



RADIO TEST REPORT

Test Report No. : 28CE0213-HO-01-C

Applicant : silex technology, Inc.
Type of Equipment : MiniPCI Wireless LAN board
Model No. : SX-10WAG
FCC ID : N6C-SX10WAG
Test regulation : FCC Part 15 Subpart C 2008
Section 15.207, Section 15.247
(5825MHz only)
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
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Date of test: January 10 to February 20, 2008

Tested by: 
Kenichi Adachi
EMC Services

Approved by : 
Hironobu Shimaji
Assistant Manager of EMC Services



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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SECTION 1: Customer information

Company Name : silex technology, Inc.
Address : 2-3-1 Hikaridai, Seika-cho, Kyoto 619-0237, Japan
Telephone Number : +81-774-98-3878
Facsimile Number : +81-774-98-3758
Contact Person : Toshiro Kometani

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : MiniPCI Wireless LAN Board
Model No. : SX-10WAG (MiniPCI Wireless LAN Board),
HG5808U (Antenna),
HG5817D (Antenna),
SR49120WDA (Antenna)
Serial No. : 32 (SX-10WAG),
1 (HG5808U),
1 (HG5817D),
1 (SR49120WDA)
Rating : DC3.3V
Country of Manufacture : Japan
Receipt Date of Sample : January 15, 2008
Condition of EUT : Engineering prototype
(Not for Sale: These samples are equivalent to mass-produced items.)
Modification of EUT : No modification by the test lab.

2.2 Product Description

Model: SX-10WAG is the MiniPCI Wireless LAN Board.

Equipment Type : Transceiver
Clock frequency : 40MHz
Method of Frequency Generation : Crystal
Operating voltage (inner) : DC3.3V +/-0.3V

	IEEE802.11b	IEEE802.11g	IEEE802.11a
Frequency of operation	2412-2462MHz	2412-2462MHz	5180-5320MHz 5745-5825MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)
Bandwidth & Channel number	22MHz & 5MHz	22MHz & 5MHz	22MHz & 5MHz
ITU Code	G1D	D1D	D1D
Antenna connector	U.FL	U.FL	U.FL

*1) Module of the EUT (MiniPCI Wireless LAN Board) is identical to the one in the following test reports:
Refer to 26GE0351-HO-B (FCC15E), 26GE0351-HO-D-1(RSS-210(5GHz)),

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116
Facsimile : +81 596 24 8124

Antenna

Antenna	antenna gain	antenna connector
HG5808U	8dBi max	N Female
HG5817D	17dBi max	N Female
SR49120WDA	11dBi max	N Female

Antenna cable

Antenna cable	Length (m)	antenna connector for module side	antenna connector for antenna side
Coxial cable	0.08	U.FL	Reverse SMA
CA-RSPNMA004	1.2 (4ft)	Reverse SMA	N male
CA-RSPNMA010	3.0 (10ft)	Reverse SMA	N male
CA-NMNFA004	1.2 (4ft)	N Female	N male
CA4NMRSF020	6.0 (20ft)	Reverse SMA	N male

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part15 Subpart C: 2008, final revised on January 30, 2008

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

*The revision on January 30, 2008 does not influence the test specification applied to the EUT.

FCC 15.31 (e)

This EUT provides stable voltage(DC3.3V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The EUT has an external and particular antenna connector, but it is installed by the professionals. Therefore, the equipment complies with the antenna requirement of Section 15.203.

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

3.2 Procedures and results

[DSSS and other forms of modulation]

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted emission	FCC: ANSI C63.4:2003 7. AC powerline conducted emission measurements ----- IC: RSS-Gen 7.2.2	FCC: Section 15.207 ----- IC: RSS-Gen 7.2.2	-	N/A	[QP] 14.8dB L, 0.20423MHz, [AV] 7.6dB, L, 0.20423MHz	Complied
2	6dB Bandwidth	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" ----- IC: RSS-Gen 4.6.2	FCC: Section 15.247(a)(2) ----- IC: RSS-210 A8.2(a)	Conducted	N/A	See data.	N/A *1)
3	Maximum Peak Output Power	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" ----- IC: RSS-Gen 4.8	FCC: Section 15.247(b)(3) ----- IC: RSS-210 A8.4(4)	Conducted	N/A		Complied
4	Restricted Band Edges	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" ----- IC: -	FCC: Section 15.247 (d) ----- IC: RSS-210 A8.5	Radiated	N/A		N/A *1)
5	Power Density	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" ----- IC: -	FCC: Section 15.247 (e) ----- IC: RSS-210 A8.2(b)	Conducted	N/A	N/A *1)	
6	Spurious Emission	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" ----- IC: RSS-Gen 4.9 RSS-Gen 4.10	FCC: Section15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 7.2.1 and 7.2.3	Radiated	N/A	[Tx] 0.9dB, 11650MHz, Horizontal, [Rx] 2.5dB, 500.000MHz, Vertical	Complied

Note: UL Japan, Inc.'s EMI Work Procedures No.QPM05 and QPM15.

*1) This test report is for Permissive Class II change application in order to add antenna and antenna cables to the approved model. Since only antenna and antenna cable was added to the model, the tests related to the module itself were excluded.

*These tests were also referred to "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247".

*These tests were performed without any deviations from test procedure except for additions or exclusions.

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

3.3 Additions or deviations to standards

No addition nor deviation has been made from standards.

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Test room	Conducted emission	Radiated emission (10m*)			Radiated emission (3m*)			Radiated emission (3m*)	
	150kHz-30MHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	1GHz-18GHz	18GHz-40GHz
No.1 semi-anechoic Chamber (±)	3.7dB	3.1dB	4.7dB	4.4dB	3.2dB	3.7dB	4.4dB	5.9dB	6.1dB
No.2 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.3dB	3.9dB	5.9dB	6.1dB
No.3 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB
No.4 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB

*10m/3m = Measurement distance

Conducted emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test(3m)

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116 Facsimile : +81 596 24 8124

	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	313583	IC4247	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	IC4247-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	IC4247-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	IC4247-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.75 x 5.4 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Mode : Transmitting (Tx) mode (OFDM, 54Mbps, Payload: PN9,) * See Remarks.
Channel 165: 5825MHz
Receiving (Rx) mode
Channel 165: 5825MHz

Conditions : 1) IEEE802.11a:6, 9, 12, 18, 24, 36, 48, 54 Mbps
2) Antenna Port A and B (same type)

<Remarks>

*We pre-confirmed the above conditions on EUT and performed the final test with the following conditions;

	IEEE802.11a
Radiated emission test	1) Rate: 54Mbps
	2) Antenna Port A

Radiated emission test : As for Rate,54Mbps (Maximum transmission rate of 11a) had worst margins.
The result of Antenna Port A had worst margin.

* The followings are the combinations of EUT's antenna and antenna cable. This report is for Permissive Class II change application in order to add the following antenna and antenna cables.

Antenna

Antenna	antenna gain	antenna connector
HG5808U	8dBi max	N Female
HG5817D	17dBi max	N Female
SR49120WDA	11dBi max	N Female

Antenna cable

Antenna cable	Length (m)	antenna connector for module side	antenna connector for antenna side
Coxial cable	0.08	U.FL	Reverse SMA
CA-RSPNMA004	1.2 (4ft)	Reverse SMA	N male
CA-RSPNMA010	3.0 (10ft)	Reverse SMA	N male
CA-NMNFA004	1.2 (4ft)	N Female	N male
CA4NMRSF020	6.0 (20ft)	Reverse SMA	N male

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

Combination

Module	Antenna cable 1	Antenna cable 2	Antenna cable 3	Antenna
SX-10WAG	Coaxial cable	CA-RSPNMA004		HG5808U
		CA-RSPNMA010	CA-NMNFA004	
		CA4NMRSF020		
		CA-RSPNMA004		HG5817D
		CA-RSPNMA010	CA-NMNFA004	
		CA4NMRSF020		
		CA-RSPNMA004		SR49120WDA
		CA-RSPNMA010	CA-NMNFA004	
		CA4NMRSF020		

< Antenna Cable Combination >

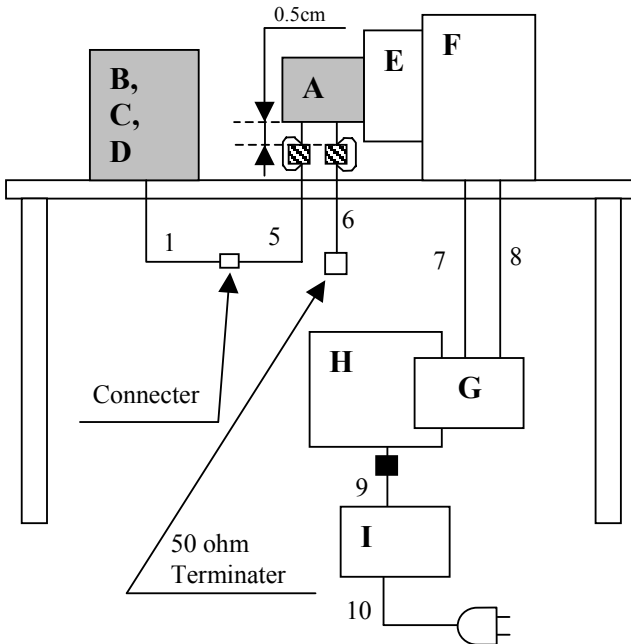
The test was performed with the all the antenna cable combination only for 10GHz to 18GHz.
For other bands, worst combination with only one antenna was performed.

- (1) HG5808U: Worst antenna cable: CA-RSPNMA010 + CA-NMNFA004 + Coaxial Cable
- (2) HG5817D: Worst antenna cable: CA-RSPNMA010 + CA-NMNFA004 + Coaxial Cable
- (3) SR49120WDA: Worst antenna cable: CA-RSPNMA004 + Coaxial Cable

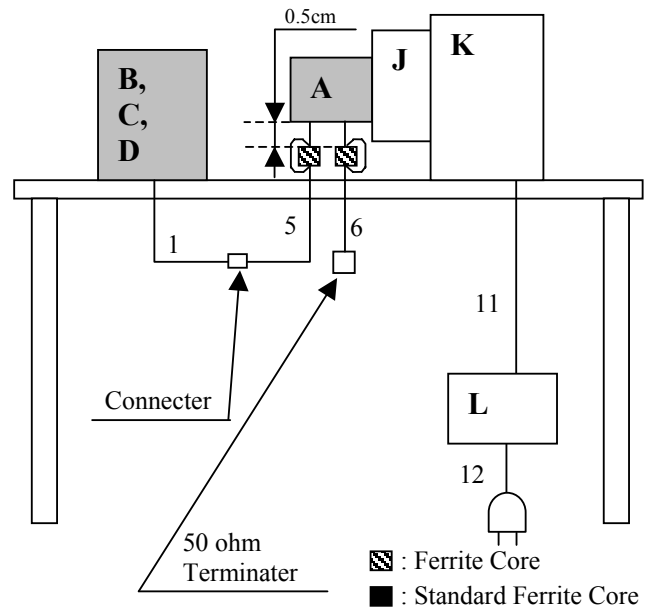
4.2 Configuration and peripherals

<Antenna cable CA-RSPNMA004>

[Radiated emission above 1GHz]



[Radiated emission below 1GHz and Conducted emission]



* Cabling and setup were taken into consideration and test data was taken under worst case conditions.

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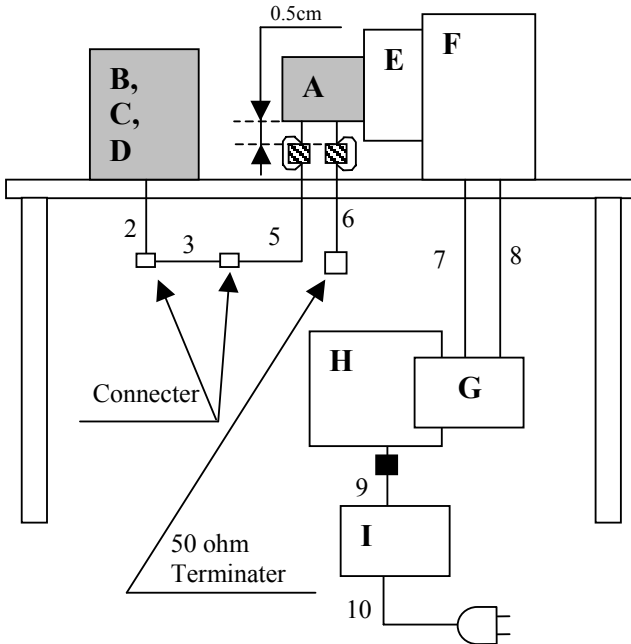
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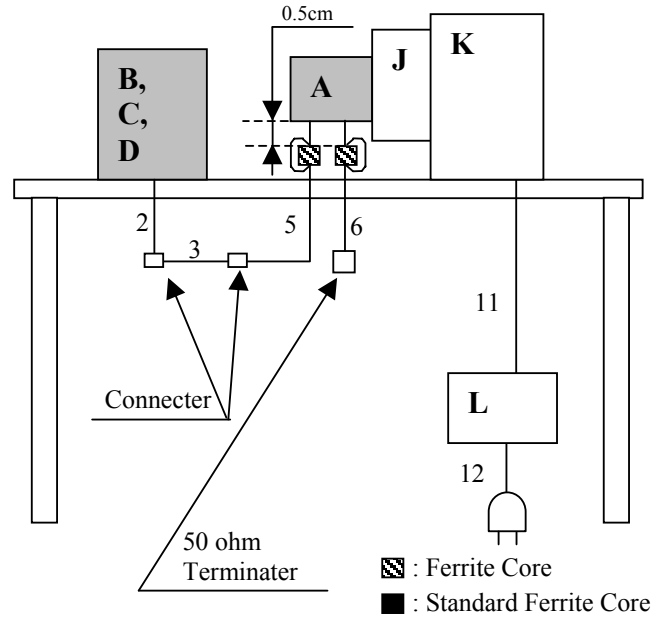
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Facsimile : +81 596 24 8124

<Antenna cable CA-RSPNMA010 + CA-NMNFA004 >
 [Radiated emission above 1GHz]

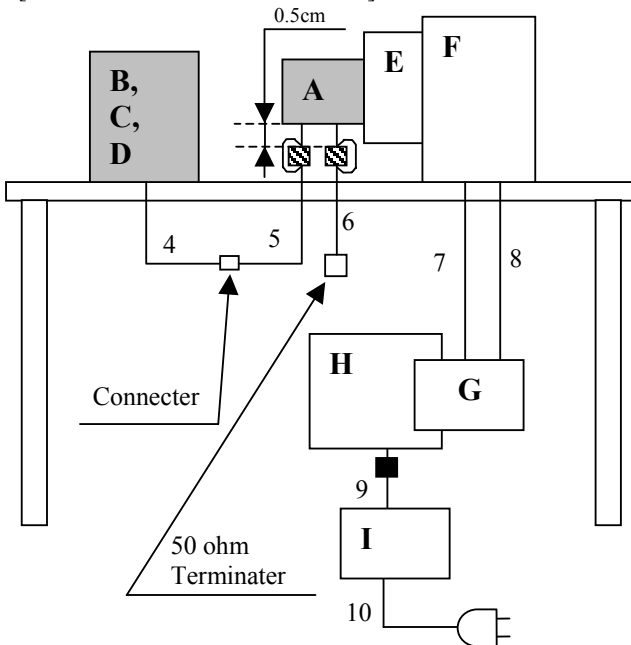


[Radiated emission below 1GHz and Conducted emission]

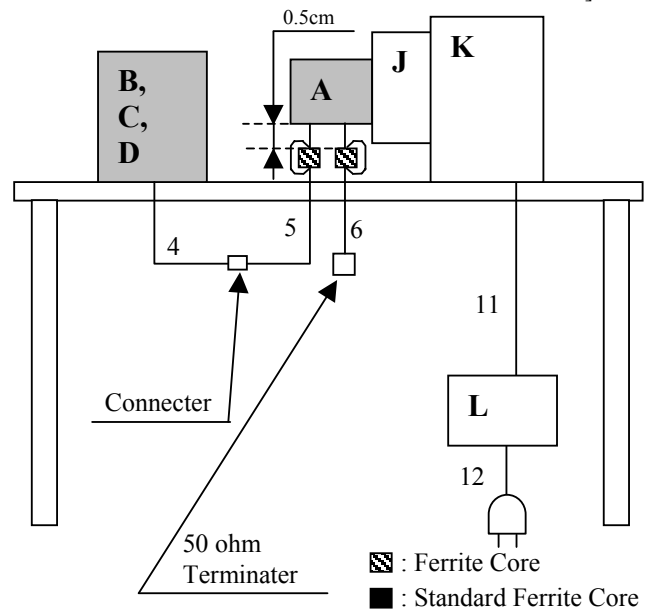


* Cabling and setup were taken into consideration and test data was taken under worst case conditions.

<Antenna cable CA4NMRSF020>
 [Radiated emission above 1GHz]



[Radiated emission below 1GHz and Conducted emission]



* Cabling and setup were taken into consideration and test data was taken under worst case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	MiniPCI Wireless LAN board	SX-10WAG	32	silex technology, Inc.	EUT
B	Antenna	HG5808U	1	silex technology, Inc.	EUT
C	Antenna	HG5817D	1	silex technology, Inc.	EUT
D	Antenna	SR49120WDA	1	silex technology, Inc.	EUT
E	MiniPCI to PCI convert adapter Jigu	-	-	silex technology, Inc.	-
F	CardBus-PCMCIA convert adapter	ECH(PCI)SF-H2B	6LRBH02000133	CONTEC	-
G	CardBus-LAN adapter	BUS-PC(CB)SF	7BRBG290000207	CONTEC	-
H	Personal Computer	CF-R3EW1AXS	4KKSA36622	Panasonic	-
I	AC adapter for PC	CF-AA1625A M2	04727084B	Panasonic	-
J	MiniPCI to PCI convert adapter Jigu	-	-	silex technology, Inc.	-
K	Personal Computer	PP341N-30S430	30016021	TOSHIBA	-
L	AC adapter for PC	PA25010	9809 C 0147495	TOSHIBA	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna cable (CA-RSPNMA004)	1.2	Shielded	Shielded	Jacket diameter 4.95mm
2	Antenna cable (CA-RSPNMA010)	3.0	Shielded	Shielded	Jacket diameter 4.95mm
3	Antenna cable (CA-NMNFA004)	1.2	Shielded	Shielded	Jacket diameter 4.95mm
4	Antenna cable (CA4NMRSF020)	6.0	Shielded	Shielded	Jacket diameter 10.29mm
5	Coaxial Cable	0.08	Shielded	Shielded	With Ferrite Core: SC-10-5-10 (TKK), 2 turn
6	Coaxial Cable	0.12	Shielded	Shielded	With Ferrite Core: SC-10-5-10 (TKK), 2 turn
7	LAN cable (STP, Cat.5e)	11.7	Shielded	Shielded	-
8	LAN cable (STP, Cat.5e)	11.7	Shielded	Shielded	-
9	DC cable	1.2	Unshielded	Unshielded	-
10	AC cable	1.8	Unshielded	Unshielded	-
11	DC cable	1.0	Unshielded	Unshielded	-
12	AC cable	2.0	Unshielded	Unshielded	-

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

SECTION 5: Conducted Emission

5.1 Operating environment

Test place : No.4 semi anechoic chamber.
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT and its peripherals was aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from the LISN/AMN and excess AC cable was bundled in center. I/O cables that were connected to the other peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN/AMN to the input power source. All unused 50 ohm connectors of the LISN/AMN were resistivity terminated in 50 ohm when not connected to the measuring equipment. A drawing of the set up is shown in the photos of APPENDIX 1.

Frequency range : 0.15 MHz-30MHz
EUT position : Table top
EUT operation mode : See Clause 4.1

5.3 Test procedure

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT within a semi anechoic chamber. The EUT was connected to a Line Impedance Stabilization Network (LISN)/ Artificial Mains network (AMN). An overview sweep with peak detection has been performed. The measurements have been performed with a quasi-peak detector and if required, with an average detector.

The conducted emission measurements were made with the following detector function of the test receiver.

Detector Type : Quasi-Peak and Average
IF Bandwidth : 9 kHz

5.4 Test result

Summary of the test results: Pass

Date: February 19 to 20, 2008

Test engineer: Kenichi Adachi

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

SECTION 6: Spurious Emission

[Radiated]

Test Procedure

It was measured based on "2. Radiated emission test" of "Guidance on Measurement of Digital Transmission Systems Operating under Section 15.247".

EUT was placed on a urethane platform of nominal size, 0.5m by 1m, raised 80cm above the conducting ground plane. The Radiated Electric Field Strength intensity has been measured in a Semi Anechoic Chamber with a ground plane and at a distance of 3m(Below 10GHz) and 1m(Upper 10GHz).

The height of the measuring varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20dBc was applied to the frequency over the limit of FCC 15.209 / Table 2 of RSS-210 2.7 (IC) and outside the restricted band of FCC15.205 / Table 1 of RSS-210 2.7 (IC).

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver / Spectrum Analyzer	Spectrum Analyzer
Detector	QP: BW 120kHz(T/R)	PK: RBW:1MHz/VBW: 1MHz
IF Bandwidth	20dBc : RBW: 100kHz VBW: 300kHz (S/A)	AV: RBW:1MHz/VBW:10Hz 20dBc : RBW:100kHz/VBW:300kHz

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT's module to see the position of maximum noise, and the test was made at the position that has the maximum noise.

- The test was made on EUT' Antenna at the normal use position.

Test data : APPENDIX 2

Test result : Pass

SECTION 7: Maximum Peak Output Power

Test Procedure

The Peak Transmit Power was measured with a spectrum analyzer connected to the antenna port.

The test was made with the spectrum analyzer that has a function of channel-power measurement.

Test data : APPENDIX 2

Test result : Pass

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124