JungAng EMC Co., Ltd.

109-2, Yepyung-ri, Kumsa-myun, Youju-kun, Kyungki-do, KOREA
TEL: 82 2 571 8217 FAX:82 31 764 0126

FCC EMI TEST REPORT

Date of Test : **March 30, 2001**
Test Report No : **01JAC006.FCC**
Test Site : **JungAng EMC Co., Ltd., Korea(31040/SIT 1300F2)**

Trade Name : **N/A**
Manufacturer : **MIRAE COMM Co., Ltd.**
Address : **1516-3, Seocho-3 Dong, Seocho-Gu, Seoul, Korea**

Contact Person : **Kyung-Chal Song**
Tel No. : 82-2-3488-6931
Fax No. : 82-2-3487-1693

Product : **MP3 Player**

Model : **MRM-2101**

Fcc Rule Part(s) : **FCC Part 15 Subpart B**

Classification : **Class B**

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 C.63.4-1992.

I attest to the accuracy of data and all measurement 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 qualification of all persons taking them.

TaeHyun Nam
President-JungAng EMC Co., Ltd.
http://www.jaemc.co.kr

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1. DESCRIPTION OF DEVICE

1.1 General

Responsible Party	**MIRAE COMM Co., Ltd.**
Contact Person	**Kyung-Chal Song** **Tel No. : 82-2-3488-6931** **Fax No. : 82-2-3487-1693**
Manufacturer	**MIRAE COMM Co., Ltd.** **1516-3, Seocho-3 Dong, Seocho-Gu, Seoul, Korea**

- Trade name **N/A**
- Model name **MRM-2101**
- EUT Type **MP3 Player**
- Classification **FCC Part 15 Subpart B Class B**
- Clock Speed **Main Clock : 14 MHz, 48 MHz**
- Rule Part(s) **FCC Part 15 & Part 2**
- Test Procedure(s) **ANSI C63.4(1992)**
- Date of Tests **March 30, 2001**
- Place of Tests **JungAng EMC Co., Ltd.**

1.2 EUT Description

The EUT is the device which is playing Audio Sound Track with formatted to MP3 standard mode. MP3 file means MPEG 1 layer 3, a standard compression method providing an excellent quality audio. MP3 makes users possible to enjoy the high quality sound of the downloaded MP3 music files from the Internet or the other audio content with the 1/12 size of commercial CD audio files.

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☑ **Note.** Please refer to the duties and responsibilities of the Responsible Party attached.

2. TEST FACILITY

The open field test site and conducted measurement facility used for this measurement, is located following address. This site was fully described in a report dated Nov. 24, 1998, that was submitted to the FCC. Our site and facility had been accepted in a letter dated Nov. 24, 1998(31040 / SIT) :

JungAng EMC Co., Ltd.

Address : 109-2, Yepyung-ri, Kumsa-myun, Youju-kun, Kyungki-do, Korea

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.

3. SUMMARY OF RESULTS

3.1 Electromagnetic Emission

RFI Voltage Measurement……..**PASS**

RFI Field Strength Measurement……**PASS**

Although the measured emissions indicate that the EUT complies with the required limits, some measurements are close to these limits.

When the uncertainty of measurement is considered, there is some possibility that the EUT may not be compliant.

3.2 Modifications to the EUT : None

4. TESTED SYSTEM DETAILS

4.1 Peripherals and Others :

Description	Model Name	Serial No.	Manufacturer	FCC ID
Computer	KAYAK	5064-7432A034598	HP	DoC
Printer	STYLUS PHOTO 750	BRL0009512	EPSON	DoC
Monitor	VX700	M902080938	Gateway	BGBTFV8705K
Keyboard	RT235BTW	B13BC90L39GU	Compaq	AQ6-22K15
Mouse #1	M-S34	F13490N5BGF	Compaq	DZL211029
Mouse #2	OK-520	00DAC0231	A4 TECH	DoC
Mouse #3	898W	5883A001	Han Long	HLA311001
Mouse #4	Pro Mouse II	96002117	NEOTEC	FSUGMZC7

4.2 Type of Cables Used:

Device from	Device to	Type of Cable	Length	Type of shield
Computer	Monitor	Signal cable	1.0	shielded
Computer	Printer	Signal cable	1.8	shielded
Computer	Keyboard	Signal cable	2.0	shielded
Computer	Mouse #1,#2	Signal cable	1.5	shielded
Computer	Mouse #3	Signal cable	1.5	shielded
Computer	MP3 Player	Signal cable	1.5	shielded
Computer	Joystick	Signal cable	1.5	shielded
Computer	Main Power	Power cable	1.5	Non-shielded
Monitor	Main Power	Power cable	1.5	Non-shielded
Printer	Main Power	Power cable	1.5	Non-shielded

4.3 System layout on EUT and peripherals

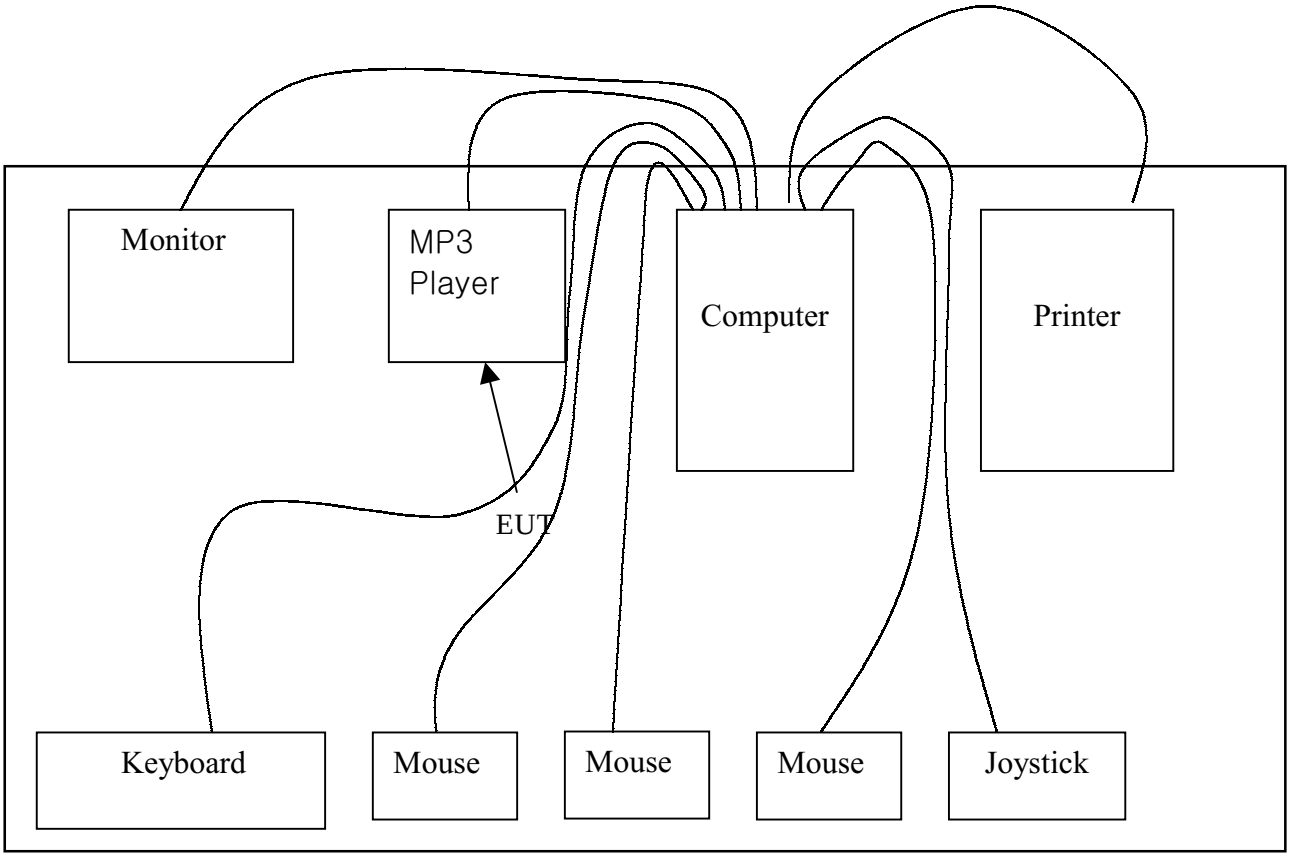


Figure 4-1 System layout

5. TEST RESULT

5.1 RFI Voltage Measurement

5.1.1 Measurement Instrumentation Used

(model / serial no. / manufacturer / last calibration / next calibration)

Signal Analyzer……(PMM9000 / 3100J70602 / PMM / 10 Oct. 2000 / Oct. 2001)

L.I.S.N……(L3-25 / 1110K70403 / PMM / 01 Sep. 2000 / Sep. 2001)

Coaxial cable……(RG213U / --- / MARLOW / - / -)

Shield Room……(JASH01 / JAC01 / DAIL EMC / --- / ---)

5.1.2 Measurement Procedure

The power line conducted interference measurement were performed according to ANSI C63.4-1992 in a Shield room placed on a table, 0.8 m high over a metal floor.
It was located more than required distance away from the shielded enclosure wall.
Deviations from the standard was none. The EUT was plugged into the LISN and the frequency range of interest scanned. **We measured device in Continuous playing and downloading "MP3" music files from PC** . We reported at maximum emission levels.

5.1.3 Operation Modes

EUT was tested according to the specifications given by the manufacturer, and exercised in the most unfavorable manner.

The EUT was operated with continuously playing "MP3" music program through earphone. Also the test was measured while the EUT was downloading the MP3 files from computer system.

5.1.4 Measurement Uncertainty

Measurement uncertainty of RFI Voltage Measurement test was estimated at ±1.8 dB(k=2)

5.1.5 Test Data

RFI Voltage Measurement Results (0.45 MHz to 30 MHz)

Operating mode : **Continuous playing and downloading "MP3" music files from PC.**
Test procedure : ANSI C63.4-1992
Date of measurement : Mar. 30, 2001
Temperature : 23.0 degree C
Humidity : 48 %

Model : **MRM-2101**

FREQ(MHz)	LEVEL(dBuV)	LINE	LIMIT(dBuV)	Result(dBuV)	MARGIN(dBuV)
0.157	37.20	H	48	37.20	−10.80
1.161	38.70	H		38.70	−9.30
1.268	39.70	H		39.70	−8.30
1.373	39.20	H		39.20	−8.80
1.480	38.40	H		38.40	−9.60
1.901	37.20	H		37.20	−10.80
2.963	40.30	H		40.30	−7.70
3.705	37.00	H		37.00	−11.00
4.328	37.80	H		37.80	−10.20
4.695	37.60	H		37.60	−10.40
5.810	37.90	H		37.90	−10.10
16.310	38.70	N		38.70	−9.30

Table 1. Line Conducted Emission Tabulated Data

Note :

1. All modes of operation were investigated and the worst-case emission are reported.
   See attached Plots.

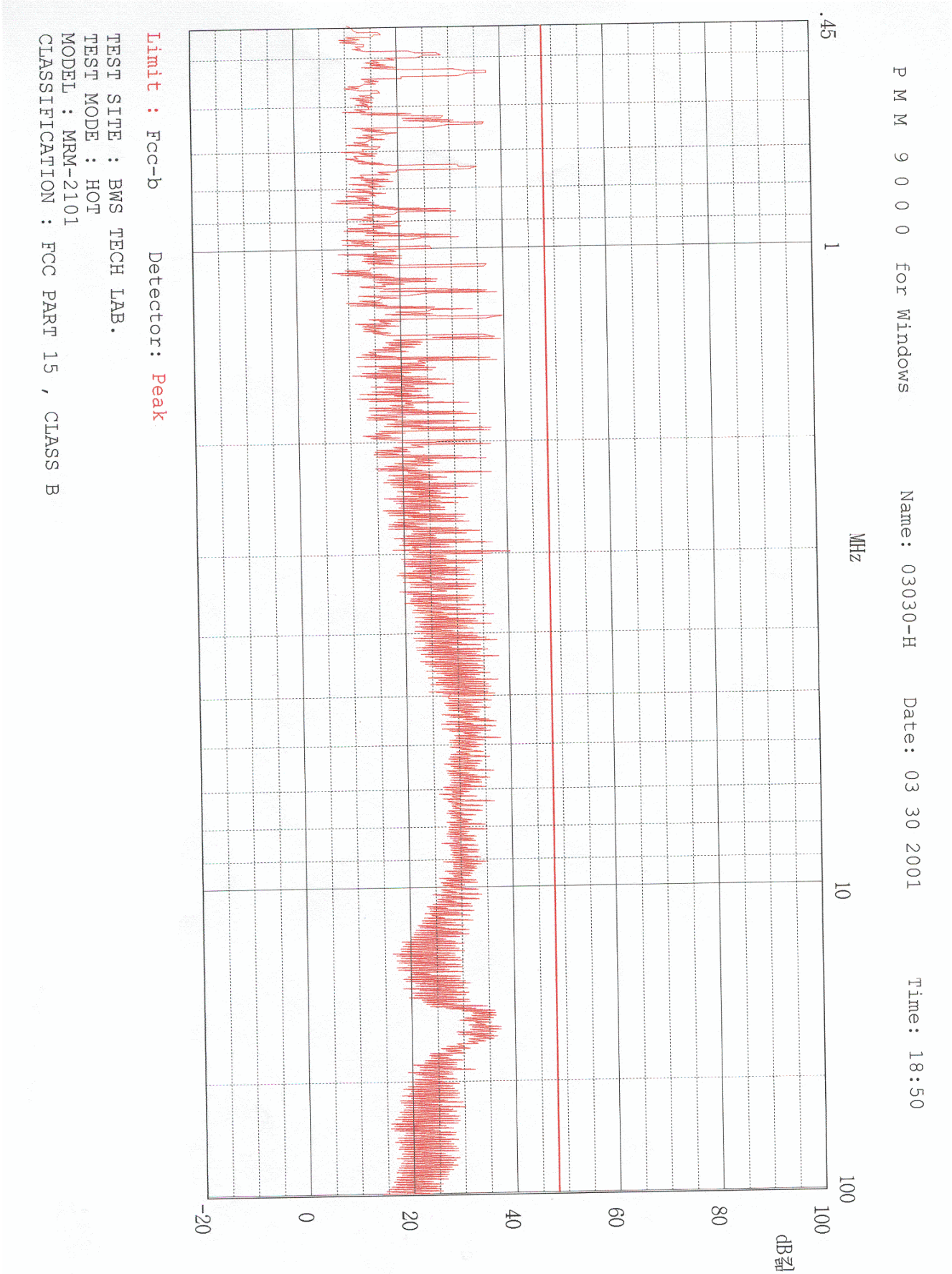
2. The limit for Class B digital device is 250 uV(48 dBuV) from 450 kHz to 30 MHz.

3. Line H = Hot Line N = Neutral

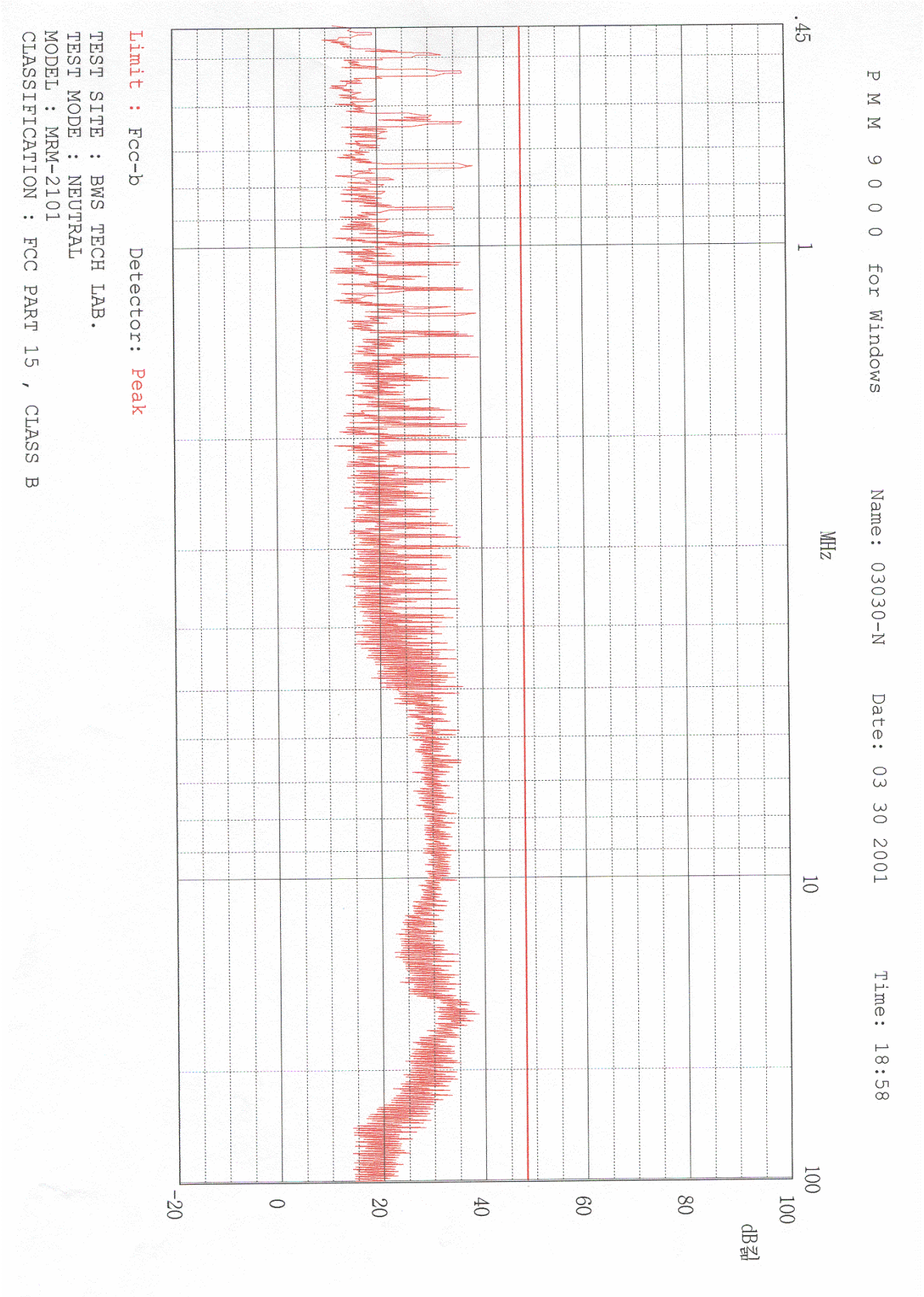
** Measurement using CISPR quasi-peak mode

Tested by **Hyung-Seok Lee**

PLOTS OF EMISSIONS



PLOTS OF EMISSIONS



5.2 RFI Field Strength Measurement

5.2.1 Measurement Instrumentation Used

Signal Analyzer……(PMM9000 / 3100J70602 / PMM / 10 Oct. 2000 / Oct. 2001)

Spectrum Analyzer……(R3261 / 61720002 / Advantest / 25 Aug. 2000 / Aug. 2001)

Biconical antenna……(BC01 / 0020J70501 / PMM / 10 Oct. 2000 / Oct. 2001)

Log periodic antenna……(LP01 / 0020J70501 / PMM / 10 Oct. 2000 / Oct. 2001)

Coaxial cable……(RG213U / --- / MARLOW / -- / --)

5.2.2 Measurement Procedure

Final test was performed according to ANSI C63.4-1992 at the open field site .
Deviations from the standard was none.

The EUT was placed in a 0.8m high table along with the peripherals. The turn table was separated from the antenna with the distance of 3 meter. Cables were placed in a position to produce maximum emissions as determined by experimentation, and operation mode was selected for maximum.

The frequencies and amplitudes of maximum emission were measured at varying azimuths, antenna heights and antenna polarities. **We measured device in Continuous playing and downloading "MP3" music files from PC.** We reported at maximum emission levels.

5.2.3 Operation Modes

EUT was tested according to the specifications given by the manufacturer, and exercised in the most unfavorable manner.

The EUT was operated with continuously playing "MP3" music program through earphone. Also the test was measured while the EUT was downloading the MP3 files from computer system.

5.2.4 Measurement Uncertainty

Measurement uncertainty of RFI Field Strength Measurement test was estimated at ±3.5 dB(k=2)

5.2.5 Test Data

RFI Field Strength Measurement Results(30 MHz to 1000 MHz)

Operating mode : **Continuous playing and downloading "MP3" music files from PC.**
Test procedure : ANSI C63.4-1992

Date of measurement : Mar. 30, 2001
Temperature : 13.0 degree C
Humidity : 50 %

Model : **MRM-2101**

MEASEMENT FREQ (MHz)	MEASEMEN TLEVEL (dBuV)	ANTENNA POLARITY (H/V)	ANTENNA FACTOR (dB)	CABLE LOSS (dB)	LIMIT (dBuV)	FIELD STRENGTH (dBuV/m)	MARGIN (dBuV/m)
47.99	23.20	V	10.00	1.37	40.00	34.57	-5.43
49.14	22.70	V	9.73	1.38		33.81	-6.19
120.01	17.40	V	11.56	2.22	43.50	31.18	-12.32
158.06	11.40	H	13.86	2.57		27.83	-15.67
200.55	20.00	H	10.61	2.94		33.55	-9.95
215.99	17.20	H	11.02	3.07		31.29	-12.21
239.99	23.80	H	11.68	3.29	46.00	38.77	-7.23
248.37	17.40	H	11.93	3.37		32.70	-13.30
336.18	10.50	H	14.77	3.89		29.16	-16.84
428.99	6.80	H	16.38	4.47		27.65	-18.35
471.82	10.90	H	17.39	4.75		33.04	-12.96
792.05	7.20	H	23.06	6.35		36.61	-9.39

Table 2. Radiated Measurements at 3meters.

Note :

1. All modes of operation were investigated and the worst-case emissions are reported.
2. The limit for Class B digital device is 100 uV(40 dBuV) from 30 MHz to 88 MHz, 150 uV(43.5 dBuV) from 88 MHz to 216 MHz, 200 µV(46 dBuV) from 216 MHz to 960 MHz and 500 µV (54 dBuV) from above 960 MHz.

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

Tested by **Hyung-Seok Lee**

5.3 Minimum Margin

Conducted emission

MP3 Player	playing and downloading mode	2.963 MHz,	7.70 dBuV

Radiated emission

MP3 Player	playing and downloading mode	47.99 MHz,	5.43 dBuV / m

5.4 SAMPLE CALCULATIONS

dBµV = 20 log 10 (µV / m)

µV = $10^{(dB\mu V / 20)}$

EX. 1.

@ 2.963 MHz Class B limit = 250 µV = 48 dBµV

Reading = 40.30 dBµV (calibrated level)

$10^{(40.3 / 20)}$ = 103.51 µV

Margin = 40.3 – 48 = -7.7

7.7 dBuV ; below limit

EX. 2.

@ 47.99 MHz Class B limit = 100 µV / m = 40 dBµV / m

Reading = 23.2 dBµV(calibrated level)
Antenna factor + Cable Loss = 11.37 dB
Total = 34.57 dBµV / m

$10^{(34.57 / 20)}$ = 53.52 µV

Margin = 34.57 – 40 = -5.43 dBµV / m

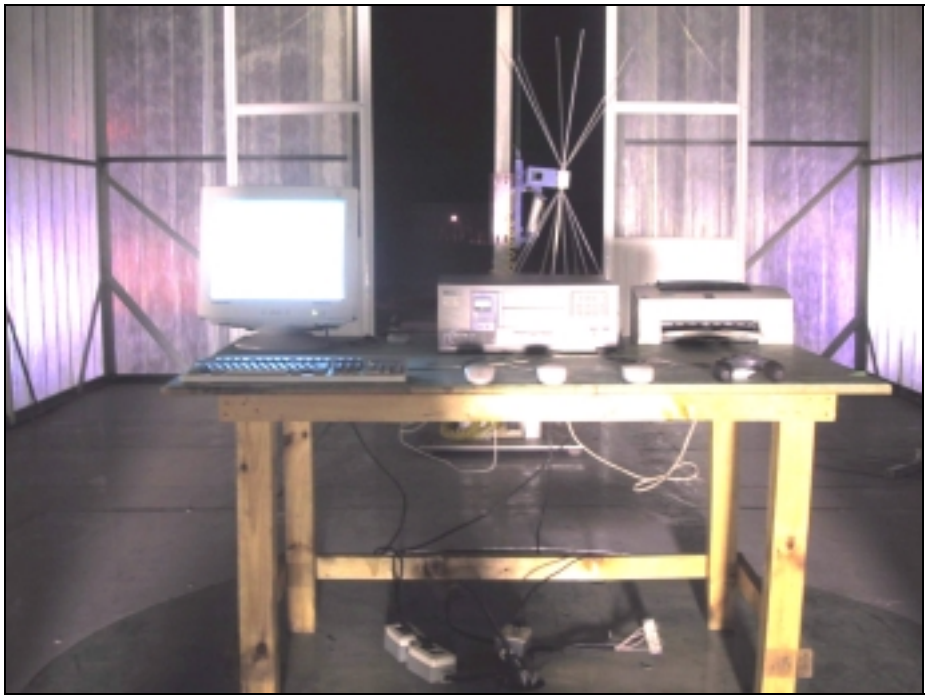
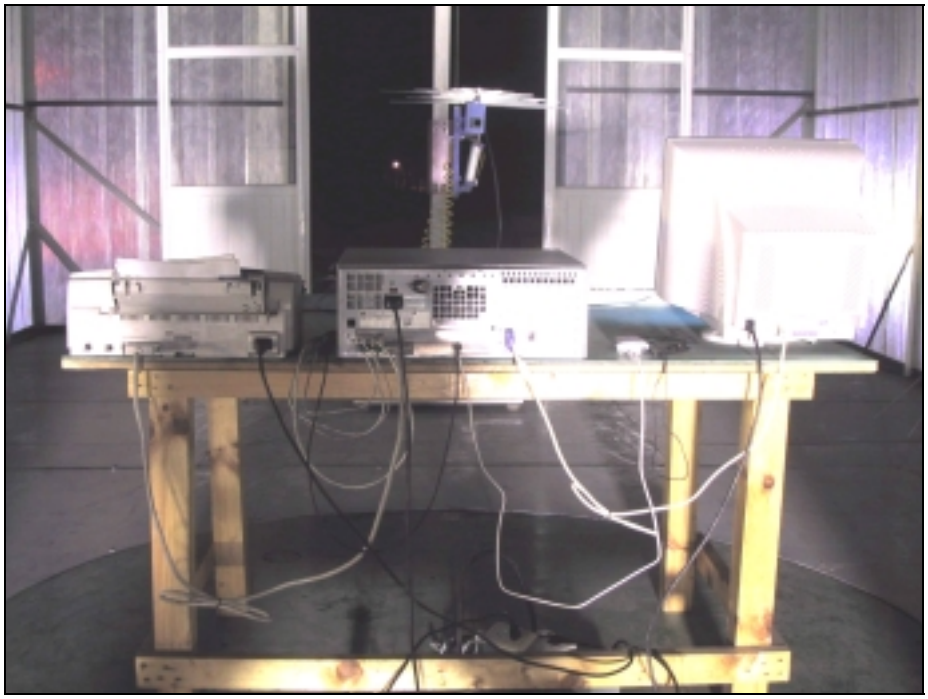
5.43 dBµV/m ; below limit

6. TEST EQUIPMENTS

The listing below denotes the test equipments utilized for the test(s).

Nomenclature	Manufacture Model Number	Serial Number	Calibration Date
Signal Analyzer (9kHz – 1.2GHz)	PMM PMM 9000	3100J70602	00 / 10 / 10
Spectrum Analyzer (9kHz – 2.6GHz)	ADVANTEST R3261C	61720002	00 / 08 / 25
Amplifier (0.1MHz-1.3GHz)	HP 8447D	2944A08872	01 / 01 / 10
LISN	PMM L3-25	1110k70403	00 / 09 / 01
Biconical Antenna	PMM BC01	0020J70501	00 / 10 / 10
Log Periodic Antenna	PMM LP01	0020J70501	00 / 10 / 10
Dipole Antenna	SWALZBECK VBA6106A	1277	00 / 09 / 05
Dipole Antenna	SWALZBECK UHA9105	91052168	00 / 09 / 05
Plotter	HP 7475A	7475A	-
Shield Room 7m x 4m x 4m	SEMITECH -	000815	
Turn Table	JAEMC JAC-2	980723	
Antenna Mast	Dail EMC	970815	

7. MEASUREMENT PHOTOS

7.1a Setup with the Maximized RFI Voltage Emission Level

7.2a Setup with the Maximized RFI Field Strength Emission Level