DAT-P-174/04-00

NO.L0447

Registration No.612767

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

Report No. : SRMC2007-H024-E0006

Product Name: GSM/GPRS Mobile Phone with Bluetooth

Product Model: CT9@9k

Manufacture: Shenzhen Sang Fei Consumer Communications Co., Ltd.

Specification: FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)

FCC ID: VQRCT9A9K

The State Radio Monitoring Center, Equipment Testing Division

The State Radio Spectrum Monitoring and Testing Center

No.80 Beilishi Road Xicheng District Beijing, China

Tel: 86-10-68009202 Fax: 86-10-68009205

Executive Summary

The CT9@9k is a GSM/GPRS tri-bands mobile phone operating in the 900MHz/1800MHz/1900MHz frequency range. The device has an internal integrated antenna .The system concepts used are the GSM1900 and GPRS1900 (Class 10) standards. Outside of North America, transmitter of tested device is capable of operating also in GSM900 and GSM1800 modes, which are not part of this filing.

The objective of the measurements done by SRMC (State radio monitoring center) was the dosimetric assessment of one device in the GSM1900 standards. The examinations have been carried out with the dosimetric assessment system, “DASY4”.

The measurements were made according to FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01) Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields .All measurements have been performed in accordance to the recommendations given by SPEAG.

The maximum SAR of the CT9@9k mobile phone is

Mode (BT active)	CH/*f*(MHz)	Power	Position	Limit (mW/g)/1g	Measured (mW/g)	Result
M1900	810/1909.8	28.3dBm	Towards Ground	1.6	**0.467**	PASS

Checked By: .... Tested By: 刘佳 ....

This Test Report Is Issued By: ....

Issued date: 2007.11.6

Tables of Contents

1. General information

1.1 Notes of the test report

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The test results relate only to individual items of the samples which have been tested.

1.2 Information about the testing laboratory

Company： The State Radio Monitoring Center, Equipment Testing Division
The State Radio Spectrum Monitoring and Testing Center
Address： No.80 Beilishi Road, Xicheng District, Beijing China
City: Beijing
Country or Region: China
Contacted person: Wang Junfeng
Tel +86 10 68009181 +86 10 68009202
Fax: +86 10 68009195 +86 10 68009205
Email: Wangjf@srrc.org.cn

1.3 Applicant's details

Company: Shenzhen Sang Fei Consumer Communications Co., Ltd.
Address: 11 Science and Technology Road, Shenzhen Hi-tech Industrial Park Nanshan District, Shenzhen, PRC
Tel: 86-755-26636330
Fax: 86-755-26614979
Grantee Code: VQR
Contact person: Helen Lin
E-mail: Helen.lin@sangfei.com

1.4 Manufacturer's details

Company: Shenzhen Sang Fei Consumer Communications Co., Ltd.
Address: 11 Science and Technology Road, Shenzhen Hi-tech Industrial Park Nanshan District, Shenzhen, PRC
Tel: 86-755-26636330
Fax: 86-755-26614979
Grantee Code: VQR
Contact person: Helen Lin
E-mail: Helen.lin@sangfei.com

1.5 Application details

Date of receipt of application: 2007-9-28

Date of receipt of test samples: 2007-10-8

Date of test: 2007-10-8 to 2007-10-25

1.6 Information of Test Sample

?Name of EUT	GSM/GPRS Mobile Phone with Bluetooth
?Model	CT9@9k
?Frequency range	GSM/GPRS: 1850-1910MHz Bluetooth: 2402-2480MHz
?Power Level	GSM: 0 (30dBm)
?Channel spacing	GSM/GPRS: 200kHz Bluetooth: 1MHz
?Modulation	GSM/GPRS: GMSK Bluetooth: GFSK
?Duty cycle	GSM:1:8 GPRS(class 10):1:4
?Power supply	Normal Voltage:3.8V Max Voltage:4.2V Mix Voltage:3.6V
?Test condition of declaration	Normal
?IMEI Number	357794010006077

1.7 Auxiliary Equipment (AE)

AE No.	Name	Model	Manufacturer	Serial Number
AE 1	Adapter	DSA-5W-05 FEU	Dee Van Enterprise Co., Ltd	---
AE 2	Battery	AB1850AWM	Shenzhen Xwoda Electronic Co., Ltd.	---

1.8 Reference Specification

FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01) Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields .

IEC 62209-1-2005: Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1:Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

IEEE 1528–2003: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques.

[DAY4]
Schmid & partner Engineering AG: DAY4 Manual. Nov.2003

2．Subject of Investigation

The CT9@9k mobile phone (Portable Device) is is operating in the 1900MHz frequency range. The system concepts used are the GSM1900 and GPRS1900 (Class 10) standards.

Fig 1: picture of the device under test

The objective of the measurements done by SRMC was the domestic assessment of one device in the GSM 1900 standards. The examinations have been carried out with the domestic assessment system “DASY4”described below.

2.1 The IEEE Standard C95.1 and the FCC Exposure Criteria

In the USA the FCC exposure criteria [OET 65] are based on the withdrawn IEEE Standard C95.1-1999 [IEEE C95.1-1999]. This version was replaced by the IEEE Standard C95.1-2005 [IEEE C95.1-2005] in October, 2005.

Both IEEE standards sets limits for human exposure to radio frequency electromagnetic fields in the frequency range 3 kHz to 300 GHz. One of the major differences in the newly revised C95.1-2005 is the change in the basic restrictions for localized exposure, from 1.6 W/kg averaged over 1 g tissue to 2.0 W/kg averaged over 10 g tissue, which is now identical to the ICNIRP guidelines [ICNIRP 1998].

2.2 Distinction Between Exposed Population, Duration of Exposure and Frequencies

The American Standard [IEEE C95.1-1999] distinguishes between controlled and uncontrolled environment. Controlled environments are locations where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment or by other cognizant persons. Uncontrolled environments are locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces. For exposure in controlled environments higher field strengths are admissible. In addition the duration of exposure is considered.

Due to the influence of frequency on important parameters, as the penetration depth of the electromagnetic fields into the human body and the absorption capability of different tissues, the limits in general vary with frequency.

2.3 Distinction between Maximum Permissible Exposure and SAR Limits

The biological relevant parameter describing the effects of electromagnetic fields in the frequency range of interest is the specific absorption rate SAR (dimension: power/mass).It is a measure of the power absorbed per unit mass. The SAR may be spatially averaged over the total mass of an exposed body or its pads-The SAR is calculated from the r.m.s. electric field strength E inside the human body, the conductivity s and the mass density p of the biological tissue:

$$SAR = \frac{s \, E_i^2}{r}$$

$$SAR = c_i \left. \frac{dT}{dt} \right|_{t=0}$$

The specific absorption rate describes the initial rate of temperature rise dT/dt as a function of the specific heat capacity c of the tissue. A limitation of the specific absorption rate prevents an excessive heating of the human body by electromagnetic energy.

As it is sometimes difficult to determine the SAR directly by measurement (e.g. whole body averaged SAR), the standard specifies more readily measurable maximum permissible exposures in terms of external electric E and magnetic field strength H and power density S, derived from the SAR limits .The limits for E, H and
the SAR limits. The limits for E, H and S have been fixed so that even under worst case conditions, the limits for the specific absorption rate SAR are not exceeded.

For the relevant frequency range the maximum permissible exposure may be exceeded if the exposure can be shown by appropriate techniques to produce SAR values below the corresponding limits.

2.4 SAR Limit

In this report the comparison between the American exposure limits and the measured data is made using the spatial peak SAR; the power level of the device under test guarantees that the whole body averaged SAR is not exceeded. Having in mind a worst case consideration, the SAR limit is valid for uncontrolled environment and mobile respectively portable transmitters. According to Table 1 the SAR values have to be averaged over a mass of 1 g (SAR1g) with the shape of a cube.

Standards	Status	SAR limit [w/kg]
IEEE C95.1-1999	Replaced	1.6

Table 1: Relevant spatial peak SAR limit averaged over a mass of 1 g.

3 The FCC Measurement Procedure

The Federal Communications Commission (FCC) has published a report and order on the 1st of August 1996 [FCC 96-326], which requires routine dosimetric assessment of mobile telecommunications devices, either by laboratory measurement techniques or by computational modeling, prior to equipment authorization or use. In 2001 the Commission's Office of Engineering and Technology has released Edition 01-01 of Supplement C to OET Bulletin 65. This revised edition, which replaces Edition 97-01, provides additional guidance and information for evaluating compliance of mobile and Portable devices with FCC limits for human exposure to radiofrequency emissions [OET 65].

3.1 General Requirements

The test shall be performed using a miniature probe that is automatically positioned to measure the internal E-field distribution in a phantom model representing the human head exposed to the EM fields produced by mobile phones. From the measured E-field values, the SAR distribution and the maximum mass averaged SAR value shall be calculated.

The test shall be performed in a laboratory conforming to the following environmental conditions:

- the ambient temperature shall be in the range of 15 °C to 30°C and the variation shall not exceed 2 °C during the test;
- the mobile phone shall not interact with the local mobile networks;
- care shall be taken to avoid significant influence on SAR measurements by

ambient EM sources;

- care shall be taken to avoid significant influence on SAR measurements by any
  reflection from the environment (such as floor, positioner, etc.).
- Validation of the system shall be done at least once a year according to the protocol defined in annex D of IEC 62209-1-2005 Standard.

3.2 Phantom specifications (shell and liquid)

Phantom requirements

The physical characteristics of the phantom model (size and shape) shall resemble the head and neck of a user since the shape is a dominant parameter for exposure. The phantom shall be made from material with dielectric properties similar to those of head tissues. To enable field scanning within it, the material shall be liquid contained in a head and neck shaped shell model. The shell model acts as a shaped container and shall be as unobtrusive as possible. The hand shall not be modeled.

The shell of the phantom shall be made of low loss and low permittivity material: *tan (d)* = 0,05 and e = 5. The thickness of the phantom is defined in the CAD files and the tolerance shall be ± 0, 2 mm in the area defined in the CAD files (where the phone touches the head).

Reference points on the phantom:

The probe positioning shall be defined in relation to three well defined points on the phantom. These points R1, R2 and R3 shall be used to calibrate the positioning system. Three other points, M for mouth, LE for left ear and/or RE for right ear (maximum acoustic coupling), shall be defined on the phantom(s) (see Figure 2). These points shall be used to allow reproducible positioning of the mobile phone in relation to the phantom.

3.3 Specifications of the SAR measurement equipment

The measurement equipment shall be calibrated as a complete system. The probe shall be calibrated together with the amplifier, measurement device and data acquisition system.

The measurement equipment shall be calibrated in each tissue equivalent liquid at the appropriate operating frequency and temperature according to the methodology defined in IEC 62209-1-2005 .The minimum detection limit shall be lower than 0,02 W/kg and the maximum detection limit shall be higher than 100 W/kg. The linearity shall be within 0,5 dB over the SAR range from 0,02 to 100 W/kg. The isotropy shall be within 1 dB. Sensitivity, linearity and isotropy shall be determined in the tissue equivalent liquid. The response time shall be specified. .

3.4 Scanning system specifications

The scanning system holding the probe shall be able to scan the whole exposed volume of the phantom in order to evaluate the three-dimensional SAR distribution. The mechanical structure of the scanning system shall not interfere with the SAR measurements.

The accuracy of the probe tip positioning over the measurement area shall be less than 0,2 mm. The sampling resolution shall be 1 mm or less.

3.5 Mobile phone holder specifications

The mobile phone holder shall permit the phone to be positioned according to a tolerance of 1° in the tilt angle. It shall be made of low loss and low permittivity material(s): *tan (d)* = 0, 05 and ? e= 5.

4. Measurement preparation

4.1 General preparation

The dielectric properties of the tissue equivalent materials shall be measured prior to the SAR measurements and at the same temperature with a tolerance of 2° C. The measured values shall comply with the values defined at the specific frequencies in IEC 62209-1-2005 6.1.1. with a tolerance of 5 % for relative permittivity and conductivity.

The phantom shell shall be filled with the tissue equivalent liquid. The depth of the tissue equivalent liquid inside the phantom and at the vertical position of the ear canal shall be at least 15 cm. The liquid shall be carefully stirred before the measurement and it shall be free of air bubbles. The coordinate system of the scanning system shall be aligned to the coordinate system of the phantom with a tolerance of ? 0, 2 mm.

4.2Simplified performance checking

The purpose of the simplified performance check is to verify that the system operates within its specifications, check is a simple test of repeatability to make sure that the system works correctly during the compliance test. The check shall be performed in order to detect possible drift over short time periods and other errors in the system,

The simplified performance check shall be carried out according to annex D of IEC 62209-1-2005. The simplified performance check shall be performed prior to compliance tests and the result shall be within ± 10 % of the target value. After the system validation check. The simplified performance check shall be performed at a central frequency of each transmitting band of the mobile phone.

4.3 Preparation of the mobile phone under test

The tested mobile phone shall use its internal transmitter. The battery shall be fully charged before each measurement .The output power and frequency (channel) shall be controlled by 8960(base station simulator). CT9@9k transmit its highest output peak power level allowed by the system. , The BTS antenna shall be placed at least 50 cm from the phone. The signal emitted by the emulator at antenna feed point shall be lower than the output level of the phone by at least 30 dB.

4.4 Position of the mobile phone in relation to the phantom

The mobile phone shall be tested in the cheek and tilted positions on left and right sides of the phantom.

Definition of the cheek position:

a) Position the device with the vertical centre line of the body of the device and the horizontal line crossing the centre of the ear piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical centre line with the reference plane containing the three ear and mouth reference points (M, RE and LE) and align the centre of the ear piece with the line RE-LE;
b) Translate the mobile phone box towards the phantom with the ear piece aligned with the line LE-RE until the phone touches the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the box until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost.

Definition of the tilted position:

a) Position the device in the Tilt position described above;
b) While maintaining the device in the reference plane described above and pivoting against the ear, move it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost. (see Figure 2)

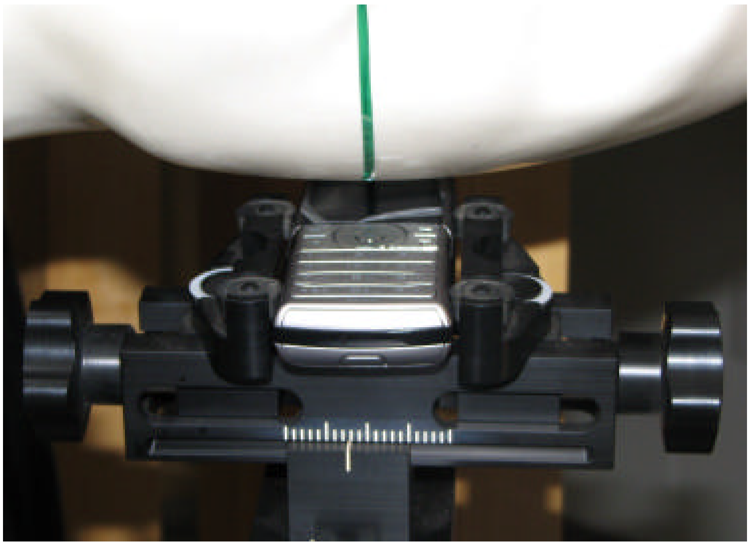


Fig 2 - Definition of the reference lines and points, on the phone and on the phantom and initial position

4.5Tests to be performed

Tests shall be performed with both phone positions described in 4.4, on the left and right sides of the head and using the centre frequency of each operating band. The configuration giving rise to the maximum mass-averaged SAR shall be used to test the low-end and the high-end frequencies of the transmitting band. If the mobile phone has a retractable antenna, all of the tests described above shall be performed both with

The antenna extended and with it retracted. When considering multi- mode and multi-band mobile phones, all of the above tests shall be performed in each transmitting mode/band with the corresponding maximum peak power level.

5. The Measurement system

5.1 DASY4 Information

DASY4is an abbreviation of "Dosimetric Assessment System" and describes a system that is able to determine the SAR distribution inside a phantom of a human being according to different standards. The DASY4 system consists of the following items as shown in Fig3. Fig4 shows the installation in the SRMC laboratory [DASY2004].

- High precision robot with controller
- Measurement server(for surveillance of the robot operation and signal filtering)
- Data acquisition electronics DAE (for signal amplification and altering)
- Field probes calibrated for use in liquids
- Electro-optical converter EOC (conversion from the optical into a digital signal)
- Light beam (improving of the absolute probe positioning accuracy)
- Two SAM phantoms filled with tissue simulating liquid
- DASY4 software
- SEMCAD

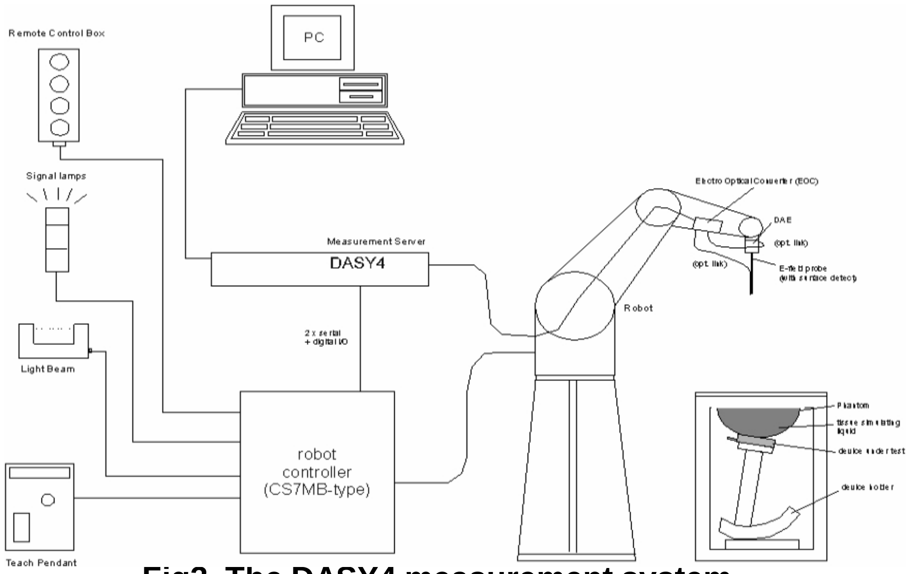


Fig3. The DASY4 measurement system

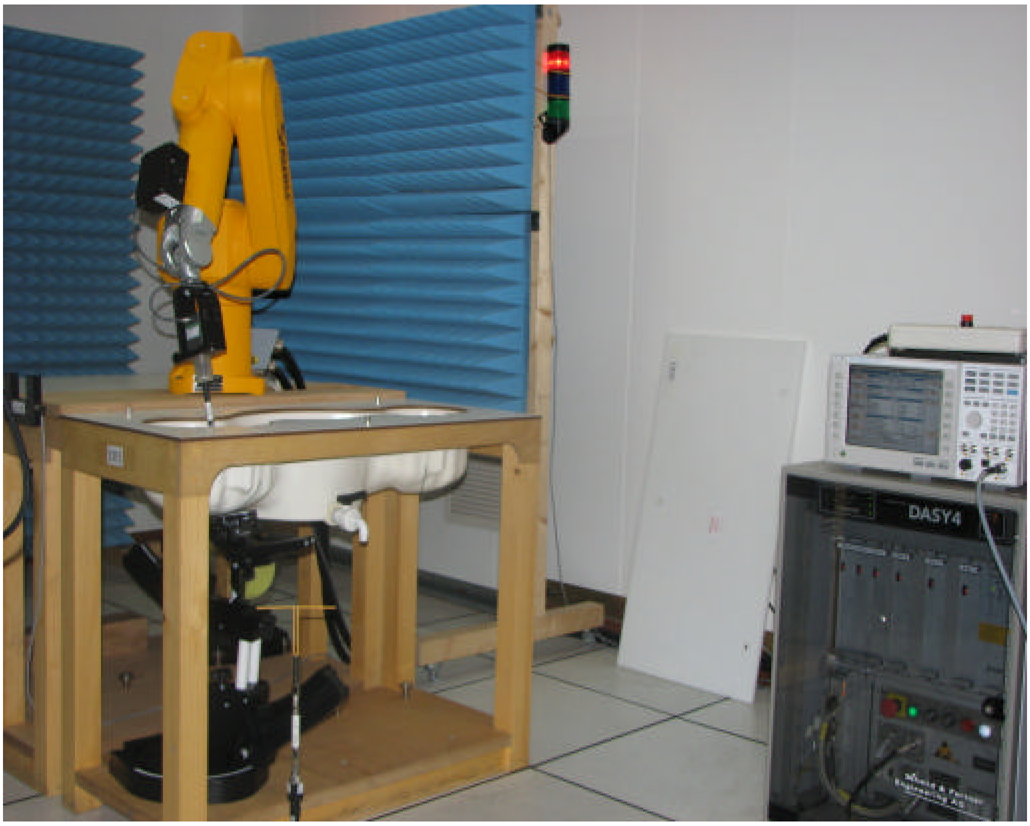


Fig 4. The measurement set-up with two SAM phantoms containing tissue simulating liquid

5.2Test Equipments:

Name		Serial Number	Cal. Data
DASY4 SYSTEM			
Software Version	V4.2	N/A	N/A
Dosimetric E-Field probe	ES3DV3	3127	2007.1
Data Acquisition Electronics	DAE4	720	2006.10.20
Data Acquisition Electronics	DAE4	725	2007.2.26
Phantom	SAM	1267	N/A
Phantom	SAM	1315	N/A
Performance checking			
System Validation Dipole	D900V2	171	2006.3
System Validation Dipole	D1800V2	2d084	2006.3
RF source	ESG-D2000A	US36260147	2007.3
RF Amplifier	5S1G4	301305	N/A
Power Meter	NRVS	8363331050	2007.8
Power Meter probe	NRV-Z55	834558/008	2007.8
Power Meter probe	N1922A	US44510189	2007.8
Power Meter	N1911A	GB45100295	2007.8
Attenuator	2	BM0059	2007.8
Attenuator	2	BM6452	2007.8
Attenuator	2	BM8993	2007.8
Directional Coupler	778D-012	13733	2007.8
Material Measurement			
Network Analyzer	8714ET	US40372083	2007.8
Dielectric Probe Kit	85070D	US33030365	N/A
General			
Radio Tester	8960	GB43194054	2007.8
Call Tester	CMU200	100313	2007.8

Note: the Dipole Calibration interval is 24 months

Table 1. Test Equipments lists

5.3 Uncertainty Assessment

DASY4 Uncertainty Budget
According to IEC 62209-1 [3]

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	±5.9%	N	1	1	1	±5.9%	±5.9%	∞
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	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
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 noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF ambient reflections	±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%	145
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 conductivity(target)	±5.0%	R	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
Liquid onductivity(means.)	±2.5%	N	1	0.6	0.49	±1.5%	±1.2%	∞
Combined std. Uncertainty						±10.9%	±10.7%	387
Expanded STD Uncertainty						**±21.9%**	**±21.4%**	

Table 2. Uncertainty assessment

6. Test Results

6.1Test Environment:

Ambient Temperature: 24.0℃ Relative Humidity: 35.5% Atmosphere: 101.0kPa

6.2Test Method and Procedure

a) Measure the local SAR at a test point within 10 mm of the inner surface of the phantom. The test point shall also be close to the ear;

b) verify that the measured SAR at the point used in item 1 is stable after 3 minutes within ± 5 % in order to ensure that there is no drift due to the mobile phone electronics;

c) Measure the SAR distribution within the phantom. The spatial grid step shall be less than 20 mm. If surface scanning is used, then the distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be constant within ± 0,5 mm and less than 8 mm. If volume scanning is performed, then the scanning volume shall be as close as possible to the inner surface of the phantom (less than 8 mm), the grid step shall be 5 mm or less, the grid shall extend to a depth of 25 mm and then go directly to item 6;

d) From the scanned SAR distribution, identify the position of the maximum SAR value, as well as the positions of any local maxima with SAR values of more than 50 % of the maximum value;

e) Measure SAR with a grid step less than 5 mm in a volume with a minimum size of 30 mm by 30 mm and 25 mm in depth. Separate grids shall be centred on each of the local SAR maxima;

f) Use interpolation and extrapolation procedures defined in annex C of IEC 62209-1-2005 to determine the local SAR values at the spatial resolution needed for mass averaging;

g) Repeat the SAR measurement at the initial test point used in item 1. If the two results differ by more than ± 5 % from the final value obtained in item 2, the measurements shall be repeated with a fully charged battery or the actual drift shall be included in the uncertainty evaluation.

Tests shall be performed with both phone positions of cheek and tilted, on the left and right sides of the head and using the centre frequency of each operating band. Then the configuration giving rise to the maximum mass-averaged SAR shall be used to test the low-end and the high-end frequencies of the transmitting band. If the mobile phone has a retractable antenna, all of the tests described above shall be performed both with the antenna extended and with it retracted. When considering multi- mode and multi-band mobile phones, all of the above tests shall be performed in each transmitting mode/band with the corresponding maximum peak power level.

6.3Test Configuration

The test shall be performed in the shield room.

Please refer to chapter 7.8; 7.9 of this test report for photo of this test setup.

6.4Test Results

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMU-200) to ensure the maximum power transmission and proper modulation. This result contains conducted output power and ERP for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

Mode: GSM1900

f_L(MHz)=1850.2 MHz f_M(MHz)=1880.0 MHz f_H(MHz)= 1909.8 MHz

SAR Values(Head, 1900MHz Band with Bluetooth)

Limit of SAR (W/kg)	1 g Average 1.6
Test Case	**Measurement Result (mW/g)** **1 g Average**
Left hand, Touch cheek , f_H	---
Left hand, Touch cheek, f_M	0.028
Left hand, Touch cheek , f_L	---
Left hand, Tilt 15 Degree, f_M	0.039
Right hand, Tilt 15 Degree , f_H	---
Right hand, Touch cheek, f_M	0.027
Right hand, Tilt 15 Degree f_L	---
Right hand, Tilt 15 Degree, f_M	0.031

So, the maximum SAR is

Phantom Configuration	Device Test Position	SAR(mW/g)		
		f_L(MHz)	f_M(MHz)	f_H(MHz)
Left Side	tilt	---	**0.039**	---

Note1: Please refer to 7.7 of this test report for graphical results.

Table 2. SAR Results

Mode: GSM1900

f_L(MHz)=1850.2MHz f_M(MHz)=1880.0 MHz f_H(MHz)= 1909.8MHz

SAR Values(Body, 1900MHz Band with Bluetooth)

Limit of SAR (W/kg)	**1g Average**
	1.6
Test Case	**Measurement Result (mW/g)**
	1g Average
Towards ground f_H	**0.467**
Towards ground with a headset f_H	**0.452**
Towards ground f_M	0.441
Towards ground f_L	0.434
Back ground f_H	---
Back ground f_M	0.030
Back ground f_L	---

So, the maximum SAR is

Phantom Configuration	SAR(mW/g)		
	f_L(MHz)	f_M(MHz)	f_H(MHz)
Towards ground	---	---	0.467

Table 3. SAR Results

Mode: GSM1900

f_L(MHz)=1850.2MHz f_M(MHz)=1880.0 MHz f_H(MHz)= 1909.8MHz

SAR Values(GPRS, 1900MHz Band with Bluetooth)

Limit of SAR (W/kg)		**1g Average**
		1.6
Test Case		**Measurement Result (mW/g)**
		1g Average
Towards ground	f_H	---
Towards ground	f_M	0.264
Towards ground	f_L	---
Back ground	f_H	---
Back ground	f_M	---
Back ground	f_L	---

So, the maximum SAR is

Phantom Configuration	SAR(mW/g)		
	f_L(MHz)	f_M(MHz)	f_H(MHz)
Towards ground	---	**0.264**	---

Table 4. SAR Results

7. Appendix

7.1 Administrative Data

Date of measurement: 1900MHz: Oct. 8, 2007

Data stored: SRMC2007-H024-E0006

7.2 Device under Test and Test Conditions

TYPE: CT9@9k

Date of receipt: Oct. 8, 2007

IMEI: **357236010000445**

Equipment class: Portable device
Power Class: GSM1900, tested with power level 0(30dBm)
RF exposure environment: General Population
Power supply: Internal Battery (Other batteries not available)
Measurement Standards: GSM1900, GPRS1900 (Class 10)
Method to establish a call: GSM1900: Base station simulator, using the air interface
Modulation: GMSK
TX range: GSM1900:1850~1910MHz
RX range: GSM1900:1930~1990MHz
Used TX Channels: L: ch512; M: ch661; H: ch810 (refer to the table 5)

Mode	**GSM1900(Head)**			**GSM1900(Body)**		
Channel	512	661	810	512	661	810
Frequency(MHz)	1850.2	1880.0	1909.8	1850.2	1880.0	1909.8
Measured Power(dBm)	29.0	28.9	28.3	29.1	29.0	28.3

Table5. Frequency and Measured power of EUT's Tx channels

Used Phantom: SAM Twin Phantom V4.0, as defined by IEC 62209-1-2005 and delivered by Schmid&Parb1er Engineering AG

7.3 Tissue Recipes

Head Tissue Simulant

The following recipes are provided in percentage by weight.

1900 MHz:

44,45 % 2-(2-butoxyethoxy) ethanol
55.24 % de-ionised water
0.31 % NaCl salt

Body Tissue Simulant

The following recipes are provided in percentage by weight.

1900MHz:

70.17% de-ionised water
29.44% DGBE
0.39 % Salt

7.4 Material Parameters

For the measurement of the following parameters the HP 85070D dielectric probe kit is used, representing the open-ended coaxial probe measurement procedure.

Head		er	s[S/m]	Temperature	
				Ambient [°C]	Liquid [°C]
1900MHz	Recommended Value	40± 1.9	1.40± 0.07	15-30	-
	Measured Value	39.7	1.35	24.0	22.3

Body		er	s[S/m]	Temperature	
				Ambient [°C]	Liquid [°C]

1900MHz	Recommended Value	53.3± 2.7	1.52± 0.15	15-30	-
	Measured Value	51.5	1.55	24.0	22.3

Table6: Parameters of the head tissue simulating liquids

7.5Setup for System Performance Check

(see also Chapter 15 System Performance Check of DAY 4 System handbook)

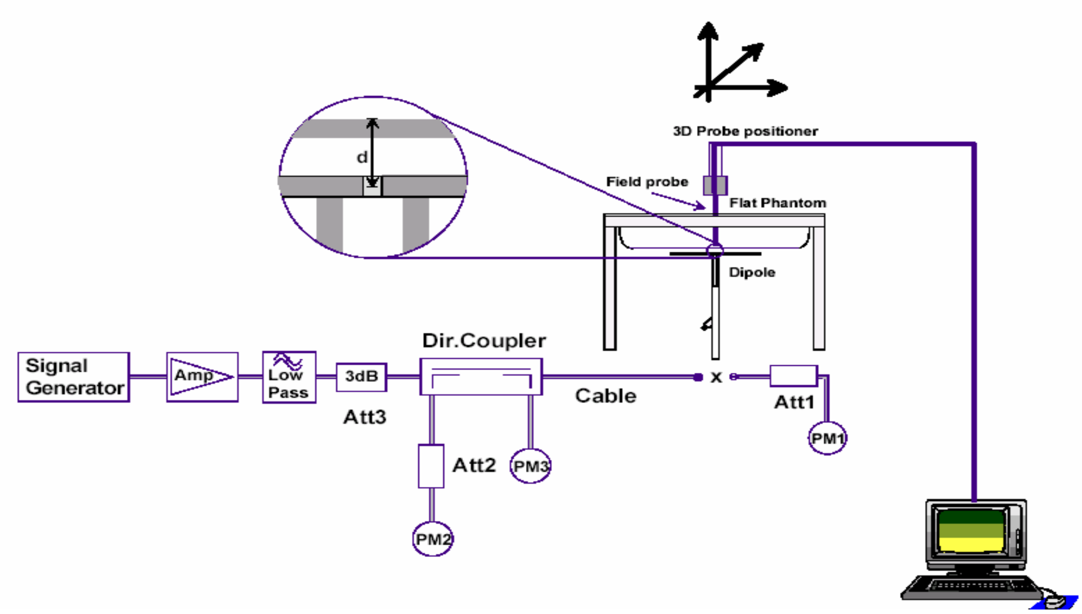


Fig5.Setup for system performance Check

First the power meter PM1 is connected to the cable and it measures the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the (Att1) value) and the power meter PM2 is read at that level. Then after connecting the cable to the dipole, the signal generator is readjusted for the same reading at the power meter PM2. If the signal generator does not allow a setting in 0,01 dB steps, the remaining difference at PM2 must be taken into consideration. PM3 records the reflected power from the dipole and ensures that the value is not changed from the previous value. The reflected power should be 20 dB below the forwarded power.

Error description	ToL.	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std.Unc (1g).	Std.Unc. (10g)	(v_i) V_{eff}
Measurement system								
Probe calibration	±5.9%	N	1	1	1	±5.9%	±5.9%	∞
Axial isotropy	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
Hemispherical isotropy	±9.6%	R	$\sqrt{3}$	0	0	0	0	∞
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	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response time	0	R	$\sqrt{3}$	1	1	0	0	∞
Integration time	0	R	$\sqrt{3}$	1	1	0	0	∞
RF ambient noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF ambient reflections	±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%	∞
Algorithms for Max.SAR Eval.	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Dipole								
Dipole Axis to Liquid Distance	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
Input power and SAR drift meas.	±4.7%	N	1	1	1	±2.7%	±2.7%	∞
Phantom and Tissue Param								
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 conductivity(target)	±5.0%	R	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
Liquid conductivity (means.)	±2.5%	N	1	0.6	0.49	±1.5%	±1.2%	∞
Combined std. Uncertainty						±9.2%	±8.9%	∞
Coverage Factor for 95%		$k_p = 2$						
Expanded STD Uncertainty						**±18.4%**	**±17.8%**	

Table 7:Uncertainty Budget for the system performance check

7.6Test Results

1900MHz/Head

Right Side	Cheek	**1880 MHz**

Touch position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Maximum value of SAR (measured) = 0.032 mW/g

Touch position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.13V/m; Power Drift =0.049 dB
Peak SAR (extrapolated) = 0.045 W/kg

SAR(1 g) = 0.027mW/g; SAR(10 g) = 0. 016mW/g

Maximum value of SAR (measured) =0.032 mW/g

0 dB = 0.032mW/g

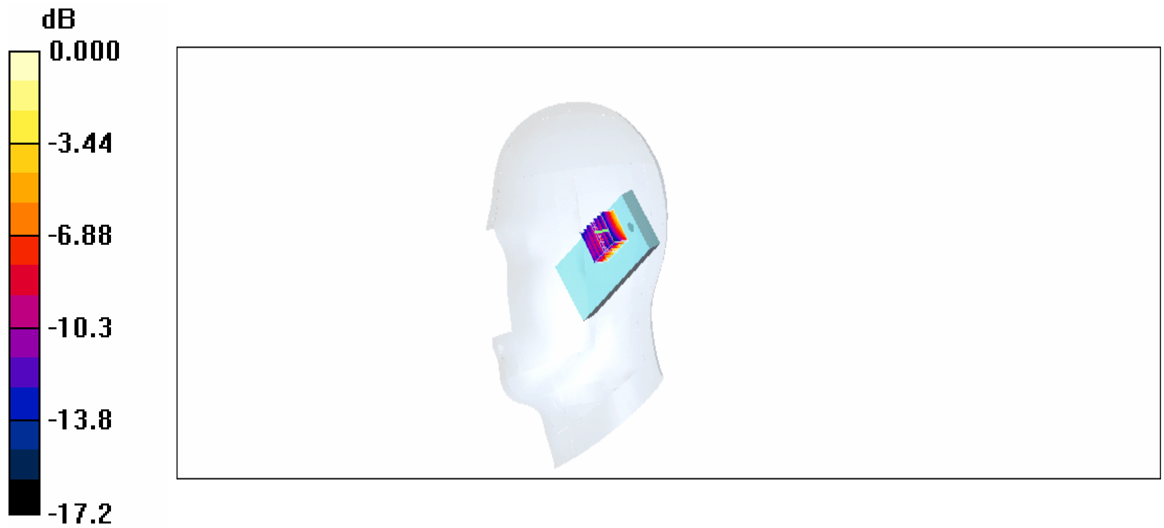
Fig 6 SAR Test result

Right Side	Tilt	**1880 MHz**

Tilt position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Maximum value of SAR (measured) = 0.034 mW/g
Tilt position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.52 V/m; Power Drift =0.087dB
Peak SAR (extrapolated) = 0.06W/kg

SAR(1 g) = 0.031 mW/g; SAR(10 g) = 0.016 mW/g

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



0 dB = 0.034 mW/g

Fig7 SAR Test result

Left Side	Cheek	**1880 MHz**

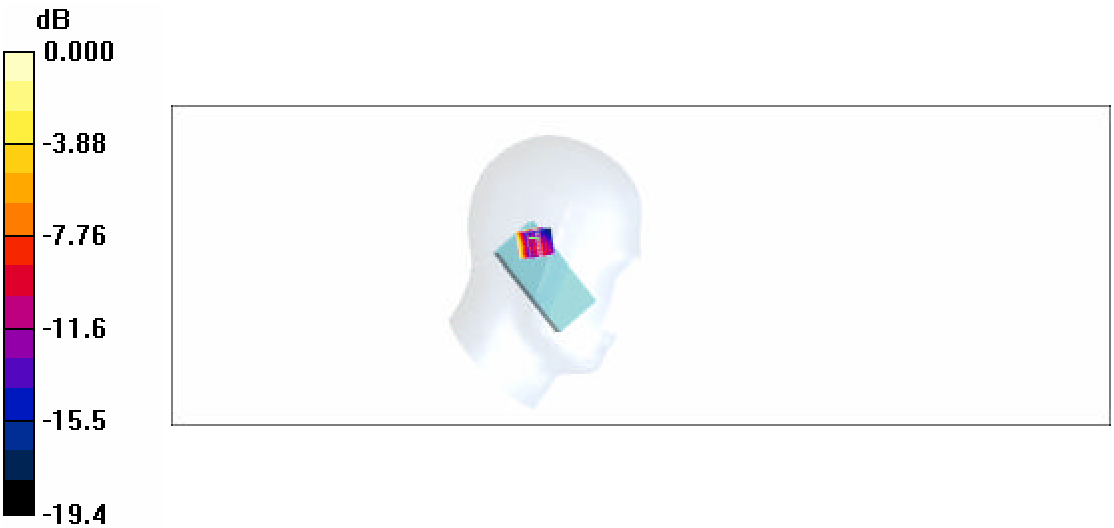
Touch position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Maximum value of SAR (measured) = 0.032 mW/g

Touch position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =4.53 V/m; Power Drift =0.051dB
Peak SAR (extrapolated) = 0.051W/kg

SAR(1 g) = 0.028 mW/g; SAR(10 g) =0.015 mW/g

Maximum value of SAR (measured) = 0.032 mW/g



0 dB =0.032mW/g

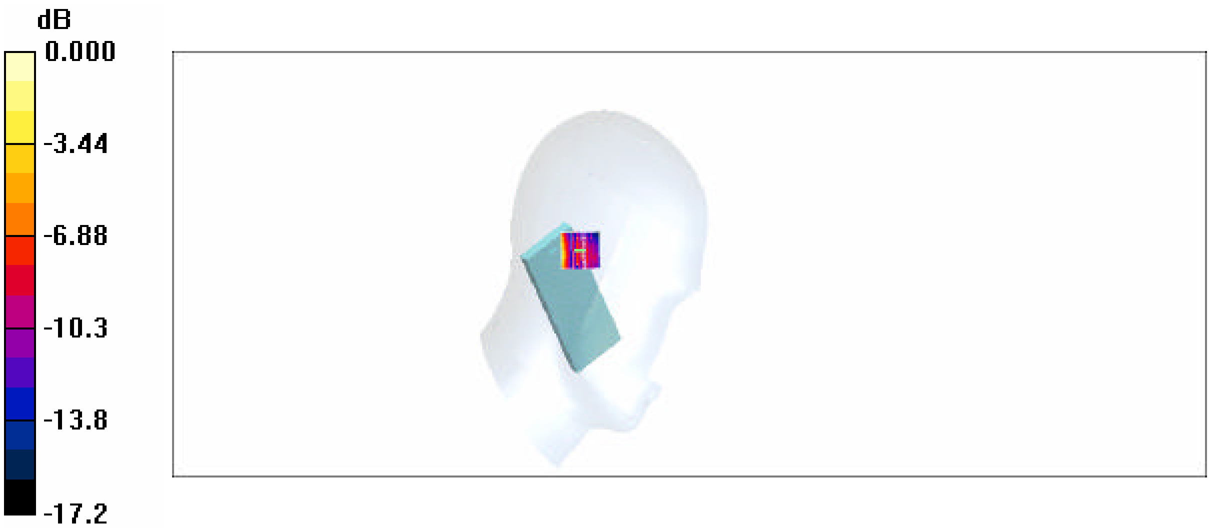
Fig8 SAR Test result

Left Side	Tilt	**1880 MHz**

Tilt position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Maximum value of SAR (measured) = 0.043 mW/g
Tilt position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.12 V/m; Power Drift =0.082dB
Peak SAR (extrapolated) = 0.077W/kg

SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.020 mW/g

Maximum value of SAR (measured) = 0.043 mW/g



0 dB = 0.043mW/g

Fig9 SAR Test result

1900MHz/ Body

Towards ground	**1880 MHz**

Towards ground - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

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

Maximum value of SAR (measured) = 0.494 mW/g

Towards ground - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11V/m; Power Drift = -0.011 dB
Peak SAR (extrapolated) = 0.819W/kg

SAR(1 g) = 0.441 mW/g; SAR(10 g) = 0.249 mW/g

Maximum value of SAR (measured) =0.494 mW/g

0 dB = 0.494mW/g

Fig10 SAR Test result

Towards ground	**1850.2MHz**

Towards ground - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

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

Maximum value of SAR (measured) =0.467 mW/g

Towards ground - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.48 V/m; Power Drift = 0.025 dB
Peak SAR (extrapolated) = 0.878 W/kg
SAR(1 g) = 0.434mW/g; SAR(10 g) = 0.246 mW/g

Maximum value of SAR (measured) = 0.467 mW/g

0 dB = 0.467mW/g

Fig11 SAR Test result

Towards ground	**1909.8MHz**

Towards ground - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

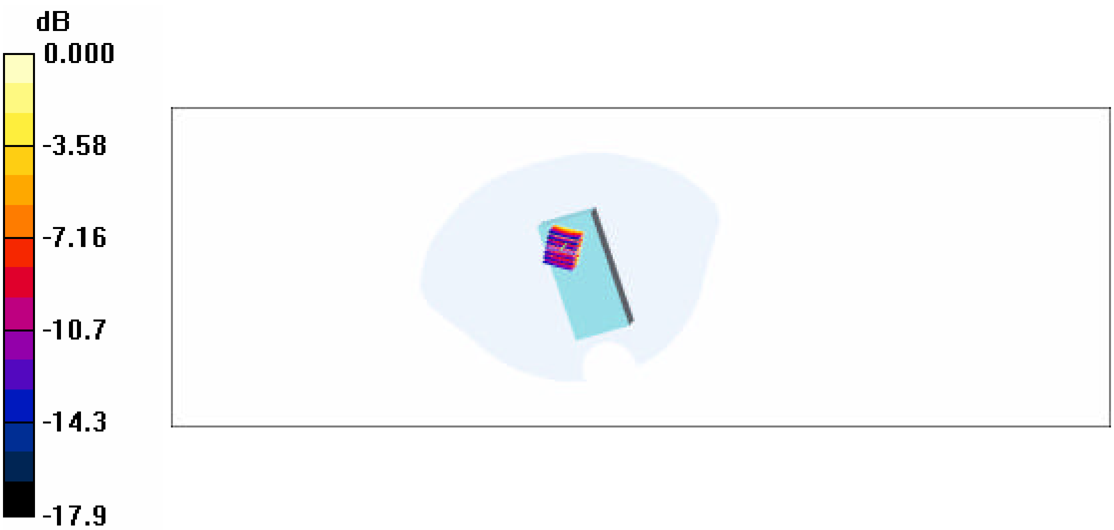
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Maximum value of SAR (measured) = 0.514 mW/g

Towards ground -High/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.1V/m; Power Drift =-0.113dB
Peak SAR (extrapolated) = 0.831W/kg

SAR(1 g) = 0.467 mW/g; SAR(10 g) = 0.264mW/g

Maximum value of SAR (measured) =0.514 mW/g



0 dB = 0.514 mW/g

Fig12 SAR Test result

Back ground	**1880 MHz**

Back ground - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

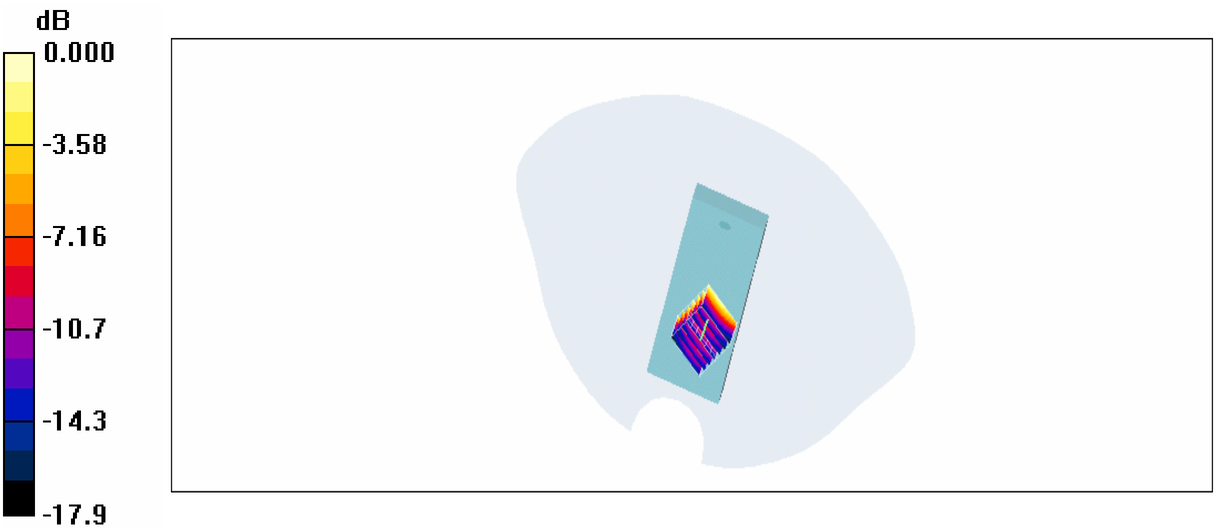
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Maximum value of SAR (measured) = 0.044 mW/g

Back ground - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =10V/m; Power Drift =-0.026 dB
Peak SAR (extrapolated) = 0.094 W/kg

SAR(1 g) = 0.030 mW/g; SAR(10 g) =0.00891mW/g

Maximum value of SAR (measured) = 0.044 mW/g



0 dB = 0.044 mW/g

Fig13 SAR Test result

1900MHz/GPRS

Towards ground	1880 MHz

Towards ground - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

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

Maximum value of SAR (measured) = 0.284mW/g

Towards ground - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.01 V/m; Power Drift = -0.123 dB
Peak SAR (extrapolated) = 0.474 W/kg
SAR(1 g) = 0.264 mW/g; SAR(10 g) = 0.154 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.284 mW/g

0 dB = 0.284mW/g

Fig14 SAR Test result

Towards ground	**1909.8MHz**

Towards ground with a headset – High /Zoom Scan (7x7x7) (7x7x7)/Cube 0:

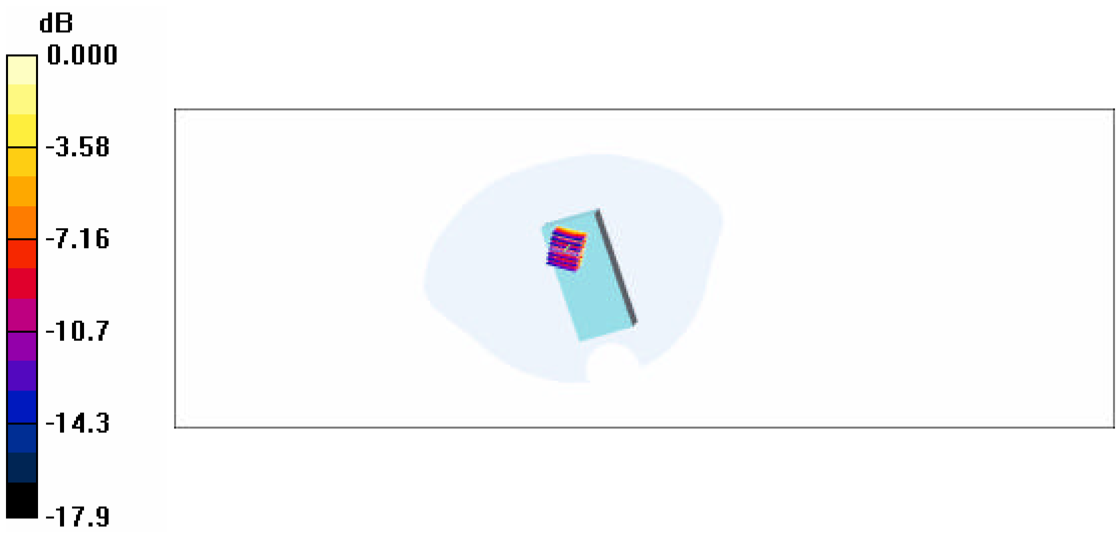
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Maximum value of SAR (measured) = 0.500 mW/g

Towards ground with a headset -High /Zoom Scan (7x7x7) (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.9V/m; Power Drift =-0.100dB
Peak SAR (extrapolated) = 0.811W/kg

SAR(1 g) = 0.452 mW/g; SAR(10 g) = 0.234mW/g

Maximum value of SAR (measured) =0.500 mW/g



0 dB = 0.500 mW/g

Fig15 SAR Test result

7.7 Pictures of the device under test

Fig15- show the device under test

Fig16: Front view of the device

Fig17: back view of the device

7.8 Test Positions for the Device under test

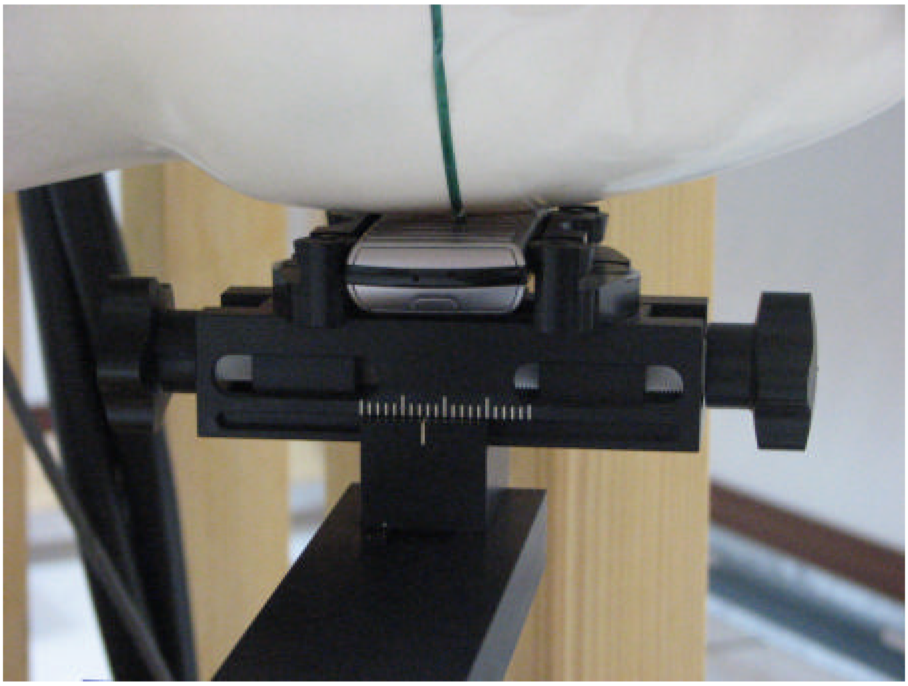


Fig 18 Cheek position, left side

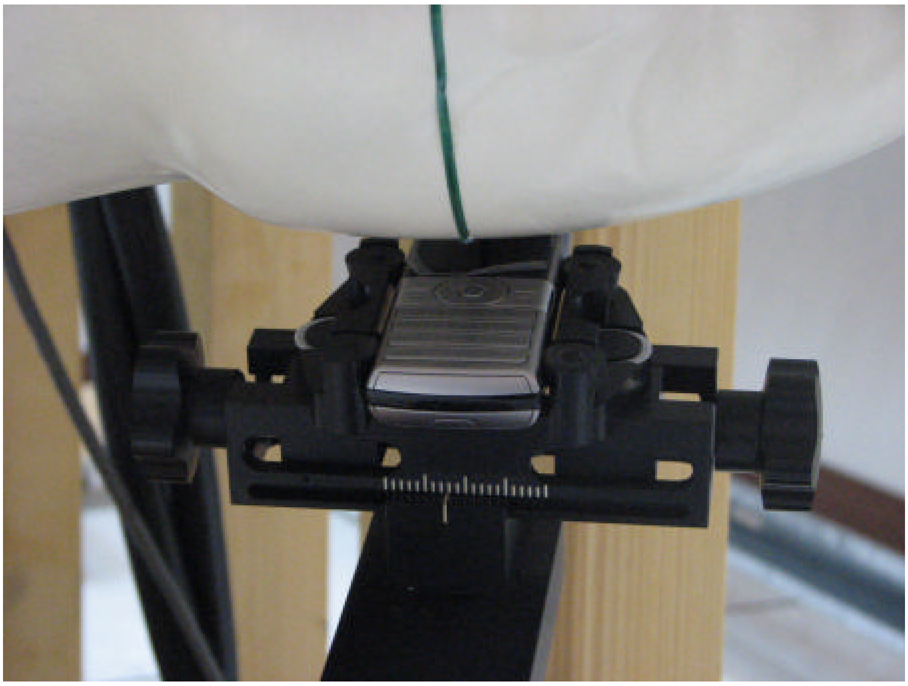


Fig 19: Tilt position, left side

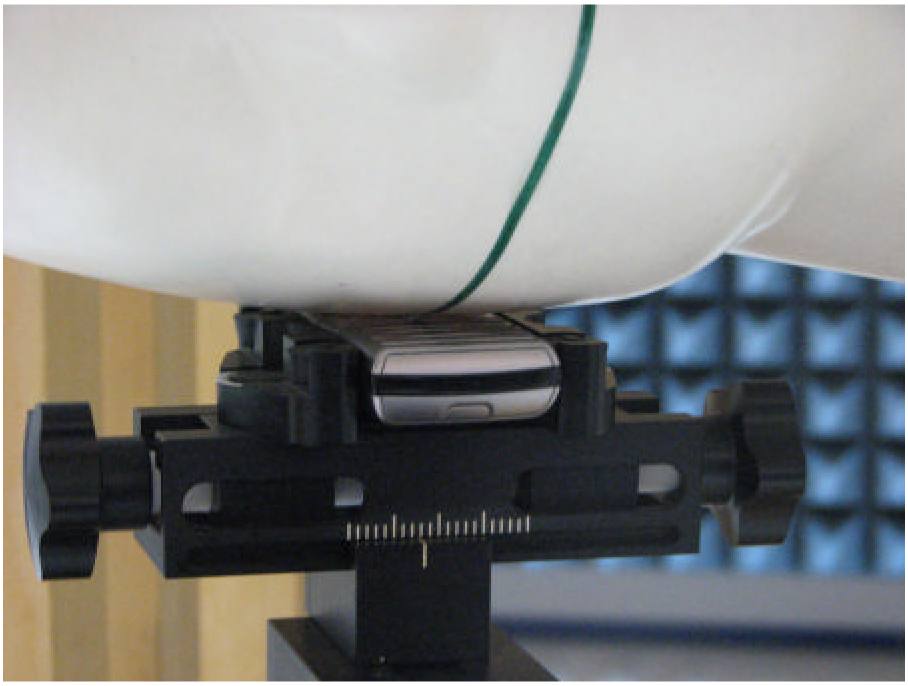


Fig20: Cheek position, Right side

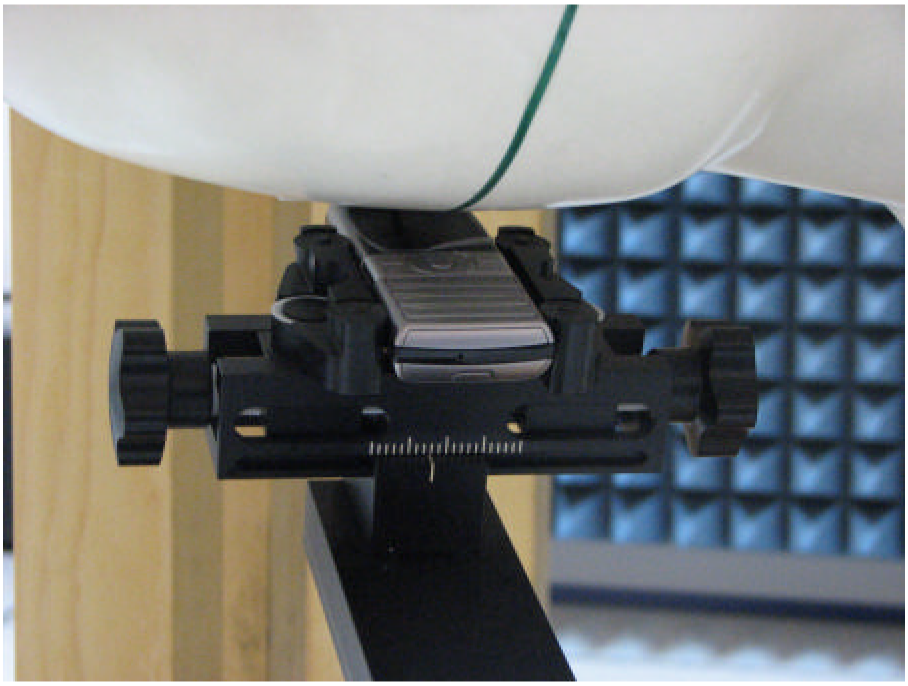


Fig 21 : Tilt position, Right side

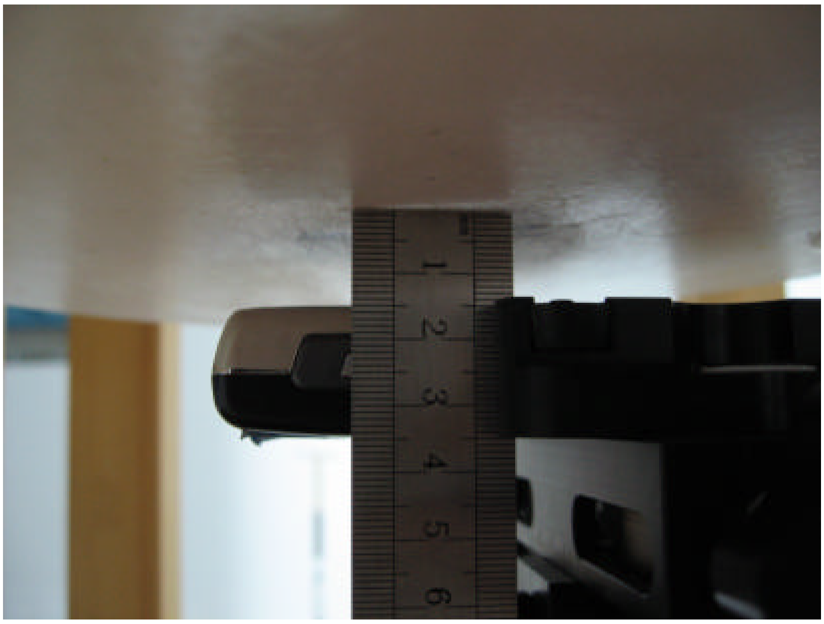


Fig22 .Body position

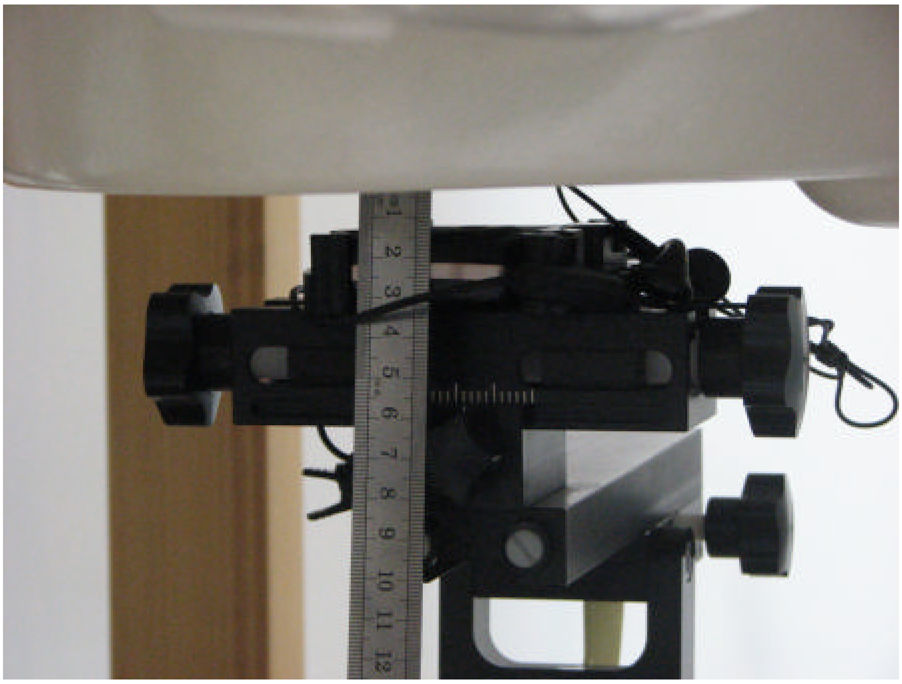


Fig23 .Body position with the headset

7.9 Picture to demonstrate the required liquid depth

the liquid depth in the used SAM phantoms

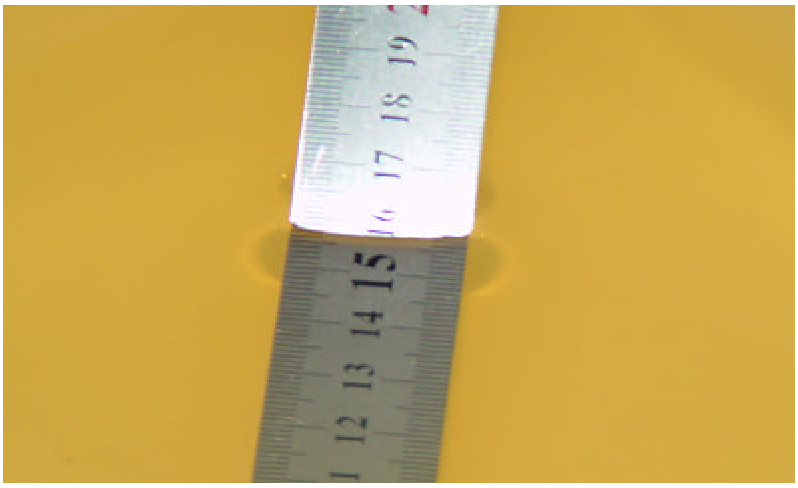


Fig23: Liquid depth for SAR Measurement

7.10 Simplified Performance Checking

The simplified performance check was realized using the dipole validation kits. The input power of the dipole antennas were 250mW (cw signal) and they were placed under the flat part of the SAM phantom. The results are listed in the Table 7 .The target values were adopted from the IEEE1528. Table 9 includes the uncertainty assessment for the system performance checking which was suggested by the IEC 62209-1-2005 and determined by Schmid & Partner Engineering AG. The expanded uncertainty is assessed to be ± 21.9%.

		SAR_{1g} [w/kg]	e_r	s[S/m]	Temperature	
					Ambient[℃]	Liquid[℃]
1900MHz	Target Value	39.7	53.3± 2.7	1.52± 0.15	15-30	-
	Measured Value	39.9	52.0	1.58	24.0	22.3

All SAR values are normalized to 1W forward power

Table8 : Validation results, 1900 MHz

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
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

Certificate No: DAE4-720_Oct06

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BC - SN: 720
Calibration procedure(s)	QA CAL-06.v12 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	October 20, 2006
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
Fluke Process Calibrator Type 702	SN: 6295803	13-Oct-06 (Elcal AG, No: 5492)	Oct-07
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-06 (Elcal AG, No: 5478)	Oct-07
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1002	15-Jun-06 (SPEAG, in house check)	In house check Jun-07

	Name	Function	Signature
Calibrated by:	Stefano Giannotta	Technician	Giannotta Stefano
Approved by:	Fin Bomholt	R&D Director	F. Bomholt

Issued: October 24, 2006

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

S Schweizerischer Kalibrierdienst
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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

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

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

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

Calibration Factors	X	Y	Z
High Range	403.516 ± 0.1% (k=2)	404.992 ± 0.1% (k=2)	403.380 ± 0.1% (k=2)
Low Range	3.94744 ± 0.7% (k=2)	3.96221 ± 0.7% (k=2)	3.92472 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	168 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Input (µV)	Reading (µV)	Error (%)
Channel X	+ Input	200000	200000.1	0.00
Channel X	+ Input	20000	20002.44	0.01
Channel X	- Input	20000	-20003.13	0.02
Channel Y	+ Input	200000	200000.1	0.00
Channel Y	+ Input	20000	20003.34	0.02
Channel Y	- Input	20000	-19999.90	0.00
Channel Z	+ Input	200000	200000.1	0.00
Channel Z	+ Input	20000	20002.21	0.01
Channel Z	- Input	20000	-20007.43	0.04

Low Range		Input (µV)	Reading (µV)	Error (%)
Channel X	+ Input	2000	2000.0	0.00
Channel X	+ Input	200	199.49	-0.25
Channel X	- Input	200	-200.73	0.36
Channel Y	+ Input	2000	2000.0	0.00
Channel Y	+ Input	200	199.23	-0.38
Channel Y	- Input	200	-200.97	0.48
Channel Z	+ Input	2000	2000.0	0.00
Channel Z	+ Input	200	199.31	-0.34
Channel Z	- Input	200	-200.03	0.02

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	-7.41	-6.36
	- 200	7.68	7.12
Channel Y	200	15.98	15.73
	- 200	-17.35	-17.00
Channel Z	200	-15.99	-16.32
	- 200	15.87	15.36

3. Channel separation

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

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	1.61	0.69
Channel Y	200	-0.57	-	3.69
Channel Z	200	-2.01	1.14	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	16159	15943
Channel Y	16202	16035
Channel Z	16513	13928

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.73	-1.17	2.20	0.61
Channel Y	-1.50	-2.60	-0.21	0.44
Channel Z	-0.68	-2.10	1.37	0.66

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	198.3
Channel Y	0.1999	199.8
Channel Z	0.2001	199.3

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

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

9. Power Consumption (verified during pre test)

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

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

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Swiss Calibration Service

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Accreditation No.: SCS 108

Client

Certificate No: DAE4-725_Feb07

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BG - SN: 725
Calibration procedure(s)	QA CAL-06.v12 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	February 26, 2007
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	13-Oct-06 (Elcal AG, No: 5492)	Oct-07
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-06 (Elcal AG, No: 5478)	Oct-07
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1002	15-Jun-06 (SPEAG, in house check)	In house check Jun-07

	Name	Function	Signature
Calibrated by:	Daniel Steinacher	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: February 26, 2007

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

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Accreditation No.: **SCS 108**

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100…+300 mV

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

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

Calibration Factors	X	Y	Z
High Range	404.194 ± 0.1% (k=2)	404.944 ± 0.1% (k=2)	404.514 ± 0.1% (k=2)
Low Range	3.89608 ± 0.7% (k=2)	3.97890 ± 0.7% (k=2)	3.97682 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	236 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	200000	199999.4	0.00
Channel X	+ Input	20000	20008.02	0.04
Channel X	- Input	20000	-19999.77	0.00
Channel Y	+ Input	200000	199999.9	0.00
Channel Y	+ Input	20000	20006.16	0.03
Channel Y	- Input	20000	-20002.13	0.01
Channel Z	+ Input	200000	199999.3	0.00
Channel Z	+ Input	20000	20005.13	0.03
Channel Z	- Input	20000	-20002.90	0.01

Low Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	2000	2000.1	0.00
Channel X	+ Input	200	200.53	0.26
Channel X	- Input	200	-199.86	-0.07
Channel Y	+ Input	2000	1999.9	0.00
Channel Y	+ Input	200	199.83	-0.08
Channel Y	- Input	200	-200.83	0.42
Channel Z	+ Input	2000	1999.9	0.00
Channel Z	+ Input	200	199.07	-0.47
Channel Z	- Input	200	-201.05	0.53

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	9.53	8.54
	- 200	-6.95	-8.23
Channel Y	200	-10.33	-10.58
	- 200	10.35	9.71
Channel Z	200	-3.28	-3.83
	- 200	3.18	2.12

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	3.17	-0.11
Channel Y	200	1.30	-	4.28
Channel Z	200	-0.39	1.82	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	16234	17028
Channel Y	16225	15769
Channel Z	16101	15831

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.38	-2.01	2.01	0.39
Channel Y	-2.66	-3.87	-0.19	0.43
Channel Z	-1.36	-2.75	0.08	0.41

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2001	201.0
Channel Y	0.2000	202.0
Channel Z	0.2000	200.2

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

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

9. Power Consumption (verified during pre test)

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

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Accreditation No.: SCS 108

Client **SRMC (MTT)**

Certificate No: ES3-3127_Jan07

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3127
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	January 24, 2007
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

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

Issued: January 24, 2007

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

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Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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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 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) 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 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.

Probe ES3DV3

SN:3127

Manufactured: July 11, 2006
Calibrated: January 24, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3127

Sensitivity in Free Space[A]

NormX	**1.25** ± 10.1%	$\mu V/(V/m)^2$	
NormY	**1.29** ± 10.1%	$\mu V/(V/m)^2$	
NormZ	**1.21** ± 10.1%	$\mu V/(V/m)^2$	

Diode Compression[B]

DCP X	**94** mV
DCP Y	**95** mV
DCP Z	**96** 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		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	5.7	2.6
SAR_{be} [%]	With Correction Algorithm	0.0	0.2

TSL **1750 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	4.0	1.8
SAR_{be} [%]	With Correction Algorithm	0.1	0.1

Sensor Offset

Probe Tip to Sensor Center **2.0** mm

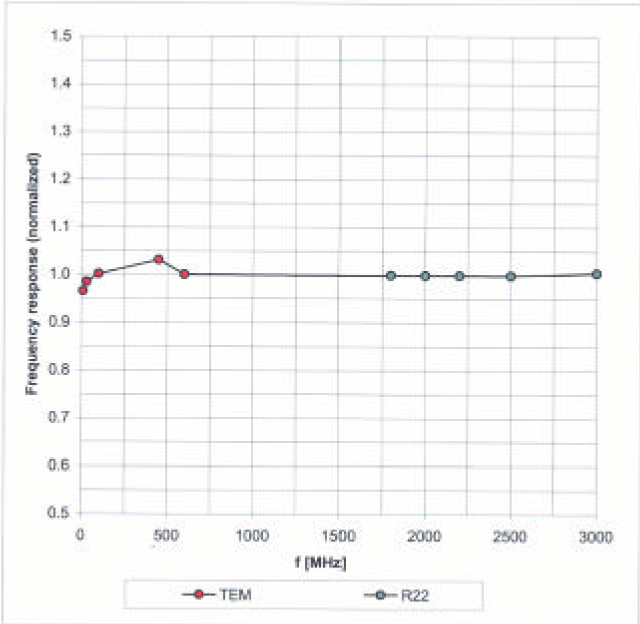
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[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.

ES3DV3 SN:3127 January 24, 2007

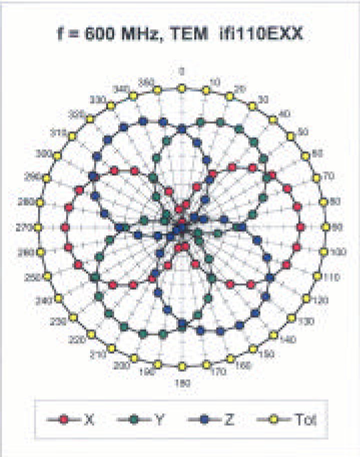
Frequency Response of E-Field

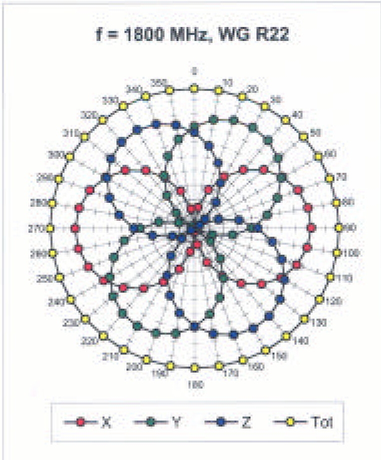
(TEM-Cell:ifi110 EXX, Waveguide: R22)

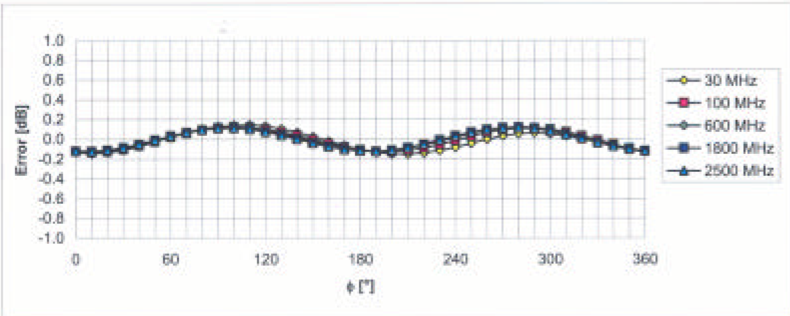


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



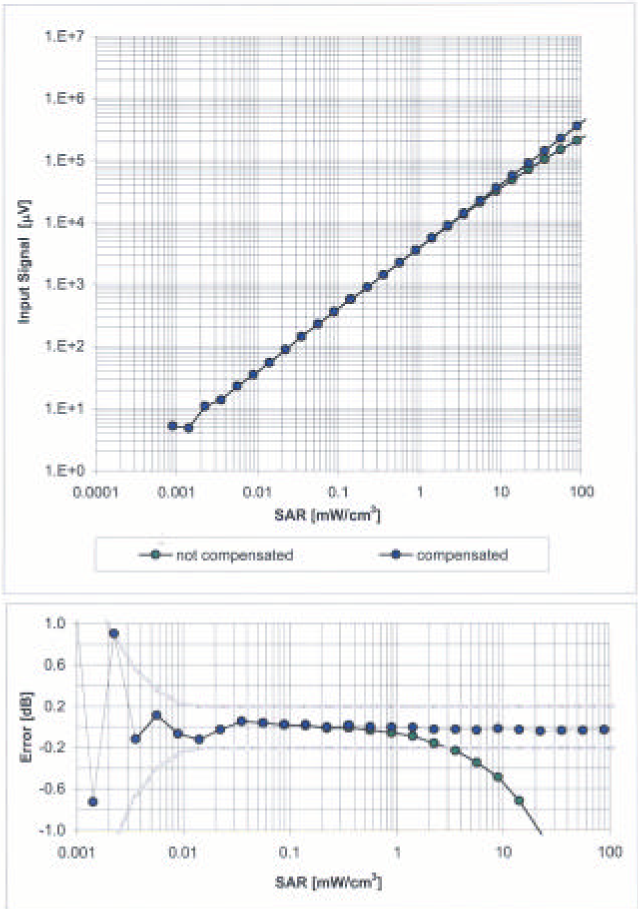




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

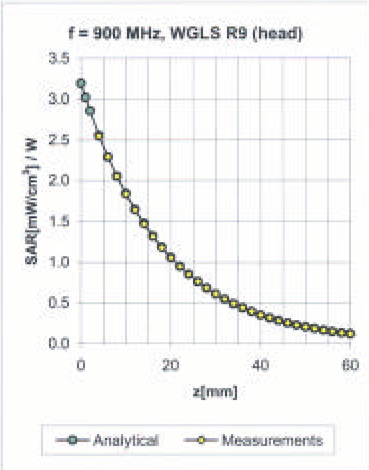
Dynamic Range f(SAR_{head})

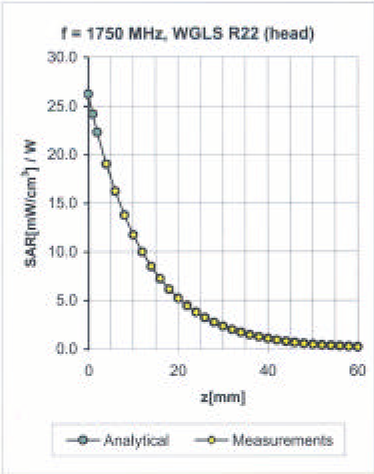
(Waveguide R22, f = 1800 MHz)



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

Conversion Factor Assessment





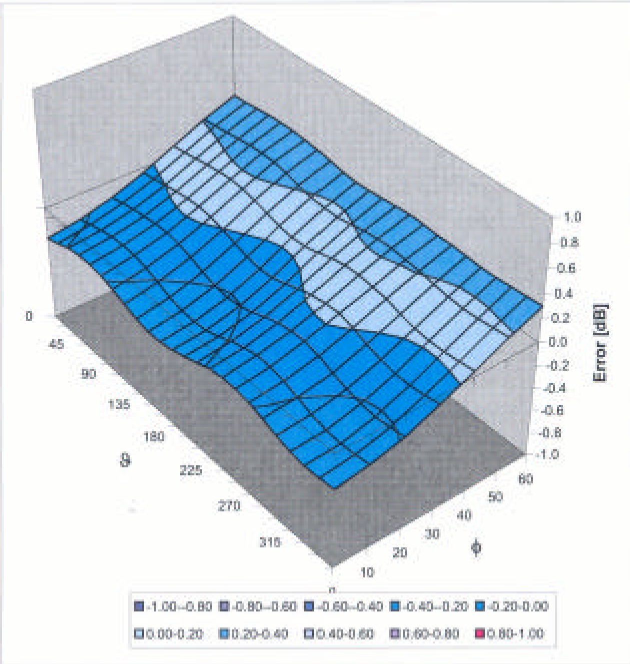
f [MHz]	Validity [MHz][c]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.90	1.12	6.19	± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.99	1.12	6.21	± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.94	1.15	4.93	± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.77	1.34	4.87	± 11.0% (k=2)
2000	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.84	1.24	4.66	± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.72	1.37	4.47	± 11.8% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.90	1.12	6.34	± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.90	1.14	6.03	± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.75	1.45	4.83	± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.84	1.26	4.64	± 11.0% (k=2)
2000	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.85	1.25	4.45	± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.90	1.06	4.16	± 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.

ES3DV3 SN:3127 January 24, 2007

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

7.11 Certificate of conformity

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 / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen 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; 6mm +/- 0.2mm at ERP	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 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 if handled and cleaned according to the instructions	DEGMBE based simulating liquids	Pre-series, First article, Samples

Standards

[1] CENELEC EN 50361
[2] IEEE Std 1528-200x Draft CD 1.1 (Dec 02)
[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 7.8.2003

Signature / Stamp

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