



**Specific Absorption Rate (SAR) Test Report**  
for  
**FIC (First International Computer, Inc.)**  
on the  
**Neo 1973**

Report No. : EA7D1802  
Trade Name : FIC  
Model Name : GTA02  
Date of Testing : Jan. 04, 2008  
Date of Report : Jan. 07, 2008  
Date of Review : Jan. 07, 2008

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- Report Version: Rev. 01

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**1. Statement of Compliance**

The Specific Absorption Rate (SAR) maximum results found during testing for the FIC (First International Computer, Inc.) Neo 1973 FIC GTA02 are as follows (with expanded uncertainty 20.5 %.) :

<b>Position</b>	<b>GSM (W/kg)</b>	<b>DCS (W/kg)</b>
<b>Head</b>	<b>1.06</b>	<b>0.902</b>

They are in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits specified in EN 50360 and Council Recommendation 1999/519/EC and had been tested in accordance with the measurement methods and procedures specified in EN 50361.

Approved by

Roy Wu  
Manager



## **2. Administration Data**

### **2.1 Testing Laboratory**

**Company Name :** Sporton International Inc.  
**Department :** Antenna Design/SAR  
**Address :** No.52, Hwa-Ya 1<sup>st</sup> RD., Hwa Ya Technology Park, Kwei-Shan Hsiang,  
TaoYuan Hsien, Taiwan, R.O.C.  
**Telephone Number :** 886-3-327-3456  
**Fax Number :** 886-3-328-4978

### **2.2 Detail of Applicant**

**Company Name :** FIC (First International Computer, Inc.)  
**Address :** 1-9F., No. 300, Yang Guang, NeiHu, Taipei, Taiwan, 114

### **2.3 Detail of Manufacturer**

**Company Name :** First International Computer (Suzhou) Inc.  
**Address :** No. 200, Central Suhong Road, SuZhou Industrial Park, China

### **2.4 Application Detail**

**Date of reception of application:** Dec. 18, 2007  
**Start of test :** Jan. 04, 2008  
**End of test :** Jan. 04, 2008

### 3 General Information

#### 3.1 Description of Device Under Test (DUT)

<b>DUT Type :</b>	Neo 1973
<b>Trade Name :</b>	FIC
<b>Model Name :</b>	GTA02
<b>Tx Frequency :</b>	EGSM : 880 ~ 915 MHz DCS : 1710 ~ 1785 MHz Bluetooth : 2400 ~ 2483.5 MHz WLAN : 2400 ~ 2483.5 MHz
<b>Rx Frequency :</b>	EGSM : 925 ~ 960 MHz DCS : 1805 ~ 1880 MHz Bluetooth : 2400 ~ 2483.5 MHz WLAN : 2400 ~ 2483.5 MHz GPS : 1575.42 MHz
<b>Number of Channels :</b>	Bluetooth : 79 Channels WLAN : 11 Channels
<b>Carrier Frequency of Each Channel :</b>	Bluetooth : 2402+n*1 MHz; n=0~78 WLAN : 2412+(n-1)*5 MHz; n=1~11
<b>Antenna Type :</b>	EGSM / DCS : Monopole Antenna Bluetooth / WLAN : Chip Antenna GPS : Ceramic Antenna
<b>Antenna Gain :</b>	EGSM / DCS : 0.07 dBi Bluetooth : -4.84 dBi WLAN : -3 dBi GPS: 0.5 dBi
<b>Power Rating :</b>	Battery : DC 3.7V Adapter : AC 100-240V
<b>HW Version :</b>	A5
<b>SW Version :</b>	Moko5
<b>Maximum Output Power to Antenna :</b>	EGSM : 31.88 dBm DCS : 28.68 dBm
<b>Type of Modulation :</b>	EGSM/DCS : GMSK Bluetooth : GFSK Bluetooth EDR : $\pi/4$ -DQPSK, 8-DPSK WLAN : DSSS, OFDM
<b>Type of Antenna Connector :</b>	N/A
<b>DUT Stage :</b>	Identical Prototype

**3.2 Basic Description of Equipment under Test**

<b>Equipment</b>		錯誤! 找不到參照來源。
<b>Trade Name</b>		錯誤! 找不到參照來源。
<b>Model Name</b>		錯誤! 找不到參照來源。
<b>AC Adapter</b>	<b>Manufacture</b>	AKII TECHNOLOGY CO., LTD.
	<b>Brand Name</b>	AKII Technology
	<b>Model Name</b>	A10P1-05MP
	<b>Power Rating</b>	I/P:100-240 Vac, 47-63 Hz, 0.3A; O/P: 5Vdc, 2.0A
	<b>AC Power Cord Type</b>	1.49 meter non-shielded cable without ferrite core
<b>Battery</b>	<b>Manufacture</b>	WELLDONE COMPANY
	<b>Brand Name</b>	FIC
	<b>Model Name</b>	GTC-01 / GTA-01
	<b>Rating</b>	3.7Vdc, 1200mAh
	<b>Type</b>	Li-ion
<b>Earphone</b>	<b>Brand Name</b>	Xport
	<b>Model Name</b>	Ko-11-1020a
	<b>Signal line Type</b>	1.42 meter non-shielded cable without ferrite core
<b>USB Cable</b>	<b>Brand Name</b>	Golden Bridge
	<b>Model Name</b>	AS52-0607007
	<b>Signal Line Type</b>	1.29 meter non-shielded cable without ferrite core

3.2 Product Photo





### **3.3 Applied Standards**

The Specific Absorption Rate (SAR) testing specification, method and procedure for this Neo 1973 is in accordance with the following standards:

CENELEC EN 50360

CENELEC EN 50361

Council Recommendation 1999/519/EC



**3.4 Device Category and SAR Limits**

Each of these devices 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 public exposure should be applied for this device, it is 2.0 W/kg as averaged over any 10 gram of tissue.

**3.5 Test Conditions**

***3.5.1 Ambient Condition***

Item	HSL_900	HSL_1800
Ambient Temperature (°C)	20-24°C	
Tissue simulating liquid temperature (°C)	21.5°C	21.6°C
Humidity (%)	<60%	

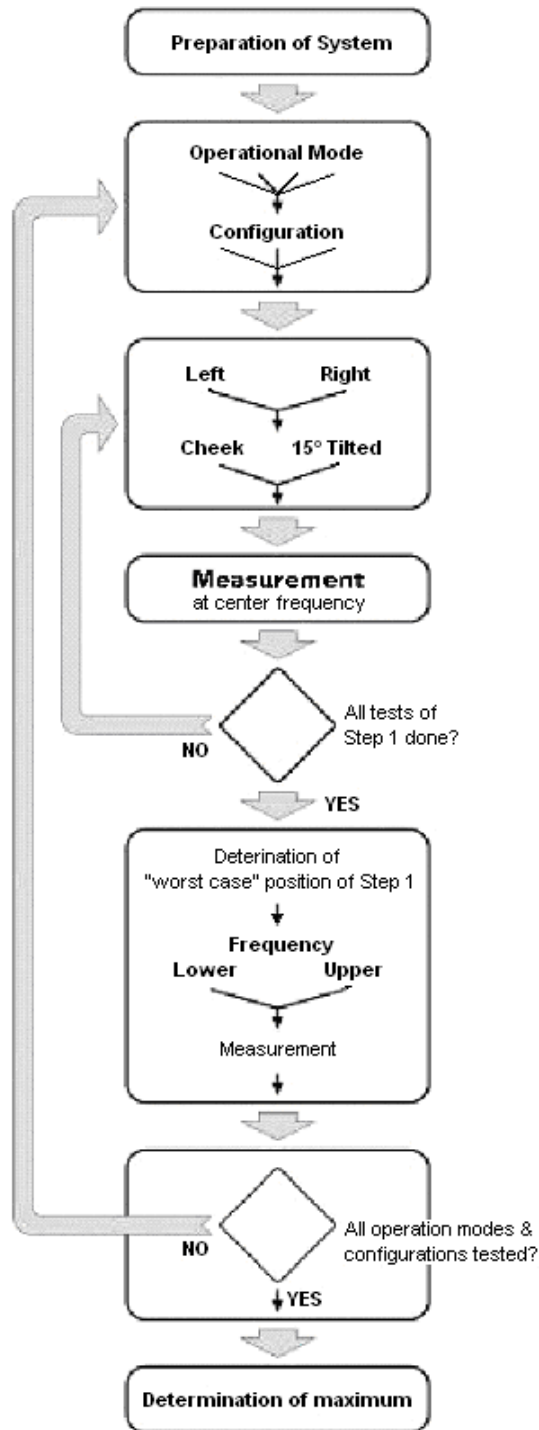
***3.5.2 Test Configuration***

The device was controlled by using a base station emulator CMU 200. Communication between the devices and the emulator was established by air link. The distance between the DUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of DUT.

For all the testing, measurements follow the EN50361 standard. The measurements were performed on the middle channel of both bands for each testing position. For the testing position with largest SAR result on each band, measurements of the lowest channel and highest channel were also performed. This testing method is illustrated in Fig. 3.5.

The DUT was set from the emulator to radiate maximum output power during all tests.

For head SAR testing, EUT is in GSM link mode and its crest factor is 8.3.



**Fig. 3.5 Testing Method**

## 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 general public group.

### 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 ( $\rho$ ). The equation description is as below:

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

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

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

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

, where C is the specific heat capacity,  $\delta T$  is the temperature rise and  $\delta t$  the exposure duration,

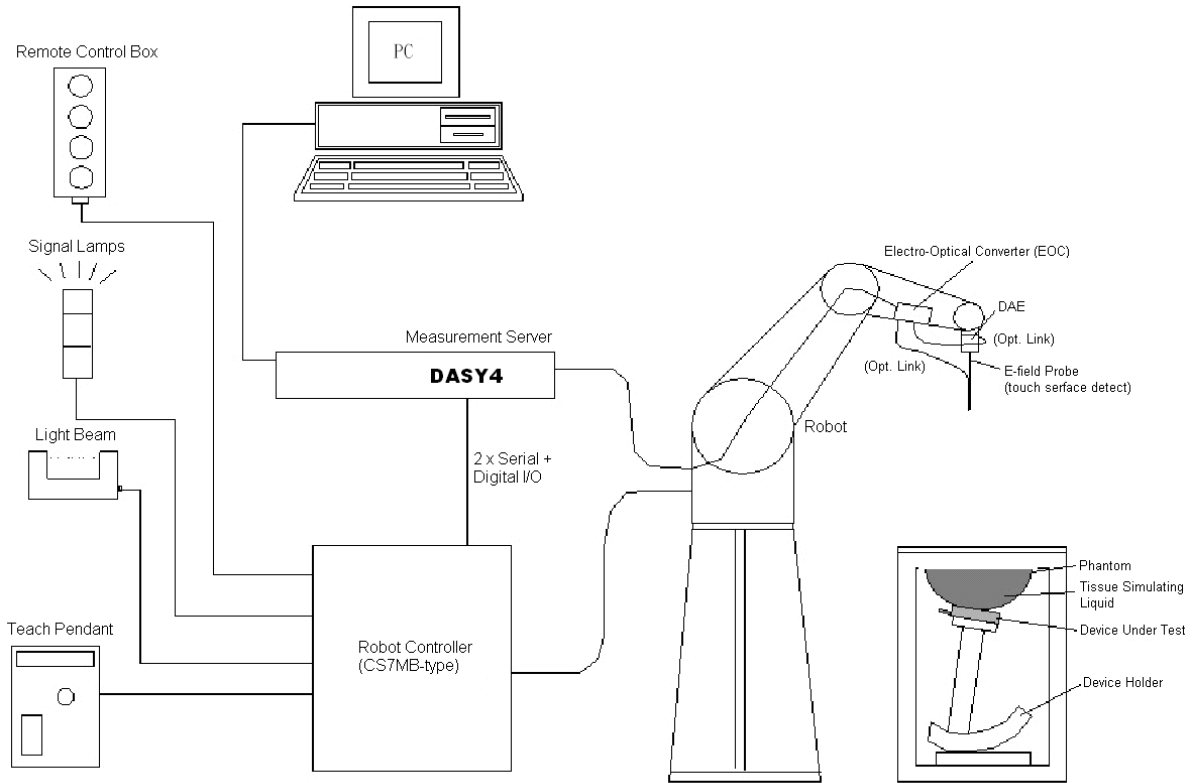
or related to the electrical field in the tissue by

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

, where  $\sigma$  is the conductivity of the tissue,  $\rho$  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 DASY4 system**

The DASY4 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 software
- Remove 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 DASY4 E-Field Probe System**

The SAR measurement is conducted with the dosimetric probe ET3DV6 (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 ET3DV6 E-Field Probe Specification**

<b>Construction</b>	<p>Symmetrical design with triangular core</p> <p>Built-in optical fiber for surface detection system</p> <p>Built-in shielding against static charges</p> <p>PEEK enclosure material (resistant to organic solvents)</p>
<b>Frequency</b>	10 MHz to > 3 GHz
<b>Directivity</b>	<p>± 0.2 dB in brain tissue (rotation around probe axis)</p> <p>± 0.4 dB in brain tissue (rotation perpendicular to probe axis)</p>
<b>Dynamic Range</b>	5 μW/g to > 100mW/g; Linearity: ±0.2dB
<b>Surface Detection</b>	± 0.2 mm repeatability in air and clear liquids on reflecting surface
<b>Dimensions</b>	<p>Overall length: 330mm</p> <p>Tip length: 16mm</p> <p>Body diameter: 12mm</p> <p>Tip diameter: 6.8mm</p> <p>Distance from probe tip to dipole centers: 2.7mm</p>
<b>Application</b>	<p>General dosimetry up to 3GHz</p> <p>Compliance tests for mobile phones and Wireless LAN</p> <p>Fast automatic scanning in arbitrary phantoms</p>



**Fig. 5.2 Probe Setup on Robot**

**5.1.2 ET3DV6 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 ± 0.25dB. 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 sn1787**

<b>Sensitivity</b>	X axis : 1.63 $\mu$ V	Y axis : 1.66 $\mu$ V	Z axis : 2.08 $\mu$ V	
<b>Diode compression point</b>	X axis : 92 mV	Y axis : 96 mV	Z axis : 91 mV	
<b>Conversion factor (Head / Body)</b>	<b>Frequency (MHz)</b>	<b>X axis</b>	<b>Y axis</b>	<b>Z axis</b>
	800~1000	6.58 / 6.10	6.58 / 6.10	6.58 / 6.10
	1710~1910	5.16 / 4.68	5.16 / 4.68	5.16 / 4.68
	1900~2100	4.80 / 4.30	4.80 / 4.30	4.80 / 4.30
<b>Boundary effect (Head / Body)</b>	<b>Frequency (MHz)</b>	<b>Alpha</b>	<b>Depth</b>	
	800~1000	0.32 / 0.36	2.42 / 2.52	
	1710~1910	0.50 / 0.61	2.61 / 2.56	
	1900~2100	0.55 / 0.60	2.45 / 2.40	

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

### 5.2 DATA Acquisition Electronics (DAE)

The data acquisition electronics (DAE4) 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 DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

### **5.3 Robot**

The DASY4 system uses the high precision robots RX90BL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASYS system, the CS7MB robot controller version from Stäubli is used. The RX 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 DASY4 measurement server is based on a PC/104 CPU board with  
166 MHz CPU  
32 MB chipset and  
64 MB RAM.

Communication with  
the DAE4 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.

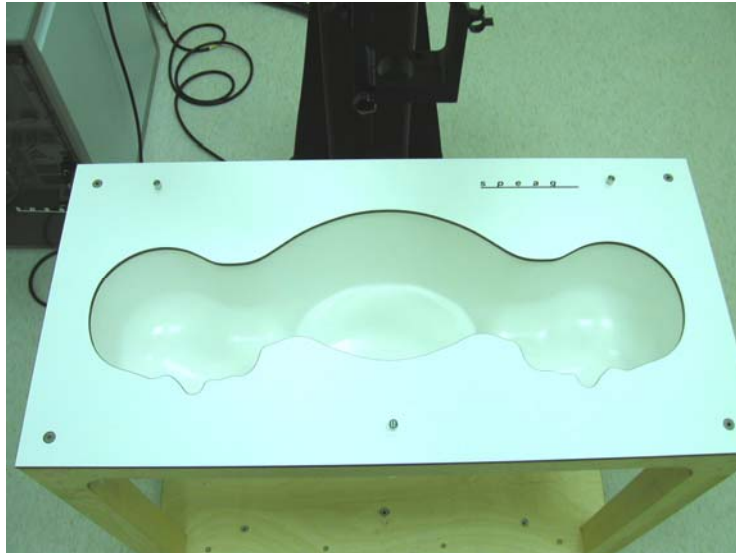
On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.



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

\*Water-sugar based liquid

\*Glycol based liquids



**Fig. 5.4 Top View of Twin Phantom**



**Fig. 5.5 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 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 centers for both scales is the ear reference point (EPR).

Thus the device needs no repositioning when changing the angles.

The DASY 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. 5.6 Device Holder**

## 5.7 Data Storage and Evaluation

### 5.7.1 Data Storage

The DASY4 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 .DA4. 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-loss 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 DASY4 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 :

<b>Probe parameters :</b>	- Sensitivity	$Norm_i, a_{i0}, a_{i1}, a_{i2}$
	- Conversion factor	$ConvF_i$
	- Diode compression point	$dcp_i$
<b>Device parameters :</b>	- Frequency	$f$
	- Crest factor	$cf$
<b>Media parameters :</b>	- Conductivity	$\sigma$
	- Density	$\rho$

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 :

$$\text{E-field probes : } E_i = \sqrt{\frac{V_i}{\text{Norm}_i \text{ConvF}}}$$

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

with  $V_i =$  compensated signal of channel  $i$  ( $i = x, y, z$ )  
 $\text{Norm}_i =$  sensor sensitivity of channel  $i$  ( $i = x, y, z$ )  
 $\mu \text{ V}/(\text{V/m})^2$  for E-field Probes  
 $\text{ConvF} =$  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.

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

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

\* 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<sup>2</sup>  
 $E_{tot}$  = total electric field strength in V/m  
 $H_{tot}$  = total magnetic field strength in A/m

**5.8 Test Equipment List**

Manufacture	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Dosimetric E-Filed Probe	ET3DV6	1787	Aug. 28, 2007	Aug. 28, 2008
SPEAG	900MHz System Validation Kit	D900V2	190	Jul. 16, 2007	Jul. 16, 2009
SPEAG	1800MHz System Validation Kit	D1800V2	2d076	Jul. 10, 2007	Jul. 10, 2009
SPEAG	Data Acquisition Electronics	DAE4	778	Sep. 17, 2007	Sep. 17, 2008
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	Phantom	QD 000 P40 C	TP-1150	NCR	NCR
SPEAG	Robot	Staubli RX90BL	F03/5W15A1/A/01	NCR	NCR
SPEAG	Software	DASY4 V4.7 Build 55	N/A	NCR	NCR
SPEAG	Software	SEMCAD V1.8 Build 176	N/A	NCR	NCR
SPEAG	Measurement Server	SE UMS 001 BA	1021	NCR	NCR
Agilent	ENA Series Network Analyzer	E5071C	MY46100746	Feb. 21, 2007	Feb. 21, 2008
Agilent	Wireless Communication Test Set	E5515C	GB46311322	Dec. 22, 2006	Dec. 22, 2008
Agilent	Dielectric Probe Kit	85070D	US01440205	NCR	NCR
Agilent	Dual Directional Coupler	778D	50422	NCR	NCR
Agilent	Power Amplifier	8449B	3008A01917	NCR	NCR
Agilent	Power Meter	E4416A	GB41292344	Feb. 08, 2007	Feb. 08, 2008
Agilent	Power Sensor	E9327A	US40441548	Feb. 08, 2007	Feb. 08, 2008
Agilent	Signal Generator	E8247C	MY43320596	Mar. 01, 2006	Mar. 01, 2008

**Table 5.1 Test Equipment List**

## 6 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY4, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. The liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm.

The following ingredients for tissue simulating liquid are used:

- **Water:** deionized water (pure H<sub>2</sub>O), resistivity  $\geq 16M\Omega$  - 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 6.1 gives the recipes for one liter of head tissue simulating liquid for frequency bands 900 MHz, 1800 MHz.

Ingredient	HSL-900	HSL-1800
<b>Water</b>	532.98 g	552.42 g
<b>Cellulose</b>	3.2 g	0 g
<b>Salt</b>	18.3 g	3.06 g
<b>Preventol D-7</b>	2.4 g	0 g
<b>Sugar</b>	766.0 g	0 g
<b>DGMBE</b>	0 g	444.52 g
<b>Total amount</b>	1 liter (1.3 kg)	1 liter (1.0 kg)
<b>Dielectric Parameters target at 22°</b>	f=900 MHz $\epsilon_r = 42.0 \pm 5\%$ , $\sigma = 0.99 \pm 5\%$ S/m	f = 1800MHz $\epsilon_r = 40.0 \pm 5\%$ , $\sigma = 1.38 \pm 5\%$ S/m

**Table 6.1 Recipes for 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 6.2 shows the measuring results for head simulating liquid.

Bands	Frequency(MHz)	Permittivity ( $\epsilon_r$ )	Conductivity ( $\sigma$ )	Measurement date
EGSM band (880 ~ 960 MHz)	880.2	40.7	0.961	Jan. 04, 2008
	897.6	40.6	0.974	
	914.8	40.4	0.988	
DCS band (1710 ~ 1880 MHz)	1710.2	39.6	1.36	Jan. 04, 2008
	1747.6	39.4	1.39	
	1784.8	39.3	1.43	

**Table 6.2 Measuring Results for Simulating Liquid**

The measuring data are consistent with  $\epsilon_r = 42.0 \pm 5\%$  and  $\sigma = 0.99 \pm 5\%$  for head EGSM band,  $\epsilon_r = 40.0 \pm 5\%$  and  $\sigma = 1.38 \pm 5\%$  for head DCS band.



## 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
<b>Multiplying factor<sup>(a)</sup></b>	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)  $k$  is the coverage factor

**Table 7.1 Multiplying Factors for Various Distributions**

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 DASY4 uncertainty Budget is showed in Table 7.2.



Error Description	Uncertainty Value $\pm$ %	Probability Distribution	Divisor	Ci 10g	Standard Unc. (10g)	vi or Veff
<b>Measurement Equipment</b>						
Probe Calibration	$\pm 5.9$ %	Normal	1	1	$\pm 5.9$ %	$\infty$
Axial Isotropy	$\pm 4.7$ %	Rectangular	$\sqrt{3}$	0.7	$\pm 1.9$ %	$\infty$
Spherical Isotropy	$\pm 9.6$ %	Rectangular	$\sqrt{3}$	0.7	$\pm 3.9$ %	$\infty$
Probe Linearity	$\pm 4.7$ %	Rectangular	$\sqrt{3}$	1	$\pm 2.7$ %	$\infty$
Detection Limit	$\pm 1.0$ %	Rectangular	$\sqrt{3}$	1	$\pm 0.6$ %	$\infty$
Boundary Effects	$\pm 1.0$ %	Rectangular	$\sqrt{3}$	1	$\pm 0.6$ %	$\infty$
Readout Electronics	$\pm 0.3$ %	Normal	1	1	$\pm 0.3$ %	$\infty$
Response Time	$\pm 0.8$ %	Normal	1	1	$\pm 0.8$ %	$\infty$
Noise	$\pm 0$ %	Normal	1	1	$\pm 0$ %	$\infty$
Integration Time	$\pm 2.6$ %	Normal	1	1	$\pm 2.6$ %	$\infty$
<b>Mechanical Constraints</b>						
Scanning System	$\pm 0.4$ %	Rectangular	$\sqrt{3}$	1	$\pm 0.2$ %	$\infty$
Phantom Shell	$\pm 4.0$ %	Rectangular	$\sqrt{3}$	1	$\pm 2.3$ %	$\infty$
Probe Positioning	$\pm 2.9$ %	Rectangular	$\sqrt{3}$	1	$\pm 1.7$ %	$\infty$
Device Positioning	$\pm 2.9$ %	Normal	1	1	$\pm 2.9$ %	145
<b>Physical Parameters</b>						
Liquid Conductivity (target)	$\pm 5.0$ %	Rectangular	$\sqrt{3}$	0.5	$\pm 1.4$ %	$\infty$
Liquid Conductivity (meas.)	$\pm 4.3$ %	Rectangular	$\sqrt{3}$	0.5	$\pm 1.2$ %	$\infty$
Liquid Permittivity (target)	$\pm 5.0$ %	Rectangular	$\sqrt{3}$	0.5	$\pm 1.4$ %	$\infty$
Liquid Permittivity (meas.)	$\pm 4.3$ %	Rectangular	$\sqrt{3}$	0.5	$\pm 1.2$ %	$\infty$
Power Drift	$\pm 5.0$ %	Rectangular	$\sqrt{3}$	1	$\pm 2.9$ %	$\infty$
RF Ambient Conditions	$\pm 3.0$ %	Rectangular	$\sqrt{3}$	1	$\pm 1.7$ %	$\infty$
<b>Post-Processing</b>						
Extrap. and Integration	$\pm 1.0$ %	Rectangular	$\sqrt{3}$	1	$\pm 0.6$ %	$\infty$
<b>Combined standard uncertainty</b>					<b><math>\pm 10.2</math> %</b>	<b>22516</b>
<b>Coverage Factor for 95 %</b>		<b><math>K=2</math></b>				
<b>Expanded uncertainty (Coverage factor = 2)</b>					<b><math>\pm 20.5</math> %</b>	

Table 7.2 Uncertainty Budget of DASY4

## 8 SAR Measurement Evaluation

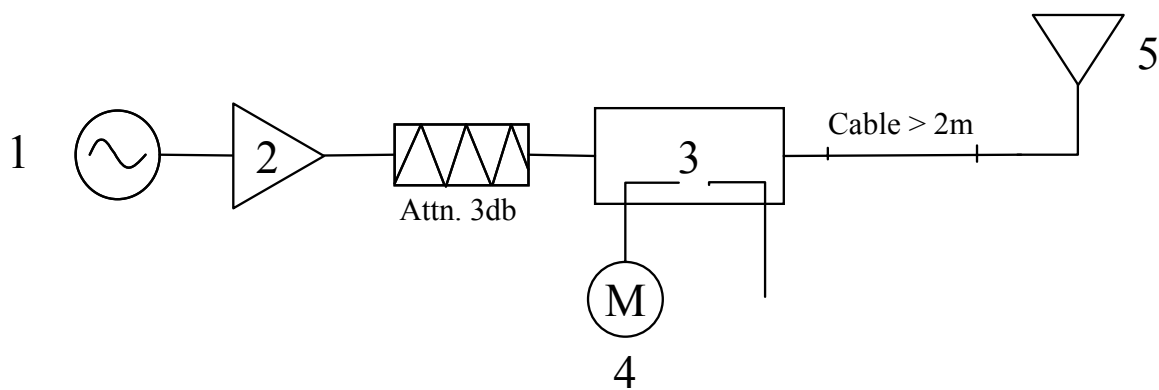
Each DASY4 system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY4 software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix 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 at frequency 900 and 1800 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 Evaluation Setup**

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. 900 MHz or 1800 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.

Band	SAR	Target (W/kg)	Measurement data (W/kg)	Variation	Measurement date
EGSM (900 MHz)	SAR (1g)	10.3	9.45	-8.3 %	Jan. 04, 2008
	SAR (10g)	6.6	6.1	-7.6 %	
DCS (1800 MHz)	SAR (1g)	37.2	37.7	1.3 %	Jan. 04, 2008
	SAR (10g)	20.0	19.8	-1.0 %	

**Table 8.1 Target and Measurement Data Comparison**

The table above indicates the system performance check can meet the variation criterion.

## **9 Description for DUT Testing Position**

This DUT was tested in 4 different positions. They are left cheek, left tilted, right cheek and right tilted as illustrated below:

### 1) “Cheek Position”

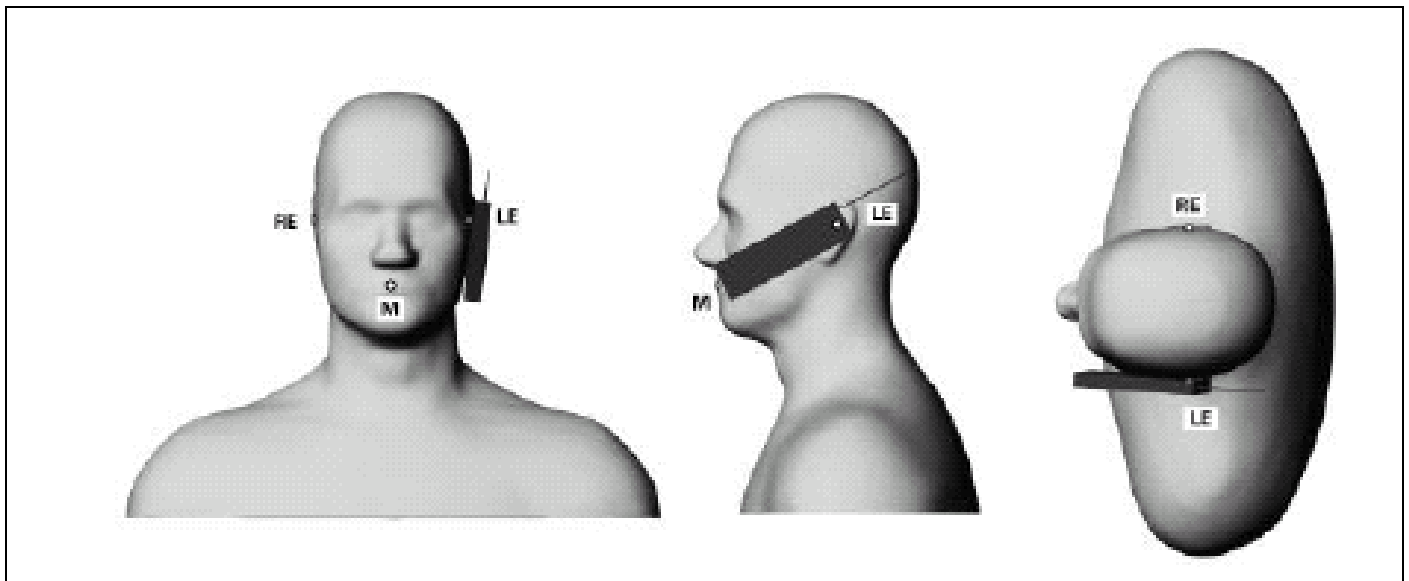
i) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M, RE and LE) and align the center of the ear piece with the line RE-LE.

ii) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see Fig. 9.1).

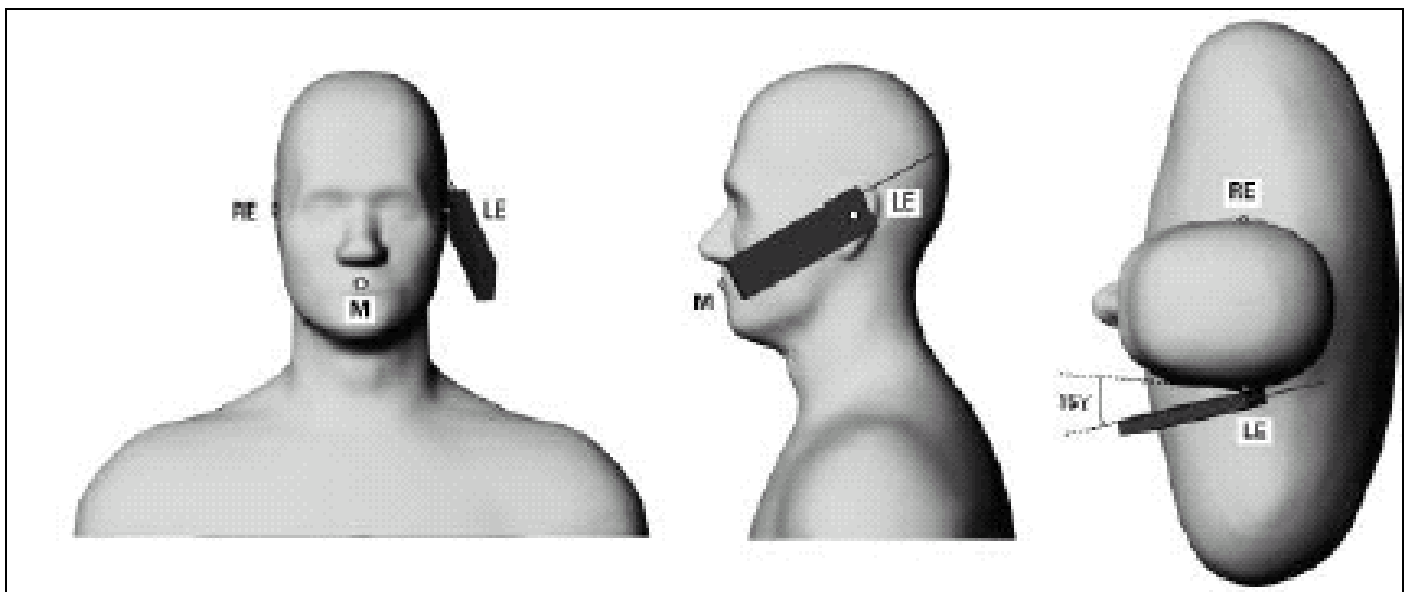
### 2) “Tilted Position”

i) To position the device in the “cheek” position described above

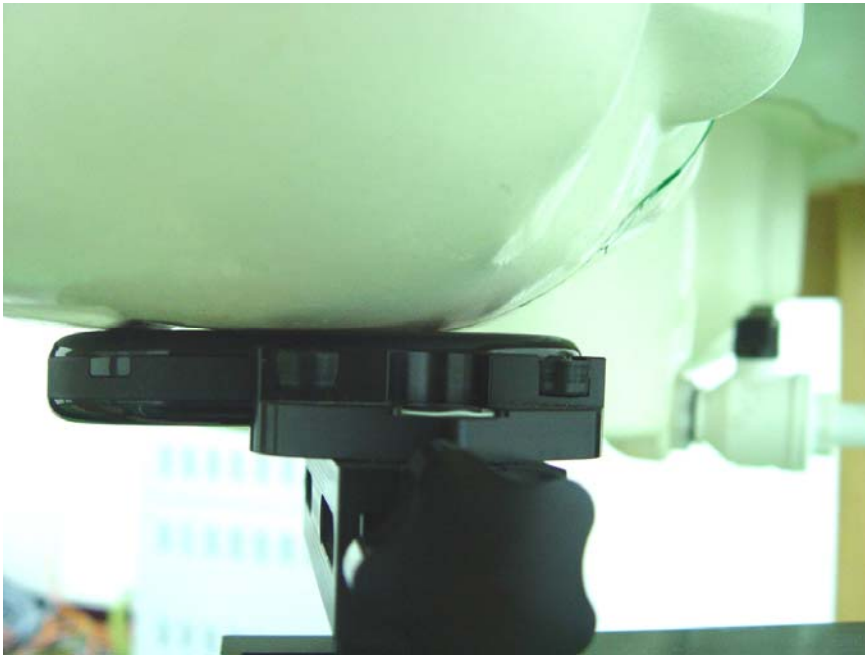
ii) While maintaining the device the reference planes described above and pivoting against the ear, move it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see Fig. 9.2).



**Fig. 9.1 Phone Position 1, “Cheek” or “Touch” Position.** The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the plane for phone positioning, are indicated.



**Fig. 9.2 Phone Position 2, “Tilted Position”.** The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the plane for phone positioning, are indicated.

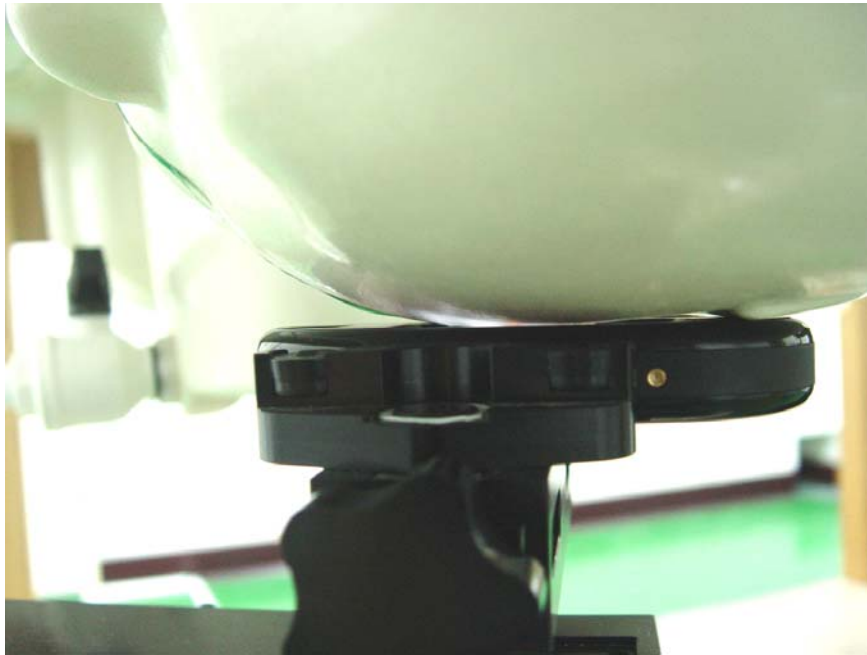


**Fig. 9.3 Right Cheek**

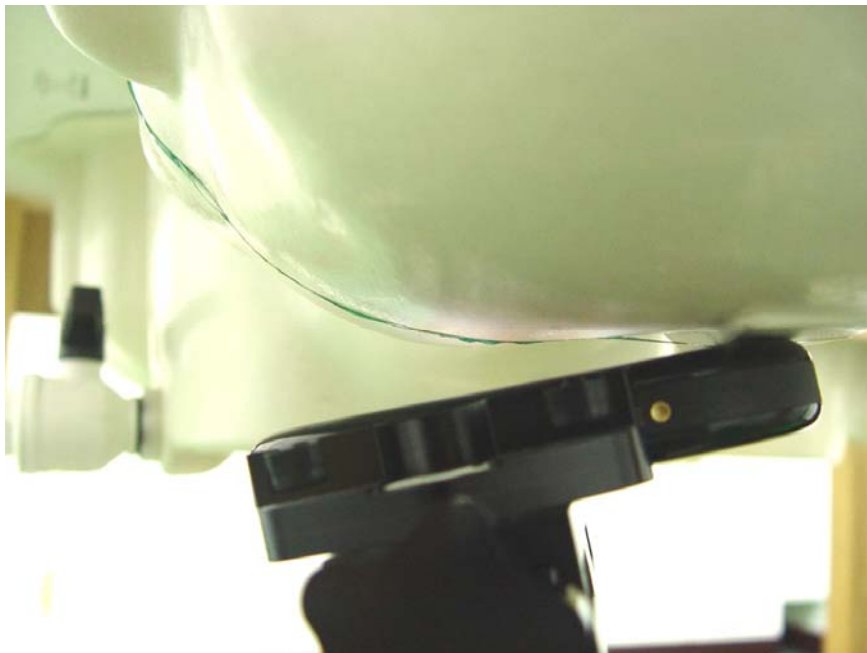


**Fig. 9.4 Right Tilted**





**Fig. 9.5 Left Cheek**



**Fig. 9.6 Left Tilted**

## **10 Measurement Procedures**

The measurement procedures are as follows:

- Linking DUT with base station simulator CMU200 in middle channel
- Setting CMU200 to allow DUT to radiate maximum output power
- Measuring output power through RF cable and power meter
- 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 middle channel on each testing position
- Finding out the largest SAR result on these testing positions of each band
- Measuring output power and SAR results for the low and high channels in this worst case testing position

According to the EN50361 draft standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- Power reference measurement
- Verification of the 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 IEEE P1528-2003 standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY4 software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

Base on the Draft: SCC-34, SC-2, WG-2-Computational Dosimetry, IEEE P1528/D1.2 (Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head From Wireless Communications Devices: Measurement Techniques), a new algorithm has been implemented. The spatial-peak SAR can be computed over any required mass.

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 10 g.

### **10.3 SAR Averaged Methods**

In DASy4, 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 Right Cheek

Bands	Chan.	Freq. (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 10g SAR (W/kg)	Limits (W/Kg)	Results
EGSM	975 (Low)	880.2	GMSK	31.88	-0.176	1.06	2.0	Pass
	38 (Mid)	897.6	GMSK	31.83	-0.139	0.992	2.0	Pass
	124 (High)	914.8	GMSK	31.63	-0.181	0.781	2.0	Pass
DCS	512 (Low)	1710.2	GMSK	28.37	-0.073	0.902	2.0	Pass
	699 (Mid)	1747.6	GMSK	28.61	-0.183	0.869	2.0	Pass
	885 (High)	1784.8	GMSK	28.68	0.021	0.638	2.0	Pass

### 11.2 Right Tilted

Bands	Chan.	Freq. (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 10g SAR (W/kg)	Limits (W/Kg)	Results
EGSM	975 (Low)	880.2	GMSK	31.88	-	-	-	-
	38 (Mid)	897.6	GMSK	31.83	-0.122	0.57	2.0	Pass
	124 (High)	914.8	GMSK	31.63	-	-	-	-
DCS	512 (Low)	1710.2	GMSK	28.37	-	-	-	-
	699 (Mid)	1747.6	GMSK	28.61	-0.015	0.275	2.0	Pass
	885 (High)	1784.8	GMSK	28.68	-	-	-	-

### 11.3 Left Cheek

Bands	Chan.	Freq. (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 10g SAR (W/kg)	Limits (W/Kg)	Results
EGSM	975 (Low)	880.2	GMSK	31.88	-	-	-	-
	38 (Mid)	897.6	GMSK	31.83	-0.121	0.91	2.0	Pass
	124 (High)	914.8	GMSK	31.63	-	-	-	-
DCS	512 (Low)	1710.2	GMSK	28.37	-	-	-	-
	699 (Mid)	1747.6	GMSK	28.61	-0.043	0.566	2.0	Pass
	885 (High)	1784.8	GMSK	28.68	-	-	-	-

### 11.4 Left Tilted

Bands	Chan.	Freq. (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 10g SAR (W/kg)	Limits (W/Kg)	Results
EGSM	975 (Low)	880.2	GMSK	31.88	-	-	-	-
	38 (Mid)	897.6	GMSK	31.83	-0.098	0.458	2.0	Pass
	124 (High)	914.8	GMSK	31.63	-	-	-	-
DCS	512 (Low)	1710.2	GMSK	28.37	-	-	-	-
	699 (Mid)	1747.6	GMSK	28.61	-0.035	0.224	2.0	Pass
	885 (High)	1784.8	GMSK	28.68	-	-	-	-

 Test Engineer : Jason Wang and Gordon Lin

## **12 References**

- [1] CENELEC EN 50360, "Product Standard to Demonstrate the Compliance of Mobile Phones with the Basic Restrictions Related to Human Exposure to Electromagnetic Fields (300 MHz-3GHz)", 2001
- [2] CENELEC EN 50361, "Basic Standard for the Measurement of Specific Absorption Rate Related to Human Exposure to Electromagnetic Fields from Mobile Phone", July 2001
- [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. 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
- [5] 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
- [6] Council Recommendation 1999/519/EC of July 1999 on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300 GHz)
- [7] 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
- [8] DAYS4 System Handbook

## Appendix A - System Performance Check Data

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

Date: 2008/1/4

### System Check\_Head\_900MHz

#### DUT: Dipole 900 MHz

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: HSL\_900 Medium parameters used:  $f = 900 \text{ MHz}$ ;  $\sigma = 0.976 \text{ mho/m}$ ;  $\epsilon_r = 40.6$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 22.8 °C ; Liquid Temperature : 21.5 °C

#### DASY4 Configuration:

- Probe: ET3DV6 - SN1787; ConvF(6.58, 6.58, 6.58); Calibrated: 2007/8/28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection) Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn778; Calibrated: 2007/9/17

- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Pin=100mW/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.01 mW/g

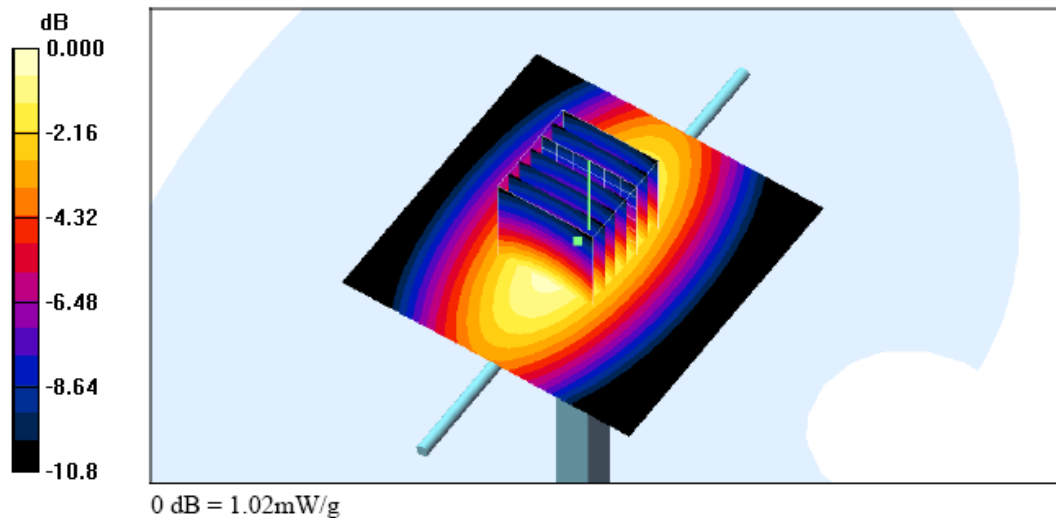
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 33.4 V/m; Power Drift = -0.010 dB

Peak SAR (extrapolated) = 1.42 W/kg

**SAR(1 g) = 0.945 mW/g; SAR(10 g) = 0.610 mW/g**

Maximum value of SAR (measured) = 1.02 mW/g



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

Date: 2008/1/4

**System Check\_Head\_1800MHz**

**DUT: Dipole 1800 MHz**

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: HSL\_1800 Medium parameters used:  $f = 1800 \text{ MHz}$ ;  $\sigma = 1.44 \text{ mho/m}$ ;  $\epsilon_r = 39.3$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 22.6 °C; Liquid Temperature : 21.6 °C

**DASY4 Configuration:**

- Probe: ET3DV6 - SN1787; ConvF(5.16, 5.16, 5.16); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection) Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2007/9/17
- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Pin=100mW/Area Scan (91x91x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 4.24 mW/g

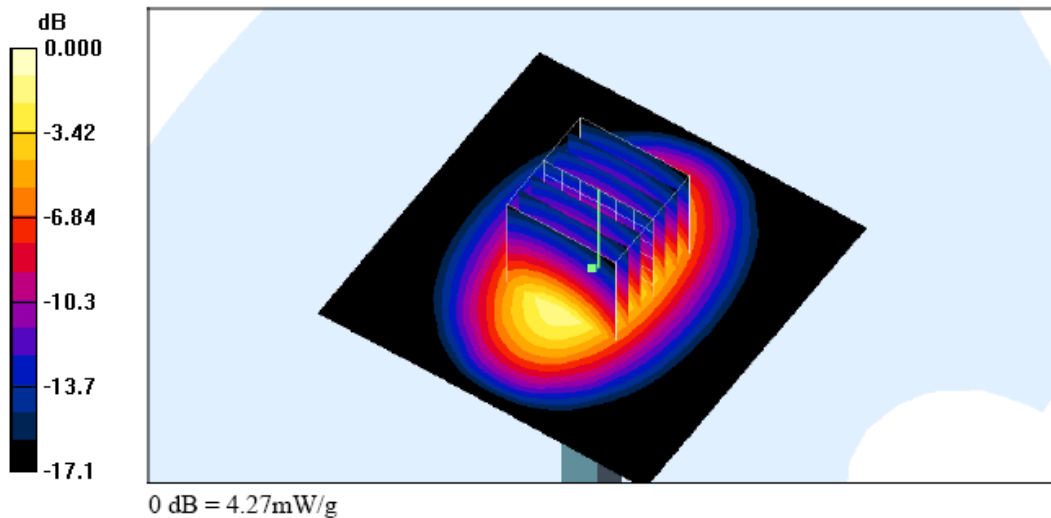
**Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.3 V/m; Power Drift = -0.044 dB

Peak SAR (extrapolated) = 6.57 W/kg

**SAR(1 g) = 3.77 mW/g; SAR(10 g) = 1.98 mW/g**

Maximum value of SAR (measured) = 4.27 mW/g





## Appendix B - SAR Measurement Data

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

Date: 2008/1/4

### Right Cheek\_GSM900 Ch975

DUT: 7D1802

Communication System: EGSM; Frequency: 880.2 MHz; Duty Cycle: 1:8.3

Medium: HSL\_900 Medium parameters used :  $f = 880.2$  MHz;  $\sigma = 0.961$  mho/m;  $\epsilon_r = 40.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 22.8 °C; Liquid Temperature : 21.5 °C

DASY4 Configuration:

- Probe: ET3DV6 - SN1787; ConvF(6.58, 6.58, 6.58); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2007/9/17
- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Ch975/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.64 mW/g

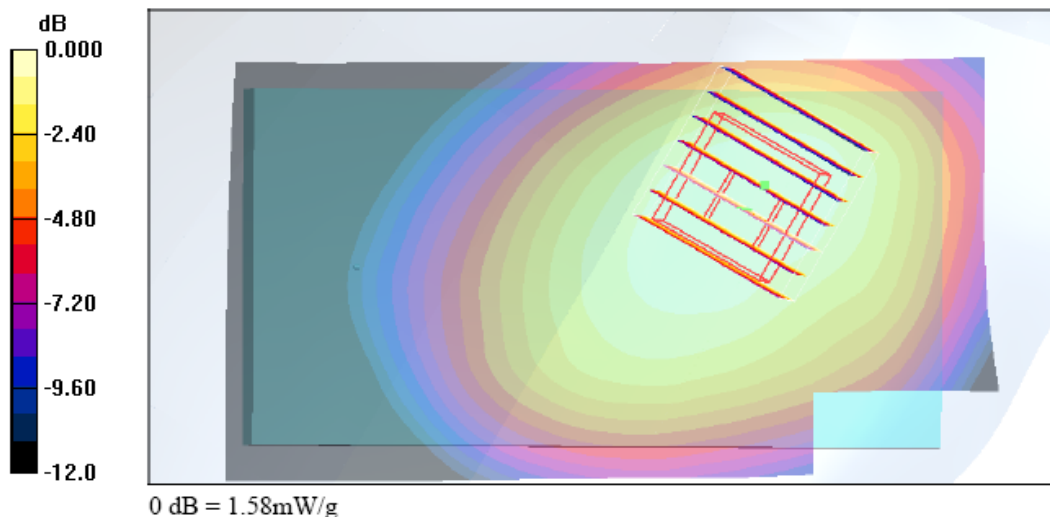
Ch975/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.8 V/m; Power Drift = -0.176 dB

Peak SAR (extrapolated) = 2.20 W/kg

SAR(1 g) = 1.48 mW/g; SAR(10 g) = 1.06 mW/g

Maximum value of SAR (measured) = 1.58 mW/g







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

Date: 2008/1/4

### Right Tilted\_GSM900 Ch38

DUT: 7D1802

Communication System: EGSM; Frequency: 897.6 MHz; Duty Cycle: 1:8.3

Medium: HSL\_900 Medium parameters used:  $f = 898$  MHz;  $\sigma = 0.974$  mho/m;  $\epsilon_r = 40.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 22.9 °C; Liquid Temperature : 21.5 °C

#### DASY4 Configuration:

- Probe: ET3DV6 - SN1787; ConvF(6.58, 6.58, 6.58); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2007/9/17
- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch38/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.821 mW/g

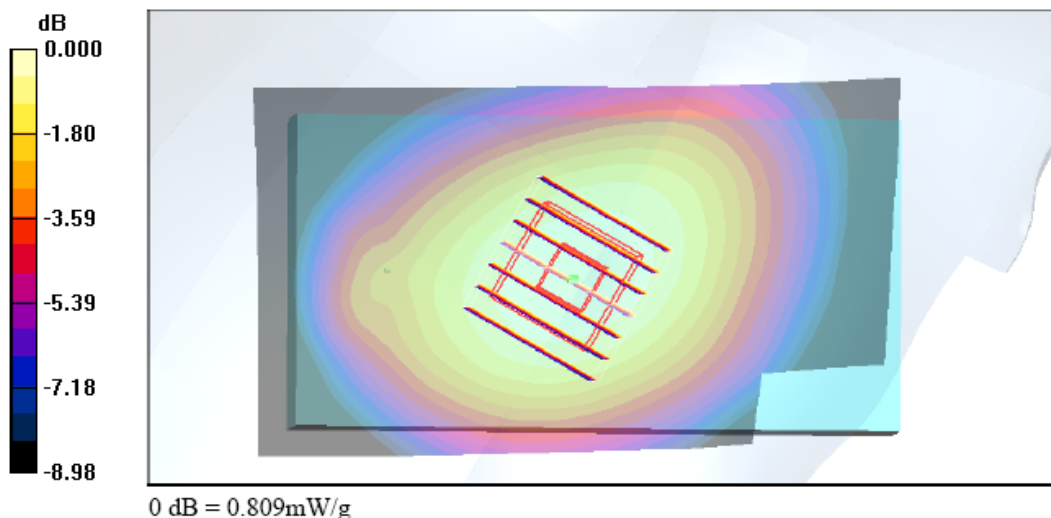
**Ch38/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 20.8 V/m; Power Drift = -0.122 dB

Peak SAR (extrapolated) = 0.949 W/kg

SAR(1 g) = 0.766 mW/g; SAR(10 g) = 0.570 mW/g

Maximum value of SAR (measured) = 0.809 mW/g



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

Date: 2008/1/4

**Left Cheek\_GSM900 Ch38**

**DUT: 7D1802**

Communication System: EGSM; Frequency: 897.6 MHz; Duty Cycle: 1:8.3

Medium: HSL\_900 Medium parameters used:  $f = 898 \text{ MHz}$ ;  $\sigma = 0.974 \text{ mho/m}$ ;  $\epsilon_r = 40.6$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature :  $22.8 \text{ }^\circ\text{C}$ ; Liquid Temperature :  $21.5 \text{ }^\circ\text{C}$

**DASY4 Configuration:**

- Probe: ET3DV6 - SN1787; ConvF(6.58, 6.58, 6.58); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2007/9/17
- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch38/Area Scan (51x91x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $1.29 \text{ mW/g}$

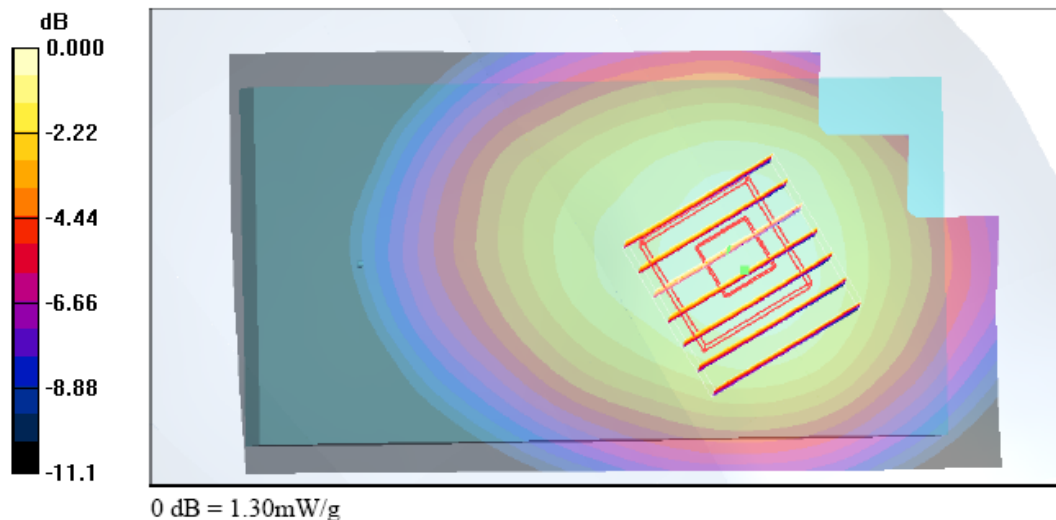
**Ch38/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $14.0 \text{ V/m}$ ; Power Drift =  $-0.121 \text{ dB}$

Peak SAR (extrapolated) =  $1.51 \text{ W/kg}$

**SAR(1 g) =  $1.22 \text{ mW/g}$ ; SAR(10 g) =  $0.910 \text{ mW/g}$**

Maximum value of SAR (measured) =  $1.30 \text{ mW/g}$



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

Date: 2008/1/4

**Left Tilted\_GSM900 Ch38**

**DUT: 7D1802**

Communication System: EGSM; Frequency: 897.6 MHz; Duty Cycle: 1:8.3

Medium: HSL\_900 Medium parameters used:  $f = 898 \text{ MHz}$ ;  $\sigma = 0.974 \text{ mho/m}$ ;  $\epsilon_r = 40.6$ ;  $\rho = 1000 \text{ kg/m}^3$

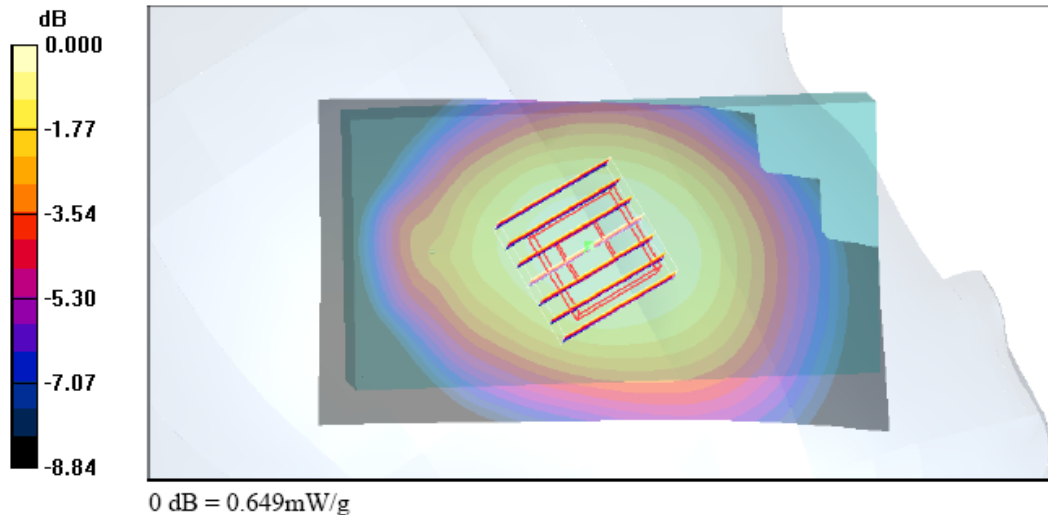
Ambient Temperature : 22.8 °C; Liquid Temperature : 21.5 °C

DASY4 Configuration:

- Probe: ET3DV6 - SN1787; ConvF(6.58, 6.58, 6.58); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2007/9/17
- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch38/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm  
 Maximum value of SAR (interpolated) = 0.654 mW/g

**Ch38/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 18.9 V/m; Power Drift = -0.098 dB  
 Peak SAR (extrapolated) = 0.765 W/kg  
**SAR(1 g) = 0.611 mW/g; SAR(10 g) = 0.458 mW/g**  
 Maximum value of SAR (measured) = 0.649 mW/g



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

Date: 2008/1/4

**Right Cheek\_DCS Ch512****DUT: 7D1802**

Communication System: DCS; Frequency: 1710.2 MHz; Duty Cycle: 1:8.3

Medium: HSL\_1800 Medium parameters used:  $f = 1710.2$  MHz;  $\sigma = 1.36$  mho/m;  $\epsilon_r = 39.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 22.7 °C; Liquid Temperature : 21.6 °C

DASY4 Configuration:

- Probe: ET3DV6 - SN1787; ConvF(5.16, 5.16, 5.16); Calibrated: 2007/8/28

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn778; Calibrated: 2007/9/17

- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch512/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.75 mW/g

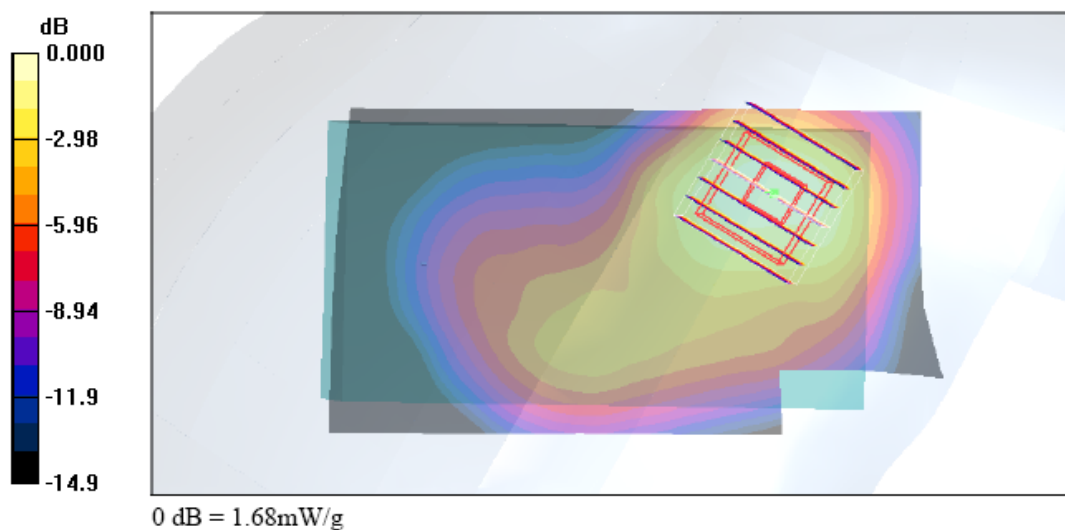
**Ch512/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.7 V/m; Power Drift = -0.073 dB

Peak SAR (extrapolated) = 2.30 W/kg

**SAR(1 g) = 1.51 mW/g; SAR(10 g) = 0.902 mW/g**

Maximum value of SAR (measured) = 1.68 mW/g



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

Date: 2008/1/4

**Right Tilted\_DCS Ch699**

**DUT: 7D1802**

Communication System: DCS; Frequency: 1747.6 MHz; Duty Cycle: 1:8.3

Medium: HSL\_1800 Medium parameters used:  $f = 1748 \text{ MHz}$ ;  $\sigma = 1.39 \text{ mho/m}$ ;  $\epsilon_r = 39.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 22.6 °C; Liquid Temperature : 21.6 °C

**DASY4 Configuration:**

- Probe: ET3DV6 - SN1787; ConvF(5.16, 5.16, 5.16); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2007/9/17
- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch699/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.459 mW/g

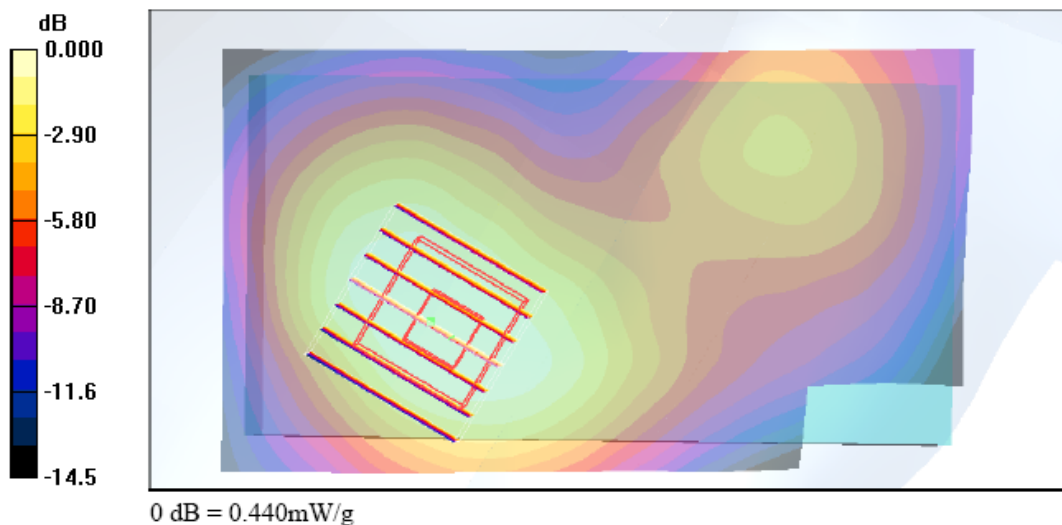
**Ch699/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.1 V/m; Power Drift = -0.015 dB

Peak SAR (extrapolated) = 0.551 W/kg

SAR(1 g) = 0.408 mW/g; SAR(10 g) = 0.275 mW/g

Maximum value of SAR (measured) = 0.440 mW/g



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

Date: 2008/1/4

**Left Cheek\_DCS Ch699**

**DUT: 7D1802**

Communication System: DCS; Frequency: 1747.6 MHz; Duty Cycle: 1:8.3

Medium: HSL\_1800 Medium parameters used:  $f = 1748 \text{ MHz}$ ;  $\sigma = 1.39 \text{ mho/m}$ ;  $\epsilon_r = 39.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 22.7 °C; Liquid Temperature : 21.6 °C

**DASY4 Configuration:**

- Probe: ET3DV6 - SN1787; ConvF(5.16, 5.16, 5.16); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2007/9/17
- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch699/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.01 mW/g

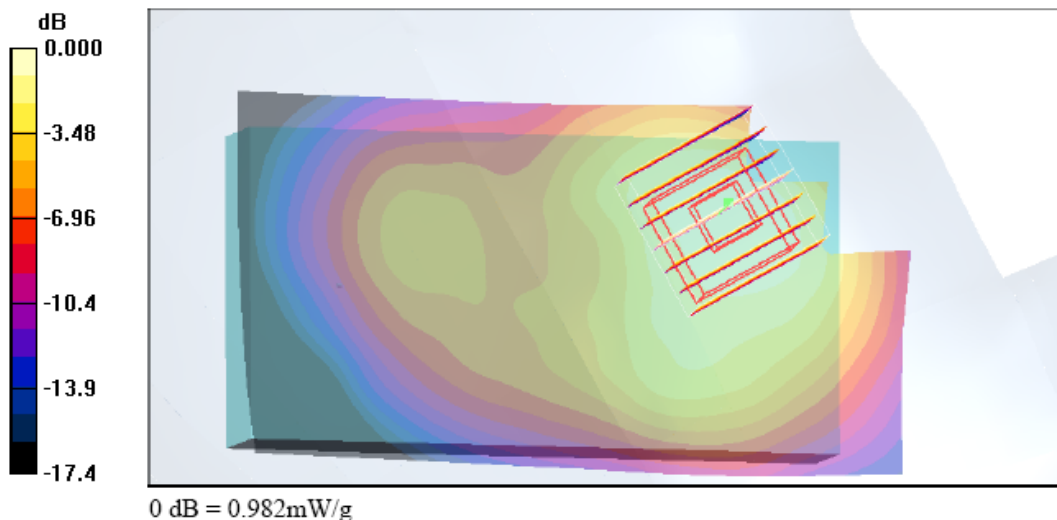
**Ch699/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.2 V/m; Power Drift = -0.043 dB

Peak SAR (extrapolated) = 1.32 W/kg

SAR(1 g) = 0.908 mW/g; SAR(10 g) = 0.566 mW/g

Maximum value of SAR (measured) = 0.982 mW/g



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

Date: 2008/1/4

**Left Tilted\_DCS Ch699**

**DUT: 7D1802**

Communication System: DCS; Frequency: 1747.6 MHz; Duty Cycle: 1:8.3

Medium: HSL\_1800 Medium parameters used:  $f = 1748 \text{ MHz}$ ;  $\sigma = 1.39 \text{ mho/m}$ ;  $\epsilon_r = 39.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 22.7 °C ; Liquid Temperature : 21.6 °C

**DASY4 Configuration:**

- Probe: ET3DV6 - SN1787; ConvF(5.16, 5.16, 5.16); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2007/9/17
- Phantom: SAM-B; Type: QD 000 P40 C; Serial: TP-1383
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch699/Area Scan (51x91x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.393 mW/g

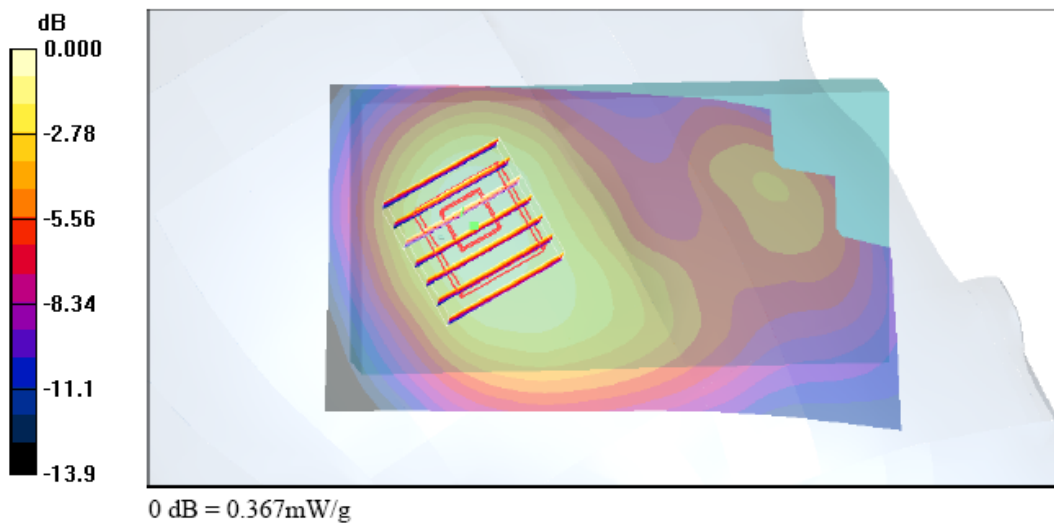
**Ch699/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.2 V/m; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 0.452 W/kg

SAR(1 g) = 0.339 mW/g; SAR(10 g) = 0.224 mW/g

Maximum value of SAR (measured) = 0.367 mW/g





Appendix C – Calibration Data

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: D900V2-190\_Jul07

CALIBRATION CERTIFICATE

Object D900V2 - SN: 190
Calibration procedure(s) QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date: July 16, 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, Reference 10 dB Attenuator, Reference Probe ET3DV6 (HF) DAE4.

Secondary Standards table with 4 columns: ID #, Check Date (in house), Scheduled Check. Includes items like Power sensor HP 8481A, RF generator Agilent E4421B, Network Analyzer HP 8753E. Below is a signature table for Marcel Fehr (Laboratory Technician) and Katja Pokovic (Technical Manager).

Issued: July 16, 2007

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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: D1800V2-2d076\_Jul07

CALIBRATION CERTIFICATE

Object D1800V2 - SN: 2d076
Calibration procedure(s) QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date: July 10 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.

Calibrated by: Name Mike Meili, Function Laboratory Technician, Signature [Handwritten]
Approved by: Name Katja Pokovic, Function Technical Manager, Signature [Handwritten]

Issued: July 11, 2007

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Accreditation No.: SCS 108

Client Sporton (Auelen)

Certificate No: DAE4-778\_Sep07

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 17, 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: Standards, ID #, Date, and Scheduled. Rows include Primary Standards (Fluke Process Calibrator, Keithley Multimeter) and Secondary Standards (Calibrator Box).

Calibrated by: Dominique Steffen, Technician
Approved by: Fin Bornholt, R&D Director

Issued: September 17, 2007

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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: ET3-1787\_Aug07

CALIBRATION CERTIFICATE

Object: ET3DV6 - SN:1787
Calibration procedure(s): QA CAL-01.v6
Calibration procedure for dosimetric E-field probes
Calibration date: August 28, 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. Lists equipment like Power meter E4419B, Power sensor E4412A, Reference 3 dB Attenuator, etc.

Table with 4 columns: Secondary Standards, ID #, Check Date (in house), Scheduled Check. Lists equipment like RF generator HP 8648C, Network Analyzer HP 8753E.

Calibrated by: Katja Pokovic, Technical Manager
Approved by: Niels Kuster, Quality Manager

Issued: August 29, 2007

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