



# EMC TEST REPORT

**Report No.:** SET2018-01697  
**Product:** Elevator Control Cabinet  
**Brand Name:** /  
**Model No:** SJT-WVF5  
**Applicant:** ShenYang Bluelight Automatic Technology co., Ltd  
**Address:** No. 37 Shiji Road, Hunnan New District, Shenyang, China  
**Issued by:** Shenzhen Electronic Product Quality Testing Center  
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## Report

**Product**.....: Elevator Control Cabinet  
**Model No.** .....: SJT-WVF5  
**Brand Name**.....: /  
**Applicant**.....: ShenYang Bluelight Automatic Technology co., Ltd  
**Applicant Address**.....: No. 37 Shiji Road, Hunnan New District, Shenyang, China  
**Manufacturer**.....: ShenYang Bluelight Automatic Technology co., Ltd  
**Manufacturer Address**.....: No.99 ChuangXin 1ST Road, Hunnan New District, Shenyang, China  
**Test Standards**.....: **EN 12015:2014** Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks – Emission  
**EN 12016:2013** Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks - Immunity  
**Test Result**.....: Pass  
**Tested by** .....: Chen Weichang Feb. 08, 2018  
Signature, Date  
**Reviewed by**.....: Lu-Tongzhou Feb. 08, 2018  
Signature, Date  
**Approved by**.....: Smartli Feb. 08, 2018  
Signature, Date



## Table of Contents

Report.....	2
1 General Information.....	5
1.1 Description of EUT.....	5
1.2 Objective.....	5
1.3 Test Date.....	5
1.4 Test Standards and Results.....	6
1.5 List of Equipment Used.....	7
2 Emission Test.....	8
2.1 EUT Setup and Operating Conditions.....	8
2.2 Mains Terminal Disturbance Voltage Measurement.....	8
2.2.1 Limits of Mains Terminal Disturbance Voltage.....	8
2.2.2 Test Procedure.....	8
2.2.3 Test Setup.....	9
2.2.4 Test Result.....	9
2.3 Radiated Disturbance Measurement.....	12
2.3.1 Limits of Radiated Disturbance.....	12
2.3.2 Test Procedure.....	12
2.3.3 Test Setup.....	13
2.3.4 Test Result.....	13
2.4 Discontinuous Disturbance, Click.....	15
2.4.1 Limits of Discontinuous Disturbance.....	15
2.4.2 Test Procedure.....	15
2.4.3 Test Setup.....	15
2.4.4 Test Result.....	16



2.5 Harmonic Current Measurement.....	17
2.5.1 Limits of Harmonic Current.....	17
2.5.2 Test Setup.....	17
2.5.3 Test Result.....	18
2.6 Voltage Fluctuation and Flick Measurement.....	19
2.6.1 Limits of Voltage Fluctuation and Flick.....	19
2.6.2 Test Procedure.....	19
2.6.3 Test Result.....	19
3 Immunity Test.....	20
3.1 Performance Criteria.....	20
3.2 Immunity tests to high-frequency disturbance.....	21
3.2.1 EUT Setup and Operating Conditions.....	21
3.2.2 Electrostatic Discharge Immunity Test.....	21
3.3.3 Radiated, Radio Frequency Electromagnetic Field Immunity Test.....	24
3.3.4 Electrical Fast Transient/Burst Immunity Test.....	26
3.3.5 Surge Immunity Test.....	27
3.3.6 Immunity to Conducted Disturbances Induced by RF Fields.....	28
3.3.7 Voltage Dips and Short Interruptions Immunity Test.....	30
Appendix I: Photographs of the EUT.....	32
Appendix II: Photographs of EMC Test Configuration.....	35



# 1 General Information

## 1.1 Description of EUT

**Product:** Elevator Control Cabinet  
**Model No.:** SJT-WVF5  
**Brand Name:** /  
**Serial No.:** K1801001  
Power: 75kW  
**Rating:** Input: AC3Ph 380, 50/60Hz, 190A  
Output: 0-380V, 0-60Hz, 165A  
**Accessories:** /

### NOTE:

1. For a more detailed features description about the EUT, please refer to User's Manual.

## 1.2 Objective

Perform ElectroMagnetic Interference (EMI) and ElectroMagnetic Susceptibility (EMS) tests for CE Marking.

## 1.3 Test Date

Emission: 2018.01.13 ~ 2018.01.14  
Immunity: 2018.01.15 ~ 2018.01.22



## 1.4 Test Standards and Results

The EUT has been tested according to the following specifications:

<b>EMISSION</b>		
<b>Standard</b>	<b>Test Type</b>	<b>Result</b>
EN 12015:2014	Mains terminal disturbance voltage	PASS
	Radiated disturbance	PASS
	Impulse noise	PASS
	Voltage fluctuations	
	Mains supply current harmonics	
<b>IMMUNITY</b>		
<b>Basic Standard</b>	<b>Test Type</b>	<b>Result</b>
Immunity to High-frequency disturbances (EN 12016:2013)		
IEC 61000-4-2	Electrostatic discharge immunity	PASS
IEC 61000-4-3	Radiated, radio frequency electromagnetic field immunity	PASS
IEC 61000-4-4	Electrical fast transient/burst immunity	PASS
IEC 61000-4-5	Surge immunity	PASS
IEC 61000-4-6	Immunity to conducted disturbances induced by RF fields	PASS
EN 61000-4-11	Voltage Dips and Short Interruptions Immunity Test	PASS

NOTE: The latest versions of basic standards are applied.



## 1.5 List of Equipment Used

Description	Manufacturer	Model No.	Calibration due date	Serial No.
Test Receiver	ROHDE&SCHWARZ	ESCI	Jun.04, 2018	A130901474
LISN	SCHWARZBECK	NNLK8130	Jun. 04, 2018	A131001541
Broadband Ant.	SCHWARZBECK	VULB 09160	May.25,2019	A0805560
Disturbance analyzer	SCHAFFNER	DIA1512D	Jul. 04, 2018	A0304244
EFT/Surge Test System	EM TEST	UCS500N7.7	Nov.02,2018	A130201094
	EM TEST	CNI503B9.3	Nov.02,2018	A130201095
ESD Test System	3C test	EDS30T	Jun.12, 2018	A161002598
Signal Generator	ROHDE&SCHWARZ	SMB100A	Nov.02,2018	A141002004
EMS Antenna	Amplifier Research	STLP 9128 E	Mar.09, 2019	A151002436
Power Amplifier	MILMEGA	80RF1000-1000	Mar.29, 2018	A140101634
	MILMEGA	AS0104R-800/400	Mar.29, 2018	A160302517
Power Meter	Amplifier Research	E4417A	Nov.02,2017	A140701873
CIP	TESEQ	CIP9136A	Aug 04,2018	A161102608
Power Amplifier	TESEQ	NSG4070	Mar.29, 2018	A160602544
Magnetic Field Tester	HAEFELY	MAG 100.1	Jun.12, 2018	A0103109
AC Power source	Chroma	Chroma 61860	Aug.06, 2018	A150202185
3 phases harmonic analyzer	EM TEST	DPA503N	Jan.09, 2019	A150202183
3 Phases Flicker Impedance	EM TEST	AIF 503N75	Jan.09, 2019	A150202184
Anechoic Chamber	Albatross	EMC 12.8*6.8*6.4(m)	Jun. 27,2019	A0802520

**NOTE:** Equipment above has been calibrated and is in the period of validation.



## 2 Emission Test

### 2.1 EUT Setup and Operating Conditions

The EUT was powered by 380V AC Mains and connected to a motor with no load. The EUT operated in SVC control and max carrier frequency mode.

### 2.2 Mains Terminal Disturbance Voltage Measurement

#### 2.2.1 Limits of Mains Terminal Disturbance Voltage

Frequency range (MHz)	Limits (dB $\mu$ V) Rated current >100A	
	Quasi-peak	Average
0.15 - 0.50	130	120
0.50 - 5	125	115
5 - 30	115	105

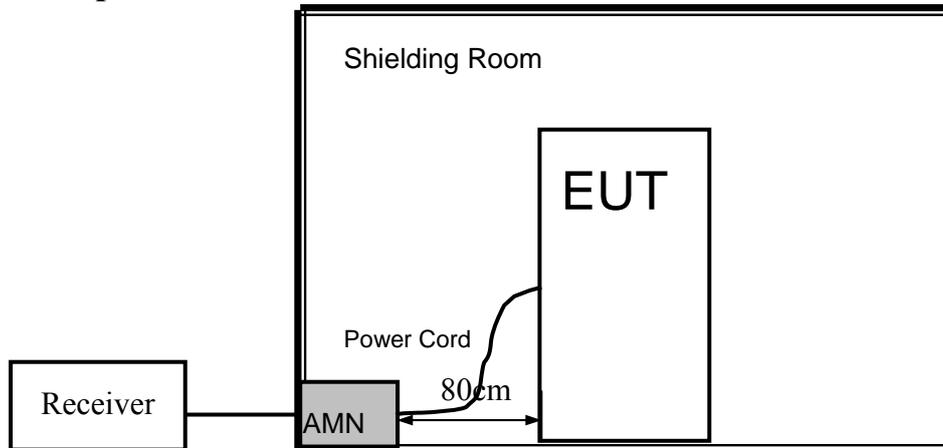
**NOTE:**

1. The lower limit shall apply at the transition frequencies.

#### 2.2.2 Test Procedure

- a. The EUT was placed 0.1 meters above the ground at a semi-anechoic chamber with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provide 50 $\Omega$ /50 $\mu$ H of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits are not reported.

### 2.2.3 Test Setup



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

### 2.2.4 Test Result

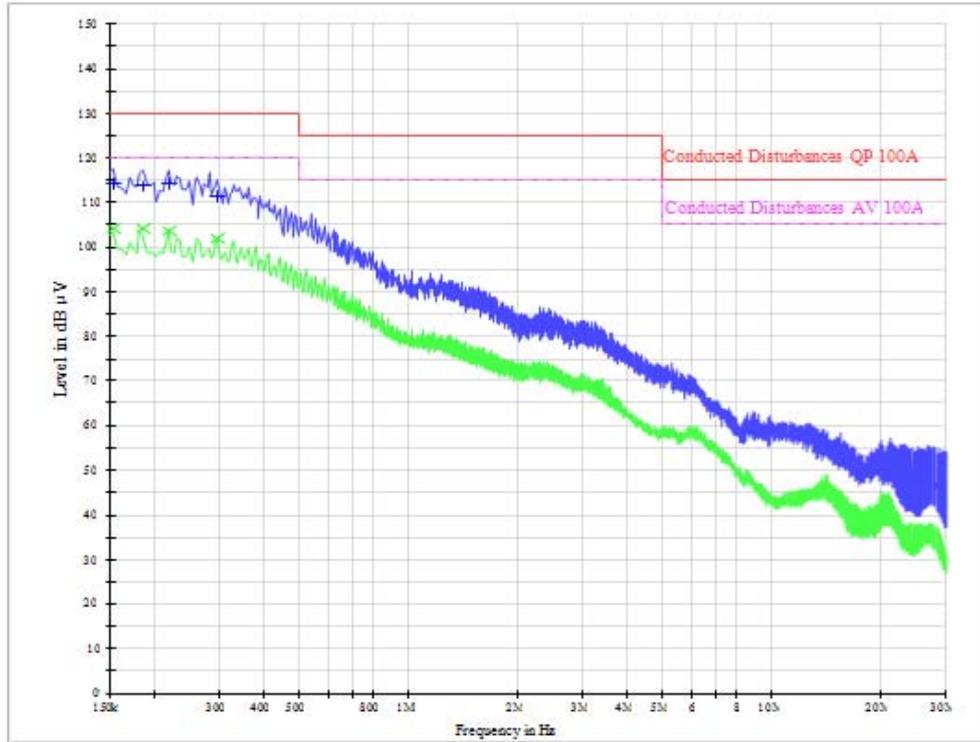
No.	Freq. (MHz)	Limit Value (dB $\mu$ V)		Emission Level (dB $\mu$ V)	
		QP	AV	QP	AV
1	0.1540	114.2	104.1	130	120
2	0.1820	115.0	104.5	130	120
3	0.2180	114.3	103.7	130	120
4	0.2300	113.7	101.9	130	120
5	0.2660	112.7	102.6	130	120
6	0.2980	111.4	102.0	130	120

#### NOTE:

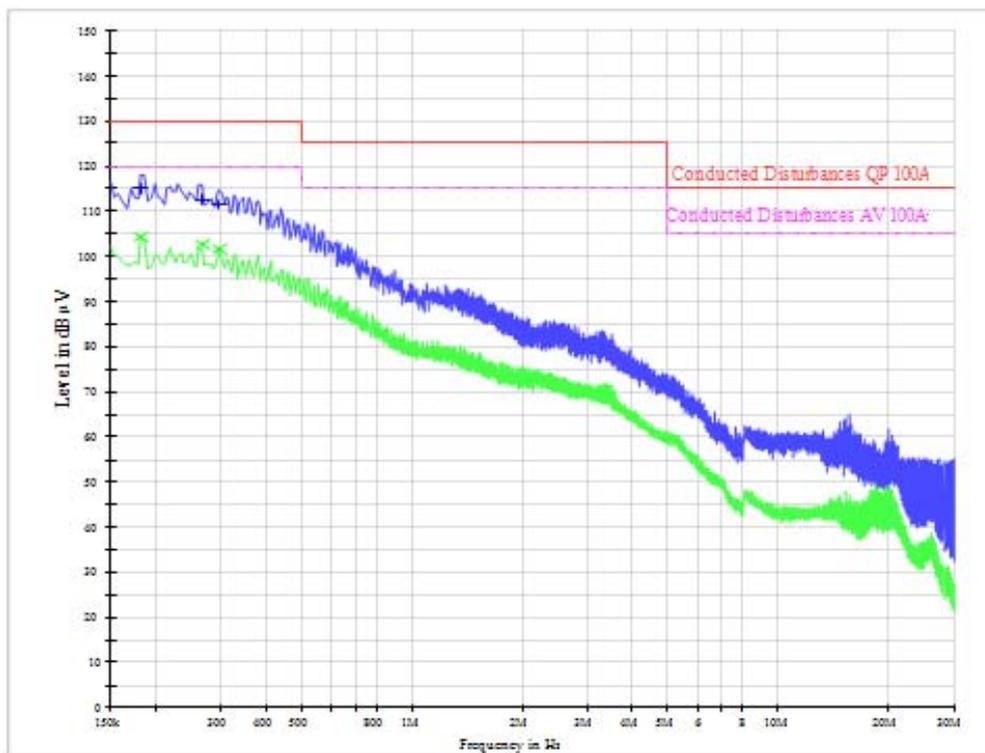
1. QP and AV are abbreviations of the quasi-peak and average individually.
2. If the emission levels measured with QP detector are lower than AV limits, there is unnecessary to measure with AV detector.
3. The emission levels recorded above is the larger ones of each phase.

## Measurement Plots

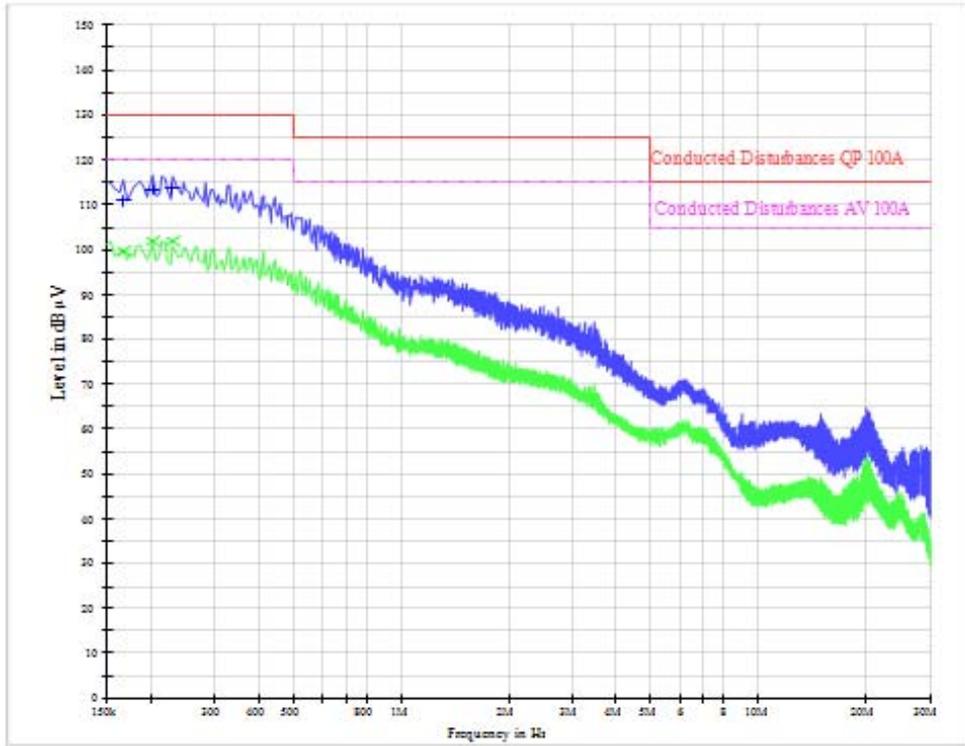
### 1. Mains terminal disturbance voltage, L1 phase



### 2. Mains terminal disturbance voltage, L2 phase



### 3. Mains terminal disturbance voltage, L3 phase





## 2.3 Radiated Disturbance Measurement

### 2.3.1 Limits of Radiated Disturbance

Frequency range (MHz)	Quasi peak limits(dB $\mu$ V/m), at 10m measurement distance
30 - 230	40
230 - 1000	47

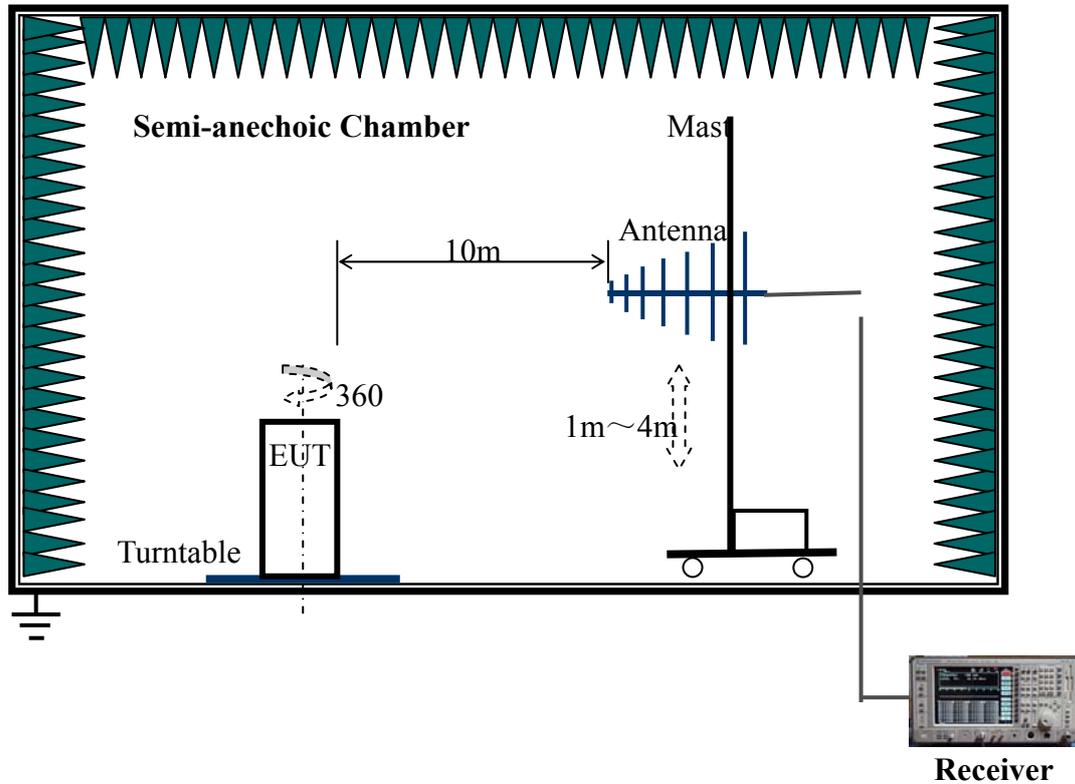
#### Notes:

- (1) The lower limit shall apply at the transition frequency.
- (2) Additional provisions may be required for cases where interference occurs.

### 2.3.2 Test Procedure

- a. The EUT was placed on the top of an insulating table 0.1 meters above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from 1 to 4 meter above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the heights from 1 to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detector Function and Specified Bandwidth with Maximum Hold Mode. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emission that did not have 10dB margin would be retested one by one using the quasi-peak method.

### 2.3.3 Test Setup



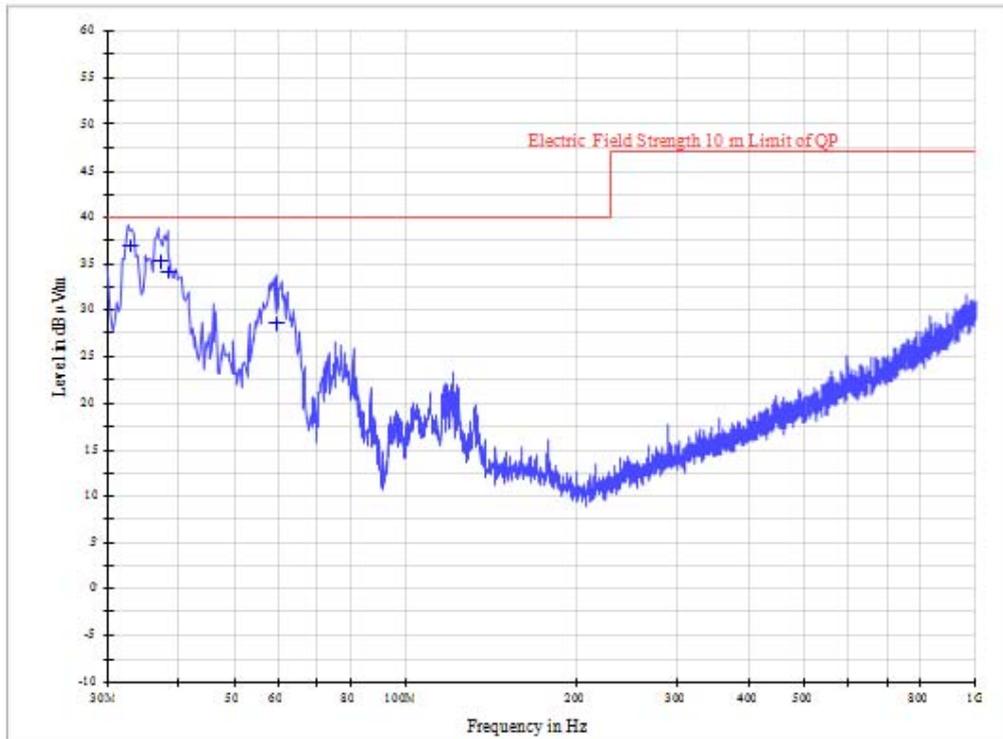
For the actual test configuration, please refer to the related item-Photographs of the Test Configuration.

### 2.3.4 Test Result

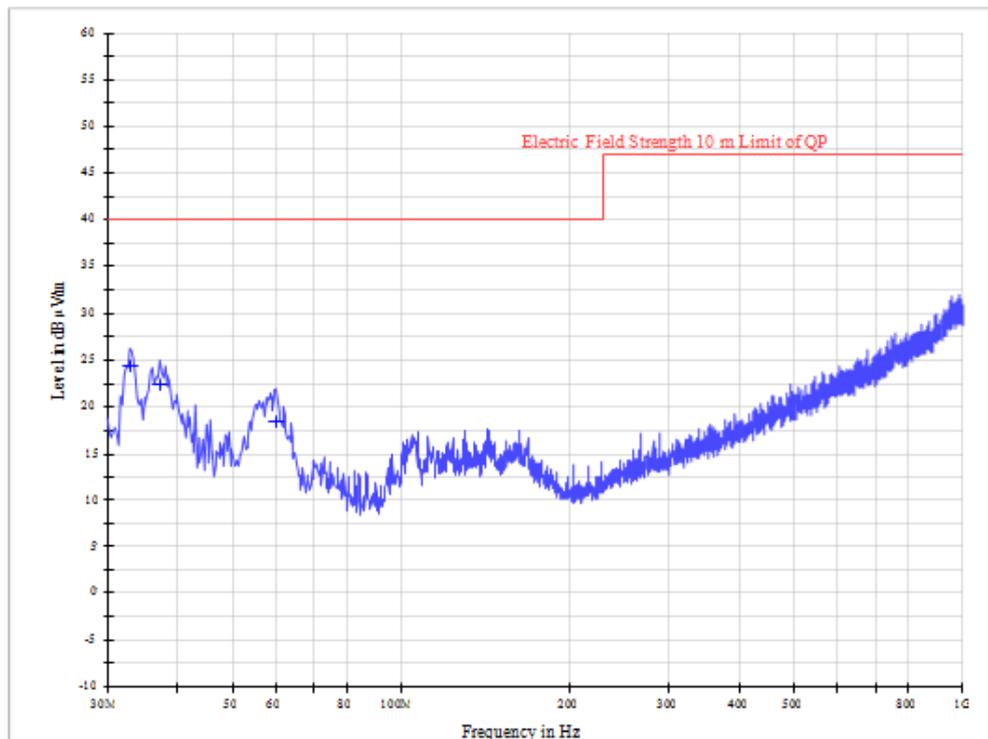
No.	Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	QP Limits (dB $\mu$ V/m)	Emission Level (dB $\mu$ V/m)
1	32.92	H	400	0	40	24.3
2	37.28	H	400	0	40	22.5
3	60.04	H	400	0	40	18.5
4	33.00	V	100	0	40	37.0
5	37.24	V	100	0	40	35.3
6	38.24	V	100	6	40	34.0
7	59.60	V	100	0	40	28.5

## Measurement Plots

### 1. Electromagnetic radiation disturbances, max peak detector, antenna polarization: Vertical



### 2. Electromagnetic radiation disturbances, max peak detector, antenna polarization: Horizontal



## 2.4 Discontinuous Disturbance, Click

### 2.4.1 Limits of Discontinuous Disturbance

For all equipment which produced discontinuous disturbances other than clicks, or clicks with a click rate  $N$  equal to or greater than 30, the limits listed in the following table apply (same as the limits of mains terminal disturbance voltage).

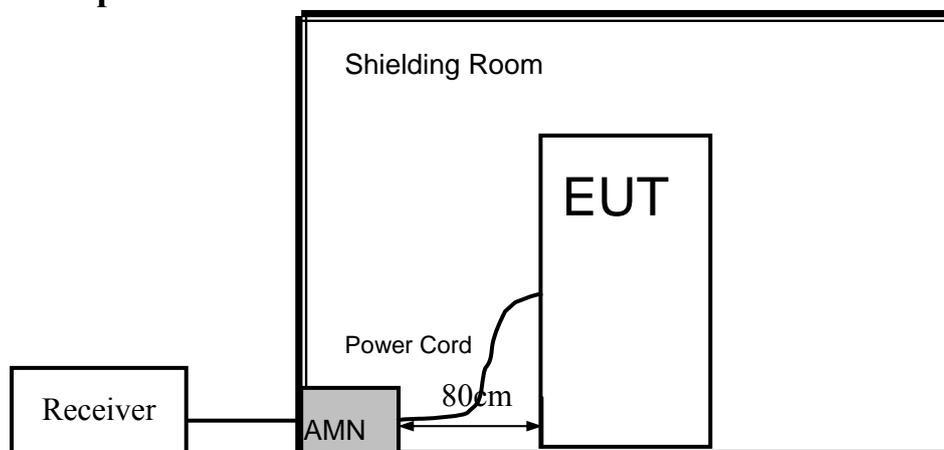
Otherwise, the click limit  $L_q$  is attained by increasing the relevant limit  $L$  listed in the following table with:

$$20\lg(30/N)\text{dB, for } 0.2 \leq N < 30.$$

### 2.4.2 Test Procedure

- The discontinuous disturbance is only measured with a measuring receiver including a quasi-peak detector. The EUT is connected to the power mains through a line impedance stabilization network (LISN). The LISN provide  $50\Omega/50\mu\text{H}$  of coupling impedance for the measuring receiver.
- The minimum observation time is either the time to register 40 clicks (or 40 switching operation) or 120 minutes.
- The click rate  $N$  shall be determined at 150 kHz for the frequency range 148.5 kHz to 500 kHz and at 500 kHz for the frequency range 500 kHz to 30 MHz.
- The measurement of disturbance generated by switching operations shall be performed at the following restricted number of frequencies: 150 kHz, 500 kHz, 1.4 MHz, and 30 MHz.
- If the EUT is assessed for compliance with the higher  $L_q$  in according with the upper quartile method, the EUT shall be tested for a time not less than the minimum observation time  $T$ .

### 2.4.3 Test Setup



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



### 2.4.4 Test Result

	Test Frequency	150kHz	500 kHz	1.4MHz	30MHz
First Test	Sensitive (dB $\mu$ V)	100	86	86	70
	Short click number, n1( $\leq$ 10ms)	1	1	0	0
	Long click number, n2(10ms-200ms)	0	0	0	0
	Total click number, n <sub>1</sub> =(n1+n2)	1	1	0	0
	Continuous disturbance (>200ms)	0	0	0	0
	Switching operation number, n <sub>2</sub>	1			
	Duration limit, T(min)	120			
	Click rate, N=n/T	0.01	0.01	0	0
	Click limit, Lq(dB $\mu$ V)	110	100	100	104
	Allowable number of click exceeding the limit Lq (n/4)	/	/	/	/
Second Test	Sensitive (dB $\mu$ V)	/	/	/	/
	Short click number, n1( $\leq$ 10ms)	/	/	/	/
	Long click number, n2(10ms-200ms)	/	/	/	/
	Total click number, n=(n1+n2)	/	/	/	/
	Number of click exceeding the limit Lq	/	/	/	/

**NOTE:**

1. No click was detected during the first test, so it's no need to perform the second test.

## 2.5 Harmonic Current Measurement

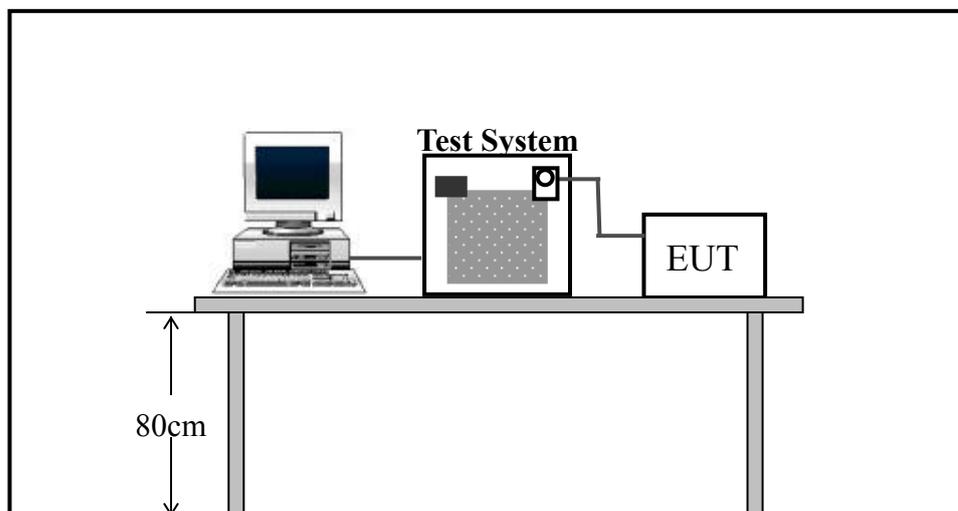
### 2.5.1 Limits of Harmonic Current

Environmental phenomena	Test set-up	Units %	Limits for permanent emission <sup>a</sup>
Harmonic distortion	EN 61000-3-12:2005	$I_5/I_1$	31
		$I_7/I_1$	20
		$I_{11}/I_1$	12
		$I_{13}/I_1$	7
Harmonic distortion factor	EN 61000-3-12:2005	THD	37
		PWHD	38

The relative value of even harmonics up to order 12 shall not exceed  $16/n[\%]$ . Even harmonics above order 12 are taken into account in THD and PWHD in the same way as odd order harmonics.

<sup>a</sup> The given limits are based on EN 61000-3-12:2005 for  $R_{sce} = 250$  (balanced three phase equipment).

### 2.5.2 Test Setup



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



### 2.5.3 Test Result

#### Test Specification

<b>Test Frequency:</b>	50Hz	<b>Test Voltage:</b>	380Vac
<b>Waveform:</b>	Sine	<b>Test Time:</b>	2.5min

#### Test Result:

Environmental phenomena	Units %	Measurement Value			Limits for permanent emission	Remarks
		L1	L2	L3		
Harmonic distortion	$I_5/I_1$	23.4	24.1	23.1	31	PASS
	$I_7/I_1$	18.1	18.8	17.5	20	PASS
	$I_{11}/I_1$	4.8	5.1	5.7	12	PASS
	$I_{13}/I_1$	2.3	2.4	4.3	7	PASS
Harmonic distortion factor	THD	31.0	32.4	33.2	37	PASS
	PWHD	31.9	33.1	34.2	38	PASS



## 2.6 Voltage Fluctuation and Flick Measurement

### 2.6.1 Limits of Voltage Fluctuation and Flick

Test Item	Limit	Note
$P_{st}$	1.0	$P_{st}$ means Short-term flicker indicator
$P_{lt}$	0.65	$P_{lt}$ means long-term flicker indicator
$T_{dt}$	500mS	$T_{dt}$ means maximum time that $d_t$ exceeds 3%
$d_{max}(\%)$	4%	$d_{max}$ means maximum relative voltage change.
$d_c(\%)$	3.3%	$d_c$ means relative steady-state voltage change.

### 2.6.2 Test Procedure

- The EUT was placed on the top of a wooden table 0.1 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal conditions
- During the flick measurement, the measure time shall include that part of whole operation changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

### 2.6.3 Test Result

#### Test Specification

<b>Test Frequency:</b>	50Hz	<b>Test Voltage:</b>	380Vac
<b>Waveform:</b>	Sine	<b>Test Time:</b>	10 minutes( $P_{st}$ ); 2 hours ( $P_{lt}$ )

#### Test Result

Test Parameter	Measurement Value			Limit	Remarks
	L1	L2	L3		
$P_{st}$	0.236	0.218	0.227	1.0	Pass
$P_{lt}$	0.236	0.218	0.227	0.65	Pass
$T_{dt(s)}$	0.0	0.0	0.0	500mS	Pass
$d_{max}(\%)$	0.415	0.416	0.409	4%	Pass
$d_c(\%)$	0.067	0.061	0.071	3.3%	Pass



### 3 Immunity Test

#### 3.1 Performance Criteria

<b>Criterion A</b>	The apparatus/assembly of shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by its manufacture, when the apparatus or assembly of apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus or assembly of apparatus if used as intended.
<b>Criterion B</b>	The apparatus/assembly of apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by its manufacturer, when the apparatus or assembly of apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus or assembly of apparatus if used as intended.
<b>Criterion C</b>	Not used.
<b>Criterion D</b>	The apparatus/assembly of apparatus and the associated safety component(s) shall continue to operate as intended. No degradation of performance or loss of function is allowed other than a failure into a safe mode.



## 3.2 Immunity tests to high-frequency disturbance

### 3.2.1 EUT Setup and Operating Conditions

The EUT was powered by 380V AC Mains and connected to a motor with no load. The EUT operated in SVC control and max carrier frequency mode.

### 3.2.2 Electrostatic Discharge Immunity Test

#### 3.2.2.1 Test Specification

<b>Ports:</b>	All Circuits	Safety circuits
<b>Basic Standard:</b>	IEC 61000-4-2	
<b>Discharge Impedance</b>	330 $\Omega$ / 150 pF	
<b>Discharge Voltage:</b>	Air Discharge: 8 kV Contact Discharge: 4 kV	Air Discharge: 15 kV Contact Discharge: 6 kV
<b>Polarity:</b>	Positive / Negative	
<b>Number of Discharge:</b>	Minimum 20 times at each test point	
<b>Discharge Mode:</b>	Single discharge	
<b>Discharge Period:</b>	1-second minimum	
<b>Criteria:</b>	B	D

#### 3.3.2.2 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. The remaining three contact test points shall each receive at least 50 direct contact discharges. If no direct contact test points are available, 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

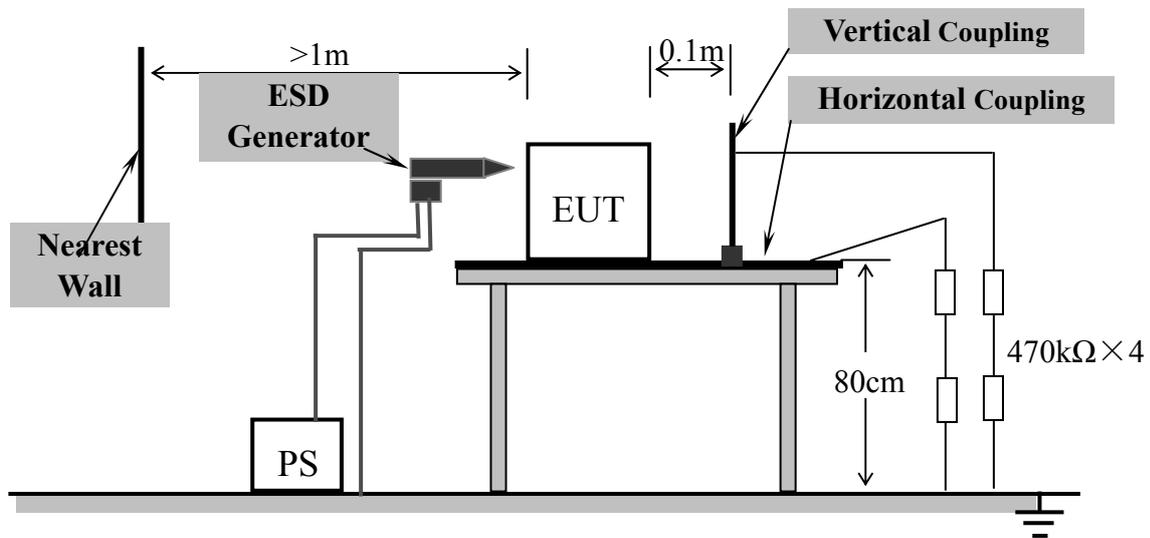


restricted to those area normally handled selected test point for each such area.

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

- a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
- b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
- c. The time interval between two successive single discharges was at least 1 second.
- d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.
- e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- f. 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 completed.
- g. At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator was positioned vertically at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.
- h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5m×0.5m) was placed vertically to and 0.1 meters from the EUT.

### 3.3.2.3 Test Setup



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

### 3.3.2.4 Test Result

Test Points	Discharge Level (kV)	Discharge Mode	Observation	Comply with Criterion
Display panel	± 8	Air	Note(1)	A
Aperture of the cover	± 8	Air	Note(1)	A
Buttons	± 8	Air	Note(1)	A
Knob	± 8	Air	Note(1)	A
Screws	± 4, ± 6	Contact	Note(1)	A
HCP	± 4, ± 6	Contact	Note(1)	A
VCP	± 4, ± 6	Contact	Note(1)	A

**NOTE:**

(1). The EUT continued to operate as intended. No degradation of performance was observed.



### 3.3.3 Radiated, Radio Frequency Electromagnetic Field Immunity Test

#### 3.3.3.1 Test Specification

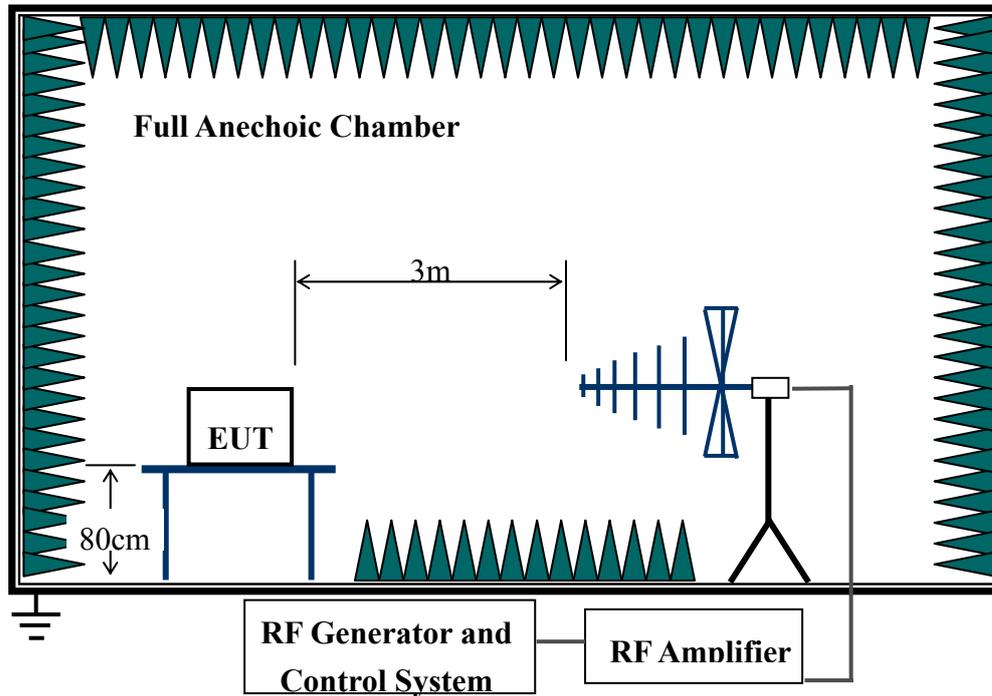
<b>Ports:</b>	All Circuits	Safety circuits
<b>Basic Standard:</b>	IEC 61000-4-3	
<b>Frequency Range &amp; Field Strength:</b>	80 – 166 MHz, 10V/m; 166 – 1000 MHz, 10V/m; 1429 – 1516 MHz, 10V/m; 1710 – 1785 MHz, 10V/m; 1840 – 2170 MHz, 10V/m; 2300 – 2655 MHz, 10V/m;	80 – 166 MHz, 10V/m; 166 – 1000 MHz, 30V/m; 1429 – 1516 MHz, 30V/m; 1710 – 1785 MHz, 30V/m; 1840 – 2170 MHz, 10V/m; 2300 – 2655 MHz, 10V/m;
<b>Modulation:</b>	1kHz sine wave, 80%, AM modulation	
<b>Frequency Step:</b>	1% of fundamental	
<b>Polarity of Antenna</b>	Horizontal and Vertical	
<b>Test Distance:</b>	3m	
<b>Antenna Height:</b>	1.5m	
<b>Dwell Time:</b>	3 seconds	
<b>Criteria:</b>	A	D

#### 3.3.3.2 Test Procedure

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

- The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
- The frequency range is swept from 80 MHz to 2655 MHz with the signal 80% amplitude modulated with a 1 kHz sine wave. The rate of sweep did not exceed  $1.5 \times 10^{-3}$  decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
- The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- The field strength level was 10V/m and 30V/m.
- The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

### 3.3.3.3 Test Setup



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

### 3.3.3.4 Test Result

Frequency	Polarity	Azimuth	Field Strength (V/m)	Observation	Comply with Criterion
80 – 166 MHz	V&H	0, 90, 180, 270	10	Note(1)	A
166 – 1000 MHz	V&H	0, 90, 180, 270	10, 30	Note(1)	A
1429 – 1516 MHz	V&H	0, 90, 180, 270	10, 30	Note(1)	A
1710 – 1785 MHz	V&H	0, 90, 180, 270	10, 30	Note(1)	A
1840 – 2170 MHz	V&H	0, 90, 180, 270	10	Note(1)	A
2300 – 2655 MHz	V&H	0, 90, 180, 270	10	Note(1)	A

**NOTE:**

(1). The EUT continued to operate as intended. No degradation of performance was observed.

### 3.3.4 Electrical Fast Transient/Burst Immunity Test

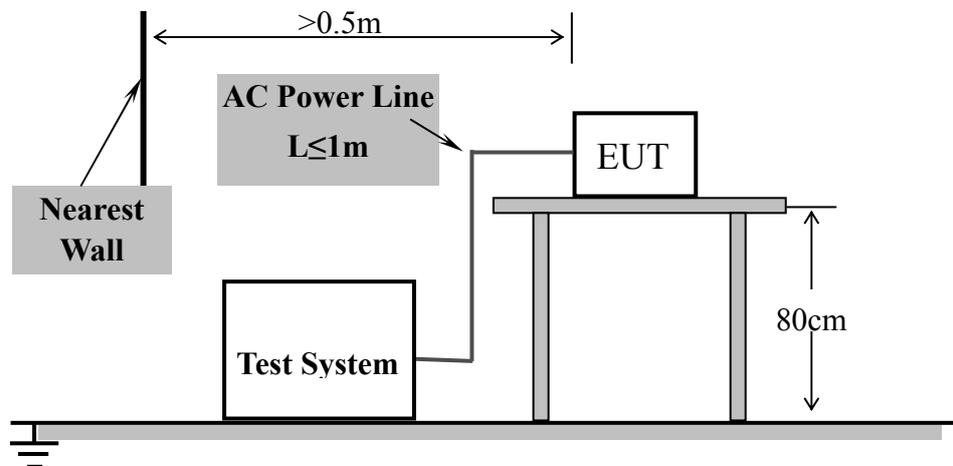
#### 3.3.4.1 Test Specification

<b>Ports:</b>	All Circuits	Safety circuits
<b>Basic Standard:</b>	IEC 61000-4-4	
<b>Test Voltage</b>	a.c. power port: 1 kV	a.c. power port: 4 kV,
<b>Polarity:</b>	Positive/Negative	
<b>Impulse Frequency:</b>	5kHz	2.5kHz
<b>Impulse wave shape:</b>	5/50ns	
<b>Burst Duration:</b>	15ms	
<b>Burst Period:</b>	300ms	
<b>Test Duration:</b>	Not less than 1 min.	
<b>Criteria:</b>	B	D

#### 3.3.4.2 Test Procedure

- The EUT was tested with 2000 volt discharges to the AC power input leads.
- Both positive and negative polarity discharges were applied.
- The length of the “hot wire” from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 meter.
- The duration time of each test sequential was 1 minute.
- The transient/burst waveform was in accordance with IEC 61000-4-4, 5/50ns.

#### 3.3.4.3 Test Setup





For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

### 3.3.4.4 Test Result

Test Point Power port	Polarity	Test Level (kV)	Observation	Comply with Criterion
a.c. power port	+/-	1, 2, 4	Note (1)	A
Signal port	+/-	0.5, 1, 2	Note (1)	A

#### NOTE:

(1). The EUT continued to operate as intended. No degradation of performance was observed..

### 3.3.5 Surge Immunity Test

#### 3.3.5.1 Test Specification

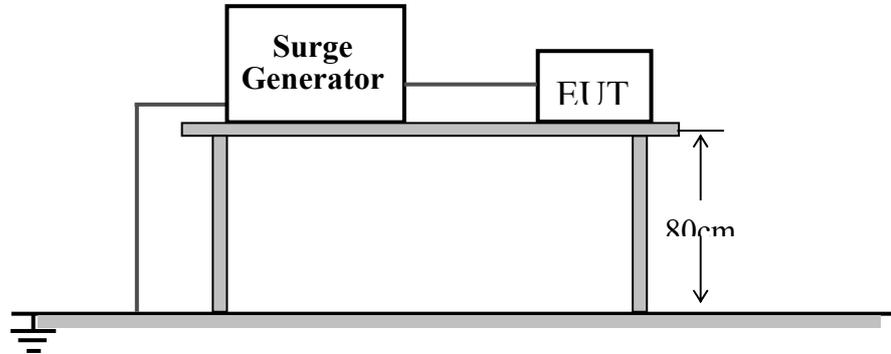
<b>Ports:</b>	All Circuits	Safety circuits
<b>Basic Standard:</b>	IEC 61000-4-5	
<b>Waveform:</b>	Voltage 1.2/50 $\mu$ s; Current 8/20 $\mu$ s	
<b>Test Voltage:</b>	line to line 1 kV, line to earth 2kV	line to line 1 kV, line to earth 2kV
<b>Polarity:</b>	Positive/Negative	
<b>Phase Angle:</b>	0° , 90° , 180° , 270°	
<b>Repetition Rate:</b>	60sec	
<b>Times:</b>	5 time/each condition.	
<b>Criteria:</b>	B	D

#### 3.3.5.2 Test Procedure

- a. The EUT and the auxiliary equipment were placed on a table of 0.8m heights above a metal ground reference plane. The size of ground plane is greater than 1m×1m and project beyond the EUT by at least 0.1m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT was less than 2 meters (provided by the manufacturer).
- b. The EUT was connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise was applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).
- c. The surges were applied line to line and line(s) to earth. When testing line to earth the test voltage was applied successively between each of the lines and earth. Steps up to the test level

specified increased the test voltage. All lower levels including the selected test level were tested. The polarity of each surge level included positive and negative test pulses.

### 3.3.5.3 Test Setup



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

### 3.3.5.4 Test Result

Coupling Line	Polarity	Voltage (kV)	Observation	Comply with Criterion
a.c. power, Line to earth	+/-	2	Note (1)	A
a.c. power, Line to line	+/-	1	Note (1)	A

#### NOTE:

(1). The EUT continued to operate as intended. No degradation of performance was observed.

## 3.3.6 Immunity to Conducted Disturbances Induced by RF Fields

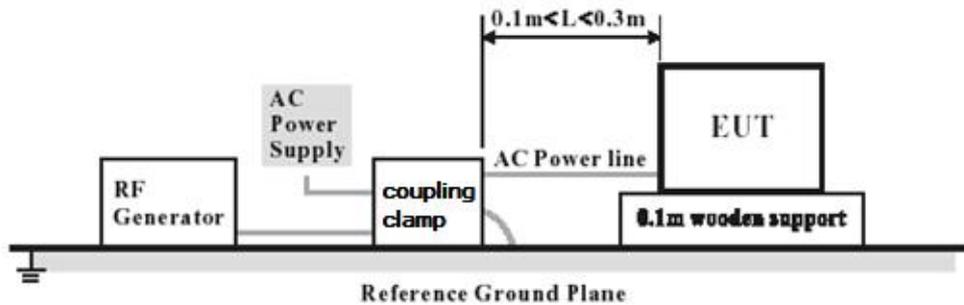
### 3.3.6.1 Test Specification

<b>Ports:</b>	All Circuits	Safety circuits
<b>Basic Standard:</b>	IEC 61000-4-6	
<b>Frequency Range:</b>	0.15 MHz – 80 MHz	
<b>Field Strength:</b>	3V	10V
<b>Modulation:</b>	1 kHz Sine Wave, 80%, AM Modulation	
<b>Frequency Step:</b>	1% of fundamental	
<b>Coupled Cable:</b>	a.c. power line, signal port	
<b>Coupling Device:</b>	Capacitive Clamp-F2301	
<b>Criteria:</b>	A	D

### 3.3.6.2 Test Procedure

- a. The EUT shall be tested within its intended operating and climatic conditions.
- b. The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.
- c. The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80% amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. The sweep rate shall not exceed  $1.5 \times 10^{-3}$  decades/s. The step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value where the frequency is swept incrementally.
- d. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequencies and harmonics or frequencies of dominant interest, shall be analyzed separately.
- e. Attempts should be made to fully exercise the EUT during test, and to fully interrogate all exercise modes selected for susceptibility.

### 3.3.6.3 Test Setup



### 3.3.6.4 Test Result

Test Point	Frequency	Field Strength (Vrms)	Observation	Comply with criterion
a.c. power line	0.15 -80 MHz	10	Note(1)	A
Signal port	0.15 -80 MHz	10	Note(1)	A

#### NOTE:

- (1). The EUT continued to operate as intended. No degradation of performance was observed.

### 3.3.7 Voltage Dips and Short Interruptions Immunity Test

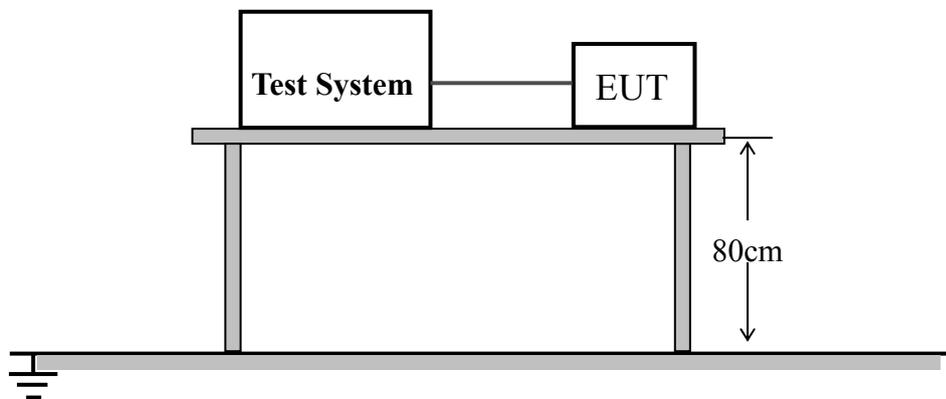
#### 3.3.7.1 Test Specification

<b>Ports:</b>	All Circuits	Safety circuits
<b>Basic Standard:</b>	IEC 61000-4-11	
<b>Voltage Dips:</b>	40% residual, 10 period; 70% residual, 25 period; 0% residual, 1 period	70% residual, 0.5 to 5 in 0.5 period steps; 40% reduction, 10 to 50 in 5 period steps
<b>Voltage Interruptions:</b>	0% residual, 250 period	0% residual, 250 period
<b>Voltage Phase Angle:</b>	0°	
<b>Criteria:</b>	C, C, B, C	D

#### 3.3.7.2 Test Procedure

- The power cord was used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.
- The EUT was tested for (I) 60% voltage dip of supplied voltage with duration of 200ms, (II) 30% voltage dip of supplied voltage and duration 500ms, (III) 100% voltage dip of supplied voltage and duration 20ms.
- 100% voltage interruption of supplied voltage with duration of 5000ms was followed, which was a sequence of three voltage interruptions with intervals of 10 seconds.
- Voltage reductions occur at 0 degree crossover point of the voltage waveform. The performance of the EUT was checked after the voltage dip or interruption.

#### 3.3.7.3 Test Setup



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

**3.3.7.4 Test Result**

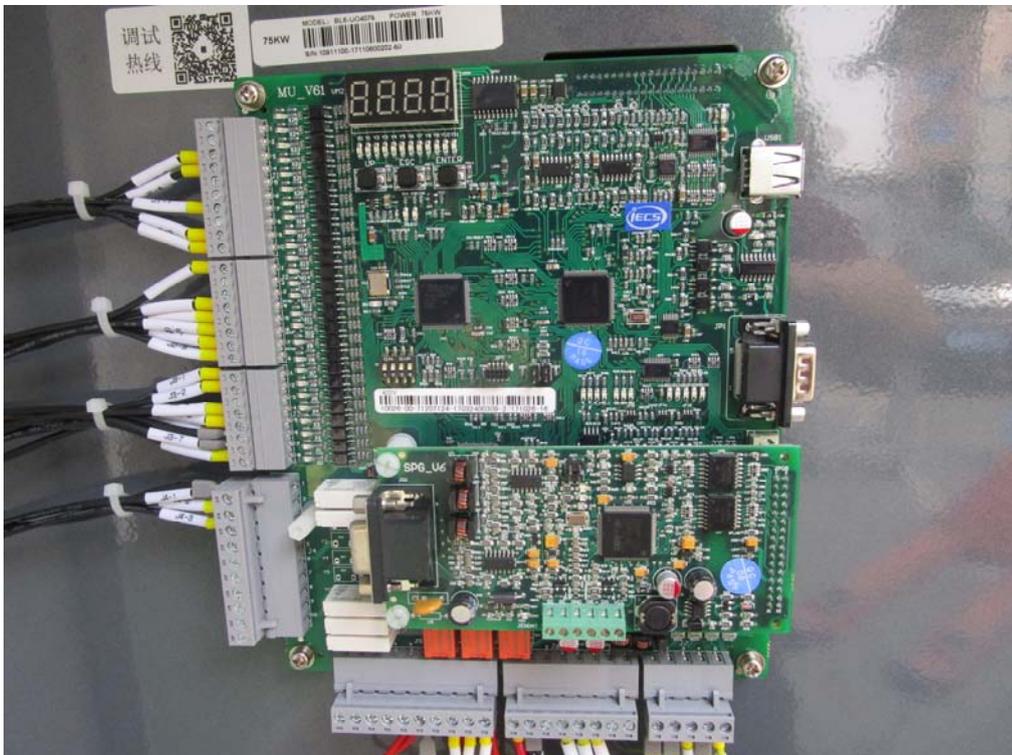
Test Mode	Voltage Reduction	Duration (ms)	Times	Interval (Sec)	Observation	Comply with Criterion
Voltage dips	60%	200	3	10	Note (1)	A
	30%	500	3	10	Note (1)	A
	100%	20	3	10	Note (1)	A
Voltage interruptions	100%	5000	3	10	Note (3)	C

Note:

- (1). The EUT continued to operate as intended. No degradation of performance was observed.
- (2). The output voltage shift of the EUT was larger than 10% during the voltage dips test. After the test, the EUT output restored automatically.
- (3). The voltage output of the EUT became zero during the voltage interruption test. After the test, the EUT output restored automatically.

## Appendix I: Photographs of the EUT







## Appendix II: Photographs of EMC Test Configuration

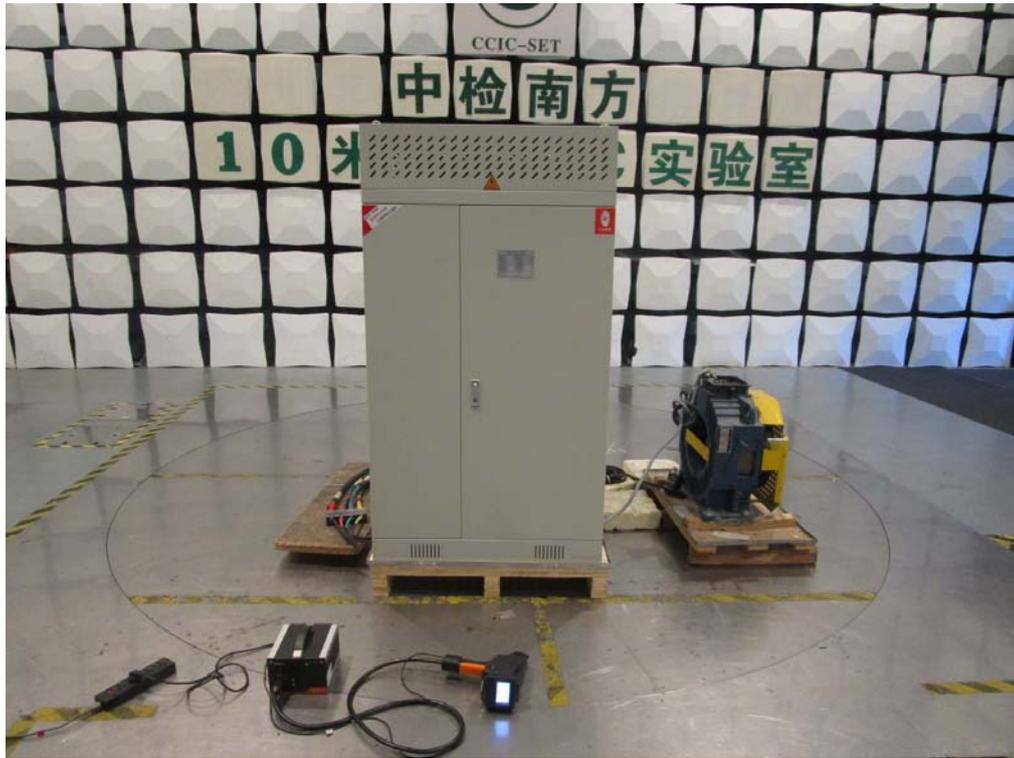
### 1. Mains Terminal Disturbance Voltage Measurement



### 2. Radiated Field Strength Measurement



### 3. Electrostatic Discharge Immunity Test



### 4. Radiated, Radio Frequency Electromagnetic Field Immunity Test



### 5. Electrical Fast Transient/Burst Immunity Test, Surge Immunity Test



### 7. Immunity to conducted disturbances induced by RF fields



### 8. Voltage Dips and Short Interruptions Immunity Test



### 9. Harmonics Current Measurement and Voltage Fluctuation and Flick Measurement



### 10. Discontinuous Disturbance, Click



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**End of report**