



CE EMC

TEST REPORT

For

Rack Mount Universal Controller with 3xLAN, 8xIsolated RS-232/422/485

Model: UNO-2668

Trade Name: ADVANTECH

Issued to

Advantech Co., Ltd.

**No. 1, Alley 20, Lane 26, Rueiguang Road,
Neihu District, Taipei 114, R.O.C.**

Issued by

**Compliance Certification Services Inc.
Hsintien Lab.**

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1 TEST RESULT CERTIFICATION

Applicant: Advantech Co., Ltd.
No. 1, Alley 20, Lane 26, Rueiguang Road,
Neihu District, Taipei 114, R.O.C.

Manufacturer: Advantech Co., Ltd.
No. 1, Alley 20, Lane 26, Rueiguang Road,
Neihu District, Taipei 114, R.O.C.

Equipment Under Test: Rack Mount Universal Controller with 3xLAN, 8xIsolated
RS-232/422/485

Trade Name: ADVANTECH

Model: UNO-2668

Detailed EUT Description: See Item 2 of this report

Date of Test: June 02, 2006 ~ June 24, 2006

| Applicable Standard | Class/Limit/Criterion | Test Result |
|---|-----------------------|-------------------------|
| EN 55011: 1998 + A1: 1999 + A2: 2000 | Group 1 / Class A | No non-compliance noted |
| EN 55022: 1994+A1: 1995+A2: 1997+ EN 55022: 1998/A1: 2000+A2: 2003 | Class A | No non-compliance noted |
| EN 61000-3-2: 2000 | Class D | N/A |
| EN 61000-3-3: 1995 + A1: 2001 | Limit | N/A |
| EN 61000-6-2: 2001 (EN 55024: 1998 + A1: 2001 + A2: 2003), including | | |
| IEC 61000-4-2: 1995 + A1: 1998 + A2: 2000 | Criterion B | No non-compliance noted |
| IEC 61000-4-3: 2002 + A1: 2002 | Criterion A | No non-compliance noted |
| IEC 61000-4-4: 1995 + A1: 2000 + A2: 2001 | Criterion B | No non-compliance noted |
| IEC 61000-4-5: 1995 + A1: 2000 | Criterion B | No non-compliance noted |
| IEC 61000-4-6: 1996 + A1: 2000 | Criterion A | No non-compliance noted |
| IEC 61000-4-8: 1993 + A1: 2000 | Criterion A | No non-compliance noted |
| IEC 61000-4-11: 1994 + A1: 2000 | Criterion B/C/C | N/A |
| Deviation from Applicable Standard | | |
| As the customers required, we adopt the above standards for testing. | | |

The above equipment was tested by Compliance Certification Services Inc. for compliance with the requirements set forth in the EMC Directive 89/336/EMC and the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Reviewed by:


David Wang
Manager of Hsintien Laboratory
Compliance Certification Services Inc.


Vince Chiang
Assistant Manager of Hsintien Laboratory
Compliance Certification Services Inc.



1. EUT DESCRIPTION

| | |
|------------------------------|---|
| Product | Rack Mount Universal Controller with 3xLAN, 8xIsolated RS-232/422/485 |
| Trade Name | ADVANTECH |
| Model | UNO-2668 |
| EUT Power Rating | 24VDC |
| DC Power During Test | 24VDC |
| OSC/Clock Frequencies | 14.74Hz |

I/O PORT OF EUT

| I/O PORT TYPE | Q'TY | TESTED WITH |
|-----------------------------|-------------|--------------------|
| 1). VIDEO-OUT Port (VGA) | 1 | 1 |
| 2). LAN Port | 3 | 3 |
| 3). PS/2 one to two adaptor | 1 | 1 |
| 4). SIO Port | 2 | 2 |
| 5). USB Port | 2 | 2 |

Note: Client consigns only one model sample (Model Number is UNO-2668) to test.



2 TEST METHODOLOGY

3.1 EUT SYSTEM OPERATION

1. Windows 2000 boots system.
2. Run Emctest.exe to activate all peripherals and display “H” pattern on monitor screen.
3. Press the start menu, select executive and type ping 192.168.0.2 -t (EUT), ping 192.168.0. 1 -t (HUB).
4. Press the start menu, select executive and type ping 192.168.1.2 -t (EUT), ping 192.168.1. 1 -t (HUB).
5. Press the start menu, select executive and type ping 192.168.2.2 -t (EUT), ping 192.168.2. 1 -t (HUB).

Note: Test program is self-repeating throughout the test.

3.2 DECISION OF FINAL TEST MODE

1. The following test mode were scanned during the preliminary test:

Mode:

| | |
|----|-------------|
| 1. | NORMAL MODE |
|----|-------------|

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

Conduction: N/A *(The subject equipment is not intended to be connected to AC mains supply. Therefore, this test is not applicable.)*

Radiation: Mode 1

Then, the EUT configuration and cable configuration of the above highest emission mode was chosen for all final test items.



3 SETUP OF EQUIPMENT UNDER TEST

Setup Diagram

See test photographs attached in Appendix I for the actual connections between EUT and support equipment.

Support Equipment

EUT Devices:

| No | Equipment | Model | Trade Name |
|----|--------------|----------|------------|
| 1. | CPU (400MHz) | Celeron | INTEL |
| 2. | Motherboard | SOM-4475 | ADVANTECH |

Peripherals Devices:

| No | Equipment | Model | Serial No. | FCC ID/ BSMI ID | Trade Name | Data Cable | Power Cord |
|----|-----------------|-----------|---------------------------------------|---------------------|------------|-------------------------------------|------------------------------------|
| 1 | PS/2 Mouse | M071KC | 443029438 | BSMI: R41108 DoC | DELL | Shielded, 1.8m | N/A |
| 2 | PS/2 Keyboard | SK-8110 | N/A | BSMI: T3A002 DoC | DELL | Shielded, 1.8m | N/A |
| 3 | USB 2.0 HDD | F12-U | N/A | BSMI ID: 4912A002 | TeraSys | Shielded, 1.8m | N/A |
| 4 | USB 2.0 HDD | F12-U | N/A | BSMI ID: 4912A002 | TeraSys | Shielded, 1.8m | N/A |
| 5 | Monitor | 710V | GS17H9NXA05869X | DOC BSMI: R33475 | SAMSUNG | Shielded, 1.8m with two cores | Unshielded, 1.8m |
| 6 | DC Power Supply | PS-140Ya | N/A | N/A | DAIWA | Shielded, 0.1m X2 | Unshielded, 1.8m |
| 7 | HUB | DGS-1008D | 042829 | DoC | D-Link | Unshielded, 20m X3 | Unshielded, 1.8m |
| 8 | Server Notebook | M285 | RD49R-7YTJR- B3C4K-G2JQX- DD3CG | DoC BSMI: R31259 | LEO | To HUB: Unshielded, 1.0m | Unshielded, 1.8m with a core |

Note: All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.

Grounding: Grounding was in accordance with the manufacturer's requirements and conditions for the intended use.

4 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES



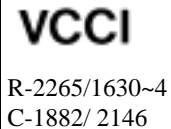


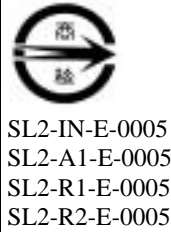

All measurement facilities used to collect the measurement data are located at CCS Taiwan Hsintien Lab at No. 165, Chungshen Road, Hsintien City, Taipei Hsien, Taiwan.

The measurement facilities are constructed in conformance with the requirements of CISPR 16-1, ANSI C63.4 and other equivalent standards.

5.2 LABORATORY ACCREDITATIONS AND LISTINGS

The test facilities used to perform Electromagnetic compatibility tests are registered or accredited by the organizations listed in the following table which includes the recognized scope specifically.

This accredited organization maintains A2LA accreditation to ISO/IEC 17025 for the specific test listed in A2LA Certificate # 0824-01. The test results included in this report, however, are not covered by this accreditation.

| Country | Agency | Scope of Accreditation | Logo |
|---------|-----------------|--|---|
| USA | A2LA | CFR 47, FCC Part 15/18; AS/NZS 3548; VCCI V3; CNS 13438; CNS 13439; CNS 13783; CNS 14115; CISPR 11/EN 55011; CISPR 14-1/EN 55014-1; CISPR 15/EN 55015; CISPR 22/EN 55022; EN 50081-1/EN 61000-6-3; EN 50082-1/EN 61000-6-4; IEC/EN 61000-4-2, IEC/EN 61000-4-3, IEC/EN 61000-4-4, IEC/EN 61000-4-5, IEC/EN 61000-4-6, IEC/EN 61000-4-8, IEC/EN 61000-4-11, IEC/EN 61000-3-2, IEC/EN 61000-3-3; CISPR 24/EN 55024; CISPR 14-2/EN 55014-2; EN 50081-2/EN 61000-6-1; EN 50082-2/EN 61000-6-2. |  |
| USA | FCC | 3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements |  |
| Japan | VCCI | 3/10 meter Open Area Test Sites and Line Conducted Test Room to perform conducted/radiated measurements |  |
| Norway | NEMKO | EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2/3/4, EN 50091-2, EN 50130-4, EN 55011, EN 55013, EN 55014-1/2, EN 55015, EN 55022, EN 55024, EN 61000-3-2/3, EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, Cisp 16-1/2/3/4 |  |
| Taiwan | CNLA | 47 CFR FCC Part 15 Subpart B, EN 61000-3-2, EN 61000-3-3, CNS 13439, CNS 13783-1, CNS 13438, AS/NZS 3548, VCCI, CNS 13022-1/2/3, EN 55022, EN 55013, EN 55014-1, EN 61000-4-2/3/4/5/6/8/11, ENV 50204, ENV 50141, ENV 50142 |  |
| Taiwan | BSMI | CNS 13438, CNS 13783-1, CNS 13439 |  |
| Canada | Industry Canada | RSS212, Issue 1 |  |

Note: No part of this report may be used to claim or imply product endorsement by CNLA, A2LA or other government agency.



5 INSTRUMENT AND CALIBRATION

6.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

6.2 TEST AND MEASUREMENT EQUIPMENT

The following list contains measurement equipment used for testing. The equipment conforms to the requirement of CISPR 16-1, ANSI C63.2 and other required standards.

Calibration of all test and measurement, including any accessories that may effect such calibration, is checked frequently to ensure the accuracy. Adjustments are made and correction factors are applied in accordance with the instructions contained in the respective manual.

Equipment Used for Emission Measurement

| Open Area Test Site # J | | | | |
|-------------------------|-----------|-----------------|---------------|-------------------------|
| EQUIPMENT | MFR | MODEL | SERIAL NUMBER | CAL. DUE |
| SITE NSA | CCS | J Site | N/A | 10/15/2006 |
| MEASURE RECEIVER | SCHAFFNER | SCR3501 | 330 | 06/11/2007 |
| SPECTRUM ANALYZER | ADVANTEST | R3132 | 120900003 | No Calibration Required |
| ANTENNA | SCHAFFNER | CBL 6112B | 2800 | 09/24/2006 |
| PRE-AMPLIFIER | SCHAFFNER | CPA9231A | 3629 | 10/08/2006 |
| CABLE | BELDEN | 9913 | N-TYPE #J3 | 04/14/2007 |
| ATTENUATOR | MCL | UNAT-6 | AT06-8 | 12/02/2006 |
| THERMO-HYGRO METER | TFA | N/A | NO.3 | 11/02/2006 |
| DECOUPLING NETWORK | FCC | F-201-DCN-5-6MM | 22, 24 | 08/24/2006 |

Note: The measurement uncertainty is less than +/- 3.36dB, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.

| Conducted Emission Test Site # A | | | | |
|----------------------------------|-------------|------------------|---------------|------------|
| EQUIPMENT | MFR | MODEL | SERIAL NUMBER | CAL. DUE |
| TEST RECEIVER | R&S | ESHS20 | 840455/006 | 02/06/2007 |
| LISN (EUT) | SCHWARZBECK | NSLK 8127 | 8127382 | 01/02/2007 |
| LISN | SOLAR | 8012-50-R-24-BNC | 8305114 | 01/02/2007 |
| BNC CABLE | JYE BAO | RG-223/U | BNC A2 | 10/08/2006 |
| THERMO-HYGRO METER | TOP | HA-202 | 9303-1 | 02/22/2007 |

Note: The measurement uncertainty is less than +/- 2.83dB, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.



| Power Harmonic & Voltage Fluctuation/Flicker Test Site (EN 61000-3-2&-3-3) | | | |
|--|------------|------------|-------------------------|
| Manufacturer/Type | Model No. | Serial No. | Cal. Due |
| Schaffner / Signal Conditioning Unit | CCN 1000-1 | 72122 | 12/01/2006 |
| Schaffner / 5KVA AC Power Source | NSG 1007 | 55131 | No Calibration Required |

Equipment Used for Immunity Measurement

| ESD Test Site (EN 61000-4-2) | | | |
|------------------------------|-----------|------------|------------|
| Manufacturer/Type | Model No. | Serial No. | Cal. Due |
| Schaffner / ESD Simulator | NSG 438 | 129 | 04/24/2007 |
| Sato / Aneroid Barometer | 7610-20 | 89090 | 08/29/2006 |
| TOP / Thermo-Hygro meter | HA-202 | 9303-1 | 02/22/2007 |

| Radiated Electromagnetic Field Immunity Test Site (EN 61000-4-3) | | | |
|--|------------|-------------|-------------------------|
| Manufacturer/Type | Model No. | Serial No. | Cal. Due |
| Calibration of Field | Chamber#RS | 200604H/V-2 | 04/11/2007 |
| Agilent / Signal Generator | E4421B | MY43350597 | 05/17/2007 |
| AR / Electric Field Probe | FP6001 | 305650 | 03/15/2007 |
| Boonton / RF Voltmeter | 9200B | 328001AE | 02/08/2007 |
| BNC / Function Generator | 625A | 25451 | 02/08/2007 |
| AR / Amplifier | 100W1000M1 | 17564 | No Calibration Required |
| AR / Direction Coupler | DC6180A | 312189 | No Calibration Required |
| AR / Broadband Antenna | AT1080 | 311819 | No Calibration Required |
| TOP / Thermo-Hygro meter | HA-202 | 9303-2 | 02/22/2007 |

| Fast Transients/Burst Test Site (EN 61000-4-4) | | | |
|--|---------------|--------------|-------------------------|
| Manufacturer/Type | Model No. | Serial No. | Cal. Due |
| Schaffner / EFT Generator | BEST EMC V2.3 | 200031A024SC | 11/07/2006 |
| Schaffner / Capacitive Clamp | N/A | N/A | No Calibration Required |



| Surge Immunity Test Site (EN 61000-4-5) | | | |
|---|---------------|--------------|----------------------------|
| Manufacturer/Type | Model No. | Serial No. | Cal. Due |
| Schaffner / Surger Generator | BEST EMC V2.3 | 200031A024SC | 11/07/2006 |
| Schaffner / Signal and Data Lines Coupling Network | CDN118 | 19328 | No Calibration Required |

| CS test (EN 61000-4-6) | | | |
|-----------------------------|-----------------|------------|----------------------------|
| Manufacturer/Type | Model No. | Serial No. | Cal. Due |
| Schaffner / RF Generator | NSG 2070-1 | 1061 | 08/03/2006 |
| Schaffner / CDN | CDN M316 | 19600 | 08/02/2006 |
| Schaffner / CDN | CDN M216 | 19294 | 08/02/2006 |
| FCC / CDN | FCC-801-M3-16A | 99122 | 08/02/2006 |
| Schaffner / EM Clamp | KEMZ 801 | 19227 | 02/19/2007 |
| Schaffner / CDN | CDN T002 | 15881 | 01/12/2007 |
| FCC / CDN | FCC-801-T8-RJ45 | 04025 | 07/03/2007 |
| Schaffner / Attenuator | INA2070-1 | 2061 | No Calibration Required |
| FCC / CDN | FCC-801-T4-RJ45 | 04031 | 08/02/2006 |

| Power Frequency Magnetic Field Immunity test (EN 61000-4-8) | | | |
|---|-----------|------------|----------------------------|
| Manufacturer/Type | Model No. | Serial No. | Cal. Due |
| Schaffner / Induction Coil Interface | INA 21141 | 6009 | No Calibration Required |
| Schaffner / 5KVA AC Power Source | NSG 1007 | 55131 | No Calibration Required |
| CHY/ TRMS Clamp Meter | 932C | 2K0900285 | 10/16/2006 |
| Sypris / Magnetic Field Meter | 4080 | 0247 | 01/23/2007 |

| Voltage Dips/Short Interruption and Voltage Variation Immunity test (EN 61000-4-11) | | | |
|---|---------------|--------------|------------|
| Manufacturer/Type | Model No. | Serial No. | Cal. Due |
| Schaffner / Dips/Interruption/Variations Tester | BEST EMC V2.3 | 200031A024SC | 11/07/2006 |
| Protronix / Digital Power Meter | 1201 | 201091 | 08/24/2006 |

6 LINE CONDUCTED & RADIATED EMISSION TEST

7.1 LIMIT

7.1.1 EN 55022

Maximum permissible level of Line Conducted Emission

| FREQUENCY (MHz) | Class A (dBuV) | | Class B (dBuV) | |
|--------------------|----------------|---------|----------------|---------|
| | Quasi-peak | Average | Quasi-peak | Average |
| 0.15 - 0.5 | 79 | 66 | 66 - 56 | 56 - 46 |
| 0.50 - 5.0 | 73 | 60 | 56 | 46 |
| 5.0 - 30.0 | 73 | 60 | 60 | 50 |

Note: The lower limit shall apply at the transition frequency.

Maximum permissible level of Common Mode Conducted Emission (Telecommunication Ports)

CLASS A

| FREQUENCY (MHz) | Voltage Limit (dBuV) | | Current Limit (dBuA) | |
|--------------------|----------------------|---------|----------------------|---------|
| | Quasi-peak | Average | Quasi-peak | Average |
| 0.15 - 0.5 | 97 - 87 | 84 - 74 | 53 - 43 | 40 - 30 |
| 0.5 - 30.0 | 87 | 74 | 43 | 30 |

CLASS B

| FREQUENCY (MHz) | Voltage Limit (dBuV) | | Current Limit (dBuA) | |
|--------------------|----------------------|---------|----------------------|---------|
| | Quasi-peak | Average | Quasi-peak | Average |
| 0.15 - 0.5 | 84 - 74 | 74 - 64 | 40 - 30 | 30 - 20 |
| 0.5 - 30.0 | 74 | 64 | 30 | 20 |

Note: The lower limit shall apply at the transition frequency.

Maximum permissible level of Radiated Emission measured at 10 meter

| FREQUENCY (MHz) | Class A (dBuV/m) | Class B (dBuV/m) |
|--------------------|------------------|------------------|
| | Quasi-peak | Quasi-peak |
| 30 - 230 | 40 | 30 |
| 230 - 1000 | 47 | 37 |

Note: The lower limit shall apply at the transition frequency.

7.1.2 EN 55011

Maximum permissible level of Mains terminal disturbance voltage (Conducted Emission)

CLASS A

| FREQUENCY (MHz) | Group 1 | | Group 2 | | Group 2* | |
|--------------------|----------------------|-------------------|---|-------------------|----------------------|-------------------|
| | Quasi-peak (dBuV) | Average (dBuV) | Quasi-peak (dBuV) | Average (dBuV) | Quasi-peak (dBuV) | Average (dBuV) |
| 0.15 - 0.5 | 79 | 66 | 100 | 90 | 130 | 120 |
| 0.50 - 5.0 | 73 | 60 | 86 | 76 | 125 | 115 |
| 5.0 - 30.0 | 73 | 60 | 90 Decreasing linearly with logarithm of frequency to 70 | 80 60 | 115 | 105 |

Note: The lower limit shall apply at the transition frequency

. Care should be taken to comply with leakage current requirements.

CLASS B

| FREQUENCY (MHz) | Group 1 & 2 | |
|--------------------|---|---|
| | Quasi-peak (dBuV) | Average (dBuV) |
| 0.15 - 0.5 | 66 Decreasing linearly with logarithm of frequency to 56 | 56 Decreasing linearly with logarithm of frequency to 46 |
| 0.50 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

Note: The lower limit shall apply at the transition frequency

. Care should be taken to comply with leakage current requirements.

Maximum permissible level of Radiated Emission measured at 10 meter

| FREQUENCY (MHz) | Measured on a test site | | Measured in situation |
|--------------------|-------------------------|------------------------|---|
| | Group 1, class A | Group 1, class B | Group 1, class A Limits with measuring distance 30 m from exterior wall outside the building in which the equipment is situated |
| | Quasi-peak (dBuV/m) | Quasi-peak (dBuV/m) | Quasi-peak (dBuV/m) |
| 0.15 - 30 | Under consideration | Under consideration | Under consideration |
| 30 - 230 | 40 | 30 | 30 |
| 230 - 1000 | 47 | 37 | 37 |

Note: The lower limit shall apply at the transition frequency.



7.2 TEST PROCEDURE OF LINE CONDUCTED EMISSION

7.2.1 EN 55022

Procedure of Preliminary Test

- The EUT was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per EN 55022 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- Support equipment, if needed, was placed as per EN 55022.
- All I/O cables were positioned to simulate typical actual usage as per EN 55022.
- The test system with EUT received AC power, 230V/50Hz, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane.
- All support equipment received power from a second LISN.
- The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The Receiver scanned from 150kHz to 30MHz for emissions in each of the test modes.
- During the above scans, the emissions were maximized by cable manipulation.
- The test mode(s) described in Item 3.2 were scanned during the preliminary test.
- After the preliminary scan, we found the test mode described in Item 3.2 producing the highest emission level.
- The EUT configuration and cable configuration of the above highest emission level were recorded for reference of the final test.

Procedure of Final Test

- EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.
- A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less -2dB to the Average limit in Q.P. mode, then the emission signal was re-checked using an Average detector.
- The test data of the worst-case condition(s) was recorded.

**Data Sample:**

| Freq. MHz | Read Level dBuV | Factor dB | Level dBuV | Limit dBuV | Over Limit dB | Reading Type (P/Q/A) | Line (L1/L2) |
|--------------|-----------------------|--------------|---------------|---------------|---------------------|----------------------------|-----------------|
| x.xx | 42.95 | 0.55 | 43.50 | 73 | -29.50 | Q | L1 |

Freq. = Emission frequency in MHz
Read Level = Uncorrected Analyzer/Receiver reading
Factor = Insertion loss of LISN + Cable Loss
Level = Read Level + Factor
Limit = Limit stated in standard
Over Limit = Reading in reference to limit
P = Peak Reading
Q = Quasi-peak Reading
A = Average Reading
L1 = Hot side
L2 = Neutral side

Calculation Formula

Over Limit (dB) = Level (dBuV) – Limit (dBuV)

7.2.2 EN 55011**Procedure of Preliminary Test**

- The EUT was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per EN 55011 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- Support equipment, if needed, was placed as per EN 55011.
- All I/O cables were positioned to simulate typical actual usage as per EN 55011.
- The test equipment EUT installed received AC power, 230V/50Hz, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane.
- All support equipment received power from a second LISN.
- The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The Receiver scanned from 150kHz to 30MHz for emissions in each of the test modes.
- During the above scans, the emissions were maximized by cable manipulation.
- The test mode(s) described in Item 3.2 were scanned during the preliminary test.



- After the preliminary scan, we found the test mode described in Item 3.2 producing the highest emission level.
- The EUT configuration and cable configuration of the above highest emission level were recorded for reference of the final test.

Procedure of Final Test

- EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.
- A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the Average limit in Q.P. mode, then the emission signal was re-checked using an Average detector.
- The test data of the worst-case condition(s) was recorded.

Data Sample:

| Freq. MHz | Read Level dBuV | Factor dB | Level dBuV | Limit dBuV | Over Limit dB | Reading Type (P/Q/A) | Line (L1/L2) |
|--------------|-----------------------|--------------|---------------|---------------|---------------------|----------------------------|-----------------|
| x.xx | 42.95 | 0.55 | 43.50 | 73 | -29.50 | Q | L1 |

Freq. = Emission frequency in MHz
Read Level = Uncorrected Analyzer/Receiver reading
Factor = Insertion loss of LISN + Cable Loss
Level = Read Level + Factor
Limit = Limit stated in standard
Over Limit = Reading in reference to limit
P = Peak Reading
Q = Quasi-peak Reading
A = Average Reading
L1 = Hot side
L2 = Neutral side

Calculation Formula

Over Limit (dB) = Level (dBuV) – Limit (dBuV)



7.3 TEST PROCEDURE OF RADIATED EMISSION

7.3.1 EN 55022

Procedure of Preliminary Test

- The equipment was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden turntable with a height of 0.8 meters is used which is placed on the ground plane. When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- Support equipment, if needed, was placed as per EN 55022.
- All I/O cables were positioned to simulate typical usage as per EN 55022.
- The EUT received AC power source, 230V/50Hz, from the outlet socket under the turntable. All support equipment received power from another socket under the turntable.
- Mains cables, telephone lines or other connections to auxiliary equipment located outside the test are shall drape to the floor, be fitted with ferrite clamps or ferrite tubes placed on the floor at the point where the cable reaches the floor and then routed to the place where they leave the turntable. No. extension cords shall be used to mains receptacle.
- The antenna was placed at 10 meter away from the EUT as stated in EN 55022. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.
- The Analyzer / Receiver quickly scanned from 30MHz to 1000MHz. The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- The test mode(s) described in Item 3.2 were scanned during the preliminary test:
- After the preliminary scan, we found the test mode described in Item 3.2 producing the highest emission level.
- The EUT and cable configuration, antenna position, polarization and turntable position of the above highest emission level were recorded for the final test.

Procedure of Final Test

- EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.
- The Analyzer / Receiver scanned from 30MHz to 1000MHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.



- Recorded at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.

Data Sample:

| Freq. MHz | Amptd dBuV/m | Margin dB | Limit dBuV/m | Reading dBuV | Factor dB/m | Reading Type (P/Q/A) | Pol. (H/V) |
|--------------|-----------------|--------------|-----------------|-----------------|----------------|----------------------------|---------------|
| x.xx | 26.2 | -13.8 | 40 | 14 | 12.2 | Q | H |

Freq. = Emission frequency in MHz
Reading = Uncorrected Analyzer/Receiver reading
Factor = Antenna Factor + Cable Loss + Attenuator (3/6/10dB) – Amplifier Gain
Amptd = Uncorrected Analyzer/Receiver reading + Factor
Limit = Limit stated in standard
Margin = Reading in reference to limit
P = Peak Reading
Q = Quasi-peak Reading
A = Average Reading
H = Antenna Polarization: Horizontal
V = Antenna Polarization: Vertical

Calculation Formula

Margin (dB) = Amptd (dBuV/m) – Limit (dBuV/m)



7.3.2 EN 55011

Procedure of Preliminary Test

- The equipment was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden turntable with a height of 0.8 meters is used which is placed on the ground plane. When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- Support equipment, if needed, was placed as per EN 55011.
- All I/O cables were positioned to simulate typical usage as per EN 55011.
- The EUT received AC power source, 230V/50Hz, from the outlet socket under the turntable. All support equipment received power from another socket under the turntable.
- The antenna was placed at 10 meter away from the EUT as stated in EN 55011. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.
- The Analyzer / Receiver quickly scanned from 30MHz to 1000MHz. The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- The test mode(s) described in Item 3.2 were scanned during the preliminary test:
- After the preliminary scan, we found the test mode described in Item 3.2 producing the highest emission level.
- The EUT and cable configuration, antenna position, polarization and turntable position of the above highest emission level were recorded for the final test.

Procedure of Final Test

- EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.
- The Analyzer / Receiver scanned from 30MHz to 1000MHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- Recorded at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.
- The test data of the worst-case condition(s) was recorded.

**Data Sample:**

| Freq. MHz | Amptd dBuV/m | Margin dB | Limit dBuV/m | Reading dBuV | Factor dB/m | Reading Type (P/Q/A) | Pol. (H/V) |
|--------------|-----------------|--------------|-----------------|-----------------|----------------|----------------------------|---------------|
| x.xx | 26.2 | -13.8 | 40 | 14 | 12.2 | Q | H |

Freq. = Emission frequency in MHz
Reading = Uncorrected Analyzer/Receiver reading
Factor = Antenna Factor + Cable Loss + Attenuator (3/6/10dB) – Amplifier Gain
Amptd = Uncorrected Analyzer/Receiver reading + Factor
Limit = Limit stated in standard
Margin = Reading in reference to limit
P = Peak Reading
Q = Quasi-peak Reading
A = Average Reading
H = Antenna Polarization: Horizontal
V = Antenna Polarization: Vertical

Calculation Formula

Margin (dB) = Amptd (dBuV/m) – Limit (dBuV/m)



7.4 TEST RESULTS

Line Conducted Emission

Model: N/A

Test Mode: N/A

Temperature: N/A

Humidity: N/A

Test Results: N/A

Tested by: N/A

(The chart below shows the highest readings taken from the final data.)

| Six Highest Conducted Emission Readings | | | | | | | |
|---|-------------------------|----------------|-----------------|-------------------------|-----------------------|----------------------------|-----------------|
| Frequency Range Investigated | | | | 150 kHz to 30 MHz | | | |
| Freq (MHz) | Read Level (dBuV) | Factor (dB) | Level (dBuV) | Limit Line (dBuV) | Over Limit (dB) | Reading Type (P/Q/A) | Line (L1/L2) |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

NOTE: The subject equipment is not intended to be connected to AC mains supply. Therefore, this test is not applicable



Radiated Emission

Model: UNO-2668

Test Mode: Mode 1

Temperature: 32°C

Humidity: 50% RH

Test Results: Passed

Tested by: Matt Hsu

(The chart below shows the highest readings taken from the final data.)

| Six Highest Radiated Emission Readings | | | | | | | |
|---|---------------------------|------------------------|---------------------------|----------------------------------|--------------------------|-------------------------------------|-----------------------|
| Frequency Range Investigated | | | | 30 MHz to 1000 MHz at 10m | | | |
| Freq (MHz) | Amptd (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Reading (dBuV) | Factor (dB/m) | Reading Type (P/Q/A) | Pol. (H/V) |
| 186.7700 | 33.69 | -6.31 | 40.00 | 45.00 | -11.31 | Q | V |
| 192.9500 | 32.16 | -7.84 | 40.00 | 43.80 | -11.64 | Q | V |
| 212.2000 | 37.73 | -2.27 | 40.00 | 48.70 | -10.97 | Q | V |
| 186.5200 | 37.10 | -2.90 | 40.00 | 48.40 | -11.30 | Q | H |
| 212.3200 | 37.34 | -2.66 | 40.00 | 48.30 | -10.96 | Q | H |
| 320.6700 | 40.31 | -6.69 | 47.00 | 46.50 | -6.19 | Q | H |

NOTE: None.



7 POWER HARMONICS TEST

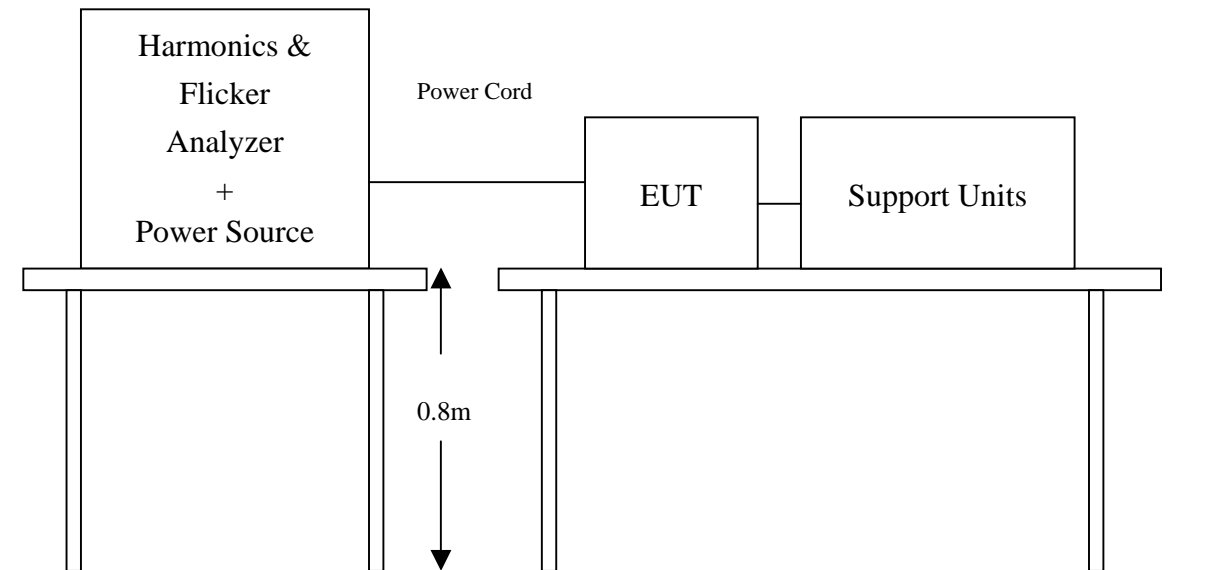
Port : AC Power Port
Basic Standard : EN 61000-3-2 (2000)
Limits : ☐ CLASS A ; ☐ CLASS D
Tested by : N/A
Temperature : N/A
Humidity : N/A

Limit:

| Limits for Class A equipment | |
|------------------------------|--|
| Harmonics Order n | Max. permissible harmonics current A |
| Odd harmonics | |
| 3 | 2.30 |
| 5 | 1.14 |
| 7 | 0.77 |
| 9 | 0.40 |
| 11 | 0.33 |
| 13 | 0.21 |
| 15<=n<=39 | 0.15x15/n |
| Even harmonics | |
| 2 | 1.08 |
| 4 | 0.43 |
| 6 | 0.30 |
| 8<=n<=40 | 0.23x8/n |

| Limits for Class D equipment | | |
|------------------------------|---|--|
| Harmonics Order n | Max. permissible harmonics current per watt mA/W | Max. permissible harmonics current A |
| Odd Harmonics only | | |
| 3 | 3.4 | 2.30 |
| 5 | 1.9 | 1.14 |
| 7 | 1.0 | 0.77 |
| 9 | 0.5 | 0.40 |
| 11 | 0.35 | 0.33 |
| 13 | 0.30 | 0.21 |
| 15<=n<=39 | 3.85/n | 0.15x15/n |
| | | |
| | | |
| | | |
| | | |

Block Diagram of Test Setup:



Test Procedure:

- a. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.
- b. The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.

Test Result :

| |
|--|
| <input type="checkbox"/> PASS <input type="checkbox"/> FAIL |
| <p>Note: The subject equipment is not intended to be connected to AC mains supply Therefore, this test is not applicable.</p> |

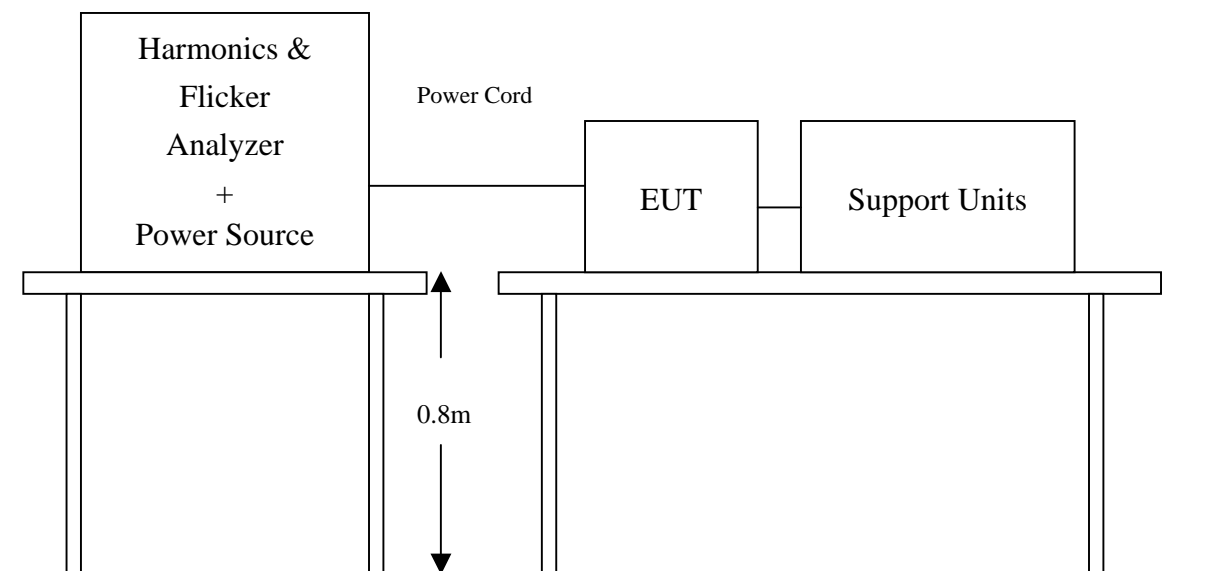
8 POWER VOLTAGE FLUCTUATION / FLICKER TEST

Port : AC Power Port
Basic Standard : EN 61000-3-3 (1995 + A1: 2001)
Limits : §5 of EN 61000-3-3
Tested by : N/A
Temperature : N/A
Humidity : N/A

Limit:

| TEST ITEM | LIMIT | REMARK |
|---------------|-------|--|
| P_{st} | 1.0 | P_{st} means short-term flicker indicator. |
| P_{lt} | 0.65 | P_{lt} means long-term flicker indicator. |
| T_{dt} (ms) | 500 | T_{dt} means maximum time that dt exceeds 3.3 %. |
| d_{max} (%) | 4% | d_{max} means maximum relative voltage change. |
| dc (%) | 3.3% | dc means relative steady-state voltage change |

Block Diagram of Test Setup:





Test Procedure:

- a. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.
- b. During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

Test Result:

| TEST PARAMETER | MEASUREMENT VALUE | LIMIT | RESULT |
|----------------------|----------------------|-------|--------|
| P _{st} | N/A | 1.0 | N/A |
| P _{lt} | N/A | 0.65 | N/A |
| T _{dt} (ms) | N/A | 500 | N/A |
| d _{max} (%) | N/A | 4% | N/A |
| dc (%) | N/A | 3.3% | N/A |

Note: The subject equipment is not intended to be connected to AC mains supply
Therefore, this test is not applicable.

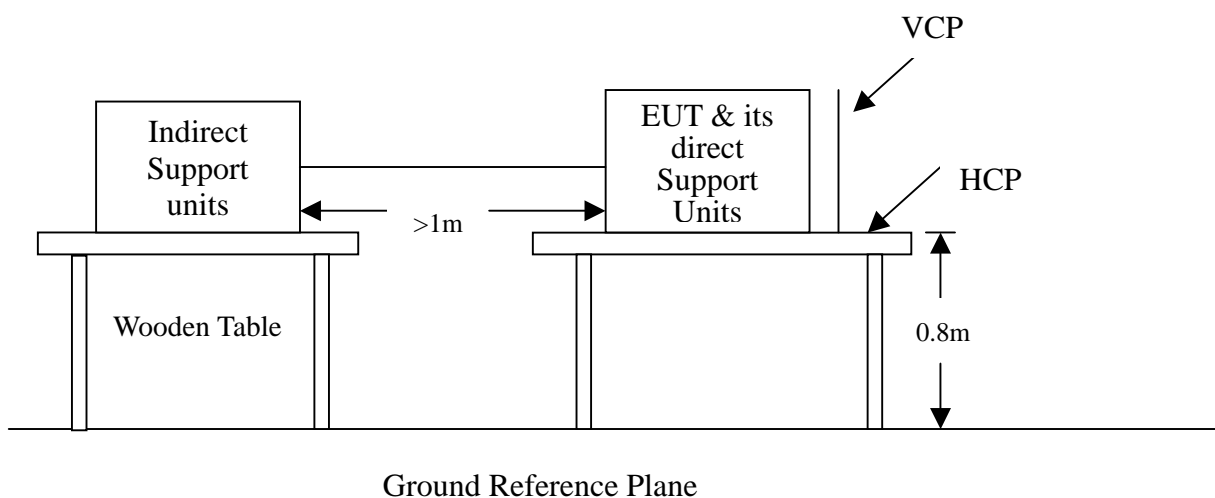
9 ELECTROSTATIC DISCHARGE (ESD) IMMUNITY TEST

10.1 EN 55024

Port : Enclosure
Basic Standard : IEC/EN 61000-4-2
Test Level : ± 8 kV (Air Discharge)
 : ± 4 kV (Contact Discharge)
 : ± 4 kV (Indirect Discharge)
Performance Criterion : B (Standard Required)
Tested by : Jason Lee
Temperature : 17°C
Humidity : 58%
Pressure : 1012mbar

Block Diagram of Test Setup:

(The 470 k ohm resistors are installed per standard requirement.)



Test Procedure:

1. The EUT was located 0.1 m minimum from all sides of the HCP.
2. The indirect support units were located 1 m minimum away from the EUT, but direct support unit was/were located at same location as EUT on the HCP and keep at a distance of 10 cm with EUT.
3. As per the requirement of EN 55024; applying direct contact discharge at the sides other than front of EUT at minimum 50 discharges (25 positive and 25 negative) if applicable, can't be applied direct contact discharge side of EUT then the indirect discharge shall be applied. One of the test points shall be subjected to at least 50 indirect discharge (contact) to the front edge of horizontal coupling plane.
4. Other parts of EUT where it is not possible to perform contact discharge then selecting appropriate points of EUT for air discharge, a minimum of 10 single air discharges shall be applied.
5. The application of ESD to the contact of open connectors is not required.
6. The EUT direct connection units also need to be applied ESD at the port of EUT cable connected.
7. Putting a mark on EUT to show tested points. The following test condition was followed during the tests.

Note: As per IEC/EN 61000-4-2, two 470k bleed resistors cable is connected between the EUT and HCP during the test applicable for power ungrounded or battery operating unit only.

The electrostatic discharges were applied as follows:

| Amount of discharge | Voltage | Coupling | Result (Pass/Fail) |
|---------------------|---------|--------------------------------|--------------------|
| Min. 10 /Point | ± 8 kV | Air Discharge | Pass |
| Min. 25 /Point | ± 4 kV | Contact Discharge | Pass |
| Min. 25 /Point | ± 4 kV | Indirect Discharge HCP (Front) | Pass |
| Min. 25 /Point | ± 4 kV | Indirect Discharge VCP (Right) | Pass |
| Min. 25 /Point | ± 4 kV | Indirect Discharge VCP (Left) | Pass |
| Min. 25 /Point | ± 4 kV | Indirect Discharge VCP (Back) | Pass |

****For the tested points to EUT, please refer to attached page.**
(Blue arrow mark for Contact Discharge and red arrow mark for Air Discharge)

**Performance & Result:**

- ☒ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

☒ **PASS** ☐ **FAIL**

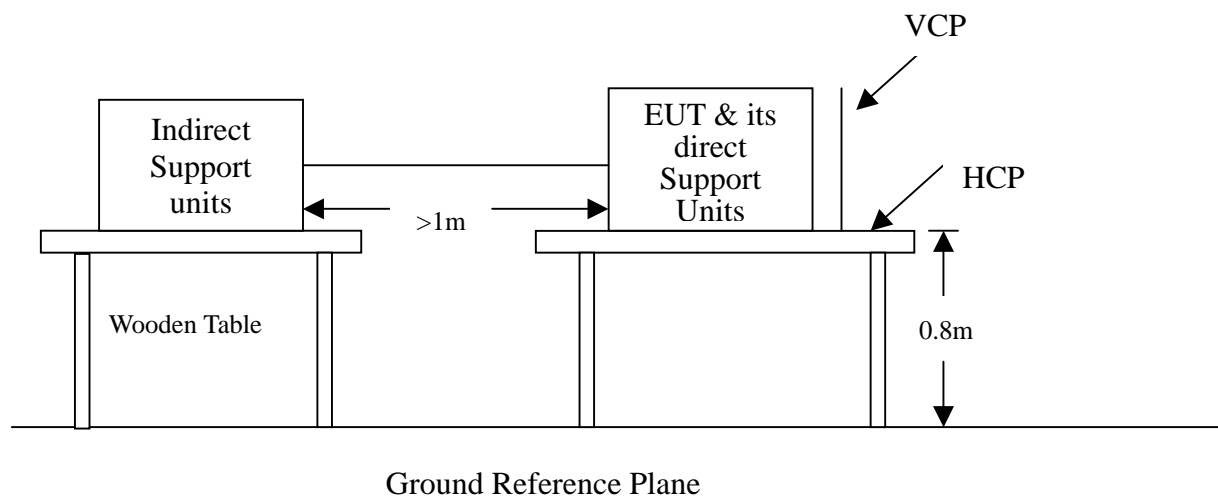
Observation: No function degraded during the tests.

10.2 EN 61000-6-2

Port : Enclosure
Basic Standard : IEC/EN 61000-4-2
Test Level : ± 8 kV (Air Discharge)
 : ± 4 kV (Contact Discharge)
 : ± 4 kV (Indirect Discharge)
Performance Criterion : B (Standard Required)
Tested by : Jason Lee
Temperature : 17°C
Humidity : 58%
Pressure : 1012mbar

Block Diagram of Test Setup:

(The 470 k ohm resistors are installed per standard requirement.)





Test Procedure:

1. The EUT was located 0.1 m minimum from all sides of the HCP.
2. The indirect support units were located 1 m minimum away from the EUT, but direct support unit was/were located at same location as EUT on the HCP and keep at a distance of 10 cm with EUT.
3. A scroll 'H' test program was loaded and executed in Windows XP mode.
4. The EUT sent above message to LCD Panel of Notebook PC at remote side and related peripherals through the test.
5. Active the communication function if the EUT with such port(s).
6. As per the requirement of IEC 61000-4-2; applying direct contact discharge each point at minimum 20 discharges (10 positive and 10 negative) if applicable, for the points can't be applied direct contact discharge then the indirect discharge shall be applied. One of the test points shall be subjected to at least 20 indirect discharge (contact) to the front edge of horizontal coupling plane and each side of EUT via vertical coupling plane .
7. Other parts of EUT where it is not possible to perform contact discharge then selecting appropriate points of EUT for air discharge, a minimum of 20 single air discharges shall be applied.
8. The application of ESD to the contact of open connectors is not required.
9. The EUT direct connection units also need to be applied ESD at the port of EUT cable connected.
10. Putting a mark on EUT to show tested points. The following test condition was followed during the tests.

Note: As per EN 61000-4-2, two 470k bleed resistors cable is connected between the EUT and HCP during the test applicable for power ungrounded or battery operating unit only.

The electrostatic discharges were applied as follows:

| Amount of discharge | Voltage | Coupling | Result (Pass/Fail) |
|---------------------|------------|--------------------------------|--------------------|
| Min. 10 /Point | ± 8 kV | Air Discharge | Pass |
| Min. 10 /Point | ± 4 kV | Contact Discharge | Pass |
| Min. 10 /Point | ± 4 kV | Indirect Discharge HCP (Front) | Pass |
| Min. 10 /Point | ± 4 kV | Indirect Discharge VCP (Right) | Pass |
| Min. 10 /Point | ± 4 kV | Indirect Discharge VCP (Left) | Pass |
| Min. 10 /Point | ± 4 kV | Indirect Discharge VCP (Back) | Pass |

****For the tested points to EUT, please refer to attached page.**
(Blue arrow mark for Contact Discharge and red arrow mark for Air Discharge)

**Performance & Result:**

- ☒ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

**PASS****FAIL****Observation:** No function degraded during the tests.

The Tested Points of EUT***Photo 1 of 5******Photo 2 of 5***



Photo 3 of 5



Photo 4 of 5





Photo 5 of 5

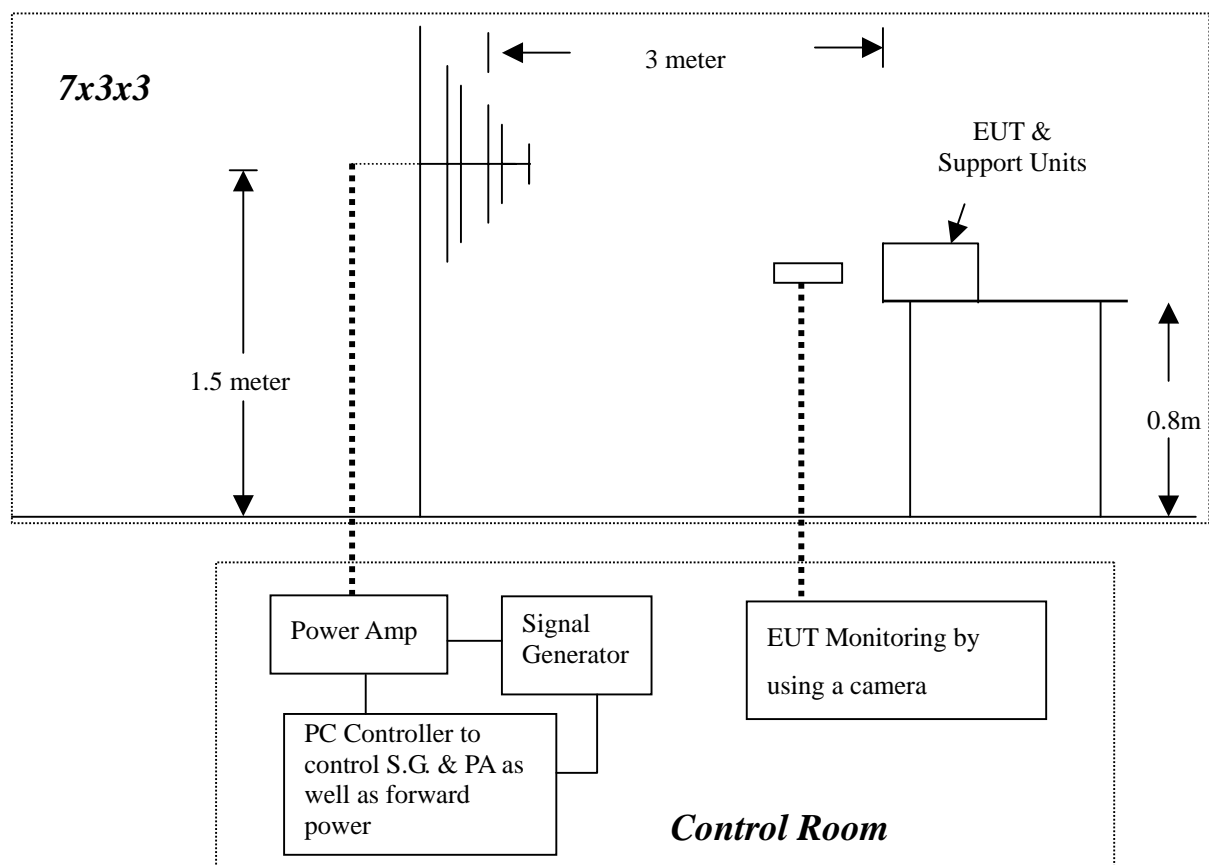


10 RADIATED ELECTROMAGNETIC FIELD IMMUNITY TEST

11.1 EN 55024

Port : Enclosure
Basic Standard : IEC/EN 61000-4-3
Requirements : 3 V/m / with 80% AM. 1kHz Modulation.
Performance Criterion: A (Standard Required)
Tested by : Jason Lee
Temperature : 24°C
Humidity : 68%
Pressure : 1010mbar

Block Diagram of Test Setup:





Test Procedure:

1. The EUT and support units were located at the edge of supporting table keep 3 meter away from transmitting antenna, it just the calibrated square area of field uniformity.
2. Adjusting the cables to be exposed to the electromagnetic field as possible.
3. Performing a Radiated Emission Scan in range of 80 to 1000 MHz prior to do RS test and records the more higher emission frequencies for the reference of RS test, due to antenna effectiveness.
4. Adjusting the monitoring camera to monitor the “H” message as clear as possible.
5. Setting the testing parameters of RS test software per IEC 61000-4-3.
6. Referring to the tested data of step 3 to performing the RS test from 80 to 1000 MHz.
7. Recording the test result in following table.
8. Changing the EUT to the other side and repeat step 3 to 6, until 4 sides of EUT were verified.

IEC 61000-4-3 Final test conditions:

Test level : 3V/m
Steps : 1 % of fundamental
Dwell Time : 3 sec

| Range (MHz) | Field | Modulation | Polarity | Position (°) | Result (Pass/Fail) |
|-------------|-------|------------|----------|--------------|--------------------|
| 80-1000 | 3V/m | Yes | H | Front | Pass |
| 80-1000 | 3V/m | Yes | V | Front | Pass |
| 80-1000 | 3V/m | Yes | H | Right | Pass |
| 80-1000 | 3V/m | Yes | V | Right | Pass |
| 80-1000 | 3V/m | Yes | H | Back | Pass |
| 80-1000 | 3V/m | Yes | V | Back | Pass |
| 80-1000 | 3V/m | Yes | H | Left | Pass |
| 80-1000 | 3V/m | Yes | V | Left | Pass |

**Performance & Result:**

- ☒ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

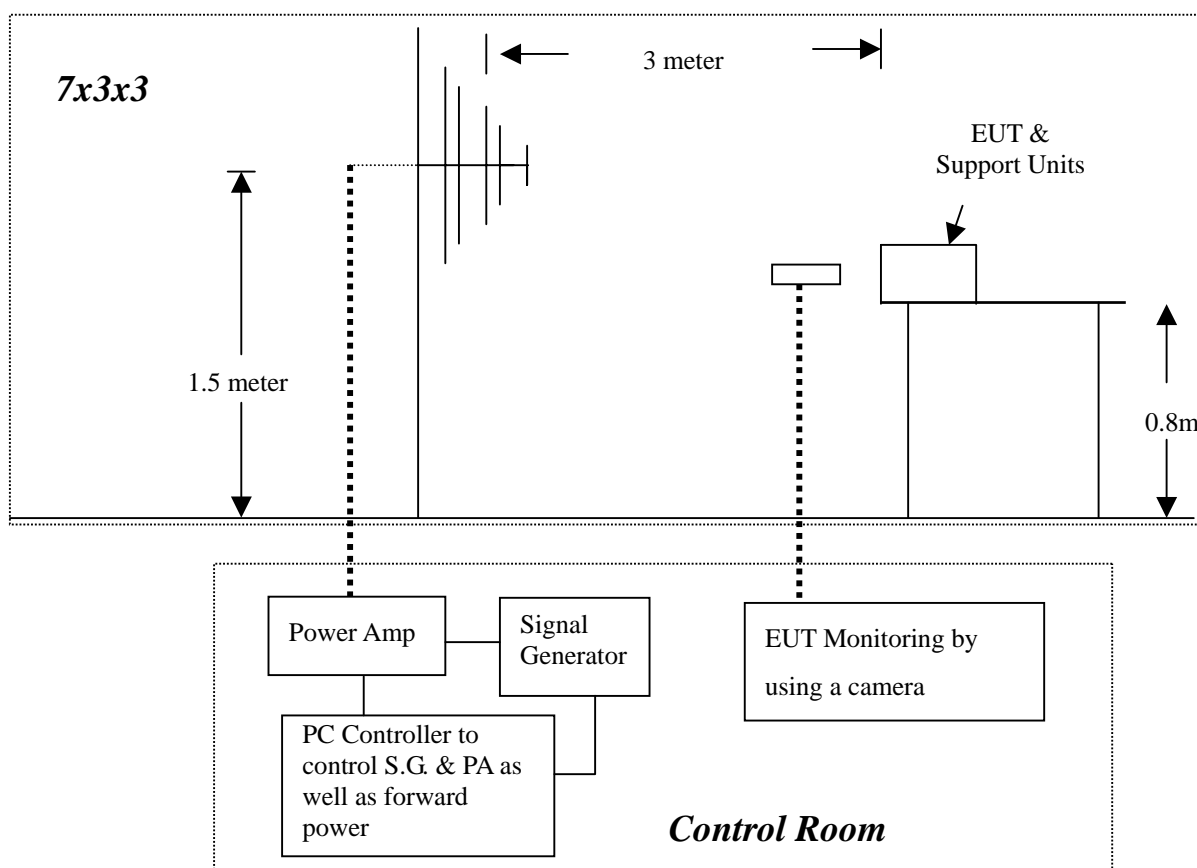
**PASS****FAIL**

Observation: No function degraded during the tests.

11.2 EN 61000-6-2

Port : Enclosure
Basic Standard : IEC/EN 61000-4-3
Requirements : 10 V/m / with 80% AM. 1kHz Modulation.
Performance Criterion: A (Standard Required)
Tested by : Jason Lee
Temperature : 24°C
Humidity : 68%
Pressure : 1010mbar

Block Diagram of Test Setup:



**Test Procedure:**

1. The EUT was located at the edge of supporting table keep 3 meter away from transmitting antenna, it just the calibrated square area of field uniformity. The support units were located outside of the uniformity area, but the cable(s) connected with EUT were exposed to the calibrated field as per IEC/EN 61000-4-3.
2. Set the testing parameters of RS test software per IEC/EN 61000-4-3.
3. From the result of pre-test in step 3, choice the worst side of EUT for final test from 80 MHz to 1000 MHz at 1% steps.
4. Recorded the test result in following table.

Final test conditions:

Test level : 10V/m
Steps : 1 % of fundamental
Dwell Time : 3 sec

| Range (MHz) | Field | Modulation | Polarity | Position | Result (Pass/Fail) |
|-------------|-------|------------|----------|----------|--------------------|
| 80-1000 | 10V/m | Yes | H | Front | Pass |
| 80-1000 | 10V/m | Yes | V | Front | Pass |
| 80-1000 | 10V/m | Yes | H | Right | Pass |
| 80-1000 | 10V/m | Yes | V | Right | Pass |
| 80-1000 | 10V/m | Yes | H | Back | Pass |
| 80-1000 | 10V/m | Yes | V | Back | Pass |
| 80-1000 | 10V/m | Yes | H | Left | Pass |
| 80-1000 | 10V/m | Yes | V | Left | Pass |

**Performance & Result:**

- ☒ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

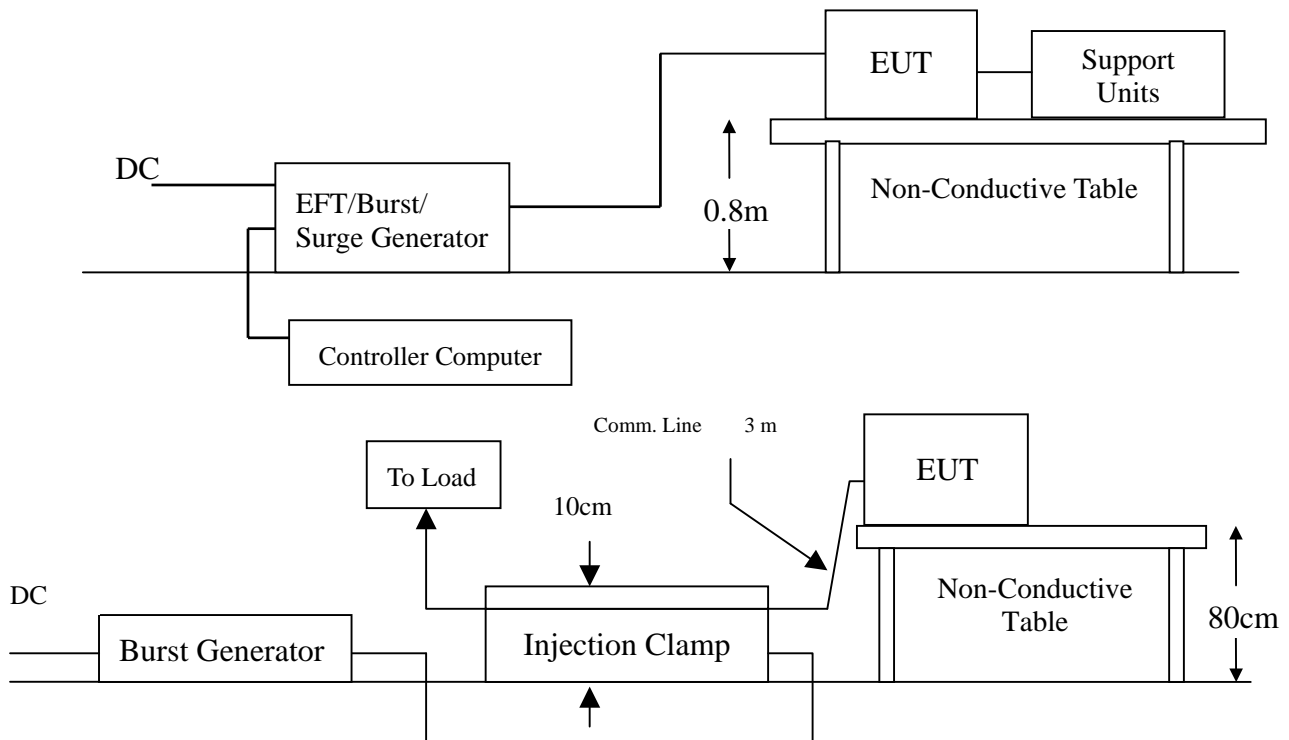
**PASS****FAIL****Observation:** No function degraded during the tests.

11 FAST TRANSIENTS/BURST IMMUNITY TEST

12.1 EN 55024

| | |
|-----------------------------|--|
| Port | : DC Power Port and RJ45 Port |
| Basic Standard | : IEC/EN 61000-4-4 |
| Requirements | : ± 0.5 kV for DC Power Port ± 0.5 kV for RJ45 Port |
| Performance Criteria | : B (Standard Required) |
| Tested by | : Jason Lee |
| Temperature | : 17°C |
| Humidity | : 58% |
| Pressure | : 1012mbar |

Block Diagram of Test Setup:



Test Procedure:

1. The EUT and support units were located on a wooden table 0.8 m away from ground reference plane.
2. A 1.0 meter long power cord was attached to EUT during the test.
3. The length of communication cable between communication port and clamp was keeping within 1 meter.
4. Injected test voltage to the EUT ports from minimum to standard request or client request.
5. Recorded the test result as shown in following table

**Test conditions:**

Impulse Frequency : 5kHz

Tr/Th : 5/50ns

Burst Duration : 15ms

Burst Period : 300ms

| Inject Line | Voltage kV | Inject Method | Result (Pass/Fail) |
|-------------|------------|---------------|--------------------|
| L | ± 0.5 | Direct | Pass |
| N | ± 0.5 | Direct | Pass |
| L + N | ± 0.5 | Direct | Pass |
| RJ45 | ± 0.5 | Clamp | Pass |

Performance & Result:

Criterion A: The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.



Criterion B: The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.



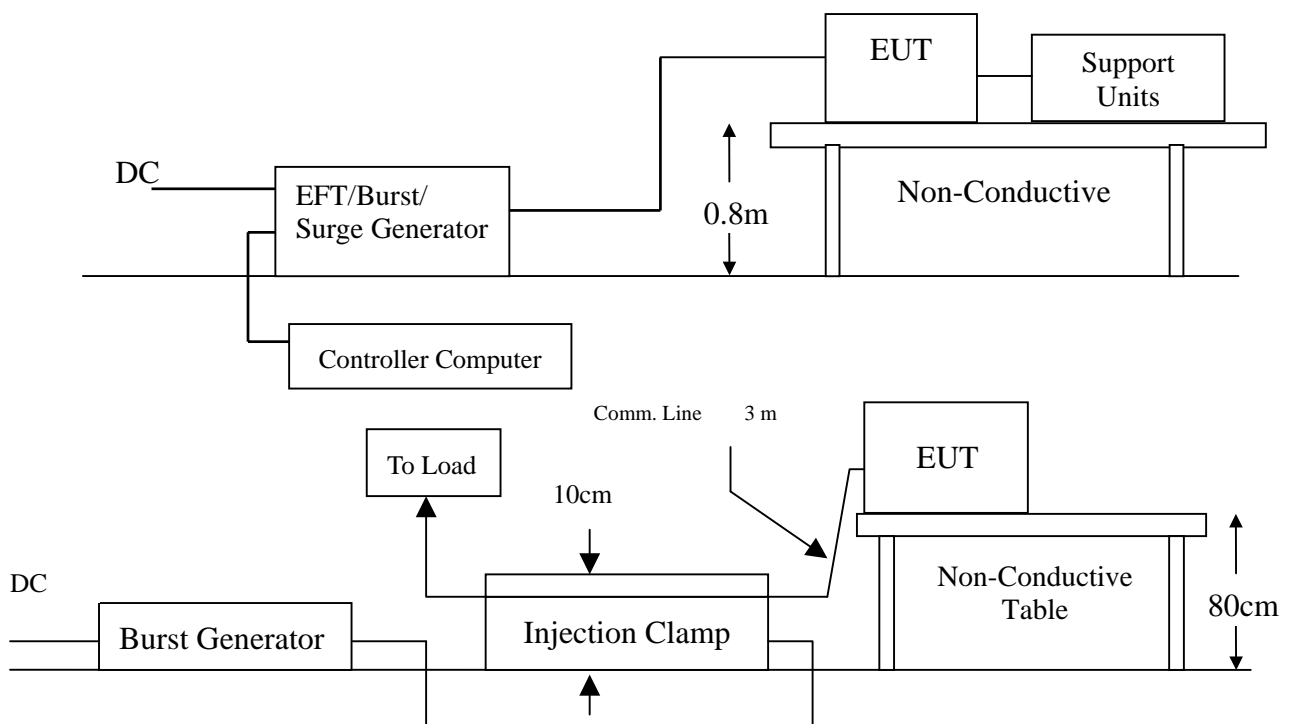
Criterion C: Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

**PASS****FAIL**

Observation: No function degraded during the tests.

12.2 EN 61000-6-2

| | |
|-----------------------------|--|
| Port | : DC Power Port and RJ45 Port |
| Basic Standard | : IEC/EN 61000-4-4 |
| Requirements | : ± 2 kV for DC Power Port ± 1 kV for RJ45 Port |
| Performance Criteria | : B (Standard Required) |
| Tested by | : Jason Lee |
| Temperature | : 17°C |
| Humidity | : 58% |
| Pressure | : 1012mbar |

Block Diagram of Test Setup:**Test Procedure:**

6. The EUT and support units were located on a wooden table 0.8 m away from ground reference plane.
 1. A 1.0 meter long power cord was attached to EUT during the test.
 2. The length of communication cable between communication port and clamp was keeping within 1 meter.
 3. Injected test voltage to the EUT ports from minimum to standard request or client request.
 4. Recorded the test result as shown in following table.

**Test conditions:**

Impulse Frequency : 5kHz
Tr/Th : 5/50ns
Burst Duration : 15ms
Burst Period : 300ms

| Inject Line | Voltage kV | Inject Method | Result (Pass/Fail) |
|-------------|------------|---------------|--------------------|
| L | ± 2 | Direct | Pass |
| N | ± 2 | Direct | Pass |
| L + N | ± 2 | Direct | Pass |
| RJ45 | ± 1 | Clamp | Pass |

Performance & Result:

- ☒ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

☒ **PASS** ☐ **FAIL**

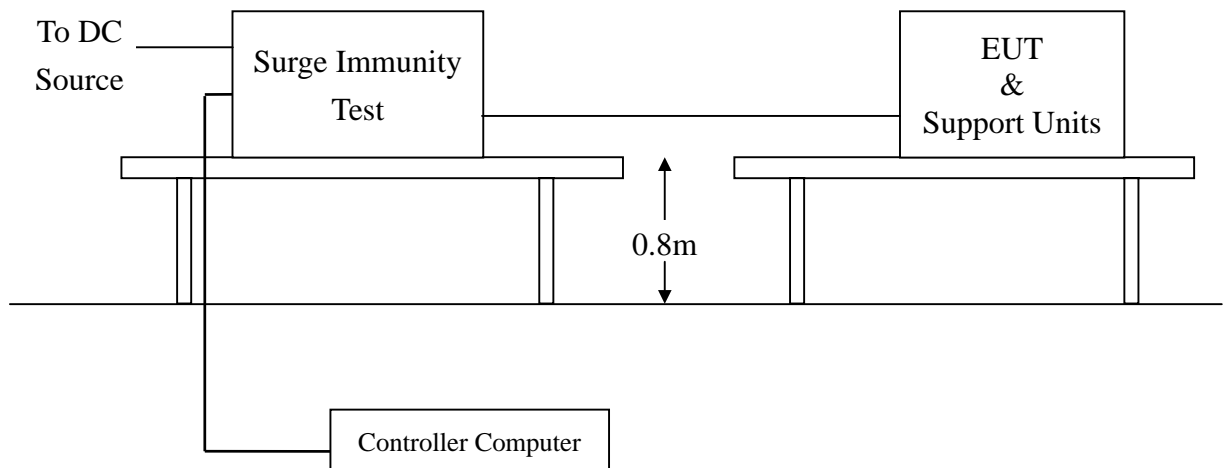
Observation: No function degraded during the tests.

12 SURGE IMMUNITY TEST

13.1 EN 55024

| | |
|-----------------------------|---|
| Port | : DC Power Port |
| Basic Standard | : IEC/EN 61000-4-5 |
| Requirements | : ± 0.5 kV (Line to Line) for DC Power Port |
| Performance Criteria | : B (Standard Required) |
| Tested by | : Jason Lee |
| Temperature | : 17°C |
| Humidity | : 58% |
| Pressure | : 1012mbar |

Block Diagram of Test Setup:



Test Procedure:

1. The EUT and support units were located on a wooden table 0.8 m away from ground floor.
2. Injected test voltage to the EUT ports from minimum to standard request or client request.
3. Recorded the test result as shown in following table.



Test conditions:

Voltage Waveform : 1.2/50 *us*
Current Waveform : 8/20 *us*
Polarity : Positive/Negative
Phase angle : 0°, 90°, 180°, 270°
Number of Test : 5

| Coupling Line | Voltage (kV) | Polarity | Coupling Method | Result (Pass/Fail) |
|---------------|--------------|----------|-----------------|--------------------|
| L1-L2 | 0.5 | Positive | Capacitive | Pass |
| L1-L2 | 0.5 | Negative | Capacitive | Pass |

Performance & Result:

- ☒ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

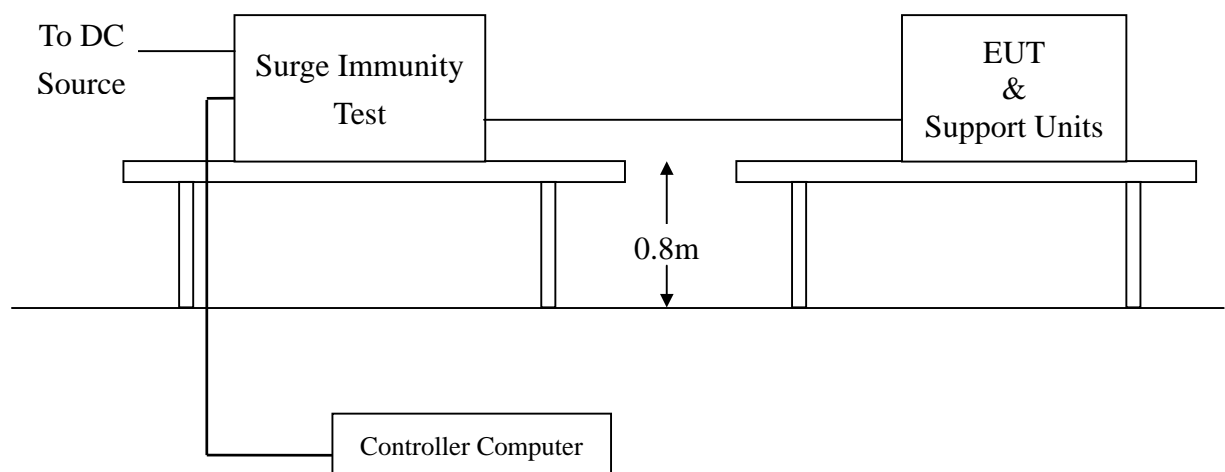
☒ **PASS** ☐ **FAIL**

Observation: Where normal functioning of LAN can't be achieved because of the impact of CDN on the EUT, no test be required.

13.2 EN 61000-6-2

| | |
|-----------------------------|---|
| Port | : DC Power Port |
| Basic Standard | : IEC/EN 61000-4-5 |
| Requirements | : ± 0.5 kV (Line to Line) for DC Power Port |
| Performance Criteria | : B (Standard Required) |
| Tested by | : Jason Lee |
| Temperature | : 17°C |
| Humidity | : 58% |
| Pressure | : 1012mbar |

Block Diagram of Test Setup:



Test Procedure:

1. The EUT and support units were located on a wooden table 0.8 m away from ground floor.
2. Injected test voltage to the EUT ports from minimum to standard request or client request.
3. Recorded the test result as shown in following table.



Test conditions:

Voltage Waveform : 1.2/50 *us*
Current Waveform : 8/20 *us*
Polarity : Positive/Negative
Phase angle : 0°, 90°, 180°, 270°
Number of Test : 5

| Coupling Line | Voltage (kV) | Polarity | Coupling Method | Result (Pass/Fail) |
|---------------|--------------|----------|-----------------|--------------------|
| L1-L2 | 0.5 | Positive | Capacitive | Pass |
| L1-L2 | 0.5 | Negative | Capacitive | Pass |

Performance & Result:

- ☒ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

☒ **PASS** ☐ **FAIL**

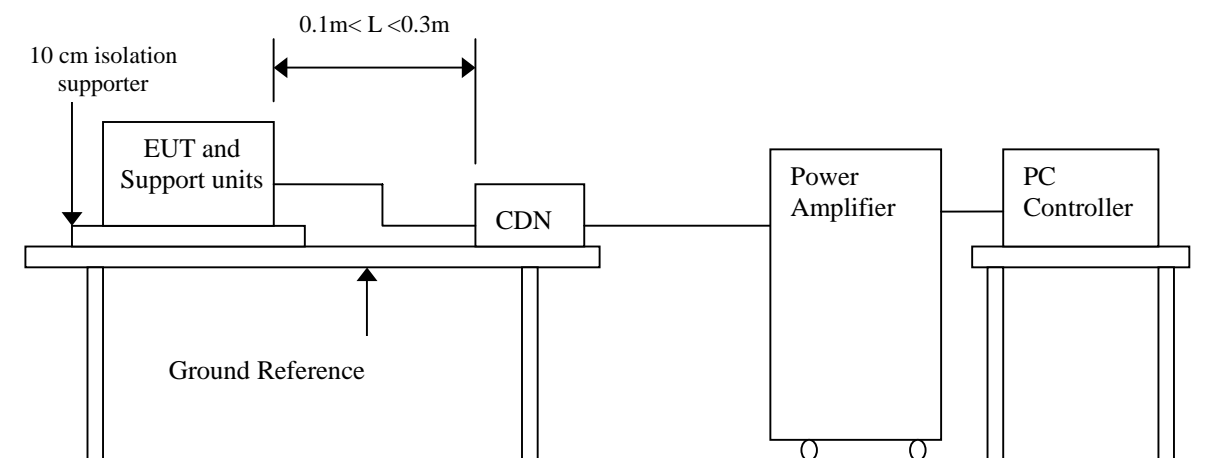
Observation: Where normal functioning of LAN can't be achieved because of the impact of CDN on the EUT, no test be required.

13 CONDUCTED DISTURBANCE/INDUCED RADIO-FREQUENCY FIELD IMMUNITY TEST

14.1 EN 55024

| | |
|------------------------------|--|
| Port | : DC Power Port and RJ45 Port |
| Basic Standard | : IEC/EN 61000-4-6 |
| Requirements | : 3V, with 80% AM. 1kHz Modulation. |
| Injection Method | : CDN-M2 for DC Power Port CDN-T4 for RJ45 Port |
| Performance Criterion | : A (Standard Required) |
| Tested by | : Jason Lee |
| Temperature | : 24°C |
| Humidity | : 68% |
| Pressure | : 1010mbar |

Block Diagram of Test Setup:



Test Procedure:

2. The EUT and support units were located at a ground reference plane with the interposition of a 0.1 m thickness insulating support and the CDN was located on GRP directly.
3. Set the testing parameters of CS test software as per IEC/EN 61000-4-6.
4. Recorded the test result in following table.



Test conditions:

Frequency Range : 0.15MHz-80MHz
Frequency Step : 1% of fundamental
Dwell Time : 3 sec

| Range (MHz) | Field | Modulation | Result (Pass/Fail) |
|-------------|-------|------------|--------------------|
| 0.15-80 | 3V | Yes | Pass |

Performance & Result:

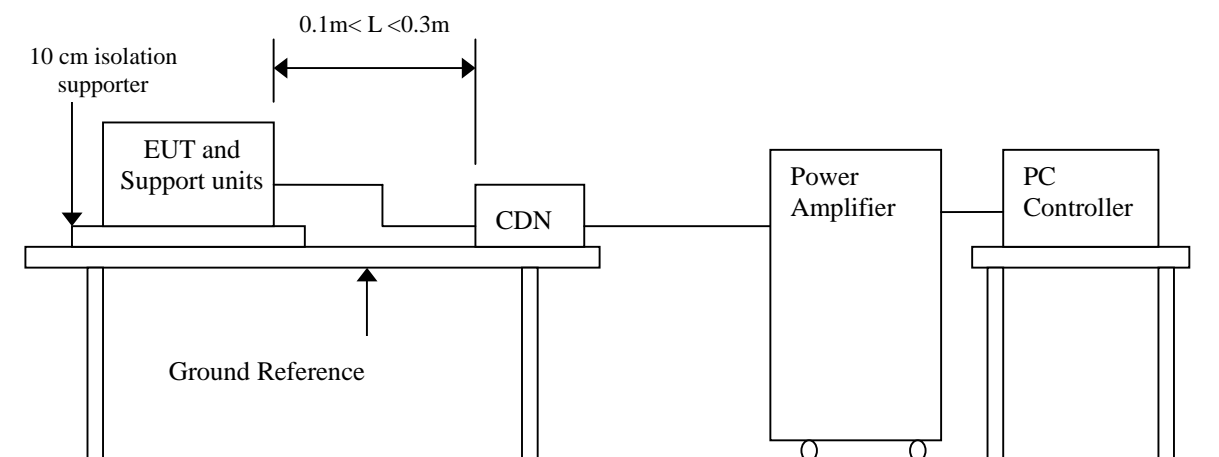
- ☒ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

| |
|--|
| <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL |
| Observation: No function degraded during the tests. |

14.2 EN 61000-6-2

| | |
|------------------------------|--|
| Port | : DC Power Port and RJ45 Port |
| Basic Standard | : IEC/EN 61000-4-6 |
| Requirements | : 10V, with 80% AM. 1kHz Modulation. |
| Injection Method | : CDN-M2 for DC Power Port CDN-T4 for RJ45 Port |
| Performance Criterion | : A (Standard Required) |
| Tested by | : Jason Lee |
| Temperature | : 24°C |
| Humidity | : 68% |
| Pressure | : 1010mbar |

Block Diagram of Test Setup:



Test Procedure:

1. The EUT and support units were located at a ground reference plane with the interposition of a 0.1 m thickness insulating support and the CDN was located on GRP directly.
2. Set the testing parameters of CS test software as per IEC/EN 61000-4-6.
3. Recorded the test result in following table.



Test conditions:

Frequency Range : 0.15MHz-80MHz
Frequency Step : 1% of fundamental
Dwell Time : 3 sec

| Range (MHz) | Field | Modulation | Result (Pass/Fail) |
|-------------|-------|------------|--------------------|
| 0.15-80 | 10V | Yes | Pass |

Performance & Result:

- ☒ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

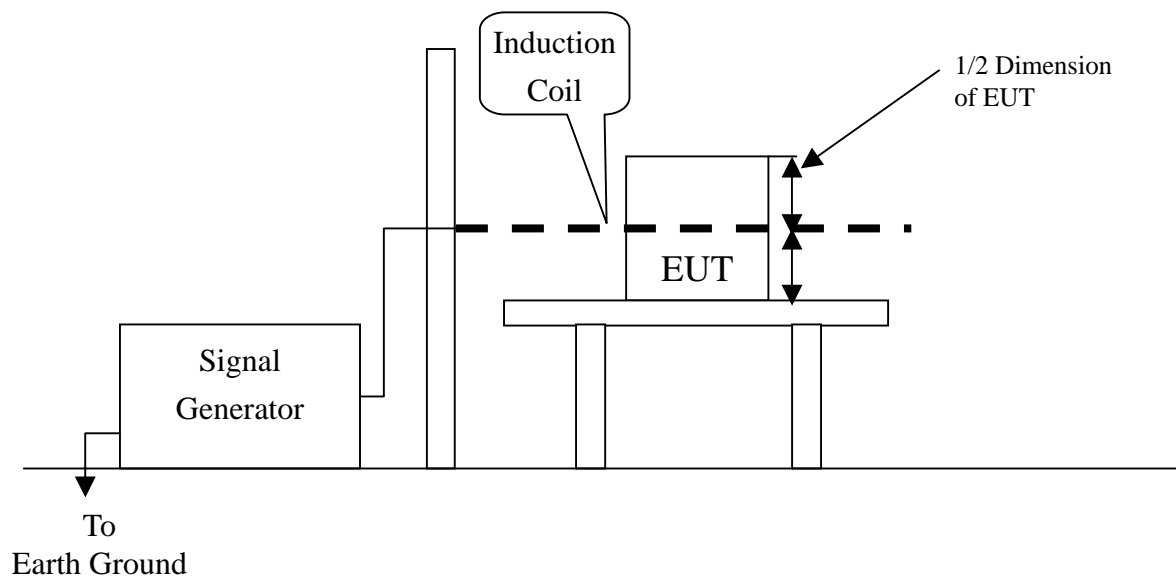
| |
|--|
| <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL |
| Observation: No function degraded during the tests. |

14 POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST

15.1 EN 55024

| | |
|------------------------------|-------------------------|
| Port | : Enclosure |
| Basic Standard | : IEC/EN 61000-4-8 |
| Requirements | : 1 A/m |
| Performance Criterion | : A (Standard Required) |
| Tested by | : N/A |
| Temperature | : N/A |
| Humidity | : N/A |
| Pressure | : N/A |

Block Diagram of Test Setup:



Test Procedure:

1. The EUT and support units were located on Ground Reference Plane with the interposition of a 0.1 m thickness insulation support.
2. Put the induction coil on horizontal direction. (X direction)
3. Recorded the test result as shown in following table.
4. Rotated the induction coil by 90° (Y direction) then repeat step 3.
5. Rotated the induction coil by 90° (Z direction) then repeat step 3.



Test conditions:

Field Strength: 1A/m
Power Freq.: 50Hz
Orientation: X, Y, Z

| Orientation | Field | Result (Pass/Fail) | Remark |
|-------------|-------|--------------------|--------|
| | | | |
| | | | |
| | | | |

Performance & Result:

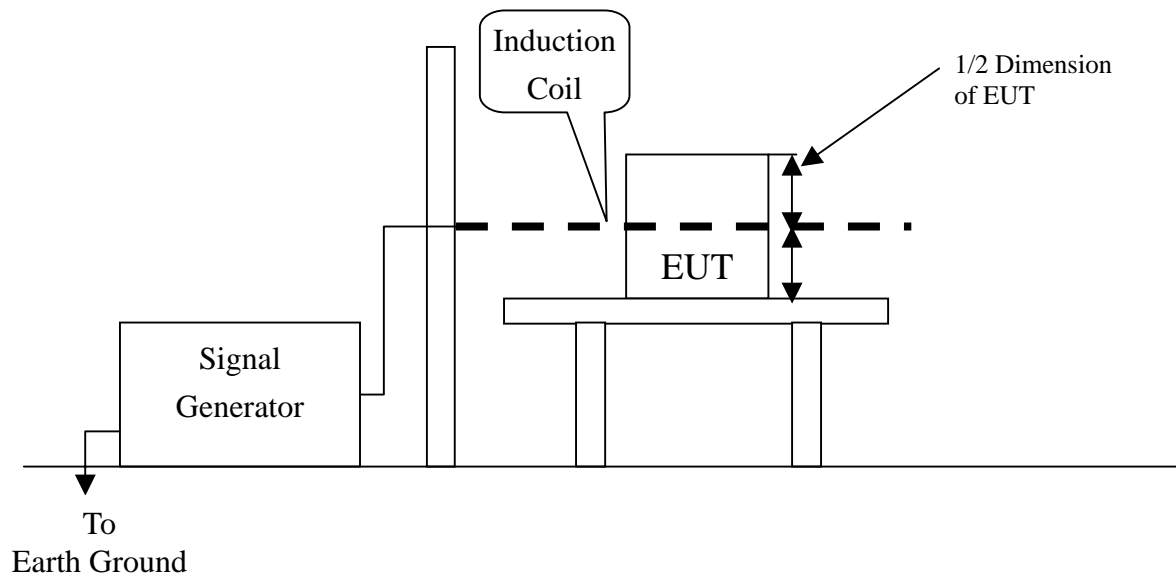
- ☐ **Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- ☐ **Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- ☐ **Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

| |
|---|
| <input type="checkbox"/> PASS <input type="checkbox"/> FAIL |
| Observation: The EUT is not containing any component that is susceptible to a 50 Hz or 60 Hz magnetic field. Therefore, this requirement is not applicable to the EUT. |

15.2 EN 61000-6-2

Port : Enclosure
Basic Standard : IEC/EN 61000-4-8
Requirements : 30 A/m
Performance Criterion : A (Standard Required)
Tested by : Jason Lee
Temperature : 17°C
Humidity : 58%
Pressure : 1012mbar

Block Diagram of Test Setup:



Test Procedure:

1. The EUT and support units were located on Ground Reference Plane with the interposition of a 0.1 m thickness insulation support.
2. Put the induction coil on horizontal direction. (X direction)
3. Recorded the test result as shown in following table.
4. Rotated the induction coil by 90° (Y direction) then repeat step 3.
5. Rotated the induction coil by 90° (Z direction) then repeat step 3.



Test conditions:

Field Strength: 30A/m
Power Freq.: 50Hz; 60Hz
Orientation: X, Y, Z

| Orientation | Field | Result (Pass/Fail) | Remark |
|-------------|-------------|--------------------|--|
| X | 30A/m, 50Hz | Pass | No function degraded during the tests. |
| Y | 30A/m, 50Hz | Pass | No function degraded during the tests. |
| Z | 30A/m, 50Hz | Pass | No function degraded during the tests. |
| X | 30A/m, 60Hz | Pass | No function degraded during the tests. |
| Y | 30A/m, 60Hz | Pass | No function degraded during the tests. |
| Z | 30A/m, 60Hz | Pass | No function degraded during the tests. |

Performance & Result:



Criterion A: The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.



Criterion B: The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.



Criterion C: Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.



PASS



FAIL

Observation: No function degraded during the tests.

15 VOLTAGE DIPS / SHORT INTERRUPTIONS

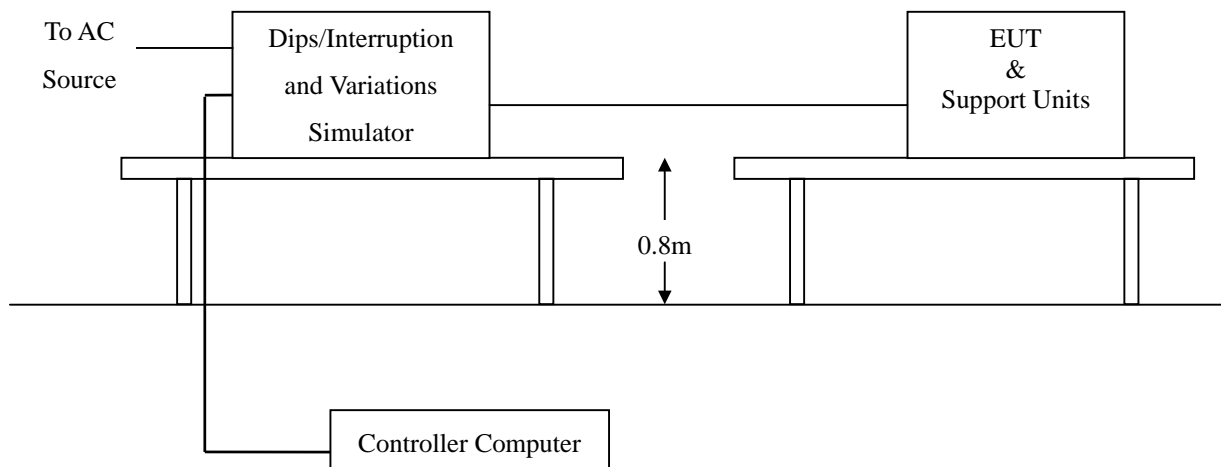
16.1 EN 55024

| | | |
|-----------------------|---|--|
| Port | : | AC Power Port |
| Basic Standard | : | IEC/EN 61000-4-11 |
| Requirement | : | PHASE ANGLE 0, 45, 90, 135, 180, 225, 270, 315 degrees |
| Test Interval | : | Min. 10 sec. |
| Tested by | : | N/A |
| Temperature | : | N/A |
| Humidity | : | N/A |
| Pressure | : | N/A |

| Voltage Dips | Test Level % U_T | Reduction (%) | Duration (periods) | Performance Criterion |
|-----------------|-----------------------|------------------|-------------------------|--------------------------|
| | <5 | >95 | 0.5 | B |
| | 70 | 30 | 25 | C |

| Voltage Interruptions | Test Level % U_T | Reduction (%) | Duration (periods) | Performance Criterion |
|--------------------------|-----------------------|------------------|-------------------------|--------------------------|
| | <5 | >95 | 250 | C |

Block Diagram of Test Setup:



Test Procedure:

1. The EUT and support units were located on a wooden table, 0.8 m away from ground floor.
2. Set the parameter of tests and then Performed the test software of test simulator.
3. Changed Condition to occur at 0 degree crossover point of the voltage waveform.
4. Recorded the test result in test record form.

**Test conditions:**

The duration with a sequence of three dips/interruptions with interval of 10 sec. minimum
(Between each test event)

Voltage Dips:

| Test Level % U _T | Reduction (%) | Duration (periods) | Observation | Meet Performance Criterion |
|--------------------------------|------------------|-----------------------|-------------|----------------------------------|
| 0 | 100 | 0.5 | N/A | N/A |
| 70 | 30 | 25 | N/A | N/A |

Voltage Interruptions:

| Test Level % U _T | Reduction (%) | Duration (periods) | Observation | Meet Performance Criterion |
|--------------------------------|------------------|-----------------------|-------------|----------------------------------|
| 0 | 100 | 250 | N/A | N/A |

Note: "Normal" means no any functions degrade during and after the test.

Performance & Result:

Criterion A: The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.

Criterion B: The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.

Criterion C: Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

☐ **PASS** ☐ **FAIL**

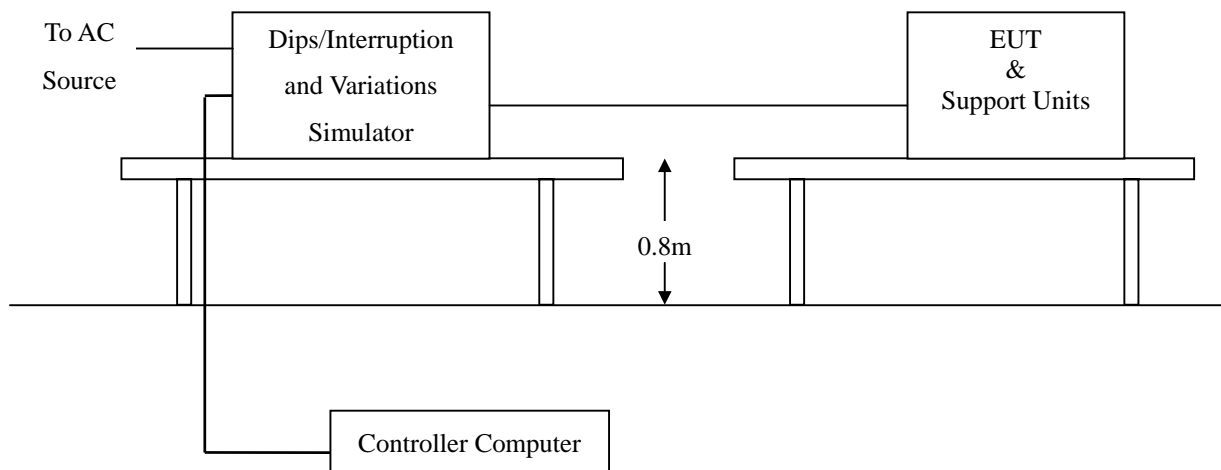
Observation: The subject equipment is not intended to be connected to AC mains supply
Therefore, this test is not applicable.

16.2 EN 61000-6-2

| | | |
|-----------------------|---|--|
| Port | : | AC Power Port |
| Basic Standard | : | IEC/EN 61000-4-11 |
| Requirement | : | PHASE ANGLE 0, 45, 90, 135, 180, 225, 270, 315 degrees |
| Test Interval | : | Min. 10 sec. |
| Tested by | : | N/A |
| Temperature | : | N/A |
| Humidity | : | N/A |
| Pressure | : | N/A |

| Test Level % U _T | Reduction (%) | Duration (Periods) | Performance Criteria |
|--------------------------------|------------------|-----------------------|-------------------------|
| 70 | 30 | 0.5 | B |
| 40 | 60 | 5 | B |
| 40 | 60 | 50 | C |
| < 5 | > 95 | 250 | C |

Block Diagram of Test Setup:



Test Procedure:

1. The EUT and support units were located on a wooden table, 0.8 m away from ground floor.
2. Set the parameter of tests and then Performed the test software of test simulator.
3. Changed Condition to occur at 0 degree crossover point of the voltage waveform.
4. Recorded the test result in test record form.



Test conditions:

The duration with a sequence of three dips/interruptions with interval of 10 s minimum
(Between each test event)

| Test Level % U _T | Reduction (%) | Duration (periods) | Observation | Meet Performance Criteria |
|--------------------------------|------------------|-----------------------|-------------|---------------------------------|
| 70 | 30 | 0.5 | N/A | N/A |
| 40 | 60 | 5 | N/A | N/A |
| 40 | 60 | 50 | N/A | N/A |
| < 5 | > 95 | 250 | N/A | N/A |

Normal: No any functions degrade during and after the test.

Performance & Result:

- Criterion A:** The apparatus continues to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance.
- Criterion B:** The apparatus continues to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed.
- Criterion C:** Temporary loss of function is allowed, provided the functions self recoverable or can be restored by the operation of controls.

| |
|---|
| <input type="checkbox"/> PASS <input type="checkbox"/> FAIL |
| Observation: The subject equipment is not intended to be connected to AC mains supply Therefore, this test is not applicable. |

APPENDIX I - PHOTOGRAPHS OF TEST SETUP

RADIATED EMISSION TEST (EN 55022)



RADIATED EMISSION TEST (EN 55011)





ELECTROSTATIC DISCHARGE TEST



RADIATED ELECTROMAGNETIC FIELD TEST



FAST TRANSIENTS/BURST TEST



(IEC 61000-4-4 FOR I/O)



SURGE IMMUNITY TEST



CONDUCTED DISTURBANCE, INDUCED BY RADIO-FREQUENCY FIELDS TEST



(IEC 61000-4-6 FOR I/O)



POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST

