



EMC Test Report



Applicant :	Yuan Hsun Electric Co., Ltd.
Address of Applicant :	No. 57, Chung He Rd., Zuo-Ying Dist., Kaohsiung city, 813 Taiwan, R.O.C.
Equipment Under Test :	Polarized Retro-Reflective Sensor
Model Number :	PBP-1000
Series :	N/A

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Verification

Applicant : Yuan Hsun Electric Co., Ltd.
Manufacturer : Yuan Hsun Electric Co., Ltd.
Equipment Under Test : Polarized Retro-Reflective Sensor
Model Number : PBP-1000
Series : N/A
Sample Received Date : 2009-07-13
Test Standard :

Emission:	Immunity:
<input checked="" type="checkbox"/> EN 55022:2006+A1:2007 Class B	<input checked="" type="checkbox"/> EN 50130-4:1995+A1:1998+A2:2003
<input checked="" type="checkbox"/> IEC 61000-3-2:2005 +A1:2008+A2:2009	<input checked="" type="checkbox"/> IEC 61000-4-2:2008
<input checked="" type="checkbox"/> IEC 61000-3-3:2008	<input checked="" type="checkbox"/> IEC 61000-4-3:2006+A1:2007
	<input checked="" type="checkbox"/> IEC 61000-4-4:2004
	<input checked="" type="checkbox"/> IEC 61000-4-5:2005
	<input checked="" type="checkbox"/> IEC 61000-4-6:2008
	<input checked="" type="checkbox"/> IEC 61000-4-11:2004

Remark:

This report details the results of the tests carried out on one sample. This report shows the EUT is technically compliant with EN 55022 and EN 50130-4 official requirements. This report applies to the above sample only and shall not be reproduced in part without written approval of Matrix Test Laboratory.

Jody Peng

Documented by: _____ Date: 2009-08-11
 Jody Peng/ ADM. Dept. Staff

Kenny Yang

Tested by: _____ Date: 2009-08-10
 Kenny Yang/ ENG. Dept. Staff

Peter Chin

Approved by: _____ Date: 2009-08-11
 Peter Chin/ Head of Laboratory

Summery of Test Result

Emission			
Test Standard	Test Item	Test Result	Remark
EN55022	Conducted Emission	Pass	Highest Emission L: 0.183MHz, Q.P.47.67dBuV, Margin -6.56 dB, A.V.40.25dBuV, Margin -3.98 dB, N: 0.184MHz, Q.P.48.18dBuV, Margin -6.03 dB, A.V.40.49dBuV, Margin -3.72 dB,
EN55022	Radiated Emission	Pass	Highest Emission H: 34.85MHz, 31.45dBuV, Margin-4.69 dB Antenna Height 3 m, Turntable Angle 208° V: 37.76MHz, 32.56dBuV, Margin-4.94 dB Antenna Height 1 m, Turntable Angle 241°
EN61000-3-2	Harmonic	Pass	Refer to Page 19
EN61000-3-3	Flicker	Pass	Refer to Page 21

Immunity		
Test Standard	Test Item	Test Result
IEC61000-4-2	Electrostatic Discharge	Pass
IEC61000-4-3	Radiated Susceptibility	Pass
IEC61000-4-4	Electrical Fast Transient	Pass
IEC61000-4-5	Surge	Pass
IEC61000-4-6	Conducted Susceptibility	Pass
IEC61000-4-11	Voltage Dips and Interruption	Pass
EN50130-4	Mains Supply Voltage Variations	Pass

1 General Description

1.1 Description of EUT

Equipment Under Test	:	Polarized Retro-Reflective Sensor
Model Number	:	PBP-1000
Series	:	N/A
Applicant Address of Applicant	:	Yuan Hsun Electric Co., Ltd. No. 57, Chung He Rd., Zuo-Ying Dist., Kaohsiung city, 813 Taiwan, R.O.C.
Manufacturer Address of Manufacturer	:	Yuan Hsun Electric Co., Ltd. No. 57, Chung He Rd., Zuo-Ying Dist., Kaohsiung city, 813 Taiwan, R.O.C.
Power Supply	:	AC 230V, 50Hz
Data Cable	:	<input checked="" type="checkbox"/> N/A
Description of EUT	:	<p>Dimensions : 11.5 cm (L) X 5.2 cm (W) X 5.4 cm (H)</p> <p>Weight : 120 g</p> <p>Test Position : <input checked="" type="checkbox"/>Table-top / <input type="checkbox"/>Floor-standing</p> <p>Intended Function : The EUT is a Polarized Retro-Reflective Sensor.</p>

1.2 Test Instruments

Instruments Used for Emission Measurement

Instrument	Manufacturer	Model	Serial No.	Calibration Date	Application
L.I.S.N.	Mess Tec	NNB-2/16Z	03/1006	2009-05-12	Conducted Emission
L.I.S.N.	EMCIS	LN2-16	LN04023	2009-01-16	Conducted Emission
Pulse Limiter	Mess Tec	PL10	N/A	2009-02-23	Conducted Emission
RF Cable	N/A	N/A	N/A	2009-05-11	Conducted Emission
EMI Receiver	R&S	ESCI	100615	2009-02-27	Conducted Emission Radiated Emission
Bilog Antenna	Teseq GmbH	CBL6111D	25769	2009-02-19	Radiated Emission
Pre-Amplifier	Schaffner	CPA9231A	N/A	2009-07-20	Radiated Emission
Spectrum Analyzer	HP	8595E	3829A03763	2009-07-19	Radiated Emission
Spectrum Analyzer	R & S	FSL6	100564	2008-12-05	Radiated Emission
RF Cable	MIYAZAKI	8D-F8	N/A	2009-07-20	Radiated Emission
Programmable AC Source	Chroma	6520	2048	2009-02-06	Harmonic, Flicker
Universal Power Analyzer	Chroma	6630	0597	2009-02-06	Harmonic, Flicker

Note: The instruments listed above are within their calibration period of 1 year.

Instruments Used for Immunity Measurement

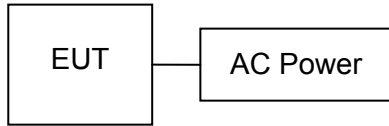
Instrument	Manufacturer	Model	Serial No.	Calibration Date	Application
ESD Simulator	Noiseken	TC-815R	ESS0868491	2008-12-12	Electrostatic Discharge
ESD Simulator	Noiseken	ESS-2002EX	ESS0868406	2008-12-12	Electrostatic Discharge
Antenna	FRANKONIA	BTA-H	030001H	2009-08-03	Radiated Immunity
Field Probe	EMCO	7201	N/A	2008-10-23	Radiated Immunity
Power Amplifier	IFI	CMX50	N/A	2008-10-23	Radiated Immunity
Signal Generator	R&S	SML03	103396	2008-10-23	Radiated Immunity
CDN	FRANKONIA	CDN M2+M3	A3011037	2008-10-23	Conducted Immunity
C.I. Test System	FRANKONIA	CIT-10/75	102C3208	2008-10-23	Conducted Immunity
Power Attenuator	FRANKONIA	75-A-FFN-06	0212	2008-11-07	Conducted Immunity
RF Cable	N/A	N/A	N/A	2009-05-07	Conducted Immunity
Antenna	EMC PARTNER	MF-1000-1	119	2008-11-04	Magnetic Field Disturbance
Transient 2000	EMC PARTNER	TRA-2000	449	2008-11-04	Electrostatic Discharge, Fast Transient, Surge, Magnetic Field Disturbance, Dips & Interruptions

Note: The instruments listed above are within their calibration period of 1 year.

1.3 Auxiliary Equipments

N/A

1.4 Block Diagram



1.5 Identifying the Final Test Mode (Worst Case)

- 1. Stand by Mode
- 2. Operation Mode

Note: After pre-test, we identified that the Operation Mode (the worst case) was most likely to cause maximum disturbance and most likely to be susceptible to disturbance. Therefore, the Final EMC Assessment was performed for the worst case.

1.6 Final Test Mode

Operation Mode

1.7 Condition of Power Supply

AC 230V, 50Hz

1.8 EUT Configuration

- 1. Setup the EUT as shown in Sec.1.4 Block Diagram.
- 2. Turn on the power of all equipments.
- 3. Activate the main function(s) of the EUT.

1.9 Test Facility

Site Description	:	All tests are completed by Matrix Test Laboratory. Radiated emission is performed at HongAn's open-site.
Name of Firm	:	Matrix Test Laboratory
Site Location	:	2F, No.146, Jian Yi Rd., Chung-Ho City, Taipei Hsien, Taiwan, R.O.C.

1.9.1 Test Methodology

All Emission Tests were performed according to the procedures specified in EN55022 and EN 50130-4. Radiated Emission Test was performed at 10 m distance from antenna to EUT. All Immunity Tests were performed according to the general standards specified in EN 50130-4.

2 Conducted Emission Test

2.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

2.2 Test Arrangement and Procedure

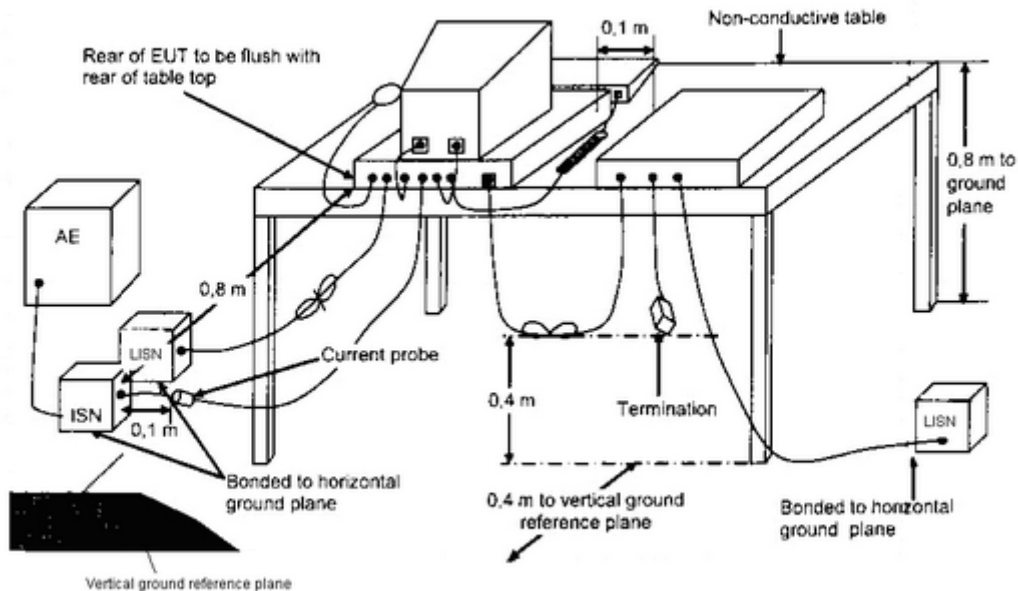


Table-top Equipment

- The EUT was placed on a non-conductive table which was 80 cm above the horizontal coupling plane. The rear of the EUT was 40 cm from the vertical coupling plane.
- The excess interface cables were folded at the cable center into a bundle no longer than 40 cm, so that the bundles were on the table.
- The EUT was connected to the main power through a L.I.S.N. This set up provided 50 ohm / 50 μ H coupling impedance for the measuring equipment.
- All auxiliary equipment received power from a second L.I.S.N.
- The conducted emissions were measured between the Line Phase and the PE ground and between the Neutral Phase and the PE ground using an EMI Receiver.
- The values were recorded.

2.3 Conducted Limit

EN 55022

Frequency (MHz)	<input type="checkbox"/> Class A		<input checked="" type="checkbox"/> Class B	
	Q.P. (Quasi-Peak)	A.V. (Average)	Q.P. (Quasi-Peak)	A.V. (Average)
0.15 ~ 0.50	79	66	66 to 56	56 to 46
0.50 ~ 5.0	73	60	56	46
5.0 ~ 30	73	60	60	50

The EMI Receiver bandwidth was set at 9 kHz.

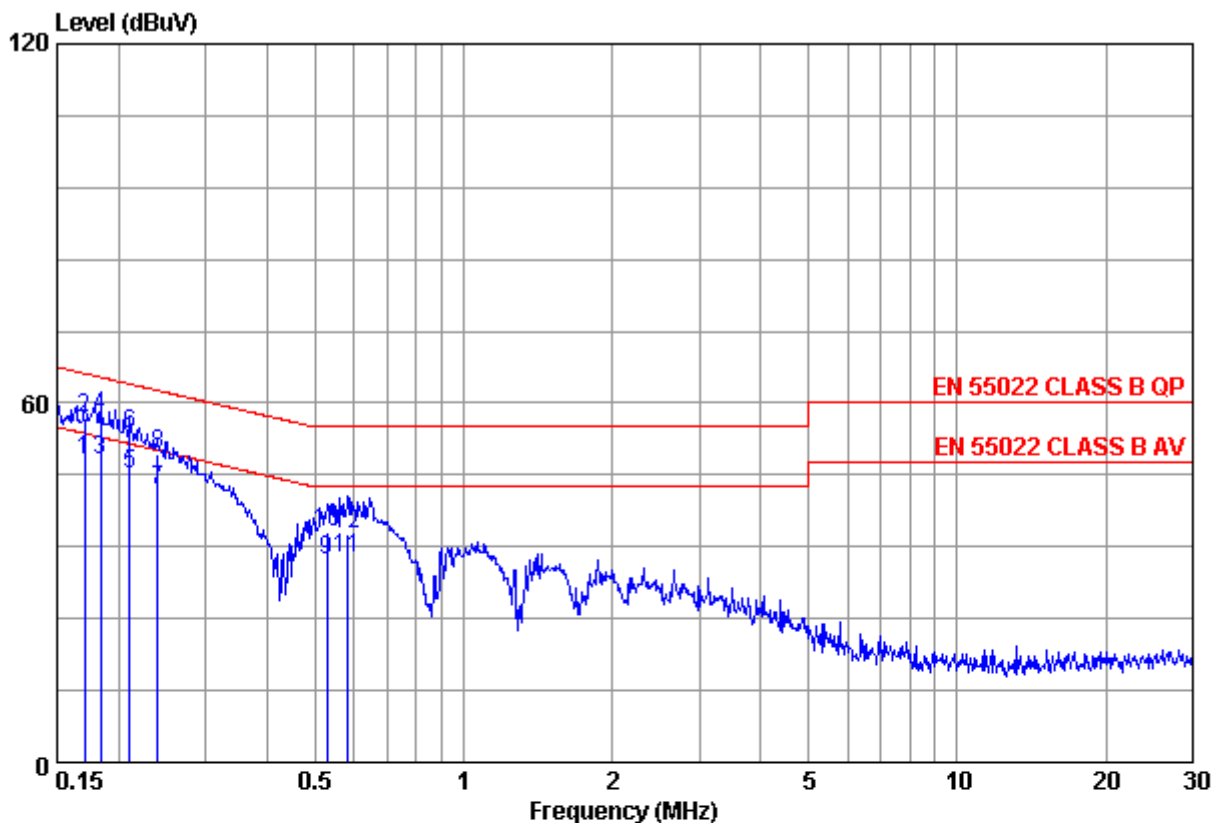
2.4 Test Result

PASS

The final test data are shown on the following page(s).

Conducted Emission Test Data

Test Date : 2009-08-06 Power Line : Line
 Temperature : 26°C Humidity : 51%



	Freq	Level	Read	Over	Limit	Factor	Remark
	MHz	dBuV	dBuV	dBuV	dBuV	dBuV	
1	0.170	50.43	40.32	-4.51	54.94	10.11	Average
2	0.170	57.47	47.36	-7.47	64.94	10.11	QP
3	* 0.183	50.35	40.25	-3.98	54.33	10.10	Average
4	@ 0.183	57.77	47.67	-6.56	64.33	10.10	QP
5	0.211	48.09	37.99	-5.09	53.18	10.10	Average
6	0.211	54.99	44.89	-8.19	63.18	10.10	QP
7	0.240	45.36	35.26	-6.72	52.08	10.10	Average
8	0.240	51.50	41.40	-10.58	62.08	10.10	QP
9	0.529	33.77	23.65	-12.23	46.00	10.12	Average
10	0.529	38.33	28.21	-17.67	56.00	10.12	QP
11	0.582	34.16	24.04	-11.84	46.00	10.12	Average
12	0.582	37.99	27.87	-18.01	56.00	10.12	QP

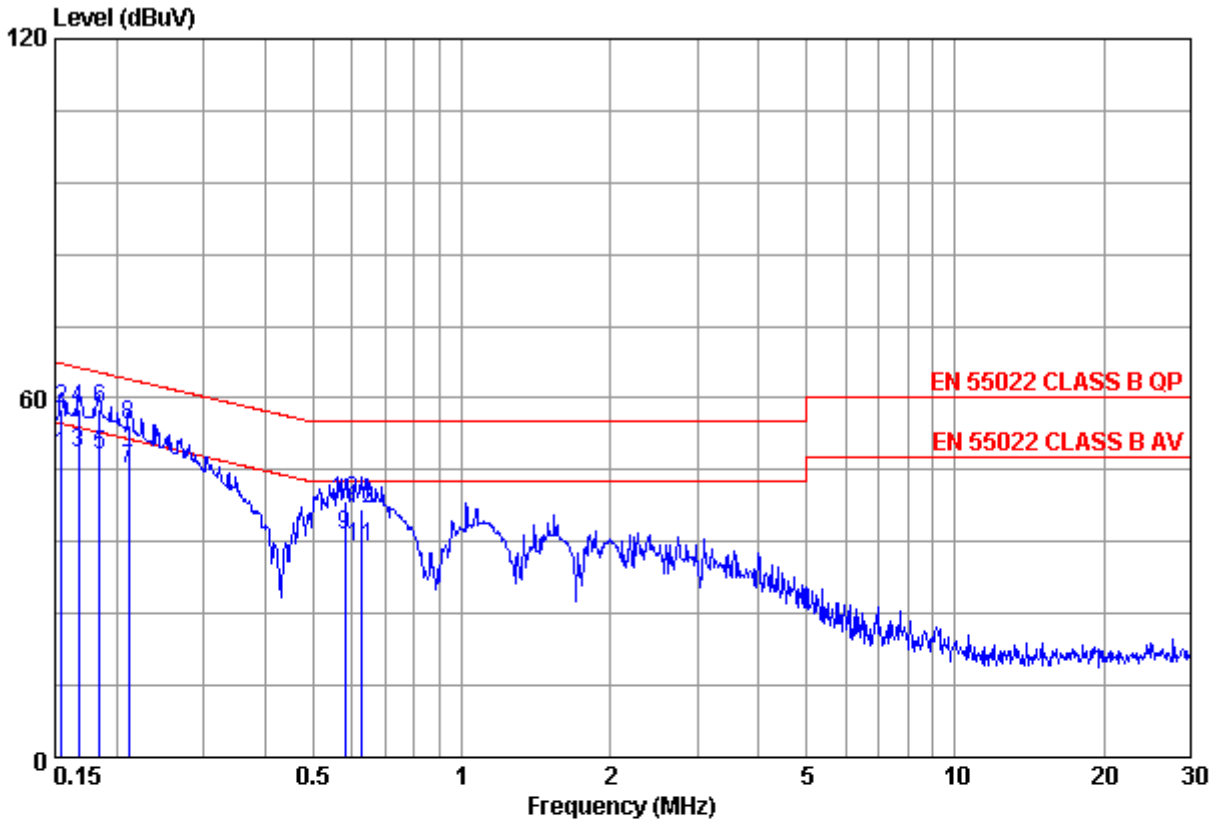
Level(dBuV) = Read Level(dBuV) + Factor(dBuV)
 Factor(dBuV) = LISN Factor(dBuV) + Cable Loss(dBuV) + PLUSE Limter(dBuV)

@ :Maximum QP * :Maximum AVG x :Over Limit ! :Over Margin
 Red Point(or Red Trace) For Average Detector
 Green Point(or Green Trace) For Quasipeak Detector

Receiver : R&S ESCI
 LISN : MessTec NNB - 2/16 Z
 Pluse Limiter : MessTec PL10

Conducted Emission Test Data

Test Date : 2009-08-06 Power Line : Neutral
 Temperature : 26°C Humidity : 51%



	Freq	Level	Read Level	Over Level	Limit Line	Factor	Remark
	MHz	dBuV	dBuV	dBuV	dBuV	dBuV	
1	0.155	50.61	40.53	-5.13	55.74	10.08	Average
2	0.155	58.29	48.21	-7.45	65.74	10.08	QP
3	0.168	50.72	40.65	-4.36	55.08	10.07	Average
4	0.168	58.33	48.26	-6.75	65.08	10.07	QP
5	* 0.184	50.56	40.49	-3.72	54.28	10.07	Average
6	@ 0.184	58.25	48.18	-6.03	64.28	10.07	QP
7	0.212	48.27	38.20	-4.87	53.14	10.07	Average
8	0.212	55.33	45.26	-7.81	63.14	10.07	QP
9	0.579	36.95	26.86	-9.05	46.00	10.09	Average
10	0.579	42.69	32.60	-13.31	56.00	10.09	QP
11	0.624	35.25	25.16	-10.75	46.00	10.09	Average
12	0.624	41.45	31.36	-14.55	56.00	10.09	QP

Level(dBuV) = Read Level(dBuV) + Factor(dBuV)
 Factor(dBuV) = LISN Factor(dBuV) + Cable Loss(dBuV) + PLUSE Limiter(dBuV)

@ :Maximum QP * :Maximum AVG x :Over Limit ! :Over Margin
 Red Point(or Red Trace) For Average Detector
 Green Point(or Green Trace) For Quasipeak Detector

Receiver : R&S ESCI
 LISN : MessTec NNB - 2/16 Z
 Pluse Limiter : MessTec PL10

3 Radiated Emission Test

3.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

3.2 Test Arrangement and Procedure

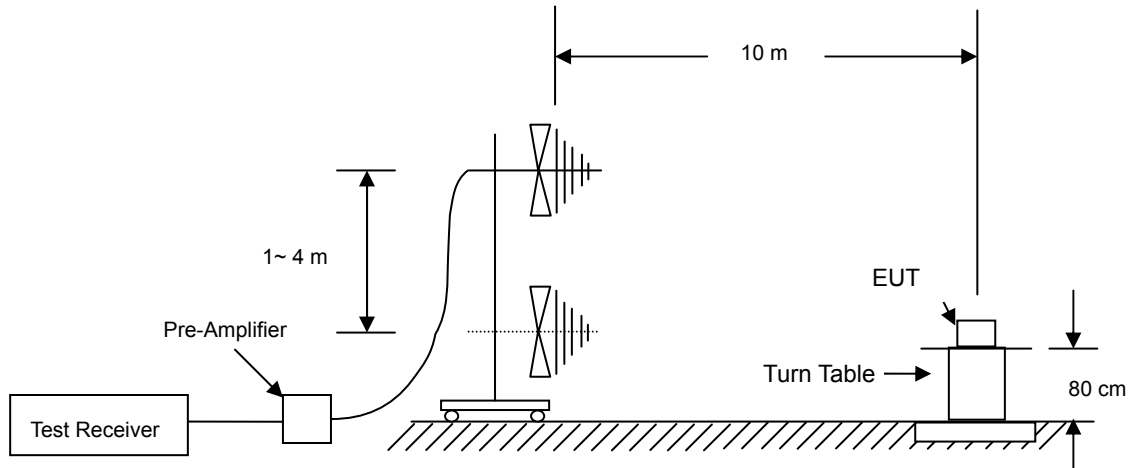


Table-top Equipment

- The EUT was placed on a non-conductive turntable which was 80 cm above the horizontal ground plane. The EUT was set 10 m away from the receiving antenna that was mounted on a non-conductive mast.
- Main cables draped to the ground plane and were routed to the mains power outlet. The mains power outlet was bonded to ground and did not protrude above the ground plane.
- The antenna was adjusted between 1 m and 4 m in height above the ground plane and the Antenna-to-EUT azimuth was also varied during the measurements to find the top 6 maximum meter readings within the frequency range limit as indicated in Sec 3.3.
- The radiated emissions were measured when the Antenna-to-EUT polarization was set horizontally and vertically.
- The values were recorded.

3.3 Radiated Limit

EN 55022

Frequency (MHz)	<input type="checkbox"/> Class A	<input checked="" type="checkbox"/> Class B
	Quasi-Peak (dBuV/m)	Quasi-Peak (dBuV/m)
30 ~ 230	40.0	30.0
230 ~ 1000	47.0	37.0

The EMI test receiver bandwidth was set at 120 kHz.

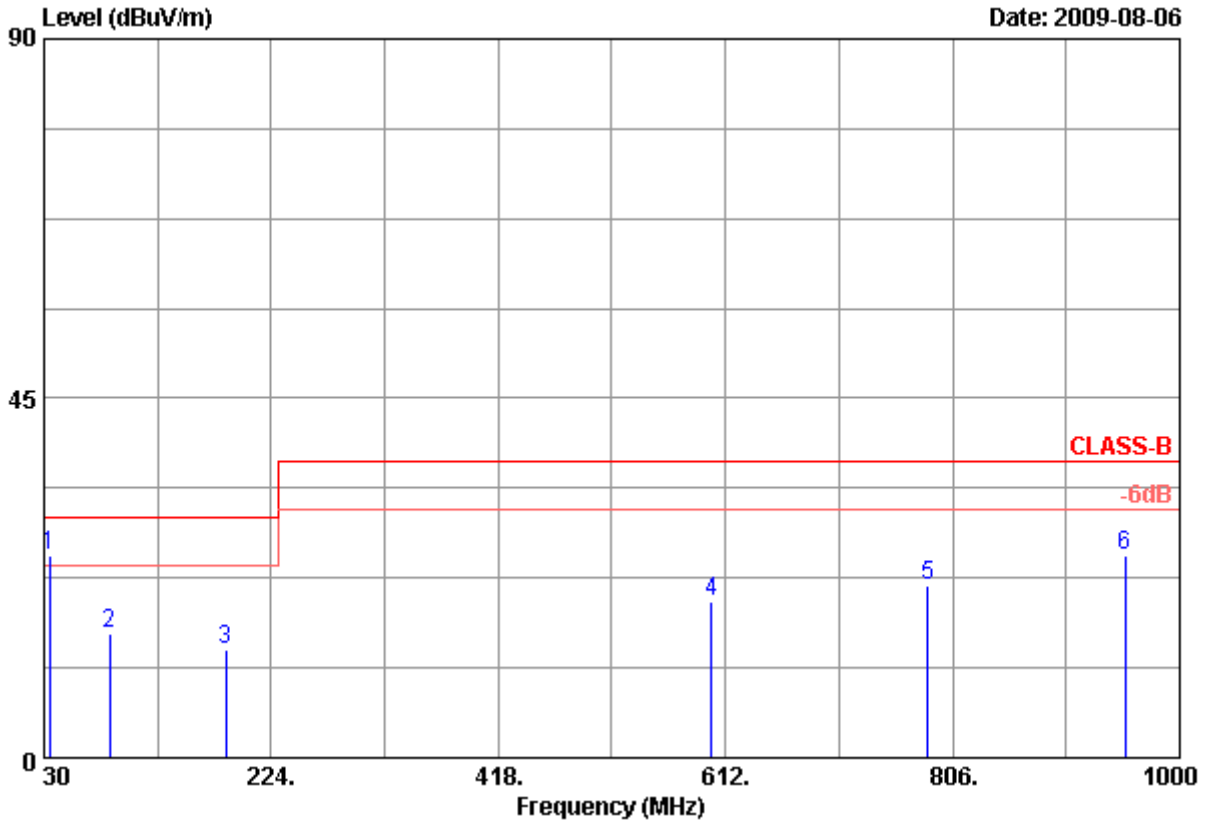
3.4 Test Result

PASS

The final test data are shown on the following page(s).

Radiated Emission Test Data

Date of Tested : 2009-08-06 Polarization : Horizontal
 Temperature : 26°C Humidity : 51%



Peak	Freq (MHz)	Level (dBuV)	Read Level (dBuV)	Over Level (dBuV)	Limit Line (dBuV)	Factor (dBuV)
1 @	34.850	25.31	31.45	-4.69	30.00	-6.14
2	86.260	15.56	39.99	-14.44	30.00	-24.43
3	185.200	13.44	31.92	-16.56	30.00	-18.48
4	600.360	19.43	31.26	-17.57	37.00	-11.83
5	784.660	21.57	30.35	-15.43	37.00	-8.78
6	953.440	25.30	32.16	-11.70	37.00	-6.86

Level(dBuV) = Read Level(dBuV) + Factor(dBuV)
 Factor(dBuV) = Antenna Factor(dBuV) + Cable Loss(dBuV) + Preamp(dBuV)

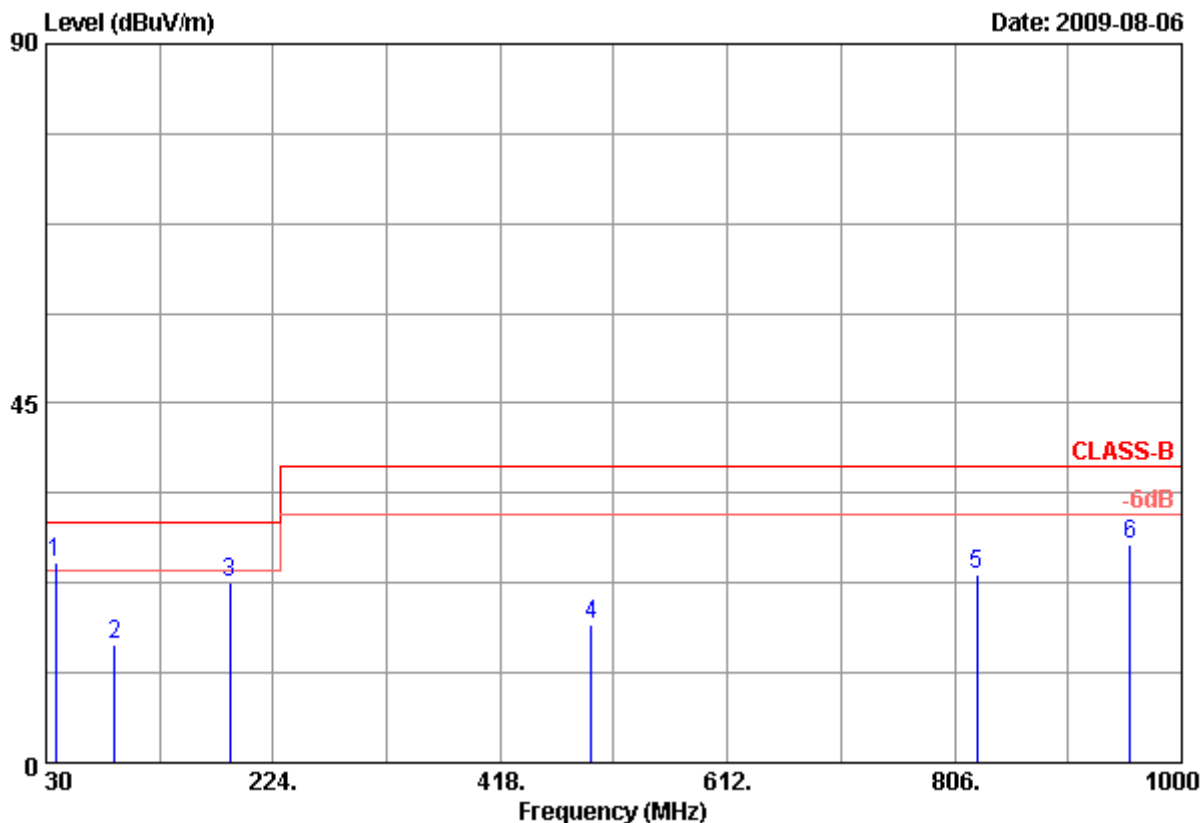
@ :Maximum Data x :Over Limit ! :Over Margin

SPECTRUM : hp 8590L
 ANTENNA & TABLE CONTROLLER : chance most CM886(1.00)

Remark : All readings are Quasi-Peak values.

Radiated Emission Test Data

Date of Tested : 2009-08-06 Polarization : Vertical
 Temperature : 26°C Humidity : 51%



	Freq	Level	Read Level	Over Level	Limit Line	Factor
	MHz	dBuV	dBuV	dBuV	dBuV	dBuV
1 @	37.760	25.06	32.56	-4.94	30.00	-7.50
2	88.200	14.75	39.13	-15.25	30.00	-24.38
3	187.140	22.57	41.04	-7.43	30.00	-18.47
4	495.600	17.37	31.26	-19.63	37.00	-13.89
5	825.400	23.53	31.64	-13.47	37.00	-8.11
6	956.350	27.44	34.26	-9.56	37.00	-6.82

Level(dBuV) = Read Level(dBuV) + Factor(dBuV)
 Factor(dBuV) = Antenna Factor(dBuV) + Cable Loss(dBuV) + Preamp(dBuV)

@ :Maximum Data x :Over Limit ! :Over Margin

SPECTRUM : hp 8590L
 ANTENNA & TABLE CONTROLLER : chance most CM886(1.00)

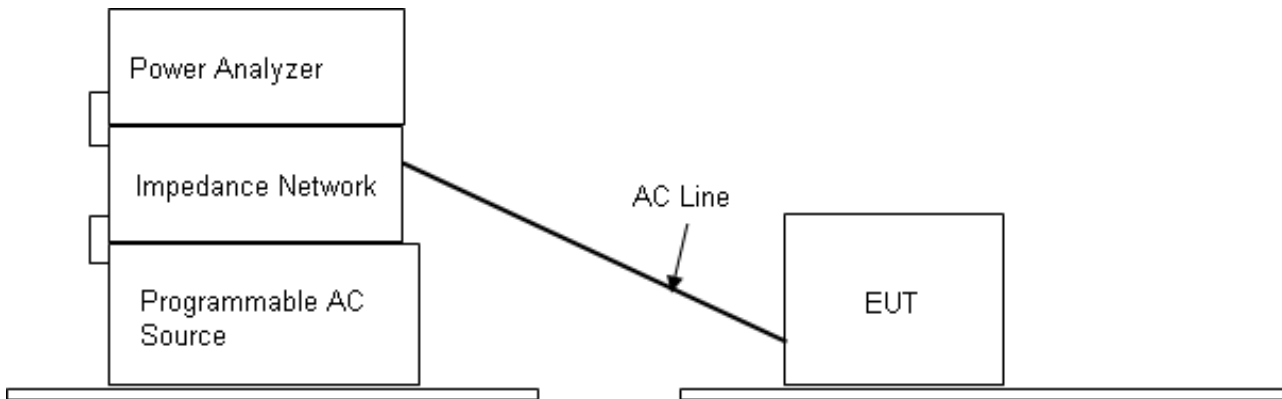
Remark : All readings are Quasi-Peak values.

4 Harmonic Current Emission Measurement

4.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

4.2 Test Configuration and Procedure



- The EUT was set in series with the Power Analyzer through an Impedance Network for the measurement of harmonic currents.
- The supply voltage and frequency setting on the Programmable AC Source was programmed as the rated voltage and frequency of the EUT.
- Classify the EUT class in accordance with the IEC61000-3-2 for the purpose of harmonic current limitation. The measurement was automatically performed by test software. The test result was collected and analyzed by the computer.

4.3 EUT Operation Condition

Environment Condition

Temperature	Humidity	Atmospheric Pressure
28°C	44%RH	1008mbar

4.4 Test Limit

Class A Equipment

Harmonic Order (n)	Maximum permissible harmonic current (A)
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33

13	0.21
$15 \leq n \leq 39$	$0.15 * 15 / n$
Even harmonics	
2	1.08
4	0.43
6	0.30
$8 \leq n \leq 40$	$0.23 * 8 / n$

4.5 Test Result

PASS

The measured result is shown on the following page(s).



ANALYZER 6630

2009.07.15 11:22:14

Current Harmonics

Setup: CLASS A Gen setting: 1(1) U : 229.88 V fu: 50.000 Hz
 Live Analysed periods: 4 I : 0.6324 A P: 126.5 W
 Module: M1 Limit: Class A (EN61000_A14) I1: 0.5622 A
 Note:
 THD=51.30 % (PF=0.870) PASSED

No	A	Lim A	No	A	Lim A	No	A	Lim A
1	0.562		15	0.008	0.150	29	0.004	0.078
2	0.007	1.081	16	0.000	0.115	30	0.000	0.061
3	0.200	2.301	17	0.017	0.132	31	0.012	0.073
4	0.002	0.430	18	0.000	0.102	32	0.000	0.058
5	0.146	1.141	19	0.006	0.118	33	0.008	0.068
6	0.001	0.300	20	0.001	0.092	34	0.000	0.054
7	0.122	0.770	21	0.014	0.107	35	0.009	0.064
8	0.001	0.230	22	0.001	0.084	36	0.000	0.051
9	0.062	0.400	23	0.008	0.098	37	0.006	0.061
10	0.001	0.184	24	0.000	0.077	38	0.000	0.048
11	0.030	0.330	25	0.013	0.090	39	0.015	0.058
12	0.000	0.153	26	0.000	0.071	40	0.000	0.046
13	0.027	0.210	27	0.001	0.083			
14	0.001	0.132	28	0.000	0.066			

Current range: 3 Ap

Next measure

Change to bar graph

Relative current

Write to disk

Appl: CLASS A&B (1212_00)

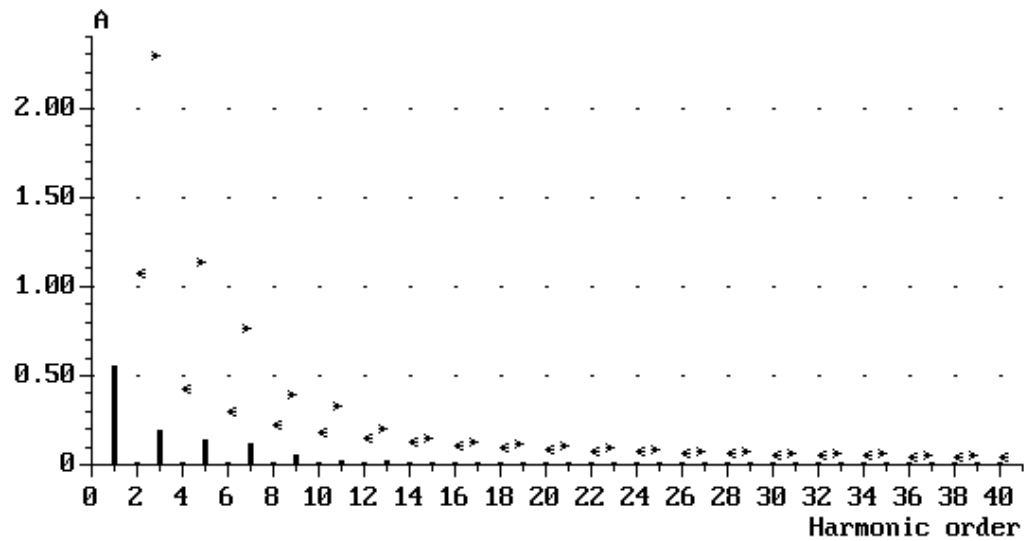


ANALYZER 6630

2009.07.15 11:23:10

Current Harmonics

Setup: CLASS A Gen setting: 1(1) U : 229.88 V fu: 50.000 Hz
 Live Analysed periods: 4 I : 0.6324 A P: 126.5 W
 Module: M1 Limit: Class A (EN61000_A14) I1: 0.5622 A
 Note:
 THD=51.30 % (PF=0.870) PASSED



Next measure

Change to table

Relative current

Log scale

Write to disk

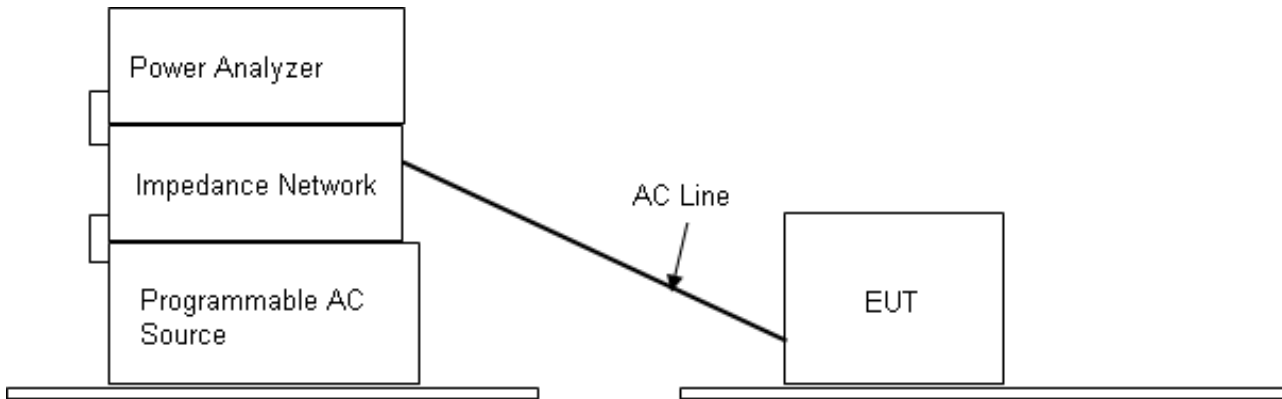
Appl: CLASS A&B (1212_01)

5 Voltage Fluctuations and Flicker Measurement

5.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

5.2 Test Configuration and Procedure



- The EUT was set in series with the Power Analyzer through an Impedance Network for the measurement of Flicker Voltage.
- The supply voltage and frequency setting on the Programmable AC Source was programmed as the rated voltage and frequency of the EUT.
- The measurement was automatically performed by test software. The test result was collected and analyzed by the computer.

5.3 EUT Operation Condition

Environment Condition

Temperature	Humidity	Atmospheric Pressure
28°C	44%RH	1008mbar

5.4 Test Limit

Test Item	Limit	Remark
Pst	1.0	Pst means short-term flicker indicator. $T_p=10$ min
Plt	0.65	Plt means long-term flicker indicator. $T_p=2$ hrs
dt (%)	3.3	For more than 500ms
dmax (%)	4	dmax means relative maximum voltage change.
dc (%)	3.3	dc means relative steady-state voltage change.

5.5 Test Result

PASS

The measured result is shown on the following page(s).



ANALYZER 6630

2009.07.15 11:38:34

Extreme Flicker-I M1

Note:

Numerical Reference Impedance
U: 230.0 V I: 0.4175 A f: 50.000 Hz PF: 0.930

EVALUATION:-----

Type of observation period	Short	Long	Limit
Observation time	10	10 min	
Maximum relative voltage change	dmax:	0.00 %	4
Max rel steady state voltage change	dc :	0.00 %	3
Duration of d(t) > 3 %	t :	0.00 s	0.2
Short term flicker severity	Pst :	0.01	1.00
Long term flicker severity	Plt :	---	0.01

Based on 1 (1) short term cycles

PASSED

Measurement completed

Appl: CLASS A&B

(1311_00)

Next measure

Extreme time graph

Change to histogram

Write to disk

Select module



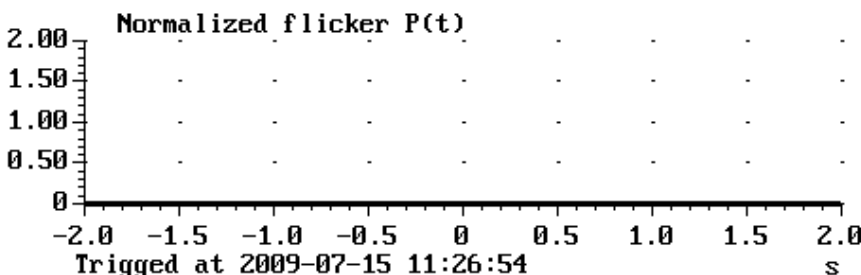
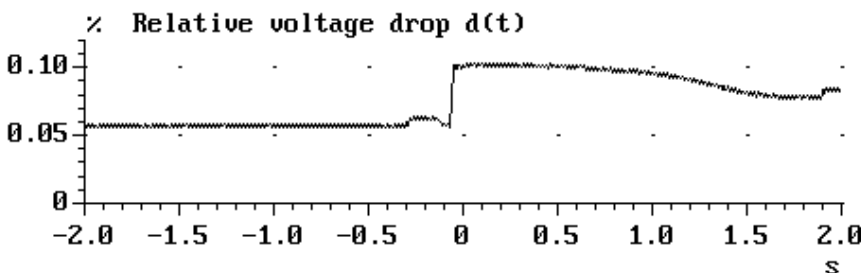
ANALYZER 6630

2009.07.15 11:41:50

Extreme Flicker-I M1

Note:

Numerical Reference Impedance
U: 230.0 V I: 0.4175 A f: 50.000 Hz PF: 0.930



Appl: CLASS A&B

(13113_00)

Next measure

Change to table

Refresh time graph

Write to disk

Select module



6 Electrostatic Discharge Immunity Test

6.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

6.2 Test Configuration and Procedure

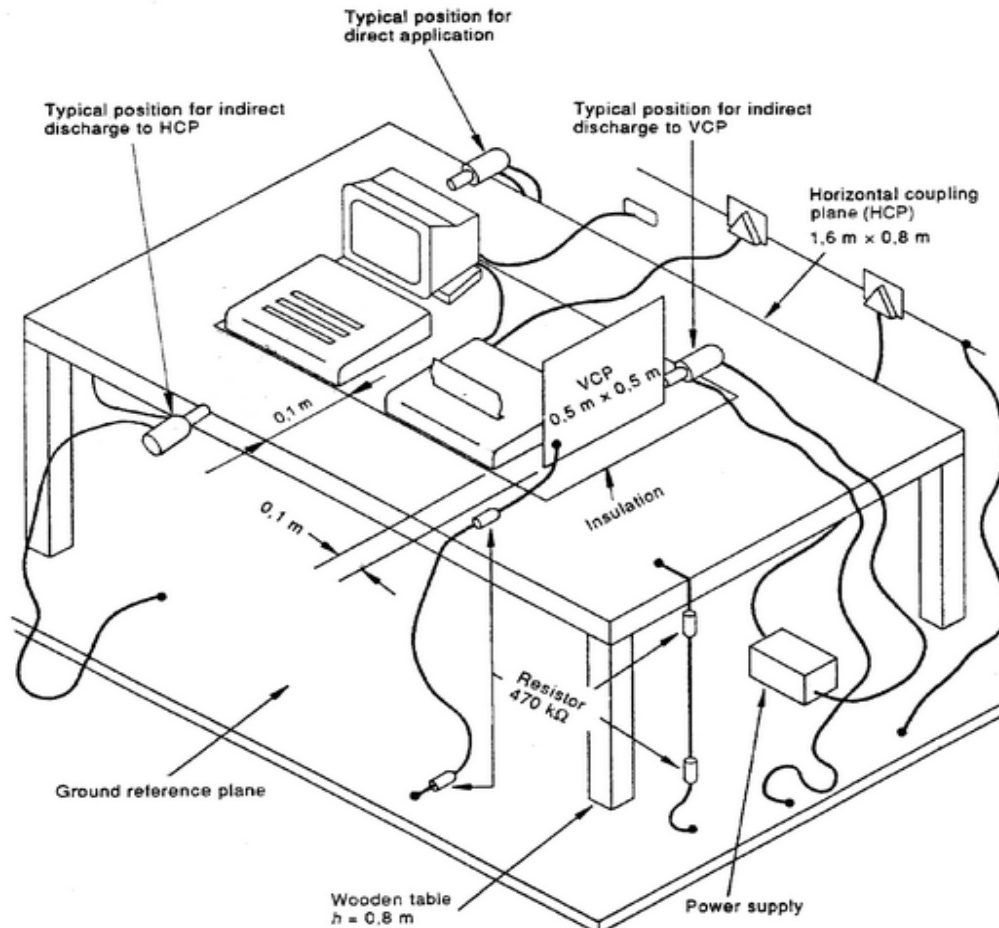


Table-top Equipment

- A functional test was performed before the conditioning.
- The EUT was located on a 0.8 m high wooden table standing on the ground reference plane with a 1.6 * 0.8 m horizontal coupling plane on the top. The EUT and cables was isolated from the coupling plane by an insulating support 0.5 mm thick.
- In Contact Discharge, the EUT was exposed to 10 single discharges (the selected test points were marked with red labels on the EUT)
- In Air Discharge, the EUT exposed to minimum of 10 single discharges on the selected test points.
- The EUT was monitored during the conditioning period.
- After the conditioning, a functional test was performed. The EUT was inspected visually for any mechanical damage.

6.3 Compliance Criteria

There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the application of the discharges is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change. And there shall be no change in the functioning of the EUT and no significant change in any measurement, which shall also remain within specification.

6.4 Test Result

6.4.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
28°C	44%RH	1008mbar

6.4.2 Observation of Direct Discharge

Test Points: 1. Surface of Case. 2. Junction of Case.

Type of Discharge	Test Specifications				Verdict
	Test Level	Polarity	Test Point	Number of Discharge	
Air Discharge	2,4,8 (kV)	±	1~2	20/ per point	Pass
Contact Discharge	2,4,6 (kV)	±	1	20/ per point	Pass
Remarks	1. No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test. 2. No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test.				

6.4.3 Observation of Indirect Discharge

Test Points: 1. Front Side. 2. Rear Side. 3. Left Side. 4. Right Side.

Type of Discharge	Test Specifications				Verdict
	Test Level	Polarity	Test Point	Number of Discharge	
HCP Application	2,4,6 (kV)	±	1~4	20/ per point	Pass
VCP Application	2,4,6 (kV)	±	1~4	20/ per point	Pass
Remarks	1. No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test. 2. No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test.				

PASS

The test result shows that the EUT is in compliance with the test performance criteria specified in EN 50130-4.

7 Radio-frequency, Electromagnetic Field Immunity Test

7.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

7.2 Test Configuration and Procedure

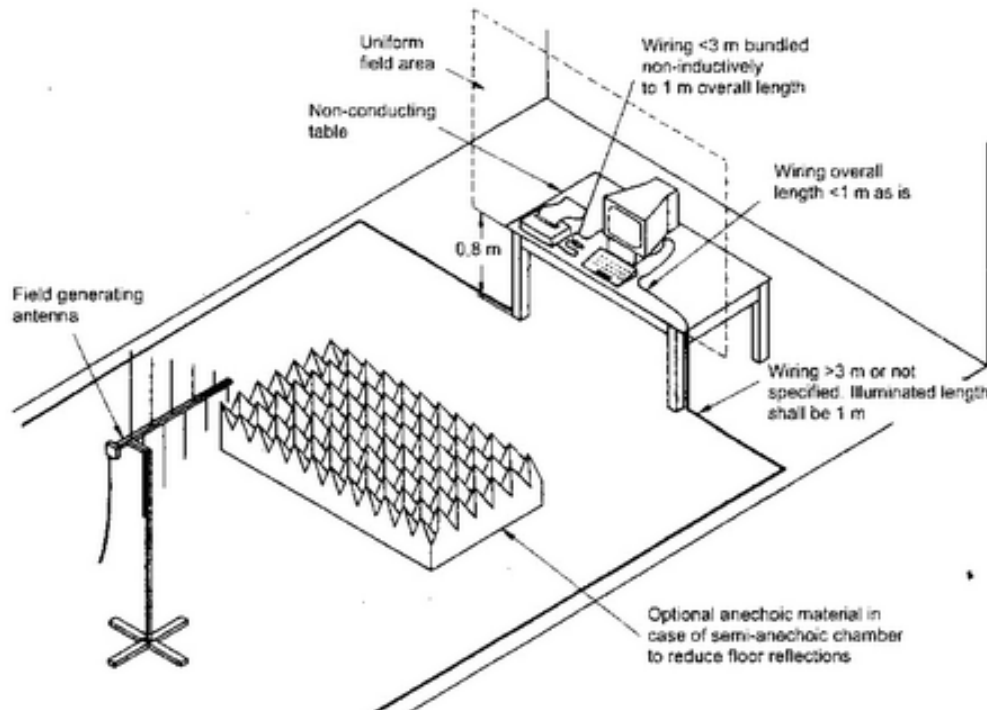


Table-top Equipment

- A functional test was performed before the conditioning.
- The field calibration was executed to create a uniform field area (UFA), 3 m away from the antenna, to ensure the validity of the test results.
- The EUT was placed on a non-conductive table 0.8 m high in the UFA.
- The EUT was then connected to power and signal wires according to relevant installation instruction.
- The EUT was positioned so that the four sides of the EUT were exposed to the electromagnetic field in sequence. In each position, the performance of the EUT was investigated and monitored by a CCD camera..
- The EUT was monitored during the conditioning period.
- After the conditioning, a functional test was performed. The EUT was inspected visually for any mechanical damage.

7.3 Compliance Criteria

There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as change, and no such flickering of indicators occurs at a field strength of 3V/m.

7.4 Test Result

7.4.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
28°C	44%RH	1008mbar

7.4.2 Observation of Test

Type of Modulation	Test Specifications			Verdict
	Field Strength	Frequency Range	Modulation	
Amplitude Modulation	10V/m	80 to 2000MHz	80%, 1kHz, Sinusoidal	Pass
Pulse Modulation	10V/m	80 to 2000MHz	1Hz (0.5s On: 0.5s Off)	Pass
Remark	1. No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test. 2. No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test.			

PASS

The test result shows that the EUT is in compliance with the test performance criteria specified in EN 50130-4.

8 Electrical Fast Transient Test

8.1 Test Instrument

Refer to Sec. 1.2 Test Instruments.

8.2 Test Configuration and Procedure

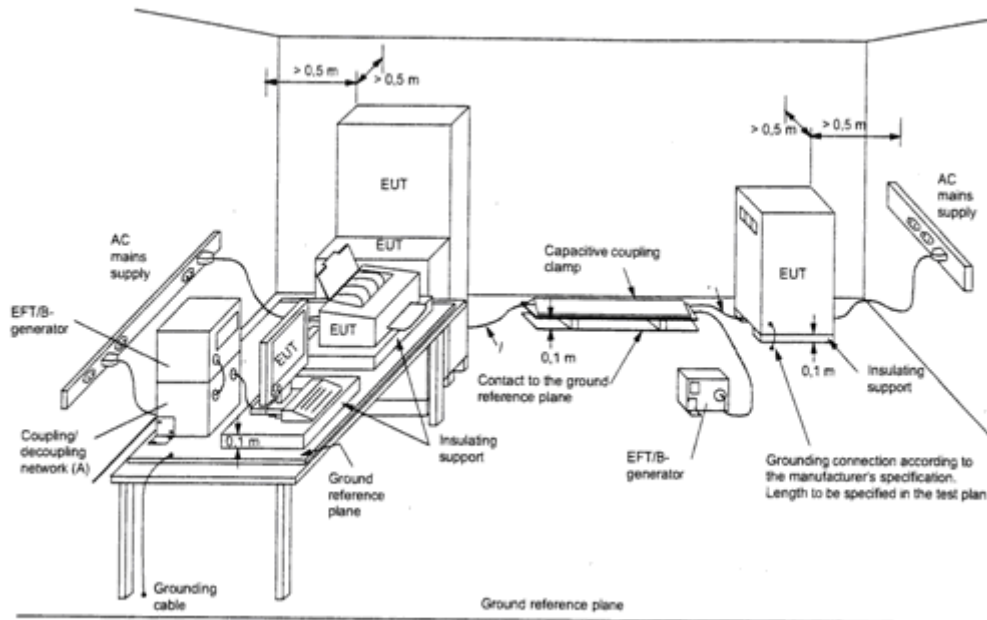


Table-top Equipment

- The EUT was placed on a table of 0.8 m height above the 1 * 1 m metallic ground reference plane, which projected beyond the EUT by at least 0.1 m on all sides.
- The ground plane was connected to the protective earth.
- The distance between the EUT and all other conductive structures, except the ground plane beneath the EUT was more than 0.5 m.
- The length of the signal and power lines between the coupling device and the EUT was 0.5 m.
- All cables to the EUT were placed on the insulation support 0.1 m above the ground reference plane.
- The EUT was connected to the power mains through a coupling device that directly coupled the EFT interference signal. Each of the Line, Neutral and Protective Earth conductors was injected with burst for 1 minute. The test time was broken down into six 10 s bursts separated by a 10 s pause for avoiding synchronization. Both voltage polarities were applied for each test level.
- Operating condition was shown on the monitor and observed.

8.3 Compliance Criteria

There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the application of the bursts is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change. And there shall be no change in the functioning of the EUT and no significant change in any measurement, which shall also remain within specification.

8.4 Test Result

8.4.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
28°C	44%RH	1008mbar

8.4.2 Observation of Power Supply Port

Coupling Selection	Test Specifications				Verdict
	Voltage (kV)	Test Duration (Sec)	Repetition Rate (kHz)	Tr/ Td (nS)	
L	±2	60	1	5/50	Pass
N	±2	60	1	5/50	Pass
PE	±2	60	1	5/50	Pass
L + N	±2	60	1	5/50	Pass
L + PE	±2	60	1	5/50	Pass
N + PE	±2	60	1	5/50	Pass
L + N +PE	±2	60	1	5/50	Pass
Remark	No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test.				
Note	Phase Shifting:0°,90°,180°,270°,360°				

8.4.3 Observation of Signal Lines (Applicable only to cable length > 3m)

The cable connected to the EUT in the test was not longer than 3m. Therefore, no test has been required.

PASS

The test result shows that the EUT is in compliance with the test performance criteria specified in EN 50130-4.

9 Surge Immunity Test

9.1 Test Instrument

Refer to Sec. 1.2 Test Instruments.

9.2 Test Configuration and Procedure

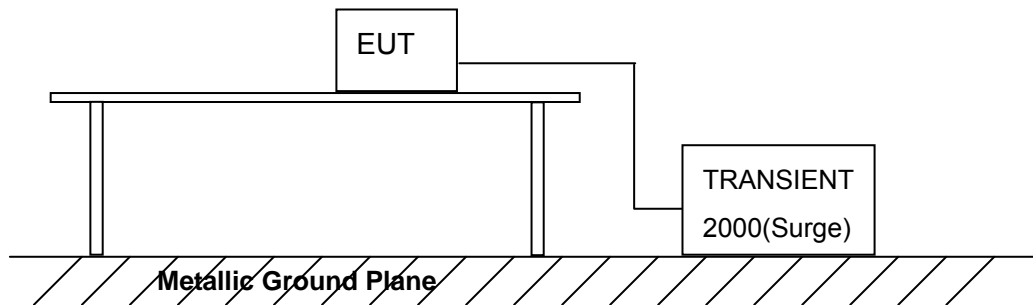


Table-top Equipment

- The EUT was placed on a table of 0.8 m height above the 1 * 1 m metallic ground reference plane, which projected beyond the EUT by at least 0.1 m on all sides.
- The ground plane was connected to the protective earth.
- The length of power cord between the coupling device and the EUT is less than 2 m (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.
- Operating condition was shown on the monitor and observed.
- After the conditioning, a functional test was performed. The EUT was inspected visually for any mechanical damage.

9.3 Compliance Criteria

There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the application of the surges is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change. And there shall be no change in the functioning of the EUT and no significant change in any measurement, which shall also remain within specification.

9.4 Test Result

9.4.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
28°C	44%RH	1008mbar

9.4.2 Observation of Power Supply Port

Coupling Selection	Test Specifications			Verdict
	Voltage (kV)	Min. of Surge at Each Polarity	Repetition Rate (per min)	
L ► N	±0.5, 1	20	< 1	Pass
L ► PE	±0.5, 1, 2	20	< 1	Pass
N ► PE	±0.5, 1, 2	20	< 1	Pass
Remark	No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test.			

9.4.3 Observation of Signal Lines (Applicable only to cable length > 30m)

The cable connected to the EUT in the test was not longer than 30m. Therefore, no test has been required.

PASS

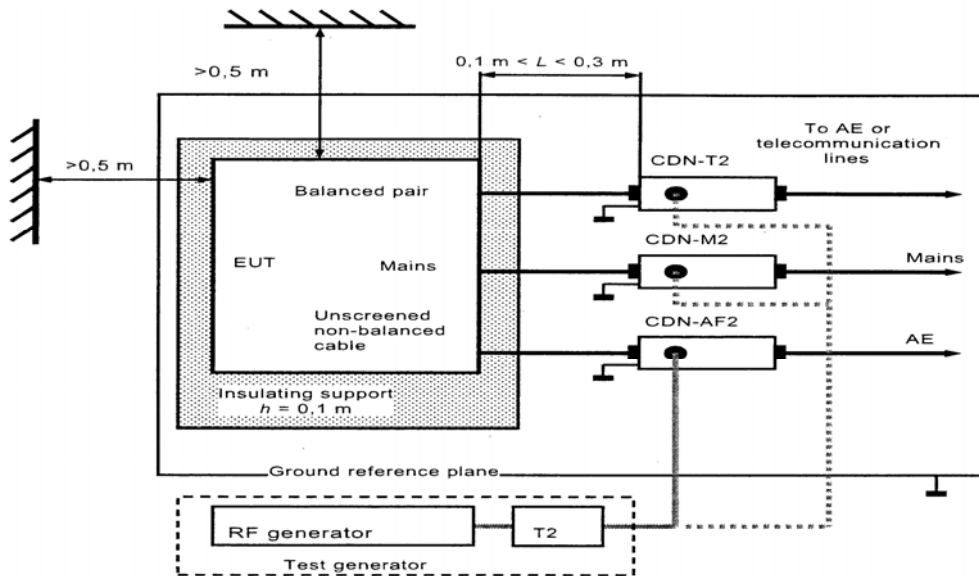
The test result shows that the EUT is in compliance with the test performance criteria specified in EN 50130-4.

10 Radio-frequency, Conducted Disturbances Immunity Test

10.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

10.2 Test Configuration and Procedure



- The EUT was placed on an insulating support of 0.1 m height above a ground reference plane. All cables exiting the EUT was supported at a height of 30 mm above the ground reference plane.
- The EUT was connected to the power mains through a Coupling and Decoupling Networks (CDN).
- The CDN was located 0.3 m from the EUT as indicated in the diagram above.
- The test was performed with the test generator connected to each of the CDN in turn while the other non-excited RF input ports of the coupling devices were terminated by a 50 Ω terminator.
- The conducted disturbance was applied on the EUT from 150 kHz to 100 MHz using the signal levels established during the setting process. .
- Operating condition was shown on the monitor and observed.

10.3 Compliance Criteria

There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change, and no such flickering of indicators occurs at $U_0=130\text{dB}\mu\text{V}$.

And there shall be no change in the functioning of the EUT and no significant change in any measurement, which shall also remain within specification.

10.4 Test Result

10.4.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
28°C	44%RH	1008mbar

10.4.2 Observation of Test

Type of Modulation	Test Specifications			Verdict
	Voltage Level (emf) U_0	Frequency Range	Modulation	
Amplitude Modulation	10V/ 140dB μ V	0.15 to 100MHz	80%, 1kHz, sinusoidal	Pass
Pulse Modulation	10V/ 140dB μ V	0.15 to 100MHz	1Hz (0.5s On: 0.5s Off)	Pass
Remark	No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test.			
Note	Phase Shifting:0°,90°,180°,270°,360°			

10.4.3 Observation of Signal Lines (Applicable only to cable length > 3m)

The cable connected to the EUT in the test was not longer than 3m. Therefore, no test has been required.

PASS

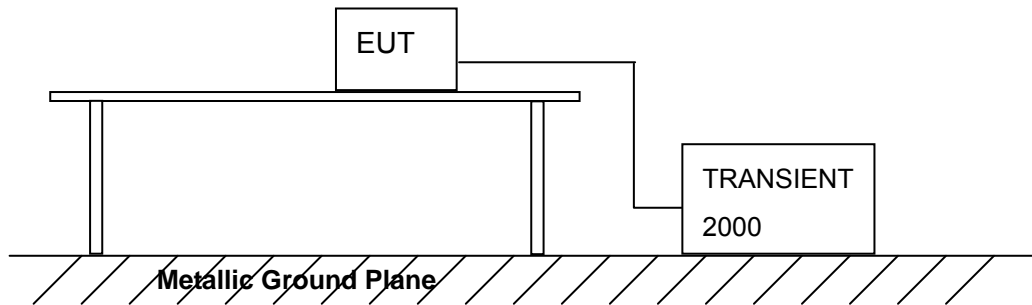
The test result shows that the EUT is in compliance with the test performance criteria specified in EN50130-4.

11 Voltage Dips, Short Interruptions Immunity Test

11.1 Test Instrument

Refer to Sec. 1.2 Test Instruments.

11.2 Test Configuration and Procedure



- A functional test was performed before the conditioning.
- The EUT was tested with (I) 30% voltage reduction (II) 60% voltage reduction (III) 100% voltage reduction with different time duration as indicated on the following page.
- During the conditioning period, the EUT status was monitored.
- After the conditioning, the EUT was inspected visually for any mechanical damage.

11.3 Compliance Criteria

There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change. And there shall be no change in the functioning of the EUT and no significant change in any measurement, which shall also remain within specification.

11.4 Test Result

11.4.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
28°C	44%RH	1008mbar

11.4.2 Observation of Power Supply Port

Voltage Dips

Voltage Reduction (%)	Test Specifications			Verdict
	Duration Periods	No. of Reductions	Interval between Each Duration (Second)	
30	0.5,1,5,10	3	≥ 10	Pass
60	0.5,1,5,10	3	≥ 10	Pass
100	0.5,1,5	3	≥ 10	Pass
Remarks	1. No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test. 2. No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test. 3. No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test.			
Note	Phase Shifting:0°,90°,180°,270°,360°			

PASS

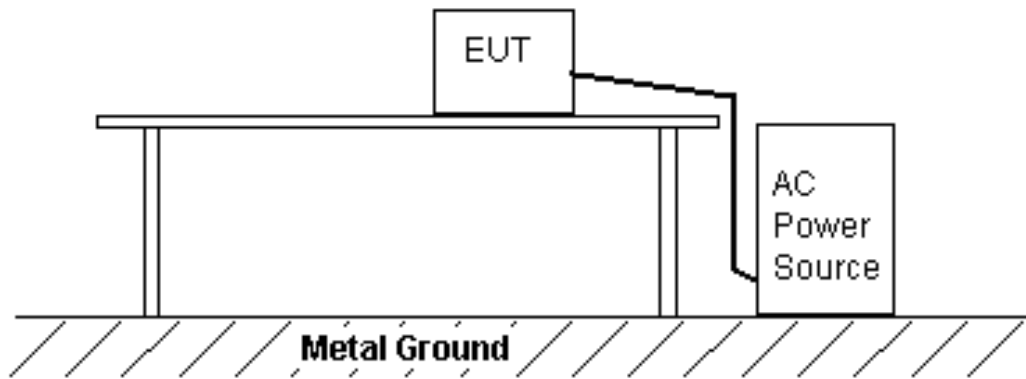
The test result shows that the EUT is in compliance with the test performance criteria specified in EN 50130-4.

12 Mains Supply Voltage Variations

12.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

12.2 Test Configuration and Procedure



- A functional test was performed before the conditioning.
- The EUT was exposed to (I) the maximum power supply condition (Nominal Mains Voltage + 10%) (II) the minimum power supply condition (Nominal Mains Voltage – 15%) until temperature stability was reached.
- During the conditioning, the EUT status was monitored.
- A functional test was performed after each conditioning once the temperature stability was obtained.
- After the conditioning, a functional test was performed. The EUT was inspected visually for any mechanical damage.

12.3 Compliance Criteria

There shall be no damage, malfunction or change of status due to the different supply voltage conditions. And there shall be no change in the functioning of the EUT and no significant change in any measurement, which shall also remain within specification.

12.4 Test Result

12.4.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
28°C	44%RH	1008mbar

12.4.2 Observation of Power Supply Port

Voltage Variance

Supply Voltage		Verdict
Supply Voltage Max. = Nominal Mains Voltage + 10%	253V	Pass
Supply Voltage Min. = Nominal Mains Voltage - 15%	195.5V	Pass
Remarks	No damage, malfunction or change of status has been observed during the conditioning and throughout the entire functional test.	

PASS

The test result shows that the EUT is in compliance with the test performance criteria specified in EN 50130-4.

13 Photographs of Test

13.1 Power Line Conducted Test



Front View



Rear View

13.2 Radiated Emission Test



Front View



Rear View

13.3 Harmonic Current & Voltage Fluctuations and Flicker Measurement



13.4 Electrostatic Discharge Immunity Test



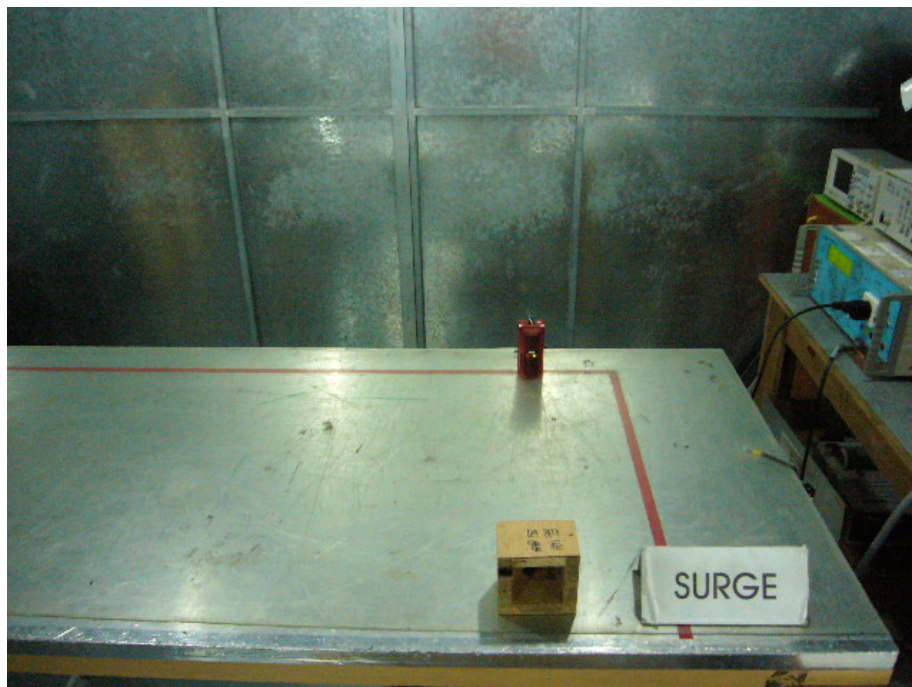
13.5 Radio-frequency, Electromagnetic Field Immunity Test



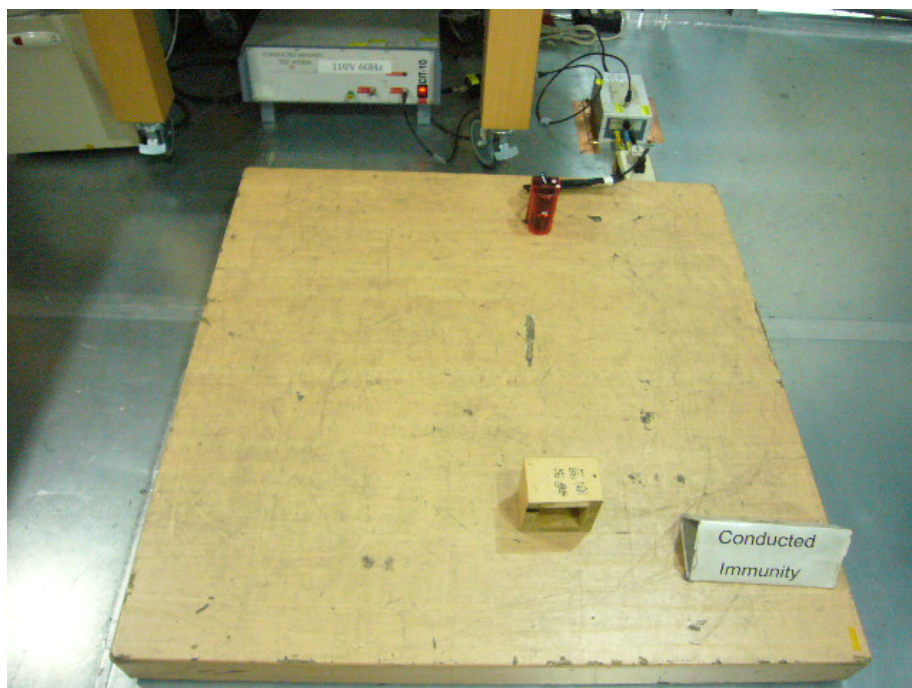
13.6 Electrical Fast Transient / Burst Immunity Test



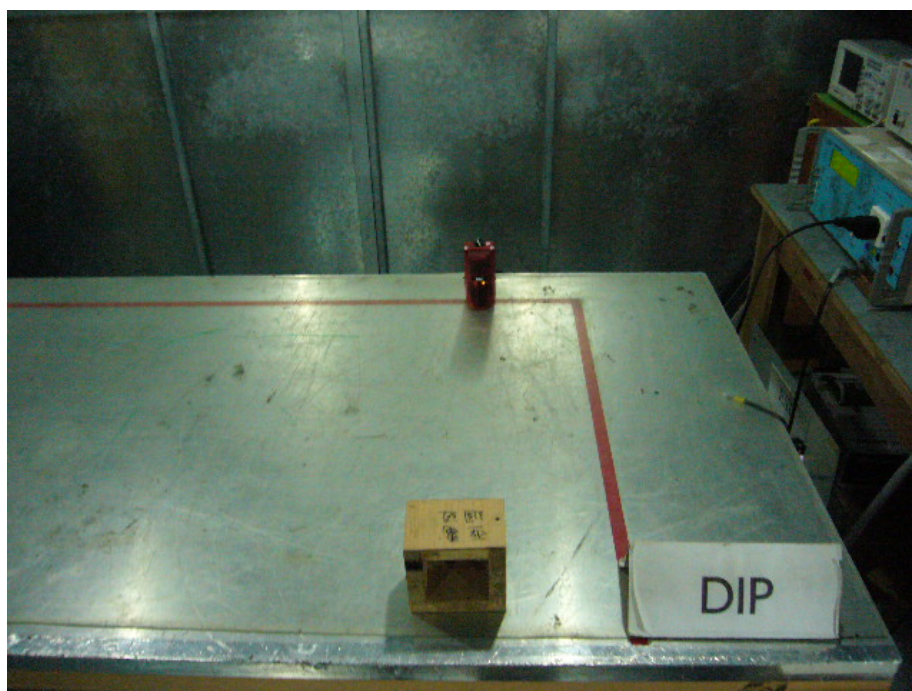
13.7 Surge Immunity Test



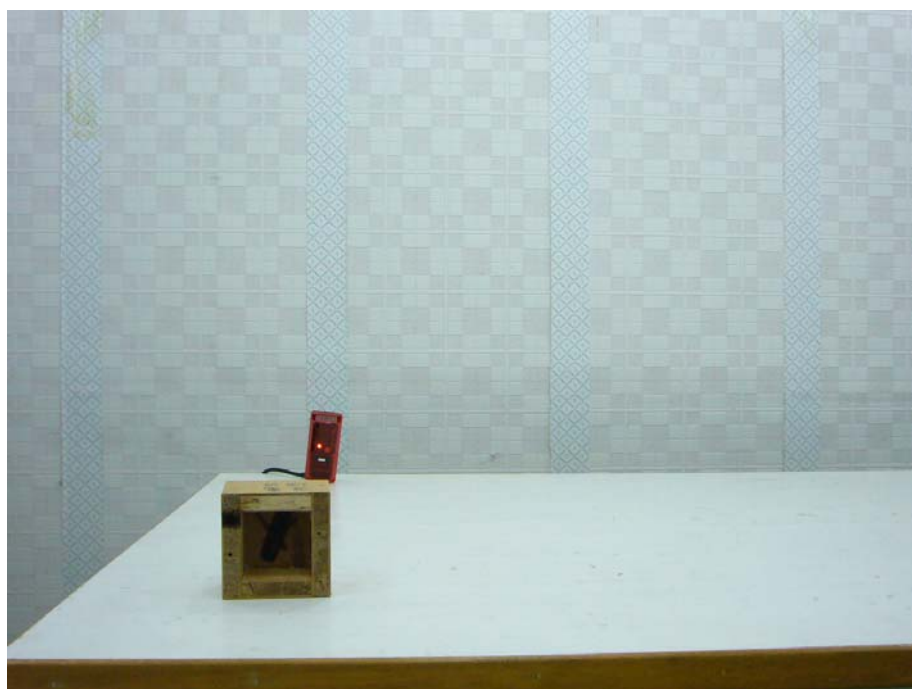
13.8 Radio-frequency, Conducted Disturbances Immunity Test



13.9 Voltage Dips, Short Interruptions Immunity Test



13.10 Mains Supply Voltage Variations



14 Photographs of EUT



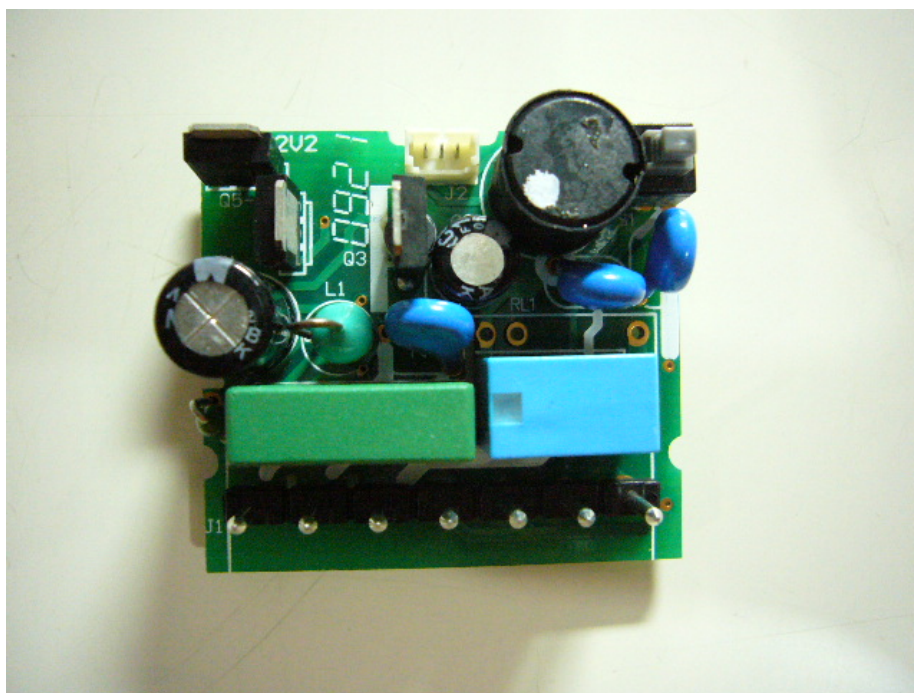
Front View of the EUT



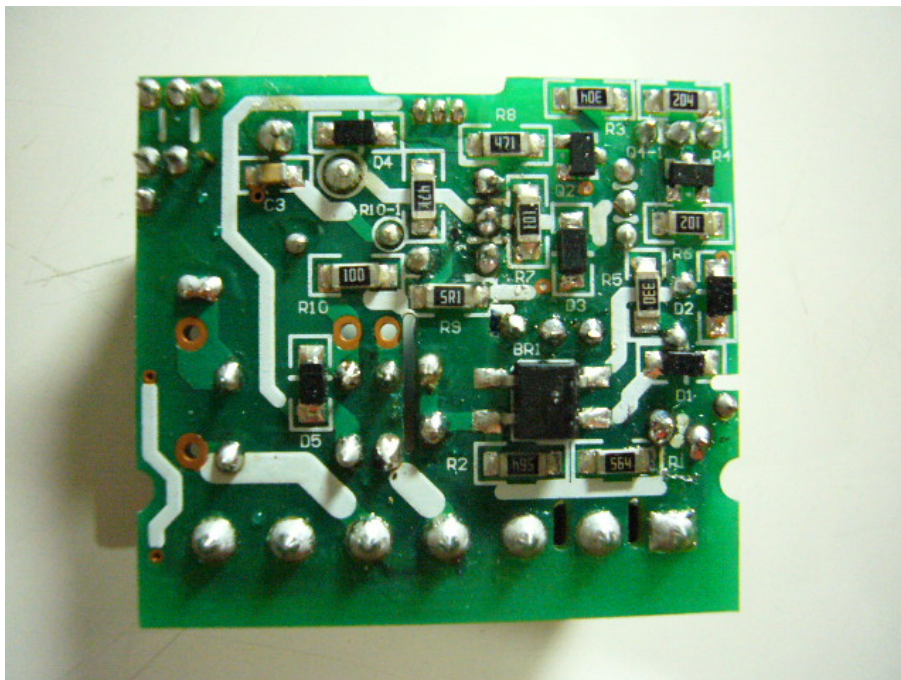
Rear View of the EUT



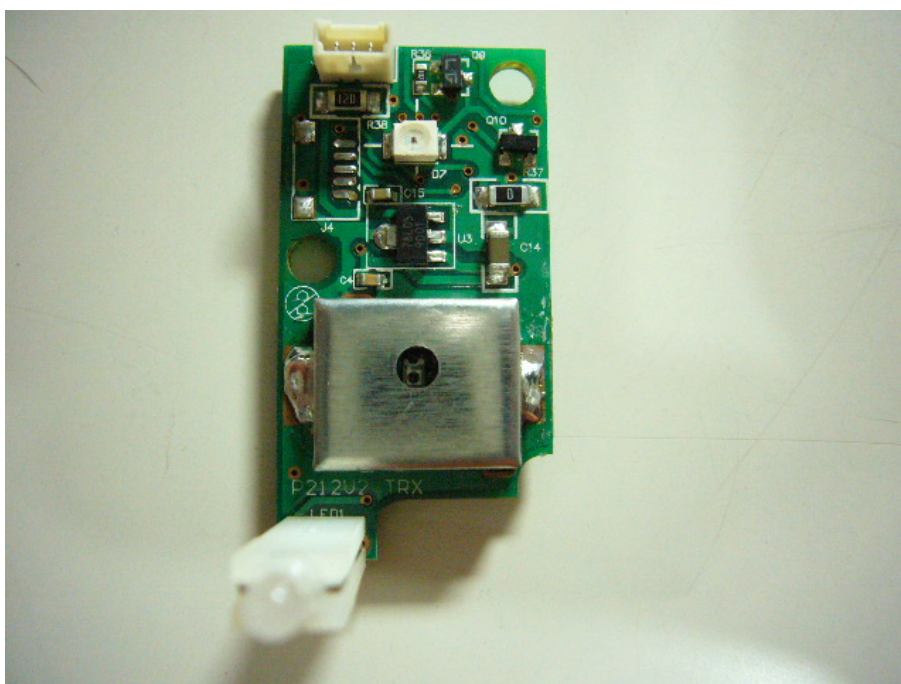
Inside View of the EUT



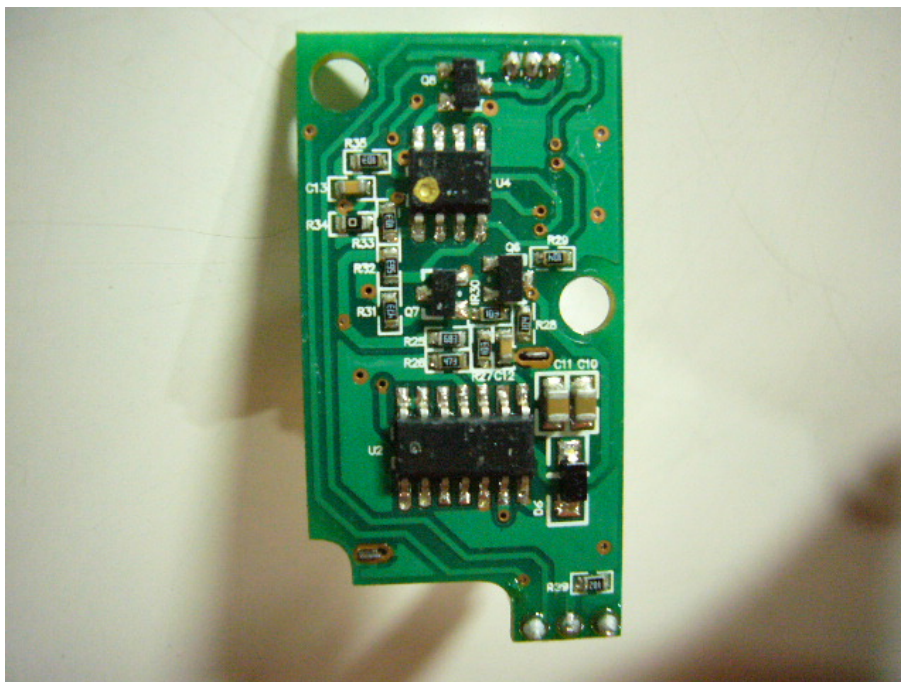
Front View of the PCB 1-1



Rear View of the PCB 1-2



Front View of the PCB 2-1



Rear View of the PCB 2-2

15 Photographs of ESD Test Points



View of ESD Test Points



View of ESD Test Points



View of ESD Test Points