



## SAR TEST REPORT

Test Report No. : 29CE0230-HO-03-A-R1

Applicant : Sony Corporation  
Type of Equipment : Digital Media Player  
Model No. : NWZ-X1050  
FCC ID : AK8NWZX1000  
Test regulation : FCC47CFR 2.1093  
FCC OET BULLETIN 65, SUPPLEMENT C  
Test Result : Complied  
Max. SAR Value : 0.839W/kg (Body, 2412MHz)

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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 NVLAP, NIST, or any agency of the Federal Government.

Date of test:

November 17 to 18, 2008

Tested by:

*H. Sato*

Hisayoshi Sato  
EMC Services

Approved by :

*T. Maeno*

Tetsuo Maeno  
Site Manager of EMC Services



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MF060b (09.01.08)

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## **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 : +81-3-5769-5915  
Contact Person : Kikuo Murata

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

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

Type of Equipment : Digital Media Player  
Model No. : NWZ-X1050  
Serial No. : 003  
Rating : DC 3.7V  
Battery : Model Name : LIS1414HNPA(SY6)  
Product Name : Lithium ion battery pack  
Rating : 3.7V/660mAh  
Manufacture : Sony Corporation  
Option Battery : N/A  
Accessories: Model Name : MDR-NC020  
Product Name : Stereo Headphones (This is bundled.)  
Size : W:52mm D:96.5mm H:9.8mm  
Receipt Date of Sample : October 29, 2008  
Country of Mass-production : Malaysia  
Condition of EUT : Engineering prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No Modification by the test lab

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## 2.2 Product Description

Model No: NWZ-X1050 (referred to as the EUT in this report) is the Digital Media Player.  
The EUT has Web browser using Wireless LAN.

### IEEE802.11b/g WLAN

Equipment Type	Transceiver
Frequency of Operation	2412-2462MHz
Type of Modulation	DSSS/OFDM
Bandwidth & Channel spacing	20MHz & 5MHz
Power Supply (inner)	DC 1.8V and DC 3.3V
Antenna Type	Chip Antenna
Antenna Gain	2.0dBi
Antenna Connector Type	-
Method of Frequency Generation	Synthesizer
Other Clock Frequencies	12MHz (USB IC), 11.2896MHz (Micom clock), 32.768kHz (Clock IC), 24.576MHz (AD/DA IC)
Operating temperature range	+5 to +35 deg. C

The EUT has series models (Model No: NWZ-X1051, NWZ-X1060 and NWZ-X1061).  
The difference between Model No: NWZ-X1050 / NWZ-X1051 and NWZ-X1060 / NWZ-X1061 is the Amount of Memory.

Model No	Amount of Memory
NWZ-X1050	16GB
NWZ-X1051	
NWZ-X1060	32GB
NWZ-X1061	

\* The difference between Model No: NWZ-X1050 and NWZ-X1051 is the user's usable range in the Amount of Memory.  
Similarly, Model No: NWZ-X1060 and NWZ-X1061 are different.

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### **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 Procedure and result

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 Max.SAR = 0.839 W/kg

Note: UL Japan, Inc. 's SAR Work Procedures QPM46 and QPM47

#### Result of Max. SAR value

Max. SAR Value: 0.839W/kg (Body, 2412MHz)

### 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**

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### 3.4 Test Location

\*Shielded room for SAR testings  
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### 3.5 Confirmation before SAR testing

#### Correlation of Output Power between EMC and SAR tests (WLAN IEEE802.11b/g)

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

- EMC and SAR tests are performed with the same test sample (S/N: 003) under the same condition.
- Peak power at EMC test  
EMC power was measured for EMC test on October 30, 2008.
- Peak power at SAR test  
SAR power was measured for SAR test on November 17, 2008.

### 3.6 Confirmation after SAR testing

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

DASY4 system calculation Power drift value[dB] =  $20\log(E_a)/(E_b)$   
Before SAR testing :  $E_b[V/m]$   
After SAR testing :  $E_a[V/m]$

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

from E-field relations with power.  
 $S = E \cdot H = E^2 / \eta = P / 4 \pi r^2$  ( $\eta$  : Space impedance)  
 $P = E^2 \cdot 4 \pi r^2 / \eta$   
Therefore, The correlation of power and the E-field  
 $X_{dB} = 10\log(P) = 10\log(E)^2 = 20\log(E)$

From the above mentioned,  
The calculated power drift of DASY4 System must be the less than  $\pm 0.212dB$ .

### 3.7 Measurement procedure

**IEEE 802.11b**(Radiated power is always monitored by Spectrum Analyzer.)

Step1. The searching for the worst modulation.

The 11b (DSSS) mode test was performed on the DBPSK[1Mbps] modulation and CCK[11Mbps] modulation, because it was the highest average power and the highest data rate.

Step2. The searching for the worst position

This test was performed at the worst modulation of Step 1

Step3. Change to the Low and High channels

This test was performed at the worst conditions of Step 2.

**IEEE 802.11g** (Radiated power is always monitored by Spectrum Analyzer.)

Step4. The data rate in the higher average power\* of each modulation was decided, then the worst modulation was searched in the SAR testing.

Step5. The searching for the worst position

This test was performed at the worst modulation of Step4.

Step6. The changing to the Low and High channels

This test was performed at the worst position of Step 5.

\*Refer to Section 6.1.2.

**Change distance between EUT and SAM Twin Phantom**(Radiated power is always monitored by Spectrum Analyzer.)

Step7. 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.

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### 3.8 Test setup of EUT

When users operate or carry 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) Rear :

The test was performed in touch with Rear surface of the EUT to the flat section of SAM Twin phantom.

(2) Top :

The test was performed in touch with Top surface of the EUT to the flat section of SAM Twin phantom.

(3) Left Side :

The test was performed in touch with Left Side surface of the EUT to the flat section of SAM Twin phantom.

(4) Right Side :

The test was performed in touch with Right Side surface of the EUT to the flat section of SAM Twin phantom.

(5) Front:

The test was performed in touch with Front surface of the EUT to the flat section of SAM Twin phantom.

(6) Rear (5mm) :

The measurement opened 5mm distance between the EUT and flat section of SAM Twin Phantom.

(7) Rear (10mm) :

The measurement opened 10mm distance between the EUT and flat section of SAM Twin Phantom.

(8 ) Rear (15mm) :

The measurement opened 15mm distance between the EUT and flat section of SAM Twin Phantom.

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## **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 is shown as a following.

1. IEEE 802.11b mode

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

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## **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 $\pm$ %	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	$\sqrt{3}$	$(1-cp)^{1/2}$	$\pm 1.9$	$\infty$
Spherical isotropy of the probe	$\pm 9.6$	Rectangular	$\sqrt{3}$	$(cp)^{1/2}$	$\pm 3.9$	$\infty$
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	$\pm 0.3$	Normal	1	1	$\pm 0.3$	$\infty$
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 Noise	$\pm 3.0$	Rectangular	$\sqrt{3}$	1	$\pm 1.7$	$\infty$
RF ambient Reflections	$\pm 3.0$	Rectangular	$\sqrt{3}$	1	$\pm 1.7$	$\infty$
Probe Positioner	$\pm 0.8$	Rectangular	$\sqrt{3}$	1	$\pm 0.5$	$\infty$
Probe positioning	$\pm 9.9$	Rectangular	$\sqrt{3}$	1	$\pm 5.7$	$\infty$
Max.SAR Eval.	$\pm 4.0$	Rectangular	$\sqrt{3}$	1	$\pm 2.3$	$\infty$
<b>Test Sample Related</b>						
Device positioning	$\pm 2.9$	Normal	1	1	$\pm 2.9$	20
Device holder uncertainty	$\pm 3.6$	Normal	1	1	$\pm 3.6$	7
Power drift	$\pm 5.0$	Rectangular	$\sqrt{3}$	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)	$\pm 10.0$	Rectangular	$\sqrt{3}$	0.6	$\pm 1.7$	$\infty$
Liquid permittivity (meas.)	$\pm 10.0$	Rectangular	1	0.6	$\pm 3.0$	$\infty$
<b>Combined Standard Uncertainty</b>					<b><math>\pm 14.360</math></b>	
<b>Expanded Uncertainty (k=2)</b>					<b><math>\pm 28.7</math></b>	

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## **SECTION 6 : Confirmation before testing**

### **6.1 Conducted power before**

#### **6.1.1 Correlation of EMC power and SAR power**

This data is reference data of EMC test. (Report No. 29CE0230-HO-01-D)

Date of test: October 30, 2008

##### **IEEE802.11b , 1Mbps**

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	7.82	0.50	10.04	18.36	68.55
Mid	2437.0	7.85	0.50	10.04	18.39	69.02
High	2462.0	7.73	0.50	10.04	18.27	67.14

##### **IEEE802.11g , 6Mbps**

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	12.48	0.50	10.04	23.02	200.45
Mid	2437.0	12.43	0.50	10.04	22.97	198.15
High	2462.0	12.27	0.50	10.04	22.81	190.99

Sample Calculation:

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

This data is confirmation before SAR test.

Date of test: November 17, 2008

##### **IEEE802.11b , 1Mbps**

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	7.90	0.50	10.04	18.44	69.82
Mid	2437.0	7.91	0.50	10.04	18.45	69.98
High	2462.0	7.81	0.50	10.04	18.35	68.39

##### **IEEE802.11g , 6Mbps**

Ch	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
					[dBm]	[mW]
Low	2412.0	12.52	0.50	10.04	23.06	202.30
Mid	2437.0	12.49	0.50	10.04	23.03	200.91
High	2462.0	12.37	0.50	10.04	22.91	195.43

Sample Calculation:

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

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### 6.1.2 Reference data of SAR test (Data rate determination)

November 17, 2008

[IEEE802.11b] Rate check (Average power)

Modulation	Data rate	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
						[dBm]	[mW]
DBPSK	1	2437.0	5.15	0.50	10.04	15.69	37.07
DQPSK	2	2437.0	5.06	0.50	10.04	15.60	36.31
CCK	5.5	2437.0	4.89	0.50	10.04	15.43	34.91
	11	2437.0	4.86	0.50	10.04	15.40	34.67

[IEEE802.11g] Rate check (Average power)

Modulation	Data rate	Freq. [MHz]	P/M Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result	
						[dBm]	[mW]
BPSK	6	2437.0	4.61	0.50	10.04	15.15	32.73
	9	2437.0	4.52	0.50	10.04	15.06	32.06
QPSK	12	2437.0	3.95	0.50	10.04	14.49	28.12
	18	2437.0	4.47	0.50	10.04	15.01	31.70
16QAM	24	2437.0	4.26	0.50	10.04	14.80	30.20
	36	2437.0	4.53	0.50	10.04	15.07	32.14
64QAM	48	2437.0	4.09	0.50	10.04	14.63	29.04
	54	2437.0	3.84	0.50	10.04	14.38	27.42

Sample Calculation:

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

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**SECTION 7 : Measurement results**

**7.1 Body SAR 2450MHz**

Liquid Depth (cm) : 15.0 Model : NWZ-X1050  
Parameters :  $\epsilon_r = 49.2, \sigma = 2.03$  Serial No. : 003  
Ambient temperature(deg.c.) : 24.5 Modulation : DSSS  
Relative Humidity (%) : 35 Crest factor : 1  
Date : November 17, 2008 Measured By : Hisayoshi Sato

BODY SAR MEASUREMENT RESULTS									
Frequency			Modulation	Phantom Section	EUT Set-up Conditions		Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Band	Channel	[MHz]			Position	Separation [mm]	Before	After	Maximum of multi-peak
<b>11b</b>	<b>Step 1 Search for the worst modulation</b>								
Mid	2437		DBPSK(1Mbps)	Flat	Rear	0	24.0	24.0	<b>0.542</b>
Mid	2437		CCK(11Mbps)	Flat	Rear	0	24.0	24.0	<b>0.520</b>
	<b>Step 2 Search for the worst position</b>								
Mid	2437		DBPSK(1Mbps)	Flat	Top	0	24.2	24.2	<b>0.119</b>
Mid	2437		DBPSK(1Mbps)	Flat	Left side	0	24.2	24.2	<b>0.017</b>
Mid	2437		DBPSK(1Mbps)	Flat	Right side	0	24.1	24.1	<b>0.00458</b>
Mid	2437		DBPSK(1Mbps)	Flat	Front	0	24.1	24.1	<b>0.0290</b>
	<b>Step 3 Change to the Low and High channels</b>								
Low	2412		DBPSK(1Mbps)	Flat	Rear	0	24.0	24.0	<b>0.839</b>
High	2462		DBPSK(1Mbps)	Flat	Rear	0	23.9	23.9	<b>0.323</b>
FCC47CFR 2.1093							Body SAR: 1.6 W/kg		
Spatial Peak Uncontrolled Exposure / General Population							(averaged over 1 gram)		

Liquid Depth (cm) : 15.0 Model : NWZ-X1050  
Parameters :  $\epsilon_r = 49.0, \sigma = 2.04$  Serial No. : 003  
Ambient temperature(deg.c.) : 24.7 Modulation : OFDM, DSSS  
Relative Humidity (%) : 32 Crest factor : 1  
Date : November 18, 2008 Measured By : Hisayoshi Sato

BODY SAR MEASUREMENT RESULTS									
Frequency			Modulation	Phantom Section	EUT Set-up Conditions		Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Band	Channel	[MHz]			Position	Separation [mm]	Before	After	Maximum value of multi-peak
<b>11g Step 4 Search for the worst modulation</b>									
	Mid	2437	BPSK(6Mbps)	Flat	Rear	0	24.0	24.0	<b>0.559</b>
	Mid	2437	QPSK(18Mbps)	Flat	Rear	0	24.0	24.0	<b>0.426</b>
	Mid	2437	16QAM(24Mbps)	Flat	Rear	0	24.1	24.1	<b>0.505</b>
	Mid	2437	64QAM(48Mbps)	Flat	Rear	0	24.1	24.1	<b>0.357</b>
<b>Step 5 Search for the worst position</b>									
	Mid	2437	BPSK(6Mbps)	Flat	Top	0	24.2	24.2	<b>0.093</b>
	Mid	2437	BPSK(6Mbps)	Flat	Left side	0	24.2	24.2	<b>0.011</b>
	Mid	2437	BPSK(6Mbps)	Flat	Right side	0	24.1	24.1	<b>0.0037</b>
	Mid	2437	BPSK(6Mbps)	Flat	Front	0	24.1	24.1	<b>0.021</b>
<b>Step 6 Change to the Low and High channels</b>									
	Low	2412	BPSK(6Mbps)	Flat	Rear	0	24.1	24.1	<b>0.660</b>
	High	2462	BPSK(6Mbps)	Flat	Rear	0	24.1	24.1	<b>0.394</b>
<b>11b Step 7. Change separation</b>									
	Low	2412	DBPSK(1Mbps)	Flat	Rear	5	23.9	23.9	<b>0.181</b>
	Low	2412	DBPSK(1Mbps)	Flat	Rear	10	24.0	24.0	<b>0.052</b>
	Low	2412	DBPSK(1Mbps)	Flat	Rear	15	24.0	24.0	<b>0.030</b>
<b>FCC47CFR 2.1093</b>								<b>Body SAR: 1.6 W/kg</b>	
<b>Spatial Peak Uncontrolled Exposure / General Population</b>								<b>(averaged over 1 gram)</b>	