FCC SAR Test Report

APPLICANT : **Loopcomm Technology Inc.**

EQUIPMENT : **802.11b/g/n Wireless USB Dongle**

BRAND NAME : **None & Loopcomm**

MODEL NAME : **LP-8617, LP-8617E, LP-8697**

FCC ID : **VYTLP-8617**

STANDARD : **FCC 47 CFR Part 2 (2.1093)**
IEEE C95.1-1999
IEEE 1528-2003
FCC OET Bulletin 65 Supplement C (Edition 01-01)

The product was received on Jun. 25, 2009 and completely tested on Sep. 01, 2009. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:

Roy Wu / Manager

ilac-MRA

TAF
Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1ˢᵗ Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

SPORTON INTERNATIONAL INC.
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FCC ID : VYTLP-8617

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA962522B	Rev. 01	Initial issue of report	Sep. 07, 2009

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1. *Statement of Compliance*

The maximum results of Specific Absorption Rate (SAR) were found during testing for **Loopcomm Technology Inc. 802.11b/g/n Wireless USB Dongle None & Loopcomm LP-8617, LP-8617E, LP-8697**, which are as follows (with expanded uncertainty 21.8 % for 300 MHz to 3 GHz, and 25.6% for 3 GHz to 6 GHz).

Band	Position	SAR_{1g} (W/kg)
802.11b/g/n	Body	1.17

They are in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1999, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003 and FCC OET Bulletin 65 Supplement C (Edition 01-01).

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2. *Administration Data*

2.1 *Testing Laboratory*

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sporton Site No. : SAR01-HY ; SAR02-HY

2.2 *Applicant*

Company Name	Loopcomm Technology Inc.
Address	1F., No. 114, Lian-Chen Rd., Chung-Ho City, Taipei county 235, Taiwan, R.O.C.

2.3 *Manufacturer*

Company Name	Loopcomm Technology Inc.
Address	1F., No. 114, Lian-Chen Rd., Chung-Ho City, Taipei county 235, Taiwan, R.O.C.

2.4 *Application Details*

Date of Receipt of Application	Jun. 25, 2009
Date of Start during the Test	Aug. 10, 2009
Date of End during the Test	Sep. 01, 2009

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3. *General Information*

3.1 *Description of Device Under Test (DUT)*

Product Feature & Specification	
DUT Type	802.11b/g/n Wireless USB Dongle
Trade Name	None & Loopcomm
Model Name	LP-8617, LP-8617E, LP-8697
FCC ID	VYTLP-8617
Tx Frequency	2400 MHz ~ 2483.5 MHz
Rx Frequency	2400 MHz ~ 2483.5 MHz
Maximum Output Power to Antenna	802.11b : 14.40 dBm 802.11g : 13.36 dBm 802.11n (BW 20MHz) : 13.80 dBm 802.11n (BW 40MHz) : 13.42 dBm
Antenna Type	Dipole Antenna
Type of Modulation	802.11b : DSSS 802.11g/n : OFDM
DUT Stage	Production Unit

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications
or user's manual for more detailed description.

3.2 *Product Photos*

Please refer to Appendix D.

3.3 Applied Standards

The Specific Absorption Rate (SAR) testing specification, method and procedure for this 802.11b/g/n Wireless USB Dongle is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- IEEE C95.1-1999
- IEEE 1528-2003
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 248227 D01 v01r02
- FCC KDB 447498 D02 v01

3.4 Device Category and SAR Limits

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

3.5 Test Conditions

3.5.1 Ambient Condition

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.5.2 Test Configuration

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.

The data rates for 802.11b/g/n SAR testing were set in 11Mbps for 802.11b, 6Mbps for 802.11g, and 6.5Mbps for 802.11n(BW 20MHz) and 13.5Mbps for 802.11n(BW 40MHz) with both antennas transmit due to the highest RF output power.

Because the swivel antenna USB dongle, this DUT has submitted a KDB inquiry to FCC and the KDB got the FCC response. The KDB's tracking number is 881829.

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4. *Specific Absorption Rate (SAR)*

4.1 *Introduction*

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

4.2 *SAR Definition*

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = C\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

$$SAR = \frac{\sigma|E|^2}{\rho}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.
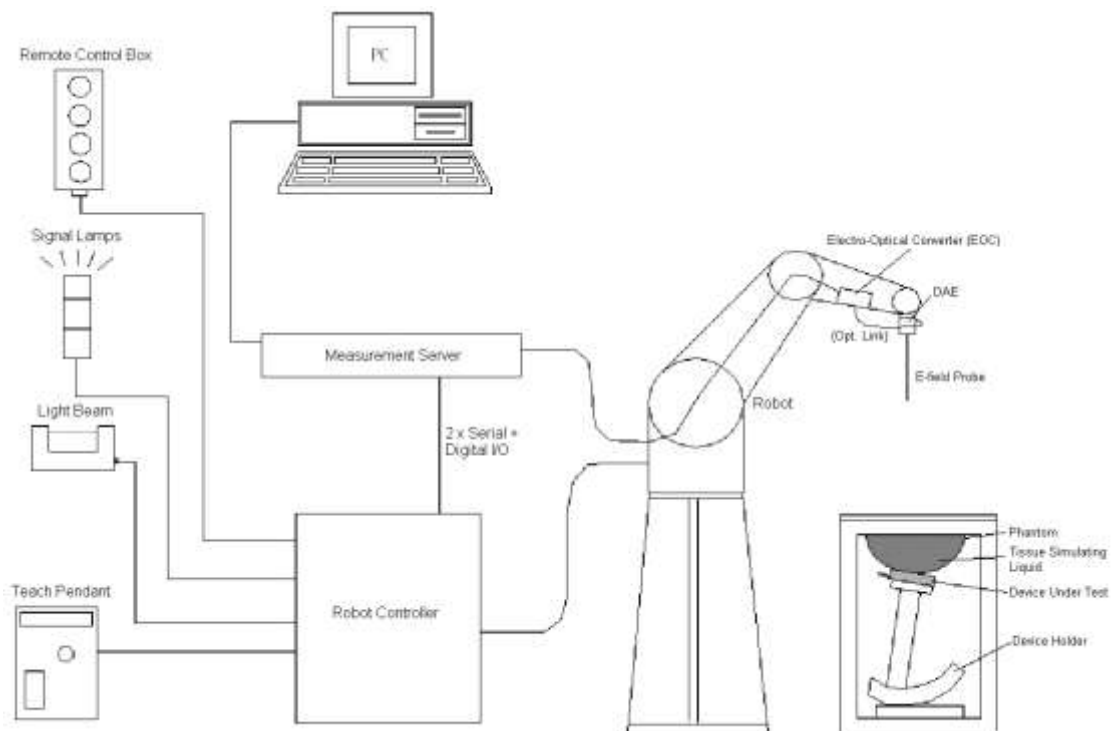
5. *SAR Measurement System*

Fig 5.1 SPEAG DASY4 or DASY5 System Configurations

The DASY4 or DASY5 system for performance compliance tests is illustrated above graphically. This system consists of the following items:

➢   A standard high precision 6-axis robot with controller, a teach pendant and software
➢   A data acquisition electronic (DAE) attached to the robot arm extension
➢   A dosimetric probe equipped with an optical surface detector system
➢   The electro-optical converter (ECO) performs the conversion between optical and electrical signals
➢   A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
➢   A probe alignment unit which improves the accuracy of the probe positioning
➢   A computer operating Windows XP
➢   DASY4 or DASY5 software
➢   Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
➢   The SAM twin phantom
➢   A device holder
➢   Tissue simulating liquid
➢   Dipole for evaluating the proper functioning of the system

Some of the components are described in details in the following sub-sections.

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5.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

5.1.1 E-Field Probe Specification

<ET3DV6>

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 3 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)	
Dynamic Range	5 µW/g to 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm	**Fig 5.2 Photo of ET3DV6**

<EX3DV3 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	**Fig 5.3 Photo of EX3DV3**

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5.1.2 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25 dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

5.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) 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. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 5.4　　Photo of DAE

5.3 Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

➢ High precision (repeatability ±0.035 mm)
➢ High reliability (industrial design)
➢ Jerk-free straight movements
➢ Low ELF interference (the closed metallic construction shields against motor control fields)

Fig 5.5　　Photo of DASY4

Fig 5.6　　Photo of DASY5

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5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

Fig 5.7   Photo of Server for DASY4   **Fig 5.8   Photo of Server for DASY5**

5.5 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	
		Fig 5.9 Photo of SAM Phantom

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI4 Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)	
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm	
		Fig 5.10 Photo of ELI4 Phantom

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

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5.6 Device Holder

<Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity $\varepsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

Fig 5.11　Device Holder

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<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.
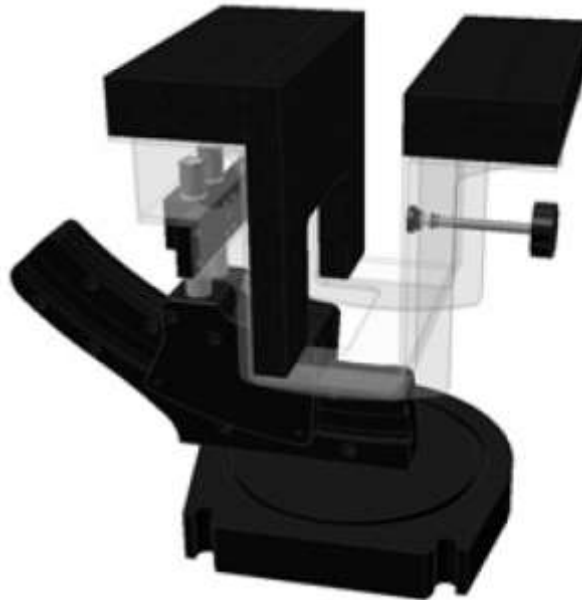

Fig 5.12   Laptop Extension Kit

5.7 Data Storage and Evaluation

5.7.1   Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

5.7.2   Data Evaluation

The DASY post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software：

Probe parameters：	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters：	- Frequency	f
	- Crest factor	cf
Media parameters：	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as：

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with V_i = compensated signal of channel i, (i = x, y, z)
U_i = input signal of channel i, (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcp_i = diode compression point (DASY parameter)

From the compensated input signals, the primary field data for each channel can be evaluated：

$$\text{E-field Probes：} E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H-field Probes：} H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

with V_i = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = sensor sensitivity of channel i, (i = x, y, z), μV/(V/m)^2 for E-field Probes
ConvF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
E_i = electric field strength of channel i in V/m
H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude)：

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with   SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

5.8 Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Dosimetric E-Filed Probe	ET3DV6	1787	May 26, 2009	May 25, 2010
SPEAG	Dosimetric E-Filed Probe	ET3DV6	1788	Sep. 23, 2008	Sep. 22, 2009
SPEAG	Dosimetric E-Filed Probe	EX3DV3	3514	Jan. 21, 2009	Jan. 20, 2010
SPEAG	835MHz System Validation Kit	D835V2	499	Mar. 17, 2008	Mar. 16, 2010
SPEAG	900MHz System Validation Kit	D900V2	190	Jul. 21, 2009	Jul. 20, 2011
SPEAG	1800MHz System Validation Kit	D1800V2	2d076	Jul. 20, 2009	Jul. 19, 2011
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Mar. 28, 2008	Mar. 27, 2010
SPEAG	2000MHz System Validation Kit	D2000V2	1010	Sep. 17, 2008	Sep. 16, 2010
SPEAG	2300MHz System Validation Kit	D2300V2	1006	Sep. 12, 2007	Sep. 11, 2009
SPEAG	2450MHz System Validation Kit	D2450V2	736	Jul. 20, 2009	Jul. 19, 2011
SPEAG	2600MHz System Validation Kit	D2600V2	1008	Sep. 12, 2007	Sep. 11, 2009
SPEAG	3500MHz System Validation Kit	D3500V2	1014	Sep. 19, 2007	Sep. 18, 2009
SPEAG	5GHz System Validation Kit	D5GHzV2	1006	Jan. 24, 2008	Jan. 23, 2010
SPEAG	Data Acquisition Electronics	DAE3	577	Nov. 12, 2008	Nov. 11, 2009
SPEAG	Data Acquisition Electronics	DAE4	778	Sep. 22, 2008	Sep. 21, 2009
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1303	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1383	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1446	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1477	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BB	1026	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BA	1029	NCR	NCR
Agilent	PNA Series Network Analyzer	E8358A	US40260131	Apr. 17, 2009	Apr. 16, 2010
Agilent	Wireless Communication Test Set	E5515C	MY48360820	Dec. 15, 2008	Dec. 14, 2009
R&S	Universal Radio Communication Tester	CMU200	105934	Nov. 11, 2008	Nov. 10, 2009
Agilent	Dielectric Probe Kit	85070D	US01440205	NCR	NCR
Agilent	Dual Directional Coupler	778D	50422	NCR	NCR
AR	Power Amplifier	5S1G4M2	0328767	NCR	NCR
R&S	Power Meter	NRVD	101394	Oct. 20, 2008	Oct. 19, 2009
R&S	Power Sensor	NRV-Z1	100130	Oct. 20, 2008	Oct. 19, 2009
R&S	Spectrum Analyzer	FSP7	101131	Mar. 12, 2009	Mar. 11, 2010

Table 5.1 Test Equipment List

Note: The calibration certificate of DASY can be referred to appendix C of this report.

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6. *Tissue Simulating Liquids*

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.2.

Fig 6.1 Photo of Liquid Height for Head SAR

Fig 6.2 Photo of Liquid Height for Body SAR

Table 6.1 gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ε_r)
For Head								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7

Table 6.1 Recipes of Tissue Simulating Liquid

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Table 6.2 gives the targets for tissue simulating liquid.

Frequency (MHz)	Liquid Type	Conductivity (σ)	±5% Range	Permittivity (ε_r)	±5% Range
2450	Head	1.80	1.71 ~ 1.89	39.2	37.2 ~ 41.2
5200	Head	4.66	4.43 ~ 4.89	36.0	34.2 ~ 37.8
5500	Head	4.96	4.71 ~ 5.21	35.6	33.8 ~ 37.4
5800	Head	5.27	5.01 ~ 5.53	35.3	33.5 ~ 37.1
2450	Body	1.95	1.85 ~ 2.05	52.7	50.1 ~ 55.3
5200	Body	5.30	5.04 ~ 5.57	49.0	46.6 ~ 51.5
5500	Body	5.65	5.37 ~ 5.93	48.6	46.2 ~ 51.0
5800	Body	6.00	5.70 ~ 6.30	48.2	45.8 ~ 50.6

Table 6.2 Targets of Tissue Simulating Liquid

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

Table 6.3 shows the measuring results for simulating liquid.

Frequency (MHz)	Liquid Type	Temperature (℃)	Conductivity (σ)	Permittivity (ε_r)	Measurement Date
2450	Body	21.3	1.92	53.2	Aug. 10, 2009
2450	Body	21.4	1.93	53.6	Aug. 30, 2009
2450	Body	21.2	1.93	53.3	Sep. 01, 2009

Table 6.3 Measuring Results for Simulating Liquid

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7. *Uncertainty Assessment*

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 7.1

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor[a]	$1/k$[b]	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

Table 7.1 Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is showed in Table 7.2 and Table 7.3.

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Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Standard Uncertainty (1g)
Measurement System					
Probe Calibration	5.9	Normal	1	1	± 5.9 %
Axial Isotropy	4.7	Rectangular	√3	0.7	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	± 3.9 %
Boundary Effects	1.0	Rectangular	√3	1	± 0.6 %
Linearity	4.7	Rectangular	√3	1	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	± 0.6 %
Readout Electronics	0.3	Normal	1	1	± 0.3 %
Response Time	0.8	Rectangular	√3	1	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	± 1.7 %
Probe Positioner	0.4	Rectangular	√3	1	± 0.2 %
Probe Positioning	2.9	Rectangular	√3	1	± 1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	± 0.6 %
Test Sample Related					
Device Positioning	2.9	Normal	1	1	± 2.9 %
Device Holder	3.6	Normal	1	1	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	± 2.9 %
Phantom and Setup					
Phantom Uncertainty	4.0	Rectangular	√3	1	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	± 1.8 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	± 1.6 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	± 1.7 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	± 1.5 %
Combined Standard Uncertainty					± 10.9 %
Coverage Factor for 95 %					K = 2
Expanded Uncertainty					**± 21.8 %**

Table 7.2 Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz

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Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Standard Uncertainty (1g)
Measurement System					
Probe Calibration	6.5	Normal	1	1	± 6.5 %
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	0.7	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	$\sqrt{3}$	0.7	± 3.9 %
Boundary Effects	2.0	Rectangular	$\sqrt{3}$	1	± 1.2 %
Linearity	4.7	Rectangular	$\sqrt{3}$	1	± 2.7 %
System Detection Limits	1.0	Rectangular	$\sqrt{3}$	1	± 0.6 %
Readout Electronics	0.3	Normal	1	1	± 0.3 %
Response Time	0.8	Rectangular	$\sqrt{3}$	1	± 0.5 %
Integration Time	2.6	Rectangular	$\sqrt{3}$	1	± 1.5 %
RF Ambient Noise	3.0	Rectangular	$\sqrt{3}$	1	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	$\sqrt{3}$	1	± 1.7 %
Probe Positioner	0.8	Rectangular	$\sqrt{3}$	1	± 0.5 %
Probe Positioning	9.9	Rectangular	$\sqrt{3}$	1	± 5.7 %
Max. SAR Eval.	4.0	Rectangular	$\sqrt{3}$	1	± 2.3 %
Test Sample Related					
Device Positioning	2.9	Normal	1	1	± 2.9 %
Device Holder	3.6	Normal	1	1	± 3.6 %
Power Drift	5.0	Rectangular	$\sqrt{3}$	1	± 2.9 %
Phantom and Setup					
Phantom Uncertainty	4.0	Rectangular	$\sqrt{3}$	1	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	$\sqrt{3}$	0.43	± 1.8 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.43	± 1.6 %
Liquid Permittivity (Target)	5.0	Rectangular	$\sqrt{3}$	0.49	± 1.7 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.49	± 1.5 %
Combined Standard Uncertainty					± 12.8 %
Coverage Factor for 95 %					K = 2
Expanded Uncertainty					**± 25.6 %**

Table 7.3 Uncertainty Budget of DASY for frequency range 3 GHz to 6 GHz

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8. SAR Measurement Evaluation

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

8.1 Purpose of System Performance check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

8.2 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:
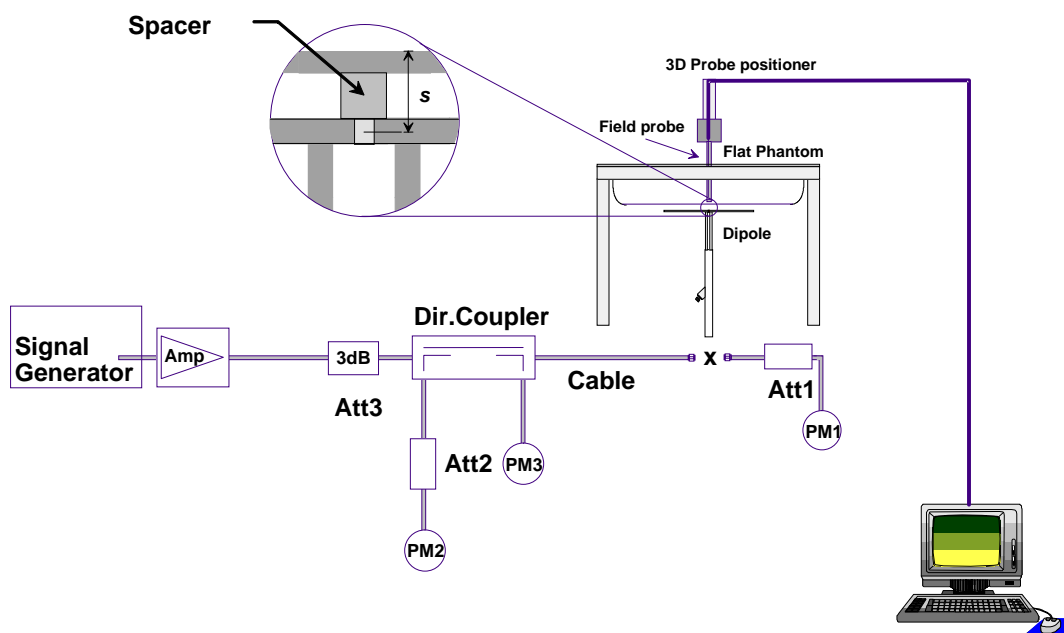
Fig 8.1 System Setup for System Evaluation

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1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole

The output power on dipole port must be calibrated to 20 dBm (100 mW) before dipole is connected.
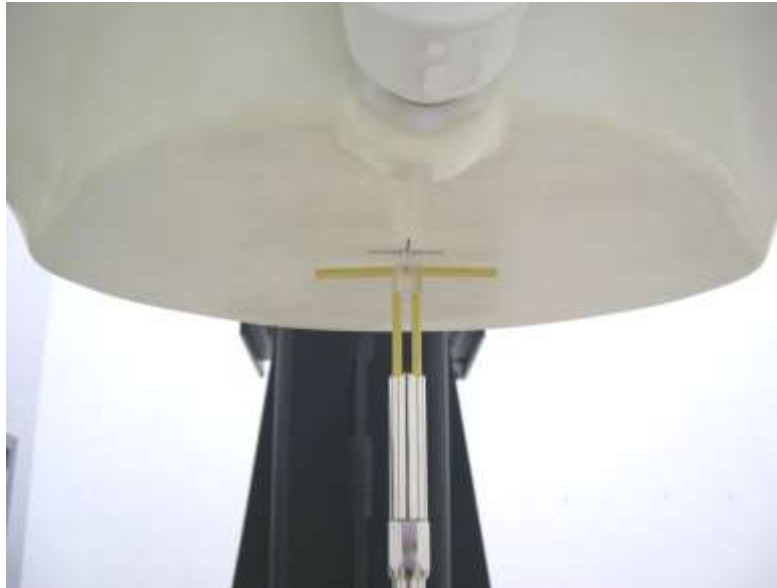
Fig 8.2 Photo of Dipole Setup

8.3 Validation Results

Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %. Table 8.1 shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to appendix A of this report.

Measurement Date	Frequency (MHz)	Targeted SAR$_{1g}$ (W/kg)	Measured SAR$_{1g}$ (W/kg)	Deviation (%)
Aug. 10, 2009	2450	53.00	52.40	-1.13
Aug. 30, 2009	2450	53.00	57.80	9.06
Sep. 01, 2009	2450	53.00	57.30	8.11

Table 8.1 Target and Measurement SAR after Normalized

9. *DUT Testing Position*

This DUT was tested in four different USB configurations. They are "direct laptop plug-in for configuration 1" and "USB cable plug-in for configuration 2 to 4" shown as below. Both direct laptop plug-in and USB cable plug-in test configurations are tested with 0.5 cm separation between the particular dongle orientation and the flat phantom.

Configuration 1 (Horizontal Up)	Configuration 2 (Horizontal Down)	Configuration 3 (Vertical Front)	Configuration 4 (Vertical Back)
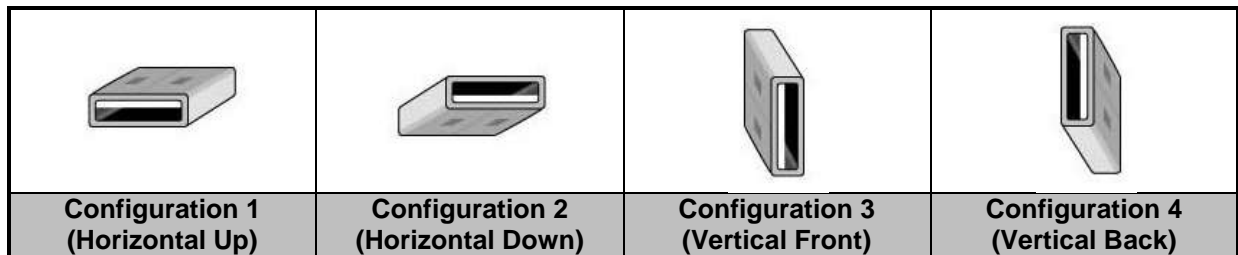
Fig 9.1   Illustration for USB Connector Orientations

10. *Measurement Procedures*

The measurement procedures are as follows:

(a) Use engineering software to transmit RF power continuously (continuous Tx) in the middle channel
(b) Measure output power through RF cable and power meter
(c) Place the DUT in the positions described in the last section
(d) Set scan area, grid size and other setting on the DASY software
(e) Taking data for the middle channel on each testing position
(f) Find out the largest SAR result on these testing positions of each band
(g) Measure SAR results for the lowest and highest channels in worst SAR testing position

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

10.1 *Spatial Peak SAR Evaluation*

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

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10.2 _Scan Procedures_

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 5x5x7 points with step size 8, 8 and 5 mm for 300 MHz to 3 GHz, and 8x8x8 points with step size 4.3, 4.3 and 3 mm for 3 GHz to 6 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

10.3 _SAR Averaged Methods_

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

11. *SAR Test Results*

11.1 *Conducted Power (Unit: dBm)*

Band	802.11b			802.11g		
Channel	**1**	**6**	**11**	**1**	**6**	**11**
Frequency (MHz)	**2412**	**2437**	**2462**	**2412**	**2437**	**2462**
Power	14.05	14.40	13.82	13.36	13.26	13.34

Band	802.11n (BW 20MHz)			802.11n (BW 40MHz)		
Channel	**1**	**6**	**11**	**3**	**6**	**9**
Frequency (MHz)	**2412**	**2437**	**2462**	**2422**	**2437**	**2452**
Power	13.58	13.63	13.80	13.28	13.40	13.42

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11.2 *Test Records for Body SAR Test*

Plot No.	Band	Mode	Test Position	Antenna Status	Separation Distance (cm)	Channel	SAR$_{1g}$ (W/kg)
#20	802.11b	-	Horizontal Up (Laptop)	Straight, 0 degree	0.5	6	1
#15	802.11b	-	Horizontal Up (Laptop)	Straight, 90 degree	0.5	6	0.892
#19	802.11b	-	Horizontal Up (Laptop)	Straight, 180 degree	0.5	6	0.958
#21	**802.11b**	**-**	**Horizontal Up (Laptop)**	**Straight, 270 degree**	**0.5**	**6**	**1.17**
#17	802.11b	-	Horizontal Up (Laptop)	Vertical, 0 degree	0.5	6	1.02
#18	802.11b	-	Horizontal Up (Laptop)	Vertical, 90 degree	0.5	6	0.024
#16	802.11b	-	Horizontal Up (Laptop)	Vertical, 180 degree	0.5	6	1
#24	802.11b	-	Horizontal Down (USB Cable)	Straight, 270 degree	0.5	6	1.15
#22	802.11b	-	Vertical Front (USB Cable)	Straight, 270 degree	0.5	6	0.475
#23	802.11b	-	Vertical Back (USB Cable)	Straight, 270 degree	0.5	6	0.325
#25	802.11g	-	Horizontal Up (Laptop)	Straight, 270 degree	0.5	6	0.969
#26	802.11n	BW 20MHz	Horizontal Up (Laptop)	Straight, 270 degree	0.5	6	0.875
#27	802.11n	BW 40MHz	Horizontal Up (Laptop)	Straight, 270 degree	0.5	6	0.791
#28	802.11b	-	Horizontal Up (Laptop)	Straight, 270 degree	0.5	1	0.733
#29	802.11b	-	Horizontal Up (Laptop)	Straight, 270 degree	0.5	11	1.05
#32	802.11b	-	Horizontal Up (Laptop)	Vertical, 0 degree	0.5	1	0.749
#33	802.11b	-	Horizontal Up (Laptop)	Vertical, 0 degree	0.5	11	0.972
#30	802.11b	-	Horizontal Down (USB Cable)	Straight, 270 degree	0.5	1	0.673
#31	802.11b	-	Horizontal Down (USB Cable)	Straight, 270 degree	0.5	11	1

11.3 *Test Records for Back-Off SAR Test*

Plot No.	Band	Mode	Test Position	Antenna Status	Separation Distance (cm)	Channel	SAR$_{1g}$ (W/kg)
#34	802.11b	-	Horizontal Up (Laptop)	Straight, 270 degree	1.0	6	0.535

Test Engineer：Robert Liu, A-Rod Chen and Gordon Lin

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12. *References*

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[3] IEEE Std. 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003

[4] FCC OET Bulletin 65 (Edition 97-01) Supplement C (Edition 01-01), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", June 2001

[5] SPEAG DASY System Handbook

[6] FCC KDB 248227 D01 v01r02, "SAR Measurement Procedures for 802.11 a/b/g Transmitters", May 2007

[7] FCC KDB 447498 D01 v03r03, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", January 2009

[8] FCC KDB 447498 D02 v01, "SAR Measurement Procedures for USB Dongle Transmitters", December 2008

[9] FCC KDB 616217 D01 v01, "SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens", December 2007

[10] FCC KDB 648474 D01 v01r05, "SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas", September 2008

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[12] FCC KDB 941225 D03 v01, "Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE", December 2008

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Appendix A.   Plots of System Performance Check

The plots are shown as follows.

System Check_Body_2450MHz_090810

DUT: Dipole 2450 MHz

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2450 MHz; σ = 1.92 mho/m; ε$_r$ = 53.2; ρ

= 1000 kg/m^3
Ambient Temperature 23.0 ; Liquid Temperature 21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Pin=100mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 6.06 mW/g

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.4 V/m; Power Drift = 0.022 dB
Peak SAR (extrapolated) = 12.2 W/kg
SAR(1 g) = 5.24 mW/g; SAR(10 g) = 2.45 mW/g
Maximum value of SAR (measured) = 5.73 mW/g
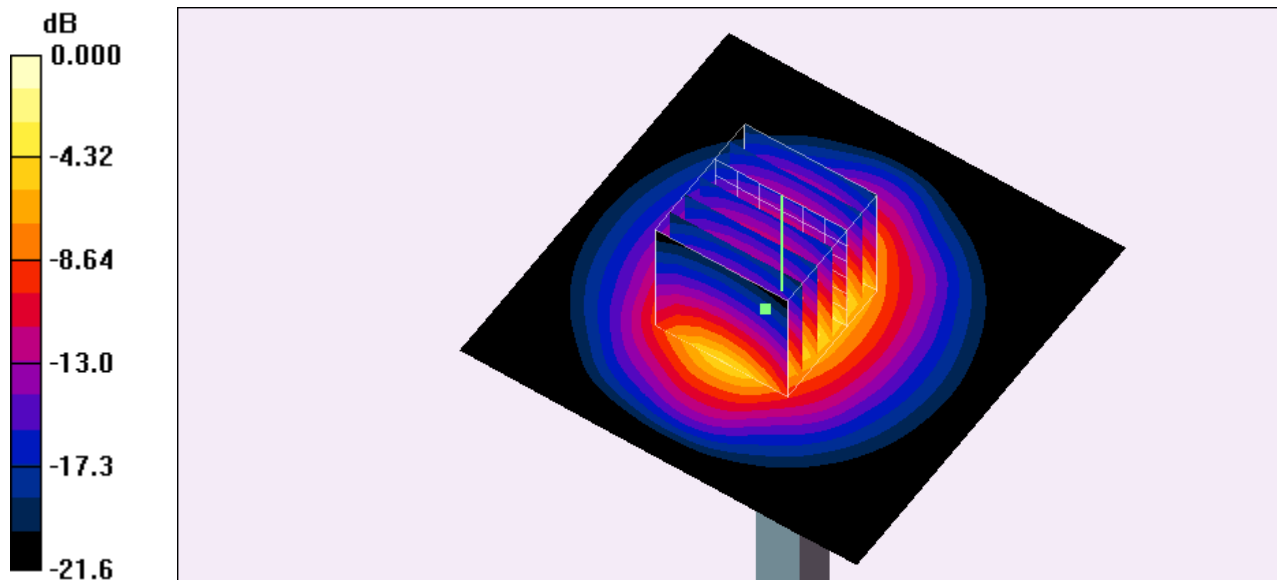
0 dB = 5.73mW/g

 System Check_Body_2450MHz_090830

DUT: Dipole 2450 MHz

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090830 Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 53.6; ρ = 1000

kg/m^3
Ambient Temperature 22.5 ; Liquid Temperature 21.4

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 6.67 mW/g

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.2 V/m; Power Drift = 0.0088 dB
Peak SAR (extrapolated) = 13.4 W/kg
SAR(1 g) = 5.78 mW/g; SAR(10 g) = 2.69 mW/g
Maximum value of SAR (measured) = 6.42 mW/g
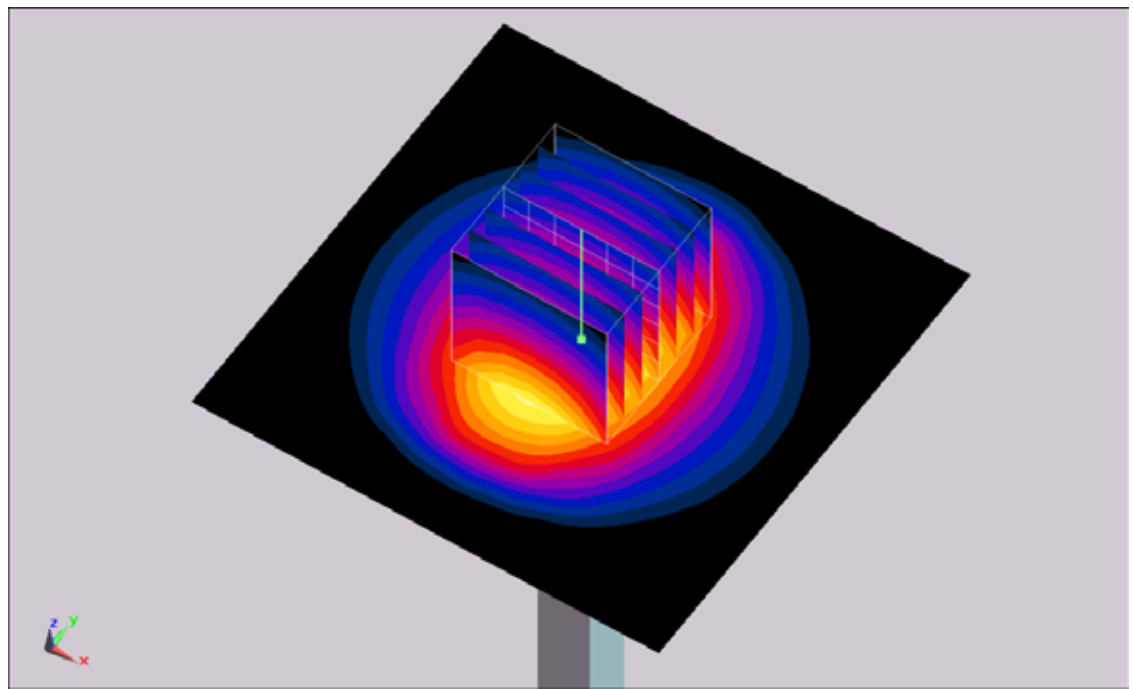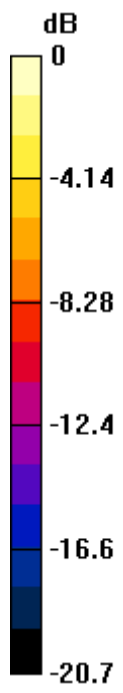
0 dB = 6.42mW/g

System Check_Body_2450MHz_090901

DUT: Dipole 2450 MHz

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090901 Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 53.3; ρ = 1000

kg/m^3
Ambient Temperature 22.5 ; Liquid Temperature 21.2

DASY5 Configuration:
- Probe: ET3DV6 - SN1788; ConvF(3.98, 3.98, 3.98); Calibrated: 2008/9/23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 6.67 mW/g

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.5 V/m; Power Drift = -0.074 dB
Peak SAR (extrapolated) = 12.2 W/kg
SAR(1 g) = 5.73 mW/g; SAR(10 g) = 2.73 mW/g
Maximum value of SAR (measured) = 6.47 mW/g
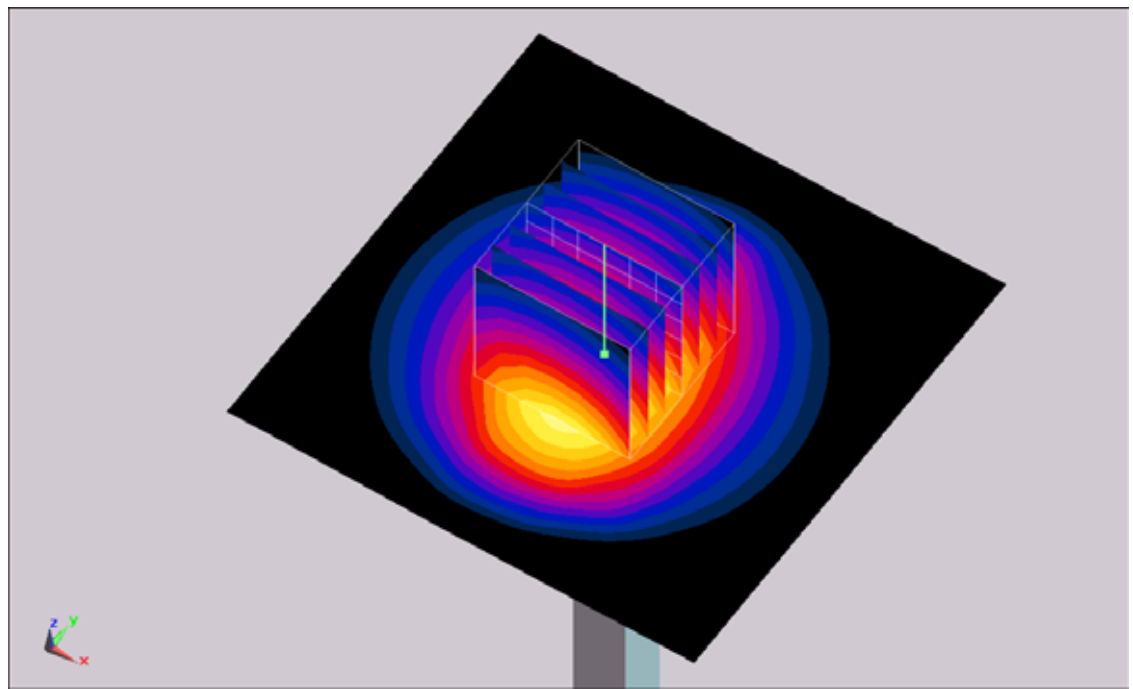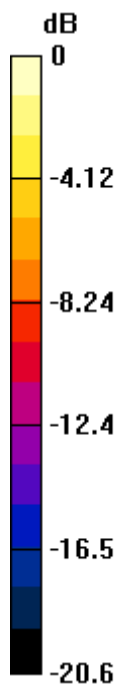
0 dB = 6.47mW/g

Appendix B.   Plots of SAR Measurement

The plots are shown as follows.

#15 802.11b_Horizontal Up_Ant Straight_90 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature 23.0   ; Liquid Temperature 21.2

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (31x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.11 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.37 V/m; Power Drift = 0.089 dB
Peak SAR (extrapolated) = 2.04 W/kg
SAR(1 g) = 0.892 mW/g; SAR(10 g) = 0.428 mW/g
Maximum value of SAR (measured) = 0.970 mW/g
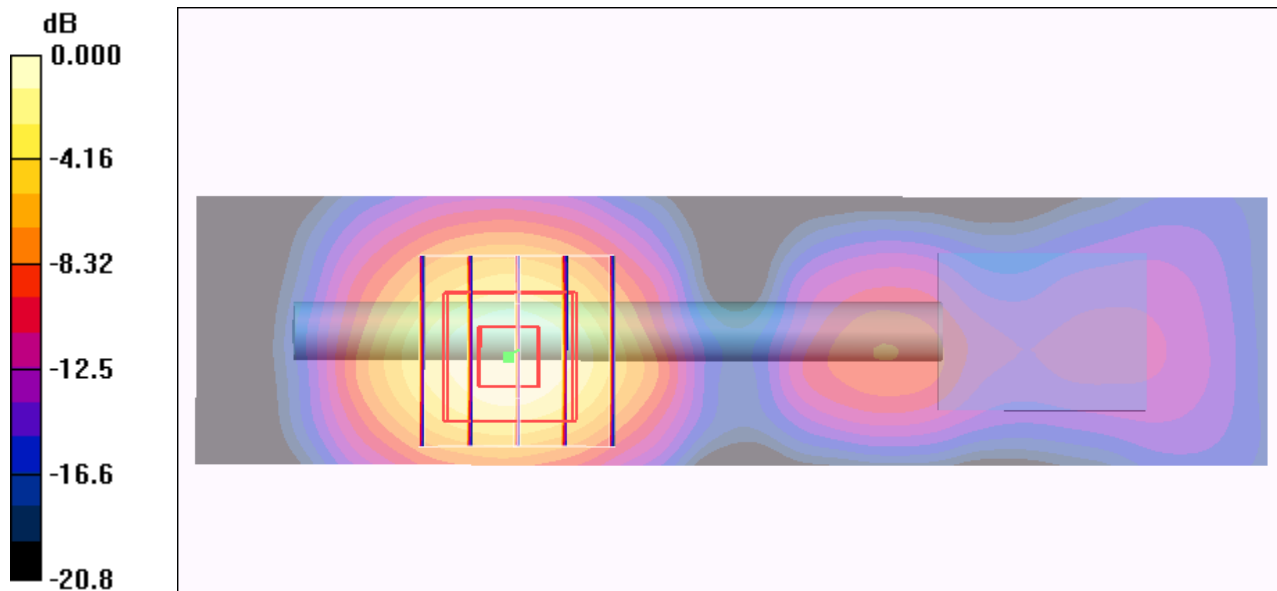
0 dB = 0.970mW/g

#16 802.11b_Horizontal Up_Ant Vertical_180 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature   23.0   ; Liquid Temperature   21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (81x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.17 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.96 V/m; Power Drift = -0.149 dB
Peak SAR (extrapolated) = 2.34 W/kg
SAR(1 g) = 1 mW/g; SAR(10 g) = 0.473 mW/g
Maximum value of SAR (measured) = 1.10 mW/g
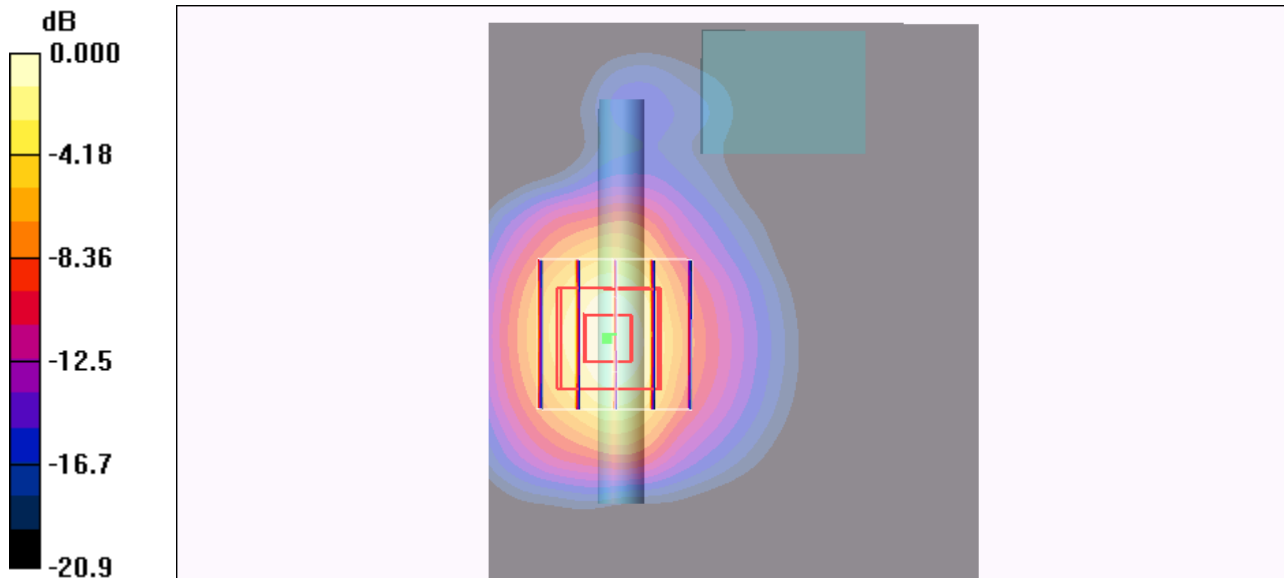
0 dB = 1.10mW/g

#17 802.11b_Horizontal Up_Ant Vertical_0 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature 22.9   ; Liquid Temperature 21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (81x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.10 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.34 V/m; Power Drift = -0.110 dB
Peak SAR (extrapolated) = 2.36 W/kg
SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.480 mW/g
Maximum value of SAR (measured) = 1.09 mW/g
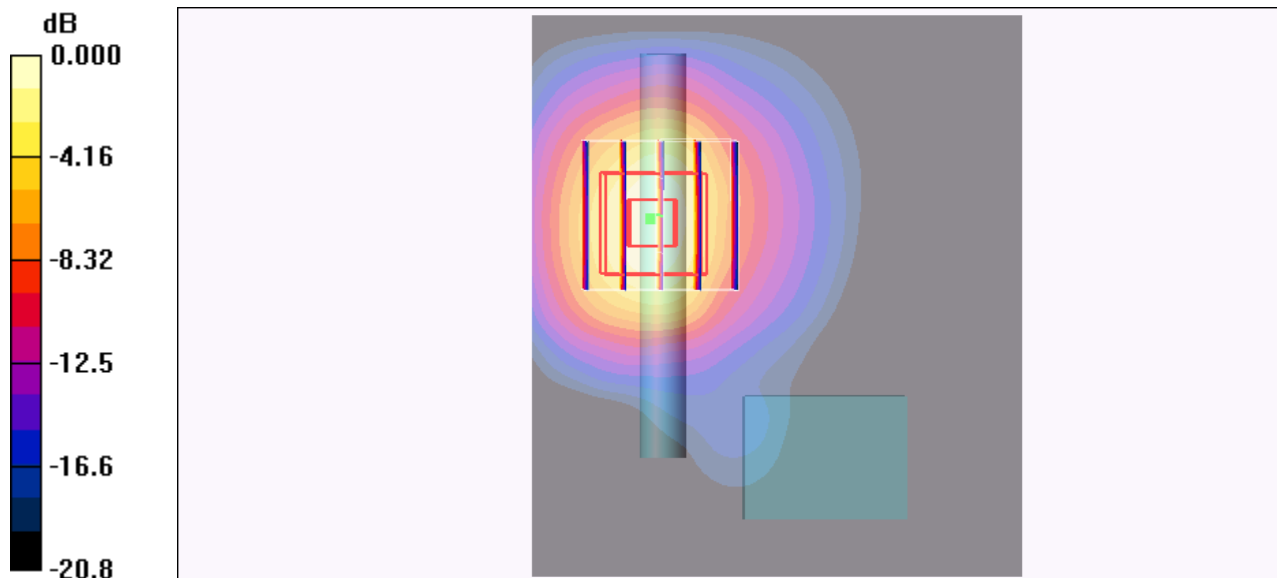
0 dB = 1.09mW/g

#18 802.11b_Horizontal Up_Ant Vertical_90 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature 22.9   ; Liquid Temperature 21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (41x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.026 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.79 V/m; Power Drift = 0.016 dB
Peak SAR (extrapolated) = 0.056 W/kg
SAR(1 g) = 0.024 mW/g; SAR(10 g) = 0.013 mW/g
Maximum value of SAR (measured) = 0.026 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.79 V/m; Power Drift = 0.016 dB
Peak SAR (extrapolated) = 0.036 W/kg
SAR(1 g) = 0.017 mW/g; SAR(10 g) = 0.010 mW/g
Maximum value of SAR (measured) = 0.019 mW/g
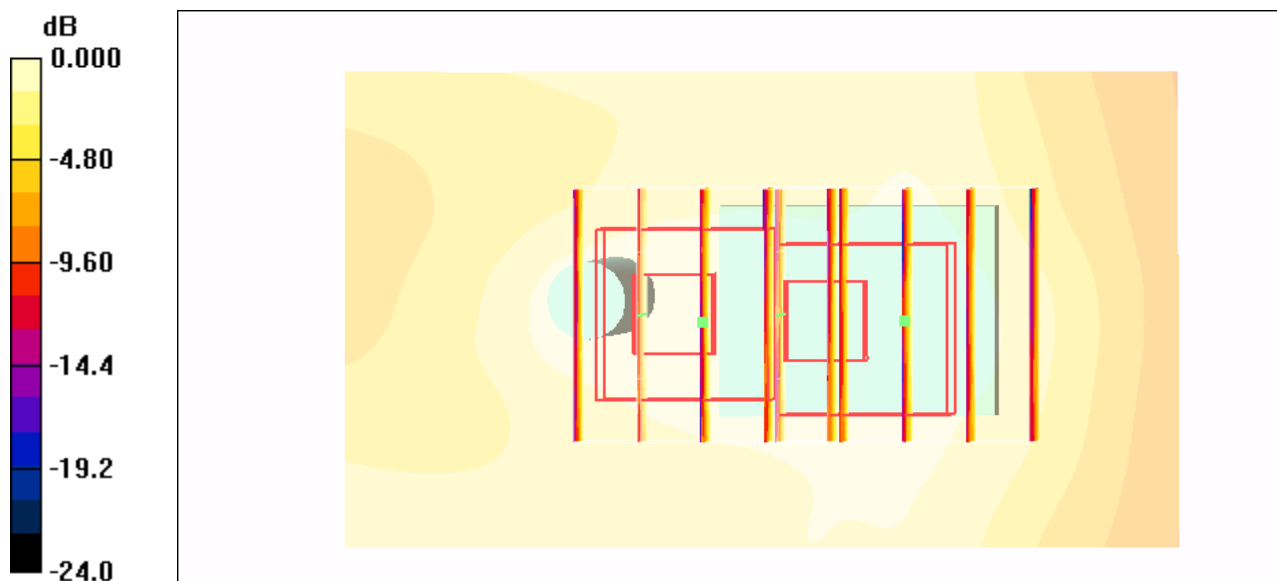
0 dB = 0.019mW/g

#15 802.11b_Horizontal Up_Ant Straight_180 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature 23.0   ; Liquid Temperature 21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (31x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.27 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.32 V/m; Power Drift = 0.108 dB
Peak SAR (extrapolated) = 2.17 W/kg
SAR(1 g) = 0.958 mW/g; SAR(10 g) = 0.459 mW/g
Maximum value of SAR (measured) = 1.02 mW/g
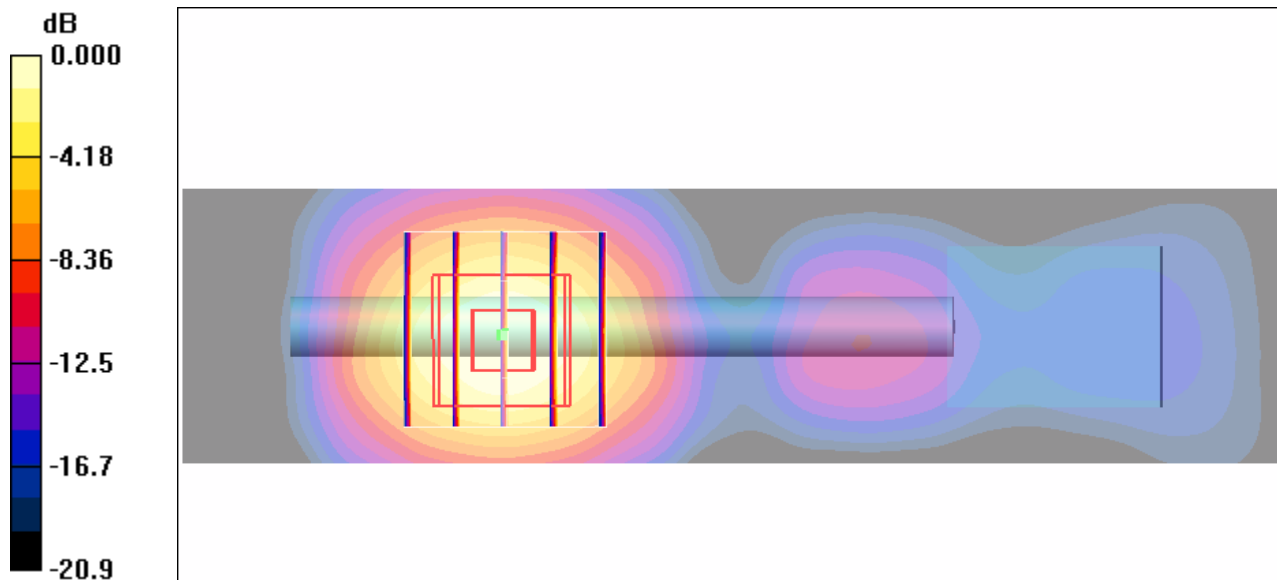
0 dB = 1.02mW/g

#20 802.11b_Horizontal Up_Ant Straight_0 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature 22.9   ; Liquid Temperature 21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (31x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.31 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.65 V/m; Power Drift = -0.044 dB
Peak SAR (extrapolated) = 2.28 W/kg
SAR(1 g) = 1 mW/g; SAR(10 g) = 0.476 mW/g
Maximum value of SAR (measured) = 1.10 mW/g
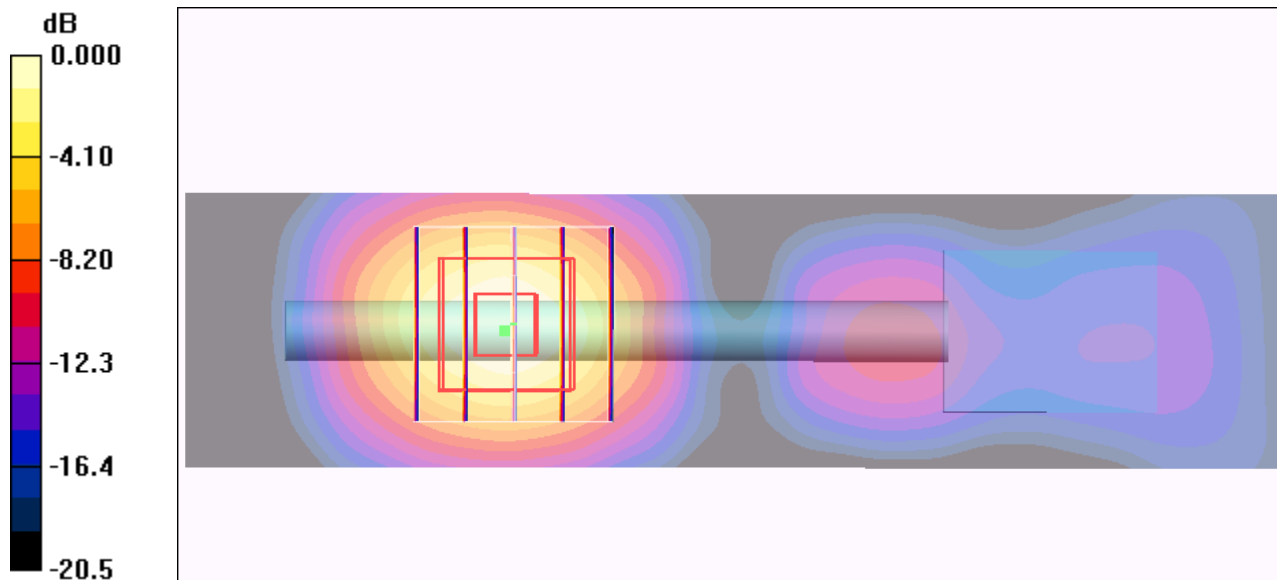
0 dB = 1.10mW/g

#21 802.11b_Horizontal Up_Ant Straight_270 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature 23.0 ; Liquid Temperature 21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (31x121x1): Measurement grid: dx=15mm, dy=15mm
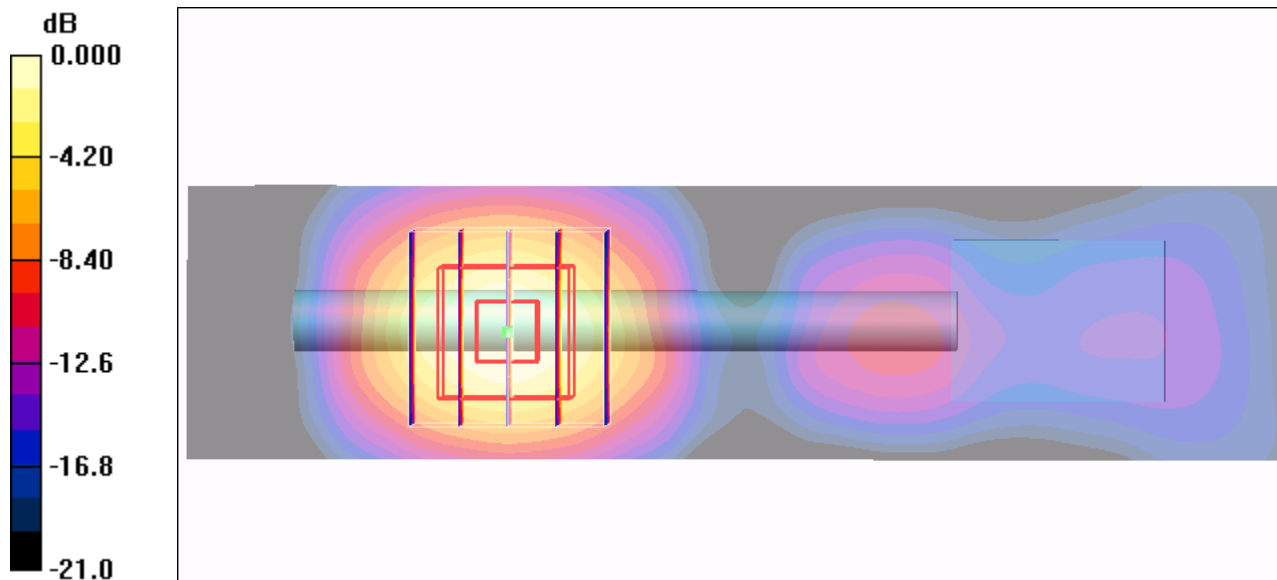Maximum value of SAR (interpolated) = 1.61 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.87 V/m; Power Drift = 0.089 dB
Peak SAR (extrapolated) = 2.67 W/kg
SAR(1 g) = 1.17 mW/g; SAR(10 g) = 0.552 mW/g
Maximum value of SAR (measured) = 1.25 mW/g

0 dB = 1.25mW/g

#21 802.11b_Horizontal Up_Ant Straight_270 degree_0.5cm_CH6_2D

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; $ε_r$ = 53.2; ρ

= 1000 kg/m^3
Ambient Temperature   23.0   ; Liquid Temperature   21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (31x121x1): Measurement grid: dx=15mm, dy=15mm
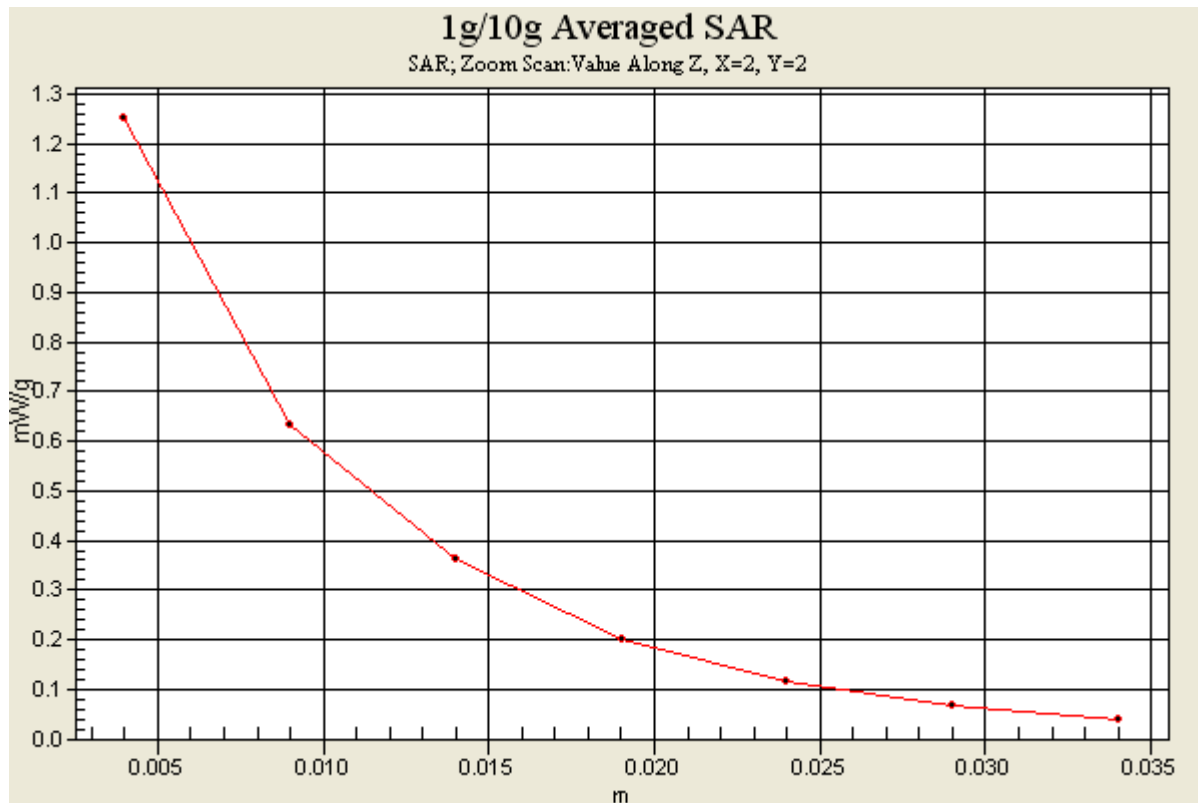Maximum value of SAR (interpolated) = 1.61 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.87 V/m; Power Drift = 0.089 dB
Peak SAR (extrapolated) = 2.67 W/kg
SAR(1 g) = 1.17 mW/g; SAR(10 g) = 0.552 mW/g
Maximum value of SAR (measured) = 1.25 mW/g

#22 802.11b_Vertical Front_Ant Straight_270 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature   23.0   ; Liquid Temperature   21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (31x121x1): Measurement grid: dx=15mm, dy=15mm
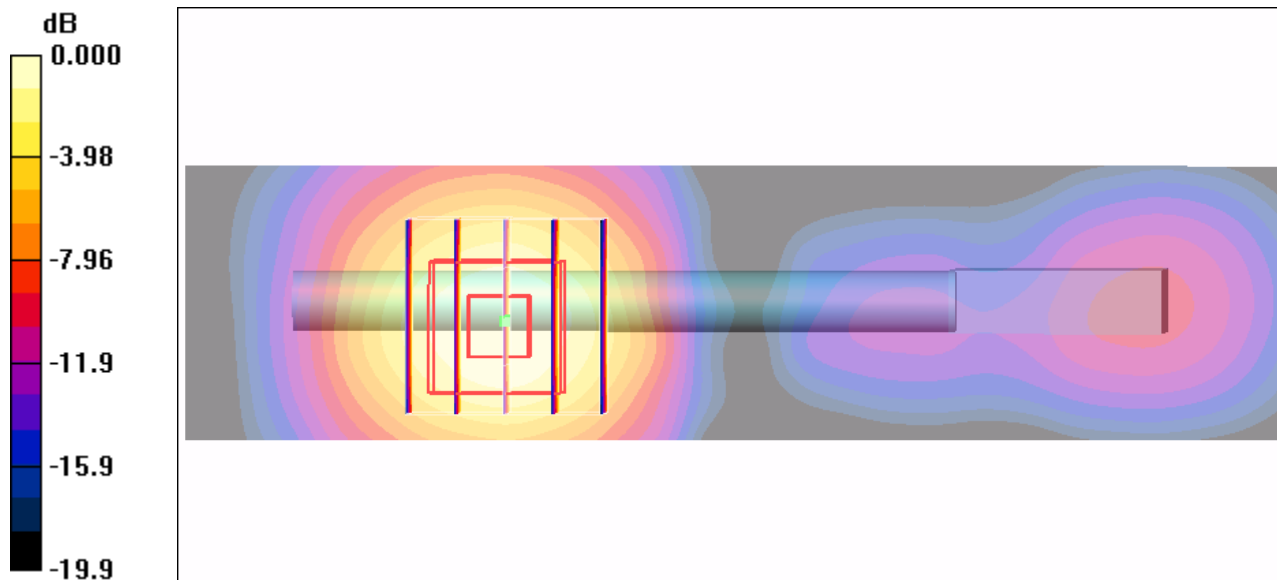Maximum value of SAR (interpolated) = 0.566 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.56 V/m; Power Drift = 0.058 dB
Peak SAR (extrapolated) = 1.02 W/kg
SAR(1 g) = 0.475 mW/g; SAR(10 g) = 0.246 mW/g
Maximum value of SAR (measured) = 0.500 mW/g

0 dB = 0.500mW/g

#23 802.11b_Vertical Back_Ant Straight_270 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature 23.0 ; Liquid Temperature 21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (31x121x1): Measurement grid: dx=15mm, dy=15mm
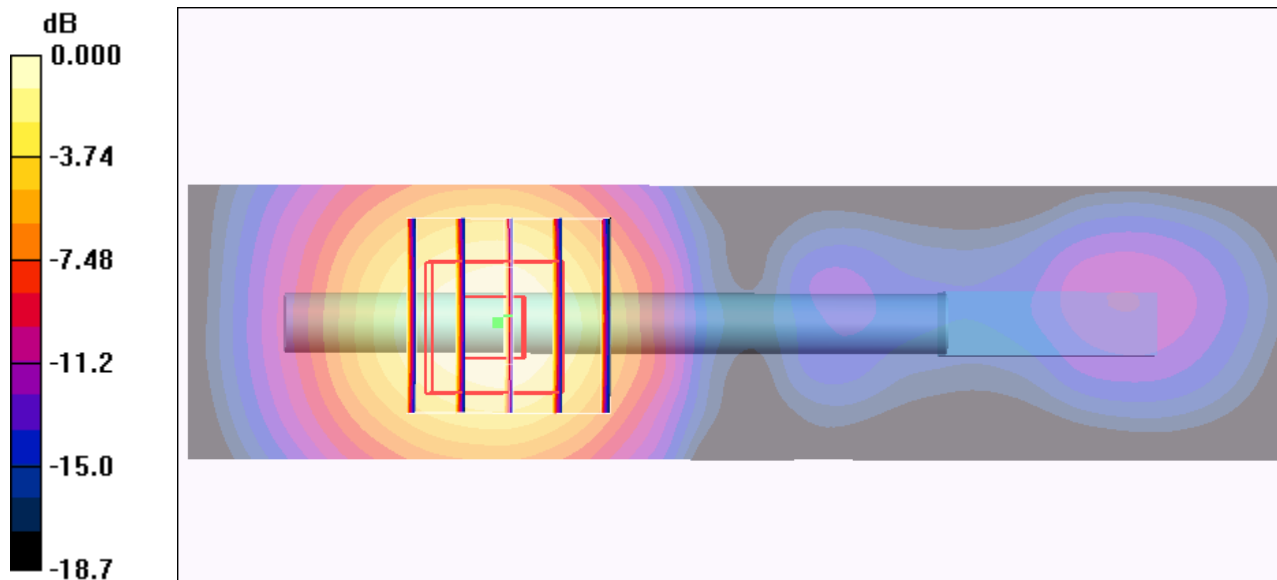Maximum value of SAR (interpolated) = 0.379 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.66 V/m; Power Drift = 0.182 dB
Peak SAR (extrapolated) = 0.686 W/kg
SAR(1 g) = 0.325 mW/g; SAR(10 g) = 0.171 mW/g
Maximum value of SAR (measured) = 0.343 mW/g

0 dB = 0.343mW/g

#24 802.11b_Horizontal Down_Ant Straight_270 degree_0.5cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090810 Medium parameters used: f = 2437 MHz; σ = 1.9 mho/m; ε_r = 53.2; ρ =

1000 kg/m^3
Ambient Temperature   23.0   ; Liquid Temperature   21.3

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch6/Area Scan (31x121x1): Measurement grid: dx=15mm, dy=15mm
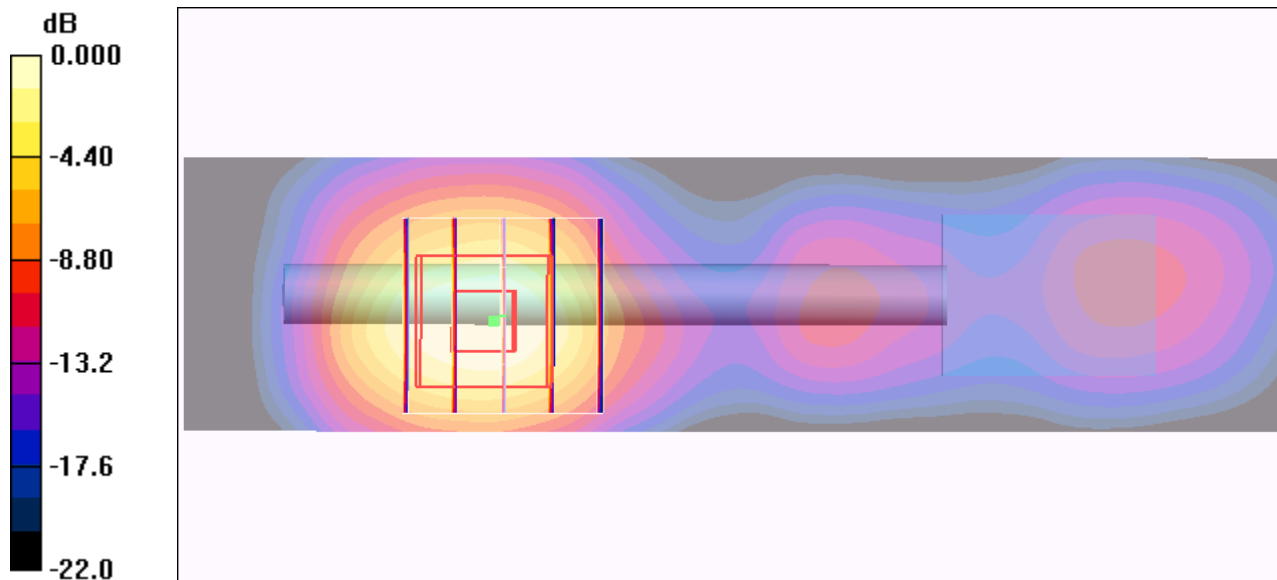Maximum value of SAR (interpolated) = 1.39 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.91 V/m; Power Drift = 0.106 dB
Peak SAR (extrapolated) = 2.62 W/kg
SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.542 mW/g
Maximum value of SAR (measured) = 1.22 mW/g

0 dB = 1.22mW/g

#34 802.11b_Horizontal Up_Ant Straight_270 degree_1cm_CH6

DUT: 962522

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_090830 Medium parameters used: f = 2437 MHz; σ = 1.91 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3

Ambient Temperature   22.5   ; Liquid Temperature   21.4

DASY5 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(3.96, 3.96, 3.96); Calibrated: 2009/5/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Ch6/Area Scan (31x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.623 mW/g
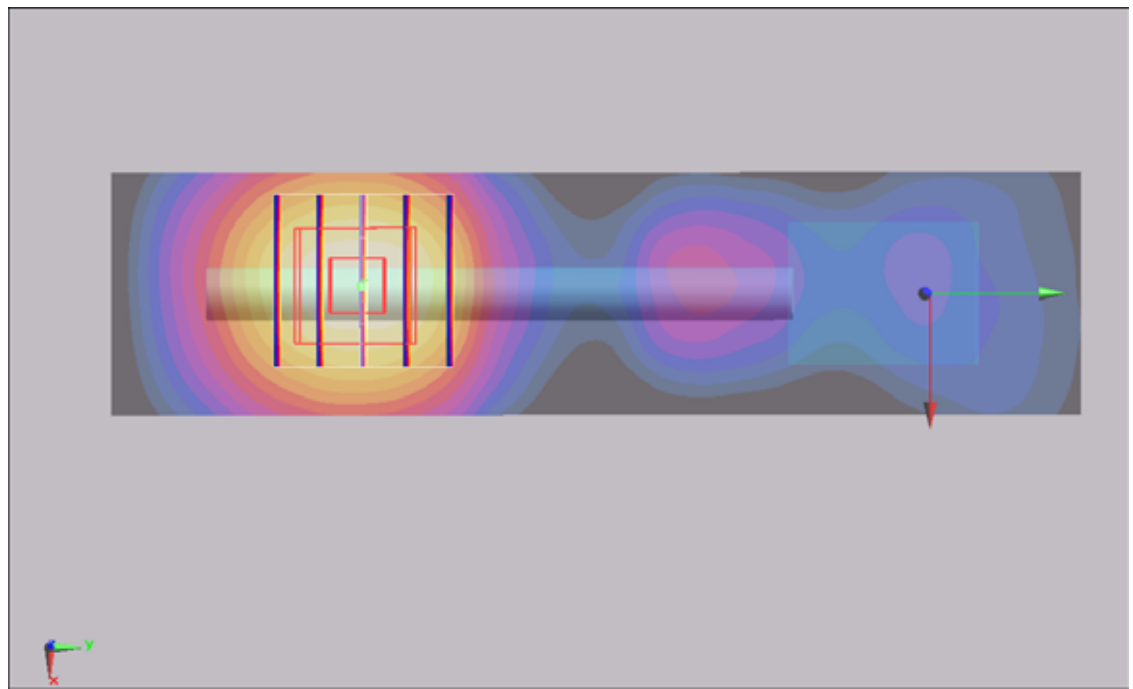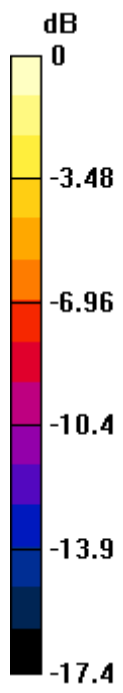
Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.96 V/m; Power Drift = -0.153 dB
Peak SAR (extrapolated) = 1.19 W/kg
SAR(1 g) = 0.535 mW/g; SAR(10 g) = 0.274 mW/g
Maximum value of SAR (measured) = 0.564 mW/g

0 dB = 0.564mW/g

Appendix C.   DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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

ilac-MRA

SWISS CALIBRATION

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

Accredited by the Swiss Accreditation Service (SAS)
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	**Sporton (Auden)**		Certificate No:	**D2450V2-736_Jul09**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 736
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	July 20, 2009
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	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV2	SN: 3025	30-Apr-09 (No. ES3-3025_Apr09)	Apr-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 22, 2009

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003

b) 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

c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 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.

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Measurement Conditions

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

DASY Version	DASY5	V5.0
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	40.2 ± 6 %	1.78 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 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	13.4 mW / g
SAR normalized	normalized to 1W	53.6 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**54.2 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.33 mW / g
SAR normalized	normalized to 1W	25.3 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**25.5 mW /g ± 16.5 % (k=2)**

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

Certificate No: D2450V2-736_Jul09   Page 3 of 9

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.8 ± 6 %	1.99 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.4 mW / g
SAR normalized	normalized to 1W	53.6 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**53.0 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.26 mW / g
SAR normalized	normalized to 1W	25.0 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**24.9 mW /g ± 16.5 % (k=2)**

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.9 Ω + 2.2 jΩ
Return Loss	- 27.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7 Ω + 4.2 jΩ
Return Loss	- 27.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.158 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	August 26, 2003

DASY5 Validation Report for Head TSL

Date/Time: 20.07.2009 17:44:29

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN736

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U11 BB
Medium parameters used: f = 2450 MHz; σ = 1.78 mho/m; ε_r = 40.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.35, 4.35, 4.35); Calibrated: 30.04.2009

- Sensor-Surface: 3mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 07.03.2009

- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001

- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

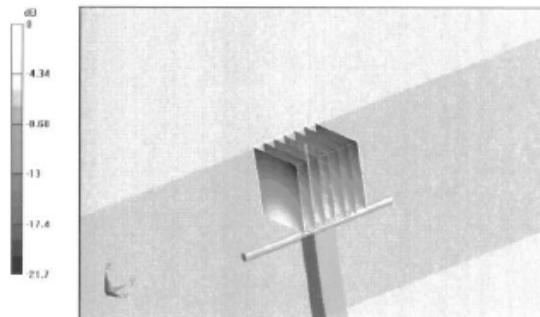### Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.6 V/m; Power Drift = 0.037 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.33 mW/g
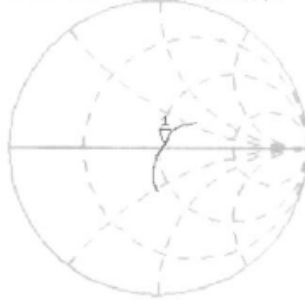Maximum value of SAR (measured) = 16.9 mW/g

0 dB = 16.9mW/g

Impedance Measurement Plot for Head TSL

20 Jul 2009 16:51:21

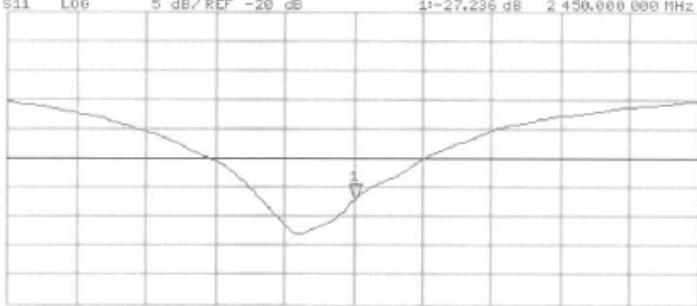CH1 S11 1 U FS 1: 53.949 Ω 2.2012 Ω 142.99 pH 2 450.000 000 MHz

*

Del

Cor

1

↑

CH2 S11 LOG 5 dB/ REF -20 dB 1:-27.236 dB 2 450.000 000 MHz

Cor

1

↑

START 2 250.000 000 MHz STOP 2 650.000 000 MHz

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DASY5 Validation Report for Body TSL

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:736

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U10 BB
Medium parameters used: f = 2450 MHz; σ = 2 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.06, 4.06, 4.06); Calibrated: 30.04.2009

- Sensor-Surface: 3mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 07.03.2009

- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002

- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

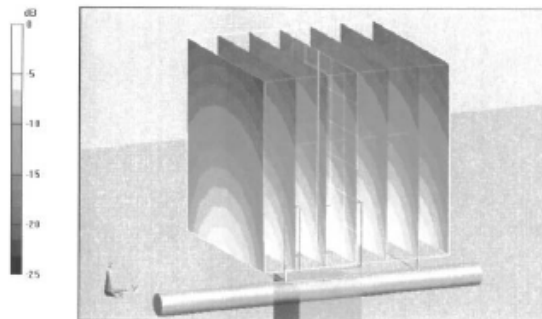### Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98 V/m; Power Drift = -0.018 dB
Peak SAR (extrapolated) = 27.1 W/kg
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.26 mW/g
Maximum value of SAR (measured) = 17.8 mW/g
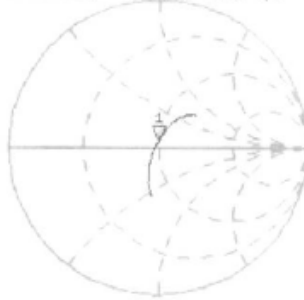

0 dB = 17.8mW/g

Impedance Measurement Plot for Body TSL
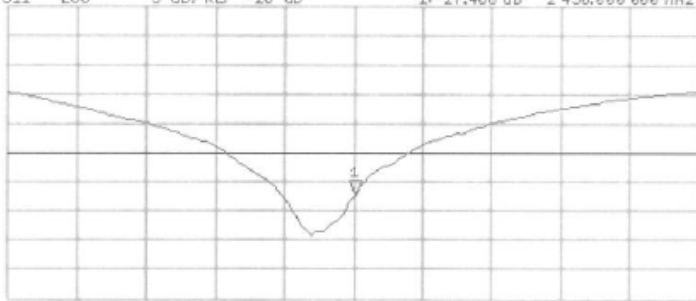
14 Jul 2009 11:56:22

CH1 S11   1 U FS   1: 49.652 Ω   4.2324 Ω 274.94 pH   2 450.000 000 MHz

*

De1

CΔ

Avg
16

CH2 S11   LOG   5 dB/ REF -20 dB   1:-27.406 dB   2 450.000 000 MHz

De1

CΔ

Avg
16

CENTER 2 450.000 000 MHz   SPAN 400.000 000 MHz

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Accreditation No.: SCS 108

Client	**Sporton (Auden)**	Certificate No: **DAE4-778_Sep08**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BG - SN: 778
Calibration procedure(s)	QA CAL-06.v12 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	September 22, 2008
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 (Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	04-Oct-07 (No: 6467)	Oct-08
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-07 (No: 6465)	Oct-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	06-Jun-08 (in house check)	In house check: Jun-09

	Name	Function	Signature
Calibrated by:	Andrea Guntli	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: September 22, 2008

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Glossary

DAE   data acquisition electronics
Connector angle   information used in DASY system to align probe sensor X to the robot
                                coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.

- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.

- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.

   - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.

   - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.

   - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.

   - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage

   - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.

   - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.

   - *Input resistance:* DAE input resistance at the connector, during internal auto-zeroing and during measurement.

   - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.

   - *Power consumption:* Typical value for information. Supply currents in various operating modes.

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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB =   6.1µV ,   full range =   -100…+300 mV

Low Range: 1LSB =   61nV ,   full range =   -1…….+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.686 ± 0.1% (k=2)	403.490 ± 0.1% (k=2)	405.045 ± 0.1% (k=2)
Low Range	3.99455 ± 0.7% (k=2)	3.96369 ± 0.7% (k=2)	3.99417 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	309 º ± 1 º

Appendix

1. DC Voltage Linearity

High Range		Input (µV)	Reading (µV)	Error (%)
Channel X	+ Input	200000	200000.3	0.00
Channel X	+ Input	20000	20004.24	0.02
Channel X	- Input	20000	-20002.46	0.01
Channel Y	+ Input	200000	200000.4	0.00
Channel Y	+ Input	20000	20002.60	0.01
Channel Y	- Input	20000	-20002.26	0.01
Channel Z	+ Input	200000	200000.6	0.00
Channel Z	+ Input	20000	20000.78	0.00
Channel Z	- Input	20000	-20005.75	0.03

Low Range		Input (µV)	Reading (µV)	Error (%)
Channel X	+ Input	2000	2000	0.00
Channel X	+ Input	200	199.37	-0.31
Channel X	- Input	200	-200.28	0.14
Channel Y	+ Input	2000	2000	0.00
Channel Y	+ Input	200	199.63	-0.19
Channel Y	- Input	200	-200.88	0.44
Channel Z	+ Input	2000	2000.1	0.00
Channel Z	+ Input	200	198.60	-0.70
Channel Z	- Input	200	-201.07	0.53

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	-7.46	-6.40
	- 200	10.00	6.86
Channel Y	200	-2.73	-2.45
	- 200	0.84	0.43
Channel Z	200	-10.91	-10.94
	- 200	7.89	8.22

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	3.08	-1.34
Channel Y	200	1.18	-	4.64
Channel Z	200	-1.74	1.44	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16048	16021
Channel Y	16167	15166
Channel Z	16416	15977

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.13	-0.88	0.92	0.33
Channel Y	-0.88	-2.47	0.72	0.55
Channel Z	-1.16	-2.17	-0.19	0.42

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	201.1
Channel Y	0.2000	201.0
Channel Z	0.2001	201.7

8. Low Battery Alarm Voltage (verified during pre test)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	−0.01	-8	-9

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Accreditation No.: **SCS 108**

Client	Sporton (Auden)		Certificate No: ET3-1787_May09

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1787
Calibration procedure(s)	QA CAL-01.v6 and QA CAL-23.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	May 26, 2009
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 $(22 \pm 3)°C$ and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Marcel Fehr	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 27, 2009

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Certificate No: ET3-1787_May09   Page 1 of 9

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003

b) 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:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ (f $\leq$ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).

- *NORM(f)x,y,z = NORMx,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*.

- *DCPx,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 NORMx,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.

Probe ET3DV6

SN:1787

Manufactured:	May 28, 2003
Last calibrated:	August 26, 2008
Modified:	May 20, 2009
Recalibrated:	May 26, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1787

Sensitivity in Free Space[A]

			Diode Compression[B]	
NormX	$1.63 \pm 10.1\%$	$\mu V/(V/m)^2$	DCP X	95 mV
NormY	$1.72 \pm 10.1\%$	$\mu V/(V/m)^2$	DCP Y	94 mV
NormZ	$2.14 \pm 10.1\%$	$\mu V/(V/m)^2$	DCP Z	94 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL	835 MHz	Typical SAR gradient: 5 % per mm		
	Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR_{be} [%]	Without Correction Algorithm		10.0	5.9
SAR_{be} [%]	With Correction Algorithm		0.9	0.6

TSL	1750 MHz	Typical SAR gradient: 10 % per mm		
	Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR_{be} [%]	Without Correction Algorithm		12.3	8.4
SAR_{be} [%]	With Correction Algorithm		0.9	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 E^2-field uncertainty inside TSL (see Page 8).

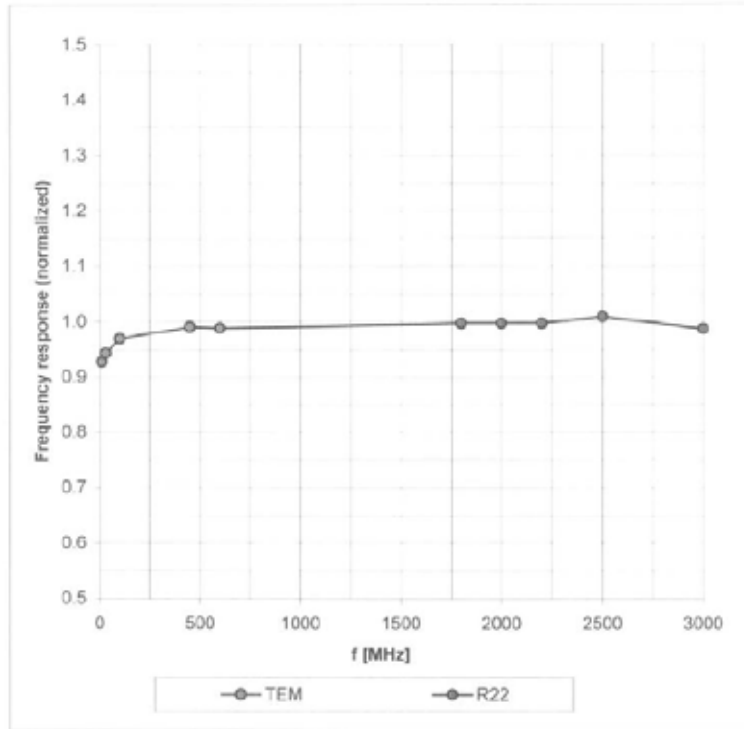[B] Numerical linearization parameter: uncertainty not required.

Frequency Response of E-Field

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

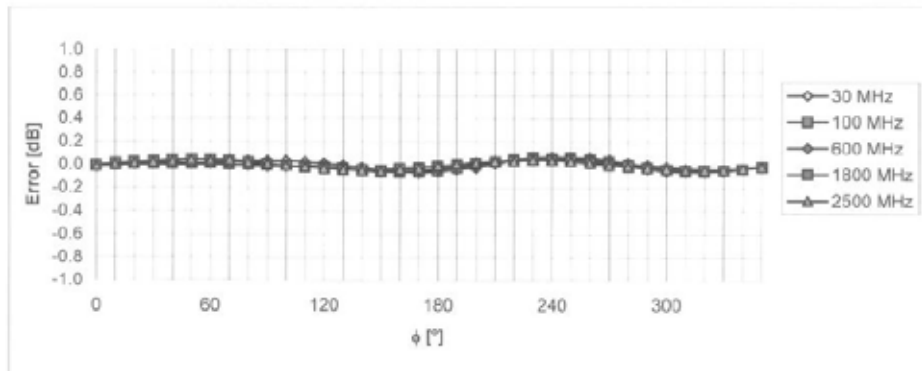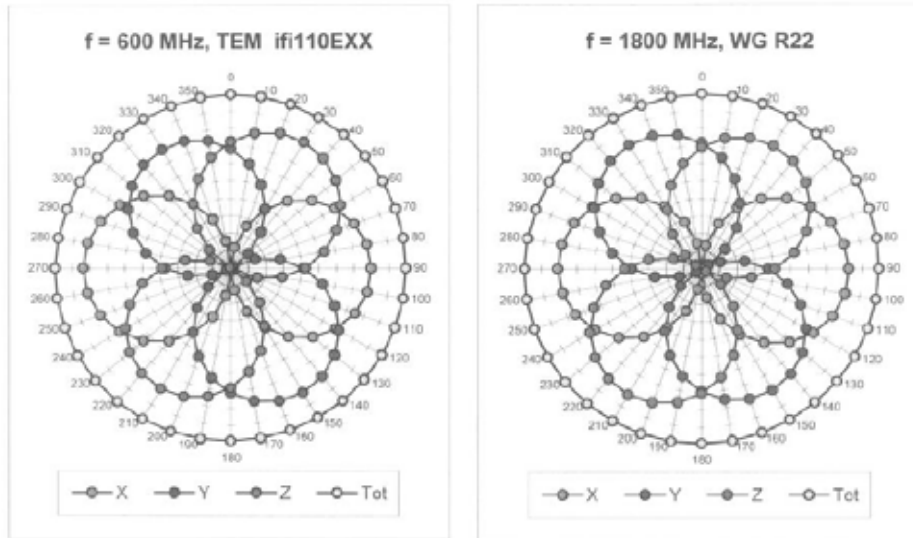Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

ET3DV6 SN:1787   May 26, 2009
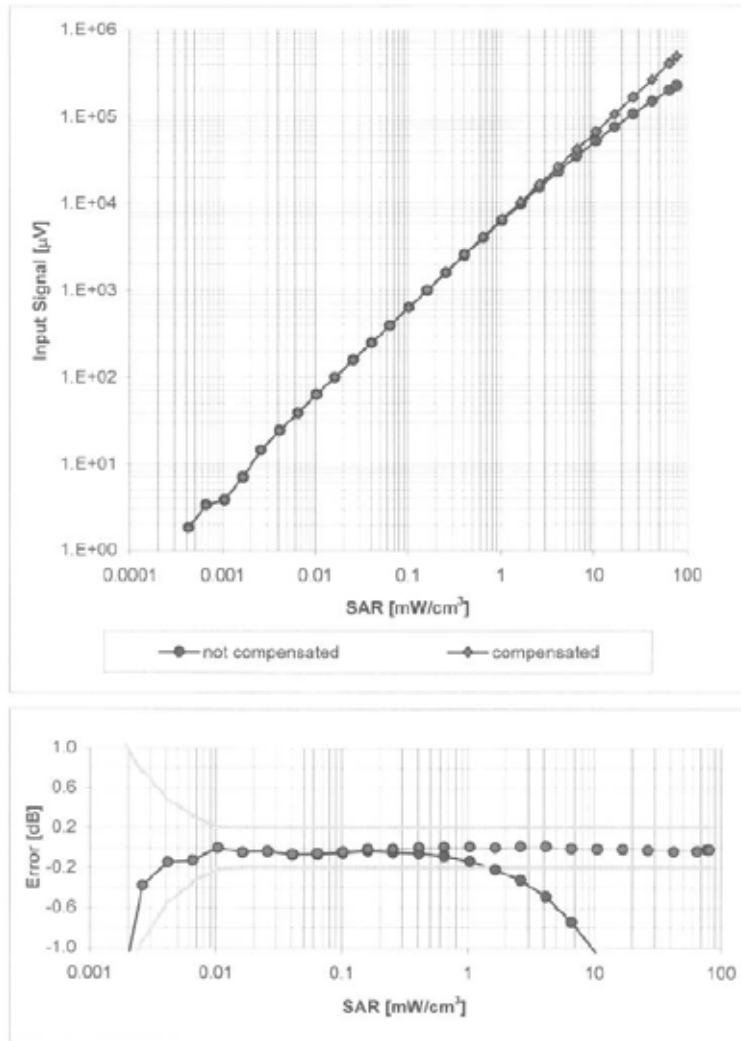
Receiving Pattern (φ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX

f = 1800 MHz, WG R22

—●—X   —●—Y   —●—Z   —○—Tot

—●—X   —●—Y   —●—Z   —○—Tot

—○— 30 MHz
—■— 100 MHz
—◆— 600 MHz
—■— 1800 MHz
—▲— 2500 MHz

Error [dB]

φ [°]

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Certificate No: ET3-1787_May09   Page 6 of 9

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

Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ET3DV6 SN:1787

May 26, 2009

Conversion Factor Assessment
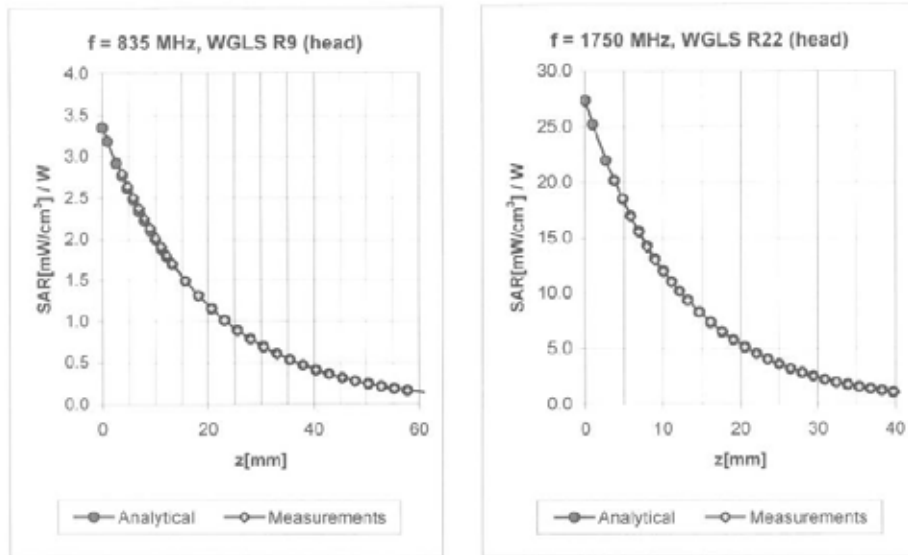
f [MHz]	Validity [MHz]^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.52	2.01	6.26	± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.49	2.72	5.34	± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.58	2.44	5.12	± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.99	1.69	4.51	± 11.0% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.39	2.37	6.09	± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.63	3.27	4.82	± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.90	2.43	4.49	± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.80	1.50	3.96	± 11.0% (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.
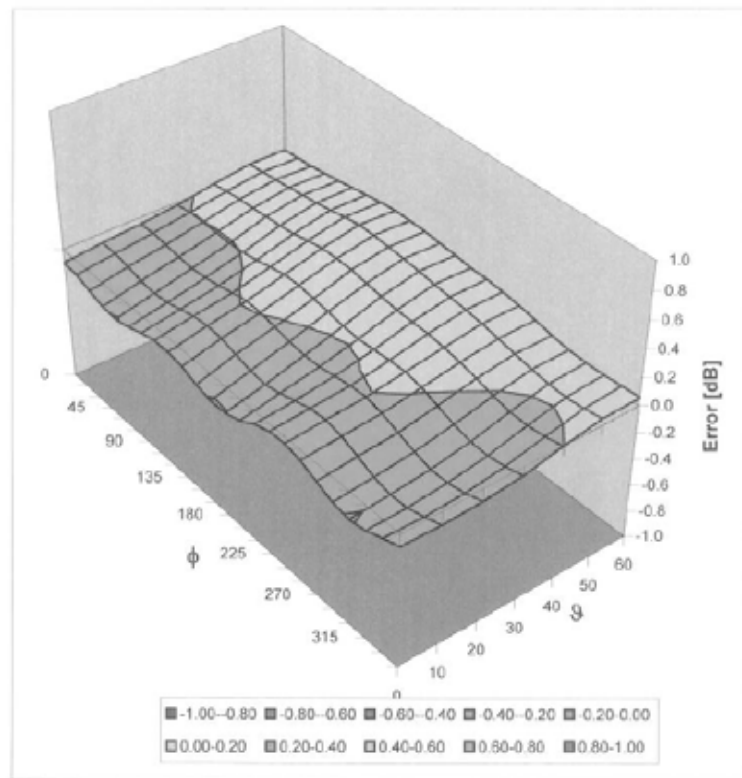
SPORTON INTERNATIONAL INC.

ET3DV6 SN:1787

May 26, 2009

Deviation from Isotropy in HSL
Error (ϕ, ϑ), f = 900 MHz

Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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Accreditation No.: **SCS 108**

Client	**Sporton (Auden)**	Certificate No: **ET3-1788_Sep08**

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1788
Calibration procedure(s)	QA CAL-01.v6 and QA CAL-23.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	September 23, 2008
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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Fin Bomholt	R&D Director	

Issued: September 24, 2008

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

ilac-MRA

SWISS CALIBRATION

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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: SCS 108

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003

b) 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:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).

- *NORM(f)x,y,z = NORMx,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*.

- *DCPx,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 ≤ 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 NORMx,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.

Probe ET3DV6

SN:1788

Manufactured: May 28, 2003
Last calibrated: September 26, 2007
Recalibrated: September 23, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1788   September 23, 2008

DASY - Parameters of Probe: ET3DV6 SN:1788

Sensitivity in Free Space[A]   Diode Compression[B]

NormX	1.73 ± 10.1%	$\mu V/(V/m)^2$	DCP X	95 mV
NormY	1.59 ± 10.1%	$\mu V/(V/m)^2$	DCP Y	98 mV
NormZ	1.72 ± 10.1%	$\mu V/(V/m)^2$	DCP Z	91 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

| TSL | 900 MHz | Typical SAR gradient: 5 % per mm |

		3.7 mm	4.7 mm
Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR_{be} [%]	Without Correction Algorithm	10.6	6.8
SAR_{be} [%]	With Correction Algorithm	0.8	0.3

| TSL | 1750 MHz | Typical SAR gradient: 10 % per mm |

		3.7 mm	4.7 mm
Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR_{be} [%]	Without Correction Algorithm	8.8	4.9
SAR_{be} [%]	With Correction Algorithm	0.7	0.6

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 E^2-field uncertainty inside TSL (see Page 8).

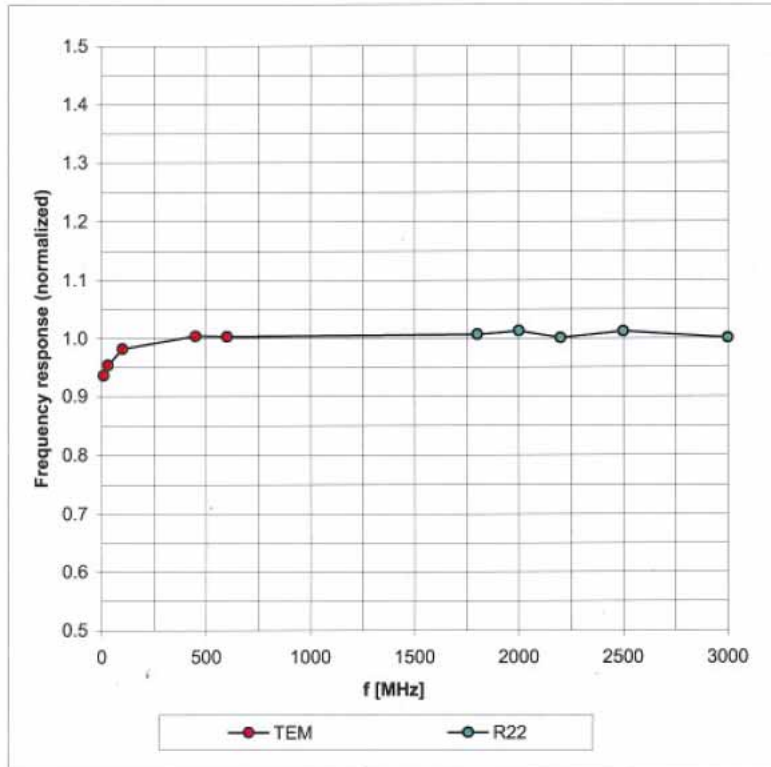[B] Numerical linearization parameter: uncertainty not required.

Frequency Response of E-Field

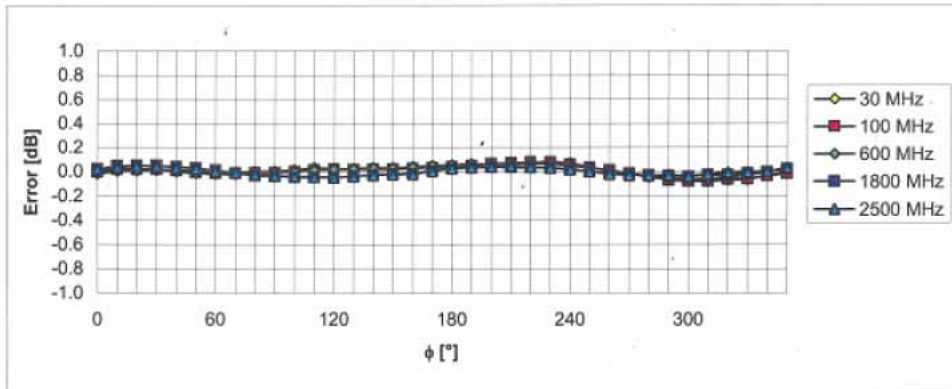### (TEM-Cell:ifi110 EXX, Waveguide: R22)
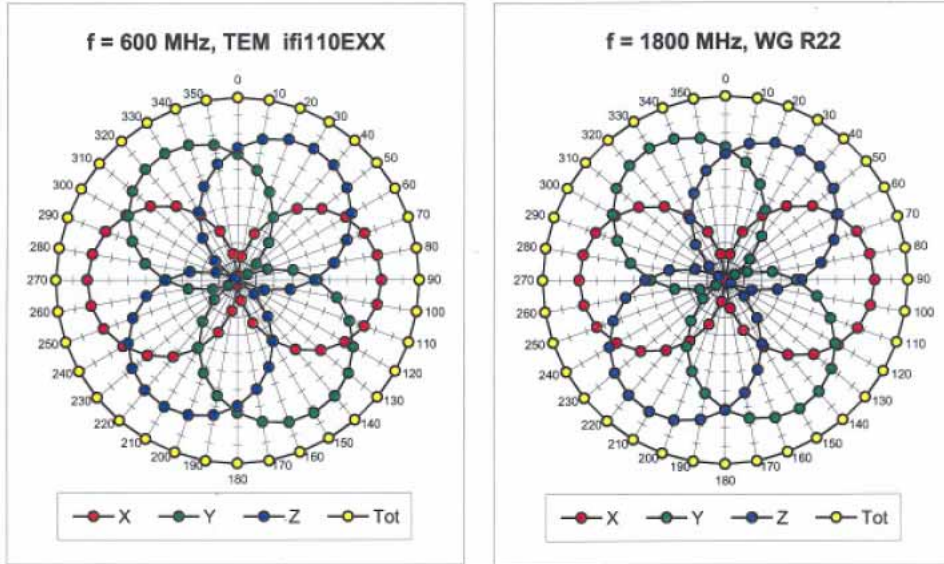

Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

ET3DV6 SN:1788   September 23, 2008
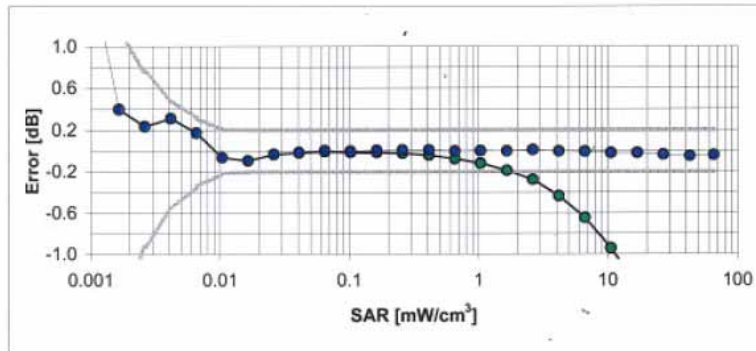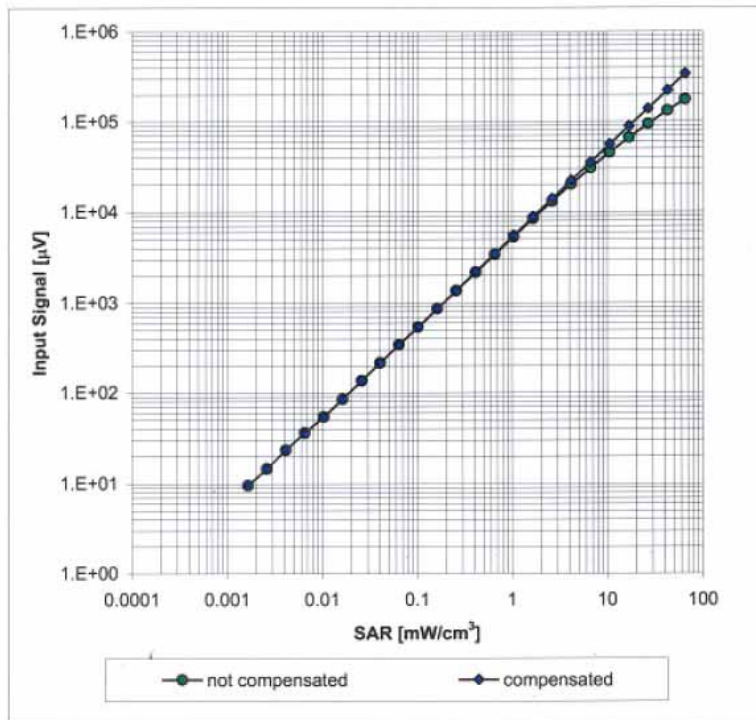
Receiving Pattern (φ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX

f = 1800 MHz, WG R22

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)
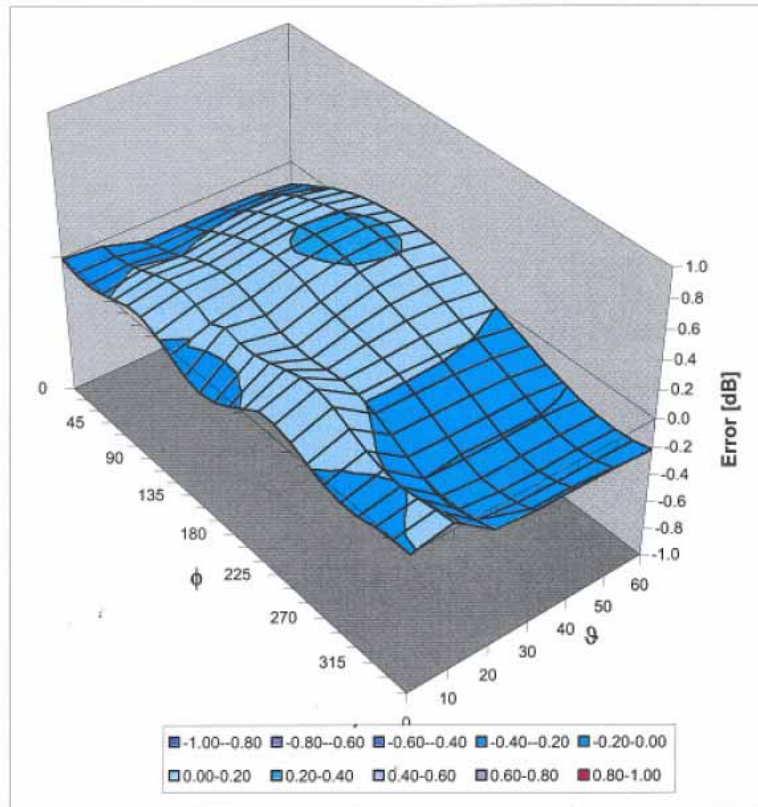
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ET3DV6 SN:1788

September 23, 2008

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

Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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Conversion Factor Assessment

f = 900 MHz, WGLS R9 (head)

f = 1750 MHz, WGLS R22 (head)
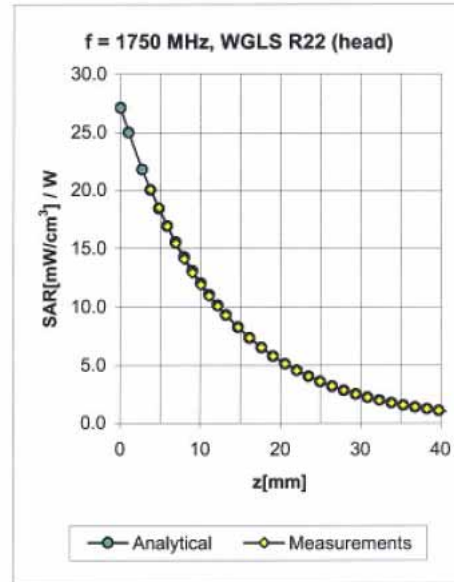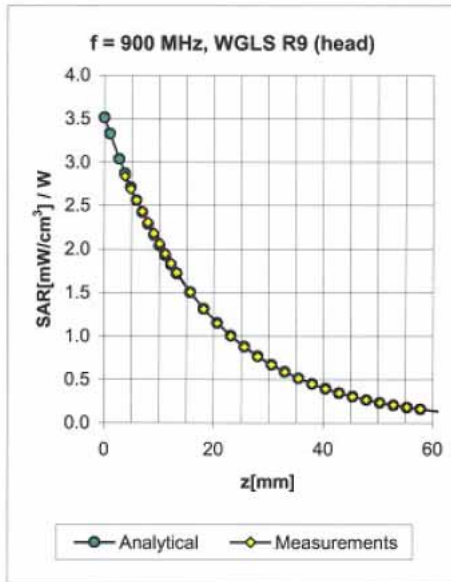
f [MHz]	Validity [MHz][c]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.44	2.65	6.55	± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.68	1.98	5.59	± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.75	1.75	5.13	± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.80	1.45	4.68	± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.50	2.48	6.34	± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.63	2.33	4.87	± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.74	1.99	4.73	± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.94	1.75	3.98	± 11.0% (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.

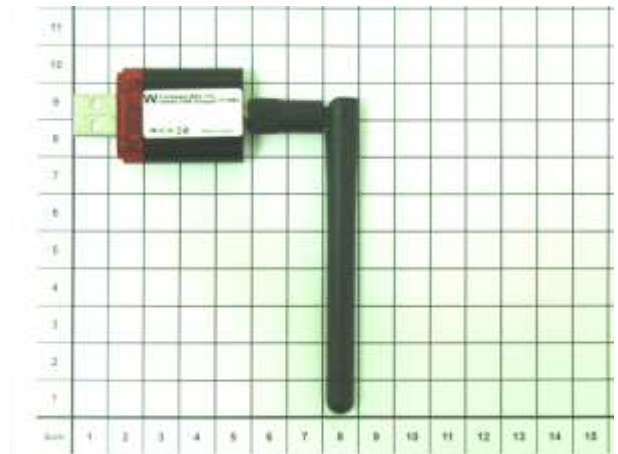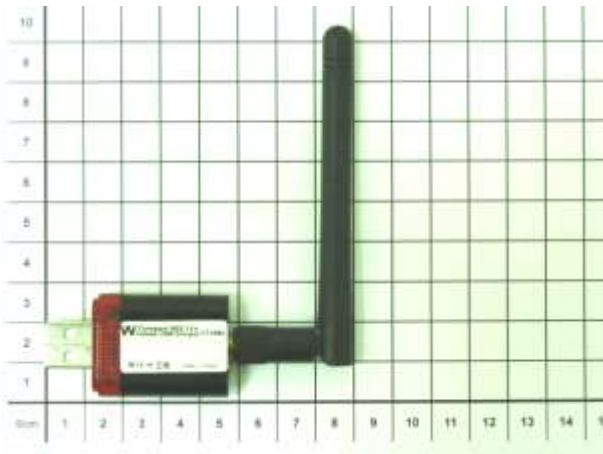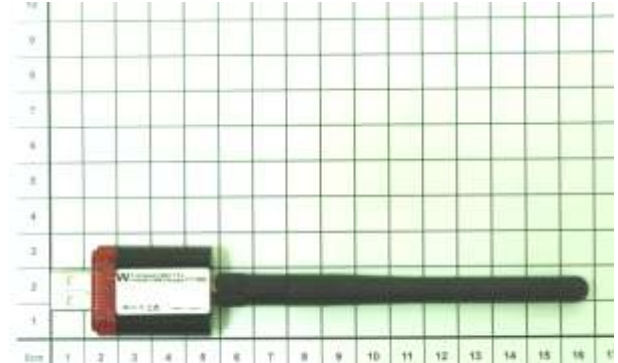ET3DV6 SN:1788   September 23, 2008

Deviation from Isotropy in HSL
Error (φ, ϑ), f = 900 MHz

Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

SPORTON INTERNATIONAL INC.

Appendix D.   Product Photos

SPORTON INTERNATIONAL INC.

TEL : 886-3-327-3456

FAX : 886-3-328-4978

FCC ID : VYTLP-8617

Report Issued Date : Sep. 07, 2009

Report Version   : Rev. 01
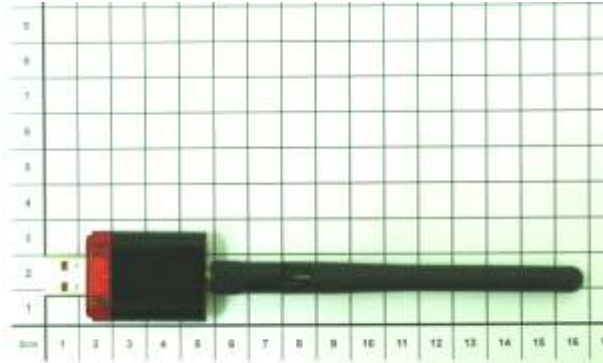
Appendix E. Test Setup Photos

USB Configuration 1
(USB Horizontal-Up with Phantom 0.5 cm Gap and
Antenna in Straight mode with 0 degree)

USB Configuration 1
(USB Horizontal-Up with Phantom 0.5 cm Gap and
Antenna in Straight mode with 90 degree)

USB Configuration 1
(USB Horizontal-Up with Phantom 0.5 cm Gap and
Antenna in Straight mode with 180 degree)

USB Configuration 1
(USB Horizontal-Up with Phantom 0.5 cm Gap and
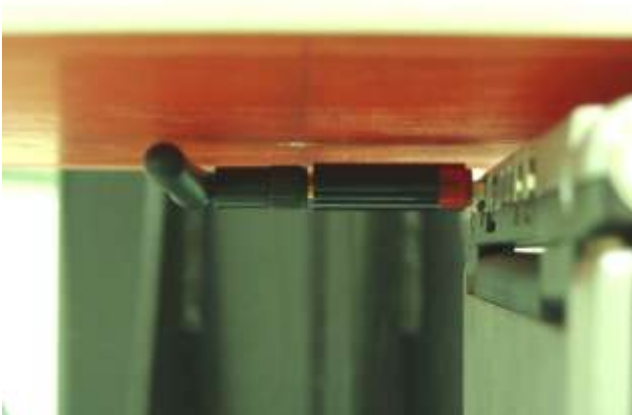**Antenna in Straight mode with 270 degree)**

USB Configuration 1
(USB Horizontal-Up with Phantom 0.5 cm Gap and
Antenna in Vertical mode with 0 degree)

USB Configuration 1
(USB Horizontal-Up with Phantom 0.5 cm Gap and
Antenna in Vertical mode with 90 degree)

USB Configuration 1
(USB Horizontal-Up with Phantom 0.5 cm Gap and
Antenna in Vertical mode with 180 degree)

USB Configuration 2
(USB Horizontal-Down with Phantom 0.5 cm Gap
and Antenna in Straight mode with 270 degree)

USB Configuration 3
(USB Vertical-Front with Phantom 0.5 cm Gap and
Antenna in Straight mode with 270 degree)

USB Configuration 4
(USB Vertical-Back with Phantom 0.5 cm Gap and
Antenna in Straight mode with 270 degree)

USB Configuration 1
(USB Horizontal-Up with Phantom 1.0 cm Gap and
Antenna in Straight mode with 270 degree)