SAR TEST REPORT

Test Report No. : 26HE0320-HO-E-1

Applicant	:	**Sony Corporation**
Type of Equipment	:	**Personal Computer**
Model No.	:	**PCG-4H2L**
Test standard	:	**FCC47CFR 2.1093** **FCC OET Bulletin 65, Supplement C**
FCC ID	:	**AK8PCG4H2L**
Test Result	:	**Complied**
Max. SAR Measured(IEEE802.11b/g)	:	**0.276W/kg (Body, 2412MHz)**
Bluetooth	:	**0.037 W/kg (2480MHz)**
Colocation evaluation		
Wireless LAN (11b/g) + Bluetooth	:	**0.313W/kg**

1. This test report shall not be reproduced except full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with the above standard. We hereby certify that the data contain a true representation of the SAR profile.
4. The test results in this test report are traceable to the national or international standards.

Date of test : April 5, 10, 11, 2006

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SECTION 1 : Client information

Company Name	Sony Corporation
Brand name	SONY
Address	6-7-35 Kitashinagawa Shinagawa-ku, Tokyo, 141-0001, Japan
Telephone Number	+81-3-5795-8702
Facsimile Number	+81-3-5795-8981
Contact Person	Katsunori Tsutsui

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

2.1 Identification of E.U.T.

Type of Equipment	Personal Computer
Model No.	PCG-4H2L
Serial No.	XTA1-15 XTB2-5
Country of Manufacture	Japan
Rating	AC adaptor VGP-AC16V8, input AC120V,output DC16.0V 4.0A
Battery	Type : Li-ion Battery Model Name : VGP-BPS5 Rating =7.4V : 7800mAh
Option Battery	N/A
Accessory	N/A
Receipt Date of Sample	April 4, 2006
Condition of EUT	Engineering prototype (Note for sale: This sample is equivalent to mass-produced item)
Category Identified	Portable device

2.2 Product description

2.2.1 General Information

Feature of EUT	Sony Corp., Model No: PCG-4H2L is the Notebook computer, which is co-located with Wireless LAN module (IEEE 802.11a, IEEE 802.11b, IEEE 802.11g) and Bluetooth module (FCC ID:CWTUGPZ6). We recognized that this EUT can be co-operated Wireless LAN and Bluetooth.
Size	About 272*185*30mm (W*L*H)
Range of operation temperature	+5 deg. C. to +35 deg. C.
Operation Clock	1250MHz, 1200MHz, 533MHz, 500MHz,400MHz, 270MHz, 160MHz, 133MHz, 77.5MHz, 71.5MHz, 48MHz, 33.3MHz, 24.576MHz, 24MHz, 14.318MHz, 10MHz

2.2.2 Radio Specification

Type of radio	Wireless LAN (IEEE802.11a)	Wireless LAN (IEEE802.11b/g)	Bluetooth
Equipment Type	Transceiver	Transceiver	Transceiver
Frequency of Operation	Low Band : Lower limit =5180 Upper limit =5320 High Band : Lower limit =5745 Upper limit =5825	Lower limit =2412 Upper limit =2462	Lower limit =2402 Upper limit =2480
Bandwidth & Channel spacing	Low Band : Bandwidth : 20MHz Ch spacing : 20MHz High Band : Bandwidth : 20MHz Ch spacing : 20MHz	Bandwidth : 20MHz Ch spacing : 5MHz	Bandwidth : 1MHz Ch spacing : 1MHz
Type of Modulation	OFDM	11b : DSSS 11g : OFDM	FHSS
Antenna Type	λ/4-Monopole Antenna (Internal)	λ/4-Monopole Antenna (Internal)	λ/4-Monopole Antenna (Internal)
Antenna Connector Type	U.FL Compatible connecter	U.FL Compatible connecter	U.FL Compatible connecter
Antenna Gain	AUX antenna : 0.90dBi MAIN antenna : 1.79dBi	AUX antenna : -2.24dBi MAIN antenna : -2.59dBi	1.5dBi (Type: HFS05-SO02NN)
Transmit Power Peak power	Low band 14.95 dBm (31.26 mW) High band 16.63 dBm (46.03 mW)	15.94dBm (39.26mW)	0.5 dBm (1.01mW)
Power Supply	DC1.5V & 3.3V	DC1.5V & 3.3V	DC 3.1~3.5V

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.

3.2 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

SECTION 4 : Test result

4.1 Result of Max. SAR value

Max SAR Measured (IEEE 802.11g) : 0.276 W/kg

Max SAR Measured (Bluetooth) : 0.037 W/kg

4.2 Colocation of SAR value

The Power of Bluetooth is lower than the power of WLAN and both powers are transmitted individually from different antenna, therefore the worst value is possible to calculate just simply sum up both measurement results. We can assume, in this case, mainly the power would be radiated from the antenna.
It is necessary to think about the case of different frequency, modulation and, simultaneous transmission from different antenna. If each worst data is added, it will become the worst case.
As the worst case, the maximum SAR value of EUT is calculated by adding maximum SAR values of IEEE 802.11b/g and Bluetooth as shown below:
Max SAR value = Max SAR value (IEEE 802.11b/g) ＋ Max SAR value (Bluetooth)

Max SAR Measured (IEEE 802.11g + Bluetooth) : 0.313W/kg

4.3 Test location

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Telephone : +81 596 24 8116
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SECTION 5 : Operation of E.U.T. during testing

5.1 Operating modes

This EUT has IEEE.802.11a/b/g and Bluetooth.
The frequency band and the modulation used in the testing of IEEE.802.11b/g and Bluetooth 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,DQPSK,CCK)
Crest factor* : 1

Remark* : Crest factor decision in SAR testing

Modulation	CCK (11Mbps)
DutyCycle[%]	87
Crestfactor	1.15 = 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 (BPSK, QPSK, 16QAM(24Mbps))
1.5 (16QAM(36Mbps))
2 (64QAM)

Remark* : Crest factor decision in SAR testing

Modulation	BPSK (6Mbps)	BPSK (9Mbps)	QPSK (18MBps)	16QAM (24Mbps)	16QAM (36Mbps)	64QAM (54Mbps)
DutyCycle[%]	91	87	78	73	64	55
Crestfactor	1.10 = 1	1.15 = 1	1.28 = 1	1.37 = 1	1.56 = 1.5	1.82 =2

3. Bluetooth mode

Tx frequency band : 2402-2480MHz
Channel : 1ch(2402MHz),40ch(2441MHz),79ch(2480MHz)
Modulation : GFSK
Crest factor : 1 (DH5)

Remark* : Crest factor decision in SAR testing

Modulation	GFSK
DutyCycle[%]	76.5
Crestfactor	1.31 =1

5.2 Measurement procedure

1. Confirmation before testing

It is checked that the conducted power is correlated within 0~+5% power of EMC test. (FCC requirements) However, the data of EMC test is used as a substitute for SAR test when there is no possibility in power change obviously as follows:

- EMC and SAR tests are performed with the same test sample 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.

2. SAR Measurement (Radiated power is always monitored by Spectrum Analyzer.)

IEEE 802.11b

The tests from Step1 to Step2 were performed with Main antenna and AUX antenna respectivrly.

Step1. The searching for the worst position
This test was performed at the worst modulation of Step1.

Step2. The changing to the Low and High channels
This test was performed at the worst conditions of Step 2.

IEEE 802.11g

The tests from Step3 to Step5 were performed with Main antenna and AUX antenna respectivrly.

Step3. The data rate in the higher peak power of each modulation was decided, then the worst modulation was searched in the SAR testing.

Step4. The searching for the worst position
This test was performed at the worst modulation of Step3.

Step5. The changing to the Low and High channels
This test was performed at the worst conditions of Step 4.

Change distance between EUT and SAM Twin Phantom

Step6. The measurement was performed with the distance, 10mm to check if the shortest distance may not have the worst value at the conditions of the highest SAR value. As a result, the shortest distance had the worst value

Bluetooth

Step1. The searching for the worst position

Step2. The changing to the Low and High channels
This test was performed at the worst conditions of Step 1.

*It is checked that the power drift value at each measurement is within ±5% as to the power change before and after the SAR test. When the power drift value is over ±5%, the data of power variation with time is taken, and it is checked that the variation is not abnormal. Moreover, the change rate is reflected on the uncertainty.

5.4 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.Right Side (Spaced 5mm) :
The measurement spaced 5mm distance between Right Side of display(Main antenna) of EUT and SAM Twin Phantom.

2.Right Bottom :
The test was performed in touch with Right bottom(Main antenna) of the EUT to the SAM Twin Phantom

3.Right Top : The test was performed in touch with Right top(Main antenna) of the EUT to the SAM Twin Phantom.

4.Right Back of display (Spaced 15mm) :
The measurement spaced 15mm distance between Right Back of display (Main antenna) of EUT and SAM Twin Phantom.

5.Right Side (Spaced 10mm) :
The measurement spaced 10mm distance between Right Side of display (Main antenna) of EUT and SAM Twin Phantom.

6.Left Side (Spaced 5mm) :
The measurement spaced 5mm distance between Left Side of display (Main antenna) of EUT and SAM Twin Phantom.

7.Left Bottom : The test was performed in touch with Left bottom(Aux antenna) of the EUT to the SAM Twin Phantom

8.Left Top : The test was performed in touch with Left top(Aux antenna) of the EUT to the SAM Twin Phantom.

9.Left Back of display (Spaced 15mm) :
The measurement spaced 15mm distance between Left Back of display (Main antenna) of EUT and SAM Twin Phantom.

10.BT Back : The test was performed in touch with Back (Bluetootn antenna) of the EUT to the SAM Twin Phantom.

11.BT Side :
The test was performed in touch with Right side (Bluetootn antenna) of the EUT to the SAM Twin Phantom.

12.BT Bottom:
The test was performed in touch with left bottom (Bluetooth antenna) of the EUT to the SAM Twin Phantom.

13.BT Surface of key board :
The test was performed in touch with surface of keyboard (Bluetooth antenna) of the EUT to the SAM Twin Phantom.

* The body of the end users is not touched to the surface of Right Back of display, Right Side, Left Back of display and Left Side while this EUT is used. Therefore the test was made with the distance between EUT and SAM Twin Phantom spaced.
*The test setup photograph is put on appendix 1.

SECTION 6 : Test surrounding

6.1 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	0.7	±1.9	∞
Spherical isotropy of the probe	±9.6	Rectangular	√3	0.7	±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	±1.0	Normal	1	1	±1.0	∞
Response time	±0.8	Rectangular	√3	1	±0.5	∞
Integration time	±2.6	Rectangular	√3	1	±1.5	∞
RF ambient Noize	±3.0	Rectangular	√3	1	±1.7	∞
RF ambient Reflections	±3.0	Rectangular	√3	1	±1.7	∞
Mech. constraints of robot	±0.8	Rectangular	√3	1	±0.5	∞
Probe positioning	±9.9	Rectangular	√3	1	±5.7	∞
Extrap. and integration	±4.0	Rectangular	√3	1	±2.3	∞
Test Sample Related						
Device positioning	±2.9	Normal	1	1	±2.9	30
Device holder uncertainty	±3.6	Normal	1	1	±3.6	10
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	Normal	1	0.64	±3.2	∞
Liquid permittivity (target)	±5.0	Rectangular	√3	0.6	±1.7	∞
Liquid permittivity (meas.)	±5.0	Normal	1	0.6	±3.0	∞
Combined Standard Uncertainty					**±13.515**	
Expanded Uncertainty (k=2)					**±27.0**	

SECTION 7 : Confirmation before testing

7.1 Conducted power of Main Antenna Port

Test Date : April 6, 2006

[IEEE802.11b : Main Antenna Port by the data rate]						
Ch	Modulation (Data rate [bps])	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
6	DBPSK (1Mbps)	2.86	2.50	10.00	15.36	34.36
6	DQPSK(2Mbps)	3.20	2.50	10.00	15.70	37.15
6	CCK(5.5Mbps)	3.16	2.50	10.00	15.66	36.81
6	CCK(11Mbps)	3.44	2.50	10.00	15.94	39.26

[IEEE802.11b : Main Antenna Port (11Mbps)]						
Ch	Freq. [MHz]	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2412.0	3.24	2.50	10.00	15.74	37.50
6	2437.0	3.44	2.50	10.00	15.94	39.26
11	2462.0	2.46	2.50	10.00	14.96	31.33

[IEEE802.11g : Main Antenna Port (by the data rate)]						
Ch	Modulation (Data rate [bps])	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
6	BPSK (6Mbps)	2.53	2.50	10.00	15.03	31.84
6	BPSK (9Mbps)	2.76	2.50	10.00	15.26	33.57
6	QPSK (12Mbps)	2.79	2.50	10.00	15.29	33.81
6	QPSK (18Mbps)	2.81	2.50	10.00	15.31	33.96
6	16QAM(24Mbps)	2.78	2.50	10.00	15.28	33.73
6	16QAM(36Mbps)	2.93	2.50	10.00	15.43	34.91
6	64QAM(48Mbps)	2.77	2.50	10.00	15.27	33.65
6	64QAM(54Mbps)	2.99	2.50	10.00	15.49	35.40

[IEEE802.11g : Main Antenna Port (9Mbps)]						
Ch	Freq. [MHz]	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2412.0	2.52	2.50	10.00	15.02	31.77
7	2442.0	2.76	2.50	10.00	15.26	33.57
13	2472.0	1.89	2.50	10.00	14.39	27.48

[IEEE802.11g : Main Antenna Port (54Mbps)]						
Ch	Freq. [MHz]	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2412.0	2.64	2.50	10.00	15.14	32.66
6	2437.0	2.99	2.50	10.00	15.49	35.40
11	2462.0	1.97	2.50	10.00	14.47	27.99

7.2 Conducted power of Aux Antenna Port

Test Date : April 6, 2006

[IEEE802.11b : Aux Antenna Port by the data rate]						
Ch	Modulation (Data rate [bps])	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
6	DBPSK (1Mbps)	3.29	2.50	10.00	15.79	37.93
6	DQPSK(2Mbps)	3.31	2.50	10.00	15.81	38.11
6	CCK(5.5Mbps)	3.28	2.50	10.00	15.78	37.84
6	CCK(11Mbps)	3.32	2.50	10.00	15.82	38.19

[IEEE802.11b : Aux Antenna Port (11Mbps)]						
Ch	Freq. [MHz]	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2412.0	3.10	2.50	10.00	15.60	36.31
6	2437.0	3.32	2.50	10.00	15.82	38.19
11	2462.0	1.76	2.50	10.00	14.26	26.67

[IEEE802.11g : Aux Antenna Port (by the data rate)]						
Ch	Modulation (Data rate [bps])	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
6	BPSK (6Mbps)	2.72	2.50	10.00	15.22	33.27
6	BPSK (9Mbps)	2.70	2.50	10.00	15.20	33.11
6	QPSK (12Mbps)	2.73	2.50	10.00	15.23	33.34
6	QPSK (18Mbps)	2.80	2.50	10.00	15.30	33.88
6	16QAM(24Mbps)	2.80	2.50	10.00	15.30	33.88
6	16QAM(36Mbps)	2.78	2.50	10.00	15.28	33.73
6	64QAM(48Mbps)	2.75	2.50	10.00	15.25	33.50
6	64QAM(54Mbps)	2.80	2.50	10.00	15.30	33.88

[IEEE802.11g : Aux Antenna Port (6Mbps)]						
Ch	Freq. [MHz]	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2412.0	2.54	2.50	10.00	15.04	31.92
6	2437.0	2.72	2.50	10.00	15.22	33.27
11	2462.0	1.81	2.50	10.00	14.31	26.98

[IEEE802.11g : Aux Antenna Port (54Mbps)]						
Ch	Freq. [MHz]	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2412.0	2.54	2.50	10.00	15.04	31.92
6	2437.0	2.80	2.50	10.00	15.30	33.88
11	2462.0	1.90	2.50	10.00	14.40	27.54

7.3 Conducted power of Bluetooth Antenna port

Test Date : April 5, 2006

Bluetooth						
Ch	Freq. [MHz]	PK Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Converted [mW]
1	2402.0	-1.05	1.10	0.00	0.05	1.01
40	2441.0	-1.05	1.10	0.00	0.05	1.01
79	2480.0	-1.14	1.10	0.00	-0.04	0.99

Sample Calculation:

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

SECTION 8 : Measurement results

8.1 SAR measurement results

After all of SAR tests, it was checked that the conducted power was correlated with the power of EMC test.
All of power drifts were within ±5%.
The measurement data is put on "APPENDIX 3".

8.1.1 Body 2450MHz SAR of Main antenna of 11b/g

Liquid Depth (cm)	:	**15.2**	Model	:	**PCG-4H2L**
Parameters	:	**ε_r =50.2 σ =2.00**	Serial No.	:	**XTA1-15**
Ambient temperature (deg.c.)	:	**25.0**	Modulation	:	**DSSS, OFDM**
Relative Humidity (%)	:	**32**	Crest factor	:	**1, 1.5 or 2**
Date	:	**April 10, 2006**	Measured By	:	**Miyo Ikuta**

SAR MEASUREMENT RESULTS OF MAIN ANTENNA									
Frequency			Modulation (Data rate[bps])	EUT Set-up Conditions			Liquid Temp.[deg.		SAR(1g) [W/kg]
Mode	ch	[MHz]		Antenna	Position	Separation [mm]	Before	After	Maximum value of
11b	**Step 1 Position search**								
	6	2437	CCK(11Mbps)	Main	Right Side	5	24.6	24.6	**0.152**
	6	2437	CCK(11Mbps)	Main	Bottom	0	24.3	24.3	**0.038**
	6	2437	CCK(11Mbps)	Main	Right Top	0	24.5	24.4	**0.038**
	6	2437	CCK(11Mbps)	Main	Right Back of display	15	24.3	24.3	**0.090**
	Step 2 Frequency Change								
	1	2412	CCK(11Mbps)	Main	Right Side	5	24.2	24.2	**0.227**
	11	2462	CCK(11Mbps)	Main	Right Side	5	24.2	24.2	**0.192**
11g	**Step 3 Modulation search**								
	6	2437	BPSK(9Mbps)	Main	Right Side	5	24.6	24.6	**0.217**
	6	2437	QPSK(18Mbps)	Main	Right Side	5	24.6	24.6	**0.201**
	6	2437	16QAM(36Mbps	Main	Right Side	5	24.6	24.6	**0.121**
	6	2437	64QAM(54Mbps	Main	Right Side	5	24.6	24.6	**0.147**
	Step 4 Position search								
	6	2437	BPSK(9Mbps)	Main	Bottom	0	24.4	24.4	**0.034**
	6	2437	BPSK(9Mbps)	Main	Right Top	0	24.4	24.4	**0.031**
	6	2437	BPSK(9Mbps)	Main	Right Back of display	15	24.3	24.3	**0.062**
	Step 5 Frequency Change								
	1	2412	BPSK(9Mbps)	Main	Right Side	5	24.2	24.2	**0.276**
	11	2462	BPSK(9Mbps)	Main	Right Side	5	24.2	24.2	**0.208**
	Step 6 Change distance between EUT and SAM phantom								
	1	2412	BPSK(9Mbps)	Main	Right Side	10	24.6	24.6	**0.131**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population							**Body SAR : 1.6 W/kg (averaged over 1 gram)**		

8.1.2 Body 2450MHz SAR of AUX antenna of 11b/g

Liquid Depth (cm)	:	**15.0**	Model	:	**PCG-4H2L**
Parameters	:	**εr =51.0 σ =2.01**	Serial No.	:	**XTA1-15**
Ambient temperature (deg.c.)	:	**25.0**	Modulation	:	**DSSS, OFDM**
Relative Humidity (%)	:	**40**	Crest factor	:	**1 or 2**
Date	:	**April 11, 2006**	Measured By	:	**Miyo Ikuta**

SAR MEASUREMENT RESULTS OF AUX ANTENNA									
Frequency			Modulation (Data rate[bps])	EUT Set-up Conditions			Liquid Temp.[de		SAR(1g) [W/kg]
Mode	ch	[MHz]		Antenna	Position	Separation [mm]	Before	After	Maximum value of
11b	**Step 1 Position search**								
	6	2437	CCK(11Mbps)	AUX	Left Side	5	24.8	24.8	**0.246**
	6	2437	CCK(11Mbps)	AUX	Left Bottom	0	24.5	24.5	**0.015**
	6	2437	CCK(11Mbps)	AUX	Left Top	0	24.8	24.8	**0.039**
	6	2437	CCK(11Mbps)	AUX	Left Back display	15	24.6	24.6	**0.116**
	Step 2 Frequency Change								
	1	2412	CCK(11Mbps)	AUX	Left Side	5	24.8	24.8	**0.175**
	11	2462	CCK(11Mbps)	AUX	Left Side	5	24.8	24.8	**0.172**
11g	**Step 3 Modulation search**								
	6	2437	BPSK(6Mbps)	AUX	Left Side	5	24.7	24.7	**0.208**
	6	2437	QPSK(18Mbps)	AUX	Left Side	5	24.7	24.7	**0.183**
	6	2437	16QAM(24Mbps	AUX	Left Side	5	24.7	24.7	**0.179**
	6	2437	64QAM(54Mbps	AUX	Left Side	5	24.7	24.7	**0.133**
	Step 4 Position search								
	6	2437	BPSK(6Mbps)	AUX	Left Bottom	0	24.6	24.6	**0.015**
	6	2437	BPSK(6Mbps)	AUX	Left Top	0	24.8	24.8	**0.039**
	6	2437	BPSK(6Mbps)	AUX	Left Back display	15	24.6	24.6	**0.093**
	Step 5 Frequency Change								
	1	2412	BPSK(6Mbps)	AUX	Left Side	5	24.7	24.7	**0.186**
	11	2462	BPSK(6Mbps)	AUX	Left Side	5	24.7	24.7	**0.204**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population							**Body SAR : 1.6 W/kg (averaged over 1 gram)**		

8.1.3 Body 2450MHz SAR (Bluetooth mode)

Liquid Depth (cm)	:	**15.0**	Model	:	**PCG-4H2L**
Parameters	:	ε_r =**50.3**, σ =**1.96**	Serial No.	:	**XTB2-5**
Ambient temperature (deg.c.)	:	**24.5**	Modulation	:	**GFSK**
Relative Humidity (%)	:	**33**	Crest factor	:	**1**
Date	:	**April 5, 2006**	Measured By	:	**Hisayoshi Sato**

SAR MEASUREMENT RESULTS OF BLUETOOTH									
Frequency			Modulation (Data rate[bps])	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Mode	ch	[MHz]		Antenna	Position	Separation [mm]	Before	After	Maximum value of multi-peak
BT	**Step 1 Position search**								
	39	2441	GFSK	Main	Back	0	24.0	24.0	**7.48E-05**
	39	2441	GFSK	Main	Side	0	24.0	24.0	**6.29E-05**
	39	2441	GFSK	Main	Bottom	0	24.1	24.1	**3.08E-05**
	39	2441	GFSK	Main	Surface of keyboard *	0	24.1	24.1	**0.037**
	Step 2 Frequency Change								
	0	2402	GFSK	Main	Surface of key board *	0	24.2	24.2	**0.032**
	78	2480	GFSK	Main	Surface of key board *	0	24.2	24.2	**0.03000**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population							**Body SAR : 1.6 W/kg (averaged over 1 gram)**		

*As for the reference, surface of key board was measured referring to obtain the worst data.

APPENDIX 1 : Photographs of test setup

BLANK-ANOTHER EXHIBIT Test Setup Photos (SAR_2.4GHz)

BLANK-ANOTHER EXHIBIT Test Setup Photos (SAR_2.4GHz)

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BLANK-ANOTHER EXHIBIT Test Setup Photos (SAR_2.4GHz)

APPENDIX 2 : Test instruments

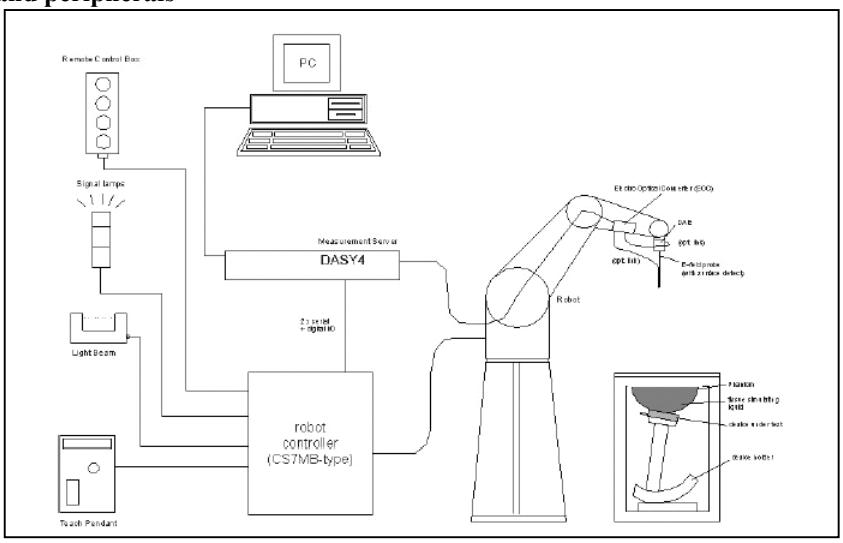
1. Equipment used

Name of Equipment	Manufacture	Model number	Serial number	Calibration	
				Last Cal	due date
Microwave Cable	Suhner	SUCOFLEX101	2366/1	2005/08/30	2006/08/29
Attenuator	Agilent	8493C	71389	2005/06/03	2006/06/02
Spectrum Analyzer	Agilent	E4448A	MY44020357	2005/09/16	2006/09/15
S-Parameter Network Analyzer	Agilent	8753ES	US39174808	2003/10/23	2006/10/22
Digital Humidity Indicator	N.T	NT-1800	MOS01	2004/11/25	2006/11/24
Power Meter	Agilent	E4417A	GB41290639	2005/11/09	2006/11/08
Power Sensor	Agilent	E9300B	US40010300	2005/11/28	2006/11/27
Power sensor	Agilent	E9327A	US40440545	2006/03/29	200703/28
Attenuator (30dB)	Agilent	US40010300	08498-60012	2005/12/16	2006/12/15
Signal Genelator	Rohde & Schwarz	SMR40	100023	2006/01/05	2007/01/04
Pre Amplifier	TSJ	TCBP0206	N/A	2006/03/11	2007/03/10
Dual Directional Coupler	-	Narda	03702	N/A	N/A
Network Analyzer	Agilent/HP	E8358A	US40260167	2003/11/02	2006/11/01
Dosimetric E-Field Probe	Schmid&Partner Engineering AG	EX3DV3	3507	2005/04/12	2006/04/11
Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE3 V1	509	2005/05/26	2006/05/25
SAR measurement System	Schmid&Partner Engineering AG	DASY4	I021834	N/A	N/A
Dipole Antenna	Schmid&Partner Engineering AG	D2450V2	713	2005/09/02	2007/09/01
SAM Twin Phantom	Schmid&Partner Engineering AG	SAM Twin Phantom V4.0	1196	N/A	N/A
Thermo-Hygrometer	Custom	CTH-190	MOS-10	2005/03/07	2007/03/06
Body 2.4GHz	N/A	N/A	N/A	Daily check Target value ± 5%	
Head 2.4GHz	N/A	N/A	N/A	Daily check Target value ± 5%	
SAR room	-	-	-	Daily check Ambient Noise <0.012W/kg	

2. Dosimetry assessment setup

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than +/- 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the dosimetry probe EX3DV3, SN: 3507 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [2] with accuracy of better than +/-10%. The spherical isotropy was evaluated with the procedure described in [3] and found to be better than +/-0.25 dB. The phantom used was the
SAM Twin Phantom as described in FCC supplement C, IEEE P1528 and CENELEC EN50361.

3. Configuration and peripherals



The DASY4 system for performing compliance tests consist of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
   An arm extension for accommodating the data acquisition electronics (DAE).

2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

3. A data acquisition electronic (DAE), which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

4. The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection.
   The EOC is connected to the measurement server.

5. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.

6. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.

7. A computer operating Windows 2000.

8. DASY4 software.

9. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

10. The SAM twin phantom enabling testing left-hand and right-hand usage.

11. The device holder for handheld mobile phones.

12. Tissue simulating liquid mixed according to the given recipes.

13. Validation dipole kits allowing to validate the proper functioning of the system.

4. System components

4.2.1 EX3DV3 Probe Specification

Construction:
Symmetrical design with triangular core
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., glycol ether)

Calibration:
Basic Broad Band calibration in air : 10-3000 MHz
Conversion Factor (Head and Body): 900 MHz, 1.8 GHz ,2.45GHz,5.2GHz, 5.8GHz

Frequency:
10 MHz to > 6GHz; Linearity: +/-0.2 dB(30 MHz to 3 GHz)

Directivity:
+/-0.3 dB in HSL (rotation around probe axis)
+/-0.5 dB in tissue material (rotation normal probe axis)

Dynamic Range:
10uW/g to > 100 mW/g;Linearity: +/-0.2 dB(noise: typically < 1uW/g)

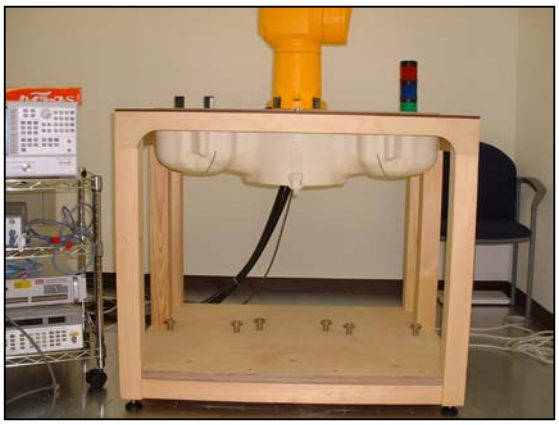
Dimensions:
Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5mm (Body: 12 mm)
Typical distance from probe tip to dipole centers: 1 mm

Application:
Highprecision dosimetric measurement in any exposure scenario
(e.g., very strong gradient fields).Only probe which enables compliance
testing for frequencies up to 6GHz with precision of better 30%.

EX3DV3 E-field Probe

SAM Twin Phantom

Construction:
The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC EN 50361 and IEC 62209.
It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid.
Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
Shell Thickness:
2 +/-0.2 mm
Filling Volume:
Approx. 25 liters
Dimensions:
(H x L x W): 810 x 1000 x 500 mm



SAM Twin Phantom

Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device enables the rotation of the mounted transmitter
in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head,flat phantom).
* Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations.
To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Device holder couldn't be used at this SAR measurement.

Device Holder

5. Test system specifications

Robot RX60L

Number of Axes	:	6
Payload	:	1.6 kg
Reach	:	800mm
Repeatability	:	+/-0.025mm
Control Unit	:	CS7M
Programming Language	:	V+
Manuafacture	:	Stäubli Unimation Corp. Robot Model: RX60

DASY4 Measurement server

Features	:	166MHz low power Pentium MMX 32MB chipdisk and 64MB RAM Serial link to DAE (with watchdog supervision) 16 Bit A/D converter for surface detection system Two serial links to robot (one for real-time communication which is supervised by watchdog) Ethernet link to PC (with watchdog supervision) Emergency stop relay for robot safety chainTwo expansion slots for future applications
Manufacture	:	Schimid & Partner Engineering AG

Data Acquisition Electronic (DAE)

Features	:	Signal amplifier, multiplexer, A/D converter and control logic Serial optical link for communication with DASY4 embedded system (fully remote controlled) 2 step probe touch detector for mechanical surface detection and emergency robot stop (not in -R version)
Measurement Range	:	1 µV to > 200 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset voltage	:	< 1 µV (with auto zero)
Input Resistance	:	200 MΩ
Battery Power	:	> 10 h of operation (with two 9 V battery)
Dimension	:	60 x 60 x 68 mm
Manufacture	:	Schimid & Partner Engineering AG

Software

Item	:	Dosimetric Assesment System DASY4
Type No.	:	SD 000 401A, SD 000 402A
Software version No.	:	4.5
Manufacture / Origin	:	Schimid & Partner Engineering AG

E-Field Probe

Model	:	EX3DV3
Serial No.	:	3507
Construction	:	Symmetrical design with triangular core
Frequency	:	10 MHz to 6 GHz
Linearity	:	+/-0.2 dB (30 MHz to 3 GHz)
Manufacture	:	Schimid & Partner Engineering AG

Phantom

Type	:	SAM Twin Phantom V4.0
Shell Material	:	Fiberglass
Thickness	:	2.0 +/-0.2 mm
Volume	:	Approx. 25 liters
Manufacture	:	Schimid & Partner Engineering AG

6. Simulated tissues composition of 2450MHz

Ingredient	MIXTURE(%)	
	Head 2450MHz	Muscle 2450MHz
Water	45.0	69.83
DGMBE	55.0	30.2

Note:DGMBE(Diethylenglycol-monobuthyl ether)

7. Validation measurement

7-a Simulated tissue liquid parameter confirmation

The dielectric parameters were checked prior to assessment using the HP85070D dielectric probe kit.
The dielectric parameters measurement are reported in each correspondent section.

7-b Head 2450 MHz

Type of liquid : **Head 2450 MHz**
Ambient temperature (deg.c.) : **24.5(April 5), 25.0(April 10, 11)**
Relative Humidity (%) : **33(April 5), 32(April 10). 40(April 11)**
Liquid depth (cm) : **15.0(April 5, 10, 11)**

DIELECTRIC PARAMETERS MEASUREMENT RESULTS								
Date	Frequency	Liquid Temp [deg.c]		Parameters	Target Value	Measured	Deviation [%]	Limit [%]
		Before	After					
5-Apr	2450	24.1	24.1	Relative Permittivity εr	39.2	37.5	-4.3	+/-5
				Coductivity σ [mho/m]	1.80	1.83	1.7	+/-5
10-Apr	2450	24.3	24.3	Relative Permittivity εr	39.2	37.7	-3.8	+/-5
				Coductivity σ [mho/m]	1.80	1.87	3.9	+/-5
11-Apr	2450	24.2	24.2	Relative Permittivity εr	39.2	37.3	-4.8	+/-5
				Coductivity σ [mho/m]	1.80	1.83	1.7	+/-5

7-c Muscle 2450 MHz

Type of liquid : **Muscle 2450 MHz**
Ambient temperature (deg.c.) : **24.5(April 5), 25.0(April 10, 11)**
Relative Humidity (%) : **33(April 5), 32(April 10). 40(April 11)**
Liquid depth (cm) : **15.0(April 5, 11), 15.2(April 10)**

DIELECTRIC PARAMETERS MEASUREMENT RESULTS								
Date	Frequency	Liquid Temp [deg.c]		Parameters	Target Value	Measured	Deviation [%]	Limit [%]
		Before	After					
5-Apr	2450	24.2	24.2	Relative Permittivity εr	52.7	50.3	-4.6	+/-5
				Coductivity σ [mho/m]	1.95	1.96	0.5	+/-5
10-Apr	2450	24.4	24.4	Relative Permittivity εr	52.7	50.2	-4.7	+/-5
				Coductivity σ [mho/m]	1.95	2.00	2.6	+/-5
11-Apr	2450	24.5	24.5	Relative Permittivity εr	52.7	51.0	-3.2	+/-5
				Coductivity σ [mho/m]	1.95	2.01	3.1	+/-5

8. System validation data

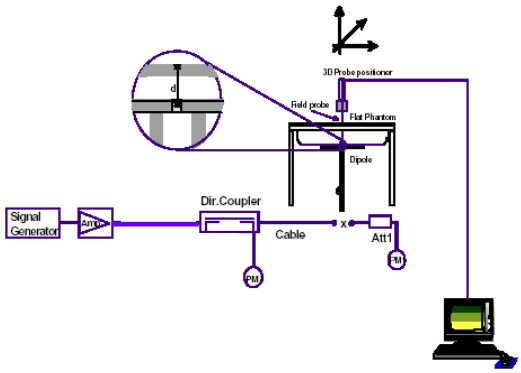
Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of +/-10%. The validation results are in the table below.
Please refer to "10. Validation measurement data".

System validation of 2450MHz

Type of liquid : **Head 2450 MHz**
Ambient temperature (deg.c.) : **24.5(April 5), 25.0(April 10, 11)**
Relative Humidity (%) : **33(April 5), 32(April 10). 40(April 11)**
Liquid depth (cm) : **15.0(April 5, 10, 11)**
Dipole : **D2450V2 SN:713**
Power : **250mW**

SYSTEM PERFORMANCE CHECK										
Date	Liquid (HEAD 2450MHz)						System dipole validation target & measured			
	Liquid Temp [deg.c.]		Relative Permittivity εr		Conductivity σ [mho/m]		SAR 1g [W/kg]		Deviation [%]	Limit [%]
	Before	After	Target	Measured	Target	Measured	Target	Measured		
5-Apr	24.2	24.2	39.2	37.5	1.80	1.83	13.1	14.0	6.9	+/-10
10-Apr	24.5	24.5	39.2	37.7	1.80	1.87	13.1	14.8	13.0	+/-10
11-Apr	24.4	24.4	39.2	37.3	1.80	1.83	13.1	13.8	5.3	+/-10

Note: Please refer to Attachment for the result representation in plot format



2450MHz System performance check setup

Test system for the system performance check setup diagram

9. Validation 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	±2.7	∞
Spherical isotropy of the probe	±9.6	Rectangular	√3	0	0	∞
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	±1.0	Normal	1	1	±1.0	∞
Response time	0	Rectangular	√3	1	0	∞
Integration time	0	Rectangular	√3	1	0	∞
RF ambient Noize	±3.0	Rectangular	√3	1	±1.7	∞
RF ambient Reflections	±3.0	Rectangular	√3	1	±1.7	∞
Mech. constraints of robot	±0.8	Rectangular	√3	1	±0.5	∞
Probe positioning	±9.9	Rectangular	√3	1	±5.7	∞
Extrap. and integration	±4.0	Rectangular	√3	1	±2.3	∞
Dipole						
Dipole Axis to Liquid Distance	±2.0	Rectangular	√3	1	±1.2	∞
Input power and SAR drift meas.	±4.7	Rectangular	√3	1	±2.7	∞
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	Normal	1	0.64	±3.2	∞
Liquid permittivity (target)	±5.0	Rectangular	√3	0.6	±1.7	∞
Liquid permittivity (meas.)	±5.0	Normal	1	0.6	±3.0	∞
Combined Standard Uncertainty					**±12.151**	
Expanded Uncertainty (k=2)					**±24.3**	

10. Validation measurement data

System Validation / Dipole 2450 MHz / Forward Conducted Power : 250mW

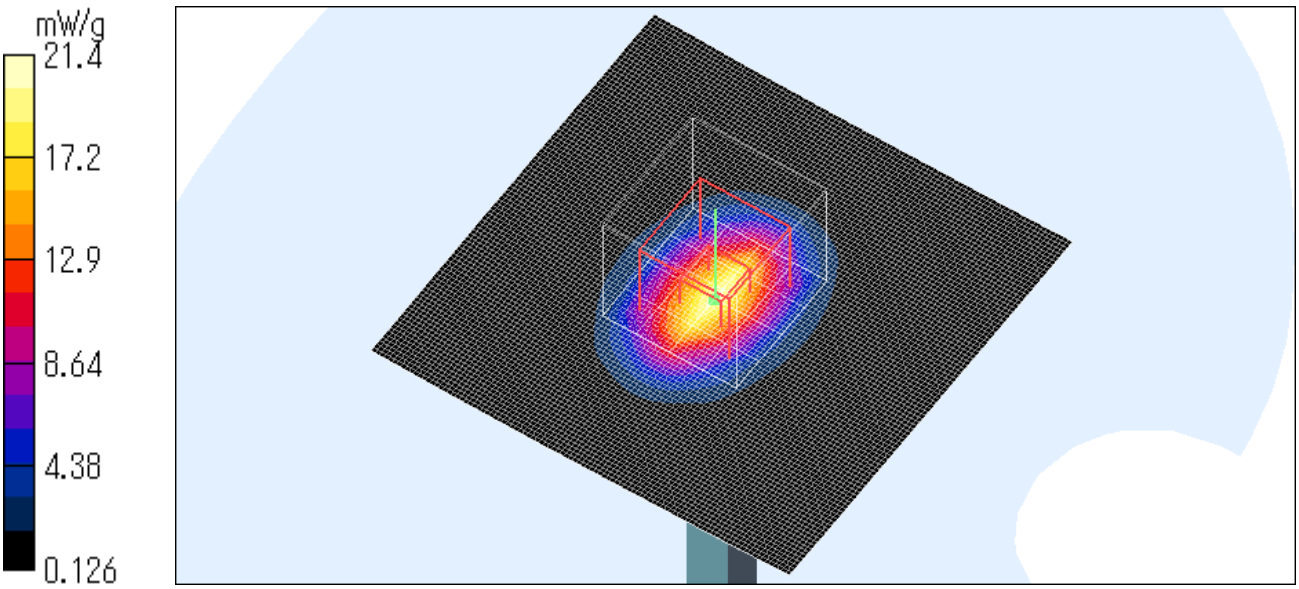
Dipole 2450 MHz; Type: D2450V2; SN: 713
Communication System: CW; Frequency: 2450 MHz; Crest factor: 1
Medium parameters used: f = 2450 MHz; σ = 1.83 mho/m; ε_r = 37.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:
Probe: EX3DV3 - SN3507; ConvF(8.25, 8.25, 8.25); Calibrated: 2005/04/12
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE3 Sn509; Calibrated: 2005/05/26
Phantom: SAM 1196
Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Area Scan (101x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 21.3 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 93.2 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 27.6 W/kg

SAR(1 g) = 14 mW/g; SAR(10 g) = 6.55 mW/g
Maximum value of SAR (measured) = 21.2 mW/g

Test Date = 04/05/06
Ambient Temperature = 24.5degree.C.
Liquid Temperature = Before 24.2degree.C. , After 24.2degree.C.



System Validation / Dipole 2450 MHz / Forward Conducted Power : 250mW

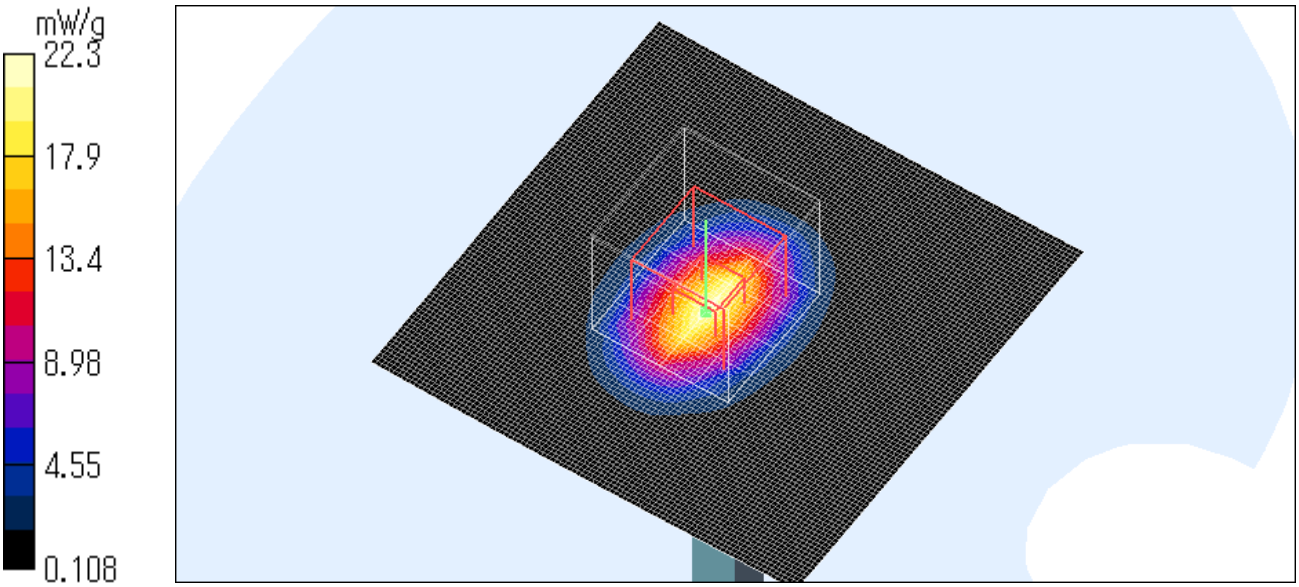
Dipole 2450 MHz; Type: D2450V2; SN: 713
Communication System: CW; Frequency: 2450 MHz; Crest factor: 1
Medium parameters used: f = 2450 MHz; σ = 1.87 mho/m; ε_r = 37.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:
Probe: EX3DV3 - SN3507; ConvF(8.25, 8.25, 8.25); Calibrated: 2005/04/12
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE3 Sn509; Calibrated: 2005/05/26
Phantom: SAM 1196
Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Area Scan (101x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 22.2 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 90.3 V/m; Power Drift = 0.050 dB
Peak SAR (extrapolated) = 29.7 W/kg

SAR(1 g) = 14.8 mW/g; SAR(10 g) = 6.84 mW/g
Maximum value of SAR (measured) = 22.3 mW/g

Test Date = 04/10/06
Ambient Temperature = 25.0degree.C.
Liquid Temperature = Before 24.5degree.C. , After 24.5degree.C.



System Validation / Dipole 2450 MHz / Forward Conducted Power : 250mW

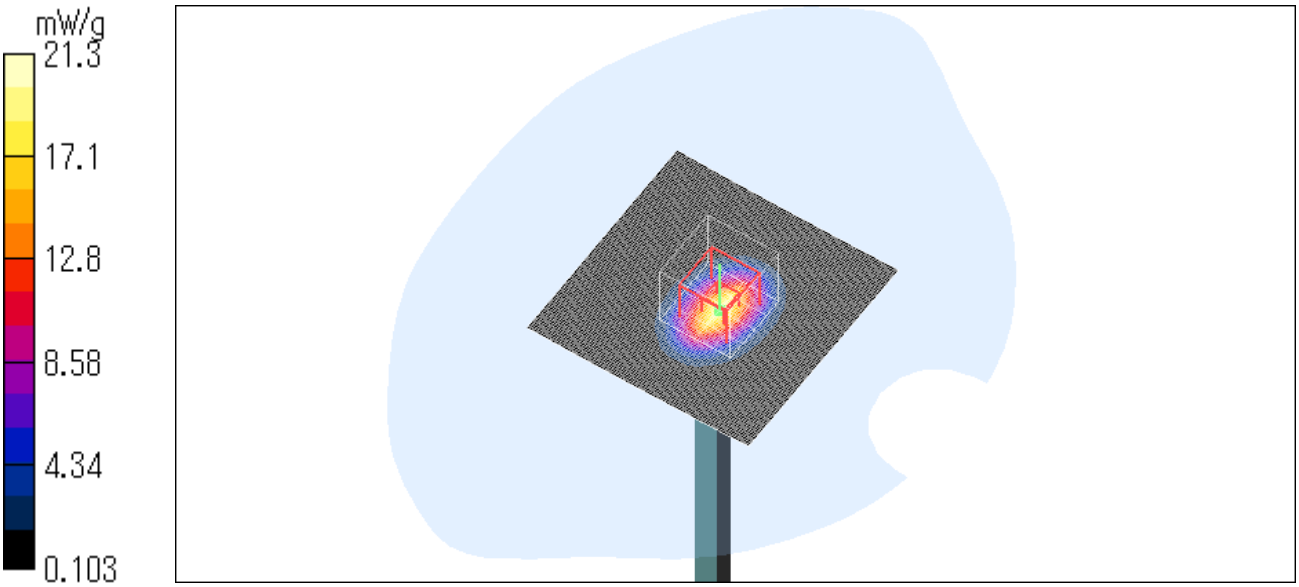
Dipole 2450 MHz; Type: D2450V2; SN: 713
Communication System: CW; Frequency: 2450 MHz; Crest factor: 1
Medium parameters used: f = 2450 MHz; σ = 1.83 mho/m; ε_r = 37.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:
Probe: EX3DV3 - SN3507; ConvF(8.25, 8.25, 8.25); Calibrated: 2005/04/12
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE3 Sn509; Calibrated: 2005/05/26
Phantom: SAM 1196
Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Area Scan (101x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 21.1 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 82.9 V/m; Power Drift = 0.093 dB
Peak SAR (extrapolated) = 28.7 W/kg

SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.33 mW/g
Maximum value of SAR (measured) = 21.3 mW/g

Test Date = 04/11/06
Ambient Temperature = 25.0 degree C.
Liquid Temperature = Before 24.4 degree C. , After 24.4 degree C.



11. System Validation Dipole (D2450V2,S/N: 713)

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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **UL A-pex (MTT)**

Certificate No: D2450V2-713_Sep05

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 713
Calibration procedure(s)	QA CAL-05.v6 Calibration procedure for dipole validation kits
Calibration date:	September 2, 2005
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E442	GB37480704	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Power sensor HP 8481A	US37292783	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Reference 20 dB Attenuator	SN: 5086 (20g)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference 10 dB Attenuator	SN: 5047.2 (10r)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference Probe ES3DV2	SN 3025	29-Oct-04 (SPEAG, No. ES3-3025_Oct04)	Oct-05
DAE4	SN 601	07-Jan-05 (SPEAG, No. DAE4-601_Jan05)	Jan-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-03)	In house check: Oct-05
RF generator R&S SML-03	100698	27-Mar-02 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov-05

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	M. Meili
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 2, 2005

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY4	V4.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.5 ± 6 %	1.73 mho/m ± 6 %
Head TSL temperature during test	(21.6 ± 0.2) °C	38.4 ± 6 %	1.75 mho/m ± 6 %

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	250 mW input power	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**53.2 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.19 mW / g
SAR normalized	normalized to 1W	24.8 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**24.9 mW / g ± 16.5 % (k=2)**

[1] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

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Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.5 ± 6 %	2.03 mho/m ± 6 %
Body TSL temperature during test	(21.8 ± 0.2) °C	52.5 ± 6 %	2.04 mho/m ± 6 %

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	condition	
SAR measured	250 mW input power	13.5 mW / g
SAR normalized	normalized to 1W	54.0 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**52.8 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.25 mW / g
SAR normalized	normalized to 1W	25.0 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**24.4 mW / g ± 16.5 % (k=2)**

[2] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω + 3.7 jΩ
Return Loss	-28.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.6 Ω + 4.8 jΩ
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.161 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 5, 2002

DASY4 Validation Report for Head TSL

Date/Time: 02.09.2005 10:54:01

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN713

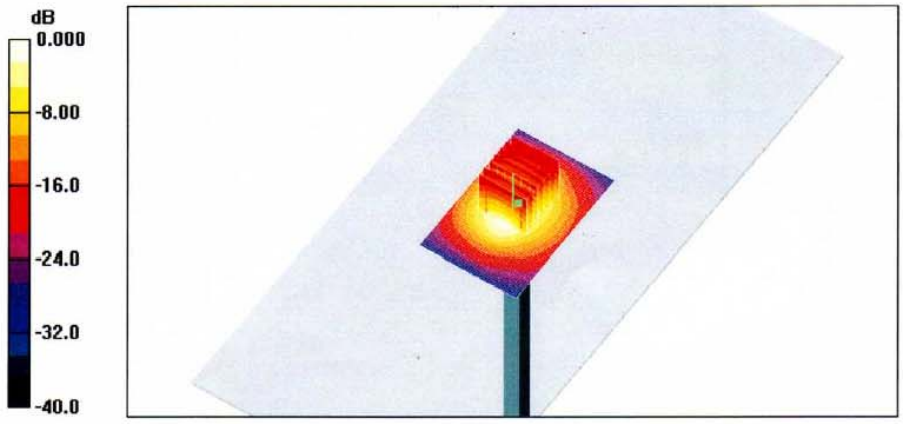
Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U10 BB;
Medium parameters used: f = 2450 MHz; σ = 1.75 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 29.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.07.2004
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA
- Measurement SW: DASY4, V4.6 Build 13; Postprocessing SW: SEMCAD, V1.8 Build 156

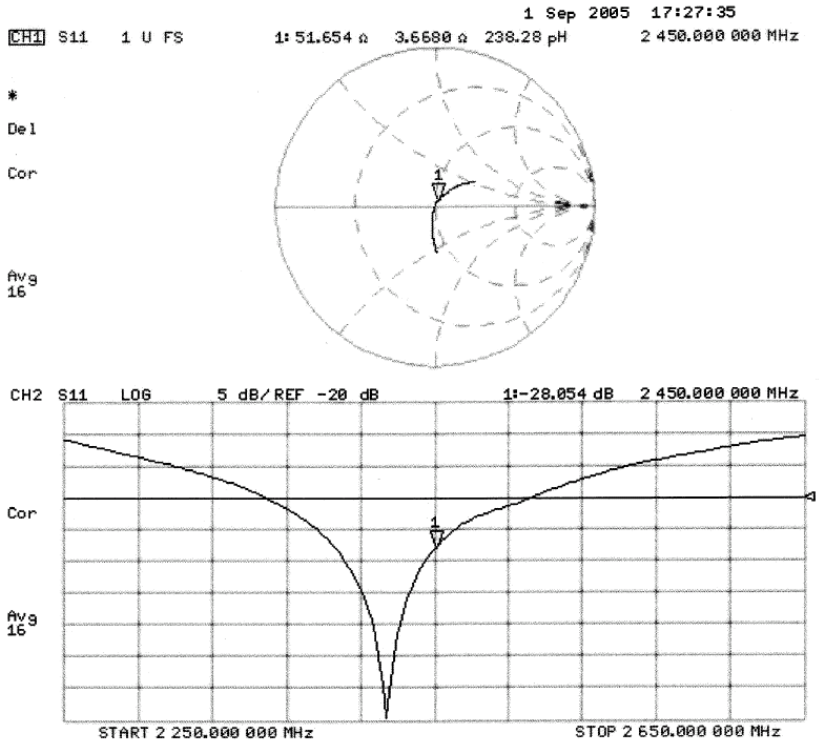
Pin = 250 mW; d = 10 mm/Area Scan (41x61x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 16.7 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.8 V/m; Power Drift = 0.035 dB
Peak SAR (extrapolated) = 27.1 W/kg
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.19 mW/g
Maximum value of SAR (measured) = 15.0 mW/g



0 dB = 15.0mW/g

Impedance Measurement Plot for Head TSL



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DASY4 Validation Report for Body TSL

Date/Time: 02.09.2005 12:04:42

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN713

Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL 2450;
Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

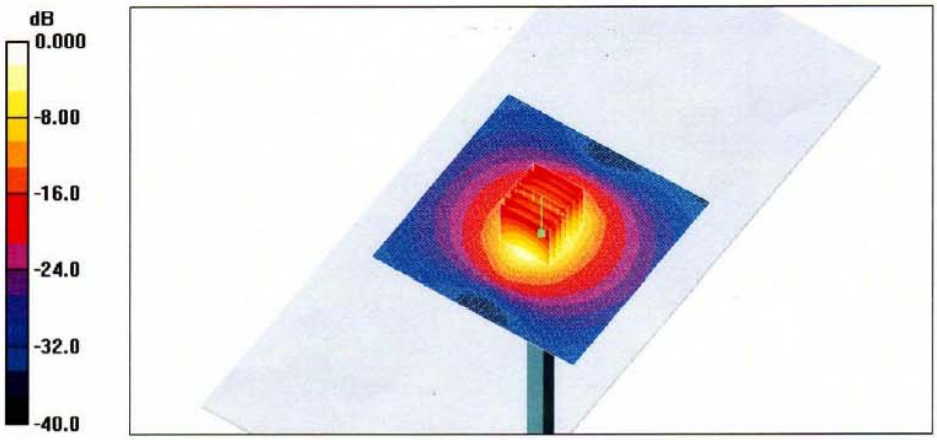
- Probe: ES3DV2 - SN3025; ConvF(4.13, 4.13, 4.13); Calibrated: 29.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.07.2004
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA
- Measurement SW: DASY4, V4.6 Build 13; Postprocessing SW: SEMCAD, V1.8 Build 156

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 15.3 mW/g

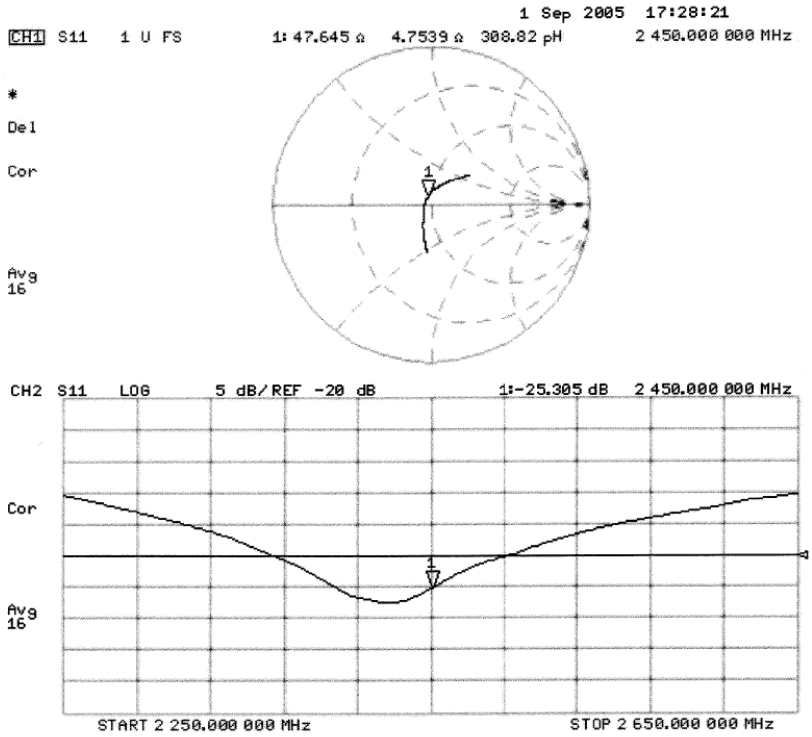
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.3 V/m; Power Drift = -0.062 dB
Peak SAR (extrapolated) = 27.6 W/kg
SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.25 mW/g
Maximum value of SAR (measured) = 15.3 mW/g



0 dB = 15.3mW/g

Impedance Measurement Plot for Body TSL



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