

CE EMC Test Report (EN 50155 & EN 50121-3-2)

Report No.: CE191219C06 R1

Test Model: ARS-2000

Series Model: ARS-2XXXXXXXXXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)

Received Date: Dec. 19, 2019

Test Date: Dec. 24, 2019 ~ Feb. 15, 2020

Issued Date: Mar. 10, 2020

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Table of Contents

Release Control Record	4
1 Certificate of Conformity	5
2 Summary of Test Results	6
2.1 Performance Criteria	8
2.2 Measurement Uncertainty	8
2.3 Modification Record.....	8
3 General Information	9
3.1 Description of EUT	9
3.2 Operating Modes of EUT and Determination of Worst Case Operating Mode	9
3.3 Test Program Used and Operation Descriptions.....	10
3.4 Primary Clock Frequencies of Internal Source.....	11
3.5 Miscellaneous.....	11
4 Configuration and Connections with EUT.....	12
4.1 Connection Diagram of EUT and Peripheral Devices	12
4.2 Configuration of Peripheral Devices and Cable Connections	14
5 Conducted Disturbance at Auxiliary a.c. or d.c. Power Ports	16
5.1 Limits	16
5.2 Test Instruments	16
5.3 Test Arrangement	17
5.4 Test Results	18
6 Radiated Disturbance up to 1 GHz	20
6.1 Limits	20
6.2 Test Instruments	20
6.3 Test Arrangement	21
6.4 Test Results	22
7 Radiated Disturbance above 1 GHz	24
7.1 Limits	24
7.2 Test Instruments	25
7.3 Test Arrangement	26
7.4 Test Results	27
8 Electrostatic Discharge Immunity Test (ESD).....	29
8.1 Test Specification	29
8.2 Test Instruments	29
8.3 Test Arrangement	30
8.4 Test Results	31
9 Radio-frequency Electromagnetic Field Immunity Test (RS)	36
9.1 Test Specification	36
9.2 Test Instruments	36
9.3 Test Arrangement	37
9.4 Test Results	37
10 Electrical Fast Transient/Burst Immunity Test (EFT).....	38
10.1 Test Specification	38
10.2 Test Instruments	38
10.3 Test Arrangement	38
10.4 Test Results	39
11 Surge Immunity Test.....	40

11.1	Test Specification	40
11.2	Test Instruments	40
11.3	Test Arrangement	41
11.4	Test Results	41
12	Immunity to Conducted Disturbances Induced by RF Fields (CS)	42
12.1	Test Specification	42
12.2	Test Instruments	42
12.3	Test Arrangement	43
12.4	Test Results	44
13	Pictures of Test Arrangements	45
13.1	Conducted Disturbance at Auxiliary a.c. or d.c. power ports	45
13.2	Radiated Disturbance up to 1 GHz	46
13.3	Radiated Disturbance above 1 GHz.....	47
13.4	Electrostatic Discharge Immunity Test (ESD)	48
13.5	Radio-frequency Electromagnetic Field Immunity Test (RS)	48
13.6	Fast Transients (EFT).....	50
13.7	Surge	52
13.8	Radio-frequency common mode (CS).....	52
Appendix – Information of the Testing Laboratories		54

Release Control Record

Issue No.	Description	Date Issued
CE191219C06	Original Release	Feb. 18, 2020
CE191219C06 R1	Revise Standards	Mar. 10, 2020

1 Certificate of Conformity

Product: Ultra-Compact Embedded System

Brand: Vecow

Test Model: ARS-2000

Series Model: ARS-2XXXXXXXXXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)

Sample Status: Mass product

Applicant: Vecow Co., Ltd.

Test Date: Dec. 24, 2019 ~ Feb. 15, 2020

Standards: **EN 50155:2017, Clause 13.4.8**
EN 50121-1:2017
EN 50121-3-2:2016
EN 61000-6-4:2007 +A1:2011
EN 61000-4-2:2009
EN 61000-4-3:2006 +A1:2008 +A2:2010
EN 61000-4-4:2012
EN 61000-4-5:2014 +A1:2017
EN 61000-4-6:2014 +AC:2015

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 : Lena Wang , **Date:** Mar. 10, 2020
Lena Wang / Specialist

Approved by : Carl Chen , **Date:** Mar. 10, 2020
Carl Chen / Project Engineer

2 Summary of Test Results

EN 50121-3-2:2016, Emission EN 50155:2017, Clause 13.4.8			
Port	Test Item / specifications	Result/Remarks	Verdict
Auxiliary a.c. or d.c. power ports - Auxiliary supply sinusoidal a.c. or d.c.	Conducted disturbance 150 kHz-500 kHz: 99 dB μ V quasi-peak 500 kHz- 30 MHz: 93 dB μ V quasi-peak	Minimum passing margin is -32.67 dB at 13.41825 MHz	Pass
Auxiliary a.c. or d.c. power ports – AC power outlet port for public use	Conducted disturbance 50 Hz-2 kHz: THD <8% (THD: total harmonic distortion)	Test not applicable because the port does not exist.	N/A
Battery referenced ports - Battery power supply	Conducted disturbance 150 kHz-500 kHz: 99 dB μ V quasi-peak 500 kHz- 30 MHz: 93 dB μ V quasi-peak	Test not applicable because the port does not exist.	N/A
Enclosure	Radiated disturbance 30 MHz-230 MHz: 40 dB μ V/m quasi-peak 230 MHz -1 GHz: 47 dB μ V/m quasi-peak	Minimum passing margin is -2.41 dB at 616.00 MHz	Pass
Enclosure	Radiated disturbance 1 GHz-3 GHz: 76 dB μ V/m peak 56 dB μ V/m average 3 GHz - 6 GHz: 80 dB μ V/m peak 60 dB μ V/m average	Minimum passing margin is -12.51 dB at 2002.04 MHz	Pass

EN 50121-3-2:2016, Immunity requirements, EN 50155:2017, Clause 13.4.8					
Table Clause	Basic standard	Port	Test Item / specifications	Result/Remarks	Verdict
3.1	EN 61000-4-6:2014 +AC:2015	Battery referenced ports (except at the output of energy sources), Auxiliary a.c. power input ports (rated voltage \leq 400 Vrms)	Radio-frequency common mode (CS) 80% AM (1kHz) 0.15-80 MHz, 10V Performance Criterion A	Performance Criterion A	Pass
3.2	EN 61000-4-4:2012	Battery referenced ports (except at the output of energy sources), Auxiliary a.c. power input ports (rated voltage \leq 400 Vrms)	Fast Transients (EFT) 5/50 (T _r /T _h) ns, 5kHz \pm 2kV Performance Criterion A	Performance Criterion A	Pass
3.3	EN 61000-4-5:2014 +A1:2017	Battery referenced ports (except at the output of energy sources), Auxiliary a.c. power input ports (rated voltage \leq 400 Vrms)	Surges 1.2/50 (8/20) (T _r /T _h) μ s Line to ground: \pm 2kV 42 Ω , 0.5 μ F Line to line: \pm 1kV 42 Ω , 0.5 μ F Performance Criterion B	Performance Criterion A	Pass

EN 50121-3-2:2016, Immunity requirements, EN 50155:2017, Clause 13.4.8					
Table Clause	Basic standard	Port	Test Item / specifications	Result/Remarks	Verdict
4.1	EN 61000-4-6: 2014 +AC:2015	Signal & communication, process measurement & control ports	Radio-frequency common mode (CS) 80 AM (1kHz) 0.15-80 MHz, 10V	Performance Criterion A	Pass
4.2	EN 61000-4-4:2012	Signal & communication, process measurement & control ports	Fast Transients (EFT) 5/50 (T _r /T _n) ns, 5kHz ±2kV, Capacitive clamp Performance Criterion A	Performance Criterion A	Pass
5.1	EN 61000-4-3:2006 +A1:2008 +A2:2010	Enclosure ports	Radio-frequency electromagnetic field amplitude modulated (RS) ¹ , 80% AM (1kHz) 80-800 MHz, 20V/m Performance Criterion A	Performance Criterion A	Pass
5.2	EN 61000-4-3:2006 +A1:2008 +A2:2010	Enclosure ports	Radio-frequency electromagnetic field from digital mobile telephones (RS) ² , 80% AM (1kHz) 800-1000 MHz, 20V/m 1400-2000 MHz, 10V/m 2000-2700 MHz, 5V/m 5100-600 MHz, 3V/m Performance Criterion A	Performance Criterion A	Pass
5.3	EN 61000-4-2:2009	Enclosure ports	Electrostatic Discharges (ESD) ±6kV Contact discharge ±8kV Air discharge Performance Criterion B	Performance Criterion A	Pass

Note 1: This limit applies to equipment mounted in the passenger compartments, drivers cab or external to the rolling stock (roof, underframe). For equipment mounted in all other areas a severity level of 10 V/m may be used.

Note 2: For large apparatus (e.g. traction drives, auxiliary converters) it is often not practical to perform the immunity test to radiated electromagnetic fields on the complete unit. In such cases the manufacturer should test susceptible sub-systems (e.g. control electronics). The test report should justify the selection or not of sub-systems and any assumptions made (e.g. reduction of field due to case shielding).

N/A: Not Applicable

Note:

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

2.1 Performance Criteria

General Performance Criteria

The general performance criteria apply for those ports for which no specific performance criteria are defined (e.g. auxiliary ports) in the report.

Performance criterion A: The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus 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, either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended..

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

Performance criterion C: Temporary loss of function is allowed, provided the function is selfrecoverable or can be restored by the operation of the controls.

2.2 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 disturbance at mains port using AMN, 150kHz ~ 30MHz	2.79 dB	3.4 dB (U_{cispr})
Radiated disturbance, 30MHz ~ 1GHz	4.14 dB	6.3 dB (U_{cispr})
Radiated disturbance, 1GHz ~ 6GHz	5.04 dB	5.2 dB (U_{cispr})

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.3 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 Description of EUT

Product	Ultra-Compact Embedded System
Brand	Vecow
Test Model	ARS-2000
Series Model	ARS-2XXXXXXXXXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)
Model Difference	Refer to note for more details
Sample Status	Mass product
Operating Software	N/A
Power Supply Rating	24 Vdc (Adapter)
Accessory Device	Refer to Note as below
Cable Supplied	Refer to Note as below

Note:

1. All models are listed as below.

Brand	Model	Difference
Vecow	ARS-2000	All models are electrically identical, different model names are for marketing purpose.
	ARS-2XXXXXXXXXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)	

2. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter	Meanwell	GST160A24-R7B (160W)	I/P: 100-240 Vac, 50/60 Hz, 2 A O/P: 24 Vdc, 6.67 A, 160W Max. 1.2 m non-shielded cable with 1 core
CPU	Intel	i7-7600U	2.8 GHz
SSD	Innodisk	3MG2-P	64G
DDR4	DSL	J44GSHFMAQHSI	8GB

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

Test modes are presented in the report as below.

Mode	Test Condition
	Conducted Emission
1	LAN Link + DIO 1&2 cable + USB with M/S + USB with K/B + USB with HDD*2 + RS232 Termina*4 + Mic+Earphone + DVI-D with Monitor + DVI-I with Monitor + PoE LAN with Camera + CF Card + Adapter
	Radiated Emission
1	LAN Link + DIO 1&2 cable + USB with M/S + USB with K/B + USB with HDD*2 + RS232 Termina*4 + Mic+Earphone + DVI-D with Monitor + DVI-I with Monitor + PoE LAN with Camera + CF Card + Adapter

Mode	Test Condition
	ESD tests
1	LAN Link + DIO 1&2 cable + USB with M/S + USB with K/B + USB with HDD*2 + RS232 Termina*4 + Mic+Earphone + DVI-D with Monitor + DVI-I with Monitor + PoE LAN with Camera + CF Card + Adapter
	RS, Surge tests
1	LAN Link + DIO 1&2 cable + USB with M/S + USB with K/B + USB with Flash *2 + RS232 Termina*4 + Mic+Earphone + DVI-D with Monitor + DVI-I with Monitor + PoE LAN with Camera + CF Card + Adapter
	EFT, CS tests
1	LAN Link + DIO 1&2 cable + USB with M/S + USB with K/B + USB with Flash *2 + RS232 Termina*4 + Mic+Earphone + DVI-D with Monitor + DVI-I with Monitor + PoE LAN with Camera + CF Card + Adapter
2	LAN Link + DIO 1&2 cable + USB with M/S + USB with K/B + USB with Flash *2 + RS232 Termina*4 + Mic+Earphone + DVI-D with Monitor + DVI-I with Monitor + PoE LAN with Camera + CF Card + Adapter <Telecommunication Port with LAN 1 Cable>
3	LAN Link + DIO 1&2 cable + USB with M/S + USB with K/B + USB with Flash *2 + RS232 Termina*4 + Mic+Earphone + DVI-D with Monitor + DVI-I with Monitor + PoE LAN with Camera + CF Card + Adapter <Telecommunication Port with LAN 3 Cable>

3.3 Test Program Used and Operation Descriptions

<Emission Tests>

- a. The EUT was charged from adapter.
- b. The EUT linked with Notebook via LAN cable.
- c. The EUT sent audio signal to the earphone.
- d. The EUT linked with Monitors via DVI cables.
- e. The EUT read and wrote data with HDDs.
- f. The EUT linked with Keyboard and Mouse via USB Cable.
- g. The EUT linked with Cameras via LAN Cable.
- h. The EUT linked with Terminals, DIO Cable and GND Cable.
- i. The EUT communicated data with the Notebook, which acted as communication partners.

<Immunity Tests>

- a. The EUT was charged from adapter.
- b. The EUT linked with Notebook via LAN cable.
- c. The EUT sent audio signal to the earphone.
- d. The EUT linked with Monitors via DVI cables.
- e. The EUT read and wrote data with Flashes and HDDs.
- f. The EUT linked with Keyboard and Mouse via USB Cable.
- g. The EUT linked with Cameras via LAN Cable.
- h. The EUT linked with Terminals, DIO Cables and GND Cable.
- i. The EUT communicated data with the Notebook, which acted as communication partners

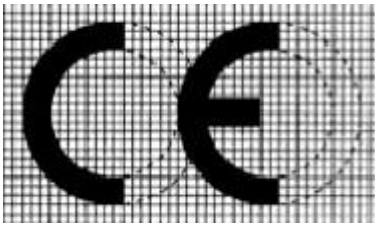
3.4 Primary Clock Frequencies of Internal Source

The highest frequency generated or used within the EUT or on which the EUT operates or tunes is 2800 MHz, provided by {applicant}, for detailed internal source, please refer to the manufacturer's specifications.

3.5 Miscellaneous

➤ Affix CE marking

The marking must be placed visibly and legibly on the product or, if not possible due to the nature of the product, be affixed to the packaging and the accompanying document. The CE marking shall consist of the initials 'CE' taking the following form:



The various components of the CE marking must have the same vertical dimension, and may not be smaller than 5 mm. If the CE marking is reduced or enlarged, the proportions given in the graduated drawing above must be respected.

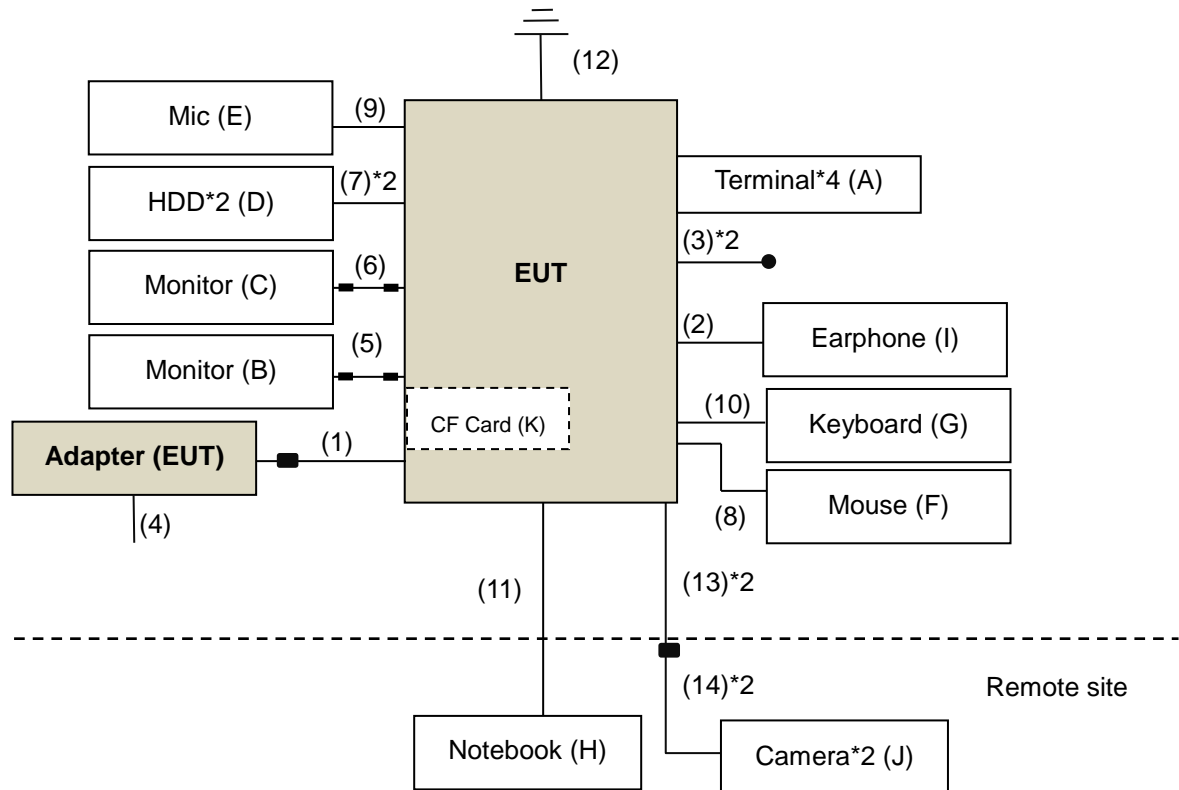
When the product is subject to other Directives covering other aspects and which also provide for the 'CE' marking, the accompanying documents must indicate that the product also conforms to those other Directives.

However, when one or more of those Directives allow the manufacturer, during a transitional period, to choose which arrangements to apply, the 'CE' marking has to indicate conformity only with the Directives applied by the manufacturer. In this case, the particularities of the Directives applied, as published in the Official Journal of the European Union, must be given in the documents, notices or instructions required by the Directives and accompanying such products.

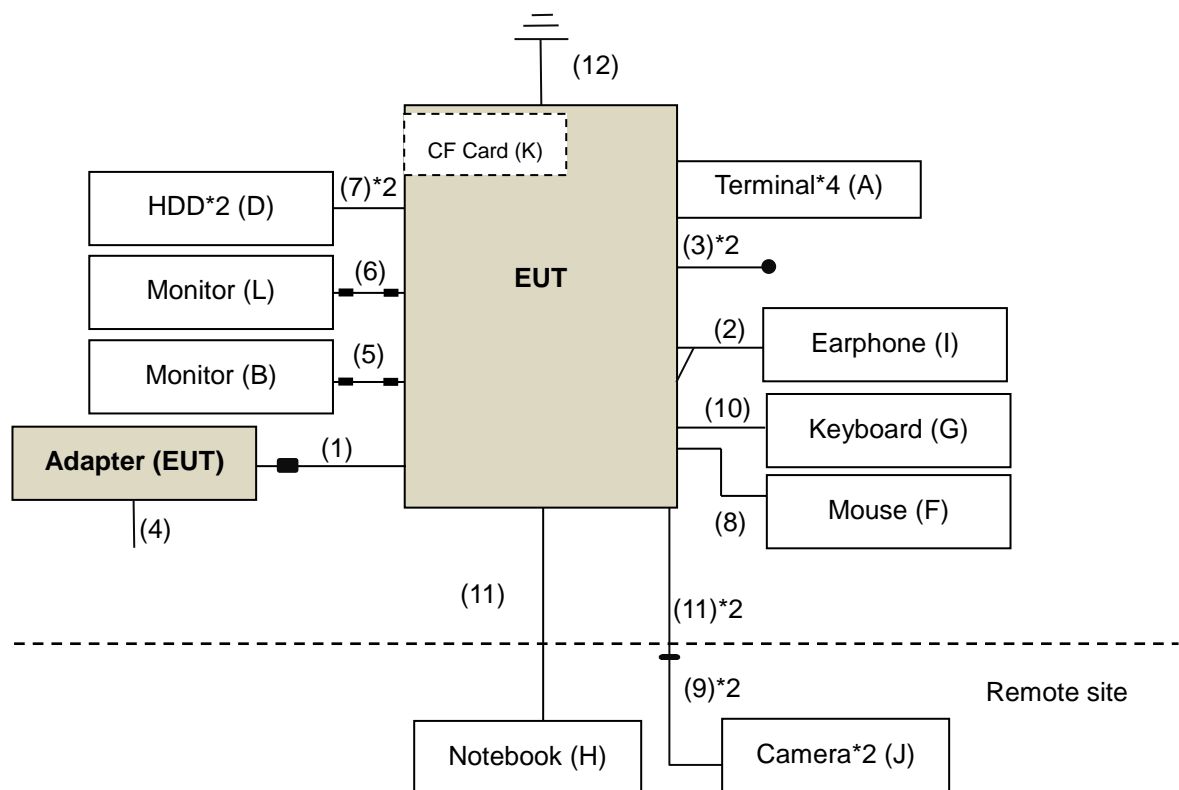
4 Configuration and Connections with EUT

4.1 Connection Diagram of EUT and Peripheral Devices

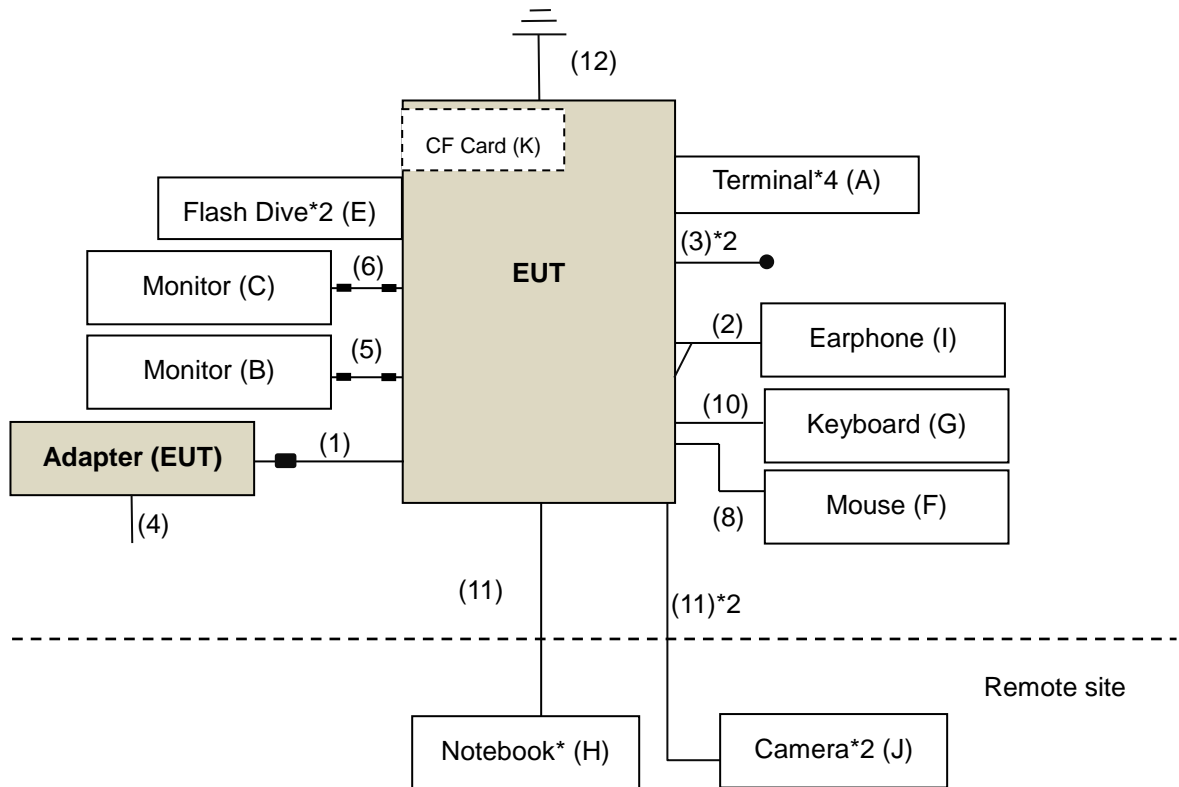
Emission tests



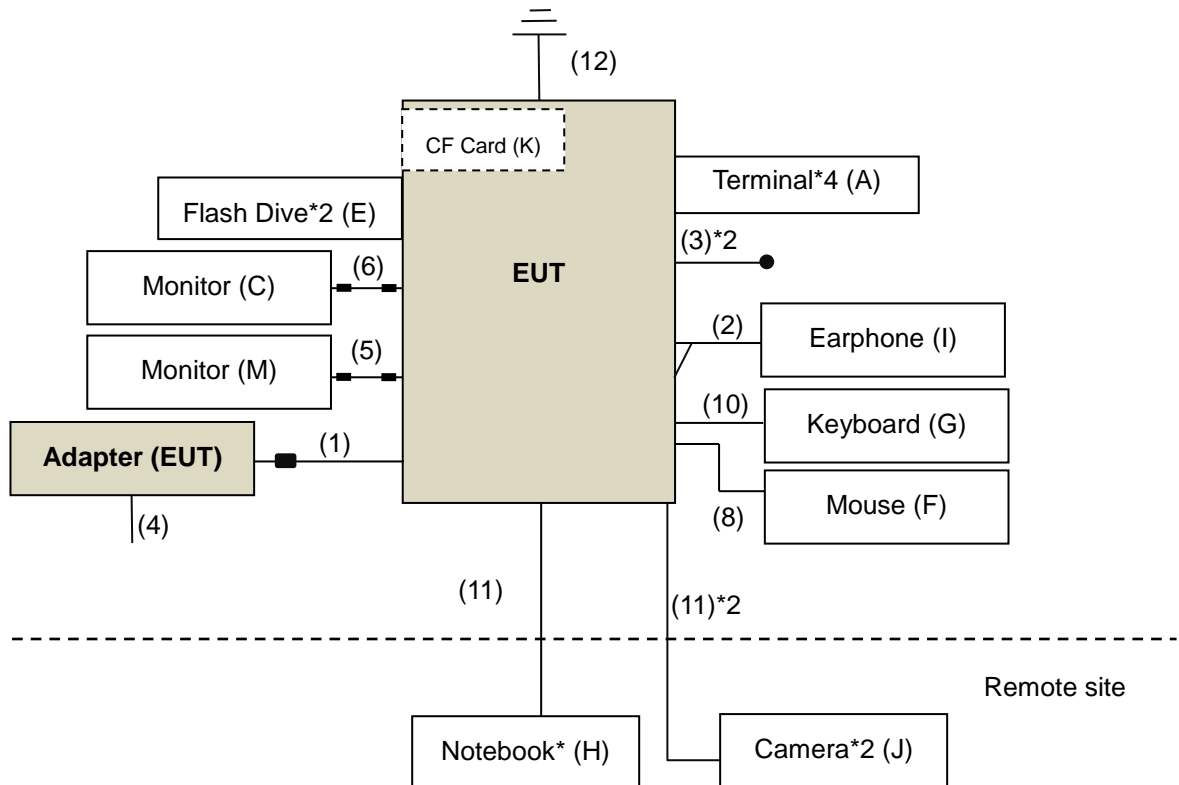
Immunity tests:
For ESD Mode 1



For RS Mode 1



For EFT, CS Mode 1 ~ 3
Surge Mode 1



4.2 Configuration of Peripheral Devices and Cable Connections

Emission tests:

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Terminal*4	N/A	N/A	N/A	N/A	Provided by client
B.	Monitor	DELL	U2410f	CN-082WXD-72872-2B7-A3VL	FCC DoC	--
C.	LCD Monitor	DELL	U2410	CN-0J257M-72872-0A6-02YL	Doc	--
D.	HDD*2	Toshiba	DTB410	N/A	N/A	--
E.	MICROPHONE	Labtec	LVA7313	N/A	N/A	--
F.	USB Mouse	DELL	MOCZUL	CN-049TWY-PRC00-79E-02GE	N/A	--
G.	USB Keyboard	Dell	KB216t	CN-0W33XP-LO300-79R-OUG6-A03	N/A	--
H.	Notebook	DELL	E6440	FNLNM32	N/A	--
I.	Earphone	PHILIPS	SBC HL150	N/A	N/A	--
J.	Camera*2	3MP	MBL030A-OR20310	N/A	N/A	Provided by client
K.	CF Card	7nnodisk	CFasA3ME3	N/A	N/A	--

Note:

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

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.2	N	1	Accessory of the EUT
2.	Audio Cable	1	1.2	N	0	--
3.	DIO Cable	1	0.92	N	0	--
4.	Power Cord	1	1.8	N	0	--
5.	DVI Cable	1	1.8	Y	2	--
6.	DVI Cable	1	1.8	Y	2	--
7.	USB Cable	1	0.5	Y	0	--
8.	USB Cable	1	1.8	Y	0	--
9.	Audio Cable	1	1.5	Y	0	--
10.	USB Cable	1	1.8	Y	0	--
11.	LAN Cable	1	10	N	0	RJ45, Cat5e
12.	GND Cable	1	1.8	N	0	--
13.	LAN Cable	1	10	N	0	RJ45, Cat5e
14.	Cable	1	0.22	N	0	--

Note: The core(s)

Immunity tests:

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Terminal*4	N/A	N/A	N/A	N/A	Provided by client
B.	Monitor	HP	D7Q14A4	N/A	N/A	For ESD, RS
C.	Monitor	Dell	2408WFPb	N/A	N/A	For RS, EFT, CS, Surge
D.	HDD*2	Transcend	TS1TSJ25MC	N/A	N/A	--
E.	USB Drive*2	Transcend	N/A	N/A	N/A	--
F.	USB Mouse	Logitech	M100r	N/A	N/A	--
G.	USB Keyboard	Logitech	K120	N/A	N/A	--
H.	Notebook	DELL	Inspiron 15 3000	JVXSD82	N/A	--
I.	Earphone	PHILIPS	SHM2100	N/A	N/A	--
J.	Camera*2	3MP	MBL030A- OR20310	N/A	N/A	Provided by client
K.	CF Card	7nnodisk	CFasA3ME3	N/A	N/A	--
L.	Monitor	AOC	U2868PQU	N/A	N/A	For ESD
M.	Monitor	DELL	ST2220L	N/A	N/A	For EFT, CS, Surge

Note:

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

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.2	N	1	Accessory of the EUT
2.	Audio Cable	1	2	N	0	--
3.	DIO Cable	1	0.92	N	0	Provided by client
4.	Power Cord	1	1.8	N	0	--
5.	DVI-I Cable	1	1.5	Y	2	--
6.	DVI-D Cable	1	1.5	Y	2	--
7.	USB Cable	1	0.6	Y	0	--
8.	USB Cable	1	1.8	Y	0	--
9.	Cable	1	0.22	N	0	--
10.	USB Cable	1	1.5	Y	0	--
11.	LAN Cable	1	3	N	0	Cat5e
12.	GND Cable	1	1.8	N	0	--

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

5 Conducted Disturbance at Auxiliary a.c. or d.c. Power Ports

5.1 Limits

Frequency (MHz)	Quasi-peak, (dBuV)
0.009 - 0.15	no limits
0.15 - 0.5	99
0.5 - 30	93

Notes: 1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases linearly with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

5.2 Test Instruments

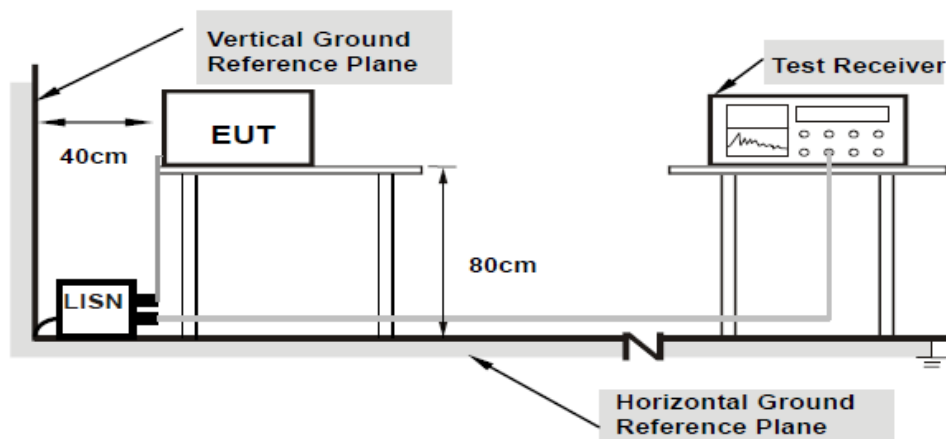
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESR3	102412	Feb. 14, 2019	Feb. 13, 2020
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Sep. 05, 2019	Sep. 04, 2020
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Feb. 11, 2019	Feb. 10, 2020
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Aug. 13, 2019	Aug. 12, 2020
Software ADT	BV ADT_Cond_ V7.3.7.4	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 HwaYa Shielded Room 2.
 3. The VCCI Site Registration No. is C-12047.

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 a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- 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 LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

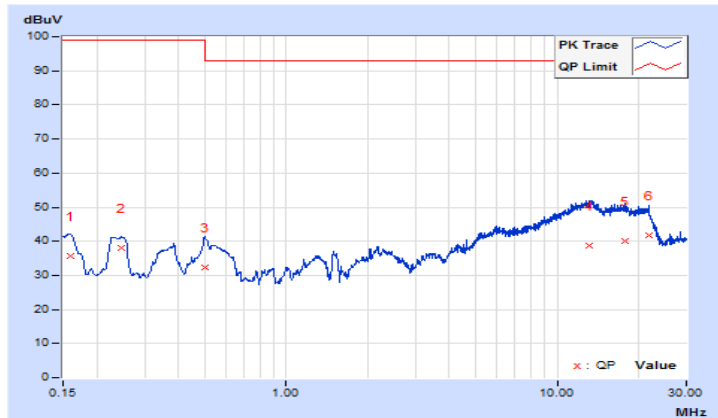
5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 66%RH
Tested by	Kai Chu	Test Date	2019/12/24
Test Mode	Mode 1		

Phase Of Power : Line (L)						
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
			Q.P.	Q.P.	Q.P.	Q.P.
1	0.15900	10.11	25.63	35.74	99.00	-63.26
2	0.24618	10.13	27.91	38.04	99.00	-60.96
3	0.50085	10.17	22.08	32.25	93.00	-60.75
4	13.05757	10.48	28.16	38.64	93.00	-54.36
5	17.73375	10.59	29.59	40.18	93.00	-52.82
6	21.71850	10.60	31.19	41.79	93.00	-51.21

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level – Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value

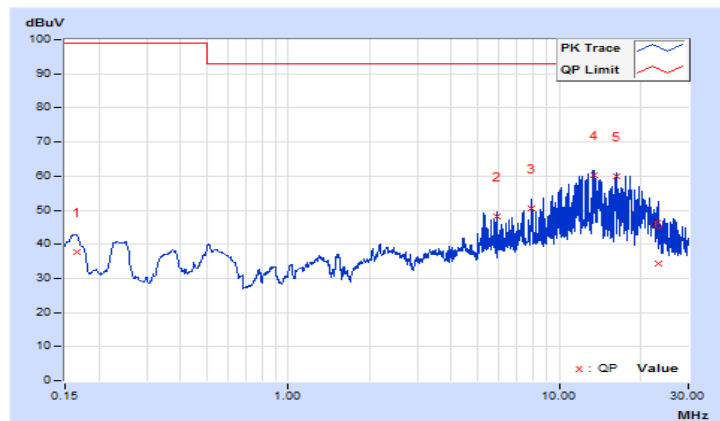


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 66%RH
Tested by	Kai Chu	Test Date	2019/12/24
Test Mode	Mode 1		

Phase Of Power : Neutral (N)						
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
			Q.P.	Q.P.	Q.P.	Q.P.
1	0.16524	10.17	27.43	37.60	99.00	-61.40
2	5.90775	10.46	37.63	48.09	93.00	-44.91
3	7.92375	10.51	39.88	50.39	93.00	-42.61
4	13.41825	10.62	49.71	60.33	93.00	-32.67
5	16.22850	10.69	49.28	59.97	93.00	-33.03
6	23.12925	10.71	23.69	34.40	93.00	-58.60

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level – Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value



6 Radiated Disturbance up to 1 GHz

6.1 Limits

Frequency (MHz)	dBuV/m (at 10m) / quasi-peak
30 - 230	40
230 - 1000	47

- Notes: 1. The lower limit shall apply at the transition frequencies.
 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

6.2 Test Instruments

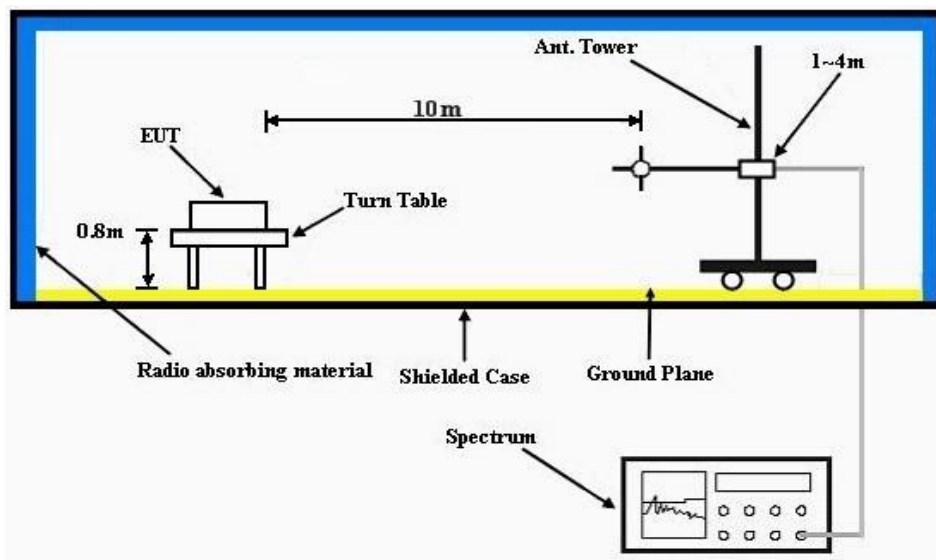
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ (V)	ESR	101240	Oct. 31, 2019	Oct. 30, 2020
Test Receiver ROHDE & SCHWARZ (H)	ESR	101264	Apr. 10, 2019	Apr. 09, 2020
BILOG Antenna SCHWARZBECK (V)	VULB9168	9168-148	Nov. 08, 2019	Nov. 07, 2020
BILOG Antenna SCHWARZBECK (H)	VULB9168	9168-156	Nov. 08, 2019	Nov. 07, 2020
Preamplifier Sonoma (V)	310N	352924	Jun. 11, 2019	Jun. 10, 2020
Preamplifier Sonoma (H)	310N	352923	Jun. 11, 2019	Jun. 10, 2020
RF signal cable (with 5dB PAD) Times (V)	LMR-600 (18M) +LMR-400 (7M)	CABLE-CH1 (VER) -01	Sep. 05, 2019	Sep. 04, 2020
RF signal cable (with 5dB PAD) Times (H)	LMR-600 (11.8M) +LMR-400 (7M)	CABLE-CH1 (HOR) -01	Sep. 05, 2019	Sep. 04, 2020
Software BV ADT	BV ADT_Radiated_ V8.7.08	NA	NA	NA
Antenna Tower (V)	MFA-440	9707	NA	NA
Antenna Tower (H)	MFA-440	970705	NA	NA
Turn Table	DS430	50303	NA	NA
Controller (V)	MF7802	074	NA	NA
Controller (H)	MF7802	08093	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 HwaYa Chamber 1.
 3. The VCCI Site Registration No. is R-11893.

6.3 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 120 kHz for quasi-peak detection (QP) at frequency up to 1 GHz.



6.4 Test Results

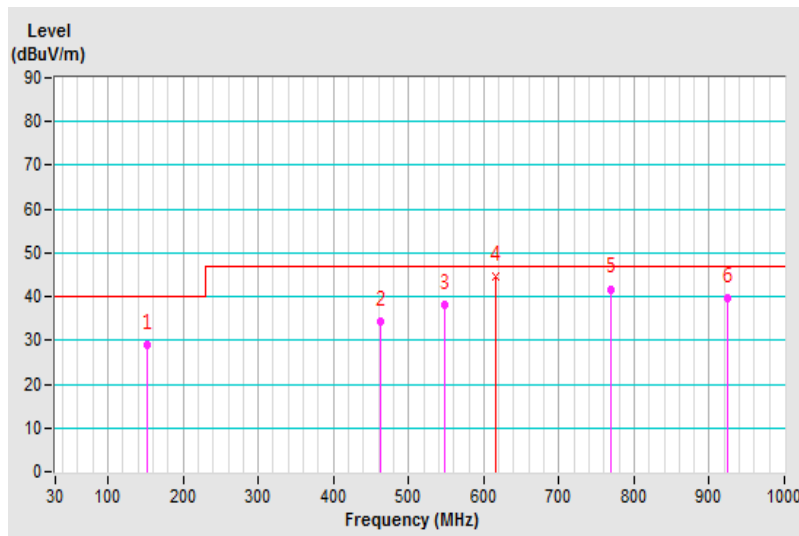
Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Jim Lee	Environmental Conditions	23°C, 68%RH
Test Mode	Mode 1	Test Date	2020/1/8

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	151.55	28.89 QP	40.00	-11.11	4.00 H	312	41.95	-13.06
2	462.01	34.44 QP	47.00	-12.56	2.50 H	174	41.60	-7.16
3	547.57	38.04 QP	47.00	-8.96	2.00 H	198	44.17	-6.13
4	616.00	44.59 QP	47.00	-2.41	1.50 H	226	49.30	-4.71
5	770.00	41.75 QP	47.00	-5.25	1.00 H	182	44.82	-3.07
6	924.00	39.78 QP	47.00	-7.22	1.00 H	204	40.19	-0.41

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

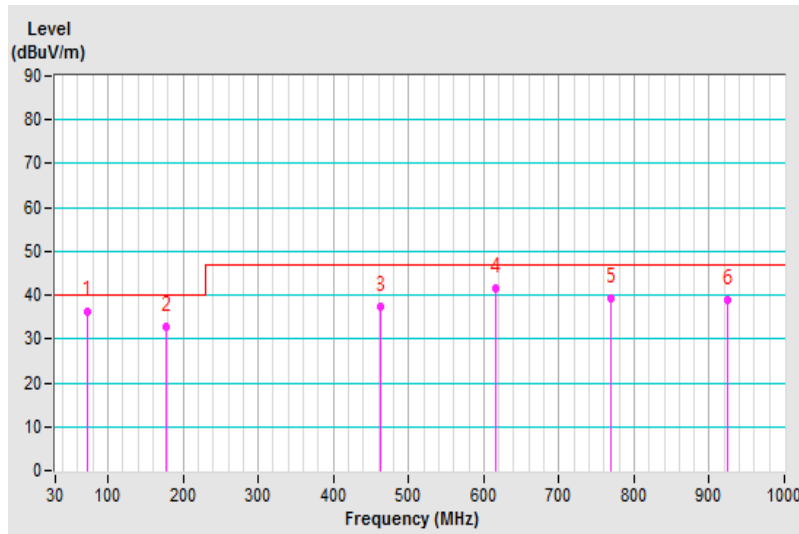


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Jim Lee	Environmental Conditions	23°C, 68%RH
Test Mode	Mode 1	Test Date	2020/1/8

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	72.68	36.32 QP	40.00	-3.68	3.00 V	79	51.81	-15.49
2	178.08	32.78 QP	40.00	-7.22	1.50 V	330	47.01	-14.23
3	462.01	37.35 QP	47.00	-9.65	1.00 V	168	45.52	-8.17
4	616.01	41.61 QP	47.00	-5.39	4.00 V	154	46.61	-5.00
5	770.00	39.10 QP	47.00	-7.90	2.00 V	280	41.84	-2.74
6	924.00	38.88 QP	47.00	-8.12	2.00 V	6	38.85	0.03

Remarks:

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



7 Radiated Disturbance above 1 GHz

7.1 Limits

Frequency (GHz)	Class A (dBuV/m) (at 3 m)		Class B (dBuV/m) (at 3 m)	
	Average	Peak	Average	Peak
1 to 3	56	76	50	70
3 to 6	60	80	54	74

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the EUT or on which the EUT operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 108	1000
108-500	2000
500-1000	5000
Above 1000	Up to 5 times of the highest frequency or 6 GHz, whichever is less

7.2 Test Instruments

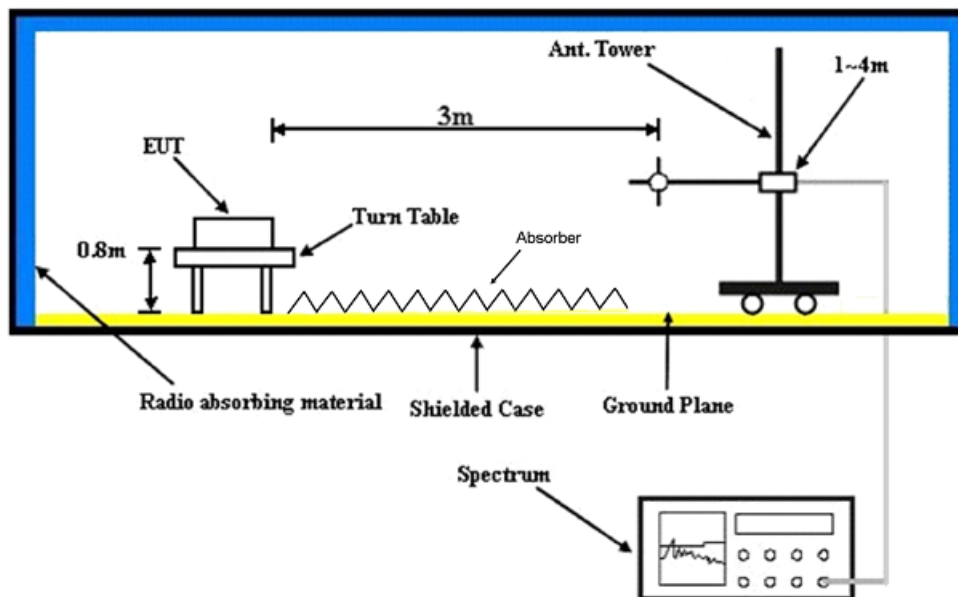
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ (Above 1GHz)	ESR7	101471	Mar. 07, 2019	Mar. 06, 2020
Spectrum Analyzer Agilent	E4446A	MY51100039	Sep. 05, 2019	Sep. 04, 2020
RF signal cable (with 5dB PAD) Times	LMR-400 (18M)	CABLE-CH2-01	Mar. 25, 2019	Mar. 24, 2020
HORN Antenna (with 4dB PAD) SCHWARZBECK	BBHA 9120 D	9120D-405	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier Agilent (Above 1GHz)	8449B	3008A01961	Sep. 05, 2019	Sep. 04, 2020
RF Coaxial Cable JUNFLON+EMC	JUNFLON+EMC10 4-SM-SM-6000	Cable-CH2- 02(MWX3221308G003+1307 10)	Jun. 11, 2019	Jun. 10, 2020
Software BV ADT	BV ADT_Radiated_ V8.7.08	NA	NA	NA
Antenna Tower BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Controller BV ADT	SC100	SC93021702	NA	NA
RF Coaxial Cable EMCI	EMC102-KM-KM- 1000	170819	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable Rosnol	K1K50-UP0279- K1K50-3000	181129-1	Oct. 08, 2019	Oct. 07, 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 HwaYa Chamber 2.
3. The VCCI Site Registration No. is G-10018.

7.3 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 3 dB 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 1 MHz and video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1 GHz.



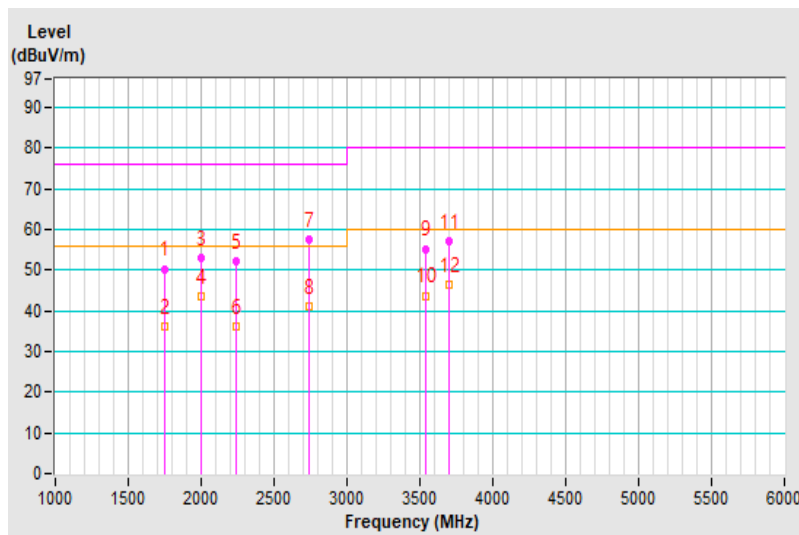
7.4 Test Results

Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Mick Chou	Environmental Conditions	25°C, 61%RH
Test Mode	Mode 1	Test Date	2019/12/24

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	1747.34	50.35 PK	76.00	-25.65	1.28 H	195	52.88	-2.53
2	1747.34	36.11 AV	56.00	-19.89	1.28 H	195	38.64	-2.53
3	2002.04	52.97 PK	76.00	-23.03	1.28 H	192	54.24	-1.27
4	2002.04	43.49 AV	56.00	-12.51	1.28 H	192	44.76	-1.27
5	2241.61	52.17 PK	76.00	-23.83	1.47 H	168	51.20	0.97
6	2241.61	36.03 AV	56.00	-19.97	1.47 H	168	35.06	0.97
7	2744.36	57.53 PK	76.00	-18.47	2.21 H	178	56.69	0.84
8	2744.36	41.18 AV	56.00	-14.82	2.21 H	178	40.34	0.84
9	3542.03	55.26 PK	80.00	-24.74	1.65 H	222	53.21	2.05
10	3542.03	43.77 AV	60.00	-16.23	1.65 H	222	41.72	2.05
11	3696.01	57.11 PK	80.00	-22.89	1.38 H	222	54.79	2.32
12	3696.01	46.30 AV	60.00	-13.70	1.38 H	222	43.98	2.32

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

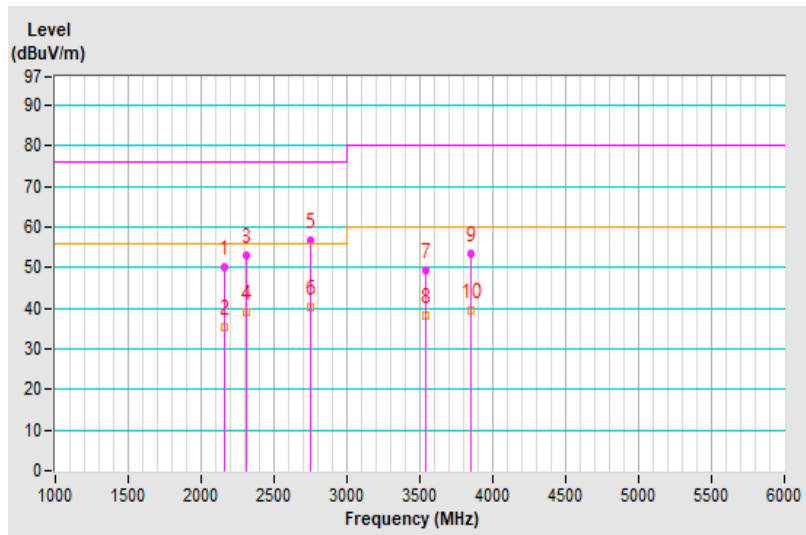


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Mick Chou	Environmental Conditions	25°C, 61%RH
Test Mode	Mode 1	Test Date	2019/12/24

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	2156.02	50.03 PK	76.00	-25.97	1.13 V	360	49.75	0.28
2	2156.02	35.32 AV	56.00	-20.68	1.13 V	360	35.04	0.28
3	2309.97	53.04 PK	76.00	-22.96	1.74 V	159	52.25	0.79
4	2309.97	38.99 AV	56.00	-17.01	1.74 V	159	38.20	0.79
5	2745.17	56.75 PK	76.00	-19.25	1.40 V	120	55.91	0.84
6	2745.17	40.18 AV	56.00	-15.82	1.40 V	120	39.34	0.84
7	3542.03	49.24 PK	80.00	-30.76	2.11 V	357	47.19	2.05
8	3542.03	38.22 AV	60.00	-21.78	2.11 V	357	36.17	2.05
9	3850.03	53.48 PK	80.00	-26.52	1.50 V	219	50.77	2.71
10	3850.03	39.36 AV	60.00	-20.64	1.50 V	219	36.65	2.71

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 Electrostatic Discharge Immunity Test (ESD)

8.1 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, ± 6 kV (Direct/Indirect)
Number of Discharge:	Minimum 20 times at each test point
Discharge Mode:	Single Discharge
Discharge Period:	1-second minimum

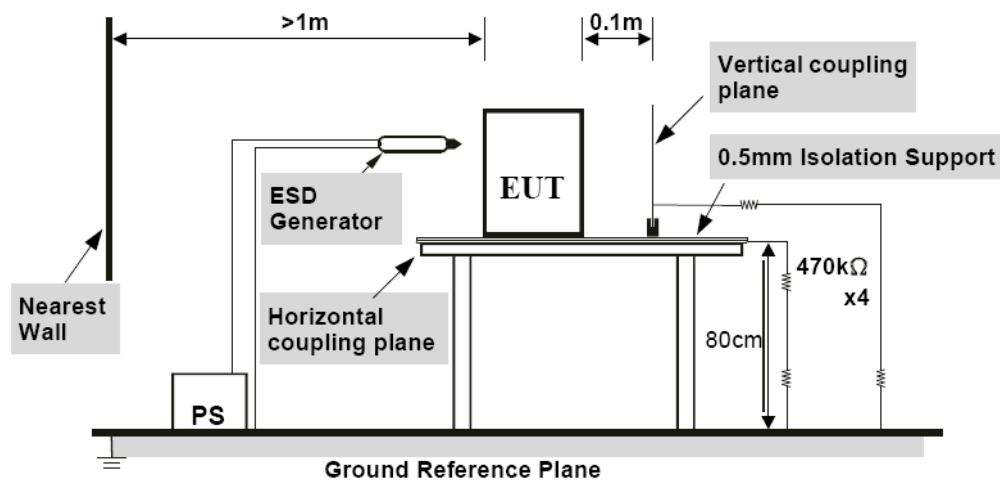
8.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Noiseken Electrostatic Analog Tester	ESS-B3011	ESS12Z5082	Nov. 12, 2019	Nov. 11, 2020

- Notes: 1. The test was performed in Hwa Ya ESD Room 2.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

8.3 Test Arrangement

- a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
- b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
- c. The time interval between two successive single discharges was at least 1 second.
- d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.
- e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
- g. At least ten single discharges (in the most sensitive polarity) were applied to the **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**.
- h. 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.



8.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Howard Yang
Environmental Conditions	23 °C, 45% RH 988 mbar	Test Date	2020/02/11
Test mode	1		

Test Results of Direct Application

Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criterion
2, 4, 8	+/-	7-9	N/A	Note 1	A
2, 4, 6	+/-	1-6	Note 1	N/A	A

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

Test Results of Indirect Application

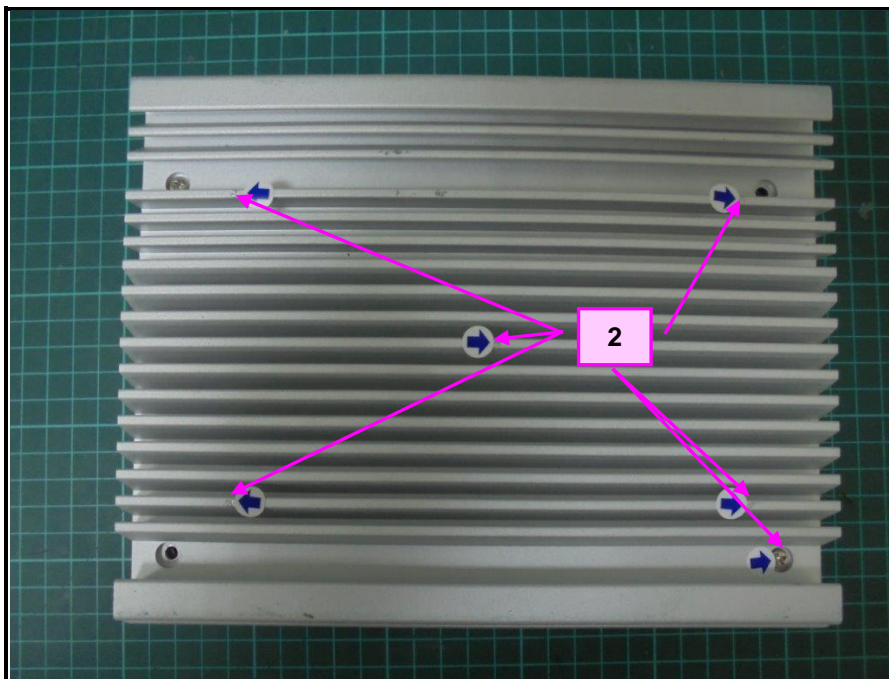
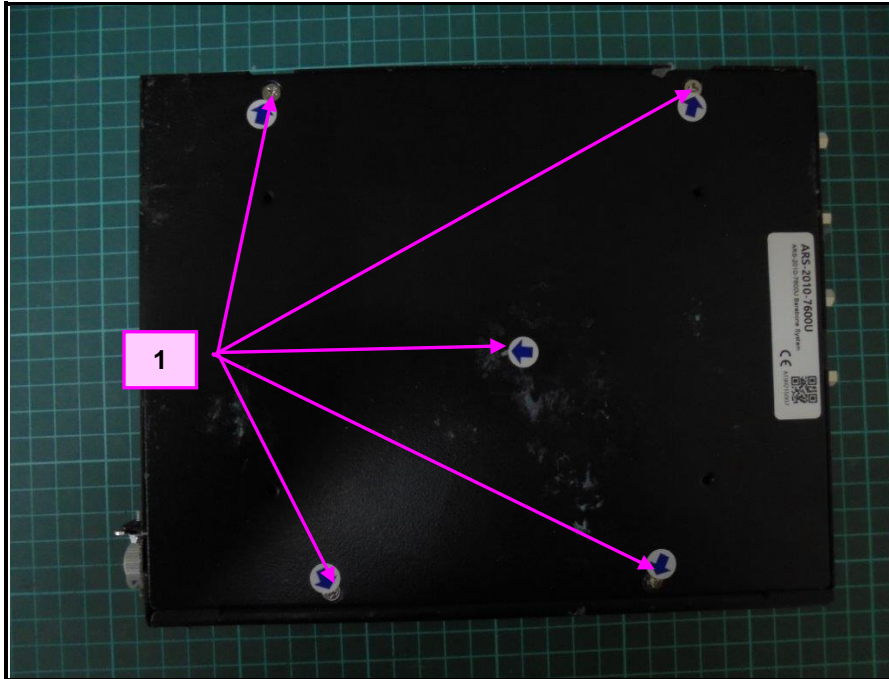
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
2, 4, 6	+/-	Four Sides	Note 1	Note 1	A

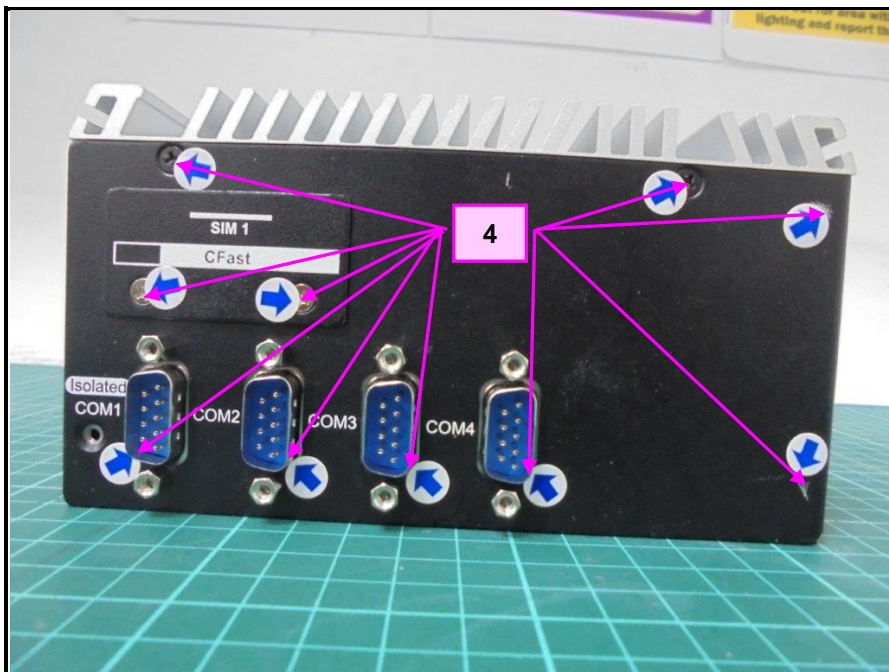
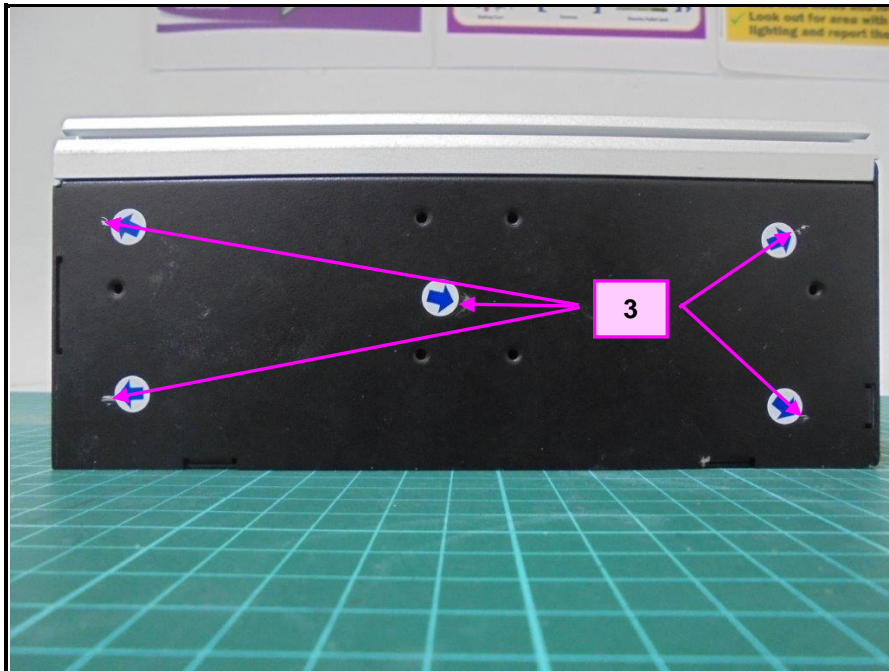
Description of test points of indirect application:

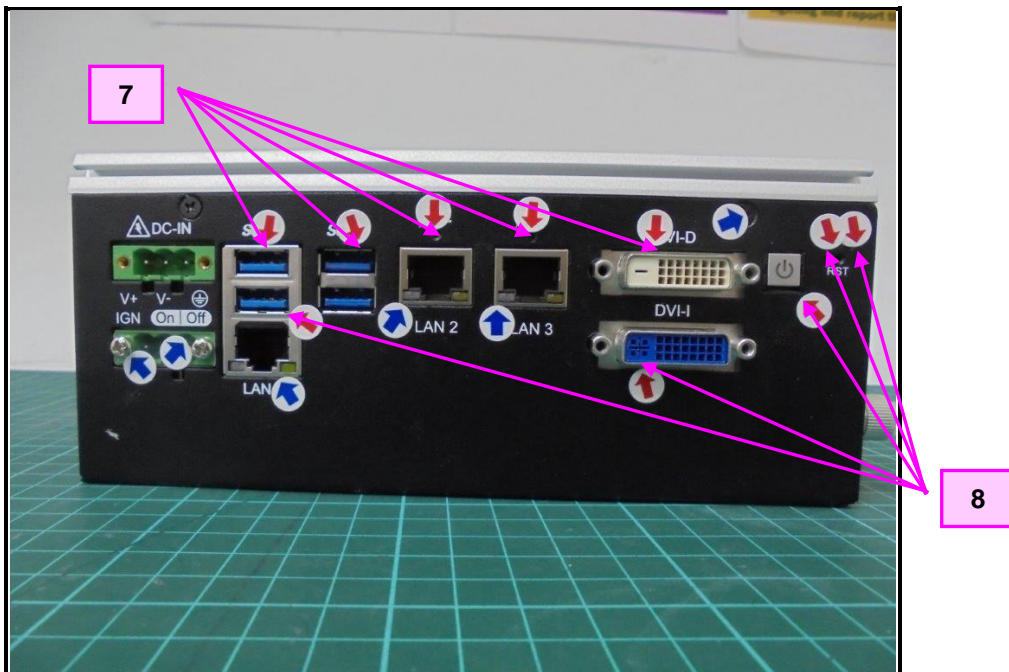
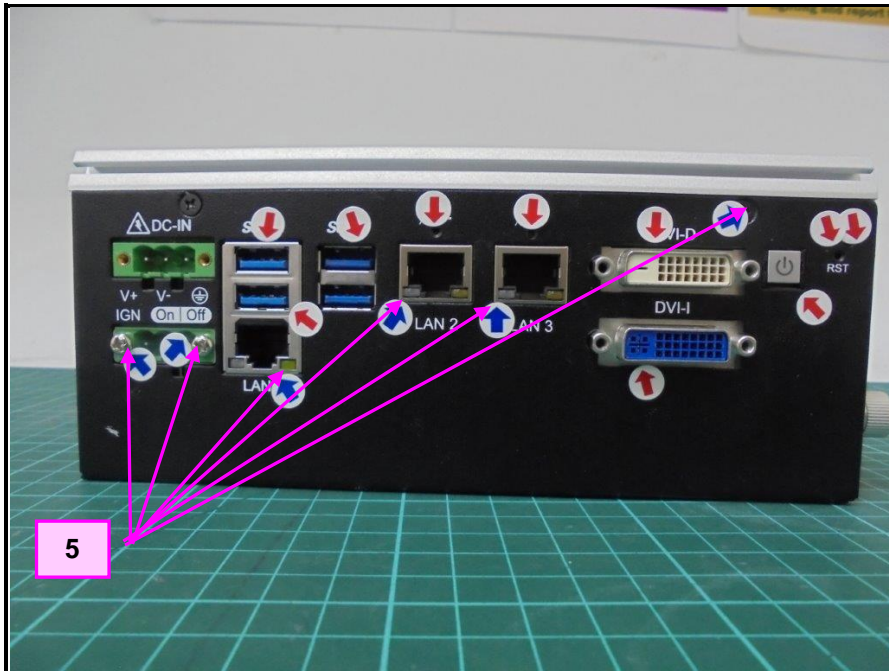
1. Front side 2. Rear side 3. Right side 4. Left side

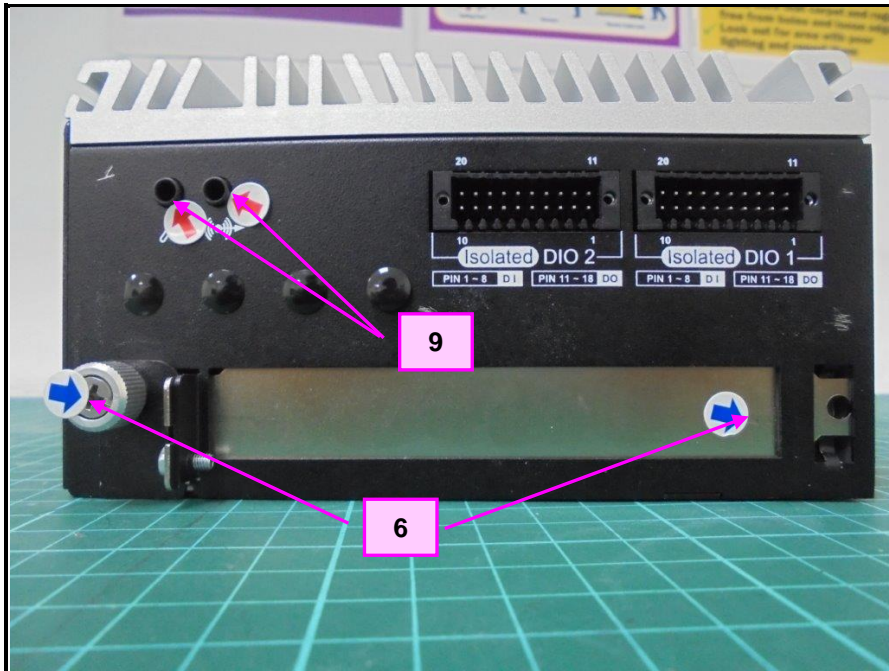
Note: 1. The EUT function was correct during the test.

Description of Test Points









9 Radio-frequency Electromagnetic Field Immunity Test (RS)

9.1 Test Specification

Basic Standard:	EN/IEC 61000-4-3 80-1000 MHz, 20V/m ¹
Frequency Range, Field Strength:	1400-2000 MHz, 10V/m 2100-2700 MHz, 5V/m 5100-6000 MHz, 3V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal and Vertical
Antenna Height:	1.55m
Dwell Time:	3 seconds

Note 1: This limit applies to equipment mounted in the passenger compartments, drivers cab or external to the rolling stock (roof, underframe). For equipment mounted in all other areas a severity level of 10 V/m may be used.

9.2 Test Instruments

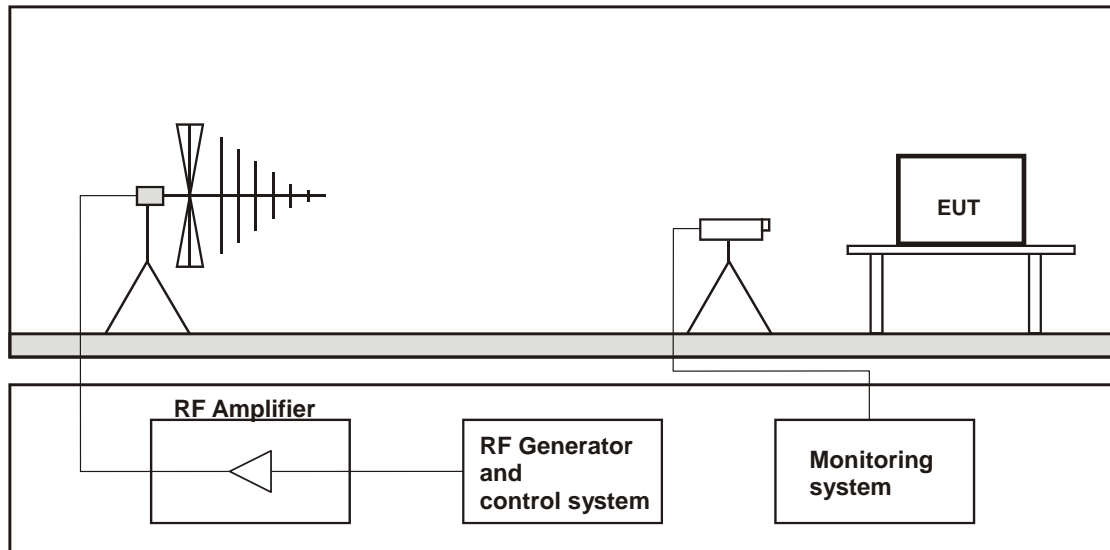
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
BONN Power Amp	BLMA 1060-100/50D	118694	NA	NA
BBA Power Amp	B250C125	101011	NA	NA
Power Sensor	NRP-Z91	101572	Dec. 17, 2019	Dec. 16, 2020
Power Sensor	NRP-Z91	101573	Dec. 03, 2019	Dec. 02, 2020
Signal Generator	SMB100A	105801	Dec. 03, 2019	Dec. 02, 2020
R&S Software	EMC32 Version 8.52.0	NA	NA	NA
Stacked Log-Per Antenna	STLP9149	9149-141	NA	NA
High GAIN LOG-Periodic Antenna	HL046E	100114	NA	NA

- Notes:
1. The test was performed in Hwa Ya RS Room 2.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. The transmit antenna was located at a distance of 3 meters from the EUT.

9.3 Test Arrangement

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

- The testing was performed in a fully chamber.
- The frequency ranges and field strength levels are 80-1000 MHz, 20V/m, 1400-2100 MHz, 10V/m, 2100-2500 MHz, 5V/m, 3V/m with the signal 80% amplitude modulated with a 1kHz sine wave.
- The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.



9.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Matt Lan
Environmental Conditions	21 °C, 55% RH	Test Date	2020/02/13
Test mode	1		

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Test Distance (m)	Performance Criterion
			(V/m)	Modulation			
80 - 1000	V&H	0, 90, 180, 270	20	80% AM (1kHz)	Note 1	1.5	A
1400 - 2000	V&H	0, 90, 180, 270	10	80% AM (1kHz)	Note 1	3	A
2000 - 2700	V&H	0, 90, 180, 270	5	80% AM (1kHz)	Note 1	3	A
5100 - 6000	V&H	0, 90, 180, 270	3	80% AM (1kHz)	Note 1	3	A

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

10 Electrical Fast Transient/Burst Immunity Test (EFT)

10.1 Test Specification

Basic Standard:	EN/IEC 61000-4-4
Test Voltage:	Signal & communication, process measurement & control ports: $\pm 2\text{kV}$, Capacitive clamp Auxiliary a.c. power input ports (rated voltage $\leq 400\text{ Vrms}$): $\pm 2\text{kV}$
Impulse Repetition Frequency:	5kHz
Impulse Wave Shape:	5/50 (T_r/T_h) ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	1 min.

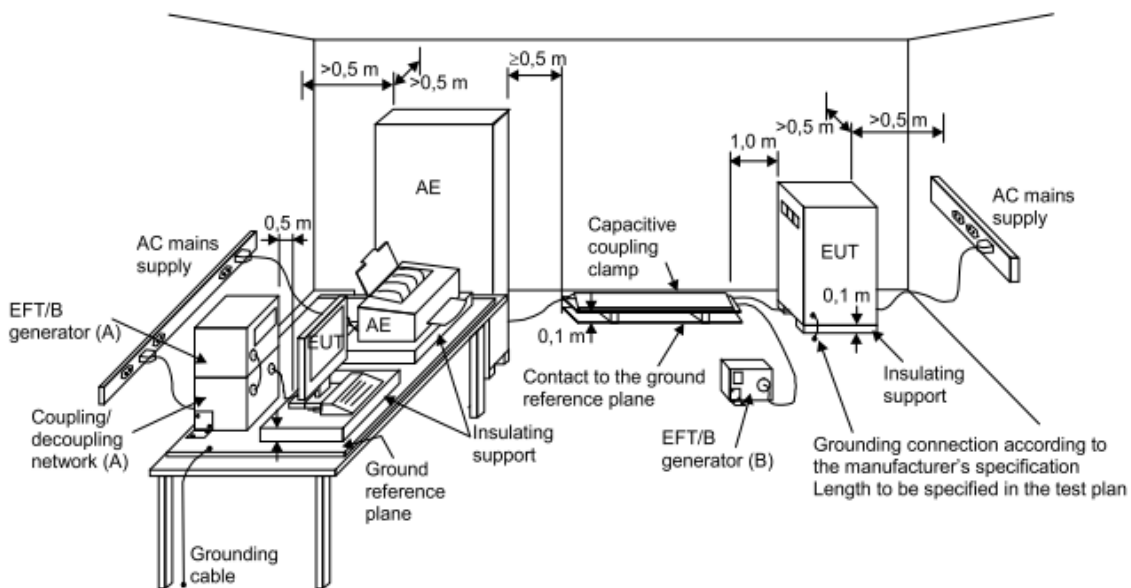
10.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
EMC Immunity Test System	NSG 3060/ CDN 3061/ VAR 3005-S16/ CDN 3425	1385/1355/857/1 763	Jun. 26, 2019	Jun. 25, 2020

- Notes: 1. The test was performed in Hwa Ya EMS Room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

10.3 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.



IEC 645/12

10.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Shawn Huang
Environmental Conditions	23 °C, 58% RH	Test Date	2020/02/15
Test mode	1		

Auxiliary a.c. power input ports (rated voltage \leq 400 Vrms)

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

Note: 1. The earphone had disturbing noise during the test, but could self-recover to the initial operation after the test. (Test result meets the requirements of manufacturer's Performance Criterion)

Input Power	230 Vac, 50 Hz	Tested by	Shawn Huang
Environmental Conditions	23 °C, 58% RH	Test Date	2020/02/08
Test mode	2		

Signal & communication, process measurement & control ports

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

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

Input Power	230 Vac, 50 Hz	Tested by	Shawn Huang
Environmental Conditions	23 °C, 58% RH	Test Date	2020/02/08
Test mode	3		

Signal & communication, process measurement & control ports

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
2	LAN 3 (PoE)	+/-	Note 1	A

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

11 Surge Immunity Test

11.1 Test Specification

Basic Standard:	EN/IEC 61000-4-5
Wave-Shape:	Auxiliary a.c. power input ports (rated voltage ≤ 400 Vrms): 1.2/50 μ s Open Circuit Voltage 8/20 μ s Short Circuit Current
Test Voltage:	Line to line: ± 0.5 kV, ± 1 kV, Line to ground: ± 0.5 kV, ± 1 kV, ± 2 kV output impedance of 42 Ω (40 Ω and 2 Ω generator) and a coupling capacitance of 0,5 μ F
AC Phase Angle (degree):	0°, 90°, 180°, 270°
Pulse Repetition Rate:	1 time / 60 sec.
Number of Tests:	5 positive and 5 negative at selected points

11.2 Test Instruments

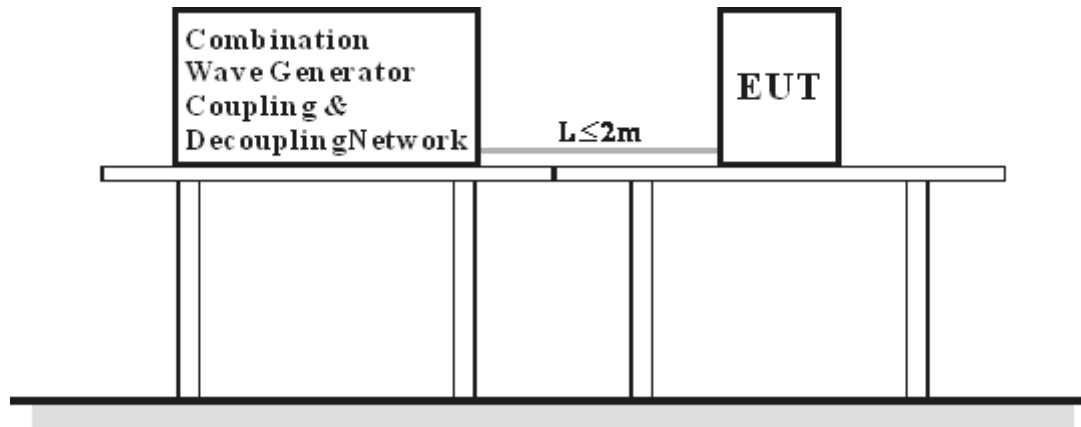
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
EMC Immunity Test System	NSG 3060	1385	Jun. 26, 2019	Jun. 25, 2020
EMC Immunity Test System	CDN 3061	1355	Jun. 26, 2019	Jun. 25, 2020
EMC Immunity Test System	VAR 3005-S16	857	Jun. 26, 2019	Jun. 25, 2020
Surge CDN	CDN HSS-2	36541	Jun. 26, 2019	Jun. 25, 2020
CDN for Unshielded symmetrical signal & Data Lines	CDN 118 / INA 172 / INA 175 / INA 180 / INA 181 / INA 182 / INA 183	33882 / 33245 / 35809 / 35806 / 35909 / 35912 / 35917 / 35927	Jun. 26, 2019	Jun. 25, 2020

- Notes: 1. The test was performed in Hwa Ya EMS Room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

11.3 Test Arrangement

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.



11.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Shawn Huang
Environmental Conditions	23 °C, 58% RH	Test Date	2020/02/08
Test mode	1		

Auxiliary a.c. power input ports (rated voltage ≤ 400 Vrms)

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

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

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

12.1 Test Specification

Basic Standard:	EN/IEC 61000-4-6
Frequency Range:	0.15 MHz - 80 MHz
Voltage Level:	Auxiliary a.c. power input ports (rated voltage \leq 400 Vrms), Signal & communication, process measurement & control ports: 10 V
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time	3 seconds

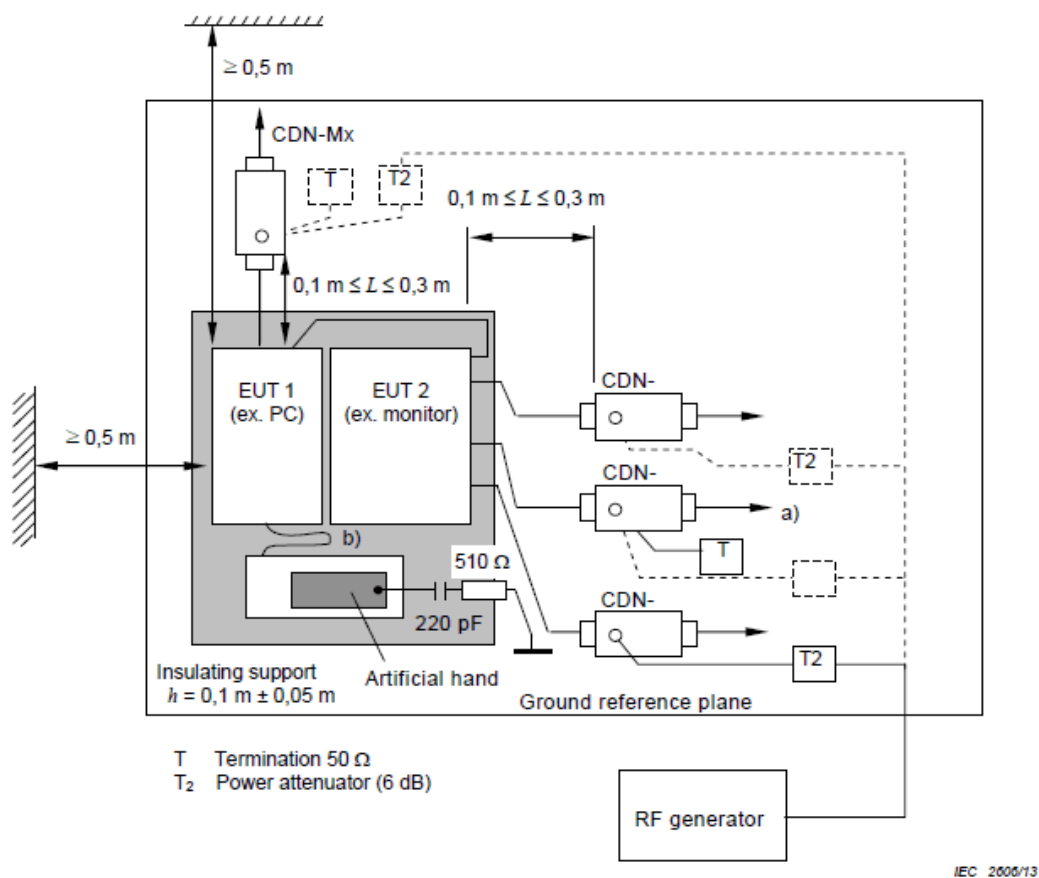
12.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
FCC POWER LINE COUPLING DECOUPLING NETWORK	FCC-801-M1-25A	03030	Mar. 05, 2019	Mar. 04, 2020
Coupling Decoupling Network TESEQ	CDN T8-10	39921	Mar. 04, 2019	Mar. 03, 2020
EMI Injection Clamp	F203I-23MM	434	Mar. 05, 2019	Mar. 04, 2020
FCC SIGNAL LINE POWER LINE COUPLING DECOUPLING NETWORK	FCC-801-M2/M3-16A	112388	Mar. 04, 2019	Mar. 03, 2020
R&S Power Amplifier	BBA100	101012	NA	NA
R&S Signal generator	SMB100A	105802	Jan. 30, 2019	Jan. 29, 2020
R&S Software	EMC32 Version 8.52.0	NA	NA	NA
Power Sensor	NRP-Z91	101574	Jul. 01, 2019	Jun. 30, 2020
Power Sensor	NRP-Z91	101575	Jun. 05, 2019	Jun. 04, 2020

- Notes: 1. The test was performed in Hwa Ya CS Room 2.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

12.3 Test Arrangement

- The EUT shall be tested within its intended operating and climatic conditions.
- An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.
- One of the CDNs not used for injection was terminated with 50 ohm, providing only one return path. All other CDNs were coupled as decoupling networks.
- The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value.
- Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.



- Only one of the CDNs not used for injection shall be terminated with 50 Ω, providing only one return path. All other CDNs shall be configured as decoupling networks.
- Interconnecting cables (≤ 1 m) belonging to the EUT shall remain on the insulating support.

12.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Howand Yang
Environmental Conditions	22 °C, 59% RH	Test Date	2020/01/11
Test mode	1		

Frequency (MHz)	Level (V rms)	Tested Line	Injection Method	Return Path	Observation	Remark	Performance Criterion
0.15 – 80	10	AC	CDN-M3	CDN-M1	Note 1	-	A

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

Input Power	230 Vac, 50 Hz	Tested by	Howand Yang
Environmental Conditions	22 °C, 59% RH	Test Date	2020/01/11
Test mode	2		

Frequency (MHz)	Level (V rms)	Tested Line	Injection Method	Return Path	Observation	Remark	Performance Criterion
0.15 – 80	10	LAN 1	CDN-T8	CDN-M1	Note 1	-	A

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

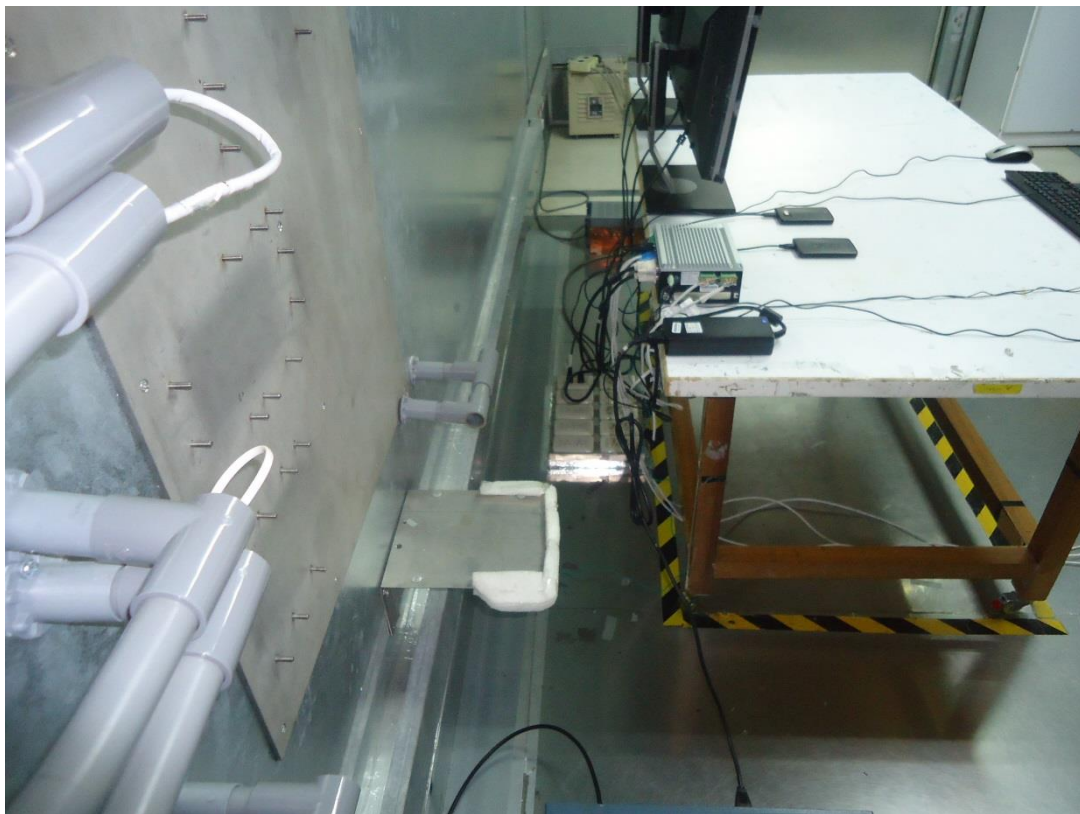
Input Power	230 Vac, 50 Hz	Tested by	Howand Yang
Environmental Conditions	22 °C, 59% RH	Test Date	2020/01/11
Test mode	3		

Frequency (MHz)	Level (V rms)	Tested Line	Injection Method	Return Path	Observation	Remark	Performance Criterion
0.15 – 80	10	LAN 3	CDN-T8	CDN-M1	Note 1	-	A

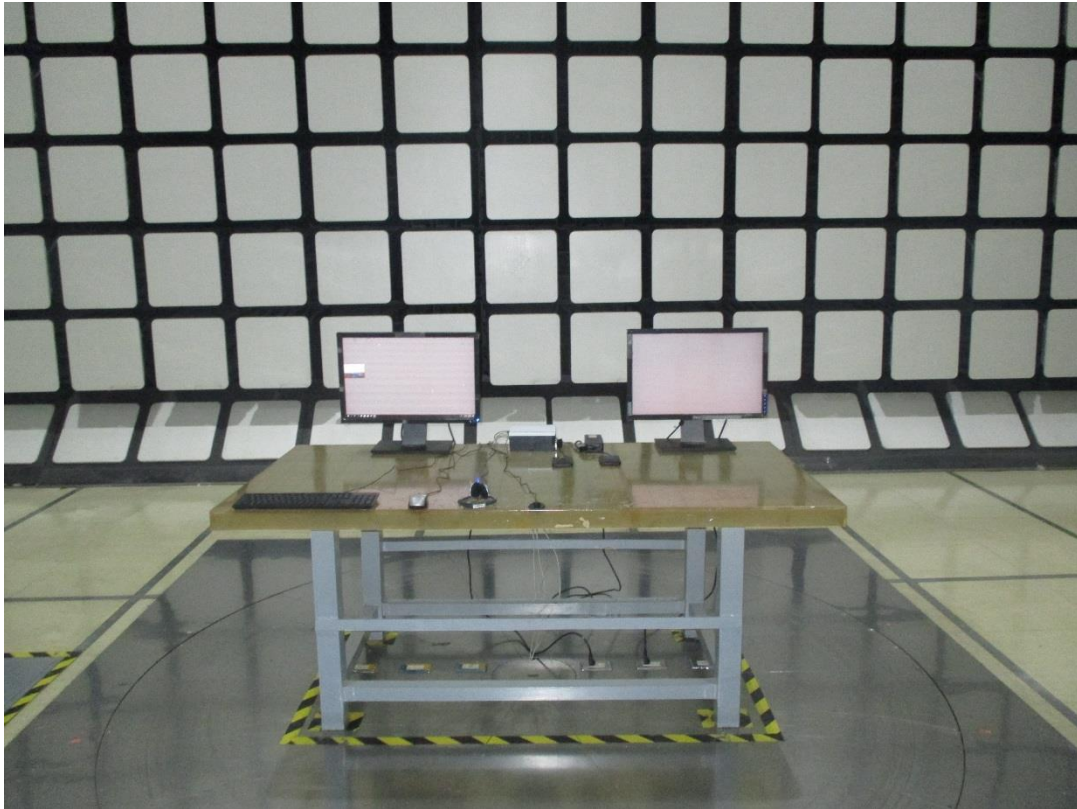
Note: 1. The EUT function was correct during the test.

13 Pictures of Test Arrangements

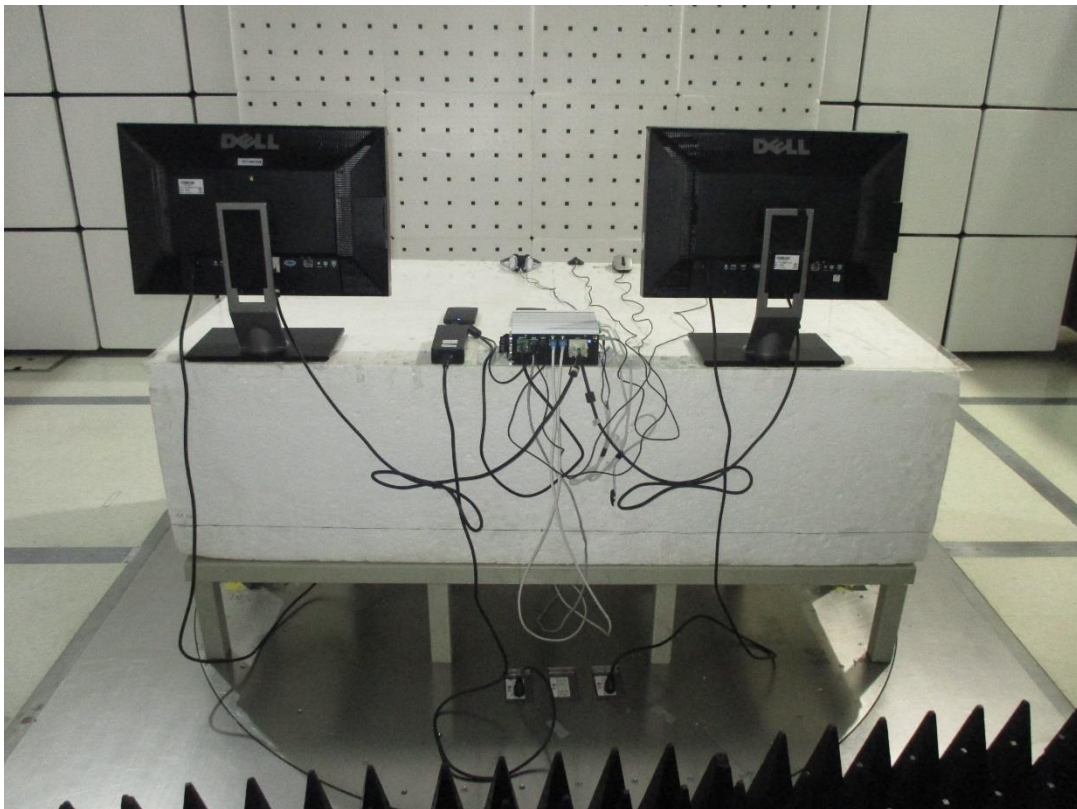
13.1 Conducted Disturbance at Auxiliary a.c. or d.c. power ports



13.2 Radiated Disturbance up to 1 GHz



13.3 Radiated Disturbance above 1 GHz

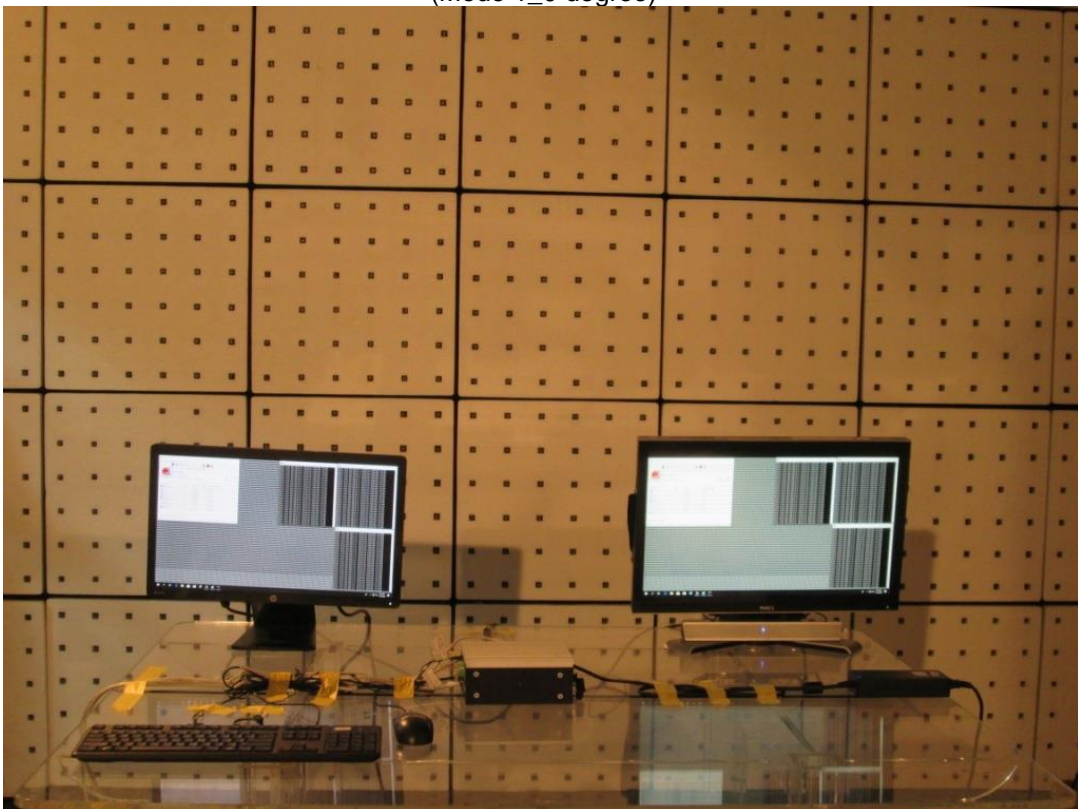


13.4 Electrostatic Discharge Immunity Test (ESD)

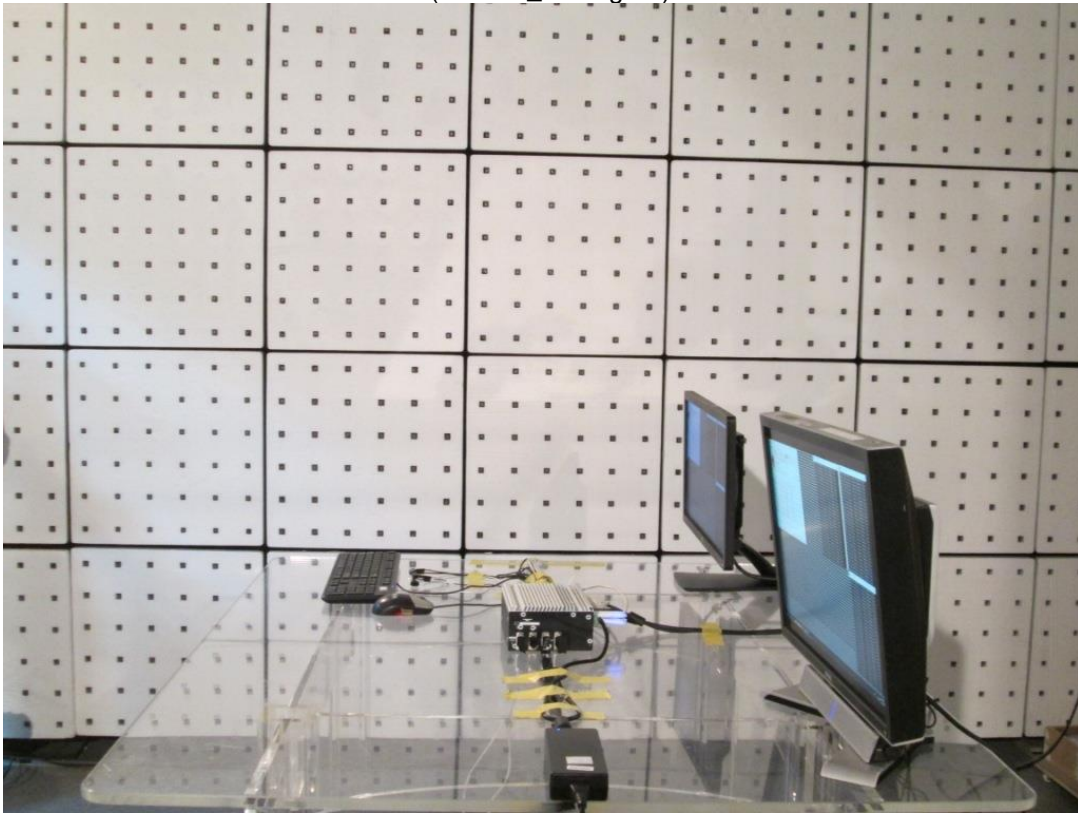


13.5 Radio-frequency Electromagnetic Field Immunity Test (RS)

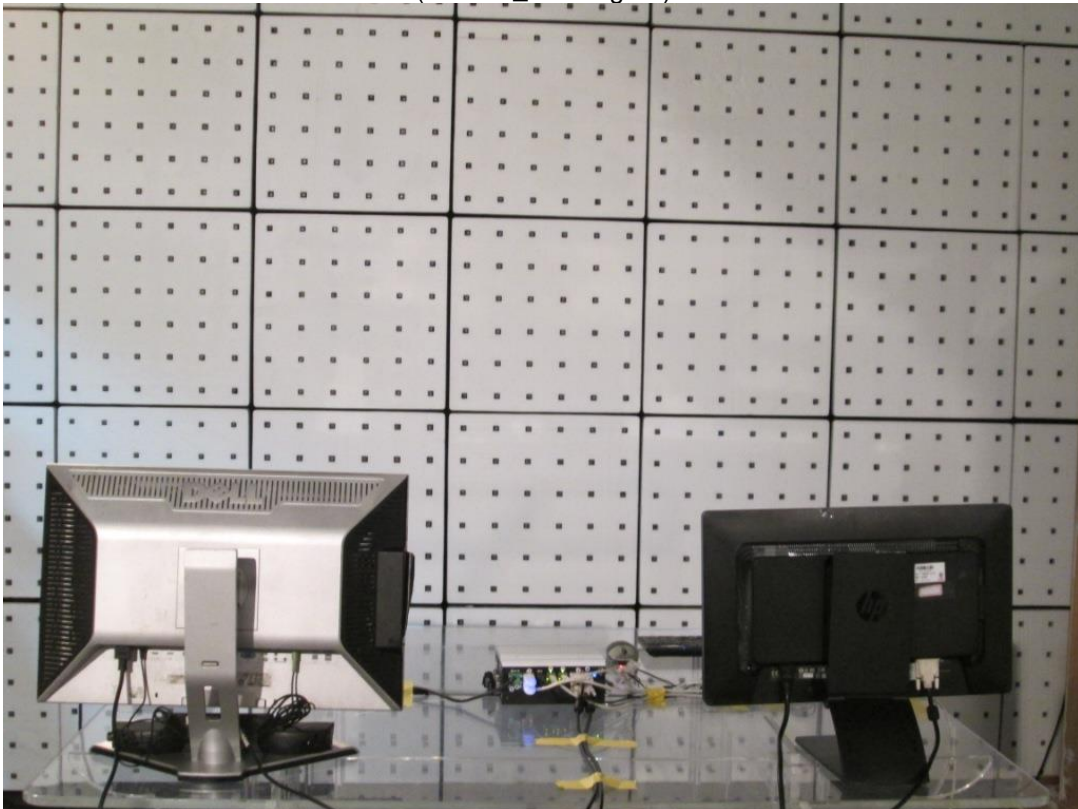
(Mode 1_0 degree)



(Mode 1_90 degree)



(Mode 1_180 degree)



(Mode 1_270 degree)

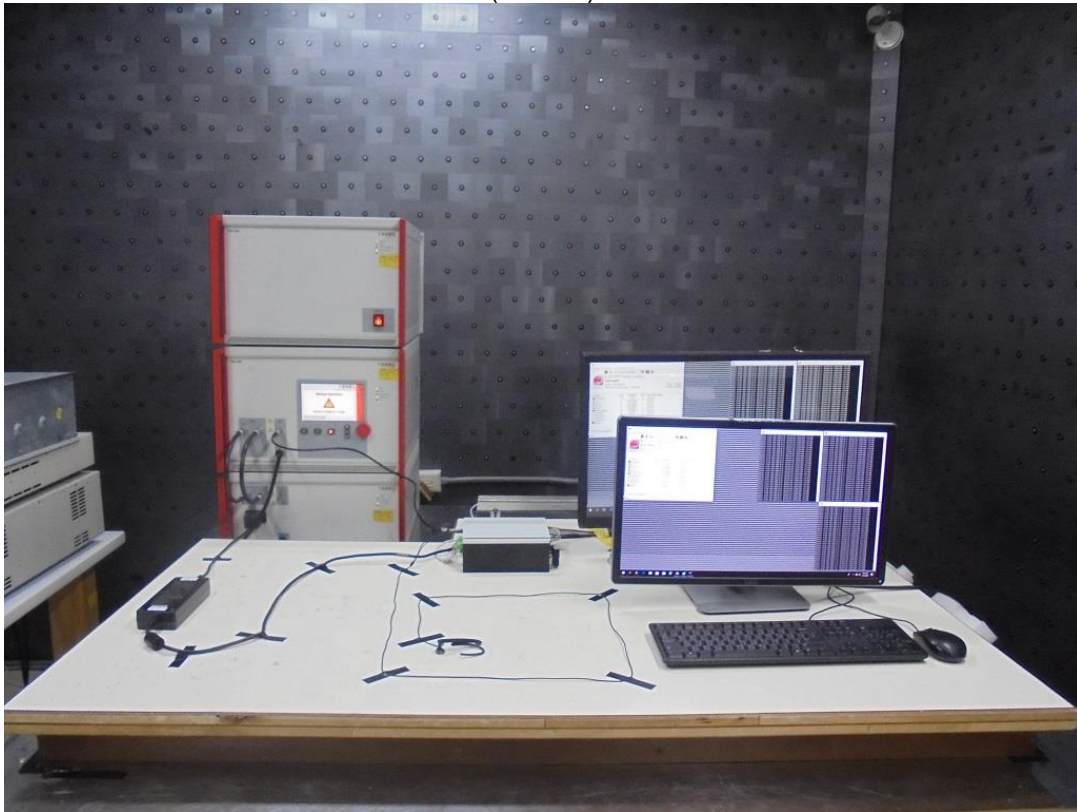


13.6 Fast Transients (EFT)

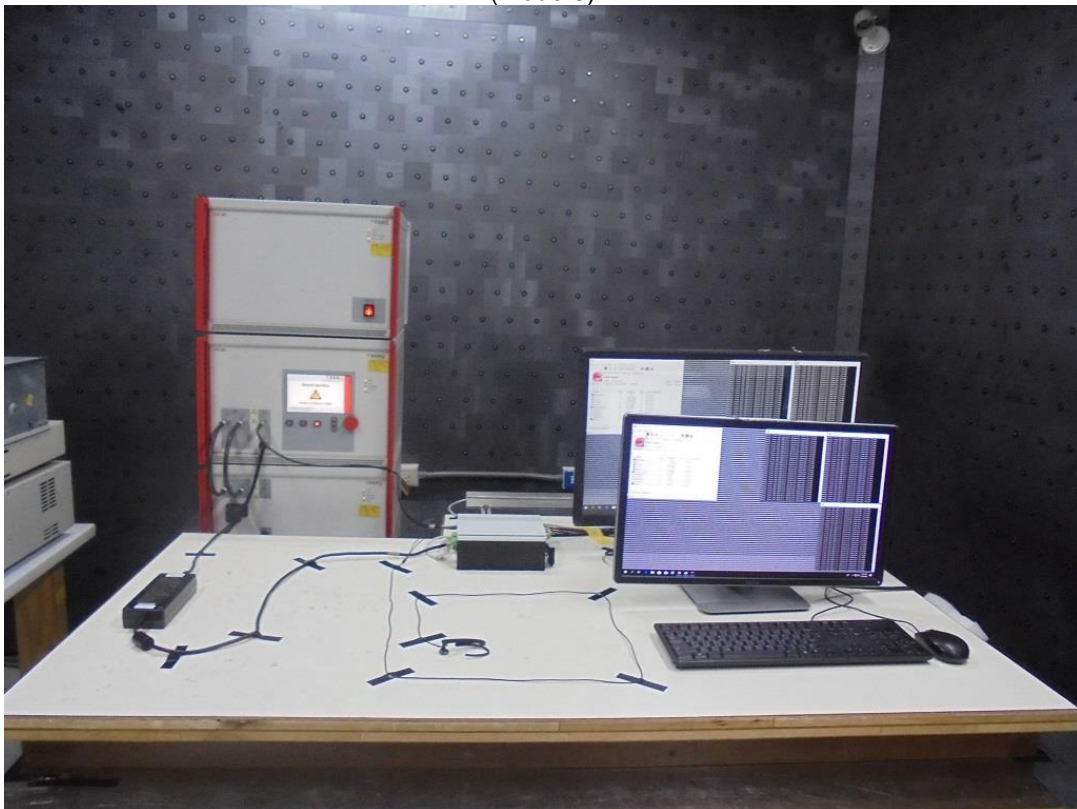
(Mode 1)



(Mode 2)



(Mode 3)

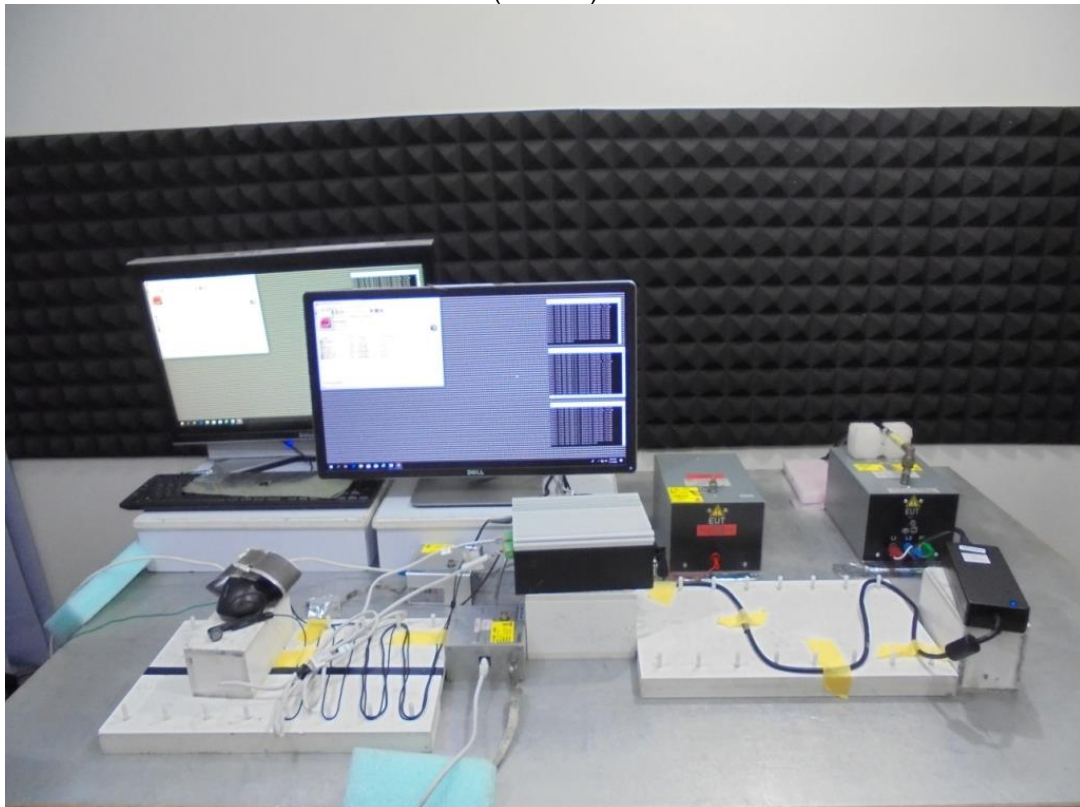


13.7 Surge



13.8 Radio-frequency common mode (CS)

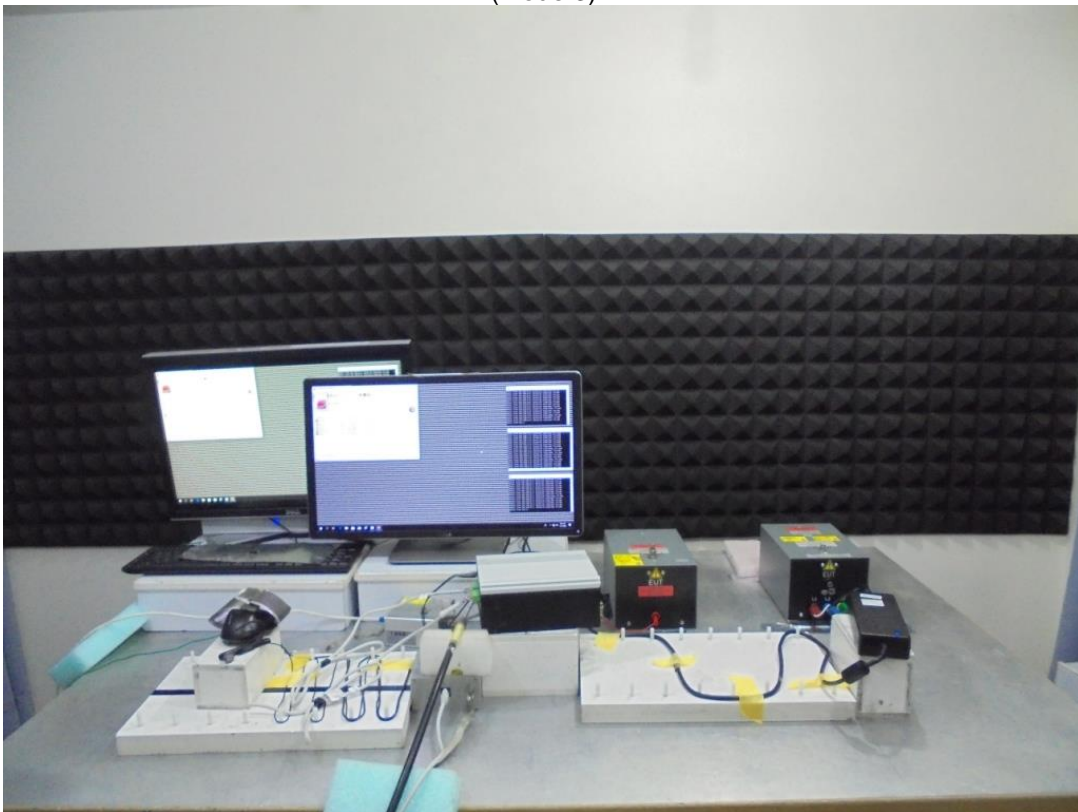
(Mode 1)



(Mode 2)



(Mode 3)



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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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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