



JungAng EMC Co., Ltd.

109-2, Yepyung-ri, Kumsa-myun, Youju-kun, Kyungki-do, KOREA
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FCC EMI TEST REPORT

Date of Test : July 18, 2000
Test Report No : 00JAC007.FCC
Test Site : JungAng EMC Co., Ltd., Korea(31040/SIT 1300F2)

Trade Name : N/A
Manufacturer : Garnet Systems Co., Ltd.
Address : Myungsung Bldg., 545-7, Dogok-Dong, Kangnam-Gu, Seoul, Korea

Contact Person : Bong-Cheol Kim
Tel No. : 82-2-2188-7188
Fax No. : 82-2-572-4911

Product : Modem

Model : GTM-56KM6

Fcc Rule Part(s) : FCC Part 15Subpart 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	Garnet Systems Co., Ltd.
Contact Person	Bong-Cheol Kim Tel No. : 82-2-2188-7188 Fax No. : 82-2-572-4911
Manufacturer	Garnet Systems Co., Ltd. Myungsung BLDG., 545-7, Dogok-Dong, Kangnam-Gu, Seoul, Korea

- Trade name **N/A**
- Model name **GTM-56KM6**
- EUT Type **Modem**
- Classification **FCC Part 15 Subpart B Class B**
- Clock Speed **Main Clock : 28.224 MHz**
- Rule Part(s) **FCC Part 15 & Part 2**
- Test Procedure(s) **ANSI C63.4(1992)**
- Date of Tests **July 18, 2000**
- Place of Tests **JungAng EMC Co., Ltd.**

1.2 EUT Description

This modem supports high speed analog data, high speed fax operation over the PSTN. In ITU-T V.90/ K56flex data mode, this modem transmit/ receive up to 54kbps from a digitally connected V.90 or K56flec-compatible central site modem.

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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	DESKPRO	7836BVD20016	Compaq	DoC
Printer	C2106A	3217S91901	HP	B94C2106X
Monitor	VX700	M902080938	Gateway	BGBTFV8705K
Keyboard	RT235BTW	B13BC90L39GU	Compaq	AQ6-22K15
Mouse #1	M-S34	F13490N5BGF	Compaq	DZL211029
Mouse #2	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	Signal cable	1.5	shielded
Computer	Mouse #2	Signal cable	1.5	shielded
Computer	MODEM	Signal cable	1.2	Non-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

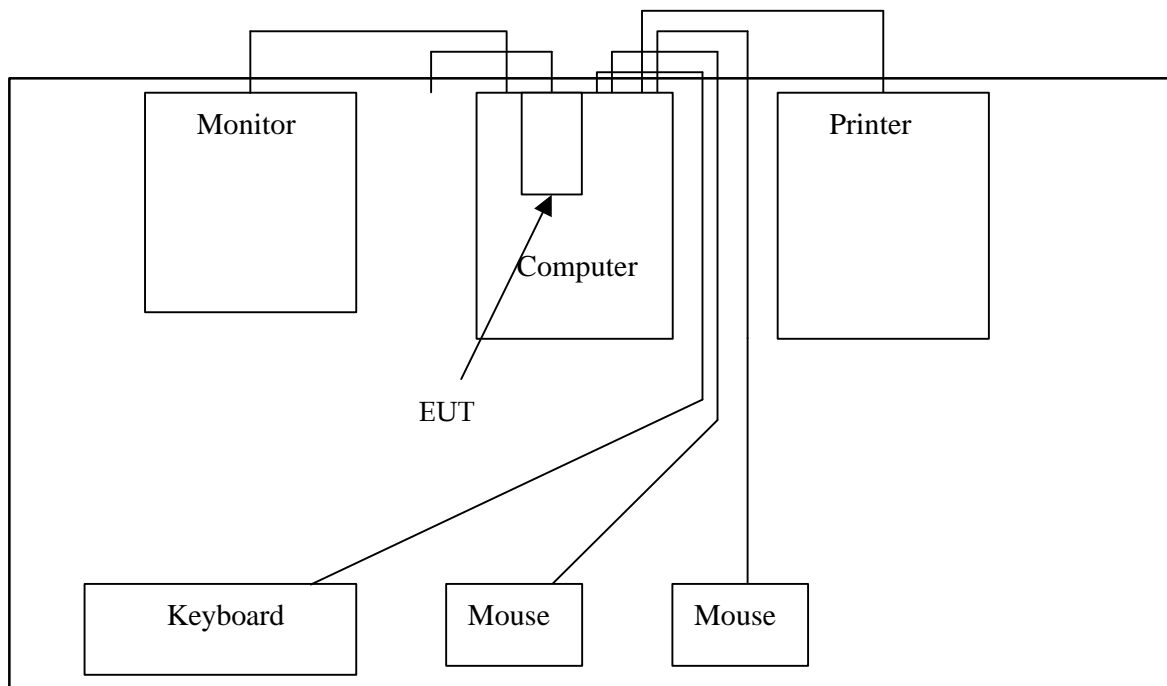


Figure 4-1 System layout

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/08 Oct. 1999/Oct. 2000)

L.I.S.N.....(L3-25/1110K70403/PMM/30 Sep. 1999/Oct. 2000)

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, 0.8m 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. RJ-11 cable is terminated with 600 ohm resistor.

We measured device in normal operation mode. 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 displaying "H" character on the monitor, and continuously operating the modem card.

5.1.4 Measurement Uncertainty

Measurement uncertainty of RFI Voltage Measurement test was estimated at $\pm 1.8\text{dB}(k=2)$

5.1.5 Test Data

RFI Voltage Measurement Results (0.45 MHz to 30MHz)

Operating mode : Continuous displaying "H" character, and operating modem card.

Test procedure : ANSI C63.4-1992

Date of measurement : July 18, 2000

Temperature : 24.1 degree C

Humidity :57 %

Model : GTM-56KM6

FREQ (MHz)	LEVEL(dBuV)	LINE	LIMIT(dBuV)	Result(dBuV)	MARGIN (dBuV)
0.909	40.70	N	48	40.70	-7.30
1.066	41.10	N		41.10	-6.90
1.225	41.30	N		41.30	-6.70
1.382	41.20	N		41.20	-6.80
1.541	41.30	N		41.30	-6.70
1.777	39.90	N		39.90	-8.10

Table 1. Line Conducted Emission Tabulated Data

Note :

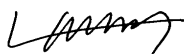
1. All modes of operation were investigated and the worst-case emission are reported.
See attached Plots.

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

3. Line H = Hot

Line N = Neutral

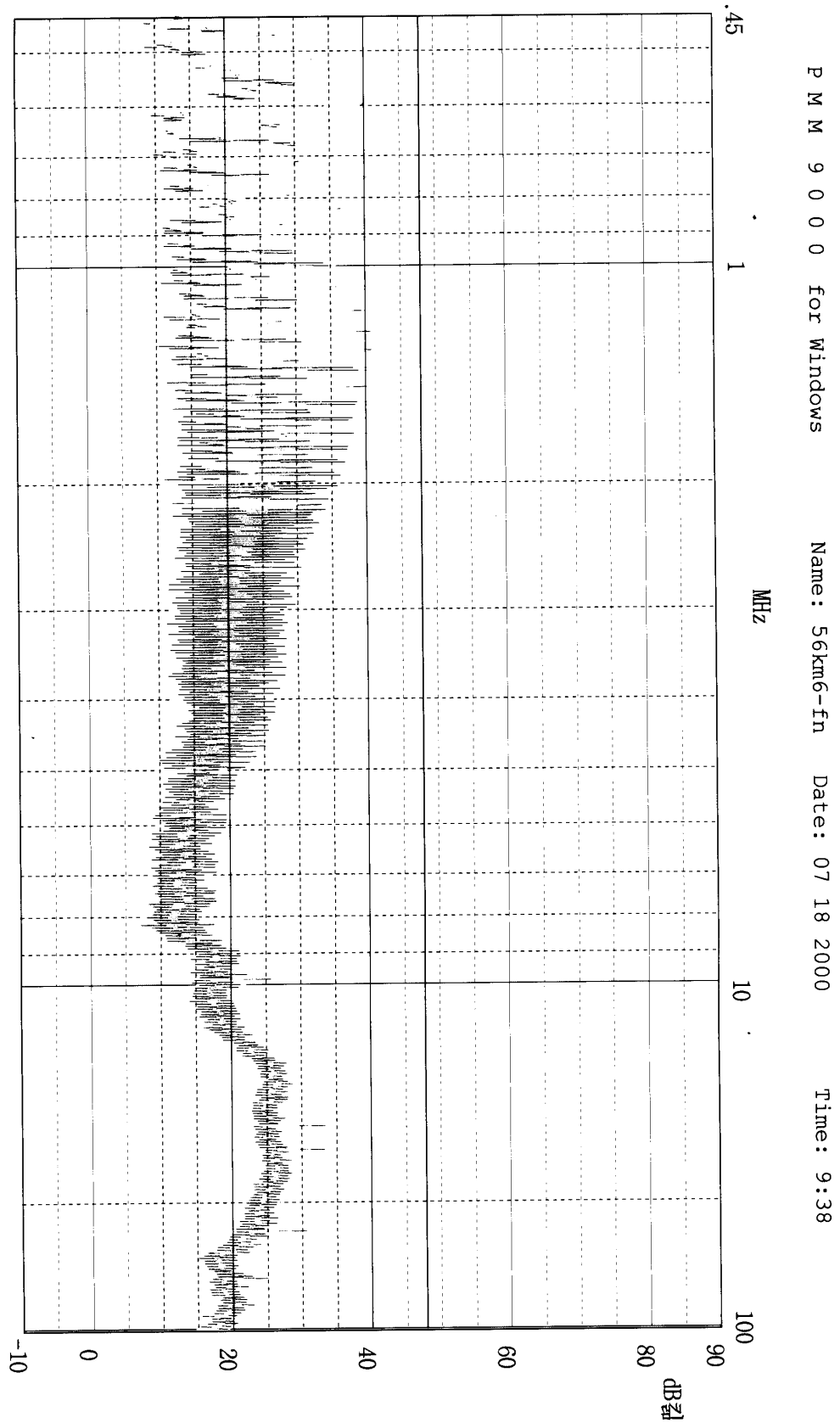
** Measurement using CISPR quasi-peak mode



Tested by **Hyung-Seok Lee**

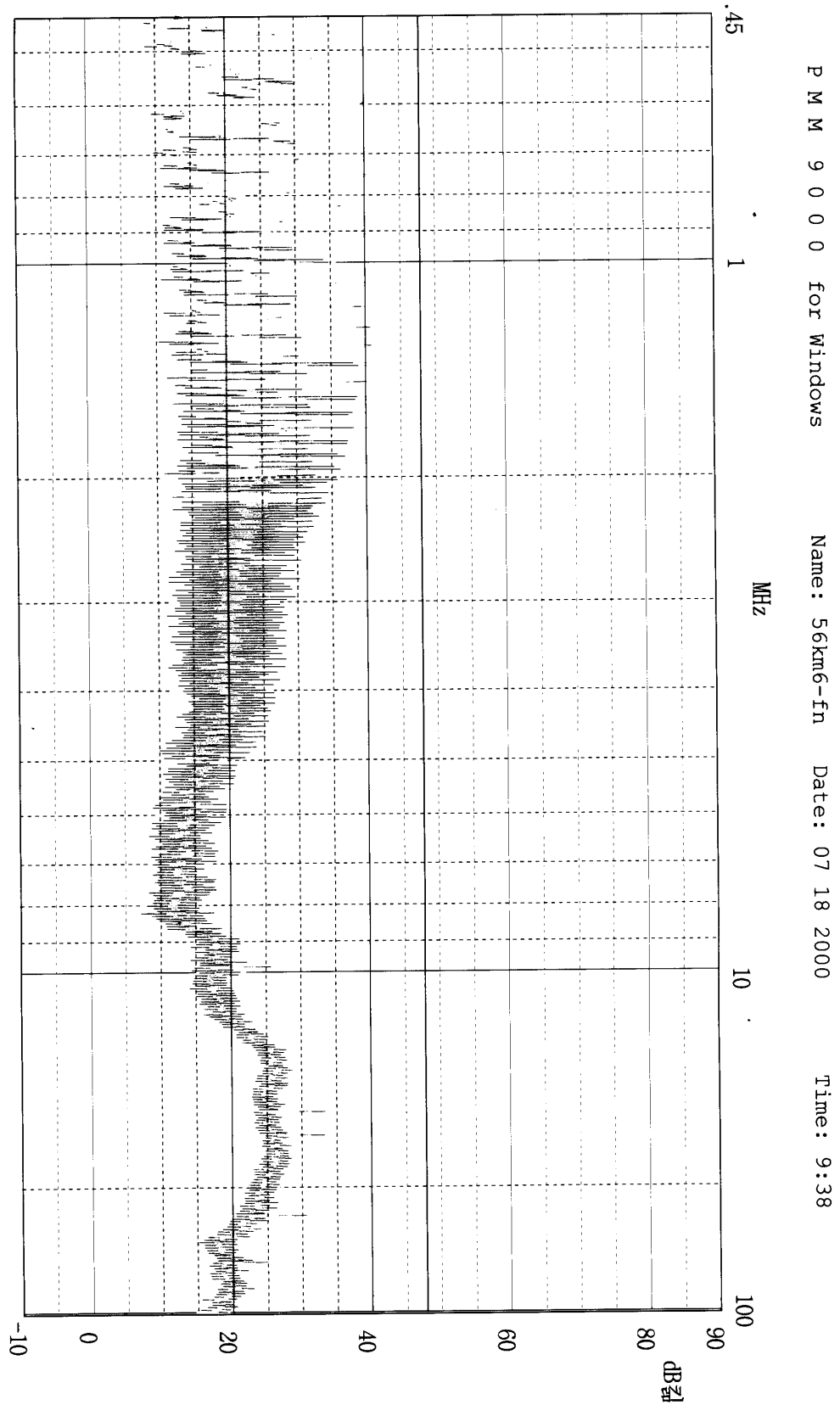
PLOTS OF EMISSIONS

Limit : Fcc_b Detector: Peak
TEST SITE : JUNGANG EMC LAB.
TEST MODE : HNEUTRAL
MODEL : GTM-56KM6
CLASSIFICATION : FCC PART 15, CLASS B



PLOTS OF EMISSIONS

Limit : Fcc_b Detector: Peak
TEST SITE : JUNGANG EMC LAB.
TEST MODE : HNEUTRAL
MODEL : GTM-56KM6
CLASSIFICATION : FCC PART 15, CLASS B



5.2 RFI Field Strength Measurement

5.2.1 Measurement Instrumentation Used

Signal Analyzer.....(PMM9000/3100J70602/PMM/08 Oct. 1999/Oct. 2000)

Spectrum Analyzer.....(R3261/61720002/Advantest/19 Aug. 1999/Aug. 2000)

Biconical antenna.....(BC01/0020J70501/PMM/08 Oct. 1999/Oct. 2000)

Log periodic antenna.....(LP01/0020J70501/PMM/08 Oct. 1999/Oct.'2000)

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 3meter. Cables were placed in a position to produce maximum emissions as determined by experimentation, and operation mode was selected for maximum. RJ-11 cable is terminated with 600 ohm resistor.

The frequencies and amplitudes of maximum emission were measured at varying azimuths, antenna heights and antenna polarities. **We measured device in normal operation mode.**
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 displaying "H" character on the monitor, and continuously operating the modem card.

5.2.4 Measurement Uncertainty

Measurement uncertainty of RFI Field Strength Measurement test was estimated
at $\pm 3.5\text{dB}(k=2)$

5.2.5 Test Data

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

Operating mode : Continuous displaying "H" character and operating modem card.

Test procedure : ANSI C63.4-1992

Date of measurement : July 18, 2000

Temperature : 24.3 degree C

Humidity :58 %

Model : GTM-56KM6

MEASUREMENT FREQ (MHz)	MEASUREMENT LEVEL (dBuV)	ANTENNA POLARITY (H/V)	ANTENNA FACTOR (dB)	CABLE LOSS (dB)	LIMIT (dBuV)	FIELD STRENGTH (dBuV/m)	MARGIN (dBuV/m)
32.69	9.50	V	16.18	1.04	40.00	26.72	-13.28
42.75	18.50	V	11.64	1.24		31.38	-8.62
54.18	14.90	V	10.46	1.44		26.80	-13.20
112.87	12.40	V	10.87	2.02	43.50	25.29	-18.21
225.75	7.40	H	14.73	3.03	46.00	25.16	-20.84
300.21	8.70	H	14.69	3.50		26.89	-19.11
333.31	12.20	H	16.10	3.47		31.77	-14.23
338.65	4.70	V	16.31	3.49		24.50	-21.50
479.38	5.70	H	17.48	4.40		27.58	-18.42
500.14	9.70	H	17.79	4.40		31.89	-14.11
502.33	11.20	H	17.82	4.42		33.44	-12.56
535.86	2.10	H	18.39	4.75		25.24	-20.76

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 100uV(40dBuV) from 30MHz to 88MHz, 150uV(43.5dBuV) from 88MHz to 216MHz, 200uV(46dBuV) from 216MHz to 960MHz and 500uV (54dBuV) from above 960MHz.

* AFCL = Antenna Factor and Cable Loss

** Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is 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 **Hyung-Seok Lee**

5.3 Minimum Margin

Conducted emission

Modem displaying and operating mode 1.225MHz, 6.7 dBuV

Radiated emission

Modem displaying and operating mode 42.75MHz, 8.62 dBuV/m

5.4 SAMPLE CALCULATIONS

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \log_{10} (\mu\text{V}/\text{m}) \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

EX. 1.

@ 1.541MHz Class B limit = 250 μV = 48 dB μV

Reading = 41.3 dB μV (calibrated level)
 $(41.3/20)$
 $10^{\quad} = 116.15 \mu\text{V}$

Margin = 41.3 - 48 = -6.7
26.6 dBuV ; below limit

EX. 2.

@ 54.18MHz Class B limit = 100 $\mu\text{V}/\text{m}$ = 40dB $\mu\text{V}/\text{m}$

Reading = 14.9dB μV (calibrated level)
Antenna factor + Cable Loss = 11.90 dB
Total = 26.80dB $\mu\text{V}/\text{m}$
 $(26.80/20)$
 $10^{\quad} = 21.88 \mu\text{V}$

Margin = 26.80 - 40 = -13.2 dB $\mu\text{V}/\text{m}$
13.2dB $\mu\text{V}/\text{m}$; below limit

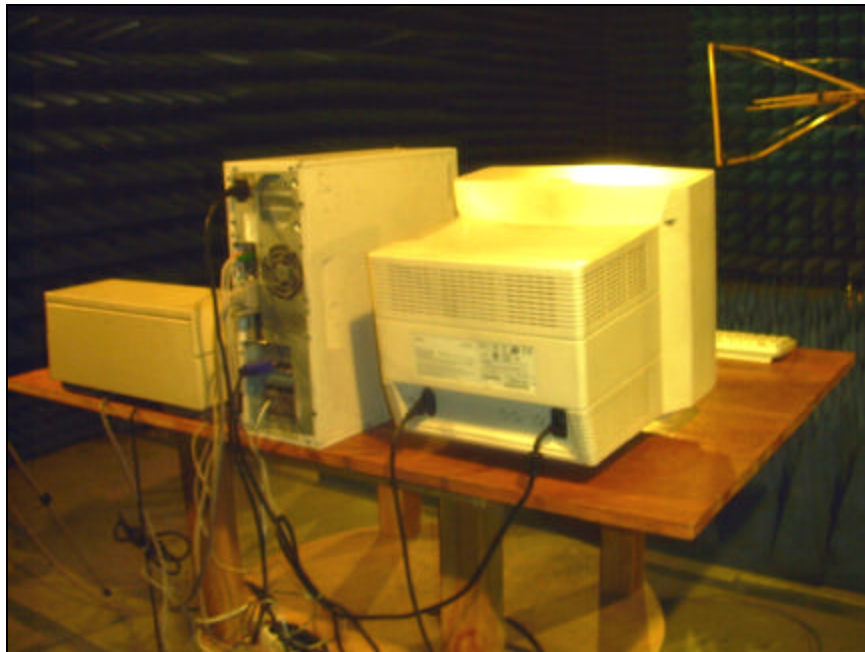
6. TEST EQUIPMENTS

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

<u>Nomenclature</u>	<u>Manufacture</u> <u>Model Number</u>	<u>Serial Number</u>	<u>Calibration</u> <u>Date</u>
Signal Analyzer (9kHz - 1.2GHz)	PMM PMM 9000	3100J70602	99/10/8
Spectrum Analyzer (9kHz - 2.6GHz)	ADVANTEST R3261C	61720002	99/08/19
Amplifier (0.1MHz-1.3GHz)	HP 8774D	2944A08872	-
LISN	PMM L3-25	1110k70403	99/09/30
LISN	KYORITSU KNW-242C	8-920-20	99/09/30
Biconical Antenna	PMM BC01	0020J70501	99/10/8
Log Periodic Antenna	PMM LP01	0020J70501	99/10/8
Dipole Antenna	SWALZBECK VBA6106A	1277	99/12/16
Dipole Antenna	SWALZBECK UHA9105	91052168	99/12/16
Plotter	HP 7475A	7475A	-
Shield Room 4m x 3.5m x 2.4m	MYUNGJIN EMC 907-MJCO-12		
Turn Table	Dail EMC JAC-2		
Antenna Master	Dail EMC		

7. MEASUREMENT PHOTOS

7.1 Setup with the Maximized RFI Voltage Emission Level



7.2 Setup with the Maximized RFI Field Strength Emission Level

