



## HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.

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# 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 26, 2003****Test Report No.: HCT-F03-1107****Test Site: HYUNDAI CALIBRATION & CERTIFICATION  
TECHNOLOGIES CO., LTD.****HCT FRN : 0005-8664-21****FCC ID :****EVOCT1702****MODEL / TYPE :****CT1702**

<b>Rule Part(s):</b>	<b>Part 15 &amp; 2; ET Docket 95-19</b>
<b>Equipment Class:</b>	<b>FCC Class B Peripheral Device (JBP)</b>
<b>Standard(s):</b>	<b>FCC Class B: 1998 (CISPR 22)</b>
<b>EUT Type:</b>	<b>17" LCD TV Monitor</b>
<b>Max. Resolution(s):</b>	<b>1280x1024(@80.0KHz/ 75Hz)</b>
<b>Model(s):</b>	<b>CT1702</b>
<b>Port/Connector(s)</b>	<b>D-sub, DVI, Component, S-Video, Audio in&amp;out, DC Power in, ANT</b>
<b>LCD PANEL</b>	<b>BOEhydis Technology (MT17E12-200)</b>

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

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# 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.

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

- **FCC ID : EVOCT1702**
- **Equipment Class: FCC Class B Peripheral Device (JBP)**
- **EUT Type: LCD TV MONITOR**
- **Model(s): CT1702**
- **Max. Resolution: 1280x1024(@80.0KHz/ 75Hz)**
- **Frequency Range: V-Sync: 56Hz – 75Hz , H-Sync: 31KHz – 82KHz**
- **Cable(s): Shielded D-Sub cable(with ferrite on both ends)**  
**Shielded DVI cable (with ferrite on both ends)**  
**Shielded COMPONENT cable**  
**Shielded S-VIDEO cable**  
**Shielded AUDIO IN cable**
- **Power Cord: Unshielded**
- **Rule Part(s): FCC Part 15 Subpart B**
- **Test Procedure(s): ANSI C63.4 (1992)**
- **Dates of Tests: NOVEMBER 24,2003~NOVEMBER 25,2003**
- **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 TV Monitor FCC ID: EVOCT1702**

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 : CT1702 )**  
**LCD TV Monitor**

FCC ID: **EVOCT1702**

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

Pixel Pitch: **0.264mm(H) 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): **D-sub, DVI, Component, S-Video, Audio in & out, DC Power in, ANT**

Brightness : **270 cd/m<sup>2</sup>**

Dimensions (WxHxD): **424.0x404.0x165.0mm**

Weight (Net):**6.6Kg**

### **EMI Suppression Devices:**

Modifications were made to the device.

**Refer to cover letter.**

## 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.

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

**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.	CT1702	EVOCT1702	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
HEADSET	SAMBO COMPUTER	DW-400M	DoC	P.C



### 5.2 Cable Description

	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
MONITOR	N	N/A	1.8(P)
D-SUB	N/A	Y	1.8(D)
DVI	N/A	Y	1.8(D)
HEADSET	N/A	Y	1.8(D)
COMPONENT	N/A	Y	1.8(D)
S-VIDEO	N/A	Y	1.5(D)
AUDIO IN	N/A	Y	1.5(D)
AUDIO OUT	N/A	Y	1.8(D)
TV TUNER	N/A	Y	3.0(D)
PC	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
D-SUB	Y	BOTH END	Y	BOTH END
DVI	Y	BOTH END	Y	BOTH END
HEADSET	N	N/A	Y	P.C END
COMPONENT	N	N/A	Y	BOTH END
S-VIDEO	N	N/A	Y	BOTH END
AUDIO IN	N	N/A	Y	BOTH END
AUDIO OUT	N	N/A	Y	P.C END
TV TUNER	N	N/A	Y	BOTH END
KEY BOARD	N	N/A	Y	P.C END
MOUSE	Y	P.C END	Y	P.C END
PRINTER	N	N/A	Y	BOTH END
SERIAL MOUSE	N	N/A	Y	P.C END

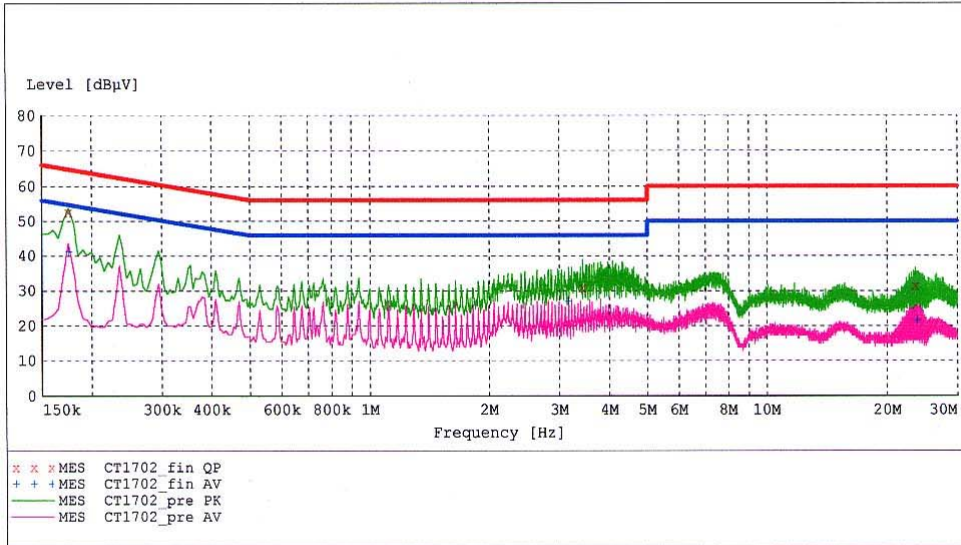
## 6.1 LINE-CONDUCTED TEST DATA

**HYUNDAI C-TECH.**  
**EMC TESTING Laboratory**

EUT: CT1702  
 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: 12/18/03 / 5:10:07PM

**SCAN TABLE: "CISPR 22 Voltage"**

Short Description:			CISPR 22 Voltage			
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
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: "CT1702\_fin QP"**

12/18/03 5:12PM

Frequency	Level	Transd	Limit	Margin	Line	PE
MHz	dBµV	dB	dBµV	dB		
0.175000	52.50	10.1	65	12.3	1	---
3.445000	30.90	10.2	56	25.1	1	---
23.625000	31.40	10.6	60	28.6	1	---

**MEASUREMENT RESULT: "CT1702\_fin AV"**

12/18/03 5:12PM

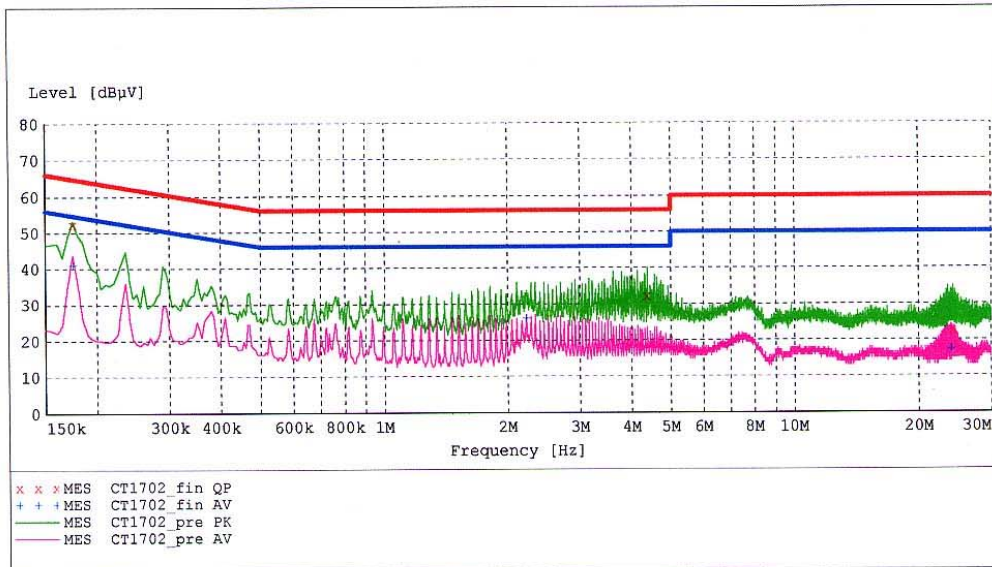
Frequency	Level	Transd	Limit	Margin	Line	PE
MHz	dBµV	dB	dBµV	dB		
0.175000	41.30	10.1	55	13.4	1	---
3.170000	27.10	10.2	46	18.9	1	---
23.805000	21.70	10.6	50	28.3	1	---

**HYUNDAI C-TECH.  
EMC TESTING Laboratory**

EUT: CT1702  
 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: 12/18/03 / 5:13:55PM

**SCAN TABLE: "CISPR 22 Voltage"**

Short Description:		CISPR 22 Voltage					
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer	
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: "CT1702\_fin\_QP"**

12/18/03 5:16PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.175000	52.30	10.1	65	12.5	1	---
4.390000	32.10	10.3	56	23.9	1	---
24.265000	22.60	10.6	60	37.4	1	---

**MEASUREMENT RESULT: "CT1702\_fin\_AV"**

12/18/03 5:16PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.175000	41.10	10.1	55	13.6	1	---
2.225000	26.20	10.3	46	19.8	1	---
23.970000	17.50	10.6	50	32.5	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**

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\*\* 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
40.50	17.44	14.96	1.3	V	33.7	40.0	-6.3
120.60	25.22	12.78	2.4	V	40.4	43.5	-3.1
135.20	23.03	14.07	2.6	V	39.7	43.5	-3.8
147.40	19.32	14.81	2.7	V	36.8	43.5	-6.7
184.30	21.00	15.96	3.0	V	40.0	43.5	-3.5
214.80	17.52	16.67	3.3	V	37.5	43.5	-6.0
405.60	20.68	17.10	4.6	H	42.4	46.0	-3.6
465.70	17.75	18.63	4.9	V	41.3	46.0	-4.7
480.70	18.27	18.83	5.0	V	42.1	46.0	-3.9
512.90	15.16	19.38	5.2	V	39.7	46.0	-6.3
540.90	12.29	20.01	5.3	H	37.6	46.0	-8.4
676.20	12.33	22.59	6.0	H	40.9	46.0	-5.1

Radiated Measurements at 3-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

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

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

### 8.2 Example 1:

**@ 20.3 MHz**

Class B limit	=	250 $\mu\text{V}$ = 47.96 dB $\mu\text{V}$
Reading	=	- 67.8 dBm (calibrated level)
Convert to db $\mu\text{V}$	=	- 67.8 + 107 = 39.2 dB $\mu\text{V}$
$10^{(39.2/20)}$	=	91.2 $\mu\text{V}$
<b>Margin</b>	=	39.2 - 47.96 = - 8.76
	=	<b>8.8 dB below limit</b>

### 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 $\mu\text{V/m}$
<b>Margin</b>	=	36.8 - 40.0 = - 3.2
	=	<b>3.2 dB below limit</b>

## 9.1 Test Equipment

<u>Type</u>	<u>Manufacture</u>	<u>Model Number</u>	<u>CAL Date</u>
EMI Test Receiver	Rohed & Schwarz	ESI40	2003.11.16
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	2003.11.25
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 TV Monitor** **FCC ID: EVOCT1702** complies with §15.107 and §15.109 of the FCC Rules.

