

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 :

Display Inside Co., Ltd.

208 Kicox Venture Center, 188-5, Guro-Dong,

Guro-Gu, Seoul, Korea

Attn : Y. I. Oh

Dates of Tests : 15 to 16 July 2002

Test Report No. : 2002KESEMC-II-0207.FCC

Test Site : SGS KES Co., Ltd. EMC site, Korea

TYPE of EUT
MODEL No.

TFT LCD AV Monitor
DiVi104SAV

Display Inside Co., Ltd.
208 Kicox Venture Center, 188-5, Guro-Dong,
Guro-Gu, Seoul, Korea

Y. I. Oh

Tel./Fax. 82-2-6300-6890/82-2-6300-6897

CONTACT PERSON

FCC Rule Part(s) :

Classification :

Port/Connector(s) :

Part 15 & 2

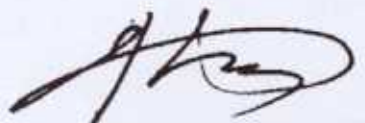
FCC Class B Device

DC IN(1), D-Sub, Video(2), Audio R/L(1),

S-Video(1), Phone(1)

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

SCOPE	3
INTRODUCTION (SITE DESCRIPTION)	4
PRODUCT INFORMATION	5
DESCRIPTION OF TEST (CONDUCTED)	6
DESCRIPTION OF TEST (RADIATED)	7
LIST OF SUPPORT EQUIPMENT	8
TEST DATA (CONDUCTED)	10
TEST DATA (RADIATED)	12
PLOTS OF EMISSION	14
SAMPLE CALCULATIONS	15
ACCURACY of MEASUREMENT	16
LIST of TEST EQUIPMENT	17
RECOMMENDATION/CONCLUSION	18
APPENDIX A - LABELLING REQUIREMENTS	19

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* :	Display Inside Co., Ltd.
Contact Person :	Y. I. Oh
	Tel./Fax. 82-2-6300-6890/82-2-6300-6897
Manufacturer :	Display Inside Co., Ltd.
	208 Kicox Venture Center, 188-5, Guro-Dong,
	Guro-Gu, Seoul, Korea

- Trade / Model: **DiVi104SAV**
- Brand Name: Display Inside Co., Ltd.
- EUT Type: TFT LCD AV Monitor
- Port/Connectors: DC IN(1), D-Sub, Video(2), Audio R/L(1), S-Video(1)
Phone(1)
- Classification: FCC Class B
- Rule Part(s): FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Test: 15 to 16 July 2002
- Place of Tests: SGS KES Co., Ltd.
- Test Report No.: 2002KESEMC-II-0207.FCC
- Order No. : SKI-02-0130

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 **Display Inside Co., Ltd. Model : DiVi104SAV**

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 (14 miles) 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.

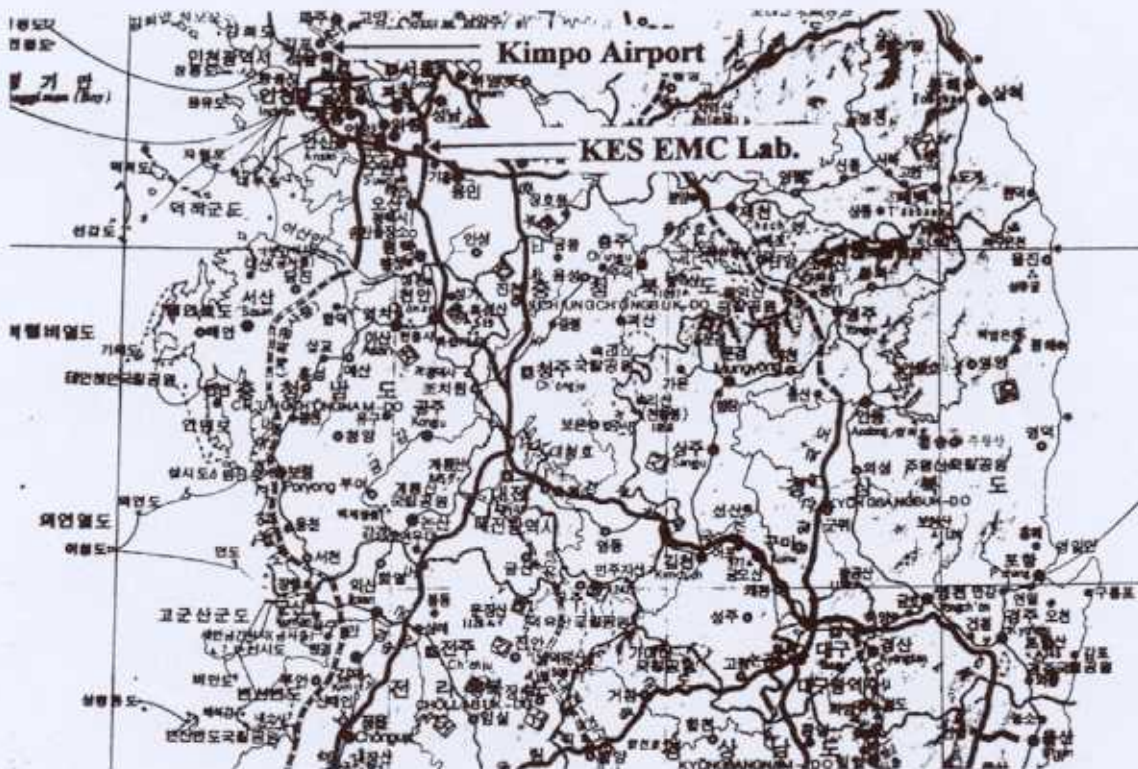


Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows SGS KES Co., Ltd. EMC Lab and Kimpo Airport.

PRODUCT INFORMATION

Equipment Description:

The Equipment Under Test (EUT) is the **Display Inside Co., Ltd.**

Model : **DiVi104SAV**

Clock : 20.25MHz, 14.31MHz

Chipset : PSD934F2-20, GM5020

Port(s) : DC IN(1), D-Sub, Video(2), Audio R/L(1), S-Video(1), Phone(1)

Power

Consumption : AC 110V, 50Hz

System Configuration

Description	Model	Serial No	Manufacturer
Inverter	AT-0104LG	N/A	PIS Corp
Power Supply	SAD3912LC	RG1200008	SERONICS Co., Ltd.
LCD Panel	PD104SL6W1800 295	JD1B000006	N/A
I/O Board	DI104S- INOUTa04	N/A	N/A
OSD Board	DI104S- KEYPADa02	N/A	N/A
Main Board	N/A	N/A	N/A

Operating Mode : Display video signal and "H" Pattern on the EUT.

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) 50 Ω /50 μ H 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.

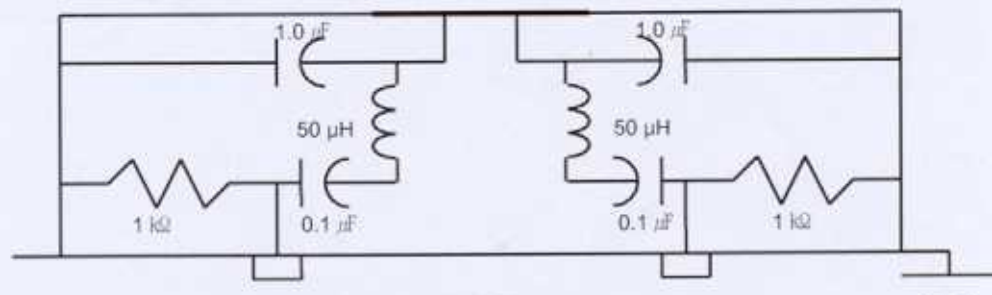


Fig. 2. LISN Schematic Diagram

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 30r10 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.

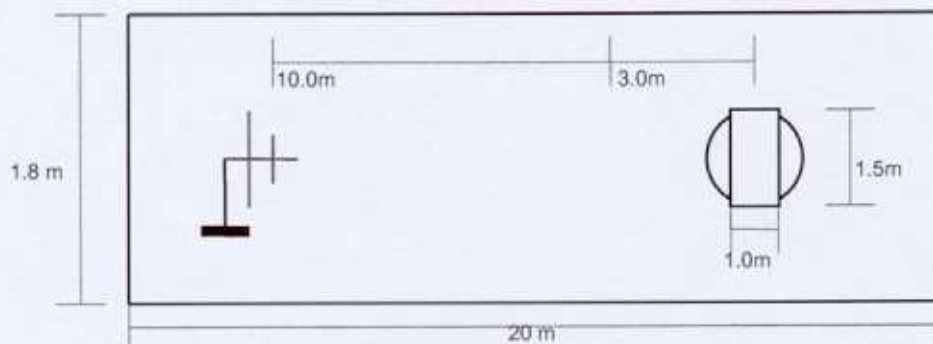


Fig. 3. Dimensions of Outdoor Test Site

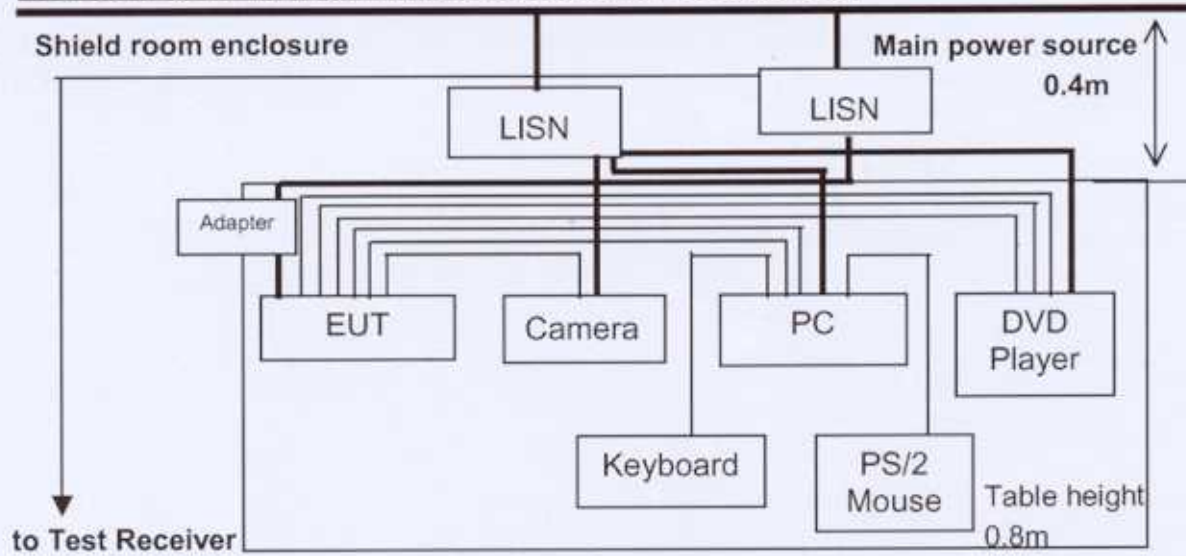
SUPPORT EQUIPMENT USED

Peripheral equipment

Description	Model	Serial No.	Manufacturer
PS/2 Mouse	OK-520	N/A	TECH
Keyboard	SEM-DT35	05068376	SAMSUNG
DVD PLAYER	DVD-5100	P060022	SANYO ELECTRIC
PC	Dreamsys/TL	N/A	TriGem Computer
Camera	ACE-200C	N/A	N/A

User Interface Cable List

Start		END		Cable Spec.	
Name	I/O Port	Name	I/O Port	Length	Shield
EUT	DC IN	Adapter	-	1.0	Unshielded
	D-sub	PC	Video	1.8	Shielded
	Video 1	DVD Player	-	1.5	Unshielded
	Audio R/L	DVD Player	-	1.5	Unshielded
	Video 2	Camera	-	1.8	Unshielded
	S-Video	DVD Player	-	1.5	Shielded
	Phone	PC	Speaker	1.8	Unshielded
Adapter	AC IN	LISN	-	1.0	Unshielded
PC	Video	EUT	D-sub	1.8	Shielded
	Keyboard	Keyboard	-	1.7	Shielded
	PS/2 Mouse	PS/2 Mouse	-	1.8	Shielded
	Speaker	EUT	Phone	1.8	Unshielded

Test set-up for Mains terminal Disturbance Voltage test

TEST DATA

Conducted Emissions

Model No. : DiVi104SAV

Date of Test : 16 July 2002

Measure Bandwidth : 9kHz

Mode : Video

Temperature : 24.5°C

Humidity : 46%

Atmospheric Pressure : 99.1kPa

FREQ (MHz)	LEVEL(dB μ V)	LINE	LIMIT(μ V)	Result(μ V)	MARGIN*(dB)
0.60	41.5	N	250	118.85	6.5
0.65	45.0	N	250	177.83	3.0
0.69	45.0	N	250	177.83	3.0
0.76	43.0	N	250	141.25	5.0
0.92	43.5	H	250	149.62	4.5
0.95	44.0	N	250	158.49	4.0

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 μ V 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

Conducted Emissions

Model No. : DiVi104SAV

Date of Test : 16 July 2002

Measure Bandwidth : 9kHz

Mode : RGB

Temperature : 24.5°C

Humidity : 46%

Atmospheric Pressure : 99.1kPa

FREQ (MHz)	LEVEL(dB μ V)	LINE	LIMIT(μ V)	Result(μ V)	MARGIN*(dB)
0.55	42.5	H	250	133.35	5.5
0.66	45.0	H	250	177.83	3.0
0.76	45.0	H	250	177.83	3.0
0.86	44.0	H	250	158.49	4.0
0.94	44.5	H	250	167.88	3.5
1.04	43.0	H	250	141.25	5.0

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.
4. The limit for Class B digital device is 250 μ V from 450 kHz to 30MHz.
5. Line H = Hot Line N = Neutral

* Measurements using CISPR quasi-peak mode



Tested by See - Ho, Lee

TEST DATA

Radiated Emissions

Model No. : DiVi104SAV

Mode : Video

Date of Test : 15 July 2002

Temperature : 27°C

Humidity : 27%

Atmospheric Pressure : 101.3kPa

Measure Bandwidth : 120kHz

Freq.	Level	AF*	CL**	POL	Limit	F/S	Margin***
(MHz)	(dB μ V)	(dB)	(dB)	(H/V)	(μ V)	(μ V/m)	(dB)
89.18	20.00	8.44	1.90	H	150	32.89	13.16
94.22	21.60	9.09	2.10	H	150	43.59	10.71
108.31	18.40	10.55	2.14	H	150	35.87	12.41
116.87	16.00	11.26	1.98	H	150	28.97	14.26
118.63	18.20	11.43	1.94	H	150	37.91	11.93
331.56	13.60	13.72	4.78	H	200	40.28	13.90

Table 2. Radiated Measurements at 3meters.

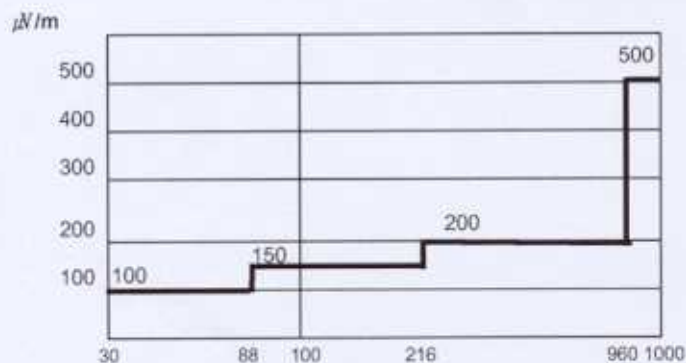


Fig. 4. Limits at 3 meters

10 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.

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 μ V/m.

Tested by  See - Ho, Lee

TEST DATA

Radiated Emissions

Model No. : DiVi104SAV

Mode : RGB

Date of Test : 15 July 2002

Temperature : 26°C

Humidity : 25%

Atmospheric Pressure : 100.6kPa

Measure Bandwidth : 120kHz

Freq. (MHz)	Level (dB μV)	AF* (dB)	CL** (dB)	POL (H/V)	Limit (μV)	F/S ($\mu V/m$)	Margin*** (dB)
84.39	19.40	7.75	1.90	V	100	28.35	10.95
94.28	20.40	9.09	2.10	H	150	37.97	11.91
108.00	20.00	10.55	2.14	H	150	43.12	10.81
116.87	18.40	11.26	1.98	H	150	38.19	11.86
118.62	19.40	11.43	1.94	H	150	43.52	10.73
331.52	16.80	13.72	4.78	H	200	58.22	10.70

Table 2. Radiated Measurements at 3meters.

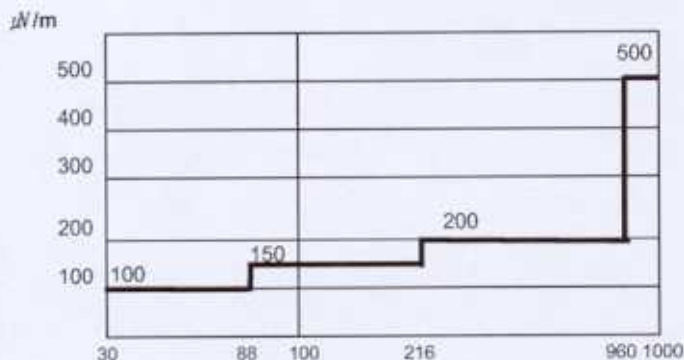


Fig. 4. Limits at 3 meters

11 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.

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 $\mu V/m$.

MHz

Tested by  See - Ho, Lee

PLOTS OF EMISSIONS

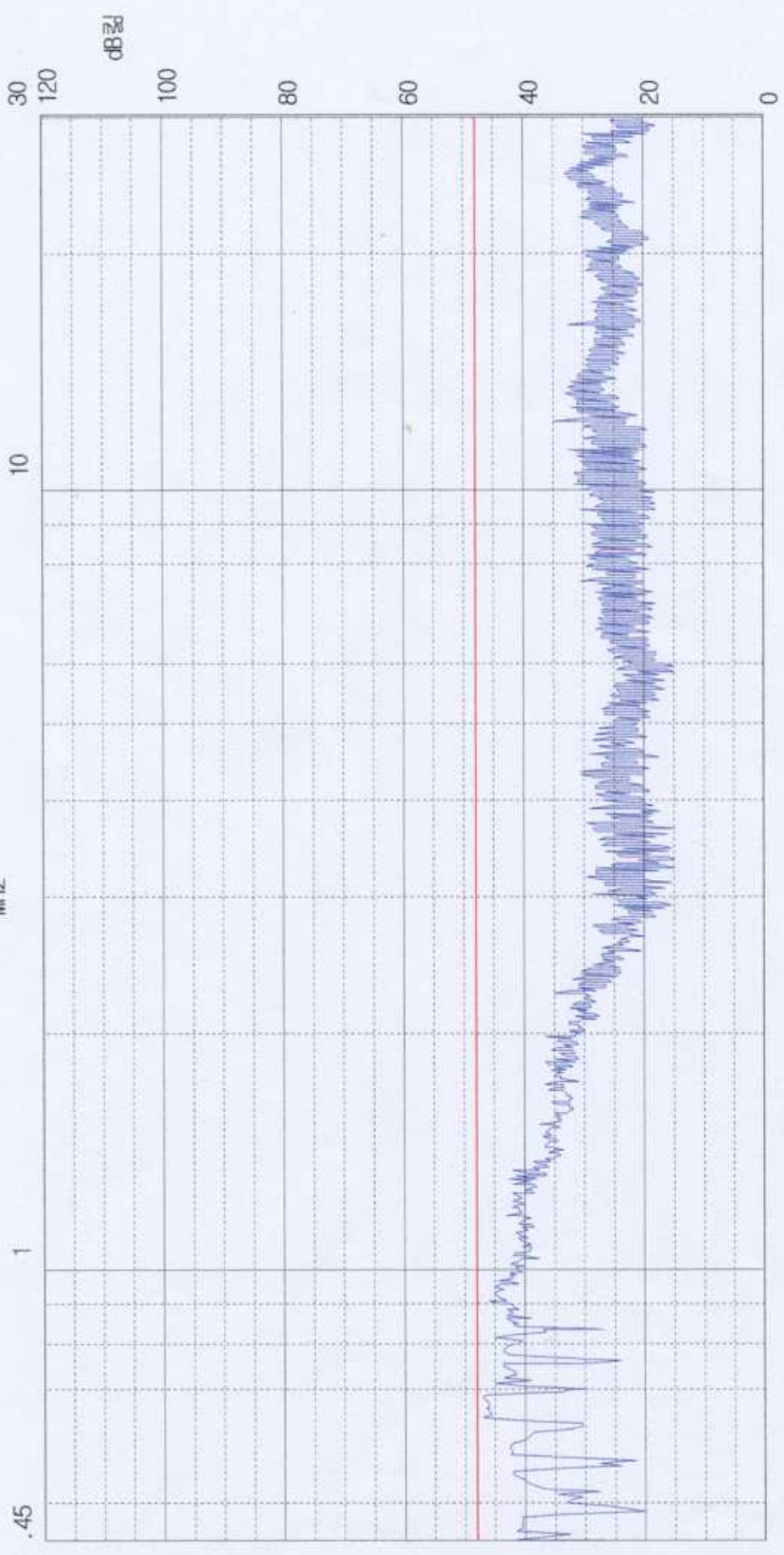
P M M 8 0 1 0 for Windows

Name:

Date: 02-07-16

Time: 11:28

MHz



Limit : Fcc_15_b Detector: Peak Lisen L2-16 Line: 1

MODEL : DiVi1104SAV
LINE : HOT
MODE : VIDEO
OPERATOR : S.H.LEE



P M M 8 0 1 0 for Windows

Name:

Date: 02-07-16

Time: 11:24

MHz

.45

1

10

30
120

dBμV

100

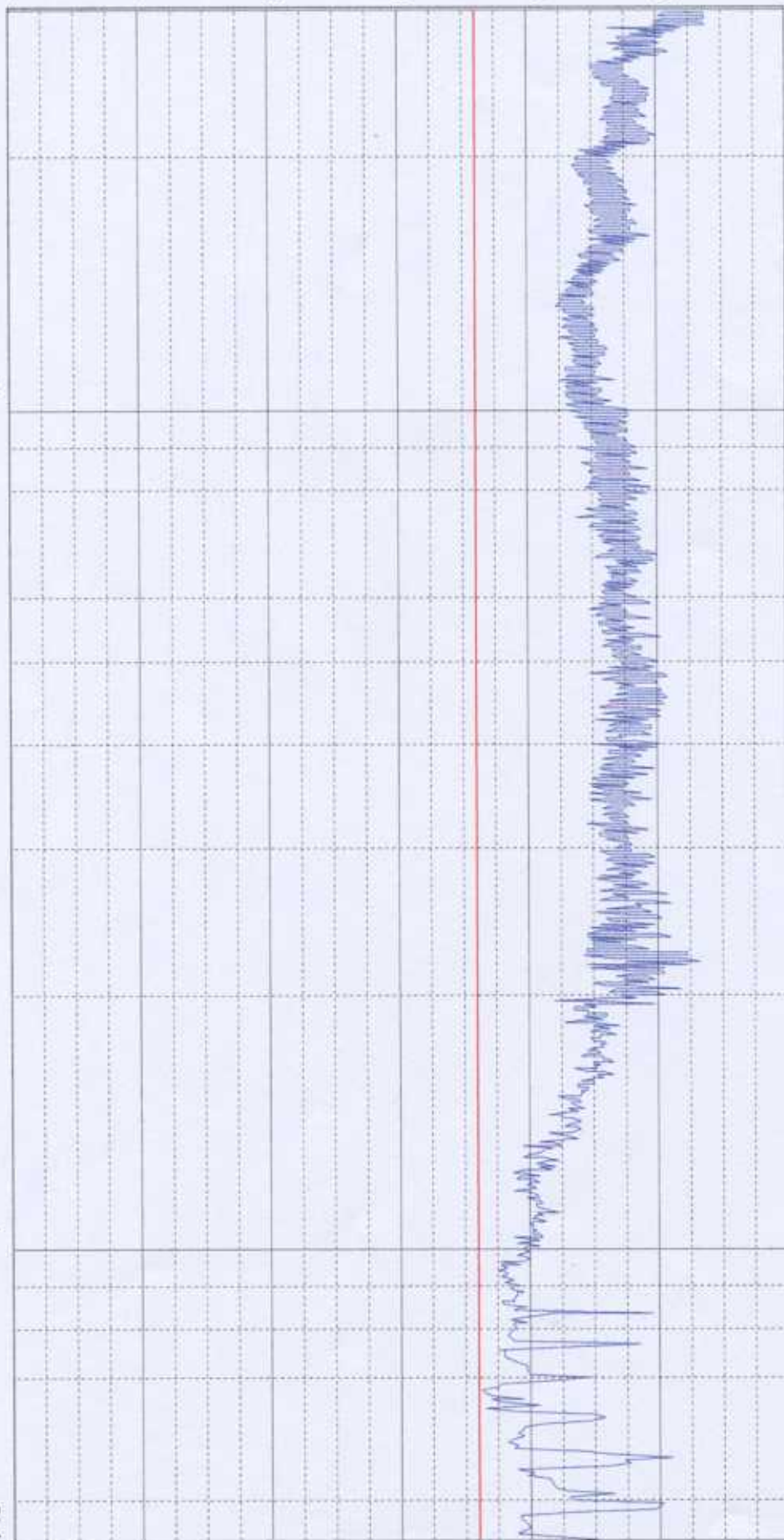
80

60

40

20

0



Limit : Fcc_15_b

Detector: Peak

Lisn L2-16 Line: 1

MODEL : DiVi104SAV

LINE : NEUTRAL

MODE : VIDEO

OPERATOR : S.H.LEE

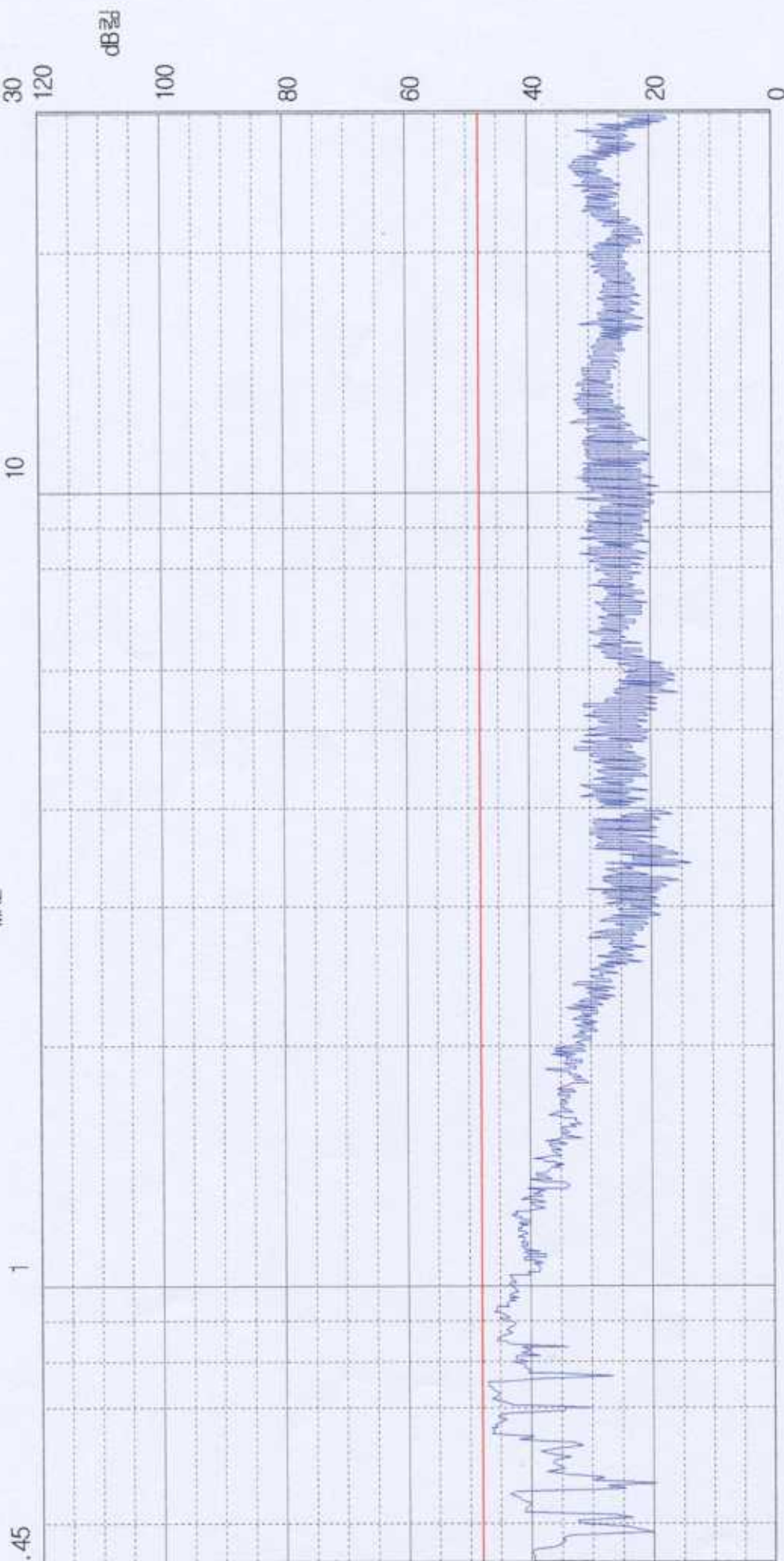
P M M 8 0 1 0 for Windows

Name:

Date: 02-07-16

Time: 11:34

MHz



Limit : Fcc_15_b

Detector: Peak

Lisn L2-16 Line: 1

MODEL : DiVi104SAV

LINE : HOT

MODE : RGB

OPERATOR : S.H.LEE

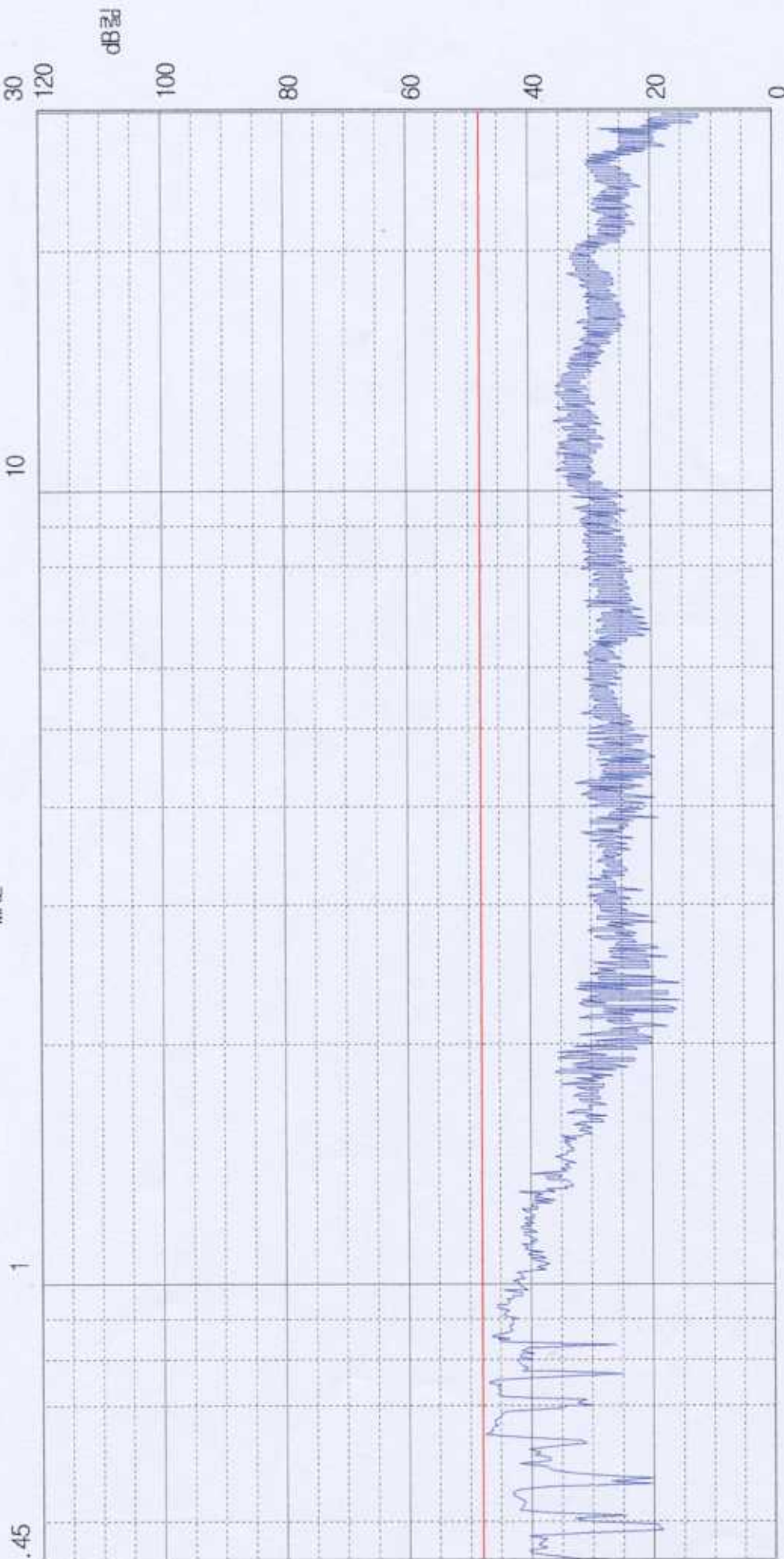
P M M 8 0 1 0 for Windows

Name:

Date: 02-07-16

Time: 11:40

MHz



Limit : Fcc_15_b

Detector : Peak

Lisn L2-16 Line: 1

MODEL : DiVi104SAV

LINE : NEUTRAL

MODE : RGB

OPERATOR : S.H.LEE

SAMPLE CALCULATIONS

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

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

EX. 1.

@20.3 MHz

Class B limit = 250 μV = 48.0 dB μV

Reading = 40.8 dB μV (calibrated level)

$$10^{(40.8/20)} = 109.64 \mu\text{V}$$

$$\text{Margin} = 48.0 - 40.8 = 7.2$$

7.2 dB below limit

EX. 2.

@57.7 MHz

Class B limit = 100 $\mu\text{V}/\text{m}$ = 40.0 dB $\mu\text{V}/\text{m}$

Reading = 19.1 dB μV (calibrated level)

Antenna factor + Cable Loss = 10.12 dB

Total = 29.22 dB $\mu\text{V}/\text{m}$

$$\text{Margin} = 40.0 - 29.22 = 10.78$$

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:

$$U = 2 \sqrt{S^2_{s1} + S^2_{s2} + \dots + S^2_{sr}}$$

TEST EQUIPMENT

Conducted Emission

Equipment	Manufactory	Model	Cal. Date
Signal Analyzer	PMM	8010	Sep. 2001
LISN	PMM	3825/2	Apr. 2002
LISN	PMM	3825/2	Apr. 2002
Pulse Limiter	PMM	PL-01	Jul. 2001
Shielded Room	Daeil	N/A	-

Radiated Emission

Equipment	Manufactory	Model	Cal. Date
Test Receiver	R & S	ESVS30	Nov. 2001
Spectrum Analyzer	H.P	E4411A	Dec. 2001
RF Amplifier	H.P	8447F	May. 2002
Bilog Antenna	SCHAFFNER	CBL6111C	Apr. 2002
RF Select s/w	DAIWA	CS201	Apr. 2002

RECOMMENDATION/CONCLUSION

The data collected shows that the **Display Inside Co., Ltd.** Model : **DiVi104SAV** complies with § 15.107 and 15.109 of the FCC Rules.

Mode : Video

The highest emission observed was at 0.65MHz & 0.69MHz for conducted emissions with a margin of 3.0dB and at 94.22MHz for radiated emissions with a margin of 10.71dB

Mode : RGB

The highest emission observed was at 0.66MHz & 0.76MHz for conducted emissions with a margin of 3.0dB and at 118.62MHz for radiated emissions with a margin of 10.73dB

APPENDIX A – SAMPLE LABEL

New Labeling 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.

TFT LCD AV Monitor Model:DiVi104SAV FCC ID:QHW-0207 DIVI104S0 Display Inside 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 UNDESIRE OPERATION.