

MEASUREMENT/TECHNICAL REPORT

HYUNDAI ELECTRONICS INDUSTRIES CO.,LTD.

MODEL : P210

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 P210(referred to as the EUT in this report) is a 21"COLOR Monitor HOR. Freq.106kHz w/max. Resolution of 1600×1200 Non-Interlaced.

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

CHASSIS TYPE	PLASTIC
LIST OF EACH OSC. OR XTAL. FREQ.(FREQ.≥ 1MHz)	6 MHz
CHIPSET BRAND AND PART NO.	SAMSUNG : KA3843 PHILIPS : TDA4856 PHILIPS : TDA8354 MITSUBISHI : M52743ASP NATIONAL : LM7805CT NATIONAL : LM7812CT NATIONAL : LM358N MICRO CHIP : 24LC08B/P MOTOROLA : MC68HC705BD9B MOTOROLA : LSC4388P2 KEC : KIA7045B N/S : LM2402 MATSUSHITA : AH5870K
POWER REQUIREMENT	100 - 240 VAC 50/60Hz (Universal Power) 140W
NUMBER OF LAYERS	MAIN BOARD 1 LAYER CRT SOCKET BOARD 1 LAYER D-SUB, BNC BOARD 1 LAYER OSD BOARD 1 LAYER
MAX. RESOLUTION	1600 X 1200 NON-INTERLACED (@ 106 kHz/85 Hz)
H-SYNC FREQUENCY RANGE	30 kHz □ 110 kHz
V-SYNC FREQUENCY RANGE	50 Hz □ 150 Hz
CRT SIZE	21" (MATSUSHITA / Type : M51LRF281X21)
VIDEO CONNECTOR TYPE	D-SUB 15-PIN, BNC

1.2 Related Submittal(s) / Grant(s)

ORIGINAL SUBMITTAL ONLY

1.3 Tested System Details

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	P210	CKLP210	HOST
PC(HOST)	H/P	HP BRIO	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	ATI	RAGER	DoC	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	E4208516001
CRT SOCKET BOARD	HYUNDAI	E4208516002
D-SUB, BNC BOARD	HYUNDAI	E4208516004
OSD BOARD	HYUNDAI	E4208516003

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.

2.3 Cable Description

	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	BOTH 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

2.5 Equipment Modifications

N/A

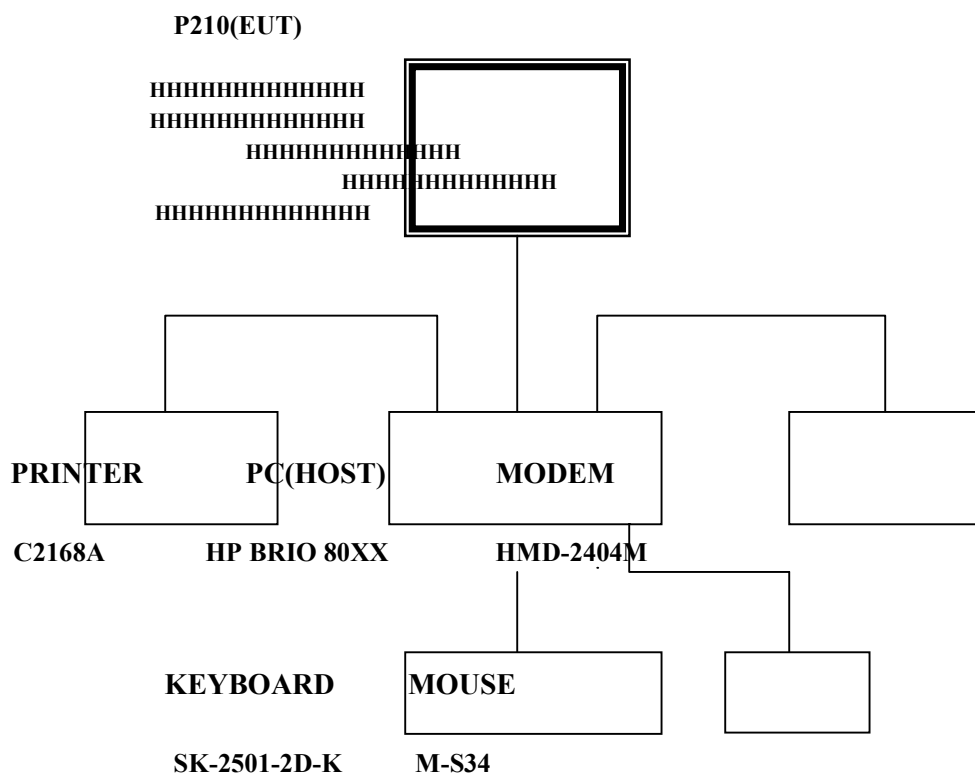
2.6 Configuration of Test system

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. PRELIMINARY TESTS

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 (106.2KHz/85Hz)	X
Pentium 75 MHz	1600 x 1200 Non-Interlaced (93.5KHz/75Hz)	
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/120Hz)	

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 (106.2KHz/85Hz)	X
Pentium 75 MHz	1600 x 1200 Non-Interlaced (93.5KHz/75Hz)	
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/120Hz)	

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 : APR. 6, 1999

4. FINAL CONDUCTED AND RADIATED EMISSION TESTS SUMMARY

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 : 22% Temperature : 15 °C
 Limit apply to : FCC CFR 47, PART 15, SUBPART B
 Type of Tests : CLASS B
 Date : APR. 7, 1999
 Result : PASSED BY 12.7 dB

EUT : 21" COLOR MONITOR
 Operating Condition : 1600 X 1200 Non-Interlaced (Hf : 106.2 KHz, Vf : 85Hz)
 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)
0.5275	35.3	NEUTRAL	48	-12.7
0.5295	34.8	NEUTRAL	48	-13.2
21.940	32.3	HOT	48	-15.7
24.380	33.7	HOT	48	-14.3
25.860	34.7	HOT	48	-13.3
26.390	33.0	HOT	48	-15.0
27.440	33.4	NEUTRAL	48	-14.7

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

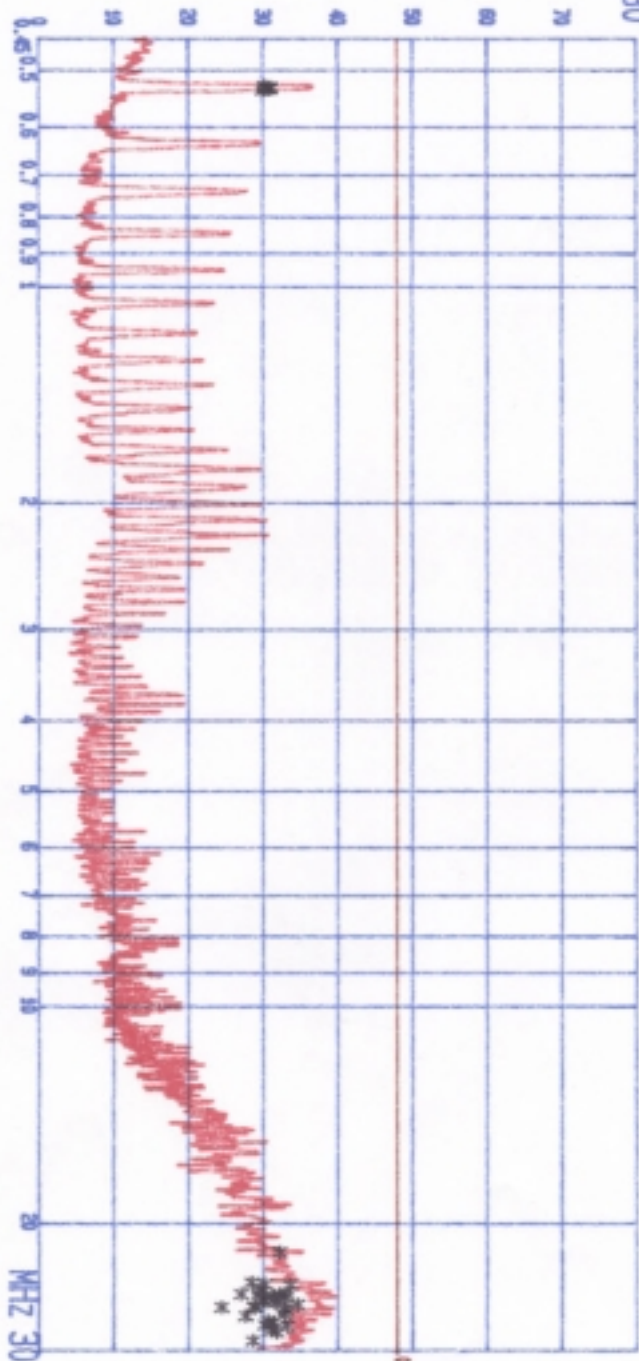
E.U.T.: P210
 Oper. Conditions: 1800 ~ 1800 (Hf=106.8MHz, V=80Hz)
 Test spec:
 FCC PART 15 SUBPART B CLASS B

Start Fr. MHz	Stop Fr. MHz	IF-BW kHz	Detector	Att. dB	Meas. T. a	Trended. 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



POWER LINE POLARITY : HOT

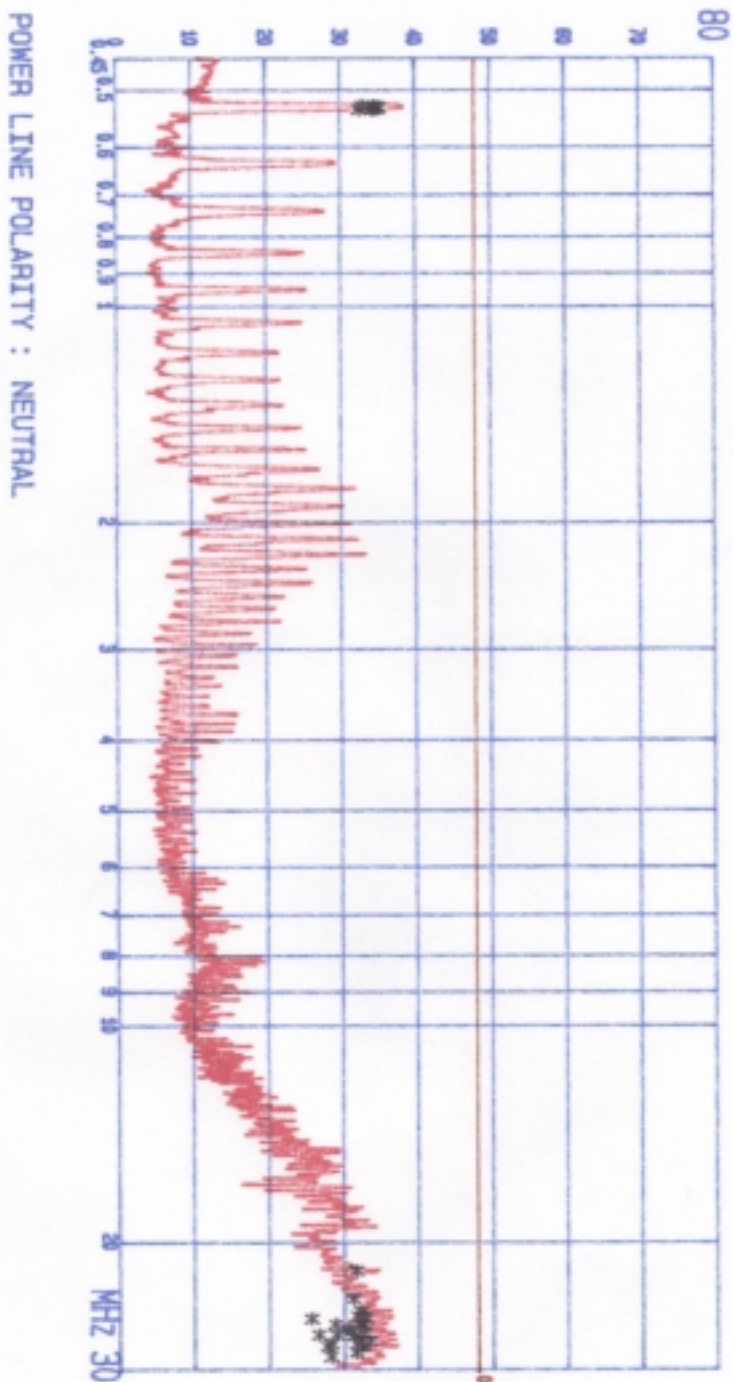
Frequency MHz	Exceeding value on dBuV	Peak dBuV	G-Peak dBuV	GP-Margin dB
0.5545	36.2	30.3		-17.7
0.5535	36.2	30.8		-17.5
0.5525	36.8	31.0		-17.0
0.5515	36.5	31.0		-17.0
0.5505	36.7	30.8		-17.2
0.5500	36.6	30.4		-17.6
0.5505	36.6	30.0		-18.0
0.5500	36.5	32.3		-15.7
24.1700	36.5	28.4		-18.6
24.2800	36.6	30.2		-17.6
24.3900	37.7	33.7		-14.3
24.7000	36.4	29.5		-18.5
24.8000	36.7	28.8		-18.1
25.0100	36.3	27.0		-15.0
25.0200	36.9	29.5		-18.5
25.1800	35.7	32.3		-15.7
25.2900	37.8	31.2		-16.6
25.3200	40.0	33.6		-14.9
25.4400	37.8	29.8		-18.2
25.5500	37.5	30.3		-17.7
25.7800	37.3	31.5		-16.4
25.8600	37.8	34.7		-13.3
26.0700	37.5	28.6		-18.2
26.1700	37.8	24.4		-23.6
26.1800	37.5	28.8		-19.1
26.2800	38.7	32.8		-15.2
26.5900	36.5	33.0		-15.0
26.8100	36.8	32.6		-16.4
27.0200	37.3	30.7		-17.3
27.3400	36.1	31.4		-18.6
27.6500	36.7	30.3		-17.7
27.7600	36.9	33.3		-14.7
28.1800	36.8	31.0		-17.0
28.5900	36.0	31.8		-16.2
29.1500	36.6	28.7		-18.3

HYUNDAI RFI Voltage Test

E.U.T.I: P210
Oper. Condition: 1800 W 1200 Ohm-100.8MHz . V1=80Hz
Test spec:
FCC PART 15 SUBPART B CLASS B

Start Freq.	Stop Freq.	IF-BW	Detec	Att.	Meas. T.	Trended.
Hz	Hz	KHz	top	dB	s	type
0.4500	5.0000	10	Peak	LN	0.050	
5.0000	30.0000	10	Peak	LN	0.010	

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



HYUNDAI RFI Voltage Test

E.U.T.: P310
Oper. conditions 1800 W 1200 (MF=105.80Hz , VF=85Hz)
Test spec:
FCC PART 15 SUBPART B CLASS B

Exceeding values on phase: L1			
Frequency MHz	Peak dBuV	0-Peak dBuV	GP-Margin dB
0.53235	37.0	33.1	-14.9
0.53245	37.9	34.6	-13.4
0.53255	38.9	36.0	-13.0
0.53265	39.3	36.3	-12.7
0.53275	39.1	36.3	-12.7
0.53285	38.7	36.1	-12.6
0.53295	38.9	34.8	-13.2
0.53305	38.8	34.4	-13.6
0.53315	38.3	32.7	-15.3
21.9400	34.8	31.6	-16.4
23.9600	35.4	31.2	-16.8
24.9100	35.7	32.3	-15.7
25.3699	35.8	31.8	-16.2
25.4400	35.8	32.6	-15.4
25.5400	36.8	32.8	-15.2
25.5500	38.9	32.7	-12.4
25.8500	38.5	32.5	-15.5
25.9700	32.8	32.5	-19.2
26.0700	36.8	32.5	-15.6
26.3800	34.3	30.5	-17.5
26.4900	34.3	31.1	-16.9
26.8100	36.3	32.6	-15.4
26.9100	30.9	26.6	-11.4
26.9500	33.1	29.0	-19.0
27.0500	35.0	31.3	-18.7
27.3400	36.9	32.4	-15.7
27.4400	37.9	33.4	-14.7
27.5500	34.1	32.0	-16.0
27.6500	32.9	28.2	-19.9
27.8600	30.7	27.8	-20.2
27.9700	28.7	26.5	-15.5
28.3900	25.6	21.7	-16.4
28.8200	23.4	20.3	-19.7

Limit exceeded

POWER LINE POLARITY : NEUTRAL

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

Humidity Level : 20 % Temperature : 19 °C
 Limit apply to : FCC CFR 47, PART 15, SUBPART B
 Type of Tests : CLASS B
 Date : APR. 7, 1999
 Result : PASSED BY 4.8 dB

EUT : 21" COLOR MONITOR
 Operating Condition : 1600 X 1200 Non-Interlaced (Hf : 106.2 kHz, Vf : 85 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)
45.9	20.7	V	13.3	34.0	40.0	-6.0
68.8	27.0	V	7.0	34.0	40.0	-6.0
114.7	23.7	V	13.3	37.0	43.5	-6.5
344.3	19.8	V	19.2	39.0	46.0	-7.0
436.1	18.0	V	21.0	39.0	46.0	-7.0
550.8	18.2	V	22.8	41.0	46.0	-5.0
573.8	16.1	V	23.2	39.3	46.0	-6.7
596.8	17.6	V	23.6	41.2	46.0	-4.8
619.7	16.9	V	24.1	41.0	46.0	-5.0
642.7	16.5	V	24.7	41.2	46.0	-4.8
665.6	15.3	V	24.9	40.2	46.0	-5.8
688.6	16.0	H	25.2	41.2	46.0	-4.8
711.5	14.5	V	25.7	40.2	46.0	-5.8
734.5	13.0	H	26.0	39.0	46.0	-7.0
780.4	13.7	V	26.8	40.5	46.0	-5.5
803.3	14.0	V	27.2	41.2	46.0	-4.8

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

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

The basic equation with a sample calculation is as follows:

$$\text{FS} = \text{RA} + \text{AF} + \text{CF}$$

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.

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

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