SAR TEST REPORT

Test Report No.: 32JE0163-SH-04-A-R01

Applicant	:	**Sony Corporation**
Type of Equipment	:	**Digital Book Reader**
Model No.	:	**PRS-T2**
FCC ID	:	**AK8PRST2**
Test Standard	:	**FCC 47CFR §2.1093, Supplement C (Edition 01-01) to OET Bulletin 65**
Test Result	:	**Complied**
Highest SAR(1g) Value	:	**0.67 W/kg** ((DTS) IEEE 802.11b, 1Mbps(DBPSK/OFDM), 2462MHz)

*. **Highest SAR(1g) across exposure conditions = 0.67 W/kg = grant listing.**

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Date of test: May 31, 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

JAB Testing RTL02610

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REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	32JE0163-SH-04-A	June 5, 2012	-	-
R01	32JE0163-SH-04-A-R01	June 21, 2012	-	(p1,2,3) Since EUT was not LMA, it was deleted SAR level category in the report. (p19) Corrected remarks of equipment list.

***. 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 (platform) including antenna and RF module)

Type of Equipment	Digital Book Reader
Model Number	PRS-T2
Serial Number	9000320
Condition of EUT	Engineering prototype (*. Not for sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample	May 21, 2012 (*. No modification by the Lab.)
Country of Mass-production	China
Rating	DC4.2V *. The EUT operates with a built-in re-chargeable Li-ion battery. Therefore, the EUT was operated with a full-charged battery when each SAR test was applied.
Feature of EUT	The EUT is a digital book reader with Wi-Fi (IEEE 802.11b/g/n(20HT)) 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).

2.2 Product Description (RF module, antenna)

Equipment type	Transceiver
Frequency of operation	2412-2462MHz
Channel spacing	5MHz
Bandwidth	20MHz
ITU code	G1D(11b), D1D(11g,11n(20HT))
Type of modulation	DSSS(11b), OFDM(11g,11n(20HT))
Q'ty of Antenna	1 pc.
Antenna type	Patterned antenna
Antenna connector type	RF PCB side: U.FL, Antenna side: soldered
Antenna gain (peak)	+2.11dBi
Transmit power (Target power)	11b: 13dBm *. Refers to the EMC test report: 32JE0163-SH-02-A.
Power supply (internal)	DC 3.3V, DC1.8V
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;

☒ **KDB 447498 D01 (v04) (11/13/2009):**	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
☒ **KDB 248227 (rev.1.2) (5/29/2007):**	SAR Measurement Procedures for 802.11a/b/g Transmitters
☒ **KDB 450824 D01 (v01r01) (Jan.2007):**	SAR Probe Calibration and System Verification Considerations for Measurements at 150MHz-3GHz
☒ **KDB 450824 D02 (v01) (11/13/2009):**	Dipole Requirements for SAR System Validation and Verification

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	**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.

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	WiFi (DTS)
Test Procedure	FCC OET Bulletin 65, Supplement C
	SAR
Category	FCC 47CFR §2.1093
Results (SAR(1g)) (Built-in)	Complied (0.67W/kg)

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 before the SAR test.
The EUT power refers to the EMC test report: 32JE0163-SH-02-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 using a modified EUT that had an antenna terminal port 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)	n/a (*2)	*2. Since the average power of 11g and 11n(20HT) were enough lower than the corresponded 11b power, the SAR test was only applied to 11b mode at lowest data rate. (KDB248227)
	2437	6	√	#	n/a (*2)	n/a (*2)	
	2462	11 (*1)	√	#	n/a (*2)	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)=0.21dB
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
Power drift limit (X) dB=10log(P_drift)=10log(E_drift)^2=20log(E_drift)
From the above mentioned, the calculated power drift of DASY4 system must be the less than ±0.21dB.

3.7 Test setup of EUT and SAR measurement procedure

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

Setup	Explanation of EUT setup position	Antenna to user distance	SAR test	SAR type
Top	The top surface of EUT was touched to the Flat phantom.	≈2mm	**applied**	Body(touch), hand-held
Rear-top	The rear-top portion of EUT was touched to the Flat phantom. This section is the closest to an antenna.	≈2mm	**applied**	
Rear	The rear surface of EUT was touched to the Flat phantom.	≈4mm	**applied**	
Front (LCD)	The front surface of EUT was touched to the Flat phantom.	≈5mm	**applied**	
Left	The left surface of EUT was touched to the Flat phantom.	≈25mm	**applied**	
Bottom	The bottom surface of EUT was touched to the Flat phantom.	≈160mm	not applied *. Since it had sufficient separation distance, the test was excepted.	
Right	The right surface of EUT was touched to the Flat phantom.	≈74mm		

***. Size of EUT: 110 mm (width) × 170 mm (depth) × 9 mm (thickness)**

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

Step 1	Change the positions.
Step 2	Change the channels.

*. During SAR test, the radiated power is always monitored by Spectrum Analyzer.

SECTION 4: Operation of EUT during testing

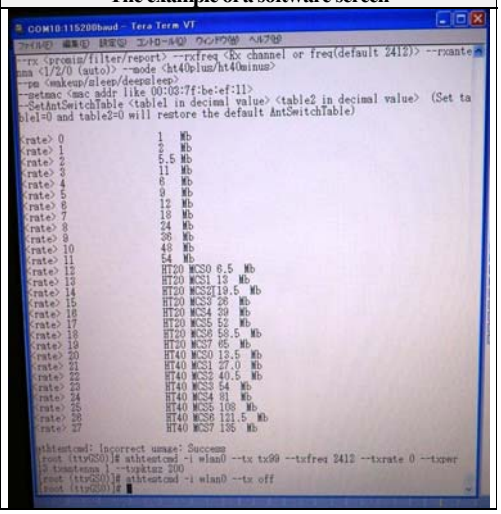
4.1 Operating modes for SAR testing

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	not applied (*1)	not applied (*1)
Modulation	DBPSK/DSSS	not applied (*1)	not applied (*1)
Data rate	1Mbps (*2)	not applied (*1)	not applied (*1)
Crest factor	1.0 (≈100% duty cycle)	not applied (*1)	not applied (*1)
Controlled software	Wi-Fi Test mode; Before the SAR test, the EUT was connected with a host PC via USB cable and set the specified transmission mode. During the SAR test, the USB cable was disconnected and the EUT was operated at battery mode. All transmission parameters were pre-set by the customer.		

*1. Since the average power of 11g and 11n(20HT) were enough lower than the corresponded 11b power, the SAR test was only applied to 11b. (KDB248227)
*2. 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 example of a software screen



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%	± 12.0%
expanded uncertainty (k=2)	± 24.6%	± 24.0%

	Error Description (Under 3GHz) (v04)	Uncertainty Value	Probability distribution	Divisor	ci (1g)	ci (10g)	ui (1g) (std. uncertainty)	ui (10g) (std. uncertainty)	Vi, veff
A	**Measurement System**								
1	Probe Calibration Error	±6.0 %	Normal	1	1	1	±6.0 %	±6.0 %	∞
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	**Test Sample Related**								
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 %	∞
C	**Phantom and Setup**								
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
	Combined Standard Uncertainty						**±12.3 %**	**±12.0 %**	479
	Expanded Uncertainty (k=2)						**±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: Measurement results

6.1 SAR test result (Consideration of contact with human body)

Measurement date: May 31, 2012 Measurement by: Hiroshi Naka

[Liquid measurement (Body tissue)]

Used Target Frequency [MHz]	Target Body Tissue		Measured Body Tissue				Environment		Measured Date
	Permittivity [-]	Conductivity [S/m]	Permittivity (εr) [-]	Conductivity (σ) [S/m]	Temp. [deg.C.]	Depth [mm]	Temp. [deg.C.]	Humidity [%RH]	
2450	**52.7**	**1.95**	50.73 (-3.7%)	1.961 (+0.6%)	23.3	155	24.8	36	May 31, 2012, before SAR test.
2412	***52.75***	***1.914***	50.92 (-3.5%)	1.925 (+0.6%)					
2437	***52.72***	***1.938***	50.81 (-3.6%)	1.959 (+1.1%)					
2462	***52.68***	***1.967***	50.66 (-3.8%)	1.992 (+1.3%)					

*. 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]

SAR measurement results (Body tissue)											
Frequency			Modulation / Data rate [Mbps] / crest factor	EUT setup conditions		Liquid temp. [deg.C]		Power drift [dB]	SAR(1g) [W/kg]	Remarks
Mode	Ch.	[MHz]		Position	Separation distance	Before	After		max. value of multi-peak	
11b	**Step 1: Change the positions**									
	6	2437	DBPSK&DSSS / 1Mbps / 1.0	Rear	0 mm (touch)	23.4	23.4	-0.009	0.398	-
	6	2437	DBPSK&DSSS / 1Mbps / 1.0	Rear-top	0 mm (touch)	23.3	23.3	-0.023	0.594	->Worst position.
	6	2437	DBPSK&DSSS / 1Mbps / 1.0	Front (LCD)	0 mm (touch)	23.3	23.3	-0.115	0.256	-
	6	2437	DBPSK&DSSS / 1Mbps / 1.0	Left	0 mm (touch)	23.3	23.3	-0.189	0.035	-
	6	2437	DBPSK&DSSS / 1Mbps / 1.0	Top	0 mm (touch)	23.3	23.3	-0.055	0.234	-
	Step 2: Change the positions									
	1	2412	DBPSK&DSSS / 1Mbps / 1.0	Rear-top	0 mm (touch)	23.3	23.3	0.127	0.505	-
	11	2462	DBPSK&DSSS / 1Mbps / 1.0	Rear-top	0 mm (touch)	23.3	23.3	0.116	0.659	->Worst SAR condition.
	11	2462	DBPSK&DSSS / 1Mbps / 1.0	Rear-top	0 mm (touch)	23.3	23.3	0.171	**0.671**	*. Repeated for the worst. →Worst SAR.

Notes:

*. Since the average power of 11g and 11n(20HT) were enough lower than the corresponded 11b power, the SAR test was only applied to 11b mode at lowest data rate. (KDB248227)

*. During test, the EUT was operated with full-charged battery and without all signal interface cables.

*. Calibration frequency of the SAR measurement probe (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.