

EMC TEST REPORT

Reference No.: 2021E0514002E

Product: Asynchronous LED displays controller (card) without gray-scale

Model No.: See Model list

Applicant: Shanghai ONBON Technology Inc

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

Issued by: Suzhou Electronic Products Test Institute Co., Ltd.

Lab location: Building 1, Yuanchang science park, No. 3-2 Dongwu South Road, Wuzhong Economic Development Zone, Suzhou.

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Revision History

Report No	Version	Date	Description
CJSETI-2021E514002E	1	May 14, 2021	Initial Issue

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1 Test Report Certification

Product: Asynchronous LED displays controller (card) without gray-scale

Model No.: See Model list

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: Shanghai ONBON Technology Inc

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

Test Standards: EN 55032:2015

EN 55035:2017 A11:2020

EN 61000-3-2:2014

EN 61000-3-3:2013

Date of Test: From 2021-05-14 to 2021-06-02

Test Result: PASS

We, Suzhou Electronic Products Test Institute 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: Shanzuo Gu, Date: June. 30, 2021
Shanzuo Gu

Checked by: Guocong Gao, Date: June. 30, 2021
Guocong Gao

2 General Information

2.1 Description of EUT

Product: Asynchronous LED displays controller (card) without gray-scale

Model No.: BX-6E1XP

Brand Name: —

Serial No.: —

Rating: DC3.3V~5.5V

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). The main test model is HRUC T 300, and the test results cover a series of models. The difference between different models is only that the model name is different, and the rest are the same. The difference does not affect the EMC performance of the product.
- (3). Model list:

NO.	MODELS	power supply
1.	BX-6M2JT、BX-6E3JT、BX-6K2LX、BX-6A0、BX-6A1、BX-6A2、BX-6MT、BX-6M0、BX-6M1、BX-6M2、BX-6M3、BX-6M4、BX-6E1X、BX-6E2X、BX-6E3、BX-6E1XP、BX-6E2XP、BX-6K1、BX-6K2、BX-6K3、BX-6K4、BX-6X1、BX-6X2、BX-6X3、BX-6X4、BX-6K1-YY、BX-6K2-YY、BX-6M1-YY、BX-6M2-YY、BX-6AT&4G、BX-6A0&4G、BX-6A1&4G、BX-6A2&4G、BX-6K1&4G、BX-6K2&4G、BX-6AT&4G-YY、BX-6A0&4G-YY、BX-6A1&4G-YY、BX-6A2&4G-YY、BX-6K1&4G-YY、BX-6K2&4G-YY、BX-4GDTU、BX-WIFI、BX-YY、BX-5MT、BX-5M1、BX-5M2、BX-5M3、BX-5M4、BX-5E1、BX-5E2、BX-5E3、BX-5K1、BX-5K2、BX-5MK1、BX-5MK2、X-U2L、X-U2、X-U3L、X-U3、X-U4L、X-U4、X-U16、X-W2L、X-W2、X-W3L、X-W3、X-W4L、X-W4、X-W16、X-WJ2L、X-WJ2、X-WJ3L、X-WJ3、X-WJ4L、X-WJ4、X-WP2L、X-WP2、X-WP3L、X-WP3、X-WP4L、X-WP4、X-WP8、X-WP16L、X-WP16	DC3.3V~5.5V

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. Set up the corresponding resolution test, and record test results.
3. Start testing.

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

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)		
Test Type	Standard	Result
Mains terminal disturbance voltage	<input checked="" type="checkbox"/> EN 55032:2015,Class B	PASS
	<input type="checkbox"/> EN 55032:2015,Class A	
Conducted Common mode Disturbance at Telecommunication Ports	<input type="checkbox"/> EN 55032:2015,Class B	N/A
	<input type="checkbox"/> EN 55032:2015,Class A	
Radiated disturbance	<input checked="" type="checkbox"/> EN 55032:2015,Class B	PASS
	<input type="checkbox"/> EN 55032:2015,Class A	
Harmonic current emissions	EN 61000-3-2:2014	N/A
Voltage fluctuation & flicker	EN 61000-3-3: 2013	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	$\pm 2.98\text{dB}$
Conducted emissions (Telecom Port)	0.15MHz~30MHz	$\pm 2.98\text{dB}$

Measurement	Polarity	Frequency	Uncertainty
Radiated emissions (below 1GHz)	H	30MHz ~ 200MHz	$\pm 3.95\text{dB}$
		200MHz ~ 1000MHz	$\pm 3.95\text{dB}$
	V	30MHz ~ 200MHz	$\pm 3.95\text{dB}$
		200MHz ~ 1000MHz	$\pm 3.95\text{dB}$
Radiated emissions (above 1GHz)	H	1000MHz ~ 6000MHz	$\pm 3.92\text{dB}$
	V	1000MHz ~ 6000MHz	$\pm 3.92\text{dB}$

- (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 22: 2008, 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.
- (3) The acceptable measurement uncertainty value without requiring revision of the compliance statement is based 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	Manufacturer	Model No.	Calibration period of validity	Serial No.
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	Mar.26, 2022	RU-001E
LISN	ROHDE&SCHWARZ	ESH 3-z5	Jul.03, 2022	EV-202E
Calibrated TRILOG Broadband Test-Antenna	Schwarzbeck	VULB9163	Mar.26, 2022	RG-001E
Horn Antenna	ROHDE&SCHWARZ	HF906	Apr.17, 2022	RG-008E
EMI Test Receiver	ROHDE&SCHWARZ	ESU 8	Apr.17, 2022	RU-007E
ISN	FCC	FCC-TLISN T4-02	Mar.26, 2022	RZ-002E
EMS Antenna	Amplifier Research	AR AT1080	Apr.07, 2022	RG-002E
Compliance Test System	CI	5001ix	Mar.26, 2022	EV-201E
ESD Generator	Teseq	NSG437	Mar.26, 2022	EV-200E
EMC Test System	KeyTek	ECAT	Mar.26, 2022	EV-203E
Signal Generator	ROHDE&SCHWARZ	SML02	Apr.17, 2022	EV-204E
Power Amplifier	Amplifier Research	AR 150W1000	Apr.17, 2022	RU-005E
Power Amplifier	Amplifier Research	AR 75A250M	Apr.17, 2022	RU-006E
Shield Room	Nanbo Tech	Site 1	Jan.16, 2022	RD-002E
Anechoic Chamber	Albatross	SAC-3	Jan.16, 2022	RD-001E
Anechoic Chamber	Albatross	H-249	Jan.16, 2022	RD-003E

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

4 Emission Test

4.1 Mains Terminal Disturbance Voltage Measurement

4.1.1 Limits of Mains Terminal Disturbance Voltage

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

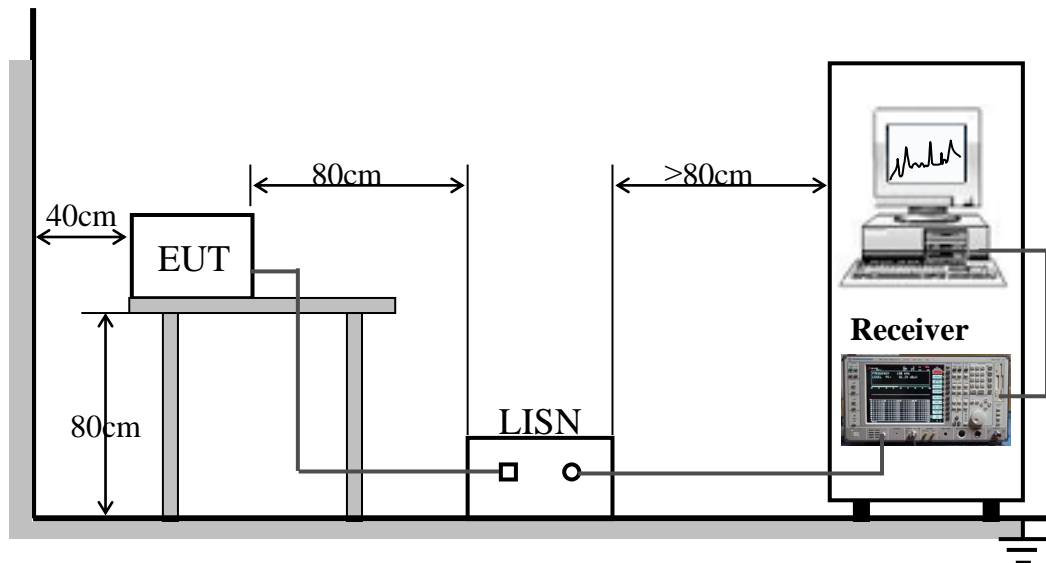
Notes:

- (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.

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.

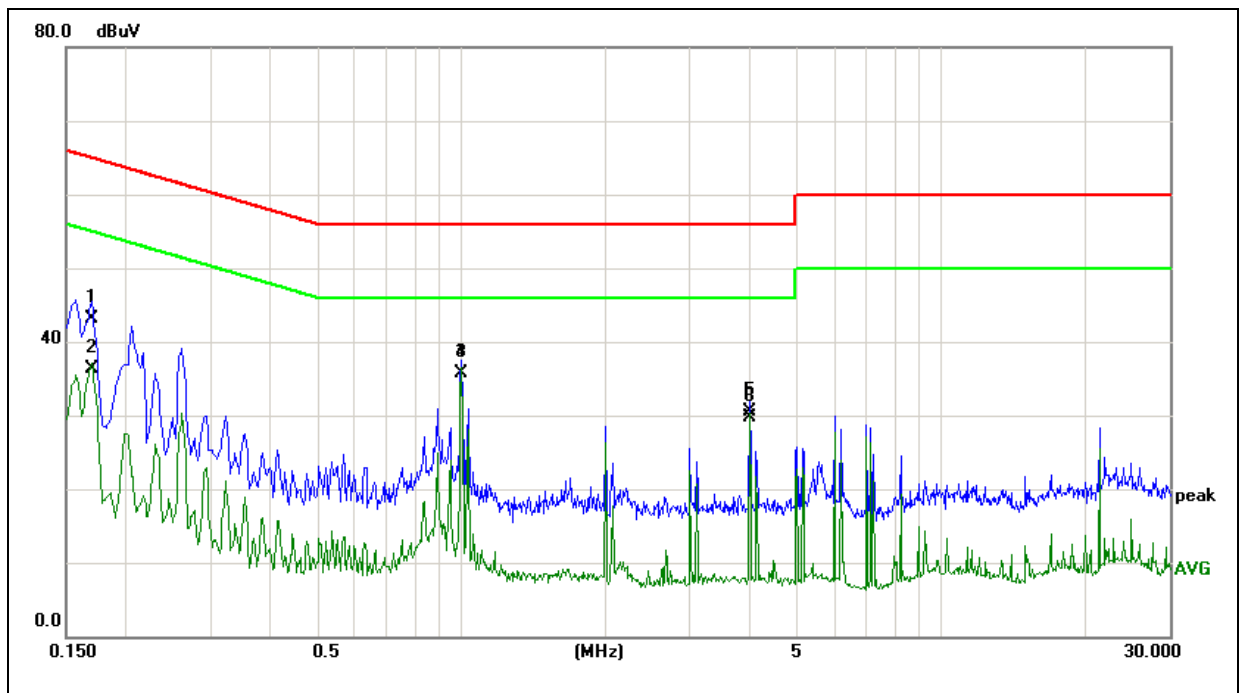
4.1.4 Data Sample

Freq. (MHz)	Measured(dBμV)		Limits(dBμV)		Margin(dB)	Note
	QP-Mode	AV-Mode	QP-Mode	AV-Mode		
x.xxx	---	44.77	0.00	64.00	-19.23	AVG
x.xxx	48.68	---	74.00	0.00	-25.32	QP

- (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 both L phase and N phase.
- (4) Calculation Formula: $\text{Margin(dB)} = \text{Measured(dB}\mu\text{V)} - \text{Limits(dB}\mu\text{V)}$

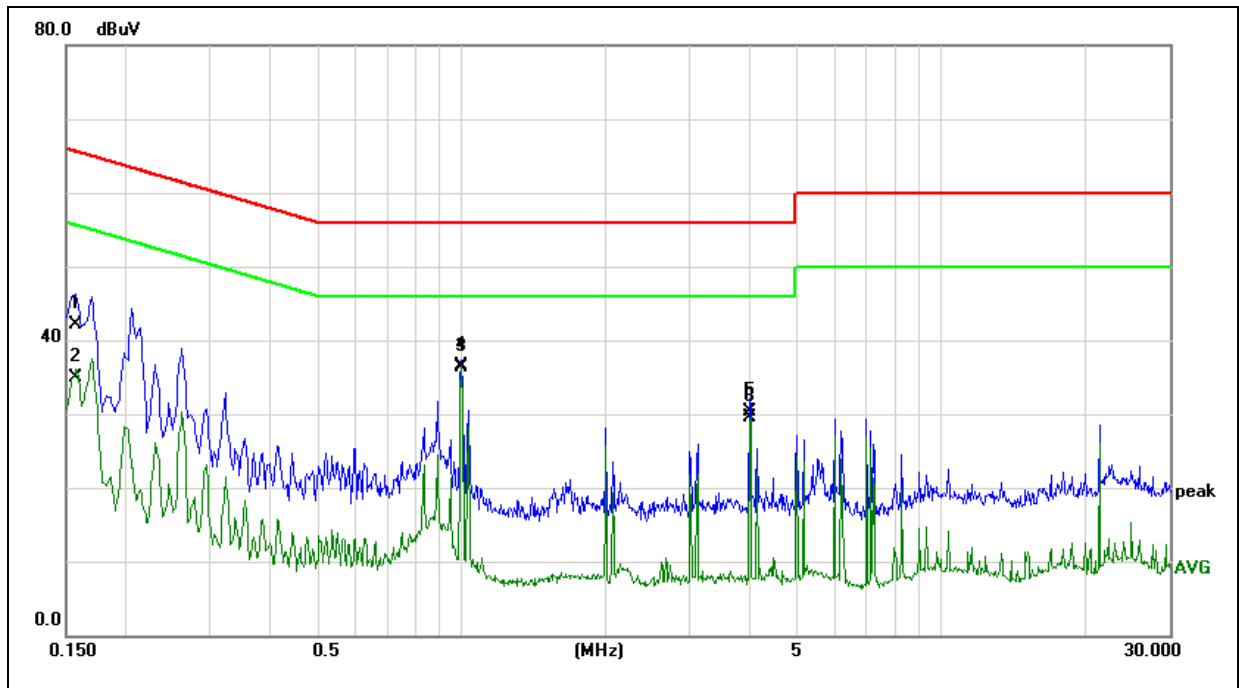
4.1.5 Test Result

E.U.T.:	Asynchronous LED displays controller (card) without gray-scale	Model Name:	BX-6E1XP
Temperature:	24°C	Relative Humidity:	48%
Pressure:	102.1 kPa	Test Voltage:	5VDC
Line:	L		
Test Mode:	Mode 1		



Freq. (MHz)	Measured(dBμV)		Limits(dBμV)		Margin(dB)	Note
	QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.170	43.12	---	64.96	0.00	-21.84	QP
0.170	---	36.28	0.00	54.96	-18.68	AVG
1.002	35.77	---	56.00	0.00	-20.23	QP
1.002	---	35.77	0.00	46.00	-10.23	AVG
4.002	30.53	---	56.00	0.00	-25.47	QP
4.002	---	29.69	0.00	46.00	-16.31	AVG

E.U.T.:	Asynchronous LED displays controller (card) without gray-scale	Model Name:	BX-6E1XP
Temperature:	24°C	Relative Humidity:	48%
Pressure:	102.1 kPa	Test Voltage:	5VDC
Line:	N		
Test Mode:	Mode 1		



Freq. (MHz)	Measured(dBμV)		Limits(dBμV)		Margin(dB)	Note
	QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.158	42.14	---	65.57	0.00	-23.43	QP
0.158	---	35.00	0.00	55.57	-20.57	AVG
1.002	36.31	---	56.00	0.00	-19.69	QP
1.002	---	36.46	0.00	46.00	-9.54	AVG
4.006	30.31	---	56.00	0.00	-25.69	QP
4.006	---	29.41	0.00	46.00	-16.59	AVG

4.2 Conducted Common mode Disturbance at Telecommunication Ports

4.2.1 Limits

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

Frequency range (MHz)	Limits (dB μ V), 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.

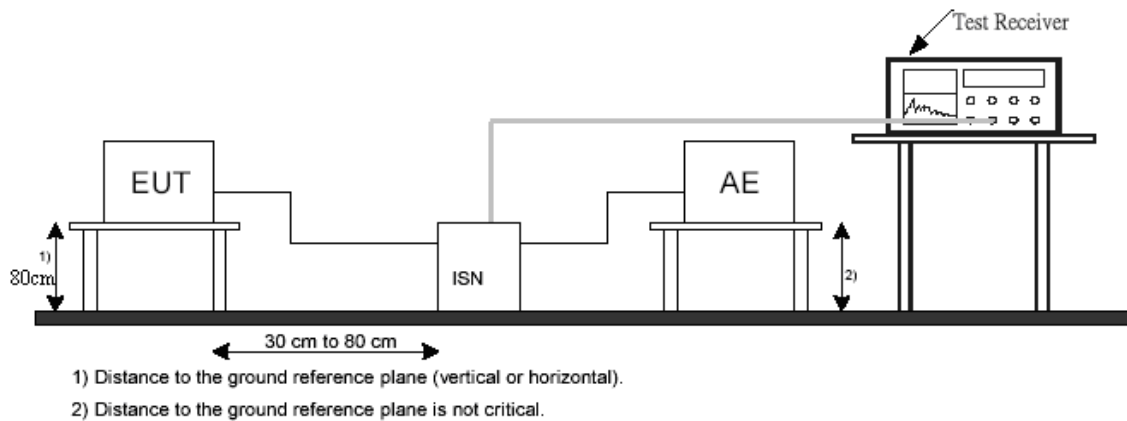
4.2.2 TEST PROCEDURE

The following test modes was scanned during the preliminary test:

Mode 1:10/100 Mbps

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 Data Sample

Freq. (MHz)	Measured(dBμV)		Limits(dBμV)		Margin(dB)	Note
	QP-Mode	AV-Mode	QP-Mode	AV-Mode		
x.xxx	---	44.77	0.00	64.00	-19.23	AVG
x.xxx	48.68	---	74.00	0.00	-25.32	QP

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). Calculation Formula: $\text{Margin(dB)} = \text{Measured(dB}\mu\text{V)} - \text{Limits(dB}\mu\text{V)}$

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 A, 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)

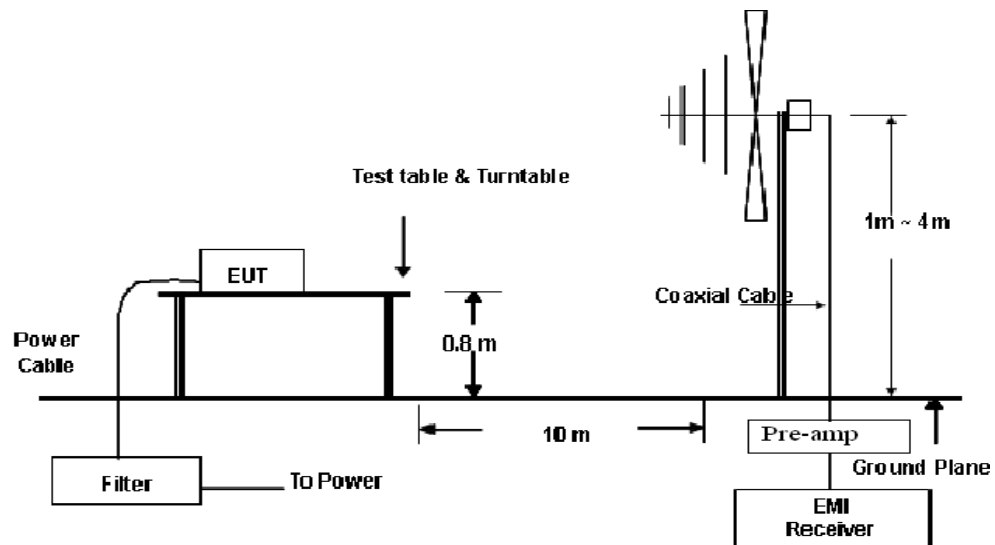
Frequency range (GHz)	Limits(dB μ V/m), Class B		Limits(dB μ V/m), Class A	
	Average	peak	Average	peak
1~3	50	70	56	76
3~6	54	74	60	80

4.3.3 Test Procedure

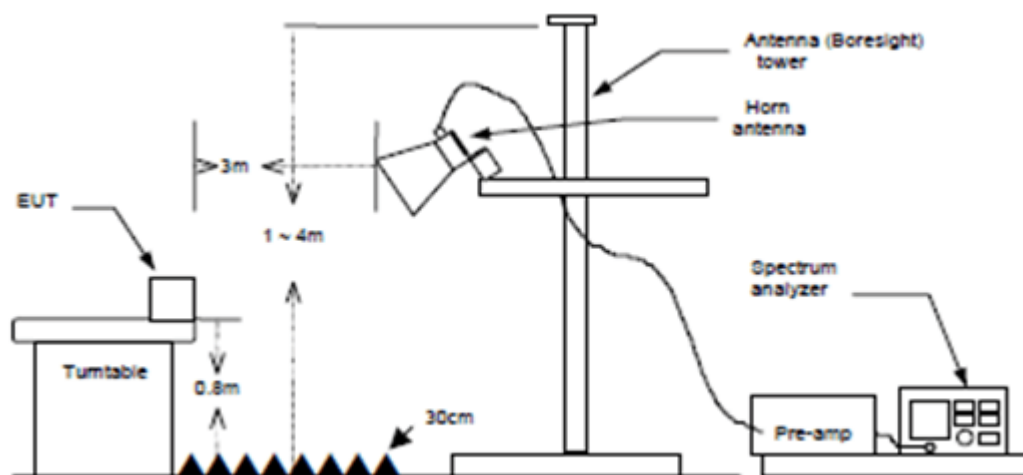
- a. The EUT was placed on the top of an insulating table 0.8 meters above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the 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 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.

4.3.4 Test Setup

Below 1GHz



Above 1GHz



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

4.3.5 Data Sample

Below 1GHz

Freq. (MHz)	Reading(RA) (dB μ V)	Corr.Factor(CF) (dB)	Measured(FS) (dB μ V/m)	Limits(QP) (dB μ V/m)	Margin (dB)
82.3870	25.32	11.43	36.75	40.00	-3.25

NOTE:

(1). Freq. = Emission frequency in MHz

Reading = Uncorrected Analyzer/Receiver reading

Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain

Measured(FS) = Reading + Factor

Limit = Limit stated in standard

Margin = Reading in reference to limit

Note = Information of value (Peak/ QuasiPeak/Average)

(2). Calculation Formula: Margin (dB) = Measured(FS) (dB μ V/m) – Limit (dB μ V/m)

Above 1GHz

Frequency (MHz)	Antenna Height (cm)	Table Angle (Degree)	Limit Value (dB μ V/m)		Emission Level (dB μ V/m)	
			PK	AV	PK	AV
xxxx.xx	100	360	80	60	43.16	34.85

NOTE:

(1). Frequency = Emission frequency in MHz

Antenna Height = Height of antenna

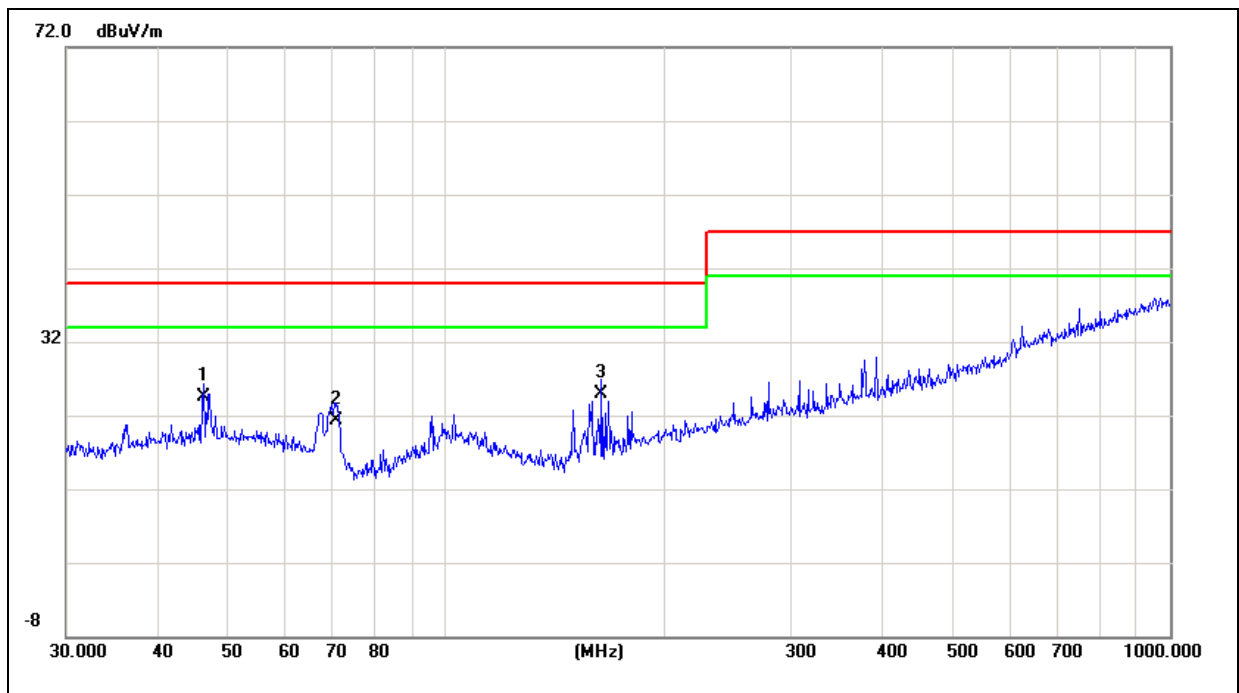
Table Angle = Position of turn table

Limit Value = Limit stated in standard

Emission Level = Reading in reference to limit

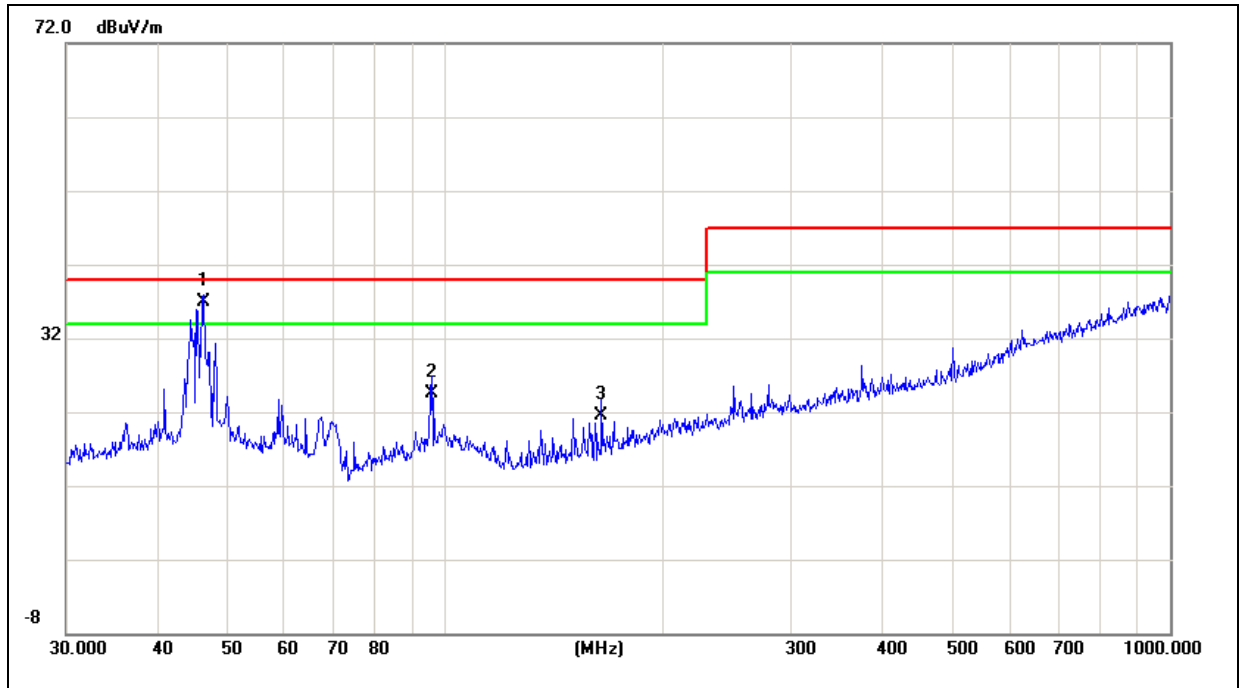
4.3.6 Test Result (30MHz~1000MHz)

E.U.T.:	Asynchronous LED displays controller (card) without gray-scale	Model Name:	BX-6E1X
Temperature:	24°C	Relative Humidity:	48%
Pressure:	102.1 kPa	Test Voltage:	5VDC
Ant.Polar:	Horizontal		
Test Mode:	Mode 1		



Freq. (MHz)	Reading(RA) (dBμV)	Corr.Factor (CF) (dB)	Measured(FS) (dBμV/m)	Limits(QP) (dBμV/m)	Margin (dB)
46.340	9.30	15.26	24.56	40.00	-15.44
7.583	8.51	12.84	21.35	40.00	-18.65
164.330	12.49	12.47	24.96	40.00	-15.04

E.U.T.:	Asynchronous LED displays controller (card) without gray-scale	Model Name:	BX-6E1X
Temperature:	24°C	Relative Humidity:	48%
Pressure:	102.1 kPa	Test Voltage:	5VDC
Ant.Polar:	Vertical		
Test Mode:	Mode 1		



Freq. (MHz)	Reading(RA) (dBμV)	Corr.Factor (CF) (dB)	Measured(FS) (dBμV/m)	Limits(QP) (dBμV/m)	Margin (dB)
46.503	21.83	15.12	36.95	40.00	-3.05
95.762	9.61	14.92	24.53	40.00	-15.47
164.330	8.33	13.13	21.46	40.00	-18.54

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	$8 \leq n \leq 40$	$0.23 \times 8/n$
11	0.33		
13	0.21		
$15 \leq n \leq 39$	$0.15 \times 15/n$		

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	$30 \cdot \lambda^*$
5	10
7	7
9	5
$11 < n < 39$ (odd harmonics only)	3
* λ is the circuit power factor	

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/n	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 > 75 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:

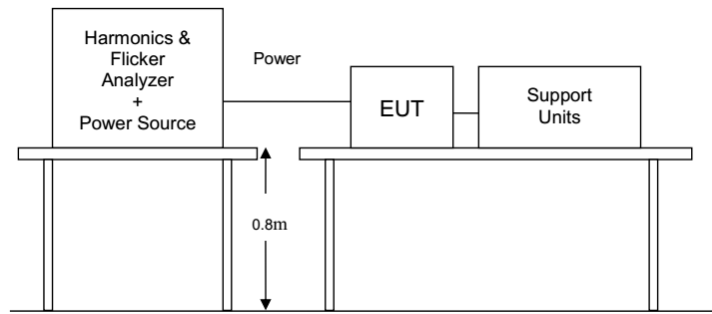
Class A: Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.

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 and television receivers.
- 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 Result

The EUT is not suitable for the test.

4.5 Voltage Fluctuation and Flick Measurement

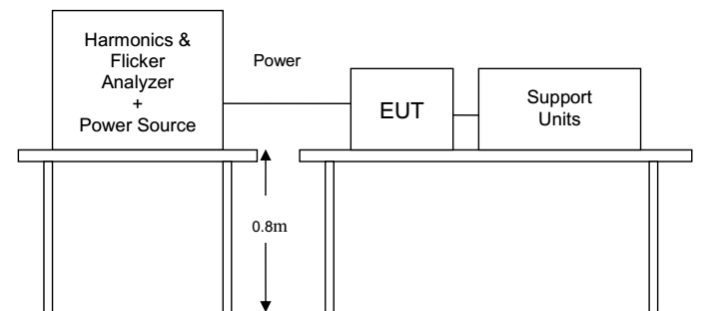
4.5.1 Limits of Voltage Fluctuation and Flick

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 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
Polarity:	Positive / Negative
Number of Discharge:	Minimum 20 times at each test point
Discharge Mode:	Single discharge
Discharge Period:	1-second minimum

5.3.2 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.

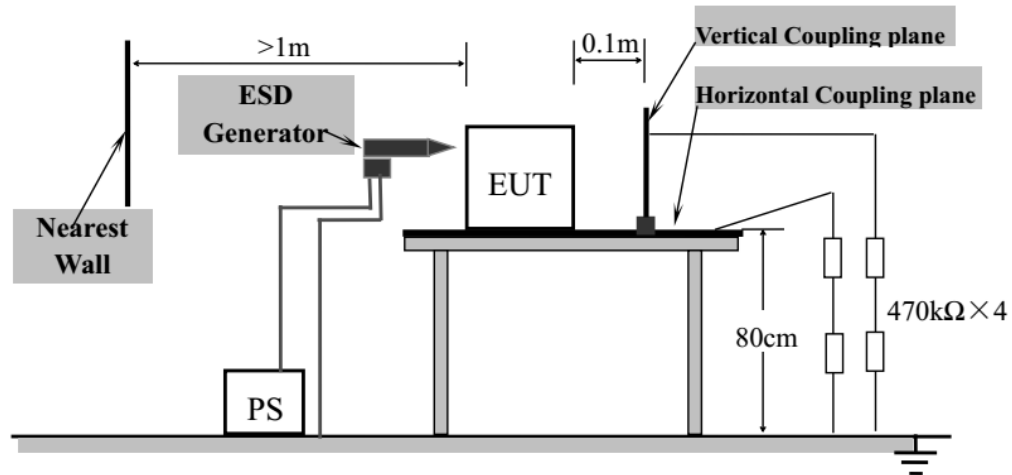
- b. Air discharges at slots and apertures and insulating surfaces:

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.

5.3.3 Test Setup



5.3.4 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
Power port	±4	Contact	Note(1)	A
USB port	±4	Contact	Note(1)	A
Network port	±4	Contact	Note(1)	A
Indicator light	±4	Contact	Note(2)	B
Display port (spot1)	±8	Air	Note(1)	A
Spot 2	±8	Air	Note(1)	A
232/485 port (spot3)	±8	Air	Note(1)	A
Sensor port (spot4)	±8	Air	Note(1)	A
I/O select program port (spot5)	±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

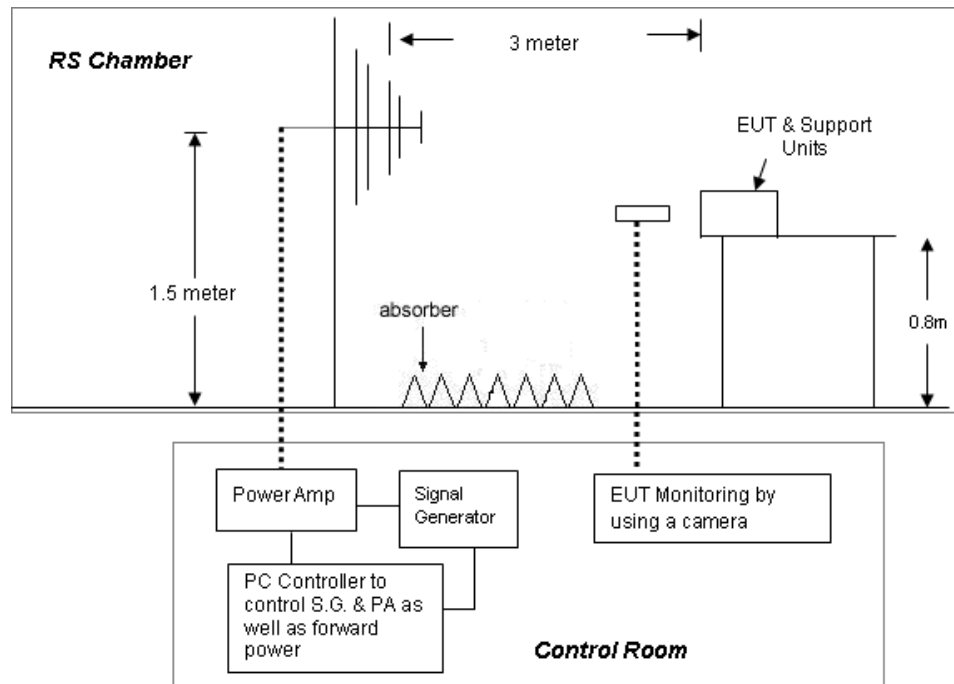
Basic Standard:	IEC 61000-4-3
Frequency Range:	80 MHz – 1000 MHz
Field Strength:	3V/m
Modulation:	1kHz sine wave, 80%, AM modulation
Frequency Step:	1% of fundamental
Polarity of Antenna	Horizontal and Vertical
Test Distance:	3m
Antenna Height:	1.5m

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 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

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

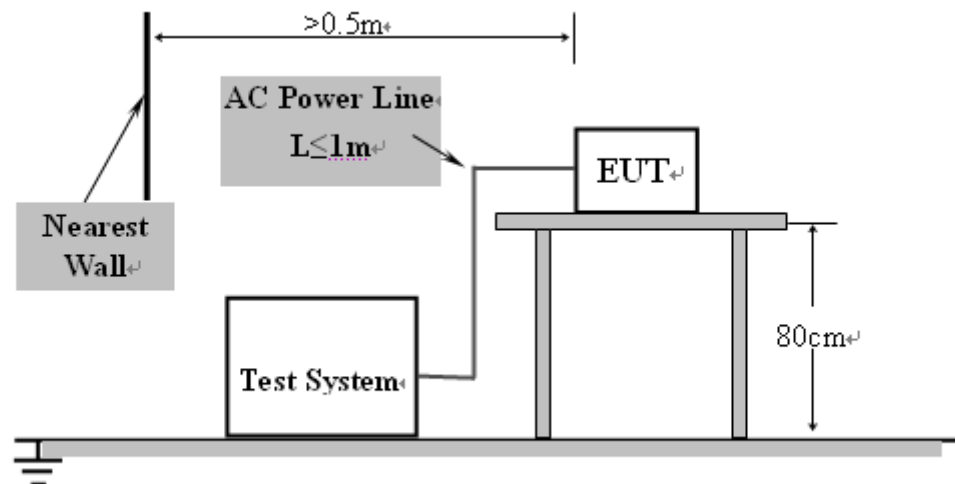
5.5.1 Test Specification

Basic Standard:	IEC 61000-4-4
Test Voltage:	d.c. Power Port: 0.5kV
Polarity:	Positive/Negative
Impulse Frequency:	5kHz
Impulse wave shape:	5/50ns
Burst Duration:	15ms
Burst Period:	300ms
Test Duration:	Not less than 1 min.

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 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

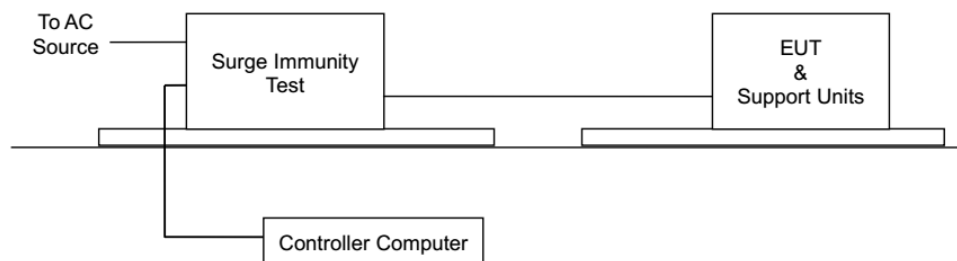
5.6.1 Test Specification

Basic Standard:	IEC 61000-4-5
Waveform:	Voltage 1.2/50 μ s; Current 8/20 μ s
Test Voltage:	Power port, 0.5 kV
Polarity:	Positive/Negative
Phase Angle:	0°, 90°, 180°, 270°
Repetition Rate:	60sec
Times:	5 time/each condition.

5.6.2 Test Procedure

- 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).
- 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).
- 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.

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 Result

Coupling Line	Polarity	Voltage (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.

5.7 Immunity to Conducted Disturbances Induced by RF Fields

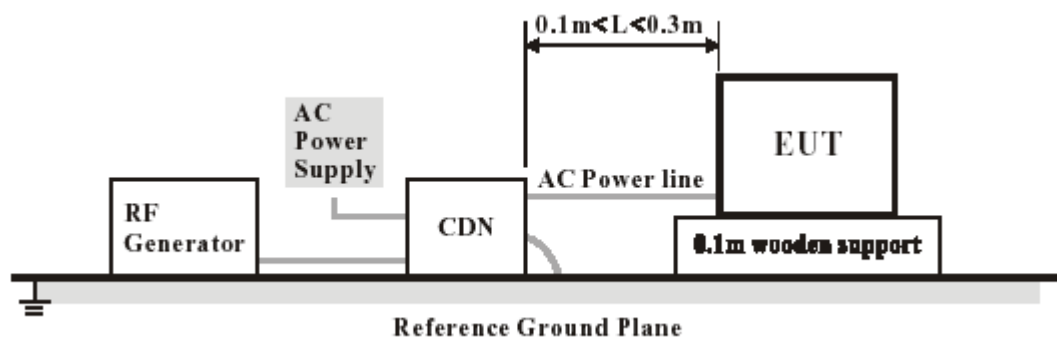
5.7.1 Test Specification

Basic Standard:	IEC 61000-4-6
Frequency Range:	0.15 MHz – 80 MHz
Field Strength:	3Vrms
Modulation:	1 kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1% of fundamental
Coupled Cable:	d.c. 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

Test Point	Frequency (MHz)	Field Strength (Vrms)	Observation	Comply with criterion
d.c. power line	0.15 – 80	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.

5.8 Power Frequency Magnetic Field Immunity Test

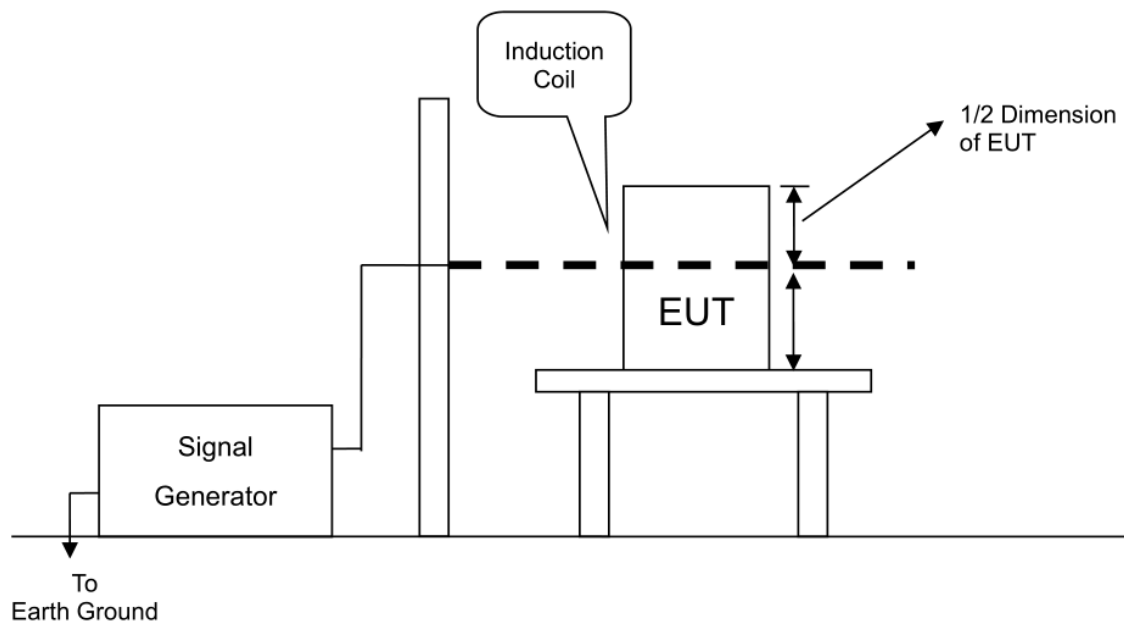
5.8.1 Test Specification

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

5.8.2 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.

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

Direction	Field Strength(A/m)	Observation	Comply with Criterion
X	1	Note(1)	A
Y	1	Note(1)	A
Z	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.

5.9 Voltage Dips and Short Interruptions Immunity Test

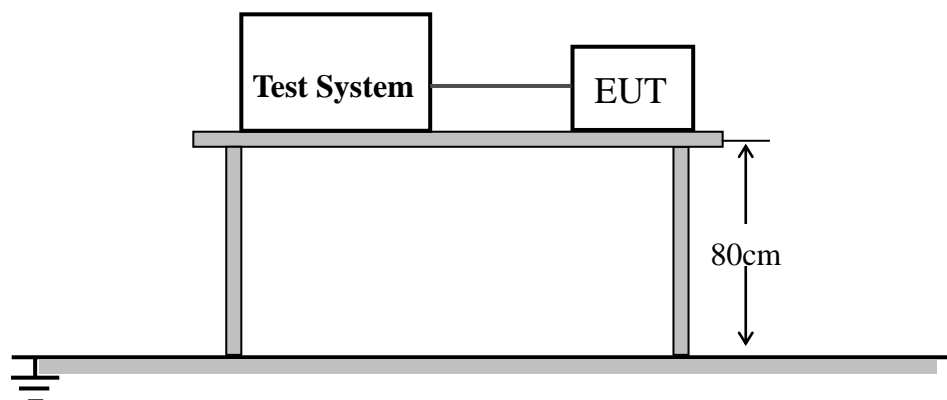
5.9.1 Test Specification

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

- 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) 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.
- 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.
- 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.

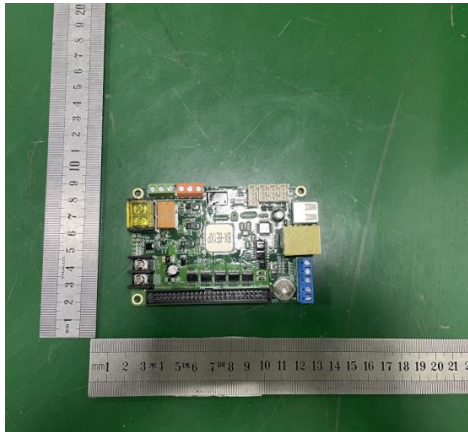
5.9.3 Test Setup



5.9.4 Test Result

The EUT is not suitable for the test.

Appendix I: Photographs of EUT



Test Points

