# SAR TEST REPORT

| | |
|---|---|
| **Equipment Under Test** | Netbook Computer |
| **Model Number** | FCC : 20033XXXX, 6909XXXX(X=0~9,A~Z or Blank)<br>IC : 20033,6909 |
| **Company Name** | Quanta Computer INC. |
| **Company Address** | No.188,Wen Hua 2nd Road,Kuei Shan Hsiang,Tao Yuan Hsien,Taiwan |
| **Date of Receipt** | 2009.07.17 |
| **Date of Test(s)** | 2009.08.25 |
| **Date of Issue** | 2009.08.28 |

Standards:

**FCC OET Bulletin 65 supplement C,**
**ANSI / IEEE C95.1 , C95.3, IEEE 1528,**
**KDB447498,RSS102**

In the configuration tested, the EUT complied with the standards specified above.

**Remarks:**

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS Taiwan Electronic & Communication Laboratory or testing done by SGS Taiwan Electronic & Communication Laboratory in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Electronic & Communication Laboratory in writing.

**Tested by : Ricky Huang** **Date : 2009.08.28**
**Asst. Supervisor**

**Approved by : Robert Chang** **Date : 2009.08.28**
**Tech Manager**

# Contents





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# 1. General Information

## 1.1 Testing Laboratory

| | |
|---|---|
| SGS Taiwan Ltd. Electronics & Communication Laboratory | |
| 134, Wu Kung Road, Wuku industrial zone | |
| Taipei county, Taiwan, R.O.C. | |
| Telephone | +886-2-2299-3279 |
| Fax | +886-2-2298-0488 |
| Internet | http://www.tw.sgs.com |

## 1.2 Details of Applicant

| | |
|---|---|
| Name | Quanta Computer INC. |
| Address | No.188,Wen Hua 2nd Road,Kuei Shan Hsiang,Tao Yuan Hsien,Taiwan |
| Telephone | 86-21-37748168-14025 |
| Fax | 86-21-67747135 |
| Contact Person | Meikeer Huang |
| E-mail | Meikeer.Huang@quantacn.com |

## 1.3 Description of EUT

| | |
|---|---|
| EUT Name | Netbook Computer |
| Model number | FCC :20033XXXX, 6909XXXX (X=0~9,A~Z or Blank)<br>IC : 20033,6909 |
| Brand Name | lenovo |
| FCC ID | HFS-BCM94312HMG |
| IC ID | 1787B-BCM94312HMG |
| Definition | Production unit |
| Mode of Operation | WLAN 802.11 b/g band |

| | | |
|---|---|---|
| Duty Cycle | WLAN 802.11 b/g | |
| | 1 | |
| Maximum RF Conducted Power(Peak) | WLAN802.11 b | WLAN802.11 g |
| | 17.25dbm | 18.46dbm |
| TX Frequency range (MHz) | WLAN802.11 b/g | |
| | 2412-2462 | |
| Channel Number (ARFCN) | WLAN802.11 b/g | |
| | 1-11 | |
| Power Supply | 11.1Vdc re-chargeable battery or 20Vdc by AC/DC power adapter | |
| LCD size | 11.6 ″ | |
| Antenna position of EUT |  | |
| Max. SAR Measured (1g) | **WLAN802.11b** | |
| | **0.00781W/kg** (WLAN802.11b _ CH6_ Configuration 1) | |

Note : The average conducted power of 802.11g is not 1/4 dB higher than 802.11b, thus we don't perform the WLAN802.11g SAR test.

Conducted power :

| EUT Mode | Frequency (MHz) | CH | Peak Power (dBm) | AVG. Power (dBm) |
|---|---|---|---|---|
| WLAN802.11b | 2412 | 1 | 17.25 | 14.73 |
| | 2437 | 6 | 17.21 | 14.57 |
| | 2462 | 11 | 17.11 | 14.46 |

| EUT Mode | Frequency (MHz) | CH | Peak Power (dBm) | AVG. Power (dBm) |
|---|---|---|---|---|
| WLAN802.11g | 2412 | 1 | 18.46 | 14.80 |
| | 2437 | 6 | 18.25 | 14.74 |
| | 2462 | 11 | 17.62 | 14.63 |

## 1.4 Test Environment

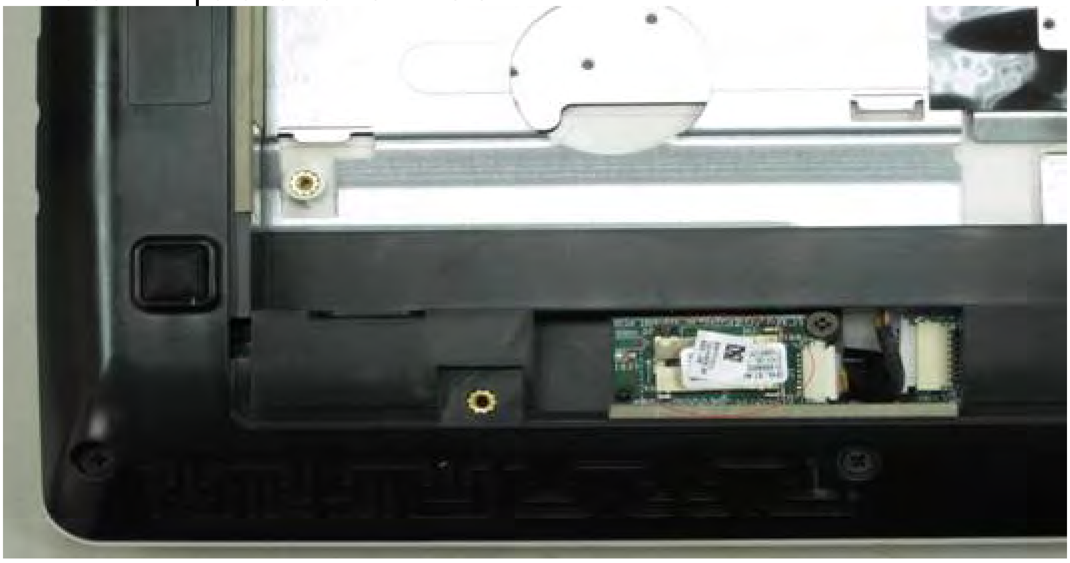
Ambient Temperature: 22±2° C
Tissue Simulating Liquid: 22±2° C

## 1.5 Operation description

Use chipset specific software to control the EUT, and makes it transmit in maximum power. Measurements are performed respectively on the lowest, middle and highest channels of the operating band(s).
The EUT is set to maximum power level during all tests, and at the beginning of each test the battery is fully charged.
The test configuration tested at the low, middle and high frequency channels.

Configuration : Bottom side of the Netbook is paralleled with flat phantom, open the panel with 90 degrees, bottom side is contact with flat phantom. (Appendix-Fig.3 & Fig.4 )

**KDB 447498 Assessment:**
WLAN-to-User Separation distance:18.5 cm
WLAN-to-BT Separation distance:30.5 cm
BT-to-user Separation distance:0.5cm



WLAN individual SAR measured:0.00781 W/kg.
BT RF conducted power= 1mW < 60/f(GHz)=25 mW. Individual SAR for BT module is not required.

Co-located SAR evaluation assessment:
WLAN-to-BT antenna separation distance is > 5 cm.
Sum of WLAN+BT SAR is 0.00781 + 0 = 0.00781 W/kg < 1.6 W/kg
Simultaneous SAR evaluation is not required.

## 1.6 The SAR Measurement System

A photograph of the SAR measurement System is given in Fig. a. This SAR Measurement System uses a Computer-controlled 3-D stepper motor system ( SPEAG DASY 4 professional system ). A Model EX3DV4 field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= $\sigma (|Ei|^2)/ \rho$ where σ and ρ are the conductivity and mass density of the tissue-simulant.

The DASY4 system for performing compliance tests consists of the following items: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- A standard high precision 6-axis robot (Staubli RX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc.

The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

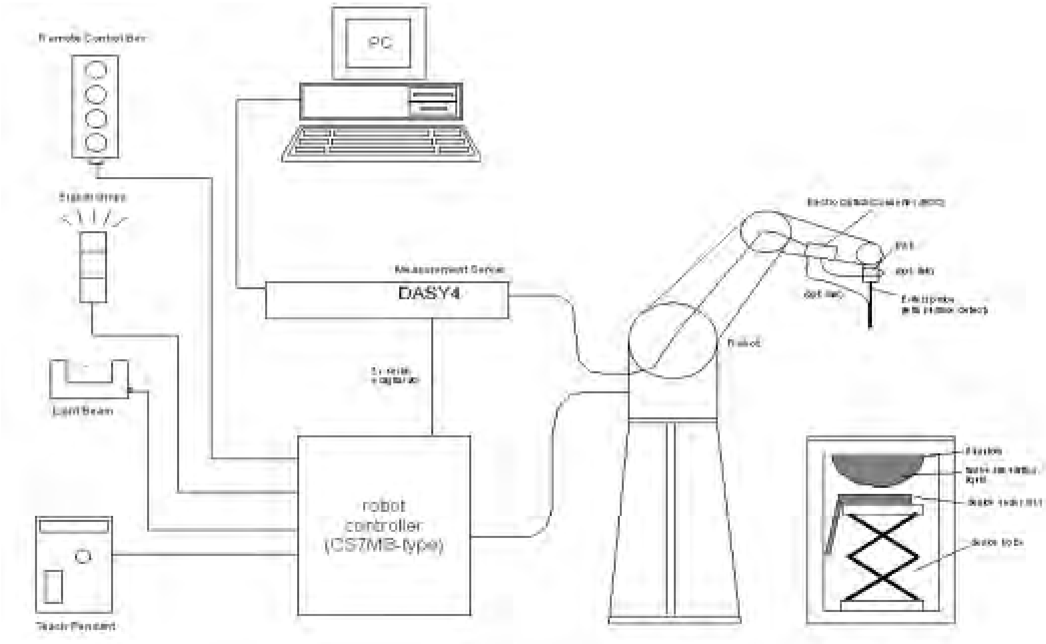


Fig.a The block diagram of SAR system

- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe

positioning.

- A computer operating Windows 2000 or Windows XP.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validate the proper functioning of the system.

## 1.7 System Components

### EX3DV4 E-Field Probe

| | | |
|---|---|---|
| Construction | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |  |
| Calibration | Basic Broad Band Calibration in air<br>Conversion Factors (CF) for HSL2450 MHZ<br>Additional CF for other liquids and frequencies upon request | |
| Frequency | 10 MHz to > 6 GHz, Linearity: ± 0.2 dB (30 MHz to 6 GHz) | |
| Directivity | ± 0.3 dB in HSL (rotation around probe axis)<br>± 0.5 dB in tissue material (rotation normal to probe axis) | |
| Dynamic Range | 10 μW/g to > 100 mW/g<br>Linearity: ± 0.2 dB (noise: typically < 1 μW/g) | |
| Dimensions | Overall length: 330 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm | |
| Application | High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%. | |


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## SAM PHANTOM V4.0C

| | | |
|---|---|---|
| Construction | The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209.<br>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. | |
| Shell Thickness | 2 ± 0.2 mm |  |
| Filling Volume | Approx. 25 liters | |
| Dimensions | Height: 251 mm;<br>Length: 1000 mm;<br>Width: 500 mm | |

## DEVICE HOLDER


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| | | |
|---|---|---|
| Construction | The device holder (Supporter) for Notebook is made by POM (polyoxymethylene resin ) , which is non-metal and non-conductive. The height can be adjusted to fit varies kind of notebooks. | <br>Device Holder |

## 1.8 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig. b. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 5% from the target SAR values. These tests were done at 2450 MHz. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1 (SAR values are normalized to 1W forward power delivered to the dipole). During the tests, the ambient temperature of the laboratory was in the range 22.1°C, the relative humidity was in the range 62% and the liquid depth above the ear reference points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

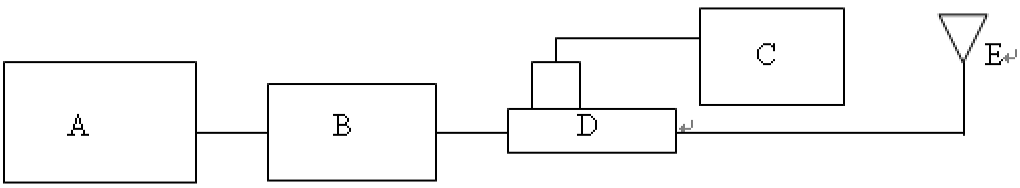
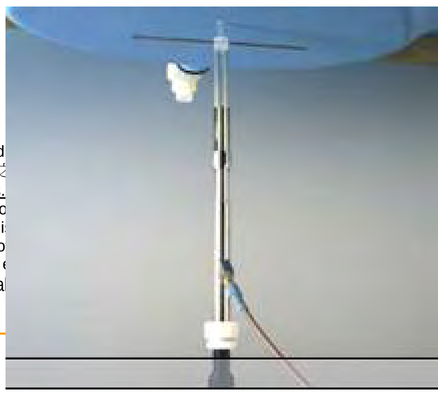



Fig.b The bloack diagram of system verification

A. Agilent Model 8648D Signal Generator



Photograph of the dipole Antenna

B. Mini circuits Model ZHL-42 Amplifier
C. Agilent Model U2001B Power Sensor
D. Agilent Model 777D Dual directional coupling
E. Reference dipole antenna

| Validation Kit | Frequency Hz | Target SAR (1g) (Pin=250mW) | Measured SAR (1g) | Measured Date |
|---|---|---|---|---|
| D2450V2 S/N: 727 | 2450 MHz (Body) | 13.2m W/g | 13.4mW/g | 2009-08-25 |

Table 1. Results of system validation

### 1.9 Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this body-simulant fluid were measured by using the Agilent Model 85070D Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with HP 8753D Network Analyzer (30 KHz-6000 MHz ) by using a procedure detailed in Section V.
All dielectric parameters of tissue simulates were measured within 24 hours of SAR measurements. The depth of the tissue simulant in the ear reference point of the phantom was 15cm±5mm during all tests. (Fig .2)

| Frequency (MHz) | Tissue type | Measurement date/ Limits | Dielectric Parameters | | |
|---|---|---|---|---|---|
| | | | ρ | σ (S/m) | Simulated Tissue Temperature(° C) |
| 2450 | Body | Measured, 2009.08.25 | 52.3 | 1.96 | 21.7 |
| | | Recommended Limits | 51.68-57.12 | 1.88-2.09 | 20-24 |

Table 2. Dielectric Parameters of Tissue Simulant Fluid

The composition of the body tissue simulating liquid is:

| Ingredient | 2450MHz (Body) |
|---|---|
| DGMBE | 301.7ml |
| Water | 698.3ml |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| | |
|---|---|
| Salt | X |
| Preventol D-7 | X |
| Cellulose | X |
| Sugar | X |
| Total amount | 1 L (1.0kg) |

Table 3. Recipes for tissue simulating liquid

## 1.10 EVALUATION PROCEDURES

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

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

The probe is calibrated at the center of the dipole sensors that 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. The angle between the probe axis and the surface normal line is less than 30 degree.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extreme of the SAR distribution. The uncertainty on the locations of the extreme is less than 1/20 of the grid size. Only local maximum within –2 dB of the global maximum are searched and passed for the Cube Scan measurement. In the Cube Scan, the


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interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5mm.

The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 7x7x7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 30x30x30mm contains about 30g of tissue.

The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume. In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

## 1.11 Test Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ("SAR") in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1–1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814.

SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and



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shall apply for portable devices transmitting in the frequency range from 100 kHz to 6 GHz. Portable devices that transmit at frequencies above 6 GHz are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter. Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 GHz should be made at a minimum distance of 5 cm from the radiating source.

(1) Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube).

(2) Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.

(3) Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section.(Table .4)

| **Human Exposure** | **Uncontrolled Environment General Population** | **Controlled Environment Occupational** |
|---|---|---|
| **Spatial Peak SAR** (Brain) | 1.60 m W/g | 8.00 m W/g |
| **Spatial Average SAR** | 0.08 m W/g | 0.40 m W/g |

| | | |
|---|---|---|
| (Whole Body) | | |
| **Spatial Peak SAR** (Hands/Feet/Ankle/Wrist) | 4.00 m W/g | 20.00 m W/g |

Table .4 RF exposure limits

Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

# 2. Summary of Results

## WLAN802.11 b

| **Configuration 1:** Bottom side of the Netbook is paralleled with flat phantom, open the panel with 90 degrees, bottom side is contact with flat phantom. | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | Channel | MHz | Conducted Output Power (Peak) | Measured(W/kg) 1g | Amb. Temp[˚C] | Liquid Temp[˚C] |
| 2450MHz | 1 | 2412 | 17.25dbm | 0.00568 | 22.1 | 21.7 |
| | 6 | 2437 | 17.21dbm | 0.00781 | 22.1 | 21.7 |
| | 11 | 2462 | 17.11dbm | 0.00748 | 22.1 | 21.7 |

Note:

SAR measurement results with transmitter at maximum output power.

# 3. Instruments List

| Manufacturer | Device | Type | Serial number | Date of last calibration |
|---|---|---|---|---|
| Schmid & Partner Engineering AG | Dosimetric E-Field Probe | EX3DV4 | 3578 | Jun.26.2009 |
| Schmid & Partner Engineering AG | 2450 MHz System Validation Dipole | D2450V2 | 727 | Apr.27.2009 |
| Schmid & Partner Engineering AG | Data acquisition Electronics | DAE4 | 547 | Jan.20.2009 |
| Schmid & Partner Engineering AG | Software | DASY 4 V4.7 Build 80 | N/A | Calibration not required |
| Schmid & Partner Engineering AG | Phantom | SAM | N/A | Calibration not required |
| Agilent | Network Analyzer | 8753D | 3410A05547 | Mar.31.2009 |
| Agilent | Dielectric Probe Kit | 85070D | US01440168 | Calibration not required |
| Agilent | Dual-directional coupler | 777D | 50114 | Aug.26.2008 |
| Agilent | RF Signal Generator | 8648D | 3847M00432 | May.25.2009 |
| Agilent | Power Sensor | U2001B | MY48100169 | Apr.23.2009 |


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| | | | | |
|---|---|---|---|---|
| R&S | Radio Communication Test | CMU200 | 113505 | Sep.03.2008 |

# 4. Measurements

Date/Time: 2009/8/25 01:05:52

## WLAN802.11 b_CH1

**DUT: 20033, 6909;**

Communication System: Wireless LAN; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: Muscle 2450 Medium parameters used: f = 2412 MHz; σ = 1.9 mho/m; $\varepsilon_r$ = 52.5; ρ = 1000 kg/$m^3$
Phantom section: Flat Section

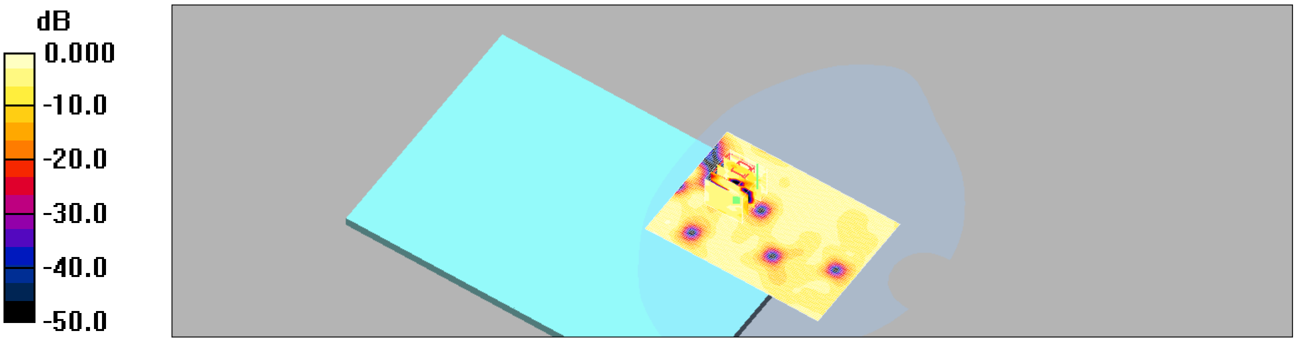
DASY4 Configuration:

- Probe: EX3DV4 - SN3578; ConvF(6.62, 6.62, 6.62); Calibrated: 2009/6/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2009/1/20
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**body/Area Scan (101x71x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.013 mW/g

**body/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.61 V/m; Power Drift = -0.165 dB
Peak SAR (extrapolated) = 0.027 W/kg

**SAR(1 g) = 0.00568 mW/g; SAR(10 g) = 0.00174 mW/g**
Maximum value of SAR (measured) = 0.018 mW/g




0 dB = 0.018mW/g

Date/Time: 2009/8/25 01:33:14

## Configuration 1_WLAN802.11 b_CH6

**DUT: 20033, 6909;**

Communication System: Wireless LAN; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: Muscle 2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.94 mho/m; $\varepsilon_r$ = 52.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

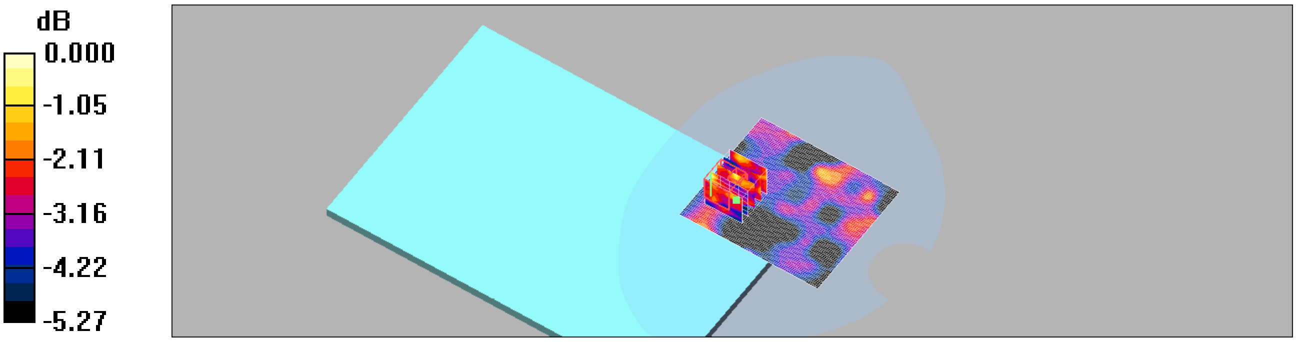
DASY4 Configuration:

- Probe: EX3DV4 - SN3578; ConvF(6.62, 6.62, 6.62); Calibrated: 2009/6/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2009/1/20
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**body/Area Scan (81x71x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.010 mW/g

**body/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.86 V/m; Power Drift = -0.147 dB
Peak SAR (extrapolated) = 0.014 W/kg

**SAR(1 g) = 0.00781 mW/g; SAR(10 g) = 0.00666 mW/g**
Maximum value of SAR (measured) = 0.012 mW/g




0 dB = 0.012mW/g

Date/Time: 2009/8/25 01:56:20

## Configuration 1_WLAN802.11 b_CH11

**DUT: 20033, 6909;**

Communication System: Wireless LAN; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: Muscle 2450 Medium parameters used: f = 2462 MHz; $\sigma$ = 1.98 mho/m; $\varepsilon_r$ = 52.3; $\rho$ = 1000 kg/$m^3$
Phantom section: Flat Section

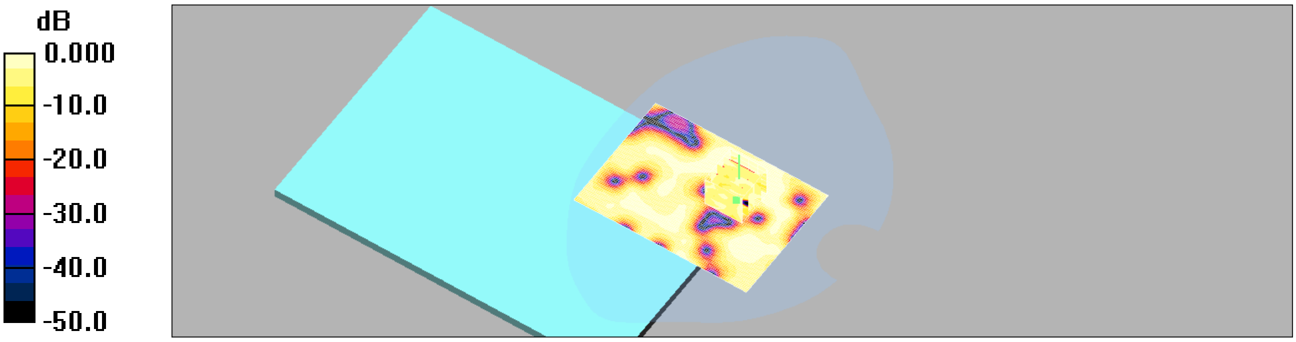
DASY4 Configuration:

- Probe: EX3DV4 - SN3578; ConvF(6.62, 6.62, 6.62); Calibrated: 2009/6/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2009/1/20
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**body/Area Scan (101x71x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.031 mW/g

**body/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.53 V/m; Power Drift = 0.150 dB
Peak SAR (extrapolated) = 0.014 W/kg

**SAR(1 g) = 0.00748 mW/g; SAR(10 g) = 0.00629 mW/g**
Maximum value of SAR (measured) = 0.014 mW/g




0 dB = 0.014mW/g

# 5. SAR System Performance Verification

Date/Time: 2009/8/25 00:13:45

**DUT: Dipole 2450 MHz;**

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M 2450 Medium parameters used: f = 2450 MHz; σ = 1.96 mho/m; $\varepsilon_r$ = 52.3; ρ = 1000 kg/$m^3$
Phantom section: Flat Section

DASY4 Configuration:

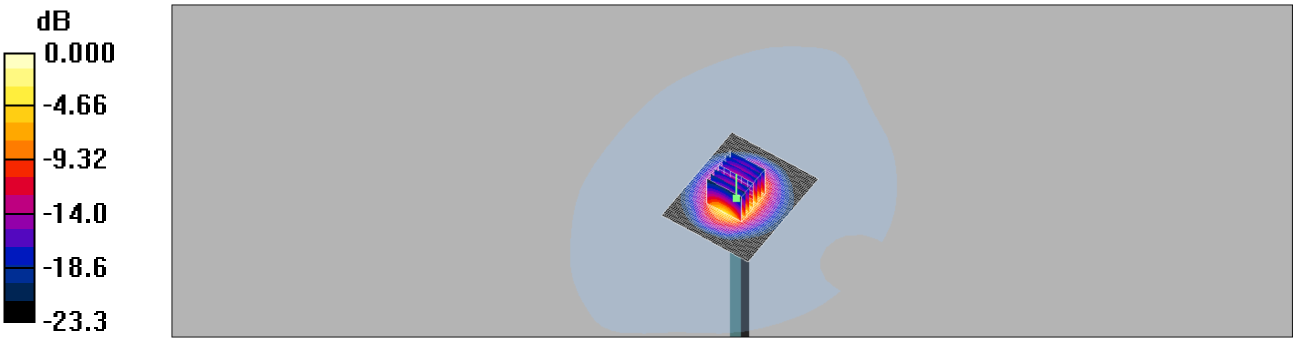
- Probe: EX3DV4 - SN3578; ConvF(6.62, 6.62, 6.62); Calibrated: 2009/6/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2009/1/20
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Pin=250mW/Area Scan (51x61x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 17.0 mW/g

**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.3 V/m; Power Drift = -0.005 dB
Peak SAR (extrapolated) = 29.4 W/kg

**SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.05 mW/g**

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




0 dB = 15.0mW/g



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# 6. DAE & Probe Calibration certificate

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

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

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

Accreditation No.: **SCS 108**

Client **SGS (Auden)**

Certificate No: **DAE4-547_Jan09**

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | DAE4 - SD 000 D04 BJ - SN: 547 |
| Calibration procedure(s) | QA CAL-06.v12<br>Calibration procedure for the data acquisition electronics (DAE) |
| Calibration date: | January 19, 2009 |
| Condition of the calibrated item | In Tolerance |

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Fluke Process Calibrator Type 702 | SN: 6295803 | 30-Sep-08 (No: 7673) | Sep-09 |
| Keithley Multimeter Type 2001 | SN: 0810278 | 30-Sep-08 (No: 7670) | Sep-09 |
| **Secondary Standards** | **ID #** | **Check Date (in house)** | **Scheduled Check** |
| Calibrator Box V1.1 | SE UMS 006 AB 1004 | 06-Jun-08 (in house check) | In house check: Jun-09 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Daniel Hess | Technician | D. Hess |
| Approved by: | Fin Bomholt | R&D Director | i.V. Bl [signature] |

Issued: January 20, 2009

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Certificate No: DAE4-547_Jan09 Page 1 of 5

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Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **EX3-3578_Jun09**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | EX3DV4 - SN:3578 |
| Calibration procedure(s) | QA CAL-01.v6, QA CAL-14.v3 and QA CAL-23.v3<br>Calibration procedure for dosimetric E-field probes |
| Calibration date: | June 26, 2009 |
| Condition of the calibrated item | In Tolerance |

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%

Calibration Equipment used (M&TE critical for calibration)

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

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

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Katja Pokovic | Technical Manager | |
| Approved by: | Niels Kuster | Quality Manager | |

Issued: June 26, 2009

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**Glossary:**

| | |
|---|---|
| TSL | tissue simulating liquid |
| NORMx,y,z | sensitivity in free space |
| ConvF | sensitivity in TSL / NORMx,y,z |
| DCP | diode compression point |
| Polarization φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis |

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

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

**Methods Applied and Interpretation of Parameters:**

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





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# Probe EX3DV4

## SN:3578

| | |
|---|---|
| Manufactured: | November 4, 2005 |
| Last calibrated: | May 20, 2008 |
| Recalibrated: | June 26, 2009 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)





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# DASY - Parameters of Probe: EX3DV4 SN:3578

**Sensitivity in Free Space**[A]

| | | |
|---|---|---|
| NormX | **0.55** ± 10.1% | $\mu V/(V/m)^2$ |
| NormY | **0.50** ± 10.1% | $\mu V/(V/m)^2$ |
| NormZ | **0.55** ± 10.1% | $\mu V/(V/m)^2$ |

**Diode Compression**[B]

| | |
|---|---|
| DCP X | **90** mV |
| DCP Y | **91** mV |
| DCP Z | **97** mV |

## Sensitivity in Tissue Simulating Liquid (Conversion Factors)

**Please see Page 8.**

## Boundary Effect

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

| Sensor Center to Phantom Surface Distance | | **2.0 mm** | **3.0 mm** |
|---|---|---|---|
| $SAR_{be}$ [%] | Without Correction Algorithm | 10.2 | 5.8 |
| $SAR_{be}$ [%] | With Correction Algorithm | 0.6 | 0.3 |

**TSL 1810 MHz Typical SAR gradient: 10 % per mm**

| Sensor Center to Phantom Surface Distance | | **2.0 mm** | **3.0 mm** |
|---|---|---|---|
| $SAR_{be}$ [%] | Without Correction Algorithm | 11.2 | 5.9 |
| $SAR_{be}$ [%] | With Correction Algorithm | 0.8 | 0.6 |

## Sensor Offset

Probe Tip to Sensor Center **1.0** mm

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

[A] The uncertainties of NormX,Y,Z do not affect the $E^2$-field uncertainty inside TSL (see Page 8).
[B] Numerical linearization parameter: uncertainty not required.





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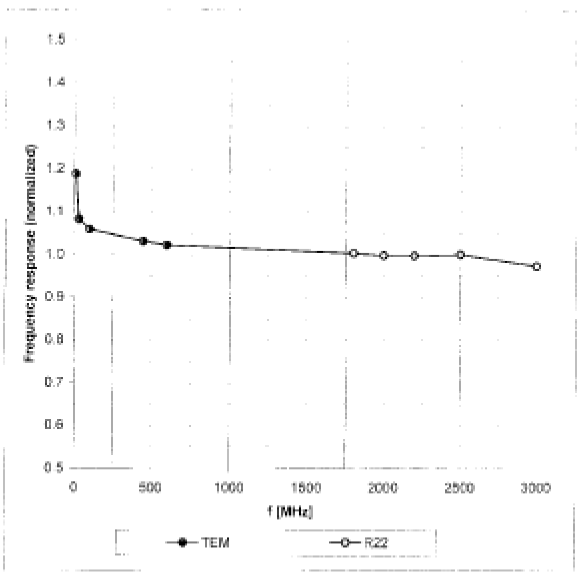
EX3DV4 SN:3578 June 26, 2009

# Frequency Response of E-Field

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




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





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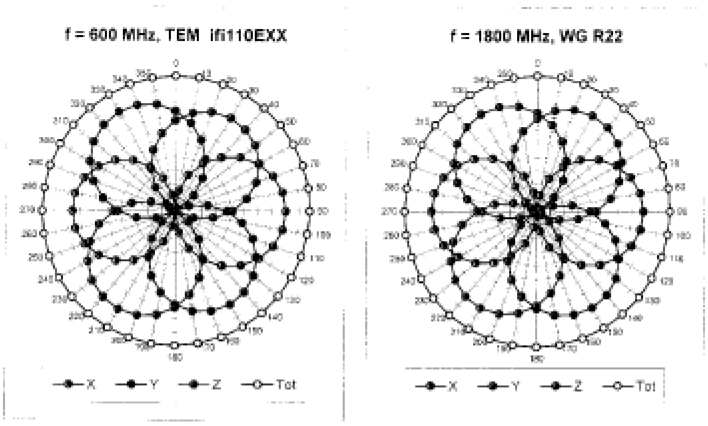
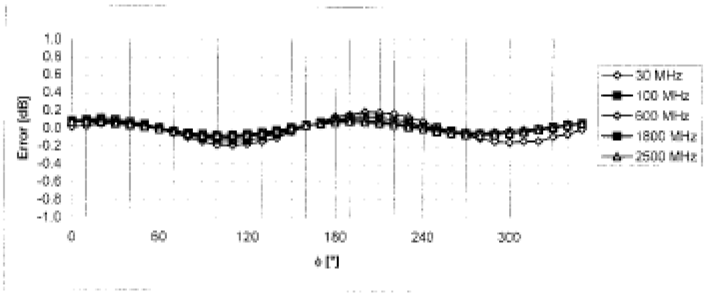
## Receiving Pattern (ϕ), ϑ = 0°




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

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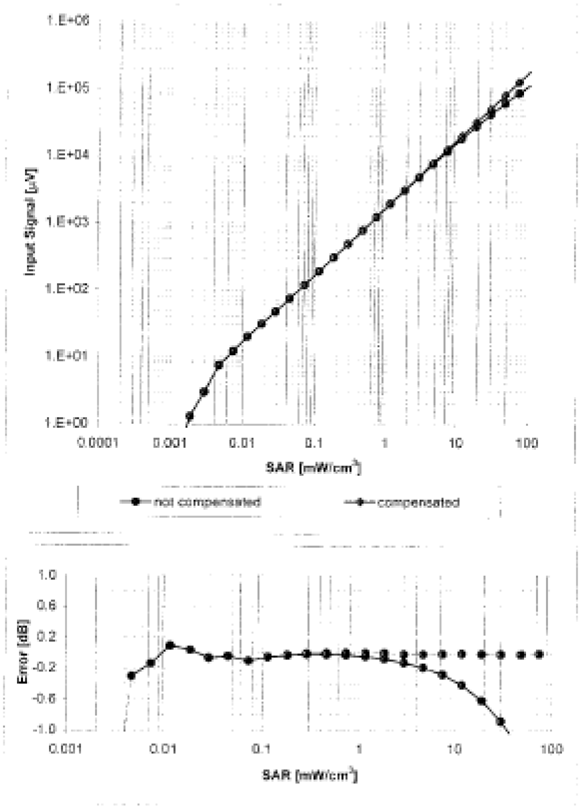
## Dynamic Range f($SAR_{head}$)

(Waveguide R22, f = 1800 MHz)




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

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# Conversion Factor Assessment

| f [MHz] | Validity [MHz][C] | TSL | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty |
|---|---|---|---|---|---|---|---|
| 835 | ± 50 / ± 100 | Head | 41.5 ± 5% | 0.90 ± 5% | 0.95 | 0.58 | 8.27 ± 11.0% (k=2) |
| 900 | ± 50 / ± 100 | Head | 41.5 ± 5% | 0.97 ± 5% | 0.83 | 0.62 | 7.97 ± 11.0% (k=2) |
| 1810 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.88 | 0.62 | 6.99 ± 11.0% (k=2) |
| 1900 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.93 | 0.60 | 6.96 ± 11.0% (k=2) |
| 2300 | ± 50 / ± 100 | Head | 39.5 ± 5% | 1.67 ± 5% | 0.79 | 0.63 | 6.71 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Head | 39.2 ± 5% | 1.80 ± 5% | 0.71 | 0.61 | 6.39 ± 11.0% (k=2) |
| 2600 | ± 50 / ± 100 | Head | 39.0 ± 5% | 1.96 ± 5% | 0.56 | 0.68 | 6.38 ± 11.0% (k=2) |
| 3500 | ± 50 / ± 100 | Head | 37.9 ± 5% | 2.91 ± 5% | 0.45 | 0.96 | 6.16 ± 13.1% (k=2) |
| 5200 | ± 50 / ± 100 | Head | 36.0 ± 5% | 4.66 ± 5% | 0.50 | 1.80 | 4.07 ± 13.1% (k=2) |
| 5300 | ± 50 / ± 100 | Head | 35.9 ± 5% | 4.76 ± 5% | 0.50 | 1.80 | 3.85 ± 13.1% (k=2) |
| 5500 | ± 50 / ± 100 | Head | 35.6 ± 5% | 4.96 ± 5% | 0.50 | 1.80 | 3.80 ± 13.1% (k=2) |
| 5600 | ± 50 / ± 100 | Head | 35.5 ± 5% | 5.07 ± 5% | 0.50 | 1.80 | 3.80 ± 13.1% (k=2) |
| 5800 | ± 50 / ± 100 | Head | 35.3 ± 5% | 5.27 ± 5% | 0.50 | 1.80 | 3.70 ± 13.1% (k=2) |
| 835 | ± 50 / ± 100 | Body | 55.2 ± 5% | 0.97 ± 5% | 0.82 | 0.64 | 8.26 ± 11.0% (k=2) |
| 900 | ± 50 / ± 100 | Body | 55.0 ± 5% | 1.05 ± 5% | 0.78 | 0.65 | 8.04 ± 11.0% (k=2) |
| 1810 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.74 | 0.67 | 6.95 ± 11.0% (k=2) |
| 1900 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.75 | 0.68 | 6.76 ± 11.0% (k=2) |
| 2300 | ± 50 / ± 100 | Body | 52.8 ± 5% | 1.85 ± 5% | 0.65 | 0.69 | 6.80 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Body | 52.7 ± 5% | 1.95 ± 5% | 0.75 | 0.62 | 6.62 ± 11.0% (k=2) |
| 2600 | ± 50 / ± 100 | Body | 52.5 ± 5% | 2.16 ± 5% | 0.51 | 0.81 | 6.47 ± 11.0% (k=2) |
| 3500 | ± 50 / ± 100 | Body | 51.3 ± 5% | 3.31 ± 5% | 0.27 | 1.51 | 5.68 ± 13.1% (k=2) |
| 5200 | ± 50 / ± 100 | Body | 49.0 ± 5% | 5.30 ± 5% | 0.60 | 1.90 | 3.70 ± 13.1% (k=2) |
| 5300 | ± 50 / ± 100 | Body | 48.5 ± 5% | 5.42 ± 5% | 0.60 | 1.90 | 3.55 ± 13.1% (k=2) |
| 5500 | ± 50 / ± 100 | Body | 48.6 ± 5% | 5.65 ± 5% | 0.55 | 1.90 | 3.42 ± 13.1% (k=2) |
| 5600 | ± 50 / ± 100 | Body | 48.5 ± 5% | 5.77 ± 5% | 0.55 | 1.90 | 3.40 ± 13.1% (k=2) |
| 5800 | ± 50 / ± 100 | Body | 48.2 ± 5% | 6.00 ± 5% | 0.60 | 1.90 | 3.40 ± 13.1% (k=2) |

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.





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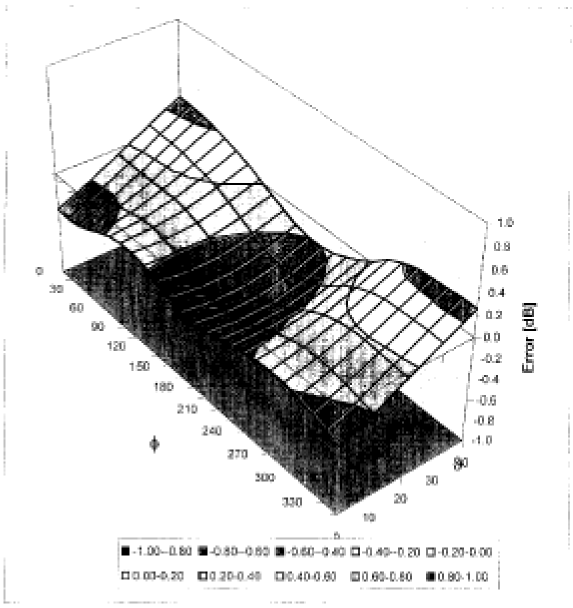
EX3DV4 SN:3578 June 26, 2009

# Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz




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

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# 7. Uncertainty Analysis

## DASY4 Uncertainty Budget
According to IEEE P1528 [1]

| Error Description | Uncertainty value | Prob. Dist. | Div. | $(c_i)$ 1g | $(c_i)$ 10g | Std. Unc. (1g) | Std. Unc. (10g) | $(v_i)$ $v_{eff}$ |
|---|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | | |
| Probe Calibration | ±4.8 % | N | 1 | 1 | 1 | ±4.8 % | ±4.8 % | ∞ |
| Axial Isotropy | ±4.7 % | R | $\sqrt{3}$ | 0.7 | 0.7 | ±1.9 % | ±1.9 % | ∞ |
| Hemispherical Isotropy | ±9.6 % | R | $\sqrt{3}$ | 0.7 | 0.7 | ±3.9 % | ±3.9 % | ∞ |
| Boundary Effects | ±1.0 % | R | $\sqrt{3}$ | 1 | 1 | ±0.6 % | ±0.6 % | ∞ |
| Linearity | ±4.7 % | R | $\sqrt{3}$ | 1 | 1 | ±2.7 % | ±2.7 % | ∞ |
| System Detection Limits | ±1.0 % | R | $\sqrt{3}$ | 1 | 1 | ±0.6 % | ±0.6 % | ∞ |
| Readout Electronics | ±1.0 % | N | 1 | 1 | 1 | ±1.0 % | ±1.0 % | ∞ |
| Response Time | ±0.8 % | R | $\sqrt{3}$ | 1 | 1 | ±0.5 % | ±0.5 % | ∞ |
| Integration Time | ±2.6 % | R | $\sqrt{3}$ | 1 | 1 | ±1.5 % | ±1.5 % | ∞ |
| RF Ambient Conditions | ±3.0 % | R | $\sqrt{3}$ | 1 | 1 | ±1.7 % | ±1.7 % | ∞ |
| Probe Positioner | ±0.4 % | R | $\sqrt{3}$ | 1 | 1 | ±0.2 % | ±0.2 % | ∞ |
| Probe Positioning | ±2.9 % | R | $\sqrt{3}$ | 1 | 1 | ±1.7 % | ±1.7 % | ∞ |
| Max. SAR Eval. | ±1.0 % | R | $\sqrt{3}$ | 1 | 1 | ±0.6 % | ±0.6 % | ∞ |
| **Test Sample Related** | | | | | | | | |
| Device Positioning | ±2.9 % | N | 1 | 1 | 1 | ±2.9 % | ±2.9 % | 875 |
| Device Holder | ±3.6 % | N | 1 | 1 | 1 | ±3.6 % | ±3.6 % | 5 |
| Power Drift | ±5.0 % | R | $\sqrt{3}$ | 1 | 1 | ±2.9 % | ±2.9 % | ∞ |
| **Phantom and Setup** | | | | | | | | |
| Phantom Uncertainty | ±4.0 % | R | $\sqrt{3}$ | 1 | 1 | ±2.3 % | ±2.3 % | ∞ |
| Liquid Conductivity (target) | ±5.0 % | R | $\sqrt{3}$ | 0.64 | 0.43 | ±1.8 % | ±1.2 % | ∞ |
| Liquid Conductivity (meas.) | ±2.5 % | N | 1 | 0.64 | 0.43 | ±1.6 % | ±1.1 % | ∞ |
| Liquid Permittivity (target) | ±5.0 % | R | $\sqrt{3}$ | 0.6 | 0.49 | ±1.7 % | ±1.4 % | ∞ |
| Liquid Permittivity (meas.) | ±2.5 % | N | 1 | 0.6 | 0.49 | ±1.5 % | ±1.2 % | ∞ |
| Combined Std. Uncertainty | | | | | | ±10.3 % | ±10.0 % | 331 |
| **Expanded STD Uncertainty** | | | | | | **±20.6 %** | **±20.1 %** | |

# 8. Phantom Description

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

## Certificate of Conformity / First Article Inspection

| | |
|---|---|
| Item | SAM Twin Phantom V4.0 |
| Type No | QD 000 P40 C |
| Series No | TP-1150 and higher |
| Manufacturer | SPEAG<br>Zeughausstrasse 43<br>CH-8004 Zürich<br>Switzerland |

**Tests**

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series items (called samples) or are tested at each item.

| Test | Requirement | Details | Units tested |
|---|---|---|---|
| Dimensions | Compliant with the geometry according to the CAD model. | IT'IS CAD File (*) | First article, Samples |
| Material thickness of shell | Compliant with the requirements according to the standards | 2mm +/- 0.2mm in flat and specific areas of head section | First article, Samples, TP-1314 ff. |
| Material thickness at ERP | Compliant with the requirements according to the standards | 6mm +/- 0.2mm at ERP | First article, All items |
| Material parameters | Dielectric parameters for required frequencies | 300 MHz – 6 GHz: Relative permittivity < 5, Loss tangent < 0.05 | Material samples |
| Material resistivity | The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe technical Note for material compatibility. | DEGMBE based simulating liquids | Pre-series, First article, Material samples |
| Sagging | Compliant with the requirements according to the standards. Sagging of the flat section when filled with tissue simulating liquid. | < 1% typical < 0.8% if filled with 155mm of HSL900 and without DUT below | Prototypes, Sample testing |

**Standards**

[1] CENELEC EN 50361
[2] IEEE Std 1528-2003
[3] IEC 62209 Part I
[4] FCC OET Bulletin 65, Supplement C, Edition 01-01
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

**Conformity**

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standards [1] to [4].

**Date** 07.07.2005

**Signature / Stamp**

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# 9. System Validation from Original equipment supplier

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

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

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

Accreditation No.: **SCS 108**

Client **SGS (Auden)**

Certificate No: **D2450V2-727_Apr09**

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D2450V2 - SN: 727 |
| Calibration procedure(s) | QA CAL-05.v7<br>Calibration procedure for dipole validation kits |
| Calibration date: | April 27, 2009 |
| Condition of the calibrated item | In Tolerance |

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter EPM-442A | GB37480704 | 08-Oct-08 (No. 217-00898) | Oct-09 |
| Power sensor HP 8481A | US37292783 | 08-Oct-08 (No. 217-00898) | Oct-09 |
| Reference 20 dB Attenuator | SN: 5086 (20g) | 31-Mar-09 (No. 217-01025) | Mar-10 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 31-Mar-09 (No. 217-01029) | Mar-10 |
| Reference Probe ES3DV2 | SN: 3025 | 28-Apr-08 (No. ES3-3025_Apr08) | Apr-09 |
| DAE4 | SN: 601 | 07-Mar-09 (No. DAE4-601_Mar09) | Mar-10 |

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

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

Issued: April 28, 2009

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

Certificate No: D2450V2-727_Apr09 Page 1 of 9


SGS Taiwan Ltd. | No.134, Wu Kung Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五工路 134 號
台灣檢驗科技股份有限公司 | t (886-2) 2299-3279 f (886-2) 2298-0488 www.tw.sgs.com
Member of SGS Group

## DASY5 Validation Report for Body TSL

Date/Time: 22.04.2009 13:12:14

Test Laboratory: SPEAG, Zurich, Switzerland

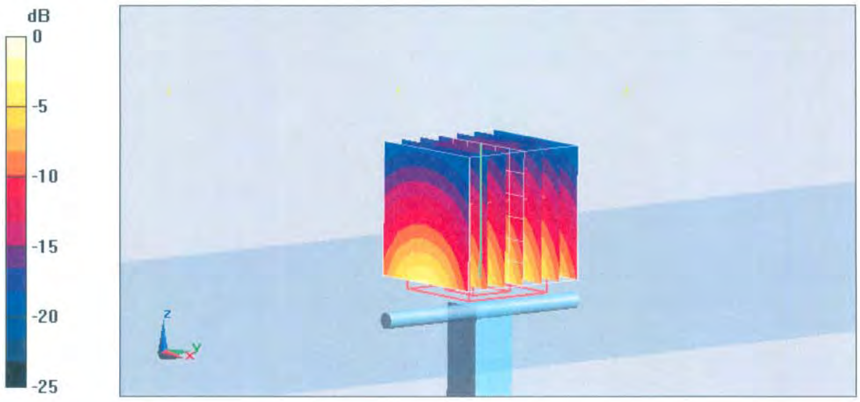
**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:727**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U10 BB
Medium parameters used: f = 2450 MHz; $\sigma$ = 1.98 mho/m; $\varepsilon_r$ = 54.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.07, 4.07, 4.07); Calibrated: 28.04.2008
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.9 V/m; Power Drift = 0.031 dB
Peak SAR (extrapolated) = 26.5 W/kg
**SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.18 mW/g**
Maximum value of SAR (measured) = 17.3 mW/g




0 dB = 17.3mW/g



## End of 1st part of report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