

CE EMC Test Report

Report No.: CE190318D03

Model No.: PA311D-BK

Received Date: Mar. 18, 2019

Test Date: Mar. 20 to 26, 2019

Issued Date: Mar. 28, 2019

Applicant: TOP VICTORY ELECTRONICS (TAIWAN) CO., LTD.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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Certificate #4327.01

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Release Control Record

Issue No.	Description	Date Issued
CE190318D03	Original release.	Mar. 28, 2019

1 Certificate of Conformity

Product: LCD Monitor
Brand: NEC
Model No.: PA311D-BK
Sample Status: Engineering sample
Applicant: TOP VICTORY ELECTRONICS (TAIWAN) CO., LTD.
Test Date: Mar. 20 to 26, 2019
Standards: EN 55032:2012 +AC:2013, Class B
EN 55032:2015 +AC:2016, Class B
EN 61000-3-2:2014, Class D
EN 61000-3-3:2013
EN 55024:2010 / EN 55024:2010 +A1:2015
EN 61000-4-2:2009 / IEC 61000-4-2:2008 ED. 2.0
EN 61000-4-3:2006 +A1:2008 +A2:2010 / IEC 61000-4-3:2010 ED. 3.2
EN 61000-4-4:2012 / IEC 61000-4-4:2012 ED. 3.0
EN 61000-4-5:2014 +A1:2017 / IEC 61000-4-5:2014 +A1:2017 ED. 3.0
EN 61000-4-6:2014 +AC:2015 / IEC 61000-4-6:2013 ED. 4.0
EN 61000-4-8:2010 / IEC 61000-4-8:2009 ED. 2.0
EN 61000-4-11:2004 +A1:2017 / IEC 61000-4-11:2004 +A1:2017 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. 28, 2019

Albee Chu / Specialist

Approved by :



, Date:

Mar. 28, 2019

Jim Hsiang / Associate Technical Manager

2 Summary of Test Results

Emission			
Standard	Test Item	Result/Remarks	Verdict
EN 55032:2012 +AC:2013/ EN 55032:2015 +AC:2016	Conducted emission from the AC mains power port	Minimum passing Class B margin is -10.05 dB at 11.99108 MHz	Pass
	Asymmetric mode conducted emission at telecommunication ports	Minimum passing Class B margin is -6.01 dB at 23.12776 MHz	Pass
	Radiated emission 30-1000 MHz	Minimum passing Class B margin is -4.11 dB at 208.91 MHz	Pass
	Radiated emission above 1GHz	Minimum passing Class B margin is -4.01 dB at 1066.02 MHz	Pass
EN 61000-3-2:2014	Harmonic current emissions	Class D	Pass
EN 61000-3-3:2013	Voltage fluctuations and flicker	$P_{st} \leq 1.0$ $d_{max} \leq 4\%$ $P_{lt} \leq 0.65$ $d_c \leq 3.3\%$ $T_{max} \leq 500ms$	Pass

Immunity				
EN 55024 Clause	Basic standard	Test Item	Result/Remarks	Verdict
4.2.1	EN 61000-4-2:2009 / IEC 61000-4-2:2008 ED. 2.0	Electrostatic discharges (ESD)	Performance Criterion B	Pass
4.2.3.2	EN 61000-4-3:2006 +A1:2008 +A2:2010 / IEC 61000-4-3:2010 ED. 3.2	Continuous radiated disturbances (RS)	Performance Criterion A	Pass
4.2.2	EN 61000-4-4:2012 / IEC 61000-4-4:2012 ED. 3.0	Electrical fast transients (EFT)	Performance Criterion A	Pass
4.2.5	EN 61000-4-5:2014 +A1:2017 / IEC 61000-4-5:2014 +A1:2017 ED. 3.0	Surges	Performance Criterion A	Pass
4.2.3.3	EN 61000-4-6:2014 +AC:2015 / IEC 61000-4-6:2013 ED. 4.0	Continuous conducted disturbances (CS)	Performance Criterion A	Pass
4.2.4	EN 61000-4-8:2010 / IEC 61000-4-8:2009 ED. 2.0	Power-frequency magnetic fields (PFMF)	Performance Criterion A	Pass
4.2.6	EN 61000-4-11:2004 +A1:2017 / IEC 61000-4-11:2004 +A1:2017 ED. 2.0	Voltage dips and interruptions	Voltage Dips: >95% reduction – 0.5 period, Performance Criterion A 30% reduction – 25 periods, Performance Criterion A Voltage Interruptions: >95% reduction – 250 periods, Performance Criterion C	Pass

Note:

1. There is no deviation to the applied test methods and requirements covered by the scope of this report.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
3. The above EN/IEC basic standards are applied with latest version if customer has no special requirement.

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:

Measurement	Expanded Uncertainty (k=2) ($\pm$)	Maximum allowable uncertainty ($\pm$)
Conducted emission from AC mains power port using AMN, 150kHz ~ 30MHz	2.79 dB	3.4 dB (U_{CISPR})
Asymmetric mode conducted emission using AAN, 150kHz ~ 30MHz	3.94 dB	5.0 dB (U_{CISPR})
Radiated emission, 30MHz ~ 1GHz	3.67 dB	6.3 dB (U_{CISPR})
Radiated emission, 1GHz ~ 6GHz	5.13 dB	5.2 dB (U_{CISPR})

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 Description of EUT

Product	LCD Monitor
Brand	NEC
Model No.	PA311D-BK
Sample Status	Engineering sample
Operating Software	N/A
Power Supply Rating	Internal switching power supply Rating: 100-240Vac, 50/60Hz Power Cord: Non-shielded AC 3 Pin (1.8m)
Accessory Device	N/A
Data Cable Supplied	Shielded Display cable (1.8m) Shielded HDMI cable (1.8m) Shielded USB-C cable (1.8m) Shielded USB-B cable (1.8m)

Note:

1. The EUT is a LCD Monitor and it has the following interfaces:

- ◆ SENS/EME
- ◆ Headphone
- ◆ USB-A *3
- ◆ USB-B *2
- ◆ USB-C (up to 4096 x 2160, 60Hz)
- ◆ Display in *2 (up to 4096 x 2160, 60Hz)
- ◆ HDMI in *2 (up to 4096 x 2160, 60Hz)
- ◆ LAN (10/100Mbps)
- ◆ GND
- ◆ AC in

3.2 Features of EUT

The tests reported herein were performed according to the method specified by TOP VICTORY ELECTRONICS (TAIWAN) CO., LTD., for detailed feature description, please refer to the manufacturer's specifications or user's manual.

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

1. The EUT was pre-tested under operating and standby condition and the worst emission level was found under **operating condition**.
2. The EUT is designed with AC power supply of 100-240Vac, 50/60Hz.
For radiated emission evaluation, 230Vac/50Hz & 110Vac/60Hz (for EN 55032 & AS/NZS CISPR 32) had been covered during the pre-test. The worst data was found at **110Vac/60Hz** and recorded in the applied test report.
3. The EUT has been pre-tested under following test modes, and **Pre-tested Mode 1** was the worst case.

Description		Pre-tested mode											
		1	2	3	4	5	6	7	8	9	10	11	12
Interface/ function	HDMI in: 4096 x 2160 (60Hz) + LAN Ping	V	V	V	V	V							
	DP in: 4096 x 2160 (60Hz) + LAN Ping						V						
	USB-C in: 4096 x 2160 (60Hz) + LAN Ping							V					
	HDMI in: 1920 x 1200 (60Hz) + LAN Ping								V				
	HDMI in: 640 x 480 (60Hz) + LAN Ping									V			
	PIP <HDMI: 4096 x 2160 (60Hz) + HDMI: 4096 x 2160 (60Hz)>										V		
	PBP<HDMI: 4096 x 2160 (60Hz) + HDMI: 4096 x 2160 (60Hz)>											V	
	HDMI from DVD: 2160p												V
Earphone	With	V		V	V	V	V	V	V	V	V	V	V
	Without		V										
Setup of Panel	Horizontal - up	V	V		V	V	V	V	V	V	V	V	V
	Horizontal - down			V									
USB-C function	Display in							V					
	PD	with 5V/3A load	V	V	V		V		V	V	V	V	V
		with 12V/3A load				V							
		with 20V/3.25A load				V							

4. According to pre-test result and client's requirement, the final test modes were as the following:

Mode		Test Condition	Color bar signal	Input Power
Conducted emission test				
1	A	Pre-tested Mode 1	ITU-R BT 471-1	110Vac/ 60Hz & 230Vac/ 50Hz
	B		ITU-R BT 1729	
2		Pre-tested Mode 12	ITU-R BT 471-1*	
Asymmetric mode conducted emission at telecommunication ports test				
1	A	Pre-tested Mode 1 - LAN Speed: 100Mbps	ITU-R BT 471-1	230Vac/ 50Hz
	B		ITU-R BT 1729	
The idle mode of conducted emission test at telecom port was pre-tested based on the worst case of link mode. Due to emissions of idle mode being very low compared to link mode, only the link mode data were presented in the test report.				
Radiated emission test				
1	A	Pre-tested Mode 1	ITU-R BT 471-1	110Vac/ 60Hz
	B		ITU-R BT 1729	
2		Pre-tested Mode 12	ITU-R BT 471-1*	
Harmonics test				
1	A	Pre-tested Mode 10		230Vac/ 50Hz
	B	Pre-tested Mode 10 <Default mode>		
Flicker & Immunity tests				
1		Pre-tested Mode 10		230Vac/ 50Hz

*: Pre evaluated color bar signal: ITU-R BT 471-1 & ITU-R BT 1729 and the worst emission level was found under ITU-R BT 471-1 color bar signal.

3.4 Test Program Used and Operation Descriptions

Emission Tests (Harmonic & Flicker Test Excluded):

- a. Turned on the power of all equipment.
- b. PC ran a test program to enable all functions.
- c. PC read and wrote messages from HDD.
- d. EUT read messages from USB flash drive and ext. HDDs.
- e. EUT sent and received messages from Notebook PC (kept in a remote area) via an UTP LAN cable (10m).
- f. PC / DVD players sent "ITU-R BT 471-1 color bars with moving element" messages to EUT, and then displayed it on its screen. **<For Mode 1A & Mode 2>**
- g. PC sent "ITU-R BT 1729 color bars with moving element" messages to EUT, and then displayed it on its screen. **<For Mode 1B>**
- h. PC sent messages to printer and printer printed them out.
- i. EUT discharge to load continuously.
- j. PC/ DVD players sent "1kHz audio" signal to earphone via EUT.
- k. Steps c-j were repeated.

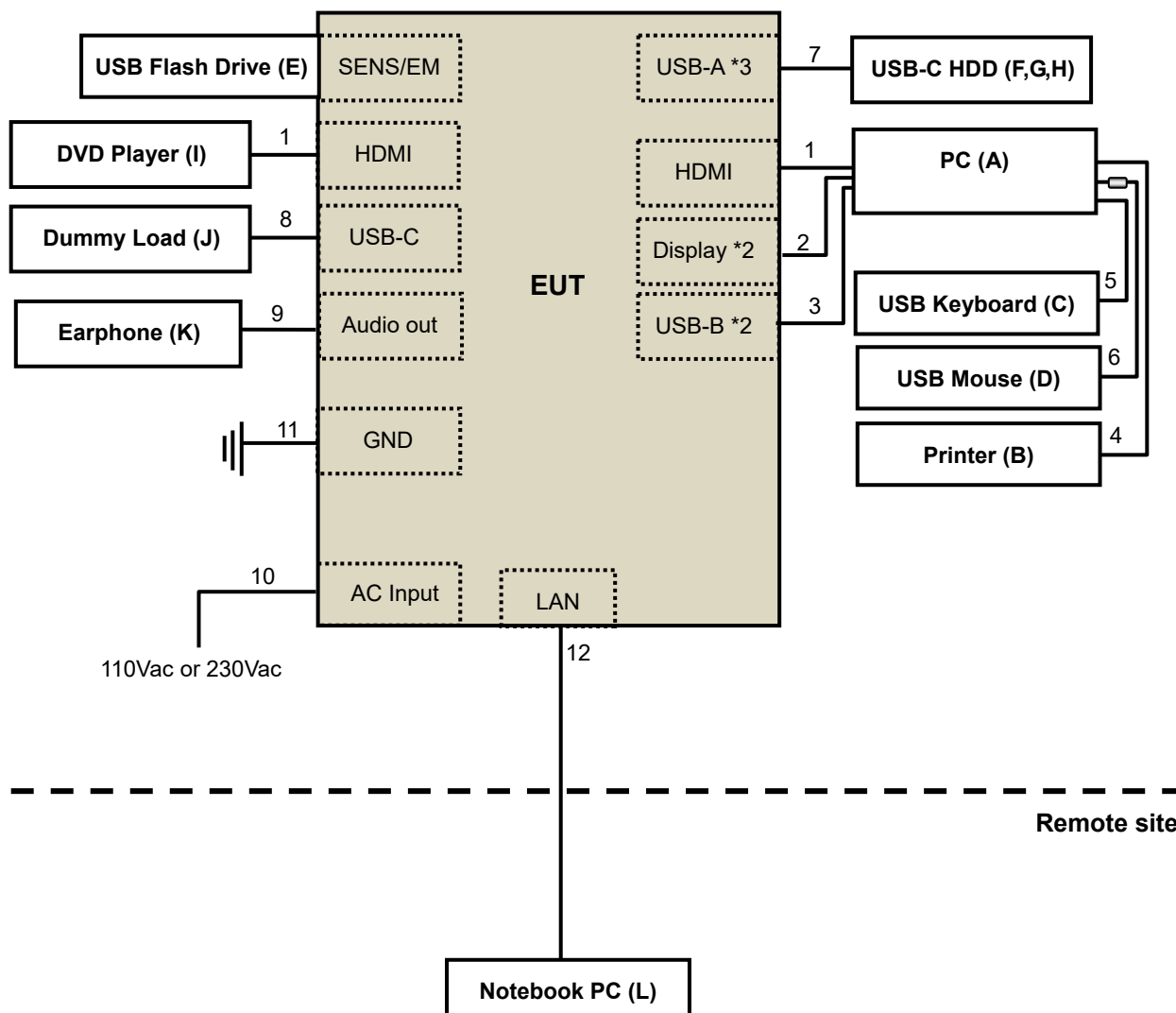
Harmonics, Flicker & Immunity Tests:

- a. Turned on the power of all equipment.
- b. PC ran a test program to enable all functions.
- c. PC read and wrote messages from HDD.
- d. EUT read messages from USB flash drives.
- e. EUT sent and received messages from Notebook PC (kept in a remote area) via an UTP LAN cable (10m).
- f. PC sent "full white screen" messages to EUT, and then displayed it on its screen. **<for Harmonics & Flicker tests>**
- g. PC sent "H" messages to EUT, and then displayed it on its screen. **<for Immunity tests>**
- h. EUT discharge to load continuously and a multimeter was used to monitor voltage of output.
- i. Steps c-h were repeated.

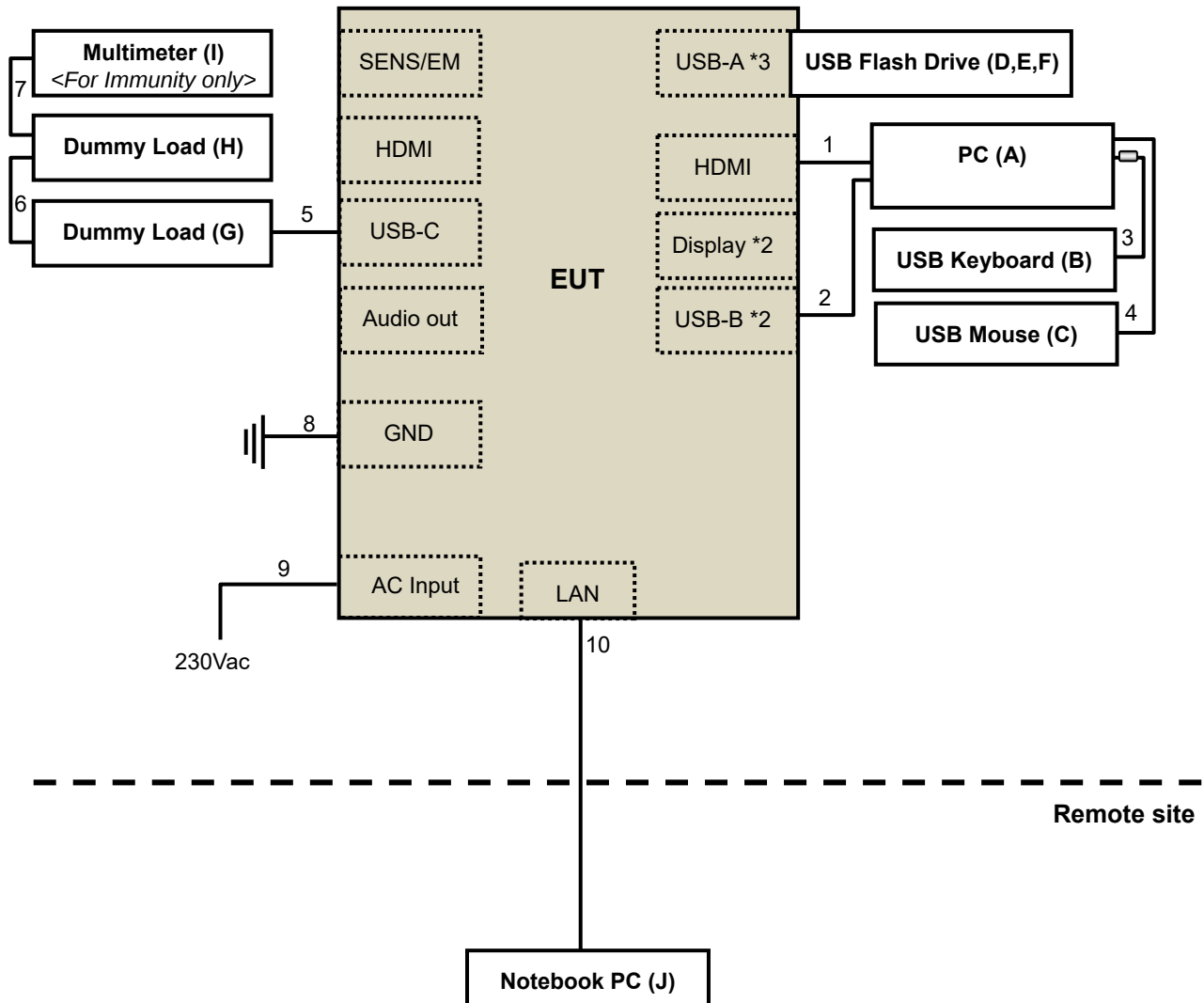
4 Configuration and Connections with EUT

4.1 Connection Diagram of EUT and Peripheral Devices

Emission tests (Harmonics & Flicker excluded):



Harmonics, Flicker, 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.	PC	HP	Elite Desk 800G4	4CE8451BKY	FCC DoC Approved	Provided by Lab
B.	Printer	HP	SNPRC-1203-01	CN57SCC0F1	B94SDGOB1191	Provided by Lab
C.	USB Keyboard	Dell	KB216t	CN-0W33XP-LO3 00-7CL-191E	FCC DoC Approved	Provided by Lab
D.	USB Mouse	Microsoft	1113	9170515153471	FCC DoC Approved	Provided by Lab
E.	USB 3.0 Flash Drive	HP	v250w	N/A	FCC DoC Approved	Provided by Lab
F.	USB-C Hard Disk	G-DRIVE	0G04878	620XHB8W	FCC DoC Approved	Provided by Lab
G.	USB-C Hard Disk	G-DRIVE	0G04878	620XHEMW	FCC DoC Approved	Provided by Lab
H.	USB-C Hard Disk	G-DRIVE	0G04878	D33TRR7M	FCC DoC Approved	Provided by Lab
I.	DVD PLAYER	SONY	BDP-S470	3200799	Verification	Provided by Lab
J.	DUMMY LOAD	BVADT	L19B	L2-010025	N/A	Provided by Lab
K.	EARPHONE	PHILIPS	SBC HL150	H2010153	N/A	Provided by Lab
L.	Notebook PC	DELL	P41G	HT4W952	FCC DoC Approved	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item L acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	HDMI cable	2	1.8	Y	0	Supplied by client
2.	Display cable	2	1.8	Y	0	Supplied by client
3.	USB-B cable	2	1.8	Y	0	Supplied by client
4.	USB cable	1	1.8	Y	0	Provided by Lab
5.	USB cable	1	1.8	Y	0	Provided by Lab
6.	USB cable	1	1.8	Y	1	Provided by Lab
7.	USB-A to USB-C cable	3	0.5	Y	0	Provided by Lab
8.	USB-C cable	1	1.8	Y	0	Supplied by client
9.	Audio cable	1	1.0	N	0	Provided by Lab
10.	AC power cable	1	1.8	N	0	Supplied by client
11.	GND cable	1	2.0	N	0	Provided by Lab
12.	LAN cable (Cat.5e)	1	10	N	0	Provided by Lab

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.	Personal Computer	HP	Elite Desk 800G4	4CE8451BL1	FCC DoC Approved	Provided by Lab
B.	USB Keyboard	DELL	SK-8115	CN-0J4635-71616-63I-076F	N/A	Provided by Lab
C.	USB Mouse	Lenovo	M-UAE119	N/A	N/A	Provided by Lab
D.	USB Flash Drive	HP	16GB	N/A	N/A	Provided by Lab
E.	USB Flash Drive	HP	16GB	N/A	N/A	Provided by Lab
F.	USB Flash Drive	HP	16GB	N/A	N/A	Provided by Lab
G.	DUMMY LOAD	BVADT	L19B	L2-010028	N/A	Provided by Lab
H.	DUMMY LOAD	BVADT	L19B	L2-010029	N/A	Provided by Lab
I.	Multimeter <For Immunity only>	YFE	YF-370A	N/A	N/A	Provided by Lab
J.	Notebook PC	LENOVO	TP00057A	R9-0JMLFS16/01	FCC DoC Approved	Provided by Lab

Note: 1. All power cords of the above support units are non-shielded (1.8m).
2. Item J acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	HDMI cable	1	1.8	Y	0	Supplied by client
2.	USB-B cable	2	1.8	Y	0	Supplied by client
3.	USB cable	1	1.8	Y	1	Provided by Lab
4.	USB cable	1	1.8	Y	0	Provided by Lab
5.	USB-C cable	1	1.8	Y	0	Supplied by client
6.	DC cable	1	0.3	N	0	Provided by Lab
7.	Data cable	1	0.3	N	0	Provided by Lab
8.	GND cable	1	3.0	N	0	Provided by Lab
9.	AC power cable	1	1.8	N	0	Supplied by client
10.	LAN cable (Cat.5e)	1	10	N	0	Provided by Lab

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

5 Conducted Emission from the AC Mains Power Port

5.1 Limits

Frequency range (MHz)	Coupling device	Detector type / bandwidth	Class A limits (dBuV)
0.15 - 0.5	AMN	Quasi-peak / 9kHz	79
0.5 - 30.0			73
0.15 - 0.5		Average / 9kHz	66
0.5 - 30.0			60

Frequency range (MHz)	Coupling device	Detector type / bandwidth	Class B limits (dBuV)
0.15 - 0.5	AMN	Quasi-peak / 9kHz	66 - 56
0.5 - 5			56
5 - 30.0			60
0.15 - 0.5		Average / 9kHz	56 - 46
0.5 - 5			46
5 - 30.0			50

5.2 Test Instruments

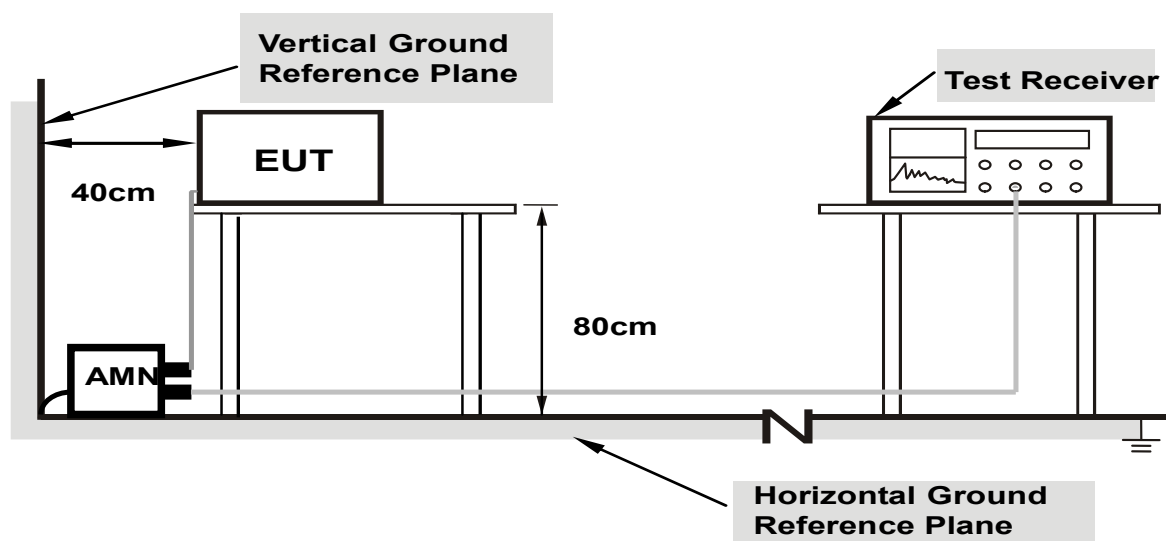
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESR3	102414	Jan. 17, 2019	Jan. 16, 2020
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ENV216	101197	May 23, 2018	May 22, 2019
LISN With Adapter (for EUT)	AD10	C10Ada-002	May 23, 2018	May 22, 2019
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	100218	Nov. 30, 2018	Nov. 29, 2019
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 3, 2018	May 2, 2019
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK 8121	8121-808	Mar. 15, 2019	Mar. 14, 2020
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C10.01	Feb. 13, 2019	Feb. 12, 2020
SUHNTER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-011484	May 8, 2018	May 7, 2019
ROHDE & SCHWARZ Artificial Mains Network (For TV EUT)	ESH3-Z5	100220	Nov. 21, 2018	Nov. 20, 2019
LISN With Adapter (for TV EUT)	100220	NA	Nov. 21, 2018	Nov. 20, 2019

- Note: 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. 10.
 3. The VCCI Site Registration No. C-11852.
 4. Tested Date: Mar 21, 2019.

5.3 Test Arrangement

- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through an Artificial Mains Network (AMN). Other support units were connected to the power mains through another AMN. The two AMNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 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 AMN.
 2. The distance specified between EUT/AE and other metallic objects is ≥ 0.8 m in the measurement arrangement for table-top EUT.
 3. Cable on the RGP must to be insulated.

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

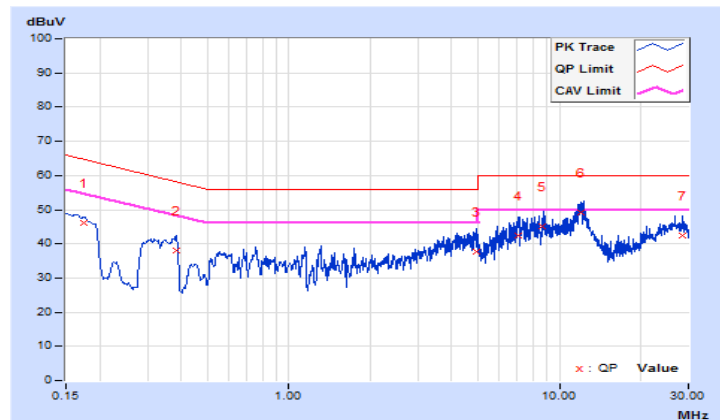
5.4 Test Results of Input Power: 110Vac, 60Hz

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	110Vac, 60Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 1A		

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	0.17374	9.67	36.32	19.30	45.99	28.97	64.78	54.78	-18.79	-25.81
2	0.38199	9.70	28.30	19.32	38.00	29.02	58.24	48.24	-20.24	-19.22
3	4.91830	9.85	27.93	17.84	37.78	27.69	56.00	46.00	-18.22	-18.31
4	7.01047	9.89	32.52	26.32	42.41	36.21	60.00	50.00	-17.59	-13.79
5	8.60520	9.92	35.23	26.87	45.15	36.79	60.00	50.00	-14.85	-13.21
6	11.99108	9.97	39.32	29.98	49.29	39.95	60.00	50.00	-10.71	-10.05
7	28.68678	10.18	32.12	26.30	42.30	36.48	60.00	50.00	-17.70	-13.52

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

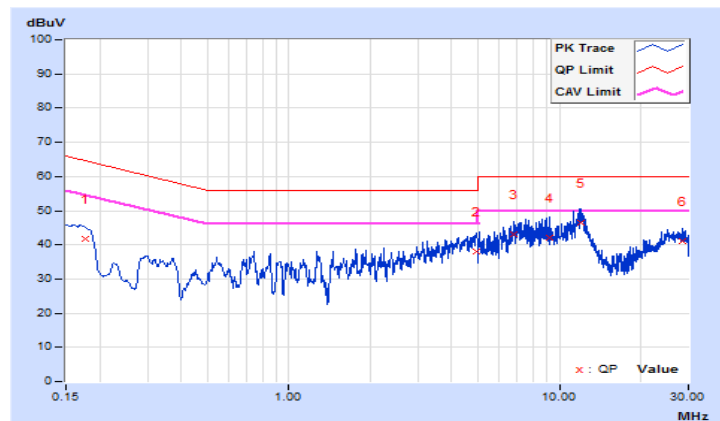


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	110Vac, 60Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 1A		

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	0.17737	9.68	32.20	20.45	41.88	30.13	64.61	54.61	-22.73	-24.48
2	4.91830	9.86	28.20	20.13	38.06	29.99	56.00	46.00	-17.94	-16.01
3	6.80642	9.90	33.32	25.38	43.22	35.28	60.00	50.00	-16.78	-14.72
4	9.22671	9.95	32.20	24.63	42.15	34.58	60.00	50.00	-17.85	-15.42
5	12.07319	9.99	36.32	27.63	46.31	37.62	60.00	50.00	-13.69	-12.38
6	28.63986	10.15	31.02	24.99	41.17	35.14	60.00	50.00	-18.83	-14.86

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

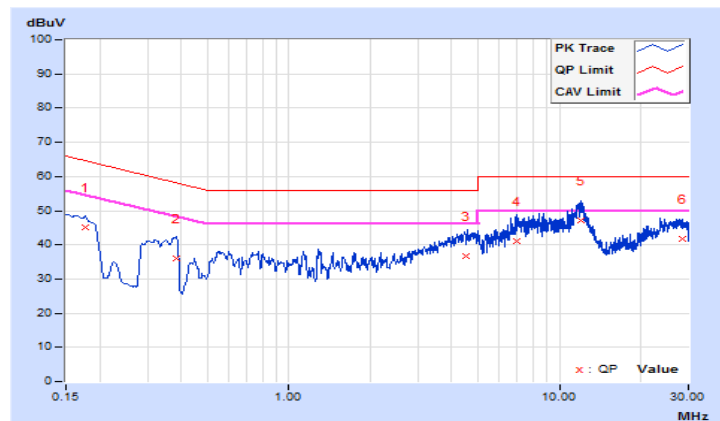


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	110Vac, 60Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 1B		

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	0.17605	9.67	35.33	18.10	45.00	27.77	64.67	54.67	-19.67	-26.90
2	0.38199	9.70	26.48	17.01	36.18	26.71	58.24	48.24	-22.06	-21.53
3	4.50502	9.84	26.95	16.20	36.79	26.04	56.00	46.00	-19.21	-19.96
4	6.95500	9.89	31.30	23.97	41.19	33.86	60.00	50.00	-18.81	-16.14
5	11.97153	9.97	37.02	28.12	46.99	38.09	60.00	50.00	-13.01	-11.91
6	28.66723	10.18	31.53	25.86	41.71	36.04	60.00	50.00	-18.29	-13.96

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

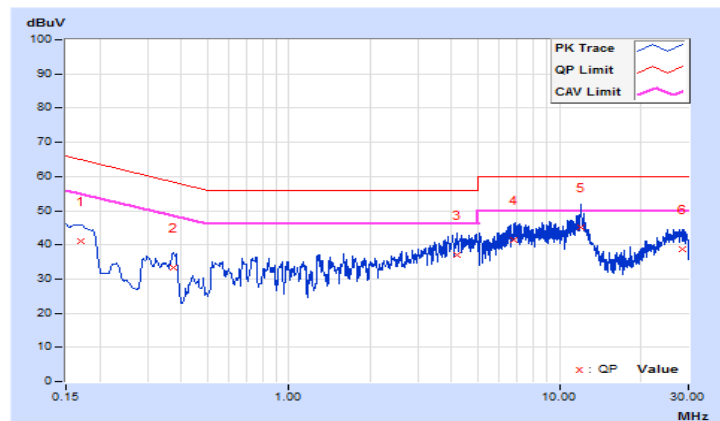


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	110Vac, 60Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 1B		

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	0.16955	9.68	31.40	18.01	41.08	27.69	64.98	54.98	-23.90	-27.29
2	0.37387	9.71	23.55	16.80	33.26	26.51	58.41	48.41	-25.15	-21.90
3	4.18895	9.84	27.32	17.99	37.16	27.83	56.00	46.00	-18.84	-18.17
4	6.74386	9.90	31.58	23.32	41.48	33.22	60.00	50.00	-18.52	-16.78
5	11.94416	9.99	35.00	26.32	44.99	36.31	60.00	50.00	-15.01	-13.69
6	28.34079	10.15	28.72	23.20	38.87	33.35	60.00	50.00	-21.13	-16.65

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

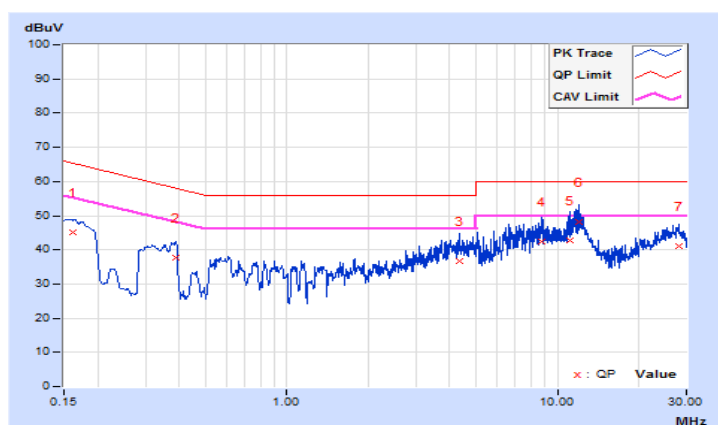


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	110Vac, 60Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 2		

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	0.16267	9.67	35.47	18.07	45.14	27.74	65.33	55.33	-20.19	-27.59
2	0.38808	9.70	27.91	17.14	37.61	26.84	58.10	48.10	-20.49	-21.26
3	4.32398	9.84	26.84	15.34	36.68	25.18	56.00	46.00	-19.32	-20.82
4	8.78097	9.93	32.54	23.99	42.47	33.92	60.00	50.00	-17.53	-16.08
5	11.10742	9.96	32.74	24.77	42.70	34.73	60.00	50.00	-17.30	-15.27
6	11.99890	9.97	38.20	29.10	48.17	39.07	60.00	50.00	-11.83	-10.93
7	28.17457	10.17	31.04	25.33	41.21	35.50	60.00	50.00	-18.79	-14.50

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

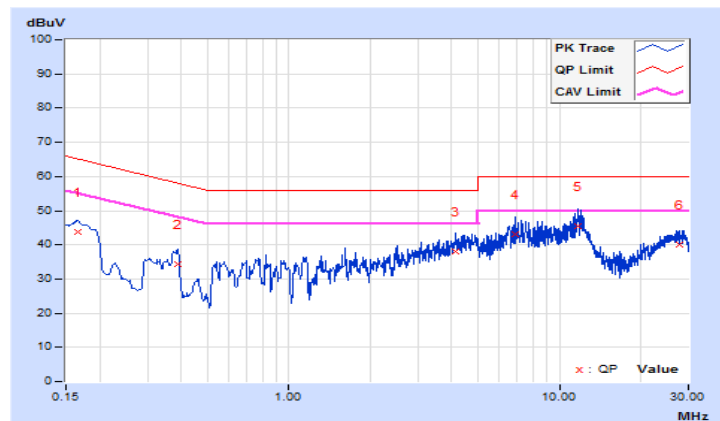


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	110Vac, 60Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 2		

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	0.16526	9.68	34.20	20.12	43.88	29.80	65.20	55.20	-21.32	-25.40
2	0.38851	9.71	24.59	15.68	34.30	25.39	58.10	48.10	-23.80	-22.71
3	4.14803	9.84	28.36	18.20	38.20	28.04	56.00	46.00	-17.80	-17.96
4	6.88462	9.90	33.20	24.62	43.10	34.52	60.00	50.00	-16.90	-15.48
5	11.70565	9.99	35.32	26.10	45.31	36.09	60.00	50.00	-14.69	-13.91
6	27.83831	10.14	29.85	22.76	39.99	32.90	60.00	50.00	-20.01	-17.10

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



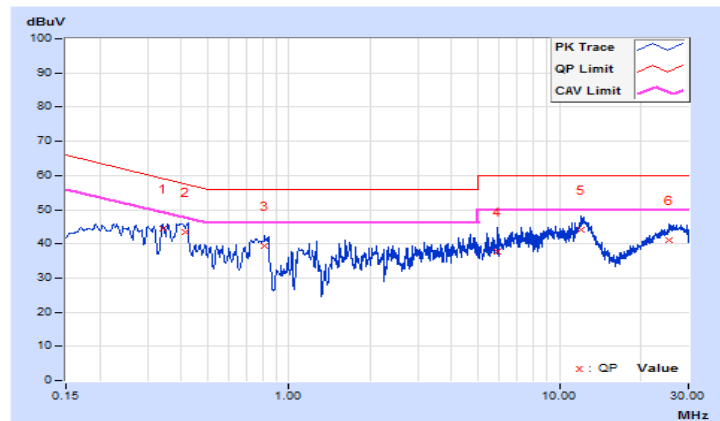
5.5 Test Results of Input Power: 230Vac, 50Hz

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 1A		

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	0.34107	9.69	34.76	15.42	44.45	25.11	59.18	49.18	-14.73	-24.07
2	0.41333	9.70	33.61	18.94	43.31	28.64	57.58	47.58	-14.27	-18.94
3	0.81585	9.74	29.74	16.30	39.48	26.04	56.00	46.00	-16.52	-19.96
4	5.93058	9.87	27.82	19.54	37.69	29.41	60.00	50.00	-22.31	-20.59
5	12.04973	9.97	34.21	28.09	44.18	38.06	60.00	50.00	-15.82	-11.94
6	25.45321	10.12	31.02	25.53	41.14	35.65	60.00	50.00	-18.86	-14.35

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

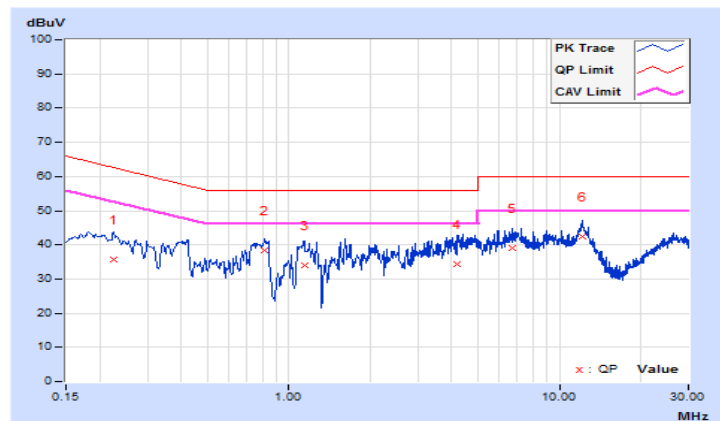


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 1A		

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	0.22429	9.69	26.14	17.03	35.83	26.72	62.66	52.66	-26.83	-25.94
2	0.81370	9.76	28.52	15.99	38.28	25.75	56.00	46.00	-17.72	-20.25
3	1.14008	9.78	24.28	11.62	34.06	21.40	56.00	46.00	-21.94	-24.60
4	4.21059	9.84	24.49	16.87	34.33	26.71	56.00	46.00	-21.67	-19.29
5	6.66175	9.90	29.00	22.35	38.90	32.25	60.00	50.00	-21.10	-17.75
6	12.14748	10.00	32.47	26.72	42.47	36.72	60.00	50.00	-17.53	-13.28

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

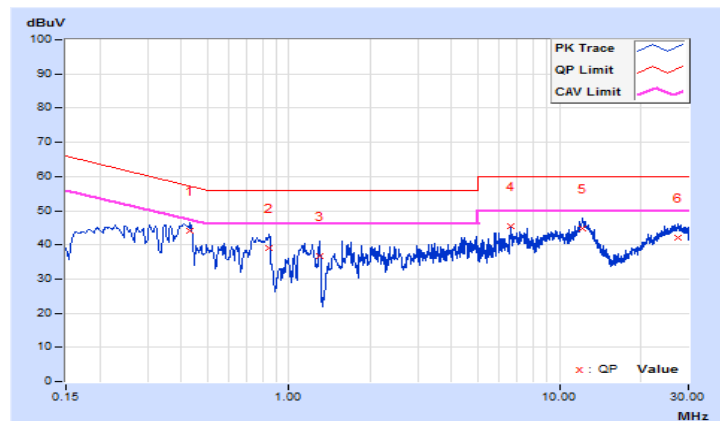


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 1B		

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	0.43252	9.70	34.36	20.26	44.06	29.96	57.20	47.20	-13.14	-17.24
2	0.84799	9.74	29.15	16.59	38.89	26.33	56.00	46.00	-17.11	-19.67
3	1.29373	9.77	26.96	11.73	36.73	21.50	56.00	46.00	-19.27	-24.50
4	6.62656	9.88	35.42	21.81	45.30	31.69	60.00	50.00	-14.70	-18.31
5	12.13575	9.97	34.89	29.11	44.86	39.08	60.00	50.00	-15.14	-10.92
6	27.49423	10.16	31.90	26.60	42.06	36.76	60.00	50.00	-17.94	-13.24

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

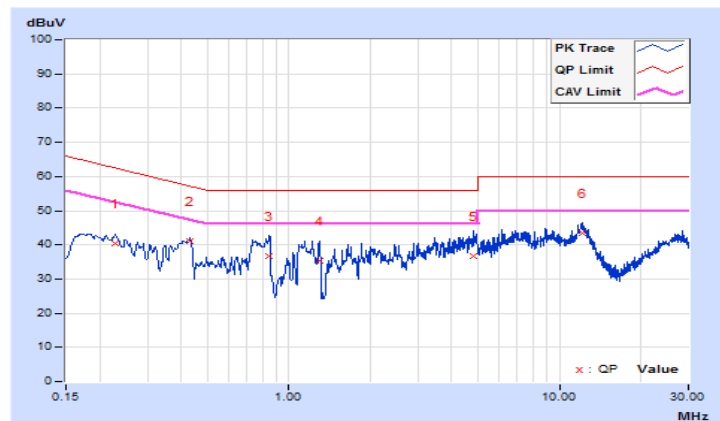


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 1B		

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	0.22791	9.69	30.75	21.56	40.44	31.25	62.53	52.53	-22.09	-21.28
2	0.43121	9.71	31.28	13.25	40.99	22.96	57.23	47.23	-16.24	-24.27
3	0.84408	9.76	27.08	13.48	36.84	23.24	56.00	46.00	-19.16	-22.76
4	1.29312	9.79	25.64	10.22	35.43	20.01	56.00	46.00	-20.57	-25.99
5	4.83005	9.86	26.87	19.34	36.73	29.20	56.00	46.00	-19.27	-16.80
6	12.12793	10.00	33.47	26.49	43.47	36.49	60.00	50.00	-16.53	-13.51

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

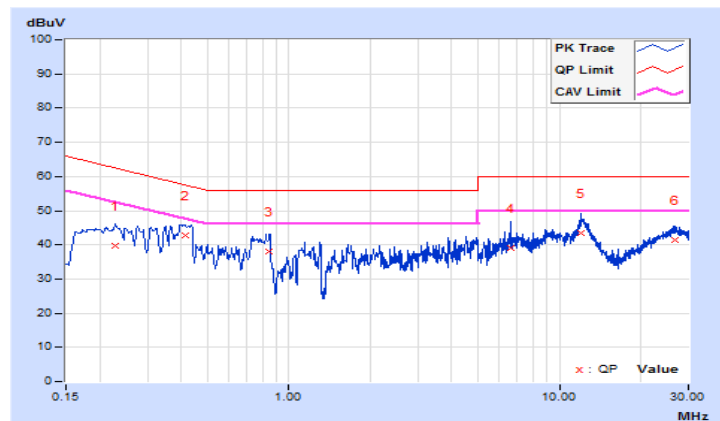


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 2		

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	0.22820	9.67	30.20	20.11	39.87	29.78	62.51	52.51	-22.64	-22.73
2	0.41232	9.70	32.94	16.99	42.64	26.69	57.60	47.60	-14.96	-20.91
3	0.84874	9.74	28.41	14.68	38.15	24.42	56.00	46.00	-17.85	-21.58
4	6.61483	9.88	29.32	21.86	39.20	31.74	60.00	50.00	-20.80	-18.26
5	11.97935	9.97	33.51	27.23	43.48	37.20	60.00	50.00	-16.52	-12.80
6	26.85690	10.15	31.24	25.73	41.39	35.88	60.00	50.00	-18.61	-14.12

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

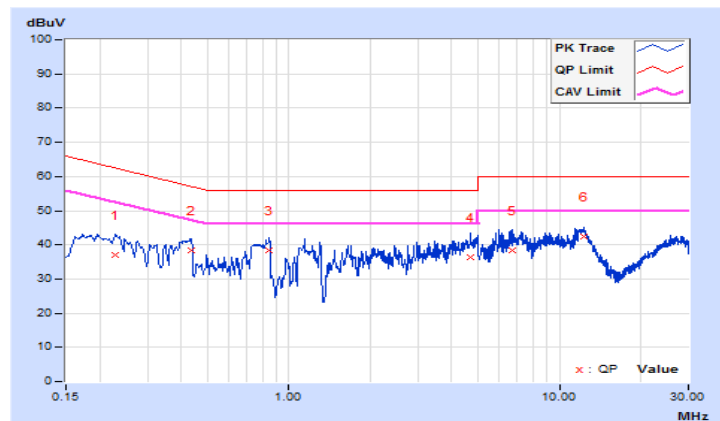


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	25°C, 79%RH, 1002mbar
Tested by	John Liao		
Test Mode	Mode 2		

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	0.22820	9.69	27.32	18.55	37.01	28.24	62.51	52.51	-25.50	-24.27
2	0.43543	9.71	28.69	9.01	38.40	18.72	57.15	47.15	-18.75	-28.43
3	0.84908	9.76	28.51	14.57	38.27	24.33	56.00	46.00	-17.73	-21.67
4	4.69934	9.86	26.37	18.06	36.23	27.92	56.00	46.00	-19.77	-18.08
5	6.67348	9.90	28.38	22.81	38.28	32.71	60.00	50.00	-21.72	-17.29
6	12.25696	10.00	32.31	26.65	42.31	36.65	60.00	50.00	-17.69	-13.35

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 Asymmetric Mode Conducted Emission at Telecommunication Ports

6.1 Limits

For Class A Equipment

Frequency range (MHz)	Coupling device	Detector type / bandwidth	Voltage limits (dBuV)	Current limits (dBuA)
0.15 - 0.5	AAN	Quasi-peak / 9kHz	97 – 87	N/A
0.5 - 30.0			87	
0.15 - 0.5	AAN	Average / 9kHz	84-74	
0.5 - 30.0			74	
0.15 - 0.5	CVP and current probe	Quasi-peak / 9kHz	97 – 87	53 – 43
0.5 - 30.0			87	43
0.15 - 0.5	CVP and current probe	Average / 9kHz	84-74	40 – 30
0.5 - 30.0			74	30
0.15 - 0.5	Current Probe	Quasi-peak / 9kHz	N/A	53 – 43
0.5 - 30.0				43
0.15 - 0.5	Current Probe	Average / 9kHz		40 – 30
0.5 - 30.0				30

For Class B Equipment

Frequency range (MHz)	Coupling device	Detector type / bandwidth	Voltage limits (dBuV)	Current limits (dBuA)
0.15 - 0.5	AAN	Quasi-peak / 9kHz	84 – 74	N/A
0.5 - 30.0			74	
0.15 - 0.5	AAN	Average / 9kHz	74-64	
0.5 - 30.0			64	
0.15 - 0.5	CVP and current probe	Quasi-peak / 9kHz	84 – 74	40 – 30
0.5 - 30.0			74	30
0.15 - 0.5	CVP and current probe	Average / 9kHz	74-64	30 – 20
0.5 - 30.0			64	20
0.15 - 0.5	Current Probe	Quasi-peak / 9kHz	N/A	40 – 30
0.5 - 30.0				30
0.15 - 0.5	Current Probe	Average / 9kHz		30 – 20
0.5 - 30.0				20

6.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESR3	102414	Jan. 17, 2019	Jan. 16, 2020
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ENV216	101197	May 23, 2018	May 22, 2019
LISN With Adapter (for EUT)	AD10	C10Ada-002	May 23, 2018	May 22, 2019
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	100218	Nov. 30, 2018	Nov. 29, 2019
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 3, 2018	May 2, 2019
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK 8121	8121-808	Mar. 15, 2019	Mar. 14, 2020
Software	Cond_V7.3.7.4	NA	NA	NA
Software	ISN_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C10.01	Feb. 13, 2019	Feb. 12, 2020
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010773	Feb. 18, 2019	Feb. 17, 2020
FCC ISN	F-071115-1057-1	20652	Jan. 17, 2019	Jan. 16, 2020

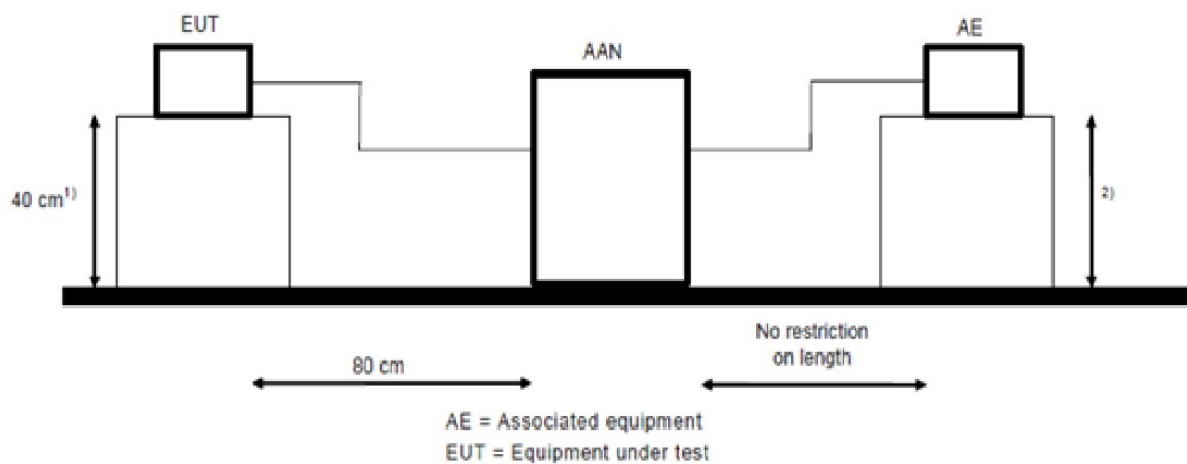
- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. 10.
3. The VCCI Site Registration No. T-11611.
4. Tested Date: Mar. 21, 2019.

6.3 Test Arrangement

Method of Using AANs:

- The EUT is placed 0.4 meters from the conducting wall of the shielded room and connected to AAN directly to reference ground plane.
- If voltage measurement is used, measure voltage at the measurement port of the AAN, correct the reading by adding the AAN voltage division factor, and compare to the voltage limit.
- It is not necessary to apply the voltage and the current limit if a AAN is used.
- The test results of disturbance at telecommunication 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.



¹⁾ Distance to the reference groundplane (vertical or horizontal).

²⁾ Distance to the reference groundplane is not critical.

Note: Cable on the RGP must to be insulated.

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

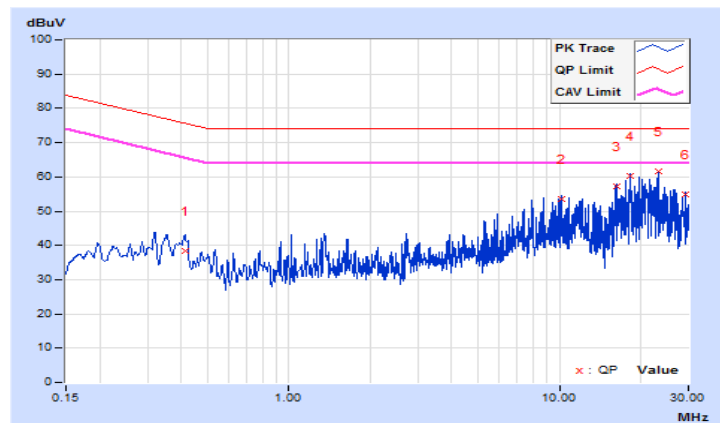
6.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 81%RH, 1000mbar
Tested by	John Liao		
Test Mode	Mode 1A RJ45 TELECOM PORT (100Mbps, TFGEN+PING)		

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	0.41197	9.44	28.82	23.86	38.26	33.30	75.61	65.61	-37.35	-32.31
2	10.24331	9.36	44.02	40.83	53.38	50.19	74.00	64.00	-20.62	-13.81
3	16.22952	9.66	47.57	45.26	57.23	54.92	74.00	64.00	-16.77	-9.08
4	18.24317	9.75	50.52	48.06	60.27	57.81	74.00	64.00	-13.73	-6.19
5	23.12776	10.04	51.51	47.95	61.55	57.99	74.00	64.00	-12.45	-6.01
6	29.23418	10.43	44.34	41.74	54.77	52.17	74.00	64.00	-19.23	-11.83

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

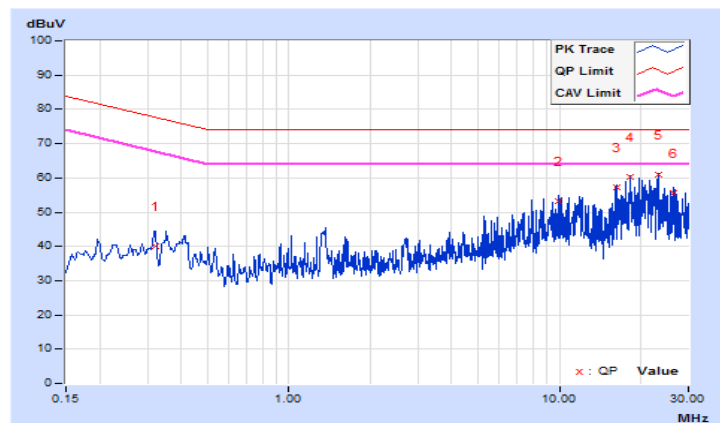


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 81%RH, 1000mbar
Tested by	John Liao		
Test Mode	Mode 1B RJ45 TELECOM PORT (100Mbps, TFGEN+PING)		

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	0.32013	9.50	30.46	27.47	39.96	36.97	77.70	67.70	-37.74	-30.73
2	9.93833	9.35	43.76	40.68	53.11	50.03	74.00	64.00	-20.89	-13.97
3	16.22952	9.66	47.57	45.25	57.23	54.91	74.00	64.00	-16.77	-9.09
4	18.24317	9.75	50.52	47.92	60.27	57.67	74.00	64.00	-13.73	-6.33
5	23.12676	10.04	50.92	47.61	60.96	57.65	74.00	64.00	-13.04	-6.35
6	26.48545	10.26	45.43	42.63	55.69	52.89	74.00	64.00	-18.31	-11.11

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



7 Radiated Emission at Frequencies up to 1GHz

7.1 Limits

For Class A Equipment

Frequency range (MHz)	Distance (m)	Limits (dBuV/m)
30 - 230	10	40
230 - 1000		47
30 - 230	3	50
230 - 1000		57

For Class B Equipment

Frequency range (MHz)	Distance (m)	Limits (dBuV/m)
30 - 230	10	30
230 - 1000		37
30 - 230	3	40
230 - 1000		47

7.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
EMCI Preamplifier	EMC9135	980326	Feb. 20, 2019	Feb. 19, 2020
EMCI Preamplifier	EMC9135	980327	Feb. 20, 2019	Feb. 19, 2020
Agilent Test Receiver	N9038A	MY50010158	Jun. 27, 2018	Jun. 26, 2019
Agilent Test Receiver	N9038A	MY51210114	Jul. 2, 2018	Jul. 1, 2019
Schwarzbeck Antenna	VULB9168	9168-316	Nov. 27, 2018	Nov. 26, 2019
Schwarzbeck Antenna	VULB9168	9168-317	Nov. 27, 2018	Nov. 26, 2019
Max Full. Turn Table & Tower	MF7802	MF7802121	NA	NA
Max Full. Tower	MF7802	MF780208105	NA	NA
Software	Radiated_V8.7.08	NA	NA	NA
JYEBAO RF cable With 5dB PAD	LMR-600	CABLE-CH8-01.V	Sep. 28, 2018	Sep. 27, 2019
JYEBAO RF cable With 5dB PAD	LMR-600	CABLE-CH8-02.H	Sep. 28, 2018	Sep. 27, 2019
WOKEN RF cable With 5dB PAD	8D	CABLE-CH8-03.3M	Sep. 28, 2018	Sep. 27, 2019

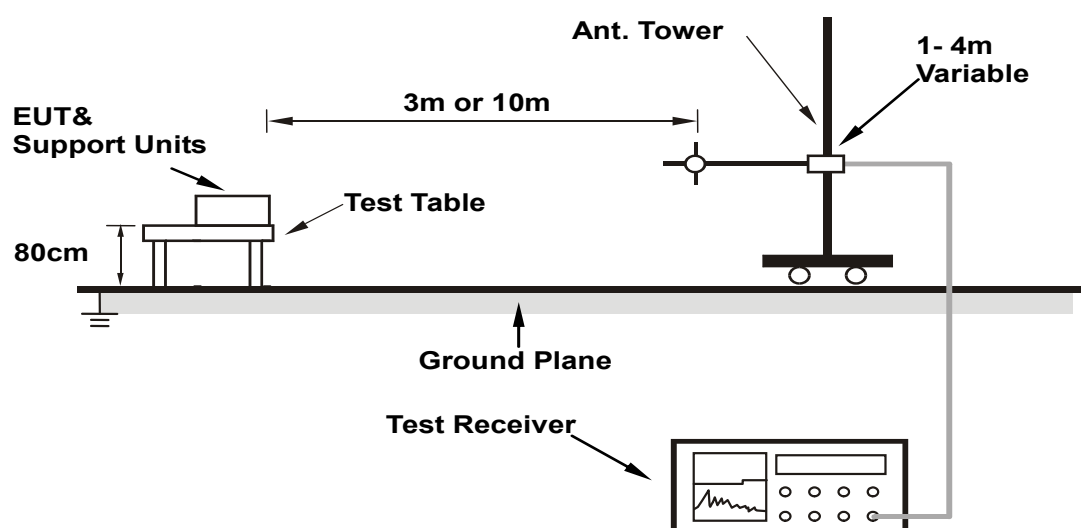
Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in Chamber No. 8.
 3. The Industry Canada Reference No. IC 7450E-8.
 4. The VCCI Site Registration No. R-12946.
 5. Tested Date: Mar. 20, 2019.

7.3 Test Arrangement

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited test facility. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna is a broadband antenna, and its height 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.
- 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.
- The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is up to 1 GHz.

Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for quasi-peak detection (QP) at frequency up to 1GHz.
- The measurement distance is the shortest horizontal distance between an imaginary circular periphery just encompassing this arrangement and the calibration point of the antenna.



Note: Cable on the RGP must be insulated.

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

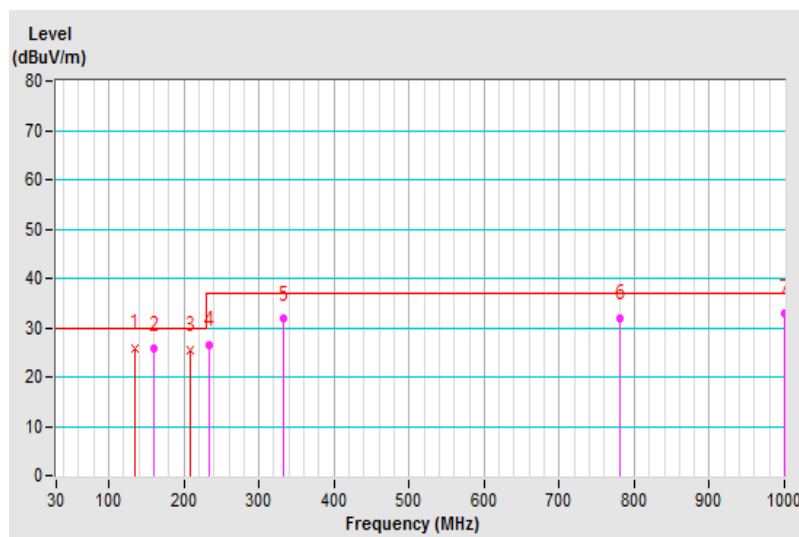
7.4 Test Results

Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 1A		

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	135.29	25.86 QP	30.00	-4.14	4.00 H	256	43.71	-17.85
2	159.89	25.61 QP	30.00	-4.39	3.96 H	164	42.48	-16.87
3	208.74	25.53 QP	30.00	-4.47	3.90 H	252	44.69	-19.16
4	234.08	26.57 QP	37.00	-10.43	3.26 H	133	44.89	-18.32
5	331.96	31.76 QP	37.00	-5.24	3.95 H	119	46.95	-15.19
6	780.02	31.84 QP	37.00	-5.16	1.12 H	227	37.96	-6.12
7	999.85	32.85 QP	37.00	-4.15	1.04 H	248	35.61	-2.76

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

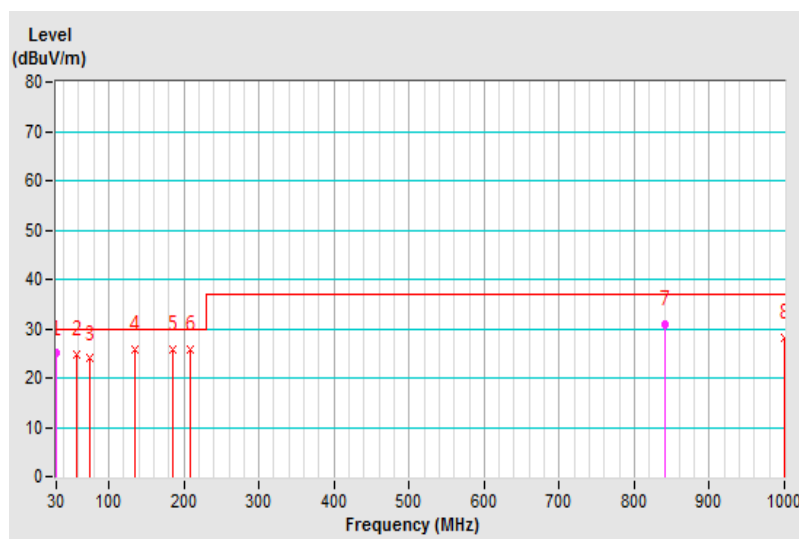


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 1A		

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	30.65	24.95 QP	30.00	-5.05	1.04 V	162	45.02	-20.07
2	56.53	24.71 QP	30.00	-5.29	1.00 V	288	42.97	-18.26
3	75.08	23.94 QP	30.00	-6.06	2.06 V	340	44.93	-20.99
4	135.14	25.87 QP	30.00	-4.13	1.24 V	312	43.62	-17.75
5	184.26	25.88 QP	30.00	-4.12	1.00 V	304	44.36	-18.48
6	208.91	25.89 QP	30.00	-4.11	1.00 V	303	45.04	-19.15
7	840.00	30.78 QP	37.00	-6.22	2.00 V	310	36.24	-5.46
8	999.39	28.15 QP	37.00	-8.85	2.24 V	319	31.64	-3.49

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

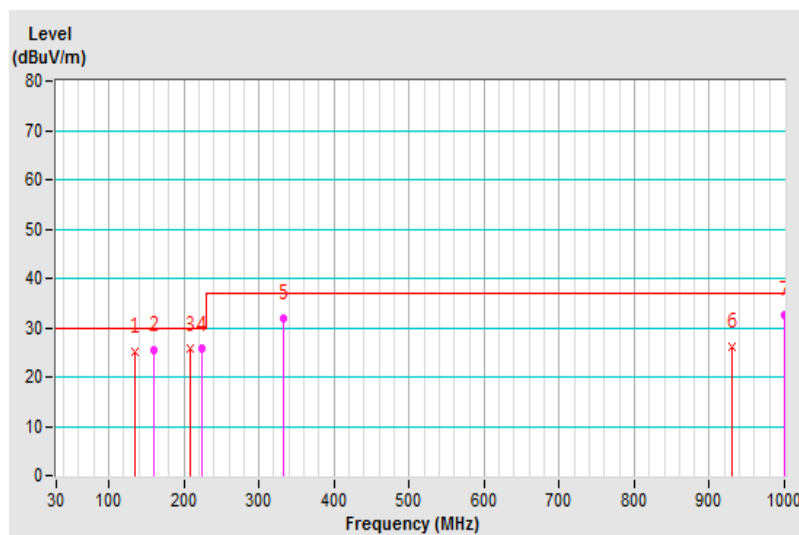


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 1B		

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	135.16	25.21 QP	30.00	-4.79	3.93 H	220	43.05	-17.84
2	159.74	25.44 QP	30.00	-4.56	4.00 H	128	42.28	-16.84
3	208.89	25.67 QP	30.00	-4.33	3.80 H	216	44.82	-19.15
4	224.85	25.66 QP	30.00	-4.34	4.00 H	97	44.56	-18.90
5	331.77	31.88 QP	37.00	-5.12	4.00 H	83	47.07	-15.19
6	930.33	26.20 QP	37.00	-10.80	1.00 H	75	29.91	-3.71
7	999.22	32.67 QP	37.00	-4.33	1.00 H	212	35.47	-2.80

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

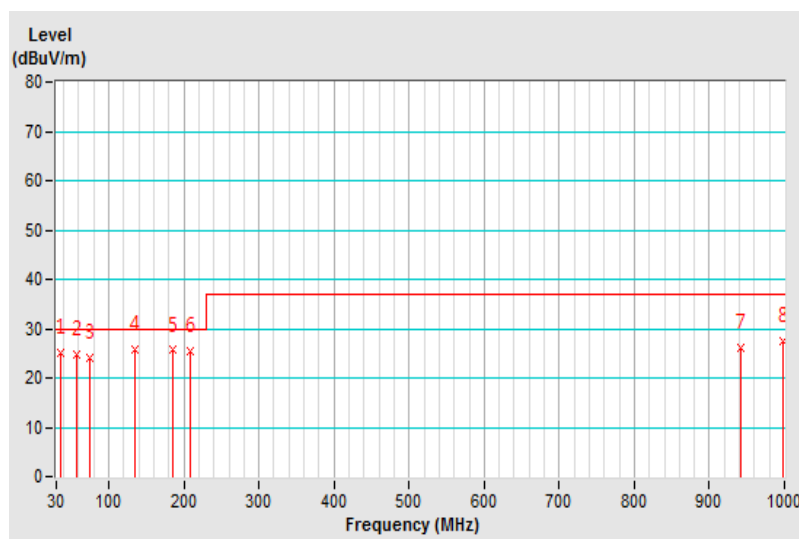


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 1B		

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	35.27	25.09 QP	30.00	-4.91	2.32 V	95	44.68	-19.59
2	56.62	24.82 QP	30.00	-5.18	1.13 V	299	43.10	-18.28
3	75.12	24.03 QP	30.00	-5.97	1.99 V	343	45.04	-21.01
4	135.17	25.71 QP	30.00	-4.29	1.23 V	4	43.46	-17.75
5	184.30	25.61 QP	30.00	-4.39	1.02 V	256	44.10	-18.49
6	208.90	25.48 QP	30.00	-4.52	1.10 V	18	44.63	-19.15
7	942.73	26.22 QP	37.00	-10.78	3.16 V	16	30.16	-3.94
8	999.01	27.62 QP	37.00	-9.38	1.99 V	4	31.12	-3.50

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

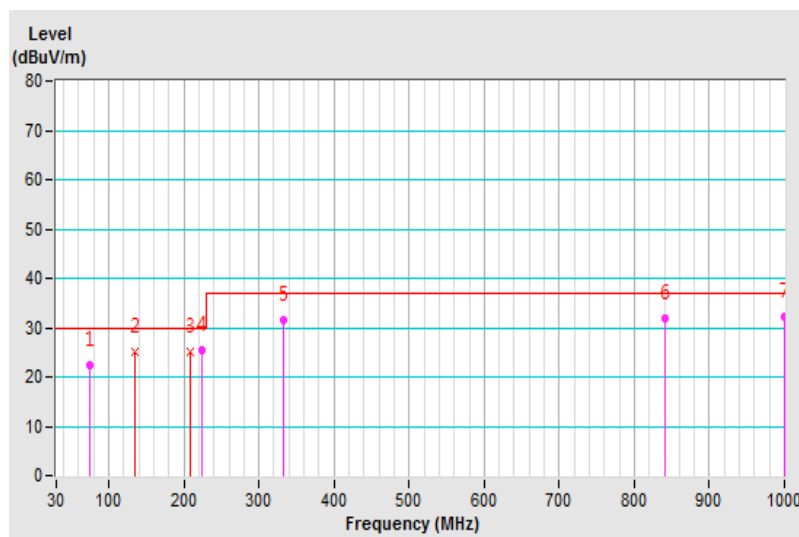


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 2		

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	75.44	22.39 QP	30.00	-7.61	3.96 H	232	43.31	-20.92
2	135.35	25.24 QP	30.00	-4.76	3.95 H	328	43.09	-17.85
3	208.58	25.09 QP	30.00	-4.91	3.97 H	324	44.25	-19.16
4	224.30	25.41 QP	30.00	-4.59	3.92 H	169	44.31	-18.90
5	331.87	31.54 QP	37.00	-5.46	3.90 H	191	46.73	-15.19
6	840.01	31.79 QP	37.00	-5.21	1.14 H	259	37.20	-5.41
7	999.77	32.32 QP	37.00	-4.68	1.20 H	320	35.10	-2.78

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

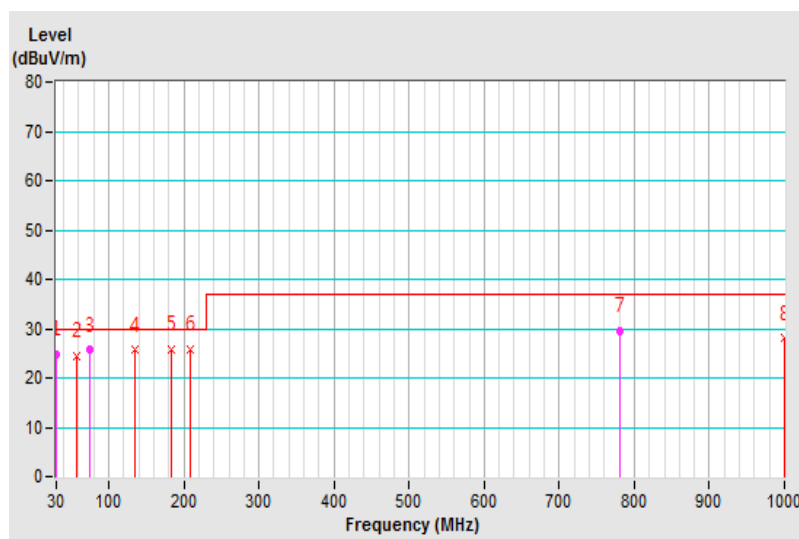


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 2		

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	30.53	24.87 QP	30.00	-5.13	1.10 V	98	44.93	-20.06
2	56.91	24.49 QP	30.00	-5.51	1.05 V	224	42.82	-18.33
3	75.32	25.64 QP	30.00	-4.36	2.01 V	247	46.73	-21.09
4	135.52	25.64 QP	30.00	-4.36	1.34 V	248	43.40	-17.76
5	184.08	25.69 QP	30.00	-4.31	1.03 V	240	44.16	-18.47
6	208.82	25.76 QP	30.00	-4.24	1.00 V	239	44.91	-19.15
7	780.00	29.64 QP	37.00	-7.36	2.24 V	265	35.69	-6.05
8	999.47	28.02 QP	37.00	-8.98	2.30 V	255	31.50	-3.48

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



8 Radiated Emission at Frequencies above 1GHz

8.1 Limits

For Class A Equipment

Frequency range (MHz)	Distance (m)	Detector type	Limits (dBuV/m)
1000 - 3000	3	Average	56
3000 - 6000			60
1000 - 3000		Peak	76
3000 - 6000			80

For Class B Equipment

Frequency range (MHz)	Distance (m)	Detector type	Limits (dBuV/m)
1000 - 3000	3	Average	50
3000 - 6000			54
1000 - 3000		Peak	70
3000 - 6000			74

Required highest frequency for radiated measurement

Highest internal frequency (F_x)	Highest measured frequency
$F_x \leq 108 \text{ MHz}$	1 GHz
$108 \text{ MHz} < F_x \leq 500 \text{ MHz}$	2 GHz
$500 \text{ MHz} < F_x \leq 1 \text{ GHz}$	5 GHz
$F_x > 1 \text{ GHz}$	$5 \times F_x$ up to a maximum of 6 GHz

NOTE 1 For FM and TV broadcast receivers, F_x is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.

NOTE 2 F_x is highest fundamental frequency generated or used within the EUT or highest frequency at which it operates.

Where F_x is unknown, the radiated emission measurements shall be performed up to 6 GHz.

8.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Agilent Spectrum	E4446A	MY51100009	Jun. 4, 2018	Jun. 3, 2019
Agilent Test Receiver	N9038A	MY51210114	Jul. 2, 2018	Jul. 1, 2019
Agilent Preamplifier	8449B	3008A01924	Feb. 21, 2019	Feb. 20, 2020
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2019	Feb. 20, 2020
EMCI Preamplifier	EMC184045B	980235	Feb. 21, 2019	Feb. 20, 2020
ETS Preamplifier	3117-PA	00215857	Nov. 25, 2018	Nov. 24, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Nov. 25, 2018	Nov. 24, 2019
ETS Horn Antenna	3117	00123980	Nov. 25, 2018	Nov. 24, 2019
Max Full. Turn Table	MF7802	MF7802121	NA	NA
Max Full. Tower	MF7802	MF780208105	NA	NA
Software	Radiated_V8.7.08	NA	NA	NA
SUHNER +WOKEN RF cable With 3/4dB PAD	SF-102 +WC01	Cable-CH8(3.6m)-02 +Cable-CH8-04	Aug. 13, 2018	Aug. 12, 2019
MICRO-TRONICS Notch filter	BRC50703-01	010	May 31, 2018	May 30, 2019
MICRO-TRONICS Band Pass Filter	BRM17690	005	May 31, 2018	May 30, 2019

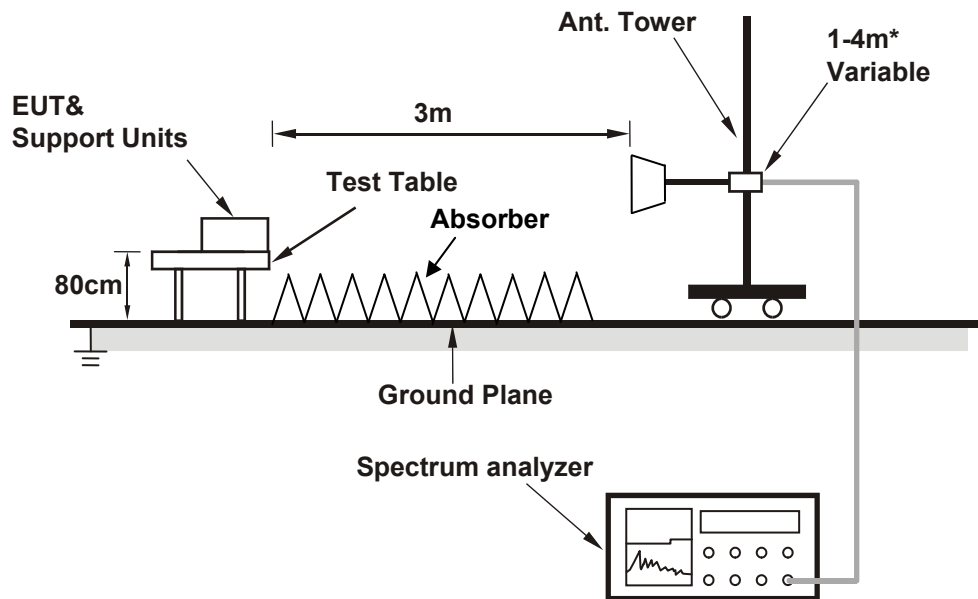
- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The 3dB beamwidth of the horn antenna is minimum 55 degree (or $w = 3.12m$ at 3m distance) for 1~6 GHz.
 3. The test was performed in Chamber No. 8.
 4. The Industry Canada Reference No. IC 7450E-8.
 5. The VCCI Site Registration No. G-10019.
 6. Tested Date: Mar. 20, 2019.

8.3 Test Arrangement

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The height of antenna can be varied from one meter to four meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The spectrum analyzer system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note:

- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection (PK) at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.
- The measurement distance is the shortest horizontal distance between an imaginary circular periphery just encompassing this arrangement and the calibration point of the antenna.



Note: Cable on the RGP must be insulated.

* :depends on the EUT height and the antenna 3dB beamwidth both.

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

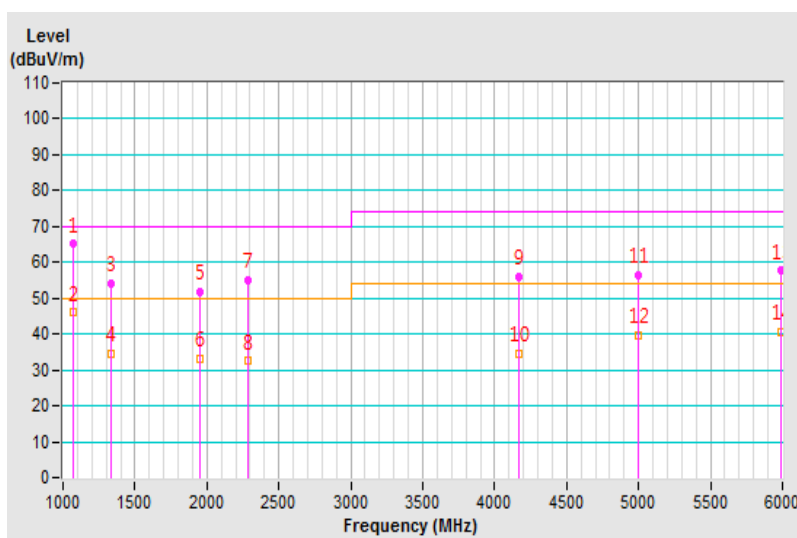
8.4 Test Results

Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 1A		

Antenna Polarity & Test Distance : Horizontal at 3 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	1066.02	65.04 PK	70.00	-4.96	1.00 H	177	79.03	-13.99
2	1066.02	45.99 AV	50.00	-4.01	1.00 H	177	59.98	-13.99
3	1331.08	54.10 PK	70.00	-15.90	1.00 H	92	67.26	-13.16
4	1331.08	34.48 AV	50.00	-15.52	1.00 H	92	47.64	-13.16
5	1956.36	51.78 PK	70.00	-18.22	1.69 H	181	62.57	-10.79
6	1956.36	33.03 AV	50.00	-16.97	1.69 H	181	43.82	-10.79
7	2281.96	54.96 PK	70.00	-15.04	1.72 H	167	65.41	-10.45
8	2281.96	32.44 AV	50.00	-17.56	1.72 H	167	42.89	-10.45
9	4171.66	55.93 PK	74.00	-18.07	1.00 H	317	60.85	-4.92
10	4171.66	34.63 AV	54.00	-19.37	1.00 H	317	39.55	-4.92
11	4995.07	56.45 PK	74.00	-17.55	2.12 H	151	60.23	-3.78
12	4995.07	39.66 AV	54.00	-14.34	2.12 H	151	43.44	-3.78
13	5994.06	57.57 PK	74.00	-16.43	1.99 H	223	60.10	-2.53
14	5994.06	40.51 AV	54.00	-13.49	1.99 H	223	43.04	-2.53

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

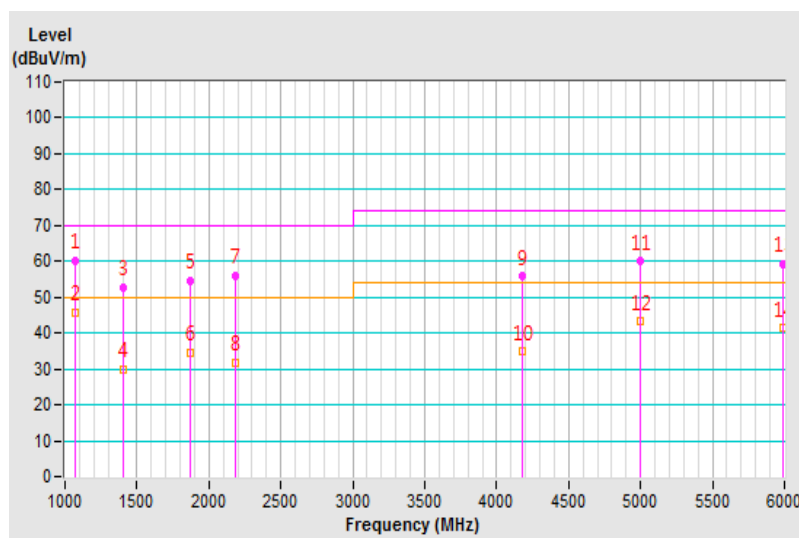


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 1A		

Antenna Polarity & Test Distance : Vertical at 3 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	1066.12	60.08 PK	70.00	-9.92	2.05 V	229	74.07	-13.99
2	1066.12	45.91 AV	50.00	-4.09	2.05 V	229	59.90	-13.99
3	1401.17	52.64 PK	70.00	-17.36	2.10 V	360	66.61	-13.97
4	1401.17	29.89 AV	50.00	-20.11	2.10 V	360	43.86	-13.97
5	1871.37	54.63 PK	70.00	-15.37	2.07 V	213	65.83	-11.20
6	1871.37	34.52 AV	50.00	-15.48	2.07 V	213	45.72	-11.20
7	2179.50	56.03 PK	70.00	-13.97	1.08 V	266	66.55	-10.52
8	2179.50	31.72 AV	50.00	-18.28	1.08 V	266	42.24	-10.52
9	4177.69	55.75 PK	74.00	-18.25	1.02 V	190	60.62	-4.87
10	4177.69	34.74 AV	54.00	-19.26	1.02 V	190	39.61	-4.87
11	4994.36	59.98 PK	74.00	-14.02	1.00 V	175	63.76	-3.78
12	4994.36	43.19 AV	54.00	-10.81	1.00 V	175	46.97	-3.78
13	5988.11	59.26 PK	74.00	-14.74	2.03 V	31	61.79	-2.53
14	5988.11	41.27 AV	54.00	-12.73	2.03 V	31	43.80	-2.53

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

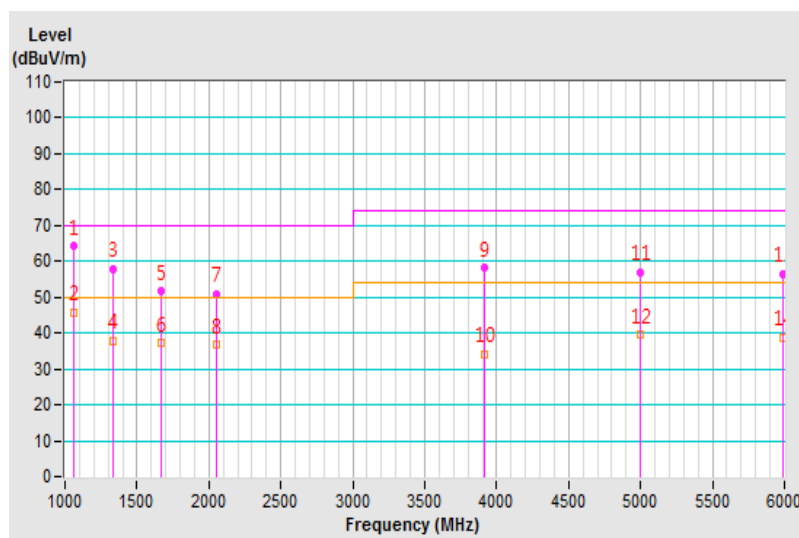


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 1B		

Antenna Polarity & Test Distance : Horizontal at 3 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	1065.62	64.15 PK	70.00	-5.85	2.03 H	182	78.15	-14.00
2	1065.62	45.82 AV	50.00	-4.18	2.03 H	182	59.82	-14.00
3	1330.73	57.73 PK	70.00	-12.27	1.00 H	32	70.89	-13.16
4	1330.73	37.84 AV	50.00	-12.16	1.00 H	32	51.00	-13.16
5	1669.56	51.62 PK	70.00	-18.38	1.43 H	156	65.10	-13.48
6	1669.56	37.16 AV	50.00	-12.84	1.43 H	156	50.64	-13.48
7	2052.39	50.85 PK	70.00	-19.15	1.00 H	141	61.21	-10.36
8	2052.39	36.60 AV	50.00	-13.40	1.00 H	141	46.96	-10.36
9	3912.39	58.12 PK	74.00	-15.88	1.16 H	132	63.95	-5.83
10	3912.39	34.25 AV	54.00	-19.75	1.16 H	132	40.08	-5.83
11	4995.91	56.94 PK	74.00	-17.06	1.40 H	162	60.72	-3.78
12	4995.91	39.43 AV	54.00	-14.57	1.40 H	162	43.21	-3.78
13	5994.00	56.58 PK	74.00	-17.42	1.29 H	246	59.11	-2.53
14	5994.00	38.85 AV	54.00	-15.15	1.29 H	246	41.38	-2.53

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

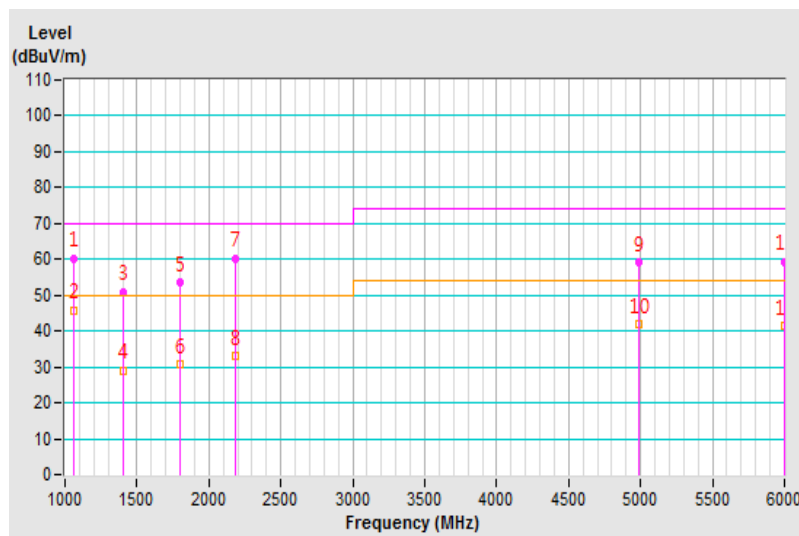


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 1B		

Antenna Polarity & Test Distance : Vertical at 3 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	1065.62	60.33 PK	70.00	-9.67	2.03 V	38	74.33	-14.00
2	1065.62	45.83 AV	50.00	-4.17	2.03 V	38	59.83	-14.00
3	1403.70	50.89 PK	70.00	-19.11	1.00 V	360	64.88	-13.99
4	1403.70	28.99 AV	50.00	-21.01	1.00 V	360	42.98	-13.99
5	1795.17	53.45 PK	70.00	-16.55	1.08 V	229	65.26	-11.81
6	1795.17	30.58 AV	50.00	-19.42	1.08 V	229	42.39	-11.81
7	2188.19	60.09 PK	70.00	-9.91	1.03 V	99	70.63	-10.54
8	2188.19	32.87 AV	50.00	-17.13	1.03 V	99	43.41	-10.54
9	4992.23	59.03 PK	74.00	-14.97	1.89 V	190	62.82	-3.79
10	4992.23	41.78 AV	54.00	-12.22	1.89 V	190	45.57	-3.79
11	5999.30	59.34 PK	74.00	-14.66	2.00 V	294	61.86	-2.52
12	5999.30	41.28 AV	54.00	-12.72	2.00 V	294	43.80	-2.52

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

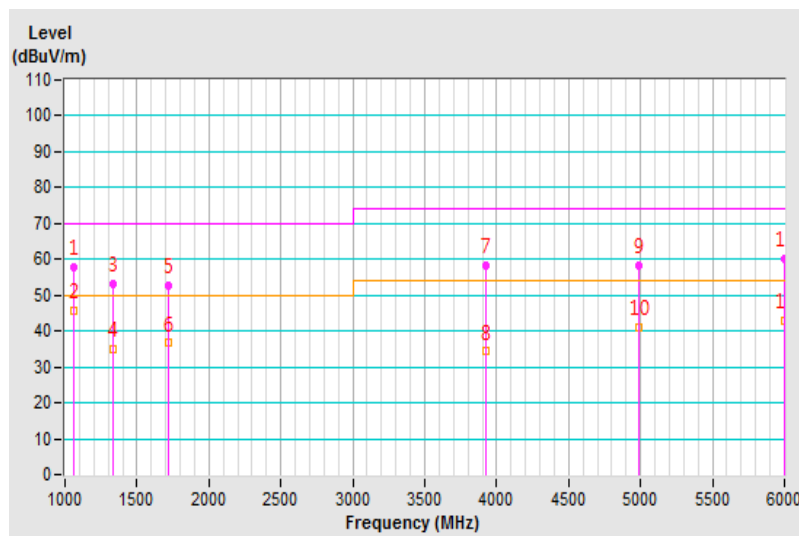


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 2		

Antenna Polarity & Test Distance : Horizontal at 3 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	1065.65	57.93 PK	70.00	-12.07	1.00 H	57	71.93	-14.00
2	1065.65	45.90 AV	50.00	-4.10	1.00 H	57	59.90	-14.00
3	1330.08	53.23 PK	70.00	-16.77	1.02 H	87	66.38	-13.15
4	1330.08	34.97 AV	50.00	-15.03	1.02 H	87	48.12	-13.15
5	1716.20	52.63 PK	70.00	-17.37	1.01 H	219	65.35	-12.72
6	1716.20	36.71 AV	50.00	-13.29	1.01 H	219	49.43	-12.72
7	3926.96	58.43 PK	74.00	-15.57	2.10 H	29	64.19	-5.76
8	3926.96	34.27 AV	54.00	-19.73	2.10 H	29	40.03	-5.76
9	4991.16	58.41 PK	74.00	-15.59	1.04 H	225	62.21	-3.80
10	4991.16	40.95 AV	54.00	-13.05	1.04 H	225	44.75	-3.80
11	5999.72	60.30 PK	74.00	-13.70	1.96 H	220	62.82	-2.52
12	5999.72	42.99 AV	54.00	-11.01	1.96 H	220	45.51	-2.52

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

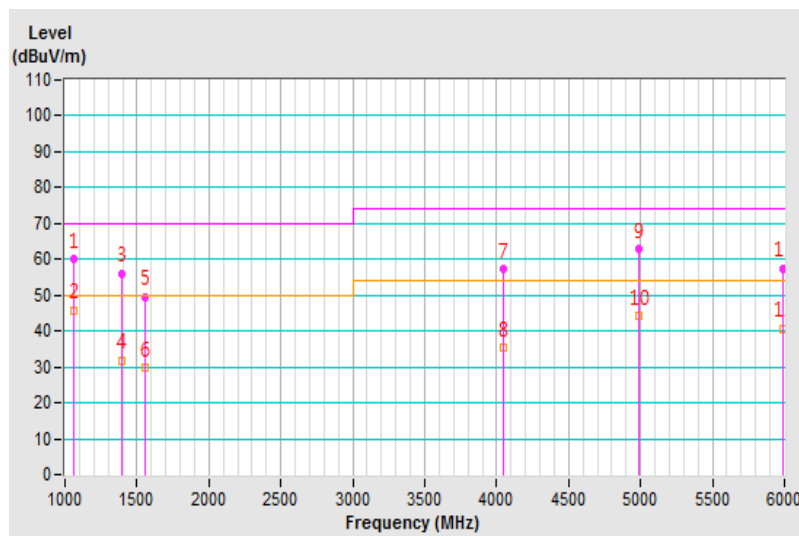


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Ken Lee	Environmental Conditions	20°C, 83%RH, 1000mbar
Test Mode	Mode 2		

Antenna Polarity & Test Distance : Vertical at 3 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	1065.77	59.96 PK	70.00	-10.04	2.02 V	37	73.96	-14.00
2	1065.77	45.81 AV	50.00	-4.19	2.02 V	37	59.81	-14.00
3	1398.88	56.10 PK	70.00	-13.90	1.00 V	360	70.05	-13.95
4	1398.88	31.82 AV	50.00	-18.18	1.00 V	360	45.77	-13.95
5	1556.66	49.39 PK	70.00	-20.61	1.00 V	299	63.59	-14.20
6	1556.66	29.64 AV	50.00	-20.36	1.00 V	299	43.84	-14.20
7	4048.18	57.22 PK	74.00	-16.78	1.05 V	126	62.72	-5.50
8	4048.18	35.29 AV	54.00	-18.71	1.05 V	126	40.79	-5.50
9	4990.91	62.75 PK	74.00	-11.25	1.86 V	221	66.55	-3.80
10	4990.91	44.05 AV	54.00	-9.95	1.86 V	221	47.85	-3.80
11	5991.39	57.30 PK	74.00	-16.70	2.06 V	297	59.82	-2.52
12	5991.39	40.54 AV	54.00	-13.46	2.06 V	297	43.06	-2.52

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



9 Harmonics Current Measurement

9.1 Limits

Limits for Class A equipment		Limits for Class D equipment		
Harmonic Order n	Max. permissible harmonics current A	Harmonic Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd harmonics		Odd Harmonics only		
3	2.30	3	3.4	2.30
5	1.14	5	1.9	1.14
7	0.77	7	1.0	0.77
9	0.40	9	0.5	0.40
11	0.33	11	0.35	0.33
13	0.21	13	0.30	0.21
$15 \leq n \leq 39$	$0.15 \times 15/n$	$15 \leq n \leq 39$	$3.85/n$	$0.15 \times 15/n$
Even harmonics				
2	1.08			
4	0.43			
6	0.30			
$8 \leq n \leq 40$	$0.23 \times 8/n$			

Notes: 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.

9.2 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; Television receivers; Refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

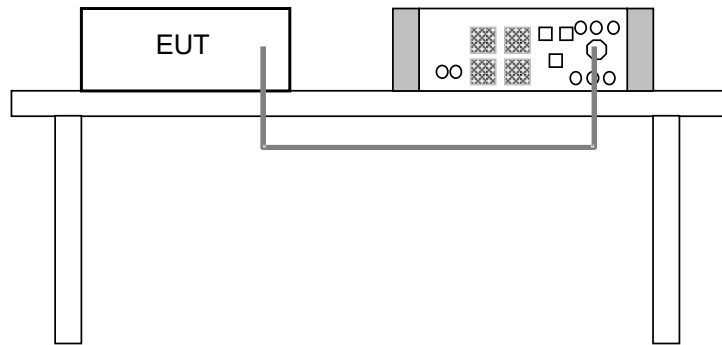
9.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Teseq Harmonics - Flicker Test System	Proflin 2105	32A00983 & 1639A01863	Sep. 27, 2018	Sep. 26, 2019
Software	CTS 4	NA	NA	NA

Note: 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. 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: Mar. 25, 2019.

9.4 Test Arrangement

- 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.
- 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.

9.5 Test Results

Fundamental Voltage/Ampere	230.27Vrms/ 0.435Arms	Power Frequency	49.99Hz
Power Consumption	93.6W	Power Factor	0.935
Environmental Conditions	23 °C, 70%RH	Tested by	Thomas Cheng
Test Mode	Mode 1A		

Harm#	Harms (avg) (A)	100% Limit (A)	Harms (max) (A)	150% Limit (A)	Test Result
3	0.068	0.318	0.068	0.478	Pass
5	0.027	0.178	0.027	0.267	Pass
7	0.016	0.094	0.016	0.140	Pass
9	0.007	0.047	0.007	0.070	Pass
11	0.002	0.033	0.002	0.049	Pass
13	0.002	0.028	0.002	0.042	Pass
15	0.003	0.024	0.003	0.037	Pass
17	0.003	0.022	0.003	0.032	Pass
19	0.003	0.019	0.003	0.029	Pass
21	0.003	0.017	0.003	0.026	Pass
23	0.001	0.016	0.001	0.023	Pass
25	0.001	0.014	0.001	0.022	Pass
27	0.003	0.013	0.003	0.020	Pass
29	0.004	0.012	0.004	0.019	Pass
31	0.002	0.012	0.002	0.017	Pass
33	0.002	0.011	0.002	0.016	Pass
35	0.003	0.010	0.003	0.015	Pass
37	0.001	0.010	0.002	0.015	Pass
39	0.002	0.009	0.002	0.014	Pass

Note: Dynamic limits were applied for this test. The highest harmonics values in the above table may not occur at the same window as the maximum harmonics/limit ratio.

Fundamental Voltage/Ampere	230.24Vrms/ 0.322Arms	Power Frequency	50.00Hz
Power Consumption	67.1W	Power Factor	0.907
Environmental Conditions	23 °C, 70%RH	Tested by	Thomas Cheng
Test Mode	Mode 1B (Default mode)		

- 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.

10 Voltage Fluctuations and Flicker Measurement

10.1 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.

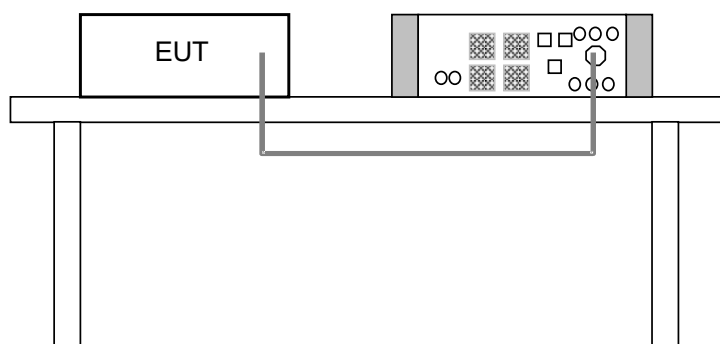
10.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Teseq Harmonics - Flicker Test System	Proflin 2105	32A00983 & 1639A01863	Sep. 27, 2018	Sep. 26, 2019
Software	CTS 4	NA	NA	NA

Note: 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: Mar. 25, 2019.

10.3 Test Arrangement

- 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.
- 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.

10.4 Test Results

Observation (T_p)	10 min.	Power Frequency	49.99Hz
Fundamental Voltage/Ampere	230.27Vrms/ 0.435Arms	Power Factor	0.935
Environmental Conditions	23 °C, 70%RH	Tested by	Thomas Cheng
Test Mode	Mode 1		

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	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.

11 General Immunity Requirements

EN 55024:2010 / EN 55024:2010 +A1:2015, Immunity requirements

Clause	Reference standard	Table	Test specification	Performance Criterion
4.2.1	EN/IEC 61000-4-2 ESD	1.3	Enclosure port: ±8kV Air discharge, ±4kV Contact discharge	B
4.2.3.2	EN/IEC 61000-4-3 RS	1.2	Enclosure port: 80-1000 MHz, 3V/m, 80% AM (1kHz)	A
4.2.2	EN/IEC 61000-4-4 EFT	2.3	Signal ports and telecommunication ports: xDSL equipment: ±0.5kV, 5/50 (T_r/T_h) ns, 100kHz others: ±0.5kV, 5/50 (T_r/T_h) ns, 5kHz	B
		3.3	Input DC power port: ±0.5kV, 5/50 (T_r/T_h) ns, 5kHz	
		4.5	Input AC Power ports: ±1kV, 5/50 (T_r/T_h) ns, 5kHz	
4.2.5	EN/IEC 61000-4-5 Surge	2.2	Signal and telecommunication ports (direct to outdoor cables): 10/700 (5/320) (T_r/T_h) µs w/o primary protectors: ±1kV, or with primary protectors fitted: ±4kV	C
		3.2	Input DC power port (direct to outdoor cables): 1.2/50 (8/20) (T_r/T_h) µs Line to earth: ±0.5kV	B
		4.4	Input AC Power ports: 1.2/50 (8/20) (T_r/T_h) µs, Line to line: ±1kV Line to earth: ±2kV	
4.2.3.3	EN/IEC 61000-4-6 CS	2.1	Signal and telecommunication ports(cable length > 3m): 0.15-80 MHz, 3V, 80% AM (1kHz)	A
		3.1	Input DC power port: 0.15-80 MHz, 3V, 80% AM (1kHz)	
		4.1	Input AC Power ports: 0.15-80 MHz, 3V, 80% AM (1kHz)	
4.2.4	EN/IEC 61000-4-8 PFMF	1.1	Enclosure port: 50 or 60 Hz, 1A/m	A
4.2.6	EN/IEC 61000-4-11 Dips & Interruptions	4.2	Input AC Power ports: Voltage Dips: >95% reduction – 0.5 period 30% reduction – 25 periods	B C
		4.3	Input AC Power ports: Voltage Interruptions: >95% reduction – 250 periods	C

11.1 Performance Criteria

General Performance Criteria

Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. 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 by what the user may reasonably expect from the equipment if used as intended.

Performance criterion B

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. 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 by what the user may reasonably expect from the equipment if used as intended.

Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

Particular performance criteria

The particular performance criteria which are specified in the normative annexes of EN 55024 take precedence over the corresponding parts of the general performance criteria. Where particular performance criteria for specific functions are not given, then the general performance criteria shall apply.

12 Electrostatic Discharge Immunity Test (ESD)

12.1 Test Specification

Basic Standard:	EN/IEC 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Discharge Voltage:	Air Discharge: $\pm 2, \pm 4, \pm 8$ kV (Direct) Contact Discharge: $\pm 2, \pm 4$ kV (Direct/Indirect)
Number of Discharge:	Air – Direct: 10 discharges per location (each polarity) Contact – Direct & Indirect: 25 discharges per location (each polarity) and min. 200 times in total
Discharge Mode:	Single Discharge
Discharge Period:	1-second minimum

12.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
EM Test ESD Simulator	Dito	V0707102251	Apr. 12, 2018	Apr. 11, 2019

- Note:
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. 3.
 3. Tested Date: Mar. 26, 2019.

12.3 Test Arrangement

The discharges shall be applied in two ways:

- a. Contact discharges to the conductive surfaces and coupling planes:

The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane. The remaining three test points shall each receive at least 50 direct contact discharges. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

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

On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user. A minimum of 10 single air discharges shall be applied to the selected test point for each such area.

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

- Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
- The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
- The time interval between two successive single discharges was at least 1 second.
- 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.
- Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- 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.
- At least ten single discharges (in the most sensitive polarity) were applied to the **Horizontal Coupling Plane** at points on each side of the EUT. The ESD generator was positioned at a distance of 0.1 meters from the EUT with the discharge electrode touching the **HCP**.
- At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **Vertical Coupling Plane** in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

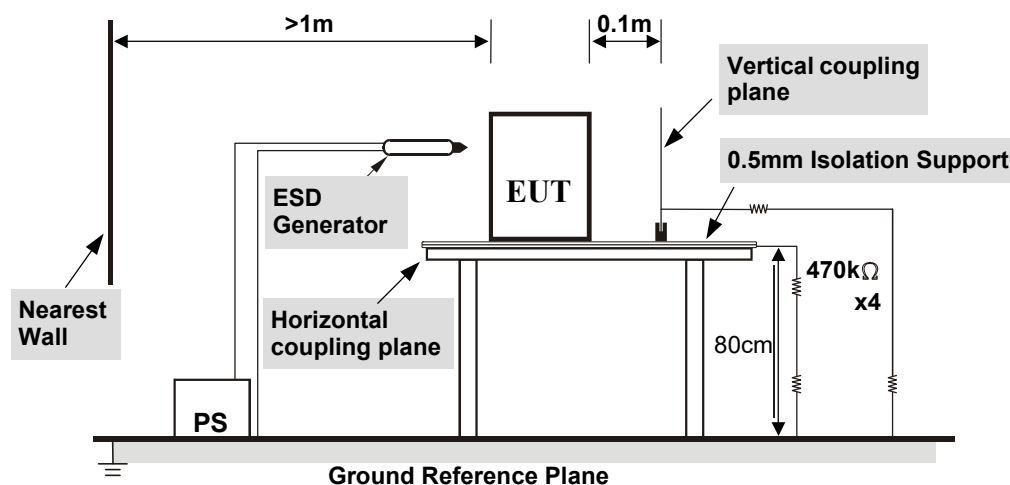


TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **Ground Reference Plane**. 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 **Horizontal Coupling Plane** (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 EN/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.

12.4 Test Results

Test mode	Mode 1	Input Power	230 Vac, 50 Hz
Environmental conditions	23 °C, 41% RH 1005 mbar	Tested by	Thomas Cheng

Test Results of Direct Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criterion
2, 4	+/-	1, 2	Note 1	NA	A
2, 4	+/-	3 ~ 15	NA	Note 1	A
8	+/-	3 ~ 14	NA	Note 1	A
8	+/-	15	NA	Note 2, 3	B

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
2, 4	+/-	Four Sides	Note 1	Note 1	A

Description of test points of indirect application:

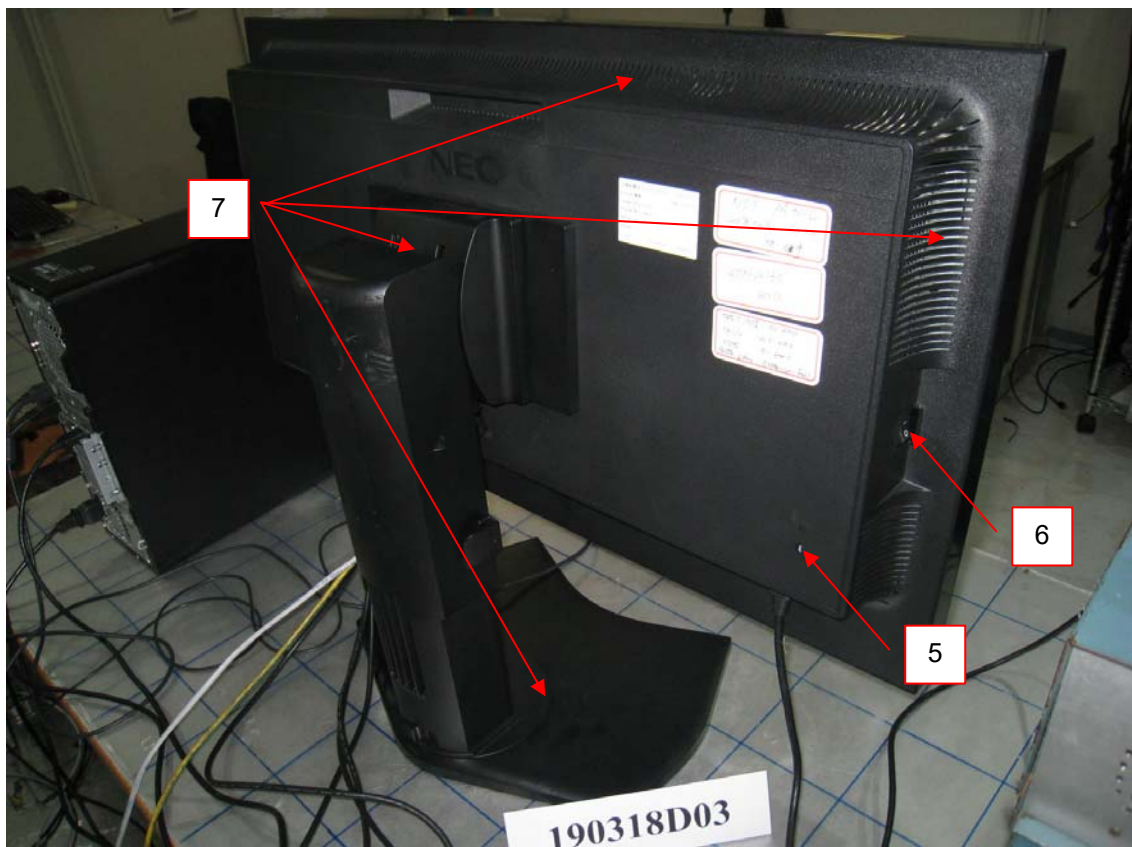
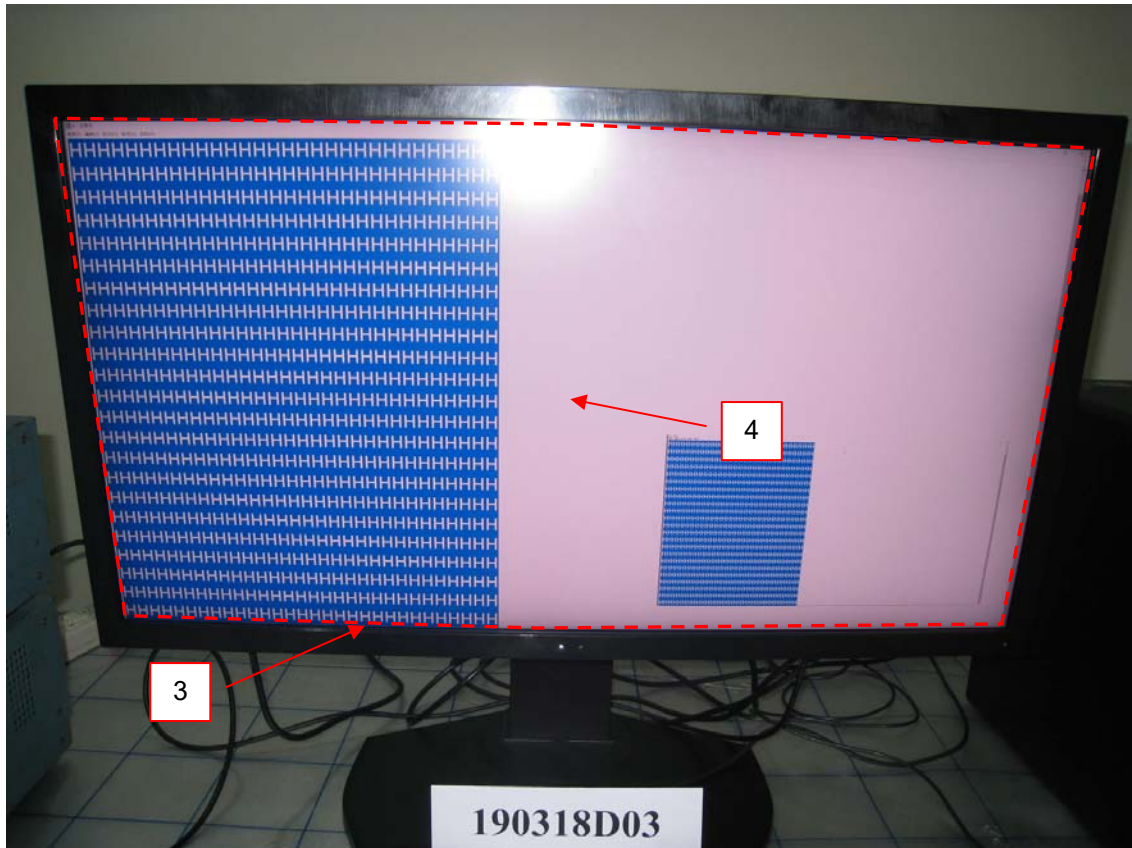
1. Front side 2. Rear side 3. Right side 4. Left side

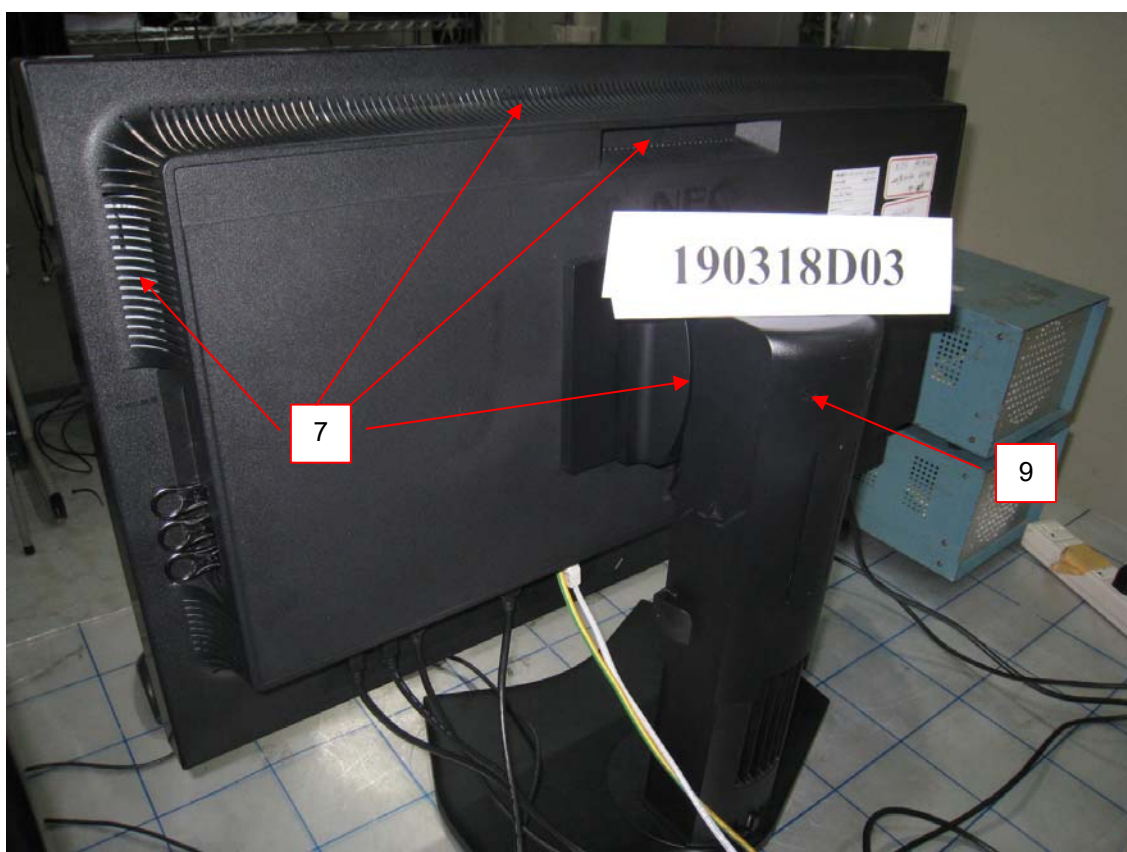
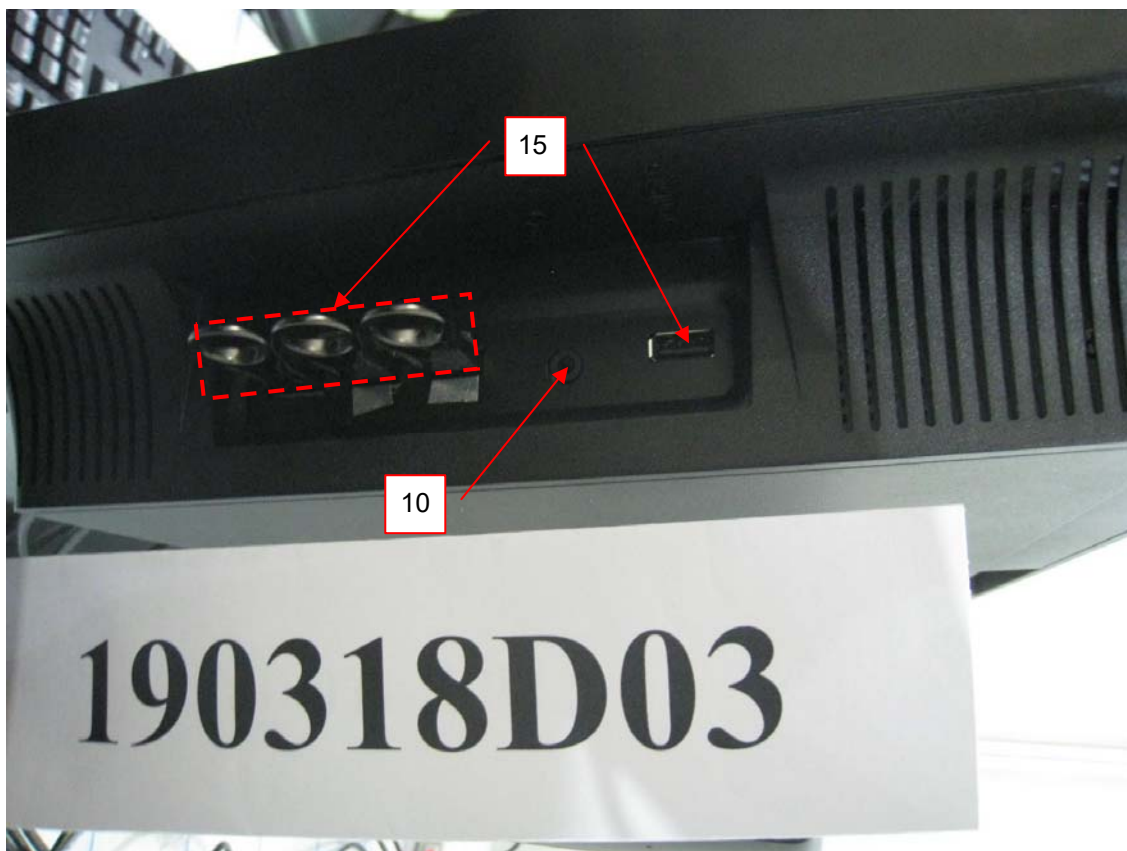
Note: 1. The EUT function was correct during the test.

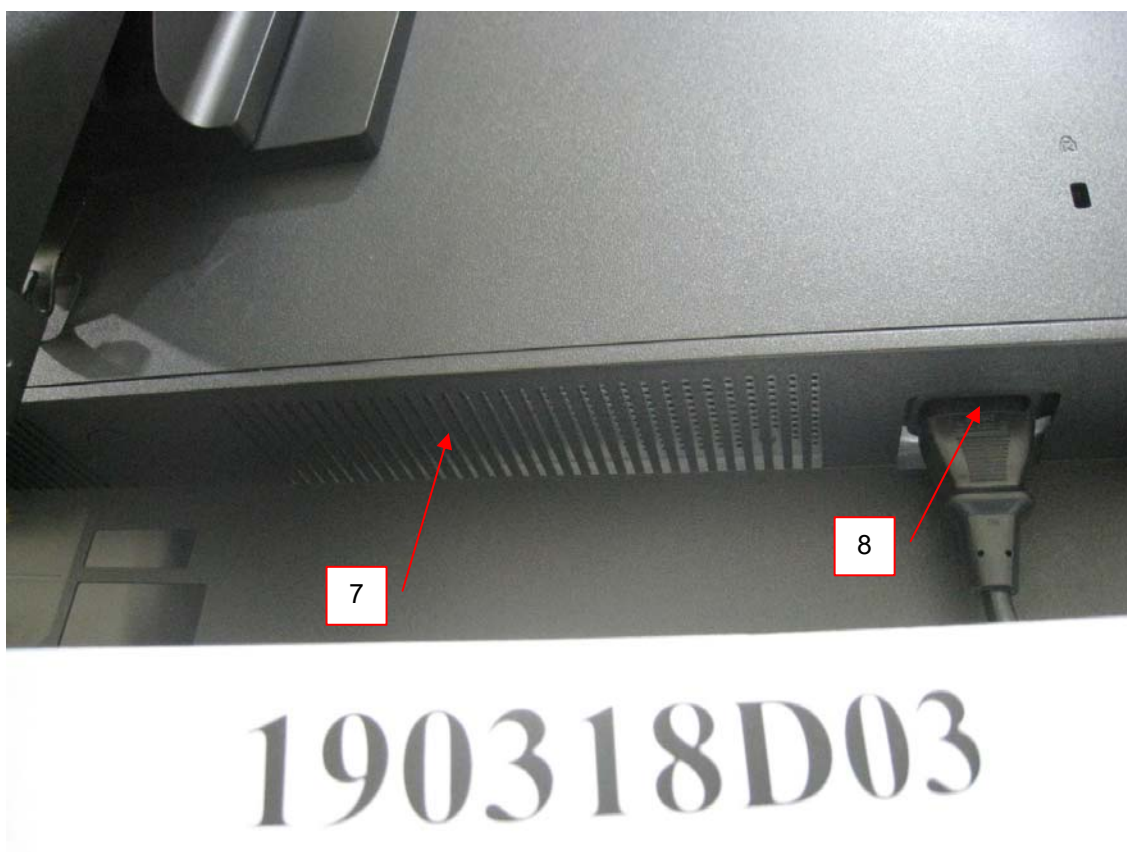
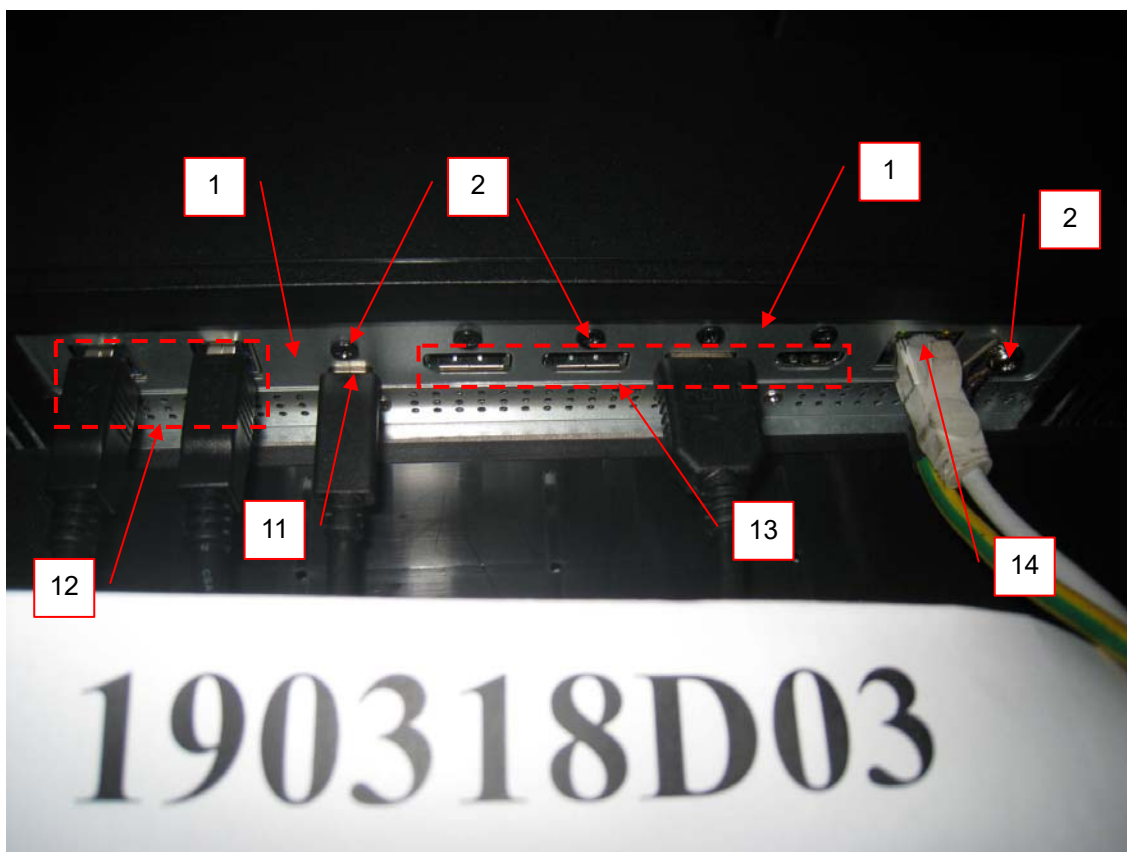
2. There was flickered disturbance on the screen during the test, but self-recoverable after the test.

3. The R/W function of USB device was pause 1 second during the test, but self-recoverable after the test.

Description of Test Points







13 Radiated, Radio-frequency, Electromagnetic Field Immunity Test (RS)

13.1 Test Specification

Basic Standard:	EN/IEC 61000-4-3
Frequency Range:	80 MHz - 1000 MHz
Field Strength:	3 V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal and Vertical
Antenna Height:	1.5m
Dwell Time:	3 seconds

13.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
AgilentSignal Generator	E8257D	MY48050465	Jun. 6, 2018	Jun. 5, 2019
PRANA RF Amplifier	AP32DP280	0811-894	NA	NA
TESTQAmplifier	AS1860-50	S-5944/1	NA	NA
AR RF Amplifier	35S4G8AM4	0326094	NA	NA
AR RF Amplifier	100S1G4M3	0329249	NA	NA
AR Controller	SC1000M3	305910	NA	NA
ETS Electric Field Sensor	HI-6105	00086973	Dec. 4, 2018	Dec. 3, 2019
BOONTON RF Voltage Meter	4232A	10180	May 23, 2018	May 22, 2019
BOONTON Power Sensor	51013-4E	34870	Jun. 4, 2018	Jun. 3, 2019
BOONTON Power Sensor	51013-4E	34873	Jun. 4, 2018	Jun. 3, 2019
ARLog-Periodic Antenna	AT6080	0329465	NA	NA
EMCO BiconiLog Antenna	3141	1001	NA	NA
ARHigh Gain Antenna	AT4010	0329800	NA	NA
SchwarzbeckLOG ANTENNA	Stlp 9149	9149-260	NA	NA
CHANCE MOST Full Anechoic Chamber (9x5x3m)	Chance Most	RS-002	Feb. 6, 2019	Feb. 5, 2020
Software	RS_V7.6	NA	NA	NA

- Note:
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 RS Room No.2.
 3. Tested Date: Mar. 25, 2019.

13.3 Test Arrangement

The test procedure was in accordance with EN/IEC 61000-4-3.

- The testing was performed in a fully anechoic chamber.
- The frequency range is swept from 80 MHz to 1000 MHz, with the signal 80% amplitude modulated with a 1kHz sine wave.
- The field strength level was 3 V/m.
- The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

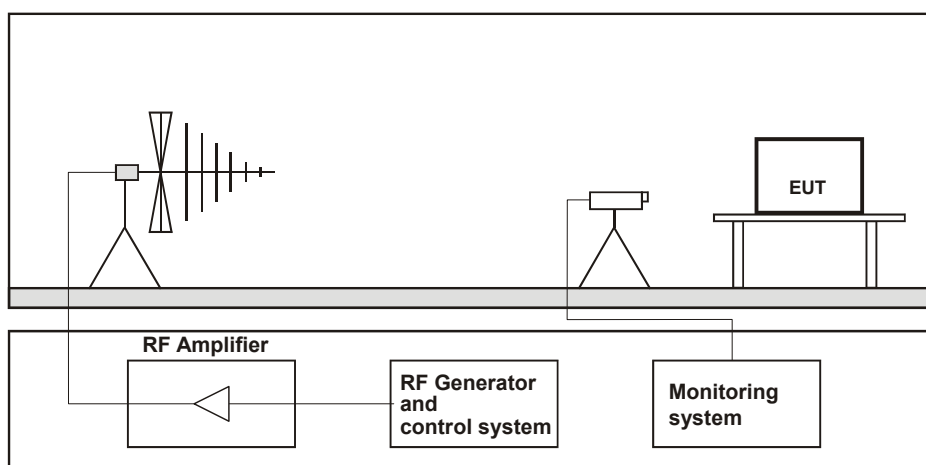


Table-top Equipment

The EUT installed in a representative system as described in section 7 of EN/IEC 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

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

13.4 Test Results

Test mode	Mode 1	Input Power	230 Vac, 50 Hz
Environmental conditions	21 °C, 62% RH	Tested by	Thomas Cheng

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Performance Criterion
			(V/m)	Modulation		
80 -1000	V&H	0	3	80% AM (1kHz)	Note	A
80 -1000	V&H	90	3	80% AM (1kHz)	Note	A
80 -1000	V&H	180	3	80% AM (1kHz)	Note	A
80 -1000	V&H	270	3	80% AM (1kHz)	Note	A

Note: The EUT function was correct during the test.

14 Electrical Fast Transient/Burst Immunity Test (EFT)

14.1 Test Specification

Basic Standard:	EN/IEC 61000-4-4
Test Voltage:	Signal / telecommunication port: $\pm 0.5\text{kV}$ Input DC power port: N/A Input AC power port: $\pm 1\text{kV}$
Impulse Repetition Frequency:	xDSL telecommunication port: 100kHz others: 5kHz
Impulse Wave Shape:	5/50 ns
Burst Duration:	0.75 ms for 100kHz Repetition Frequency 15 ms for 5kHz Repetition Frequency
Burst Period:	300 ms
Test Duration:	1 min.

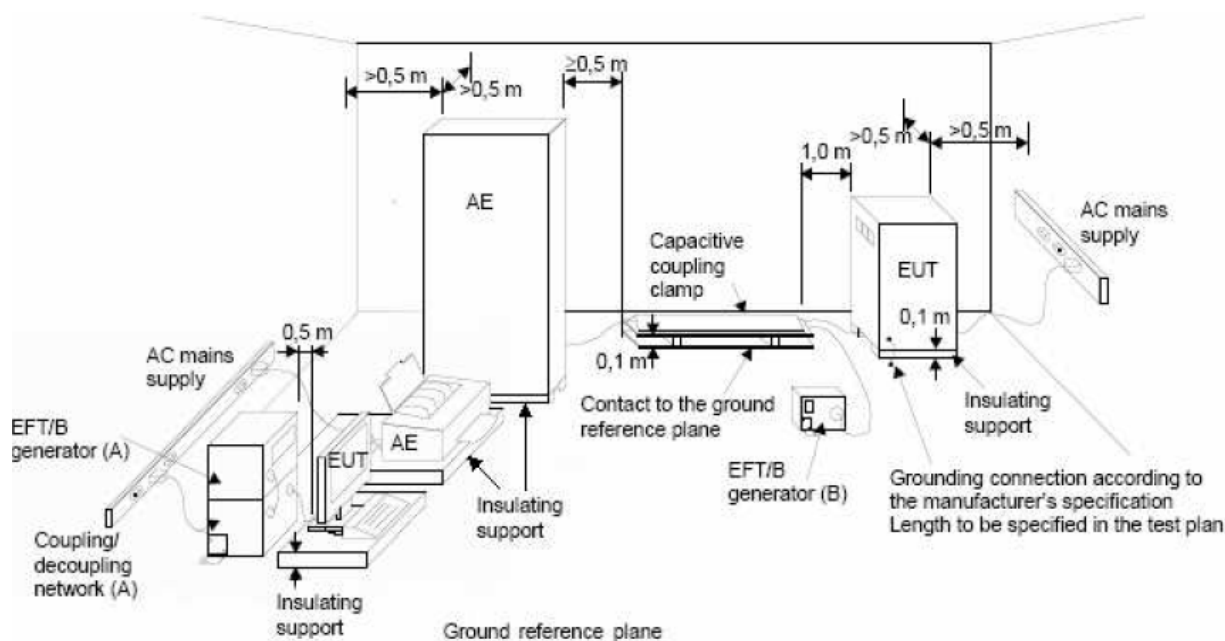
14.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Haefely, EFT Generator	PEFT 4010	154954	Apr. 25, 2018	Apr. 24, 2019
Haefely, Capacitive Clamp	IP4A	155173	Apr. 25, 2018	Apr. 24, 2019

- Note:
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: Mar. 25, 2019.

14.3 Test Arrangement

- Both positive and negative polarity discharges were applied.
- The distance between any coupling devices and the EUT should be 0.5 m for table-top equipment testing, and 1.0 m for floor standing equipment.
- The duration time of each test sequential was 1 minute.
- The transient/burst waveform was in accordance with EN/IEC 61000-4-4, 5/50 ns.



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.

14.4 Test Results

Test mode	Mode 1	Input Power	230 Vac, 50 Hz
Environmental conditions	22 °C, 64% RH	Tested by	Thomas Cheng

Input AC power port

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

Signal / telecommunication port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN	+/-	Note	A

Note: The EUT function was correct during the test.

15 Surge Immunity Test

15.1 Test Specification

Basic Standard:	EN/IEC 61000-4-5
Wave-Shape:	Signal / telecommunication port (direct to outdoor cables*): 10/700 μ s Open Circuit Voltage 5/320 μ s Short Circuit Current Input DC power port (direct to outdoor cables*): 1.2/50 μ s Open Circuit Voltage 8/20 μ s Short Circuit Current Input AC power port: 1.2/50 μ s Open Circuit Voltage 8/20 μ s Short Circuit Current
Test Voltage:	Signal and telecommunication ports**: w/o primary protectors: N/A with primary protectors fitted: N/A Input DC power port: Line to earth or ground: N/A Input AC power ports: Line to line: ± 0.5 kV, ± 1 kV Line to earth or ground: ± 0.5 kV, ± 1 kV, ± 2 kV
AC Phase Angle (degree):	0°, 90°, 180°, 270°
Pulse Repetition Rate:	1 time / 20 sec.
Number of Tests:	5 positive and 5 negative at selected points

* This test is only applicable only to ports, which according to the manufacturer's specification, may connect directly to outdoor cables.

** For ports where primary protection is intended, surges are applied at voltages up to 4 kV with the primary protectors fitted. Otherwise the 1 kV test level is applied without primary protection in place.

15.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
TESEQ, Surge Simulator	NSG 3060	1572	May 28, 2018	May 27, 2019
Coupling Decoupling Network	CDN-UTP8	045	Aug. 27, 2018	Aug. 26, 2019
TESEQ Coupling Decoupling Network	CDN HSS-2	41009	May 23, 2018	May 22, 2019
TESEQ Coupling Decoupling Network	CDN 118-T8	40386	Sep. 20, 2018	Sep. 19, 2019
TESEQ CDN for Unshielded Unsymmetrical Signal & Data Lines	CDN117	40144	Sep. 20, 2018	Sep. 19, 2019

- Note:
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. 25, 2019.

15.3 Test Arrangement

a. Input AC/DC Power ports:

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).

For double-insulated products without PE or external earth connections, the test shall be done in a similar way as for grounded products but without adding any additional external grounded connections. If there are no other possible connections to earth, line-to-ground tests may be omitted.

b. Signal and telecommunication ports,

- Unshielded unsymmetrical interconnection lines:

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.

- Unshielded symmetrical interconnections communication lines:

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.

- High speed communications lines

Prior to the test, the correct operation of the port shall be verified; the external connection shall then be removed and the surge applied directly to the port's terminals with no coupling /decoupling network. After the surge, the correct operation of the port shall again be verified.

- Shielded lines:

- Direct application,

The EUT is isolated from ground and the surge is applied to its metallic enclosure; the termination (or auxiliary equipment) at the port(s) under test is grounded. This test applies to equipment with single or multiple shielded cables.

Rules for application of the surge to shielded lines:

a) Shields grounded at both ends

- The surge injection on the shield.

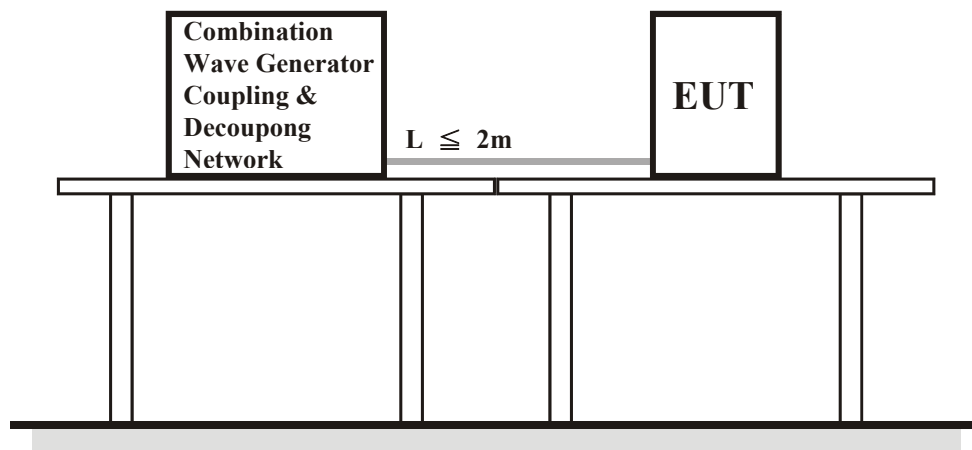
b) Shields grounded at one end

- If in the installation the shield is connected only at the auxiliary equipment, test shall be done in that configuration but with the generator still connected to the EUT side. If cable lengths allow, the cables shall be on insulated supports 0,1 m above the ground plane or cable tray.

For products which do not have metallic enclosures, the surge is applied directly to the shielded cable.

- Alternative coupling method for testing single cables in a multi-shield configuration,

Surges are applied in close proximity to the interconnection cable under test by a wire. The length of the cable between the port(s) under test and the device attached to the other end of the cable shall be the lesser of: the maximum length permitted by the EUT's specification, or 20 m. Where the length exceeds 1 m, excess lengths of cables shall be bundled at the approximate centre of the cables with the bundles 30 cm to 40 cm in length.



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

15.4 Test Results

Test mode	Mode 1	Input Power	230 Vac, 50 Hz
Environmental conditions	22 °C, 61% RH	Tested by	Thomas Cheng

Input AC power port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5, 1	L1-L2	+/-	Note	A
0.5, 1, 2	L1-PE	+/-	Note	A
0.5, 1, 2	L2-PE	+/-	Note	A

Note: The EUT function was correct during the test.

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

16.1 Test Specification

Basic Standard:	EN/IEC 61000-4-6
Frequency Range:	0.15 MHz - 80 MHz
Voltage Level:	3 V
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time	3 seconds

16.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ Signal Generator	SML03	101801	Jan. 14, 2019	Jan. 13, 2020
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. 20, 2018	Jun. 19, 2019
FISCHER CUSTOM COMMUNICATIONS EM Injection Clamp	F-203I-23mm	455	NA	NA
FISCHER CUSTOM COMMUNICATIONS Current Injection Clamp	F-120-9A	361	Jul. 24, 2018	Jul. 23, 2019
B&K Ear Simulator	4185	2553594	NA	NA
EM TEST Coupling Decoupling Network	CDN M1/32A	306508	Jun. 20, 2018	Jun. 19, 2019
TESEQ Coupling Decoupling Network	CDN T800	34428	Jun. 20, 2018	Jun. 19, 2019
TESEQ Coupling Decoupling Network	CDN T800	29459	Jun. 20, 2018	Jun. 19, 2019
FCC Coupling Decoupling Network	FCC-801-T4	02031	Jun. 20, 2018	Jun. 19, 2019
EM TEST Coupling Decoupling Network	CDN T2	306509	Jun. 20, 2018	Jun. 19, 2019
R&S Power Sensor	NRV-Z5	837878/039	Nov. 10, 2018	Nov. 9, 2019
R&S Power Meter	NRVD	837794/040	Nov. 10, 2018	Nov. 9, 2019
TESEQ Coupling Decoupling Network	CDN M232	37702	Jun. 20, 2018	Jun. 19, 2019
TESEQ Coupling Decoupling Network	CDN M332	41258	Jun. 20, 2018	Jun. 19, 2019
TESEQ Coupling Decoupling Network	CDN M332	41256	Jun. 20, 2018	Jun. 19, 2019
TESEQ Coupling Decoupling Network	CDN T400A	28569	Jun. 20, 2018	Jun. 19, 2019
TESEQ Coupling Decoupling Network	CDN T8-10	40376	Jun. 20, 2018	Jun. 19, 2019
TESEQ Coupling Decoupling Network	ISN ST08	41212	Jun. 20, 2018	Jun. 19, 2019
FCC Coupling Decoupling Network	FCC-801-M5-50A	100018	Jan. 21, 2019	Jan. 20, 2020
Software	CS_V7.4.2	NA	NA	NA

- Note:
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: Mar. 25, 2019.

16.4 Test Results

Test mode	Mode 1	Input Power	230 Vac, 50 Hz
Environmental conditions	21 °C, 60% RH	Tested by	Thomas Cheng

Frequency (MHz)	Level (Vrms)	Tested Line	Injection Method	Return Path	Observation	Performance Criterion
0.15 – 80	3	AC Power	CDN-M3	CDN-M1	Note	A
0.15 – 80	3	LAN	CDN-T4	CDN-M1	Note	A

Note: The EUT function was correct during the test.

17 Power Frequency Magnetic Field Immunity Test

17.1 Test Specification

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

17.2 Test Instruments

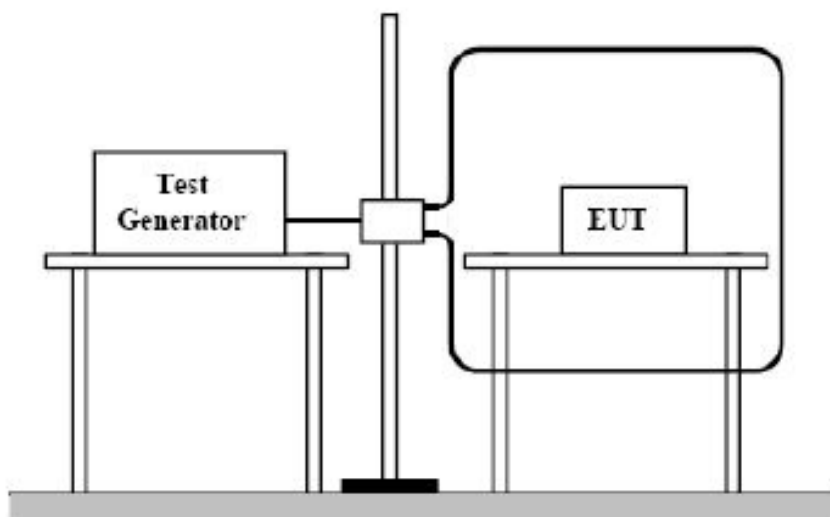
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
HAEFELY Magnetic Field Tester	MAG 100	083794-06	NA	NA
COMBINOVA Magnetic Field Meter	MFM10	224	Apr. 24, 2018	Apr. 23, 2019

Note:

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: Mar. 25, 2019.

17.3 Test Arrangement

- a. The equipment is configured and connected to satisfy its functional requirements.
- b. The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.
- c. The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.



TABLETOP EQUIPMENT

The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimension (1 m x 1 m). The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

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

17.4 Test Results

Test mode	Mode 1	Input Power	230 Vac, 50 Hz
Environmental conditions	22 °C, 66% RH	Tested by	Thomas Cheng

Application	Frequency (Hz)	Field Strength (A/m)	Observation	Performance Criterion
X - Axis	50	1	Note	A
Y - Axis	50	1	Note	A
Z - Axis	50	1	Note	A

Note: The EUT function was correct during the test.

18 Voltage Dips and Interruptions

18.1 Test Specification

Basic Standard:	EN/IEC 61000-4-11
Test levels:	Voltage Dips: >95% reduction – 0.5 period 30% reduction – 25 periods Voltage Interruptions: >95% reduction – 250 periods
Interval between Event:	Minimum ten seconds
Sync Angle (degrees):	0° / 180°
Test Cycle:	3 times

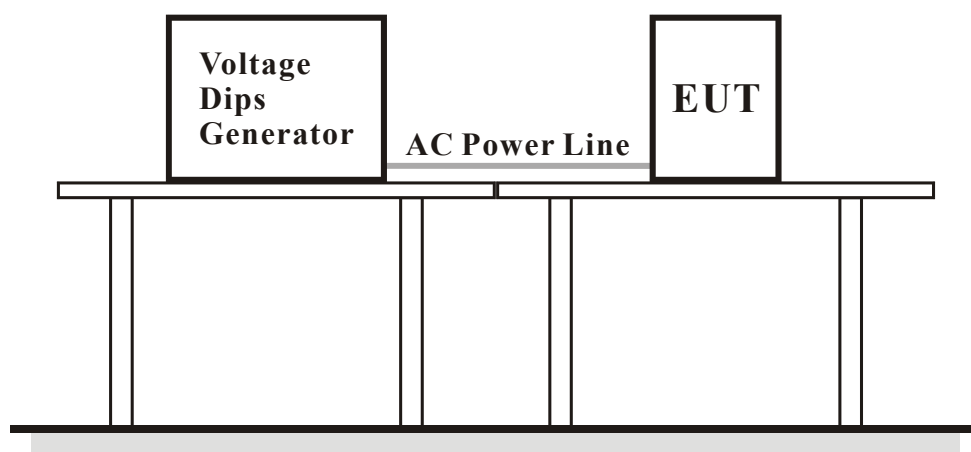
18.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Teseq Immunity Test System	Proflin 2105	1632A00983 & 1639A01863	Sep. 27, 2018	Sep. 26, 2019
Software	WIN2120	NA	NA	NA

- Note:
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: Mar. 25, 2019.

18.3 Test Arrangement

The EUT shall be tested for each selected combination of test levels and duration with a sequence of 3 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 0 degree crossover point of the voltage waveform.



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

18.4 Test Results

Test mode	Mode 1	Input Power	230 Vac, 50 Hz/ 240 Vac, 50 Hz/ 100 Vac, 50 Hz
Environmental conditions	22°C, 66% RH	Tested by	Thomas Cheng

Input Power for testing: 230 Vac, 50 Hz (Nominal input Voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
>95	0.5	10	3	Note 1	A
30	25	10	3	Note 1	A
>95	250	10	3	Note 2	C

Input Power for testing: 240 Vac, 50 Hz (Maximum rated input voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
>95	0.5	10	3	Note 1	A
30	25	10	3	Note 1	A
>95	250	10	3	Note 2	C

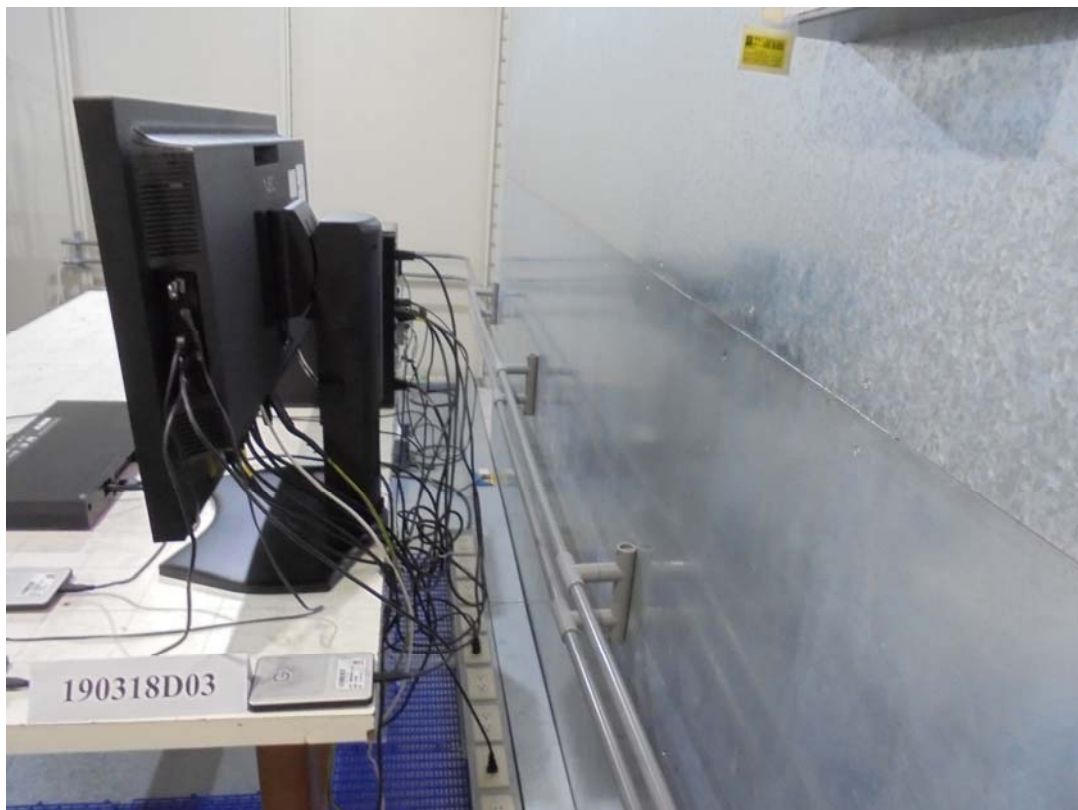
Input Power for testing: 100 Vac, 50 Hz (Minimum rated input voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
>95	0.5	10	3	Note 1	A
30	25	10	3	Note 1	A
>95	250	10	3	Note 2	C

Note: 1. The EUT function was correct during the test.
 2. The EUT power reset during the test and needed operator to reset.

19 Pictures of Test Arrangements

19.1 Conducted Emission from the AC Mains Power Port

Mode 1A & Mode 2



Mode 1B

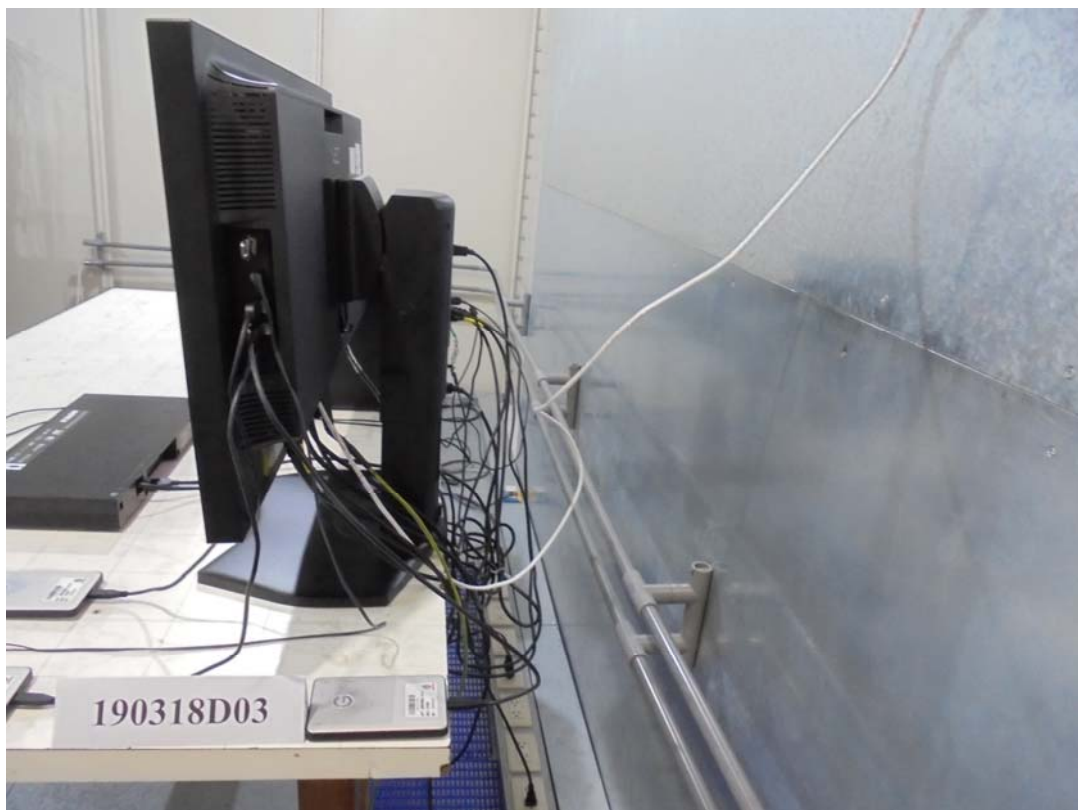


19.2 Asymmetric Mode Conducted Emission at Telecommunication Ports

Mode 1A



Mode 1B

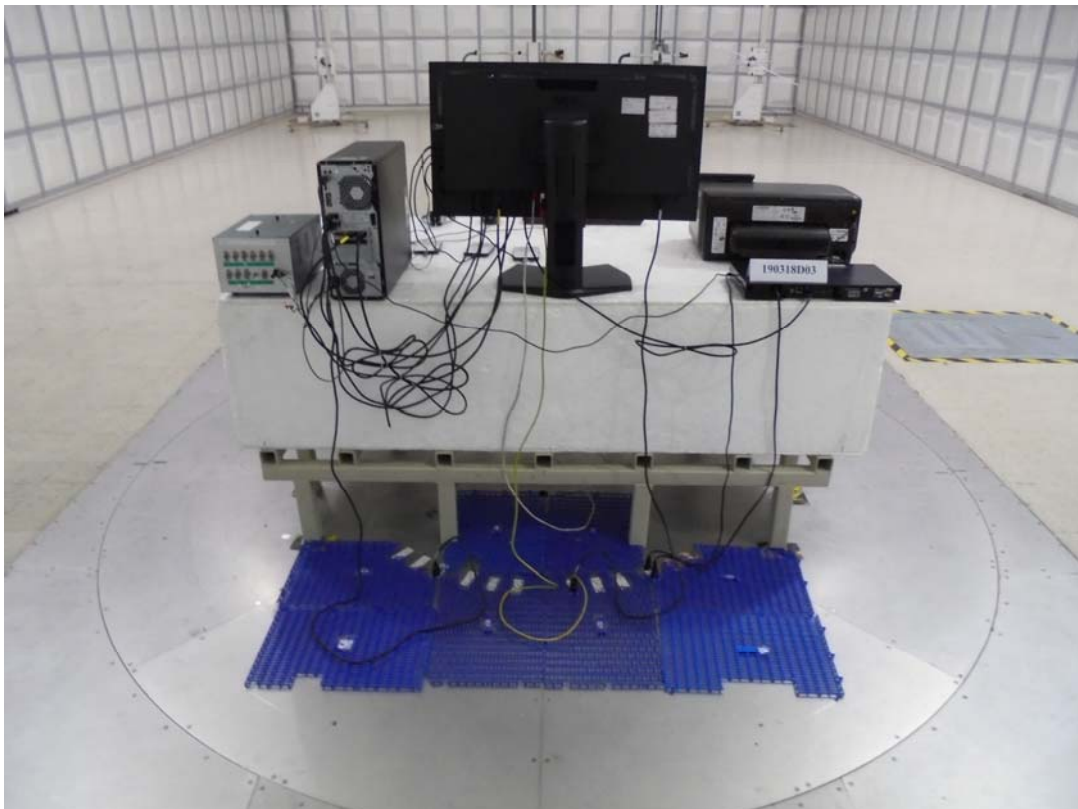


19.3 Radiated Emission at Frequencies up to 1GHz

Mode 1A & Mode 2

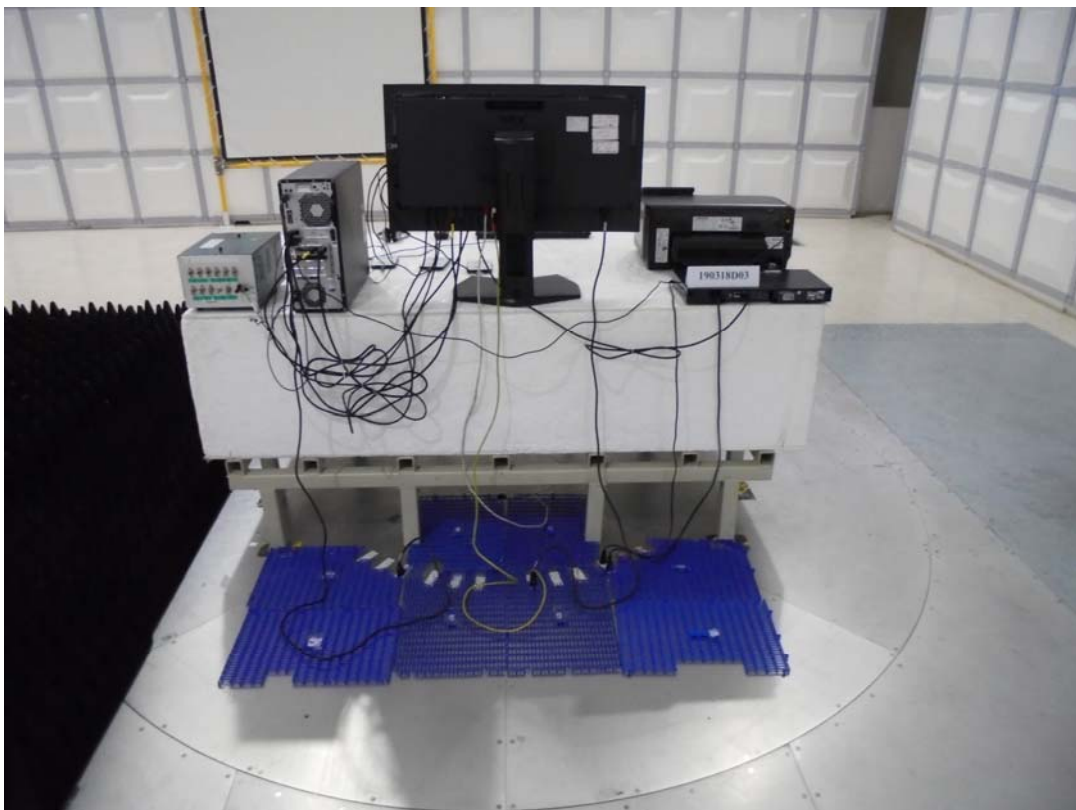
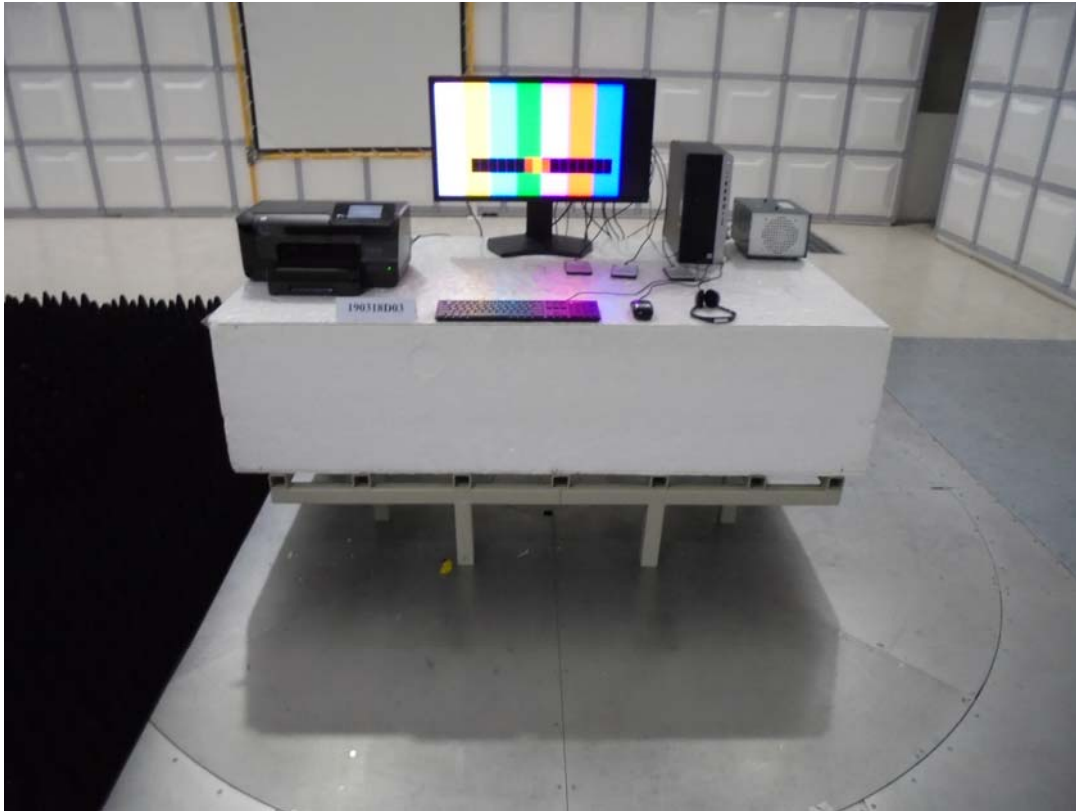


Mode 1B

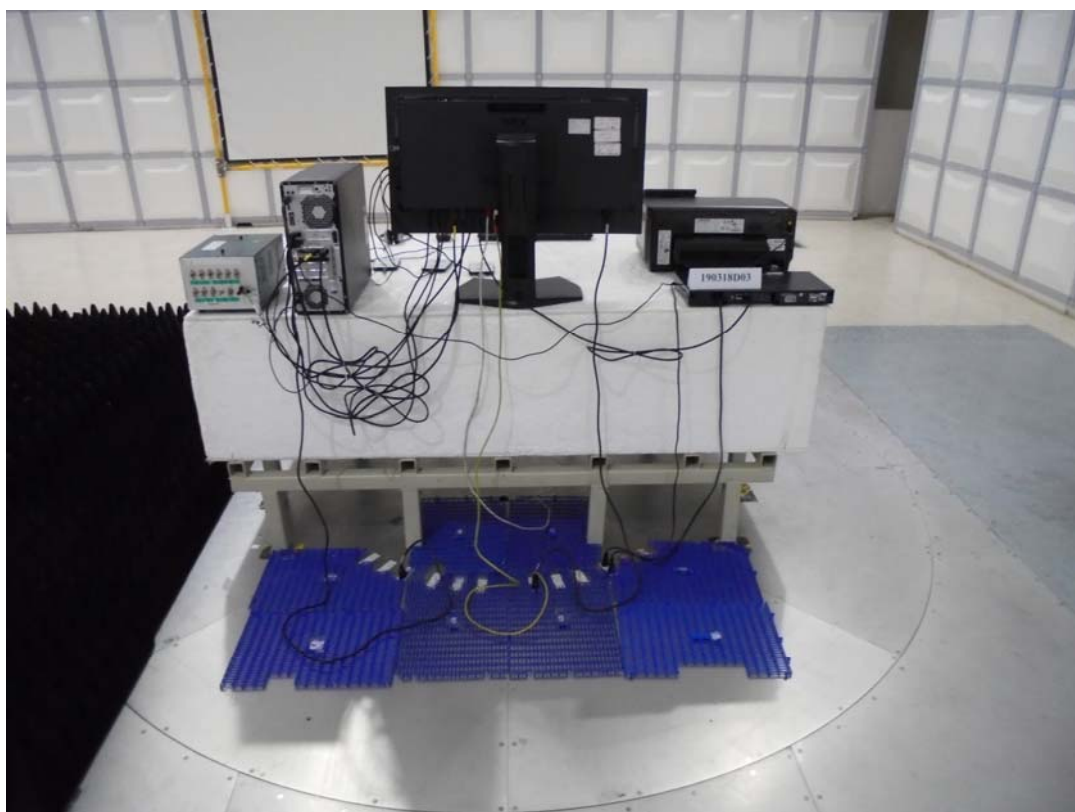


19.4 Radiated Emission at Frequencies above 1GHz

Mode 1A & Mode 2



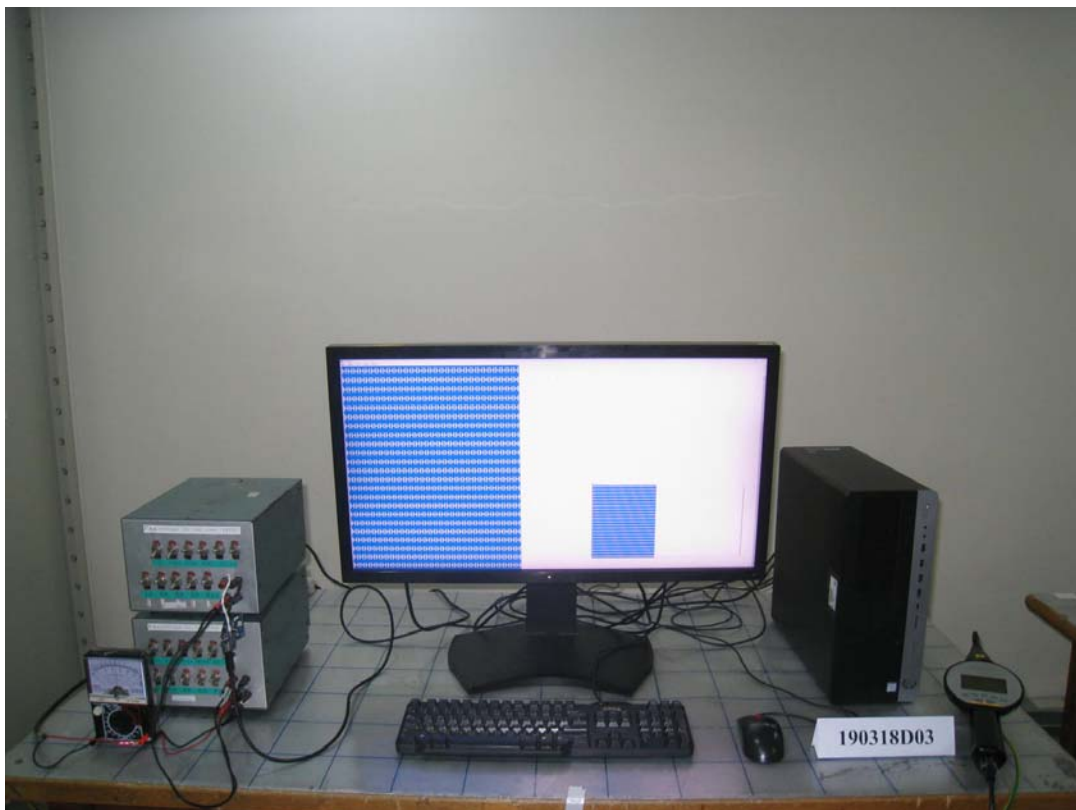
Mode 1B



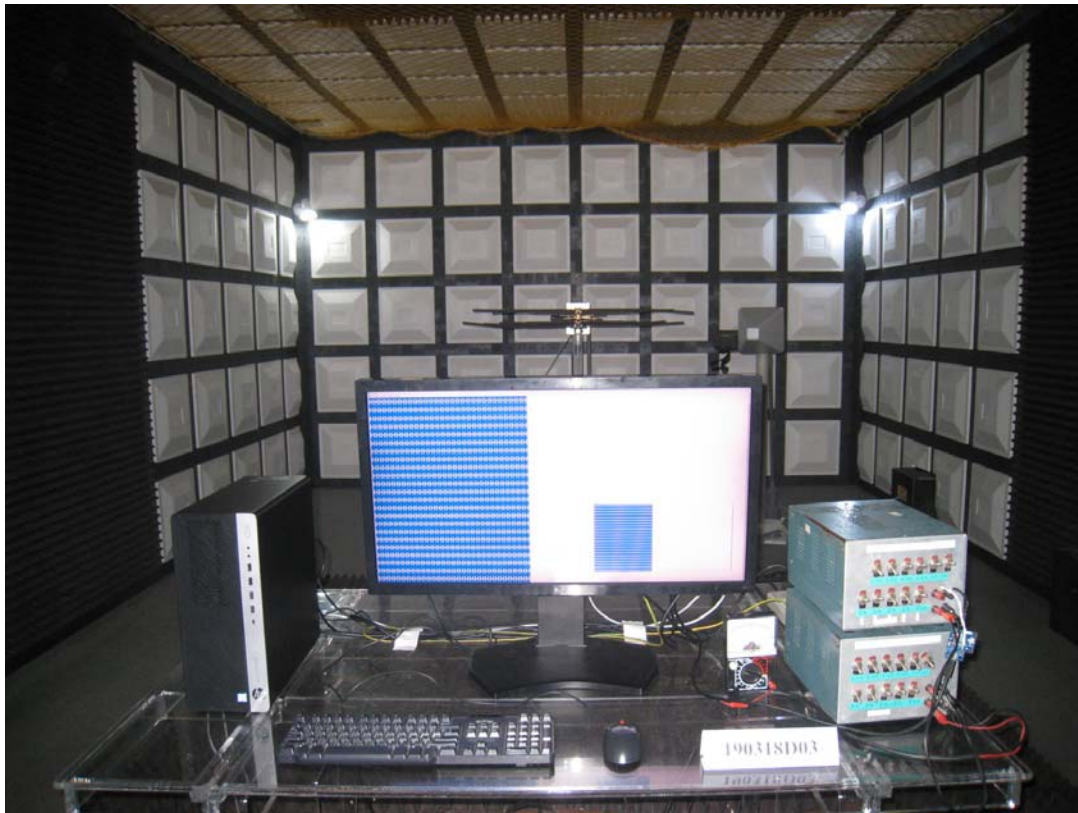
19.5 Harmonics Current, Voltage Fluctuations and Flicker Measurement



19.6 Electrostatic Discharge Immunity Test (ESD)

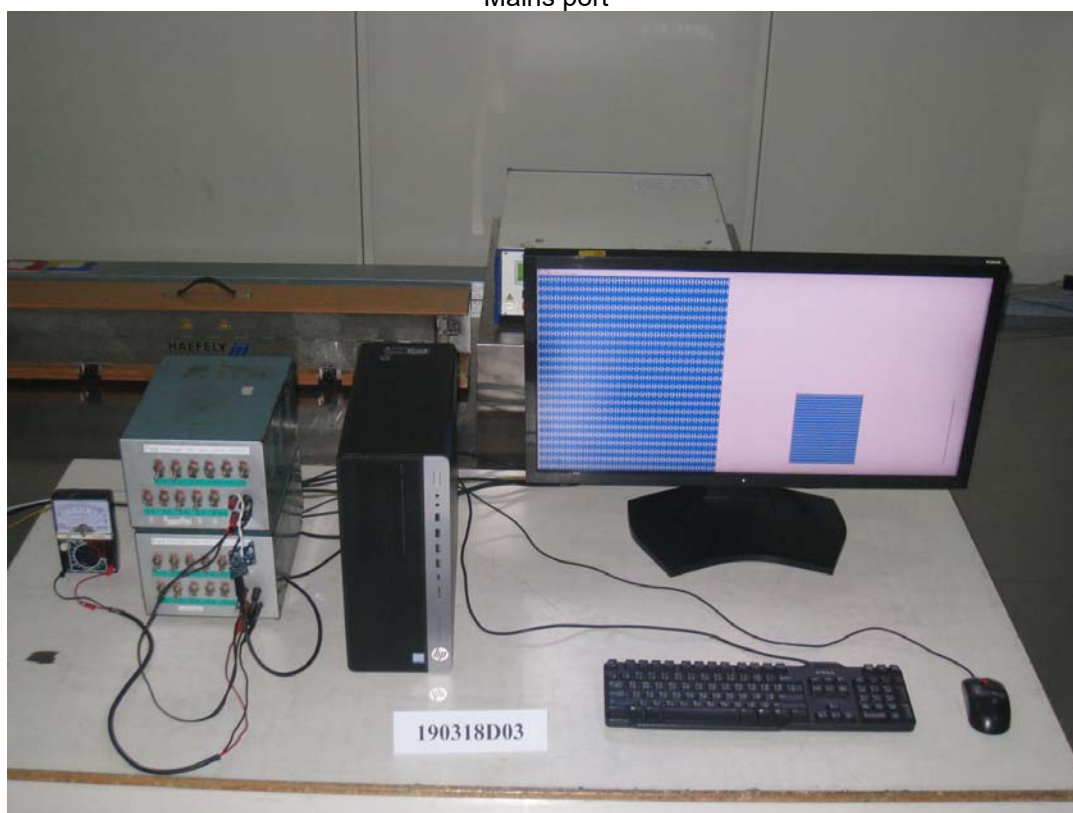


19.7 Radio-frequency, Electromagnetic Field Immunity Test (RS)

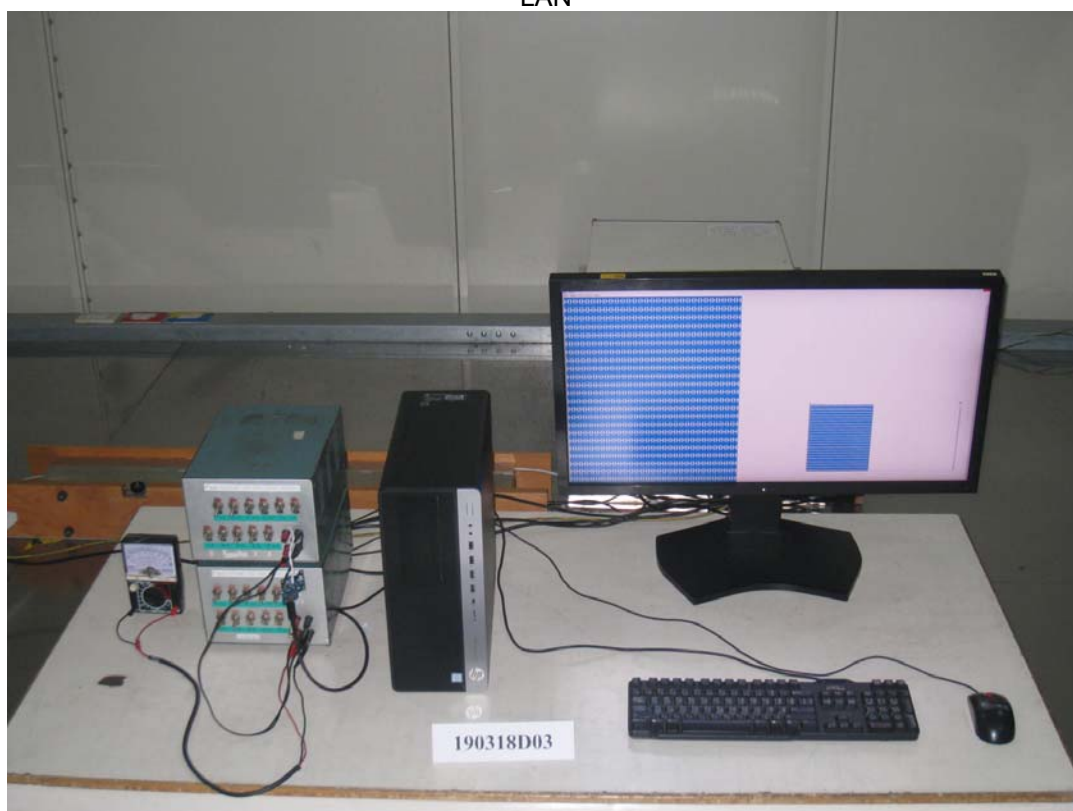


19.8 Electrical Fast Transient/Burst Immunity Test (EFT)

Mains port

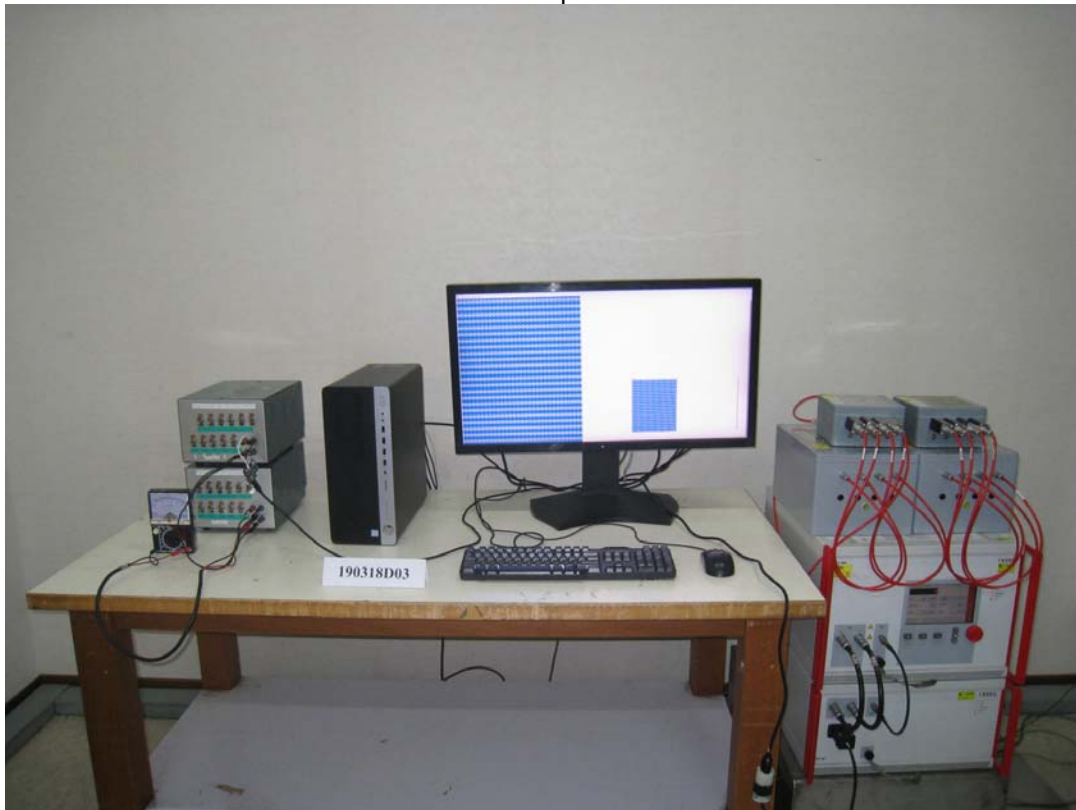


LAN



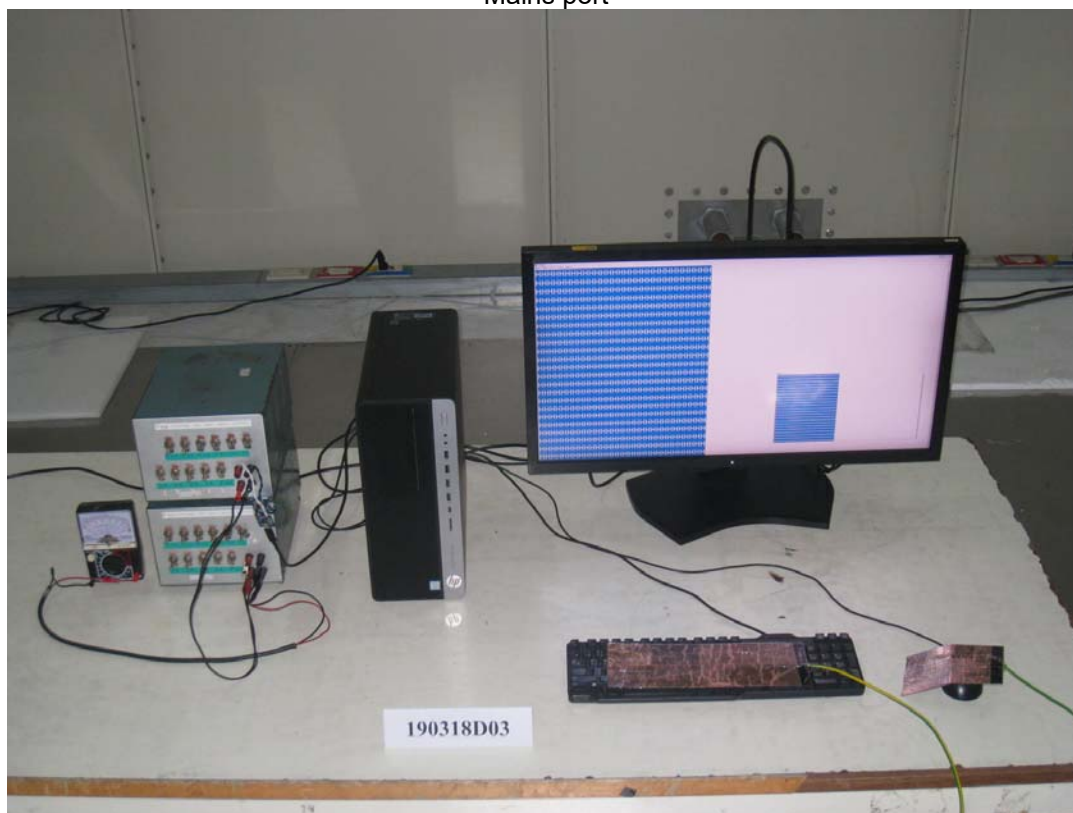
19.9 Surge Immunity Test

Mains port

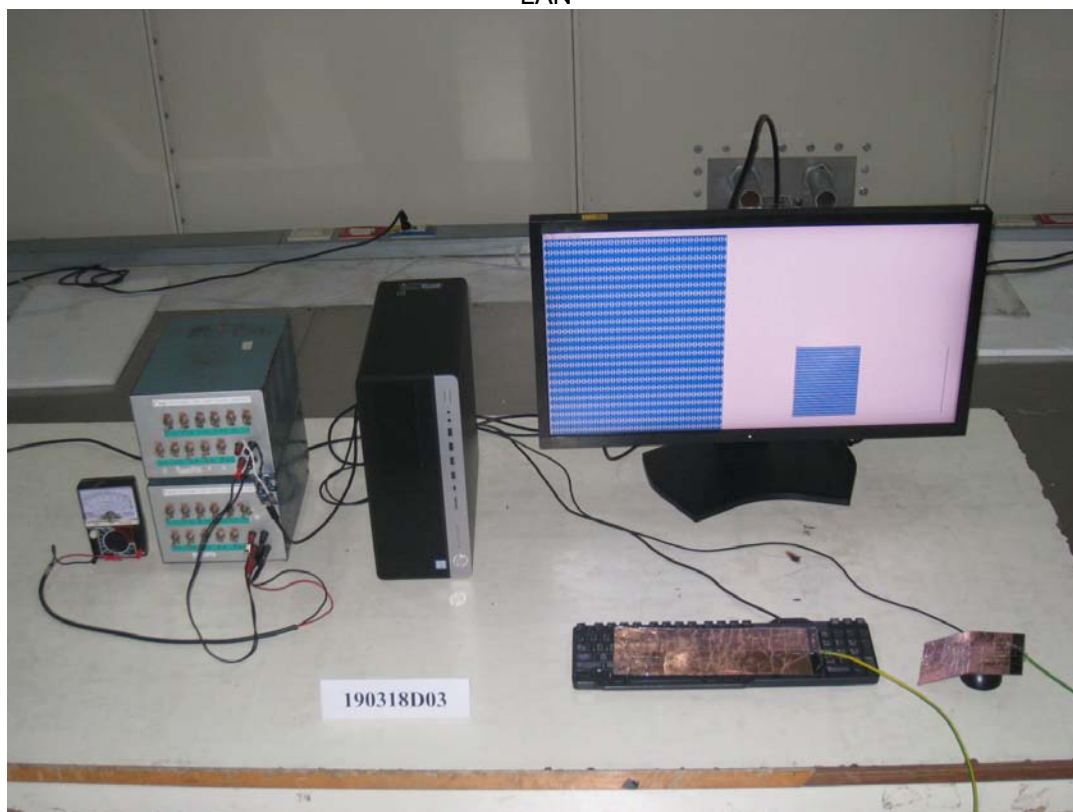


19.10 Conducted Disturbances Induced by RF Fields (CS)

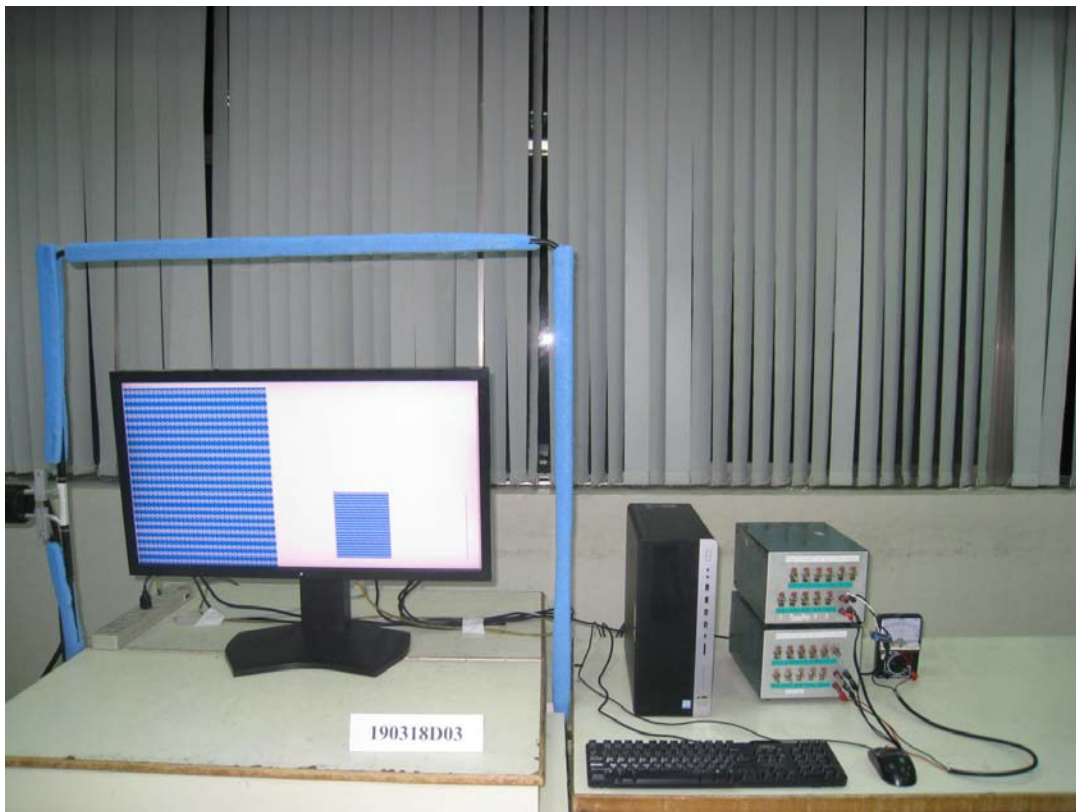
Mains port



LAN



19.11 Power Frequency Magnetic Field Immunity Test (PFMF)



19.12 Voltage Dips and Interruptions



Appendix – Information of 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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Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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