SGS KES CO., LTD. EMC Laboratory

705, Dongchun-Ri Sooji-Eub, Yongin-Shi Kyungki-Do, KOREA
TEL82-31-263-0409 FAX.82-31-263-0454

FCC TEST REPORT

Manufacture :
HYOJIN CONTEC CO., LTD.
Ki-im Bldg 399 Shindorim-Dong, Kuro-Gu,
Seoul, Korea
Attn : H. J. Park

Dates of Tests : 17 September 2002
07 January 2003
Test Report No. : 2003KESEMC-II-010.FCC
Test Site : SGS KES Co., Ltd. EMC site, Korea.

TYPE of EUT
MODEL No.

LCD PC
QREX-X170

HYOJIN CONTEC CO., LTD.
Ki-im Bldg, 399, Shindorim-Dong, Kuro-Gu, Seoul, Korea

H. J. Park
Telephone No. 82-2-2631-0871

CONTACT PERSON

FCC Rule Part(s) : Part 15 & 2
Classification : FCC Class B Device

The device bearing the trade name and model specified above has been shown to comply 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.

I attest to the accuracy of data and 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.

Kew – Seung, Lim
EMC Lab. Manager
SGS KES CO., LTD. EMC Laboratory

FCC

TABLE OF CONTENTS

MEASUREMENT REPORT

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 under FCC part 15.

Responsible Party* :	**HYOJIN CONTEC CO., LTD**
Contact Person :	**H. J. Park**
	Tel No. 82-2-2631-0871
Manufacturer :	**HYOJIN CONTEC CO., LTD**
	Ki-im Bldg 399, Shindorim-Dong, Kuro-Gu,
	Seoul, Korea

- Trade / Model: ***QREX-X170***
- Brand Name: HYOJIN CONTEC CO., LTD
- EUT Type: LCD PC
- Port/Connectors: USB, LAN, Keyboard, PS/2 Mouse, Parallel, Video, Serial GAME, Video Out, SPK, MIC, LINE IN
- Classification: FCC Class B
- Rule Part(s): FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Test: 17 September 2002
  07 January 2003
- Place of Tests: SGS KES Co., Ltd.
- Test Report No.: 2003KESEMC-II-010.FCC
- Order No. : SKE-02-0478/E
- Operating mode for EUT : Output some data in HDD, FDD and CD-ROM through the Monitor and the Printer. Continuously display "H" pattern on the Monitor. Communicate through LAN

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 ***HYOJIN CONTEC CO., LTD.*** Model : ***QREX-X170***

These measurement tests were conducted at ***SGS KES CO., LTD. EMC Laboratory*** .
The site address is 705, Dongchun-Ri, Sooji-Eub, Yongin-Shi, Kyungki-Do, Korea.
The area of SGS KES CO., LTD. EMC Test Site is located in a mountain area at 45 kilometers (28 miles) southeast and Seoul International Airport (Kimpo Airport), 23 kilometers (14miles) south-southeast from central Seoul.
It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.
The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 1992.

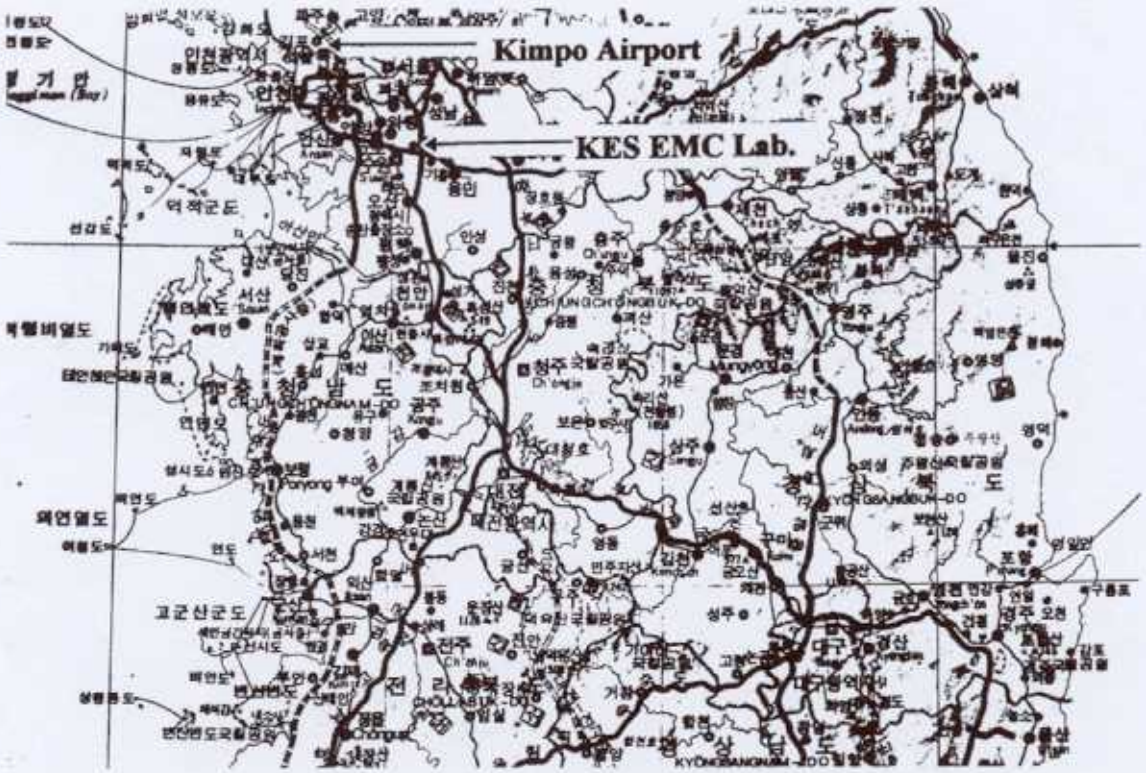


Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows SGS KES CO., LTD. EMC Lab and Kimpo Airport.

PRODUCT INFORMATION

The Equipment Under Test (EUT) is the **HYOJIN CONTEC CO., LTD.**
Model : **QREX-X170**

Clock :	24.576MHz, 13.5MHz, 1.6GHz, 25MHz, 14.318MHz	
Port(s) :	USB, LAN, Keyboard, PS/2 Mouse, Parallel, Video, Serial GAME, Video Out, SPK, MIC, LINE IN	
Power Consumption :	AC 110V, 60Hz	
Main Board :	Model : QREX LPC-845 (Hyojin Contec Co., Ltd.)	S/N : N/A
VGA Card :	Model : Qrex-LPC-N200 (Hyojin Contec Co., Ltd.)	S/N : 90C03202
Sound Card :	Model : SIDE V1.0 (N/A)	S/N : N/A
CD-ROM :	Model : SN-124 (24X) (SAMSUNG)	S/N : N/A
CPU :	Model : Pentium Ⅳ(1.6GHz) (INTEL)	S/N : N/A
AMP Board :	Model : X170 (N/A)	S/N : N/A
Inverter :	Model : SIC 1802 (SAMSUNG)	S/N : N/A
Power Supply :	Model : ENP-2120H (Enhance Electronics Co., Ltd)	S/N : 460539268
Touch Screen Board :	Model : N/A (SENA Technologies)	S/N : N/A
LCD Panel :	Model : LTM170EH-L01(17") (SAMSUNG.)	S/N : 4E2E60007D
FDD :	Model : SFD-321S (SAMSUNG)	S/N : P4YM6032931
HDD :	Model : SV4002H(40GB) (SAMSUNG)	S/N : 0478J1FT615404
A/D Board :	Model : nVIDIA INF (Hyojin Contec Co., Ltd.)	S/N : N/A
I/O 1 Board :	Model : PCB REAR1X (N/A)	S/N : N/A
I/O 2 Board :	Model : PCB REAR2X (N/A)	S/N : N/A

EMI suppression device(s) installed in production:
- see circuit diagram

EMI suppression device(s) added and/or modified during testing:
- none

DESCRIPTION OF TESTS

Conducted Emissions

The line-conducted facility is located inside a 3.0x6.0x2.5 shielded enclosure. It is manufactured by Daeil EMC Engineering. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-6. A 1mx1.5m. wooden table 0.8m. height is placed 0.4m. away from the vertical wall and 1.5m away from the side wall of the shielded room. PMM L3-25, L1-150 and EMCO Model 3825-2 (10kHz-30MHz) 50Ω /50 μH Line Impedance Stabilization Networks (LISNs) are bonded to the shielded room. The EUT is powered from the PMM LISN and the support equipment is powered from the EMCO LISN. Power to the LISNs are filtered by a high-current high-insertion loss Sangshin power line filters (100dB 14kHz-10GHz). The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure. All electrical cables are shielded by braided tinned copper zipper tubing with inner diameter of 1/2". 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 PMM LISN. LISN schematic diagram is shown in Figure 2. All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1-meter 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 spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 450 kHz to 30 MHz with 20 msec sweep time. The frequency producing the maximum level was reexamined using EMI/Field Intensity Meter and Quasi-Peak adapter. The detector function was set to CISPR quasi-peak mode. The bandwidth of the receiver was set to 10 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by: switching power lines; 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 from the floor mounted outlet box and the computer aux AC outlet, if applicable; which ever determined the worst-case emission. Photographs of the worst-case emission can be seen in Appendix C. Each EME reported was calibrated using the R/S SMG signal generator.

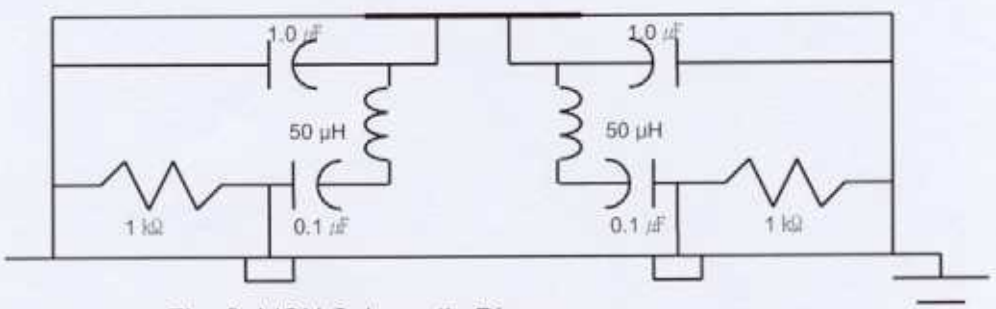


Fig. 2. LISN Schematic Diagram

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 system configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna were note for each frequency found. The spectrum was scanned from 30 to 300 MHz using biconical antenna and 300 to 1000 MHz using log-periodic antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3or10 meter test range using EMCO Dipole antennas or horn antenna . The test equipment was placed on a wooden and plastic bench situated on a 1.5x2 meter area adjacent to measurement area. 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 reexamined and investigated using EMI/Field Intensity Meter and Quasi-Peak Adapter. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 100 kHz or 1 MHz depending on the frequency or type of signal.

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. 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 non-metallic 1x1.5 meter table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission. 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 from the floor mounted outlet box and the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Appendix C. Each EME reported was calibrated using the R/S SMG signal generator.

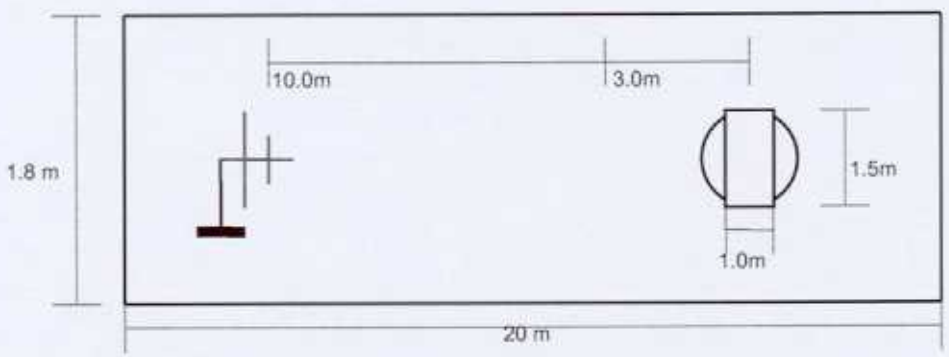


Fig. 3. Dimensions of Outdoor Test Site

TEST CONFIGURATION

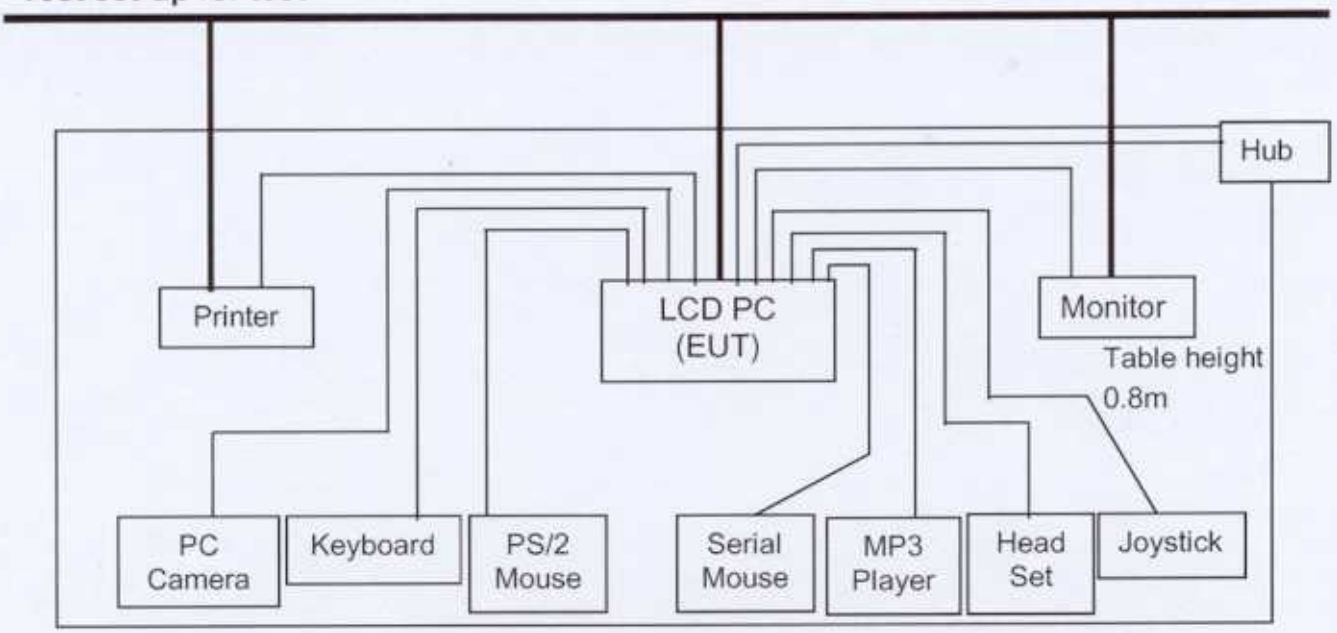
Peripheral equipment

Description	Model	Serial No.	Manufacturer
Monitor	950P(T)	P029H3NR703070	SAMSUNG
Printer	BJC-2100SP	CME010503120	CANON
Serial Mouse	MSW-5	N/A	A-FOUR TECH
PS/2 Mouse	M-S34	LZB00207183	LOGITECH
Keyboard	SEM-DT35	06087043	SAMSUNG
Game	DHA-2000	N/A	DA-HUN
PC Camera	MPC-M20 PLUS	00011454	Neeze Tec
MIC/Headphone	CD-2MVs	N/A	Hi-Sonic
Hub	Ethernet Hub8	N/A	3COM
MP3 Play	SM-320VH1	N/A	PINE TECH

Cable List

Start		END		Cable Spec.	
Name	I/O Port	Name	I/O Port	Length	Shield
EUT	AC IN	LISN	-	1.0	Unshielded
	VGA	Monitor	-	1.8	Shielded
	Parallel	Printer	-	1.8	Shielded
	USB	PC Camera	-	1.8	Shielded
	Keyboard	Keyboard	-	1.7	Shielded
	PS/2 Mouse	PS/2 Mouse	-	1.7	Shielded
	Serial	Serial Mouse	-	1.7	Shielded
	Line IN	MP3 Player	-	1.6	Unshielded
	MIC/Headphone	MIC/Headphone	-	2.5	Unshielded
	Game	Joystick	-	2.0	Shielded
	LAN	Hub	-	6.0	Unshielded

- **Test set-up for test**



TEST DATA

Conducted Emissions

Model No. : QREX-X170
Date of Test : 07 January 2003
Measure Bandwidth : 9kHz
Temperature : 21℃ Humidity : 32% Atmospheric Pressure : 101.1kPa

FREQ (MHz)	LEVEL(dBμV)	LINE	LIMIT(μV)	Result(μV)	MARGIN*(dB)
0.50	41.2	N	250	114.82	6.8
0.79	38.3	N	250	82.22	9.7
1.18	31.8	N	250	38.90	16.2
1.87	29.3	N	250	29.17	18.7
29.42	39.8	H	250	97.72	8.2
29.53	37.3	H	250	73.28	10.7

Table 1. Line Conducted Emissions Tabulated Data

NOTES:

1. ***All modes of operation were investigated and the worst -case emission are reported. See attached Plots.***
2. ***The limit for Class B digital device is 250 μV from 450 kHz to 30MHz.***
3. ***Line H = Hot Line N = Neutral***

* *Measurements using CISPR quasi-peak mode*

Tested by ***See – Ho, Lee***

TEST DATA

Radiated Emissions

Model No. : QREX-X170
Date of Test : 17 September 2002
Temperature : 21℃ Humidity : 26 % Atmospheric Pressure : 100.3kPa
Measure Bandwidth : 120kHz

Freq. (MHz)	Level (dBμV)	AF* (dB)	CL** (dB)	POL (H/V)	Limit (μV)	F/S (μV/m)	Margin*** (dB)
108.01	22.30	10.55	2.14	H	150	56.20	8.51
459.06	15.90	16.96	5.87	H	200	86.46	7.26
668.37	14.80	20.37	7.54	H	200	136.60	3.29
1040.23	20.00	23.84	3.10	H	500	222.33	7.06
1168.56	18.80	24.37	3.22	H	500	208.69	7.66
1505.94	17.90	25.28	3.72	H	500	221.31	7.10
3088.21	15.30	28.16	6.00	H	500	297.17	4.54
3612.54	15.20	28.71	6.60	H	500	335.35	3.49

Table 2. Radiated Measurements at 3meters

NOTES:

1. ***All modes of operation were investigated the worst-case emission are reported.***
2. ***The radiated limits are shown on Figure 4. Above 1GHz the limit is 500 μV/m.***

Fig. 4. Limits at 3 meters

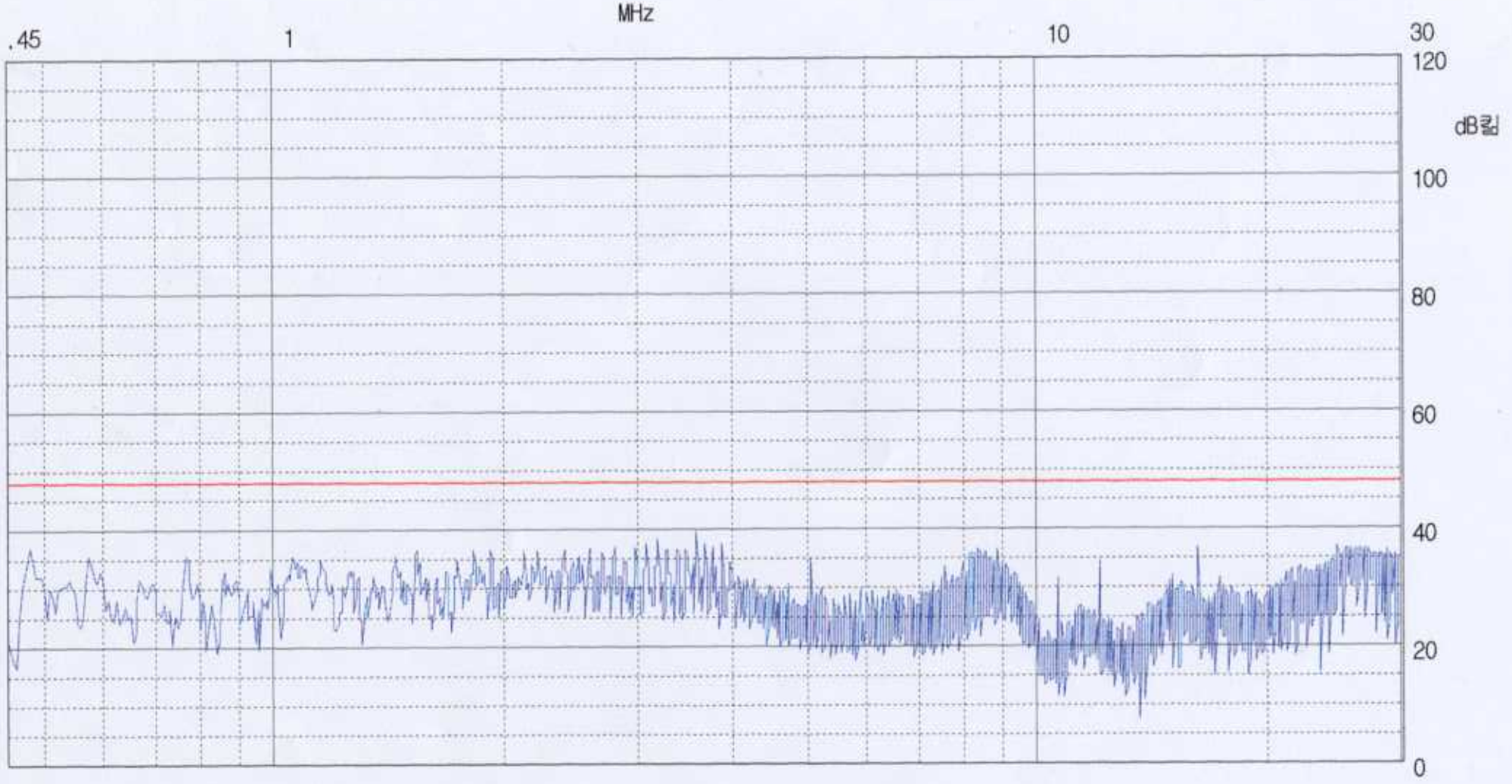
* *AF = Antenna Factor* ** *CL = Cable Loss.*

*** *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.*

Tested by ***See - Ho, Lee***

PLOTS OF EMISSIONS

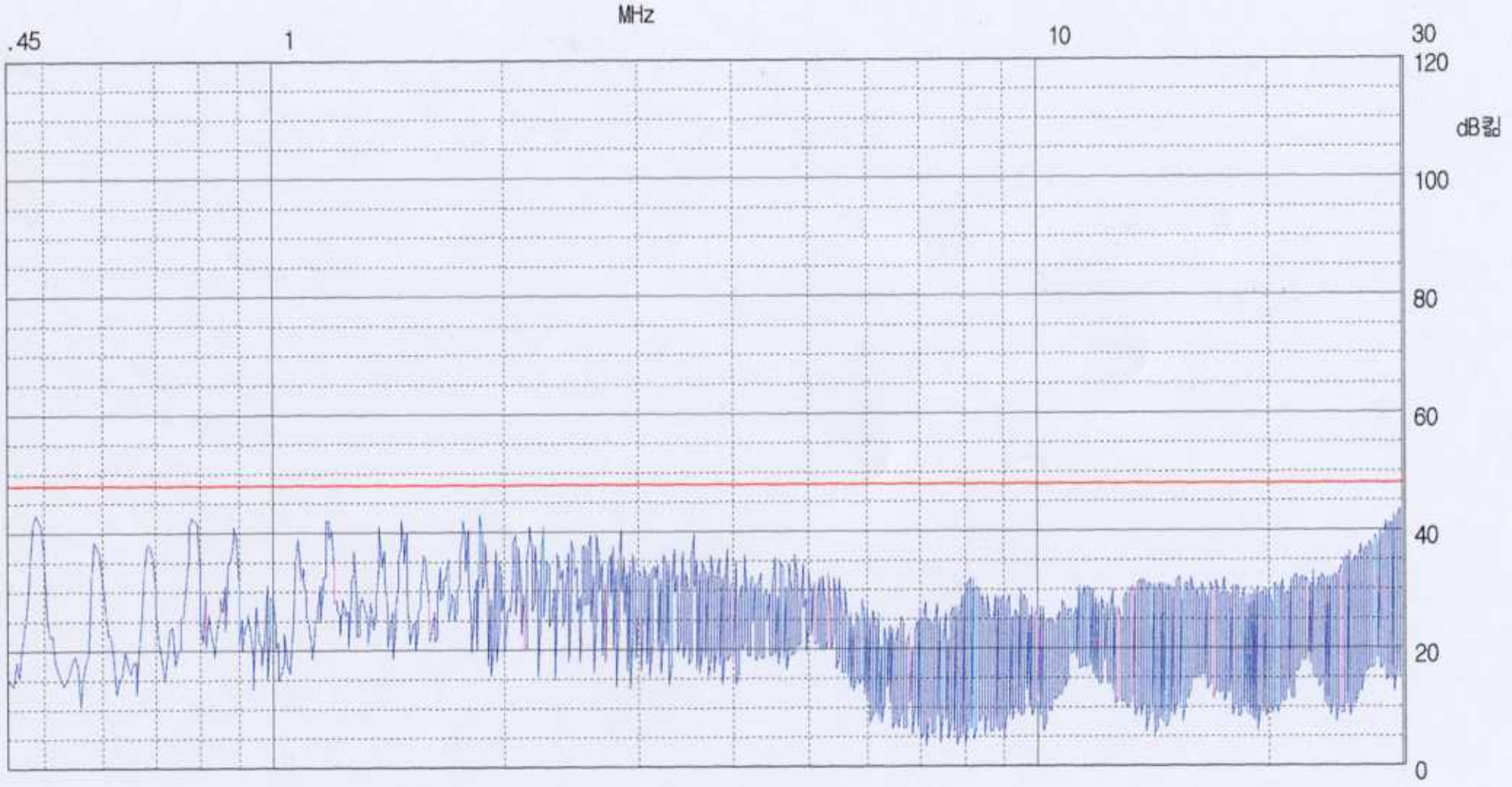
P M M 8 0 1 0 for Windows Name: Date: 03-01-07 Time: 16:18



Limit : Fcc_15_b Detector: Peak Input None

MODEL: QREX-X170
LINE : HOT
OPERATOR: S.H.LEE

P M M 8 0 1 0 for Windows Name: Date: 03-01-07 Time: 16:33



Limit : Fcc_15_b Detector: Peak Input None

MODEL: QREX-X170
LINE : NEUTRAL
OPERATOR: S.H.LEE

SAMPLE CALCULATIONS

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

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

EX. 1.

@20.3 MHz Class B limit = 250 μV = 48.0 dB μV

Reading = 40.8 dB μV (calibrated level)

$10^{(40.8/20)}$ = 109.64 μV

Margin = 48.0 - 40.8 = 7.2

7.2 dB below limit

EX. 2.

@57.7 MHz Class B limit = 100 μV/m = 40.0 dB μV/m

Reading = 19.1 dB μV(calibrated level)

Antenna factor + Cable Loss = 10.12 dB

Total = 29.22 dB μV/m

Margin = 40.0 - 29.22 = 10.78

10.78 dB below the limit

ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 with the confidence level of 95%

Contribution	Distribution	Uncertainties	
		3 m	10 m
Field Strength Monitor	Gaussian (2s)	+/- 0.5	+/- 0.5
Field Strength Variation	Rectangular	+/- 1.2	+/- 1.5
Random	Gaussian (1s)	+/- 0.7	+/- 0.7
Total Uncertainty@95% min. confidence probability		+/- 1.91	+/- 2.11

Measurement Uncertainty Calculations:

$$U = 2\sqrt{S^2\ s1 + S^2\ s1... + S^2\ sr}$$

TEST EQUIPMENT

Conducted Emission

Equipment	Manufactory	Model	Cal. Date
Test Receiver	PMM	8010	Sep. 2002
LISN	PMM	L3-25	Jul. 2002
LISN	EMCO	3825/2	Nov. 2002
Pulse Limiter	PMM	PL-01	Jul. 2002
Shielded Room	Daeil	N/A	-

Radiated Emission

Equipment	Manufactory	Model	Cal. Date
Test Receiver	R & S	ESVS30	Nov. 2002
Spectrum Analyzer	H.P	E4411A	Oct. 2002
RF Amplifier	H.P	8447F	May. 2002
Horn Antenna	SCHWARZBECK	BBHA9120D	May. 2002
Bilog Antenna	Scaffner	CBL6111C	Apr. 2002
RF Select s/w	DAIWA	CS201	Oct. 2002

RECOMMENDATION/CONCLUSION

The data collected shows that the **Hyojin Contec Co., Ltd.**
Model : **QREX-X170** complies with § 15.107 and 15.109 of the FCC Rules.

The highest emission observed was at 0.50MHz conducted emissions with a margin of 6.8 dB and at 668.37MHz radiated emissions with a margin of 3.29dB.

APPENDIX A – SAMPLE LABEL

New Labelling Requirements

The sample label shown shall be *permanently affixed* at a conspicuous location on the device and be readily visible to the user at the time of purchase.

LCD PC **Model:QREX-X170** **FCC ID : P6JQREX-X170** **HYOJIN CONTEC CO., LTD**
THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1)THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE AND (2)THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.