SAR TEST REPORT

Test Report No. : 30GE0232-HO-02-E-R1

Applicant	:	**Ricoh Company, Ltd.**
Type of Equipment	:	**Module Circuit Board**
Model No.	:	**SG4G2-TB3**
FCC ID	:	**T9FG700SE**
Test regulation	:	**FCC47CFR 2.1093** **FCC OET BULLETIN 65, SUPPLEMENT C** **(Edition 01-01)**
Test Result	:	**Complied**
Max. SAR Value **IEEE802.11b/g**	:	**0.125W/kg (2462MHz)**

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3. This sample tested is in compliance with the above regulation.
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6. This report is a revised version of 30GE0232-HO-02-E.30GE0232-HO-02-E is replaced with this report.

Date of test: July 22 and August 2, 2010

jmested by:
Miyo Kishimoto
Engineer of EMC Service

Approved by :
Mitsuru Fujimura
Manager of EMC Service

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://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

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CONTENTS PAGE

SECTION 1: Customer information

Company Name	:	Ricoh Company, Ltd.
Address	:	8-13-1 Ricoh building,Ginza,Chuo-ku,Tokyo-to 104-8222, Japan
Telephone Number	:	81-45-475-7499
Facsimile Number	:	81-45-475-2799
Contact Person	:	Daisuke Fujioka

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

2.1 Identification of E.U.T.

Type of Equipment	:	Module Circuit Board *
Model No.	:	SG4G2-TB3
Serial No.	:	1
Rating	:	DC3.3V & DC4.2V
Receipt Date of Sample	:	June 2, 2010
Country of Mass-production	:	Vietnam
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

*Remarks:
Ricoh Company, Ltd. designates SANYO Electric Co., Ltd. as manufacturer of the product (Module Circuit Board).

2.2 Product Description

Model No: SG4G2-TB3 (referred to as the EUT in this report) is the Module Circuit Board which is installed in the Digital Camera (host device) manufactured by Ricoh Company, Ltd..

Equipment Type	:	Transceiver
Clock frequency	:	26MHz(Bluetooth part/Wireless LAN part)32.768kHz
Method of Frequency Generation	:	Synthesizer
Operating temperature range	:	-10 to +40 deg. C.

This EUT has multi transmitters of Wireless LAN and Bluetooth.
However, this EUT doesn't have the simultaneous transmission since these two communication methods share the same one antenna.

	IEEE802.11b	IEEE802.11g	Bluetooth
Frequency of operation	2412-2462MHz	2412-2462MHz	2402-2480
Type of modulation	DSSS	OFDM	FHSS
Bandwidth & Channel spacing	20M & 5MHz	20M & 5MHz	1MHz & 1MHz
Antenna type	Chip Multilayer antenna（LDA312G4413H-280）		
Antenna Gain	3.4dBi max	3.4dBi max	3.4dBi max
Operating voltage (Inner)	DC3.3V & DC1.8V		DC3.3V

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.

Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01):

Supplement C (Edition 01-01) - Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions
OET Bulletin 65 (Edition 97-01) - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

IEEE Std 1528-2003:

IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques Supplement C

In additions;

KDB 447498 D01(v04):	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB 248227 (rev.1.2):	SAR Measurement Procedures for 802.11a//b/g Transmitters

3.2 Procedure and result

TEST Outline
This EUT is a limited module approval according to section 15.212(b). The procedure of SAR was measured according to the KDB447498 2).
The EUT has multi transmitters of Wireless LAN and Bluetooth. However this EUT doesn't have the simultaneous transmission since these two communication methods share the same one antenna. In addition, standalone Bluetooth SAR testing was excluded since the output power [mW] is $\leq 60/f_{[GHz]}$. Therefore the SAR testing report is only result for wireless LAN transmitter.

No.	Item	Test Procedure	Limit	Remarks	Exclusion	Result
1	Human Exposure	FCC OET BULLETIN 65, SUPPLEMENT C	FCC47CFR 2.1093	SAR Measurement	N/A	Complied
Note: UL Japan, Inc. 's SAR Work Procedures QPM46 and QPM47						

Result of Max. SAR value
Max. SAR Value:

IEEE802.11b/g : 0.125W/kg (2462MHz)

The 1-g SAR was <0.4W/kg for all configurations.
Therefore according to the KDB447498 D01, the EUT can be used in portable exposure conditions with no restrictions on host platforms. (within the range of tested worst)

3.3 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

3.4 Test Location

*Shielded room for SAR testings
UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
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3.5 Confirmation before SAR testing

3.5.1 Correlation of Output Power between EMC and SAR tests

It was checked that the antenna port power was correlated within 0~+5% (FCC requirements)
The result is shown in Section 6.1.

Peak Power test

SAR power is equal to DATA of EMC test. (July 22, 2010) based on the following reason.

- EMC and SAR tests are performed with the same test sample (S/N: 1) under the same condition.
- EMC and SAR tests are performed at the same laboratory.
- The test mode setting is simple, and there is no possibility that the power (value) is changed by the wrong setting.

The result is shown in Section 7.1.

3.5.2 Average power for SAR testing

Step.1 Data rate check

The data rate check was measurement all data rate in the middle frequency of each frequency band.

Reference of modulation table

11b		**11g**	
Modulation	**Data rate [Mbps]**	**Modulation**	**Data rate [Mbps]**
DBPSK	1	BPSK	6
DQPSK	2	BPSK	9
CCK	5.5	QPSK	12
CCK	11	QPSK	18
-	-	16QAM	24
-	-	16QAM	36
-	-	64QAM	48
-	-	64QAM	54

3.6 Confirmation after SAR testing

It was checked that the power drift [W] is within +/-5%.The verification of power drift during the SAR test is that DASY4 system calculates the power drift by measureing the e-filed at the same location at beginning and the end of the scan measurement for each test position.

DASY4 system calucation Power drift value[dB] =20log(Ea)/(Eb)
Before SAR testing : Eb[V/m]
After SAR testing : Ea[V/m]

Limit of power drift[W] =+/-5%
X[dB]=10log[P]=10log(1.05/1)=10log(1.05)-10log(1)=0.212dB

from E-filed relations with power.
S=E*H=E^2/ η =P/4 π r^2 (η : Space impedance)
P=E^2*4 π r^2/η
Therefore, The correlation of power and the E-filed
XdB=10log(P)=10log(E)^2=20log(E)

From the above mentioned,
The calculated power drift of DASY4 System must be the less than +/-0.212dB.

3.7 Measurement procedure

1. IEEE 802.11b/g

Step1. The searching for the worst position
The 11b(DSSS) mode test was performed on the DBPSK(1Mbps) modulations of maximum average power.

Step2. Change to the Low and High channels
This test was performed at the worst conditions of Step1.

Step3. Change to the mode
The 11g(OFDM) mode test was performed on the BPSK(6Mbps) modulations of maximum average power.

Step4. Separation change for 2.4GHz band
The device is moved away from the phantom in 5mm increments from the touching.
A single-point SAR is measured until the SAR is less than 50% of that measured at the touching position.

2. Check testing of GPS unit

The influence of SAR when the GPS unit was attached to a surface in a direction opposite to antenna of host device was checked.

3. Check testing of battery

The influence of SAR in the AAA size battery was checked. The testing was compared with Normal Battery at the peak SAR in area scan.

3.8 Test setup of EUT

Body-worn configuration
The digital camera has accessories (Neck strap) that contain no metal.
When these straps are used with EUT, it is a body-worn configuration since they were worn on a user's neck or shoulder.
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 phantom.

(2) Rear:
The test was performed in touch with rear surface of the digital camera to the flat phantom.

(3) Top:
The test was performed in touch with top surface of the digital camera to the flat phantom.

(4) Bottom:
The test was performed in touch with bottom surface of the digital camera to the flat phantom.

(5) Side :
The test was performed in touch with side surface of the digital camera to the flat phantom.

(6) Front (5mm) :
The measurement opened 5mm distance between the digital camera and flat phantom.

(7) Front with GPS unit:
The test was performed in touch with front surface of the digital camera with GPS unit to the flat phantom.

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

4.1 Operating modes for SAR testing

4.1.1 Setting of EUT

This EUT has IEEE.802.11b/g continuous transmitting modes.
The frequency band and the modulation used in the testing of IEEE.802.11b/g are shown as a following.

1. IEEE 802.11b mode

Tx frequency band	: 2412-2462MHz
Channel	: 1ch(2412MHz),6ch(2437MHz),11ch(2462MHz)
Modulation	: DSSS (DBPSK)
Crest factor	: 1 (Duty 100%)
Firmware	: BV3E_firmware Ver.1.0
Power setting	: 10dBm

2. IEEE 802.11g mode

Tx frequency band	: 2412-2462MHz
Channel	: 1ch(2412MHz),6ch(2437MHz),11ch(2462MHz)
Modulation	: OFDM (BPSK)
Crest factor	: 1 (Duty 100%)
Firmware	: BV3E_firmware Ver.1.0
Power setting	: 13dBm

SECTION 5 : Test surrounding

5.1 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 ± %	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	12
Device holder uncertainty	±3.6	Normal	1	1	±3.6	6
Power drift	±5.0	Rectangular	√3	1	±2.9	∞
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					**±13.453**	
Expanded Uncertainty (k=2)					**±26.9**	

SECTION 6 : Confirmation before testing

6.1 Correlation of Output Power between EMC and SAR tests

6.1.1 EMC power

This data is reference data of EMC test(Report No. 30GE0232-HO-02-A).
Date of test: July 22, 2010

[IEE802.11b 1Mbps]

Freq.	Reading	Cable Loss	Atten.	Result	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
2412	-7.79	1.01	19.96	13.18	20.80
2437	-7.70	1.01	19.96	13.27	21.23
2462	-7.87	1.02	19.96	13.11	20.46

[IEE802.11g 6Mbps]

Freq.	Reading	Cable Loss	Atten.	Result	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
2412	1.57	1.01	19.96	22.54	179.47
2437	1.65	1.01	19.96	22.62	182.81
2462	1.56	1.02	19.96	22.54	179.47

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

6.1.2 SAR power

[IEE802.11b 1Mbps]

Freq.	Reading	Cable Loss	Atten.	Result	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
2412	-7.79	1.01	19.96	13.18	20.80
2437	-7.70	1.01	19.96	13.27	21.23
2462	-7.87	1.02	19.96	13.11	20.46

[IEE802.11g 6Mbps]

Freq.	Reading	Cable Loss	Atten.	Result	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
2412	1.57	1.01	19.96	22.54	179.47
2437	1.65	1.01	19.96	22.62	182.81
2462	1.56	1.02	19.96	22.54	179.47

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

6.2 Average power for SAR testing

[IEEE802.11b] Rate Check

Rate	Freq.	P/M Reading [dBm]		Cable Loss	Atten.	Result [dBm]		Result [mW]	
[Mbps]	[MHz]	PK	AVG	[dB]	[dB]	PK	AVG	PK	AVG
1.0	2437	-7.70	-10.08	1.01	19.96	13.27	10.89	21.23	12.27
2.0	2437	-8.08	-10.16	1.01	19.96	12.89	10.81	19.45	12.05
5.5	2437	-8.04	-10.16	1.01	19.96	12.93	10.81	19.63	12.05
11.0	2437	-8.11	-10.19	1.01	19.96	12.86	10.78	19.32	11.97

IEEE802.11b Max.AVG power datarate

Ch	Frequency	P/M Reading [dBm]		Cable Loss	Atten.	Result [dBm]		Result [mW]	
	[MHz]	PK	AVG	[dB]	[dB]	PK	AVG	PK	AVG
1	2412	-7.79	-9.72	1.01	19.96	13.18	11.25	20.80	13.34
6	2437	-7.70	-10.08	1.01	19.96	13.27	10.89	21.23	12.27
11	2462	-7.87	-9.91	1.02	19.96	13.11	11.07	20.46	12.79

[IEEE802.11g] Rate Check

Rate	Freq.	P/M Reading [dBm]		Cable Loss	Atten.	Result [dBm]		Result [mW]	
[Mbps]	[MHz]	PK	AVG	[dB]	[dB]	PK	AVG	PK	AVG
6.0	2437	1.65	-8.00	1.01	19.96	22.62	12.97	182.81	19.82
9.0	2437	1.53	-8.26	1.01	19.96	22.50	12.71	177.83	18.66
12.0	2437	1.47	-8.41	1.01	19.96	22.44	12.56	175.39	18.03
18.0	2437	1.16	-8.57	1.01	19.96	22.13	12.40	163.31	17.38
24.0	2437	1.17	-8.58	1.01	19.96	22.14	12.39	163.68	17.34
36.0	2437	1.16	-8.51	1.01	19.96	22.13	12.46	163.31	17.62
48.0	2437	1.29	-8.41	1.01	19.96	22.26	12.56	168.27	18.03
54.0	2437	1.51	-8.55	1.01	19.96	22.48	12.42	177.01	17.46

IEEE802.11g Max.AVG power datarate

Ch	Frequency	P/M Reading [dBm]		Cable Loss	Atten.	Result [dBm]		Result [mW]	
	[MHz]	PK	AVG	[dB]	[dB]	PK	AVG	PK	AVG
1	2412	1.57	-7.95	1.01	19.96	22.54	13.02	179.47	20.04
6	2437	1.65	-8.00	1.01	19.96	22.62	12.97	182.81	19.82
11	2462	1.56	-8.13	1.02	19.96	22.54	12.85	179.47	19.28

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

SECTION 7 : Measurement results

7.1 BODY SAR 2450MHz

Model : **SG4G2-TB3**
Serial No. : **1**
Modulation : **DSSS**
Measured By : **Miyo Kishimoto**

Date : **August 2, 2010**
Liquid Depth (cm) : **15.0**
Parameters : **εr =50.6, σ =1.98**
Ambient temperature(deg.c.) : **24.0**
Relative Humidity (%) : **58**

BODY SAR RESULT									
Frequency		Modulation	Phantom Section	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Channel	[MHz]			Antenna	Position	Separation [mm]	Before	After	value of multi-peak
Step 1. Search for the worst position									
6	2437	DBPSK(1Mbps)	Flat	Fixed	Front	0	24.3	24.3	**0.115**
6	2437	DBPSK(1Mbps)	Flat	Fixed	Rear	0	24.3	24.3	**0.00231**
6	2437	DBPSK(1Mbps)	Flat	Fixed	Top	0	24.3	24.3	**0.00533**
6	2437	DBPSK(1Mbps)	Flat	Fixed	Bottom	0	24.3	24.3	**0.00355**
6	2437	DBPSK(1Mbps)	Flat	Fixed	Side	0	24.2	24.0	**0.0560**
Step 2. Change to the channels									
1	2412	DBPSK(1Mbps)	Flat	Fixed	Front	0	24.0	24.0	**0.117**
11	2462	DBPSK(1Mbps)	Flat	Fixed	Front	0	24.0	24.0	**0.125**
Step 3. 11g mode Change to the channels									
1	2412	BPSK(6Mbps)	Flat	Fixed	Front	0	24.0	24.0	**0.080**
6	2437	BPSK(6Mbps)	Flat	Fixed	Front	0	24.0	24.0	**0.077**
11	2462	BPSK(6Mbps)	Flat	Fixed	Front	0	24.0	24.0	**0.075**
Step 4. Separation change									
11	2462	DBPSK(1Mbps)	Flat	Fixed	Front	5	24.0	24.0	**0.049**

7.2 Check testing of GPS unit

The influence of SAR in the GPS unit did not change.

BODY SAR RESULT									
Frequency		Modulation	Phantom Section	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Channel	[MHz]			Antenna	Position	Separation [mm]	Before	After	value of multi-peak
6	2437	DBPSK(1Mbps)	Flat	Fixed	Front	0	24.0	24.0	**0.111**

7.3 Check testing of Battery (Peak SAR in Area scan)

The influence of SAR in the AAA size battery did not change. The EUT is sufficient SAR margin to ensure compliance.

BODY SAR RESULT									
Battery	Frequency		Modulation	Phantom Section	EUT Set-up Conditions		Liquid Temp.[deg.c]		Peak SAR in Area Scan [W/kg]
	Channel	[MHz]			Position	Separation [mm]	Before	After	
Normal	6	2437	DBPSK(1Mbps)	Flat	Front	0	24.3	24.3	**0.230**
AAA size	6	2437	DBPSK(1Mbps)	Flat	Front	0	24.0	24.0	**0.215**