UL Korea, Ltd

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Project:	07CA31821
File:	TC8312
Report	07CA31821-FCC
Date:	July 19, 2007
Model:	FS-L2401D

Electromagnetic Compatibility Test Report

FCC Certification
Part 15 Subpart B Class B

For

D&T Inc.
Daedeok Valley, 60-1, jang Dong, Yuseong Gu, Daejeon,
305-343, Korea

UL Korea Ltd.

33rdFl. Gangnam finance Center, 737 Yeoksam-Dong, Kangnam-Gu, Seoul, 135-984, Korea

TEST REPORT DETAILS

Tests Performed By:	UL Korea Ltd. 33rd FL. Gangnam Finance Center, 737 Yeoksam-dong, Kangnam-ku, Seoul, 135-984, Korea
Test site:	BWS TECH Inc. 611-1, Maesan-ri, Mohyeon-myeon, Yongin-si, Gyeonggi-do 449-853, Korea Registration No. : 553281
Tests Performed For:	D&T Inc. Daedeok Valley, 60-1, jang Dong, Yuseong Gu, Daejeon, 305-343, Korea
Applicant Contact: Title: Phone: E-mail:	W.W.Lee General Manager/QA 82-18-311-1246 Wwlee88@dntinc.co.kr
Test Report Number: Test Report Date:	07CA31821-FCC July 12, 2007
Product Type:	LCD Monitor
Product standards	FCC Part 15 Subpart B Class B
Model Number: FCC ID:	FS-L2401D THCFS-L2401D
Sample Serial Number:	None (Proto type)
Sample Receive Date:	June 25, 2007
Testing Start Date:	June 28, 2007
Date Testing Complete:	July 10, 2007
Overall Results:	**PASS**

UL Korea Ltd. reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports.

TEST SUMMARY

Test Result

Requirement – Test	Reference standards	Verdict
Conducted Disturbance at the mains ports	FCC Part 15 Subpart B Class B	Complied
Radiated Disturbance		Complied

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea, Ltd. in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

The equipment under test has

☒ met the technical requirements

☐ not met the technical requirements

Tested by
Sung Hoon Baek, Associate Project Engineer

Conformity Assessment Services - 3014ASEO
UL Korea Ltd.
July 19, 2007

Reviewed by

Kyung Yong, Kim , Senior Project Engineer
Conformity Assessment Services - 3014ASEO
UL Korea Ltd.
July 20, 2007

Report Directory

1. EQUIPMENT UNDER TEST (EUT)

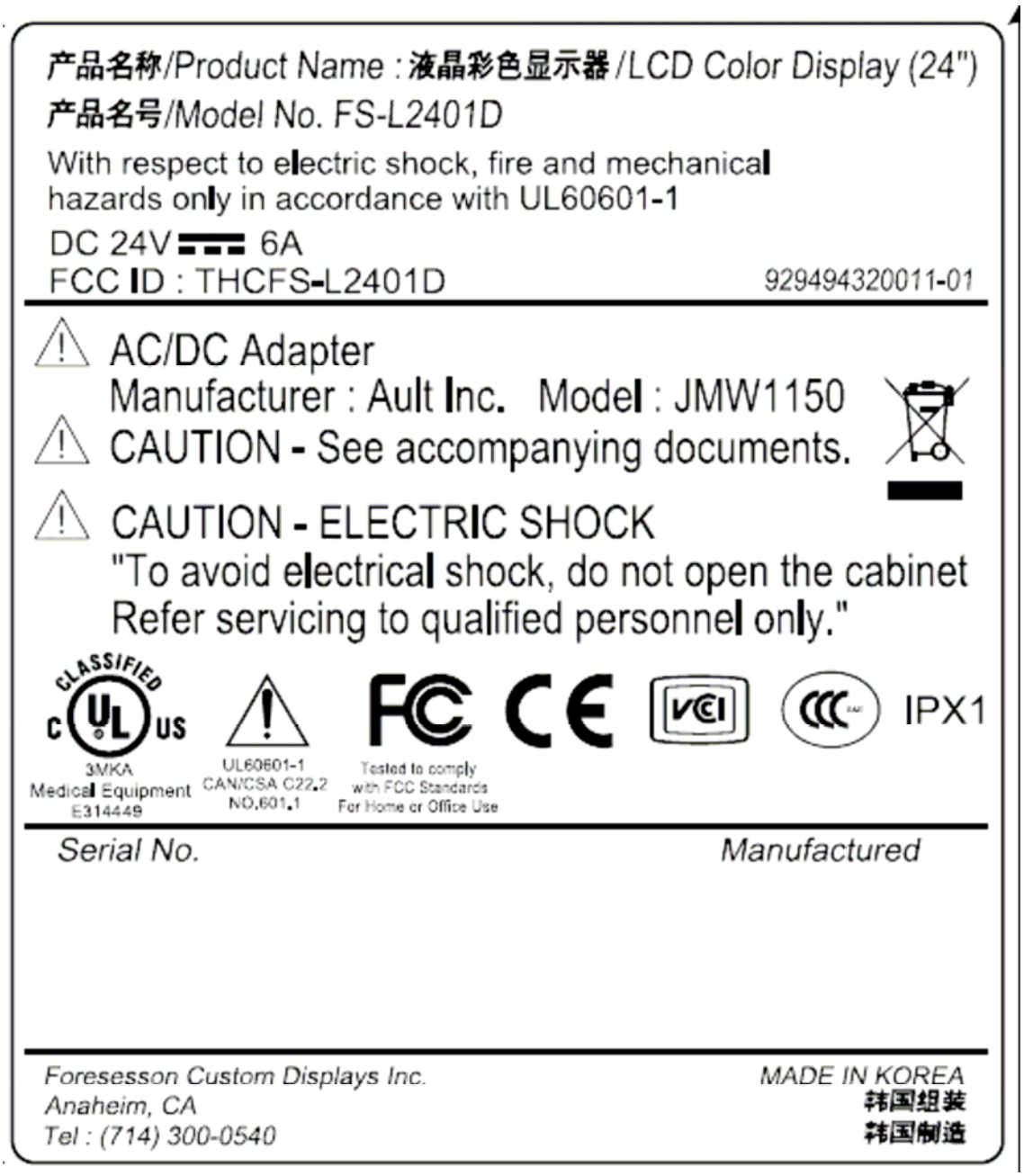
1.1 Equipment Description Specification

LCD Panel	Type	TFT-LCD
	Screen Size	24 linch
	Maximum Resolution	1920 ∗ 1200 @ 60 Hz
	Pixel pitch	0.270(H) mm ∗ 0.270(V) mm
	Display Colors	16.7 M
	Contrast Ratio	700:1
	Viewing Angle	89° / 89° / 89° / 89°
	Response Time	12 msec (Rising + falling)
	Luminance	400 cd/m²
Synchronization	Horizontal Frequency	30 KHz~75 KHz
	Vertical Frequency	50 Hz~75 Hz
Power Consumption	Maximum	Max 100 W
	Standby Mode	Max 20 W
Control Key	Front side	INPUT, -, +,▲ , ▼, PIP, MENU, POWER
Input Signal	Video	1XDVI, 1XOptical DVI, 1XD-SUB, 1XBNC (CVBS) 2XBNC (SVHS Y/C), 1XBNC (SDI), 5XBNC (Component Y/G, Pb/B, Pr/R, H/CS, VS Input)
Out Signal	Video	1XDVI, 1XBNC (SDI)
Input power	DC 24 V, 6.25A Max	
Dimension	Size and Weight	580 *386 *87.5 (mm)/ 10 Kg

Output Signal	SDI Video format Description
SMPTE-274M	1080i (60 / 59.94 /50) 1080p (30 /29.97 / 25 /24 /24sF /23.98 / 23.98sF)
SMPTE-296M	720p (60 /59.94 /50)
SMPTE-260M	1035i (60 / 59.94)
ITU-R BT.656	576i (50)

AC/DC Adapter Description	
Rated Voltage	AC 100 ~ 240Vac
Rated Line Frequency	50 ~ 60 Hz
Output Voltage / Current	+24 VDC at 6.25 A
Load regulation	+24 VDC +/- 5%

1.2 Equipment Marking Plate



1.3 Equipment Used During Test

Use*	Product Type	Manufacturer	Model
EUT	LCD Monitor	D&T Inc.	FS-L2401D
EUT	AC/DC Adaptor	AULT KOREA.CORP.	JMW1150
AE	Video card	REX TECHNOLOGY	FX6200A
AE	Key board	SAMSUNG	SEM-DT35
AE	Serial mouse	SAMSUNG	SMOP5000WX
AE	Joy stick	MICROSOFT	Side Winder Game Pad USB
SIM	DVD Player	LG Elecronics	LC-93
SIM	TV Pattern Generator	Philips	PM5515
SIM	DVI to HDSDI	Gefen	Converter
SIM	AC/DC Adaptor	Gefen	GT-4201D-05
AE	PC	HP	DX7300
AE	PC	HP	d530
AE	CCTV	SAMSUNG	HK150F

* Note: **EUT** - Equipment Under Test , **AE** - Auxiliary/Associated Equipment, **SIM** - Simulator (Not Subjected to Test)

1.4 EUT Input/Output Ports

Port #	Name	Type*	Cable Max. >3m	Cable Shielded	Comments
1	DVI Out	I/O	1.8	Shielded	24 pin DVI-D
2	DVI In	I/O	4.6	Shielded	24 pin DVI-D
3	VGA	I/O	1.8	Shielded	15 pin D-Sub
4	SDI-In	I/O	4.6	Shielded	BNC
5	SDI-Out	I/O	4.6	Shielded	BNC
6	Optical	N/E	20.0	Unshielded	4 pin Optical
7	RGBS (CVBS)	I/O	1.8	Shielded	5 port BNC
8	S-Video	I/O	1.8	Shielded	BNC
9	C-Video	I/O	1.6	Shielded	BNC
10	Mains	AC	2.1	Unshielded	

Note:
*AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports
* RS-232 port is used for service purpose only. No user interface port

1.5 EUT Internal Operating Frequencies:

Frequency (MHz)	Description	Frequency (MHz)	Description
27.000 MHz	DVI clock	154.000 MHz	Panel clock
28.322 MHz	System clock	192.000 MHz	Memory clock

1.6 Power Interface:

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	AC 100-240	3.0		50~60	Single	Rating of AC/DC Adapter

2. EUT Operation Modes:

2.1 Modes of Testing

	Mode	Comment
1	DVI In Out Mode	
2	Optical DVI Mode	
3	D-Sub Mode	Worst case condition
4	SDI In Out Mode	Worst case condition
5	RGBS Mode	
6	C-VIDEO Mode	
7	S-VIDEO Mode	

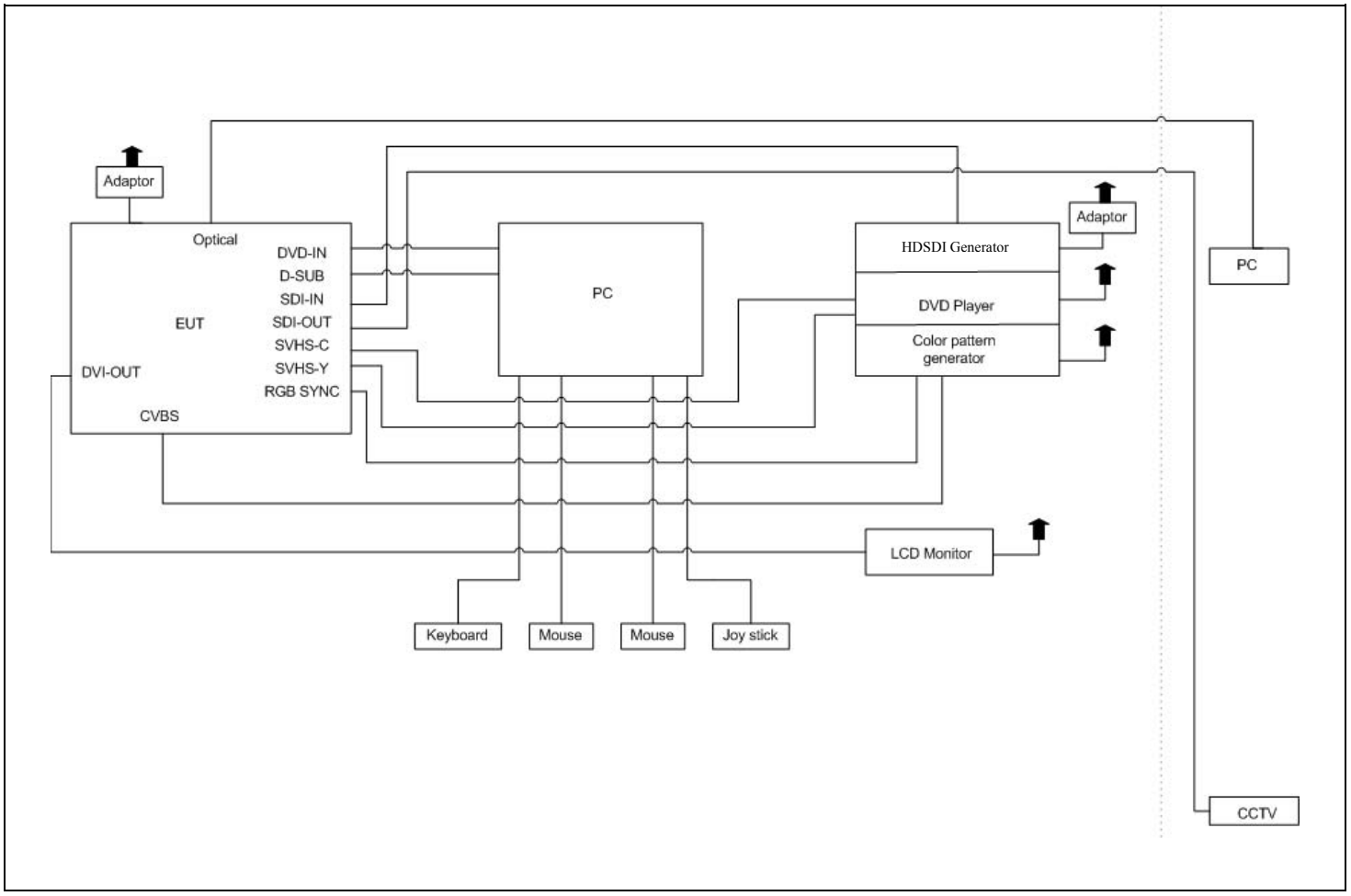
Note
1. Emission testing have been performed under continuous displaying “H” Patten for configuration modes of 1,2,3
2. Emission testing have been performed under continuous displaying “Color Bar” Patten for configuration modes of 4,5,6,7
3. All the configuration described above have been investigated during the preliminary testing and selected two cases as worst case condition for final measurements

2.2 Modes of Video resolution

	Resolution	Comment
1	640 * 350 @ 70Hz	VGA mode
2	1920 * 1200 @ 60Hz	VGA mode
3	SMPTE 296M	SDI mode

Note
1. Emission testing have been performed under continuous displaying “H” Patten for configuration modes of 1,2,
2. Emission testing have been performed under continuous displaying “Color Bar” Patten for configuration modes of 3

3. **EUT Configurations:**



4. CONDUCTED EMISSION

	TEST: Limits of mains terminal disturbance voltage	
Method	Measurements were made on a ground plane that extends 1-meter minimum beyond all sides of the system under test. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.	—

Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	40 %
	Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range	150 kHz to 30 MHz	Mains

Limits – Class A

Frequency (MHz)	Limit (dBμV)			
	Quasi-Peak	Results	Average	Results
0.15 to 0.50	79	N/A	66	N/A
0.50 to 30	73	N/A	60	N/A

Limits – Class B

Frequency (MHz)	Limit (dBμV)			
	Quasi-Peak	Results	Average	Results
0.15 to 0.50	66 to 56	Pass	56 to 46	Pass
0.50 to 5	56	Pass	46	Pass
5 to 30	60	Pass	50	Pass

Supplementary information:

Test Equipment Used

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Test Receiver	Rohde&Schwarz	ESPI	100063	2006. 11. 09	2007. 11. 09
Artificial Mains Network	PMM	L3-25	1110K70403	2006. 09. 09	2007. 09. 09
LISN	FCC	FCC-LISN-50-50-2-02	03074	2006. 11. 13	2007. 11. 13

Figure 1
Conducted Emission Test Setup: D-SUB Mode

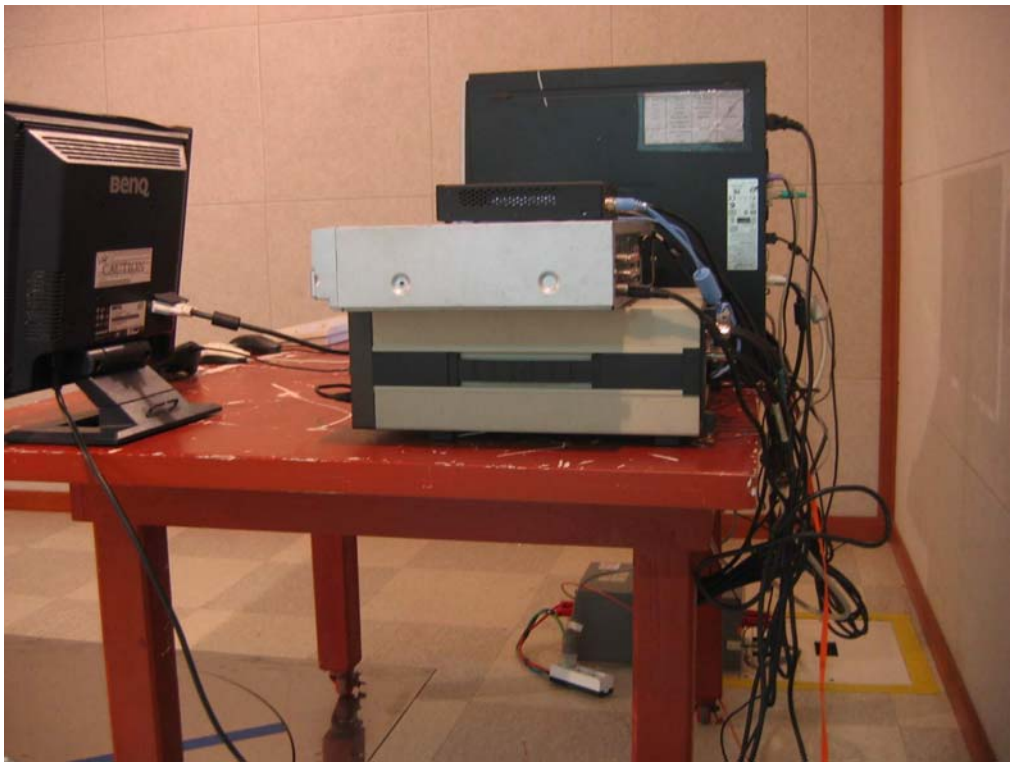


Figure 2
Conducted Emission Test Setup: SDI Mode

Table 1. Test data for conducted emission
Test Condition: D-Sub Mode

Test Frequency (MHz)	Correction Factor		Reading value(dBuV)		Line	Level(dBuV)		Limit (dBuV)		Margin (dB)	
	Cable	LISN	QP	AV		QP	AV	QP	AV	QP	AV
0.162	0.03	0.06	48.94	-	H	49.03	-	65.70	55.70	16.67	-
0.218	0.10	0.07	46.92	-	H	47.09	-	64.10	54.10	17.01	-
0.326	0.22	0.08	41.93	-	N	42.23	-	61.00	51.00	18.77	-
0.378	0.24	0.08	35.97	-	N	36.29	-	59.60	49.60	23.31	-
0.434	0.26	0.08	37.33	-	N	37.67	-	58.00	48.00	20.33	-
0.486	0.28	0.07	37.36	-	N	37.71	-	56.40	46.40	18.69	-
2.870	0.59	0.04	40.24	-	H	40.87	-	56.00	46.00	15.13	-
2.978	0.60	0.04	40.47	-	H	41.11	-			14.89	-
3.142	0.62	0.04	41.75	-	H	42.41	-			13.59	-
3.250	0.64	0.03	42.52	-	N	43.19	-			12.81	-
3.790	0.73	0.03	42.45	-	H	43.21	-			12.79	-
3.954	0.76	0.03	41.84	-	N	42.63	-			13.37	-
8.394	1.00	0.06	46.58	-	N	47.64	-	60.00	50.00	12.36	-
8.502	1.00	0.06	46.68	-	N	47.74	-			12.26	-
11.806	1.13	0.04	46.79	-	N	47.96	-			12.04	-
12.022	1.15	0.04	46.61	-	N	47.80	-			12.20	-
13.862	1.21	0.07	48.31	-	N	49.59	-			10.41	-
14.946	1.22	0.06	47.06	-	N	48.34	-			11.66	-

Note
1. Margin (dB)= Limit (dBuV) - Level (dBuV)
2. If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.

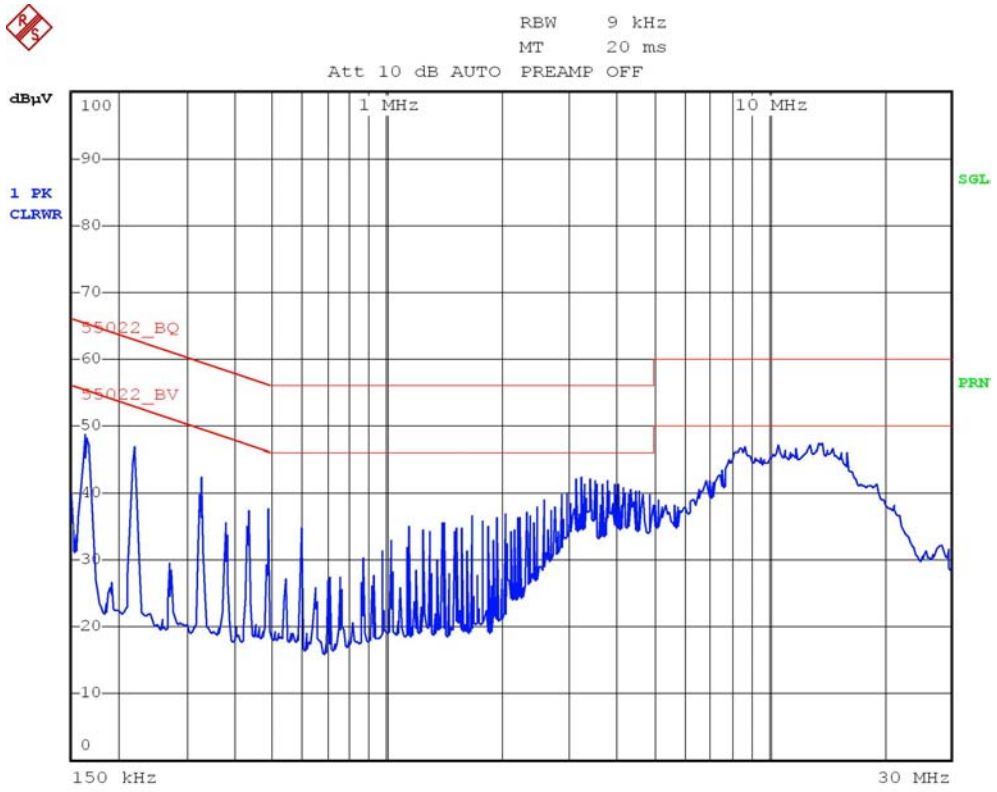
Table 2. Test data for conducted emission
Test Condition: SDI Mode

Test Frequency (MHz)	Correction Factor		Reading value(dBuV)		Line	Level(dBuV)		Limit (dBuV)		Margin (dB)	
	Cable	LISN	QP	AV		QP	AV	QP	AV	QP	AV
0.162	0.03	0.06	48.73	-	N	48.82	-	65.70	55.70	16.88	-
0.218	0.10	0.07	46.90	-	N	47.07	-	64.10	54.10	17.03	-
0.326	0.22	0.08	42.37	-	H	42.67	-	61.00	51.00	18.33	-
0.378	0.24	0.08	35.68	-	H	36.00	-	59.60	49.60	23.60	-
0.434	0.26	0.08	37.42	-	H	37.76	-	58.00	48.00	20.24	-
0.486	0.28	0.07	38.00	-	N	38.35	-	56.40	46.40	18.05	-
2.598	0.58	0.03	38.86	-	H	39.47	-	56.00	46.00	16.53	-
2.870	0.59	0.04	39.72	-	N	40.35	-			15.65	-
2.978	0.60	0.04	40.97	-	N	41.61	-			14.39	-
3.250	0.64	0.03	42.31	-	H	42.98	-			13.02	-
3.414	0.67	0.03	42.23	-	H	42.93	-			13.07	-
4.062	0.77	0.03	41.80	-	N	42.60	-			13.40	-
8.394	1.00	0.06	46.57	-	N	47.63	-	60.00	50.00	12.37	-
8.666	1.00	0.06	46.93	-	H	47.99	-			12.01	-
10.670	1.06	0.06	47.05	-	H	48.17	-			11.83	-
11.590	1.11	0.04	46.80	-	N	47.95	-			12.05	-
13.758	1.21	0.07	47.74	-	N	49.02	-			10.98	-
14.678	1.22	0.06	47.00	-	N	48.28	-			11.72	-

Note
1. Margin (dB)= Limit (dBuV) - Level (dBuV)
2. If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.

Figure 3. Operating condition : D-SUB Mode

Live line



Neutral line

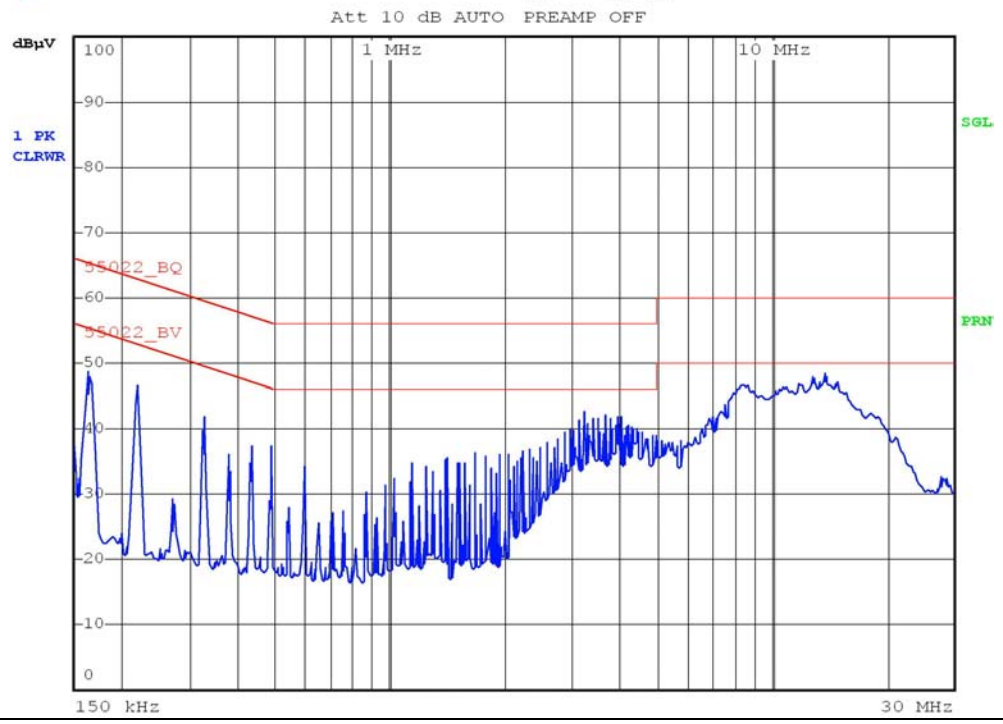
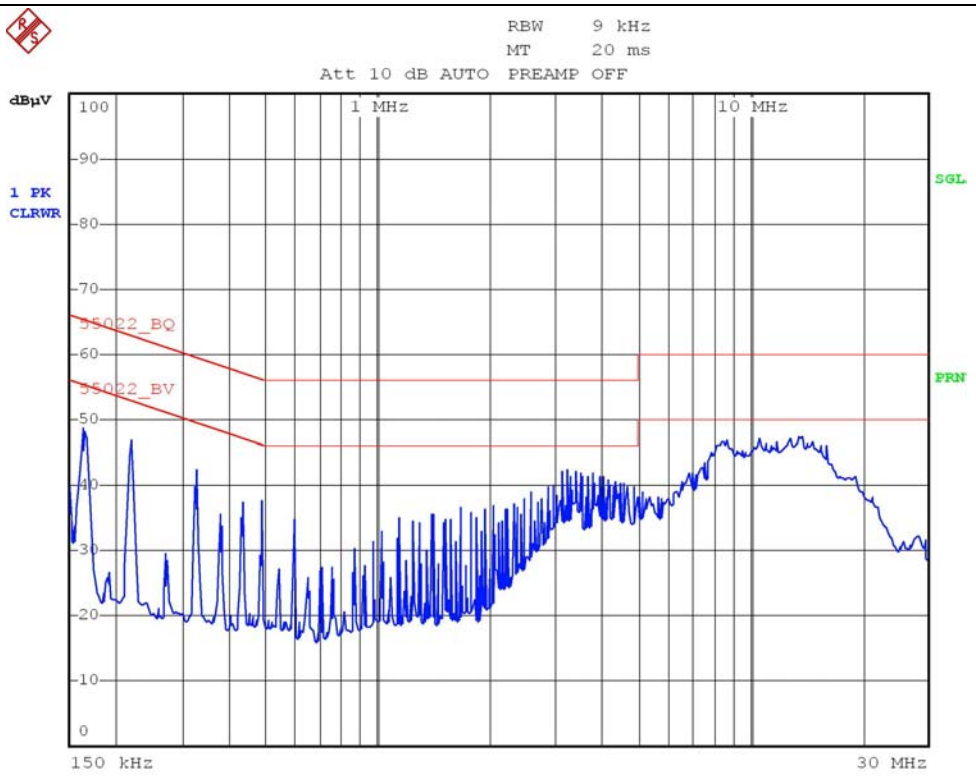
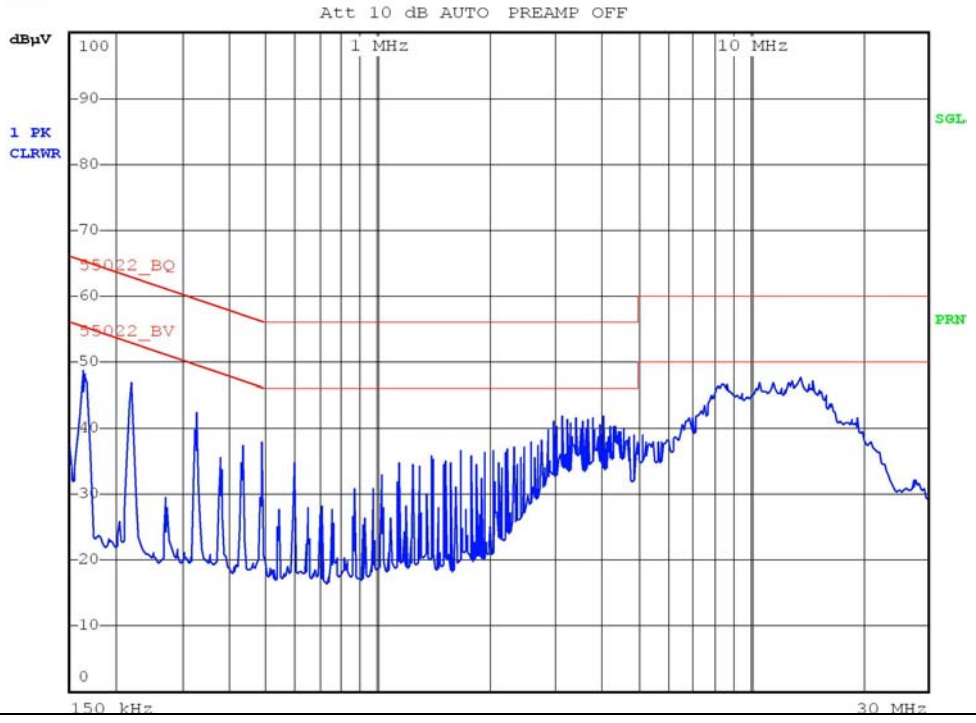


Figure 4. Operating condition : SDI Mode

Live line



Neutral line



5. RADIATED EMISSION

	TEST: Limits for radiated disturbance	
Method	Measurements were made at Open area test site that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at 1, 2, 3 and 4 meter heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	—

Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	13°C
	Relative Humidity	38%
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30 MHz – 2.0 GHz	(10 meter measurement distance)

Limits - Class B

Frequency (MHz)	Limit (dBμV/m)	
	Quasi-Peak	Results
30 to 230	30	Pass
230 to 1000	37	Pass
1000 to 2000	43.5 (Average)	Pass

Supplementary information:

Test Equipment Used

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMI test receiver	Rohde & Schwarz	ESVS10	863247/019	2007. 06.	2008. 06.
Bilog antenna	Schwarzbeck	VULB9160	3122	2006. 12. 29	2007. 12. 29
Open Site Cable	N/A	N/A	N/A	N/A	N/A
Antenna Mast	Dae Il EMC	JAC-3	N/A	N/A	N/A
Antenna Turntable Controller	JAEMC	JAC-2	N/A	N/A	N/A

Figure 5
Photo of Radiated emission test setup: D-SUB Mode

Figure 6
Photo of Radiated emission test setup: SDI Mode

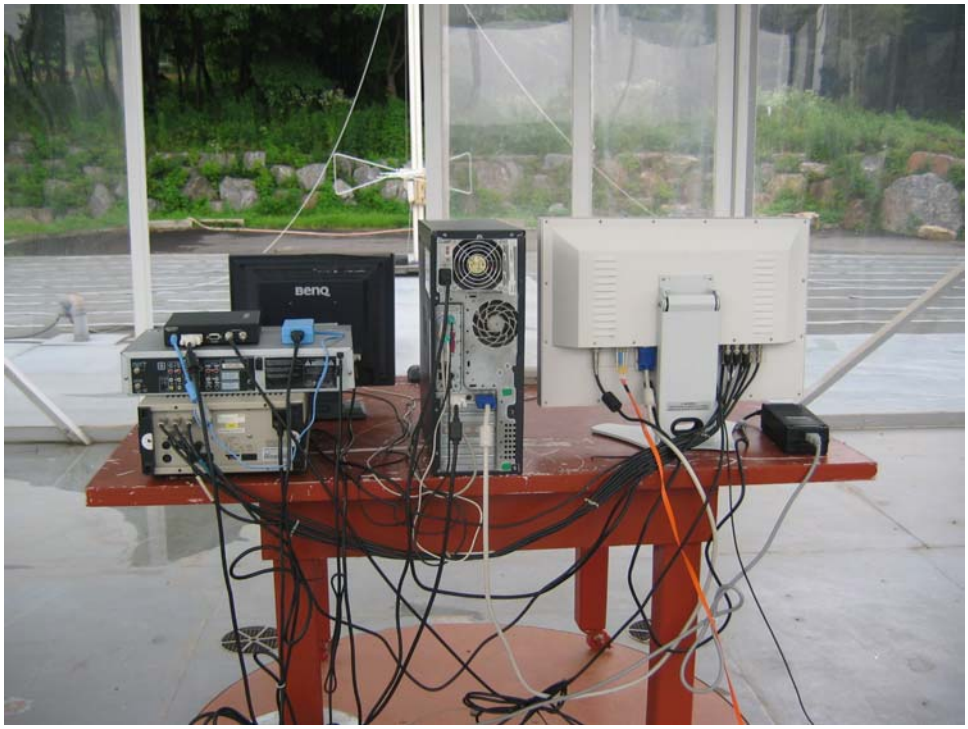


Table 3
Radiated emission Test data : D-Sub Mode

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk/QP)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (m)	Gain/Loss Factor (dB)	Transducer Factor (dB/m)	Level dBuV/m	Limit dBuV/m	Margin (dB)
66.02	12.34	QP	V	180	1.1	1.80	11.26	25.40	30.00	4.60
268.86	14.73	QP	V	200	1.2	3.68	12.40	30.80	37.00	6.20
395.34	12.91	QP	V	190	1.1	4.51	15.68	33.10	37.00	3.90
434.84	11.92	QP	V	180	1.2	4.70	16.58	33.20	37.00	3.80
316.27	16.73	QP	V	180	1.1	3.97	13.80	34.50	37.00	2.50
384.88	12.54	QP	V	170	1.3	4.43	15.43	32.40	37.00	4.60

Note
1. Margin (dB)= Limit (dBuV) - Level (dBuV)
2. If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.
3. No peak emission was detected at the frequency range above 1000MHz.

Table 4
Radiated emission Test data : SDI Mode

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk/QP)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (m)	Gain/Loss Factor (dB)	Transducer Factor (dB/m)	Level dBuV/m	Limit dBuV/m	Margin (dB)
78.21	13.79	QP	V	160	1.0	1.94	8.77	24.50	30.00	5.50
222.75	11.39	QP	V	190	1.1	3.31	10.39	25.10	30.00	4.90
316.23	16.44	QP	H	190	3.3	3.97	13.80	34.20	37.00	2.80
395.32	12.71	QP	H	180	3.2	4.51	15.68	32.90	37.00	4.10
816.76	4.46	QP	H	180	3.0	6.79	22.75	34.00	37.00	3.00
961.76	2.01	QP	H	200	3.4	7.51	24.38	33.90	37.00	3.10

Note
1. Margin (dB)= Limit (dBuV) - Level (dBuV)
2. If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.
3. No peak emission was detected at the frequency range above 1000MHz.

6. EUT Modification

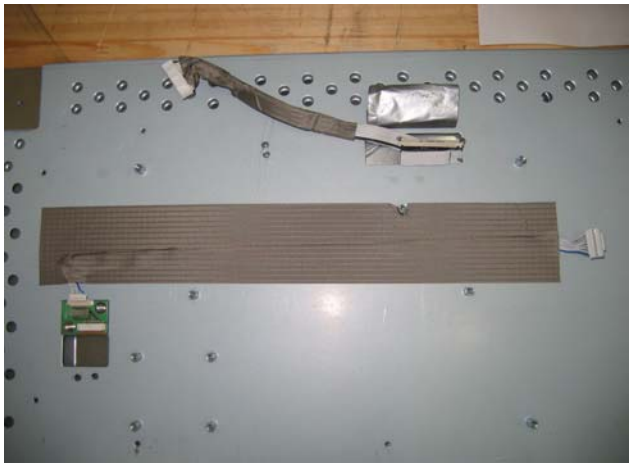
#1	Wrap the LCD Data cable with EMI tape or AL tape(50x100mm) and adhere it to LCD body closely, insert flat ferrite core (SCC Co.,Ltd. Type: PC2910).
#2	Attach EMI form gasket(10x15x170mm) to make contact with LCD body and chassis
#3	Attach EMI form gasket(10x15x170mm) to make contact with LCD body and chassis
#4	Wrap the inverter cable with EMI tape, adhere OSD cable to the chassis closely with EMI Tape or AL tape
#5	Cover the contact point where we must be inserted LCD data cable to CN7 of the main board with EMI tape or AL tape(45x54mm)
#6	Mask all the ground contact points to prevent spray painting when we make the rear cover of the monitor.
#7	Contact I/O bracket and shield cover with EMI tape or AL tape, attach the EMI form gasket (25x2x170mm) to make contact with rear cover.

EUT Modification for Radiation Disturbance

#1

#2

#3



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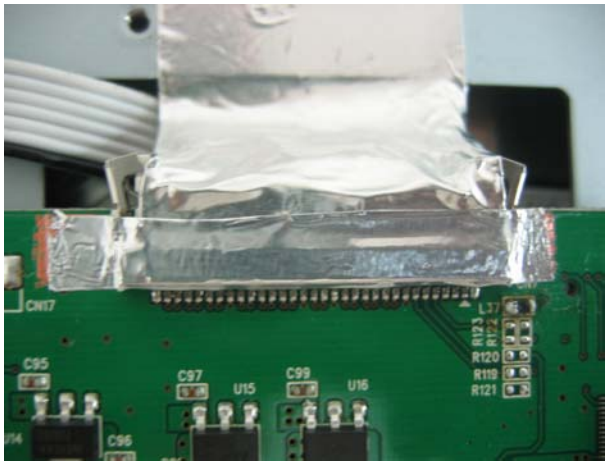

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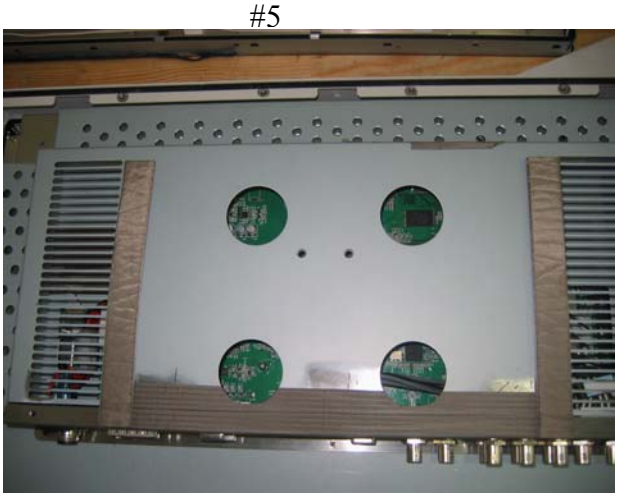
#6



#7

7. Measurement Uncertainties

Test	Uncertainty
Radiated Emissions	±3.56 dB
Conducted Emissions	±5.52 dB