



**SPORTON LAB.**

Certificate No: EC332611

# CERTIFICATE

● **EQUIPMENT:** External five bay RAID system

**MODEL NO. :** DR5-WBS3

**APPLICANT :** RAIDON TECHNOLOGY, INC.

7F-9, No. 16, Lane 609, Sec. 5, Chung-Hsin Rd.,  
San-Chung Dist., New Taipei City, Taiwan ( R.O.C )



**I HEREBY**

**CERTIFY THAT:**

THE MEASUREMENTS SHOWN IN THIS TEST REPORT WERE MADE IN  
ACCORDANCE WITH THE PROCEDURES GIVEN IN **EUROPEAN COUNCIL  
DIRECTIVE 2004/108/EC**. THE EQUIPMENT WAS **PASSED** THE TEST  
PERFORMED ACCORDING TO

**European Standard EN 55022:2010 Class B,  
EN 61000-3-2:2006/A1:2009/A2:2009, EN 61000-3-3:2008 and  
EN 55024:2010 (IEC 61000-4-2:2008, IEC 61000-4-3:2006/A1:2007/A2:2010,  
IEC 61000-4-4:2004/A1:2010, IEC 61000-4-5:2005, IEC 61000-4-6:2008,  
IEC 61000-4-8:2009, IEC 61000-4-11:2004).**

THE TEST WAS CARRIED OUT ON **Apr. 10, 2013** AT  
**SPORTON INTERNATIONAL INC. LAB.**

\_\_\_\_\_  
Jack Deng

Engineering Manager

# CE EMC TEST REPORT

according to

**European Standard EN 55022:2010 Class B,  
EN 61000-3-2:2006/A1:2009/A2:2009, EN 61000-3-3:2008 and  
EN 55024:2010 (IEC 61000-4-2:2008,  
IEC 61000-4-3:2006/A1:2007/A2:2010, IEC 61000-4-4:2004/A1:2010,  
IEC 61000-4-5:2005, IEC 61000-4-6:2008,  
IEC 61000-4-8:2009, IEC 61000-4-11:2004)**

Equipment : External five bay RAID system

Model No. : DR5-WBS3

Applicant : **RAIDON TECHNOLOGY, INC.**  
7F-9, No. 16, Lane 609, Sec. 5, Chung-Hsin Rd.,  
San-Chung Dist., New Taipei City, Taiwan ( R.O.C )

## Statement

- The test result refers exclusively to the test presented test model / sample.
- Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.
- This test report is only applicable to European Community.

***SPORTON International Inc.***

*6F, No. 106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.*

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**History of this test report**

| Report No. | Version | Issue Date    | Description             |
|------------|---------|---------------|-------------------------|
| EC332611   | Rev.01  | Apr. 12, 2013 | Initial issue of report |
|            |         |               |                         |
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|            |         |               |                         |

## CERTIFICATE OF COMPLIANCE

according to

**European Standard EN 55022:2010 Class B,  
EN 61000-3-2:2006/A1:2009/A2:2009, EN 61000-3-3:2008 and  
EN 55024:2010 (IEC 61000-4-2:2008,  
IEC 61000-4-3:2006/A1:2007/A2:2010, IEC 61000-4-4:2004/A1:2010,  
IEC 61000-4-5:2005, IEC 61000-4-6:2008,  
IEC 61000-4-8:2009, IEC 61000-4-11:2004)**

Equipment : External five bay RAID system

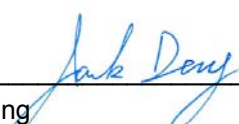
Model No. : DR5-WBS3

Applicant : **RAIDON TECHNOLOGY, INC.**  
7F-9, No. 16, Lane 609, Sec. 5, Chung-Hsin Rd.,  
San-Chung Dist., New Taipei City, Taiwan ( R.O.C )

### I **HEREBY** CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **EUROPEAN COUNCIL DIRECTIVE 2004/108/EC**. The equipment was **passed** the test performed according to **European Standard EN 55022:2010 Class B, EN 61000-3-2:2006/A1:2009/A2:2009, EN 61000-3-3:2008 and EN 55024:2010 (IEC 61000-4-2:2008, IEC 61000-4-3:2006/A1:2007/A2:2010, IEC 61000-4-4:2004/A1:2010, IEC 61000-4-5:2005, IEC 61000-4-6:2008, IEC 61000-4-8:2009, IEC 61000-4-11:2004).**

The test was carried out on Apr. 10, 2013 at **SPORTON International Inc.** LAB.

  
\_\_\_\_\_  
Jack Deng  
Engineering Manager

**SPORTON International Inc.**

6F, No. 106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

## **1. General Description of Equipment under Test**

### **1.1. Applicant**

RAIDON TECHNOLOGY, INC.

7F-9, No. 16, Lane 609, Sec. 5, Chung-Hsin Rd., San-Chung Dist., New Taipei City, Taiwan ( R.O.C )

### **1.2. Manufacturer**

Same as 1.1

### **1.3. Basic Description of Equipment under Test**

|              |                                 |
|--------------|---------------------------------|
| Equipment    | : External five bay RAID system |
| Model No.    | : DR5-WBS3                      |
| Trade Name   | : RAIDON, STARDOM               |
| 1394A Cable  | : D-Shielded, 1.8 m             |
| 1394B Cable  | : D-Shielded, 1.8 m             |
| e-SATA Cable | : D-Shielded, 1 m               |
| USB3.0 Cable | : D-Shielded, 1 m               |
| Power Cable  | : Non-Shielded, 1.8 m           |

#### **Associated with interface cables**

|                   |                                                          |
|-------------------|----------------------------------------------------------|
| Data Cable Type   | : Please see section 3.2 of this test report for details |
| Power Supply Type | : From Switching Power Supply                            |
| AC Power Cord     | : Non-Shielded, 1.8 m, 3 pin                             |

### **1.4. Feature of Equipment under Test**

Please refer to user manual.

## 2. Summary of the Test Result

### 2.1. Emission Tests

| Emissions                         |                                   |          |        |
|-----------------------------------|-----------------------------------|----------|--------|
| Test Standard                     | Description of Test               | Result   | Remark |
| EN 55022:2010                     | AC Power Conducted Emissions      | Complies | -      |
| EN 55022:2010                     | Telecommunication Ports Conducted | -        | N/A    |
| EN 55022:2010                     | Radiated Emissions (Below 1GHz)   | Complies | -      |
|                                   | Radiated Emissions (Above 1GHz)   | Complies | -      |
| EN 61000-3-2:2006/A1:2009/A2:2009 | Harmonic Current Emissions        | -        | N/A    |
| EN 61000-3-3:2008                 | Voltage Fluctuations and Flicker  | Complies | -      |

Remark: The "N/A" is means not applicable.

### 2.2. Immunity Tests

| Applicable Standard : EN 55024:2010 |                                                         |          |          |
|-------------------------------------|---------------------------------------------------------|----------|----------|
| Test Standard                       | Description of Test                                     | Result   | Criteria |
| IEC 61000-4-2:2008                  | ESD (EUT of Enclosure)                                  | Complies | B        |
| IEC 61000-4-3:2006/A1:2007/A2:2010  | RS (EUT of Enclosure)                                   | Complies | A        |
| IEC 61000-4-4:2004/A1:2010          | EFT (EUT of AC Power Port)                              | Complies | A        |
| IEC 61000-4-4:2004/A1:2010          | EFT (EUT of signal ports and telecommunication ports)   | -        | -        |
| IEC 61000-4-5:2005                  | Surge (EUT of AC Power Port)                            | Complies | A        |
| IEC 61000-4-5:2005                  | Surge (EUT of signal ports and telecommunication ports) | -        | -        |
| IEC 61000-4-6:2008                  | CS (EUT of AC Power Port)                               | Complies | A        |
| IEC 61000-4-6:2008                  | CS (EUT of signal ports and telecommunication ports)    | -        | -        |
| IEC 61000-4-8:2009                  | PFMF (EUT of Enclosure)                                 | Complies | A        |
| IEC 61000-4-11:2004                 | DIP (EUT of AC Power Port)                              | Complies | C/B/A    |

### 3. Test Configuration of Equipment under Test

#### 3.1. Test Manner

- a. The EUT has been associated with personal computer and peripherals pursuant to European Standard EN 55022 and EN 55024.
- b. The equipment under test were performed the following test modes:

| Test Items                            | Description of test modes                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AC Conducted Emission</b>          | Mode 1. 1394B 1<br>Mode 2. 1394B 2<br>Mode 3. 1394A<br>Mode 4. e-SATA<br>Mode 5. USB3.0<br>Cause "mode 1" generated the worst test result; it was reported as final data.                                                                                                                                                                         |
| <b>Radiated Emissions</b>             | Mode 1. 1394B 1<br>Mode 2. 1394B 2<br>Mode 3. 1394A<br>Mode 4. e-SATA<br>Mode 5. USB3.0<br><b>&lt; below 1GHz &gt;</b><br>Cause "mode 1" generated the worst test result; it was reported as final data.<br><b>&lt; above 1GHz &gt;</b><br>Cause "mode 5" is highest frequency of the internal sources of the EUT; it was reported as final data. |
| <b>Harmonic and Flicker Emissions</b> | Mode 1. 1394B 1                                                                                                                                                                                                                                                                                                                                   |
| <b>EMS</b>                            | Mode 1. 1394B 1                                                                                                                                                                                                                                                                                                                                   |

- c. Frequency range investigated: Conduction 150 kHz to 30 MHz, Radiation 30 MHz to 6,000 MHz.
- d. Frequency range investigated immunity test: CS 150 kHz to 80 MHz, RS 80 MHz to 1,000 MHz.

### 3.2. Description of Test System

#### < EMI ><Conducted and Radiated below 1GHz>

| No. | Peripheral        | Manufacturer | Model Number  | FCC ID     | Cable / Spec. Description       | Placed |
|-----|-------------------|--------------|---------------|------------|---------------------------------|--------|
| 1   | Personal Computer | DELL         | DCTA          | DoC        | N/A                             | Local  |
| 2   | LCD Monitor       | DELL         | E198WFPf      | DoC        | D-SUB Cable, D-Shielded, 1.8m   | Local  |
| 3   | Keyboard          | DELL         | SK-8175       | DoC        | USB Cable, AL-F-Shielded, 1.8m  | Local  |
| 4   | Mouse             | DELL         | MOC5UO        | DoC        | USB Cable, AL-F-Shielded, 1.8m  | Local  |
| 5   | Printer           | HP           | C2642X(DJ400) | B94C2642X  | LPT Cable, D-Shielded, 1.2m     | Local  |
| 6   | Modem             | ACEEX        | DM1414        | IFAXDM1414 | RS-232 Cable, D-Shielded, 1.15m | Local  |
| 7   | 1394B HDD         | ONNTO        | AT-S111       | DoC        | 1394B Cable, D-Shielded, 1.8m   | Local  |
| 8   | HDD               | Seagate      | ST3250318AS   | DoC        | 250GB                           | Local  |
| 9   | HDD x4            | Seagate      | ST3500318AS   | DoC        | 500GB                           | Local  |

#### < EMI ><Radiated above 1GHz>

| No. | Peripheral        | Manufacturer | Model Number  | FCC ID     | Cable / Spec. Description      | Placed |
|-----|-------------------|--------------|---------------|------------|--------------------------------|--------|
| 1   | Personal Computer | DELL         | DCTA          | DoC        | N/A                            | Local  |
| 2   | LCD Monitor       | DELL         | U2410F        | DoC        | D-SUB Cable, D-Shielded, 1.8m  | Local  |
| 3   | Keyboard          | Microsoft    | 1366          | DoC        | PS/2 Cable, AL-F-Shielded, 2m  | Local  |
| 4   | Mouse             | Microsoft    | 1113          | JNZ211443  | PS/2 Cable, Non-Shielded, 1.8m | Local  |
| 5   | Printer           | HP           | C2642X(DJ400) | B94C2642X  | LPT Cable, D-Shielded, 1.8m    | Local  |
| 6   | Modem             | ACEEX        | DM1414        | IFAXDM1414 | RS-232 Cable, D-Shielded, 1m   | Local  |
| 7   | 1394B HDD         | ONNTO        | AT-S111       | DoC        | 1394B Cable, D-Shielded, 1.8m  | Local  |
| 8   | HDD               | Seagate      | ST3250318AS   | DoC        | 250GB                          | Local  |
| 9   | HDD x4            | Seagate      | ST3500318AS   | DoC        | 500GB                          | Local  |

**< EMS >**

| No. | Peripheral        | Manufacturer | Model Number | FCC ID | Cable / Spec. Description     | Placed |
|-----|-------------------|--------------|--------------|--------|-------------------------------|--------|
| 1   | Personal Computer | DELL         | T3500        | DoC    | N/A                           | Local  |
| 2   | LCD Monitor       | DELL         | E1911F       | DoC    | DVI Cable, Shielded, 1.8m     | Local  |
| 3   | Wireless Keyboard | Microsoft    | 1066         | DoC    | N/A                           | Local  |
| 4   | Wireless Mouse    | Microsoft    | 1058         | DoC    | N/A                           | Local  |
| 5   | 1394B HDD         | ONNTO        | AT-S111      | DoC    | 1394B Cable, D-Shielded, 1.8m | Local  |
| 6   | HDD               | Seagate      | ST3250318AS  | DoC    | 250GB                         | Local  |
| 7   | HDD x4            | Seagate      | ST3500318AS  | DoC    | 500GB                         | Local  |

## 4. Test Software

### < EMI >

Two executive programs, "EMCTEST.exe & EMITEST.exe" under WIN XP, which generate a complete line of continuously repeating "H" pattern were used as the test software.

The program was executed as follows:

- a. Turn on the power of all equipment.
- b. The PC reads the test program from the hard disk drive and runs it.
- c. The PC sends "H" pattern to the monitor, and the monitor displays "H" patterns on the screen.
- d. The PC sends "H" messages to the printer, and then the printer prints them on the paper.
- e. The PC sends signal messages to the modem.
- f. The PC sends signal messages to the internal Hard Disk, and the Hard Disk reads and writes the message.
- g. Repeat the steps from c to f.

At the same time, the following program was executed:

- Executed "Winthrax.exe" to read and write data from EUT.

### < EMS >

During the test, the program under Win 7 was executed:

- Executed "Winthrax.exe" to read and write data from EUT.

## 5. General Information of Test

### 5.1. Test Facility

#### <EMI>

**Test Site : SPORTON INTERNATIONAL INC.**

Test Site Location : No. 3, Lane 238, Kang Lo Street, Nei Hwu District, Taipei 11424,  
Taiwan, R.O.C.

TEL : 886-2-2631-4739

FAX : 886-2-2631-9740

Test Site No. : CO01-NH, OS03-NH

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang,  
Tao Yuan Hsien, Taiwan, R.O.C.

TEL : 886-3-327-3456

FAX : 886-3-318-0055

Test Site No. : 03CH03-HY

#### <EMS>

Test Site Location : 3F, No.587, Tanmeu St., Neihsu District, Taipei, Taiwan, R.O.C.

TEL : 886-2-2794-8886

FAX : 886-2-2794-9777

### 5.2. Test Voltage

AC 230V / 50Hz

### 5.3. Measurement Procedure

EMI Test : European Standard EN 55022 Class B

Harmonics Test : European Standard EN 61000-3-2

Voltage Fluctuations Test : European Standard EN 61000-3-3

EMS Test : European Standard EN 55024

(ESD: IEC 61000-4-2, RS: IEC 61000-4-3, EFT: IEC 61000-4-4, SURGE: IEC 61000-4-5,  
CS: IEC 61000-4-6, Power Frequency Magnetic Field: IEC 61000-4-8, DIPS: IEC 61000-4-11)

### 5.4. Test in Compliance with

EMI Test : European Standard EN 55022 Class B

Harmonics Test : European Standard EN 61000-3-2

Voltage Fluctuations Test : European Standard EN 61000-3-3

EMS Test : European Standard EN 55024

(ESD: IEC 61000-4-2, RS: IEC 61000-4-3, EFT: IEC 61000-4-4, SURGE: IEC 61000-4-5,  
CS: IEC 61000-4-6, Power Frequency Magnetic Field: IEC 61000-4-8, DIPS: IEC 61000-4-11)

## **5.5. Frequency Range Investigated**

- a. Conducted emission test: from 150 kHz to 30 MHz
- b. Radiated emission test: from 30 MHz to 6,000 MHz
- c. Radio frequency electromagnetic field immunity test: 80-1000 MHz

## **5.6. Test Distance**

- a. The test distance of radiated emission test from antenna to EUT is 10 M (from 30MHz~1GHz).
- b. The test distance of radiated emission test from antenna to EUT is 3 M (from 1GHz~6GHz).
- c. The test distance of radio frequency electromagnetic field immunity test from antenna to EUT is 3 M.

## 6. Conducted Emissions Measurement

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 kHz and return leads of the EUT according to the methods defined in European Standard EN 55022 Clause 9. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meter above the ground plane as shown in section 6.4. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position producing maximum conducted emissions.

### 6.1. Limits for conducted disturbance at mains terminals

#### Limits for conducted disturbance at mains terminals

| Frequency range<br>(MHz) | Class A Limits<br>dB(μV) |         | Class B Limits<br>dB(μV) |         |
|--------------------------|--------------------------|---------|--------------------------|---------|
|                          | Quasi-peak               | Average | Quasi-peak               | Average |
| 0.15 to 0.50             | 79                       | 66      | 66 - 56                  | 56 - 46 |
| 0.50 to 5                | 73                       | 60      | 56                       | 46      |
| 5 to 30                  | 73                       | 60      | 60                       | 50      |

NOTE: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

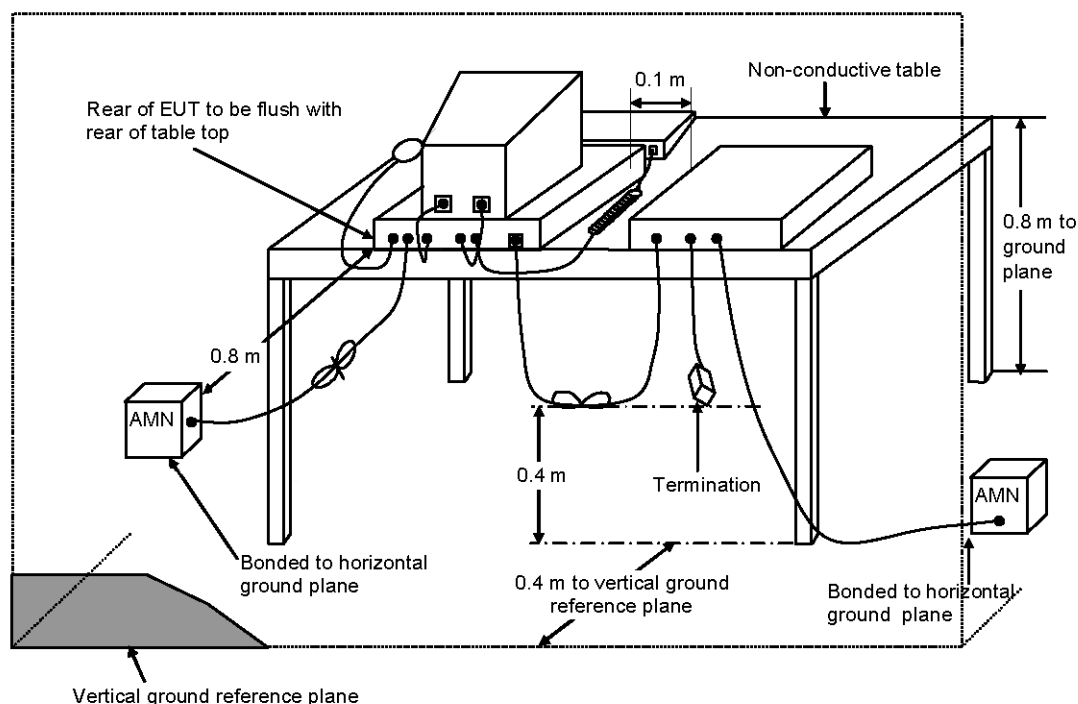
## 6.2. Description of Major Test Instruments

| Test Receiver Parameters | Setting          |
|--------------------------|------------------|
| Test Receiver            | R&S ESCS 30      |
| Attenuation              | 10 dB            |
| Start Frequency          | 0.15 MHz         |
| Stop Frequency           | 30 MHz           |
| IF Bandwidth             | 9 kHz            |
| Signal Input             | 9 kHz - 2.75 GHz |

## 6.3. Test Procedures

- The EUT was placed on a desk 0.8 meter height from the metal ground plane and 0.4 meter from the conducting wall of the shielding room and it was kept at least 0.8 meter from any other grounded conducting surface.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connect to the other LISN.
- The LISN provides 50 ohm, coupling impedance for the measuring instrument.
- The CISPR states that a 50 ohm, 50 microhenry LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

## 6.4. Typical Test Setup Layout of AC Powerline Conducted Emissions



- AMN is 80 cm from the EUT and at least 80 cm from other units and other metal planes.
- EUT is connected to one artificial mains network (AMN).
- All other units of a system are powered from a second AMN. A multiple outlet strip can be used for multiple mains cords.
- Rear of EUT to be flushed with rear of table top.
- Peripherals shall be placed at a distance of 10 cm from each other and from the controller, except for the monitor which, if this is an acceptable installation practice, shall be placed directly on the top of the controller.
- If cables, which hang closer than 40 cm to the horizontal metal ground plane, cannot be shortened to appropriate length, the excess shall be folded back and forth forming a bundle 30 cm to 40 cm long.
- Mains cords and signal cables shall be positioned for their entire lengths, as far as possible, at 40 cm from the vertical reference plane.
- Cables of hand operated devices, such as keyboards, mice, etc. shall be placed as for normal usage.

## 6.5. Test Result of AC Powerline Conducted Emission

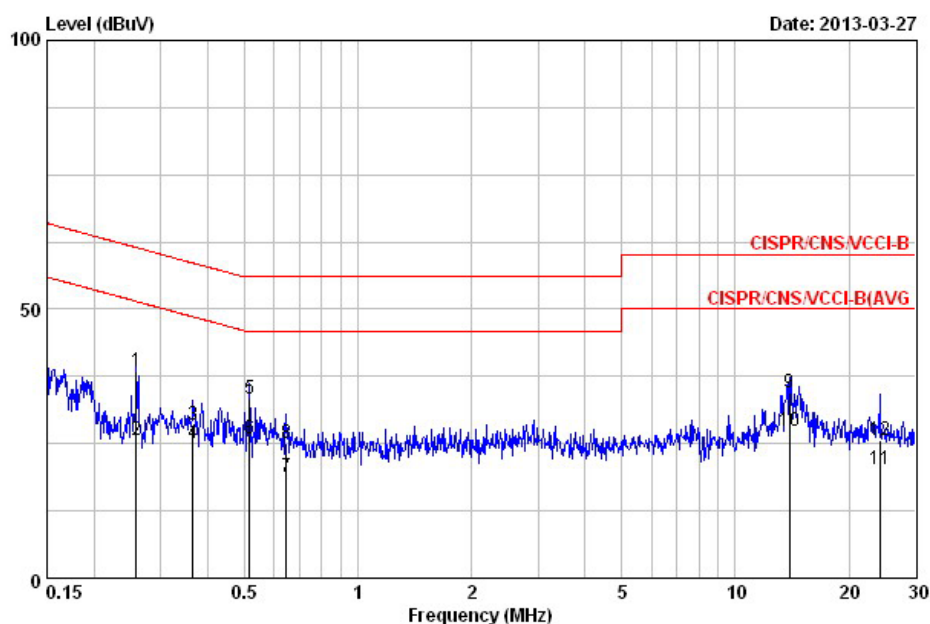
|                |                   |                   |         |
|----------------|-------------------|-------------------|---------|
| Test Mode      | Mode 1            | Test Site No.     | CO01-NH |
| Test Frequency | 0.15 MHz ~ 30 MHz | Test Engineer     | Willy   |
| Temperature    | 25 °C             | Relative Humidity | 51 %    |

Note: 1. Corrected Reading (dB $\mu$ V) = LISN Factor + Cable Loss + Read Level = Level

2. All emissions not reported here are more than 10 dB below the prescribed limit.

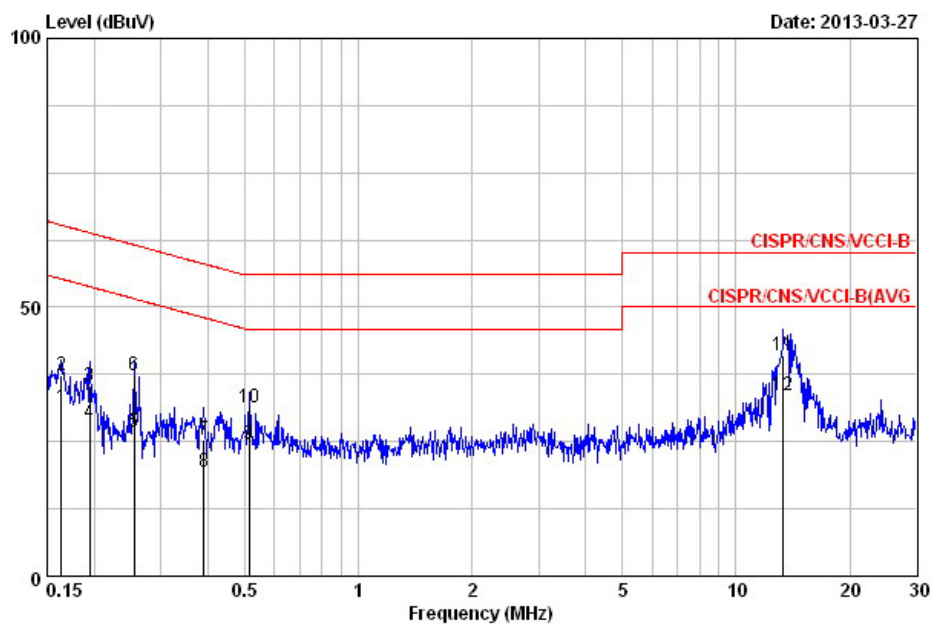
■ The test was passed at the minimum margin that marked by the frame in the following data

Line



|    | Freq   | Level      | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark  |
|----|--------|------------|------------|------------|------------|-------------|------------|---------|
|    | MHz    | dB $\mu$ V | dB         | dB $\mu$ V | dB $\mu$ V | dB          | dB         |         |
| 1  | 0.259  | 38.38      | -23.09     | 61.47      | 28.11      | 10.17       | 0.10       | QP      |
| 2  | 0.259  | 25.61      | -25.86     | 51.47      | 15.34      | 10.17       | 0.10       | AVERAGE |
| 3  | 0.365  | 28.52      | -30.09     | 58.61      | 18.25      | 10.17       | 0.10       | QP      |
| 4  | 0.365  | 25.12      | -23.49     | 48.61      | 14.85      | 10.17       | 0.10       | AVERAGE |
| 5  | 0.516  | 33.27      | -22.73     | 56.00      | 23.00      | 10.18       | 0.10       | QP      |
| 6  | 0.516  | 25.98      | -20.02     | 46.00      | 15.71      | 10.18       | 0.10       | AVERAGE |
| 7  | 0.647  | 18.86      | -27.14     | 46.00      | 8.58       | 10.18       | 0.10       | AVERAGE |
| 8  | 0.647  | 25.13      | -30.87     | 56.00      | 14.85      | 10.18       | 0.10       | QP      |
| 9  | 13.915 | 34.38      | -25.62     | 60.00      | 23.71      | 10.39       | 0.28       | QP      |
| 10 | 13.915 | 27.32      | -22.68     | 50.00      | 16.65      | 10.39       | 0.28       | AVERAGE |
| 11 | 24.142 | 20.36      | -29.64     | 50.00      | 9.54       | 10.52       | 0.30       | AVERAGE |
| 12 | 24.142 | 25.56      | -34.44     | 60.00      | 14.74      | 10.52       | 0.30       | QP      |

Neutral



|      | Freq   | Level | Over   | Limit | Read  | LISN   | Cable | Remark  |
|------|--------|-------|--------|-------|-------|--------|-------|---------|
|      | MHz    | dBuV  | Limit  | Line  | Level | Factor | Loss  |         |
|      |        |       | dB     | dBuV  | dBuV  | dB     | dB    |         |
| 1    | 0.163  | 31.35 | -23.95 | 55.30 | 21.11 | 10.14  | 0.10  | AVERAGE |
| 2    | 0.163  | 37.26 | -28.04 | 65.30 | 27.02 | 10.14  | 0.10  | QP      |
| 3    | 0.194  | 35.43 | -28.41 | 63.84 | 25.19 | 10.14  | 0.10  | QP      |
| 4    | 0.194  | 28.53 | -25.31 | 53.84 | 18.29 | 10.14  | 0.10  | AVERAGE |
| 5    | 0.255  | 26.66 | -24.94 | 51.60 | 16.42 | 10.14  | 0.10  | AVERAGE |
| 6    | 0.255  | 37.29 | -24.31 | 61.60 | 27.05 | 10.14  | 0.10  | QP      |
| 7    | 0.389  | 25.31 | -32.77 | 58.08 | 15.07 | 10.14  | 0.10  | QP      |
| 8    | 0.389  | 19.31 | -28.77 | 48.08 | 9.07  | 10.14  | 0.10  | AVERAGE |
| 9    | 0.513  | 24.45 | -21.55 | 46.00 | 14.21 | 10.14  | 0.10  | AVERAGE |
| 10   | 0.513  | 31.28 | -24.72 | 56.00 | 21.04 | 10.14  | 0.10  | QP      |
| 11   | 13.337 | 40.90 | -19.10 | 60.00 | 30.27 | 10.36  | 0.27  | QP      |
| 12 @ | 13.337 | 33.51 | -16.49 | 50.00 | 22.88 | 10.36  | 0.27  | AVERAGE |

## 7. Radiated Emission Measurement

Radiated emissions from 30 MHz to 6,000 MHz were measured with a bandwidth of 120 kHz for 30 MHz to 1,000 MHz and 1 MHz for above 1GHz according to the methods defines in European Standard EN 55022, Clause 10. The EUT was placed on a nonmetallic stand, 0.8 meter above the ground plane, as shown in section 7.4. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions.

### 7.1. Limits for radiated disturbance

#### Limits for radiated disturbance at a measuring distance of 10 m

| Frequency range<br>(MHz) | Class A                       | Class B                       |
|--------------------------|-------------------------------|-------------------------------|
|                          | Quasi-peak limits<br>dB(μV/m) | Quasi-peak limits<br>dB(μV/m) |
| 30 to 230                | 40                            | 30                            |
| 230 to 1000              | 47                            | 37                            |

#### Limits for radiated disturbance at a measuring distance of 3 m

| Frequency range<br>(MHz) | Class A                   |                        | Class B                   |                        |
|--------------------------|---------------------------|------------------------|---------------------------|------------------------|
|                          | Average limit<br>dB(μV/m) | Peak limit<br>dB(μV/m) | Average limit<br>dB(μV/m) | Peak limit<br>dB(μV/m) |
| 1000 to 3000             | 56                        | 76                     | 50                        | 70                     |
| 3000 to 6000             | 60                        | 80                     | 54                        | 74                     |

## 7.2. Description of Major Test Instruments

### For Below 1GHz

| Amplifier Parameters | Setting           |
|----------------------|-------------------|
| Amplifier            | HP 8447D          |
| RF Gain              | 25 dB             |
| Signal Input         | 0.1 MHz - 1.3 GHz |

| Spectrum Analyzer Parameters | Setting          |
|------------------------------|------------------|
| Spectrum Analyzer            | ADVANTEST R3261C |
| Attenuation                  | 10 dB            |
| Start Frequency              | 30 MHz           |
| Stop Frequency               | 1000 MHz         |
| Resolution Bandwidth         | 120 kHz          |
| Signal Input                 | 9 kHz – 2.6 GHz  |

| Test Receiver Parameters | Setting                |
|--------------------------|------------------------|
| Test Receiver            | R&S ESCS 30            |
| Resolution Bandwidth     | 120 kHz                |
| Frequency Band           | 9 kHz - 2.75 GHz       |
| Quasi-Peak Detector      | ON for Quasi-Peak Mode |
|                          | OFF for Peak Mode      |

### For above 1GHz

| Amplifier Parameters | Setting          |
|----------------------|------------------|
| Amplifier            | Agilent 8449B    |
| RF Gain              | 35 dB            |
| Signal Input         | 1 GHz - 26.5 GHz |

| Test Receiver Parameters | Setting      |
|--------------------------|--------------|
| Test Receiver            | R&S FSP30    |
| Attenuation              | 10 dB        |
| Start Frequency          | 1000 MHz     |
| Stop Frequency           | 6000 MHz     |
| Resolution Bandwidth     | 1 MHz        |
| Signal Input             | 9kHz ~ 30GHz |

### **7.3. Test Procedures**

#### **For Below 1GHz**

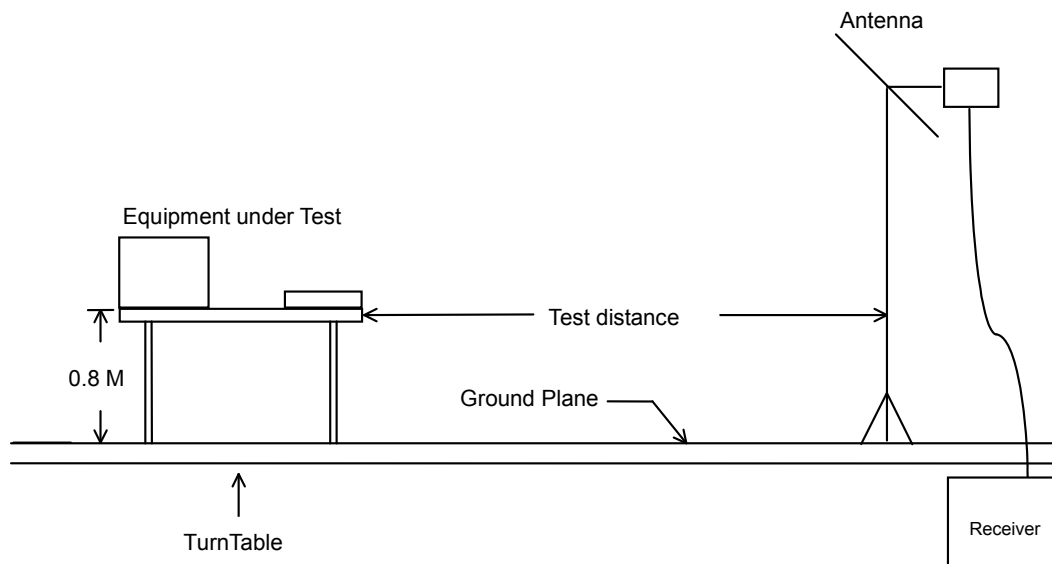
- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 10 meters from the interference-receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a half wave dipole and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.

#### **For above 1GHz**

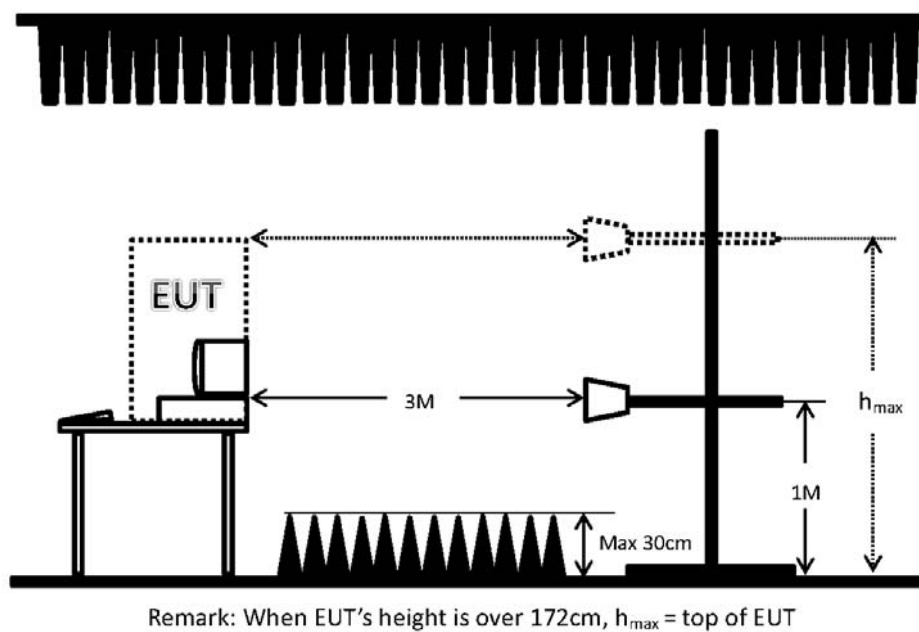
- a. Same test set up as below 1GHz radiated testing.
- b. The EUT was set 3 meters from the interference-receiving antenna which was mounted on the top of a variable height antenna tower.
- c. There should be absorber placed between the EUT and Antenna and its located size should let the test site meet CISPR16-1-4 requirement.
- d. The table was rotated 360 degrees to determine the position of the highest radiation.
- e. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- f. Set the DRG Horn Antenna (Model: 3115) at 1M height, then run the turn table to get the maximum noise reading from Horizontal and Vertical polarity separately.
- g. When EUT locating on the turn-table, and its height is over 172cm (Antenna's 3dB beam width of 6GHz is 27° ), the DRG Horn Antenna must be raised up and descended down, then turning around the turn-table to get the maximum noise reading of the Horizontal and Vertical polarity separately. Note the maximum raise up height is same as the top of EUT.
- h. If emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

## 7.4. Typical Test Setup Layout of Radiated Emissions

### For Below 1GHz



### For above 1GHz



## 7.5. Test Result of Radiated Emission for Below 1GHz

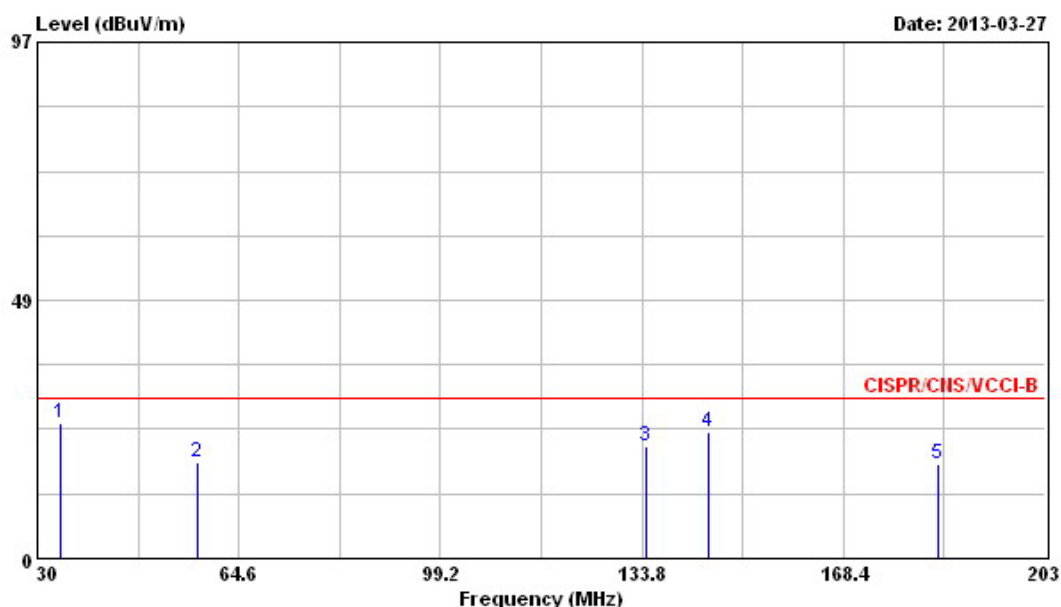
|                |                   |                   |         |
|----------------|-------------------|-------------------|---------|
| Test mode      | Mode 1            | Test Site No.     | OS03-NH |
| Test frequency | 30 MHz ~ 1000 MHz | Test Engineer     | Alan    |
| Temperature    | 24 °C             | Relative Humidity | 54 %    |

Note: 1. Emission level (dB $\mu$ V/m) = 20 log Emission level ( $\mu$ V/m)

2. Corrected Reading : Antenna Factor + Cable Loss + Read Level – Preamp Factor = Level

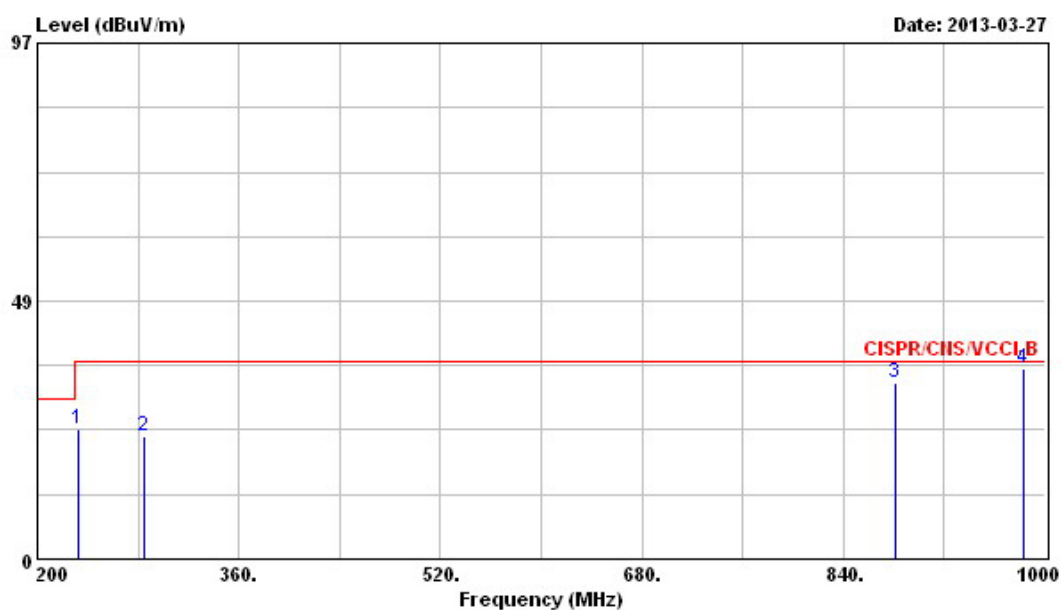
■ The test was passed at the minimum margin that marked by the frame in the following data

Vertical



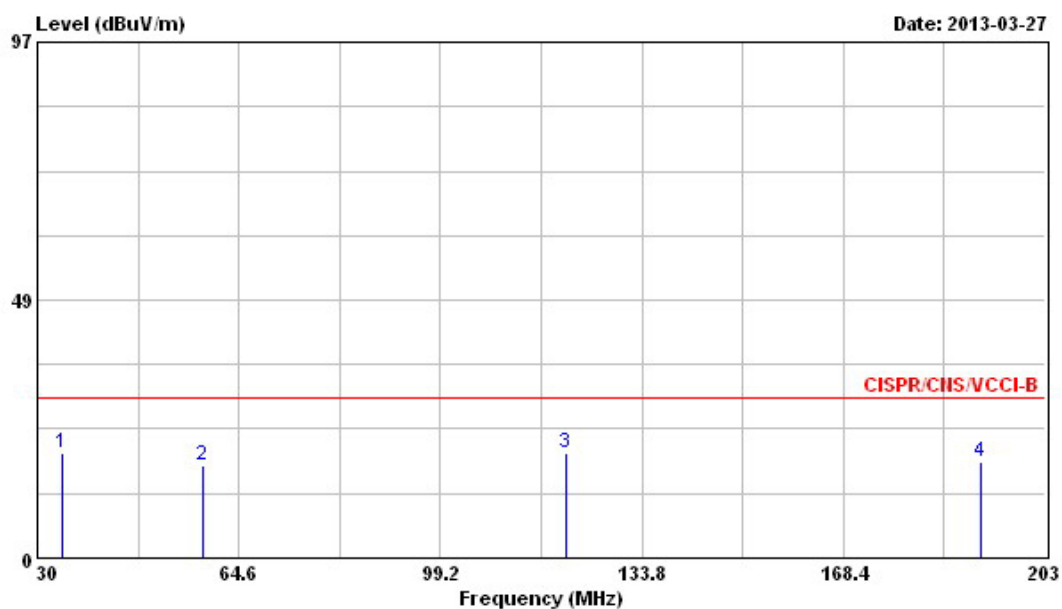
|   | Freq    | Level        | Over   | Limit        | Read       | Antenna | Cable | Preamp |        | Ant | Table |
|---|---------|--------------|--------|--------------|------------|---------|-------|--------|--------|-----|-------|
|   | MHz     | dB $\mu$ V/m | Limit  | Line         | Level      | Factor  | Loss  | Factor | Remark | Pos | Pos   |
|   |         |              | dB     | dB $\mu$ V/m | dB $\mu$ V | dB/m    | dB    | dB     |        | cm  | deg   |
| 1 | 33.980  | 25.27        | -4.73  | 30.00        | 36.23      | 16.51   | 1.01  | 28.48  | Peak   | --- | ---   |
| 2 | 57.510  | 18.05        | -11.95 | 30.00        | 38.06      | 7.12    | 1.31  | 28.44  | Peak   | --- | ---   |
| 3 | 134.490 | 21.02        | -8.98  | 30.00        | 35.39      | 11.68   | 2.16  | 28.21  | Peak   | --- | ---   |
| 4 | 145.220 | 23.76        | -6.24  | 30.00        | 38.80      | 10.86   | 2.27  | 28.17  | Peak   | --- | ---   |
| 5 | 184.660 | 17.75        | -12.25 | 30.00        | 33.61      | 9.46    | 2.71  | 28.03  | Peak   | --- | ---   |

Vertical



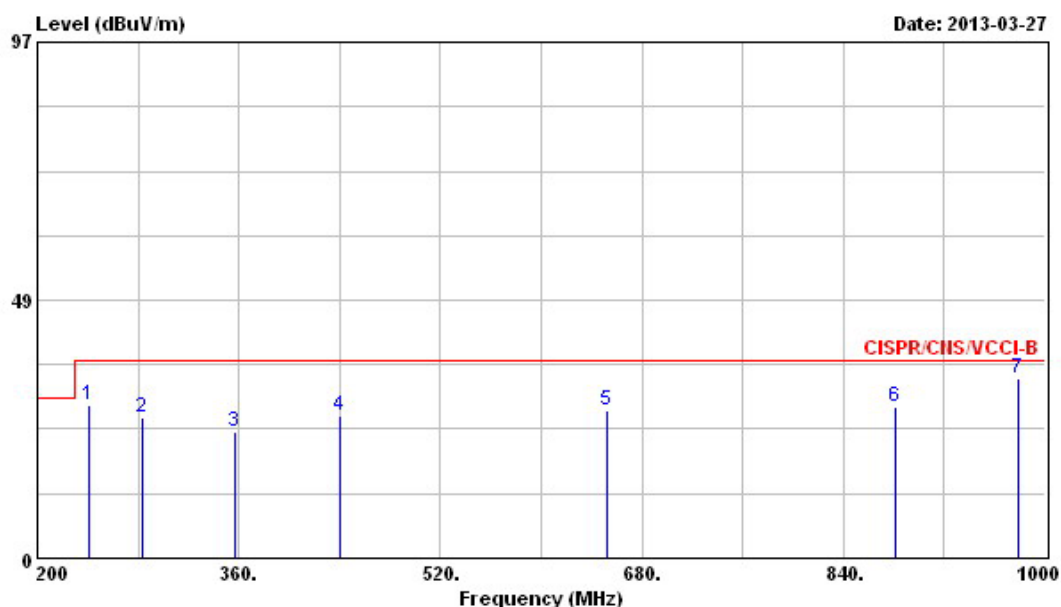
|   | Freq    | Level  | Over   | Limit  | ReadAntenna | Cable  | Preamp |        | Ant  | Table   |
|---|---------|--------|--------|--------|-------------|--------|--------|--------|------|---------|
|   | MHz     | dBuV/m | Limit  | Line   | Level       | Factor | Loss   | Factor | Pos  | Pos     |
|   | MHz     | dBuV/m | dB     | dBuV/m | dBuV        | dB/m   | dB     | dB     | cm   | deg     |
| 1 | 232.800 | 24.53  | -12.47 | 37.00  | 38.00       | 11.25  | 3.20   | 27.92  | Peak | ---     |
| 2 | 284.800 | 22.99  | -14.01 | 37.00  | 34.10       | 12.96  | 3.77   | 27.84  | Peak | ---     |
| 3 | 881.600 | 33.19  | -3.81  | 37.00  | 35.41       | 20.30  | 6.17   | 28.69  | Peak | ---     |
| 4 | 983.200 | 35.91  | -1.09  | 37.00  | 36.50       | 21.19  | 6.63   | 28.41  | QP   | 200 180 |

Horizontal



|   | Freq    | Level  | Over Limit | Limit Line | ReadAntenna Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---------|--------|------------|------------|-------------------|----------------|------------|---------------|--------|---------|-----------|
|   | MHz     | dBuV/m | dB         | dBuV/m     | dBuV              | dB/m           | dB         | dB            |        | cm      | deg       |
| 1 | 34.330  | 19.62  | -10.38     | 30.00      | 30.58             | 16.51          | 1.01       | 28.48         | Peak   | ---     | ---       |
| 2 | 58.370  | 17.30  | -12.70     | 30.00      | 37.49             | 6.93           | 1.32       | 28.44         | Peak   | ---     | ---       |
| 3 | 120.830 | 19.78  | -10.22     | 30.00      | 33.40             | 12.63          | 2.01       | 28.26         | Peak   | ---     | ---       |
| 4 | 191.930 | 18.00  | -12.00     | 30.00      | 33.80             | 9.39           | 2.81       | 28.00         | Peak   | ---     | ---       |

# Horizontal



|     | Freq    | Level  | Over   | Limit  | ReadAntenna | Cable  | Preamp |        | Ant  | Table |
|-----|---------|--------|--------|--------|-------------|--------|--------|--------|------|-------|
|     | MHz     | dBuV/m | Limit  | Line   | Level       | Factor | Loss   | Factor | Pos  | Pos   |
|     | MHz     | dBuV/m | dB     | dBuV/m | dBuV        | dB/m   | dB     | dB     | cm   | deg   |
| 1   | 240.800 | 28.68  | -8.32  | 37.00  | 41.61       | 11.70  | 3.28   | 27.91  | Peak | ---   |
| 2   | 284.000 | 26.46  | -10.54 | 37.00  | 37.61       | 12.94  | 3.76   | 27.85  | Peak | ---   |
| 3   | 356.800 | 23.74  | -13.26 | 37.00  | 32.80       | 14.66  | 4.47   | 28.19  | Peak | ---   |
| 4   | 440.000 | 26.63  | -10.37 | 37.00  | 34.00       | 16.44  | 4.89   | 28.70  | Peak | ---   |
| 5   | 652.000 | 27.60  | -9.40  | 37.00  | 32.80       | 18.66  | 5.33   | 29.19  | Peak | ---   |
| 6   | 881.600 | 28.49  | -8.51  | 37.00  | 30.71       | 20.30  | 6.17   | 28.69  | Peak | ---   |
| 7 @ | 978.400 | 33.74  | -3.26  | 37.00  | 34.40       | 21.15  | 6.61   | 28.42  | Peak | ---   |

## 7.6. Test Result of Radiated Emission for Above 1GHz

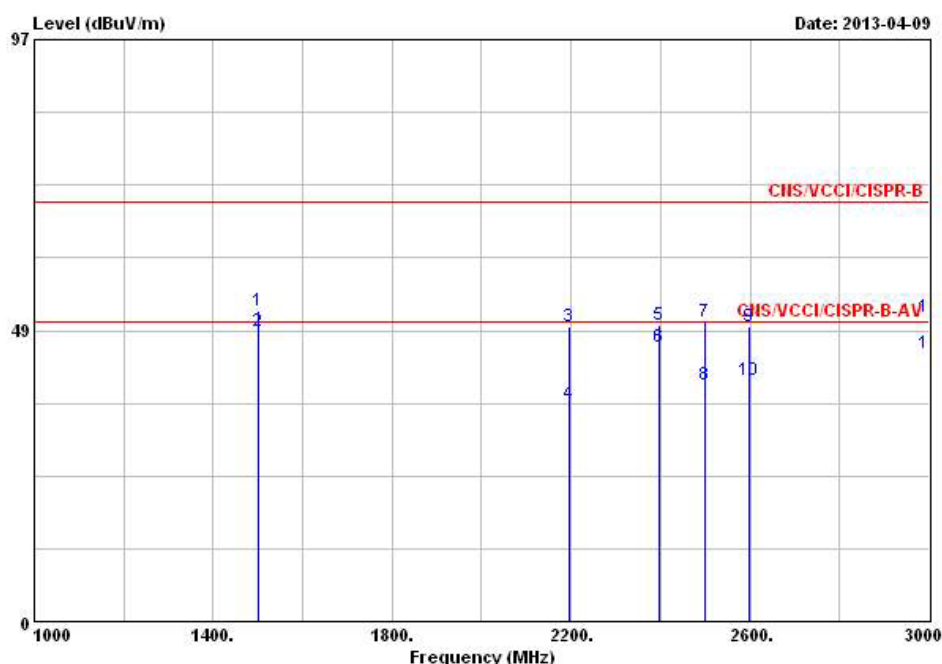
|                |               |                   |           |
|----------------|---------------|-------------------|-----------|
| Test mode      | Mode 5        | Test Site No.     | 03CH03-HY |
| Test frequency | 1 GHz ~ 6 GHz | Test Engineer     | Alan Chen |
| Temperature    | 21 °C         | Relative Humidity | 53 %      |

Note: 1. Emission level (dB $\mu$ V/m) = 20 log Emission level ( $\mu$ V/m)

2. Corrected Reading : Antenna Factor + Cable Loss + Read Level – Preamp Factor = Level

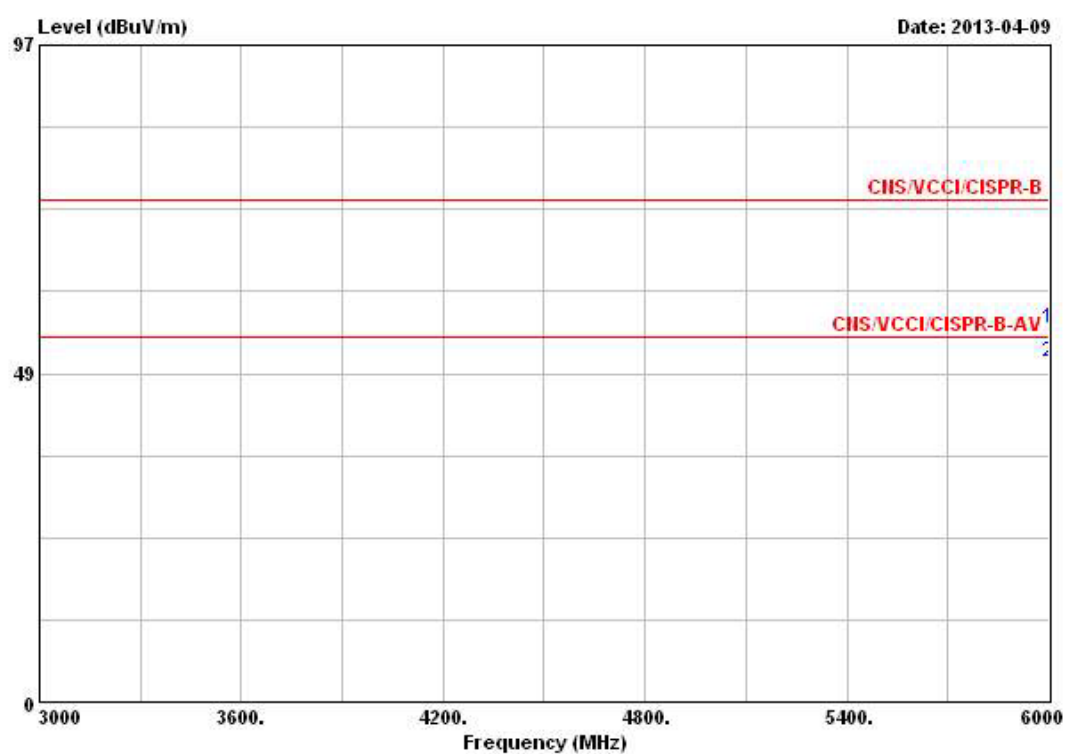
■ The test was passed at the minimum margin that marked by the frame in the following data

Vertical



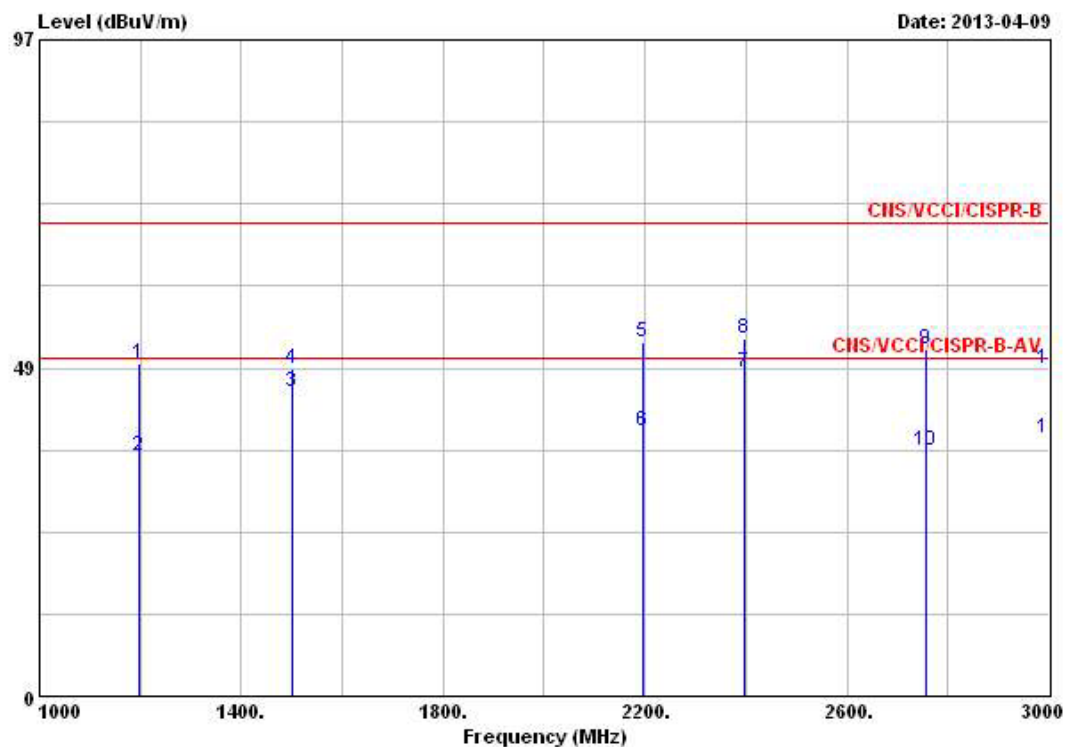
|    | Freq     | Level        | Over Limit | Limit Line   | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark  | Ant Pos | Table Pos |
|----|----------|--------------|------------|--------------|------------|----------------|------------|---------------|---------|---------|-----------|
|    | MHz      | dB $\mu$ V/m | dB         | dB $\mu$ V/m | dB $\mu$ V | dB/m           | dB         | dB            |         | cm      | deg       |
| 1  | 1500.000 | 51.70        | -18.30     | 70.00        | 57.49      | 25.10          | 2.09       | 32.98         | Peak    | 100     | 175       |
| 2  | 1500.000 | 48.46        | -1.54      | 50.00        | 54.25      | 25.10          | 2.09       | 32.98         | Average | 100     | 175       |
| 3  | 2196.000 | 49.06        | -20.94     | 70.00        | 51.69      | 27.54          | 2.51       | 32.68         | Peak    | 100     | 166       |
| 4  | 2196.000 | 36.24        | -13.76     | 50.00        | 38.87      | 27.54          | 2.51       | 32.68         | Average | 100     | 166       |
| 5  | 2398.000 | 49.42        | -20.58     | 70.00        | 51.59      | 27.91          | 2.63       | 32.71         | Peak    | 100     | 167       |
| 6  | 2398.000 | 45.64        | -4.36      | 50.00        | 47.81      | 27.91          | 2.63       | 32.71         | Average | 100     | 167       |
| 7  | 2500.000 | 49.89        | -20.11     | 70.00        | 51.83      | 28.10          | 2.69       | 32.73         | Peak    | 100     | 334       |
| 8  | 2500.000 | 39.34        | -10.66     | 50.00        | 41.28      | 28.10          | 2.69       | 32.73         | Average | 100     | 334       |
| 9  | 2598.000 | 49.15        | -20.85     | 70.00        | 50.72      | 28.44          | 2.74       | 32.75         | Peak    | 100     | 200       |
| 10 | 2598.000 | 40.15        | -9.85      | 50.00        | 41.72      | 28.44          | 2.74       | 32.75         | Average | 100     | 200       |
| 11 | 3000.000 | 50.64        | -19.36     | 70.00        | 50.71      | 29.80          | 2.94       | 32.81         | Peak    | 100     | 0         |
| 12 | 3000.000 | 44.61        | -5.39      | 50.00        | 44.68      | 29.80          | 2.94       | 32.81         | Average | 100     | 0         |

Vertical



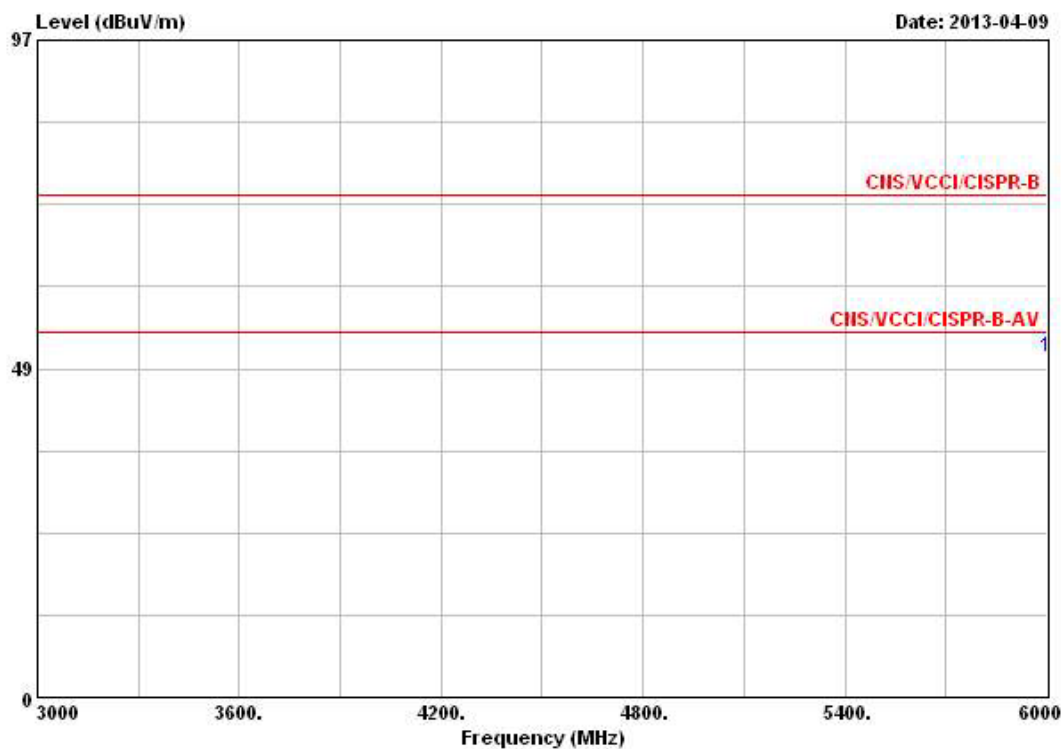
|   | Freq     | Level  | Over Limit | Limit Line | ReadAntenna Level | Antenna Factor | Cable Loss | Preamp Factor | Remark  | Ant Pos | Table Pos |
|---|----------|--------|------------|------------|-------------------|----------------|------------|---------------|---------|---------|-----------|
|   | MHz      | dBuV/m | dB         | dBuV/m     | dBuV              | dB/m           | dB         | dB            |         | cm      | deg       |
| 1 | 6000.000 | 55.15  | -18.85     | 74.00      | 49.69             | 34.00          | 4.06       | 32.60         | Peak    | 100     | 180       |
| 2 | 6000.000 | 50.13  | -3.87      | 54.00      | 44.67             | 34.00          | 4.06       | 32.60         | Average | 100     | 180       |

Horizontal



|    | Freq     | Level  | Over Limit | Limit Line | ReadAntenna Level | Antenna Factor | Cable Loss | Preamp Factor | Remark  | Ant Pos | Table Pos |
|----|----------|--------|------------|------------|-------------------|----------------|------------|---------------|---------|---------|-----------|
|    | MHz      | dBuV/m | dB         | dBuV/m     | dBuV              | dB/m           | dB         | dB            |         | cm      | deg       |
| 1  | 1196.000 | 49.23  | -20.77     | 70.00      | 56.39             | 24.57          | 1.92       | 33.65         | Peak    | 100     | 165       |
| 2  | 1196.000 | 35.51  | -14.49     | 50.00      | 42.67             | 24.57          | 1.92       | 33.65         | Average | 100     | 165       |
| 3  | 1500.000 | 44.89  | -5.11      | 50.00      | 50.68             | 25.10          | 2.09       | 32.98         | Average | 100     | 226       |
| 4  | 1500.000 | 48.26  | -21.74     | 70.00      | 54.05             | 25.10          | 2.09       | 32.98         | Peak    | 100     | 226       |
| 5  | 2196.000 | 52.22  | -17.78     | 70.00      | 54.85             | 27.54          | 2.51       | 32.68         | Peak    | 100     | 124       |
| 6  | 2196.000 | 39.18  | -10.82     | 50.00      | 41.81             | 27.54          | 2.51       | 32.68         | Average | 100     | 124       |
| 7  | 2398.000 | 47.92  | -2.08      | 50.00      | 50.09             | 27.91          | 2.63       | 32.71         | Average | 100     | 146       |
| 8  | 2398.000 | 52.86  | -17.14     | 70.00      | 55.03             | 27.91          | 2.63       | 32.71         | Peak    | 100     | 146       |
| 9  | 2756.000 | 51.13  | -18.87     | 70.00      | 52.13             | 28.95          | 2.82       | 32.77         | Peak    | 100     | 117       |
| 10 | 2756.000 | 36.26  | -13.74     | 50.00      | 37.26             | 28.95          | 2.82       | 32.77         | Average | 100     | 117       |
| 11 | 3000.000 | 48.43  | -21.57     | 70.00      | 48.50             | 29.80          | 2.94       | 32.81         | Peak    | 100     | 158       |
| 12 | 3000.000 | 38.20  | -11.80     | 50.00      | 38.27             | 29.80          | 2.94       | 32.81         | Average | 100     | 158       |

**Horizontal**



|   | Freq     | Level  | Over Limit | Limit Line | ReadAntenna Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|----------|--------|------------|------------|-------------------|----------------|------------|---------------|--------|---------|-----------|
|   | MHz      | dBuV/m | dB         | dBuV/m     | dBuV              | dB/m           | dB         | dB            |        | cm      | deg       |
| 1 | 6000.000 | 50.17  | -23.83     | 74.00      | 44.71             | 34.00          | 4.06       | 32.60         | Peak   | ---     | ---       |

## 8. Harmonic Current Emissions Measurement

As specified on clause 7 of EN 61000-3-2:2006/A1:2009/A2:2009, the limits are not specified for equipment with a rated power of 75W or less.

The EUT meets the above condition, so it conforms to EN 61000-3-2.

## 9. Voltage Fluctuations and Flicker Measurement

### 9.1. Standard

- Product Standard : EN 61000-3-3:2008

### 9.2. Test Procedure

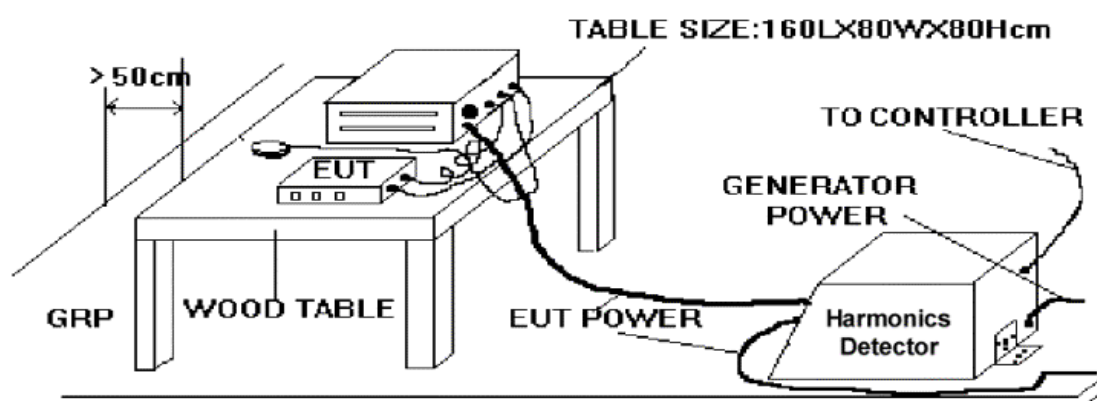
The equipment shall be tested under the conditions of **Clause 5**.

The total impedance of the test circuit, excluding the appliance under test, but including the internal impedance of the supply source, shall be equal to the reference impedance. The stability and tolerance of the reference impedance shall be adequate to ensure that the overall accuracy of  $\pm 8\%$  is achieved during the whole assessment procedure.

### 9.3. Test Equipment Settings

| Flicker Parameters      | Setting      |
|-------------------------|--------------|
| Line Voltage            | 230 V        |
| Line Frequency          | 50 Hz        |
| Measurement Delay       | 10.0 seconds |
| Pst Integration Time    | 10.0 minutes |
| Pst Integration Periods | 1            |
| Test Duration           | 10.0 minutes |

### 9.4. Typical Test Setup Layout of Voltage Fluctuations and Flicker



## 9.5. Test Result of Voltage Fluctuation and Flicker

|                      |           |                   |               |
|----------------------|-----------|-------------------|---------------|
| Test mode            | Mode 1    |                   |               |
| Temperature          | 22 °C     | Final Test Result | <u>PASS</u>   |
| Relative Humidity    | 48 %      | Test Date         | Apr. 10, 2013 |
| Atmospheric Pressure | 102.4 kPa | Test Engineer     | Yen-Liang     |

Urms = 230.1V    Freq = 49.987    Range: 0.5 A  
 Irms = 0.171A    Ipk = 0.275A    cf = 1.611  
 P = 33.18W    S = 39.27VA    pf = 0.845

Test - Time : 1 x 10min = 10min ( 100 %)

LIN (Line Impedance Network) : SLIN 0.24ohm +j0.15ohm N:0.16ohm +j0.10ohm

Limits :    Plt : 0.65    Pst : 1.00  
              dmax : 4.00 %    dc : 3.30 %  
              dtLim: 3.30 %    dt>Lim: 500ms

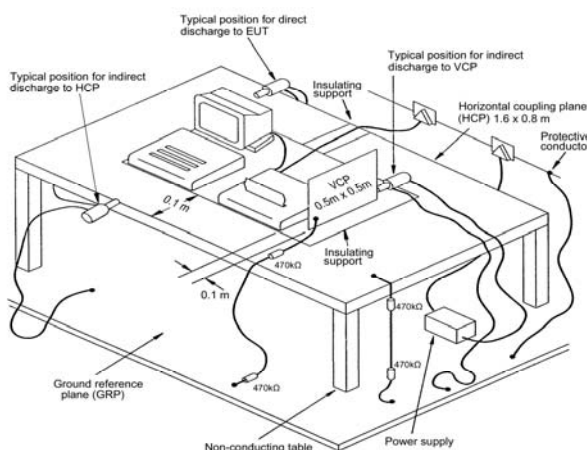
Test completed, Result: PASSED

|   | Pst   | P50s  | P10s  | P3s   | P1s   | P0.1s | dmax  | dc    | dt>Lim |
|---|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1 | 0.072 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.000 | 0.020 | 0.000  |

## 10. Electrostatic Discharge Immunity Measurement (ESD)

- Final Test Result : **PASS**
- Pass Performance Criteria : **B**
- Required Performance Criteria : B
- Basic Standard : IEC 61000-4-2:2008
- Product Standard : EN 55024:2010
- Level : 3 for air discharge  
2 for contact discharge
- Test Voltage :  $\pm 2 / \pm 4 / \pm 8$  kV for air discharge  
 $\pm 2 / \pm 4$  kV for contact discharge
- Discharge Impedance : 330 ohm / 150 pF
- Temperature : 22 °C
- Relative Humidity : 44 %
- Atmospheric Pressure : 102.4 kPa
- Test Date : Apr. 14, 2013
- Test Engineer : Yen-Liang
- Observation : When testing at contact discharge  $\pm 4$  kV on case, screw & bracket, the function of R/W was disconnected caused by interference. After the test, the equipment continued to operate as intended without operator intervention.

### 10.1. Test Setup



The test setup consists of the test generator, EUT and auxiliary instrumentation necessary to perform DIRECT and INDIRECT application of discharges to the EUT as applicable, in the follow manner:

- a. CONTACT DISCHARGE to the conductive surfaces and to coupling plane;
- b. AIR DISCHARGE at insulating surfaces.

The preferred test method is that of type tests performed in laboratories and the only accepted method of demonstrating conformance with this standard. The EUT was arranged as closely as possible to arrangement in final installed conditions.

## **10.2. Test Setup for Tests Performed in Laboratory**

A ground reference plane was provided on the floor of the test site. It was a metallic sheet (copper or aluminum) of 0.25 mm, minimum thickness; other metallic may be used but they shall have at least 0.65 mm thickness. In the SPORTON EMC LAB., we provided 1 mm thickness aluminum ground reference plane or 1 mm thickness stainless steel ground reference plane. The minimum size of the ground reference plane is 1 m x 1 m, the exact size depending on the dimensions of the EUT. It was connected to the protective grounding system.

The EUT was arranged and connected according to its functional requirements. A distance of 1 m minimum was provided between the EUT and the wall of the Lab., and any other metallic structure. In cases where this length exceeds the length necessary to apply the discharges to the selected points, the excess length shall, where possible, be placed non-inductively off the ground reference plane and shall not come closer than 0.2 m to other conductive parts in the test setup.

Where the EUT is installed on a metal table, the table was connected to the reference plane via a cable with a 470k ohm resistor located at each end, to prevent a build-up of charge. The test setup was consist a wooden table, 0.8 m high, standing on the ground reference plane. A HCP, 1.6 m x 0.8 m, was placed on the table. The EUT and cables was isolated from the HCP by an insulating support 0.5 mm thick. The VCP size, 0.5 m x 0.5 m.

### 10.3. ESD Test Procedure

- a. In the case of air discharge testing the climatic conditions shall be within the following ranges:
  - ambient temperature: 15 °C to 35 °C;
  - relative humidity : 30 % to 60 %;
  - atmospheric pressure : 86 kPa (860 mbar) to 106 kPa (1060 mbar).
- b. Test programs and software shall be 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.
- c. The test voltage shall be increased from the minimum to the selected test severity level, in order to determine any threshold of failure. The final severity level should not exceed the product specification value in order to avoid damage to the equipment.
- d. The test shall be performed with both air discharge and contact discharge. On preselected points at least 10 single discharges (in the most sensitive polarity) shall be applied on air discharge. On preselected points at least 25 single discharges (in the most sensitive polarity) shall be applied on contact discharge.
- e. For the time interval between successive single discharges an initial value of one second is recommended. Longer intervals may be necessary to determine whether a system failure has occurred.
- f. In the case of contact discharges, the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.
- g. In the case of painted surface covering a conducting substrate, the following procedure shall be adopted:
  - If the coating is not declared to be an insulating coating by the equipment manufacturer, then the pointed tip of the generator shall penetrate the coating so as to make contact with the conducting substrate.
  - Coating declared as insulating by the manufacturer shall only be submitted to the air discharge.
  - The contact discharge test shall not be applied to such surfaces.
- h. In the case of air discharges, the round discharge tip of the discharge electrode shall be approached as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator (discharge electrode) shall be removed from the EUT. The generator is then retriggered for a new single discharge. This procedure shall be repeated until the discharges are completed. In the case of an air discharge test, the discharge switch, which is used for contact discharge, shall be closed.

## 10.4. Test Severity Levels

### 10.4.1. Contact Discharge

| Level                          | Test Voltage (KV) of Contact discharge |
|--------------------------------|----------------------------------------|
| 1                              | $\pm 2$                                |
| 2                              | $\pm 4$                                |
| 3                              | $\pm 6$                                |
| 4                              | $\pm 8$                                |
| X                              | Specified                              |
| Remark : "X" is an open level. |                                        |

### 10.4.2. Air Discharge

| Level                          | Test Voltage (KV) of Air Discharge |
|--------------------------------|------------------------------------|
| 1                              | $\pm 2$                            |
| 2                              | $\pm 4$                            |
| 3                              | $\pm 8$                            |
| 4                              | $\pm 15$                           |
| X                              | Specified                          |
| Remark : "X" is an open level. |                                    |

## 10.5. Test Points

### 10.5.1. Test Result of Air Discharge

| Test Method     | No. of Discharges                                   | Air Discharge/Round Tip |      |      |      |      |      | Test Record       |
|-----------------|-----------------------------------------------------|-------------------------|------|------|------|------|------|-------------------|
|                 |                                                     | +2kV                    | -2kV | +4kV | -4kV | -8kV | +8kV |                   |
| Power Switching | 10                                                  | ND                      | ND   | ND   | ND   | ND   | ND   | Note <sup>1</sup> |
| USB Port        | 10                                                  | A                       | A    | A    | A    | A    | A    | None              |
| LED             | 10                                                  | ND                      | ND   | ND   | ND   | ND   | ND   | Note <sup>1</sup> |
| AC Socket       | 10                                                  | ND                      | ND   | ND   | ND   | ND   | ND   | Note <sup>1</sup> |
| e-SATA Port     | 10                                                  | ND                      | ND   | ND   | ND   | ND   | ND   | Note <sup>1</sup> |
| Panel           | 10                                                  | ND                      | ND   | ND   | ND   | ND   | ND   | Note <sup>1</sup> |
| 1394A Port      | 10                                                  | ND                      | ND   | ND   | ND   | ND   | ND   | Note <sup>1</sup> |
| 1394B Port      | 10                                                  | ND                      | ND   | ND   | ND   | ND   | ND   | Note <sup>1</sup> |
| Remark          | Note <sup>1</sup> . The "ND" is means No Discharge. |                         |      |      |      |      |      |                   |

### 10.5.2. Test Result of Contact Discharge

#### Direct discharge

| Test Method | No. of Discharges                                                                                                                                                                                                                               | Contact Discharge/Pointed Tip |      |      |      | Test Record       |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------|------|------|-------------------|
|             |                                                                                                                                                                                                                                                 | +2kV                          | -2kV | +4kV | -4kV |                   |
| Case        | 25                                                                                                                                                                                                                                              | A                             | A    | B    | B    | Note <sup>1</sup> |
| Screw       | 25                                                                                                                                                                                                                                              | A                             | A    | B    | B    | Note <sup>1</sup> |
| Bracket     | 25                                                                                                                                                                                                                                              | A                             | A    | B    | B    | Note <sup>1</sup> |
| Remark      | Note 1. When testing at contact discharge $\pm 4\text{kV}$ on case, screw & bracket, the function of R/W was disconnected caused by interference. After the test, the equipment continued to operate as intended without operator intervention. |                               |      |      |      |                   |

#### Indirect discharge to HCP and VCP

| Test Method    | No. of Discharges | Contact Discharge/Pointed Tip |      |      |      | Test Record |
|----------------|-------------------|-------------------------------|------|------|------|-------------|
|                |                   | +2kV                          | -2kV | +4kV | -4kV |             |
| HCP (At Front) | 25                | A                             | A    | A    | A    | None        |
| HCP (At Left)  | 25                | A                             | A    | A    | A    | None        |
| HCP (At Right) | 25                | A                             | A    | A    | A    | None        |
| HCP (At Rear)  | 25                | A                             | A    | A    | A    | None        |
| VCP (At Front) | 25                | A                             | A    | A    | A    | None        |
| VCP (At Left)  | 25                | A                             | A    | A    | A    | None        |
| VCP (At Right) | 25                | A                             | A    | A    | A    | None        |
| VCP (At Rear)  | 25                | A                             | A    | A    | A    | None        |

## 11. Radio Frequency Electromagnetic Field Immunity Measurement (RS)

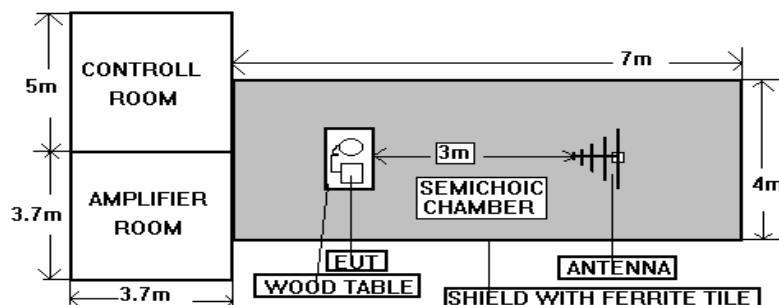
- Final Test Result : **PASS**
- Pass Performance Criteria : **A**
- Required Performance Criteria : A
- Basic Standard : IEC 61000-4-3:2006/A1:2007/A2:2010
- Product Standard : EN 55024:2010
- Level : 2
- Frequency Range : 80-1000 MHz
- Additional Selection Frequency : 80, 120, 160, 230, 434, 460, 600, 863, 900MHz
- Dwell Time : 2.9 seconds
- Frequency Step size : 1 % of the preceding frequency value
- Field Strength : 3 V/m (unmodulated, r.m.s) 80% AM (1 kHz)
- Temperature : 22 °C
- Relative Humidity : 48 %
- Atmospheric Pressure : 102.4 kPa
- Test Date : Apr. 10, 2013
- Test Engineer : Yen-Liang

### 11.1. Test Record

Frequency Band: 80-1000 MHz

| Sides of the EUT have been exposed to the field | Antenna positioned | Test field strength Level | Test field strength (V/m) | Observation             |
|-------------------------------------------------|--------------------|---------------------------|---------------------------|-------------------------|
| Front                                           | Vertical           | 2                         | 3                         | Normal (No influencing) |
|                                                 | Horizontally       | 2                         | 3                         | Normal (No influencing) |
| Left                                            | Vertical           | 2                         | 3                         | Normal (No influencing) |
|                                                 | Horizontally       | 2                         | 3                         | Normal (No influencing) |
| Back                                            | Vertical           | 2                         | 3                         | Normal (No influencing) |
|                                                 | Horizontally       | 2                         | 3                         | Normal (No influencing) |
| Right                                           | Vertical           | 2                         | 3                         | Normal (No influencing) |
|                                                 | Horizontally       | 2                         | 3                         | Normal (No influencing) |

## 11.2. Test Setup



**NOTE :** The SPORTON 7m x 4m x 4m semi-anechoic chamber is compliance with the sixteen point's uniform field requirement as stated in IEC 61000-4-3 Section 6.2.

The procedure defined in this part requires the generation of electromagnetic fields within which the test sample is placed and its operation observed. To generate fields that are useful for simulation of actual (field) conditions may require significant antenna drive power and the resultant high field strength levels. To comply with local regulations and to prevent biological hazards to the testing personnel, it is recommended that these tests be carried out in a shielded enclosure or semi-anechoic chamber.

## 11.3. Test Procedure

- The equipment to be tested is placed in the center of the enclosure on a wooden table. The equipment is then connected to power and signal leads according to pertinent installation instructions.
- The bilog antenna which is enabling the complete frequency range of 80-1000MHz is placed 3m away from the equipment. The required field strength is determined by placing the field strength meter(s) on top of or directly alongside the equipment under test and monitoring the field strength meter via a remote field strength indicator outside the enclosure while adjusting the continuous-wave to the applicable antennae.
- The test is normally performed with the generating antenna facing each of four sides of the EUT. The polarization of the field generated by the broadband (bilog) antenna necessitates testing each position twice, once with the antenna positioned vertically and again with the antenna positioned horizontally.
- The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies e.g. clock frequency(ies) and harmonics or frequencies of dominant interest shall be analyzed separately.
- At each of the above conditions, the frequency range is swept 80-1000MHz, pausing to adjust the R.F. signal level or to switch oscillators and antenna. The rate of sweep is in the order of  $1.5 \times 10^{-3}$  decades/s. The sensitive frequencies or frequencies of dominant interest may be discretely analyzed.

**11.4. Test Severity Levels**

Frequency Band : 80-1000MHz

| Level                          | Test field strength (V/m) |
|--------------------------------|---------------------------|
| 1                              | 1                         |
| 2                              | 3                         |
| 3                              | 10                        |
| X                              | Specified                 |
| Remark : "X" is an open class. |                           |

## 12. Electrical Fast Transient/Burst Immunity Measurement (EFT/BURST)

- Final Test Result : **PASS**
- Pass Performance Criteria : **A**
- Required Performance Criteria : B
- Basic Standard : IEC 61000-4-4:2004/A1:2010
- Product Standard : EN 55024:2010
- Level : on Input power ports -- 2  
on signal ports and telecommunication ports -- N/A
- Test Voltage : on Input power ports --  $\pm 0.5 / \pm 1.0$  kV  
on signal ports and telecommunication ports -- N/A
- Impulse wave shape : 5/50 ns (Tr/Th)
- Impulse frequency : 5 kHz
- Temperature : 22 °C
- Relative Humidity : 48 %
- Atmospheric Pressure : 102.4 kPa
- Test Date : Apr. 10, 2013
- Test Engineer : Yen-Liang

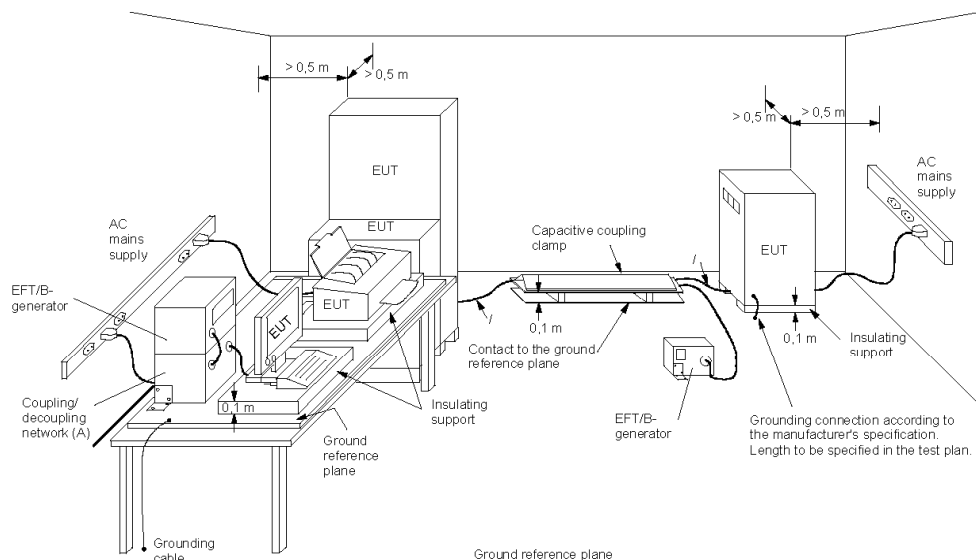
### 12.1. Test Record

■ Input power port:

| Test port | Polarity | Test Level | Voltage (Peak) | Observation             |
|-----------|----------|------------|----------------|-------------------------|
| L         | +        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
|           | —        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
| N         | +        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
|           | —        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
| PE        | +        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
|           | —        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
| L+N       | +        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
|           | —        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
| L+PE      | +        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
|           | —        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
| N+PE      | +        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
|           | —        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
| L+N+PE    | +        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |
|           | —        | 2          | 0.5 / 1.0 kV   | Normal (No influencing) |

Remark : Other cable applied exemption. (Cable lengths < 3m)

## 12.2. Test setup



IEC 901/04

**Kev**

- l* length between clamp and the EUT to be tested (should be 0,5 m ± 0,05 m)
- (A) location for supply line coupling
- (B) location for signal lines coupling

The EUT was placed on a ground reference plane and was insulated from it by an insulating support about 0.1 m thick. If the EUT is table-top equipment, it was located approximately 0.8 m above the GRP. The GRP. Was a metallic sheet (copper or aluminum) of 0.25 mm, minimum thickness; other metallic may be used but they shall have at least 0.65 mm thickness. It shall project beyond the EUT by at least 0.1 m on all sides and connected to the protective earth. In the SPORTON EMC LAB., We provided 1 mm thickness aluminum ground reference plane or 1 mm thickness stainless steel ground reference plane. The minimum size of the ground reference plane is 1 m x 1 m, the exact size depending on the dimensions of the EUT. It was connected to the protective grounding system. The EUT was arranged and connected according to its functional requirements. The minimum distance between the EUT and other conductive structures, except the GRP. Beneath the EUT, was more than 0.5 m. using the coupling clamp, the minimum distance between the coupling plates and all other conductive structures, except the GRP. Beneath the EUT, was more than 0.5 m. The length of the signal and power lines between the coupling device and the EUT was 1 m or less.

### 12.3. Test on Power Line

- a. The EFT/B-generator was located on the GRP. The length from the EFT/B-generator to the EUT as not exceeds 1 m.
- b. The EFT/B-generator provides the ability to apply the test voltage in a non-symmetrical condition to the power supply input terminals of the EUT.

## 12.4. Test on Communication Lines

- a. The coupling clamp is composed of a clamp unit for housing the cable (length more than 3 m), and was placed on the GRP.
- b. The coupling clamp provides the ability of coupling the fast transient/bursts to the cable under test.

## 12.5. Test Procedure

- a. In order to minimize the effect of environmental parameters on test results, the climatic conditions when test is carrying out shall comply with the following requirements:
  - ambient temperature: 15 °C to 35 °C;
  - relative humidity : 45 % to 75 %;
  - atmospheric pressure : 86 kPa (860 mbar) to 106 kPa (1060 mbar).
- b. In order to minimize the effect of environmental parameters on test results, the electromagnetic environment of the laboratory shall not influence the test results.
- c. The variety and diversity of equipment and systems to be tested make it difficult to establish general criteria for the evaluation of the effects of fast transients/bursts on equipment and systems.
- d. The test results may be classified on the basic of the operating conditions and the functional specification of the equipment under test, according to the following performance criteria :
  - Normal performance within the specification limits.
  - Temporary degradation or loss of function or performance which is self-recoverable.
  - Temporary degradation or loss of function or performance which requires operator intervention or system reset.
  - Degradation or loss of function which is not recoverable due to damage of equipment (components).

## 12.6. Test Severity Levels

The following test severity levels are recommended for the fast transient/burst test :

| Open circuit output test voltage $\pm 10\%$                                                                    |                      |                                            |
|----------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------------|
| Level                                                                                                          | On Input power ports | On signal port and telecommunication ports |
| 1                                                                                                              | 0.5 KV               | 0.25 KV                                    |
| 2                                                                                                              | 1.0 KV               | 0.50 KV                                    |
| 3                                                                                                              | 2.0 KV               | 1.00 KV                                    |
| 4                                                                                                              | 4.0 KV               | 2.00 KV                                    |
| X                                                                                                              | Specified            | Specified                                  |
| Remark : " X " is an open level.                                                                               |                      |                                            |
| The level is subject to negotiation between the user and the manufacturer or is specified by the manufacturer. |                      |                                            |

### 13. Surge Immunity Measurement

- Final Test Result : PASS
- Pass Performance Criteria : A
- Required Performance Criteria : B for Input power ports  
: C for signal ports and telecommunication ports
- Basic Standard : IEC 61000-4-5:2005
- Product Standard : EN 55024:2010
- Surge wave form (Tr/Th) : on Input power ports -- 1.2/50 ( 8/20 )  $\mu$ s  
: on signal ports and telecommunication ports -- 10/700 $\mu$ s
- Level : on Input power ports -- 3  
: on signal ports and telecommunication ports -- N/A
- Test Voltage : on Input power ports --  $\pm 0.5$  /  $\pm 1.0$  /  $\pm 2.0$  kV  
: on signal ports and telecommunication ports -- N/A
- Phase Angle : 0°, 90°, 180°, 270°
- Number of surges : 5 positive and 5 negative pulses
- Pulse Repetition Rate : 1 time / min. (maximum)
- Temperature : 22 °C
- Relative Humidity : 48 %
- Atmospheric Pressure : 102.4 kPa
- Test Date : Apr. 10, 2013
- Test Engineer : Yen-Liang

### 13.1. Test Record

■ Input power port:

| Test Location | Voltage (kV) | Polarity | Phase Angle |    |     |     | Observation             |
|---------------|--------------|----------|-------------|----|-----|-----|-------------------------|
|               |              |          | 0           | 90 | 180 | 270 |                         |
| L - N         | 0.5          | +        | A           | A  | A   | A   | Normal (No influencing) |
|               |              | —        | A           | A  | A   | A   | Normal (No influencing) |
|               | 1.0          | +        | A           | A  | A   | A   | Normal (No influencing) |
|               |              | —        | A           | A  | A   | A   | Normal (No influencing) |
| L - PE        | 0.5          | +        | A           | A  | A   | A   | Normal (No influencing) |
|               |              | —        | A           | A  | A   | A   | Normal (No influencing) |
|               | 1.0          | +        | A           | A  | A   | A   | Normal (No influencing) |
|               |              | —        | A           | A  | A   | A   | Normal (No influencing) |
|               | 2.0          | +        | A           | A  | A   | A   | Normal (No influencing) |
|               |              | —        | A           | A  | A   | A   | Normal (No influencing) |
| N - PE        | 0.5          | +        | A           | A  | A   | A   | Normal (No influencing) |
|               |              | —        | A           | A  | A   | A   | Normal (No influencing) |
|               | 1.0          | +        | A           | A  | A   | A   | Normal (No influencing) |
|               |              | —        | A           | A  | A   | A   | Normal (No influencing) |
|               | 2.0          | +        | A           | A  | A   | A   | Normal (No influencing) |
|               |              | —        | A           | A  | A   | A   | Normal (No influencing) |

Remark : PE = Earth reference

### 13.2. Test Severity Levels

| Level                                                                                         | Open-circuit test voltage, $\pm 10\%$ , KV |
|-----------------------------------------------------------------------------------------------|--------------------------------------------|
| 1                                                                                             | 0.5                                        |
| 2                                                                                             | 1.0                                        |
| 3                                                                                             | 2.0                                        |
| 4                                                                                             | 4.0                                        |
| x                                                                                             | Specified                                  |
| Remark : " X " is an open level.<br>This level can be specified in the product specification. |                                            |

### 13.3. Test Procedure

a. Climatic conditions

The climatic conditions shall comply with the following requirements :

- ambient temperature : 15 °C to 35 °C
- relative humidity : 10 % to 75 %
- atmospheric pressure : 86 kPa to 106 kPa ( 860 mbar to 1060 mbar )

b. Electromagnetic conditions

The electromagnetic environment of the laboratory shall not influence the test results.

c. The test shall be performed according the test plan that shall specify the test set-up with

- generator and other equipment utilized;
- test level ( voltage/current );
- generator source impedance;
- internal or external generator trigger;
- number of tests : at least five positive and five negative at the selected points;
- repetition rate : maximum 1/min.
- inputs and outputs to be tested;
- representative operating conditions of the EUT;
- sequence of application of the surge to the circuit;
- phase angle in the case of a.c. power supply;
- actual installation conditions, for example :  
AC : neutral earthed,  
DC : ( + ) or ( - ) earthed to simulated the actual earthing conditions.

d. If not otherwise specified the surges have to be applied synchronized to the voltage phase at the zero-crossing and the peak value of the a.c. voltage wave ( positive and negative ).

e. The surges have to be applied line to line and line(s) and earth. When testing line to earth, the test voltage has to be applied successively between each of the lines and earth, if there is no other specification.

f. The test procedure shall also consider the non-linear current-voltage characteristics of the equipment under test. Therefore the test voltage has to be increased by steps up to the test level specified in the product standard or test plan.

g. All lower levels including the selected test level shall be satisfied. For testing the secondary protection, the output voltage of the generator shall be increased up to the worst-case voltage breakdown level ( let-through level ) of the primary protection.

h. If the actual operating signal sources are not available, the may be simulated. Under no circumstances may the test level exceed the product specification. The test shall be carried out according the test plan.

i. To find all critical points of the duty cycle of the equipment, a sufficient number of positive and negative

test pulses shall be applied. For acceptance test previously unstressed equipment shall be used to the protection devices shall be replaced.

#### **13.4. Operating Condition**

Full system

## 14. Conducted Disturbances Induced by Radio-Frequency Field Immunity Measurement (CS)

- Final Test Result : **PASS**
- Pass Performance Criteria : **A**
- Required Performance Criteria : A
- Basic Standard : IEC 61000-4-6:2008
- Product Standard : EN 55024:2010
- Level : 2
- Test Voltage : 3 V (unmodulated, r.m.s) 80% AM (1 kHz)
- Frequency Range : 0.15 MHz to 80 MHz
- Additional Selection Frequency : 0.2, 1, 7.1, 13.56, 21, 27.12, 40.68MHz
- Dwell time : 2.9 seconds
- Frequency step size : 1 % of the preceding frequency value
- Coupling mode : CDN-M2+M3 for Input power ports
- Temperature : 22 °C
- Relative Humidity : 48 %
- Atmospheric Pressure : 102.4 kPa
- Test Date : Apr. 10, 2013
- Test Engineer : Yen-Liang

### 14.1. Test Record

| Test port           | Test field strength level | Test field strength (V rms) | Observation             |
|---------------------|---------------------------|-----------------------------|-------------------------|
| Input ac power port | 2                         | 3                           | Normal (No influencing) |

Remark : Other cable applied exemption. (Cable lengths < 3m)

### 14.2. Test Severity Levels

| Level                                                                                         | Voltage Level (EMF) |
|-----------------------------------------------------------------------------------------------|---------------------|
| 1                                                                                             | 1 V rms             |
| 2                                                                                             | 3 V rms             |
| 3                                                                                             | 10 V rms            |
| x                                                                                             | Specified           |
| Remark : " X " is an open level.<br>This level can be specified in the product specification. |                     |

### 14.3. Operating Condition

Full system

#### **14.4. Test Procedure**

- a. The EUT shall be operated within its intended climatic conditions. The temperature and relative humidity should be recorded.
- b. This test method test can be performed without using a sell shielded enclosure. This is because the disturbance levels applied and the geometry of the setups are not likely to radiated a high amount of energy, especially at the lower frequencies. If under certain circumstances the radiated energy is too high, a shielded enclosure has to be used.
- c. The test shall be 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 ohm load resistor.
- d. 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 devices as necessary. The rate of sweep shall no exceed  $1.5 \times 10^{-3}$  decades/s. Where the frequency is swept incrementally, the step size shall no exceed 1% of the start and thereafter 1% of the preceding frequency value.
- e. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies e.g. clock frequency(ies) and harmonics or frequencies of dominant interest shall be analyzed separately.
- f. In cases of dispute, the test procedure using a step size not exceeding 1% of the start and thereafter 1% of preceding frequency value shall take precedence.
- g. Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.
- h. The use of special exercising programs is recommended.
- i. Testing shall be performed according to a Test Plan, which shall be included in the test report.
- j. It may be necessary to carry out some investigatory testing in order to establish some aspects of the test plan.

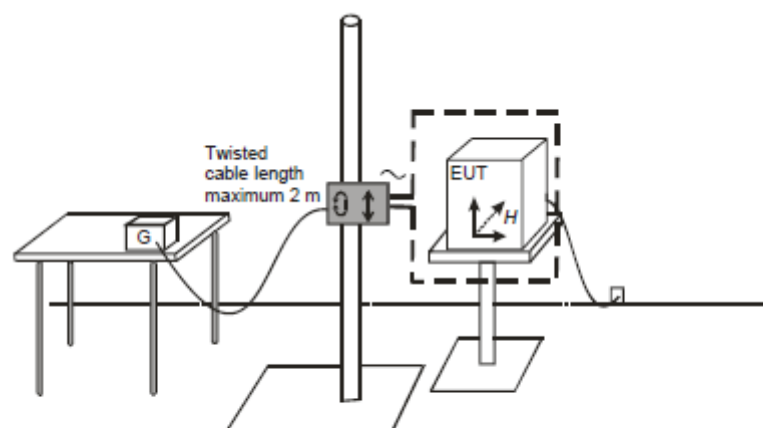
## 15. Power Frequency Magnetic Field immunity Measurement (PFMF)

- Final Test Result : **PASS**
- Pass Performance Criteria : **A**
- Required Performance Criteria : A
- Basic Standard : IEC 61000-4-8:2009
- Product Standard : EN 55024:2010
- Temperature : 22 °C
- Relative Humidity : 48 %
- Atmospheric Pressure : 102.4 kPa
- Test Date : Apr. 10, 2013
- Test Engineer : Yen-Liang

### 15.1. Test Record

| Power Frequency<br>Magnetic Field | Testing<br>duration | Coil<br>Orientation | Observation             |
|-----------------------------------|---------------------|---------------------|-------------------------|
| 50/60Hz, 1A/m                     | 1.0 Min             | X-axis              | Normal (No influencing) |
| 50/60Hz, 1A/m                     | 1.0 Min             | Y-axis              | Normal (No influencing) |
| 50/60Hz, 1A/m                     | 1.0 Min             | Z-axis              | Normal (No influencing) |

### 15.2. Test Setup



EUT : Equipment under test    G : Test Generator

## 16. Voltage Dips and Voltage Interruptions Immunity Measurement (DIP)

- Final Test Result : **PASS**
- Pass Performance Criteria : C for voltage interruption, B/A for voltage dips – for 100V  
C for voltage interruption, A/A for voltage dips – for 240V
- Required Performance Criteria : C for voltage interruption, C/B for voltage dips
- Basic Standard : IEC 61000-4-11:2004
- Product Standard : EN 55024:2010
- Test Port : Input power ports
- Phase Angle : 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°, 360°
- Temperature : 22 °C
- Relative Humidity : 48 %
- Atmospheric Pressure : 102.4 kPa
- Test Date : Apr. 10, 2013
- Test Engineer : Yen-Liang

### 16.1. Test Record of Voltage Interruption

| Voltage<br>( V ) | Performance Criterion (Phase Angle) |    |    |     |     |     |     |     |     | Reduction<br>Voltage | Duration<br>(Periods) | Observation                                                   |
|------------------|-------------------------------------|----|----|-----|-----|-----|-----|-----|-----|----------------------|-----------------------|---------------------------------------------------------------|
|                  | 0                                   | 45 | 90 | 135 | 180 | 225 | 270 | 315 | 360 |                      |                       |                                                               |
| 100              | C                                   | C  | C  | C   | C   | C   | C   | C   | C   | >95 %                | 250                   | After the interruption, the power of EUT reset automatically. |
| 240              | C                                   | C  | C  | C   | C   | C   | C   | C   | C   | >95 %                | 250                   | After the interruption, the power of EUT reset automatically. |

### 16.2. Test Record of Voltage Dips

| Voltage<br>( V ) | Performance Criterion (Phase Angle) |    |    |     |     |     |     |     |     | Reduction<br>Voltage | Duration<br>(Periods) | Observation                                                   |
|------------------|-------------------------------------|----|----|-----|-----|-----|-----|-----|-----|----------------------|-----------------------|---------------------------------------------------------------|
|                  | 0                                   | 45 | 90 | 135 | 180 | 225 | 270 | 315 | 360 |                      |                       |                                                               |
| 100              | B                                   | B  | B  | B   | B   | B   | B   | B   | B   | 30 %                 | 25                    | After the interruption, the power of EUT reset automatically. |
| 100              | A                                   | A  | A  | A   | A   | A   | A   | A   | A   | >95 %                | 0.5                   | Normal (No influencing)                                       |
| 240              | A                                   | A  | A  | A   | A   | A   | A   | A   | A   | 30 %                 | 25                    | Normal (No influencing)                                       |
| 240              | A                                   | A  | A  | A   | A   | A   | A   | A   | A   | >95 %                | 0.5                   | Normal (No influencing)                                       |

### **16.3. Testing Requirement and Procedure**

The test was based on IEC 61000-4-11:2004

### **16.4. Test Conditions**

1. Source voltage and frequency : 100/240V, 50Hz, Single phase.
2. Test of interval : 10 sec.
3. Level and duration : Sequency of 3 dips/interrupts.
4. Voltage rise (and fall) time : 1 ~ 5  $\mu$ s.

### **16.5. Operating Condition**

Full system

## 17. Photographs of Test Configuration

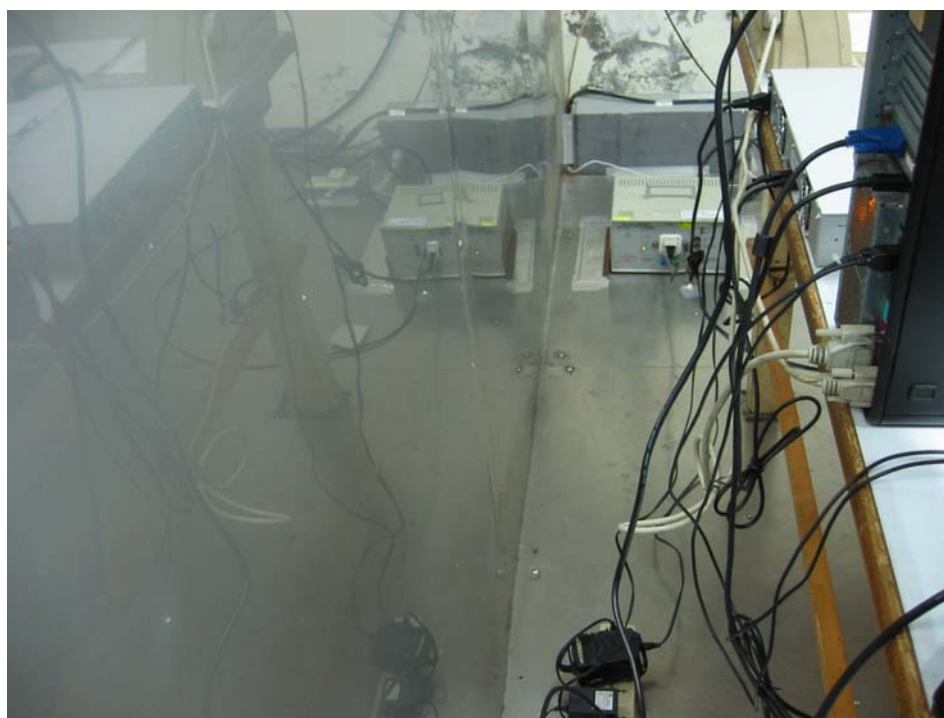
### 17.1. Photographs of AC Powerline Conducted Emissions Test Configuration

- The photographs show the configuration that generates the maximum emission.

FRONT VIEW



REAR VIEW



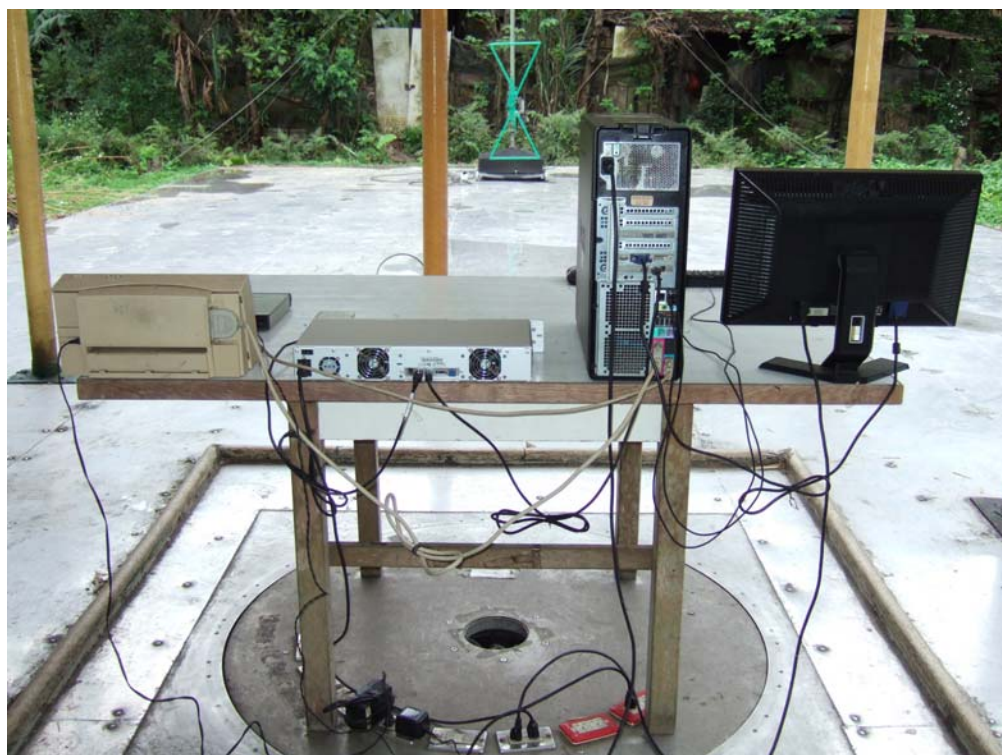
## 17.2. Photographs of Radiated Emissions Test Configuration

- The photographs show the configuration that generates the maximum emission.  
For Below 1GHz

FRONT VIEW

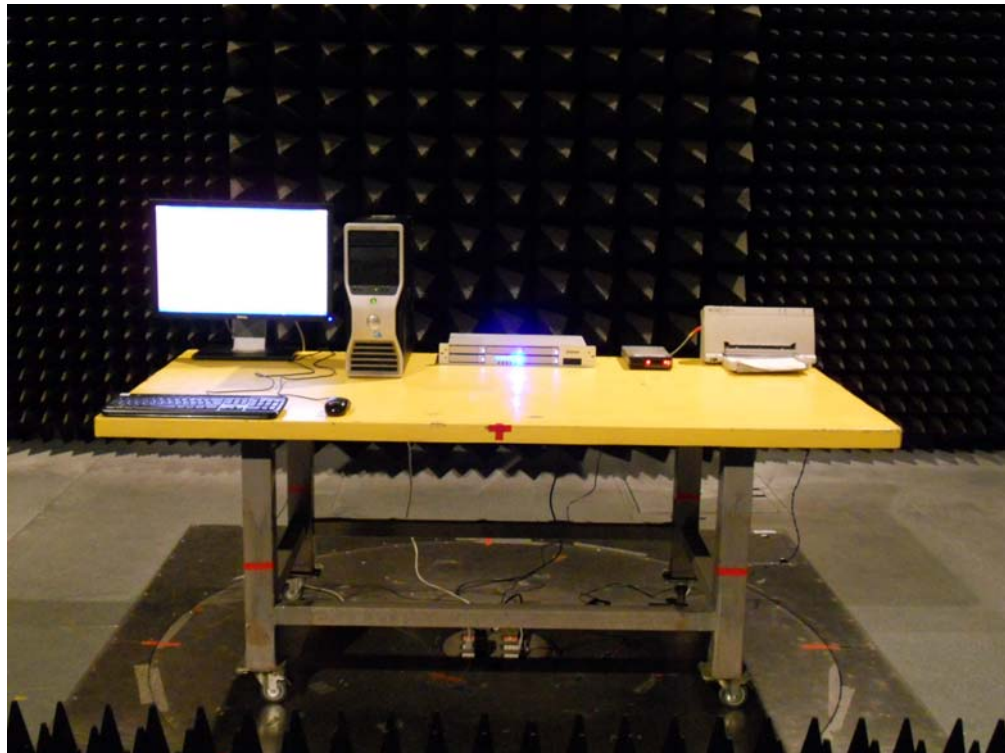


REAR VIEW

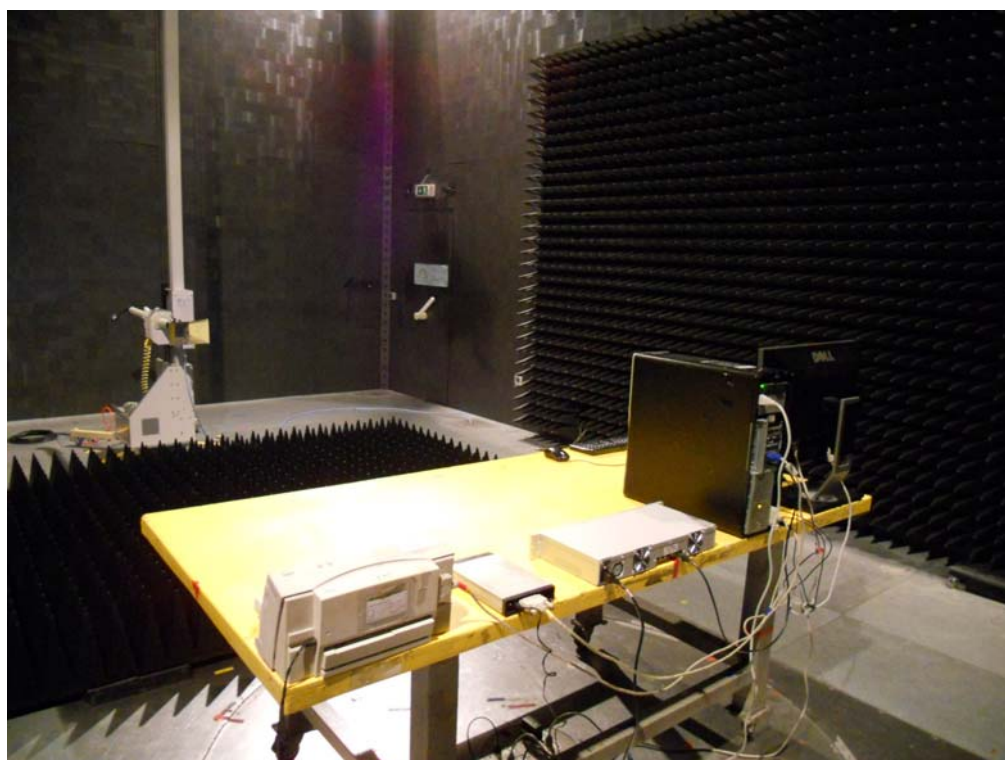


- The photographs show the configuration that generates the maximum emission.  
For Above 1GHz

FRONT VIEW

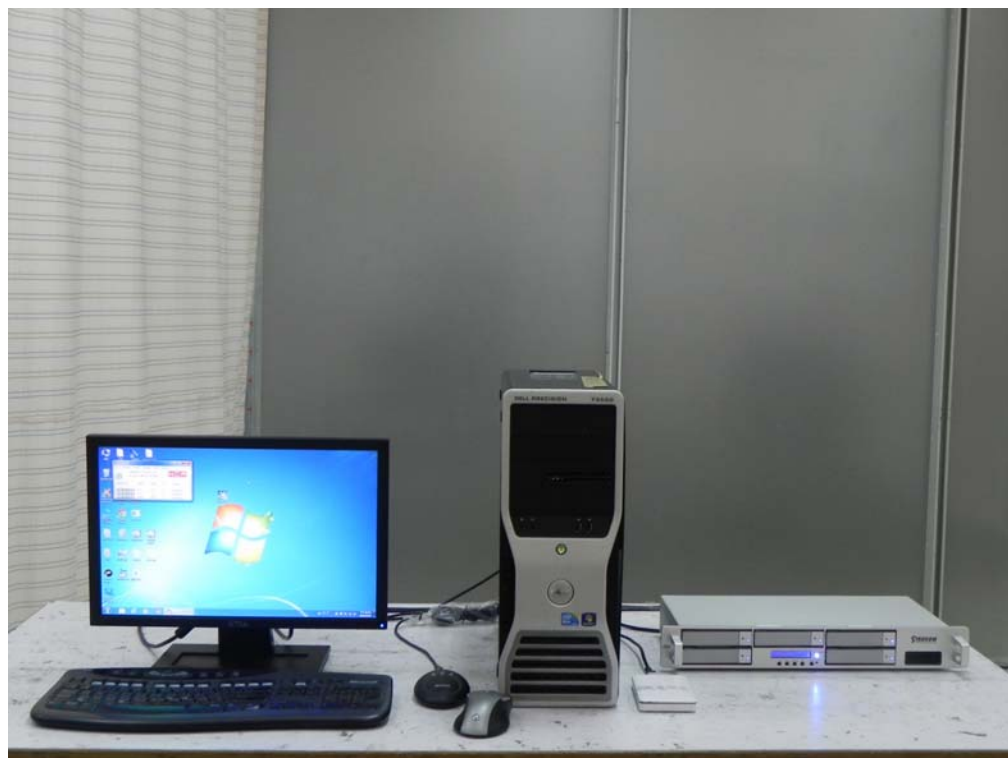


REAR VIEW

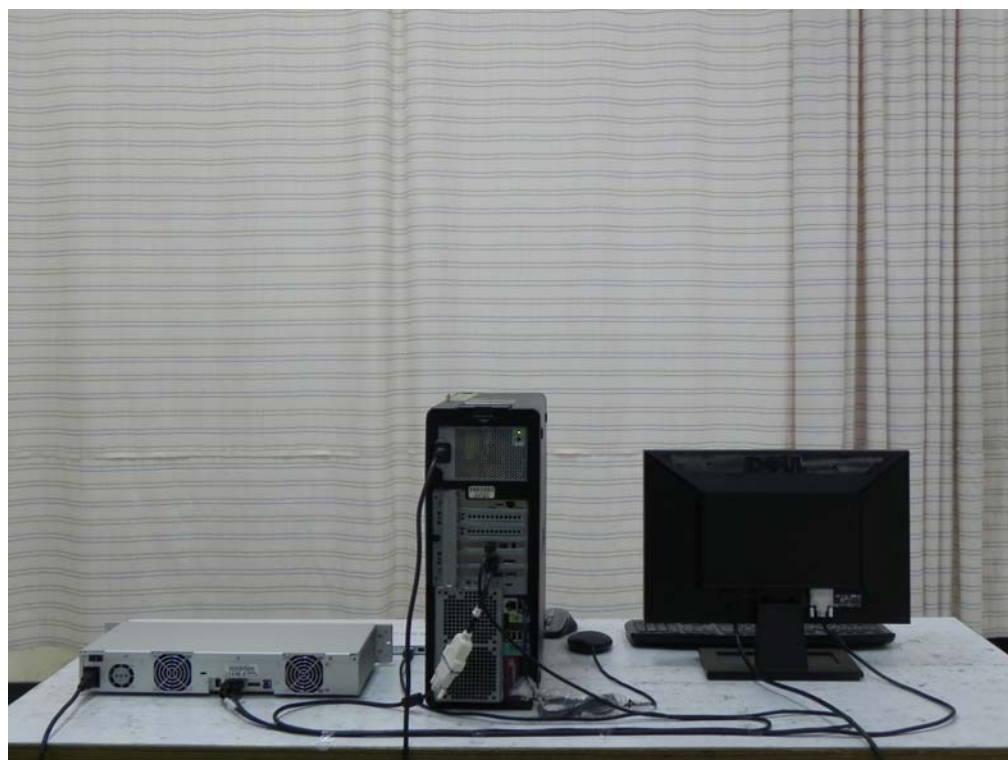


### 17.3. Photographs of Harmonic, Flicker, Surge, Dip Test Configuration

FRONT VIEW



REAR VIEW



#### 17.4. Photographs of ESD Immunity Test Configuration

FRONT VIEW

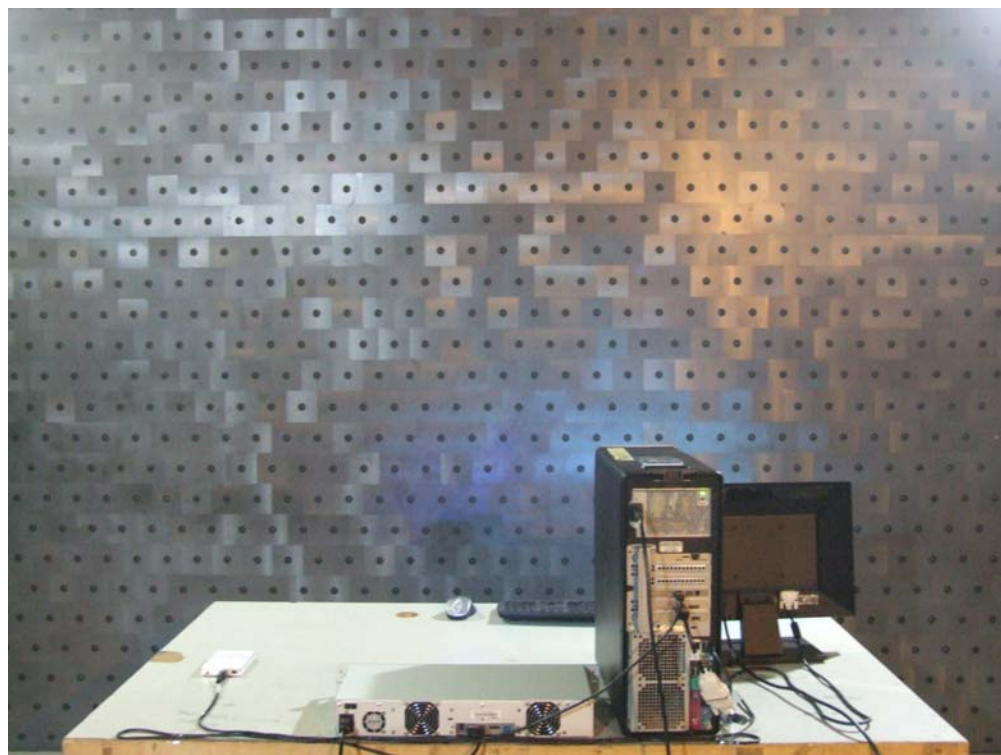


REAR VIEW



## 17.5. Photographs of RS Immunity Test Configuration

FRONT VIEW



REAR VIEW



## 17.6. Photographs of EFT/BURST Immunity Test Configuration

FRONT VIEW



REAR VIEW



### 17.7. Photographs of CS Immunity Test Configuration

FRONT VIEW



REAR VIEW

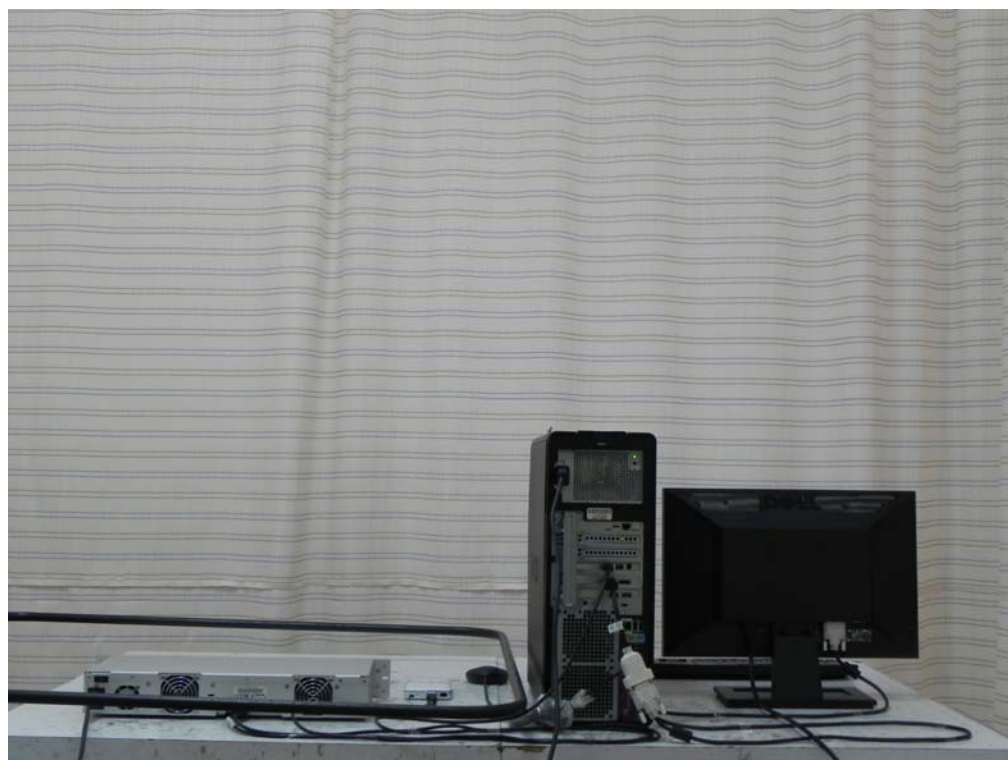


## 17.8. Photographs of PFMF immunity test Configuration

FRONT VIEW



REAR VIEW



## 18. List of Measuring Equipment Used

### Conducted Emission

| Instrument   | Manufacturer       | Model No. | Serial No. | Characteristics  | Calibration Date | Remark               |
|--------------|--------------------|-----------|------------|------------------|------------------|----------------------|
| Receiver     | R&S                | ESCS 30   | 100357     | 9 kHz ~ 2.75 GHz | Nov. 22, 2012    | Conduction (CO01-NH) |
| LISN         | SCHAFFNER          | NNB41     | 04/10053   | 9 kHz ~ 30 MHz   | Nov. 20, 2012    | Conduction (CO01-NH) |
| Power Filter | CORCOM             | MR12030   | N/A        | 30A*2            | NCR              | Conduction (CO01-NH) |
| RF Cable-CON | Suhner Switzerland | RG223/U   | CB004      | 9 kHz ~ 30 MHz   | Dec. 12, 2012    | Conduction (CO01-NH) |

Note: Calibration Interval of instruments listed above is one year.

NCR: NO CALIBRATION REQUEST.

### Radiation Emission Below 1GHz

| Instrument          | Manufacturer | Model No. | Serial No. | Characteristics           | Calibration Date | Remark              |
|---------------------|--------------|-----------|------------|---------------------------|------------------|---------------------|
| Open Area Test Site | SPORTON      | OATS-10   | OS03-NH    | 30 MHz - 1 GHz<br>10m, 3m | Nov. 11, 2012    | Radiation (OS03-NH) |
| Amplifier           | HP           | 8447D     | 2944A08292 | 0.1 MHz - 1.3 GHz         | May. 14, 2012    | Radiation (OS03-NH) |
| Spectrum Analyzer   | Advantest    | R3261C    | 81720147   | 9 kHz - 2.6 GHz           | Sep. 13, 2012    | Radiation (OS03-NH) |
| Receiver            | R&S          | ESCS 30   | 838251/002 | 9 kHz - 2.75 GHz          | Oct. 12, 2012    | Radiation (OS03-NH) |
| Bilog Antenna       | CHASE        | CBL6112D  | 25234      | 30 MHz - 2 GHz            | Feb. 26, 2013    | Radiation (OS03-NH) |
| Turn Table          | EMCO         | 2080      | 9805-2065  | 0 - 360 degree            | NCR              | Radiation (OS03-NH) |
| Antenna Mast        | EMCO         | 2075      | 9804-2151  | 1 m - 4 m                 | NCR              | Radiation (OS03-NH) |
| RF Cable-R10m       | HSCN         | RG213U    | 2X11N      | 30 MHz - 1 GHz            | Aug. 09, 2012    | Radiation (OS03-NH) |

Note: Calibration Interval of instruments listed above is one year.

NCR: NO CALIBRATION REQUEST.

**Radiation Emission Above 1GHz**

| Instrument               | Manufacturer   | Model No.       | Serial No. | Characteristics   | Calibration Date | Remark                   |
|--------------------------|----------------|-----------------|------------|-------------------|------------------|--------------------------|
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M          | 03CH03-HY  | 1GHz ~ 6GHz<br>3m | Dec. 01, 2012    | Radiation<br>(03CH03-HY) |
| Amplifier                | Agilent        | 8449B           | 3008A02120 | 1GHz ~ 26.5GHz    | Aug. 16, 2012    | Radiation<br>(03CH03-HY) |
| Horn Antenna             | EMCO           | 3115            | 6741       | 1GHz ~ 18GHz      | May 30, 2012     | Radiation<br>(03CH03-HY) |
| RF Cable-high            | SUHNER         | SUCOFLEX<br>106 | 03CH03-HY  | 1GHz ~ 40GHz      | Jan. 17, 2013    | Radiation<br>(03CH03-HY) |
| Spectrum Analyzer        | R&S            | FSP30           | 100793     | 9kHz ~ 30GHz      | Sep. 26, 2012    | Radiation<br>(03CH03-HY) |

Note: Calibration Interval of instruments listed above is one year.

**EMS**

| Instrument                        | Manufacturer           | Model No.            | Serial No. | Characteristics                                                                 | Calibration Date | Remark                |
|-----------------------------------|------------------------|----------------------|------------|---------------------------------------------------------------------------------|------------------|-----------------------|
| ESD Generator                     | TESEQ                  | NSG 437              | 102        | Air: 0KV~30KV<br>Contact: 0KV~15KV                                              | Oct. 18, 2012    | ESD                   |
| Amplifier                         | AMPLIFIER&<br>RESEARCH | 250W1000A            | 0325368    | 80MHz~1GHz                                                                      | Sep. 12, 2012    | RS                    |
| DUAL DIRECTIONAL<br>COUPLER       | FARNKONIA              | FLH200/100(C 5982)   | 11927      | 80MHz~1GHz                                                                      | Sep. 13, 2012    | RS                    |
| S.G.                              | ROHDE&<br>SCHWARZ      | SML03                | 103349     | 9kHz~3.3GHz                                                                     | Sep. 11, 2012    | RS                    |
| METER                             | HP                     | 438A                 | 3513U04050 | 100kHz~26.5GHz                                                                  | Sep. 13, 2012    | RS                    |
| POWER Sensor                      | HP                     | 8481D                | 3318A13140 | 10MHz~18GHz                                                                     | Sep. 13, 2012    | RS                    |
| POWER Sensor                      | HP                     | 8482A                | 3318A26464 | 100kHz~4.2GHz                                                                   | Sep. 13, 2012    | RS                    |
| Attenuator                        | HP                     | 8491A                | 53603      | 3dB                                                                             | N/A              | RS                    |
| EMC PRO System                    | KEYTEK                 | EMC PRO              | 0609221    | 0KV~4.4KV                                                                       | Oct. 26, 2012    | EFT                   |
| SURGE Generator<br>Bi-Wave        | KEYTEK                 | EMC PRO              | 0609221    | 0KV -6KV/2Ω<br>0V-500V/12Ω                                                      | Oct. 26, 2012    | SURGE                 |
| Conducted Immunity<br>Test System | SCHAFFNER              | NSG2070              | 1091       | 100KHz~250MHz<br>FM 1KHz 80%                                                    | Apr. 12, 2012    | CS                    |
| Attenuator                        | EM TEST                | 75W-DC-250<br>MHz 06 | 0004166A   | 150kHz~230MHz                                                                   | Apr. 16, 2012    | CS                    |
| Koppel-<br>Eutkoppelnetzwerk      | FRANKONIA              | CDN M2+M3            | A3011018   | 150kHz~230MHz                                                                   | Apr. 17, 2012    | CS                    |
| Magnetic Field Antenna            | FCC                    | F-1000-4-8/9/10-L-1M | 9830       | 0~125A                                                                          | Apr. 12, 2012    | Magnetic              |
| Magnetic Generator                | FCC                    | F-1000-4-8-G-125A    | 05004      | 0~125A                                                                          | Apr. 12, 2012    | Magnetic              |
| EMC PRO System                    | KEYTEK                 | EMC PRO              | 0609221    | 230VA/50Hz/60Hz<br>0% Open/5Sec<br>0% Short/5Sec<br>40% 0.10Sec<br>70%/ 0.01Sec | Oct. 26, 2012    | DIP                   |
| Harmonic/Flicker<br>Test System   | EMC PARTNER            | Harmonics -1000      | 088        | 4000VA<br>16A PEAK                                                              | Sep. 17, 2012    | Harmonics,<br>Flicker |

Note: Calibration Interval of instruments listed above is one year.

## 19. Uncertainty of Test Site

### Emission Test Measurement Uncertainty

#### Uncertainty of Conducted Emission Measurement from 150kHz to 30MHz

| Contribution                                                       | Uncertainty of $x_i$ |                          | $u(x_i)$    |
|--------------------------------------------------------------------|----------------------|--------------------------|-------------|
|                                                                    | dB                   | Probability Distribution |             |
| Receiver reading                                                   | 0.20                 | Normal(k=2)              | 0.10        |
| Cable loss                                                         | 0.19                 | Normal(k=2)              | 0.10        |
| AMN insertion loss                                                 | 2.50                 | Rectangular              | 0.63        |
| Receiver Spec                                                      | 1.50                 | Rectangular              | 0.43        |
| Site imperfection                                                  | 1.75                 | Rectangular              | 1.01        |
| Mismatch                                                           | +0.44/-0.46          | U-shape                  | 0.32        |
| combined standard uncertainty $U_c(y)$                             |                      |                          | <b>1.31</b> |
| Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$ |                      |                          | <b>2.62</b> |

#### Uncertainty of Radiated Emission Measurement from 30MHz to 1000MHz

| Contribution                                                       | Uncertainty of $x_i$ |                          | $u(x_i)$    |
|--------------------------------------------------------------------|----------------------|--------------------------|-------------|
|                                                                    | dB                   | Probability Distribution |             |
| Receiver reading                                                   | 0.08                 | Normal(k=2)              | 0.04        |
| Antenna factor calibration                                         | 0.96                 | Normal(k=2)              | 0.48        |
| Cable loss calibration                                             | 0.17                 | Normal(k=2)              | 0.09        |
| Pre Amplifier Gain calibration                                     | 0.21                 | Normal(k=2)              | 0.11        |
| RCV/SPA specification                                              | 2.50                 | Rectangular              | 0.72        |
| Antenna Factor Interpolation for Frequency                         | 1.00                 | Rectangular              | 0.29        |
| Site imperfection                                                  | 1.95                 | Rectangular              | 1.13        |
| Mismatch                                                           | +0.39/-0.41          | U-shaped                 | 0.28        |
| combined standard uncertainty $U_c(y)$                             |                      |                          | <b>1.48</b> |
| Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$ |                      |                          | <b>2.96</b> |

| Uncertainty of Radiated Emission Measurement from 1 GHz to 6 GHz |                  |                      |                                   |          |            |              |
|------------------------------------------------------------------|------------------|----------------------|-----------------------------------|----------|------------|--------------|
| Input quantity                                                   | $X_i$            | Uncertainty of $x_i$ |                                   | $u(x_i)$ | $c_i$      | $c_i u(x_i)$ |
|                                                                  |                  | dB                   | Probability distribution function | dB       |            | dB           |
| Spectrum reading                                                 | $V_r$            | $\pm 0.1$            | k=1                               | 0.10     | 1          | 0.10         |
| Attenuation: antenna-receiver                                    | $L_c$            | $\pm 0.1$            | k=2                               | 0.05     | 1          | 0.05         |
| Receiver corrections:                                            | $\delta RC$      | $\pm 1.0$            | k=2                               | 0.50     | 1          | 0.50         |
| Antenna factor                                                   | AF               | $\pm 1.3$            | k=2                               | 0.65     | 1          | 0.65         |
| Horn antenna corrections:                                        |                  |                      |                                   |          |            |              |
| AF frequency interpolation                                       | $\delta AF_f$    | $\pm 0.5$            | Rectangular                       | 0.29     | 1          | 0.29         |
| AF height deviations                                             | $\delta AF_h$    | $\pm 0.5$            | Rectangular                       | 0.29     | 1          | 0.29         |
| Directivity difference                                           | $\delta A_{dir}$ | $\pm 1.0$            | Rectangular                       | 0.58     | 1          | 0.58         |
| Phase centre location                                            | $\delta A_{ph}$  | $\pm 1.0$            | Rectangular                       | 0.58     | 1          | 0.58         |
| Cross-polarization                                               | $\delta A_{cp}$  | $\pm 0.9$            | Rectangular                       | 0.52     | 1          | 0.52         |
| Mismatch: antenna-receiver                                       | $\delta M$       | +0.9/-1.0            | U-shaped                          | 0.67     | 1          | 0.67         |
| Site corrections                                                 |                  |                      |                                   |          |            |              |
| Site imperfections                                               | $\delta SA$      | $\pm 5.6$            | Triangular                        | 2.29     | 1          | 2.29         |
| Measurement system repeatability                                 | R                | $\pm 0.20$           | Rectangular                       | 0.117    | 1          | 0.117        |
| Cable loss                                                       | C                | $\pm 0.68$           | Rectangular                       | 0.394    | 1          | 0.394        |
| Preamplifier factor                                              | PA               | $\pm 0.06$           | Rectangular                       | 0.037    | 1          | 0.037        |
| $u_c(y) =$                                                       |                  |                      |                                   |          | <b>2.7</b> |              |
| $2 u_c(y) =$                                                     |                  |                      |                                   |          | <b>5.4</b> |              |

**Immunity Test Measurement Uncertainty****ESD Immunity (IEC 61000-4-2)****Negative Discharge Current**

| From Standard  |                    |                 |                 |
|----------------|--------------------|-----------------|-----------------|
| 2kV            | First Peak Current | Current at 30ns | Current at 60ns |
| Nominal        | 7.5                | 4               | 2               |
| Min            | 6.75               | 2.8             | 1.4             |
| Max            | 8.25               | 5.2             | 2.6             |
| Tolerance in % | 10%                | 30%             | 30%             |

| From calibration certificate |                          |                          |                      |                          |                      |
|------------------------------|--------------------------|--------------------------|----------------------|--------------------------|----------------------|
| Measured First Peak Current  | 1st Peak Worst case. +5% | Measured Current at 30ns | 30ns Worst case. +5% | Measured Current at 60ns | 60ns Worst case. +5% |
| 7.48                         | 7.85                     | 4.2                      | 4.41                 | 2.01                     | 2.11                 |
|                              | 6.75                     |                          | 2.8                  |                          | 1.4                  |
|                              | 8.25                     |                          | 5.2                  |                          | 2.6                  |

| 4kV            | First Peak Current | Current at 30ns | Current at 60ns |
|----------------|--------------------|-----------------|-----------------|
| Nominal        | 15                 | 8               | 4               |
| Min            | 13.5               | 5.6             | 2.8             |
| Max            | 16.5               | 10.4            | 5.2             |
| Tolerance in % | 10%                | 30%             | 30%             |

| First Peak Current | 1st Peak Worst case. +5% | Measured Current at 30ns | 30ns Worst case. +5% | Measured Current at 60ns | 60ns Worst case. +5% |
|--------------------|--------------------------|--------------------------|----------------------|--------------------------|----------------------|
| 15.12              | 15.88                    | 8.03                     | 8.43                 | 3.68                     | 3.86                 |
|                    | 13.5                     |                          | 5.6                  |                          | 2.8                  |
|                    | 16.5                     |                          | 10.4                 |                          | 5.2                  |

| 6kV            | First Peak Current | Current at 30ns | Current at 60ns |
|----------------|--------------------|-----------------|-----------------|
| Nominal        | 22.5               | 12              | 6               |
| Min            | 20.25              | 8.4             | 4.2             |
| Max            | 24.75              | 15.6            | 7.8             |
| Tolerance in % | 10%                | 30%             | 30%             |

| First Peak Current | 1st Peak Worst case. +5% | Measured Current at 30ns | 30ns Worst case. +5% | Measured Current at 60ns | 60ns Worst case. +5% |
|--------------------|--------------------------|--------------------------|----------------------|--------------------------|----------------------|
| 22.78              | 23.92                    | 12.37                    | 12.99                | 5.45                     | 5.72                 |
|                    | 20.25                    |                          | 8.4                  |                          | 4.2                  |
|                    | 24.75                    |                          | 15.6                 |                          | 7.8                  |

| 8kV            | First Peak Current | Current at 30ns | Current at 60ns |
|----------------|--------------------|-----------------|-----------------|
| Nominal        | 30                 | 16              | 8               |
| Min            | 27                 | 11.2            | 5.6             |
| Max            | 33                 | 20.8            | 10.4            |
| Tolerance in % | 10%                | 30%             | 30%             |

| First Peak Current | 1st Peak Worst case. +5% | Measured Current at 30ns | 30ns Worst case. +5% | Measured Current at 60ns | 60ns Worst case. +5% |
|--------------------|--------------------------|--------------------------|----------------------|--------------------------|----------------------|
| 30.26              | 31.77                    | 16.13                    | 16.94                | 7.39                     | 7.76                 |
|                    | 27                       |                          | 11.2                 |                          | 5.6                  |
|                    | 33                       |                          | 20.8                 |                          | 10.4                 |

Negative Discharge Voltage

| Standard Parameters |            |       |       | Measured Values |
|---------------------|------------|-------|-------|-----------------|
| Indicated Voltage.  | Tolerance. | Max.  | Min.  |                 |
| kV                  | %          | kV    | kV    | kV              |
| 2                   | 10         | 2.20  | 1.80  | 2.05            |
| 4                   | 10         | 4.40  | 3.60  | 4.027           |
| 6                   | 10         | 6.60  | 5.40  | 5.955           |
| 8                   | 10         | 8.80  | 7.20  | 7.916           |
| 15                  | 10         | 16.50 | 13.50 | 14.839          |

Negative Rise Time

| Standard Parameters |       | Measured Values    |                     |                     |                     |
|---------------------|-------|--------------------|---------------------|---------------------|---------------------|
| T max.              | 1ns   | Indicated Voltage. | Measured Rise Time. | Worst Case max. +6% | Worst Case min. -6% |
| T min               | 0.7ns | 2kV                | 0.851               | 0.902               | 0.799               |
|                     |       | 4kV                | 0.780               | 0.268               | 0.733               |
|                     |       | 6kV                | 0.750               | 0.795               | 0.705               |
|                     |       | 8kV                | 0.772               | 0.818               | 0.726               |

It has been demonstrated that the ESD generator meets the specified requirements in the standard with at least a 95% confidence

RF Radiated Immunity (IEC 61000-4-3)

| Symbol | Source of Uncertainty               | Value | Probability distribution | Divisor | ui(y) |
|--------|-------------------------------------|-------|--------------------------|---------|-------|
| FSM    | Felds Strength monitor              | 1.5   | Normal 2                 | 2.000   | 0.75  |
| FSAW   | Field Strength acceptability window | 0.50  | Rectangular              | 1.732   | 0.29  |
| PAH    | Power Amplifier Harmonics           | 0.50  | Rectangular              | 1.732   | 0.29  |
| RS     | Measurement System Repeatability    | 0.50  | Normal 1                 | 1.000   | 0.50  |
| REUT   | Repeatability of EUT                | 0.00  | Normal 1                 | 1.000   | 0.00  |
| uc(FS) | Combined Standard Uncertainty       | -     | Normal                   | -       | 0.83  |
| U(FS)  | Expanded Uncertainty                | -     | Normal k= 2              |         | 1.66  |

| Specified Level (V/m) | Test level (V/m) |
|-----------------------|------------------|
| For 1 Volts           | 1.25             |
| For 3 Volts           | 3.33             |
| For 10 Volts          | 11.22            |

**RF Conducted Immunity (IEC 61000-4-6)**

| Symbol     | Source of Uncertainty            | Value | Probability distribution | Divisor | $u_i(y)$    |
|------------|----------------------------------|-------|--------------------------|---------|-------------|
| $S_A$      | Spectrum Analyzer                | 1.50  | Rectangular              | 1.732   | 0.87        |
| $C_C$      | Current coil Calibration         | 1.00  | Normal 2                 | 2.000   | 0.50        |
| $M$        | Mismatch                         | -0.5  | U-shaped                 | 1.414   | -0.35       |
| $M$        | Mismatch                         | -0.3  | U-shaped                 | 1.414   | -0.35       |
| $R_S$      | Measurement System Repeatability | 0.50  | Normal 1                 | 1.000   | 0.50        |
| $R_{EUT}$  | Repeatability of EUT             | 0.00  | Normal 1                 | 1.000   | 0.00        |
| $u_c(F_S)$ | Combined Standard Uncertainty    | -     | Normal                   | -       | 1.57        |
| $U(F_S)$   | <b>Expanded Uncertainty</b>      | -     | <b>normal k= 2</b>       |         | <b>3.14</b> |

| Specified Level | Test level (V) |
|-----------------|----------------|
| For 1 Volts     | 1.30           |
| For 3 Volts     | 3.88           |
| For 10 Volts    | 12.15          |

## APPENDIX A. Photographs of EUT

