EMC TEST REPORT

Report Reference No.	:	JNDL-NE-15E-0002
Product Name	:	DIGITAL PID CONTROLLER
Model Name	:	T34
Applicant	:	TEMCOLINE Co., Ltd. #217-1, Misung Bldg, Gurojungang-ro, Seoul, 152-865 Korea
Manufacturer	:	TEMCOLINE Co., Ltd. #217-1, Misung Bldg, Gurojungang-ro, Seoul, 152-865 Korea
Test Standard	:	EN55011:2009+A1:2010, Class A, Group 1 EN61326-1:2013, EN61326-2-1:2013 EN 61000-3-2:2006+A2:2009 Class A, EN 61000-3-3:2013
Date of Test	:	December 24, 2014 ~ December 29, 2014
Date of Issue	:	January 13 , 2015

This Report applies only to the model named in the title of this report. It is the responsibility of manufacturer to assure that the additional production units of this product are manufactured with identical, electrical and mechanical components. Test results apply only to the particular equipment and functionality described in this test report.
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Tested by : _____
Dong Wook Park / EMC Engineer

Reviewed by : _____
Rex Lee / EMC Leader

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1.0 GENERAL DESCRIPTION

1.1 APPLICANT

Company Name	TEMCOLINE Co., Ltd.
Address	#217-1, Misung Bldg, Gurojungang-ro, Seoul, 152-865 Korea
Contact Person	won sub Cho
E-mail	wscho@temcoline
Phone / Fax. No.	TEL. : +82-2 -3667-5521 FAX. : +82-2-2632-5549

1.2 MANUFACTURER

Company Name	Same as Applicant
Address	Same as Applicant

1.3 TEST LABORATORY

Company Name	JNDL Laboratory. CO., LTD.
Address	(B 114~115 Kumgang Penterium IT Tower, KwanYang-Dong), 282 HagUi-Ro, DongAn-Gu, Anyang-Si, Kyunggi-Do, Korea
Contact Person	Rex Lee
E-mail	rex.lee@jndcerti.com
Phone / Fax. No.	TEL. : +82-31-337-7677 FAX. : +82-31-337-7679

Note : Our Laboratory is accredited and designated in accordance with the provisions of Radio Waves Act and International Standard ISO/IEC 17025:2005 by RRA and TÜV Rheinland.

2.0 GENERAL INFORMATION OF EUT

2.1 BASIC DESCRIPTION OF EUT

Trade Name	TEMCOLINE Co., Ltd.
Product Name	DIGITAL PID CONTROLLER
Model Name	T34
Alt. Model Name	T54
Serial No.	None
EMI Class	Class A
Rating	AC 230 V 50 Hz

2.2 OPERATING MODES AND CONDITIONS

Mode	Operating Mode
Normal	It was tested to measure atmosphere temperature.

EUT was tested according to the following operation mode provided by the specifications given by the manufacturer, and reported the worst emissions.

Z

2.3 PERIPHERAL EQUIPMENT

Description	Model	Serial No.	Manufacturer
Temperature Sensor	None	None	None

2.4 INPUT/OUTPUT PORTS

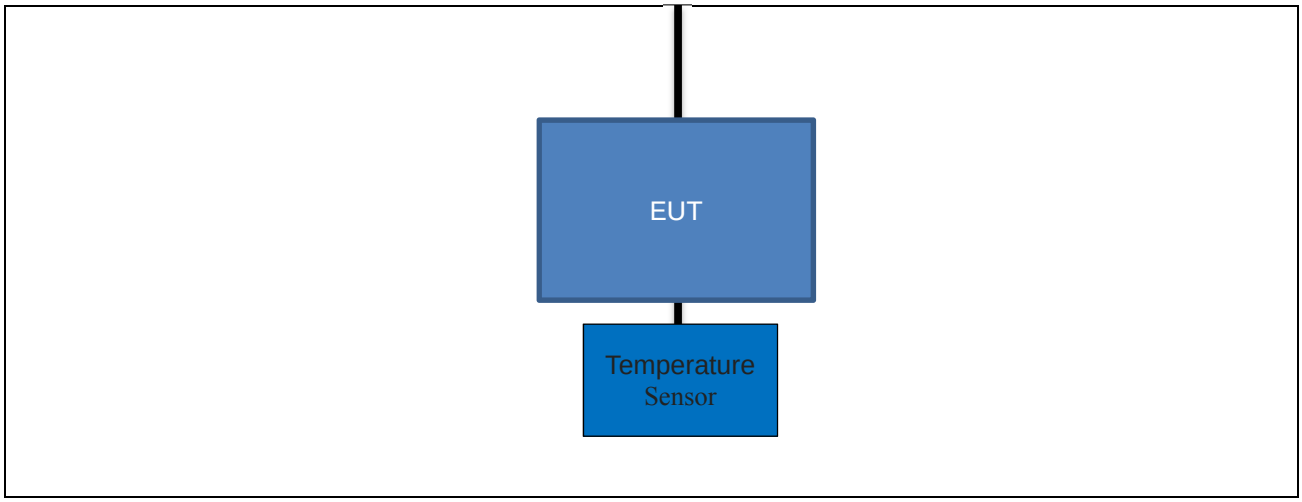
Name	Type*	Cable Length	Cable Type	Comments
EUT	AC IN	1.5 m	LINE	Connected to AC Outlet
	T.C	1.5 m	LINE	Connected to Temperature Sensor

* Type:
AC - AC Power Port DC – DC Power Port N/E – Non-Electrical
TP - Telecommunication Port I/O - Signal Input or Output Port (not involved in process control)

2.5 INTERNAL OPERATING FREQUENCIES OF EUT

Frequency (MHz)	Description
-	14.7456 MHz

2.6 TEST CONFIGURATIONS



Interface cable, Power cable

2.7 MODIFICATIONS

- None

2.8 VARIATION COVERED BY THIS REPORT

- None

3.0 TEST SUMMARY

3.1 STANDARD FOR METHODS OF MEASUREMENT

EMISSION			
Basic Standard	Test Type	Result	Remarks
EN 55011:2009+A1:2010, Class A, Group 1	Terminal disturbance voltage	PASS	
	Radiated disturbance	PASS	
EN 61000-3-2:2006 +A2:2009 Class A	Harmonic Distortion	PASS	
EN 61000-3-3:2013	Voltage fluctuations & flicker	PASS	

Note : EN 61000-3-2 and EN 61000-3-3 were tested by subcontract Laboratory.

IMMUNITY			
Standard	Test Type (Immunity test)	Result	Remarks
EN61326-1:2013 EN61326-2-1:2013	Include below test types	PASS	Refer to below each criterion
EN 61000-4-2:2009	Electrostatic discharge	PASS	Criterion B
EN 61000-4-3:2006 +A1:2008+A2:2010	Radiated, radio-frequency, electromagnetic field	PASS	Criterion A
EN 61000-4-4:2004 +A1:2010	Electrical fast transient / burst	PASS	Criterion B
EN 61000-4-5:2006	Surge	PASS	Criterion B
EN 61000-4-6:2009	Conducted disturbances, induced by radio-frequency fields	PASS	Criterion A
EN 61000-4-8:2010	Power frequency magnetic field	N/A	Criterion A
EN 61000-4-11:2004	Voltage dips, short interruptions and voltage variations	PASS	0 % during half cycle : Criterion B 0 % during 1 cycle : Criterion B 70 % during 25/30 cycles : Criterion C 0 % during 250/300 cycles : Criterion C

Note : The EUT has been tested / evaluated and passed the above standards.

3.2 PERFORMANCE CRITERIA

According to clause 6.4 of EN 61326-1 standard, the following describes the performance criteria.

Criterion A	During testing, normal performance within the specification limits. Example 1 If electronic equipment is required to work with high reliability, the EUT shall operate without any apparent degradation from the manufacturer's specification.
Criterion B	During testing, temporary degradation, or loss of function or performance which is selfrecovering. Example 1 A data transfer is controlled/checked by parity check or by other means. In the case of malfunctioning, such as caused by a lightning strike, the data transfer will be repeated automatically. The reduced data transfer rate at this time is acceptable. Example 2 During testing, an analogue function value may deviate. After the test, the deviation vanishes. Example 3 In the case of a monitor used only for man-machine monitoring, it is acceptable that some degradation takes place for a short time, such as flashes during the burst application.
Criterion C	During testing, temporary degradation, or loss of function or performance which requires operator intervention or system reset occurs. Example 1 In the case of an interruption in the mains longer than the specified buffer time, the power supply unit of the equipment is switched off. The switch-on may be automatic or carried out by the operator. Example 2 After a programme interruption caused by a disturbance, the processor functions of the equipment stops at a defined position and is not left in a "crashed state". The operator's decision prompts may be necessary. Example 3 The test results in an opening of an over-current protection device that is replaced or reset by the operator.

3.3 MEASURMENT 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 Emission	150 kHz ~ 30 MHz	2.2 dBμV
Radiated Emission	30 MHz ~ 1 GHz	4.0 dBμV/m
	1 GHz ~ 6 GHz	5.0 dBμV/m

This uncertainty represents an expanded uncertainty expressed at approximately than 95% confidence level using a converge factor of k=2.

4.0 EMISSION TEST

4.1 CONDUCTED DISTURBANCE AT MAINS TERMINALS(Class A Group 1 equipment)

4.1.1 LIMITS OF MAINS TERMINAL DISTURBANCE VOLTAGE

Frequency [MHz]	Rated input power of ≤ 20 kVA		Rated input power of > 20 kVA a	
	Quasi-peak [dBuV]	Average [dBuV]	Quasi-peak [dBuV]	Average [dBuV]
0.15 ~ 0.5	79	66	100	90
0.5 ~ 5	73	60	86	76
5 ~ 30	73	60	90 decreasing linearly with logarithm of frequency to 73	80 60

At the transition frequency, the more stringent limit shall apply.
NOTE 1 Limits only apply to low voltage a.c. mains input ports.
NOTE 2 For class A equipment intended to be connected solely to isolated neutral or high impedance earthed (IT) industrial power distribution networks (see IEC 60364-1), the limits defined for group 2 equipment with a rated input power > 75 kVA in Table 6 can be applied.

a These limits apply to equipment with a rated input power > 20 kVA and intended to be powered by a dedicated power transformer or generator, and which is not connected to Low Voltage (LV) overhead power lines. For equipment not intended to be powered by a user specific power transformer, the limits for ≤ 20 kVA apply. The manufacturer and/or supplier shall provide information on installation measures that can be used to reduce emissions from the installed equipment. In particular, it shall be indicated that this equipment is intended to be powered by a dedicated power transformer or generator and not by LV overhead power lines.

NOTE The rated input power consumption of 20 kVA corresponds for example to a current of approximately 29 A per phase in case of 400 V three-phase power supply networks, and to a current of approximately 58 A per phase in case of 200 V three phase power supply networks.

4.1.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
EMI RECEIVER	PMM 9010	Narda S.T.S/PMM	697WW40306	2015.09.07	■
EMI TEST RECEIVER	ESCI 7	ROHDE&SCHWARZ	100933	2015.07.30	□
Software	ESxS-K1 Ver.2.10	ROHDE&SCHWARZ	-	-	□
LISN(2line)	ENV216	ROHDE&SCHWARZ	101456	2015.05.06	■
LISN(2line)	ENV216	ROHDE&SCHWARZ	101457	2015.05.06	□
ISN CAT6 8 WIRE	NTFM 8158	SCHWARZBECK	8158-0049	2015.10.15	□
ISN 8 WIRE	CAT5 8158	SCHWARZBECK	8158-0053	2015.10.15	□
ISN 8 WIRE	CAT3 8158	SCHWARZBECK	8158-0034	2015.10.15	□

4.1.3 TEST PROCEDURE

a. The EUT was placed 0.4 m from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ω / 50 μH 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.

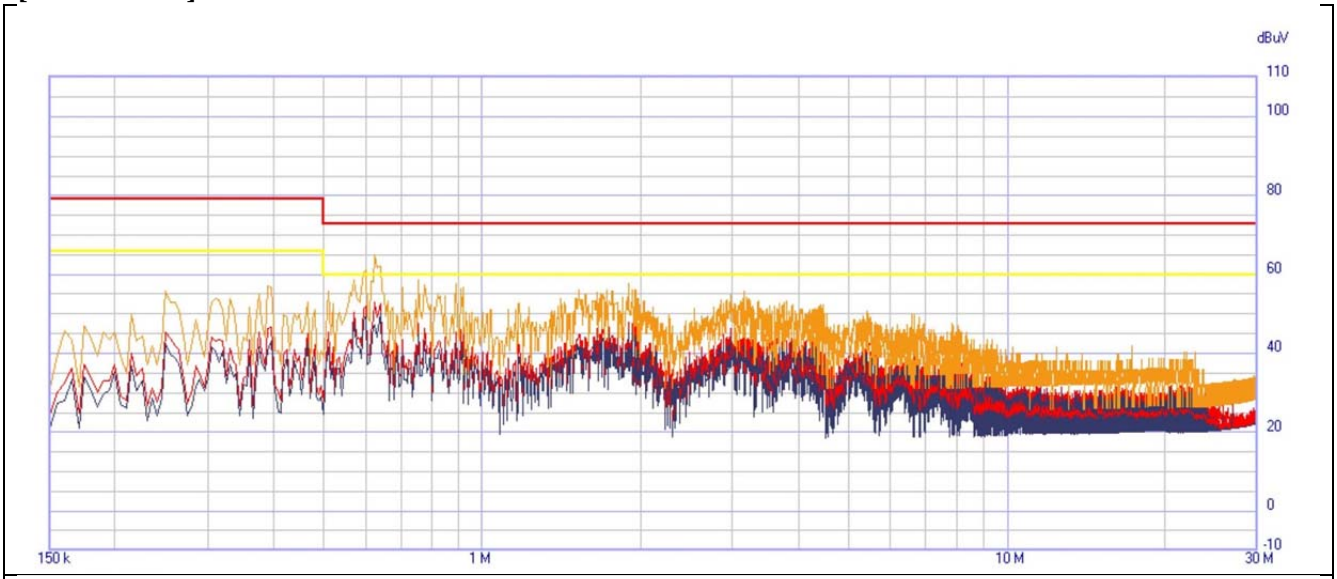
4.1.4 ENVIRONMENT CONDITIONS

Test Site	Shield Room
Temperature	20 °C
Relative Humidity	40 %

4.1.5 TEST RESULTS

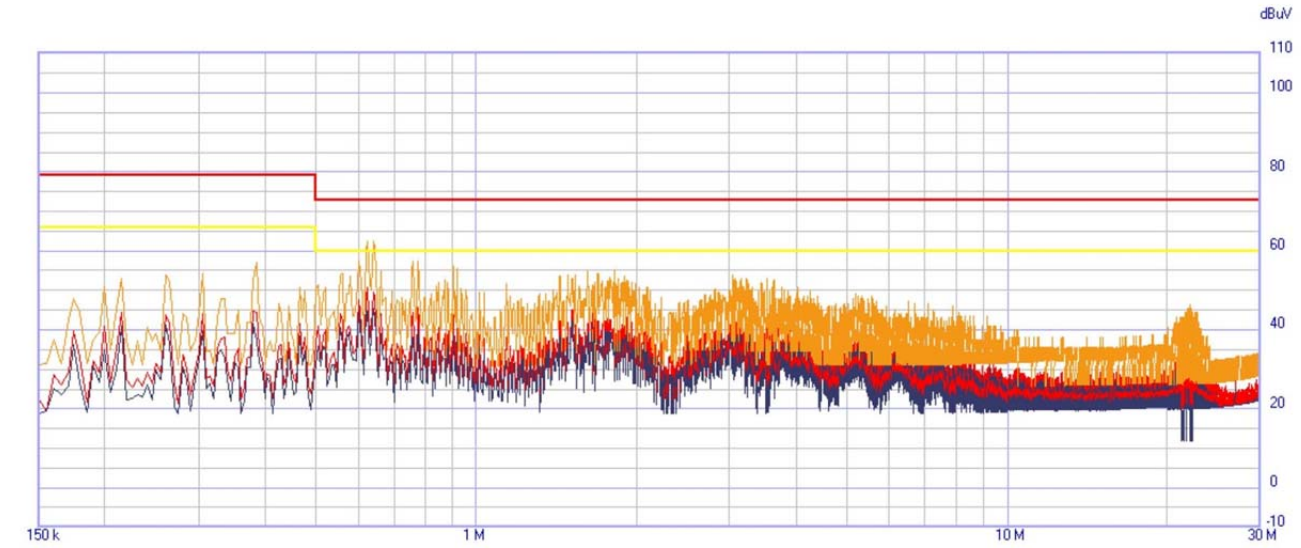
Test Mode	Normal	Test date	December 24, 2014

[HOT LINE]



	Frequency [MHz]	QPeak [dBuV]	Limit 1.22_A_QP [dBuV]	Delta [dB]	C-Avg [dBuV]	Limit 2.22_A_CAV [dBuV]	Delta [dB]	Factor cable loss [dB]	Factor LISN_L [dB]
1	0.57	50.35	73.00	---	48.30	60.00	-11.70	0.11	9.59
2	0.595	51.46	73.00	---	48.21	60.00	-11.79	0.11	9.59
3	0.6	51.96	73.00	---	49.64	60.00	-10.36	0.11	9.59
4	0.62	48.98	73.00	---	47.00	60.00	-13.00	0.10	9.59
5	0.625	52.86	73.00	---	47.14	60.00	-12.86	0.10	9.59
6	0.635	50.26	73.00	---	46.71	60.00	-13.29	0.10	9.59
7	0.64	52.50	73.00	---	49.95	60.00	-10.05	0.10	9.59

[NEUTRAL LINE]



	Frequency [MHz]	QPeak [dBuV]	Limit 1.22_A_QP [dBuV]	Delta [dB]	C-Avg [dBuV]	Limit 2.22_A_CAV [dBuV]	Delta [dB]	Factor cable loss [dB]	Factor LISN_N [dB]
1	0.6	47.56	73.00	---	44.79	60.00	-15.21	0.11	9.59
2	0.62	48.12	73.00	---	44.89	60.00	-15.11	0.10	9.59
3	0.625	50.58	73.00	---	44.83	60.00	-15.17	0.10	9.59
4	0.64	49.59	73.00	---	45.22	60.00	-14.78	0.10	9.59
5	0.645	48.95	73.00	---	44.07	60.00	-15.93	0.10	9.59
6	1.515	44.96	73.00	---	42.12	60.00	-17.88	0.06	9.60

If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

4.2 RADIATED DISTURBANCE (Class A Group 1 equipment)

4.2.1 LIMITS FOR RADIATED DISTURBANCE

Frequency range MHz	Quasi-peak limits [dBμV/m] ≤ 20 kVA	
	10 m measuring distance	3 m measuring distance
30 ~ 230	40	50
230 ~ 1 000	47	57
On a test site, class A equipment can be measured at a nominal distance of 3 m, 10 m or 30 m. A measuring distance less than 10 m is allowed only for equipment which complies with the definition given in 3.10. In case of measurements at a separation distance of 30 m, an inverse proportionality factor of 20 dB per decade shall be used to normalize the measured data to the specified distance for determining compliance. At the transition frequency, the more stringent limit shall apply.		

4.2.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
EMI Receiver	ESVS 30	ROHDE&SCHWARZ	828525/005	2015.10.14	■
Trilog-Broadband Antenna	VULB 9168	SCHWARZBECK	9168-506	2016.10.22	■
Turn Table	EMRT2012	EM Engineering	RT9812201	N/A	■
Antenna Master	EAM-40	DAEIL EMC Engineering	N/A	N/A	■
Antenna Master, Turn table Controller	DE-2000	DAEIL EMC Engineering	N/A	N/A	■

4.2.3 TEST PROCEDURE

a. Radiated emission testing was performed at an Open field test site. The EUT was placed on a turntable top 0.8 m above ground. The table rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 10 meters from the EMI receiving antenna, which was mounted on a variable-height antenna tower.
c. The antenna height was varied between 1 meter and 4 meters above ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna were 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 heights from 1 meter 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 quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

4.2.4 ENVIRONMENT CONDITIONS

Test Site	Open field test site
Temperature	4 °C
Relative Humidity	63 %

4.2.5 TEST RESULTS

Test Mode	Normal	Test date	December 24, 2014

Freq. [MHz]	Read Level [dB(μV)]	Pol. [H/V]	Ant. Height [m]	Corr. Factor		Limit [dB(μV)/m]	Level [dB(μV)/m]	Margin [dB]
				Ant. Factor [dB/m]	Cable loss [dB]			
32.45	10.43	V	1.0	12.64	1.22	40	24.3	15.7
35.87	9.36	V	1.0	12.86	1.29	40	23.5	16.5
45.64	10.42	V	1.0	13.73	1.45	40	25.6	14.4
124.23	9.03	V	1.0	11.86	2.41	40	23.3	16.7
250.67	12.82	V	1.0	12.04	3.44	47	28.3	18.7
562.56	5.18	V	2.0	19.15	5.17	47	29.5	17.5

* Polarization (Pol.): H = Horizontal, V = Vertical
* Level [dB(μV/m)] = Read Level [dB(μV)] + Correction Factor [dB/m]
* Correction Factor [dB/m] = Antenna Factor [dB/m] + Cable Factor [dB]
* Margin = Limit – Level

4.3 HARMONIC CURRENT EMISSIONS

4.3.1 LIMITS FOR HARMONIC CURRENT EMISSIONS

Limits for Class A equipment	
Harmonics order	Maximum permissible harmonic current
n	A
Odd harmonics	
3	2.3
5	1.14
7	0.77
9	0.4
11	0.33
13	0.21
15 ≤ n ≤ 39	0.15 x 15/n
Even harmonics	
2	1.08
4	0.43
6	0.3
8 ≤ n ≤ 40	0.23 x 8/n

Limits for Class D equipment		
Harmonics order	Maximum permissible harmonic current	Maximum permissible harmonic current
n	A	A
Odd harmonics only		
3	3.4	2.3
5	1.9	1.14
7	1	0.77
9	0.5	0.4
11	0.35	0.33
13	0.3	0.21
15 ≤ n ≤ 39	3.85/n	0.15 x 15/n

Note: 1. Class A and Class D are classified according to section 5 of EN 61000-3-2:2006.
2. According to section 7 of EN61000-3-2:2006, the above limits for all equipment except for lighting equipment are for all application having an active input power > 75 W and no limits apply for equipment with an active input power up to and including 75 W.

4.3.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
Filcker Meter	CCN1000-1LR1	Schaffner	X71836	N/A	■
AC Power Source	ProfLine 2105-400	Schaffner	HK53887	2015.03.19	■

4.3.3 TEST PROCEDURE

The EUT was placed on the top of a wooden table 0.8 m above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

4.3.4 ENVIRONMENT CONDITIONS

Test Site	Shield room
Temperature	22 °C
Humidity	41 % R.H.

4.3.5 TEST RESULTS

Test Mode	Normal	Tested by	ETL

Harmonics – Class-A per Ed. 3.0 (2005-11)(Run time) incl. inter-harmonics

EUT: Equipment Under Test **Tested by: Test Operator**

Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**

Test date: 2014-12-24

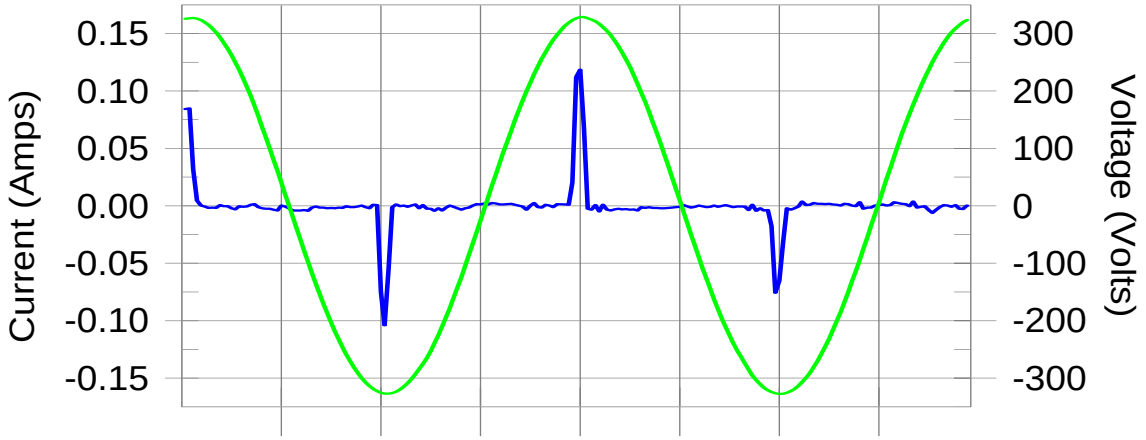
Test duration (min): 2.5

Comment: Comments

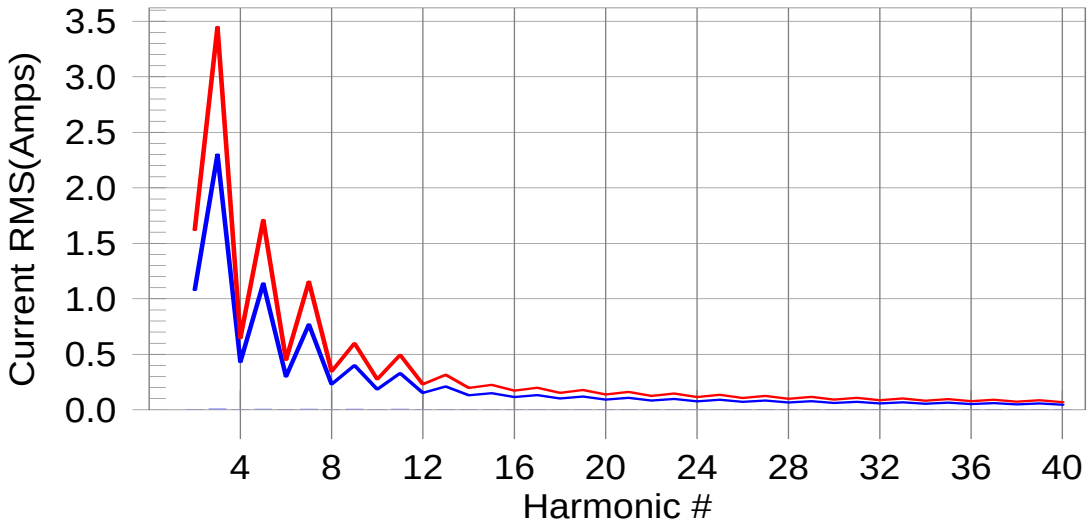
Customer: Customer

Test Result: Pass **Source qualification: Normal**

Current & voltage waveforms



Harmonics and Class A limit line **European Limits**



Test result: Pass Worst harmonic was #19 with 2.13% of the limit.

Current Test Result Summary (Run time)

EUT: Equipment Under Test **Tested by: Test Operator**

Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**

Test date: 2014-12-24

Test duration (min): 2.5

Comment: Comments

Customer: Customer

Test Result: Pass **Source qualification: Normal**

THC(A): 0.02 **I-THD(%): 273.02** **POHC(A): 0.006** **POHC Limit(A): 0.251**

Highest parameter values during test:

V_RMS (Volts):	**231.43**	**Frequency(Hz):**	**50.00**
I_Peak (Amps):	**0.149**	**I_RMS (Amps):**	**0.019**
I_Fund (Amps):	**0.006**	**Crest Factor:**	**8.085**
Power (Watts):	**1.5**	**Power Factor:**	**0.355**

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.001	1.080	0.1	0.002	1.620	0.11	Pass
3	0.006	2.300	0.3	0.006	3.450	0.18	Pass
4	0.001	0.430	0.3	0.002	0.645	0.34	Pass
5	0.006	1.140	0.5	0.006	1.710	0.36	Pass
6	0.001	0.300	0.4	0.002	0.450	0.41	Pass
7	0.006	0.770	0.8	0.006	1.155	0.51	Pass
8	0.001	0.230	0.5	0.002	0.345	0.52	Pass
9	0.006	0.400	1.4	0.006	0.600	0.94	Pass
10	0.001	0.184	0.7	0.002	0.276	0.62	Pass
11	0.005	0.330	1.6	0.005	0.495	1.08	Pass
12	0.001	0.153	0.8	0.002	0.230	0.70	Pass
13	0.005	0.210	2.3	0.005	0.315	1.59	Pass
14	0.001	0.131	0.8	0.001	0.197	0.74	Pass
15	0.005	0.150	3.0	0.005	0.225	2.05	Pass
16	0.001	0.115	0.9	0.001	0.173	0.83	Pass
17	0.004	0.132	3.1	0.004	0.199	2.12	Pass
18	0.001	0.102	0.9	0.001	0.153	0.90	Pass
19	0.004	0.118	3.1	0.004	0.178	2.13	Pass
20	0.001	0.092	1.0	0.001	0.138	1.00	Pass

21	0.003	0.107	3.0	0.003	0.161	2.09	Pass
22	0.001	0.084	1.0	0.001	0.125	1.02	Pass
23	0.003	0.098	2.9	0.003	0.147	2.01	Pass
24	0.001	0.077	1.0	0.001	0.115	1.07	Pass
25	0.002	0.090	2.7	0.003	0.135	1.88	Pass
26	0.001	0.071	0.9	0.001	0.106	1.10	Pass
27	0.002	0.083	2.5	0.002	0.125	1.73	Pass
28	0.001	0.066	0.9	0.001	0.099	1.08	Pass
29	0.002	0.078	2.2	0.002	0.116	1.55	Pass
30	0.001	0.061	0.9	0.001	0.092	1.03	Pass
31	0.001	0.073	1.9	0.001	0.109	1.34	Pass
32	0.000	0.058	0.8	0.001	0.086	0.94	Pass
33	0.001	0.068	1.6	0.001	0.102	1.16	Pass
34	0.000	0.054	0.8	0.001	0.081	0.91	Pass
35	0.001	0.064	1.3	0.001	0.096	0.97	Pass
36	0.000	0.051	0.8	0.001	0.077	0.79	Pass
37	0.001	0.061	1.1	0.001	0.091	0.80	Pass
38	0.000	0.048	0.8	0.001	0.073	0.71	Pass
39	0.001	0.058	0.9	0.001	0.087	0.68	Pass
40	0.000	0.046	0.6	0.000	0.069	0.52	Pass

Voltage Source Verification Data (Run time)

EUT: Equipment Under Test **Tested by: Test Operator**

Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**

Test date: 2014-12-24

Test duration (min): 2.5

Comment: Comments

Customer: Customer

Test Result: Pass **Source qualification: Normal**

Highest parameter values during test:

Voltage (Vrms):	**231.43**	**Frequency(Hz):**	**50.00**
I_Peak (Amps):	**0.149**	**I_RMS (Amps):**	**0.019**
I_Fund (Amps):	**0.006**	**Crest Factor:**	**8.085**
Power (Watts):	**1.5**	**Power Factor:**	**0.355**

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.125	0.463	27.04	OK
3	0.563	2.083	27.02	OK
4	0.066	0.463	14.35	OK
5	0.058	0.926	6.26	OK
6	0.053	0.463	11.51	OK
7	0.057	0.694	8.21	OK
8	0.048	0.463	10.47	OK
9	0.049	0.463	10.62	OK
10	0.043	0.463	9.30	OK
11	0.041	0.231	17.83	OK
12	0.140	0.231	60.36	OK
13	0.035	0.231	15.30	OK
14	0.031	0.231	13.44	OK
15	0.027	0.231	11.47	OK
16	0.031	0.231	13.46	OK
17	0.026	0.231	11.35	OK
18	0.030	0.231	13.14	OK
19	0.023	0.231	10.14	OK
20	0.032	0.231	13.62	OK

21	0.019	0.231	8.29	OK
22	0.020	0.231	8.73	OK
23	0.021	0.231	9.09	OK
24	0.040	0.231	17.15	OK
25	0.019	0.231	8.38	OK
26	0.018	0.231	7.76	OK
27	0.018	0.231	7.81	OK
28	0.015	0.231	6.31	OK
29	0.013	0.231	5.77	OK
30	0.014	0.231	6.14	OK
31	0.014	0.231	5.93	OK
32	0.012	0.231	5.28	OK
33	0.012	0.231	5.08	OK
34	0.010	0.231	4.43	OK
35	0.011	0.231	4.88	OK
36	0.018	0.231	7.98	OK
37	0.010	0.231	4.28	OK
38	0.009	0.231	3.96	OK
39	0.009	0.231	4.04	OK
40	0.020	0.231	8.53	OK

4.4 VOLTAGE FLUCTUATIONS AND FLICKER

4.4.1 LIMITS FOR VOLTAGE FLUCTUATIONS AND FLICKER

Limit
The value of Pst shall not be greater than 1.0
The value of Plt shall not be greater than 0.65
The value of *d(t)* during a voltage change shall not exceed 3.3 % for more than 500 ms
The relative steady-state voltage change, d*c* shall not exceed 3.3 %
The maximum relative voltage change d*max* shall not exceed 4 % without additional conditions

4.4.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
Filcker Meter	CCN1000-1LR1	Schaffner	X71836	N/A	■
AC Power Source	ProfLine 2105-400	Schaffner	HK53887	2015.03.19	■

4.4.3 TEST PROCEDURE

a. The EUT was placed on the top of a wooden table 0.8 m above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.
b. During the flicker measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator was 10 minutes and observation period for long-term flicker indicator was 2 hours.

4.4.4 ENVIRONMENT CONDITIONS

Test Site	Shield room
Temperature	22 °C
Humidity	41 % R.H.

4.4.5 TEST RESULTS

Test Mode	Normal	Tested by	ETL

Flicker Test Summary per EN/IEC61000-3-3 (Run time)

EUT: Equipment Under Test

Tested by: Test Operator

Test category: All parameters (European limits)

Test Margin: 100

Test date: 2014-12-24

Test duration (min): 10

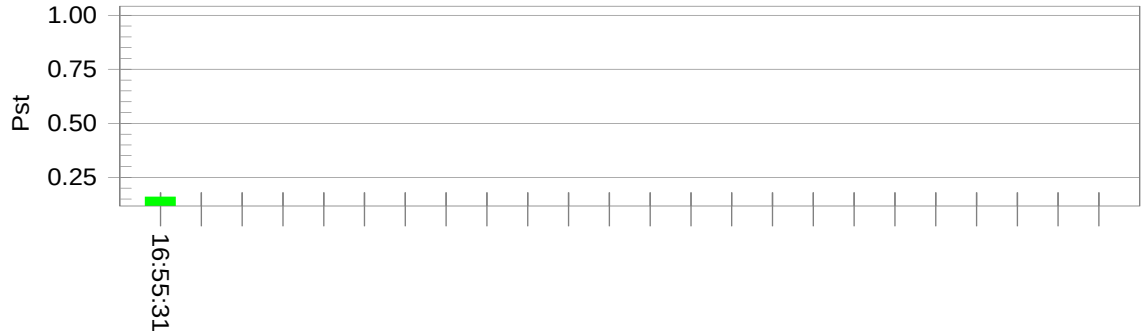
Comment: Comments

Customer: Customer

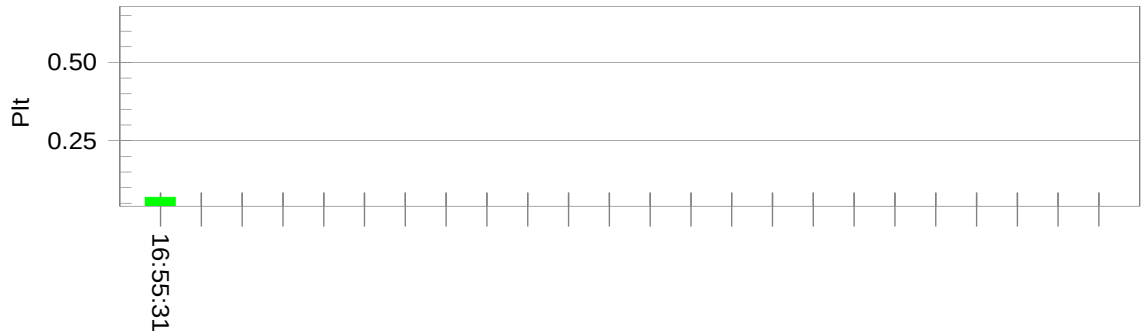
Test Result: Pass

Status: Test Completed

Pst_i and limit line **European Limits**



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	**231.59**			
Highest dt (%):	**0.23**	**Test limit (%):**	**3.30**	**Pass**
Time(mS) > dt:	**0.0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**-0.16**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.160**	**Test limit:**	**1.000**	**Pass**
Highest Plt (2 hr. period):	**0.070**	**Test limit:**	**0.650**	**Pass**

5.0 IMMUNITY TEST

5.1 ELECTROSTATIC DISCHARGE

5.1.1 TEST CONDITIONS

Basic Standard	EN 61000-4-2
Discharge Period	1 second minimum
Discharge Impedance	330 Ω / 150 pF
Discharge Voltage	- Air Discharge : 4 kV (Direct) - Contact Discharge : 4 kV (Direct / Indirect)
Polarity	Positive & Negative
Number of Discharge	- Air Discharge : min. 20 times at each test point - Contact Discharge : min. 50 times at each test point

5.1.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
Electrostatic Discharge Simulator	ESS-2000	Noiseken	ESS0281010	2015.10.14	■

5.1.3 TEST PROCEDURE

1. Tabletop equipment
   a. The test set-up shall consist of a wooden table, 0.8 m high, standing on the ground reference plane (GRP).
   b. A horizontal coupling plane (HCP), 1.6 m x 0.8 m, shall be placed on the table. The EUT and cables shall be isolated from the coupling plane by insulating support 0.5 mm thick.
   c. A vertical coupling plane (VCP) and HCP shall be connected to the GRP via a cable with a 470 kΩ resistor located at each end.
2. Floor-standing equipment
   a. The EUT and cable shall be isolated from the ground reference plane by an insulation support about 0.1 m thick.
   b. Any mounting feet associated with the EUT shall remain in place.

5.1.4 ENVIRONMENT CONDITIONS

Environment	Standard Conditions	Operating Conditions
Temperature	15 °C to 35 °C	21 °C
Humidity	30 % to 60 % R.H.	41 % R.H.
Atmospheric Pressure	86 kPa to 106 kPa	101.3 kPa

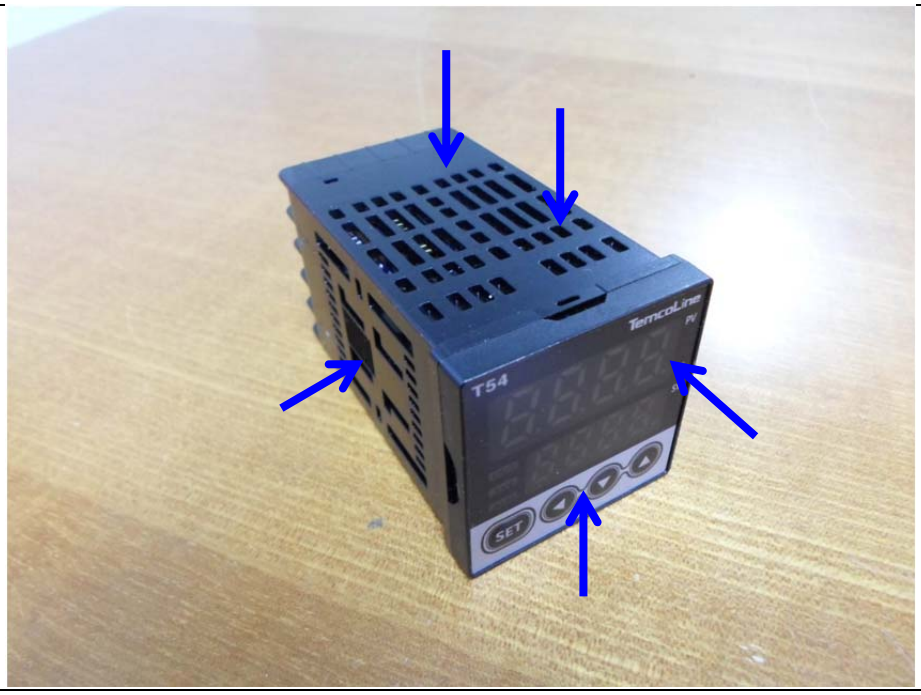
5.1.5 TEST RESULTS

Test Mode	Normal	Test date	December 26, 2014

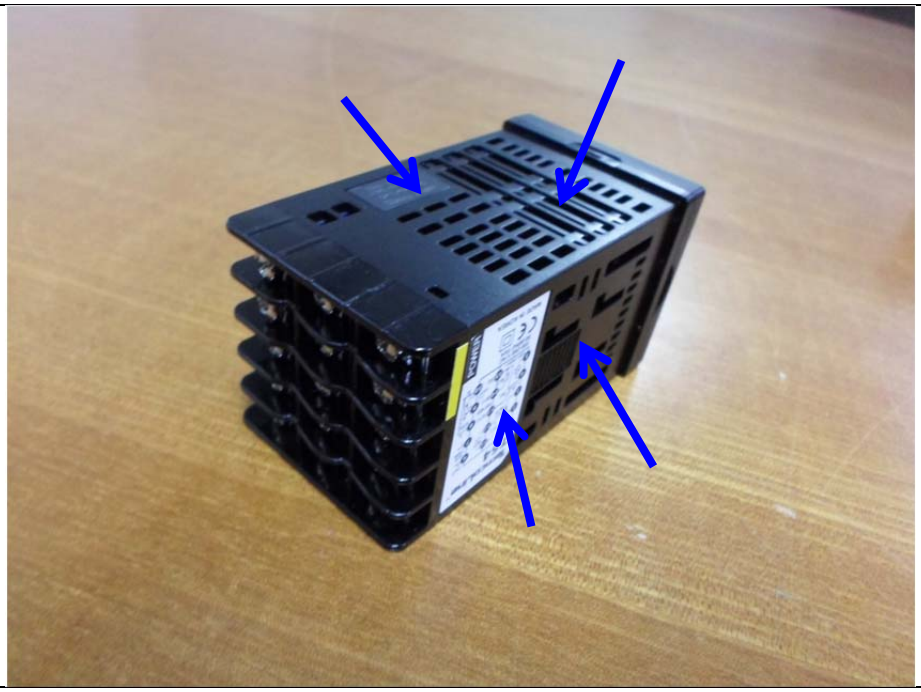
Test Point	Discharge Type	Test Vlotage(kV)	Evaluation	Result
HCP	Contact	2, 4	A	PASS
VCP	Contact	2, 4	A	PASS
Case	Contact	2, 4	A	PASS
All Screw	Contact	2, 4	A	PASS
Power button	Air	2, 4	A	PASS

5.1.6 TEST POINTS

Air	→
Contact	→



[Top]



[Bottom]

5.2 RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD

5.2.1 TEST CONDITIONS

Basic Standard	EN 61000-4-3
Frequency Range	80 MHz ~ 1 GHz, 1.4 GHz ~ 2GHz, 2 GHz ~ 2.7 GHz
Field Strength	3 V/m, 3 V/m , 1V/m
Modulation	AM 80 %, 1 kHz sine wave
Frequency Step	1 %
Polarity of Antenna	Horizontal and Vertical
Side of Test	4 sides
Rate of Sweep	1.5 x 10^{-3} decades/sec

5.2.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
RF AMPLIFIER	150W1000M1	AMPLIFIER RESEARCH	0340908	N/A	■
RF AMPLIFIER	40S1G4M1	AMPLIFIER RESEARCH	0341007	N/A	■
Signal Generator	SMT 03	ROHDE& SCHWARZ	844208	2015.10.14	■
DUAL DIRECTIONAL COUPLER	DC6180A	AMPLIFIER RESEARCH	0340558	2015.10.15	■
DUAL DIRECTIONAL COUPLER	DC7144A	AMPLIFIER RESEARCH	0340348	2015.10.15	■
FIELD PROBE & SWITCHING LASER PROBE INTERFACE	SI-300_LSM	TDK	40008	N/A	□
LASER PROBE INTERFACE	FI7000	AMPLIFIER RESEARCH	0340809	N/A	□
STACKED LOGARITHMIC-PERIODIC TEST ANTENNA	STLP 9128D Special	SCHWARZBECK	9128DS 024	N/A	■

5.2.3 TEST PROCEDURE

a. The test was performed in a modified semi-anechoic chamber.
b. Tabletop equipment was placed on a non-conductive table 0.8 m high.
Floor-standing equipment was mounted on a non-conducting support 0.1 m high.

5.2.4 ENVIRONMENT CONDITIONS

Temperature	21 °C
Humidity	39 % R.H.

5.2.5 TEST RESULTS

Test Mode	Normal	Test date	December 26, 2014

[80 MHz ~ 1 GHz, 3 V/m]

Test Side	Evaluation		Result	Remark
	Horizontal	Vertical		
Front	A	A	PASS	-
Rear	A	A	PASS	-
Left	A	A	PASS	-
Right	A	A	PASS	-

[1.4 GHz ~ 2.0 GHz, 3V/m]

Test Side	Evaluation		Result	Remark
	Horizontal	Vertical		
Front	A	A	PASS	-
Rear	A	A	PASS	-
Left	A	A	PASS	-
Right	A	A	PASS	-

[2.0 MHz ~ 2.7 GHz, 1 V/m]

Test Side	Evaluation		Result	Remark
	Horizontal	Vertical		
Front	A	A	PASS	-
Rear	A	A	PASS	-
Left	A	A	PASS	-
Right	A	A	PASS	-

Comment : During the test, the EUT was judged suitable for the normal operation

5.3 ELECTRICAL FAST TRANSIENT/BURST

5.3.1 TEST CONDITIONS

Basic Standard	EN 61000-4-4
Test Voltage	AC Power line : 1.0 kV Signal line : 0.5 kV
Polarity	Positive & Negative
Impulse Frequency	5 kHz
Impulse Wave Shape	5/50 ns ± 30 %
Burst Duration	15 ms ± 20 %
Burst Period	300 ms ± 20 %
Test Duration	1 min

5.3.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
Ultra compact simulator	UCS 500N7	EM TEST	V1229113204	2015.08.18	■
Capacitive coupling clamp	HFK	EM TEST	0712-17	N/A	□

5.3.3 TEST PROCEDURE

a. The EUT was placed on a non-metallic support 0.1 m above a reference ground plane (RGP).
b. For I/O ports testing, the EUT was placed on a non-metallic support 0.1 m above a RGP.
c. The length of the “hot wire” from the coaxial output of the EFT/Burst generator to the terminals on the EUT was 0.5 m.

5.3.4 ENVIRONMENT CONDITIONS

Temperature	20 °C
Humidity	40 % R.H.

5.3.5 TEST RESULTS

Test Mode	Normal	Test date	December 29, 2014

Test Point	Test Level (kV)	Evaluation		Result
		(+)	(-)	
L1 – L2	1.0	A	A	PASS

. Comment : During the test, the EUT was judged suitable for the normal operation

5.4 SURGE

5.4.1 TEST CONDITIONS

Basic Standard	EN 61000-4-5
Wave-Shape	Combination wave 1.2/50 μs open circuit voltage 8/20 μs short circuit current
Test Voltage	Line to Line : 0.5 kV Line to earth : 0.5, 1 kV
Test Point	L1- L2, L1-PE, L2-PE
Generator Source Impedance	2 Ω for L1-L2 12 Ω for L1-PE, L2-PE
Polarity	Positive & Negative
Phase Angle	0°, 90°, 180°, 270°
Pulse Repetition Rate	1 time / min
Number of Tests	5 positive and 5 negative

Note 1: Apply only up to 0.5 kV for line to line test and up to 1 kV for line to earth (ground).

5.4.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
Ultra compact simulator	UCS 500N7	EM TEST	V1229113204	2015.08.18	■
External 10/700us pulse module	TSurge7	EM TEST	V1229113205	2015.08.17	□
4kV coupling/ decoupling network	CNV 508N1	EM TEST	V1229113207	N/A	□
4kV Coupling/ decoupling network	CNV 508S1	EM TEST	V1229113208	N/A	□

5.4.3 TEST PROCEDURE

The EUT was placed on a non-metallic support 0.8 m above a reference ground plane (RGP).

5.4.4 ENVIRONMENT CONDITIONS

Temperature	21 °C
Humidity	40 % R.H.

5.4.5 TEST RESULTS

Test Mode	Nomal	Test date	Decenber 29, 2014

Test Point	Test Level (kV)	Evaluation		Result
		(+)	(-)	
L1 – L2	0.5	A	A	Pass

. Comment : During the test, the EUT was judged suitable for the normal operation

5.5 CONDUCTED DISTURBANCES, INDUCED BY RADIO-FREQUENCY FIELDS

5.5.1 TEST CONDITIONS

Basic Standard	EN 61000-4-6
Frequency Range	0.15 MHz ~ 80.00 MHz
Field Strength	3 Vrms
Modulation	AM 80 %, 1 kHz sine wave
Frequency Step	1 %
Dwell Time	3 sec
Coupled Port	Mains power , I/O

5.5.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
Signal generator	CWS 500N1	EM TEST	V1229113209	2015.10.15	■
Attenuator	ATT 6/75	EM TEST	0712-91	2015.08.10	■
CDN	CDN-M2/M3N	EM TEST	0812-51	2015.08.11	■
CDN	CDN-S1-50	EM TEST	0812-52	2015.08.11	□
CDN	CDN-S1/75	EM TEST	0812-53	2015.08.11	□
CDN	CDN-S8-RJ45	EM TEST	0812-54	2015.08.11	□
CDN	CDN-T8-RJ45	EM TEST	0812-55	2015.08.11	□
CDN	CDN-T2-RJ11	EM TEST	0113-27	2015.10.14	□
RF Injection clamp	EM101	LÜTHI	36131	2015.08.10	□
Decoupling clamp	FTC 101	LÜTHI	5003	N/A	□

5.5.3 TEST PROCEDURE

a. The EUT was placed on an insulation support of 0.1 m height above a ground reference plane.
b. All relevant cable was provided with the appropriate coupling/decoupling networks (CDN) at a distance between 0.1 m and 0.3 m from the EUT.

5.5.4 ENVIRONMENT CONDITIONS

Temperature	20 °C
Humidity	39 % R.H..

5.5.5 TEST RESULTS

Test Mode	Normal	Test date	December 26, 2014

Frequency (MHz)	Tested Line	Injection Method	Evaluation	Result	Remark
0.15 ~ 80.00	AC Main	CDN-M2	A	PASS	-

. Comment : During the test, the EUT was judged suitable for the normal operation

5.6 VOLTAGE DIPS, SHORT INTERRUPTIONS AND VOLTAGE VARIATIONS

5.6.1 TEST CONDITIONS

Basic Standard	EN 61000-4-11
Test Duration Time	Minimum 3 test events in sequence
Interval Between Event	Minimum 10 seconds
Phase Angle	0°, 180°
Test Cycle	3 times
Voltage Dips and Period	100 %, 0.5 Period 100 %, 1 Period 30 %, 25 Period(50Hz)/ 30 Period(60Hz)
Voltage Interruptions and Duration	100% 250 Period(50Hz)/300 Period(60Hz)

5.6.2 TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due Date of Calibration	Used
Ultra compact simulator	UCS 500N7	EM TEST	V1229113204	2015.08.18	■
Motorized Variac	MV2616	EM TEST	V1229113206	N/A	■

5.6.3 TEST PROCEDURE

The EUT was placed on a non-metallic support 0.8 m above a reference ground plane and was put into operation according to the specified operation mode.

5.6.4 ENVIRONMENT CONDITIONS

Temperature	20 °C
Humidity	40 % R.H..

5.6.5 TEST RESULTS

Test Mode	Normal	Test date	December 29, 2014

Voltage Dips and Interruptions (%)	Duration (period, s)	Test Cycle (time)	Evaluation	Result
100	0.5	3	A	Pass
100	1	3	A	Pass
30	25	3	A	Pass
100	250	3	B	Pass

Comment : During the test, the EUT is turned off . But after the test, it is judged suitable for the normal operation

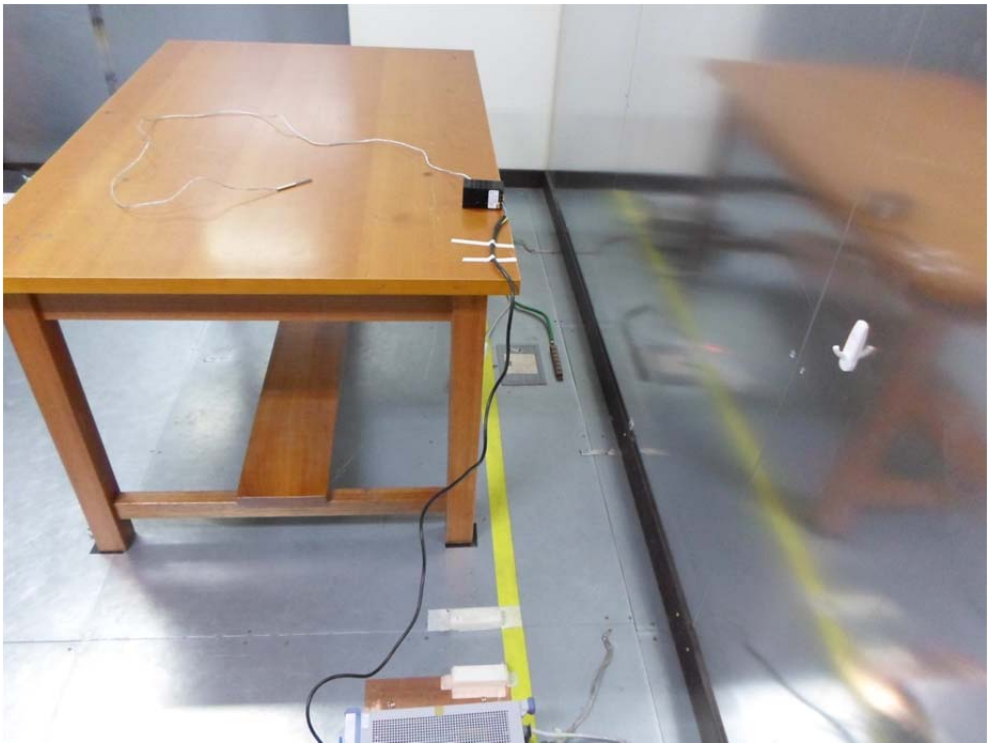
6.0 PHOTHGRAPHS OF THE TEST CONFIGURATION

6.1 CONDUCTED DISTURBANCE AT MAINS TERMINALS

<Front>



<Rear>



6.2 RADIATED DISTURBANCE

<Front>



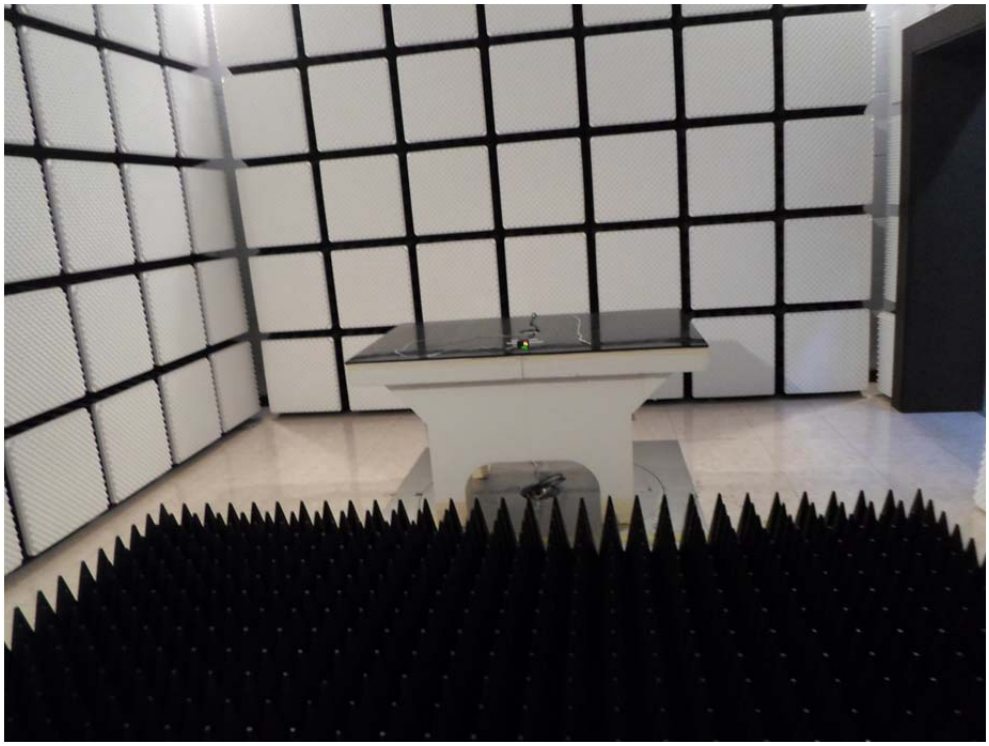
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6.3 ELECTROSTATIC DISCHARGE



6.4 RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD



6.5 ELECTRICAL FAST TRANSIENT/BURST



6.6 SURGE



6.7 CONDUCTED DISTURBANCES, INDUCED BY RADIO-FREQUENCY FIELDS



6.8 VOLTAGE DIPS, SHORT INTERRUPTIONS AND VOLTAGE VARIATIONS

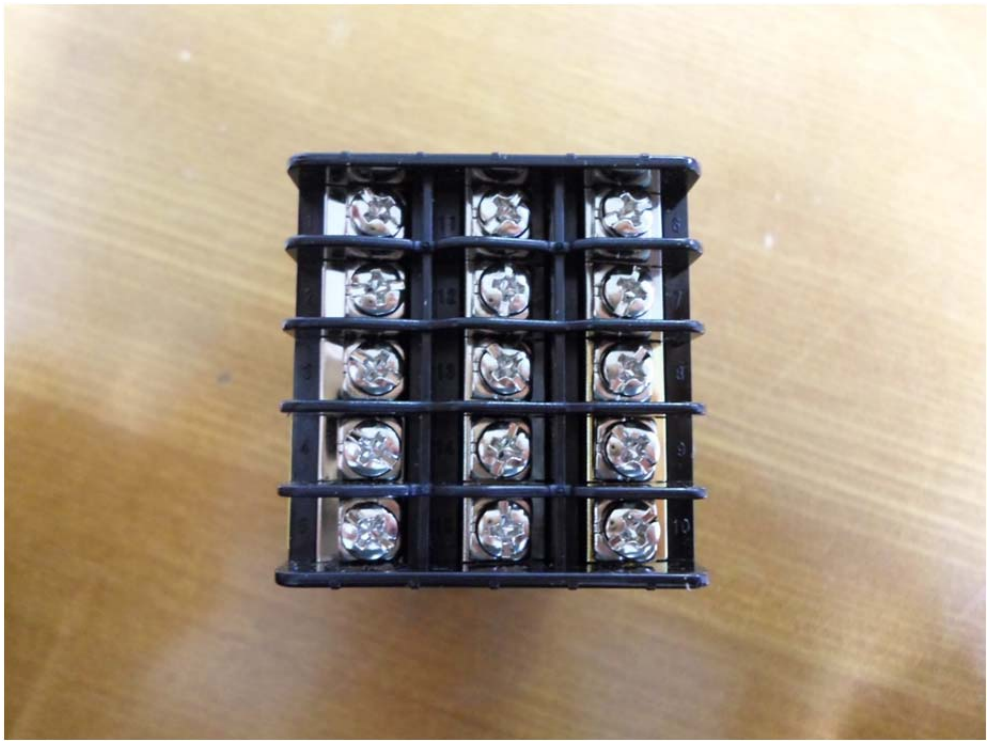


7.0 PHOTOGRAPHS OF EUT

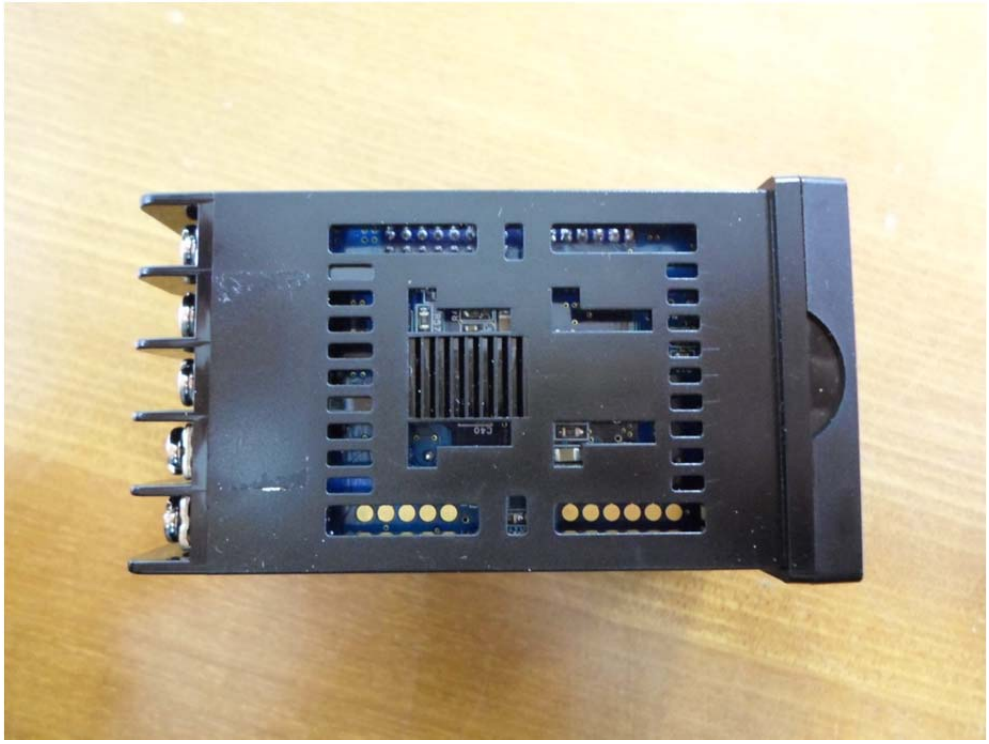
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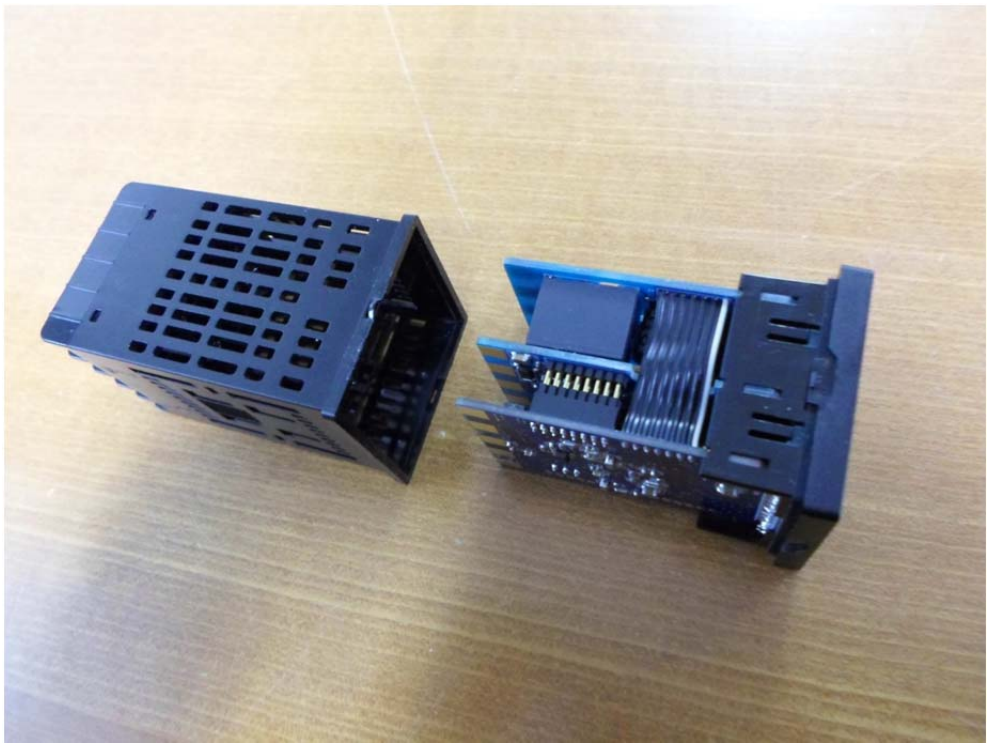
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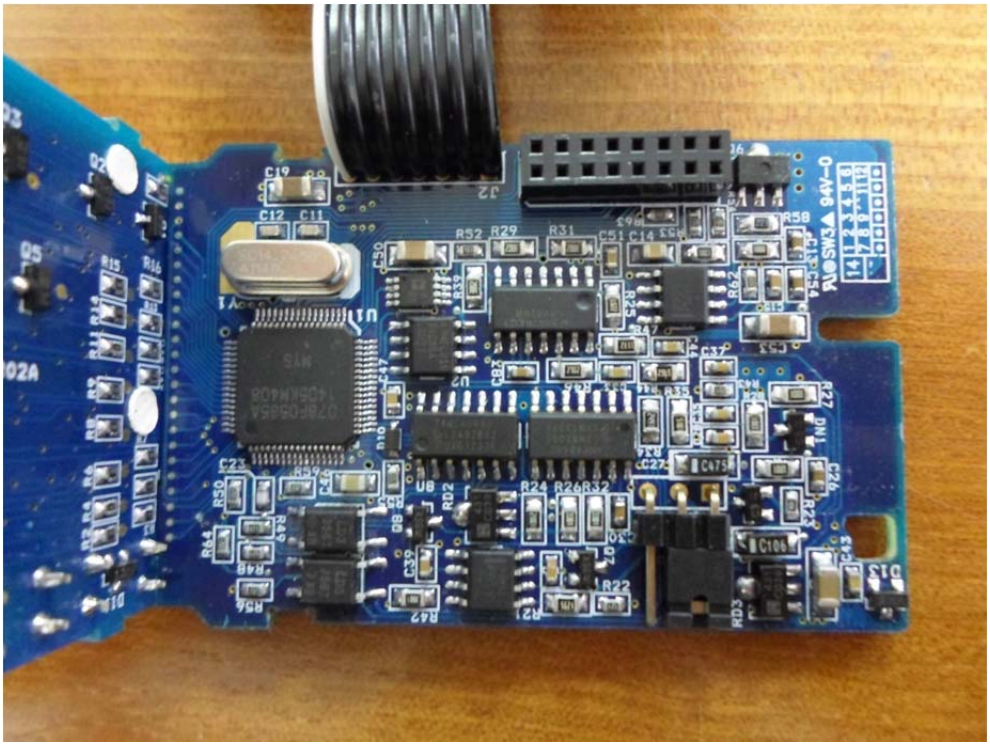
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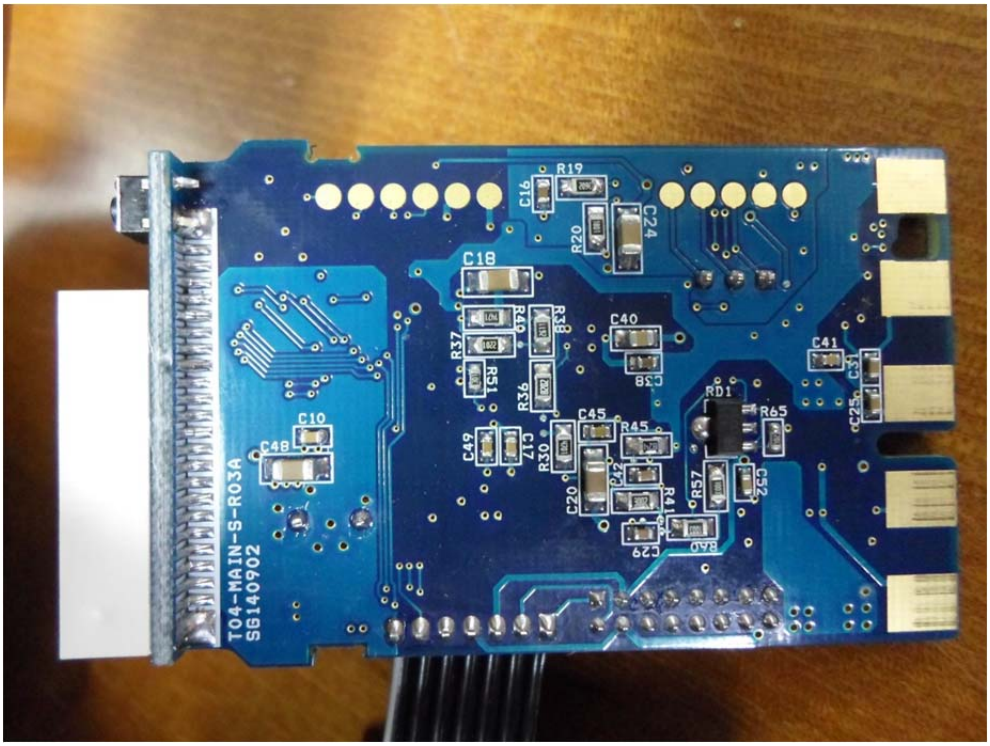
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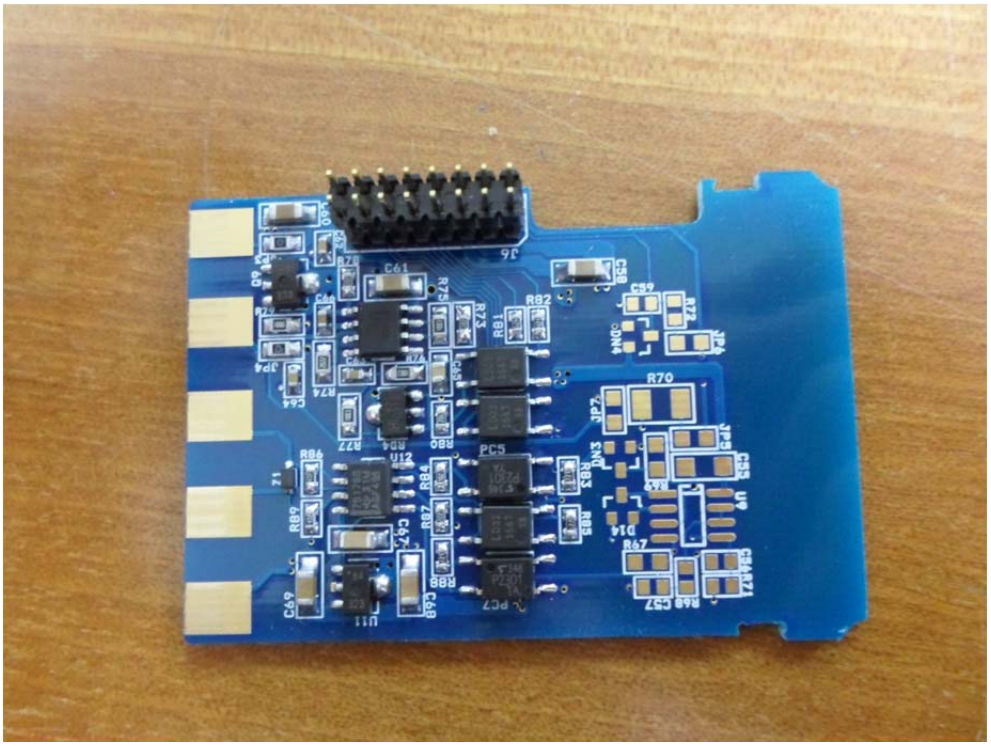
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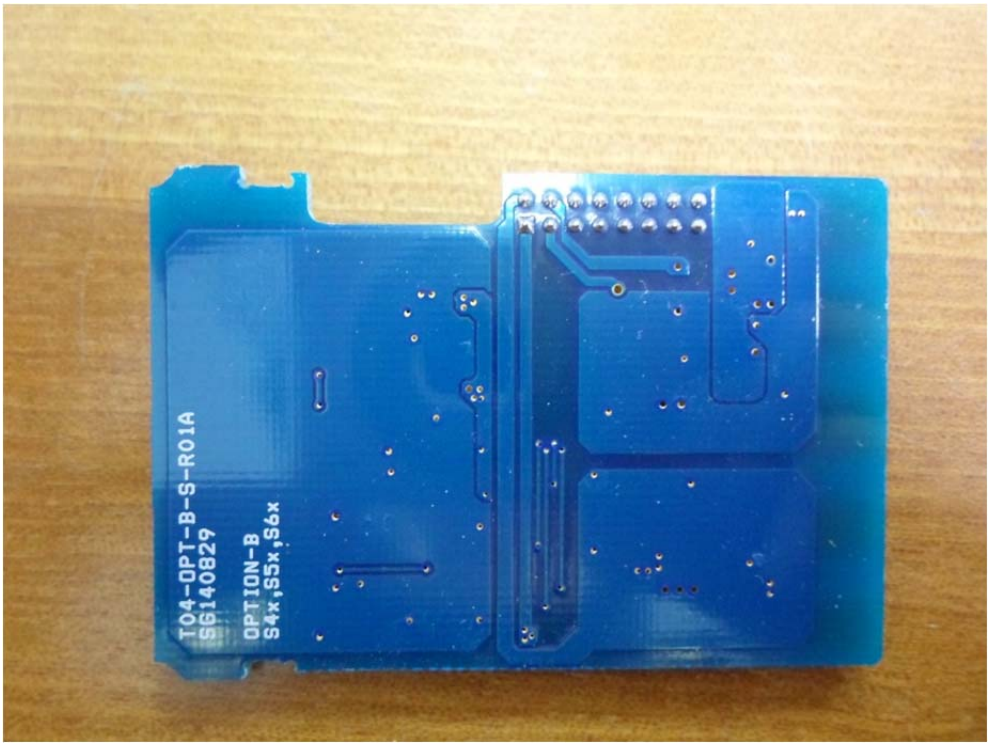
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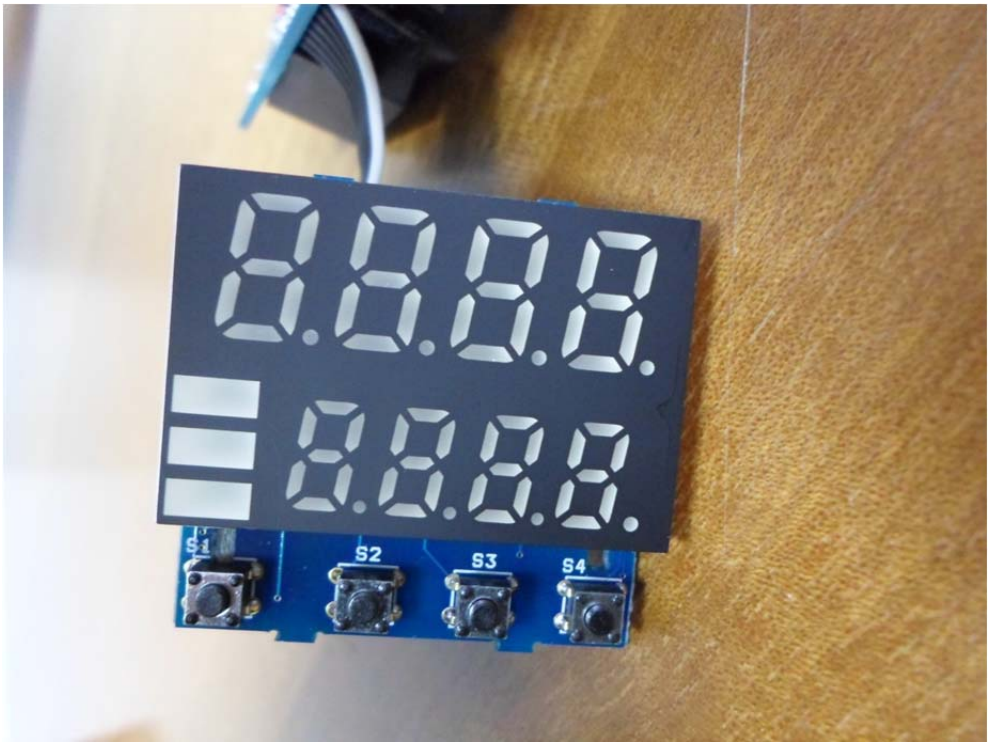
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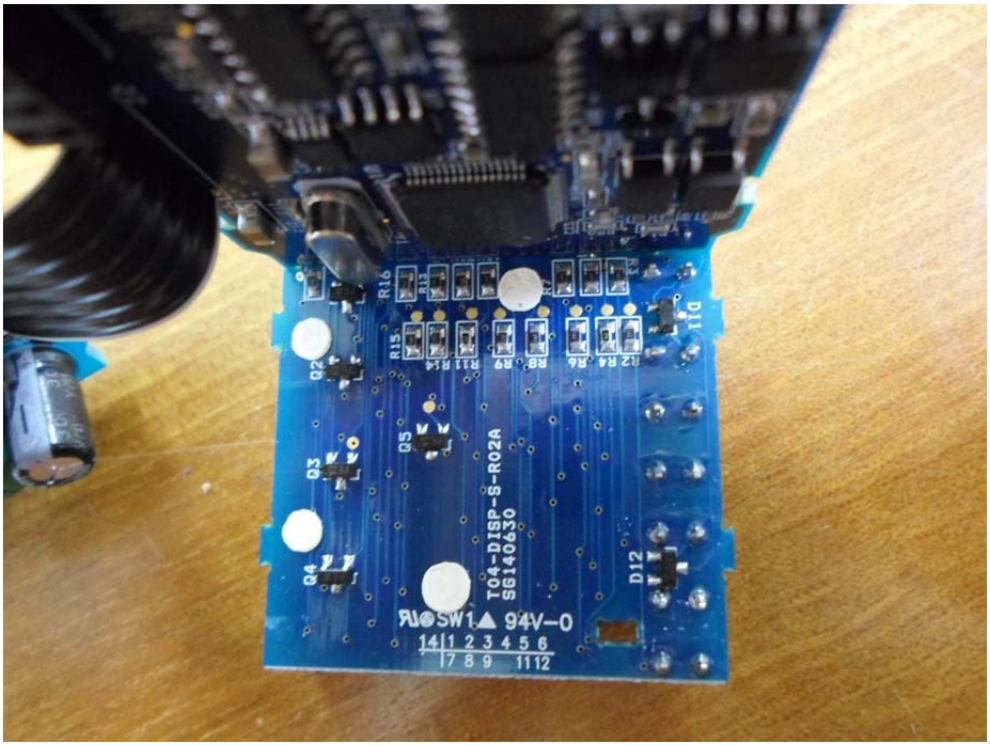
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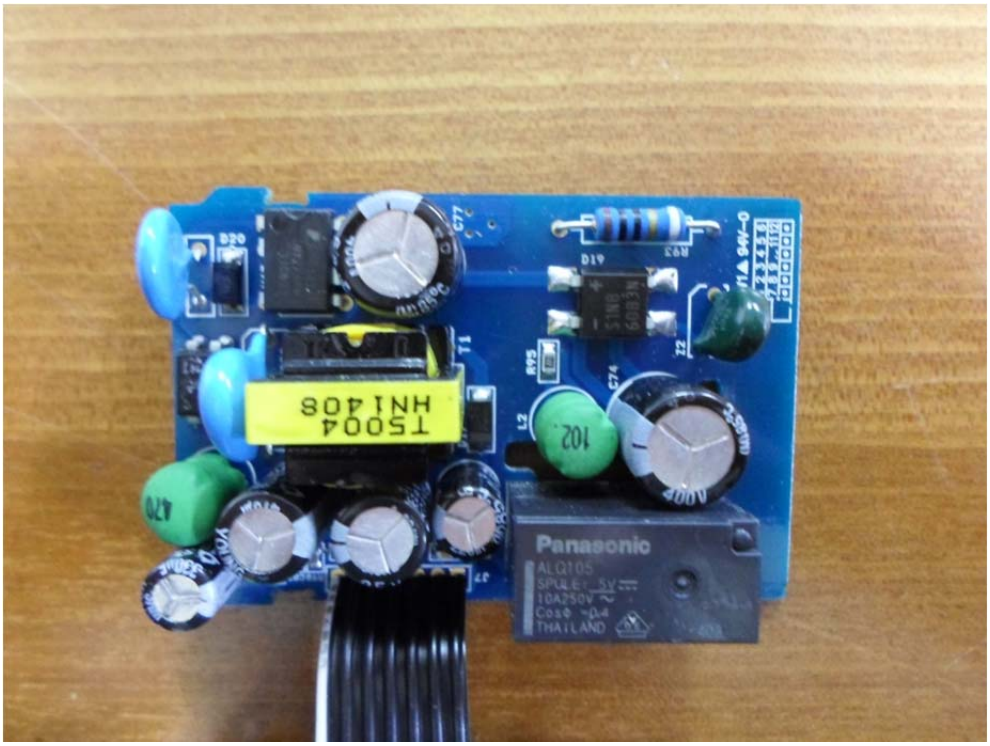
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< Bottom of DISPLAY board >



< Top of Power board>



< Bottom of Power board >

