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SAR Test Report

Report Number: M080404_CERT_533AN_HMW_SAR_2.4

Test Sample: Portable TABLET Computer
Radio Modules: WLAN 533AN_HMW & Bluetooth
EYSMJCS
Model Number: T5010
Tested For: Fujitsu Australia Pty Ltd
FCC ID: EJE-WB0058
IC: 337J-WB0058
Date of Issue: 19th June 2008

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SAR TEST REPORT

Report Number: **M080404_CERT_533AN_HMW_SAR_2.4**

FCC ID: **EJE-WB0058**

IC: **337J-WB0058**

1.0 GENERAL INFORMATION

Test Sample: Portable TABLET Computer
Model Name: T5010
Radio Modules: WLAN 533AN_HMW & Bluetooth EYSMJCS
Interface Type: Mini-PCI Module
Device Category: Portable Transmitter
Test Device: Pre-Production Unit
FCC ID: EJE-WB0058
IC: 337J-WB0058
RF exposure Category: General Population/Uncontrolled

Manufacturer: Fujitsu Limited

Test Standard/s:

1. Evaluating Compliance with FCC Guidelines For Human Exposure to Radiofrequency Electromagnetic Fields Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01)
2. Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) RSS-102 Issue 2 November 2005

Statement Of Compliance: The Fujitsu TABLET Computer T5010 with Wireless LAN model 533AN_HMW and Bluetooth module EYSMJCS complied* with the FCC General public/uncontrolled RF exposure limits of 1.6mW/g per requirements of 47CFR2.1093(d). It also complied with IC RSS-102 requirements.
*. Refer to compliance statement section 9.

Test Dates: 4th – 5th April 2008

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Peter Jakubiec



SAR TEST REPORT
Portable TABLET Computer
Model: T5010
Report Number: M080404_CERT_533AN_HMW_SAR_2.4

2.0 INTRODUCTION

Testing was performed on the Fujitsu TABLET PC, Model: T5010 with INTEL Mini-PCI Wireless LAN Module (SHIRLEY PEAK 802.11a/b/g/n), Model: 533AN_HMW & TAIYO YUDEN Bluetooth Module, Model: EYSMJCS. The SHIRLEY PEAK module is an OEM product. The Mini-PCI Wireless LAN (WLAN) was tested in the dedicated host – LIFEBOOK T SERIES, Model T5010.

The measurement test results mentioned hereon only apply to the 2450MHz frequency band; an additional report titled "M080404_CERT_533AN_HMW_SAR_5.6" applies to the 5GHz range.

3.0 SAMPLE TECHNICAL INFORMATION

(Information supplied by the client)

3.1 EUT (WLAN) Details

Transmitter:	Half Mini-Card Wireless LAN Module
Wireless Module:	WiFi Link 5300(Shirley Peak) (11a/b/g/n)
Model Number:	533AN_HMW
Manufacturer:	Intel Corporation
Modulation Type:	DSSS for 802.11b OFDM for 802.11g OFDM for 802.11a OFDM for 802.11n
5GHz (802.11a/n)	BPSK, QPSK, 16QAM, 64QAM
2.4GHz (802.11b/g/n)	CCK, DQPSK, DBPSK, 16QAM, 64QAM
Maximum Data Rate:	802.11b = 11 Mbps, 802.11g and 802.11a = 54 Mbps 802.11n = 450 Mbps
Frequency Range:	2.412–2.462 GHz for 11b/g/n 5.18-5.32 GHz, 5.500-5.700 GHz and 5.745-5.825 GHz for 11a/n
Number of Channels:	11 channels for 11b/g/n 24 channels for 11a/n with 20MHz Bandwidth 18 channels for 11n with 40MHz Bandwidth
Antenna Types:	Nissei Electric Inverted F Antenna(1 st , 2 nd), Yokowa Monopole(3 rd) Location: Top edge of LCD screen(1 st , 2 nd), right side of hinge (3 rd)
Power Supply:	3.3 VDC from PCI bus



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Channels and Output power setting:

Channel and Mode	Frequency MHz	Average Output Power dBm
802.11b/g/n mode		
Channels 1	2412	12.5
Channels 6	2437	16.5
Channels 11	2462	11.5
802.11a/n mode with 20MHz Bandwidth		
Channels 36	5180	16.5
Channels 52	5260	
Channels 64	5320	
Channels 149	5745	
Channels 157	5785	
Channels 165	5825	
Channels 100	5500	
Channels 120	5600	
Channels 140	5700	
802.11n mode with 40MHz Bandwidth		
Channels 38	5190	13.5
Channels 46	5270	16.5
Channels 62	5310	14.0
Channels 151	5755	16.5
Channels 159	5795	

NOTE: For 5GHz SAR results refer to report titled "M080404_CERT_533AN_HMW_SAR_5.6".

3.2 EUT (Bluetooth) Details

Transmitter:	Bluetooth
Model Number:	EYSMJCS
Manufacturer:	TAIYO YUDEN
Network Standard:	Bluetooth™ RF Test Specification
Modulation Type:	Frequency Hopping Spread Spectrum (FHSS)
Frequency Range:	2402 MHz to 2480 MHz
Number of Channels:	79
Carrier Spacing:	1.0 MHz
Antenna Types:	Included BT module
Location:	Left side of hinge
Max. Output Power:	4 dBm
Reference Oscillator:	16 MHz (Built-in)

Frequency allocation:

Channel Number	Frequency (MHz)	Bluetooth Utility power setting
1	2402	Power (Ext, Int) = 0, 96
2	2403	
-	-	
39	2440	
40	2441	
41	2442	
-	-	
78	2479	
79	2480	



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3.3 EUT (Notebook PC) Details

Host notebook :	LifeBook T series
Model Name:	T5010
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Core2 Duo T9600 2.8GHz
LCD	13.3"WXGA LED
Wired LAN:	Intel 82567LM : 10 Base-T/100 Base-TX/1000Base-T
Modem:	Agere MDC1.5 modem Model: D40
Port Replicator Model:	FPCPR85
AC Adapter Model:	SEC100P2-19.0(Sanken) / SEC100P3-19.0(Sanken, 3pin) / ADP-80NB A(Delta) / SED100P2-19.0(Sanken)
Voltage:	19 V
Current Specs:	4.22A
Watts:	80W
Radio Modules:	WLAN (Shirley Peak IEEE802.11a/b/g/n, 3x3)
WLAN Model Number:	533AN_HMW
WLAN Manufacturer:	Intel Corp.
Interface Type:	Half Mini-Card Wireless LAN Module
Radio Modules:	Bluetooth module
Model Number:	EYSMJCS
Manufacturer:	TAIYO YUDEN
Interface Type:	USB

3.4 Test sample Accessories

3.4.1 Battery Types

One type of Fujitsu Lithium Ion Battery is used to power the Portable TABLET Computer Wireless LAN Model: 533AN_HMW. SAR measurements were performed with the battery as shown below.

Standard Battery

Model	FPCBP155
V/mAh	10.8V/5200mAh
Cell No.	6



4.0 TEST SIGNAL, FREQUENCY AND OUTPUT POWER

INTEL's CRTU test tool was used to configure the WLAN for testing. The Portable Tablet Computer Wireless LAN had a total of 11 channels (USA model) within the 2412 to 2462 MHz frequency band and 17 channels within the frequency range 5180 – 5825 MHz. In The frequency range 2412 MHz to 2462 MHz the device operates in 2 modes, OFDM and DSSS. Within the 5180 – 5825 MHz frequency range the device operates in OFDM mode only. For the SAR measurements the device was operating in continuous transmit mode using programming codes supplied by Fujitsu.

The test results mentioned in this report only apply to the 2450MHz frequency range. An additional report titled "M080404_CERT_533AN_HMW_SAR_5.6" is specific to the 5GHz range.

The WLAN modules can be configured in a number of different data rates. It was found that the highest source based time averaged power was measured when using the lowest data rates available in each mode. This lowest data rate corresponds to 6Mbps in OFDM mode and 1Mbps in DSSS mode.

The frequency span of the 2450 MHz range Band was more than 10MHz consequently; the SAR levels of the test sample were measured for lowest, centre and highest channels in the applicable modes. The EUT is capable of using two antennas transmitting simultaneously (HT8 DATA mode) the power level is 3dB lower (50%) than if a single antenna was transmitting, and also the EUT is capable of using three antennas transmitting simultaneously (HT16 DATA mode) the power level is 5dB lower than if a single antenna was transmitting. There were no wires or other connections to the Portable TABLET Computer during the SAR measurements.

4.1 Battery Status

The device battery was fully charged prior to commencement of measurement. Each SAR test was completed within 30 minutes. The battery condition was monitored by measuring the RF field at a defined position inside the phantom before the commencement of each test and again after the completion of the test. It was not possible to perform conducted power measurements at the output of the device, at the beginning and end of each scan due to lack of a suitable antenna port. The uncertainty associated with the power drift was less than 12% and was assessed in the uncertainty budget.



5.0 DETAILS OF TEST LABORATORY

5.1 Location

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5.2 Accreditations

EMC Technologies Pty. Ltd. is accredited by the National Association of Testing Authorities, Australia (NATA).
NATA Accredited Laboratory Number: 5292

EMC Technologies Pty Ltd is NATA accredited for the following standards:

AS/NZS 2772.1:	RF and microwave radiation hazard measurement
ACA:	Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2003
FCC:	Guidelines for Human Exposure to RF Electromagnetic Field OET65C 01/01
EN 50360: 2001	Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)
EN 50361: 2001	Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300MHz – 3GHz)
IEEE 1528: 2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.

Refer to NATA website www.nata.asn.au for the full scope of accreditation.

5.3 Environmental Factors

The measurements were performed in a shielded room with no background RF signals. The temperature in the laboratory was controlled to within $21 \pm 1^\circ\text{C}$, the humidity was in the range 44% to 51%. The liquid parameters are measured daily prior to the commencement of each test. Tests were performed to check that reflections within the environment did not influence the SAR measurements. The noise floor of the DASY4 SAR measurement system using the SN1377 probe was less than $5\mu\text{V}$ in both air and liquid mediums.



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6.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM

Applicable Head Configurations	: None
Applicable Body Configurations	: Tablet Position
	: Laps On Position
	: Edge On Bottom Position
	: Edge On Side Position

6.1 Probe Positioning System

The measurements were performed with the state-of-the-art automated near-field scanning system **DASY4 V4.7 Build 53** from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision 6-axis robot (working range greater than 1.1m), which positions the SAR measurement probes with a positional repeatability of better than ± 0.02 mm. The DASY4 fully complies with the OET65 C (01-01), IEEE 1528 and EN50361 SAR measurement requirements.

6.2 E-Field Probe Type and Performance

The SAR measurements were conducted with SPEAG dosimetric probe ET3DV6 Serial: 1377 (2.45 GHz) designed in the classical triangular configuration and optimised for dosimetric evaluation. The probes have been calibrated and found to be accurate to better than ± 0.25 dB. The probe is suitable for measurements close to material discontinuity at the surface of the phantom. The sensors of the probe are directly loaded with Schottky diodes and connected via highly resistive lines (length = 300 mm) to the data acquisition unit.

6.3 Data Acquisition Electronics

The data acquisition electronics (DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. The input impedance of the DAE3 box is 200 M Ω ; the inputs are symmetrical and floating. Common mode rejection is above 80dB. Transmission to the PC-card is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The mechanical probe-mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.



6.4 Validation

6.4.1 Validation Results @ 2450MHz

The following tables lists the dielectric properties of the tissue simulating liquid measured prior to SAR validation. The results of the validation are listed in columns 4 and 5. The forward power into the reference dipole for SAR validation was adjusted to 250 mW.

Table: Validation Results (Dipole: SPEAG D2450V2 SN: 724)

1. Validation Date	2. ϵ_r (measured)	3. σ (mho/m) (measured)	4. Measured SAR 1g (mW/g)	5. Measured SAR 10g (mW/g)
4 th April 2008	39.2	1.74	13.7	6.51
5 th April 2008	39.7	1.79	13.8	6.54

6.4.2 Deviation from reference validation values

The reference SAR values are derived using a reference dipole and flat section of the SAM phantom suitable for a centre frequency of 2450MHz. These reference SAR values are obtained from the IEEE Std 1528-2003 and are normalized to 1W.

The SPEAG calibration reference SAR value is the SAR validation result obtained in a specific dielectric liquid using the validation dipole (D2450V2) during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in table below (2450MHz) below.

Table: Deviation from reference validation values @ 2450MHz

Frequency and Date	Measured SAR 1g (mW/g)	Measured SAR 1g (Normalized to 1W)	SPEAG Calibration reference SAR Value 1g (mW/g)	Deviation From SPEAG Reference (1g)	IEEE Std 1528 reference SAR value 1g (mW/g)	Deviation From IEEE (1g)
2450MHz 4 th April 2008	13.7	54.80	53.3	2.81	52.4	4.58
2450MHz 5 th April 2008	13.8	55.20	53.3	3.56	52.4	5.34

NOTE: All reference validation values are referenced to 1W input power.



6.4.3 Liquid Depth 15cm

During the SAR measurement process the liquid level was maintained to a level of 15cm with a tolerance of 0.5cm.



Photo of liquid Depth in Flat Phantom



6.5 Phantom Properties (Size, Shape, Shell Thickness)

The phantom used during the validations was the SAM Phantom model: TP - 1260 from SPEAG. It is a phantom with a single thickness of 2 mm and was filled with the required tissue simulating liquid. The SAM phantom support structures were all non-metallic and spaced more than one device width away in transverse directions.

For SAR testing in the body worn positions an AndreT Flat phantom P 10.1 was used. The phantom thickness is 2.0mm \pm 0.2 mm and was filled with the required tissue simulating liquid. Below table provides a summary of the measured phantom properties.

Table: Phantom Properties (300MHz-2500MHz)

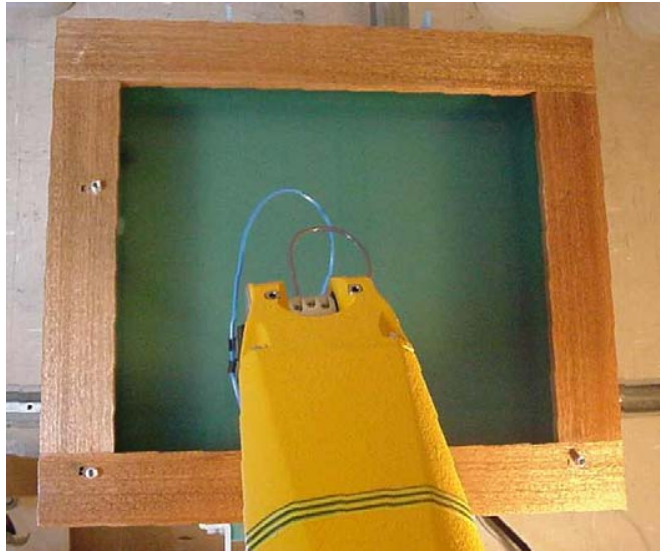
Phantom Properties	Required	Measured
Thickness of flat section	2.0mm \pm 0.2mm (bottom section)	2.12-2.20mm
Dielectric Constant	<5.0	4.603 @ 300MHz (worst-case frequency)
Loss Tangent	<0.05	0.0379 @ 2500MHz (worst-case frequency)

Depth of Phantom 200mm
Length of Flat Section 620mm
Width of Flat Section 540mm

P 10.1 Flat Phantom



P 10.1 Flat Phantom



6.6 Tissue Material Properties

The dielectric parameters of the brain simulating liquid were measured prior to SAR assessment using the HP85070A dielectric probe kit and HP8753ES Network Analyser. The actual dielectric parameters are shown in the following table.

Table: Measured Brain Simulating Liquid Dielectric Values for Validations

Frequency Band	ϵ_r (measured range)	ϵ_r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m ³
2450 MHz Brain	39.2 – 39.7	39.2 \pm 5% (37.2 to 41.2)	1.74 – 1.79	1.80 \pm 5% (1.71 to 1.89)	1000

NOTE: The brain liquid parameters were within the required tolerances of \pm 5%.

Table: Measured Body Simulating Liquid Dielectric Values

Frequency Band	ϵ_r (measured range)	ϵ_r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m ³
2412 MHz Muscle	51.7 – 51.8	52.7 \pm 5% (50.1 to 55.3)	1.87 – 1.90	1.95 \pm 5% (1.85 to 2.05)	1000
2437 MHz Muscle	51.5 – 51.6	52.7 \pm 5% (50.1 to 55.3)	1.91 – 1.93	1.95 \pm 5% (1.85 to 2.05)	1000
2462 MHz Muscle	51.5	52.7 \pm 5% (50.1 to 55.3)	1.95 – 1.97	1.95 \pm 5% (1.85 to 2.05)	1000

NOTE: The brain and muscle liquid parameters were within the required tolerances of \pm 5%.

6.6.1 Liquid Temperature and Humidity

The humidity and dielectric/ambient temperatures were recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than $|2|^\circ\text{C}$.

Table: Temperature and Humidity recorded for each day

Date	Ambient Temperature ($^\circ\text{C}$)	Liquid Temperature ($^\circ\text{C}$)	Humidity (%)
4 th April 2008	21.1	21.3	44.0
5 th April 2008	20.8	20.7	51.0

6.7 Simulated Tissue Composition Used for SAR Test

The tissue simulating liquids are created prior to the SAR evaluation and often require slight modification each day to obtain the correct dielectric parameters.

Table: Tissue Type: Brain @ 2450MHz

Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	62.7
Salt	0.5
Triton X-100	36.8

Table: Tissue Type: Muscle @ 2450MHz

Volume of Liquid: 60 Litres

Approximate Composition	% By Weight
Distilled Water	73.2
Salt	0.04
DGBE	26.7

*Refer "OET Bulletin 65 97/01 P38"



6.8 Device Holder for Laptops and P 10.1 Phantom

A low loss clamp was used to position the TABLET underneath the phantom surface. Small pieces of foam were then used to press the TABLET flush against the phantom surface.

Refer to Appendix A for photographs of device positioning

7.0 SAR MEASUREMENT PROCEDURE USING DASY4

The SAR evaluation was performed with the SPEAG DASY4 system. A summary of the procedure follows:

- a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test, and then again at the end of the test.
- b) The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 3.9 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 15 mm x 15 mm. The actual Area Scan has dimensions of 120mm x 150mm surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation.
- c) Around this point, a volume of 30 mm x 30 mm x 30 mm is assessed by measuring 7 x 7 x 7 points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:
 - (i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.
 - (ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the "Not a knot"- condition (in x, y and z-direction). The volume is integrated with the trapezoidal – algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.
 - (iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.
 - (iv) The SAR value at the same location as in Step (a) is again measured to evaluate the actual power drift.



8.0 MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE Std 1528-2003 for both Handset SAR tests and Validation uncertainty. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95% confidence level) must be less than 30%.

Table: Uncertainty Budget for DASY4 V4.7 Build 53 – EUT SAR test 2450MHz

a	b	c	d	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (%)	Prob. Dist.	Div.	C _i (1g)	C _i (10g)	1g u _i (%)	10g u _i (%)	v _i
Measurement System									
Probe Calibration (k=1) (numerical calibration)	E.2.1	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1	N	1	1	1	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	4.32	R	1.73	1	1	2.5	2.5	∞
RF Ambient Conditions	E.6.1	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	1.61	N	1	1	1	1.6	1.6	11
Device Holder Uncertainty	E.4.1	3.34	N	1	1	1	3.3	3.3	7
Output Power Variation – SAR Drift Measurement	6.6.2	11.08	R	1.73	1	1	6.4	6.4	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	E.3.2	5	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	10	N	1	0.64	0.43	6.4	4.3	5
Liquid Permittivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	E.3.3	5	N	1	0.6	0.49	3.0	2.5	5
Combined standard Uncertainty			RSS				13.3	12.2	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				26.6	24.39	

Estimated total measurement uncertainty for the DASY4 measurement system was $\pm 13.3\%$. The extended uncertainty (K = 2) was assessed to be $\pm 26.6\%$ based on 95% confidence level. The uncertainty is not added to the measurement result.



Table: Uncertainty Budget for DASY4 V4.7 Build 53 – Validation 2450MHz

a	b	c	D	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (6%)	Prob. Dist.	Div.	C _i (1g)	C _i (10g)	1g u _i (6%)	10g u _i (6%)	v _i
Measurement System									
Probe Calibration (k=1) (standard calibration)	E.2.1	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Hemispherical Isotropy	E.2.2	0	R	1.73	1	1	0.0	0.0	∞
Boundary Effect	E.2.3	1	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1	N	1	1	1	1.0	1.0	∞
Response Time	E.2.7	0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related									
Dipole Axis to Liquid Surface		2	R	1.73	1	1	1.2	1.2	∞
Power Drift		4.7	R	1.73	1	1	2.7	2.7	∞
				□					□
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.43	1.7	1.2	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	2.5	N	1.73	0.6	0.43	0.9	0.6	5
Liquid Permittivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	E.3.3	2.5	N	1.73	0.6	0.49	0.9	0.7	5
Combined standard Uncertainty			RSS				8.0	7.8	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				16.0	15.63	

Estimated total measurement uncertainty for the DASY4 measurement system was $\pm 8.0\%$. The extended uncertainty ($K = 2$) was assessed to be $\pm 16.0\%$ based on 95% confidence level. The uncertainty is not added to the Validation measurement result.



9.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table: SPEAG DASY4 Version V4.7 Build 53

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX90BL	N/A	Not applicable	✓
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	✓
SAM Phantom	SPEAG	N/A	1260	Not applicable	✓
SAM Phantom	SPEAG	N/A	1060	Not applicable	
Flat Phantom	AndreT	10.1	P 10.1	Not Applicable	✓
Flat Phantom	AndreT	9.1	P 9.1	Not Applicable	
Flat Phantom	SPEAG	PO1A 6mm	1003	Not Applicable	
Data Acquisition Electronics	SPEAG	DAE3 V1	359	03-July-2008	
Data Acquisition Electronics	SPEAG	DAE3 V1	442	26-Feb-09	✓
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	
Probe E-Field	SPEAG	ET3DV6	1380	18-Dec-2008	
Probe E-Field	SPEAG	ET3DV6	1377	09-July-2008	✓
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	
Probe E-Field	SPEAG	EX3DV4	3563	13-July-2008	
Antenna Dipole 300 MHz	SPEAG	D300V2	1005	14-Dec-2009	
Antenna Dipole 450 MHz	SPEAG	D450V2	1009	14-Dec-2008	
Antenna Dipole 900 MHz	SPEAG	D900V2	047	6-July-2008	
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	30-June-2008	
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	3-July-2008	
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	5-March-2009	
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	06-July-2008	
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	13-Dec-2008	✓
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	07-Dec-2009	
RF Amplifier	EIN	603L	N/A	Not applicable	
RF Amplifier	Mini-Circuits	ZHL-42	N/A	Not applicable	✓
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	Not applicable	
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	*In test	✓
RF Power Meter Dual	Hewlett Packard	437B	3125012786	30-May-2008	✓
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	30-May-2008	✓
RF Power Meter Dual	Gigatronics	8542B	1830125	11-May-2008	
RF Power Sensor	Gigatronics	80301A	1828805	11-May-2008	
RF Power Meter Dual	Hewlett Packard	435A	1733A05847	*In test	✓
RF Power Sensor	Hewlett Packard	8482A	2349A10114	*In test	✓
Network Analyser	Hewlett Packard	8714B	GB3510035	06-Sept-2008	
Network Analyser	Hewlett Packard	8753ES	JP39240130	02 Oct-2008	✓
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	*In test	
Dual Directional Coupler	NARDA	3022	75453	*In test	✓

* Calibrated during the test for the relevant parameters.



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10.0 OET BULLETIN 65 – SUPPLEMENT C TEST METHOD

Notebooks should be evaluated in normal use positions, typical for lap-held bottom-face only. However the number of positions will depend on the number of configurations the laptop can be operated in. The “LIFEBOOK T SERIES” can be used in either a conventional laptop position (see Appendix A1) or a Tablet configuration.

10.1.1 Lap Held Position

The device was suspended underneath the 2.00mm flat section of the AndreT Flat phantom P 10.1, with the base of the device pressed against the phantom. This orientation simulates the normal use of the device as a conventional notebook, with the PC being placed on the lap of a user.

10.1.2 “Tablet” Position Definition (0mm spacing)

The device was tested in the 2.00 mm flat section of the AndreT Flat phantom P 10.1 for the “Tablet” position. The Transceiver was placed at the bottom of the phantom and suspended in such way that the back of the device was touching the phantom. This device orientation simulates the PC’s normal use – being held on the lap of the user. A spacing of 0mm ensures that the SAR results are conservative and represent a worst-case position.

10.1.3 “Edge On” Position

The device was tested in the (2.00 mm) flat section of the AndreT phantom for the “Edge On” position. The Antenna edge of the Transceiver was placed underneath the flat section of the phantom and suspended until the edge touched the phantom. *Refer to Appendix A for photos of measurement positions.*



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10.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)

The device has a fixed antenna. Depending on the measured SAR level up to three test channels with the test sample operating at maximum power, as specified in section 4.0 were recorded. The following table represents the matrix used to determine what testing was required.

Table: Testing configurations

Phantom Configuration	*Device Mode	Antenna	Test Configurations		
			CHANNEL (LOW)	Channel (Middle)	Channel (High)
Laps On	DSSS 2.4GHz	C		X	
Tablet	DSSS 2.4GHz	A		X	
		B		X	
		C		X	
Edge On	OFDM 2.4GHz	A		X	
	DSSS 2.4GHz	A		X	
		B		X	
		C		X	

Legend

X	Testing Required in this configuration
	Testing required in this configuration only if SAR of middle channel is more than 3dB below the SAR limit or it is the worst case.

10.3 FCC RF Exposure Limits for Occupational/ Controlled Exposure

Spatial Peak SAR Limits For:

Partial-Body:	8.0 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	20.0 mW/g (averaged over 10g cube of tissue)

10.4 FCC RF Exposure Limits for Un-controlled/Non-occupational

Spatial Peak SAR Limits For:

Partial-Body:	1.6 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	4.0 mW/g (averaged over 10g cube of tissue)



11.0 SAR Measurement Results

The SAR values averaged over 1g tissue masses were determined for the sample device for all test configurations listed in section 7.2. A series of "Pre-Scans" were performed to determine the worst case modulation type.

11.1 2450MHz SAR Results

There are two modes of operation within the 2450MHz band, they include OFDM and DSSS modulations. Table below displays the SAR results.

Table: SAR MEASUREMENT RESULTS – DSSS Mode

Test Position	Plot No.	Ant	Bit rate Mode (Mbps)	Channel Bandwidth (MHz)	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Edge On Top	1	A	1	-	06	2437	Pre-Scan Only	-
Tablet	2	A	1	-	06	2437	0.041	0.315
	3	B	1	-	06	2437	0.046	-0.159
	4	C	1	-	06	2437	0.280	-0.112
Laps On	5	C	1	-	06	2437	0.287	-0.01
Edge On Bottom	6	C	1	-	01	2412	0.359	0.456
	7	C	1	-	06	2437	0.832	-0.343
	8	C	1	-	11	2462	0.242	-0.254
Edge On Side	9	B	1	-	06	2437	0.226	-0.409

NOTE: The measurement uncertainty of 26.6% for 2.45GHz was not added to the result.

Table: SAR MEASUREMENT RESULTS – OFDM Mode

Test Position	Plot No.	Ant A or B	Bit rate Mode (Mbps)	Channel Bandwidth (MHz)	Test Channel	Test Freq (MHz)	Measured 1g SAR Results (mW/g)	Measured Drift (dB)
Edge On Top	10	A	6	-	06	2437	Pre-Scan Only	-
	11	A	HT0	20	06	2437	Pre-Scan Only	-
	12	A	HT0	40	06	2437	Pre-Scan Only	-

NOTE: The measurement uncertainty of 26.6% for 2.45GHz was not added to the result.

The highest SAR level recorded in the 2450MHz band was 0.832 mW/g as evaluated in a 1g cube of averaging mass. This value was obtained in the Edge On Bottom position in DSSS mode, utilizing channel 6 (2437 MHz) and antenna C.



12.0 COMPLIANCE STATEMENT

The Fujitsu TABLET PC, Model: T5010 with INTEL Mini-PCI Wireless LAN Module (SHIRLEY PEAK 802.11a/b/g/n), Model: 533AN_HMW & TAIYO YUDEN Bluetooth Module, Model: EYSMJCS was found to comply with the FCC and RSS-102 SAR requirements.

The highest SAR level recorded was 0.832 mW/g for a 1g cube. This value was measured at 2437 MHz (channel 6) in the “Edge On Bottom” position in DSSS modulation mode at antenna C. This was below the limit of 1.6 mW/g for uncontrolled exposure, even taking into account the measurement uncertainty of 26.6 %.



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APPENDIX A1 TEST SAMPLE PHOTOGRAPHS

T5010 Host - Conventional Laptop Configuration



T5010 Host - Tablet Configuration



APPENDIX A2 TEST SAMPLE PHOTOGRAPHS

Model: 533AN_HMW – WLAN Module

Front



Back



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APPENDIX A3 TEST SAMPLE PHOTOGRAPHS

Battery 1



Battery 2

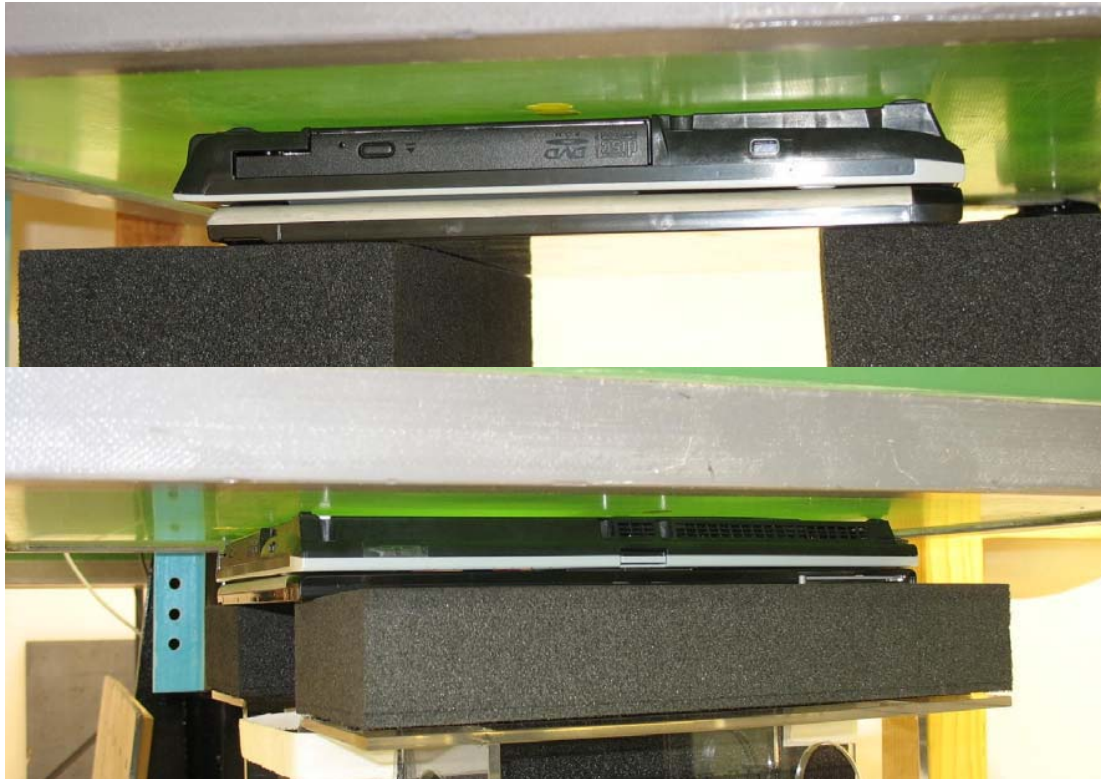


533AN_HMW inside the Fujitsu TABLET Computer



APPENDIX A4 TEST SETUP PHOTOGRAPHS

Tablet Position



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APPENDIX A5 TEST SETUP PHOTOGRAPHS

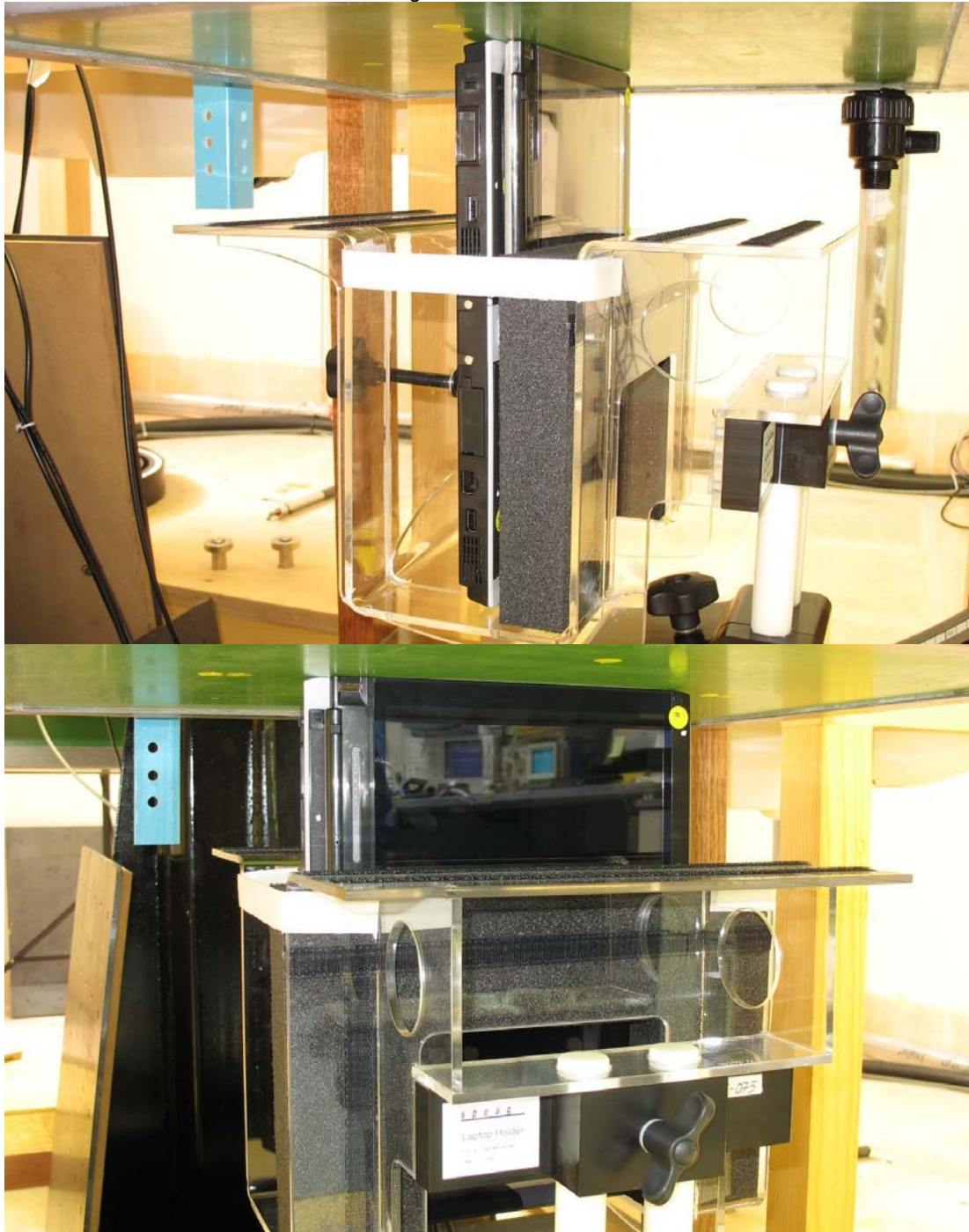
Edge On Top Position



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APPENDIX A6 TEST SETUP PHOTOGRAPHS

Edge On Side Position



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APPENDIX A7 TEST SETUP PHOTOGRAPHS

Edge On Bottom Position



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APPENDIX A8 TEST SETUP PHOTOGRAPHS

Laps On Position



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APPENDIX B PLOTS OF THE SAR MEASUREMENTS

Plots of the measured SAR distributions inside the phantom are given in this Appendix for all tested configurations. The spatial peak SAR values were assessed with the procedure described in this report.

Table: 2450 MHz DSSS Band SAR Measurement Plot Numbers

Test Position	Plot No.	Ant	Bit rate Mode (Mbps)	Channel Bandwidth (MHz)	Test Channel
*Edge On Top	1	A	1	-	06
Tablet	2	A	1	-	06
	3	B	1	-	06
	4	C	1	-	06
Z-Axis graphs for Plots 1 to 4					
Laps On	5	C	1	-	06
Edge On Bottom	6	C	1	-	01
	7	C	1	-	06
	8	C	1	-	11
Z-Axis graphs for Plots 5 to 8					
Edge On Side	9	B	1	-	06

Table: 2450 MHz OFDM Band SAR Measurement Plot Numbers

Test Position	Plot No.	Ant	Bit rate Mode (Mbps)	Channel Bandwidth (MHz)	Test Channel
*Edge On Top	10	A	6	-	06
	11	A	HT0	20	06
	12	A	HT0	40	06
Z-Axis graphs for Plots 9 to 12					

Table: 2450MHz Validation Plot

Plot 13	4 th April 2008 Validation 2450 MHz
Plot 14	5 th April 2008 Validation 2450 MHz
Z-Axis graphs for Plots 13 to 14	



Test Date: 4 April 2008

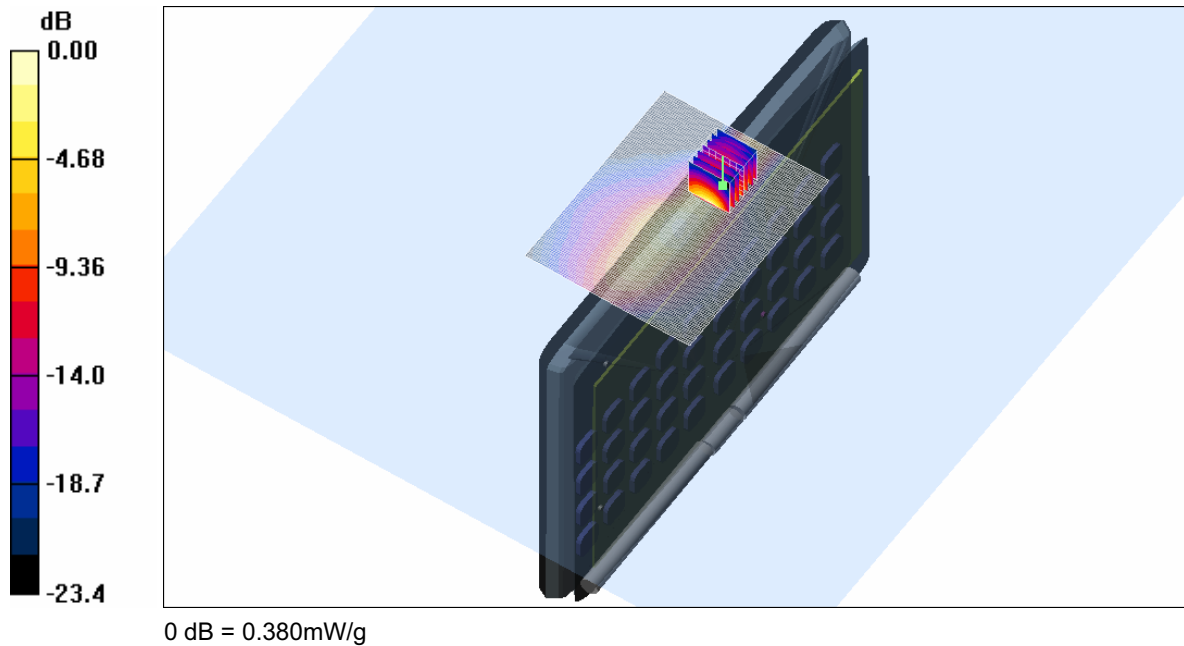
File Name: Edge On Top DSSS 2450 MHz Seneca Antenna A Bluetooth Off 04-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

- * Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.9138$ mho/m, $\epsilon_r = 51.6461$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.354 mW/g

Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.5 V/m; Power Drift = -0.212 dB
Peak SAR (extrapolated) = 0.745 W/kg
SAR(1 g) = 0.322 mW/g; SAR(10 g) = 0.147 mW/g
Maximum value of SAR (measured) = 0.380 mW/g



SAR MEASUREMENT PLOT 1

Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 5 April 2008

File Name: Tablet DSSS 2450 MHz Seneca Antenna A Bluetooth Off 05-08.da4

DUT: **Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224**

* Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.93445$ mho/m, $\epsilon_r = 51.5839$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.041 mW/g

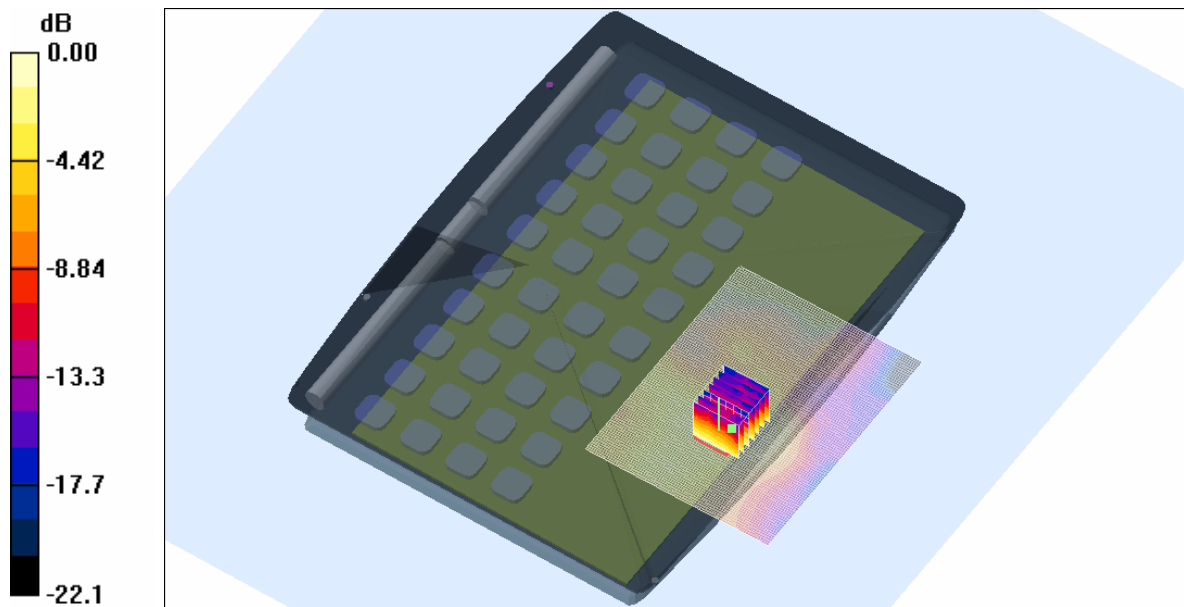
Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.49 V/m; Power Drift = 0.315 dB

Peak SAR (extrapolated) = 0.080 W/kg

SAR(1 g) = 0.041 mW/g; SAR(10 g) = 0.023 mW/g

Maximum value of SAR (measured) = 0.043 mW/g



0 dB = 0.043mW/g

SAR MEASUREMENT PLOT 2

Ambient Temperature
Liquid Temperature
Humidity

20.8 Degrees Celsius
20.7 Degrees Celsius
51.0 %



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Test Date: 5 April 2008

File Name: Tablet DSSS 2450 MHz Seneca Antenna B Bluetooth Off 05-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

* Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.93445$ mho/m, $\epsilon_r = 51.5839$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.050 mW/g

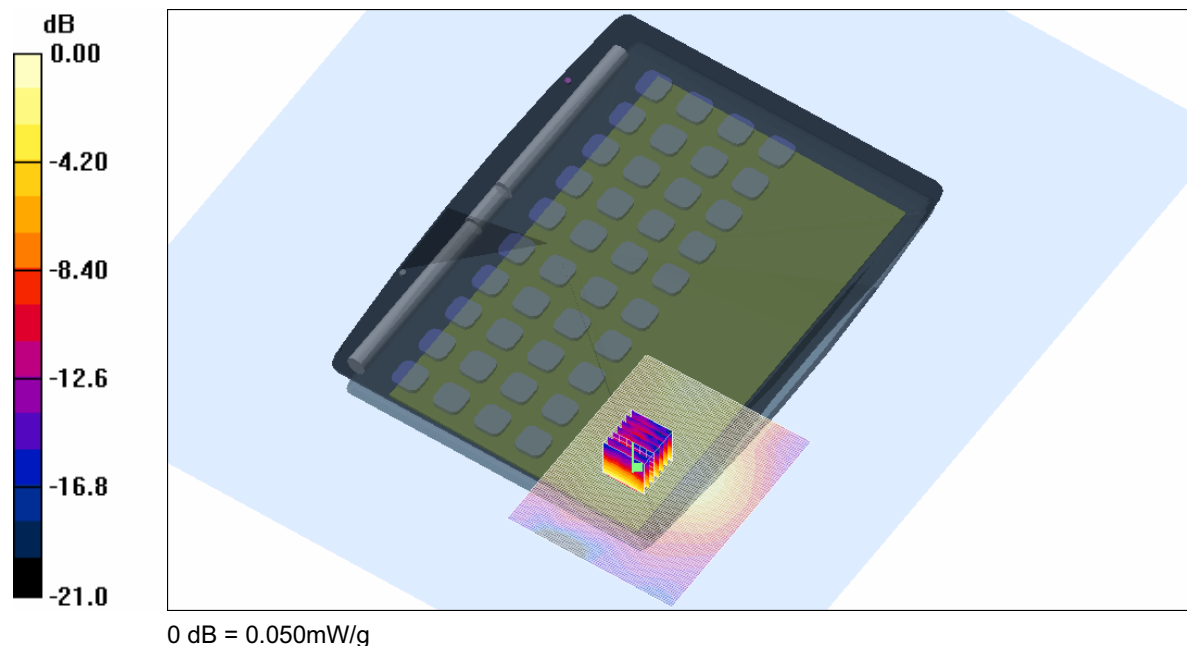
Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.87 V/m; Power Drift = -0.159 dB

Peak SAR (extrapolated) = 0.090 W/kg

SAR(1 g) = 0.046 mW/g; SAR(10 g) = 0.025 mW/g

Maximum value of SAR (measured) = 0.050 mW/g



SAR MEASUREMENT PLOT 3

Ambient Temperature
Liquid Temperature
Humidity

20.8 Degrees Celsius
20.7 Degrees Celsius
51.0 %



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Test Date: 4 April 2008

File Name: Tablet DSSS 2450 MHz Seneca Antenna C Bluetooth Off 04-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

* Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.9138$ mho/m, $\epsilon_r = 51.6461$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.279 mW/g

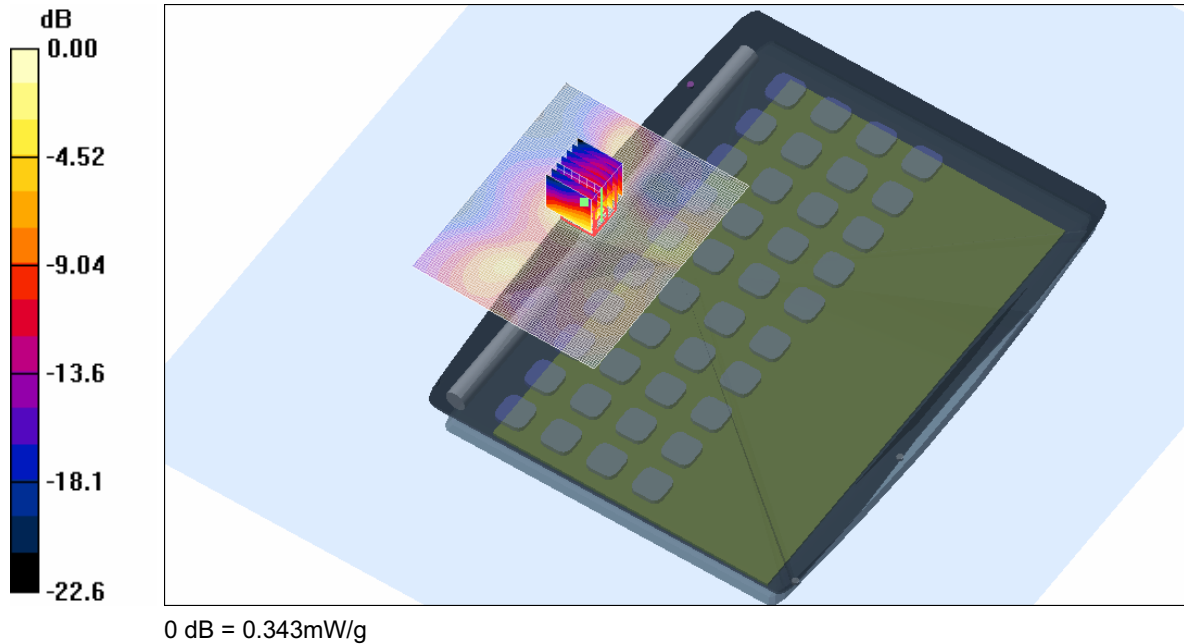
Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.23 V/m; Power Drift = -0.112 dB

Peak SAR (extrapolated) = 0.810 W/kg

SAR(1 g) = 0.280 mW/g; SAR(10 g) = 0.147 mW/g

Maximum value of SAR (measured) = 0.343 mW/g



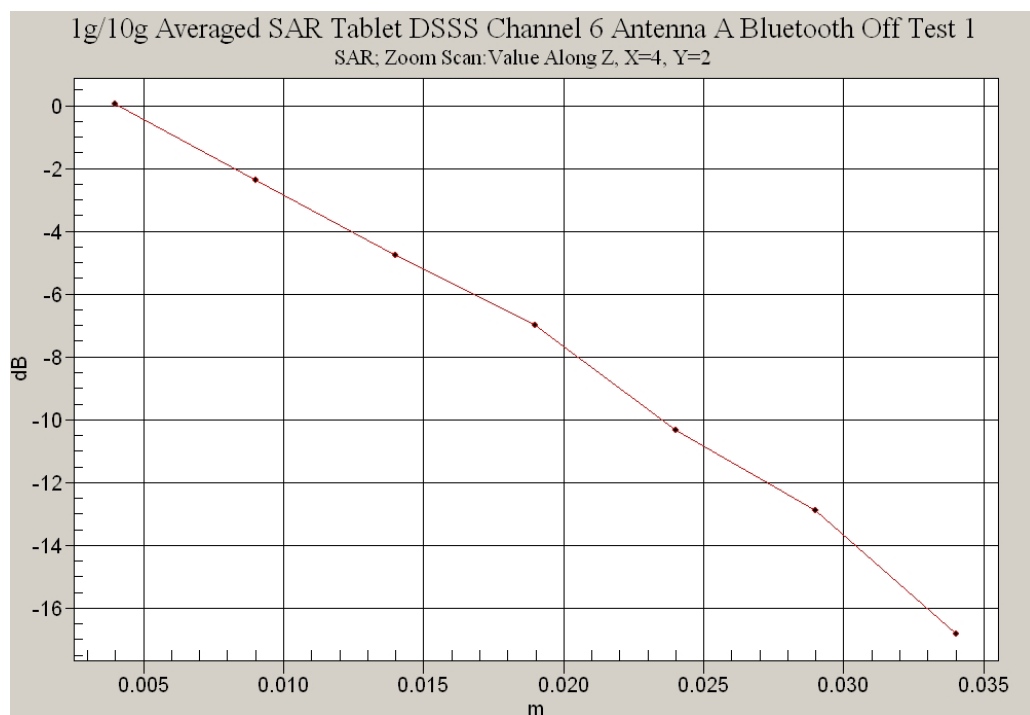
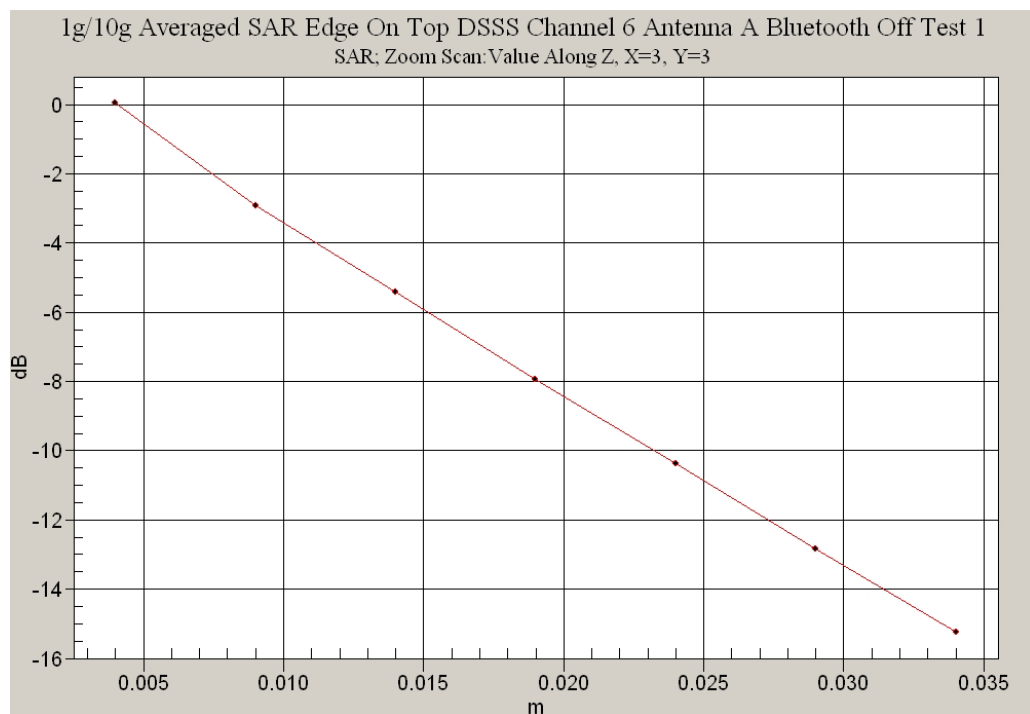
SAR MEASUREMENT PLOT 4

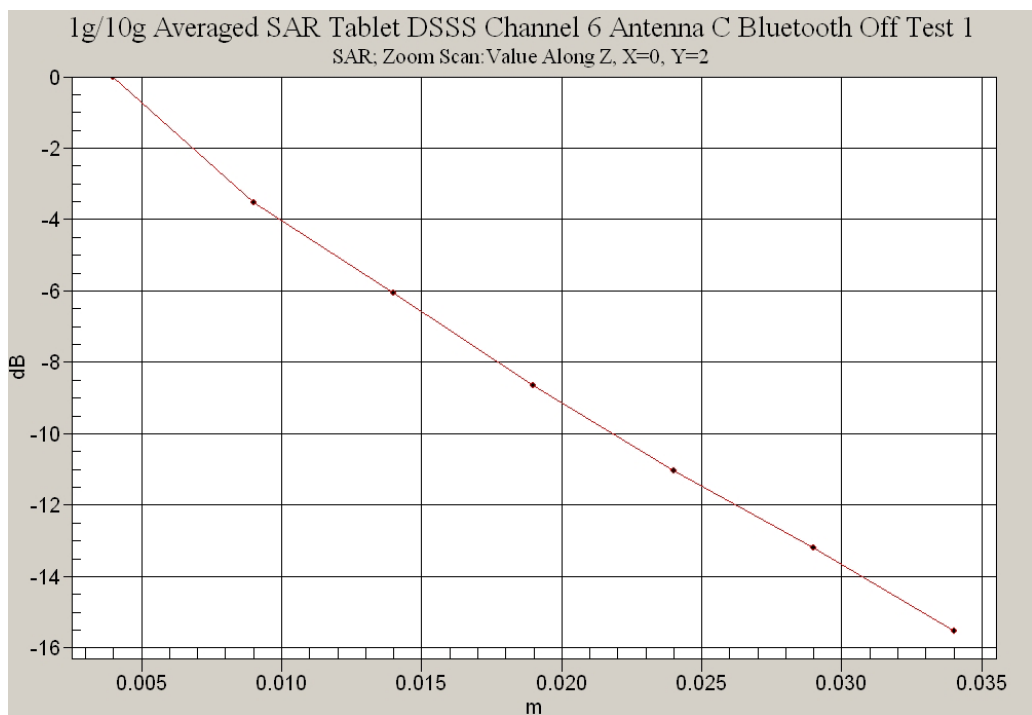
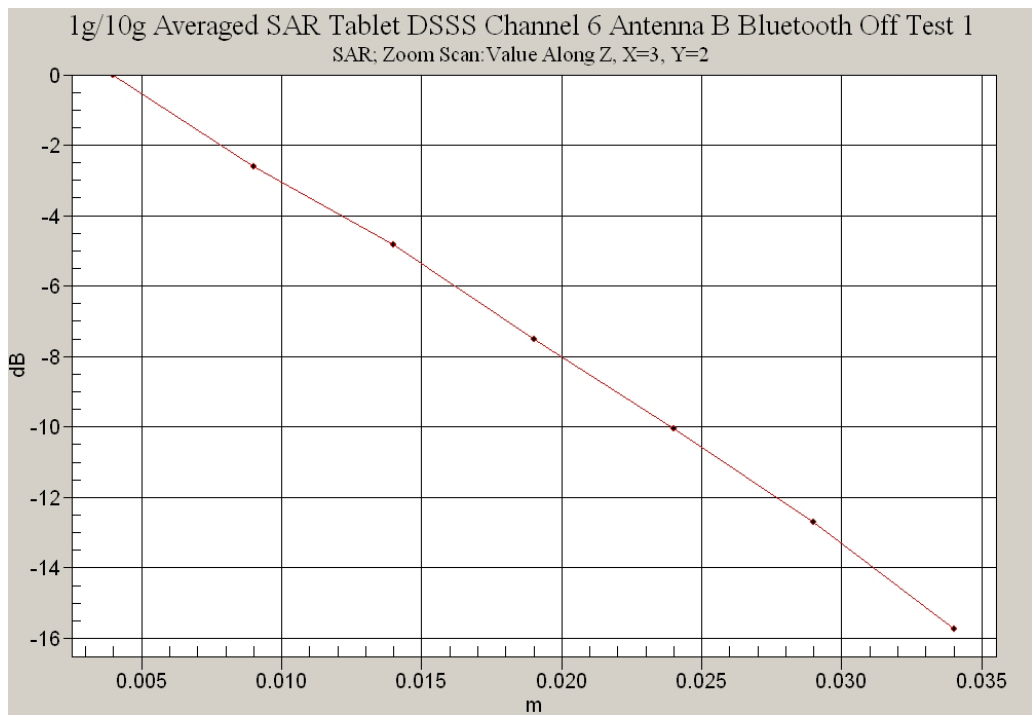
Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 4 April 2008

File Name: Laps On DSSS 2450 MHz Seneca Antenna C Bluetooth Off 04-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

* Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.9138$ mho/m, $\epsilon_r = 51.6461$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.321 mW/g

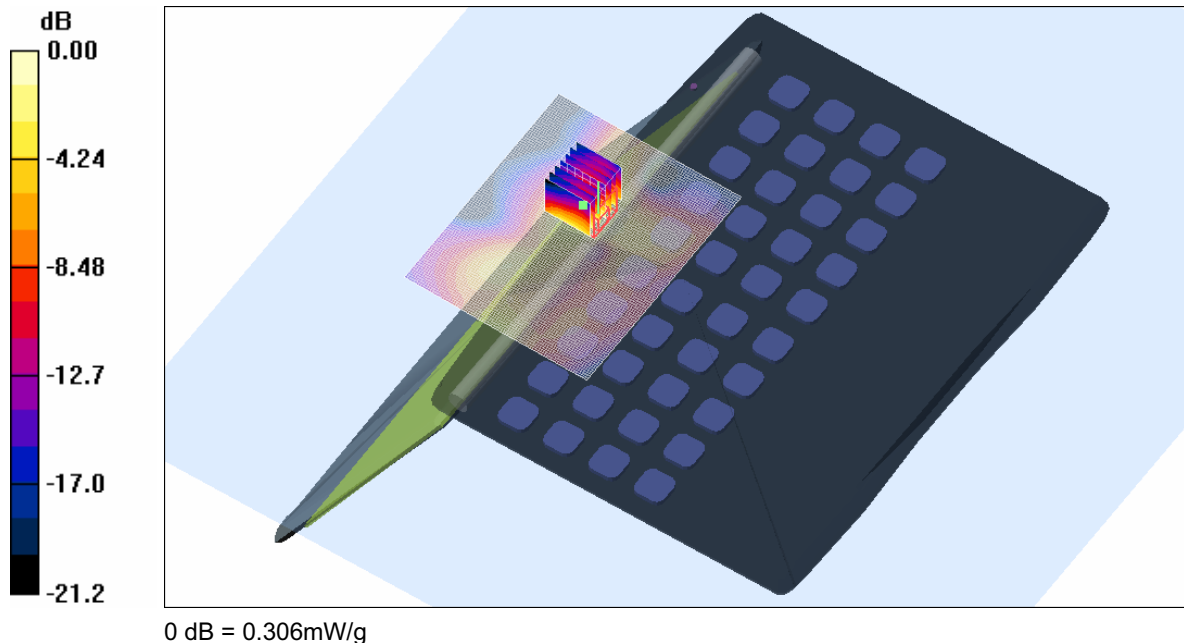
Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.06 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.733 W/kg

SAR(1 g) = 0.287 mW/g; SAR(10 g) = 0.152 mW/g

Maximum value of SAR (measured) = 0.306 mW/g



SAR MEASUREMENT PLOT 5

Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 4 April 2008

File Name: Edge On Bottom DSSS 2450 MHz Seneca Antenna C Bluetooth Off 04-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

* Communication System: DSSS 2450 MHz; Frequency: 2412 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.87341$ mho/m, $\epsilon_r = 51.787$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 1 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.438 mW/g

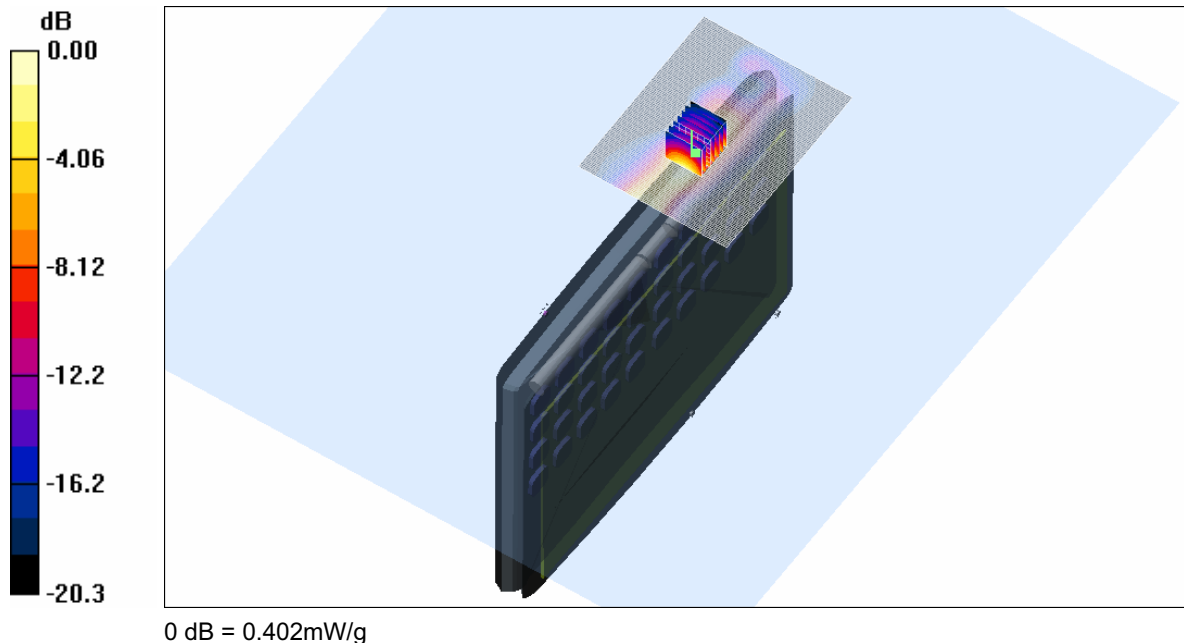
Channel 1 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.2 V/m; Power Drift = 0.456 dB

Peak SAR (extrapolated) = 0.814 W/kg

SAR(1 g) = 0.359 mW/g; SAR(10 g) = 0.177 mW/g

Maximum value of SAR (measured) = 0.402 mW/g



SAR MEASUREMENT PLOT 6

Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 4 April 2008

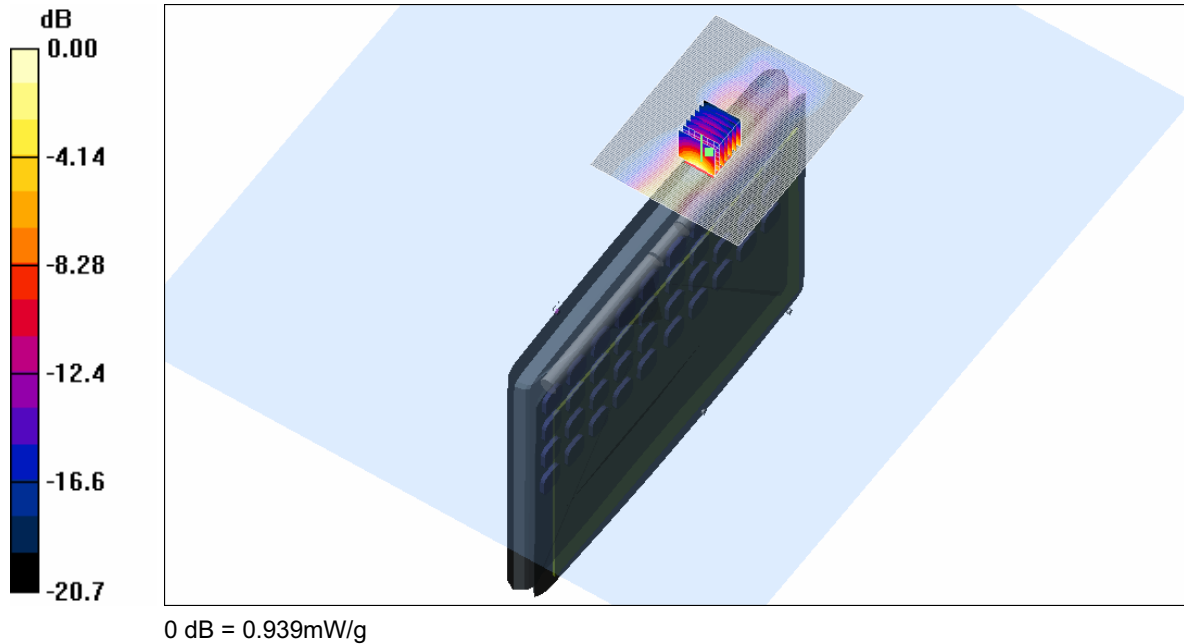
File Name: Edge On Bottom DSSS 2450 MHz Seneca Antenna C Bluetooth Off 04-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

- * Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.9138$ mho/m, $\epsilon_r = 51.6461$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.03 mW/g

Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.8 V/m; Power Drift = -0.343 dB
Peak SAR (extrapolated) = 1.91 W/kg
SAR(1 g) = 0.832 mW/g; SAR(10 g) = 0.414 mW/g
Maximum value of SAR (measured) = 0.939 mW/g



SAR MEASUREMENT PLOT 7

Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 4 April 2008

File Name: Edge On Bottom DSSS 2450 MHz Seneca Antenna C Bluetooth Off 04-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

- * Communication System: DSSS 2450 MHz; Frequency: 2462 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.94761$ mho/m, $\epsilon_r = 51.4879$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 11 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.285 mW/g

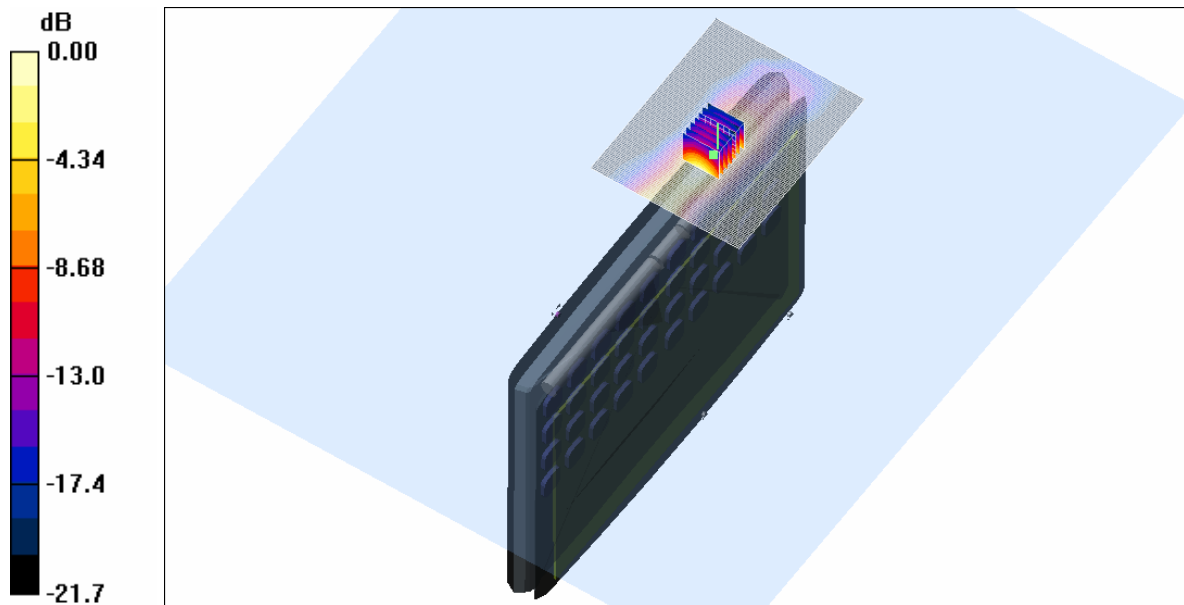
Channel 11 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.17 V/m; Power Drift = -0.254 dB

Peak SAR (extrapolated) = 0.588 W/kg

SAR(1 g) = 0.242 mW/g; SAR(10 g) = 0.115 mW/g

Maximum value of SAR (measured) = 0.272 mW/g



0 dB = 0.272mW/g

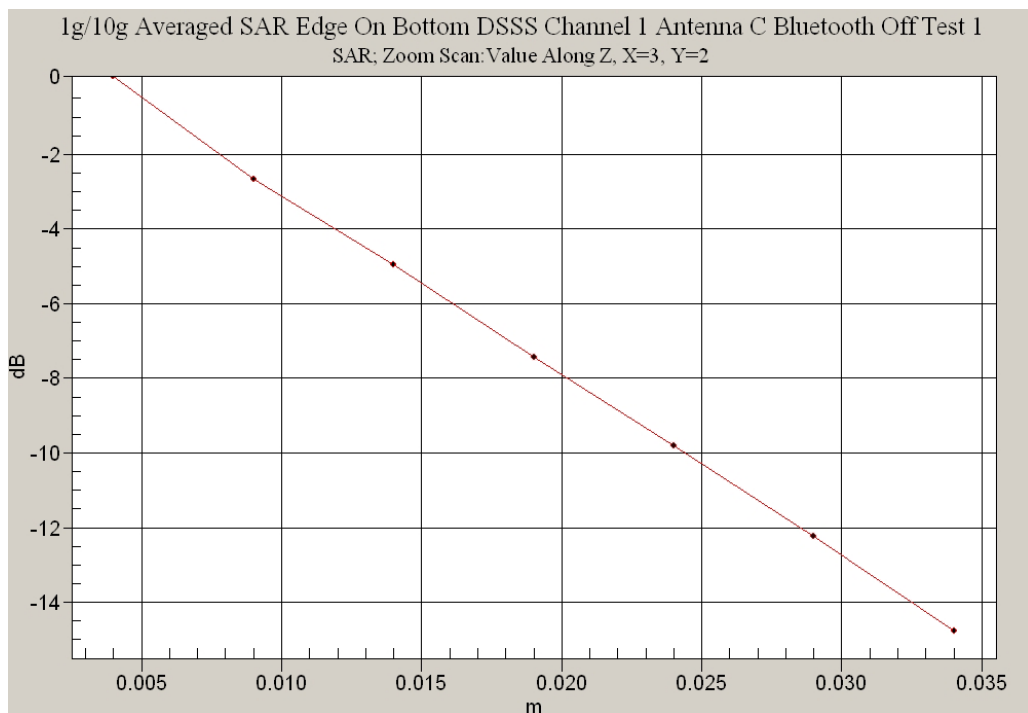
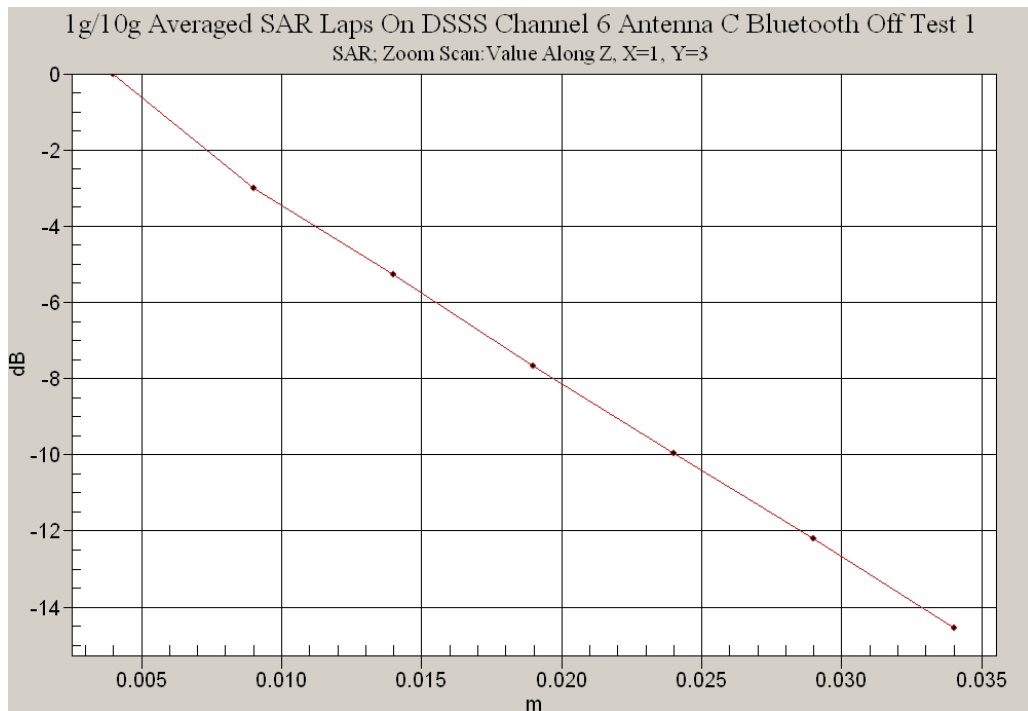
SAR MEASUREMENT PLOT 8

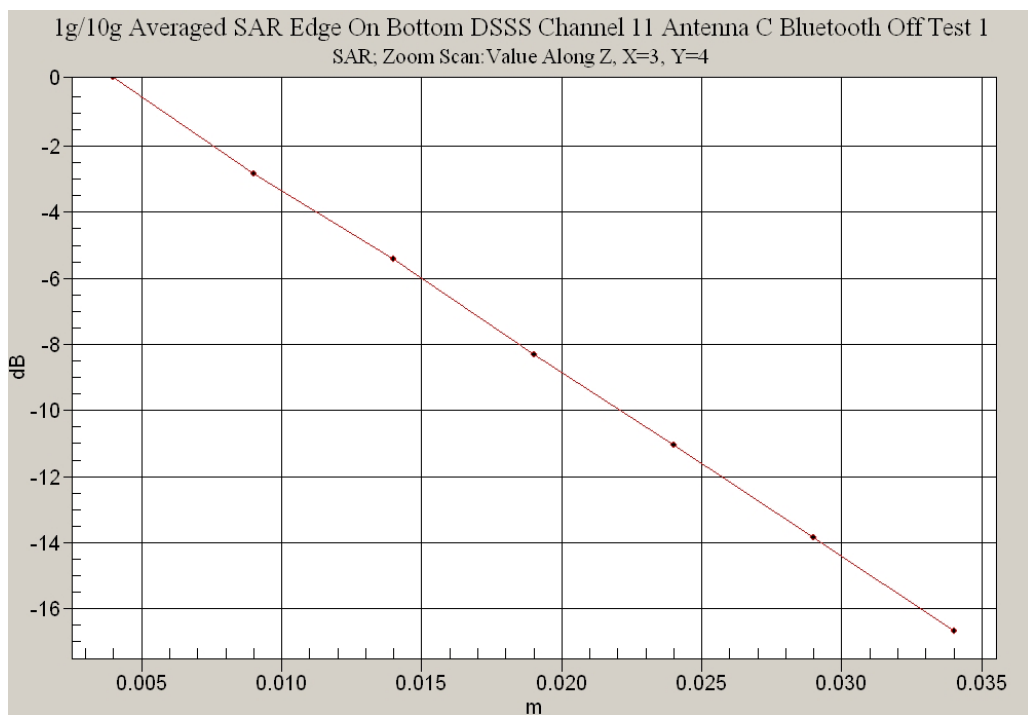
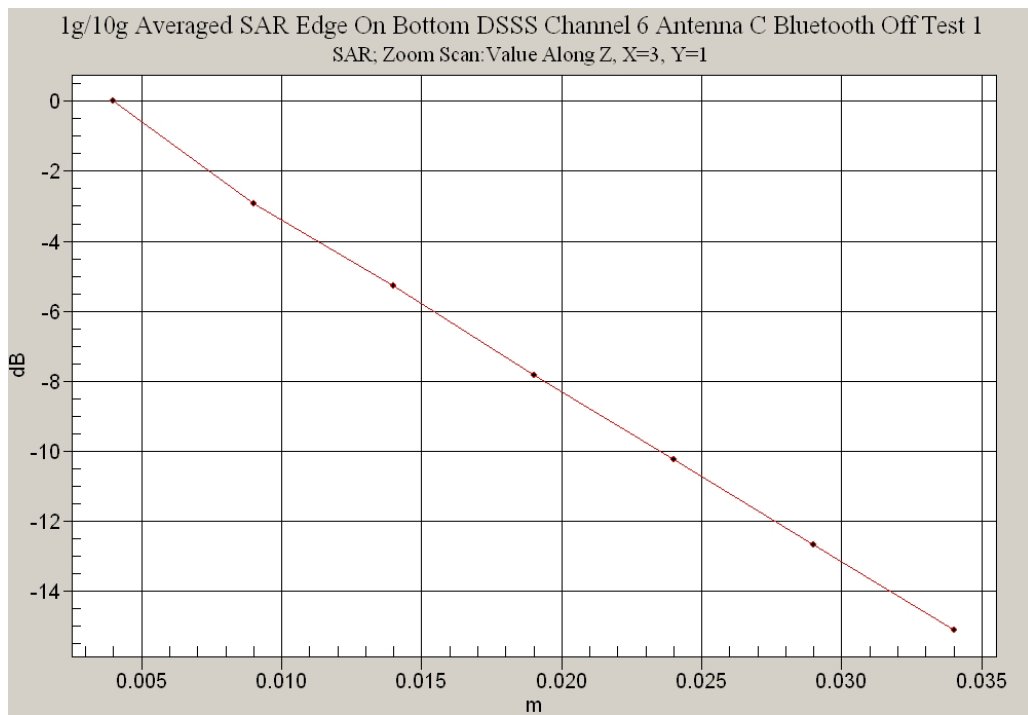
Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 5 April 2008

File Name: Edge On Side DSSS 2450 MHz Seneca Antenna B Bluetooth Off 05-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

* Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.93445$ mho/m, $\epsilon_r = 51.5839$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.214 mW/g

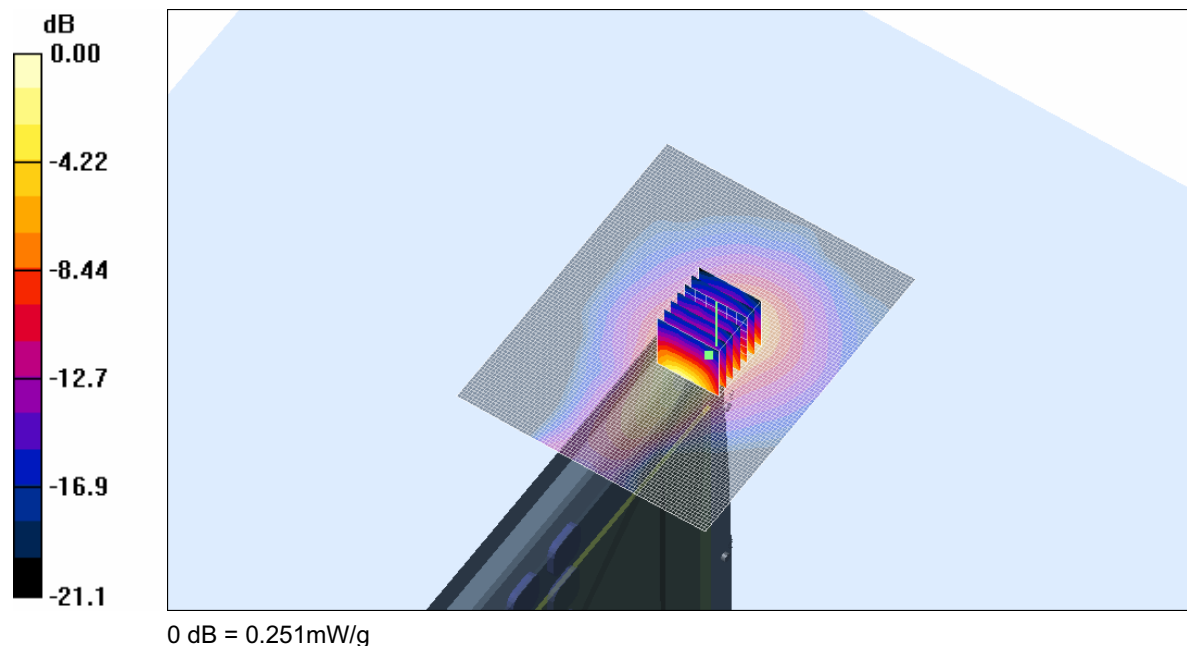
Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.48 V/m; Power Drift = -0.409 dB

Peak SAR (extrapolated) = 0.521 W/kg

SAR(1 g) = 0.226 mW/g; SAR(10 g) = 0.106 mW/g

Maximum value of SAR (measured) = 0.251 mW/g



SAR MEASUREMENT PLOT 9

Ambient Temperature
Liquid Temperature
Humidity

20.8 Degrees Celsius
20.7 Degrees Celsius
51.0 %



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Test Date: 4 April 2008

File Name: Edge On Top OFDM 2450 MHz Seneca Antenna A Bluetooth Off 04-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

* Communication System: OFDM 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.9138$ mho/m, $\epsilon_r = 51.6461$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.312 mW/g

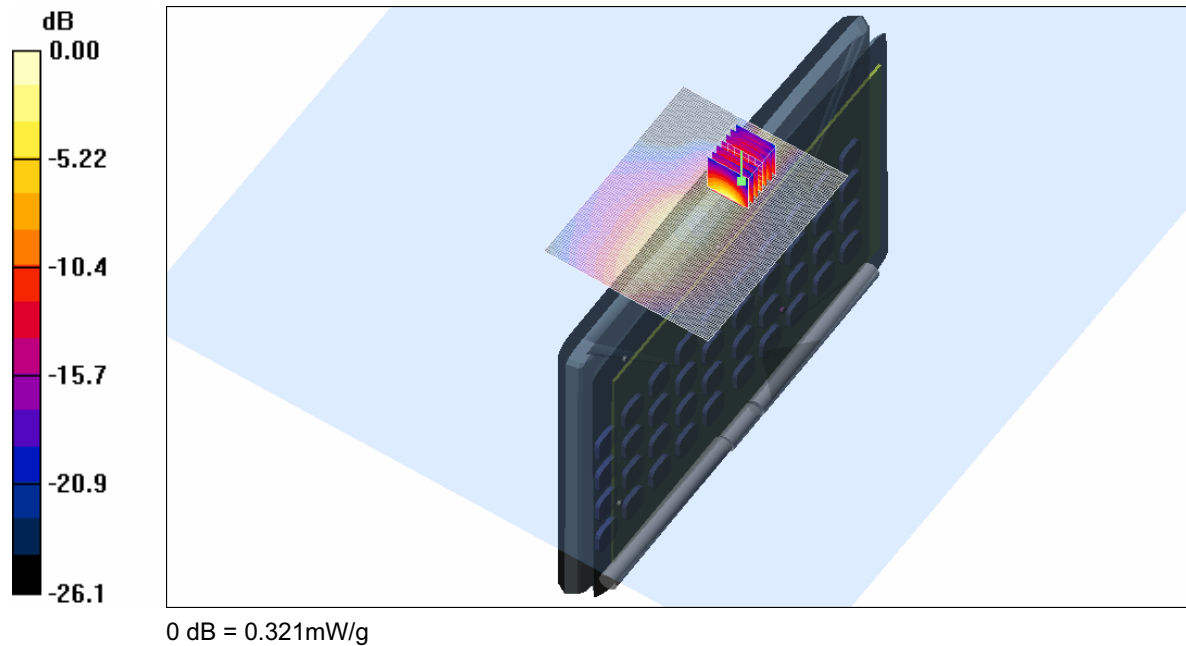
Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.7 V/m; Power Drift = -0.148 dB

Peak SAR (extrapolated) = 0.629 W/kg

SAR(1 g) = 0.275 mW/g; SAR(10 g) = 0.126 mW/g

Maximum value of SAR (measured) = 0.321 mW/g



SAR MEASUREMENT PLOT 10

Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 4 April 2008

File Name: Edge On Top OFDM HT0 (20MHz) 2450 MHz Seneca Antenna A Bluetooth Off 04-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

* Communication System: OFDM HT0 (20MHz) 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.9138$ mho/m, $\epsilon_r = 51.6461$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.336 mW/g

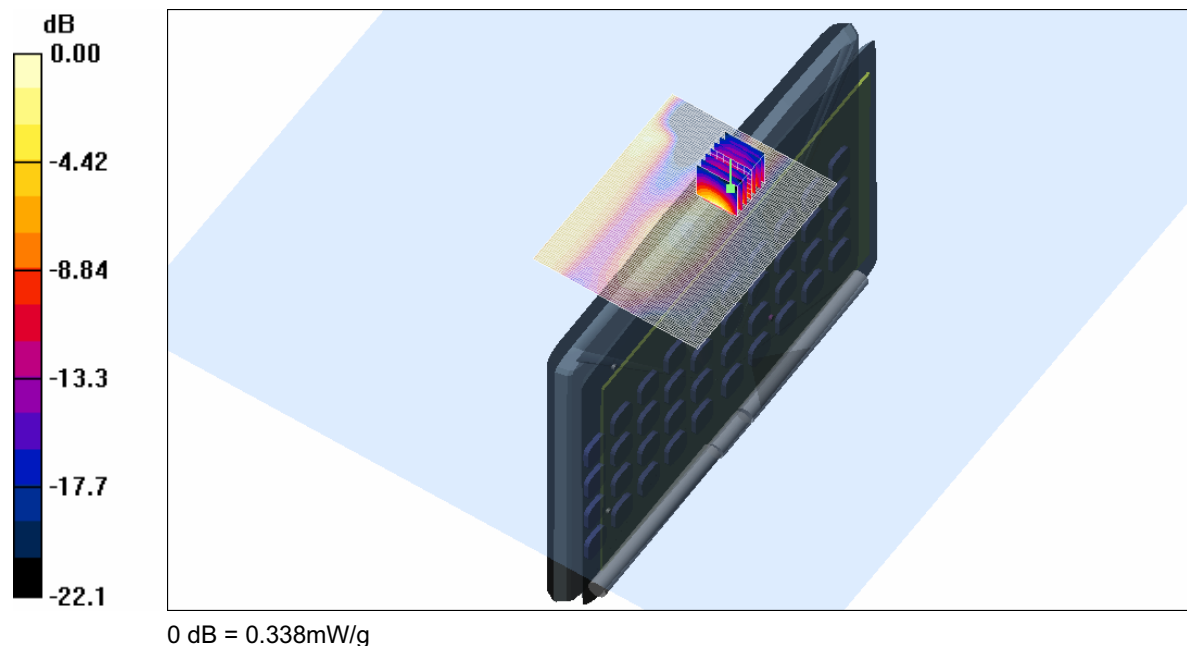
Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.9 V/m; Power Drift = -0.129 dB

Peak SAR (extrapolated) = 0.664 W/kg

SAR(1 g) = 0.288 mW/g; SAR(10 g) = 0.132 mW/g

Maximum value of SAR (measured) = 0.338 mW/g



SAR MEASUREMENT PLOT 11

Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 4 April 2008

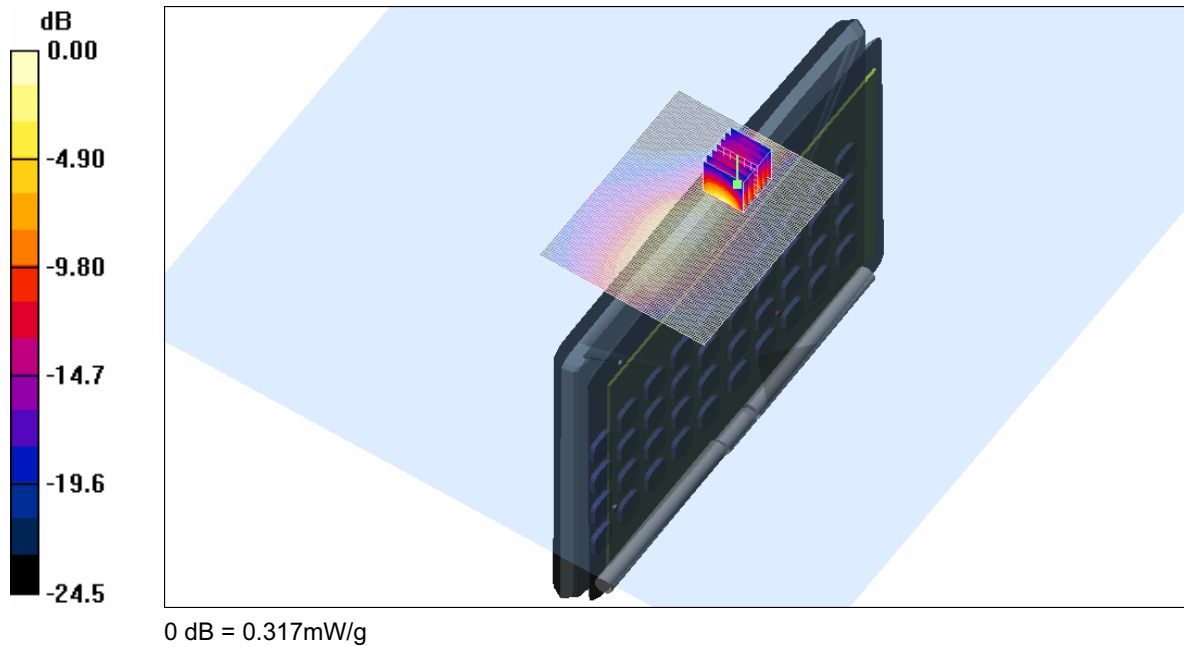
File Name: Edge On Top OFDM HT0 (40MHz) 2450 MHz Seneca Antenna A Bluetooth Off 04-08.da4

DUT: Fujitsu Notebook Seneca with Shirley Peak 11abgn and Bluetooth; Type: 533AN_HMW; Serial: MAC: 0016EA042224

- * Communication System: OFDM HT0 (40MHz) 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.9138$ mho/m, $\epsilon_r = 51.6461$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(3.98, 3.98, 3.98)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6 Test/Area Scan (81x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.316 mW/g

Channel 6 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.5 V/m; Power Drift = -0.071 dB
Peak SAR (extrapolated) = 0.624 W/kg
SAR(1 g) = 0.271 mW/g; SAR(10 g) = 0.124 mW/g
Maximum value of SAR (measured) = 0.317 mW/g



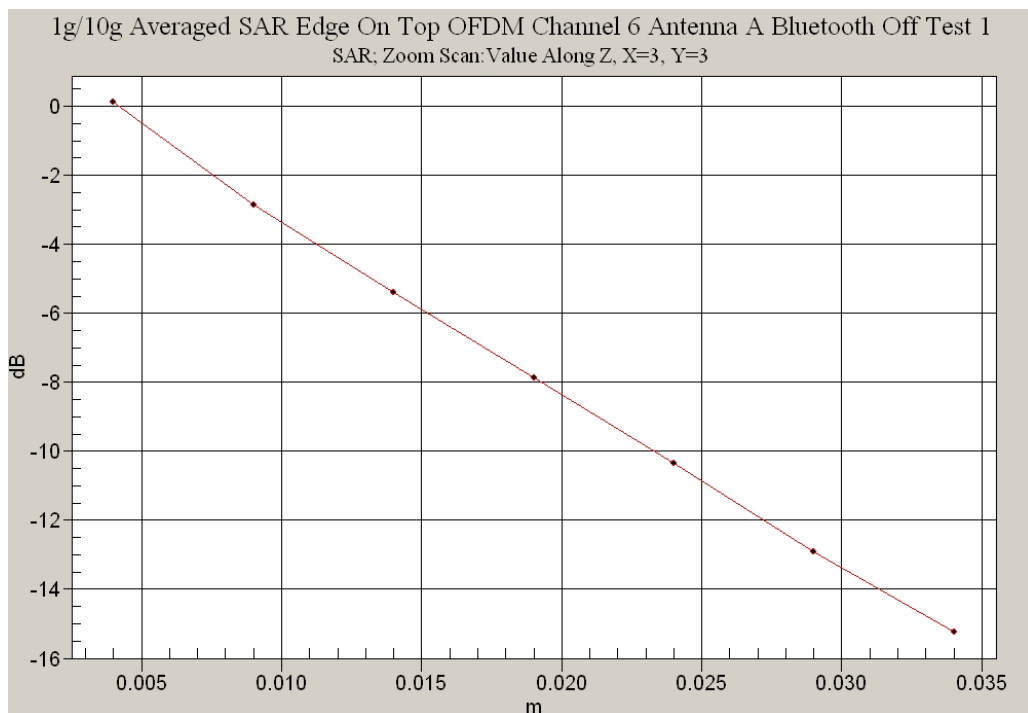
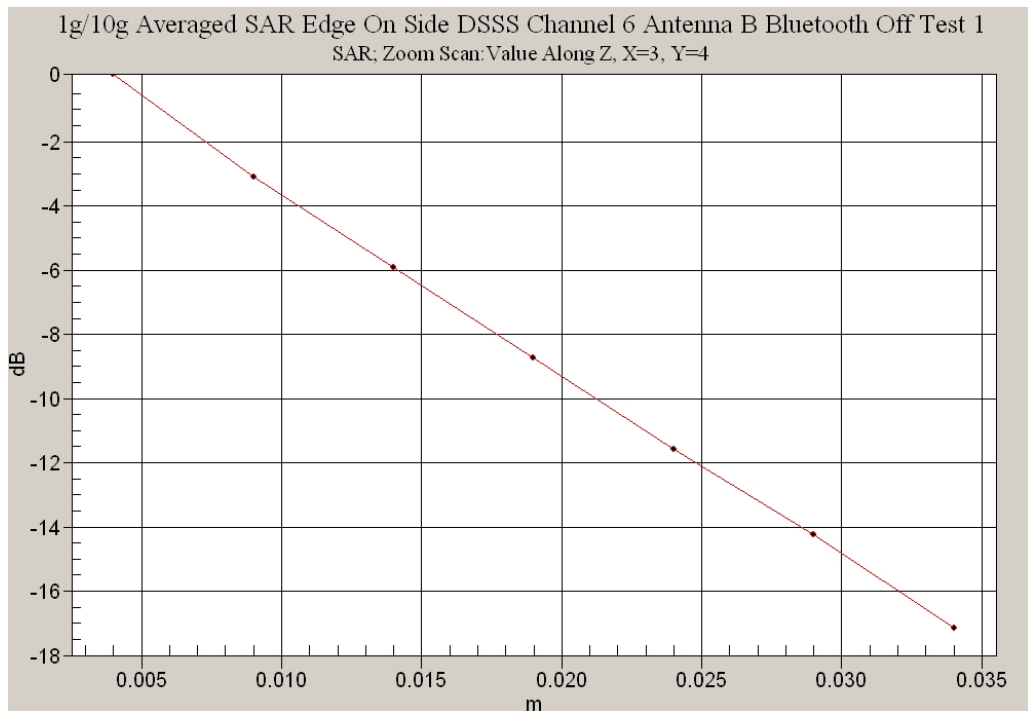
SAR MEASUREMENT PLOT 12

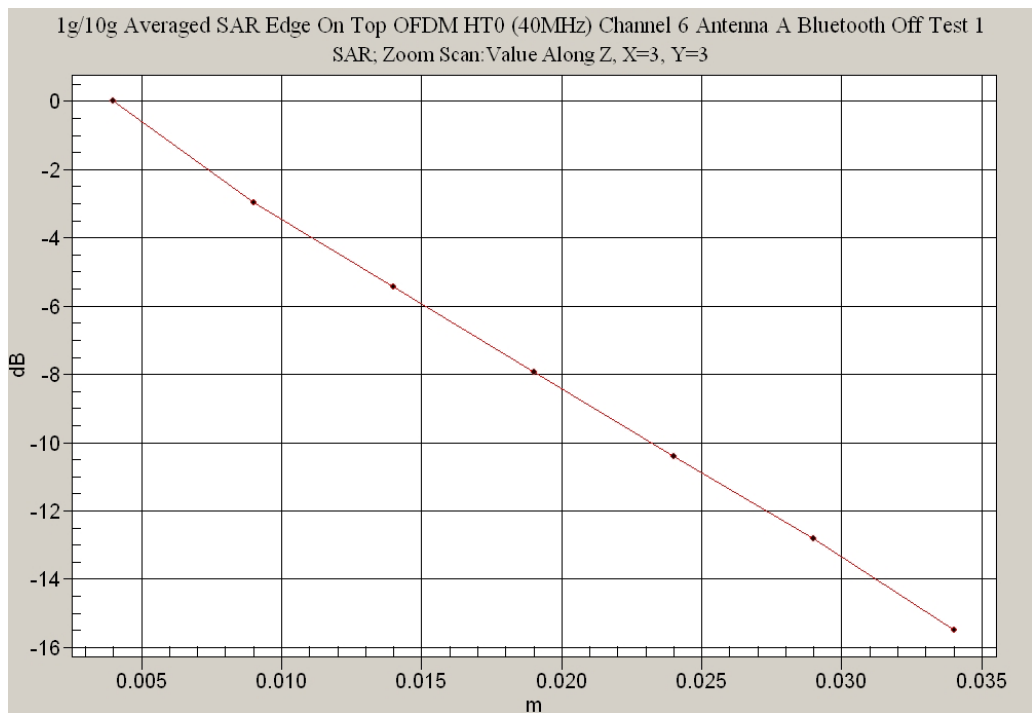
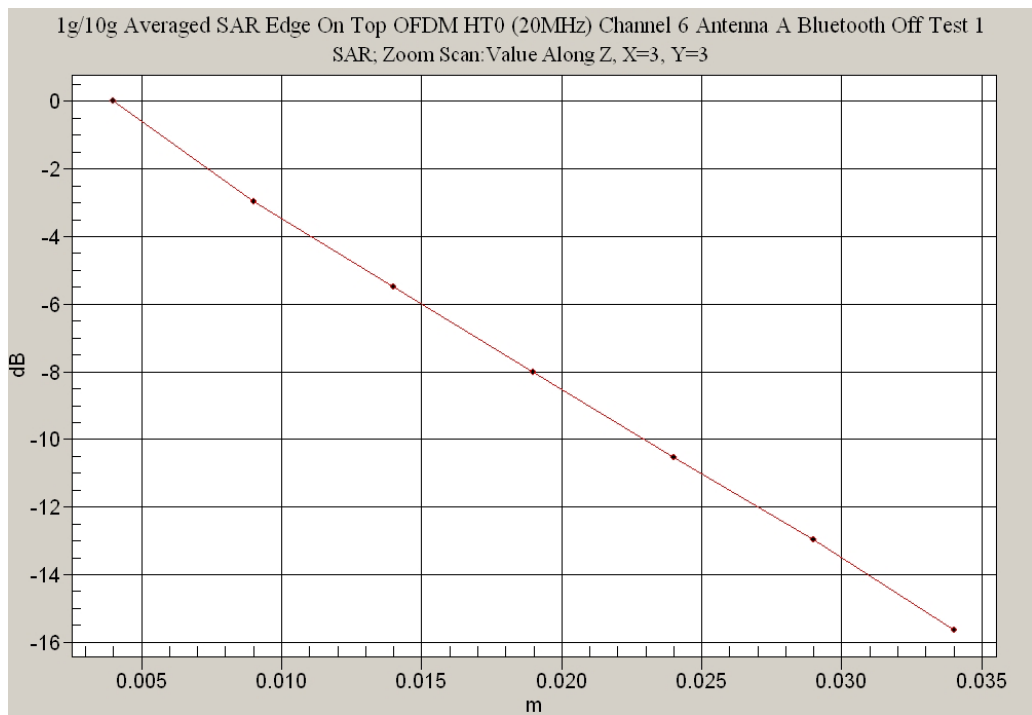
Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 4 April 2008

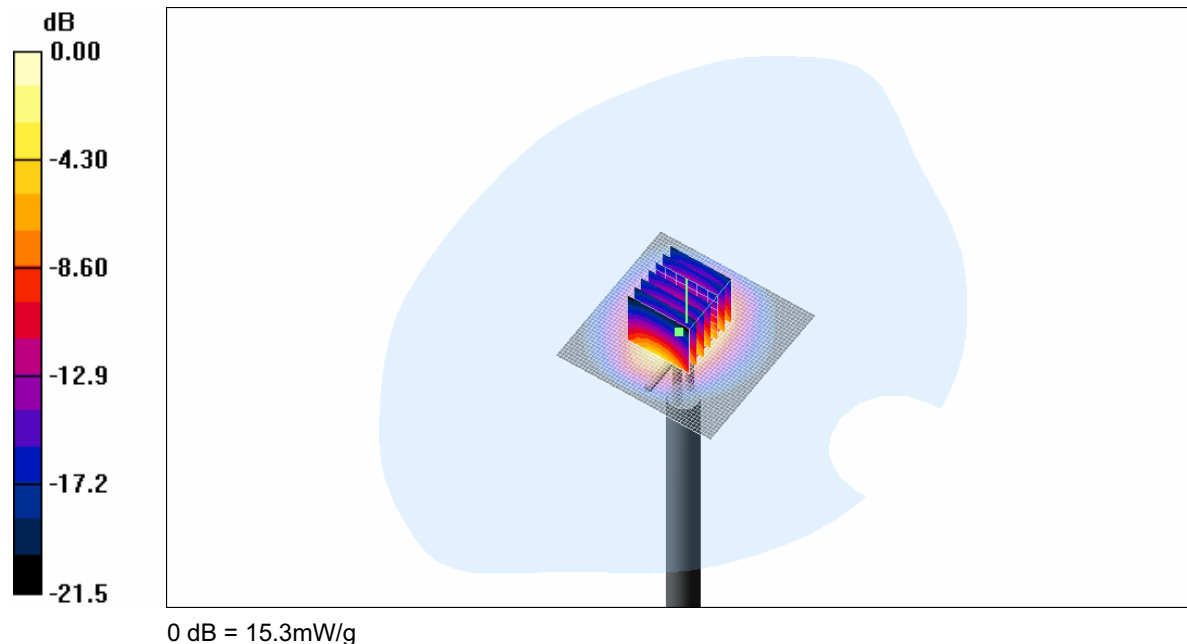
File Name: Validation 2450 MHz (DAE442 Probe1377) 04-04-08.da4

DUT: Dipole 2450 MHz; Type: DV2450V2; Serial: 724

- * Communication System: CW 2450 MHz; Frequency: 2450 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.74333$ mho/m, $\epsilon_r = 39.2334$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(4.45, 4.45, 4.45)
- Phantom: SAM 22; Serial: 1260; Phantom section: Flat Section

Channel 1 Test/Area Scan (51x51x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 18.7 mW/g

Channel 1 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.2 V/m; Power Drift = 0.013 dB
Peak SAR (extrapolated) = 29.3 W/kg
SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.51 mW/g
Maximum value of SAR (measured) = 15.3 mW/g



SAR MEASUREMENT PLOT 13

Ambient Temperature
Liquid Temperature
Humidity

21.1 Degrees Celsius
21.3 Degrees Celsius
44.0 %



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Test Date: 5 April 2008

File Name: Validation 2450 MHz (DAE442 Probe1377) 05-04-08.da4

DUT: Dipole 2450 MHz; Type: DV2450V2; Serial: 724

* Communication System: CW 2450 MHz; Frequency: 2450 MHz; Duty Cycle: 1:1

* Medium parameters used: $\sigma = 1.78838$ mho/m, $\epsilon_r = 39.7035$; $\rho = 1000$ kg/m³

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(4.45, 4.45, 4.45)

- Phantom: SAM 22; Serial: 1260; Phantom section: Flat Section

Channel 1 Test/Area Scan (51x51x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 18.5 mW/g

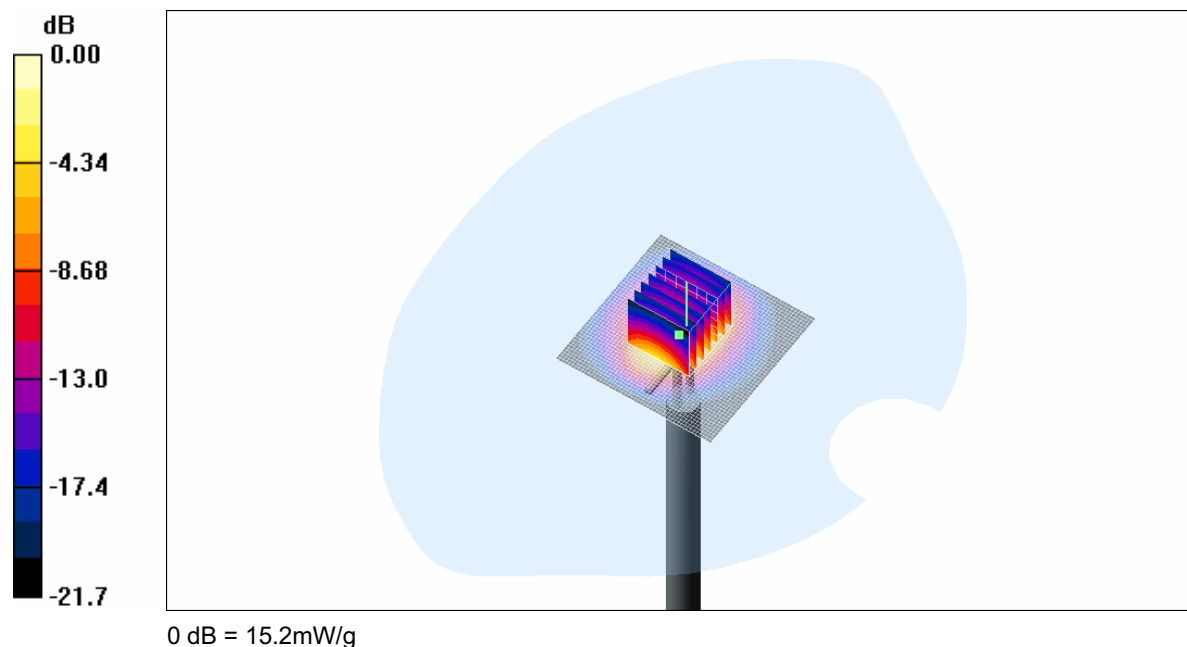
Channel 1 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.5 V/m; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 29.2 W/kg

SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.54 mW/g

Maximum value of SAR (measured) = 15.2 mW/g



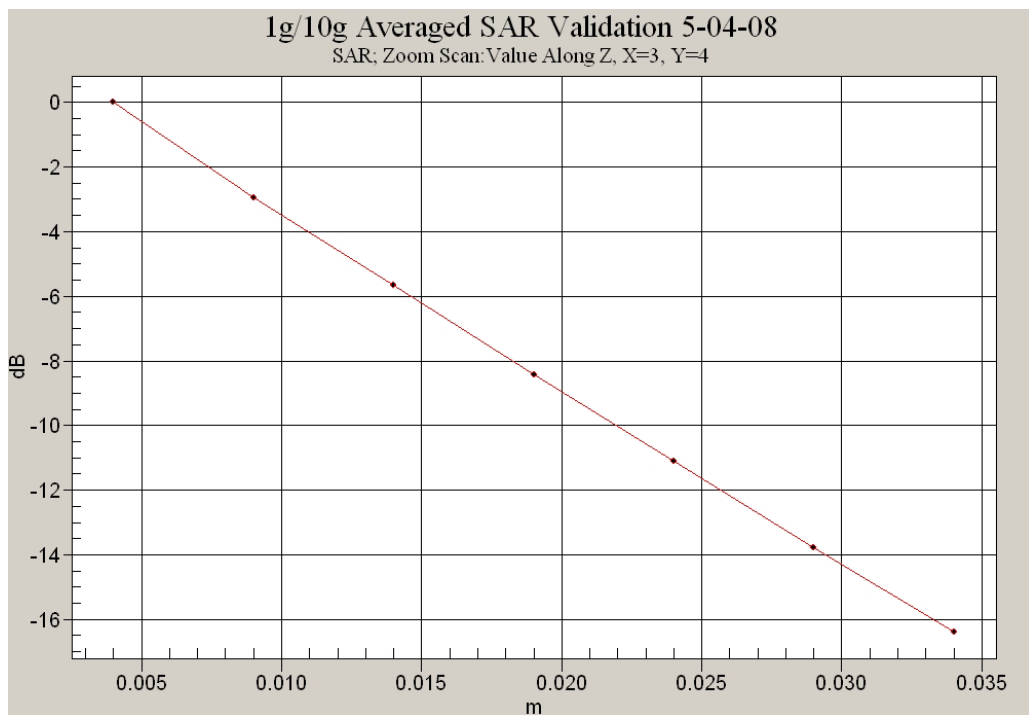
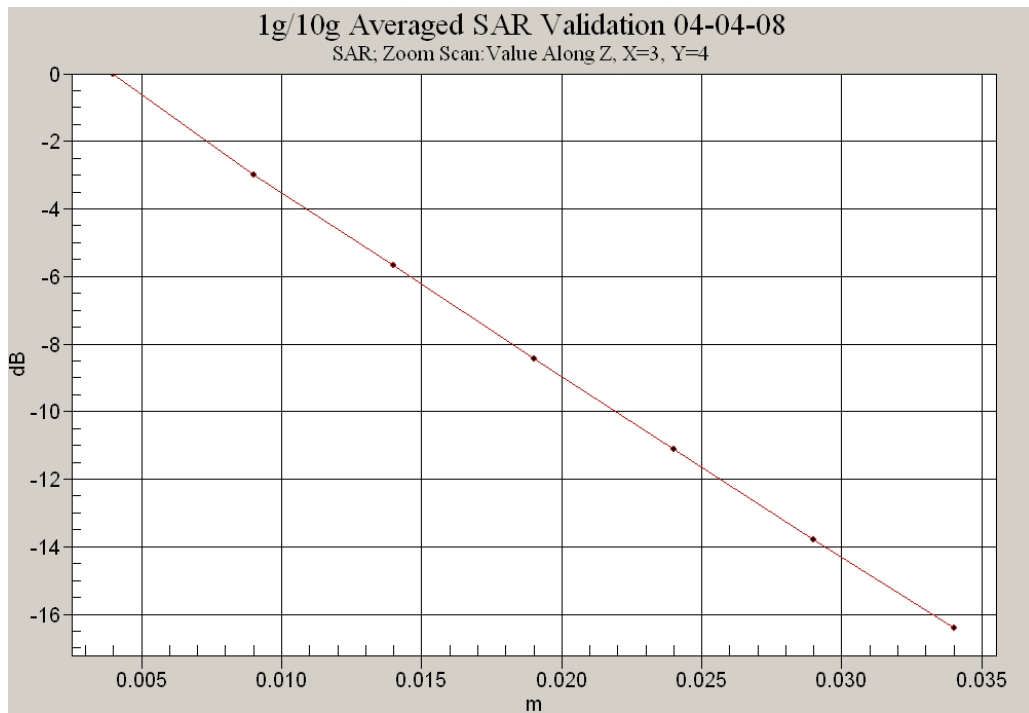
SAR MEASUREMENT PLOT 14

Ambient Temperature
Liquid Temperature
Humidity

20.8 Degrees Celsius
20.7 Degrees Celsius
51.0 %



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APPENDIX C CALIBRATION DOCUMENTS

1. SN: 1377 Probe Calibration Certificate
2. SN: D2450V2 Dipole Calibration Certificate



Accreditation No. 5292

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Calibration Laboratory of
Schmid & Partner
Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
 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 **EMC Technologies**

Certificate No: **ET3-1377_Jul06**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1377**

Calibration procedure(s) **QA CAL-01.v5**
Calibration procedure for dosimetric E-field probes

Calibration date: **July 14, 2006**

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 E4419B	GB41293874	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	11-Aug-05 (METAS, No. 251-00499)	Aug-06
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	11-Aug-05 (METAS, No. 251-00500)	Aug-06
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-07
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

Calibrated by:	Name Katja Pokovic	Function Technical Manager	Signature
Approved by:	Niels Kuster	Quality Manager	

Issued: July 15, 2006

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

Certificate No: ET3-1377_Jul06

Page 1 of 9



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ET3DV6 SN:1377

July 14, 2006

DASY - Parameters of Probe: ET3DV6 SN:1377**Sensitivity in Free Space^A****Diode Compression^B**

NormX	1.91 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	93 mV
NormY	1.81 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	95 mV
NormZ	1.95 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	92 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect**TSL 900 MHz Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	8.8	4.7
SAR _{be} [%]	With Correction Algorithm	0.1	0.2

TSL 1810 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	10.4	6.3
SAR _{be} [%]	With Correction Algorithm	0.4	0.7

Sensor Offset

Probe Tip to Sensor Center 2.7 mm

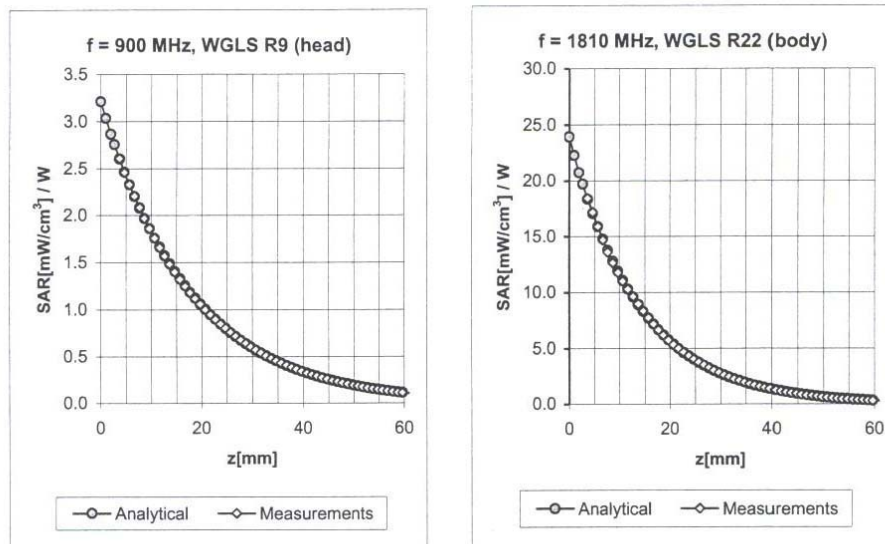
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).^B Numerical linearization parameter: uncertainty not required.

ET3DV6 SN:1377

July 14, 2006

Conversion Factor Assessment



f [MHz]	Validity [MHz] ^C	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.59	1.86	6.49	± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.48	2.70	5.30	± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.65	1.94	4.49	± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.49	2.07	6.22	± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.62	2.44	4.73	± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.63	2.10	4.20	± 11.8% (k=2)

^C The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Certificate No: ET3-1377_Jul06

Page 8 of 9



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Calibration Laboratory of
Schmid & Partner
Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
 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 **EMC Technologies**

Certificate No: **D2450V2-724_Dec06**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 724**

Calibration procedure(s) **QA CAL-05.v6**
Calibration procedure for dipole validation kits

Calibration date: **December 13, 2006**

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-442A	GB37480704	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Power sensor HP 8481A	US37292783	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference Probe ES3DV2	SN 3025	19-Oct-06 (SPEAG, No. ES3-3025_Oct06)	Oct-07
DAE4	SN 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

Calibrated by: **Marcel Fehr** **Laboratory Technician** *[Signature]*

Approved by: **Katja Pokovic** **Technical Manager** *[Signature]*

Issued: December 14, 2006

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Certificate No: D2450V2-724_Dec06

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Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz \pm 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 \pm 0.2) °C	37.7 \pm 6 %	1.77 mho/m \pm 6 %
Head TSL temperature during test	(21.8 \pm 0.2) °C	-----	-----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	250 mW input power	13.5 mW / g
SAR normalized	normalized to 1W	54.0 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	53.3 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.24 mW / g
SAR normalized	normalized to 1W	25.0 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	24.7 mW / g \pm 16.5 % (k=2)

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

DASY4 Validation Report for Head TSL

Date/Time: 13.12.2006 12:39:25

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN724

Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB_060425;

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 37.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025 (HF); ConvF(4.5, 4.5, 4.5); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.2 V/m; Power Drift = 0.053 dB

Peak SAR (extrapolated) = 28.4 W/kg

SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.24 mW/g

Maximum value of SAR (measured) = 15.0 mW/g

