



HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.

Product Compliance Division, EMC Team
SAN 136-1, AMI-RI , BUBAL-EUP, ICHEON-SI, KYOUNKI-DO, 467-701, KOREA
TEL : +82 31 639 8518 FAX : +82 31 639 8525

CERTIFICATION

Manufacture;
KOREA DATA SYSTEMS CO.,LTD.

170 Gongdan-Dong, Gumi-Si, Gyungbuk, 730-030,
Korea

KOREA DATA SYSTEMS FRN : 0005-8974-34

Date of Issue : NOVEMBER 11, 2003

Test Report No.: HCT-F03-1101

**Test Site: HYUNDAI CALIBRATION & CERTIFICATION
TECHNOLOGIES CO., LTD.**

HCT FRN : 0005-8664-21

FCC ID :

EVOCT1701

MODEL / TYPE :

CT1701

Rule Part(s): Part 15 & 2; ET Docket 95-19
Equipment Class: FCC Class B Peripheral Device (JBP)
Standard(s): FCC Class B: 1998 (CISPR 22)
EUT Type: 17" LCD Monitor
Max. Resolution(s): 1280x1024(@80.0KHz/ 75Hz)
Model(s): CT1701
Port/Connector(s) VGA 15-pin D-sub, DC power-in
LCD PANEL BOEhydis Technology (HM17E11-A00)

This equipment has been shown to be in 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 (Grant Notes: #19, #28).

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are 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.

Report prepared by : Ki-Soo Kim
Manager of EMC Tech. Part



HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.



TABLE OF CONTENTS

PAGE

REPORT COVER	1
TABLE OF CONTENTS	2
1.1 SCOPE	3
2.1 INTRODUCTION (SITE DESCRIPTION)	4
3.1 PRODUCTION INFORMATION	5
4.1 DESCRIPTION OF TESTS (CONDUCTED)	6
4.3 DESCRIPTION OF TESTS (RADIATED)	7
5.1 LIST OF SUPPORT EQUIPMENT	8-9
6.1 TEST DATA (CONDUCTED)	10-14
7.1 TEST DATA (RADIATED)	15
8.1 SMPLE CALCULATIONS	16
9.1 TEST EQUIPMENT	17
10.1 TEST SOFTWARE USED	18
11.1 CONCLUSION	19

ATTACHMENT A: FCC ID LABEL & LOCATION

ATTACHMENT B: EXTERNAL PHOTOGRAPHS

ATTACHMENT C: BLOCK DIAGRAM(S)

ATTACHMENT D: TEST SETUP PHOTOGRAPHS

ATTACHMENT E: USER'S MANUAL

ATTACHMENT F-1: INTERNAL PHOTOGRAPHS

ATTACHMENT F-2: INTERNAL PHOTOGRAPHS

ATTACHMENT G: CIRCUIT

MEASUREMENT REPORT

1.1 Scope

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

Applicant Name:	KOREA DATA SYSTEMS CO., LTD.
Address:	170 Gongdan-Dong, Gumi-Si, Gyungbuk, Korea

- **FCC ID : EVOCT1701**
- **Equipment Class: FCC Class B Peripheral Device (JBP)**
- **EUT Type: LCD MONITOR**
- **Model(s): CT1701**
- **Max. Resolution: 1280x1024(@80.0KHz/ 75Hz)**
- **Frequency Range: V-Sync: 56Hz – 75Hz , H-Sync: 31KHz – 61KHz**
- **Cable(s): Shielded D-Sub (with ferrite on both ends)**
- **Power Cord: Unshielded**
- **Rule Part(s): FCC Part 15 Subpart B**
- **Test Procedure(s): ANSI C63.4 (1992)**
- **Dates of Tests: March 17,2003~March 21,2003**
- **Place of Tests: 254-1,MAEKOK-RI,HOBUP-MYUN,ICHON-SI,KYOUNGKI-DO,467-701,KOREA**

2.1 INTRODUCTION

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-1992) was used in determining radiated and conducted emissions emanating from **KOREA DATA SYSTEMS CO., LTD LCD Monitor FCC ID: EVOCT1701**

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 and accepted dated July 23, 2003 (Confirmation Number: EA90661)

3.1 PRODUCT INFORMATION

3.2 Equipment Description

Equipment Under Test (EUT) is the **KOREA DATA SYSTEMS CO.,LTD. (Model : CT1701) LCD Monitor**

FCC ID: **EVOCT1701**

Maximum Resolution(s): **1280 X 1024 (@80.0KHz/ 75Hz)**

Pixel Pitch: **0.088mm(H) x RGB x 0.264mm(V)**

Power Supply: **AC 100-240V, 12V, 5A Max DC Output, 50/ 60Hz**

Power Cord: **Unshielded AC power cord**

Port(s)/Input Connector(s): **VGA 15-pin D-sub , DC Power-in**

Brightness : **250 cd/m²**

Dimensions (WxHxD): **414.6x369.0x170.5mm**

Weight (Net):**4.9Kg**

EMI Suppression Devices:

Modifications were made to the device.

4.1 Description of Tests(Conducted)

4.2 Powerline Conducted RFI (150kHz- 30MHz)

The power line conducted RFI measurements were performed according to CISPR 22.

The EUT was placed on a non-conducting 1.0 by 1.5 meter table which is 0.8 meters in height and 0.40 meters away from the vertical wall of the shielded enclosure. Power to the EUT is provided through a Rohde & Schwarz 50 Ω / 50 uH Line Impedance Stabilization Network (LISN) and the support equipment through a separate Solar 50 Ω / 50 uH Line- Conducted Test Facility LISN. Sufficient time for the EUT, support equipment, and test equipment were allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME. The spectrum was scanned from 150kHz to 30 MHz. Each maximum EME was remeasured using an EMI receiver. The detector function of the receiver was set to CISPR quasi- peak and average mode with the bandwidth set to 9 kHz. Each emission was maximized consistent with the typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum Diagram emission. Excess cable lengths were bundled at the centre with 30- 40cm. in length. The worst-case configuration is noted in the test report and the photographs are attached. Each EME reported was calibrated using the Rohde & Schwarz SMX signal generator and are listed on Table 1. RFI Conducted FCC Class B

RFI CONDUCTED	FCC CLASS B Limits dB(uV/m)	CISPR 22 CLASS B Limits dB(uV/m)	
Freq. Range	FCC Class B Quasi-Peak	CISPR 22 Quasi-Peak	CISPR 22 Average
150kHz - 0.5MHz	48*	66-56**	56-46**
0.5MHz - 5MHz	48	56	46
5MHz - 30MHz	48	60	50
*FCC Class B limits starts from 450kHz			
**Limits decreases linearly with the logarithm of frequency			

Table 1. RFI Conducted Limits

4.3 Description of Tests(Radiated)

Radiated Emissions

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The spectrum was scanned from 30 to 300 MHz using biconical antenna, 300 to 1000 MHz using log- periodic antenna, and above 1 GHz using linearly polarized horn antennas. Final measurements were made outdoors at 10-meter test range using Dipole antennas and EMI receiver. For frequencies above 1 GHz, horn antennas were used. Sufficient time for the EUT, support equipment, and test equipment were allowed in order for them to warm up to their normal operating condition. The EMI receiver detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120 kHz. The EUT, support equipment, and interconnecting cables were arranged to the configuration that produces the maximum EME emission found during preliminary scan. 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. Horizontal and vertical antenna polarizations were checked. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/ or support equipment, and powering the monitor the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission.

ITE Radiated Limits			
Frequency (MHz)	FCC Limit @ 3m. Quasi-Peak dB[μV/m]	FCC Limit @ 10m.* Quasi – Peak dB [μV/m]	CISPR Limit @ 10m. Quasi-Peak dB [μV/m]
30-88	40.0	29.5	30.0
88-216	43.5	33.0	30.0
216-230	46.0	35.6	30.0
230-960	46.0	35.6	37.0
960-1000	54.0	43.5	37.0
> 1000	54.0	43.5	No Specified Limit
* Limit extrapolated 20 dB/decade			

Table 2. Radiated Class B limits @ 10-meters

5.1 Support Equipment Used

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
MONITOR (EUT)	KOREA DATA SYSTEMS CO., LTD.	CT1701	EVOCT1701	P.C
P.C	H.P	HP Pavilion 700	DoC	EUT
KEY BOARD	H.P	5181	DoC	P.C
MOUSE	Microsoft	Intellimouse optical USB and PS/2 compatible	DoC	P.C
PRINTER	H/P	C6410A	DoC	P.C
SERIAL MOUSE	LOGITECH	M-M28	DoC	P.C

5.2 Cable Description

	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
MONITOR(EUT)	N	Y	1.8(P), 1.5(D)
PC(HOST)	N	N/A	1.8(P)
KEY BOARD	N/A	Y	1.8(D)
PS/2 MOUSE	N/A	Y	1.8(D)
PRINTER	N	Y	1.8(P),1.8(D)
SERIAL MOUSE	N/A	Y	1.8(D)

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

5.3 Noise Suppression Parts on Cable. (I/O CABLE)

	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
MONITOR(EUT)	Y	BOTH END	Y	BOTH END
KEY BOARD	N	N/A	Y	P.C END
MOUSE	N	N/A	Y	P.C END
PRINTER	N	N/A	Y	BOTH END
SERIAL MOUSE	N	N/A	Y	P.C END

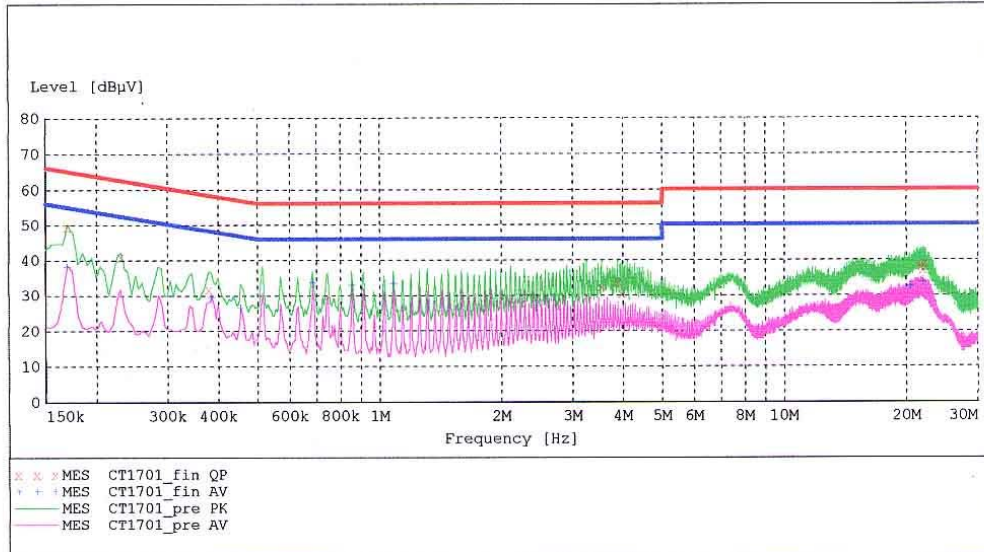
6.1 LINE-CONDUCTED TEST DATA

HYUNDAI C-TECH.
EMC TESTING Laboratory

EUT: CT1701
 Manufacturer: KOREA DATA SYSTEMS
 Operating Condition: 1280 X 1024 75Hz
 Test Site: SHIELD ROOM
 Operator: KH-SEO
 Test Specification: CISPR 22 CLASS B
 Comment: H
 Start of Test: 10/30/03 / 9:37:54AM

SCAN TABLE: "CISPR 22 Voltage"

Short Description:		CISPR 22 Voltage					Transducer
Start	Stop	Step	Detector	Meas. Time	IF Bandw.		
150.0 kHz	500.0 kHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	None	
500.0 kHz	5.0 MHz	5.0 kHz	Average	10.0 ms	9 kHz	None	
			MaxPeak				
			Average				



MEASUREMENT RESULT: "CT1701_fin QP"

10/30/03 9:41AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.170000	49.30	10.1	65	15.6	1	---
0.230000	40.90	10.1	62	21.6	1	---
0.380000	31.70	10.1	58	26.6	1	---
3.545000	32.30	10.2	56	23.7	1	---
3.885000	33.80	10.3	56	22.2	1	---
3.985000	30.50	10.3	56	25.5	1	---
21.655000	38.20	10.6	60	21.8	1	---
22.030000	37.10	10.6	60	22.9	1	---
22.220000	39.20	10.6	60	20.8	1	---

MEASUREMENT RESULT: "CT1701_fin AV"

10/30/03 9:41AM

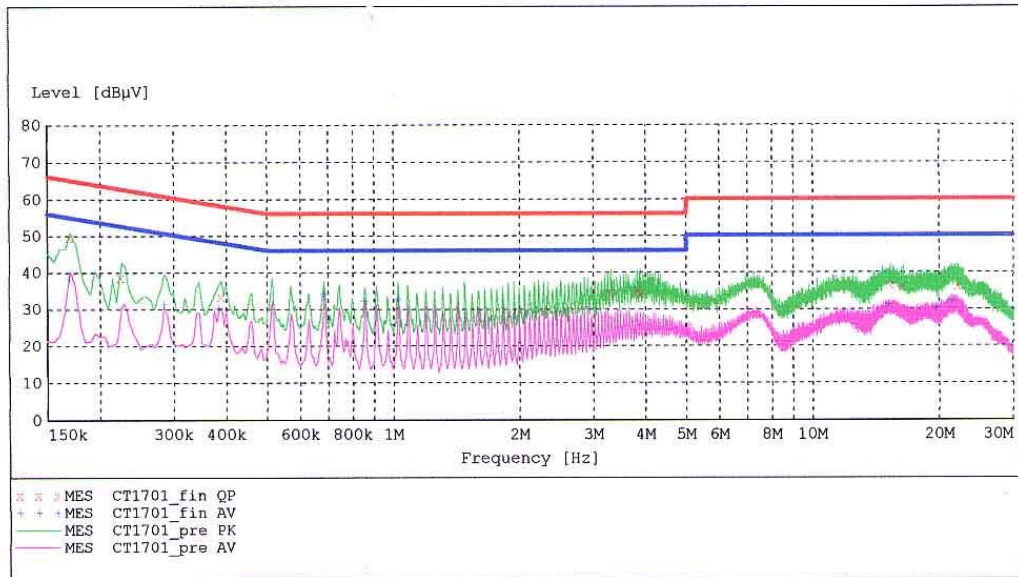
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.170000	38.20	10.1	55	16.8	1	---
0.385000	29.40	10.1	48	18.8	1	---
0.455000	26.60	10.1	47	20.2	1	---
0.685000	33.60	10.2	46	12.4	1	---
0.855000	33.00	10.1	46	13.0	1	---
1.085000	33.30	10.1	46	12.7	1	---
20.450000	32.60	10.5	50	17.4	1	---
20.565000	32.50	10.5	50	17.5	1	---
22.050000	33.80	10.6	50	16.2	1	---

HYUNDAI C-TECH.
EMC TESTING Laboratory

EUT: CT1701
 Manufacturer: KOREA DATA SYSTEMS
 Operating Condition: 1280 X 1024 75Hz
 Test Site: SHIELD ROOM
 Operator: KH-SEO
 Test Specification: CISPR 22 CLASS B
 Comment: N
 Start of Test: 10/30/03 / 9:31:52AM

SCAN TABLE: "CISPR 22 Voltage"

Short Description:		CISPR 22 Voltage					Transducer
Start	Stop	Step	Detector	Meas. Time	IF Bandw.		
Frequency	Frequency	Width					
150.0 kHz	500.0 kHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	None	
			Average				
500.0 kHz	5.0 MHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	None	
			Average				



MEASUREMENT RESULT: "CT1701_fin QP"

10/30/03 9:35AM

Frequency	Level	Transd	Limit	Margin	Line	PE
MHz	dBµV	dB	dBµV	dB		
0.170000	49.60	10.1	65	15.3	1	---
0.225000	38.70	10.1	63	23.9	1	---
0.390000	33.40	10.1	58	24.6	1	---
3.315000	34.60	10.2	56	21.4	1	---
3.830000	35.20	10.3	56	20.8	1	---
3.885000	34.00	10.3	56	22.0	1	---
15.315000	36.50	10.5	60	23.5	1	---
16.410000	36.00	10.5	60	24.0	1	---
22.190000	36.40	10.6	60	23.6	1	---

MEASUREMENT RESULT: "CT1701_fin AV"

10/30/03 9:35AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.170000	38.60	10.1	55	16.4	1	---
0.285000	31.40	10.1	51	19.3	1	---
0.385000	30.40	10.1	48	17.7	1	---
0.685000	34.10	10.2	46	11.9	1	---
0.855000	32.20	10.1	46	13.8	1	---
1.030000	32.60	10.1	46	13.4	1	---
15.210000	31.30	10.5	50	18.7	1	---
19.670000	30.10	10.5	50	19.9	1	---
21.500000	32.10	10.6	50	17.9	1	---

NOTES:

- 1. All modes of operation were investigated and the worst-case emissions are reported.**
- 2. The CISPR RFI conducted limits are listed on Table 1 (Page 6).**
- 3. Line A = Phase Line B = Neutral**

** Measurements using CISPR quasi-peak mode.

7.1 RADIATED TEST DATA

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
33.8	7.44	17.70	1.3	V	26.4	30	3.6
56.3	14.27	9.05	1.7	V	25.0	30	5.0
90.0	14.73	8.87	2.1	V	25.7	30	4.3
125.9	10.03	13.27	2.6	V	25.9	30	4.1
176.0	8.21	15.79	3.0	V	27.0	30	3.0
199.9	6.67	16.24	3.2	V	26.1	30	3.9
232.8	11.54	17.10	3.5	V	32.1	37	4.9
377.5	12.22	16.72	4.5	V	33.4	37	3.6
431.2	11.08	17.86	4.8	V	33.7	37	3.3
480.2	8.07	18.83	5.0	V	31.9	37	5.1
503.0	8.41	19.18	5.1	V	32.7	37	4.3
604.0	6.14	21.24	5.6	V	33.0	37	4.0

Radiated Measurements at 10-meters.
1280x1024(@80.0KHz/ 75Hz)

NOTES:

1. All modes of operation were investigated, and the worst-case emissions are reported.
2. The radiated limits are listed on Table 2 (Page 7).

** AFCL = Antenna Factor (Roberts dipole) and Cable Loss .

*** Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.

8.1 Sample Calculations

$$\text{dB } \square = 20 \log_{10} (\text{mV/m})$$

$$\text{dB } \square = \text{dBm} + 107$$

8.2 Example 1:

@ 20.3 MHz

Class B limit	= 250 μV = 47.96 dB μV
Reading	= - 67.8 dBm (calibrated level)
Convert to db μV	= - 67.8 + 107 = 39.2 dB μV
$10^{(39.2/20)}$	= 91.2 μV

Margin	= 39.2 - 47.96 = - 8.76
	= 8.8 dB below limit

8.3 Example 2:

@ 66.7 MHz

Class B limit	= 100 $\mu\text{V/m}$ = 40.0 dB $\mu\text{V/m}$
Reading	= - 76.0 dBm (calibrated level)
Convert to db $\mu\text{V/m}$	= - 76.0 + 107 = 31.0 dB $\mu\text{V/m}$
Antenna Factor + Cable Loss	= 5.8 dB
Total	= 36.8 dB $\mu\text{V/m}$

Margin	= 36.8 - 40.0 = - 3.2
	= 3.2 dB below limit

9.1 Test Equipment

<u>Type</u>	<u>Manufacture</u>	<u>Model Number</u>	<u>CAL Date</u>
EMI Test Receiver	Rohed & Schwarz	ESI40	2002.11.16
EMI Test Receiver	Rohed & Schwarz	ESVS30	2003.07.16
LISN	Rohed & Schwarz	ESH2-Z5	2004.08.21
LISN	EMCO	3825/2	2004.02.24
Amplifier	Hewlett-Packard	8447E	2003.08.23
Absorbing Clamp	Rohed & Schwarz	MDS-21	2003.04.24
Dipole Antennas	Schwarzbeck	VHAP	2003.07.24
Dipole Antennas	Schwarzbeck	UHAP	2003.07.24
Biconical Antenna	Schwarzbeck	VHA9103	2003.07.23
Log-Periodic Antenna	Schwarzbeck	UHALP9107	2003.07.23
Antenna Position Tower	HD	MA240	N/A
Turn Table	EMCO	1050	N/A
Power Analyzer	Voltech	PM 3300	2003.02.15
Reference Network Impedance	Voltech	IEC 555	N/A
AC Power Source	PACIFIC	Magnetic Module	N/A
AC Power Source	PACIFIC	360AMX	2002.11.25
Controller	HD GmbH	HD 100	N/A
SlideBar	HD GmbH	KMS 560	N/A

10.1 Test Software Used

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.

NOTE: This is a sample of the basic program used during the test. However, during testing, a different software program may be used; whichever determines the worst-case condition. In addition, the program used also depends on the number and type of devices being tested.

Actual program used is the "H" pattern in Notepad under Windows environment. All resolution modes (**1280 X 1024, 1024x768, 800x600, 640x480, 720x400, 640x350**) were investigated and tested

11.1 Conclusion

The data collected shows that the KOREA DATA SYSTEMS CO., LTD. LCD Monitor **FCC ID: EVOCT1701**. complies with §15.107 and §15.109 of the FCC Rules.