

CE Conformance EMC Test Report

Test Report No. : TK-CC100152

Date of Issue : 12/24/2010

Description of Product : Temperature Controller (include in heating cable)

Model No. : DW25W

Variant Model. : DW25W11L, DW25W33L, DW25W44L, DW25W66L, DW25W66L and
DW25W110L

Applicant : DAEWOO ENERTEC Co., Ltd.
148-21, Namsan-Dong, Jung-Gu, Daegu, Rep. of Korea
(Zip Code : 700-831)

Manufacturer : DAEWOO ENERTEC Co., Ltd.
148-21, Namsan-Dong, Jung-Gu, Daegu, Rep. of Korea
(Zip Code : 700-831)

Applicable Regulation : EMC Directive 2004/108/EC
EN 55014-1:2006
Electromagnetic compatibility – Requirements for household
appliances, electric tools and similar apparatus – Part 1: Emission
EN 55014-2:1997+A1:2001+A2:2008
Electromagnetic compatibility – Requirements for household
appliances, electric tools and similar apparatus
– Part 2: Immunity – Product family standard
EN61000-3-2:2006, EN61000-3-3:1995+A1:2001+A2:2005

Test Date : 12/21/2010 – 12/22/2010

Tested by:

Jeong-Eun, Choi
Test Engineer

Reviewed by:

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469-803, Korea Tel : +82-31-883-5092

Test Report No.: TK-CC100152

Model No : DW25W

Applicant : DAEWOO ENERTEC Co., Ltd.

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1. General Information

1.1 Introduction

The EMC Test Report for CE Declaration of Conformity is prepared on behalf of named applicant in accordance with the EMC Directive(2004/108/EC) of the European Economic Community. The test results reported in this document relate only to the item that was tested.

All measurements contained in this report were conducted in accordance with CISPR14-1/EN55014-1:2006 Publication Electromagnetic compatibility –

Requirements for household appliances, electric tools and similar apparatus. The instrumentation utilized for the measurements conforms with CISPR16 Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. Calibration checks are performed yearly on the instruments by a local calibration laboratories.

All radiated emission, conducted emission measurements required by the EMC Directive were performed manually at KES Co., Ltd. (here in after called KES), 477-6, Hageo-ri, Yeoju-eup, Yeoju-gun, Gyeonggi-do, 469-803 KOREA.

The radiated emission measurements performed on 10 meter, Open Area Test Site, test range maintained by KES. Complete ANSI63.4:2003 description and site attenuation measurement data records are maintained at the test facility and have been placed on file with the Federal Communications Commission. The power line conducted emission

All immunity measurements required by the EMC Directive were performed manually at KES, C-3002/3003 Dongil Techno Town, 889-1, Gwanyang2-dong, Dongan-gu, Anyang-city Gyeonggi-do, 431-716 KOREA.

The immunity measurements were performed in a shielded enclosure and/or anechoic chamber also located at the same facility.

The KES EMC test facilities in Anyang-City and Yeoju-eup are designated testing laboratory according to ISO/IEC 17025 by Radio Research Agency(RRA), Korea Communication Commission.

1.2 Product Description for Equipment Under Test (EUT)

DAEWOO ENERTEC Co., Ltd., Model No: DW25W, or the "EUT" as referred to in this report

*Controllor

Input Power	100 Vac ~ 250 Vac
Allowable Current	18Amp. Max.
Peak Load	4kW
Dimensions (mm)	70(W) X 120(H) X 27 (D)

*Heating Cable

Model no.	Power (w/h)	Dimensions	Remarks
DW25W11L	275	11m x Φ 7.5mm	25W/per
DW25W22L	550	22m x Φ 7.5mm	
DW25W33L	825	33m x Φ 7.5mm	
DW25W44L	1100	44m x Φ 7.5mm	
DW25W66L	1650	66m x Φ 7.5mm	
DW25W88L	2200	88m x Φ 7.5mm	
DW25W110L	2750	110m x Φ 7.5mm	

* Test Mode : Normal operating mode

1.3 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
Temperature Controller	DW25W	None	DAEWOO ENERTEC Co., Ltd.	EUT
–	–	–	–	–

1.4 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
N/A	N/A	N/A	N/A	N/A

1.5 External I/O Cabling

Description	Length (m)	Port/From	Port/To	Remarks
N/A	N/A	N/A	N/A	N/A

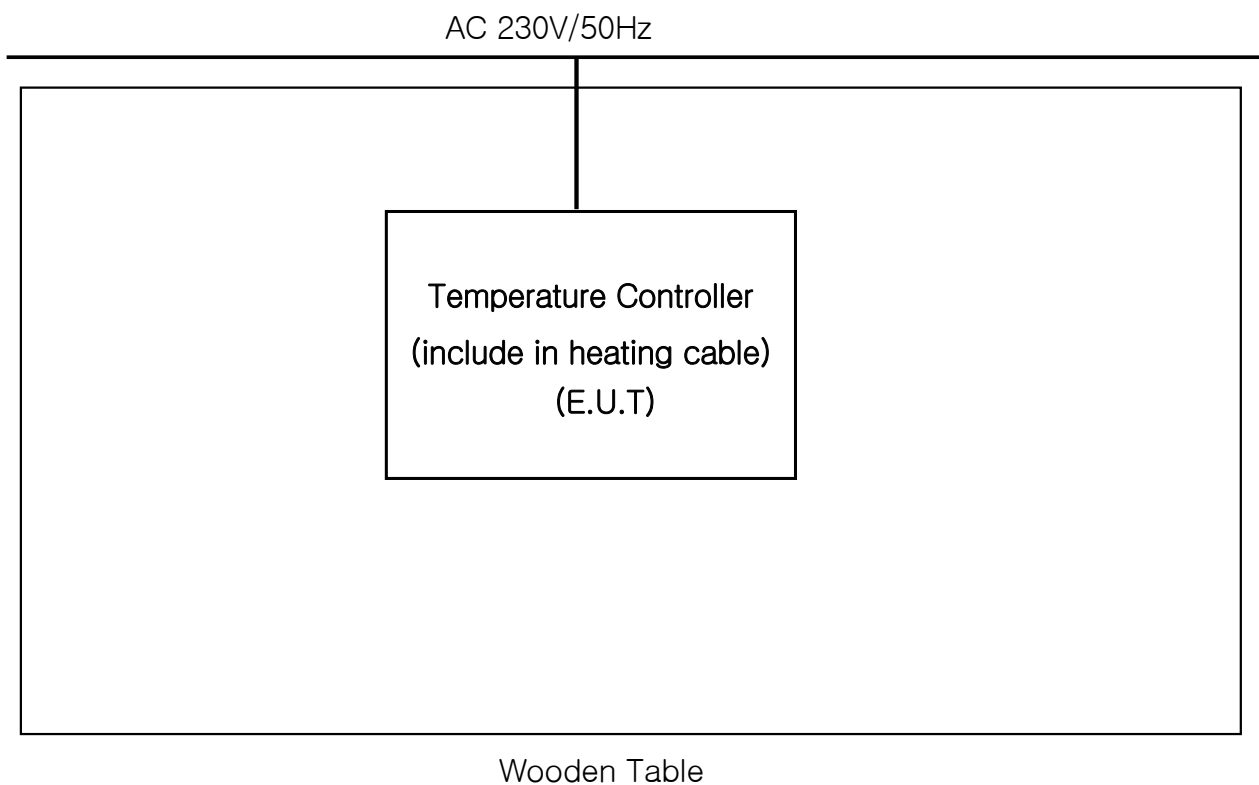
1.6 Special Accessories

As shown in section 1.8, all interface cables used for compliance testing are shielded as normally supplied or by use respective component manufacturers.

1.7 EUT Modifications

No modifications were made to the EUT in order to achieve and maintain compliance to the standards described in this report.

1.8 Configuration of Test System

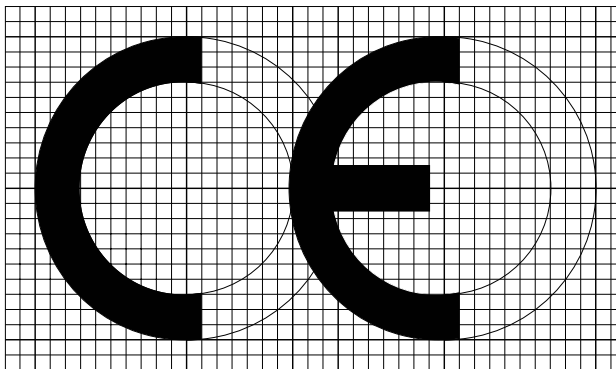


2. Product Labelling Requirements

2.1 CE Mark

The CE Conformity Marking must consist of the initials "CE" in the stylized font and proportional to the dimensional requirements shown in following figure. Regardless of its size, the symbol must retain the specified proportionality.

The Various components of the CE Marking must have substantially the same vertical dimensions, and shall not be less than 5mm in height.



Radius of Outer Circle	100units
Radius of Inner Circle	70units
Stroke Width	30units
Length of Bar	85units
Axis to Axis	170units
Minimum Height	5.0mm

3. Applicable Regulations

3.1 Emission

EN55014-1:2006/CISPR14-1 are the applicable regulations that apply to Electromagnetic compatibility Requirements for household appliances, electric tools and similar apparatus

Part 1:Emission. The intention of these standards, is to establish uniform requirements for the radio disturbance level of the equipment contained in the scope, to fix limits of disturbance, to describe method of measurement and to standardize operation conditions and interpretation of the results.

EN61000-3-2:1995 A1, A2:2006 and EN61000-3-3:1995+A1:2001 +A2:2005 is applicable to electrical and electronic equipment having an input current up to and including 16A per phase, and intended to be connected to public low-voltage distribution systems. The standard specifies limits of voltage fluctuations and maximum permissible values of harmonics components of the input current.

EN55014-1:2006/CISPR14-1 defines Electromagnetic compatibility as follows:

- a. It includes such equipment as: household electrical appliances, electric tools, regulating controls using semiconductor devices, motor-driven electro-medical apparatus, electric/electronic toys, automatic dispensing machines as well as cine or slide projectors.
- b. Excluded from the scope of this standard are: apparatus for which all emission requirements in the radio frequency range are explicitly formulated in other IEC or CISPR standards;

3.2 Immunity

EN55014-2:1997, +A1:2001+A2:2008 is the Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus –Part 2: Immunity – Product family standard. Immunity requires the following as specific performance criteria:

A: The apparatus shall continue to operate as intended during the test.

No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. If the minimum performance level or the permissible

performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

B: The apparatus shall continue to operate as intended after the test.

No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however. No change

C: Temporary loss of function is allowed, provided the function is selfrecoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.

Testing was performed using procedures and criteria contained in

EN 61000-4-2: 1995 +A1:1998, +A2 : 2001, EN61000-4-3:2006,
EN61000-4-4: 2004, EN61000-4-5:2006, EN61000-4-6:2006,
and EN61000-4-11:2004.

4. Test Performed

4.1 Powerline Conducted Emission Measurements

4.1.1 Test Description

The power line conducted emission measurements were performed in a shielded enclosure, using the setup in accordance with ANSI C63.4/CISPR Pub 14-1 conducted emission measurement procedure.

4.1.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
EMI TEST Receiver	R & S	ESHS10	862970/018	06, 2011
EMI Receiver	ISA-80	LIG Nex1	L0912K014	07, 2011
LISN	R & S	ENV216	101137	02, 2011
LISN	EMCO	3825/2	1409	05, 2011
Electro wave Shieldroom	Korea Shield	–	–	–

4.1.3 Test Environments

Ambient Temperatures : 15~35℃
Relative Humidity : 40~60%

4.1.4 Test Limits

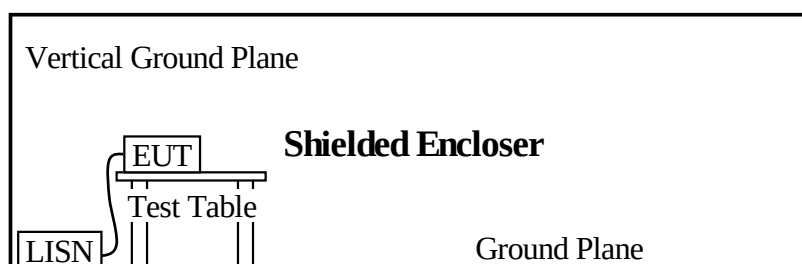
Frequency (MHz)	EN55014-1:2006			
	At mains terminals (dBuV)		At load terminals and additional terminals (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 to 0.50	66.0 to 56.0	59.0 to 46.0	80.0	70.0
0.50 to 5.00	56.0	46.0	74.0	64.0
5.00 to 30.00	60.0	50.0	74.0	64.0

4.1.5 Test Procedure

The conducted emission levels were measured on each current-carrying line with the Receiver operating in the CISPR quasi-peak mode (or peak mode if applicable). The Receiver's 6dB bandwidth was set to 9kHz. The initial step in collecting conducted data is a Receiver peak scan of the measurement range. If the conducted emission exceed the average limit with the instrument set to the quasi-peak mode, the measurements are made in the average mode. The emission spectrum was scanned from 150kHz to 30MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded. Quasi-peak readings are distinguished with a "QP".

The conducted emission test was performed with the EUT exercise program loaded, and the emissions were scanned between 150kHz to 30MHz on the HOT side and NEUTRAL side, herein referred to as H and N, respectively.

4.1.6 Test Configuration



4.1.7 Test Results

According to the data in section 4.1.8, the EUT complied with the EN55014-1:2006 standards, and had the worst margin reading of:

21.41dB at 0.18MHz in the HOT side and 21.31dB at 0.18MHz in the NEUTRAL side.

4.1.8 Test Data

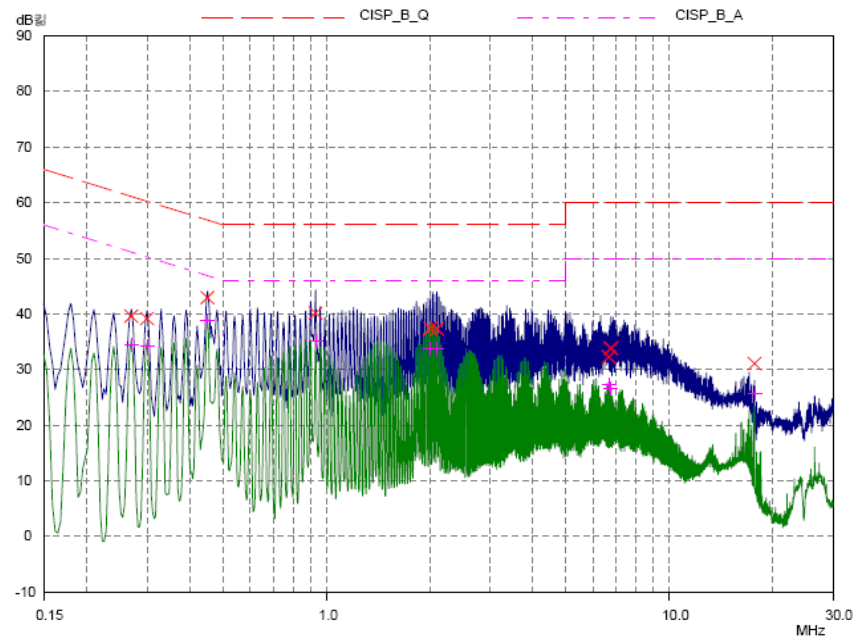
Line Conducted Emission						EN55014-1:2006 At mains terminals		
Frequency (MHz)	Amplitude (dBuV)		Phase Hot/Neutral	Detector (dBuV)		Applicable Limit (dBuV)		Quasi-peak Margin (dB)
	LISN	Cable		Quasi-peak	Average	Quasi-peak	Average	
0.270	0.057	0.100	H	79	39.620	39.777	66	34.410
0.270	0.076	0.100	N	79	44.810	44.986	66	34.800
0.300	0.060	0.100	H	79	39.150	39.310	66	34.120
0.390	0.061	0.100	N	79	45.000	45.161	66	35.380
0.450	0.050	0.100	H	79	42.940	43.090	66	38.860
0.450	0.055	0.100	N	79	49.350	49.505	66	39.320
0.810	0.050	0.100	N	73	44.770	44.920	60	34.530
0.900	0.050	0.100	N	73	45.710	45.860	60	34.910
0.930	0.053	0.100	H	73	40.140	40.293	60	35.170
0.990	0.059	0.100	N	73	42.500	42.659	60	33.060
2.010	0.060	0.190	H	73	37.350	37.600	60	33.830
2.100	0.062	0.168	H	73	37.209	37.439	60	33.640
6.663	0.163	0.100	H	73	32.270	32.533	60	27.180
6.663	0.173	0.100	N	73	37.170	37.443	60	25.210
6.753	0.165	0.100	H	73	33.810	34.075	60	26.510
16.851	0.645	0.192	N	73	40.200	41.037	60	28.280
16.986	0.659	0.199	N	73	38.590	39.448	60	27.820
17.697	0.678	0.117	H	73	31.070	31.864	60	25.750

Temperature: 19.6℃ Humidity: 35% Test Date: 12.21.2010

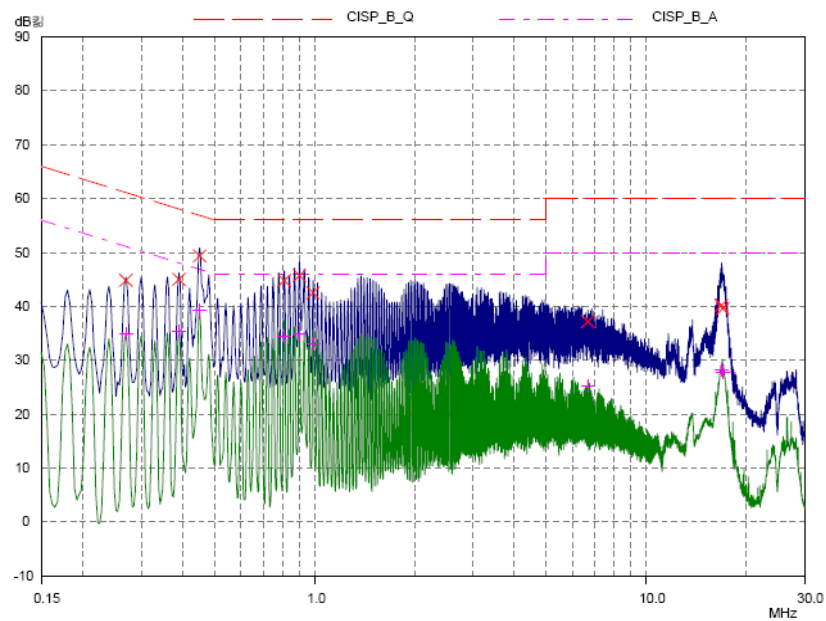
Tested by: Jeong-Eun, Choi

4.1.9 Plots of Test Data

Polarization: HOT



Polarization: NEUTRAL



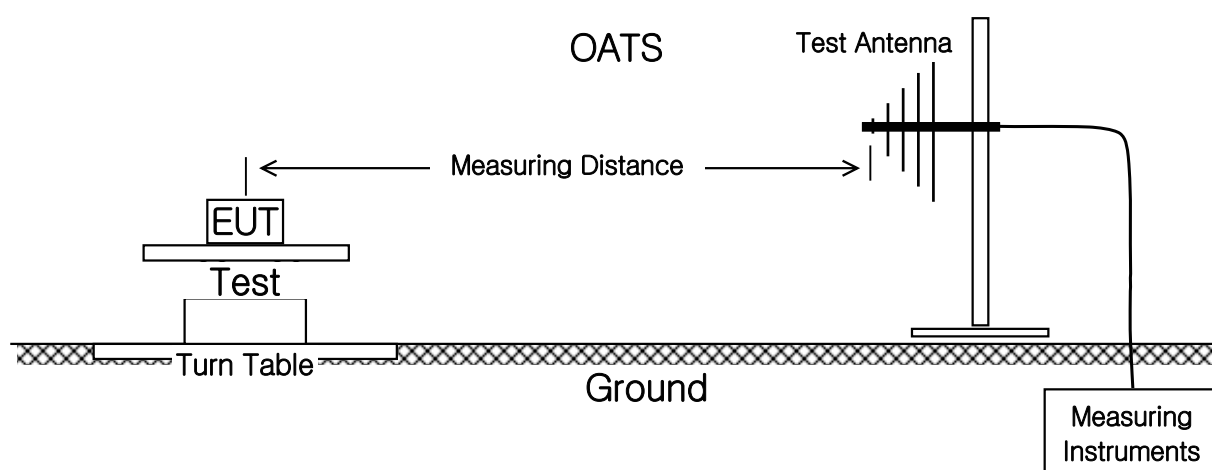
4.2 Radiated Emission Measurements

4.2.1 Test Description

The radiated emissions measurements were performed on the ten-meter, open-field test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane.

The frequency spectrum from 30MHz to 1000MHz was scanned and maximum emission levels at each frequency recorded.

The system was rotated 360°, and the antenna was varied in the height between 1.0 and 4.0 meters in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.



4.2.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
EMI TEST Receiver	R & S	ESVS10	826008/014	06. 2011
Spectrum Analyzer	HP	8566B	2728A01577	05. 2011
Pre-Amplifier	HP	8447F	2805A02570	05. 2011
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-350	03. 2011
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-385	03. 2012

4.2.3 Test Environments

Ambient Temperatures : 15~35℃

Relative Humidity : 40~60%

4.2.4 Test Limits

Frequency (MHz)	EN55014-1:2006
30 to 230	30.0
230 to 1000	37.0

4.2.5 Test Procedure

Before final measurements of radiated emission were made on the OATS, the EUT was scanned in semi-anechoic chamber in order to determine its emission spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emission in amplitude, direction and frequency. This process was repeated during final radiated emission measurements on the OATS range, at each frequency, in order to ensure that maximum emissions amplitudes were attained.

The radiated emission test was performed with EUT exercise program loaded, and the emissions were scanned between 30 to 1000MHz using the spectrum analyzer. The spectrum analyzer's 6dB bandwidth was set to 120kHz, and the analyzer was operated in the CISPR quasi-peak detection mode.

Measurements were taken using both HORIZONTAL and VERTICAL antenna polarization, herein referred to as H and V, respectively.

4.2.6 Field Strength Calculation

The Field Strength (FS) is calculated by adding the Antenna Factor (AF) and Cable Factor (CF) from the Measured Reading (MR). The basic equation with a sample calculation is as follows:

$$FS(dBuV/m) = MR(dBuV) + [AF(dB/m) + CF(dB)]$$

4.2.7 Test Results

N/A

Radiated disturbance requirements in this standard are restricted to toys.

4.2.8 Test Data

Indicated		Antenna		Correction Factor		Corrected Amplitude	EN55014-1:2006		
Frequency (MHz)	Amplitude (dBuV/m)	Polar. (H/V)	Height (m)	Ant. (dB)	Cable (dB)	(dBuV/m)	Applicable Limit		Margin (dB)
							(dBuV/m)	(uV/m)	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Temperature:

Humidity:

Test Date:

Tested by:

4.3 Disturbance power test

4.3.1 Test Description

The disturbance power test measurements were performed in a shielded enclosure, using the setup in accordance with EN55014-1:2006 disturbance power test procedure.

4.3.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
EMI TEST Receiver	R & S	ESVS10	826008/014	06. 2011
EMI Receiver	ISA-80	LIG Nex1	L0912K014	07. 2011
Absorbing Clamp	Rohde & Schwarz	MDS-21	100017	09, 2011

4.3.3 Test Environment

Ambient Temperatures : 15~35℃
Relative Humidity : 40~60%

4.3.4 Test Limits

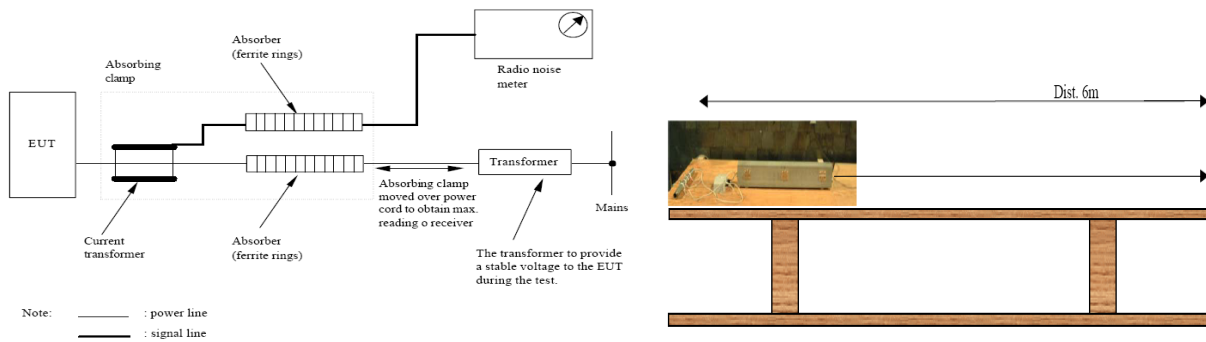
	Household and similar appliances		Tools					
1	2	3	4	5	6	7	8	9
Frequency range			Rated motor power not exceeding 700 W		Rated motor power above 700 W and not exceeding 1 000 W		Rated motor power above 1 000 W	
(MHz)	dB (pw) Quasi-pe ak	dB (pw) Average*	dB (pw) Quasi-pe ak	dB (pw) Average*	dB (pw) Quasi-pe ak	dB (pw) Average*	dB (pw) Quasi-pe ak	dB (pw) Average*
30 to 300	Increasing linearly with the frequency from :							
	45 to 55	35 to 45	45 to 55	35 to 45	49 to 59	39 to 49	55 to 65	45 to 55
* if the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.								

4.3.5 Test Procedure

The EUT is placed on the ground and away from other metallic surface at least 0.4m. It is connected to power mains through an extension cord of 6m min. The absorber clamp clamps the cord and moves from the far end to the EUT to measure the disturbing energy emitted the cord.

The bandwidth of the test receiver is set at 120KHz

4.3.6 Test Configuration



4.3.7 Test Results

According to the data in section 4.3.8, the EUT complied with the EN55014-1:2006 standards

22.83dB at 45.13MHz in the 1m of power cable length.

4.3.8 Test Data

Disturbance power test			EN55014-1:2006 At mains terminals		
Frequency (MHz)	Amplitude (dBuV)	Detector QP/AV/PK	Applicable Limit		Quasi-peak Margin (dB)
			Quasi-peak (dBuV)	Average (dBuV)	
32.513	14.58	QP	45.35	—	30.77
41.186	8.18	QP	46.38	—	38.19
49.343	8.53	QP	47.16	—	38.63
73.340	8.83	QP	48.88	—	40.06
79.463	8.02	QP	49.23	—	41.21
110.993	5.99	QP	50.68	—	44.69
135.892	5.53	QP	51.56	—	46.03
188.552	6.37	QP	52.98	—	46.62
195.596	6.38	QP	53.14	—	46.77
292.528	7.00	QP	54.89	—	47.89
—	—	—	—	—	—

Temperature: 19.6°C Humidity: 35% Test Date: 12.21.2010

Tested by: Jeong-Eun, Choi

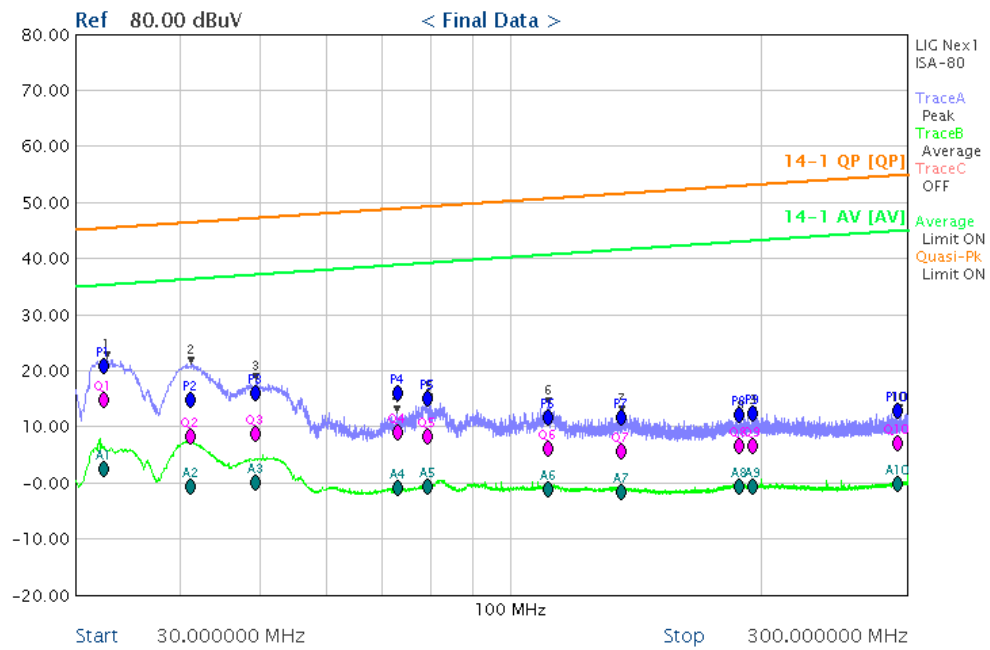
Test Report No.: TK-CC100152

Model No : DW25W

Applicant : DAEWOO ENERTEC Co., Ltd.

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4.3.9 Plots of Test Data



4.4 Electrostatic Discharge Immunity Measurements

4.4.1 Test Description

The EUT and all local support equipment were placed on non-metallic support 0.8m above a reference ground plane (RGP) and was put into operation according to the specified operating mode.

4.4.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
ESD simulator	EM TEST	dito	V0936105124	09, 2011

4.4.3 Test Environment

Ambient Temperatures :	15~35℃
Relative Humidity :	40~60%
Atmospheric Pressure :	860~1060mbar

4.4.4 Test Levels

Discharge Impedance :	330Ω ±10% / 150pF ±10%
Type of Discharge :	Direct – Air Discharge(2/4/8kV), Contact Discharge(2/4kV) Indirect – HCP Discharge(4kV), VCP Discharge(4kV)
Polarity of Output Voltage :	Positive and Negative
Discharge Repetition Rate :	1/sec
Number of Discharges :	more than 20 times(10 with Positive and 10 Negative)
Performance Criteria :	B

4.4.5 Test Procedure

Test programs and software were chosen so as to exercise all normal modes of operation of the EUT. The use of special exercising software is encouraged, but permitted only where it can be shown that the EUT is being comprehensively exercised.

The test was conducted in the following order: Air Discharge, Direct Contact Discharge, Indirect Contact Horizontal Coupling Plane (HCP) Discharge, and Indirect Contact Vertical Coupling Plane (VCP) Discharge. The electrostatic discharge test levels were set and discharges for the different test modes were set appropriately. The electrostatic discharge is applied to the conductive surface of the EUT, and along all seams and control surfaces on the EUT. When a discharge occurs and an error is caused, the type of error, discharge level and location is recorded.

4.4.6 Test Results

According to the data in section 4.4.7, the EUT complied with the EN61000-4-2 standards, and detailed test results are found in the following test data.

4.4.7 Test Data

No.	Test Point	Discharge Method	Performance		Remarks
			Criteria	Results	
1	HCP Contact	Contact Discharge	B	A	–
2	VCP Contact	Contact Discharge	B	A	–

Direct Discharge

No.	Test Point	Discharge Method	Performance		Remarks
			Criteria	Results	
1	enclosure	Air Discharge	B	B	–
2	LED & Button	Air Discharge	B	A	–
3	Screw	Contact Discharge	B	A	–

Performance Results

- A: Normal performance within the specification limits.
- B: Temporary degradation or loss of function or performance which is self-recoverable.
- C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.
- D: Degradation or loss of function which is not recoverable due to damage or equipment.

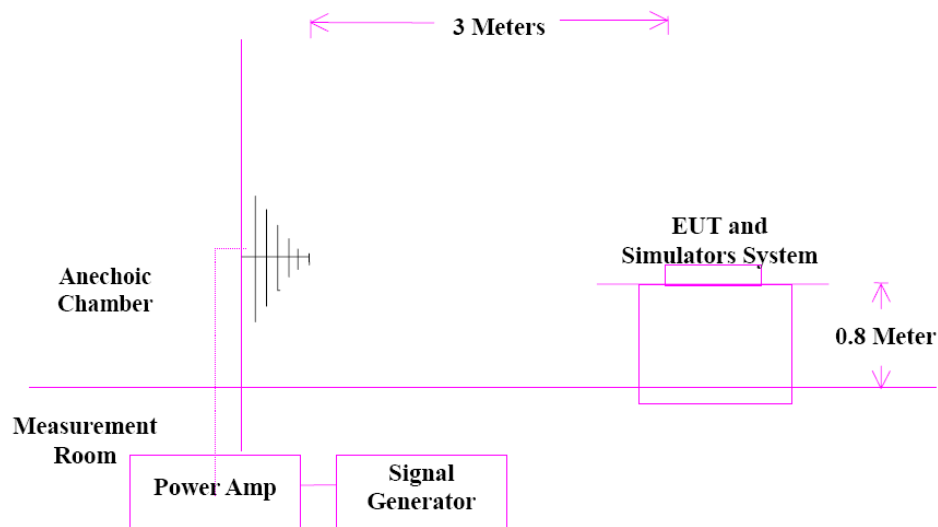
Temperature: 21.5℃ Humidity: 36% Test Date: 12.22.2010 Tested by: Jeong-Eun, Choi

4.5 Radiated RF–Electromagnetic Fields Immunity Measurements

4.5.1 Test Description

The EUT and all local support equipment were placed on a non-metallic support 0.8m above a reference ground plane

(RGP) and was put into operation according to the specified operating mode.



4.5.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Integrated measurement system for EMS	ROHDE & SCHWARZ	IMS	100027	09, 2011
USB adaptor(Passive).	ROHDE & SCHWARZ	NRP-Z4	109360	09, 2011
Average Power Sensor	ROHDE & SCHWARZ	NRP-Z91	100784	09, 2011
Power Amplifier	AR	100W1000M1	19510	09, 2011
High Power Dual Directional Coupler	WELRATON	C3910	30447	09, 2011
Hybrid Log–Periodic Antenna	EMC Automation (TDK)	HLP-2603	100400	09, 2011
Electric Field Probe	ETL	HI-6105USB	00110086	09, 2011
Probe Stand Adjustable to 7 1/2 FT	AR	PS2000	10004439	09, 2011
Readout/Display Interface USB	National Instruments	GPB-USB-HS	145FDC6	09, 2011
Load Termination	Bird Electronic Corporation	300-T-MN	1033774	09, 2011

4.5.3 Test Environments

Ambient Temperatures :	15~35℃
Relative Humidity :	40~60%
Atmospheric Pressure :	860~1060mbar

4.5.4 Test Levels

Frequency Range :	80MHz to 1000MHz
Field Strength :	3 V/m(r.m.s, unmodulated)
Amplitude Modulation :	80% AM in depth by a 1kHz sine wave
Distance of ANT-EUT :	3 meters
Antenna Polarity :	Horizontal and Vertical
Frequency Step :	1%
Performance Criteria :	A

4.5.5 Test Procedures

The EUT is set into operation and was monitored for variations in performance. The test signal start frequency (80MHz) and stop frequency (1000MHz) were set, including the field strength at 3V/m, 80% modulated through immunity test software. The software maintains the necessary field strength through the frequency range, with the transmitting antenna horizontally polarized. If an error is detected, the field is reduced until the error is not repeatable, the field is then manually increased until the error begins to occur. This threshold level, the frequency and the error created are noted before continuing. The test is then repeated with vertical polarization, using the same test configuration for all four sides.

4.5.6 Test Results

According to the data in section 4.5.7, the EUT complied with the EN61000-4-3 standards, and detailed test results are found in the following test data.

4.5.7 Test Data

No.	Test Point	Performance Criteria	Performance Results		Remarks
			Horizontal	Vertical	
1	Front	A	A	A	—
2	Rear	A	A	A	—
3	Right Side	A	A	A	—
4	Left Side	A	A	A	—

Performance Results

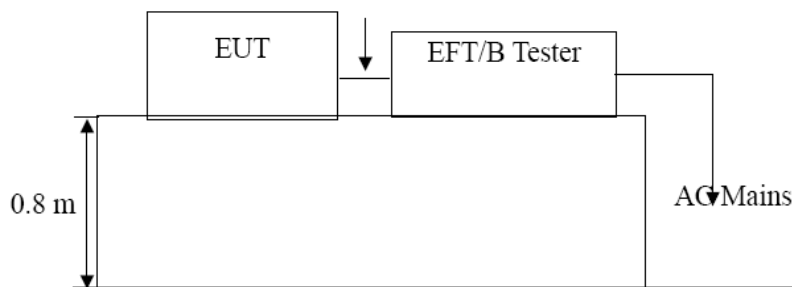
- A: Normal performance within the specification limits.
- B: Temporary degradation or loss of function or performance which is self-recoverable.
- C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.
- D: Degradation or loss of function which is not recoverable due to damage or equipment.

Temperature: 21.5℃ Humidity: 36% Test Date: 12.22.2010 Tested by: Jeong-Eun, Choi

4.6 Electrical Fast Transient/Burst Immunity Measurements

4.6.1 Test Description

The EUT and all local support equipment were placed a non-metallic support 0.8m above a reference ground plane (RGP) and was put into operation according to the specified operating mode. If the EUT has a non-detachable supply cable more than 1 m long, the excess length of this cable was gathered into a flat coil with a 0.4m diameter and situated at a distance of 0.1m above the RGP.



4.6.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Ultra compact simulator	EM TEST	UCS 500 N5	V0936105120	09, 2011
Capacitive coupling clamp	EM TEST	HFK	070925	09, 2011
Calibration kit	EM TEST	CA EFT kit	0209-74 -114	09, 2011
Motorized variac	EM TEST	MV2616	V0936105123	09, 2011

4.6.3 Test Environments

Ambient Temperatures :	15~35℃
Relative Humidity :	40~60%
Atmospheric Pressure :	860~1060mbar

4.6.4 Test Levels

Open Circuit Output Test Voltage :	☒ Power Supply; $\pm 1\text{kV(PEAK)}$ ☐ Protective Earth(PE) ports: $\pm 1\text{kV(PEAK)}$ ☐ I/O Signal, Data and Control ports: 0.5kV
Repetition Frequency of the Impulses :	5kHz
Polarity :	Positive and Negative
Rise Time of One Pulse :	5ns $\pm 30\%$
Impulse Duration :	50ns $\pm 30\%$
Burst Duration :	15ms $\pm 20\%$
Burst Period :	300ms $\pm 20\%$
Performance Criteria :	B

4.6.5 Test Procedure

The EUT was connected to the test equipment, and monitored for performance. The test level was set and the test signal was applied for 120 seconds. A test signal of $\pm 1\text{kV(peak)}$ was Coupled to Line and Ground, Neutral and Ground, Line plus Neutral and Ground, and Protective Earth and Ground. When an error occurs, the test level is reduced until the error recovers and then increased until the threshold level is reached. This threshold and the error conditions were noted. This procedure was then repeated for the other coupling modes.

4.6.6 Test Results

According to the data in section 4.6.7, the EUT complied with the EN61000-4-4 standards, and detailed test results are found in the following test data.

4.6.7 Test Data

On Power port

No.	Test Point	Performance Criteria	Performance Results		Remarks
			+Burst	-Burst	
1	L1	B	A	A	–
2	L2	B	A	A	–
3	PE	B	–	–	–
4	L1-L2	B	A	A	–
5	L1-PE	B	–	–	–
6	L2-PE	B	–	–	–
7	L1-L2-PE	B	–	–	–

On I/O Signal, Data and Control ports

No.	Test Point	Performance Criteria	Performance Results		Remarks
			+Burst	-Burst	
1	N/A	N/A	N/A	N/A	–
2	N/A	N/A	N/A	N/A	–

Performance Results

- A: Normal performance within the specification limits.
- B: Temporary degradation or loss of function or performance which is self-recoverable.
- C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.
- D: Degradation or loss of function which is not recoverable due to damage or equipment.

Temperature: 21.5℃ Humidity: 36% Test Date: 12.22.2010 Tested by: Jeong-Eun, Choi

4.7 Surge Immunity Measurements

4.7.1 Test Description

The EUT and all local support equipment was placed on a non-metallic support 0.8m above a reference ground plane (RGP) and was put into operation according to the specified operating mode.

4.7.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Ultra compact simulator	EM TEST	UCS 500 N5	V0936105120	09, 2011
CDN	EM TEST	CNV 504 N	V0936105121	09, 2011
CDN	EM TEST	CNV 504 S1	V0936105122	09, 2011
Motorized variac	EM TEST	MV2616	V0936105123	09, 2011

4.7.3 Test Environments

Ambient Temperatures :	15~35℃
Relative Humidity :	40~60%
Atmospheric Pressure :	860~1060mbar

4.7.4 Test Levels

Open Circuit Test Voltage :	☒ AC Power; $\pm 0.5/1$ kV line-to-line, ☐ AC POWER, $\pm 0.5/1/2$ kV line-to-ground ☐ DC Power; ± 0.5 kV line-to-ground ☐ Data and Control Line; ± 1.0 kV line-to-ground
Open Circuit Voltage Waveform :	1.2/50 microsecond
Short Circuit Current Waveform :	8/20 microsecond
Number of Tests :	5 positive and 5 negative
Repetition Rate :	1/min
Performance Criteria :	B

4.7.5 Test Procedure

The surges have to be applied line to line and line(s) and ground. In case of testing line to ground the test voltage has to be applied successively between each of the lines and ground, if there is no other specification. All lower levels including the selected test level must be satisfied. For testing the secondary protection the output voltage of the generator must be increased up to the worst case voltage break down level of the primary protection.

4.7.6 Test Results

According to the data in section 4.7.7, the EUT complied with the EN61000-4-5 standards, and detailed test results are found in the following test data.

4.7.7 Test Data

On Power Supply, Protective Earth(PE) ports

No.	Test Point	Performance Criteria	Performance Results		Remarks
			+Surge	-Surge	
1	L1-L2	B	A	A	-
2	L1-PE	-	-	-	-
3	L2-PE	-	-	-	-

On I/O Signal, Data and Control ports

No.	Test Point	Performance Criteria	Performance Results		Remarks
			+Surge	-Surge	
1	N/A	N/A	N/A	N/A	-
2	N/A	N/A	N/A	N/A	-

Performance Results

- A: Normal performance within the specification limits.
- B: Temporary degradation or loss of function or performance which is self-recoverable.
- C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.
- D: Degradation or loss of function which is not recoverable due to damage or equipment.

Temperature: 21.5℃ Humidity: 36% Test Date: 12.22.2010 Tested by: Jeong-Eun, Choi

4.8 Conducted Disturbances Induced by Radio Frequency Fields

4.8.1 Test Descriptions

The EUT and all local support equipment were placed on a non-metallic support 0.1m above a reference ground plane (RGP) and was put into operation according to the specified operating mode.

4.8.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Continuous Wave Simulator	EM TEST	CWS 500N1	V0936105119	09, 2011
Attenuator	EM TEST	ATT 6dB/75W	1208-34	09, 2011
Basic calibration kit	EM TEST	CWS-CAL	0209 -182 -183 -184	09, 2011
CDN	EM TEST	CDN-M2/M3	0909-06	09, 2011
CDN	EM TEST	CDN-T2-RJ11	0909-07	09, 2011
CDN	EM TEST	CDN-T4	0909-08	09, 2011
CDN	EM TEST	CDN-T8RJ45	0909-09	09, 2011
CDN	EM TEST	CDN-AF2	0909-10	09, 2011
CDN	EM TEST	CDN-AF4	0909-11	09, 2011
EM Clamp	EM TEST	EM 101	35943	11, 2011

4.8.3 Test Environments

Ambient Temperatures :	15~35℃
Relative Humidity :	40~60%
Atmospheric Pressure :	860~1060mbar

4.8.4 Test Levels

Frequency Range :	150kHz to 80MHz
Voltage Level :	3V
Amplitude Modulation :	80% AM in depth by a 1kHz sine wave
Frequency Step :	1%
Performance Criteria :	A

4.8.5 Test Procedure

The test was performed with the test generator connected to each of the coupling and decoupling devices in turn while the other non-excited RF-input ports of the coupling devices are terminated by a 50-ohms load resistor. The frequency range is swept from 150kHz to 80MHz using the signal levels established during the setting process, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave, pausing to adjust the RF-signal level or to switch coupling device as necessary.

4.8.6 Test Results

According to the data in section 4.8.7, the EUT complied with the EN61000-4-6 standards, and detailed test results are found in the following test data.

4.8.7 Test Data

On Power Supply, Protective Earth(PE) ports

No.	Test Point	Performance		Remarks
		Criteria	Results	
1	CDN-M2	A	A	–
2	–	–	–	–

On I/O Signal, Data and Control ports

No.	Test Point	Performance		Remarks
		Criteria	Results	
1	N/A	N/A	N/A	–
2	N/A	N/A	N/A	–

Performance Results

- A: Normal performance within the specification limits.
- B: Temporary degradation or loss of function or performance which is self-recoverable.
- C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.
- D: Degradation or loss of function which is not recoverable due to damage or equipment.

Temperature: 21.5℃ Humidity: 36% Test Date: 12.22.2010 Tested by: Jeong-Eun, Choi

4.9 Voltage Dips and Short Interruptions Immunity Measurements

4.9.1 Test Descriptions

The EUT and all local support equipment was placed on a non-metallic support 0.8m above a reference ground plane (RGP) and was put into operation according to the specified operating mode.

4.9.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Ultra Compact Simulator	EM Test AG	UCS 500 N5	V0936105120	09, 2011
Motorized variac	EM TEST	MV2616	V0936105123	09, 2011

4.9.3 Test Environments

Ambient Temperatures :	15~35℃
Relative Humidity :	40~60%
Atmospheric Pressure :	860~1060mbar

4.9.4 Test Levels

Overshoot/Undershoot of Actual Voltage :	Less than $\pm 5\%$ of the change in voltage
Voltage Rise and Fall Time :	Between 1 and 5 microseconds
Test Voltage :	220V A.C. and 230V A.C.
Frequency Deviation of Test Voltage :	Less than $\pm 2\%$ of rated frequency
Number of Tests :	3 times
Test Intervals :	10 sec
Performance Criteria :	C for Voltage Dips and Short Interruptions C for Voltage Variation

4.9.5 Test Procedure

For each test any degradation of performance were recorded. The monitoring equipment should be capable of displaying the status of the operational mode of the EUT during and after the tests. After each group of tests a full functional check were performed.

4.9.6 Test Results

According to the data in section 4.9.7, the EUT complied with the EN61000-4-11 standards, and detailed test results are found in the following test data.

4.9.7 Test Data

Voltage Dips and Short Interruptions

No.	Depth	Duration	Performance		Remarks
			Criteria	Results	
1	100%	0.5T	C	A	At 50Hz
2	100%	0.5T	C	A	At 60Hz
3	60%	10T	C	A	At 50Hz
4	60%	12T	C	A	At 60Hz
5	30%	25T	C	B	At 50Hz
6	30%	30T	C	B	At 60Hz

Performance Results

- A: Normal performance within the specification limits.
- B: Temporary degradation or loss of function or performance which is self-recoverable.
- C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.
- D: Degradation or loss of function which is not recoverable due to damage or equipment.

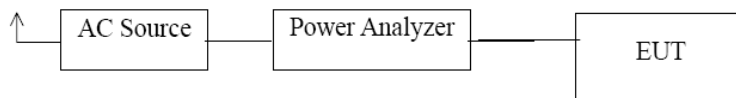
Temperature: 21.5℃ Humidity: 36% Test Date: 12.22.2010 Tested by: Jeong-Eun, Choi

4.10 Harmonics / Voltage Fluctuations Measurements

4.10.1 Test Description

Harmonics of the fundamental current were measured up to 2 kHz using a universal power analyzer. The measurements were carried out under steady conditions and using averaging. Before making measurements the class of the EUT has been evaluated, it is necessary for the EUT to decide which class the EUT fulfills into; A, B, C or D

AC Mains



4.10.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
AC Power Source	Schaffner-Chase EMC Ltd.	NSG 1007-5-208 -CTS-413	HK53453	09. 2010
Flicker & Harmonic Tester	Schaffner-Chase EMC Ltd.	CCN-1000-1	72585	09. 2010

4.10.3 Test Environments

Ambient Temperatures :	15~35℃
Relative Humidity :	40~60%
Atmospheric Pressure :	860~1060mbar

4.10.4 Test Procedures

The EUT was installed and placed on a non-conductive table and was connected to the AC power source, 230VAC, via the measuring equipment with its attached AC power cord. All other equipment or peripherals included in the test, and having a separate power supply, are connected to the outlet, supplying 230VAC, 50Hz. A typical configuration is defined in the specification ANSI 63.4 or CISPR22. This ensures the repeatability of the test.

The EUT is set in operation and was monitored for measurements with the software, supplied by test equipment manufacturer. An EMC test program provided by client was used to exercise the EUT.

4.10.5 Test Results

There are no any problem during this test and test data above test limit.

According to the data in section 4.10.6 and 4.10.7, the EUT complied with the EN61000-3-2:2006 and EN61000-3-3:1995+A1:2001 +A2:2005 standards, and detailed test results are found in the following test data and EUT is take the test max normal load operation conditions

4.10.6 Test Data – Harmonic

Maximum harmonic current results

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	2.594			
2	45.651E-3	1.409	3.24	PASS
3	28.227E-3	0.409	6.90	PASS
4	15.985E-3	1.239	1.29	PASS
5	16.725E-3	0.489	3.42	PASS
6	10.266E-3	1.141	900.00E-3	PASS
7	13.117E-3	0.568	2.31	PASS
8	7.730E-3	1.120	690.00E-3	PASS
9	10.972E-3	0.914	1.20	PASS
10	6.359E-3	1.152	552.00E-3	PASS
11	9.017E-3	0.911	990.00E-3	PASS
12	5.404E-3	1.175	459.99E-3	PASS
13	8.387E-3	1.331	630.00E-3	PASS
14	4.636E-3	1.176	394.29E-3	PASS
15	6.523E-3	1.449	450.00E-3	PASS
16	4.100E-3	1.188	345.00E-3	PASS
17	6.194E-3	1.560	397.05E-3	PASS
18	3.632E-3	1.184	306.66E-3	PASS
19	4.889E-3	1.376	355.26E-3	PASS
20	3.360E-3	1.217	276.00E-3	PASS
21	4.822E-3	1.500	321.42E-3	PASS
22	3.124E-3	1.245	250.92E-3	PASS
23	4.106E-3	1.399	293.49E-3	PASS
24	2.971E-3	1.292	229.98E-3	PASS
25	4.421E-3	1.637	270.00E-3	PASS
26	2.918E-3	1.374	212.31E-3	PASS
27	3.987E-3	1.595	249.99E-3	PASS
28	2.583E-3	1.311	197.13E-3	PASS
29	3.893E-3	1.673	232.77E-3	PASS
30	2.493E-3	1.355	183.99E-3	PASS
31	3.579E-3	1.644	217.74E-3	PASS
32	2.425E-3	1.406	172.50E-3	PASS
33	3.936E-3	1.924	204.54E-3	PASS

34	2.328E-3	1.434	162.36E-3	PASS
35	3.008E-3	1.560	192.87E-3	PASS
36	2.273E-3	1.483	153.33E-3	PASS
37	3.955E-3	2.168	182.43E-3	PASS
38	2.172E-3	1.495	145.26E-3	PASS
39	3.110E-3	1.797	173.07E-3	PASS
40	2.122E-3	1.538	138.00E-3	PASS

Maximum harmonic voltage results

Hn	Ueff [V]	Ueff [%]	Limit [%]	Result
1	230.71	100.290		
2	61.95E-3	0.027	0.2	PASS
3	57.59E-3	0.025	0.9	PASS
4	43.97E-3	0.019	0.2	PASS
5	70.92E-3	0.031	0.4	PASS
6	32.87E-3	0.014	0.2	PASS
7	57.04E-3	0.025	0.3	PASS
8	21.95E-3	0.010	0.2	PASS
9	82.70E-3	0.036	0.2	PASS
10	7.68E-3	0.003	0.2	PASS
11	57.42E-3	0.025	0.1	PASS
12	15.16E-3	0.007	0.1	PASS
13	81.84E-3	0.036	0.1	PASS
14	27.72E-3	0.012	0.1	PASS
15	70.34E-3	0.031	0.1	PASS
16	28.81E-3	0.013	0.1	PASS
17	94.54E-3	0.041	0.1	PASS
18	19.63E-3	0.009	0.1	PASS
19	58.00E-3	0.025	0.1	PASS
20	21.51E-3	0.009	0.1	PASS
21	78.81E-3	0.034	0.1	PASS
22	18.23E-3	0.008	0.1	PASS
23	31.27E-3	0.014	0.1	PASS
24	10.05E-3	0.004	0.1	PASS
25	82.24E-3	0.036	0.1	PASS
26	16.54E-3	0.007	0.1	PASS
27	57.45E-3	0.025	0.1	PASS
28	15.52E-3	0.007	0.1	PASS
29	62.81E-3	0.027	0.1	PASS
30	7.86E-3	0.003	0.1	PASS
31	34.31E-3	0.015	0.1	PASS
32	14.20E-3	0.006	0.1	PASS
33	52.49E-3	0.023	0.1	PASS
34	12.37E-3	0.005	0.1	PASS
35	37.40E-3	0.016	0.1	PASS
36	9.44E-3	0.004	0.1	PASS

37	48.02E-3	0.021	0.1	PASS
38	14.49E-3	0.006	0.1	PASS
39	42.45E-3	0.018	0.1	PASS
40	11.09E-3	0.005	0.1	PASS

4.10.7 Test Data – Voltage Fluctuations

	EUT values	Limit	Result
Pst	0.110	1.00	PASS
Plt	0.110	0.65	PASS
dc [%]	0.483	3.30	PASS
dmax [%]	0.535	4.00	PASS
dt [s]	0.000	0.50	PASS

Temperature: 19.6℃ Humidity: 35% Test Date: 12.21.2010 Tested by: Jeong-Eun, Choi

4.11 Discontinuous disturbance (CLICKS)

4.11.1 Test Description

Switching operations in thermostatically controlled appliances, automatic programme controlled machines and other electrically controlled or operated appliances generate discontinuous disturbance. The subjective effect of discontinuous disturbance varies with repetition rate and amplitude in audio and video presentation. Therefore distinction is made between various kinds of discontinuous disturbance.

4.11.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
EMI TEST Receiver	LIG NEX1	LSA-265	L7098003	07, 2011
LISN1	Electro Metrics	ANS-25/2	2535	09, 2011
LISN2	Kyoritsu	KNW-407	8-1010-14	09, 2011

4.11.3 Test Environments

Ambient Temperatures :	15~35℃
Relative Humidity :	40~60%

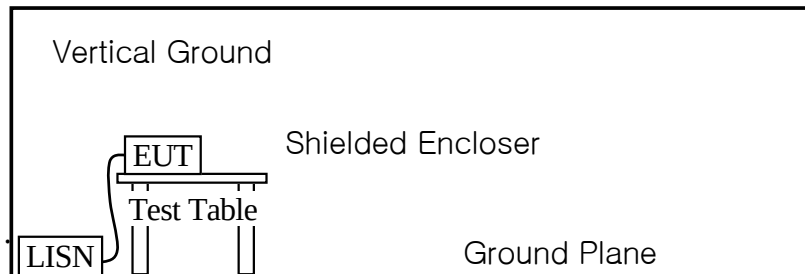
4.11.4 Test Limits

Frequency (MHz)	EN55014-1:2006(Quasi-Peak dBμV)
0.15 to 0.50	66 to 56
0.5 to 5.0	56
5 to 30	60

4.11.5 Test Procedure

A disturbance, the amplitude of which exceeds the quasi-peak limit of continuous disturbance, the duration of which is not longer than 200 ms and which is separated from a subsequent disturbance by at least 200 ms. The durations are determined from the signal which exceeds the i.f. reference level of the measuring receiver. A click may contain a number of impulses; in which case the relevant time is that from the beginning of the first to the end of the last impulse.

4.11.6 Test Configuration



Limit L for household appliances and equipment causing similar disturbances and regulating controls incorporating semiconductor devices at mains terminals

4.11.7 Test Results

According to the data in section 4.11.8, the EUT complied with the EN55014-1:2006 standards, and The appliance has a program which stops automatically; therefore the observation time is defined and contains more than 40 clicks. If less than 25% of the clicks exceeds the limit the product complies with the limits

The items are not considering the Click the test result did not

4.11.8 Test Data

Clicks Factor =							
Observation Time =							
Line	Freq. MHz	Limit dBuV	Total Clicks n	Click Rate $N=(n*f)/T$	Relaxation dB	Relaxed Limit dBuV	Permitted Clicks (25%)
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N	Relaxation (dB)
$N < 0.2$	N/A
$0.2 \leq N < 30$	N/A
$N > 30$	N/A

Temperature: – Humidity: – Test Date: – Tested by: –

5. Test Setup Photographs

5.1 Conducted Emission and Click

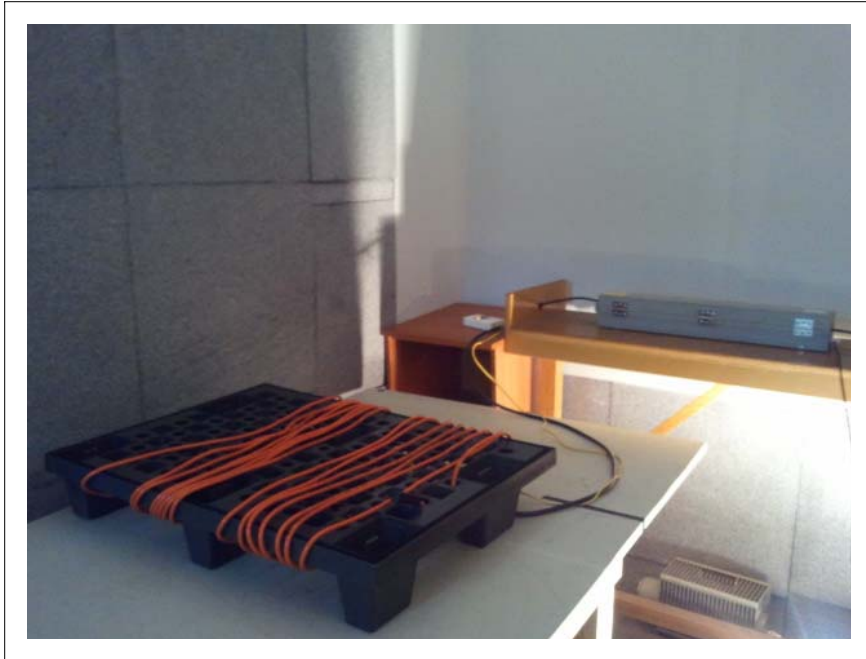


5.2 Radiated Emission

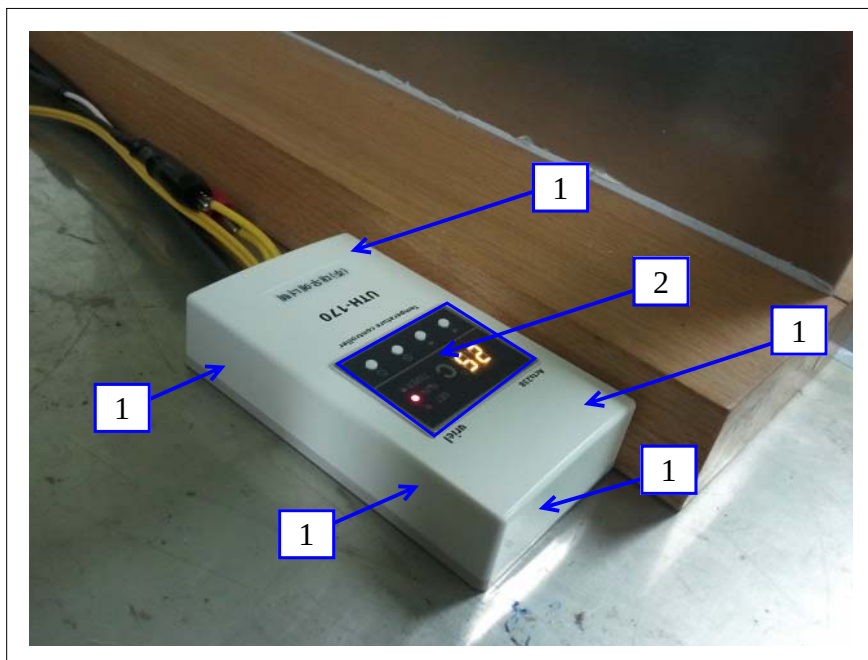
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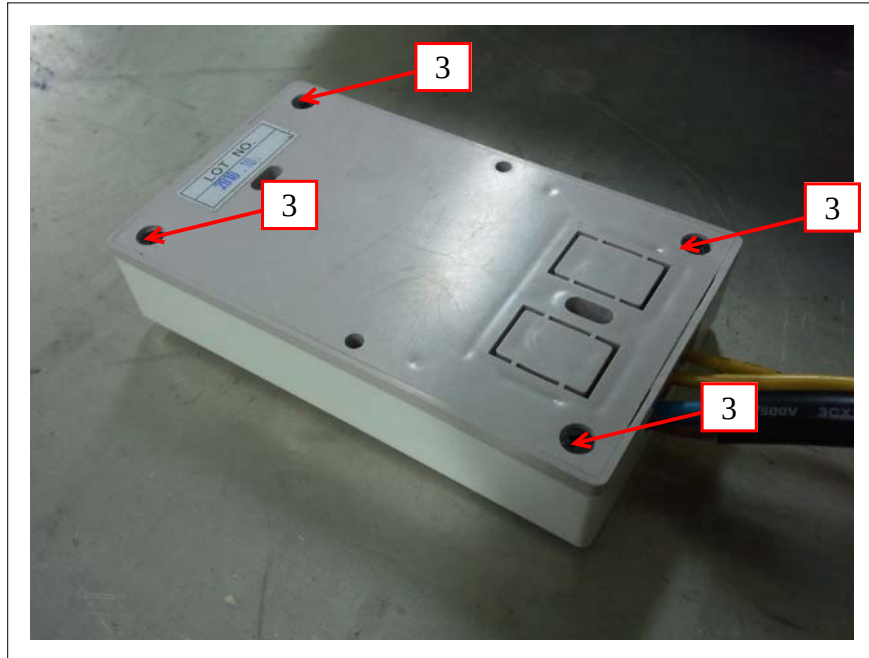
N/A

5.3 Disturbance power



5.4 Electrostatic Discharge Immunity





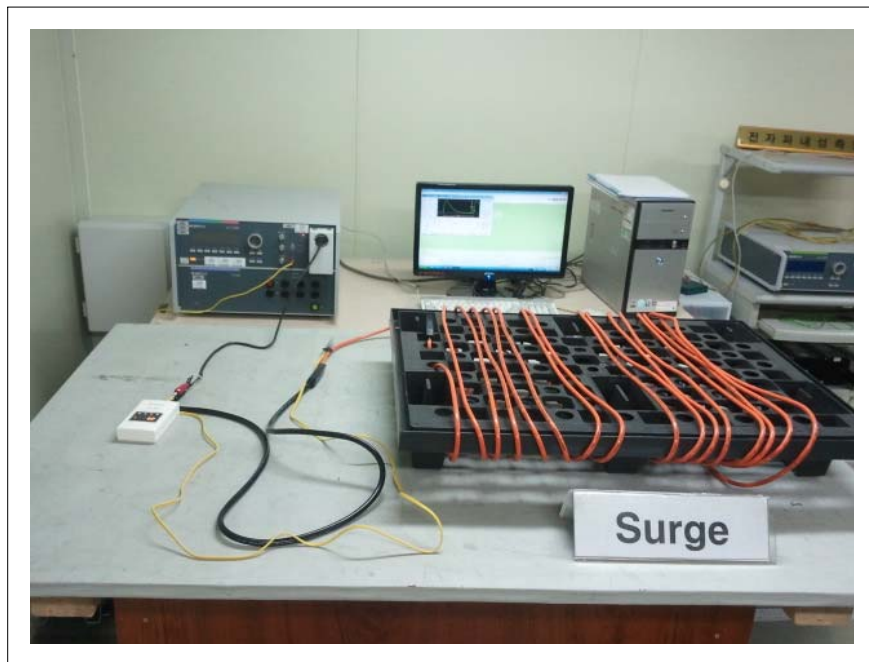
5.5 Radiated RF-Electromagnetic Fields



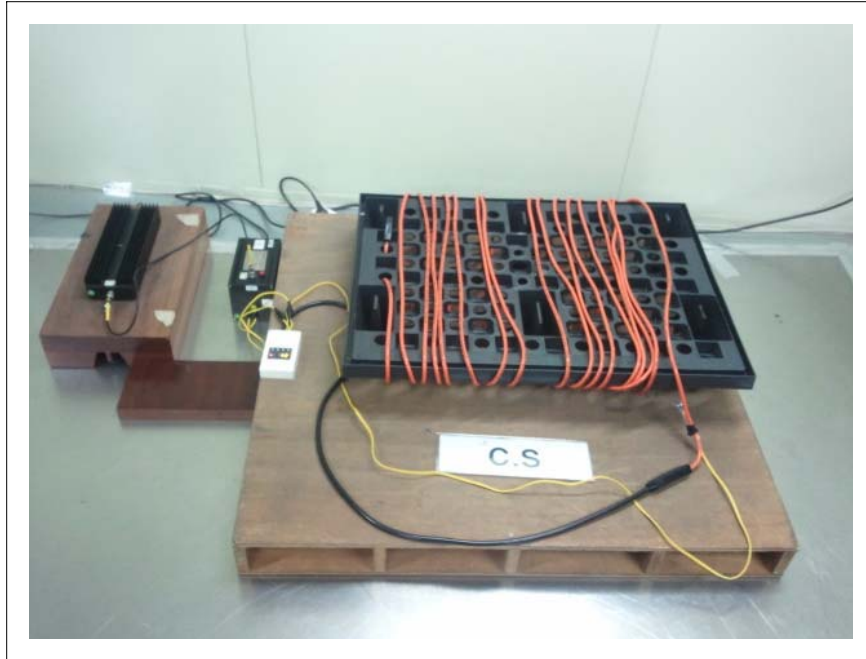
5.6 Electrical Fast Transient/Burst Immunity



5.7 Surge Immunity



5.8 Conducted Disturbances Induced by Radio Frequency Fields



5.9 Voltage Dips and Short Interruptions Immunity



5.10 Harmonics / Voltage Fluctuations Measurements



4. External Photographs

4.1 EUT: Side1 View



4.2 EUT: Side2 View



4.3 EUT: Side3 View



4.4 EUT: Side4 View



4.5 EUT: Side5 View



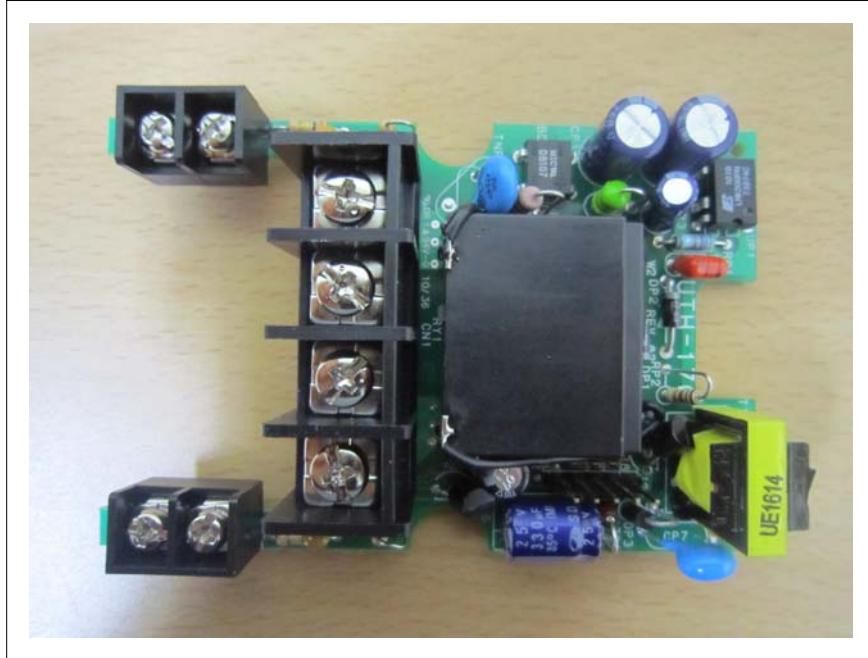
4.6 EUT: Side6 View



4.7 EUT: Internal View



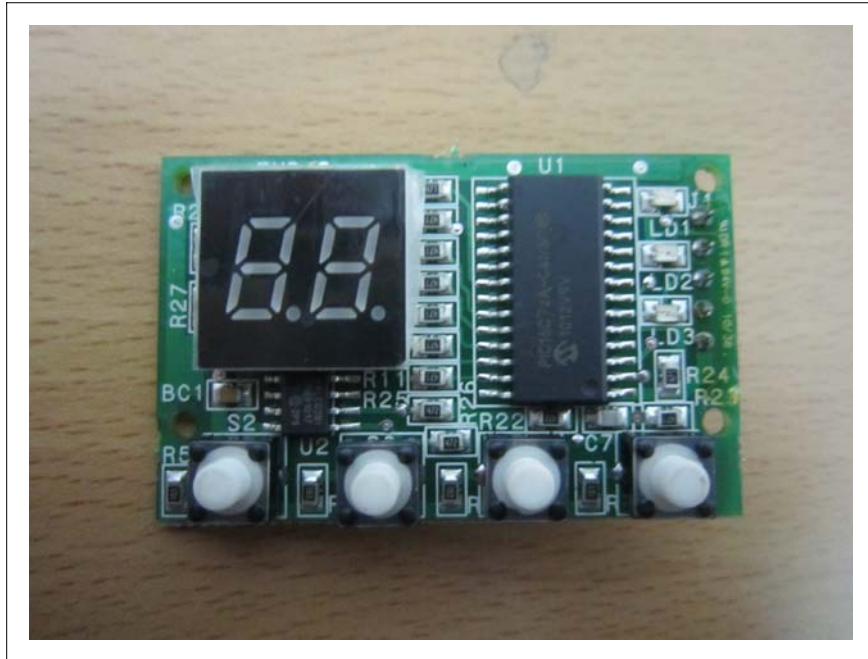
4.8 EUT: Main Board Front View



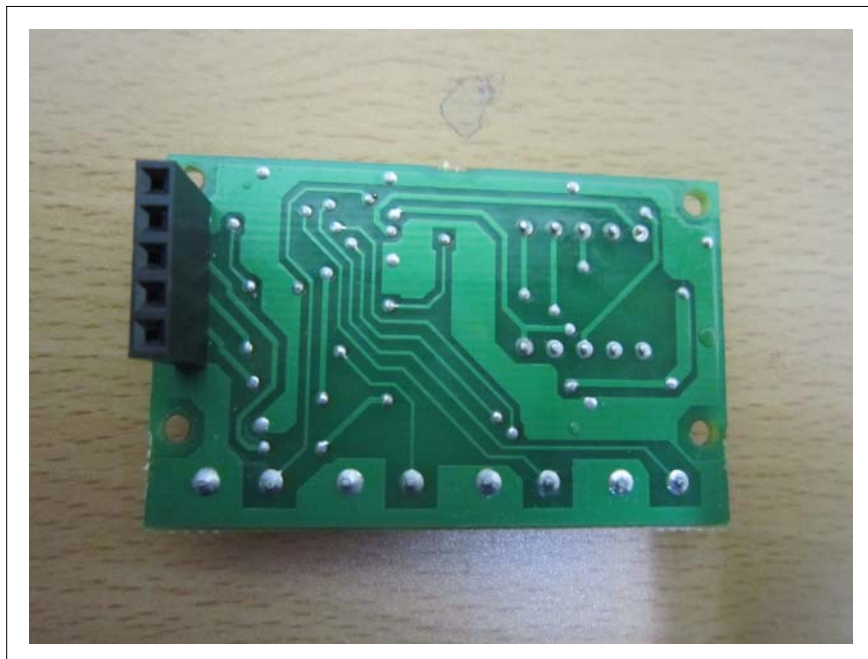
4.9 EUT: Main Board Rare View



4.10 EUT: Sub Board Front View



4.11 EUT: Sub Board Rare View



4.12 EUT : Heating Cable



Appendix A – Schematics/Block Diagram

Please see attached document(s).

Appendix B – User's Manual

Please see attached document(s).