



SAR TEST REPORT

Test Report No. : 27KE0242-HO-D

Applicant : **silex Technology, Inc.**
Type of Equipment : **Mini PCI Wireless LAN Board**
Model No. : **SX-10WAG**
FCC ID : **N6C-SX10WAG**
Test standard : **FCC47CFR 2.1093**
FCC OET Bulletin 65, Supplement C
Test Result : **Complied**
Max. SAR Value
IEEE802.11b/g : **0.642W/kg (Body, 2437MHz)**

1. This test report shall not be reproduced except full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above standard. We hereby certify that the data contain a true representation of the SAR profile.
4. The test results in this test report are traceable to the national or international standards.

Date of test: August 10 to 31, 2007

Tested by:

Miyo Kishimoto
EMC Services

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Approved by :

Hironobu Shimoji
Assistant Manager of EMC Services



NVLAP LAB CODE: 200572-0

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*As for the range of Accreditation in NVLAP, you may refer to the WEB address, <http://uljapan.co.jp/emc/nvlap.htm>

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SECTION 1: Client information

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Contact Person : Toshiro Kometani

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

2.1 Identification of E.U.T.

Type of Equipment : Mini PCI Wireless LAN Board
Model No. : SX-10WAG
Serial No. : 008092-011009
Rating : DC3.3V
Country of Manufacture : JAPAN
Receipt Date of Sample : August 6, 2007
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No modification by the test lab.
Category Identified : Portable device

2.2 Product Description

Model: SX-10WAG (referred to as the EUT in this report) is MiniPCI Wireless LAN Board.
It is integrated into a WIRELESS TRANSMITTER.

Equipment Type : Transceiver
Clock frequency : 40MHz
Method of Frequency Generation : Crystal
Operating voltage (inner) : DC3.3V +/-10%

	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)
Channel spacing	5MHz	5MHz	20MHz
ITU Code	G1D	D1D	D1D
Antenna type	Omni-Directional	Omni-Directional	Omni-Directional
Antenna Gain	1.5dBi	1.5dBi	2.1dBi

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SECTION 3 : Test standard information

3.1 Requirements for compliance testing defined by the FCC

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992. According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

1 Specific Absorption Rate (SAR) is a measure of the rate of energy absorption due to exposure to an RF transmitting source (wireless portable device).

2 IEEE/ANSI Std. C95.1-1992 limits are used to determine compliance with FCC ET Docket 93-62.

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3.2 Exposure limit

(A) Limits for Occupational/Controlled Exposure (W/kg)

Spatial Average (averaged over the whole body)	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.4	8.0	20.0

(B) Limits for General population/Uncontrolled Exposure (W/kg)

Spatial Average (averaged over the whole body)	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.08	1.6	4.0

Occupational/Controlled Environments: are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

General Population/Uncontrolled Environments: are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

<p>NOTE:GENERAL POPULATION/UNCONTROLLED EXPOSURE SPATIAL PEAK(averaged over any 1g of tissue) LIMIT 1.6 W/kg</p>

SECTION 4 : Test result

4.1 Result of Max. SAR value

Max. SAR Value

IEEE802.11b/g : 0.642W/kg (Body, 2437MHz)

4.2 Test Location

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SECTION 5 : Operation of E.U.T. during testing

5.1 Confirmation before SAR testing

5.1.1 Correlation of Output Power between EMC and SAR tests

EMC Power<(Sample S/N:ES0002 / May 17, 2006)>

Maximum Peak Output Power test

As for the Maximum Peak Output Power, the data is shown as a reference data.
The result is shown in section 7.1.

SAR Power<(Sample S/N: 008092-011009 / Test date: August 10,2007)>

The test was performed before SAR test.

Since this host device can be using antenna A port only ,the SAR power was tested in the antenna A port.

Maximum Peak Output Power test

It was checked that the antenna port power is correlated within 0~+5% (FCC requirements) at EMC test result
Maximum Peak Output Power were tested by the same measurement method as EMC test.

Average Power test

The average power by the data rate was checked in the middle channel (2437MHz)
The result is shown in section 7.2.

5.2 Confirmation after SAR testing

It was checked that the power drift is within $\pm 5\%$ in the evaluation procedure of SAR testing.
The result is shown in APPENDIX 2.

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5.3 Operating modes for SAR testing

5.3.1 Setting of EUT

1. IEEE 802.11b mode
Tx frequency band : 2412 ~2462MHz
Channel : 1ch(2412MHz),6ch(2437MHz),11ch(2462MHz)
Modulation : DSSS (DBPSK,DQPSK,CCK)
Crest factor : 1

2. IEEE 802.11g mode
Tx frequency band : 2412 ~2462MHz
Channel : 1ch(2412MHz),6ch(2437MHz),11ch(2462MHz)
Modulation : OFDM (BPSK,QPSK,16QAM,64QAM)
Crest factor : 1

5.3.2 SAR Measurement (Radiated power is always monitored by Spectrum Analyzer.)

1. IEEE 802.11b

The tests from Step1 to Step2 were performed.

The CCK (11Mbps) of the highest data rate and the highest average power*.

Step1. The searching for the worst position

Step2. The test for the Low and High channels

This test was performed at the worst conditions of Step1.

2. IEEE 802.11g

The tests from Step3 to Step7 were performed.

Step3. The searching for the worst modulation

The data rate in the higher average power* of each modulation was decided, then the worst modulation was searched in the SAR testing.

Step4. The searching for the worst position

This test was performed at the worst modulation of Step3.

Step5. The changing to the Low and High channels

This test was performed at the worst conditions of Step4.

Step6. The confirmation in the condition with accessory (Case)

This test was performed in the conditions of Antenna up and Antenna down.

Step7. The confirmation in the condition without accessory (Case).

This test was performed at the worst conditions of from Step 1 to Step 6.

The measurement was performed with the distance 15mm to check the influence of accessory.

* Refer to the average power data to Section 7.2.

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5.4 Test setup of EUT

When users operate or carry the EUT, it could be considered to touch or get close to their bodies. In order to assume this situation, we performed the test at the following positions. Please refer to "Appendix 1" for more details.

(1) Rear(Ant.down):

The test was performed in touch with rear surface of host device to the flat phantom.
The distance between the downed antenna and flat phantom is 10mm.

(2) Rear(Ant.up):

The test was performed in touch with rear surface of host device to the flat phantom.
The distance between the antenna and flat phantom is 10mm.

(3) Right Side(Ant.down):

The test was performed in touch with top of downed antenna to the flat phantom.

(4) Front(Ant.up):

The test was performed in touch with front surface of host device to the flat phantom.
The distance between the downed antenna and flat phantom is 13mm.

(5) Left Side(Ant.up):

The test was performed in touch with left side of host device to the flat phantom.
The distance between the antenna and flat phantom is 15mm.

(6) Left Side(Ant.down):

The test was performed in touch with left side of host device to the flat phantom.
The distance between the downed antenna and flat phantom is 15mm.

(7) Rear(Ant.up) with case:

The test was performed in touch with rear surface of host device with case to the flat phantom.
The distance between the antenna and flat phantom is 15mm.

(8) Rear(Ant.down) with case:

The test was performed in touch with rear surface of host device with case to the flat phantom.
The distance between the downed antenna and flat phantom is 15mm.

(9) Rear(Ant.up) (separation 15mm):

The measurement was a distance of 15mm between the downed antenna of host device and flat phantom.
The host device was rear surface position.

(10) Top (Ant.down): *1

The test was performed in touch with top of antenna to the flat phantom.

(11) Top (Ant.up): *1

The test was performed in touch with side of downed antenna the flat phantom.

*1: These positions were tested as a reference.

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SECTION 6 : Test surrounding

6.1 Measurement uncertainty

The uncertainty budget has been determined for the DASY4 measurement system according to the SPEAG documents[6][7] and is given in the following Table.

Error Description	Uncertainty value \pm %	Probability distribution	divisor	(ci) 1g	Standard Uncertainty (1g)	vi or v _{eff}
Measurement System						
Probe calibration	± 6.8	Normal	1	1	± 6.8	∞
Axial isotropy of the probe	± 4.7	Rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	$\sqrt{3}$	$(cp)^{1/2}$	± 3.9	∞
Boundary effects	± 2.0	Rectangular	$\sqrt{3}$	1	± 1.2	∞
Probe linearity	± 4.7	Rectangular	$\sqrt{3}$	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	$\sqrt{3}$	1	± 0.6	∞
Readout electronics	± 0.3	Normal	1	1	± 0.3	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	± 0.5	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	± 1.5	∞
RF ambient Noise	± 3.0	Rectangular	$\sqrt{3}$	1	± 1.7	∞
RF ambient Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	± 1.7	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	± 0.5	∞
Probe positioning	± 9.9	Rectangular	$\sqrt{3}$	1	± 5.7	∞
Max.SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	± 2.3	∞
Test Sample Related						
Device positioning	± 2.9	Normal	1	1	± 2.9	18
Device holder uncertainty	± 3.6	Normal	1	1	± 3.6	10
Power drift	± 5.0	Rectangular	$\sqrt{3}$	1	± 5.8	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	$\sqrt{3}$	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	± 1.8	∞
Liquid conductivity (meas.)	± 5.0	Rectangular	1	0.64	± 3.2	∞
Liquid permittivity (target)	± 5.0	Rectangular	$\sqrt{3}$	0.6	± 1.7	∞
Liquid permittivity (meas.)	± 5.0	Rectangular	1	0.6	± 3.0	∞
Combined Standard Uncertainty					± 13.48	
Expanded Uncertainty (k=2)					± 26.96	

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SECTION 7 : Confirmation before testing

7.1 EMC power and SAR power(WLAN IEEE802.11a)

EMC power

This data is reference data of EMC test. (Report No. 26GE0351-HO-A-1)

FCC15.247 Maximum Peak Output Power

Date of test: May 17, 2006

[IEEE802.11b Ant:A 11Mbps]

Ch	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]
Low	2412.0	2.23	2.80	10.00	15.03
Mid	2437.0	2.58	2.80	10.00	15.38
High	2462.0	2.97	2.80	10.00	15.77

[IEEE802.11g Ant:A 54Mbps]

Ch	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]
Low	2412.0	2.48	2.80	10.00	15.28
Mid	2437.0	2.97	2.80	10.00	15.77
High	2462.0	3.53	2.80	10.00	16.33

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

SAR Power

Date of test: August 10, 2007

[IEEE802.11b Ant:A 11Mbps]

Ch	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]
Low	2412.0	4.30	0.85	10.07	15.22
Mid	2437.0	4.48	0.96	10.07	15.51
High	2462.0	4.88	1.01	10.07	15.96

[IEEE802.11g Ant:A 54Mbps]

Ch	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]
Low	2412.0	4.53	0.85	10.07	15.45
Mid	2437.0	4.88	0.96	10.07	15.91
High	2462.0	5.30	1.01	10.07	16.38

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

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7.2 Reference data of SAR test (Data rate determining)

Date of test: August 10, 2007

Ant:A

Data rate [Mbps]	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]
1	2437.0	3.95	0.96	10.07	14.98
2	2437.0	3.95	0.96	10.07	14.98
5.5	2437.0	3.95	0.96	10.07	14.98
11	2437.0	3.96	0.96	10.07	14.99
6	2437.0	4.98	0.96	10.07	16.01
9	2437.0	4.53	0.96	10.07	15.56
12	2437.0	4.99	0.96	10.07	16.02
18	2437.0	4.99	0.96	10.07	16.02
24	2437.0	5.00	0.96	10.07	16.03
36	2437.0	4.54	0.96	10.07	15.57
48	2437.0	4.54	0.96	10.07	15.57
54	2437.0	5.00	0.96	10.07	16.03

Sample Calculation: Result = Reading + Cable Loss + Attenuator Loss

*The test result is round off to one or two decimal places, so some differences might be observed.

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SECTION 8 : Measurement results

8.1 2450MHz SAR (11b/g mode)

Date : August 10, 2007 Measured By : Miyo Kishimoto
Liquid Depth (cm) : 15.0 Model : SX-10WAG
Parameters : $\epsilon_r = 52.5, \sigma = 2.04$ Serial No. : 008092-011009
Ambient temperature (deg.c.) : 24.5 Modulation : DSSS (11b), OFDM(11g)
Relative Humidity (%) : 54 Crest factor : 1

SAR MEASUREMENT RESULTS									
Frequency			Modulation (Data rate[bps])	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Mode	ch	[MHz]		Antenna	Position	Separation [mm]	Before	After	Maximum value of multi-peak
11b	Step1. The searching for the worst position								
	6	2437	CCK(11Mbps)	Ant.A	Rear (Ant.down)	10	23.5	23.5	0.354
	6	2437	CCK(11Mbps)	Ant.A	Rear (Ant.up)	10	23.5	23.5	0.406
	6	2437	CCK(11Mbps)	Ant.A	Right Side (Ant.down)	0	23.5	23.5	0.034
	6	2437	CCK(11Mbps)	Ant.A	Front (Ant.up)	13	23.5	23.5	0.141
	6	2437	CCK(11Mbps)	Ant.A	Left Side (Ant.up)	15	23.5	23.5	0.141
	6	2437	CCK(11Mbps)	Ant.A	Left Side (Ant.down)	15	23.5	23.6	0.100
	Step2. The test for the Low and High channels								
	1	2412	CCK(11Mbps)	Ant.A	Rear (Ant.up)	10	23.6	23.7	0.577
	11	2462	CCK(11Mbps)	Ant.A	Rear (Ant.up)	10	23.7	23.7	0.555
11g	Step3. The searching for the worst modulation								
	6	2437	BPSK(6Mbps)	Ant.A	Rear (Ant.up)	10	23.7	23.7	0.545
	6	2437	QPSK(18Mbps)	Ant.A	Rear (Ant.up)	10	23.7	23.7	0.642
	6	2437	16QAM(24Mbps)	Ant.A	Rear (Ant.up)	10	23.7	23.7	0.533
	6	2437	64QAM(54Mbps)	Ant.A	Rear (Ant.up)	10	23.7	23.5	0.586
	Step4. The searching for the worst position								
	6	2437	QPSK(18Mbps)	Ant.A	Rear (Ant.down)	10	23.5	23.5	0.278
	6	2437	QPSK(18Mbps)	Ant.A	Right Side (Ant.down)	0	23.8	23.8	0.020
	Step5. The changing to the Low and High channels								
	1	2412	QPSK(18Mbps)	Ant.A	Rear (Ant.up)	10	23.8	23.8	0.480
	11	2462	QPSK(18Mbps)	Ant.A	Rear (Ant.up)	10	23.5	23.5	0.612
	Step6. The confirmation in the condition with accessory (Case)								
	6	2437	QPSK(18Mbps)	Ant.A	Rear (Ant.up)	15	23.8	23.8	0.369
	6	2437	QPSK(18Mbps)	Ant.A	Rear (Ant.down)	15	23.8	23.8	0.259
	Step7. The confirmation in the condition without accessory (Case)								
	6	2437	QPSK(18Mbps)	Ant.A	Rear (Ant.up)	15	23.8	23.8	0.239
	ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body SAR: 1.6 W/kg
Spatial Peak Uncontrolled Exposure / General Population								(averaged over 1 gram)	

8.2 Reference data 2450MHz SAR (11b/g mode)

Date : August 31, 2007 Measured By : Hisayoshi Sato
Liquid Depth (cm) : 15.0 Model : SX-10WAG
Parameters : $\epsilon_r = 52.6, \sigma = 2.03$ Serial No. : 008092-011009
Ambient temperature (deg.c.) : 25.0 Modulation : DSSS (11b), OFDM(11g)
Relative Humidity (%) : 50 Crest factor : 1

SAR MEASUREMENT RESULTS									
Frequency			Modulation (Data rate[bps])	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Mode	ch	[MHz]		Antenna	Position	Separation [mm]	Before	After	Maximum value of multi-peak
11b	Reference data								
	6	2437	CCK(11Mbps)	Ant.A	Top (Ant.down)	0	24.5	24.5	1.34
	6	2437	CCK(11Mbps)	Ant.A	Top (Ant.up)	0	24.5	24.5	0.013
11g	Reference data								
	6	2437	QPSK(18Mbps)	Ant.A	Top (Ant.down)	0	24.5	24.5	1.18
	6	2437	QPSK(18Mbps)	Ant.A	Top (Ant.up)	0	24.5	24.5	0.024
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population							Body SAR: 1.6 W/kg (averaged over 1 gram)		