

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 :

WONNET Co., Ltd.

4F Sangwang Bldg., 8-9, Sangwangshipi-Dong,
Sungdong-Gu, Seoul, Korea
Attn : Kyung-Woo, Jang

Dates of Tests : 9 May 2002

14 June 2002

Test Report No. : 2002KESEMC-II-0188.FCC

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

TYPE of EUT
MODEL No.

Portable Storage Device
WS-131F

WONNET Co., Ltd.

4F Sangwang Bldg., 8-9, Sangwangshipi-Dong,
Sungdong-Gu, Seoul, Korea

CONTACT PERSON

Kyung-Woo, Jang

Tel./Fax. 82-2-2299-6151/82-2-2299-6155

FCC Rule Part(s) :

Part 15 & 2

Classification :

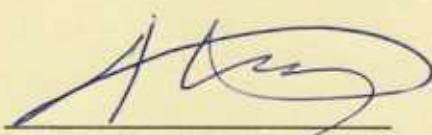
FCC Class B Device

Port/Connector(s) :

USB(1), IEEE1394(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)	11
PLOTS OF EMISSION	12
SAMPLE CALCULATIONS	13
ACCURACY of MEASUREMENT	14
LIST of TEST EQUIPMENT	15
RECOMMENDATION/CONCLUSION	16
APPENDIX A - LABELLING REQUIREMENTS	17

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* :

WONNET Co., Ltd.

Contact Person :

Kyung-Woo, Jang

Tel./Fax. 82-2-2299-6151/82-2-2299-6155

Manufacturer :

WONNET Co., Ltd.

4F Sangwang Bldg., 8-9, Sangwangshipi-Dong,
Sungdong-Gu, Seoul, Korea

- Trade / Model: **WS-131F**
- Brand Name: WONNET Co., Ltd.
- EUT Type: Portable Storage Device
- Port/Connectors: USB(1), IEEE1394(1)
- Classification: FCC Class B
- Rule Part(s): FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Test: 09 May 2002
14 June 2002
- Place of Tests: SGS KES Co., Ltd.
- Test Report No.: 2002KESEMC-II-0188.FCC
- Order No.: SKI-02-0072

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 **WONNET Co., Ltd.** Model : **WS-131F**

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

Equipment Description:

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

Model : **WS-131F**

Clock : 24.576MHz

Chipset : FW802A, QXFW911-TQ-A

Port(s) : USB(1), IEEE1394(1)

Power

Consumption : DC 5V from USB port of PC

Main Board : Model : WS-131F S/N : N/A
(WONNET Co., Ltd.)

HDD : Model : IC25N010ATDA04-0 S/N : 97LX9019
(IBM)

Operating Mode : Connect EUT to Note PC and upload or download a data.

EMI suppression device(s) installed in production:

- see circuit diagram (Appendix B)

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 / $50\text{ }\mu\text{H}$ 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.

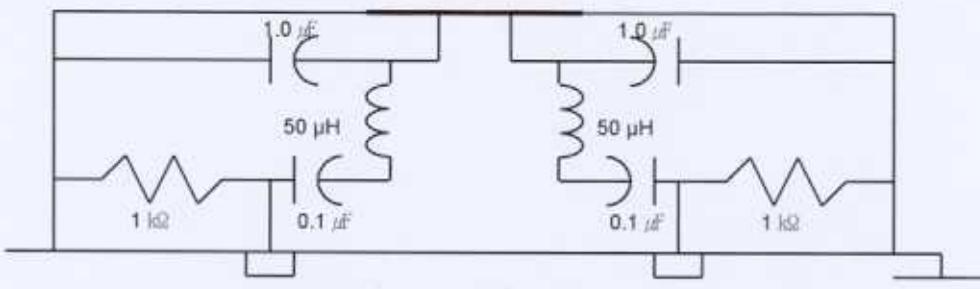


Fig. 2. LISN Schematic Diagram

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 3 or 10 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.

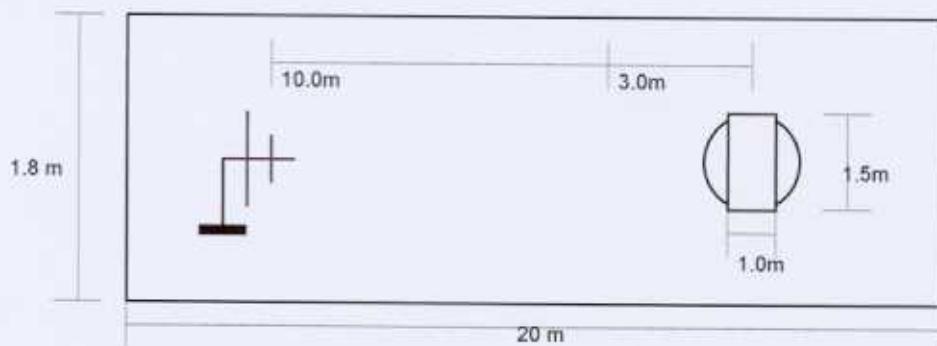


Fig. 3. Dimensions of Outdoor Test Site

SUPPORT EQUIPMENT USED

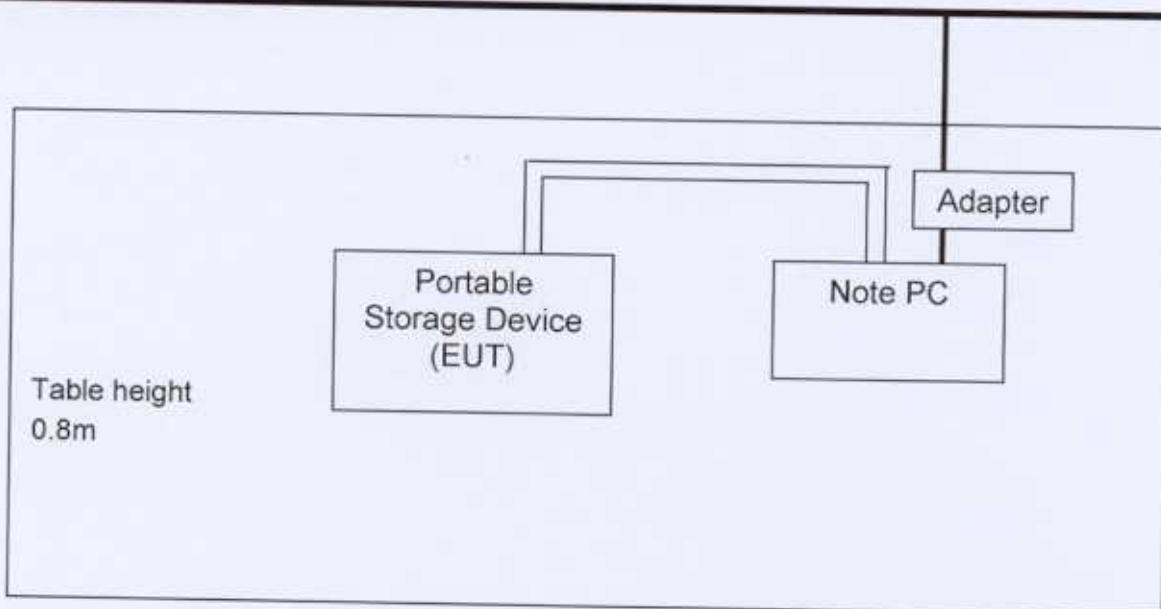
Note PC : Model : LifebookE-7010 S/N : N/A
 (Fujitsu Limited)

Portable Storage Model : WS-131F S/N : N/A
 Device (WONNET Co., Ltd.)
 (EUT)

- **User Interface Cable List**

Start		END		Cable Spec.	
Type	I/O Port	Type	I/O Port	Length(m)	Shield
Note PC	DC IN	Adapter	-	1.0	Unshielded
	Adapter	LISN	-	1.0	Unshielded
	USB	EUT	DC IN	1.5	Unshielded
	IEEE1394	EUT	-	1.8	Unshielded

● Test set-up for test



TEST DATA

Conducted Emissions

Model No. : WS-131F

Date of Test : 09 May 2002

Measure Bandwidth : 9kHz

Temperature : 22.3 °C Humidity : 40% Atmospheric Pressure : 101.1 kPa

FREQ (MHz)	LEVEL(dB/ μ V)	LINE	LIMIT(μ V)	Result(μ V)	MARGIN*(dB)
0.50	37.5	N	250	74.99	10.5
0.57	39.5	H	250	94.41	8.5
0.64	38.0	N	250	79.43	10.0
16.80	38.0	N	250	79.43	10.0
17.38	38.0	H	250	79.43	10.0
18.43	37.5	H	250	74.99	10.5

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

Levins

Tested by *Eun – Ju, Choi*

TEST DATA

Radiated Emissions

Model No. : WS-131F

Date of Test : 14 June 2002

Temperature : 27°C

Humidity : 28%

Atmospheric Pressure : 100.2kPa

Measure Bandwidth : 120kHz

Freq. (MHz)	Level (dB μ V)	AF* (dB)	CL** (dB)	POL (H/V)	Limit (μ V)	F/S (μ V/m)	Margin*** (dB)
146.57	9.70	11.13	2.70	H	150	15.02	19.97
249.76	11.40	12.29	3.99	H	200	24.20	18.32
345.16	10.80	14.15	4.91	H	200	31.09	16.15
391.40	5.50	15.31	5.32	H	200	20.24	19.87
416.78	7.20	16.21	5.53	H	200	27.99	17.06
432.79	4.10	16.62	5.66	H	200	20.83	19.63

Table 2. Radiated Measurements at 3meters.

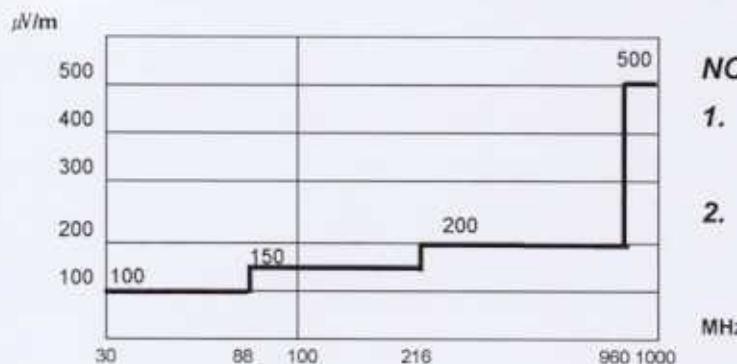


Fig. 4. Limits at 3 meters

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

PLOTS OF EMISSIONS

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:

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

TEST EQUIPMENT**Conducted Emission**

Equipment	Manufactory	Model	Cal. Date
Signal Analyzer	PMM	8010	Sep. 2001
LISN	PMM	L3-25	Jun. 2002
LISN	PMM	3825/2	Nov. 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 **WONNET Co., Ltd.** Model : **WS-131F** complies with § 15.107 and 15.109 of the FCC Rules. The highest emission observed was at 0.57 MHz for conducted emissions with a margin of 8.5dB and at 345.16MHz for radiated emissions with a margin of 16.15dB