Certification of Compliance

CFR 47 Part 15 Subpart B

Test Report File No. : 06-IST-0371 **Date of Issue** : September 27, 2006

Model(s)	:	FSV-510
Kind of Product	:	Digital Voice Recorder
FCC ID	:	R28FSV-510
Applicant	:	Forus electronics Co., Ltd.
Address	:	757-4, BANDO PLAZA Rm.502, NAESON-DONG, UIWANG-SI, GYEONGGI-DO, KOREA
Manufacturer	:	Forus electronics Co., Ltd.
Address	:	757-4, BANDO PLAZA Rm.502, NAESON-DONG, UIWANG-SI, GYEONGGI-DO, KOREA

Test Result ■ **Positive** □ **Negative**

Reviewed By

S.J.CHO / EMC Group Manager

Approved By

J.H.LEE / Chief

Comment(s)

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart B – Unintentional Radiators, Class B.
- The test report with appendix consists of 26 pages.
- The test result only responds to the tested sample.
- It is not allowed to copy this report even partly without the allowance of IST EMC Laboratory.
- This equipment as for has been shown to be capable of continued 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 2003.

TABLE OF CONTENTS

Note:

INFORMATIONS OF TEST LABORATORY

EMC LABORATORY of IST Co., Ltd. ***(FCC Filing Lab.)***
80, Jeil-Ri, Yangji-Myun, Yongin-City
Kyonggi-Do, 449-860, Korea
TEL : +82 31 333 9018 FAX : +82 31 333 9019

ENVIRONMENTAL CONDITIONS

Temperature	25.2 ℃
Humidity	45 %
Atmospheric pressure	1010 mbar

POWER SUPPLY SYSTEM USED

Power supply system	AC 120Vac, 60Hz (Refer to the product information)

PRODUCT INFORMATION

The Equipment Under Test(EUT) is Digital Voice Recorder Forus electronics Co., Ltd.
(FCC ID : R28FSV-510)

Continuous recording time	128 MB	XQ:15 Hours, HQ:22 Hours, SP:30 Hours, LP:65 Hours
	256 MB	XQ:30 Hours, HQ:44 Hours, SP:60 Hours, LP:130 Hours
Maximum number of recording files	99 files per folder x 4 folders = 396 files	
Dimensions	32 x 16 x 86.5 mm	
Weight	33.3 g (excluding the batteries weight of 24 g)	
Power Source	Two DC 3 V(Size "AAA", Alkaline) batteries	
Battery life	Recording:Approx.12hours / Playback:Approx.12hours (E/P normal level)	
Recording medium	Built-in Flash Memory(128 MB)	
Effective maximum output	Speaker:25 mW	
Frequency range	500 Hz~3.5 KHz	
PC interface	USB(Universal Serial Bus)	

- EMC suppression device is not used during the test.
- Please refer to user's manual.

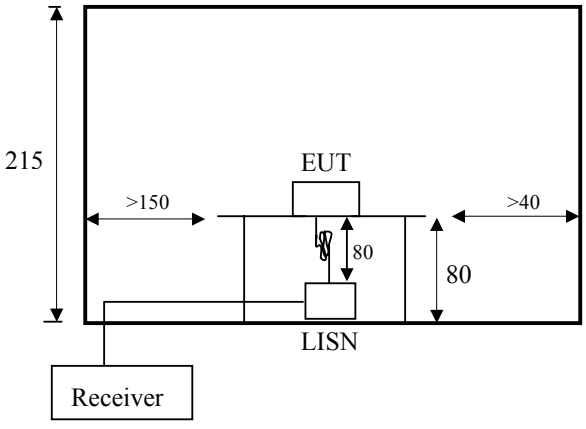
DESCRIPTIONS OF TEST

Conducted Emissions:

The measurement were performed over the frequency range of 0.15MHz to 30MHz using a ESH2-Z5 LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" & "Average" within a bandwidth of 9KHz.

-Procedure of Test

The line-conducted facility is located inside a shielded room No.1. A 1m X 1.5m wooden table 80cm height is placed 40cm away from the vertical wall and 1.5m away from the other wall of the shielded room. The ESCS30 and ESH2-Z5 LISN are bonded to bottom of the shielded room. The EUT is located on the wooden table with distance more than 80cm from the LISN and powered from the ESH2-Z5 LISN .The peripheral equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2cm. 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 ESH2-Z5 LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating conditions. The RF output of the LISN was connected to the ESCS30 receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using Quasi-Peak mode by manual measurement, after scanned by automatic Peak mode for frequency range from 0.15 to 30MHz. The bandwidth of the receiver was set to 10kHz. The EUT, peripheral equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.



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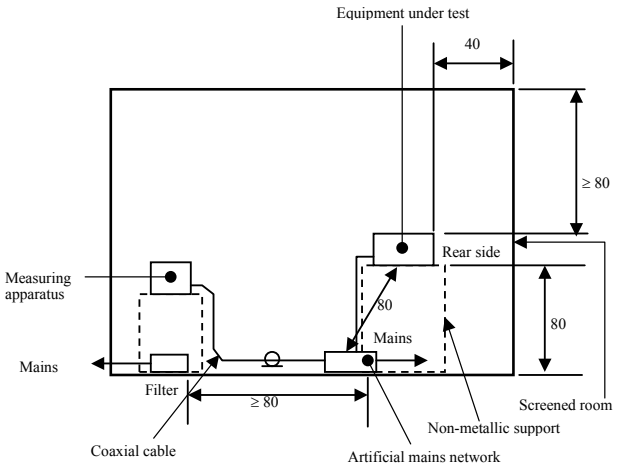


< Concept Drawing >

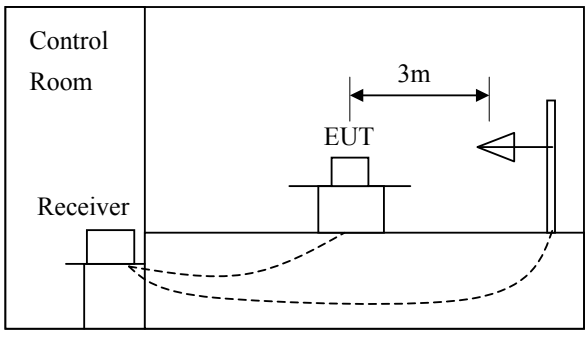
DESCRIPTION OF TEST

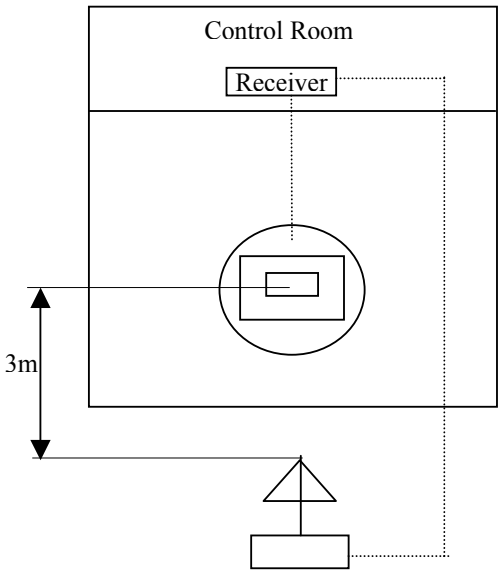
Radiated Emissions:

The measurement was performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120KHz.

-Procedure of Test

Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30MHz to 1000MHz using bi-log antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using bi-log antenna or horn antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral 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 re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. 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. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission.





Measurement Uncertainty Calculations

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

Contribution (Conducted Emissions)	Probability Distribution	Uncertainty (±dB) 0.15-30MHz
Receiver Specification	Rectangular	1.5
LISN Coupling Specification	Rectangular	1.5
Cable and Input Attenuator Calibration	Normal (k=2)	0.5
Mismatch to Reciver	U-Shaped	-0.8 / +0.7
System Repeatability	Normal (k=1)	0.2
Combined Standard Uncertainty	Normal (k=2)	-1.85 / +1.71
Expanded Uncertainty U	Normal (k=2)	-3.7 / +3.42

$U_{c,minus}$ = -1.85, $U_{c,plus}$ = 1.71

U = -3.70 / +3.42 (k=2, 95.45% confidence level)

Contribution (Radiated Emissions)	Probability Distribution	Uncertainties(±dB) 3 m
Antenna		
Factor	Normal (k=2)	0.9968
Frequency Interpolation	Rectangular	0.1039
Height Variation	Rectangular	-2.6 / +1.5
Directivity Difference	Rectangular	-1.0 / +0
Phase Center Location	Rectangular	1.0
Cable Loss	Normal (k=2)	0.5
Receiver		
Voltage Accuracy	Normal (k=2)	2.0
Pulse Response	Rectangular	1.5
Absolute Repetition Rate	Rectangular	1.5
Mismatch to Receiver $\lvert \Gamma_{antenna} \rvert = 0.33$ $\lvert \Gamma_{receiver} \rvert = 0.33$	U-Shaped	-1.0 / +0.9
System Repeatibility	Std Deviation	0.5
Combined Standard Uncertainty	Normal	-2.6048 / 2.2775
Expanded Uncertainty U	Normal (k=2)	-5.21 / +4.55

$U_{c,minus}$ = -2.6048, $U_{c,plus}$ = 2.2775

U = -5.21 / +4.55 (k=2, 95.45% confidence level)

Equipment Under Test

EUT Type :

■ Table-Top. ☐ Floor-Standing.

☐ Table-Top and Floor-Standing(Combination).

Operation – mode of the E.U.T. :

The equipment under test was operated during the measurement under following conditions :

☐ Standby Mode

■ Operational Condition : ■ Files read/write mode

■ Recording mode

■ Playback mode

Configuration of the equipment under test :

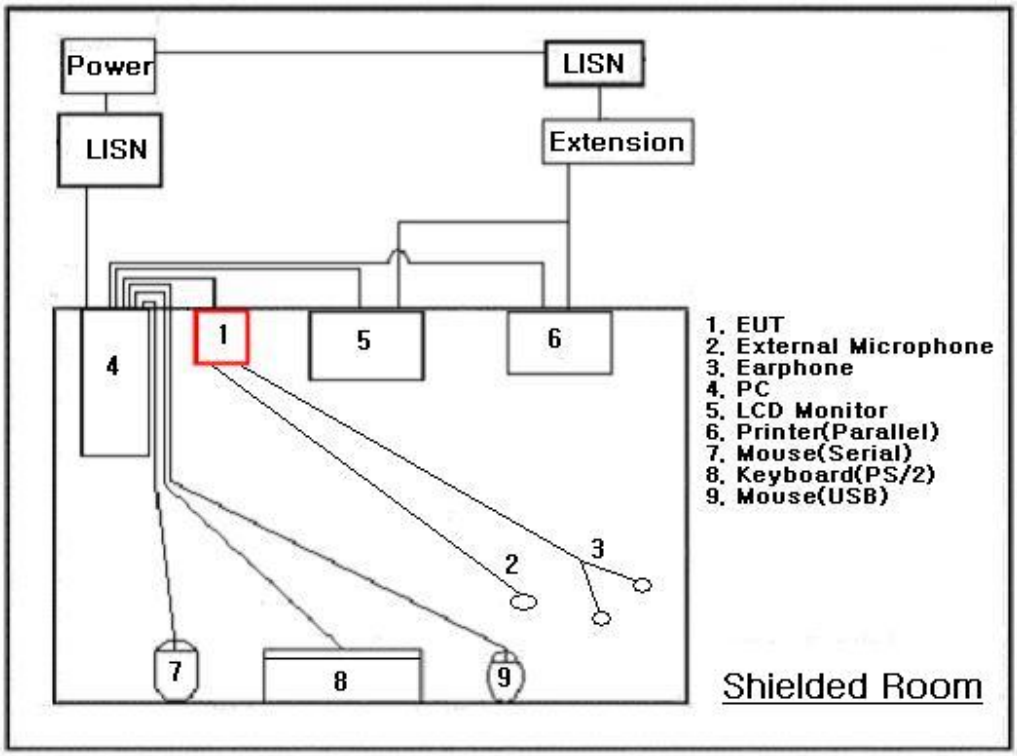
Following peripheral devices and interface cables were connected during the measurement :

Equipment	Type	Brand	Serial No.	FCC Compliance Info.
PC	dx6120 MT	HP	CNG5210N2R	DOC
LCD Monitor	TGL A176	SAMPO ELECTRONIC TECHNOLOGY	N/A	DOC
Keyboard(PS/2)	SK-2880	HP	N/A	DOC
Mouse(USB)	M-UV69a	HP	N/A	DOC
Mouse(Serial)	M-M28	Logitech	N/A	DZL210365
Printer	A0302380	Northern Telecom	2633S60168	DSI6XU2225C-L

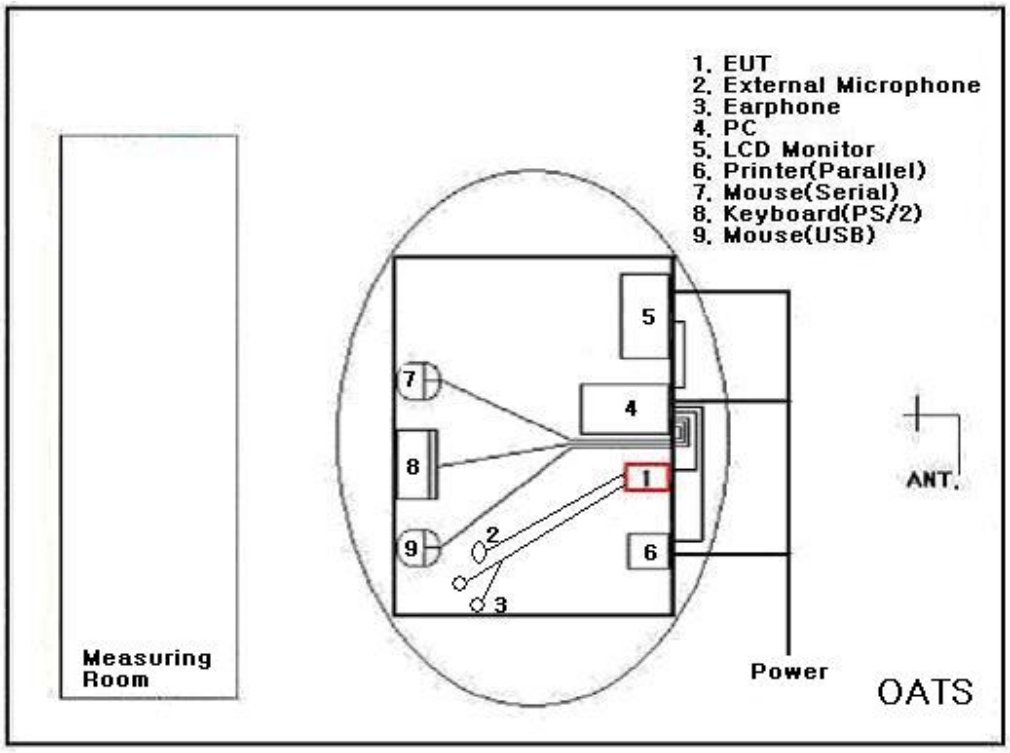
Connecting Interface Cables :
- Unshielded AC power cable : 1.8 m
- Shielded monitor's signal cable (with two ferrite core) : 1.8 m
- Shielded printer's signal cable (without ferrite core) : 1.8 m
- Unshielded keyboard's signal cable (without ferrite core) : 1.6 m
- Unshielded mouse's signal cable (without ferrite core) : 1.8 m
- Unshielded usb cable (with one ferrite core) : 1.2 m
- Unshielded earphone cable(without ferrite core) : 1.6 m
- Unshielded external microphone cable(without ferrite core) : 1.2 m

Note :

Test Set-Up



Conducted Emissions



Radiated Emissions

SUMMARY

Emissions

■ Conducted Emission

The requirements are ● MET ○ Not MET
Minimum limit margin 12.25dB at 0.23MHz
Maximum limit exceeding
Remarks : With Neutral phase, for average detect mode.
(Files read/write mode)
Find the test data in following pages 11 to 12.

■ Radiated Emission

The requirements are ● MET ○ Not MET
Minimum limit margin 6.1dB at 169.96MHz
Maximum limit exceeding
Remarks : Files read/write mode.
Find the test data in following page 14 to 19.

Test Date

Begin of Testing : Sep. 20, 2006
End of Testing : Sep. 26, 2006

Prepared By

J.H.Park / EMC Engineer

Note :

- ■ means the test is applicable,
- □ is not applicable.

TEST CONDITIONS AND DATA

Conducted Emissions

[Applicable]

◆ Test Equipment Used

Model Name	Description	Manufacture	Calibration Date	Serial Number
ESCS 30	Test Receiver	Rohde & Schwarz	Aug. 17, 2006	100171
ESH3-Z2	Pulse Limiter	Rohde & Schwarz	May 22, 2006	357.8810.52
ESH2-Z5	LISN	Rohde & Schwarz	May 22, 2006	842966/007

◆ Test Accessories Used

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

◆ Test Program Files read/write mode

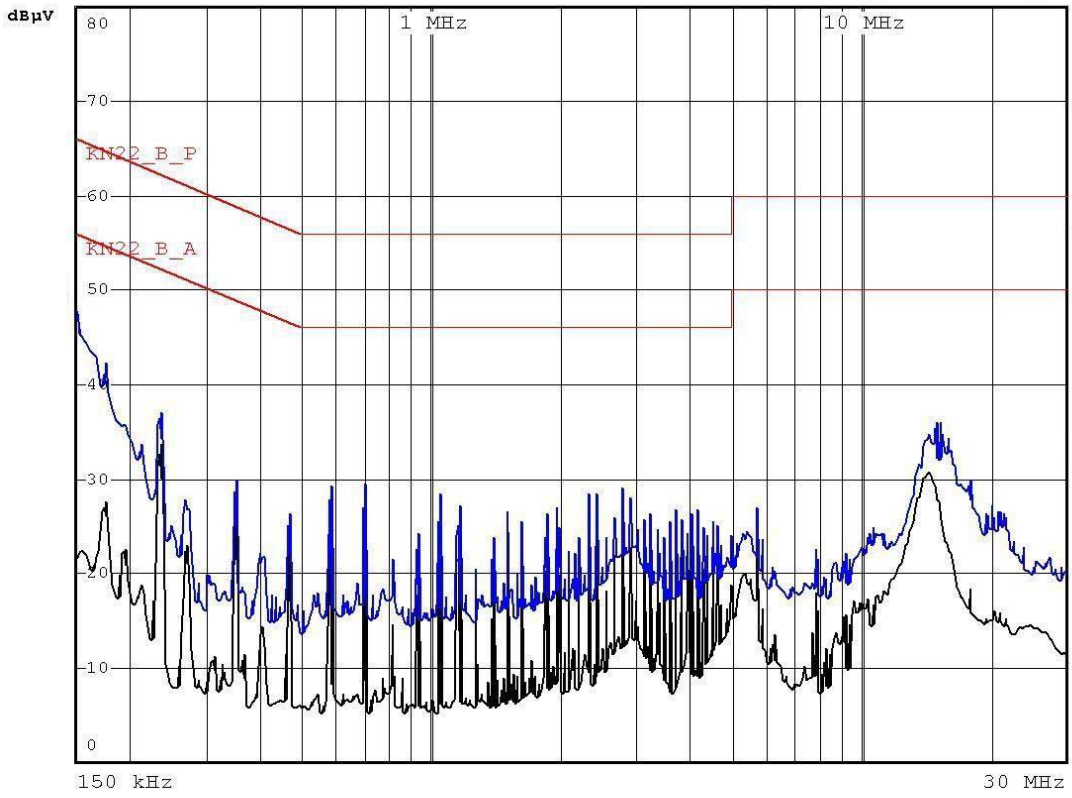
◆ Test Date Sep. 21, 2006

◆ Test Area Conducted room

Note : The equipment used is calibrated in regular for every year.

Conducted Emissions

Live Phase



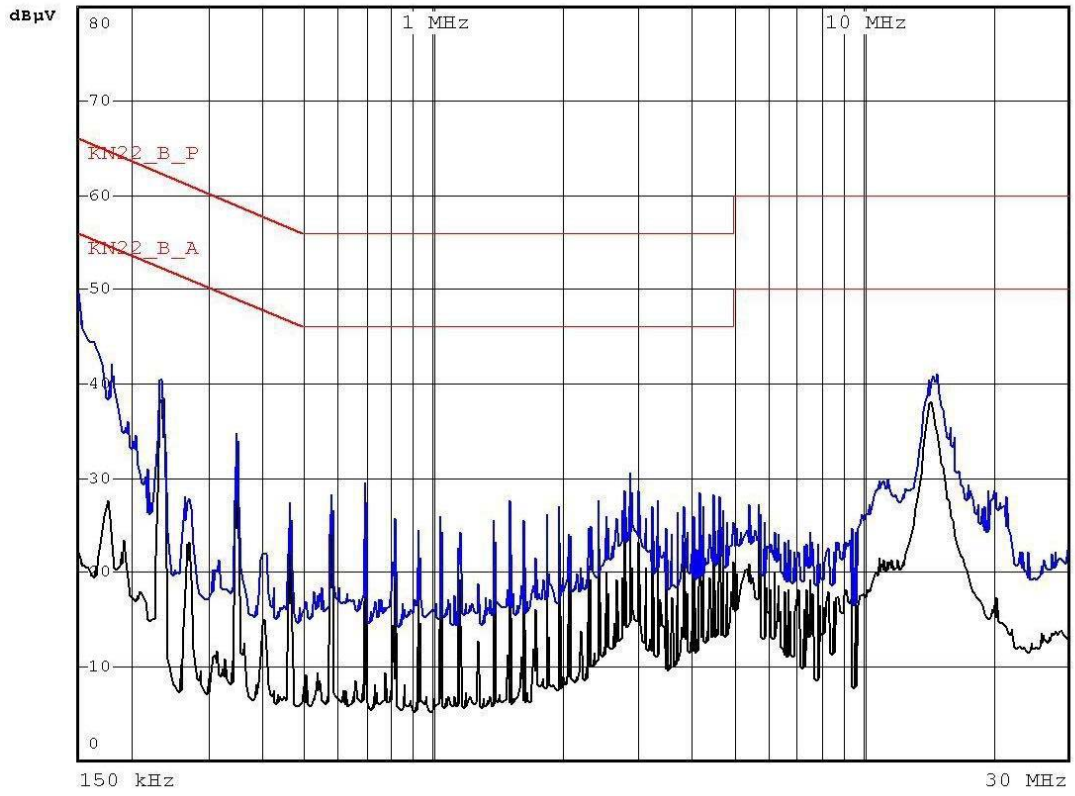
Model Name : FSV-510 120Vac 60Hz Phase : Live

Freq. [MHz]	Measurement [dB µV]		Limit [dB µV]		Insertion Loss	Cable Loss	Result [dB µV]		Margin [dB]	
	Q-peak	Average	Q-peak	Average	[dB]	[dB µV]	Q-peak	Average	Q-peak	Average
0.15	36.70	21.37	66.00	56.00	0.33	0.20	37.23	21.90	28.77	34.10
0.23	35.83	34.24	62.41	52.41	0.29	0.33	36.45	34.86	25.96	17.55
0.35	28.78	28.59	59.01	49.01	0.24	0.40	29.42	29.23	29.59	19.78
0.58	28.06	28.14	56.00	46.00	0.19	0.57	28.82	28.90	27.18	17.10
2.78	26.86	25.56	56.00	46.00	0.28	0.70	27.84	26.54	28.16	19.46
15.17	30.17	27.53	60.00	50.00	0.55	0.90	31.62	28.98	28.38	21.02

Note : PC power line

Conducted Emissions

Neutral Phase



Model Name : FSV-510 120Vac 60Hz Phase : Neutral

Freq. [MHz]	Measurement [dB µV]		Limit [dB µV]		Insertion Loss	Cable Loss	Result [dB µV]		Margin [dB]	
	Q-peak	Average	Q-peak	Average	[dB]	[dB µV]	Q-peak	Average	Q-peak	Average
0.15	37.90	21.20	66.00	56.00	0.33	0.20	38.43	21.73	27.57	34.27
0.23	40.11	39.56	62.41	52.41	0.27	0.33	40.71	40.16	21.70	12.25
0.35	34.15	34.30	59.01	49.01	0.24	0.40	34.79	34.94	24.22	14.07
0.58	26.68	23.31	56.00	46.00	0.22	0.57	27.32	27.00	28.68	19.00
2.78	25.68	23.31	56.00	46.00	0.29	0.70	26.67	24.30	29.33	21.70
15.16	37.13	34.58	60.00	50.00	0.55	0.90	38.58	36.03	21.42	13.97

Note : PC power line

TEST CONDITIONS AND DATA

Radiated Emission

[Applicable]

◆ Test Equipment Used

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESCS 30	Test Receiver	Rohde & Schwarz	Jan. 16, 2006	828985/023
VULB 9160	Antenna	Schwarzbeck	Aug. 14, 2006	3047

◆ Test Accessories Used

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

◆ Test Program — Files read/write mode
Recording mode
Playback mode

◆ Test Date — Sep. 25, 2006

◆ Test Area — Open site

Note : The equipment used is calibrated in regular for every year.

X axis plane was the worst test result than Y axis plane and Z axis plane.

Radiated Emissions

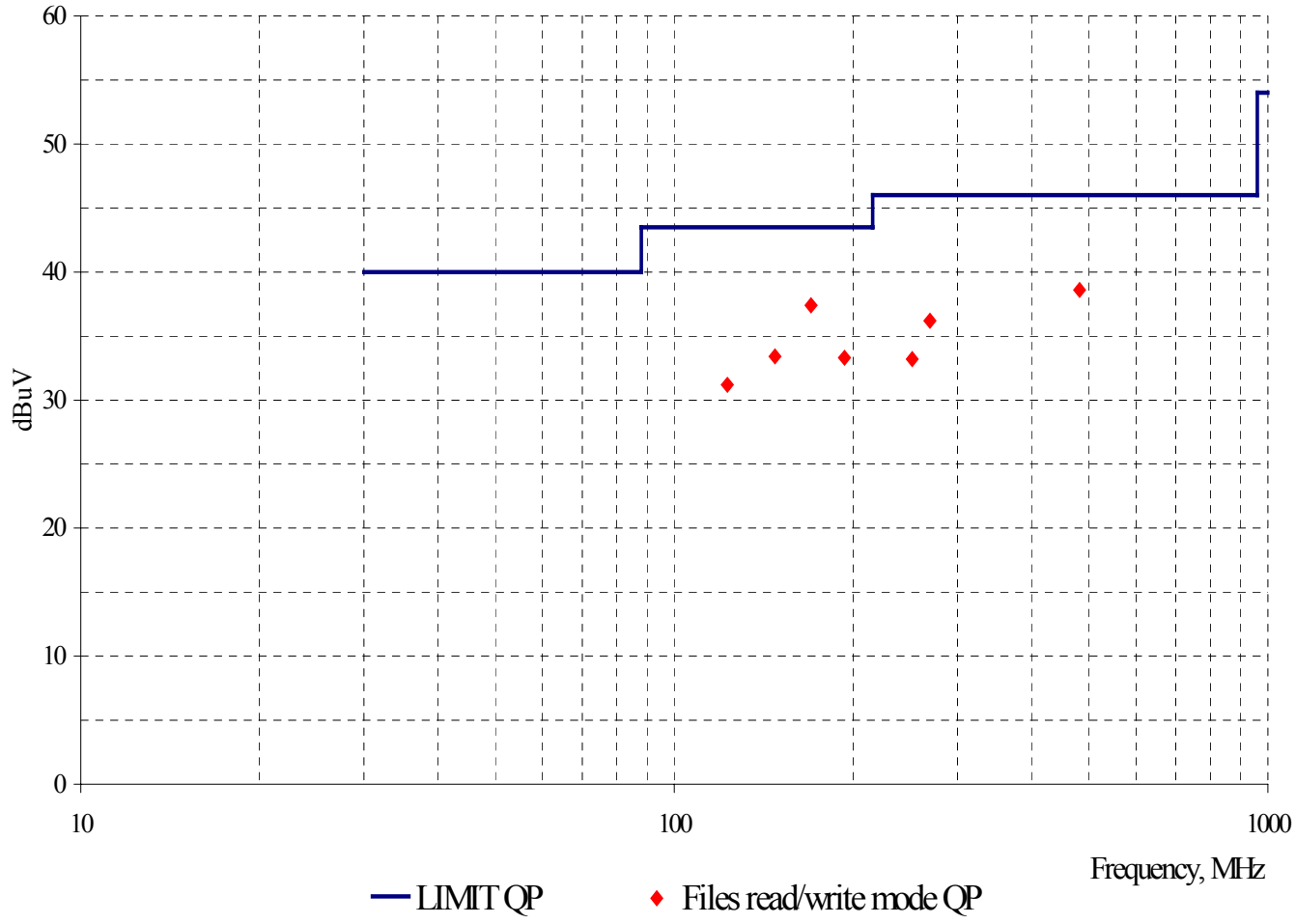
(Disturbance Radiation)

[Applicable]

Freq. [MHz]	Reading [dBuV]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
122.84	17.8	10.9	2.5	V	31.2	43.5	12.3
147.79	18.3	12.3	2.8	V	33.4	43.5	10.1
169.96	22.3	12.4	2.7	V	37.4	43.5	6.1
193.51	21.1	9.1	3.1	H	33.3	43.5	10.2
251.71	18.5	10.8	3.9	H	33.2	46.0	12.8
269.73	20.7	11.5	4.0	H	36.2	46.0	9.8
481.74	18.3	14.5	5.8	H	38.6	46.0	7.4

Note: ***Files read/write mode.***

MEASUREMENT OF DISTURBANCE RADIATION



Radiated Emissions

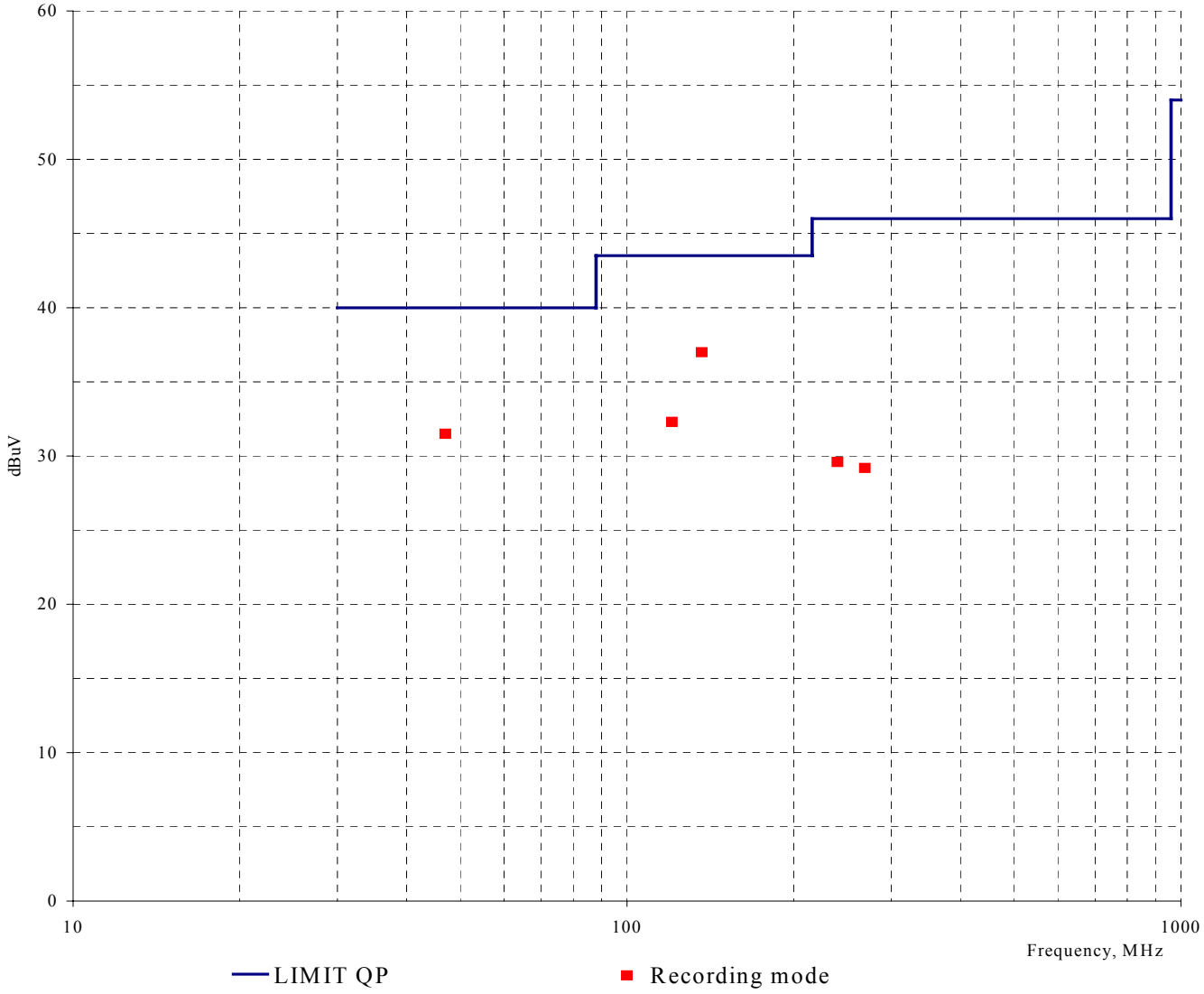
(Disturbance Radiation)

[Applicable]

Freq. [MHz]	Reading [dBuV]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
47.00	18.60	11.90	1.00	V	31.50	40.00	8.50
120.50	18.40	11.40	2.50	H	32.30	43.50	11.20
136.50	23.1	11.40	2.50	H	37.00	43.50	6.50
240.06	15.60	10.20	3.80	H	29.60	46.00	16.40
269.00	13.70	11.50	4.00	H	29.20	46.00	16.80

Note: ***Recording mode.***

MEASUREMENT OF DISTURBANCE RADIATION



Radiated Emissions

(Disturbance Radiation)

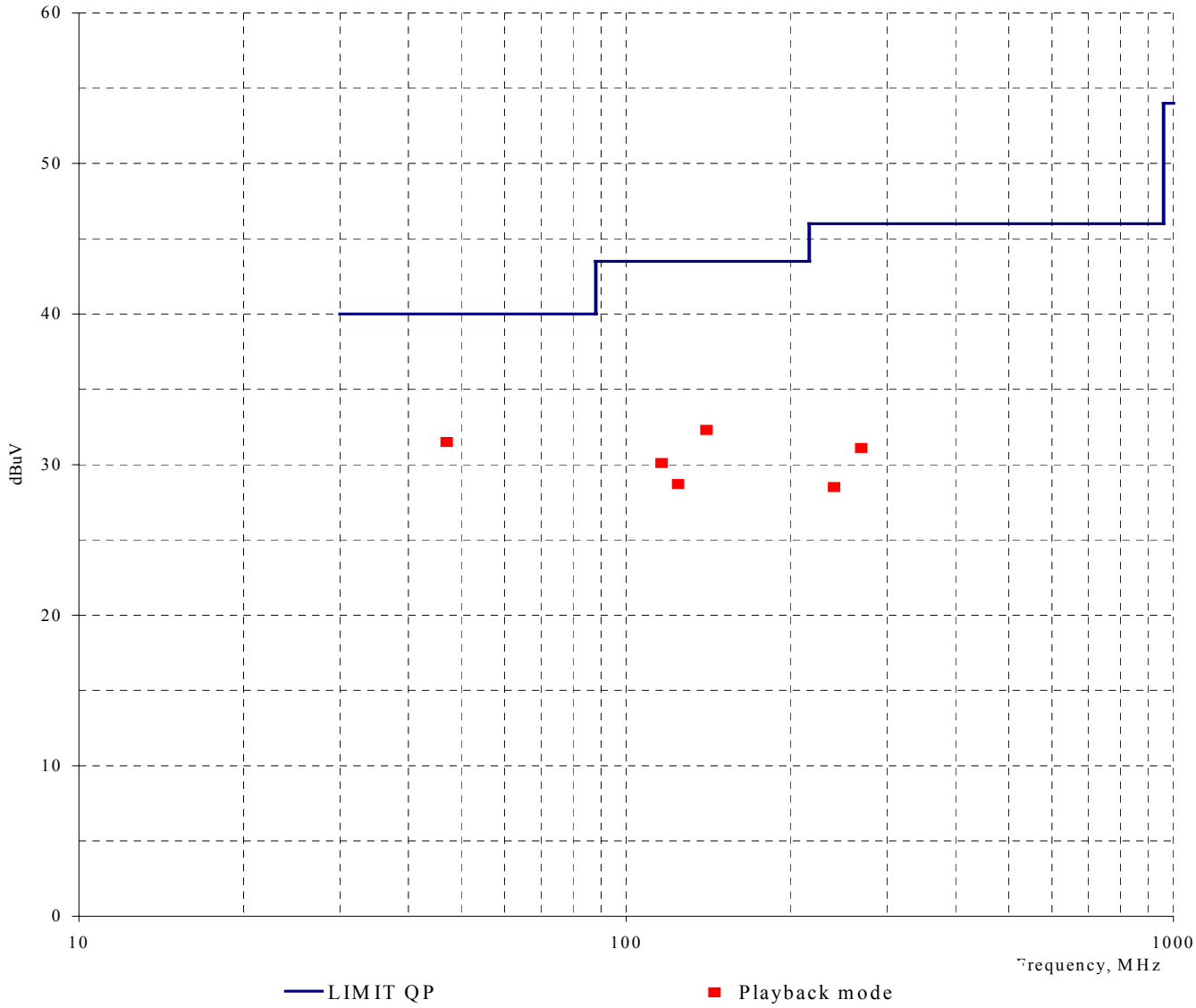
[Applicable]

Freq. [MHz]	Reading [dBuV]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
47.00	18.60	11.90	1.00	V	31.50	40.00	8.50
116.10	17.40	10.30	2.40	H	30.10	43.50	13.40
124.50	15.70	10.50	2.50	H	28.70	43.50	14.80
140.20	16.80	12.80	2.70	H	32.30	43.50	11.20
240.00	14.50	10.20	3.80	H	28.50	46.00	17.50
269.00	15.60	11.50	4.00	H	31.10	46.00	14.90

Note: ***Playback mode.***

End of Data

MEASUREMENT OF DISTURBANCE RADIATION



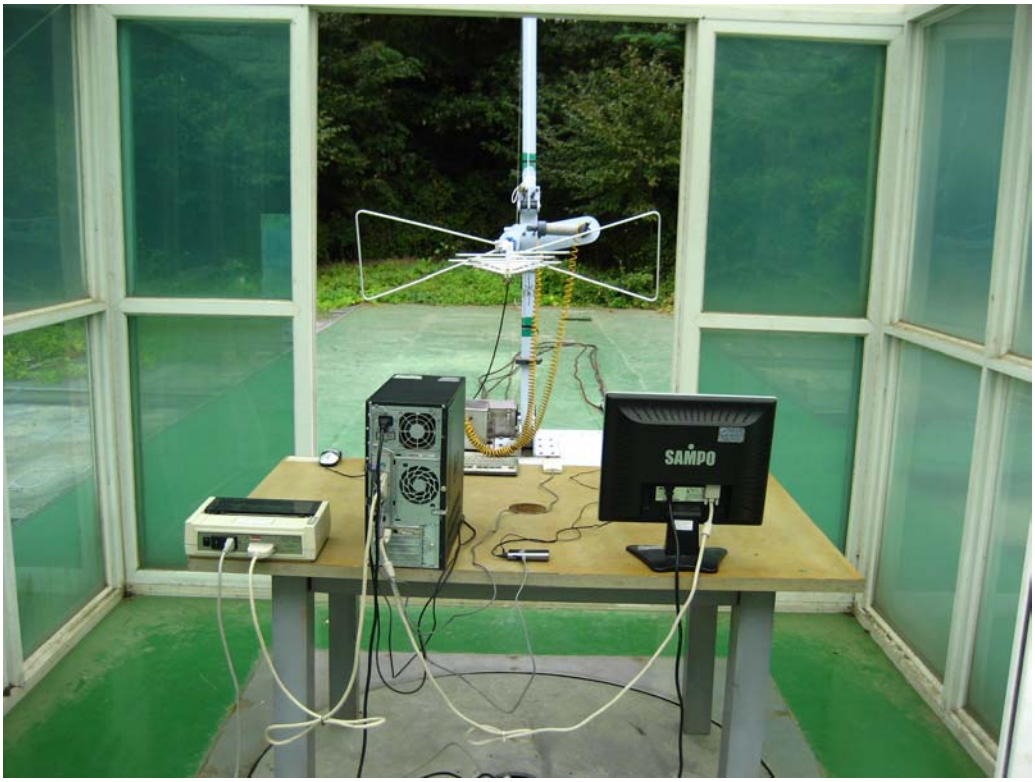
Appendix A. The Photos of Test Setup

Conducted Emissions(PC power line) - Front View

Conducted Emissions(PC power line) - Rear View

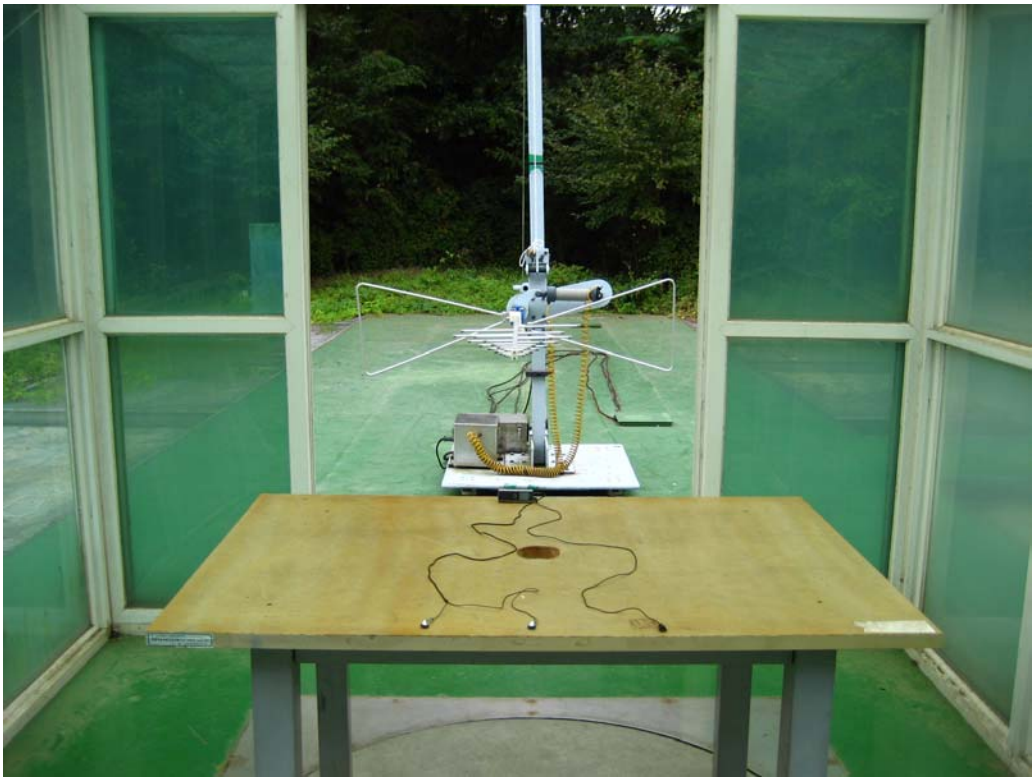
Appendix A. The Photos of Test Setup

Radiated Emissions(Files read/write mode)-Front View

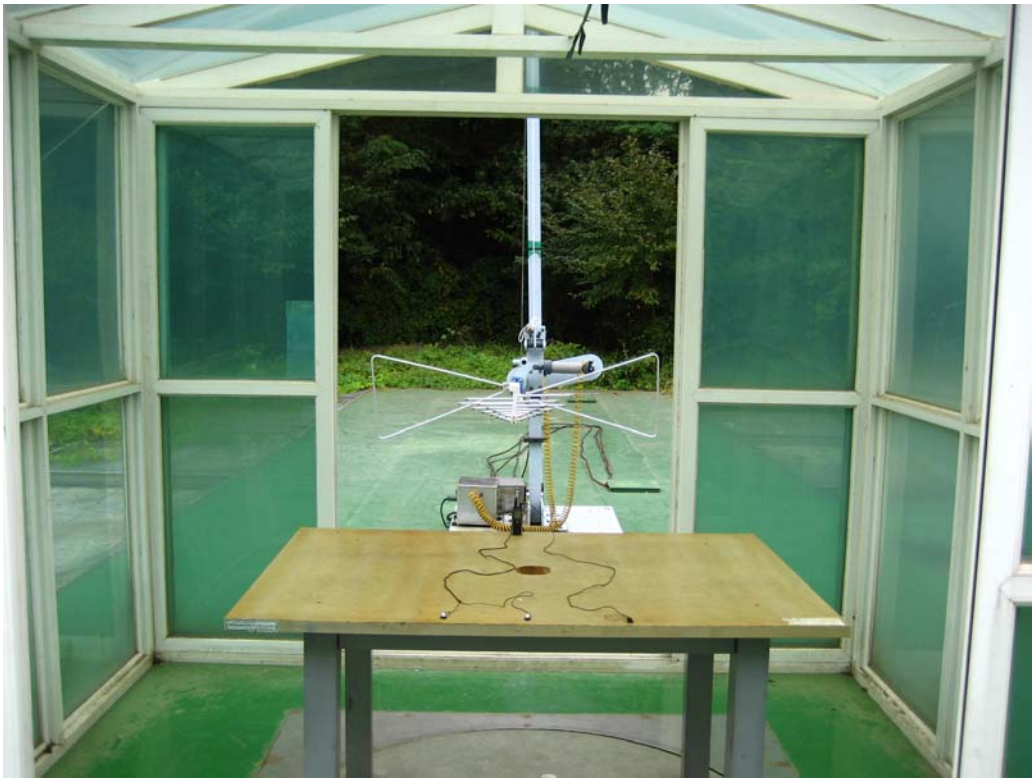


Radiated Emissions(Files read/write mode)-Front View

Appendix A. The Photos of Test Setup



Radiated Emissions(Recording/Playback mode)X-axis View



Radiated Emissions(Recording/Playback mode)Y-axis View

Radiated Emissions(Recording/Playback mode) Z-axis View

Appendix B. The Photos of Equipment Under Test

Front View

Rear View

Appendix B. The Photos of Equipment Under Test

USB cable

Earphone

External Microphone