



SAR TEST REPORT

Test Report No. : 27KE0162-HO-E

Applicant : Fujitsu Limited
Type of Equipment : B-PAD
Model No. : CA06178-A521
FCC ID : EJE-BPAD05
Test standard : FCC47CFR 2.1093
FCC OET Bulletin 65, Supplement C
Test Result : Complied

Max. SAR Value(IEEE802.11b/g): 1.09W/kg (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 : June 27 and 28, 2007

Tested by : 
Hisayoshi Sato
EMC Services

Approved by : 
Tetsuo Maeno
Site 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.*As for the range of Accreditation in NVLAP, you may refer to the WEB address, <http://uljapan.co.jp/emc/nvlap.html>

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[W-LAN module: IEEE802.11b/g]

		IEEE802.11b/g Wireless LAN
Frequency band	Lower limit	2412MHz
	Upper limit	2462MHz
Type of Modulation		DSSS, OFDM
Antenna Type		$\lambda/4$ dielectric chip antenna
Antenna Connector Type		W. FL
Antenna Gain		1.8dBi
ITU code		G1D(DSSS), D1D(OFDM)
Power Supply (Inner)		DC 3.3V
Maximum Output Power (Peak:FCC15.247)		20.90dBm (122.90mW)

[Bluetooth module: Class3]

		Bluetooth
Frequency band	Lower limit	2402MHz
	Upper limit	2480MHz
Bandwidth & Channel spacing		1MHz & 1MHz / CH
Type of Modulation		FHSS
Antenna Type		$\lambda/4$ dielectric chip antenna
Antenna Connector Type		U. FL
Antenna Gain		-4.3dBi
ITU code		F1D
Power Supply (Inner)		DC 3.3V
Maximum Output Power (Peak:FCC15.247)		0.55dBm (1.14mW)

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) : 1.09 W/kg

Bluetooth and Wireless LAN powers are transmitted individually from different antenna.
IEEE802.11b/g Wireless LAN and Bluetooth modules cannot transmit simultaneously.
Bluetooth power is under 60/f (mW), so SAR test of Bluetooth is excluded.
(refer to section 7.3)

4.2 Test location

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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(June 22, 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 (June 22, 2007).

The tested mode was performed at the worst data rate of middle channel (2437MHz).
The result is shown in section 7.1. and 7.2.

5.2 Confirmation after SAR testing

It is checked that the power drift value at each measurement is within $\pm 5\%$ as to the power change before and after the SAR test. When the power drift value is over $\pm 5\%$, the power changes against time is measured to confirm the changes are within tolerance. Moreover, the change rate is reflected on the uncertainty.
Refer to Section 7.4.

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 (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 CCK (11Mbps) of the highest data rate and the highest average power^{*1}.

Step1. The searching for the worst position

This test was performed at the worst modulation.

Step2. The changing to the Low and High channels

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

2. IEEE 802.11g

Step3. The searching for the modulation.

The data rate in the higher average power^{*1} 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 Step 4.

^{*1}The result is shown in section 7.2.

3. Change distance between EUT and SAM Twin Phantom

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

5.4 Test setup of EUT

In order to assume this situation, we performed the test at the following positions. Please refer to "APPENDIX 1" for more details.

1. Front side : The test was performed in touch with Front side of the EUT to the flat section of SAM Twin Phantom.
2. Left side : The test was performed in touch with left side of the EUT to the flat section of SAM Twin Phantom.
3. Right side : The test was performed in touch with right side of the EUT to the flat section of SAM Twin Phantom.
4. Top side : The test was performed in touch with Top side of the EUT to the flat section of SAM Twin Phantom.
5. Back side : The test was performed in touch with back side of the EUT to the flat section of SAM Twin Phantom.
6. Front side (Separation 5mm) : The test was performed in the separation of 5mm between EUT and flat sections of the SAM Twin Phantom.
7. Front side (Separation 10mm) : The test was performed in the separation of 10mm between EUT and flat sections of the SAM Twin Phantom.
8. Front side (Separation 15mm) : The test was performed in the separation of 15mm between EUT and flat sections of the SAM Twin Phantom.

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
Measurement System						
Probe calibration	± 6.8	Normal	1	1	± 6.8	∞
Axial isotropy of the probe	± 4.7	Rectangular	$\sqrt{3}$	$(1-c_p)^{1/2}$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	$\sqrt{3}$	$(c_p)^{1/2}$	± 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	40
Device holder uncertainty	± 3.6	Normal	1	1	± 3.6	8
Power drift	± 10.0	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					± 14.36	
Expanded Uncertainty (k=2)					± 28.7	

SECTION 7 : Results of confirmation before SAR testing**7.1 EMC power and SAR power (WLAN IEEE802.11b/g)****7.1.1 EMC power**

This data is reference data of EMC test. (Report No. 27KE0162-HO-A)

FCC15.247 Maximum Output Peak Power

Date of test: June 22, 2007

[IEEE802.11b 11Mbps] Peak Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	9.75	0.00	10.00	19.75	94.31
Mid	2437.0	9.94	0.00	10.03	19.97	99.21
High	2462.0	9.91	0.00	10.03	19.94	98.65

[IEEE802.11g 54Mbps] Peak Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	10.73	0.00	10.00	20.73	118.18
Mid	2437.0	10.87	0.00	10.03	20.90	122.90
High	2462.0	10.84	0.00	10.03	20.87	122.21

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

Reference data for SAR testing

Date of test: June 22, 2007

[IEEE802.11b 11Mbps] Average Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	7.29	0.00	10.02	17.31	53.83
Mid	2437.0	8.51	0.00	10.02	18.53	71.29
High	2462.0	8.09	0.00	10.02	18.11	64.71

[IEEE802.11g 54Mbps] Average Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	4.40	0.00	10.02	14.42	27.67
Mid	2437.0	4.61	0.00	10.02	14.63	29.04
High	2462.0	4.78	0.00	10.02	14.80	30.20

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

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7.1.2 SAR power

Date of test: June 27, 2007

[IEEE802.11b 11Mbps] Average Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	7.31	0.00	10.02	17.33	54.08
Mid	2437.0	8.55	0.00	10.02	18.57	71.94
High	2462.0	8.09	0.00	10.02	18.11	64.71

[IEEE802.11g 54Mbps] Average Power

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	4.43	0.00	10.02	14.45	27.86
Mid	2437.0	4.62	0.00	10.02	14.64	29.11
High	2462.0	4.79	0.00	10.02	14.81	30.27

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

7.2 Reference data of SAR test (Data rate determining of WLAN IEEE802.11b/g)

Date of test: June 27, 2007

[IEEE802.11b] Rate Check (Average Power)

Moduration	Rate	Freq.	P/M	Cable Loss	Atten.	Result	
	[Mbps]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
DBPSK	1.0	2437.0	6.83	0.00	10.02	16.85	48.42
DQPSK	2.0	2437.0	5.87	0.00	10.02	15.89	38.82
CCK	5.5	2437.0	8.25	0.00	10.02	18.27	67.14
	11.0	2437.0	8.51	0.00	10.02	18.53	71.29

[IEEE802.11g] Rate Check (Average Power)

Moduration	Rate	Freq.	P/M	Cable Loss	Atten.	Result	
	[Mbps]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
BPSK	6.0	2437.0	3.15	0.00	10.02	13.17	20.75
	9.0	2437.0	3.53	0.00	10.02	13.55	22.65
QPSK	12.0	2437.0	2.82	0.00	10.02	12.84	19.23
	18.0	2437.0	2.54	0.00	10.02	12.56	18.03
16QAM	24.0	2437.0	2.83	0.00	10.02	12.85	19.28
	36.0	2437.0	2.46	0.00	10.02	12.48	17.70
64QAM	48.0	2437.0	4.57	0.00	10.02	14.59	28.77
	54.0	2437.0	4.61	0.00	10.02	14.63	29.04

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

7.3 Reference data of EMC power(Bluetooth)

This data is reference data of EMC test. (Report No. 27KE0162-HO-C)

FCC15.247 Maximum Output Peak Power

Date of test: June 26, 2007

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2402.0	-10.06	0.63	9.98	0.55	1.14
Mid	2441.0	-10.37	0.63	10.03	0.29	1.07
High	2480.0	-10.64	0.63	10.03	0.02	1.00

Sample Calculation:

Result = Reading + Cable Loss+ Attenuator

7.4 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 Output power was measured under the condition of Max. Power of IEEE802.11b.

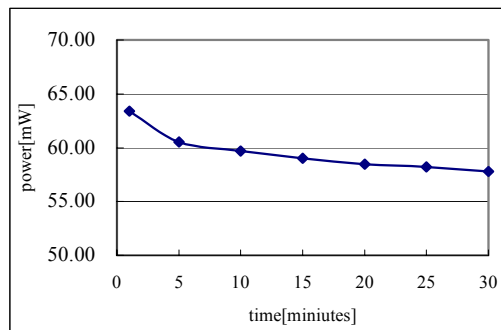
As a result, power changed by -8.8% . The result is shown in the following.

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

* Refer to clause 7.1.

2437 MHz(IEEE 802.11b)

Time [Minutes]	Result [dBm]	Converted [mW]	Diviation [%]
1	18.02	63.39	-
5	17.82	60.53	-4.5
10	17.76	59.70	-5.8
15	17.71	59.02	-6.9
20	17.67	58.48	-7.7
25	17.65	58.21	-8.2
30	17.62	57.81	-8.8



SECTION 8 : Measurement results**8.1 SAR measurement results**All of power drifts were within $\pm 10\%$.

The measurement data is put on "APPENDIX 2".

8.1.1 2450MHz SAR (WLAN 11b/g mode)

Liquid Depth (cm)	: 15.0	Model	: CA06178-A521
Parameters	: $\epsilon_r = 51.5$ $\sigma = 2.03$	Serial No.	: 0001
Ambient temperature (deg.c.)	: 24.0	Modulation	: DSSS(11b), OFDM(11g)
Relative Humidity (%)	: 57	Crest factor	: 1
Date	: June 27, 2007	Measured By	: Hisayoshi Sato

Liquid Depth (cm)	: 15.0	Model	: CA06178-A521
Parameters	: $\epsilon_r = 51.6$ $\sigma = 2.03$	Serial No.	: 0001
Ambient temperature (deg.c.)	: 24.0	Modulation	: OFDM(11g)
Relative Humidity (%)	: 59	Crest factor	: 1
Date	: June 28, 2007	Measured By	: Hisayoshi Sato

BODY SAR MEASUREMENT RESULTS										
Frequency			Modulation	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	Step1. Position search									
	6	2437.0	CCK(11Mbps)	Flat	Fixed	Front	0	24.3	24.3	1.09
	6	2437.0	CCK(11Mbps)	Flat	Fixed	Left	0	24.3	24.3	0.029
	6	2437.0	CCK(11Mbps)	Flat	Fixed	Right	0	24.3	24.3	0.027
	6	2437.0	CCK(11Mbps)	Flat	Fixed	Top	0	24.3	24.3	0.663
	6	2437.0	CCK(11Mbps)	Flat	Fixed	Back	0	24.3	24.3	0.019
	Step2. Frequency Change									
	1	2412.0	CCK(11Mbps)	Flat	Fixed	Front	0	24.3	24.3	1.01
	11	2462.0	CCK(11Mbps)	Flat	Fixed	Front	0	24.3	24.3	0.939
11g	Step3. Moduration Change									
	6	2437.0	BPSK(9Mbps)	Flat	Fixed	Front	0	24.3	24.3	0.411
	6	2437.0	QPSK(12Mbps)	Flat	Fixed	Front	0	24.4	24.4	0.371
	6	2437.0	16QAM(24Mbps)	Flat	Fixed	Front	0	24.4	24.4	0.465
	6	2437.0	64QAM(54Mbps)	Flat	Fixed	Front	0	24.4	24.4	0.572
	Step 4. Position Search									
	6	2437.0	64QAM(54Mbps)	Flat	Fixed	Left	0	24.1	24.1	0.022
	6	2437.0	64QAM(54Mbps)	Flat	Fixed	Right	0	24.1	24.1	0.012
	6	2437.0	64QAM(54Mbps)	Flat	Fixed	Top	0	24.1	24.1	0.323
	6	2437.0	64QAM(54Mbps)	Flat	Fixed	Back	0	24.1	24.1	0.012
	Step5. Frequency Change									
	1	2412.0	64QAM(54Mbps)	Flat	Fixed	Front	0	24.1	24.1	0.554
	11	2462.0	64QAM(54Mbps)	Flat	Fixed	Front	0	24.1	24.1	0.388
11b	Step6. Separation Change									
	6	2437.0	CCK(11Mbps)	Flat	Fixed	Front	5	24.1	24.1	0.307
	6	2437.0	CCK(11Mbps)	Flat	Fixed	Front	10	24.1	24.2	0.189
	6	2437.0	CCK(11Mbps)	Flat	Fixed	Front	15	24.2	24.2	0.117
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population								Body SAR: 1.6 W/kg (averaged over 1 gram)		

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