

# CE EMC TEST REPORT

for

**Product Name: TEACH PENDANT**

**Model No.: HTS-E913-1CK**

**Test Report Number:  
C180913E14-ET**

Issued to:

**JIANGSU HAUTO CNC TECHNOLOGY CO.,LTD  
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Issued by:

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**Issued Dated: September 27, 2018**



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**Revision History**

| Version | Report No.    | Date               | Description   | Revised By  |
|---------|---------------|--------------------|---------------|-------------|
| Rev 00  | C180913E14-ET | September 27, 2018 | Initial Issue | Ellien Zhou |

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# 1 TEST CERTIFICATION

|                              |                                                                                                                           |                                                                                                                                                                                                                                                                                  |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Name:</b>         | TEACH PENDANT                                                                                                             |                                                                                                                                                                                                                                                                                  |
| <b>Model Name:</b>           | HTS-E913-1CK                                                                                                              |                                                                                                                                                                                                                                                                                  |
| <b>Brand Name:</b>           | HAUTO                                                                                                                     |                                                                                                                                                                                                                                                                                  |
| <b>Applicant:</b>            | JIANGSU HAUTO CNC TECHNOLOGY CO.,LTD                                                                                      |                                                                                                                                                                                                                                                                                  |
| <b>Address:</b>              | 1-3 Floor, No. 3 Building , Science and Technology Avenue, Science and Technology New Town, Jurong City ,Jiangsu Province |                                                                                                                                                                                                                                                                                  |
| <b>Manufacturer:</b>         | JIANGSU HAUTO CNC TECHNOLOGY CO.,LTD                                                                                      |                                                                                                                                                                                                                                                                                  |
| <b>Address:</b>              | 1-3 Floor, No. 3 Building , Science and Technology Avenue, Science and Technology New Town, Jurong City ,Jiangsu Province |                                                                                                                                                                                                                                                                                  |
| <b>Date of Test:</b>         | September 19~26, 2018                                                                                                     |                                                                                                                                                                                                                                                                                  |
| <b>Test Voltage:</b>         | DC 24V                                                                                                                    |                                                                                                                                                                                                                                                                                  |
| <b>Applicable Standards:</b> | <b>EN 55032:2015/AC:2016*</b><br>EN 61000-3-2:2014<br>EN 61000-3-3:2013                                                   | <b>EN 55024:2010</b><br>IEC 61000-4-2 ed2.0 (2008-12)<br>IEC 61000-4-3 ed3.2 Consol. With AMD1&2 (2010-04)<br>IEC 61000-4-4 ed3.0 (2012-04)<br>IEC 61000-4-5 ed3.0 (2014-05)<br>IEC 61000-4-6 ed4.0 (2013-10)<br>IEC 61000-4-8 ed2.0 (2009-09)<br>IEC 61000-4-11 ed2.0 (2004-03) |

- 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. Where postfix'\*' representative the client require.

| 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:**

**Reviewed by:**




Jeff.Fang  
EMC Manager  
Compliance Certification Service Inc.

Ken.Yao  
EMC Section Manager  
Compliance Certification Service Inc.

## 2 TEST RESULT SUMMARY

| EMISSION     |                                |        |                        |
|--------------|--------------------------------|--------|------------------------|
| Standard     | Item                           | Result | Minimum Requirement    |
| EN 55032     | Conducted (Power Port)         | N/A    | Meets Class A Limit    |
|              | Conducted (Telecom port)       | PASS   | Meets Class A Limit    |
|              | Radiated                       | PASS   | Meets Class A Limit    |
| EN 61000-3-2 | Harmonic current emissions     | N/A    | Meets the requirements |
| EN 61000-3-3 | Voltage fluctuations & flicker | N/A    | Meets the requirements |

| IMMUNITY       |                                   |        |                                                                                                                                                                                                                                  |
|----------------|-----------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard       | Item                              | Result | Minimum Requirement                                                                                                                                                                                                              |
| IEC 61000-4-2  | ESD                               | PASS   | Meets the requirements of Performance Criterion B                                                                                                                                                                                |
| IEC 61000-4-3  | RS                                | PASS   | Meets the requirements of Performance Criterion A                                                                                                                                                                                |
| IEC 61000-4-4  | EFT                               | PASS   | Meets the requirements of Performance Criterion B                                                                                                                                                                                |
| IEC 61000-4-5  | Surge                             | PASS   | Meets the requirements of Performance Criterion B                                                                                                                                                                                |
| IEC 61000-4-6  | CS                                | PASS   | Meets the requirements of Performance Criterion A                                                                                                                                                                                |
| IEC 61000-4-8  | PFMF                              | PASS   | Meets the requirements of Performance Criterion A                                                                                                                                                                                |
| IEC 61000-4-11 | Voltage dips & voltage variations | N/A    | Meets the requirements of<br><b>Voltage Dips:</b><br>1) >95% reduction<br>Performance Criterion B<br>2) 30% reduction<br>Performance Criterion C<br><b>Voltage Interruptions:</b><br>1)>95% reduction<br>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. The product listed above, is evaluated by test on representative samples which cover the matrix of configurations. No change or modification is made on the product hardware during the test to achieve compliance. It's confirmed to be in compliance with the requirements of the about standards.

### 3 EUT DESCRIPTION

|                          |                                      |
|--------------------------|--------------------------------------|
| <b>Product Name:</b>     | TEACH PENDANT                        |
| <b>Model Name:</b>       | HTS-E913-1CK                         |
| <b>Brand Name:</b>       | HAUTO                                |
| <b>Applicant:</b>        | JIANGSU HAUTO CNC TECHNOLOGY CO.,LTD |
| <b>Identify Number:</b>  | C180913E14-ET                        |
| <b>Received Date:</b>    | September 13, 2018                   |
| <b>EUT Power Rating:</b> | DC 24V                               |

**I/O PORT:**

| I/O PORT TYPE | Q'TY | TESTED WITH |
|---------------|------|-------------|
| 1). Lan Port  | 1    | 1           |

## 4 TEST METHODOLOGY

### 4.1. DECISION OF FINAL TEST MODE

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

The following test mode(s) were scanned during the preliminary test:

| Pre Test Mode |                    |                                 |
|---------------|--------------------|---------------------------------|
| Emission      | Conducted Emission | <b>Mode 1: Normal operation</b> |
|               | Radiated Emission  | <b>Mode 1: Normal operation</b> |

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

| Final Test Mode |                    |                                 |
|-----------------|--------------------|---------------------------------|
| Emission        | Conducted Emission | <b>Mode 1: Normal operation</b> |
|                 | Radiated Emission  | <b>Mode 1: Normal operation</b> |

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

### 4.2. EUT SYSTEM OPERATION

|   |                                                            |
|---|------------------------------------------------------------|
| 1 | According to the erection of figure for site erection.     |
| 2 | Marking sure the EUT can work normally, and start testing. |
| 3 | Recording the test results.                                |

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.

| No. | Equipment | Model No. | Serial No. | Trade Name | Data Cable         | Power Cord          |
|-----|-----------|-----------|------------|------------|--------------------|---------------------|
| 1   | Note book | E430      | N/A        | Lenovo     | Unshielded,<br>10m | Unshielded,<br>1.8m |

**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

|              |  |  |
|--------------|--|--|
| 1. Note book |  |  |
|--------------|--|--|





## 6 FACILITIES AND ACCREDITATIONS

### 6.1. FACILITIES

All measurement facilities used to collect the measurement data are located at No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 32. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4, CISPR 16-1-5, "Radio Interference Measuring Apparatus and Measurement Methods."

### 6.2. ACCREDITATIONS

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

|              |      |
|--------------|------|
| <b>USA</b>   | A2LA |
| <b>China</b> | CNAS |

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

|               |                 |
|---------------|-----------------|
| <b>Canada</b> | Industry Canada |
| <b>Japan</b>  | VCCI            |
| <b>Taiwan</b> | BSMI            |
| <b>USA</b>    | 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<br>(Power Port)   | 0.15MHz~30MHz | +/- 2.2485 dB |
| Conducted emissions<br>(Telecom Port) | 0.15MHz~30MHz | +/- 2.7700dB  |

| Measurement                        | Polarity | Frequency        | Uncertainty  |
|------------------------------------|----------|------------------|--------------|
| Radiated emissions<br>(below 1GHz) | H        | 30MHz ~ 200MHz   | +/- 4.0213dB |
|                                    |          | 200MHz ~1000MHz  | +/- 4.5310dB |
|                                    | V        | 30MHz ~ 200MHz   | +/- 3.8257dB |
|                                    |          | 200MHz ~1000MHz  | +/- 4.0231dB |
| Radiated emissions<br>(above 1GHz) | H        | 1000MHz ~6000MHz | +/- 3.9713dB |
|                                    | V        | 1000MHz ~6000MHz | +/- 4.0105dB |

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 32: 2015, clause 11, Measurement Uncertainty) determining compliance with the limits shall be based on the results of the compliance measurement. Consequently the measured emissions being less than the maximum allowed emission result in this being a compliant test or passing test.

The acceptable measurement uncertainty value without requiring revision of the compliance statement is based 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

| CE (Shielding Room) |                |           |               |                  |                 |
|---------------------|----------------|-----------|---------------|------------------|-----------------|
| Name of Equipment   | Manufacturer   | Model     | Serial Number | Calibration Date | Calibration Due |
| EMI TEST RECEIVER   | R&S            | ESCI      | 100781        | 02/26/2018       | 02/25/2019      |
| V (V-LISN)          | SCHWARZBECK    | NNLK 8129 | 8129-143      | 10/29/2017       | 10/28/2018      |
| TWO-LINE V-NETWORK  | R&S            | ENV216    | 101604        | 10/29/2017       | 10/28/2018      |
| Pulse LIMITER       | R&S            | ESH3-Z2   | 100524        | 12/27/2017       | 12/26/2018      |
| Test Software       | EZ-EMC ver.3A1 |           |               |                  |                 |

- 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.

### 7.1.3. TEST PROCEDURES

#### 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 15cm 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.

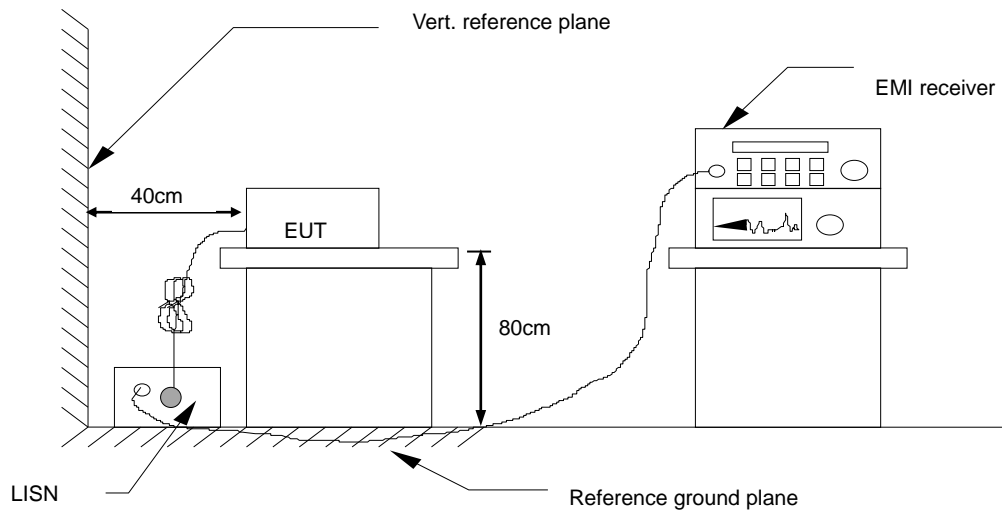
#### Procedure of Final Test

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

| Frequency | Quasi Peak Reading (dBuV) | Average Reading (dBuV) | Correction Factor (dB) | Quasi Peak Result (dBuV) | Average Result (dBuV) | Quasi Peak Limit (dBuV) | Average Limit (dBuV) | Quasi Peak Margin (dB) | Average Margin (dB) |
|-----------|---------------------------|------------------------|------------------------|--------------------------|-----------------------|-------------------------|----------------------|------------------------|---------------------|
| x.xxxx    | 29.89                     | 15.22                  | 11.09                  | 40.98                    | 26.31                 | 56.00                   | 46.00                | -15.02                 | -19.69              |

Correction factor (dB) = cable loss + Insertion loss of LISN+ Insertion loss of transient limiter (The transient limiter included 10 dB attenuation)

(Quasi Peak/ Average)Result = (Quasi Peak/ Average)reading + Correction Factor (dB)

Calculation Formula

(Quasi Peak/ Average)Margin (dB) = (Quasi Peak/ Average)Result (dBuV) –(Quasi Peak/ Average)Limit (dBuV)

### 7.1.6. TEST RESULTS

Note: The EUT is DC supply, so the test item needn't performance.

## 7.2. CONDUCTED EMISSION MEASUREMENT AT TELECOMMUNICATION PORTS

### 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 0.5MHz.

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 0.5MHz.

### 7.2.2. TEST INSTRUMENTS

| CE (Shielding Room)                     |                |                 |               |                  |                 |
|-----------------------------------------|----------------|-----------------|---------------|------------------|-----------------|
| Name of Equipment                       | Manufacturer   | Model           | Serial Number | Calibration Date | Calibration Due |
| EMI TEST RECEIVER                       | R&S            | ESCI            | 100781        | 02/26/2018       | 02/25/2019      |
| V (V-LISN)                              | SCHWARZBECK    | NNLK 8129       | 8129-143      | 10/29/2017       | 10/28/2018      |
| TWO-LINE V-NETWORK                      | R&S            | ENV216          | 101604        | 10/29/2017       | 10/28/2018      |
| Pulse LIMITER                           | R&S            | ESH3-Z2         | 100524        | 12/27/2017       | 12/26/2018      |
| CISPR22 FOUR BALANCED TELECOM PARIS ISN | FCC            | FCC-TLISN-T2-02 | 20625         | 09/03/2018       | 09/02/2019      |
| RF CURRENT PROBE                        | FCC            | F-65A           | 146           | 04/25/2018       | 04/24/2019      |
| COUPLING AND DECOUPLING NETWORK         | TESEQ          | ISN ST08        | 31272         | 09/03/2018       | 09/02/2019      |
| IMPEDANCE STABILIZATION NETWORK         | TESEQ          | ISN T800        | 34450         | 09/03/2018       | 09/02/2019      |
| Test Software                           | EZ-EMC ver.3A1 |                 |               |                  |                 |

- 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.

### 7.2.3. TEST PROCEDURE

Selecting ISN 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 ISN/Current Probe and communication in normal condition.

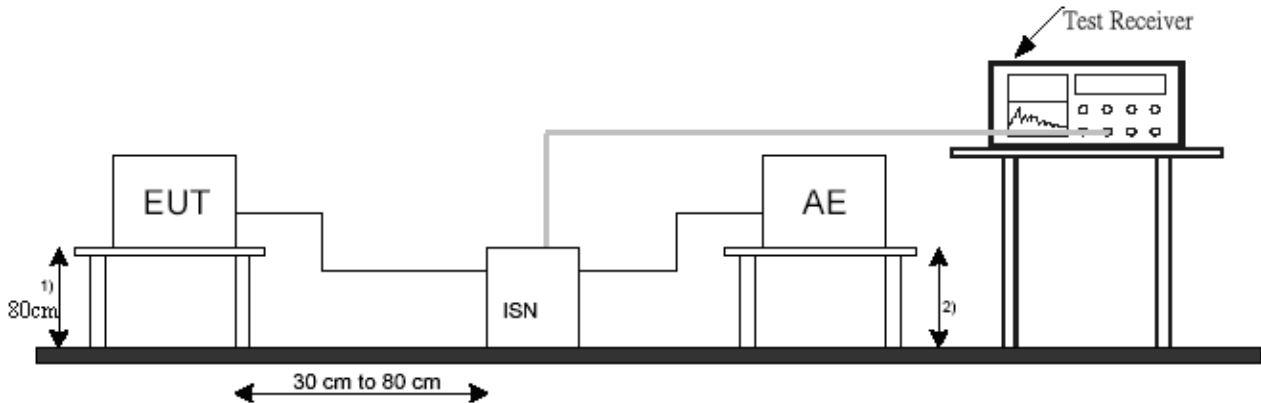
Making a overall range scan by using the test receiver controlled by controller and record at least six highest emissions for showing in the test report.

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.



### 7.2.4. TEST SETUP



1) Distance to the ground reference plane (vertical or horizontal).

2) Distance to the ground reference plane is not critical.

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

### 7.2.5. DATA SAMPLE

| Frequency | QuasiPeak Reading (dBuV) | Average Reading (dBuV) | Correction Factor (dB) | QuasiPeak Result (dBuV) | Average Result (dBuV) | QuasiPeak Limit (dBuV) | Average Limit (dBuV) | QuasiPeak Margin (dB) | Average Margin (dB) |
|-----------|--------------------------|------------------------|------------------------|-------------------------|-----------------------|------------------------|----------------------|-----------------------|---------------------|
| x.xx      | 35.81                    | 34.89                  | 10.16                  | 45.97                   | 45.05                 | 59.93                  | 49.93                | -13.96                | -4.88               |

Correction factor (dB) = Cable loss + Insertion loss of ISN

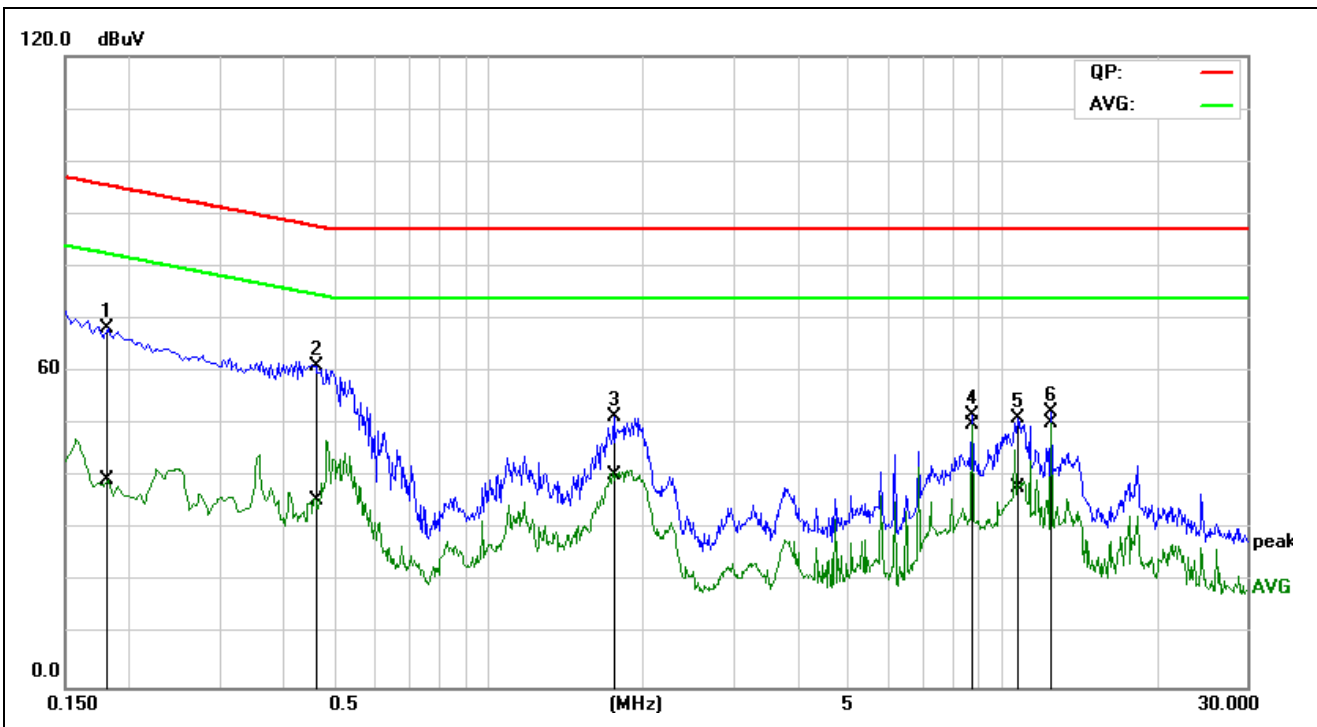
(Quasi Peak/ Average)Result = (Quasi Peak/ Average)Reading + Correction Factor (dB)

#### Calculation Formula

(Quasi Peak/ Average)Margin (dB) = (Quasi Peak/ Average)Result (dBuV) – (Quasi Peak/ Average)Limit (dBuV)

### 7.2.6. TEST RESULTS

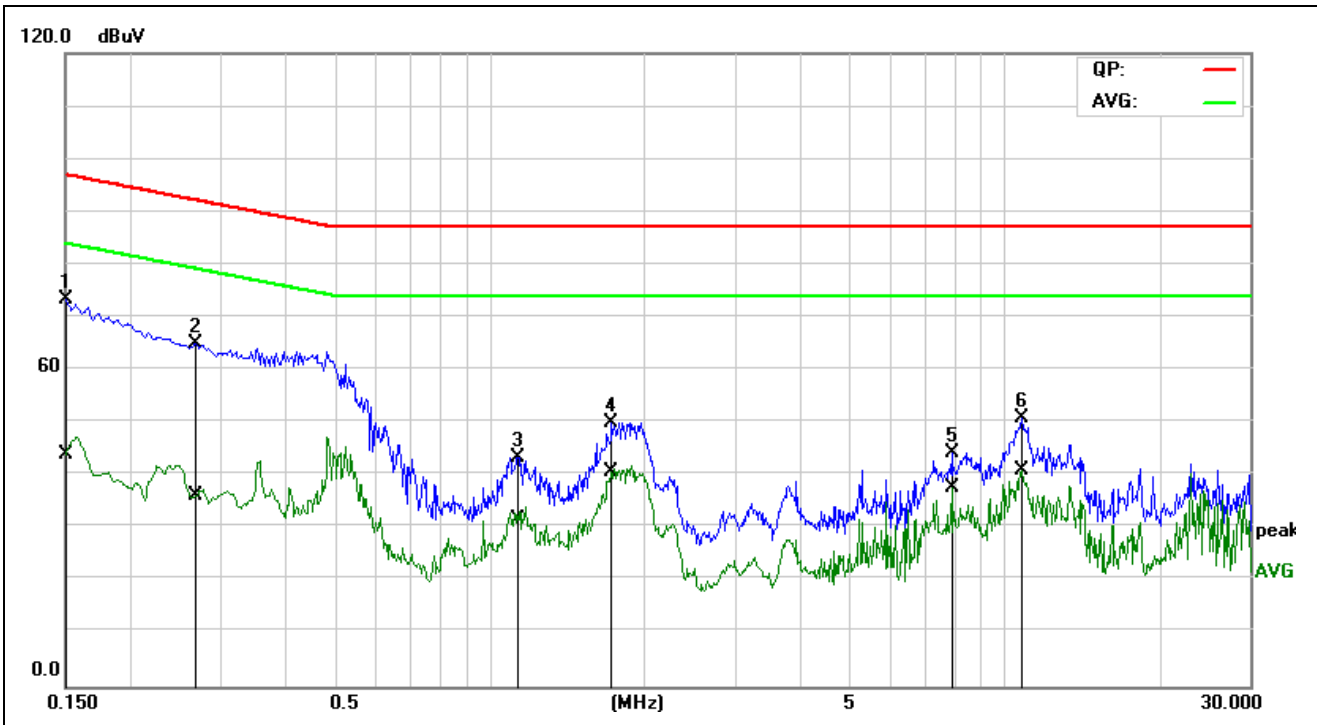
|              |                           |                   |           |
|--------------|---------------------------|-------------------|-----------|
| Job No.:     | C180913E14                | Date:             | 2018/9/19 |
| Company:     | HAUTO                     | Time:             | 15:39:23  |
| Standard:    | ISN(Voltage)-CLASS A (QP) | Temp.(C)/Hum.(%): | 22(C)/41% |
| Test item:   | ISN test                  | Test By:          | King.Xu   |
| Model:       | HTS-E913-1CK              | Test Voltage:     | DC 24V    |
| Description: | LAN:10M                   |                   |           |



| No. | Frequency | QuasiPeak reading | Average reading | Correction factor | QuasiPeak result | Average result | QuasiPeak limit | Average limit | QuasiPeak margin | Average margin | Remark |
|-----|-----------|-------------------|-----------------|-------------------|------------------|----------------|-----------------|---------------|------------------|----------------|--------|
|     | (MHz)     | (dBuV)            | (dBuV)          | (dB)              | (dBuV)           | (dBuV)         | (dBuV)          | (dBuV)        | (dB)             | (dB)           |        |
| 1   | 0.1819    | 37.47             | 8.64            | 30.74             | 68.21            | 39.38          | 95.39           | 82.40         | -27.18           | -43.02         | Pass   |
| 2   | 0.4620    | 36.73             | 11.22           | 24.40             | 61.13            | 35.62          | 87.66           | 74.66         | -26.53           | -39.04         | Pass   |
| 3   | 1.7580    | 30.80             | 19.63           | 20.80             | 51.60            | 40.43          | 87.00           | 74.00         | -35.40           | -33.57         | Pass   |
| 4   | 8.7500    | 31.76             | 29.80           | 20.05             | 51.81            | 49.85          | 87.00           | 74.00         | -35.19           | -24.15         | Pass   |
| 5   | 10.7900   | 31.11             | 17.94           | 20.11             | 51.22            | 38.05          | 87.00           | 74.00         | -35.78           | -35.95         | Pass   |
| 6*  | 12.4980   | 32.25             | 30.24           | 20.16             | 52.41            | 50.40          | 87.00           | 74.00         | -34.59           | -23.60         | Pass   |

**Note:** 1. The other emission levels were very low against the limit.

|              |                           |                   |           |
|--------------|---------------------------|-------------------|-----------|
| Job No.:     | C180913E14                | Date:             | 2018/9/19 |
| Company:     | HAUTO                     | Time:             | 15:41:59  |
| Standard:    | ISN(Voltage)-CLASS A (QP) | Temp.(C)/Hum.(%): | 22(C)/41% |
| Test item:   | ISN test                  | Test By:          | King.Xu   |
| Model:       | HTS-E913-1CK              | Test Voltage:     | DC 24V    |
| Description: | LAN:100M                  |                   |           |



| No. | Frequency<br>(MHz) | QuasiPeak<br>reading<br>(dBuV) | Average<br>reading<br>(dBuV) | Correction<br>factor<br>(dB) | QuasiPeak<br>result<br>(dBuV) | Average<br>result<br>(dBuV) | QuasiPeak<br>limit<br>(dBuV) | Average<br>limit<br>(dBuV) | QuasiPeak<br>margin<br>(dB) | Average<br>margin<br>(dB) | Remark |
|-----|--------------------|--------------------------------|------------------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|---------------------------|--------|
| 1*  | 0.1500             | 40.97                          | 11.37                        | 32.45                        | 73.42                         | 43.82                       | 96.99                        | 84.00                      | -23.57                      | -40.18                    | Pass   |
| 2   | 0.2700             | 37.12                          | 8.19                         | 27.86                        | 64.98                         | 36.05                       | 92.12                        | 79.12                      | -27.14                      | -43.07                    | Pass   |
| 3   | 1.1380             | 22.48                          | 10.74                        | 21.00                        | 43.48                         | 31.74                       | 87.00                        | 74.00                      | -43.52                      | -42.26                    | Pass   |
| 4   | 1.7340             | 29.26                          | 20.00                        | 20.80                        | 50.06                         | 40.80                       | 87.00                        | 74.00                      | -36.94                      | -33.20                    | Pass   |
| 5   | 7.9220             | 24.38                          | 17.75                        | 19.99                        | 44.37                         | 37.74                       | 87.00                        | 74.00                      | -42.63                      | -36.26                    | Pass   |
| 6   | 10.7940            | 30.69                          | 20.91                        | 20.11                        | 50.80                         | 41.02                       | 87.00                        | 74.00                      | -36.20                      | -32.98                    | Pass   |

**Note:** 1. The other emission levels were very low against the limit.

## 7.3. RADIATED EMISSION MEASUREMENT

### 7.3.1. LIMITS

#### Below 1GHz

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

#### 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 55032:2012 clause 8, the measurement frequency range shown in the following table:

| Highest frequency generated or used within the EUT or on which the EUT operates or tunes (MHz) | Upper frequency of measurement range (MHz)                  |
|------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Less than 108                                                                                  | 1000                                                        |
| 108-500                                                                                        | 2000                                                        |
| 500-1000                                                                                       | 5000                                                        |
| Above 1000                                                                                     | 5 times of the highest frequency or 6GHz, whichever is less |

### 7.3.2. TEST INSTRUMENTS

| Radiated Emission (Test Site Anechoic Chamber (10m chamber)) |                |             |               |                  |                 |
|--------------------------------------------------------------|----------------|-------------|---------------|------------------|-----------------|
| Name of Equipment                                            | Manufacturer   | Model       | Serial Number | Calibration Date | Calibration Due |
| EMI Test Receiver                                            | R&S            | ESCI        | 100002        | 02/26/2018       | 02/25/2019      |
| EMI Test Receiver                                            | R&S            | ESCI        | 101379        | 12/27/2017       | 12/26/2018      |
| Bilog Antenna                                                | Sunol          | JB1         | A110204-1     | 11/05/2017       | 11/04/2018      |
| Bilog Antenna                                                | Sunol          | JB1         | A110204-2     | 05/26/2018       | 05/25/2019      |
| Pre-Amplifier                                                | Anritsu        | MH648A      | M64192        | 12/27/2017       | 12/26/2018      |
| Pre-Amplifier                                                | Mini-circuits  | ZFL-1000VH2 | 070306        | 12/27/2017       | 12/26/2018      |
| Test Software                                                | EZ-EMC ver.3A1 |             |               |                  |                 |

**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.

| Radiated Emission (3M Semi Anechoic Chamber (977)) |                |                      |               |                  |                 |
|----------------------------------------------------|----------------|----------------------|---------------|------------------|-----------------|
| Name of Equipment                                  | Manufacturer   | Model                | Serial Number | Calibration Date | Calibration Due |
| Spectrum Analyzer                                  | R&S            | FSU26                | 200789        | 07/13/2018       | 07/12/2019      |
| Amplifier                                          | Miteq          | JS41-00101800-32-10P | 1675713       | 07/13/2018       | 07/12/2019      |
| Horn-antenna                                       | SCHWARZBECK    | BBHA9120D            | 266           | 02/26/2018       | 02/25/2019      |
| Test Software                                      | EZ-EMC ver.3A1 |                      |               |                  |                 |

**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.

### 7.3.3. TEST PROCEDURE

#### 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 FRP turntable (Below 1GHz) and a EPS turntable (Above 1GHz) 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 15cm 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.

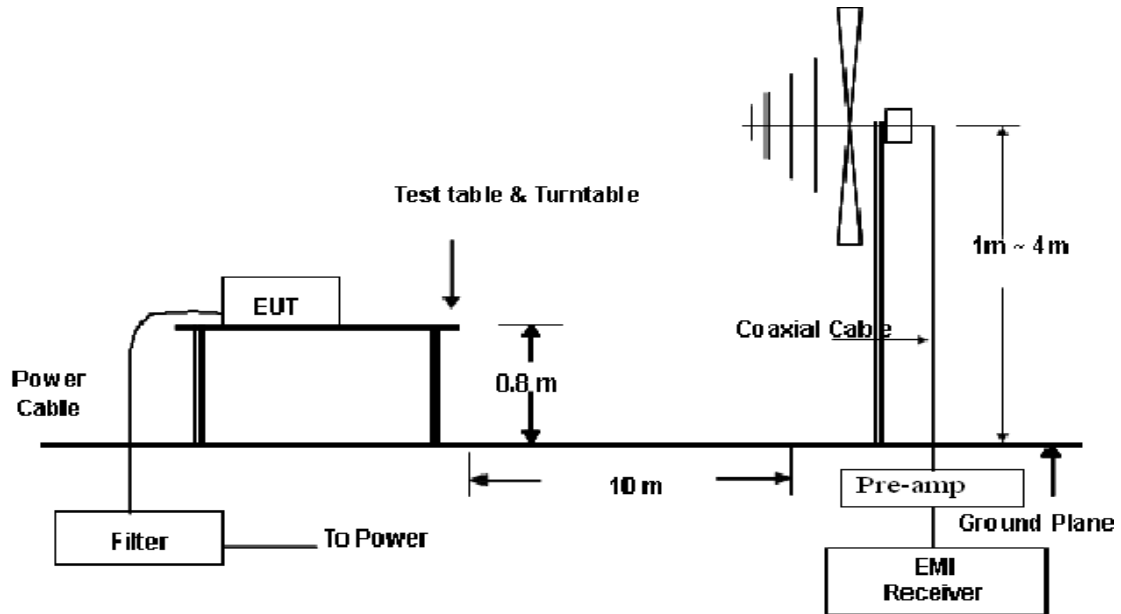
The Analyzer / Receiver scanned from 30MHz to 6000MHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading 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.

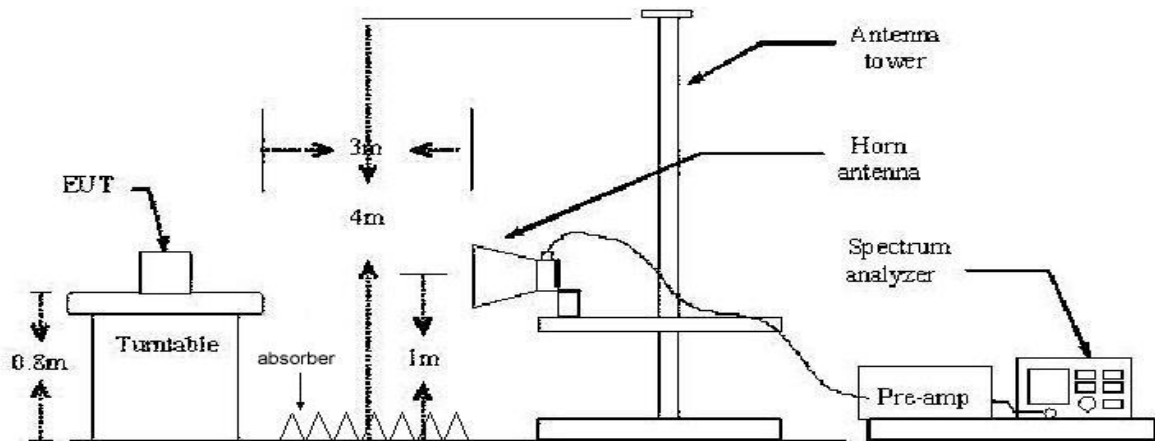
The test data of the worst-case condition(s) was recorded.

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

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (°) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|-------------|------------|--------|
| XX.X.XXX        | 41.74          | -8.38                 | 33.36           | 30.00          | 3.36        | 100         | 160        | peak   |

Freq. = Emission frequency in MHz  
 Reading = Uncorrected Analyzer/Receiver reading  
 Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain  
 Result = Reading + Factor  
 Limit = Limit stated in standard  
 Margin = Reading in reference to limit  
 Height = Height of antenna  
 Degree = Position of turn table  
 Remark = Information of value (Peak/ Quasi Peak/Average)

#### Calculation Formula

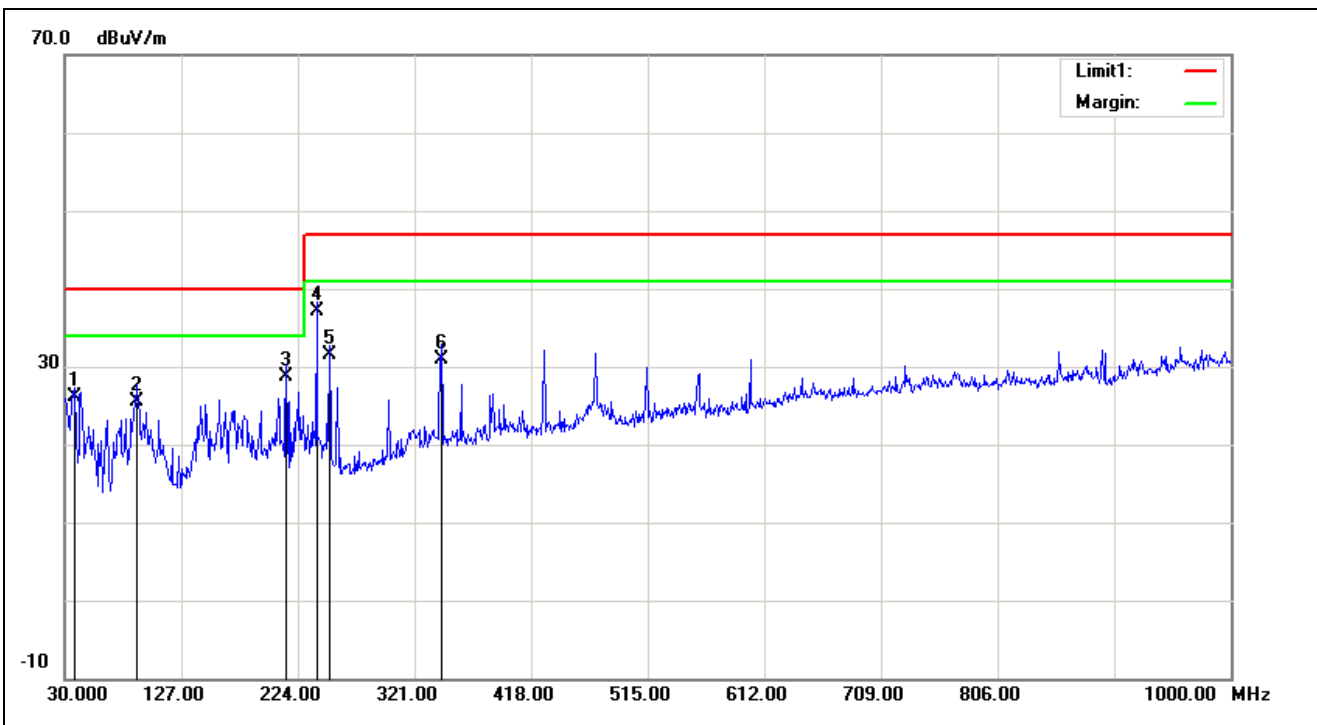
Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)



### 7.3.6. TEST RESULTS

#### Below 1GHz

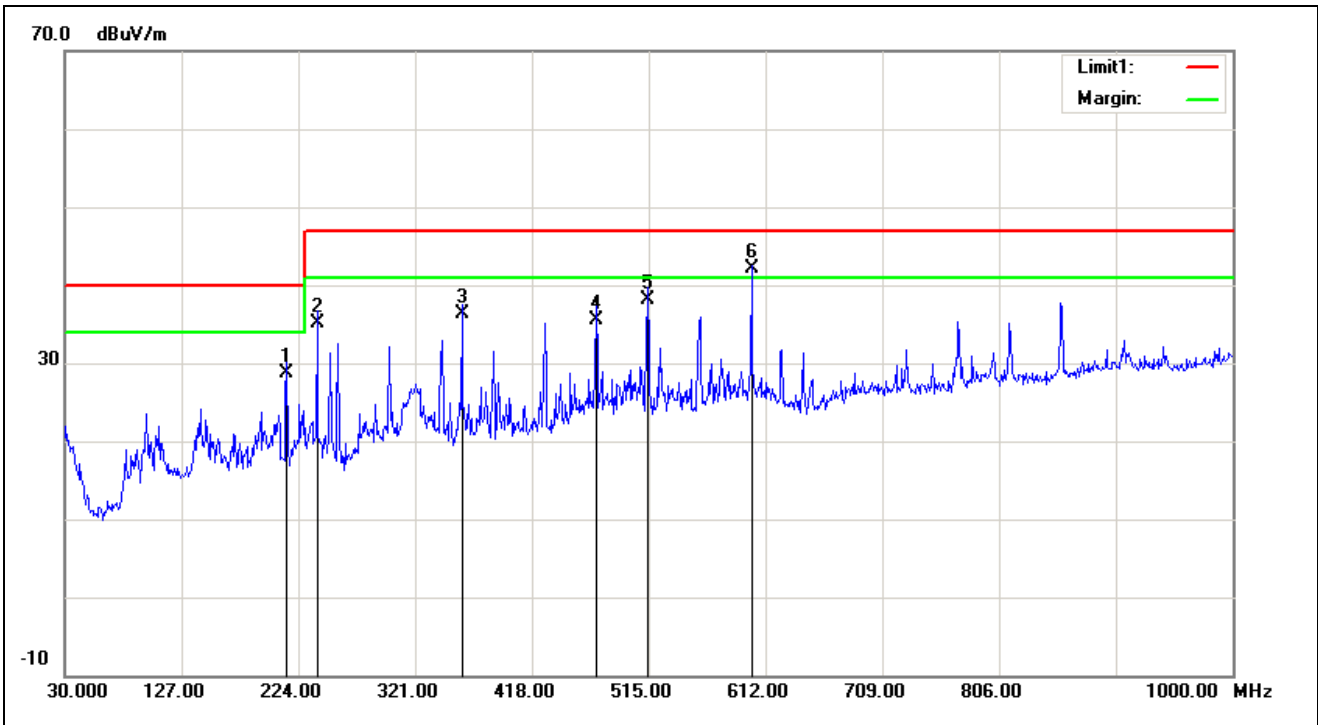
|                     |                  |                |               |
|---------------------|------------------|----------------|---------------|
| Job No.:            | C180913E14       | Ant. Polar.:   | Vertical      |
| Standard:           | EN 55032 Class A | Test Distance: | 10m           |
| Test item:          | Radiation Test   | Power:         | DC 24V        |
| Temp.(C)/Hum.(%RH): | 26 (C)/ 60%RH    | Date:2018-9-19 | Time:18:54:29 |
| Company:            | HAUTO            | Test By:       | Osmond.Chen   |
| Model:              | HTS-E913-1CK     | Description:   | Mode 1        |



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (deg) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|-------------|--------------|--------|
| 1   | 38.7300         | 35.11          | -9.10                | 26.01           | 40.00          | -13.99      | 100         | 200          | QP     |
| 2   | 90.1400         | 40.31          | -14.89               | 25.42           | 40.00          | -14.58      | 300         | 151          | QP     |
| 3   | 214.3000        | 37.95          | -9.33                | 28.62           | 40.00          | -11.38      | 100         | 182          | QP     |
| 4   | 239.5200        | 46.61          | -9.47                | 37.14           | 47.00          | -9.86       | 100         | 245          | QP     |
| 5   | 250.1900        | 40.94          | -9.52                | 31.42           | 47.00          | -15.58      | 100         | 114          | QP     |
| 6   | 343.3100        | 36.55          | -5.66                | 30.89           | 47.00          | -16.11      | 400         | 209          | QP     |

**Note:** 1. The other emission levels were very low against the limit.

|                     |                  |                |               |
|---------------------|------------------|----------------|---------------|
| Job No.:            | C180913E14       | Ant. Polar.:   | Horizontal    |
| Standard:           | EN 55032 Class A | Test Distance: | 10m           |
| Test item:          | Radiation Test   | Power:         | DC 24V        |
| Temp.(C)/Hum.(%RH): | 26 (C)/ 60%RH    | Date:2018-9-19 | Time:18:54:28 |
| Company:            | HAUTO            | Test By:       | Osmond.Chen   |
| Model:              | HTS-E913-1CK     | Description:   | Mode 1        |

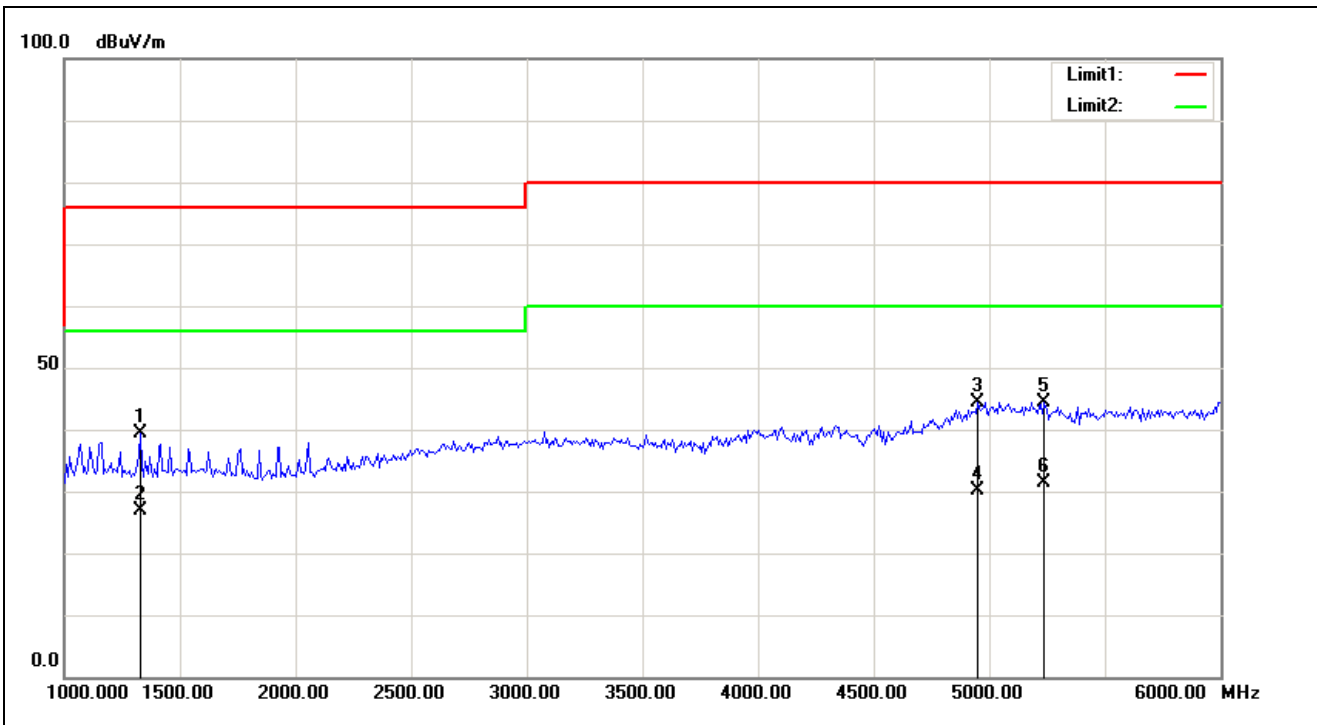


| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (deg) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|-------------|--------------|--------|
| 1   | 214.3000        | 40.00          | -11.38               | 28.62           | 40.00          | -11.38      | 400         | 282          | QP     |
| 2   | 239.5200        | 46.67          | -11.55               | 35.12           | 47.00          | -11.88      | 300         | 301          | QP     |
| 3   | 359.8000        | 43.74          | -7.49                | 36.25           | 47.00          | -10.75      | 200         | 323          | QP     |
| 4   | 471.3500        | 40.29          | -4.87                | 35.42           | 47.00          | -11.58      | 200         | 313          | QP     |
| 5   | 514.0300        | 41.99          | -3.87                | 38.12           | 47.00          | -8.88       | 200         | 327          | QP     |
| 6   | 600.5000        | 44.10          | -1.97                | 42.13           | 47.00          | -4.87       | 100         | 190          | QP     |

**Note:** 1. The other emission levels were very low against the limit.

### Above 1GHz

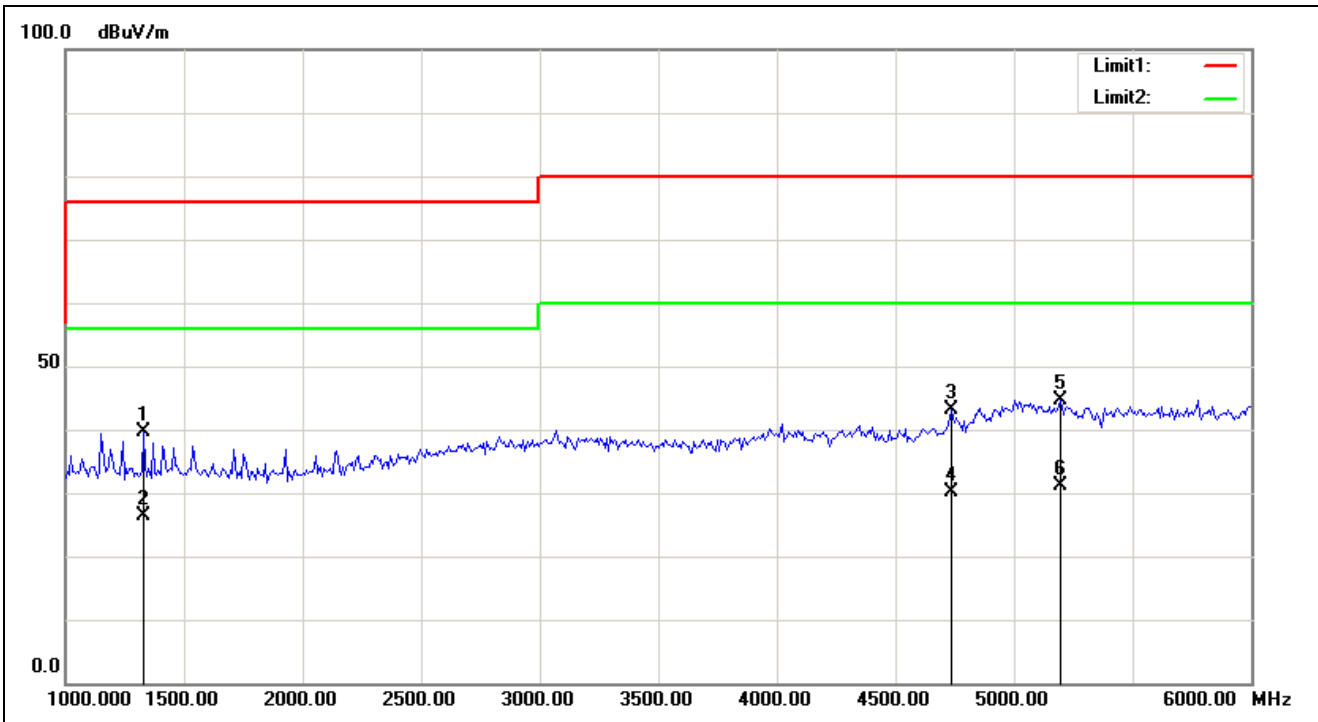
|                     |                  |                |              |
|---------------------|------------------|----------------|--------------|
| Job No.:            | C180913E14       | Ant. Polar.:   | Vertical     |
| Standard:           | EN 55032 Class A | Test Distance: | 3m           |
| Test item:          | Radiation Test   | Power:         | DC 24V       |
| Temp.(C)/Hum.(%RH): | 24 (C) 42%RH     | Date:2018-9-20 | Time:9:40:32 |
| Company:            | HAUTO            | Test By:       | Tim.Cao      |
| Model:              | HTS-E913-1CK     | Description:   | Mode 1       |



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (deg.) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|-------------|---------------|--------|
| 1   | 1328.525        | 51.07          | -11.60               | 39.47           | 76.00          | -36.53      | 100         | 301           | peak   |
| 2   | 1328.525        | 38.42          | -11.60               | 26.82           | 56.00          | -29.18      | 100         | 301           | AVG    |
| 3   | 4950.320        | 44.23          | 0.26                 | 44.49           | 80.00          | -35.51      | 100         | 142           | peak   |
| 4   | 4950.320        | 29.98          | 0.26                 | 30.24           | 60.00          | -29.76      | 100         | 142           | AVG    |
| 5   | 5238.782        | 43.52          | 0.80                 | 44.32           | 80.00          | -35.68      | 100         | 33            | peak   |
| 6   | 5238.782        | 30.62          | 0.80                 | 31.42           | 60.00          | -28.58      | 100         | 33            | AVG    |

**Note:** 1. The other emission levels were very low against the limit.

|                     |                  |                |              |
|---------------------|------------------|----------------|--------------|
| Job No.:            | C180913E14       | Ant. Polar.:   | Horizontal   |
| Standard:           | EN 55032 Class A | Test Distance: | 3m           |
| Test item:          | Radiation Test   | Power:         | DC 24V       |
| Temp.(C)/Hum.(%RH): | 24 (C) 42%RH     | Date:2018-9-20 | Time:9:34:15 |
| Company:            | HAUTO            | Test By:       | Tim.Cao      |
| Model:              | HTS-E913-1CK     | Description:   | Mode 1       |



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (deg.) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|-------------|---------------|--------|
| 1   | 1328.525        | 51.25          | -11.60               | 39.65           | 76.00          | -36.35      | 100         | 301           | peak   |
| 2   | 1328.525        | 37.95          | -11.60               | 26.35           | 56.00          | -29.65      | 100         | 301           | AVG    |
| 3   | 4733.974        | 44.81          | -1.59                | 43.22           | 80.00          | -36.78      | 100         | 141           | peak   |
| 4   | 4733.974        | 31.83          | -1.59                | 30.24           | 60.00          | -29.76      | 100         | 141           | AVG    |
| 5   | 5198.718        | 43.91          | 0.78                 | 44.69           | 80.00          | -35.31      | 100         | 33            | peak   |
| 6   | 5198.718        | 30.46          | 0.78                 | 31.24           | 60.00          | -28.76      | 100         | 33            | AVG    |

**Note:** 1. The other emission levels were very low against the limit.

## 7.4. HARMONICS CURRENT MEASUREMENT

### 7.4.1. LIMITS OF HARMONICS CURRENT MEASUREMENT

| Limits for Class A equipment |                                         | Limits for Class D equipment |                                                  |                                         |
|------------------------------|-----------------------------------------|------------------------------|--------------------------------------------------|-----------------------------------------|
| Harmonics Order<br>n         | Max. permissible harmonics current<br>A | Harmonics Order<br>n         | Max. permissible harmonics current per watt mA/W | Max. permissible harmonics current<br>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.

### 7.4.2. TEST INSTRUMENTS

| Power Harmonics & Voltage Fluctuation and Flicker |              |            |               |                  |                 |
|---------------------------------------------------|--------------|------------|---------------|------------------|-----------------|
| Name of Equipment                                 | Manufacturer | Model      | Serial Number | Calibration Date | Calibration Due |
| Harmonic & Flicker Tester                         | SCHAFFNER    | CCN 1000-1 | 72585         | 10/31/2017       | 10/30/2018      |
| AC Power Source                                   | SCHAFFNER    | NSG 1007   | 54788         | 10/31/2017       | 10/30/2018      |

- 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.

### 7.4.3. TEST PROCEDURE

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.

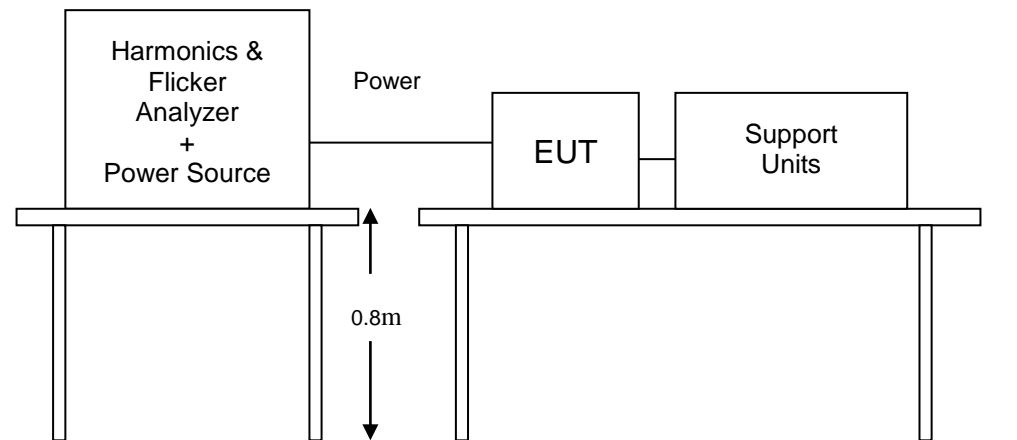
The classification of EUT is according to section 5 of EN 61000-3-2.

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.

### 7.4.4. TEST SETUP



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

### 7.4.5. TEST RESULTS

|                                 |     |                     |     |
|---------------------------------|-----|---------------------|-----|
| <b>Power Consumption</b>        | N/A | <b>Test Results</b> | N/A |
| <b>Environmental Conditions</b> | N/A | <b>Limits</b>       | N/A |
| <b>Test Mode</b>                | N/A | <b>Tested by</b>    | N/A |

Note: The EUT is DC supply, so the test item needn't performance.

## 7.5. VOLTAGE FLUCTUATION AND FLICKER MEASUREMENT

### 7.5.1. LIMITS OF VOLTAGE FLUCTUATION AND FLICKER MEASUREMENT

The following limits apply:

- the value of Pst shall not be greater than 1,0;
- the value of Plt shall not be greater than 0,65;
- the value of d(t) during a voltage change shall not exceed 3,3 % for more than 500 ms;
- the relative steady-state voltage change, dc, shall not exceed 3,3 %;
- the maximum relative voltage change, dmax, shall not exceed;

a) 4 % without additional conditions;

b) 6 % for equipment which is:

- switched manually, or
- switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.

NOTE The cycling frequency will be further limited by the Pst and Plt limit.

For example: a dmax of 6 % producing a rectangular voltage change characteristic twice per hour will give a Plt of about 0.65.

c) 7 % for equipment which is:

- attended whilst in use (for example: hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as lawn mowers, portable tools such as electric drills), or
- switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

Pst and Plt requirements shall not be applied to voltage changes caused by manual switching.

### 7.5.2. TEST INSTRUMENTS

| Power Harmonics & Voltage Fluctuation and Flicker |              |            |               |                  |                 |
|---------------------------------------------------|--------------|------------|---------------|------------------|-----------------|
| Name of Equipment                                 | Manufacturer | Model      | Serial Number | Calibration Date | Calibration Due |
| Harmonic & Flicker Tester                         | SCHAFFNER    | CCN 1000-1 | 72585         | 10/31/2017       | 10/30/2018      |
| AC Power Source                                   | SCHAFFNER    | NSG 1007   | 54788         | 10/31/2017       | 10/30/2018      |

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

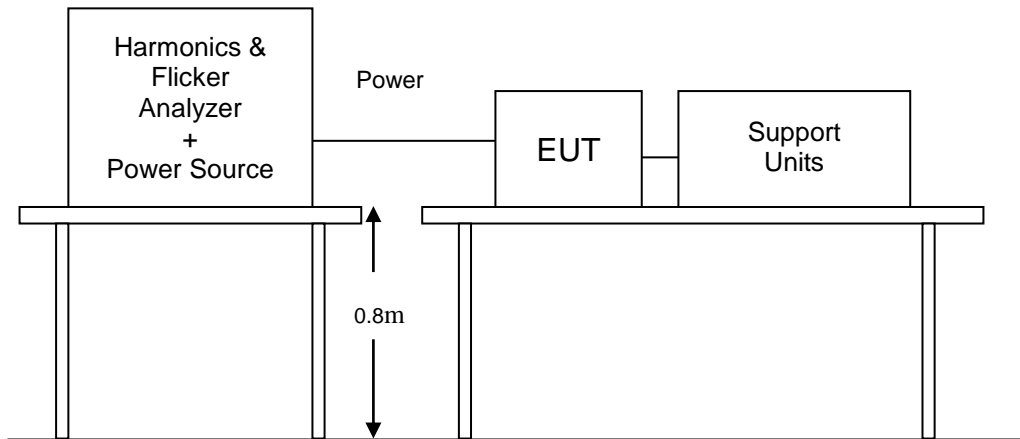
2. N.C.R = No Calibration Required.

**7.5.3. TEST PROCEDURE**

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.

**7.5.4. TEST SETUP**



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

**7.5.5. TEST RESULTS**

|                                 |     |                  |     |
|---------------------------------|-----|------------------|-----|
| <b>Observation Period (Tp)</b>  | N/A | <b>Test Mode</b> | N/A |
| <b>Environmental Conditions</b> | N/A | <b>Tested by</b> | N/A |

Note: The EUT is DC supply, so the test item needn't performance.



## 8 IMMUNITY TEST

### 8.1. GENERAL DESCRIPTION

| Product Standard                                                  | EN 55024       |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                   | Test Type      | Minimum Requirement                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Basic Standard, Specification, and Performance Criterion required | IEC 61000-4-2  | Electrostatic Discharge – ESD:<br>8KV air discharge, 4KV Contact discharge,<br>Performance Criterion B                                                                                                                                                                                                                                                                                                                                      |
|                                                                   | IEC 61000-4-3  | Radio-Frequency Electromagnetic Field Susceptibility Test – RS:<br>80 ~1000 MHz, 3V/m, 80% AM(1KHz),<br>Performance Criterion A                                                                                                                                                                                                                                                                                                             |
|                                                                   | IEC 61000-4-4  | Electrical Fast Transient/Burst - EFT,<br>AC Power Port: 1KV<br>DC Power Port: 0.5KV<br>Signal Ports and Telecommunication Ports: 0.5KV<br>Performance Criterion B                                                                                                                                                                                                                                                                          |
|                                                                   | IEC 61000-4-5  | Surge Immunity Test:<br>For Power:<br>1.2/50 $\mu$ s Open Circuit Voltage,<br>8/20 $\mu$ s Short Circuit Current,<br>AC Power Port ~ line to line: 1KV, line to earth (ground): 2KV<br>DC Power Port ~ line to earth: 0.5KV<br>Performance Criterion B<br><br>For Signal Ports and Telecommunication Ports:<br>10/700 $\mu$ s generator:<br>With primary protectors fitted:4KV<br>Without primary protectors:1KV<br>Performance Criterion C |
|                                                                   | IEC 61000-4-6  | Conducted Radio Frequency Disturbances Test –CS:<br>0.15 ~ 80 MHz, 3Vrms, 80% AM, 1KHz,<br>Performance Criterion A                                                                                                                                                                                                                                                                                                                          |
|                                                                   | IEC 61000-4-8  | Power frequency magnetic field immunity test<br>50/60 Hz, 1A/m<br>Performance Criterion A                                                                                                                                                                                                                                                                                                                                                   |
|                                                                   | IEC 61000-4-11 | Voltage Dips:AC 50Hz<br>i) >95% reduction for 0.5 period,<br>Performance Criterion B<br>ii) 30% reduction for 25 period,<br>Performance Criterion C<br><br>Voltage Interruptions:<br>>95% reduction for 250 period<br>Performance Criterion C                                                                                                                                                                                               |

## 8.2. GENERAL PERFORMANCE CRITERIA DESCRIPTION

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Criteria A:</b> | The apparatus shell continues 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.                                                                                                                                                                                                                        |
| <b>Criteria B:</b> | After test, the apparatus shell continues 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.<br><br>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. |
| <b>Criteria C:</b> | 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.<br><br>Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

### 8.3. ELECTROSTATIC DISCHARGE (ESD)

#### 8.3.1. TEST SPECIFICATION

|                             |                                                                                                                                                  |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic Standard:</b>      | IEC 61000-4-2                                                                                                                                    |
| <b>Discharge Impedance:</b> | 330 ohm / 150 pF                                                                                                                                 |
| <b>Discharge Voltage:</b>   | Air Discharge: 2 ; 4 ; 8 KV (Direct)<br>Contact Discharge: 2 ; 4 KV (Direct/Indirect)                                                            |
| <b>Polarity:</b>            | Positive & Negative                                                                                                                              |
| <b>Number of Discharge:</b> | Air Discharge: minimum 10 times at each test point for each polarity<br>Contact Discharge: minimum 25 times at each test point for each polarity |
| <b>Discharge Mode:</b>      | Single Discharge<br>1 second minimum                                                                                                             |

#### 8.3.2. TEST INSTRUMENT

| Electrostatic Discharge |              |             |               |                  |                 |
|-------------------------|--------------|-------------|---------------|------------------|-----------------|
| Name of Equipment       | Manufacturer | Model       | Serial Number | Calibration Date | Calibration Due |
| ESD Simulator           | EM TEST      | DITO 509030 | V0936105118   | 02/27/2018       | 02/26/2019      |

**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.

### 8.3.3. TEST PROCEDURE

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.

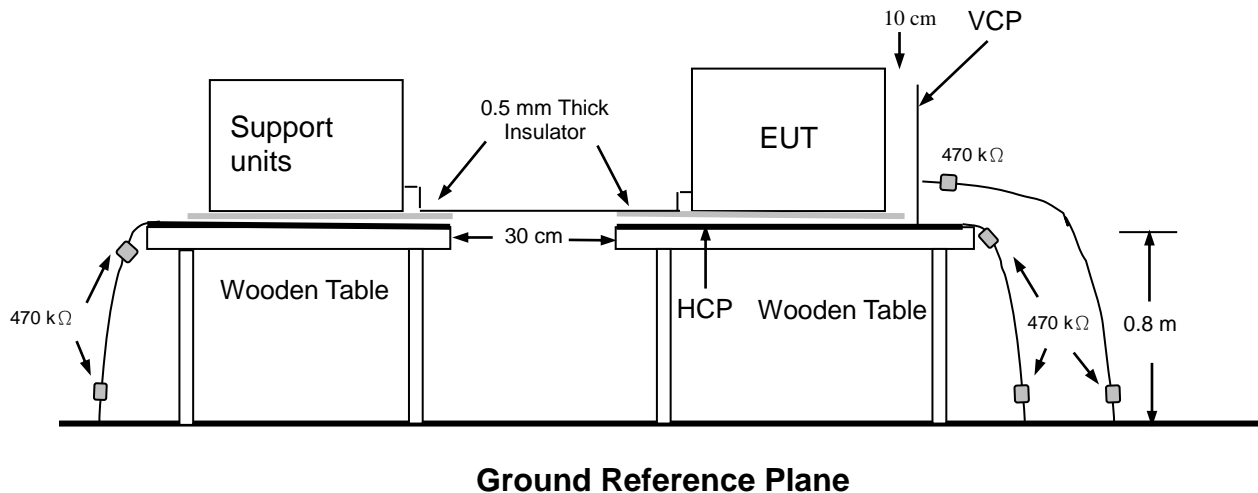
b) Air discharges at slots and apertures and insulating surfaces:

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 EN 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 10cm 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



#### Ground Reference Plane

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 940kΩ total impedance.

The equipment under test, was installed in a representative system as described in section 7 of EN 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 EN 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                  | 22°C     | Humidity     | 43% RH    |
| Pressure                     | 1017mbar | Tested By    | Tony.qi   |
| Test Mode                    | Mode 1   | Date of Test | 2018-9-25 |
| Required Passing Performance |          | Criterion B  |           |

| Air Discharge |                                     |                                     |                                     |                          |                       |         |
|---------------|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------|-----------------------|---------|
| Test Points   | Test Levels                         |                                     |                                     |                          | Performance Criterion | Results |
|               | ± 2 KV                              | ± 4 KV                              | ± 8 KV                              | ± 15 KV                  |                       |         |
| 1-22          | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | A                     | Pass    |
| 29-36         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | A                     | Pass    |

| Contact Discharge |                                     |                                     |                          |                          |                       |         |
|-------------------|-------------------------------------|-------------------------------------|--------------------------|--------------------------|-----------------------|---------|
| Test Points       | Test Levels                         |                                     |                          |                          | Performance Criterion | Results |
|                   | ± 2 KV                              | ± 4 KV                              | ± 6 KV                   | ± 8 KV                   |                       |         |
| HCP               | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | A                     | Pass    |
| VCP               | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | A                     | Pass    |
| 23-28             | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | A                     | Pass    |

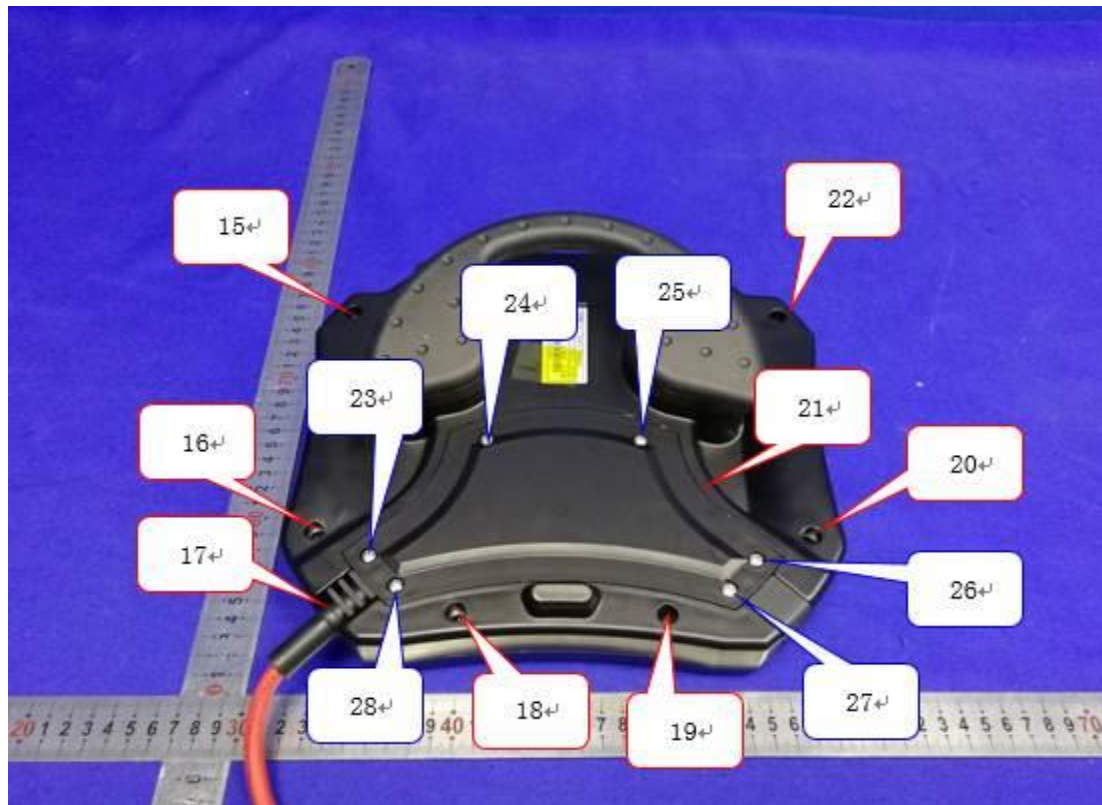
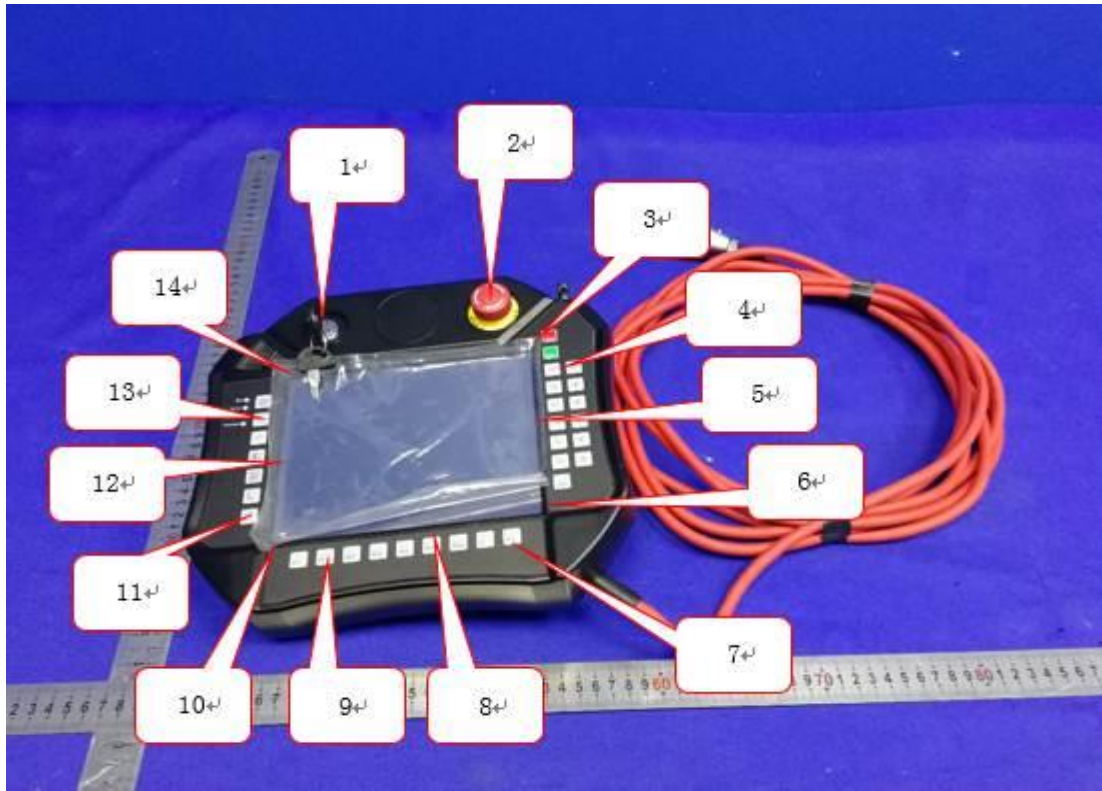
**Performance Criterion :**

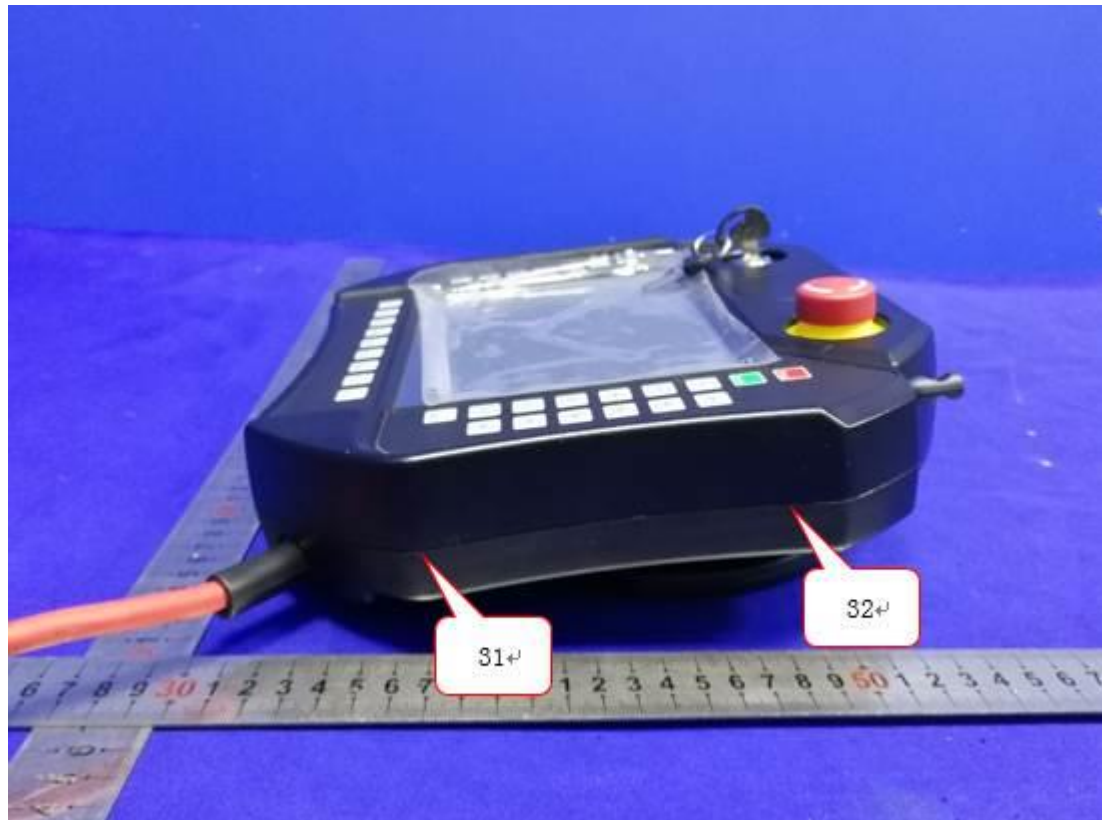
A : There was no change compared with initial operation during and after the test.

No unintentional response was found during the test.

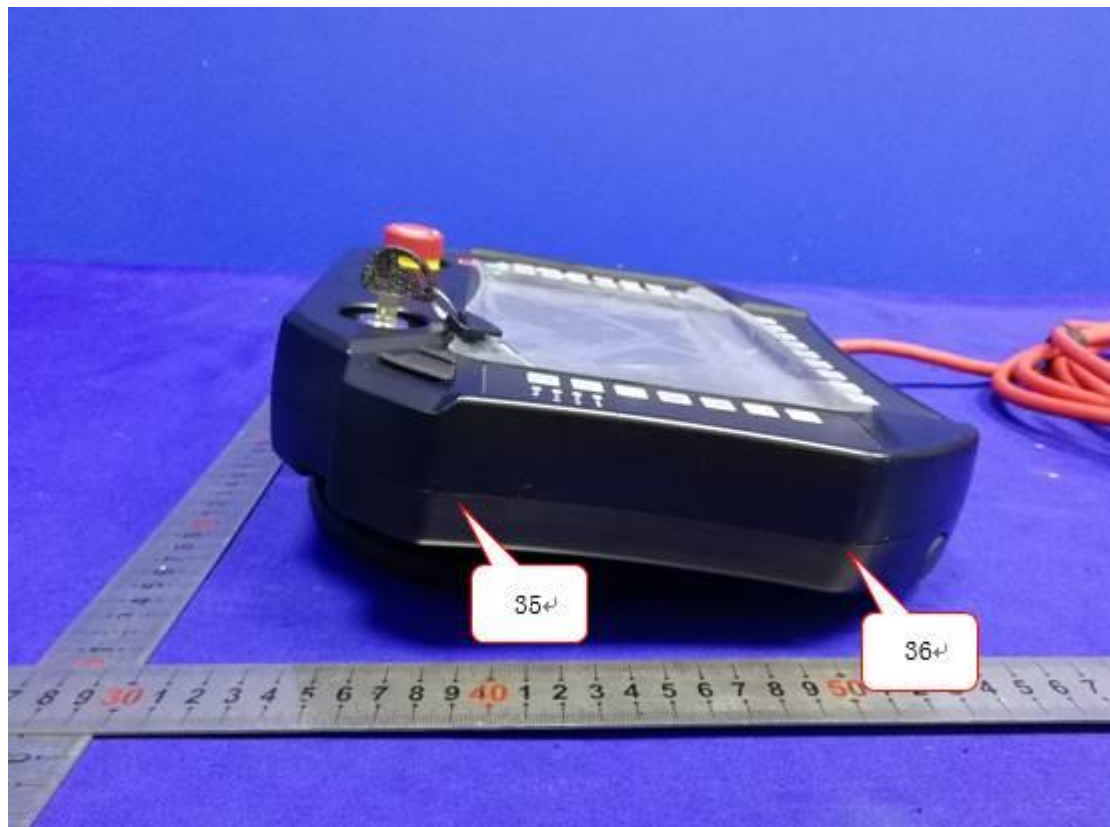
B : Performance degradation or loss of function part during the test, but can self-recover .

The Photo for Discharge Points of EUT









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

### 8.4.1. TEST SPECIFICATION

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

### 8.4.2. TEST INSTRUMENT

| Radiated susceptibility                          |              |                    |               |                  |                 |
|--------------------------------------------------|--------------|--------------------|---------------|------------------|-----------------|
| Name of Equipment                                | Manufacturer | Model              | Serial Number | Calibration Date | Calibration Due |
| E-Field Sensor                                   | AR Worldwide | FL7006<br>100K-6G  | 0342390       | 05/03/2018       | 05/02/2019      |
| Amplifier Research<br>(80~1000MHz 150w)          | AR Worldwide | 150W1000M1         | 320947        | N.C.R            | N.C.R           |
| Amplifier Research<br>(1~6GHz 50w)               | AR Worldwide | 50S1G6M1           | 0342706       | N.C.R            | N.C.R           |
| Dual Directional<br>Coupler (1-11G)              | AR Worldwide | C1-A47NFNF<br>35dB | 001           | N.C.R            | N.C.R           |
| Dual Directional<br>Coupler<br>(80~1000MHz 400w) | AR Worldwide | DC6180             | 302211        | N.C.R            | N.C.R           |
| RF POWER METER                                   | BOONTON      | 4232A-01           | 1614          | 02/26/2018       | 02/25/2019      |
| POWER SENSOR                                     | BOONTON      | 51011-EMC          | 34149         | 02/26/2018       | 02/25/2019      |
| POWER SENSOR                                     | BOONTON      | 51011A-EMC         | 36351         | 07/13/2018       | 07/12/2019      |
| Antenna                                          | AR Worldwide | TP1000A            | 302624        | N.C.R            | N.C.R           |
| Laser probe interface                            | AR Worldwide | F1700              | 0354057       | 05/03/2018       | 05/02/2019      |
| Synthesized Signal<br>Generator                  | AGILENT      | 83732B             | US37101915    | 02/26/2018       | 02/25/2019      |

**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

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

a) The testing was performed in a fully anechoic chamber. The EUT and load, which are placed on a table that is 0.8 meter above ground, are placed with one coincident with the calibration plane such that the distance from antenna to the EUT was 3 meters.

b) All the scanning conditions are as follows:

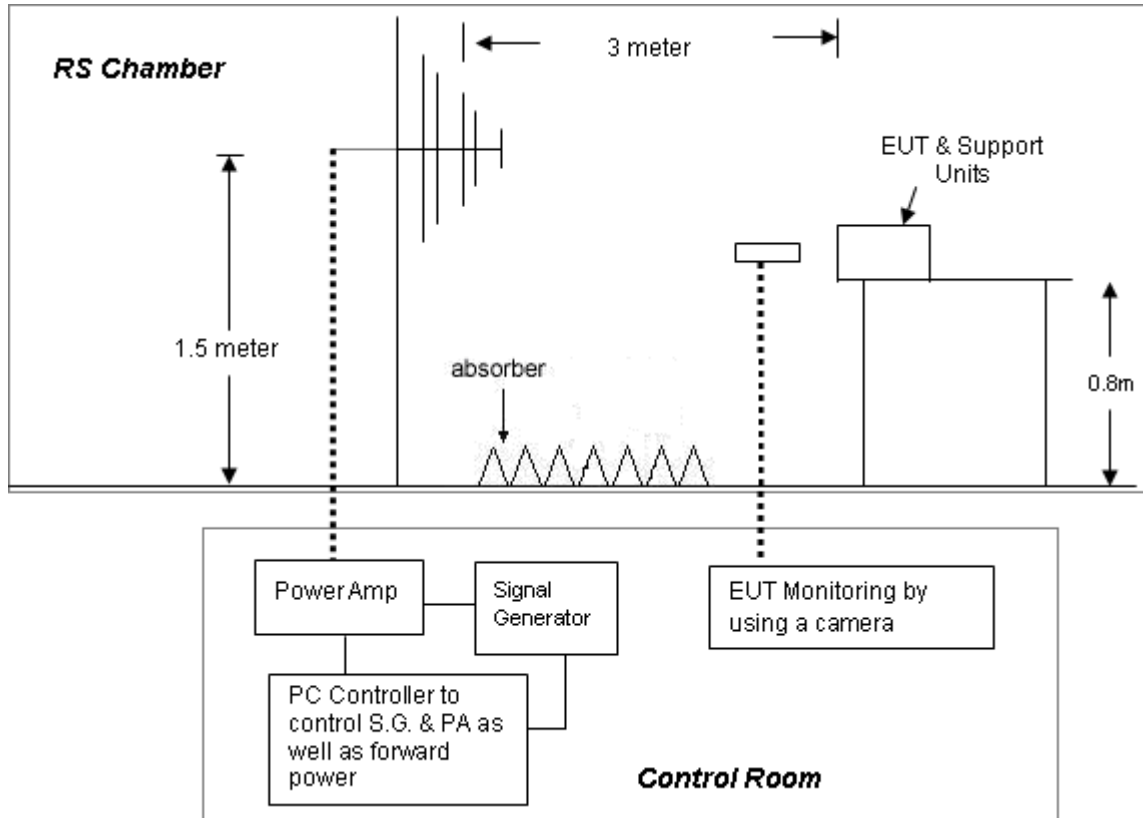
| Condition of Test                   | Remarks                        |
|-------------------------------------|--------------------------------|
| 1. Field Strength                   | 3 V/m Level 2                  |
| 2. Radiated Signal                  | AM80% Modulated with 1kHz      |
| 3. Scanning Frequency               | 80MHz - 1000MHz                |
| 4. Dwell Time                       | 3 Seconds                      |
| 5. Frequency step size $\Delta f$ : | 1%                             |
| 6. The rate of Swept of Frequency   | $1.5 \times 10^{-3}$ decades/s |

c) The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.

d) The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

e) In order to judge the EUT performance, a CCD camera is used to monitor EUT screen.

## 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 EN 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 EN 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 | 22°C     | Humidity                     | 48% RH      |
| Pressure    | 1017mbar | Dwell Time                   | 3 sec.      |
| Test Mode   | Mode 1   | Date of Test                 | 2018-9-23   |
| Tested By   | Tony.qi  | Required Passing Performance | Criterion A |

| Frequency (MHz) | Polarity | Azimuth | Field Strength (V/m) | Performance Criterion | Result |
|-----------------|----------|---------|----------------------|-----------------------|--------|
| 80 ~ 1000       | H&V      | 0       | 3                    | A                     | Pass   |
| 80 ~ 1000       | H&V      | 90      | 3                    | A                     | Pass   |
| 80 ~ 1000       | H&V      | 180     | 3                    | A                     | Pass   |
| 80 ~ 1000       | H&V      | 270     | 3                    | A                     | Pass   |

**Performance Criterion :**

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

## 8.5. ELECTRICAL FAST TRANSIENT (EFT)

### 8.5.1. TEST SPECIFICATION

|                            |                                                                                               |
|----------------------------|-----------------------------------------------------------------------------------------------|
| <b>Basic Standard:</b>     | IEC 61000-4-4                                                                                 |
| <b>Test Voltage:</b>       | AC Power Port: 1KV<br>DC Power Port: 0.5KV<br>Signal Ports and Telecommunication Ports: 0.5KV |
| <b>Polarity:</b>           | Positive & Negative                                                                           |
| <b>Impulse Frequency:</b>  | 5 kHz (100 kHz for XDSL equipment)                                                            |
| <b>Impulse Wave-shape:</b> | 5/50 ns                                                                                       |
| <b>Burst Duration:</b>     | 15 ms                                                                                         |
| <b>Burst Period:</b>       | 300 ms                                                                                        |
| <b>Test Duration:</b>      | Not less than 1 min.                                                                          |

### 8.5.2. TEST INSTRUMENT

| Electrical fast transient/burst |              |            |                        |                  |                 |
|---------------------------------|--------------|------------|------------------------|------------------|-----------------|
| Name of Equipment               | Manufacturer | Model      | Serial Number          | Calibration Date | Calibration Due |
| EMC Immunity Tester             | EMC PARTNER  | TRA2006    | TRA2006_F-S-T-D-R-1503 | 02/26/2018       | 02/25/2019      |
| Coupling Network                | EMC PARTNER  | CN-EFT1000 | CN-EFT1000_1535        | 02/26/2018       | 02/25/2019      |

- 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

a) The EUT is placed on a table that is 0.8 meter height. A ground reference plane is placed on the table, and uses a 0.1m insulation between the EUT and ground reference plane. The minimum area of the ground reference plane is 1m\*1m, and 0.65mm thick min, and projected beyond the EUT by at least 0.1m on all sides.

b) Test on I/O and communication ports:

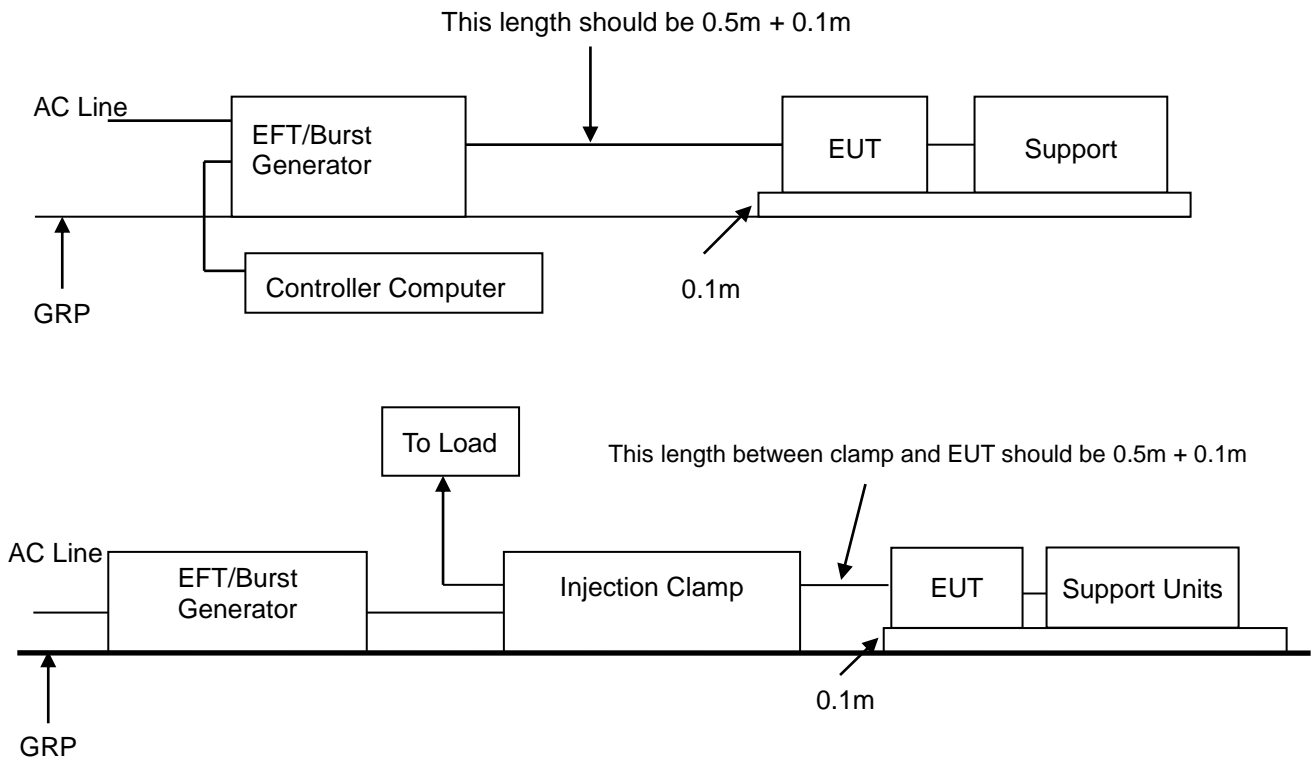
The EFT interference signal is through a coupling clamp device couples to the signal and control lines of the EUT with burst noise for 1minute.

c) Test on power supply ports:

The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal.

Each of the Line and Neutral conductors is impressed with burst noise for 1 minute. The length of the signal and power lines between the coupling device and the EUT is 0.5m.

### 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 EN 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                  | 21°C      | Humidity     | 48 % RH   |
| Pressure                     | 1017 mbar | Tested By    | Tony.qi   |
| Test Mode                    | Mode 1    | Date of Test | 2018-9-24 |
| Required Passing Performance |           | Criterion B  |           |

| Test Point | Polarity | Test Level(KV) | Performance Criterion | Result |
|------------|----------|----------------|-----------------------|--------|
| L(+)       | +/-      | 0.5            | A                     | Pass   |
| N(-)       | +/-      | 0.5            | A                     | Pass   |
| L(+)+N(-)  | +/-      | 0.5            | A                     | Pass   |
| Lan        | +/-      | 0.5            | A                     | Pass   |

**Performance Criterion :**

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

B : Performance degradation or loss of function part during the test, but can self-recover .



## 8.6. SURGE IMMUNITY TEST

### 8.6.1. TEST SPECIFICATION

|                                    |                                                                                                                                                                                                                    |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic Standard:</b>             | IEC 61000-4-5                                                                                                                                                                                                      |
| <b>Wave-Shape:</b>                 | For Power port: Combination Wave<br>1.2/50 $\mu$ s Open Circuit Voltage<br>8/20 $\mu$ s Short Circuit Current<br>For Signal Ports and Telecommunication Ports:<br>10/700 $\mu$ s generator:                        |
| <b>Test Voltage:</b>               | AC Power Port~ line to line: 1KV, line to ground: 2KV<br>DC Power Port ~ line to earth: 0.5KV<br>Signal Ports and Telecommunication Ports:<br>With primary protectors fitted:4KV<br>Without primary protectors:1KV |
| <b>Surge Input/Output:</b>         | AC Power Line: L-N / L-PE / N-PE<br>Telecommunication line: T-Ground / R-Ground                                                                                                                                    |
| <b>Generator Source Impedance:</b> | 2 ohm between networks<br>12 ohm between network and ground<br>40 ohm between telecom line and ground                                                                                                              |
| <b>Polarity:</b>                   | Positive/Negative                                                                                                                                                                                                  |
| <b>Phase Angle:</b>                | 0° / 90° / 180° / 270°                                                                                                                                                                                             |
| <b>Pulse Repetition Rate:</b>      | 1 time / min. (maximum)                                                                                                                                                                                            |
| <b>Number of Tests:</b>            | 5 positive and 5 negative at selected points                                                                                                                                                                       |

### 8.6.2. TEST INSTRUMENT

| Surge                           |              |          |                |                  |                 |
|---------------------------------|--------------|----------|----------------|------------------|-----------------|
| Name of Equipment               | Manufacturer | Model    | Serial Number  | Calibration Date | Calibration Due |
| EMC Immunity Tester             | EMC PARTNER  | TRA2006  | F-S-T-D-R-1503 | 02/26/2018       | 02/25/2019      |
| Coupling and Decoupling Network | EMC PARTNER  | CDN-UTP8 | 1511           | 12/27/2017       | 12/26/2018      |

- 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

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.

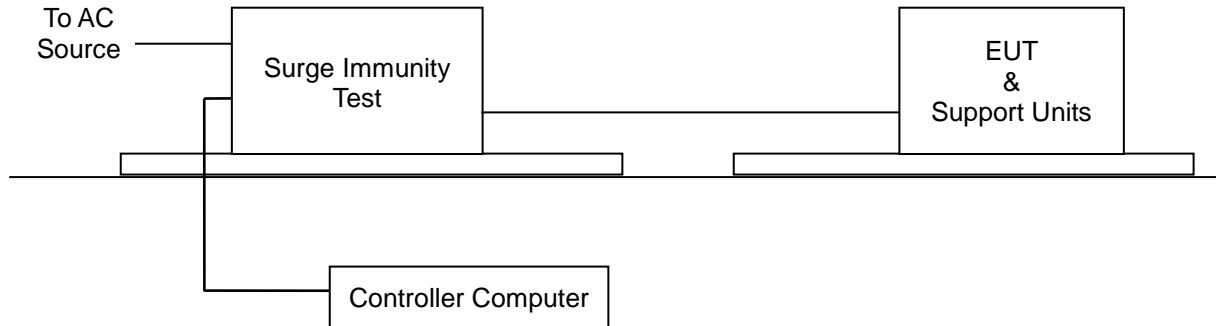
b) For test applied to unshielded un-symmetrically operated interconnection lines of EUT:

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

|                                     |           |                                                               |           |
|-------------------------------------|-----------|---------------------------------------------------------------|-----------|
| <b>Temperature</b>                  | 21 °C     | <b>Humidity</b>                                               | 48 % RH   |
| <b>Pressure</b>                     | 1017 mbar | <b>Tested By</b>                                              | Tony.qi   |
| <b>Test Mode</b>                    | Mode 1    | <b>Date of Test</b>                                           | 2018-9-26 |
| <b>Required Passing Performance</b> |           | <b>Criterion B<br/>For Power Port</b>                         |           |
|                                     |           | <b>Criterion C<br/>For Signal and Telecommunication Ports</b> |           |

| Test Point | Polarity | Test Level (KV) | Performance Criterion | Result |
|------------|----------|-----------------|-----------------------|--------|
| L(+)-N(-)  | +/-      | 0.5             | A                     | Pass   |
| Lan        | +/-      | 0.5;1           | A                     | Pass   |

**Performance Criterion :**

- A : There was no change compared with initial operation during the test.
- B : Performance degradation or loss of function part during the test, but can self-recover .
- C : The function stopped during the test, but can be recoverable manually after the test.

## 8.7. CONDUCTED RADIO FREQUENCY DISTURBANCES (CS)

### 8.7.1. TEST SPECIFICATION

|                         |                                                |
|-------------------------|------------------------------------------------|
| <b>Basic Standard:</b>  | IEC 61000-4-6                                  |
| <b>Frequency Range:</b> | 0.15 MHz ~ 80 MHz                              |
| <b>Field Strength:</b>  | 3 Vrms                                         |
| <b>Modulation:</b>      | 1kHz Sine Wave, 80%, AM Modulation             |
| <b>Frequency Step:</b>  | 1 % of preceding frequency value               |
| <b>Coupled cable:</b>   | Power Mains, Unshielded; RJ45 Line, Unshielded |
| <b>Coupling device:</b> | CDN- M216 (3 wires); T8                        |

### 8.7.2. TEST INSTRUMENT

| Conducted susceptibility                        |              |              |               |                  |                 |
|-------------------------------------------------|--------------|--------------|---------------|------------------|-----------------|
| Name of Equipment                               | Manufacturer | Model        | Serial Number | Calibration Date | Calibration Due |
| EM-Koppelzange                                  | SCHAFFNER    | KEMZ 801     | 17629         | 02/26/2018       | 02/25/2019      |
| Attenuator                                      | EURO MC      | 7860 ORGEVAL | 2226          | 09/03/2018       | 09/02/2019      |
| CDN(Coupling and Decoupling Network)            | SCHAFFNER    | CDN M216     | 16399         | 09/03/2018       | 09/02/2019      |
| CDN(Coupling and Decoupling Network)            | SCHAFFNER    | CDN M316     | 16939         | 09/03/2018       | 09/02/2019      |
| CDN                                             | TESEQ        | CDN T2-10S   | 39812         | 04/25/2018       | 04/24/2019      |
| CDN                                             | TESEQ        | CDN T4-10S   | 37195         | 04/25/2018       | 04/24/2019      |
| CDN                                             | TESEQ        | CDN T8-10S   | 42002         | 04/25/2018       | 04/24/2019      |
| Test System for Conducted and Radiated Immunity | TESEQ        | NSG 4070B    | 44279         | 02/26/2018       | 02/25/2019      |
| Amplifier                                       | TESEQ        | SCCXE75      | U2060-0916    | 02/26/2018       | 02/25/2019      |

- 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

- a) The EUT are placed on a table that is 0.8 meter height, and a Ground reference plane on the table, EUT are placed upon table and use a 10cm insulation between the EUT and Ground reference plane.

The test shell 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.

- b) For Signal Ports and Telecommunication Ports

The disturbance signal is through a coupling and decoupling networks (CDN) or EM-clamp device couples to the signal and Telecommunication lines of the EUT.

- c) For Input DC and AC Power Ports

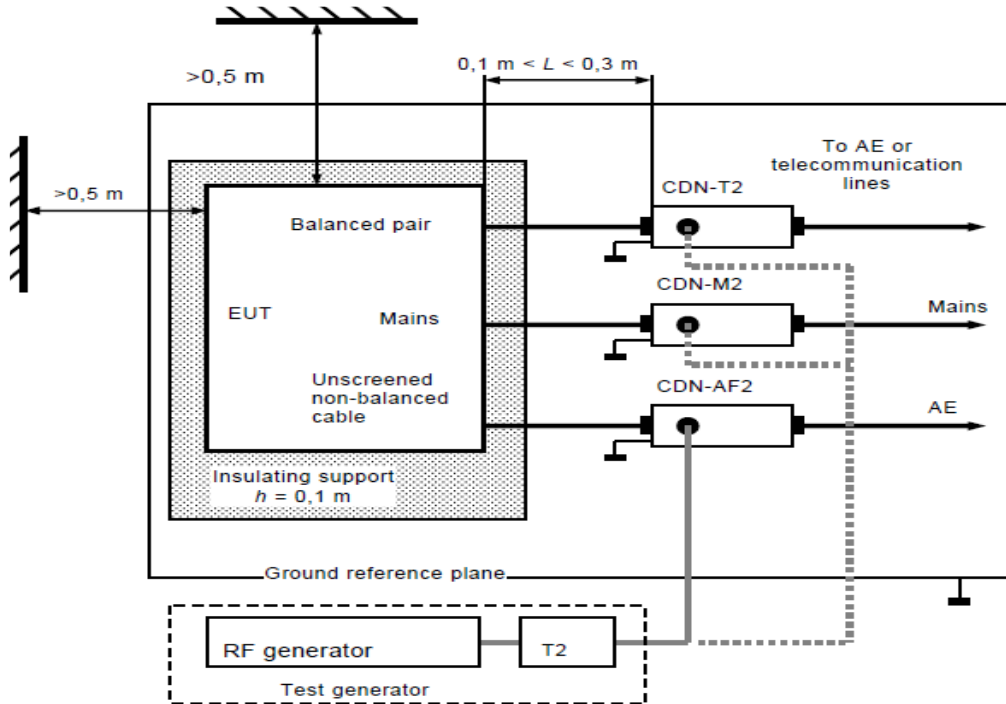
The EUT is connected to the power mains through a coupling and decoupling networks for power supply lines. And directly couples the disturbances signal into EUT.

Used CDN-M2 for two wires or CDN-M3 for three wires.

- d) All the scanning conditions are as follows:

| Condition of Test                   | Remarks                        |
|-------------------------------------|--------------------------------|
| 1. Field Strength                   | 130dBuV(3V) Level 2            |
| 2. Radiated Signal                  | AM 80% Modulated with 1kHz     |
| 3. Scanning Frequency               | 0.15MHz – 80MHz                |
| 4. Dwell Time                       | 3 Seconds                      |
| 5. Frequency step size $\Delta f$ : | 1%                             |
| 6. The rate of Swept of Frequency   | $1.5 \times 10^{-3}$ decades/s |

8.7.4. TEST SETUP



- Note:** 1. The EUT is setup 0.1m above Ground Reference Plane  
 2. The CDNs and / or EM clamp used for real test depends on ports and cables configuration of EUT.

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

|                                     |           |                     |           |
|-------------------------------------|-----------|---------------------|-----------|
| <b>Temperature</b>                  | 21 °C     | <b>Humidity</b>     | 48 % RH   |
| <b>Pressure</b>                     | 1017 mbar | <b>Tested By</b>    | Tony.qi   |
| <b>Test Mode</b>                    | Mode 1    | <b>Date of Test</b> | 2018-9-25 |
| <b>Required Passing Performance</b> |           | <b>Criterion A</b>  |           |

| Frequency Band (MHz) | Field Strength (Vrms) | Cable    | Injection Method | Performance Criterion | Result |
|----------------------|-----------------------|----------|------------------|-----------------------|--------|
| 0.15 ~ 80            | 3                     | DC Power | CDN-M216         | A                     | Pass   |
| 0.15 ~ 80            | 3                     | Lan      | T8               | A                     | Pass   |

**Performance Criterion:**

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

## 8.8. POWER FREQUENCY MAGNETIC FIELD

### 8.8.1. TEST SPECIFICATION

|                          |                    |
|--------------------------|--------------------|
| <b>Basic Standard:</b>   | IEC 61000-4-8      |
| <b>Frequency Range:</b>  | 50/60Hz            |
| <b>Field Strength:</b>   | 1A/m               |
| <b>Observation Time:</b> | 1 minute           |
| <b>Inductance Coil:</b>  | Square type, 1mx1m |

### 8.8.2. TEST INSTRUMENT

| Power frequency magnetic field     |              |          |               |                  |                 |
|------------------------------------|--------------|----------|---------------|------------------|-----------------|
| Name of Equipment                  | Manufacturer | Model    | Serial Number | Calibration Date | Calibration Due |
| Inductive Coil Interface           | SCHAFFNER    | INA2141  | 6004          | 02/26/2018       | 02/25/2019      |
| PFMF                               | SCHAFFNER    | INA702   | 200149-078SC  | 02/26/2018       | 02/25/2019      |
| AC Power Source                    | SCHAFFNER    | NSG 1007 | 54788         | 10/31/2017       | 10/30/2018      |
| EMF Tester (Electromagnetic Field) | TES          | TES-1390 | 120408340     | 12/28/2017       | 12/27/2018      |
| Clamp meter                        | FLUKE        | 303      | N/A           | 02/27/2018       | 02/26/2019      |

- 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.

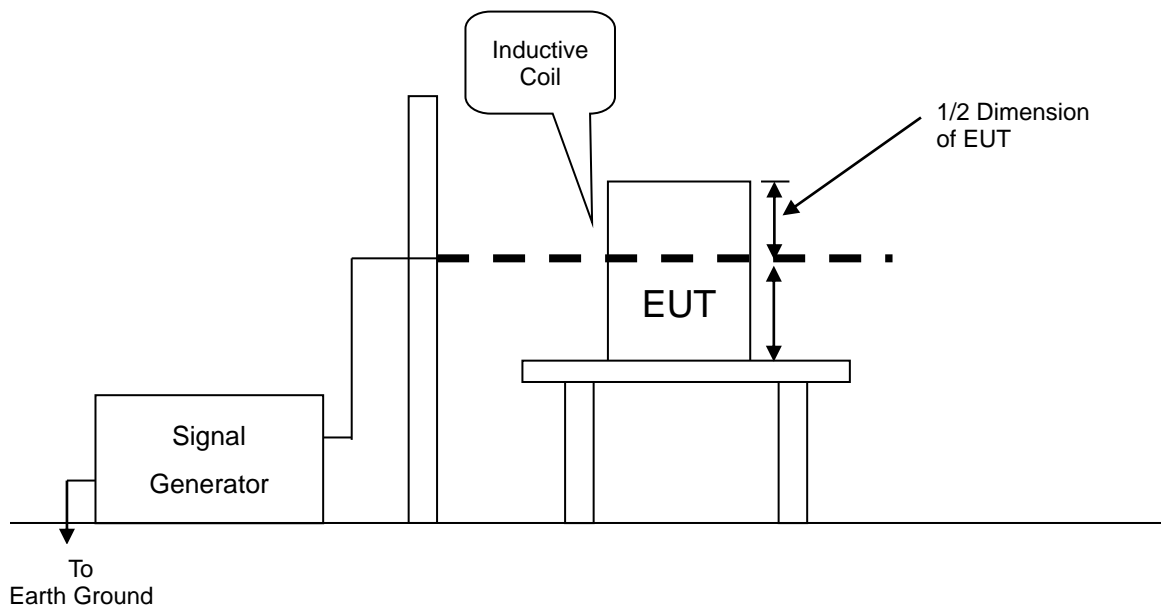


**8.8.3. TEST PROCEDURE**

- a. 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.
- b. The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.
- c. The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.
- d. 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 Inductive coil of standard dimension (1 m x 1 m). The Inductive 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 Inductive coils of suitable dimensions. The test shall be repeated by moving and shifting the Inductive coils, in order to test the whole volume of the EUT for each orthogonal direction. The test shall be repeated with the coil moved to different positions, in steps corresponding to 50 % of the shortest side of the coil. The Inductive 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

|                                     |           |                     |           |
|-------------------------------------|-----------|---------------------|-----------|
| <b>Temperature</b>                  | 20 °C     | <b>Humidity</b>     | 47 % RH   |
| <b>Pressure</b>                     | 1011 mbar | <b>Tested By</b>    | Tony.qi   |
| <b>Test Mode</b>                    | Mode 1    | <b>Date of Test</b> | 2018-9-25 |
| <b>Required Passing Performance</b> |           | <b>Criterion A</b>  |           |

| DIRECTION | Frequency (Hz) | Field Strength (A/m) | Performance Criterion | Result |
|-----------|----------------|----------------------|-----------------------|--------|
| X         | 50/60          | 1                    | A                     | Pass   |
| Y         | 50/60          | 1                    | A                     | Pass   |
| Z         | 50/60          | 1                    | A                     | Pass   |

**Performance Criterion :**

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

## 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° / 45° / 90° / 135° / 180° / 225° / 270° / 315° / 360° |
| Test cycle:             | 3 times                                                  |

### 8.9.2. TEST INSTRUMENT

| Voltage dips and interruption |              |         |                        |                  |                 |
|-------------------------------|--------------|---------|------------------------|------------------|-----------------|
| Name of Equipment             | Manufacturer | Model   | Serial Number          | Calibration Date | Calibration Due |
| EMC Immunity Tester           | EMC PARTNER  | TRA2006 | TRA2006_F-S-T-D-R-1503 | 02/26/2018       | 02/25/2019      |

**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

a) The EUT and its load are placed on a wood table which is 0.8 meter above a metal ground plane measured 1m\*1m min. And 0.65mm thick min. And projected beyond the EUT by at least 0.1m on all sides. The power cord shall be used the shortest power cord as specified by the manufacturer.

b) For Voltage Dips/ Interruptions test:

The selection of test voltage is based on the rated power range. If the operation range is large than 20% of lower power range, both end of specified voltage shall be tested.

Otherwise, the typical voltage specification is selected as test voltage.

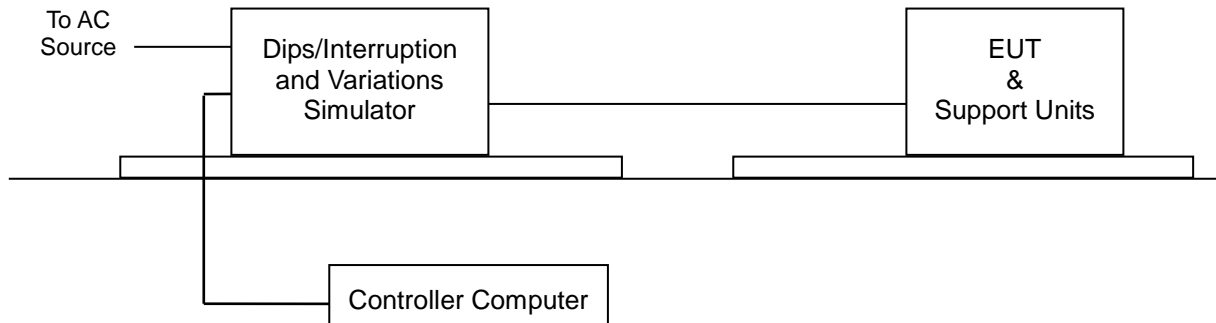
The EUT is connected to the power mains through a coupling device that directly couples to the Voltage Dips and Interruption Generator.

The EUT shall be tested for 30% voltage dip of supplied voltage and duration 25 Periods, for 95% voltage dip of supplied voltage and duration 0.5 Periods with a sequence of three voltage dips with intervals of 10 seconds, and for 95% voltage interruption of supplied voltage and duration 250 Periods with a sequence of three voltage interruptions with intervals of 10 seconds.

Voltage phase shifting are shall occur at 0° / 45° / 90° / 135° / 180° / 225° / 270° / 315° / 360° of the voltage.

c) Recording the test result in test record form.

#### 8.9.4. TEST SETUP



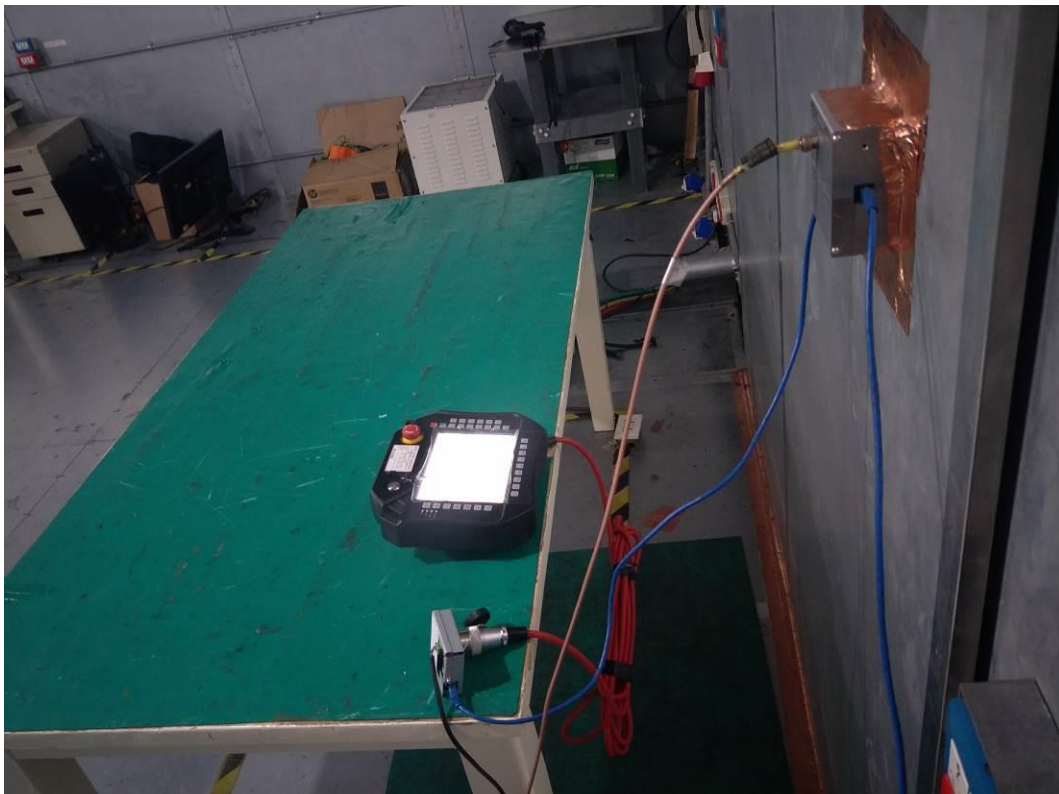
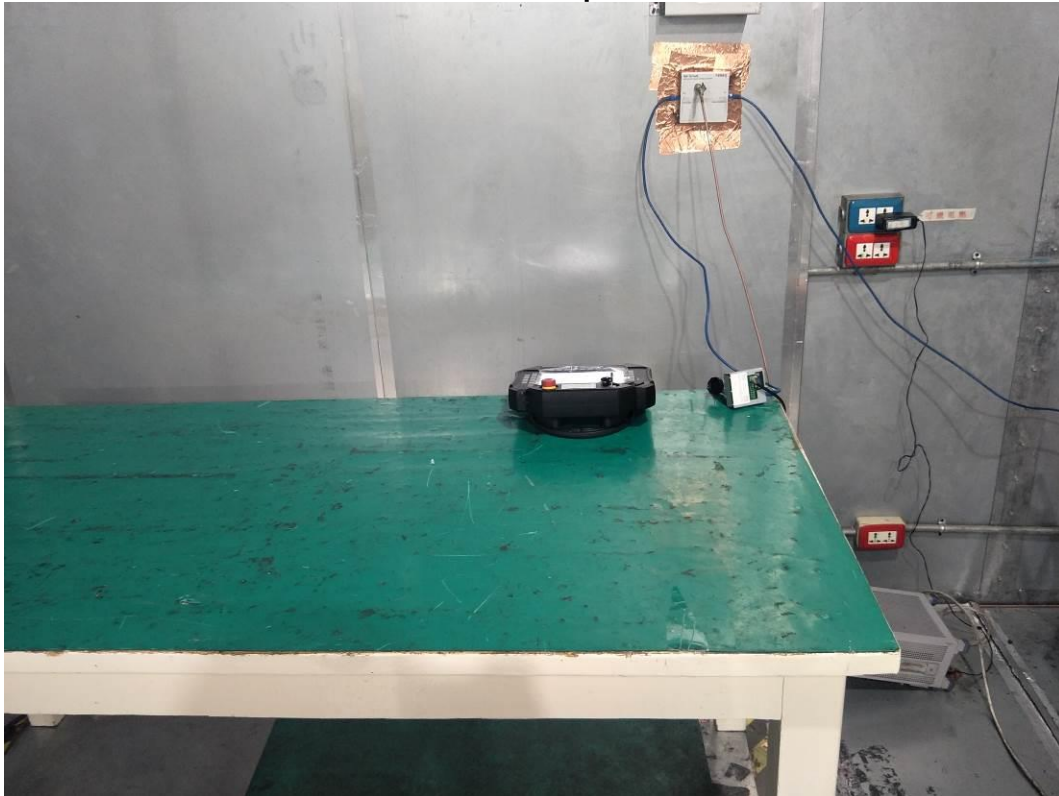
For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

#### 8.9.5. TEST RESULTS

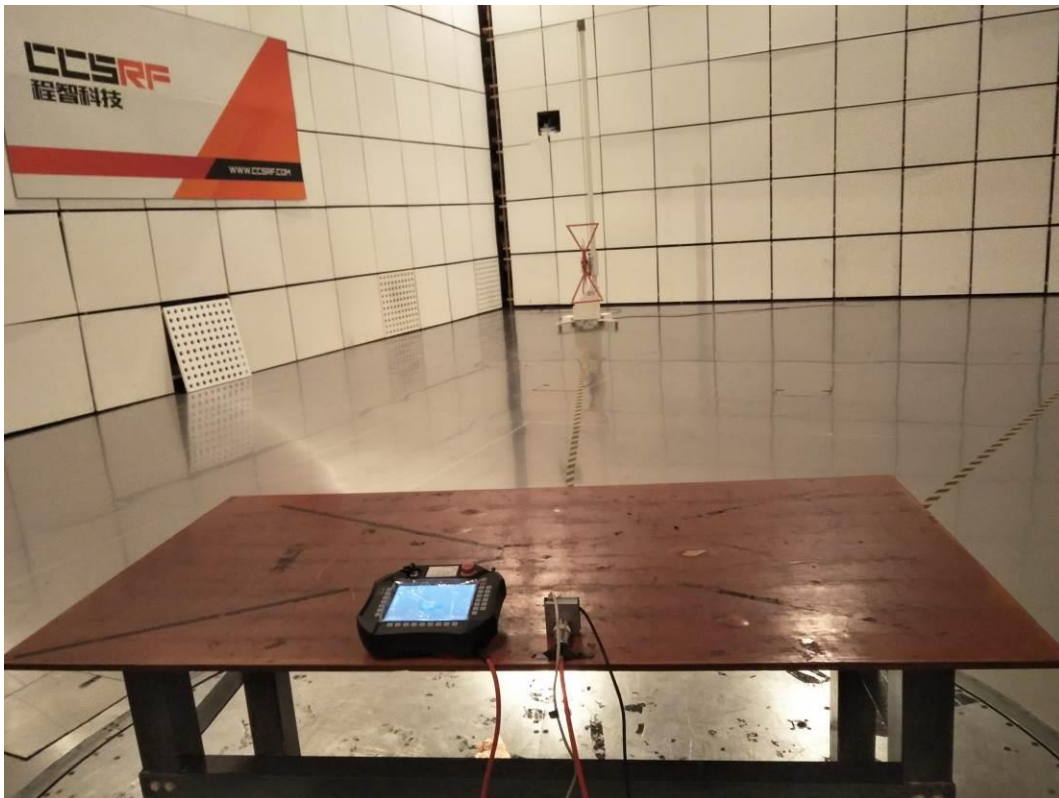
Note: The EUT is DC supply, so the test item needn't performance.

## 9 PHOTOGRAPHS OF THE TEST CONFIGURATION

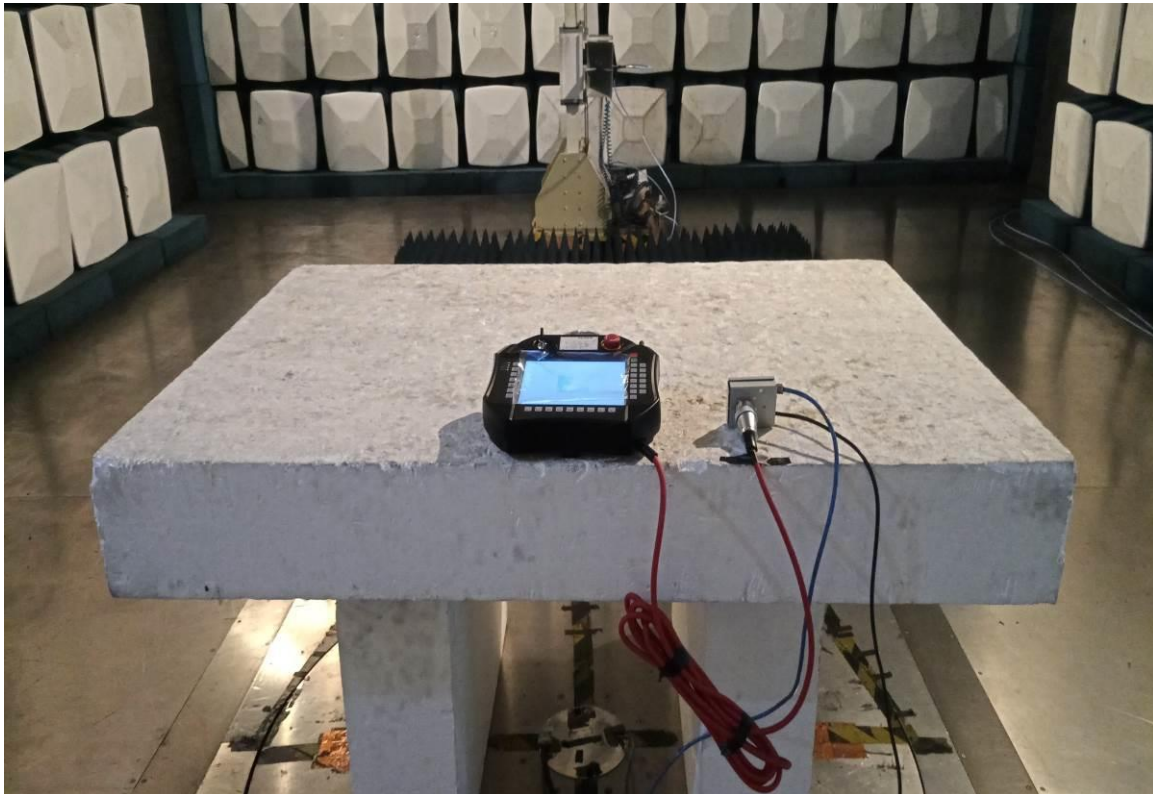
### CONDUCTED EMISSION TEST At telecom port



RADIATED EMISSION TEST  
Below 1GHz



Above 1GHz



ESD TEST



RS TEST





### EFT TEST At power port



### At telecom port



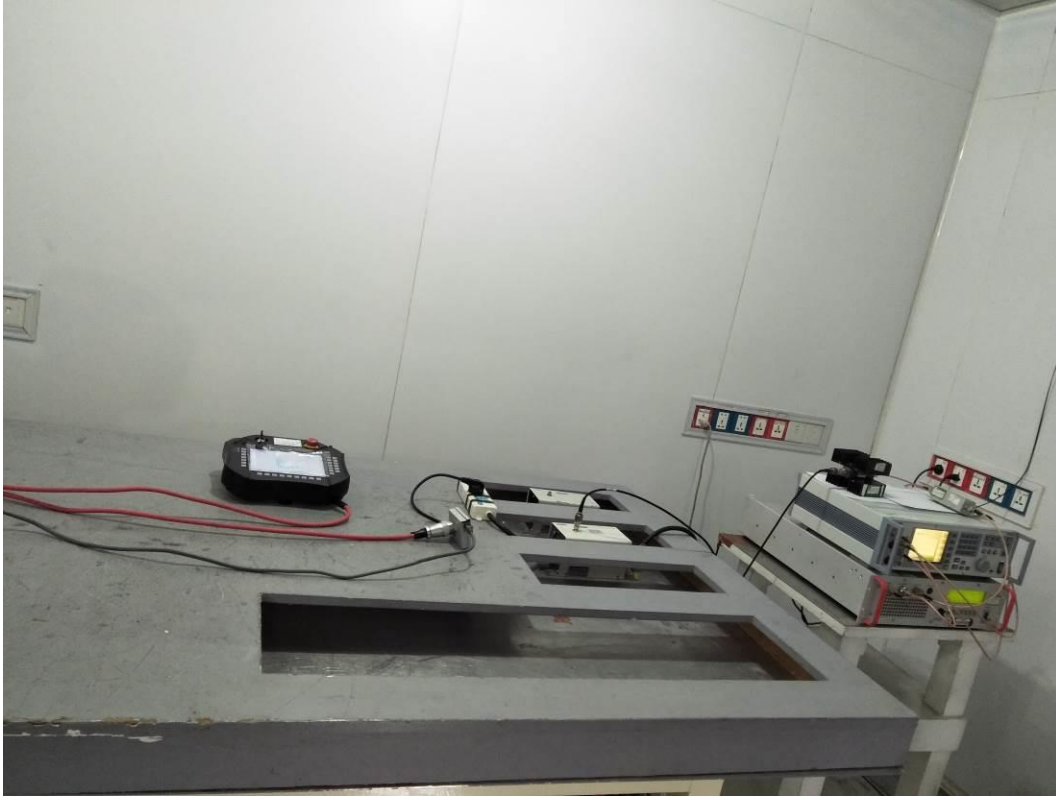
### SURGE TEST At power port



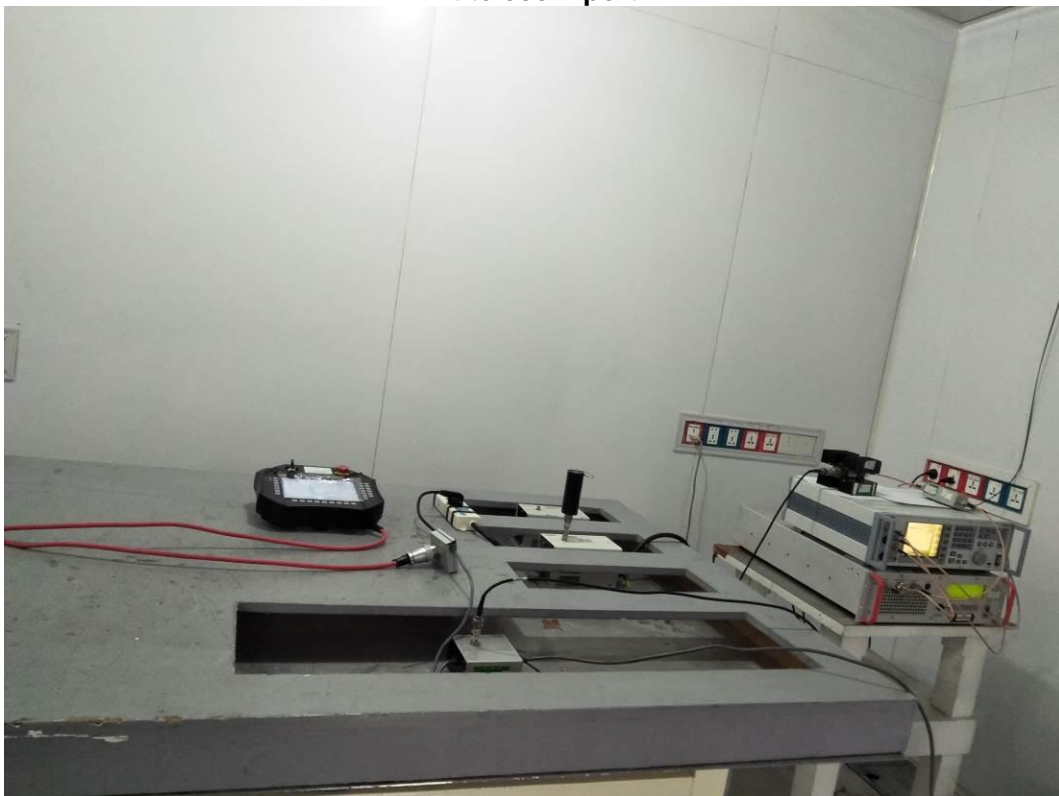
### At telecom port



### CS TEST At power port



### At telecom port



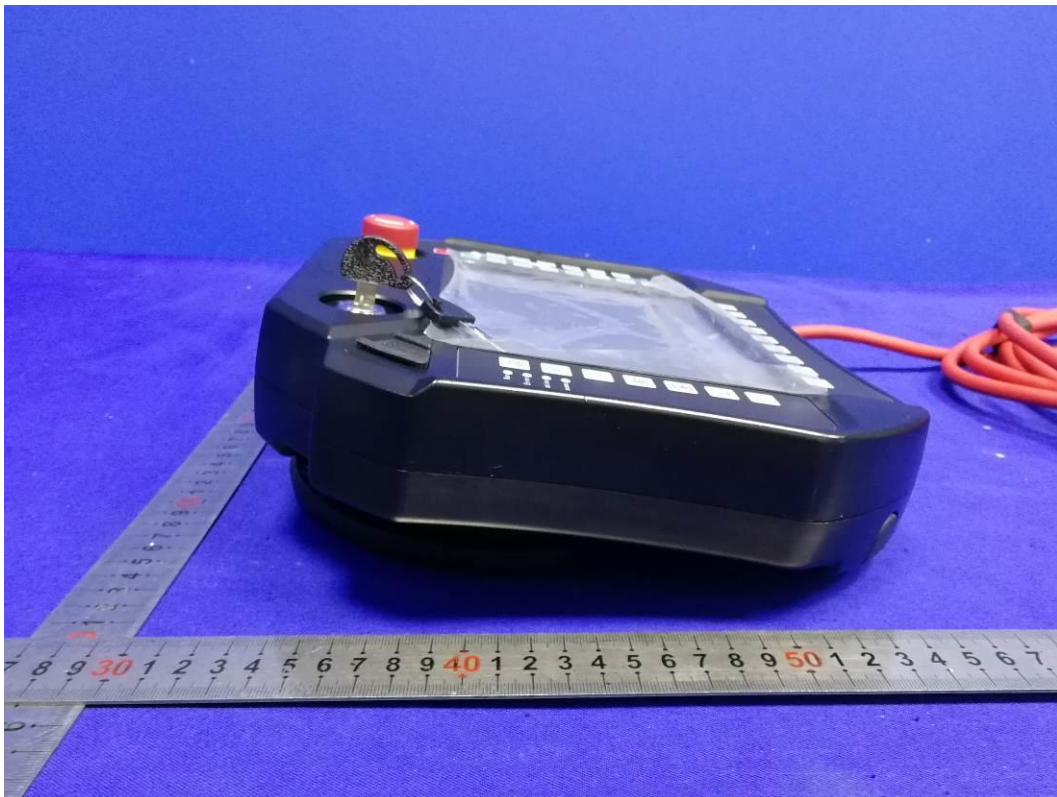
PFMF TEST



### APPENDIX I - PHOTOGRAPHS OF EUT







**END OF REPORT**