

CE EMC TEST REPORT

for

UP-Core board

**MODEL: xUPC-CHT01x (x-where x may be any combination of
alphanumeric characters or "-" or blank)**

Test Report Number:
T171027D06-B-E

Issued to:

AAEON Technology Inc.

**5F, No.135, Lane 235, Pao Chiao Rd, Hsin-Tien Dist.,
New Taipei City, Taiwan, R.O.C.**

Issued by:

Compliance Certification Services Inc.

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Issued Date: November 23, 2017



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Revision History

| Rev. | | Issue Date | | Revisions | Effect Page | Revised By |
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| 00 | | November 23, 2017 | | Initial Issue | ALL | Amy Wang |
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| | | | | | | |
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1 TEST CERTIFICATION

Product: UP-Core board

Model: xUPC-CHT01x (x-where x may be any combination of alphanumeric characters or "-" or blank)

Brand: AAEON

Applicant: AAEON Technology Inc.

5F, No.135, Lane 235, Pao Chiao Rd, Hsin-Tien Dist.,
New Taipei City, Taiwan, R.O.C.

Manufacturer: AAEON Technology Inc.

5F, No.135, Lane 235, Pao Chiao Rd, Hsin-Tien Dist.,
New Taipei City, Taiwan, R.O.C.

Tested: November 14, 2017 & November 23, 2017

Applicable Standards: EN 55032: 2015 / AC: 2016, Class A EN 55024: 2010 + A1: 2015

CISPR 32: 2015 (Ed 2.0) / C1: 2016 IEC 61000-4-2: 2008

EN 61000-3-2: 2014 IEC 61000-4-3: 2006 + A1: 2007 + A2: 2010

EN 61000-3-3: 2013 IEC 61000-4-4: 2012

IEC 61000-4-5: 2014

IEC 61000-4-6: 2013

IEC 61000-4-8: 2009

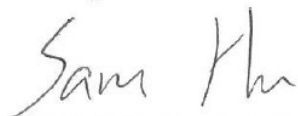
IEC 61000-4-11: 2004

Deviation from Applicable Standard

None

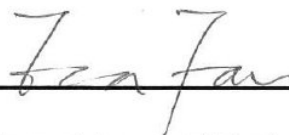
The above equipment was tested by Compliance Certification Services Inc. for compliance with the requirements of technical standards specified above under the EMC Directive 2014/30/EU. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:



Sam Hu
Assistant Manager

Reviewed by:



Eva Fan
Supervisor of report document dept.

2 TEST RESULT SUMMARY

| EMISSION | | | |
|---|---|--------|------------------------|
| Standard | Item | Result | Remarks |
| EN 55032: 2015 / AC: 2016 CISPR 32: 2015 (Ed 2.0) / C1: 2016 | Conducted (Power Port) | PASS | Meet Class A limit |
| | Conducted (Telecom port) | PASS | Meet Class A limit |
| | Radiated | PASS | Meet Class A limit |
| | Radiated emissions from FM receivers | N/A | Please see the page 27 |
| | Conducted differential voltage emissions from Class B equipment | N/A | Please see the page 30 |
| EN 61000-3-2: 2014 | Harmonic current emissions | PASS | Meet Class A limit |
| EN 61000-3-3: 2013 | Voltage fluctuations & flicker | PASS | Meets the requirements |

| IMMUNITY [EN 55024 (2010 + A1: 2015)] | | | |
|---|-----------------------------------|--------|--|
| Standard | Item | Result | Remarks |
| IEC 61000-4-2: 2008 | ESD | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-3: 2006 + A1: 2007 + A2: 2010 | RS | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-4: 2012 | EFT | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-5: 2014 | Surge | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-6: 2013 | CS | PASS | Meets the requirements of Performance Criterion A |
| IEC 61000-4-8: 2009 | PFMF | N/A | Please see the page 55 |
| IEC 61000-4-11: 2004 | Voltage dips & voltage variations | PASS | Meets the requirements of Voltage Dips: 1) >95% reduction Performance Criterion A 2) 30% reduction Performance Criterion A Voltage Interruptions: 1) >95% reduction Performance Criterion C |

Note: 1. The statements of test result on the above are decided by the request of test standard only; the measurement uncertainties are not factored into this compliance determination.
2. The information of measurement uncertainty is available upon the customer's request.

3 EUT DESCRIPTION

| | |
|-------------------------|---|
| Product | UP-Core board |
| Brand Name | AAEON |
| Model | xUPC-CHT01x (x-where x may be any combination of alphanumeric characters or "-" or blank) |
| Applicant | AAEON Technology Inc. |
| Housing material | Metal case |
| Identify Number | T171027D06-B |
| Received Date | October 27, 2017 |
| EUT Power Rating | 5VDC from AC Adaptor |
| AC Power During Test | 110VAC / 50Hz & 230VAC / 50Hz to AC Adaptor |
| AC Adaptor Manufacturer | Powertron |
| AC Adaptor Model | PA1024-050IB400 |
| AC Adaptor Power Rating | I/P: 100-240VAC~ 50-60Hz, 0.6A O/P: 5VDC, 4.0A |
| DC Power Cord Type | Unshielded, 1.2m (Non-detachable) |

Model Differences

| Model | Difference | Tested (Check) |
|--------------------|---|-------------------------------------|
| UPC-CHT01-A20-0464 | Original | <input checked="" type="checkbox"/> |
| xUPC-CHT01x | 1. For marketing purpose only 2. x-where x may be any combination of alphanumeric characters or "-" or blank | <input type="checkbox"/> |

I/O PORT

| I/O PORT TYPES | Q'TY | TESTED WITH |
|-----------------|------|-------------|
| 1. COM Port | 1 | 1 |
| 2. HDMI Port | 1 | 1 |
| 3. USB 3.0 Port | 1 | 1 |
| 4. LAN Port | 1 | 1 |
| 5. Antenna Port | 1 | 1 |

Note: Client consigns only one model sample to test (Model Number: UPC-CHT01-A20-0464).

4 TEST METHODOLOGY

4.1. DECISION OF FINAL TEST MODE

The EUT was tested together with the below additional components, and a configuration, which produced the worst emission levels, was selected and recorded in this report.

The test configuration/ modes are as the following:

Conduction Modes (Power port):

| | | |
|---|-------------|--------------|
| 1 | Normal Mode | 110VAC, 50Hz |
| 2 | | 230VAC, 50Hz |

Conduction Modes (Telecom port):

| | |
|---|---------|
| 1 | 10Mbps |
| 2 | 100Mbps |
| 3 | 1Gbps |

Radiation Modes:

| | | |
|---|----------------------|--------------|
| 1 | Normal Mode | 110VAC, 50Hz |
| 2 | Normal Mode | 230VAC, 50Hz |
| | Normal Mode / 1-6GHz | |

Worst:

Conduction (Power port): Mode 2

Conduction (Telecom port): Mode 2

Radiation: Mode 2

4.2. EUT SYSTEM OPERATION

1. Windows 10 boots system.
2. Run colorbarmove.exe to activate all peripherals for test EUT.
3. Press the start menu, select executive and type ping 192.168.0.2 -t (EUT), ping 192.168.0.1 -t (Server PC).

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

5 SETUP OF EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Host PC Devices:

| No. | Equipment | Model No. | Brand Name |
|-----|--|---------------------------------|------------|
| 1 | CPU (1.92GHz) | Intel® Atom™ x5-Z8350 Processor | Intel |
| 2 | Memory (on board DDR3L 1600 / 1GB/2GB/4GB) | N/A | N/A |
| 3 | STORAGE (eMMC 5.1 Flash / 16GB/32GB/64GB) | N/A | Hynix |
| 4 | Power Adapter | PA1024-050IB400 | Powertron |

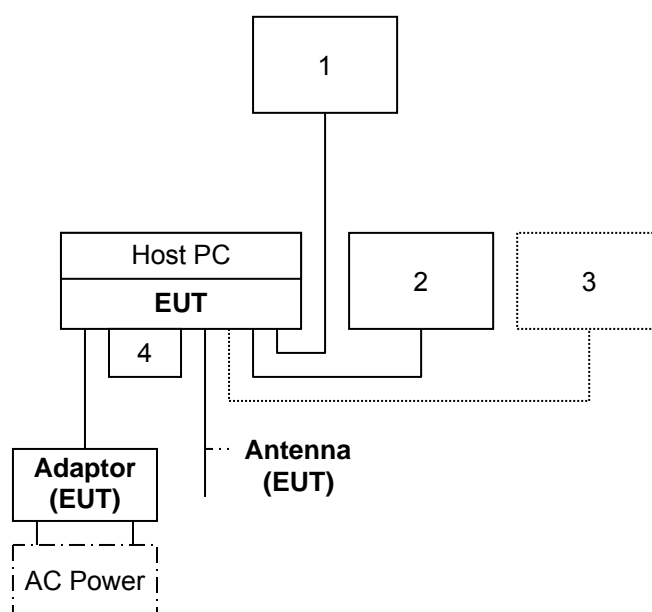
Peripherals Devices:

| No. | Equipment | Model No. | Serial No. | FCC ID / BSMI ID | Brand Name | Data Cable | Power Cord |
|-----|---------------|-----------|--------------|---------------------|------------|-----------------|------------------|
| 1 | USB Mouse | M-U0026 | 810-002181 | DOC BSMI: T41126 | Logitech | Shielded, 1.8m | N/A |
| 2 | Monitor | PA248Q | G5LMQS071284 | DOC BSMI: R31018 | ASUS | Shielded, 1.5m | Unshielded, 1.8m |
| 3 | Server PC | T3500 | 8X36VBX | DOC BSMI: R33002 | DELL | Unshielded, 20m | Unshielded, 1.8m |
| 4 | COM Connector | N/A | N/A | N/A | N/A | N/A | N/A |

Note:

- 1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

5.2. CONFIGURATION OF SYSTEM UNDER TEST



6 FACILITIES AND ACCREDITATIONS

6.1. FACILITIES

All measurement facilities used to collect the measurement data are located at CCSrf Taiwan Xindian Lab. at No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City, 23151 Taiwan.

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4 and CISPR 16-1-5.

6.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

| | |
|--------|------|
| Taiwan | TAF |
| USA | A2LA |

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

| | |
|--------|-----------------|
| Canada | Industry Canada |
| Japan | VCCI |
| Taiwan | BSMI |
| USA | FCC |

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsrf.com>

6.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement | Frequency | Uncertainty |
|------------------------------------|-------------------|-------------|
| Conducted emissions (Power port) | 0.15MHz ~ 30MHz | ± 1.07 |
| Conducted emissions (Telecom port) | 0.15MHz ~ 30MHz | ± 1.60 |
| Radiated emissions | 30MHz ~ 1000MHz | ± 4.84 |
| | 1000MHz ~ 6000MHz | ± 4.17 |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Consistent with industry standard (e.g. CISPR 22: 2005, clause 11, Measurement Uncertainty) determining compliance with the limits shall be base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.

The acceptable measurement uncertainty value without requiring revision of the compliance statement is base on conducted and radiated emissions being less than U_{CISPR} which is 3.6dB and 5.2dB respectively. CCS values (called U_{Lab} in CISPR 16-4-2) is less than U_{CISPR} as shown in the table above. Therefore, MU need not be considered for compliance.

7 EMISSION TEST

7.1. CONDUCTED EMISSION MEASUREMENT

7.1.1. LIMITS

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

NOTE:

- (1) The lower limit shall apply at the transition frequencies.
- (2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
- (3) All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

7.1.2. TEST INSTRUMENTS

| Conducted Emission room # A | | | | |
|-----------------------------|--------------|-----------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| BNC Cable | EMEC | EMG178 | BNC#A9 | 03/27/2018 |
| EMI Test Receiver | R&S | ESCI | 101201 | 08/22/2018 |
| LISN | Schwarzbeck | NNLK 8129 | 8129-286 | 08/15/2018 |
| LISN(EUT) | Schwarzbeck | NSLK 8127 | 8127527 | 08/15/2018 |
| Pulse Limiter | R&S | ESH3Z2 | C3010026-2 | 08/17/2018 |
| Thermo-Hygro Meter | Wisewind | 201A | No. 02 | 05/08/2018 |
| Test S/W | EZ-EMC | | | |

- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. N.C.R = No Calibration Request.

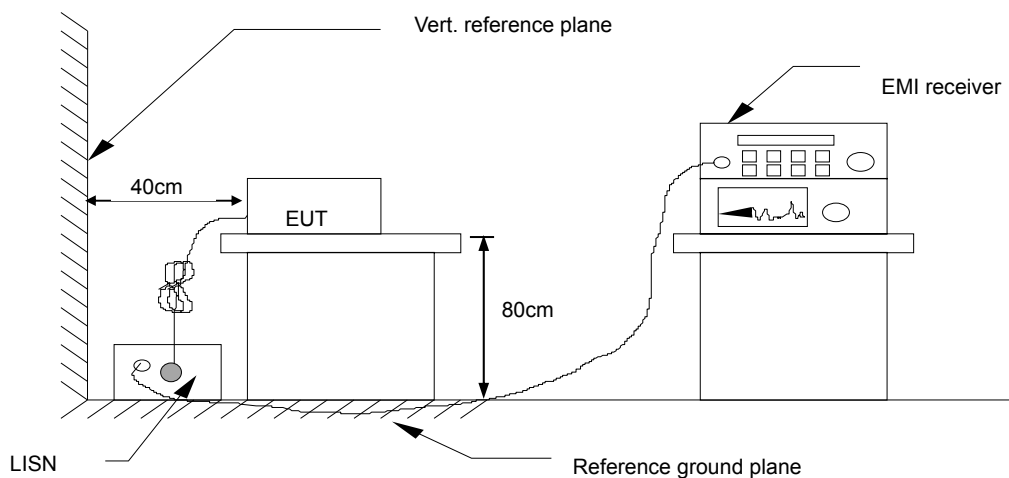
7.1.3. TEST PROCEDURES (please refer to measurement standard or CCS SOP PA-031 & PA-041)**Procedure of Preliminary Test**

- The EUT and Support equipment, if needed, was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per EN 55032 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor standing equipment, it is placed on the ground plane, which has a 15 cm non-conductive covering to insulate the EUT from the ground plane.
- All I/O cables were positioned to simulate typical actual usage as per EN 55032.
- The test equipment EUT installed received AC main power, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane.
- All support equipment power received from a second LISN.
- The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The Receiver scanned from 150kHz to 30MHz for emissions in each of the test modes.
- During the above scans, the emissions were maximized by cable manipulation.
- The test mode(s) described in Item 4.1 were scanned during the preliminary test.
- After the preliminary scan, we found the test mode described in Item 4.1 producing the highest emission level.
- The EUT configuration and cable configuration of the above highest emission levels were recorded for reference of the final test.

Procedure of Final Test

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

7.1.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

7.1.5. DATA SAMPLE

| Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector (P/Q/A) | Line (L1/L2) |
|-------------|----------------|-------------|---------------|--------------|-------------|------------------|--------------|
| x.xx | 42.95 | 0.55 | 43.50 | 73 | -29.50 | Q | L1 |

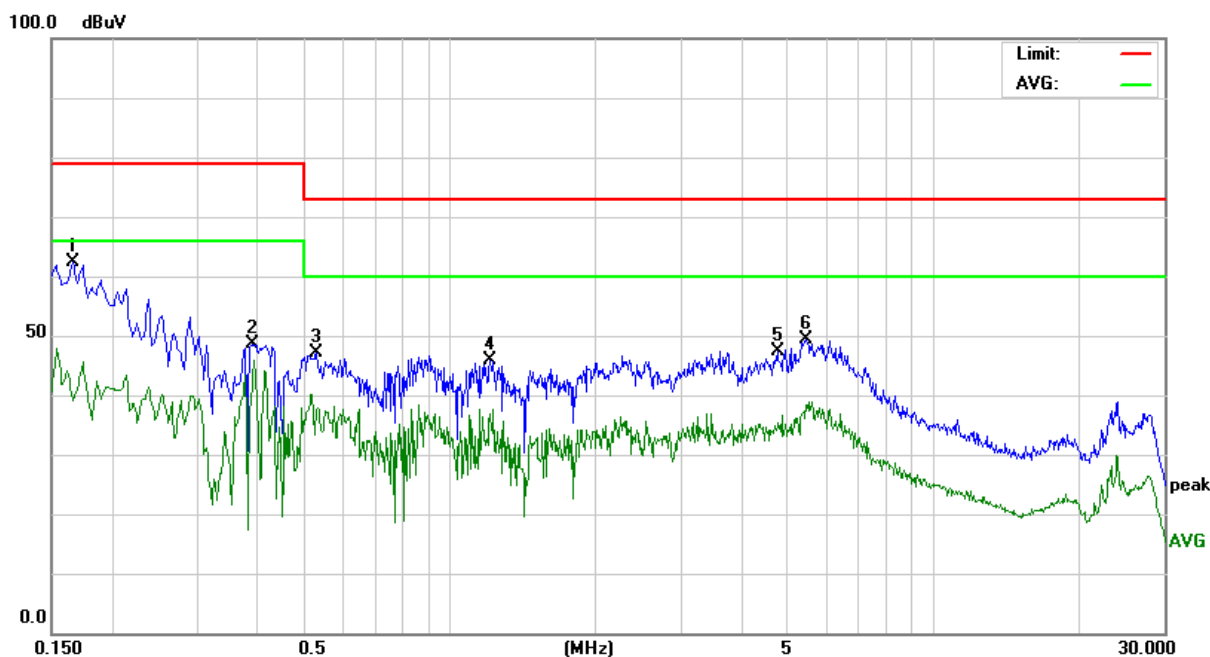
Freq. = Emission frequency in MHz
 Reading = Uncorrected Analyzer/Receiver reading
 Factor = Insertion loss of LISN + Cable Loss + Pulse Limit
 Result = Reading + Factor
 Limit = Limit stated in standard
 Margin = Reading in reference to limit
 P = Peak Reading
 Q = Quasi-peak Reading
 A = Average Reading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

Calculation Formula

Margin (dB) = Result (dBuV) – Limit (dBuV)

7.1.6. TEST RESULTS

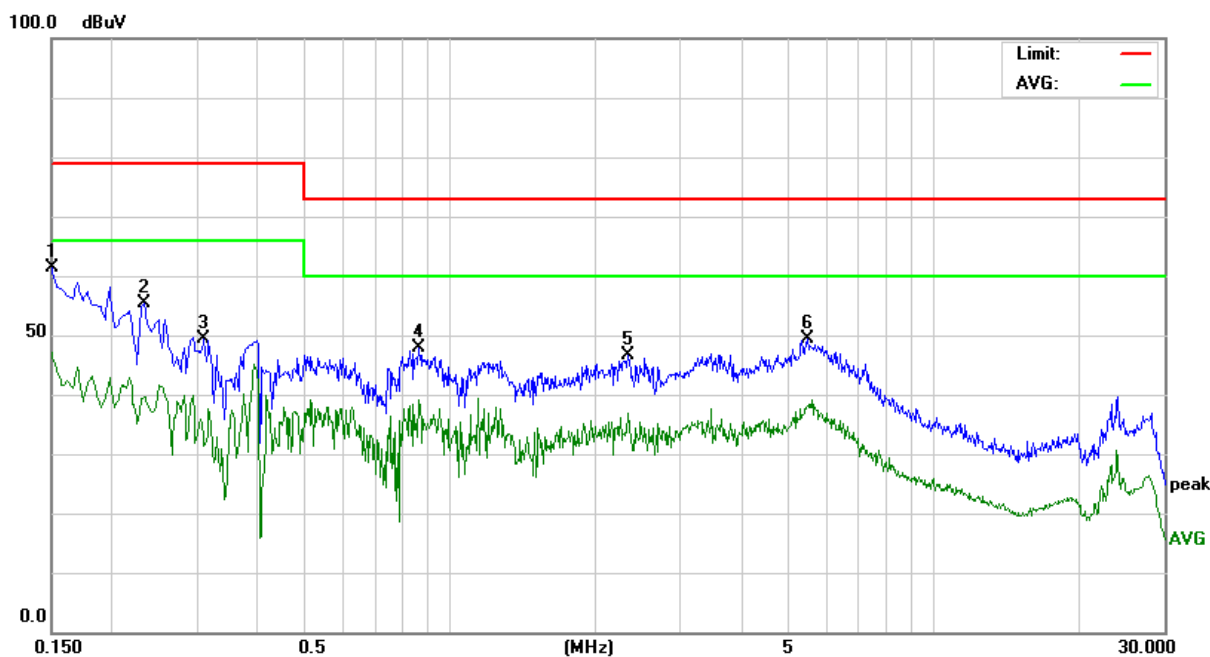
| | | | |
|--------------------------|--------------------|---------------|--------|
| Model No. | UPC-CHT01-A20-0464 | 6dB Bandwidth | 9 kHz |
| Environmental Conditions | 25°C, 58% RH | Test Mode | Mode 2 |
| Tested by | Rax Chen | Phase | L1 |
| Standard | EN 55032 CLASS A | | |



| Conducted Emission Readings | | | | | | | |
|------------------------------|----------------|-------------|---------------|-------------------|-------------|------------------|--------------|
| Frequency Range Investigated | | | | 150 kHz to 30 MHz | | | |
| Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector (P/Q/A) | Line (L1/L2) |
| 0.1660 | 52.35 | 10.02 | 62.37 | 79.00 | -16.63 | P | L1 |
| 0.3899 | 38.50 | 10.04 | 48.54 | 79.00 | -30.46 | P | L1 |
| 0.5299 | 37.00 | 10.04 | 47.04 | 73.00 | -25.96 | P | L1 |
| 1.2140 | 35.71 | 10.14 | 45.85 | 73.00 | -27.15 | P | L1 |
| 4.7659 | 36.96 | 10.38 | 47.34 | 73.00 | -25.66 | P | L1 |
| 5.4499 | 38.89 | 10.39 | 49.28 | 73.00 | -23.72 | P | L1 |

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

| | | | |
|---------------------------------|--------------------|----------------------|--------|
| Model No. | UPC-CHT01-A20-0464 | 6dB Bandwidth | 9 kHz |
| Environmental Conditions | 25°C, 58% RH | Test Mode | Mode 2 |
| Tested by | Rax Chen | Phase | L2 |
| Standard | EN 55032 CLASS A | | |



| Conducted Emission Readings | | | | | | | |
|------------------------------|----------------|-------------|---------------|-------------------|-------------|------------------|--------------|
| Frequency Range Investigated | | | | 150 kHz to 30 MHz | | | |
| Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector (P/Q/A) | Line (L1/L2) |
| 0.1499 | 51.47 | 10.02 | 61.49 | 79.00 | -17.51 | P | L2 |
| 0.2340 | 45.38 | 10.03 | 55.41 | 79.00 | -23.59 | P | L2 |
| 0.3100 | 39.37 | 10.03 | 49.40 | 79.00 | -29.60 | P | L2 |
| 0.8620 | 37.76 | 10.11 | 47.87 | 73.00 | -25.13 | P | L2 |
| 2.3420 | 36.29 | 10.24 | 46.53 | 73.00 | -26.47 | P | L2 |
| 5.4779 | 38.97 | 10.39 | 49.36 | 73.00 | -23.64 | P | L2 |

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

7.2. REQUIREMENTS FOR ASYMMETRIC MODE CONDUCTED EMISSIONS

7.2.1. LIMITS

For Class A Equipment

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

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

For Class B Equipment

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

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

7.2.2. TEST INSTRUMENTS

| Conducted Emission room # A | | | | |
|-----------------------------|--------------|-----------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| BNC Cable | EMEC | EMG178 | BNC#A9 | 03/27/2018 |
| EMI Test Receiver | R&S | ESCI | 101201 | 08/22/2018 |
| ISN | Teseq | ISN T800 | 29449 | 08/15/2018 |
| LISN | Schwarzbeck | NNLK 8129 | 8129-286 | 08/15/2018 |
| LISN(EUT) | Schwarzbeck | NSLK 8127 | 8127527 | 08/15/2018 |
| Pulse Limiter | R&S | ESH3Z2 | C3010026-2 | 08/17/2018 |
| Thermo-Hygro Meter | Wisewind | 201A | No. 02 | 05/08/2018 |
| Test S/W | EZ-EMC | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. N.C.R = No Calibration Request.

7.2.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-031)

- Selecting AAN for unscreened cable or a current probe for screened cable to take measurement.
- The port of the EUT was connected to the remote side support equipment through the AAN/Current Probe and communication in normal condition.
- Making a overall range scan by using the test receiver controlled by controller and record at least six highest emissions for showing in the test report.
- Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.
- In case of measuring on the screened cable, the current limit shall be applied; otherwise the voltage limit should be applied.
- The following test modes was scanned during the preliminary test:

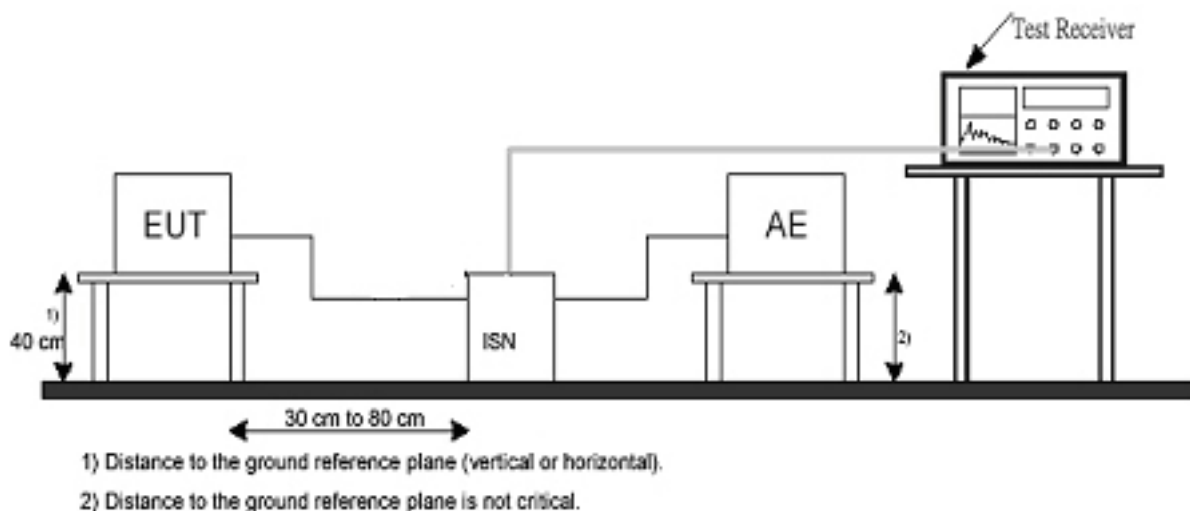
Modes:

| | |
|---|---------|
| 1 | 10Mbps |
| 2 | 100Mbps |
| 3 | 1Gbps |

- After the preliminary scan, we found the following test mode(s) producing the highest emission level and test data of the worst case was recorded.

Mode: 2

7.2.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

7.2.5. DATA SAMPLE

| Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector (P/Q/A) |
|----------------|-------------------|----------------|------------------|-----------------|----------------|---------------------|
| x.xx | 62.95 | 0.55 | 63.50 | 87 | -23.50 | Q |

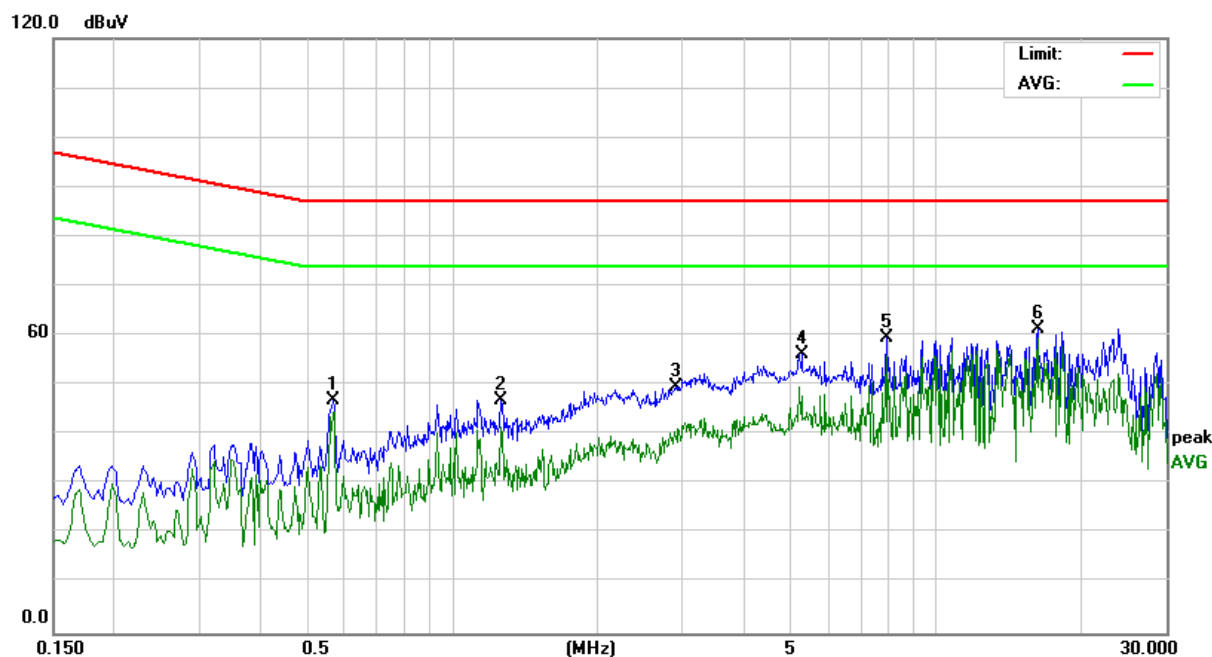
Freq. = Emission frequency in MHz
 Reading = Uncorrected Analyzer/Receiver reading
 Factor = Insertion loss of LISN + Cable Loss + Pulse Limit
 Result = Reading + Factor
 Limit = Limit stated in standard
 Margin = Reading in reference to limit
 P = Peak Reading
 Q = Quasi-peak Reading
 A = Average Reading

Calculation Formula

Margin (dB) = Result (dBuV) – Limit (dBuV)

7.2.6. TEST RESULTS

| | | | |
|---------------------------------|--------------------|----------------------|------------------|
| Model No. | UPC-CHT01-A20-0464 | 6dB Bandwidth | 9 kHz |
| Environmental Conditions | 25°C, 58% RH | Test Mode | Mode 2 |
| Tested by | Rax Chen | Standard | EN 55032 CLASS A |



| Conducted Emission Readings | | | | | | |
|------------------------------|----------------|-------------|---------------|-------------------|-------------|------------------|
| Frequency Range Investigated | | | | 150 kHz to 30 MHz | | |
| Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector (P/Q/A) |
| 0.5700 | 27.15 | 19.66 | 46.81 | 87.00 | -40.19 | P |
| 1.2660 | 27.33 | 19.62 | 46.95 | 87.00 | -40.05 | P |
| 2.9060 | 29.93 | 19.64 | 49.57 | 87.00 | -37.43 | P |
| 5.2980 | 36.56 | 19.67 | 56.23 | 87.00 | -30.77 | P |
| 7.9220 | 39.91 | 19.70 | 59.61 | 87.00 | -27.39 | P |
| 16.2260 | 41.53 | 19.88 | 61.41 | 87.00 | -25.59 | P |

7.3. RADIATED EMISSION MEASUREMENT

7.3.1. LIMITS

Below 1GHz

| FREQUENCY (MHz) | dBuV/m (At 10m) | | dBuV/m (At 3m) | |
|-----------------|-----------------|---------|----------------|---------|
| | Class A | Class B | Class A | Class B |
| 30 ~ 230 | 40 | 30 | 50 | 40 |
| 230 ~ 1000 | 47 | 37 | 57 | 47 |

Above 1GHz

| Frequency (MHz) | Class A (dBuV/m) (At 3m) | | Class B (dBuV/m) (At 3m) | |
|-----------------|--------------------------|------|--------------------------|------|
| | Average | Peak | Average | Peak |
| 1000 ~ 3000 | 56 | 76 | 50 | 70 |
| 3000 ~ 6000 | 60 | 80 | 54 | 74 |

NOTE: The lower limit shall apply at the transition frequencies.

According to EN 55032: 2015 / AC: 2016 Table 1 the measurement frequency range shown in the following table:

Table 1 – Required highest frequency for radiated measurement

| Highest internal frequency (F_x) | Highest internal frequency |
|--|--|
| $F_x \leq 108 \text{ MHz}$ $108 \text{ MHz} < F_x \leq 500 \text{ MHz}$ $500 \text{ MHz} < F_x \leq 1 \text{ GHz}$ $F_x > 1 \text{ GHz}$ | 1 GHz 2 GHz 5 GHz $5 \times F_x$ up to a maximum of 6 GHz |
| NOTE 1 For FM and TV broadcast receivers, F_x is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies. | |
| NOTE 2 F_x is defined in 3.1.19. | |

Where F_x is unknown, the radiated emission measurements shall be performed up to 6 GHz.

Radiated emissions from FM receivers

| Frequency range MHz | Measurement | | Class B limit dB(μV/m) | |
|------------------------|---------------|------------------------------|-------------------------------|-------------------------------|
| | Distance m | Detector type / bandwidth | Fundamental | Harmonics |
| | | | OATS / SAC (see Table A.1) | OATS / SAC (see Table A.1) |
| 30 – 230 | 10 | Quasi peak/ 120kHz | 50 | 42 |
| 230 – 300 | | | | 42 |
| 300 – 1000 | | | | 46 |
| 30 – 230 | 3 | | 60 | 52 |
| 230 – 300 | | | | 52 |
| 300 – 1000 | | | | 56 |

These relaxed limits apply only to emissions at the fundamental and harmonic frequencies of the local oscillator. Signals at all other frequencies shall be compliant with the limits given in 7.3.1 Class B Limit

7.3.2. TEST INSTRUMENTS

| Open Area Test Site # J | | | | |
|-----------------------------------|--------------|------------------------------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Bilog Antenna | Sunol | JB1 | A100209-2 | 05/09/2018 |
| Cable | EMEC | CFD400NL-LW | N-Type#J9&JA | 04/06/2018 |
| EMI Test Receiver | R&S | ESCI | 101054 | 04/11/2018 |
| Pre-Amplifier | Schaffner | CPA9231A | 3626 | 09/28/2018 |
| Thermo-Hygro Meter | Wisewind | 201A | No. 04 | 05/23/2018 |
| Test S/W | EZ-EMC | | | |
| Above 1GHz Used | | | | |
| Horn Antenna | ETS | 3117 | 139062 | 09/24/2018 |
| K-Type Cable x 1m (1-40GHz) | Rosnol | K1K50-UP0264- K1k50-1M | 160215-1 | 12/11/2017 |
| Microflex Cable x 7m (1-18GHz) | Rosnol | A1K50-EW0630- A1k50-700CM | SD-R028 | 12/12/2017 |
| Pre-Amplifier | HP | 8449B | 3008A01266 | 12/08/2017 |
| Signal Analyzer | Agilent | N9010A | MY53440125 | 01/12/2018 |
| Spectrum Analyzer | Agilent | E4440A | MY46185957 | 01/10/2018 |
| Thermo-Hygro Meter | Wisewind | N/A | SD-R027 | 10/01/2018 |
| Test S/W | EZ-EMC | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. N.C.R = No Calibration Request.

7.3.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-031 & PA-041)**Procedure of Preliminary Test**

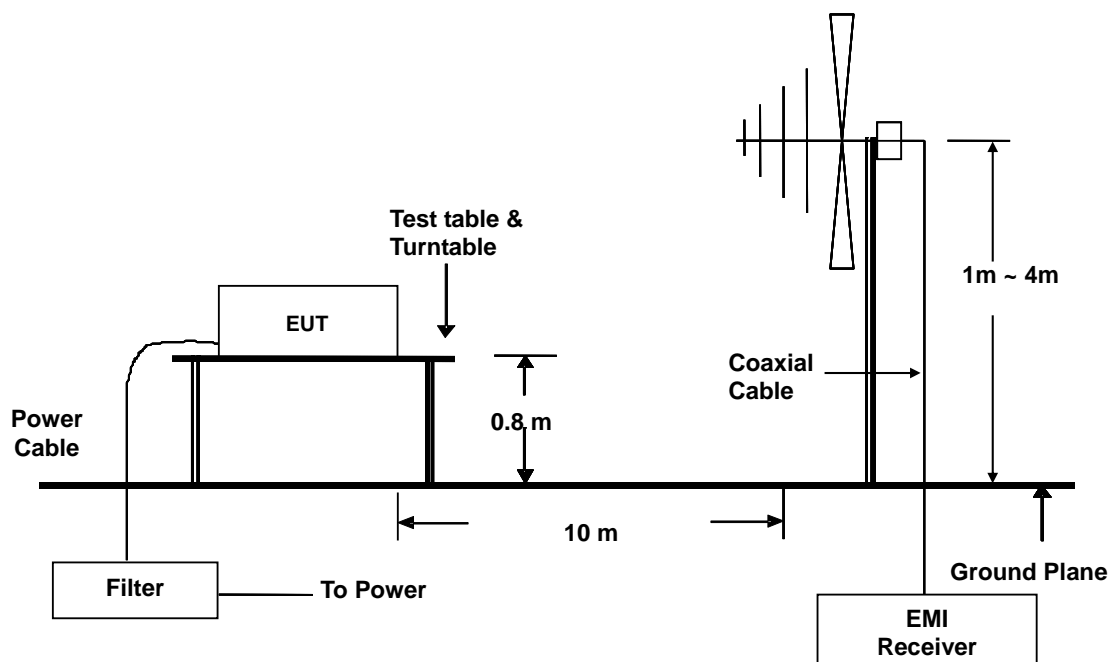
- The equipment was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden turntable with a height of 0.8 meters is used which is placed on the ground plane. When the EUT is a floor standing equipment, it is placed on the ground plane which has a 15 cm non-conductive covering to insulate the EUT from the ground plane.
- Support equipment, if needed, was placed as per EN 55032.
- All I/O cables were positioned to simulate typical usage as per EN 55032.
- The EUT received AC power source from the outlet socket under the turntable. All support equipment power received from another socket under the turntable.
- The antenna was placed at 3 or 10 meter away from the EUT as stated in EN 55032. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.
- The Analyzer / Receiver quickly scanned from 30MHz to 6000MHz. The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- The test mode(s) described in Item 4.1 were scanned during the preliminary test:
- After the preliminary scan, we found the test mode described in Item 4.1 producing the highest emission level.
- The EUT and cable configuration, antenna position, polarization and turntable position of the above highest emission level were recorded for the final test.

Procedure of Final Test

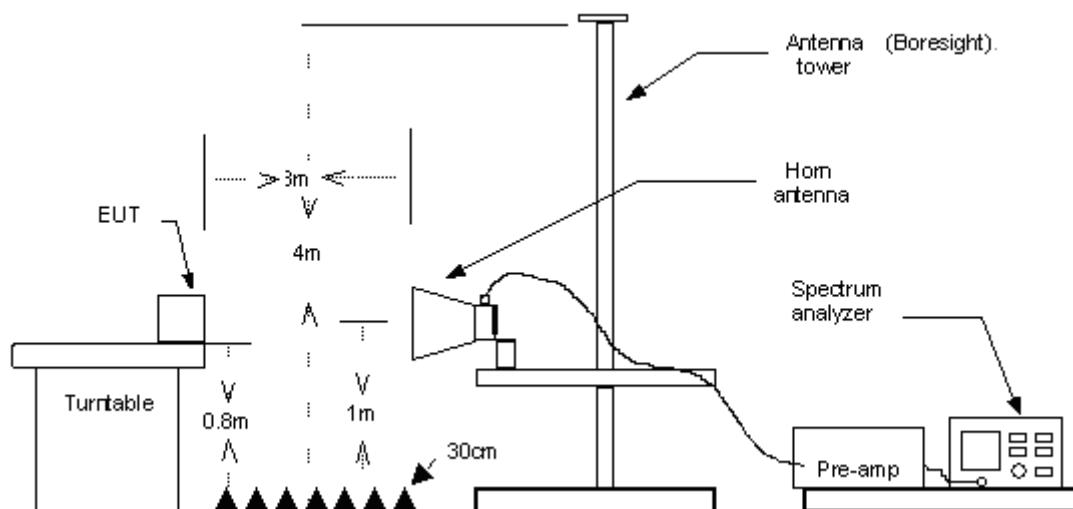
- EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.
- The Analyzer / Receiver scanned from 30MHz to 6000MHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- Recorded at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. Below 1GHz the Q.P. reading and above 1GHz the Peak and Average reading are presented.
- The test data of the worst-case condition(s) was recorded.

7.3.4. TEST SETUP

Below 1GHz



Above 1GHz



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

7.3.5. DATA SAMPLE**Below 1GHz**

| Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector (P/Q) | Pol. (H/V) |
|----------------|-------------------|------------------|--------------------|-------------------|----------------|-------------------|---------------|
| x.xx | 14.0 | 12.2 | 26.2 | 40 | -13.8 | Q | H |

Above 1GHz

| Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector (P/A) | Pol. (H/V) |
|----------------|-------------------|------------------|--------------------|-------------------|----------------|-------------------|---------------|
| x.xx | 42.95 | 0.55 | 43.50 | 60 | -16.50 | A | H |

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

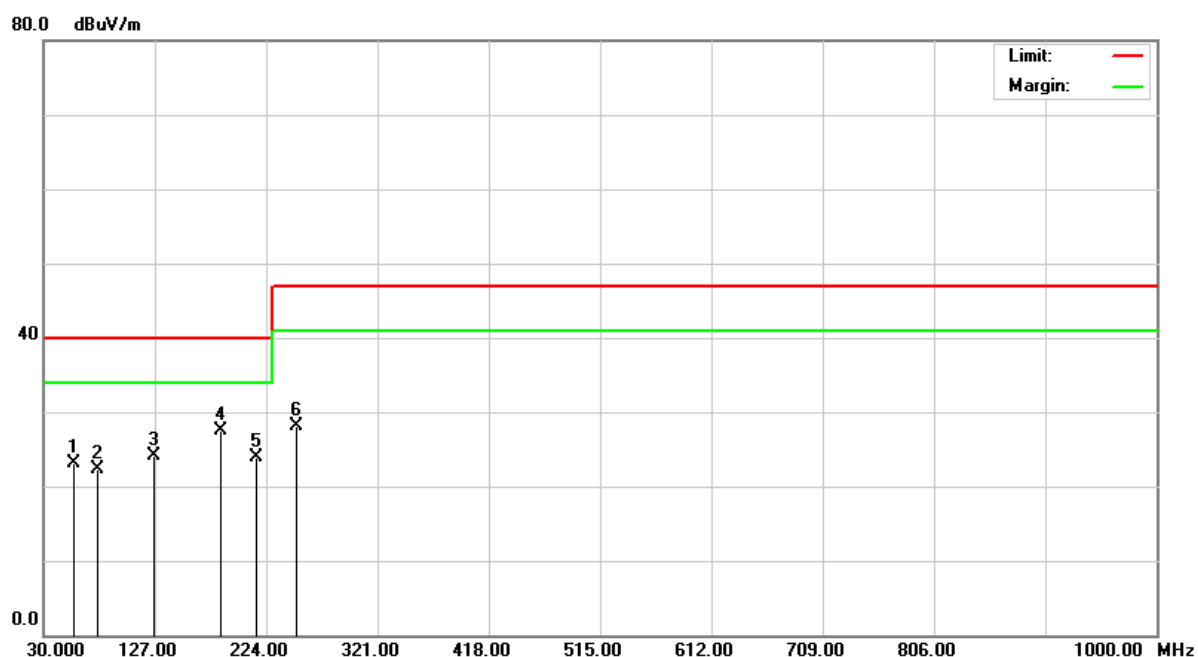
Calculation Formula

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

7.3.6. TEST RESULTS

Below 1GHz

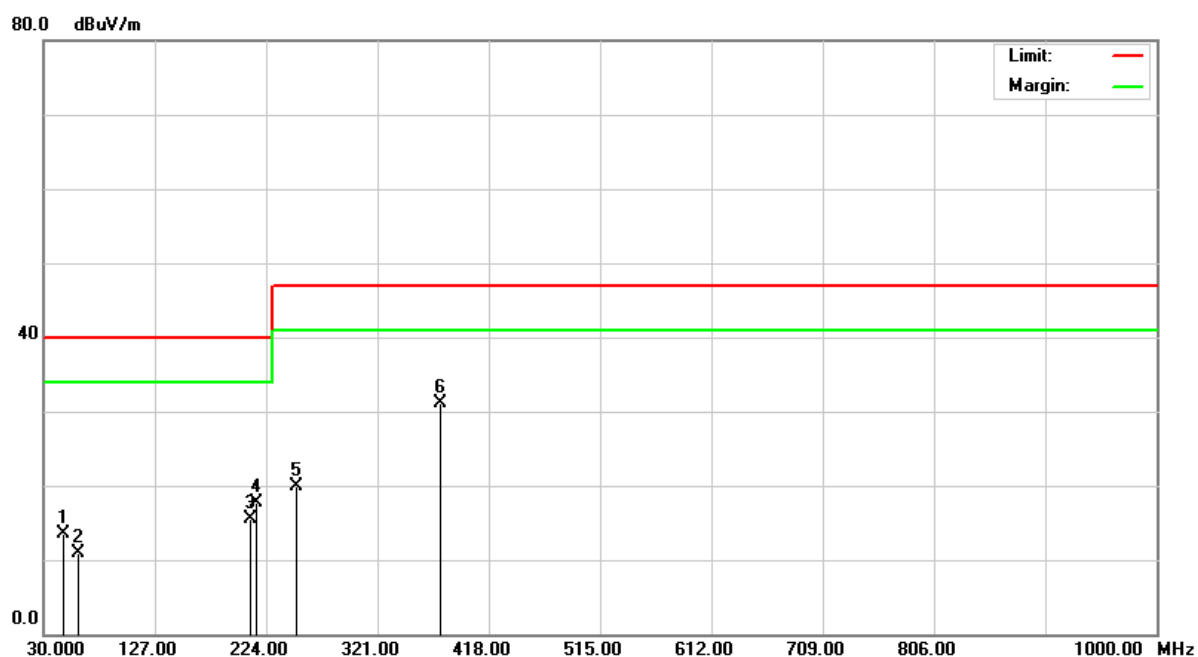
| | | | |
|--------------------------|--------------------|------------------|----------|
| Model No. | UPC-CHT01-A20-0464 | Test Mode | Mode 2 |
| Environmental Conditions | 25°C, 66% RH | 6dB Bandwidth | 120 kHz |
| Antenna Pole | Vertical | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested by | Rax Chen |
| Standard | EN 55032 CLASS A | | |



| Radiated Emission Readings | | | | | | | | | |
|------------------------------|----------------|---------------|-----------------|----------------|---------------------------|-------------|------------|----------------|------------|
| Frequency Range Investigated | | | | | 30 MHz to 1000 MHz at 10m | | | | |
| Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (°) | Detector (P/Q) | Pol. (H/V) |
| 56.2620 | 38.70 | -15.67 | 23.03 | 40.00 | -16.97 | 100 | 203 | Q | V |
| 77.1839 | 37.60 | -15.33 | 22.27 | 40.00 | -17.73 | 100 | 185 | Q | V |
| 125.7260 | 33.00 | -8.90 | 24.10 | 40.00 | -15.90 | 100 | 270 | Q | V |
| 183.9800 | 38.60 | -11.02 | 27.58 | 40.00 | -12.42 | 100 | 237 | Q | V |
| 215.4780 | 35.60 | -11.66 | 23.94 | 40.00 | -16.06 | 100 | 328 | Q | V |
| 250.6920 | 38.70 | -10.61 | 28.09 | 47.00 | -18.91 | 100 | 119 | Q | V |

Note: P= Peak Reading; Q= Quasi-peak Reading.

| | | | |
|---------------------------------|--------------------|-------------------------|----------|
| Model No. | UPC-CHT01-A20-0464 | Test Mode | Mode 2 |
| Environmental Conditions | 25°C, 66% RH | 6dB Bandwidth | 120 kHz |
| Antenna Pole | Horizontal | Antenna Distance | 10m |
| Detector Function | Quasi-peak. | Tested by | Rax Chen |
| Standard | EN 55032 CLASS A | | |



| Radiated Emission Readings | | | | | | | | | |
|------------------------------|----------------|---------------|-----------------|----------------|---------------------------|-------------|------------|----------------|------------|
| Frequency Range Investigated | | | | | 30 MHz to 1000 MHz at 10m | | | | |
| Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (°) | Detector (P/Q) | Pol. (H/V) |
| 48.0170 | 28.10 | -14.67 | 13.43 | 40.00 | -26.57 | 400 | 219 | Q | H |
| 60.3480 | 26.60 | -15.67 | 10.93 | 40.00 | -29.07 | 400 | 264 | Q | H |
| 210.6260 | 27.20 | -11.72 | 15.48 | 40.00 | -24.52 | 400 | 158 | Q | H |
| 215.1800 | 29.40 | -11.66 | 17.74 | 40.00 | -22.26 | 400 | 171 | Q | H |
| 250.4660 | 30.60 | -10.63 | 19.97 | 47.00 | -27.03 | 400 | 322 | Q | H |
| 375.7200 | 37.70 | -6.56 | 31.14 | 47.00 | -15.86 | 400 | 301 | Q | H |

Note: P= Peak Reading; Q= Quasi-peak Reading.

Above 1GHz

| | | | |
|-------------------------------------|-----------------------|------------------|----------|
| Model No. | UPC-CHT01-A20-0464 | Test Mode | Mode 2 |
| Environmental Conditions | 26°C, 60% RH | 6dB Bandwidth | 1 MHz |
| Antenna Pole | Vertical / Horizontal | Antenna Distance | 3m |
| Highest frequency generated or used | 1920MHz | Upper frequency | 6000MHz |
| Detector Function | Peak and average. | Tested by | Rax Chen |
| Standard | EN 55032 CLASS A | | |

| Radiated Emission Readings | | | | | | | |
|------------------------------|----------------|---------------|-----------------|------------------|-------------|----------------|------------|
| Frequency Range Investigated | | | | Above 1GHz at 3m | | | |
| Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector (P/A) | Pol. (H/V) |
| 1100.000 | 57.99 | -8.31 | 49.68 | 76.00 | -26.32 | P | V |
| 1158.333 | 54.95 | -8.11 | 46.84 | 76.00 | -29.16 | P | V |
| 1425.000 | 52.64 | -7.17 | 45.47 | 76.00 | -30.53 | P | V |
| 1533.333 | 50.55 | -6.64 | 43.91 | 76.00 | -32.09 | P | V |
| 1808.333 | 48.97 | -4.50 | 44.47 | 76.00 | -31.53 | P | V |
| 1908.333 | 48.25 | -3.71 | 44.54 | 76.00 | -31.46 | P | V |

| Radiated Emission Readings | | | | | | | |
|------------------------------|----------------|---------------|-----------------|------------------|-------------|----------------|------------|
| Frequency Range Investigated | | | | Above 1GHz at 3m | | | |
| Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector (P/A) | Pol. (H/V) |
| 1175.000 | 56.25 | -8.06 | 48.19 | 76.00 | -27.81 | P | H |
| 1375.000 | 54.92 | -7.35 | 47.57 | 76.00 | -28.43 | P | H |
| 2241.667 | 48.07 | -2.58 | 45.49 | 76.00 | -30.51 | P | H |
| 2466.667 | 47.63 | -2.22 | 45.41 | 76.00 | -30.59 | P | H |
| 3108.333 | 47.55 | -1.61 | 45.94 | 80.00 | -34.06 | P | H |
| 3850.000 | 45.49 | -0.47 | 45.02 | 80.00 | -34.98 | P | H |

Note: P= Peak Reading; A= Average Reading.

Radiated emissions from FM receivers

| | | | |
|---------------------------------|-----|-------------------------|-----|
| Model No. | N/A | Test Mode | N/A |
| Environmental Conditions | N/A | 6dB Bandwidth | N/A |
| Antenna Pole | N/A | Antenna Distance | N/A |
| Detector Function | N/A | Tested by | N/A |

Note: No applicable, the EUT doesn't have FM port.

7.4. CONDUCTED DIFFERENTIAL VOLTAGE EMISSIONS FROM CLASS B EQUIPMENT

Applicable to

1. TV broadcast receiver tuner ports with an accessible connector

2. RF modulator output ports

3. FM broadcast receiver tuner ports with an accessible connector

| Frequency range MHz | Class B limits DB(μV) 75 Ω | | | Applicability |
|------------------------|-------------------------------|------------------------------------|----------------------------------|---------------|
| | other | Local Oscillator Fundamental | Local Oscillator Harmonics | |
| 30 – 950 | 46 | 46 | 46 | See a) |
| 950 – 2 150 | 46 | 54 | 54 | |
| 950 – 2 150 | 46 | 54 | 54 | See b) |
| 30 – 300 | 46 | 54 | 50 | See c) |
| 300 – 1 000 | | | 52 | |
| 30 – 300 | 46 | 66 | 59 | See d) |
| 300 – 1 000 | | | 52 | |
| 30 – 950 | 46 | 76 | 46 | See e) |
| 950 – 2 150 | | n/a | 54 | |

a) Television receivers (analogue or digital), video recorders and PC TV broadcast receiver tuner cards working in channels between 30 MHz and 1 GHz, and digital audio receivers.

b) Tuner units (not the LNB) for satellite signal reception.

c) Frequency modulation audio receivers and PC tuner cards.

d) Frequency modulation car radios.

e) Applicable to EUTs with RF modulator output ports (for example DVD equipment, video recorders, camcorders and decoders etc.) designed to connect to TV broadcast receiver tuner ports.

Testing is required at only one EUT supply voltage and frequency.

The term ‘other’ refers to all emissions other than the fundamental and the harmonics of the local oscillator.

The test shall be performed with the device operating at each reception channel.

The test shall cover the entire frequency range.

7.4.1. TEST PROCEDURES (please refer to measurement standard or CCS SOP PA-041)**Procedure of Preliminary Test**

- The equipment was set up as per the test configuration to simulate typical usage per the user's manual. The EUT was placed on a wooden table with a height of 0.8 meters was used that was placed on the ground plane.
- Support equipment, if needed, was placed as per EN 55032.
- All I/O cables were positioned to simulate typical usage as per EN 55032.
- The EUT received AC power source, from the outlet socket. All support equipment received power was from another socket.
- Added a $75 \longleftrightarrow 50 \Omega$ matching network, between EUT and EMI test receiver to get impedance match condition during the test.
- The output level of the auxiliary signal generator shall be set to give the value of 60 dB (μ V) for FM receiver or 70 dB (μ V) for TV and VCR to the input of the frequency-modulation or television receiver (or video recorder) respectively, on a 75Ω impedance. An additional amplifier should be inserted at the generator output, if necessary.
- The output level of the auxiliary signal generator shall be a standard TV color bar Move signal for TV receivers and video recorders with sound carrier that defined in Table A12 of EN 55032. An additional amplifier should be inserted at the generator output, if necessary.
- The results shall be expressed in the terms of the substitution voltage in decibels (μ V), as supplied by the standard signal generator. The specified source impedance of the receiver shall be stated with the results.
- When measurements are made at the antenna terminals of the EUT, an auxiliary signal generator shall be used to feed the equipment under test input with a standard test signal (see Table A.12 of CISPR 32/ EN 55032) at the receiver tuning frequency (30MHz to 2150MHz).
- The test mode(s) described in Item 4.1 were scanned during the preliminary test:
- After the preliminary scan, we found the test mode described in Item 4.1 producing the highest emission level.
- The EUT and cable configuration of the above highest emission levels were recorded for the final test.

Procedure of Final Test

- EUT and support equipment were set up on the table as per the configuration with highest emission level in the preliminary test.
- The Analyzer / Receiver scanned from 30MHz to 2150MHz. recorded the value, the local frequency, amplitude, were recorded in which correction factors were used to calculate the emission level and compare reading to the applicable limit, and only Q.P reading will record in this report.
- Recorded at least the six highest emissions. Emission frequencies, amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.
- The test data of the worst-case condition(s) was recorded.

7.4.2. DATA SAMPLE

| Freq. (MHz) | Matching Factor (dB) | Spectrum Reading (dBuV) | SG Level (dBuV) | Emission (dBuV) | Limit Line (dBuV) | Over Limit (dB) | Note (F/H/O) |
|-------------|----------------------|-------------------------|-----------------|-----------------|-------------------|-----------------|--------------|
| x.xx | 12.2 | 14.0 | 38.4 | 26.2 | 46 | -19.8 | F |

Freq. = Emission frequency in MHz
 Matching Factor = Matching network(50/75 Ω) attenuation
 Spectrum Reading=Spectrum analyzer reading
 S.G. Level = Standard S.G. output level
 Emission = SG Level - Matching Factor
 Limit Line = Limit stated in standard
 Over Limit = Reading in reference to limit
 F = Fundamental
 H = Harmonics
 O = Other

Calculation Formula

Over Limit (dB) = Emission (dB μ V) – Limit Line (dB μ V)

7.4.3. TEST RESULTS

| | | | |
|---------------------------------|-----|----------------------|-----|
| Model No. | N/A | 6dB Bandwidth | N/A |
| Environmental Conditions | N/A | Test Mode | N/A |
| Tested by | N/A | | |

Note: No applicable, the EUT doesn't have tuner port.

7.5. HARMONICS CURRENT MEASUREMENT

7.5.1. LIMITS OF HARMONICS CURRENT MEASUREMENT

| Limits for Class A equipment | | Limits for Class D equipment | | |
|------------------------------|--------------------------------------|------------------------------|--|--------------------------------------|
| Harmonics Order n | Max. permissible harmonics current A | Harmonics Order n | Max. permissible harmonics current per watt mA/W | Max. permissible harmonics current A |
| Odd harmonics | | Odd Harmonics only | | |
| 3 | 2.30 | 3 | 3.4 | 2.30 |
| 5 | 1.14 | 5 | 1.9 | 1.14 |
| 7 | 0.77 | 7 | 1.0 | 0.77 |
| 9 | 0.40 | 9 | 0.5 | 0.40 |
| 11 | 0.33 | 11 | 0.35 | 0.33 |
| 13 | 0.21 | 13 | 0.30 | 0.21 |
| 15<=n<=39 | 0.15x15/n | 15<=n<=39 | 3.85/n | 0.15x15/n |
| Even harmonics | | | | |
| 2 | 1.08 | | | |
| 4 | 0.43 | | | |
| 6 | 0.30 | | | |
| 8<=n<=40 | 0.23x8/n | | | |

NOTE: 1. Class A and Class D are classified according to item 7.4.3.

2. According to section 7 of EN 61000-3-2, the above limits for all equipment except for lighting equipment having an active input power > 75 W and no limits apply for equipment with an active input power up to and including 75 W.

7.5.2. TEST INSTRUMENTS

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|------------------------|--------------|----------------|---------------|-----------------|
| 5kVA Power Source | Teseq | 5001IX-208-TSQ | 1537A01296 | 11/02/2018 |
| H/F Measurement System | EMC Partner | HAR1000-1P | 189 | 11/02/2018 |
| Software | HARCS V4.19 | | | |

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

7.5.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-029)

- The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.
- The classification of EUT is according to section 5 of EN 61000-3-2.
- The EUT is classified as follows:

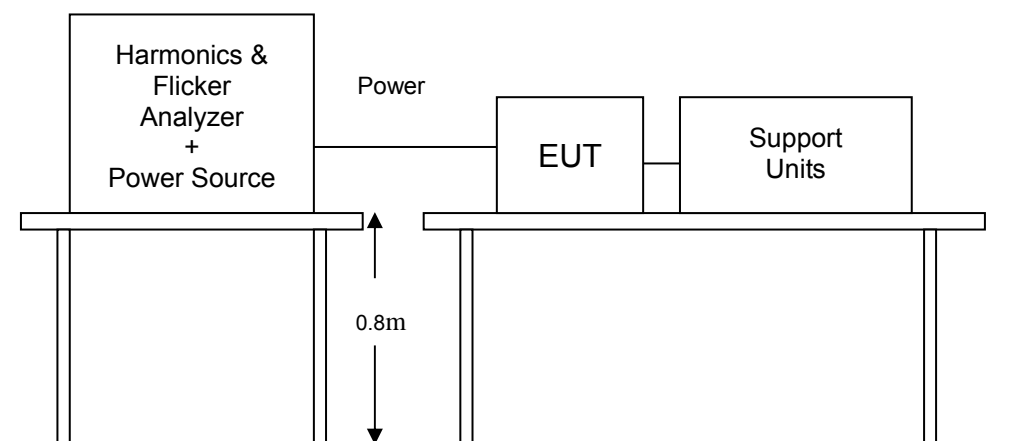
Class A: Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.

Class B: Portable tools; Arc welding equipment which is not professional equipment.

Class C: Lighting equipment.

Class D: Equipment having a specified power less than or equal to 600 W of the following types: Personal computers and personal computer monitors; television receivers and refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

- The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.

7.5.4. TEST SETUP

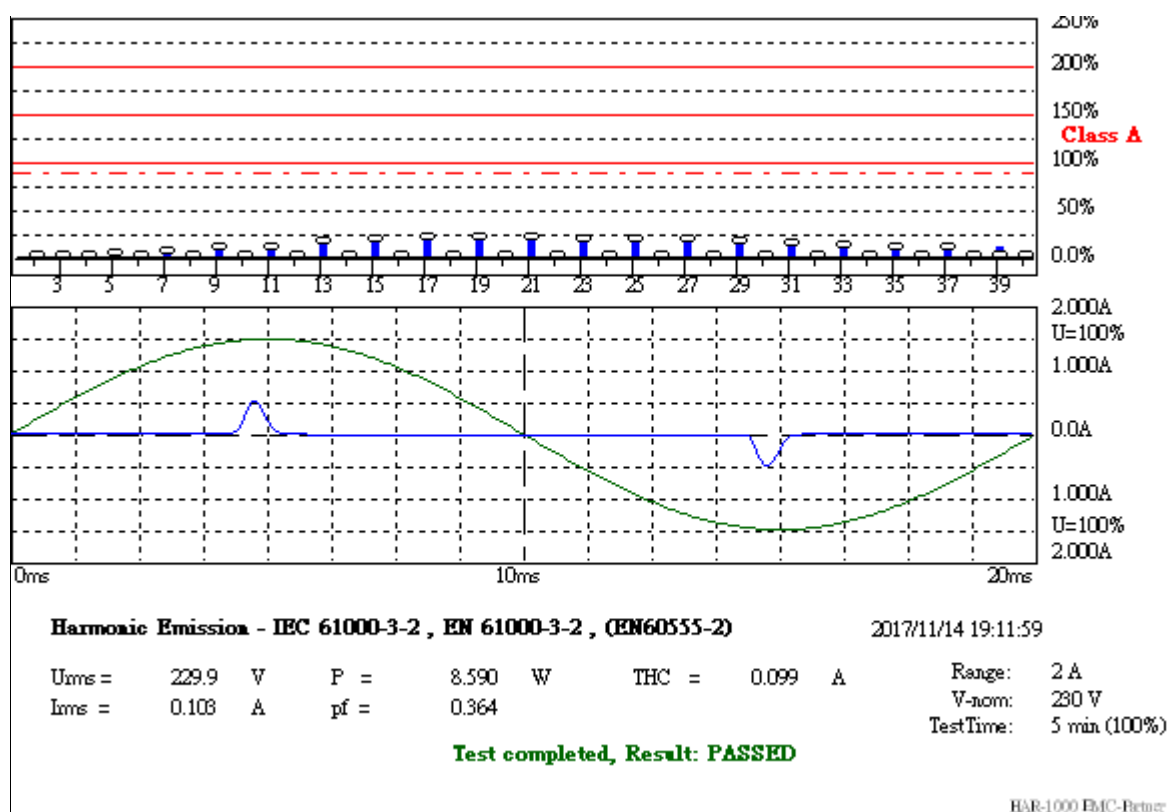
- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

7.5.5. TEST RESULTS

| | | | |
|--------------------------|------------------------|--------------|--|
| Power Consumption | 8.590W | Test Results | PASS |
| Environmental Conditions | 20°C, 54% RH, 1011mbar | Limits | Class <input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| Test Mode | Operating | Tested by | Rax Chen |

NOTE: Limits classified according to item 7.5.1.

Test result of EN 61000-3-2



Urms = 229.9V Freq = 50.000 Range: 2 A
 Irms = 0.103A Ipk = 0.632A cf = 6.162
 P = 8.590W S = 23.57VA pf = 0.364
 THDi = 242 % THDu = 0.10 % Class A

Test - Time : 5min (100 %)

Test completed, Result: PASSED

| Order | Freq. [Hz] | Iavg [A] | Irms [A] | Irms% [%] | Irms%L [%] | Imax [A] | Imax% [%] | Imax%L [%] | Limit [A] | Status |
|-------|---------------|-------------|-------------|--------------|---------------|-------------|--------------|---------------|--------------|--------|
| 1 | 50 | 0.0426 | 0.0411 | 40.119 | | 0.0471 | 45.952 | | | |
| 2 | 100 | 0.0000 | 0.0013 | 1.3095 | 0.1243 | 0.0016 | 1.5476 | 0.1469 | 1.0800 | |
| 3 | 150 | 0.0363 | 0.0347 | 33.810 | 1.5073 | 0.0408 | 39.762 | 1.7727 | 2.3000 | |
| 4 | 200 | 0.0000 | 0.0013 | 1.3095 | 0.3123 | 0.0016 | 1.5476 | 0.3690 | 0.4300 | |
| 5 | 250 | 0.0357 | 0.0342 | 33.333 | 2.9982 | 0.0400 | 39.048 | 3.5122 | 1.1400 | |
| 6 | 300 | 0.0000 | 0.0015 | 1.4286 | 0.4883 | 0.0017 | 1.6667 | 0.5697 | 0.3000 | |
| 7 | 350 | 0.0348 | 0.0333 | 32.500 | 4.3279 | 0.0389 | 37.976 | 5.0572 | 0.7700 | |
| 8 | 400 | 0.0000 | 0.0015 | 1.4286 | 0.6369 | 0.0017 | 1.6667 | 0.7430 | 0.2300 | |
| 9 | 450 | 0.0335 | 0.0321 | 31.310 | 8.0261 | 0.0374 | 36.429 | 9.3384 | 0.4000 | |
| 10 | 500 | 0.0000 | 0.0016 | 1.5476 | 0.8625 | 0.0018 | 1.7857 | 0.9951 | 0.1840 | |
| 11 | 550 | 0.0319 | 0.0306 | 29.881 | 9.2847 | 0.0354 | 34.524 | 10.727 | 0.3300 | |
| 12 | 600 | 0.0000 | 0.0016 | 1.5476 | 1.0349 | 0.0018 | 1.7857 | 1.1942 | 0.1533 | |
| 13 | 650 | 0.0301 | 0.0291 | 28.333 | 13.835 | 0.0333 | 32.500 | 15.869 | 0.2100 | |
| 14 | 700 | 0.0000 | 0.0016 | 1.5476 | 1.2074 | 0.0018 | 1.7857 | 1.3932 | 0.1314 | |
| 15 | 750 | 0.0281 | 0.0271 | 26.429 | 18.066 | 0.0309 | 30.119 | 20.589 | 0.1500 | |
| 16 | 800 | 0.0000 | 0.0017 | 1.6667 | 1.4861 | 0.0018 | 1.7857 | 1.5922 | 0.1150 | |
| 17 | 850 | 0.0259 | 0.0250 | 24.405 | 18.907 | 0.0282 | 27.500 | 21.305 | 0.1324 | |
| 18 | 900 | 0.0000 | 0.0017 | 1.6667 | 1.6718 | 0.0018 | 1.7857 | 1.7912 | 0.1022 | |
| 19 | 950 | 0.0236 | 0.0229 | 22.381 | 19.379 | 0.0255 | 24.881 | 21.544 | 0.1184 | |
| 20 | 1000 | 0.0000 | 0.0017 | 1.6667 | 1.8576 | 0.0018 | 1.7857 | 1.9903 | 0.0920 | |
| 21 | 1050 | 0.0212 | 0.0208 | 20.238 | 19.368 | 0.0227 | 22.143 | 21.191 | 0.1071 | |
| 22 | 1100 | 0.0000 | 0.0016 | 1.5476 | 1.8974 | 0.0018 | 1.7857 | 2.1893 | 0.0836 | |
| 23 | 1150 | 0.0188 | 0.0184 | 17.976 | 18.842 | 0.0200 | 19.524 | 20.464 | 0.0978 | |
| 24 | 1200 | 0.0000 | 0.0016 | 1.5476 | 2.0699 | 0.0018 | 1.7857 | 2.3883 | 0.0767 | |
| 25 | 1250 | 0.0165 | 0.0162 | 15.833 | 18.039 | 0.0172 | 16.786 | 19.124 | 0.0900 | |
| 26 | 1300 | 0.0000 | 0.0015 | 1.4286 | 2.0699 | 0.0017 | 1.6667 | 2.4149 | 0.0708 | |
| 27 | 1350 | 0.0142 | 0.0142 | 13.810 | 16.992 | 0.0148 | 14.405 | 17.725 | 0.0833 | |
| 28 | 1400 | 0.0000 | 0.0015 | 1.4286 | 2.2291 | 0.0016 | 1.5476 | 2.4149 | 0.0657 | |
| 29 | 1450 | 0.0121 | 0.0121 | 11.786 | 15.576 | 0.0123 | 12.024 | 15.891 | 0.0776 | |
| 30 | 1500 | 0.0000 | 0.0013 | 1.3095 | 2.1893 | 0.0015 | 1.4286 | 2.3883 | 0.0613 | |
| 31 | 1550 | 0.0101 | 0.0103 | 10.000 | 14.128 | 0.0103 | 10.000 | 14.128 | 0.0726 | |
| 32 | 1600 | 0.0000 | 0.0012 | 1.1905 | 2.1230 | 0.0013 | 1.3095 | 2.3353 | 0.0575 | |
| 33 | 1650 | 0.0084 | 0.0085 | 8.3333 | 12.533 | 0.0085 | 8.3333 | 12.533 | 0.0682 | |
| 34 | 1700 | 0.0000 | 0.0011 | 1.0714 | 2.0301 | 0.0013 | 1.3095 | 2.4812 | 0.0541 | |
| 35 | 1750 | 0.0069 | 0.0071 | 6.9048 | 11.013 | 0.0071 | 6.9048 | 11.013 | 0.0643 | |
| 36 | 1800 | 0.0000 | 0.0010 | 0.9524 | 1.9107 | 0.0012 | 1.1905 | 2.3883 | 0.0511 | |
| 37 | 1850 | 0.0057 | 0.0057 | 5.5952 | 9.4347 | 0.0059 | 5.7143 | 9.6354 | 0.0608 | |
| 38 | 1900 | 0.0000 | 0.0009 | 0.8333 | 1.7647 | 0.0010 | 0.9524 | 2.0168 | 0.0484 | |
| 39 | 1950 | 0.0000 | 0.0048 | 4.6429 | 8.2520 | 0.0050 | 4.8810 | 8.6751 | 0.0577 | |
| 40 | 2000 | 0.0000 | 0.0009 | 0.8333 | 1.8576 | 0.0010 | 0.9524 | 2.1230 | 0.0460 | |

Definitions of Abbreviations

| | | |
|------|-----|---|
| Urms | *** | Actual total Voltage in Volt RMS |
| Irms | *** | Actual total Current in Ampere RMS |
| Ipk | *** | Actual Peak value of the Current in Ampere |
| cf | *** | Actual Crest Factor (Ipk/Irms) |
| P | *** | Actual Active Power in Watt |
| S | *** | Actual Apparent Power in VA (Urms*Irms) |
| pf | *** | Actual Power Factor (P/S) |
| THDi | *** | Actual Total Harmonic Current Distortion in % |
| THDu | *** | Actual Total Harmonic Voltage Distortion in % |
| THC | *** | Actual Total Harmonic Current in Ampere |
| PHC | *** | Actual Partial Harmonic Current in Ampere |

Individual measurements for 2nd to 40th order:

| | | |
|------------|-----|--|
| lavg | | Average value of the Individual Harmonic Current in Ampere RMS |
| Irms | *** | Actual Individual Harmonic Current in Ampere RMS |
| Irms% | *** | Actual Individual Harmonic Current in percentage of the actual total RMS Current |
| Irms%L | *** | Actual Individual Harmonic Current in percentage of the applicable Limit |
| Imax | | Maximum Individual Harmonic Current in Ampere RMS |
| Imax% | | Maximum Individual Harmonic Current in percentage of the actual total RMS Current |
| Imax%lim | | Maximum Individual Harmonic Current in percentage of the applicable Limit |
| Limit Irms | | Individual Limit (100%) for the selected Class in Ampere RMS |

7.6. VOLTAGE FLUCTUATION AND FLICKER MEASUREMENT

7.6.1. LIMITS OF VOLTAGE FLUCTUATION AND FLICKER MEASUREMENT

| TEST ITEM | LIMIT | REMARK |
|---------------|-------|--|
| P_{st} | 1.0 | P_{st} means short-term flicker indicator. |
| P_{lt} | 0.65 | P_{lt} means long-term flicker indicator. |
| T_{dt} (ms) | 500 | T_{dt} means maximum time that dt exceeds 3 %. |
| d_{max} (%) | 4% | d_{max} means maximum relative voltage change. |
| dc (%) | 3.3% | dc means relative steady-state voltage change |

7.6.2. TEST INSTRUMENTS

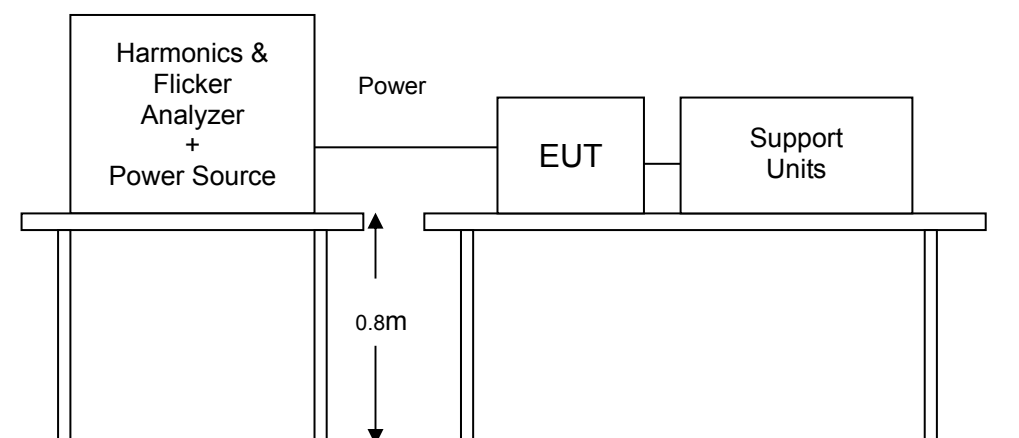
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|------------------------|--------------|----------------|---------------|-----------------|
| 5kVA Power Source | Teseq | 5001IX-208-TSQ | 1537A01296 | 11/02/2018 |
| H/F Measurement System | EMC Partner | HAR1000-1P | 189 | 11/02/2018 |
| Software | HARCS V4.19 | | | |

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

7.6.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-030)

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

7.6.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

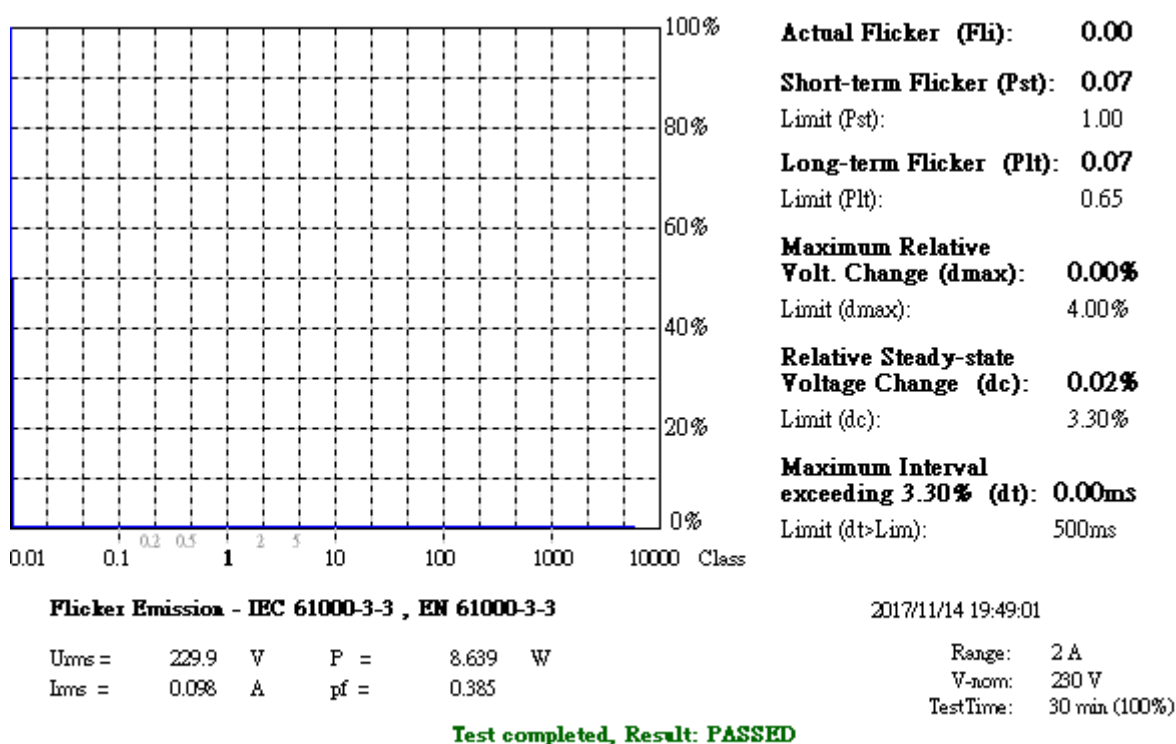
7.6.5. TEST RESULTS

| | | | |
|--------------------------|------------------------|-----------|-----------|
| Observation Period (Tp) | 30mins | Test Mode | Operating |
| Environmental Conditions | 20°C, 54% RH, 1011mbar | Tested by | Rax Chen |

| TEST PARAMETER | MEASUREMENT VALUE | LIMIT | REMARK |
|----------------------|-------------------|-------|--------|
| P _{st} | 0.07 | 1.0 | PASS |
| P _{lt} | 0.07 | 0.65 | PASS |
| T _{dt} (ms) | 0.00 | 500 | PASS |
| d _{max} (%) | 0.00 | 4% | PASS |
| dc (%) | 0.02 | 3.3% | PASS |

Note: None.

Test result of EN 61000-3-3



HAR-1000 EMC-Retire

8 IMMUNITY TEST

8.1. GENERAL DESCRIPTION

| Product Standard | EN 55024: 2010 + A1: 2015 | |
|--|---------------------------|--|
| | Test Type | Minimum Requirement |
| Basic Standard, Specification, and Performance Criterion required | IEC 61000-4-2 | Electrostatic Discharge – ESD: 8kV air discharge, 4kV Contact discharge, Performance Criterion B |
| | IEC 61000-4-3 | Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80 ~1000 MHz, 3V/m, 80% AM(1kHz), Performance Criterion A |
| | IEC 61000-4-4 | Electrical Fast Transient/Burst - EFT, AC Power Port: 1kV DC Power Port: 0.5kV Signal Ports and Telecommunication Ports: 0.5kV Performance Criterion B |
| | IEC 61000-4-5 | Surge Immunity Test: 1.2/50 μ s Open Circuit Voltage, 8/20 μ s Short Circuit Current, AC Power Port ~ line to line: 1kV, line to earth (ground): 2kV DC Power Port ~ line to earth: 0.5kV Signal Ports and Telecommunication Ports ~ line to ground: 1kV Performance Criterion B 10/700 μ s Open Circuit Voltage Performance Criterion C |
| | IEC 61000-4-6 | Conducted Radio Frequency Disturbances Test – CS: 0.15 ~ 80 MHz, 3Vrms, 80% AM, 1kHz, Performance Criterion A |
| | IEC 61000-4-8 | Power frequency magnetic field immunity test 50 or 60Hz, 1A/m Performance Criterion A |
| | IEC 61000-4-11 | Voltage Dips: i) >95% reduction for 0.5 period, Performance Criterion B ii) 30% reduction for 25 period, Performance Criterion C Voltage Interruptions: >95% reduction for 250 period Performance Criterion C |

8.2. GENERAL PERFORMANCE CRITERIA DESCRIPTION

| | |
|--------------------|---|
| Criteria A: | The apparatus shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the manufacturer does not specify the minimum performance level or the permissible performance loss, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended. |
| Criteria B: | <p>After test, the apparatus shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomenon below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance.</p> <p>During the test, degradation of performance is however allowed. However, no change of operating state if stored data is allowed to persist after the test. If the manufacturer does not specify the minimum performance level or the permissible performance loss, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.</p> |
| Criteria C: | <p>Temporary loss of function is allowed, provided the functions is self-recoverable or can be restored by the operation of controls by the user in accordance with the manufacturer instructions.</p> <p>Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</p> |

8.3. ELECTROSTATIC DISCHARGE (ESD)

8.3.1. TEST SPECIFICATION

| | |
|-----------------------------|---|
| Basic Standard: | IEC 61000-4-2 |
| Discharge Impedance: | 330 ohm / 150 pF |
| Discharge Voltage: | Air Discharge: 2 ; 4 ; 8 kV (Direct) Contact Discharge: 2 ; 4 kV (Direct/Indirect) |
| Polarity: | Positive & Negative |
| Number of Discharge: | Air Discharge: min. 10 times at each test point for each polarity Contact Discharge: min. 200 times in total |
| Discharge Mode: | Single Discharge 1 second minimum |

8.3.2. TEST INSTRUMENT

| IMMUNITY SHIELDED ROOM | | | | |
|------------------------|--------------|---------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Aneroid Barometer | SATO | 7610-20 | 89090 | 09/25/2018 |
| ESD Generator | Teseq | NSG 437 | 249 | 12/06/2017 |
| Thermo-Hygro Meter | Wisewind | N/A | SD-S017 | 10/01/2018 |

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

8.3.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-022)

The discharges shall be applied in two ways:

a) Contact discharges to the conductive surfaces and coupling planes:

The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the **Horizontal Coupling Plane (HCP)**. The remaining three test points shall each receive at least 50 direct contact discharges. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

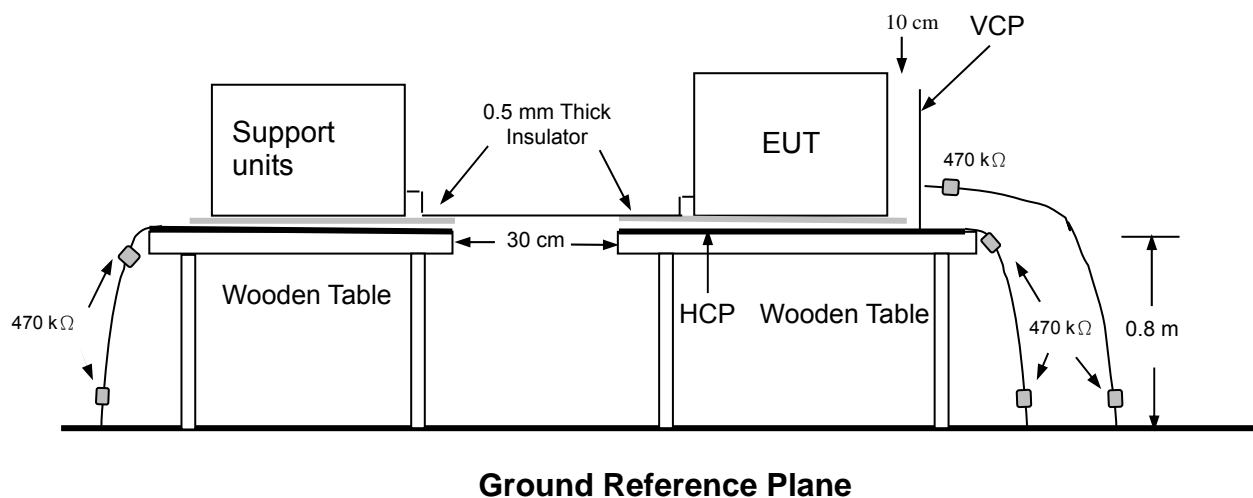
b) Air discharges at slots and apertures and insulating surfaces:

On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user. A minimum of 10 single air discharges shall be applied to the selected test point for each such area.

The basic test procedure was in accordance with IEC 61000-4-2:

- a) The EUT was located 0.1 m minimum from all side of the **HCP** (dimensions 1.6m x 0.8m).
- b) The support units were located another table 30 cm away from the EUT, but direct support unit was/were located at same location as EUT on the HCP and keep at a distance of 10 cm with EUT.
- c) The time interval between two successive single discharges was at least 1 second.
- d) Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- e) Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
- f) At least ten single discharges (in the most sensitive polarity) were applied at the front edge of each **HCP** opposite the center point of each unit of the EUT and 0.1 meters from the front of the EUT. The long axis of the discharge electrode was in the plane of the **HCP** and perpendicular to its front edge during the discharge.
- g) At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **Vertical Coupling Plane (VCP)** in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

8.3.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **Ground Reference Plane**. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **Horizontal Coupling Plane** (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 940k total impedance. The equipment under test, was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were placed on the **HCP** and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

8.3.5. TEST RESULTS

| | | | |
|------------------------------|----------|-------------|----------|
| Temperature | 21°C | Humidity | 45% RH |
| Pressure | 1010mbar | Tested By | Rax Chen |
| Required Passing Performance | | Criterion B | |

| Air Discharge | | | | | | | | | |
|---------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------|---------------------------------------|----------------------------|--|---------------------------------------|
| Test Points | Test Levels | | | Results | | | | | |
| | ± 2 kV | ± 4 kV | ± 8 kV | Pass | Fail | Performance Criterion | | Observation | |
| Front | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Back | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input type="checkbox"/> 1 | <input checked="" type="checkbox"/> 2 |
| Left | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input type="checkbox"/> 1 | <input checked="" type="checkbox"/> 2 |
| Right | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input type="checkbox"/> 1 | <input checked="" type="checkbox"/> 2 |
| Top | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input type="checkbox"/> 1 | <input checked="" type="checkbox"/> 2 |

| Contact Discharge | | | | | | | | | |
|-------------------|-------------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|---------------------------------------|----------------------------|--|----------------------------|
| Test Points | Test Levels | | | Results | | | | | |
| | ± 2 kV | ± 4 kV | ± 8 kV | Pass | Fail | Performance Criterion | | Observation | |
| Front | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Back | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Left | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Right | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Top | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |

| Discharge To Horizontal Coupling Plane | | | | | | | | | |
|--|-------------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|---------------------------------------|----------------------------|--|----------------------------|
| Side of EUT | Test Levels | | | Results | | | | | |
| | ± 2 kV | ± 4 kV | ± 8 kV | Pass | Fail | Performance Criterion | | Observation | |
| Front | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Back | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Left | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Right | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |

| Discharge To Vertical Coupling Plane | | | | | | | | | |
|--------------------------------------|-------------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|---------------------------------------|----------------------------|--|----------------------------|
| Side of EUT | Test Levels | | | Results | | | | | |
| | ± 2 kV | ± 4 kV | ± 8 kV | Pass | Fail | Performance Criterion | | Observation | |
| Front | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Back | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Left | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |
| Right | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> A | <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 2 |

NOTE: 1. There was no change compared with initial operation during the test.

2. No discharge point.

8.4. RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD (RS)

8.4.1. TEST SPECIFICATION

| | |
|-----------------------------|------------------------------------|
| Basic Standard: | IEC 61000-4-3 |
| Frequency Range: | 80 MHz ~1000 MHz |
| Field Strength: | 3 V/m |
| Modulation: | 1kHz Sine Wave, 80%, AM Modulation |
| Frequency Step: | 1 % of preceding frequency value |
| Polarity of Antenna: | Horizontal and Vertical |
| Test Distance: | 3 m |
| Antenna Height: | 1.5m |

8.4.2. TEST INSTRUMENT

| 844 RS Chamber | | | | |
|----------------------|-----------------------|--------------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Electric Field Probe | AR | FL7006 | 0338955 | 05/23/2018 |
| Field of Calibration | CCS | Chamber#RS | 80-1000MHz | 05/07/2018 |
| Power Sensor | Boonton | 51013-4E | 35811 | 02/13/2018 |
| Power Sensor | Boonton | 51013-4E | 35812 | 02/13/2018 |
| RF Power Meter | Boonton | 4242-01-02 | 14357 | 02/13/2018 |
| Thermo-Hygro Meter | Wisewind | N/A | SD-S018 | 10/01/2018 |
| Broadband Antenna | AR | AT1080 | 311819 | N.C.R |
| Power Amplifier | Milmega | 80RF1000-600 | 1079361 | N.C.R |
| Signal Generator | Agilent | N5181A | MY47421336 | 12/04/2017 |
| Software | Emcware Ver. 2.6.0.16 | | | |

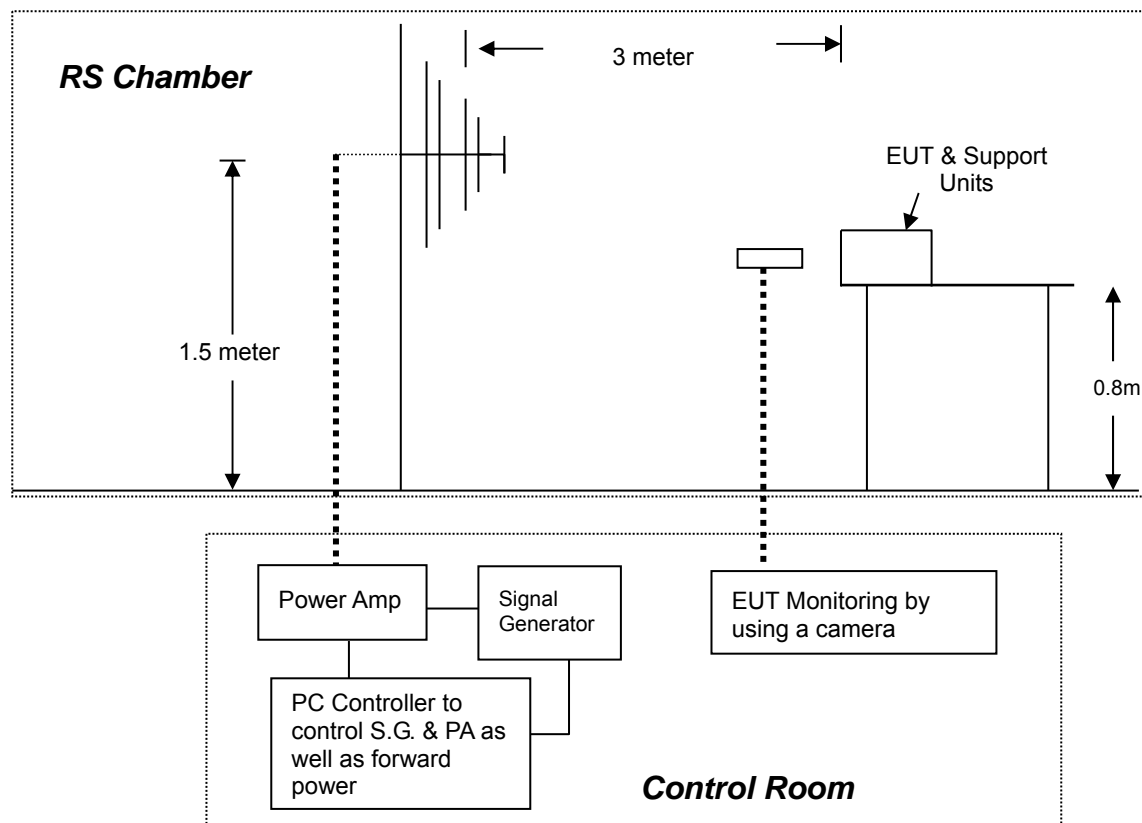
NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R.= No Calibration required.

8.4.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-023)

The test procedure was in accordance with IEC 61000-4-3

- The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
- The frequency range is swept from 80 MHz to 1000 MHz, with the signal 80% amplitude modulated with a 1kHz sine-wave. The rate of sweep did not exceed 1.5×10^{-3} decade/s, where the frequency range is swept incrementally, the step size was 1% of preceding frequency value.
- The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

8.4.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLETOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

8.4.5. TEST RESULTS

| | | | |
|-------------|----------|------------------------------|-------------|
| Temperature | 23°C | Humidity | 49% RH |
| Pressure | 1007mbar | Dwell Time | 3 sec. |
| Tested By | Rax Chen | Required Passing Performance | Criterion A |

| Frequency (MHz) | Polarity | Azimuth | Field Strength (V/m) | Performance Criterion | Observation | Result |
|-----------------|----------|---------|----------------------|--|---|--------|
| 80 ~ 1000 | V&H | 0 | 3 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |
| 80 ~ 1000 | V&H | 90 | 3 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |
| 80 ~ 1000 | V&H | 180 | 3 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |
| 80 ~ 1000 | V&H | 270 | 3 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |

NOTE: 1. There was no change compared with the initial operation during the test.

8.5. ELECTRICAL FAST TRANSIENT (EFT)

8.5.1. TEST SPECIFICATION

Basic Standard: IEC 61000-4-4

Test Voltage: AC Power Port: 1kV
Signal Ports and Telecommunication Ports: 0.5kV

Polarity: Positive & Negative

Impulse Frequency: 5 kHz

Impulse Wave-shape: 5/50 ns

Burst Duration: 15 ms

Burst Period: 300 ms

Test Duration: Not less than 1 min.

8.5.2. TEST INSTRUMENT

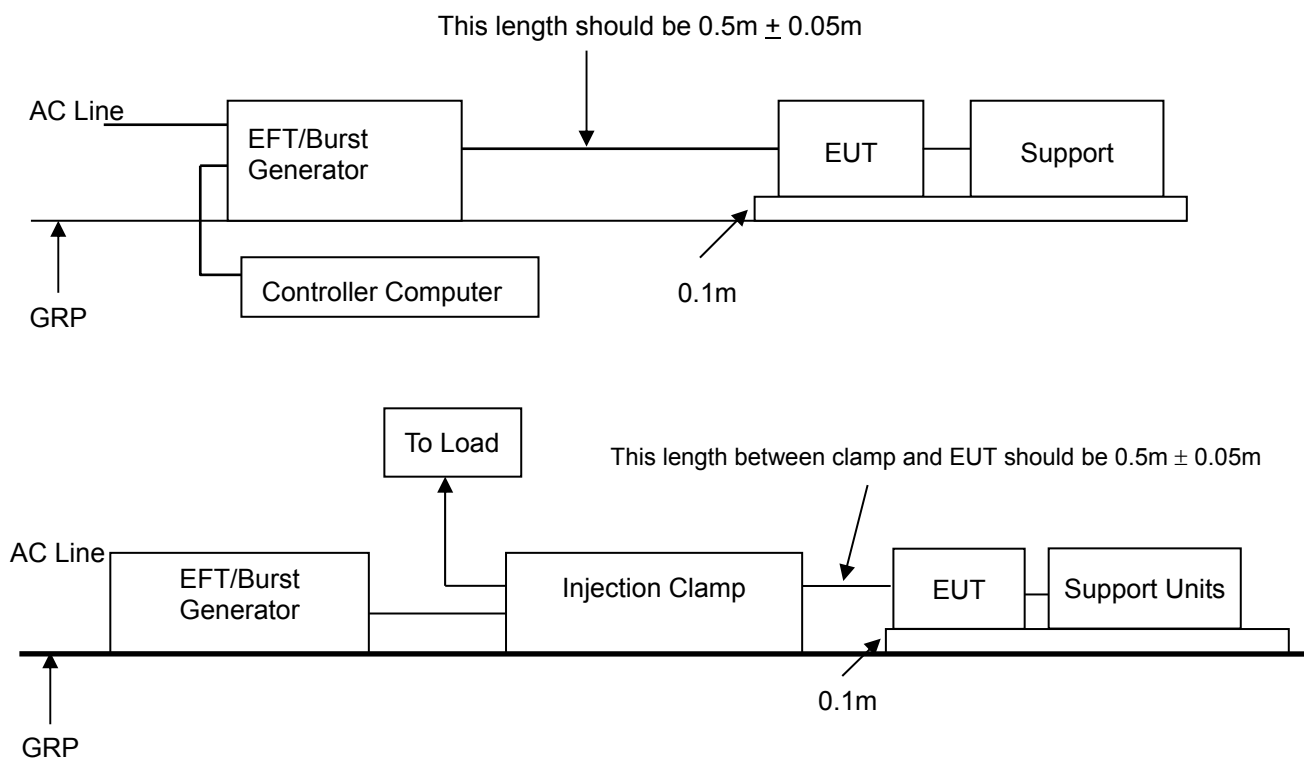
| Immunity Shield Room | | | | |
|----------------------|-----------------|---------------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Capacitive Clamp | EMC-Partner | CN-EFT1000 | 589 | 07/17/2018 |
| EMC Immunity Tester | EMC Partner | TRANSINT 2000 | 1117 | 03/07/2018 |
| Software | GenecsVer. 3.27 | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R.= No Calibration required.

8.5.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-024)

- All types of cables, including their length, and the interface port of the EUT to which they were connected.
- Both positive and negative polarity discharges were applied.
- The length of the “hot wire” from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 0.5 meter.
- The duration time of each test sequential was 1 minute.
- The transient/burst waveform was in accordance with IEC 61000-4-4, 5/50ns.

8.5.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLETOP EQUIPMENT

The configuration consisted of a wooden table (0.1m high) standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system. A minimum distance of 0.5m was provided between the EUT and the walls of the laboratory or any other metallic structure.

FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-4 and its cables, were isolated from the Ground Reference Plane by an insulating support that is 0.1-meter thick. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system.

8.5.5. TEST RESULTS

| | | | |
|------------------------------|----------|-------------|----------|
| Temperature | 20°C | Humidity | 56% RH |
| Pressure | 1009mbar | Tested By | Rax Chen |
| Required Passing Performance | | Criterion B | |

| Test Point | Polarity | Test Level (kV) | Performance Criterion | Observation | Result |
|------------|----------|-----------------|--|---|--------|
| L | +/- | 1 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |
| N | +/- | 1 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |
| L - N | +/- | 1 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |
| RJ45 | +/- | 0.5 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |

NOTE: 1. There was no change compared with initial operation during the test.

8.6. SURGE IMMUNITY TEST

8.6.1. TEST SPECIFICATION

| | |
|------------------------------------|--|
| Basic Standard: | IEC 61000-4-5 |
| Wave-Shape: | Combination Wave 1.2/50 μ s Open Circuit Voltage 8/20 μ s Short Circuit Current 10/700 μ s Open Circuit Voltage |
| Test Voltage: | AC Power Port~ line to line: 1kV Signal Ports and Telecommunication Ports ~ line to ground: 1kV |
| Surge Input/Output: | AC Power Line: L-N Signal Line: L-G |
| Generator Source Impedance: | 2 ohm between networks 42 ohm between network and ground |
| Polarity: | Positive/Negative |
| Phase Angle: | 0° / 90° / 180° / 270° |
| Pulse Repetition Rate: | 1 time / min. (maximum) |
| Number of Tests: | 5 positive and 5 negative at selected points |

8.6.2. TEST INSTRUMENT

| Immunity Shield Room | | | | |
|----------------------|------------------|---------------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| CDN | EMC-Partner | CDN-UTP8 | 1505 | 02/22/2018 |
| EMC Immunity Tester | EMC Partner | TRANSINT 2000 | 1117 | 03/07/2018 |
| Software | Genecs Ver. 3.27 | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R.= No Calibration required.

8.6.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-025)

a) For EUT power supply:

The surge is applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

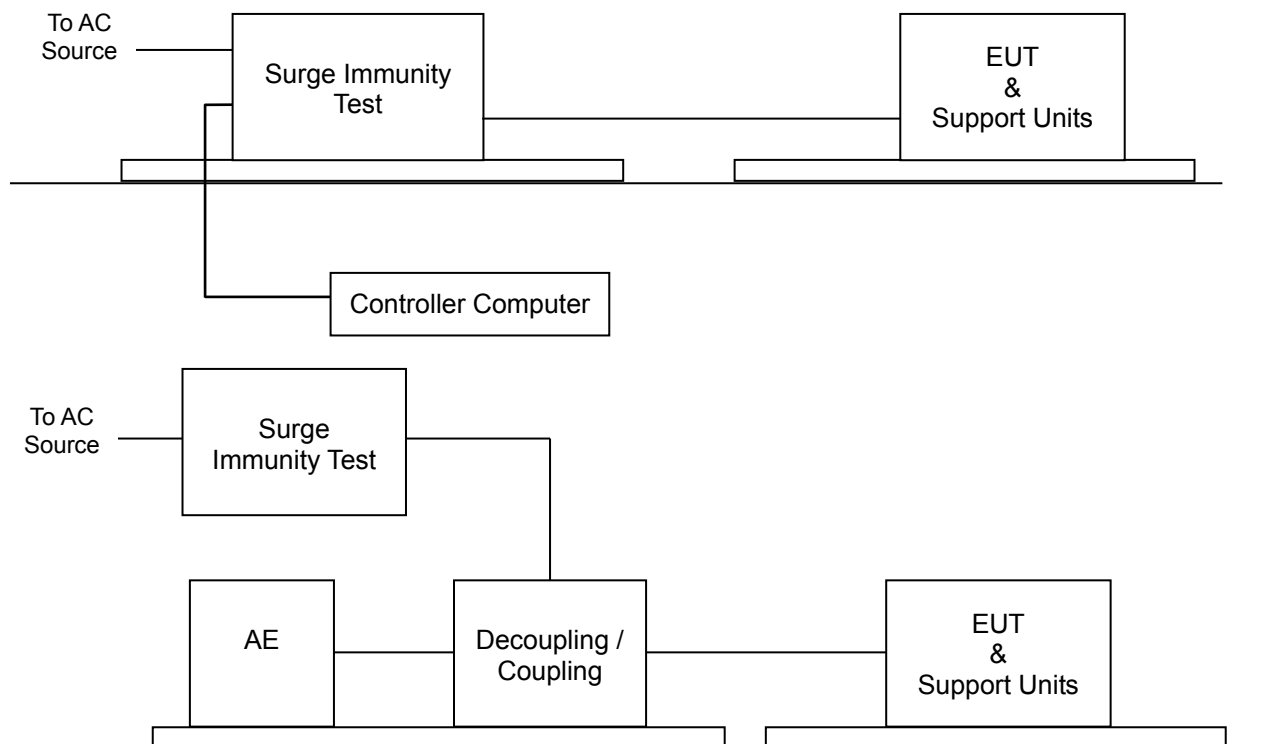
b) For test applied to unshielded un-symmetrically operated interconnection lines of EUT:

The surge was applied to the lines via the capacitive coupling. The coupling / decoupling networks didn't influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

c) For test applied to unshielded symmetrically operated interconnection / telecommunication lines of EUT:

The surge was applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor were not specified. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

8.6.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

8.6.5. TEST RESULTS

| | | | |
|------------------------------|----------|-------------|----------|
| Temperature | 20°C | Humidity | 56% RH |
| Pressure | 1009mbar | Tested By | Rax Chen |
| Required Passing Performance | | Criterion B | |

| Test Point | Polarity | Test Level (kV) | Performance Criterion | Observation | Result |
|------------|----------|-----------------|--|---|--------|
| L - N | +/- | 1 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |

NOTE: 1. There was no change compared with initial operation during the test.

| | | | |
|------------------------------|----------|-------------|----------|
| Temperature | 20°C | Humidity | 56% RH |
| Pressure | 1009mbar | Tested By | Rax Chen |
| Required Passing Performance | | Criterion C | |

| Test Point | Polarity | Test Level (kV) | Performance Criterion | Observation | Result |
|------------|----------|-----------------|---|---|--------|
| RJ45 | +/- | 1 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |

NOTE: 1. There was no change compared with initial operation during the test.

8.7. CONDUCTED RADIO FREQUENCY DISTURBANCES (CS)

8.7.1. TEST SPECIFICATION

| | |
|-------------------------|--|
| Basic Standard: | IEC 61000-4-6 |
| Frequency Range: | 0.15 MHz ~ 80 MHz |
| Field Strength: | 3 Vrms |
| Modulation: | 1kHz Sine Wave, 80%, AM Modulation |
| Frequency Step: | 1 % of preceding frequency value |
| Coupled cable: | Power Mains, Unshielded; RJ45 Line, Unshielded |
| Coupling device: | CDN-M2 (2 wires); CDN-T8 |

8.7.2. TEST INSTRUMENT

| CS Room | | | | |
|---------------------------|-----------------------|-------------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Attenuator | EMCI | SA3NL | 10006F | 01/16/2018 |
| CDN | Teseq | CDN M016 | 35820 | 02/13/2018 |
| CDN | Teseq | CDN M016 | 35821 | 01/16/2018 |
| CDN | Teseq | CDN T400A | 25674 | 02/13/2018 |
| CDN | Teseq | CDN T8-10 | 40369 | 02/14/2018 |
| Continuous Wave Simulator | EM Test | CWS 500N1.4 | P1446143188 | 02/13/2018 |
| Software | icd.controlVer. 5.3.5 | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R.= No Calibration required.

8.7.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-026)

The EUT shall be tested within its intended operating and climatic conditions.

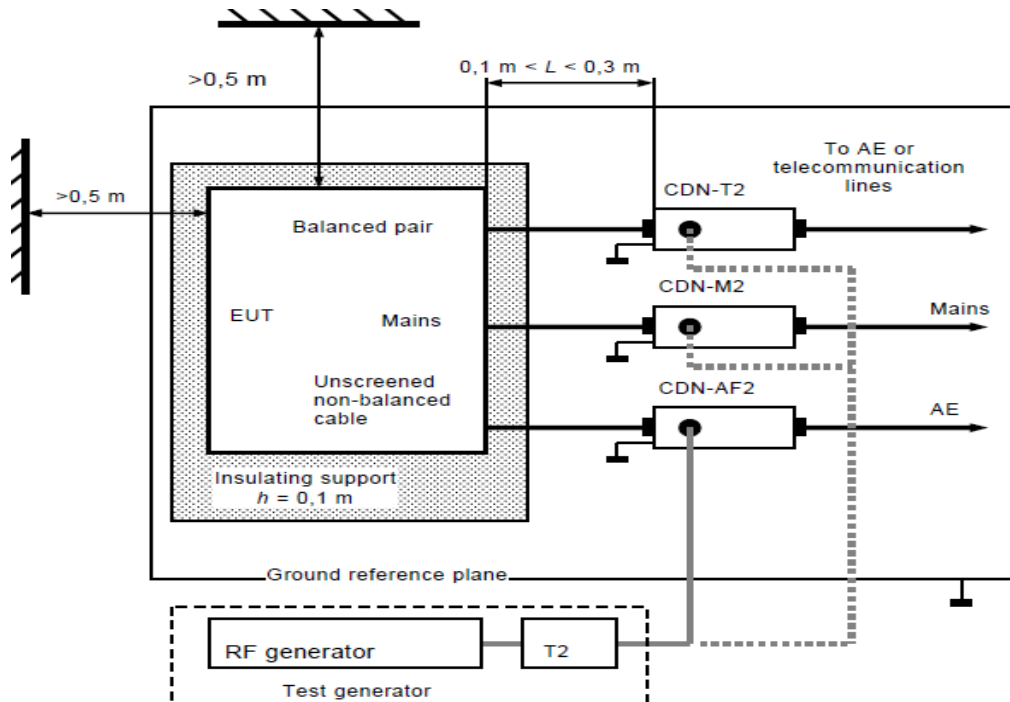
The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.

The frequency range was swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal was modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. The sweep rate was 1.5×10^{-3} decades/s. Where the frequency range is swept incrementally, the step size was 1 % of preceding frequency value from 150 kHz to 80 MHz.

The dwell time at each frequency was less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequency(ies) and harmonics or frequencies of dominant interest, was analyzed separately.

Attempts were made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

8.7.4. TEST SETUP



Note: 1. The CDNs and / or EM clamp used for real test depends on ports and cables configuration of EUT.
2. The EUT clearance from any metallic obstacles shall be at least 0.5m.

- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLE-TOP AND FLOOR-STANDING EQUIPMENT

The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

8.7.5. TEST RESULTS

| | | | |
|------------------------------|----------|-------------|----------|
| Temperature | 20°C | Humidity | 54% RH |
| Pressure | 1011mbar | Tested By | Rax Chen |
| Required Passing Performance | | Criterion A | |

| Frequency Band (MHz) | Field Strength (Vrms) | Cable | Injection Method | Performance Criterion | Observation | Result |
|----------------------|-----------------------|----------------------|------------------|--|--|--------|
| 0.15 ~ 80 | 3 | AC Power Line (0.3m) | CDN-M2 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |
| 0.15 ~ 80 | 3 | RJ45 Line (0.3m) | CDN-T8 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |

NOTE: 1. There was no change compared with initial operation during the test.

8.8. POWER FREQUENCY MAGNETIC FIELD

8.8.1. TEST SPECIFICATION

| | |
|--------------------------|-------------------------|
| Basic Standard: | IEC 61000-4-8 |
| Frequency Range: | 50Hz |
| Field Strength: | 1 A/m |
| Observation Time: | 1 minute |
| Inductance Coil: | Rectangular type, 1mx1m |

8.8.2. TEST INSTRUMENT

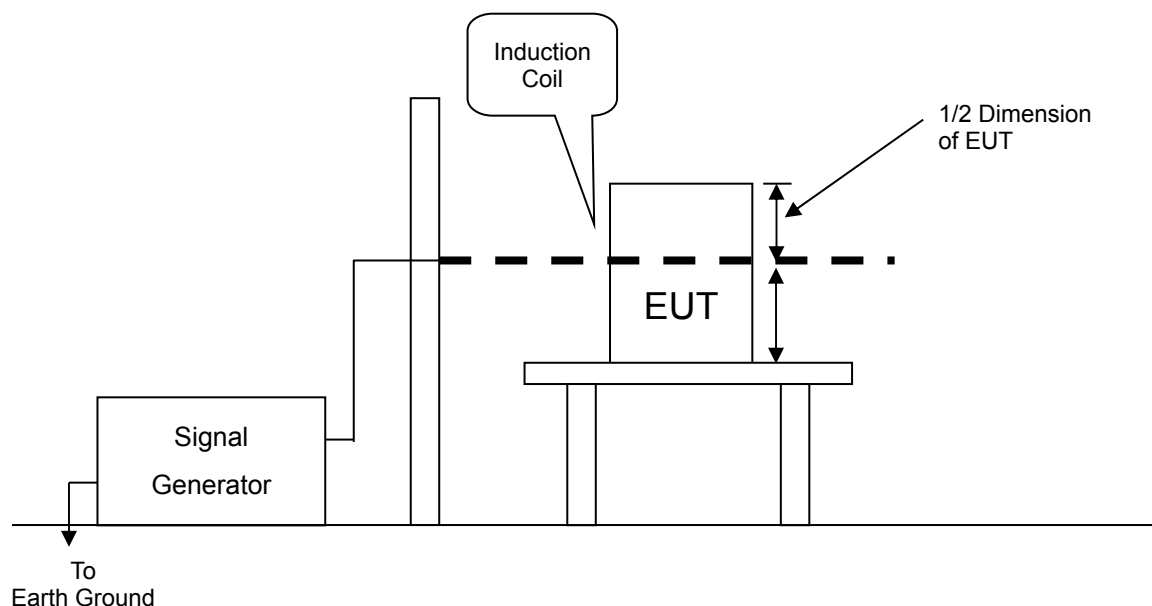
| Immunity Shield Room | | | | |
|----------------------|--------------|-------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R.= No Calibration required.

8.8.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-027)

- The equipment is configured and connected to satisfy its functional requirements. It shall be placed on the GRP with the interposition of a 0.1m-thick insulating support.
- The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.
- The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.
- The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.

8.8.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:**TABLETOP EQUIPMENT**

The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimension (1 m x 1 m). The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

FLOOR-STANDING EQUIPMENT

The equipment shall be subjected to the test magnetic field by using induction coils of suitable dimensions. The test shall be repeated by moving and shifting the induction coils, in order to test the whole volume of the EUT for each orthogonal direction. The test shall be repeated with the coil shifted to different positions along the side of the EUT, in steps corresponding to 50 % of the shortest side of the coil. The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

8.8.5. TEST RESULTS

| | | | |
|------------------------------|-----|-------------|-----|
| Temperature | N/A | Humidity | N/A |
| Pressure | N/A | Tested By | N/A |
| Required Passing Performance | | Criterion A | |

| DIRECTION | Field Strength (A/m) | Performance Criterion | OBSERVATION | RESULTS |
|-----------|----------------------|-----------------------|-------------|---------|
| X | 1 | A | Note | N/A |
| Y | 1 | A | Note | N/A |
| Z | 1 | A | Note | N/A |

NOTE: There is no any sensitive part for magnetic field test. Applicable only to equipment containing susceptible to magnetic field.

8.9. VOLTAGE DIPS & VOLTAGE INTERRUPTIONS

8.9.1. TEST SPECIFICATION

Basic Standard: IEC 61000-4-11

Test duration time: Minimum three test events in sequence

Interval between event: Minimum 10 seconds

Phase Angle: 0° / 180°

Test cycle: 3 times

8.9.2. TEST INSTRUMENT

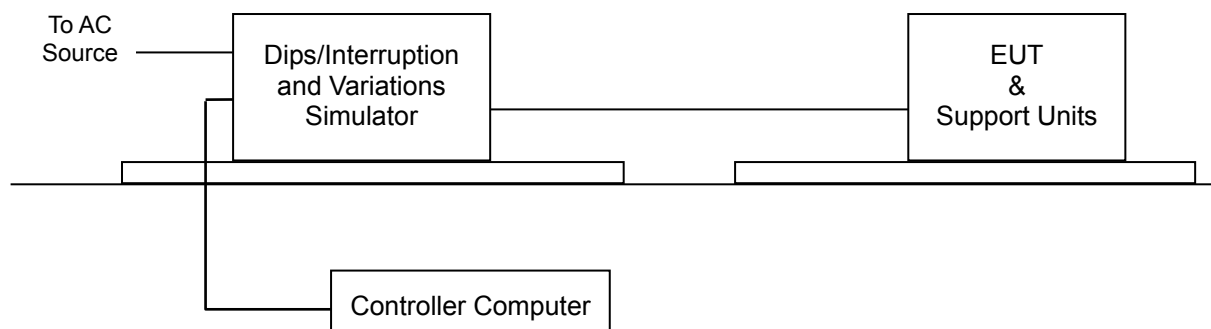
| Immunity shielded room | | | | |
|------------------------|-----------------|---------------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| AC/DC Clamp Meter | Lutron | CM-9930R | I.200121 | 05/23/2018 |
| EMC Immunity Tester | EMC Partner | TRANSINT 2000 | 1117 | 03/07/2018 |
| Software | GenecsVer. 3.27 | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R.= No Calibration required.

8.9.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-028)

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

8.9.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

8.9.5. TEST RESULTS

| | | | |
|------------------------------|--|-----------|----------|
| Temperature | 20°C | Humidity | 56% RH |
| Pressure | 1009mbar | Tested By | Rax Chen |
| Required Passing Performance | Criterion B: >95% reduction 0.5 period Criterion C: 30% reduction 25 period & >95% reduction 250 period | | |

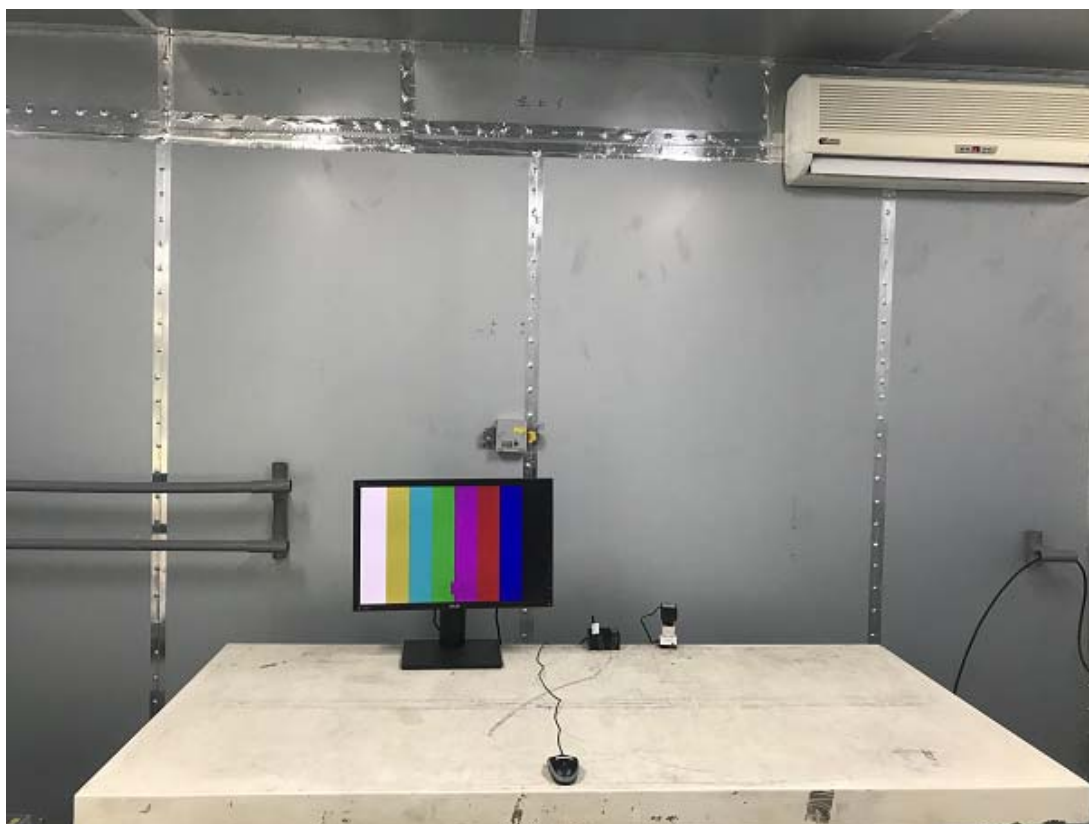
| Test Power: 230Vac, 50Hz | | | | |
|--------------------------|----------------------|---|---|-------------|
| Voltage (% Reduction) | Duration (Period) | Performance Criterion | Observation | Test Result |
| >95 | 0.5 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |
| 30 | 25 | <input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C | Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 | PASS |
| >95 | 250 | <input type="checkbox"/> A <input type="checkbox"/> B <input checked="" type="checkbox"/> C | Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 | PASS |

NOTE: 1. There was no change compared with initial operation during and after the test. No unintentional response was found during the test.

2. EUT shut down, it could not become normal except reinstalled by operator.

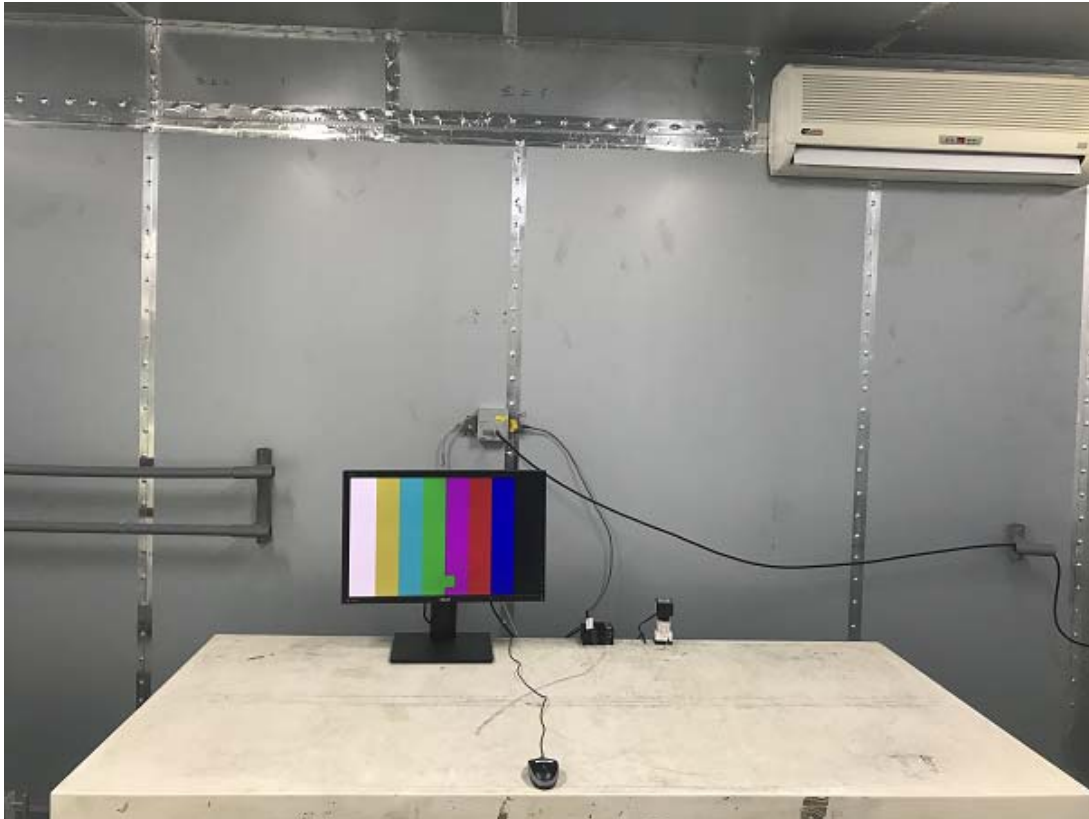
9 PHOTOGRAPHS OF THE TEST CONFIGURATION

CONDUCTED EMISSION TEST



CONDUCTED EMISSION TEST AT TELECOMMUNICATION PORTS

RJ45 Telecom Port with ISN (10Mbps & 100Mbps & 1Gbps)



RADIATED EMISSION TEST



Harmonic & Flicker Test



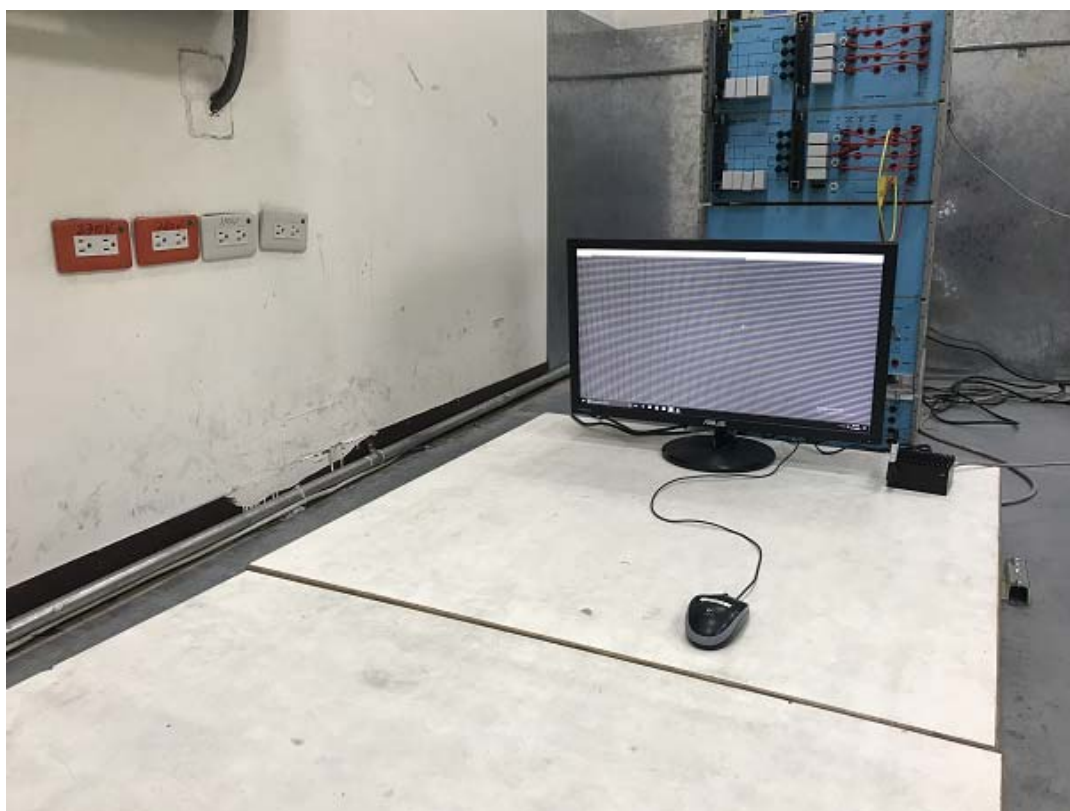
ESD Test



RS Test



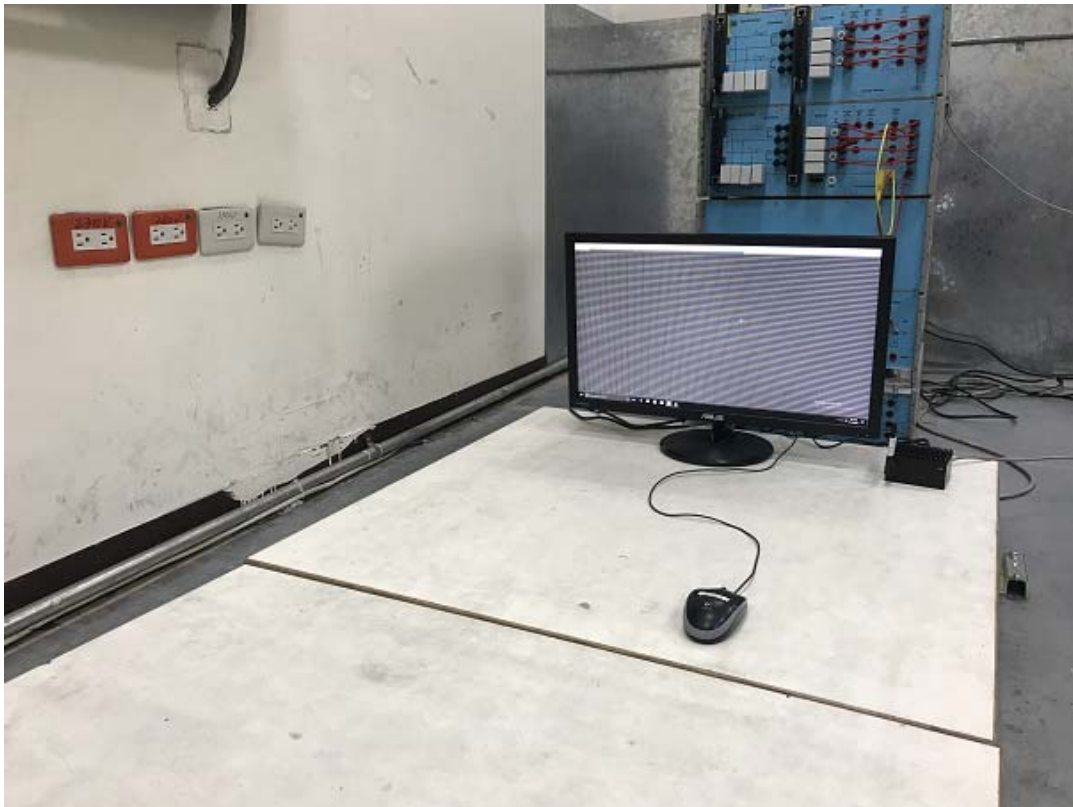
EFT Test



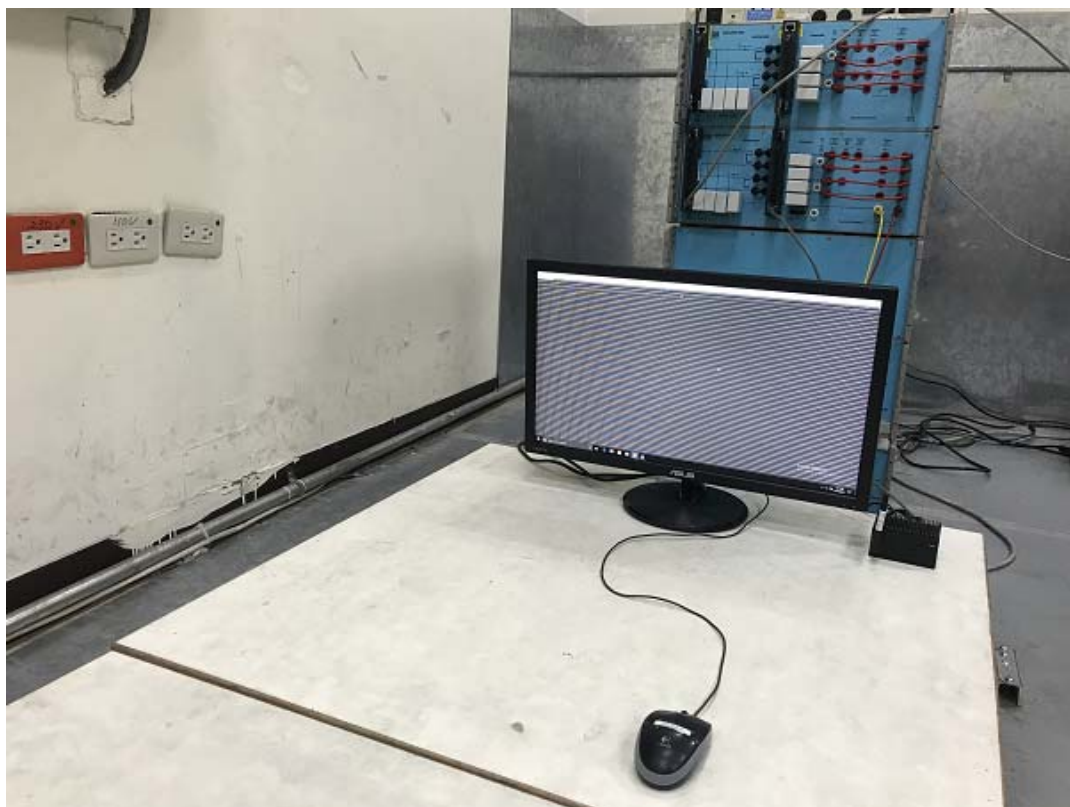
EFT For I/O Test



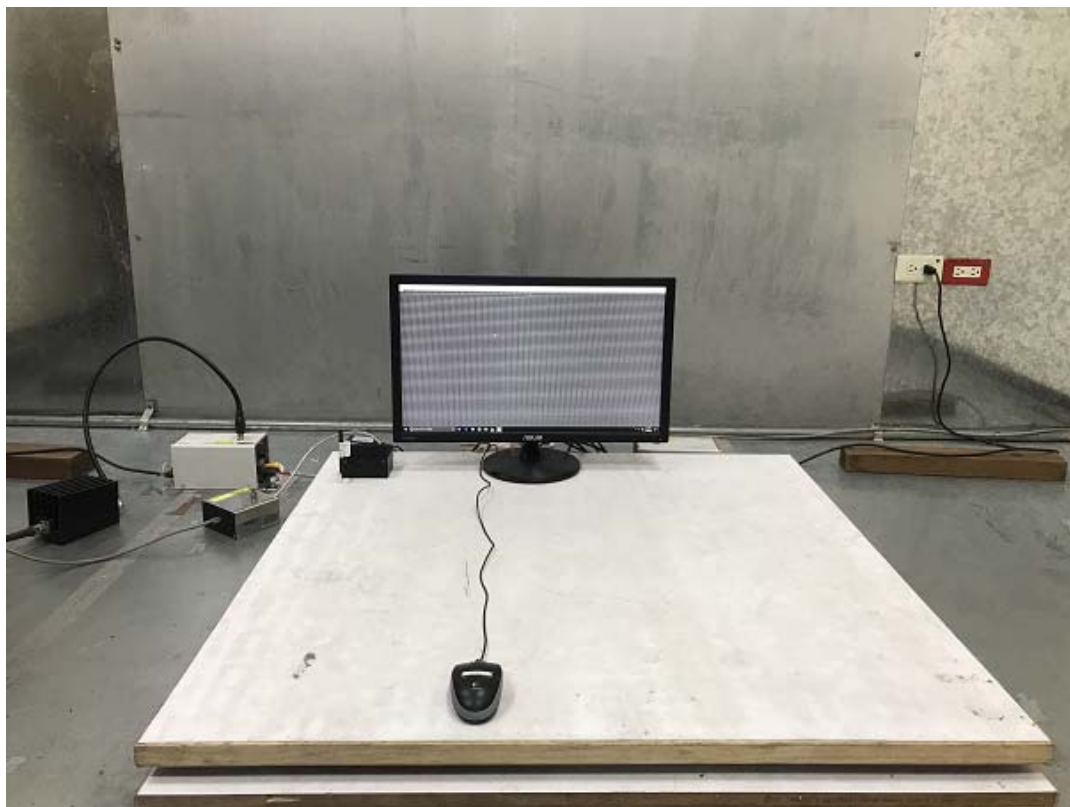
Surge Test



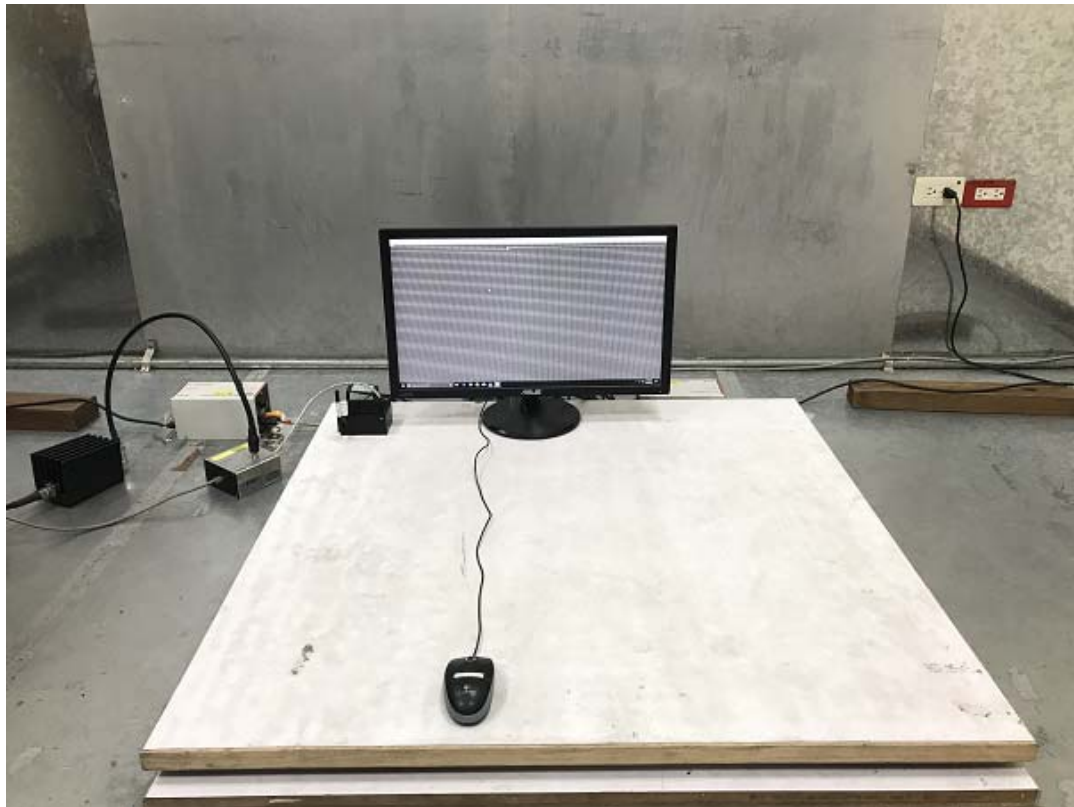
Surge For I/O Test



CS Test



CS For I/O Test



Voltage Dips / Interruptions Test

