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SAR Test Report

Report Number: M071142_CERT_4965AGN_SAR_2.4

Test Sample: Portable Notebook Computer
Radio Modules: WLAN 4965AGN & Bluetooth EYSMJCS
Model Number: P8010
Tested For: Fujitsu Australia Pty Ltd
FCC ID: EJE-WB0054
IC: 337J-WB0054
Date of Issue: 7th January 2007

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SAR TEST REPORT**Report Number: M071142_CERT_4965AGN_SAR_2.4****FCC ID: EJE-WB0054****IC: 337J-WB0054****1.0 GENERAL INFORMATION**

Test Sample: Portable Notebook Computer
Model Name: P8010
Radio Modules: WLAN 4965AGN & Bluetooth EYSMJCS
Interface Type: Mini-PCI Module
Device Category: Portable Transmitter
Test Device: Pre-Production Unit
FCC ID: EJE-WB0054
IC: 337J-WB0054
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. Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields. RSS-102 Issue 1 (Provisional) September 25, 1999

Statement Of Compliance: The Fujitsu Notebook Computer P8010 with Wireless LAN model 4965AGN 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 Date: 4th December 2007

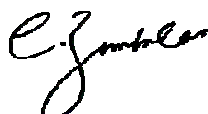
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SAR TEST REPORT
Portable Notebook Computer
Model: P8010
Report Number: M071142_CERT_4965AGN_SAR_2.4

2.0 INTRODUCTION

Testing was performed on the Fujitsu Notebook PC, Model: P8010 with INTEL Mini-PCI Wireless LAN Module (KEDRON 802.11a/b/g/n), Model: 4965AGN & TAIYO YUDEN Bluetooth Module, Model: EYSMJCS. The KEDRON module is an OEM product. The Mini-PCI Wireless LAN (WLAN) was tested in the dedicated host – SAVOR, Model P8010.

The measurement test results mentioned hereon only apply to the 2450MHz frequency band; an additional report titled “M071142_CERT_4965AGN_SAR_5.6” applies to the 5GHz range.

3.0 SAMPLE TECHNICAL INFORMATION

(Information supplied by the client)

3.1 EUT (WLAN) Details

Transmitter:	Mini-Card Wireless LAN Module
Wireless Module:	KEDRON (802.11a/b/g/n)
Model Number:	4965AGN
Manufacturer:	Intel Corporation
Modulation Type:	Direct Sequence Spread Spectrum (DSSS for 802.11b) Orthogonal Frequency Division Multiplexing (OFDM for 802.11g) Orthogonal Frequency Division Multiplexing (OFDM for 802.11a) Orthogonal Frequency Division Multiplexing (OFDM for 802.11n)
2.4 GHz (802.11b/g/n):	DBPSK, DQPSK, CCK, 16QAM and 64QAM
5 GHz (802.11a/n):	BPSK, QPSK, 16QAM and 64QAM
Maximum Data Rate:	802.11b = 11Mbps, 802.11g and 802.11a = 54Mbps 802.11n = 300 Mbps
Frequency Ranges:	2.412 –2.462 GHz for 802.11b/g/n 5.18 - 5.32 GHz and 5.745 - 5.825 GHz for 802.11a/n
Number of Channels:	11 channels for 802.11b/g/n 13 channels for 802.11a/n with 20 MHz bandwidth 6 channels for 802.11n with 40 MHz bandwidth
Antenna Types:	Electric Inverted F Antenna- Model: CP313544 (Main:Rihgt), CP313545(Aux:Left) Location: Top edge of LCD screen
Power Supply:	3.3 VDC from PCI bus



Frequency allocation and maximum output power for 802.11a/g/n:

Channel and Mode	Frequency(MHz)	Output power
802.11b/g/n mode		In Average (mW)
Channels 1	2412	14
Channels 6	2437	14
Channels 11	2462	14
802.11a mode, 802.11n mode with 20MHz Bandwidth		
Channels 36	5180	15
Channels 52	5260	15
Channels 64	5320	15
Channels 149	5745	16
Channels 157	5785	16
Channels 165	5825	16
802.11n mode with 40MHz Bandwidth		
Channels 38	5190	13
Channels 46	5230	15
Channels 54	5270	15
Channels 62	5310	14
Channels 151	5755	16
Channels 159	5795	16

NOTE: For 5GHz SAR results refer to report titled “M071142_CERT_4965AGN_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: Electric Inverted F Antenna, Model: CP115428
 Location: Left palm rest area
Max. Output Power: 4 dBm
Reference Oscillator: 16 MHz (Built-in)
Power Supply: 3.3 VDC from host.



Frequency allocation:

Channel Number	Frequency (MHz)	Bluetooth Utility power setting
1	2402	Power (Ext, Int) = 0, 96
2	2403	
3	2404	
.	.	
.	.	
39	2440	
40	2441	
41	2442	
.	.	
.	.	
77	2478	
78	2479	
79	2480	

3.3 EUT (Notebook PC) Details

EUT: SAVOR
Model Name: P8010
Serial Number: Pre-production Sample
Manufacturer: FUJITSU LIMITED

CPU Type and Speed: Core2 Duo SL7100 1.2GHz
LCD 12.1" WXGA
Wired LAN: Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
Modem: Agere MDC1.5 modem Model: D40
Port Replicator Model: FPCPR82

AC Adapter Model: 60W:SED80N2-16.0(Sanken),
 PXW1637N(Tamura)(Japan only)
Voltage: 16 V
Current Specs: 3.75A
Watts: 60W

3.4 Test sample Accessories

3.4.1 Battery Types

One type of Fujitsu Lithium Ion Battery is used to power the Portable Notebook Computer Wireless LAN Model: 4965AGN. SAR measurements were performed with the battery as shown below.

Standard Battery

Model CP316200_01
 V/mAh 10.8V/4400mAh
 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 Notebook 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 fixed frequency channels used in the testing are shown in the table below.

The Bluetooth module operates over 79 channels within the frequency range 2402 to 2480 MHz. It is possible for the Bluetooth module to operate simultaneously with the WLAN module (co-transmission). For the SAR measurements the device was operating in continuous transmit mode using programming codes supplied by Fujitsu. The tests were conducted with only the WLAN operating and also with the WLAN and Bluetooth module operating in co-transmission. The fixed frequency channels used in the testing are shown in the table below. The Bluetooth interface utilizes dedicated antenna, for the purpose of this report labelled antenna "D".

The test results mentioned in this report only apply to the 2450MHz frequency range. An additional report titled "M071142_CERT_4965AGN_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. There were no wires or other connections to the Portable Notebook Computer during the SAR measurements.

At the beginning and at the completion of the SAR tests, the conducted power of the device was measured after temporary modification of antenna connector inside the device's TX RX compartment. Measurements were performed with a calibrated Power Meter. The results of this measurement are listed in table below.

Table: Frequency and Conducted Power Results

Channel	Channel Frequency MHz	Data Rates	Maximum Conducted Output Power - Peak Measured (dBm)
Channel 01	2412	1 (DSSS)	15.6
Channel 06	2437	1 (DSSS)	15.5
Channel 11	2462	1 (DSSS)	15.3
Channel 01	2412	6	15.5
Channel 06	2437	6	15.7
Channel 11	2462	6	15.4

Frequency and Conducted Power Results Bluetooth

Channel	Channel Frequency MHz	*Data Rate (Mbps)	Maximum Conducted Output Power Measured (dBm)
Channel 40	2441	N/A	1.0

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 64%. 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.

6.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM

Applicable Head Configurations	: None
Applicable Body Configurations	: Lap On 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 Dec 07	40.0	1.81	14.2	6.63

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	14.2	56.8	55.6	2.16	52.4	8.39

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.

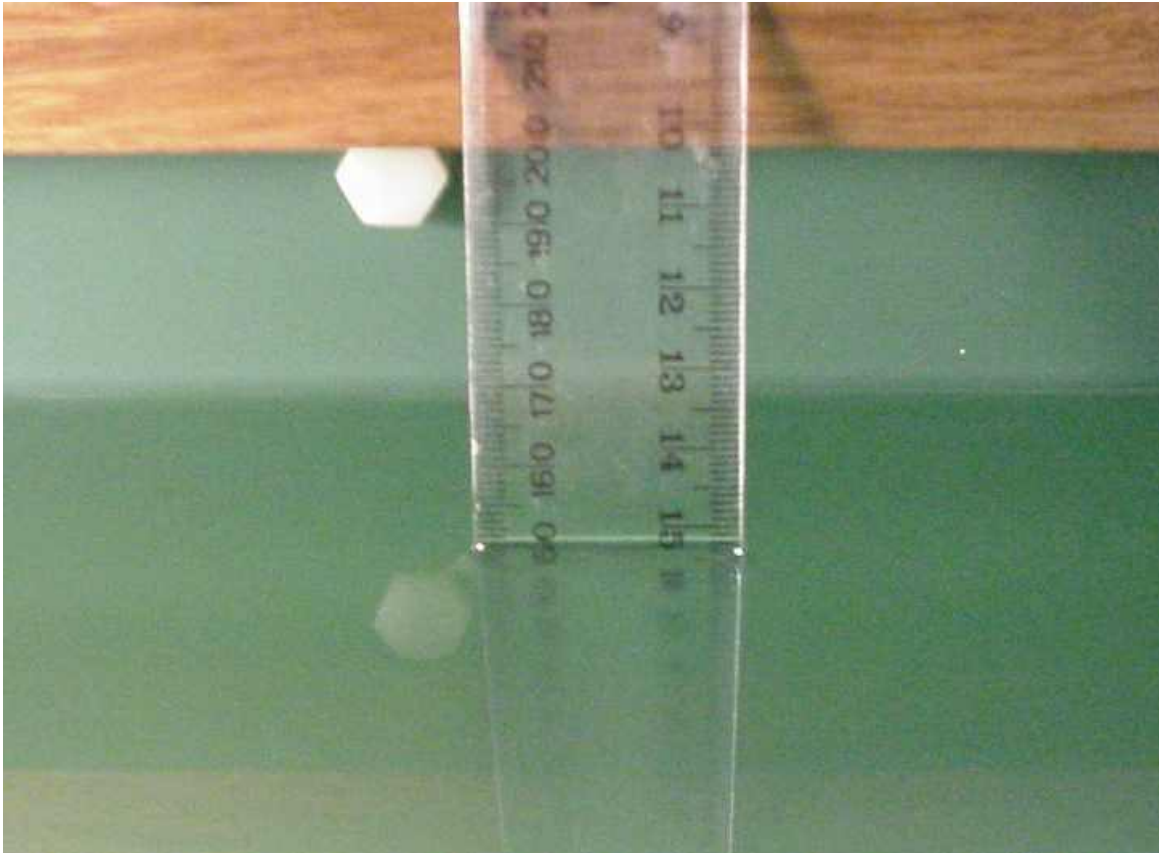


Photo of liquid Depth in Flat Phantom

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+/-0.2 mm and was filled with the required tissue simulating liquid. Below table provides a summary of the measured phantom properties. Refer to Appendix C Part 4, for details of P 10.1 phantom dielectric properties and loss tangent.

Table: Phantom Properties

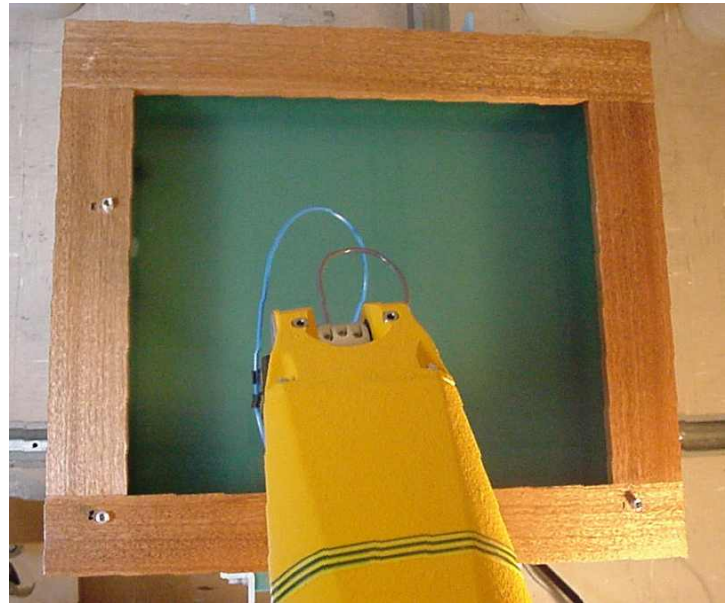
Phantom Properties	Required	Measured
Thickness of flat section	2.0mm ± 0.2mm (bottom section)	2.12-2.20mm
Dielectric Constant	<5.0	4.603 @ 300MHz (worst-case frequency)
Loss Tangent	<0.05	0.0379 @ 2500MHz (worst-case frequency)

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	40.0	39.2 ±5% (37.2 to 41.2)	1.81	1.80 ±5% (1.71 to 1.89)	1000

NOTE: The brain liquid parameters were within the required tolerances of ±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
2437 MHz Muscle	53.7	52.7 ±5% (50.1 to 55.3)	1.95	1.95 ±5% (1.85 to 2.05)	1000

NOTE: The brain and muscle liquid parameters were within the required tolerances of ±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|°C.

Table: Temperature and Humidity recorded for each day

Date	Ambient Temperature (°C)	Liquid Temperature (°C)	Humidity (%)
4 th December 2007	21.8	21.2	64.0

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 notebook underneath the phantom surface. Small pieces of foam were then used to press the notebook 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 171 mm x 171 mm surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation. The first “pre-scans” covered an area of 171 mm x 171 mm to ensure that the hotspot was correctly identified.
- 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-axis. 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)	7.2.1	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	7.2.1	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	7.2.1	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	7.2.1	1	R	1.73	1	1	0.6	0.6	∞
Linearity	7.2.1	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	7.2.1	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	7.2.1	1	N	1	1	1	1.0	1.0	∞
Response Time	7.2.1	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	7.2.1	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions	7.2.3	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	7.2.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	7.2.2	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	7.2.4	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	7.2.2	1.61	N	1	1	1	1.6	1.6	11
Device Holder Uncertainty									
Output Power Variation – SAR Drift Measurement	7.2.3	5	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	7.2.2	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	7.2.3	5	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity – Measurement uncertainty	7.2.3	4.3	N	1	0.64	0.43	2.8	1.8	5
Liquid Permittivity – Deviation from target values	7.2.3	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	7.2.3	4.3	N	1	0.6	0.49	2.6	2.1	5
Combined standard Uncertainty			RSS				9.7	9.2	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				19.4	18.38	

Estimated total measurement uncertainty for the DASy4 measurement system was $\pm 9.7\%$. The extended uncertainty (K = 2) was assessed to be $\pm 19.4\%$ 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 ±8.0%. The extended uncertainty (K = 2) was assessed to be ±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	Yes
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	Yes
SAM Phantom	SPEAG	N/A	1260	Not applicable	Yes
SAM Phantom	SPEAG	N/A	1060	Not applicable	No
Flat Phantom	AndreT	10.1	P 10.1	Not Applicable	Yes
Flat Phantom	AndreT	9.1	P 9.1	Not Applicable	No
Flat Phantom	SPEAG	PO1A 6mm	1003	Not Applicable	No
Data Acquisition Electronics	SPEAG	DAE3 V1	359	03-July-2008	Yes
Data Acquisition Electronics	SPEAG	DAE3 V1	442	13-Oct-2007	No
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	No
Probe E-Field	SPEAG	ET3DV6	1380	12-Dec-2007	No
Probe E-Field	SPEAG	ET3DV6	1377	09-July-2008	Yes
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	No
Probe E-Field	SPEAG	EX3DV4	3563	13-July-2008	No
Antenna Dipole 300 MHz	SPEAG	D300V2	1005	26-Oct-2007	No
Antenna Dipole 450 MHz	SPEAG	D450V2	1009	14-Dec-2008	No
Antenna Dipole 900 MHz	SPEAG	D900V2	047	6-July-2008	No
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	30-June-2008	No
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	3-July-2008	No
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	5-March-2009	No
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	06-July-2008	No
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	13-Dec-2008	Yes
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	27-Oct-2007	No
RF Amplifier	EIN	603L	N/A	Not applicable	No
RF Amplifier	Mini-Circuits	ZHL-42	N/A	Not applicable	Yes
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	Not applicable	No
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	*In test	Yes
RF Power Meter Dual	Hewlett Packard	437B	3125012786	30-May-2008	Yes
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	30-May-2008	Yes
RF Power Meter Dual	Gigatronics	8542B	1830125	11-May-2008	Yes
RF Power Sensor	Gigatronics	80301A	1828805	11-May-2008	Yes
RF Power Meter Dual	Hewlett Packard	435A	1733A05847	*In test	Yes
RF Power Sensor	Hewlett Packard	8482A	2349A10114	*In test	Yes
Network Analyser	Hewlett Packard	8714B	GB3510035	06-Sept-2008	Yes
Network Analyser	Hewlett Packard	8753ES	JP39240130	02 Oct-2008	Yes
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	*In test	No
Dual Directional Coupler	NARDA	3022	75453	*In test	Yes

* Calibrated during the test for the relevant parameters.



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 “SAVOR” can be used in a conventional laptop position (see Appendix A1). The antenna location in the “SAVOR” is closest to the top of the screen when used in a conventional laptop configuration and due to the separation distances involved between the phantom and the laptop antenna, testing is not required in this position.

10.1 Positions

10.1.1 “Lap On” 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 “Lap On” 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.

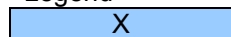
10.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)

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. The worst case result was verified with the Bluetooth transmitting at full power in co-transmission with the WLAN.

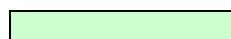
Table: Testing configurations

Phantom Configuration	*Device Mode	Antenna	Test Configurations		
			CHANNEL (LOW)	Channel (Middle)	Channel (High)
Lap-On Held	DSSS 2.4GHz	A		X	
		B		X	

Legend



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.

11.1 2450MHz SAR Results

SAR testing within the 2450MHz band was tested in OFDM modulations. Refer to section 7.2 for selection of all device test configurations. Table below displays the SAR results.

Table: SAR MEASUREMENT RESULTS – OFDM 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)
*Lap On	1	A	1	-	06	2437	Noise Floor 0.002	-
*Lap On	2	B	1	-	06	2437	Noise Floor 0.001	-

NOTE: The measurement uncertainty of 19.4% for 2.45GHz was not added to the result.

* Prescan

The highest SAR level recorded in the 2450 MHz band was 0.002 (measurement noise floor) tested in the OFDM mode. The Bluetooth was ON at the Frequency of 2441 MHz.

12.0 COMPLIANCE STATEMENT

The Fujitsu NOTEBOOK PC, Model: P8010 with INTEL Mini-PCI Wireless LAN Module (KEDRON 802.11a/b/g/n), Model: 4965AGN & TAIYO YUDEN Bluetooth Module, Model: EYSMJCS was found to comply with the FCC and RSS-102 SAR requirements.

The highest SAR level recorded was 0.002mW/g (measurement noise floor). The Bluetooth was ON at the Frequency of 2441 MHz. This was below the limit of 1.6 mW/g for uncontrolled exposure, even taking into account the measurement uncertainty of 19.4%.

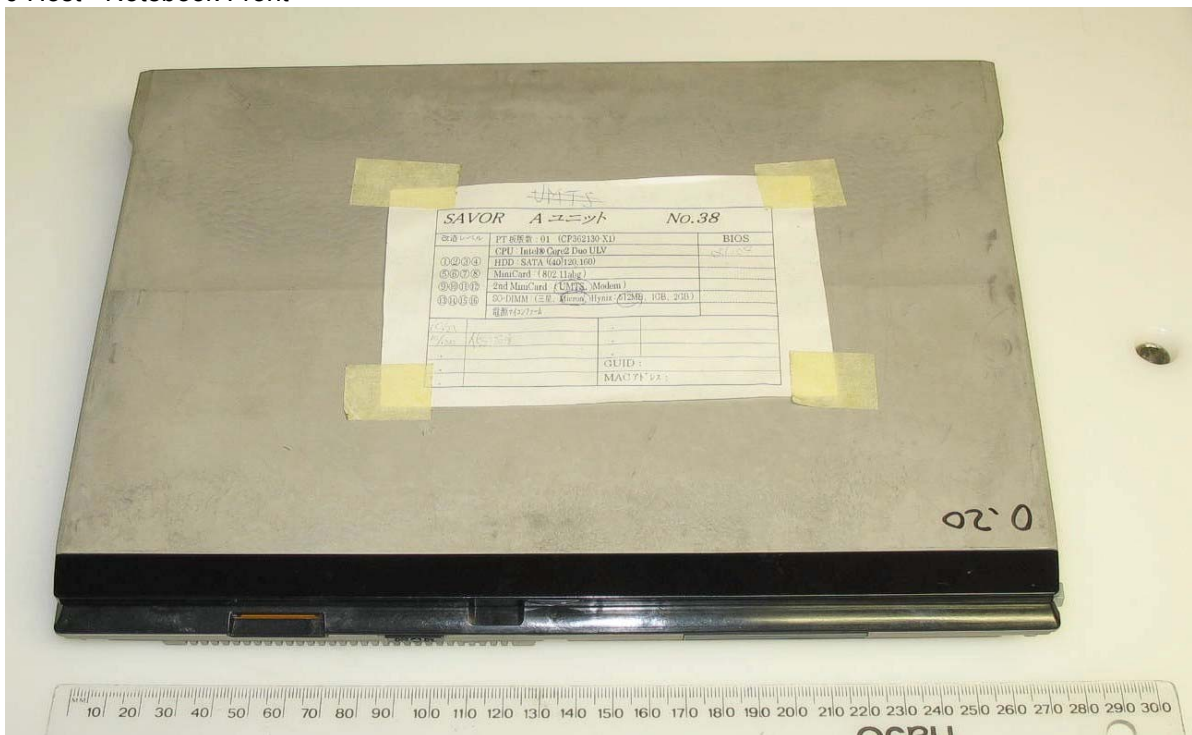


APPENDIX A1 TEST SAMPLE PHOTOGRAPHS

P8010 Host - Conventional Laptop Configuration



P8010 Host - Notebook Front



APPENDIX A2 TEST SAMPLE PHOTOGRAPHS

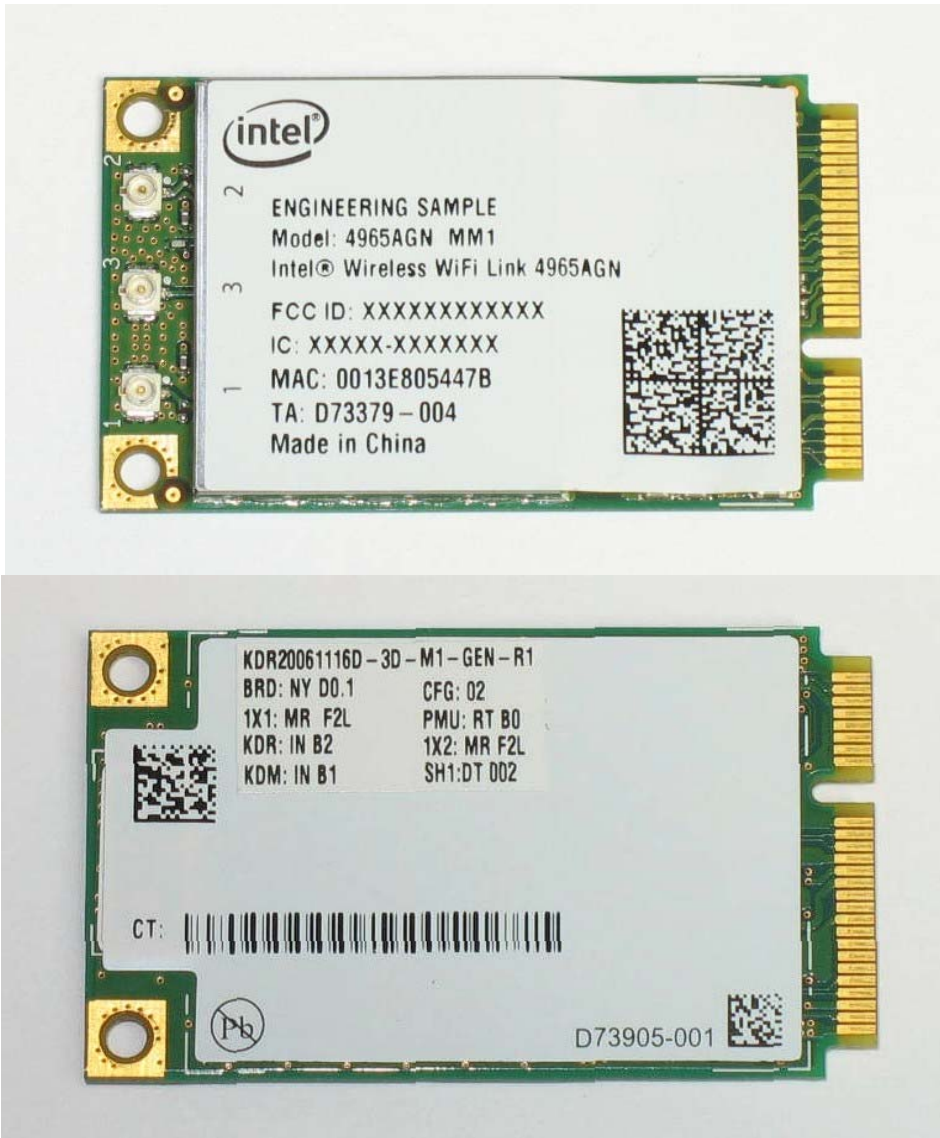
Battery 1



Battery 2

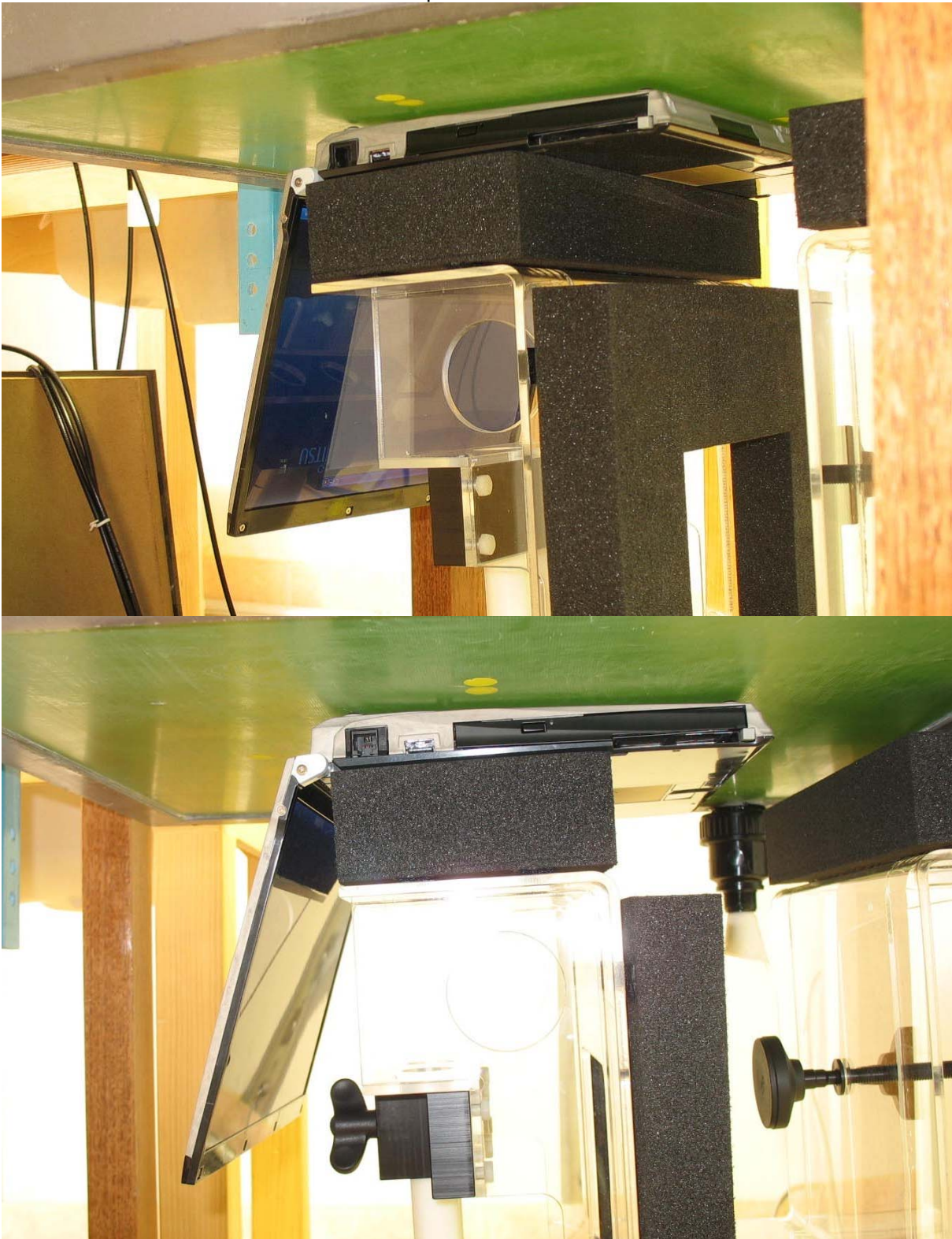


Model: 4965AGN – WLAN Module



APPENDIX A3 TEST SETUP PHOTOGRAPHS

Lap On Position



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
*Lap On	1	A	1	-	06
*Lap On	2	B	1	-	06

*Prescan

Table: 2450MHz Validation Plot

Plot 3	Validation 2450 MHz 4 th December 2007
--------	---

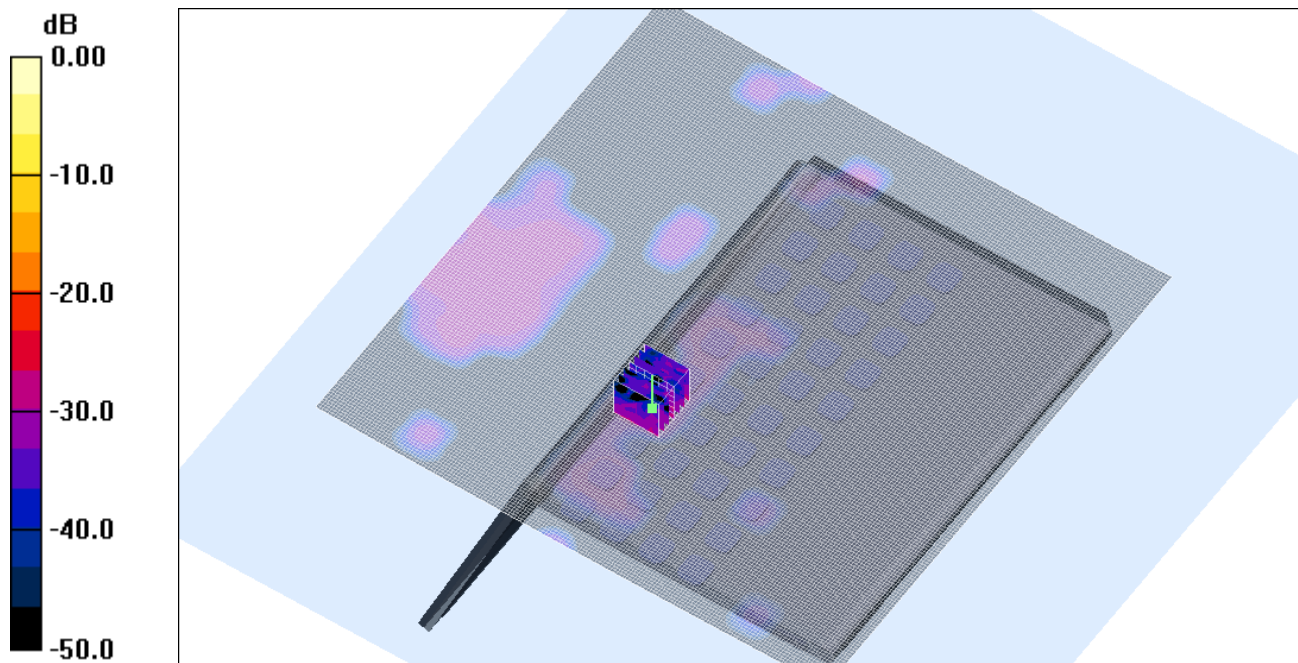
Test Date: 04 December 2007

File Name: Laps On DSSS 2450 MHz Antenna A Bluetooth Off 04-12-07.da4

DUT: **Fujitsu Tablet Savot with Kedron 11abgn and Bluetooth; Type: 4965 AGN; Serial: MAC: 0013E805447B**

- * Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.95528$ mho/m, $\epsilon_r = 53.7236$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn359; 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 (171x171x1): Measurement grid: dx=20mm, dy=20mm
 Maximum value of SAR (interpolated) = 0.00 mW/g



0 dB = 0.00mW/g

SAR MEASUREMENT PLOT 1

Ambient Temperature
 Liquid Temperature
 Humidity

21.8 Degrees Celsius
 21.2 Degrees Celsius
 64.0 %



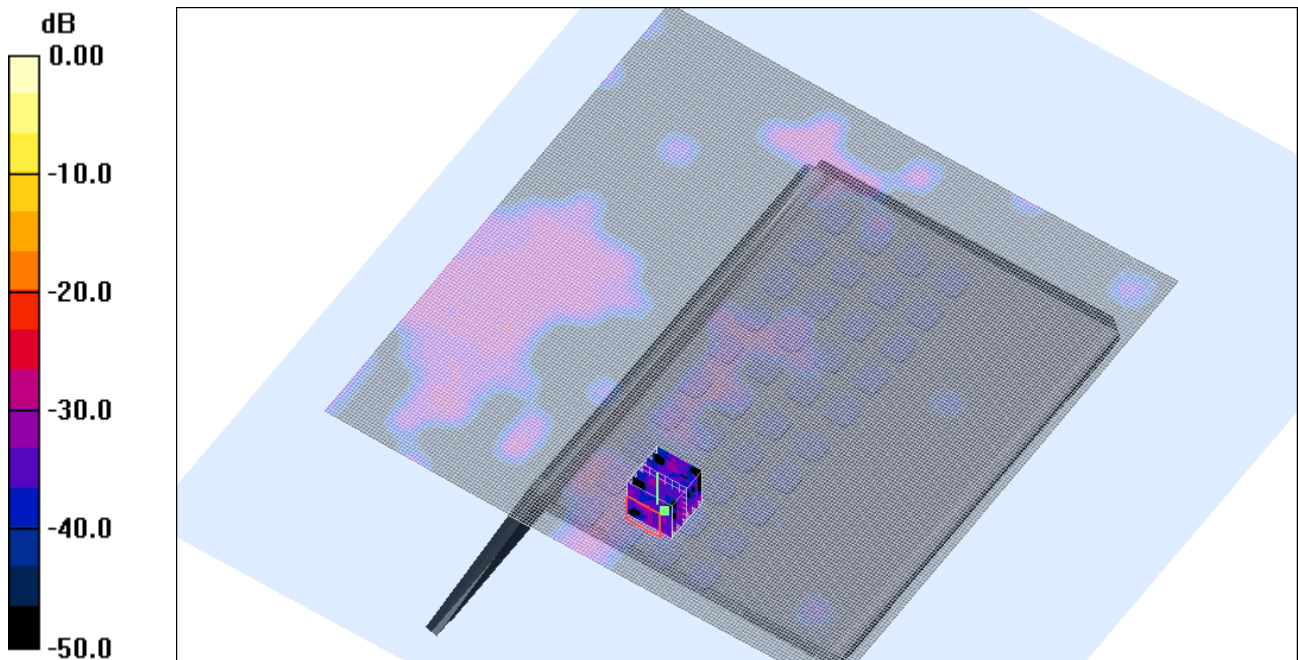
Test Date: 04 December 2007

File Name: Laps On DSSS 2450 MHz Antenna B Bluetooth Off 04-12-07.da4

DUT: Fujitsu Tablet Savot with Kedron 11abgn and Bluetooth; Type: 4965 AGN; Serial: MAC: 0013E805447B

- * Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.95528$ mho/m, $\epsilon_r = 53.7236$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn359; 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 (171x171x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.00 mW/g



SAR MEASUREMENT PLOT 2

Ambient Temperature
Liquid Temperature
Humidity

21.8 Degrees Celsius
21.2 Degrees Celsius
64.0 %



Test Date: 04 December 2007

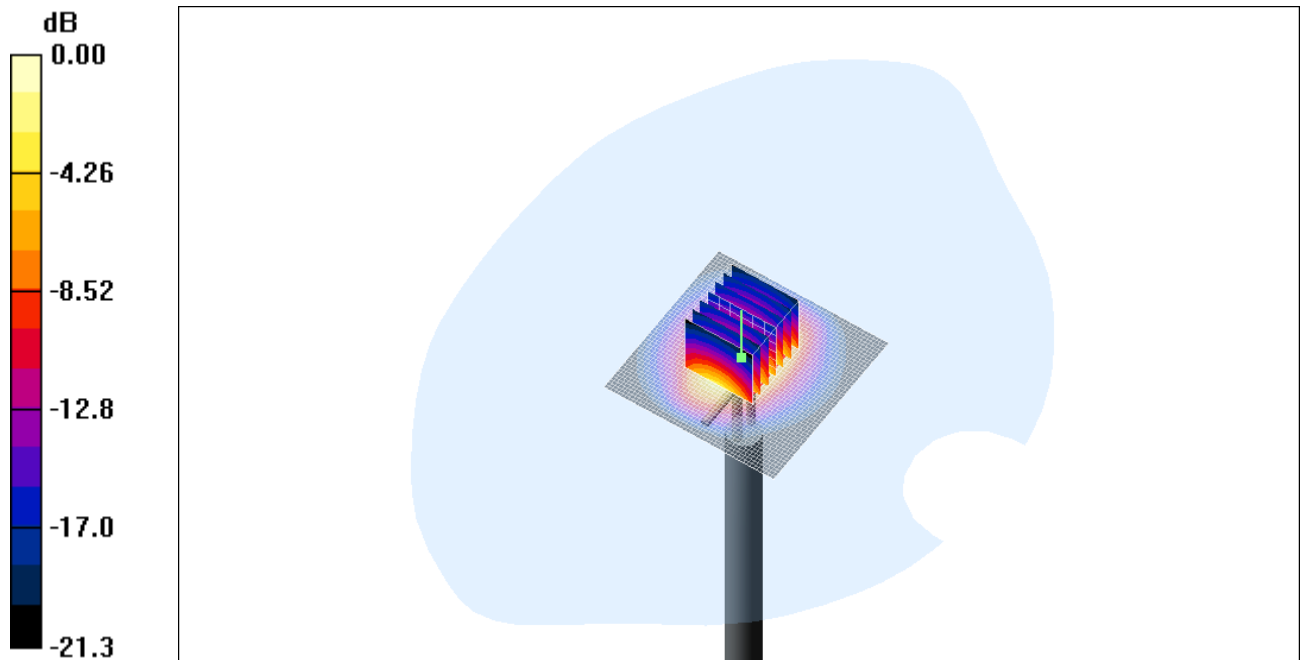
File Name: Validation 2450 MHz (DAE359 Probe1377) 04-12-07.da4

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

- * Communication System: CW 2450 MHz; Frequency: 2450 MHz; Duty Cycle: 1:1
- * Medium parameters used: $\sigma = 1.80998$ mho/m, $\epsilon_r = 39.9547$; $\rho = 1000$ kg/m³
- Electronics: DAE3 Sn359; 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) = 19.2 mW/g

Channel 1 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.8 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 30.8 W/kg
SAR(1 g) = 14.2 mW/g; SAR(10 g) = 6.63 mW/g
Maximum value of SAR (measured) = 15.9 mW/g



SAR MEASUREMENT PLOT 3

Ambient Temperature
Liquid Temperature
Humidity

21.8 Degrees Celsius
21.2 Degrees Celsius
64.0 %



APPENDIX C CALIBRATION DOCUMENTS

**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_Jul07**

CALIBRATION CERTIFICATE																																																			
Object	ET3DV6 - SN:1377																																																		
Calibration procedure(s)	QA CAL-01.v6 Calibration procedure for dosimetric E-field probes																																																		
Calibration date:	July 9, 2007																																																		
Condition of the calibrated item	In Tolerance																																																		
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter E4419B</td> <td>GB41293874</td> <td>29-Mar-07 (METAS, No. 217-00670)</td> <td>Mar-08</td> </tr> <tr> <td>Power sensor E4412A</td> <td>MY41495277</td> <td>29-Mar-07 (METAS, No. 217-00670)</td> <td>Mar-08</td> </tr> <tr> <td>Power sensor E4412A</td> <td>MY41498087</td> <td>29-Mar-07 (METAS, No. 217-00670)</td> <td>Mar-08</td> </tr> <tr> <td>Reference 3 dB Attenuator</td> <td>SN: S5054 (3c)</td> <td>10-Aug-06 (METAS, No. 217-00592)</td> <td>Aug-07</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: S5086 (20b)</td> <td>29-Mar-07 (METAS, No. 217-00671)</td> <td>Mar-08</td> </tr> <tr> <td>Reference 30 dB Attenuator</td> <td>SN: S5129 (30b)</td> <td>10-Aug-06 (METAS, No. 217-00593)</td> <td>Aug-07</td> </tr> <tr> <td>Reference Probe ES3DV2</td> <td>SN: 3013</td> <td>4-Jan-07 (SPEAG, No. ES3-3013_Jan07)</td> <td>Jan-08</td> </tr> <tr> <td>DAE4</td> <td>SN: 654</td> <td>20-Apr-07 (SPEAG, No. DAE4-654_Apr07)</td> <td>Apr-08</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Check Date (in house)</th> <th>Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>RF generator HP 8648C</td> <td>US3642U01700</td> <td>4-Aug-99 (SPEAG, in house check Nov-05)</td> <td>In house check: Nov-07</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585</td> <td>18-Oct-01 (SPEAG, in house check Oct-06)</td> <td>In house check: Oct-07</td> </tr> </tbody> </table>				Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	Power meter E4419B	GB41293874	29-Mar-07 (METAS, No. 217-00670)	Mar-08	Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08	Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08	Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07	Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08	Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07	Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08	DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08	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 Oct-06)	In house check: Oct-07
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Calibrated by:	Name Katja Pokovic	Function Technical Manager	Signature 																																																
Approved by:	Name Niels Kuster	Function Quality Manager	Signature 																																																
			Issued: July 10, 2007																																																
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.																																																			



**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**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- 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
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * *frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

ET3DV6 SN:1377

July 9, 2007

Probe ET3DV6

SN:1377

Manufactured:	August 16, 1999
Last calibrated:	July 14, 2006
Recalibrated:	July 9, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)



ET3DV6 SN:1377

July 9, 2007

DASY - Parameters of Probe: ET3DV6 SN:1377

Sensitivity in Free Space ^A			Diode Compression ^B	
NormX	1.93 ± 10.1%	μV/(V/m) ²	DCP X	94 mV
NormY	1.91 ± 10.1%	μV/(V/m) ²	DCP Y	97 mV
NormZ	1.87 ± 10.1%	μV/(V/m) ²	DCP Z	94 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	4.3
	SAR _{be} [%] With Correction Algorithm	0.1	0.1

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	13.1	8.7
	SAR _{be} [%] With Correction Algorithm	0.2	0.1

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.

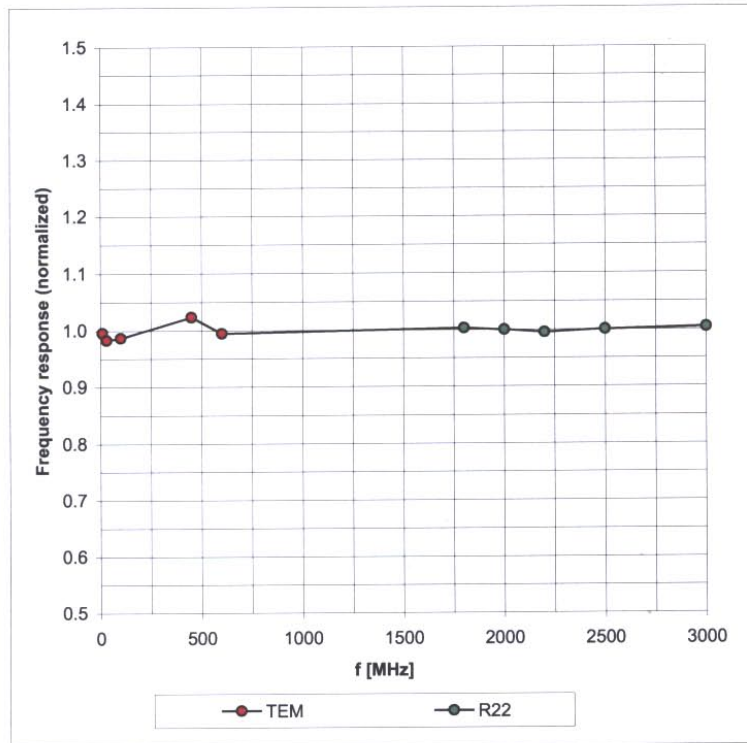


ET3DV6 SN:1377

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Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



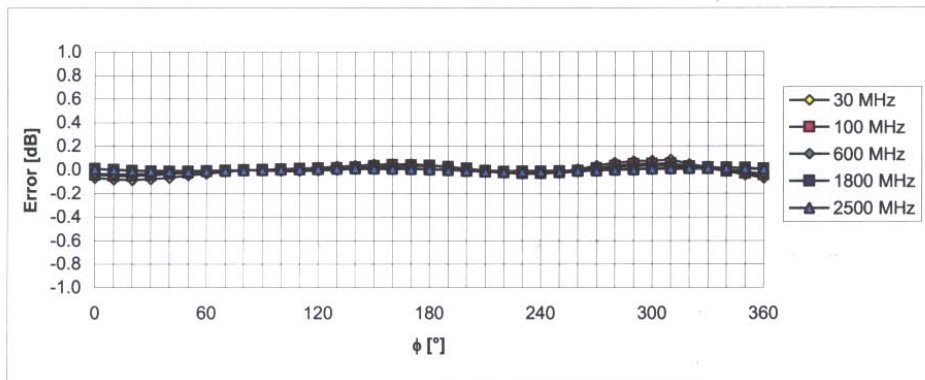
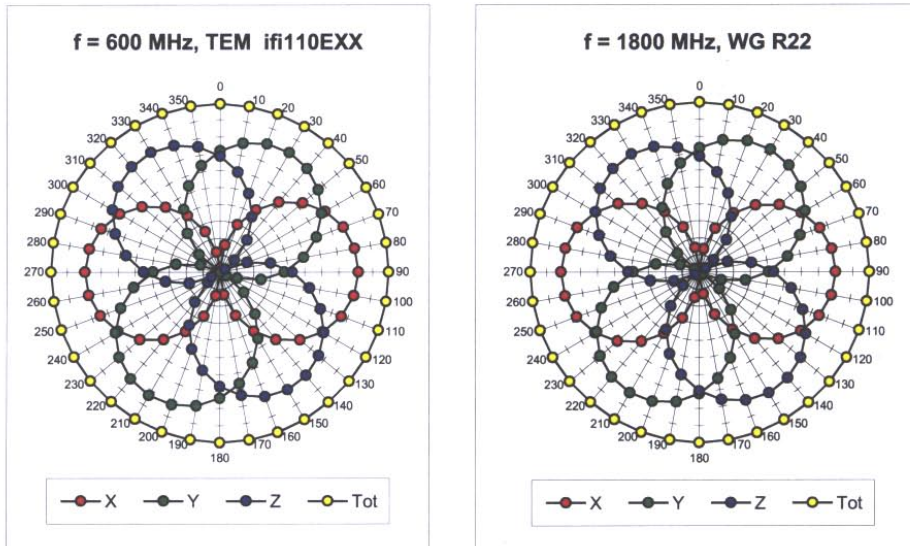
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)



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Receiving Pattern (ϕ), $\vartheta = 0^\circ$



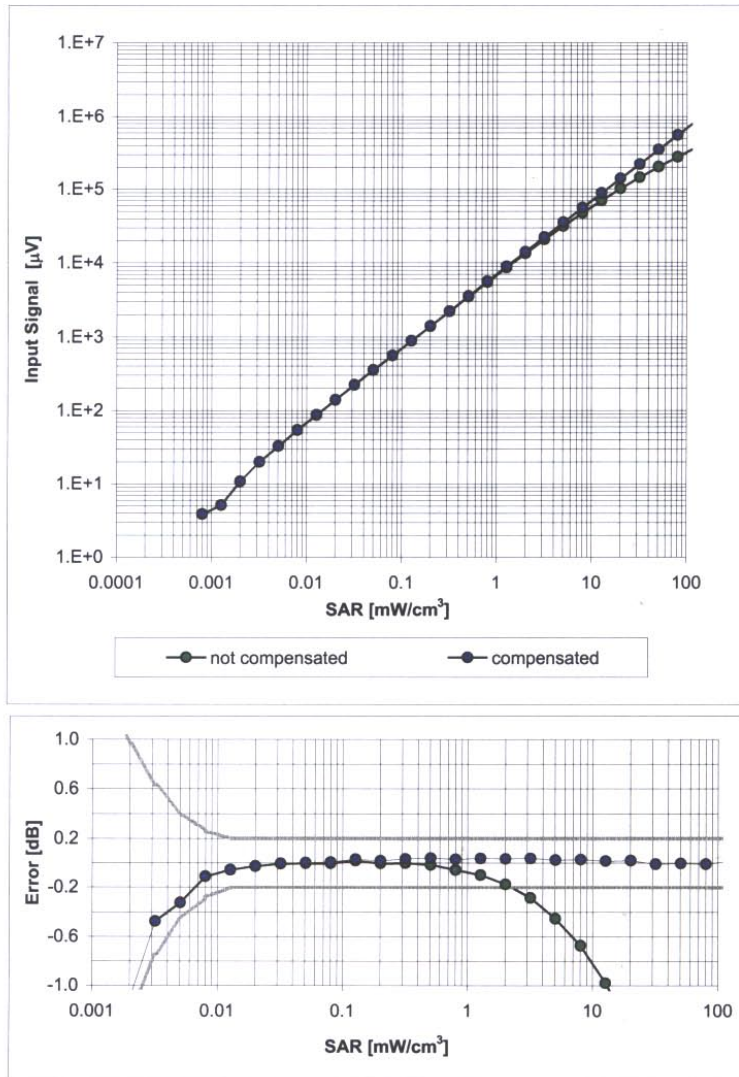
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)



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Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$)



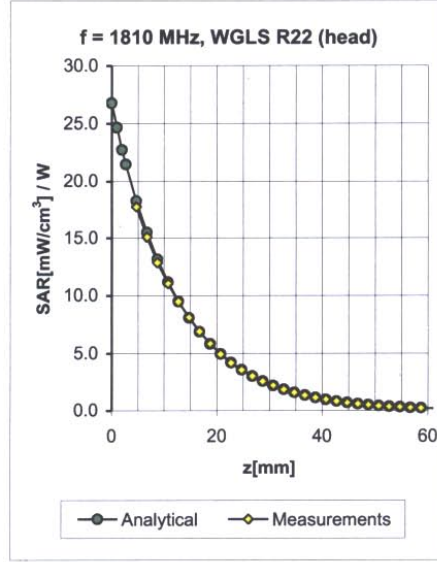
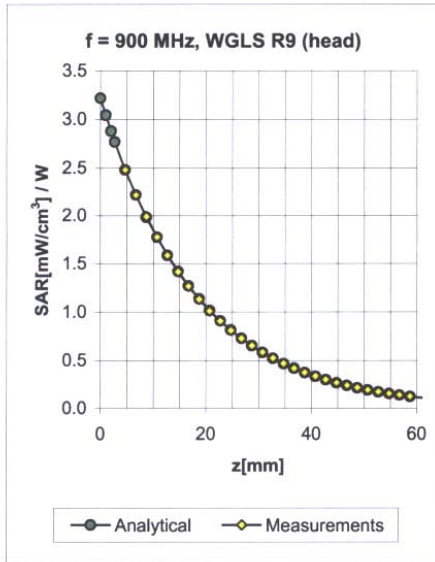
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)



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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%	0.26	2.83	6.43 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.47	2.81	5.13 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.72	1.82	4.45 ± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.31	2.86	6.03 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.61	2.53	4.74 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.69	1.89	3.98 ± 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.

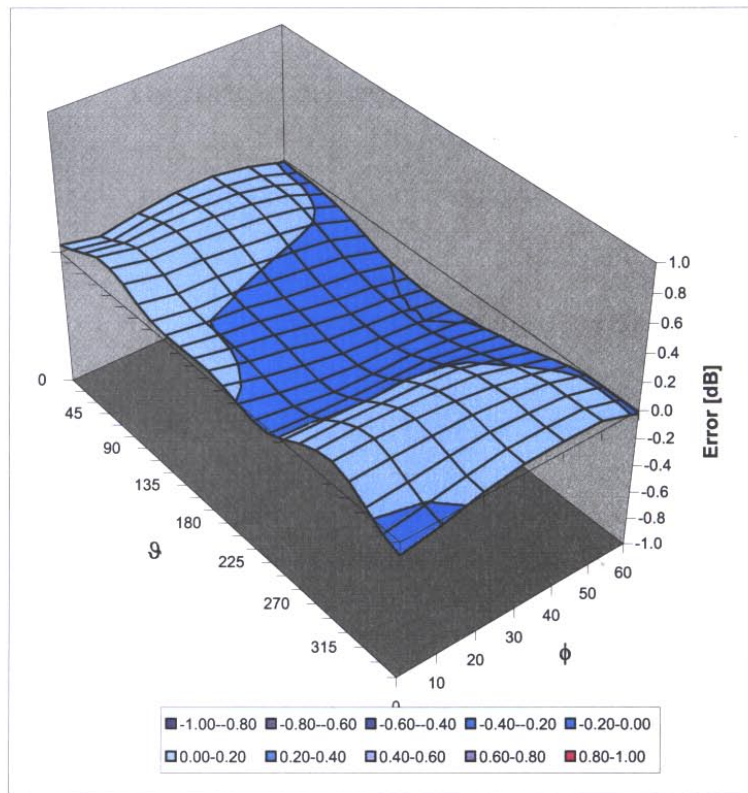


ET3DV6 SN:1377

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Deviation from Isotropy in HSL

Error (ϕ , ϑ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)



**Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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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
M. Fehr

Approved by: **Katja Pokovic** **Technical Manager**

Katja Pokovic

Issued: December 14, 2006

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



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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:

- 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
- 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
- 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:

- 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	V4.7
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 ± 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	37.7 ± 6 %	1.77 mho/m ± 6 %
Head TSL temperature during test	(21.8 ± 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 ± 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 ± 16.5 % (k=2)

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



Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω + 3.7 jΩ
Return Loss	- 27.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 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	October 16, 2002



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

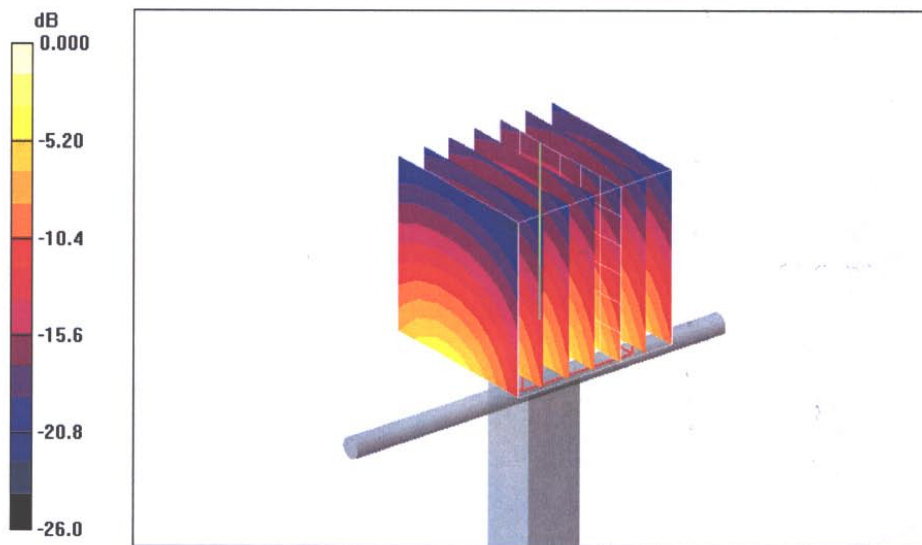
Communication System: CW-2450; Frequency: 2450 MHz;Duty Cycle: 1:1
 Medium: HSL U10 BB_060425;
 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 37.7$; $\rho = 1000$ kg/m³
 Phantom section: Flat Section
 Measurement Standard: DASY4 (High Precision Assessment)

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



0 dB = 15.0mW/g



Impedance Measurement Plot for Head TSL

