# TEST REPORT

| | |
|---|---|
| **Equipment Under Test** | : SEKITO WAP1 |
| **Model Number** | : KMP7N2K1-1A |
| **FCC ID** | : A98-KMP7N2K1 |
| **Applicant** | : NEC America Inc. |
| **Address of Applicant** | : Radio Communications Systems Division 6535 N, State Highway 161, Irving, TX 75039 |
| **Date of Receipt** | : 2006.03.15 |
| **Date of Test(s)** | : 2006.03.20.-2006.04.04 |
| **Date of Issue** | : 2006.04.12 |

Standards:

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

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 E&E Services or testing done by SGS Taiwan E&E Services in connection with distribution or use of the product described in this report must be approved by SGS Taiwan E&E Services in writing.

**Tested by** : **Leo Hsu** Leo. Hsu **Date** : **2006.04.12**

**Approved by** : **DIKIN YANG** Dikin Yang **Date** : **2006.04.12**

# Contents

# 1. General Information

## 1.1 Testing Laboratory

SGS Taiwan Ltd.
5F, No. 134, Wukung Road, Wuku industrial zone
Taipei county , Taiwan , R.O.C.
Telephone : +886-2-2299-3279
Fax : +886-2-2298-0488
Internet : http://www.sgs.com.tw

## 1.2 Details of Applicant

Name : NEC America Inc.
Address : Radio Communications Systems Division 6535 N, State Highway 161, Irving, TX 75039
Telephone : 214-262-4241
Fax : 214-262-4225

## 1.3 Description of EUT(s)

| | |
|---|---|
| EUT Type | SEKITO WAP1 |
| Mode of Operation | GSM/UMTS Dual Mode |
| FCC ID | A98-KMP7N2K1 |
| IMEI | 004401040160786 |
| Modulation Mode | GMSK |
| Duty Cycle | 1 / 8.3 on GSM/GPRS |
| GPRS Class | 8 ( 4 downlink & 1 uplink) |
| TX Frequency range | 1850.2-1909.8MHz |
| Channel Number (AFRFCN) | 512-810 |
| Battery Type | 3.8V Lithium-Ion |
| Antenna Type | PIFA |
| Antenna Gain | -4.5dBi |

| | |
|---|---|
| HW Version | SP |
| SW Version | W1000 |
| Exposure environment | Uncontrolled exposure |
| Max. SAR Measured (1 g) | 1.36 W/kg (At Left-Head Cheek810 Channel) |

### 1.4 Test Environment

Ambient temperature : 22.1° C

Tissue Simulating Liquid : 21.6° C

Relative Humidity : 58 %

### 1.5 Operation description

The device was controlled by using a Universal Radio Communication Tester (CMU 200). Communication between the device and the tester was established by air link. Measurements were performed on the lowest, middle and highest channels of the operating band. The phone was set to maximum power level during all tests and at the beginning of each test the battery was fully charged.
The DASY4 system measures power drift during SAR testing by comparing e-field in the same location at the beginning and at the end of measurement.

### 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 ET3DV6 1759 E-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:

- A standard high precision 6-axis robot (Stabile RX family) with controller, teach pendant and software. An arm extension 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.

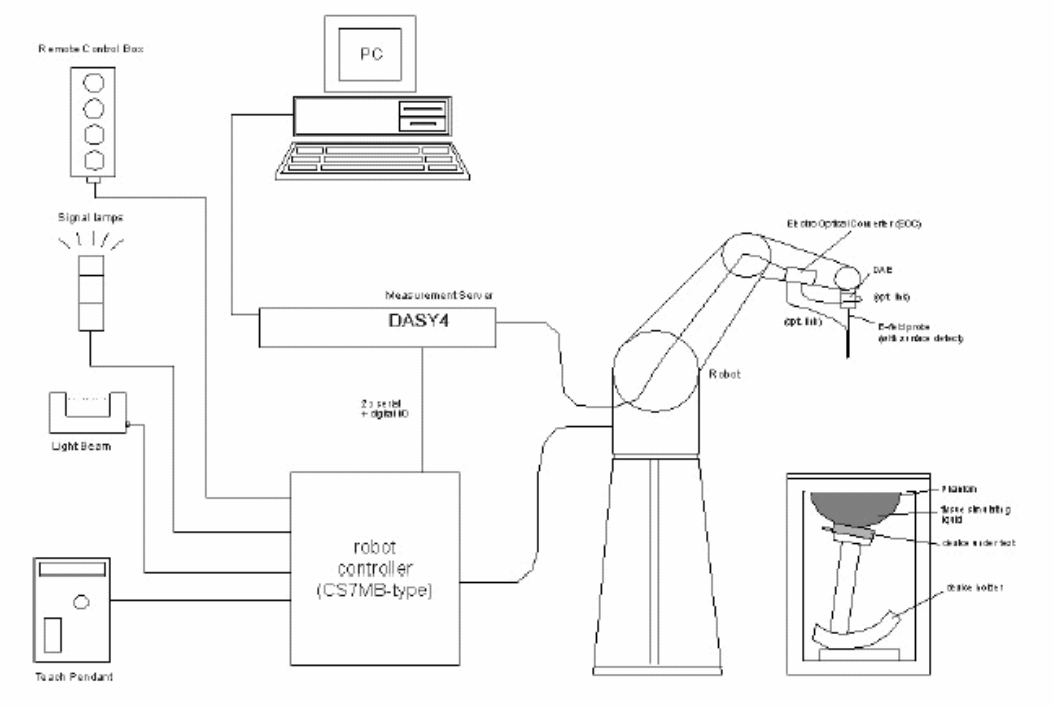


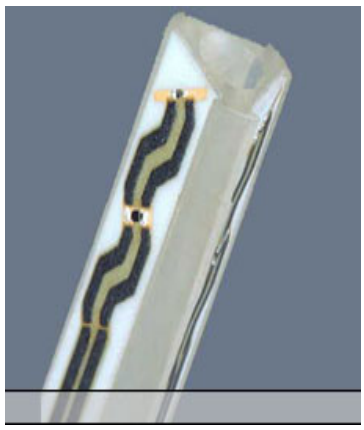

Fig. a The microwave circuit arrangement used for SAR system verification

- 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

### ET3DV6 E-Field Probe



**ET3DV6 E-Field Probe**

| | |
|---|---|
| Construction: | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material<br>(resistant to organic solvents, e.g. glycol) |
| Calibration: | In air from 10 MHz to 2.5 GHz<br>In brain simulating tissue at<br>frequencies of 850 MHz & 1900 MHz<br>(accuracy ± 8%) |
| Frequency: | 10 MHz to >6 GHz; Linearity: ±0.2 dB<br>(30 MHz to 3 GHz) |
| Directivity: | ±0.2 dB in brain tissue (rotation around probe axis)<br>±0.4 dB in brain tissue (rotation normal to probe axis) |
| Dynamic Range: | 5 µW/g to >100 mW/g; Linearity: ±0.2 dB |
| Surface. Detect: | ±0.2 mm repeatability in air and clear liquids over<br>diffuse reflecting surfaces |
| Dimensions: | Overall length: 330 mm<br>Tip length: 16 mm<br>Body diameter: 12 mm<br>Tip diameter: 6.8 mm<br>Distance from probe tip to dipole centers: 2.7 mm |
| Application: | General dosimetry up to 3 GHz<br>Compliance tests of mobile phone |

### 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**

Construction

In combination with the Twin SAM Phantom V4.0/V4.0C or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

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 +/- 10% from the target SAR values. These tests were done at 1900 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 58% 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.

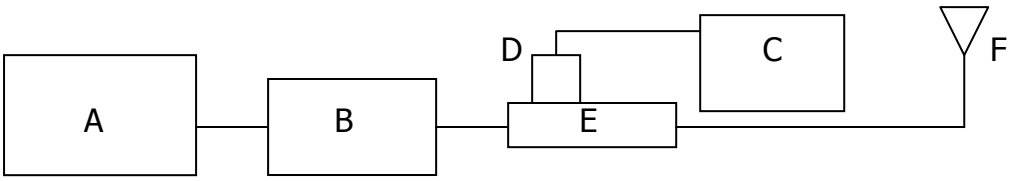
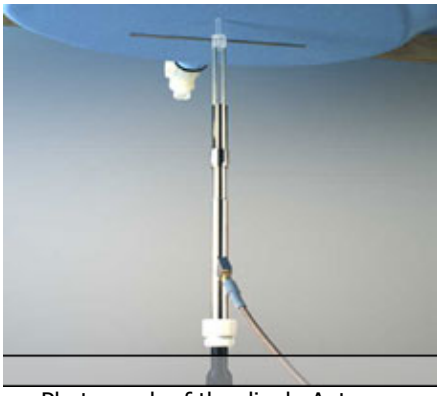



Fig.b The microwave circuit arrangement used for SAR system verification

A. Agilent Model 8648D Signal Generator
B. Mini circuits Model ZHL-42 Amplifier
C. Agilent Model E4416A Power Meter
D. Agilent Model 8481H Power Sensor
E. Agilent Model 778D and 777D
   Dual directional coupling
F. Reference dipole antenna



Photograph of the dipole Antenna

| Validation Kit | Frequency (Position) | Target SAR 1g (250mW) | Target SAR 10g (250mW) | Measured SAR 1g | Measured SAR 10g | Measured date |
|---|---|---|---|---|---|---|
| D1900V2 S/N :5d027 | 1900 MHz (Head) | 9.97 m W/g | 5.25 m W/g | 9.45 m W/g | 5.06 m W/g | 2006/03/20 |
| | 1900 MHz (Body) | 10.3 m W/g | 5.5 m W/g | 9.74 m W/g | 5.23 m W/g | 2006/03/20 |

Table 1. Results system validation

### 1.9 Tissue Simulant Fluid for the Frequency Band

| F (Mhz) | Tissue type | Limits/ Measured | Dielectric Parameters | | |
|---|---|---|---|---|---|
| | | | ρ | σ (S/m) | Simulated Tissue Temp(° C) |
| 1900 | Head | Measured, 2006.03.20 | 39.5 | 1.44 | 21.7 |
| | | Recommended Limits | 38-42 | 1.305-1.595 | 20-24 |
| | Body | Measured, 2006.03.20 | 53.2 | 1.56 | 21.7 |
| | | Recommended Limits | 50.6-56 | 1.44-1.6 | 20-24 |

Table 2. Dielectric Parameters of Tissue Simulant Fluid

The dielectric properties for this body-simulant fluid were measured by using the HP Model 85070D Dielectric Probe (rates frequence band 200 MHz to 20 GHz) in conjuncation 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 & Fig.3)

The composition of the brain tissue simulating liquid for 1900 MHz is:

| Ingredient | 1900Mhz(Head) | 1900Mhz(Body) |
|---|---|---|
| DGMBE | 444.52 g | 300.67 |
| Water | 552.42 g | 716.56 |
| Salt | 3.06 g | 4.0 |
| Preventol D-7 | X | X |
| Cellulose | X | X |
| Sugar | X | X |
| Total amount | 1 L (1.0kg) | 1 L (1.0kg) |

Table 3. Recipes for tissue simulating liquid

### 1.10 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 Radiofrequency 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 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). 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.

(2) 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** (Whole Body) | 0.08 m W/g | 0.40 m W/g |
| **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

## GSM 1900 MHZ

| Right Head (Cheek Position) | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | Channel | MHz | Conducted Output Power(Average) | Measured(W/kg) 1g/10g | Amb. Temp[°C] | Liquid Temp[°C] |
| 1900 MHz | 512 | 1850.2 | 29.56dbm | 0.443/0.229 | 22.1 | 21.6 |
| | 661 | 1880 | 30.03dbm | 0.558/0.269 | 22.1 | 21.6 |
| | 810 | 1909.8 | 28.86dbm | 0.831/0.396 | 22.1 | 21.6 |
| **Left Head (Cheek Position)** | | | | | | |
| Frequency | Channel | MHz | Conducted Output Power(Average) | Measured(W/kg) 1g/10g | Amb. Temp[°C] | Liquid Temp[°C] |
| 1900 MHz | 512 | 1850.2 | 29.56dbm | 0.811/0.387 | 22.1 | 21.6 |
| | 661 | 1880 | 30.03dbm | 1.03/0.49 | 22.1 | 21.6 |
| | 810 | 1909.8 | 28.86dbm | 1.36/0.648 | 22.1 | 21.6 |
| **Right Head (15° Tilt Position)** | | | | | | |
| Frequency | Channel | MHz | Conducted Output Power(Average) | Measured(W/kg) 1g/10g | Amb. Temp[°C] | Liquid Temp[°C] |
| 1900 MHz | 512 | 1850.2 | 29.56dbm | 0.182/0.105 | 22.1 | 21.6 |
| | 661 | 1880 | 30.03dbm | 0.255/0.145 | 22.1 | 21.6 |
| | 810 | 1909.8 | 28.86dbm | 0.371/0.211 | 22.1 | 21.6 |
| **Left Head (15° Tilt Position)** | | | | | | |
| Frequency | Channel | MHz | Conducted Output Power(Average) | Measured(W/kg) 1g/10g | Amb. Temp[°C] | Liquid Temp[°C] |
| 1900 MHz | 512 | 1850.2 | 29.56dbm | 0.195/0.111 | 22.1 | 21.6 |
| | 661 | 1880 | 30.03dbm | 0.266/0.150 | 22.1 | 21.6 |
| | 810 | 1909.8 | 28.86dbm | 0.382/0.213 | 22.1 | 21.6 |
| **Body Worn with Headset** | | | | | | |
| Frequency | Channel | MHz | Conducted Output Power(Average) | Measured(W/kg) 1g/10g | Amb. Temp[°C] | Liquid Temp[°C] |
| 1900 MHz | 512 | 1850.2 | 29.56dbm | 0.071/0.039 | 22.1 | 21.6 |
| | 661 | 1880 | 30.03dbm | 0.111/0.060 | 22.1 | 21.6 |
| | 810 | 1909.8 | 28.86dbm | 0.092/0.053 | 22.1 | 21.6 |

Note:SAR measurement results for the Mobile Phone at maximum output power.

# 3. Instruments List

| Manufacturer | Device | Type | Serial number | Date of last calibration |
|---|---|---|---|---|
| Schmid & Partner Engineering AG | Dosimetric E-Field Probe | ET3DV6 | 1759 | Aug.30.2005 |
| Schmid & Partner Engineering AG | 1900 MHz System Validation Dipole | D1900V2 | 5d027 | Mar.21.2006 |
| Schmid & Partner Engineering AG | Data acquisition Electronics | DAE3 | 547 | Feb.14.2006 |
| Schmid & Partner Engineering AG | Software | DASY 4 V4.6c Build 23 | N/A | Calibration isn't necessary |
| Schmid & Partner Engineering AG | Phantom | SAM | N/A | Calibration isn't necessary |
| Agilent | Network Analyzer | 8753D | 3410A05547 | Jun.02.2005 |
| Agilent | Dielectric Probe Kit | 85070D | US01440168 | Calibration isn't necessary |
| Agilent | Dual-directional coupler | 777D<br>778D | 50114<br>50313 | Aug.12.2005<br>Aug12.2005 |
| Agilent | RF Signal Generator | 8648D | 3847M00432 | Apr.15.2005 |
| Agilent | Power Sensor | 8481H | MY41091361 | May.27.2005 |
| Rohde & Schwarz | Universal Radio Communication Tester | CMU200 | 102189 | Oct.24.2005 |

# 4.Measurements

RE_Cheek_CH512 Date/Time: 2006/3/20 15:25:51

DUT: NEC-20060320; Type: SAKITO WAP; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used (interpolated): f = 1850.2 MHz; $\sigma$ = 1.39 mho/m; $\varepsilon_r$ = 39.6; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

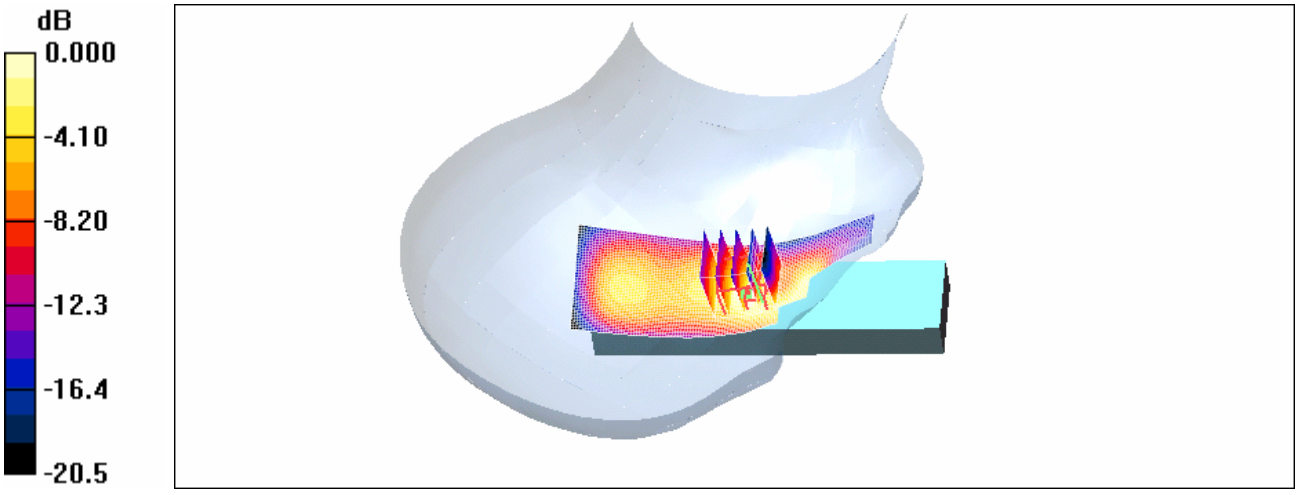
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Right Cheek/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.457 mW/g

**Right Cheek/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.4 V/m; Power Drift = -0.039 dB
Peak SAR (extrapolated) = 0.893 W/kg

**SAR(1 g) = 0.443 mW/g; SAR(10 g) = 0.229 mW/g**
Maximum value of SAR (measured) = 0.531 mW/g




0 dB = 0.531mW/g

## RE_Cheek_CH661

### DUT: NEC-20060320; Type: SAKITO WAP; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used: f = 1880 MHz; $\sigma$ = 1.42 mho/m; $\varepsilon_r$ = 39.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

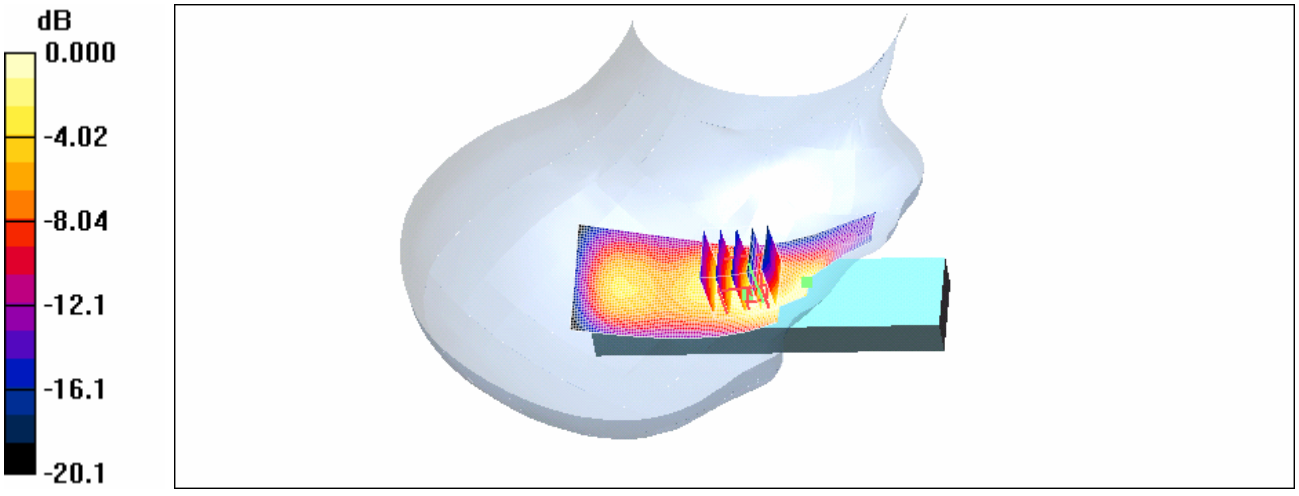
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Right Cheek/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.575 mW/g

**Right Cheek/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.4 V/m; Power Drift = 0.016 dB
Peak SAR (extrapolated) = 1.05 W/kg

**SAR(1 g) = 0.558 mW/g; SAR(10 g) = 0.269 mW/g**
Maximum value of SAR (measured) = 0.591 mW/g




0 dB = 0.591mW/g

## RE_Cheek_CH810

### DUT: NEC-20060320; Type: SAKITO WAP; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used: f = 1910 MHz; $\sigma$ = 1.45 mho/m; $\varepsilon_r$ = 39.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

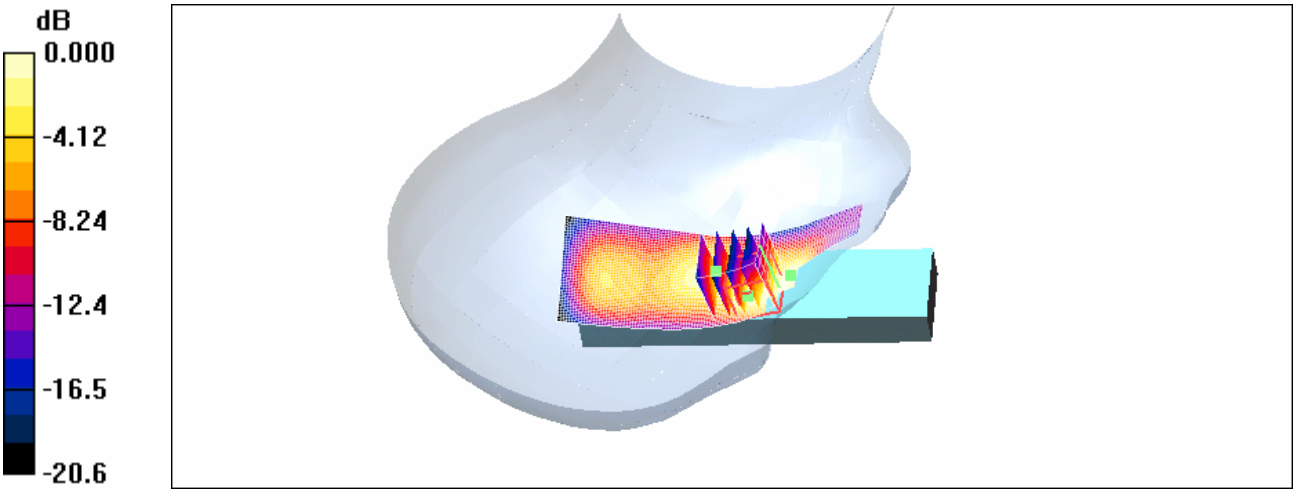
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Right Cheek/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.828 mW/g

**Right Cheek/Zoom Scan (5x5x7)/Cube 1:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.5 V/m; Power Drift = 0.007 dB
Peak SAR (extrapolated) = 1.58 W/kg

**SAR(1 g) = 0.831 mW/g; SAR(10 g) = 0.396 mW/g**
Maximum value of SAR (measured) = 0.869 mW/g




0 dB = 0.869mW/g

## LE_Cheek_CH512

### DUT: NEC-20060320; Type: GSM1900; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used (interpolated): f = 1850.2 MHz; $\sigma$ = 1.39 mho/m; $\varepsilon_r$ = 39.6; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

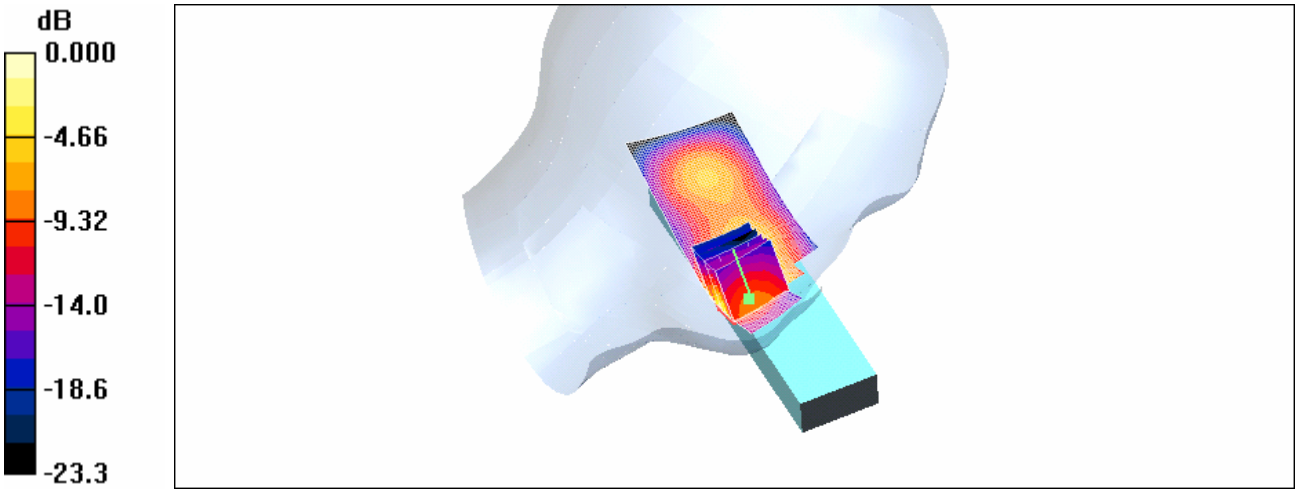
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Left Cheek/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.909 mW/g

**Left Cheek/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.1 V/m; Power Drift = 0.037 dB
Peak SAR (extrapolated) = 1.52 W/kg

**SAR(1 g) = 0.811 mW/g; SAR(10 g) = 0.387 mW/g**
Maximum value of SAR (measured) = 0.914 mW/g




0 dB = 0.914mW/g

## LE_Cheek_CH661

### DUT: NEC-SAKITO WAP; Type: GSM1900; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used: f = 1880 MHz; $\sigma$ = 1.42 mho/m; $\varepsilon_r$ = 39.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

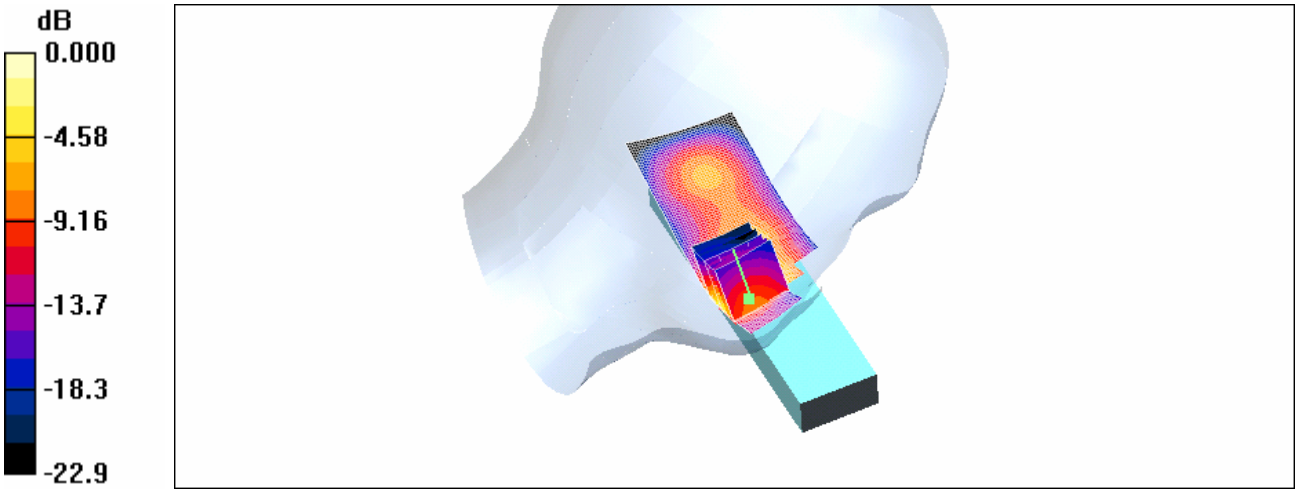
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Left Cheek/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.09 mW/g

**Left Cheek/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.1 V/m; Power Drift = -0.028 dB
Peak SAR (extrapolated) = 1.95 W/kg

**SAR(1 g) = 1.03 mW/g; SAR(10 g) = 0.490 mW/g**
Maximum value of SAR (measured) = 1.17 mW/g




0 dB = 1.17mW/g

## LE_Cheek_CH810

### DUT: NEC-SAKITO WAP; Type: GSM1900; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used: f = 1910 MHz; $\sigma$ = 1.45 mho/m; $\varepsilon_r$ = 39.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

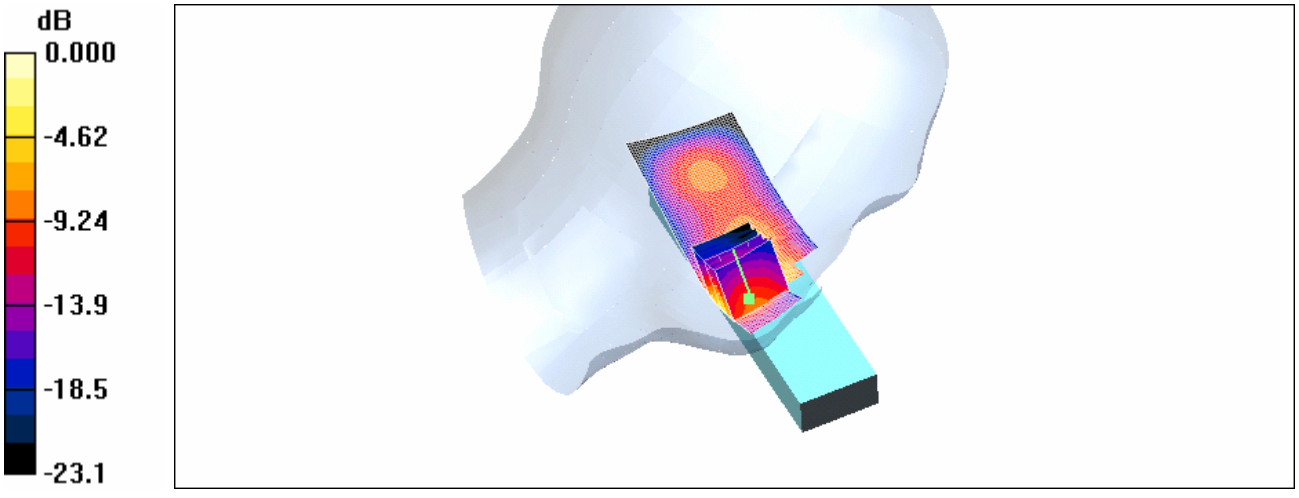
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Left Cheek/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.44 mW/g

**Left Cheek/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.3 V/m; Power Drift = -0.006 dB
Peak SAR (extrapolated) = 2.55 W/kg

**SAR(1 g) = 1.36 mW/g; SAR(10 g) = 0.648 mW/g**
Maximum value of SAR (measured) = 1.55 mW/g




0 dB = 1.55mW/g

## RE_Tilt_CH512

### DUT: NEC-20060320; Type: SAKITO WAP; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used (interpolated): f = 1850.2 MHz; $\sigma$ = 1.39 mho/m; $\varepsilon_r$ = 39.6; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

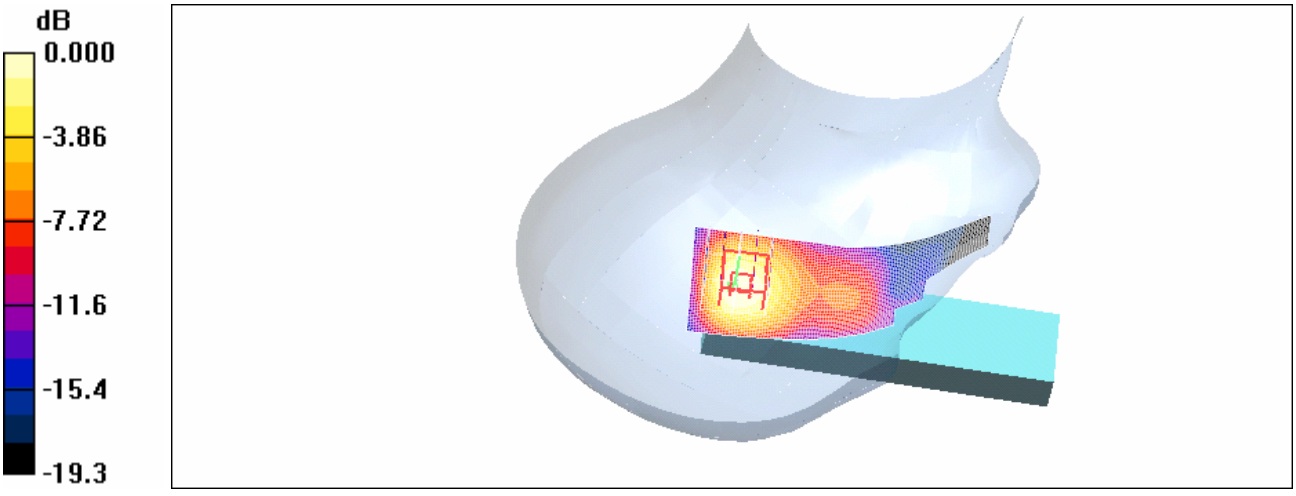
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Right Tilt/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.222 mW/g

**Right Tilt/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.3 V/m; Power Drift = 0.039 dB
Peak SAR (extrapolated) = 0.284 W/kg

**SAR(1 g) = 0.182 mW/g; SAR(10 g) = 0.105 mW/g**
Maximum value of SAR (measured) = 0.198 mW/g




0 dB = 0.198mW/g

## RE_Tilt_CH661

### DUT: NEC-20060320; Type: SAKITO WAP; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used: f = 1880 MHz; $\sigma$ = 1.42 mho/m; $\varepsilon_r$ = 39.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

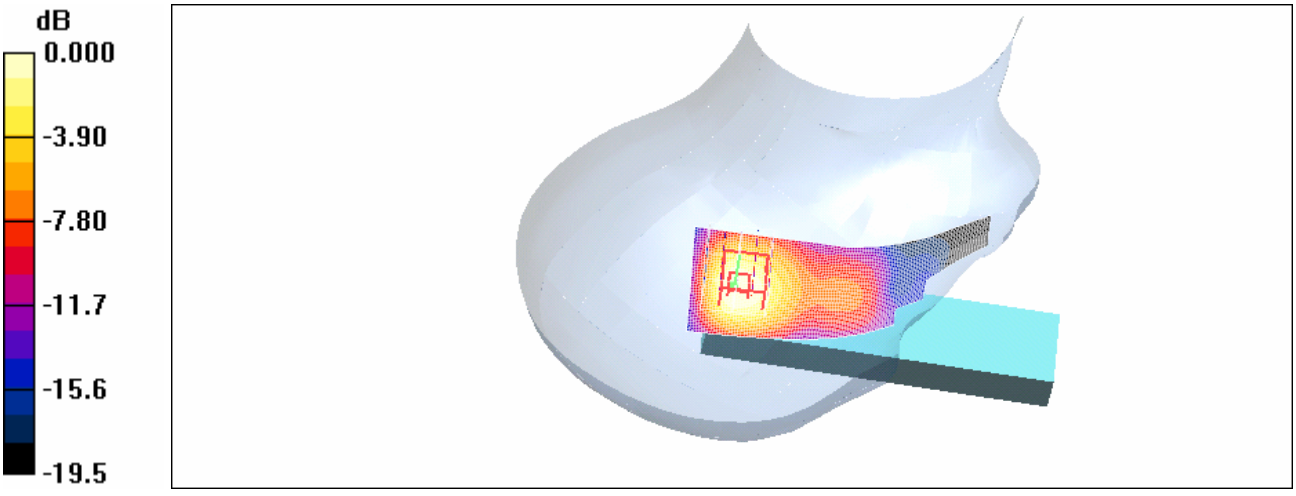
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Right Tilt/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.309 mW/g

**Right Tilt/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.5 V/m; Power Drift = 0.016 dB
Peak SAR (extrapolated) = 0.402 W/kg

**SAR(1 g) = 0.255 mW/g; SAR(10 g) = 0.145 mW/g**
Maximum value of SAR (measured) = 0.277 mW/g




0 dB = 0.277mW/g

## RE_Tilt_CH810

### DUT: NEC-20060320; Type: SAKITO WAP; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used: f = 1910 MHz; $\sigma$ = 1.45 mho/m; $\varepsilon_r$ = 39.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Right Section

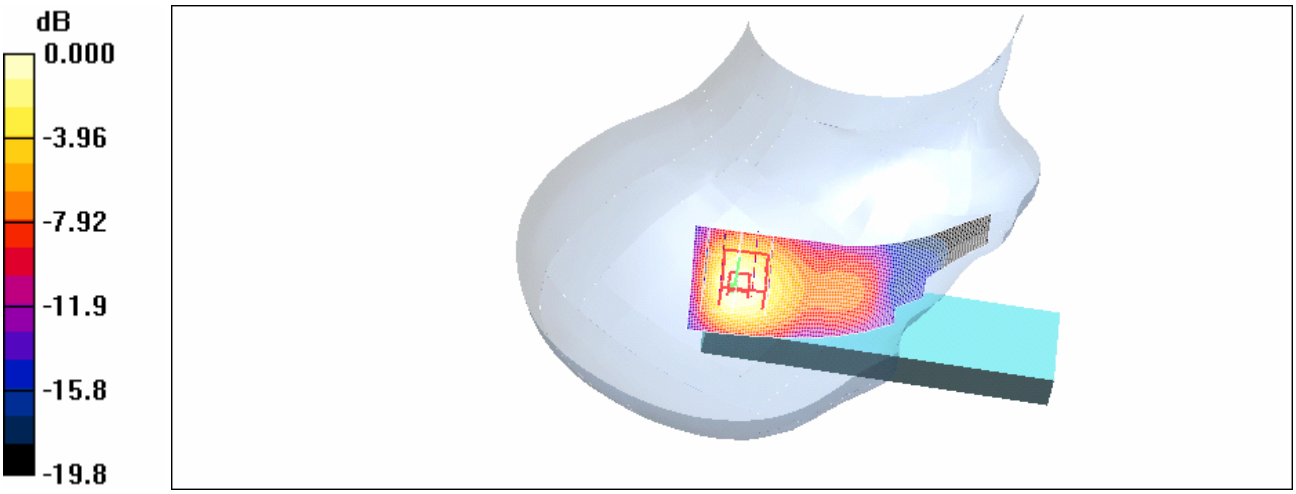
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Right Tilt/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.462 mW/g

**Right Tilt/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.4 V/m; Power Drift = 0.018 dB
Peak SAR (extrapolated) = 0.587 W/kg

**SAR(1 g) = 0.371 mW/g; SAR(10 g) = 0.211 mW/g**
Maximum value of SAR (measured) = 0.404 mW/g




0 dB = 0.404mW/g

## LE_Tilt_CH512

### DUT: NEC-SAKITO WAP; Type: GSM1900; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used (interpolated): f = 1850.2 MHz; $\sigma$ = 1.39 mho/m; $\varepsilon_r$ = 39.6; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

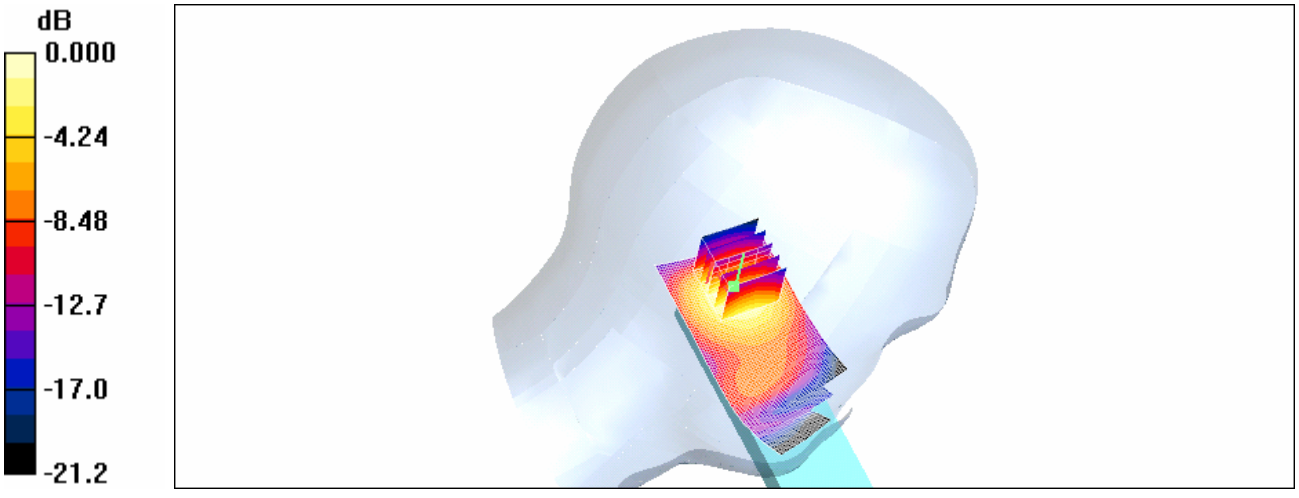
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Left Cheek/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.227 mW/g

**Left Cheek/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.5 V/m; Power Drift = -0.026 dB
Peak SAR (extrapolated) = 0.303 W/kg

**SAR(1 g) = 0.195 mW/g; SAR(10 g) = 0.111 mW/g**
Maximum value of SAR (measured) = 0.211 mW/g




0 dB = 0.211mW/g

## LE_Tilt_CH661

### DUT: NEC-SAKITO WAP; Type: GSM1900; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used: f = 1880 MHz; $\sigma$ = 1.42 mho/m; $\varepsilon_r$ = 39.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

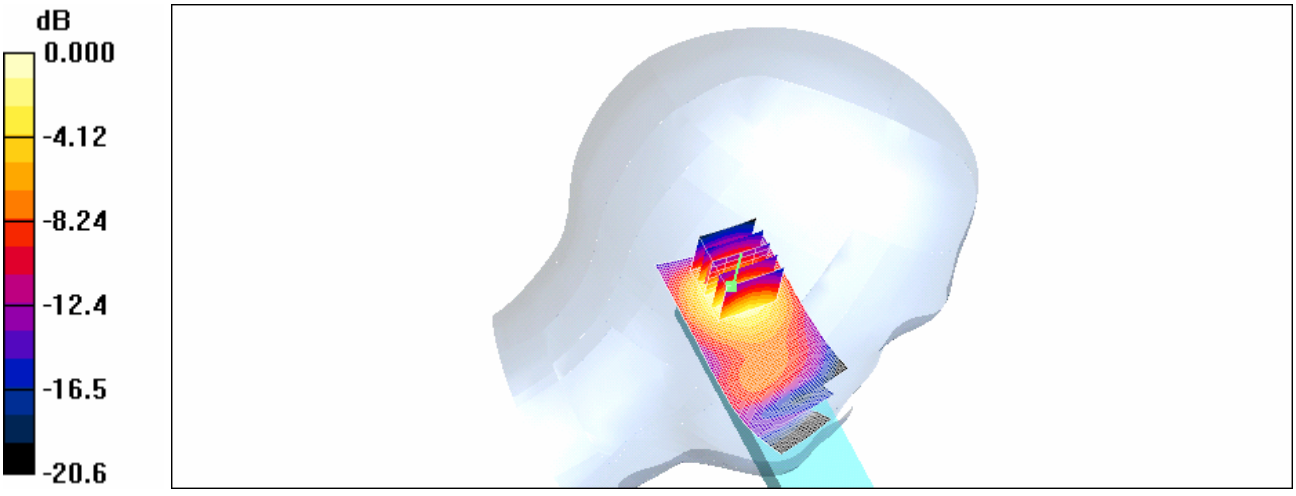
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Left Cheek/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.309 mW/g

**Left Cheek/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.3 V/m; Power Drift = 0.066 dB
Peak SAR (extrapolated) = 0.425 W/kg

**SAR(1 g) = 0.266 mW/g; SAR(10 g) = 0.150 mW/g**
Maximum value of SAR (measured) = 0.291 mW/g




0 dB = 0.291mW/g

## LE_Tilt_CH810

### DUT: NEC-SAKITO WAP; Type: GSM1900; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium: Head 1900MHz Medium parameters used: f = 1910 MHz; $\sigma$ = 1.45 mho/m; $\varepsilon_r$ = 39.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

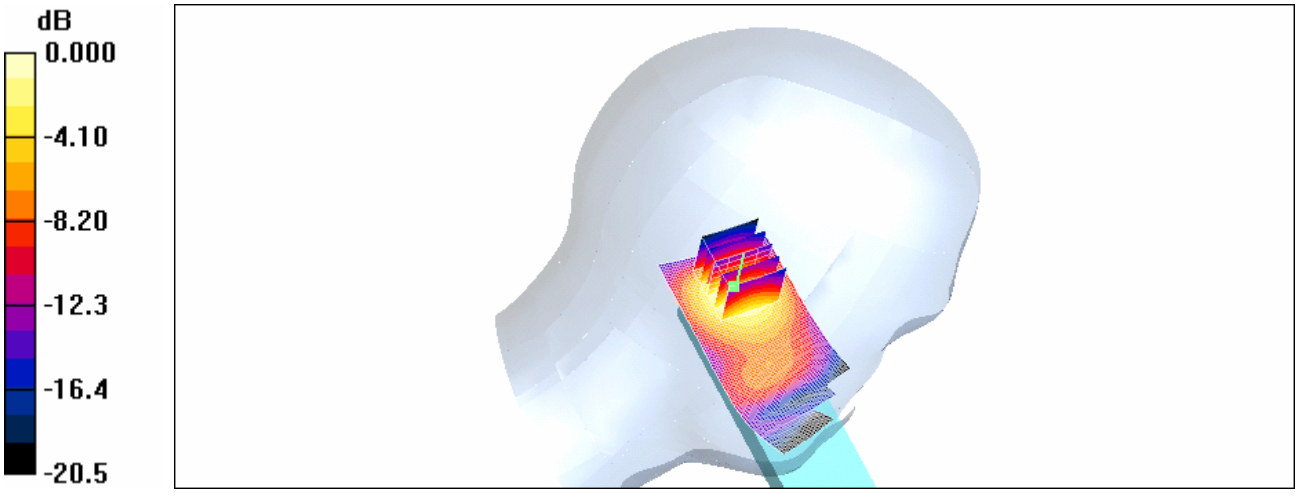
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Left Cheek/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.447 mW/g

**Left Cheek/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.0 V/m; Power Drift = 0.054 dB
Peak SAR (extrapolated) = 0.612 W/kg

**SAR(1 g) = 0.382 mW/g; SAR(10 g) = 0.213 mW/g**
Maximum value of SAR (measured) = 0.419 mW/g




0 dB = 0.419mW/g

# BODY-512

## DUT: NEC-SAKITO WAP; Type: GSM1900; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: M1800 & 1900 Medium parameters used (interpolated): f = 1850.2 MHz; $\sigma$ = 1.52 mho/m; $\varepsilon_r$ = 53.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

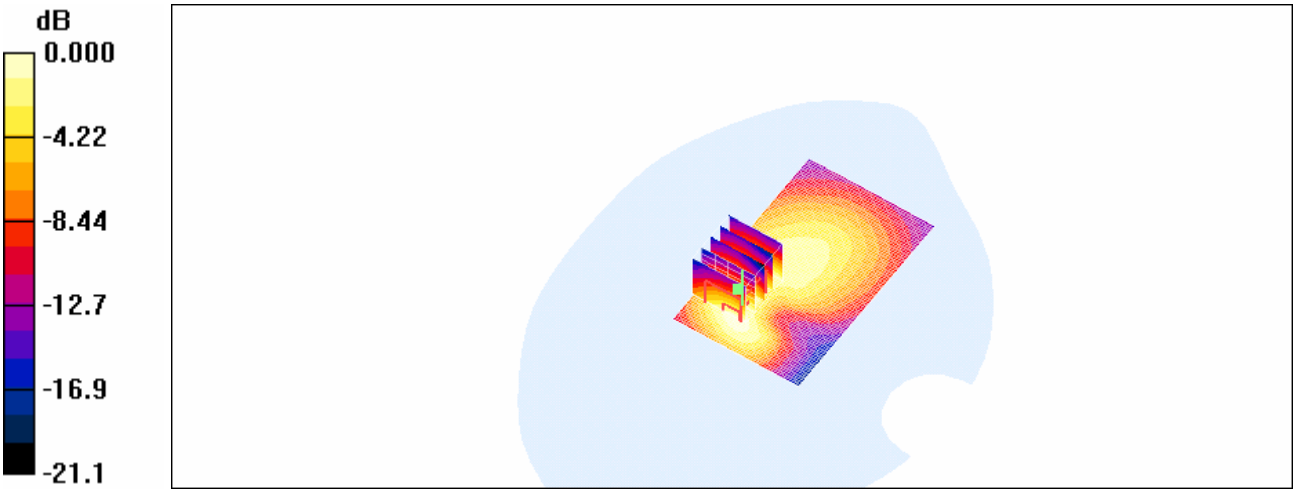
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(4.4, 4.4, 4.4); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Body/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.076 mW/g

**Body/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.18 V/m; Power Drift = -0.036 dB
Peak SAR (extrapolated) = 0.122 W/kg

**SAR(1 g) = 0.071 mW/g; SAR(10 g) = 0.039 mW/g**
Maximum value of SAR (measured) = 0.077 mW/g




0 dB = 0.077mW/g

# BODY-661

## DUT: NEC-SAKITO WAP; Type: GSM1900; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: M1800 & 1900 Medium parameters used (interpolated): f = 1880 MHz; $\sigma$ = 1.54 mho/m; $\varepsilon_r$ = 53.2; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

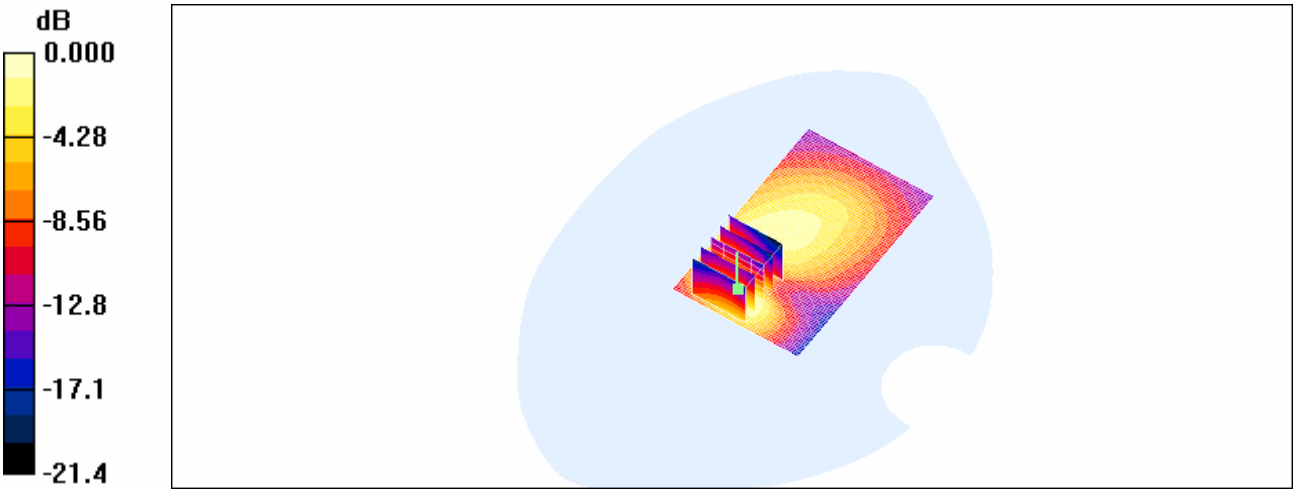
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(4.4, 4.4, 4.4); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Body/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.115 mW/g

**Body/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.62 V/m; Power Drift = -0.073 dB
Peak SAR (extrapolated) = 0.194 W/kg

**SAR(1 g) = 0.111 mW/g; SAR(10 g) = 0.060 mW/g**
Maximum value of SAR (measured) = 0.123 mW/g




0 dB = 0.123mW/g

# BODY-810

## DUT: NEC-SAKITO WAP; Type: GSM1900; Serial: 004401040160786

Communication System: GSM 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium: M1800 & 1900 Medium parameters used: f = 1910 MHz; $\sigma$ = 1.57 mho/m; $\varepsilon_r$ = 53.1; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

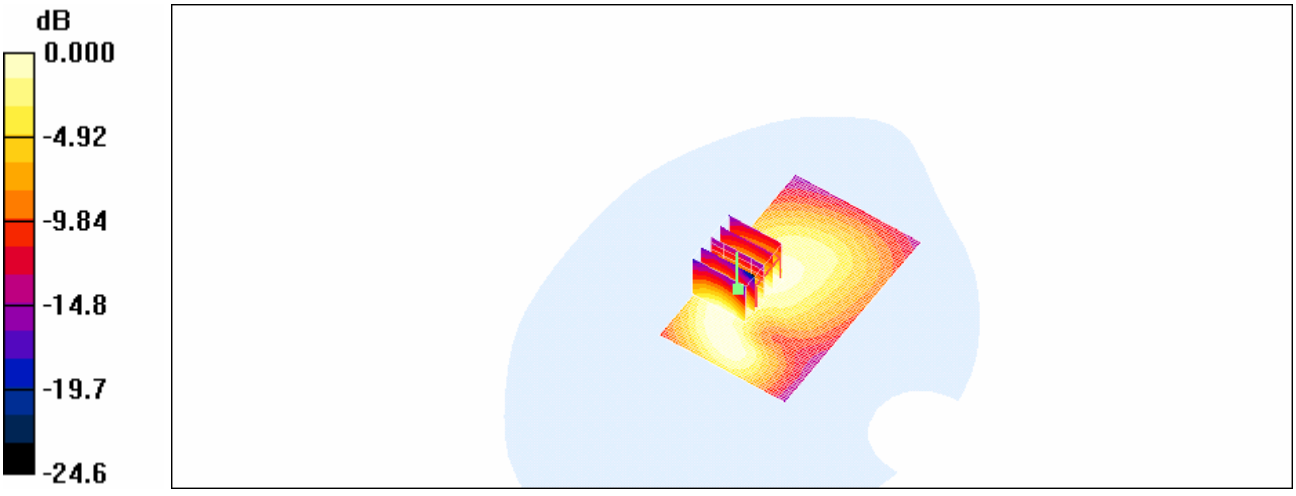
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(4.4, 4.4, 4.4); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Body/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.103 mW/g

**Body/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.19 V/m; Power Drift = -0.121 dB
Peak SAR (extrapolated) = 0.158 W/kg

**SAR(1 g) = 0.092 mW/g; SAR(10 g) = 0.053 mW/g**
Maximum value of SAR (measured) = 0.100 mW/g




0 dB = 0.100mW/g

## SAR System Performance Verification

### DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 – SN:5d027

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: Head 1900MHz Medium parameters used: f = 1900 MHz; $\sigma$ = 1.44 mho/m; $\varepsilon_r$ = 39.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

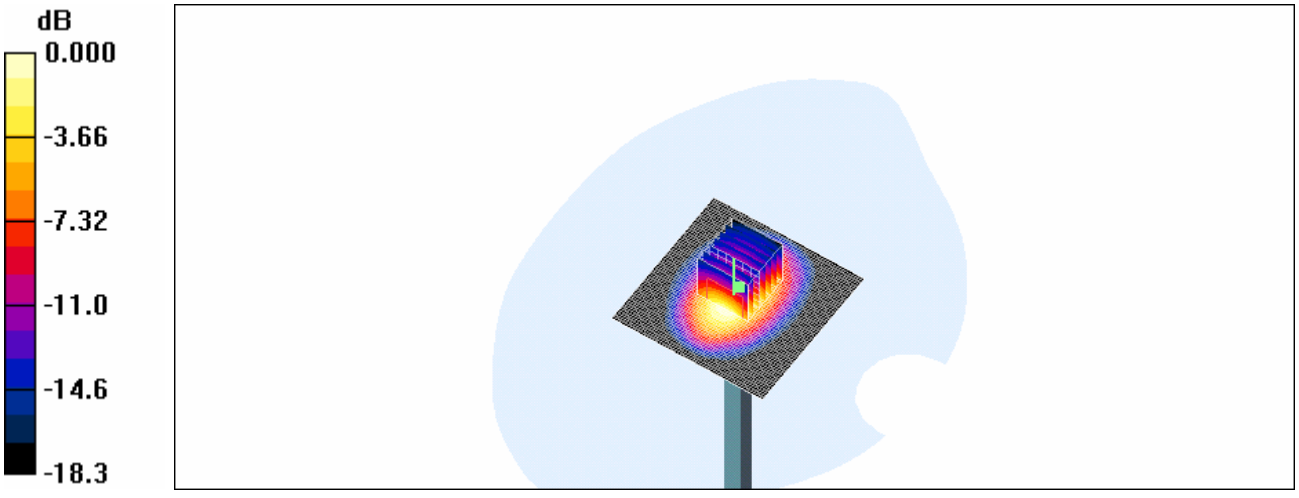
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(5.11, 5.11, 5.11); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Pin=250mw/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 11.1 mW/g

**Pin=250mw/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.7 V/m; Power Drift = -0.039 dB
Peak SAR (extrapolated) = 15.9 W/kg

**SAR(1 g) = 9.45 mW/g; SAR(10 g) = 5.06 mW/g**
Maximum value of SAR (measured) = 10.5 mW/g




0 dB = 10.5mW/g

## SAR System Performance Verification

### DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d027

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: M1800 & 1900 Medium parameters used (interpolated): f = 1900 MHz; $\sigma$ = 1.56 mho/m; $\varepsilon_r$ = 53.2; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

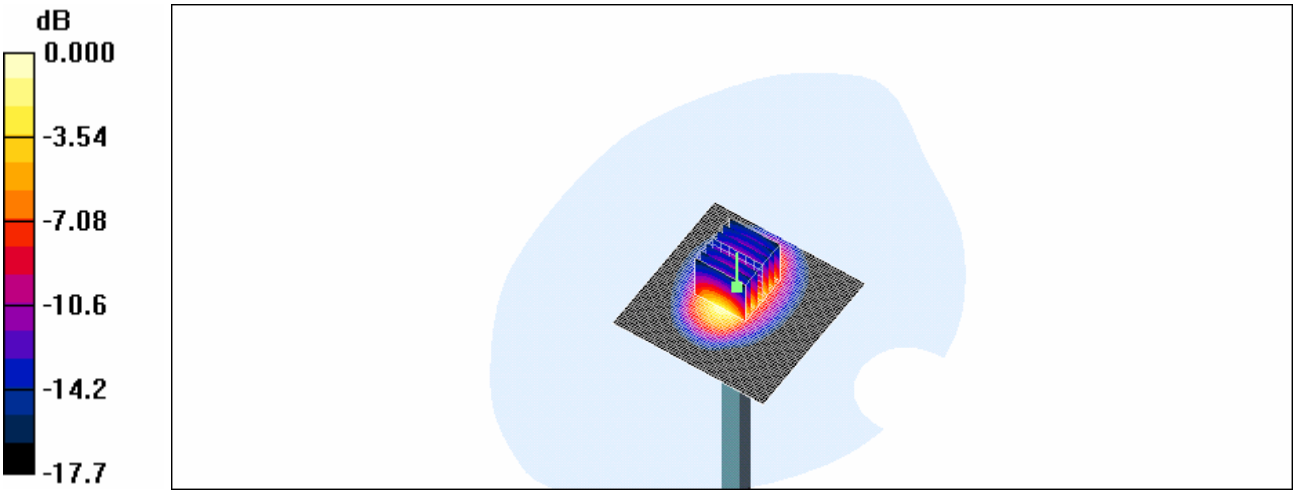
DASY4 Configuration:

- Probe: ET3DV6 - SN1759; ConvF(4.4, 4.4, 4.4); Calibrated: 2005/8/30
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn547; Calibrated: 2006/2/14
- Phantom: SAM 12; Type: SAM 4.0; Serial: TP:1150
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Pin=250mW/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.5 mW/g

**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.6 V/m; Power Drift = 0.003 dB
Peak SAR (extrapolated) = 17.4 W/kg

**SAR(1 g) = 9.74 mW/g; SAR(10 g) = 5.23 mW/g**
Maximum value of SAR (measured) = 11.1 mW/g




0 dB = 11.1mW/g

# Probe Calibration certificate

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

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

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

**Accreditation No.: SCS 108**

**Client** SGS (Auden)

**Certificate No: ET3-1759_Aug05**

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | ET3DV6 - SN:1759 |
| Calibration procedure(s) | QA CAL-01.v5<br>Calibration procedure for dosimetric E-field probes |
| Calibration date: | August 30, 2005 |
| 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 E4419B | GB41293874 | 3-May-05 (METAS, No. 251-00466) | May-06 |
| Power sensor E4412A | MY41495277 | 3-May-05 (METAS, No. 251-00466) | May-06 |
| Power sensor E4412A | MY41498087 | 3-May-05 (METAS, No. 251-00466) | May-06 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 11-Aug-05 (METAS, No. 251-00499) | Aug-06 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 3-May-05 (METAS, No. 251-00467) | May-06 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 11-Aug-05 (METAS, No. 251-00500) | Aug-06 |
| Reference Probe ES3DV2 | SN: 3013 | 7-Jan-05 (SPEAG, No. ES3-3013_Jan05) | Jan-06 |
| DAE4 | SN: 654 | 29-Nov-04 (SPEAG, No. DAE4-654_Nov04) | Nov-05 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (SPEAG, in house check Dec-03) | In house check: Dec-05 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (SPEAG, in house check Nov-04) | In house check: Nov 05 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Nico Vetterli | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: August 30, 2005

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

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

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

**Accreditation No.: SCS 108**

**Glossary:**

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

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

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

**Methods Applied and Interpretation of Parameters:**

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

# Probe ET3DV6

# SN:1759

| | |
|---|---|
| Manufactured: | November 12, 2002 |
| Last calibrated: | March 23, 2005 |
| Repaired: | July 28, 2005 |
| Recalibrated: | August 30, 2005 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

**ET3DV6 SN:1759** **August 30, 2005**

# DASY - Parameters of Probe: ET3DV6 SN:1759

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

| | | | | |
|---|---|---|---|---|
| NormX | **1.97** ± 10.1% | $\mu V/(V/m)^2$ | DCP X | **93** mV |
| NormY | **1.90** ± 10.1% | $\mu V/(V/m)^2$ | DCP Y | **93** mV |
| NormZ | **1.93** ± 10.1% | $\mu V/(V/m)^2$ | DCP Z | **93** 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 | | **3.7 mm** | **4.7 mm** |
|---|---|---|---|
| $SAR_{be}$ [%] | Without Correction Algorithm | 8.3 | 4.7 |
| $SAR_{be}$ [%] | With Correction Algorithm | 0.0 | 0.2 |

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

| Sensor Center to Phantom Surface Distance | | **3.7 mm** | **4.7 mm** |
|---|---|---|---|
| $SAR_{be}$ [%] | Without Correction Algorithm | 13.4 | 9.2 |
| $SAR_{be}$ [%] | With Correction Algorithm | 0.8 | 0.2 |

## Sensor Offset

| | |
|---|---|
| Probe Tip to Sensor Center | **2.7** mm |

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

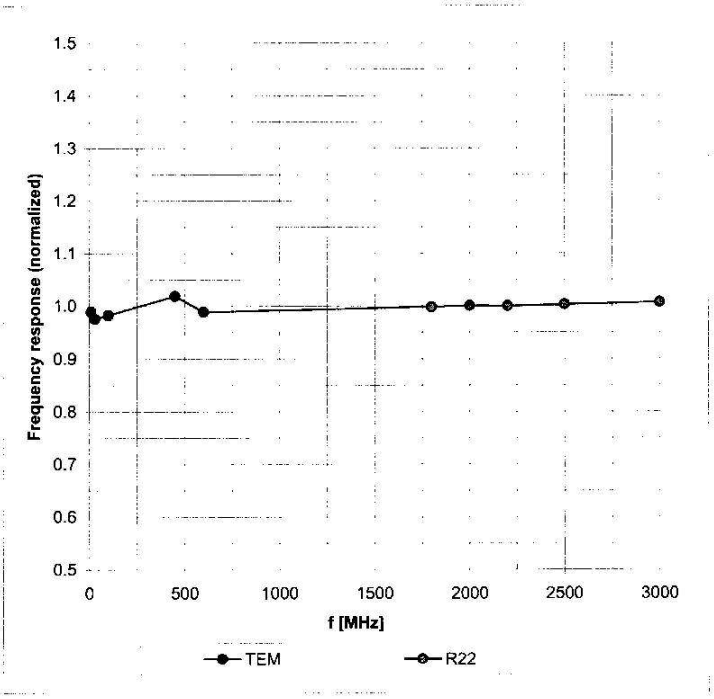
[A] The uncertainties of NormX,Y,Z do not affect the $E^2$-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

**ET3DV6 SN:1759** **August 30, 2005**

## Frequency Response of E-Field

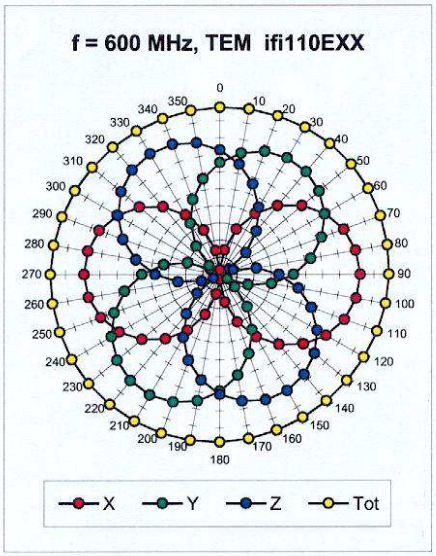
**(TEM-Cell:ifi110 EXX, Waveguide: R22)**

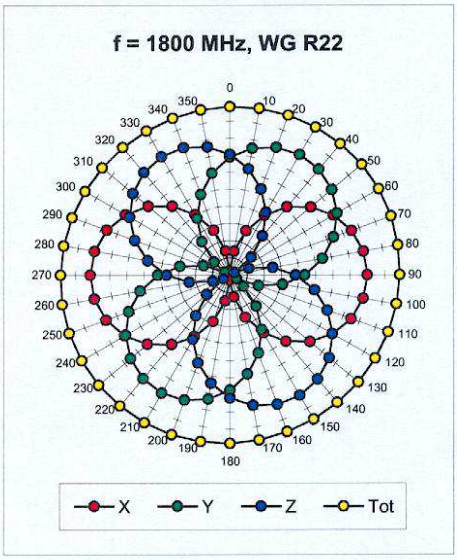


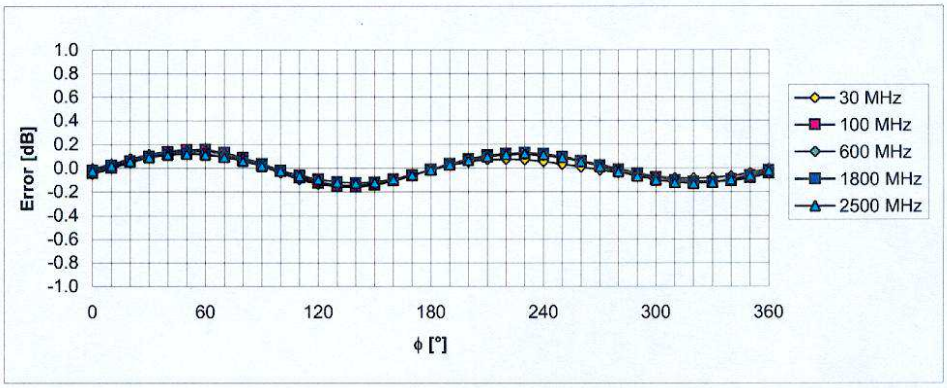

**Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)**

ET3DV6 SN:1759 August 30, 2005

## Receiving Pattern ($\phi$), $\vartheta$ = 0°



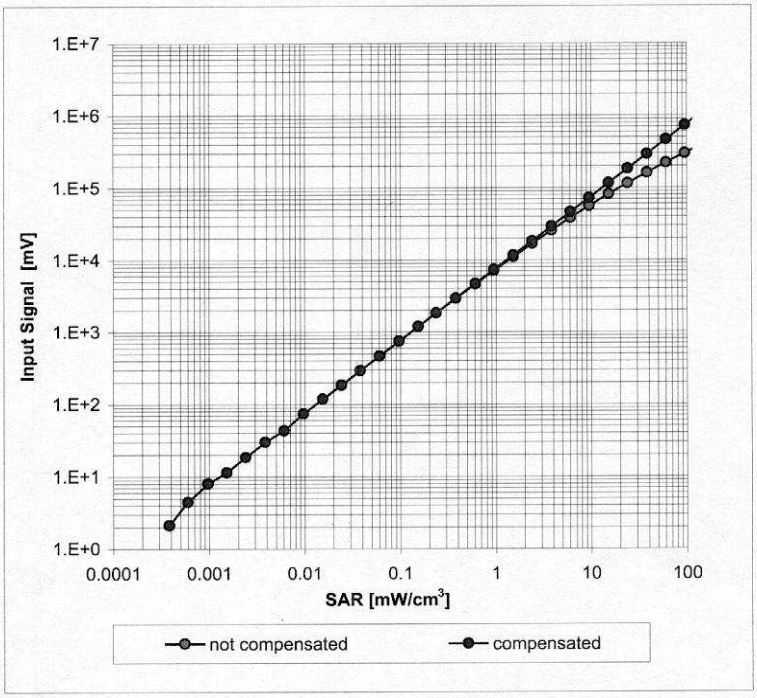



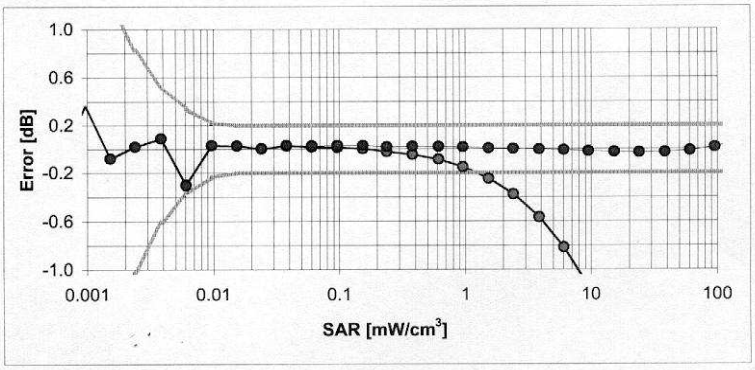

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ET3DV6 SN:1759 August 30, 2005

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

(Waveguide R22, f = 1800 MHz)

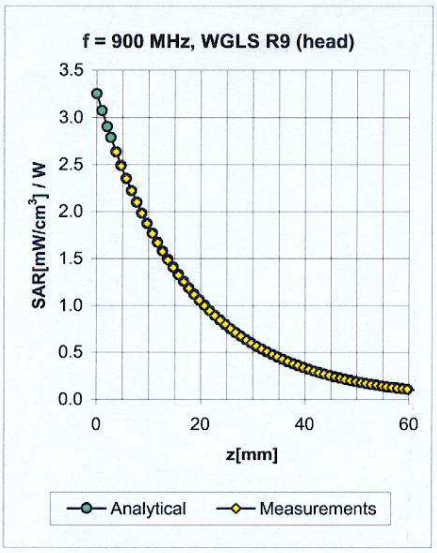


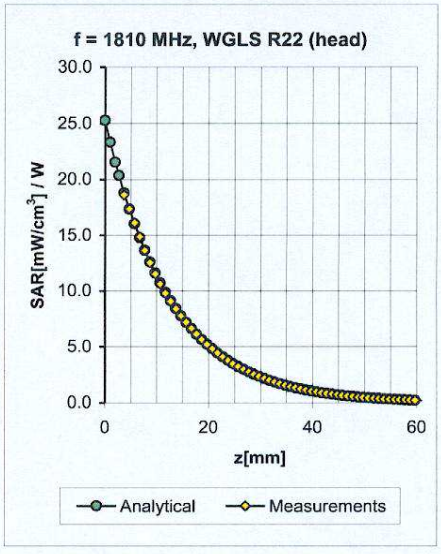




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

**ET3DV6 SN:1759** **August 30, 2005**

# Conversion Factor Assessment




| f [MHz] | Validity [MHz][C] | TSL | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty |
|---|---|---|---|---|---|---|---|
| 900 | ± 50 / ± 100 | Head | 41.5 ± 5% | 0.97 ± 5% | 0.48 | 2.00 | 6.15 ± 11.0% (k=2) |
| 1810 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.58 | 2.42 | 5.11 ± 11.0% (k=2) |
| 2000 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.58 | 2.56 | 4.72 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Head | 39.2 ± 5% | 1.80 ± 5% | 0.69 | 2.15 | 4.39 ± 11.8% (k=2) |
| | | | | | | | |
| 900 | ± 50 / ± 100 | Body | 55.0 ± 5% | 1.05 ± 5% | 0.46 | 2.16 | 5.93 ± 11.0% (k=2) |
| 1750 | ± 50 / ± 100 | Body | 53.4 ± 5% | 1.49 ± 5% | 0.53 | 2.87 | 4.40 ± 11.0% (k=2) |
| 1900 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.53 | 2.98 | 4.33 ± 11.0% (k=2) |
| 2000 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.59 | 2.54 | 4.20 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Body | 52.7 ± 5% | 1.95 ± 5% | 0.70 | 1.95 | 4.08 ± 11.8% (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.

## 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 %** | |

## Phantom description

**Schmid & Partner Engineering AG**

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

### Certificate of conformity / First Article Inspection

| | |
|---|---|
| Item | SAM Twin Phantom V4.0 |
| Type No | QD 000 P40 CA |
| Series No | TP-1150 and higher |
| Manufacturer / Origin | Untersee Composites<br>Hauptstr. 69<br>CH-8559 Fruthwilen<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 units (called samples).

| Test | Requirement | Details | Units tested |
|---|---|---|---|
| Shape | Compliance with the geometry according to the CAD model. | IT'IS CAD File (*) | First article, Samples |
| Material thickness | Compliant with the requirements according to the standards | 2mm +/- 0.2mm in specific areas | First article, Samples |
| Material parameters | Dielectric parameters for required frequencies | 200 MHz – 3 GHz<br>Relative permittivity < 5<br>Loss tangent < 0.05. | Material sample TP 104-5 |
| Material resistivity | The material has been tested to be compatible with the liquids defined in the standards | Liquid type HSL 1800 and others according to the standard. | Pre-series, First article |

**Standards**

[1] CENELEC EN 50361
[2] IEEE P1528-200x draft 6.5
[3] IEC PT 62209 draft 0.9
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

**Conformity**

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

**Date** 28.02.2002

**Signature / Stamp**

Schmid & Partner Engineering AG
Zeughausstrasse 43, CH-8004 Zurich
Tel. +41 1 245 97 00, Fax +41 1 245 97 79

# System Validation from Original equipment supplier SPEAG Schmid & Partner of 1900 HSL

## DASY4 Validation Report for Head TSL

Date/Time: 14.03.2006 15:20:51

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d027**

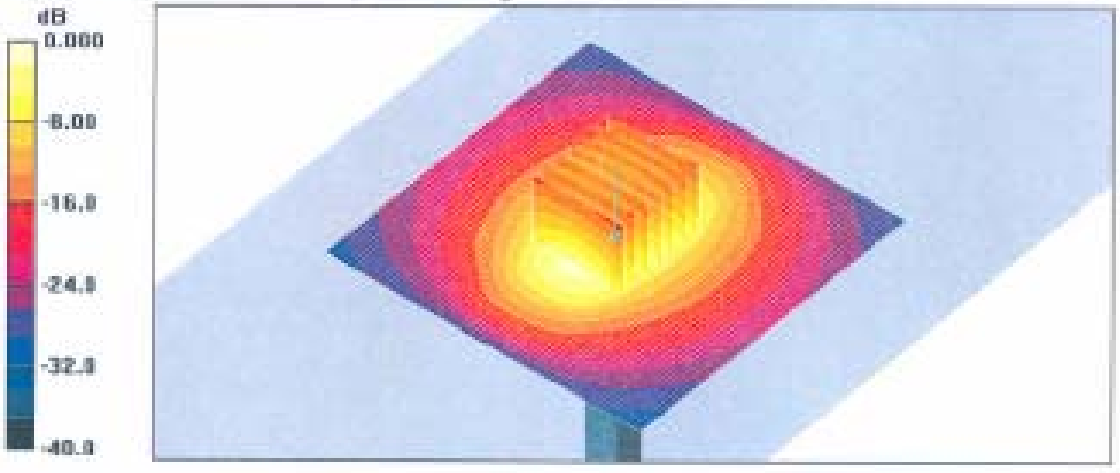
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL U10 BB;
Medium parameters used: f = 1900 MHz; $\sigma$ = 1.42 mho/m; $\varepsilon_r$ = 39.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.74, 4.74, 4.74); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 14; Postprocessing SW: SEMCAD, V1.8 Build 165

**Pin = 250 mW; d = 10 mm/Area Scan (71x71x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 11.9 mW/g

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.0 V/m; Power Drift = -0.001 dB
Peak SAR (extrapolated) = 17.1 W/kg
**SAR(1 g) = 9.97 mW/g; SAR(10 g) = 5.25 mW/g**
Maximum value of SAR (measured) = 11.3 mW/g




0 dB = 11.3mW/g

**DASY4 Validation Report for Body TSL**

Date/Time: 21.03.2006 12:56:12

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d027**

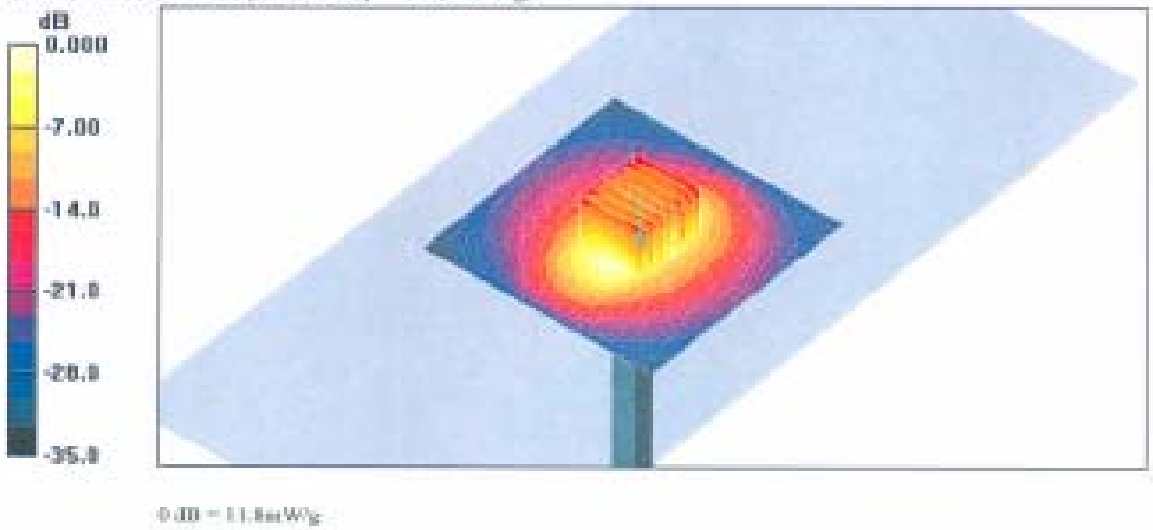
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL U10;
Medium parameters used: f = 1900 MHz; $\sigma$ = 1.54 mho/m; $\varepsilon_r$ = 54.7; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); Conv(4.3, 4.3, 4.3); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161

**Pin = 250 mW; d = 10 mm 2/Area Scan (71x71x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.1 mW/g

**Pin = 250 mW; d = 10 mm 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.5 V/m; Power Drift = 0.043 dB
Peak SAR (extrapolated) = 17.7 W/kg
**SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.5 mW/g**
Maximum value of SAR (measured) = 11.8 mW/g




0 dB = 11.8mW/g