



KES Co., Ltd.

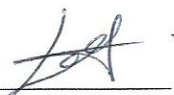
C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (1) of (53)

CE Conformance EMC Test Report

Test Report No. : KES-E1-120074
Date of Issue : 02.06.2012
Description of Product : Heating Film
Model No. : HP-SPN305
Variant Model : -
Applicant : Seggi Century Co., Ltd.
Address : #278, Eunam-Ri, Chopyeong-Myeon, Jincheon-Gun, Chungbuk, Korea
Manufacturer : Seggi Century Co., Ltd.
Address : #278, Eunam-Ri, Chopyeong-Myeon, Jincheon-Gun, Chungbuk, Korea
Applicable Regulation : **EMC Directive 2004/108/EC**
EN 55014-1:2006+A1:2009
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
Test Date : 01.27.2012 - 01.30.2012

Tested by:


Jae Ju, Lee
Test Engineer

Reviewed by:


Won Wook, Kim
Technical Manager



Testing Laboratories for EMS and Safety and RF Compliance
C-3002/3003 Dongil Techno Town, 889-1, Gwanyang 2-dong, Dongan-gu, Anyang-city,
Gyeonggi-do, 431-716, KOREA Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Testing Laboratories for EMI Compliance 477-6, Hageo-ri, Yeosu-eup, Yeosu-gun, Gyeonggi-do,
469-803, Korea Tel : +82-31-883-5092 / Fax: +82-31-883-5169

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (2) of (52)

Revision history

Revision	Date of issue	Test report No.	Description
-	02.06.2012	KES-E1-120074	Initial

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (3) of (52)

TABLE OF CONTENTS

1	General Information	4
2	Product Labelling Requirements	8
3	Applicable Regulations	9
4	Test standards and results	11
5	Test Performed	12
5.1	Conducted Emission Measurements	12
5.2	Radiated Emission Measurements	15
5.3	Disturbance Power Measurements (30 MHz - 300 MHz)	18
5.4	Harmonics / Voltage Fluctuations Measurements (EN61000-3-2 / EN61000-3-3)	20
5.5	Electrostatic Discharge Immunity	24
5.6	Radio-frequency electromagnetic field Amplitude modulated Immunity	26
5.7	Fast Transients Immunity	29
5.8	Surge Immunity	32
5.9	Radio-frequency continuous conducted Immunity	34
5.10	Voltage Dips and Interruptions Immunity	36
5.11	Clicks Measurements	38
6	Test Setup Photographs	40
6.1	Conducted Emission Measurements	40
6.2	Radiated Emission Measurements	41
6.3	Disturbance Power Measurements (30 MHz - 300 MHz)	42
6.4	Harmonics / Voltage Fluctuations Measurements (EN61000-3-2 / EN61000-3-3)	42
6.5	Electrostatic Discharge Immunity	43
6.6	Radio frequency electromagnetic field immunity	45
6.7	Fast Transients Immunity	45
6.8	Surge Immunity	46
6.9	Radio-frequency continuous conducted Immunity	46
6.10	Voltage Dips and Interruptions Immunity	47
6.11	Clicks Measurements	47
7	Photographs	48
	Appendix A -Schematics/Block Diagram	53
	Appendix B - User's Manual	54

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (4) of (52)

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 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.

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.



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (5) of (52)

1.2 Product Description for Equipment Under Test (EUT)

Seggi Century Co., Ltd., Heating Film, Model No: HP-SPN305, or the "EUT" as referred to in this report is best model.

- Main Specifications of EUT : See the manual.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (6) of (52)

1.3 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
Heating Film	HP-SPN305	N/A	Seggi Century 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

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

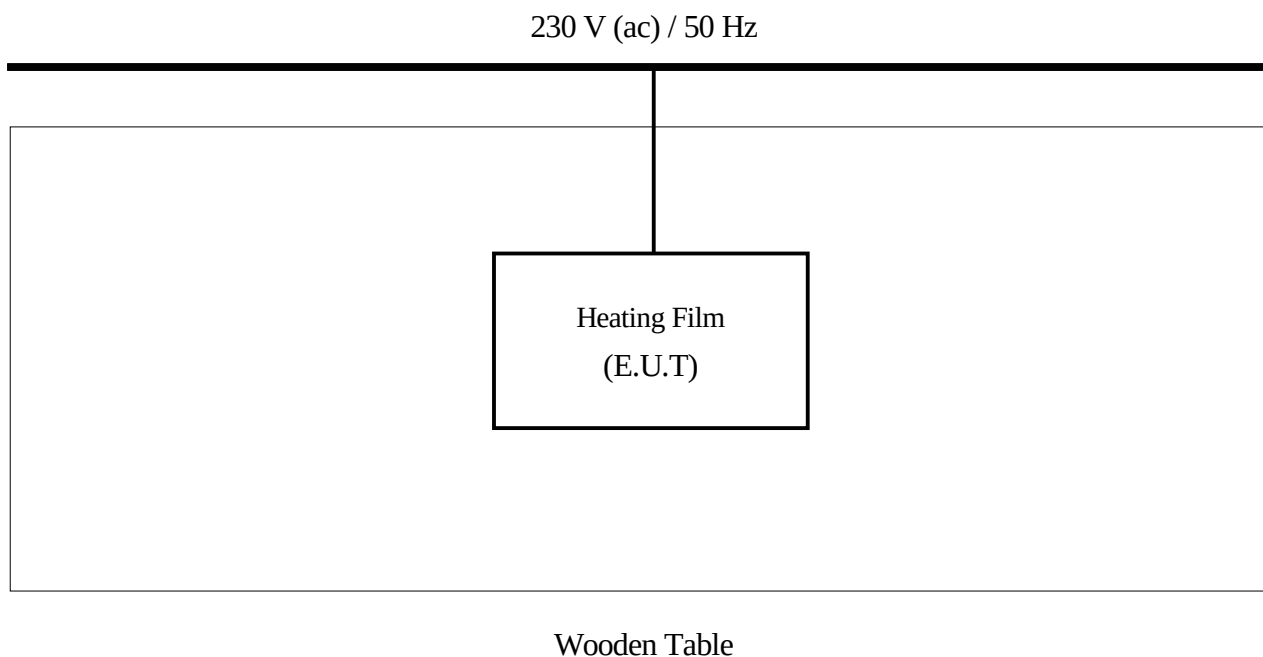
1.6 Special Accessories

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



1.9 Operating condition :

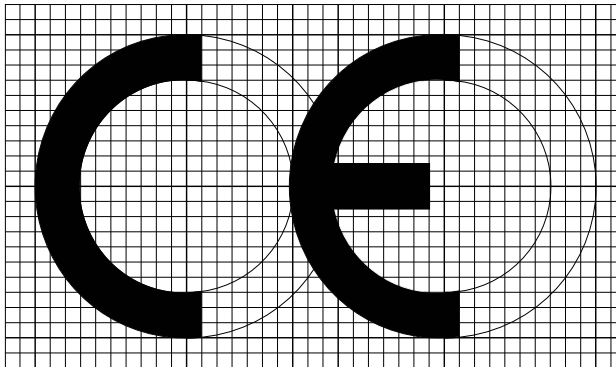
EUT in the normal operation of the test.

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

EN 55014-1:2006+A1:2009/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.

EN61000-3-2:2006 and EN61000-3-3:2008 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.

EN 55014-1:2006+A1:2009/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

EN 55014-2:1997+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:

- Criterion A. The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.
- Criterion 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 specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.
- Criterion C. Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (11) of (52)

4. Test standards and results

STANDARDS		LIMIT	RESULTS
EN 55014-1	Conducted Emission at mains terminal	Refer to EN55014-1	PASS
	Conducted Emission at load terminal	Refer to EN55014-1	N/A
	Disturbance power at 30 MHz to 300 MHz	Refer to EN55014-1	PASS
	Radiated Emission at 30 MHz to 1 000 MHz	Refer to CISPR 16-2-3	PASS
	Click Test	Refer to EN55014-1	N/A
EN 61000-3-2	Harmonic Current Emission on AC Mains Input Port	Refer to EN 61000-3-2	PASS
EN 61000-3-3	Voltage Fluctuations and Flicker on AC Mains Input Port	Refer to EN 61000-3-3	PASS
EN 55014-2	Electrostatic Discharge Immunity	Refer to EN 61000-4-2 (Criterion B)	PASS
	Radio-frequency electromagnetic field Amplitude modulated Immunity	Refer to EN 61000-4-3 (Criterion A)	PASS
	Fast Transients Immunity	Refer to EN 61000-4-4 (Criterion B)	PASS
	Surges Immunity	Refer to EN 61000-4-5 (Criterion B)	PASS
	Radio-frequency common mode Immunity	Refer to EN 61000-4-6 (Criterion A)	PASS
	Voltage Dips, Voltage Interruptions Immunity	Refer to EN 61000-4-11 (Criterion B or C)	PASS

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (12) of (52)

5. Test Performed

5.1 Conducted Emission Measurements

5.1.1 Test Description

The power line conducted emission measurements were performed in a shielded enclosure. The EUT was placed on a wooden table, 80 centimeters height above the floor. Power was fed to the EUT through a 50 ohm/ 50 micro henry Line Impedance Stabilization Network (LISN). The ground plane that was electrically bonded to the shield room ground system and all power lines entering the shield room were filtered.

5.1.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
EMI TEST Receiver	Rohde & Schwarz	ESHS10	862970/018	05. 08. 2012
LISN	Rohde & Schwarz	ENV216	101137	02. 16. 2012
LISN	EMCO	3825/2	1409	04. 11. 2012
Electro wave Shieldroom	Korea Shield	-	-	-

5.1.3 Test Environments

Ambient Temperatures : 15 °C ~ 35 °C
Relative Humidity : 40 % ~ 60 %

5.1.4 Test Limits

Frequency (MHz)	EN 55014-1:2006+A1:2009			
	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	56.0 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

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (13) of (52)

5.1.5 Test Procedure

The conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emission exceeded 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 150 kHz to 30 MHz. 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 150 kHz to 30 MHz on the HOT side and NEUTRAL side, herein referred to as H and N, respectively.

5.1.6 Test Results

According to the data in section 5.1.7, the EUT complied with the EN 55014-1:2006+A1:2009 standards.

5.1.7 Test Data

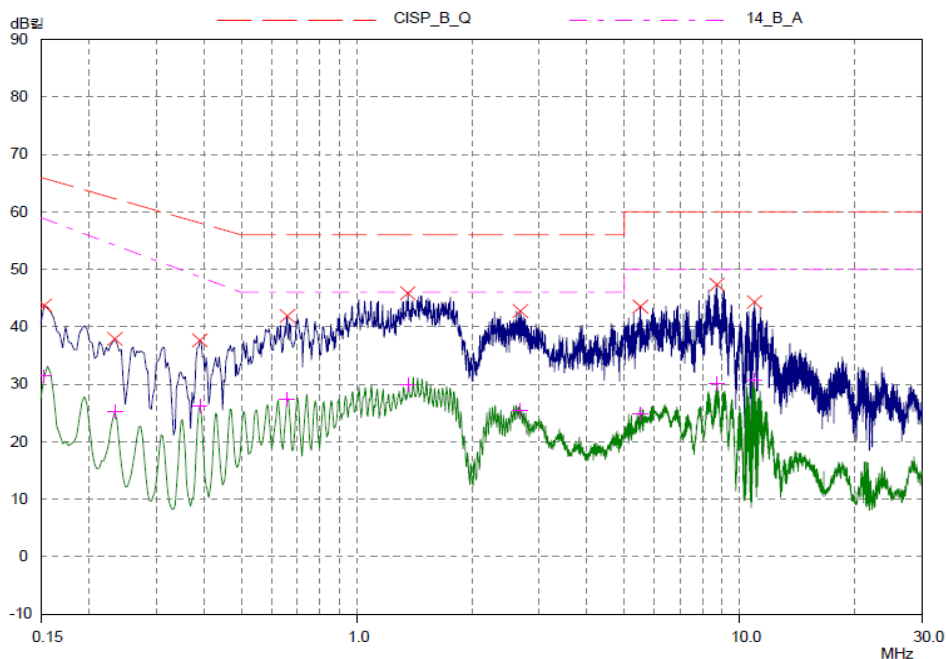
Temperature: 18.1 °C Humidity: 36 % Test Date: 01.27.2012 Tested by: Jae Ju, Lee

Frequency (MHz)	Correction		Phase Hot/ Neutral	Quasi peak			Average		
	LISN	Cable		Limit	Measure	Result	Limit	Measure	Result
0.153	9.798	0.035	H	65.836	43.710	43.710	55.836	31.400	31.400
0.189	9.774	0.035	N	64.080	40.550	40.550	54.080	28.570	28.570
0.234	9.767	0.035	H	62.307	37.890	37.890	52.307	25.290	25.290
0.234	9.767	0.035	N	62.307	35.540	35.540	52.307	27.440	27.440
0.390	9.760	0.035	H	58.064	37.630	37.630	48.064	26.270	26.270
0.393	9.751	0.035	N	58.000	34.670	34.670	48.000	23.600	23.600
0.657	9.756	0.046	N	56.000	37.790	37.790	46.000	26.870	26.870
0.660	9.760	0.046	H	56.000	41.880	41.880	46.000	27.360	27.360
1.362	9.764	0.066	H	56.000	45.850	45.850	46.000	29.970	29.970
1.440	9.760	0.067	N	56.000	41.350	41.350	46.000	29.740	29.740
2.679	9.777	0.093	H	56.000	42.760	42.760	46.000	25.380	25.380
4.188	9.782	0.120	N	56.000	42.880	42.880	46.000	25.100	25.100
5.511	9.805	0.144	H	60.000	43.510	43.510	50.000	24.900	24.900
6.384	9.804	0.163	N	60.000	43.700	43.700	50.000	28.040	28.040
8.679	9.810	0.211	N	60.000	46.180	46.180	50.000	32.060	32.060
8.733	9.820	0.211	H	60.000	47.330	47.330	50.000	30.100	30.100
10.830	9.840	0.212	N	60.000	43.280	43.280	50.000	34.390	34.390
10.947	9.850	0.210	H	60.000	44.300	44.300	50.000	30.750	30.750

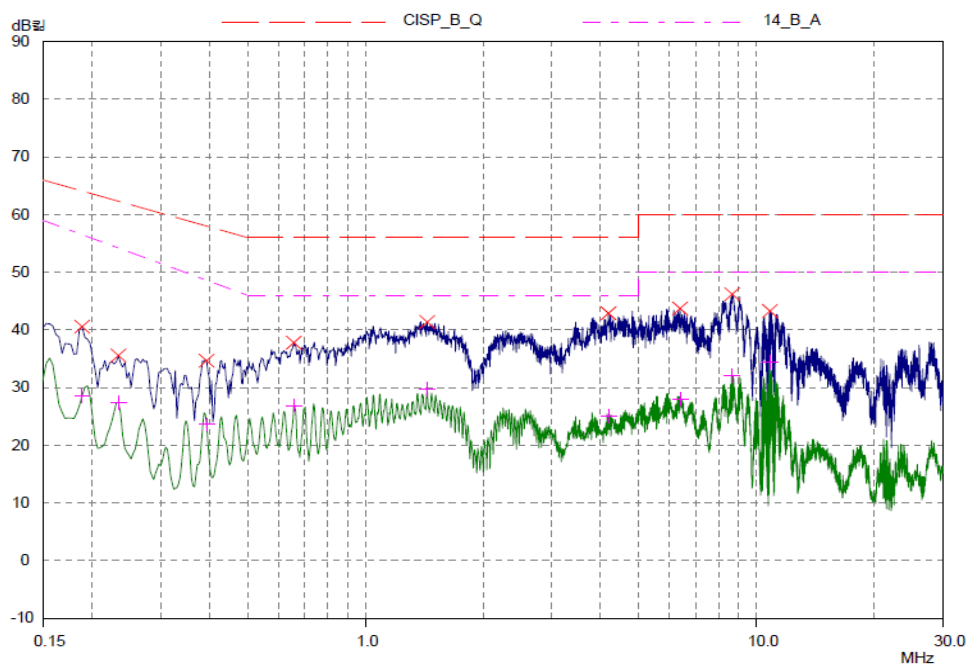
* The LISN factor and Cable loss is included in the measurement Value

5.1.8 Plots of Test Data

Polarization: HOT



Polarization: NEUTRAL



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

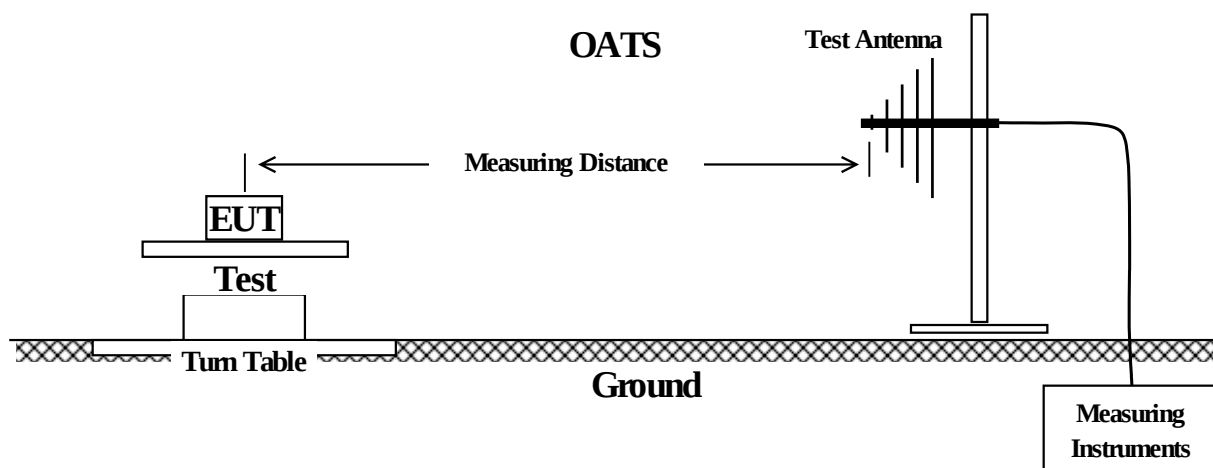
5.2 Radiated Emission Measurements

5.2.1 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 30 MHz to 1 000 MHz 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.



5.2.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
EMI TEST Receiver	Rohde & Schwarz	ESVS10	826008/014	05. 20. 2012
Pre-Amplifier	HP	8447F	2805A02570	02. 16. 2012
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-350	03. 18. 2013
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-385	04. 28. 2013



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (16) of (52)

5.2.3 Test Environments

Ambient Temperatures : 15 °C ~ 35 °C

Relative Humidity : 40 % ~ 60 %

5.2.4 Test Limits

Frequency (MHz)	EN 55014-1:2006+A1:2009
	10 m (dBuV/m)
30 to 230	30.0
230 to 1000	37.0

5.2.5 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 1 000 MHz using the spectrum analyzer. The spectrum analyzer's 6dB bandwidth was set to 120 kHz, 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.

5.2.6 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:

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

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (17) of (52)

5.2.7 Test Results Test Data

According to the data in section 5.2.8, the EUT complied with the EN 55014-1:2006+A1:2009 standards

5.2.8 Test Data

Temperature: 18.1 °C Humidity: 36 % Test Date: 01.27.2012 Tested by: Jae Ju, Lee

Indicated		Antenna		Correction Factor		Corrected Amplitude	EN 55014-1:2006+A1:2009	
Frequency (MHz)	Amplitude (dBuV/m)	Polar. (H/V)	Height (m)	Ant. (dB)	Cable (dB)	(dBuV/m)	Applicable Limit (dBuV/m)	Margin (dB)
44.600	6.780	H	1.380	13.540	0.890	21.210	30.000	8.790
44.600	9.980	V	2.550	13.540	0.890	24.410	30.000	5.590
66.400	7.190	H	3.580	12.110	1.030	20.330	30.000	9.670
112.500	8.610	V	1.480	10.260	1.280	20.150	30.000	9.850
129.400	9.190	H	2.080	11.910	1.310	22.410	30.000	7.590
173.100	3.080	V	3.260	12.220	1.630	16.930	30.000	13.070
241.000	7.890	V	1.690	11.360	1.880	21.130	37.000	15.870
270.100	6.700	H	2.440	12.350	1.930	20.980	37.000	16.020
284.600	6.170	V	1.550	12.840	1.960	20.970	37.000	16.030
301.600	7.010	H	2.030	13.400	1.980	22.390	37.000	14.610
369.500	5.930	H	3.220	14.920	2.130	22.980	37.000	14.020
376.800	4.610	V	2.420	15.090	2.140	21.840	37.000	15.160

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (18) of (52)

5.3 Disturbance power Measurements (30 MHz - 300 MHz)**5.3.1 Test Description**

The disturbance power test measurements were performed in a shielded enclosure, using the setup in accordance with EN 55014-1:2006+A1:2009 disturbance power test procedure.

5.3.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
EMI TEST Receiver	Rohde & Schwarz	ESVS10	826008/014	05.20. 2012
EMI TEST Receiver	LIG NEX1	ISA-80	L0912K014	08. 05. 2012
Absorbing Clamp	Rohde & Schwarz	MDS-21	100389	02. 23. 2012

5.3.3 Test Environments

Ambient Temperatures : 15 °C ~ 35 °C
Relative Humidity : 40 % ~ 60 %

5.3.4 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-peak	dB (pw) Average*	dB (pw) Quasi-peak	dB (pw) Average*	dB (pw) Quasi-peak	dB (pw) Average*	dB (pw) Quasi-peak	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

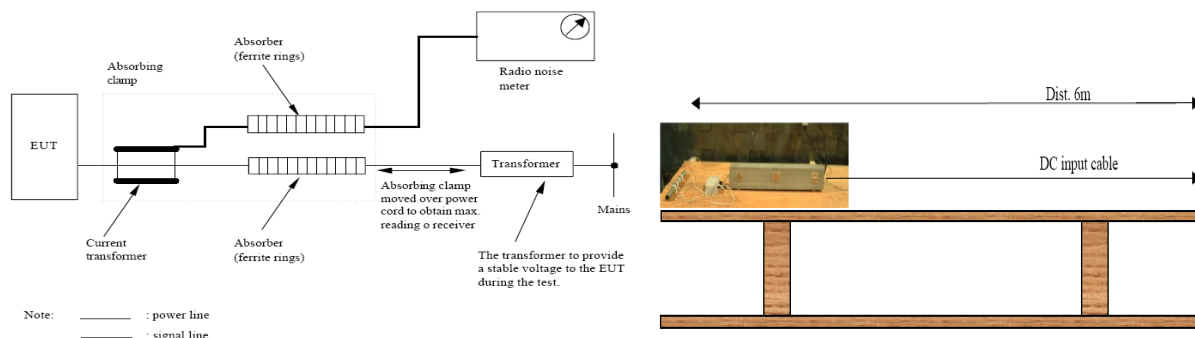
* if the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.

5.3.5 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 120 kHz

5.3.6 Test Configuration



5.3.7 Test Results

According to the data in section 5.3.8, the EUT complied with the EN 55014-1:2006+A1:2009 standard.
=> Disturbance power test is not applicable: E.U.T operated by batteries.

5.3.8 Test Data

Disturbance power test			EN 55014-1:2006+A1:2009 At mains terminals		
Frequency (MHz)	Amplitude (dBuV)	Detector QP/AV/PK	Applicable Limit		Quasi-peak Margin (dB)
			Quasi-peak (dBuV)	Average (dBuV)	
38.610	31.00	QP	45.32	35.32	14.32
69.200	35.40	QP	46.45	36.45	11.05
105.400	34.20	QP	47.79	37.79	13.59
148.510	33.60	QP	49.39	39.39	15.79
177.890	35.40	QP	50.47	40.47	15.07
190.500	31.80	QP	50.94	40.94	19.14
211.300	36.40	QP	51.71	41.71	15.31
231.540	36.70	QP	52.46	42.46	15.76
260.900	33.20	QP	53.55	43.55	20.35
279.530	37.10	QP	54.24	44.24	17.14

Temperature: 18.1 °C Humidity: 36 % Test Date: 01.27.2012 Tested by: Jae Ju, Lee

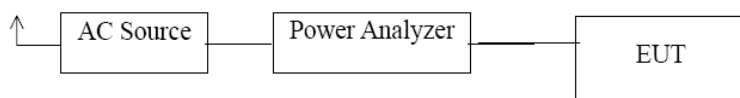
5.4 Harmonics / Voltage Fluctuations Measurements

5.4.1 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



5.4.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
AC Source	EM test	ACE 500 N6	V1024106760	08. 22. 2012
Digital Power Analyzer	EM test	DPA 500 N	V1024106759	08. 22. 2012

5.4.3 Test Environments

Ambient Temperatures :	15 °C ~ 35 °C
Relative Humidity :	40 % ~ 60 %
Atmospheric Pressure :	86.0 kPa ~ 106.0 kPa

5.4.4 Test Procedures

The EUT was installed and placed on a non-conductive table and was connected to the AC power source, 230 VAC, 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 230 VAC, 50 Hz. 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.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (21) of (52)

5.4.5 Test Results

According to the data in section 5.3.6 and 5.3.7, the EUT complied with the EN61000-3-2:2006 and EN61000-3-3:2008 standards, and detailed test results are found in the following test data.

Temperature: 18.1 °C Humidity: 36 % Test Date: 01.27.2012 Tested by: Jae Ju, Lee

5.4.6 Test Data - Harmonic

Maximum harmonic current results				
Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	580.735E-3			
2	947.007E-6	0.029	3.24	PASS
3	8.655E-3	0.125	6.90	PASS
4	868.935E-6	0.067	1.29	PASS
5	8.135E-3	0.238	3.42	PASS
6	782.948E-6	0.087	900.00E-3	PASS
7	7.952E-3	0.344	2.31	PASS
8	903.622E-6	0.131	690.00E-3	PASS
9	7.036E-3	0.586	1.20	PASS
10	1.159E-3	0.210	552.00E-3	PASS
11	6.271E-3	0.633	990.00E-3	PASS
12	751.149E-6	0.163	459.99E-3	PASS
13	5.956E-3	0.945	630.00E-3	PASS
14	786.999E-6	0.200	394.29E-3	PASS
15	5.120E-3	1.138	450.00E-3	PASS
16	749.707E-6	0.217	345.00E-3	PASS
17	4.218E-3	1.062	397.05E-3	PASS
18	1.540E-3	0.502	306.66E-3	PASS
19	3.629E-3	1.022	355.26E-3	PASS
20	1.341E-3	0.486	276.00E-3	PASS
21	2.789E-3	0.868	321.42E-3	PASS
22	946.024E-6	0.377	250.92E-3	PASS
23	2.783E-3	0.948	293.49E-3	PASS
24	808.910E-6	0.352	229.98E-3	PASS
25	2.343E-3	0.868	270.00E-3	PASS
26	690.724E-6	0.325	212.31E-3	PASS
27	2.167E-3	0.867	249.99E-3	PASS
28	891.774E-6	0.452	197.13E-3	PASS
29	2.349E-3	1.009	232.77E-3	PASS
30	792.138E-6	0.431	183.99E-3	PASS
31	1.560E-3	0.717	217.74E-3	PASS
32	868.285E-6	0.503	172.50E-3	PASS
33	1.652E-3	0.807	204.54E-3	PASS
34	863.000E-6	0.532	162.36E-3	PASS
35	1.582E-3	0.820	192.87E-3	PASS
36	826.592E-6	0.539	153.33E-3	PASS
37	1.622E-3	0.889	182.43E-3	PASS
38	913.437E-6	0.629	145.26E-3	PASS
39	1.303E-3	0.753	173.07E-3	PASS
40	1.104E-3	0.800	138.00E-3	PASS

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.



Test Data - Harmonics (continued)

Maximum harmonic voltage results

Hn	Ueff [V]	Ueff [%]	Limit [%]	Result
1	230.83	100.360		
2	89.08E-3	0.039	0.2	PASS
3	50.57E-3	0.022	0.9	PASS
4	40.63E-3	0.018	0.2	PASS
5	30.82E-3	0.013	0.4	PASS
6	28.32E-3	0.012	0.2	PASS
7	65.49E-3	0.028	0.3	PASS
8	17.81E-3	0.008	0.2	PASS
9	81.36E-3	0.035	0.2	PASS
10	10.21E-3	0.004	0.2	PASS
11	48.97E-3	0.021	0.1	PASS
12	13.48E-3	0.006	0.1	PASS
13	47.99E-3	0.021	0.1	PASS
14	25.83E-3	0.011	0.1	PASS
15	78.25E-3	0.034	0.1	PASS
16	26.70E-3	0.012	0.1	PASS
17	37.93E-3	0.016	0.1	PASS
18	17.73E-3	0.008	0.1	PASS
19	46.87E-3	0.020	0.1	PASS
20	16.78E-3	0.007	0.1	PASS
21	74.34E-3	0.032	0.1	PASS
22	12.59E-3	0.005	0.1	PASS
23	38.52E-3	0.017	0.1	PASS
24	11.09E-3	0.005	0.1	PASS
25	37.69E-3	0.016	0.1	PASS
26	11.63E-3	0.005	0.1	PASS
27	56.71E-3	0.025	0.1	PASS
28	11.46E-3	0.005	0.1	PASS
29	29.16E-3	0.013	0.1	PASS
30	8.26E-3	0.004	0.1	PASS
31	34.94E-3	0.015	0.1	PASS
32	8.96E-3	0.004	0.1	PASS
33	46.71E-3	0.020	0.1	PASS
34	6.28E-3	0.003	0.1	PASS
35	18.12E-3	0.008	0.1	PASS
36	7.43E-3	0.003	0.1	PASS
37	29.07E-3	0.013	0.1	PASS
38	10.29E-3	0.004	0.1	PASS
39	36.70E-3	0.016	0.1	PASS
40	9.85E-3	0.004	0.1	PASS



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (23) of (52)

5.4.7 Test Data - Voltage Fluctuations

Maximum Flicker results

	EUT values	Limit	Result
Pst	0.028	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.275	4.00	PASS
dt [s]	0.000	0.50	PASS

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (24) of (52)

5.5 Electrostatic Discharge Immunity

5.5.1 Test Description

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

5.5.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
ESD simulator	Noise Ken	ESS-2000	ESS020454	09. 08. 2012

5.5.3 Test Environment

Ambient Temperatures :	15 °C ~ 35 °C
Relative Humidity :	40 % ~ 60 %
Atmospheric Pressure :	86.0 kPa ~ 106.0 kPa

5.5.4 Test Levels

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

5.5.5 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.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (25) of (52)

5.5.6 Test Results

According to the data in section 5.4.7, the EUT complied with the EN61000-4-2 standards, and detailed test results are found in the following test data.

5.5.7 Test Data

Indirect Discharge

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	Volt	Contact Discharge	B	A	-

Performance Results

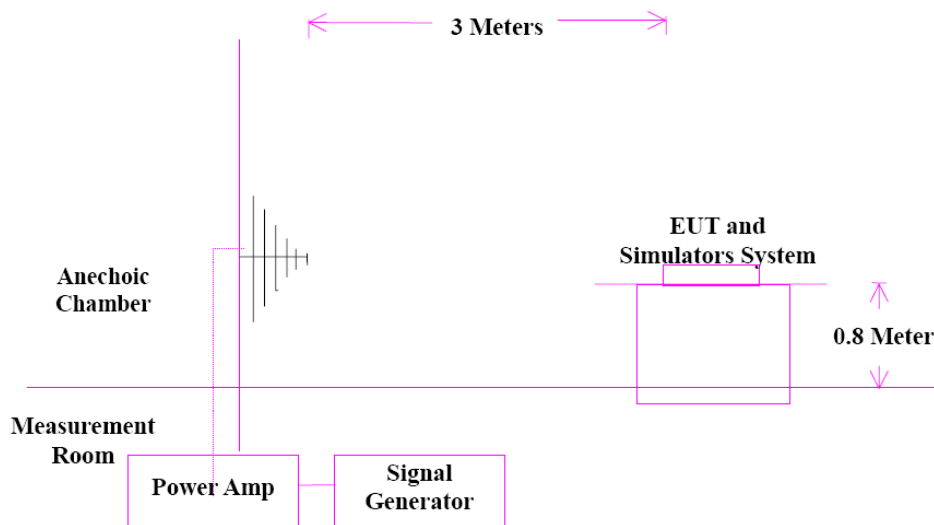
- A: Normal performance within the specification limits.
B: Temporary degradation or loss of function or performance which is self-recoverable.
C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.

Temperature: 19.7 °C Humidity: 39 % Test Date: 01.30.2012 Tested by: Jae Ju, Lee

5.6 Radio-frequency electromagnetic field Amplitude modulated Immunity

5.6.1 Test Description

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



5.6.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Average Power Sensor	Agilent	E9301A	MY41498011	09. 15. 2012
Average Power Sensor	Agilent	E9301A	-	09. 15. 2012
Signal Generator	HP	ESG-3000A	US37040210	09. 15. 2012
Power Meter	Agilent	E4419B	MY45101506	09. 15. 2012
Power Amplifier	Infinitech	ITA0300-200	-	09. 15. 2012
Power Amplifier	Infinitech	ITA0750-200	-	09. 15. 2012
Power Amplifier	Infinitech	ITA1500-100	-	09. 15. 2012
Power Amplifier	Infinitech	ITA2500-100	-	09. 15. 2012
Hybrid Log-Periodic Antenna	HLP-2603	EMC Automation (TDK)	100400	-
Electric Field Probe	HI-6105USB	ETL	00091296	12. 09. 2011
Probe Stand	PS 2000	AR	-	-
Load Termination	Bird Electronic Corporation	300-T-MN	1033774	08. 22. 2012
RS CHAMBER	KES Co., Ltd.	-	-	-



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (27) of (52)

5.6.3 Test Environments

Ambient Temperatures :	15 °C ~ 35 °C
Relative Humidity :	40 % ~ 60 %
Atmospheric Pressure :	86.0 kPa ~ 106.0 kPa

5.6.4 Test Levels

Frequency Range :	80 MHz to 1 000 MHz
Field Strength :	3 V/m(unmodulated, r.m.s)
Amplitude Modulation :	80 % AM in depth by a 1 kHz sine wave
Distance of ANT-EUT :	3 meters
Antenna Polarity :	Horizontal and Vertical
Frequency Step :	1 %
Performance Criteria :	A

5.6.5 Test Procedures

The EUT is set into operation and was monitored for variations in performance. The test signal start frequency (80 MHz) and stop frequency (1 000 MHz) were set, including the field strength at 10 V/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.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (28) of (52)

5.6.6 Test Results

According to the data in section 5.5.7, the EUT complied with the EN61000-4-3 standards, and detailed test results are found in the following test data.

5.6.7 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

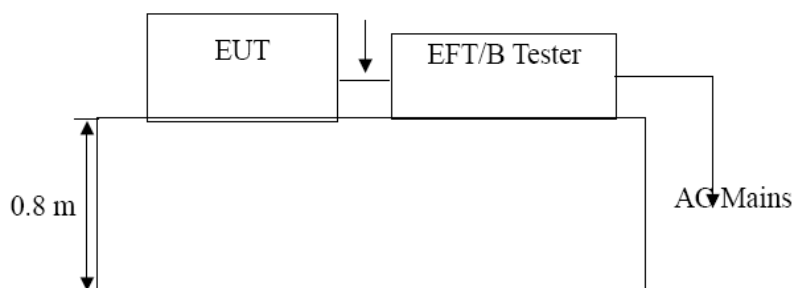
- A: Normal performance within the specification limits.
B: Temporary degradation or loss of function or performance which is self-recoverable.
C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.

Temperature: 19.7 °C Humidity: 39 % Test Date: 01.30.2012 Tested by: Jae Ju, Lee

5.7 Fast Transient Immunity

5.7.1 Test Description

The EUT and all local support equipment were placed a non-metallic support 0.8 m 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 0.4 m diameter and situated at a distance of 0.1 m above the RGP.



5.7.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Ultra compact simulator	EM TEST	UCS 500 N5	V0936105120	08. 22. 2012
Capacitive coupling clamp	EM TEST	HFK	070925	08. 22. 2012
Calibration kit	EM TEST	CA EFT kit	0209-74 -114	-
Motorized variac	EM TEST	MV2616	V0936105123	-

5.7.3 Test Environments

Ambient Temperatures :	15 °C ~ 35 °C
Relative Humidity :	40 % ~ 60 %
Atmospheric Pressure :	86.0 kPa ~ 106.0 kPa



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (30) of (52)

5.7.4 Test Levels

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

5.7.5 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 200 seconds. A test signal of ± 0.5 kV, and ± 1 kV 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.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (31) of (52)

5.7.6 Test Results

According to the data in section 5.6.7, the EUT complied with the EN61000-4-4 standards, and detailed test results are found in the following test data.

5.7.7 Test Data

On Power Supply, Protective Earth(PE) ports

No.	Test Point	Performance Criteria	Performance Results		Remarks
			+Burst	-Burst	
1	L1	B	A	A	
2	L2	B	A	A	
3	PE	B	A	A	
4	L1-L2	B	A	A	
5	L1-PE	B	A	A	
6	L2-PE	B	A	A	
7	L1L2-PE	B	A	A	

On I/O Signal, Data and Control ports

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

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.

Temperature: 19.7 °C Humidity: 39 % Test Date: 01.30.2012 Tested by: Jae Ju, Lee

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (32) of (52)

5.8 Surge Immunity

5.8.1 Test Description

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

5.8.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Ultra compact simulator	EM TEST	UCS 500 N5	V0936105120	08. 22. 2012
CDN	EM TEST	CNV 504 N	V0936105121	-
CDN	EM TEST	CNV 504 S1	V0936105122	-
Motorized variac	EM TEST	MV2616	V0936105123	-

5.8.3 Test Environments

Ambient Temperatures :	15 °C ~ 35 °C
Relative Humidity :	40 % ~ 60 %
Atmospheric Pressure :	86.0 kPa ~ 106.0 kPa

5.8.4 Test Levels

Open Circuit Test Voltage :	☒ AC Power; ± 1 kV line-to-line, ☒ AC Power, ± 2 kV line-to-ground ☐ DC Power; ± 0.5 kV line-to-ground ☐ Data and Control Line; ± 1 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

5.8.5 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.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (33) of (52)

5.8.6 Test Results

According to the data in section 5.7.7, the EUT complied with the EN61000-4-5 standards, and detailed test results are found in the following test data.

=> Surge Immunity test is not applicable : E.U.T operated by batteries.

5.8.7 Test Data

On DC Power Supply, Protective Earth(PE) ports

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

On I/O Signal, Data and Control ports

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

Performance Results

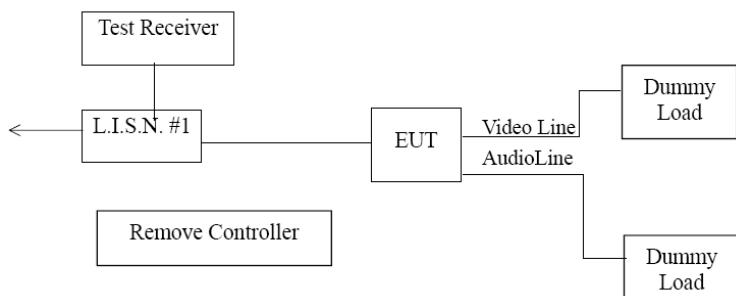
- A: Normal performance within the specification limits.
B: Temporary degradation or loss of function or performance which is self-recoverable.
C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.

Temperature: 19.7 °C Humidity: 39 % Test Date: 01.30.2012 Tested by: Jae Ju, Lee

5.9 Radio-frequency continuous conducted Immunity

5.9.1 Test Descriptions

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



5.9.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Continuous Wave Simulator	EM TEST	CWS 500N1	V0936105119	08. 22. 2012
Attenuator	EM TEST	ATT 6dB/75W	1208-34	08. 22. 2012
Basic calibration kit	EM TEST	CWS-CAL	0209 -182 -183 -184	08. 22. 2012
CDN	EM TEST	CDN-M2/M3	0909-06	08. 22. 2012
CDN	EM TEST	CDN-T2-RJ11	0909-07	08. 22. 2012
CDN	EM TEST	CDN-T4	0909-08	08. 22. 2012
CDN	EM TEST	CDN-T8RJ45	0909-09	08. 22. 2012
CDN	EM TEST	CDN-AF2	0909-10	08. 22. 2012
CDN	EM TEST	CDN-AF4	0909-11	08. 22. 2012
EM Clamp	EM TEST	EM 101	35943	11. 30. 2012

5.9.3 Test Environments

Ambient Temperatures :	15 °C ~ 35 °C
Relative Humidity :	40 % ~ 60 %
Atmospheric Pressure :	86.0 kPa ~ 106.0 kPa

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (35) of (52)

5.9.4 Test Levels

Frequency Range :	150 kHz to 80 MHz
Voltage Level :	3 V(unmodulated r.m.s)
Amplitude Modulation :	80 % AM in depth by a 1 kHz sine wave
Frequency Step :	1 %
Performance Criteria :	A

5.9.5 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 150 kHz to 80 MHz, 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.

5.9.6 Test Results

According to the data in section 5.8.7, the EUT complied with the EN61000-4-6 standards, and detailed test results are found in the following test data.

=> Radio-frequency continuous conducted Immunity test is not applicable : E.U.T operated by batteries.

5.9.7 Test Data

On Power Supply, Protective Earth(PE) ports

No.	Test Point	Performance		Remarks
		Criteria	Results	
1	CDN(M3)	A	A	-

On I/O Signal, Data and Control ports

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

Temperature: 19.7 °C Humidity: 39 % Test Date: 01.30.2012 Tested by: Jae Ju, Lee

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (36) of (52)

5.10 Voltage Dips and Voltage Interruptions Immunity

5.10.1 Test Descriptions

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

5.10.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
Ultra Compact Simulator	EM Test AG	UCS 500 N5	V0936105120	08. 22. 2012
Motorized variac	EM TEST	MV2616	V0936105123	-

5.10.3 Test Environments

Ambient Temperatures :	15 °C ~ 35 °C
Relative Humidity :	40 % ~ 60 %
Atmospheric Pressure :	86.0 kPa ~ 106.0 kPa

5.10.4 Test Levels

Overshoot/Undershoot of Actual Voltage :	Less than ± 5 % of the change in voltage
Voltage Rise and Fall Time :	Between 1 and 5 microseconds
Test Voltage :	230 V (ac).
Frequency Deviation of Test Voltage :	Less than ± 2 % of rated frequency
Number of Tests :	3 times
Test Intervals :	10 s
Performance Criteria :	C for Voltage Dips(>95 %, 0,5 T) C for Voltage Dips(30 %, 25 T) C for Voltage Interruptions(>95 %, 250 T)

5.10.5 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.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (37) of (52)

5.10.6 Test Results

According to the data in section 5.9.7, the EUT complied with the EN61000-4-11 standards, and detailed test results are found in the following test data.

5.10.7 Test Data**Voltage Dips**

No.	Depth	Duration	Performance		Remarks
			Criteria	Results	
1	60 %	10 T	C	A	-
2	30 %	25 T	C	A	-

Short Interruptions

No.	Depth	Duration	Performance		Remarks
			Criteria	Results	
1	100 %	0.5 T	C	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.

Temperature: 19.7 °C Humidity: 39 % Test Date: 01.30.2012 Tested by: Jae Ju, Lee

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (38) of (52)

5.11 Clicks Measurements**5.11.1 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.

5.11.2 Test Equipments

Description	Manufacturer	Model Number	Serial Number	Cal. Due
EMI TEST Receiver	LIG Nex1	IAS-80	L0912K014	08. 05. 2012
LISN	Rohde & Schwarz	ENV216	101137	02. 16. 2012
LISN	EMCO	3825/2	1409	04. 11. 2012

5.11.3 Test Environments

Ambient Temperatures : 15 °C ~ 35 °C
Relative Humidity : 40 % ~ 60 %

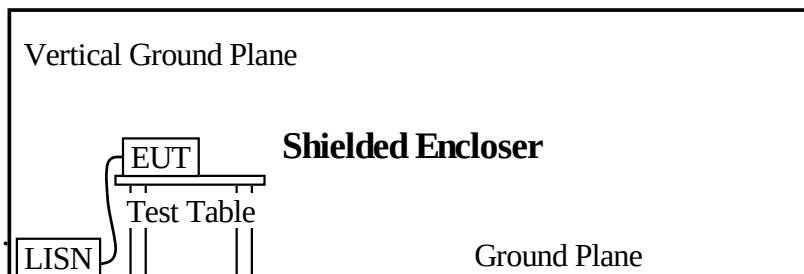
5.11.4 Test Limits

Frequency (MHz)	EN55014-1:2006+A1:2009(Quasi-Peak dB μ V)
0.15 to 0.50	66 to 56
0.5 to 5.0	56
5 to 30	60

5.11.5 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.

5.11.6 Test Configuration



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

5.11.7 Test Results

According to the data in section 5.11.8, the EUT complied with the EN55014-1:2006+A1:2009 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 20 % of the clicks exceeds the limit the product complies with the limits.

5.11.8 Test Data

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

N	Relaxation (dB)
$N < 0.2$	44
$0.2 \leq N < 30$	$20\text{Log}(30/N)$
$N > 30$	0

Temperature:

Humidity:

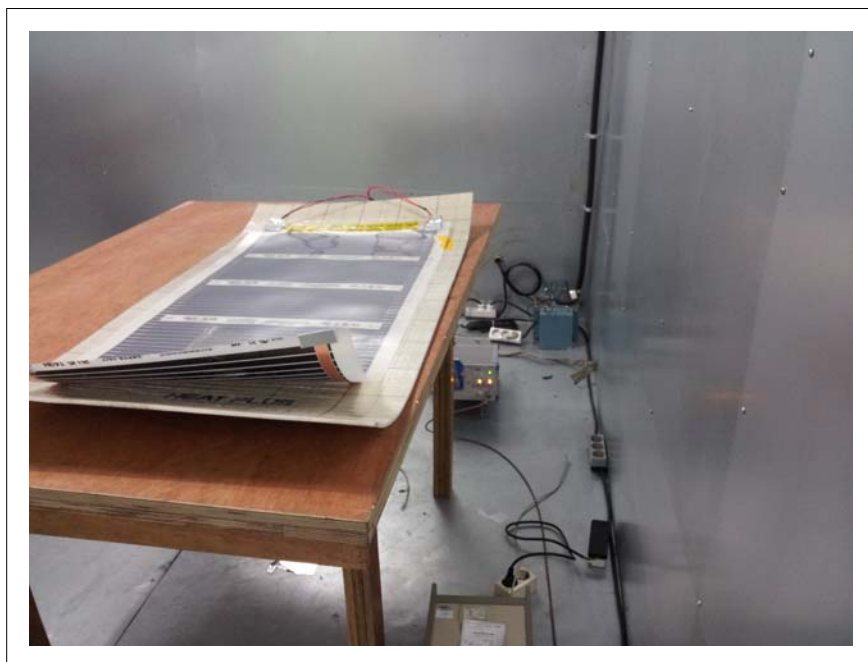
Test Date:

Tested by:

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

6. Test Setup Photographs

6.1 Conducted Emission Measurements



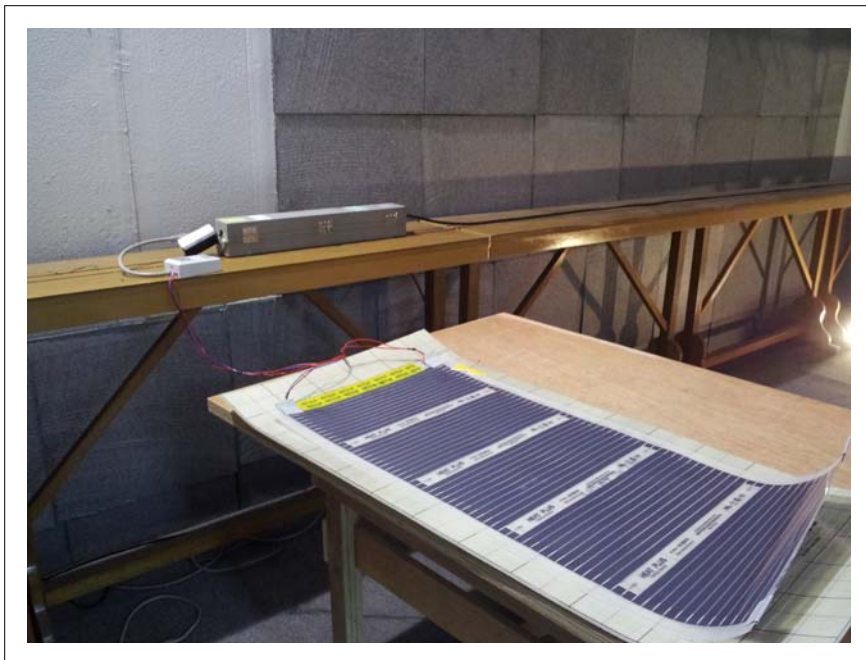
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

6.2 Radiated Emission Measurements



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

6.3 Disturbance power Measurements (30 MHz - 300 MHz)

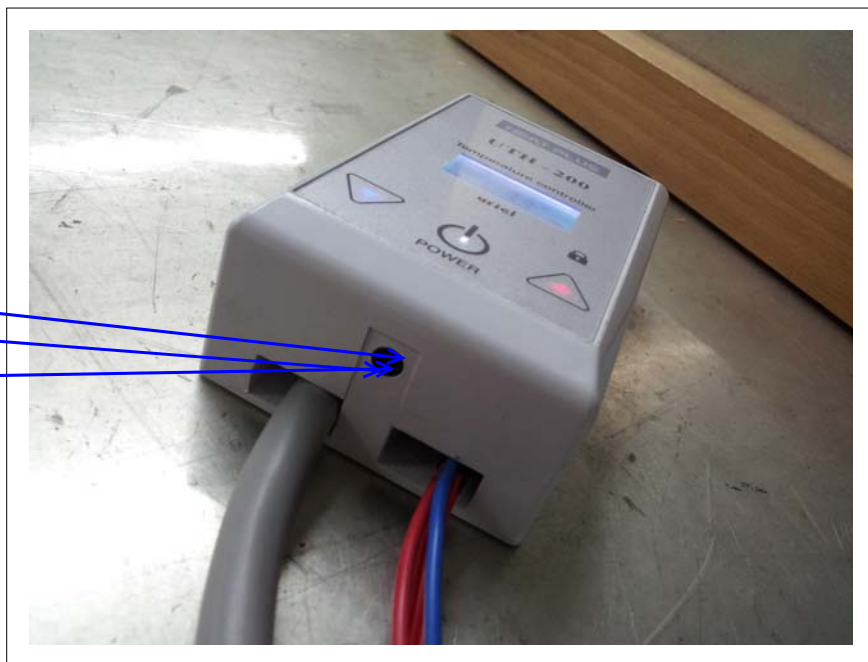
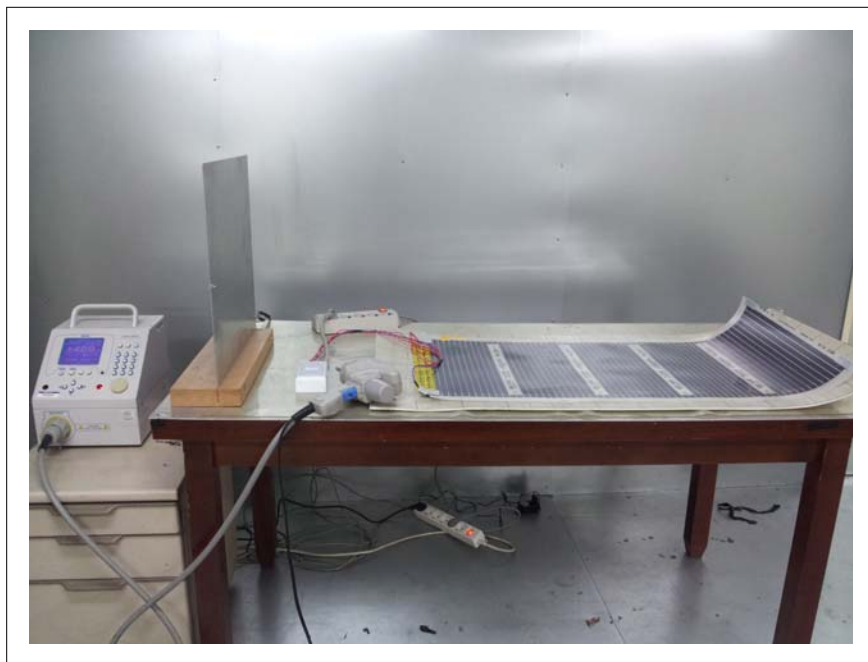


6.4 Harmonics / Voltage Fluctuations Measurements



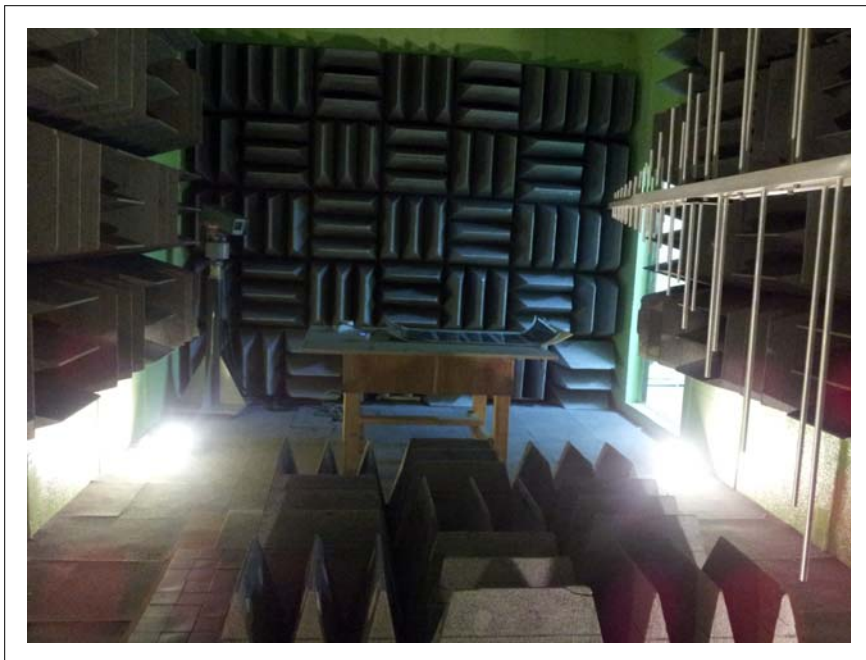
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

6.5 Electrostatic Discharge Immunity



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

6.6 Radio frequency electromagnetic field immunity



6.7 Fast Transient Immunity



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

6.8 Surge Immunity



6.9 Radio-frequency continuous conducted Immunity



6.10 Voltage Dips and Voltage Interruptions Immunity



6.11 Clicks Measurements

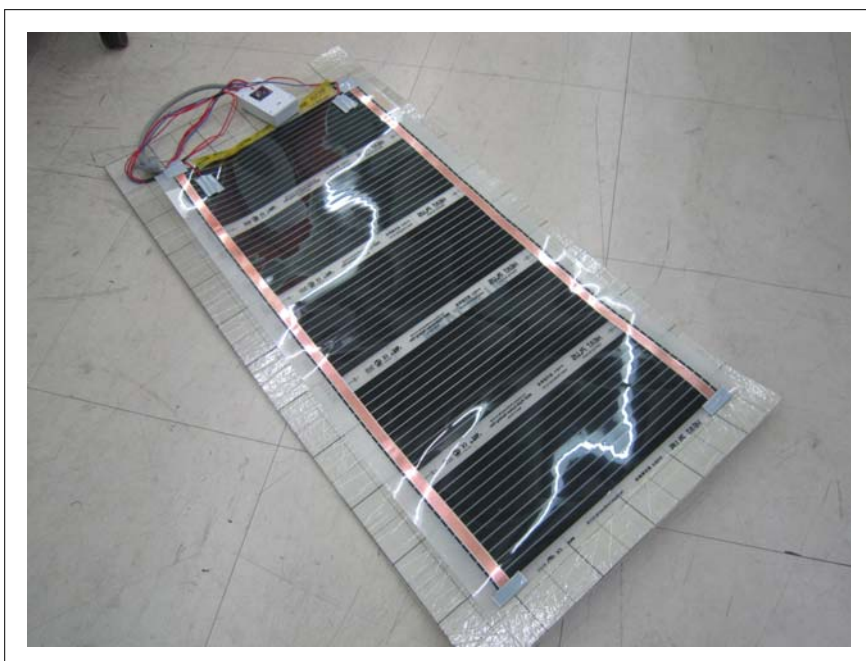
N/A

7. Photographs

Exernal Photographs

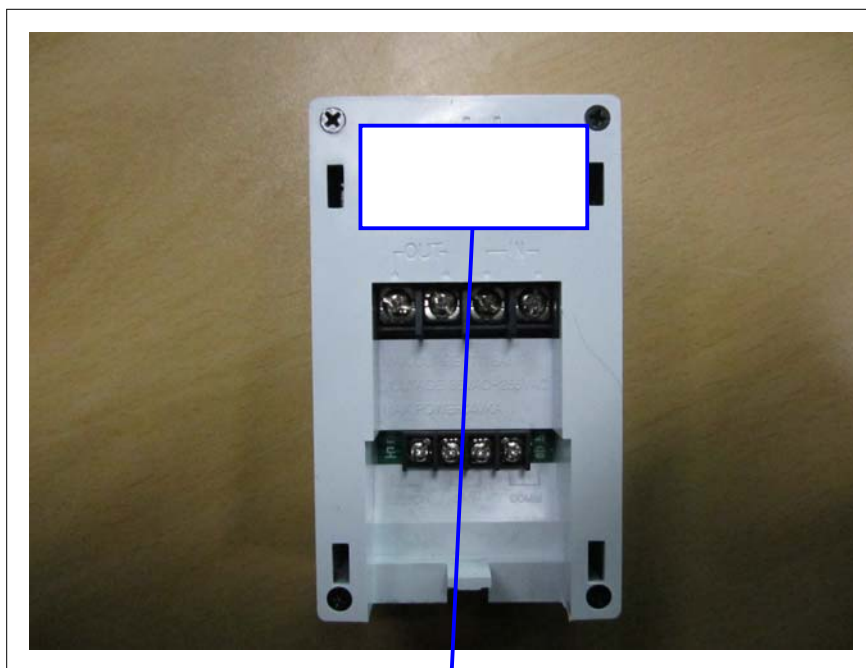


[FRONT VIEW]



[REAR VIEW]

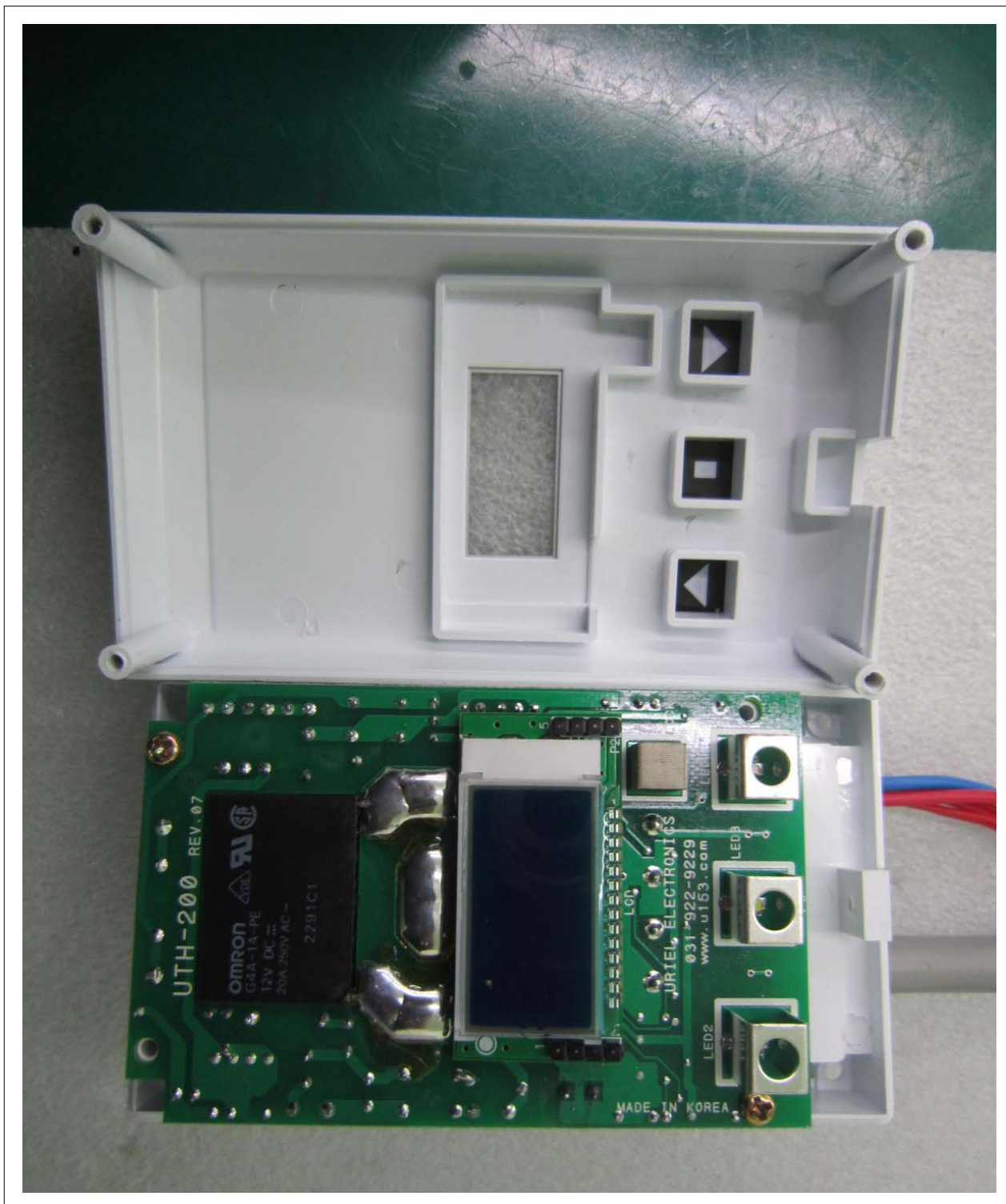
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.



[LABEL VIEW]



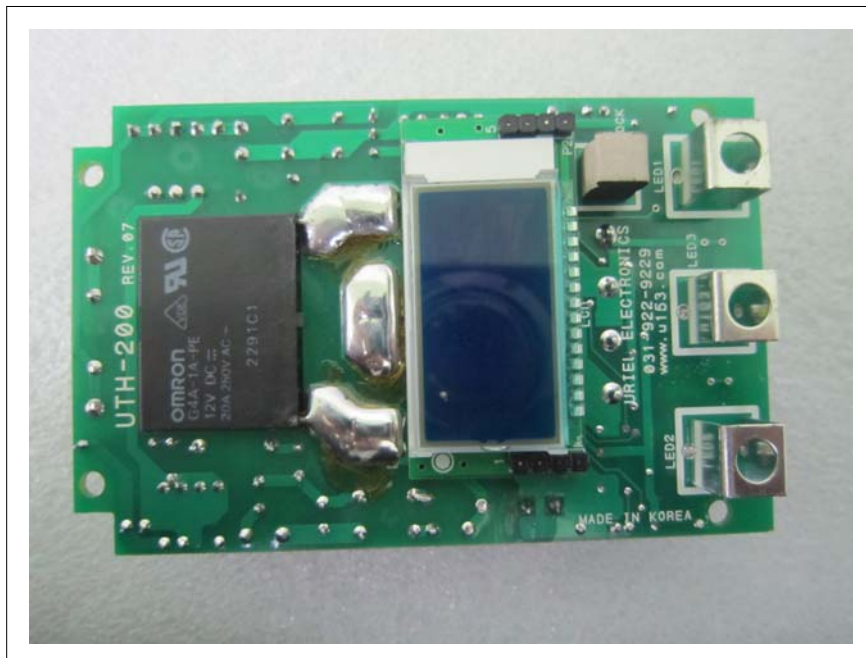
Internal Photographs



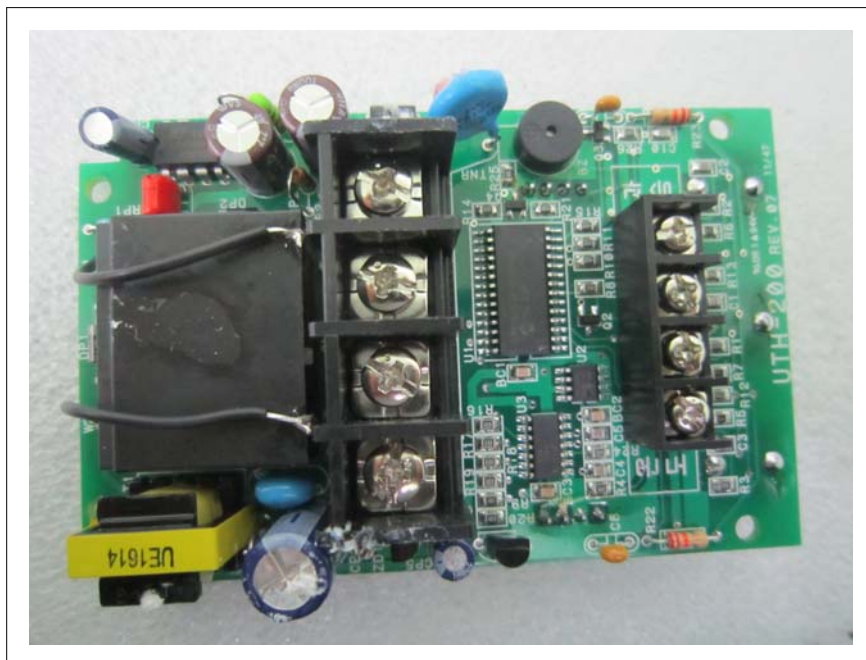
[INTERNAL VIEW]

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.

MAIN BOARD



[TOP VIEW]



[BOTTOM VIEW]

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The test results in the report only apply to the tested sample.



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (51) of (52)

Appendix A - Schematics/Block Diagram

Please see attached document(s).



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-E1-120074
Page (52) of (52)

Appendix B - User's Manual

Please see attached document(s).