



## SAR TEST REPORT

**Test Report No. : 25LE0299-HO-5**

**Applicant** : Nikon Corporation  
**Type of Equipment** : Wireless LAN Module  
**Model No.** : UJ-087  
**Test standard** : FCC47CFR 2.1093  
FCC OET Bulletin 65, Supplement C  
**FCC ID** : CGJ2142EB  
**Test Result** : Complied  
**Max. SAR Measured** : 0.131W/kg (Body, 2412MHz)

1. This test report shall not be reproduced except full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment 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** : October 19-20, 2005

**Tested by** : H. Sato  
Hisayoshi Sato  
EMC Services

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

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## **SECTION 1 : Client information**

Company Name	Nikon Corporation
Brand name	Nikon
Address	6-3, Nishi-ohi 1-chome, Shinagawa-ku, Tokyo 140-8601, Japan
Telephone Number	+81-3-3773-8395
Facsimile Number	+81-3-3773-8112
Contact Person	Makoto Kimura

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

### **2.1 Identification of E.U.T.**

Type of Equipment	Wireless LAN Module
Model No.	UJ-087
Serial No.	0060570014E4
Country of Manufacture	Japan
Rating	DC3.1V-3.5V (Operating voltage 3.3V)
Receipt Date of Sample	August 8, 2005
Condition of EUT	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Category Identified	Portable device

### **2.2 Product description**

#### **2.2.1 General Information**

Feature of EUT	UJ-087 (Type of Equipment : Wireless LAN Module) has IEEE802.11b/g. UJ-087 is installed in the Digital Camera (Model No. : COOLPIX P3).
Size	36.5 mm*18.2 mm*3.1 mm (W*L*H)
Range of operation temperature	-10 to +50 deg. C.
Operation Clock	40MHz

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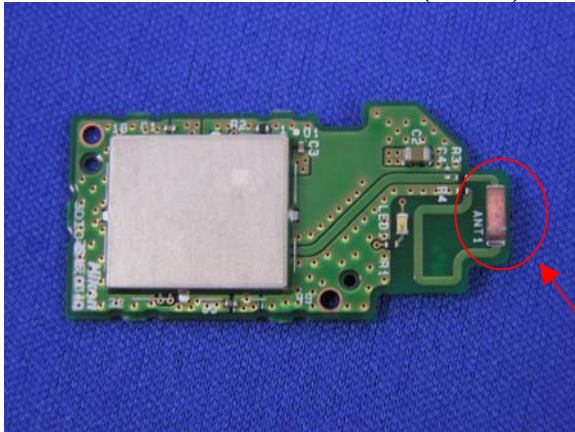
Facsimile: +81 596 24 8124

**Radio specification/Wireless LAN (IEEE802.11b/g)**

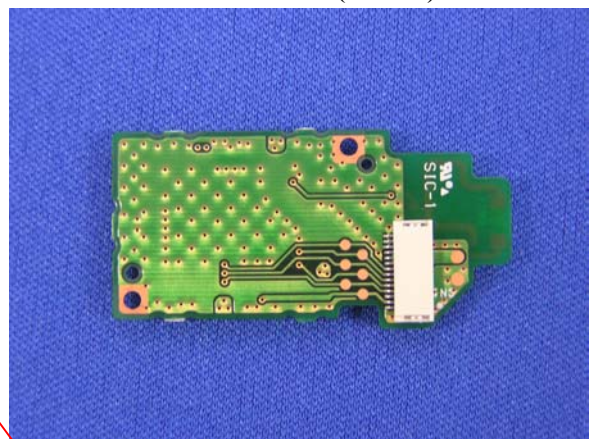
Equipment Type	Transceiver
Frequency band	2412-2462MHz
Bandwidth & Channel spacing	20MHz & 5MHz
Type of Modulation	11b : DSSS 11g : OFDM
Antenna Type	Mono pole
Antenna Connector Type	None
Antenna Gain	-0.4 dBi max
Max. Output Power (Peak)	18.58dBm, 72.11mW
ITU code	11b : G1D 11g : D1D
Mode of Operation	Simplex
Operating frequency	Synthesizer

**2.3 Antenna location**

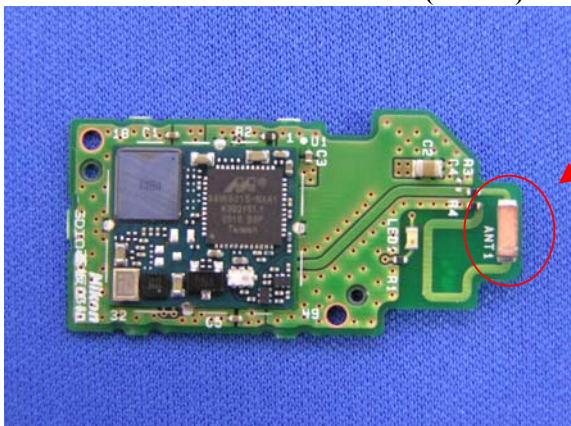
**Front Side of Wireless LAN module(UJ-087) with shield**



**Back Side of Wireless LAN(UJ-087) module**



**Front Side of Wireless LAN module(UJ-087) without shield**



Antenna

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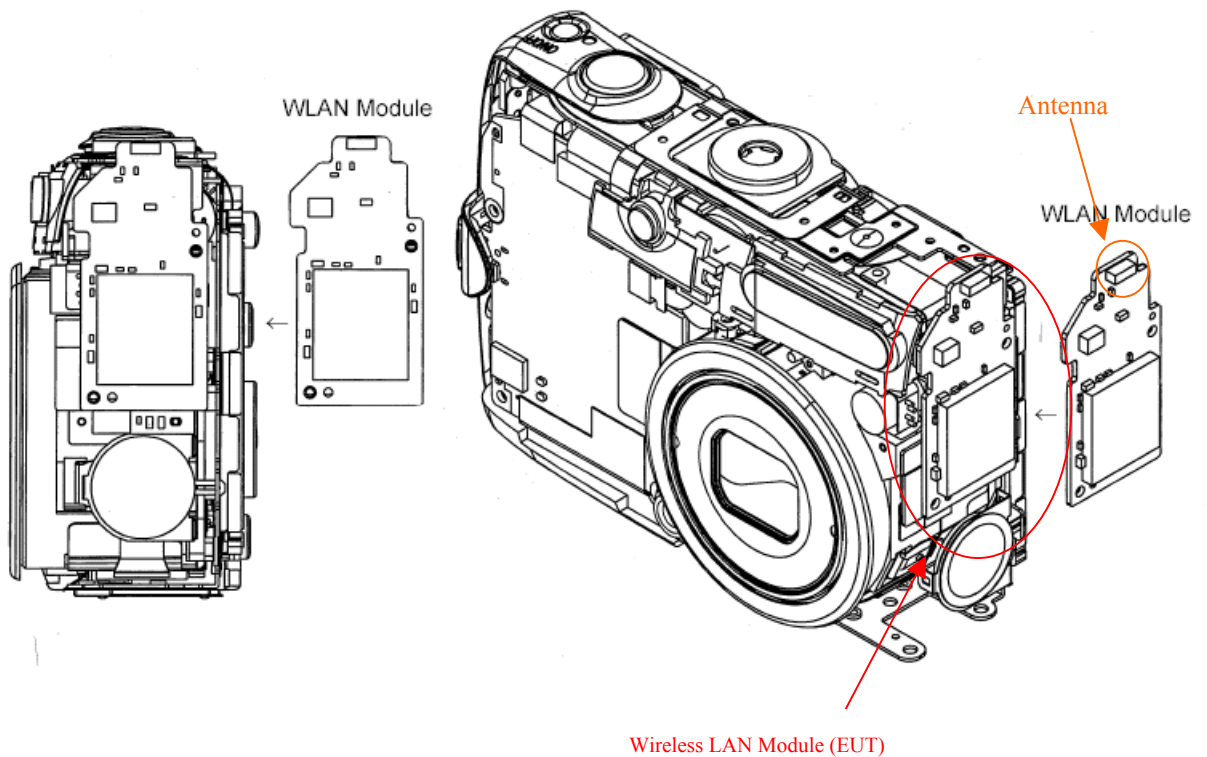
## 2.4 Information of host device

EUT is installed in the Digital Camera.

### 2.4.1 Product description of Digital Camera

Type of Equipment	Digital Camera
Model No.	COOLPIX P3
Serial No.	113
Rating	DC3.7V
Size	92mm * 61mm * 31mm (W*L*H) (excluding projection parts)
Battery	Type : LITHIUMION BATTERY PACK Model Name : EN-EL5 Rating =3.7V : 1100mAh
Range of operation temperature	0 to +40 deg. C.
Manufacture	Nikon Corporation

### 2.4.2 Position of Wireless LAN Module (EUT)



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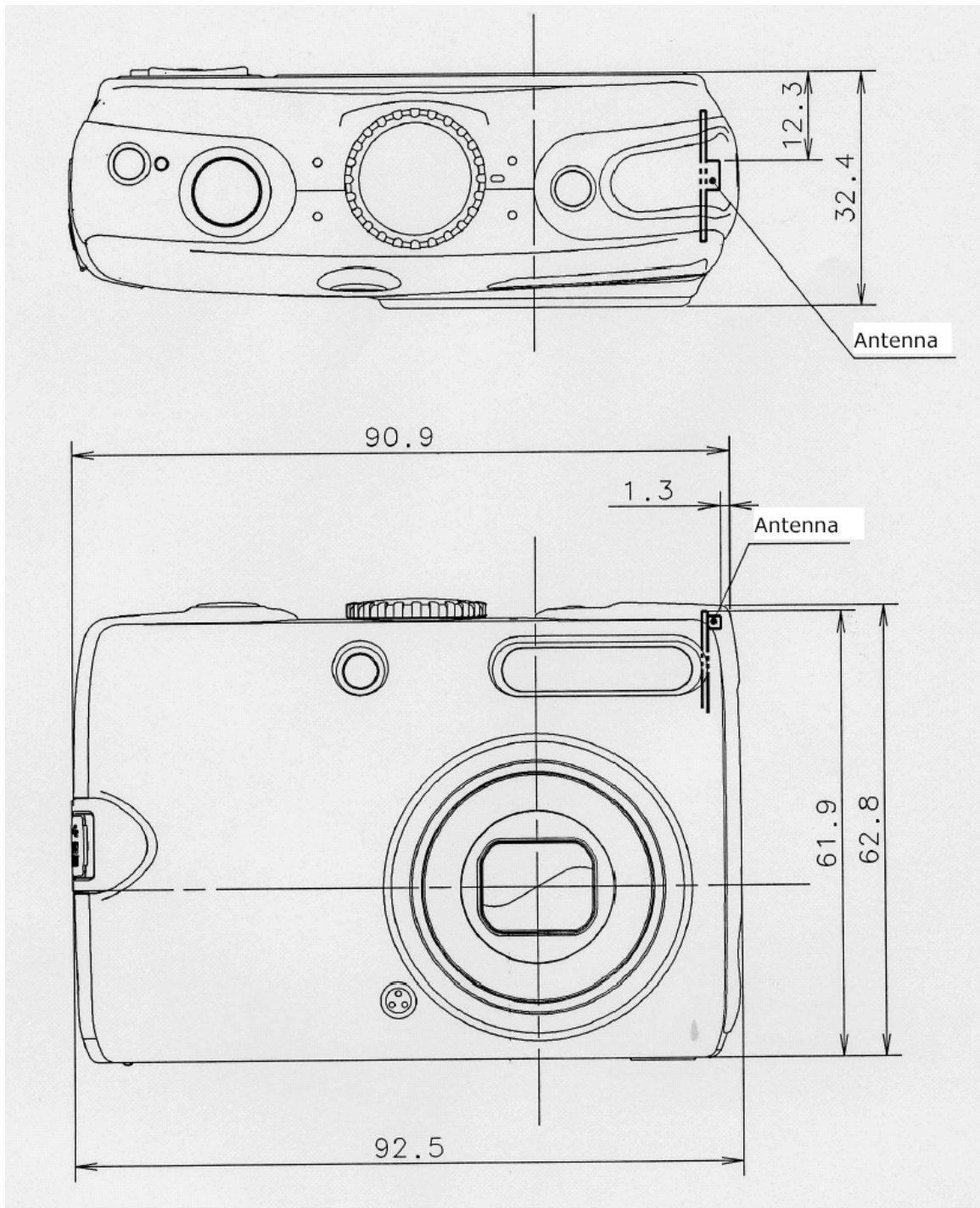
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The diagram of the Digital Camera with the EUT inside is shown as the following.  
The shortest distance between the surface of Digital Camera and the antenna of EUT is 0.9mm.



## **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><b>NOTE:GENERAL POPULATION/UNCONTROLLED EXPOSURE SPATIAL PEAK(averaged over any 1g of tissue) LIMIT 1.6 W/kg</b></p>
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## **SECTION 4 : Test result**

### **4.1 Result of Max. SAR value**

**Max. SAR Measured (IEEE 802.11b) : 0.131 W/kg (Body, 2412MHz)**

### **4.2 Test location**

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

### **5.1 Operating modes**

Operation mode	The frequency band and the modulation used in this test are shown as a following.  1. IEEE 802.11b/g mode Frequency band : 2412-2462MHz Channel : 1ch(2412MHz), 6ch(2437MHz), 11ch(2462MHz) Modulation : 11b : DSSS (DBPSK, DQPSK, CCK) 11g : OFDM (BPSK, DQPSK, 16QAM, 64 QAM) Crest factor : 1
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## **5.2 Measurement procedure**

### **1. IEEE 802.11b**

The 11b (DSSS) test was performed in the CCK(11Mbps) modulation because it was the highest peak power and data rate.

Step1. The searching for the worst position

Step2. The changing to 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

Step4. The searching for the worst position

Step5. The changing to the Low and High channels

This test was performed at the worst conditions of Step3 and Step4.

### **3. Distance between EUT and SAM Twin Phantom**

Step6. The position for the highest SAR value of this EUT was at "Left Side" position.

The measurement was performed with the distance, 5mm, 10mm and 15mm to check if the shortest distance (0mm) may not have the worst value at the conditions of the highest SAR value. As a result, the shortest distance (0mm) had the worst value.

### **5.3 Test setup of EUT**

We tested the Digital Camera with the EUT inside.

When users operate or carry the Digital Camera, 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) Front:

The test was performed in touch with Front surface of the Digital Camera to the flat section of SAM Twin Phantom.

(2) Back :

The test was performed in touch with Back of the Digital Camera to the flat section of SAM Twin Phantom.

(3) Top :

The test was performed in touch with Top surface of the Digital Camera to the flat section of SAM Twin Phantom.

(4) Left Side :

The test was performed in touch with Left Side surface of the Digital Camera to the flat section of SAM Twin Phantom.

(6) ) Left Side (5mm) :

The measurement opened 5mm distance between Digital Camera and SAM Twin Phantom.

(7) ) Left Side (10mm) :

The measurement opened 10mm distance between Digital Camera and SAM Twin Phantom.

(8) ) Left Side (15mm) :

The measurement opened 15mm distance between Digital Camera and SAM Twin Phantom.

\*The test setup photograph is put on appendix 1.

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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 veff
<b>Measurement System</b>						
Probe calibration	$\pm 6.8$	Normal	1	1	$\pm 6.8$	$\infty$
Axial isotropy of the probe	$\pm 4.7$	Rectangular	$\sqrt{3}$	$(1-c_p)^{1/2}$	$\pm 1.9$	$\infty$
Spherical isotropy of the probe	$\pm 9.6$	Rectangular	$\sqrt{3}$	$(c_p)^{1/2}$	$\pm 3.9$	$\infty$
Boundary effects	$\pm 2.0$	Rectangular	$\sqrt{3}$	1	$\pm 1.2$	$\infty$
Probe linearity	$\pm 4.7$	Rectangular	$\sqrt{3}$	1	$\pm 2.7$	$\infty$
Detection limit	$\pm 1.0$	Rectangular	$\sqrt{3}$	1	$\pm 0.6$	$\infty$
Readout electronics	$\pm 1.0$	Normal	1	1	$\pm 1.0$	$\infty$
Response time	$\pm 0.8$	Rectangular	$\sqrt{3}$	1	$\pm 0.5$	$\infty$
Integration time	$\pm 2.6$	Rectangular	$\sqrt{3}$	1	$\pm 1.5$	$\infty$
RF ambient conditions	$\pm 3.0$	Rectangular	$\sqrt{3}$	1	$\pm 1.7$	$\infty$
Mech. constraints of robot	$\pm 0.8$	Rectangular	$\sqrt{3}$	1	$\pm 0.5$	$\infty$
Probe positioning	$\pm 5.7$	Normal	1	1	$\pm 5.7$	$\infty$
Extrap. and integration	$\pm 4.0$	Rectangular	$\sqrt{3}$	1	$\pm 2.3$	$\infty$
<b>Test Sample Related</b>						
Device positioning	$\pm 2.9$	Normal	1	1	$\pm 2.9$	35
Device holder uncertainty	$\pm 3.6$	Rectangular	1	1	$\pm 3.6$	13
Power drift	$\pm 10.0$	Normal	$\sqrt{3}$	1	$\pm 5.8$	$\infty$
<b>Phantom and Setup</b>						
Phantom uncertainty	$\pm 4.0$	Rectangular	$\sqrt{3}$	1	$\pm 2.3$	$\infty$
Liquid conductivity (target)	$\pm 5.0$	Rectangular	$\sqrt{3}$	0.64	$\pm 1.8$	$\infty$
Liquid conductivity (meas.)	$\pm 5.0$	Rectangular	1	0.64	$\pm 3.2$	$\infty$
Liquid permittivity (target)	$\pm 5.0$	Rectangular	$\sqrt{3}$	0.6	$\pm 1.7$	$\infty$
Liquid permittivity (meas.)	$\pm 5.0$	Normal	1	0.6	$\pm 3.0$	$\infty$
<b>Combined Standard Uncertainty</b>					<b><math>\pm 14.298</math></b>	
<b>Expanded Uncertainty (k=2)</b>					<b><math>\pm 28.6</math></b>	

The test result shows that the power drift exceeded  $\pm 5\%$ . Therefore, the uncertainty of power drift expanded to  $\pm 10\%$ . However, the extended uncertainty ( $k=2$ ) of a test is less than 30%.

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**SECTION 7 : Confirmation before testing****7.1 Conducted power**

[IEEE802.11b : 2437MHz]						
Ch	Modulation (Data rate [bps])	S/A Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
6	DBPSK (1Mbps)	1.95	0.43	10.68	13.06	20.23
6	DQPSK(2Mbps)	2.25	0.43	10.68	13.36	21.68
6	CCK(5.5Mbps)	3.71	0.43	10.68	14.82	30.34
6	CCK(11Mbps)	5.38	0.43	10.68	16.49	44.57

[IEEE802.11b: 11Mbps]						
Ch	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2412	5.17	0.45	10.68	16.30	42.66
6	2437	5.38	0.43	10.68	16.49	44.57
11	2462	5.39	0.40	10.68	16.47	44.36

11Mbps is the worst data rate in SAR(11b) result.

[IEEE802.11g : 2437MHz]						
Ch	Modulation (Data rate [bps])	S/A Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
6	BPSK (6Mbps)	6.70	0.43	10.68	17.81	60.39
6	BPSK (9Mbps)	7.01	0.43	10.68	18.12	64.86
6	QPSK (12Mbps)	7.09	0.43	10.68	18.20	66.07
6	QPSK (18Mbps)	6.92	0.43	10.68	18.03	63.53
6	16QAM(24Mbps)	7.03	0.43	10.68	18.14	65.16
6	16QAM(36Mbps)	7.09	0.43	10.68	18.20	66.07
6	64QAM(48Mbps)	6.91	0.43	10.68	18.02	63.39
6	64QAM(54Mbps)	7.10	0.43	10.68	18.21	66.22

[IEEE802.11g : 54Mbps]						
Ch	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2412	7.45	0.45	10.68	18.58	72.11
6	2437	7.10	0.43	10.68	18.21	66.22
11	2462	7.20	0.40	10.68	18.28	67.30

[IEEE802.11g : 36Mbps]						
Ch	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2412	7.04	0.45	10.68	18.17	65.61
6	2437	7.09	0.43	10.68	18.20	66.07
11	2462	6.28	0.40	10.68	17.36	54.45

36Mbps is the worst data rate in SAR(11g) result.

Sample Calculation:

Result = Reading + Cable Loss (supplied by customer)+ Attenuator

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## 7.2 Power drift measurement

The power drift was not within  $\pm 5\%$  on SAR re-testing with full-charged battery.  
Therefore the conducted power was measured in elapsed time.

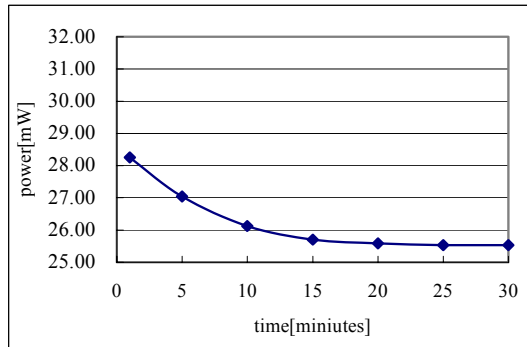
The average power was measured under the condition of Max. Power of IEEE802.11g.

As a result, power changed by  $-9.6\%$ . The result is shown in the following.

So the uncertainty of power drift was expanded to  $\pm 10\%$ .

2412 MHz(IEEE 802.11g) Average power

Time [Minutes]	Result [dBm]	Converted [mW]	Diviation [%]
1	14.51	28.25	-
5	14.32	27.04	-4.3
10	14.17	26.12	-7.5
15	14.10	25.70	-9.0
20	14.08	25.59	-9.4
25	14.07	25.53	-9.6
30	14.07	25.53	-9.6



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**SECTION 8 : Measurement results****8.1 SAR measurement results****8.1.1 Body 2450MHz SAR**

Liquid Depth (cm)	: 15.1	Model	: UJ-087
Parameters	: $\epsilon_r = 50.1, \sigma = 1.95$	Serial No.	: 0060570014E4
Ambient temperature (deg.c.)	: 24.8	Modulation	: DSSS, OFDM
Relative Humidity (%)	: 60	Crest factor	: 1
Date	: October 19, 2005	Measured By	: Hisayoshi Sato

BODY SAR MEASUREMENT RESULTS										
Frequency			Modulation (Data rate[bps])	Phantom Section	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Mode	Channel	[MHz]			Antenna	Position	Separation [mm]	Before	After	Maximum value of multi-peak
11b	<b>Step1. Position search</b>									
	6	2437	CCK(11Mbps)	Flat	Fixed	Front	0	24.0	24.0	0.00599
	6	2437	CCK(11Mbps)	Flat	Fixed	Back	0	24.0	24.0	0.011
	6	2437	CCK(11Mbps)	Flat	Fixed	Top	0	24.1	24.1	0.067
	6	2437	CCK(11Mbps)	Flat	Fixed	Left Side	0	24.0	24.0	0.099
	<b>Step2. Frequency Change</b>									
	1	2412	CCK(11Mbps)	Flat	Fixed	Left Side	0	23.9	23.9	0.131
11	2462	CCK(11Mbps)	Flat	Fixed	Left Side	0	24.0	24.0	0.081	
11g	<b>Step3. Modulation search</b>									
	6	2437	BPSK(9Mbps)	Flat	Fixed	Left Side	0	23.8	23.8	0.105
	6	2437	QPSK(12Mbps)	Flat	Fixed	Left Side	0	23.8	23.8	0.094
	6	2437	16QAM(36Mbps)	Flat	Fixed	Left Side	0	23.9	23.9	0.106
	6	2437	64QAM(54Mbps)	Flat	Fixed	Left Side	0	23.9	23.9	0.092
	<b>Step4. Position search</b>									
	6	2437	16QAM(36Mbps)	Flat	Fixed	Front	0	23.8	23.8	0.0092
	6	2437	16QAM(36Mbps)	Flat	Fixed	Back	0	23.8	23.9	0.010
	6	2437	16QAM(36Mbps)	Flat	Fixed	Top	0	23.8	23.8	0.063
	<b>Step5. Frequency Change</b>									
	1	2412	16QAM(36Mbps)	Flat	Fixed	Left Side	0	23.9	23.9	0.119
11	2462	16QAM(36Mbps)	Flat	Fixed	Left Side	0	23.8	23.8	0.083	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Head SAR: 1.6 W/kg		
Spatial Peak Uncontrolled Exposure / General Population								(averaged over 1 gram)		

BODY SAR MEASUREMENT RESULTS										
Frequency			Modulation (Data rate[bps])	Phantom Section	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Mode	Channel	[MHz]			Antenna	Position	Separation [mm]	Before	After	Maximum value of multi-peak
11b	<b>Step 6. Separation Change</b>									
	1	2412	CCK(11Mbs)	Flat	Fixed	Left Side	5	23.9	23.9	0.042
	1	2412	CCK(11Mbs)	Flat	Fixed	Left Side	10	23.8	23.8	0.00742
	1	2412	CCK(11Mbs)	Flat	Fixed	Left Side	15	23.9	23.8	0.00434

\* The measurement data is put on appendix 3.

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**8.1.2 Head 2450MHz SAR (Reference data)**

Liquid Depth (cm)	: 15.2	Model	: UJ-087
Parameters	: $\epsilon_r = 37.6, \sigma = 1.84$	Serial No.	: 0060570014E4
Ambient temperature (deg.c.)	: 24.8	Modulation	: DSSS, OFDM
Relative Humidity (%)	: 61	Crest factor	: 1
Date	: October 20, 2005	Measured By	: Hisayoshi Sato

HEAD SAR MEASUREMENT RESULTS										
Frequency			Modulation (Data rate[bps])	Phantom Section	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Mode	Channel	[MHz]			Antenna	Position	Separation [mm]	Before	After	Maximum value of multi-peak
11b	<b>Step1. Position search</b>									
	6	2437	CCK(11Mbps)	Flat	Fixed	Front	0	24.0	24.0	<b>0.012</b>
	6	2437	CCK(11Mbps)	Flat	Fixed	Back	0	24.1	24.1	<b>0.010</b>
	6	2437	CCK(11Mbps)	Flat	Fixed	Top	0	23.9	23.9	<b>0.094</b>
	6	2437	CCK(11Mbps)	Flat	Fixed	Left Side	0	24.0	24.0	<b>0.097</b>
	<b>Step2. Frequency Change</b>									
	1	2412	CCK(11Mbps)	Flat	Fixed	Left Side	0	24.0	24.0	<b>0.141</b>
11	2462	CCK(11Mbps)	Flat	Fixed	Left Side	0	23.9	23.9	<b>0.089</b>	
11g	<b>Step3. Modulation search</b>									
	6	2437	BPSK(9Mbps)	Flat	Fixed	Left Side	0	23.9	23.9	<b>0.104</b>
	6	2437	QPSK(12Mbps)	Flat	Fixed	Left Side	0	23.9	23.9	<b>0.107</b>
	6	2437	16QAM(36Mbps)	Flat	Fixed	Left Side	0	23.9	23.8	<b>0.111</b>
	6	2437	64QAM(54Mbps)	Flat	Fixed	Left Side	0	23.9	23.9	<b>0.092</b>
	<b>Step4. Position search</b>									
	6	2437	16QAM(36Mbps)	Flat	Fixed	Front	0	23.8	23.7	<b>0.00766</b>
	6	2437	16QAM(36Mbps)	Flat	Fixed	Back	0	23.7	23.7	<b>0.00872</b>
	6	2437	16QAM(36Mbps)	Flat	Fixed	Top	0	23.7	23.7	<b>0.081</b>
	<b>Step5. Frequency Change</b>									
	1	2412	16QAM(36Mbps)	Flat	Fixed	Left Side	0	23.7	23.7	<b>0.127</b>
11	2462	16QAM(36Mbps)	Flat	Fixed	Left Side	0	23.8	23.8	<b>0.087</b>	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Head SAR: 1.6 W/kg		
Spatial Peak Uncontrolled Exposure / General Population								(averaged over 1 gram)		

HEAD SAR MEASUREMENT RESULTS										
Frequency			Modulation (Data rate[bps])	Phantom Section	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Mode	Channel	[MHz]			Antenna	Position	Separation [mm]	Before	After	Maximum value of multi-peak
11g	<b>Step 6. Separation Change</b>									
	1	2412	CCK(11Mbps)	Flat	Fixed	Left Side	5	23.8	23.8	<b>0.020</b>
	1	2412	CCK(11Mbps)	Flat	Fixed	Left Side	10	23.7	23.7	<b>0.00504</b>
	1	2412	CCK(11Mbps)	Flat	Fixed	Left Side	15	23.7	23.7	<b>0.00268</b>

\* The measurement data is put on appendix 3.

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