

## CE Conformance EMC Test Report

Test Report No. : TK-CC110005

Date of Issue : 1/20/2011

Description of Product : Mat Cable

Model No. : DW-20W

Variant Model. : DW20W 1.0M, DW20W 1.5M, DW20W 3.0M, DW20W 4.0M,  
DW20W 5.0M, DW20W 6.0M, DW20W 8.0M, DW20W 10.0M,  
DW20W 15.0M, DW20W 20.0M

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 : 1/17/2011 – 1/18/2011

Tested by:   
Taeyeon, Kim  
Test Engineer

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

## 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: DW-20W, or the "EUT" as referred to in this report is best model.

### Hardware Specification

#### \*Controller

|                   |                        |
|-------------------|------------------------|
| Input Power       | 230V Vac               |
| Allowable Current | 10 A. Max.             |
| Peak Load         | 2kW                    |
| Demensions (mm)   | 80(W) X 80(H) X 39 (D) |

#### \* Mat Cable

| Name                            | Specification                  |
|---------------------------------|--------------------------------|
| Rating Voltage                  | AC 230V, 50Hz                  |
| Power                           | 280 W/h                        |
| Length                          | 14 m                           |
| Square meter                    | 0.5 x 4 m = 2.0 m <sup>2</sup> |
| Installed out put               | 20 W/h                         |
| Distance between heating cables | Within 15 cm                   |

\* Test Mode : Mat cable tested, normal temperature mode with controller operation mode.

### 1.3 Equipment Under Test

| Description | Model Number | Serial Number | Manufacturer             | Remarks |
|-------------|--------------|---------------|--------------------------|---------|
| Mat Cable   | DW-20W       | None          | DAEWOO ENERTEC Co., Ltd. | EUT     |

### 1.4 Support Equipments

| Description | Model Number | Serial Number | Manufacturer      | Remarks |
|-------------|--------------|---------------|-------------------|---------|
| Controller  | UTH-150      | –             | URIEL ELECTRONICS | –       |
| 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     |
|             |            |           |         |         |
|             |            |           |         |         |
|             |            |           |         |         |
|             |            |           |         |         |
|             |            |           |         |         |

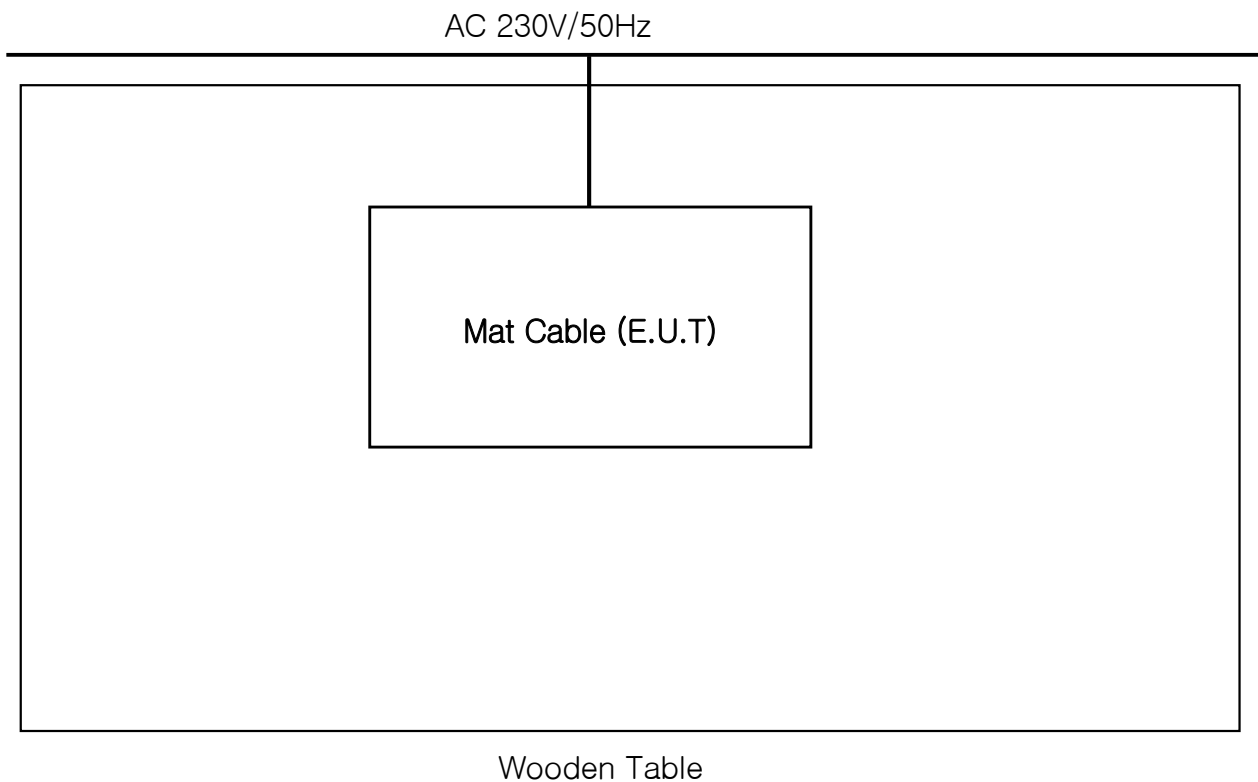
## 1.6 Special Accessories

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

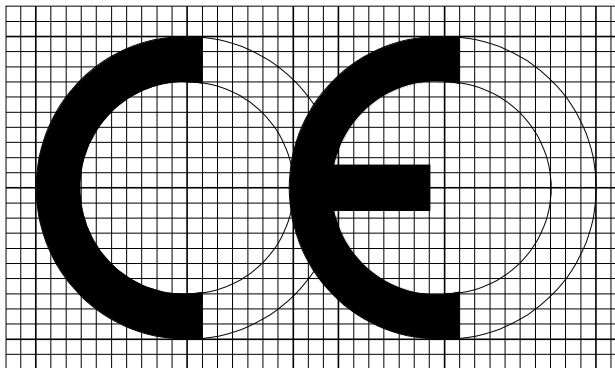


## 2. Product Labelling Requirements

### 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 self recoverable 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 °C  
Relative Humidity : 40 ~ 60 %

#### 4.1.4 Test Limits

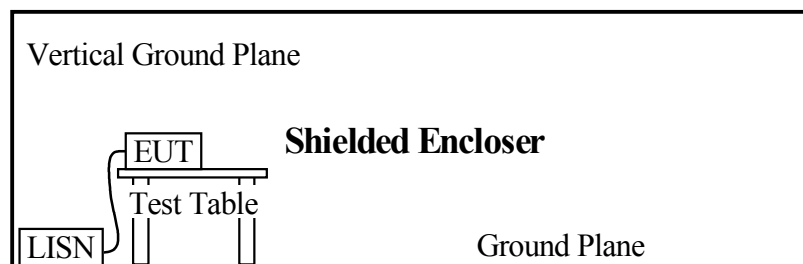
| Frequency<br>(MHz) | EN55014-1:2006               |              |                                                         |         |
|--------------------|------------------------------|--------------|---------------------------------------------------------|---------|
|                    | At mains terminals<br>(dBuV) |              | At load terminals and<br>additional terminals<br>(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:

47.664dB at 5.7MHz in the HOT side and 45.200dB at 0.549MHz in the NEUTRAL side.

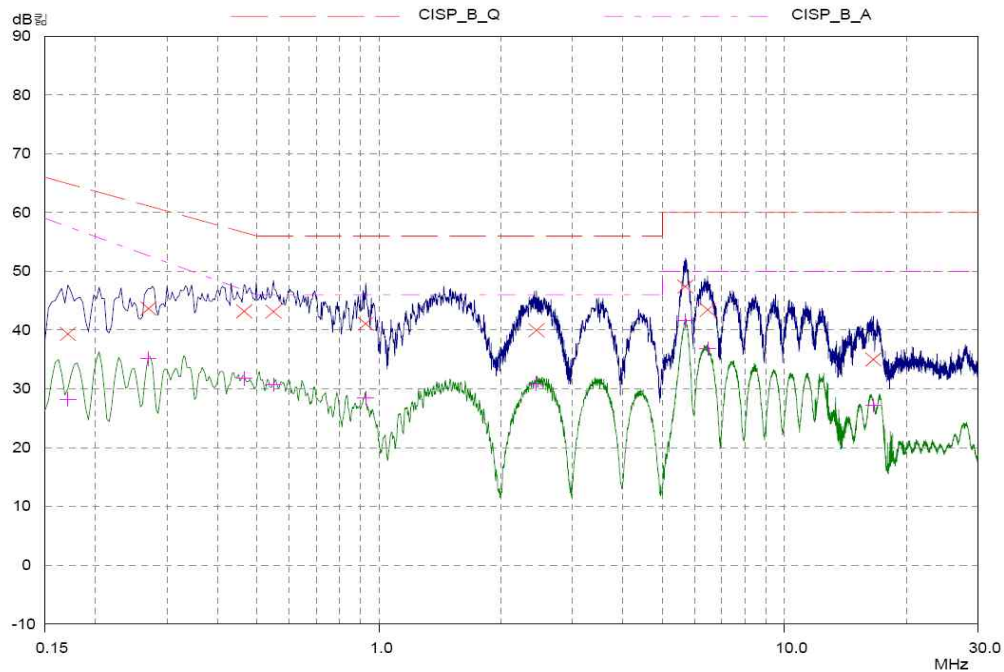
#### 4.1.8 Test Data

| Line Conducted Emission |                     |       |                      |                    |         | EN55014-1:2006<br>At mains terminals |         |                              |
|-------------------------|---------------------|-------|----------------------|--------------------|---------|--------------------------------------|---------|------------------------------|
| Frequency<br>(MHz)      | Amplitude<br>(dBuV) |       | Phase<br>Hot/Neutral | Detector<br>(dBuV) |         | Applicable Limit<br>(dBuV)           |         | Quasi-peak<br>Margin<br>(dB) |
|                         | LISN                | Cable |                      | Quasi-peak         | Average | Quasi-peak                           | Average |                              |
| 0.171                   | 0.067               | 0.100 | H                    | 39.497             | 28.427  | 65                                   | 58      | 25.414                       |
| 0.270                   | 0.057               | 0.100 | H                    | 43.807             | 35.287  | 61                                   | 54      | 17.311                       |
| 0.270                   | 0.076               | 0.100 | N                    | 46.456             | 40.006  | 61                                   | 54      | 14.662                       |
| 0.273                   | 0.075               | 0.100 | N                    | 46.735             | 40.815  | 61                                   | 54      | 14.291                       |
| 0.465                   | 0.050               | 0.100 | H                    | 43.330             | 31.910  | 57                                   | 50      | 13.273                       |
| 0.480                   | 0.052               | 0.100 | N                    | 45.442             | 37.972  | 56                                   | 49      | 10.897                       |
| 0.549                   | 0.050               | 0.100 | H                    | 43.290             | 30.870  | 56                                   | 46      | 12.710                       |
| 0.549                   | 0.050               | 0.100 | N                    | 45.200             | 37.560  | 56                                   | 46      | 10.800                       |
| 0.927                   | 0.053               | 0.100 | H                    | 41.253             | 28.563  | 56                                   | 46      | 14.747                       |
| 1.572                   | 0.066               | 0.176 | N                    | 43.191             | 37.601  | 56                                   | 46      | 12.809                       |
| 2.445                   | 0.069               | 0.133 | H                    | 40.162             | 31.102  | 56                                   | 46      | 15.838                       |
| 2.529                   | 0.075               | 0.127 | N                    | 42.193             | 37.543  | 56                                   | 46      | 13.807                       |
| 5.700                   | 0.138               | 0.116 | H                    | 47.664             | 41.814  | 60                                   | 50      | 12.336                       |
| 6.465                   | 0.159               | 0.100 | H                    | 43.699             | 37.109  | 60                                   | 50      | 16.301                       |
| 6.600                   | 0.172               | 0.100 | N                    | 41.592             | 36.152  | 60                                   | 50      | 18.408                       |
| 12.549                  | 0.398               | 0.100 | N                    | 39.508             | 33.848  | 60                                   | 50      | 20.492                       |
| 16.572                  | 0.594               | 0.176 | H                    | 35.770             | 27.960  | 60                                   | 50      | 24.230                       |
| 16.824                  | 0.642               | 0.191 | N                    | 34.613             | 29.263  | 60                                   | 50      | 25.387                       |

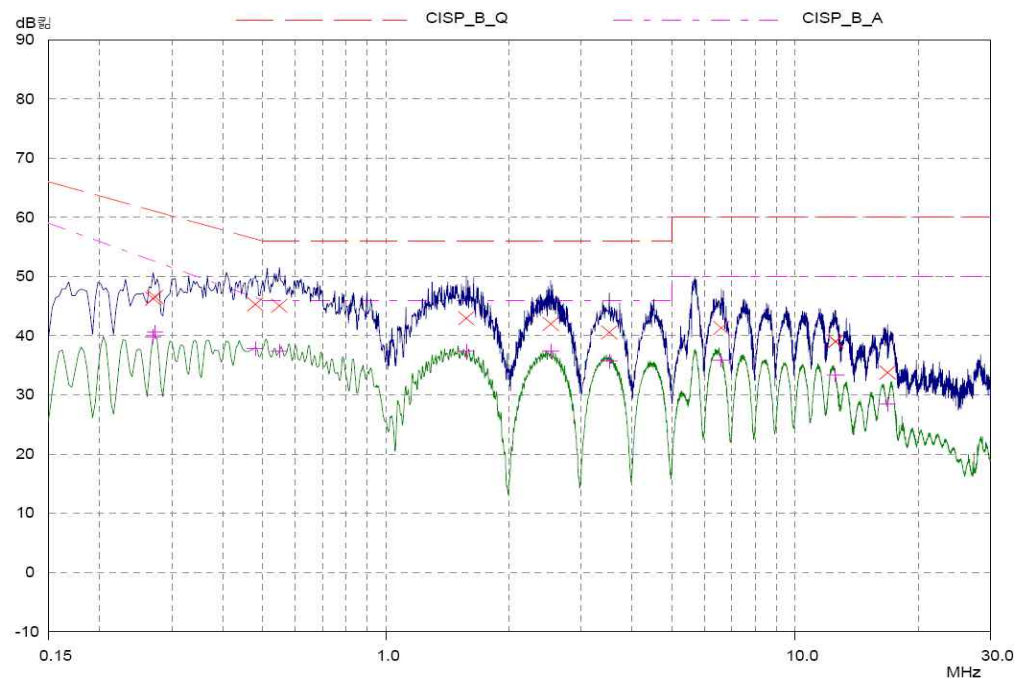
Temperature: 18 °C Humidity: 35% Test Date: 1.18.2011 Tested by: Taeyeon, Kim

#### 4.1.9 Plots of Test Data

Polarization: HOT



Polarization: NEUTRAL



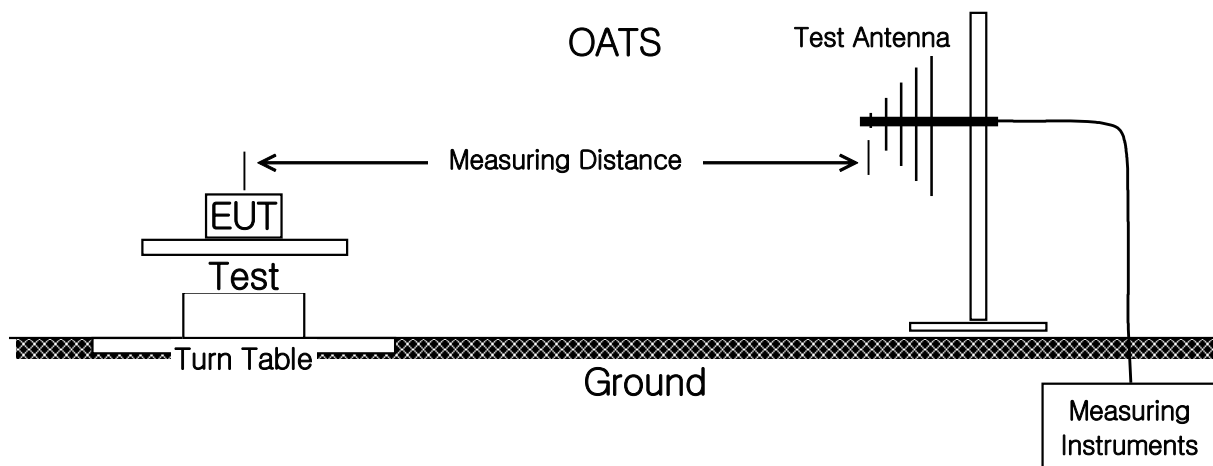
## 4.2 Radiated Emission Measurements

### 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 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.



### 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 °C |
| Relative Humidity :    | 40 ~ 60 %  |

#### 4.2.4 Test Limits

| Frequency<br>(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 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.

#### 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

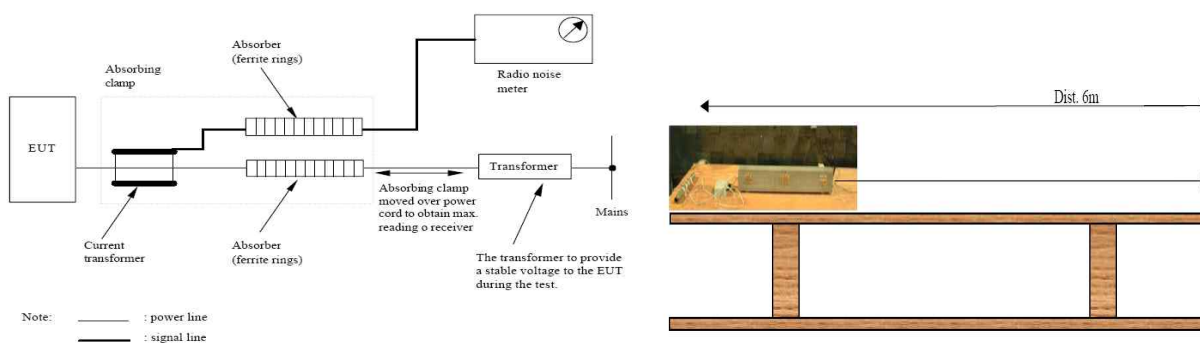
|                                                                                                                                                                                                                                                                             | Household and similar appliances              |                  | 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<br>ak                        | dB (pw) Average* | dB (pw) Quasi-pe<br>ak                | dB (pw) Average* | dB (pw) Quasi-pe<br>ak                                  | dB (pw) Average* | dB (pw) Quasi-pe<br>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 120 KHz

### 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.

24.30 dB at 30.129 MHz 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) |                        |
| 30.129                 | 24.30            | QP                | 45.02                             | —              | 20.71                  |
| 45.450                 | 21.94            | QP                | 46.80                             | —              | 24.86                  |
| 49.059                 | 21.18            | QP                | 47.14                             | —              | 25.96                  |
| 75.527                 | 18.72            | QP                | 49.01                             | —              | 30.29                  |
| 76.939                 | 18.97            | QP                | 49.09                             | —              | 30.12                  |
| 119.344                | 14.31            | QP                | 51.00                             | —              | 36.69                  |
| 164.835                | 11.50            | QP                | 52.40                             | —              | 40.90                  |
| 222.149                | 9.64             | QP                | 53.70                             | —              | 44.06                  |
| 274.811                | 9.91             | QP                | 54.62                             | —              | 44.70                  |
| —                      | —                | —                 | —                                 | —              | —                      |
| —                      | —                | —                 | —                                 | —              | —                      |

Temperature: 20 °C Humidity: 36 % Test Date: 1.17.2011 Tested by: Taeyeon, Kim

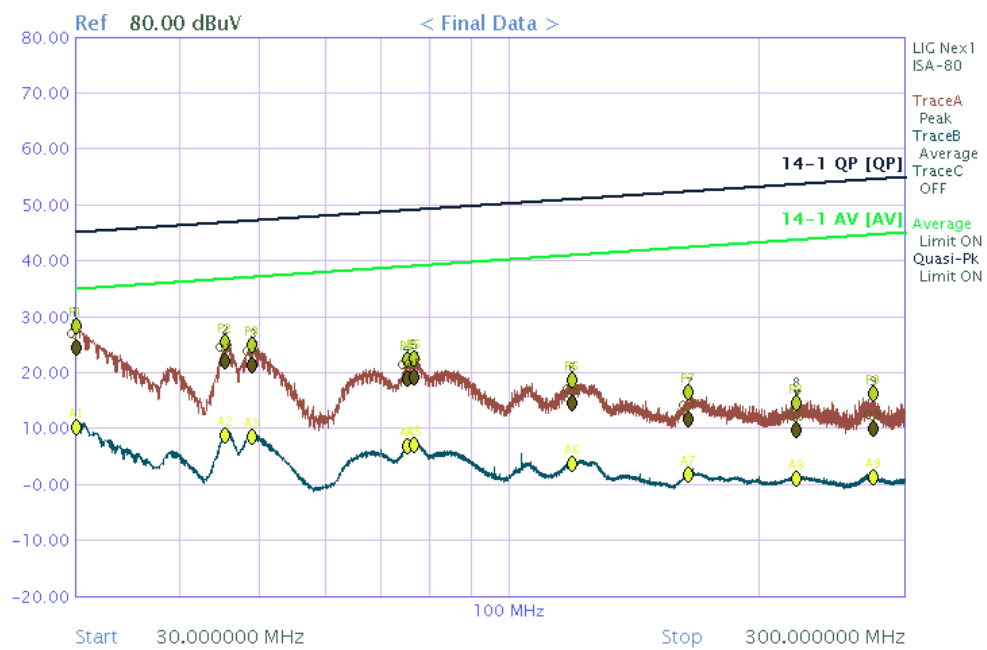
Test Report No.: TK-CC110005

Model No : DW-20W

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 0.8 m 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   | 07, 2011 |

### 4.4.3 Test Environment

|                        |                 |
|------------------------|-----------------|
| Ambient Temperatures : | 15 ~ 35 °C      |
| Relative Humidity :    | 40 ~ 60 %       |
| Atmospheric Pressure : | 860 ~ 1060 mbar |

### 4.4.4 Test Levels

|                              |                                                                                                                 |
|------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Discharge Impedance :        | 330 $\Omega$ $\pm$ 10 % / 150 pF $\pm$ 10 %                                                                     |
| Type of Discharge :          | Direct – Air Discharge(8 kV),<br>Contact Discharge(4 kV)<br>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 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   | controller enclosure | Air Discharge     | B           | B       | –       |
| 2   | controller – screw   | Contact Discharge | B           | A       | –       |
| 3   | –                    | –                 | –           | –       | –       |
| 4   |                      |                   |             |         |         |

#### 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.

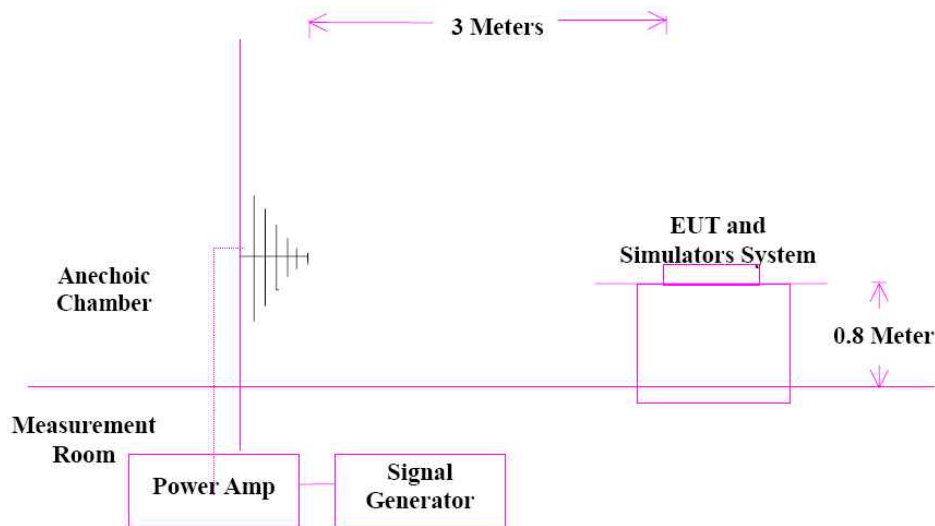
Temperature: 18 °C Humidity: 35 % Test Date: 1.18.2011 Tested by: Taeyeon, Kim

## 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        | 08, 2011 |
| USB adaptor(Passive).                 | ROHDE & SCHWARZ             | NRP-Z4       | 109360        | 08, 2011 |
| Average Power Sensor                  | ROHDE & SCHWARZ             | NRP-Z91      | 100784        | 08, 2011 |
| Power Amplifier                       | AR                          | 100W1000M1   | 19510         | 08, 2011 |
| High Power Dual Directional Coupler   | WELRATON                    | C3910        | 30447         | 08, 2011 |
| Hybrid Log–Periodic Antenna           | EMC Automation (TDK)        | HLP-2603     | 100400        | 08, 2011 |
| Electric Field Probe                  | ETL                         | HI-6105USB   | 00110086      | 08, 2011 |
| Probe Stand Adjustable to 7 1/2 FT    | AR                          | PS2000       | 10004439      | 08, 2011 |
| Readout/Display Interface USB         | National Instruments        | GPB-USB-HS   | 145FDC6       | 08, 2011 |
| Load Termination                      | Bird Electronic Corporation | 300-T-MN     | 1033774       | 08, 2011 |

#### 4.5.3 Test Environments

|                        |               |
|------------------------|---------------|
| Ambient Temperatures : | 15~35 °C      |
| Relative Humidity :    | 40~60 %       |
| Atmospheric Pressure : | 860~1060 mbar |

#### 4.5.4 Test Levels

|                        |                                       |
|------------------------|---------------------------------------|
| Frequency Range :      | 80 MHz to 1 000 MHz                   |
| Field Strength :       | 3 V/m(r.m.s, unmodulated)             |
| 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                                     |

#### 4.5.5 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 3 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.

#### 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

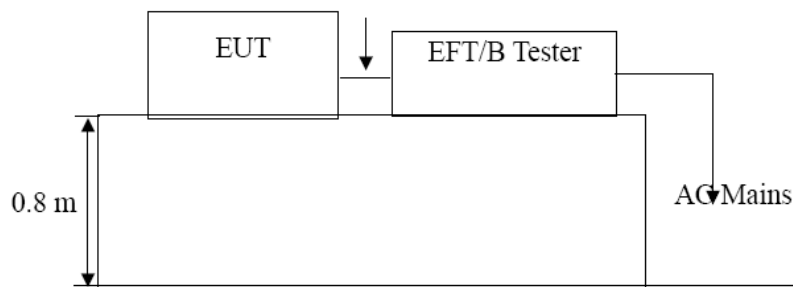
- A: Normal performance within the specification limits.
- B: Temporary degradation or loss of function or performance which is self-recoverable.
- C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.
- D: Degradation or loss of function which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

Temperature: 20 °C Humidity: 36 % Test Date: 1.17.2011 Tested by: Taeyeon, Kim

## 4.6 Electrical Fast Transient/Burst Immunity Measurements

### 4.6.1 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. 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   | 08, 2011 |
| Capacitive coupling clamp | EM TEST      | HFK          | 070925        | 08, 2011 |
| Calibration kit           | EM TEST      | CA EFT kit   | 0209-74 -114  | 08, 2011 |
| Motorized variac          | EM TEST      | MV2616       | V0936105123   | 08, 2011 |

### 4.6.3 Test Environments

|                        |               |
|------------------------|---------------|
| Ambient Temperatures : | 15~35 °C      |
| Relative Humidity :    | 40~60 %       |
| Atmospheric Pressure : | 860~1060 mbar |

#### 4.6.4 Test Levels

|                                        |                                                                                                                                                                                                                    |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Open Circuit Output Test Voltage :     | <input checked="" type="checkbox"/> Power Supply: $\pm 1$ kV(PEAK)<br><input type="checkbox"/> Protective Earth(PE) ports: $\pm 1$ kV(PEAK)<br><input type="checkbox"/> 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                                                                                                                                                                                                                  |

#### 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  $\pm 1$  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: 20 °C Humidity: 36 % Test Date: 1.17.2011 Tested by: Taeyeon, Kim

## 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   | 08, 2011 |
| CDN                     | EM TEST      | CNV 504 N    | V0936105121   | 08, 2011 |
| CDN                     | EM TEST      | CNV 504 S1   | V0936105122   | 08, 2011 |
| Motorized variac        | EM TEST      | MV2616       | V0936105123   | 08, 2011 |

### 4.7.3 Test Environments

|                        |               |
|------------------------|---------------|
| Ambient Temperatures : | 15~35 °C      |
| Relative Humidity :    | 40~60 %       |
| Atmospheric Pressure : | 860~1060 mbar |

### 4.7.4 Test Levels

|                                  |                                                                                                                                        |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Open Circuit Test Voltage :      | <input checked="" type="checkbox"/> AC Power; $\pm 1$ kV line-to-line,<br><input type="checkbox"/> AC POWER, $\pm 2$ 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: 20 °C Humidity: 36 % Test Date: 1.17.2011 Tested by: Taeyeon, Kim

## 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            | 08, 2011 |
| Attenuator                | EM TEST      | ATT 6dB/75W  | 1208-34                | 08, 2011 |
| Basic calibration kit     | EM TEST      | CWS-CAL      | 0209 -182<br>-183 -184 | 08, 2011 |
| CDN                       | EM TEST      | CDN-M2/M3    | 0909-06                | 08, 2011 |
| CDN                       | EM TEST      | CDN-T2-RJ11  | 0909-07                | 08, 2011 |
| CDN                       | EM TEST      | CDN-T4       | 0909-08                | 08, 2011 |
| CDN                       | EM TEST      | CDN-T8RJ45   | 0909-09                | 08, 2011 |
| CDN                       | EM TEST      | CDN-AF2      | 0909-10                | 08, 2011 |
| CDN                       | EM TEST      | CDN-AF4      | 0909-11                | 08, 2011 |
| EM Clamp                  | EM TEST      | EM 101       | 35943                  | 11, 2011 |

### 4.8.3 Test Environments

|                        |               |
|------------------------|---------------|
| Ambient Temperatures : | 15~35 °C      |
| Relative Humidity :    | 40~60 %       |
| Atmospheric Pressure : | 860~1060 mbar |

### 4.8.4 Test Levels

|                        |                                       |
|------------------------|---------------------------------------|
| Frequency Range :      | 150 kHz to 80 MHz                     |
| Voltage Level :        | 3 V                                   |
| Amplitude Modulation : | 80 % AM in depth by a 1 kHz 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: 18 °C Humidity: 35 % Test Date: 1.18.2011 Tested by: Taeyeon, Kim

## 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 0.8 m 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   | 08, 2011 |
| Motorized variac        | EM TEST      | MV2616       | V0936105123   | 08, 2011 |

### 4.9.3 Test Environments

|                        |               |
|------------------------|---------------|
| Ambient Temperatures : | 15~35 °C      |
| Relative Humidity :    | 40~60 %       |
| Atmospheric Pressure : | 860~1060 mbar |

### 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 :                           | 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<br>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   | 60%   | 10T      | C           | A       | At 50Hz |
| 3   | 30%   | 25T      | C           | B       | At 50Hz |
| 4   | —     | —        | —           | —       | —       |
| 5   |       |          |             |         |         |
| 6   |       |          |             |         |         |

Performance Results

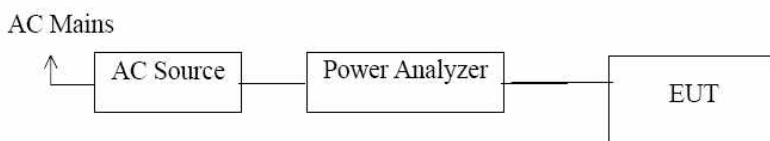
- A: Normal performance within the specification limits.
- B: Temporary degradation or loss of function or performance which is self-recoverable.
- C: Temporary degradation or loss of function or performance which requires operator intervention or system reset.
- D: Degradation or loss of function which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

Temperature: 19 °C Humidity: 34 % Test Date: 1.18.2011 Tested by: Taeyeon, Kim

## 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



### 4.10.2 Test Equipments

| Description               | Manufacturer             | Model Number               | Serial Number | Cal. Due |
|---------------------------|--------------------------|----------------------------|---------------|----------|
| AC Power Source           | Schaffner-Chase EMC Ltd. | NSG 1007-5-208<br>-CTS-413 | HK53453       | 09. 2011 |
| Flicker & Harmonic Tester | Schaffner-Chase EMC Ltd. | CCN-1000-1                 | 72585         | 09. 2011 |

### 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 <sub>eff</sub> [A] | % of Limit | Limit [A] | Result |
|----|----------------------|------------|-----------|--------|
| 1  | 1.328                |            |           |        |
| 2  | 6.581E-3             | 0.203      | 3.24      | PASS   |
| 3  | 5.574E-3             | 0.081      | 6.90      | PASS   |
| 4  | 5.206E-3             | 0.404      | 1.29      | PASS   |
| 5  | 5.097E-3             | 0.149      | 3.42      | PASS   |
| 6  | 5.409E-3             | 0.601      | 900.00E-3 | PASS   |
| 7  | 5.263E-3             | 0.228      | 2.31      | PASS   |
| 8  | 5.131E-3             | 0.744      | 690.00E-3 | PASS   |
| 9  | 4.763E-3             | 0.397      | 1.20      | PASS   |
| 10 | 4.799E-3             | 0.869      | 552.00E-3 | PASS   |
| 11 | 4.530E-3             | 0.458      | 990.00E-3 | PASS   |
| 12 | 4.055E-3             | 0.882      | 459.99E-3 | PASS   |
| 13 | 3.686E-3             | 0.585      | 630.00E-3 | PASS   |
| 14 | 3.618E-3             | 0.918      | 394.29E-3 | PASS   |
| 15 | 3.676E-3             | 0.817      | 450.00E-3 | PASS   |
| 16 | 3.379E-3             | 0.980      | 345.00E-3 | PASS   |
| 17 | 3.267E-3             | 0.823      | 397.05E-3 | PASS   |
| 18 | 3.041E-3             | 0.992      | 306.66E-3 | PASS   |
| 19 | 3.012E-3             | 0.848      | 355.26E-3 | PASS   |
| 20 | 2.546E-3             | 0.923      | 276.00E-3 | PASS   |
| 21 | 2.252E-3             | 0.700      | 321.42E-3 | PASS   |
| 22 | 2.126E-3             | 0.847      | 250.92E-3 | PASS   |
| 23 | 2.384E-3             | 0.812      | 293.49E-3 | PASS   |
| 24 | 2.092E-3             | 0.910      | 229.98E-3 | PASS   |
| 25 | 1.763E-3             | 0.653      | 270.00E-3 | PASS   |
| 26 | 1.499E-3             | 0.706      | 212.31E-3 | PASS   |
| 27 | 1.332E-3             | 0.533      | 249.99E-3 | PASS   |
| 28 | 1.066E-3             | 0.541      | 197.13E-3 | PASS   |
| 29 | 1.150E-3             | 0.494      | 232.77E-3 | PASS   |
| 30 | 1.074E-3             | 0.584      | 183.99E-3 | PASS   |
| 31 | 1.293E-3             | 0.594      | 217.74E-3 | PASS   |
| 32 | 818.427E-6           | 0.474      | 172.50E-3 | PASS   |
| 33 | 1.514E-3             | 0.740      | 204.54E-3 | PASS   |
| 34 | 1.089E-3             | 0.670      | 162.36E-3 | PASS   |
| 35 | 1.305E-3             | 0.677      | 192.87E-3 | PASS   |
| 36 | 1.504E-3             | 0.981      | 153.33E-3 | PASS   |
| 37 | 1.040E-3             | 0.570      | 182.43E-3 | PASS   |
| 38 | 1.428E-3             | 0.983      | 145.26E-3 | PASS   |
| 39 | 1.018E-3             | 0.588      | 173.07E-3 | PASS   |
| 40 | 1.056E-3             | 0.765      | 138.00E-3 | PASS   |

#### 4.10.7 Test Data – Voltage Fluctuations

|          | EUT values | Limit | Result |
|----------|------------|-------|--------|
| Pst      | 0.028      | 1.00  | PASS   |
| Plt      | 0.028      | 0.65  | PASS   |
| dc [%]   | 0.000      | 3.30  | PASS   |
| dmax [%] | 0.274      | 4.00  | PASS   |
| dt [s]   | 0.000      | 0.50  | PASS   |

Temperature: 20 °C Humidity: 36 % Test Date: 1.18.2011 Tested by: Taeyeon, Kim

#### 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% |

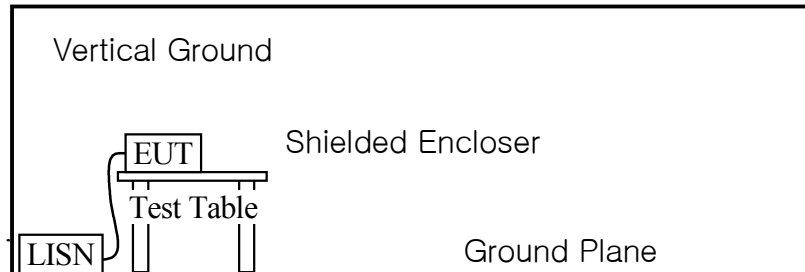
##### 4.11.4 Test Limits

| Frequency<br>(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

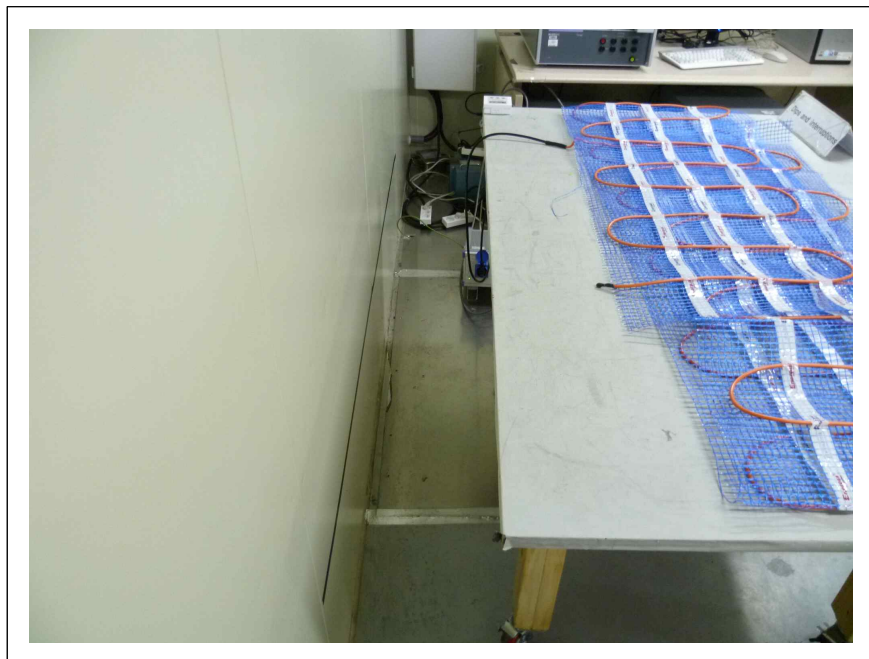
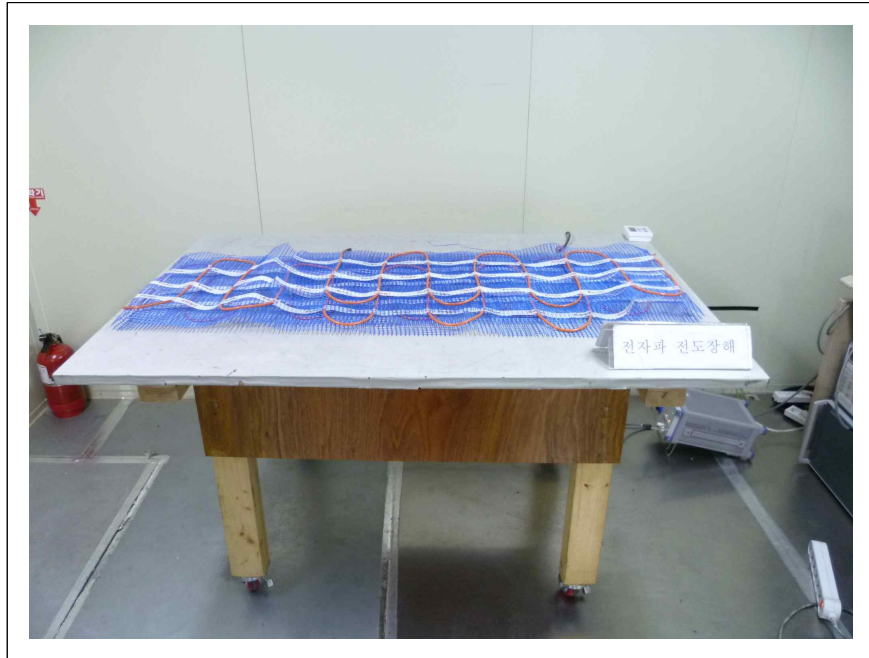
| Clicks Factor =    |           |               |                   |                           |                  |                       |                           |
|--------------------|-----------|---------------|-------------------|---------------------------|------------------|-----------------------|---------------------------|
| Observation Time = |           |               |                   |                           |                  |                       |                           |
| Line               | Freq. MHz | Limit<br>dBuV | Total<br>Clicks n | Click Rate<br>$N=(n*f)/T$ | Relaxation<br>dB | Relaxed<br>Limit dBuV | Permitted<br>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

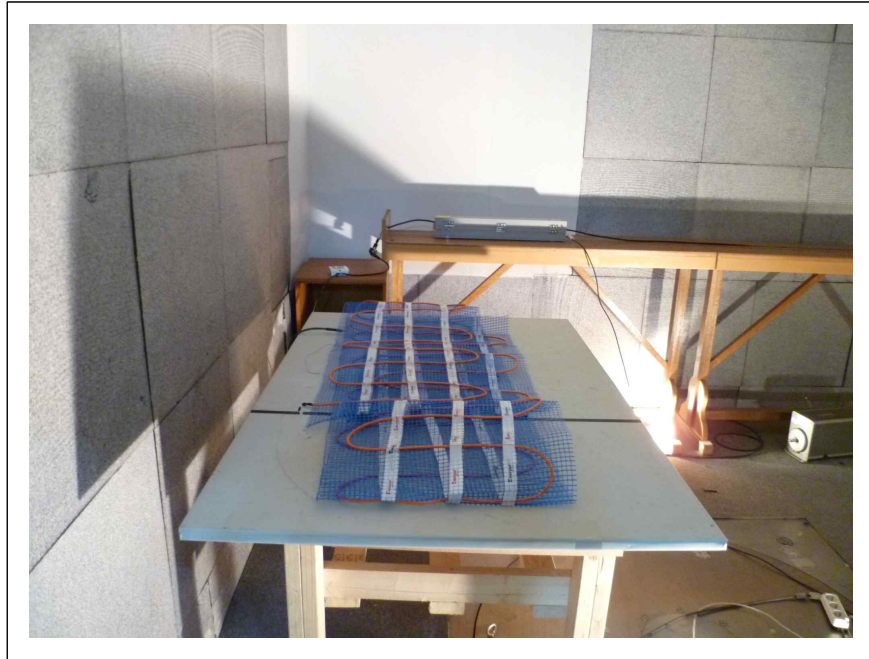


## 5.2 Radiated Emission

N/A

N/A

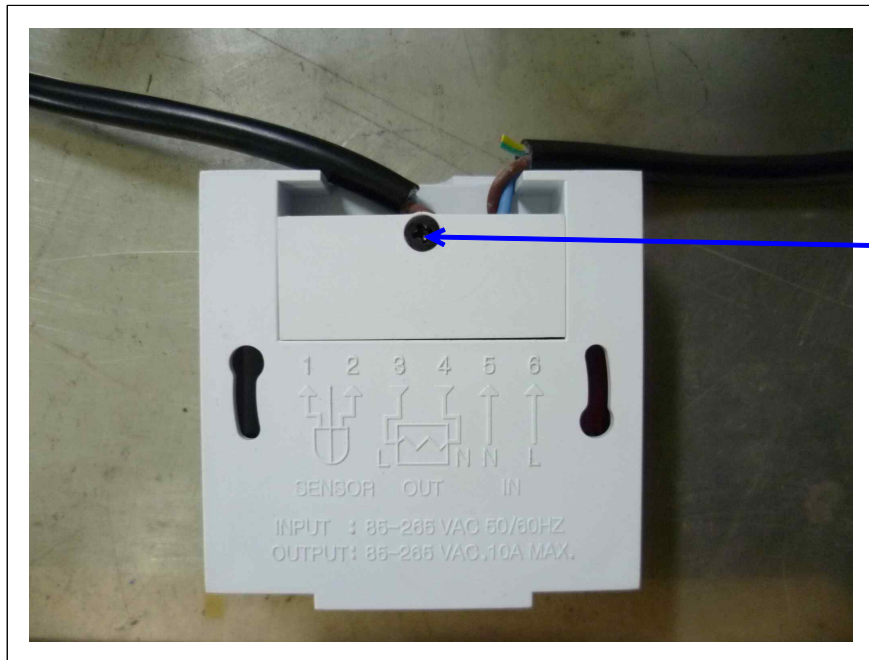
### 5.3 Disturbance power



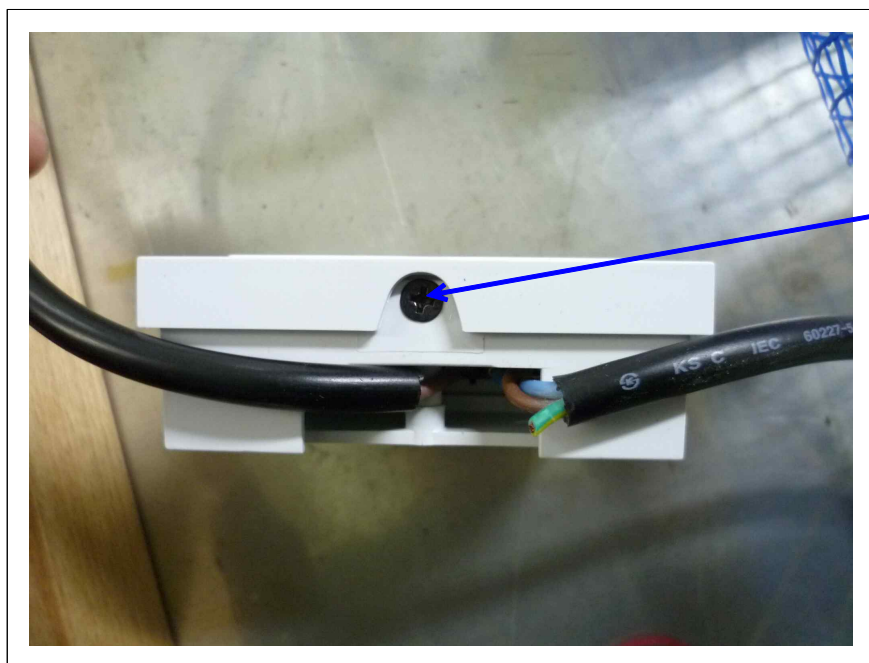
## 5.4 Electrostatic Discharge Immunity



Air  
Discharge

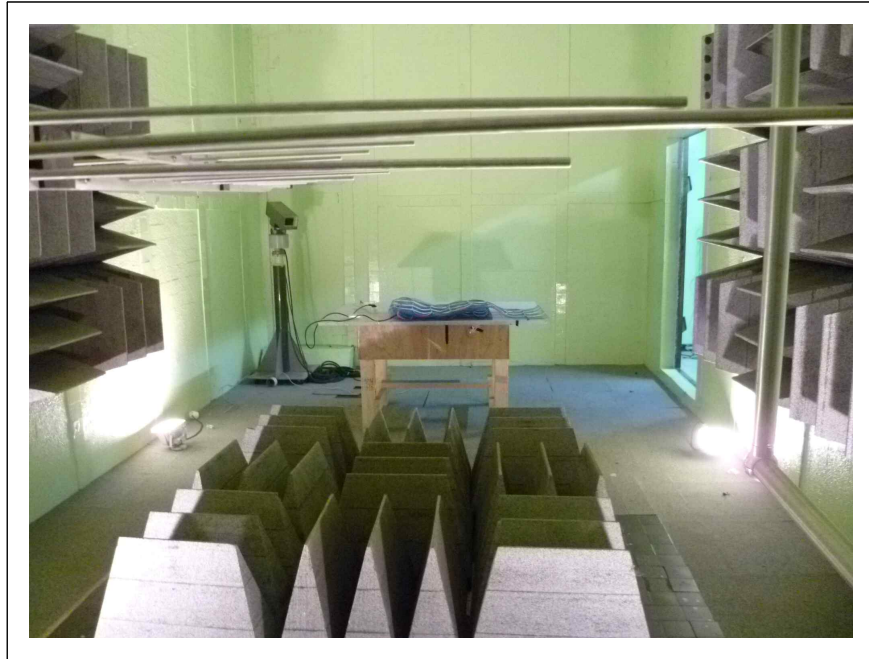


Contact Discharge



Contact Discharge

## 5.5 Radiated RF-Electromagnetic Fields



## 5.6 Electrical Fast Transient/Burst Immunity



## 5.7 Surge Immunity



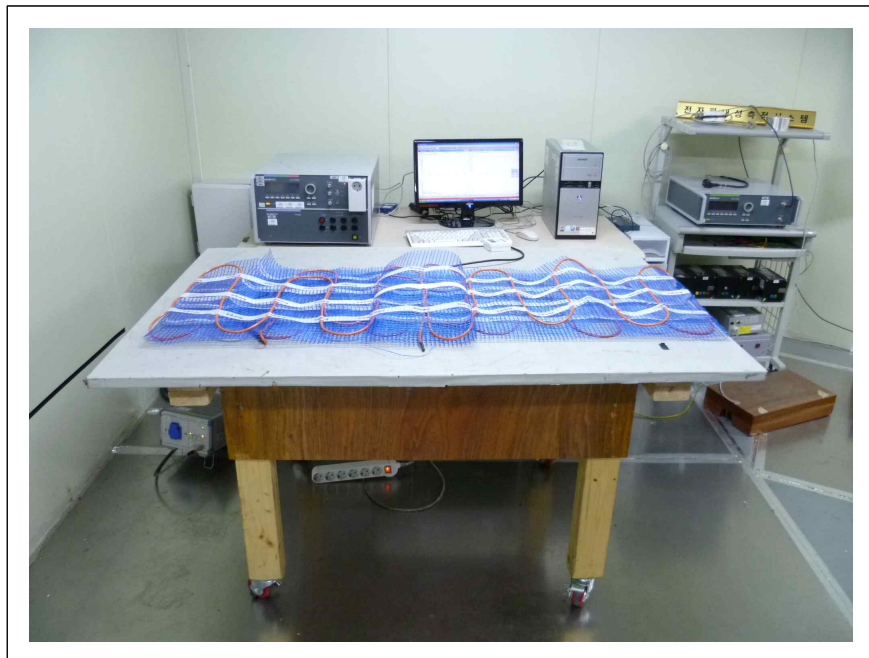
## 5.8 Conducted Disturbances Induced by Radio Frequency Fields



## 5.9 Voltage Dips and Short Interruptions Immunity

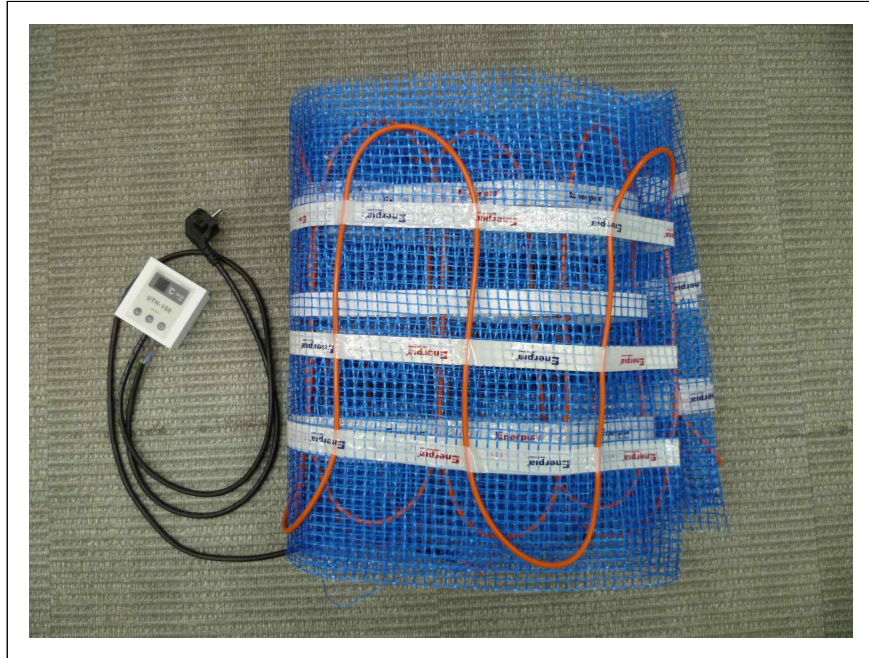


## 5.10 Harmonics / Voltage Fluctuations Measurements

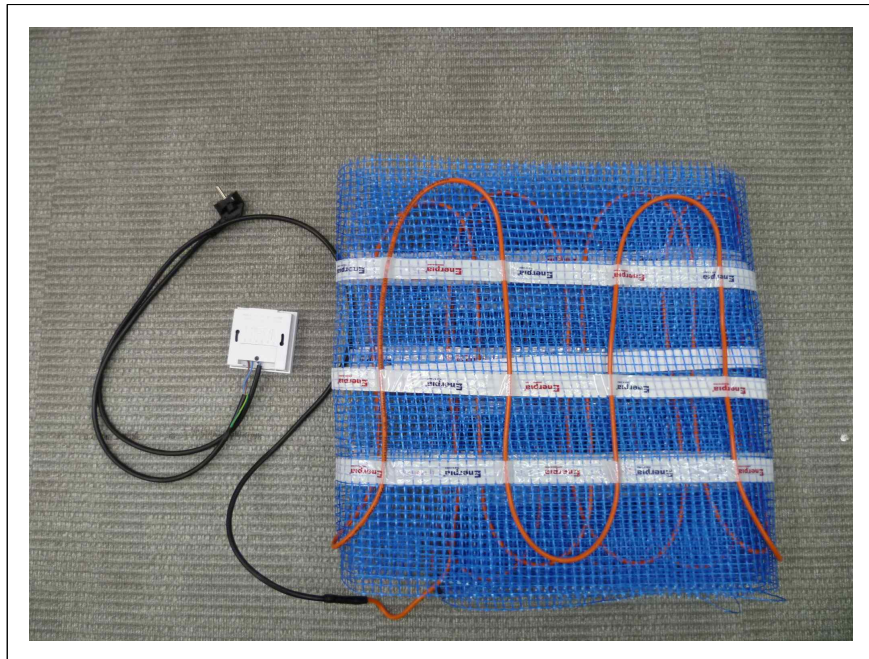


## 4. EUT Photographs

### 4.1 EUT: External View – TOP



### 4.2 EUT: External View – BOTTOM



#### 4.3 EUT: External View – TOP – CONTROLLER



#### 4.4 EUT: External View – BOTTOM – CONTROLLER



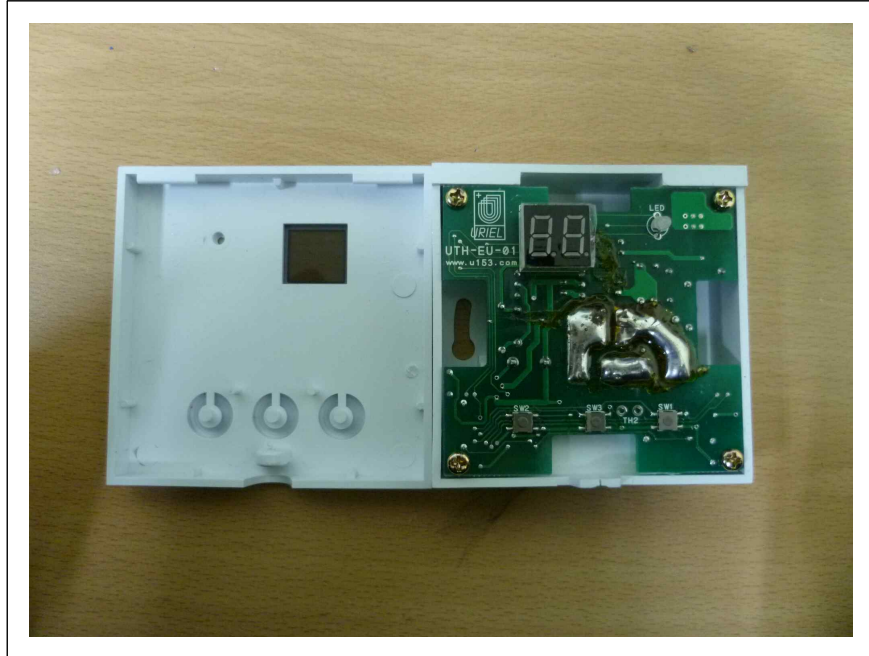
#### 4.5 EUT: External View – TOP – MAT CABLE



#### 4.6 EUT: External View – BOTTOM – MAT CABLE



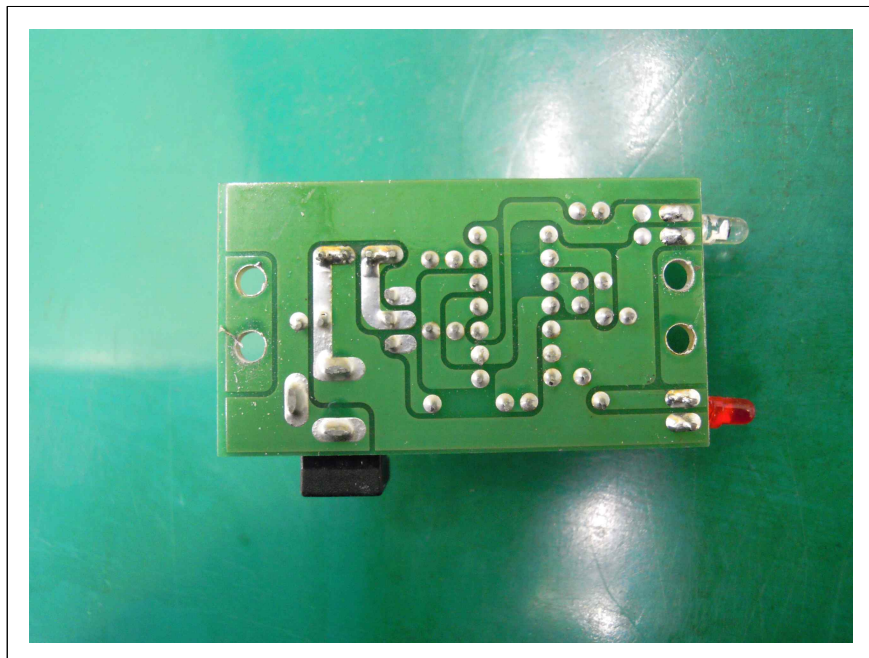
#### 4.7 EUT: Internal View – CONTROLLER



#### 4.8 EUT: Internal View – CONTROLLER – TOP



#### 4.9 EUT: Internal View – BOTTOM – CONTROLLER



## Appendix A – Schematics/Block Diagram

Please see attached document(s).

## Appendix B – User's Manual

Please see attached document(s).