

# MEASUREMENT/TECHNICAL REPORT

**HYUNDAI ELECTRONICS INDUSTRIES CO.,LTD.**

**MODEL : P790**

This report concerns(check one) : Original grant **X** Class ☐ change

Equipment type : **MONITOR**

Deferred grant requested per 47 CFR 0.457(d)(1)(☐) ? yes ☐ no **X**

If yes, defer until:

           agrees to notify the Commission by

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? yes ☐ no **X**

If no, assumed Part 15, Subpart B for unintentional radiators - the new 47 CFR [10-1-91 Edition] provision.

Report prepared by : **BONG JAE, HUR - Manager of QA Office**

**Company : HYUNDAI ELECTRONICS INDUSTRIES CO., LTD.**

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# 1. GENERAL INFORMATION

## 1.1 Product Description

The Hyundai Electronics Industries Co., Ltd. Model P790(referred to as the EUT in this report) is a 17"COLOR Monitor HOR. Freq. 93.5kHz w/max. Resolution of 1600×1200 Non-Interlaced.

Product specification information described herein was obtained from product data sheet or user's manual.

<b>CHASSIS TYPE</b>	<b>PLASTIC</b>
<b>LIST OF EACH OSC. OR XTAL. FREQ.(FREQ.≥ 1MHz)</b>	<b>6 MHz</b>
<b>CHIPSET BRAND AND PART NO.</b>	<b>SAMSUNG : LM7805</b> <b>SAMSUNG : LM7812</b> <b>SAMSUNG : KA3843</b> <b>PHILIPS : TDA4856</b> <b>PHILIPS : TDA4866</b> <b>SANKEN : STRF6654A</b> <b>NATIONAL : LM2402</b> <b>NATIONAL : LM358</b> <b>MICRO CHIP : 24LC08</b> <b>MOTOROLA : LSC4388</b> <b>TOSHIBA : TLP621</b>
<b>POWER REQUIREMENT</b>	<b>100 - 240 VAC(Universal Power) 2.5A</b>
<b>NUMBER OF LAYERS</b>	<b>MAIN BOARD 1 LAYER</b> <b>CRT SOCKET BOARD 2 LAYER</b> <b>BNC BOARD 2 LAYER</b> <b>OSD BOARD 1 LAYER</b>
<b>MAX. RESOLUTION</b>	<b>1600 X 1200 NON-INTERLACED (@ 93.5kHz/75Hz)</b>
<b>H-SYNC FREQUENCY RANGE</b>	<b>30 kHz □ 95 kHz</b>
<b>V-SYNC FREQUENCY RANGE</b>	<b>50 Hz □ 150 Hz</b>
<b>CRT SIZE</b>	<b>17" (HITACHI/ Type : M41KSX683X24)</b>
<b>VIDEO CONNECTOR TYPE</b>	<b>D-SUB 15-PIN, BNC</b>

## 1.2 Related Submittal(s) / Grant(s)

**ORIGINAL SUBMITTAL ONLY**

**The Model names for all equipment, plus descriptions used in the tested system (including inserted cards) are:**

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
COLOR MONITOR(EUT)	HYUNDAI	P790	CKLP790	HOST
PC(HOST)	H/P	HP VECTRA 500	DoC	N/A
KEYBOARD	H/P	SK-2501-2D-K	DZL211029	HOST
PRINTER	H/P	C2168A	B94C2121X	HOST
MODEM	HYUNDAI	HMD-2404M	CKL8J7HMD-2404M	HOST
VIDEO CARD	DIAMOND	STEATH 3D 3000	FTUPCI130208	HOST
MOUSE	H/P	M-S34	GYUR38SK	HOST

## 1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4/1992. Radiated testing was performed at an antenna to EUT distance of 3 meters.

## 1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data are located at the 254-1,MAEKOK-RI,HOBUP-MYUN,ICHON-SI,KYOUNGKI-DO, 467-701,KOREA. The site is constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. Detailed description of test facility was submitted to the Commission on May 22, 1997 and accepted dated July 25,1997(1300F2)

## 2.SYSTEM TEST CONFIGURATION

### 2.1 Justification

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following components and I/O cards inside the E.U.T were used.

DEVICE TYPE	MANUFACTURE	MODEL/PART NUMBER
MAIN BOARD	HYUNDAI	E4208615901
BNC BOARD	HYUNDAI	E4208615904
OSD BOARD	HYUNDAI	E4208615903
CRT SOCKET BOARD	HYUNDAI	E4208615902

### 2.2 EUT exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The software, contained on a 3-1/2 inch disc, was inserted into drive A and is auto starting on power-up. Once loaded, the program sequentially exercises each system component in turn. The sequence used is :(1) Display test, (2) RS 232 test (3) Key board test,(4) Printer test,(5) FDD test,(6) HDD test. The complete cycle takes about 20 seconds and is repeated continuously. As the keyboard and mouse are strictly input devices, no data is transmitted to them during test. They are however, continuously scanned for data input activity. The video resolution modes setup and change program was used during the radiated and conducted emission testing.

	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
PC(HOST)	N	N/A	1.5(P)
COLOR MONITOR(EUT)	N	Y	1.5(P), 1.5(D)
PARALLEL	N	Y	1.5(P), 1.5(D)
KEYBOARD	N/A	Y	1.0(D)
SERIAL	N	Y	1.5(P), 1.5(D)
MOUSE(PS/2)	N/A	Y	1.8(D)

The marked "(D)" means the Data Cable and "(P)" means the Power Cable.

## 2.4 Noise Suppression Parts on Cable.

	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
PC(HOST)	N	N/A	N	N/A
COLOR MONITOR(EUT)	Y	PC END	Y	PC END
KEYBOARD	Y	PC END	Y	PC END
PARALLEL	N	N/A	Y	BOTH END
SERIAL	N	N/A	Y	BOTH END
MOUSE(PS/2)	N	N/A	Y	PC END

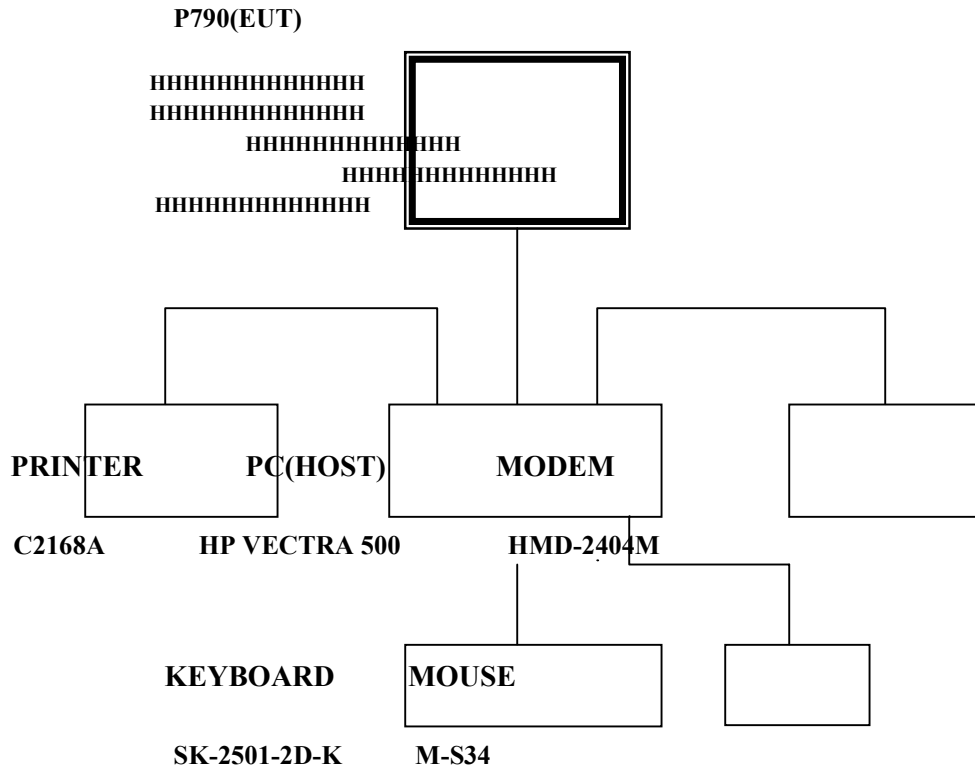
**N/A**

**Line Conducted Test :** EUT was connected to LISN, all other supporting equipment were connected to another LISN.

Preliminary Power line Conducted Emission tests were performed by using the procedure in ANSI C63.4/1992 7.2.3 to determine the worse operating conditions.

**Radiated Emission Test :** Preliminary Radiated Emissions tests were conducted using the procedure in ANSI C63.4/1992 8.3.1.1 to determine the worse operating condition. Final Radiated Emission tests were conducted at 3 meter open area test site.

**[Configuration of Tested System]**





### 3.1 AC Power line Conducted Emission Tests

During Preliminary Tests, the following operating mode were investigated

Processor Speed (MHz)	Video Resolution (w/max)	The worst operating condition
Pentium 75 MHz	1600 x 1200 Non-Interlaced (93.5KHz/75Hz)	X
Pentium 75 MHz	1280 x 1024 Non-Interlaced (91.1KHz/85Hz)	
Pentium 75 MHz	1024 x 768 Non-Interlaced (81.1KHz/100Hz)	
Pentium 75 MHz	800 x 600 Non-Interlaced (53.6KHz/85Hz)	
Pentium 75 MHz	640 x 480 Non-Interlaced (63.6KHz/120z)	

### 4.2 Radiated Emission Tests

During Preliminary Tests, the following operating mode were investigated

Processor Speed (MHz)	Video Resolution (w/max)	The worst operating condition
Pentium 75 MHz	1600 x 1200 Non-Interlaced (93.5KHz/75Hz)	X
Pentium 75 MHz	1280 x 1024 Non-Interlaced (91.1KHz/85Hz)	
Pentium 75 MHz	1024 x 768 Non-Interlaced (81.1KHz/100Hz)	
Pentium 75 MHz	800 x 600 Non-Interlaced (53.6KHz/85Hz)	
Pentium 75 MHz	640 x 480 Non-Interlaced (63.6KHz/120z)	

**NOTE :**

The monitor(EUT) has two(2) video interface port(VGA 15pin D-sub, 5 BNC) to support various kinds of graphics adapters. So the test were performed with each video interface port. The final measurement was performed with VGA 15pin D-sub video interface port that produce the worst case emission.

Tested by Sang Jun, Lee

Date : MAY. 19, 1999

## 4.1 Conducted Emissions Tests

The following table shows the highest levels of conducted emissions on both polarization of hot and neutral line.

Humidity Level : 26%                      Temperature : 24 °C  
Limit apply to : FCC CFR 47, PART 15, SUBPART B  
Type of Tests : CLASS B  
Date : MAY. 20, 1999  
Result : PASSED BY 14.4 dB

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EUT : 17" COLOR MONITOR  
Operating Condition : 1600 X 1200 Non-Interlaced (Hf : 93.5KHz, Vf : 75Hz)  
Detector : CISPR Quasi-Peak (6 dB Bandwidth : 9 KHz)

Power Line Conducted Emissions			FCC Class B	
Frequency (MHz)	Amplitude (dBuV)	Conductor	Limit (dBuV)	Margin (dB)
0.4693	27.6	HOT	48	-20.4
0.6560	29.6	NEUTRAL	48	-18.4
0.9371	26.5	HOT	48	-21.5
1.0304	33..6	HOT	48	-14.4
1.2186	28.7	HOT	48	-19.3
9.6600	26.7	HOT	48	-21.3
10.0399	26.4	NEUTRAL	48	-21.6

#### Line Conducted Emissions Tabulated Data

#### NOET:

1. All video modes and resolutions were investigated and the worst-case emissions are reported  
Other video modes & resolution were tested and found to be in compliance.
2. The limit for Class B device is 250 uV from 450 kHz to 30 MHz.

Measured by : Sang Jun, Lee / Engineer

## HYUNDAI

## RFI Voltage Test

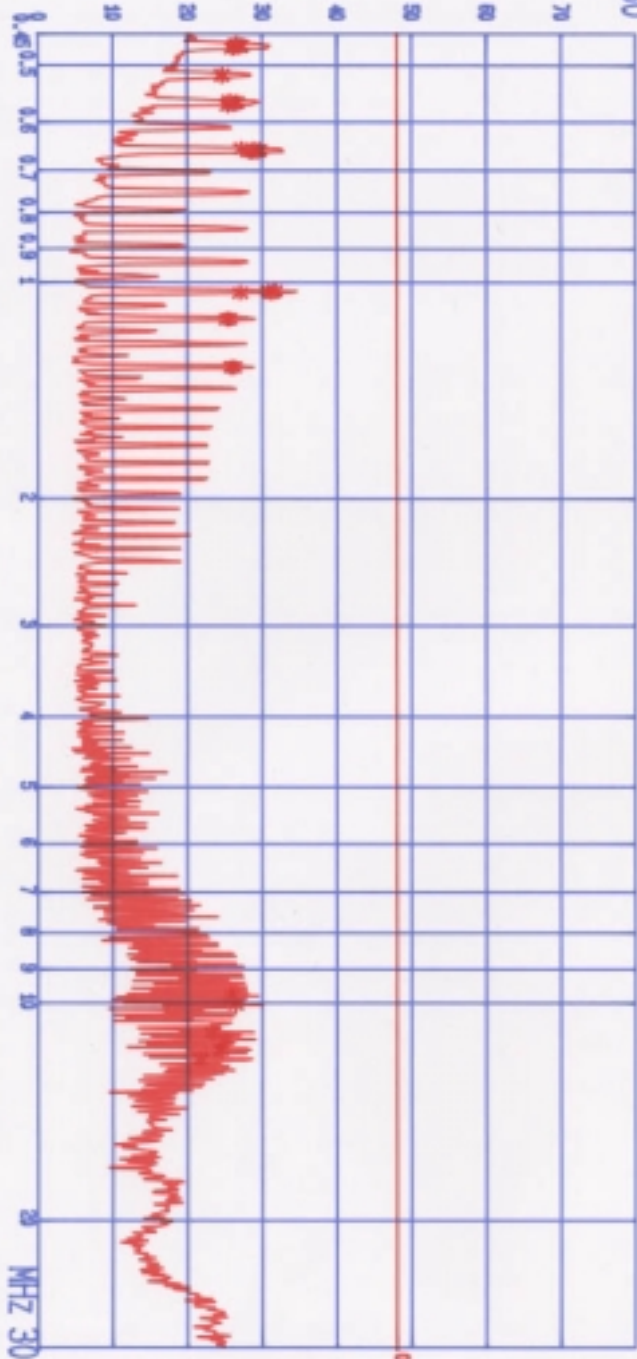
E.U.T.i P730  
Oper. Condition: 1600W1200 (Mf: 89.8MHz, Vfr: 75Hz)  
Test spec:  
PCO PART 15 SUBPART B CLASS B

Start Fr. Stop Fr. IF-BW Detec Att. Meas. T. Tread.  
MHz MHz KHz Cur dB a type  
0.4500 5.0000 10 Peak LN 0.020  
5.0000 30.0000 10 Peak LN 0.010

dBuV

80

Final evaluation: Quasi Peak  
\* = QUASI PEAK on phase: N



# HYUNDAI RFI Voltage Test

E.U.T.: P730  
 Oper. condition: 1500W1200 (44: 83.8MHz, Vt: 75Hz)  
 Test spec:  
 FCC PART 15 SUBPART B CLASS B

Frequency MHz	Exceeding values on phase: N		dB
	Peak dBV	g-Peak dBV	
0.4657	29.4	26.4	-21.5
0.4658	29.5	26.7	-21.2
0.4675	29.9	27.1	-20.8
0.4684	31.1	27.2	-20.7
0.4693	31.0	27.1	-20.8
0.4702	30.9	27.0	-20.9
0.4711	30.3	26.5	-21.4
0.4720	30.6	26.5	-21.0
0.5145	28.4	24.7	-23.2
0.5165	28.4	24.6	-23.3
0.5195	28.9	25.7	-22.2
0.5205	29.3	26.3	-21.6
0.5215	29.5	26.5	-21.3
0.5225	29.4	26.7	-21.2
0.5235	28.6	26.4	-21.5
0.5245	28.5	26.1	-21.8
0.5257	28.5	25.5	-22.4
0.5324	30.3	27.3	-20.6
0.5336	32.2	28.9	-19.0
0.5348	32.5	29.4	-18.5
0.5350	32.6	29.6	-18.3
0.5372	32.8	29.4	-18.5
0.5384	32.2	28.9	-19.0
0.5396	31.2	28.3	-19.6
1.0284	29.9	29.9	-17.0
1.0304	34.5	31.7	-16.2
1.0324	34.1	31.5	-16.3
1.0344	33.7	31.2	-16.7
1.0364	30.0	27.1	-20.8
1.1247	29.1	25.7	-22.2
1.1268	28.5	25.3	-22.6
1.3105	28.8	25.9	-22.0
1.3131	28.5	25.2	-21.7
10.7800	29.4	25.8	-22.1
10.0389	30.0	26.4	-21.5
10.9800	28.9	23.3	-24.5
11.2600	29.1	23.5	-22.9
11.6300	28.5	24.5	-23.4
11.9100	28.7	21.7	-26.2

M Limit exceeded

POWER LINE POLARITY: NEUTRAL

## HYUNDAI

## RFI Voltage Test

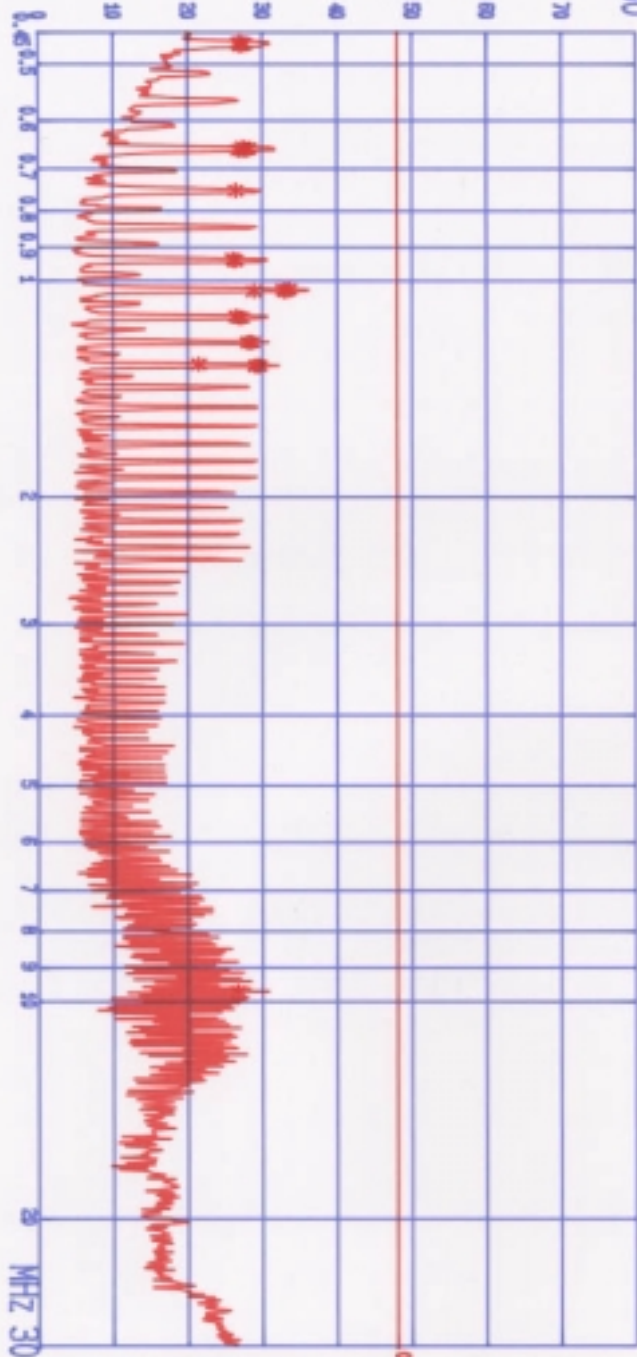
E.U.T.i P730  
Oper. condition: 1600W1200 (Mf: 88.8MHz, Vfr: 75Hz)  
Test spec:  
PCO PART 15 SUBPART B CLASS B

Start F.	Stop F.	IF-BW	Detec	Att.	Meas.T.	Transd.
MHz	MHz	KHz	Cor	dB	a	type
0.4500	5.0000	10	Peak	LN	0.020	
5.0000	30.0000	10	Peak	LN	0.010	

dBuV

80

Final evaluation: Quasi Peak  
\* = QUASI PEAK on phase: L1



POWER LINE POLARITY: HOT

# HYUNDAI RFI Voltage Test

E.U.T.: P730  
 Oper. condition: 1600W1200 (Hf: 93.60Hz, Vfr: 75Hz)  
 Test spec:  
 FCC PART 15 SUBPART B CLASS B

Exceeding values on phase: L1			
Frequency MHz	Peak dBV	2-Peak dBV	2-Peak dB-Margin
0.4687	30.6	26.9	-21.1
0.4688	30.5	27.2	-20.9
0.4675	31.1	27.5	-20.5
0.4684	30.5	27.7	-20.4
0.4693	31.1	27.6	-20.4
0.4702	30.4	27.5	-20.7
0.4711	29.5	27.0	-21.0
0.4714	30.5	27.4	-20.6
0.6548	30.4	27.9	-20.1
0.6560	32.1	28.2	-19.8
0.6572	30.6	27.9	-20.1
0.6584	31.6	27.5	-20.5
0.6595	30.0	26.8	-21.2
0.7498	29.5	26.5	-21.5
0.9353	28.9	26.0	-22.0
0.9371	30.6	26.5	-21.5
0.9389	29.4	26.5	-21.7
1.0284	30.5	26.9	-21.2
1.0304	30.3	26.5	-21.4
1.0324	30.3	26.5	-21.4
1.0344	30.8	26.0	-19.0
1.0364	31.2	26.9	-19.2
1.1226	30.4	26.4	-21.6
1.1247	30.7	27.2	-20.9
1.1268	29.7	26.8	-21.2
1.2164	30.8	28.1	-19.9
1.2185	31.0	28.7	-19.5
1.2210	30.5	28.3	-19.7
1.3081	24.8	21.5	-26.5
1.3106	32.0	29.3	-18.7
1.3131	32.1	29.5	-18.4
1.3155	31.6	29.1	-19.0
9.6600	30.8	26.7	-21.5

M List exceeded

POWER LINE POLARITY: HOT

## 4.2 Radiated Emissions Tests

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 23 %                      Temperature : 24 °C  
 Limit apply to : FCC CFR 47, PART 15, SUBPART B  
 Type of Tests : CLASS B  
 Date : MAY. 19, 1999  
 Result : PASSED BY 5.0 dB

EUT : 17" COLOR MONITOR

Operating Condition : 1600 X 1200 Non-Interlaced (Hf : 93.5 KHz, Vf : 75 Hz)

Detector : CISPR Quasi-Peak (6 dB Bandwidth : 120 KHz)

Radiated Emissions		Ant.	Correction Factors	Total	FCC Class B	
Freq. (MHz)	Ampl. (dBuV)	Pol.	Antenna & Cable Loss (dB/m)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
40.4	19.5	V	15.2	34.7	40.0	-5.3
60.7	26.1	V	8.9	35.0	40.0	-5.0
80.9	26.1	V	8.0	34.1	40.0	-5.9
162.0	19.3	V	17.5	36.8	43.5	-6.7
202.2	16.0	V	19.6	35.6	43.5	-7.9
242.7	18.7	V	20.5	39.2	46.0	-6.8
343.9	20.8	H	19.2	40.0	46.0	-6.0
364.1	19.3	H	19.8	39.1	46.0	-6.9
404.6	18.9	V	20.4	39.3	46.0	-6.7
505.7	17.0	V	22.2	39.2	46.0	-6.8
526.0	15.9	V	22.5	38.4	46.0	-7.6
546.2	17.4	V	22.6	40.0	46.0	-6.0
667.3	15.3	H	24.9	40.2	46.0	-5.8
748.1	12.8	V	26.1	38.9	46.0	-7.1
808.7	11.7	H	27.2	38.9	46.0	-7.1
869.3	8.1	H	28.1	36.2	46.0	-9.8

### NOTE:

- 1.All video modes and resolutions were investigated and the worst-case emissions are reported.
- 2.Other video modes & resolution were tested and found to be in compliance.
- 3.The EUT was test up to 2GHz and no significant emission was found.

Measured by : Sang Jun, Lee / Engineer



## 5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

Assume a receiver reading of 21.5 dBuV is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The 30 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 21.5 + 7.4 + 1.1 = 30 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm } [(30 \text{ dBuV/m})/20] = 31.6 \text{ uV/m}$$