SAR TEST REPORT

Test Report No. : 27IE0024-HO-G

Applicant	:	**Nagano Japan Radio Co., Ltd.**
Type of Equipment	:	**Wireless LAN Module**
Model No.	:	**NJT-511**
FCC ID	:	**D7LNJT511**
Test standard	:	**FCC47CFR 2.1093** **FCC OET Bulletin 65, Supplement C**
Test Result	:	**Complied**
Max. SAR Value (IEEE 802.11b/g)	:	**0.356W/kg (2412MHz)**

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(s). 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: October 5,6, 2007

Tested by: H. Sato
Hisayoshi Sato
EMC Services

Approved by : T. Maeno
Tetsuo Maeno
Site Manager of EMC Services

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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

Company Name	:	Nagano Japan Radio Co., Ltd.
Address	:	1163 Inasato-machi, Nagano City 381-2288 Japan
Telephone Number	:	+81-26-285-1093
Facsimile Number	:	+81-26-285-1037
Contact Person	:	Takaaki Fukaya

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

2.1 Identification of E.U.T.

Type of Equipment	:	Wireless LAN Module
Model No.	:	NJT-511
Serial No.	:	0013E0997E17
Country of Manufacture	:	JAPAN
Rating	:	DC3.3V
Receipt Date of Sample	:	October 4, 2007
Condition of EUT	:	Production Prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No modification by this test lab

2.2 Product Description

Model No: NJT-511, referred as the EUT in this report, is the Wireless LAN Module.
It is integrated into a 2D Code Handy Terminal.
Clock Frequency : 38.4MHz

Equipment Type		Transceiver
Frequency band	Lower limit	2400MHz
	Upper limit	2483.5MHz
Frequency of Operation		2412-2462MHz
Bandwidth & Channel spacing		20MHz & 5MHz
Type of Modulation		DSSS (DBPSK, DQPSK, CCK) OFDM (BPSK, QPSK, 16QAM, 64QAM)
Antenna Type		Chip Antenna
Antenna Connector Type		U. FL-R-SMT
Antenna Gain		2.14dBi max
ITU code		G1D / D1D
Power Supply		DC 3.3V
Maximum Output Power (Peak:FCC15.247)		23.91dBm (246.04mW)

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.

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.

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

SECTION 4 : Test result

4.1 Result of Max. SAR value

Max. SAR Value (IEEE 802.11b/g) : 0.356W/kg (2412MHz)

4.2 Test Location

UL Japan, Inc. Head Office EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116
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SECTION 5 : Operation of E.U.T. during testing

5.1 Confirmation before SAR testing

Correlation of EMC power and SAR power (WLAN IEEE802.11b/g)

Peak Power test
As for the peak power, the data of EMC test(September 15, 2007) is shown as a reference data.
The result is shown in section 7.1.

Average Power test
It was checked that the antenna port power is correlated within 0~+5% (FCC requirements) at EMC test result (September 15, 2007).

5.2 Confirmation after SAR testing

It was checked that the powerdrift is within ±5% in the evaluation procedure of SAR testing.
The result is shown in APPENDIX 2.

5.3 Operating modes for SAR testing

5.3.1 Setting of EUT

1. IEEE 802.11b mode (2412-2462 band)

Tx frequency band : 2412-2462MHz
Channel : 1ch(2412MHz), 6ch(2437MHz), 11ch(2462MHz)
Modulation : DSSS (DBPSK, DQPSK, CCK)
Crest factor : 1.0

2. IEEE 802.11g mode (2412-2462 band)

Tx frequency band : 2412-2462MHz
Channel : 1ch(2412MHz), 6ch(2437MHz), 11ch(2462MHz)
Modulation : OFDM (BPSK, QPSK, 16QAM, 64QAM)
Crest factor : 1.0

5.3.2 Measurement procedure

1. IEEE 802.11b

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

Step3. The searching for the worst modulation
The data rate in the higher average power* 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 test for the Low and High channels
This test was performed at the worst conditions of Step4 .

3. Change distance between EUT and SAM Twin Phantom

Step6. Change separation
The measurement was performed with the distance, 5mm,10mm and 15mm to check if the shortest distance may not have the worst value at the conditions of the highest SAR value.

* Refer to Section 7.2

5.3.3 Test setup of EUT

When users operate 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) Top:
The test was performed in touch with top surface to the flat phantom.

(2) Front:
The test was performed in touch with front surface to the flat phantom.

(3) Rear:
The test was performed in touch with rear surface to the flat phantom.

(4) Left side:
The test was performed in touch with left side surface to the flat phantom.

(5) Right side:
The test was performed in touch with right side surface to the flat phantom.

(6) Rear (separation 5mm) :
The measurement opened 5mm distance between the EUT and the flat phantom.

(7) Rear (separation 10mm):
The measurement opened 10mm distance between the EUT and the flat phantom.

(8) Rear (separation 15mm) :
The measurement opened 15mm distance between the EUT and the flat phantom.

SECTION 6 : Test surrounding

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 ± %	Probability distribution	divisor	(ci) 1g	Standard Uncertainty (1g)	vi or veff
Measurement System						
Probe calibration	±6.8	Normal	1	1	±6.8	∞
Axial isotropy of the probe	±4.7	Rectangular	√3	$(1\text{-cp})^{1/2}$	±1.9	∞
Spherical isotropy of the probe	±9.6	Rectangular	√3	$(cp)^{1/2}$	±3.9	∞
Boundary effects	±2.0	Rectangular	√3	1	±1.2	∞
Probe linearity	±4.7	Rectangular	√3	1	±2.7	∞
Detection limit	±1.0	Rectangular	√3	1	±0.6	∞
Readout electronics	±0.3	Normal	1	1	±0.3	∞
Response time	±0.8	Rectangular	√3	1	±0.5	∞
Integration time	±2.6	Rectangular	√3	1	±1.5	∞
RF ambient Noise	±3.0	Rectangular	√3	1	±1.7	∞
RF ambient Reflections	±3.0	Rectangular	√3	1	±1.7	∞
Probe Positioner	±0.8	Rectangular	√3	1	±0.5	∞
Probe positioning	±9.9	Rectangular	√3	1	±5.7	∞
Max.SAR Eval.	±4.0	Rectangular	√3	1	±2.3	∞
Test Sample Related						
Device positioning	±2.9	Normal	1	1	±2.9	19
Device holder uncertainty	±3.6	Normal	1	1	±3.6	7
Power drift	±5.0	Rectangular	√3	1	±5.8	∞
Phantom and Setup						
Phantom uncertainty	±4.0	Rectangular	√3	1	±2.3	∞
Liquid conductivity (target)	±5.0	Rectangular	√3	0.64	±1.8	∞
Liquid conductivity (meas.)	±5.0	Rectangular	1	0.64	±3.2	∞
Liquid permittivity (target)	±5.0	Rectangular	√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**	

SECTION 7 : Confirmation before testing

7.1 Correlation of EMC power and SAR power

7.1.1 EMC power

This data is reference data of EMC test. (Report No. 27IE0024-HO-A-R1)

FCC15.247 Maximum Output Peak Power

Date: September 15, 2007

[IEEE802.11b 11Mbps] Peak Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Result [mW]
Low	2412.0	8.17	0.88	10.02	19.07	80.72
Mid	2437.0	8.46	0.89	10.02	19.37	86.50
High	2462.0	7.49	0.89	10.02	18.40	69.18

[IEEE802.11g 9Mbps] Peak Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Result [mW]
Low	2412.0	12.92	0.88	10.02	23.82	240.99
Mid	2437.0	13.00	0.89	10.02	23.91	246.04
High	2462.0	12.65	0.89	10.02	23.56	226.99

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

Reference data for SAR testing

Date: September 15, 2007

[IEEE802.11b 11Mbps] Average Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Result [mW]
Low	2412.0	5.60	0.88	10.02	16.50	44.67
Mid	2437.0	5.79	0.89	10.02	16.70	46.77
High	2462.0	4.79	0.89	10.02	15.70	37.15

[IEEE802.11g 9Mbps] Average Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Result [mW]
Low	2412.0	5.34	0.88	10.02	16.24	42.07
Mid	2437.0	4.79	0.89	10.02	15.70	37.15
High	2462.0	5.74	0.89	10.02	16.65	46.24

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

7.1.2 SAR power

Date: October 5, 2007

[IEEE802.11b 11Mbps] Average Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Result [mW]
Low	2412.0	5.75	0.88	10.02	16.65	46.24
Mid	2437.0	5.97	0.89	10.02	16.88	48.75
High	2462.0	4.97	0.89	10.02	15.88	38.73

[IEEE802.11g 9Mbps] Average Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Result [mW]
Low	2412.0	5.38	0.88	10.02	16.28	42.46
Mid	2437.0	4.98	0.89	10.02	15.89	38.82
High	2462.0	5.76	0.89	10.02	16.67	46.45

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

7.2 Reference data of SAR test (Data rate determination)

Date: October 5, 2007

IEEE 802 11b Average power						
Modulation	Data rate [Mbps]	Freq. [MHz]	P/M(AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]
DBPSK	1	2437	5.26	0.89	10.02	16.17
DQPSK	2	2437	5.63	0.89	10.02	16.54
CCK	5.5	2437	5.69	0.89	10.02	16.60
CCK	11	2437	5.97	0.89	10.02	16.88

IEEE 802 11g Average power						
Modulation	Data rate [Mbps]	Freq. [MHz]	P/M(AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]
BPSK	6	2437	4.91	0.89	10.02	15.82
BPSK	9	2437	4.98	0.89	10.02	15.89
QPSK	12	2437	4.92	0.89	10.02	15.83
QPSK	18	2437	4.97	0.89	10.02	15.88
16QAM	24	2437	4.85	0.89	10.02	15.76
16QAM	36	2437	4.88	0.89	10.02	15.79
64QAM	48	2437	4.97	0.89	10.02	15.88
64QAM	54	2437	4.89	0.89	10.02	15.80

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

SECTION 8 : Measurement results

8.1 SAR Measurement results

8.1.1 IEEE 802.11 b/g SAR

Date	: **October 5, 2007**	Measured By	: **Hisayoshi Sato**
Liquid Depth (cm)	: **15.0**	Model	: **NJT-511**
Parameters	: εr =**50.3**, σ =**2.00**	Serial No.	: **0013E0997E17**
Ambient temperature (deg.c.)	: **24.5**	Modulation	: **DSSS**
Relative Humidity (%)	: **60**	Crest factor	: **1**

Date	: **October 6, 2007**	Measured By	: **Hisayoshi Sato**
Liquid Depth (cm)	: **15.0**	Model	: **NJT-511**
Parameters	: εr =**51.1**, σ =**1.96**	Serial No.	: **0013E0997E17**
Ambient temperature (deg.c.)	: **24.5**	Modulation	: **OFDM**
Relative Humidity (%)	: **55**	Crest factor	: **1**

BODY SAR MEASUREMENT RESULTS

Frequency			Modulation	Phantom Section	EUT Set-up Conditions		Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Mode	Channel	[MHz]			Position	Separation [mm]	Before	After	Maximum value of multi-peak
11b mode	**Step 1. The searching for the worst position**								
	6	2437	CCK(11Mbps)	Flat	Top	0	24.0	24.0	**0.100**
	6	2437	CCK(11Mbps)	Flat	Front	0	24.0	24.0	**0.020**
	6	2437	CCK(11Mbps)	Flat	Rear	0	24.0	24.0	**0.231**
	6	2437	CCK(11Mbps)	Flat	Left side	0	24.0	23.9	**0.058**
	6	2437	CCK(11Mbps)	Flat	Right side	0	23.9	23.9	**0.030**
	Step 2. The test for the Low and High channels								
	1	2412	CCK(11Mbps)	Flat	Rear	0	23.8	23.8	**0.275**
	11	2462	CCK(11Mbps)	Flat	Rear	0	23.8	23.8	**0.267**
11g mode	**Step 3. The searching for the worst modulation**								
	6	2437	BPSK(9Mbps)	Flat	Rear	0	24.0	24.0	**0.283**
	6	2437	QPSK(18Mbps)	Flat	Rear	0	24.0	24.0	**0.319**
	6	2437	16QAM(36Mbps)	Flat	Rear	0	24.0	24.0	**0.251**
	6	2437	64QAM(48Mbps)	Flat	Rear	0	24.0	24.0	**0.253**
	Step 4. The searching for the worst position								
	6	2437	QPSK(18Mbps)	Flat	Top	0	24.0	24.0	**0.097**
	6	2437	QPSK(18Mbps)	Flat	Front	0	24.0	24.0	**0.023**
	6	2437	QPSK(18Mbps)	Flat	Left side	0	23.9	23.9	**0.068**
	6	2437	QPSK(18Mbps)	Flat	Right side	0	23.9	23.8	**0.030**
	Step 5. The test for the Low and High channels								
	1	2412	QPSK(18Mbps)	Flat	Rear	0	23.9	23.9	**0.356**
	11	2462	QPSK(18Mbps)	Flat	Rear	0	23.9	23.8	**0.208**
11g mode	**Step 6. Separation change**								
	1	2412	QPSK(18Mbps)	Flat	Rear	5	23.8	23.9	**0.112**
	1	2412	QPSK(18Mbps)	Flat	Rear	10	23.9	24.0	**0.079**
	1	2412	QPSK(18Mbps)	Flat	Rear	15	24.0	24.0	**0.057**