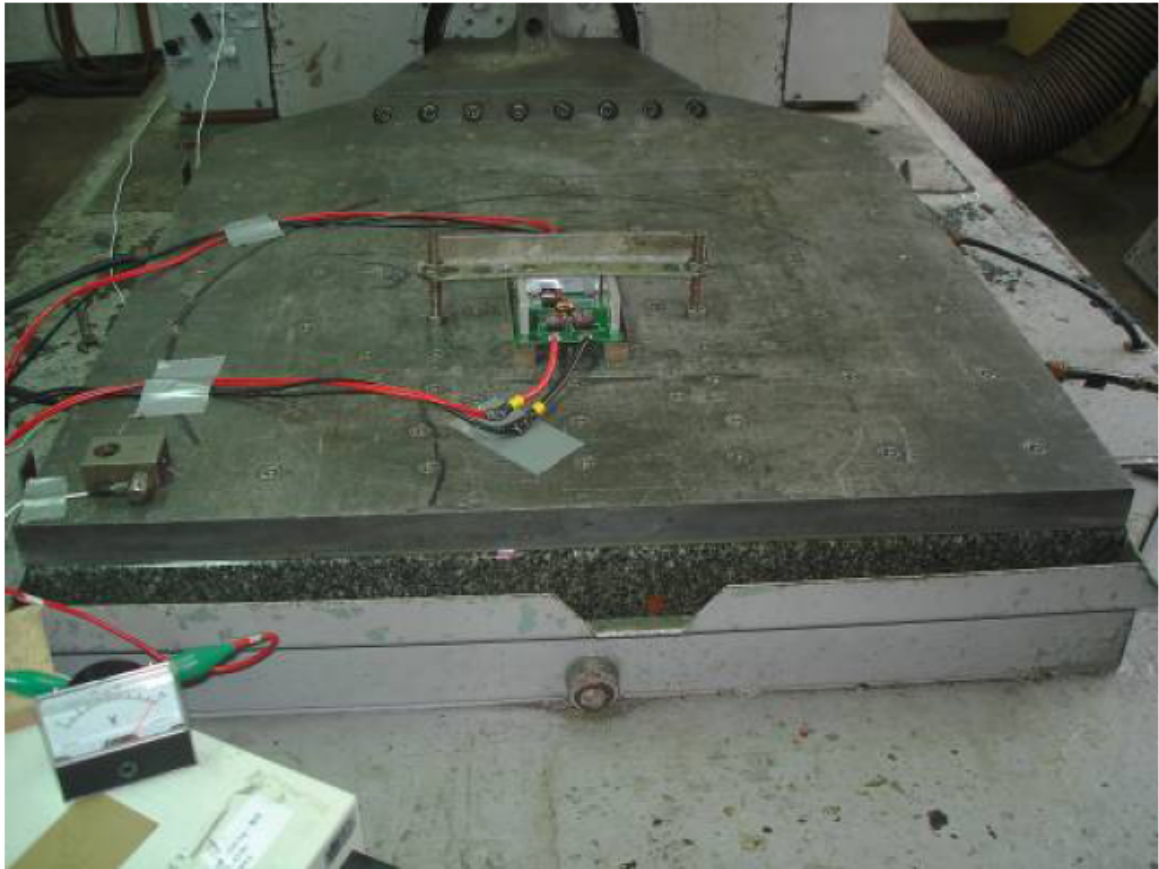


Fig. 1 : Vibration and Shock Test in X-Axis



Fig. 2 : Vibration and Shock Test in Y-Axis

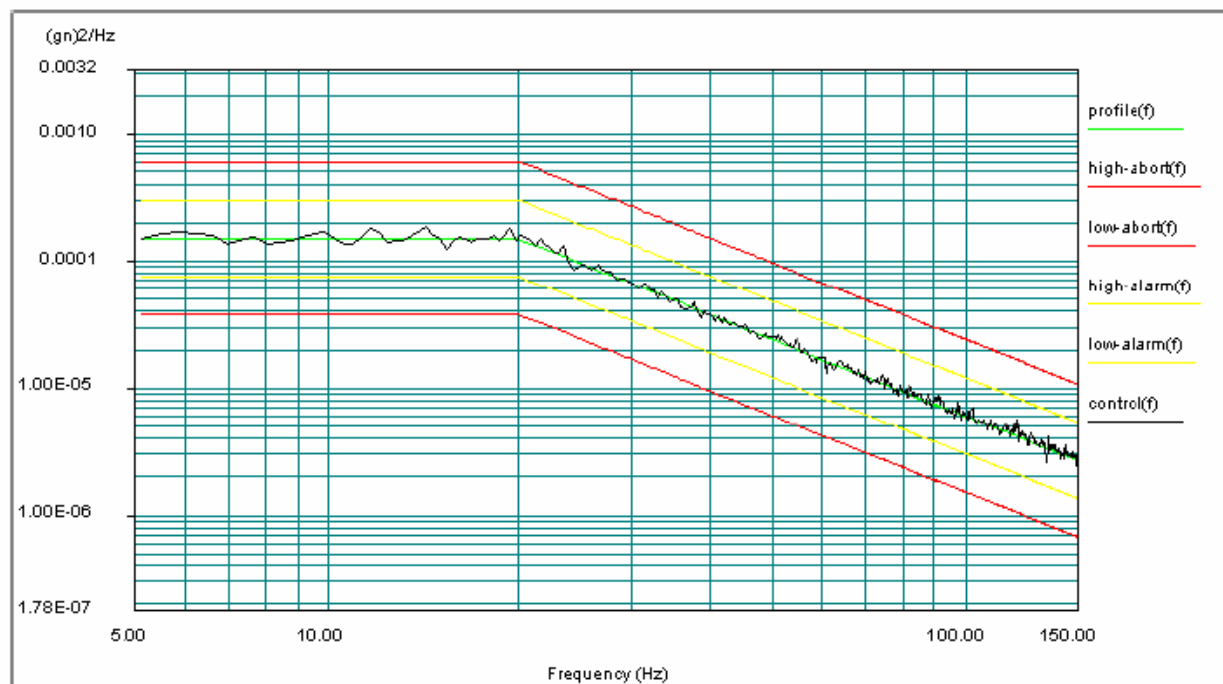


Fig. 3 : Vibration and Shock Test in Z-Axis

DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC61373X-op.prj

Profile Name: X-Axis (Operating) Test Type: Random Run Folder: \RunDefault Apr 02, 2012 15-55-26



Level: 100 %

Control RMS: 0.077780 gn Full Level Elapsed Time: 00:10:00 Lines: 400 Frame Time: 2.730667 Seconds

Demand RMS: 0.069882 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

Data saved at 04:06:54 PM, Monday, April 02, 2012

Fig. 4 : Vibration Testing data of X-Axis

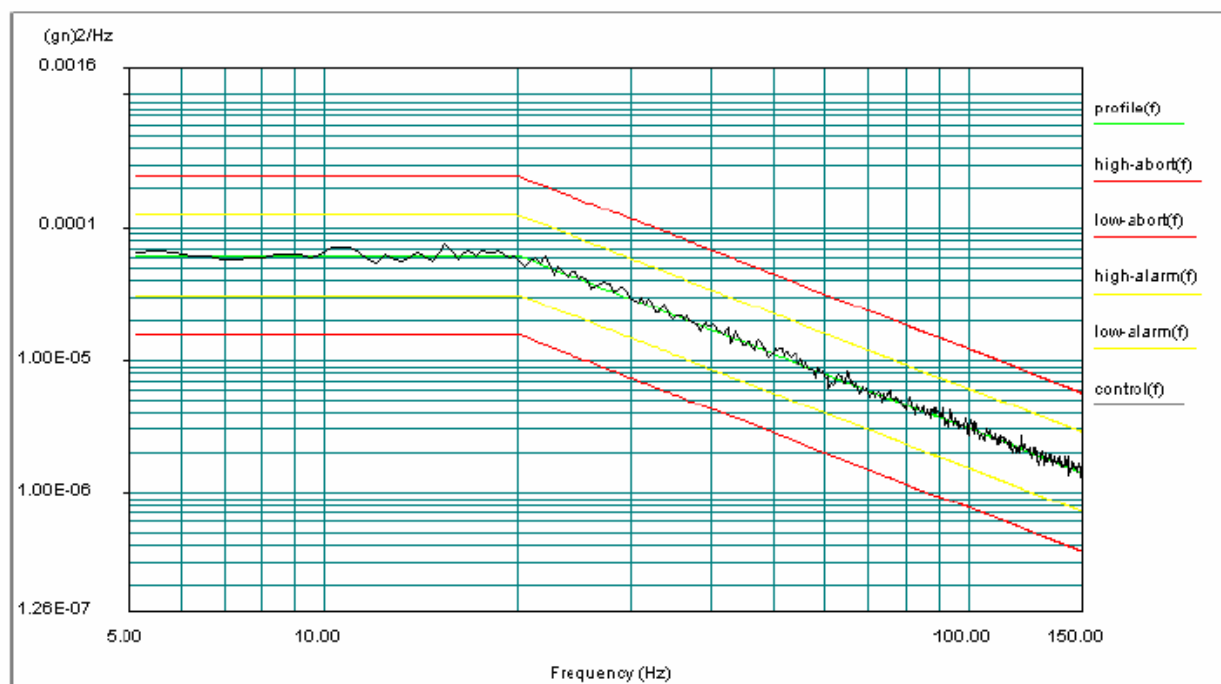
DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC61373Y-op.prj

Profile Name: Y-Axis (Operating)

Test Type: Random

Run Folder: \RunDefault Apr 02, 2012 10-30-11



Level: 100 %

Control RMS: 0.055706 gn Full Level Elapsed Time: 00:10:00 Lines: 400 Frame Time: 2.730667 Seconds

Demand RMS: 0.045471 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

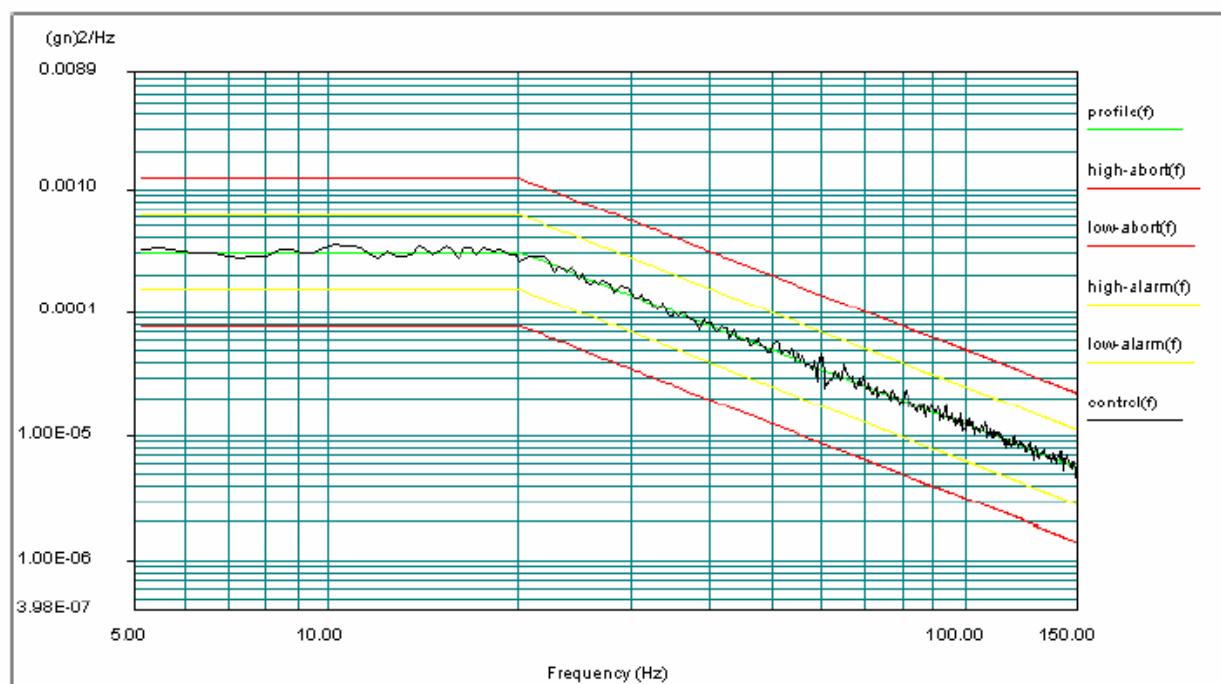
Data saved at 10:41:33 AM, Monday, April 02, 2012

Fig. 5 : Vibration Testing data of Y-Axis

DC/DC Converter (TEN 20-7223WIR)

Profile Name: Z-Axis (Operating) Test Type: Random

Run Folder: \RunDefault Apr 03, 2012 09-44-17



Level: 100 %

Control RMS: 0.110257 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 09:56:09 AM, Tuesday, April 03, 2012

Fig. 6 : 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 CONTROLLER	N/A	N/A
Accelerometer	DYTRAN	3055B2	N/A

4.5.2 Test Ambience

Temperature: $21 \pm 3^{\circ}\text{C}$

Humidity: $65\% \pm 5\%$ (RH)

4.5.3 Specimen & Model Quantity

Specimen : DC/DC Converter

Model : TEN 20-7223WIR

Quantity : 1 set

4.5.4 Test Requirement

Frequency Range : 5Hz~150Hz,

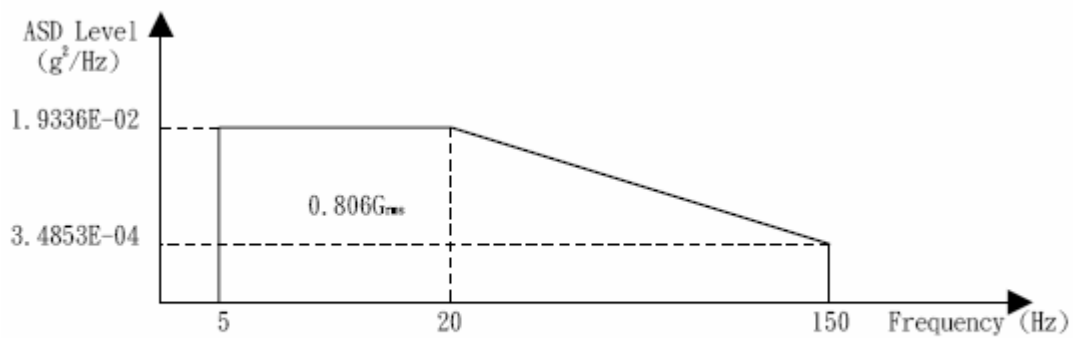
G_{rms} value: Vertical (Z-Axis) $0.806 G_{\text{rms}}$ (7.90m/s²),

Transverse (Y-Axis) $0.357 G_{\text{rms}}$ (3.50m/s²),

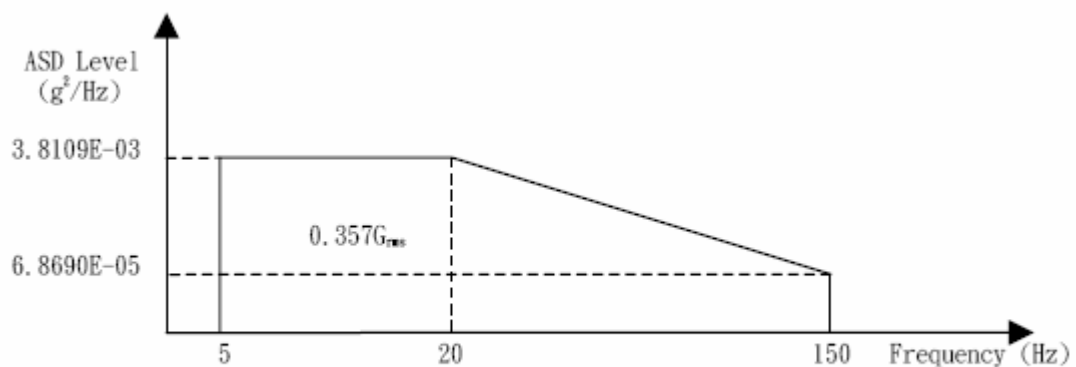
Longitudinal (X-Axis) $0.561 G_{\text{rms}}$ (5.50m/s²).

Duration: 5 hours/axis.

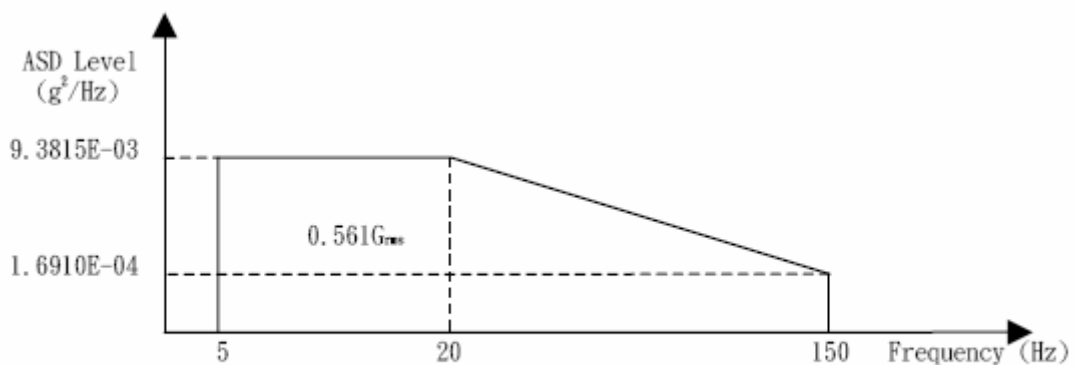
Power Spectrum Density shown as follow:



PSD of Vertical (Z) Axis



PSD of Transverse (Y) Axis



PSD of Longitudinal (X) Axis

4.5.5 Test Procedures

Reference to EN 61373

4.5.6 Test Result

PASS.

1. Test configurations were shown in Fig.1~Fig.3.
2. The testing data were shown in Fig.7~Fig.9.
3. Test specimen was visually inspected after test. No external physical damage was noted.
4. The function of specimen was normal after the increased vibration test.

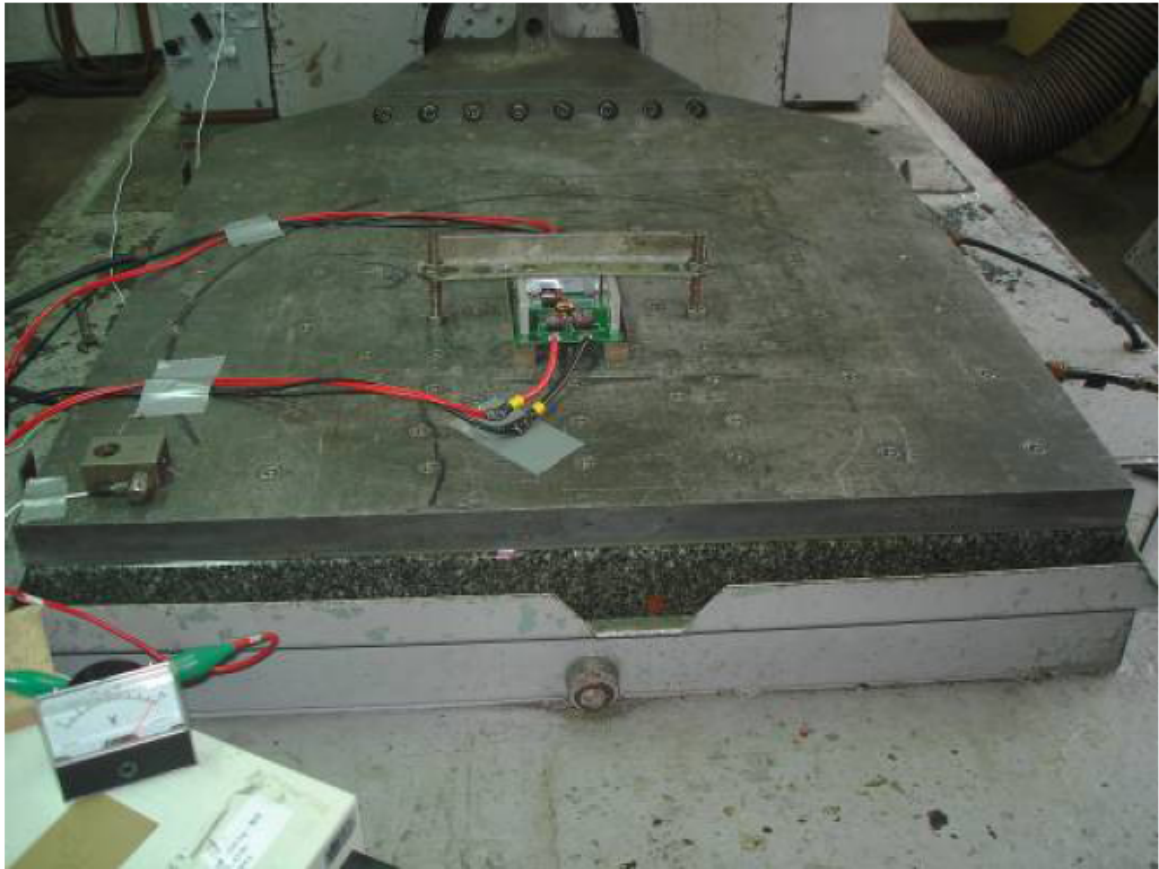


Fig. 1 : Vibration and Shock Test in X-Axis



Fig. 2 : Vibration and Shock Test in Y-Axis

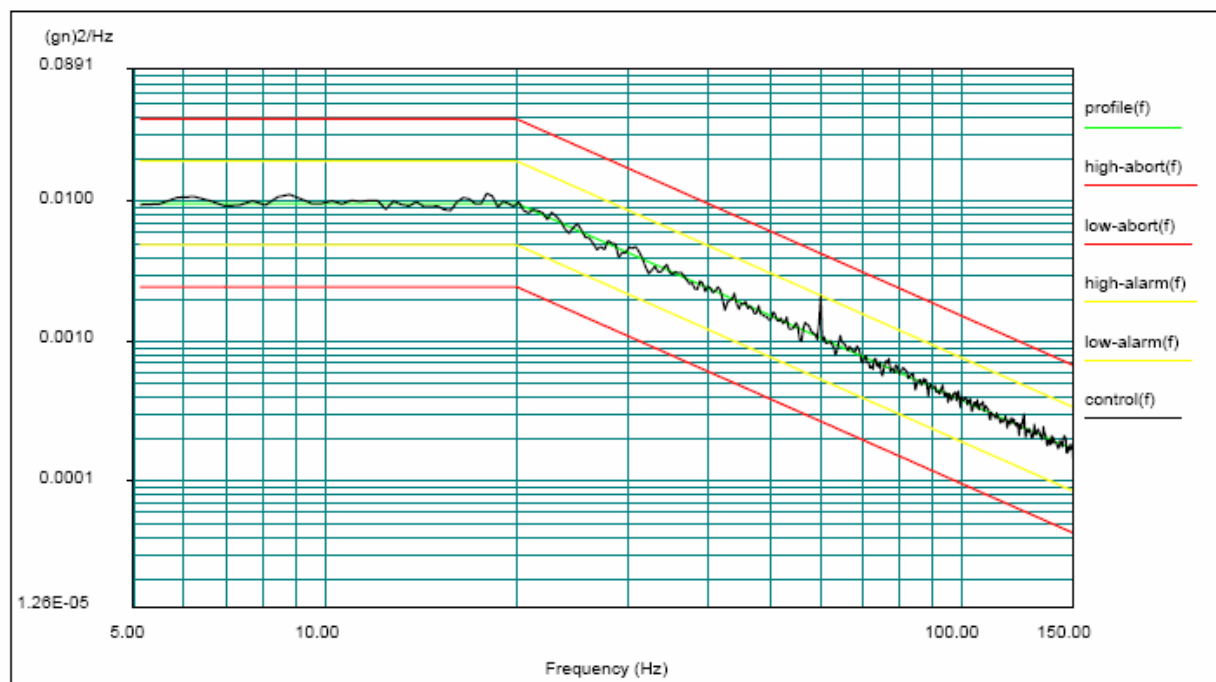


Fig. 3 : Vibration and Shock Test in Z-Axis

DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC61373X-nop.prj

Profile Name: X-Axis (non-operating) Test Type: Random Run Folder: \RunDefault Apr 02, 2012 16-08-11



Level: 100 %

Control RMS: 0.563864 gn Full Level Elapsed Time: 05:00:00 Lines: 400 Frame Time: 2.730667 Seconds

Demand RMS: 0.562334 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

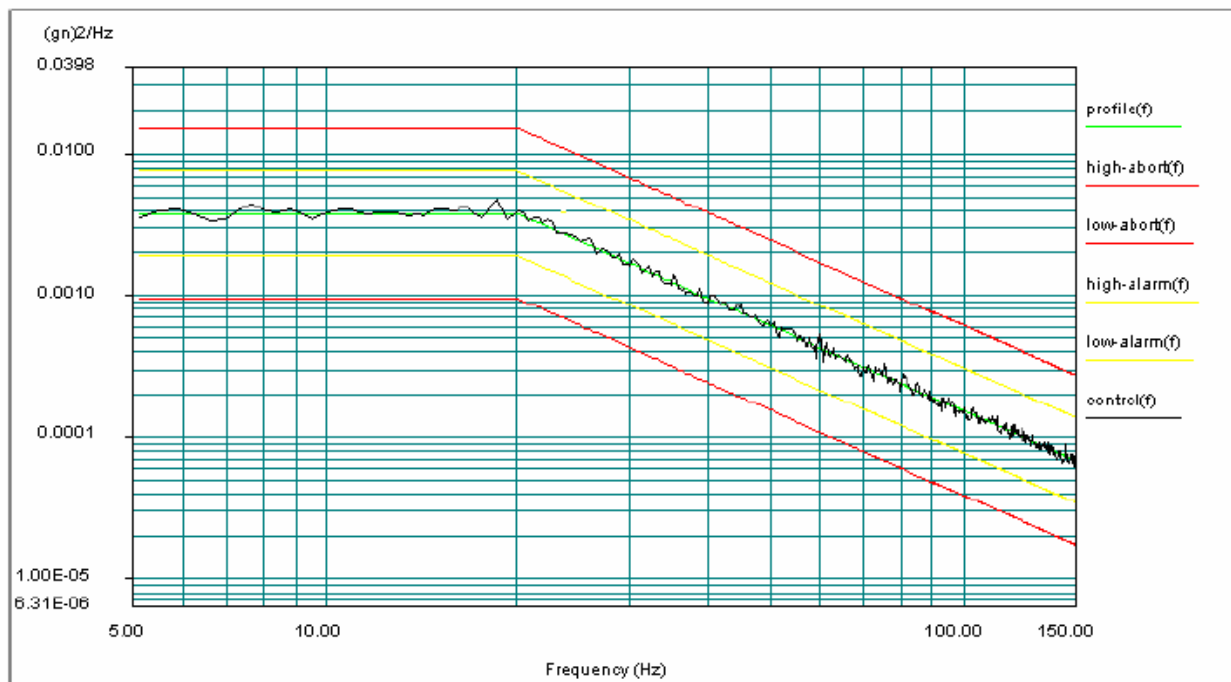
Data saved at 09:09:21 PM, Monday, April 02, 2012

Fig. 7 : Increased Vibration Testing data of X-Axis

DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC61373Y-nop.prj

Profile Name: Y-Axis (non-operating) Test Type: Random Run Folder: \RunDefault Apr 02, 2012 10-42-55



Level: 100 %

Control RMS: 0.356820 gn Full Level Elapsed Time: 05:00:00 Lines: 400 Frame Time: 2.730667 Seconds

Demand RMS: 0.352487 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.366211 Hz

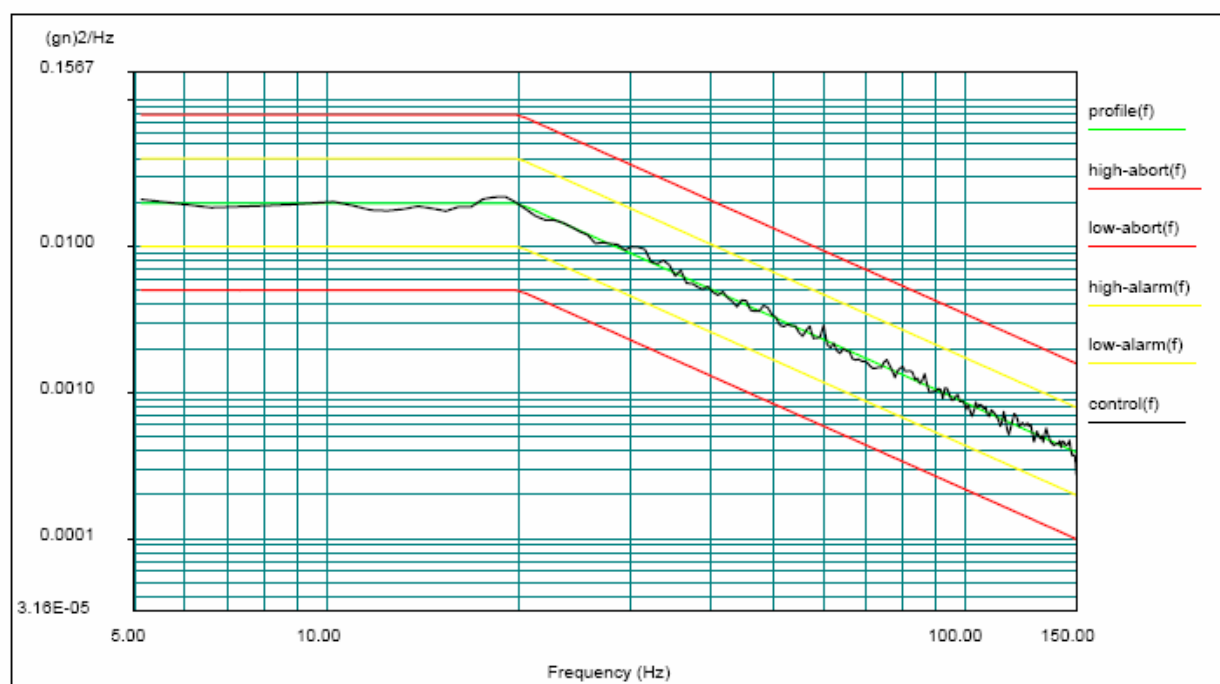
Data saved at 03:46:04 PM, Monday, April 02, 2012

Fig. 8 : Increased Vibration Testing data of Y-Axis

DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC61373Z-nop(RANDOM).prj

Profile Name: Z-Axis (non-operating) Test Type: Random Run Folder: \RunDefault Apr 03, 2012 09-59-28



Level: 100 %

Control RMS: 0.808406 gn Full Level Elapsed Time: 05:00:00 Lines: 200 Frame Time: 1.365333 Seconds

Demand RMS: 0.813269 gn Remaining Time: 00:00:00 DOF: 154 dF: 0.732422 Hz

Data saved at 03:02:21 PM, Tuesday, April 03, 2012

Fig. 9 : Increased 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	N/A

4.6.2 Test Ambience

Temperature: $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Humidity: $65\% \pm 5\%$ (RH)

4.6.3 Specimen & Model Quantity

Specimen : DC/DC Converter

Model : TEN 20-7223WIR

Quantity : 1 set

4.6.4 Test Requirement

Wave Form : Half Sine Wave

Acceleration Peak : Vertical(Z)3.0612 G (30m/s²), Transverse(Y)3.0612 G (30m/s²),
Longitudinal(X)5.1020 G (50m/s²).

Duration : 30ms

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

4.6.5 Test Procedures

Reference to EN 61373

4.6.6 Test Result

PASS.

1. Test configurations were shown in Fig.1~Fig.3.
2. The testing data were shown in Fig.10~Fig.15.
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.

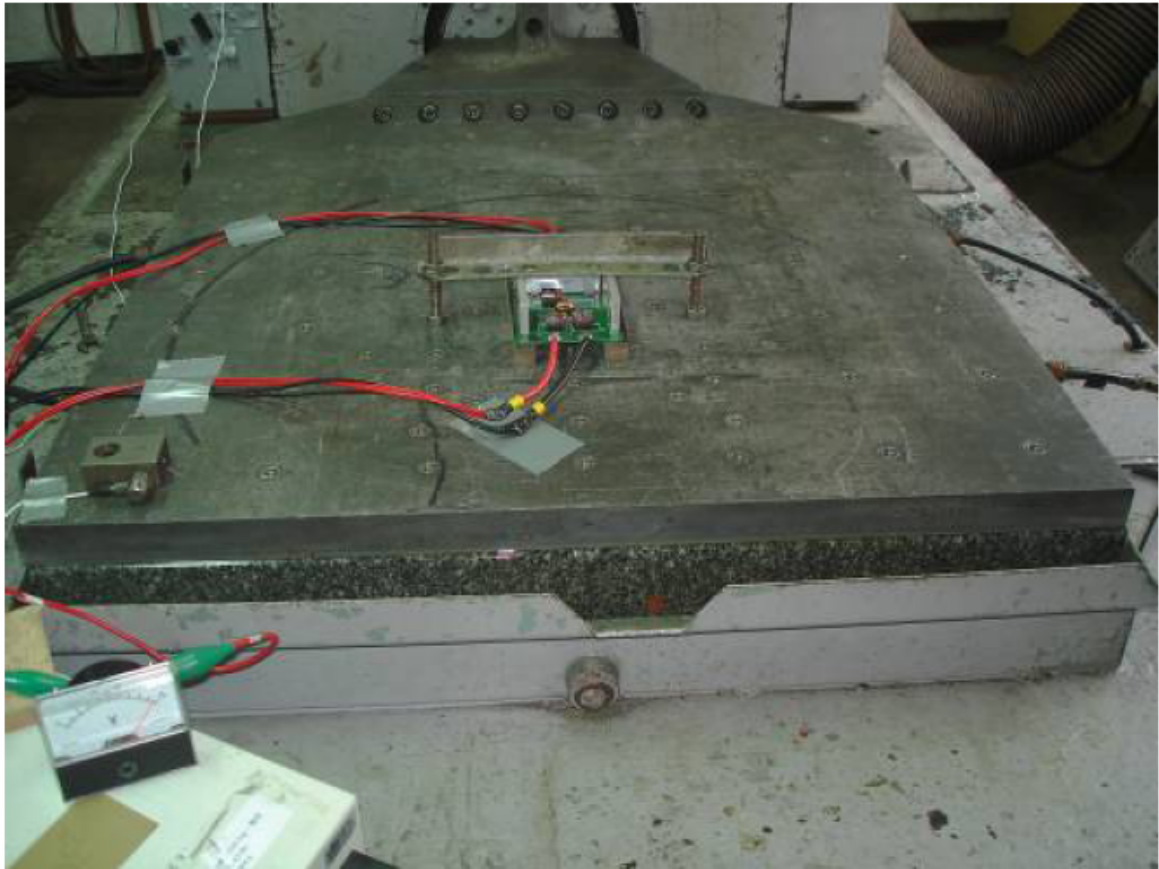


Fig. 1 : Vibration and Shock Test in X-Axis



Fig. 2 : Vibration and Shock Test in Y-Axis



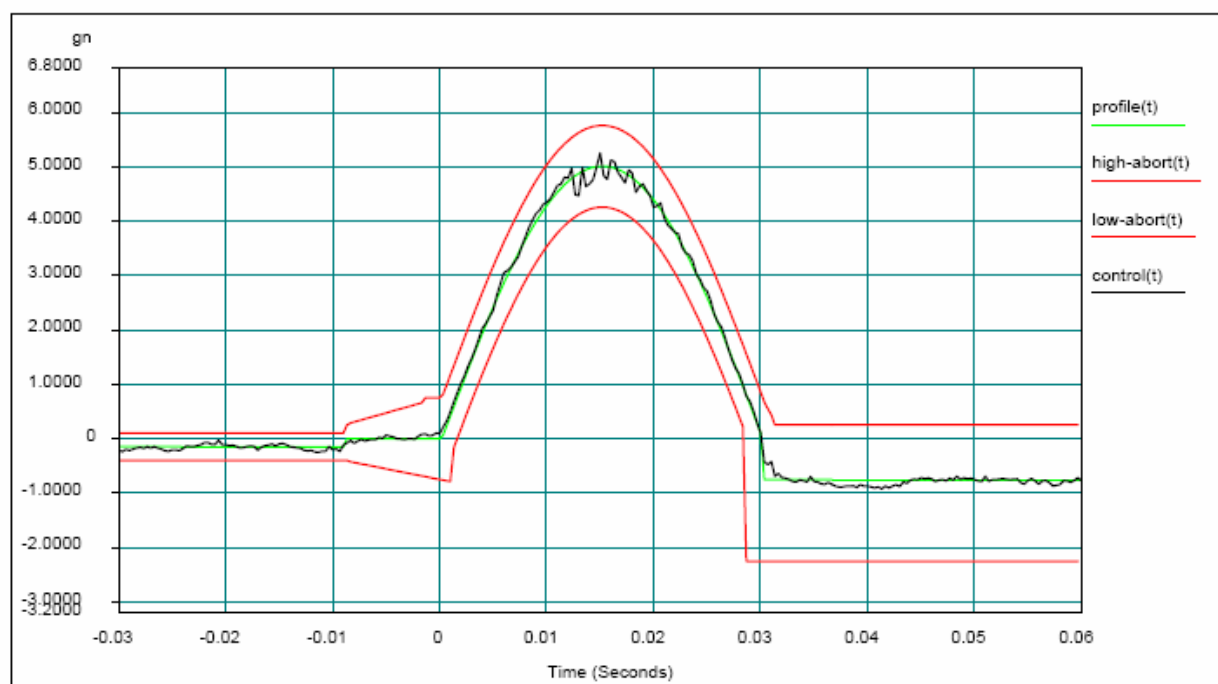
Fig. 3 : Vibration and Shock Test in Z-Axis

DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC67373Sk(X).prj

Profile Name: 5gn 30mSec Test Type: Classical Shock

Run Folder: \RunDefault Apr 02, 2012 21-12-03



Level: 100 %

Block Size: 4096

Elapsed Pulses: 11

Frame Time: 1.365333 Seconds

Control Peak: 5.243384 gn

Full Level Elapsed Pulses: 3

dT: 0.000333 Seconds

Demand Peak: 5.000000 gn

Remaining Pulses: 0

Pulse Type: Half Sine

Amplitude: 5.000000 gn

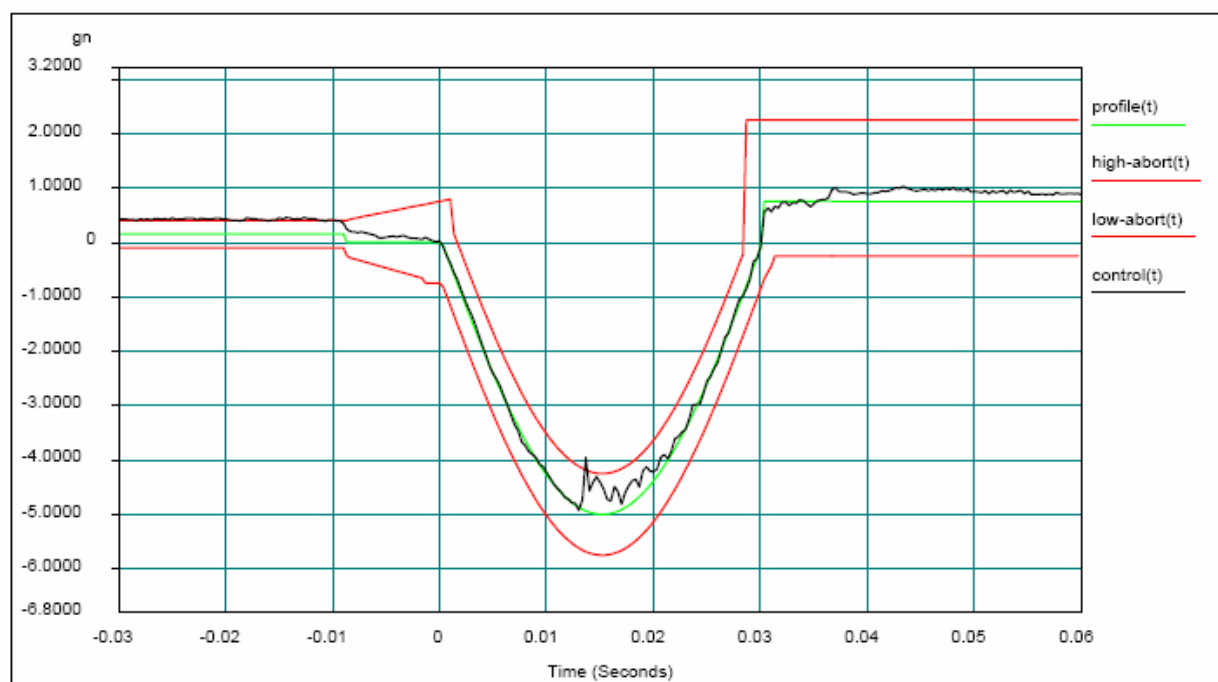
Data saved at 09:12:35 PM, Monday, April 02, 2012

Fig. 10 : Shock Testing data of +X Axis

DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC67373Sk(X).prj

Profile Name: 5gn 30mSec Test Type: Classical Shock Run Folder: \RunDefault Apr 02, 2012 21-12-52



Level: 100 %

Block Size: 4096

Elapsed Pulses: 11

Frame Time: 1.365333 Seconds

Control Peak: 4.952137 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 09:13:15 PM, Monday, April 02, 2012

Fig. 11 : Shock Testing data of -X Axis

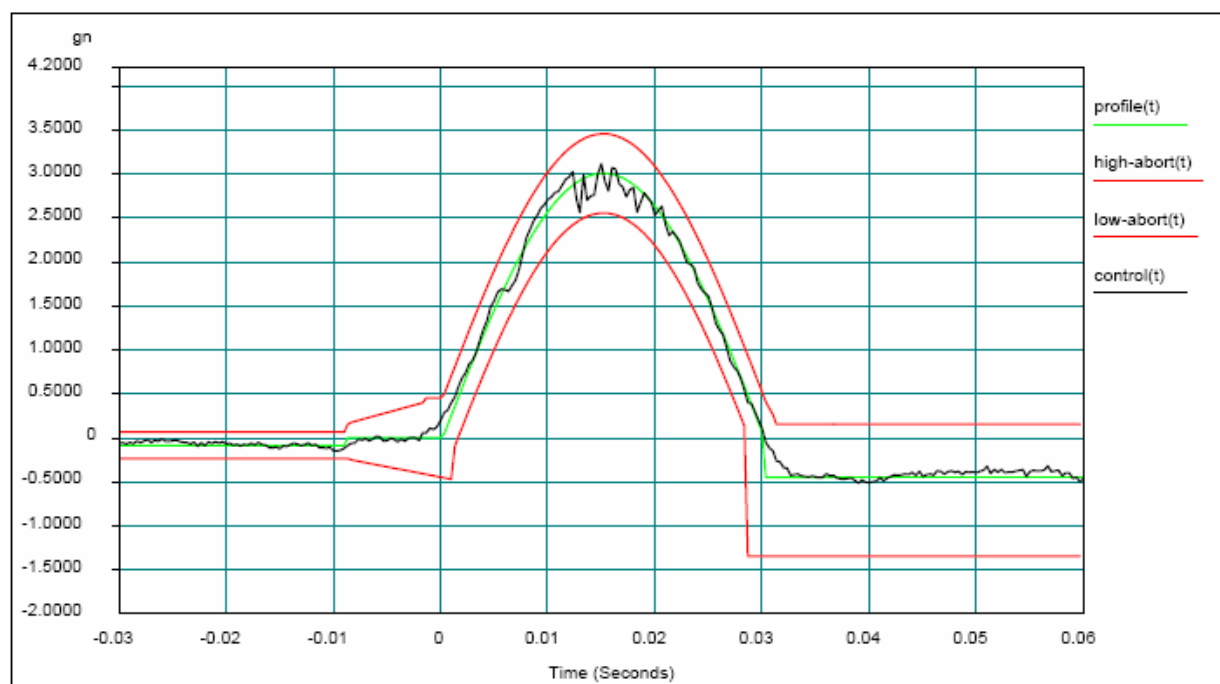
DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC67373Sk(Y,Z)(SHOCK).prj

Profile Name: 3gn 30mSec

Test Type: Classical Shock

Run Folder: \RunDefault Apr 02, 2012 15-48-19



Level: 100 %

Block Size: 4096

Elapsed Pulses: 11

Frame Time: 1.365333 Seconds

Control Peak: 3.104562 gn

Full Level Elapsed Pulses: 3

dT: 0.000333 Seconds

Demand Peak: 3.060000 gn

Remaining Pulses: 0

Pulse Type: Half Sine

Amplitude: 3.060000 gn

Data saved at 03:48:42 PM, Monday, April 02, 2012

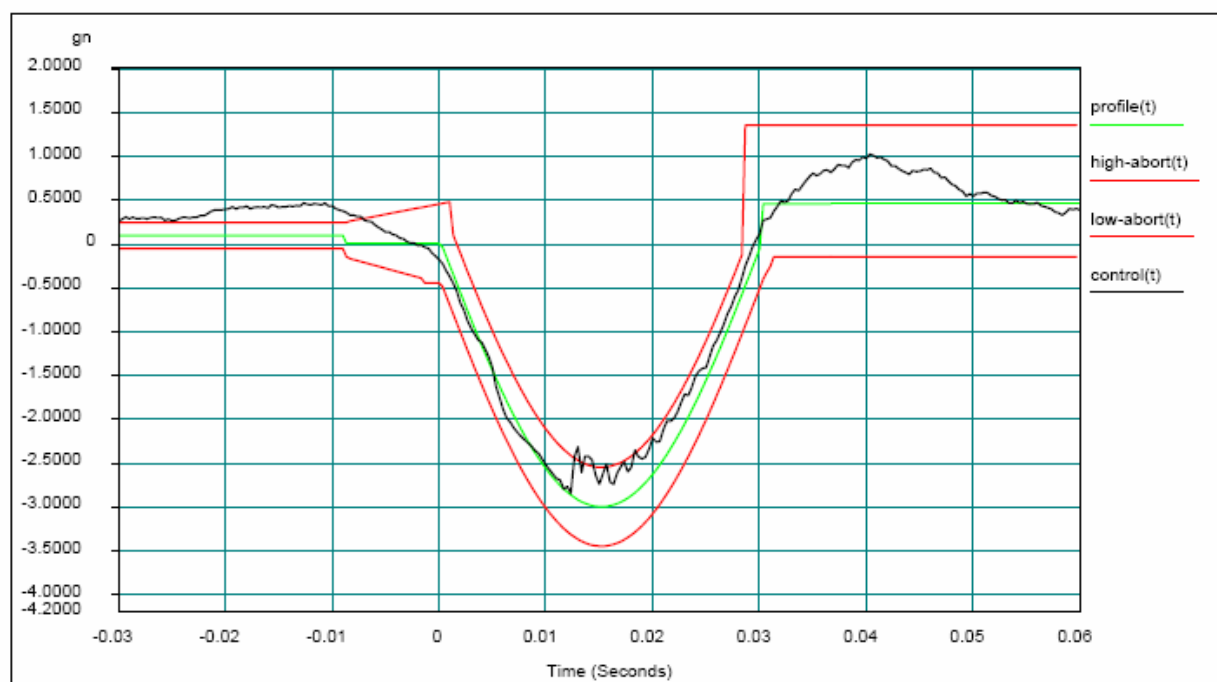
Fig. 12 : Shock Testing data of +Y Axis

DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC67373Sk(Y,Z)(SHOCK).prj

Profile Name: 3gn 30mSec Test Type: Classical Shock

Run Folder: \RunDefault Apr 02, 2012 15-49-38



Level: 100 %

Block Size: 4096

Elapsed Pulses: 11

Frame Time: 1.365333 Seconds

Control Peak: 2.870652 gn

Full Level Elapsed Pulses: 3

dT: 0.000333 Seconds

Demand Peak: 3.060000 gn

Remaining Pulses: 0

Pulse Type: Half Sine

Amplitude: 3.060000 gn

Data saved at 03:50:19 PM, Monday, April 02, 2012

Fig. 13 : Shock Testing data of - Y Axis

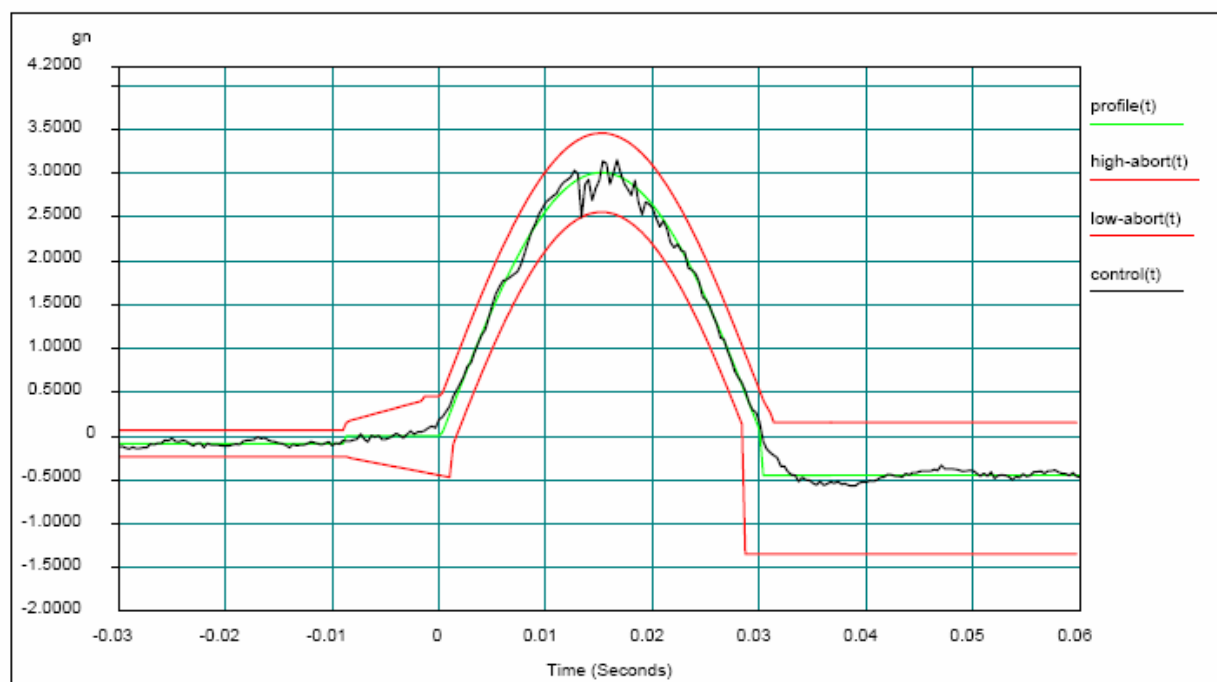
DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC67373Sk(Y,Z)(SHOCK).prj

Profile Name: 3gn 30mSec

Test Type: Classical Shock

Run Folder: \RunDefault Apr 03, 2012 15-03-16



Level: 100 %

Block Size: 4096

Elapsed Pulses: 11

Frame Time: 1.365333 Seconds

Control Peak: 3.123156 gn

Full Level Elapsed Pulses: 3

dT: 0.000333 Seconds

Demand Peak: 3.060000 gn

Remaining Pulses: 0

Pulse Type: Half Sine

Amplitude: 3.060000 gn

Data saved at 03:03:48 PM, Tuesday, April 03, 2012

Fig. 14 : Shock Testing data of +Z Axis

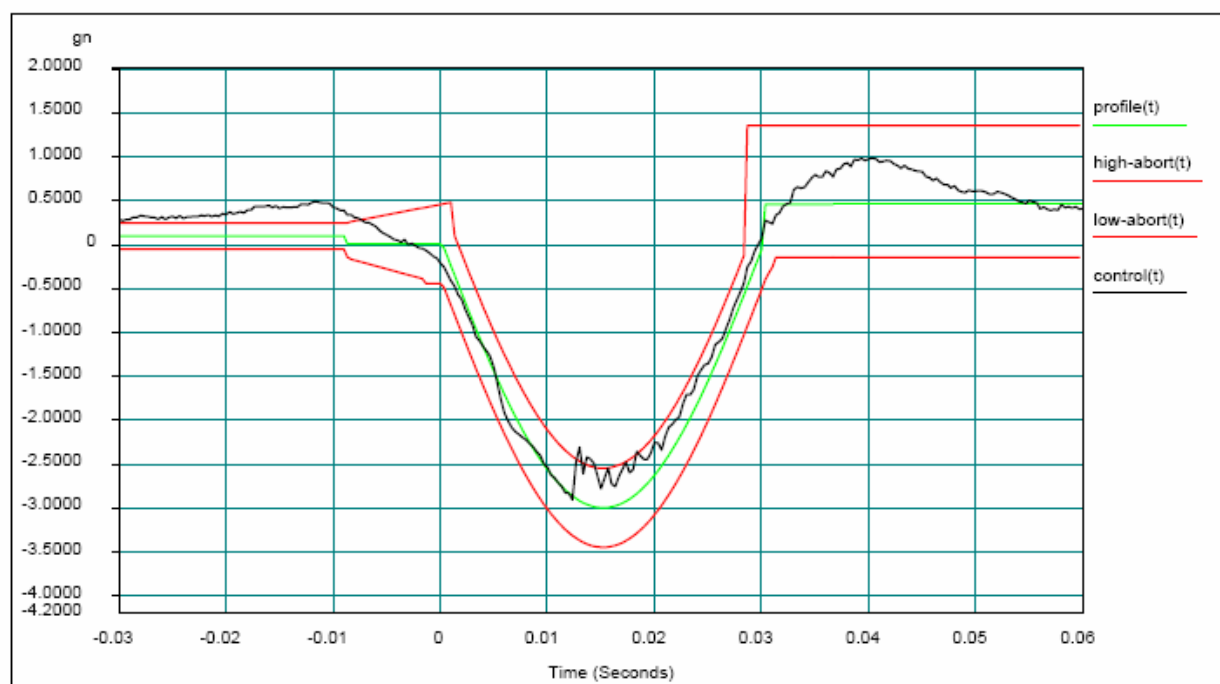
DC/DC Converter (TEN 20-7223WIR)

Project File Name: IEC67373Sk(Y,Z)(SHOCK).prj

Profile Name: 3gn 30mSec

Test Type: Classical Shock

Run Folder: \RunDefault Apr 03, 2012 15-04-12



Level: 100 %

Block Size: 4096

Elapsed Pulses: 11

Frame Time: 1.365333 Seconds

Control Peak: 2.896731 gn

Full Level Elapsed Pulses: 3

dT: 0.000333 Seconds

Demand Peak: 3.060000 gn

Remaining Pulses: 0

Pulse Type: Half Sine

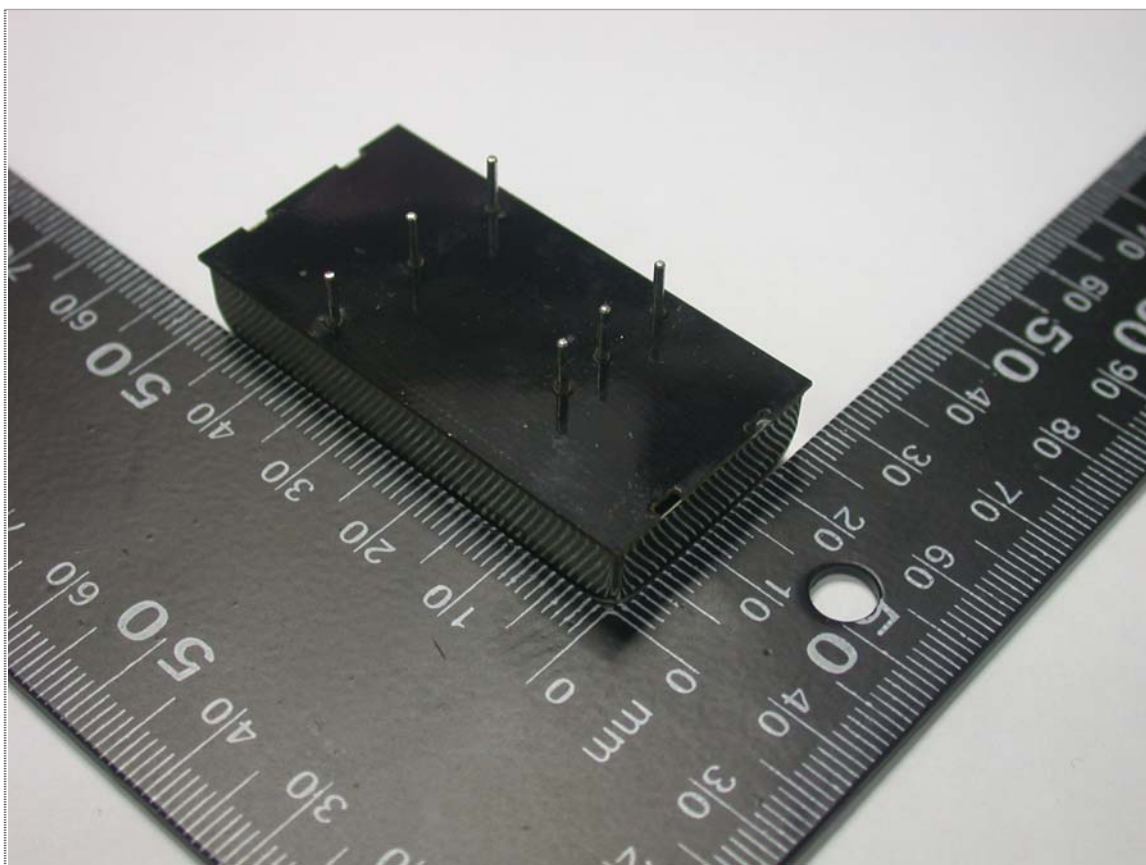
Amplitude: 3.060000 gn

Data saved at 03:04:42 PM, Tuesday, April 03, 2012

Fig. 15 : Shock Testing data of -Z Axis

5 Photographs of EUT

5.1 Model No.: TEN 20-7223WIR



Front View of EUT



Rear View of EUT