



EMC Test Report



Applicant :	FATEK AUTOMATION CORP
Address of Applicant :	26FL, NO. 29, SEC. 2, JUNGJENG E. RD., DANSHUEI DIST., NEW TAIPEI CITY 25170, TAIWAN, R.O.C.
Equipment Under Test :	PLC
Model Number :	FBs-60MCR2-AC
Series :	Please refer to page 2

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Series Number:

FBs-10MA◇Δ-◎-C, FBs-14MA◇Δ-◎-C, FBs-20MA◇Δ-◎-C, FBs-24MA◇Δ-◎-C,
 FBs-32MA◇Δ-◎-C, FBs-32MB◇Δ-◎-C, FBs-40MA◇Δ-◎-C, FBs-40MB◇Δ-◎-C,
 FBs-60MA◇Δ-◎-C, FBs-60MB◇Δ-◎-C, FBs-10MC◇Δ-◎, FBs-14MC◇Δ-◎, FBs-20MC◇Δ-◎,
 FBs-24MC◇Δ-◎, FBs-32MC◇Δ-◎, FBs-40MC◇Δ-◎, FBs-60MC◇Δ-◎, FBs-20MN◇Δ-◎,
 FBs-32MN◇Δ-◎, FBs-44MN◇Δ-◎, FBs-EPW-AC/D24, FBs-24XY◇-◎, FBs-40XY◇-◎,
 FBs-60XY◇-◎, FBs-8X, FBs-8Y◇, FBs-8XY◇, FBs-16Y◇, FBs-16XY◇, FBs-20X, FBs-24XY◇,
 FBs-40XY◇, FBs-60XY◇, FBs-24X, FBs-24YT/J, FBs-32DGI, FBs-7SG1, FBs-7SG2, FBs-2DA, FBs-4DA,
 FBs-4A2D, FBs-6AD, FBs-2TC, FBs-6TC, FBs-16TC, FBs-6RTD, FBs-16RTD, FBs-6NTC, FBs-2A4TC,
 FBs-2A4RTD, FBs-VOM, FBs-1LC, FBs-2LC, FBs-4PT, FBs-3SSI, FBs-CM22, FBs-CM55, FBs-CM25,
 FBs-CM25E, FBs-CM55E, FBs-CM25C, FBs-CM5R, FBs-CM5H, FBs-CB2, FBs-CB22, FBs-CB5,
 FBs-CB55, FBs-CB25, FBs-CBE, FBs-CBEH, FBs-CBCAN, FBs-BSSI, FBs-B2DA, FBs-B2A1D, FBs-B4AD,
 FBs-1HLC, FBs-RZR, FBs-B2C, FBs-BDAP, FBs-BPEP, FBs-PEP, FBs-XTNR, FBs-CMZBR, FBs-30GM,
 FBs-CMGSM, FBs-CM-G, FBs-60MAR2-AC-C-F, FBs-60MAT2-AC-C-F, FBs-60MAT2-AC-F, FBs-60XYR-F,
 FBs-60XYT-F, FBs-60XYT-AC-F, FBs-16YT-F, FBs-20XYT-F, FBs-24X-F, FBs-20MB◇2-◎-C,
 FBs-24MB◇2-◎-C, FBs-24XY◇-◎-B, FBs-40XY◇-◎-B, FBs-60XY◇-◎-B, FBs-16Y◇-B,
 FBs-16XY◇-B, FBs-20X-B, FBs-24XY◇-B, FBs-40XY◇-B, FBs-60XY◇-B, FBs-16TC-B, FBs-16RTD-B
 (◇stands for R, T or J; Δ stands for 2 or U; ◎ stands for AC, D12 or D24; -C stands for blank or add in
 RTC)

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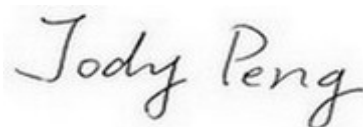
Verification

Applicant : FATEK AUTOMATION CORP
Manufacturer : FATEK AUTOMATION CORP
Equipment Under Test : PLC
Model Number : FBs-60MCR2-AC
Series : Please refer to page 2
Sample Received Date : 2014-07-22
Test Standard :

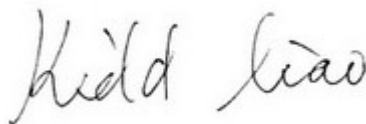
Emission:	Immunity:
☒ EN 61131-2:2007	☒ EN 61131-2:2007
☒ IEC 61000-3-2:2005	☒ IEC 61000-4-2:2008
+A1:2008	☒ IEC 61000-4-3:2006+A1:2007+A2:2010
+A2:2009	☒ IEC 61000-4-4:2004+A1:2010
☒ IEC 61000-3-3:2008	☒ IEC 61000-4-5:2005
	☒ IEC 61000-4-6:2008
	☒ IEC 61000-4-8:2009
	☒ IEC 61000-4-11:2004

Remark:

This report details the results of the test carried out on one sample. This report shows the EUT is technically compliant with the EN 61000-6-4 and EN 61000-6-2 official requirements. This report applies to the above sample only and shall not be reproduced in part without written approval of Matrix Test Laboratory.



Documented by : _____ **Date:** 2014-08-01
Jody Peng/ Adm. Dept Staff



Tested by : _____ **Date:** 2014-07-31
Kidd Liao/ Eng. Dept. Staff



Approved by : _____ **Date:** 2014-08-01
Peter Chin/ Head of Laboratory

Summary of Test Result – Emission

Emission			
Test Standard	Test Item	Test Result	Remark
EN 61131-2 IEC 61000-6-4	Conducted Emission	Pass	Highest Emission L: 9.302MHz, Q.P.49.31dBuV, Margin -23.34 dB A.V.35.41dBuV, Margin -24.24 dB N: 8.822MHz, Q.P.44.22dBuV, Margin -28.44 dB
EN 61131-2 IEC 61000-6-4	Radiated Emission	Pass	Highest Emission H: 166.770MHz, 60.38dBuV, Margin-2.01 dB Antenna Height 2.21m, Turntable Angle 112° V: 328.760MHz, 60.63dBuV, Margin-2.09 dB Antenna Height 1.34 m, Turntable Angle 257°
EN 61131-2 IEC 61000-6-4	Radiated Emission (1 to 3 GHz)	N/A	The highest frequency of the internal sources of the EUT is less than 108MHz. Hence, up to 1GHz Radiated Measurement shall not be made.
EN 61131-2 IEC 61000-6-4	Radiated Emission (1 to 6 GHz)	N/A	
IEC 61000-3-2	Harmonic	Pass	Refer to Page 21
IEC 61000-3-3	Flicker	Pass	Refer to Page 24

Measurement Uncertainty – Emission

The following measurement uncertainty has been calculated for Emission Tests performed on the EUT as specified in CISPR 16-4-2:

Test Item		Uncertainty
Conducted Emission		± 3.61dB
Radiated Emission	Below 1GHz	± 5.04dB
	Above 1GHz	± 4.97dB

This reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k = 2$, providing a level of confidence of approximately 95%.

Summary of Test Result – Immunity

Immunity				
Test Standard	Test Item	Performance Criteria	Observed Result Class	Test Result
IEC61000-4-2	Electrostatic Discharge	B	A	Pass
IEC61000-4-3	Radiated Susceptibility	A	A	Pass
IEC61000-4-4	Electrical Fast Transient	B	A	Pass
IEC61000-4-5	Surge	B	A	Pass
IEC61000-4-6	Conducted Susceptibility	A	A	Pass
IEC61000-4-8	Magnetic Field	A	A	Pass
IEC61000-4-11	Voltage Dips and Interruption	Dip 0% B	A	Pass
		Dip 40% C	A	
		Dip 70% C	A	
		Interruptions 0% C	B	

Measurement Uncertainty – Immunity

It has been demonstrated that the test equipments for the above Immunity Tests meet the specified requirements in the standard with at least a 95% confidence.

1 General Description

1.1 Description of EUT

Equipment Under Test	:	PLC
Model Number	:	FBs-60MCR2-AC
Series	:	Please refer to page 2
Applicant Address of Applicant	:	FATEK AUTOMATION CORP : 26FL, NO. 29, SEC. 2, JUNGJENG E. RD., DANSHUEI DIST., NEW TAIPEI CITY 25170, TAIWAN, R.O.C.
Manufacturer Address of Manufacturer	:	FATEK AUTOMATION CORP : 26FL, NO. 29, SEC. 2, JUNGJENG E. RD., DANSHUEI DIST., NEW TAIPEI CITY 25170, TAIWAN, R.O.C.
Power Supply	:	Input: 100-240Vac, 180mA, 60Hz Output: 24Vdc, 190mA, Max. 36W
Data Cable	:	☒ N/A
Description of EUT	:	Dimensions : 42 cm (L) X 9 cm (W) X 8 cm (H) Weight : 1.8 kg Highest Frequency of the Internal Source : below 108MHz Position : ☒ Table-top / ☐ Floor-standing Intended Function : The EUT is a PLC. Product Variance : The manufacturer declares that the series products share the identical circuit design with the main test sample. The main test sample is the most sophisticated product with full functions. The series products have less function than the main test sample. Matrix only takes the responsibility to the main test sample.

1.2 Test Facility

Conducted Emission, Harmonic, Flicker, Electrostatic Discharge, Electrical Fast Transient, Surge, Conducted Susceptibility, Voltage Dips and Interruptions Tests are performed at 2F, No.146, Jian Yi Rd., Chung-Ho District, New Taipei City, Taiwan, R.O.C.

Radiated Emission, Radiated Susceptibility, Magnetic Field Tests are performed at No. 15-1, Cweishuh Keng, Cweipin Village, Linkou, New Taipei City, Taiwan, R.O.C.

1.3 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	2014-01-24	Conducted Disturbance
L.I.S.N.	EMCIS	LN2-16	LN04023	2013-08-01	
Pulse Limiter	Mess Tec	PL10	N/A	2013-11-30	
RF Cable	N/A	N/A	N/A	2013-10-05	
Coupling AND Decoupling Network	SCHAFFNER	ISN T400	16832	2013-10-08	Conducted Disturbance at Telecommunication Port
RF Current Probe	FCC	F-33-4	53	2014-05-16	
EMI Receiver	R&S	ESCI	100615	2014-06-18	Conducted Disturbance Radiated Disturbance (Below 1GHz)
Bilog Antenna	Teseq GmbH	CBL6111D	25769	2014-02-06	Radiated Disturbance (Below 1GHz)
Pre-Amplifier	WIRELESS	FPA-6592G	60009	2013-07-08	
Spectrum Analyzer	R & S	FSL6	100564	2014-06-15	
RF Cable	MIYAZAKI	8D-F8	N/A	2014-02-08	
Double-Ridged Waveguide Horn	EMCO	3115	9912-5992	2014-05-14	Radiated Disturbance (Above 1GHz)
Preamplifier	HD	HD17187	004	2014-02-14	
Spectrum Analyzer	ADVANTEST	R3172	101202158	2014-06-23	
Coaxial Cable	HUBER SUHNER	SUCOFLEX 104	197541/4	2013-08-02	
Programmable AC Source	Chroma	6520	2048	2014-01-31	Harmonic, Flicker
Universal Power Analyzer	Chroma	6630	0597	2014-01-31	

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	2013-12-14	Electrostatic Discharge
ESD Simulator	Noiseken	ESS-2002EX	ESS0868406	2013-12-14	
Antenna	EMCO	3142	9710-1221	2014-02-11	Radiated Immunity
Power Amplifier	IFI	CMX50	N/A	2014-02-07	
Signal Generator	R&S	SML03	103396	2014-06-17	
CDN	FRANKONIA	CDN M2+M3	A3011134	2014-06-23	Conducted Immunity
C.I. Test System	FRANKONIA	CIT-10/75	102C3208	2013-12-27	
Power Attenuator	FRANKONIA	75-A-FFN-06	0212	2013-12-27	
RF Cable	N/A	N/A	N/A	2013-11-30	
Antenna	FCC	F-1000-4-8/9/10-L-1M	9953	2014-03-02	Magnetic Field Disturbance
Advanced EMC Immunity Test System	KEYTEK	EMC PRO	0002255	2014-03-02	
Transient 2000	EMC PARTNER	TRA-2000	449	2013-11-09	Electrostatic Discharge, Fast Transient, Surge, Dips & Interruptions

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

1.4 Test Methodology

All Emission Tests were performed according to the procedures specified in EN 61131-2.

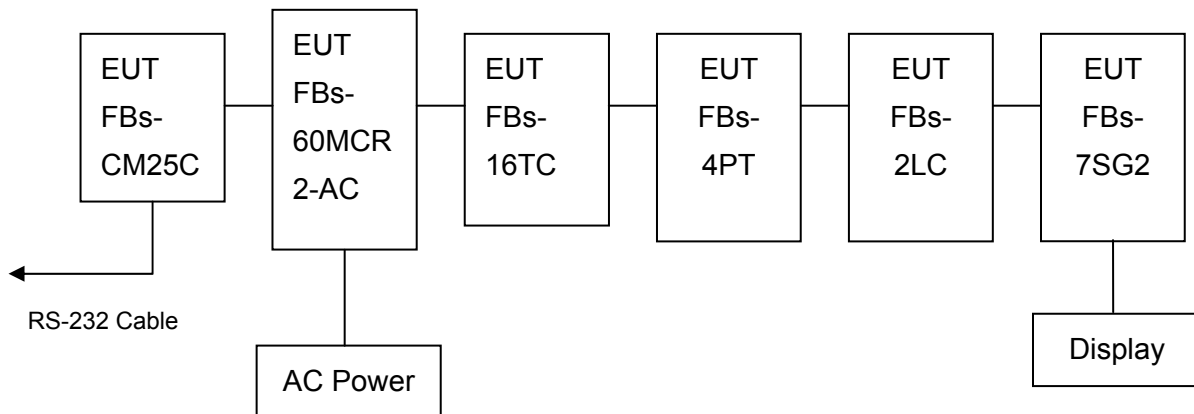
All Immunity Tests were performed according to the procedures specified in EN 61131-2.

1.5 Auxiliary Equipments

Provided by Matrix Test Lab.

No.	Equipment	Model No.	Serial No.	EMC Approved	Brand	Power Cord
01	RS-232 Cable	N/A	N/A	N/A	N/A	Non-shielded, Detachable, 1.8m, w/o core

Block Diagram



1.6 Identifying the Final Test Mode (Worst Case)

1. 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.

1.7 Final Test Mode

Operation Mode

1.8 Condition of Power Supply

AC 230V, 50Hz

1.9 EUT Configuration

1. Setup the EUT as shown in Sec.1.6 Block Diagram
2. Turn on the power of all equipments.
3. Activate the selected Final Test Mode.

1.10 Immunity Performance Classification

Criterion	Test Description	
	During Test	After test
A	The PLC-system shall continue to operate as intended. No loss of function or performance, according to PFVPs (2.5)	The PLC-system shall continue to operate as intended.
B	Degradation of performance accepted. No change of operating mode. No irreversible loss of stored data, according to PFVPs (2.5).	The PLC-system shall continue to operate as intended. Temporary degradation of performance must be self recoverable.
C	Loss of functions accepted, but no destruction of hardware or software (programme or data)	The PLC-system shall continue to operate as intended automatically, after manual restart or power off/ power on.

1.11 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.

1.11.1 Test Methodology

All Emission Tests were performed according to the procedures specified in EN 61131-2. Radiated Emission Test was performed at 10 m distance from antenna to EUT. All Immunity Tests were performed according to the procedures specified in EN 61131-2.

2 Conducted Emission Test

2.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

2.2 Test Arrangement and Procedure

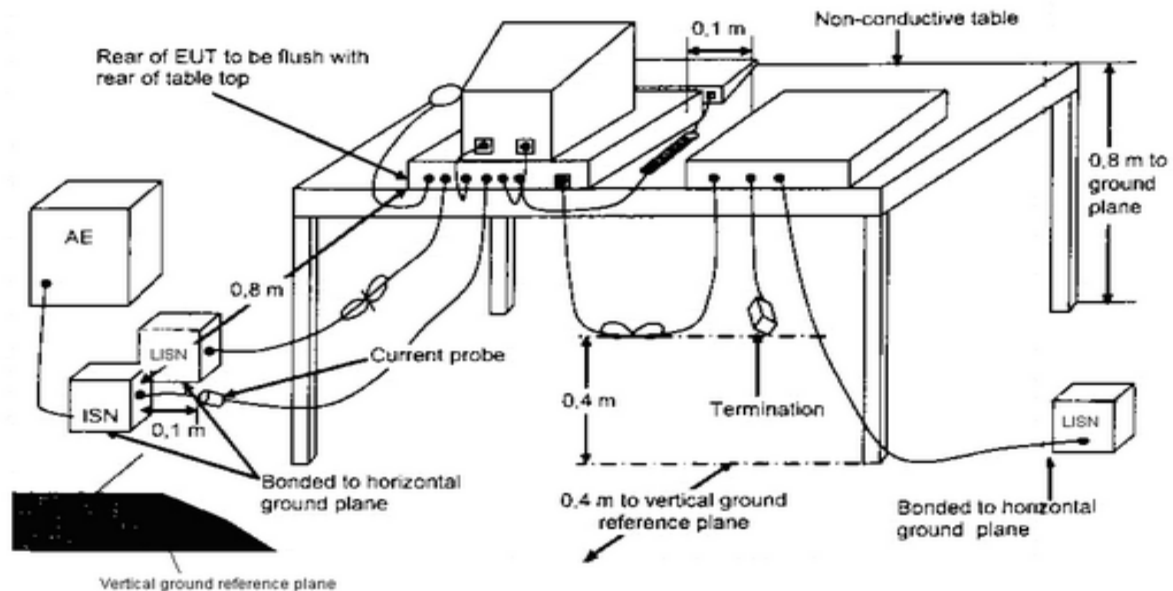


Table-top Equipment

- 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

IEC 61000-6-4

Frequency (MHz)	Quasi-Peak dB(μ V)	Average dB(μ V)
0.15 ~ 0.50	79	66
0.5 – 30	73	60

2.4 Test Result

PASS

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

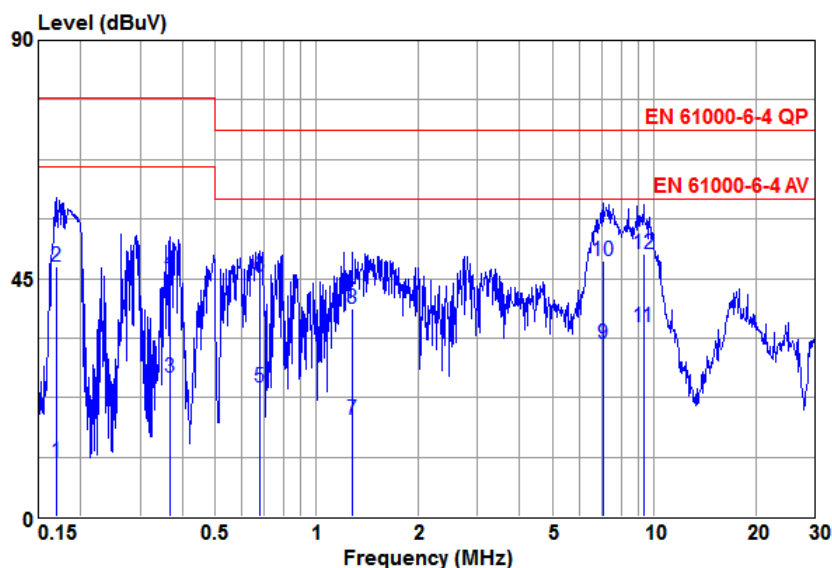
Conducted Emission Test Data

Test Date : 2014-07-28

Power Line : Line

Temperature : 25°C

Humidity : 46%



	Freq	Reading	C.F	Result	Limit	Margin	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.169	10.17	0.15	10.32	66.00	-55.68	Average
2	0.169	47.21	0.15	47.36	79.00	-31.64	QP
3	0.369	26.34	0.09	26.43	66.00	-39.57	Average
4	0.369	46.02	0.09	46.11	79.00	-32.89	QP
5	0.683	24.42	0.11	24.53	60.00	-35.47	Average
6	0.683	45.22	0.11	45.33	73.00	-27.67	QP
7	1.276	18.09	0.12	18.21	60.00	-41.79	Average
8	1.276	39.15	0.12	39.27	73.00	-33.73	QP
9	7.062	32.50	0.29	32.79	60.00	-27.21	Average
10	7.062	47.98	0.29	48.27	73.00	-24.73	QP
11	* 9.302	35.41	0.35	35.76	60.00	-24.24	Average
12	@ 9.302	49.31	0.35	49.66	73.00	-23.34	QP

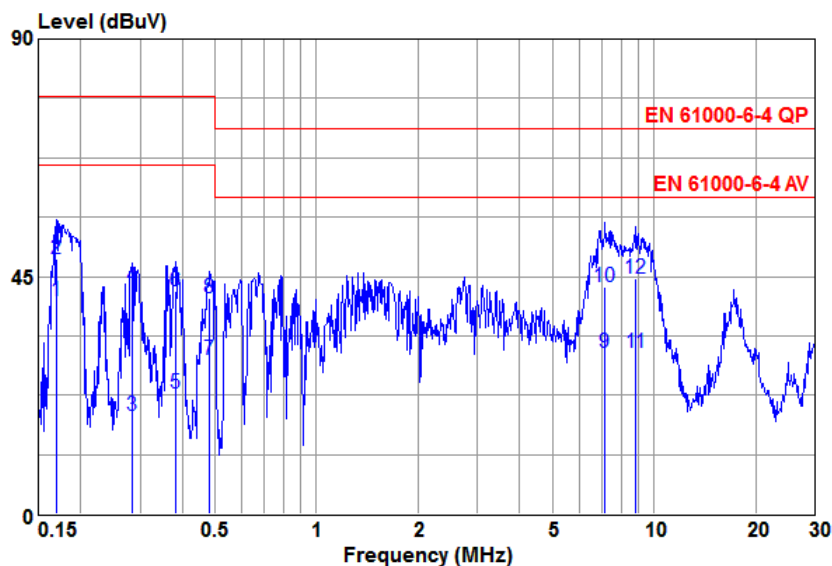
Result = Reading + C.F ; C.F = LISN Factor + Cable Loss

@ :Maximum QP * :Maximum AVG x :Over Limit

Remark : All readings are Quasi-Peak and Average values.

Conducted Emission Test Data

Test Date	: 2014-07-28	Power Line	: Neutral
Temperature	: 25°C	Humidity	: 46%



		Freq	Reading	C.F	Result	Limit	Margin	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	
1	*	0.170	40.37	0.13	40.50	66.00	-25.50	Average
2		0.170	48.27	0.13	48.40	79.00	-30.60	QP
3		0.285	18.46	0.08	18.54	66.00	-47.46	Average
4		0.285	42.98	0.08	43.06	79.00	-35.94	QP
5		0.381	22.77	0.08	22.85	66.00	-43.15	Average
6		0.381	42.17	0.08	42.25	79.00	-36.75	QP
7		0.484	29.14	0.08	29.22	66.00	-36.78	Average
8		0.484	40.87	0.08	40.95	79.00	-38.05	QP
9		7.175	30.34	0.29	30.63	60.00	-29.37	Average
10		7.175	42.83	0.29	43.12	73.00	-29.88	QP
11		8.822	30.22	0.34	30.56	60.00	-29.44	Average
12	@	8.822	44.22	0.34	44.56	73.00	-28.44	QP

Result = Reading + C.F ; C.F = LISN Factor + Cable Loss

@ :Maximum QP * :Maximum AVG x :Over Limit

Remark : All readings are Quasi-Peak and Average values.

3 Radiated Emission Test

3.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

3.2 Test Arrangement and Procedure

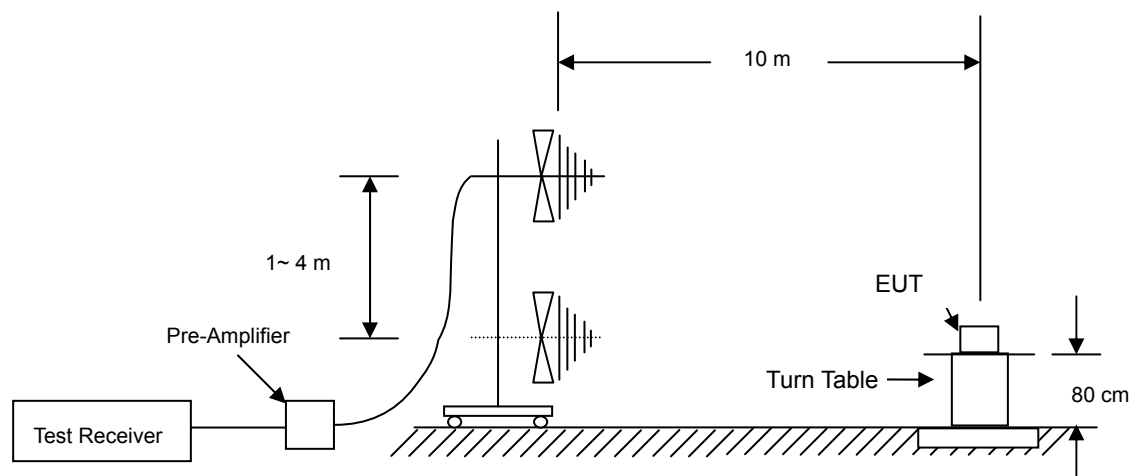


Table-top Equipment

- 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 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

IEC 61000-6-4

Frequency (MHz)	Quasi-Peak (dBuV/m) at 10m
30 ~ 230	40.0
230 ~ 1000	47.0

Note: If the internal emission source(s) is operating at a frequency below 9kHz then measurements need only to be performed up to 230 MHz.

3.4 Test Result

PASS

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

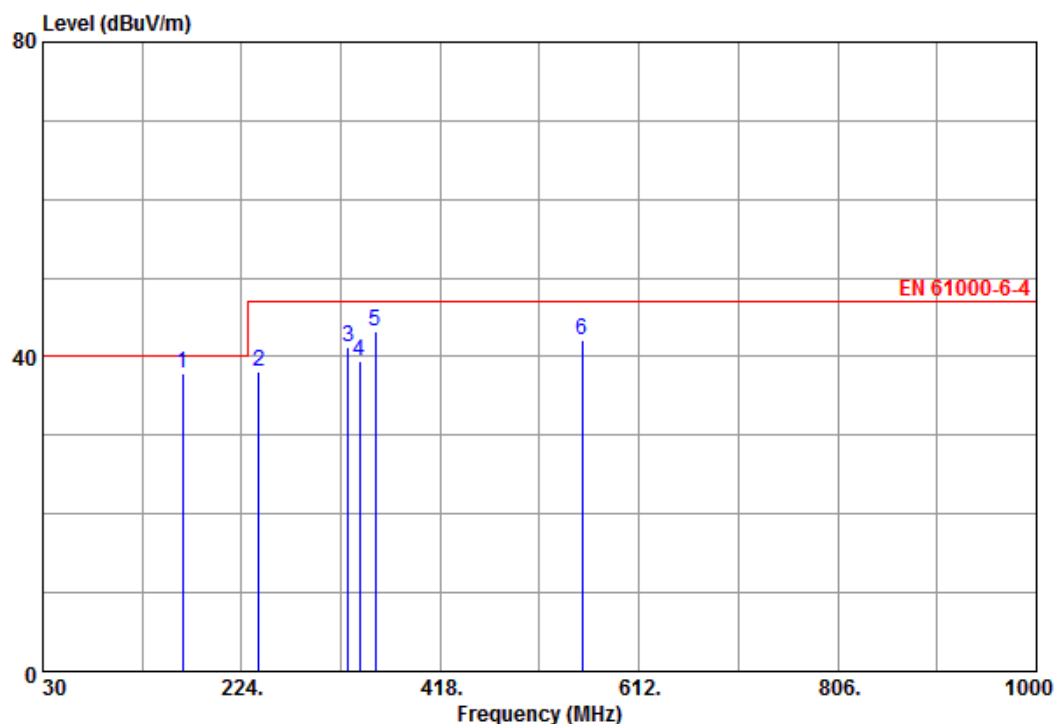
Radiated Emission Test Data

Test Date : 2014-07-28

Polarization : Horizontal

Temperature : 25°C

Humidity : 46%



Freq	Reading	C.F	Result	Limit	Margin	A/pos	T/pos	Remark
MHz	dBuV	dB	dBuV/m	dBuV/m	dB			
1 @ 166.770	60.38	-22.39	37.99	40.00	-2.01	221	112	
2 240.490	56.98	-18.93	38.05	47.00	-8.95	235	54	
3 327.790	57.03	-15.78	41.25	47.00	-5.75	289	330	
4 339.430	54.45	-14.97	39.48	47.00	-7.52	302	134	
5 354.950	57.92	-14.77	43.15	47.00	-3.85	320	321	
6 556.710	52.57	-10.42	42.15	47.00	-4.85	354	168	

C.F = Antenna Factor + Cable Loss - Preamp gain
 Result = Reading + C.F ; Margin = Result - Limit

@ : Maximum Data x : Over Limit

Remark : All readings are Quasi-Peak values.

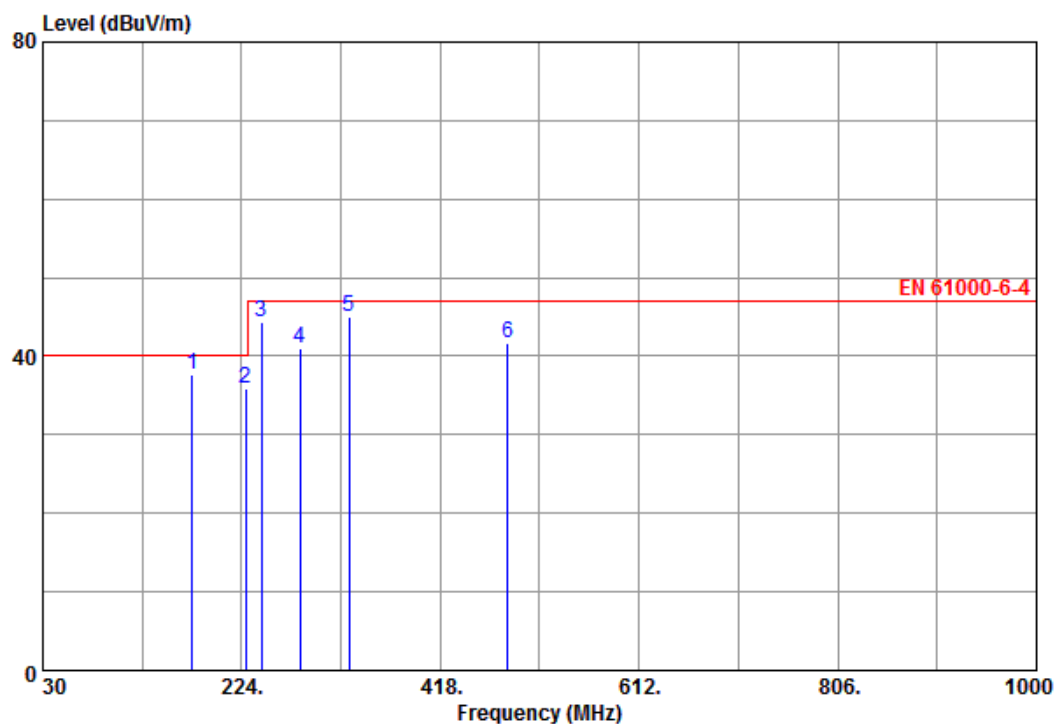
Radiated Emission Test Data

Test Date : 2014-07-28

Polarization : Vertical

Temperature : 25°C

Humidity : 46%



	Freq	Reading	C.F	Result	Limit	Margin	A/pos	T/pos	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB			
1	175.500	57.37	-19.65	37.72	40.00	-2.28	122	220	
2	227.880	54.22	-18.36	35.86	40.00	-4.14	135	52	
3	243.400	63.40	-19.02	44.38	47.00	-2.62	163	238	
4	281.230	59.19	-18.25	40.94	47.00	-6.06	188	97	
5 @	328.760	60.63	-15.72	44.91	47.00	-2.09	134	257	
6	483.960	53.96	-12.21	41.75	47.00	-5.25	177	301	

C.F = Antenna Factor + Cable Loss - Preamp gain
 Result = Reading + C.F ; Margin = Result - Limit

@ : Maximum Data x : Over Limit

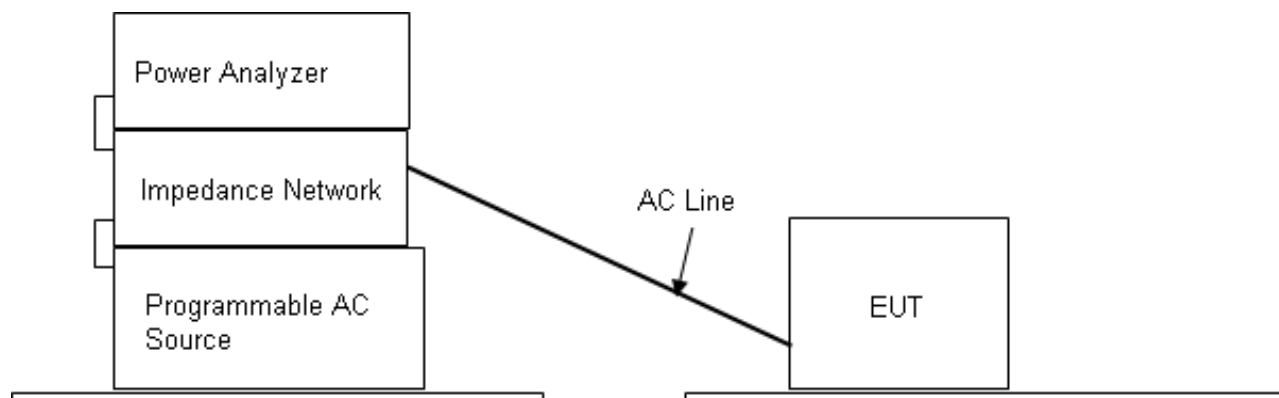
Remark : All readings are Quasi-Peak values.

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
25°C	46%RH	1002mbar

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).

Chroma

ANALYZER 6630

2014.07.25 18:03:26

Current Harmonics

Setup: CLASSA
Live
Module: M1

Gen setting: 1(1) U : 230.13 V fu: 50.001 Hz
Analysed periods: 4 I : 42.84 mA P: 4.25 W
Limit: Class A (IEC1000) I1: 22.83 mA

Note:

THD=158.69 % (PF=0.431) PASSED

No	A	Lim A	No	A	Lim A	No	A	Lim A
1	0.023		15	0.007	0.150	29	0.002	0.078
2	0.000	1.000	16	0.000	0.115	30	0.000	0.061
3	0.018	2.300	17	0.005	0.132	31	0.002	0.073
4	0.000	0.430	18	0.000	0.102	32	0.000	0.058
5	0.017	1.140	19	0.003	0.118	33	0.001	0.068
6	0.000	0.300	20	0.000	0.092	34	0.000	0.054
7	0.015	0.770	21	0.001	0.107	35	0.001	0.064
8	0.000	0.230	22	0.000	0.084	36	0.000	0.051
9	0.013	0.400	23	0.000	0.098	37	0.001	0.061
10	0.000	0.184	24	0.000	0.077	38	0.000	0.048
11	0.011	0.330	25	0.001	0.090	39	0.000	0.058
12	0.000	0.153	26	0.000	0.071	40	0.000	0.046
13	0.009	0.210	27	0.001	0.083			
14	0.000	0.131	28	0.000	0.066			

Current range: 0.3 Ap

Next
measureChange to
bar graphRelative
currentWrite to
disk

Appl: CLASSA&B

(1212_00)

Chroma

ANALYZER 6630

2014.07.25 18:03:38

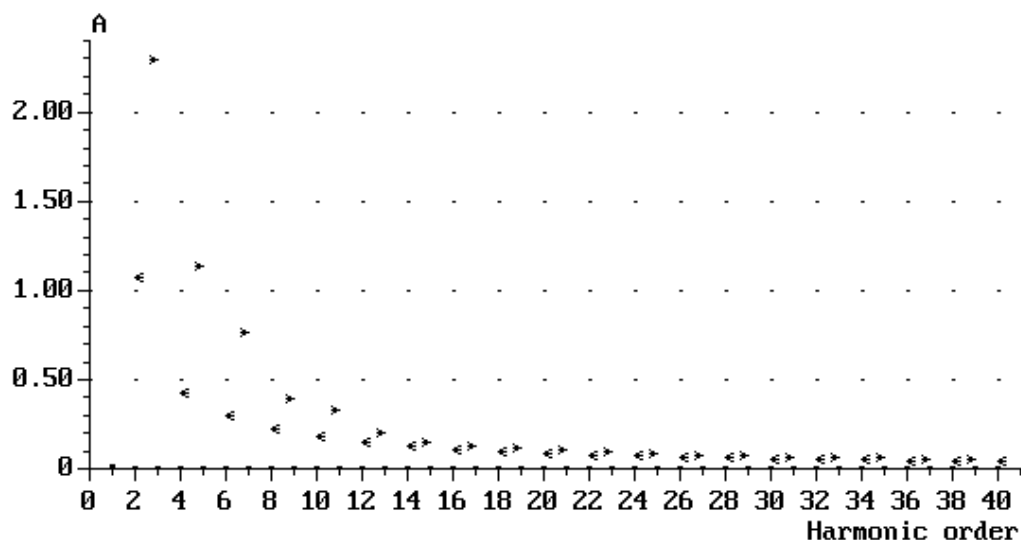
Current Harmonics

Setup: CLASSA
Live
Module: M1

Gen setting: 1(1) U : 230.13 V fu: 50.001 Hz
Analysed periods: 4 I : 42.84 mA P: 4.25 W
Limit: Class A (IEC1000) I1: 22.83 mA

Note:

THD=158.69 % (PF=0.431) PASSED

Next
measureChange to
tableRelative
currentLog
scaleWrite to
disk

Appl: CLASSA&B

(1212_01)

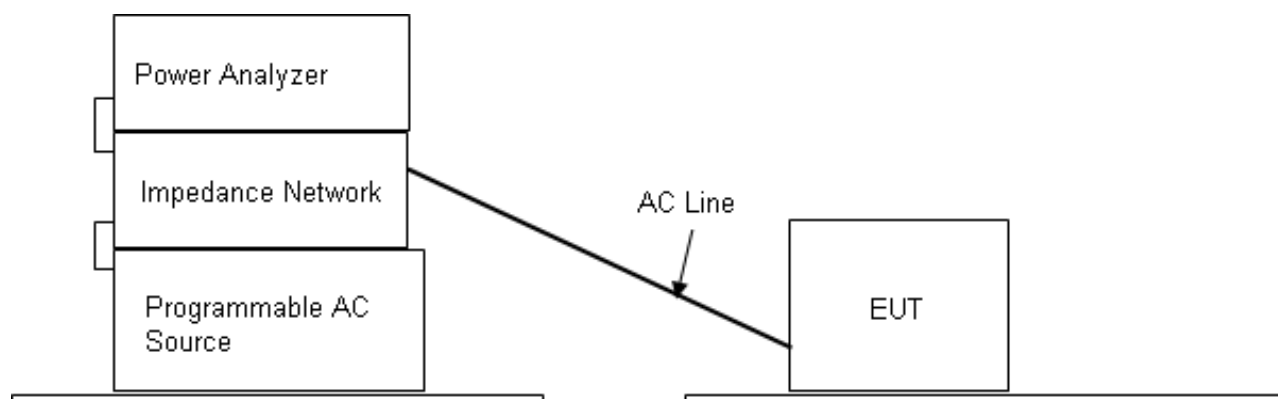
Note: The EUT power level is below 75watts therefore has no defined limits.

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
25°C	46%RH	1002mbar

5.4 Test Limit

Test Item	Limit	Remark
P _{st}	1.0	P _{st} means short-term flicker indicator. T _p =10 min
P _{lt}	0.65	P _{lt} means long-term flicker indicator. T _p =2 hrs
dt (%)	3.3	For more than 500ms
d _{max} (%)	4	d _{max} means relative maximum voltage change.
d _c (%)	3.3	d _c means relative steady-state voltage change.

5.5 Test Result

PASS

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

Chroma

ANALYZER 6630

2014.07.25 18:15:05

Extreme Flicker-I M1

Note:

Numerical Reference Impedance

U: 230.2 V I: 43.30 mA f: 50.000 Hz PF: 0.428

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 :	0.00	1.00
Long term flicker severity	Plt :	---	0.65

Based on 1 (1) short term cycles

Next
measureExtreme
time graphChange to
histogramWrite to
diskSelect
module

PASSED

Measurement completed

Appl: CLASSA&B

(1311_00)

Chroma

ANALYZER 6630

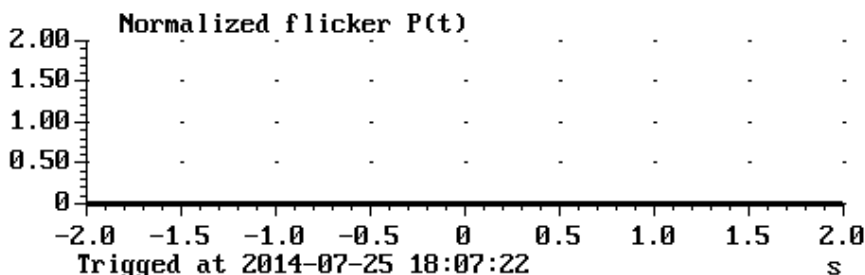
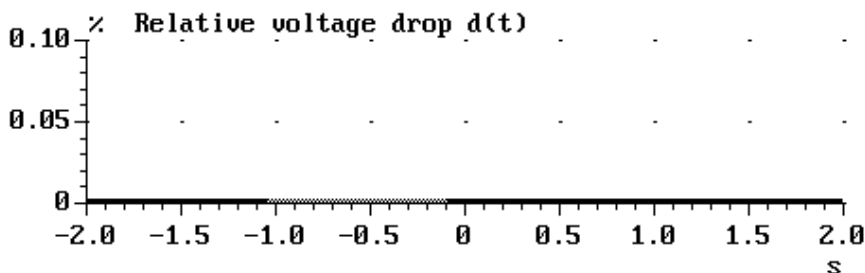
2014.07.25 18:15:21

Extreme Flicker-I M1

Note:

Numerical Reference Impedance

U: 230.2 V I: 43.30 mA f: 50.000 Hz PF: 0.428

Next
measureChange to
tableRefresh
time graphWrite to
diskSelect
module

Appl: CLASSA&B

(13113_00)

6 Electrostatic Discharge Immunity Test

6.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

6.2 Test Configuration and Procedure

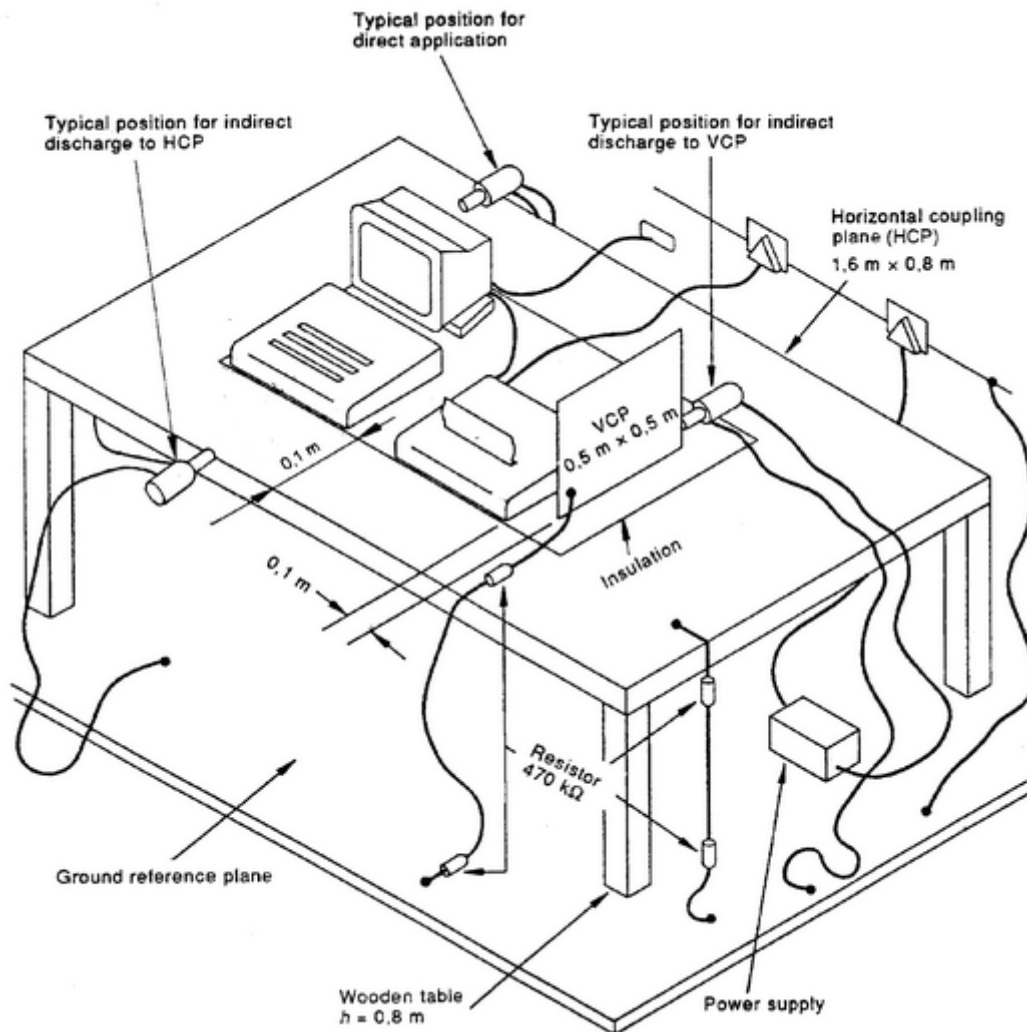


Table-top Equipment

- 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 minimum 20 discharges each at negative and positive polarity on the selected test points (the selected test points were marked with red labels on the EUT)
- In Air Discharge, the EUT exposed to minimum of 20 discharges each at negative and positive polarity on the selected test points as well.
- The result was observed and analyzed.

6.3 Test Result

6.3.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
25°C	46%RH	1002mbar

6.3.2 Observation of Direct Discharge

Test Points: 1. Surface of Case 2. Junction of Case. 3. FBs-CM25C' RS-232 Port.
4. Indicators.

Type of Discharge	Test Specifications				Performance Required by IEC 61000-6-2	Observed Result	Verdict
	Test Level	Polarity	Test Point	Number of Discharge			
Air Discharge	2,4,8 (kV)	±	1~4	20/ per point	B	A	Pass
Contact Discharge	2,4 (kV)	±	3	20/ per point	B	A	Pass
Remarks	1. No temporary degradation or loss of function has been observed throughout the entire time interval of air discharge. 2. No temporary degradation or loss of function has been observed throughout the entire time interval of contact discharge.						

6.3.3 Observation of Indirect Discharge

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

Type of Discharge	Test Specifications				Performance Required by IEC 61000-6-2	Observed Result	Verdict
	Test Level	Polarity	Test Point	Number of Discharge			
HCP Application	2,4 (kV)	±	1~4	20/ per point	B	A	Pass
VCP Application	2,4 (kV)	±	1~4	20/ per point	B	A	Pass
Remarks	1. No temporary degradation or loss of function has been observed throughout the entire time interval of HCP application. 2. No temporary degradation or loss of function has been observed throughout the entire time interval of VCP application.						

PASS

The test result shows that the EUT is in compliance with the test performance criteria specified in IEC 61000-6-2.

7 Radio-frequency, Electromagnetic Field Immunity Test

7.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

7.2 Test Configuration and Procedure

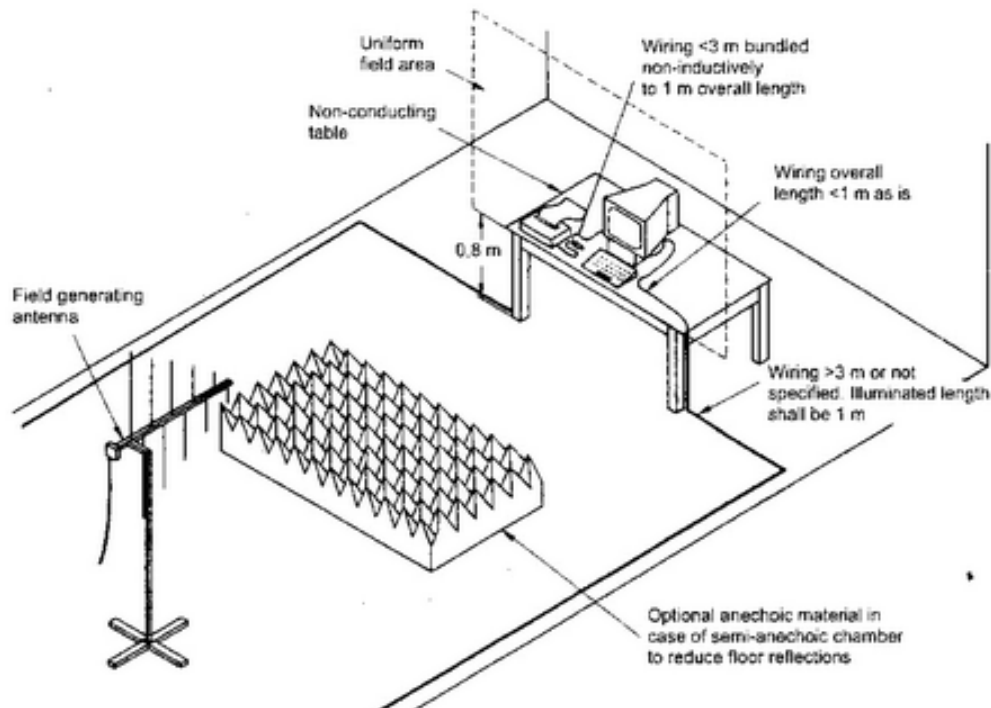


Table-top Equipment

- 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..

7.3 Test Result

7.3.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
25°C	46%RH	1002mbar

7.3.2 Observation of Direct Discharge

Type of Modulation	Test Specification			Performance Required by IEC 61000-6-2	Observed Result	Verdict
	Field Strength	Frequency Range	Modulation			
Amplitude Modulation	10V/m	80 to 1000MHz	80%, 1kHz, sinusoidal	A	A	Pass
Amplitude Modulation	3V/m	1.4 to 2.0 GHz	80%, 1kHz, sinusoidal	A	A	Pass
Amplitude Modulation	1V/m	2.0 to 2.7 GHz	80%, 1kHz, sinusoidal	A	A	Pass
Remark: No temporary degradation or less of function has been observed through out the entire time interval of the test.						

PASS

The test result shows that the EUT compliant with the test requirement specified in IEC 61000-6-2.

8 Electrical Fast Transient Test

8.1 Test Instrument

Refer to Sec. 1.2 Test Instruments.

8.2 Test Configuration and Procedure

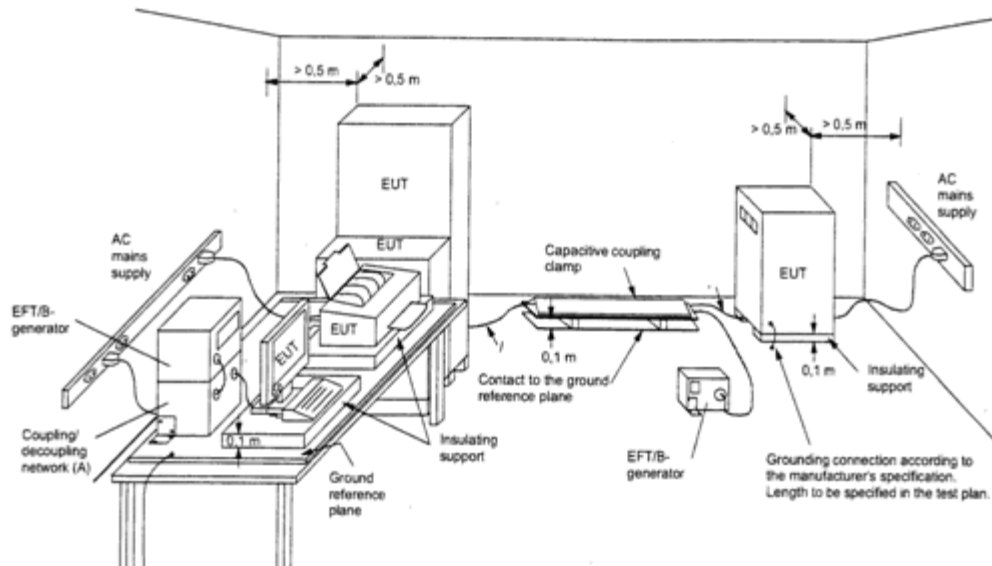


Table-top Equipment

- 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 Test Result

8.3.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
25°C	46%RH	1002mbar

8.3.2 Observation of AC Power Port

Coupling Selection	Test Specifications				Performance Required by IEC 61000-6-2	Observed Result	Verdict
	Voltage (kV)	Test Duration (Sec)	Repetition Rate (kHz)	Tr/ Td (nS)			
L	±1,2	120	5	5/50	B	A	Pass
N	±1,2	120	5	5/50	B	A	Pass
PE	±1,2	120	5	5/50	B	A	Pass
L + N	±1,2	120	5	5/50	B	A	Pass
L + PE	±1,2	120	5	5/50	B	A	Pass
N + PE	±1,2	120	5	5/50	B	A	Pass
L + N +PE	±1,2	120	5	5/50	B	A	Pass
Remark	No temporary degradation or loss of function has been observed throughout the entire test.						
Note	Phase Shifting:0°,90°,180°,270°,360°						

8.3.3 Observation of I/O, communication ports (Applicable only to cable length >3m)

There was no I/O and communication cable longer than 3 meter; therefore, no test has been required.

PASS

The test result shows that the EUT is in compliance with the test performance criteria specified in IEC 61000-6-2.

9 Surge Immunity Test

9.1 Test Instrument

Refer to Sec. 1.2 Test Instruments.

9.2 Test Configuration and Procedure

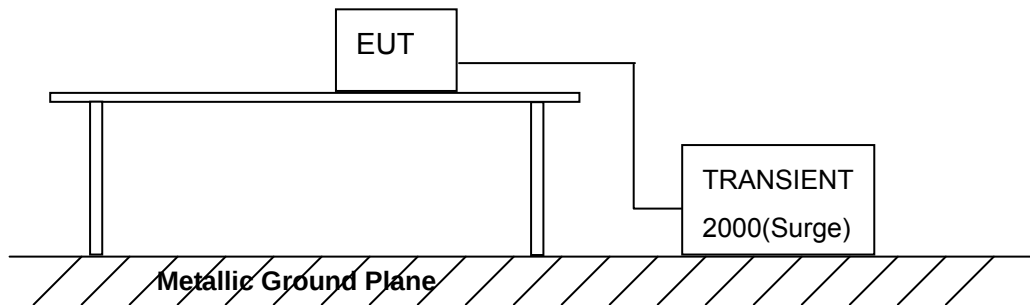


Table-top Equipment

- 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.

9.3 Test Result

9.3.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
25°C	46%RH	1002mbar

9.3.2 Observation of AC Power Port

Coupling Selection	Test Specifications			Performance	Observed Result	Verdict
	Voltage (kV)	Min. of Surge at Each Polarity	Repetition Rate (per min)	Required by IEC 61000-6-2		
L ► N	±1	5	1	B	A	Pass
L ► PE	±2	5	1	B	A	Pass
N ► PE	±2	5	1	B	A	Pass
Remark	No temporary degradation or loss of function has been observed throughout the entire test.					

9.3.3 Observation of other supply/ signal lines: (Applicable only to ports which according to the manufacturer's specification may exceed 30m)

N/A

PASS

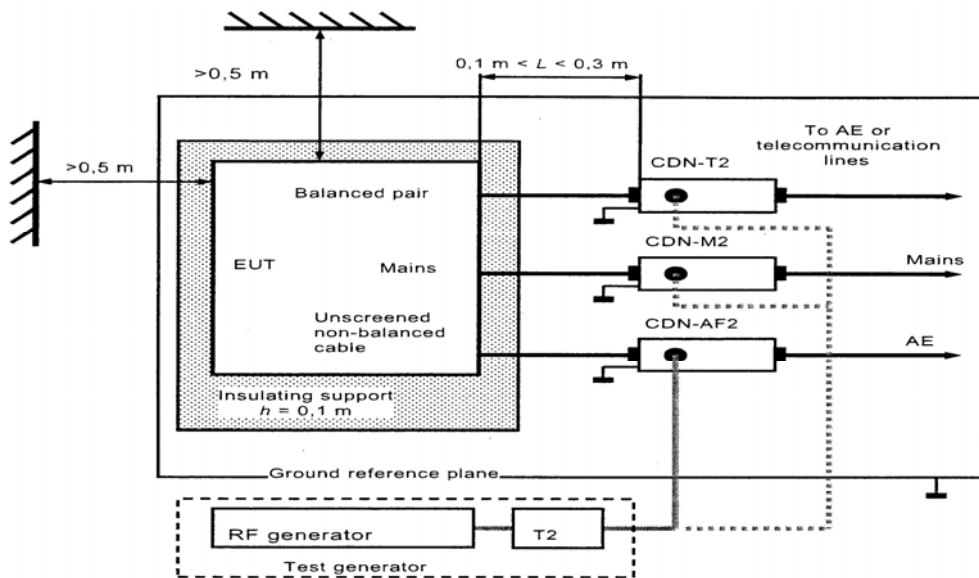
The test result shows that the EUT is in compliance with the test performance criteria specified in IEC 61000-6-2.

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 80 MHz using the signal levels established during the setting process. .
- Operating condition was shown on the monitor and observed.

10.3 Test Result

10.3.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
25°C	46%RH	1002mbar

10.3.2 Observation of AC Power Port

Type of Modulation	Test Specifications			Performance Required by IEC 61000-6-2	Observed Result	Verdict
	Voltage Level (emf) U_0	Frequency Range	Modulation			
Amplitude Modulation	10V/ 140dB μ V	0.15 to 80MHz	80%, 1kHz, sinusoidal	A	A	Pass
Remark	No temporary degradation or loss of function has been observed throughout the entire test.					
Note	1. Phase Shifting:0°,90°,180°,270°,360°					

Type of Modulation	Test Specifications			Performance Required by IEC 61000-6-2	Observed Result	Verdict
	Voltage Level (emf) U_0	Frequency Range	Modulation			
Amplitude Modulation	10V/ 140dB μ V	0.15 to 80MHz	80%, 1kHz, sinusoidal	A	A	Pass
Remark	No temporary degradation or loss of function has been observed throughout the entire test.					
Note	1. Phase Shifting:0°,90°,180°,270°,360°					

10.3.3 Observation of DC Power Port

10.3.4 Observation of I/O communication ports: (Applicable only to cable length >3m).

There was no I/O communication cable longer than 3 m, therefore, no test has been required.

PASS

The test result shows that the EUT is in compliance with the test performance criteria specified in IEC 61000-6-2.

11 Power Frequency Magnetic Field Immunity Test

11.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

11.2 Test Configuration and Procedure

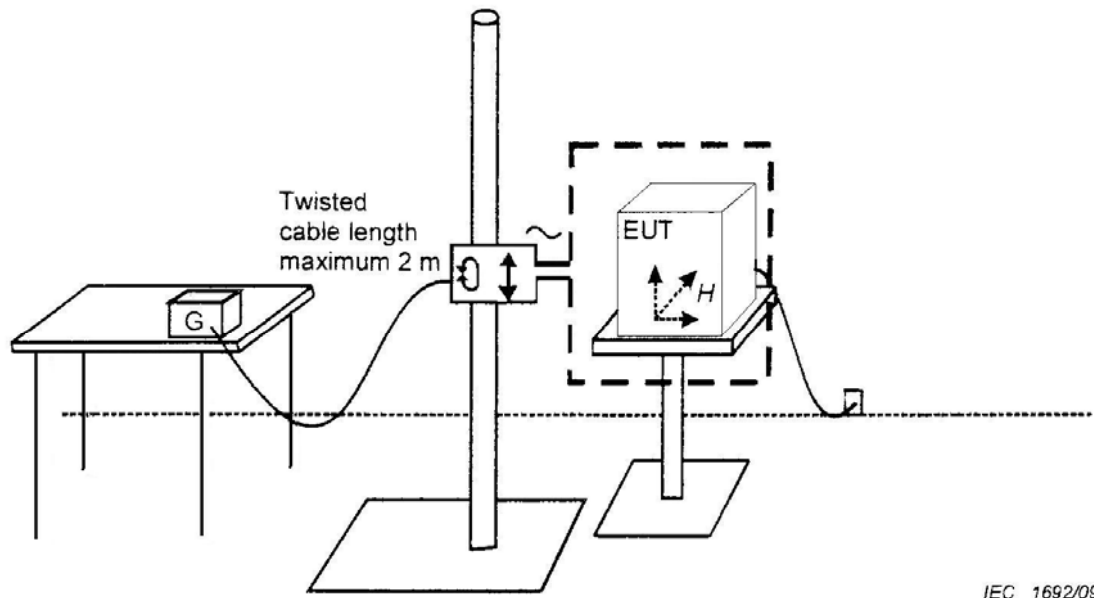


Table-top Equipment

- The EUT was placed on a non-magnetic metal ground plane of 0.25 mm thickness with the interposition of a 0.1 m thickness insulating support. The ground plane was connected to the protected earth.
- The EUT was placed at the center of the 1 * 1 m induction coil with the test generator placed within 3 m distance.
- The test was operated by moving and shifting the induction coil to expose to the test field.
- The operation condition was observed and analyzed.
- The induction coil was then rotated by 90° to expose the EUT to the test field with different orientations and the same procedure.

11.3 Test Result

11.3.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
25°C	46%RH	1002mbar

11.3.2 Observation of Test

Level (A/m)	Frequency (Hz)	Performance Required by IEC 61000-6-2	Observed Result	Verdict
30	50	A	A	Pass
Remark	No temporary degradation or loss of function has been observed throughout the entire test.			

PASS

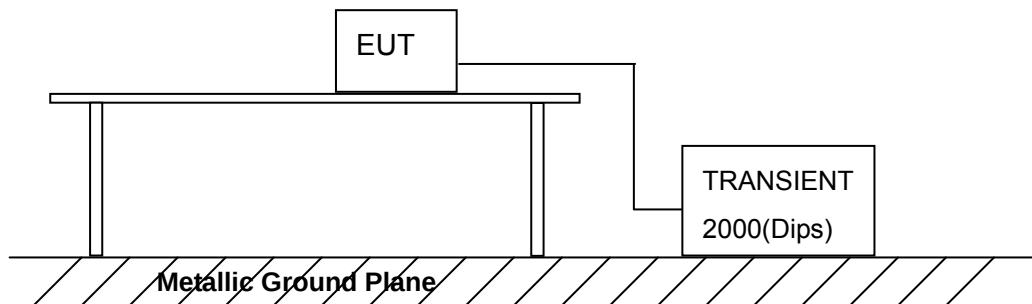
The test result shows that the EUT is in compliance with the test performance criteria specified in IEC 61000-6-2.

12 Voltage Dips, Short Interruptions Immunity Test

12.1 Test Instrument

Refer to Sec. 1.2 Test Instruments.

12.2 Test Configuration and Procedure



- The EUT was tested with (I) >95% voltage dip of supplied voltage with a duration of 10 ms (II) 30% voltage dip of supplied voltage with duration 500 ms (III) A 95% voltage interruption of supplied voltage with duration of 5000 ms,
- For each selected combination of test level and duration with a sequence of three dips / interruptions with intervals of 10 s.
- For Voltage Dips, changes in supply voltage occurred at zero crossings of the voltage.
- For Short Interruptions, changes in supply voltage also occurred at zero crossings of the voltage.
- The performance of the EUT was monitored and recorded.

12.3 Test Result

12.3.1 Environment Condition

Temperature	Humidity	Atmospheric Pressure
25°C	46%RH	1002mbar

12.3.2 Observation of Power Supply Port

Voltage Dips

Voltage Residual (%)	Test Specifications			Performance	Observed Result	Verdict
	Duration Periods	No. of Reductions	Interval between Each Duration (sec.)	Required by IEC 61000-6-2		
0	1	3	≥ 10	B	A	Pass
40	10	3	≥ 10	C	A	Pass
70	25	3	≥ 10	C	A	Pass
Remarks	1. No temporary degradation or loss of function has been observed throughout the entire test. 2. No temporary degradation or loss of function has been observed throughout the entire test. 3. No temporary degradation or loss of function has been observed throughout the entire test.					

Voltage Interruptions

Voltage Residual (%)	Test Specifications			Performance	Observed Result	Verdict
	Duration Periods	No. of Reductions	Interval between Each Duration (sec.)	Required by IEC 61000-6-2		
0	250	3	≥ 10	C	B	Pass
Remark	When testing Voltage Dip with residual voltage 4% of normal power supply, the EUT malfunction. After testing, the EUT recovered its function.					

PASS

The test result shows that the EUT is in compliance with the test performance criteria specified in EN 61000-6-2.

13 Photographs of Test

13.1 Power Line Conducted Test



Front View



Rear View

13.2 Radiated Emission Test

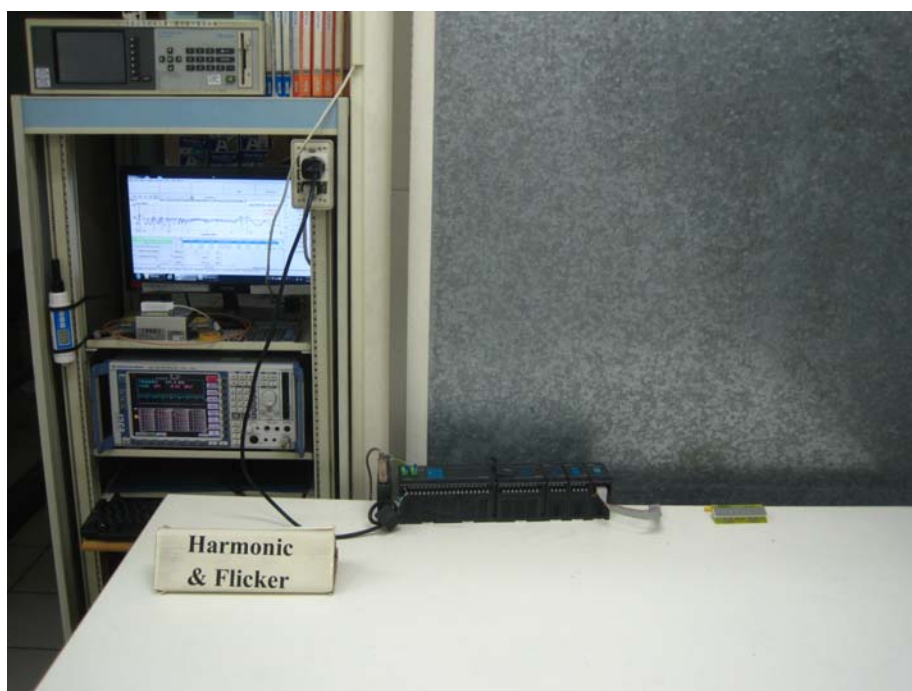


Front View



Rear View

13.3 Harmonic Current & Voltage Fluctuations and Flicker Measurement



13.4 Electrostatic Discharge Immunity Test



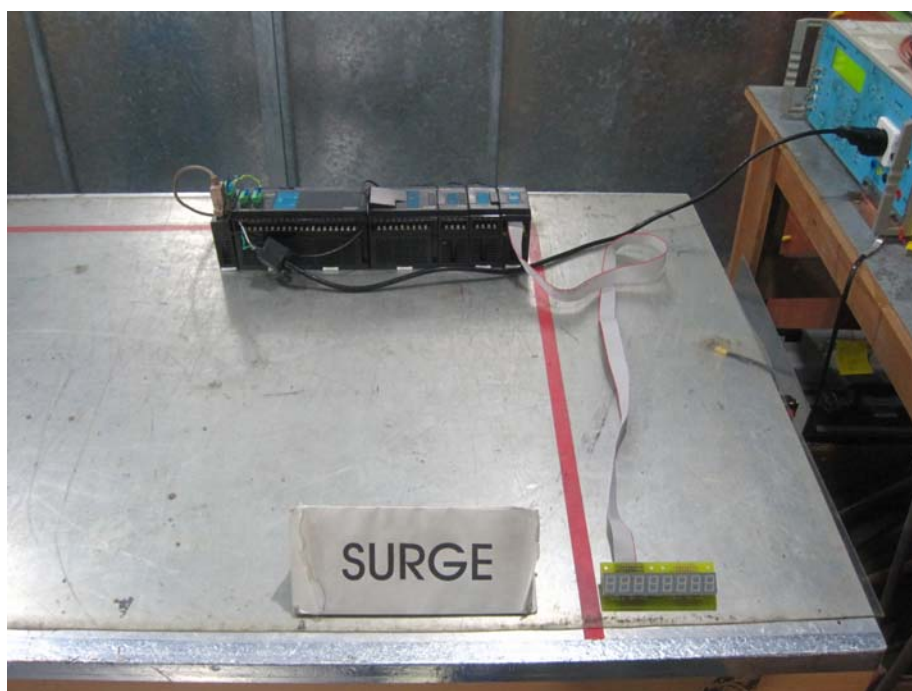
13.5 Radio-frequency, Electromagnetic Field Immunity Test



13.6 Electrical Fast Transient / Burst Immunity Test



13.7 Surge Immunity Test



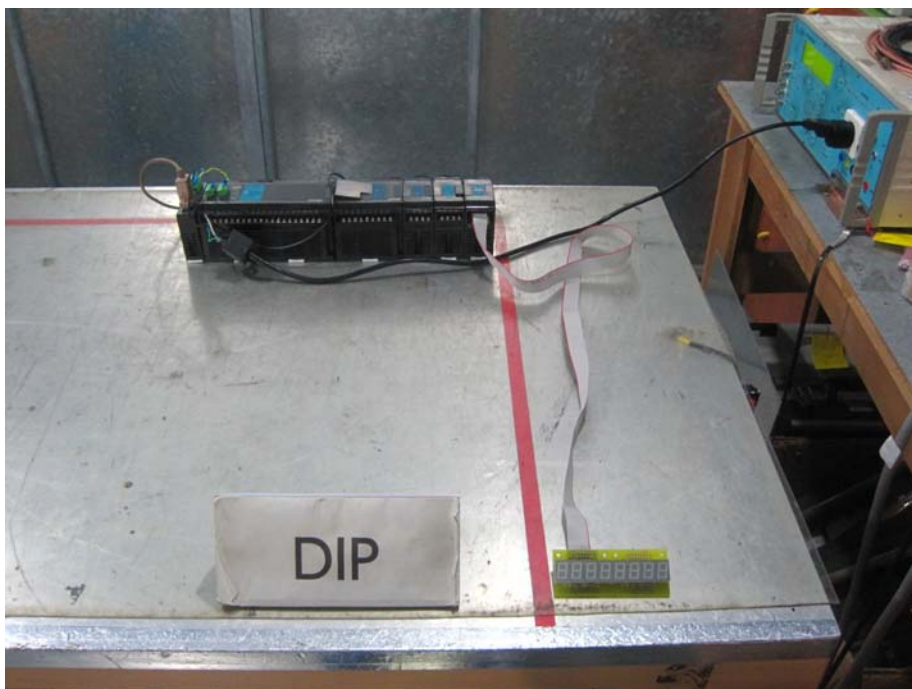
13.8 Radio-frequency, Conducted Disturbances Immunity Test



13.9 Power Frequency Magnetic Field Immunity Test



13.10 Voltage Dips, Short Interruptions Immunity Test



14 Photographs of EUT



Front View of the EUT



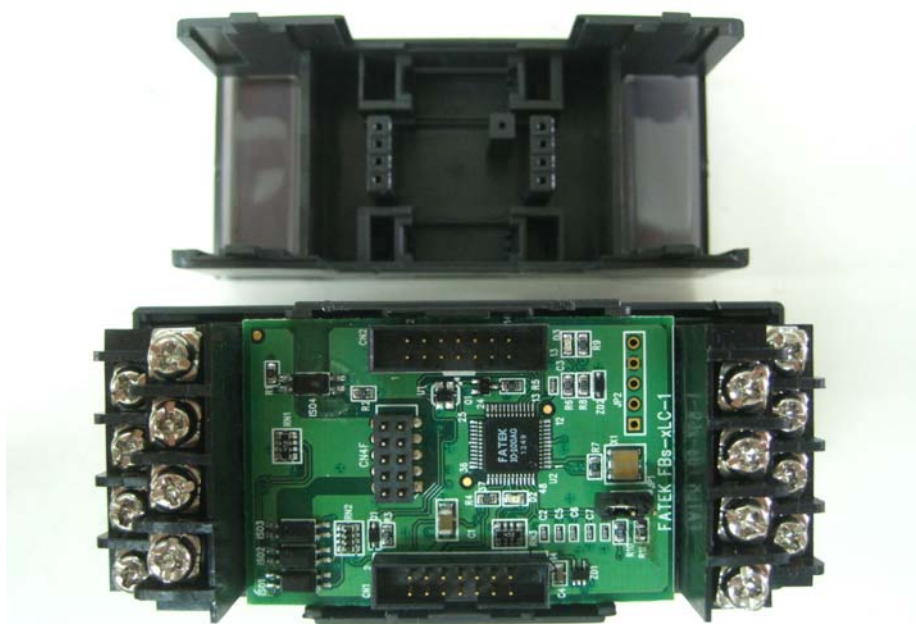
Rear View of the EUT



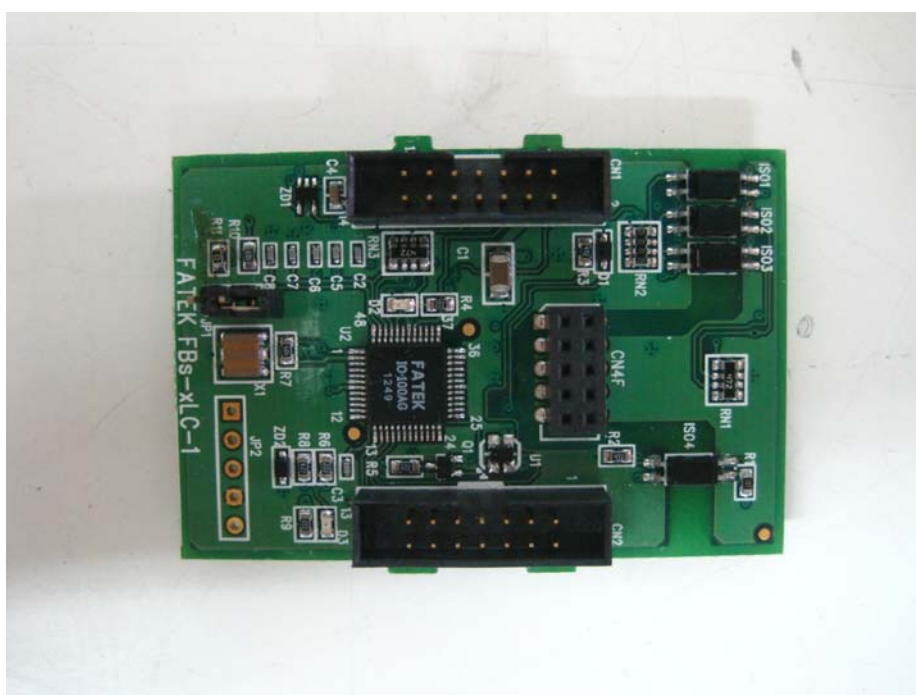
Front View of the EUT (FBs-2LC)



Front View of the EUT (FBs-2LC)



Inside View of the EUT

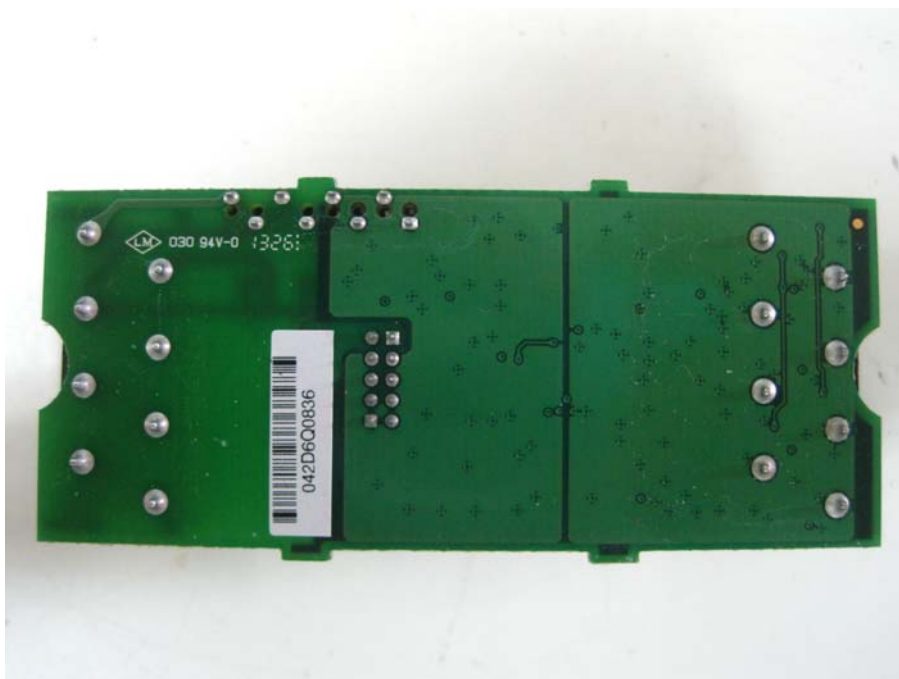




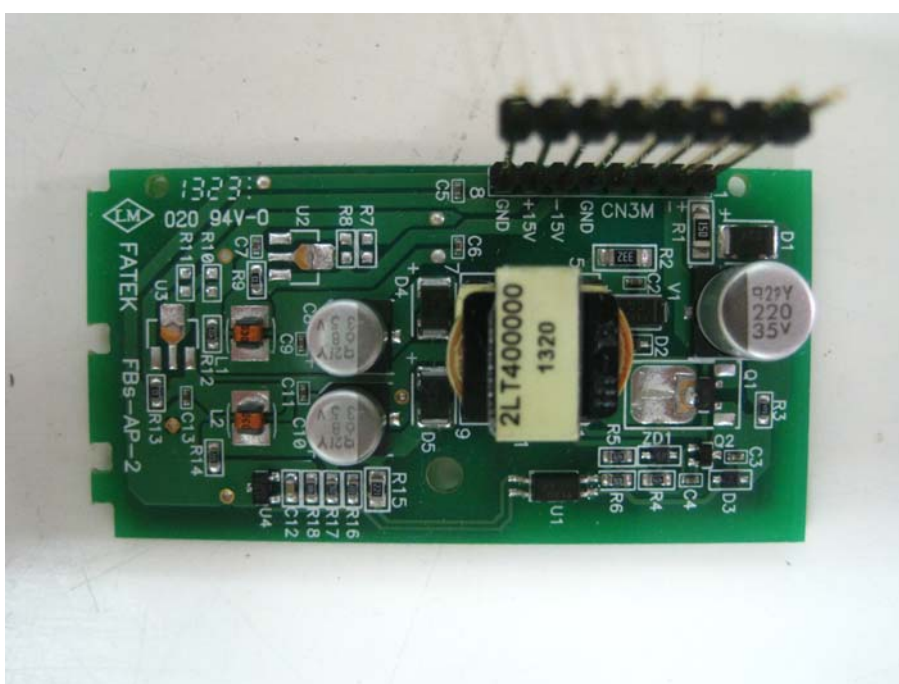
Rear View of the PCB 1



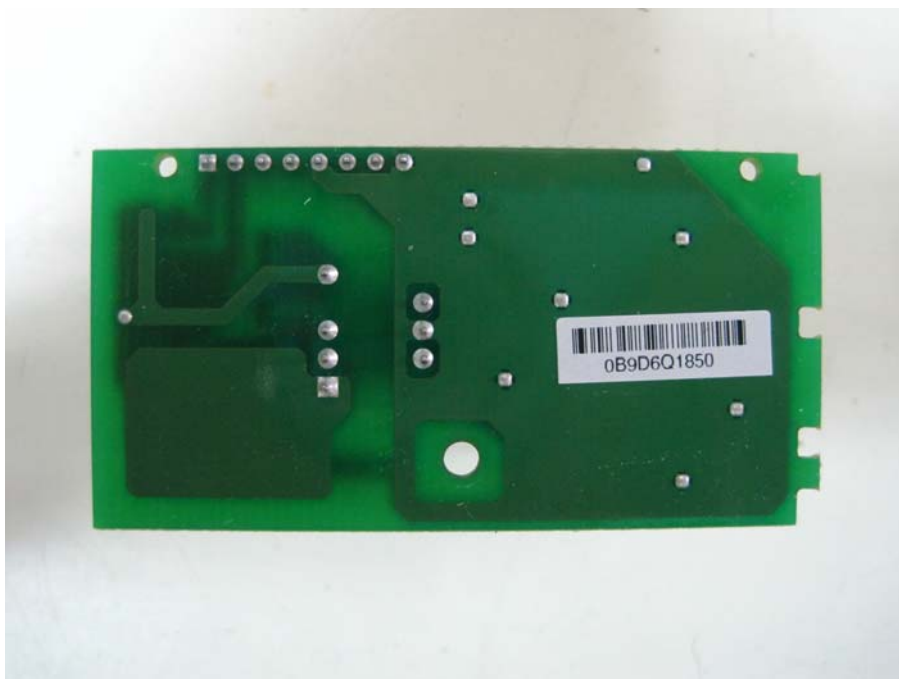
Front View of the PCB 2



Rear View of the PCB 2



Front View of the PCB 3



Rear View of the PCB 3



View of the EUT's Label



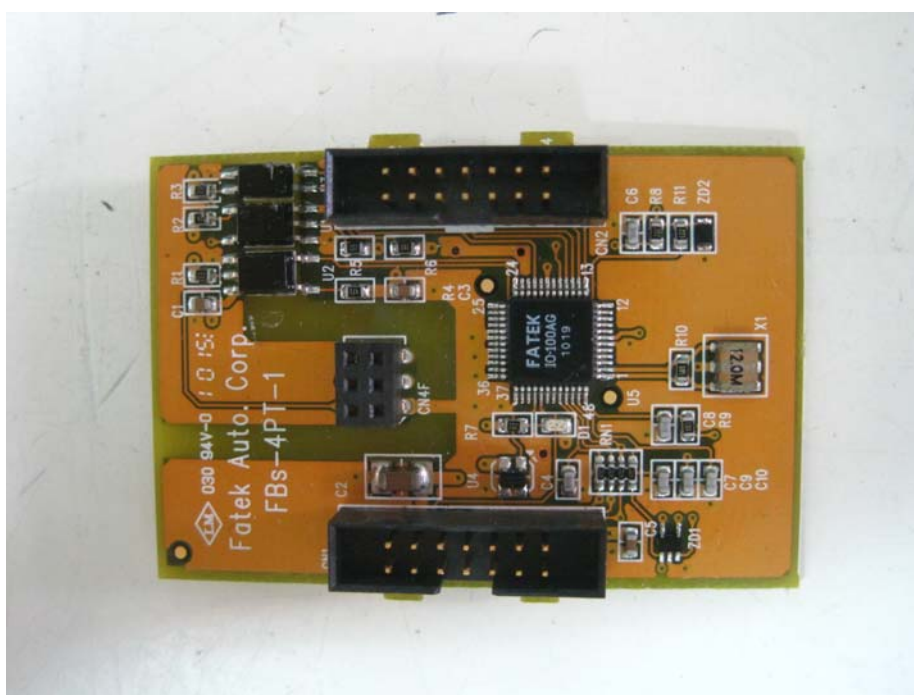
Front View of the EUT (FBs-4PT)



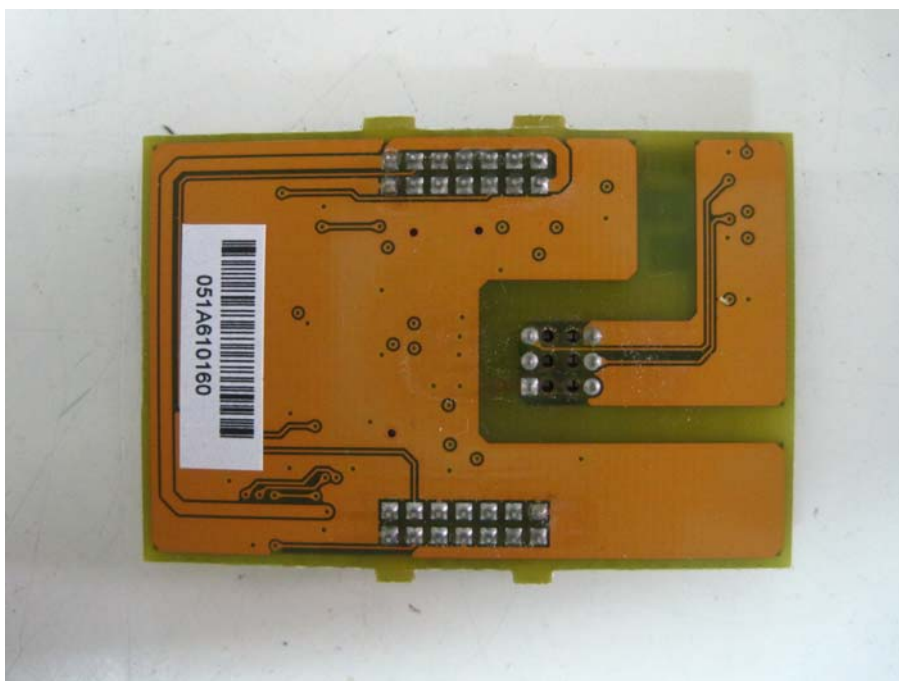
Front View of the EUT (FBs-2LC)



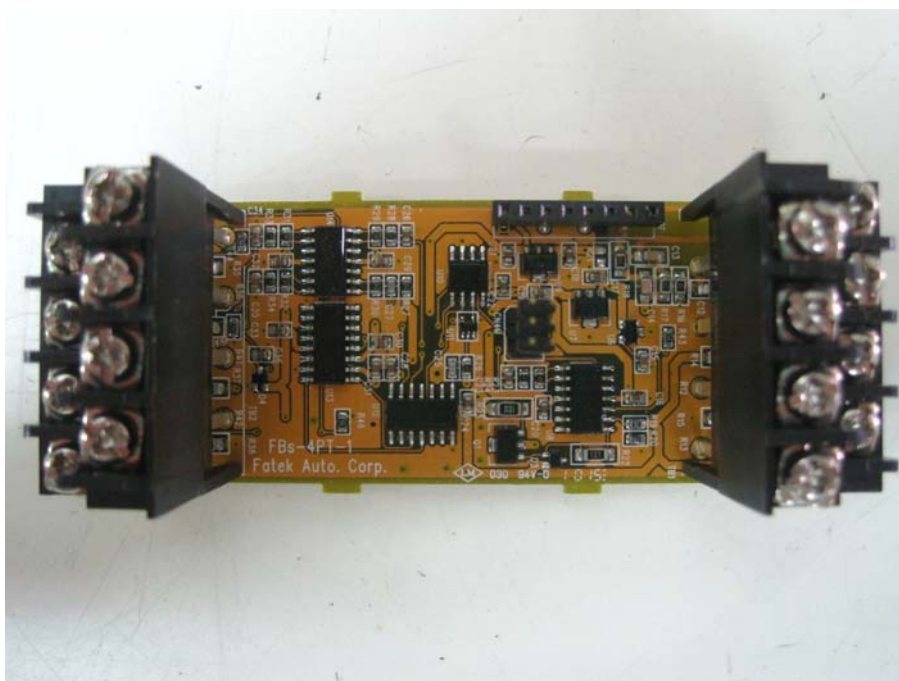
Inside View of the EUT



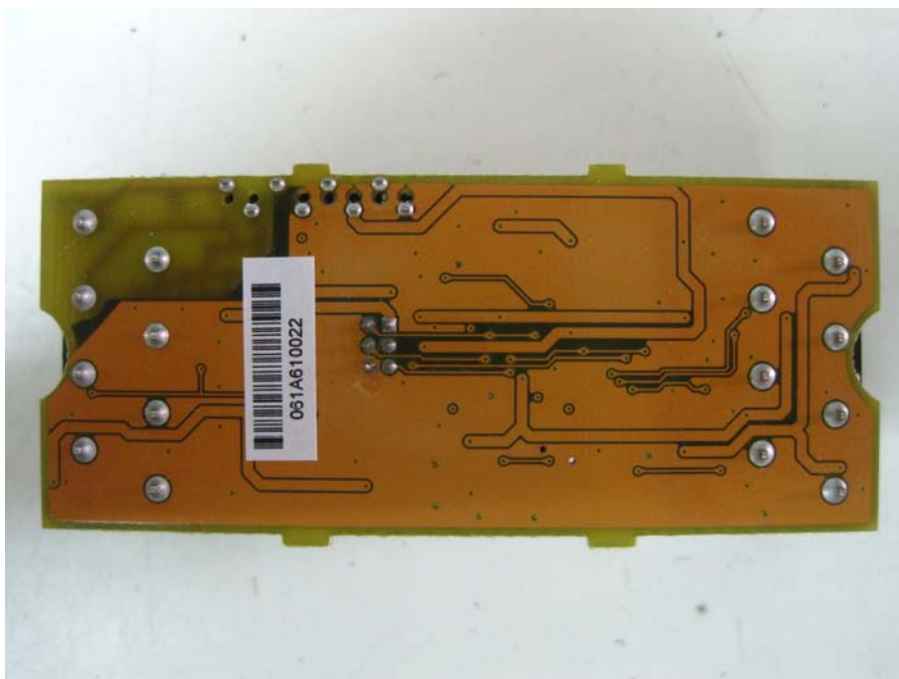
Front View of the PCB 1



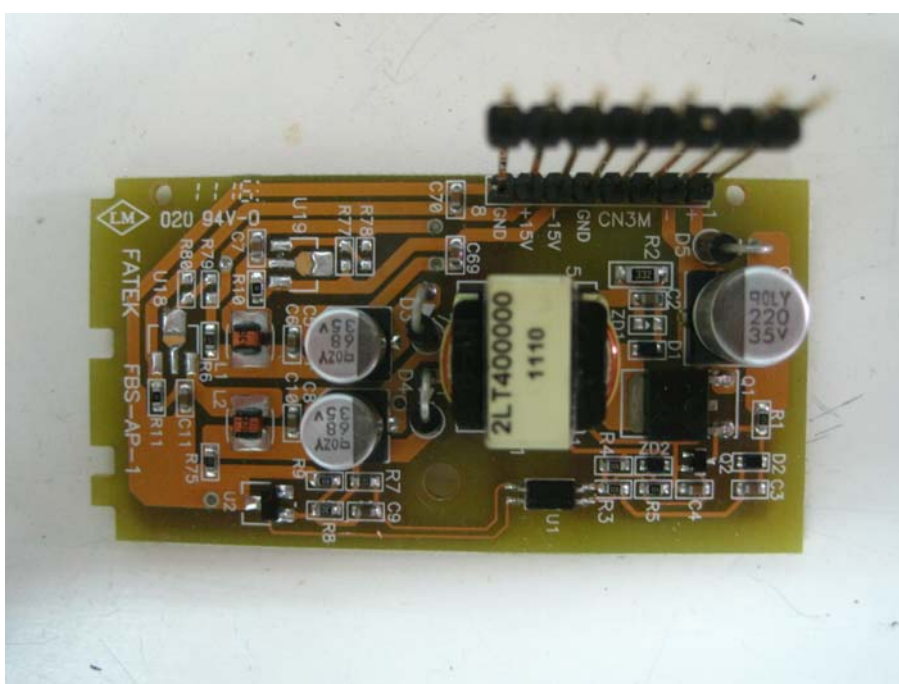
Rear View of the PCB 1



Front View of the PCB 2



Rear View of the PCB 2



Front View of the PCB 3



Rear View of the PCB 3



View of the EUT's Label



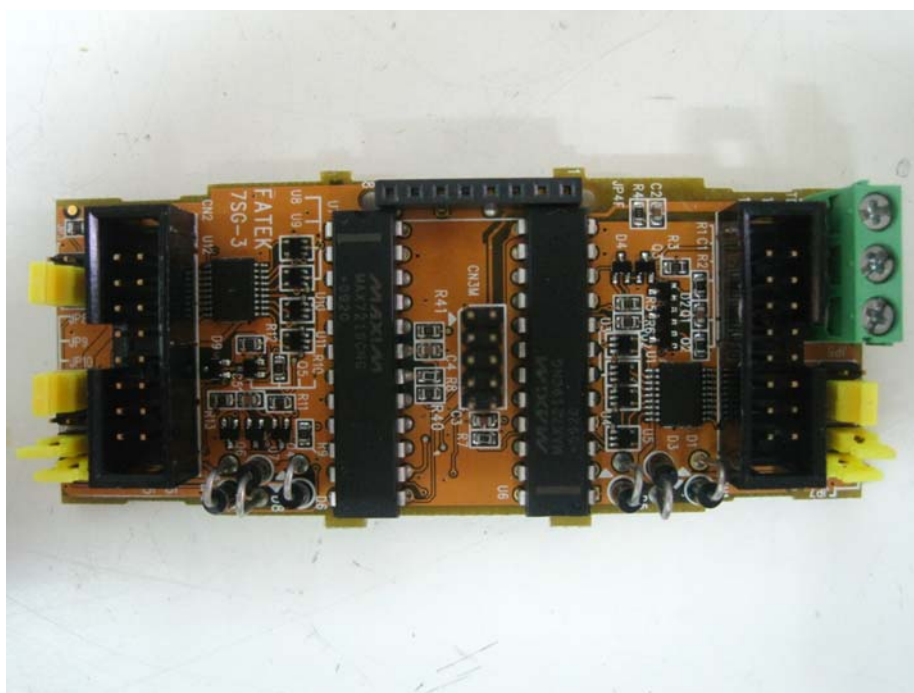
Front View of the EUT (FBs-7SG2)



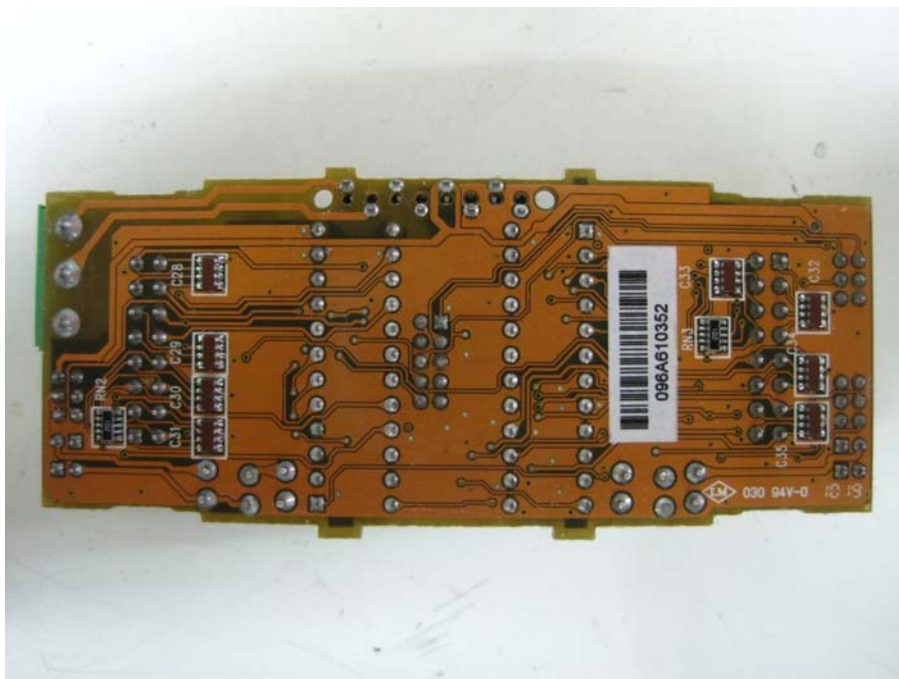
Rear View of the EUT (FBs-7SG2)



Inside View of the EUT



Front View of the PCB 1



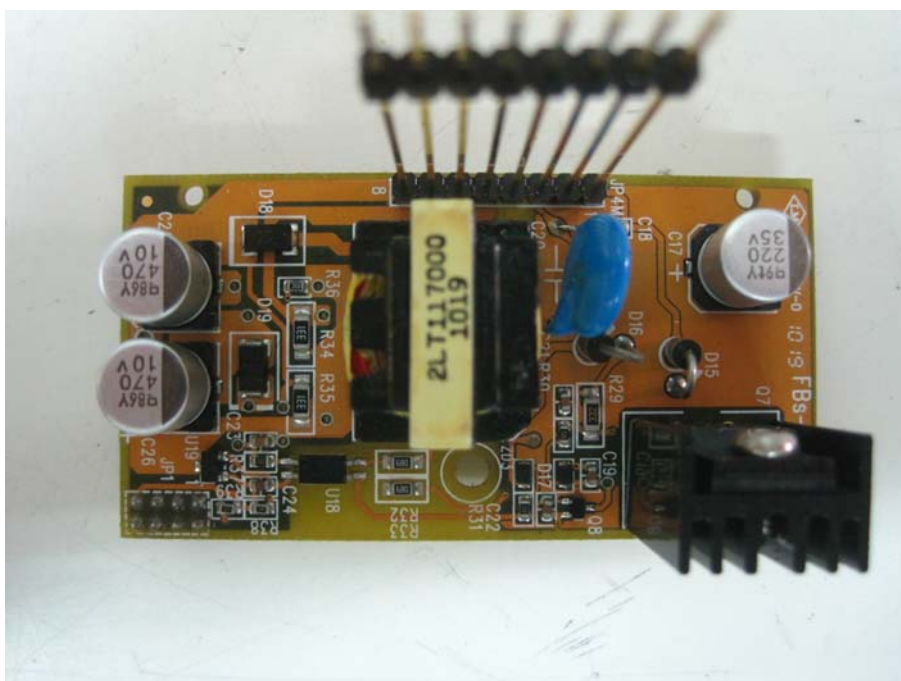
Rear View of the PCB 1



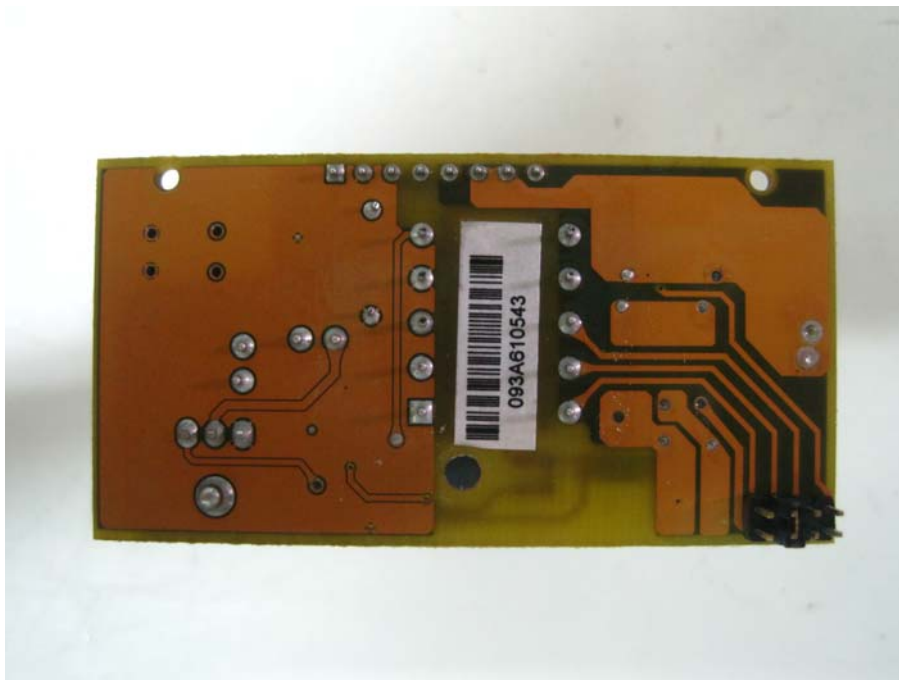
Front View of the PCB 2



Rear View of the PCB 2



Front View of the PCB 3



Rear View of the PCB 3



Front View of the EUT (FBs-16TC)



Rear View of the EUT (FBs-16TC)



Inside View of the EUT



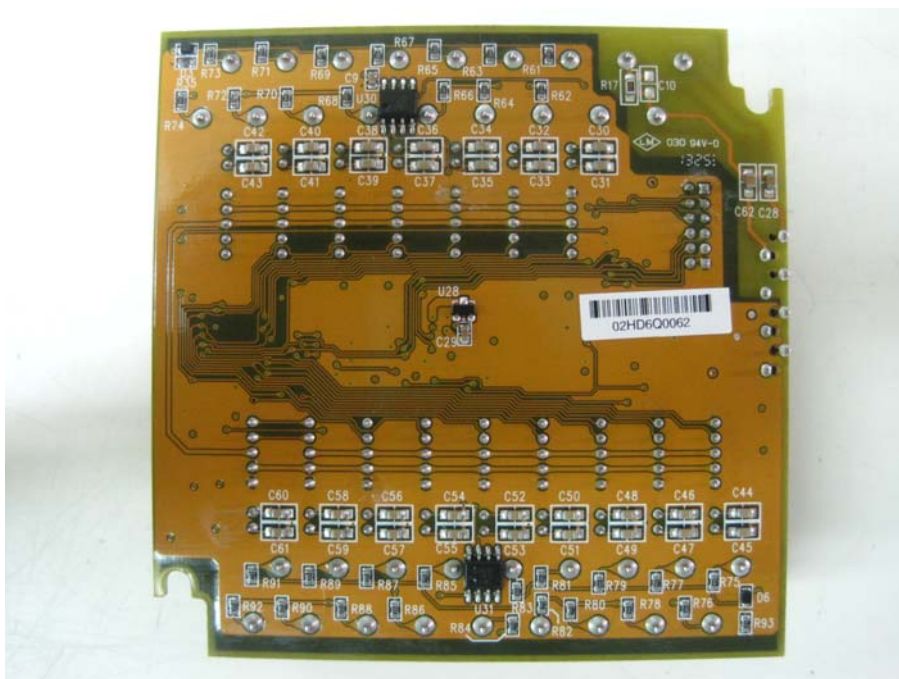
Front View of the PCB 1



Rear View of the PCB 1



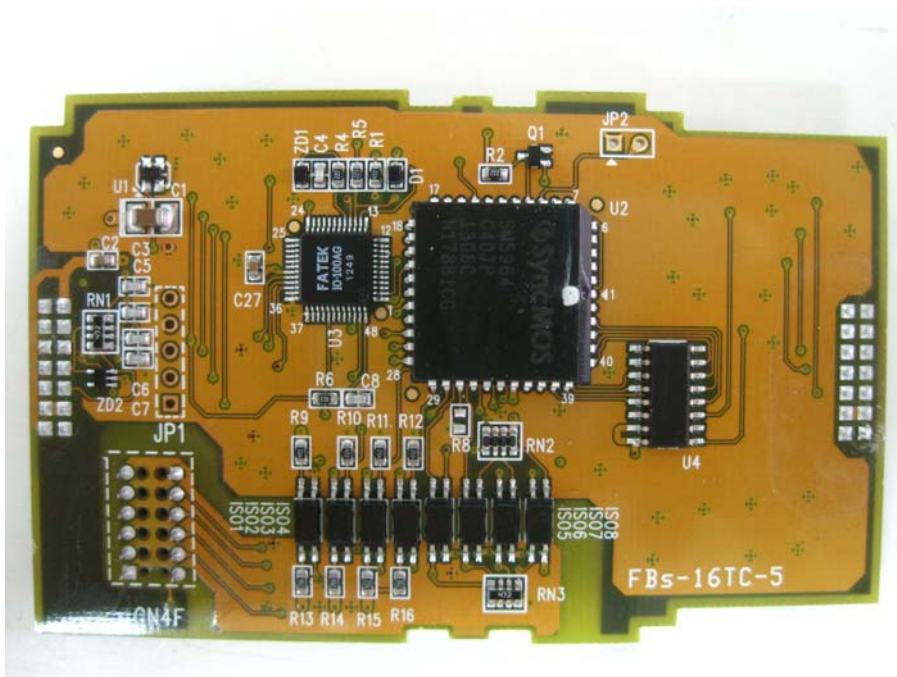
Front View of the PCB 2



Rear View of the PCB 2



Front View of the PCB 3



Rear View of the PCB 3



View of the EUT's Label



Front View of the EUT (FBs-60MCR2-AC)



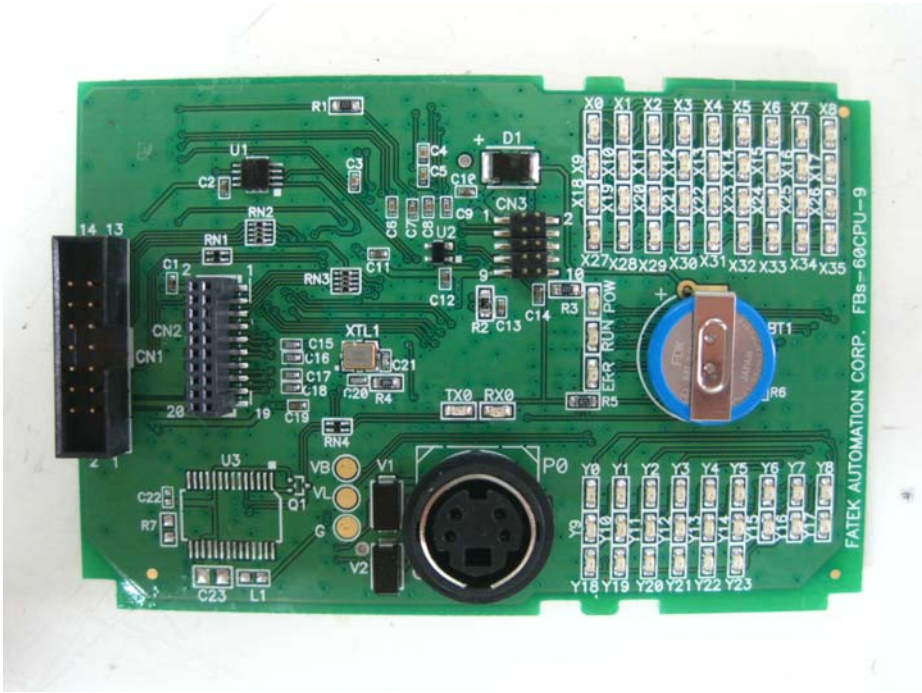
Rear View of the EUT (FBs-60MCR2-AC)



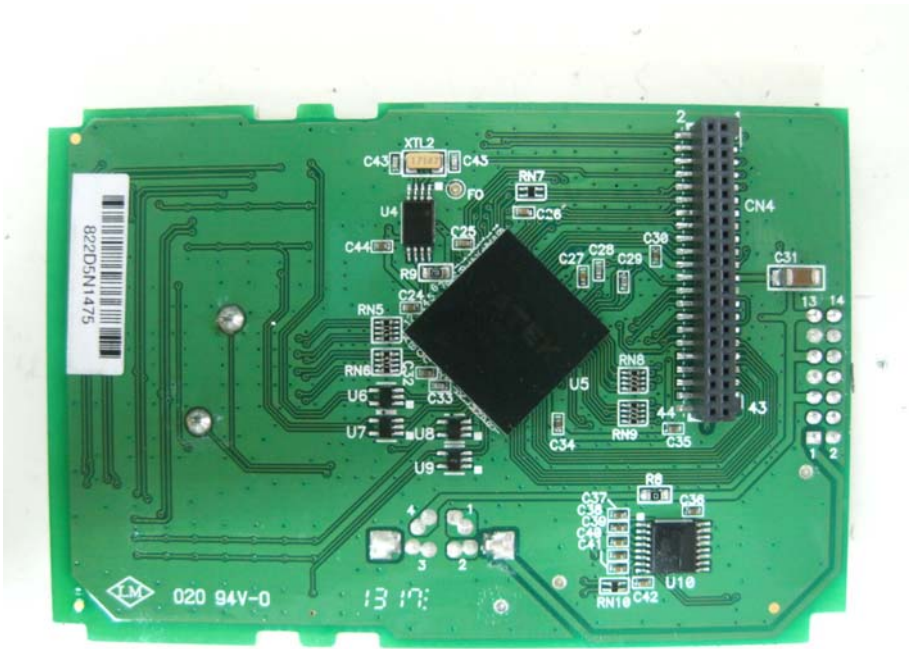
Inside View-1 of the EUT



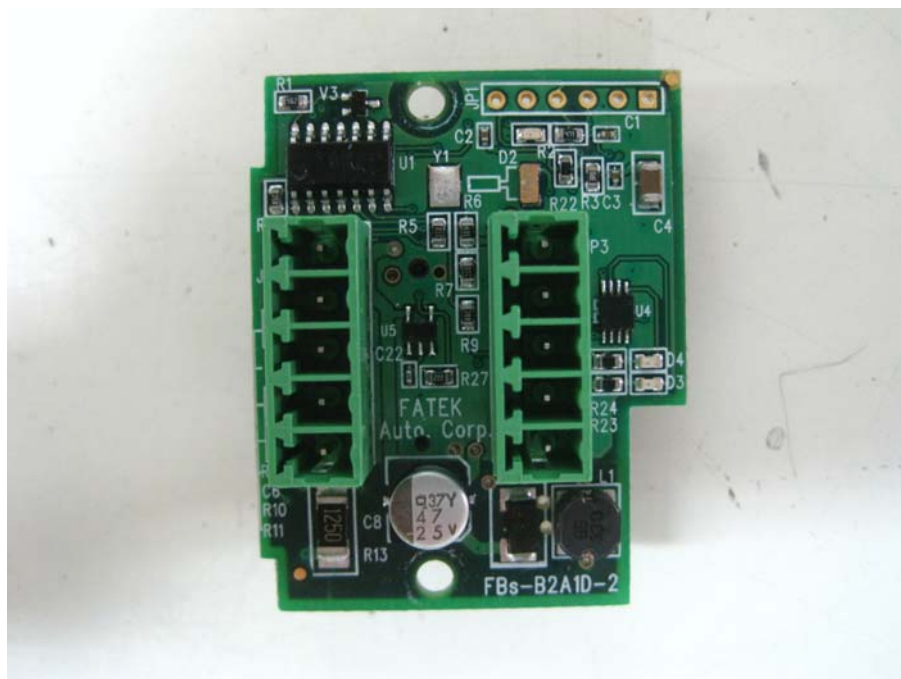
Inside View-2 of the EUT



Front View of the PCB 1



Rear View of the PCB 1



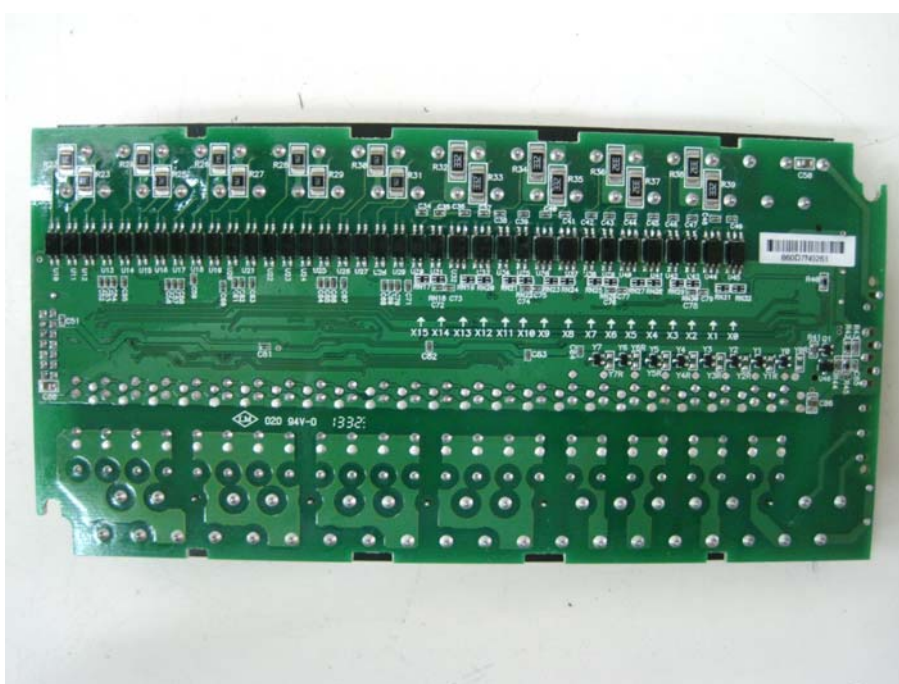
Front View of the PCB 2



Rear View of the PCB 2



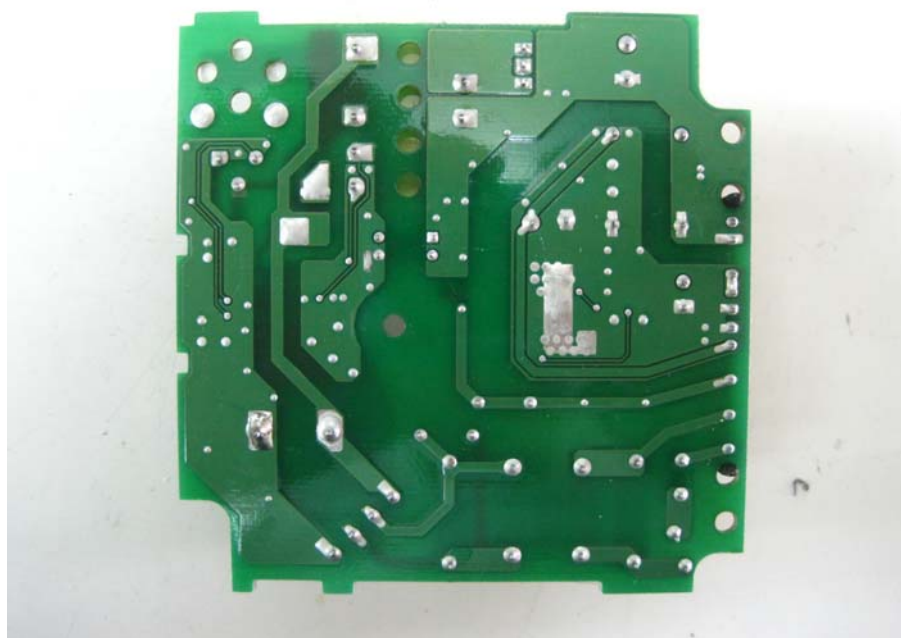
Front View of the PCB 3



Rear View of the PCB 3



Front View of the PCB 4



Rear View of the PCB 4



View of the EUT's Label



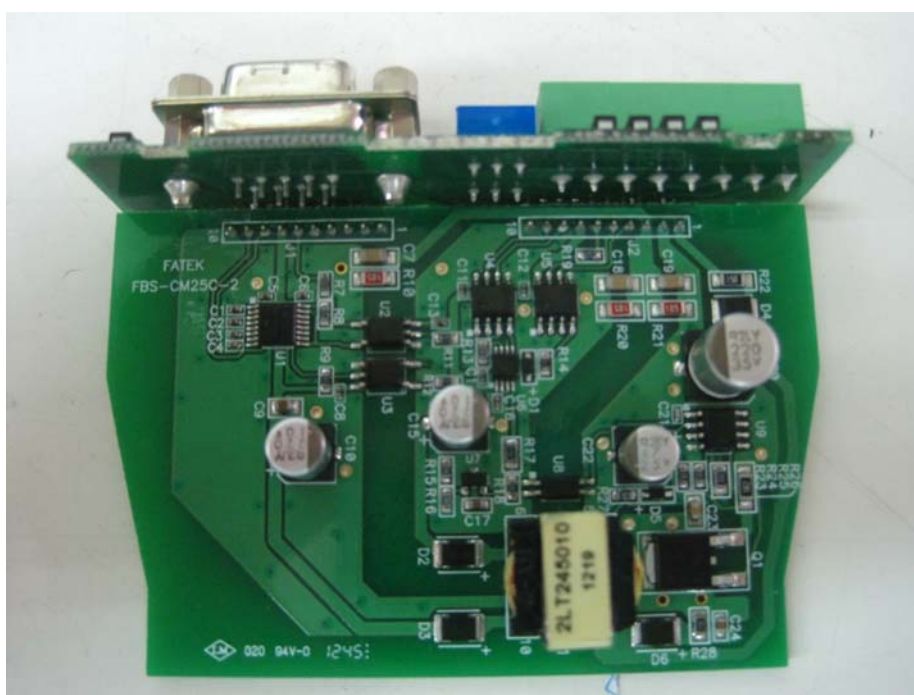
Front View of the EUT (FBs-CM25C)



Front View of the EUT (FBs-CM25C)



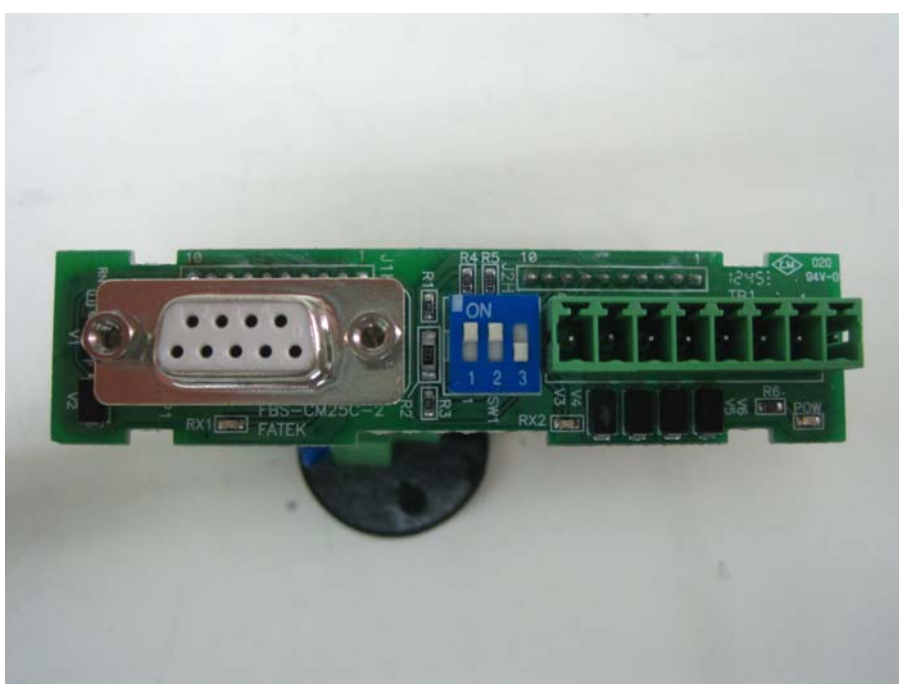
Inside View of the EUT



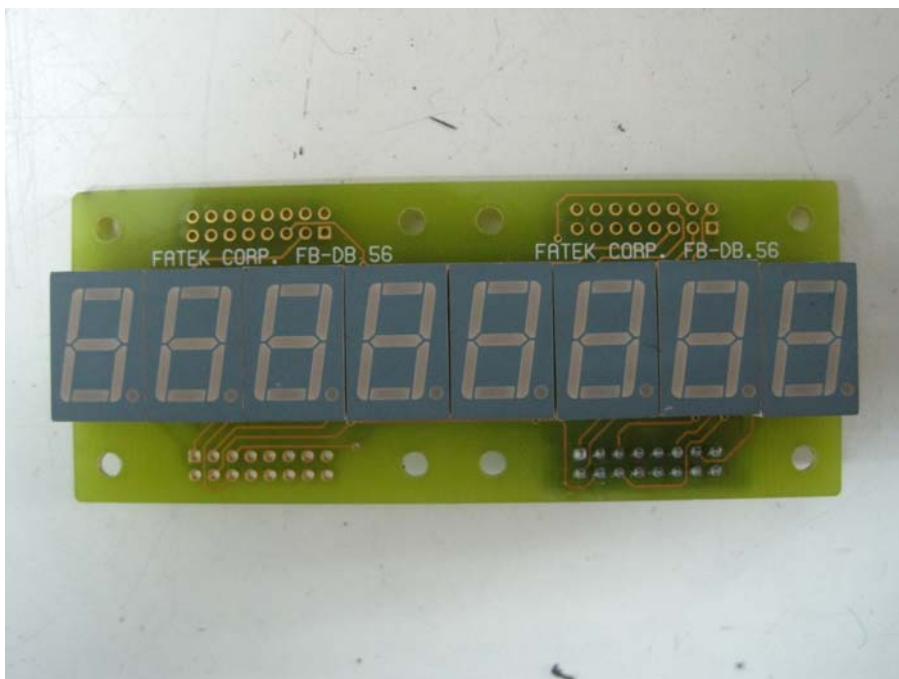
Front View of the PCB 1



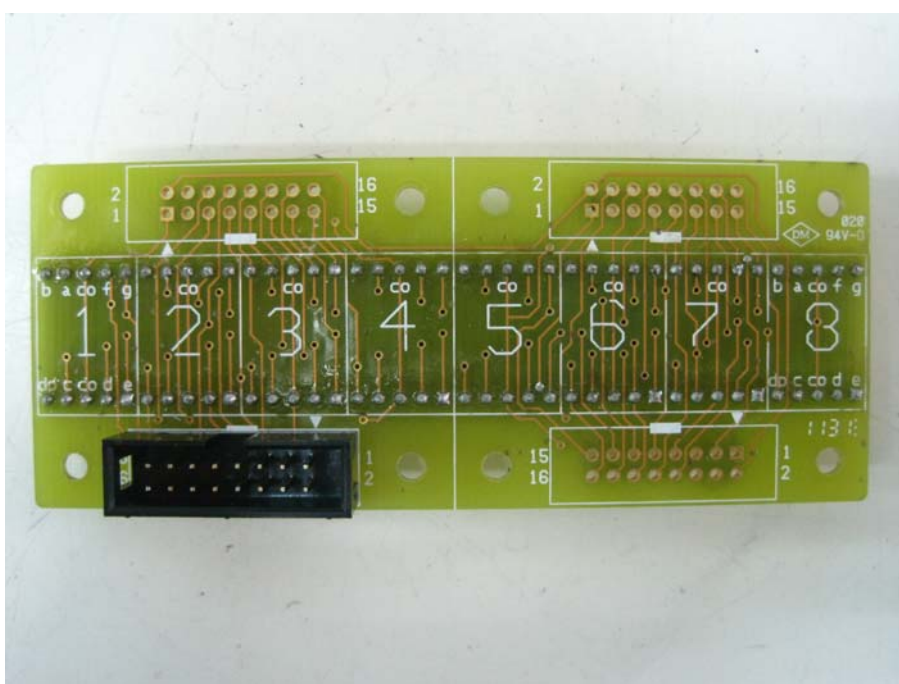
Rear View of the PCB 1



Front View of the PCB 2



Front View of the Display



Rear View of the Display



View of the Display Cable

15 Photographs of ESD Test Points



View of ESD Test Points