# Certificate

Issue Date: December 12, 2012
Ref. Report No. ISL-12HE327CE

| | | |
|---|---|---|
| Product Name | : | Network Attached Storage |
| Model(s) | : | TS-420U; TS-421U; TS-420U II; TS-421U II; NAS-420UG; NAS-421UG |
| Responsible Party | : | QNAP Systems, Inc. |
| Address | : | 2F, No.22, Zhongxing Rd., Xizhi Dist., New Taipei City 221, Taiwan |

We, **International Standards Laboratory**, hereby certify that:

The device bearing the trade name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in European Council Directive- EMC Directive 2004/108/EC. The device was passed the test performed according to :

CE

**Standards:**

EN 55022: 2010 and CISPR 22: 2008 (modified)
EN 61000-3-2: 2006+A1:2009 +A2:2009 and IEC 61000-3-2: 2005+A1:2008 +A2:2009
EN 61000-3-3: 2008 and IEC 61000-3-3: 2008
EN 55024: 2010 and CISPR 24: 2010
EN 61000-4-2: 2009 and IEC 61000-4-2: 2008
EN 61000-4-3: 2006+A1: 2008 +A2: 2010 and
IEC 61000-4-3:2006+A1: 2007+A2: 2010
EN 61000-4-4: 2004 +A1:2010 and IEC 61000-4-4: 2004 +A1:2010
EN 61000-4-5: 2006 and IEC 61000-4-5: 2005
EN 61000-4-6: 2009 and IEC 61000-4-6: 2008
EN 61000-4-8: 2010 and IEC 61000-4-8: 2009
EN 61000-4-11: 2004 and IEC 61000-4-11: 2004

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

**International Standards Laboratory**

Jim Chu / Director

☒ **Hsi-Chih LAB**:
No. 65, Gu Dai Keng St., Hsichih District,
New Taipei City 22179, Taiwan
Tel: 886-2-2646-2550; Fax: 886-2-2646-4641

Nemko
ELA113A

# CE MARK TECHNICAL FILE

# AS/NZS EMC CONSTRUCTION FILE

of

Product Name

## Network Attached Storage

Model

## TS-420U; TS-421U; TS-420U II; TS-421U II; NAS-420UG; NAS-421UG

Contains:

1. Declaration of Conformity
2. EN55022/CISPR 22, AS/NZS CISPR 22 EMI test report
3. EN55024/CISPR 24, EN61000-3-2 / IEC 61000-3-2, and EN61000-3-3 / IEC 61000-3-3 test report
4. Certificate of EN60950-1
5. Block Diagram and Schematics
6. Users' manual

# Declaration of Conformity

| | |
|---|---|
| Name of Responsible Party: | QNAP Systems, Inc. |
| Address of Responsible Party: | 2F, No.22, Zhongxing Rd., Xizhi Dist., New Taipei City 221, Taiwan |
| Declares that product: | Network Attached Storage |
| Model: | TS-420U; TS-421U; TS-420U II; TS-421U II; NAS-420UG; NAS-421UG |
| Assembled by: | Same as above |
| Address: | Same as above |

Conforms to the EMC Directive 2004/108/EC as attested by conformity with the following harmonized standards:

EN 55022:2010, CISPR 22:2008 (modified) and AS/NZS CISPR 22: 2009: Limits and methods of measurement of Radio Interference characteristics of Information Technology Equipment.
EN 55024:2010 and CISPR 24:2010: Information technology equipment-Immunity characteristics - Limits and methods of measurement.

| Standard | Description | Results | Criteria |
|---|---|---|---|
| EN 61000-4-2:2009<br>IEC 61000-4-2:2008 | Electrostatic Discharge | Pass | B |
| EN 61000-4-3:2006+A1:2008 +A2:2010<br>IEC 61000-4-3:2006+A1:2007+A2:2010 | Radio-Frequency, Electromagnetic Field | Pass | A |
| EN 61000-4-4: 2004 +A1:2010<br>IEC 61000-4-4: 2004 +A1:2010 | Electrical Fast Transient/Burst | Pass | B |
| EN 61000-4-5: 2006<br>IEC 61000-4-5: 2005 | Surge | Pass | B |
| EN 61000-4-6:2009<br>IEC 61000-4-6:2008 | Conductive Disturbance | Pass | A |
| EN 61000-4-8:2010<br>IEC 61000-4-8:2009 | Power Frequency Magnetic Field | Pass | A |
| EN 61000-4-11: 2004<br>IEC 61000-4-11: 2004 | Voltage Dips / Short Interruption and Voltage Variation | | |
| | >95% in 0.5 period | Pass | B |
| | 30% in 25 period | Pass | C |
| | >95% in 250 period | Pass | C |

| Standard | Description | Results |
|---|---|---|
| EN 61000-3-2: 2006 +A1:2009 +A2:2009<br>IEC 61000-3-2: 2005 +A1:2008 +A2:2009 | Limits for harmonics current emissions | Pass |
| EN 61000-3-3: 2008<br>IEC 61000-3-3: 2008 | Limits for voltage fluctuations and flicker in low-voltage supply systems. | Pass |

<to be continued>

Conforms to the Low Voltage Directive 2006/95/EC, 93/68/EEC as attested by conformity with the following harmonized standard:

EN60950-1:2006+A11:2009+A1:2010+A12:2011: Safety of Information Technology Equipment Including electrical business equipment

*We, QNAP Systems, Inc., hereby declare that the equipment bearing the trade name and model number specified above was tested conforming to the applicable Rules under the most accurate measurement standards possible, and that all the necessary steps have been taken and are in force to assure that production units of the same equipment will continue to comply with the requirements.*

---
QNAP Systems, Inc.

**Date: December 12, 2012**

# Declaration of Conformity

| | |
|---|---|
| Name of Responsible Party: | QNAP Systems, Inc. |
| Address of Responsible Party: | 2F, No.22, Zhongxing Rd., Xizhi Dist., New Taipei City 221, Taiwan |
| Declares that product: | Network Attached Storage |
| Model: | TS-420U; TS-421U; TS-420U II; TS-421U II; NAS-420UG; NAS-421UG |
| Assembled by: | Same as above |
| Address: | Same as above |

Conforms to the C-Tick Mark requirement as attested by conformity with the following standards:

EN 55022:2010, CISPR 22:2008 (modified) and AS/NZS CISPR 22: 2009: Limits and methods of measurement of Radio Interference characteristics of Information Technology Equipment.
EN 55024:2010 and CISPR 24:2010: Information technology equipment-Immunity characteristics - Limits and methods of measurement.

| Standard | Description | Results | Criteria |
|---|---|---|---|
| EN 61000-4-2:2009<br>IEC 61000-4-2:2008 | Electrostatic Discharge | Pass | B |
| EN 61000-4-3:2006+A1:2008 +A2:2010<br>IEC 61000-4-3:2006+A1:2007+A2:2010 | Radio-Frequency, Electromagnetic Field | Pass | A |
| EN 61000-4-4: 2004 +A1:2010<br>IEC 61000-4-4: 2004 +A1:2010 | Electrical Fast Transient/Burst | Pass | B |
| EN 61000-4-5: 2006<br>IEC 61000-4-5: 2005 | Surge | Pass | B |
| EN 61000-4-6:2009<br>IEC 61000-4-6:2008 | Conductive Disturbance | Pass | A |
| EN 61000-4-8:2010<br>IEC 61000-4-8:2009 | Power Frequency Magnetic Field | Pass | A |
| EN 61000-4-11: 2004<br>IEC 61000-4-11: 2004 | Voltage Dips / Short Interruption and Voltage Variation | | |
| | >95% in 0.5 period | Pass | B |
| | 30% in 25 period | Pass | C |
| | >95% in 250 period | Pass | C |

<*to be continued*>

| Standard | Description | Results |
|---|---|---|
| EN 61000-3-2: 2006 +A1:2009 +A2:2009<br>IEC 61000-3-2: 2005 +A1:2008 +A2:2009 | Limits for harmonics current emissions | Pass |
| EN 61000-3-3: 2008<br>IEC 61000-3-3: 2008 | Limits for voltage fluctuations and flicker in low-voltage supply systems. | Pass |

*We, QNAP Systems, Inc., hereby declare that the equipment bearing the trade name and model number specified above was tested conforming to the applicable Rules under the most accurate measurement standards possible, and that all the necessary steps have been taken and are in force to assure that production units of the same equipment will continue to comply with the requirements.*

---
QNAP Systems, Inc.

**Date: December 12, 2012**

# CE TEST REPORT

of

## EN55022 / CISPR 22 / AS/NZS CISPR 22
## Class A
## EN55024 / CISPR 24 / IMMUNITY
## EN61000-3-2 / EN61000-3-3

Product : **Network Attached Storage**

Model(s): **TS-420U; TS-421U; TS-420U II; TS-421U II; NAS-420UG; NAS-421UG**

Applicant: **QNAP Systems, Inc.**

Address: **2F, No.22, Zhongxing Rd., Xizhi Dist., New Taipei City 221, Taiwan**

Test Performed by:


**International Standards Laboratory**
<Hsi-Chih LAB>
*Site Registration No.
BSMI:SL2-IN-E-0037; SL2-R1/R2-E-0037; TAF: 1178
FCC: TW1067; IC: IC4067A-1; NEMKO: ELA 113A
VCCI: <Conduction01>C-354, T-1749, <OATS01>R-341,
<Chamber01>G-443
*Address:
No. 65, Gu Dai Keng St.
Hsichih District, New Taipei City 22179, Taiwan
*Tel: 886-2-2646-2550; Fax: 886-2-2646-4641


Report No.: **ISL-12HE327CE**
Issue Date : **December 12, 2012**

This report totally contains 56 pages including this cover page and contents page.

## Contents of Report

# 1. General

## 1.1 Certification of Accuracy of Test Data

| | |
|---|---|
| **Standards:** | Please refer to 1.2 |
| **Equipment Tested:** | Network Attached Storage |
| **Model:** | TS-420U; TS-421U; TS-420U II; TS-421U II; NAS-420UG; NAS-421UG |
| **Applicant:** | QNAP Systems, Inc. |
| **Sample received Date:** | December 5, 2012 |
| **Final test Date:** | EMI:refer to the date of test data<br>EMS: December 12, 2012 |
| **Test Site:** | International Standards Laboratory<br>OATS 01; Chamber 01; Conduction 01; Immunity01 |
| **Test Distance:** | 10M; 3M (above1GHz) (EMI test) |
| **Temperature:** | refer to each site test data |
| **Humidity:** | refer to each site test data |
| **Input power:** | Conduction input power: AC 230 V / 50 Hz<br>Radiation input power: AC 230 V / 50 Hz<br>Immunity input power: AC 230 V / 50 Hz |
| **Test Result:** | **PASS** |
| **Report Engineer:** | Maggy Han |
| **Test Engineer:** | EDDIE CHUNG<br>Eddie Chung |
| **Approved By:** | Eddy Hsiung<br>Eddy Hsiung |

## 1.2 Test Standards

The tests which this report describes were conducted by an independent electromagnetic compatibility consultant, International Standards Laboratory in accordance with the following

EN 55022:2010, CISPR 22:2008 (modified) and AS/NZS CISPR 22: 2009: Class A: Limits and methods of measurement of Radio Interference characteristics of Information Technology Equipment.
EN 55024:2010 and CISPR 24:2010: Information technology equipment-Immunity characteristics - Limits and methods of measurement.

| Standard | Description | Results | Criteria |
|---|---|---|---|
| EN 61000-4-2:2009<br>IEC 61000-4-2:2008 | Electrostatic Discharge | Pass | B |
| EN 61000-4-3:2006+A1:2008 +A2:2010<br>IEC 61000-4-3:2006+A1:2007+A2:2010 | Radio-Frequency, Electromagnetic Field | Pass | A |
| EN 61000-4-4: 2004 +A1:2010<br>IEC 61000-4-4: 2004 +A1:2010 | Electrical Fast Transient/Burst | Pass | B |
| EN 61000-4-5: 2006<br>IEC 61000-4-5: 2005 | Surge | Pass | B |
| EN 61000-4-6:2009<br>IEC 61000-4-6:2008 | Conductive Disturbance | Pass | A |
| EN 61000-4-8:2010<br>IEC 61000-4-8:2009 | Power Frequency Magnetic Field | Pass | A |
| EN 61000-4-11: 2004<br>IEC 61000-4-11: 2004 | Voltage Dips / Short Interruption and Voltage Variation | | |
| | >95% in 0.5 period | Pass | B |
| | 30% in 25 period | Pass | C |
| | >95% in 250 period | Pass | C |

| Standard | Description | Results |
|---|---|---|
| EN 61000-3-2: 2006 +A1:2009 +A2:2009<br>IEC 61000-3-2: 2005 +A1:2008 +A2:2009 | Limits for harmonics current emissions | Pass |
| EN 61000-3-3: 2008<br>IEC 61000-3-3: 2008 | Limits for voltage fluctuations and flicker in low-voltage supply systems. | Pass |

### 1.2.1 Criteria for Compliance: EN 55024

**Performance criterion A**
During and after the test the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a minimum performance level specified by the manufacturer when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.

**Performance criterion B**
After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.

**Performance criterion C**
During and after testing, a temporary loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls or cycling of the power to the EUT by the user in accordance with the manufacturer's instructions.
Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

### 1.3 Description of EUT

# EUT

| | |
|---|---|
| Product Name | Network Attached Storage |
| Condition | Pre-Production |
| Model Number(s) | TS-420U; TS-421U; TS-420U II; TS-421U II; NAS-420UG; NAS-421UG |
| Serial Number | N/A |
| Power Supply | DELTA (Model: DPS-250AB-44 D)<br>AC input: 100-240V, 47-63Hz , 3.5A<br>DC output:<br>+3.3V, 6A<br>+5VSB, 2A<br>+5V, 12A<br>+12V, 17A<br>-12V, 0.5A<br>Total output wattage: 240W MAX. |
| CPU1 | MARVELL 88F6282 2.0GHz |
| CPU2 | MARVELL 88F6282 1.6GHz |
| Motherboard | Model: TS-419U II V2.0 |
| SATA board | Model: TS-419U II BP QU89 V2.0 |
| LED board | Model: 20Z20-A00125-RS V1.00 |
| SATA Hard Disk1 | Western Digital (Model: WD5000AADS-00S9B0) 500GB x2 |
| SATA Hard Disk2 | Western Digital (Model: WD5000AZRX-00A8LBO) 500GB x2 |
| Power button | one |
| Backup button | one |
| USB 2.0 Port | two 5-pin |
| USB 3.0 Port | two 9-pin |
| E-SATA Port | two 7-pin |
| RJ45 Port | two 8-pin (10/100/1000M bps) |
| AC Power Port | one |
| Maximum Operating Frequency | 5GHz |

All types of EUT have been tested. We present the worst case test data (Configurations: 1) in the report. The test configurations are listed below:

Configurations:

| **Configurations** | **MODEL** | **CPU** |
|---|---|---|
| 1 | TS-421U | CPU 1 |
| 2 | TS-420U | CPU 2 |

**Telecom** test configurations are listed below:

| Configurations | Speed |
|---|---|
| RJ45 port 1 | 10/100/1000Mbps |
| RJ45 port 2 | 10/100/1000Mbps |

**EMI Noise Source**

| | |
|---|---|
| **Motherboard Crystal** | 25MHz (Y1) |
| | 25MHz (Y2) |
| | 25MHz (Y3) |
| | 12MHz(Y4) |
| | 32.768Hz (Y5) |
| | 25MHz (Y6) |
| **SATA Board Crystal** | 25MHz (Y1) |

**EMI Solution**

| |
|---|
| N/A |

**Model difference**

| **Model** | **Package** | **Selling Markets** |
|---|---|---|
| TS-420U | Color standard Box (Model Name difference) | General storage related products supply chain management |
| TS-421U | Color standard Box (Model Name difference) | Business storage related products supply chain management |
| TS-420U II | Color standard Box (Model Name difference) | Large video storage related products supply chain management |
| TS-421U II | Color standard Box (Model Name difference) | Business video storage related products supply chain management |
| NAS-420U G | Brown Box (NO QNAP Logo, Model Name Label difference) | General storage related products cooperative project |
| NAS-421U G | Brown Box (NO QNAP Logo, Model Name Label difference) | Business storage related products cooperative project |

## 1.4 Description of Support Equipment

| Unit | Model<br>Serial No. | Brand | Power Cord | FCC ID |
|---|---|---|---|---|
| Notebook Personal Computer | Latitude D400<br>S/N: N/A | DELL | Non-shielded, Detachable | FCC DOC |
| Rack mountable Switch | DGS-1008D | D-Link | Non-Shielded, Detachable | FCC DOC |
| USB2.0 External HDD Enclosure*2 | Ipod nano<br>S/N: N/A | Apple | N/A | FCC DOC |
| USB3.0 External HDD Enclosure*2 | WDBACY5000ABK-PESN<br>S/N: XH1E31FSV80 | WD | Non-Shielded, Detachable | FCC DOC |
| E-SATA Hard Disk*2 | NST-200SU-BK | Vantec | Non-shielded, Detachable | FCC DOC |

## 1.5 Software for Controlling Support Unit

Test programs exercising various part of EUT were used. The programs were executed as follows:

A. Read and write to the disk drives.
B. Send package to the Router LAN port (Router).
C. Receive and transmit package of EUT to the Rack mountable Switch HUB through LAN port.
D. Used Tfgen.exe to send signal to EUT RJ45 port through PC RJ45 Port.
E. Read and write data in the USB2.0 Hard Disk through EUT USB2.0 port.
F. Read and write data in the E-SATA Hard Disk through EUT E-SATA port.
G. Search External HDD from PC RJ45 to EUT RJ45 with Finder.exe.
H. Repeat the above steps.

| | Filename | Issued Date |
|---|---|---|
| USB2.0 External HDD Enclosure | InterEMC.exe | 9/04/2000 |
| USB3.0 External HDD Enclosure | InterEMC.exe | 9/04/2000 |
| E-SATA External Hard Disk | InterEMC.exe | 9/04/2000 |
| LAN | ping.exe | 05/05/1999 |
| LAN | Tfgen.exe | 06/23/1999 |
| EUT | Finder.exe | 11/15/2008 |
| EUT Hard Disk | InterEMC.exe | 9/04/2000 |

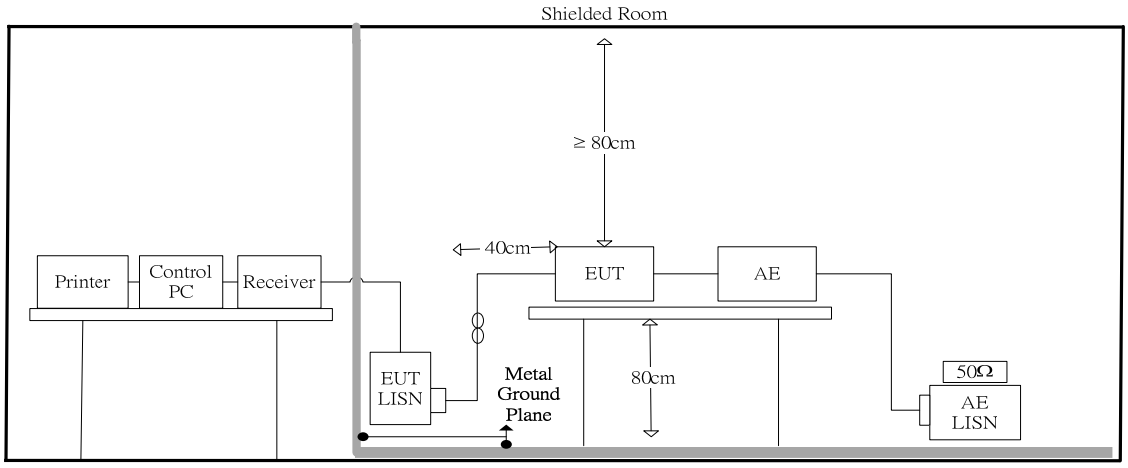
## 1.6 I/O Cable Condition of EUT and Support Units

| Description | Path | Cable Length | Cable Type | Connector Type |
|---|---|---|---|---|
| AC Power Cord | 110V (~240V) to EUT SPS | 1.8M | Non-shielded, Detachable | Plastic Head |
| USB2.0 Data Cable*2 | USB2.0 External HDD Enclosure to EUT USB 2.0Port | 1M | Shielded, Detachable | Metal Head |
| USB3.0 Data Cable*2 | External HDD Enclosure USB Port to EUT USB 3.0Port | 1.0M | Shielded, Detachable | Metal Head |
| E-SATA Data Cable*2 | External Hard Disk E-SATA Port to EUT E-SATA Port | 1.0M | Shielded, Detachable | Metal Head |
| LAN Data Cable | NB LAN port to Switch HUB RJ-45 Port | 1.0M | Non-shielded, Detachable | RJ-45, with Plastic Head |
| LAN Data Cable*2 | EUT LAN Port to Switch HUB RJ-45 Port | 10M | Non-shielded, Detachable | RJ-45, with Plastic Head |

# 2. Power Main Port Conducted Emissions

## 2.1 Test Setup and Procedure

### 2.1.1 Test Setup




### 2.1.2 Test Procedure

The measurements are performed in a 3.5m x 3.4m x 2.5m shielded room, which referred as Conduction 01 test site, or a 3m x 3m x 2.3m test site, which referred as Conduction 02 test site. The EUT was placed on non-conduction 1.0m x 1.5m table, which is 0.8 meters above an earth-grounded.

Power to the EUT was provided through the LISN which has the Impedance (50ohm/50uH) vs. Frequency Characteristic in accordance with the standard. Power to the LISNs were filtered to eliminate ambient signal interference and these filters were bonded to the ground plane. Peripheral equipment required to provide a functional system (support equipment) for EUT testing was powered from the second LISN through a ganged, metal power outlet box which is bonded to the ground plane at the LISN.

The interconnecting cables were arranged and moved to get the maximum measurement. Both the line of power cord, hot and neutral, were measured.

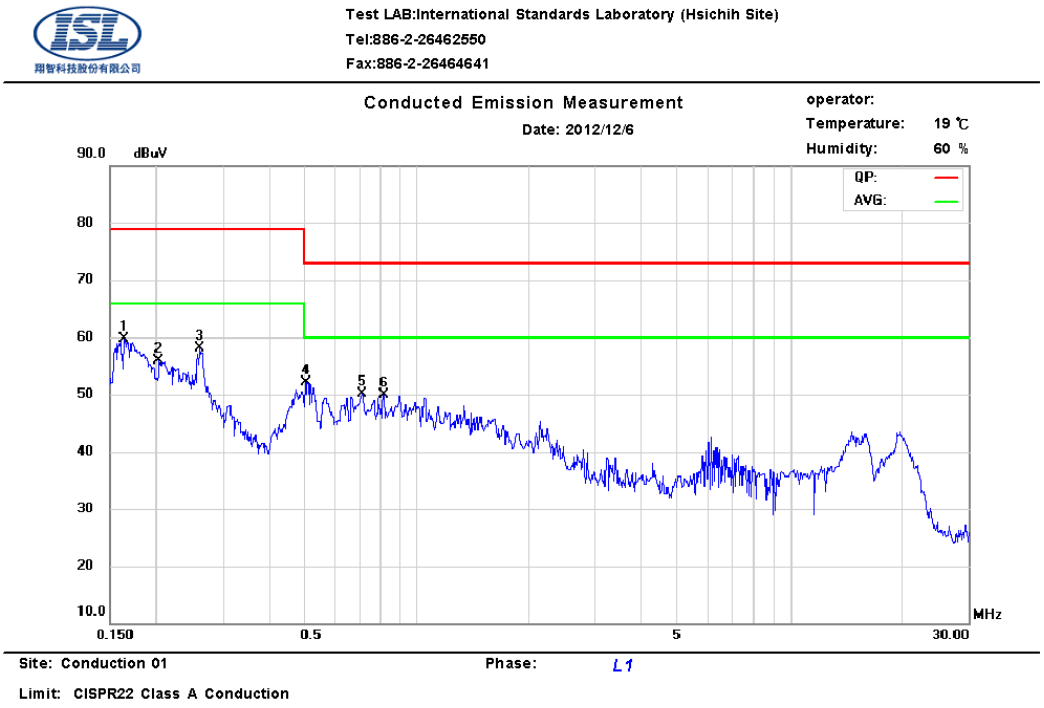
The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

### 2.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

| | |
|---|---|
| Frequency Range: | 150KHz--30MHz |
| Detector Function: | Quasi-Peak / Average Mode |
| Resolution Bandwidth: | 9KHz |

## 2.2 Conduction Test Data: Configuration 1

### Table 2.2.1 Power Line Conducted Emissions (Hot)

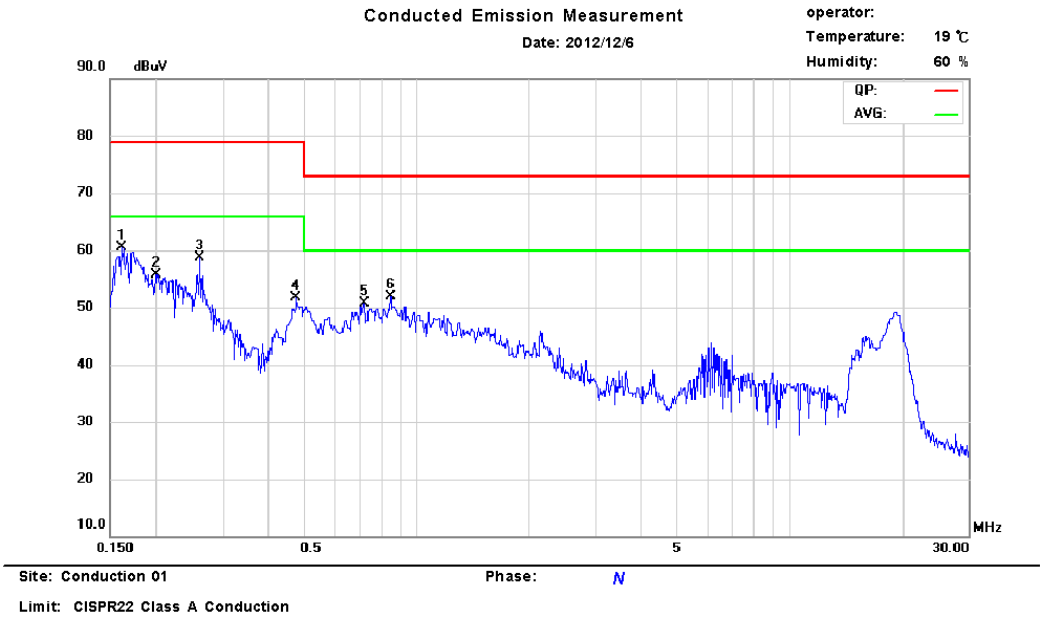



| No. | Frequency MHz | LISN Loss dB | Cable Loss dB | QP Correct. dBuV | QP Limit dBuV | QP Margin dB | AVG Correct. dBuV | AVG Limit dBuV | AVG Margin dB | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.1630 | 9.39 | 0.02 | 47.72 | 79.00 | -31.28 | 34.26 | 66.00 | -31.74 | |
| 2 | 0.2028 | 9.74 | 0.02 | 43.92 | 79.00 | -35.08 | 34.03 | 66.00 | -31.97 | |
| 3 | 0.2615 | 9.72 | 0.03 | 51.58 | 79.00 | -27.42 | 36.26 | 66.00 | -29.74 | |
| 4 | 0.5045 | 9.63 | 0.05 | 45.91 | 73.00 | -27.09 | 33.30 | 60.00 | -26.70 | |
| 5 | 0.7160 | 9.58 | 0.07 | 42.90 | 73.00 | -30.10 | 30.96 | 60.00 | -29.04 | |
| 6 | 0.8105 | 9.59 | 0.08 | 41.47 | 73.00 | -31.53 | 28.70 | 60.00 | -31.30 | |

Note:
Margin = Corrected Amplitude - Limit
Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
**The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.**
**If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.**

## Table 2.2.2 Power Line Conducted Emissions (Neutral)

Test LAB:International Standards Laboratory (Hsichih Site)
Tel:886-2-26462550
Fax:886-2-26464641



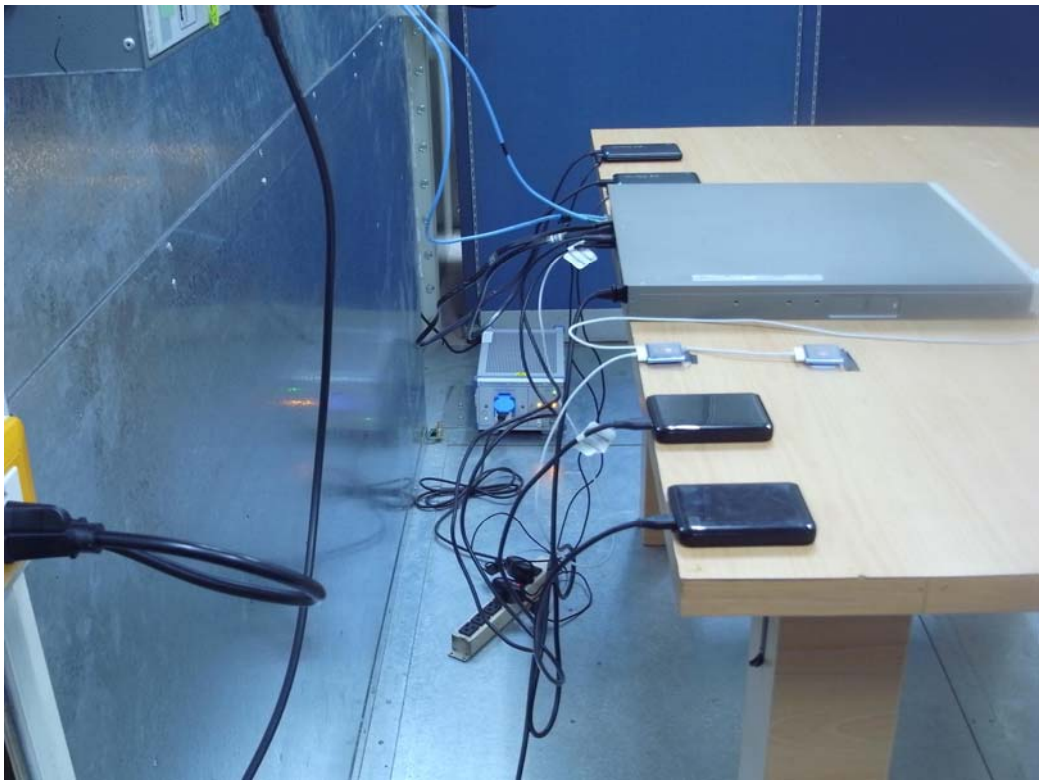

| No. | Frequency MHz | LISN Loss dB | Cable Loss dB | QP Correct. dBuV | QP Limit dBuV | QP Margin dB | AVG Correct. dBuV | AVG Limit dBuV | AVG Margin dB | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.1615 | 9.92 | 0.02 | 48.18 | 79.00 | -30.82 | 38.96 | 66.00 | -27.04 | |
| 2 | 0.2000 | 9.73 | 0.02 | 40.16 | 79.00 | -38.84 | 25.68 | 66.00 | -40.32 | |
| 3 | 0.2610 | 9.71 | 0.03 | 51.43 | 79.00 | -27.57 | 36.08 | 66.00 | -29.92 | |
| 4 | 0.4717 | 9.64 | 0.05 | 44.11 | 79.00 | -34.89 | 31.93 | 66.00 | -34.07 | |
| 5 | 0.7205 | 9.63 | 0.07 | 42.67 | 73.00 | -30.33 | 31.41 | 60.00 | -28.59 | |
| 6 | 0.8510 | 9.63 | 0.08 | 42.26 | 73.00 | -30.74 | 30.40 | 60.00 | -29.60 | |

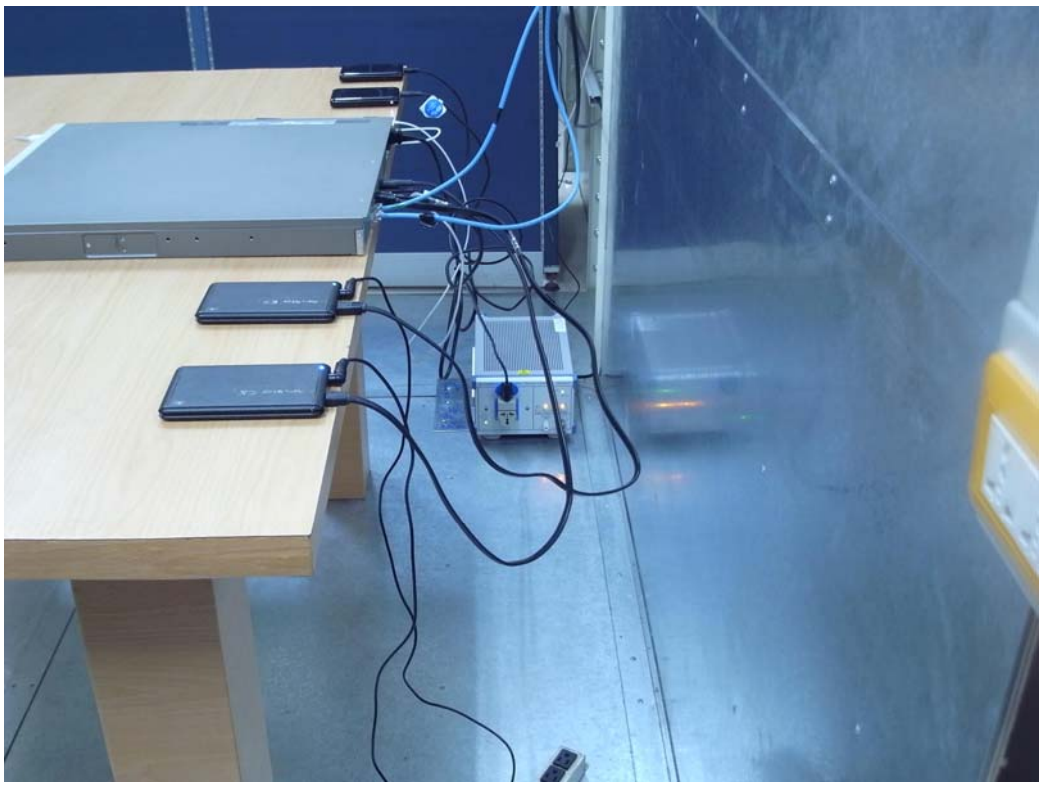
Note:
Margin = Corrected Amplitude - Limit
Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
**The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result. If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.**

## 2.3 Test Setup Photo

Front View

Back View

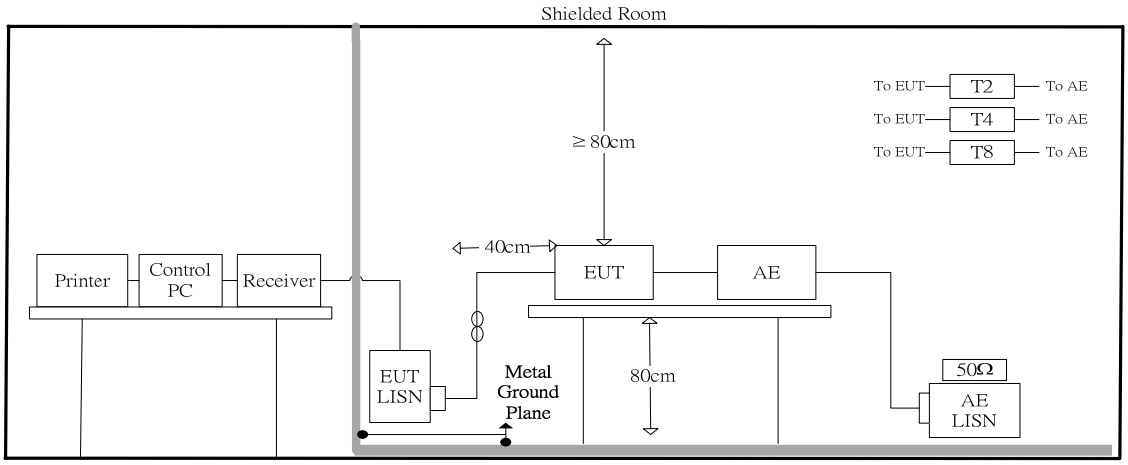




# 3. Telecommunication Port Conducted Emissions

## 3.1 Test Setup and Procedure

### 3.1.1 Test Setup




### 3.1.2 Test Procedure

The measurements are performed in a 3.5m x 3.4m x 2.5m shielded room, which referred as Conduction 01 test site, or a 3m x 3m x 2.3m test site, which referred as Conduction 02 test site. The EUT was placed on non-conduction 1.0m x 1.5m table, which is 0.8 meters above an earth-grounded.

The EUT, any support equipment, and any interconnecting cables were arranged and moved to get the maximum measurement.

Power to the EUT was provided through the LISN which has the Impedance (50 Ohm/50uH) vs. Frequency Characteristic in accordance with the standard. Power to the LISN was filtered to eliminate ambient signal interference and this filter was bonded to ground. Peripheral equipment to provide a functional system (support equipment) for EUT testing was powered through a ganged, metal power outlet box bonded to the ground. AC input power for the auxiliary power outlets was obtained from the same filtered source that provides input power to the LISN.

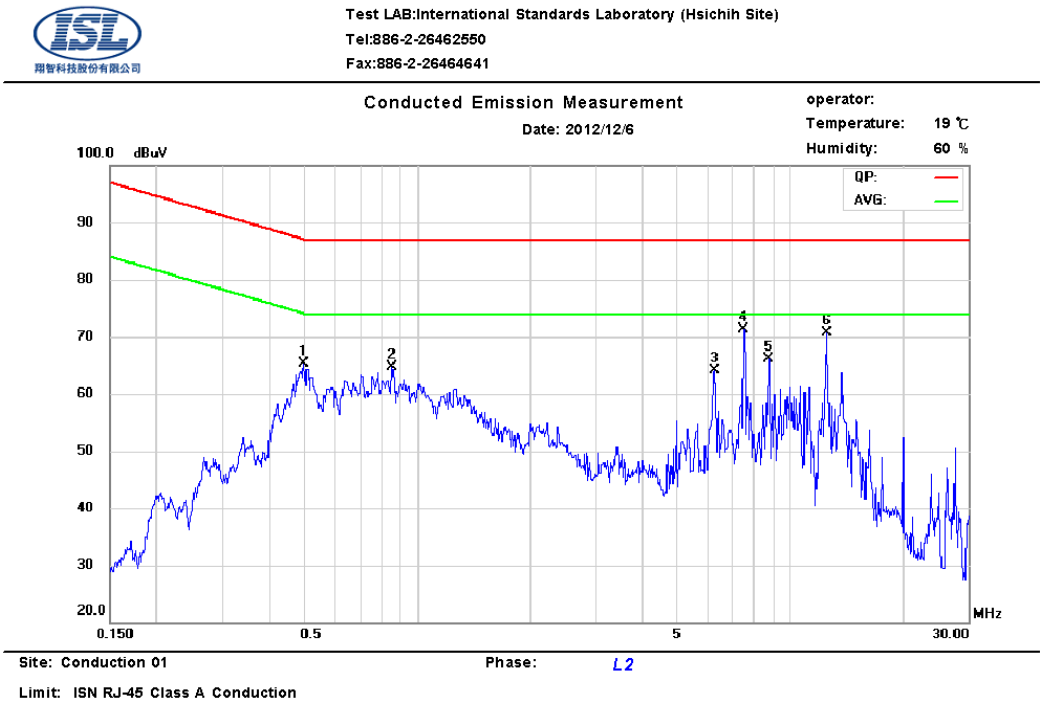
The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information could be useful in reducing their amplitude.

### 3.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

| | |
|---|---|
| Frequency Range: | 150KHz--30MHz |
| Detector Function: | Quasi-Peak / Average Mode |
| Resolution Bandwidth: | 9KHz |

## 3.2 Test Data: Configuration 1 : LAN--10M

### Table 3.2.1 Telecommunication Port Conducted Emission

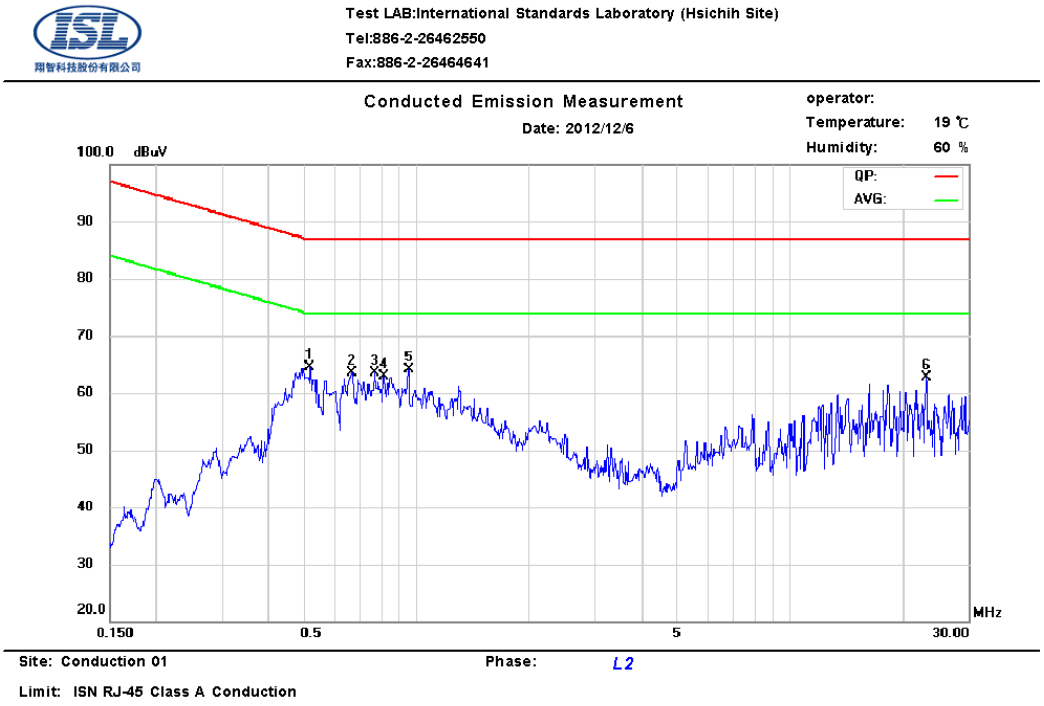



| No. | Frequency MHz | LISN Loss dB | Cable Loss dB | QP Correct. dBuV | QP Limit dBuV | QP Margin dB | AVG Correct. dBuV | AVG Limit dBuV | AVG Margin dB | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.4970 | 9.97 | 0.05 | 56.93 | 87.05 | -30.12 | 45.38 | 74.05 | -28.67 | |
| 2 | 0.8555 | 9.96 | 0.08 | 56.66 | 87.00 | -30.34 | 43.15 | 74.00 | -30.85 | |
| 3 | 6.2500 | 9.96 | 0.21 | 55.72 | 87.00 | -31.28 | 44.21 | 74.00 | -29.79 | |
| 4 | 7.5000 | 9.96 | 0.23 | 61.97 | 87.00 | -25.03 | 48.57 | 74.00 | -25.43 | |
| 5 | 8.7500 | 9.96 | 0.24 | 57.59 | 87.00 | -29.41 | 44.79 | 74.00 | -29.21 | |
| 6 | 12.5000 | 9.96 | 0.27 | 61.96 | 87.00 | -25.04 | 47.93 | 74.00 | -26.07 | |

**Note :**
Margin = Corrected Amplitude - Limit
Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
**The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.**
**If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.**

## 3.3 Test Data: Configuration 1 : LAN--100M

### Table 3.3.1 Telecommunication Port Conducted Emission




| No. | Frequency MHz | LISN Loss dB | Cable Loss dB | QP Correct. dBuV | QP Limit dBuV | QP Margin dB | AVG Correct. dBuV | AVG Limit dBuV | AVG Margin dB | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.5180 | 9.97 | 0.05 | 58.09 | 87.00 | -28.91 | 45.57 | 74.00 | -28.43 | |
| 2 | 0.6710 | 9.97 | 0.07 | 56.60 | 87.00 | -30.40 | 42.99 | 74.00 | -31.01 | |
| 3 | 0.7700 | 9.96 | 0.07 | 56.91 | 87.00 | -30.09 | 43.19 | 74.00 | -30.81 | |
| 4 | 0.8105 | 9.96 | 0.08 | 54.70 | 87.00 | -32.30 | 41.39 | 74.00 | -32.61 | |
| 5 | 0.9455 | 9.96 | 0.09 | 55.18 | 87.00 | -31.82 | 43.22 | 74.00 | -30.78 | |
| 6 | 23.1250 | 9.98 | 0.35 | 57.86 | 87.00 | -29.14 | 55.26 | 74.00 | -18.74 | |

**Note :**

Margin = Corrected Amplitude - Limit

Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss

A margin of -8dB means that the emission is 8dB below the limit

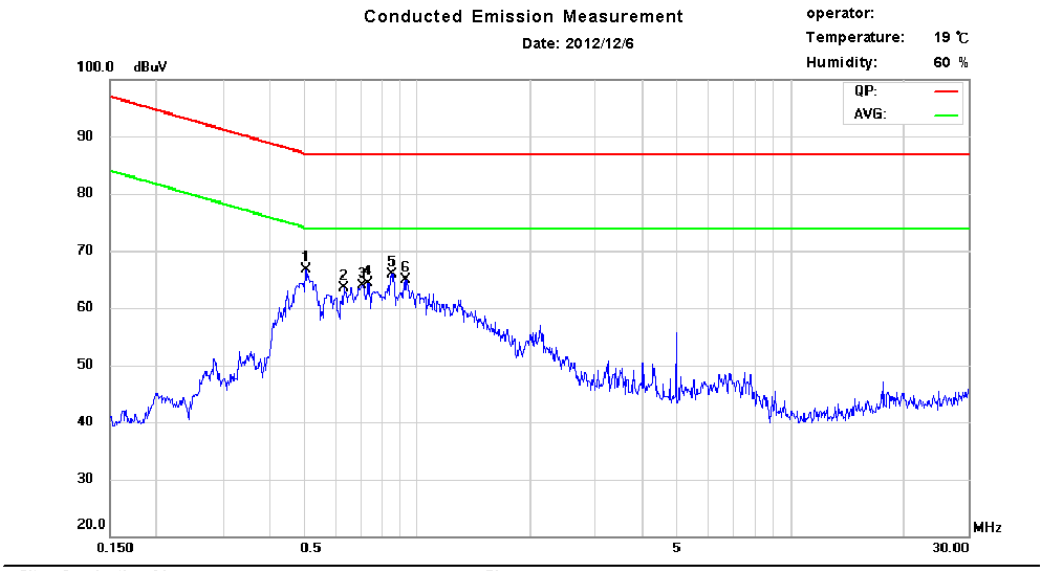
**The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.**

**If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.**

## 3.4 Test Data: Configuration 1 : LAN--GIGA (Voltage)

### Table 3.4.1 Telecommunication Port Conducted Emission

Test LAB:International Standards Laboratory (Hsichih Site)
Tel:886-2-26462550
Fax:886-2-26464641



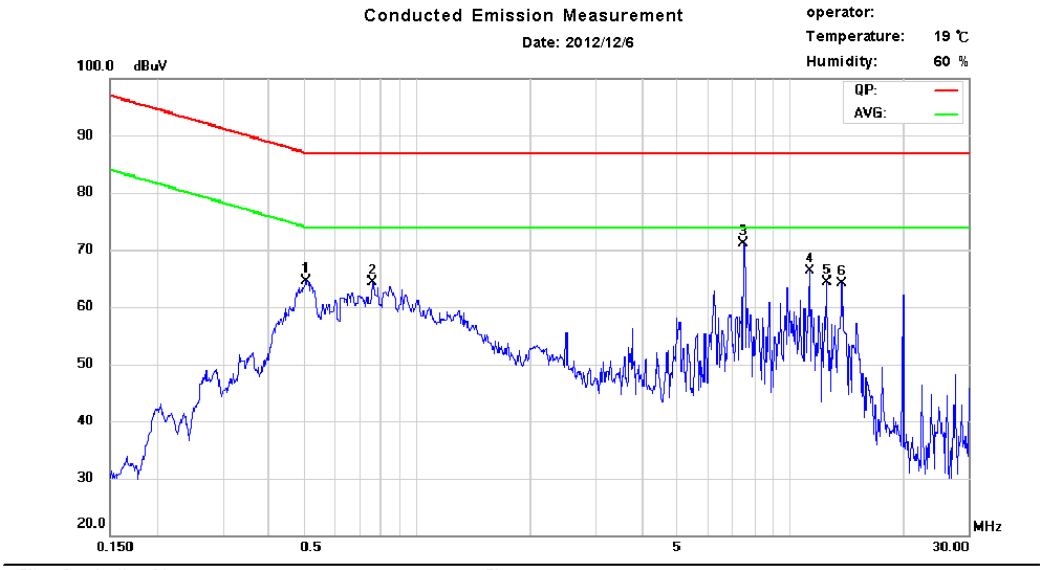

| No. | Frequency MHz | LISN Loss dB | Cable Loss dB | QP Correct. dBuV | QP Limit dBuV | QP Margin dB | AVG Correct. dBuV | AVG Limit dBuV | AVG Margin dB | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.5045 | 9.95 | 0.05 | 60.04 | 87.00 | -26.96 | 47.75 | 74.00 | -26.25 | |
| 2 | 0.6350 | 9.94 | 0.06 | 56.77 | 87.00 | -30.23 | 43.24 | 74.00 | -30.76 | |
| 3 | 0.7160 | 9.93 | 0.07 | 57.54 | 87.00 | -29.46 | 43.95 | 74.00 | -30.05 | |
| 4 | 0.7430 | 9.93 | 0.07 | 55.96 | 87.00 | -31.04 | 42.47 | 74.00 | -31.53 | |
| 5 | 0.8600 | 9.92 | 0.08 | 58.35 | 87.00 | -28.65 | 44.03 | 74.00 | -29.97 | |
| 6 | 0.9365 | 9.92 | 0.09 | 56.41 | 87.00 | -30.59 | 44.18 | 74.00 | -29.82 | |

**Note :**
Margin = Corrected Amplitude - Limit
Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
**The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.**
**If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.**

## 3.5 Test Data: Configuration 2 : LAN--10M

### Table 3.5.1 Telecommunication Port Conducted Emission

Test LAB:International Standards Laboratory (Hsichih Site)
Tel:886-2-26462550
Fax:886-2-26464641

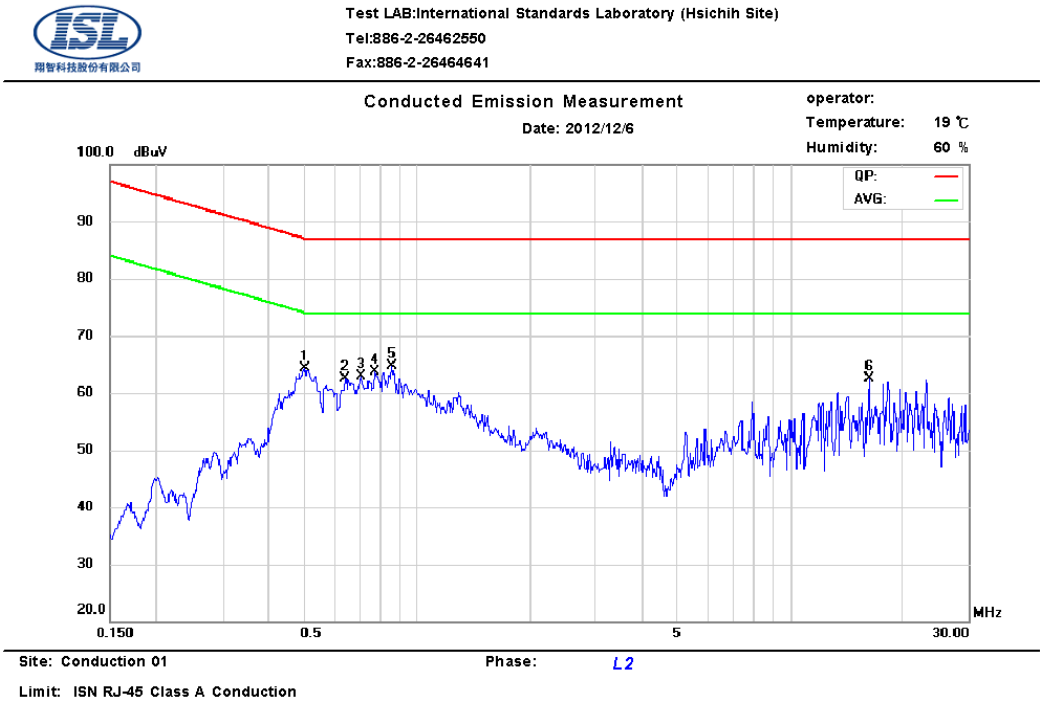



| No. | Frequency MHz | LISN Loss dB | Cable Loss dB | QP Correct. dBuV | QP Limit dBuV | QP Margin dB | AVG Correct. dBuV | AVG Limit dBuV | AVG Margin dB | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.5090 | 9.97 | 0.05 | 57.65 | 87.00 | -29.35 | 45.50 | 74.00 | -28.50 | |
| 2 | 0.7610 | 9.96 | 0.07 | 53.94 | 87.00 | -33.06 | 39.78 | 74.00 | -34.22 | |
| 3 | 7.5000 | 9.96 | 0.23 | 55.77 | 87.00 | -31.23 | 49.88 | 74.00 | -24.12 | |
| 4 | 11.2500 | 9.96 | 0.26 | 37.73 | 87.00 | -49.27 | 44.43 | 74.00 | -29.57 | |
| 5 | 12.5000 | 9.96 | 0.27 | 61.57 | 87.00 | -25.43 | 48.15 | 74.00 | -25.85 | |
| 6 | 13.7500 | 9.96 | 0.28 | 55.30 | 87.00 | -31.70 | 42.05 | 74.00 | -31.95 | |

**Note :**
Margin = Corrected Amplitude - Limit
Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
**The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.**
**If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.**

## 3.6 Test Data: Configuration 2 : LAN--100M

### Table 3.6.1 Telecommunication Port Conducted Emission




| No. | Frequency MHz | LISN Loss dB | Cable Loss dB | QP Correct. dBuV | QP Limit dBuV | QP Margin dB | AVG Correct. dBuV | AVG Limit dBuV | AVG Margin dB | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.5000 | 9.97 | 0.05 | 55.72 | 87.00 | -31.28 | 44.98 | 74.00 | -29.02 | |
| 2 | 0.6440 | 9.97 | 0.06 | 55.24 | 87.00 | -31.76 | 41.87 | 74.00 | -32.13 | |
| 3 | 0.7070 | 9.97 | 0.07 | 54.76 | 87.00 | -32.24 | 42.07 | 74.00 | -31.93 | |
| 4 | 0.7700 | 9.96 | 0.07 | 55.27 | 87.00 | -31.73 | 41.75 | 74.00 | -32.25 | |
| 5 | 0.8555 | 9.96 | 0.08 | 55.49 | 87.00 | -31.51 | 41.95 | 74.00 | -32.05 | |
| 6 | 16.2250 | 9.96 | 0.30 | 58.49 | 87.00 | -28.51 | 55.53 | 74.00 | -18.47 | |

**Note :**

Margin = Corrected Amplitude - Limit

Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss

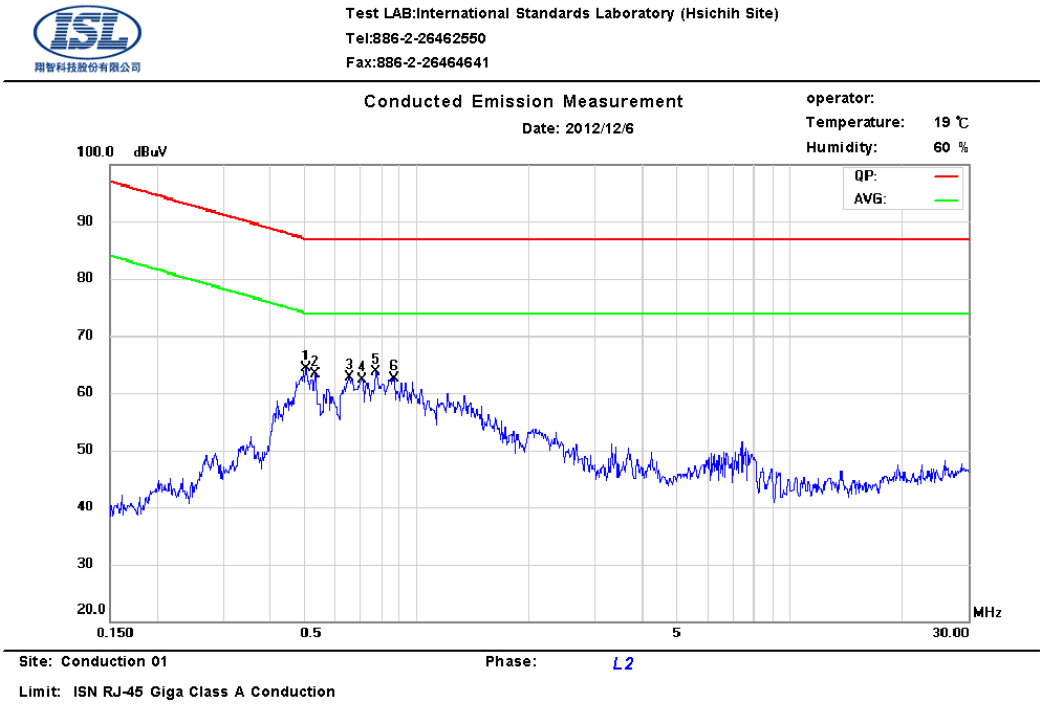
A margin of -8dB means that the emission is 8dB below the limit

**The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.**

**If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.**

## 3.7 Test Data: Configuration 2 : LAN--GIGA (Voltage)

### Table 3.7.1 Telecommunication Port Conducted Emission




| No. | Frequency MHz | LISN Loss dB | Cable Loss dB | QP Correct. dBuV | QP Limit dBuV | QP Margin dB | AVG Correct. dBuV | AVG Limit dBuV | AVG Margin dB | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.5045 | 9.95 | 0.05 | 58.79 | 87.00 | -28.21 | 47.09 | 74.00 | -26.91 | |
| 2 | 0.5360 | 9.95 | 0.05 | 55.84 | 87.00 | -31.16 | 44.15 | 74.00 | -29.85 | |
| 3 | 0.6575 | 9.94 | 0.07 | 55.82 | 87.00 | -31.18 | 42.08 | 74.00 | -31.92 | |
| 4 | 0.7160 | 9.93 | 0.07 | 56.14 | 87.00 | -30.86 | 42.88 | 74.00 | -31.12 | |
| 5 | 0.7790 | 9.93 | 0.08 | 55.79 | 87.00 | -31.21 | 43.08 | 74.00 | -30.92 | |
| 6 | 0.8645 | 9.92 | 0.08 | 56.67 | 87.00 | -30.33 | 42.22 | 74.00 | -31.78 | |

**Note :**
Margin = Corrected Amplitude - Limit
Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
**The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.**
**If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.**

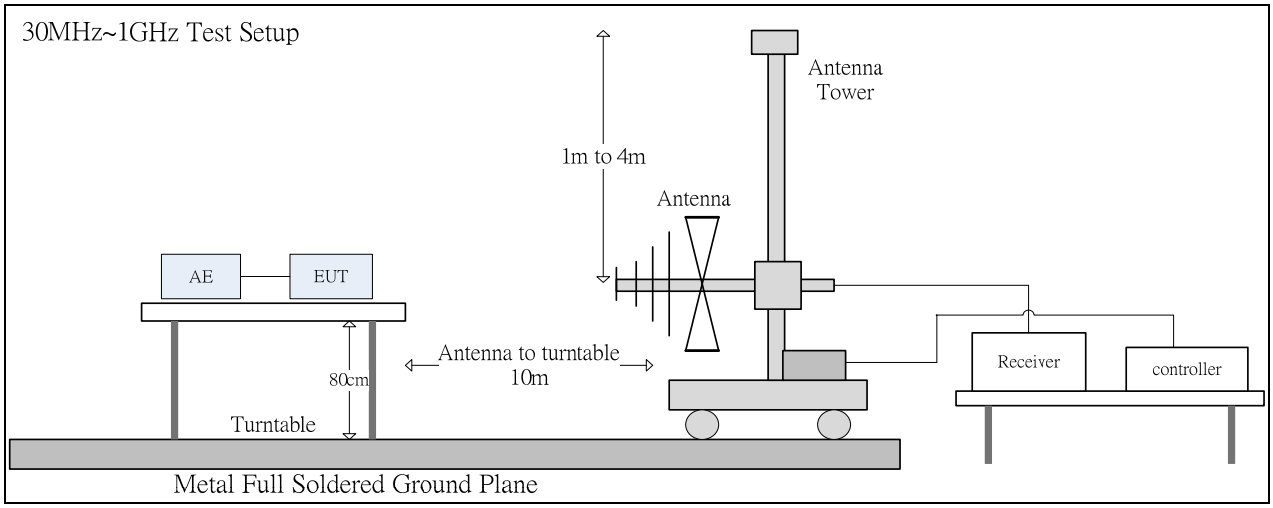
### 3.8 Test Setup Photo

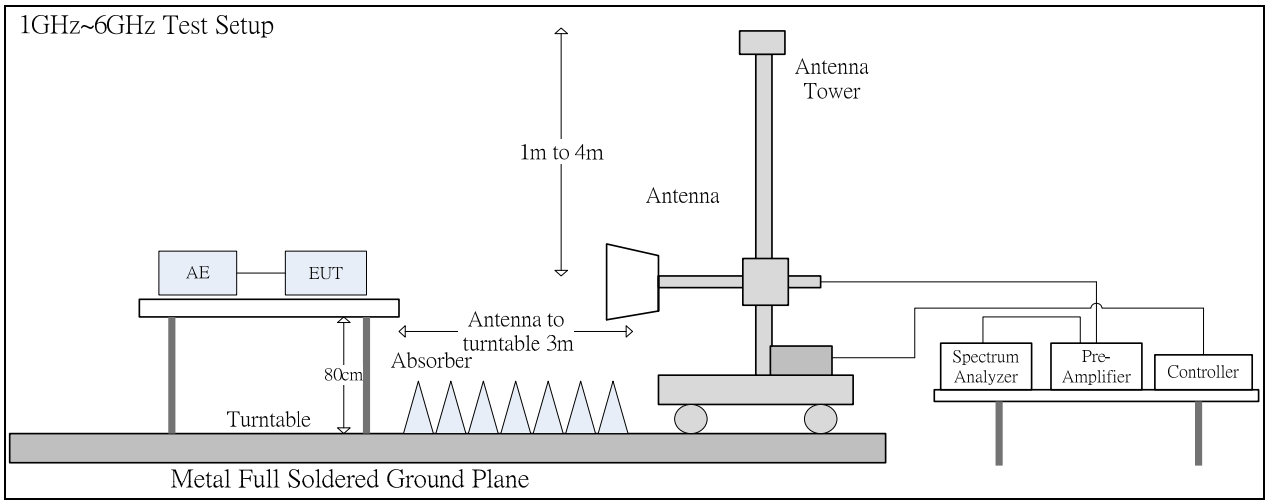
Refer to the Setup Photos for Power Main Port Conducted Emissions

# 4. Radiated Disturbance Emissions

## 4.1 Test Setup and Procedure

### 4.1.1 Test Setup




### 4.1.2 Test Procedure

The radiated emissions test will then be repeated on the open site or chamber to measure the amplitudes accurately and without the multiple reflections existing in the shielded room. The EUT and support equipment are set up on the turntable of one of 10 meter open field sites or 10 meter chamber. Desktop EUT are set up on a wooden stand 0.8 meter above the ground or floor-standing arrangement shall be placed on the horizontal ground reference plane. The test volume for a height of up to 30 cm may be obstructed by absorber placed on the ground plane.

For the initial measurements, the receiving antenna is varied from 1-4 meter height and is changed in the vertical plane from vertical to horizontal polarization at each frequency. The highest emissions between 30 MHz to 1000 MHz were analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions. The highest emissions between 1 GHz to 6 GHz were analyzed in details by operating the spectrum analyzer in peak and average mode to determine the precise amplitude of the emissions.

At the highest amplitudes observed, the EUT is rotated in the horizontal plane while changing the antenna polarization in the vertical plane to maximize the reading. The interconnecting cables were arranged and moved to get the maximum measurement. Once the maximum reading is obtained, the antenna elevation and polarization will be varied between specified limits to maximize the readings.

The highest internal source of an EUT is defined as the highest frequency generated or used within the EUT or on which the EUT operates or tunes. If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. If the highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz. If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 6 GHz, whichever is less.

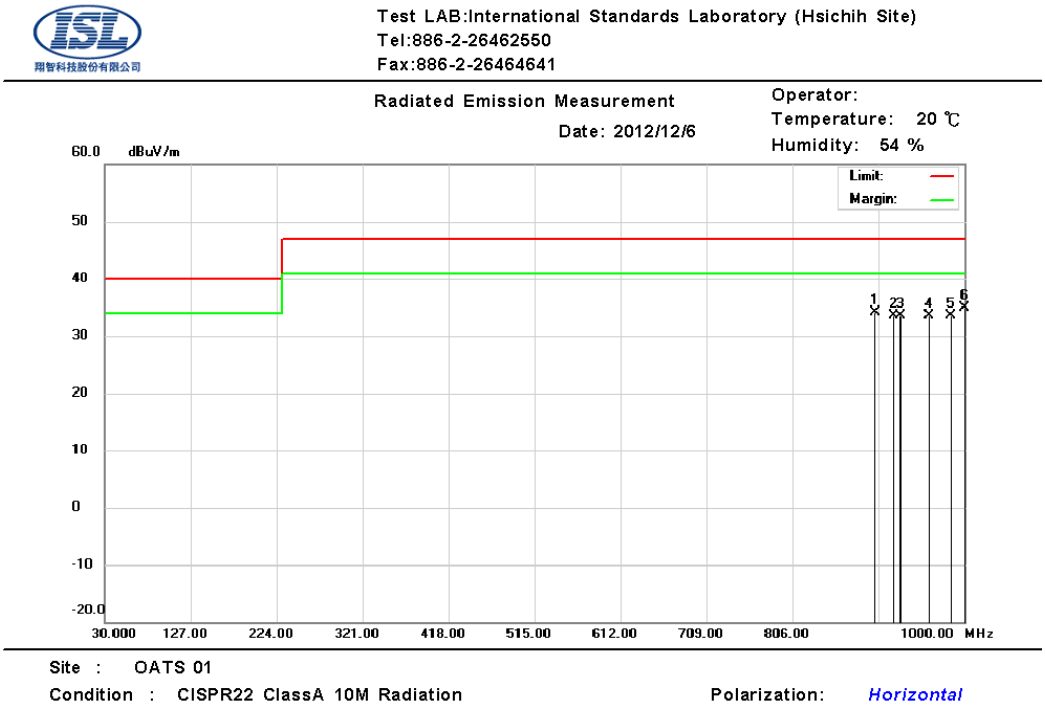
### 4.1.3 Spectrum Analyzer Configuration (for the frequencies tested)

| | |
|---|---|
| Frequency Range: | 30MHz--1000MHz |
| Detector Function: | Quasi-Peak Mode |
| Resolution Bandwidth: | 120KHz |

| | |
|---|---|
| Frequency Range: | Above 1 GHz to 6 GHz |
| Detector Function: | Peak/Average Mode |
| Resolution Bandwidth: | 1MHz |

## 4.2 Radiation Test Data: Configuration 1

### Table 4.2.1 Radiated Emissions (Horizontal)




| Mk. | Frequency (MHz) | RX_R (dBuV/m) | Ant_F (dB) | Cab_L (dB) | PreAmp (dB) | Emission (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.Pos (cm) | Tab.Pos (deg.) | Detector |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 899.3600 | 8.26 | 22.79 | 3.15 | 0.00 | 34.20 | 47.00 | -12.80 | 129 | 293 | QP |
| 2 | 920.1300 | 7.47 | 22.92 | 3.19 | 0.00 | 33.58 | 47.00 | -13.42 | 195 | 298 | QP |
| 3 | 927.6500 | 7.30 | 22.97 | 3.2 | 0.00 | 33.47 | 47.00 | -13.53 | 170 | 71 | QP |
| 4 | 959.9300 | 7.11 | 23.18 | 3.26 | 0.00 | 33.55 | 47.00 | -13.45 | 108 | 260 | QP |
| 5 | 984.8200 | 6.76 | 23.38 | 3.32 | 0.00 | 33.46 | 47.00 | -13.54 | 346 | 155 | QP |
| 6 | 999.9950 | 7.98 | 23.5 | 3.36 | 0.00 | 34.84 | 47.00 | -12.16 | 100 | 51 | QP |

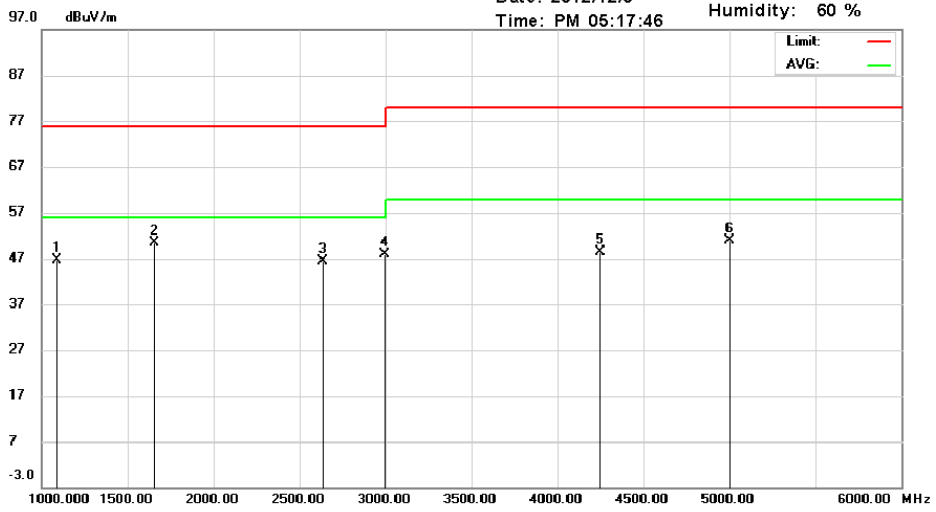
* Note:
Margin = Corrected Amplitude – Limit
Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
BILOG Antenna Distance: 10 meters

**Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement. measurement.**

Test LAB:International Standards Laboratory (Hsichih Site)
Tel:886-2-26462550
Fax:886-2-26464641

Radiated Emission Measurement

Operator:
Temperature: 20 ℃
Humidity: 60 %
Date: 2012/12/5
Time: PM 05:17:46




Site : Chamber 01
Condition : CISPR22 ClassA 3M Radiation
Polarization: *Horizontal*

| Mk. | Frequency (MHz) | RX_R (dBuV/m) | Ant_F (dB) | Cab_L (dB) | PreAmp (dB) | Emission (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.Pos (cm) | Tab.Pos (deg.) | Detector |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1088.141 | 67.18 | 28.3 | 3.05 | 51.96 | 46.57 | 76.00 | -29.43 | 288 | 125 | peak |
| 2 | 1657.051 | 69.46 | 29.18 | 3.81 | 52.08 | 50.37 | 76.00 | -25.63 | 156 | 279 | peak |
| 3 | 2634.615 | 61.43 | 32.16 | 4.87 | 52.1 | 46.36 | 76.00 | -29.64 | 231 | 193 | peak |
| 4 | 2987.180 | 62.16 | 32.58 | 5.22 | 52.16 | 47.80 | 76.00 | -28.20 | 280 | 29 | peak |
| 5 | 4253.205 | 61.01 | 33.51 | 6.32 | 52.49 | 48.35 | 80.00 | -31.65 | 100 | 90 | peak |
| 6 | 5006.410 | 62.44 | 34.11 | 6.89 | 52.65 | 50.79 | 80.00 | -29.21 | 100 | 212 | peak |

*:Maximum data x:Over limit !:over margin

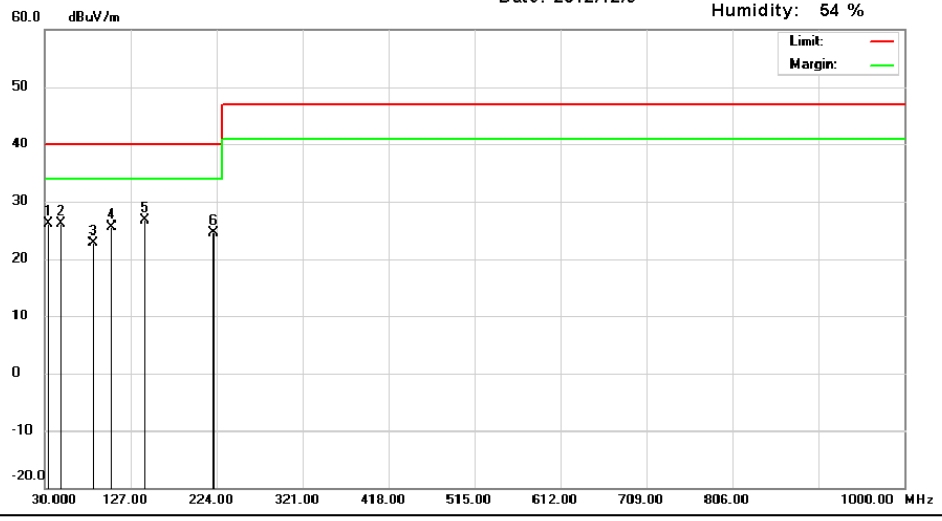
* Note:
Margin = Corrected Amplitude – Limit
Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
Horn Antenna Distance: 3 meters

**Above 1GHz test, if the peak measured value meets the average limit, it is unnecessary to perform the average measurement.**

## Table 4.2.2 Radiated Emissions (Vertical)

Test LAB:International Standards Laboratory (Hsichih Site)
Tel:886-2-26462550
Fax:886-2-26464641

Radiated Emission Measurement
Date: 2012/12/6
Operator:
Temperature: 20 ℃
Humidity: 54 %




Site : OATS 01
Condition : CISPR22 ClassA 10M Radiation
Polarization: *Vertical*

| Mk. | Frequency (MHz) | RX_R (dBuV/m) | Ant_F (dB) | Cab_L (dB) | PreAmp (dB) | Emission (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.Pos (cm) | Tab.Pos (deg.) | Detector |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 33.2060 | 6.36 | 19.12 | 0.61 | 0.00 | 26.09 | 40.00 | -13.91 | 268 | 303 | QP |
| 2 | 47.5700 | 16.33 | 9.01 | 0.72 | 0.00 | 26.06 | 40.00 | -13.94 | 100 | 222 | QP |
| 3 | 84.6500 | 13.99 | 7.8 | 0.92 | 0.00 | 22.71 | 40.00 | -17.29 | 295 | 309 | QP |
| 4 | 104.9100 | 12.72 | 11.83 | 1.02 | 0.00 | 25.57 | 40.00 | -14.43 | 248 | 58 | QP |
| 5 | 142.7016 | 12.46 | 13.14 | 1.18 | 0.00 | 26.78 | 40.00 | -13.22 | 155 | 318 | QP |
| 6 | 220.5800 | 12.18 | 10.82 | 1.48 | 0.00 | 24.48 | 40.00 | -15.52 | 120 | 267 | QP |

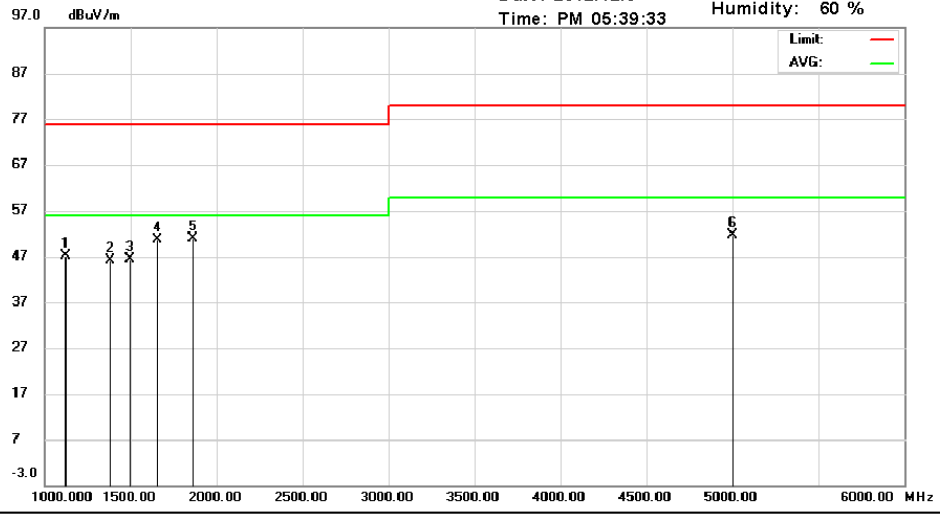
* Note:
Margin = Corrected Amplitude – Limit
Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
BILOG Antenna Distance: 10 meters

**Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement. measurement.**

Test LAB:International Standards Laboratory (Hsichih Site)
Tel:886-2-26462550
Fax:886-2-26464641

Radiated Emission Measurement

Operator:
Temperature: 20 ℃
Humidity: 60 %
Date: 2012/12/5
Time: PM 05:39:33




Site : Chamber 01
Condition : CISPR22 ClassA 3M Radiation
Polarization: *Vertical*

| Mk. | Frequency (MHz) | RX_R (dBuV/m) | Ant_F (dB) | Cab_L (dB) | PreAmp (dB) | Emission (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.Pos (cm) | Tab.Pos (deg.) | Detector |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1120.192 | 67.58 | 28.3 | 3.1 | 51.97 | 47.01 | 76.00 | -28.99 | 100 | 327 | peak |
| 2 | 1376.603 | 66.28 | 28.3 | 3.45 | 52.02 | 46.01 | 76.00 | -29.99 | 100 | 37 | peak |
| 3 | 1496.795 | 66.59 | 28.3 | 3.62 | 52.05 | 46.46 | 76.00 | -29.54 | 296 | 57 | peak |
| 4 | 1657.051 | 69.60 | 29.18 | 3.81 | 52.08 | 50.51 | 76.00 | -25.49 | 264 | 324 | peak |
| 5 | 1857.372 | 68.51 | 30.43 | 4.05 | 52.11 | 50.88 | 76.00 | -25.12 | 183 | 239 | peak |
| 6 | 5006.410 | 63.18 | 34.11 | 6.89 | 52.65 | 51.53 | 80.00 | -28.47 | 197 | 54 | peak |

*:Maximum data x:Over limit !:over margin

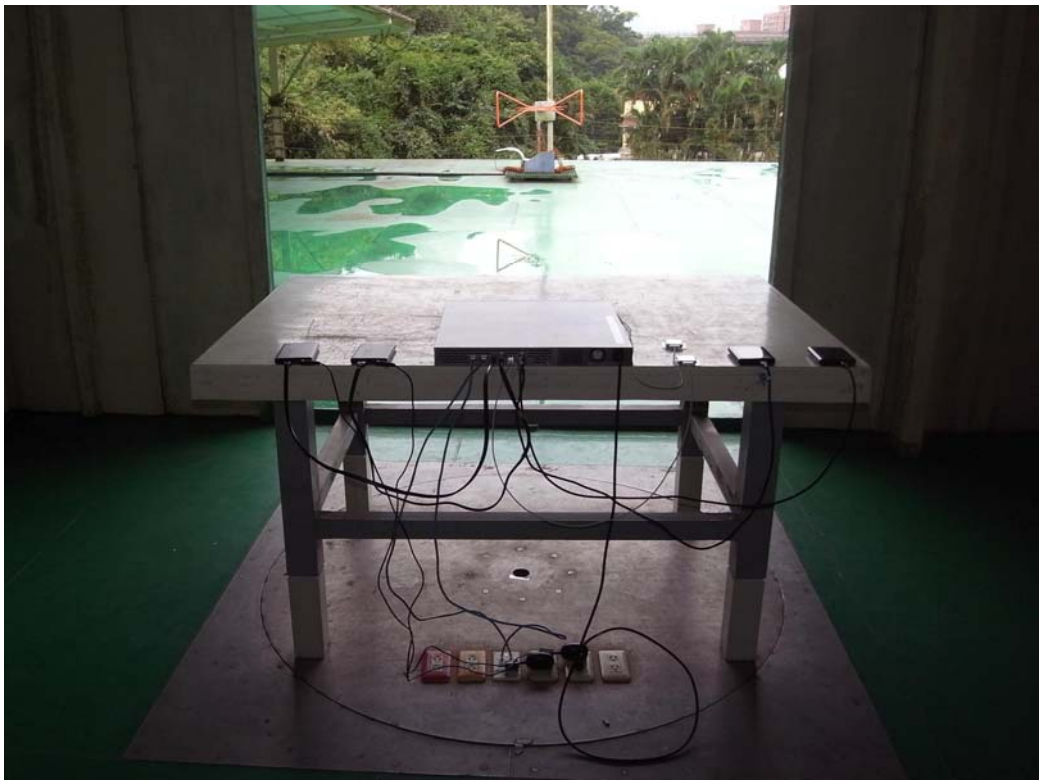
* Note:
Margin = Corrected Amplitude – Limit
Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
Horn Antenna Distance: 3 meters

**Above 1GHz test, if the peak measured value meets the average limit, it is unnecessary to perform the average measurement.**

## 4.3 Test Setup Photo

Front View (30MHz~1GHz)

Back View (30MHz~1GHz)



Front View (above 1GHz)

Back View (above 1GHz)

# 5. Electrostatic discharge (ESD) immunity

## 5.1 Test Specification

| | |
|---|---|
| Port: | Enclosure |
| Basic Standard: | EN 61000-4-2/ IEC EN61000-4-2 (details referred to Sec 1.2) |
| Test Level: | Air +/- 2 kV, +/- 4 kV, +/- 8 kV<br>Contact +/- 4 kV |
| Criteria: | B |
| Test Procedure | refer to ISL QA -T4-E-S7 |
| Temperature: | 25 °C |
| Humidity: | 56% |

**Selected Test Point**

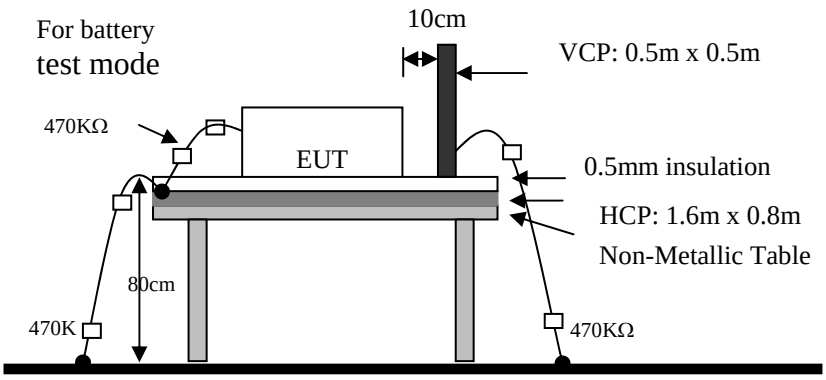
Air: discharges were applied to slots, aperture or insulating surfaces. 10 single air discharges were applied to each selected points.

Contact: Total 200 discharges minimum were to the selected contact points.

Indirect Contact Points: 25 discharges were applied to center of one edge of VCP and each EUT side of HCP with 10 cm away from EUT.

## 5.2 Test Setup

EUT is 1m from the wall and other metallic structure. When Battery test mode is needed, a cable with one 470KΩ resister at two rare ends is connected from metallic part of EUT and screwed to HCP.




Ground reference Plane

## 5.3 Test Result

**Performance of EUT complies with the given specification.**

## 5.4 Test Point

Red arrow lines indicate the contact points, and blue arrow lines indicate the air points.

## 5.5 Test Setup Photo

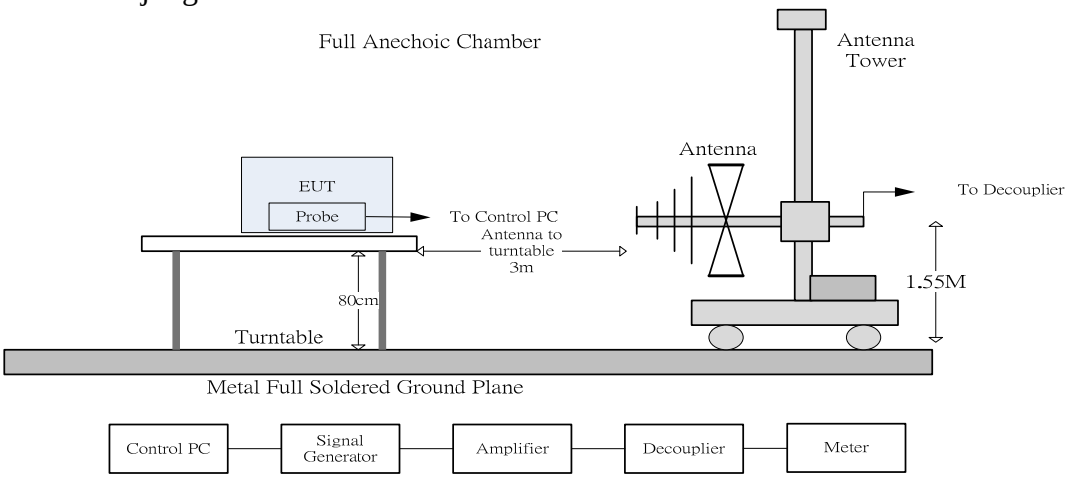
# 6. Radio-Frequency, Electromagnetic Field immunity

## 6.1 Test Specification

| | |
|---|---|
| Port: | Enclosure |
| Basic Standard: | EN 61000-4-3/ IEC EN61000-4-3 (details referred to Sec 1.2) |
| Test Level: | 3 V/m |
| Modulation: | AM 1KHz 80% |
| Frequency range: | 80 MHz~1 GHz |
| Frequency Step: | 1% of last step frequency |
| Dwell time: | 3s |
| Polarization: | Vertical and Horizontal |
| EUT Azimuth Angle | ☒0° ☒90° ☒180° ☒270° |
| Criteria: | A |
| Test Procedure | refer to ISL QA -T4-E-S8 |
| Temperature: | 24°C |
| Humidity: | 67% |

## 6.2 Test Setup

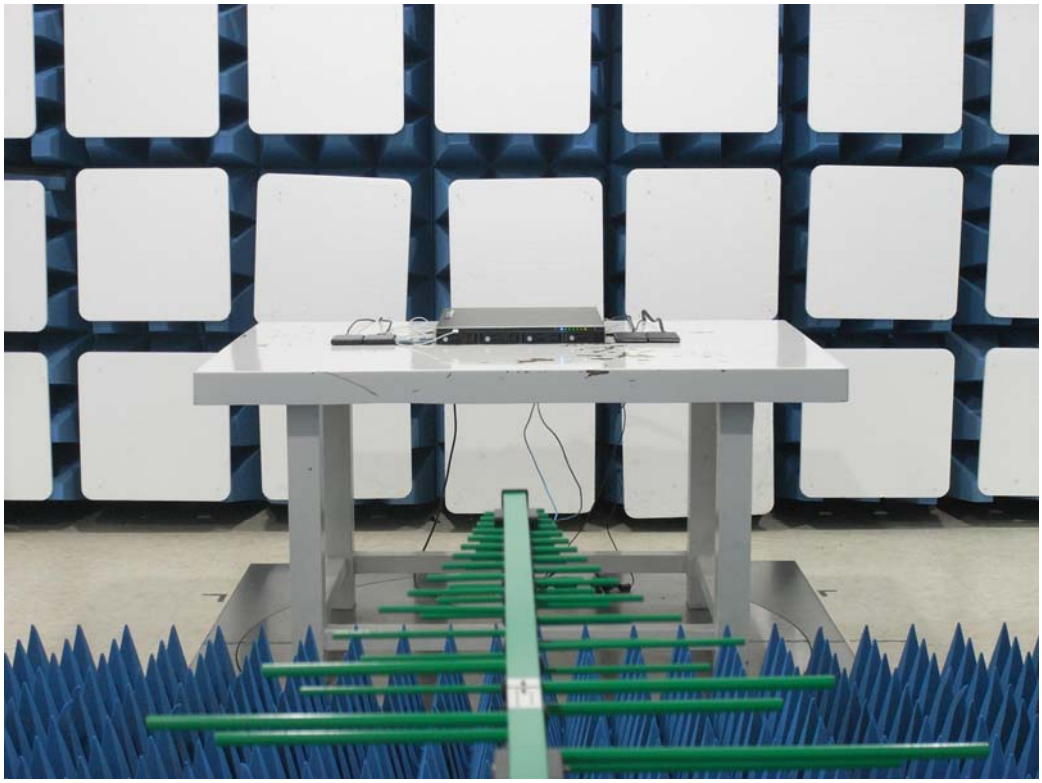
The field sensor is placed at one calibration grid point to check the intensity of the established fields on both polarizations. EUT is adjusted to have each side of EUT face coincident with the calibration plane. A CCD camera and speakers are used to monitor the condition of EUT for the performance judgment.




## 6.3 Test Result

**Performance of EUT complies with the given specification.**

## 6.4 Test Setup Photo



# 7. Electrical Fast transients/burst immunity

## 7.1 Test Specification

| | |
|---|---|
| Port: | AC mains |
| Basic Standard: | EN 61000-4-4/ IEC EN61000-4-4 (details referred to Sec 1.2) |
| Test Level: | AC Power Port: +/- 1 kV |
| Rise Time: | 5ns |
| Hold Time: | 50ns |
| Repetition Frequency: | 5KHz |
| Criteria: | B |
| Test Procedure | refer to ISL QA -T4-E-S9 |
| Temperature: | 25 °C |
| Humidity: | 56% |

**Test Procedure**

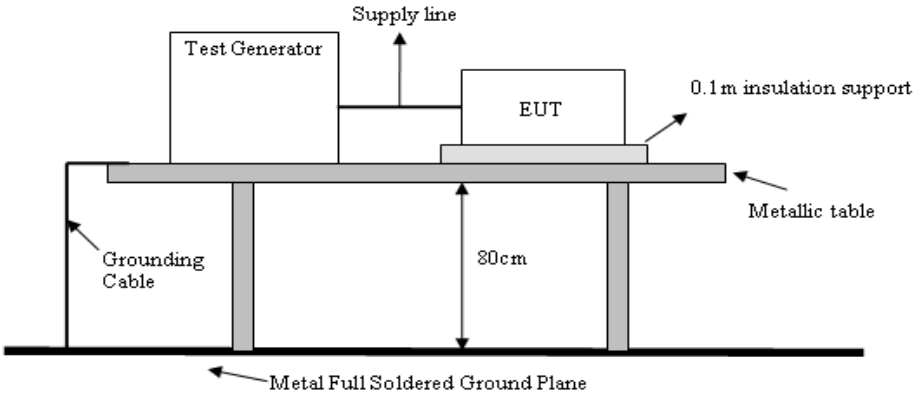
The EUT was setup on a nonconductive table 0.1 m above a reference ground plane.

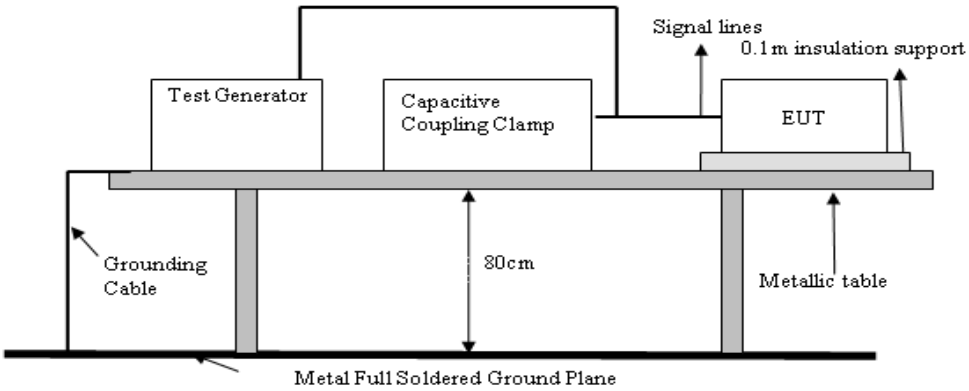
| Test Points | Polarity | Result | Comment |
|---|---|---|---|
| Line | + | N | 60 sec |
| | - | N | 60 sec |
| Neutral | + | N | 60 sec |
| | - | N | 60 sec |
| Ground | + | N | 60 sec |
| | - | N | 60 sec |
| Line to Neutral | + | N | 60 sec |
| | - | N | 60 sec |
| Line to Ground | + | N | 60 sec |
| | - | N | 60 sec |
| Neutral to Ground | + | N | 60 sec |
| | - | N | 60 sec |
| Line to Neutral to Ground | + | N | 60 sec |
| | - | N | 60 sec |
| Capacitive coupling clamp | + | N | 60 sec |
| | - | N | 60 sec |

Note: 'N' means normal, the EUT function is correct during the test.

## 7.2 Test Setup

EUT is at least 50cm from the conductive structure.




## 7.3 Test Result

**Performance of EUT complies with the given specification.**

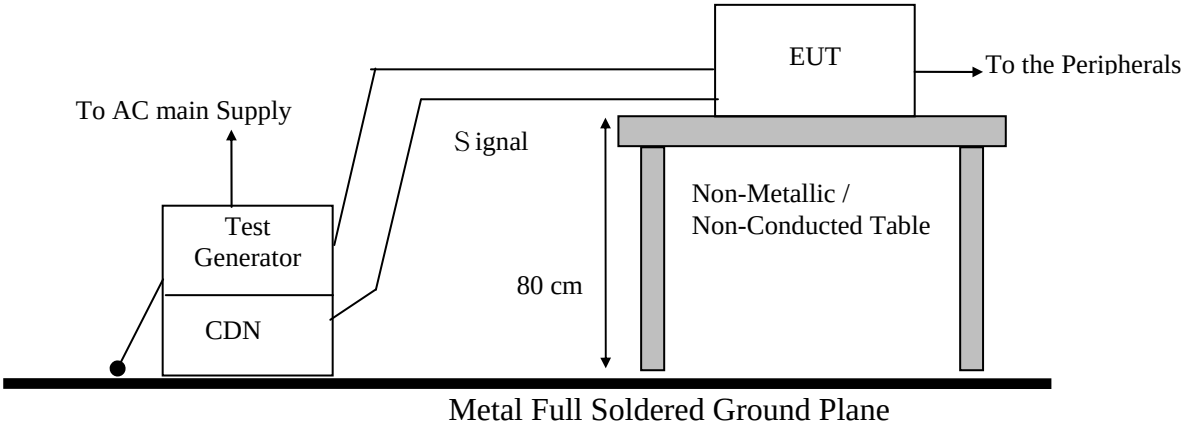
## 7.4 Test Setup Photo

# 8. Surge Immunity

## 8.1 Test Specification

| | | |
|---|---|---|
| Port: | AC mains | Signal and telecommunication port-NA |
| Basic Standard: | EN 61000-4-5/ IEC EN61000-4-5 (details referred to Sec 1.2) | |
| Test Level: | Line to Line: +/- 0.5 kV, +/- 1 kV Line to Earth: +/- 0.5 kV, +/- 1 kV, +/- 2kV | Line to Earth: +/- 0.5 kV, +/- 1 kV, +/- 4 kV |
| Rise Time: | 1.2us | 10us |
| Hold Time: | 50us | 700us |
| Repetition Rate: | 30 second | 60 second |
| Angle: | ☒0° ☒90° ☒180° ☒270° | NA |
| Criteria: | B | C |
| Remarks: | | Where the coupling network for the 10/700 us waveform affects the functioning of high speed data ports, the test shall be carried out using a 1.2/50 (8/20) us waveform and appropriate coupling network. |
| Test Procedure: | refer to ISL QA -T4-E-S10 | |
| Temperature: | 25°C | |
| Humidity: | 56% | |

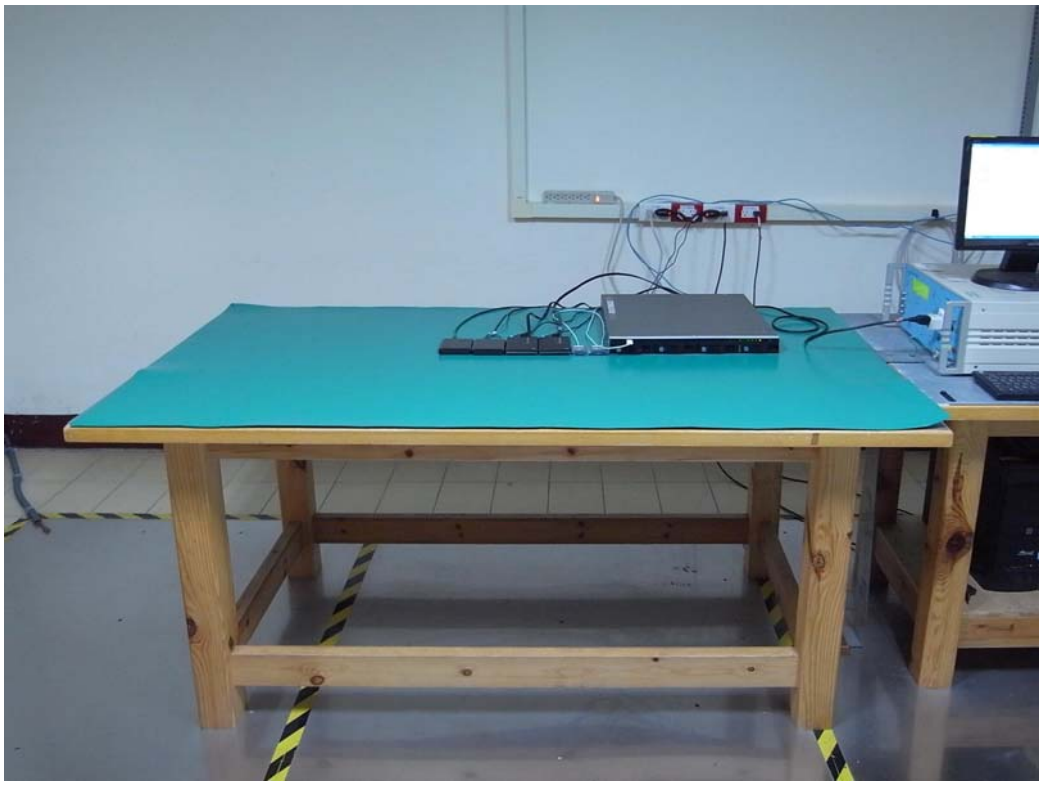
## 8.2 Test Setup




## 8.3 Test Result

**Performance of EUT complies with the given specification.**

## 8.4 Test Setup Photo

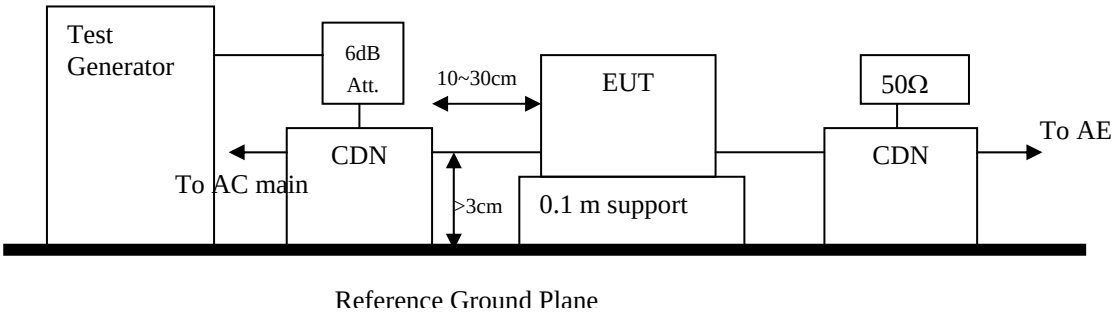


# 9. Immunity to Conductive Disturbance

## 9.1 Test Specification

| | |
|---|---|
| Port: | AC mains |
| Basic Standard: | EN 61000-4-6/ IEC EN61000-4-6 (details referred to Sec 1.2) |
| Test Level: | 3 V |
| Modulation: | AM 1KHz 80% |
| Frequency range: | 0.15 MHz - 80MHz |
| Frequency Step: | 1% of last Frequency |
| Dwell time: | 3s |
| Criteria: | A |
| CDN Type: | CDN M2+M3, CDN T2, CDN T4, CDN T8, EM Clamp |
| Test Procedure | refer to ISL QA -T4-E-S11 |
| Temperature: | 25°C |
| Humidity: | 56% |

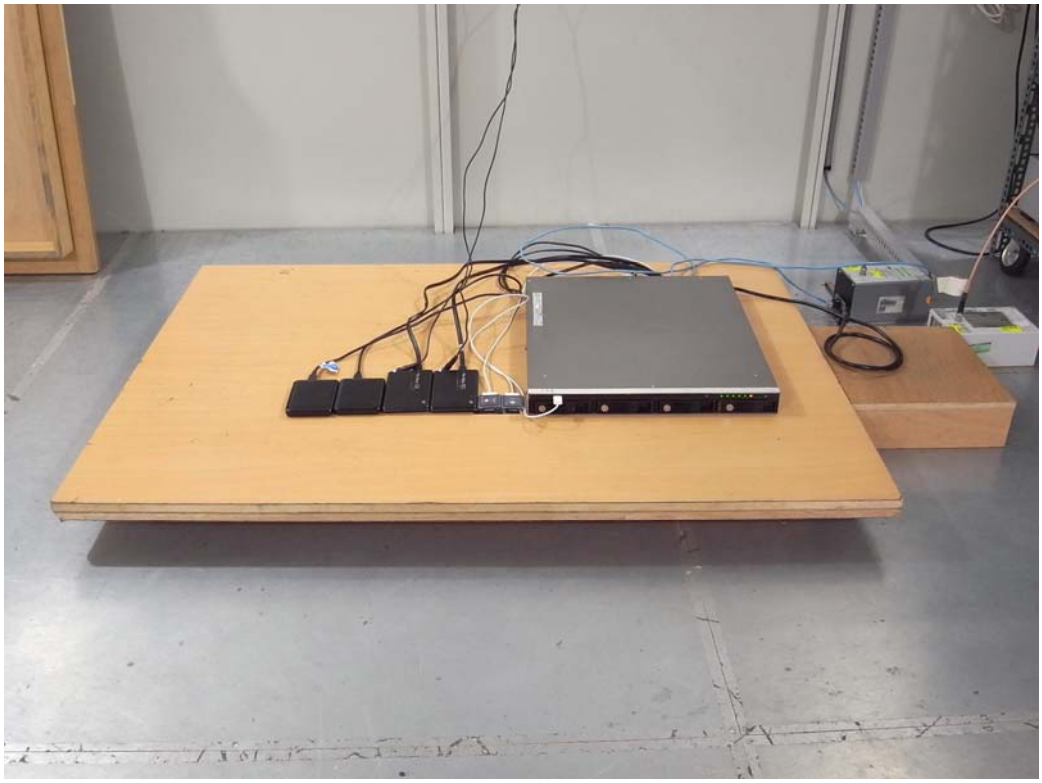
## 9.2 Test Setup




## 9.3 Test Result

**Performance of EUT complies with the given specification.**

## 9.4 Test Setup Photo

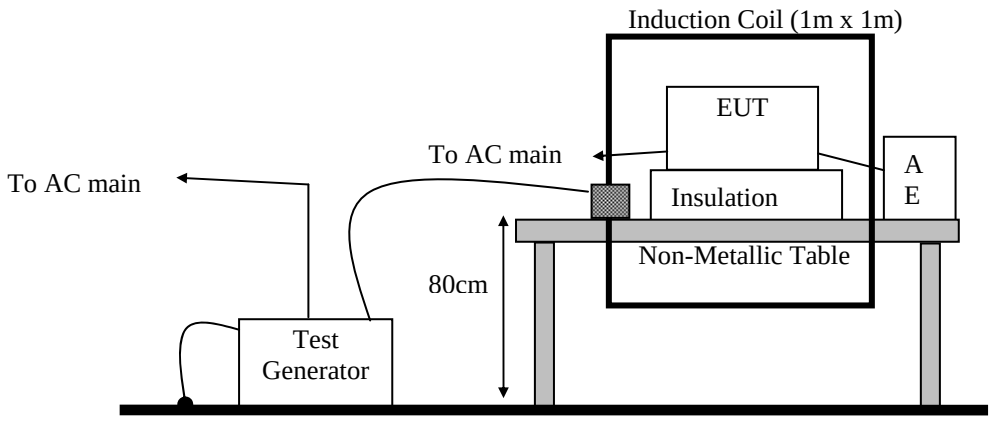


# 10. Power Frequency Magnetic Field immunity

## 10.1 Test Specification

| | |
|---|---|
| Port: | Enclosure |
| Basic Standard: | EN 61000-4-8/ IEC EN61000-4-8 (details referred to Sec 1.2) |
| Test Level: | 1A/m |
| Polarization: | X, Y, Z |
| Criteria: | A |
| Test Procedure | refer to ISL QA -T4-E-S12 |
| Temperature: | 25°C |
| Humidity: | 56% |

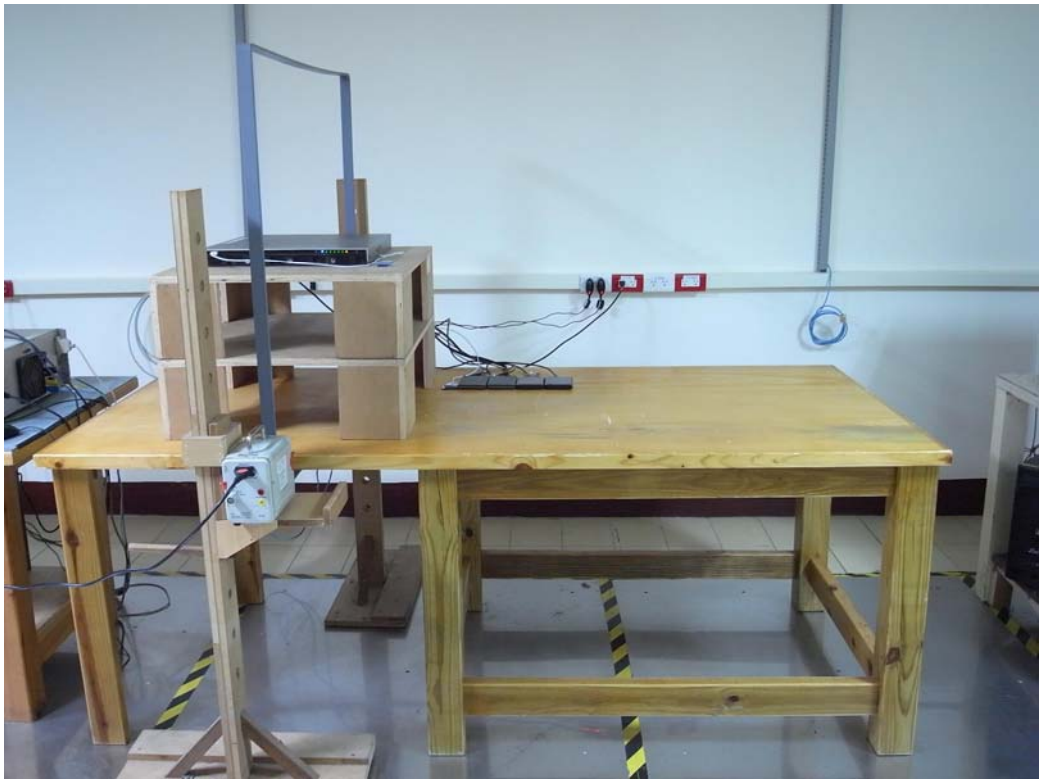
## 10.2 Test Setup




## 10.3 Test Result

**Performance of EUT complies with the given specification.**

## 10.4 Test Setup Photo

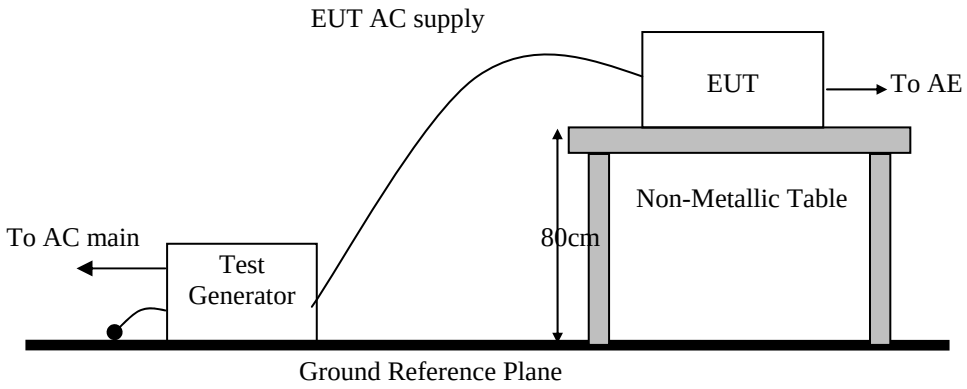


# 11. Voltage Dips, Short Interruption and Voltage Variation immunity

## 11.1 Test Specification

| | |
|---|---|
| Port: | AC mains |
| Basic Standard: | EN 61000-4-11/ IEC EN61000-4-11 (details referred to Sec 1.2) |
| Test Level:<br>Criteria: | >95% in 0.5 period<br>B |
| Test Level:<br>Criteria: | 30% in 25 period<br>C |
| Test Level:<br>Criteria: | >95% in 250 period<br>C |
| Phase: | 0°; 180° |
| Test intervals: | 3 times with 10s each |
| Test Procedure | refer to ISL QA -T4-E-S13 |
| Temperature: | 25°C |
| Humidity: | 56% |

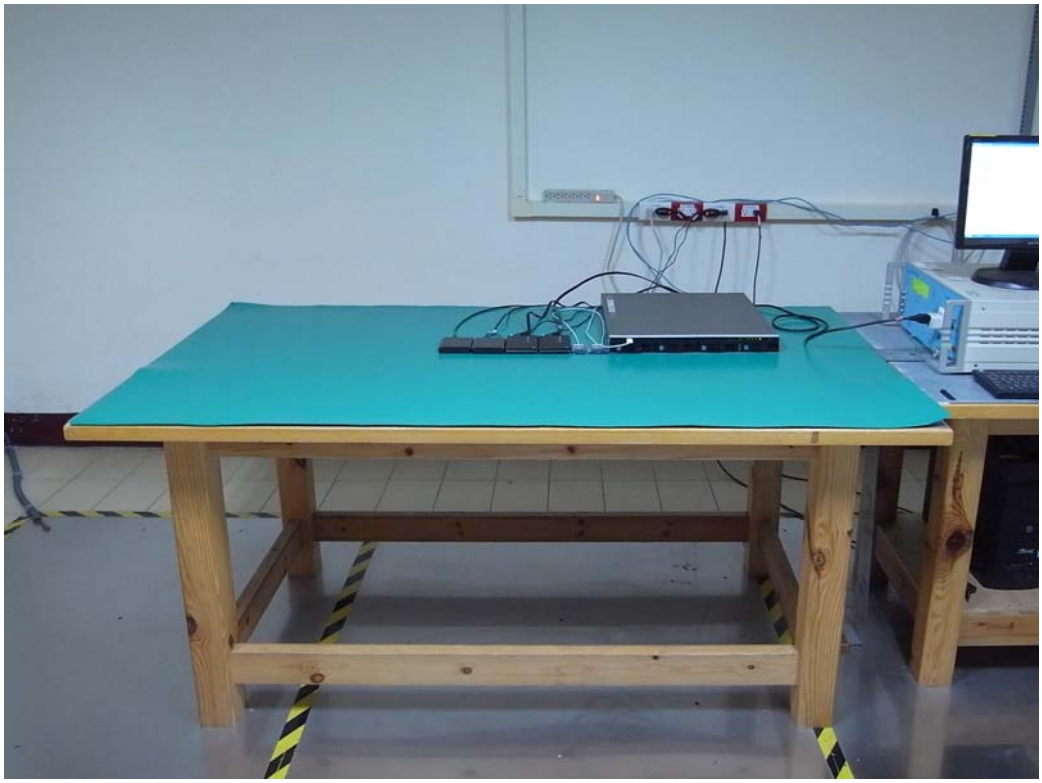
## 11.2 Test Setup




## 11.3 Test Result

**Performance of EUT complies with the given specification.**

## 11.4 Test Setup Photo



# 12. Harmonics

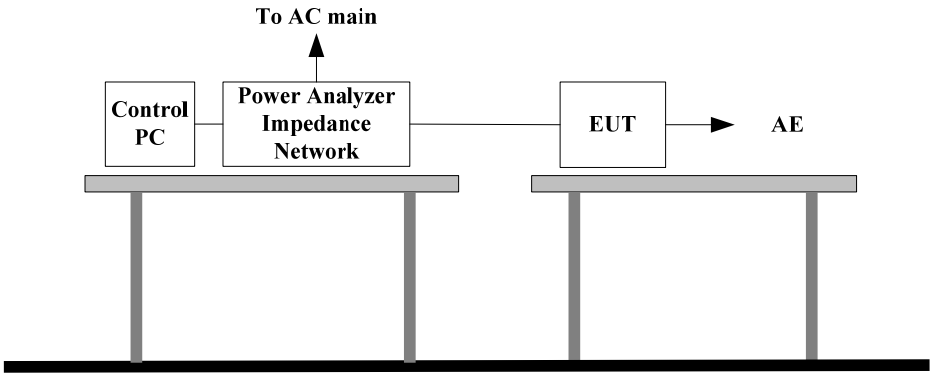
## 12.1 Test Specification

| | |
|---|---|
| Port: | AC mains |
| Active Input Power: | <75W |
| Basic Standard: | EN61000-3-2/IEC 61000-3-2<br>(details referred to Sec 1.2) |
| Test Duration: | 2.5min |
| Class: | D |
| Test Procedure | refer to ISL QA -T4-E-S14 |
| Temperature: | 25°C |
| Humidity: | 68% |

**Test Procedure**

The EUT is supplied in series with shunts or current transformers from a source having the same nominal voltage and frequency as the rated supply voltage and frequency of the EUT. The EUT is configured to its rated current with additional resistive load when the testing is performed.
Equipment having more than one rated voltage shall be tested at the rated voltage producing the highest harmonics as compared with the limits.

## 12.2 Test Setup




## 12.3 Test Result

**Active input power under 75W, no limit apply, declare compliance**

# 13. Voltage Fluctuations

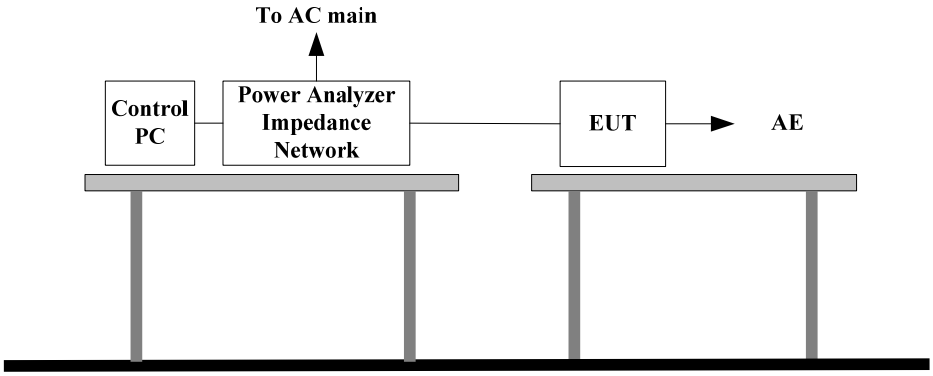
## 13.1 Test Specification

| | |
|---|---|
| Port: | AC mains |
| Basic Standard: | EN61000-3-3/IEC61000-3-3<br>(details referred to Sec 1.2) |
| Test Procedure | refer to ISL QA -T4-E-S14 |
| Observation period: | For Pst 10min |
| | For Plt 2 hours |
| Temperature: | 25°C |
| Humidity: | 68% |

**Test Procedure**

The EUT is supplied in series with reference impedance from a power source with the voltage and frequency as the nominal supply voltage and frequency of the EUT.

## 13.2 Test Setup



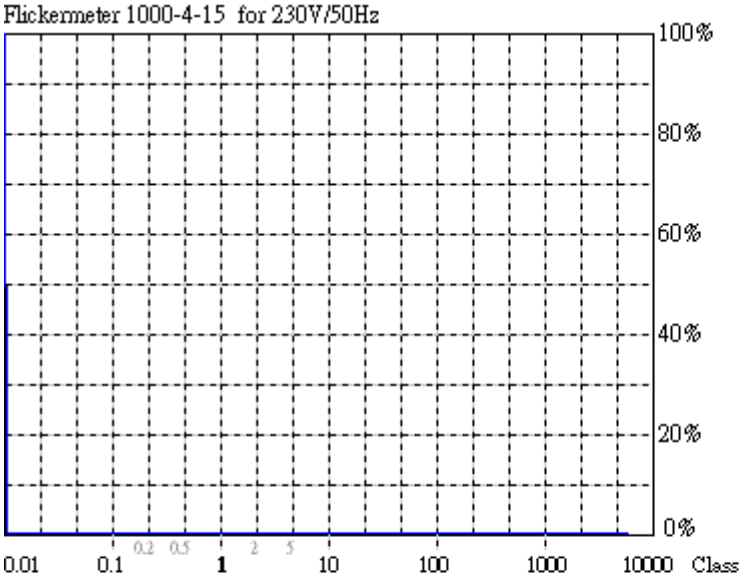

## 13.3 Test Result

**Performance of EUT complies with the given specification.**

## Test Data:

10min

Flickermeter 1000-4-15 for 230V/50Hz




| | |
|---|---|
| **Actual Flicker (Fli):** | **0.00** |
| **Short-term Flicker (Pst):** | **0.07** |
| Limit (Pst): | 1.00 |
| **Long-term Flicker (Plt):** | **0.07** |
| Limit (Plt): | 0.65 |
| **Maximum Relative Volt. Change (dmax):** | **0.00%** |
| Limit (dmax): | 4.00% |
| **Relative Steady-state Voltage Change (dc):** | **0.02%** |
| Limit (dc): | 3.30% |
| **Maximum Interval exceeding 3.30% (dt):** | **0.00ms** |
| Limit (dt>Lim): | 500ms |

**Flicker Emission - IEC 61000-3-3 , EN 61000-3-3 , (EN60555-3)**

2012/12/11 AM 10:20:35

| | | | | |
|---|---|---|---|---|
| Urms = | 229.9 | V | P = | 35.79 W |
| Irms = | 0.191 | A | pf = | 0.817 |

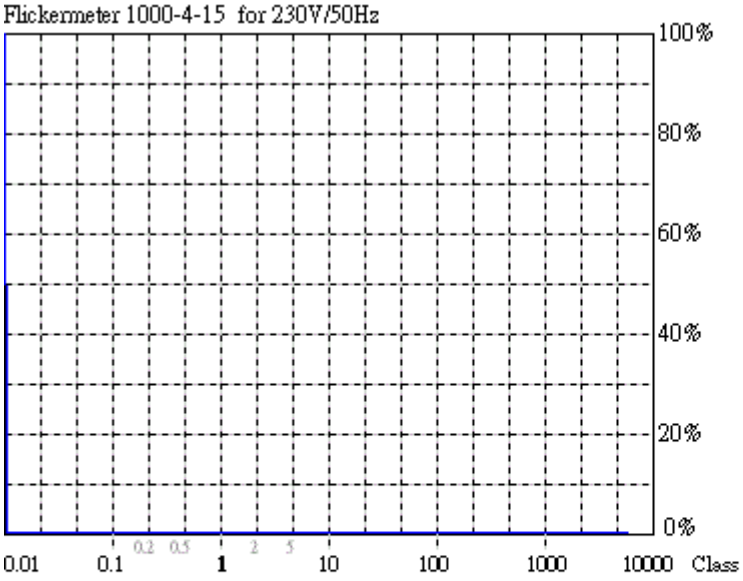
| | |
|---|---|
| Range: | 0.5 A |
| V-nom: | 230 V |
| TestTime: | 10 min (100%) |

**Test completed, Result: PASSED**

HAR-1000 EMC-Retest

120min

Flickermeter 1000-4-15 for 230V/50Hz




| | |
|---|---|
| **Actual Flicker (Fli):** | **0.00** |
| **Short-term Flicker (Pst):** | **0.07** |
| Limit (Pst): | 1.00 |
| **Long-term Flicker (Plt):** | **0.07** |
| Limit (Plt): | 0.65 |
| **Maximum Relative Volt. Change (dmax):** | **0.00%** |
| Limit (dmax): | 4.00% |
| **Relative Steady-state Voltage Change (dc):** | **0.01%** |
| Limit (dc): | 3.30% |
| **Maximum Interval exceeding 3.30% (dt):** | **0.00ms** |
| Limit (dt>Lim): | 500ms |

**Flicker Emission - IEC 61000-3-3 , EN 61000-3-3 , (EN60555-3)**

2012/12/11 PM 12:32:29

| | | | | |
|---|---|---|---|---|
| Urms = | 229.9 | V | P = | 33.49 W |
| Irms = | 0.181 | A | pf = | 0.806 |

| | |
|---|---|
| Range: | 0.5 A |
| V-nom: | 230 V |
| TestTime: | 120 min (10000%) |

**Test completed, Result: PASSED**

HAR-1000 EMC-Retest

## 13.4 Test Setup Photo

# 14. Appendix

## 14.1 Appendix A: Test Equipment

### 14.1.1 Test Equipment List

| Location CON01 | Equipment Name | Brand | Model | S/N | Last Cal. Date | Next Cal. Date |
|---|---|---|---|---|---|---|
| Conduction | Coaxial Cable 1F-C1 | EMEC | 5D Cable | 1F-C1 | 10/26/2012 | 10/26/2013 |
| Conduction | LISN 21 | ROHDE & SCHWARZ | ENV216 | 101476 | 05/10/2012 | 05/10/2013 |
| Conduction | LISN 22 | ROHDE & SCHWARZ | ENV216 | 101478 | 05/10/2012 | 05/10/2013 |
| Conduction | ISN T2 03 | FCC | FCC-TLISN-T2-02 | 20618 | 08/03/2012 | 08/03/2013 |
| Conduction | ISN T4 05 | FCC | FCC-TLISN-T4-02 | 20619 | 08/03/2012 | 08/03/2013 |
| Conduction | ISN T8 03 | FCC | FCC-TLINS-T8-02 | 20620 | 08/03/2012 | 08/03/2013 |
| Conduction | ISN T8 06 (Shielding) | Teseq GmbH | ISN ST08 | 33999 | 08/09/2012 | 08/09/2013 |
| Conduction | EMI Receiver 15 | ROHDE & SCHWARZ | ESCI | 101166 | 04/24/2012 | 04/24/2013 |

| Location OATS01 | Equipment Name | Brand | Model | S/N | Last Cal. Date | Next Cal. Date |
|---|---|---|---|---|---|---|
| Radiation | BILOG Antenna 10 | Sumol Sciences | JB1 | A013004-1 | 07/18/2012 | 07/18/2013 |
| Radiation | Coaxial Cable 3F-10M | EMCI | CFD400-NL | ISL-R001 | 03/16/2012 | 03/16/2013 |
| Radiation | EMI Receiver 13 | ROHDE & SCHWARZ | ESCI | 101015 | 02/22/2012 | 02/22/2013 |

| Location Chamber 01 | Equipment Name | Brand | Model | S/N | Last Cal. Date | Next Cal. Date |
|---|---|---|---|---|---|---|
| Rad. above 1Ghz | Horn Antenna 11 | ETS-LINDGREN | 3117 | 00114397 | 03/07/2012 | 03/07/2013 |
| Rad. above 1Ghz | Horn Antenna 03 | COM-Power | AH-826 | 100A | 03/15/2011 | 03/15/2013 |
| Rad. above 1Ghz | Horn Antenna 05 | Com-Power | AH-640 | 100A | 01/11/2011 | 01/11/2013 |
| Rad. above 1Ghz | Microwave Cable-16 | HUBER SUHNER | SUCFLEX 104 | 345760/4 | 12/13/2011 | 12/13/2012 |
| Rad. above 1Ghz | Preamplifier 20 | EMCI | EMC051845 | 980084 | 10/30/2012 | 10/30/2013 |
| Rad. above 1Ghz | Microwave Cable-19 | HUBER SUHNER | SUCFLEX 102 | MY 2151/2 | 05/03/2012 | 05/03/2013 |
| Rad. above 1Ghz | Preamplifier 22 | EMCI | EMC184045 | 980124 | 04/02/2012 | 04/02/2013 |
| Rad. above 1Ghz | Spectrum Analyzer 23 | ROHDE & SCHWARZ | FSU43 | 101255 | 11/01/2012 | 11/01/2013 |

| Location | Equipment Name | Brand | Model | S/N | Last Cal. Date | Next Cal. Date |
|---|---|---|---|---|---|---|
| EN61K-3-2/3 | DC Burn-In Load 02 | D-RAM | DBS-2100 | 2100-910027 | N/A | N/A |
| EN61K-3-2/3 | Harmonic/Flicker Test System 03 | EMC Partner | HARMONICS-1000 | 178 | 03/23/2012 | 03/23/2013 |
| EN61K-4-,4,5,8,11 | TRANSIENT 2000 01 | EMC Partner | TRANSIENT-2000 | 950 | 12/01/2012 | 12/01/2013 |
| EN61K-4-2 | ESD GUN 04 | Schaffner | NSG 438 | 489 | 03/28/2012 | 03/28/2013 |
| EN61K-4-3 | BILOG Antenna 06 | Schaffner | CBL6112B | 2754 | N/A | N/A |
| EN61K-4-3 | Amplifier 80Mz~1GHz 250W | AR | 250W1000A | 312494 | N/A | N/A |
| EN61K-4-3 | Amplifier 800MHz~3.0GHz 60W | AR | 60S1G3 | 312762 | N/A | N/A |
| EN61K-4-3 | Broadband coupler 10K~220Mhz | Amplifier Research | DC2500 | 19810 | N/A | N/A |
| EN61K-4-3 | Broadband Coupler 80M~1GHz | Amplifier Research | DC6180 | 20364 | N/A | N/A |
| EN61K-4-3 | Broadband Coupler 1~4GHz | Werlatone | C5291 | 6516 | N/A | N/A |
| EN61K-4-3 | Coaxial Cable Chmb 04-3M-2 | Belden | RG-8/U | Chmb 04-3M-2 | N/A | N/A |
| EN61K-4-3 | Signal Generator 03 | Anritsu | MG3642A | 6200162550 | 06/26/2012 | 06/26/2013 |
| EN61K-4-4 | Digital Oscilloscope | Tektronix | TDS 684A | B010761 | N/A | N/A |
| EN61K-4-4 | EFT Clamp | Precision | 1604242 | CNEFT1000-103 | N/A | N/A |
| EN61K-4-5 | CDN-UTP8 01 | EMC Partner | CDN-UTP8 | 032 | 12/01/2012 | 12/01/2013 |
| EN61K-4-5 | SURGE-TESTER 01 | EMC Partner | MIG0603IN3 | 778 | 12/01/2012 | 12/01/2013 |
| EN61K-4-6 | 6dB Attenuator | Weinschel Corp | 33-6-34 | BC5975 | N/A | N/A |
| EN61K-4-6 | Amplifier 4-6 | Amplifier Research | 150A100 | 1-1-R-02157 | N/A | N/A |
| EN61K-4-6 | Attenuator 6dB 4-6 | BIRO | 100-A-FFN-06 | 0123 | N/A | N/A |
| EN61K-4-6 | CDN M2+M3 | Frankonia | M2+M3 | A3011016 | 07/31/2012 | 07/31/2013 |
| EN61K-4-6 | CDN T2 01 | Frankonia | T2 | A3010003 | 07/31/2012 | 07/31/2013 |
| EN61K-4-6 | CDN T4 05 | FCC Inc. | FCC-801-T4-RJ45 | 08020 | 09/01/2012 | 09/01/2013 |
| EN61K-4-6 | CDN T8 01 | FCC Inc. | FCC-801-T8-RJ45 | 08021 | 09/01/2012 | 09/01/2013 |
| EN61K-4-6 | CDN RJ45S 01 | Frankonia | CDN-RJ45/S | A3150047 | 10/15/2012 | 10/15/2013 |
| EN61K-4-6 | EM-Clamp 01 | FCC | F-203I-23MM | 539 | N/A | N/A |
| EN61K-4-6 | Coaxial Cable 4-6 01-1 | Harbour Industries | M17/128-RG400 | 4-6 01-1 | N/A | N/A |
| EN61K-4-6 | Coaxial Cable 4-6 01-2 | Harbour Industries | M17/128-RG400 | 4-6 01-2 | N/A | N/A |
| EN61K-4-6 | Coaxial Cable 4-6 01-3 | Harbour Industries | M17/128-RG400 | 4-6 01-3 | N/A | N/A |
| EN61K-4-6 | KAL-AD RJ45S | BIRO | | | N/A | N/A |
| EN61K-4-6 | KAL-AD T2 | BIRO | | | N/A | N/A |
| EN61K-4-6 | Passive Impedance Adaptor 4-6 | FCC | FCC-801-150-50-CDN | 9758;9759 | N/A | N/A |
| EN61K-4-6, CISPR 13, Antenna | Signal Generator 02 | HP | 8648B | 3642U01040 | 08/28/2012 | 08/28/2013 |
| EN61K-4-8 | Magnetic Field Antenna | Precision | TRAIZ44B | MF1000-23 | N/A | N/A |

PS: N/A => The equipment does not need calibration.

### 14.1.2 Software for Controlling Spectrum/Receiver and Calculating Test Data

| Test Item | Filename | Version |
|---|---|---|
| EN61000-3-2 | HARCS.EXE | 4.16 |
| EN61000-3-3 | HARCS.EXE | 4.16 |
| EN61000-4-2 | N/A | 2.0 |
| EN61000-4-3 | Tile.Exe | 2.0.P |
| EN61000-4-4 | Tema.EXE | 1.69 |
| EN61000-4-5 | Tema.EXE | 1.69 |
| EN61000-4-6 | EN61000-4-6 Application Software | 1.13.e |
| EN61000-4-8 | N/A | |
| EN61000-4-11 | VDS-2002Rs.EXE | 2.00 |

| Radiation/Conduction | Filename | Version | Issued Date |
|---|---|---|---|
| Hsichih Conduction | EZ EMC | 1.1.4.2 | 2/10/2007 |
| Hsichih Radiation | EZ EMC | 1.1.4.2 | 1/24/2007 |

## 14.2 Appendix B: Uncertainty of Measurement

The measurement uncertainty refers to CISPR 16-4-2:2003. The coverage factor k = 2 yields approximately a 95 % level of confidence.

<Conduction 01>
AMN: ±3.29dB
ISN: ±4.43dB

<OATS 01 (10M)>
Horizontal
30MHz~200MHz: ±3.06dB
200MHz~1000MHz: ±3.22dB
Vertical
30MHz~200MHz: ±3.41dB
200MHz~1000MHz: ±3.20dB

<Chamber 01 (3M)>
1GHz~6GHz: ±4.69dB
6GHz~18GHz: ±4.72dB
18GHz~26.5GHz: ±3.44dB
18GHz~26.5GHz: ±3.49dB

<Immunity 01>

| Test item | Uncertainty | Test item | Uncertainty |
|---|---|---|---|
| EN61000-4-2 (ESD) | | EN61000-4-5 (Surge) | |
| Rise time tr | ≦ 15% | Time | ± 1.16% |
| Peak current Ip | ≦ 6.3% | Voltage | ± 1.63% |
| current at 30 ns | ≦ 6.3% | Current | ± 1.28% |
| current at 60 ns | ≦ 6.3% | EN61000-4-6 (CS) | |
| EN61000-4-3 (RS) | ±2.19dB | CDN | ± 1.36dB |
| EN61000-4-4 (EFT) | | EM Clamp | ± 3.19dB |
| Time | ± 1.43% | EN61000-4-8 (Magnetic) | ±1.12% |
| Voltage | ± 1.11% | EN61000-4-11 (Dips) | |
| Current | ± 1.85% | Time | ± 1.16% |
| | | Voltage | ± 0.10% |

| Test item | Uncertainty | Test item | Uncertainty |
|---|---|---|---|
| EN61000-3-2 (Harmonics) | ± 4.43 % | EN61000-3-3 (Fluctuations and Flicker) | ± 4.43 % |

## 14.3 Appendix C: Photographs of EUT

Please refer to the File of **ISL-12HE327P**