CE EMC Test Report

Report No.:	CE170612D26A-1
Test Model:	TMPS 10-103, TMPS 10-112, TMPS 10-148
Series Model:	TMPS 10-103, TMPS 10-105, TMPS 10-109, TMPS 10-112, TMPS 10-115, TMPS 10-124, TMPS 10-148
Received Date:	Jun. 12, 2017
Test Date:	Jul. 28 ~ Aug. 4, 2017 & Mar. 5, 2018
Issued Date:	Mar. 5, 2018
Applicant:	TRACO ELECTRONIC AG
Address:	SIHLBRUGGSTRASSE 111 CH-6340 BAAR, SWITZERLAND
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)

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Release Control Record

Issue No.	Description	Date Issued
CE170612D26A-1	Original release.	Mar. 5, 2018

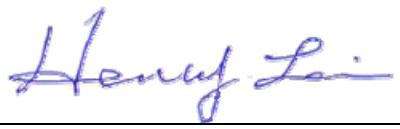
1 Certificate of Conformity

Product:	AC to DC Converter
Brand:	TRACO
Test Model:	TMPS 10-103, TMPS 10-112, TMPS 10-148
Series Model:	TMPS 10-103, TMPS 10-105, TMPS 10-109, TMPS 10-112, TMPS 10-115, TMPS 10-124, TMPS 10-148
Sample Status:	Engineering sample
Applicant:	TRACO ELECTRONIC AG
Test Date:	Jul. 28 ~ Aug. 4, 2017 & Mar. 5, 2018
Standards:	**EN 55014-1:2006+A1:2009+A2:2011**
	EN 61000-3-2:2014
	EN 61000-3-3:2013
	EN 55014-2:2015 (Category II)
	IEC 61000-4-2:2008 ED.2.0
	IEC 61000-4-4:2012 ED.3.0
	IEC 61000-4-5:2014 ED.3.0
	IEC 61000-4-6:2013 ED.4.0
	IEC 61000-4-11:2004 ED.2.0

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :  , **Date:** Mar. 5, 2018

Sandra Lin / Specialist

Approved by :  , **Date:** Mar. 5, 2018

Henry Lai / Director

2 Summary of Test Results

Emission			
Standard	Test Item	Result/Remarks	Verdict
EN 55014-1:2006 +A1:2009 +A2:2011	Terminal Continuous Disturbance Voltage Emission Test	Meets Requirement Limit margin is -2.00dB at 0.88047MHz	Pass
	Terminal Discontinuous Disturbance Voltage Emission Test	The EUT did not generate the discontinuous disturbance.	N/A
	Radiated Disturbance Emission Test (30MHz ~ 1GHz)	Meets Requirement Limit margin is -2.70dB at 175.11MHz	Pass
EN 61000-3-2:2014	Harmonic current emissions	The power consumption of EUT is less than 75W and no limits apply	Pass
EN 61000-3-3:2013	Voltage fluctuations and flicker	Pst ≦ 1.0 dmax ≦ 4% Plt ≦ 0.65 dc ≦ 3.3% Tmax ≦ 500ms	Pass

Immunity			
Basic standard	Test Item	Result/Remarks	Verdict
IEC 61000-4-2:2008 ED.2.0	Electrostatic discharge immunity test	Performance Criterion A	Pass
IEC 61000-4-4:2012 ED.3.0	Electrical fast transient / burst immunity test.	Performance Criterion A	Pass
IEC 61000-4-5:2014 ED.3.0	Surge immunity test	Performance Criterion A	Pass
IEC 61000-4-6:2013 ED.4.0	Immunity to conducted disturbances, induced by radio-frequency fields	Performance Criterion A	Pass
IEC 61000-4-11:2004 ED.2.0	Voltage dips, short interruptions and voltage variations immunity tests	Voltage dips and interruption: 0% UT – Performance Criterion A 40% UT – Performance Criterion B 30% UT – Performance Criterion A **<Addition Test>** 70% UT – Performance Criterion A	Pass

Notes:

1. The above IEC basic standards are applied with latest version if customer has no special requirement.
2. The EUT met the following mains operated appliance.
   a) The absorbing clamp measurement from 200MHz to 300MHz met the margin limits.
   b) The highest clock frequency generated from EUT was 100kHz, which was less than 30MHz.
3. N/A: Not Applicable

2.1 Measurement Uncertainty

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

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Expanded Uncertainty (k=2) (±)
Terminal Continuous Disturbance Voltage emissions	2.77 dB
Radiated Disturbance emissions	3.89 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 Features of EUT

The tests reported herein were performed according to the method specified by TRACO ELECTRONIC AG, for detailed feature description, please refer to the manufacturer's specifications or user's manual.

3.2 General Description of EUT

Product	AC to DC Converter
Brand	TRACO
Test Model	TMPS 10-103, TMPS 10-112, TMPS 10-148
Series Model	TMPS 10-103, TMPS 10-105, TMPS 10-109, TMPS 10-112, TMPS 10-115, TMPS 10-124, TMPS 10-148
Model Difference	Refer to note as below
Sample Status	Engineering sample
Operating Software	N/A
Power Supply Rating	Refer to note as below
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

The EUT is an AC to DC Converter, the specifications of standard models were listed as below:

Model Selection Guide		
Model Number	Input Voltage	Output Voltage
		VDC
TMPS 10-103	115VAC, 60Hz 230VAC, 50Hz	3.3
TMPS 10-105		5
TMPS 10-109		9
TMPS 10-112		12
TMPS 10-115		15
TMPS 10-124		24
TMPS 10-148		48

During the test, the Model No.: **TMPS 10-103, TMPS 10-112, TMPS 10-148** were selected as the representative one for the test and therefore only its test data were recorded in this report.

3.3 Operating Modes of EUT and Determination of Worst Case Operating Mode

1. The EUT was adjusted mains voltage 207V-253V (230V +/- 10%) to survey the worst emission level of 160kHz for Conducted test and 50MHz for Disturbance Power Emission Test. And after pretest, the worst emission was found in **230V** input voltage.
2. As client's requirement, test modes are presented in the report as below.

Mode	Model No.	Test Condition	Input power
Conducted emission test			
1	TMPS 10-103	With Load	230Vac/ 50Hz
2	TMPS 10-112		
3	TMPS 10-148		
Radiated emission test			
1	TMPS 10-103	With Load	230Vac/ 50Hz
2	TMPS 10-112		
3	TMPS 10-148		
Immunity tests			
2	TMPS 10-112	With Load	230Vac/ 50Hz

3.4 Test Program Used and Operation Descriptions

- **For Conducted & Radiated tests:**
  Set the EUT with load.
- **For Harmonics, Flicker tests:**
  Connected a resistor load to DC output port of EUT to make EUT have maximum power consumption.
- **For Immunity tests:**
  Connected a resistor load to DC output port of EUT to make EUT have maximum power consumption and a multimeter was used to monitor voltage of output.

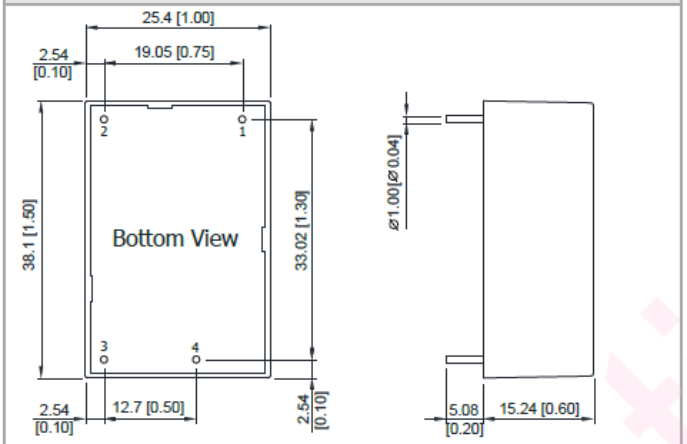
3.5 Primary Clock Frequencies of Internal Source

The highest frequency generated or used within the EUT or on which the EUT operates or tunes is 50kHz, provided by TRACO ELECTRONIC AG, for detailed internal source, please refer to the manufacturer's specifications.

3.6 Package Specifications by Manufacturer

Package Specifications

Mechanical Dimensions



Pin Connections

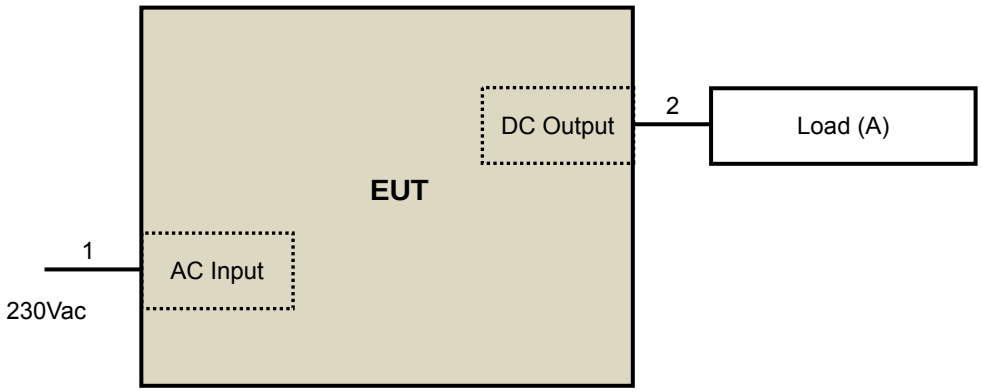
Pin	Function
1	AC(N)
2	AC(L)
3	-Vout
4	+Vout

- All dimensions in mm (inches)
- Tolerance: ±0.5 (±0.01)
- Pin diameter Ø 1.0 ±0.1 (0.02±0.004)

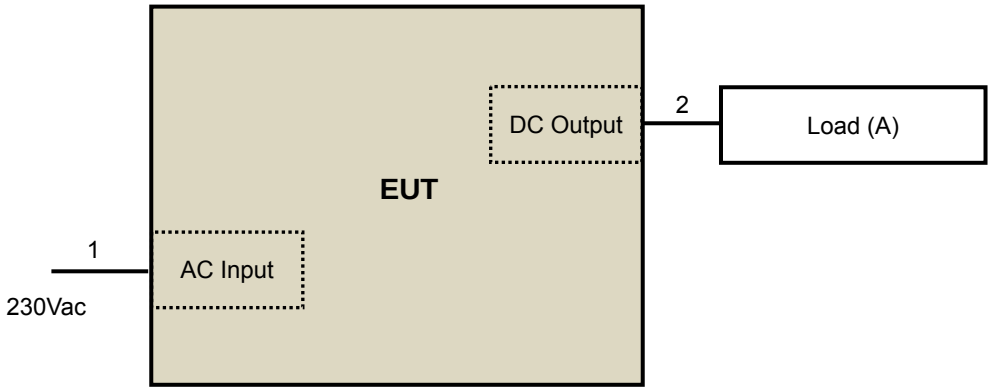
4 Configuration and Connections with EUT

4.1 Connection Diagram of EUT and Peripheral Devices

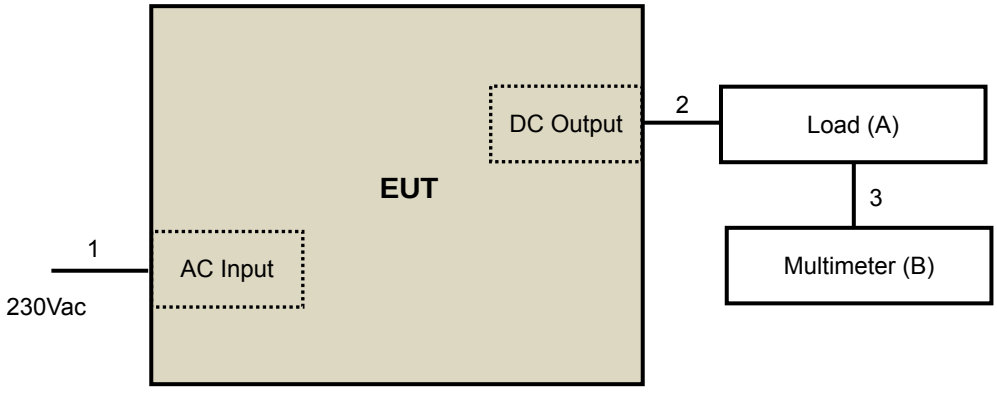
Emission tests (Harmonics & Flicker excluded):



Harmonics, Flicker tests:



Immunity tests:



4.2 Configuration of Peripheral Devices and Cable Connections

Emission tests (Harmonics & Flicker excluded):

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	DUMMY LOAD	N/A	N/A	N/A	N/A	Supplied by client

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	AC power cable	1	1.0	N	0	Provided by Lab
2.	DC cable	1	0.05	N	0	Supplied by clie

Note: The core(s) is(are) originally attached to the cable(s).

Harmonics, Flicker & Immunity tests:

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	DUMMY LOAD	N/A	N/A	N/A	N/A	Supplied by client
B.	Multimeter	YFE	YF-370A	N/A	N/A	Provided by Lab

Note: All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	AC power cable	1	1.0	N	0	Provided by Lab
2.	DC cable	1	0.05	N	0	Supplied by clie
3.	Data cable	1	1.0	N	0	Provided by Lab

Note: The core(s) is(are) originally attached to the cable(s).

5 Terminal Continuous Disturbance Voltage Emission Measurement

5.1 Limits

TEST STANDARD: EN 55014-1

HOUSEHOLD APPLIANCES AND EQUIPMENT CAUSING SIMILAR DISTURBANCES AND REGULATING CONTROLS INCORPORATING SEMICONDUCTOR DEVICES				
Frequency range	At mains terminals		At load terminals and at additional terminals	
1	2	3	4	5
MHz	dB (μV) Quasi-peak	dB (μV) Average	dB (μV) Quasi-peak	dB (μV) Average
0.15 to 0.50	Decreasing linearly with the logarithm of the frequency from: 66 to 56	59 to 46	80	70
0.50 to 5	56	46	74	64
5 to 30	60	50	74	64

MAIN TERMINALS OF TOOLS						
1	6	7	8	9	10	11
Frequency range	Rated motor power not exceeding 700 W		Rated motor power above 700 W and not exceeding 1000w		Rated motor power above 1000w	
MHz	dB (μV) Quasi-peak	dB (μV) Average	dB (μV) Quasi-peak	dB (μV) Average	dB (μV) Quasi-peak	dB (μV) Average
0.15 to 0.35	Decreasing Linearly with the logarithm of the frequency from					
	66 to 59	59 to 49	70 to 63	63 to 53	76 to 69	69 to 59
0.35 to 5	59	49	63	53	69	59
5 to 30	64	54	68	58	74	64

Note: The limits for the measurement with the average detector are tentative and may be modified after a period of experience.
If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not to be carried out.

5.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100290	Dec. 26, 2016	Dec. 25, 2017
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH2-Z5	100104	Dec. 01, 2016	Nov. 30, 2017
LISN With Adapter (for EUT)	AD10	C09Ada-001	Dec. 01, 2016	Nov. 30, 2017
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	847265/023	Oct. 27, 2016	Oct. 26, 2017
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 09, 2017	May 08, 2018
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C09.01	Feb. 21, 2017	Feb. 20, 2018
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010789	May 18, 2017	May 17, 2018
ROHDE & SCHWARZ Artificial Mains Network (For TV EUT)	ESH3-Z5	100220	Nov. 08, 2016	Nov. 07, 2017
LISN With Adapter (for TV EUT)	100220	N/A	Nov. 08, 2016	Nov. 07, 2017

Notes:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. 9.
3. The VCCI Site Registration No. C-1312.
4. Tested Date: Jul. 28, 2017

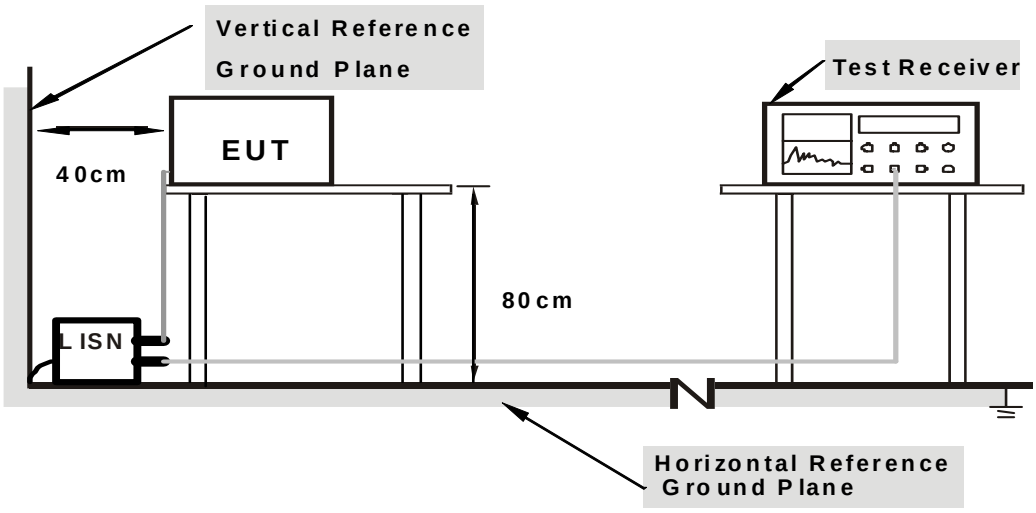
5.3 Test Arrangement

a. The EUT was placed 0.4 meters 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 Ohm/ 50uH 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 test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

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

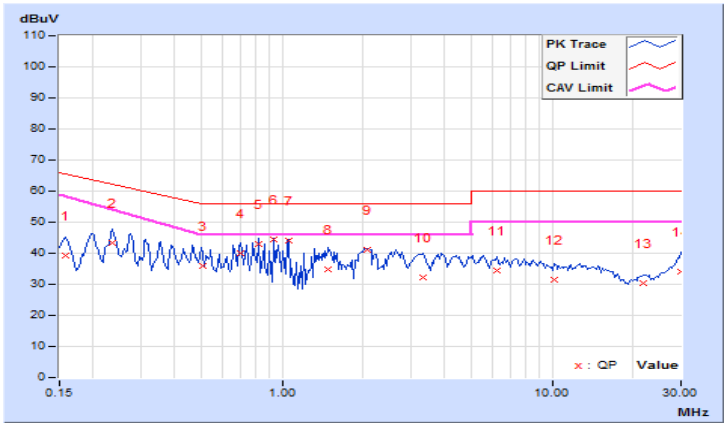
5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	26℃, 73%RH
Tested by	ED. Lin		
Test Mode	Mode 1		

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	10.08	29.28	20.84	39.36	30.92	65.58	58.45	-26.22	-27.53
2	0.23594	10.12	33.20	30.58	43.32	40.70	62.24	54.11	-18.92	-13.41
3	0.50801	10.20	25.87	17.08	36.07	27.28	56.00	46.00	-19.93	-18.72
4	0.70078	10.22	29.93	25.68	40.15	35.90	56.00	46.00	-15.85	-10.10
5	0.81797	10.23	32.86	30.56	43.09	40.79	56.00	46.00	-12.91	-5.21
6	0.93516	10.24	34.36	31.80	44.60	42.04	56.00	46.00	-11.40	-3.96
7	1.05469	10.26	33.75	30.41	44.01	40.67	56.00	46.00	-11.99	-5.33
8	1.48438	10.32	24.60	18.05	34.92	28.37	56.00	46.00	-21.08	-17.63
9	2.06641	10.40	30.64	27.71	41.04	38.11	56.00	46.00	-14.96	-7.89
10	3.31641	10.50	21.76	14.40	32.26	24.90	56.00	46.00	-23.74	-21.10
11	6.22266	10.62	23.81	16.34	34.43	26.96	60.00	50.00	-25.57	-23.04
12	10.23047	10.73	20.90	16.00	31.63	26.73	60.00	50.00	-28.37	-23.27
13	21.80469	11.11	19.38	13.19	30.49	24.30	60.00	50.00	-29.51	-25.70
14	29.99998	11.12	22.88	16.20	34.00	27.32	60.00	50.00	-26.00	-22.68

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

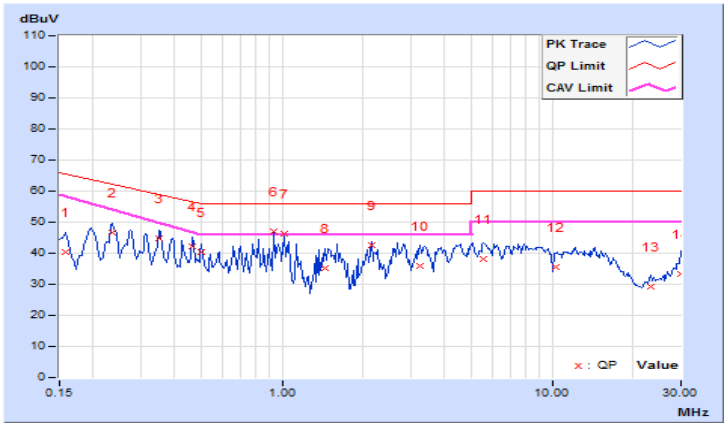


Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	26℃, 73%RH
Tested by	ED. Lin		
Test Mode	Mode 1		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15781	10.09	30.30	23.90	40.39	33.99	65.58	58.45	-25.19	-24.46
2	0.23594	10.06	36.72	34.13	46.78	44.19	62.24	54.11	-15.46	-9.92
3	0.35177	10.13	34.86	31.70	44.99	41.83	58.92	49.80	-13.93	-7.97
4	0.46641	10.18	31.97	25.52	42.15	35.70	56.58	46.75	-14.43	-11.05
5	0.50512	10.19	30.36	21.84	40.55	32.03	56.00	46.00	-15.45	-13.97
6	0.93516	10.33	36.78	33.62	47.11	43.95	56.00	46.00	-8.89	-2.05
7	1.01435	10.35	36.10	33.64	46.45	43.99	56.00	46.00	-9.55	-2.01
8	1.44141	10.33	24.72	17.67	35.05	28.00	56.00	46.00	-20.95	-18.00
9	2.14453	10.31	32.29	27.71	42.60	38.02	56.00	46.00	-13.40	-7.98
10	3.24709	10.42	25.62	20.20	36.04	30.62	56.00	46.00	-19.96	-15.38
11	5.58594	10.54	27.70	19.76	38.24	30.30	60.00	50.00	-21.76	-19.70
12	10.37891	10.69	25.00	19.06	35.69	29.75	60.00	50.00	-24.31	-20.25
13	23.16406	10.72	18.57	10.86	29.29	21.58	60.00	50.00	-30.71	-28.42
14	29.99999	10.43	23.04	16.34	33.47	26.77	60.00	50.00	-26.53	-23.23

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

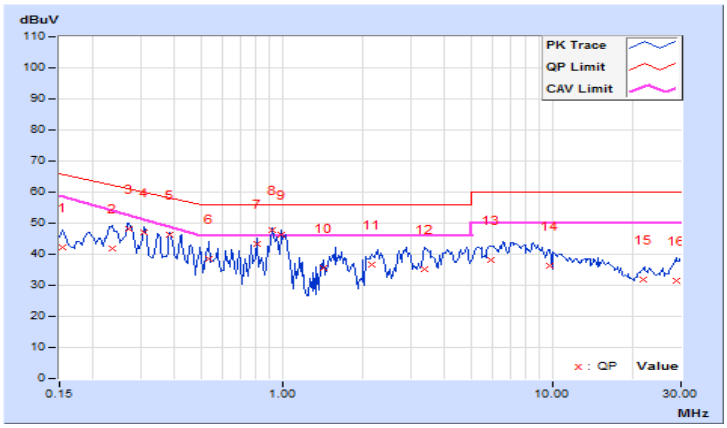


Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	26℃, 73%RH
Tested by	ED. Lin		
Test Mode	Mode 2		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15391	10.08	32.26	25.60	42.34	35.68	65.79	58.72	-23.45	-23.04
2	0.23594	10.12	31.72	25.69	41.84	35.81	62.24	54.11	-20.40	-18.30
3	0.27101	10.14	38.13	33.20	48.27	43.34	61.09	52.61	-12.82	-9.27
4	0.31007	10.15	36.76	32.35	46.91	42.50	59.97	51.16	-13.06	-8.66
5	0.38438	10.18	36.17	32.29	46.35	42.47	58.18	48.84	-11.83	-6.37
6	0.53672	10.20	28.14	20.34	38.34	30.54	56.00	46.00	-17.66	-15.46
7	0.80625	10.23	33.28	30.58	43.51	40.81	56.00	46.00	-12.49	-5.19
8	0.91953	10.24	37.65	33.73	47.89	43.97	56.00	46.00	-8.11	-2.03
9	0.99766	10.25	36.09	31.78	46.34	42.03	56.00	46.00	-9.66	-3.97
10	1.41797	10.31	25.08	19.40	35.39	29.71	56.00	46.00	-20.61	-16.29
11	2.13716	10.40	26.44	22.25	36.84	32.65	56.00	46.00	-19.16	-13.35
12	3.37500	10.51	24.58	19.02	35.09	29.53	56.00	46.00	-20.91	-16.47
13	5.92969	10.61	27.52	20.85	38.13	31.46	60.00	50.00	-21.87	-18.54
14	9.81250	10.72	25.48	20.93	36.20	31.65	60.00	50.00	-23.80	-18.35
15	21.82422	11.11	20.64	13.73	31.75	24.84	60.00	50.00	-28.25	-25.16
16	28.82422	11.12	20.31	16.08	31.43	27.20	60.00	50.00	-28.57	-22.80

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

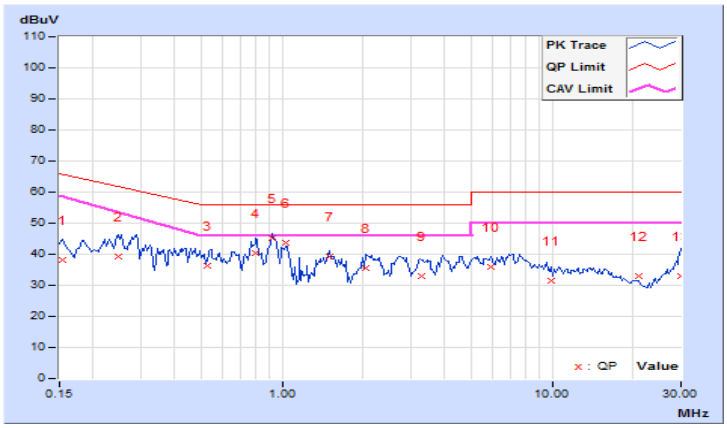


Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	26℃, 73%RH
Tested by	ED. Lin		
Test Mode	Mode 2		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15391	10.10	28.16	20.55	38.26	30.65	65.79	58.72	-27.53	-28.07
2	0.24766	10.07	29.06	23.01	39.13	33.08	61.84	53.59	-22.71	-20.51
3	0.53048	10.20	26.05	20.23	36.25	30.43	56.00	46.00	-19.75	-15.57
4	0.80234	10.29	30.17	26.08	40.46	36.37	56.00	46.00	-15.54	-9.63
5	0.92080	10.32	34.82	31.76	45.14	42.08	56.00	46.00	-10.86	-3.92
6	1.03807	10.35	33.48	29.44	43.83	39.79	56.00	46.00	-12.17	-6.21
7	1.50000	10.33	28.90	24.38	39.23	34.71	56.00	46.00	-16.77	-11.29
8	2.03906	10.30	25.34	19.16	35.64	29.46	56.00	46.00	-20.36	-16.54
9	3.28125	10.42	22.39	14.88	32.81	25.30	56.00	46.00	-23.19	-20.70
10	5.89844	10.55	25.34	18.82	35.89	29.37	60.00	50.00	-24.11	-20.63
11	9.91406	10.69	20.90	15.56	31.59	26.25	60.00	50.00	-28.41	-23.75
12	20.97656	10.80	22.07	15.40	32.87	26.20	60.00	50.00	-27.13	-23.80
13	30.00000	10.43	22.67	16.34	33.10	26.77	60.00	50.00	-26.90	-23.23

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

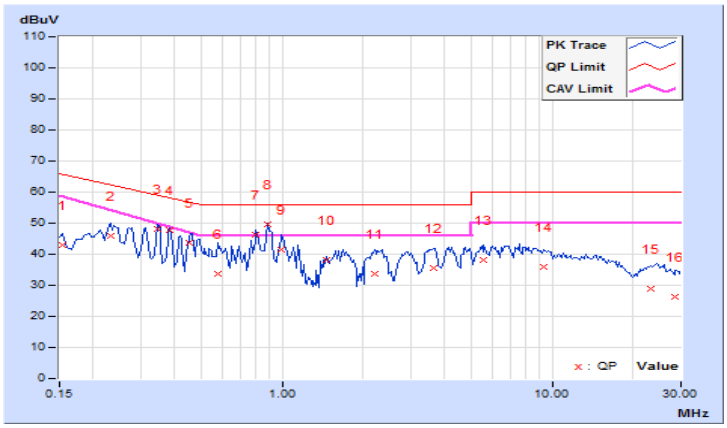


Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	26℃, 73%RH
Tested by	ED. Lin		
Test Mode	Mode 3		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15391	10.08	32.83	26.62	42.91	36.70	65.79	58.72	-22.88	-22.02
2	0.23203	10.12	35.79	30.76	45.91	40.88	62.38	54.29	-16.47	-13.41
3	0.34531	10.17	38.07	34.60	48.24	44.77	59.07	50.00	-10.83	-5.23
4	0.38175	10.18	37.44	33.88	47.62	44.06	58.24	48.91	-10.62	-4.85
5	0.45487	10.20	33.66	29.57	43.86	39.77	56.79	47.02	-12.93	-7.25
6	0.57578	10.21	23.50	15.20	33.71	25.41	56.00	46.00	-22.29	-20.59
7	0.80090	10.23	36.05	33.01	46.28	43.24	56.00	46.00	-9.72	-2.76
8	**0.88047**	**10.24**	**39.51**	**33.76**	**49.75**	**44.00**	**56.00**	**46.00**	**-6.25**	**-2.00**
9	0.99766	10.25	31.20	25.16	41.45	35.41	56.00	46.00	-14.55	-10.59
10	1.45703	10.31	27.98	22.11	38.29	32.42	56.00	46.00	-17.71	-13.58
11	2.19531	10.41	23.28	17.29	33.69	27.70	56.00	46.00	-22.31	-18.30
12	3.62109	10.53	24.95	19.14	35.48	29.67	56.00	46.00	-20.52	-16.33
13	5.58203	10.60	27.61	21.38	38.21	31.98	60.00	50.00	-21.79	-18.02
14	9.25000	10.70	25.35	19.10	36.05	29.80	60.00	50.00	-23.95	-20.20
15	23.09766	11.11	17.69	10.30	28.80	21.41	60.00	50.00	-31.20	-28.59
16	28.64063	11.12	15.24	7.81	26.36	18.93	60.00	50.00	-33.64	-31.07

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

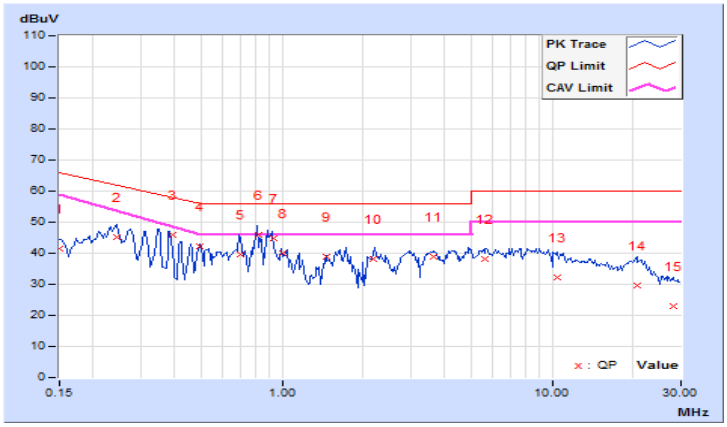


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	26℃, 73%RH
Tested by	ED. Lin		
Test Mode	Mode 3		

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15001	10.10	31.34	22.73	41.44	32.83	66.00	59.00	-24.56	-26.17
2	0.24375	10.07	35.14	28.72	45.21	38.79	61.97	53.76	-16.76	-14.97
3	0.39200	10.16	35.77	31.52	45.93	41.68	58.02	48.63	-12.09	-6.95
4	0.49894	10.19	32.17	27.23	42.36	37.42	56.02	46.02	-13.66	-8.60
5	0.70304	10.26	29.47	23.40	39.73	33.66	56.00	46.00	-16.27	-12.34
6	0.81779	10.29	35.73	32.59	46.02	42.88	56.00	46.00	-9.98	-3.12
7	0.93215	10.33	34.40	31.32	44.73	41.65	56.00	46.00	-11.27	-4.35
8	1.00265	10.35	29.60	24.16	39.95	34.51	56.00	46.00	-16.05	-11.49
9	1.46720	10.33	28.41	23.25	38.74	33.58	56.00	46.00	-17.26	-12.42
10	2.16931	10.32	27.81	24.04	38.13	34.36	56.00	46.00	-17.87	-11.64
11	3.64844	10.46	28.43	22.19	38.89	32.65	56.00	46.00	-17.11	-13.35
12	5.66406	10.55	27.49	22.09	38.04	32.64	60.00	50.00	-21.96	-17.36
13	10.43359	10.69	21.50	16.00	32.19	26.69	60.00	50.00	-27.81	-23.31
14	20.78906	10.81	18.66	12.59	29.47	23.40	60.00	50.00	-30.53	-26.60
15	28.03516	10.51	12.54	4.78	23.05	15.29	60.00	50.00	-36.95	-34.71

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



6 Radiated disturbance Emission Measurement

6.1 Limits

TEST STANDARD: CISPER 16-2-3
FOR FREQUENCY RANGE 30-1000 MHz

Testing method	Standard	FREQUENCY range (MHz)	Limit dBuV/m	Remark
OATS(1) or SAC (2)(3)	CISPR 16-2-3	30 – 230	30	Measurement distance 10 m
		230 – 300	37	
		300-1000	37	

Note: The lower limit is applicable at the transition frequency.
(1) OATS=open area test site
(2) SAC=semi-anechoic chamber
(3) Measurements may be made at closer distance, down to 3m. an inverse proportionality factor of 20dB per decade shall be used to normalize the measured data to the specified distance for determining compliance.

6.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCI	100412	Sep. 05, 2016	Sep. 04, 2017
Schwarzbeck BILOG Antenna	VULB9168	9168-479	Dec. 16, 2016	Dec. 15, 2017
Agilent Preamplifier	8447D	2944A08312	Feb. 21, 2017	Feb. 20, 2018
CT Turn Table	TT100	CT-0055	NA	NA
CT Tower	AT100	CT-0055	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
ADT RF Switches BOX	EM-H-01-1	1002	Sep. 22 2016	Sep. 21, 2017
WOKEN RF cable With 5dB PAD	8D	CABLE-ST6-01	Sep. 22 2016	Sep. 21, 2017

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Open Site No. 6.
3. The VCCI Site Registration No. R-728.
4. Tested Date: Jul. 28, 2017

6.3 Test Arrangement

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.

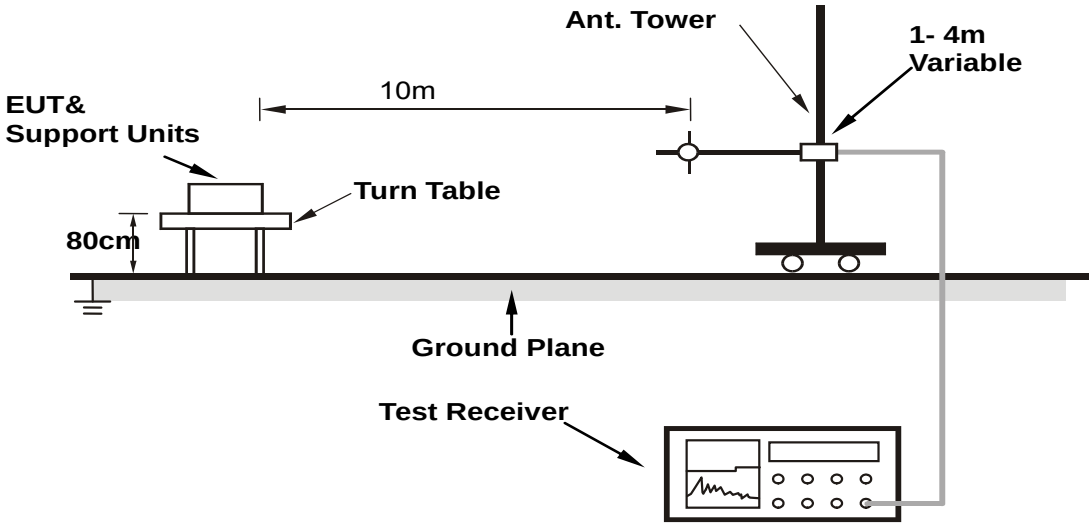
b. The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn 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.

NOTE: The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.



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

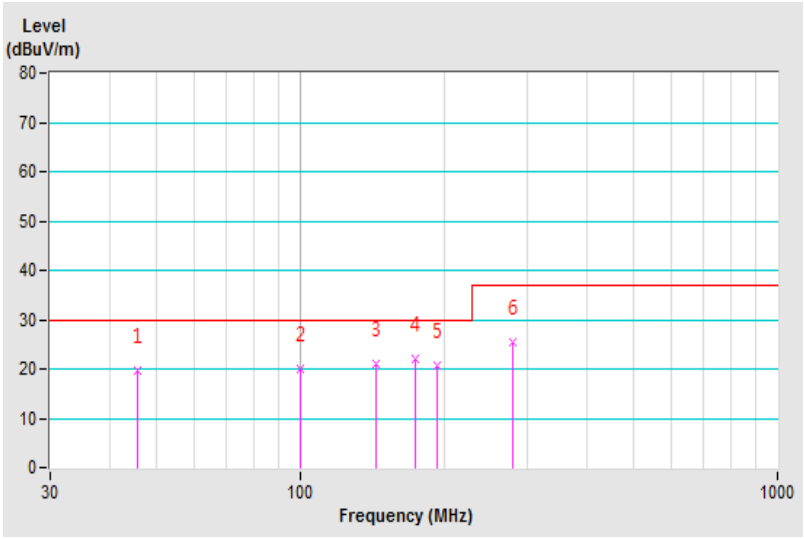
6.4 Test Results

Frequency Range	30MHz ~ 1GHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	30℃, 60%RH
Tested by	Vincent Lin		
Test Mode	Mode 1		

Antenna Polarity & Test Distance : Horizontal at 10 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	45.60	19.64 QP	30.00	-10.36	4.00 H	320	29.23	-9.59
2	100.15	19.93 QP	30.00	-10.07	4.00 H	208	33.86	-13.93
3	144.30	21.03 QP	30.00	-8.97	4.00 H	90	30.11	-9.08
4	174.19	22.04 QP	30.00	-7.96	4.00 H	18	31.78	-9.74
5	194.02	20.59 QP	30.00	-9.41	4.00 H	24	32.21	-11.62
6	279.31	25.35 QP	37.00	-11.65	4.00 H	174	33.24	-7.89

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

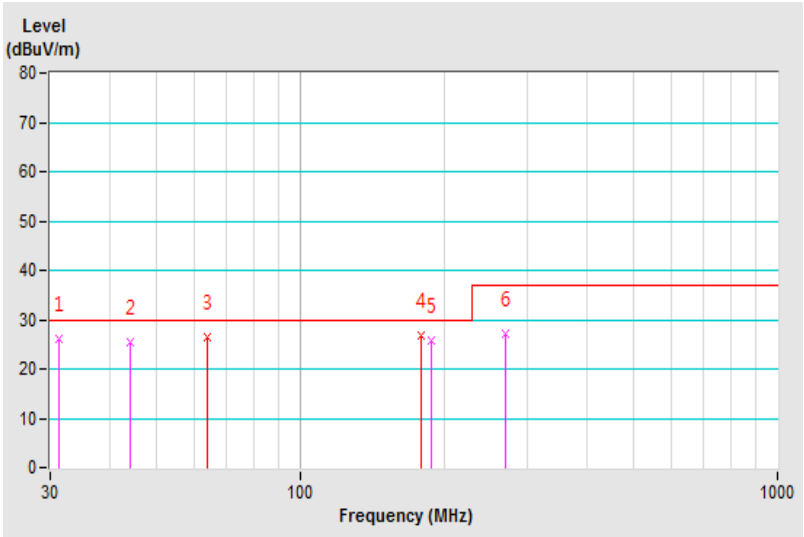


Frequency Range	30MHz ~ 1GHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	30℃, 60%RH
Tested by	Vincent Lin		
Test Mode	Mode 1		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	31.37	25.95 QP	30.00	-4.05	1.00 V	354	37.08	-11.13
2	44.24	25.59 QP	30.00	-4.41	1.00 V	326	35.18	-9.59
3	63.93	26.36 QP	30.00	-3.64	1.00 V	236	36.66	-10.30
4	178.77	26.89 QP	30.00	-3.11	1.00 V	152	37.14	-10.25
5	188.21	25.71 QP	30.00	-4.29	1.00 V	51	36.95	-11.24
6	270.26	27.22 QP	37.00	-9.78	1.00 V	144	35.52	-8.30

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

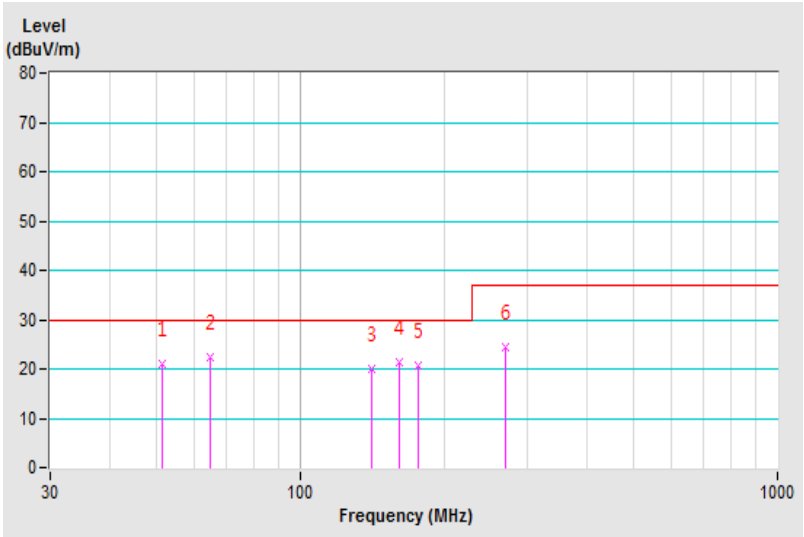


Frequency Range	30MHz ~ 1GHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	30℃, 60%RH
Tested by	Vincent Lin		
Test Mode	Mode 2		

Antenna Polarity & Test Distance : Horizontal at 10 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	51.32	21.08 QP	30.00	-8.92	4.00 H	232	30.63	-9.55
2	64.80	22.47 QP	30.00	-7.53	4.00 H	187	33.04	-10.57
3	141.60	19.84 QP	30.00	-10.16	4.00 H	156	29.19	-9.35
4	162.04	21.27 QP	30.00	-8.73	4.00 H	189	30.21	-8.94
5	177.37	20.52 QP	30.00	-9.48	4.00 H	87	30.64	-10.12
6	270.08	24.57 QP	37.00	-12.43	4.00 H	229	32.88	-8.31

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

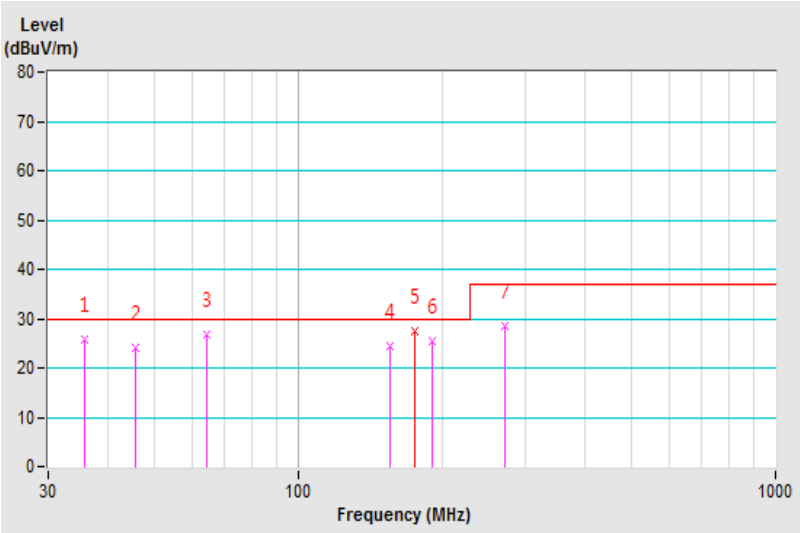


Frequency Range	30MHz ~ 1GHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	30℃, 60%RH
Tested by	Vincent Lin		
Test Mode	Mode 2		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	35.80	25.76 QP	30.00	-4.24	1.00 V	171	36.52	-10.76
2	45.66	24.19 QP	30.00	-5.81	1.00 V	103	33.78	-9.59
3	64.51	26.68 QP	30.00	-3.32	1.22 V	211	37.15	-10.47
4	155.59	24.51 QP	30.00	-5.49	1.00 V	276	33.38	-8.87
5	**175.11**	**27.30 QP**	**30.00**	**-2.70**	**1.00 V**	**324**	**37.18**	**-9.88**
6	190.66	25.39 QP	30.00	-4.61	1.00 V	329	36.80	-11.41
7	271.13	28.39 QP	37.00	-8.61	2.06 V	283	36.64	-8.25

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

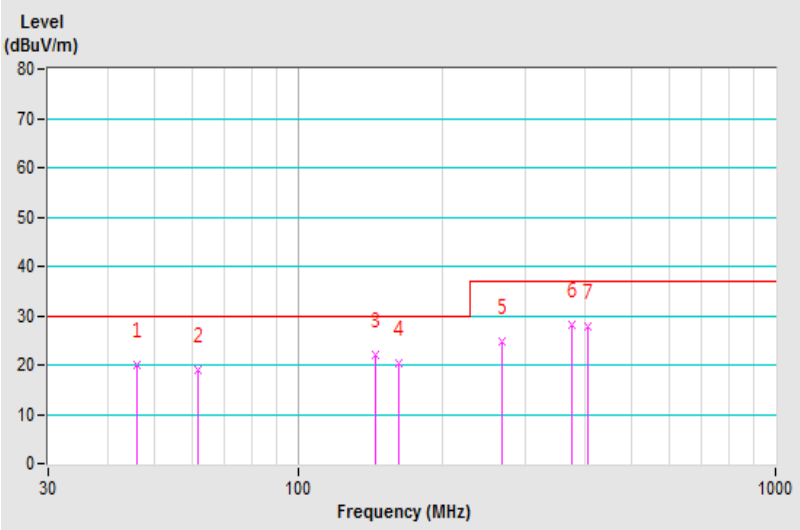


Frequency Range	30MHz ~ 1GHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	30℃, 60%RH
Tested by	Vincent Lin		
Test Mode	Mode 3		

Antenna Polarity & Test Distance : Horizontal at 10 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	46.17	20.07 QP	30.00	-9.93	4.00 H	251	29.65	-9.58
2	61.57	19.08 QP	30.00	-10.92	4.00 H	196	29.36	-10.28
3	145.25	22.01 QP	30.00	-7.99	4.00 H	71	31.06	-9.05
4	162.77	20.49 QP	30.00	-9.51	4.00 H	36	29.46	-8.97
5	267.16	24.61 QP	37.00	-12.39	3.39 H	55	33.16	-8.55
6	374.47	28.12 QP	37.00	-8.88	4.00 H	141	34.01	-5.89
7	404.53	27.86 QP	37.00	-9.14	1.22 H	58	33.14	-5.28

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

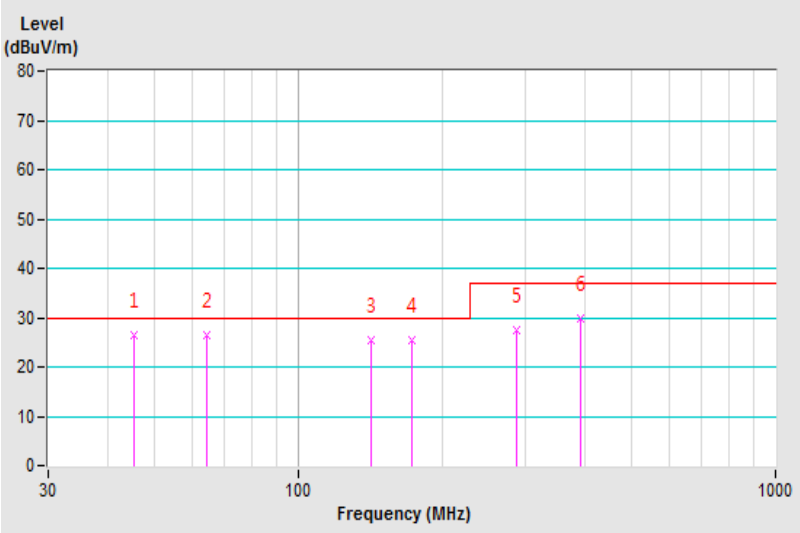


Frequency Range	30MHz ~ 1GHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	30℃, 60%RH
Tested by	Vincent Lin		
Test Mode	Mode 3		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	45.37	26.32 QP	30.00	-3.68	1.00 V	72	35.91	-9.59
2	64.51	26.30 QP	30.00	-3.70	1.00 V	108	36.77	-10.47
3	142.33	25.56 QP	30.00	-4.44	1.00 V	80	34.83	-9.27
4	172.99	25.43 QP	30.00	-4.57	1.00 V	139	35.06	-9.63
5	287.60	27.29 QP	37.00	-9.71	1.00 V	190	34.99	-7.70
6	389.80	29.87 QP	37.00	-7.13	1.00 V	36	35.47	-5.60

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



7 Harmonics Current Measurement

7.1 Limits

Limits for Class A equipment	
Harmonic Order n	Max. permissible harmonics current A
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15≦n≦39	0.15 x 15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8≦n≦40	0.23 x 8/n

Limits for Class D equipment		
Harmonic Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd Harmonics only		
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
13	0.30	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.
2. According to section 7 of EN 61000-3-2, the above limits for all equipment except for lighting equipment having an active input power > 75 W and no limits apply for equipment with an active input power up to and including 75 W.

7.2 Classification of equipment

Class A	Class B	Class C	Class D
Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.	Portable tools.; Arc welding equipment which is not professional equipment	Lighting equipment.	Equipment having a specified power less than or equal to 600 W of the following types: Personal computers and personal computer monitors and television receivers. Refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

7.3 Test Instruments

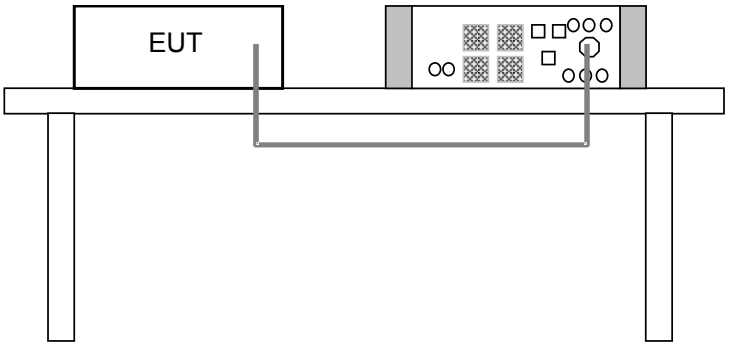
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Teseq Harmonics - Flicker Test System	Profline 2145	1323A03998	Jan. 06, 2017	Jan. 05, 2018
Software	WIN2105	NA	NA	NA

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS Room No. 2.
3. According to IEC 61000-4-7: 2002, the time window shall be synchronized with each group of 10 or 12 cycles (200 ms)for power frequency of 50 or 60Hz.
4. Tested Date: Aug. 2, 2017

7.4 Test Arrangement

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

b. The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.



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

7.5 Test Results

Fundamental Voltage/Ampere	229.878Vrms/ 0.121Arms	Power Frequency	50.00Hz
Power Consumption	12.1 W	Power Factor	0.440
Environmental Conditions	27°C, 60%RH	Tested by	Michael Cheng
Test Mode	Mode 2		

Note: 1. Limits are not specified for equipment with a rated power of 75W or less (other than lighting equipment).
2. According to EN 61000-3-2 the manufacturer shall specify the power of the apparatus. This value shall be used for establishing limits. The specified power shall be within +/-10% of the measured power.

8 Voltage Fluctuations and Flicker Measurement

8.1 Limits

Test item	Limit	Note
P_{st}	1.0	P_{st}: short-term flicker severity.
P_{lt}	0.65	P_{lt}: long-term flicker severity.
T_{max} (ms)	500	T_{max}: maximum time duration during the observation period that the voltage deviation d(t) exceeds the limit for d_c .
d_{max} (%)	4	d_{max}: maximum absolute voltage change during an observation period.
d_c (%)	3.3	d_c: maximum steady state voltage change during an observation period.

8.2 Test instruments

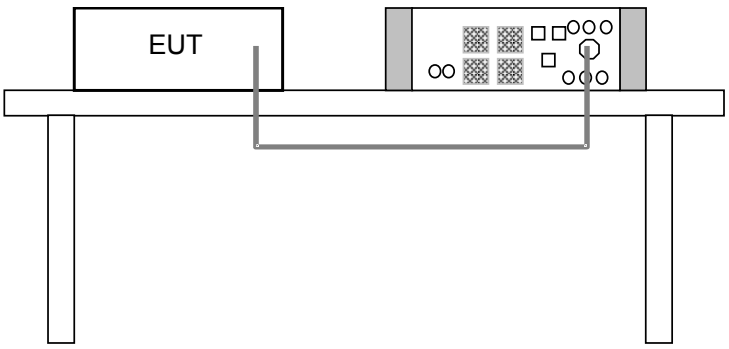
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Teseq Harmonics - Flicker Test System	Profline 2145	1323A03998	Jan. 06, 2017	Jan. 05, 2018
Software	WIN2105	NA	NA	NA

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS Room No. 2.
3. Tested Date: Aug. 2, 2017

8.3 Test Arrangement

a. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.

b. During the flick 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 is 10 minutes and the observation period for long-term flicker indicator is 2 hours.



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

8.4 Test Results

Observation (T_p)	10 min.	Power Frequency	50.00Hz
Fundamental Voltage/Ampere	229.878 Vrms / 0.121Arms	Power Factor	0.440
Environmental Conditions	27 °C, 60 % RH	Tested by	Michael Cheng
Test Mode	Mode 2		

Test Parameter	Measurement Value	Limit	Remarks
P_{st}	0.064	1.00	Pass
P_{lt}	0.028	0.65	Pass
T_{max} (ms)	0	500	Pass
d_{max} (%)	0.04	4	Pass
d_c (%)	0	3.3	Pass

Note: (1) P_{st} means short-term flicker indicator.
(2) P_{lt} means long-term flicker indicator.
(3) T_{max} means accumulated time value of d(t) with a deviation exceeding 3.3 %.
(4) d_{max} means maximum relative voltage change.
(5) d_c means maximum relative steady-state voltage change.

9 General Immunity requirements

EN 55014-2:2015 (Category II), Immunity requirements		
Reference standard	Test specification	Performance Criterion
IEC 61000-4-2 ESD	Enclosure port: ±8kV Air discharge, ±4kV Contact discharge,	B
IEC 61000-4-4 EFT	AC power line: ±1kV, DC power line: ±0.5kV, Signal & Control line: ±0.5kV	B
IEC 61000-4-5 Surge	1.2/50 us Open Circuit Voltage, 8 /20 us Short Circuit Current, Power Line: Line to line: ±1kV, Line to earth: ±2kV	B
IEC 61000-4-6 CS	Test frequency: 0.15-230 MHz, Modulation: 80% AM, 1kHz, AC power line: 3 $V_{r.m.s.}$, DC power line: 1 $V_{r.m.s.}$, Signal & Control line: 1 $V_{r.m.s.}$,	A
IEC 61000-4-11 Dips & Interruptions	i) 0% U_T – 0.5 period, ii) 40% U_T – 10 period, iii) 70% U_T – 25 period	C C C

9.1 Specific Immunity Requirements by Manufacturer

Additional Test		
Reference standard	Test specification	Performance Criterion
IEC 61000-4-2 ESD	Enclosure port: ±6kV Contact discharge	A
IEC 61000-4-4 EFT	Input AC power port: ±2kV, 5/50 (T_r/T_h) ns, 5kHz	A
IEC 61000-4-6 CS	Input AC Power ports: 0.15-230 MHz, 10V, 80% AM (1kHz)	A
IEC 61000-4-11 Dips & Interruptions	Input AC Power ports: Voltage Dips: 30% reduction – 10 ms	A

9.2 Performance Criteria

General Performance Criteria

Performance criterion A

The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance criterion B

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however, No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance criterion C

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.

10 Electrostatic Discharge Immunity Test (ESD)

10.1 Test Specification

Basic Standard:	IEC 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Discharge Voltage:	Air Discharge: ±8kV (Direct) Contact Discharge: ±4kV, ±6kV (Indirect)
Polarity:	Positive & Negative
Number of Discharge:	Minimum 20 times at each test point
Discharge Mode:	Single Discharge
Discharge Period:	1-second minimum

10.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
EM Test ESD Simulator	Dito	V0707102251	Apr. 11, 2017	Apr. 10, 2018

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in ESD Room No. 2.
3. Tested Date: Aug. 4, 2017

10.3 Test Arrangement

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

a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.

b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

c. The time interval between two successive single discharges was at least 1 second.

d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.

e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.

g. At least ten single discharges (in the most sensitive polarity) were applied to the **H**orizontal **C**oupling **P**lane at points on each side of the EUT. The ESD generator was positioned horizontally at a distance of 0.1 meters from the EUT with the discharge electrode touching the **HCP.**

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **V**ertical **C**oupling **P**lane in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

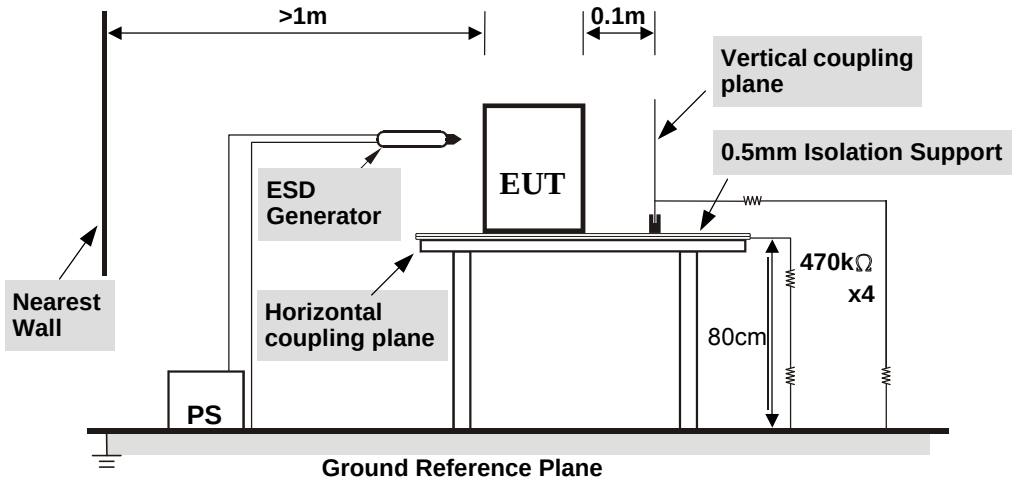


TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **G**round **R**eference **P**lane. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **H**orizontal **C**oupling **P**lane (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 940kΩ total impedance. The equipment under test, was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were placed on the **HCP** and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

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

10.4 Supplementary Information

The requirement followed by the client's specification. (Refer to item 9.1)

10.5 Test Results

Test mode	Mode 2	Input Power	230 Vac, 50 Hz
Environmental conditions	25 °C, 40% RH 1003 mbar	Tested by	Thomas Cheng

Test Results of Direct Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criterion
8	+/-	1, 2	NA	Note	A

Description of test points of direct application: Please refer to following page for representative mark only.

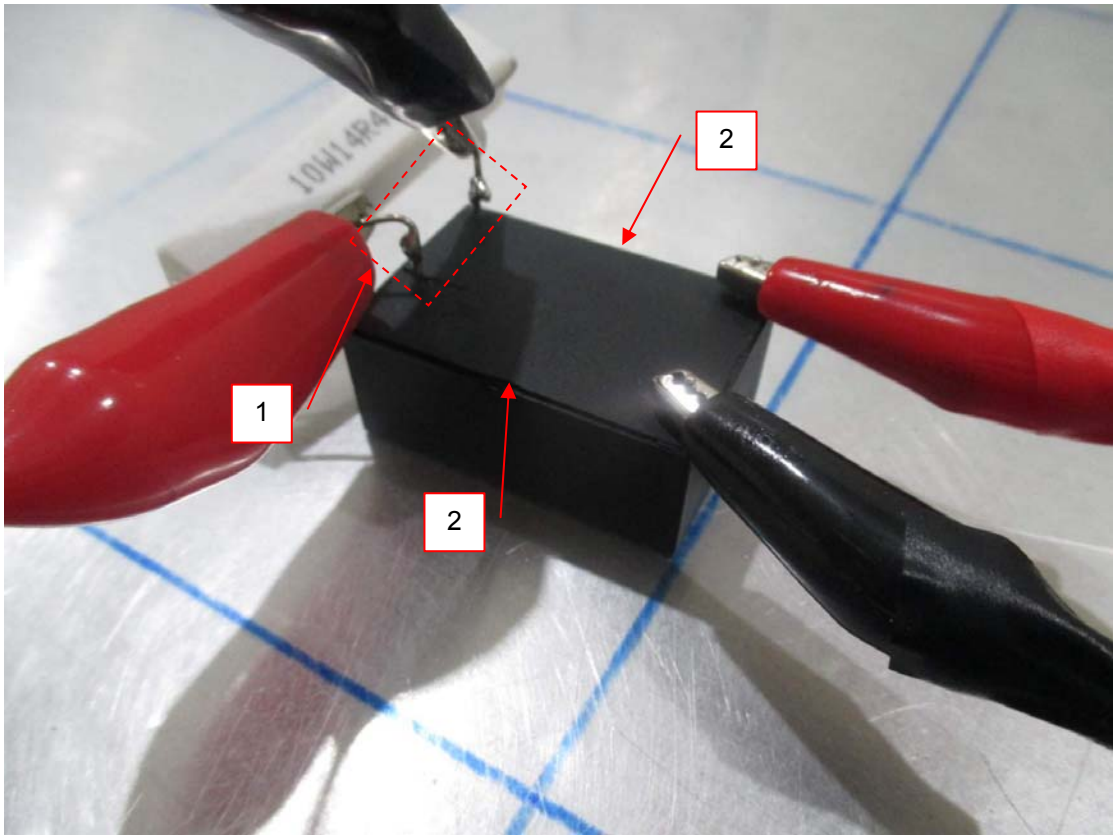
Test Results of Indirect Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
4, 6	+/-	Four Sides	Note	Note	A

Description of test points of indirect application:

1. Front side 2. Rear side 3. Right side 4. Left side

Note: The EUT function was correct during the test.

Description of Test Points



11 Electrical Fast Transient/Burst Immunity Test (EFT)

11.1 Test Specification

Basic Standard:	IEC 61000-4-4
Test Voltage:	AC Power Line : ±1kV, ±2kV DC Power Line : N/A Signal Line : N/A
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Wave shape :	5/50 ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	2 min.

11.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Haefely, EFT Generator	PEFT 4010	154954	Apr. 17, 2017	Apr. 16, 2018
Haefely,Capacitive Clamp	IP4A	155173	Apr. 17, 2017	Apr. 16, 2018

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EFT Room.
3. Tested Date: Aug. 2, 2017

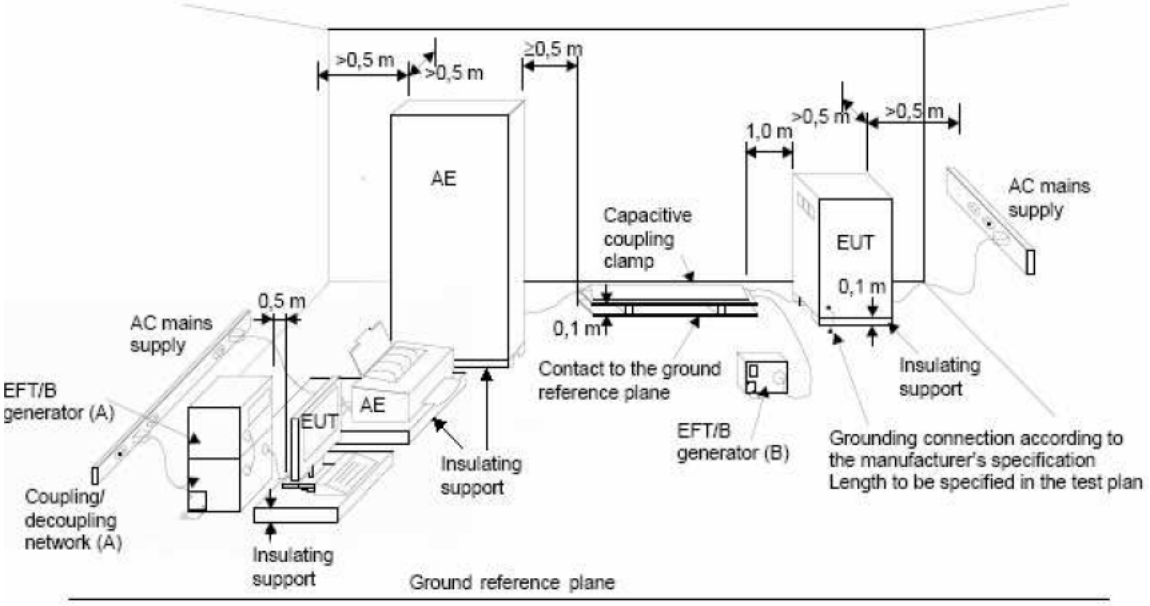
11.3 Test Arrangement

a. Both positive and negative polarity discharges were applied.

b. The distance between any coupling devices and the EUT should be (0.5 − 0/+0.1) m for table-top equipment testing, and (1.0 ± 0.1) m for floor standing equipment.

c. The duration time of each test sequential was 2 minutes.

d. The transient/burst waveform was in accordance with IEC 61000-4-4, 5/50ns.



NOTE:
(A) location for supply line coupling
(B) location for signal lines coupling

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

11.4 Supplementary Information

The requirement followed by the client's specification. (Refer to item 9.1)

11.5 Test Results

Test mode	Mode 2	Input Power	230 Vac, 50 Hz
Environmental conditions	26 °C, 61% RH	Tested by	Michael Cheng

Input AC power port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
1, 2	L1	+/-	Note	A
1, 2	L2	+/-	Note	A
1, 2	L1-L2	+/-	Note	A

Note: The EUT function was correct during the test.

12 Surge Immunity Test

12.1 Test Specification

Basic Standard:	IEC 61000-4-5
Wave-Shape:	Combination Wave 1.2/50 us Open Circuit Voltage 8 /20 us Short Circuit Current
Test Voltage:	Power Line: Line to line: ±1kV, Line to earth: N/A
Generator Source Impedance:	2 ohm between networks 12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	90°/ 270°
Pulse Repetition Rate:	1 time / 40 Sec.
Number of Tests:	5 positive and 5 negative at selected points

12.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
TESEQ, Surge Simulator	NSG 3060	1572	May 23, 2017	May 22, 2018
Coupling Decoupling Network	CDN-UTP8	028	Aug. 18, 2017	Aug. 17, 2018
TESEQ Coupling Decoupling Network	CDN HSS-2	41009	May 19, 2017	May 18, 2018
TESEQ Coupling Decoupling Networ	CDN 118-T8	40386	Sep. 14, 2017	Sep. 13, 2018
TESEQ CDN for Unshielded Unsymmetrical Signal & Data Lines	CDN117	40144	Sep. 14, 2017	Sep. 13, 2018

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS Room No. 2.
3. Tested Date: Mar. 5, 2018

12.3 Test Arrangement

a. For EUT power supply:

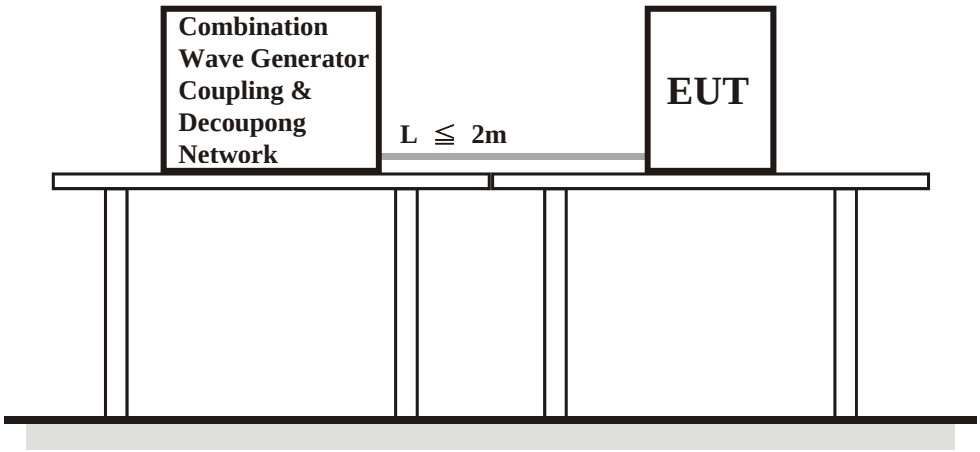
The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

b. For test applied to unshielded unsymmetrically operated interconnection lines of EUT:

The surge is applied to the lines via the capacitive coupling. The coupling / decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

c. For test applied to unshielded symmetrically operated interconnection / telecommunication lines of EUT:

The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).



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

12.4 Test Results

Test mode	Mode 2	Input Power	230 Vac, 50 Hz
Environmental conditions	23 °C, 69% RH	Tested by	Aga Lin

Input AC power port

Voltage (kV)	Test Point	Phase Angle	Polarity (+/-)	Observation	Performance Criterion
1	L1-L2	90°	+	Note	A
		270°	-	Note	A

Note: The EUT power off during the test, but auto recover after the test.

13 Immunity to Conducted Disturbances Induced by RF Fields (CS)

13.1 Test Specification

Basic Standard:	IEC 61000-4-6
Frequency Range:	0.15 MHz - 230 MHz
Voltage Level:	AC Power Line: 3 $V_{r.m.s}$, 10 $V_{r.m.s.}$ DC Power Line: N/A Signal & Control Line: N/A
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time	3 seconds

13.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ Signal Generator	SML03	101801	Jan. 06, 2017	Jan. 05, 2018
Digital Sweep Function Generator	8120	984801	NA	NA
AR Power Amplifier	75A250AM1	306331	NA	NA
FCC Coupling Decoupling Network	FCC-801-M2-16A	01047	Jun. 21, 2017	Jun. 20, 2018
FISCHER CUSTOM COMMUNICATIONS EM Injection Clamp	F-203I-23mm	455	NA	NA
FISCHER CUSTOM COMMUNICATIONS Current Injection Clamp	F-120-9A	361	Jul. 26, 2017	Jul. 25, 2018
B&K Ear Simulator	4185	2553594	NA	NA
EM TEST Coupling Decoupling Network	CDN M1/32A	306508	Jun. 21, 2017	Jun. 20, 2018
TESEQ Coupling Decoupling Network	CDN T800	34428	Jun. 21, 2017	Jun. 20, 2018
FCC Coupling Decoupling Network	FCC-801-T4	02031	Jun. 21, 2017	Jun. 20, 2018
EM TEST Coupling Decoupling Network	CDN T2	306509	Jun. 21, 2017	Jun. 20, 2018
R&S Power Sensor	NRV-Z5	837878/039	Oct. 27, 2016	Oct. 26, 2017
R&S Power Meter	NRVD	837794/040	Oct. 27, 2016	Oct. 26, 2017
TESEQ Coupling Decoupling Network	CDN M232	37702	Jun. 21, 2017	Jun. 20, 2018
TESEQ Coupling Decoupling Network	CDN M332	41258	Jun. 21, 2017	Jun. 20, 2018
TESEQ Coupling Decoupling Network	CDN M332	41256	Jun. 21, 2017	Jun. 20, 2018
TESEQ Coupling Decoupling Network	CDN T400A	28569	Jun. 21, 2017	Jun. 20, 2018
TESEQ Coupling Decoupling Network	CDN T8-10	40376	Jun. 21, 2017	Jun. 20, 2018
Software	CS_V7.4.2	NA	NA	NA

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in CS Room No. 1.
3. Tested Date: Aug. 1, 2017

13.3 Test Arrangement

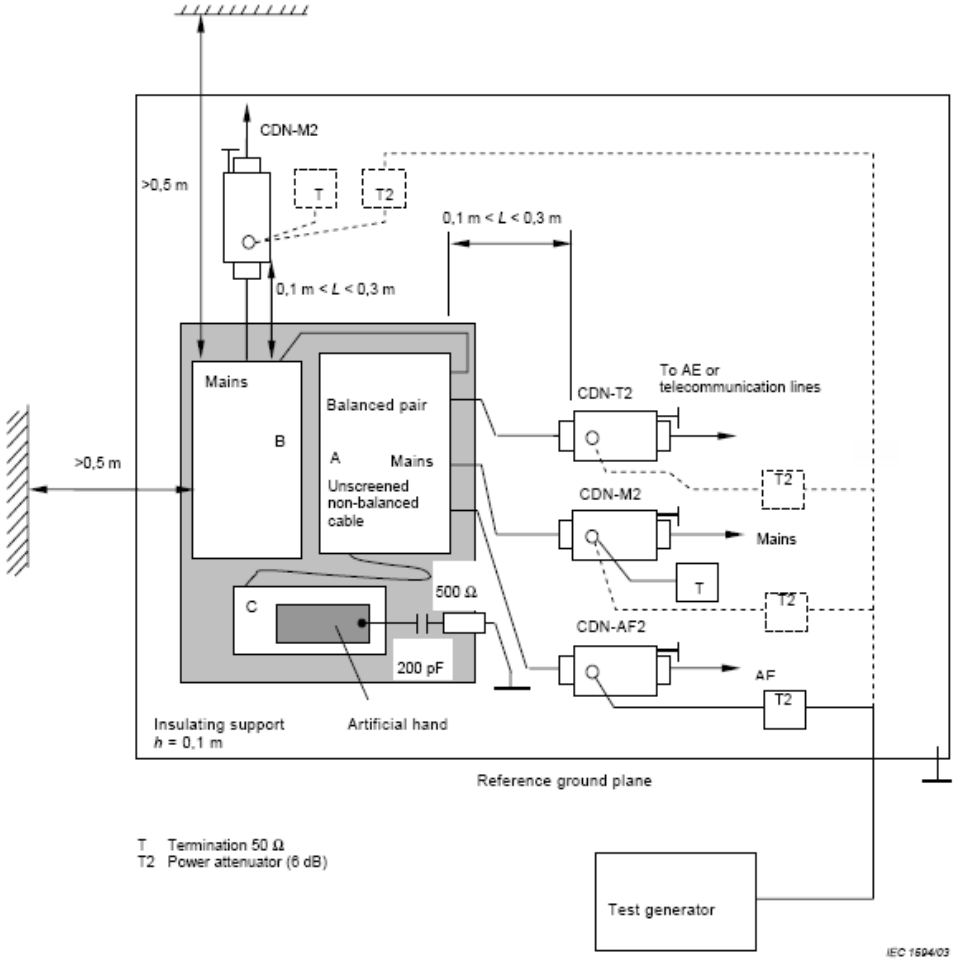
a. The EUT shall be tested within its intended operating and climatic conditions.

b. An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.

c. One of the CDNs not used for injection was terminated with 50Ω, providing only one return path. All other CDNs were coupled as decoupling networks.

d. The frequency range is swept from 150 kHz to 230 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value.

e. Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.



Note: 1.The EUT clearance from any metallic obstacles shall be at least 0,5 m.
2. Interconnecting cables (≦1 m) belonging to the EUT shall remain on the insulating support.
3. The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

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

13.4 Supplementary Information

The requirement followed by the client's specification. (Refer to item 9.1)

13.5 Test Results

Test mode	Mode 2	Input Power	230 Vac, 50 Hz
Environmental conditions	26 °C, 60% RH	Tested by	Michael Cheng

Frequency (MHz)	Level (Vrms)	Tested Line	Injection Method	Return Path	Observation	Performance Criterion
0.15 – 230	3, 10	AC Power	CDN-M2	N/A	Note	A

Note: The EUT function was correct during the test.

14 Voltage Dips and Interruptions

14.1 Test Specification

Basic Standard:	IEC 61000-4-11
Test levels:	0% UT – 0.5 period 40% UT – 10 period 70% UT – 10 ms **<Addition Test>** 70% UT – 25 period
Interval between Event:	Minimum ten seconds
Sync Angle (degrees):	0° / 180°
Test Cycle:	3 times

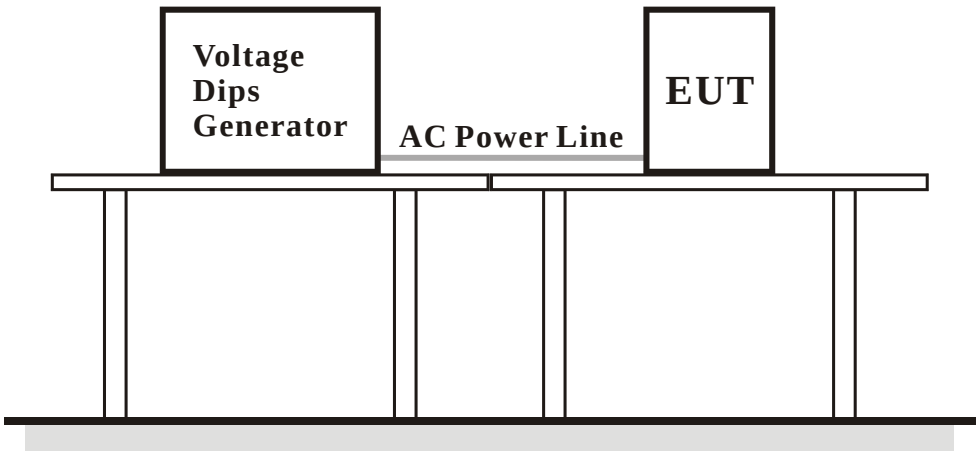
14.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
KeyTek, PQF Generator	EMC Pro	9902207	May 11, 2017	May 10, 2018

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS Room No. 1.
3. Tested Date: Aug. 2, 2017

14.3 Test Arrangement

The EUT shall be tested for each selected combination of test levels and duration with a sequence of tree dips/interruptions with intervals of 10 s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform.



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

14.4 Test Results

Test mode	Mode 2	Input Power	230 Vac, 50 Hz 240 Vac, 50 Hz 100 Vac, 50 Hz
Environmental conditions	21 °C, 63% RH	Tested by	Michael Cheng

Input Power for testing: 230 Vac, 50 Hz (Nominal input Voltage)						
Voltage Reduction (%)	Duration		Interval (sec)	Times	Observation	Performance Criterion
	period	ms				
100	0.5	-	10	3	Note 1	A
60	10	-	10	3	Note 1	A
30	-	10	10	3	Note 1	A
30	25	-	10	3	Note 1	A

Input Power for testing: 240 Vac, 50 Hz (Maximum rated input voltage)						
Voltage Reduction (%)	Duration (period)		Interval (sec)	Times	Observation	Performance Criterion
100	0.5	-	10	3	Note 1	A
60	10	-	10	3	Note 1	A
30	-	10	10	3	Note 1	A
30	25	-	10	3	Note 1	A

Input Power for testing: 100 Vac, 50 Hz (Minimum rated input voltage)						
Voltage Reduction (%)	Duration (period)		Interval (sec)	Times	Observation	Performance Criterion
100	0.5	-	10	3	Note 1	A
60	10	-	10	3	Note 2	B
30	-	10	10	3	Note 1	A
30	25	-	10	3	Note 1	A

Note: 1. The EUT function was correct during the test.
2. The EUT power off during the test, but auto recover after the test.

Test mode	Mode 2	Input Power	230 Vac, 60 Hz 240 Vac, 60 Hz 100 Vac, 60 Hz
Environmental conditions	21 °C, 63% RH	Tested by	Michael Cheng

Input Power for testing: 230 Vac, 60 Hz (Nominal input Voltage)						
Voltage Reduction (%)	Duration		Interval (sec)	Times	Observation	Performance Criterion
	period	ms				
100	0.5	-	10	3	Note 1	A
60	12	-	10	3	Note 1	A
30	-	10	10	3	Note 1	A
30	30	-	10	3	Note 1	A

Input Power for testing: 240 Vac, 60 Hz (Maximum rated input voltage)						
Voltage Reduction (%)	Duration (period)		Interval (sec)	Times	Observation	Performance Criterion
100	0.5	-	10	3	Note 1	A
60	12	-	10	3	Note 1	A
30	-	10	10	3	Note 1	A
30	30	-	10	3	Note 1	A

Input Power for testing: 100 Vac, 60 Hz (Minimum rated input voltage)						
Voltage Reduction (%)	Duration (period)		Interval (sec)	Times	Observation	Performance Criterion
100	0.5	-	10	3	Note 1	A
60	12	-	10	3	Note 2	B
30	-	10	10	3	Note 1	A
30	30	-	10	3	Note 1	A

Note: 1. The EUT function was correct during the test.
2. The EUT power off during the test, but auto recover after the test.

15 Pictures of Test Arrangements

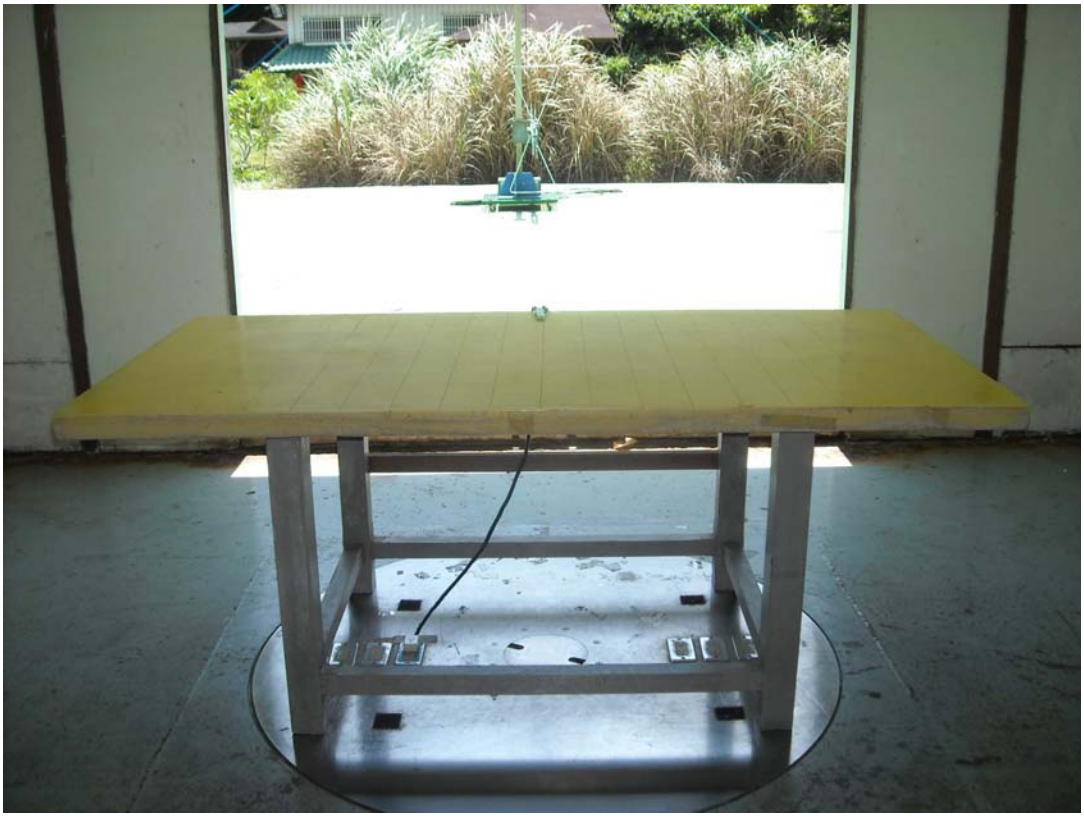
15.1 Terminal Continuous Voltage Emission Test

Mode 1

Mode 2

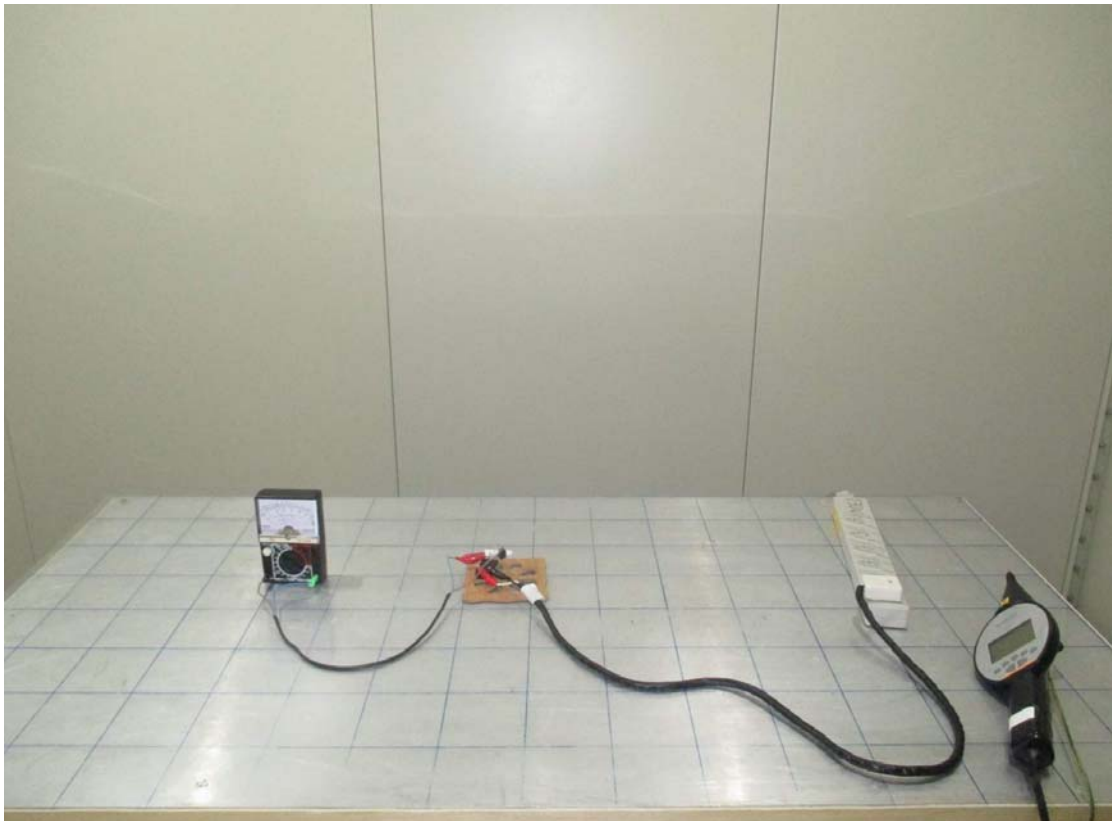
Mode 3

15.2 Radiated Disturbance Emission



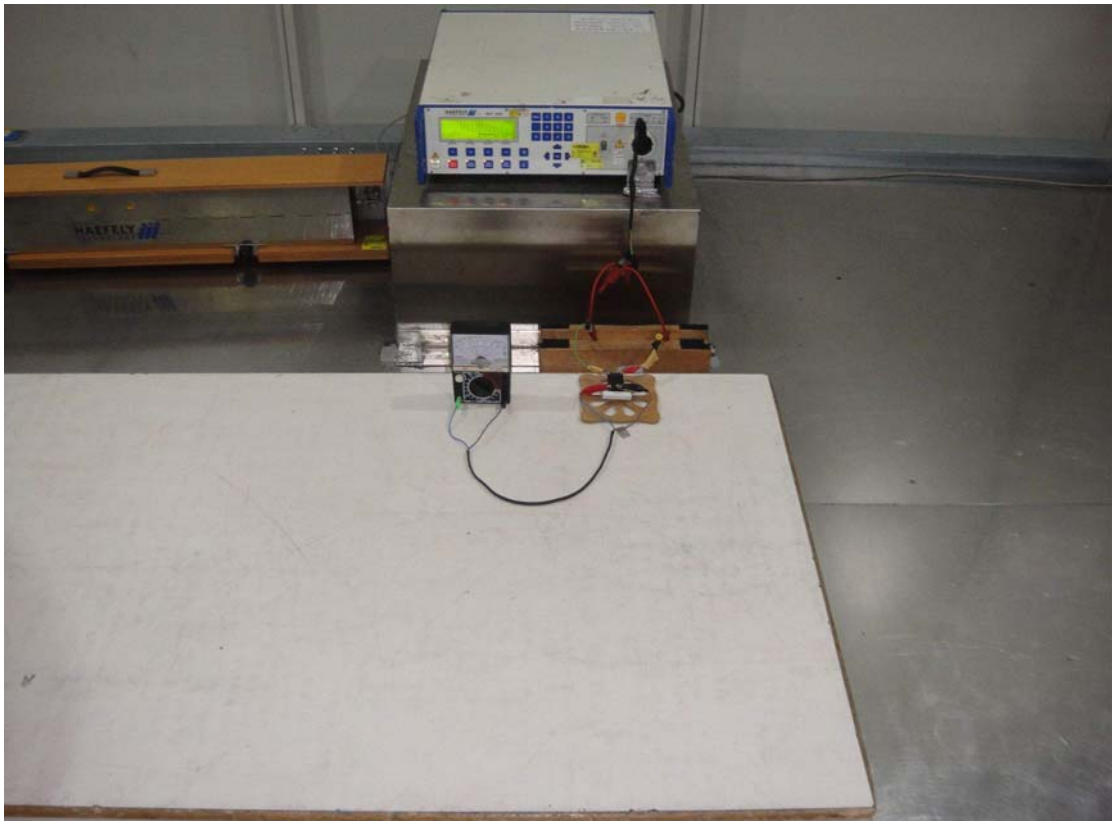
15.3 Harmonics Current, Voltage Fluctuations and Flicker Measurement

15.4 Electrostatic Discharge Immunity Test (ESD)



15.5 Electrical Fast Transient/Burst Immunity Test (EFT)

Mains ports

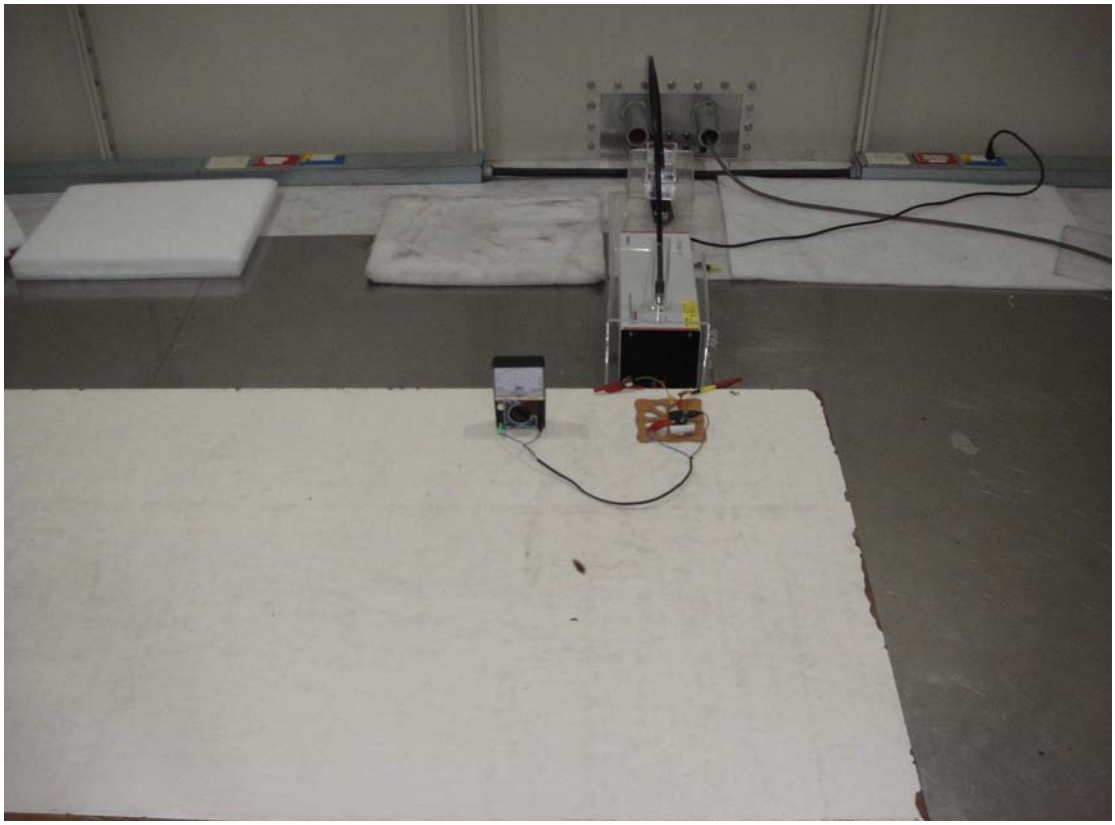


15.6 Surge Immunity Test

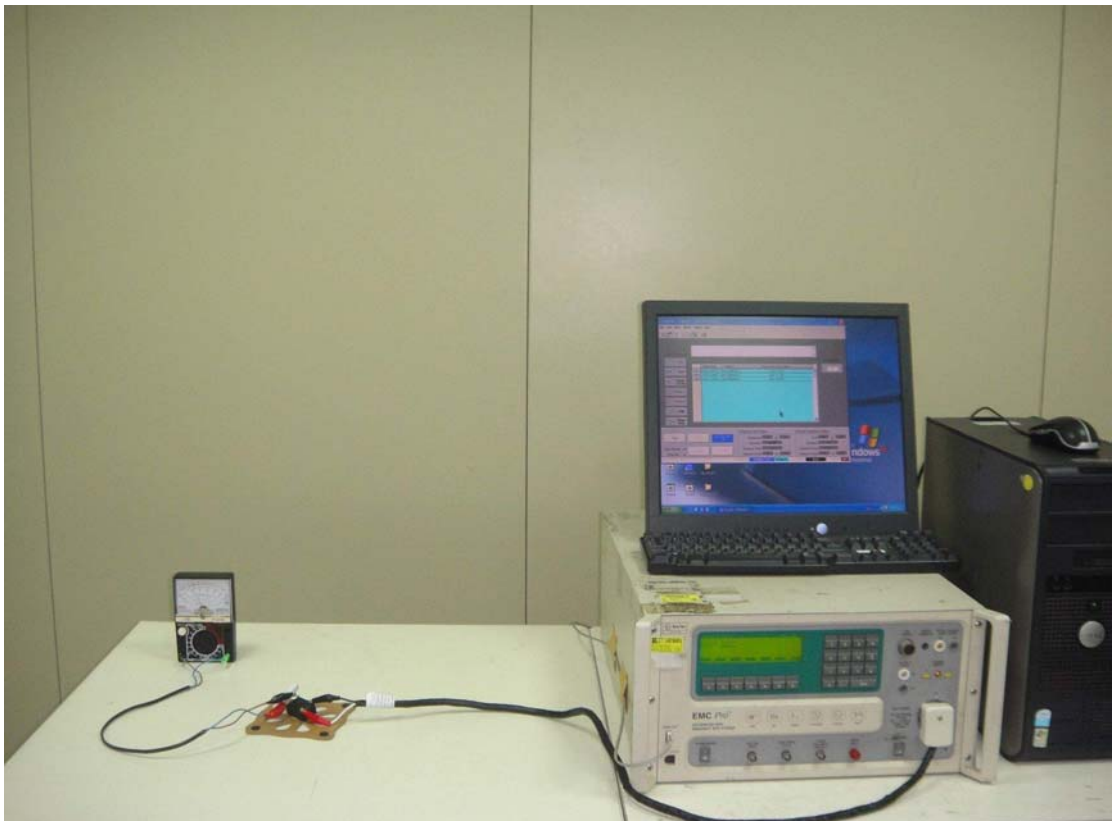
Mains ports

15.7 Conducted Disturbances Induced by RF Fields (CS)

Mains ports



15.8 Voltage Dips and Interruptions



Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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