

EMC TEST REPORT

Reference No.: SZQLAB-20230824001E
Product: Asynchronous LED displays player
Model No.: See Appendix
Applicant: Shanghai ONBON Technology Inc
Address: Floor 7, Tower 88, 1199#, North Qinzhou Road,Xuhui District,shanghai,China
Issued by: Suzhou SZQ Testing Co., Ltd.
Lab location: Building 1, Yuanchang Park, No.3-2, Dongwu South Road, Wuzhong Economic Development Zone, Suzhou
Tel: 86 512 68796618



This test report consists of 40 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product endorsement by SZQLAB. The test results in the report only apply to the tested sample. The test report shall be invalid without all the signatures of testing engineers, reviewer and approver. Any objections must be raised to SZQLAB within 15 days since the date when the report is received. It will not be taken into consideration beyond this limit.

Revision History

Report No	Version	Date	Description
SZQLAB-20230824001E	1	August 24, 2023	Initial Issue

Table of Contents

1	Test Report Certification	3
2	General Information	4
	2.1 Description of EUT	4
	2.2 Details of Support Equipment(s)	4
3	Test Methodology	5
	3.1 Objective	5
	3.2 Description of Test Modes	5
	3.3 EUT System Operation	5
	3.4 Setup Of Equipment Under Test	5
	3.5 Test Standards and Results	6
	3.6 Measurement uncertainty	7
	3.7 List of Equipments Used	8
4	Emission Test	9
	4.1 Conducted Disturbance at Mains Terminals	9
	4.2 Conducted Disturbance at Telecommunication ports	13
	4.3 Radiated Disturbance Measurement	15
	4.4 Harmonic Current Measurement	19
	4.5 Voltage Fluctuation and Flick Measurement	22
5	Immunity Test	23
	5.1 EUT Setup and Operating Conditions	23
	5.2 Performance Criteria	23
	5.3 Electrostatic Discharge Immunity Test	23
	5.4 Radiated, Radio Frequency Electromagnetic Field Immunity Test	26
	5.5 Electrical Fast Transient/Burst Immunity Test	28
	5.6 Surge Immunity Test	30
	5.6.1 Test Specification	30

5.7 Immunity to Conducted Disturbances Induced by RF Fields	32
5.8 Power Frequency Magnetic Field Immunity Test	34
5.9 Voltage Dips and Short Interruptions Immunity Test	36
ANNEX I - EUT PHOTOS	38

1 Test Report Certification

Product: Asynchronous LED displays player

Model No.: See Appendix

Applicant: Shanghai ONBON Technology Inc

Applicant Address: Floor 7, Tower 88, 1199#, North Qinzhou Road, Xuhui District, Shanghai, China

Manufacturer: Shanghai ONBON Technology Inc

Manufacturer Address: Floor 7, Tower 88, 1199#, North Qinzhou Road, Xuhui District, Shanghai, China

Factory: ONBON (Jiangsu) Optoelectronic Industrial Co., LTD

Factory Address: No. 1299 Fuchunjiang Road, Kunshan, Jiangsu, China

Test Standards: EN 55032:2015+A1:2020
EN 55032:2015+A11:2020
EN 55035:2017+A11:2020
IEC 61000-3-2:2020
EN 61000-3-3:2013+A1:2019

Date of Test: From 2023-09-04 to 2023-09-05

Test Result: PASS

We, Suzhou SZQ Testing Co., Ltd. hereby certify that the Equipment Under Test (EUT) described above has been tested in our facility. The test record, data evaluation and EUT configuration represented herein are true and accurate accounts of measurements of the sample's EMC characteristics under the conditions herein specified.

Tested by: Shan zuo Gu, Date: September 13, 2023

Checked by: White Ma, Date: September 13, 2023

2 General Information

2.1 Description of EUT

Product:	Asynchronous LED displays player
Model No.:	BX-Y1A
Brand Name:	—
Serial No.:	—
Rated power supply:	DC 5V
I/O Ports:	USB、RJ45 (Debug only, no network function.)
Accessories:	—

Note:

- (1). The EUT is class B information technology equipment according to EN55032. The test samples are preproduction. For more detailed features description about the EUT, please refer to User's Manual.
- (2). Model List

NO.	MODELS	power supply
1	BX-Y08A, BX-Y1A, BX-Y2A, BX-Y3A, BX-Y001, BX-Y04, BX-Y08, BX-Y1L, BX-Y1, BX-Y1M, BX-Y2L, BX-Y2, BX-Y3, BX-YL, BX-Y2E, BX-Y3E, BX-YV, BX-C08A, BX-C1A, BX-C001, BX-C01, BX-C04, BX-C08, BX-C1, BX-C2, BX-CV, BX-Z001, BX-Z01, BX-Z08, BX-Z08A, BX-Z02A, BX-TAXI	DC 5V

2.2 Details of Support Equipment(s)

Description	Manufacturer	Model No.	Connection Port	Working State
Laptop	Thinkpad	SL410(2824)	RJ45	Normal
/	/	/	/	/

3 Test Methodology

3.1 Objective

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

3.2 Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	Normal Operation

Final Mode	Description
Mode 1	Normal Operation

3.3 EUT System Operation

1. According to the erection of figure for site erection.
2. The tested sample is in rated working condition.
3. Start testing.

3.4 Setup Of Equipment Under Test

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.

3.5 Test Standards and Results

The EUT has been tested according to the following specifications:

EMISSION (EN 55032:2015+A1:2020)		
Test Type	Standard	Result
Mains terminal disturbance voltage	<input checked="" type="checkbox"/> EN 55032:2015+A1:2020,Class B	PASS
	<input type="checkbox"/> EN 55032:2015+A1:2020,Class A	
Conducted Common mode Disturbance at Telecommunication Ports	<input type="checkbox"/> EN 55032:2015+A1:2020,Class B	N/A
	<input type="checkbox"/> EN 55032:2015+A1:2020,Class A	
Radiated disturbance (30MHz-1GHz)	<input checked="" type="checkbox"/> EN 55032:2015+A1:2020,Class B	PASS
	<input type="checkbox"/> EN 55032:2015+A1:2020,Class A	
Radiated disturbance (1GHz-6GHz)	<input type="checkbox"/> EN 55032:2015+A1:2020,Class B	N/A
	<input type="checkbox"/> EN 55032:2015+A1:2020,Class A	
Harmonic current emissions	IEC 61000-3-2:2020	N/A
Voltage fluctuation & flicker	EN 61000-3-3: 2013/A1:2019	N/A
IMMUNITY (EN 55035:2017+A11:2020)		
Test Type	Basic Standard	Result
Electrostatic discharge immunity	IEC 61000-4-2	PASS
Radiated, radio frequency electromagnetic field immunity	IEC 61000-4-3	PASS
Electrical fast transient/burst immunity	IEC 61000-4-4	PASS
Surge immunity	IEC 61000-4-5	PASS
Immunity to conducted disturbances induced by RF fields	IEC 61000-4-6	PASS
Power frequency magnetic field immunity	IEC 61000-4-8	PASS
Voltage dips and short interruptions immunity	IEC 61000-4-11	N/A

Note: The latest versions of basic standards are applied.

3.6 Measurement uncertainty

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

Measurement	Frequency	Uncertainty
Conducted emissions (Power Port)	0.15MHz~30MHz	±1.7dB
Conducted emissions (Telecom Port)	0.15MHz~30MHz	±2.4dB

Measurement	Polarity	Frequency	Uncertainty
Radiated emissions (below 1GHz)	H	30MHz ~ 200MHz	±4.7dB
		200MHz ~1000MHz	±4.7dB
	V	30MHz ~ 200MHz	±4.7dB
		200MHz ~1000MHz	±4.7dB
Radiated emissions (above 1GHz)	H	1000MHz ~6000MHz	±4.7dB
	V	1000MHz ~6000MHz	±4.7dB

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.
- (2) Consistent with industry standard (e.g. CISPR 32: 2019, clause 11, Measurement Uncertainty) determining compliance with the limits shall be base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.
- (3) The acceptable measurement uncertainty value without requiring revision of the compliance statement is base on conducted and radiated emissions being less than UCISPR which is 3.6dB and 5.2dB respectively. CCS values (called ULab in CISPR 16-4-2) is less than UCISPR as shown in the table above. Therefore, MU need not be considered for compliance.

3.7 List of Equipments Used

Description	Model No.	Calibration period of validity	Serial No.
EMI Test Receiver	ESCI	2024.07.13	RU-001E
LISN	ESH 3-z5	2024.07.13	EV-202E
PULSE LINITER	ESH 3-z2	2024.04.17	RZ-032E
TRILOG Broadband Antenna	VULB9163	2024.07.15	RG-001E
Spectrum Analyzer	N9000A	2024.02.06	RU-002E
Pre-Amplifier	LNA0640	2024.04.17	RZ-020E
Broad-Band Horn Antenna	3115	2024.02.06	RG-003E
ISN	FCC-TLISN T2-02	2024.07.13	RZ-001E
ISN	FCC-TLISN T4-02	2024.07.13	RZ-002E
ISN	FCC-TLISN T8-02	2024.07.13	RZ-003E
EMC HARMONICS & FLICKER TEST SYSTEMS	ECTS2-140M	2024.07.13	RZ-018E
ESD Generator	NSG437	2024.07.15	EV-200E
Signal Generator	SMB100A	2024.02.06	EV-003E
Power Amplifier	HAP_80M01G-250W	2024.07.13	RZ-011E
Power Amplifier	HAP_01G06G-75W	2024.07.13	RZ-012E
Power Sensor	U2001A	2024.07.13	RZ-030E
Power Sensor	U2001A	2024.07.13	RZ-031E
RF Switch	PFSU_DC18G-4C	2024.07.13	RZ-013E
Stacked logarithmic periodic antenna	STLP 9129 PLUS	N/A	RZ-014E
Filed Probe	EFS-10	2024.07.16	RZ-015E
Combined immunity tester	CCS 600	2024.07.13	RZ-004E
RF conducted immunity testing system	CST 1075	2024.07.13	RZ-005E
Coupled decoupling network	CDN M2M3	2024.07.13	RZ-024E
EM Clamp	EM CL100	2024.07.13	RZ-021E
Capacitive coupling clamp	CCC 100	2024.07.13	RZ-006E
Power fail simulator	PFS 2216SD	2024.07.13	RZ-007E
AC/DC variable frequency magnetic field with coil	MFS 300AP TYX130	2024.07.13	RZ-010E
50ohm Termination	TF2-1G-A	2024.07.13	RZ-022E
50ohm Termination	TF2-1G-A	2024.07.13	RZ-023E

Note: Equipments above have been calibrated and are in the period of validation.

4 Emission Test

4.1 Conducted Disturbance at Mains Terminals

4.1.1 Limits

Frequency range (MHz)	Limits (dB μ V), Class B		Limits (dB μ V), Class A	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46	79	66
0.50 - 5	56	46	73	60
5 - 30	60	50	73	60

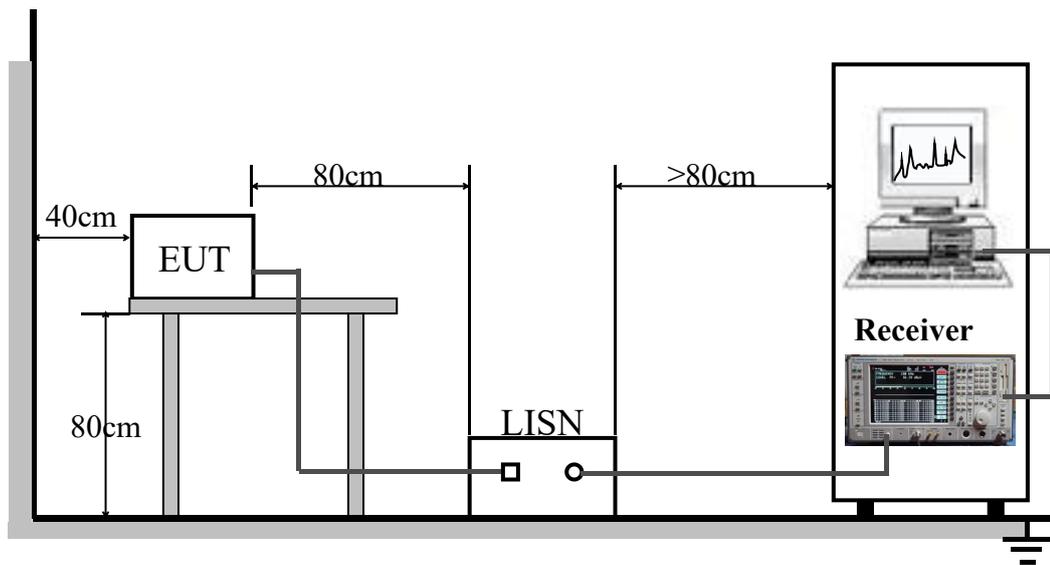
Notes:

- (1) The lower limit shall apply at the transition frequencies.
- (2) The limit decreases linearly with the logarithm of the frequency in the range 50 kHz to 150 kHz and 150 kHz to 0.5 MHz.
- (3) If the quasi-peak value is lower than Average Limits, it is no necessary to conduct the average measurement.

4.1.2 Test Procedure

- a. The EUT was placed 0.4 meters from the conducting wall of shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provide 50 Ω /50 μ 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.

4.1.3 Test Setup



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

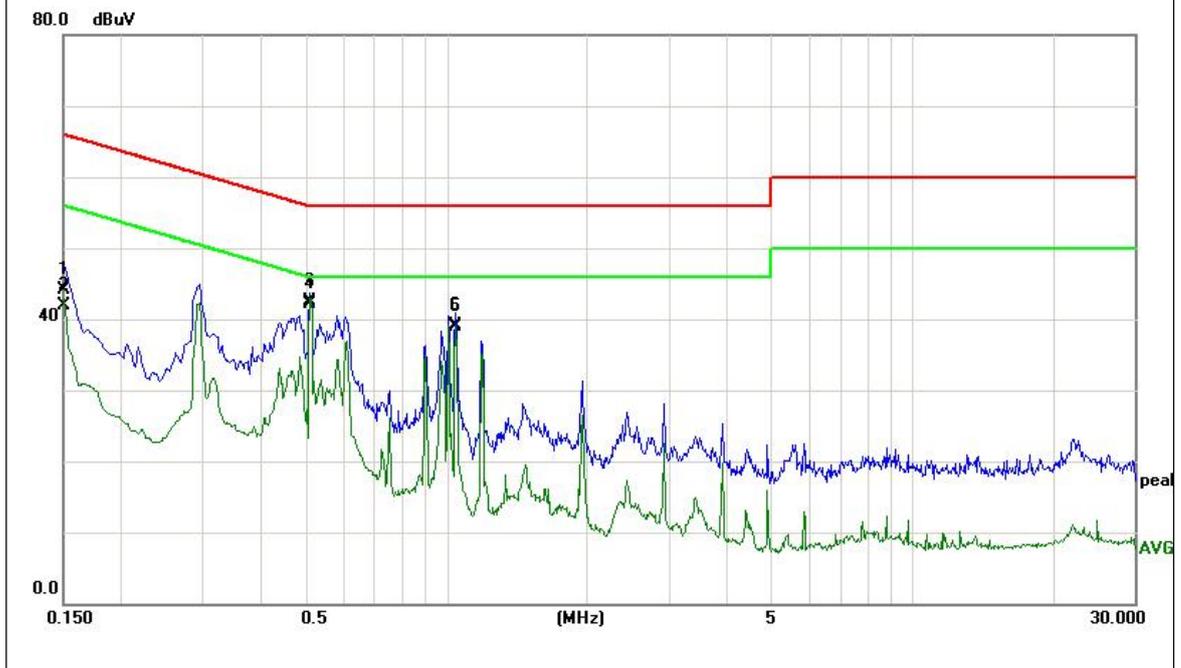
4.1.4 Test Location

Shield Room: Located at C2.

4.1.5 Test Result

Conducted Disturbance at Mains Terminals (L-Line)

Test Curve

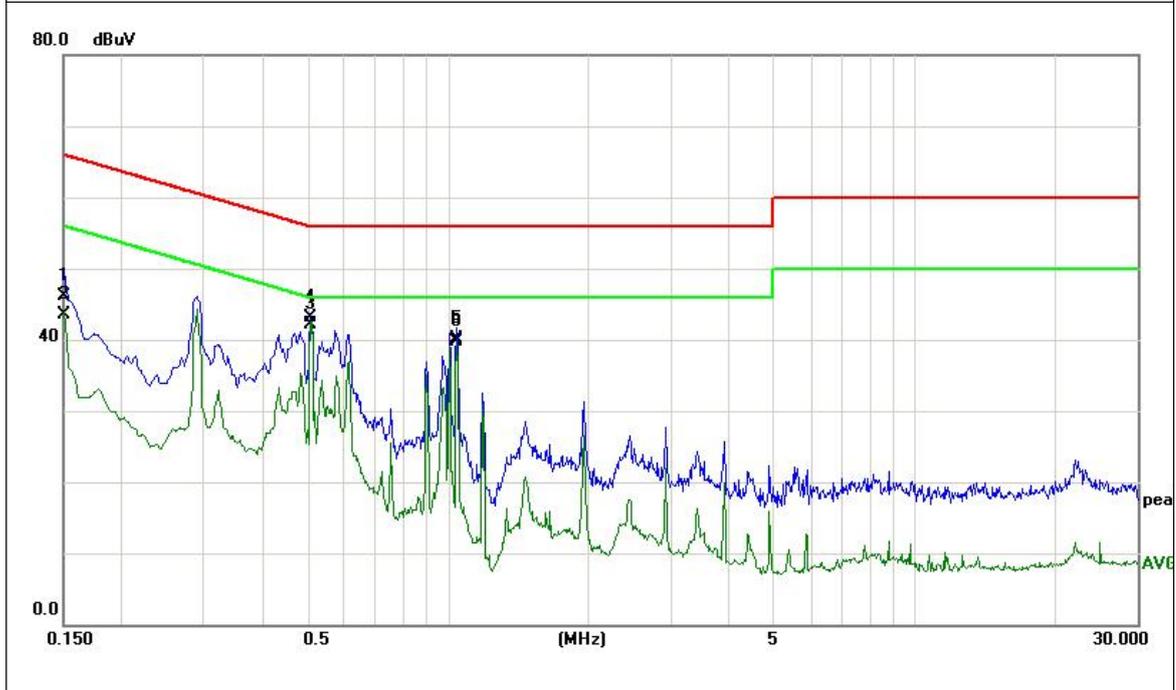


Test Data

Freq. (MHz)	Measured (dBuV)	Limits (dBuV)	Margin (dB)	Note
0.150	44.04	66.00	-21.96	QP
0.150	42.00	56.00	-14.00	AVG
0.510	42.56	46.00	-13.44	QP
0.510	42.06	60.00	-3.94	AVG
1.046	38.96	56.00	-17.04	QP
1.046	39.06	46.00	-6.94	AVG

Conducted Disturbance at Mains Terminals (N-Line)

Test Curve



Test Data

Freq. (MHz)	Measured (dBuV)	Limits (dBuV)	Margin (dB)	Note
0.150	46.13	66.00	-19.87	QP
0.150	43.41	56.00	-12.59	AVG
0.510	42.03	56.00	-13.97	QP
0.510	43.01	46.00	-2.99	AVG
1.046	40.03	56.00	-15.97	QP
1.046	39.76	46.00	-6.24	AVG

4.2 Conducted Disturbance at Telecommunication ports

4.2.1 Limits

Frequency range (MHz)	Limits (dBuV), Class B	
	Quasi-peak	Average
0.15 - 0.50	84 to 74	74 to 64
0.50 - 30	74	64

Frequency range (MHz)	Limits (dBuV), Class A	
	Quasi-peak	Average
0.15 - 0.50	97 to 87	84 to 74
0.50 - 30	87	74

NOTE:

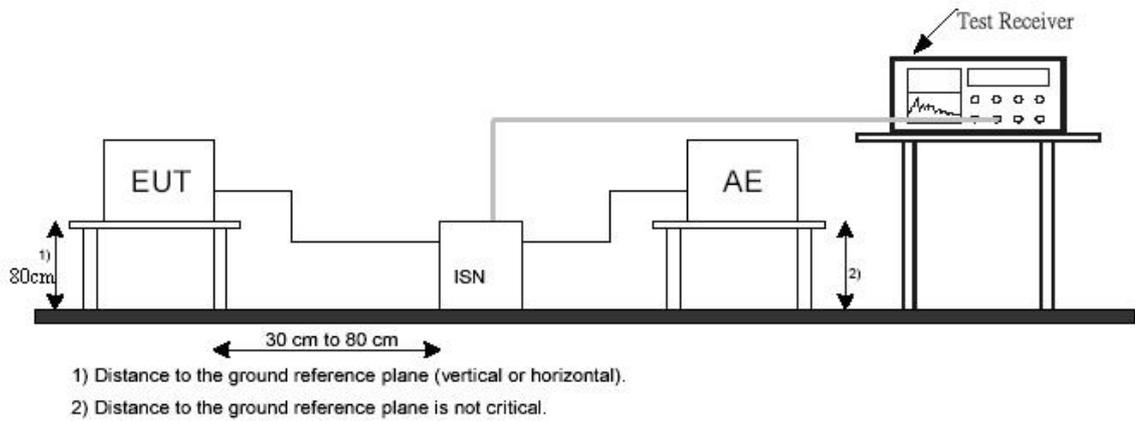
- (1). The lower limit shall apply at the transition frequencies.
- (2). The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.
- (3). If the quasi-peak value is lower than Average Limits, it is no necessary to conduct the average measurement.

4.2.2 TEST Procedure

The following test modes was scanned during the preliminary test:/

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

4.2.3 Test Setup



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

4.2.4 Test Location

Shield Room: Located at C2.

4.2.5 Test Result

The EUT is not suitable for the test.

4.3 Radiated Disturbance Measurement

4.3.1 Limits of Radiated Disturbance (30MHz~1000MHz)

Frequency range (MHz)	Quasi peak limits(dB μ V/m)	
	For Class B, at 3m measurement distance	For Class B, at 3m measurement distance
30 - 230	40	50
230 - 1000	47	57

Notes:

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

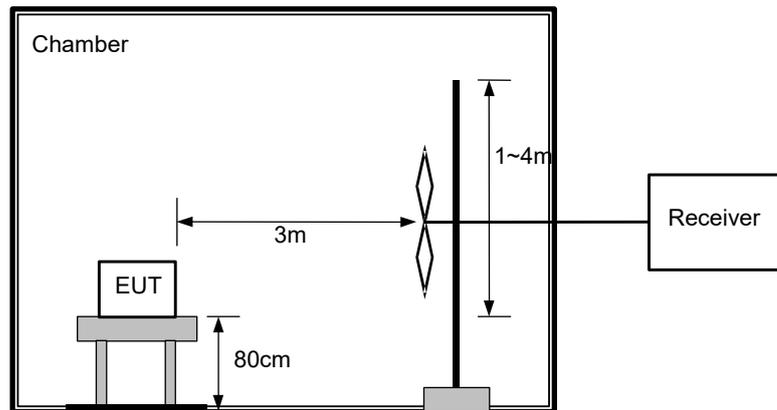
4.3.2 Limits of Radiated Disturbance (Above 1GHz)

Frequency range (GHz)	Limits(dB μ V/m), Class B		Limits(dB μ V/m), Class A	
	Average	peak	Average	peak
1~3	50	70	56	76
3~6	54	74	60	80

4.3.3 Test Procedure

- a. The EUT was placed on the top of an insulating table 0.8 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 Boundary of EUT(imaginary circular periphery) was set 3 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 ratable 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.

4.4.4 Test Setup

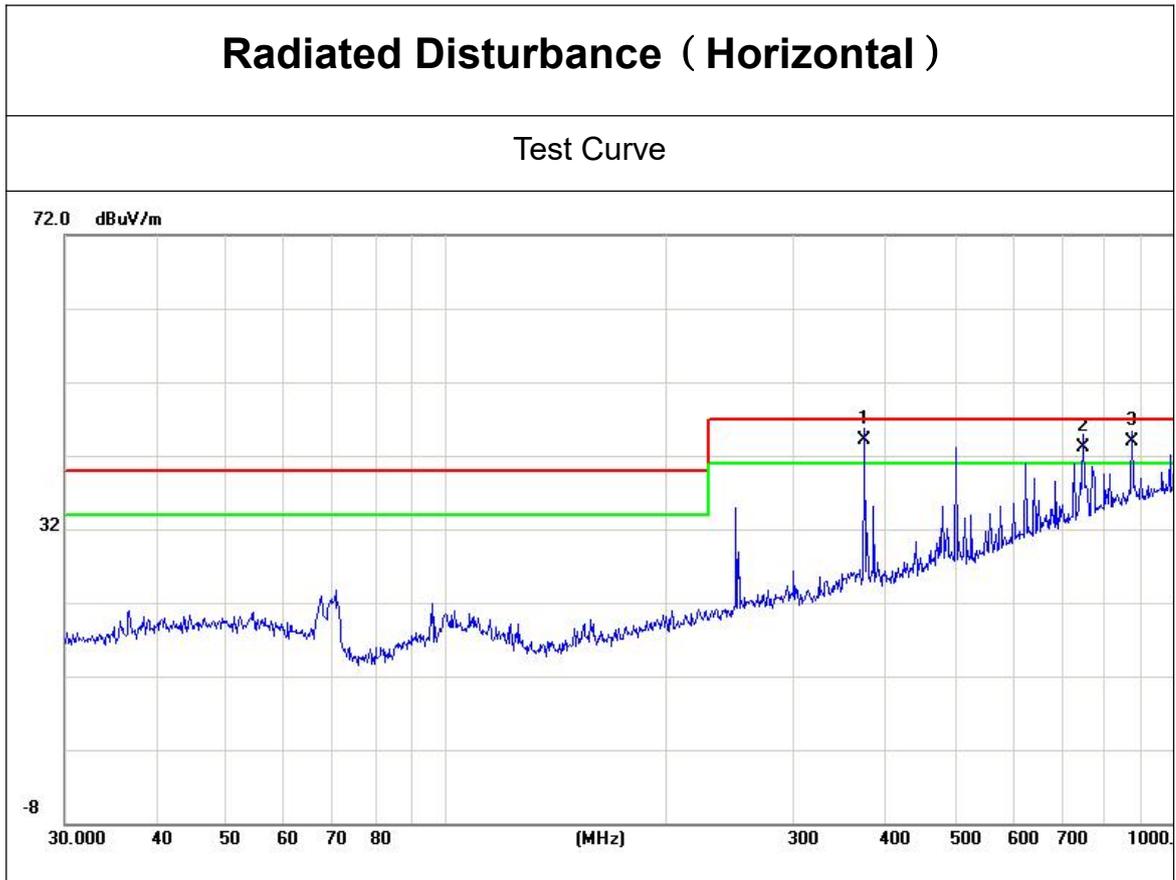


For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

4.3.5 Test Location

Semi-anechoic chamber: SAC3.

4.3.6 Test Result (30MHz~1000MHz)

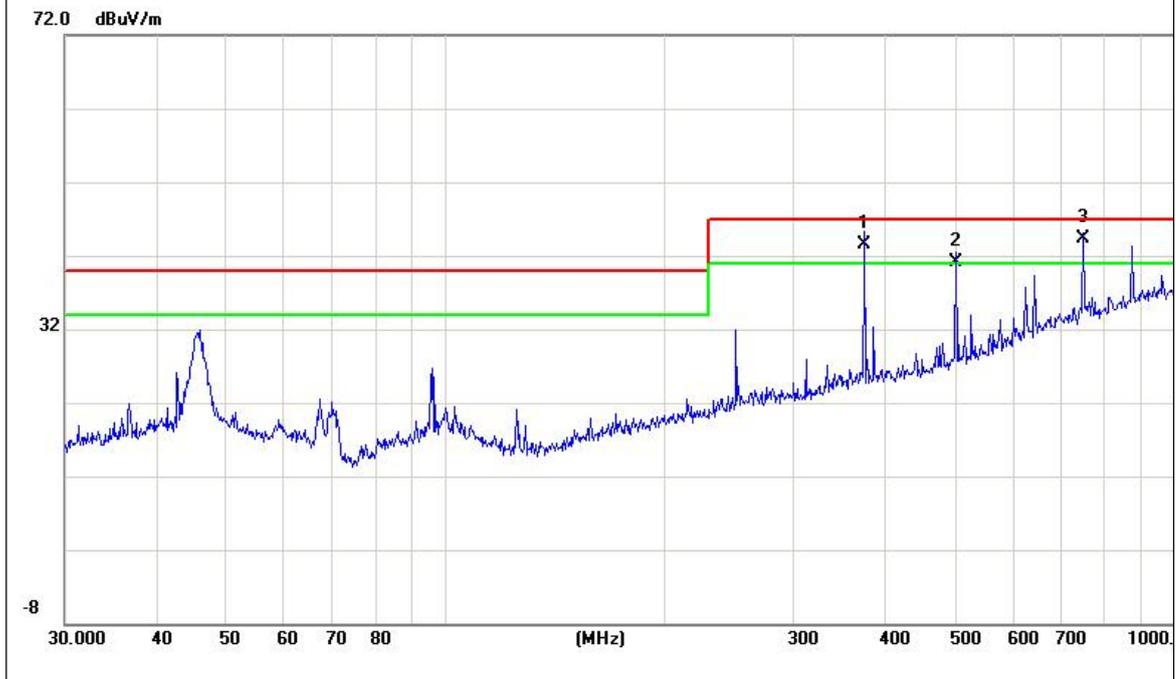


Test Data

Freq. (MHz)	Height of Antenna (cm)	Angle of Turntable (°)	Limits(QP) (dBuV/m)	Measurement Value (QP) dB(V/m)	Margin (dB)
375.938	200	244	47.00	44.06	-2.94
750.108	200	125	47.00	43.19	-3.81
875.247	200	302	47.00	43.96	-3.04

Radiated Disturbance (Vertical)

Test Curve



Test Data

Freq. (MHz)	Height of Antenna (cm)	Angle of Turntable (°)	Limits(QP) (dBuV/m)	Measurement Value (QP) dB(V/m)	Margin (dB)
375.938	100	211	47.00	43.51	-3.49
501.179	100	124	47.00	41.06	-5.94
750.108	100	308	47.00	44.36	-2.64

4.3.7 Test Result (Above 1GHz)

The EUT is not suitable for the test.

4.4 Harmonic Current Measurement

4.4.1 Limits of Harmonic Current

Limits for Class A Equipment			
Harmonics Order n	Max. permissible harmonic current (A)	Harmonics Order n	Max. permissible harmonic current (A)
Odd harmonics		Even harmonics	
3	2.30	2	1.08
5	1.14	4	0.43
7	0.77	6	0.30
9	0.40	8≤n≤40	0.23×8/h
11	0.33		
13	0.21		
15≤n≤39	0.15×15/h		

Limits for Class B Equipment
For Class B equipment, the harmonics of the input current shall not exceed the values given in Table that is the limit of Class A multiplied by a factor of 1,5

Limits for Class C Equipment	
Harmonics Order n	Maximum permissible harmonic current expressed as a percentage of the input current at the fundamental frequency %
2	2
3	27*
5	10
7	7
9	5
11<n<39 (odd harmonics only)	3
*The limit is determined based on the assumption of modern lighting technologies having power factors of 0,90 or higher	

Limits for Class D Equipment		
Harmonics Order n	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
11 < n < 39 (odd harmonics only)	3.85/h	See limit of Class A

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 > 5 W and no limits apply for equipment with an active input power up to and including 75 W.

4.4.2 Test Procedure

- a. 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.
- b. The EUT is classified as follows:

Class A: Balanced three-phase equipment, household appliances, Excluding those specified as belonging to Class B, C or D, Vacuum cleaners, High pressure cleaners, Tools, Excluding portable tools, Independent phase control dimmers, Audio equipment, Professional luminaires for stage lighting and studios.

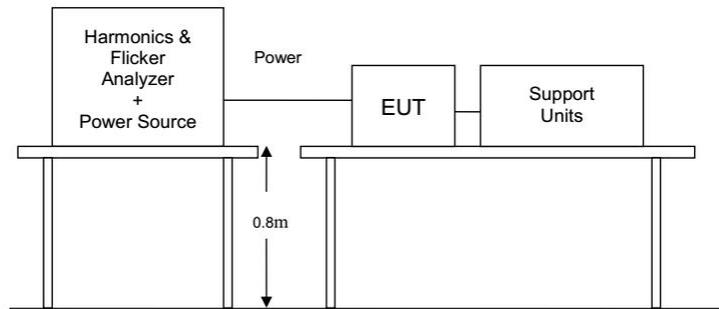
Class B: Portable tools, Arc welding equipment which is not professional equipment.

Class C: Lighting equipment.

Class D: Equipment having a specified power less than or equal to 600 W according to 6.3.2, of the following types: Personal computers and personal computer monitors, Television receivers, Refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

- c. 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 necessary for the EUT to be exercised.

4.4.3 Test Setup



4.4.4 Test Location

Testing room: Located at C2.

4.4.5 Test Result

The EUT is not suitable for the test.

4.5 Voltage Fluctuation and Flick Measurement

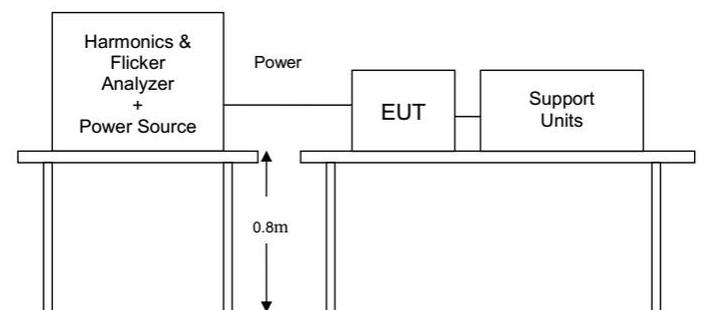
4.5.1 Limits of Voltage Fluctuation and Flick

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.

4.5.2 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 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.

4.5.3 Test Setup



4.5.4 Test Location

Testing room: Located at C2.

4.5.5 Test Result

The EUT is not suitable for the test.

5 Immunity Test

5.1 EUT Setup and Operating Conditions

Same as 3.1

5.2 Performance Criteria

Criterion A	The apparatus shall continue to operate as intended. 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.
Criterion B	The 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 the manufacturer, when the apparatus is used as intended.
Criterion C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

5.3 Electrostatic Discharge Immunity Test

5.3.1 Test Specification

Basic Standard:	IEC 61000-4-2
Discharge Impedance	330Ω / 150 pF
Discharge Voltage:	Air Discharge : ± 8 kV Contact Discharge : ± 4 kV
Number of Discharge:	Minimum 10 times at each test point
Discharge Mode:	Single discharge
Discharge Period:	1-second minimum

5.3.2 Test Procedure

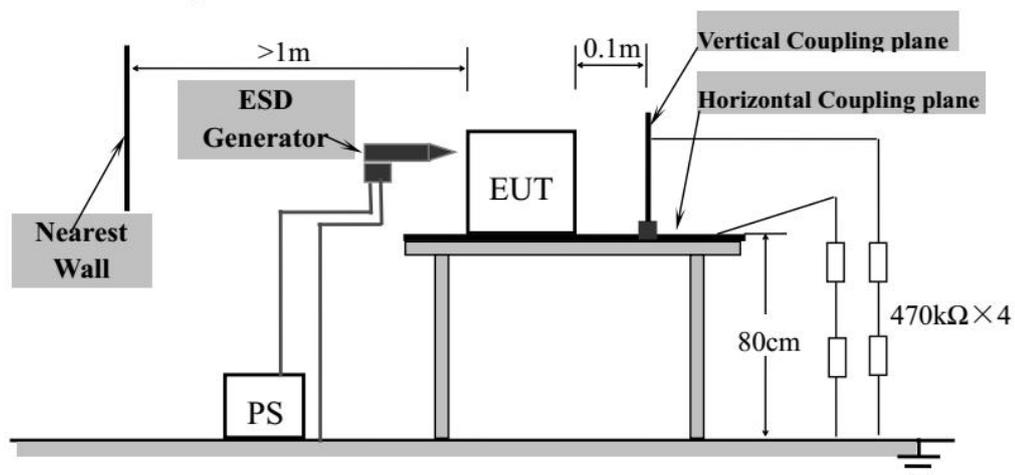
The basic test procedure was in accordance with IEC 61000-4-2:

- 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.

5.3.3 Test Setup



5.3.4 Test Result

Testing Room: Located at C1.

5.3.5 Test Result

Test Points	Discharge Level (kV)	Discharge Mode	Observation	Comply with Criterion
HCP	±4	Contact	Note(1)	A
VCP	±4	Contact	Note(1)	A
Network port	±4	Contact	Note(1)	A
USB port	±4	Contact	Note(1)	A
Power port	±4	Contact	Note(1)	A
Indicator light	±4	Contact	Note(2)	B
Sensor 232/485 I/O select program port (Spot 1)	±8	Air	Note(1)	A
Spot 2	±8	Air	Note(1)	A
Spot 3	±8	Air	Note(1)	A
Spot 4	±8	Air	Note(1)	A

Note:

- (1). The apparatus shall continue to operate as intended. 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.
- (2). The 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 the manufacturer, when the apparatus is used as intended.

5.4 Radiated, Radio Frequency Electromagnetic Field Immunity Test

5.4.1 Test Specification

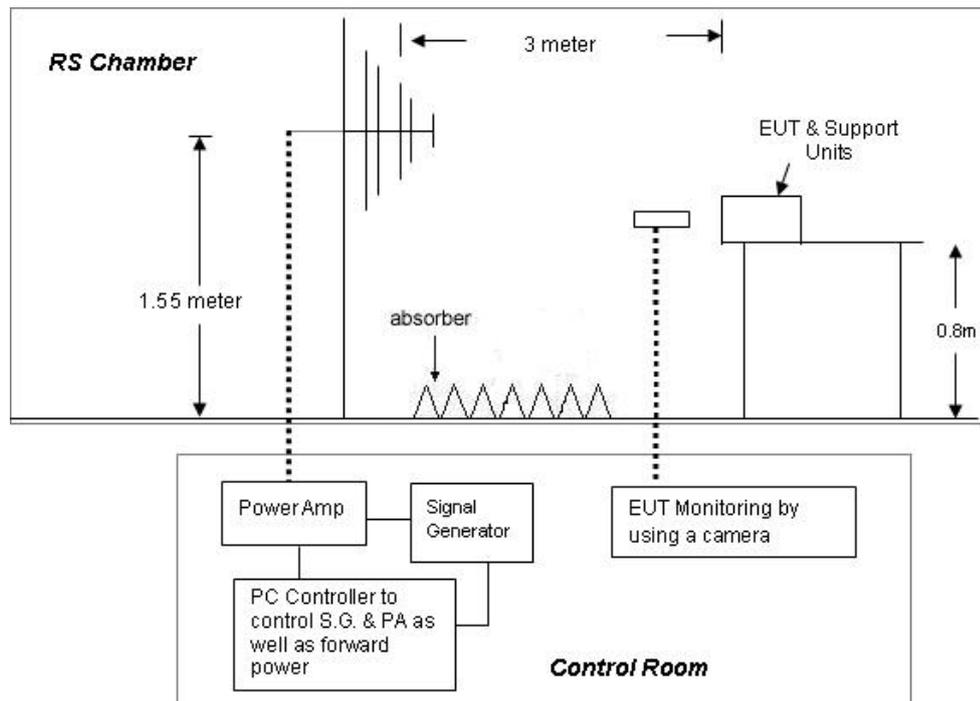
Basic Standard:	IEC 61000-4-3
Frequency Range:	80 MHz – 1000 MHz 1800 MHz, 2600 MHz, 3500 MHz, 5000 MHz (Frequency $\pm 1\%$)
Field Strength:	3V/m
Modulation:	1kHz sine wave, 80%, AM modulation
Frequency Step:	1% of fundamental
Polarity of Antenna	Horizontal and Vertical
Test Distance:	3m
Antenna Height:	1.55m

5.4.2 Test Procedure

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

- a. The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
- b. The frequency range is swept from 80 MHz to 1000MHz , 1800 MHz, 2600 MHz, 3500 MHz, 5000 MHz (Frequency $\pm 1\%$) with the signal 80% amplitude modulated with a 1 kHz sine wave. The rate of sweep did not exceed 1.5×10^{-3} decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
- 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 field strength level was 3V/m.
- e. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

5.4.3 Test Setup



5.4.4 Test Result

Testing Room: Located at SAC 3.

5.4.5 Test Result

Frequency (MHz)	Polarity	Azimuth	Field Strength (V/m)	Observation	Comply with Criterion
80-1000,1800,2600,3500,5000	H&V	Front	3	Note(1)	A
80-1000,1800,2600,3500,5000	H&V	Rear	3	Note(1)	A
80-1000,1800,2600,3500,5000	H&V	Left	3	Note(1)	A
80-1000,1800,2600,3500,5000	H&V	Right	3	Note(1)	A

Note:

- (1). The apparatus shall continue to operate as intended. 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.
- (2). The 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 the manufacturer, when the apparatus is used as intended.

5.5 Electrical Fast Transient/Burst Immunity Test

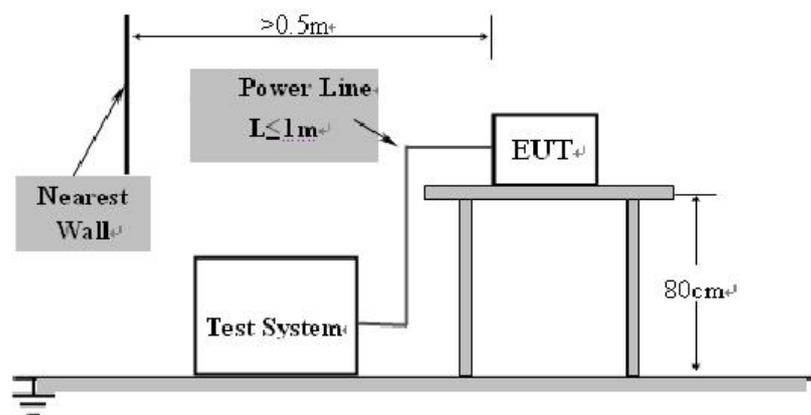
5.5.1 Test Specification

Basic Standard:	IEC 61000-4-4
Test Voltage:	DC Power Port: $\pm 0.5\text{kV}$
Impulse Frequency:	5kHz
Impulse wave shape:	5/50ns
Burst Duration:	15ms
Burst Period:	300ms
Test Duration:	≥ 1 min. / polarity

5.5.2 Test Procedure

- The EUT was tested with 1000 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.

5.5.3 Test Setup



5.5.4 Test Location

Testing Room: Located at C3.

5.5.5 Test Result

Test Point	Polarity	Test Level (kV)	Observation	Comply with Criterion
d.c. power line	±	0.5	Note (1)	A

Note:

- (1). The apparatus shall continue to operate as intended. 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.
- (2). The 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 the manufacturer, when the apparatus is used as intended.

5.6 Surge Immunity Test

5.6.1 Test Specification

Basic Standard:	IEC 61000-4-5
Waveform:	Voltage 1.2/50 μ s; Current 8/20 μ s
Test Voltage:	Power port, line to line \pm 0.5 kV
Phase Angle:	90°,270°
Repetition Rate:	60sec
Times:	5 times/each condition.

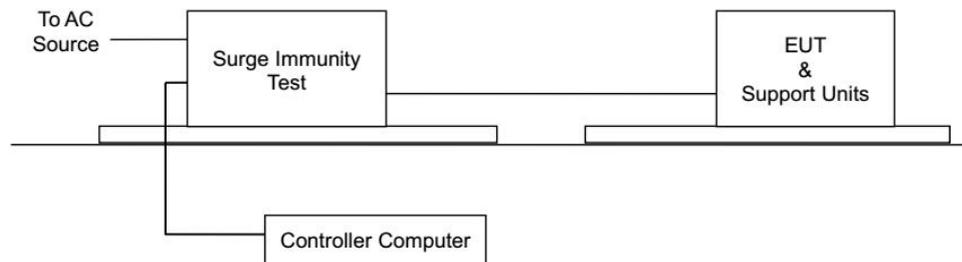
5.6.2 Test Procedure

- 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 \times 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.
- d. The number of pulses applied shall be as follows:
 - Five positive pulses line-to-neutral at 90° phase
 - Five negative pulses line-to-neutral at 270° phase

The following additional pulses are required only if the EUT has an earth connection or if the EUT is earthed via any AE.

- Five positive pulses line-to-earth at 90° phase
- Five negative pulses line-to-earth at 270° phase
- Five negative pulses neutral-to-earth at 90° phase
- Five positive pulses neutral-to-earth at 270° phase

5.6.3 Test Setup



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

5.6.4 Test Location

Testing Room: Located at C3.

5.6.5 Test Result

Coupling Line	Polarity	Voltage (kV)	Observation	Comply with Criterion
Positive-Negative	±	0.5	Note (1)	A

Note:

- (1). The apparatus shall continue to operate as intended. 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.
- (2). The 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 the manufacturer, when the apparatus is used as intended.

5.7 Immunity to Conducted Disturbances Induced by RF Fields

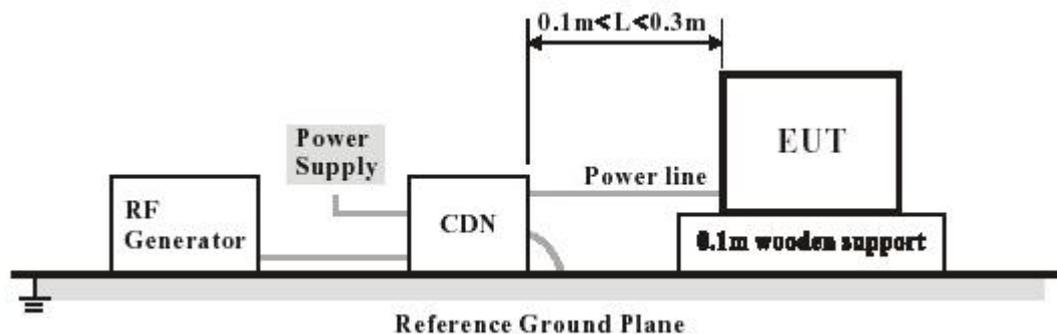
5.7.1 Test Specification

Basic Standard:	IEC 61000-4-6		
Frequency Range:	0.15 MHz – 10 MHz	10 MHz – 30 MHz	30 MHz – 80 MHz
Field Strength:	3 Vms	3 Vms to 1 Vms	3 Vms
Modulation:	1 kHz Sine Wave, 80%, AM Modulation		
Frequency Step:	1% of fundamental		
Coupled Cable:	power line		

5.7.2 Test Procedure

- The EUT shall be tested within its intended operating and climatic conditions.
- The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.
- The frequency range 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 1.5×10^{-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.
- 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.
- Attempts should be made to fully exercise the EUT during test, and to fully interrogate all exercise modes selected for susceptibility.

5.7.3 Test Setup



5.7.4 Test Result

Testing Room: Located at C4.

5.7.5 Test Result

Test Point	Frequency (MHz)	Field Strength (Vrms)	Observation	Comply with criterion
power line	0.15 to 10	3	Note(1)	A
	10 to 30	3 to 1	Note(1)	A
	30 to 80	1	Note(1)	A

Note:

- (1). The apparatus shall continue to operate as intended. 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.
- (2). The 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 the manufacturer, when the apparatus is used as intended.

5.8 Power Frequency Magnetic Field Immunity Test

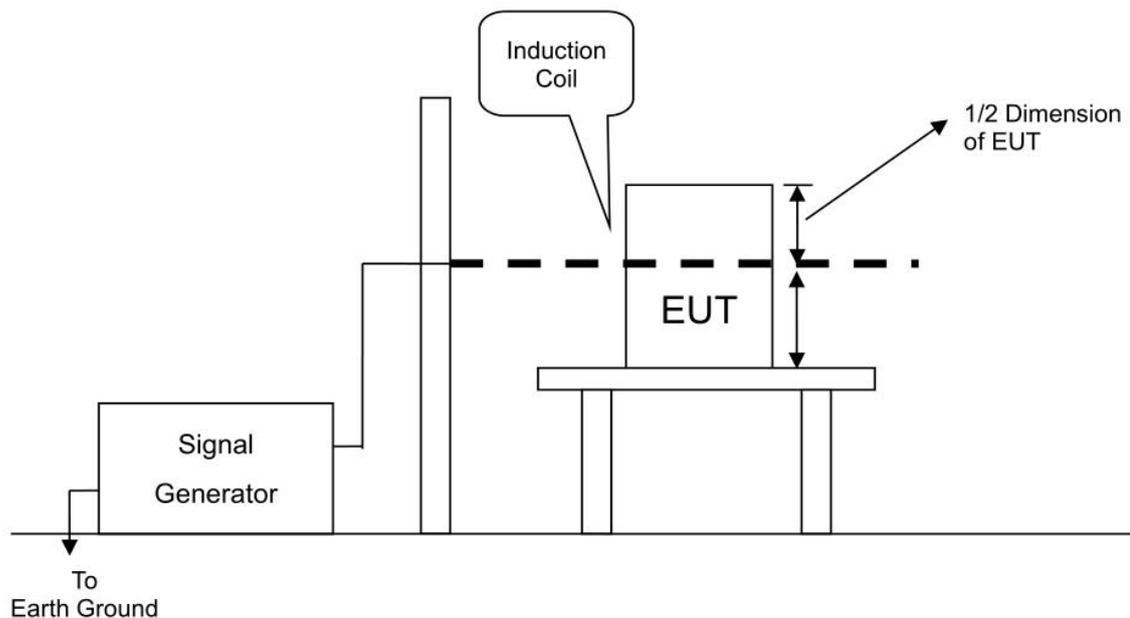
5.8.1 Test Specification

Basic Standard:	IEC 61000-4-8
Frequency Range:	50 Hz or 60 Hz
Field Strength:	1 A/m
Observation Time:	1 minute
Inductance Coil:	Rectangular type, 1m×1m

5.8.2 Test Procedure

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

5.8.3 Test Setup



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

5.8.4 Test Result

Testing Room: Located at C3.

5.8.5 Test Result

Direction	Field Strength (A/m)	Frequency Range:	Observation	Comply with Criterion
X	1	50Hz	Note(1)	A
Y	1	50Hz	Note(1)	A
Z	1	50Hz	Note(1)	A

Note:

- (1). The apparatus shall continue to operate as intended. 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.
- (2). The 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 the manufacturer, when the apparatus is used as intended.

5.9 Voltage Dips and Short Interruptions Immunity Test

5.9.1 Test Specification

Basic Standard:	IEC 61000-4-11
Voltage Dips:	>95% reduction, 0.5 period 30% reduction, 25 periods
Voltage Interruptions:	>95% reduction, 250 periods
Voltage Phase Angle:	0° / 45° / 90° / 135° / 180° / 225° / 270° / 315°
Test cycle:	3 times

5.9.2 Test Procedure

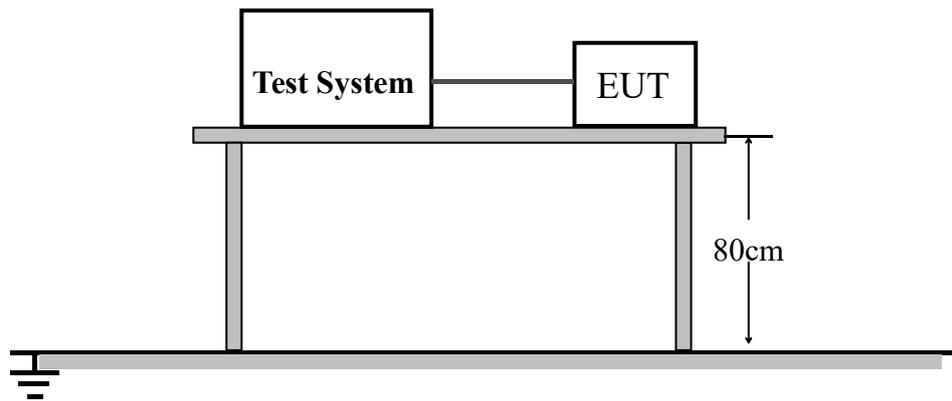
- a. The power cord was used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.
- b. The EUT was tested for (I) 95% voltage dip of supplied voltage with duration of 10ms, (II)30% voltage dip of supplied voltage and duration 500ms. Both of the dip tests were carried out for a sequence of three voltage dips with intervals of 10 seconds.
- c. 95% voltage interruption of supplied voltage with duration of 5000ms was followed, which was a sequence of three voltage interruptions with intervals of 10 seconds.
- d. Changes to occur at 0 degree crossover point of the voltage waveform. If the EUT does not demonstrate compliance when tested with 0 degree switching, the test shall be repeated with the switching occurring at both 90 degrees and 270 degrees. If the EUT satisfies these alternative requirements, then it fulfils the requirements. This condition shall be recorded in the test report.

- e. Where the equipment has a rated voltage range the following shall apply:

If the voltage range does not exceed 20 % of the lower voltage specified for the rated voltage range. A single voltage within that range may be selected for testing.

In all other cases, the test procedure shall be applied for both the lowest and highest voltages declared in the voltage range.

5.9.3 Test Setup



5.9.4 Test Location

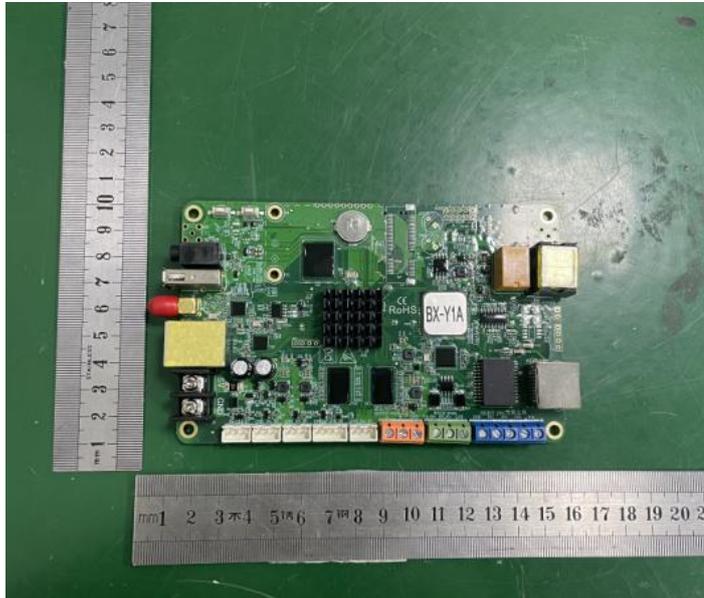
Testing Room: Located at C3.

5.9.5 Test Result

The EUT is not suitable for the test.

ANNEX I - EUT PHOTOS

EUT PHOTOS (1)



EUT PHOTOS (2)



Name Plate



Port photo



Test Points



End of the report
