



Specific Absorption Rate (SAR) Test Report

for
Acer Inc.
on the
Notebook Computer

Report Number : FA870804-01
Trade Name : ACER, GATEWAY, PACKARD BELL
Model Name : ZG5, Aspire one
FCC ID : HLZZG5WIIM
Date of Testing : Dec. 02, 2008 ~ Mar. 10, 2009
Issued Date of Report : Mar. 13, 2009

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- Report Version: Rev. 02

SPORTON INTERNATIONAL INC.

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



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1. Statement of Compliance

The Specific Absorption Rate (SAR) maximum results found during testing for the **Acer Inc. Notebook Computer ACER, GATEWAY, PACKARD BELL ZG5, Aspire one** are as follows (with expanded uncertainty 21.9%):

Position \ SAR	802.11b/g/n SAR (W/kg)	802.11a/n SAR (W/kg)	802.16e SAR (W/kg)
Body	0.00638	0.147	0.03

They are in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits 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 OET Bulletin 65 Supplement C (Edition 01-01).

Approved by

Roy Wu
Manager



2. Administration Data

2.1 Testing Laboratory

Company Name : Sporton International Inc.
Address : No.52, Hwa-Ya 1st RD., Hwa Ya Technology Park, Kwei-Shan Hsiang, TaoYuan Hsien, Taiwan, R.O.C.
Test Site : SAR01-HY
Telephone Number : 886-3-327-3456
Fax Number : 886-3-328-4978

2.2 Applicant

Company Name : Acer Inc.
Address : 8F, 88, Sec. 1, Hsin Tai Wu Rd., Hsichih, Taipei Hsien 221, Taiwan, R.O.C.

2.3 Manufacturer

Company Name : Quanta Computer Inc.
Address :

1. No. 2, Lane 58, Sanzhuang Road, Songjiang Export Processing Zone, Shanghai, P.R. China
2. No. 4, Wen Ming 1st Street, Kuei Shan Hsiang, Taoyuan Shien, Taiwan, R.O.C. 333
3. No. 8, Dongjing Rd., Songjiang Industrial Zone, Shanghai, P.R. China
4. No. 4, Lane 58, Sanzhuang Road, Songjiang Export Processing Zone, Shanghai, P.R. China
5. North to Songsheng. Road, Songjiang Industrial Zone, Shanghai, P.R. China
6. B#, No. 1, South Rongteng Road, Songjiang Export Processing Zone, Shanghai, P.R. China
7. Standard Factory, South to Valqua, Rongxin Road, Songjiang Export Processing Zone, Shanghai, P.R. China
8. C#, No. 1, South Rongteng Road, Songhjang Export Processing Zone, Shanghai, P.R. China
9. No. 6, Lane 66, Sanzhuang Road, Songjiang Export Processing Zone, Shanghai, P.R. China
10. No. 6, Lane 58, Sanzhuang Road, Songjiang Export Processing Zone, Shanghai, P.R. China
11. Huade Building, No. 18, ChuangYe Rd., ShandDi Zone, HaiDian District, Beijing, P.R.C.
12. No. 68, Sanzhuang Road, Songjiang Export Processing Zone, Shanghai, P.R. China
13. 2F, C Building, XinYe Rd, Export Processing District In Torch, Zhongshan, Guangdong, P.R.C.

2.4 Application Details

Date of reception of application: Nov. 14, 2008
Start of test : Dec. 02, 2008
End of test : Mar. 10, 2009



3. General Information

3.1 Description of Device Under Test (DUT)

Product Feature & Specification	
DUT Type	Notebook Computer
Trade Name	ACER, GATEWAY, PACKARD BELL
Model Name	ZG5, Aspire one
FCC ID	HLZZG5WIIM
Tx/Rx Frequency Range	802.11b/g/n : 2400 MHz ~ 2483.5 MHz 802.11a/n : 5150 MHz ~ 5250 MHz, 5250 MHz ~ 5350 MHz 5470 MHz ~ 5725 MHz, 5725 MHz ~ 5850 MHz 802.16e : 2496 MHz ~ 2690 MHz
Antenna Type	Fixed Internal Antenna
Notebook HW Version	D
Notebook SW Version	V0.3305_DSC (BIOS)
Type of Modulation	802.11b : DSSS 802.11g/a/n : OFDM 802.16e : QPSK / 16-QAM
DUT Stage	Identical Prototype

Remark: WLAN and WiMAX share the same antenna and they can not simultaneous transmit.

Accessories List:

Accessories Specification		
AC Adapter	Brand Name	DELTA
	Model Name	ADP-30JH B
	Power Rating	I/P: 100-240Vac, 50-60Hz, 1.2A; O/P: 19Vdc, 1.58A
	AC Power Cord Type	1.82 meter without shielded cable without ferrite core
	DC Power Cord Type	1.6 meter shielded cable with ferrite core
Battery	Brand Name	Simplo
	Model Name	UM08B74
	Power Rating	11.1Vdc, 5200mAh/52Wh
	Type	Li-ion

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



Notebook Specification			
Housing Type	Plastic		
AC Power Adapter	DELTA	Model	ADP-30JH B
AC Power Adapter Rating	I/P: 100-240Vac O/P:19Vdc, 1.58A		
AC Power Core Type	Non-shielded AC 3-pin (1.8m)		
DC Power Cable Type	Non-shielded DC (1.5m) with one ferrite core		
CPU	Intel	Model	N270 (1.6GHz)
Memory Capacity	512MB / 1GB		
8.9" LCD Panel	AUO	Model	A089SW01 V0 A089SW01 V1
	CHI MEI	Model	N089L6-L02
HDD	Intel	Model	Z-U130 SLC (4GB)
			ZT4 MLC (4GB)
			ZT4 MLC (8GB)
	Sandisk	Model	uSSD MLC (8GB)
	Seagate	Model	ST980310AS (80GB)
	WD	Model	WD800BEVT-22ZCT0 (80GB)
Battery	SIMPLO	Model	UM08A71
			UM08A72
			UM08A73
			UM08B74
	Panasonic	Model	UM08A52
Intel WiMax/WiFi Link 5150	INTEL	Model	512ANXMMW
Camera	Lite-On	Model	08PC01 SP0814V1.2
	Suyin		CN0316-M608-0V01

3.2 Product Photos

Refer to Appendix D.



3.3 Applied Standards

The Specific Absorption Rate (SAR) testing specification, method and procedure for this Notebook Computer is in accordance with the following standards:

- 47 CFR Part 2 (2.1093)
- IEEE C95.1-1999
- OET Bulletin 65 Supplement C (Edition 01-01)
- KDB 248227 r1.2

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	20-24
Humidity	<60 %

3.5.2 Test Configuration

For WLAN link mode, engineering testing software installed on the EUT 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 WLAN SAR testing were set in 1Mbps for 802.11b, 6Mbps for 802.11g, 6Mbps for 802.11a, 6Mbps for 802.11n BW 20MHz and 15Mbps for 802.11n BW 40MHz due to the highest RF output power.

For Wi-Max link mode, engineering testing software installed on the EUT can provide continuous transmitting RF signal. This RF signal utilized in SAR measurement has almost 38.3% duty cycle and its crest factor is 2.611.

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:

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

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

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

$$\text{SAR} = C \frac{\delta T}{\delta t}$$

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

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

, 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 Setup

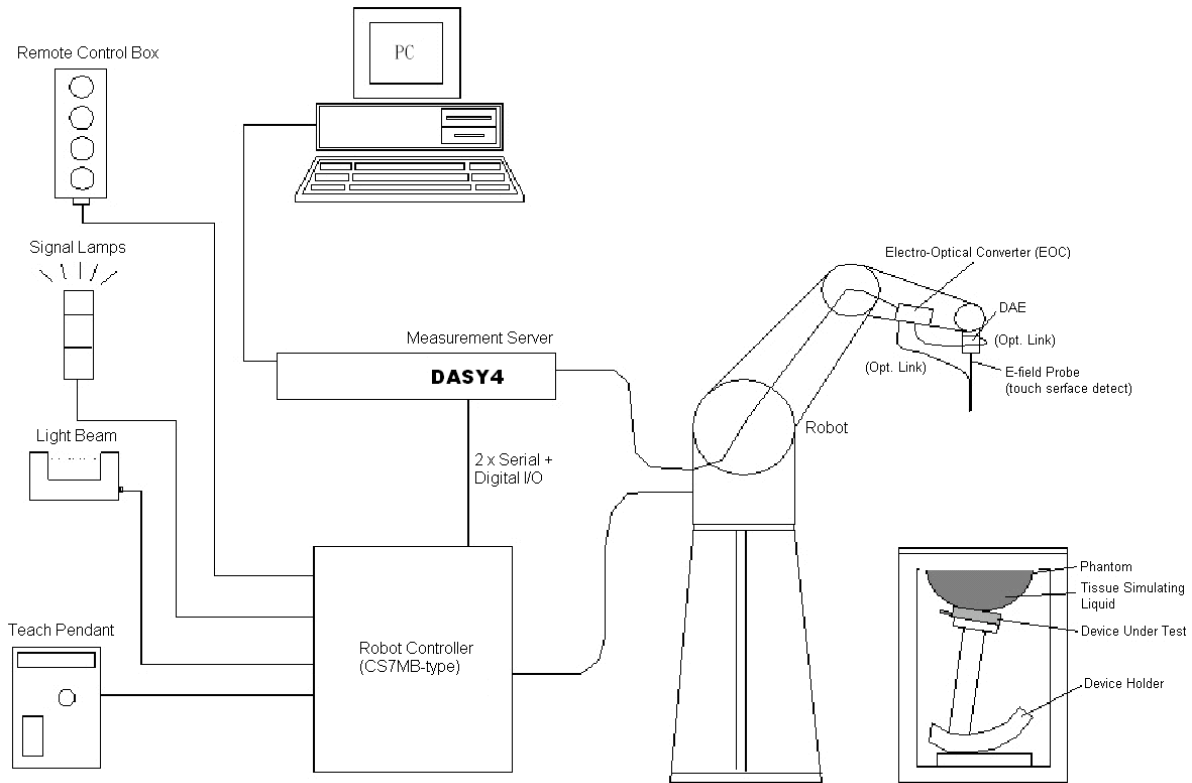


Fig. 5.1 DASY5 System

The 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
- DASY5 software
- Remote control with teach pendant and additional circuitry for robot safety such as warning 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.

5.1 DASY5 E-Field Probe System

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)	
Frequency	10 MHz to 3 GHz	
Directivity	± 0.2 dB in brain tissue (rotation around probe axis) ± 0.4 dB in brain tissue (rotation perpendicular to probe axis)	
Dynamic Range	5µW/g to 100mW/g; Linearity: ±0.2dB	
Surface Detection	± 0.2 mm repeatability in air and clear liquids on reflecting surface	
Dimensions	Overall length: 330mm Tip length: 16mm Body diameter: 12mm Tip diameter: 6.8mm Distance from probe tip to dipole centers: 2.7mm	
Application	General dosimetry up to 3GHz Compliance tests for mobile phones and Wireless LAN Fast automatic scanning in arbitrary phantoms	

Fig. 5.2 Probe Setup on Robot

<EX3DV3 Probe>


Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents)	
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal 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	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

Fig. 5.3 EX3DV3 E-field Probe



5.1.2 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy shall be evaluated and within $\pm 0.25\text{dB}$. 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 are as below:

ET3DV6 sn1788 (Cal: Sep. 23, 2008)			
Item	X axis	Y axis	Z axis
Sensitivity (μV)	1.73	1.59	1.72
Diode Compression Point (mV)	95	98	91
Conversion Factor (Head / Body)	Frequency (MHz)	X,Y,Z axis	
	2350~2550	4.68 / 3.98	
Boundary Effect (Head / Body)	Frequency (MHz)	Alpha	Depth
	2350~2550	0.80 / 0.94	1.45 / 1.75

EX3DV3 sn3514 (Cal: Jan. 31, 2008)			
Item	X axis	Y axis	Z axis
Sensitivity (μV)	0.65	0.69	0.58
Diode Compression Point (mV)	95	93	96
Conversion Factor (Head / Body)	Frequency (MHz)	X,Y,Z axis	
	2500~2700	7.31 / 6.91	
	5100~5300	- / 4.34	
	5200~5400	- / 4.06	
	5400~5600	- / 3.88	
	5500~5700	- / 4.19	
Boundary Effect (Head / Body)	Frequency (MHz)	Alpha	Depth
	2500~2700	0.62 / 0.52	0.60 / 0.76
	5100~5300	- / 0.35	- / 1.70
	5200~5400	- / 0.38	- / 1.70
	5400~5600	- / 0.43	- / 1.70
	5500~5700	- / 0.35	- / 1.70
	5700~5900	- / 0.30	- / 1.70



EX3DV3 sn3514 (Cal: Jan. 21, 2009)			
Item	X axis	Y axis	Z axis
Sensitivity (μV)	0.66	0.70	0.60
Diode Compression Point (mV)	91	94	95
Conversion Factor (Head / Body)	Frequency (MHz)	X,Y,Z axis	
	2500~2700	7.34 / 7.20	
	5100~5300	4.78 / 4.29	
	5200~5400	4.40 / 3.94	
	5400~5600	4.22 / 3.88	
	5500~5700	4.13 / 3.89	
	5700~5900	4.13 / 3.85	
Boundary Effect (Head / Body)	Frequency (MHz)	Alpha	Depth
	2500~2700	0.16 / 0.34	2.19 / 1.14
	5100~5300	0.40 / 0.45	1.70 / 1.75
	5200~5400	0.40 / 0.45	1.70 / 1.75
	5400~5600	0.40 / 0.45	1.70 / 1.75
	5500~5700	0.40 / 0.45	1.70 / 1.75
	5700~5900	0.40 / 0.45	1.70 / 1.75

NOTE: The probe parameters have been calibrated by the SPEAG.

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

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

5.3 Robot

The DASY5 system uses the high precision robots TX90 XL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASY5 system, the CS8C robot controller version from Stäubli is used. The XL robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

5.4 Measurement Server

The DASY5 measurement server is based on a PC/104 CPU board with
400 MHz CPU
128 MB chipdisk and
128 MB RAM.

Communication with
the DAE electronic box
the 16-bit AD-converter system for optical detection and digital I/O interface.

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

5.5 SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

- Left head
- Right head
- Flat 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.

The phantom can be used with the following tissue simulating liquids:

- *Water-sugar based liquid
- *Glycol based liquids

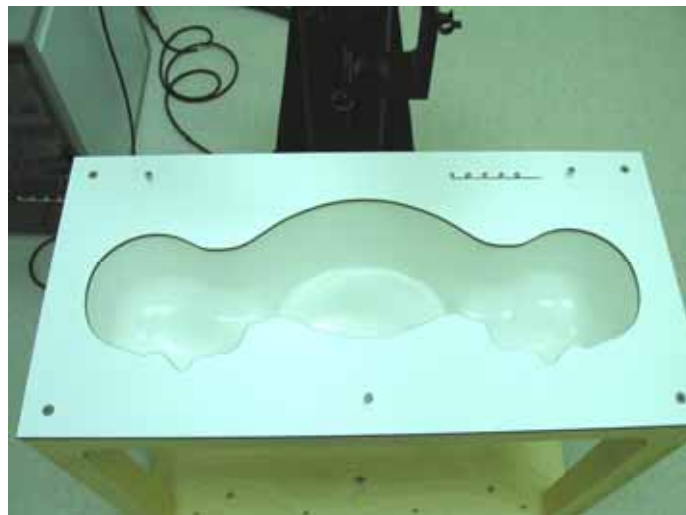


Fig. 5.3 Top View of Twin Phantom



Fig. 5.4 Bottom View of Twin Phantom

5.6 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 in 5 mm distance, a positioning uncertainty of $\pm 0.5\text{mm}$ would produce a SAR uncertainty of $\pm 20\%$. An accurate device position is therefore crucial for accurate and repeatable measurement. The position in which the devices must be measured, are defined by the standards.

The DASY5 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 DASY5 device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon_r = 3$ 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. 5.5 Device Holder



5.7 Data Storage and Evaluation

5.7.1 Data Storage

The DASY5 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 with the extension .DA5. 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 DASY5 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 _j , a _ρ , a _{i1} , a _{i2}
	- Conversion factor	ConvF _j
	- Diode compression point	dcp _j
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 DASY5 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 :

E-field probes : $E_i = \sqrt{\frac{V_i}{Norm_i ConvF}}$

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

with **V_i** = compensated signal of channel i ($i = x, y, z$)
 $Norm_i$ = sensor sensitivity of channel i ($i = x, y, z$)
 $\mu V/(V/m)^2$ 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.

The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with **P_{pwe}** = equivalent power density of a plane wave in mW/cm^2
 E_{tot} = total electric field strength in V/m
 H_{tot} = total magnetic field strength in A/m



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	Aug. 26, 2008	Aug. 25, 2009
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. 16, 2007	Jul. 15, 2009
SPEAG	1800MHz System Validation Kit	D1800V2	2d076	Jul. 10, 2007	Jul. 09, 2009
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. 12, 2007	Jul. 11, 2009
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. 02, 2008	Apr. 01, 2009
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

Table 5.1 Test Equipment List

6. Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY5, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. The liquid height from the bottom of the phantom body is 15.2 centimeters, which is shown in Fig. 6.1.



Fig 6.1 Liquid height from the bottom of the phantom body is 15.2 centimeters

The following ingredients for tissue simulating liquid are used:

- **Water:** deionized water (pure H₂O), resistivity 16MΩ- as basis for the liquid
- **Sugar:** refined sugar in crystals, as available in food shops – to reduce relative permittivity
- **Salt:** pure NaCl – to increase conductivity
- **Cellulose:** Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20°C), CAS#54290-to increase viscosity and to keep sugar in solution.
- **Preservative:** Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS#55965-84-9- to prevent the spread of bacteria and molds.
- **DGMBE:** Deithlenglycol-monobuthyl ether (DGMBE), Fluka Chemie GmbH, CAS#112-34-5 – to reduce relative permittivity.

Table 6.2 shows the measuring results for muscle simulating liquid.

Band	Temperature ()	Frequency (MHz)	Conductivity (σ)	Permittivity (ϵ_r)	Measurement date
802.11b/g/n (2400~2450 MHz)	21.5	2412	1.92	51.3	Dec. 02, 2008
		2437	1.95	51.2	
		2462	1.98	51.1	
802.16e (2496~2690 MHz)	21.4	2501	2.07	53.0	Dec. 02, 2008
		2593	2.19	52.8	
		2685	2.25	52.6	
	21.6	2501	2.06	54.0	Jan. 15, 2009
		2593	2.16	53.8	
		2685	2.21	53.6	
	21.5	2501	2.10	51.3	Mar. 10, 2009
		2593	2.20	51.1	
		2685	2.25	50.9	
802.11a/n (5150~5250 MHz)	21.4	5180	5.30	48.7	Dec. 03, 2008
		5240	5.39	48.6	
802.11a/n (5250~5350 MHz)	21.4	5260	5.42	48.6	Dec. 03, 2008
		5320	5.50	48.4	
802.11a/n (5470~5725 MHz)	21.4	5520	5.75	48.0	Dec. 03, 2008
		5580	5.82	47.8	
		5620	5.87	47.7	
		5670	5.93	47.6	
		5680	5.94	47.5	
802.11a/n (5725~5850 MHz)	21.4	5745	6.05	47.5	Dec. 03, 2008
		5785	6.09	47.4	
		5825	6.13	47.2	

Table 6.1 Measuring Results for Muscle Simulating Liquid

The measuring data are consistent with $\epsilon_r = 52.7 \pm 5\%$, $\sigma = 1.95 \pm 5\%$ for 2400~2483.5 MHz, $\epsilon_r = 52.51 \pm 5\%$, $\sigma = 2.16 \pm 5\%$ for 2496~2690 MHz, $\epsilon_r = 49.0 \pm 5\%$ and $\sigma = 5.30 \pm 5\%$ for 5150~5350 MHz, $\epsilon_r = 48.6 \pm 5\%$ and $\sigma = 5.65 \pm 5\%$ for 5470~5725 MHz, and $\epsilon_r = 48.2 \pm 5\%$, $\sigma = 6.00 \pm 5\%$ for 5725~5850 MHz.



7. Uncertainty Assessment

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A 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
Multiplying factor^(a)	1/k ^(b)	1/√3	1/√6	1/√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 DASY5 uncertainty Budget is showed in Table 7.2.



Error Description	Uncertainty Value \pm %	Probability Distribution	Divisor	Ci (1g)	Standard Unc. (1g)	vi or Veff
Measurement Equipment						
Probe Calibration	± 5.9 %	Normal	1	1	± 5.9 %	∞
Axial Isotropy	± 4.7 %	Rectangular	$\sqrt{3}$	0.7	± 1.9 %	∞
Hemispherical Isotropy	± 9.6 %	Rectangular	$\sqrt{3}$	0.7	± 3.9 %	∞
Boundary Effects	± 1.0 %	Rectangular	$\sqrt{3}$	1	± 0.6 %	∞
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	± 0.4 %	Rectangular	$\sqrt{3}$	1	± 0.2 %	∞
Probe Positioning	± 2.9 %	Rectangular	$\sqrt{3}$	1	± 1.7 %	∞
Max. SAR Eval.	± 1.0 %	Rectangular	$\sqrt{3}$	1	± 0.6 %	∞
Test Sample Related						
Device Positioning	± 2.9 %	Normal	1	1	± 2.9	145
Device Holder	± 3.6 %	Normal	1	1	± 3.6	5
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	$\sqrt{3}$	0.64	± 1.8	∞
Liquid Conductivity (meas.)	± 2.5 %	Normal	1	0.64	± 1.6	∞
Liquid Permittivity (target)	± 5.0 %	Rectangular	$\sqrt{3}$	0.6	± 1.7	∞
Liquid Permittivity (meas.)	± 2.5 %	Normal	1	0.6	± 1.5	∞
Combined Standard Uncertainty					± 10.9	387
Coverage Factor for 95 %		K=2				
Expanded uncertainty (Coverage factor = 2)					± 21.9	

Table 7.2 Uncertainty Budget of DASY5

8. SAR Measurement Evaluation

Each DASY5 system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY5 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 which comes from a signal generator at frequency 2450 MHz, 2600 MHz, 5200 MHz, 5500 MHz and 5800 MHz. 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:

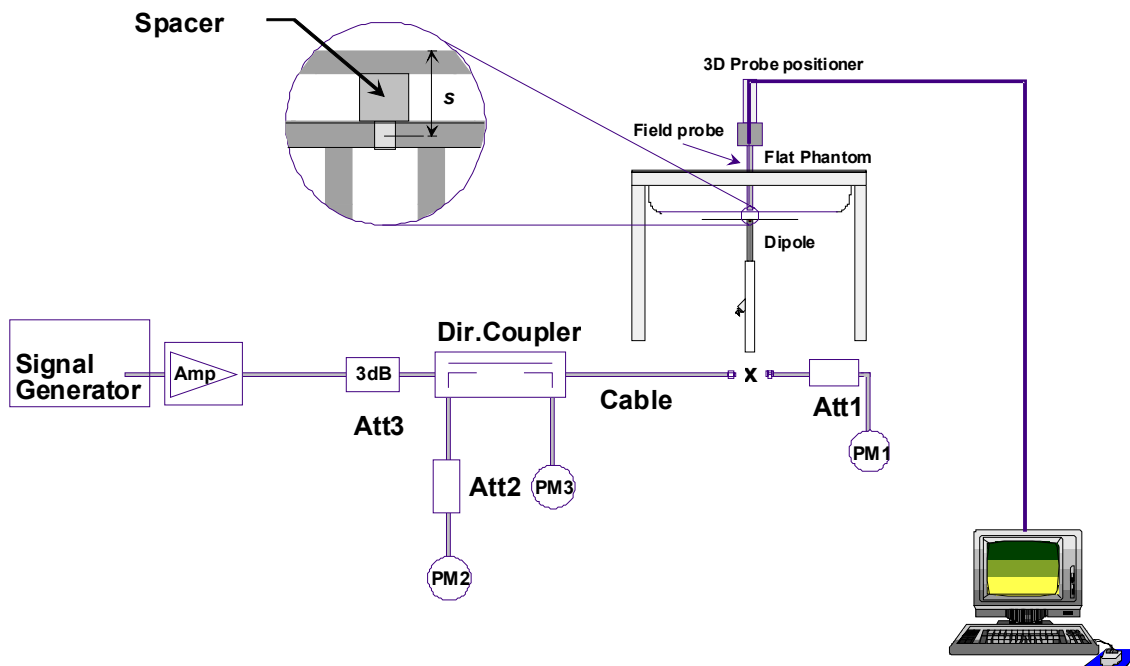


Fig. 8.1 System Setup for System Evaluation

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. 2450 MHz or 2600 MHz or 5200 MHz or 5500 MHz or 5800 MHz Dipole

The output power on dipole port must be calibrated to 20dBm (100mW) before dipole is connected.



Fig 8.2 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.

Frequency (MHz)	SAR	Target (W/kg)	Measurement Data (W/kg)	Variation	Measurement Date
2450	SAR (1g)	52.5	48.9	-6.9 %	Dec. 02, 2008
	SAR (10g)	24.4	22.9	-6.1 %	
2600	SAR (1g)	57.6	58.1	0.9 %	Dec. 02, 2008
	SAR (10g)	25.5	25.4	-0.4 %	Mar. 10, 2009
	SAR (1g)	57.6	53.7	-6.8 %	
	SAR (10g)	25.5	23.6	-7.5 %	Jan. 15, 2009
	SAR (1g)	57.6	57.1	-0.9 %	
	SAR (10g)	25.5	25.0	2.0 %	
5200	SAR (1g)	76.8	75.0	-2.3 %	Dec. 03, 2008
	SAR (10g)	21.6	21.0	-2.8 %	
5500	SAR (1g)	80.1	82.6	3.1 %	Dec. 03, 2008
	SAR (10g)	22.3	23.2	4.0 %	
5800	SAR (1g)	69.4	71.2	2.6 %	Dec. 03, 2008
	SAR (10g)	19.3	20.1	4.1 %	

Table 8.1 Target and Measurement Data Comparison



9. Description for DUT Testing Position

This DUT was tested in one position only, which was bottom of the EUT and the gap between notebook and flat phantom was 0cm.

Remark: Please refer to Appendix E for the test setup photos.

10. Measurement Procedures

The measurement procedures are as follows:

- Using engineering software to transmit RF power continuously (continuous Tx) in the middle channel
- Placing the DUT in the positions described in the last section
- Setting scan area, grid size and other setting on the DASY4 software
- Taking data for the low channel
- Repeat the previous steps for the lowest and highest channels.

According to the OET Bulletin 65 Supplement C standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- Power reference measurement
- Area scan
- Zoom scan
- Power reference measurement

10.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the OET Bulletin 65 Supplement C standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY5 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:

- extraction of the measured data (grid and values) from the Zoom Scan
- calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- generation of a high-resolution mesh within the measured volume
- interpolation of all measured values from the measurement grid to the high-resolution grid
- extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- calculation of the averaged SAR within masses of 1g and 10g



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. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 1 g.

10.3 SAR Averaged Methods

In DASYS, 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

Channel Band-width	Modulation	802.16e (dBm)		
		Low Ch 0 (2501MHz)	Mid Ch 1 (2593MHz)	High Ch 2 (2685MHz)
10	16QAM	22.86	22.90	23.01
	QPSK	22.95	23.05	23.12
5	16QAM	23.81	23.83	23.83
	QPSK	23.57	23.76	23.80

Channel	Band Data Rate	802.11b (dBm)	802.11g (dBm)	802.11n (BW 20M) (dBm)
		1 Mbps	6 Mbps	6Mbps
1		20.24	27.29	27.08
6		20.27	27.50	26.87
11		19.99	27.69	27.19

Channel	Band Data Rate	802.11n (BW 40M) (dBm)	
		15Mbps	
3		26.22	
6		27.60	
9		28.00	

Channel	Band Data Rate	802.11a (dBm)	802.11n (BW 20M) (dBm)
		6 Mbps	6Mbps
36		16.58	16.37
40		16.64	16.46
48		16.41	16.39
52		16.62	16.60
56		16.74	16.73
64		16.53	16.80
100		16.56	16.72
104		16.69	16.81
116		16.47	16.54
120		16.38	16.64
124		16.72	16.86
136		16.54	16.21
140		16.56	16.75
149		25.19	24.97
157		25.12	25.00
165		25.28	25.14



Channel	Band	802.11a (BW 40M) (dBm)
	Data Rate	15Mbps
102		16.52
118		16.67
134		16.52
151		23.40
159		23.10

11.2 Test Records for Body SAR Test

Position	Band	Chan.	Freq. (MHz)	Modulation Type	Measured 1g SAR (W/kg)	Limit (W/kg)	Result
NB Bottom with 0cm Gap	802.11b	6	2437	DSSS	0.0042	1.6	Pass
NB Bottom with 0cm Gap	802.11g	6	2437	OFDM	0.00515	1.6	Pass
NB Bottom with 0cm Gap	802.11n (BW 20MHz)	6	2437	OFDM	0.00441	1.6	Pass
NB Bottom with 0cm Gap	802.11n (BW 40MHz)	6	2437	OFDM	0.00484	1.6	Pass
NB Bottom with 0cm Gap	802.11g	1	2412	OFDM	0.00583	1.6	Pass
NB Bottom with 0cm Gap	802.11g	11	2462	OFDM	0.00638	1.6	Pass

Position	Band	Chan.	Freq. (MHz)	Modulation Type	Measured 1g SAR (W/kg)	Limit (W/kg)	Result
NB Bottom with 0cm Gap	802.16e (BW 5MHz)	0	2501	QPSK1/2	0.015	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 5MHz)	1	2593	QPSK 1/2	0.025	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 5MHz)	2	2685	QPSK1/2	0.014	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 10MHz)	0	2501	QPSK1/2	0.012	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 10MHz)	1	2593	QPSK 1/2	0.026	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 10MHz)	2	2685	QPSK1/2	0.017	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 5MHz)	0	2501	16QAM 3/4	0.025	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 5MHz)	1	2593	16QAM 3/4	0.03	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 5MHz)	2	2685	16QAM 3/4	0.03	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 10MHz)	0	2501	16QAM3/4	0.015	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 10MHz)	1	2593	16QAM 3/4	0.025	1.6	Pass
NB Bottom with 0cm Gap	802.16e (BW 10MHz)	2	2685	16QAM3/4	0.013	1.6	Pass



Position	Band	Chan.	Freq. (MHz)	Modulation Type	Measured 1g SAR (W/kg)	Limit (W/kg)	Result
NB Bottom with 0cm Gap	802.11a	36	5180	OFDM	0.122	1.6	Pass
NB Bottom with 0cm Gap	802.11a	48	5240	OFDM	0.115	1.6	Pass
NB Bottom with 0cm Gap	802.11a	52	5260	OFDM	0.112	1.6	Pass
NB Bottom with 0cm Gap	802.11a	64	5320	OFDM	0.121	1.6	Pass
NB Bottom with 0cm Gap	802.11a	104	5520	OFDM	0.138	1.6	Pass
NB Bottom with 0cm Gap	802.11a	116	5580	OFDM	0.13	1.6	Pass
NB Bottom with 0cm Gap	802.11a	124	5620	OFDM	0.126	1.6	Pass
NB Bottom with 0cm Gap	802.11a	136	5680	OFDM	0.147	1.6	Pass
NB Bottom with 0cm Gap	802.11a	149	5745	OFDM	0.110	1.6	Pass
NB Bottom with 0cm Gap	802.11a	157	5785	OFDM	0.118	1.6	Pass
NB Bottom with 0cm Gap	802.11a	165	5825	OFDM	0.128	1.6	Pass
NB Bottom with 0cm Gap	802.11n (BW 20MHz)	136	5680	OFDM	0.146	1.6	Pass
NB Bottom with 0cm Gap	802.11n (BW 40MHz)	134	5670	OFDM	0.134	1.6	Pass

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



12. References

- [1] FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
- [2] IEEE Std. P1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", April 21, 2003
- [3] Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01), "Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to RF Emissions", June 2001
- [4] IEEE Std. C95.1-1999, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", 1999
- [5] Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148
- [6] DASY5 System Handbook



Appendix A - System Performance Check Data

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/2

System Check_Body_2450MHz_081202

DUT: Dipole 2450 MHz

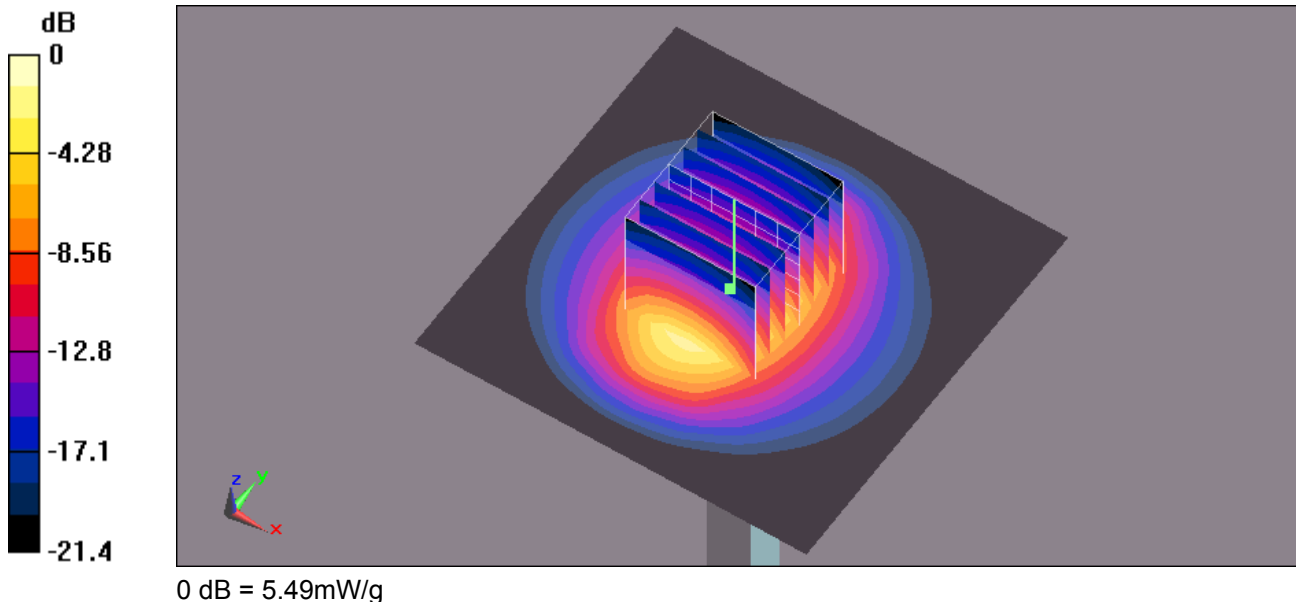
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL_2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.97$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³
Ambient Temperature : 22.5 ; Liquid Temperature : 21.5

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 120; SEMCAD X Version 13.2 Build 87

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 5.64 mW/g

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55 V/m; Power Drift = 0.024 dB
Peak SAR (extrapolated) = 10.6 W/kg
SAR(1 g) = 4.89 mW/g; SAR(10 g) = 2.29 mW/g
Maximum value of SAR (measured) = 5.49 mW/g





Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/2

System Check_Body_2600MHz_081202

DUT: Dipole 2600MHz

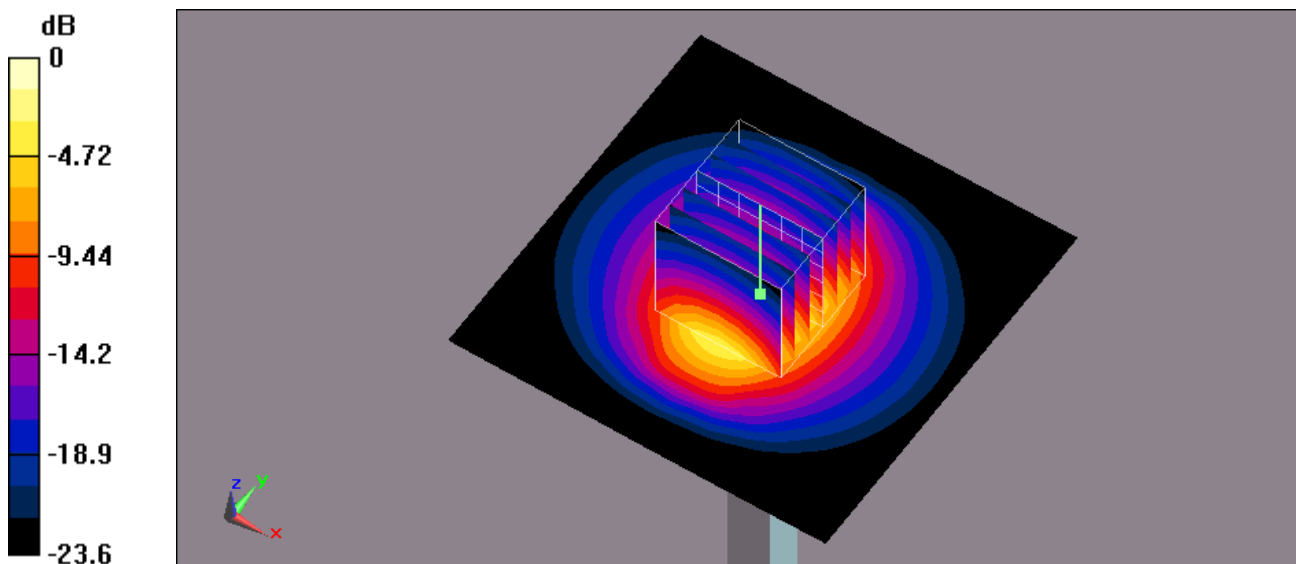
Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: MSL_2600 Medium parameters used: $f = 2600$ MHz; $\sigma = 2.2$ mho/m; $\epsilon_r = 52.8$; $\rho = 1000$ kg/m³
Ambient Temperature : 22.5 ; Liquid Temperature : 21.4

DASY5 Configuration:

- Probe: EX3DV3 - SN3514; ConvF(6.91, 6.91, 6.91); Calibrated: 2008/1/31
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.2 Build 87

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 8.04 mW/g

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.7 V/m; Power Drift = 0.014 dB
Peak SAR (extrapolated) = 12.8 W/kg
SAR(1 g) = 5.81 mW/g; SAR(10 g) = 2.54 mW/g
Maximum value of SAR (measured) = 7.83 mW/g



0 dB = 7.83mW/g



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2009/1/15

System Check_Body_2600MHz_090115

DUT: Dipole 2600MHz

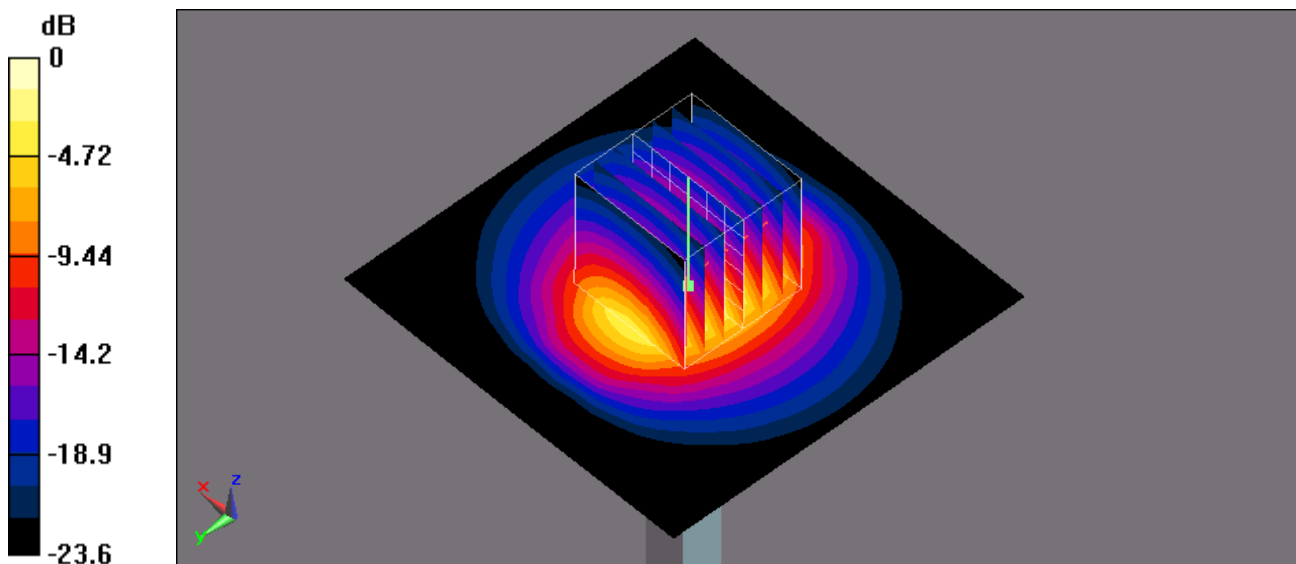
Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: MSL_2600 Medium parameters used: $f = 2600$ MHz; $\sigma = 2.17$ mho/m; $\epsilon_r = 53.8$; $\rho = 1000$ kg/m³
Ambient Temperature : 22.8 ; Liquid Temperature : 21.6

DASY5 Configuration:

- Probe: EX3DV3 - SN3526; ConvF(8.14, 8.14, 8.14); Calibrated: 2008/8/26;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.2 Build 87

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 7.91 mW/g

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.7 V/m; Power Drift = 0.034 dB
Peak SAR (extrapolated) = 12.6 W/kg
SAR(1 g) = 5.71 mW/g; SAR(10 g) = 2.5 mW/g
Maximum value of SAR (measured) = 7.7 mW/g



0 dB = 7.7mW/g



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2009/3/10

System Check_Body_2600MHz_090310

DUT: Dipole 2600MHz

Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: MSL_2600 Medium parameters used: $f = 2600$ MHz; $\sigma = 2.21$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³
Ambient Temperature : 22.9 °C; Liquid Temperature : 21.5 °C

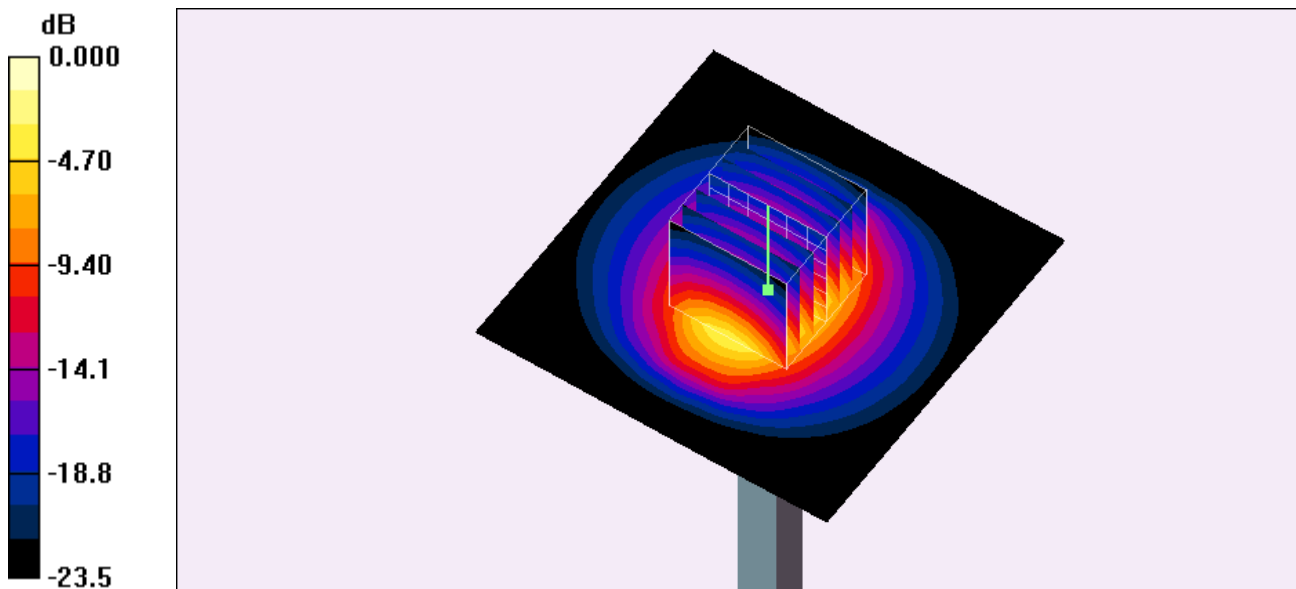
DASY4 Configuration:

- Probe: EX3DV3 - SN3514; ConvF(7.2, 7.2, 7.2); Calibrated: 2009/1/21
- Sensor-Surface: 3mm (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 (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 7.42 mW/g

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.7 V/m; Power Drift = 0.014 dB
Peak SAR (extrapolated) = 11.6 W/kg

SAR(1 g) = 5.37 mW/g; SAR(10 g) = 2.36 mW/g
Maximum value of SAR (measured) = 7.23 mW/g





Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/3

System Check_Body_5200MHz_081203

DUT: Dipole 5GHz

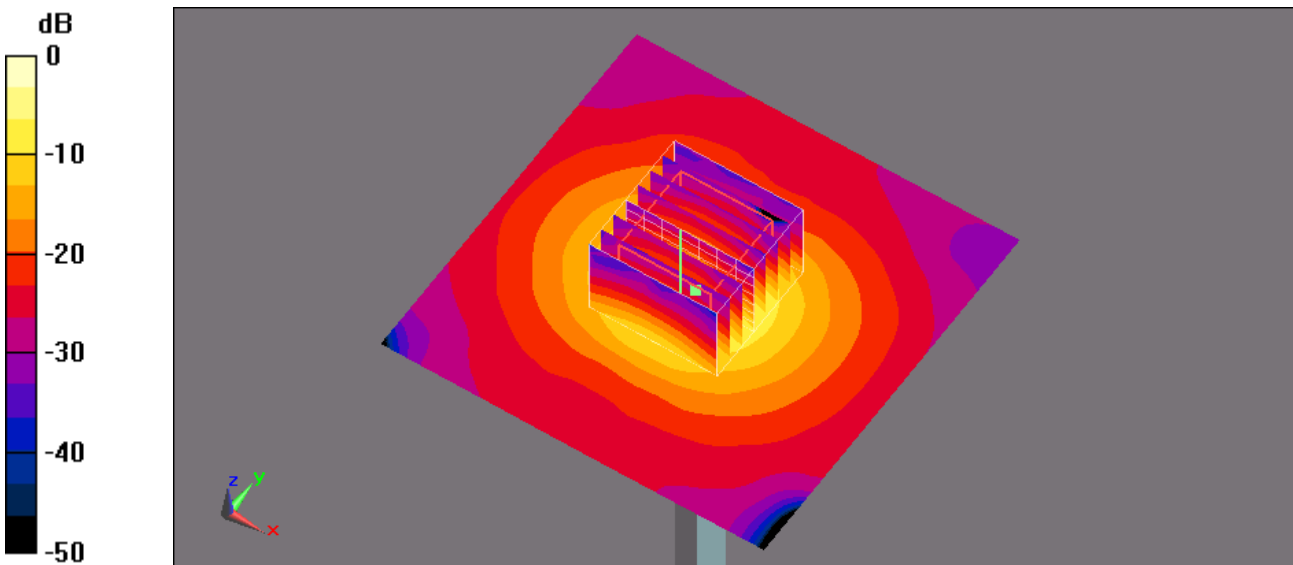
Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: MSL_5000~6000 Medium parameters used: $f = 5200$ MHz; $\sigma = 5.33$ mho/m; $\epsilon_r = 48.6$; $\rho = 1000$ kg/m³
Ambient Temperature : 22.3 ; Liquid Temperature : 21.4

DASY5 Configuration:

- Probe: EX3DV3 - SN3514; ConvF(4.34, 4.34, 4.34); Calibrated: 2008/1/31
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.2 Build 87

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 12.6 mW/g

Pin=100mW/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 52.5 V/m; Power Drift = 0.080 dB
Peak SAR (extrapolated) = 29.4 W/kg
SAR(1 g) = 7.5 mW/g; SAR(10 g) = 2.1 mW/g
Maximum value of SAR (measured) = 12.4 mW/g



0 dB = 12.4mW/g



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/3

System Check_Body_5500MHz_081203

DUT: Dipole 5GHz

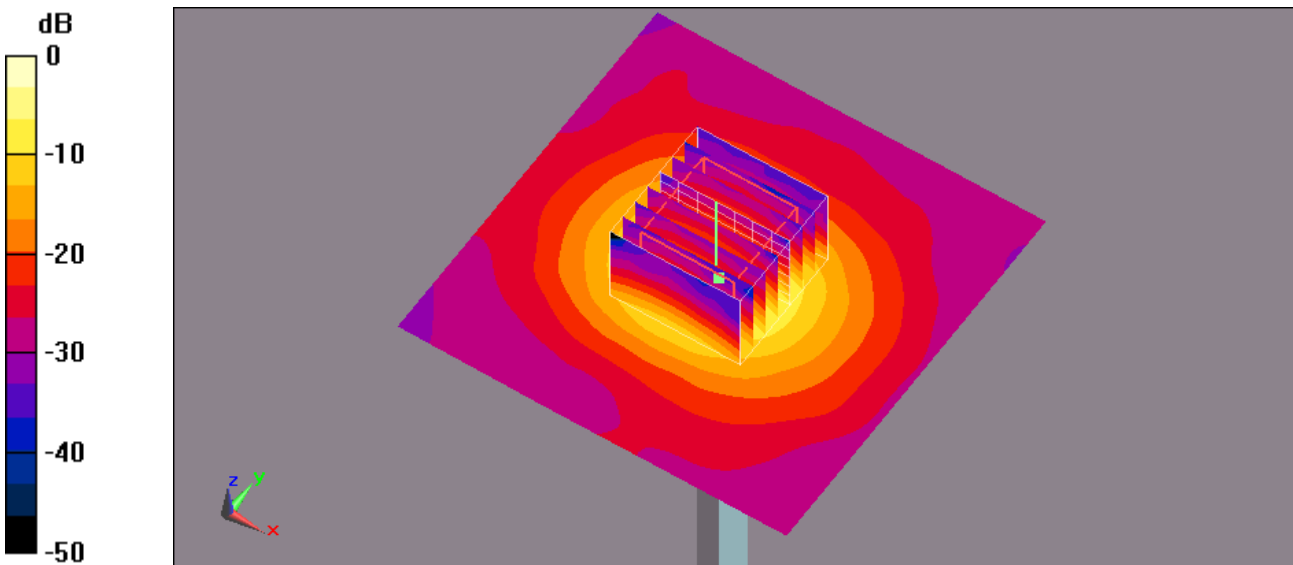
Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: MSL_5000~6000 Medium parameters used: $f = 5500$ MHz; $\sigma = 5.74$ mho/m; $\epsilon_r = 48.1$; $\rho = 1000$ kg/m³
Ambient Temperature : 22.4 ; Liquid Temperature : 21.4

DASY5 Configuration:

- Probe: EX3DV3 - SN3514; ConvF(3.98, 3.98, 3.98); Calibrated: 2008/1/31
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.2 Build 87

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 14.3 mW/g

Pin=100mW/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 54 V/m; Power Drift = 0.065 dB
Peak SAR (extrapolated) = 32.6 W/kg
SAR(1 g) = 8.26 mW/g; SAR(10 g) = 2.32 mW/g
Maximum value of SAR (measured) = 13.7 mW/g



0 dB = 13.7mW/g



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/3

System Check_Body_5800MHz_081203

DUT: Dipole 5GHz

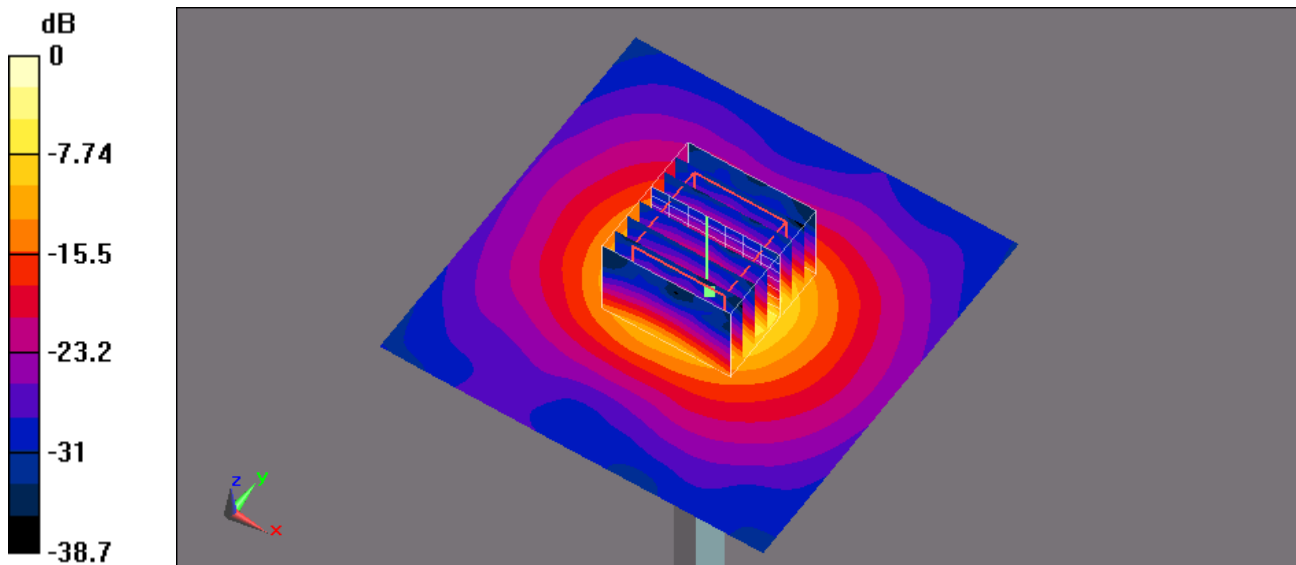
Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: MSL_5000~6000 Medium parameters used: $f = 5800 \text{ MHz}$; $\sigma = 6.11 \text{ mho/m}$; $\epsilon_r = 47.4$; $\rho = 1000 \text{ kg/m}^3$
Ambient Temperature : 22.3 ; Liquid Temperature : 21.4

DASY5 Configuration:

- Probe: EX3DV3 - SN3514; ConvF(4.2, 4.2, 4.2); Calibrated: 2008/1/31
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.2 Build 87

Pin=100mW/Area Scan (91x91x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$
Maximum value of SAR (interpolated) = 12.7 mW/g

Pin=100mW/Zoom Scan (8x8x8)/Cube 0: Measurement grid: $dx=4.3\text{mm}$, $dy=4.3\text{mm}$, $dz=3\text{mm}$
Reference Value = 45.9 V/m; Power Drift = -0.026 dB
Peak SAR (extrapolated) = 31.3 W/kg
SAR(1 g) = 7.12 mW/g; SAR(10 g) = 2.01 mW/g
Maximum value of SAR (measured) = 11.7 mW/g



0 dB = 11.7mW/g



Appendix B - SAR Measurement Data

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/2

Body_802.11g Ch11_NB Bottom with 0cm Gap

DUT: 870804-01

Communication System: 802.11g; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: MSL_2450 Medium parameters used: $f = 2462$ MHz; $\sigma = 1.98$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.5 ; Liquid Temperature : 21.5

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 120; SEMCAD X Version 13.2 Build 87

Ch11/Area Scan (151x191x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.00787 mW/g

Ch11/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.17 V/m; Power Drift = -0.115 dB

Peak SAR (extrapolated) = 0.00812 W/kg

SAR(1 g) = 0.00638 mW/g; SAR(10 g) = 0.00475 mW/g

Maximum value of SAR (measured) = 0.00729 mW/g

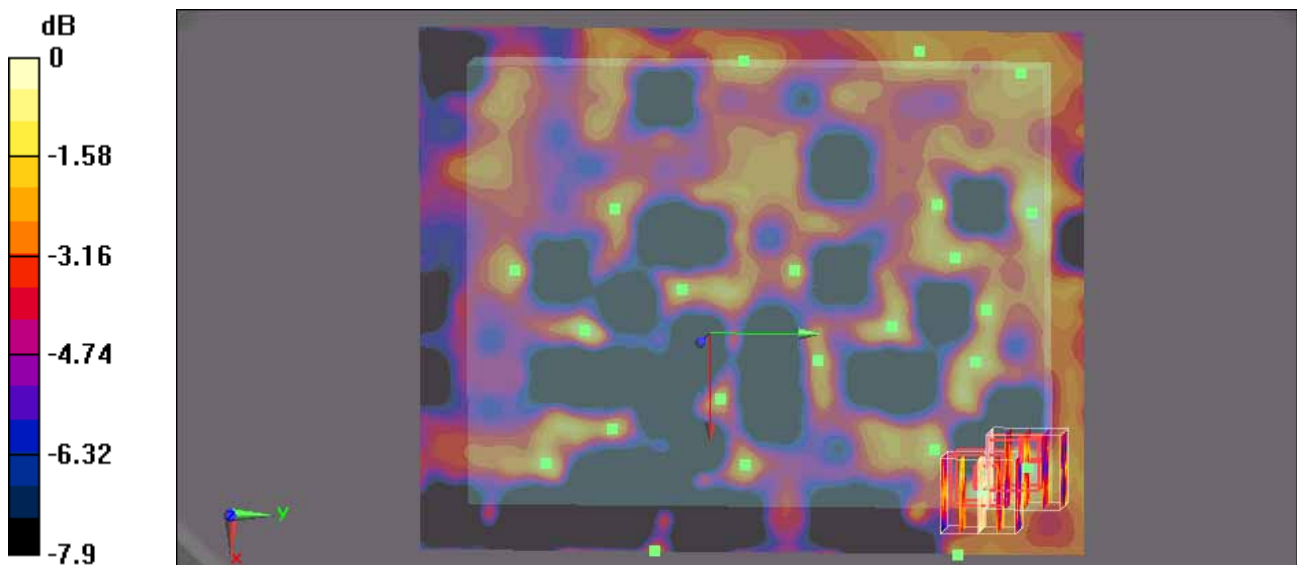
Ch11/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.17 V/m; Power Drift = -0.115 dB

Peak SAR (extrapolated) = 0.015 W/kg

SAR(1 g) = 0.00479 mW/g; SAR(10 g) = 0.00385 mW/g

Maximum value of SAR (measured) = 0.00777 mW/g



0 dB = 0.00777mW/g



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/2

Body_Wimax Ch2_Bottom with 0cm Gap_16QAM3-4(5M)

DUT: 870804-01

Communication System: Wimax; Frequency: 2687.5 MHz; Duty Cycle: 1:3.15

Medium: MSL_2600 Medium parameters used: $f = 2687.5$ MHz; $\sigma = 2.25$ mho/m; $\epsilon_r = 52.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.5 ; Liquid Temperature : 21.4

DASY5 Configuration:

- Probe: EX3DV3 - SN3514; ConvF(6.91, 6.91, 6.91); Calibrated: 2008/1/31
- Sensor-Surface: 3mm (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

Ch2/Area Scan (51x301x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.033 mW/g

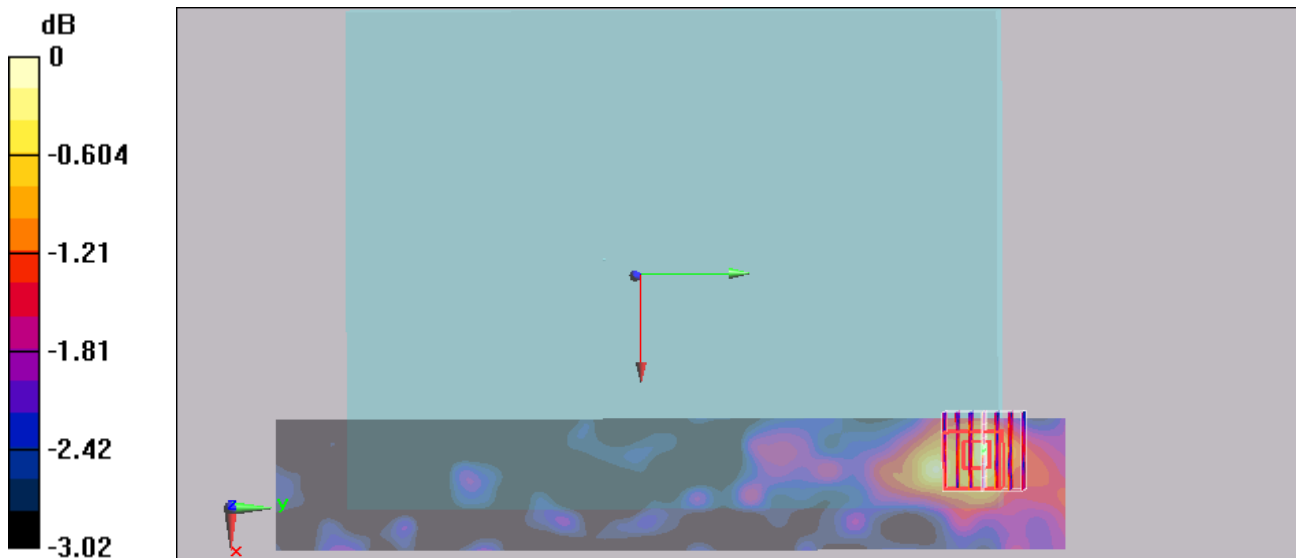
Ch2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.4 V/m; Power Drift = 0.188 dB

Peak SAR (extrapolated) = 0.067 W/kg

SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.025 mW/g

Maximum value of SAR (measured) = 0.034 mW/g





Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/3

Body_802.11a Ch136_NB Bottom with 0cm Gap

DUT: 870804-01

Communication System: 802.11a; Frequency: 5680 MHz; Duty Cycle: 1:1

Medium: MSL_5000~6000 Medium parameters used: $f = 5680$ MHz; $\sigma = 5.94$ mho/m; $\epsilon_r = 47.5$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.5 ; Liquid Temperature : 21.4

DASY5 Configuration:

- Probe: EX3DV3 - SN3514; ConvF(4.19, 4.19, 4.19); Calibrated: 2008/1/31
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.2 Build 87

Ch136/Area Scan (221x281x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.127 mW/g

Ch136/Zoom Scan (8x8x8)/Cube 1: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 4.01 V/m; Power Drift = 0.144 dB

Peak SAR (extrapolated) = 0.169 W/kg

SAR(1 g) = 0.147 mW/g; SAR(10 g) = 0.137 mW/g

Maximum value of SAR (measured) = 0.168 mW/g

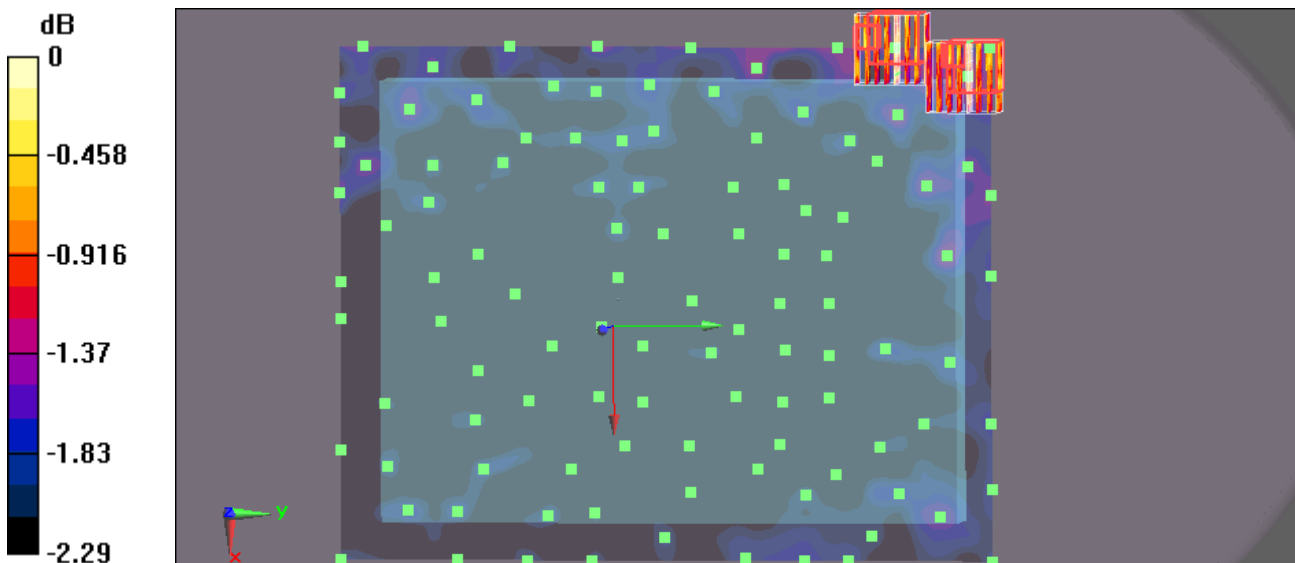
Ch136/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 4.01 V/m; Power Drift = 0.144 dB

Peak SAR (extrapolated) = 0.165 W/kg

SAR(1 g) = 0.143 mW/g; SAR(10 g) = 0.135 mW/g

Maximum value of SAR (measured) = 0.165 mW/g



0 dB = 0.165mW/g



Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/2

Body_802.11g Ch11_NB Bottom with 0cm Gap_2D

DUT: 870804-01

Communication System: 802.11g; Frequency: 2462 MHz; Duty Cycle: 1:1
Medium: MSL_2450 Medium parameters used: $f = 2462$ MHz; $\sigma = 1.98$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³
Ambient Temperature : 22.5 ; Liquid Temperature : 21.5

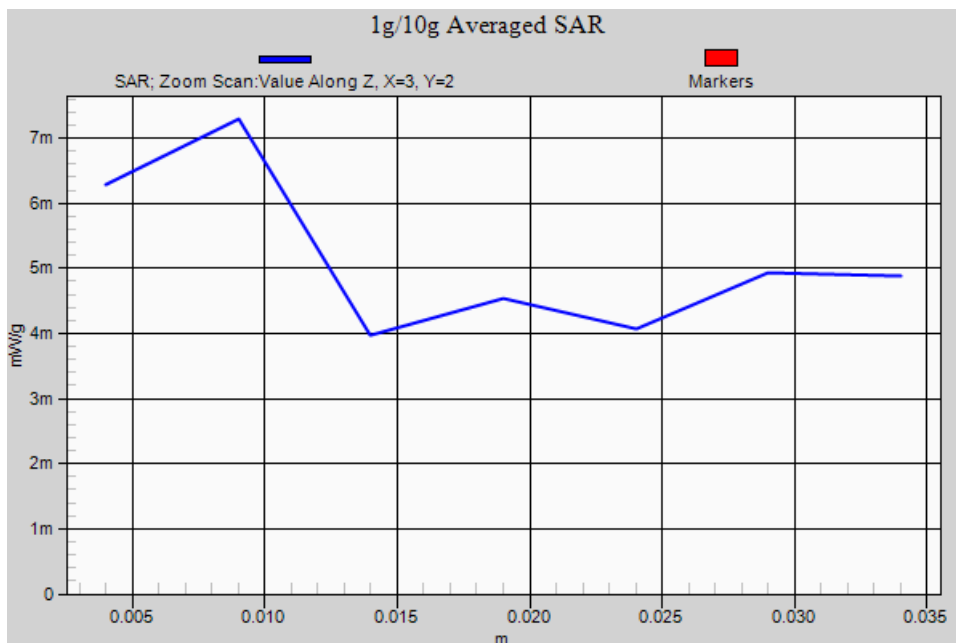
DASY5 Configuration:

- 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 120; SEMCAD X Version 13.2 Build 87

Ch11/Area Scan (151x191x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.00787 mW/g

Ch11/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.17 V/m; Power Drift = -0.115 dB
Peak SAR (extrapolated) = 0.00812 W/kg
SAR(1 g) = 0.00638 mW/g; SAR(10 g) = 0.00475 mW/g
Maximum value of SAR (measured) = 0.00729 mW/g

Ch11/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.17 V/m; Power Drift = -0.115 dB
Peak SAR (extrapolated) = 0.015 W/kg
SAR(1 g) = 0.00479 mW/g; SAR(10 g) = 0.00385 mW/g
Maximum value of SAR (measured) = 0.00777 mW/g





Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/2

Body_Wimax Ch2_Bottom with 0cm Gap_16QAM3-4(5M)_2D

DUT: 870804-01

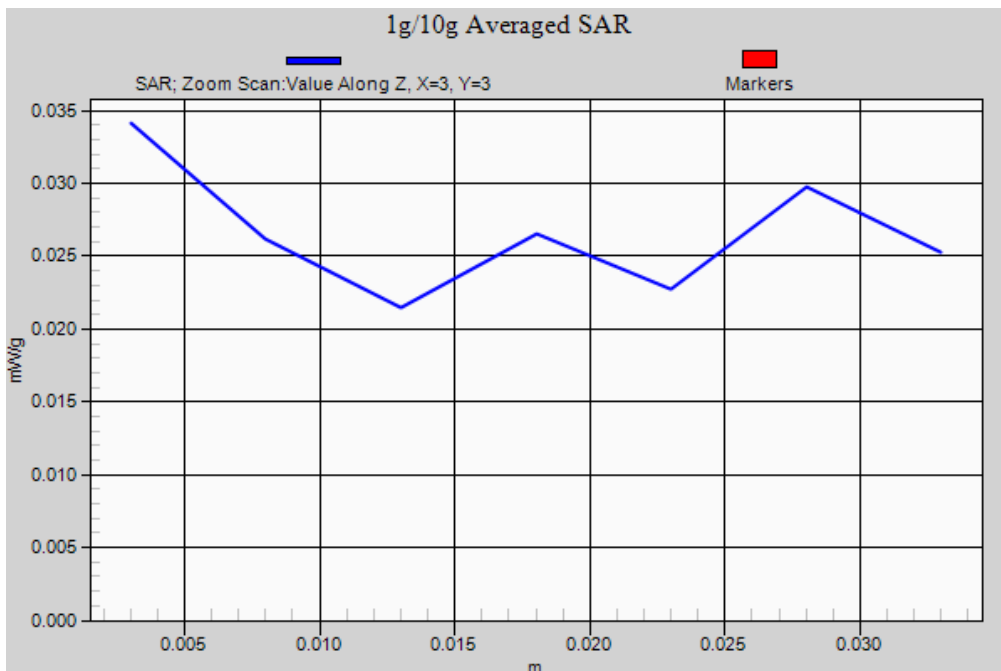
Communication System: Wimax; Frequency: 2687.5 MHz; Duty Cycle: 1:3.15
Medium: MSL_2600 Medium parameters used: $f = 2687.5$ MHz; $\sigma = 2.25$ mho/m; $\epsilon_r = 52.6$; $\rho = 1000$ kg/m³
Ambient Temperature : 22.5 ; Liquid Temperature : 21.4

DASY5 Configuration:

- Probe: EX3DV3 - SN3514; ConvF(6.91, 6.91, 6.91); Calibrated: 2008/1/31
- Sensor-Surface: 3mm (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

Ch2/Area Scan (51x301x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.033 mW/g

Ch2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.4 V/m; Power Drift = 0.188 dB
Peak SAR (extrapolated) = 0.067 W/kg
SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.025 mW/g
Maximum value of SAR (measured) = 0.034 mW/g





Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab

Date: 2008/12/3

Body_802.11a Ch136_NB Bottom with 0cm Gap_2D

DUT: 870804-01

Communication System: 802.11a; Frequency: 5680 MHz; Duty Cycle: 1:1

Medium: MSL_5000~6000 Medium parameters used: $f = 5680$ MHz; $\sigma = 5.94$ mho/m; $\epsilon_r = 47.5$; $\rho = 1000$ kg/m³

Ambient Temperature : 22.5 ; Liquid Temperature : 21.4

DASY5 Configuration:

- Probe: EX3DV3 - SN3514; ConvF(4.19, 4.19, 4.19); Calibrated: 2008/1/31
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1029
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.2 Build 87

Ch136/Area Scan (221x281x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.127 mW/g

Ch136/Zoom Scan (8x8x8)/Cube 1: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 4.01 V/m; Power Drift = 0.144 dB

Peak SAR (extrapolated) = 0.169 W/kg

SAR(1 g) = 0.147 mW/g; SAR(10 g) = 0.137 mW/g

Maximum value of SAR (measured) = 0.168 mW/g

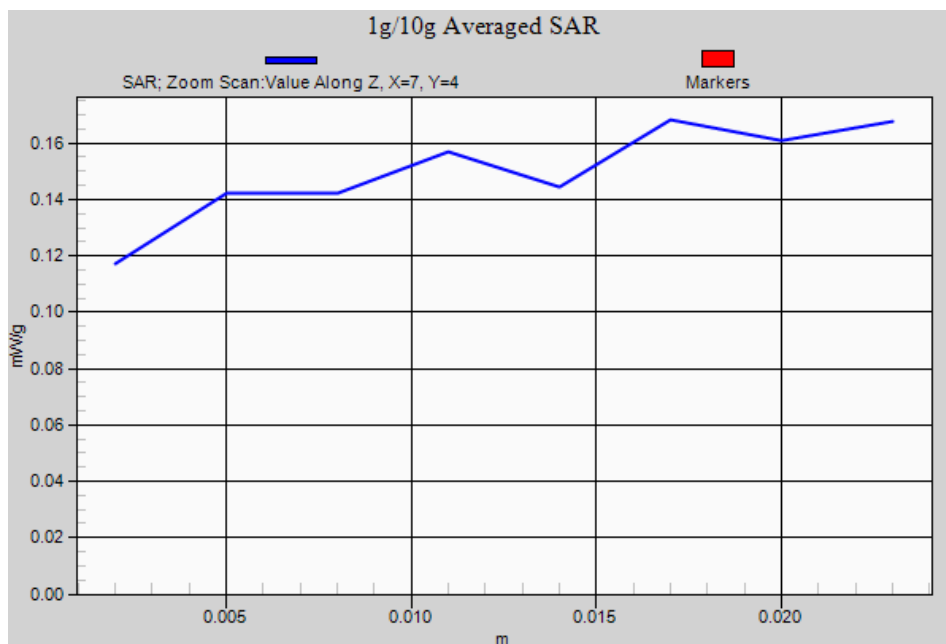
Ch136/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 4.01 V/m; Power Drift = 0.144 dB

Peak SAR (extrapolated) = 0.165 W/kg

SAR(1 g) = 0.143 mW/g; SAR(10 g) = 0.135 mW/g

Maximum value of SAR (measured) = 0.165 mW/g





Appendix C – Calibration Data

Please refer to the calibration certificates of DASY as below.



Calibration Laboratory of Schmid & Partner Engineering AG



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

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client Sporton (Auden)

Certificate No: D2450V2-736_Jul07

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 736
Calibration procedure(s): QA CAL-05.v6
Calibration procedure for dipole validation kits
Calibration date: July 12, 2007
Condition of the calibrated item: In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).

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)

Table with 4 columns: Primary Standards, ID #, Cal Date (Calibrated by, Certificate No.), Scheduled Calibration. Includes items like Power meter EPM-442A, Power sensor HP 8481A, etc.

Calibrated by: Mike Mellli, Laboratory Technician
Approved by: Katja Pokovic, Technical Manager
Signature of Mike Mellli and Katja Pokovic.

Issued: July 12, 2007

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

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

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



Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.6 ± 6 %	1.81 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	13.3 mW / g
SAR normalized	normalized to 1W	53.2 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	52.7 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.17 mW / g
SAR normalized	normalized to 1W	24.7 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	24.5 mW / g ± 16.5 % (k=2)

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



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	53.5 ± 6 %	1.94 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	-----	-----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR normalized	normalized to 1W	52.0 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	52.5 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.05 mW / g
SAR normalized	normalized to 1W	24.2 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	24.4 mW / g ± 16.5 % (k=2)

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



Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω + 3.0 j Ω
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.7 Ω + 4.6 j Ω
Return Loss	- 26.3 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

DASY4 Validation Report for Head TSL

Date/Time: 12.07.2007 11:00:03

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: HSL U10 BB;

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.81$ mho/m; $\epsilon_r = 38.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025 (HF); ConvP(4.5, 4.5, 4.5); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

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

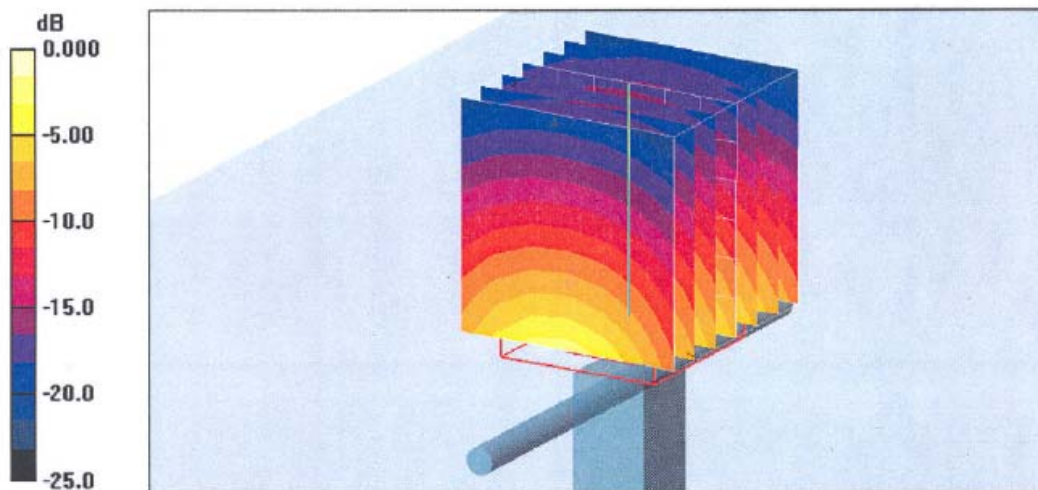
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.0 V/m; Power Drift = -0.004 dB

Peak SAR (extrapolated) = 28.1 W/kg

SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.17 mW/g

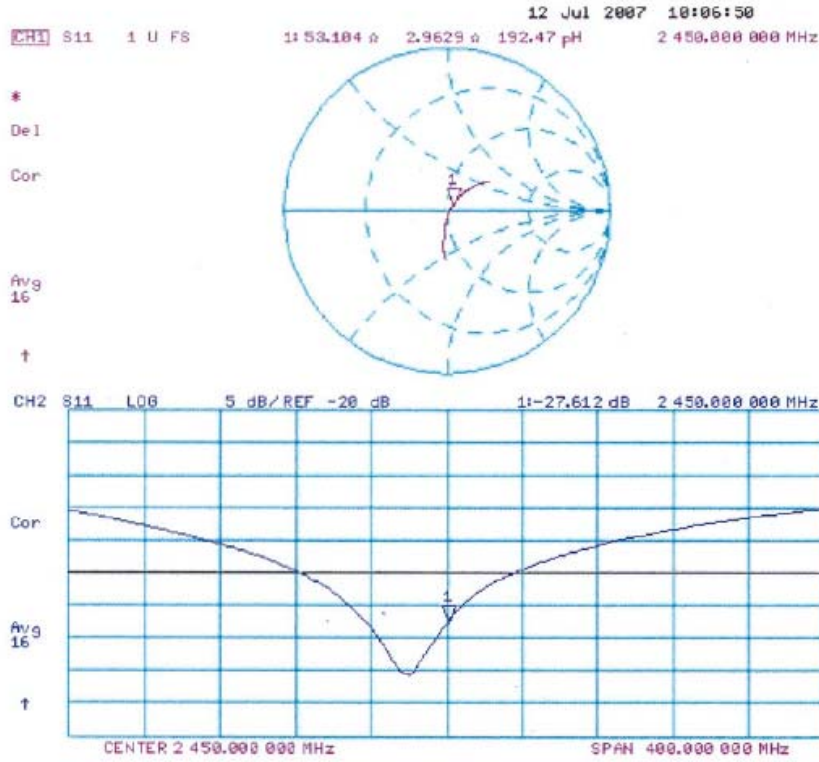
Maximum value of SAR (measured) = 15.0 mW/g



0 dB = 15.0mW/g



Impedance Measurement Plot for Head TSL



DASY4 Validation Report for Body TSL

Date/Time: 12.07.2007 12:28:49

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: MSL U10 BB;

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 53.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025 (HF); ConvF(4.16, 4.16, 4.16); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

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

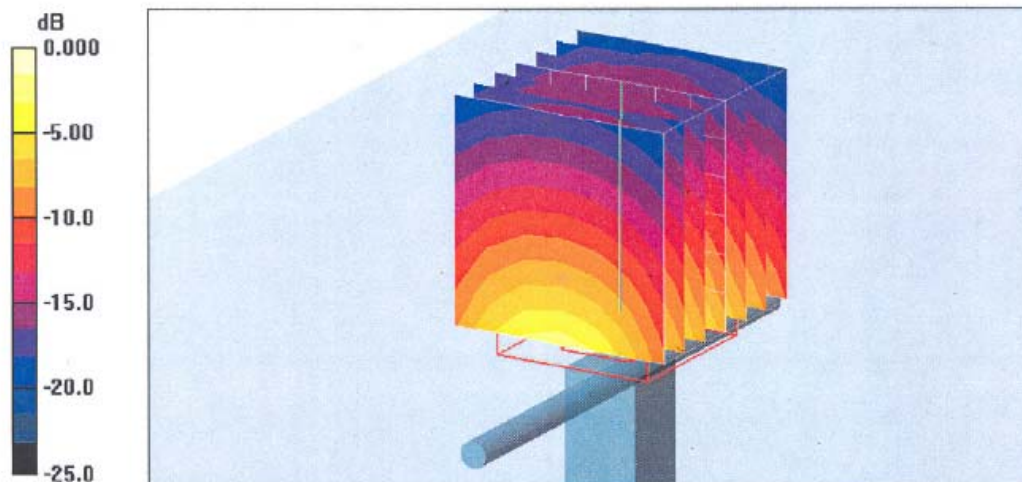
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.6 V/m; Power Drift = 0.005 dB

Peak SAR (extrapolated) = 27.0 W/kg

SAR(1 g) = 13 mW/g; SAR(10 g) = 6.05 mW/g

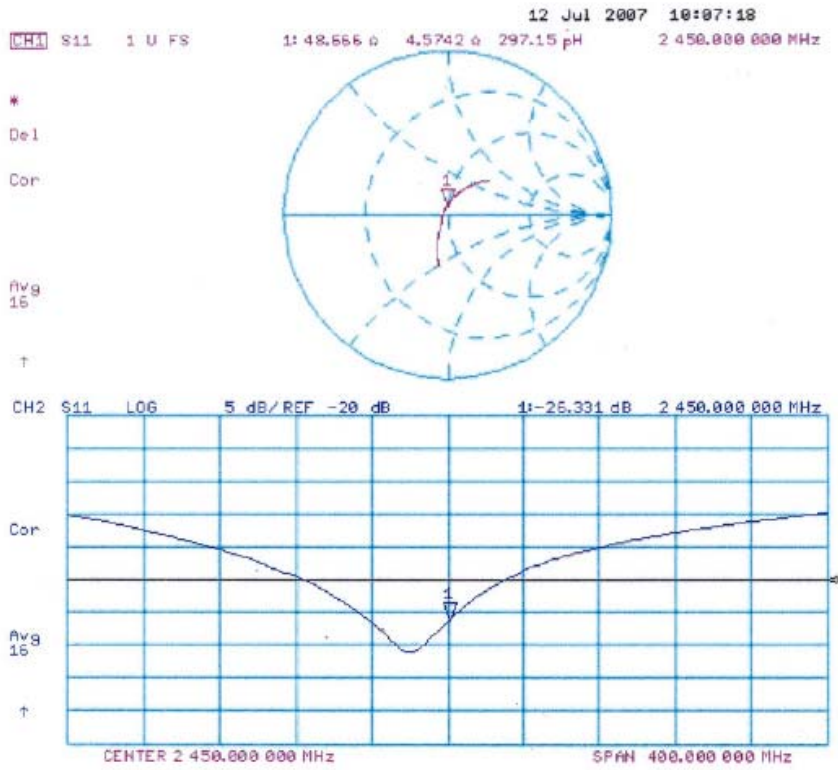
Maximum value of SAR (measured) = 14.8 mW/g



0 dB = 14.8mW/g



Impedance Measurement Plot for Body TSL





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



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Accreditation No.: SCS 108

Client Sporton (Auden)

Certificate No: D2600V2-1008_Sep07/2

CALIBRATION CERTIFICATE (Replacement of No: D2600V2-1008_Sep07)

Object: D2600V2 - SN: 1008
Calibration procedure(s): QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date: September 12, 2007
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)

Table with 4 columns: Primary Standards, ID #, Cal Date (Calibrated by, Certificate No.), Scheduled Calibration. Includes items like Power meter EPM-442A, Power sensor HP 8481A, Reference 20 dB Attenuator, etc.

Secondary Standards table with 4 columns: Secondary Standards, ID #, Check Date (in house), Scheduled Check. Includes items like Power sensor HP 8481A, RF generator R&S SMT-06, Network Analyzer HP 8753E.

Signature section with columns: Name, Function, Signature. Includes Mike Meili (Laboratory Technician) and Katja Pokovic (Technical Manager).

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

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



Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.6 ± 6 %	2.11 mho/m ± 6 %
Body TSL temperature during test	(20.7 ± 0.2) °C	-----	-----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	condition	
SAR measured	250 mW input power	14.1 mW / g
SAR normalized	normalized to 1W	56.4 mW / g
SAR for nominal Body TSL parameters ¹	normalized to 1W	57.6 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.30 mW / g
SAR normalized	normalized to 1W	25.2 mW / g
SAR for nominal Body TSL parameters ¹	normalized to 1W	25.5 mW / g ± 16.5 % (k=2)

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



Appendix

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2 Ω - 2.9 j Ω
Return Loss	- 26.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 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	December 23, 2006

DASY4 Validation Report for Body TSL

Date/Time: 12.09.2007 14:46:19

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN1008

Communication System: CW-2600; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB;

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.12$ mho/m; $\epsilon_r = 53.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025 (HF); ConvF(3.95, 3.95, 3.95); Calibrated: 19.10.2006
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin = 250 mW; d = 10 mm/Area Scan (31x41x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 19.6 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (dist=3mm) (7x7x7)/Cube 0:

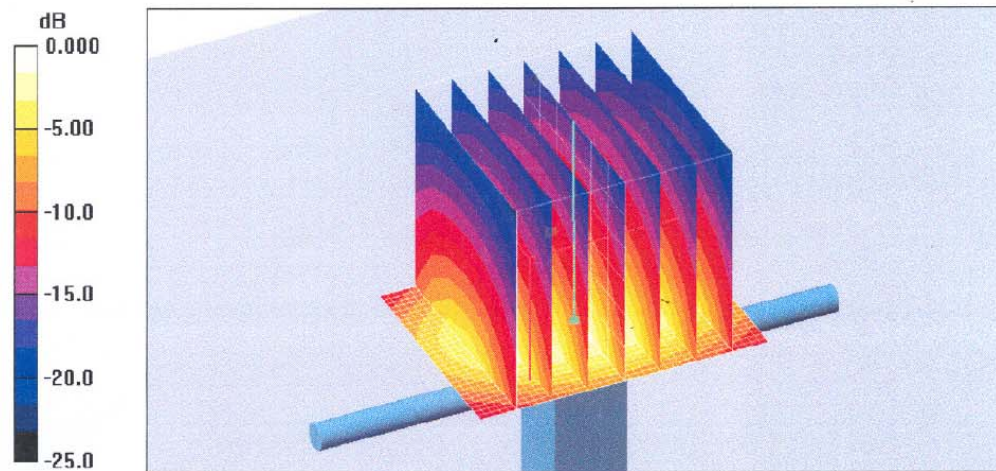
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.2 V/m; Power Drift = 0.013 dB

Peak SAR (extrapolated) = 31.0 W/kg

SAR(1 g) = 14.1 mW/g; SAR(10 g) = 6.3 mW/g

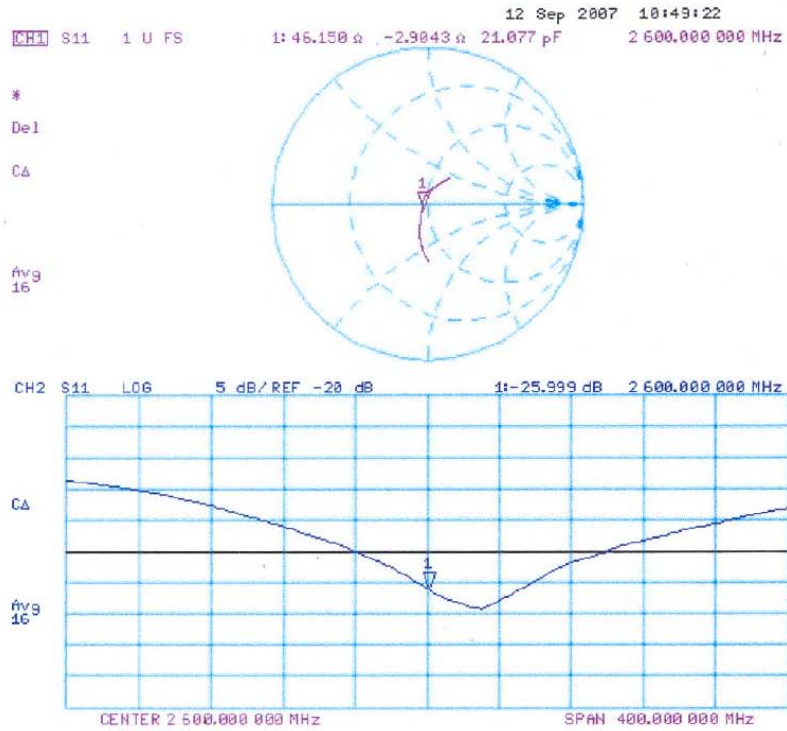
Maximum value of SAR (measured) = 18.8 mW/g



0 dB = 18.8mW/g



Impedance Measurement Plot for Body TSL





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Accreditation No.: SCS 108

Client Sporton (Auden)

Certificate No: D5GHzV2-1006_Jan08

CALIBRATION CERTIFICATE

Object D5GHzV2 - SN: 1006
Calibration procedure(s) QA CAL-22.v1
Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date: January 24, 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)

Table with 4 columns: Primary Standards, ID #, Cal Date (Calibrated by, Certificate No.), Scheduled Calibration. Lists equipment like Power meter EPM-442A, Power sensor HP 8481A, Reference 20 dB Attenuator, Reference Probe EX3DV4, DAE4.

Table with 4 columns: Secondary Standards, ID #, Check Date (in house), Scheduled Check. Lists equipment like RF generator R&S SMT-06, Network Analyzer HP 8753E, Power meter E4419B, Power sensor HP 8481A.

Calibrated by: Name Mike Mell, Function Laboratory Technician, Signature [Handwritten]

Approved by: Name Katja Pokovic, Function Technical Manager, Signature [Handwritten]

Issued: January 24, 2008

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

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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:

- IEC Std 62209 Part 2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", Draft Version 0.9, December 2004
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

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



Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 10 mm	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 2.5 mm	
Frequency	5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.0 ± 6 %	4.53 mho/m ± 6 %
Head TSL temperature during test	(21.2 ± 0.2) °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.24 mW / g
SAR normalized	normalized to 1W	82.4 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	82.4 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 mW / g
SAR normalized	normalized to 1W	23.1 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	23.0 mW / g ± 19.5 % (k=2)

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



Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	4.81 mho/m ± 6 %
Head TSL temperature during test	(21.1 ± 0.2) °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.63 mW / g
SAR normalized	normalized to 1W	86.3 mW / g
SAR for nominal Head TSL parameters ²	normalized to 1W	86.2 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 mW / g
SAR normalized	normalized to 1W	24.2 mW / g
SAR for nominal Head TSL parameters ²	normalized to 1W	24.1 mW / g ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	5.11 mho/m ± 6 %
Head TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.13 mW / g
SAR normalized	normalized to 1W	81.3 mW / g
SAR for nominal Head TSL parameters ²	normalized to 1W	80.8 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 mW / g
SAR normalized	normalized to 1W	22.7 mW / g
SAR for nominal Head TSL parameters ²	normalized to 1W	22.5 mW / g ± 19.5 % (k=2)

² Correction to nominal TSL parameters according to c), chapter "SAR Sensitivities"



Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3 ± 6 %	5.27 mho/m ± 6 %
Body TSL temperature during test	(20.7 ± 0.2) °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.77 mW / g
SAR normalized	normalized to 1W	77.7 mW / g
SAR for nominal Body TSL parameters ³	normalized to 1W	76.8 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.18 mW / g
SAR normalized	normalized to 1W	21.8 mW / g
SAR for nominal Body TSL parameters ³	normalized to 1W	21.6 mW / g ± 19.5 % (k=2)

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.6 ± 6 %	5.62 mho/m ± 6 %
Body TSL temperature during test	(20.7 ± 0.2) °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	8.12 mW / g
SAR normalized	normalized to 1W	81.2 mW / g
SAR for nominal Body TSL parameters ³	normalized to 1W	80.1 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.26 mW / g
SAR normalized	normalized to 1W	22.6 mW / g
SAR for nominal Body TSL parameters ³	normalized to 1W	22.3 mW / g ± 19.5 % (k=2)

³ Correction to nominal TSL parameters according to c), chapter "SAR Sensitivities"



Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.0 ± 6 %	6.04 mho/m ± 6 %
Body TSL temperature during test	(20.6 ± 0.2) °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.04 mW / g
SAR normalized	normalized to 1W	70.4 mW / g
SAR for nominal Body TSL parameters ⁴	normalized to 1W	69.4 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	1.95 mW / g
SAR normalized	normalized to 1W	19.5 mW / g
SAR for nominal Body TSL parameters ⁴	normalized to 1W	19.3 mW / g ± 19.5 % (k=2)

⁴ Correction to nominal TSL parameters according to c), chapter "SAR Sensitivities"



Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	52.7 Ω - 10.9 j Ω
Return Loss	-19.3 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	49.4 Ω - 2.6 j Ω
Return Loss	-31.2 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.0 Ω - 6.1 j Ω
Return Loss	-21.9 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	52.8 Ω - 9.1 j Ω
Return Loss	-20.7 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	49.3 Ω - 1.0 j Ω
Return Loss	-38.1 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	56.1 Ω + 7.7 j Ω
Return Loss	-20.7 dB



General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns
----------------------------------	----------

After long term use with 40 W 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 28, 2003



DASY4 Validation Report for Head TSL

Date/Time: 18.01.2008 17:52:55

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHz; Serial: D5GHzV2 - SN:1006

Communication System: CW-5GHz; Frequency: 5200 MHz, 5500 MHz, 5800 MHz; Duty Cycle: 1:1
Medium: HSL 5800 MHz;

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.53$ mho/m; $\epsilon_r = 36$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5500$ MHz; $\sigma = 4.81$ mho/m; $\epsilon_r = 35.5$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.14$ mho/m; $\epsilon_r = 34.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.56, 5.56, 5.56)ConvF(5.2, 5.2, 5.2)ConvF(4.97, 4.97, 4.97); Calibrated: 09.03.2007
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 03.01.2008
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

d=10mm, Pin=100mW, f=5200 MHz/Area Scan (91x91x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 17.6 mW/g

d=10mm, Pin=100mW, f=5200 MHz/Zoom Scan (8x8x10), dist=2mm (8x8x10)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 48.9 V/m; Power Drift = 0.055 dB

Peak SAR (extrapolated) = 31.1 W/kg

SAR(1 g) = 8.24 mW/g; SAR(10 g) = 2.31 mW/g

Maximum value of SAR (measured) = 16.1 mW/g

d=10mm, Pin=100mW, f=5500 MHz/Zoom Scan (8x8x10), dist=2mm 2 (8x8x10)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 48.1 V/m; Power Drift = 0.131 dB

Peak SAR (extrapolated) = 33.9 W/kg

SAR(1 g) = 8.63 mW/g; SAR(10 g) = 2.42 mW/g

Maximum value of SAR (measured) = 16.9 mW/g

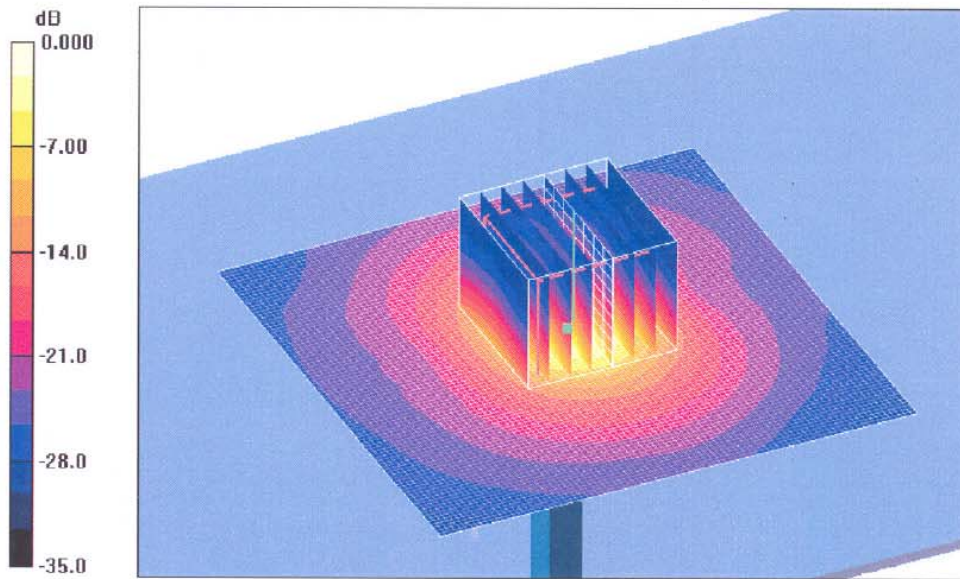
d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (8x8x10), dist=2mm (8x8x10)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 45.2 V/m; Power Drift = 0.091 dB

Peak SAR (extrapolated) = 33.6 W/kg

SAR(1 g) = 8.13 mW/g; SAR(10 g) = 2.27 mW/g



0 dB = 16.1mW/g