

Electromagnetic Emission

FCC MEASUREMENT REPORT

CERTIFICATION OF COMPLIANCE

FCC Part 15 Certification Measurement

PRODUCT : LCD Monitor
MODEL/TYPE NO : ELM-900K
FCC ID : OIOELM-900K
APPLICANT : Erae Electronics Industry Co., Ltd.
#371-51, Kasan-Dong, Keumcheon-Ku, Seoul, 153-803, Korea
Attn.: Woon Seok, Yu / Deputy General Manager
MANUFACTURER : Erae Electronics Industry Co., Ltd.
#371-51, Kasan-Dong, Keumcheon-Ku, Seoul, 153-803, Korea
FCC CLASSIFICATION : Class B personal computers and peripherals
FCC RULE PART(S) : FCC Part 15 Subpart B
FCC PROCEDURE : Certification
TRADE NAME : ERAE
TEST REPORT No. : ETLE060601.242
DATES OF TEST : June 05, 2006
REPORT ISSUE DATE : June 12, 2006
TEST LABORATORY : ETL Inc. (FCC Registration Number : 95422)

This LCD Monitor, Model ELM-900K has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 at the ETL/EMC Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart B:

I attest to the accuracy of data. All measurement herein was performed by me or was made under my supervision and is correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.


Chon Sik, Kim / Chief Engineer

ETL Inc.

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FCC MEASUREMENT REPORT

Scope – Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)

General Information

Applicant Name : Erae Electronics Industry Co., Ltd.

Address : 371-51,Kasan-Dong,Keumcheon-Ku,Seoul,
153-803, Korea

Attention : Woon Seok, Yu / Deputy General Manager

- **EUT Type** : LCD Monitor
- **Model Number** : ELM-900K
- **FCC ID** : OIOELM-900K
- **S/N** : N/A
- **FCC Rule Part(s)** : FCC Part 15 Subpart B
- **Test Procedure** : ANSI C63.4-2003
- **FCC Classification** : Class B personal computers and peripherals
- **Dates of Tests** : June 05, 2006
- **Place of Tests** : ETL Inc.
EMC Testing Lab. (FCC Registration Number : 95422)
#584, Sangwhal-ri, Ganam-myeon, Yoju-gun,
Gyeonggi-do, 469-885, Korea
Tel : 82-31-885-0072 Fax : 82-31-885-0074
- **Test Report No.** : ETLE060601.242

1. INTRODUCTION

The measurement test for radiated and conducted emission test were conducted at the open area test site of E-RAE Testing Laboratory Inc. facility located at #584, Sangwhal-ri, Ganam-myeon, Yoju-gun, Gyeonggi-do, 469-885, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-2003 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 and 10 meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-2003 and registered to the Federal Communications Commission (Registration Number : 95422).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions from the Erae Electronics Industry Co., Ltd., Model: ELM-900K.

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the Erae Electronics Industry Co., Ltd., Model: ELM-900K.

2.2 General Specification

Model Name		ELM-900K
LCD	Visible Screen Area	376.32(H) × 301.056(V) 19.0 inch
	Pixel Pitch	0.294(H) × 0.294(W)
	Maximum Visible Angle	89 °/ 89 °/ 89 °/ 89 ° (Top/Bottom/Left/Right)
	Displayed Color	16.7 M
	Response Time	8 msec (G to G)
	Brightness	300 cd/m ²
	Contrast Rate	1000:1
	Recommended Resolution	1280 × 1024 (60 Hz)
Video Signal	Horizontal Frequency	31 KHz ~ 81 KHz
	Vertical Frequency	56 Hz ~ 75 Hz
Power	AC (Adapter)	110 – 240 V, 50/60 Hz
	DC (Monitor)	(12 V, 3.5 A)
	Power Consumption	Max. 40 W, Power Save Mode 2 W

3. DESCRIPTION OF TESTS

3.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2003. The measurements were performed over the frequency range of 0.15MHz to 30MHz using a 50Ω/50uH LISN as the input transducer to a Spectrum Analyzer or a Test Receiver. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 9 kHz or for "quasi-peak" within a bandwidth of 9 kHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1 m x 1.5 m x 0.8m wooden table which is placed 40 cm away from the vertical wall and 1.5 m away from the side wall of the chamber room. Two LISN are bonded to the shielded room. The EUT is powered from the LISN and the support equipment is powered from the other 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 these supply lines will be connected to the LISN. Non-inductive bundling to a 1m length shortened all interconnecting cables more than 1m. 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 EMI Test Receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using to set Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.15 to 30 MHz. The bandwidth of the spectrum analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission.

Photographs of the worst-case emission can be seen in photographs of conducted emission test setup in Appendix B.

3.2 Radiated Emission Measurement

Radiated emission measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2003. The measurements were performed over the frequency range of 30 MHz to 1 GHz 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 120 kHz.

Preliminary measurements were made at 10 meter using broadband antennas, and spectrum analyzer to determine the frequency producing the maximum emission in shielded room. 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 1000 MHz using Log-Bicon antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site at 10-meters. 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 120 kHz 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 maximum 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 maximum 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 Photographs of the worst-case emission test setup can be seen in Appendix B.

4. TEST CONDITION

4.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the EUT and the supported equipments were installed to meet FCC requirement and operated in a manner and which tends to maximize its emission level in a typical application.

4.2 EUT operation

Operating Mode	The worst operating condition
Stand-by mode	X
640 * 480 Vf = 75 Hz, Full "H" pattern display mode	X
800 * 600 Vf = 75 Hz, Full "H" pattern display mode	X
1024 * 768 Vf = 75 Hz, Full "H" pattern display mode	X
1280 * 1024 Vf = 75 Hz, Full "H" pattern display mode	◎

◎ : Worst case investigated during the test.

4.3 Support Equipment Used

EUT – LCD Monitor

FCC ID : OIOELM-900K
Model Name : ELM-900K
Serial No. : N/A
Manufacturer : Erae Electronics Industry Co., Ltd.
Power Supply Type : Power Supply from DC 12V of AC/DC Adapter
Power Cord : Shielded, Detachable : 1.5m
Data Cable : D-SUB 1.5 m, DVI 1.5 m

Support Unit 2 – Personal computer (DELL)

FCC ID : N/A (DoC)
Model Name : DHM
Serial No. : H9MB71S
Manufacturer : DELL Asia Pacific Sdn.
Power Supply Type : Switching
Power Cord : Non-Shielded, Detachable: 1.2m
Data Port : RGB out:1, DVI out:1, Parallel:1, RS-232:1, PS/2: 2, USB: 4, RJ-45:1
Audio in:1, Audio out:1, MIC in:1

Support Unit 2 – Printer

FCC ID : N/A
Model Name : Color cap 330
Serial No. : 11-03098
Manufacturer : Lexmark International
Power Supply Type : AC 110V~220V
Power Cord : Non-Shield, 1.5m
Data Cable : Shielded, 1.5m

Support Unit 3 – Keyboard

FCC ID : N/A (DoC)
Model Name : KB-9963
Serial No. : B26960GBUKO13F
Manufacturer : Chicony Elec.
Power Supply Type : N/A
Power Cord : N/A
Data Cable : Shielded, 1.5m

Support Unit 4 – Mouse

FCC ID : N/A (DoC)
Model Name : M-S34
Serial No. : LNA10212779
Manufacturer : Logitech
Power Supply Type : N/A
Power Cord : N/A
Data Cable : None-Shielded, 1.2m

Support Unit 5 – EAR MIC

FCC ID : N/A (DoC)
Model Name : JE101
Serial No. : NONE
Manufacturer : Jotech
Power Supply Type : N/A
Power Cord : N/A
Data Cable : None-Shielded, 1.0m

5. TEST RESULTS

5.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

FCC Rule	Measurement Required	Result
15.107	Conducted Emission Measurement	Passed by 7.6 dB
15.109	Radiated Emission Measurement	Passed by 3.0 dB

The data collected shows that the **Erae Electronics Industry Co., Ltd. / LCD Monitor / ELM-900K** complied with technical requirements of above rules part 15.107 and 15.109 Class B Limits and CISPR Publication 22.

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

5.2 Conducted Emissions Measurement

EUT	LCD Monitor / ELM-900K (SN :N/A)
Limit apply to	FCC Part 15. 107(CISPR Pub.22 Class B)
Test Date	June 05, 2006
Operating Condition	1280 * 1024 Vf = 75Hz, Full "H" pattern display mode
Environment Condition	Humidity Level : 58 % R.H., Temperature : 20 °C
Result	Passed by 7.6 dB

Conducted Emission Test Data

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

Detector mode: CISPR Quasi-Peak mode (6dB Bandwidth : 9 kHz)

Frequency [MHz]	Result [dB μ V]		Phase (*H/**N)	Limit [dB μ V]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Quasi-peak	Average
0.180	42.0	33.3	H	64.5	54.5	22.2	21.2
0.420	37.2	35.3	H	57.4	47.4	20.2	12.1
0.482	40.2	38.7	N	56.3	46.3	16.1	7.6
0.541	39.8	38.1	N	56.0	46.0	16.2	7.9
0.661	37.4	34.3	N	56.0	46.0	18.6	11.7
0.779	36.5	32.2	H	56.0	46.0	19.5	13.8
15.561	35.0	31.2	N	60.0	50.0	25.0	18.8
17.781	35.9	33.1	N	60.0	50.0	24.1	16.9
19.458	37.8	34.0	N	60.0	50.0	22.2	16.0

NOTES: 1. * H: HOT Line , **N: Neutral Line

2. Margin value = Limit – Result

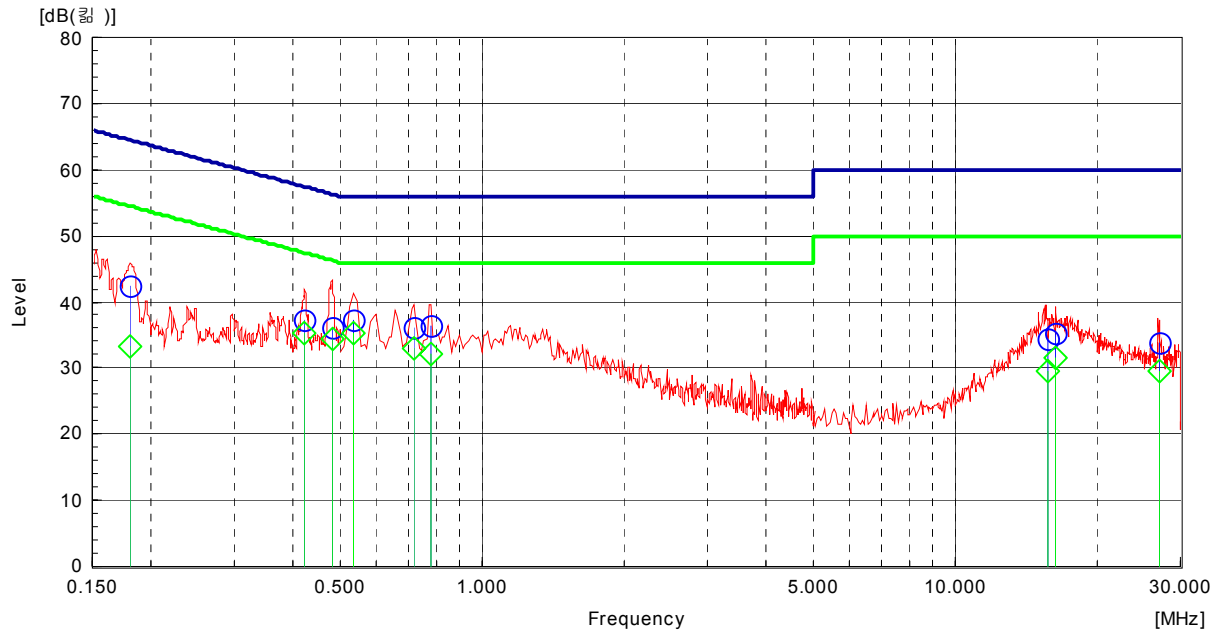
3. Measurement were performed at the AC Power Inlet in the frequency band of 150 kHz ~ 30 MHz according to the FCC Part 15 and CISPR 22 Class B



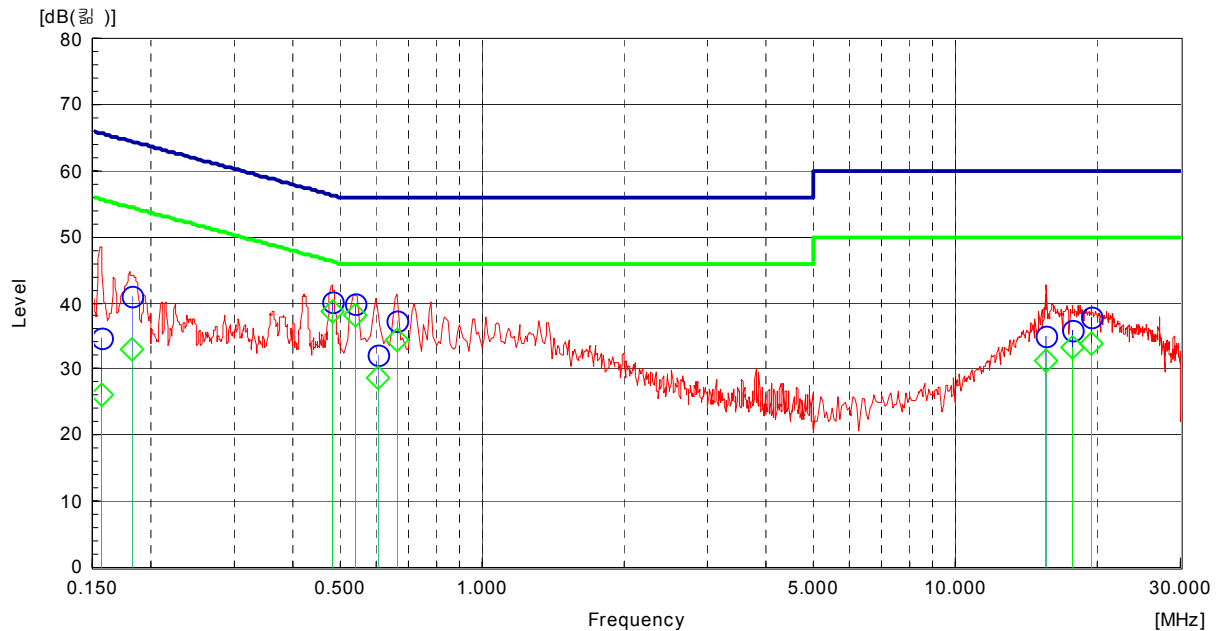
Test Engineer: Jae Young, Kwon

Line: HOT Line

Limit : — Quasi-Peak
— Average



Line: Neutral Line



Quasi-peak ○ Average ◇

5.3. Radiated Emissions Measurement

EUT	LCD Monitor / ELM-900K (SN :N/A)
Limit apply to	FCC Part 15. 109(CISPR Pub.22 Class B)
Test Date	June 05, 2006
Operating Condition	1280 * 1024 Vf = 75Hz, Full "H" pattern display mode
Environment Condition	Humidity Level : 58 % R.H., Temperature : 20 °C
Result	Passed by 3.0 dB

Radiated Emission Test Data

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

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

Frequency [MHz]	Reading [dB μ V]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB μ V]	Emission Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
48.90	9.32	V	9.80	2.08	21.20	30.0	8.80
115.05	11.84	H	10.56	3.00	25.40	30.0	4.60
143.40	11.05	V	11.70	3.45	26.20	30.0	3.80
162.30	11.56	V	11.62	3.72	26.90	30.0	3.10
171.75	12.10	V	10.78	3.82	26.70	30.0	3.30
345.50	8.89	H	13.57	6.05	28.50	37.0	8.50
402.34	5.64	V	14.53	6.63	26.80	37.0	10.20
459.25	5.78	V	16.04	7.27	29.10	37.0	7.90
574.75	7.04	V	18.31	8.65	34.00	37.0	3.00
688.50	4.04	H	20.23	9.53	33.80	37.0	3.20

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

Result = Reading + Antenna factor + Cable loss

Margin value = Limit - Result

The measurement was performed for the frequency range 30 MHz ~ 1 000 MHz according to the CISPR 22 Class B



Test Engineer: Jae Young, Kwon

6. SAMPLE CALCULATION

Sample 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

$$\text{dB}(\mu\text{V}) = 20 \log_{10} (\mu\text{V})$$

$$\text{dB}\mu\text{V} = \text{dBm} + 107$$

Example : @ 574.75 MHz

$$\text{Class B Limit} = 70.8 \mu\text{V/m} = 37 \text{ dB } \mu\text{V/m}$$

$$\text{Reading} = 7.04 \text{ dB } \mu\text{V}$$

$$\text{Antenna Factor} + \text{Cable Loss} = 18.31 + 8.65 = 26.96 \text{ dB } \mu\text{V/m}$$

$$\text{Total} = 34.0 \text{ dB } \mu\text{V/m}$$

$$\text{Margin} = 37 - 34.0 = 3.0 \text{ dB}$$

$$= 3.0 \text{ dB below Limit}$$

7. List of test equipments used for measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
☒	EMI TEST Receiver	ESVS 10	R & S	835165/001	07-04-25
☒	EMI TEST Receiver	ESPI	R & S	100478	06-10-17
☒	LISN	3816-2	EMCO	1002	06-10-17
☒	LISN	3825/2	EMCO	9208-1995	07-04-06
☒	LogBicon Antenna	VULB9165	Schwarz Beck	2023	06-07-05
☒	Turn-Table	DETT-03	Daeil EMC	-	N/A
☒	Antenna Master	DEAM-03	Daeil EMC	-	N/A

End of Test Report