



# SAR TEST REPORT

Test Report No.: 32JE0056-SH-04-A

Applicant : Sony Corporation  
Type of Equipment : Digital Media Player  
Model No. : NWZ-F804  
FCC ID : AK8NWZF800  
Test Standard : FCC 47CFR §2.1093,  
Supplement C (Edition 01-01) to OET Bulletin 65  
Test Result : Complied

Highest SAR(1g) Value : **0.85 W/kg** ((DTS) IEEE 802.11b, 1Mbps(DBPSK/OFDM), 2462MHz)

\*. Highest SAR(1g) across exposure conditions = 0.85 W/kg = grant listing.

1. This test report shall not be reproduced in 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 limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

Date of test: June 18, 2012

Test engineer: *H. Naka*  
Hiroshi Naka  
Engineer of WiSE Japan, UL Verification Service

Approved by: *T. Imamura*  
Toyokazu Imamura  
Leader of WiSE Japan, UL Verification Service

- The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.  
 There is no testing item of "Non-accreditation".



<b>CONTENTS</b>	<b>PAGE</b>
<b>SECTION 1: Customer information .....</b>	<b>3</b>
<b>SECTION 2: Equipment under test (EUT).....</b>	<b>3</b>
<b>SECTION 3: Test specification, procedures and results.....</b>	<b>4</b>
3.1 Test specification .....	4
3.2 Exposure limit.....	4
3.3 Procedure and result .....	4
3.4 Test location .....	4
3.5 Confirmation for SAR testing.....	5
3.6 Confirmation after SAR testing .....	5
3.7 Test setup of EUT and SAR measurement procedure.....	5
<b>SECTION 4: Operation of EUT during testing.....</b>	<b>6</b>
<b>SECTION 5: Uncertainty Assessment (SAR measurement) .....</b>	<b>6</b>
<b>SECTION 6: Confirmation before testing.....</b>	<b>7</b>
<b>SECTION 7: Measurement results .....</b>	<b>8</b>

**Contents of appendixes**

<b>APPENDIX 1: Photographs of test setup .....</b>	<b>9</b>
Appendix 1-1 Photograph of EUT and antenna position.....	9
Appendix 1-2 EUT and support equipment (for SAR test).....	9
Appendix 1-3 Photograph of test setup.....	10
<b>APPENDIX 2: SAR Measurement data .....</b>	<b>11</b>
Appendix 2-1 Evaluation procedure.....	11
Appendix 2-2 Measurement data.....	12
<b>APPENDIX 3: Test instruments .....</b>	<b>22</b>
Appendix 3-1 Equipment used .....	22
Appendix 3-2 Dosimetry assessment setup.....	23
Appendix 3-3 Configuration and peripherals.....	23
Appendix 3-4 System components .....	24
Appendix 3-5 Test system specification .....	25
Appendix 3-6 Simulated tissues composition.....	25
Appendix 3-7 Simulated tissues parameter confirmation .....	26
Appendix 3-8 System check data.....	26
Appendix 3-9 System check measurement data.....	27
Appendix 3-10 System check uncertainty.....	27
Appendix 3-11 Calibration certificate: Dipole (D2450V2) .....	28
Appendix 3-12 Calibration certificate: E-Field Probe (EX3DV4) .....	36
Appendix 3-13 References .....	47

**REVISION HISTORY**

Revision	Test report No.	Date	Page revised	Contents
Original	32JE0056-SH-04-A	June 29, 2012	-	-
Revised 01 (-r01)	32JE0056-SH-04-A	July 11, 2012	1, 2, 5, 8	(p1, 2) Added revised information. (p5) Corrected the antenna to user distance. (p8) Corrected the antenna to user distance, and the operation mode.

\*. By issue of new revision report, the report of an old revision becomes invalid.

**SECTION 1: Customer information**

Company Name	Sony Corporation
Brand Name	SONY
Address	Shinagawa INTERCITY C Tower 2-15-3, Konan Minato-ku, Tokyo, 108-6201 Japan
Telephone Number	+81-3-5769-5640
Facsimile Number	+81-3-5769-5901
Contact Person	Shinichi Maru

**SECTION 2: Equipment under test (EUT)****2.1 Identification of EUT** (\*.Main unit including antenna and RF module)

Type of Equipment	Digital Media Player
Model Number	NWZ-F804
Serial Number	2000196
Condition of EUT	Engineering prototype (*. Not for sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample	June 6, 2012 (*. No modification by the Lab.)
Country of Mass-production	Malaysia
Rating	DC3.7V *. The EUT operates with a built-in re-chargable Li-ion battery. Therefore, the EUT was operated with a full-charged battery when each SAR test was applied.
Category Identified	Portable device *. This EUT is hand-held and hand-operated device with output power < 645 mW (1000×[2.4GHz] <sup>-0.5</sup> ). Therefore, the hand-SAR is not required (KDB447498). *. This EUT may contact a human body during Wi-Fi, Bluetooth operation.
Feature of EUT	The EUT is a digital media player with Wi-Fi (IEEE 802.11b/g/n(20HT)) and Bluetooth data transfer specification.
Accessory of EUT	Any accessories of body-worn application were not supplied for the EUT. Therefore, the SAR test was applied with touch conditions (0mm for separation distance).

\*. The EUT has the following series model. The difference of each model is the memory size. Since memory size did not affect SAR, the SAR test was applied to NWZ-F804 (8GB) model representative.

Model:	NWZ-F804	NWZ-F805	NWZ-F806
Memory size:	8GB	16GB	32GB

**2.2 Product Description** (\*.Antenna and RF module)

	Wi-Fi	Bluetooth
Equipment type	Transceiver	
Frequency of operation channel	2412-2462 MHz	2402-2480
Channel spacing	5MHz	1MHz
Bandwidth	20MHz	79MHz
ITU code	G1D(11b), D1D(11g,11n(20HT))	F1D, G1D
Type of modulation	DSSS(11b), OFDM(11g,11n(20HT))	FHSS
Q'ty of Antenna	1 pc. *. <b>No simultaneous transmission for Wi-Fi mode and Bluetooth mode.</b> Therefore, the SAR test was applied to Wi-Fi mode operation alone. The SAR test was not applied to Bluetooth mode, because the operation power was enough small (less than 5 mW).	
Antenna type	Chip antenna	
Antenna gain (peak)	0.9 dBi	
Transmit power	Refer to section 6 in this report.	
Power supply	DC1.8V (*. with constantly voltage circuit operation.)	
Operation temperature range	+5 to +35 deg.C.	

\*. The EUT do not use the special transmitting technique such as "beam-forming" and "time-space code diversity."

## SECTION 3: Test specification, procedures and results

### 3.1 Requirements for compliance testing defined by the FCC / Test specification

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;

<input checked="" type="checkbox"/> KDB 447498 D01 (v04) (11/13/2009):	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
<input checked="" type="checkbox"/> KDB 248227 (rev.1.2) (5/29/2007):	SAR Measurement Procedures for 802.11a/b/g Transmitters
<input checked="" type="checkbox"/> KDB 450824 D01 (v01r01) (Jan.2007):	SAR Probe Calibration and System Verification Considerations for Measurements at 150MHz-3GHz
<input checked="" type="checkbox"/> KDB 450824 D02 (v01) (11/13/2009):	Dipole Requirements for SAR System Validation and Verification
<input checked="" type="checkbox"/> KDB 447498 DR01 (4/23/2012):	General RF Exposure Polices for Equipment Authorization

### 3.2 Exposure limit

Environments of exposure limit	Whole-Body (averaged over the entire body)	Partial-Body (averaged over any 1g of tissue)	Hands, Wrists, Feet and Ankles (averaged over any 10g of tissue)
(A) Limits for Occupational /Controlled Exposure (W/kg)	0.4	8.0	20.0
(B) Limits for General population /Uncontrolled Exposure (W/kg)	0.08	<b>1.6</b>	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.

#### The limit applied in this test report is;

**General population / uncontrolled exposure, Partial-Body (averaged over any 1g of tissue) limit: 1.6 W/kg**

### 3.3 Procedures and Results

RF Type	Wi-Fi (DTS)
Test Procedure	FCC OET Bulletin 65, Supplement C SAR
Category	FCC 47CFR §2.1093
Results (SAR(1g)) (Built-in)	<b>Complied (0.85W/kg)</b>

Note: UL Japan's SAR Work Procedures No.13-EM-W0429 and 13-EM-W0430. No addition, deviation nor exclusion has been made from standards

### 3.4 Test Location

No.7 shielded room (2.76(Width) × 3.76m(Depth) × 2.4m(Height)) for SAR testing.

#### UL Japan, Inc., Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN

Telephone number: +81 463 50 6400 / Facsimile number: +81 463 50 6401

### 3.5 Confirmation before SAR testing

#### 3.5.1 Correlation of Output Power between EMC and SAR tests

The EUT that was used for the SAR test was identical with the EUT that was used for the EMC test. Therefore, the reference power was measured at EMC test procedure before the SAR test.

The EUT power refers to the section 6 in this report, and more detail for EMC test report: 32JE0056-SH-03-A.

- \*. The original EUT did not have the terminal for antenna terminal conducted power measurement. The EUT power was measured and confirmed at the EMC test, by the radiated power and by using an original designed EUT.
- \*. After EMC test, the EUT was used at the SAR test and with same control software as EMC test.

#### Data rate

- \*. The power corresponding with the data rate was measured. The following table is reference of modulation.

11b		11g				11n(20HT)			
Modulation	Data rate	Modulation	Data rate	Modulation	Data rate	Modulation	MCS	Modulation	MCS
DBPSK/DSSS	1 Mbps	BPSK/OFDM	6 Mbps	16QAM/OFDM	24 Mbps	BPSK/OFDM	MCS0	16QAM/OFDM	MCS4
DQPSK/DSSS	2 Mbps	BPSK/OFDM	9 Mbps	16QAM/OFDM	36 Mbps	QPSK/OFDM	MCS1	64QAM/OFDM	MCS5
CCK/DSSS	5.5 Mbps	QPSK/OFDM	12 Mbps	64QAM/OFDM	48 Mbps	QPSK/OFDM	MCS2	64QAM/OFDM	MCS6
CCK/DSSS	11 Mbps	QPSK/OFDM	18 Mbps	64QAM/OFDM	54 Mbps	16QAM/OFDM	MCS3	64QAM/OFDM	MCS7

#### Decision of SAR test channel

- \*. The following operation mode, data rate and channels were determined by the EMC reference power measured.

Mode	MHz	Channel	default	SAR tested channel			Remarks
			11b/g/n(20HT)	11b	11g	11n(20HT)	
802.11 b/g/n	2412	1 (*1)	√	#	#	n/a (*2)	*2. Since the average power of 11n(20HT) were enough lower than the corresponded 11b and 11g power, the SAR test was not applied to 11n(20HT) mode. (KDB248227)
	2437	6	√	#	#	n/a (*2)	
	2462	11 (*1)	√	#	#	n/a (*2)	

√ = "default test channels of requested by KDB248227", n/a: SAR test was not applied, # = SAR test was applied.

- \*1. Any output power reducing for channel 1 and 11 to meet restricted band requirements was not observed.

### 3.6 Confirmation after SAR testing

It was checked that the power drift [W] is within ±5% in the evaluation procedure of SAR testing. The verification of power drift during the SAR test is that DASY4 system calculates the power drift by measuring the e-filed at the same location at beginning and the end of the scan measurement for each test position. The result is shown in APPENDIX 2.

- \*. DASY4 system calculation Power drift value[dB] = 20log(Ea)/(Eb) (where, Before SAR testing: Eb[V/m] / After SAR testing: Ea[V/m])

Limit of power drift[W] = ±5%

Power drift limit (X) [dB] = 10log(P\_drift)=10log(1.05/1)=10log(1.05)-10log(1)=0.212dB  
from E-filed relations with power.

$$S = E \times H = E^2 / \eta = P / (4 \times \pi \times r^2) \quad (\eta: \text{Space impedance}) \rightarrow P = (E^2 \times 4 \times \pi \times r^2) / \eta$$

Therefore, The correlation of power and the E-filed

$$\text{Power drift limit (X) dB} = 10 \log(P_{\text{drift}}) = 10 \log(E_{\text{drift}})^2 = 20 \log(E_{\text{drift}})$$

From the above mentioned, the calculated power drift of DASY4 system must be the less than ±0.212dB.

### 3.7 Test setup of EUT and SAR measurement procedure [r01]

After considering the outline of EUT, the SAR test was carried out on the following setup conditions.

- \*. Refer to Appendix 1 for test setup photographs.

Setup	Explanation of EUT setup position	Antenna to user distance	SAR test	SAR type
Front	The front surface of EUT was touched to the Flat phantom.	≈7mm	applied	Body-touch
Rear	The rear surface of EUT was touched to the Flat phantom. <b>This section is the closest to an antenna.</b>	≈2mm	applied	Body-touch, Hand-held
Top	The top surface of EUT was touched to the Flat phantom.	≈2~5mm (taper)	applied	Body-touch, Hand-held
Left	The left surface of EUT was touched to the Flat phantom.	≈14mm	applied	Body-touch, Hand-held
Right	The right surface of EUT was touched to the Flat phantom.	≈43mm	not applied (*1)	Body-touch, Hand-held
Bottom	The bottom surface of EUT was only touched to the Flat phantom.	≈107mm	not applied (*1)	Body-touch, Hand-held

- \*. Size of EUT: 57 (width) × 114 (depth) × 9 (thickness)[mm]

- \*1. "Appendix A, SAR Exclusion Thresholds", KDB 447498 General RF Exposure Guideline DR01.

MHz	5	10	15	20	25	30	35	40	45	50	mm
2450	10	19	29	38	48	57	67	77	86	96	SAR Test Exclusion Threshold (mW)

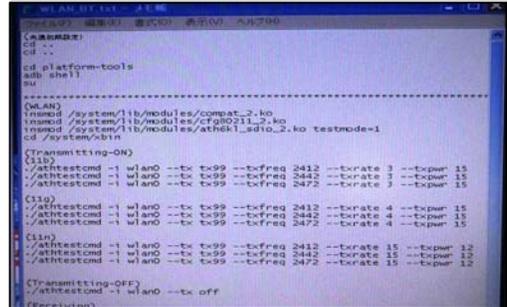
By the determined test setup shown above, the SAR test was applied in the following procedures.

Step 1	Worst position search.
Step 2	Change the channels.
Step 3	Change the operation mode. (and channels, when it is required.)
Step 4	Repeat worst SAR condition.

## SECTION 4: Operation of EUT during testing

This EUT has IEEE.802.11b, 11g and 11n(20HT) continuous transmitting modes. The frequency and the modulation used in the SAR testing are shown as a following.

Operation mode	11b	11g	11n(20HT)
Tx frequency band	2412-2462MHz		
Tested frequency	2412MHz, 2437MHz, 2462MHz	2412MHz, 2437MHz, 2462MHz	not applied (*1)
Modulation	DBPSK/DSSS(*2)	BPSK/OFDM(*2)	not applied (*1)
Data rate	1Mbps (*2)	6Mbps (*2)	not applied (*1)
Crest factor	1.0 (≈100% duty cycle)		not applied (*1)
Controlled software	* Before SAR test, the EUT was connected with the host PC via USB cable in order to set the transmission condition. During SRA test, the EUT was operated at standalone mode. * The sample photograph of setting parameters and setting window (adb shell) is in right.		



- Since the average power of 11n(20HT) was enough lower than the corresponded 11b and 11g power, the SAR test was not applied to 11n(20HT) mode.
- Since the average power of higher data rate was less than 0.25dB higher than the lowest data rate, the SAR test was only applied to the lowest data rate. (KDB248227)
- The specification of power setting on the software was as follows.

11b		11g		11n(20HT)	
Data Rate	Power Setting	Data Rate	Power Setting	Data Rate	Power Setting
1Mbps	15	6Mbps	15	MCS0	10
2Mbps	15	9Mbps	15	MCS1	11
5.5Mbps	15	12Mbps	15	MCS2	10
11Mbps	15	18Mbps	15	MCS3	12
		24Mbps	15	MCS4	11
		36Mbps	15	MCS5	11
		48Mbps	14	MCS6	10
		54Mbps	13	MCS7	10

## SECTION 5: Uncertainty Assessment (SAR measurement)

Uncertainty of SAR measurement system (v04)	Under 3 GHz (v04)	
	1g SAR	10g SAR
	combined measurement uncertainty of the measurement system (k=1)	± 12.3%
expanded uncertainty (k=2)	± 24.6%	± 24.0%

A	Error Description (Under 3GHz) (v04)	Uncertainty Value	Probability distribution	Divisor	ci		ui		Vi, veff
					(1g)	(10g)	(1g)	(10g)	
<b>Measurement System</b>									
1	Probe Calibration Error	±6.0 %	Normal	1	1	1	(std. uncertainty)	(std. uncertainty)	∞
2	Axial isotropy Error	±4.7 %	Rectangular	√3	0.7	0.7	±1.9 %	±1.9 %	∞
3	Hemispherical isotropy Error (<5deg, flat phantom)	±9.6 %	Rectangular	√3	0.7	0.7	±3.9 %	±3.9 %	∞
4	Boundary effects Error	±1.4 %	Rectangular	√3	1	1	±0.8 %	±0.8 %	∞
5	Linearity Error	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	∞
6	Sensitivity Error (detection limit)	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
7	Response Time Error (<5ms/100ms wait)	±0.0 %	Normal	1	1	1	±0.0 %	±0.0 %	∞
8	Integration Time Error (100% duty cycle)	±0.0 %	Rectangular	√3	1	1	±0.0 %	±0.0 %	∞
9	Readout Electronics Error(DAE)	±0.3 %	Rectangular	√3	1	1	±0.3 %	±0.3 %	∞
10	RF ambient conditions-noise (<0.01mW/g)	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
11	RF ambient conditions-reflections (<0.12mW/g)	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
12	Probe positioner mechanical tolerance	±1.1 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
13	Probe Positioning with respect to phantom shell	±2.9 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
14	Errors: Extrapol., Interpol. & Integration Algorithms	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
<b>B Test Sample Related</b>									
15	Test Sample Positioning Error	±5.0 %	Normal	1	1	1	±5.0 %	±5.0 %	145
16	Device Holder or Positioner Tolerance	±3.6 %	Normal	1	1	1	±3.6 %	±3.6 %	5
17	Test Sample Output Power Drift Error	±5.0 %	Rectangular	√3	1	1	±2.9 %	±2.9 %	∞
<b>C Phantom and Setup</b>									
18	Phantom uncertainty (shape, thickness tolerances)	±7.5 %	Rectangular	√3	1	1	±4.3 %	±4.3 %	∞
19	Target Liquid Conductivity Tolerance	±5.0 %	Rectangular	√3	0.64	0.43	±1.8 %	±1.2 %	∞
20	Measurement Liquid Conductivity Error	±2.9 %	Normal	1	0.64	0.43	±1.9 %	±1.2 %	3
21	Target Liquid Permittivity Tolerance	±5.0 %	Rectangular	√3	0.6	0.49	±1.7 %	±1.4 %	∞
22	Measurement Liquid Permittivity Error	±2.9 %	Normal	1	0.6	0.49	±1.7 %	±1.4 %	3
<b>Combined Standard Uncertainty</b>							±12.3 %	±12.0 %	479
<b>Expanded Uncertainty (k=2)</b>							±24.6 %	±24.0 %	

\* This measurement uncertainty budget is suggested by IEEE 1528 and determined by Schmid & Partner Engineering AG (DASY4 Uncertainty Budget). [6]

## SECTION 6: Confirmation before testing

### 6.1 Assessment for the conducted power of EUT

#### 6.1.1 Worst data rate & worst channel determination at EMC test (for SAR test reference)

##### 1) IEEE 802.11b (EUT serial number: 2000196)

Ch	Freq. [MHz]	P/M (Average) Reading [dBuV]		Ant Factor [dB]	Att+Cable Loss [dB]	Amp Gain [dB]	Result 1.*1 [dBuV]		Result 2.*2 [dBm]		Limit [dBm]		Margin [dB]			
		HOR	VER				HOR	VER	HOR	VER	HOR	VER				
		[dBm]	[mW]				[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]				
Low	2412.0	104.19	103.83	27.36	14.14	41.12	104.50	104.14	8.57	6.87	8.01	6.33	30.00	1000	21.63	21.99
Mid	2437.0	103.87	103.47	27.36	14.16	41.12	104.27	103.87	8.14	6.52	7.74	5.94	30.00	1000	21.86	22.26
High	2462.0	104.27	103.90	27.43	14.19	41.11	104.78	104.41	8.65	7.33	8.28	6.73	30.00	1000	21.35	21.72

Sample Calculation:  
 \*1: Result 1=Reading+Antenna Factor+Cable Loss+Atten.Loss-Amp Gain  
 \*2: Result 2=-P/(ED)<sup>2</sup>/30G, E=Result1, D=3m, G=1.626

Data rate [Mbps]	Freq. [MHz]	P/M (Average) Reading [dBuV]	Ant Factor [dB]	Att+Cable Loss [dB]	Amp Gain [dB]	Result 1.*1 [dBuV]	Result 2.*2 [dBm]	Limit [dBm]	Margin [dB]		
1	2437.0	103.87	27.36	14.16	41.12	104.27	8.14	6.52	30.00	1000	21.86
2	2437.0	103.83	27.36	14.16	41.12	104.25	8.12	6.49	30.00	1000	21.88
6	2437.0	103.84	27.36	14.16	41.12	104.24	8.11	6.47	30.00	1000	21.89
11	2437.0	103.82	27.36	14.16	41.12	104.22	8.09	6.44	30.00	1000	21.91

Sample Calculation:  
 \*1: Result 1=Reading+Antenna Factor+Cable Loss+Atten.Loss-Amp Gain  
 \*2: Result 2=-P/(ED)<sup>2</sup>/30G, E=Result1, D=3m, G=1.626  
 \*3: Signal levels were compared at polarizations of horizontal and vertical, and pre-check measurement was performed at the polarization in which the level was greater.

##### 2) IEEE 802.11g (EUT serial number: 2000196)

Ch	Freq. [MHz]	P/M (Average) Reading [dBuV]		Ant Factor [dB]	Att+Cable Loss [dB]	Amp Gain [dB]	Result 1.*1 [dBuV]		Result 2.*2 [dBm]		Limit [dBm]		Margin [dB]			
		HOR	VER				HOR	VER	HOR	VER	HOR	VER				
		[dBm]	[mW]				[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]				
Low	2412.0	103.68	103.34	27.29	14.14	41.12	103.99	103.55	7.86	6.11	7.42	5.52	30.00	1000	22.14	22.58
Mid	2437.0	103.29	102.79	27.36	14.16	41.12	103.69	103.19	7.56	5.70	7.06	5.08	30.00	1000	22.44	22.94
High	2462.0	105.03	104.64	27.43	14.19	41.11	105.56	105.15	9.43	8.77	9.02	7.98	30.00	1000	20.57	20.98

Sample Calculation:  
 \*1: Result 1=Reading+Antenna Factor+Cable Loss+Atten.Loss-Amp Gain  
 \*2: Result 2=-P/(ED)<sup>2</sup>/30G, E=Result1, D=3m, G=1.626

Data rate [Mbps]	Freq. [MHz]	P/M (Average) Reading [dBuV]	Ant Factor [dB]	Att+Cable Loss [dB]	Amp Gain [dB]	Result 1.*1 [dBuV]	Result 2.*2 [dBm]	Limit [dBm]	Margin [dB]		
6	2437.0	103.29	27.36	14.16	41.12	103.69	7.56	5.70	30.00	1000	22.44
9	2437.0	103.25	27.36	14.16	41.12	103.65	7.52	5.65	30.00	1000	22.48
12	2437.0	103.24	27.36	14.16	41.12	103.64	7.51	5.64	30.00	1000	22.49
18	2437.0	103.21	27.36	14.16	41.12	103.61	7.48	5.60	30.00	1000	22.52
24	2437.0	103.19	27.36	14.16	41.12	103.59	7.46	5.57	30.00	1000	22.54
36	2437.0	103.16	27.36	14.16	41.12	103.56	7.43	5.54	30.00	1000	22.57
48	2437.0	103.22	27.36	14.16	41.12	103.62	7.49	5.61	30.00	1000	22.51
54	2437.0	100.85	27.36	14.16	41.12	101.25	5.12	3.25	30.00	1000	24.88

Sample Calculation:  
 \*1: Result 1=Reading+Antenna Factor+Cable Loss+Atten.Loss-Amp Gain  
 \*2: Result 2=-P/(ED)<sup>2</sup>/30G, E=Result1, D=3m, G=1.626  
 \*3: Signal levels were compared at polarizations of horizontal and vertical, and pre-check measurement was performed at the polarization in which the level was greater.

##### 3) IEEE 802.11n(20HT) (EUT serial number: 2000196)

Ch	Freq. [MHz]	P/M (Average) Reading [dBuV]		Ant Factor [dB]	Att+Cable Loss [dB]	Amp Gain [dB]	Result 1.*1 [dBuV]		Result 2.*2 [dBm]		Limit [dBm]		Margin [dB]			
		HOR	VER				HOR	VER	HOR	VER	HOR	VER				
		[dBm]	[mW]				[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]				
Low	2412.0	101.12	100.80	27.29	14.14	41.12	101.43	101.11	5.30	3.39	4.98	3.15	30.00	1000	24.70	25.02
Mid	2437.0	100.56	100.06	27.36	14.16	41.12	100.96	100.46	4.83	3.04	4.33	2.71	30.00	1000	25.17	25.67
High	2462.0	101.61	101.29	27.43	14.19	41.11	102.12	101.80	5.99	3.97	5.67	3.69	30.00	1000	24.01	24.53

Sample Calculation:  
 \*1: Result 1=Reading+Antenna Factor+Cable Loss+Atten.Loss-Amp Gain  
 \*2: Result 2=-P/(ED)<sup>2</sup>/30G, E=Result1, D=3m, G=1.626

Data rate [MCS]	Freq. [MHz]	P/M (Average) Reading [dBuV]	Ant Factor [dB]	Att+Cable Loss [dB]	Amp Gain [dB]	Result 1.*1 [dBuV]	Result 2.*2 [dBm]	Limit [dBm]	Margin [dB]		
0	2437.0	99.15	27.36	14.16	41.12	99.55	3.42	2.20	30.00	1000	26.58
1	2437.0	100.11	27.36	14.16	41.12	100.51	4.38	2.74	30.00	1000	25.62
2	2437.0	99.10	27.36	14.16	41.12	99.50	3.37	2.17	30.00	1000	26.63
3	2437.0	100.56	27.36	14.16	41.12	100.96	4.83	3.04	30.00	1000	25.17
4	2437.0	99.55	27.36	14.16	41.12	99.95	3.82	2.41	30.00	1000	26.18
5	2437.0	99.39	27.36	14.16	41.12	99.79	3.66	2.32	30.00	1000	26.34
6	2437.0	98.59	27.36	14.16	41.12	98.99	3.86	1.93	30.00	1000	27.14
7	2437.0	98.28	27.36	14.16	41.12	98.68	2.55	1.80	30.00	1000	27.45

Sample Calculation:  
 \*1: Result 1=Reading+Antenna Factor+Cable Loss+Atten.Loss-Amp Gain  
 \*2: Result 2=-P/(ED)<sup>2</sup>/30G, E=Result1, D=3m, G=1.626  
 \*3: Signal levels were compared at polarizations of horizontal and vertical, and pre-check measurement was performed at the polarization in which the level was greater.

- \* The average power of 1ch, 6ch of 11b was higher than corresponded 11g mode. The average power of 1ch 11g was more than 0.25 dB higher than corresponded 11b mode. Therefore the SAR test was applied to both 11b and 11g mode for all channels. (KDB248227)
- \* Since the average power of 11n(20HT) was lower than the corresponded 11b and 11g power, the SAR test was not applied to 11n(20HT) mode. (KDB248227)
- \* The above table is a copy of EMC test result. (Refer to the EMC test report: 32JE0056-SH-03-A.)

## SECTION 7: Measurement results

### 7.1 SAR test results

Measurement date: June 18, 2012 Measurement by: Hiroshi Naka

#### [Liquid measurement (Body tissue)]

Used Target Frequency [MHz]	Target Body Tissue		Measured Body Tissue			Environment			Measured Date
	Permittivity [-]	Conductivity $\gamma$ [S/m]	Permittivity ( $\epsilon_r$ ) [-]	Conductivity ( $\sigma$ ) [S/m]	Temp. [deg.C.]	Depth [mm]	Temp. [deg.C.]	Humidity [%RH]	
2450	52.7	1.95	50.86 (-3.5%)	1.909 (-2.1%)	24.2	155	24.3	65	June 18, 2012, before SAR test.
2412	52.75	1.914	50.94 (-3.4%)	1.855 (-3.1%)					
2437	52.72	1.938	50.90 (-3.5%)	1.894 (-2.3%)					
2462	52.68	1.967	50.76 (-3.6%)	1.931 (-1.8%)					

\*. The target value is a parameter defined in OET65 Supplement C. In the current standards (e.g., IEEE 1528, OET 65 Supplement C), the dielectric parameters suggested for head and body tissue simulating liquid are given at 2450MHz. As an intermediate solution, dielectric parameters for the frequencies between 2000 to 2450 MHz and 2450 to 3000MHz were obtained using linear interpolation. (Refer to Appendix 3-7 in this report)

#### [SAR measurement results] -r01

SAR measurement results (Body tissue)												
Mode	Frequency		Modulation / Data rate / crest factor	EUT setup conditions			Liquid temp. [deg.C]		Power drift [dB]	SAR(1g) [W/kg] max. value of multi-peak	Data# in Appendix 2-2	Remarks
	Ch.	[MHz]		Position	Separation distance	Antenna to user distance	Before	After				
<b>Step 1: Worst position search</b>												
11b	11	2462	DBPSK&DSSS / 1Mbps / 1.0	Rear	0 mm (touch)	≈ 2 mm	23.9	23.8	-0.11	<b>0.854</b>	Step 1-1	→Worst SAR.
				Front			23.7	23.7	0.008	<b>0.239</b>	Step 1-2	-
				Top			23.7	23.6	-0.001	<b>0.365</b>	Step 1-3	-
				Left			23.6	23.6	0.043	<b>0.032</b>	Step 1-4	-
<b>Step 2: Change the channels</b>												
11b	1	2412	DBPSK&DSSS / 1Mbps / 1.0	Rear	0 mm (touch)	≈ 2 mm	24.0	23.9	0.062	<b>0.853</b>	Step 2-1	-
	6	2437					23.9	23.9	-0.023	<b>0.844</b>	Step 2-2	-
<b>Step 3: Change the operation mode and channels</b>												
11g	1	2412	BPSK&OFDM / 6Mbps / 1.0	Rear	0 mm (touch)	≈ 2 mm	23.7	23.7	0.0066	<b>0.773</b>	Step 3-1	-
	6	2437					23.7	23.7	-0.024	<b>0.787</b>	Step 3-2	-
	11	2462					23.7	23.7	0.070	<b>0.821</b>	Step 3-3	-
<b>Step 4: Repeat worst SAR condition</b>												
11b	11	2462	DBPSK&DSSS / 1Mbps / 1.0	Rear	0 mm (touch)	≈ 2 mm	23.7	23.6	-0.022	<b>0.820</b>	Step 4-1	-

#### Notes:

- \*1. Since the average power of 11n(20HT) was lower than the corresponded 11b and 11g power, the SAR test was not applied to 11n(20HT) mode. (KDB248227)
- \*. During test, the EUT was operated with full-charged battery and without all signal interface cables.
- \*. Calibration frequency of the SAR measurement probe: EX3DV4 (serial number: 3540) (and used conversion factors)

SAR test frequency [MHz]	Probe calibration frequency [MHz]	Validity [MHz]	Used conversion factor	Uncertainty
2412	2450	-38MHz, within ±50 of cal.frequency	7.64	±12.0%
2437	2450	-13MHz, within ±50 of cal.frequency	7.64	±12.0%
2462	2450	+12MHz, within ±50 of cal.frequency	7.64	±12.0%

\*. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.