CE TEST REPORT

Product Name	:	Notebook
Model No.	:	MS-1688, CX620Z (Z=0~9, A~Z or blank), A6205

Applicant	:	Micro-Star INT'L CO., LTD.
Address	:	No. 69, Lide St., Jhonghe City, Taipei County 235, Taiwan

Date of Receipt	:	Dec. 30, 2009
Issued Date	:	Jan. 20, 2010
Report No.	:	91230002

The test results relate only to the samples tested.
The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.
This report must not be used to claim product endorsement by TAF
The test report shall not be reproduced except in full without the written approval of Compliance Certification Services Inc.

CE

Declaration of Conformity

The following product is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility Directive (2004/108/EC). The listed standards as below were applied:

The following Equipment:

Product Name	:	Notebook
Model No.	:	MS-1688, CX620Z (Z=0~9, A~Z or blank), A6205
Trade Name	:	MSI

This product is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility Directive (2004/108/EC). For the evaluation regarding EMC, the following standards were applied:

ETSI EN 301 489-1 V1.8.1 2008-04;
ETSI EN 301 489-4 V1.4.1 2009-05

EN 55022:2006 + A1: 2007, Class B
EN 61000-3-2: 2006, Class D
EN 61000-3-3: 1995+ A1: 2001 + A2: 2005
EN 61000-4-2: 1995 + A1: 1998 + A2: 2001
EN 61000-4-3: 2006
EN 61000-4-4: 2004
EN 61000-4-5: 2006
EN 61000-4-6: 2007
EN 61000-4-11: 2004

The following importer/manufacturer is responsible for this declaration:

Company Name : _____

Company Address : _____

Telephone : _____

Facsimile : _____

Person is responsible for marking this declaration:

_____ _____
Name (Full Name) Position/ Title

_____ _____
Date Legal Signature

CE

Statement of Conformity

Product Name	:	Notebook
Model No.	:	MS-1688, CX620Z (Z=0~9, A~Z or blank), A6205
Trade Name	:	MSI
Company Name	:	Micro-Star INT'L CO., LTD.

This product is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility Directive (2004/108/EC). For the evaluation regarding EMC, the following standards were applied:

ETSI EN 301 489-1 V1.8.1 2008-04;
ETSI EN 301 489-4 V1.4.1 2009-05

EN 55022:2006 + A1: 2007, Class B
EN 61000-3-2: 2006, Class D
EN 61000-3-3: 1995+ A1: 2001 + A2: 2005
EN 61000-4-2: 1995 + A1: 1998 + A2: 2001
EN 61000-4-3: 2006
EN 61000-4-4: 2004
EN 61000-4-5: 2006
EN 61000-4-6: 2007
EN 61000-4-11: 2004

TAF
Testing Laboratory
1309

Test Laboratory

Rex Lai

Senior Manager / Rex Lai

The verification is based on a single evaluation of one sample of above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab. Logo.

Test Report Certification

Issued Date: Jan. 20, 2010

Applicant	:	Micro-Star INT'L CO., LTD.
Address	:	No. 69, Lide St., Jhonghe City, Taipei County 235, Taiwan
Equipment	:	Notebook
Model No.	:	MS-1688, CX620Z (Z=0~9, A~Z or blank), A6205
Rated Voltage	:	AC 230V/ 50Hz
EUT Voltage	:	AC 100-240V, 50-60Hz
Applicable Standard	:	ETSI EN 301 489-1 V1.8.1 2008-04; ETSI EN 301 489-4 V1.4.1 2009-05 EN 55022:2006 + A1: 2007, Class B EN 61000-3-2: 2006, Class D EN 61000-3-3: 1995+ A1: 2001 + A2: 2005 EN 61000-4-2: 1995 + A1: 1998 + A2: 2001 EN 61000-4-3: 2006 EN 61000-4-4: 2004 EN 61000-4-5: 2006 EN 61000-4-6: 2007 EN 61000-4-11: 2004
Report No.	:	91230002
Trade Name	:	MSI
Test Result	:	Complied
Performed Location	:	Compliance Certification Services Inc. No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan Tel:886-2-2299-9720 Fax:886-2-2299-9721

Documented By

Specialist / Sandy Lin

Reviewed By

Assistant Manager / Gina Lo

Approved By

Senior Manager / Rex Lai

Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		January 20, 2010		Initial Issue	ALL	Sandy Lin

TABLE OF CONTENTS

1 TEST CERTIFICATION

Product:	Notebook
Model:	MS-1688, CX620Z (Z=0~9, A~Z or blank), A6205
Brand:	MSI
Applicant:	**Micro-Star INT' L CO., LTD.** No. 69, Lide St., Jhonghe City, Taipei County 235, Taiwan
Manufacturer:	**Micro-Star INT' L CO., LTD.** No. 69, Lide St., Jhonghe City, Taipei County 235, Taiwan
Tested:	January 4 ~ 7, 2010
Test Voltage:	230VAC, 50Hz
Applicable Standards:	**ETSI EN 301 489-1 V1.8.1 2008-04;** **ETSI EN 301 489-4 V1.4.1 2009-05** EN 55022:2006 + A1: 2007, Class B EN 61000-3-2: 2006, Class D EN 61000-3-3: 1995+ A1: 2001 + A2: 2005 EN 61000-4-2: 1995 + A1: 1998 + A2: 2001 EN 61000-4-3: 2006 EN 61000-4-4: 2004 EN 61000-4-5: 2006 EN 61000-4-6: 2007 EN 61000-4-11: 2004

Deviation from Applicable Standard
None

The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Rex Lai
Section Manager

Reviewed by:

Gina Lo
Section Manager

2 TEST RESULT SUMMARY

EMISSION			
Standard	**Item**	**Result**	**Remarks**
EN 55022: 2006 + A1: 2007	Conducted (Main Port)	PASS	Meet Class B limit
	Conducted (Telecom port)	PASS	Meet Class B limit
	Radiated	PASS	Meet Class B limit
EN 61000-3-2: 2006	Harmonic current emissions	PASS	Meet Class D limit
EN 61000-3-3: 1995+ A1: 2001 + A2: 2005	Voltage fluctuations & flicker	PASS	Meets the requirements

IMMUNITY 【 ETSI EN 301 489-1 V1.8.1 (2008-04); ETSI EN 301 489-4 V1.4.1 (2009-05) 】			
Standard	**Item**	**Result**	**Remarks**
EN 61000-4-2: 1995 + A1: 1998 + A2: 2001	ESD	PASS	Meets the requirements of Performance Criterion TT&TR
EN 61000-4-3: 2006	RS	PASS	Meets the requirements of Performance Criterion CT&CR
EN 61000-4-4: 2004	EFT	PASS	Meets the requirements of Performance Criterion TT&TR
EN 61000-4-5: 2006	Surge	PASS	Meets the requirements of Performance Criterion TT&TR
EN 61000-4-6: 2007	CS	PASS	Meets the requirements of Performance Criterion CT&CR
EN 61000-4-11: 2004	Voltage dips & voltage variations	PASS	Meets the requirements of Voltage Dips: i) 0% residual for 0.5 & 1period, Performance Criterion B ii) 70% residual for 25 period (at 50Hz), Performance Criterion C Voltage Interruptions: i) 0% residual for 250 period (at 50Hz), Performance Criterion C

Note: 1. The statements of test result on the above are decided by the request of test standard only; the measurement uncertainties are not factored into this compliance determination.
2. The information of measurement uncertainty is available upon the customer's request.

3 EUT DESCRIPTION

Product	Notebook		
Brand Name	MSI		
Model	MS-1688, CX620Z (Z=0~9, A~Z or blank), A6205		
Applicant	Micro-Star INT' L CO., LTD.		
Housing material	Plastic		
Serial Number	91230002		
Received Date	December 30, 2009		
EUT Power Rating	1. Powered by Power Adapter 2. Powered by Batteries (11.1V, 6600mAh, 74Wh)		
AC Adaptor Manufacturer	LI SHIN		
AC Adaptor Model	LSE0202C1990		
AC Adaptor Power During	I/P: 100-240VAC, 50-60Hz, 1.5A O/P: 19VDC, 4.74A		
AC Power Cord Type	Unshielded, 1.8m (Detachable) to Power Adapter		
DC Power Cable Type	Unshielded, 1.8m (Non-Detachable) with a core		
CPU	Intel	**Model**	CPU,CPU+GPU,CORE I7 CPU M620,INTEL/2.66GHz(Q3G5),2.66GHz,PGA-9, 88pin
		Model	CPU,CPU+GPU,CORE I7 CPU U620,INTEL/1.06GHz(Q3G2),1.06GHz,BGA-12, 88pin
		Model	CPU,CPU+GPU,CORE I5 CPU M540,INTEL/2.53GHz(Q3G9),2.53GHz,PGA-9, 88pin
		Model	CPU,CPU+GPU,CORE I5 CPU M520,INTEL/2.4GHz(Q3GB),2.4GHz,PGA-988, pin
		Model	CPU,CPU+GPU,CORE I5 CPU M430,INTEL/2.26GHz(Q3LR),2.26GHz,PGA-9, 88pin
		Model	CPU, CPU+GPU, I3+330M, INTEL/2.13GHz, PGA-988pin

GPU	ATI	**Model**	Park LP
		Model	Park XT
LED Panel	CMO	**Model**	15.6" \ N156B6-L04
	Samsung	**Model**	15.6" \ LTN156AT05-H
	AUO	**Model**	15.6" \ B156XW02
	CPT	**Model**	15.6" \ CLAA156WA11A
	HANNSTAR	**Model**	16" \ HSD160PHW1-B
	Samsung	**Model**	16" \ LTN160AT06-A01
HDD (SATA)	WD	**Model**	WD5000BEVT \ 500GB, 5400rpm
			WD3200BEKT \ 320GB, 7200rpm
			WD3200BEVT \ 320GB, 5400rpm
			WD2500BEVT \ 250GB, 5400rpm
			WD2500BEVT \ 250GB, 5400rpm
			WD3200BEVT \ 320GB, 5400rpm
			WD5000BEVT \ 500GB, 5400rpm
			WD6400BEVT \ 640GB, 5400rpm
	Toshiba	**Model**	MK5055GSX \ 500GB, 5400rpm
			MK3263GSX \ 320GB, 5400rpm
			MK3265GSX \ 320GB, 5400rpm
			MK2555GSX \ 250GB, 5400rpm
	Seagate	**Model**	ST9500325AS \ 500GB, 5400rpm
			ST9500420AS \ 500GB, 7200rpm
			ST9320325AS \ 320GB, 5400rpm
			ST9250315AS \ 250GB, 5400rpm
	Fujitsu	**Model**	MJA2500BH \ 500GB, 5400rpm
			MJA2320BH \ 320GB, 5400rpm
			MHZ2320BJ \ 320GB, 7200rpm
			MJA2250BH \ 250GB, 5400rpm

HDD (SATA)	Hitachi	**Model**	HTS545050B9A300 \ 500GB, 5400rpm
			HTS545032B9A300 \ 320GB, 5400rpm
			HTS545025B9A300 \ 250GB, 5400rpm
DRAM (DDRIII)	Hynix	**Model**	HMT112S6BFR6C-G7N0 \ 1GB
	Samsung		M471B2874EH1-CF8 \ 1GB
	Hynix		HMT125S6BFR8C-G7N0 \ 2GB
	Samsung		M471B5673EH1-CF8 \ 2GB
	Transcend		TS256MSK64V1U \ 2GB
ODD	HLDS	**Model**	GT10N
	HLDS		GT30N
	Optiarc		AD-7560S
	TSST		TS-L633
	PLDS		DS-8A3S
	HLDS		CT21N
WLAN	Atheros	**Model**	AR5B95
Bluetooth	CSR	**Model**	BSMAN1
WLAN+BT Combo	MSI	**Model**	MS-3870
Touch Pad	SYNAPTICS	**Model**	TM-00300-000
	SENTELIC	**Model**	TPA2D2IC99RA1
Webcam	BISON	**Model**	BN29M6SSB-000 \ 1.3M/RIGHT PLUG
	AzureWave	**Model**	AM-1C016 \ 1.3M/RIGHT PLUG
Battery	Celxpert	**Model**	BTY-L74 \ 6 CELL
	MiTAC	**Model**	BTY-L74 \ 6 CELL
	Celxpert	**Model**	BTY-L75 \ 9 CELL
Adapter	LI SHIN	**Model**	LSE0202C1990
	Delta	**Model**	ADP-90SB BB
Keyboard	Chicony	**Model**	MP-09C13U4-3591
	SUNREX	**Model**	V111922AK1
WiMax Card	Intel	**Model**	622ANXHMW

Remark:

1. *The suffix of "X" (X= 0~9, A~Z or Blank) on model number is just for marketing purpose only.*
2. *Client consigns only one sample to test (model number: MS-1688). Therefore, the testing Lab. just guarantees the unit, which has been tested.*

I/O PORT

I/O PORT TYPES	Q'TY	TESTED WITH
1). USB Port	2	2
2). eSATA Port	1	1
3). Headset Port	1	1
4). D-Sub Port	1	1
5). HDMI Port	1	1
6). Card Reader	1	1
7). LAN Port	1	1

According to customer request, the HDMI port just connected an open loop cable during all tested.

4 TEST METHODOLOGY

4.1. DECISION OF FINAL TEST MODE

1. The following test modes were scanned during the preliminary test:

Pre-Test Mode
Mode 1: EUT operating with VGA mode (1366 x 768 dpi)
Mode 2: EUT operating with HDMI mode (1366 x 768 dpi)

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

Final Test Mode		
Emission	Conducted Emission	**Mode 1**
	Radiated Emission	**Mode 1**
Immunity		**Mode 1**

Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.

4.2. EUT SYSTEM OPERATION

1	Setup the EUT and simulators as shown on 5.2.
2	Turn on the power of all equipment.
3	EUT link to Notebook and ping to 192.168.2.2 .
4	Run WINTHRAX to process Read/Write work.
5	Run Wimax and connect to EUT.
6	EUT will sends “H” pattern to monitor, the monitor will show “H” pattern on the screen.
7	EUT sends “H” pattern to printer, the printer will print “H” pattern on paper.
8	EUT reads and writes data into and from modem.
9	Repeat the above procedure (3) to (8).

Note: Test program is self-repeating throughout the test.

5 SETUP OF EQUIPMENT UNDER TEST

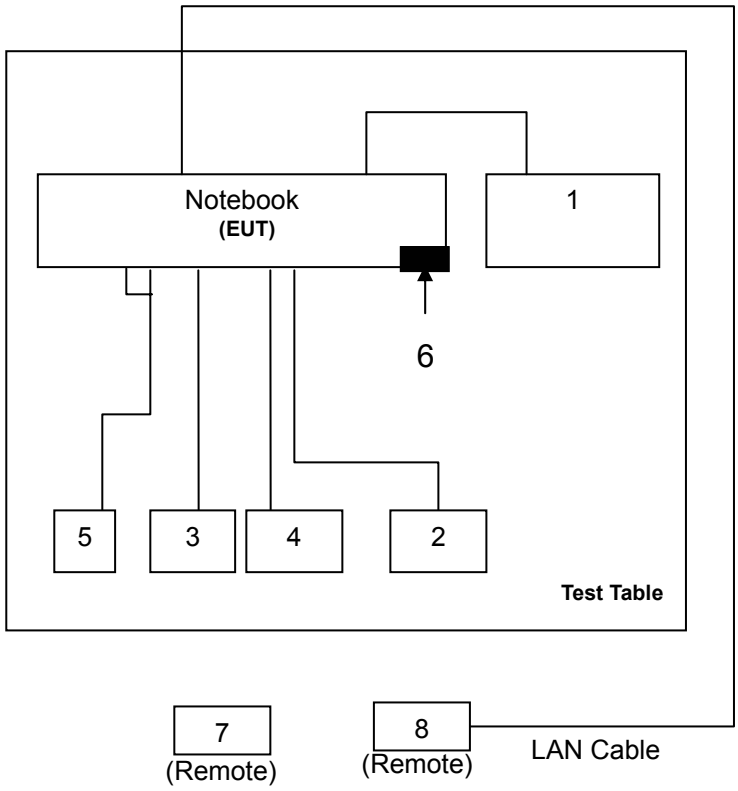
5.1. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Equipment	Model No.	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
1	LCD Monitor	2408WFPb	CN-OG293H-74261-95M-1KGS	FCC DoC	DELL	Shielded, 1.8m with 2 cores	Unshielded, 1.8m
2.	320GB 2.5" HDD	9ZA2MG-500	2GE1RKNC	FCC DoC	Seagate	Shielded, 1.8m	N/A
3.	320GB 2.5" HDD	9ZA2MG-500	2GE20JD9	FCC DoC	Seagate	Shielded, 1.8m	N/A
4	USB Mouse	M-UAG96B	HC8500L	FCC DoC	Logitech	Shielded, 1.8m	N/A
5	Multimedia Earphone	Axis-301	N/A	FCC DoC	Labtec	Unshielded, 1.8m*2	N/A
6	SD Card	N/A	N/A	N/A	SANDISK	N/A	N/A
7	Mobile Wimax Test Set (Remote)	Agilent	E6651A	MY41850118	N/A	N/A	N/A
8	Notebook PC (Remote)	PP05L	7T390 A03	E2K5HCKT	DELL	LAN Cable: Unshielded, 10m	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

Note: Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

5.2. CONFIGURATION OF SYSTEM UNDER TEST



6 FACILITIES AND ACCREDITATIONS

6.1. FACILITIES

All measurement facilities used to collect the measurement data are located at:

☐ No. 81-1, Lane 210, Pa-De 2nd Rd., Luchu Hsiang, Taoyuan Shien, Taiwan.

☒ No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR 22. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4, CISPR 16-1-5.

6.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Taiwan	TAF
USA	A2LA

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

USA	FCC
Canada	INDUSTRY CANADA
Taiwan	NCC

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccsrf.com

6.3. 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	Frequency	Uncertainty
Conducted emissions	9kHz~30MHz	+/-2.81dB
Radiated emissions	30~200MHz	+/- 3.89 dB
	200~1000MHz	+/- 3.88 dB
Radiated emissions # 966 A	Above 1GHz	+/- 3.09 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
Consistent with industry standard (e.g. CISPR 22: 2006, clause 11, Measurement Uncertainty) determining compliance with the limits shall be base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.
The acceptable measurement uncertainty value without requiring revision of the compliance statement is base on conducted and radiated emissions being less than U_{CISPR} which is 3.6dB and 5.2dB respectively. CCS values (called U_{Lab} in CISPR 16-4-2) is less than U_{CISPR} as shown in the table above. Therefore, MU need not be considered for compliance.

7 EMISSION TEST

7.1. CONDUCTED EMISSION MEASUREMENT

7.1.1. LIMITS

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

NOTE:

(1) The lower limit shall apply at the transition frequencies.
(2) The limit decreases in line with the logarithm of the frequency in the range 0.15 to 0.50 MHz.
(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.

7.1.2. TEST INSTRUMENTS

Conducted Emission Room				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver 9kHz-30MHz	Rohde & Schwarz	ESHS30	828144/003	11/17/2010
Two-Line V-Network 9kHz-30MHz	Schaffner	NNB41	03/10013	06/10/2010
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	04/08/2010
ISN 9kHz-30MHz	FCC	FCC-TLISN-T4	20167	10/15/2010
Test S/W	LABVIEW (V 6.1)			

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

7.1.3. TEST PROCEDURES (please refer to measurement standard or CCS SOP PA-031)

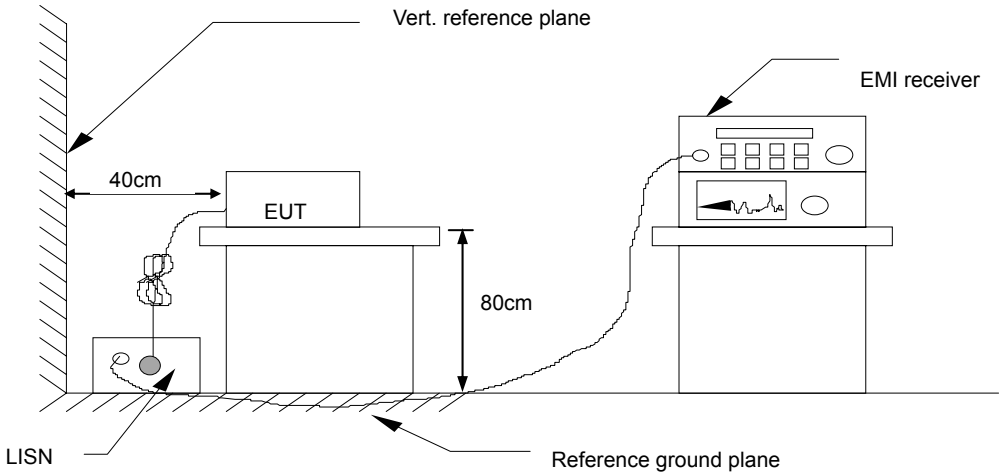
Procedure of Preliminary Test

- The EUT and support equipment, if needed, were set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per EN 55022 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor standing equipment, it is placed on the ground plane, which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- All I/O cables were positioned to simulate typical actual usage as per EN 55022.
- The test equipment EUT installed by AC main power, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane.
- All support equipment power by from a second LISN.
- The test program of the EUT was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The Receiver scanned from 150kHz to 30MHz for emissions in each of the test modes.
- During the above scans, the emissions were maximized by cable manipulation.
- The test mode(s) described in Item 3.1 were scanned during the preliminary test.
- After the preliminary scan, we found the test mode described in Item 3.1 producing the highest emission level.
- The worst configuration of EUT and cable of the above highest emission level were recorded for reference of the final test.

Procedure of Final Test

- EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.
- A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.
- The test data of the worst-case condition(s) was recorded.

7.1.4. TEST SETUP



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

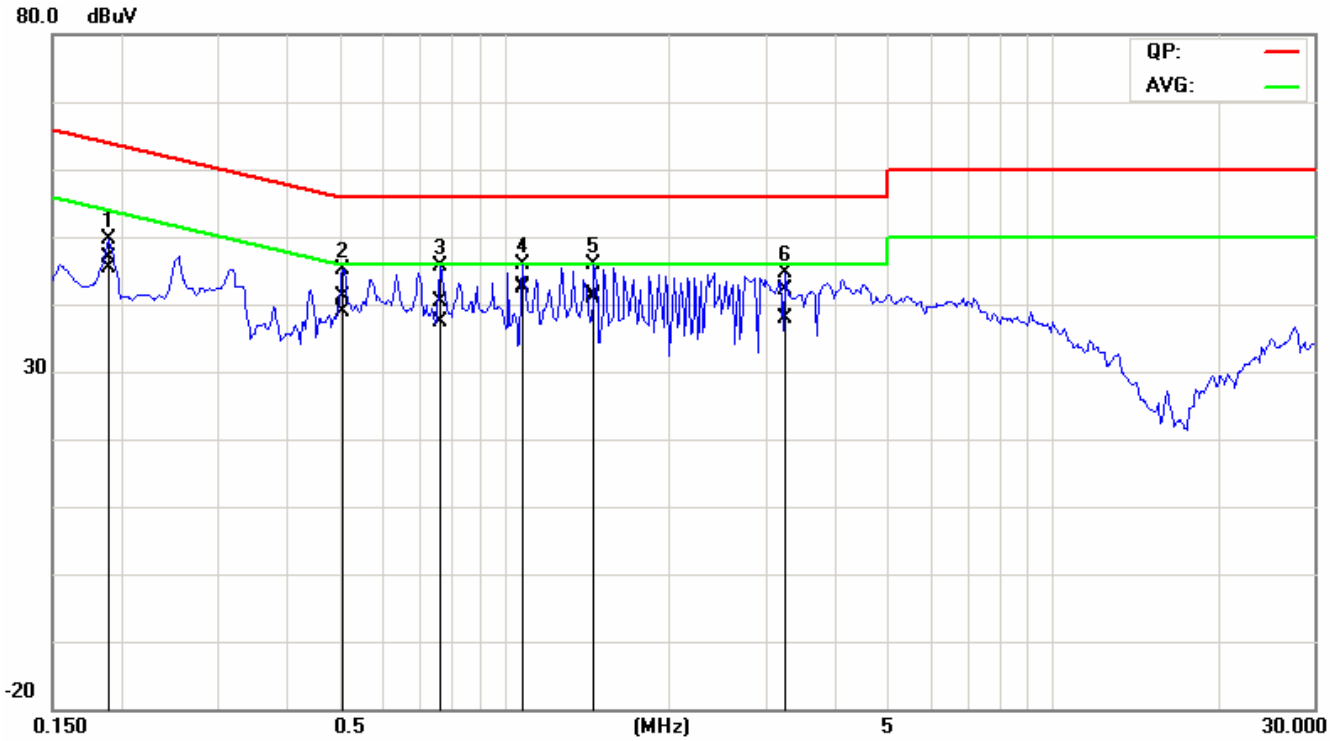
7.1.5. Data Sample:

Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak. limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
x.xx	43.95	33	10.00	53.95	43.00	56.00	46.00	-2.05	-3.00	Pass

Frequency (MHz) = Emission frequency in MHz
Reading (dBuV) = Uncorrected Analyzer/Receiver reading + Insertion loss of LISN, if it > 0.5 dB
Correction Factor (dB) = LISN Factr + Cable Loss
Result (dBuV) = Raw reading converted to dBuV and CF added
Limit (dBuV) = Limit stated in standard
Margin (dB) = Result (dBuV) – Limit (dBuV)

7.1.6. TEST RESULTS

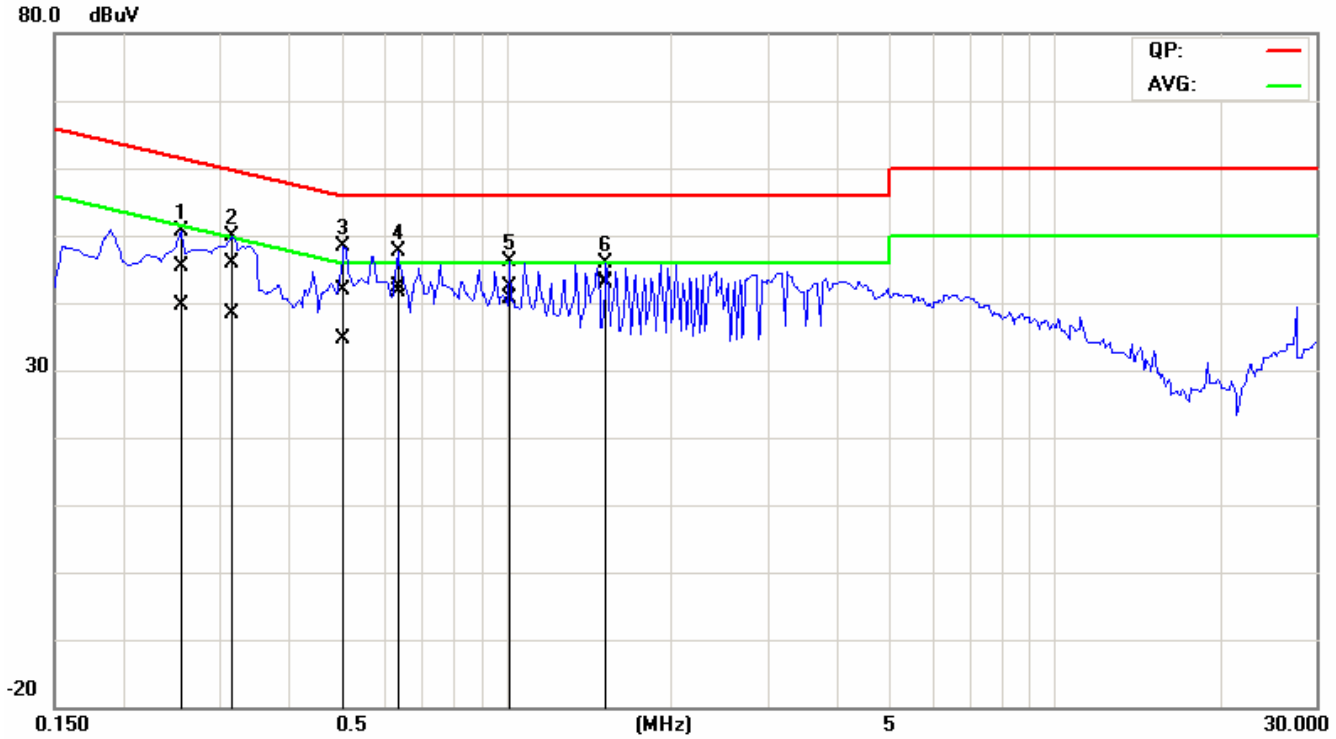
Model No.	MS-1688	Date	2010/1/4
Environmental Conditions	22℃, 45% RH	Test Mode	Mode 1
Tested By	Snake Shan	Line	L1
Note	1366 x 768 dpi		



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.1900	46.81	45.31	0.19	47.00	45.50	64.04	54.04	-17.04	-8.54	Pass
2*	0.5100	41.04	38.74	0.06	41.10	38.80	56.00	46.00	-14.90	-7.20	Pass
3	0.7650	40.25	37.35	0.05	40.30	37.40	56.00	46.00	-15.70	-8.60	Pass
4	1.0800	42.65	42.25	0.05	42.70	42.30	56.00	46.00	-13.30	-3.70	Pass
5	1.4600	41.45	40.75	0.05	41.50	40.80	56.00	46.00	-14.50	-5.20	Pass
6	3.2450	42.01	37.71	0.09	42.10	37.80	56.00	46.00	-13.90	-8.20	Pass

REMARKS: L1 = Line One (Live Line)

Model No.	MS-1688	**Date:**	2010/1/4
Environmental Conditions	22℃, 45% RH	**Test Mode**	Mode 1
Tested By	Snake Shan	**Line**	L2
Note	1366 x 768 dpi		



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.2550	45.32	39.52	0.18	45.50	39.70	61.59	51.59	-16.09	-11.89	Pass
2*	0.3150	45.85	38.35	0.15	46.00	38.50	59.84	49.84	-13.84	-11.34	Pass
3	0.5050	41.72	34.52	0.08	41.80	34.60	56.00	46.00	-14.20	-11.40	Pass
4	0.6350	42.32	41.62	0.08	42.40	41.70	56.00	46.00	-13.60	-4.30	Pass
5	1.0150	42.32	40.62	0.08	42.40	40.70	56.00	46.00	-13.60	-5.30	Pass
6	1.5250	43.12	42.92	0.08	43.20	43.00	56.00	46.00	-12.80	-3.00	Pass

REMARKS: L2 = Line Two (Neutral Line)

7.2. CONDUCTED EMISSION MEASUREMENT AT TELECOMMUNICATION PORTS

7.2.1. LIMITS

For Class A Equipment

FREQUENCY (MHz)	Voltage Limit (dBuV)		Current Limit (dBuA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	97 ~ 87	84 ~ 74	53 ~ 43	40 ~ 30
0.5 ~ 30.0	87	74	43	30

NOTE: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

For Class B Equipment

FREQUENCY (MHz)	Voltage Limit (dBuV)		Current Limit (dBuA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	84 ~ 74	74 ~ 64	40 ~ 30	30 ~ 20
0.5 - 30.0	74	64	30	20

NOTE: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

7.2.2. TEST INSTRUMENTS

Conducted Emission Room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCS30	847793/012	03/08/2010
LISN	R&S	ENV216	100066	05/10/2010
LISN	R&S	ENV 4200	830326/016	04/09/2010
ISN	FCC	FCC-TLISN-T2-02	20324	06/11/2010
ISN	FCC	FCC-TLISN-T4-02	20325	06/11/2010
ISN	FCC	FCC-TLISN-T8-02	20326	06/11/2010
Test S/W	LabVIEW 6.1 (CCS Conduction Test SW Version_01)			

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

7.2.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-031)

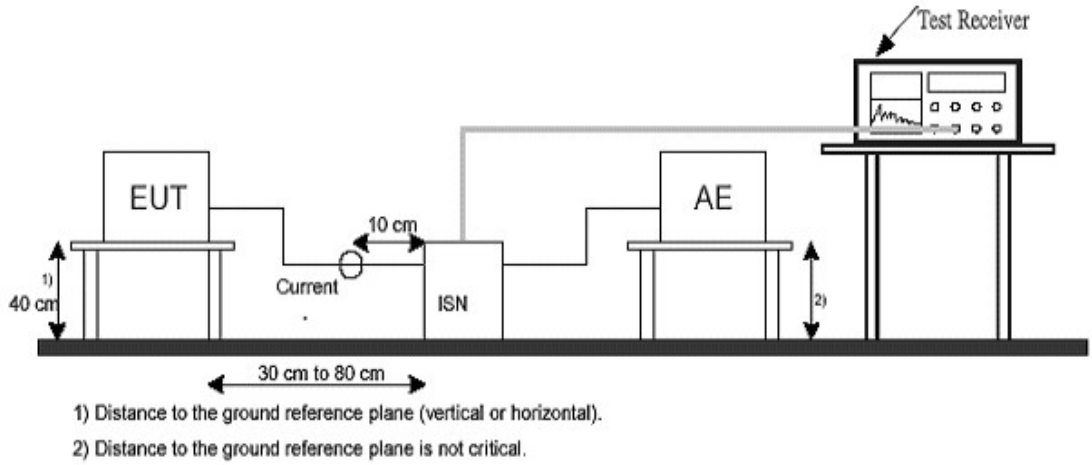
- Selecting ISN for unscreened cable or a current probe for screened cable to take measurement.
- The port of the EUT was connected to the remote side support equipment through the ISN/Current Probe and communication in normal condition.
- Making a overall range scan by using the test receiver controlled by controller and record at least six highest emissions for showing in the test report.
- Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.
- In case of measuring on the screened cable, the current limit shall be applied; otherwise the voltage limit should be applied.
- The following test mode was scanned during the preliminary test:

  Mode 1: 10/100 Mbps

- After the preliminary scan, we found the following test mode(s) producing the highest emission level and test data of the worst case was recorded.

  Mode 1.

7.2.4. TEST SETUP



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

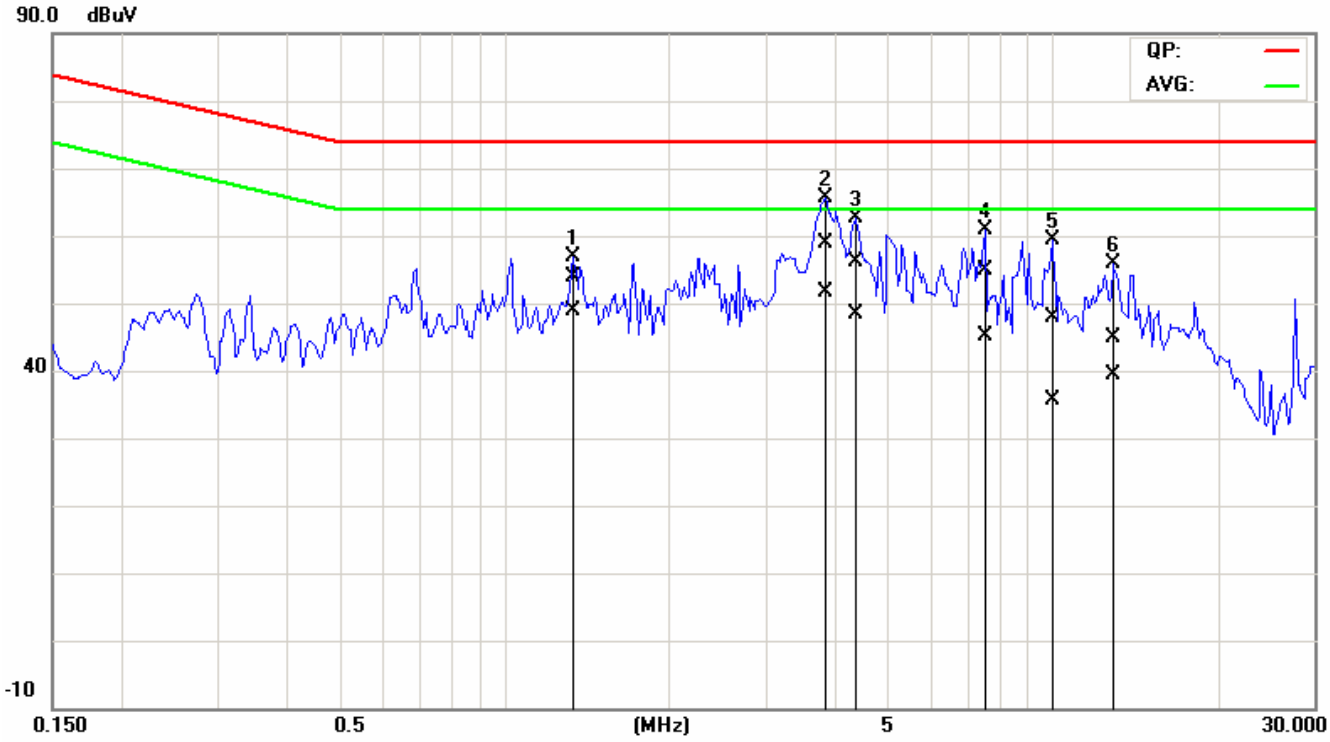
7.2.5. Data Sample:

Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak. limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
x.xx	43.95	33	10.00	53.95	43.00	74.00	64.00	-20.05	-21.00	Pass

Frequency (MHz) = Emission frequency in MHz
Reading (dBuV) = Uncorrected Analyzer/Receiver reading + Insertion loss of LISN, if it > 0.5 dB
Correction Factor (dB) = ISN Factor + Cable loss
Result (dBuV) = Raw reading converted to dBuV and CF added
Limit (dBuV) = Limit stated in standard
Margin (dB) = Result (dBuV) – Limit (dBuV)

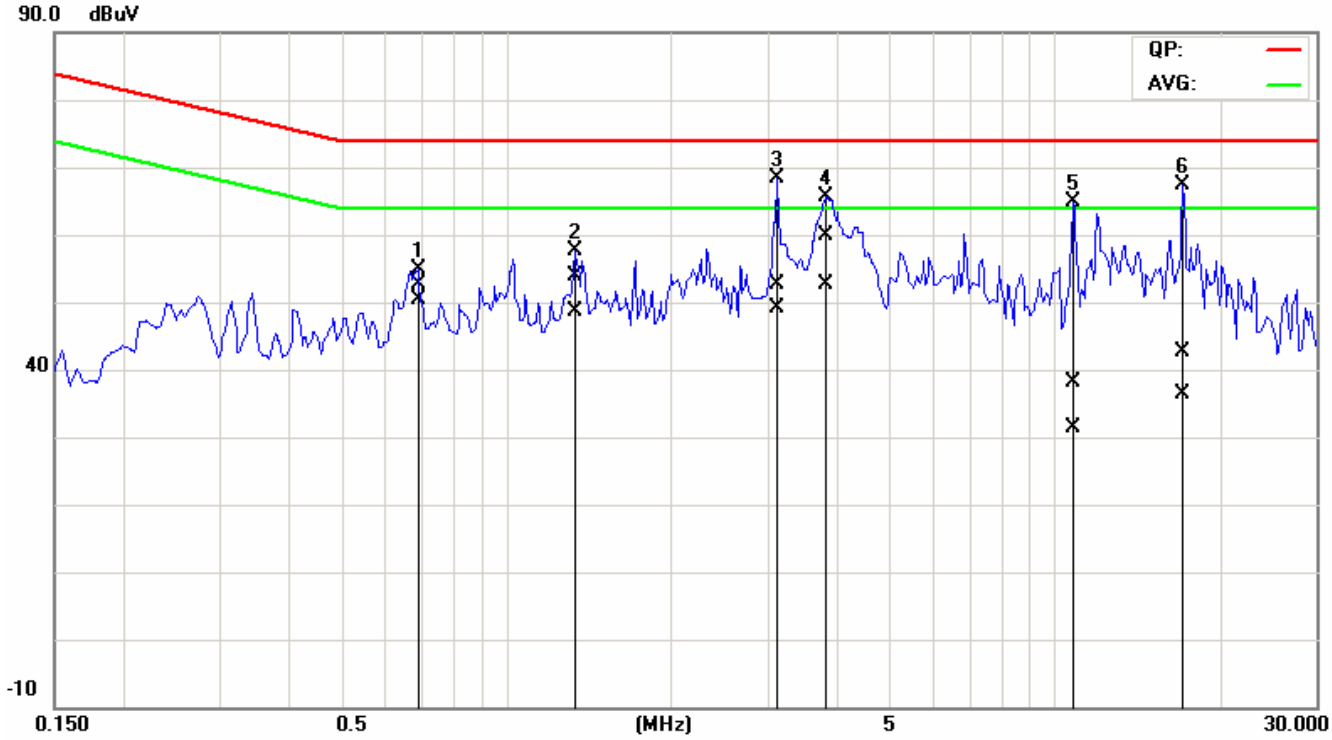
7.2.6. TEST RESULTS

Model No.	MS-1688	Date:	2010/1/4
Environmental Conditions	22°C, 45% RH	Test Mode	Mode 1
Tested By	Snake Shan	Line	10Mbps
Note	1366 x 768 dpi		



NO.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	(Pass/Fail)
1	1.3350	44.27	39.27	9.73	54.00	49.00	74.00	64.00	-20.00	-15.00	Pass
2	3.8600	49.08	41.88	9.72	58.80	51.60	74.00	64.00	-15.20	-12.40	Pass
3	4.3800	46.49	38.59	9.71	56.20	48.30	74.00	64.00	-17.80	-15.70	Pass
4	7.5500	45.20	35.40	9.80	55.00	45.20	74.00	64.00	-19.00	-18.80	Pass
5	9.9950	38.02	25.72	9.88	47.90	35.60	74.00	64.00	-26.10	-28.40	Pass
6	12.8650	35.07	29.37	9.93	45.00	39.30	74.00	64.00	-29.00	-24.70	Pass

Model No.	MS-1688	Date:	2010/1/4
Environmental Conditions	22°C, 45% RH	Test Mode	Mode 1
Tested By	Snake Shan	Line	100Mbps
Note	1366 x 768 dpi		



NO.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Averag e result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	(Pass/Fail)
1	0.6900	42.86	40.66	9.74	52.60	50.40	74.00	64.00	-21.40	-13.60	Pass
2	1.3350	44.27	38.97	9.73	54.00	48.70	74.00	64.00	-20.00	-15.30	Pass
3	3.1200	42.98	39.48	9.72	52.70	49.20	74.00	64.00	-21.30	-14.80	Pass
4	3.8350	50.28	42.88	9.72	60.00	52.60	74.00	64.00	-14.00	-11.40	Pass
5	10.8400	28.20	21.60	9.90	38.10	31.50	74.00	64.00	-35.90	-32.50	Pass
6	17.1550	32.76	26.36	9.94	42.70	36.30	74.00	64.00	-31.30	-27.70	Pass

7.3. RADIATED EMISSION MEASUREMENT

7.3.1. LIMITS

FREQUENCY (MHz)	dBuV/m (At 10m)	
	Class A	Class B
30 ~ 230	40	30
230 ~ 1000	47	37

***NOTE**: (1) The lower limit shall apply at the transition frequencies.*
(2) Emission level (dBuV/m) = 20 log Emission level (uV/m).

FREQUENCY (MHz)	dBuV/m (At 3m)	
	Average	Peak
1000 ~ 3000	50	70
3000 ~ 6000	54	74

***NOTE**: (1) The lower limit shall apply at the transition frequencies.*

7.3.2. TEST INSTRUMENTS

Wugu 10M Chamber				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY48250297	10/14/2010
EMI Test Receiver	R&S	ESCI	100961	09/13/2010
EMI Test Receiver	R&S	ESCI	100962	09/13/2010
Pre-Amplifier	MITEQ	1625-3000	1490939	11/20/2010
Pre-Amplifier	MITEQ	1625-3000	1490940	11/20/2010
Pre-Amplifier	MITEQ	AFS44-00102650-42-10P-44	1415367	11/20/2010
Bilog Antenna	Sunol Sciences	JB1	A100209-2	10/08/2010
Bilog Antenna	Sunol Sciences	JB1	A100209-3	10/08/2010
Horn Antenna	EMCO	3117	00055165	12/07/2010
Turn Table	CCS	CC-T-1F	N/A	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R
Site NSA	CCS	N/A	N/A	11/26/2010
Site VSWR	CCS	N/A	N/A	11/24/2010
Test S/W	EZ-EMC (CCS-3A1RE)			

Radiated emissions # 966				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	ADVANTEST	R3271A	85060321	10/22/2010
Bilog Antenna	SCHWAZBECK	VULB9160	3084	N.C.R.
EMI Test Receiver	SCHAFFNER	SCR 3501	436	02/15/2010
Pre-Amplifier	HP	8447D	2944A06530	12/07/2010
Antenna Tower	HD	MA240	240/443	N.C.R
Controller	HD	HD100	100/529	N.C.R
Turn Table	HD	HD320	N/A	N.C.R
Site NSA	SIDT EUROPE	9x6x6	N/A	05/15/2010
Test S/W	CCS-3A1RE Luchu Hsiang			

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). N.C.R = No Calibration Request.

7.3.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-031)

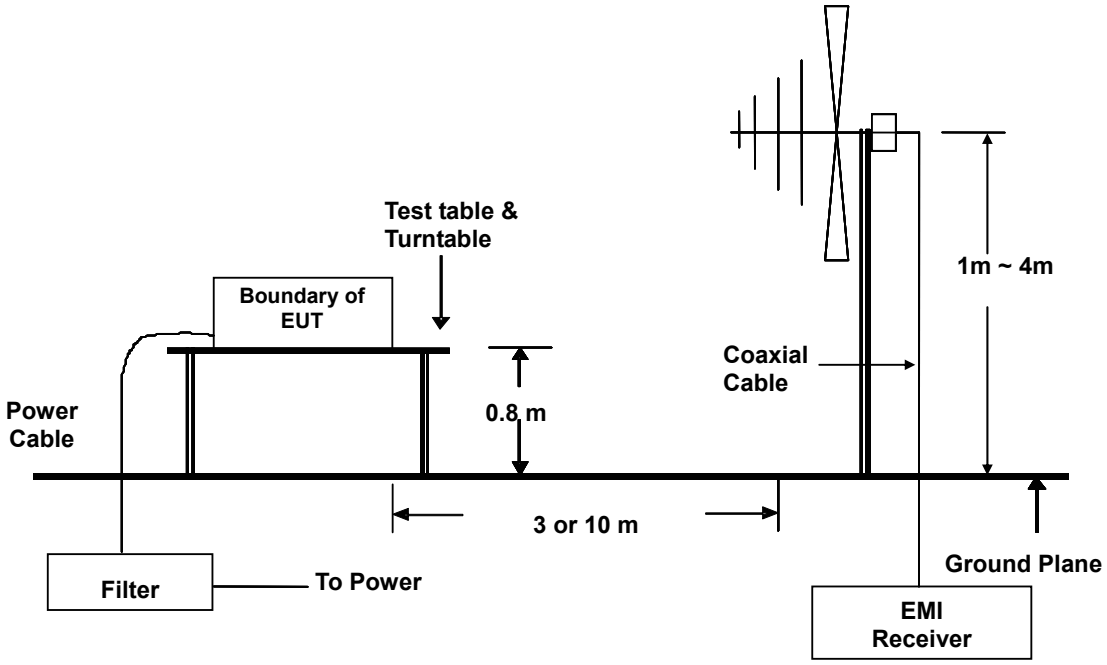
Procedure of Preliminary Test

- The equipment was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden turntable with a height of 0.8 meters is used which is placed on the ground plane. When the EUT is a floor standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- Support equipment, if needed, was placed as per EN 55022.
- All I/O cables were positioned to simulate typical usage as per EN 55022.
- The EUT received AC power source from the outlet socket under the turntable. All support equipment power received from another socket under the turntable.
- The antenna was placed at 3 or 10 meter away from the EUT as stated in EN 55022. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.
- The Analyzer / Receiver quickly scanned from 30MHz to 6000MHz. The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- The test mode(s) described in Item 3.1 were scanned during the preliminary test:
- After the preliminary scan, we found the test mode described in Item 3.1 producing the highest emission level.
- The worst configuration of EUT and cable of the above highest emission level were recorded for reference of the final test.

Procedure of Final Test

- EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.
- The Analyzer / Receiver scanned from 30MHz to 6000MHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- Recording at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.
- The test data of the worst-case condition(s) was recorded.

7.3.4. TEST SETUP



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

7.3.5. Data Sample:

Below 1GHz

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (◦)	Height (cm)	Remark
xx.xx	16.49	9.86	26.35	30.00	-3.65	116.00	101.00	QP

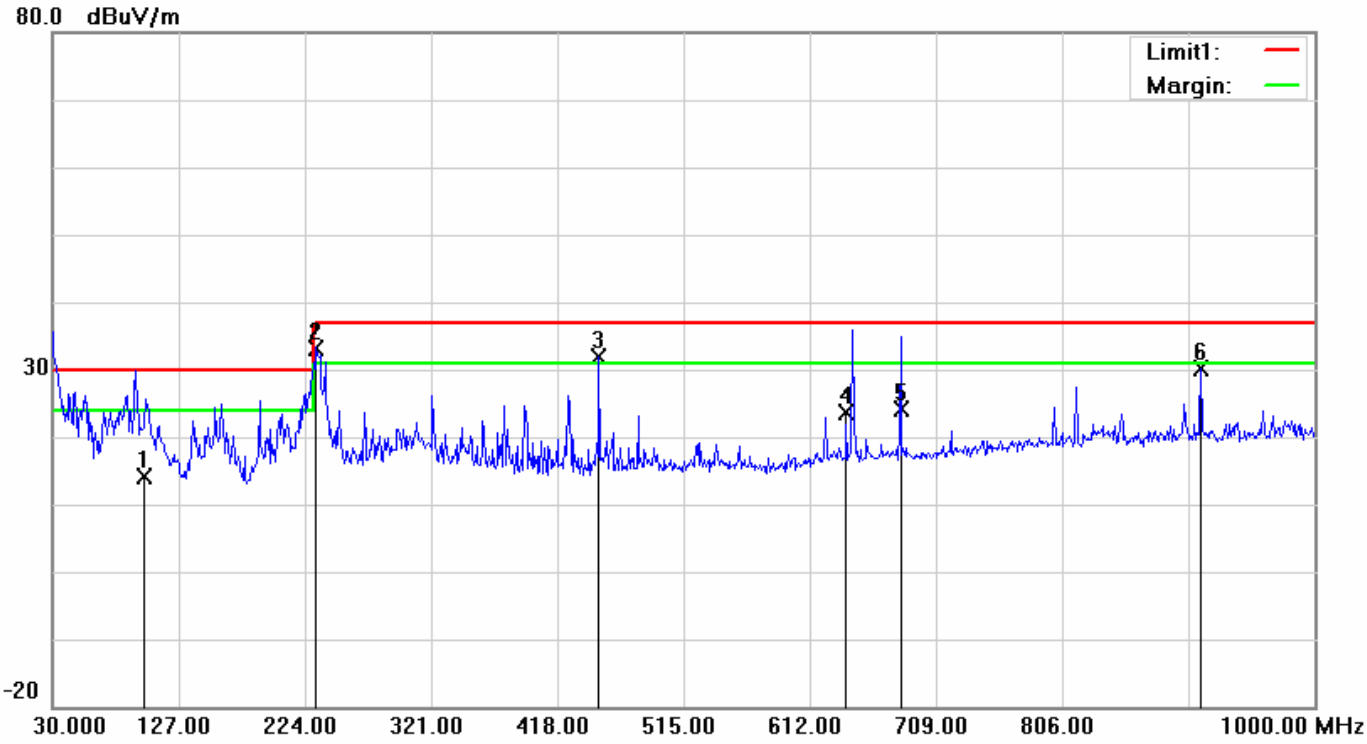
Above 1GHz

Frequency MHz	Corr. Factor (dB/m)	Reading		Result		Limit		Margin	
		Peak (dBuV/m)	Average (dBuV/m)	Peak (dBuV/m)	Average (dBuV/m)	Peak e (dBuV/m)	Average (dBuV/m)	Peak (dB)	Average (dB)
xxxx.xxx	-4.35	58.74	49.81	54.39	45.46	70.00	50.00	-15.61	-4.54

Frequency (MHz) = Emission frequency in MHz
Reading (dBuV) = Uncorrected Analyzer / Receiver reading
Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain
Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
Limit (dBuV/m) = Limit stated in standard
Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)
Q.P. = Quasi-Peak

7.3.6. TEST RESULTS

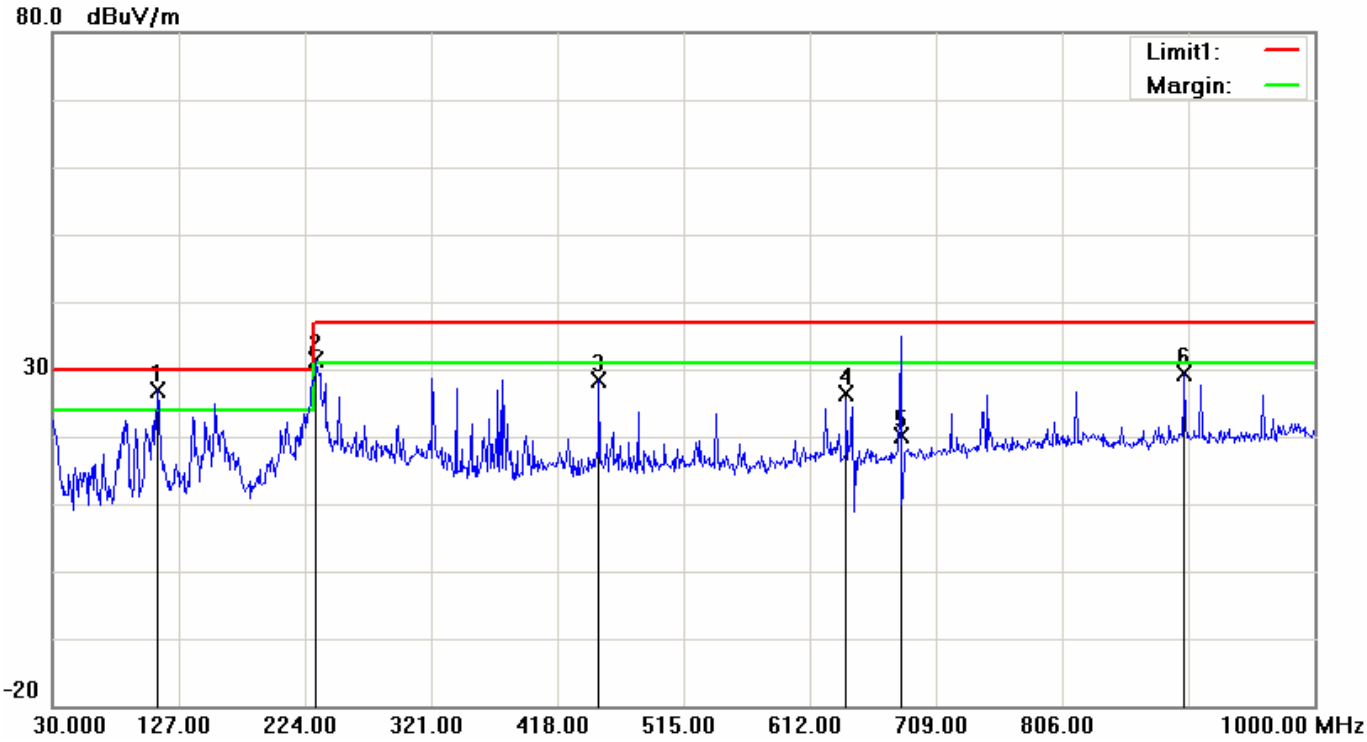
Model No.	MS-1688	Test Mode	Mode 1
Environmental Conditions	26°C, 60% RH	Test Frequency Range	30MHz ~ 1000MHz
Antenna Pole	Vertical	Antenna Distance	10m
Detector Function:	Quasi-peak.	Tested By	Eddy Chung
Note	1366 x 768 dpi		



No.	Frequency (MHz)	Reading (dBuV)	Correction Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	99.5800	46.62	-32.45	14.17	30.00	-15.83	309	100	QP
2	232.7300	63.90	-30.65	33.25	37.00	-3.75	100	100	Peak
3	450.0100	55.83	-23.97	31.86	37.00	-5.14	289	100	Peak
4	640.0144	44.11	-20.46	23.65	37.00	-13.35	92	100	QP
5	681.8400	44.16	-20.03	24.13	37.00	-12.87	228	100	QP
6	912.7000	46.31	-16.28	30.03	37.00	-6.97	75	399	Peak

REMARKS: The other emission levels were very low against the limit.

Model No.	MS-1688	**Test Mode**	Mode 1
Environmental Conditions	26°C, 60% RH	**Test Frequency Range**	30MHz ~ 1000MHz
Antenna Pole	Horizontal	**Antenna Distance**	10m
Detector Function:	Quasi-peak.	**Tested By**	Eddy Chung
Note	1366 x 768 dpi		



No.	Frequency (MHz)	Reading (dBuV)	Correction Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	110.5100	56.74	-29.79	26.95	30.00	-3.05	359	399	Peak
2	232.7300	61.20	-29.93	31.27	37.00	-5.73	0	399	Peak
3	450.0100	51.51	-23.06	28.45	37.00	-8.55	251	399	Peak
4	640.0080	45.93	-19.57	26.36	37.00	-10.64	10	400	QP
5	681.8400	39.06	-18.89	20.17	37.00	-16.83	228	399	QP
6	900.0900	44.22	-14.87	29.35	37.00	-7.65	260	399	Peak

REMARKS: The other emission levels were very low against the limit.

Model No.	MS-1688	**Test Mode**	Mode 1
Environmental Conditions	23°C, 53% RH	**Test Frequency Range**	1000MHz ~ 6000MHz
Antenna Pole	Vertical	**Antenna Distance**	3m
Detector Function:	Peak/Average	**Tested By**	Mimic Yang
Note	1366 x 768 dpi		

Frequency	Corr.	Reading		Result		Limit		Margin	
	Factor	Peak	Average	Peak	Average	Peak	Average	Peak	Average
MHz	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	(dB)
2325.00	-1.71	48.15	---	46.44	---	70.00	50.00	-3.56	---
N/A									

REMARKS: *1. The other emission levels were very low against the limit.*

2. "--", means the average measurement was not performed when the measured peak data under the limit of average detection.

Model No.	MS-1688	**Test Mode**	Mode 1
Environmental Conditions	23°C, 53% RH	**Test Frequency Range**	1000MHz ~ 6000MHz
Antenna Pole	Horizontal	**Antenna Distance**	3m
Detector Function:	Peak/Average	**Tested By**	Mimic Yang
Note	1366 x 768 dpi		

Frequency	Corr.	Reading		Result		Limit		Margin	
	Factor	Peak	Average	Peak	Average	Peak	Average	Peak	Average
MHz	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	(dB)
1375.00	-7.26	53.22	---	45.96	---	70.00	50.00	-4.04	---
1600.00	-6.07	53.27	---	47.19	---	70.00	50.00	-2.81	---
N/A									

REMARKS: *1. The other emission levels were very low against the limit.*

2. "--", means the average measurement was not performed when the measured peak data under the limit of average detection.

7.4. HARMONICS CURRENT MEASUREMENT

7.4.1. LIMITS OF HARMONICS CURRENT MEASUREMENT

Limits for Class A equipment	
Harmonics Order n	Max. permissible harmonics current A
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15<=n<=39	0.15x15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8<=n<=40	0.23x8/n

Limits for Class D equipment		
Harmonics Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd Harmonics only		
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
13	0.30	0.21
15<=n<=39	3.85/n	0.15x15/n

NOTE: 1. Class A and Class D are classified according to item 4.4.3.

2. According to section 7 of EN 61000-3-2, the above limits for all equipment except for lighting equipment having an active input power > 75 W and no limits apply for equipment with an active input power up to and including 75 W.

7.4.2. TEST INSTRUMENTS

Immunity Shielded Room				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Harmonic & Flicker Tester	EMC-Partner	HAR1000-1P	107	07/13/2010
Test S/W	HARCS (Ver. 4.16)			

NOTE: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.*

7.4.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-029)

- 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 classification of EUT is according to section 5 of EN 61000-3-2.
- The EUT is classified as follows:

Class A: 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.

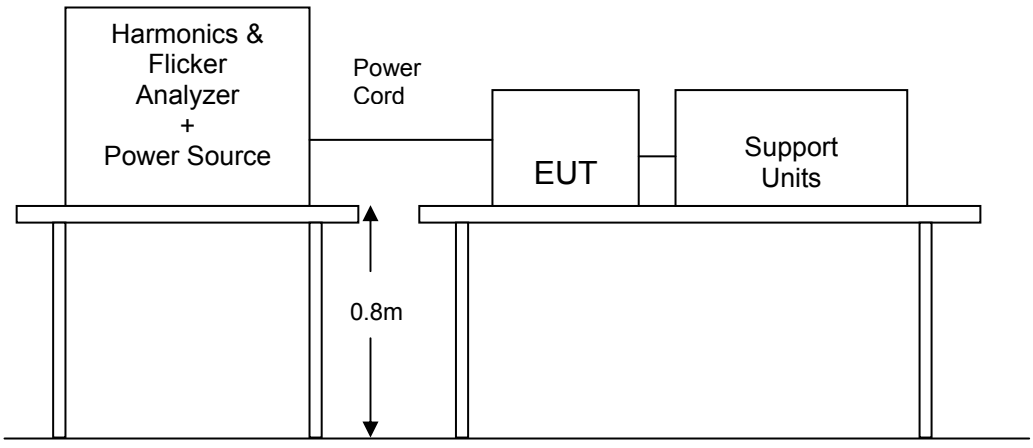
Class B: Portable tools; Arc welding equipment which is not professional equipment.

Class C: Lighting equipment.

Class D: Equipment having a specified power less than or equal to 600 W of the following types: Personal computers and personal computer monitors and television receivers.

- 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.

7.4.4. TEST SETUP



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

7.4.5. TEST RESULTS

Power Consumption	61.70W	Test Results	PASS
Environmental Conditions	25°C, 55% RH	Limits	Class ☐ A ☐ B ☐ C ☒ D
Test Mode	Mode 1	Tested By	Snake Shan
Note	1366 x 768 dpi		

Harmonic Emission - IEC 61000-3-2 , EN 61000-3-2 , (EN60555-2)

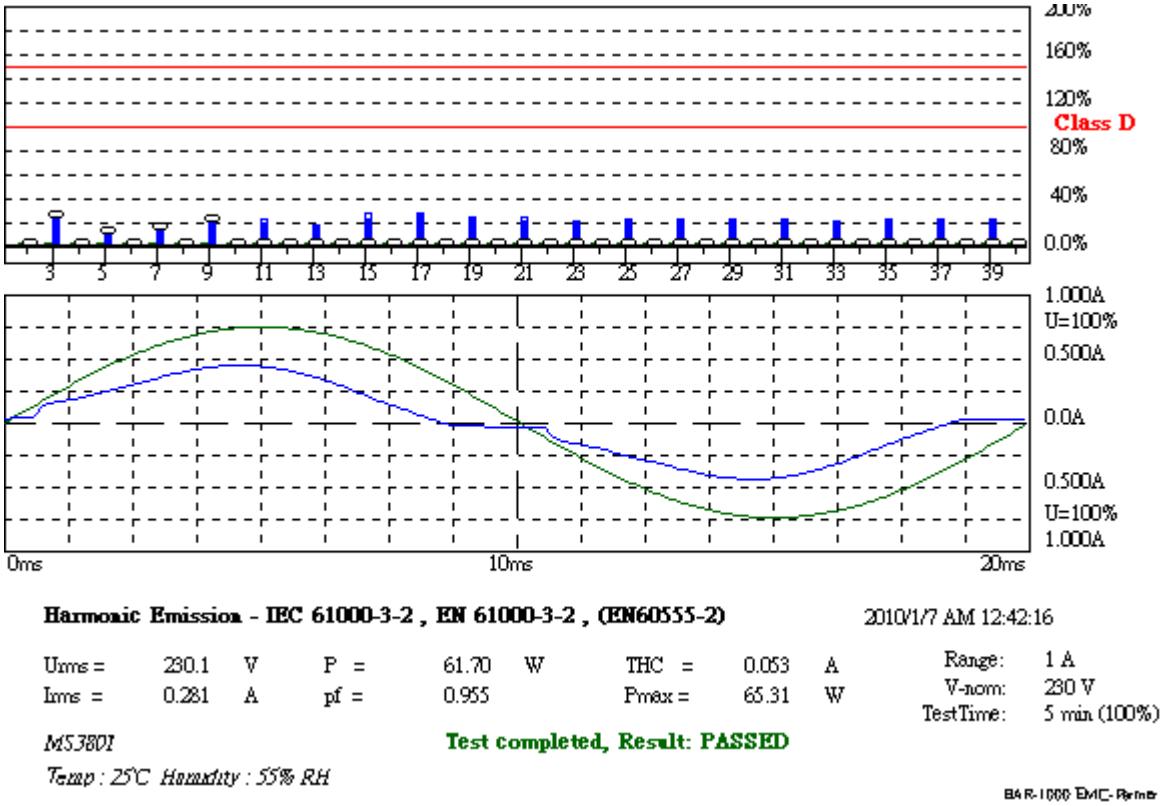
Comply: IEC 61000-3-2 Ed.3.0 - IEC 61000-4-7 Ed.2.0

NoteBook

MS-1688

Snake Shan

Remarks : Temp : 25'C Humidity : 55% RH



Harmonic Emission - IEC 61000-3-2 , EN 61000-3-2 , (EN60555-2) 2010/1/7 AM 12:42:16

Urms =	230.1	V	P =	61.70	W	THC =	0.053	A	Range: 1 A
Irms =	0.281	A	pf =	0.955		Pmax =	65.31	W	V-nom: 230 V
									TestTime: 5 min (100%)

MS3801 **Test completed, Result: PASSED**

Temp : 25'C Humidity : 55% RH

BAR-1000 EMC-Pamb

Full Bar : Actual Values

Empty Bar : Maximum Values

Blue : Current , Green : Voltage , Red : Failed

NOTE: Limits classified according to item 7.4.3.

Note: *According to clause 7 of EN 61000-3-2, equipment with a rated power of 75W or less, no limits apply.*

7.5. VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

7.5.1. LIMITS OF VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

TEST ITEM	LIMIT	REMARK
P_{st}	1.0	P_{st} means short-term flicker indicator.
P_{lt}	0.65	P_{lt} means long-term flicker indicator.
T_{dt} (ms)	500	T_{dt} means maximum time that dt exceeds 3.3 %.
d_{max} (%)	4%	d_{max} means maximum relative voltage change.
dc (%)	3.3%	dc means relative steady-state voltage change

7.5.2. TEST INSTRUMENTS

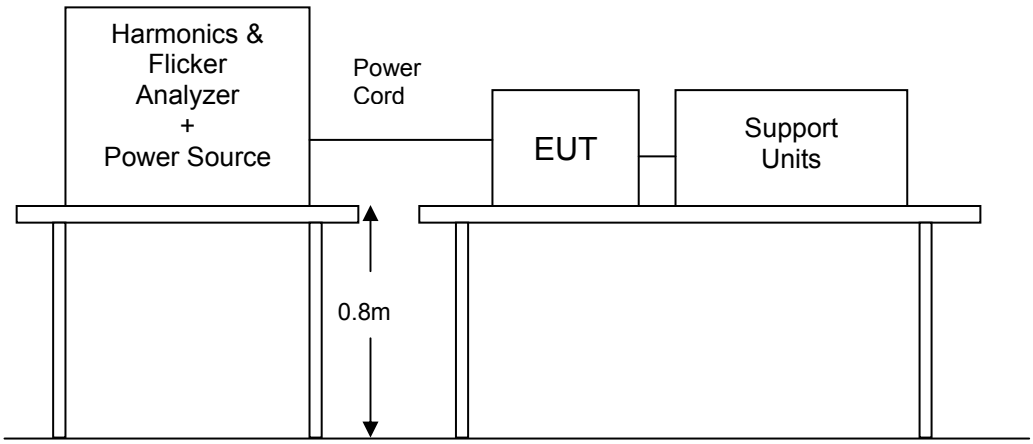
Immunity Shielded Room				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Harmonic & Flicker Tester	EMC-Partner	HAR1000-1P	107	07/13/2010
Test S/W	HARCS (Ver. 4.16)			

NOTE: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.*

7.5.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-030)

- 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.

7.5.4. TEST SETUP



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

7.5.5. TEST RESULTS

Observation Period (Tp)	10mins	**Test Mode**	Mode 1
Environmental Conditions	25°C, 55% RH	**Tested By**	Snake Shan
Note	1366 x 768 dpi		

TEST PARAMETER	MEASUREMENT VALUE	LIMIT	REMARK
P_{st}	0.165	1.0	PASS
P_{lt}	0.165	0.65	PASS
T_{dt} (ms)	0	500	PASS
d_{max} (%)	0%	4%	PASS
dc (%)	0.040%	3.3%	PASS

Note: d_{max} (%) limit classified:
1. 6% for equipment which is switched manually or switched automatically more frequently than twice per day.
2. 7% for equipment which is attended whilst use or switched on automatically no more than twice per day

Measurement

Date : 2010/1/7 AM 01:24:31 V4.16

File :

NoteBook
MS-1688
Snake Shan

Remarks : Temp : 25'C Humidity : 55% RH

Urms =	229.9V	Freq =	49.870	Range:	1 A
Irms =	0.257A	Ipk =	0.436A	cf =	1.696
P =	55.76W	S =	59.05VA	pf =	0.944

Test - Time : 1 x 10min = 10min (100 %)

LIN (Line Impedance Network) : L: 0.24ohm +j0.15ohm N: 0.16ohm +j0.10ohm

Limits :	Plt :	0.65	Pst :	1.00	
		dmax :	4.00 %	dc :	3.30 %
		dtLim:	3.30 %	dt>Lim:	500ms

Test completed, Result: PASSED

Plt = 0.165

	Pst	P50s	P10s	P3s	P1s	P0.1s	Fli	dmax	dc	dt>Lim
								[%]	[%]	[ms]
1	0.165	0.010	0.034	0.079	0.120	0.172	0.001	0.000	0.040	0.000

8 IMMUNITY TEST

8.1. GENERAL DESCRIPTION

Product Standard	ETSI EN 301 489-1 V1.8.1 2008-04; ETSI EN 301 489-4 V1.4.1 2009-05	
	Test Type	**Minimum Requirement**
Basic Standard, Specification, and Performance Criterion required	EN 61000-4-2	Electrostatic Discharge – ESD: 8kV air discharge, 4kV Contact discharge, Performance Criterion TT / TR
	EN 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80 ~1000 MHz and 1400 ~ 2700MHz, 3V/m, 80% AM(1kHz), Performance Criterion CT&CR
	EN 61000-4-4	Electrical Fast Transient/Burst - EFT, AC Power Port: 1kV DC Power Port: 0.5kV Signal Ports and Telecommunication Ports: 0.5kV Performance Criterion TT / TR
	EN 61000-4-5	Surge Immunity Test: 1.2/50 us or 10/700 us Open Circuit Voltage, 8/20 μs or 5/320 Short Circuit Current, AC Power Port ~ line to line: 1kV, line to earth (ground): 2kV DC Power Port ~ line to earth: 0.5kV Signal Ports and Telecommunication Ports ~ line to ground: 1kV Performance Criterion TT / TR
	EN 61000-4-6	Conducted Radio Frequency Disturbances Test – CS: 0.15 ~ 80 MHz, 3Vrms, 80% AM, 1kHz, Performance Criterion CT&CR
	EN 61000-4-11	Voltage Dips: i) 0% residual for 0.5 & 1period, Performance Criterion B ii) 70% residual for 25 period (at 50Hz), Performance Criterion C Voltage Interruptions: 0% residual for 250 period (at 50Hz), Performance Criterion C

8.2. GENERAL PERFORMANCE CRITERIA DESCRIPTION

Performance table for EN 301 489-4		
Criteria	**During test**	**After test**
A	Shall operate as intended May show degradation of performance (see note 1) Shall be no loss of function Shall be no unintentional transmissions	Shall operate as intended Shall be no degradation of performance (see note 2) Shall be no loss of function Shall be no loss of stored data or user programmable functions
B	May show loss of function (one or more) May show degradation of performance (see note 1) No unintentional transmissions	Functions shall be self-recoverable Shall operate as intended after recovering Shall be no degradation of performance (see note 2) Shall be no loss of stored data or user programmable functions
C	May be loss of function (one or more)	Functions shall be recoverable by the operator Shall operate as intended after recovering Shall be no degradation of performance (see note 2)

NOTE 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.

If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

NOTE 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed.

If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

Performance criteria for Continuous phenomena applied to Transmitters (CT)

The performance criteria A shall apply.

Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

Performance criteria for Transient phenomena applied to Transmitters (TT)

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement.

(NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

Performance criteria for Continuous phenomena applied to Receivers (CR)

The performance criteria A shall apply.

Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

Performance criteria for Transient phenomena applied to Receivers (TR)

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply.

Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

8.3. ELECTROSTATIC DISCHARGE (ESD)

8.3.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Discharge Voltage:	Air Discharge: 2; 4; 8 kV (Direct) Contact Discharge: 2; 4 kV (Direct/Indirect)
Polarity:	Positive & Negative
Number of Discharge:	Air Discharge: min. 10 times at single test point for each negative and positive polarity Contact Discharge: min. 200 times in total
Discharge Mode:	Single Discharge 1 second minimum

8.3.2. TEST INSTRUMENT

Immunity Shielded Room				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
ESD Simulator	NoiseKen	ESS-2002	ESS0463036	07/20/2010

NOTE: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.*

8.3.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-022)

The discharges shall be applied in two ways:

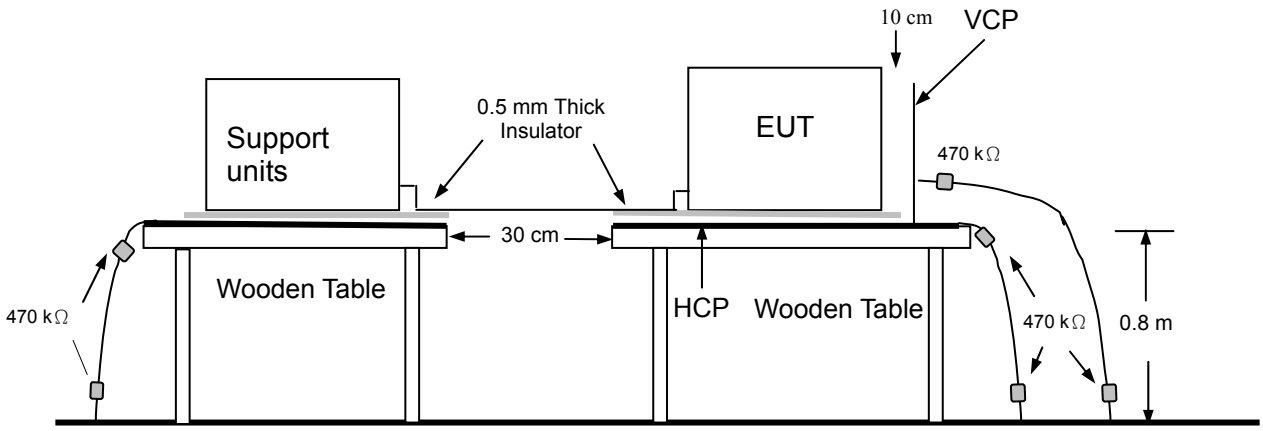
a) Contact discharges to the conductive surfaces and coupling planes:
   The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the **H**orizontal **C**oupling **P**lane (**HCP**). 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 61000-4-2:

a) The EUT was located 0.1 m minimum from all side of the **HCP** (dimensions 1.6m x 0.8m).
b) The support units were located another table 30 cm away from the EUT, but direct support unit was/were located at same location as EUT on the HCP and keep at a distance of 10 cm with EUT.
c) The time interval between two successive single discharges was at least 1 second.
d) Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
e) 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.
f) At least ten single discharges (in the most sensitive polarity) were applied at the front edge of each **HCP** opposite the center point of each unit of the EUT and 0.1 meters from the front of the EUT. The long axis of the discharge electrode was in the plane of the **HCP** and perpendicular to its front edge during the discharge.
g) At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **V**ertical **C**oupling **P**lane (**VCP**) 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.

8.3.4. TEST SETUP



Ground Reference Plane

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

NOTE:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **G**round **R**eference **P**lane. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **H**orizontal **C**oupling **P**lane (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 940k Ω total impedance. The equipment under test, was installed in a representative system as described in section 7 of EN 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.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of EN 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

8.3.5. TEST RESULTS

Temperature	24°C	**48midity**	50% RH
Pressure	960mbar	**Tested By**	Sehni Hu
Required Passing Performance		**Criterion TT / TR**	

Air Discharge										
Test Points	Test Levels						Results		
	± 2 kV	Performance Criterion	± 4 kV	Performance Criterion	± 8 kV	Performance Criterion	Pass	Fail	Observation
Front	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☐	Note 1
Back	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☐	Note 1
Left	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☐	Note 1
Right	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☐	Note 1
Top	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☐	Note 1
Bottom	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☐	Note 2

Contact Discharge										
Test Points	Test Levels						Results		
	± 2 kV	Performance Criterion	± 4 kV	Performance Criterion	± 8 kV	Performance Criterion	Pass	Fail	Observation
Front	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐	Note 3
Back	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐	Note 3
Left	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐	Note 3
Right	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐	Note 3
Top	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☐	☐	Note 3
Bottom	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☒	☒ CT / ☒ CR ☐ TT / ☐ TR	☐	☐ CT / ☐ CR ☐ TT / ☐ TR	☒	☐	Note 2

For the tested points to EUT, please refer to attached page. (Blue arrow mark for Contact Discharge and red arrow mark for Air Discharge)

Discharge To Horizontal Coupling Plane							
Side of EUT	Test Levels			Results			
	± 2 kV	± 4 kV	± 8 kV	Pass	Fail	Performance Criterion	Observation
Front	☒	☒	☐	☒	☐	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1
Back	☒	☒	☐	☒	☐	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1
Left	☒	☒	☐	☒	☐	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 2
Right	☒	☒	☐	☒	☐	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 2

Discharge To Vertical Coupling Plane							
Side of EUT	Test Levels			Results			
	± 2 kV	± 4 kV	± 8 kV	Pass	Fail	Performance Criterion	Observation
Front	☒	☒	☐	☒	☐	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1
Back	☒	☒	☐	☒	☐	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 2
Left	☒	☒	☐	☒	☐	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1
Right	☒	☒	☐	☒	☐	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1

NOTE: *1 There was no change compared with the initial operation during the test.*
2. The System were delayed during contact discharge tested, but can be auto recovered at the events disappearing.
3. No discharge point had been occurred during that particular coupling method.

The Tested Points of EUT

Photo 1 of 6

Photo 2 of 6

Photo 3 of 6

Photo 4 of 6

Photo 5 of 6

Photo 6 of 6

8.4. RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD (RS)

8.4.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-3
Frequency Range:	80 MHz ~1000 MHz, 1400 MHz ~ 2700 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
Test Distance:	3 m
Antenna Height:	1.5m

8.4.2. TEST INSTRUMENT

Immunity Shield Room				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Pulse Generator	Agilent	81101A	DE41B01423	12/21/2010
Signal Generator (250kHz-40GHz)	Agilent	E8257C	US42340383	09/01/2010
500 Watt 10kHz Amplifier	Amplifier Research	500A100A	300299	N.C.R
500 Watts 80-1000MHz Amplifier	Amplifier Research	500W 1000A	320994	N.C.R.
250 Watts 1-2.5GHz Amplifier	Amplifier Research	250T1G3M1	320245	N.C.R.
300 Watts 2.5-7.5GHz Amplifier	Amplifier Research	300T2G8M1	320255	N.C.R.
250 Watts 7.5-18GHz Amplifier	Amplifier Research	250T8G18M1	320246	N.C.R.
RF Test System Controller	Amplifier Research	SC1000M3	306666	N.C.R.
Power Meter	Boonton	4232A-01-02	98601	10/15/2010
Power Sensor	Boonton	51013-4E	34242	10/11/2010
Power Sensor	Boonton	51013-4E	34241	10/18/2010
Bi-log Antenna	SCHWAZBECK	VULB9166	9166-1093	N.C.R
Log-Periodic Antenna	Amplifier Research	AT1080	306709	N.C.R.
Horn	SCHWAZBECK	BBHA 9120D	530	N.C.R.
Field Probe (3M-18GHz)	Amplifier Research	FP7018	311430	07/08/2010
Dual Directional Coupler (80-1000MHz)	Amplifier Research	DC6180A	320285	N.C.R.
Dual Directional Coupler (0.8-4.2GHz)	Amplifier Research	DC7144A	313674	N.C.R.
Dual Directional Coupler (2-8GHz)	Amplifier Research	DC7280A	320524	N.C.R.
Dual Directional Coupler (7.5-18GHz)	Amplifier Research	DC7450M1	0320073	N.C.R.
Antenna Tower	Amplifier Research	TP2000	N/A	N.C.R.
Probe Stand	Amplifier Research	PS2000	N/A	N.C.R.
LISN	FCC	FCC-LISN-5-50-1-01-CISPR 25	06038	03/24/2010
LISN	FCC	FCC-LISN-5-50-1-01-CISPR 25	06039	03/24/2010
Software	SW1006			

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. N.C.R.= No Calibration required

8.4.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-023)

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

a) The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.

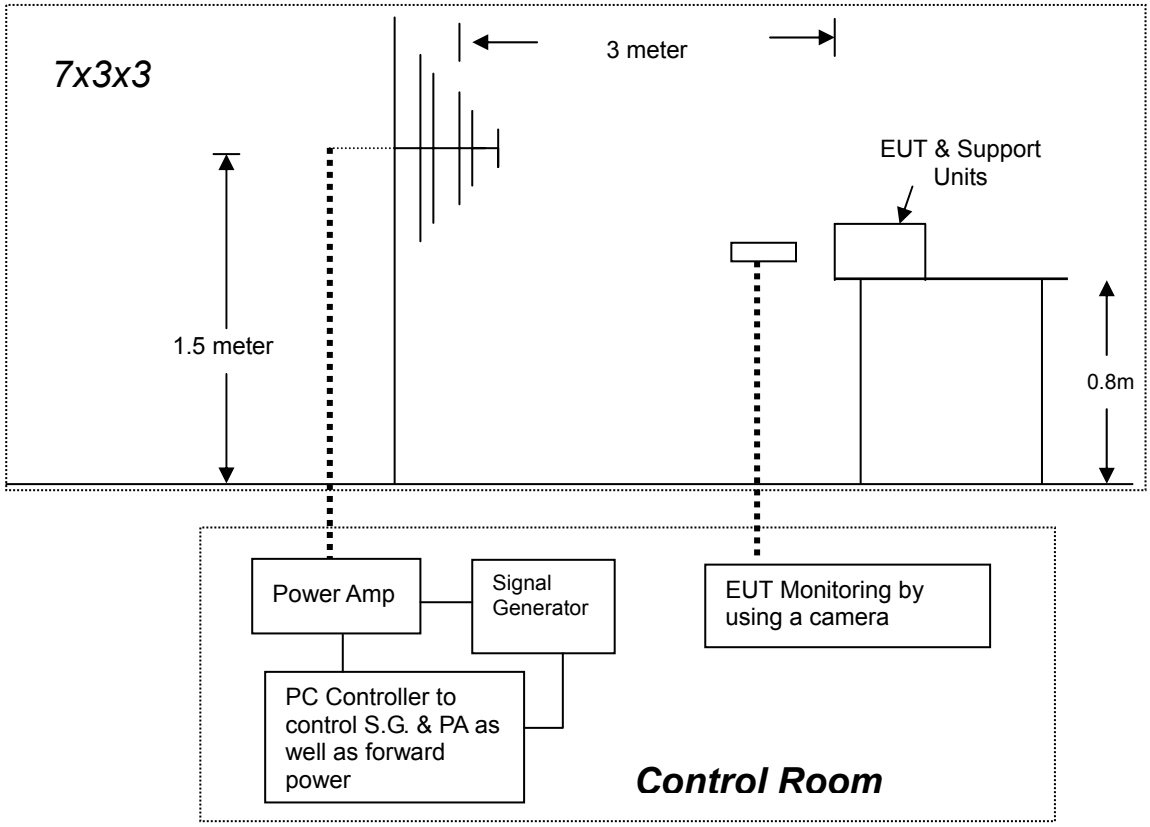
b) The frequency range is swept from 80 MHz to 1000 MHz / 1400 MHz to 2700 MHz, with the signal 80% amplitude modulated with a 1kHz sine-wave. The rate of sweep did not exceed 1.5×10^{-3} decade/s, where the frequency range is swept incrementally, the step size was 1% of preceding frequency value.

c) The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.

d) The field strength level was 3V/m.

e) The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

8.4.4. TEST SETUP



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

NOTE:

TABLETOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of EN 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.

FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of EN 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

8.4.5. TEST RESULTS

Temperature	24°C	**Humidity**	47% RH
Pressure	1017mbar	**Dwell Time**	3 sec.
Tested By	Snake Shan	**Required Passing Performance**	**Criterion CT / CR**

Frequency (MHz)	Polarity	Azimuth	Field Strength (V/m)	Performance Criterion	Observation	Result
80 ~ 1000	V&H	0	3	☒CT ☒CR	**Note 1**	PASS
80 ~ 1000	V&H	90	3	☒CT ☒CR	**Note 1**	PASS
80 ~ 1000	V&H	180	3	☒CT ☒CR	**Note 1**	PASS
80 ~ 1000	V&H	270	3	☒CT ☒CR	**Note 1**	PASS
1400 ~ 2700	V&H	0	3	☒CT ☒CR	**Note 1**	PASS
1400 ~ 2700	V&H	90	3	☒CT ☒CR	**Note 1**	PASS
1400 ~ 2700	V&H	180	3	☒CT ☒CR	**Note 1**	PASS
1400 ~ 2700	V&H	270	3	☒CT ☒CR	**Note 1**	PASS

NOTE: *1 There was no change compared with the initial operation during the test.*

8.5. ELECTRICAL FAST TRANSIENT (EFT)

8.5.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-4
Test Voltage:	AC Power Port: 1kV DC Power Port: 0.5kV Signal Ports and Telecommunication Ports: 0.5kV
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Wave-shape:	5/50 ns
Burst Duration:	15 ms
Burst Period:	3 Hz
Test Duration:	Not less than 1 min.

8.5.2. TEST INSTRUMENT

Immunity Shield Room				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EFT/SURGE/BURST	EMTest	UCS 500	0804-08	10/14/2010
Capacitor Clamp	KeyTek	CCL-4	9503290	N.C.R.
Test S/W	E400 Burstware (V4.19 (c))			

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. N.C.R.= No Calibration required

8.5.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-024)

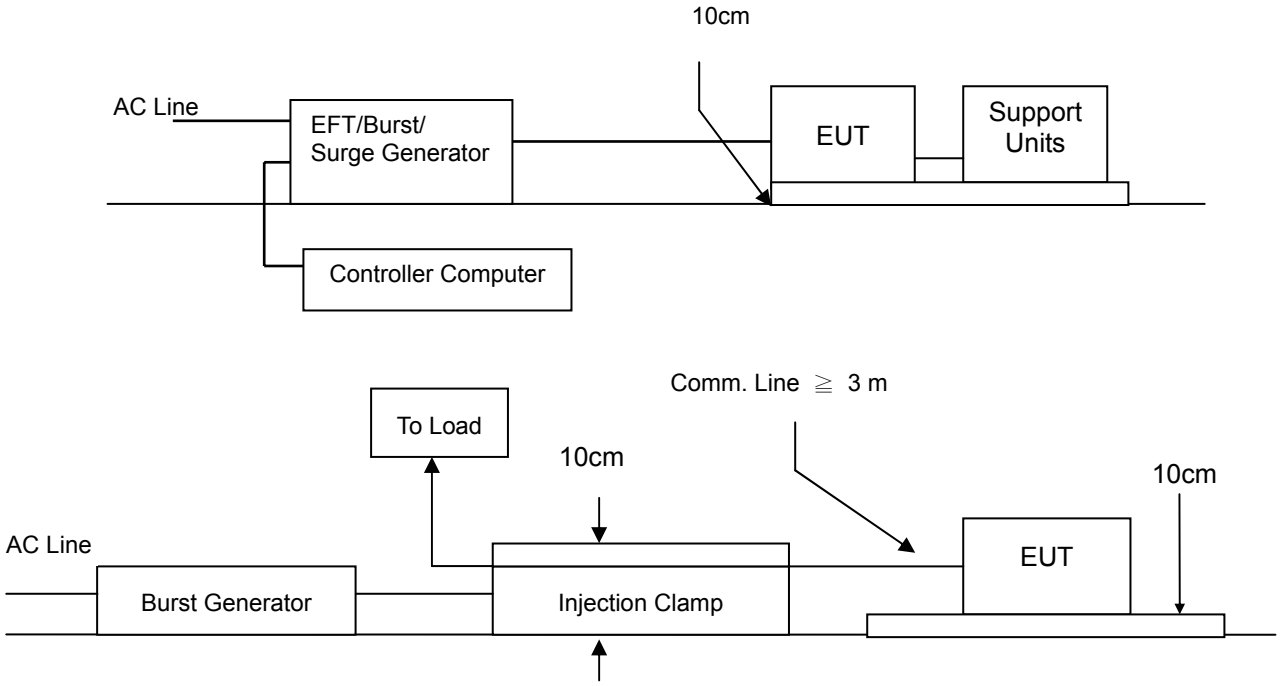
a) Both positive and negative polarity discharges were applied.

b) The length of the "hot wire" from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 meter.

c) The duration time of each test sequential was 1 minute.

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

8.5.4. TEST SETUP



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

NOTE:

TABLETOP EQUIPMENT

The configuration consisted of a wooden table (0.8m high) standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system. A minimum distance of 0.5m was provided between the EUT and the walls of the laboratory or any other metallic structure.

FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of EN 61000-4-4 and its cables, were isolated from the Ground Reference Plane by an insulating support that is 0.1-meter thick. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system.

8.5.5. TEST RESULTS

Temperature	23°C	Humidity	47% RH
Pressure	1017mbar	Tested By	Snake Shan
Required Passing Performance		Criterion TT / TR	

Test Point	Polarity	Test Level (kV)	Performance Criterion	Observation	Result
L	+/-	1	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1	PASS
N	+/-	1	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1	PASS
PE	+/-	1	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 2	PASS
L+N	+/-	1	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1	PASS
L +PE	+/-	1	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 2	PASS
N + PE	+/-	1	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 2	PASS
L +N +PE	+/-	1	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 2	PASS
LAN Port	+/-	0.5	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1	PASS

NOTE: *1. There was no change compared with initial operation during the test.*
2. the screen of monitor were slight flicker during the test, but can be auto recovered as the events disappear.

8.6. SURGE IMMUNITY TEST

8.6.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-5; ETSI EN301 489-1; ETSI EN301 489-17
Wave-Shape:	Combination Wave 1.2/50 us or 10/700 us Open Circuit Voltage 8/20 μs or 5/320 Short Circuit Current
Test Voltage:	AC Power Port ~ line to line: 1kV, line to earth (ground): 2kV DC Power Port ~ line to earth: 0.5kV Signal Ports and Telecommunication Ports ~ line to ground: 1kV
Surge Input/Output:	Power Line: L1-L2 / L1-PE / L2-PE
Generator Source Impedance:	2 ohm between networks 12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	0 / 90 / 180 / 270
Pulse Repetition Rate:	1 time / min. (maximum)
Number of Tests:	5 positive and 5 negative at selected points

8.6.2. TEST INSTRUMENT

Immunity Shield Room				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EFT/SURGE/BURST	EMTest	UCS 500	0804-08	10/14/2010
External Coupler / Decoupler For Telecom Lines	KeyTek	CM-TELCD	0104399	N.C.R.
I/O Signal Line Coupler / Decoupler	KeyTek	CM-I / OCD	0103234	N.C.R.
Test S/W	E500 Surgeware (V4.19cc)			

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. N.C.R.= No Calibration required

8.6.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-025)

a) For EUT power supply:

The surge is 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 was shorter than 2 meters in length.

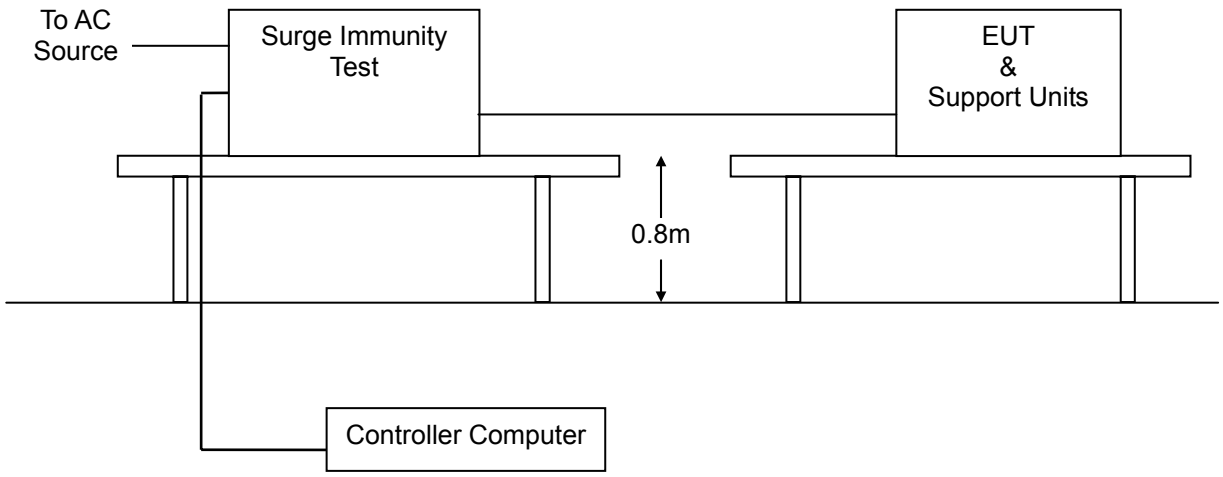
b) For test applied to unshielded un-symmetrically operated interconnection lines of EUT:

The surge was applied to the lines via the capacitive coupling. The coupling / decoupling networks didn't influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

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

The surge was applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor were not specified. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

8.6.4. TEST SETUP



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

8.6.5. TEST RESULTS

Temperature	23°C	Humidity	47% RH
Pressure	1017mbar	Tested By	Snake Shan
Required Passing Performance		Criterion TT / TR	

Test Point	Polarity	Test Level (kV)	Performance Criterion	Observation	Result
L – N	+/-	1	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1	PASS
L - PE	+/-	2	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1	PASS
N - PE	+/-	2	☒ CT / ☒ CR ☐ TT / ☐ TR	Note 1	PASS

NOTE: *1. There was no change compared with initial operation during the test.*

8.7. CONDUCTED RADIO FREQUENCY DISTURBANCES (CS)

8.7.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-6
Frequency Range:	0.15 MHz ~ 80 MHz
Field Strength:	3 Vrms
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Coupled cable:	Power Mains, Unshielded
Coupling device:	CDN-M3 (3 wires)
	CDN-T4 for LAN

8.7.2. TEST INSTRUMENT

Immunity Shield Room				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Signal Generator	Agilent	8648C	4108A05773	10/14/2010
Power Amplifier	ar	500A100A	300299	N.C.R.
High Power Attenuator	Narda	769-6	02541	N.C.R.
Power Meter	Boonton	4232A-01-02	98501	12/23/2010
Power Sensor	Boonton	51011-EMC	32862	12/23/2010
Power Sensor	Boonton	51011-EMC	32864	12/23/2010
Power Line Coupling Decoupling Network	Fischer Custom Communications, Inc.	FCC-801-M2-16A	03026	10/14/2010
Power Line Coupling Decoupling Network	Fischer Custom Communications, Inc.	FCC-801-M3-16A	03027	10/14/2010
Signal Line Coupling Decoupling Network	Fischer Custom Communications, Inc.	FCC-801-T2	03016	10/14/2010
Signal Line Coupling Decoupling Network	Fischer Custom Communications, Inc.	FCC-801-T4	03017	10/14/2010
EM Injection Clamp	Fischer Custom Communications, Inc.	F-203I-23mm	421	11/20/2010
Passive Impedance Adapters	Fischer Custom Communications, Inc.	FCC-801-150-50-CDN	03053&03054	10/19/2010
Calibration Fixture	Fischer Custom Communications, Inc.	F-203I-CF-23mm	408	10/19/2010
Signal Line Coupling Decoupling Network	Fischer Custom Communications, Inc.	FCC-801-T8-RJ45	04024	10/14/2010
Attenuator	Amplifier Research	HFP-575-3/6-NM	NF201875106	N.C.R.
Coupler	Amplifier Research	DC2600A	306621	N.C.R.
Test S/W	SW1005 (Release 1.4)			

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. N.C.R.= No Calibration required

8.7.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-026)

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

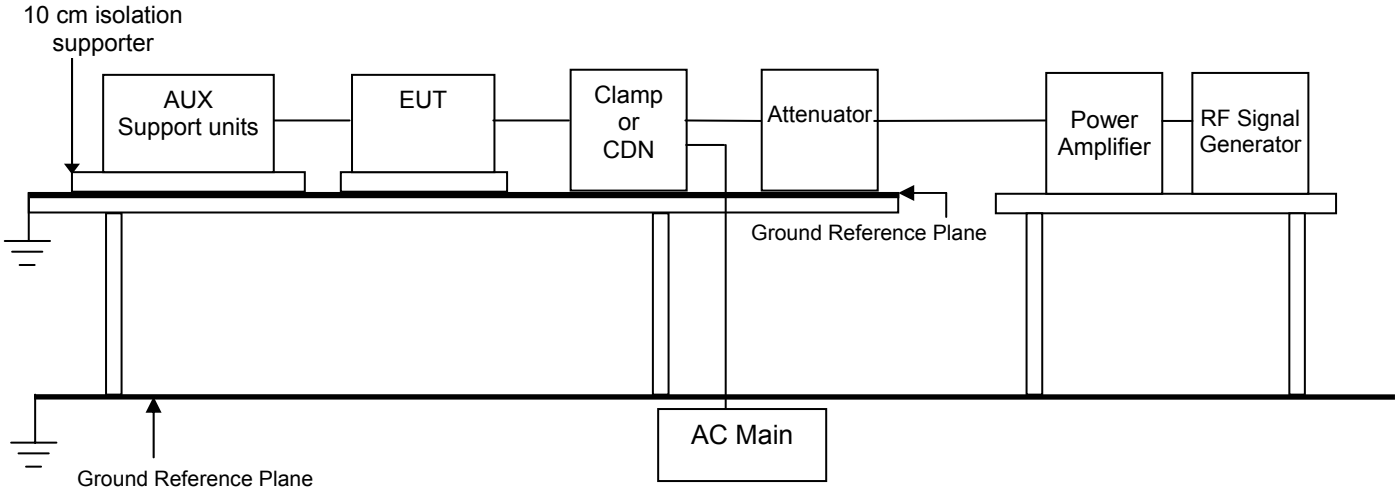
The test shell performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.

The frequency range was 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 was modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. The sweep rate was 1.5×10^{-3} decades/s. Where the frequency range is swept incrementally, the step size was 1 % of preceding frequency value from 150 kHz to 80 MHz.

The dwell time at each frequency was less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequency(ies) and harmonics or frequencies of dominant interest, was analyzed separately.

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

8.7.4. TEST SETUP



Note: 1. The EUT is setup 0.1m above Ground Reference Plane
2. The CDNs and / or EM clamp used for real test depends on ports and cables configuration of EUT.

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

NOTE:

TABLE-TOP AND FLOOR-STANDING EQUIPMENT

The equipment to be tested was placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

8.7.5. TEST RESULTS

Temperature	24°C	**Humidity**	47% RH
Pressure	1017mbar	**Tested By**	Snake Shan
Required Passing Performance		**Criterion TT / TR**	

Frequency Band (MHz)	Field Strength (Vrms)	Cable	Injection Method	Performance Criterion	Observation	Result
0.15 ~ 80	3	Power Line	CDN-M3	☒**CT** ☒**CR**	**Note 1**	PASS
0.15 ~ 80	3	LAN Port	CDN-T4	☒**CT** ☒**CR**	**Note 1**	PASS

NOTE: *1. There was no change compared with initial operation during the test.*

8.8. VOLTAGE DIP & VOLTAGE INTERRUPTIONS

8.8.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-11
Test duration time:	Minimum three test events in sequence
Interval between event:	Minimum 10 seconds
Angle:	0~360 degree
Step:	45 degree

8.8.2. TEST INSTRUMENT

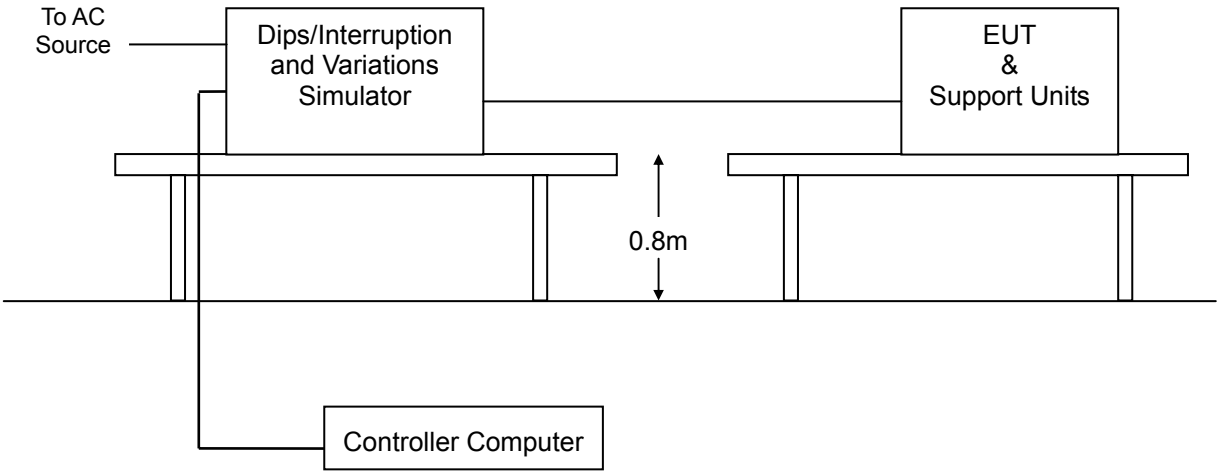
Immunity shielded room				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Dips/Interruption and Variations Simulator	Haefely Trench	PLINE 1610	081568-06	12/16/2010
Test S/W	WinPATS (V. 3.26)			

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. N.C.R.= No Calibration required

8.8.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-028)

1. The EUT and support units were located on a wooden table, 0.8 m away from ground floor.
2. Setting the parameter of tests and then perform the test software of test simulator.
3. Conditions changes to occur at 0 degree crossover point of the voltage waveform.
4. Recording the test result in test record form.
5. Removes the Battery Pack to test if any.

8.8.4. TEST SETUP



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

8.8.5. TEST RESULTS

Temperature	24°C	**Humidity**	48% RH
Pressure	1016mbar	**Tested By**	Snake Shan
Required Passing Performance	Voltage Dips: **Criterion B: 0% residual 0.5 & 1 period** **Criterion C: 70% residual 25 period (at 50Hz) &** Voltage Interruptions: **Criterion C: 0% residual 250 period (at 50Hz)**		

Test Power: 230Vac, 50Hz				
Voltage (% residual)	**Duration (Period)**	**Performance Criterion**	**Observation**	**Test Result**
0	0.5	☒**A** ☐**B** ☐**C**	**Note 1**	PASS
0	1	☒**A** ☐**B** ☐**C**	**Note 1**	PASS
70	25	☒**A** ☐**B** ☐**C**	**Note 1**	PASS
0	250	☒**A** ☐**B** ☐**C**	**Note 1**	PASS

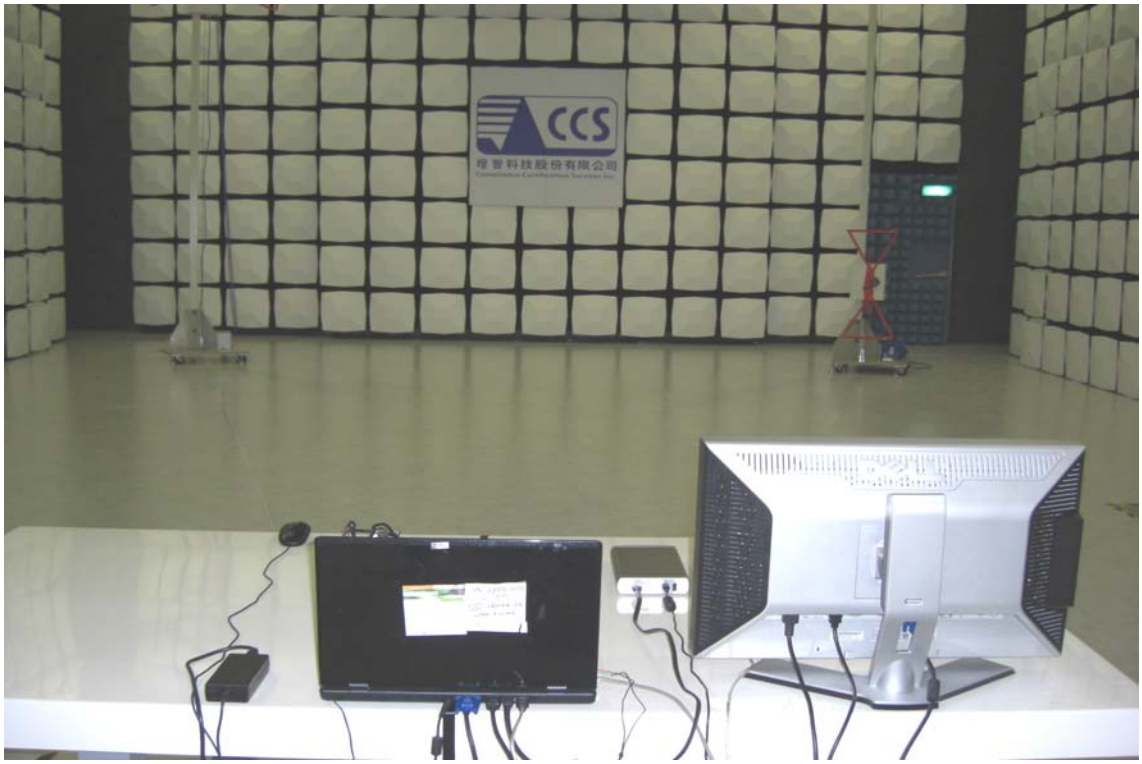
NOTE *1. There was no change compared with initial operation during and after the test. No unintentional response was found during the test.*

9 PHOTOGRAPHS OF THE TEST CONFIGURATION

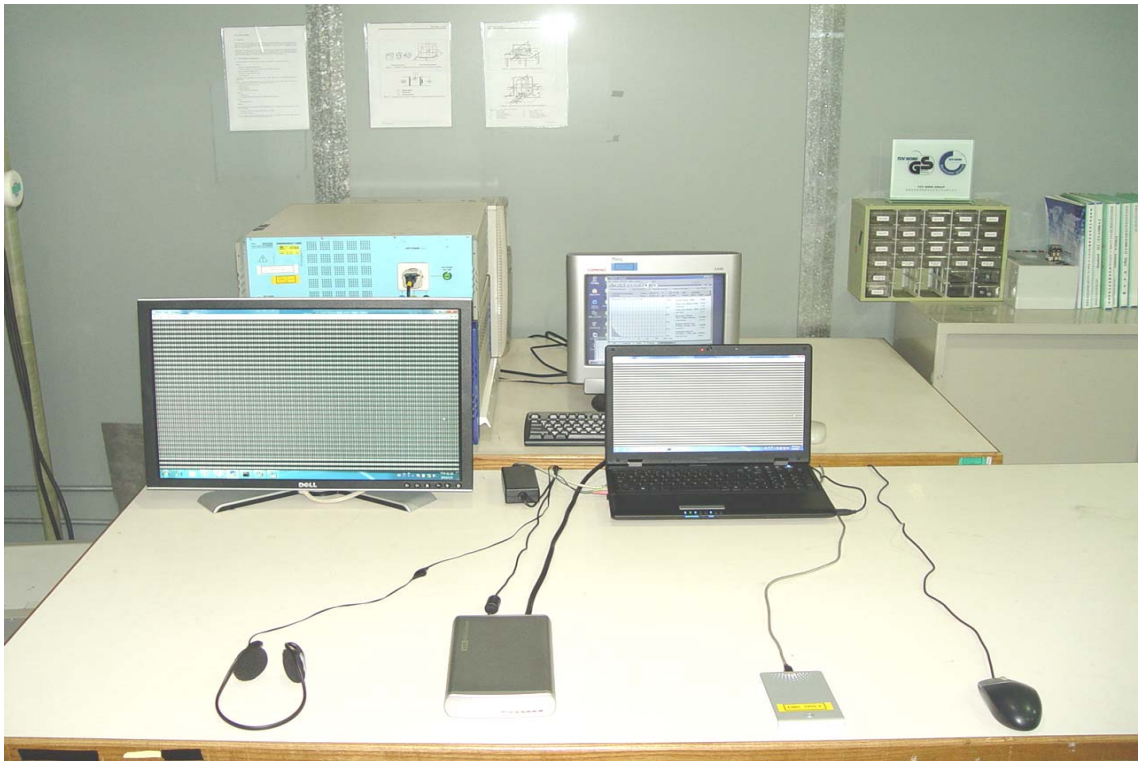
CONDUCTED EMISSION TEST

CONDUCTED EMISSION TEST AT TELECOMMUNICATION PORTS
RJ45 Telecom Port with ISN (10/100 Mbps)

RADIATED EMISSION TEST

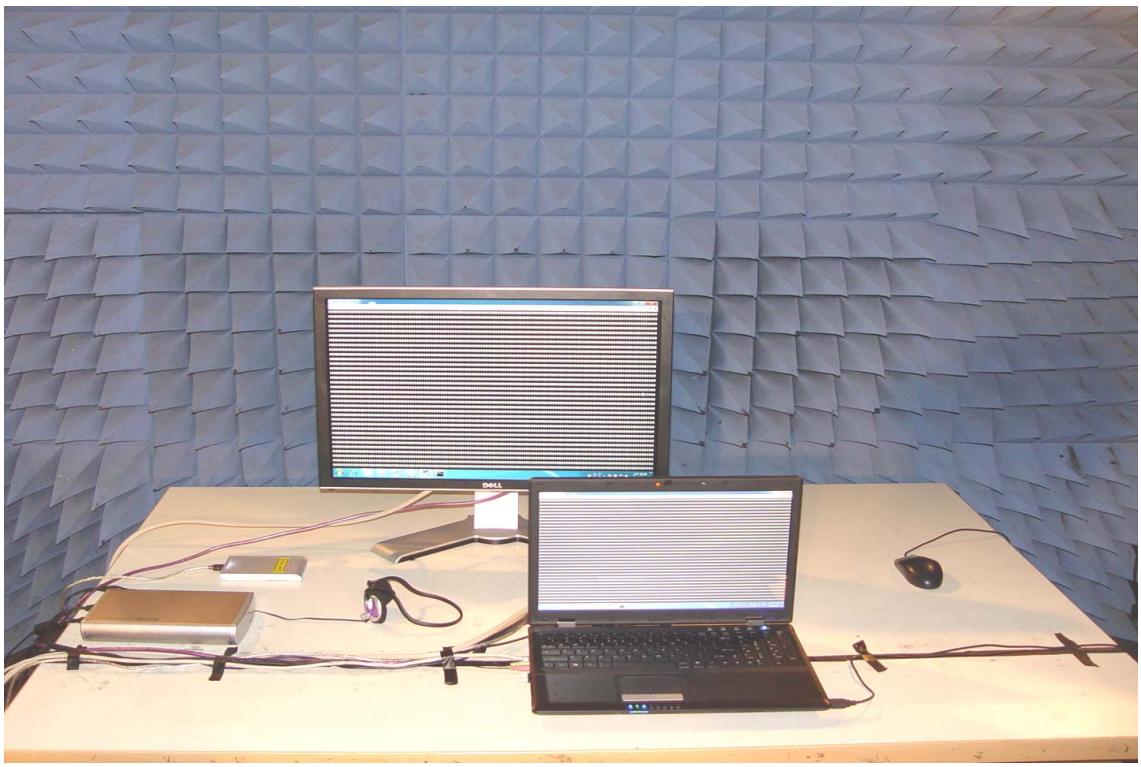


POWER HARMONIC & VOLTAGE FLUCTUATION / FLICKER TEST

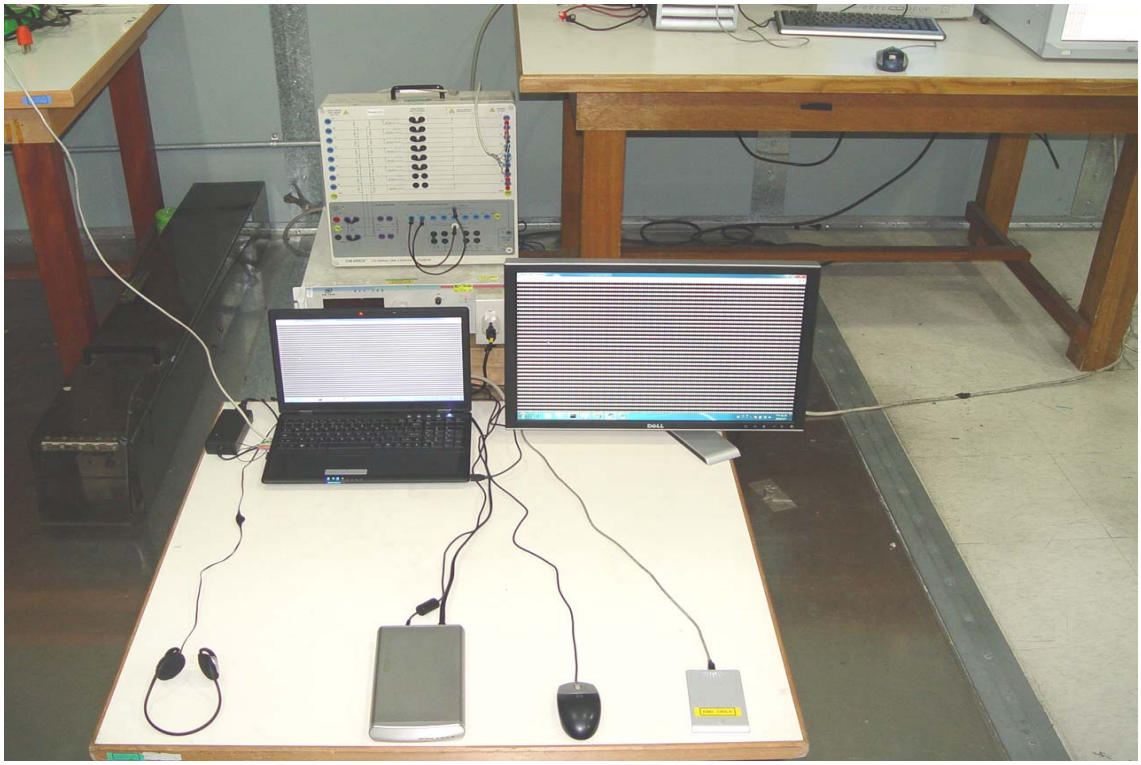


ELECTROSTATIC DISCHARGE TEST

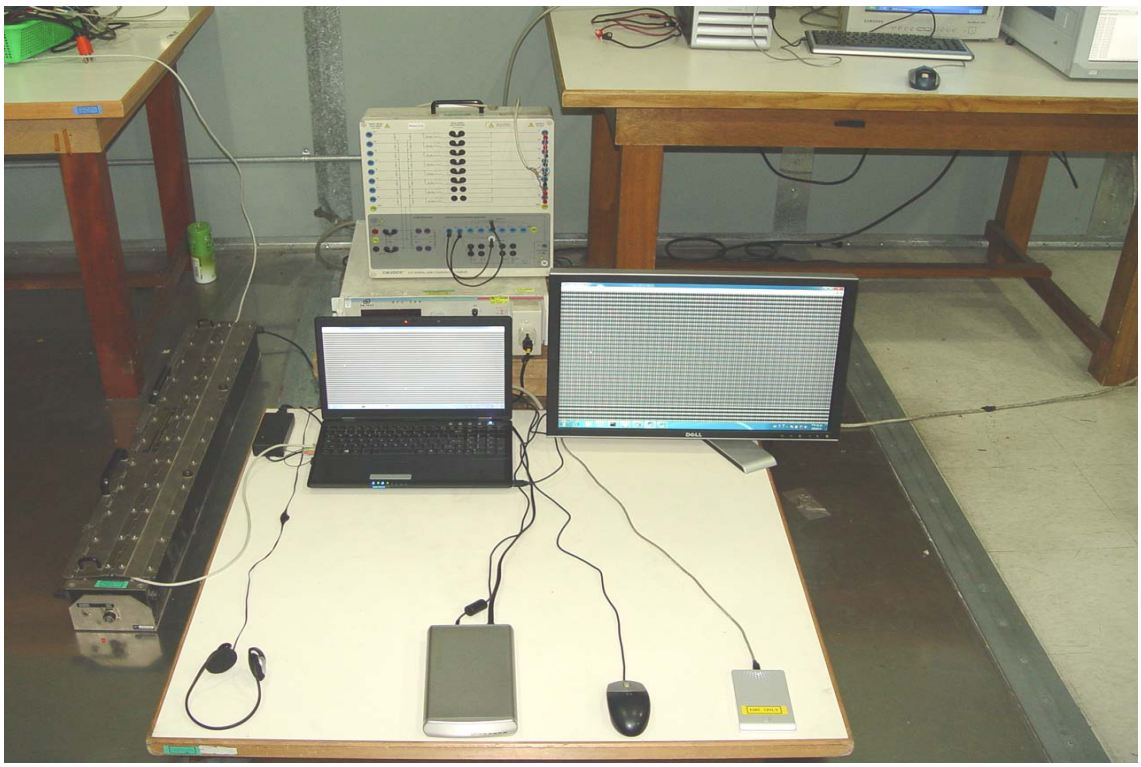
RADIATED ELECTROMAGNETIC FIELD TEST



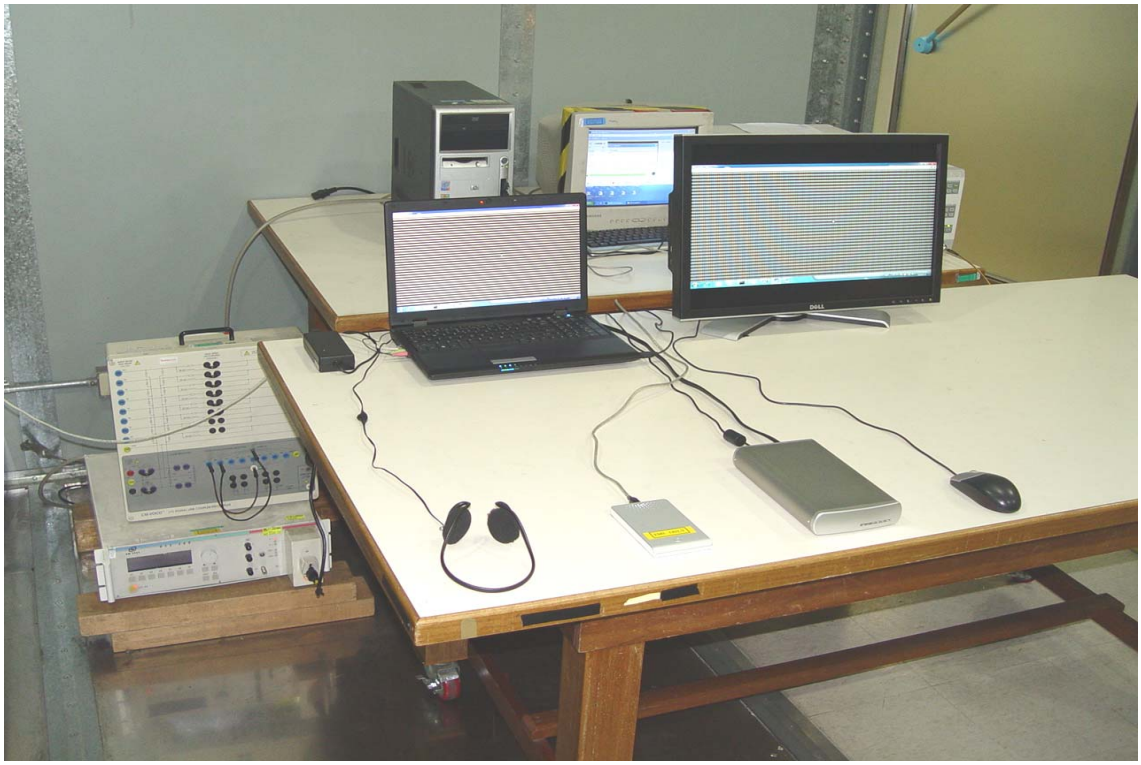
FAST TRANSIENTS/BURST TEST (MAIN PORT)



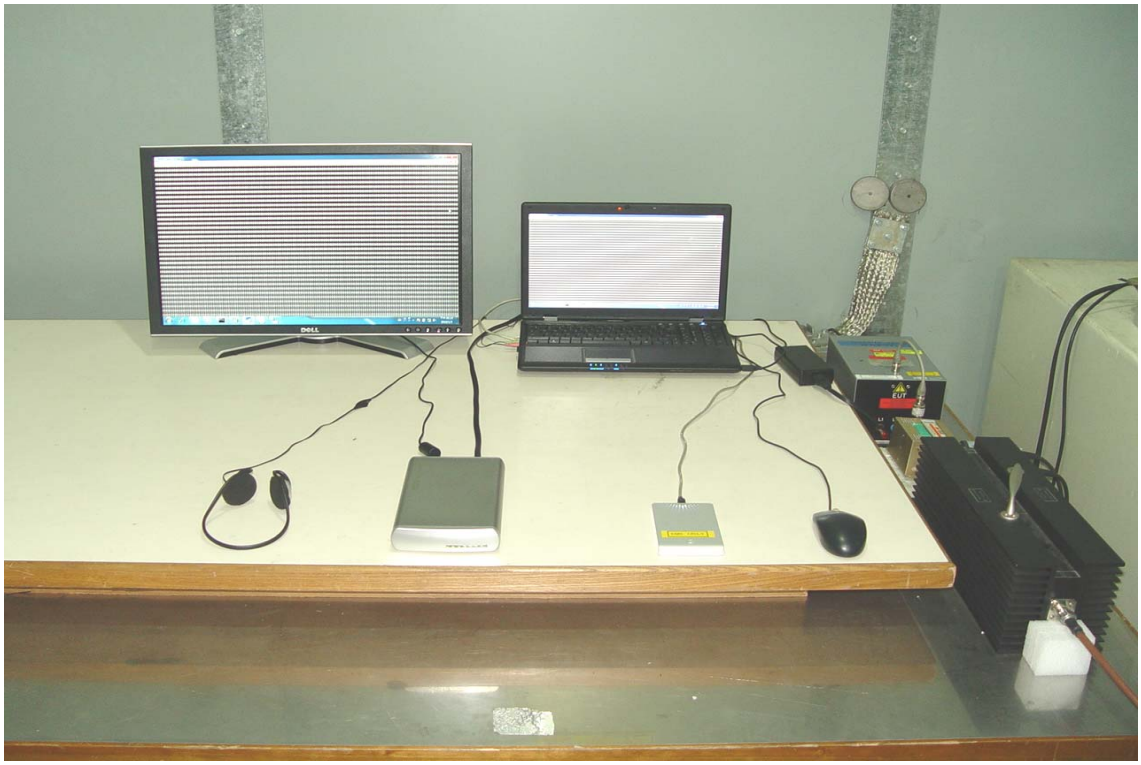
FAST TRANSIENTS/BURST TEST (TELECOMMUNICATION PORT)



SURGE IMMUNITY TEST



CONDUCTED DISTURBANCE TEST (MAIN PORT)



CONDUCTED DISTURBANCE TEST (TELECOMMUNICATION PORT)

VOLTAGE DIPS / INTERRUPTION TEST