



# A Test Lab Techno Corp.

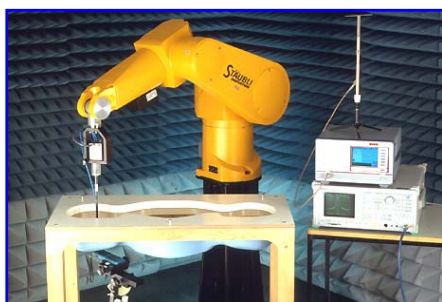
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## SAR EVALUATION REPORT



|                    |                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------|
| Test Report No.    | : 1101FS11                                                                                          |
| Applicant          | : Philips Consumer Lifestyle                                                                        |
| EUT Type           | : DECT Baby Monitor                                                                                 |
| FCC ID             | : BOUSCD505H                                                                                        |
| Trade Name         | : Philips Avent                                                                                     |
| Model Number       | : SCD505-R                                                                                          |
| Dates of Test      | : Jan. 05, 2011                                                                                     |
| Test Environment   | : Ambient Temperature : $22 \pm 2^{\circ}\text{C}$<br>Relative Humidity : 40 - 70 %                 |
| Test Specification | : Standard C95.1-2005<br>IEEE Std. 1528-2003<br>2.1093;FCC/OET Bulletin 65 Supplement C [July 2001] |
| Max. SAR           | : 0.016 W/kg Body SAR                                                                               |
| Test Lab Location  | : Chang-an Lab                                                                                      |



1. The test operations have to be performed with cautious behavior, the test results are as attached.
2. The test results are under chamber environment of A Test Lab Techno Corp. A Test Lab Techno Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples.
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Approve Signer

20110201

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## 1. Description of Equipment Under Test (EUT)

|                                |   |                                                                          |
|--------------------------------|---|--------------------------------------------------------------------------|
| <b>Applicant</b>               | : | Philips Consumer Lifestyle                                               |
| <b>Applicant Address</b>       | : | 3029 Governor John Sevier Hwy Knoxville,<br>TN 37914                     |
| <b>Manufacturer</b>            | : | Dongguan VTech Satellite Equipment Co. Ltd.                              |
| <b>Manufacturer Address</b>    | : | Xia Ling Bei Management Zone Liaobu,<br>Dongguan,Guangdong, China 511758 |
| <b>EUT Type</b>                | : | DECT Baby Monitor                                                        |
| <b>FCC ID</b>                  | : | BOUSCD505H                                                               |
| <b>Trade Name</b>              | : | Philips Avent                                                            |
| <b>Model Number</b>            | : | SCD505-R                                                                 |
| <b>Battery Type</b>            | : | Ni-MH Battery (2.4V , 850mAh )                                           |
| <b>Tx Frequency</b>            | : | 1921.536 -1928.448 MHz ( UPCS )                                          |
| <b>Max. RF Conducted Power</b> | : | 0.084 W (19.26dBm ) UPCS                                                 |
| <b>Max. SAR Measurement</b>    | : | 0.016 W/kg UPCS Body SAR                                                 |
| <b>HW Version</b>              | : | NA                                                                       |
| <b>SW Version</b>              | : | NA                                                                       |
| <b>Antenna Type</b>            | : | Fixed Type                                                               |
| <b>Antenna Gain</b>            | : | 0dBi                                                                     |
| <b>Device Category</b>         | : | Portable                                                                 |
| <b>RF Exposure Environment</b> | : | General Population / Uncontrolled                                        |
| <b>Application Type</b>        | : | Certification                                                            |
| <b>Adapter Information</b>     | : | Model : 1920US-2<br>Input : 100-240V,50-60Hz,0.2A<br>Output : 6.0V,500mA |

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment / general population exposure limits specified in Standard C95.1-2005 and had been tested in accordance with the measurement procedures specified in IEEE Std. 1528-2003.

## 2. Introduction

The A Test Lab Techno Corp. has performed measurements of the maximum potential exposure to the user of **Philips Consumer Lifestyle Trade Name : Philips Avent Model(s) : SCD505-R**. The test procedures, as described in American National Standards, Institute C95.1 - 2005 [ 1 ], FCC/OET Bulletin 65 Supplement C [July 2001] were employed and they specify the maximum exposure limit of 1.6mW/g as averaged over any 1 gram of tissue for portable devices being used within 20cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

## 3. SAR Definition

Specific Absorption Rate (SAR) is defined as 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 ( $\rho$ ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body.

**SAR Mathematical Equation**

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

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

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

Where :

$\sigma$  = conductivity of the tissue (S/m)

$\rho$  = mass density of the tissue (kg/m<sup>3</sup>)

$E$  = RMS electric field strength (V/m)

**\* Note :**

The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane [ 2 ]

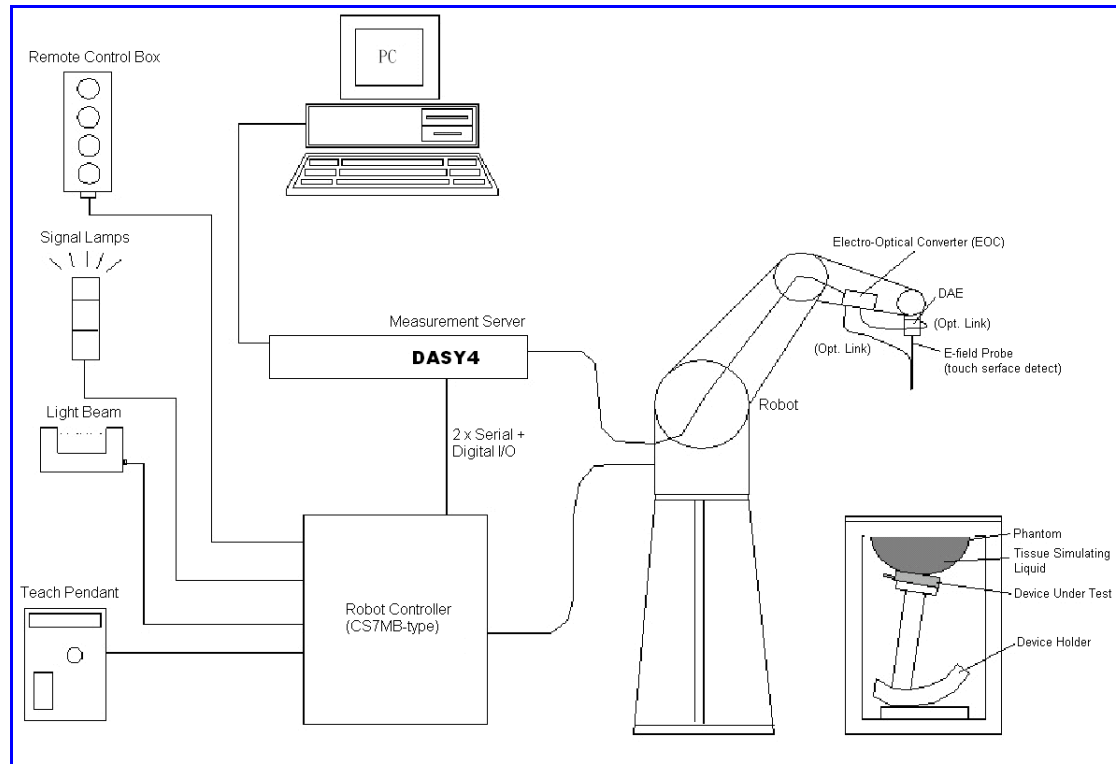


#### **4. SAR Measurement Setup**

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than  $\pm 0.025\text{mm}$ . Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines (length = 300mm) to the data acquisition unit.

A cell controller system contains the power supply, robot controller, teaches pendant (Joystick) and remote control, and is used to drive the robot motors. The Measurement Server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chipdisk and 64MB RAM. The necessary circuits for communication with either the DAE4 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The PC consists of the Intel Pentium 4 2.4GHz computer with Windows XP system and SAR Measurement Software DASY4, Post Processor SEMCAD, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection...etc. is connected to the Electro-optical converter (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the Measurement Server.

The DAE4 (or DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [ 3 ] .



**Figure 1. SAR Lab Test Measurement Setup**



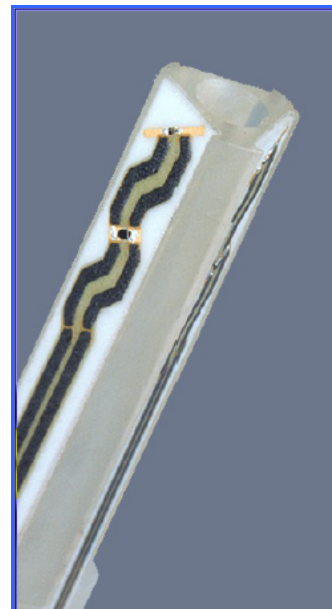
## **5. System Components**

### **5.1 DASY4 E-Field Probe System**

The SAR measurements were conducted with the dosimetric probe ES3DV3 or ET3DV6 (manufactured by SPEAG), designed in the classical triangular configuration [3] and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

### 5.1.1 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</p> <p>(resistant to organic solvents, e.q., glycol)</p> |
| <b>Calibration</b>       | <p>In air from 10 MHz to 2.5 GHz</p> <p>In brain and muscle simulating tissue at frequencies of 1900MHz and 2000MHz (accuracy <math>\pm 8\%</math>)</p> <p>Calibration for other liquids and frequencies upon request</p>                      |
| <b>Frequency</b>         | <p>10 MHz to &gt; 6 GHz; Linearity: <math>\pm 0.2</math> dB</p> <p>(30 MHz to 3 GHz)</p>                                                                                                                                                       |
| <b>Directivity</b>       | <p><math>\pm 0.2</math> dB in brain tissue</p> <p>(rotation around probe axis)</p> <p><math>\pm 0.4</math> dB in brain tissue</p> <p>(rotation normal probe axis)</p>                                                                          |
| <b>Dynamic Range</b>     | <p><math>5 \mu\text{W/g}</math> to &gt; <math>100\text{mW/g}</math>; Linearity: <math>\pm 0.2\text{dB}</math></p>                                                                                                                              |
| <b>Surface Detection</b> | <p><math>\pm 0.2</math> mm repeatability in air and clear liquids over diffuse reflecting surface(ET3DV6 only)</p>                                                                                                                             |
| <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 of mobile phones</p> <p>Fast automatic scanning in arbitrary phantoms</p>                                                                                                              |



**Figure 2. E-field Probe**



**Figure 3. Probe setup on robot**



### 5.1.2 E-Field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure described in [ 4 ] with accuracy better than  $\pm 10\%$ . The spherical isotropy was evaluated with the procedure described in [ 5 ] and found to be better than  $\pm 0.25\text{dB}$ . The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1GHz, and in a wave guide above 1GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

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

Where :

$\Delta t$  = Exposure time (30 seconds),

$C$  = Heat capacity of tissue (brain or muscle),

$\Delta T$  = Temperature increase due to RF exposure.

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

Where :

$\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density ( $\text{kg/m}^3$ ).



## **5.2 Data Acquisition Electronic (DAE) System**

### **Cell Controller**

Processor : Intel Pentium 4  
Clock Speed : 2.4GHz  
Operating System : Windows XP Professional

### **Data Converter**

Features : Signal Amplifier, multiplexer, A/D converter, and control logic  
Software : DASY4 v4.7 (Build 80) & SEMCAD v1.8 (Build 186)  
Connecting Lines : Optical downlink for data and status info  
Optical uplink for commands and clock

## **5.3 Robot**

Positioner : Stäubli Unimation Corp. Robot Model: RX90L  
Repeatability :  $\pm 0.025$  mm  
No. of Axis : 6

## **5.4 Measurement Server**

Processor : PC/104 with a 166MHz low-power Pentium  
I/O-board : Link to DAE4 (or DAE3)  
16-bit A/D converter for surface detection system  
Digital I/O interface  
Serial link to robot  
Direct emergency stop output for robot

## 5.5 Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device (POM) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeat ably positioned according to the IEEE SCC34-SC2 and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

**\* Note :** A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations [ 6 ] . To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Larger DUT cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values. Therefore those devices are normally only tested at the flat part of the SAM.

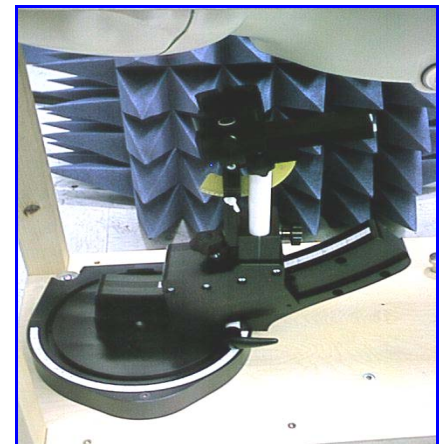


Figure 4. Device Holder

## 5.6 Phantom - SAM v4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, EN 62209-1 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

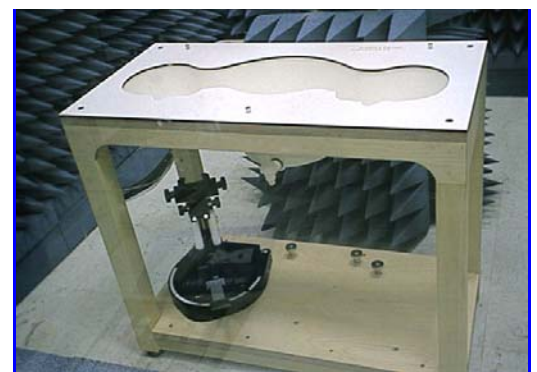


Figure 5. SAM Twin Phantom

|                 |                         |
|-----------------|-------------------------|
| Shell Thickness | 2 ± 0.2 mm              |
| Filling Volume  | Approx. 25 liters       |
| Dimensions      | 810×1000×500 mm (H×L×W) |

Table 1. Specification of SAM v4.0



## 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 postprocessing 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.

### 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             | Normi, ai0, ai1, ai2 |
|                            | - Conversion factor       | ConvFi               |
|                            | - Diode compression point | dcpi                 |
| <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 multimeter 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 :**

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

**H-field probes :**

$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

with  $V_i$  = compensated signal of channel  $i$  ( $i = x, y, z$ )

$Norm_i$  = sensor sensitivity of channel  $i$  ( $i = x, y, z$ )

$\mu V/(V/m)^2$  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

$Hi$  = 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

**$\sigma$**  = conductivity in [mho/m] or [Siemens/m]

**$\rho$**  = equivalent tissue density in g/cm<sup>3</sup>

**\* 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.

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

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



## 6. Test Equipment List

| Manufacturer  | Name of Equipment               | Type/Model            | Serial Number     | Calibration   |               |
|---------------|---------------------------------|-----------------------|-------------------|---------------|---------------|
|               |                                 |                       |                   | Last Cal.     | Due Date      |
| SPEAG         | Dosimetric E-Field Probe        | ES3DV3                | 3071              | Jun. 22, 2010 | Jun. 22, 2011 |
| SPEAG         | 1900MHz System Validation Kit   | D1950V3               | SN1117            | Feb. 18, 2010 | Feb. 18, 2011 |
| SPEAG         | Data Acquisition Electronics    | DAE4                  | 541               | Jul. 21, 2010 | Jul. 21, 2011 |
| SPEAG         | Measurement Server              | SE UMS 001 BA         | 1021              | NCR           |               |
| SPEAG         | Device Holder                   | N/A                   | N/A               | NCR           |               |
| SPEAG         | Phantom                         | SAM V4.0              | 1009              | NCR           |               |
| SPEAG         | Robot                           | Staubli RX90L         | F00/589B1/A/01    | NCR           |               |
| SPEAG         | Software                        | DASY4 V4.7 Build 80   | N/A               | NCR           |               |
| SPEAG         | Software                        | SEMCAD V1.8 Build 186 | N/A               | NCR           |               |
| R&S           | Wireless Communication Test Set | CMU200                | 109369            | Jul. 29, 2009 | Jul. 29, 2011 |
| Agilent       | Wireless Communication Test Set | E5515C                | GB47020167        | May 25, 2009  | May 25, 2011  |
| Agilent       | ENA Series Network Analyzer     | E5071B                | MY42404655        | Apr. 14, 2010 | Apr. 04, 2012 |
| Agilent       | Dielectric Probe Kit            | 85070C                | US99360094        | NCR           |               |
| R&S           | Power Sensor                    | NRP-Z22               | 100179            | May 20, 2010  | May 20, 2011  |
| Agilent       | Signal Generator                | E8257D                | MY44320425        | NCR           |               |
| Agilent       | Dual Directional Coupler        | 778D                  | 50334             | NCR           |               |
| Mini-Circuits | Power Amplifier                 | ZHL-42W-SMA           | D111103#5         | NCR           |               |
| Mini-Circuits | Power Amplifier                 | ZVE-8G-SMA            | D042005 671800514 | NCR           |               |

**Table 2. Test Equipment List**

## 7. Tissue Simulating Liquids

The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue. The dielectric parameters of the liquids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an E5071B Network Analyzer.

### IEEE SCC-34/SC-2 in 1528 recommended Tissue Dielectric Parameters

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in human head. Other head and body tissue parameters that have not been specified in 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equation and extrapolated according to the head parameter specified in 1528.

| Target Frequency                                                                                      | Head         |                | Body         |                |
|-------------------------------------------------------------------------------------------------------|--------------|----------------|--------------|----------------|
| (MHz)                                                                                                 | $\epsilon_r$ | $\sigma$ (S/m) | $\epsilon_r$ | $\sigma$ (S/m) |
| 150                                                                                                   | 52.3         | 0.76           | 61.9         | 0.80           |
| 300                                                                                                   | 45.3         | 0.87           | 58.2         | 0.92           |
| 450                                                                                                   | 43.5         | 0.87           | 56.7         | 0.94           |
| 835                                                                                                   | 41.5         | 0.90           | 55.2         | 0.97           |
| 900                                                                                                   | 41.5         | 0.97           | 55.0         | 1.05           |
| 915                                                                                                   | 41.5         | 0.98           | 55.0         | 1.06           |
| 1450                                                                                                  | 40.5         | 1.20           | 54.0         | 1.30           |
| 1610                                                                                                  | 40.3         | 1.29           | 53.8         | 1.40           |
| 1800 - 2000                                                                                           | 40.0         | 1.40           | 53.3         | 1.52           |
| 2450                                                                                                  | 39.2         | 1.80           | 52.7         | 1.95           |
| 3000                                                                                                  | 38.5         | 2.40           | 52.0         | 2.73           |
| 5800                                                                                                  | 35.3         | 5.27           | 48.2         | 6.00           |
| ( $\epsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$ = 1000 kg/m <sup>3</sup> ) |              |                |              |                |

**Table 3. Tissue dielectric parameters for head and body phantoms**

## 7.1 Ingredients

The following ingredients are used:

- Water: deionized water (pure H<sub>2</sub>O), resistivity  $\geq 16 \text{ M } \Omega$  -as basis for the liquid
- Sugar: refined white sugar (typically 99.7 % sucrose, available as crystal sugar 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
- DGBE: Diethylenglycol-monobuthyl ether (DGBE), Fluka Chemie GmbH, CAS # 112-34-5 -to reduce relative permittivity

## 7.2 Recipes

The following tables give the recipes for tissue simulating liquids to be used in different frequency bands.

Note: The goal dielectric parameters (at 22 °C) must be achieved within a tolerance of  $\pm 5\%$  for  $\epsilon$  and  $\pm 5\%$  for  $\sigma$ .

| Liquid type                | HSL 1950-B |            |
|----------------------------|------------|------------|
| Ingredient                 | Weight (g) | Weight (%) |
| Water                      | 554.12     | 55.41      |
| DGBE                       | 445.08     | 44.51      |
| Salt                       | 0.80       | 0.08       |
| Total amount               | 1,000.00   | 100.00     |
| Goal dielectric parameters |            |            |
| Frequency [MHz]            | 1950       | 2000       |
| Relative Permittivity      | 40.0       | 40.0       |
| Conductivity [S/m]         | 1.40       | 1.40       |

| Liquid type                | MSL 1950-B |            |
|----------------------------|------------|------------|
| Ingredient                 | Weight (g) | Weight (%) |
| Water                      | 697.94     | 69.79      |
| DGBE                       | 300.03     | 30.00      |
| Salt                       | 2.03       | 0.20       |
| Total amount               | 1,000.00   | 99.99      |
| Goal dielectric parameters |            |            |
| Frequency [MHz]            | 1950       | 2000       |
| Relative Permittivity      | 53.3       | 53.3       |
| Conductivity [S/m]         | 1.52       | 1.52       |

## 7.3 Liquid Confirmation

### 7.3.1 Parameters

| Liquid Verify                                                             |           |           |              |              |                |                |           |               |
|---------------------------------------------------------------------------|-----------|-----------|--------------|--------------|----------------|----------------|-----------|---------------|
| Ambient Temperature : 22 ± 2 °C ; Relative Humidity : 40 -70%             |           |           |              |              |                |                |           |               |
| Liquid Type                                                               | Frequency | Temp (°C) | Parameters   | Target Value | Measured Value | Deviation (%)  | Limit (%) | Measured Date |
| 1900MHz Body                                                              | 1820MHz   | 22.0      | $\epsilon_r$ | 53.3         | <b>53.7</b>    | <b>0.75 %</b>  | ± 5 %     | Jan. 05, 2011 |
|                                                                           |           |           | $\sigma$     | 1.52         | <b>1.55</b>    | <b>1.97 %</b>  | ± 5 %     |               |
|                                                                           | 1950MHz   | 22.0      | $\epsilon_r$ | 53.3         | <b>53.2</b>    | <b>-0.19 %</b> | ± 5 %     | Jan. 05, 2011 |
|                                                                           |           |           | $\sigma$     | 1.52         | <b>1.56</b>    | <b>2.63 %</b>  | ± 5 %     |               |
|                                                                           | 1978MHz   | 22.0      | $\epsilon_r$ | 53.3         | <b>52.5</b>    | <b>-1.50 %</b> | ± 5 %     | Jan. 05, 2011 |
|                                                                           |           |           | $\sigma$     | 1.52         | <b>1.58</b>    | <b>3.95 %</b>  | ± 5 %     |               |
| Table 4. Measured Tissue dielectric parameters for head and body phantoms |           |           |              |              |                |                |           |               |

### 7.3.2 Liquid Depth

The liquid level was during measurement 15cm ±0.5cm.

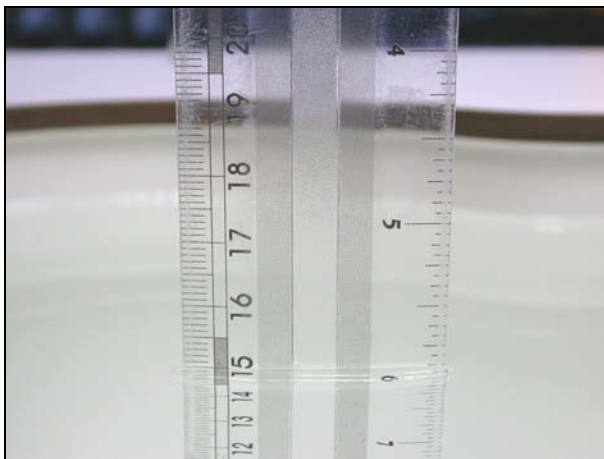


Figure 6. Head-Tissue-Simulating-Liquid

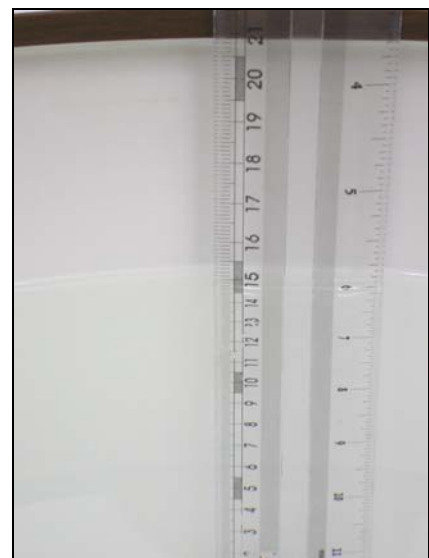


Figure 7. Body-Tissue-Simulating-Liquid

## 8. Measurement Process

### 8.1 Device and Test Conditions

The Test Device was provided by **Philips Consumer Lifestyle** for this evaluation. The spatial peak SAR values were assessed for the middle channel defined by UPCS (Ch2 = 1924.992MHz) systems. The antenna(s), battery and accessories shall be those specified by the manufacturer. The battery shall be fully charged before each measurement and there shall be no external connections.

|                                                                    |                    |                                               |               |                       |                      |
|--------------------------------------------------------------------|--------------------|-----------------------------------------------|---------------|-----------------------|----------------------|
| Usage                                                              |                    | Operates with normal mode by client           |               |                       |                      |
| Distance between antenna axis at the joint and the liquid surface: |                    | For Body, EUT back to phantom 2mm separation. |               |                       |                      |
| Simulating human Head/Body                                         |                    | Body                                          |               |                       |                      |
| EUT Battery                                                        |                    | Fully-charged with Ni-MH batteries.           |               |                       |                      |
| Conducted power                                                    | Channel            |                                               | Frequency MHz | Before SAR Test (dBm) | After SAR Test (dBm) |
|                                                                    | Middle Channel - 2 |                                               | 1924.992      | 19.26                 | 19.24                |

### 8.2 General description of the test procedures

The Parent unit was tested using a connection to the fix part to keep the device transmitting at maximum power during the SAR measurements .All tests were performed in that configuration, which generates the highest time based averaged output power single full slot with duty cycle 1:24.

## 8.3 System Performance Check

### 8.3.1 Symmetric Dipoles for System Validation

#### Construction

Symmetrical dipole with 1/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in brain simulating solutions.

**Frequency** 900, 1800, 1900 MHz

**Return Loss** > 20 dB at specified validation position

**Power Capability** > 100 W ( $f < 1\text{GHz}$ ); > 40 W ( $f > 1\text{GHz}$ )

#### Options

Dipoles for other frequencies or solutions and other calibration conditions are available upon request

#### Dimensions

D1950V3 : dipole length 62 mm; overall height 300 mm



Figure 8. Validation Kit

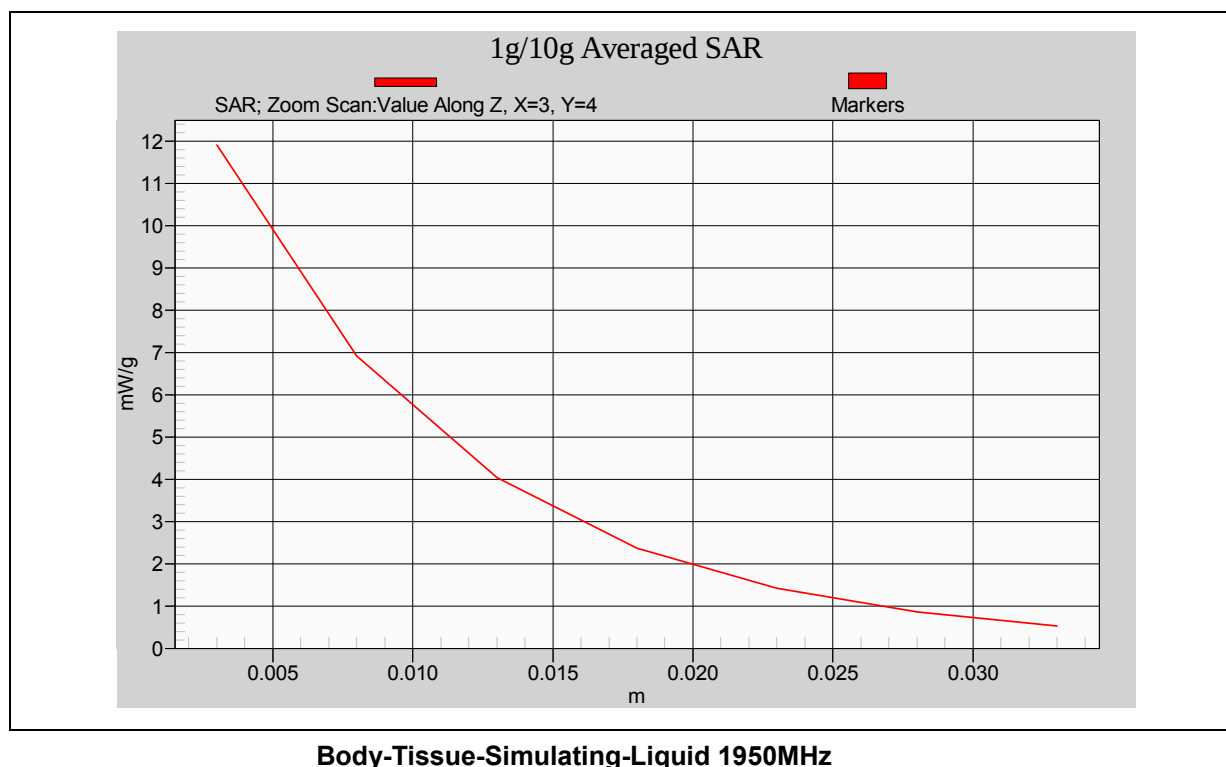
### 8.3.2 Validation

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of  $\pm 7\%$ . The validation was performed at 1950MHz.

| Validation kit     |                     | Mixture Type                | SAR <sub>1g</sub><br>[mW/g]  | SAR <sub>10g</sub><br>[mW/g] | Date of Calibration   |        |               |
|--------------------|---------------------|-----------------------------|------------------------------|------------------------------|-----------------------|--------|---------------|
| D1950V3 – SN1117   |                     | Body                        | 38.6                         | 20.4                         | Feb. 18, 2010         |        | Feb. 18, 2011 |
| Frequency<br>(MHz) | Power               | SAR <sub>1g</sub><br>(mW/g) | SAR <sub>10g</sub><br>(mW/g) | Drift<br>(dB)                | Difference percentage |        | Date          |
|                    |                     |                             |                              |                              | 1g                    | 10g    |               |
| 1950<br>(Body)     | 250mW               | 9.34                        | 4.87                         | 0.084                        | -3.2 %                | -4.5 % | Jan. 05, 2011 |
|                    | Normalize to 1 Watt | 37.36                       | 19.48                        |                              |                       |        |               |

Detail results see Appendix A.

### Z-axis Plot of System Performance Check





## **8.4 Dosimetric Assessment Setup**

### **8.4.1 Body Test Position**

#### **Body - Worn Configuration**

Body - Worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device.

Body - Worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 15 mm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances.

For this test :

- ☐ The EUT is placed into the holster/belt clip and the holster is positioned against the surface of the phantom in a normal operating position.
  
- Since this EUT doesn't supply any body-worn accessory to the end user, a distance of 2 mm was tested to confirm the necessary "minimum SAR separation distance".  
(\*Note : This distance includes the 2 mm phantom shell thickness.)



#### 8.4.2 Measurement Procedures

The evaluation was performed with the following procedures :

- Surface Check :** A surface checks job gathers data used with optical surface detection. It determines the distance from the phantom surface where the reflection from the optical detector has its peak. Any following measurement jobs using optical surface detection will then rely on this value. The surface check performs its search a specified number of times, so that the repeatability can be verified. The probe tip distance is 1.3mm to phantom inner surface during scans.
- Reference :** The reference job measures the field at a specified reference position, at 4 mm from the selected section's grid reference point.
- Area Scan :** The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines can find the maximum locations even in relatively coarse grids. When an area scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. Any following zoom scan within the same procedure will then perform fine scans around these maxima. The area covered the entire dimension of the EUT and the horizontal grid spacing was 15 mm × 15 mm.
- Zoom Scan :** Zoom scans are used to assess the highest averaged SAR for cubic averaging volumes with 1 g and 10 g of simulated tissue. The zoom scan measures 7 x 7 x 9 points in a 30 x 30 x 24 mm cube whose base faces are centered around the maxima returned from a preceding area scan within the same procedure.
- Drift :** The drift job measures the field at the same location as the most recent reference job within the same procedure, with the same settings. The drift measurement gives the field difference in dB from the last reference measurement. Several drift measurements are possible for each reference measurement. This allows monitoring of the power drift of the device in the batch process. If the value changed by more than 5%, the evaluation was repeated.



## 8.5 Spatial Peak SAR Evaluation

The DASY4 software includes all numerical procedures necessary to evaluate the spatial peak SAR values. Based on the Draft: SCC-34, SC-2, WG-2 - Computational Dosimetry, IEEE P1529/D0.0 (Draft Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) Associated with the Use of Wireless Handsets - Computational 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 in a volume of ( 30 x 30 x 24 mm<sup>3</sup> ) ( 7 x 7 x 9 points). 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. If the 10g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the Postprocessing engine (SEMCAD). This means that if the measured volume is shifted, higher values might be possible. To get the correct values you can use a finer measurement grid for the area scan. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location.

The entire evaluation of the spatial peak values is performed within the Postprocessing 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 three stages:

### Interpolation and Extrapolation

The probe is calibrated at the center of the dipole sensors which is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.

In DASY4, the choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and SAR extrapolation routines. The interpolation, Maxima Search and extrapolation routines are all based on the modified Quadratic Shepard's method [7].



## 9. **Measurement Uncertainty**

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR to be less than  $\pm 22.4\%$  [ 8 ] .

According to Std. C95.3 [ 9 ] , the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of  $\pm 1$  to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least  $\pm 2$  dB can be expected.

According to CENELEC [ 10 ] , typical worst-case uncertainty of field measurements is  $\pm 5$  dB. For well-defined modulation characteristics the uncertainty can be reduced to  $\pm 3$  dB.

| Uncertainty Component                                                | Uncertainty Value | Probability Distribution | Divisor    | $c_i$ (1g) | $c_i$ (10g) | Standard Uncertainty $\pm 1\%$ (1-g) | Standard Uncertainty $\pm 1\%$ (10-g) | $v_i$ or $v_{eff}$ |
|----------------------------------------------------------------------|-------------------|--------------------------|------------|------------|-------------|--------------------------------------|---------------------------------------|--------------------|
| <b>Measurement System</b>                                            |                   |                          |            |            |             |                                      |                                       |                    |
| Probe Calibration (k=1)                                              | 5.5               | Normal                   | 1          | 1          | 1           | 5.5                                  | 5.5                                   | $\infty$           |
| Probe Isotropy                                                       | 7.6               | Rectangular              | $\sqrt{3}$ | 0.7        | 0.7         | 3.1                                  | 3.1                                   | $\infty$           |
| Boundary Effect                                                      | 1.0               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 0.6                                  | 0.6                                   | $\infty$           |
| Linearity                                                            | 4.7               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 2.7                                  | 2.7                                   | $\infty$           |
| System Detection Limit                                               | 1.0               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 0.58                                 | 0.58                                  | $\infty$           |
| Readout Electronics                                                  | 0.3               | Normal                   | 1          | 1          | 1           | 0.3                                  | 0.3                                   | $\infty$           |
| Response Time                                                        | 0.8               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 0.5                                  | 0.5                                   | $\infty$           |
| Integration Time                                                     | 2.6               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 1.5                                  | 1.5                                   | $\infty$           |
| RF Ambient Conditions                                                | 0                 | Rectangular              | $\sqrt{3}$ | 1          | 1           | 0                                    | 0                                     | $\infty$           |
| RF Ambient Reflections                                               | 0                 | Rectangular              | $\sqrt{3}$ | 1          | 1           | 0                                    | 0                                     | $\infty$           |
| Probe Positioner Mechanical Tolerance                                | 0.4               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 0.2                                  | 0.2                                   | $\infty$           |
| Probe Positioning with respect to Phantom Shell                      | 2.9               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 1.7                                  | 1.7                                   | $\infty$           |
| Extrapolation, interpolation and integration Algorithms for Max. SAR | 1.0               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 0.6                                  | 0.6                                   | $\infty$           |
| <b>Test sample Related</b>                                           |                   |                          |            |            |             |                                      |                                       |                    |
| Test sample Positioning                                              | 3.6               | Normal                   | 1          | 1          | 1           | 3.6                                  | 3.6                                   | 89                 |
| Device Holder Uncertainty                                            | 3.5               | Normal                   | 1          | 1          | 1           | 3.5                                  | 3.5                                   | 5                  |
| Output Power Variation - SAR drift measurement                       | 5.0               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 2.9                                  | 2.9                                   | $\infty$           |
| <b>Phantom and Tissue Parameters</b>                                 |                   |                          |            |            |             |                                      |                                       |                    |
| Phantom Uncertainty ( shape and thickness tolerances)                | 4.0               | Rectangular              | $\sqrt{3}$ | 1          | 1           | 2.3                                  | 2.3                                   | $\infty$           |
| Liquid Conductivity - deviation from target values                   | 5.0               | Rectangular              | $\sqrt{3}$ | 0.64       | 0.43        | 1.8                                  | 1.2                                   | $\infty$           |
| Liquid Conductivity - measurement uncertainty                        | 1.93              | Normal                   | 1          | 0.64       | 0.43        | 1.24                                 | 0.83                                  | 69                 |
| Liquid Permittivity - deviation from target values                   | 5.0               | Rectangular              | $\sqrt{3}$ | 0.6        | 0.49        | 1.7                                  | 1.4                                   | $\infty$           |
| Liquid Permittivity - measurement uncertainty                        | 1.4               | Normal                   | 1          | 0.6        | 0.49        | 0.84                                 | 1.69                                  | 69                 |
| <b>Combined standard uncertainty</b>                                 |                   | RSS                      |            |            |             | 10.05                                | 9.98                                  | 313                |
| <b>Expanded uncertainty (95% CONFIDENCE LEVEL )</b>                  |                   | k=2                      |            |            |             | 20.10                                | 19.96                                 |                    |

Table 5. System uncertainty: 300MHz -3000MHz

| Uncertainty Component         | Uncertainty Value | Probability Distribution | Divisor    | $c_i$ (1g) | $c_i$ (10g) | Standard Uncertainty $\pm 1\%$ ( 1-g ) | Standard Uncertainty $\pm 1\%$ ( 10-g ) | $v_i$ or $v_{eff}$ |
|-------------------------------|-------------------|--------------------------|------------|------------|-------------|----------------------------------------|-----------------------------------------|--------------------|
| <b>Measurement System</b>     |                   |                          |            |            |             |                                        |                                         |                    |
| Probe Calibration             | $\pm 6.55\%$      | Normal                   | 1          | 1          | 1           | $\pm 6.55\%$                           | $\pm 6.55\%$                            | $\infty$           |
| Axial Isotropy                | $\pm 4.7\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 2.7\%$                            | $\pm 2.7\%$                             | $\infty$           |
| Hemispherical Isotropy        | $\pm 9.6\%$       | Rectangular              | $\sqrt{3}$ | 0          | 0           | $\pm 0\%$                              | $\pm 0\%$                               | $\infty$           |
| Boundary Effects              | $\pm 1.0\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 0.6\%$                            | $\pm 0.6\%$                             | $\infty$           |
| Linearity                     | $\pm 4.7\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 2.7\%$                            | $\pm 2.7\%$                             | $\infty$           |
| System Detection Limits       | $\pm 1.0\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 0.6\%$                            | $\pm 0.6\%$                             | $\infty$           |
| Modulation Response           | $\pm 0\%$         | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 0\%$                              | $\pm 0\%$                               | $\infty$           |
| Readout Electronics           | $\pm 0.3\%$       | Normal                   | 1          | 1          | 1           | $\pm 0.3\%$                            | $\pm 0.3\%$                             | $\infty$           |
| Response Time                 | $\pm 0\%$         | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 0\%$                              | $\pm 0\%$                               | $\infty$           |
| Integration Time              | $\pm 0\%$         | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 0\%$                              | $\pm 0\%$                               | $\infty$           |
| RF Ambient Noise              | $\pm 1.0\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 0.6\%$                            | $\pm 0.6\%$                             | $\infty$           |
| RF Ambient Reflections        | $\pm 1.0\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 0.6\%$                            | $\pm 0.6\%$                             | $\infty$           |
| Probe Positioner              | $\pm 0.8\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 0.5\%$                            | $\pm 0.5\%$                             | $\infty$           |
| Probe Positioning             | $\pm 6.7\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 3.9\%$                            | $\pm 3.9\%$                             | $\infty$           |
| Max. SAR Eval.                | $\pm 2.0\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 1.2\%$                            | $\pm 1.2\%$                             | $\infty$           |
| <b>Dipole Related</b>         |                   |                          |            |            |             |                                        |                                         |                    |
| Deviation of exp. dipole      | $\pm 5.5\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 3.2\%$                            | $\pm 3.2\%$                             | $\infty$           |
| Dipole Axis to Liquid Dist.   | $\pm 2.0\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 1.2\%$                            | $\pm 1.2\%$                             | $\infty$           |
| Input power & SAR drift       | $\pm 3.4\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 2.0\%$                            | $\pm 2.0\%$                             | $\infty$           |
| <b>Phantom and Setup</b>      |                   |                          |            |            |             |                                        |                                         |                    |
| Phantom Uncertainty           | $\pm 4.0\%$       | Rectangular              | $\sqrt{3}$ | 1          | 1           | $\pm 2.3\%$                            | $\pm 2.3\%$                             | $\infty$           |
| SAR correction                | $\pm 1.9\%$       | Rectangular              | $\sqrt{3}$ | 1          | 0.84        | $\pm 1.1\%$                            | $\pm 0.9\%$                             | $\infty$           |
| Liquid Conductivity (meas.)   | $\pm 2.5\%$       | Normal                   | 1          | 0.78       | 0.71        | $\pm 2.0\%$                            | $\pm 1.8\%$                             | $\infty$           |
| Liquid Permittivity (meas.)   | $\pm 2.5\%$       | Normal                   | 1          | 0.26       | 0.26        | $\pm 0.6\%$                            | $\pm 0.7\%$                             | $\infty$           |
| Temp. unc. -Conductivity      | $\pm 1.7\%$       | Rectangular              | $\sqrt{3}$ | 0.78       | 0.71        | $\pm 0.8\%$                            | $\pm 0.7\%$                             | $\infty$           |
| Temp. unc. -Permittivity      | $\pm 0.3\%$       | Rectangular              | $\sqrt{3}$ | 0.23       | 0.26        | $\pm 0.0\%$                            | $\pm 0.0\%$                             | $\infty$           |
| Combined standard uncertainty |                   |                          |            |            |             | $\pm 10.1\%$                           | $\pm 10.1\%$                            |                    |
| Expanded uncertainty          |                   |                          |            |            |             | $\pm 20.2\%$                           | $\pm 20.1\%$                            |                    |

**Table 6. Uncertainty Budget for System Validation for the 0.3 -6 GHz range**

## 10. SAR Test Results Summary

### 10.1 UPCS Body SAR\_ Close body

Ambient :

Temperature (°C) : 22 ± 2

Relative HUMIDITY (%) : 40 - 70

Liquid :

Mixture Type : MSL1950

Liquid Temperature (°C) : 22.0

Depth of liquid (cm) : 15

Measurement :

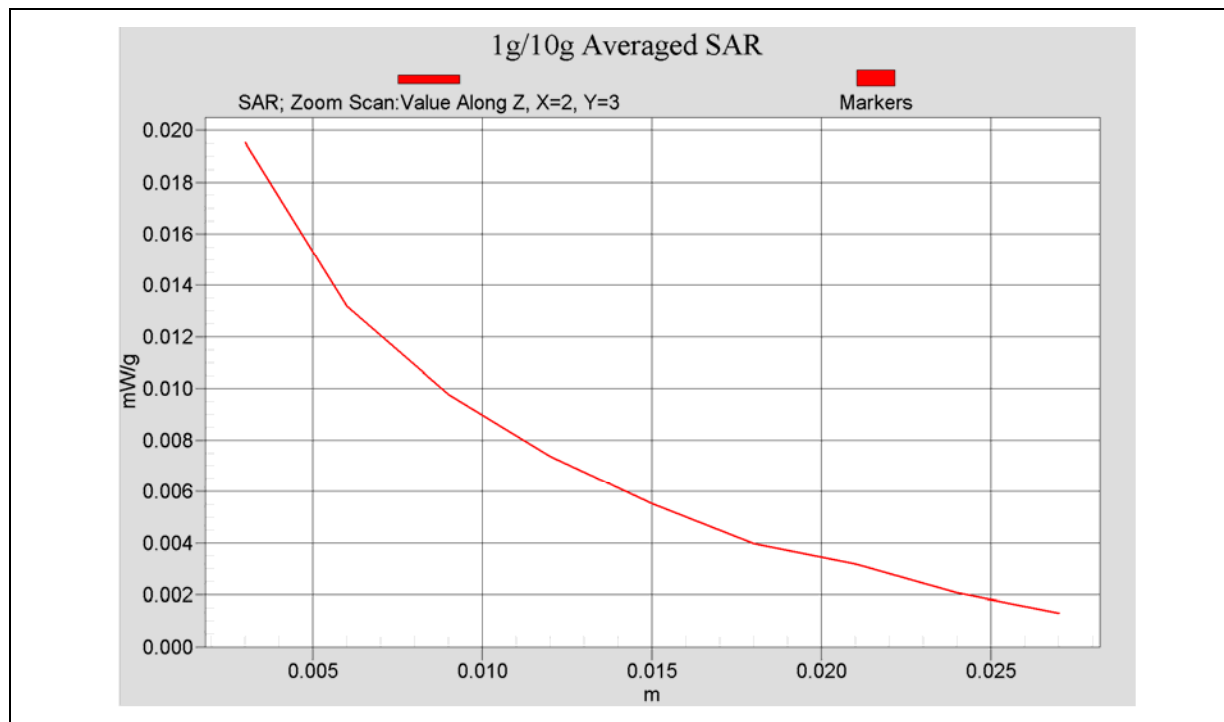
Crest Factor : 24

Probe S/N : 3071

| Frequency                                                                                  |    | Battery | Phantom Position | Accessory | SAR <sub>1g</sub> [mW/g]                | Power Drift [dB] | Amb. Temp. | Remark      |
|--------------------------------------------------------------------------------------------|----|---------|------------------|-----------|-----------------------------------------|------------------|------------|-------------|
| MHz                                                                                        | CH |         |                  |           |                                         |                  |            |             |
| 1924.992                                                                                   | 2  | Ni-MH   | Flat             | N/A       | 0.016                                   | -0.14            | 22.0       | Parent Unit |
| Std. C95.1-2005 - Safety Limit<br>Spatial Peak<br>Uncontrolled Exposure/General Population |    |         |                  |           | 1.6 W/kg (mW/g)<br>Averaged over 1 gram |                  |            |             |

Detail results see Appendix B.

#### Z-axis Plot of SAR Measurement



Body SAR Measurement \_ Parent unit\_close body \_CH2

## 10.2 Std. C95.1-2005 RF Exposure Limit

| Human Exposure                                                 | Population<br>Uncontrolled<br>Exposure<br>( W/kg ) or (mW/g) | Occupational<br>Controlled<br>Exposure<br>( W/kg ) or (mW/g) |
|----------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------|
| <b>Spatial Peak SAR*</b><br>(head)                             | 1.60                                                         | 8.00                                                         |
| <b>Spatial Peak SAR**</b><br>(Whole Body)                      | 0.08                                                         | 0.40                                                         |
| <b>Spatial Peak SAR***</b><br>(Partial-Body)                   | 1.60                                                         | 8.00                                                         |
| <b>Spatial Peak SAR****</b><br>(Hands / Feet / Ankle / Wrist ) | 4.00                                                         | 20.00                                                        |

**Table 7. Safety Limits for Partial Body Exposure**

### Notes :

- \* The Spatial Peak value of the SAR averaged over any 1 gram of tissue.  
( defined as a tissue volume in the shape of a cube ) and over the appropriate averaging time.
- \*\* The Spatial Average value of the SAR averaged over the whole – body.
- \*\*\* The Spatial Average value of the SAR averaged over the partial – body.
- \*\*\*\* The Spatial Peak value of the SAR averaged over any 10 grams of tissue.  
( defined as a tissue volume in the shape of a cube ) and over the appropriate averaging time.

**Population / Uncontrolled Environments** : are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

**Occupational / Controlled Environments** : are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).



## 11. Conclusion

The SAR test values found for the portable mobile phone **Philips Consumer Lifestyle Trade Name : Philips Avent Model(s) : SCD505-R** is below the maximum recommended level of 1.6 W/kg (mW/g).

## 12. References

- [1] Std. C95.1-2005, "*American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz*", New York.
- [2] NCRP, National Council on Radiation Protection and Measurements, "*Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields*", NCRP report NO. 86, 1986.
- [3] T. Schmid, O. Egger, and N. Kuster, "*Automatic E-field scanning system for dosimetric assessments*", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.
- [4] K. Poković, T. Schmid, and N. Kuster, "*Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequency*", in ICECOM'97, Dubrovnik, October 15-17, 1997, pp.120-124.
- [5] K. Poković, T. Schmid, and N. Kuster, "*E-field probe with improved isotropy in brain simulating liquids*", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.
- [6] N. Kuster, and Q. Balzano, "*Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz*", IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [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] N. Kuster, R. Kastle, T. Schmid, "*Dosimetric evaluation of mobile communications equipment with known precision*", IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [9] Std. C95.3-1991, "*IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave*", New York: IEEE, Aug. 1992.
- [10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), "*Human Exposure to Electromagnetic Fields High-frequency: 10KHz-300GHz*", Jan. 1995.

## Appendix A - System Performance Check

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/1/5 AM 04:20:55

### System Performance Check at 1950MHz\_20110105\_Body

**DUT: Dipole 1950 MHz; Type: D1950V3; Serial: D1950V3 - SN:1117**

Communication System: CW; Frequency: 1950 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1950 \text{ MHz}$ ;  $\sigma = 1.56 \text{ mho/m}$ ;  $\epsilon_r = 53.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3071; ConvF(4.36, 4.36, 4.36); Calibrated: 2010/6/22
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

### System Performance Check at 1950MHz/Area Scan (61x61x1):

Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 11.7 mW/g

### System Performance Check at 1950MHz/Zoom Scan (7x7x7)/Cube 0:

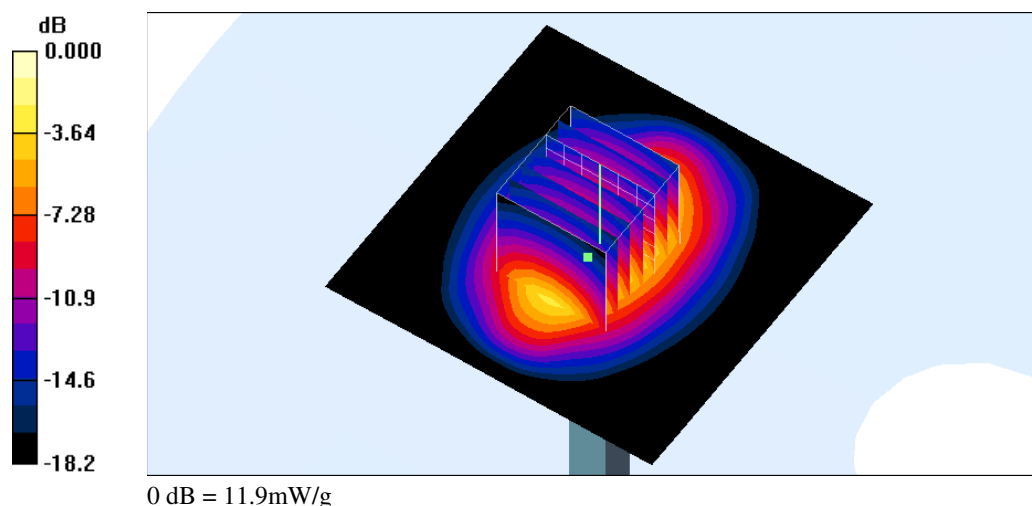
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 90.5 V/m; Power Drift = 0.084 dB

Peak SAR (extrapolated) = 16.4 W/kg

**SAR(1 g) = 9.34 mW/g; SAR(10 g) = 4.87 mW/g**

Maximum value of SAR (measured) = 11.9 mW/g



## Appendix B - SAR Measurement Data

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/1/5 AM 11:42:21

### Flat\_DECT CH2\_Parent Unit\_close body

**DUT: SCD505; Type: DECT Baby Monitor; FCC ID:BOUSCD505H**

Communication System: DECT; Frequency: 1924.992 MHz; Duty Cycle: 1:24

Medium parameters used:  $f = 1924.992$  MHz;  $\sigma = 1.55$  mho/m;  $\epsilon_r = 53.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3071; ConvF(4.36, 4.36, 4.36); Calibrated: 2010/6/22
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

### Flat/Area Scan (71x101x1):

Measurement grid:  $dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (interpolated) = 0.019 mW/g

### Flat/Zoom Scan (7x7x9)/Cube 0:

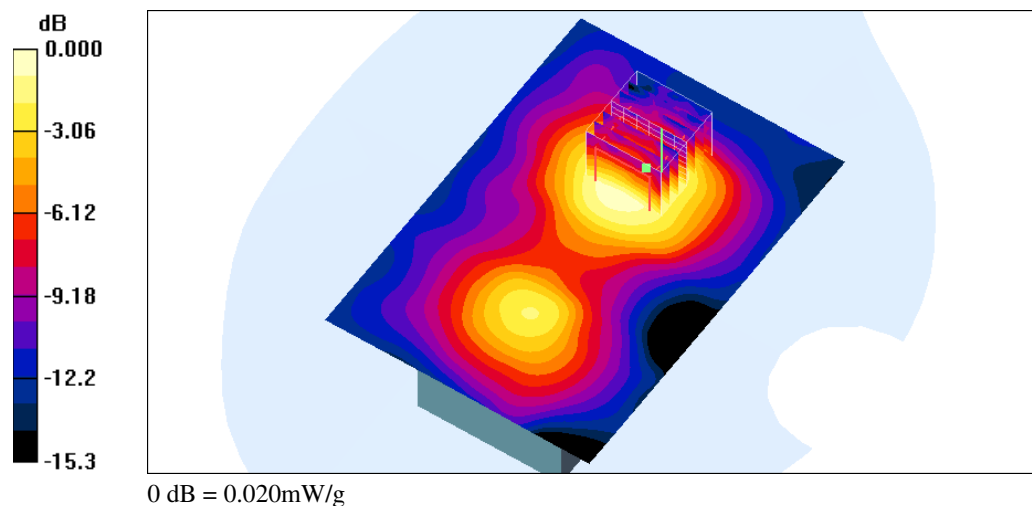
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=3$ mm

Reference Value = 2.05 V/m; Power Drift = -0.140 dB

Peak SAR (extrapolated) = 0.028 W/kg

**SAR(1 g) = 0.016 mW/g; SAR(10 g) = 0.00987 mW/g**

Maximum value of SAR (measured) = 0.020 mW/g





## ***Appendix C - Calibration***

All of the instruments Calibration information are listed below.

- Dipole \_ D1950V3 SN:1117 Calibration No.D1950V3-1117\_Feb10
- Probe \_ ES3DV3 SN:3071 Calibration No.ES3-3071\_Jun10
- DAE \_ DAE4 SN:541 Calibration No.DAE4-541\_ Jul10



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Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **D1950V3\_1117\_Feb10**

## CALIBRATION CERTIFICATE

Object **D1950V3 - SN: 1117**

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

Calibration date: **February 18, 2010**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)     | Scheduled Calibration |
|-----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A        | GB37480704         | 06-Oct-09 (No. 217-01086)      | Oct-10                |
| Power sensor HP 8481A       | US37292783         | 06-Oct-09 (No. 217-01086)      | Oct-10                |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 31-Mar-09 (No. 217-01025)      | Mar-10                |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 31-Mar-09 (No. 217-01029)      | Mar-10                |
| Reference Probe ES3DV3      | SN: 3205           | 26-Jun-09 (No. ES3-3205_Jun09) | Jun-10                |
| DAE4                        | SN: 601            | 07-Mar-09 (No. DAE4-601_Mar09) | Mar-10                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A     | MY41092317       | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06   | 100005           | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-09) | In house check: Oct-10 |

Calibrated by: **Name** **Function**  
**Claudio Leubler** **Laboratory Technician**

Signature

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

Issued: February 25, 2010

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Certificate No: D1950V3-1117\_Feb10

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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:

- 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:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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



## Measurement Conditions

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

|                                     |                           |             |
|-------------------------------------|---------------------------|-------------|
| <b>DASY Version</b>                 | DASY5                     | V5.2        |
| <b>Extrapolation</b>                | Advanced Extrapolation    |             |
| <b>Phantom</b>                      | Modular Flat Phantom V5.0 |             |
| <b>Distance Dipole Center - TSL</b> | 10 mm                     | with Spacer |
| <b>Zoom Scan Resolution</b>         | dx, dy, dz = 5 mm         |             |
| <b>Frequency</b>                    | 1950 MHz $\pm$ 1 MHz      |             |

## Head TSL parameters

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Head TSL parameters</b>      | 22.0 °C             | 40.0           | 1.40 mho/m           |
| <b>Measured Head TSL parameters</b>     | (22.0 $\pm$ 0.2) °C | 40.7 $\pm$ 6 % | 1.35 mho/m $\pm$ 6 % |
| <b>Head TSL temperature during test</b> | (22.0 $\pm$ 0.2) °C | ----           | ----                 |

## SAR result with Head TSL

| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                                 |
|-------------------------------------------------------------|--------------------|-------------------------------------------------|
| SAR measured                                                | 250 mW input power | 9.83 mW / g                                     |
| SAR normalized                                              | normalized to 1W   | 39.3 mW / g                                     |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>40.3 mW /g <math>\pm</math> 17.0 % (k=2)</b> |

| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                                 |
|---------------------------------------------------------------|--------------------|-------------------------------------------------|
| SAR measured                                                  | 250 mW input power | 5.18 mW / g                                     |
| SAR normalized                                                | normalized to 1W   | 20.7 mW / g                                     |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>21.0 mW /g <math>\pm</math> 16.5 % (k=2)</b> |

### Body TSL parameters

The following parameters and calculations were applied.

|                                  | Temperature     | Permittivity | Conductivity     |
|----------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters      | 22.0 °C         | 53.3         | 1.52 mho/m       |
| Measured Body TSL parameters     | (22.0 ± 0.2) °C | 53.8 ± 6 %   | 1.51 mho/m ± 6 % |
| Body TSL temperature during test | (22.0 ± 0.2) °C | ----         | ----             |

### SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                                   |
|-------------------------------------------------------|--------------------|-----------------------------------|
| SAR measured                                          | 250 mW input power | 9.60 mW / g                       |
| SAR normalized                                        | normalized to 1W   | 38.4 mW / g                       |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | <b>38.6 mW / g ± 17.0 % (k=2)</b> |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                                   |
|---------------------------------------------------------|--------------------|-----------------------------------|
| SAR measured                                            | 250 mW input power | 5.09 mW / g                       |
| SAR normalized                                          | normalized to 1W   | 20.4 mW / g                       |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | <b>20.4 mW / g ± 16.5 % (k=2)</b> |



## Appendix

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.6 $\Omega$ - 2.0 j $\Omega$ |
| Return Loss                          | - 33.5 dB                      |

### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 46.9 $\Omega$ - 0.9 j $\Omega$ |
| Return Loss                          | - 29.5 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.198 ns |
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

|                 |                  |
|-----------------|------------------|
| Manufactured by | SPEAG            |
| Manufactured on | October 20, 2006 |

## DASY5 Validation Report for Head TSL

Date/Time: 18.02.2010 13:22:16

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1950 MHz; Type: D1950V3; Serial: D1950V3 - SN1117**

Communication System: CW; Frequency: 1950 MHz; Duty Cycle: 1:1

Medium: HSL1950

Medium parameters used:  $f = 1950 \text{ MHz}$ ;  $\sigma = 1.35 \text{ mho/m}$ ;  $\epsilon_r = 40.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

### DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.96, 4.96, 4.96); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

**Head/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

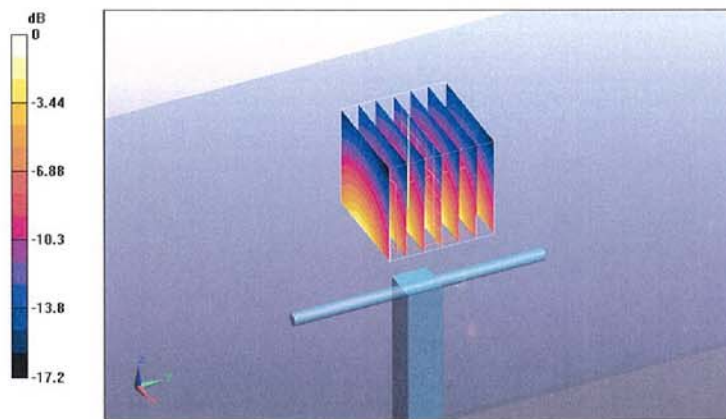
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 96.8 V/m; Power Drift = 0.061 dB

Peak SAR (extrapolated) = 17.6 W/kg

**SAR(1 g) = 9.83 mW/g; SAR(10 g) = 5.18 mW/g**

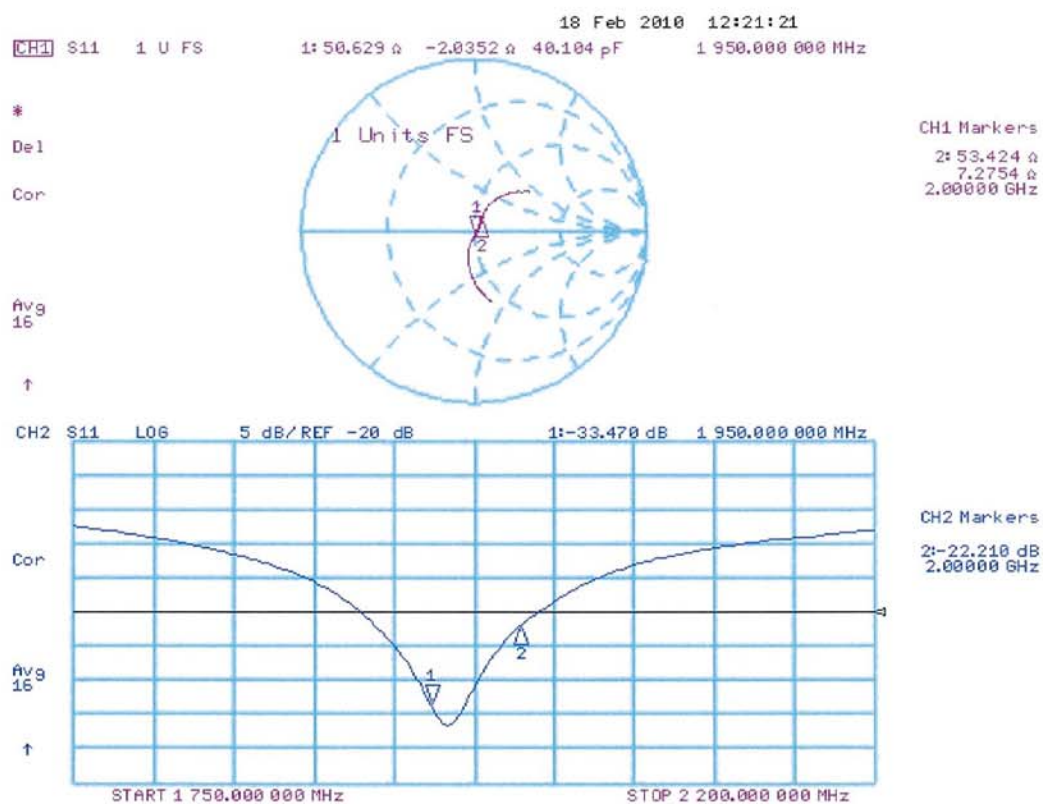
Maximum value of SAR (measured) = 12 mW/g



0 dB = 12mW/g



## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date/Time: 18.02.2010 17:00:47

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1950 MHz; Type: D1950V3; Serial: D1950V3 - SN1117**

Communication System: CW; Frequency: 1950 MHz; Duty Cycle: 1:1

Medium: MSL1950

Medium parameters used:  $f = 1950 \text{ MHz}$ ;  $\sigma = 1.51 \text{ mho/m}$ ;  $\epsilon_r = 53.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.7, 4.7, 4.7); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

**Body (above 1GHz)/d=10mm, Pin250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)**

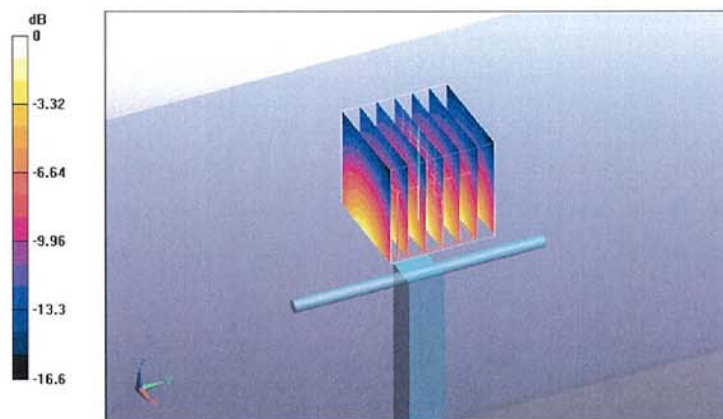
(7x7x7)/Cube 0: Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 94.3 V/m; Power Drift = 0.013 dB

Peak SAR (extrapolated) = 16.1 W/kg

**SAR(1 g) = 9.6 mW/g; SAR(10 g) = 5.09 mW/g**

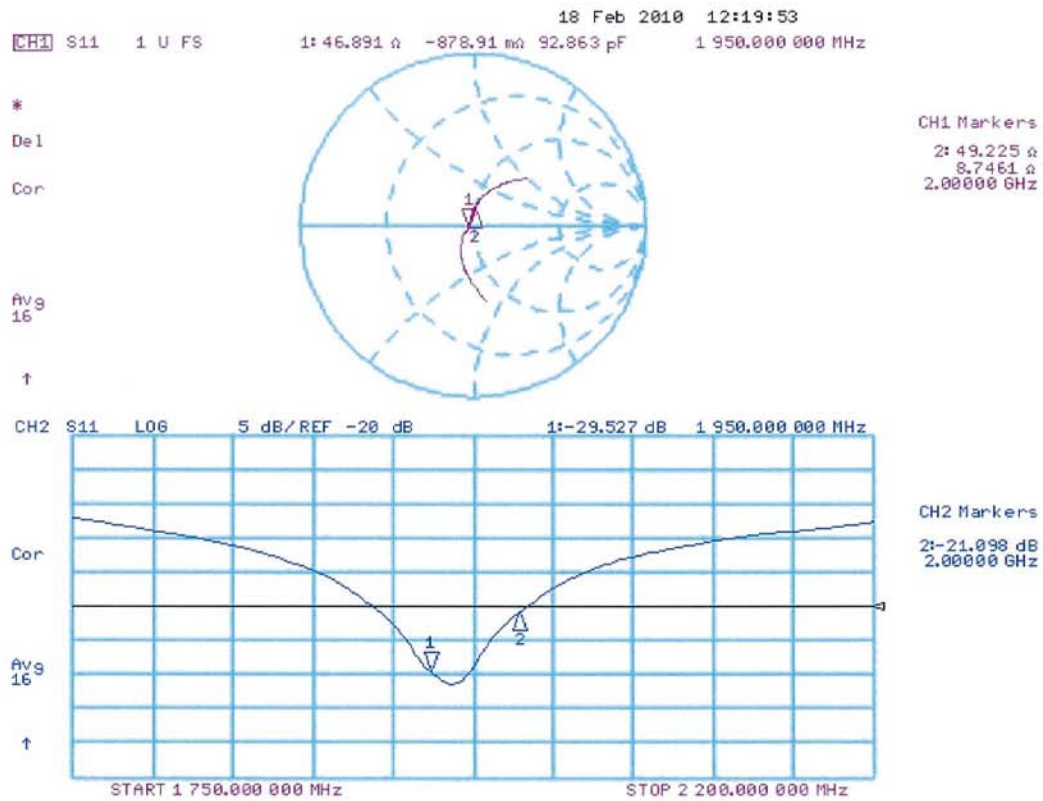
Maximum value of SAR (measured) = 12 mW/g



0 dB = 12mW/g



## Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **ES3-3071\_Jun10**

## CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3071**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2  
Calibration procedure for dosimetric E-field probes**

Calibration date: **June 22, 2010**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID #            | Cal Date (Certificate No.)     | Scheduled Calibration |
|----------------------------|-----------------|--------------------------------|-----------------------|
| Power meter E4419B         | GB41293874      | 1-Apr-10 (No. 217-01136)       | Apr-11                |
| Power sensor E4412A        | MY41495277      | 1-Apr-10 (No. 217-01136)       | Apr-11                |
| Power sensor E4412A        | MY41498087      | 1-Apr-10 (No. 217-01136)       | Apr-11                |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 30-Mar-10 (No. 217-01159)      | Mar-11                |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 30-Mar-10 (No. 217-01161)      | Mar-11                |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 30-Mar-10 (No. 217-01160)      | Mar-11                |
| Reference Probe ES3DV2     | SN: 3013        | 30-Dec-09 (No. ES3-3013_Dec09) | Dec-10                |
| DAE4                       | SN: 660         | 20-Apr-10 (No. DAE4-660_Apr10) | Apr-11                |

| Secondary Standards       | ID #         | Check Date (in house)             | Scheduled Check        |
|---------------------------|--------------|-----------------------------------|------------------------|
| RF generator HP 8648C     | US3642U01700 | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585   | 18-Oct-01 (in house check Oct-09) | In house check: Oct10  |

|                | Name           | Function              | Signature |
|----------------|----------------|-----------------------|-----------|
| Calibrated by: | Jeton Kastrati | Laboratory Technician |           |
| Approved by:   | Katja Pokovic  | Technical Manager     |           |

Issued: June 22, 2010

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Certificate No: ES3-3071\_Jun10

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Accreditation No.: **SCS 108**

### Glossary:

|                          |                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| TSL                      | tissue simulating liquid                                                                                                                                |
| NORM <sub>x,y,z</sub>    | sensitivity in free space                                                                                                                               |
| ConvF                    | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                              |
| DCP                      | diode compression point                                                                                                                                 |
| CF                       | crest factor (1/duty_cycle) of the RF signal                                                                                                            |
| A, B, C                  | modulation dependent linearization parameters                                                                                                           |
| Polarization $\phi$      | $\phi$ rotation around probe axis                                                                                                                       |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ is normal to probe axis |

### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.



ES3DV3 SN:3071

June 22, 2010

# Probe ES3DV3

## SN:3071

|                  |                   |
|------------------|-------------------|
| Manufactured:    | December 14, 2004 |
| Last calibrated: | June 22, 2009     |
| Recalibrated:    | June 22, 2010     |

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



ES3DV3 SN:3071

June 22, 2010

## DASY/EASY - Parameters of Probe: ES3DV3 SN:3071

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|-----------------------------------------------------------|----------|----------|----------|-----------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.24     | 1.22     | 0.97     | ± 10.1%   |
| DCP (mV) <sup>B</sup>                                     | 96.6     | 92.2     | 92.6     |           |

### Modulation Calibration Parameters

| UID   | Communication System Name | PAR  |   | A<br>dB | B<br>dBuV | C    | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-------|---------------------------|------|---|---------|-----------|------|----------|---------------------------|
| 10000 | CW                        | 0.00 | X | 0.00    | 0.00      | 1.00 | 300.0    | ± 1.5%                    |
|       |                           |      | Y | 0.00    | 0.00      | 1.00 | 300.0    |                           |
|       |                           |      | Z | 0.00    | 0.00      | 1.00 | 300.0    |                           |

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.



ES3DV3 SN:3071

June 22, 2010

## DASY/EASY - Parameters of Probe: ES3DV3 SN:3071

### Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] | Validity [MHz] <sup>c</sup> | Permittivity | Conductivity | ConvF X | ConvF Y | ConvF Z | Alpha | Depth Unc (k=2) |
|---------|-----------------------------|--------------|--------------|---------|---------|---------|-------|-----------------|
| 835     | ± 50 / ± 100                | 41.5 ± 5%    | 0.90 ± 5%    | 5.81    | 5.81    | 5.81    | 0.98  | 1.02 ± 11.0%    |
| 900     | ± 50 / ± 100                | 41.5 ± 5%    | 0.97 ± 5%    | 5.67    | 5.67    | 5.67    | 0.75  | 1.15 ± 11.0%    |
| 1750    | ± 50 / ± 100                | 40.1 ± 5%    | 1.37 ± 5%    | 4.94    | 4.94    | 4.94    | 0.35  | 1.77 ± 11.0%    |
| 1900    | ± 50 / ± 100                | 40.0 ± 5%    | 1.40 ± 5%    | 4.73    | 4.73    | 4.73    | 0.57  | 1.35 ± 11.0%    |
| 2000    | ± 50 / ± 100                | 40.0 ± 5%    | 1.40 ± 5%    | 4.67    | 4.67    | 4.67    | 0.56  | 1.35 ± 11.0%    |
| 2450    | ± 50 / ± 100                | 39.2 ± 5%    | 1.80 ± 5%    | 4.20    | 4.20    | 4.20    | 0.38  | 1.93 ± 11.0%    |

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



ES3DV3 SN:3071

June 22, 2010

## DASY/EASY - Parameters of Probe: ES3DV3 SN:3071

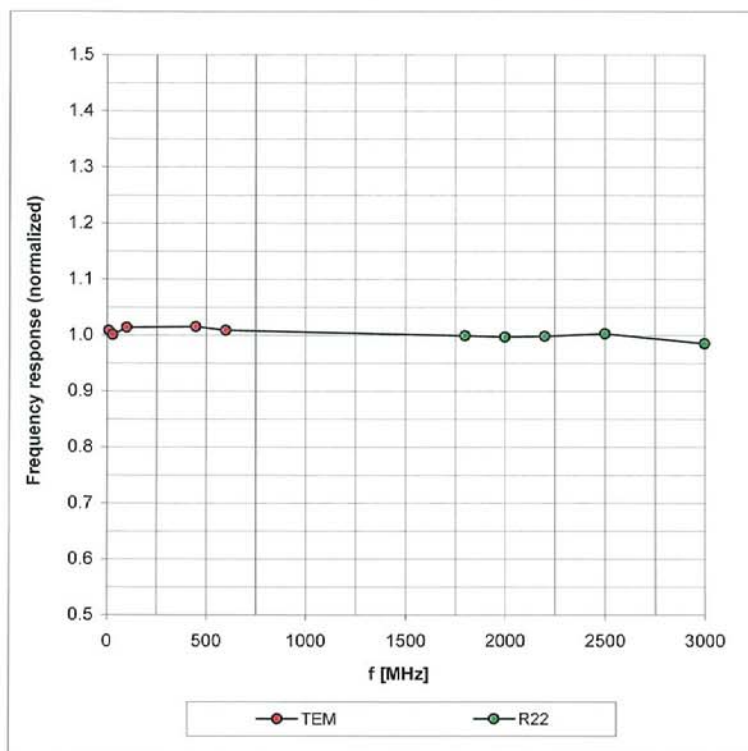
### Calibration Parameter Determined in Body Tissue Simulating Media

| f [MHz] | Validity [MHz] <sup>c</sup> | Permittivity | Conductivity | ConvF X | ConvF Y | ConvF Z | Alpha | Depth Unc (k=2) |
|---------|-----------------------------|--------------|--------------|---------|---------|---------|-------|-----------------|
| 835     | ± 50 / ± 100                | 55.2 ± 5%    | 0.97 ± 5%    | 5.79    | 5.79    | 5.79    | 0.73  | 1.17 ± 11.0%    |
| 900     | ± 50 / ± 100                | 55.0 ± 5%    | 1.05 ± 5%    | 5.71    | 5.71    | 5.71    | 0.85  | 1.14 ± 11.0%    |
| 1750    | ± 50 / ± 100                | 53.4 ± 5%    | 1.49 ± 5%    | 4.52    | 4.52    | 4.52    | 0.40  | 1.79 ± 11.0%    |
| 1900    | ± 50 / ± 100                | 53.3 ± 5%    | 1.52 ± 5%    | 4.30    | 4.30    | 4.30    | 0.38  | 2.04 ± 11.0%    |
| 2000    | ± 50 / ± 100                | 53.3 ± 5%    | 1.52 ± 5%    | 4.36    | 4.36    | 4.36    | 0.42  | 1.91 ± 11.0%    |
| 2450    | ± 50 / ± 100                | 52.7 ± 5%    | 1.95 ± 5%    | 4.00    | 4.00    | 4.00    | 0.80  | 1.25 ± 11.0%    |

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

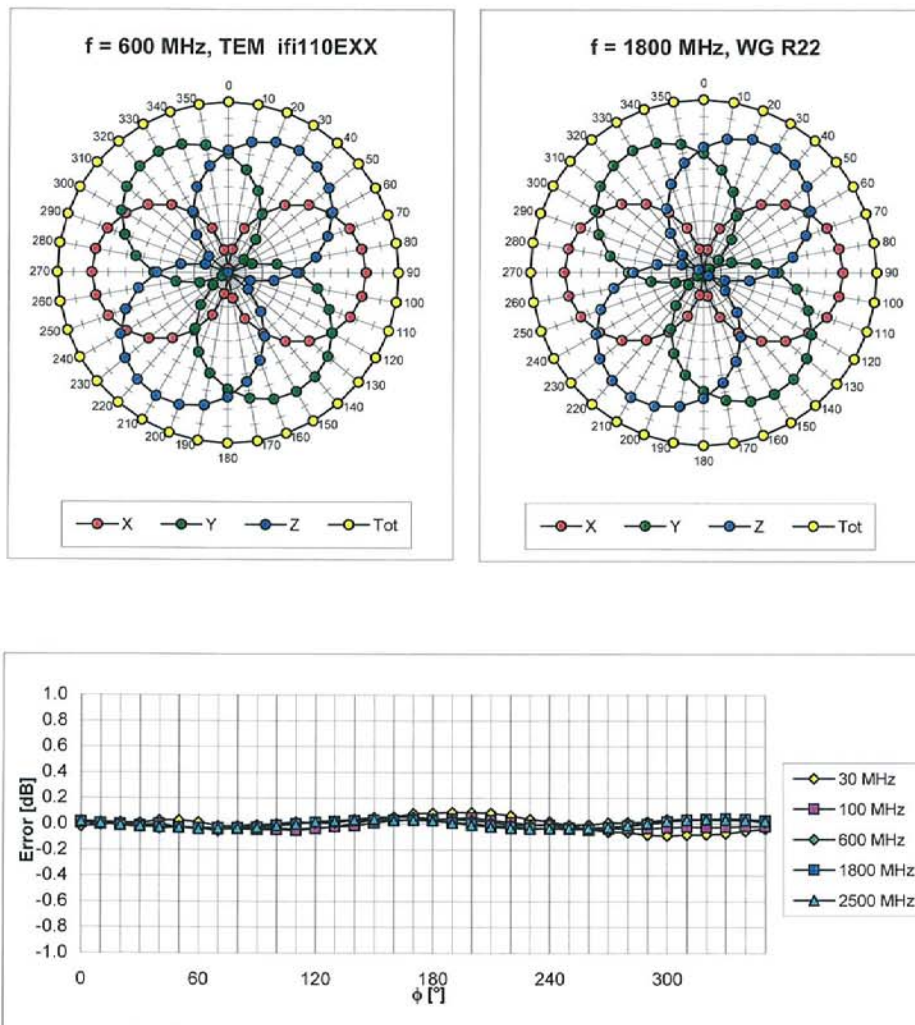
## Frequency Response of E-Field

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



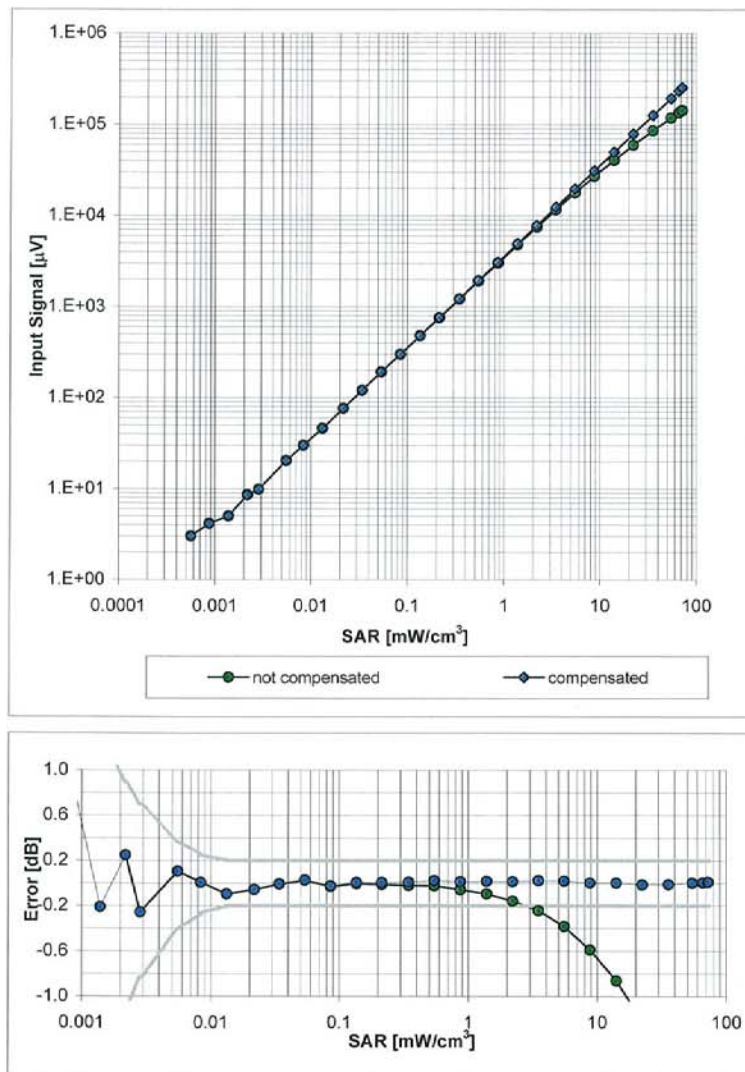
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

## Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



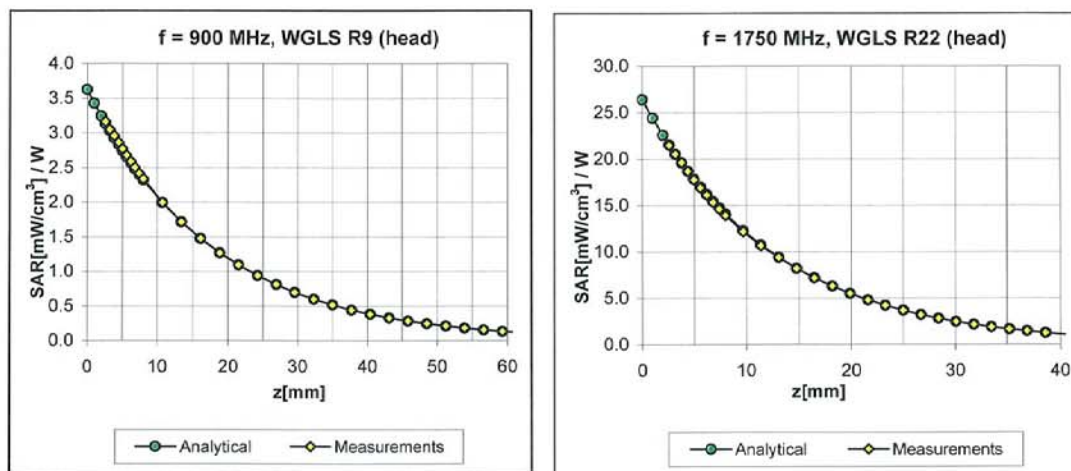
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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



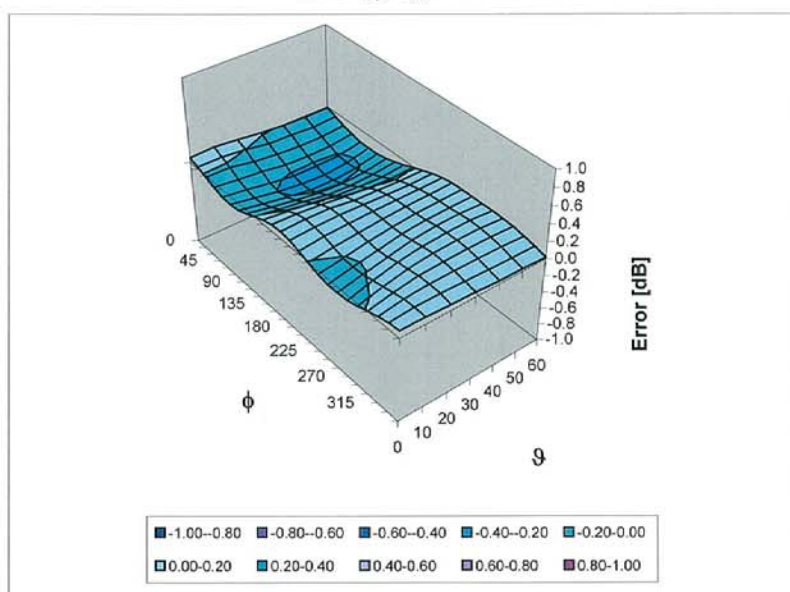
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Conversion Factor Assessment



## Deviation from Isotropy in HSL

Error ( $\phi$ ,  $\theta$ ), f = 900 MHz



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



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## Other Probe Parameters

|                                               |                |
|-----------------------------------------------|----------------|
| Sensor Arrangement                            | Triangular     |
| Connector Angle (°)                           | Not applicable |
| Mechanical Surface Detection Mode             | enabled        |
| Optical Surface Detection Mode                | disabled       |
| Probe Overall Length                          | 337 mm         |
| Probe Body Diameter                           | 10 mm          |
| Tip Length                                    | 10 mm          |
| Tip Diameter                                  | 4.0 mm         |
| Probe Tip to Sensor X Calibration Point       | 2 mm           |
| Probe Tip to Sensor Y Calibration Point       | 2 mm           |
| Probe Tip to Sensor Z Calibration Point       | 2 mm           |
| Recommended Measurement Distance from Surface | 3 mm           |



**Calibration Laboratory of**  
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Accreditation No.: **SCS 108**

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

Client **ATL (Auden)**

Certificate No: **DAE4-541\_Jul10**

## CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 541**

Calibration procedure(s) **QA CAL-06.v21**  
**Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **July 21, 2010**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards             | ID #               | Cal Date (Certificate No.) | Scheduled Calibration  |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278        | 1-Oct-09 (No: 9055)        | Oct-10                 |
| Secondary Standards           | ID #               | Check Date (in house)      | Scheduled Check        |
| Calibrator Box V1.1           | SE UMS 006 AB 1004 | 07-Jun-10 (in house check) | In house check: Jun-11 |

|                |                   |              |           |
|----------------|-------------------|--------------|-----------|
| Calibrated by: | Name              | Function     | Signature |
|                | Dominique Steffen | Technician   |           |
| Approved by:   | Name              | Function     | Signature |
|                | Fin Bomholt       | R&D Director |           |

Issued: July 21, 2010

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

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

## Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.



### DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V, full range = -100...+300 mV

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

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

| Calibration Factors | X                        | Y                        | Z                        |
|---------------------|--------------------------|--------------------------|--------------------------|
| High Range          | 404.537 $\pm$ 0.1% (k=2) | 404.418 $\pm$ 0.1% (k=2) | 404.182 $\pm$ 0.1% (k=2) |
| Low Range           | 3.96832 $\pm$ 0.7% (k=2) | 3.93576 $\pm$ 0.7% (k=2) | 3.97526 $\pm$ 0.7% (k=2) |

### Connector Angle

|                                           |                                     |
|-------------------------------------------|-------------------------------------|
| Connector Angle to be used in DASY system | 290.5 $^{\circ}$ $\pm$ 1 $^{\circ}$ |
|-------------------------------------------|-------------------------------------|

## Appendix

### 1. DC Voltage Linearity

| High Range        | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 200007.6                  | -2.45                        | -0.00     |
| Channel X + Input | 20002.71                  | 3.11                         | 0.02      |
| Channel X - Input | -19993.80                 | 5.60                         | -0.03     |
| Channel Y + Input | 200009.7                  | 0.90                         | 0.00      |
| Channel Y + Input | 19997.49                  | -2.11                        | -0.01     |
| Channel Y - Input | -20001.06                 | -0.96                        | 0.00      |
| Channel Z + Input | 200007.5                  | -0.73                        | -0.00     |
| Channel Z + Input | 20001.10                  | 1.40                         | 0.01      |
| Channel Z - Input | -19996.58                 | 3.52                         | -0.02     |

| Low Range         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2000.2                    | 0.31                         | 0.02      |
| Channel X + Input | 199.75                    | -0.05                        | -0.03     |
| Channel X - Input | -200.44                   | -0.34                        | 0.17      |
| Channel Y + Input | 2001.5                    | 1.51                         | 0.08      |
| Channel Y + Input | 199.36                    | -0.64                        | -0.32     |
| Channel Y - Input | -200.93                   | -0.93                        | 0.47      |
| Channel Z + Input | 2000.3                    | 0.13                         | 0.01      |
| Channel Z + Input | 198.98                    | -1.02                        | -0.51     |
| Channel Z - Input | -201.02                   | -1.02                        | 0.51      |

### 2. Common mode sensitivity

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

|           | Common mode Input Voltage (mV) | High Range Average Reading ( $\mu\text{V}$ ) | Low Range Average Reading ( $\mu\text{V}$ ) |
|-----------|--------------------------------|----------------------------------------------|---------------------------------------------|
| Channel X | 200                            | 11.44                                        | 10.03                                       |
|           | - 200                          | -8.47                                        | -10.20                                      |
| Channel Y | 200                            | 1.54                                         | 1.18                                        |
|           | - 200                          | -2.96                                        | -2.67                                       |
| Channel Z | 200                            | 1.08                                         | 0.90                                        |
|           | - 200                          | -2.05                                        | -2.13                                       |

### 3. Channel separation

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

|           | Input Voltage (mV) | Channel X ( $\mu\text{V}$ ) | Channel Y ( $\mu\text{V}$ ) | Channel Z ( $\mu\text{V}$ ) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200                | -                           | 1.55                        | -0.83                       |
| Channel Y | 200                | 2.34                        | -                           | 3.70                        |
| Channel Z | 200                | 0.27                        | -0.67                       | -                           |

#### 4. AD-Converter Values with inputs shorted

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

|           | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16010            | 15908           |
| Channel Y | 15784            | 14840           |
| Channel Z | 15973            | 16097           |

#### 5. Input Offset Measurement

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

Input 10M $\Omega$

|           | Average ( $\mu$ V) | min. Offset ( $\mu$ V) | max. Offset ( $\mu$ V) | Std. Deviation ( $\mu$ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | -0.03              | -0.96                  | 1.03                   | 0.29                      |
| Channel Y | -0.54              | -1.32                  | 0.40                   | 0.34                      |
| Channel Z | -0.86              | -1.49                  | -0.32                  | 0.26                      |

#### 6. Input Offset Current

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

#### 7. Input Resistance

|           | Zeroing (MOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 0.2000         | 199.5            |
| Channel Y | 0.2000         | 203.1            |
| Channel Z | 0.2001         | 203.2            |

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

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

#### 9. Power Consumption (verified during pre test)

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