# ETSI EN 301 489-1 & 17 TEST REPORT
for
ASUSTeK COMPUTER INC.
Motherboard
Model No: H170I-PLUS D3
Brand: ASUS

Prepared for

**ASUSTeK COMPUTER INC.**
4F. No.150, Li-Te Rd., Peitou, Taipei112, Taiwan

Prepared by

**Audix Technology (Wujiang) Co., Ltd. EMC Dept.**
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| | | |
|---|---|---|
| Report Number | : | ACWE-RF1509005 |
| Date of Test | : | Aug.20~25, 2015 |
| Date of Report | : | Sep.15,2015 |

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# TEST REPORT VERIFICATION

| | | |
|---|---|---|
| Applicant | : | ASUSTeK COMPUTER INC. |
| Manufacturer#1 | : | MainTek Computer (Suzhou) Co., Ltd. |
| Manufacturer#2 | : | Danriver Technology (GZ) Inc. |
| Manufacturer#3 | : | Global Brands Manufacture Ltd. |
| Manufacturer#4 | : | First International Computer (Suzhou) Inc. |
| Manufacturer#5 | : | Boatek Electronic Co., Ltd. |
| Manufacturer#6 | : | Cal-Comp Electronics and Communications (Suzhou) Co., Ltd. |
| Manufacturer#7 | : | NBM Production (Dongguan) Co., Ltd. |
| Manufacturer#8 | : | INFO-TEK Electronics Co., Ltd. |
| Manufacturer#9 | | Amtertek Computer(Shenzhen) Co., Ltd. |
| Manufacturer#10 | | ONGGUAN G-PRO COMPUTER Co., Ltd. |
| EUT Description | : | Motherboard |
| (A) Model No. | : | H170I-PLUS D3 |
| (B) Brand | : | ASUS |
| (C) Test Voltage | : | AC 230V, 50Hz (Via PC) |

Applicable standards:

**ETSI EN301 489-1 V1.9.2: 2011-09**
**ETSI EN301 489-17 V2.2.1: 2012-09**
(EN 55022:2010+AC:2011, EN 61000-3-2:2014 and EN 61000-3-3:2013
EN 61000-4-2:2009, EN 61000-4-3:2006+A2:2010, EN 61000-4-4:2012
EN 61000-4-5:2006, EN 61000-4-6:2014, EN 61000-4-11:2004)

The device described above is tested by Audix Technology (Wujiang) Co., Ltd. EMC Dept. to determine the maximum emission levels emanating from the device and the severity levels of the device endured and its performance Criteria. The measurement results were contained in this test report and Audix Technology (Wujiang) Co., Ltd. EMC Dept. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this test report shows that the EUT is technically compliance with the ETSI EN 301-489-1 & -17 requirements.

This test report applies to above tested sample only and shall not be reproduced in part without written approval of Audix Technology (Wujiang) Co., Ltd. EMC Dept.

Date of Test: Aug.20~25, 2015 : Date of Report: Sep.15,2015

Prepared by : Emma Hu
(Emma Hu/Assistant Administrator)

Reviewer : Danny Sun
(Danny Sun/ Section Manager)

Approved & Authorized Signer : Ken Lu
(Ken Lu/ Assistant General Manager)

# 1 SUMMARY OF MEASUREMENTS AND RESULTS

Description of Standards and Results
The EUT have been tested according to the applicable standards as referenced below.

| **EMISSION** | | | | | |
|---|---|---|---|---|---|
| **Subclause** **ETSI EN 301 489-1 V1.9.2:2011-09** | **Description of Test Item** | **Standard** | **Limits** | **Results** | **Remark** |
| 8.2 | Radiated disturbance | EN 55022:2010+AC: 2011 | CLASS B | PASS | Minimum passing margin is 6.57 dB at 183.27 MHz |
| 8.3 | Conducted disturbance (DC power input/output port) | EN 55022:2010+AC: 2011 | Not Applicable | Not Applicable | --- |
| 8.4 | Conducted disturbance (AC mains input/output port) | EN 55022:2010+AC: 2011 | CLASS B | PASS | Minimum passing margin is 6.97 dB at 0.57 MHz |
| 8.5 | Harmonic current emissions | EN 61000-3-2:2014 | CLASS D | PASS | Meets the Class D requirement |
| 8.6 | Voltage fluctuations & flicker | EN 61000-3-3:2013 | --- | PASS | Meets the requirement |
| 8.7 | Conducted disturbance Telecommunication ports | EN 55022:2010+AC: 2011 | CLASS B | PASS | Minimum passing margin is 12.97 dB at 11.96 MHz |
| **IMMUNITY** | | | | | |
| **Subclause** **ETSI EN 301 489-1 V1.9.2:2011-09** | **Description of Test Item** | **Standard** | **Performance Criteria** | **Results** | **Observation Criteria** |
| 9.2 | RF electromagnetic field (80MHz to 2700MHz) | EN 61000-4-3:2006+ A2:2010 | A | PASS | A |
| 9.3 | Electrostatic discharge | EN 61000-4-2 :2009 | B | PASS | A |
| 9.4 | Electrical Fast Transient/Burst | EN 61000-4-4:2012 | B | PASS | A |
| 9.5 | RF common mode (0.15MHz to 80MHz) | EN 61000-4-6:2014 | A | PASS | A |
| 9.7 | Voltage dips | EN 61000-4-11:2004 | B | PASS | A |
| 9.7 | Voltage interruptions | | C | PASS | C |

| | | | | | |
|---|---|---|---|---|---|
| 9.8 | Surge | EN 61000-4-5:2006 | B | PASS | A |

# 2 DESCRIPTION OF PERFORMANCE CRITERION

## 2.1 Criterion (ETSI EN301 489-1/2011)

| **Performance Criterion** | | |
|---|---|---|
| 1 | Performance Criterion for continuous phenomena applied to transmitters and receivers (CT, CR) | If no further details are given in the relevant part of the present document dealing with particular type of radio equipment, the following general performance Criterion for continuous phenomena shall apply.<br>During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss performance. During the test EUT shall not unintentionally transmit or change its actual operating state and stored data.<br>If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended. |
| 2 | Performance Criterion for transient phenomena applied to transmitters and receivers (TT, TR) | If no further details are given in the relevant part of the present document dealing with particular type of radio equipment, the following general performance Criterion for transient phenomena shall apply.<br>After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss performance. During the EMC exposure to an electromagnetic phenomena, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed .<br>If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended. |
| 3 | Performance Criterion for equipment which does not provide a continuous communications link | For radio equipment which does not provide a continuous communication link, the performance Criterion described in the subclauses above are not appropriate, then the manufacturer shall declare, for inclusion in test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation. The related specifications set out in subclause 5.3 have also to be taken into account.<br>The performance Criterion specified by manufacturer shall give the same degree of immunity protection as called for in the foregoing subclause. |
| 4 | Performance Criterion for ancillary equipment tested on a stand alone basis | For radio equipment which does not provide a continuous communication link, the performance Criterion described in the subclauses above are not appropriate, then the manufacturer shall declare, for inclusion in test report, his own specification for an acceptable level of performance or degradation<br>The performance Criterion specified by manufacturer shall give the same degree of immunity protection as called for in the foregoing subclause. |

2.2 Performance Criterion (ETSI EN301 489-17/2012)

The performance Criteria are:

- Performance Criterion A for immunity tests with phenomena of a continuous nature (CT, CR);
- Performance Criterion B for immunity tests with phenomena of a transient nature (TT, TR);
- Performance Criterion C for immunity tests with power interruptions exceeding a certain time.

| **Performance Criterion** | | |
|---|---|---|
| **Criterion** | **During test** | **After test** |
| A | Shall operate as intended<br>May show degradation of performance(note 1)<br>Shall be no loss of function<br>Shall be no unintentional transmissions | Shall operate as intended<br>Shall be no degradation of performance (note 2)<br>Shall be no loss of function<br>Shall be no loss of stored data or user programmable functions |
| B | May show loss of function (one or more)<br>May show degradation of performance(note 1)<br>No unintentional transmissions | Functions shall be self-recoverable<br>Shall operate as intended after recovering<br>Shall be no degradation of performance (note 2)<br>Shall be no loss of stored data or user programmable functions |
| C | May be loss of function (one or more) | Functions shall be recoverable by the operator<br>Shall operate as intended after recovering<br>Shall be no degradation of performance (note 2) |

NOTE 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.
If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

NOTE 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed.
If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

# 3 GENERAL INFORMATION

## 3.1 Description of Device (EUT)

| | | |
|---|---|---|
| Product | : | Motherboard |
| Model Number | : | H170I-PLUS D3 |
| Serial Number | | 5VP2ZM7J |
| Brand | : | ASUS |
| Applicant | : | ASUSTeK COMPUTER INC.<br>4F, No.150, Li-Te Rd., Peitou, Taipei 112, Taiwan |
| Manufacturer # 1 | : | Cal-Comp Electronics and Communications (Suzhou) Co., Ltd.<br>Wujiang Export Processing Zone, No.688, Pangjin Road,<br>Wujiang Economic Development Zone, Jiangsu Province,<br>China. |
| Manufacturer # 2 | : | Danriver Technology (GZ) Inc.<br>No.16, Baoying Dadao, Guangzhou Free Trade Zone,<br>Guangdong, P.R.China |
| Manufacturer # 3 | : | Boatek Electronic Co., Ltd.<br>No.124 bubugao road, wu sha kong bavillage, chang an, dong guan, Guangdong province |
| Manufacturer # 4 | : | Global Brands Manufacture Ltd.<br>EMS Business unit Global Brands Manufacture Limited<br>Yuyuan Industrial Estate, Huangjiang Town, Dongguan City,<br>Guangdong, P.R.China |
| Manufacturer # 5 | : | First International Computer (Suzhou) Inc.<br>Export Processing Zone, No.200 Central Suhong Road, SuZhou Industrial Park, Jiangsu, P.R.China |
| Manufacturer # 6 | : | MainTek Computer (Suzhou) Co., Ltd.<br>No.233, Jinfeng Road, Suzhou City New District, Jiangsu, P.R. China |
| Manufacturer # 7 | : | NBM Production (Dongguan) Co., Ltd.<br>No.51 Xinju Rd., Shangjiao community, Changan Town,<br>Dongguan City, Guangdong, P.R. China |
| Manufacturer # 8 | : | INFO-TEK Electronics Co., Ltd.<br>NO.183 Jinfeng Rd.,Hi-tech Development Zone Suzhou,<br>Jiangsu, P.R. China |
| Manufacturer#9 | | Amtertek Computer(Shenzhen) Co., Ltd. |
| Manufacturer#10 | | ONGGUAN G-PRO COMPUTER Co., Ltd. |
| Date of Receipt of Sample | : | Aug.20, 2015 |
| Date of Test | : | Aug.20~25, 2015 |

3.2 EUT's Specification under application

| | | |
|---|---|---|
| Interface Ports | : | (1) PS-2 port*1<br>(2) USB 3.0 port*6<br>(3) DP port*1<br>(4) HDMI port*1<br>(5) D-sub port*1<br>(6) DVI port*1<br>(7) RJ-45 port*1 (10M/bps, 100M/bps, 1000M/bps)<br>(8) Audio port*3<br>(9) WIFI*1<br>(10)SPDIF*1 |
| CPU | : | Intel 2.70GHz |
| Chipset | : | PCH Vendor Intel<br>PCH Type: H170 |
| Memory Type | : | DDR3 |
| Memory Size | : | Min: 1024 MB; Max: 16 GB |
| HDMI Max. resolution | : | 2560*1600@60Hz |
| DP Max. resolution | : | 2560*1600@60Hz |
| DVI Max. resolution | | 2560*1600@60Hz |
| D-sub Max. resolution | | 1920*1200@60Hz |
| Highest Working Frequency （CPU） | : | 2.70GHz |

3.3 List of all the components under test

| Product | : | Brand/Model Number/Specification |
|---|---|---|
| CPU | : | Intel 2.70GHz |
| **Motherboard (EUT)** | : | **H170I-PLUS D3** |
| Wifi Module | : | Model: QCNFA364A<br>LITEON/WCBN808A-AD<br>802.11A/B/G/N/AC WLAN+BT4.1 |
| HDD | : | Seagate,ST3750528AS, 750GB |
| RAM | : | Crucial, CT102464BA160B.16FED |
| Switching Power Supply | : | Brand: FSP GROUP INC.<br>Model No.: FSP400-60EPN<br>Input: AC 100-240V, 6-3A, 50-60Hz<br>Output:DC(+3.3V/24.0A; +5V/15.0A; +12V1/17.0A; +12V2/17.0A; +5Vsb/2.5A -12V/0.3A;)<br>400W (+3.3V&+5V=120W Max) (+12V1&+12V2=336W Max);<br>DC Power cord: Unshielded, Undetachable, 0.4m |

3.4 Operating Condition of EUT

| EUT Exercise Program and Condition | |
|---|---|
| Operating System | Windows 7 |
| Test Program | “BurnIn Test V 6.0” |
| Graphic Controller | Display scrolling “H” pattern (Font: Arial, Size: 11) with respective resolution. |
| Audio Controller | Run the program “Windows Media Player” and play 1kHz audio signal. |
| LAN Controller (10M/bps) | Data transfer to host PC (pin test) |
| LAN Controller (100M/bps & 1G/bps) | Data transfer to host PC (tfgen.exe.) |
| One USB Port | Write operation to USB peripherals (WINTHRAX.exe.) |
| Other USB Ports | Read operation to USB peripherals (WINTHRAX.exe.) |
| PS-2 Port | Write operation to PS-2 peripherals. |
| USB port | Connect to Printer |

3.5 Tested Supporting System Details

3.5.1 USB Mouse

| | | |
|---|---|---|
| Manufacturer | : | HP |
| Model Number | : | UAE86 |
| Serial Number | : | N/A |
| BSMI ID | : | R41108 |
| Data Cable | : | Shielded, Undetachable, 1.8m |

3.5.2 PS-2 Keyboard

| | | |
|---|---|---|
| Manufacturer | : | HP |
| Model Number | : | KB-0316 |
| Serial Number | : | **537745-AA1** |
| BSMI ID | : | R33001 |
| Data Cable | : | Shielded, Undetachable, 1.8m |

3.5.3 LCD Monitor #1

| | | |
|---|---|---|
| Manufacturer | : | DELL |
| Model Number | : | 3008WFPt |
| Serial Number | : | CN-ORW915-71618-84T-102L |
| Display Cable | : | Shielded, Detachable, 1.8m |
| AC Power Cord | : | Unshielded, Detachable, 1.8m |

3.5.4 LCD Monitor #2

| | | |
|---|---|---|
| Manufacturer | : | DELL |
| Model Number | : | U3011t |
| Serial Number | : | CN-0PH5NY-74445-17F-060L |
| HDMI Cable | : | Shielded, Detachable, 1.8m |
| AC Power Cord | : | Unshielded, Detachable, 1.8m |

3.5.5 LCD Monitor #3

| | | |
|---|---|---|
| Manufacturer | : | DELL |
| Model Number | : | U3014t |
| Serial Number | : | CN-0P1V6N-74445-34J-110L |
| D-sub Cable | : | Shielded, Detachable, 1.8m. 2core |
| DVI Cable | | Shielded, Detachable, 1.8m. 2core |
| AC Power Cord | : | Unshielded, Detachable, 1.8m |

3.5.6 Walkman

| | | |
|---|---|---|
| Manufacturer | : | WINGO |
| Model Number | : | SP-2311 |

| | | |
|---|---|---|
| Serial Number | : | o143360731 |
| Audio Cable | : | Shielded, Detachable, 1.8m |

3.5.7 Speaker

| | | |
|---|---|---|
| Manufacturer | : | Plank |
| Model Number | : | CAT-522 |
| Serial Number | : | 204896 |
| BSMI ID | | R41307 |
| Audio Cable | : | Shielded, Detachable, 1.8m |
| SPDIF Cable | : | Shielded, Detachable, 1.8m |

3.5.8 Printer

| | | |
|---|---|---|
| Manufacturer | : | HP |
| Model Number | : | DESKJET3918 |
| Serial Number | : | CN64S1N0T6 |
| USB Cable | : | Shielded, Detachable, 2.0m |
| AC Adapter | : | HP/090-4397<br>I/P: AC100-240V, 50-60Hz, 500mA,<br>O/P: DC +32Vdc, 500mA max; +15Vdc, 530mA max<br>AC Cord: Unshielded,Detachable, 1.8m<br>DC Cord: Unshielded, Undetachable, 1.8m, 1 ferrite core |

3.5.9 Earphone #1

| | | |
|---|---|---|
| Manufacturer | : | SALAR |
| Model Number | : | V81 |
| Audio Cable | : | Unshielded, Undetachable, 2.2m |

3.5.10 USB HDD # 1

| | | |
|---|---|---|
| Manufacturer | : | BUFFALO |
| Model Number | : | HD-HX1.OTU3-AP |
| Serial Number | : | 45564800402028 |
| Data Cable | : | Shielded, Detachable, 1.0m |

3.5.11 USB HDD # 2

| | | |
|---|---|---|
| Manufacturer | : | BUFFALO |
| Model Number | : | HD-HX1.OTU3-AP |
| Serial Number | : | 45564800402035 |
| Data Cable | : | Shielded, Detachable, 1.0m |

3.5.12 USB HDD # 3

| | | |
|---|---|---|
| Manufacturer | : | BUFFALO |
| Model Number | : | HD-HX1.OTU3-AP |

| | | |
|---|---|---|
| Serial Number | : | 45564800402202 |
| Data Cable | : | Shielded, Detachable, 1.0m |

3.5.13 USB HDD # 4

| | | |
|---|---|---|
| Manufacturer | : | BUFFALO |
| Model Number | : | HD-HX1.OTU3-AP |
| Serial Number | : | 45564800401977 |
| Data Cable | : | Shielded, Detachable, 1.0m |

3.5.14 AC Power Cord: Unshielded, Detachable, 1.8m, 3C (Connecting to PC)

For Conducted Disturbance Measurement:

3.5.15 RJ-45 Cable *1: Unshielded, Detachable, 9m (Connecting between AE and ISN)

3.5.16 RJ-45 Cable *1: Shielded, Detachable, 9m (Connecting between AE and ISN)

3.5.17 RJ-45 Cable *1: Unshielded, Detachable, 1.0m (Connecting between EUT and ISN)

3.5.18 RJ-45 Cable *1: Shielded, Detachable, 1.0m (Connecting between EUT and ISN)

For Radiated Disturbance Measurement (10m Chamber):

3.5.19 RJ-45 Cable *1: Unshielded, Detachable, 25m (Connecting between EUT and PC)

3.6 Description of Test Facility

| | | |
|---|---|---|
| Name of Firm | : | **Audix Technology (Wujiang) Co., Ltd. EMC Dept.** |
| Site Location | : | No. 1289 Jiangxing East Road, the Eastern Part of Wujiang Economic Development Zone Jiangsu China 215200 |
| Test Facilities | : | **No.1 10m semi-anechoic chamber**<br>**No. 1 conducted shielding enclosure**<br>**The Complex Immunity Test Room**<br>**RS&CS Test Room** |
| NVLAP Lab Code | : | 200786-0<br>Valid until on Sep. 30, 2016<br>(NVLAP is a signatory member of ILAC MRA)<br>Remark: This report shall not be imply endorsement, certification or approval by NVLAP, NIST, or any agency of the U.S. Federal Government. |

3.7 Measurement Uncertainty

| Test Item | Range Frequency | Uncertainty |
|---|---|---|
| No.1 Conducted Shielding Enclosure | | |
| Conducted Disturbance Measurement at mains port | 0.15MHz ~ 30MHz | ± 3.30dB |
| Conducted Disturbance Measurement at telecommunication port | 0.15MHz ~ 30MHz | ± 3.80dB |
| At 10m Semi-Anechoic Chamber | | |
| Radiated Disturbance Measurement (Distance 10m) | 30MHz ~ 1000MHz | ± 3.96dB (Horizontal) |
| | | ± 4.17dB (Vertical) |
| Radiated Disturbance Measurement (Distance 3m) | 1000MHz ~ 6000MHz | ± 5.13dB |

Remark：Uncertainty = $ku_c(y)$

# 4 CONDUCTED DISTURBANCE AT MAINS TERMINALS TEST

4.1 Test Equipment

The following test equipment are used during the power-line conducted test in a shielded room:

4.1.1 For AC Mains Port

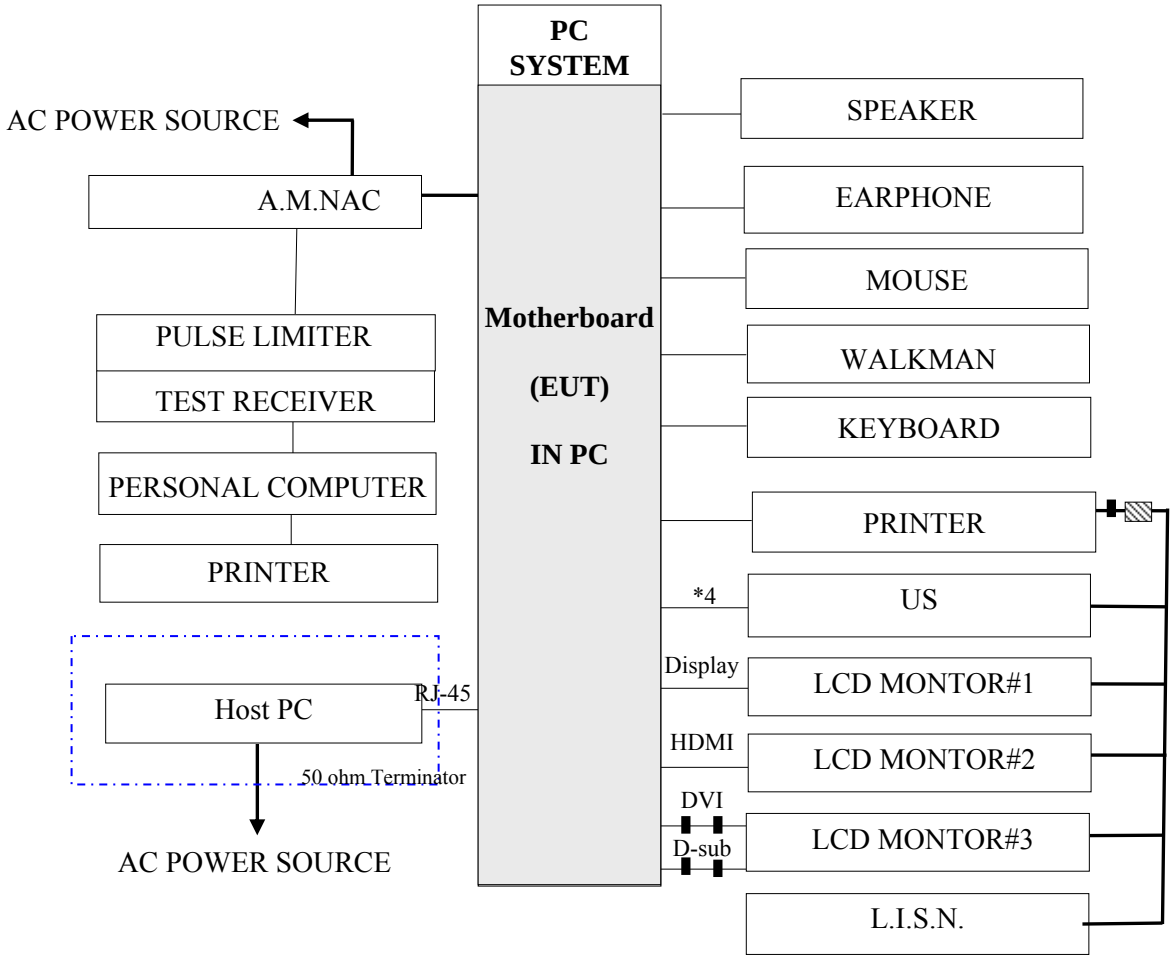
| Item | Type | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | Test Receiver | R & S | ESCI | 100839 | 2015-01-05 | 2016-01-04 |
| 2. | A.M.N. | R&S | ESH2-Z5 | 100153 | 2015-05-15 | 2016-05-14 |
| 3. | L.I.S.N | Kyoritsu | KNW-407 | 8-1793-4 | 2015-07-03 | 2016-07-03 |
| 4. | Pulse Limiter | R&S | ESH3-Z2 | 100605 | 2015-07-03 | 2016-07-03 |
| 5. | RF Cable | Harbour Industries | RG400 | 001 | 2015-01-05 | 2016-01-04 |
| 6. | Software | Audix/e3(6.7.0313) | | | | |

4.1.2 For Telecommunication Port

| Item | Type | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | Test Receiver | R & S | ESCI | 100839 | 2015-01-05 | 2016-01-04 |
| 2. | A.M.N. | R&S | ESH2-Z5 | 100153 | 2015-05-15 | 2016-05-14 |
| 3. | L.I.S.N | Kyoritsu | KNW-407 | 8-1793-4 | 2015-07-03 | 2016-07-03 |
| 4. | I.S.N. | TESEQ | T800 | 30804 | 2015-07-03 | 2016-07-03 |
| 5. | C.D.N | TESEQ | CDN ST08A | 36281 | 2014-12-09 | 2015-12-08 |
| 6. | Pulse Limiter | R&S | ESH3-Z2 | 100605 | 2015-07-03 | 2016-07-03 |
| 7. | RF Cable | Harbour Industries | RG400 | 001 | 2015-01-05 | 2016-01-04 |
| 8. | Software | Audix/e3(6.7.0313) | | | | |

4.2 Block Diagram of Test Setup

4.2.1 for AC Mains Port

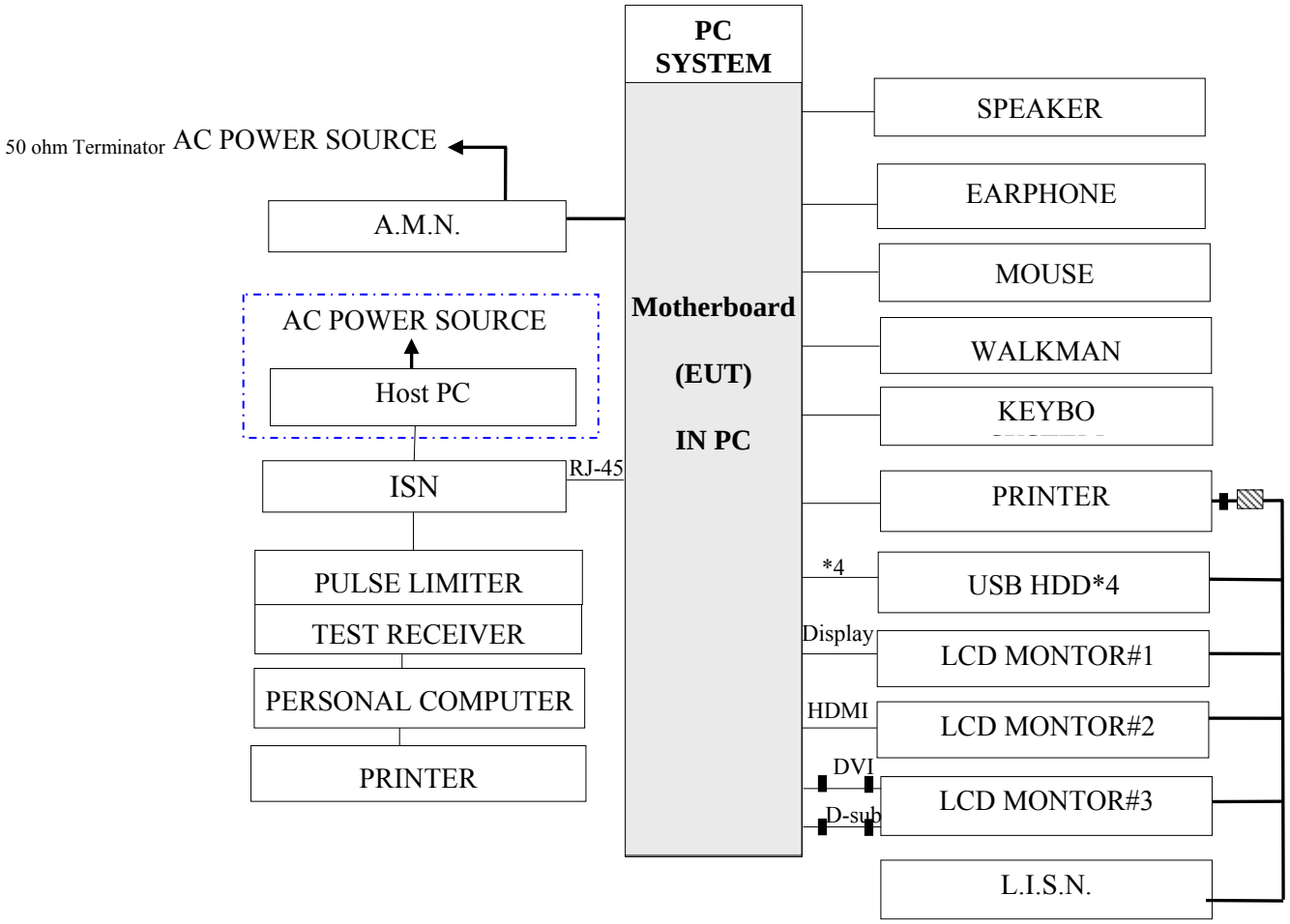



: SIGNAL

: FERRITE

: AC ADAPT

4.2.2 for Telecommunication Port




: POWER
: SIGNAL
: FERRITE CORE
: AC ADAPTER

4.3 Limits for Conducted Emissions from AC Mains Port
(ETSI EN 301 489-1 V1.9.2:2011-09 Subclause 8.4 (EN55022,Class B)

| Frequency range | Limit (quasi-peak) | Limit (average) |
|---|---|---|
| 150kHz ~ 500kHz | 66 dBμV ~ 56 dBμV | 56 dBμV ~ 46 dBμV |
| 500kHz ~ 5MHz | 56 dBμV | 46 dBμV |
| 5MHz ~ 30MHz | 60 dBμV | 50 dBμV |

Remark 1.The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.
2. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary.
3. The lower limit applies at the band edges.

4.4 Limits for Conducted Emissions from the telecommunication ports
ETSI EN 301 489-1 V1.9.2:2011-09 Sub clause 8.7 (EN55022,Class B)

| Frequency | Voltage Limits(dBμV) | | Current Limits(dBμA) | |
|---|---|---|---|---|
| | Quasi-Peak | Average | Quasi-Peak | Average |
| 0.15MHz ~ 0.5MHz | 84 ~ 74 | 74 ~ 64 | 40 ~ 30 | 30 ~ 20 |
| 0.5MHz ~ 30MHz | 74 | 64 | 30 | 20 |

Remark 1.The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

4.5 Test Procedure
The measuring process is according to the standard of EN 55022, The standard of EN 55022 and laboratory internal procedure TKC-301-004.

4.5.1 For AC Main Port

In the conducted emission measurement, the EUT and all peripheral devices were set up on a non-metallic table which was 0.8 meter height above the ground plane, and 0.4 meter far away from the vertical plane. The mains cable of the EUT connected to one Artificial Main Network(AMN). All other unit of the EUT and AE connected to a second Line Impedance Stabilization Network(L.I.S.N.). The telecommunication cable connected to the AE through a Impedance Stabilization Network(ISN) which terminated a 50Ω resistor. For the measurement, the A.M.N measuring port was terminated by a 50Ω measuring equipment and the second L.I.S.N measuring port was terminated by a 50Ω terminator. All measurements were done between the phase lead and the reference ground, and between the neutral lead and the reference ground. All cables or wires placement were verified to find out the maximum emission.

4.5.2 For Telecommunication Port

The setup is the same as conduction besides this, connecting between AE and telecommunication port through ISN. Each phase of telecommunication wire is measured to evaluate the maximum conducted emission in accordance with clause 9 of EN 55022.

The bandwidth of measuring receiver was set at 9 kHz.

The required frequency band (0.15 MHz ~ 30 MHz) was pre-scanned with peak detector, the final measurement was measured with quasi-peak detector and average detector. (If the average limit is met when using a quasi-peak detector, the average detector is unnecessary).

The emission level is calculated automatically by the test system which uses the following equation:

Emission level (dBμV) = Reading (dBμV) + A.M.N / I.S.N. factor (dB) + Cable loss (dB). (Cable loss includes pulse limiter loss)

4.6 Measurement Results

4.6.1 AC main port Measurement Results

**PASSED**

EUT with the following configuration is performed during this section testing and all the test results are listed in next pages.

Test Date: Aug.22,2015 Temperature: 21.4℃ Humidity: 59%

| Item | Test Mode | Reference Test Data No. | |
|---|---|---|---|
| | | Neutral | Line |
| **1** | **WLAN+BT Operating** | **# 29** | **※# 30** |

NOTE 1- '※'means the worst test mode**.**

NOTE 2- The worst emission is detected at 0.57 MHz with emission level of 39.03 dB (μV) and with AV detector (limit is 46.00 dB (μV)), when the Line of the EUT is connected to A.M.N.

EUT with the following configuration is performed during this section testing and all the test results are listed in next pages.

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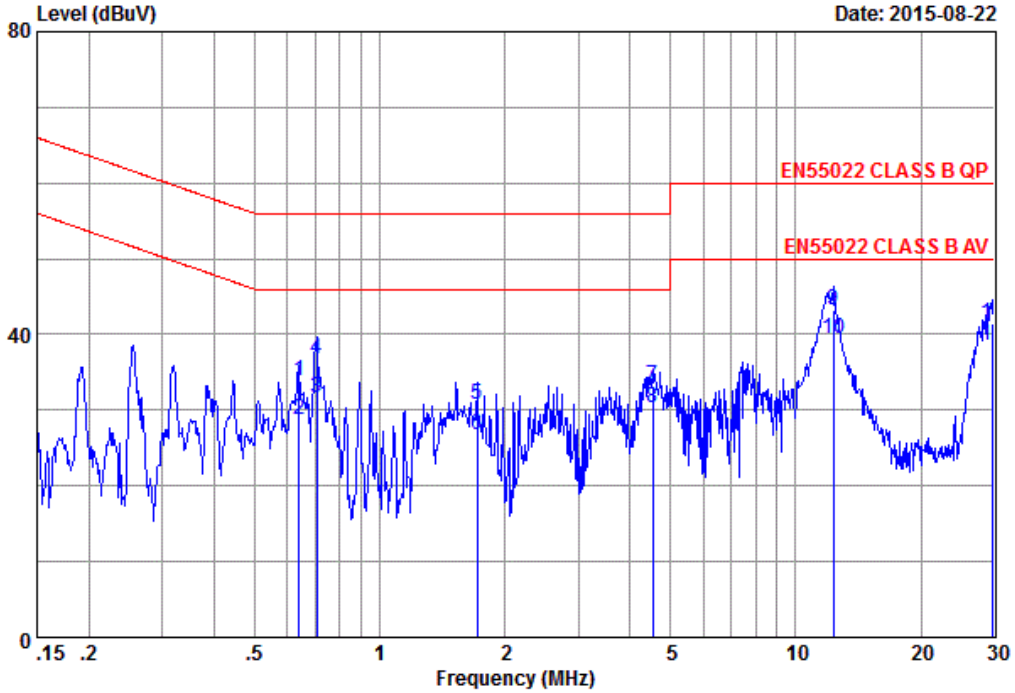
Data: 29 File: F:\2015Test Data\Report\8\G1508022.EM6 (48)




Site no. : No.1 Conducted shielding Enclosure
AMN/LISN . : ESH2-Z5-1505
Limit : EN55022 CLASS B QP
Env. / Ins. : 21.4C&59%/ESCI
EUT : Motherboard
M/N : H170I-PLUS D3
Power Rating : 230Vac/50Hz
Test mode : WLAN+BT Operating
Memo : Intel(R) Core(TM) i5-6400 CPU@2.70GHz
: BIOS:0302

Data no. : 29
Phase : NEUTRAL
Engineer : Miller

| | Freq. (MHz) | AMN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.64 | 0.17 | 9.89 | 23.76 | 33.82 | 56.00 | 22.18 | QP |
| 2 | 0.64 | 0.17 | 9.89 | 18.76 | 28.82 | 46.00 | 17.18 | Average |
| 3 | 0.70 | 0.17 | 9.89 | 21.66 | 31.72 | 46.00 | 14.28 | Average |
| 4 | 0.70 | 0.17 | 9.89 | 26.66 | 36.72 | 56.00 | 19.28 | QP |
| 5 | 1.72 | 0.20 | 9.92 | 20.61 | 30.73 | 56.00 | 25.27 | QP |
| 6 | 1.72 | 0.20 | 9.92 | 16.61 | 26.73 | 46.00 | 19.27 | Average |
| 7 | 4.53 | 0.29 | 9.96 | 23.04 | 33.29 | 56.00 | 22.71 | QP |
| 8 | 4.53 | 0.29 | 9.96 | 20.04 | 30.29 | 46.00 | 15.71 | Average |
| 9 | 12.32 | 0.49 | 10.05 | 32.79 | 43.33 | 60.00 | 16.67 | QP |
| 10 | 12.32 | 0.49 | 10.05 | 28.79 | 39.33 | 50.00 | 10.67 | Average |
| 11 | 29.68 | 0.76 | 10.22 | 30.52 | 41.50 | 60.00 | 18.50 | QP |
| 12 | 29.68 | 0.76 | 10.22 | 27.52 | 38.50 | 50.00 | 11.50 | Average |

Remarks:
1.Emission Level= AMN factor + Cable loss + Reading .

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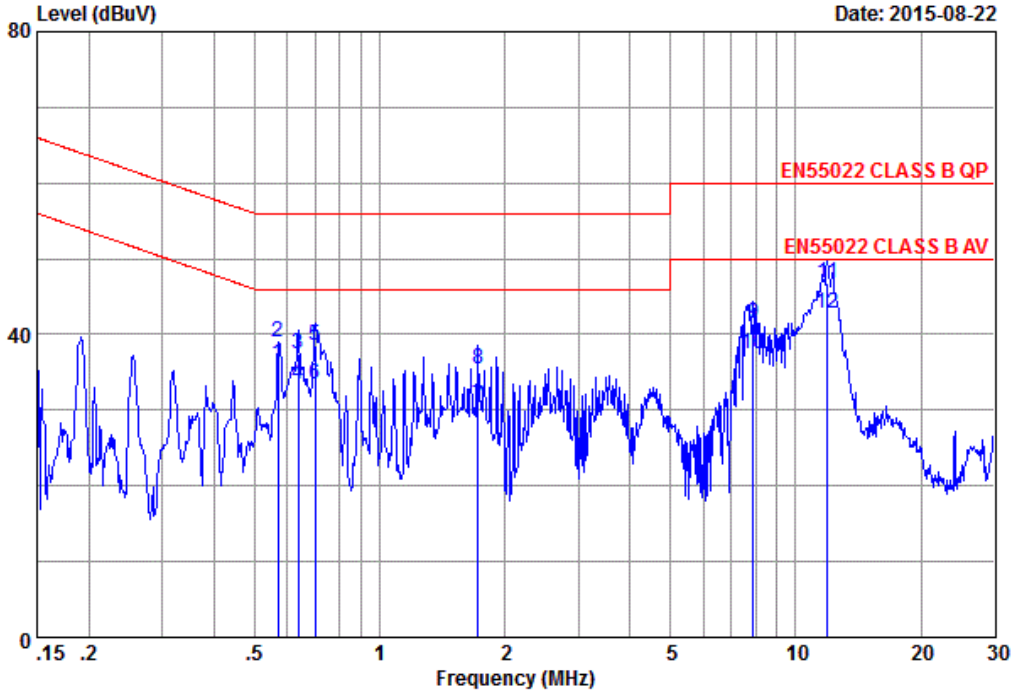
Data: 30 File: F:\2015Test Data\Report\8\G1508022.EM6 (48)




| | | | |
|---|---|---|---|
| Site no. | : No.1 Conducted shielding Enclosure | Data no. | : 30 |
| AMN/LISN | : ESH2-Z5-1505 | Phase | : LINE |
| Limit | : EN55022 CLASS B QP | | |
| Env. / Ins. | : 21.4C&59%/ESCI | Engineer | : Miller |
| EUT | : Motherboard | | |
| M/N | : H170I-PLUS D3 | | |
| Power Rating | : 230Vac/50Hz | | |
| Test mode | : WLAN+BT Operating | | |
| Memo | : Intel(R) Core(TM) i5-6400 CPU@2.70GHz | | |
| | : BIOS:0302 | | |

| | Freq. (MHz) | AMN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.57 | 0.17 | 9.88 | 25.97 | 36.02 | 56.00 | 19.98 | QP |
| 2 | 0.57 | 0.17 | 9.88 | 28.98 | 39.03 | 46.00 | 6.97 | Average |
| 3 | 0.64 | 0.18 | 9.89 | 27.40 | 37.47 | 56.00 | 18.53 | QP |
| 4 | 0.64 | 0.18 | 9.89 | 23.40 | 33.47 | 46.00 | 12.53 | Average |
| 5 | 0.70 | 0.18 | 9.89 | 28.46 | 38.53 | 56.00 | 17.47 | QP |
| 6 | 0.70 | 0.18 | 9.89 | 23.46 | 33.53 | 46.00 | 12.47 | Average |
| 7 | 1.73 | 0.20 | 9.92 | 20.42 | 30.54 | 46.00 | 15.46 | Average |
| 8 | 1.73 | 0.20 | 9.92 | 25.42 | 35.54 | 56.00 | 20.46 | QP |
| 9 | 7.89 | 0.31 | 10.00 | 31.14 | 41.45 | 60.00 | 18.55 | QP |
| 10 | 7.89 | 0.31 | 10.00 | 27.14 | 37.45 | 50.00 | 12.55 | Average |
| 11 | 11.93 | 0.38 | 10.04 | 36.34 | 46.76 | 60.00 | 13.24 | QP |
| 12 | 11.93 | 0.38 | 10.04 | 32.34 | 42.76 | 50.00 | 7.24 | Average |

Remarks:
1.Emission Level= AMN factor + Cable loss + Reading .

4.6.2 Telecommunication Port Measurement Results

EUT with the following worst test modes were performed during this section testing and all the test results are listed in next pages.

Test Date:Aug.22,2015 Temperature: 21.4℃ Humidity: 59%

| Item | Test Condition | Reference Test Data No. |
|---|---|---|
| No shielding | | |
| **※1** | **RJ-45 10Mbps** | **# 34** |
| 2 | RJ-45 100Mbps | # 35 |
| 3 | RJ-45 1000Mbps | # 36 |
| Shielding | | |
| 4 | RJ-45 10Mbps | #46 |
| 5 | RJ-45 100Mbps | #47 |
| 6 | RJ-45 1000Mbps | #48 |

NOTE 1 - '※'means the worst test mode**.**

NOTE 2 - The worst emission is detected at 11.96 MHz with emission level of 51.03 dB (μV) and with AV detector (limit is 64.00 dB (μV)), when the RJ-45 port (under 10M/bps) of the EUT is connected to I.S.N.

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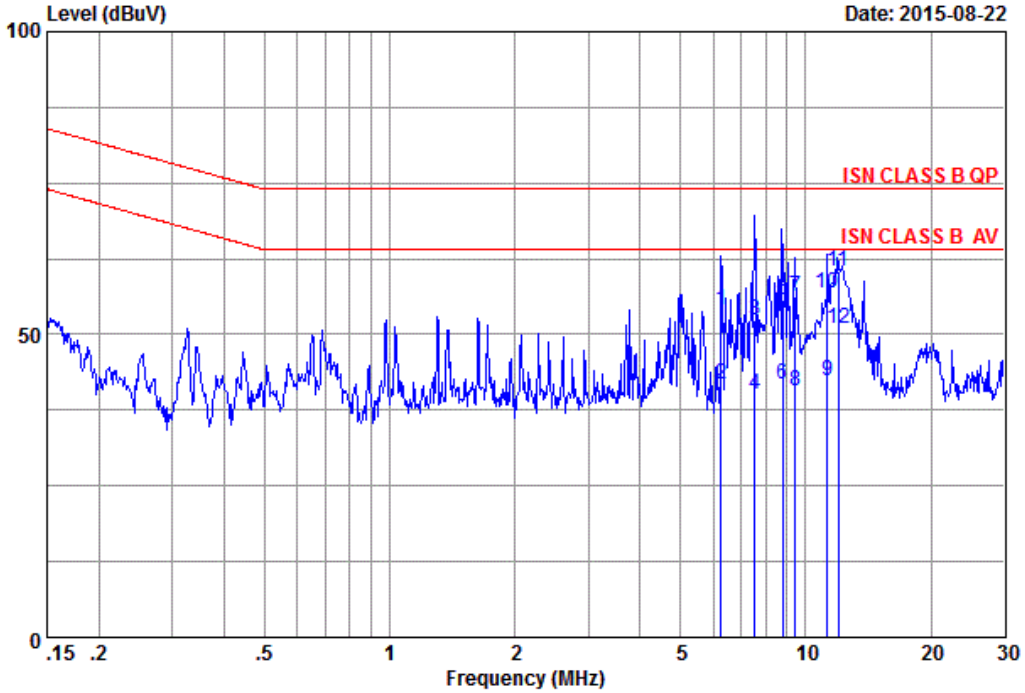
Data: 34 File: F:\2015Test Data\Report\8\G1508022.EM6 (48)




| | | | |
|---|---|---|---|
| Site no. | : No.1 Conducted shielding Enclosure | Data no. | : 34 |
| AMN/LISN | : T800-CAT.5-1507 | Phase | : |
| Limit | : ISN CLASS B QP | | |
| Env. / Ins. | : 21.4C&59%/ESCI | Engineer | : Miller |
| EUT | : Motherboard | | |
| M/N | : H170I-PLUS D3 | | |
| Power Rating | : 230Vac/50Hz | | |
| Test mode | : RJ45 10Mbps | | |
| Memo | : Intel(R) Core(TM) i5-6400 CPU@2.70GHz | | |
| | : BIOS:0302 | | |
| | : noshiedling | | |

| | Freq. (MHz) | ISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 6.25 | 9.57 | 9.98 | 34.60 | 54.15 | 74.00 | 19.85 | QP |
| 2 | 6.25 | 9.57 | 9.98 | 22.10 | 41.65 | 64.00 | 22.35 | Average |
| 3 | 7.55 | 9.56 | 10.00 | 32.80 | 52.36 | 74.00 | 21.64 | QP |
| 4 | 7.55 | 9.56 | 10.00 | 20.50 | 40.06 | 64.00 | 23.94 | Average |
| 5 | 8.80 | 9.56 | 10.01 | 36.10 | 55.67 | 74.00 | 18.33 | QP |
| 6 | 8.80 | 9.56 | 10.01 | 22.10 | 41.67 | 64.00 | 22.33 | Average |
| 7 | 9.45 | 9.56 | 10.02 | 36.80 | 56.38 | 74.00 | 17.62 | QP |
| 8 | 9.45 | 9.56 | 10.02 | 21.10 | 40.68 | 64.00 | 23.32 | Average |
| 9 | 11.25 | 9.58 | 10.03 | 22.80 | 42.41 | 64.00 | 21.59 | Average |
| 10 | 11.25 | 9.58 | 10.03 | 37.10 | 56.71 | 74.00 | 17.29 | QP |
| 11 | 11.96 | 9.58 | 10.04 | 40.81 | 60.43 | 74.00 | 13.57 | QP |
| 12 | 11.96 | 9.58 | 10.04 | 31.41 | 51.03 | 64.00 | 12.97 | Average |

Remarks:
1.Emission Level= ISN factor + Cable loss + Reading .

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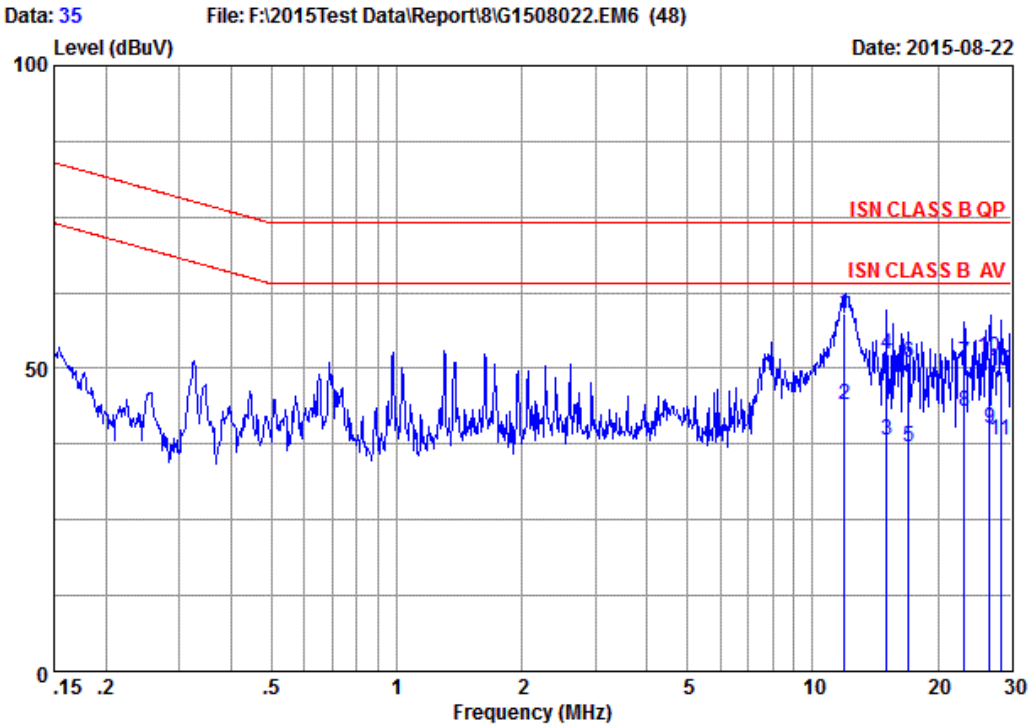


Site no. : No.1 Conducted shielding Enclosure
Data no. : 35
AMN/LISN : T800-CAT.5-1507
Phase :
Limit : ISN CLASS B QP
Env. / Ins. : 21.4C&59%/ESCI
Engineer : Miller
EUT : Motherboard
M/N : H170I-PLUS D3
Power Rating : 230Vac/50Hz
Test mode : RJ45 100Mbps
Memo : Intel(R) Core(TM) i5-6400 CPU@2.70GHz
: BIOS:0302
: noshiedling

| | Freq. (MHz) | ISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 11.93 | 9.58 | 10.04 | 39.40 | 59.02 | 74.00 | 14.98 | QP |
| 2 | 11.93 | 9.58 | 10.04 | 24.50 | 44.12 | 64.00 | 19.88 | Average |
| 3 | 15.08 | 9.62 | 10.07 | 18.50 | 38.19 | 64.00 | 25.81 | Average |
| 4 | 15.08 | 9.62 | 10.07 | 32.80 | 52.49 | 74.00 | 21.51 | QP |
| 5 | 17.03 | 9.64 | 10.09 | 17.20 | 36.93 | 64.00 | 27.07 | Average |
| 6 | 17.03 | 9.64 | 10.09 | 31.20 | 50.93 | 74.00 | 23.07 | QP |
| 7 | 23.19 | 9.75 | 10.14 | 31.11 | 51.00 | 74.00 | 23.00 | QP |
| 8 | 23.19 | 9.75 | 10.14 | 23.11 | 43.00 | 64.00 | 21.00 | Average |
| 9 | 26.69 | 9.83 | 10.18 | 20.10 | 40.11 | 64.00 | 23.89 | Average |
| 10 | 26.69 | 9.83 | 10.18 | 31.90 | 51.91 | 74.00 | 22.09 | QP |
| 11 | 28.31 | 9.86 | 10.20 | 18.20 | 38.26 | 64.00 | 25.74 | Average |
| 12 | 28.31 | 9.86 | 10.20 | 29.60 | 49.66 | 74.00 | 24.34 | QP |

Remarks:
1.Emission Level= ISN factor + Cable loss + Reading .

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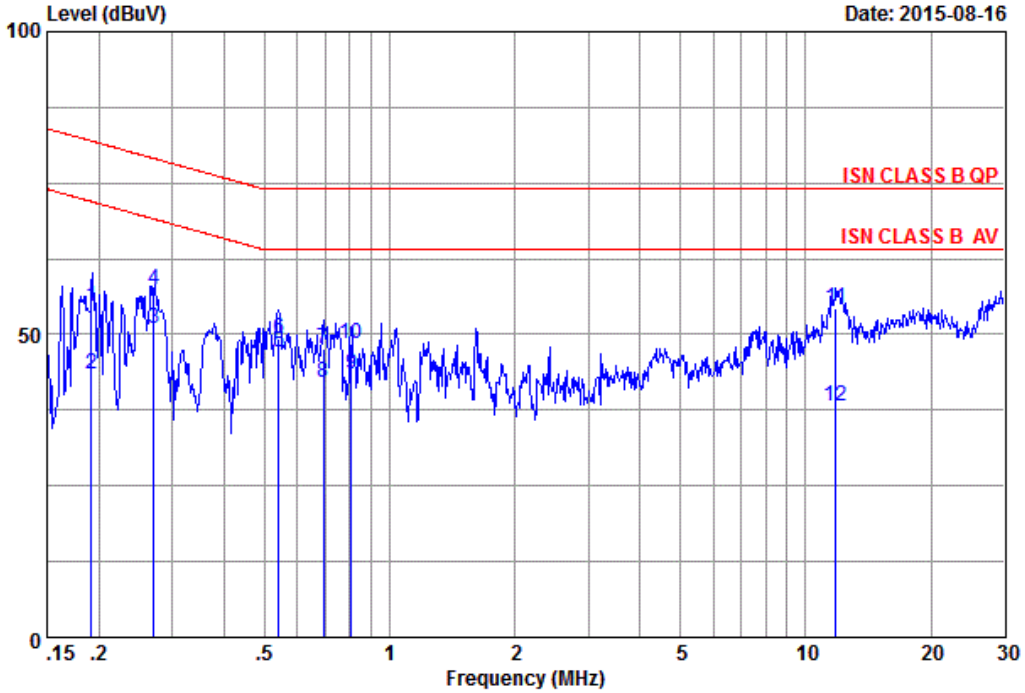
Data: 36 File: F:\2015Test Data\Report\8\G1508022.EM6 (48)




| | | | |
|---|---|---|---|
| Site no. | : No.1 Conducted shielding Enclosure | Data no. | : 36 |
| AMN/LISN | : T800-CAT.5-1507 | Phase | : |
| Limit | : ISN CLASS B QP | | |
| Env. / Ins. | : 21.5C&58%/ESCI | Engineer | : Miller |
| EUT | : Motherboard | | |
| M/N | : H170I-PLUS D3 | | |
| Power Rating | : 230Vac/50Hz | | |
| Test mode | : RJ45 1000Mbps | | |
| Memo | : Intel(R) Core(TM) i5-6400 CPU@2.70GHz | | |
| | : BIOS:0302 | | |
| | : noshiedling | | |

| | Freq. (MHz) | ISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.19 | 10.18 | 9.87 | 34.51 | 54.56 | 81.95 | 27.39 | QP |
| 2 | 0.19 | 10.18 | 9.87 | 23.51 | 43.56 | 71.95 | 28.39 | Average |
| 3 | 0.27 | 10.08 | 9.88 | 30.89 | 50.85 | 69.09 | 18.24 | Average |
| 4 | 0.27 | 10.08 | 9.88 | 37.29 | 57.25 | 79.09 | 21.84 | QP |
| 5 | 0.54 | 9.78 | 9.88 | 27.30 | 46.96 | 64.00 | 17.04 | Average |
| 6 | 0.54 | 9.78 | 9.88 | 29.70 | 49.36 | 74.00 | 24.64 | QP |
| 7 | 0.69 | 9.74 | 9.89 | 28.00 | 47.63 | 74.00 | 26.37 | QP |
| 8 | 0.69 | 9.74 | 9.89 | 22.30 | 41.93 | 64.00 | 22.07 | Average |
| 9 | 0.81 | 9.71 | 9.89 | 23.80 | 43.40 | 64.00 | 20.60 | Average |
| 10 | 0.81 | 9.71 | 9.89 | 28.90 | 48.50 | 74.00 | 25.50 | QP |
| 11 | 11.80 | 9.58 | 10.04 | 34.70 | 54.32 | 74.00 | 19.68 | QP |
| 12 | 11.80 | 9.58 | 10.04 | 18.50 | 38.12 | 64.00 | 25.88 | Average |

Remarks:
1.Emission Level= ISN factor + Cable loss + Reading .

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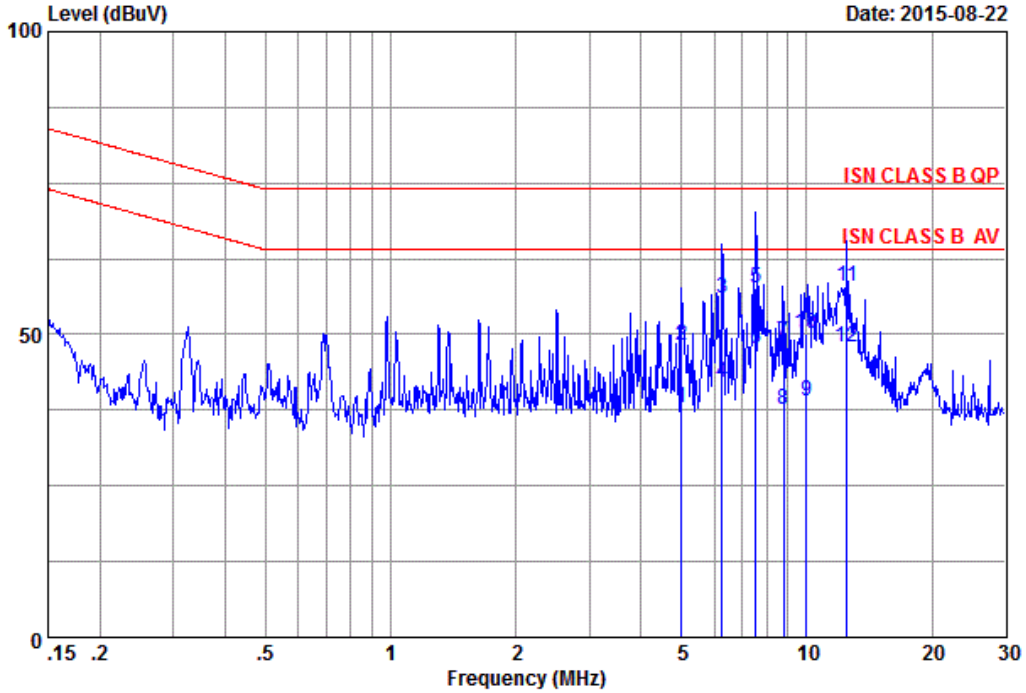
Data: 46 File: F:\2015Test Data\Report\8\G1508022.EM6 (48)




| | | | |
|---|---|---|---|
| Site no. | : No.1 Conducted shielding Enclosure | Data no. | : 46 |
| AMN/LISN | : ST08A 141209 | Phase | : |
| Limit | : ISN CLASS B QP | | |
| Env. / Ins. | : 21.4C&59%/ESCI | Engineer | : Miller |
| EUT | : Motherboard | | |
| M/N | : H170I-PLUS D3 | | |
| Power Rating | : 230Vac/50Hz | | |
| Test mode | : RJ45 10Mbps | | |
| Memo | : Intel(R) Core(TM) i5-6400 CPU@2.70GHz | | |
| | : BIOS:0302 | | |
| | : shiedling | | |

| | Freq. (MHz) | ISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 5.00 | 9.76 | 9.96 | 18.10 | 37.82 | 64.00 | 26.18 | Average |
| 2 | 5.00 | 9.76 | 9.96 | 28.60 | 48.32 | 74.00 | 25.68 | QP |
| 3 | 6.25 | 9.82 | 9.98 | 36.10 | 55.90 | 74.00 | 18.10 | QP |
| 4 | 6.25 | 9.82 | 9.98 | 22.30 | 42.10 | 64.00 | 21.90 | Average |
| 5 | 7.55 | 9.87 | 10.00 | 37.90 | 57.77 | 74.00 | 16.23 | QP |
| 6 | 7.55 | 9.87 | 10.00 | 27.70 | 47.57 | 64.00 | 16.43 | Average |
| 7 | 8.80 | 9.94 | 10.01 | 28.79 | 48.74 | 74.00 | 25.26 | QP |
| 8 | 8.80 | 9.94 | 10.01 | 17.59 | 37.54 | 64.00 | 26.46 | Average |
| 9 | 10.00 | 10.00 | 10.02 | 18.90 | 38.92 | 64.00 | 25.08 | Average |
| 10 | 10.00 | 10.00 | 10.02 | 30.20 | 50.22 | 74.00 | 23.78 | QP |
| 11 | 12.50 | 10.09 | 10.05 | 37.89 | 58.03 | 74.00 | 15.97 | QP |
| 12 | 12.50 | 10.09 | 10.05 | 27.69 | 47.83 | 64.00 | 16.17 | Average |

Remarks:
1.Emission Level= ISN factor + Cable loss + Reading .

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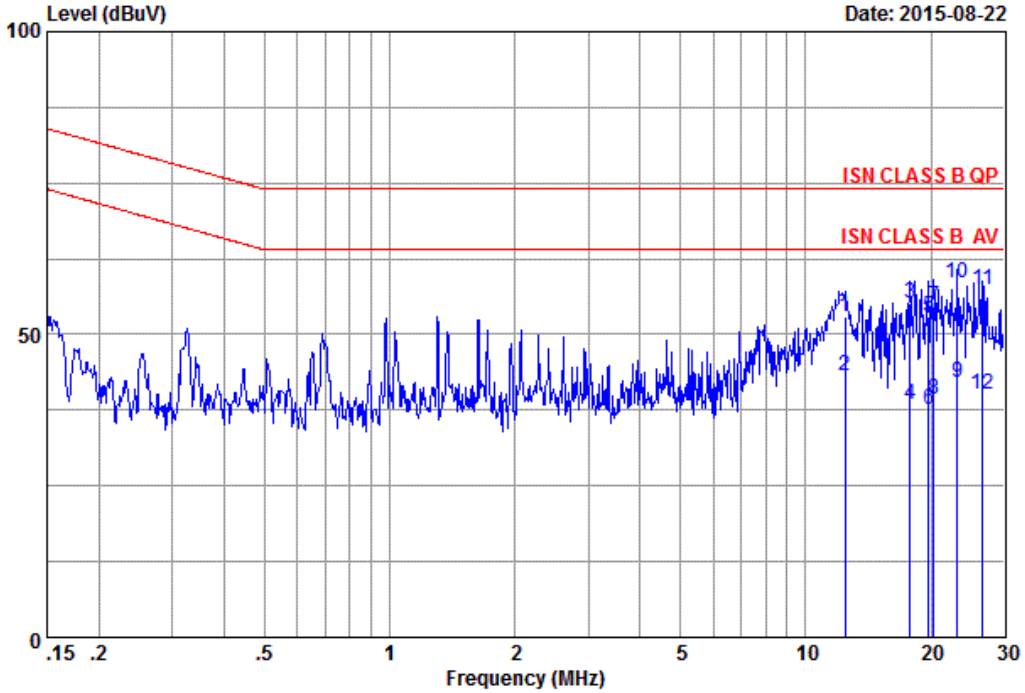
Data: 47 File: F:\2015Test Data\Report\8\G1508022.EM6 (48)




| | | | |
|---|---|---|---|
| Site no. | : No.1 Conducted shielding Enclosure | Data no. | : 47 |
| AMN/LISN | : ST08A 141209 | Phase | : |
| Limit | : ISN CLASS B QP | | |
| Env. / Ins. | : 21.4C&59%/ESCI | Engineer | : Miller |
| EUT | : Motherboard | | |
| M/N | : H170I-PLUS D3 | | |
| Power Rating | : 230Vac/50Hz | | |
| Test mode | : RJ45 100Mbps | | |
| Memo | : Intel(R) Core(TM) i5-6400 CPU@2.70GHz | | |
| | : BIOS:0302 | | |
| | : shiedling | | |

| | Freq. (MHz) | ISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 12.44 | 10.08 | 10.05 | 32.70 | 52.83 | 74.00 | 21.17 | QP |
| 2 | 12.44 | 10.08 | 10.05 | 23.00 | 43.13 | 64.00 | 20.87 | Average |
| 3 | 17.83 | 10.22 | 10.09 | 34.91 | 55.22 | 74.00 | 18.78 | QP |
| 4 | 17.83 | 10.22 | 10.09 | 18.11 | 38.42 | 64.00 | 25.58 | Average |
| 5 | 19.77 | 10.26 | 10.11 | 32.60 | 52.97 | 74.00 | 21.03 | QP |
| 6 | 19.77 | 10.26 | 10.11 | 17.20 | 37.57 | 64.00 | 26.43 | Average |
| 7 | 20.32 | 10.29 | 10.11 | 34.30 | 54.70 | 74.00 | 19.30 | QP |
| 8 | 20.32 | 10.29 | 10.11 | 18.90 | 39.30 | 64.00 | 24.70 | Average |
| 9 | 23.13 | 10.43 | 10.14 | 21.60 | 42.17 | 64.00 | 21.83 | Average |
| 10 | 23.13 | 10.43 | 10.14 | 38.00 | 58.57 | 74.00 | 15.43 | QP |
| 11 | 26.60 | 10.58 | 10.18 | 36.60 | 57.36 | 74.00 | 16.64 | QP |
| 12 | 26.60 | 10.58 | 10.18 | 19.30 | 40.06 | 64.00 | 23.94 | Average |

Remarks:
1.Emission Level= ISN factor + Cable loss + Reading .

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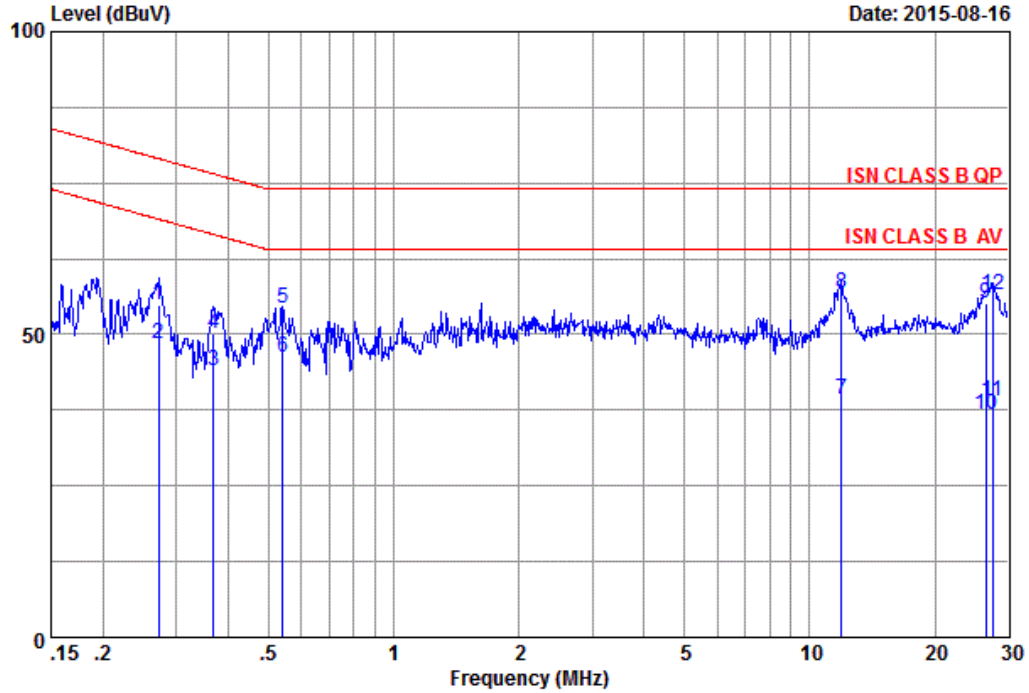
Data: 48 File: F:\2015Test Data\Report\8\G1508022.EM6 (48)




| | | | |
|---|---|---|---|
| Site no. | : No.1 Conducted shielding Enclosure | Data no. | : 48 |
| AMN/LISN | : ST08A 141209 | Phase | : |
| Limit | : ISN CLASS B QP | | |
| Env. / Ins. | : 21.5C&58%/ESCI | Engineer | : Miller |
| EUT | : Motherboard | | |
| M/N | : H170I-PLUS D3 | | |
| Power Rating | : 230Vac/50Hz | | |
| Test mode | : RJ45 1000Mbps | | |
| Memo | : Intel(R) Core(TM) i5-6400 CPU@2.70GHz | | |
| | : BIOS:0302 | | |
| | : shiedling | | |

| | Freq. (MHz) | ISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV) | Limits (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.27 | 9.77 | 9.88 | 35.09 | 54.74 | 79.06 | 24.32 | QP |
| 2 | 0.27 | 9.77 | 9.88 | 28.79 | 48.44 | 69.06 | 20.62 | Average |
| 3 | 0.37 | 9.75 | 9.88 | 24.30 | 43.93 | 66.52 | 22.59 | Average |
| 4 | 0.37 | 9.75 | 9.88 | 30.60 | 50.23 | 76.52 | 26.29 | QP |
| 5 | 0.54 | 9.74 | 9.88 | 34.70 | 54.32 | 74.00 | 19.68 | QP |
| 6 | 0.54 | 9.74 | 9.88 | 26.60 | 46.22 | 64.00 | 17.78 | Average |
| 7 | 11.93 | 10.07 | 10.04 | 19.30 | 39.41 | 64.00 | 24.59 | Average |
| 8 | 11.93 | 10.07 | 10.04 | 36.60 | 56.71 | 74.00 | 17.29 | QP |
| 9 | 26.55 | 10.58 | 10.18 | 34.50 | 55.26 | 74.00 | 18.74 | QP |
| 10 | 26.55 | 10.58 | 10.18 | 15.90 | 36.66 | 64.00 | 27.34 | Average |
| 11 | 27.56 | 10.62 | 10.19 | 18.10 | 38.91 | 64.00 | 25.09 | Average |
| 12 | 27.56 | 10.62 | 10.19 | 35.60 | 56.41 | 74.00 | 17.59 | QP |

Remarks:
1.Emission Level= ISN factor + Cable loss + Reading .

# 5 RADIATED EMISSION TEST

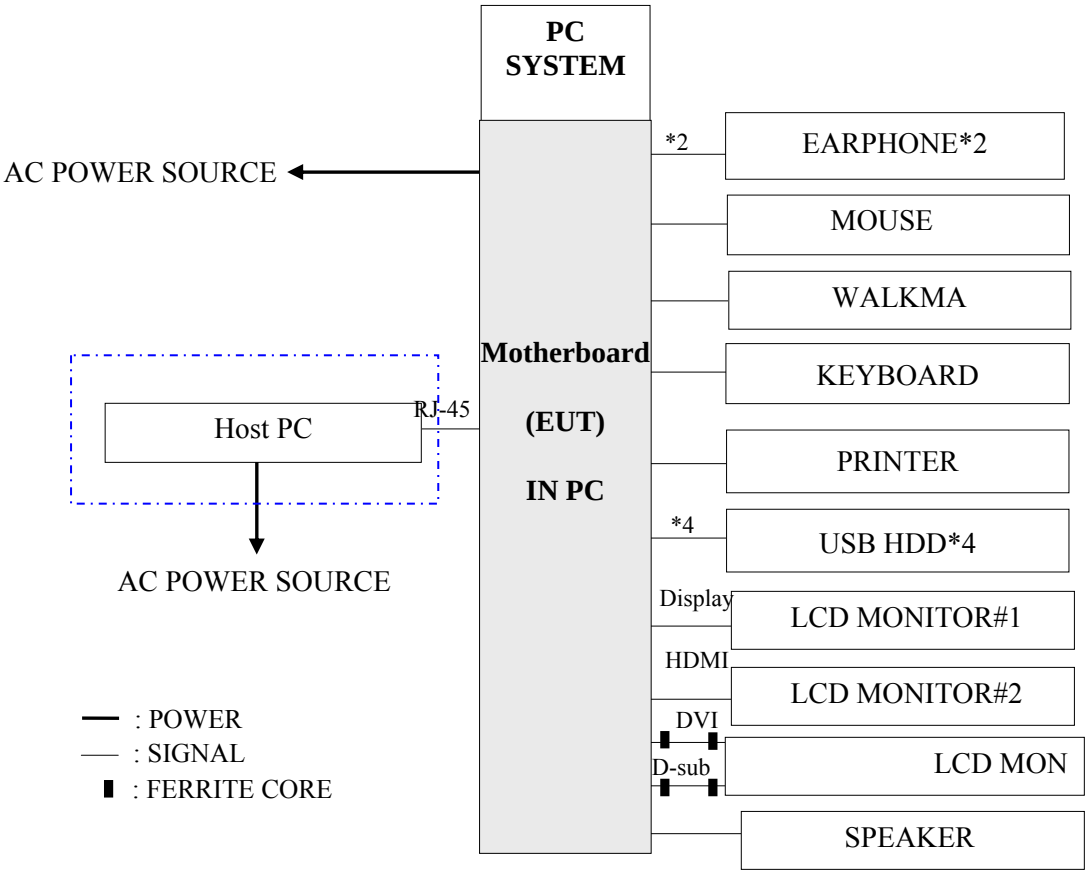
5.1 Test Equipment

The following test equipment was used during the radiated emission measurement (At 10m Semi-Anechoic Chamber)

| Item | Type | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | Spectrum Analyzer | Agilent | E7405A | MY45107028 | 2015-01-05 | 2016-01-04 |
| 2. | PXA signal analyzer | Agilent | N9030A | MY53120367 | 2015-06-23 | 2016-06-22 |
| 3. | Pre-Amplifier | Agilent | 8447D | 2944A10923 | 2015-07-03 | 2016-07-03 |
| 4. | Pre-Amplifier | Agilent | 8447D | 2944A10922 | 2015-07-03 | 2016-07-03 |
| 5. | Bi-log Antenna (Horizontal) | Schaffner | CBL6112D | 22251 | 2015-05-20 | 2016-05-19 |
| 6. | Bi-log Antenna (Vertical) | Schaffner | CBL6112D | 22252 | 2014-11-24 | 2015-11-23 |
| 7. | Horn Antenna | EMCO | 3115 | 62959 | 2015-06-30 | 2016-06-29 |
| 8. | Test Receiver | R&S | ESCI | 100839 | 2015-01-05 | 2016-01-04 |
| 9. | RF SWITCH | AUDIX | R2S | 20121102111250 | 2015-01-05 | 2016-01-04 |
| 10. | Microwave amplifier | Agilent | 8449B | 3008A02234 | 2015-01-05 | 2016-01-04 |
| 11. | RF Cable | Yuhang | CSRH | 001 | 2015-01-05 | 2016-01-04 |
| 12. | RF Cable | Yuhang | CSRH | 002 | 2015-01-05 | 2016-01-04 |
| 13. | RF Cable | Yuhang | CSRH | 003 | 2015-01-05 | 2016-01-04 |
| 14. | RF Cable | Yuhang | CSRH | 004 | 2015-01-05 | 2016-01-04 |
| 15. | RF Cable | Yuhang | CSRH | 005 | 2015-01-05 | 2016-01-04 |
| 16. | RF Cable | Yuhang | CSRH | 006 | 2015-01-05 | 2016-01-04 |
| 17. | RF Cable | Yuhang | CSRH | 008 | 2015-01-05 | 2016-01-04 |
| 18. | RF Cable | Yuhang | CSRH | 009 | 2015-01-05 | 2016-01-04 |
| 19. | RF Cable | Huber+Suhner | SUCOFLEX 102 | 28571 | 2015-01-05 | 2016-01-04 |
| 20. | RF Cable | Huber+Suhner | SUCOFLEX 102 | 28579 | 2015-01-05 | 2016-01-04 |
| 21. | Software | Audix/e3(6.7.0313) | | | | |

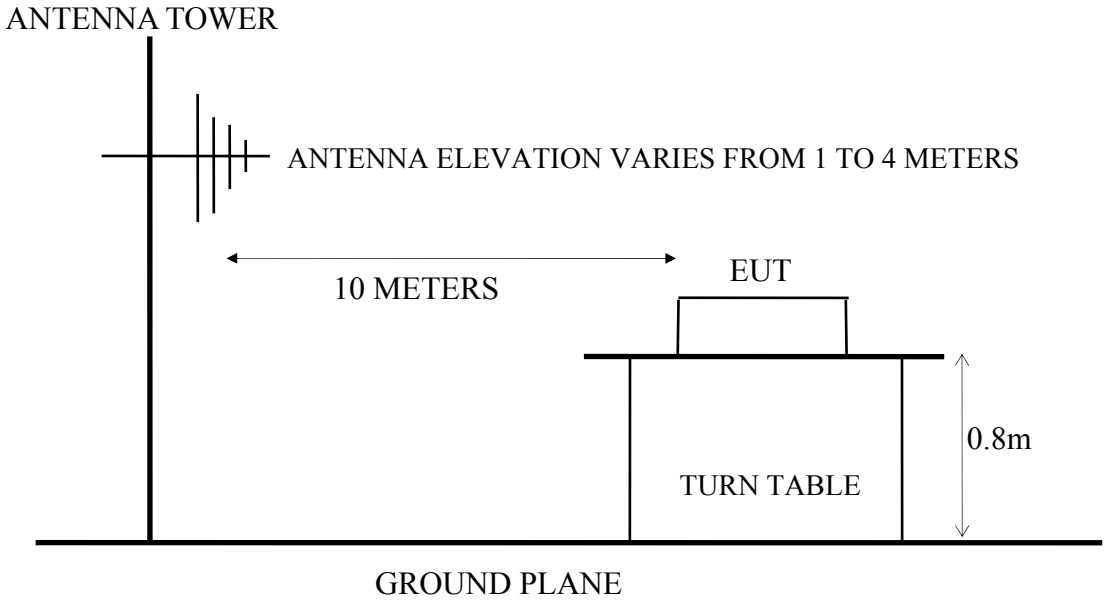
5.2 Block Diagram of Test Setup

5.2.1 Block Diagram of connection between EUT and simulators



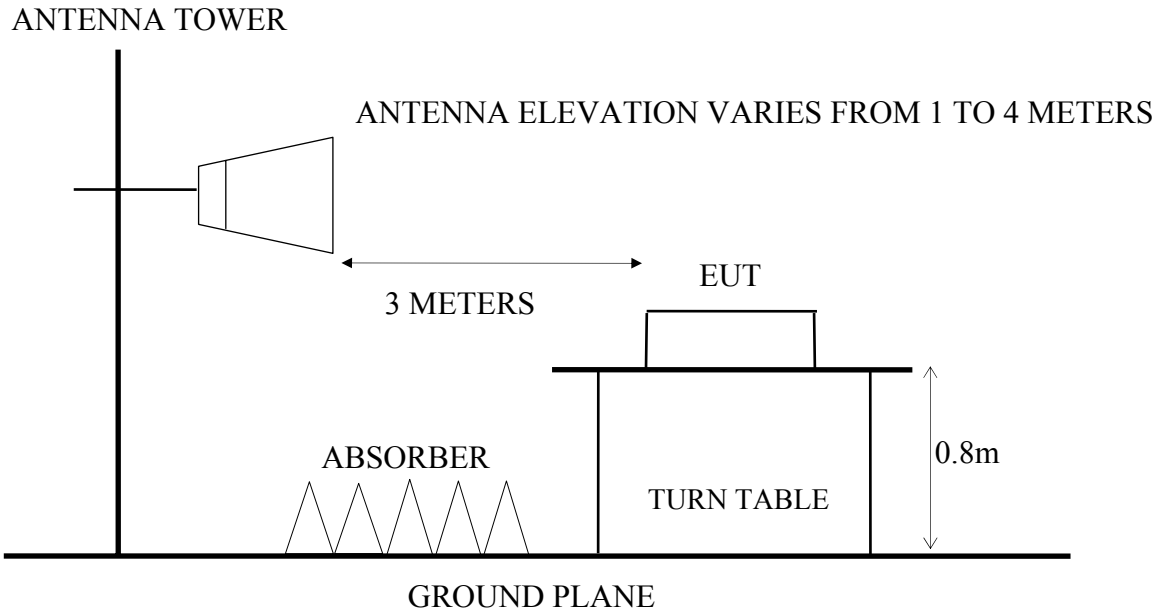

5.2.2 No. 1 10m Semi-Anechoic Chamber Setup Diagram (Test distance: 10m)

**For Below 1G**



5.2.3 No. 1 10m Semi-Anechoic Chamber Setup Diagram (Test distance: 3m)

**For Above 1GHz**




5.3 Limits for Radiated Emission

ETSI EN 301 489-1 V1.8.1/2008, Sub clause 8.2 (EN 55022, Class B)

| FREQUENCY (MHz) | DISTANCE (Meters) | Field Strengths Limits |
|---|---|---|
| 30 ~ 230 | 10 | 30(dBμV/m) |
| 230 ~ 1000 | 10 | 37(dBμV/m) |
| 1000~ 3000 | 3 | AV 50(dBμV/m) |
| | | PEAK 70(dBμV/m) |
| 3000~ 6000 | 3 | AV 54(dBμV/m) |
| | | PEAK 74(dBμV/m) |

Note： (1) The tighter limit shall apply at the edge between two frequency bands.

(2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the EUT

5.4 Test Procedure

The measuring process is according to ETSI EN 301 489-1 V1.9.2 (EN 55022) and laboratory internal procedure TKC-301-001.

In the radiated disturbance measurement, the EUT and all simulators were set up on a non-metallic turn table which was 0.8 meter above the ground plane. Measurement distance between EUT and receiving antennas was set at 10 meters at 30MHz~1GHz and 3 meters at 1GHz~6GHz. The measurement distance is the shortest horizontal distance between an imaginary circular periphery which consist of EUT periphery and cables and the reference point of the antenna.During the radiated measurement, the EUT was rotated 360° and receiving antennas were moved from 1 ~ 4 meters for finding maximum emission. Two receiving antennas were used for both horizontal and vertical polarization detection for 30MHz~1GHz, One receiving antennas was used for both horizontal and vertical polarization detection for 1GHz~6GHz (the absorbing material was added when testing of 1GHz~6GHz was done). All cables or wires placement were verified to find out the maximum emission.

The bandwidth of measuring receiver (or spectrum analyzer) was set to:
RBW (120 kHz), VBW (1MHz) for QP detector below 1GHz
RBW (1 MHz), VBW (1MHz) for Peak detector above 1GHz
RBW (1 MHz), VBW (10 Hz) for Average detector above 1GHz
which is defined against CISPR16-1-1 6.4.3 section.

The required frequency band (30 MHz ~ 6GHz)) was pre-scanned with peak detector; all final measurements were measured with quasi-peak detector below 1GHz, measured with average detector and peak detector above 1GHz.

The emission level is calculated automatically by the test system which uses the following equation:

1. For 30MHz~1GHz measurement:
   Emission Level (dBμV/m) = Reading (dBμV)+Antenna Factor (dB/m)+Cable Loss (dB)
2. For 1GHz~6GHz measurement:
   Emission Level (dBμV/m) = Reading (dBμV)+Antenna Factor (dB/m)+Cable Loss(dB)
   -Pre-amplifier factor (dB)

In chapter 7.6.6.1 the standard EN 55016-2-3 requires to include the values of w in the test report:
"w: The dimension of the line tangent to the EUT formed by Θ3dB at the measurement distance d.
Equation (10) shall be used to calculate w for each actual antenna and measurement distance used.
The values of w hall be included in the test report. This calculation may be based on the manufacturer-provided receive-antenna beamwidth specifications:
$w=2 \times d \times \tan(0{,}5 \times \Theta 3dB)$

| Frequency | 3115 Horn | |
|---|---|---|
| GHz | Θ3dB | d=3m |
| | ( ° ) | w (M) |
| 1.00 | 66 | 3.90 |
| 2.00 | 54 | 3.06 |
| 4.00 | 50 | 2.80 |
| 6.00 | 34 | 1.83 |

The values of w. are greater than chapter 7.6.6.1 of Table 2, the minimum dimension of w. (Wmin) requirements.

5.5 Measurement Results

**PASSED.**

EUT with the following were performed during the test and all the test results are listed in next pages.

5.5.1 For 30MHz~1GHz

Test Date:Aug,25.2015 Temperature: 21.4℃ Humidity: 63%

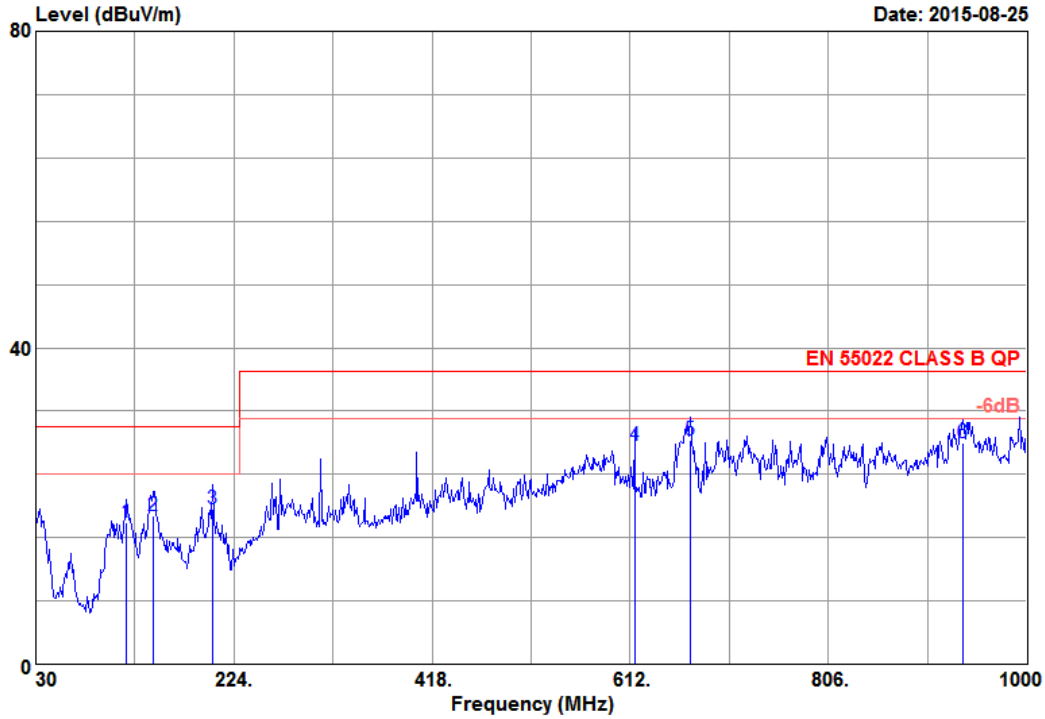
| Item | Test Mode | Reference Test Data No. | |
|---|---|---|---|
| | | Horizontal | Vertical |
| 1 | WLAN+ BT Operating | # 11 | # 12 |

NOTE 1 - 0° was the table front facing the antenna. Degree is calculated from 0° clockwise facing the antenna.

NOTE 2 - The worst emission at horizontal polarization was detected at 671.16 MHz with emission level of 28.27 dBμV/m (limit is 37.00 dBμV/m), when the antenna was 3.1 m height and the turntable was at 192°. The worst emission at vertical polarization was detected at 183.27 MHz with emission level of 23.43 dBμV/m (limit is 30.00 dBμV/m), when the antenna was 1.0 m height and the turntable was at 210°.

Audix Technology(Wujiang)Co.,Ltd.
No.1289,Jiang Xing East Road,Eastern Part of WuJiang
Economic Development Zone,JiangSu,China
Tel:0512-63403993 Fax:0512-63403339

Data: 11 File: G:\TEST DATA\2015\Report\08\G1508022.EM6 (22)




Site No. : NO.1 10m Semi-Anechoic Chamber Data NO. : 11
Dis./Ant. : 10m . 6112D(50)-1409-H-10M Ant.pol : HORIZONTAL
Env./Ins. : 21.4*C 63%/ESCI Engineer : Frank
EUT. : Motherboard
M/N : H170I-PLUS D3
Power Rating: 230Vac/50Hz
Test Mode : WLAN+BT Operating
Memo : Intel(R) Core(TM) i5-6400 CPU@ 2.70GHz
BIOS:0302

| | Freq. (MHz) | Ant. Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 118.92 | 12.25 | 2.00 | 3.65 | 17.90 | 30.00 | 12.10 | QP |
| 2 | 144.66 | 11.00 | 2.24 | 5.56 | 18.80 | 30.00 | 11.20 | QP |
| 3 | 203.16 | 9.10 | 2.65 | 7.87 | 19.62 | 30.00 | 10.38 | QP |
| 4 | 616.17 | 18.94 | 4.86 | 3.77 | 27.57 | 37.00 | 9.43 | QP |
| 5 | 671.16 | 19.00 | 5.08 | 4.19 | 28.27 | 37.00 | 8.73 | QP |
| 6 | 937.92 | 21.00 | 6.08 | 0.82 | 27.90 | 37.00 | 9.10 | QP |

Remarks: 1.Emission Level= Antenna factor + Cable loss + Reading
2.The emission level that are 20dB below the offical limit are not reported

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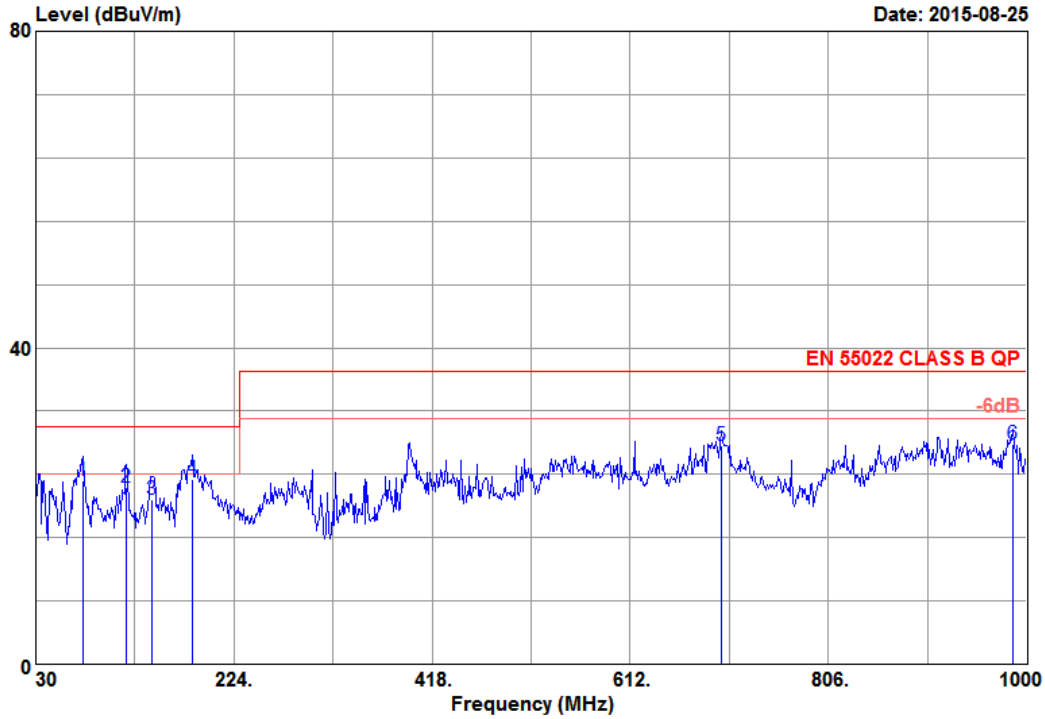
Data: 12 File: G:\TEST DATA\2015\Report\08\G1508022.EM6 (22)




Site No. : NO.1 10m Semi-Anechoic Chamber Data NO. : 12
Dis./Ant. : 10m . 6112D(52)-1411-V-10M Ant.pol : VERTICAL
Env./Ins. : 21.4*C 63%/ESCI Engineer : Frank
EUT. : Motherboard
M/N : H170I-PLUS D3
Power Rating: 230Vac/50Hz
Test Mode : WLAN+BT Operating
Memo : Intel(R) Core(TM) i5-6400 CPU@ 2.70GHz
BIOS:0302

| | Freq. (MHz) | Ant. Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 75.63 | 7.70 | 1.25 | 14.27 | 23.22 | 30.00 | 6.78 | QP |
| 2 | 118.92 | 12.40 | 1.61 | 8.29 | 22.30 | 30.00 | 7.70 | QP |
| 3 | 143.49 | 11.50 | 1.79 | 7.49 | 20.78 | 30.00 | 9.22 | QP |
| 4 | 183.27 | 10.00 | 2.02 | 11.41 | 23.43 | 30.00 | 6.57 | QP |
| 5 | 701.58 | 19.83 | 4.24 | 3.53 | 27.60 | 37.00 | 9.40 | QP |
| 6 | 987.06 | 22.40 | 5.06 | 0.29 | 27.75 | 37.00 | 9.25 | QP |

Remarks: 1.Emission Level= Antenna factor + Cable loss + Reading
2.The emission level that are 20dB below the offical
limit are not reported

5.5.2 For 1GHz~6GHz

Test Date: Aug.25,2015 Temperature:21.4℃ Humidity: 63%

| Item | Test Mode | Reference Test Data No. | |
|---|---|---|---|
| | | Horizontal | Vertical |
| 1 | Full System (WLAN+ BT Operating) | # 43 | # 44 |

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Economic Development Zone,JiangSu,China
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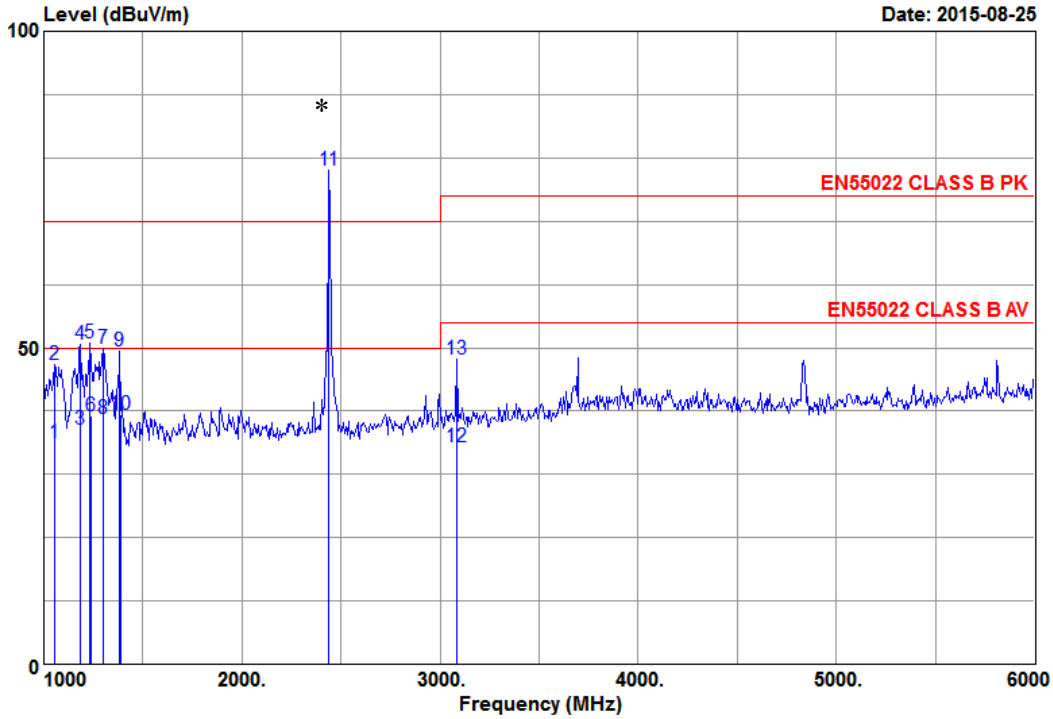
Data: 21 File: G:\TEST DATA\2015\Report\08\G1508022.EM6 (22)




Site No. : NO.1 10m Semi-Anechoic Chamber Data NO. : 21
Dis./Ant. : 3m . 3115-62960-150630 Ant.pol : HORIZONTAL
Limit : EN55022 CLASS B PK
Env./Ins. : 21.4*C 63%/N9030A Engineer : Frank
EUT. : Motherboard
M/N : H170I-PLUS D3
Power Rating : 230Vac/50Hz
Test Mode : WLAN+BT Operating
Memo : Intel(R) Core(TM) i5-6400 CPU@ 2.70GHz
BIOS:0302

| | Freq. (MHz) | Ant. Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Preamp Factor (dB) | Emission Level (dBuV/m | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1053.00 | 23.48 | 3.24 | 44.20 | 35.98 | 34.94 | 50.00 | 15.06 | Average |
| 2 | 1054.00 | 23.48 | 3.24 | 56.50 | 35.98 | 47.24 | 70.00 | 22.76 | Peak |
| 3 | 1184.50 | 23.94 | 3.43 | 45.61 | 35.85 | 37.13 | 50.00 | 12.87 | Average |
| 4 | 1186.00 | 23.94 | 3.43 | 59.13 | 35.85 | 50.65 | 70.00 | 19.35 | Peak |
| 5 | 1234.00 | 24.12 | 3.51 | 58.82 | 35.79 | 50.66 | 70.00 | 19.34 | Peak |
| 6 | 1237.00 | 24.12 | 3.51 | 47.30 | 35.79 | 39.14 | 50.00 | 10.86 | Average |
| 7 | 1300.00 | 24.36 | 3.62 | 57.71 | 35.71 | 49.98 | 70.00 | 20.02 | Peak |
| 8 | 1302.00 | 24.36 | 3.62 | 46.50 | 35.71 | 38.77 | 50.00 | 11.23 | Average |
| 9 | 1384.00 | 24.65 | 3.74 | 56.61 | 35.63 | 49.37 | 70.00 | 20.63 | Peak |
| 10 | 1385.00 | 24.65 | 3.74 | 46.80 | 35.63 | 39.56 | 50.00 | 10.44 | Average |
| 11 | 2440.00 | 28.58 | 5.12 | 79.49 | 35.16 | 78.03 | 70.00 | -8.03 | Peak * |
| 12 | 3081.40 | 30.27 | 5.84 | 33.50 | 35.29 | 34.32 | 54.00 | 19.68 | Average |
| 13 | 3082.00 | 30.27 | 5.84 | 47.39 | 35.29 | 48.21 | 74.00 | 25.79 | Peak |

Remarks: 1.Emission Level= Antenna factor + Cable loss + Reading - Preamp
2.The emission level that are 20dB below the offical limit are not reported

3. "*" is the fundamental frequency emission emanating from the intentional radio components such as WLAN module. It could be ignored in this report according to ETSI EN301489-1.

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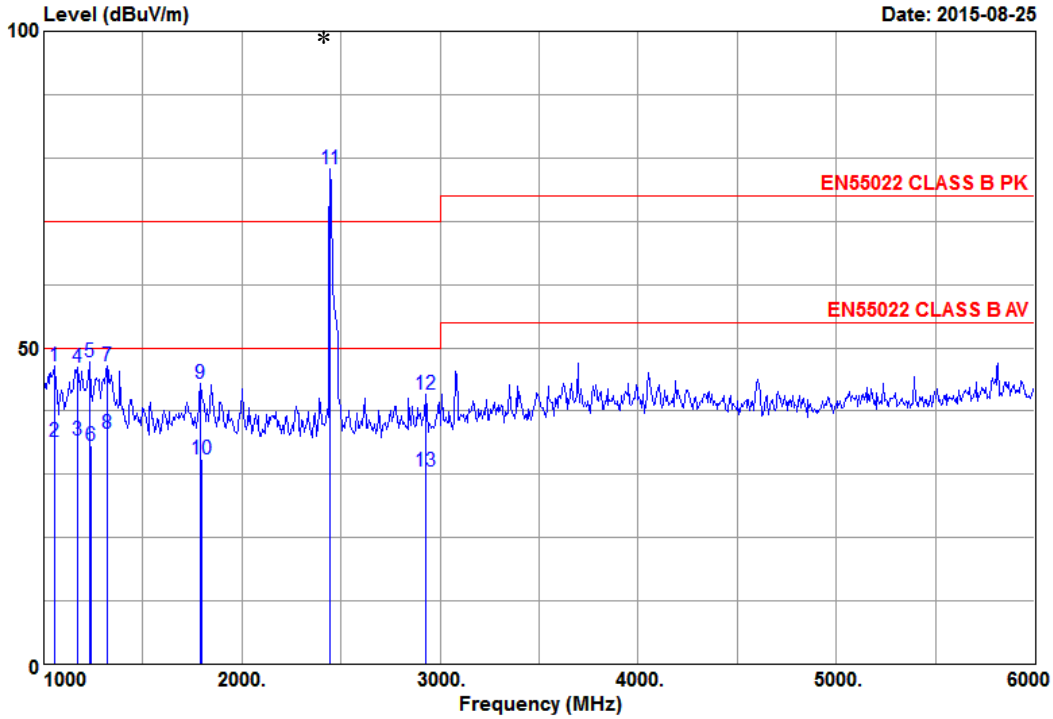
Data: 22 File: G:\TEST DATA\2015\Report\08\G1508022.EM6 (22)




| | | | |
|---|---|---|---|
| Site No. | : NO.1 10m Semi-Anechoic Chamber | Data NO. | : 22 |
| Dis./Ant. | : 3m . 3115-62960-150630 | Ant.pol | : VERTICAL |
| Limit | : EN55022 CLASS B PK | | |
| Env./Ins. | : 21.4*C 63%/N9030A | Engineer | : Frank |
| EUT. | : Motherboard | | |
| M/N | : H170I-PLUS D3 | | |
| Power Rating | : 230Vac/50Hz | | |
| Test Mode | : WLAN+BT Operating | | |
| Memo | : Intel(R) Core(TM) i5-6400 CPU@ 2.70GHz<br>BIOS:0302 | | |

| | Freq. (MHz) | Ant. Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Preamp Factor (dB) | Emission Level (dBuV/m | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1054.00 | 23.48 | 3.24 | 56.47 | 35.98 | 47.21 | 70.00 | 22.79 | Peak |
| 2 | 1055.00 | 23.48 | 3.24 | 44.50 | 35.98 | 35.24 | 50.00 | 14.76 | Average |
| 3 | 1167.50 | 23.89 | 3.43 | 43.90 | 35.85 | 35.37 | 50.00 | 14.63 | Average |
| 4 | 1168.00 | 23.89 | 3.43 | 55.54 | 35.85 | 47.01 | 70.00 | 22.99 | Peak |
| 5 | 1234.00 | 24.12 | 3.51 | 55.95 | 35.79 | 47.79 | 70.00 | 22.21 | Peak |
| 6 | 1236.00 | 24.12 | 3.51 | 42.70 | 35.79 | 34.54 | 50.00 | 15.46 | Average |
| 7 | 1318.00 | 24.41 | 3.62 | 54.90 | 35.71 | 47.22 | 70.00 | 22.78 | Peak |
| 8 | 1319.00 | 24.41 | 3.66 | 44.11 | 35.69 | 36.49 | 50.00 | 13.51 | Average |
| 9 | 1792.00 | 26.50 | 4.36 | 48.69 | 35.21 | 44.34 | 70.00 | 25.66 | Peak |
| 10 | 1795.00 | 26.50 | 4.36 | 36.80 | 35.21 | 32.45 | 50.00 | 17.55 | Average |
| 11 | 2446.00 | 28.58 | 5.15 | 79.80 | 35.17 | 78.36 | 70.00 | -8.36 | Peak * |
| 12 | 2926.00 | 29.87 | 5.66 | 42.55 | 35.34 | 42.74 | 70.00 | 27.26 | Peak |
| 13 | 2928.00 | 29.87 | 5.66 | 30.39 | 35.34 | 30.58 | 50.00 | 19.42 | Average |

Remarks: 1.Emission Level= Antenna factor + Cable loss + Reading - Preamp
2.The emission level that are 20dB below the offical
limit are not reported

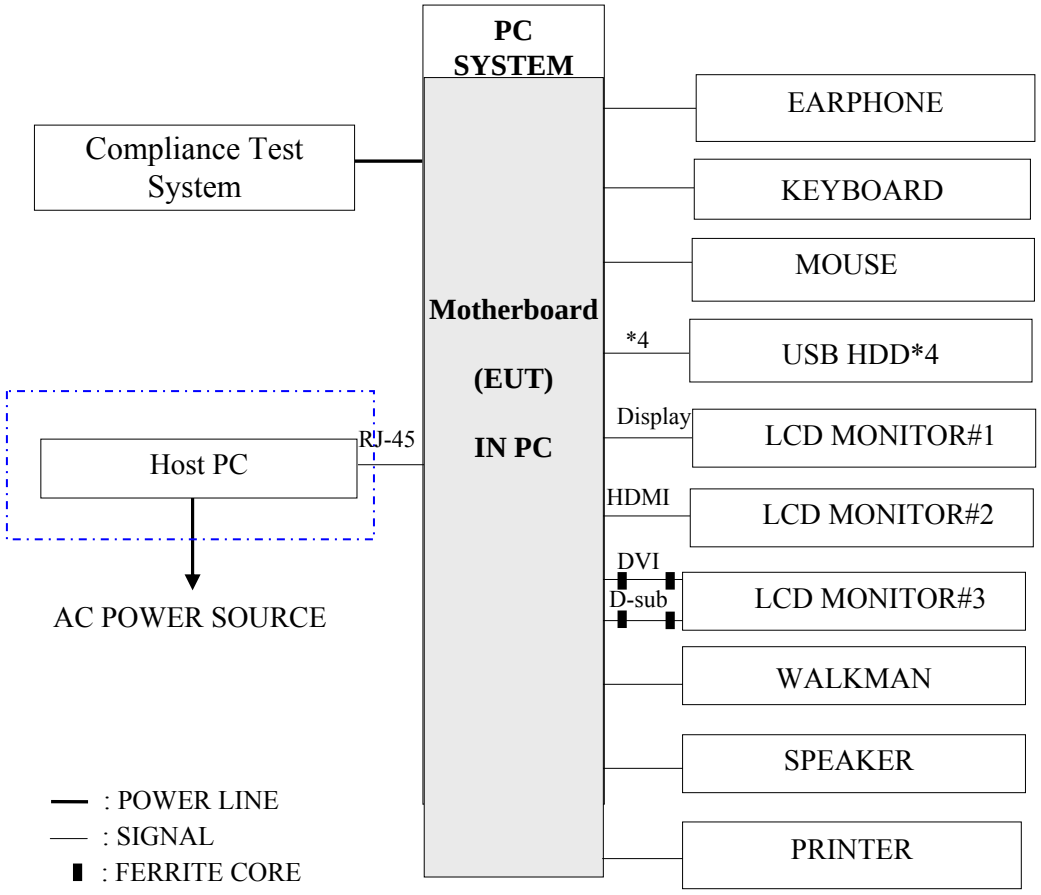
3. "*" is the fundamental frequency emission emanating from the intentional radio components such as WLAN module. It could be

# 6 POWER HARMONICS AND FLICKER MEASUREMENT TEST EQUIPMENT

6.1 Test Equipment

| Item | Type | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | AC power source | TESEQ | NSG1007-45-3PI | 1236A00705 | 2015-09-17 | 2017-09-16 |
| 2. | Signal Conditioning Unit | TESEQ | CCN1000-3 | 1236A00705 | 2015-09-17 | 2017-09-16 |
| 3. | Threephase Impedance network | TESEQ | INA2197 | 1236A00705 | 2015-09-17 | 2017-09-16 |

6.2 Block Diagram of Test Setup



6.3 Test Standard

ETSI EN 301 489-1 V1.9.2:2011-09, Sub clause 8.5&8.6
(EN 61000-3-2:2014 & EN 61000-3-3:2013)

6.4 Test Procedure

The measuring process is according to EN61000-3-2:2014&
EN 61000-3-3:2013 and laboratory internal procedure TKC-301-012.

6.5 Test Results

6.5.1 The limits for Class D equipment are valid for all applications having an active input power is >75W, due to the EUT measured active input power is <75W, therefore, no limits apply for this equipment according to EN 61000-3-2.

6.5.2 PASSED. (complied with Class D limit)

EUT with the following test mode was measured during this section testing and all the test results are listed in next page.

Test Date: Aug.21, 2015 Temperature: 23.8℃ Humidity: 62%

| Item | Test Condition |
|---|---|
| 1 | WLAN+BT Operating |

Teseq Profline
4542 Luterbach, Switzerland

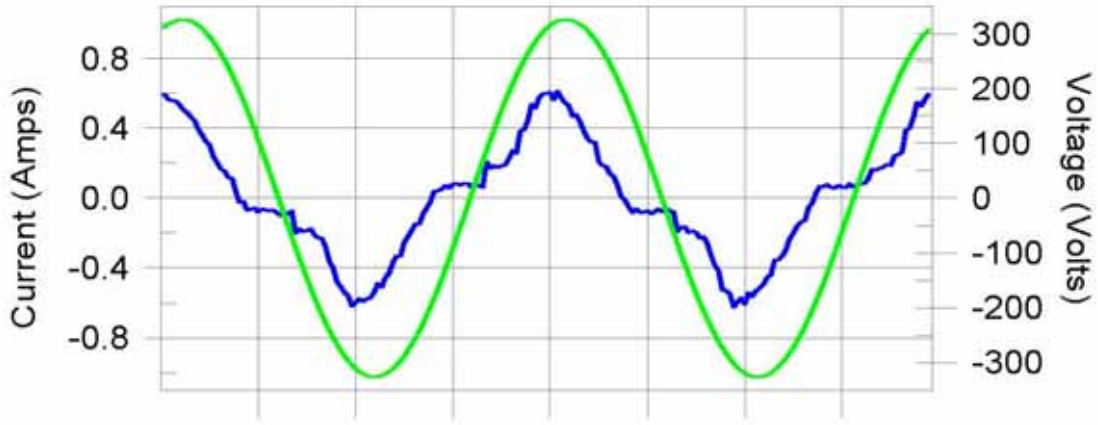
10/8/2015
5:22:17 PM

## Harmonics – Class-D per Ed. 4.0 (2014)(Run time)

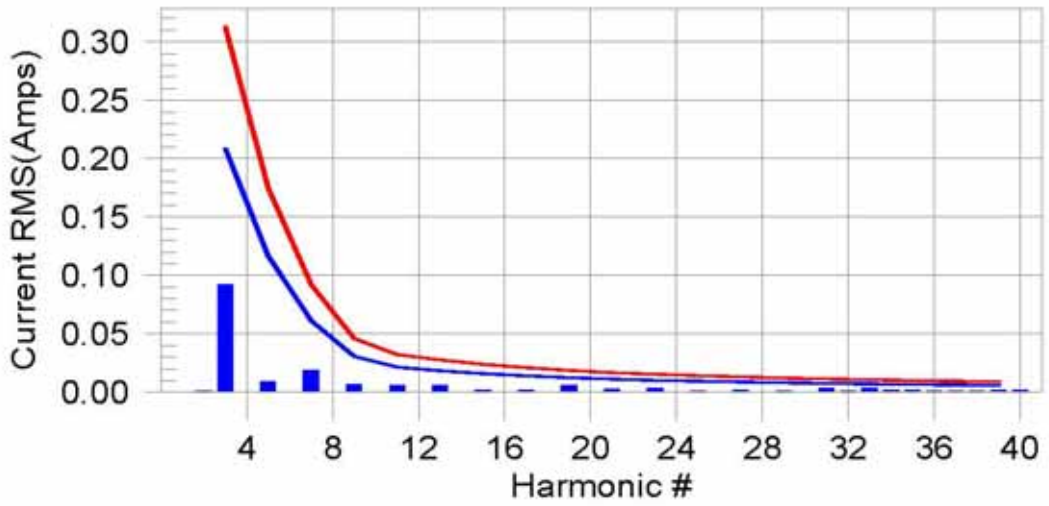
**EUT: Motherboard** **Tested by: Puck**
**Test category: Class-D per Ed. 4.0 (2014) (Japanese limits)** **Test Margin: 100**
**Test date: 2015-8-21**
**Test duration (min): 5** **Data file name: WIN2105_H-000093.cts_data**
**Comment: M/N: H170I-PLUS D3 Test Mode: WLAN+BT Operating**
**Customer: ASUSTeK COMPUTER INC.**

**Test Result: N/L** **Source qualification: Normal**

**Current & voltage waveforms**




**Harmonics and Class D limit line** **Japanese Limits**




**Test result: N/L Worst harmonic was #19 with 45.4% of the limit.**

Teseq AG Win2105 V2.6.0

Page 1 of 3

Teseq Profline
4542 Luterbach, Switzerland

10/8/2015
5:22:17 PM

## Current Test Result Summary (Run time)

**EUT: Motherboard** **Tested by: Puck**
**Test category: Class-D per Ed. 4.0 (2014) (Japanese limits)** **Test Margin: 100**
**Test date: 2015-8-21**
**Test duration (min): 5** **Data file name: WIN2105_H-000093.cts_data**
**Comment: M/N: H170I-PLUS D3 Test Mode: Full System(HDMI+DP 2560*1600@60Hz**
**Customer: ASUSTeK COMPUTER INC.**

**Test Result: N/L** **Source qualification: Normal**
**THC: 0.000 A** **I-THD: 0.0 %** **POHC(A): 0.000 A** **POHC Limit(A): 0.000 A**
**Highest parameter values during test:**

| | | | |
|---|---|---|---|
| V_RMS (Volts): | 230.712 | Frequency(Hz): | 50.00 |
| I_Peak (Amps): | 0.644 | I_RMS (Amps): | 0.299 |
| I_Fund (Amps): | 0.281 | Crest Factor: | 2.120 |
| Power (Watts): | 61.3 | Power Factor: | 0.896 |

| Harm# | Harms(avg) | 100%Limit | %of Limit | Harms(max) | 150%Limit | %of Limit | Status |
|---|---|---|---|---|---|---|---|
| 2 | 0.001 | 0.000 | N/A | 0.002 | 0.000 | N/A | Pass |
| 3 | 0.092 | 0.208 | N/A | 0.096 | 0.313 | N/A | Pass |
| 4 | 0.001 | 0.000 | N/A | 0.001 | 0.000 | N/A | Pass |
| 5 | 0.009 | 0.116 | N/A | 0.010 | 0.175 | N/A | Pass |
| 6 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 7 | 0.019 | 0.061 | N/A | 0.020 | 0.092 | N/A | Pass |
| 8 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 9 | 0.007 | 0.031 | N/A | 0.008 | 0.046 | N/A | Pass |
| 10 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 11 | 0.006 | 0.021 | N/A | 0.007 | 0.032 | N/A | Pass |
| 12 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 13 | 0.006 | 0.018 | N/A | 0.006 | 0.028 | N/A | Pass |
| 14 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 15 | 0.002 | 0.016 | N/A | 0.003 | 0.024 | N/A | Pass |
| 16 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 17 | 0.002 | 0.014 | N/A | 0.003 | 0.021 | N/A | Pass |
| 18 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 19 | 0.006 | 0.012 | N/A | 0.006 | 0.019 | N/A | Pass |
| 20 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 21 | 0.003 | 0.011 | N/A | 0.004 | 0.017 | N/A | Pass |
| 22 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 23 | 0.003 | 0.010 | N/A | 0.003 | 0.015 | N/A | Pass |
| 24 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 25 | 0.001 | 0.009 | N/A | 0.002 | 0.014 | N/A | Pass |
| 26 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 27 | 0.002 | 0.009 | N/A | 0.002 | 0.013 | N/A | Pass |
| 28 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 29 | 0.001 | 0.008 | N/A | 0.002 | 0.012 | N/A | Pass |
| 30 | 0.000 | 0.000 | N/A | 0.000 | 0.000 | N/A | Pass |
| 31 | 0.004 | 0.008 | N/A | 0.004 | 0.011 | N/A | Pass |
| 32 | 0.001 | 0.000 | N/A | 0.002 | 0.000 | N/A | Pass |
| 33 | 0.003 | 0.007 | N/A | 0.004 | 0.011 | N/A | Pass |
| 34 | 0.002 | 0.000 | N/A | 0.004 | 0.000 | N/A | Pass |
| 35 | 0.002 | 0.007 | N/A | 0.003 | 0.010 | N/A | Pass |
| 36 | 0.001 | 0.000 | N/A | 0.002 | 0.000 | N/A | Pass |
| 37 | 0.001 | 0.006 | N/A | 0.002 | 0.010 | N/A | Pass |
| 38 | 0.001 | 0.000 | N/A | 0.002 | 0.000 | N/A | Pass |
| 39 | 0.002 | 0.006 | N/A | 0.003 | 0.009 | N/A | Pass |
| 40 | 0.002 | 0.000 | N/A | 0.004 | 0.000 | N/A | Pass |

*Note: The EUT power level is below 75.0 Watts and therefore has no defined limits*

Teseq AG Win2105 V2.6.0

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Teseq Profline
4542 Luterbach, Switzerland

10/8/2015
5:22:17 PM

## Voltage Source Verification Data (Run time)

**EUT: Motherboard** **Tested by: Puck**
**Test category: Class-D per Ed. 4.0 (2014) (Japanese limits)** **Test Margin: 100**
**Test date: 2015-8-21**
**Test duration (min): 5** **Data file name: WIN2105_H-000093.cts_data**
**Comment: M/N: H170I-PLUS D3 Test Mode: Full System(HDMI+DP 2560*1600@60Hz)**
**Customer: ASUSTeK COMPUTER INC.**

**Test Result: N/L** **Source qualification: Normal**

**Highest parameter values during test:**

| | | | |
|---|---|---|---|
| Voltage (Vrms): | 230.712 | Frequency(Hz): | 50.00 |
| I_Peak (Amps): | 0.644 | I_RMS (Amps): | 0.299 |
| I_Fund (Amps): | 0.281 | Crest Factor: | 2.120 |
| Power (Watts): | 61.3 | Power Factor: | 0.896 |

| Harm# | Harmonics V-rms | Limit V-rms | % of Limit | Status |
|---|---|---|---|---|
| 2 | 0.094 | 0.461 | 20.29 | OK |
| 3 | 0.106 | 2.076 | 5.13 | OK |
| 4 | 0.031 | 0.461 | 6.78 | OK |
| 5 | 0.057 | 0.923 | 6.13 | OK |
| 6 | 0.014 | 0.461 | 3.10 | OK |
| 7 | 0.042 | 0.692 | 6.00 | OK |
| 8 | 0.015 | 0.461 | 3.25 | OK |
| 9 | 0.035 | 0.461 | 7.53 | OK |
| 10 | 0.016 | 0.461 | 3.39 | OK |
| 11 | 0.028 | 0.231 | 12.28 | OK |
| 12 | 0.010 | 0.231 | 4.21 | OK |
| 13 | 0.017 | 0.231 | 7.35 | OK |
| 14 | 0.009 | 0.231 | 3.93 | OK |
| 15 | 0.017 | 0.231 | 7.16 | OK |
| 16 | 0.007 | 0.231 | 3.03 | OK |
| 17 | 0.011 | 0.231 | 4.80 | OK |
| 18 | 0.005 | 0.231 | 2.21 | OK |
| 19 | 0.012 | 0.231 | 5.01 | OK |
| 20 | 0.011 | 0.231 | 4.57 | OK |
| 21 | 0.012 | 0.231 | 5.14 | OK |
| 22 | 0.007 | 0.231 | 3.18 | OK |
| 23 | 0.017 | 0.231 | 7.30 | OK |
| 24 | 0.007 | 0.231 | 2.83 | OK |
| 25 | 0.014 | 0.231 | 5.94 | OK |
| 26 | 0.007 | 0.231 | 3.10 | OK |
| 27 | 0.011 | 0.231 | 4.66 | OK |
| 28 | 0.006 | 0.231 | 2.64 | OK |
| 29 | 0.008 | 0.231 | 3.39 | OK |
| 30 | 0.005 | 0.231 | 2.35 | OK |
| 31 | 0.017 | 0.231 | 7.46 | OK |
| 32 | 0.005 | 0.231 | 2.19 | OK |
| 33 | 0.012 | 0.231 | 5.32 | OK |
| 34 | 0.007 | 0.231 | 3.02 | OK |
| 35 | 0.012 | 0.231 | 5.33 | OK |
| 36 | 0.006 | 0.231 | 2.68 | OK |
| 37 | 0.009 | 0.231 | 4.03 | OK |
| 38 | 0.006 | 0.231 | 2.46 | OK |
| 39 | 0.011 | 0.231 | 4.72 | OK |
| 40 | 0.011 | 0.231 | 4.75 | OK |

Teseq Profline
4542 Luterbach, Switzerland

10/8/2015
5:23:31 PM

## Flicker Test Summary per EN/IEC61000-3-3 (Run time)

**EUT: Motherboard** **Tested by: Puck**
**Test category: dt,dmax,dc and Pst (European limits)** **Test Margin: 100**
**Test date: 2015-8-21**
**Test duration (min): 10** **Data file name: WIN2105_F-000094.cts_data**
**Comment: M/N: H170I-PLUS D3 Test Mode: WLAN+BT Operating**
**Customer: ASUSTeK COMPUTER INC.**

**Test Result: Pass** **Status: Test Completed**

**Pst and limit line** **European Limits**


**Plt and limit line**


**Parameter values recorded during the test:**

| | | | | |
|---|---|---|---|---|
| **Vrms at the end of test (Volt):** | **230.68** | | | |
| **Highest dt (%):** | **0.00** | **Test limit (%):** | **N/A** | **N/A** |
| **T-max (mS):** | **0.0** | **Test limit (mS):** | **500.0** | **Pass** |
| **Highest dc (%):** | **0.00** | **Test limit (%):** | **3.30** | **Pass** |
| **Highest dmax (%):** | **0.04** | **Test limit (%):** | **4.00** | **Pass** |
| **Highest Pst (10 min. period):** | **0.108** | **Test limit:** | **1.000** | **Pass** |

Teseq AG Win2105 V2.6.0

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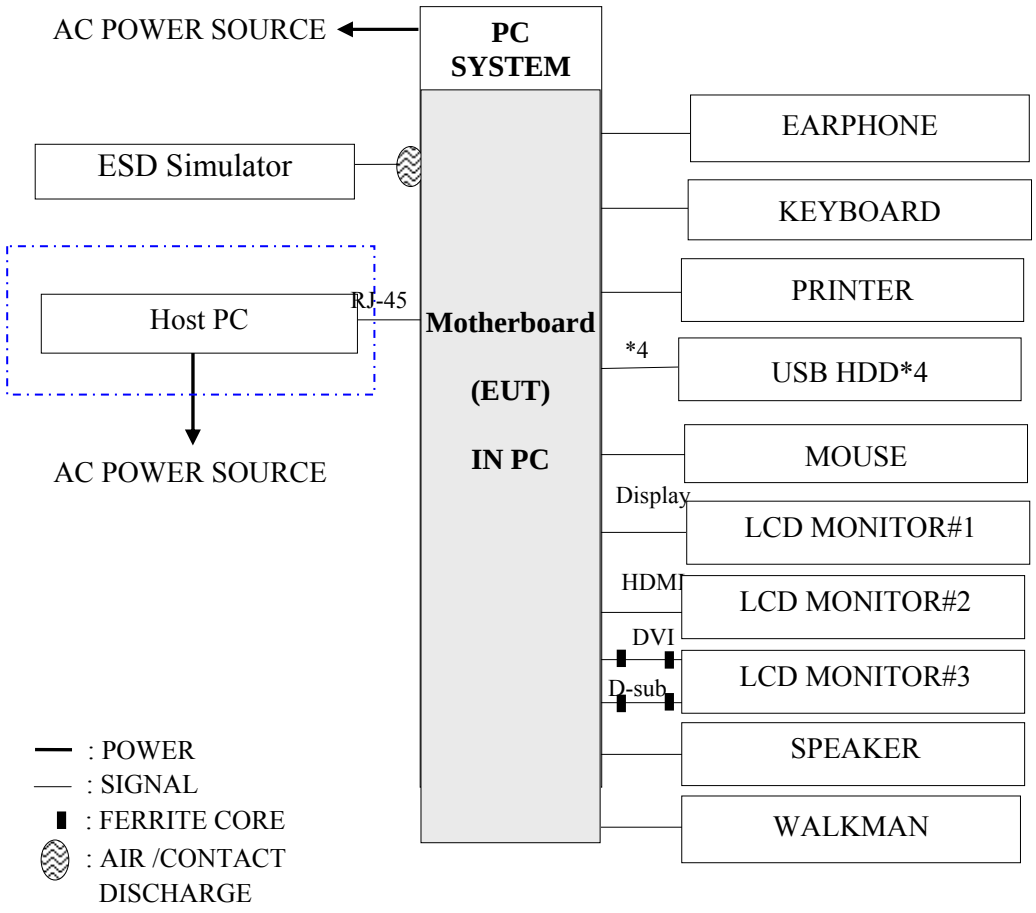
# 7 ELECTROSTATIC DISCHARGE IMMUNITY TEST

## 7.1 Test Equipment

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | ESD SIMULATOR | NoiseKen | ESS-2000 | ESS07X7519 | 2015-07-03 | 2016-07-03 |

## 7.2 Block Diagram of Test Setup




## 7.3 Test Standard

ETSI EN 301 489-1 V1.9.2:2011, Sub clause 9.3 (EN 61000-4-2:2009) &
ETSI EN 301 489-17 V 2.2.1:2012

## 7.4 Test Levels and Performance Criteria

| Test Level | | Performance Criteria |
|---|---|---|
| Air Discharge | ±2kV, ±4kV and ±8kV | **B** |
| Contact Discharge | ±2kV and ±4kV | |

7.5 Test Procedure

7.5.1 Air Discharge**:**

The test was applied on non-conductive surfaces of EUT. The round discharge tip of the discharge electrode was approached as fast as possible until contact the EUT. After each discharge, the discharge electrode was removed from the EUT. The generator was re-triggered for a new single discharge and repeated 20 times for each pre-selected test point. This procedure was repeated until all the air discharge completed

7.5.2 Contact Discharge**:**

All the procedure was same as Section 7.5.1. except that the generator was re-triggered for a new single discharge and repeated 50 times for each pre-selected test point. The tip of the discharge electrode was touching the EUT before the discharge switch was operated.

7.5.3 Indirect discharge for horizontal coupling plane

At least 20 single discharges were applied to the horizontal coupling plane, at points on each side of the EUT. The discharge electrode positions vertically at a distance of 0.1m from the EUT and with the discharge electrode touching the coupling plane.

7.5.4 Indirect discharge for vertical coupling plane

At least 20 single discharges were applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

7.6 Test Results

**PASS.**

The details of test modes and reference test data are as follows:

# Electrostatic Discharge Immunity Test Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Applicant* | *ASUSTeK COMPUTER INC.* | | | *Date of Test* | *2015.08.24* | | |
| *EUT* | *Motherboard* | | | *Power rating* | *AC: 230 V ; 50 Hz* | | |
| *Model No.* | *H170I-PLUS D3* | *Temp.* | *23.5℃* | *Humidity* | *45 %* | *Atmosphere Pressure* | *101kPa* |
| *Test Mode* | *WLAN+BT Operating* | | | | | | |
| *Working Condition* | *Operating* | | | *Results* | *PASS* | | |

| *Item* | *Amount of Discharges* | *Discharge Voltage* | *Performance Criterion* |
|---|---|---|---|
| *Contact Discharge* | *1300* | *+ 2kV,+ 4kV* | *A* |
| | | *- 2kV, - 4kV* | *A* |
| *Air Discharge* | *520* | *+ 2kV,+ 4kV,+ 8kV* | *A* |
| | | *- 2kV, - 4kV, - 8kV* | *A* |
| *Indirect Discharge (HCP)* | *50* | *+ 2kV,+ 4kV* | *A* |
| | | *- 2kV, - 4kV* | *A* |
| *Indirect Discharge (VCP Front)* | *50* | *+ 2kV,+ 4kV* | *A* |
| | | *- 2kV, - 4kV* | *A* |
| *Indirect Discharge (VCP Left)* | *50* | *+ 2kV,+ 4kV* | *A* |
| | | *- 2kV, - 4kV* | *A* |
| *Indirect Discharge (VCP Back)* | *50* | *+ 2kV,+ 4kV* | *A* |
| | | *- 2kV, - 4kV* | *A* |
| *Indirect Discharge (VCP Right)* | *50* | *+ 2kV,+ 4kV* | *A* |
| | | *-2kV,-4kV* | *A* |

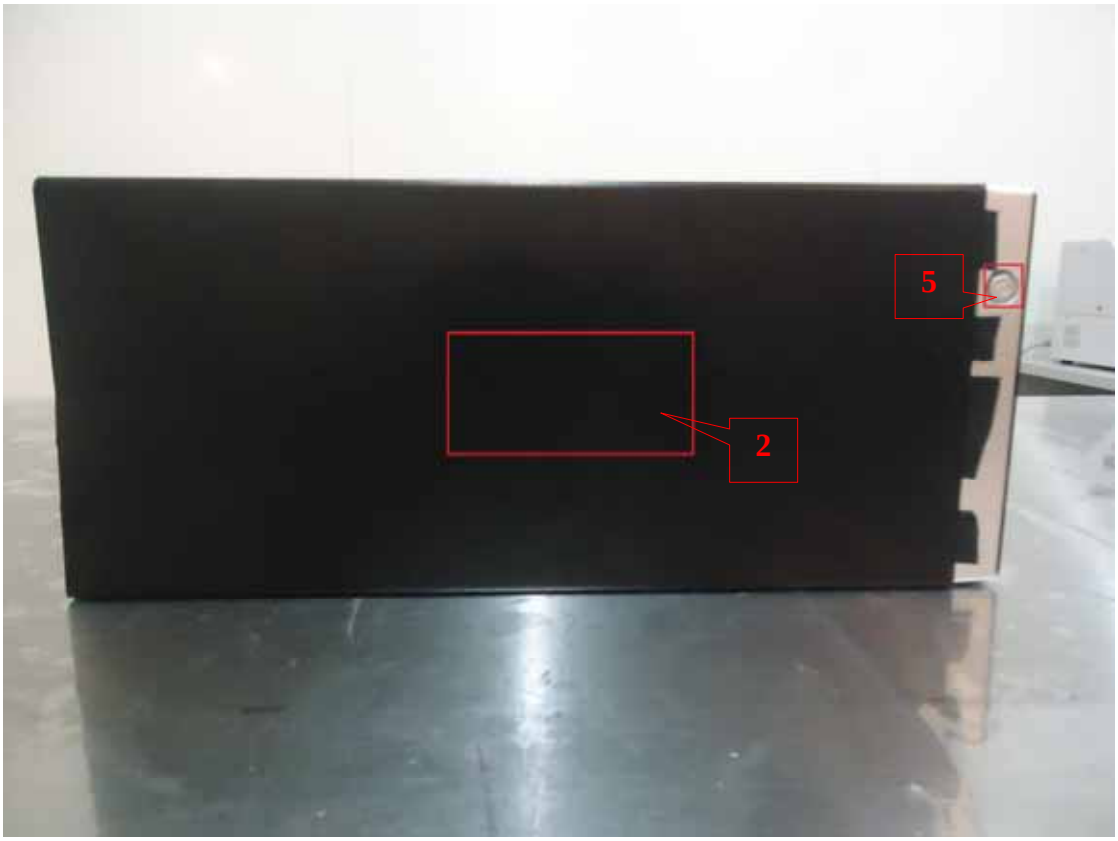
| | | | | | | |
|---|---|---|---|---|---|---|
| *Test Points* | *1.* | *Screw×4* | *Contact Discharge* | *2.* | *Metal×3* | *Contact Discharge* |
| | *3.* | *Cover×5* | *Contact Discharge* | *4.* | *VGA* | *Contact/ Air Discharge* |
| | *5.* | *Button×2* | *Air Discharge* | *6.* | *DVI* | *Contact/ Air Discharge* |
| | *7.* | *USB×6* | *Contact/Air Discharge* | *8.* | *Line in* | *Air Discharge* |
| | *9.* | *Line out* | *Air Discharge* | *10.* | *Mic in* | *Air Discharge* |
| | *11.* | *Lan* | *Air Discharge* | *12.* | *SPDIF OUT* | *Contact/ Air Discharge* |
| | *13.* | *DP* | *Contact/ Air Discharge* | *14* | *AC IN* | *Air Discharge* |
| | *15* | *PS/2* | *Air Discharge* | *16* | *ANT×2* | *Contact/ Air Discharge* |
| | *17* | *HDMI* | *Contact/ Air Discharge* | | | |

| | |
|---|---|
| *Note: IEC 61000-6-2* | |
| | *Engineer :Puck* |

Photos of Discharge Points:


2


2


5
2

# 8 RF FIELD STRENGTH SUSCEPTIBILITY TEST

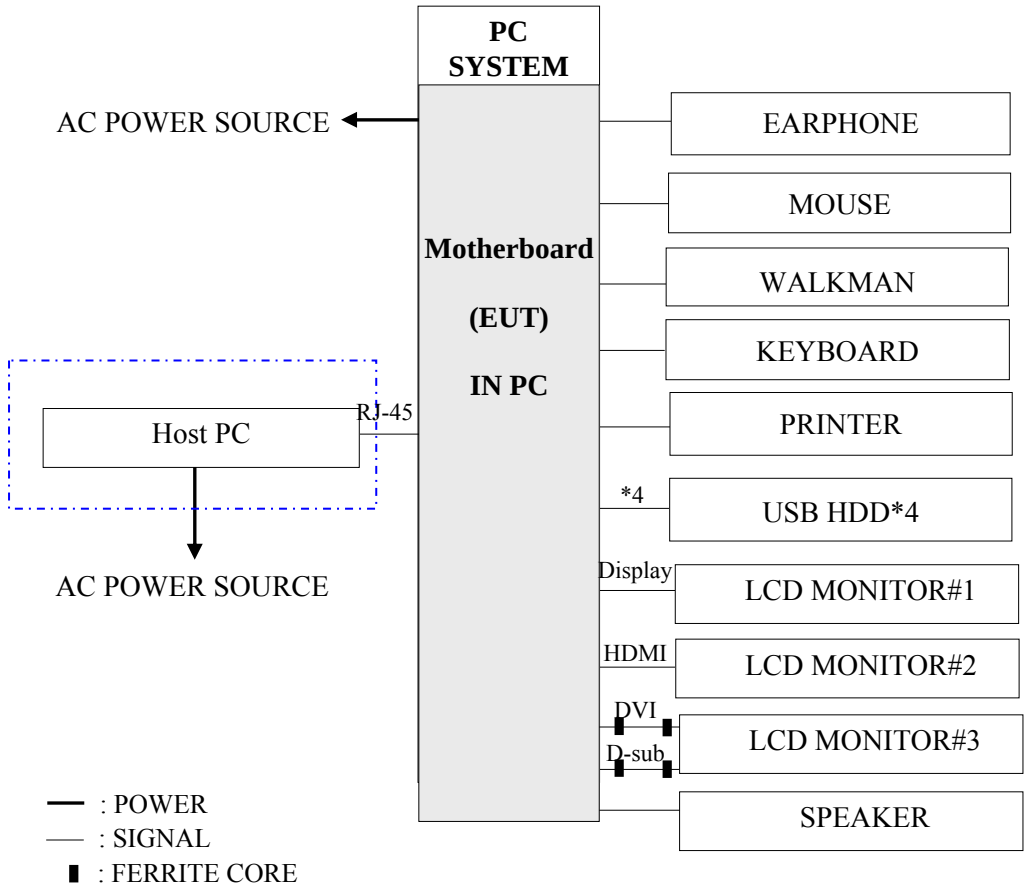
8.1 Test Equipment

| Item | Type | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | Signal Generator | Agilent | 8648C | 3847M01438 | 2015-01-05 | 2016-01-04 |
| 2. | Dual Band Power Amplifier | AR | KAW 2180 | 10088-2 | NCR | NCR |
| 3. | Power Sensor | Agilent | 8481D | MY41093045 | 2015-01-05 | 2016-01-04 |
| 4. | Dual Channel EPM Series Power Meter | Agilent | E4419B | MY45100928 | 2015-01-05 | 2016-01-04 |
| 5. | Log-Periodic Antenna | AR | AT1080 | 0323131 | NCR | NCR |
| 6. | Dual directional coupler | AR | DC6180A | 322333 | 2015-07-03 | 2016-07-03 |
| 7. | Dual directional coupler | AR | DC7144A | 322193 | 2015-07-03 | 2016-07-03 |
| 8. | Software | Audix/i2(4.110314) | | | | |

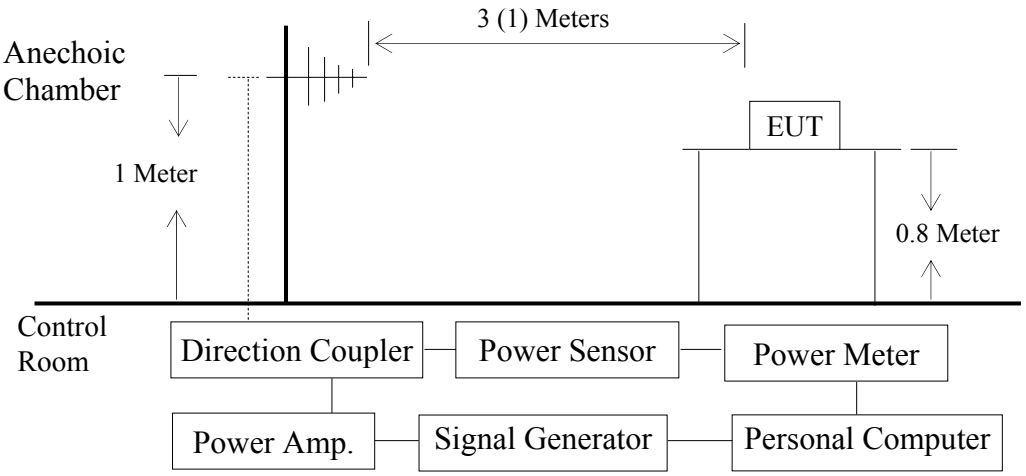
NCR: Non-Calibration Requirement.

8.2 Block Diagram of Test Setup

8.2.1 Block Diagram of connection between EUT and simulators.




8.2.2 R/S Test Setup




8.3 Test Standard

ETSI EN 301 489-1 V1.9.2:2011-09, clause 9.2 (EN 61000-4-3:2006+A2:2010) &
ETSI EN 301 489-17 V2.2.1:2012-09

8.4 Test Levels and Performance Criteria

| Test Level | | Performance Criteria |
|---|---|---|
| Frequency | 80MHz-1GHz,1.4GHz-2.7GHz | A |

| | | |
|---|---|---|
| Field Strength | 3V/m | |
| Modulation & Signal | 80%, 1kHz | |

8.5 Exclusion bands

The frequency on which the transmitter part of the EUT is intended to operate shall be excluded from conducted and radiated emission measurements when performed in transmit mode of operation.

The exclusion band for the transmitter and/or receiver part of the 2.45GHz RLAN equipment under test shall extend from 2280MHz to 2607.675MHz

8.6 Test Procedure

The field sensor is placed on the EUT table (0.8 meter above the ground) which is 3 meters for frequency range 80MHz-1GHz and 1meter for frequency range 1.4GHz-2.7GHz away from the transmitting antenna. Through the signal generator, power amplifier and transmitting antenna to produce a uniformity field strength (3V/m measured by field sensor) around the EUT table from frequency range 80MHz-1000MHz,1.4GHz-2.7GHz and records the signal generator‘s output level at the same time for whole measured frequency range. Then, put EUT and its simulators on the EUT turn table and keep them 3 meters away from the transmitting antenna which is mounted on an antenna tower and fixed at 1 meter height above the ground. Using the recorded signal generator’s output level to measure the EUT from frequency range 80MHz-1000MHz, 1.4GHz-2.7GHz and both horizontal & vertical polarization of antenna must be set and measured. Each of the four sides of EUT must be faced this transmitting antenna and measures individually.

In this report, chose the most sensible side to measure that is right side to face transmitting antenna.

All the scanning conditions are as follows：

| Condition of Test | Remarks |
|---|---|
| Test Fielded Strength | 3 V/m |
| Amplitude Modulated | 1 kHz, 80%AM |
| Scanning Frequency | 80 - 1000 MHz, 1.4GHz-2.7GHz |
| Step Size | 1% increments |
| The Rate of Sweep | 0.0015 decade/s |
| Dwell Time | 3 Sec. |

8.7 Test Results

**PASS.**

The EUT was tested and all the test results are listed in next page.

# RF Field Strength Immunity Test Results

| | | | | | |
|---|---|---|---|---|---|
| *Applicant* | *ASUSTeK COMPUTER INC.* | *Date of Test* | *2015.08.21* | | |
| *EUT* | *Motherboard* | *Power rating* | *AC: 230 V ; 50Hz* | | |
| *Model No.* | *H170I-PLUS D3* | *Temp.* | *23.8℃* | *Humidity* | *62 %* |
| *Test Mode* | *WLAN+BT Operating* | | | | |
| *Working Condition* | *Operating* | *Results* | *PASS* | | |

| *Frequency Range (MHz)* | *E.U.T. Position ( Angle )* | *Ant. Polarity (Hor. or Ver.)* | *Field Strength (V/m)* | *Performance Criterion* | *Remark* |
|---|---|---|---|---|---|
| *80~1000* | *0* | *H* | *3* | *A* | |
| *80~1000* | *90* | *H* | *3* | *A* | |
| *80~1000* | *180* | *H* | *3* | *A* | |
| *80~1000* | *270* | *H* | *3* | *A* | |
| *80~1000* | *0* | *V* | *3* | *A* | |
| *80~1000* | *90* | *V* | *3* | *A* | |
| *80~1000* | *180* | *V* | *3* | *A* | |
| *80~1000* | *270* | *V* | *3* | *A* | |

Note:
I/O: RJ-45 port

*Engineer : Puck*

# RF Field Strength Immunity Test Results

| | | | | | |
|---|---|---|---|---|---|
| *Applicant* | *ASUSTeK COMPUTER INC.* | *Date of Test* | *2015.08.21* | | |
| *EUT* | *Motherboard* | *Power rating* | *AC: 230 V ; 50Hz* | | |
| *Model No.* | *H170I-PLUS D3* | *Temp.* | *23.8℃* | *Humidity* | *62 %* |
| *Test Mode* | *WLAN+BT Operating* | | | | |
| *Working Condition* | *Operating* | | *Results* | *PASS* | |

| *Frequency Range (MHz)* | *E.U.T. Position ( Angle )* | *Ant. Polarity (Hor. or Ver.)* | *Field Strength (V/m)* | *Performance Criterion* | *Remark* |
|---|---|---|---|---|---|
| *1400~2700* | *0* | *H* | *3* | *A* | |
| *1400~2700* | *90* | *H* | *3* | *A* | |
| *1400~2700* | *180* | *H* | *3* | *A* | |
| *1400~2700* | *270* | *H* | *3* | *A* | |
| *1400~2700* | *0* | *V* | *3* | *A* | |
| *1400~2700* | *90* | *V* | *3* | *A* | |
| *1400~2700* | *180* | *V* | *3* | *A* | |
| *1400~2700* | *270* | *V* | *3* | *A* | |

| | |
|---|---|
| *Note：* | |
| | *Engineer : Puck* |

# 9 ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST

9.1 Test Equipment

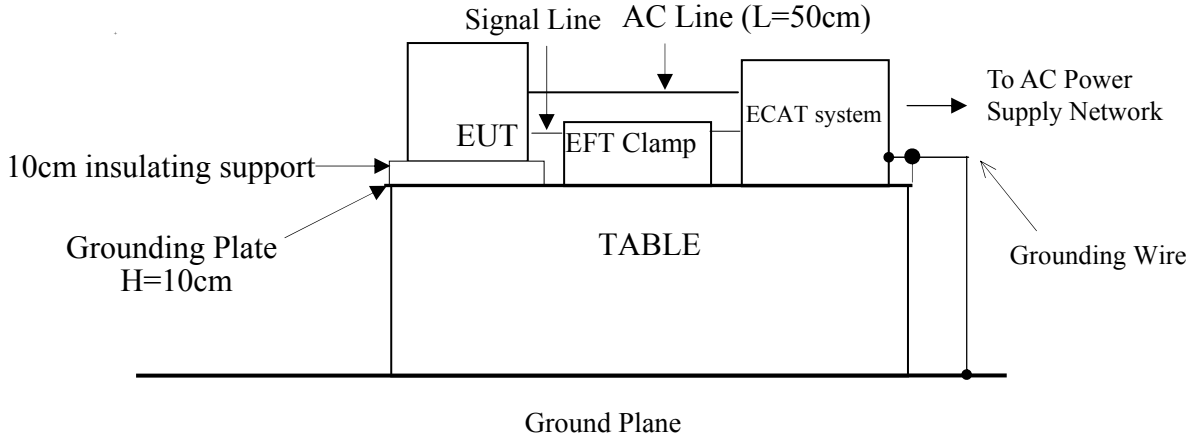
| Item | Type | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | EFT | 3C TEST | EFT-4003G | EC0471226 | 2015-07-03 | 2016-07-03 |

9.2 Block Diagram of Test Setup

9.2.1 Block Diagram of connection between EUT and simulators.

Same as section 8.2.1

9.2.2 EFT Test Setup




Remark: Combination wave generator and decoupling networks are included.

9.3 Test Standard

ETSI EN 301 489-1V1.9.2:2011-09, clause 9.4 (EN61000-4-4:2012) &
ETSI EN 301 489-17 V2.2.1:2012-09:2009
Severity Level 2 for L and N and L to N at 1kV

9.4 Severity Levels and Performance Criterion

9.4.1 Severity level

| Open Circuit Output Test Voltage ±10% | | |
|---|---|---|
| Level | On Power Supply Lines | On I/O (Input/Output) Signal data and control lines |
| 1. | 0.5 kV | 0.25 kV |
| 2. | 1 kV | 0.5 kV |
| 3. | 2 kV | 1 kV |
| 4. | 4 kV | 2 kV |
| X | Special | Special |

9.4.2 Performance criterion: **B**

9.5 Test Procedure

The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m ± 0.01m thick. The ground reference plane was 1m*1m metallic sheet with 0.65mm minimum thickness. This reference ground plane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables.

9.5.1 For input and AC power ports**:**

The EUT was connected to the power mains by using a coupling device that couples the EFT interference signal to AC power lines. Both positive transients and negative transients of test voltage were applied during compliance test and the duration of the test can't less than 1min.

9.5.2 For signal lines and control lines ports**:**

Ports which are intended to be connected to telecommunication networks (e.g. public switched telecommunication networks, integrated services digital networks, local area networks and similar networks.)

9.5.3 For DC input and DC output power ports**:**

It's unnecessary to test.

9.6 Test Results

**PASS.**

The EUT was tested and all the test results are listed in next page.

# Electrical Fast Transient / Burst Immunity Test Results

| | | | | | |
|---|---|---|---|---|---|
| *Applicant* | *ASUSTeK COMPUTER INC.* | *Date of Test* | *2015.08.21* | | |
| *EUT* | *Motherboard* | *Power rating* | *AC: 230 V ; 50 Hz* | | |
| *Model No.* | *H170I-PLUS D3* | *Temp.* | *22.6℃* | *Humidity* | *48 %* |
| *Test Mode* | *WLAN+BT Operating* | | | | |
| *Working Condition* | *Operating* | | *Results* | *PASS* | |

*Inject Place: Power Supply Line*

| *Inject Line* | *Voltage (kV)* | *Inject Time(s)* | *Inject Method* | *Performance Criterion* |
|---|---|---|---|---|
| *L1* | *+0.5, +1.0* | *60* | *Direct* | *A* |
| *L1* | *-0.5, -1.0* | *60* | *Direct* | *A* |
| *L2* | *+0.5, +1.0* | *60* | *Direct* | *A* |
| *L2* | *-0.5, -1.0* | *60* | *Direct* | *A* |
| *PE* | *+0.5, +1.0* | *60* | *Direct* | *A* |
| *PE* | *-0.5, -1.0* | *60* | *Direct* | *A* |
| *L1,L2* | *+0.5, +1.0* | *60* | *Direct* | *A* |
| *L1,L2* | *-0.5, -1.0* | *60* | *Direct* | *A* |
| *L1,PE* | *+0.5, +1.0* | *60* | *Direct* | *A* |
| *L1,PE* | *-0.5, -1.0* | *60* | *Direct* | *A* |
| *L2,PE* | *+0.5, +1.0* | *60* | *Direct* | *A* |
| *L2,PE* | *-0.5, -1.0* | *60* | *Direct* | *A* |
| *L1,L2,PE* | *+0.5, +1.0* | *60* | *Direct* | *A* |
| *L1,L2,PE* | *-0.5, -1.0* | *60* | *Direct* | *A* |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |

*Inject Place: I/O Cable*

| *Inject Line* | *Voltage (kV)* | *Inject Time(s)* | *Inject Method* | *Performance Criterion* |
|---|---|---|---|---|
| *I/O* | *+0.25,+0.5* | *60* | *Clamp* | *A* |
| *I/O* | *-0.25,-0.5* | *60* | *Clamp* | *A* |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |
| ／ | ／ | ／ | ／ | ／ |

*Note:*
*I/O: RJ-45 port*

*Engineer: Puck*

# 10 SURGE TEST

10.1 Test Equipment

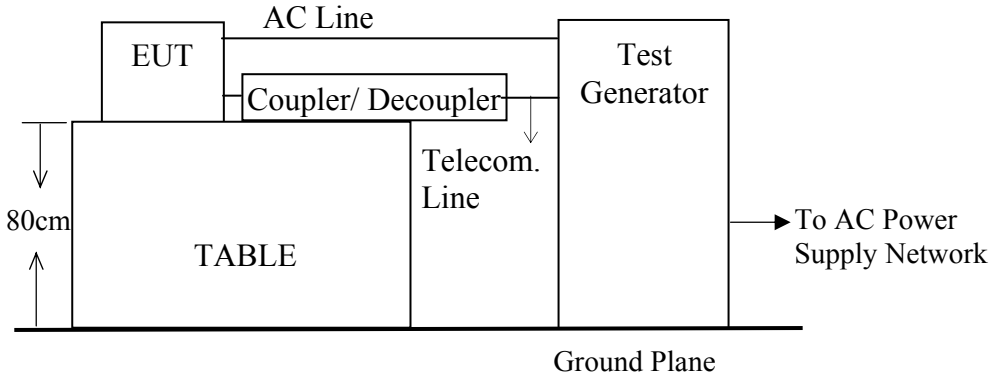
| Item | Type | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | Surge Generator | 3C TEST | SG-5010G | EC5531208 | 2015-07-03 | 2016-07-03 |

10.2 Block Diagram of Test Setup

10.2.1 Block Diagram of the EUT

Same as section 8.2.1

10.2.2 Surge Test Setup




Remark: Test generator includes control center、surge combination and coupler.

10.3 Test Standard

ETSI EN 301 489-1 V1.9.2:2011-09, clause 9.8 (EN 61000-4-5:2006) &
ETSI EN 301 489-17 V2.2.1:2012-09
Severity Level: Line to Line: Level 2 at 1kV
Line to Ground: Level 3 at 2kV)

10.4 Severity Levels and Performance Criterion

10.4.1 Severity level

| Severity Level | Open-Circuit Test Voltage<br>kV |
|---|---|
| 1 | 0.5 |
| 2 | 1.0 |
| 3 | 2.0 |
| 4 | 4.0 |
| * | Special |

10.4.2 Performance criterion: **B**

10.5 Test Procedure

(1) Set up the EUT and test generator as shown on Section 10.2.2.
(2) For line-to-line coupling mode, provide a 1kV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is 2kV.
(3) At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test.
(4) Different phase angles are done individually.
(5) Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

10.6 Test Results

**PASS.**

The EUT was tested and all the test results are listed in next page.

# Surge Immunity Test Results

| | | | | | |
|---|---|---|---|---|---|
| Applicant | ASUSTeK COMPUTER INC. | Date of Test | 2015.08.21 | | |
| EUT | Motherboard | Power rating | AC: 230 V ; 50Hz | | |
| Model No. | H170I-PLUS D3 | Temp. | 22.6℃ | Humidity | 48 % |
| Test Mode | WLAN+BT Operating | | | | |
| Working Condition | Operating | | Results | PASS | |

Input and Output AC Power Port

| Location | Polarity | Phase Angle | No of Pulse | Pulse Voltage | Performance Criterion |
|---|---|---|---|---|---|
| L-N | + | 0 | 5 | 0.5kV, 1.0kV | A |
| | + | 90 | 5 | 0.5kV, 1.0kV | A |
| | + | 180 | 5 | 0.5kV, 1.0kV | A |
| | + | 270 | 5 | 0.5kV ,1.0kV | A |
| | | 0 | 5 | 0.5kV ,1.0kV | A |
| | | 90 | 5 | 0.5kV , 1.0kV | A |
| | | 180 | 5 | 0.5kV , 1.0kV | A |
| | | 270 | 5 | 0.5kV , 1.0kV | A |
| L-PE | + | 0 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | + | 90 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | + | 180 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | + | 270 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 0 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 90 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 180 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 270 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| N-PE | + | 0 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | + | 90 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | + | 180 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | + | 270 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 0 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 90 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 180 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 270 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| L, N-PE | + | 0 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | + | 90 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | + | 180 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | + | 270 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 0 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 90 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 180 | 5 | 0.5kV, 1.0kV , 2.0kV | A |
| | | 270 | 5 | 0.5kV, 1.0kV , 2.0kV | A |

Engineer: Puck

# Surge Immunity Test Results 2

| | | | | | |
|---|---|---|---|---|---|
| Applicant | ASUSTeK COMPUTER INC. | Date of Test | 2015.08.21 | | |
| EUT | Motherboard | Power rating | AC: 230 V ; 50Hz | | |
| Model No. | H170I-PLUS D3 | Temp. | 22.6℃ | Humidity | 48 % |
| Test Mode | WLAN+BT Operating | | | | |
| Working Condition | Operating | | Results | PASS | |

Telecom Line Coupling

| Line | Polarity | No of Pulse | Pulse Voltage | Performance Criterion |
|---|---|---|---|---|
| T1 | + | 5 | 0.5kV 1kV | N/A |
| | - | 5 | 0.5kV 1kV | N/A |
| R1 | + | 5 | 0.5kV 1kV | N/A |
| | - | 5 | 0.5kV 1kV | N/A |
| T2 | + | 5 | 0.5kV 1kV | N/A |
| | - | 5 | 0.5kV 1kV | N/A |
| R2 | + | 5 | 0.5kV 1kV | N/A |
| | - | 5 | 0.5kV 1kV | N/A |
| T1, R1 | + | 5 | 0.5kV 1kV | N/A |
| | - | 5 | 0.5kV 1kV | N/A |
| T2, R2 | + | 5 | 0.5kV 1kV | N/A |
| | - | 5 | 0.5kV 1kV | N/A |
| T1, R1, T2, R2 | + | 5 | 0.5kV 1kV | N/A |
| | - | 5 | 0.5kV 1kV | N/A |

[ ]DC Input and Output Power Port/[√]I/O Signal Cable

| Location | Polarity | No of Pulse | Pulse Voltage | Performance Criterion |
|---|---|---|---|---|
| Differential | + | 5 | 0.5kV 1kV | N/A |
| Mode | - | 5 | 0.5kV 1kV | N/A |
| Common | + | 5 | 0.5kV 1kV | A |
| Mode | - | 5 | 0.5kV 1kV | A |

Note：
1. N/A means not applicable.
2. I/O:RJ-45 port

Engineer: Puck

# 11 INJECTED CURRENTS SUSCEPTIBILITY TEST

11.1 Test Equipment

| Item | Type | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | Signal Generator | Agilent | 8648C | 3847M01438 | 2015-01-05 | 2016-01-04 |
| 2. | Power Amplifier | AR | KAW 2180 | 10088-2 | NCR | NCR |
| 3. | Attenuator | ShanghaiHuaxiang | DTS150 | 6092701 | 2015-01-05 | 2016-01-04 |
| 4. | CDN-M2 | FCC | FCC-801-M3-25A | 06041 | 2015-01-05 | 2016-01-04 |
| 5. | CDN-M3 | FCC | FCC-801-M3-25A | 06042 | 2015-01-05 | 2016-01-04 |
| 6. | Decoupling Network | FCC | F-203I-23MM-DCN | 196 | 2015-01-05 | 2016-01-04 |
| 7. | EM Injection Clamp | FCC | F-203I-03MM | 503 | 2015-01-05 | 2016-01-04 |
| 8. | Software | i2(4.110314) | | | | |

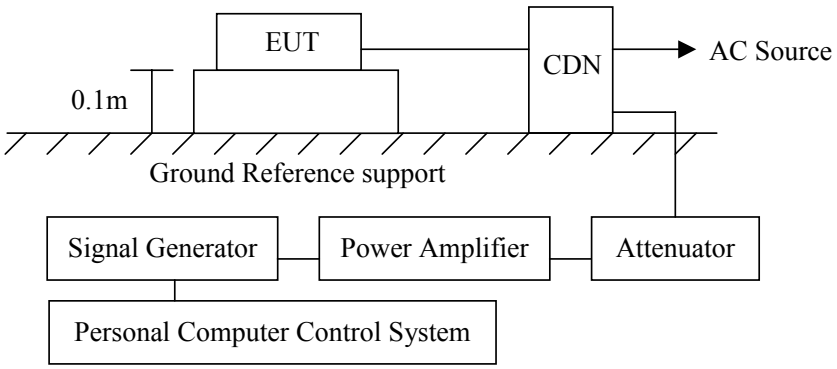
NCR: Non-Calibration Requirement.

11.2 Block Diagram of Test Setup

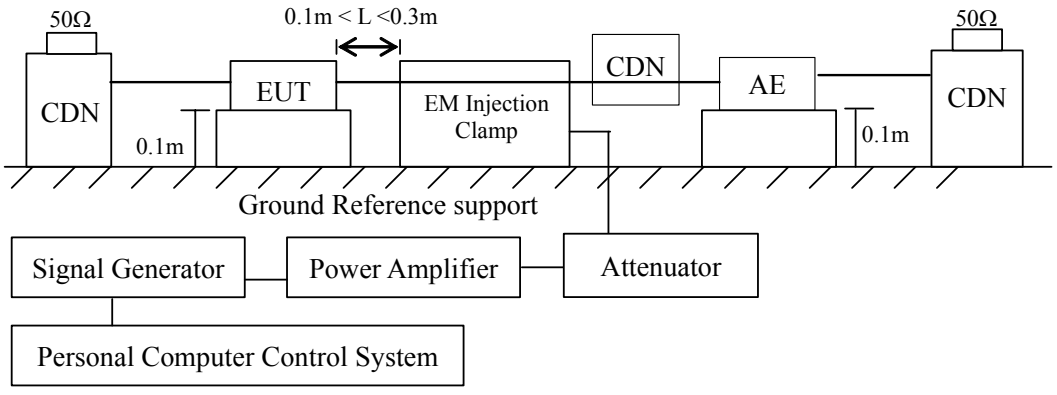
11.2.1 Block Diagram of connection between EUT and simulators.

Same as Section 8.2.1

11.2.2 Common Mode Test Setup




11.2.3 EM Clamp Mode Test Setup



11.3 Test Standard

ETSI EN 301 489-1 V1.9.2:2011-09, clause 9.5 (EN 61000-4-6:2014) &
ETSI EN 301 489-17 V2.2.1:2012-09
Severity Level 2 at 3 V (rms) and frequency is from 0.15MHz to 80MHz)

11.4 Severity Levels and Performance Criterion

11.4.1 Severity level

| Level | Voltage Level (e.m.f.) V |
|---|---|
| 1. | 1 |
| 2. | 3 |
| 3. | 10 |
| X | Special |

11.4.2 Performance criterion: **A**

11.5 Test Procedure

1) Setup the EUT, CDN and test generators as shown on Section 11.2.2.
2) Let the EUT work in test mode and test it.
3) The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).
4) The disturbance signal described below is injected to EUT through CDN.
5) The EUT operates within its operational mode(s) under intended climatic conditions after power on.
6) The frequency range is swept from 0.150MHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1 kHz sine wave.
7) The rate of sweep shall not exceed $1.5*10^{-3}$decades/s. Where the frequency is swept incrementally; the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.
8) Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

11.6 Test Results

**PASS.**

The EUT was tested and all the test results are listed in next page.

# Inject Currents Immunity Test Results

| | | | | | |
|---|---|---|---|---|---|
| *Applicant* | *ASUSTeK COMPUTER INC.* | *Date of Test* | *2015.08.21* | | |
| *EUT* | *Motherboard* | *Power rating* | *AC: 230V ; 50Hz* | | |
| *Model No.* | *H170I-PLUS D3* | *Temp.* | *23.8℃* | *Humidity* | *62 %* |
| *Test Mode* | *WLAN+BT Operating* | | | | |
| *Working Condition* | *Operating* | | *Results* | *PASS* | |

| *Frequency Range (MHz)* | *Inject Position* | *Strength* | *Performance Criterion* | *Remark* |
|---|---|---|---|---|
| *0.15MHz~80MHz* | *Main* | *3V* | *A* | *Power* |
| *0.15MHz~230MHz* | *Main* | *3V* | *N/A* | |
| *0.15MHz~80MHz* | *I/O* | *3V* | *A* | *RJ-45* |
| *0.15MHz~230MHz* | *I/O* | *3V* | *N/A* | |

| | |
|---|---|
| *Note:*<br>*I/O: RJ-45 port* | |
| | *Engineer : Puck* |

# 12 VOLTAGE DIPS AND INTERRUPTIONS TEST

12.1 Test Equipment

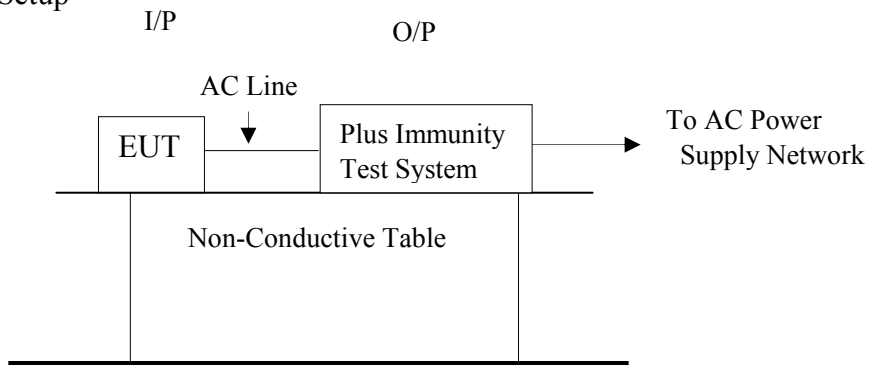
| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|---|
| 1. | AC power source | TESEQ | NSG1007-45-3PI | 1236A00705 | 2013-09-17 | 2015-09-17 |

12.2 Block Diagram of Test Setup

12.2.1 Block Diagram of connection between EUT and simulators.

Same as section 8.2.1.

12.2.2 Test Setup




12.3 Test Standard

ETSI EN 301 489-1 V1.9.2:2011-09, clause 9.7 (EN 61000-4-11:2004) &
ETSI EN 301 489-17 V2.2.1:2012-09

12.4 Severity Levels and Performance Criterion

12.4.1 Severity level

| Test Level %$U_T$ | Voltage dip and short interruptions %$U_T$ | Performance Criterion | Duration (in period) |
|---|---|---|---|
| 0 | 100 | B | 0.5 |
| 0 | 100 | B | 1 |
| 70 | 30 | B | 5 |
| 0 | 100 | C | 250 |

Performance criterion: **B & C**

12.5 Test Procedure

1) The EUT and test generator were setup as shown on Section 12.2.2.
2) The interruptions are introduced at selected phase angles with specified duration.
3) Record any degradation of performance.

12.6 Test Results

**PASS.**

The EUT was tested and all the test results are listed in next page.

# Voltage Dips and Interruptions Immunity Test Results

| | | | | | |
|---|---|---|---|---|---|
| Applicant | ASUSTeK COMPUTER INC. | Date of Test | 2015.08.21 | | |
| EUT | Motherboard | Power rating | AC: 230 V ; 50 Hz | | |
| Model No. | H170I-PLUS D3 | Temp. | 22.6℃ | Humidity | 48 % |
| Test Mode | WLAN+BT Operating | | | | |
| Working Condition | Operating | | Results | PASS | |

| Type of Test | Test Voltage | Phase Angle | % Reduction | Period | Performance Criterion |
|---|---|---|---|---|---|
| Voltage Interruption | 230 | 0 | >95% | 250 | C |
| | | 45 | >95% | 250 | C |
| | | 90 | >95% | 250 | C |
| | | 135 | >95% | 250 | C |
| | | 180 | >95% | 250 | C |
| | | 225 | >95% | 250 | C |
| | | 270 | >95% | 250 | C |
| | | 315 | >95% | 250 | C |
| Voltage Dips | 230 | 0 | 30% | 25 | A |
| | | 45 | 30% | 25 | A |
| | | 90 | 30% | 25 | A |
| | | 135 | 30% | 25 | A |
| | | 180 | 30% | 25 | A |
| | | 225 | 30% | 25 | A |
| | | 270 | 30% | 25 | A |
| | | 315 | 30% | 25 | A |
| | 230 | 0 | >95% | 0.5 | A |
| | | 45 | >95% | 0.5 | A |
| | | 90 | >95% | 0.5 | A |
| | | 135 | >95% | 0.5 | A |
| | | 180 | >95% | 0.5 | A |
| | | 225 | >95% | 0.5 | A |
| | | 270 | >95% | 0.5 | A |
| | | 315 | >95% | 0.5 | A |

*Note:*

*The performance criterion "C" means the power of the EUT is turned off, and it cannot recover by itself during the test interval .*

*Engineer Puck*

# 13 PHOTOGRAPHS

13.1 Photos of Conducted Disturbance Measurement

Front View of Conducted Measurement (AC Mains Port)

Side View of Conducted Measurement (AC Mains Port)

Front View of Conducted Emission Measurement (Telecommunication port)

Side View of Conducted Emission Measurement (Telecommunication port)

13.2 Photos of Radiated Disturbance Measurement

**For 30MHz ~1GHz**

Front View of Radiated Disturbance Measurement


Back View of Radiated Disturbance Measurement

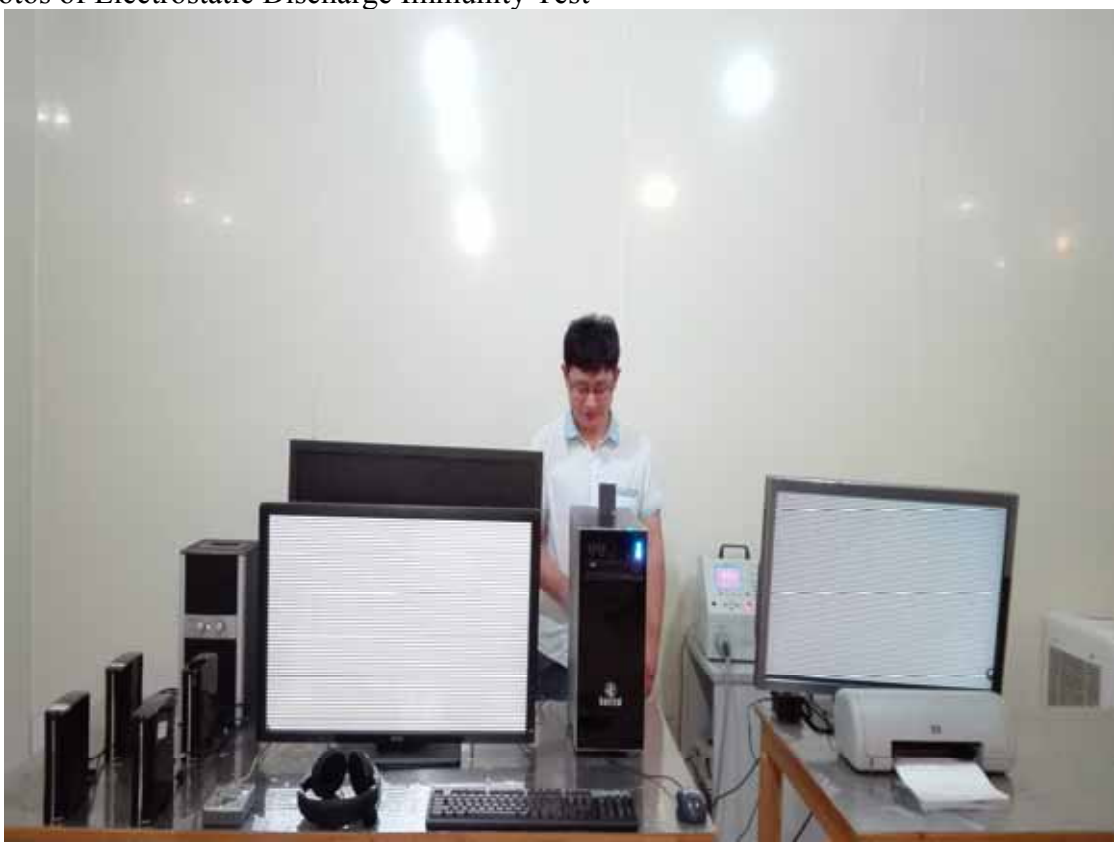
**For above 1GHz**

Front View of Radiated Disturbance Measurement

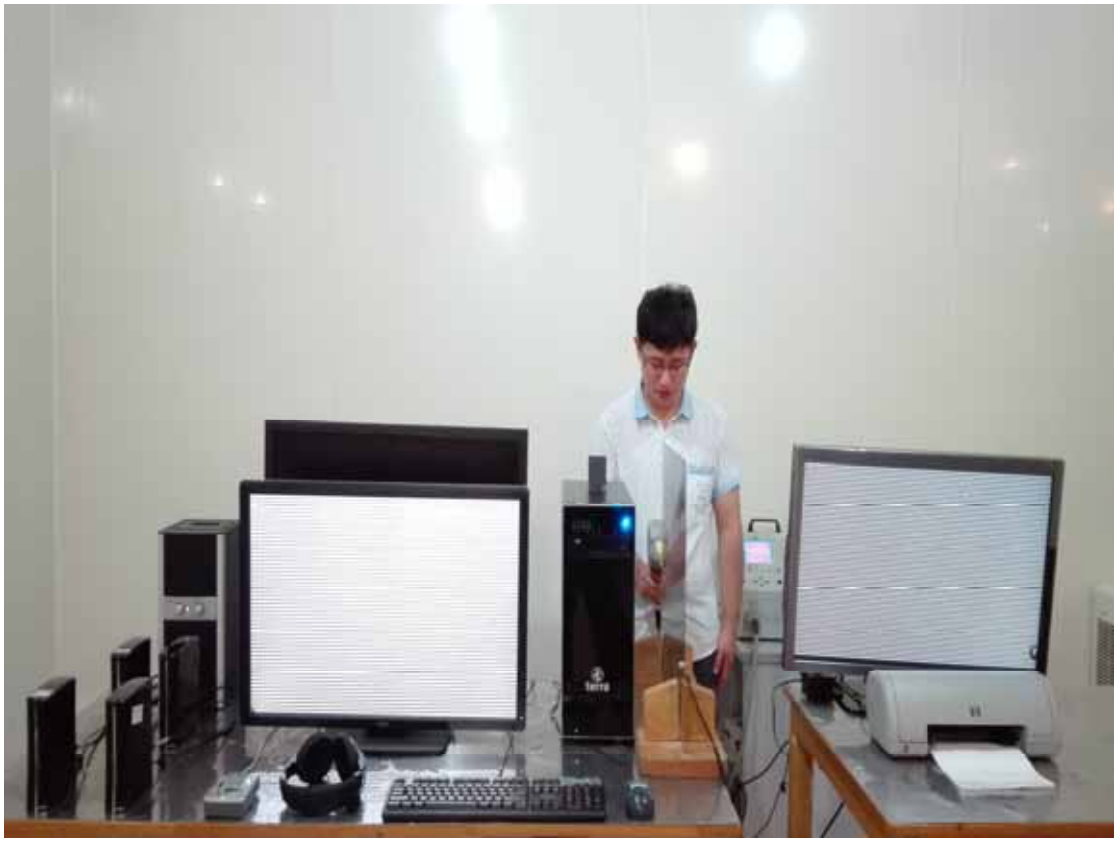

Back View of Radiated Disturbance Measurement

13.3 Photos of Harmonic & Flicker Measurement

13.4 Photos of Electrostatic Discharge Immunity Test

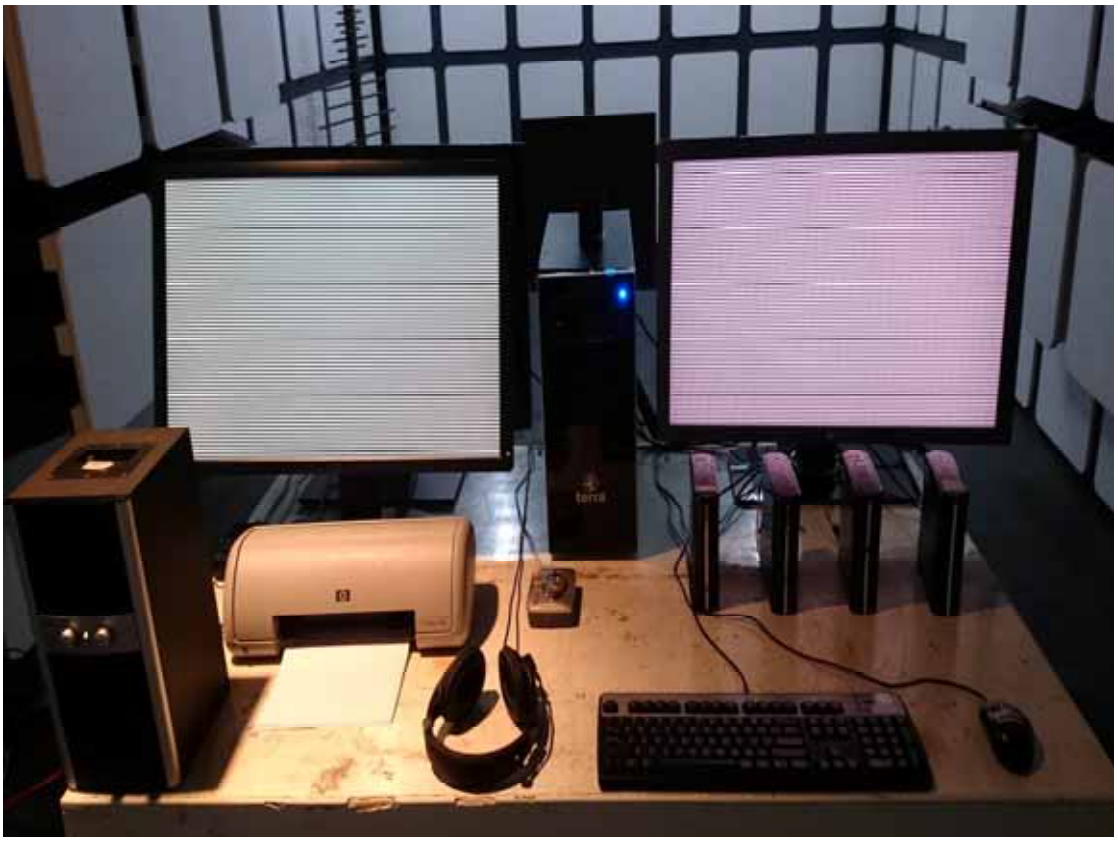


Contact & Air Discharge

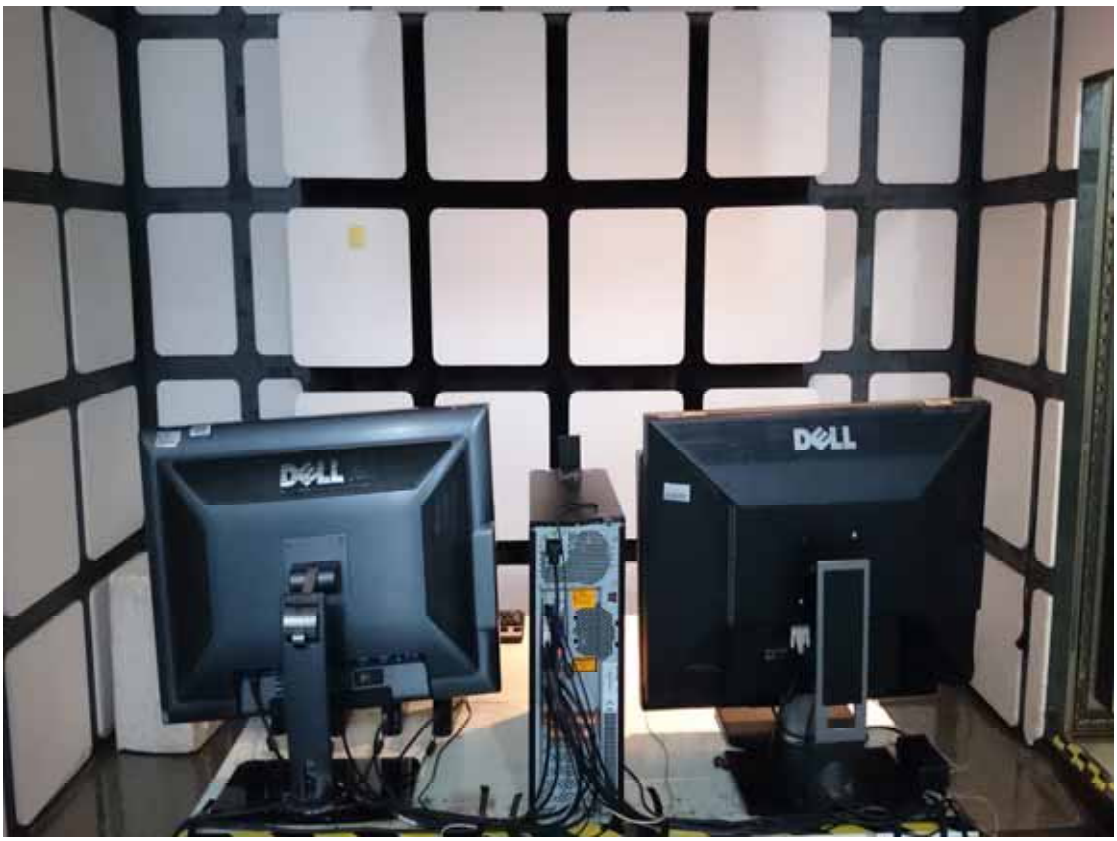


VCP & HCP

13.5 Photos of RF Field Strength Immunity Test



Front View of R/S Test




Back View of R/S Test

13.6 Photos of Electrical Fast Transient Immunity Test

For AC Mains port

For Telecommunication port

13.7 Photos of Surge Immunity Test

For AC Mains port

For Telecommunication port

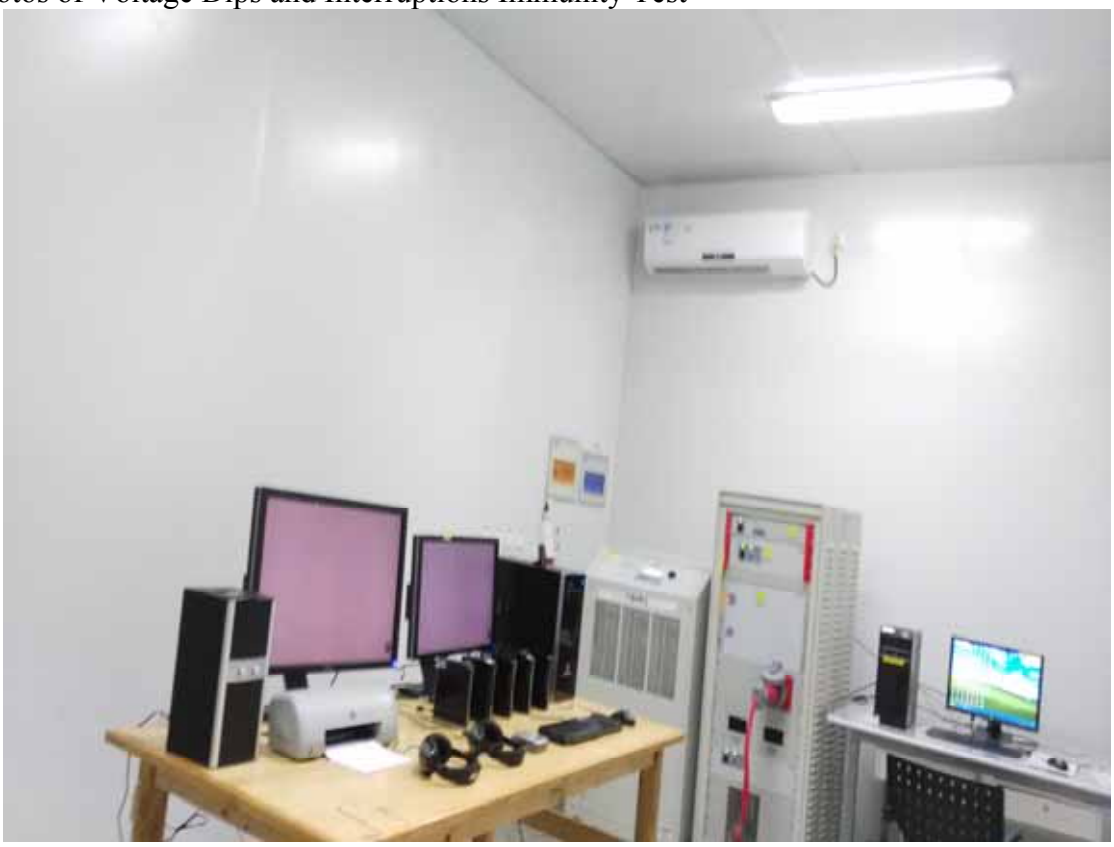
13.8 Photos of Conducted Disturbance Immunity Test

For AC Mains port

For Telecommunication port

13.9 Photos of Power Frequency Magnetic Field Immunity Test

13.10 Photos of Voltage Dips and Interruptions Immunity Test



13.11 Photos of Host PC for RJ-45 Ping Test

# APPENDIX

## Photos of EUT

Figure 1
General Appearance (Motherboard, Front View)


Figure 2
General Appearance (Motherboard, Back View)

Figure 3
General Appearance (Motherboard, Fan Set Removed)

Figure 4
Fan Set(Front View)

Figure 5
Fan Set(Back View)

Figure 6
General Appearance (Motherboard, I/O Ports)

Figure 7
CPU(Front View)


Figure 8
CPU (Back View)

Figure 9
Crystal Oscillator

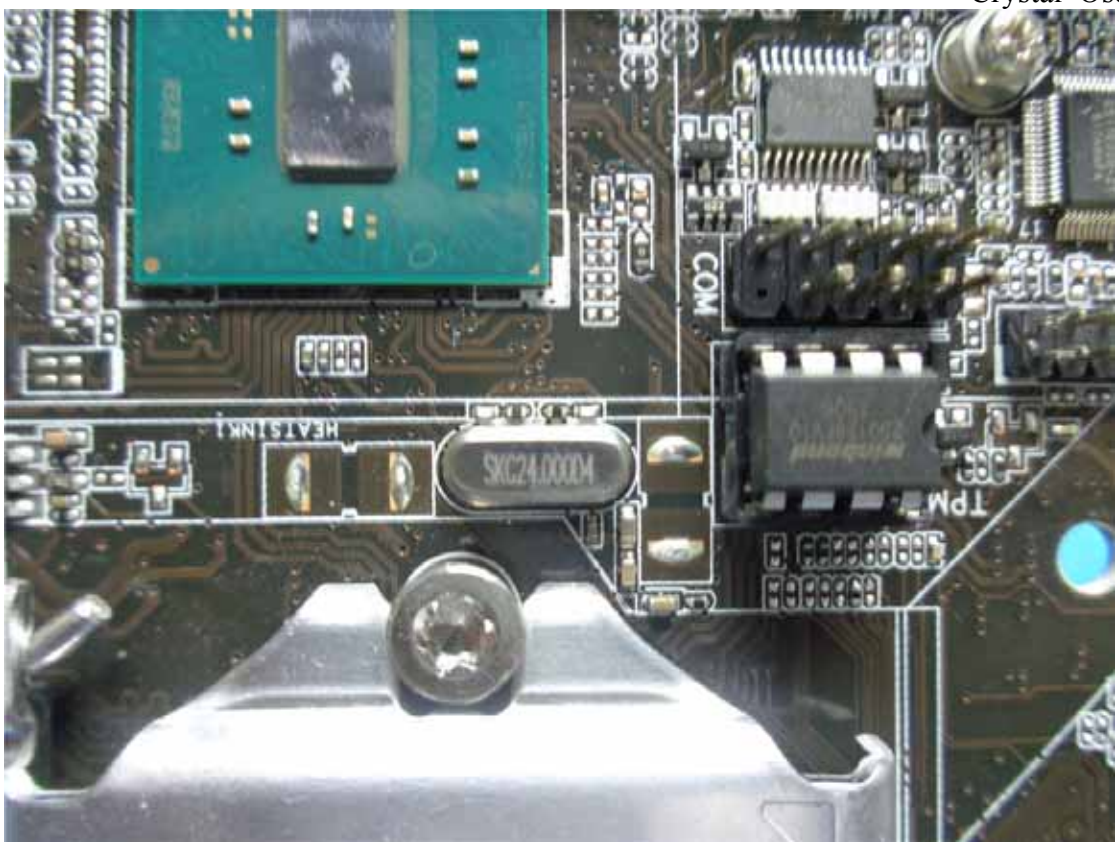



Figure 10
Crystal Oscillator

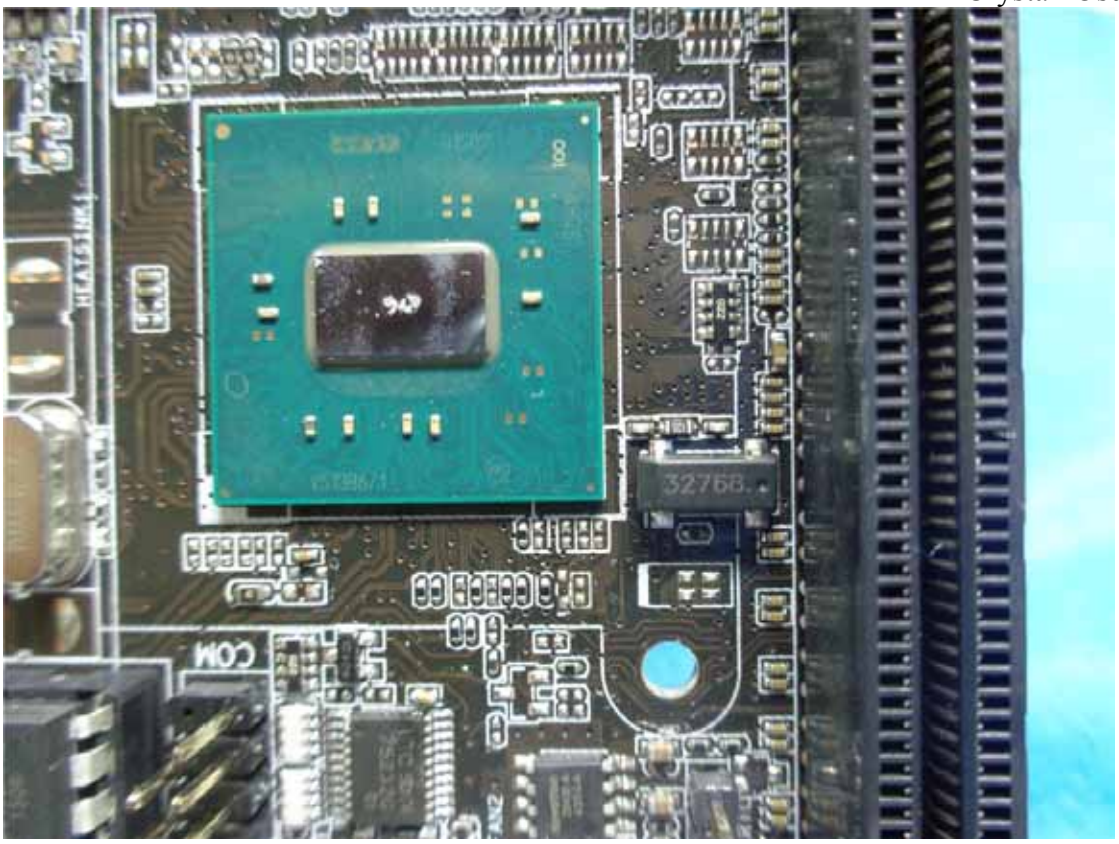


Figure 11
Crystal Oscillator