



SAR TEST REPORT

Test Report No. : 30IE0007-YK-01-D

Applicant : Sony EMCS Corporation Kisarazu TEC
Type of Equipment : Network Remote Controller
Model No. : RMN-U1
FCC ID : AK8RMNU1
Test Standard : FCC 47CFR §2.1093,
Supplement C (Edition 01-01) to OET Bulletin 65
Test Result : Complied
Maximum SAR(1g) Value : 1.09 W/kg (Body, 2462MHz (11b, 2Mbps))

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 standards.
4. The test results in this test report are traceable to the national or international standards.

Date of test: April 19, 20 and 21, 2010

Tested by: H. Naka

Hiroshi Naka
Engineer of EMC Service

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SECTION 1: Customer information

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Brand Name	Sony
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Sony EMCS Corporation Kisarazu TEC is on behalf of the applicant: Sony corporation.

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

2.1 Identification of E.U.T.

Type of Equipment	Network Remote Controller
Model Number	RMN-U1
Serial Number	6
Condition of EUT	Engineering prototype (Not for sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample	April 8, 2010
Country of Mass-production	China
Category Identified	Portable device
Accessories	Stand (for charging), AC adaptor

[Battery used for SAR test]

Type	Li-ion Rechargeable Battery
Model name	LIS1430HNPA(SY6)
Rating	DC3.7V/1150mAh
Manufacturer	SONY

*. The test lab did not make the modification to the EUT supplied from the customer to have it pass the tests.

2.2 Product Description

Equipment type	Transceiver
Frequency of operation	2412-2462MHz
Channel spacing	5MHz
ITU code	D1D, G1D
Type of modulation	DSSS, OFDM
Clock Frequency	Real Time Clock: 32.768kHz, Audio Clock: 11.2896MHz, IR μ COM: 8MHz, Wireless Module: 38.4MHz, CODEC: 11.2896MHz, Charge PUMP: 1MHz, Main CPU: 500MHz, DD converter: 2.25MHz & 400kHz & 700kHz & 1MHz & 2MHz
Method of frequency generation	Synthesizer
Antenna model	-
Antenna type	Chip antenna
Antenna connector type	Integral
Antenna gain	+2.51 dBi
Transmit power	Refer to section 6.1.1 in this report.
Mode of operation	Simplex
Power supply	DC1.8V & DC3.3V
Operation temperature range	0~+40 deg.C.

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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 Guidelines 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)(Nov.13, 2009):** Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB 248227 (rev.1.2)(May 29, 2007): SAR Measurement Procedures for 802.11a/b/g Transmitters

3.2 Exposure limit

(A) Limits for Occupational/Controlled Exposure (W/kg)

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)
0.4	8.0	20.0

(B) Limits for General population/Uncontrolled Exposure (W/kg)

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)
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

Item	Test Procedure	Limit	Exclusion	Remarks	Result
Human exposure	FCC OET Bulletin 65, Supplement C	1.6 W/kg (FCC 47CFR §2.1093)	None	SAR measurement	Complied Maximum SAR: 1.09 W/kg (*1)

Note: UL Japan's SAR Work Procedures No. QPM46 and QPM47.

Other than above, no addition, deviation nor exclusion has been made from standards.

*1. Results of maximum SAR value: **1.09W/kg (1g average) (Body, IEEE 802.11b, 2Mbps(DQPSK/DSSS), 2462MHz)**

3.4 Test Location

No.3 shielded room (4.0m(Width) × 5.0m(Depth) × 2.7m(Height)) for SAR testing.

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3.5 Confirmation before SAR testing

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 6.1.2.

Peak power at EMC test	The power was measured on the EMC test sample (S/N: 6).
Peak power at SAR test	The power was measured before SAR on the same EMC test sample (S/N: 6). The power corresponding with the data rate was measured in the middle frequency. (*1)

*1. Reference of modulation table

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

3.6 Confirmation after SAR testing

It was checked that the power drift [W] is within $\pm 5\%$ 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] = $20\log(E_a)/(E_b)$ (where, Before SAR testing: $E_b[V/m]$ / After SAR testing: $E_a[V/m]$)

Limit of power drift[W] = $\pm 5\%$

Power drift limit (X) [dB] = $10\log(P_drift) = 10\log(1.05/1) = 10\log(1.05) - 10\log(1) = 0.212\text{dB}$

from E-filed relations with power.

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

Therefore, The correlation of power and the E-filed

Power drift limit (X) dB = $10\log(P_drift) = 10\log(E_drift)^2 = 20\log(E_drift)$

From the above mentioned, the calculated power drift of DASY4 system must be the less than $\pm 0.212\text{dB}$.

3.7 Measurement procedure

Operation mode: **IEEE 802.11b**

*. SAR test was not applied for 802.11g, because the maximum average output power of 802.11g was less than 0.25dB higher than that measured on the corresponding 802.11b channel. (KDB 248227 (rev.1.2))

Radiated power is always monitored by Spectrum Analyzer.

The 11b (DSSS) mode test was performed on the lowest data rate (1Mbps, DBPSK) and higher data rate that was the highest average power for the antenna port conducted power measurement.

Step 1	The searching for the worst position. (at lowest data rate)
Step 2	Change to the Low and High channels. (when the highest SAR value is more than 0.8W/kg.)
Step 3	Change to the highest average power channel at worst position.
Step 4	Set with the cradle and operate with the transmitting&charging mode in highest average power channel at worst position.
Step 5	Change separation. (Change distance between EUT and Flat Phantom) The measurement was performed with the distance of 5mm to check if the shortest distance may not have the worst value at the conditions of the highest SAR value.

3.8 Test setup of EUT

Front (touch)	The front surface (LCD side) of the EUT was touched to the flat section of Flat phantom.
Rear (touch)	The rear surface of the EUT was touched to the flat section of Flat phantom.
Left (touch)	The left side surface (jog stick side) of the EUT was touched to the flat section of Flat phantom.
Right (touch)	The right side surface of the EUT was touched to the flat section of Flat phantom.
Bottom (touch)	The bottom surface of the EUT was touched to the flat section of Flat phantom.
Top (touch)	The top surface of the EUT was touched to the flat section of Flat phantom.
Top (5mm)	The 5mm distance between the top surface of the EUT and the flat section of Flat phantom was set.

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

4.1 Operating modes for SAR testing

This EUT has IEEE.802.11b continuous transmitting modes.

The frequency band and the modulation used in the testing of IEEE.802.11b is shown as a following.

Operation mode : IEEE 802.11b mode
Tx frequency band : 2412-2462MHz
Channel : 1ch(2412MHz), 6ch(2437MHz), 11ch(2462MHz)
Modulation : without cradle → DBPSK/DSSS (1Mbps (lowest data rate)), DQPSK/DSSS (2Mbps)
with cradle & charging → CCK/DSSS (11Mbps)
Crest factor : 1.0 (*. During the power measurement and the SAR test, the EUT transmitted with 100% duty cycle.)

*. SAR test was not applied for 802.11g, because the maximum average output power of 802.11g was less than 0.25dB higher than that measured on the corresponding 802.11b channel. (KDB 248227 (rev.1.2))

Software & Setting

Software: Tera Tern Ver. 4.64

Setting: Power: 15dBm

Channel:

1	2412MHz	Low	6	2437MHz	Middle	11	2462MHz	High
2	2417MHz	-	7	2442MHz	-			
3	2422MHz	-	8	2447MHz	-			
4	2427MHz	-	9	2452MHz	-			
5	2432MHz	-	10	2457MHz	-			

*This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.

SECTION 5: Uncertainty Assessment (SAR measurement)

Uncertainty of SAR measurement system	Under 3GHz	
	1g SAR	10g SAR
combined measurement uncertainty of the measurement system (k=1)	± 11.7%	± 11.4%
expanded uncertainty (k=2)	± 23.3%	± 22.8%

[Under 3GHz]

	Error Description	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	±5.9 %	Normal	1	1	1	±5.9 %	±5.9 %	∞
2	Axial isotropy	±4.7 %	Rectangular	√3	0.7	0.7	±1.9 %	±1.9 %	∞
3	Hemispherical isotropy (*flat phantom, <5°)	±2.6 %	Rectangular	√3	0.7	0.7	±1.1 %	±1.1 %	∞
4	Boundary effects	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
5	Probe linearity	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	∞
6	System detection limit	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
7	System readout electronics	±0.3 %	Normal	1	1	1	±0.3 %	±0.3 %	∞
8	Response time	±0.8 %	Rectangular	√3	1	1	±0.5 %	±0.5 %	∞
9	Integration time	±2.6 %	Rectangular	√3	1	1	±1.5 %	±1.5 %	∞
10	RF ambient – noise	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
11	RF ambient – reflections	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
12	Probe positioner mechanical tolerance	±0.4 %	Rectangular	√3	1	1	±0.2 %	±0.2 %	∞
13	Probe positioning with respect to phantom shell	±2.9 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
14	Max.SAR evaluation	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
B	Test Sample Related								
15	Device positioning	±5.0 %	Normal	1	1	1	±5.0 %	±5.0 %	5
16	Device holder uncertainty	±5.0 %	Normal	1	1	1	±5.0 %	±5.0 %	5
17	Power drift	±5.0 %	Rectangular	√3	1	1	±2.9 %	±2.9 %	∞
C	Phantom and Setup								
18	Phantom uncertainty	±4.0 %	Rectangular	√3	1	1	±2.3 %	±2.3 %	∞
19	Liquid conductivity (target)	±5.0 %	Rectangular	√3	0.64	0.43	±1.8 %	±1.2 %	∞
20	Liquid conductivity (meas.)	±2.9 %	Normal	1	0.64	0.43	±1.9 %	±1.2 %	3
21	Liquid permittivity (target)	±5.0 %	Rectangular	√3	0.6	0.49	±1.7 %	±1.4 %	∞
22	Liquid permittivity (meas.)	±2.9 %	Normal	1	0.6	0.49	±1.7 %	±1.4 %	3
	Combined Standard Uncertainty						±11.7 %	±11.4 %	59
	Expanded Uncertainty (k=2)						±23.3 %	±22.8 %	

*. This measurement uncertainty budget is suggested by IEEE 1528 and determined by Schmid & Partner Engineering AG (DASY4 Uncertainty Budget). [5]

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SECTION 6: Confirmation before/after testing

6.1 Assessment for the conducted power of EUT

6.1.1 Reference data of SAR test (data rate determination)

Mode	Data rate [Mbps]	Ch.	Freq. [MHz]	P/M Reading (Ave) [dBm]	Cable loss [dB]	Attenuator loss [dB]	Results (Ave) [dBm]	Worst	Remarks
IEEE 802.11b	1	Mid.	2437.0	3.84	1.00	10.03	14.87	-	Without cradle..
	2	Mid.	2437.0	4.31	1.00	10.03	15.34	Worst 11b	
	5.5	Mid.	2437.0	4.28	1.00	10.03	15.31	-	
	11	Mid.	2437.0	3.74	1.00	10.03	14.77	-	
	1	Mid.	2437.0	3.84	1.00	10.03	14.87	-	With cradle & charging..
	2	Mid.	2437.0	3.75	1.00	10.03	14.78	-	
	5.5	Mid.	2437.0	3.76	1.00	10.03	14.79	-	
	11	Mid.	2437.0	4.21	1.00	10.03	15.24	-	
IEEE 802.11g	6	Mid.	2437.0	3.80	1.00	10.03	14.83	-	Without cradle.
	9	Mid.	2437.0	3.82	1.00	10.03	14.85	-	
	12	Mid.	2437.0	3.32	1.00	10.03	14.35	-	
	18	Mid.	2437.0	3.90	1.00	10.03	14.93	Worst 11g	
	24	Mid.	2437.0	3.26	1.00	10.03	14.29	-	
	36	Mid.	2437.0	3.22	1.00	10.03	14.25	-	
	48	Mid.	2437.0	3.78	1.00	10.03	14.81	-	
	54	Mid.	2437.0	3.77	1.00	10.03	14.80	-	With cradle & charging..
	6	Mid.	2437.0	3.40	1.00	10.03	14.43	-	
	9	Mid.	2437.0	3.83	1.00	10.03	14.86	-	
	12	Mid.	2437.0	3.86	1.00	10.03	14.89	-	
	18	Mid.	2437.0	3.89	1.00	10.03	14.92	-	
	24	Mid.	2437.0	3.79	1.00	10.03	14.82	-	
	36	Mid.	2437.0	3.80	1.00	10.03	14.83	-	
48	Mid.	2437.0	3.39	1.00	10.03	14.42	-		
54	Mid.	2437.0	3.38	1.00	10.03	14.41	-		

*. Measured date: April 19, 2010 / Measured by: Hiroshi Naka / Measured place: No. 3 shielded room. (22.0 deg.C. / 44%)

*. Calculating formula: Results = (P/M Reading) + (Cable loss) + (Attenuator loss)

*. SAR test was not applied for 802.11g, because the maximum average output power of 802.11g was less than 0.25dB higher than that measured on the corresponding 802.11b channel. (KDB 248227 (rev.1.2))

6.1.2 Correction of the power at EMC test and at SAR test

Test	Mode	Data rate [Mbps]	Ch.	Freq. [MHz]	P/M Reading (Peak) [dBm]	P/M Reading (Ave.) [dBm]	Cable loss [dB]	Attenuator loss [dB]	Results (Peak) [dBm]	Δ pk(SAR-EMC) (0≤ Δ ≤0.21)[dB]	Remarks
EMC		2	Low	2412.0	6.17	-	1.00	10.03	17.20	-	Without cradle, Data rate: 2Mbps, DQPSK/DSSS
		2	Mid.	2437.0	6.76	-	1.00	10.03	17.79	-	
		2	High	2462.0	7.67	-	1.00	10.03	18.70	-	
SAR	IEEE 802.11b	2	Low	2412.0	6.18	3.52	1.00	10.03	17.21	0.01	
		2	Mid.	2437.0	6.77	4.31	1.00	10.03	17.79	0.01	
		2	High	2462.0	7.67	4.98	1.00	10.03	18.70	0	
EMC		11	Low	2412.0	5.51	-	1.00	10.03	16.54	-	With cradle & charging, Data rate: 11Mbps, CCK/DSSS
		11	Mid.	2437.0	6.67	-	1.00	10.03	17.70	-	
		11	High	2462.0	7.40	-	1.00	10.03	18.43	-	
SAR		11	Low	2412.0	5.71	3.40	1.00	10.03	16.74	0.20	
		11	Mid.	2437.0	6.72	4.21	1.00	10.03	17.75	0.05	
		11	High	2462.0	7.40	4.89	1.00	10.03	18.43	0	
EMC	IEEE 802.11g	6	Mid.	2437.0	12.00	-	1.00	10.03	23.03	-	Without cradle, Data rate: 6Mbps, BPSK/OFDM
SAR		6	Mid.	2437.0	12.05	3.80	1.00	10.03	23.08	0.05	

*. For pre-check of SAR test, Measured date: April 19, 2010 / Measured by: Hiroshi Naka / Measured place: No. 3 shielded room. (22.0 deg.C. / 44%)

*. Calculating formula: Results = (P/M Reading) + (Cable loss) + (Attenuator loss)

*. For EMC test data, the reference is described in the test report of 30IE0007-YK-01-B. The EMC test data measured on April 15, 2010.

SECTION 7: Measurement results

7.1 Body SAR

Measurement date : April 20 and 21, 2010

Measurement by : Hiroshi Naka

[Liquid measurement (Body)]

Used Target Frequency [MHz]	Target Body Tissue		Measured Body Tissue				Environment		Measured Date
	Permittivity [-]	Conductivity [S/m]	Permittivity (ϵ') [-]	Conductivity (σ) [S/m]	Temperature [deg.C]	Depth [mm]	Temperature [deg.C]	Humidity [%]	
2450	52.7	1.95	51.6 (-2.1%)	2.00 (+2.4%)	22.8	151	23.5	44	April 20, 2010
2450	52.7	1.95	51.6 (-2.1%)	2.02 (+3.4%)	22.9	151	23.1	51	April 21, 2010

*. The target value is a parameter defined in OET65 Sup.C.

[SAR measurement results (Body)]

SAR measurement results										
Frequency		Modulation & Data rate [Mbps / crest factor]	EUT setup conditions			Liquid temp. [deg.C]		Power drift [dB]	SAR(1g) [W/kg] maximum value of multi-peak	Remarks
Mode	ch [MHz]		Antenna no#.	Position	Separation [mm]	Before	After			
Step 1: Worst setup position search (at lowest data rate)										
6(mid)	2437.0	DBPSK&DSSS / 1Mbps / 1.0	-(single)	Top	0	22.3	22.3	-0.056	0.634	(→Worst direction)
6(mid)	2437.0	DBPSK&DSSS / 1Mbps / 1.0	-(single)	Bottom	0	22.5	22.4	-0.2	0.014	(Within -3dB of limit.)
6(mid)	2437.0	DBPSK&DSSS / 1Mbps / 1.0	-(single)	Front	0	22.4	22.3	0.032	0.332	(Within -3dB of limit.)
6(mid)	2437.0	DBPSK&DSSS / 1Mbps / 1.0	-(single)	Rear	0	22.7	22.6	-0.025	0.140	(Within -3dB of limit.)
6(mid)	2437.0	DBPSK&DSSS / 1Mbps / 1.0	-(single)	Left side	0	22.4	22.4	-0.2	0.072	(Within -3dB of limit.)
6(mid)	2437.0	DBPSK&DSSS / 1Mbps / 1.0	-(single)	Right side	0	22.4	22.4	0.047	0.044	(Within -3dB of limit.)
Step 2: Change to high and low channels (at lowest data rate)										
11(high)	2462.0	DBPSK&DSSS / 1Mbps / 1.0	-(single)	Top	0	22.3	22.3	-0.111	0.963	(→Worst channel)
1(low)	2412.0	DBPSK&DSSS / 1Mbps / 1.0	-(single)	Top	0	22.3	22.3	-0.054	0.513	-
Step 3: Change to the highest average power channel at worst position.										
11(high)	2462.0	DQPSK&DSSS / 2Mbps / 1.0	-(single)	Top	0	22.3	22.2	-0.090	1.09	→Worst SAR
6(mid)	2437.0	DQPSK&DSSS / 2Mbps / 1.0	-(single)	Top	0	22.2	22.1	-0.034	0.741	-
1(low)	2412.0	DQPSK&DSSS / 2Mbps / 1.0	-(single)	Top	0	22.1	22.1	-0.054	0.548	-
Step 4: With cradle & charging operation										
11(high)	2462.0	CCK&DSSS / 11Mbps / 1.0	-(single)	Top	0	22.5	22.5	0.017	0.998	-
6(mid)	2437.0	CCK&DSSS / 11Mbps / 1.0	-(single)	Top	0	22.5	22.5	-0.069	0.676	-
1(low)	2412.0	CCK&DSSS / 11Mbps / 1.0	-(single)	Top	0	22.5	22.5	-0.028	0.571	-
Step 5: Separation check										
11(high)	2462.0	DQPSK&DSSS / 2Mbps / 1.0	-(single)	Top	5	22.5	22.5	-0.017	0.361	-

Notes:

*. Battery is fully charged before starting the SAR measurement.