

**DAEWOO EMC LAB.****F C C M E A S U R E M E N T R E P O R T**

Test report file No.	99-DEL-102	Date of issue :	Sept. 15. 1999
Model / Type No.	IM986A		
Kind of product	Color Monitor		
Original Applicant	IMRI Co., Ltd.		
Manufacturer	IMRI Co., Ltd.		
Address	270-2, Hunshin-Dong, Sangju-City, Kyungsangbuk-Do, Korea		

Test result according to the regulation(s)

☒ Compliance
 ☐ Fail

Report prepared for : Korea Compliance Engineering Service Inc.
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Report prepared by

 **DAEWOO EMC Lab.**

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This test report with appendix consists of **18** pages. The test result only responds to the tested sample (**SN : N/A**). It is not allowed to copy this report even partly without the allowance of the Test Laboratory.

This equipment as for has been shown to be capable of continued compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in **ANSI C63.4-1992** .

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1. SUMMARY

GENERAL REMARKS:

The equipment is not modified anything, mechanical or circuit to improve EMI status during a measurement and complied the regulation “Part 15 subpart B Class B of CRF 47”.

FINAL JUDGMENT:

The requirements according to the technical regulations are

- - Kept □ - Not kept

The equipment under test does

- - fulfill the general approval requirements of Class B Part 15 subpart B of CRF 47 .
- - Not fulfill the general approval requirements.

Begin of testing : September 14, 1999

End of testing : September 15, 1999

Reviewed by :

Approved by :

Joon Hwan, Lee

Joon H. Lee / EMC Manager

Gil , Chung

G. Chung / Chip Manager

2. GENERAL DESCRIPTION

2.1 Test Facility

The open field test site and conducted measurement facility used to collect the radiated data are located San 21-8 Goan-Ri Baekam-Myun, Yongin-Shi, Kyunggi-Do, KOREA.

The site is constructed in conformance with the requirement of ANSI C63.4 and CISPR Publication 22. The detail description of test facility was submitted to the commission and accepted by commission.

2.2 Test Regulation

Both conducted and radiated emission testing were performed according to the procedures in ANSI C63.4/1992. The radiated emission test was performed at an antenna to EUT distance of 3 meters as described below.

2.3 Description of Test

Radiated Emissions:

Radiated emission measurements were in accordance with § 12.2 in ANSI C63.4-1992 "Measurement of TV Interface Devices". The measurements were performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurements were made with the detector set for "quasi-peak" within a bandwidth of 120KHz.

- Procedure of Test

Preliminary measurements were made at 3 meter using broadband antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 200MHz using S/B biconical antenna and 200 to 1000MHz using S/B log-periodic antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site no. 2 at 3-meter test range using S/B bi-log antennas or horn antenna. The test equipment was placed on a wooden turn-table. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the max. emission. Each emission was maximized by: varying the mode of operation to the EUT and/or support equipment and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Photo 2 of page 10.

Conducted Emissions:

Conducted emissions measurements were made in accordance with § 12.2 in ANSI C63.4-1992 "Measurement of TV Interface Devices". The measurement were performed over the frequency

range of 0.45MHz to 30MHz using a 50 Ω /50uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within an bandwidth of 10KHz or for "quasi-peak" within a bandwidth of 9KHz.

- Procedure of Test

The line-conducted facility is located inside a shielded room no. 1. A 1m X 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 1.5m away from the side wall of the shielded room. R/S ESH3-Z5 and EMCO 3825/2 LISN are bonded to the shielded room. The EUT is powered from the EMCO LISN and the support equipment is powered from the R/S LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the EMCO LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the R/S receiver to determine the frequency producing the max. emission from the EUT. The frequency producing the max. level was reexamined using to set Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.45 to 30MHz. The bandwidth of the receiver was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission.

2.4 Test Conditions

The measurement the conducted emissions (interference voltage) was performed in a shielded room.

Test location :

■ - Shielded room no. 1

□ - Compact chamber 2

Used testing instruments :

■ - ESH 3	Rohde & Schwarz	Receiver	No.90-IRV-07
■ - EZM	Rohde & Schwarz	Spectrum Monitor	No.90-IAS-03
□ - 8566B	HP	Spectrum Analyzer	No. 94-ISP-12
□ - FMLK1518	Schwarzbeck	Receiver	No.90-IRV-12

Test - accessories :

□ - 3725/2	EMCO	LISN	No.90-ILN-08
■ - 3825/2	EMCO	LISN	No.90-ILN-09
□ - ESH 2-Z5	Rohde & Schwarz	LISN	No.88-ILN-06
□ - KNW-407	Kyoriteu	LISN	No.91-ILN-12
■ - ESH 3-Z5	Rohde & Schwarz	LISN	No.91-ILN-07

The measurement of the radiated emissions(electric field) in the frequency range of 30 MHz ~ 1000MHz was performed in horizontal and vertical antenna polarization at a non-reflecting open-site and a test distance of:

- - Open-site 2
- - 3 meters

- - Compact chamber
- - 10 meters

Used testing instruments :

□ - ESVS 10	Rohde & schwarz	Receiver	No.95-IRV-13
■ - ESVP	Rohde & schwarz	Receiver	No.90-IRV-09
□ - 8447D	HP	Amplifier	No.90-IAP-03

Test - accessories :

□ - BBA 9106	Schwarzbeck	Balun	No.90-IAN-29
■ - VHALP 9107	Schwarzbeck	Dipole Antenna	No.90-IAN-36
■ - UHALP 9107	Schwarzbeck	Dipole Antenna	No.90-IAN-37
□ - UHA 9105	Schwarzbeck	Dipole Antenna	No.90-IAN-22
□ - VHA 9103	Schwarzbeck	Dipole Antenna	No.90-IAN-15
■ - VULB 9160	Schwarzbeck	Bi-Log Antenna	No.98-IAN-47
□ - 6502	EMCO	Biconical Antenna	No.90-IAN-04
□ - 3115	EMCO	Log-periodic Antenna	No.90-IAN-39

All used test-instruments as well as the test-accessories are calibrated regularly.

2.5 Product (Equipment Under Test) Information

The Equipment Under Test(EUT) is the IMRI Co.,Ltd. 19 inch Color Monitor Model : IM986A.

- H-Sync Frequency Range : 30KHz ~ 95KHz
- V-Sync Frequency Range : 50Hz ~ 150Hz
- Max Resolution : 1600 ×1200 Non-Interlaced (@93.5KHz/75Hz)
- CRT Size : 19" (LG / Type : M46QCG913X01)
- List of Each OSC. or X-TAL Freq.(Freq.≥1MHz) : 6MHz
- Input Video Signal : Analogue 0.7 Vp-p Positive at 75 Ohms
- Input Sync Signal : Seperate Sync : TTL Level Positive/Negative
Composite Sync : TTL Level Positive/Negative
- Power Requirement: 100 – 240 VAC 1.8A 50/60 Hz
- Power Consumption: 110W Max.
- Cable: Unshielded Power cable / Shielded Signal cable
- Video Input Connector : 15-Pin D-SUB type connector
- Operating Condition Humidity : 80% RH max, Temperature 0°C ~ 40°C(32°F ~ 104°F)
- Dimensions: 455mm(W) X 465mm(H) X 465mm(D)
- Weight(Approx): 23kg

3. SYSTEM TEST CONFIGURATION

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following conditions and configurations were used.

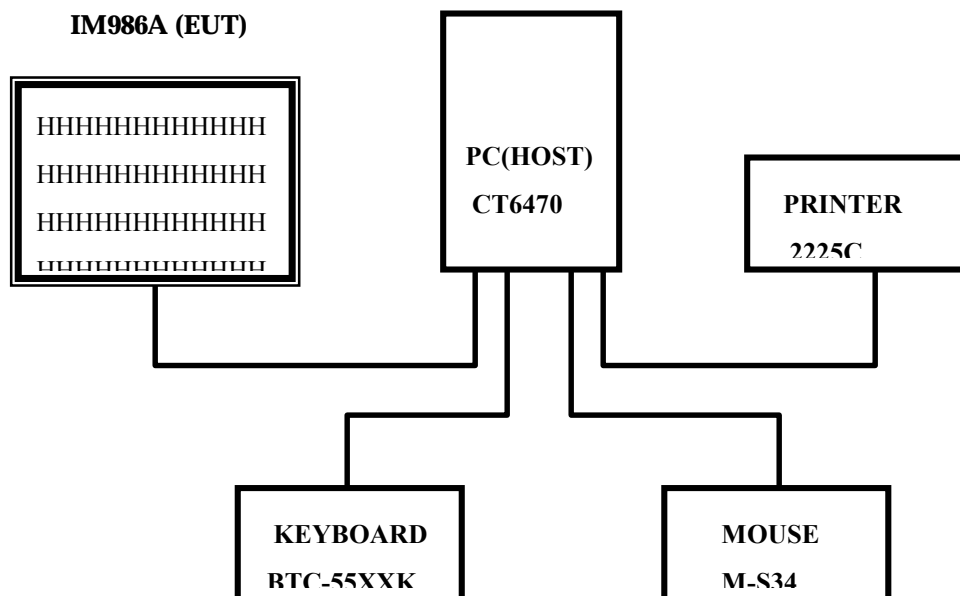
3.1 EUT exercise software

The EUT exercise program used during the radiated and conducted testing was designated 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) RS232 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.

3.2 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 Clause 7.2.3 to determine the worst operating conditions.

- Radiated Emission Test : Preliminary radiated emission tests were conducted using the procedure in ANSI C63.4/1992 Clause 8.3.1.1 to determine the worst operating condition. Final radiated emission tests were conducted at 3 meter open field test site.



3.3 Tested System Details

Following peripheral devices and interface cables were connected during the measurement:

Equipment	Type	Brand	Serial No.	FCC ID
Color Monitor (EUT)	IM986A	IMRI	N/A	OMNIM986
PC(HOST)	CT6470	Daewoo	CT6470-4M468M	DoC
Keyboard	BTC-55XXK	Daewoo	K78101009	LAK55XXK-A1
Printer	22225C	Northern Telecom	3119S96158	DSI6XU2225
Video Card	Revolution 3D PCI	Number Nine	32800200-12731 -7AD-1677	DoC
Mouse	M-S34	Logitech	LZB8421250B	DZL211029

3.4 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)

NOTE : The marked "(D)" means the data cable and "(P)" means the power cable

3.5 Noise Suppression Parts on Cable.

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

4. Preliminary Tests

4.1 AC Power line Conducted Emission Tests

During Preliminary Tests, the following operating modes 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 (64KHz/60Hz)	
Pentium 75 MHz	1024 X 768 Non-Interlaced (68.7KHz/85Hz)	
Pentium 75 MHz	800 X 600 Non-Interlaced (53.6KHz/85Hz)	
Pentium 75 MHz	640 X 480 Non-Interlaced (43.2KHz/85Hz)	

4.2 Radiated Emission Tests

During Preliminary Tests, the following operating modes 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 (64KHz/60Hz)	
Pentium 75 MHz	1024 X 768 Non-Interlaced (68.7KHz/85Hz)	
Pentium 75 MHz	800 X 600 Non-Interlaced (53.6KHz/85Hz)	
Pentium 75 MHz	640 X 480 Non-Interlaced (43.2KHz/85Hz)	

4.3 Operation mode of the E.U.T.:

The equipment under test was operated during the measurement under following conditions:

- ☐ - Standby
- ☒ - Play mode: Pull H-Character
- ☐ - Testprogram

5. FINAL CONDUCTED AND RADIATED EMISSION TESTS SUMMARY

5.1 TEST RESULT SUMMARY

Conducted emissions 450 kHz ~ 30MHz

■ - Pass

The requirements are.

■ - Kept

□ - Not kept

Min. limit margin.

-4.8 dB

at 11.5641 MHz

Remarks: See the test-data & graphs to be attached .

Radiated emissions (electric field) 30 MHz ~ 1000 MHz

■ - Pass

The requirements are.

■ - Kept

□ - Not kept

Min. limit margin.

-3.3 dB

At 389.28 MHz

Remarks: See the test to be attached.

5.2 Conducted Emission Test Data

EUT Type	19" Color Monitor IM-986A (SN:N/A)
Limit apply to	FCC CFR 47, PART15, SUBPART B
Type of Tests	CLASS B
Manufacturer	IMRI Co., Ltd.
Operation Condition	1600 X 1200 Non-Interlaced (Hf : 93.5KHz, Vf : 75Hz)
	Humidity Level : 22%, Temperature : 25 °C
Date	September 15, 1999

Line Conducted Emission Tabulated Data

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

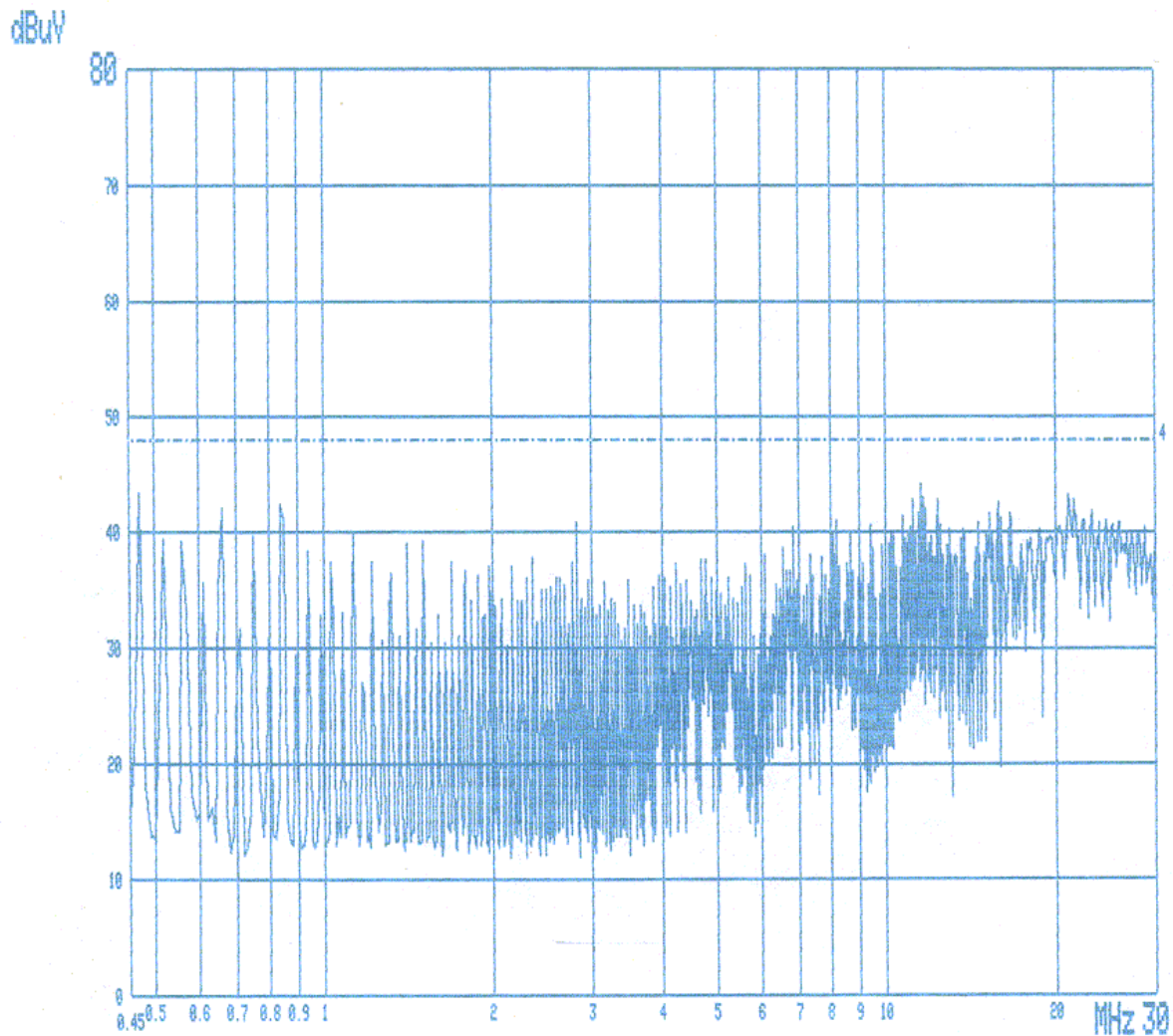
Detector mode : Peak mode (6dB Bandwidth : 9 Hz)

Frequency [MHz]	Reading [dBμV]	Phase (*L/**N)	Limit [dBμV]	Margin [dB]
0.4701	41.8	N	48	-6.2
0.6581	41.2	N	48	-6.8
0.8462	40.7	N	48	-7.3
2.8206	40.3	N	48	-7.7
11.1880	40.8	N	48	-7.2
11.5641	43.2	N	48	-4.8
12.4102	41.5	N	48	-6.5
15.8889	40.5	N	48	-7.5
21.0590	39.3	N	48	-8.7
23.3100	36.9	N	48	-11.1
All frequencies had been -4.8dB margin at least.				

NOTE : * L: Live Line , ** N: Neutral Line

All video modes and resolutions were investigated and the worst case emissions are reported. Other video modes and resolutions were tested and found to be compliance.

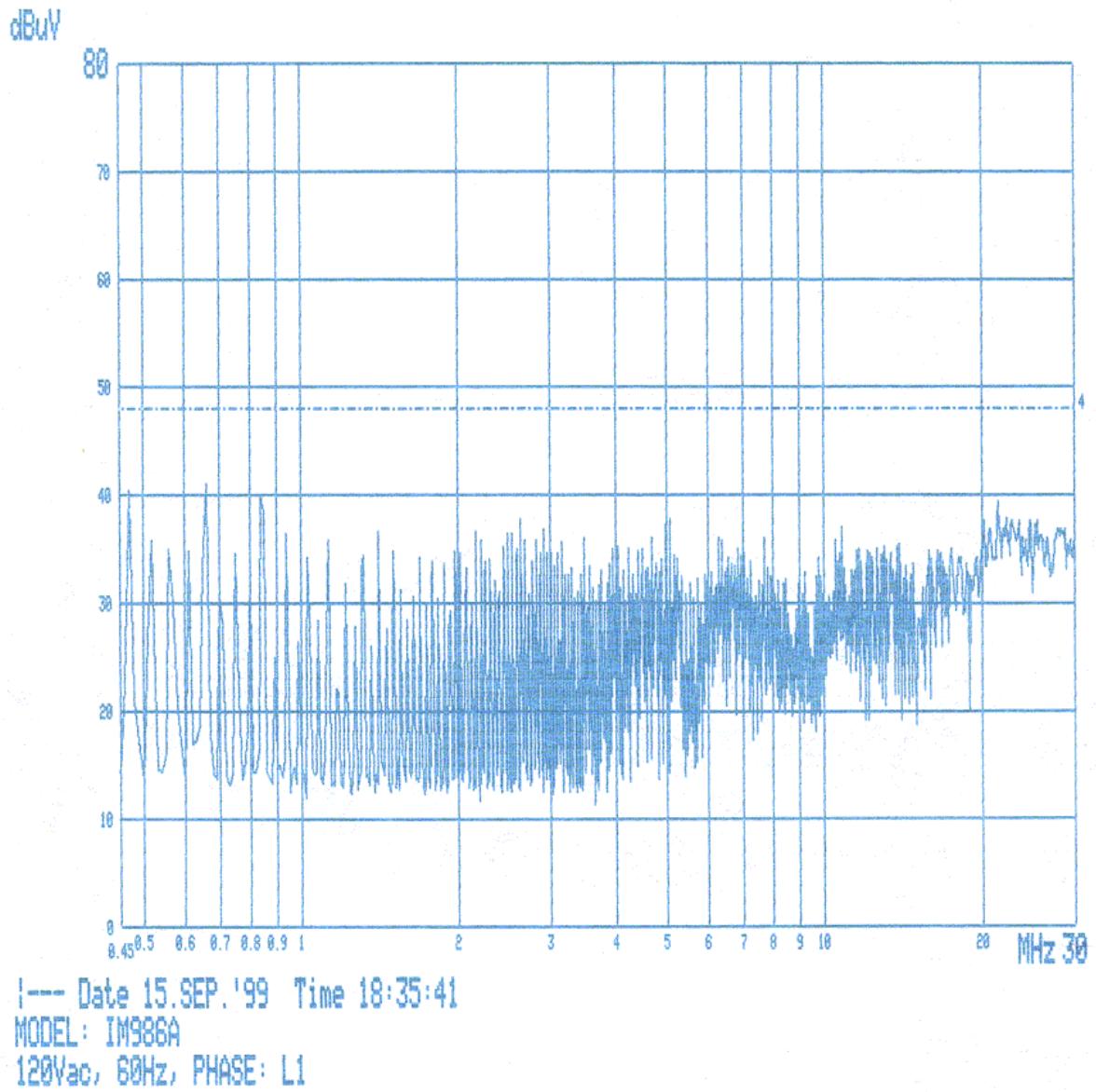
Tested by : Soon-Chul, Jang / Test Engineer
Daewoo EMC Lab.



--- Date 15.SEP.'99 Time 18:22:46

MODEL: IM986A

120Vac, 60Hz, PHASE: N



5.3 Radiated Emission Test Data

EUT Type	19" Color Monitor IM-986A (SN:N/A)
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Limit apply to	FCC CFR 47, PART15, SUBPART B
Type of Tests	CLASS B
Manufacturer	IMRI Co., Ltd.
Operation Condition	1600 X 1200 Non-Interlaced (Hf : 93.5KHz, Vf : 75Hz)
	Humidity Level : 22%, Temperature : 25 °C
Date	September 15, 1999

Radiated Emission Tabulated Data

The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

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

Frequency [MHz]	Reading [dBμV/m]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Result [dBμV/m]	Limit [dB]	Margin [dB]
82.00	16.0	V	7.5	3.8	27.3	40.0	-12.7
118.50	16.5	H	10.2	4.1	30.8	43.5	-12.7
152.35	14.2	H	12.8	4.3	31.3	43.5	-12.2
169.27	19.3	H	12.9	4.1	36.3	43.5	-7.2
186.11	23.1	H	10.8	4.2	38.1	43.5	-5.4
253.82	21.3	H	10.9	4.7	36.9	46.0	-9.1
270.75	20.7	H	11.5	4.9	37.1	46.0	-8.9
279.19	19.0	H	11.5	4.9	35.4	46.0	-10.6
287.67	17.1	H	11.9	4.9	33.9	46.0	-12.1
304.66	21.7	H	12.5	5.4	39.6	46.0	-6.4
389.28	22.3	V	14.2	6.2	42.7	46.0	-3.3
406.18	16.8	V	14.8	6.9	38.5	46.0	-7.5
575.42	15.0	H	18.2	7.3	40.5	46.0	-5.5

NOTE : * H : Horizontal polarization , ** V : Vertical polarization

All video modes and resolutions were investigated and the worst case emissions are reported. Other video modes and resolutions were tested and found to be compliance.

Tested by : Soon-Chul, Jang / Test Engineer
Daewoo EMC Lab.

6. 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 ;

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

where FS = Field strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

Assume a receiver reading of 16 dBuV is obtained. The antenna factor of 7.5 and cable factor of 3.8 is added. The 30 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$\mathbf{FS = 16 + 7.5 + 3.8 = 27.3 \text{ dBuV/m}}$$

$$\mathbf{\text{Level in uV/m} = \text{Common Antilogarithm } [(27.3 \text{ dBuV/m})/20] = 23.2 \text{ uV/m}}$$