



CONFORMANCE TEST REPORT FOR HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

Report No. : SRMC2010-H024-E0006

Product Name: GSM Wireless Phone

Product Model: ZTE WP650

Applicant: ZTE Corporation

Manufacture: ZTE Corporation

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

Supplement C (Edition 01-01)

47CFR 2.1093

FCC ID: Q78-ZTEWP650

The State Radio Monitoring Center

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

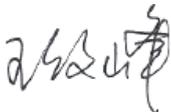
The ZTE WP650 is a GSM Wireless Phone. The phone can operate in the PCS1900MHz frequency range and GSM850MHz frequency range. The device has a internal integrated antenna. The system concepts used are the GSM850, GSM1900 standards.

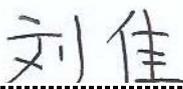
The objective of the measurements done by SRMC (The State radio monitoring center) was the dosimetric assessment of one device in the GSM850 and GSM1900 standards. The examinations have been carried out with the dosimetric assessment system, "DASY4".

The measurements were made according to FCC OET Bulletin 65 (Edition 97-01) Supplement C (Edition 01-01) and 47CFR 2.1093 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 ZTE WP650 mobile phone is

Mode	CH/f(MHz)	Power	Position	Limit (mW/g)/1g	Measured (mW/g)	Result
GSM850	189/836.4	32.8dBm	Right cheek	1.6	1.53	PASS

Checked By: 

Tested By: 

This Test Report Is Issued By: 

Issued date: **2010.03.12**

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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
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: ZTE Corporation
Address: 10# TangYan Road South, Hi-Tech Industrial Park, 710065
City: xi'an
Country or Region: P.R. China
Contacted person: Wang Lei
Tel: +86-029-88724011
Fax: +86-029-88723249
Email: wang.lei57@zte.com.cn

1.4 Manufacturer's details

Company: ZTE Corporation
Address: Zhongxing Bldg, Hi-Tech Park, NanShan, 518057
City: Shenzhen
Country or Region: P.R.China
Contacted person: LI De Zi
Tel: +86-021-68895196
Fax: +86-021-50801070
Email: li.dezi@zte.com.cn

1.5 Application details

Date of receipt of application: 2010.2.28

Date of receipt of test samples: 2010.2.28

Date of test: 2010.3.4

1.6 Information of Test Sample

□Name EUT	GSM wireless phone
□type	ZTE WP650
□Frequency range	GSM850: Tx:824~849MHz Rx:869~894MHz PCS1900: Tx:1850~1910MHz Rx:1930~1990MHz
□Power Level	GSM850:5 (33dBm) PCS1900:0 (30dBm)
□Channel spacing	GSM: 200kHz
□Duty Cycle	GSM: 1:8
□Modulation	GSM: GMSK
□Power supply	Normal Voltage:3.60V Max Voltage:4.35V Min Voltage:3.40V
□Test condition of declaration	Normal
Product Stage	production unit
□IMEI Number	863725000000578

1.7 Auxiliary Equipment (AE)

AE No.	Name	Model	Manufacturer	Serial Number
AE 1	Adapter	STC-A22○ 50U5-A	ZTE Corporation	---
AE 2	Battery	Ni3607T30P3S473 211	BYD Company Limited	---

1.8 Reference

OET Bulletin 65 (Edition 97-01) and Supplement C(Edition 01-01): Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits.

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.

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

47CFR 2.1093

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)

[DAY4]

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

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.

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 mm of the user in the uncontrolled environment.

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 σ and the mass density ρ of the biological tissue:

$$SAR = \frac{\sigma E_i^2}{\rho}$$
$$SAR = c_i \left. \frac{dT}{dt} \right|_t = 0$$

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.

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 the standards.

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: $\tan(\delta) \leq 0,05$ and $\epsilon \leq 5$. The thickness of the phantom is defined in the CAD files and the tolerance shall be $\pm 0,2$ 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 the standards. 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): $\tan(\delta) \leq 0,05$ and $\epsilon \leq 5$.

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 the standards.

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.

4.2 Simplified 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 the standards. The simplified performance check shall be performed prior to compliance tests and the result shall be within $\pm 10\%$ 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). ZTE WP650 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)

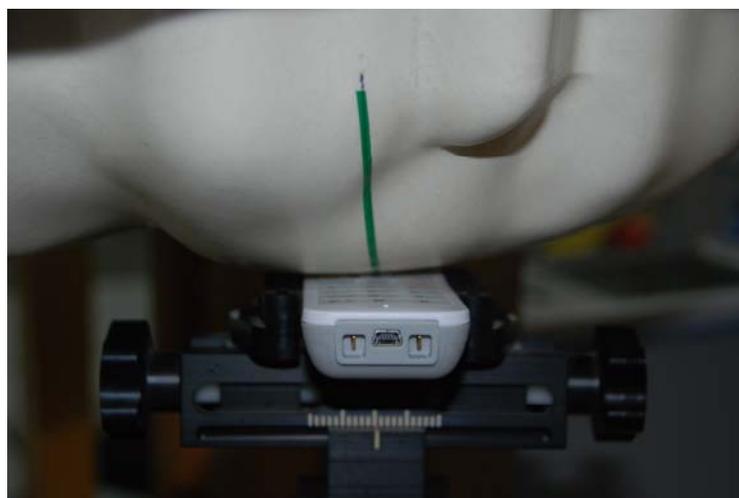


Fig 2 - Definition of the reference lines and points, on the phone and on the phantom and initial position

4.5 Tests 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

DASY4 is 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

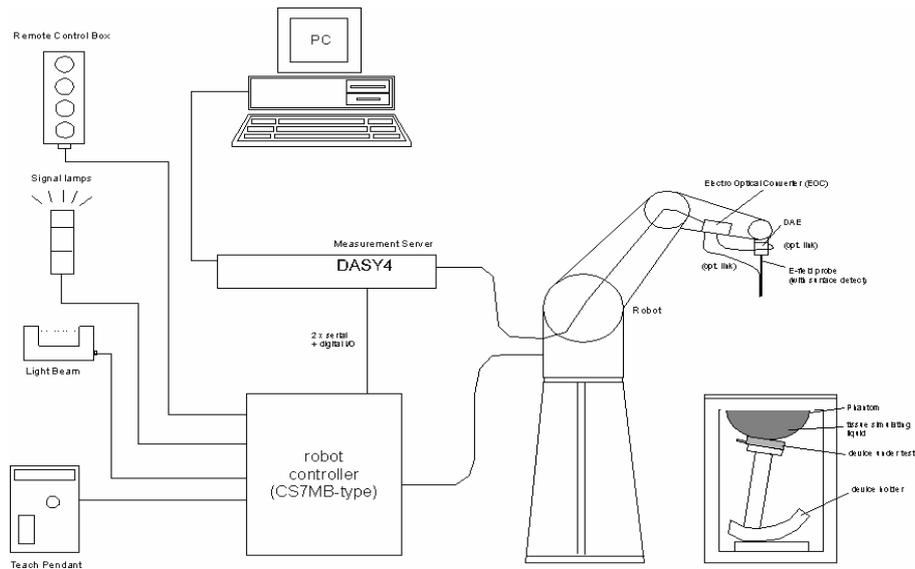


Fig3. The DASY4 measurement system

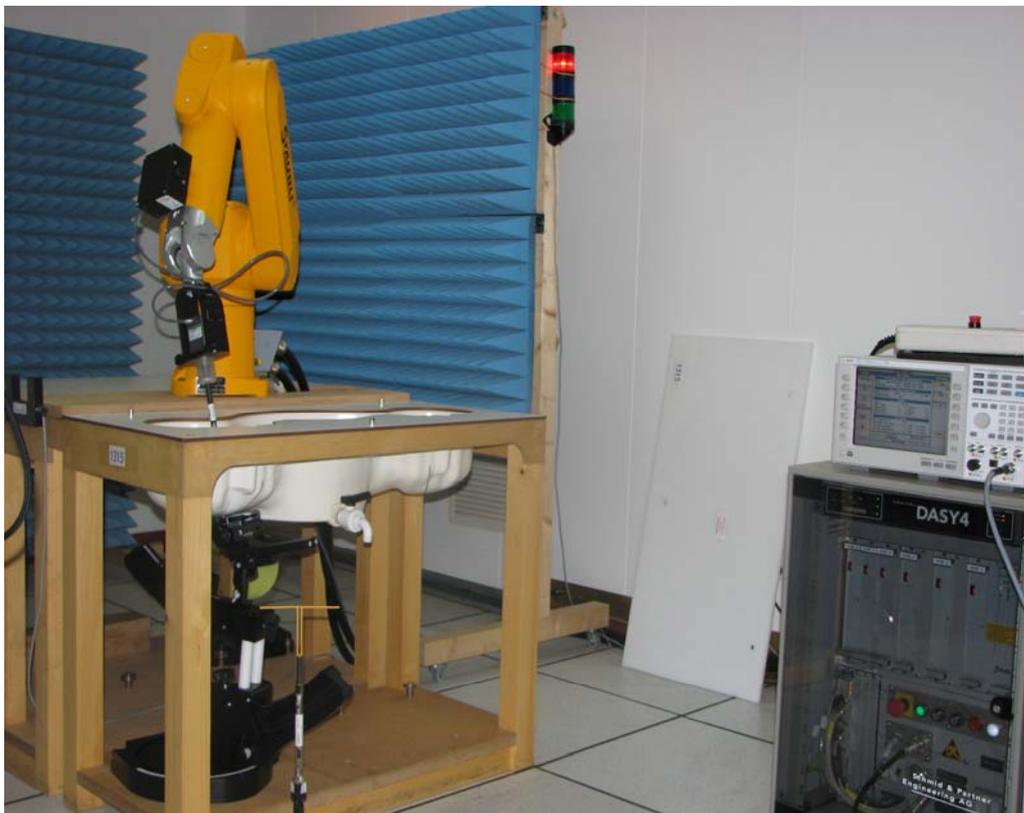


Fig 4. The measurement set-up with two SAM phantoms containing tissue simulating liquid

5.2 Test Equipments:

Name		Serial Number	Last Cal. Data
DASY4 SYSTEM			
Software Version	V4.7	N/A	N/A
Dosimetric E-Field probe	ES3DV3	3128	2009.06
Data Acquisition Electronics	DAE4	725	2009.06
Phantom	SAM	1267	N/A
Phantom	SAM	1315	N/A
Performance checking			
System Validation Dipole	D835V2	473	2008.06
System Validation Dipole	D1900V2	5d024	2008.06
RF source	E4428C	MY45280865	2009.8
RF Amplifier	5S1G4	0323472	N/A
Power Meter	E4417A	MY45101182	2009.8
Power Meter probe	E4412A	MY41502214	2009.8
Power Meter probe	E4412A	MY41502130	2009.8
Attenuator	2	BM0059	2009.8
Attenuator	2	BM6452	2009.8
Attenuator	2	BM8993	2009.8
Directional Coupler	778D-012	13733	2009.8
Material Measurement			
Network Analyzer	8714ET	US40372083	2009.8
Dielectric Probe Kit	85070D	US33030365	N/A
General			
Radio Tester	8960	GB43194054	2009.8

Note: the Dipole Calibration interval is 24 months

Table 1. Test Equipments list

5.3 Uncertainty Assessment

DASY4 Uncertainty Budget								
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

6.1 Test Environment:

Ambient Temperature: 24.0°C Relative Humidity: 35.5% Atmosphere:
101.0kPa

6.2 Test 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 $\pm 5\%$ 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 $\pm 0,5$ 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 the standard 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 $\pm 5\%$ 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.

6.3 Test 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.

6.4 Test Results

Mode: GSM 850

f_L (MHz)=824.2MHz f_M (MHz)=836.4 MHz f_H (MHz)= 848.8MHz

SAR Values (Head, 850MHz Band)

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	1.13
Left hand, Touch cheek, f_M	1.11
Left hand, Touch cheek, f_L	1.04
Left hand, Tilt 15 Degree, f_M	0.43
Right hand, Touch cheek, f_H	1.20
Right hand, Touch cheek, f_M	1.53
Right hand, Touch cheek, f_L	1.10
Right hand, Tilt 15 Degree, f_M	0.58

So, the maximum SAR is

Phantom Configuration	Device Test Position	SAR(mW/g)		
		f_L (MHz)	f_M (MHz)	f_H (MHz)
Right hand	Cheek	---	1.53	---

Table 3. SAR Results

Mode: GSM1900

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

SAR Values (Head, 1900MHz Band)

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	0.98
Left hand, Touch cheek, f_M	1.02
Left hand, Touch cheek , f_L	0.92
Left hand, Tilt 15 Degree, f_M	0.38
Right hand, Touch cheek , f_H	0.95
Right hand, Touch cheek, f_M	0.94
Right hand, Touch cheek f_L	0.90
Right hand, Tilt 15 Degree, f_M	0.36

So, the maximum SAR is

Phantom Configuration	Device Test Position	SAR(mW/g)		
		f_L (MHz)	f_M (MHz)	f_H (MHz)
Left Side	cheek	---	1.02	---

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

Table 4. SAR Results

7. Appendix

7.1 Administrative Data

Date of measurement: 2010.3.4

Data stored: SRMC2010-H024-E0006

7.2 Device under Test and Test Conditions

TYPE: ZTE WP650

Date of receipt: 2010.2.28

IMEI: 863725000000578

Equipment class: Portable device

Power Class: GSM850 tested with power level 5 (33dBm)
 GSM1900 tested with power level 0 (30dBm)

RF exposure environment: General Population

Power supply: Internal Battery (Other batteries not available)

Measurement Standards: GSM 850, GSM1900

Method to establish a call: GSM 850&GSM1900: Base station simulator, using the air interface

Modulation: GMSK

TX range: GSM850:824MHz~849MHz GSM1900:1850~1910MHz

RX range: GSM850:869MHz~894MHz GSM1900:1930~1990MHz

Used TX Channels: L: ch128; M: ch189; H: ch251

Used TX Channels: L: ch512; M: ch661; H: ch810 (refer to the table 5)

Mode	GSM850(Head) Duty cycle: 1:8(12.5%)			GSM1900(Head) Duty cycle: 1:8(12.5%)			
	Channel	128	189	251	512	661	810
Frequency(MHz)		824.2	836.4	848.8	1850.2	1880.0	1909.8
Measured Power(dBm)		32.8	32.8	32.8	29.7	29.7	29.7

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.

850MHz:	57.90%	Sugar;
	40.29%	de-ionised water
	1.38%	Salt
	0.24%	Cellulose
	0.18%	Preventol
1900 MHz:	44,45 %	2-(2-butoxyethoxy) ethanol
	55.24 %	de-ionised water
	0.31 %	NaCl 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. Liquid temperature during the test: 22.3°C. Tested date is 2010.3.4

Head		ϵ_r	σ [S/m]	Temperature	
				Ambient [°C]	Liquid [°C]
850MHz	Recommended Value	41.5±2.1	0.97±0.05	15-30	-
	Measured Value	41.5	0.98	24.0	22.3
1900MHz	Recommended Value	40±1.9	1.40±0.07	15-30	-
	Measured Value	39.0	1.44	24.0	22.3

Table6: Parameters of the head tissue simulating liquids

7.5 Simplified Performance Checking

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyser. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system checking results (dielectric parameters and SAR values) are given in the table below.

The target values were adopted from the manufactures calibration certificates which are attached in the appendix. 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 $\pm 21.9\%$.

Liquid temperature during the test: 22.3°C. System validation date: 2010.3.4

		SAR _{1g} [w/kg]	ϵ_r	σ [S/m]	Temperature	
					Ambient[°C]	Liquid[°C]
835MHz	Target Value	10.8	41.5±2.1	0.97±0.05	15-30	-
	Measured Value	10.9	41.5	0.98	24.0	22.3

All SAR values are normalized to 1W forward power

Table7: Validation results, 850 MHz

		SAR _{1g} [w/kg]	ϵ_r	σ [S/m]	Temperature	
					Ambient[°C]	Liquid[°C]
1900MHz	Target Value	39.7	40±1.9	1.40±0.07	15-30	-
	Measured Value	39.9	39.0	1.44	24.0	22.3

All SAR values are normalized to 1W forward power Plot of the system checking scans are given in Appendix7.7

Table 8: Validation results, 1900 MHz

7.6 Setup for System Performance Check

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

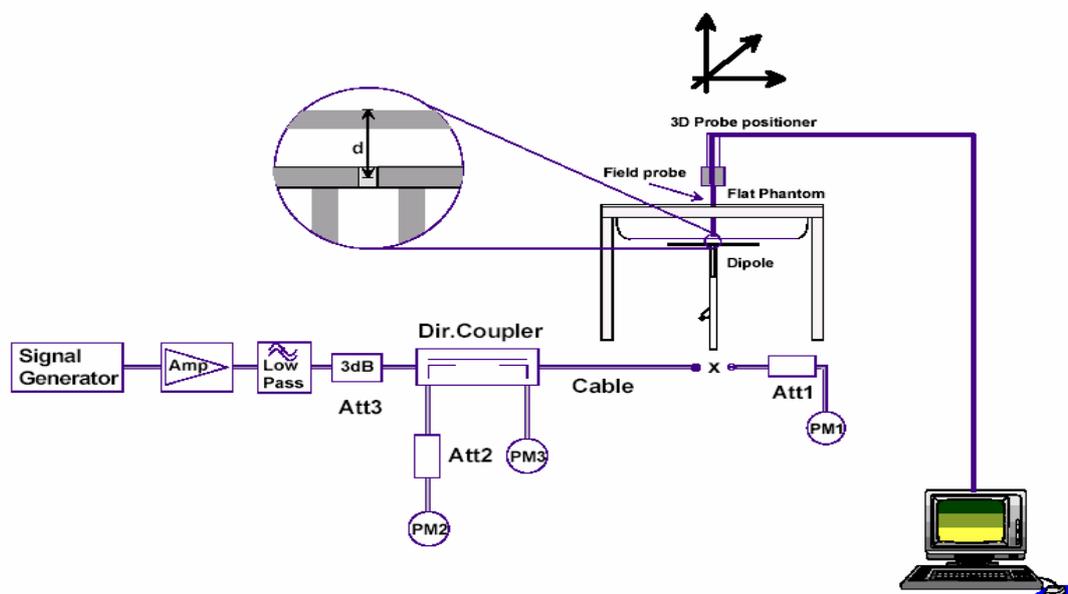


Fig5. Setup for system performance Check

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 9:Uncertainty Budget for the system performance check

7.7 Test Results

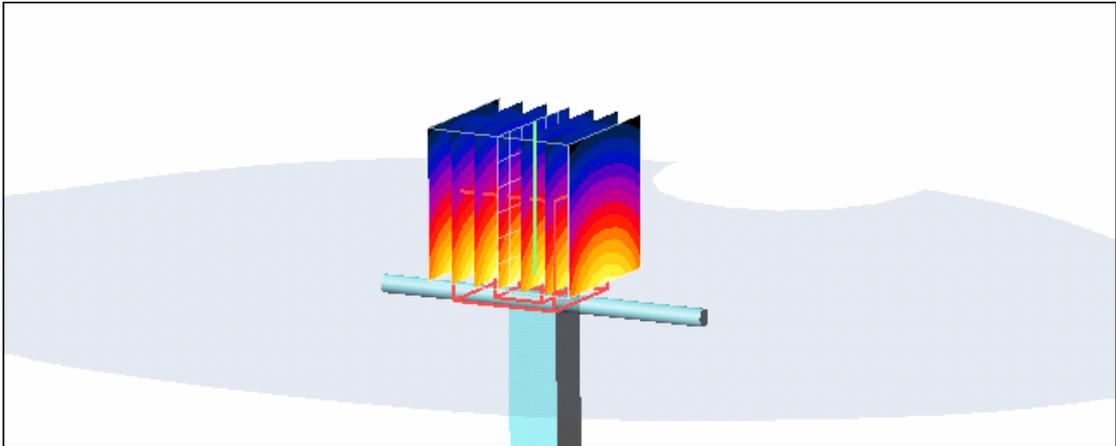
SYSTEM CHECKING SCANS	835MHz
<p>DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d023 Medium parameters used (interpolated): $f = 835$ MHz; $\sigma = 0.98$ mho/m; $\epsilon_r = 41.5$; $\rho = 1000$ kg/m³</p> <p>DASY4 Configuration: Probe: ES3DV3 - SN3128; ConvF(5.68,5.68,5.68); Calibrated: 6/22/2009 Electronics: DAE4 Sn725; Calibrated: 6/15/2009 Sensor-Surface: 4mm (Mechanical Surface Detection) Phantom: SAM 1315; Type: SAM; Serial: 1315 Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186</p> <p>d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 56.3V/m; Power Drift = -0.047 dB Peak SAR (extrapolated) = 4.08 W/kg SAR(1 g) = 2.72 mW/g; SAR(10 g) = 1.32 mW/g Maximum value of SAR (measured) = 2.9 mW/g</p> <div data-bbox="135 1232 1428 1691"></div> <p>0 dB = 2.9 mW/g</p>	

Fig6 SYSTEM CHECK

SYSTEM CHECKING SCANS

1900 MHz

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d113

Medium parameters used (interpolated): $f = 1900$ MHz; $\sigma = 1.44$ mho/m; $\epsilon_r = 39$; $\rho = 1000$ kg/m³

DASY4 Configuration:

Probe: ES3DV3 - SN3128; ConvF(4.75, 4.75, 4.75); Calibrated: 6/22/2009

Electronics: DAE4 Sn725; Calibrated: 6/15/2009

Sensor-Surface: 4mm (Mechanical Surface Detection)

Phantom: SAM 1267; Type: SAM; Serial: 1267

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

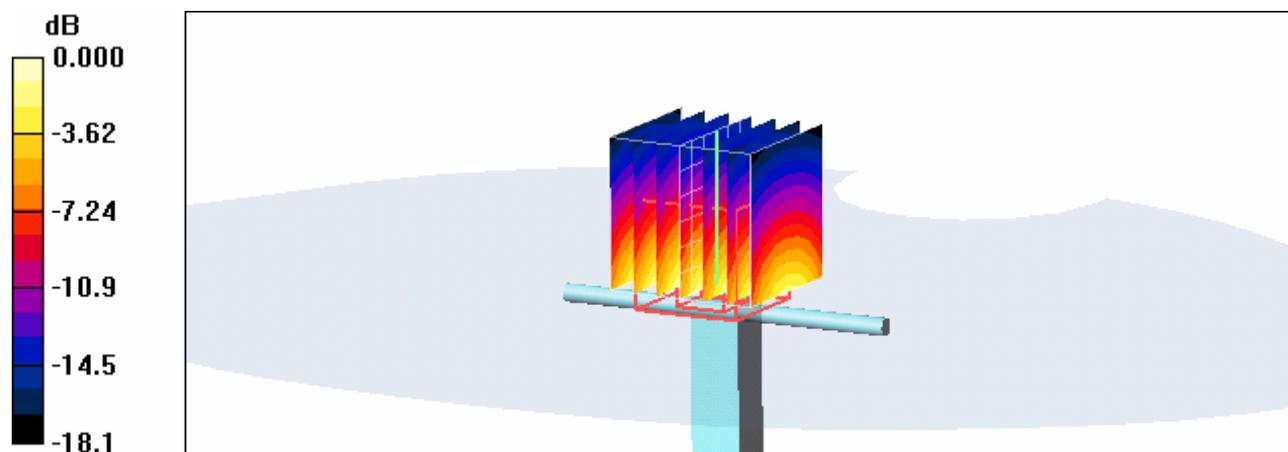
dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.3V/m; Power Drift = -0.047 dB

Peak SAR (extrapolated) = 17.8 W/kg

SAR(1 g) = 9.98 mW/g; SAR(10 g) = 5.32 mW/g

Maximum value of SAR (measured) = 11.6 mW/g



0 dB = 11.6 mW/g

Fig7 SYSTEM CHECK

GSM (850MHz/Head)

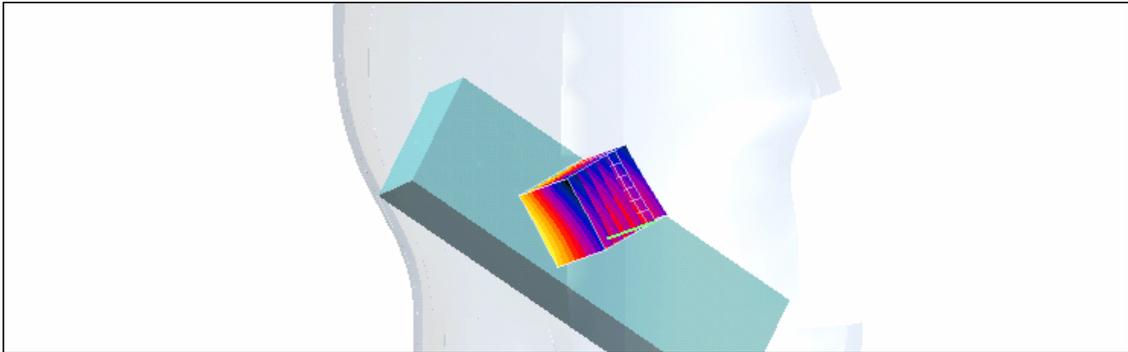
Left Side	Cheek	836.4 MHz						
Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.978$ mho/m; $\epsilon_r = 39.4$; $\rho = 1000$ kg/m ³								
DASY4 Configuration:								
- Probe: ES3DV3 - SN3128; ConvF(5.68, 5.68, 5.68); Calibrated: 6/22/2009								
- Sensor-Surface: 4mm (Mechanical Surface Detection)								
- Electronics: DAE4 Sn725; Calibrated: 6/15/2009								
- Phantom: SAM 1315; Type: SAM; Serial: 1315								
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186								
Touch position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:								
dx=5mm, dy=5mm, dz=5mm								
Reference Value = 19.8 V/m; Power Drift = -0.039 dB								
Peak SAR (extrapolated) = 1.43 W/kg								
SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.802 mW/g								
Info: Interpolated medium parameters used for SAR evaluation.								
Maximum value of SAR (measured) = 1.16 mW/g								
<div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>dB</p> <table border="1"> <tr><td>0.000</td></tr> <tr><td>-2.10</td></tr> <tr><td>-4.20</td></tr> <tr><td>-6.30</td></tr> <tr><td>-8.40</td></tr> <tr><td>-10.5</td></tr> </table> </div>  </div>			0.000	-2.10	-4.20	-6.30	-8.40	-10.5
0.000								
-2.10								
-4.20								
-6.30								
-8.40								
-10.5								

Fig8 SAR Test result

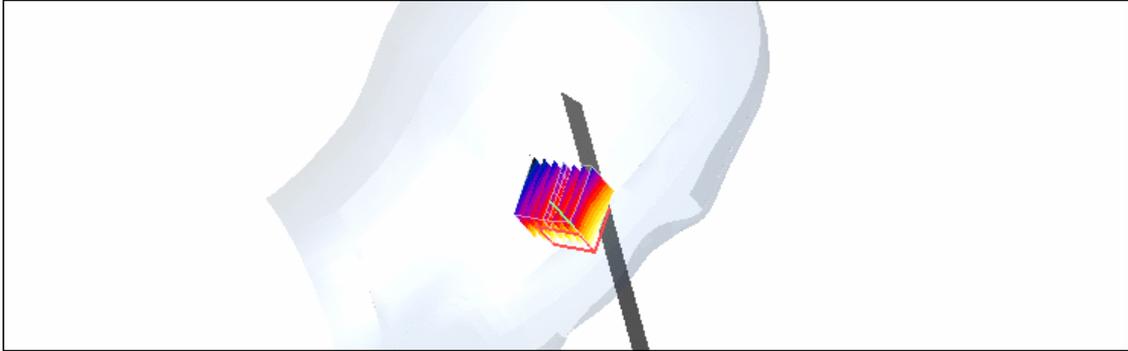
Left Side	Tilt	836.4 MHz						
<p>Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.978$ mho/m; $\epsilon_r = 39.4$; $\rho = 1000$ kg/m³</p> <p>DASY4 Configuration:</p> <ul style="list-style-type: none"> - Probe: ES3DV3 - SN3128; ConvF(5.68, 5.68, 5.68); Calibrated: 6/22/2009 - Sensor-Surface: 4mm (Mechanical Surface Detection) - Electronics: DAE4 Sn725; Calibrated: 6/15/2009 - Phantom: SAM 1315; Type: SAM; Serial: 1315 - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186 <p>Tilt position - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5$mm, $dy=5$mm, $dz=5$mm Reference Value = 14.4 V/m; Power Drift = -0.173 dB Peak SAR (extrapolated) = 0.556 W/kg SAR(1 g) = 0.434 mW/g; SAR(10 g) = 0.326 mW/g</p> <p>Info: Interpolated medium parameters used for SAR evaluation. Maximum value of SAR (measured) = 0.455 mW/g</p> <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>dB</p> <table border="1"> <tr><td style="background-color: yellow;">0.000</td></tr> <tr><td style="background-color: orange;">-2.08</td></tr> <tr><td style="background-color: red;">-4.16</td></tr> <tr><td style="background-color: purple;">-6.24</td></tr> <tr><td style="background-color: blue;">-8.32</td></tr> <tr><td style="background-color: black;">-10.4</td></tr> </table> </div> <div style="flex-grow: 1;">  <p>0 dB = 0.455mW/g</p> </div> </div>			0.000	-2.08	-4.16	-6.24	-8.32	-10.4
0.000								
-2.08								
-4.16								
-6.24								
-8.32								
-10.4								

Fig9 SAR Test result

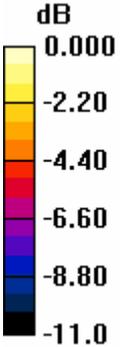
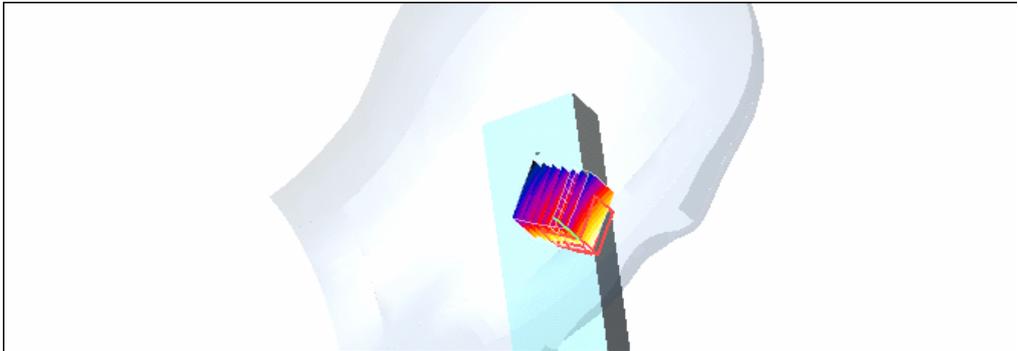
Left Side	Cheek	824.2 MHz
<p>Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.961$ mho/m; $\epsilon_r = 39.6$; $\rho = 1000$ kg/m³ DASY4 Configuration:</p> <ul style="list-style-type: none"> - Probe: ES3DV3 - SN3128; ConvF(5.68, 5.68, 5.68); Calibrated: 6/22/2009 - Sensor-Surface: 4mm (Mechanical Surface Detection) - Electronics: DAE4 Sn725; Calibrated: 6/15/2009 - Phantom: SAM 1315; Type: SAM; Serial: 1315 - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186 <p>Touch position - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 19.8 V/m; Power Drift = -0.209 dB Peak SAR (extrapolated) = 1.32 W/kg SAR(1 g) = 1.04 mW/g; SAR(10 g) = 0.746 mW/g</p> <p>Info: Interpolated medium parameters used for SAR evaluation.</p> <p>Maximum value of SAR (measured) = 1.10 mW/g</p> <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>dB</p>  <p>0 dB = 1.10mW/g</p> </div> <div>  </div> </div>		

Fig10 SAR Test result

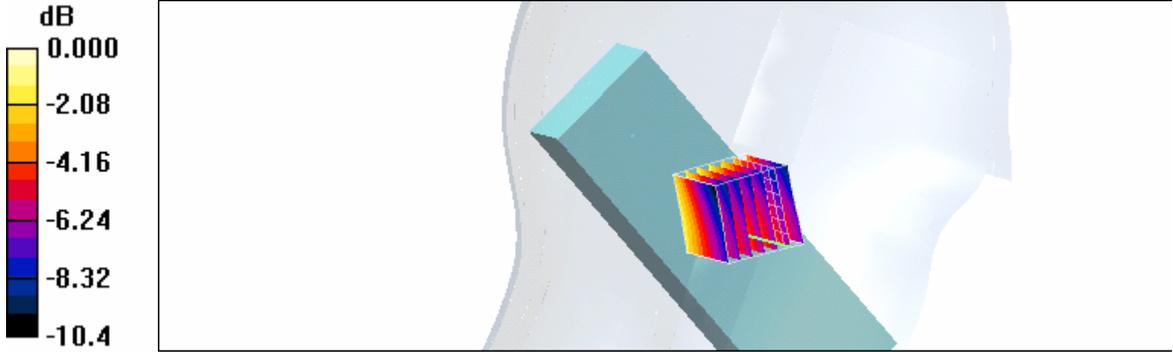
Left Side	Cheek	848.8MHz
<p>Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.987$ mho/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³ DASY4 Configuration: - Probe: ES3DV3 - SN3128; ConvF(5.68, 5.68, 5.68); Calibrated: 6/22/2009 - Sensor-Surface: 4mm (Mechanical Surface Detection) - Electronics: DAE4 Sn725; Calibrated: 6/15/2009 - Phantom: SAM 1315; Type: SAM; Serial: 1315 - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186</p>		
<p>Touch position - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 19.7 V/m; Power Drift = -0.003 dB Peak SAR (extrapolated) = 1.46 W/kg SAR(1 g) = 1.13 mW/g; SAR(10 g) = 0.808 mW/g</p> <p>Info: Interpolated medium parameters used for SAR evaluation. Maximum value of SAR (measured) = 1.18 mW/g</p>		
 <p>0 dB = 1.18mW/g</p>		

Fig11 SAR Test result

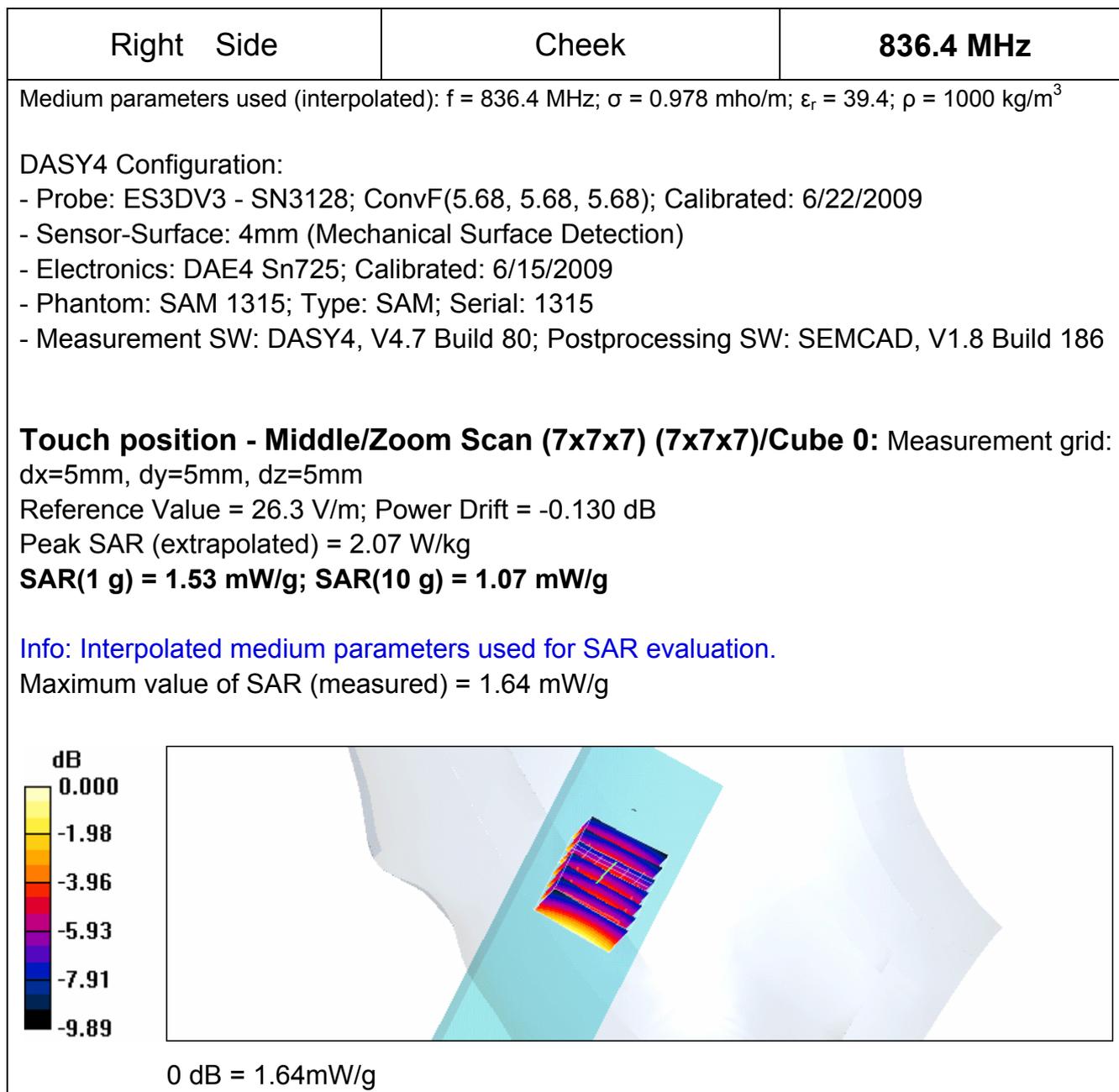


Fig12 SAR Test result

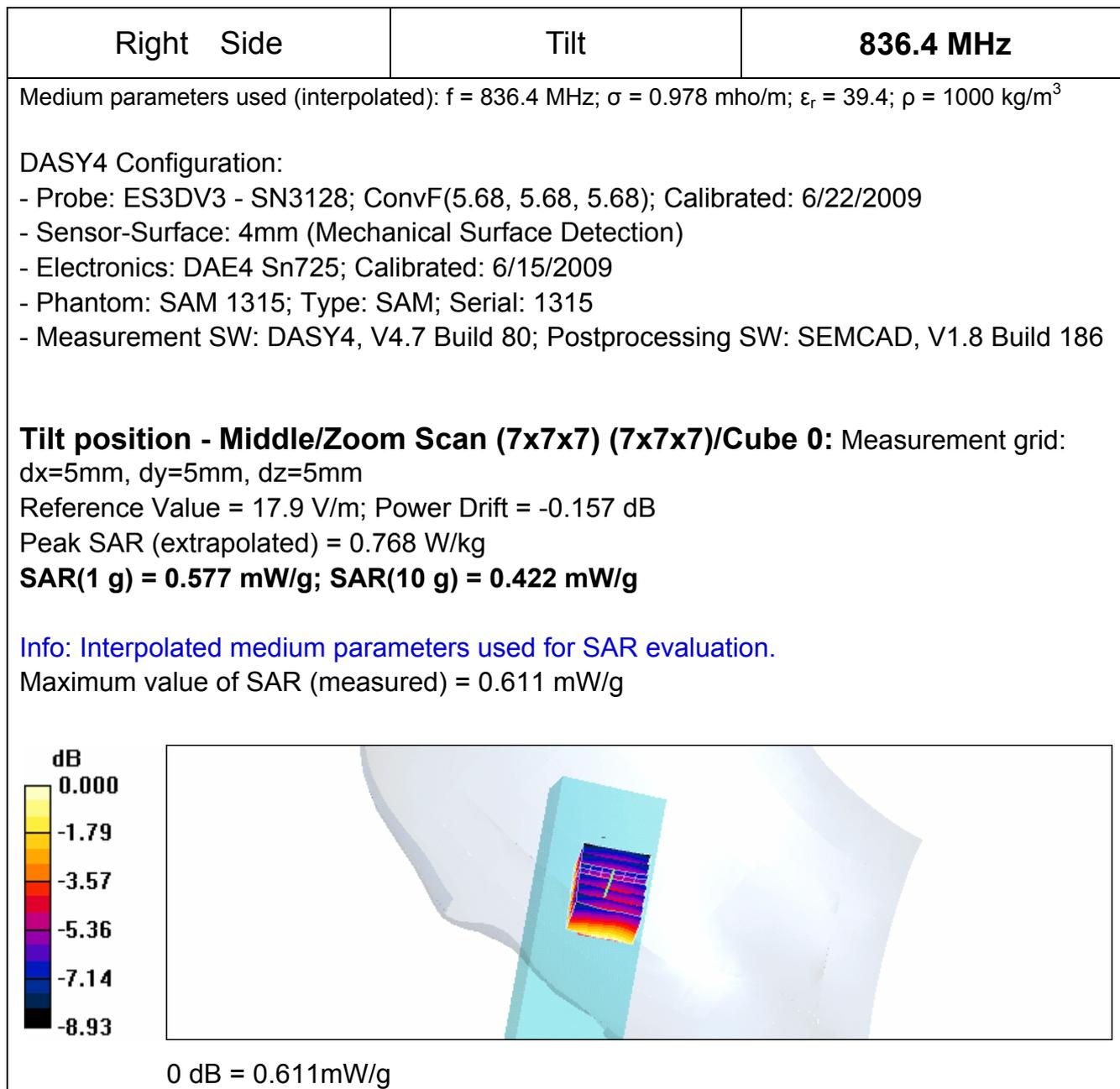


Fig13 SAR Test result

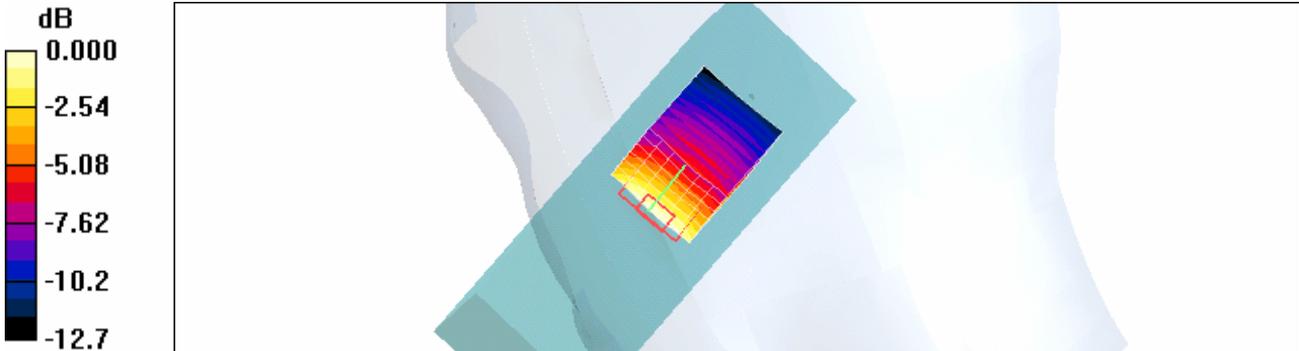
Right Side	Cheek	824.2 MHz
<p>Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.961$ mho/m; $\epsilon_r = 39.6$; $\rho = 1000$ kg/m³ DASY4 Configuration: - Probe: ES3DV3 - SN3128; ConvF(5.68, 5.68, 5.68); Calibrated: 6/22/2009 - Sensor-Surface: 4mm (Mechanical Surface Detection) - Electronics: DAE4 Sn725; Calibrated: 6/15/2009 - Phantom: SAM 1315; Type: SAM; Serial: 1315 - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186</p> <p>Touch position - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 19.6 V/m; Power Drift = -0.135 dB Peak SAR (extrapolated) = 1.48 W/kg SAR(1 g) = 1.1 mW/g; SAR(10 g) = 0.712 mW/g</p> <p>Info: Interpolated medium parameters used for SAR evaluation.</p> <p>Maximum value of SAR (measured) = 1.20 mW/g</p>  <p>0 dB = 1.20mW/g</p>		

Fig14 SAR Test result

Right Side	Cheek	848.8 MHz
<p>Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.987$ mho/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³</p> <p>DASY4 Configuration:</p> <ul style="list-style-type: none"> - Probe: ES3DV3 - SN3128; ConvF(5.68, 5.68, 5.68); Calibrated: 6/22/2009 - Sensor-Surface: 4mm (Mechanical Surface Detection) - Electronics: DAE4 Sn725; Calibrated: 6/15/2009 - Phantom: SAM 1315; Type: SAM; Serial: 1315 - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186 <p>Touch position - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5$mm, $dy=5$mm, $dz=5$mm Reference Value = 19.4 V/m; Power Drift = -0.038 dB Peak SAR (extrapolated) = 1.54 W/kg SAR(1 g) = 1.2 mW/g; SAR(10 g) = 0.862 mW/g</p> <p>Info: Interpolated medium parameters used for SAR evaluation.</p> <p>Maximum value of SAR (measured) = 1.27 mW/g</p> <div data-bbox="129 1160 1463 1576"> </div>		

Fig15 SAR Test result

GSM (1900MHz/Head)

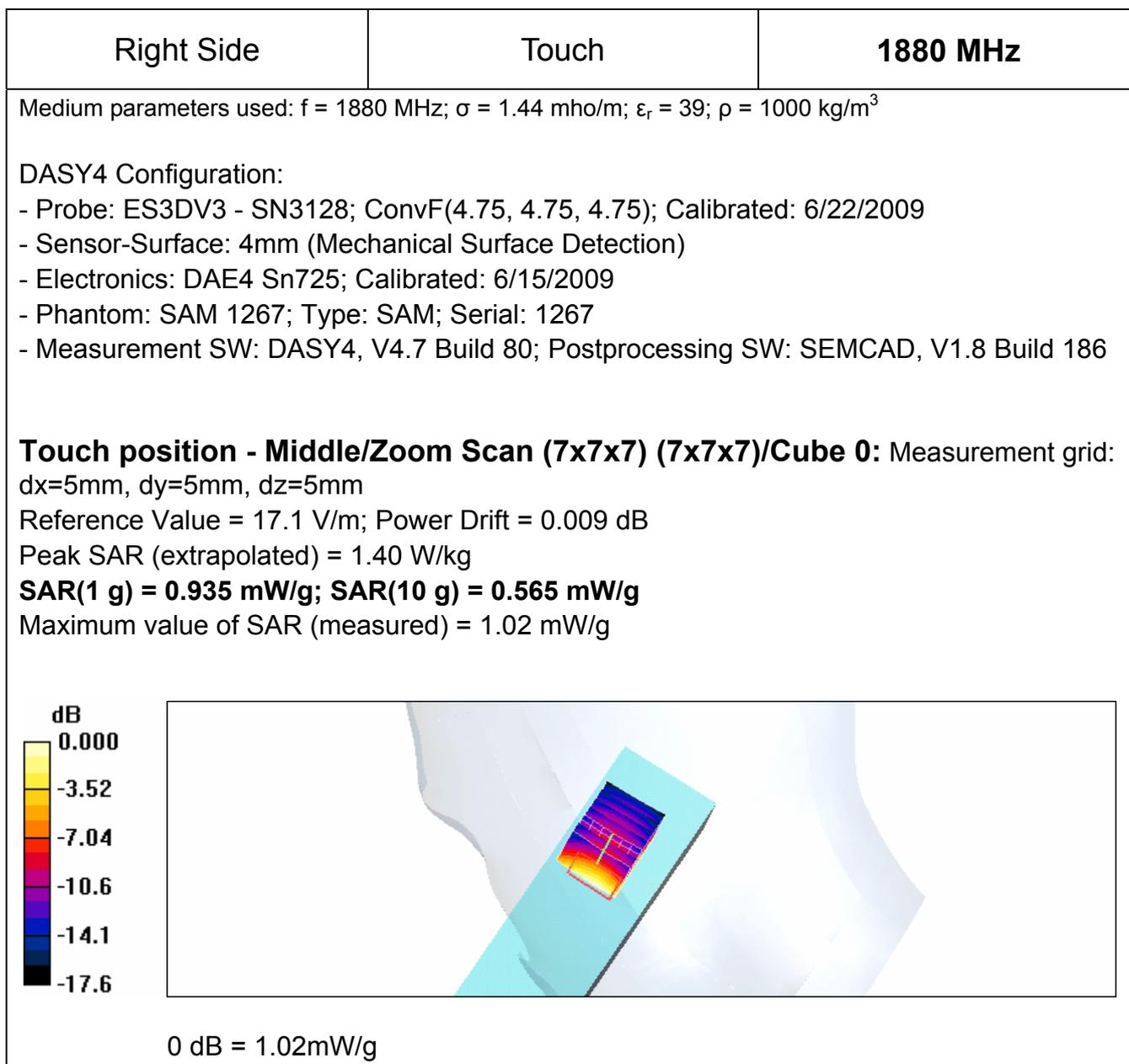


Fig16 SAR Test result

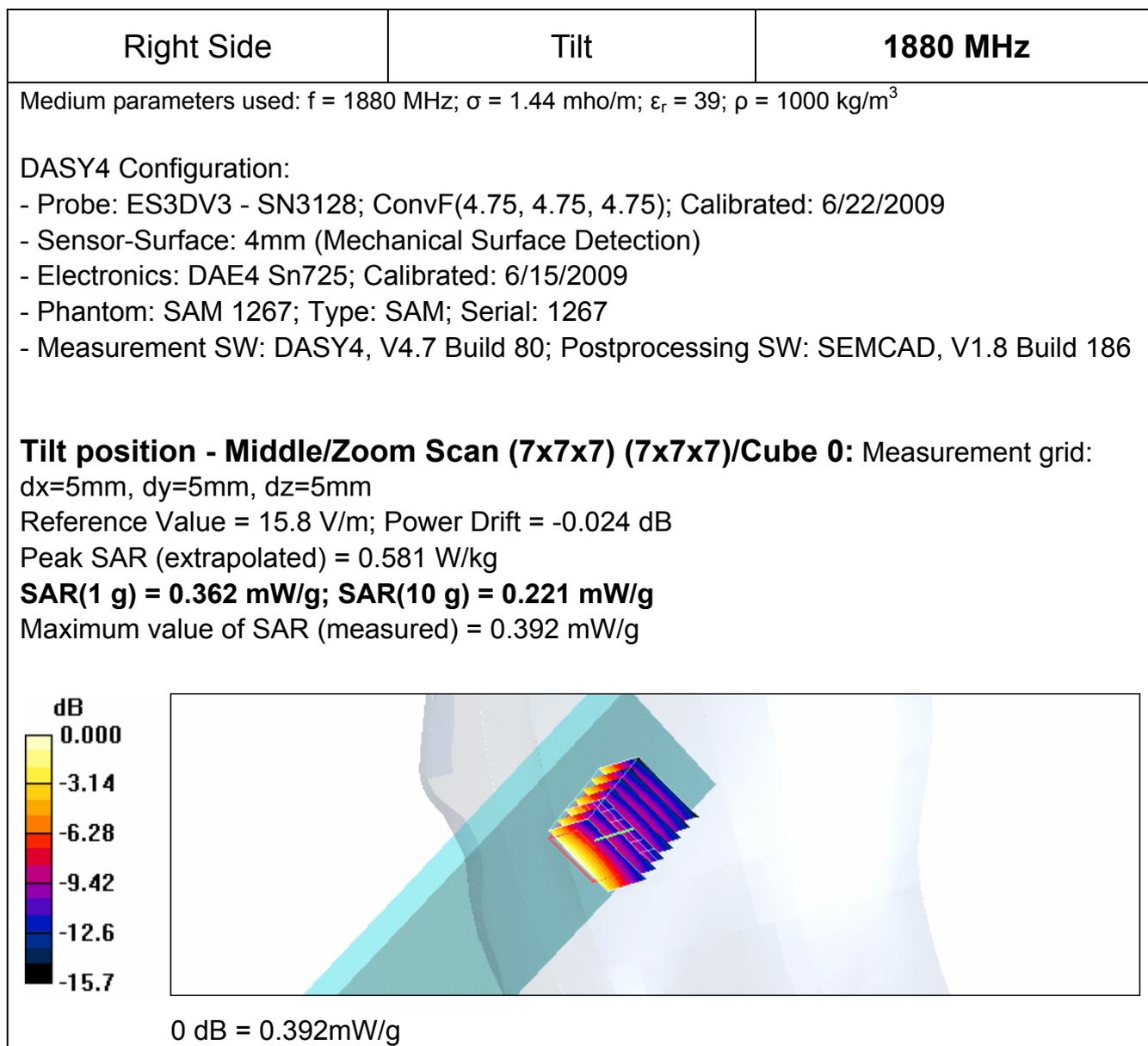


Fig17 SAR Test result

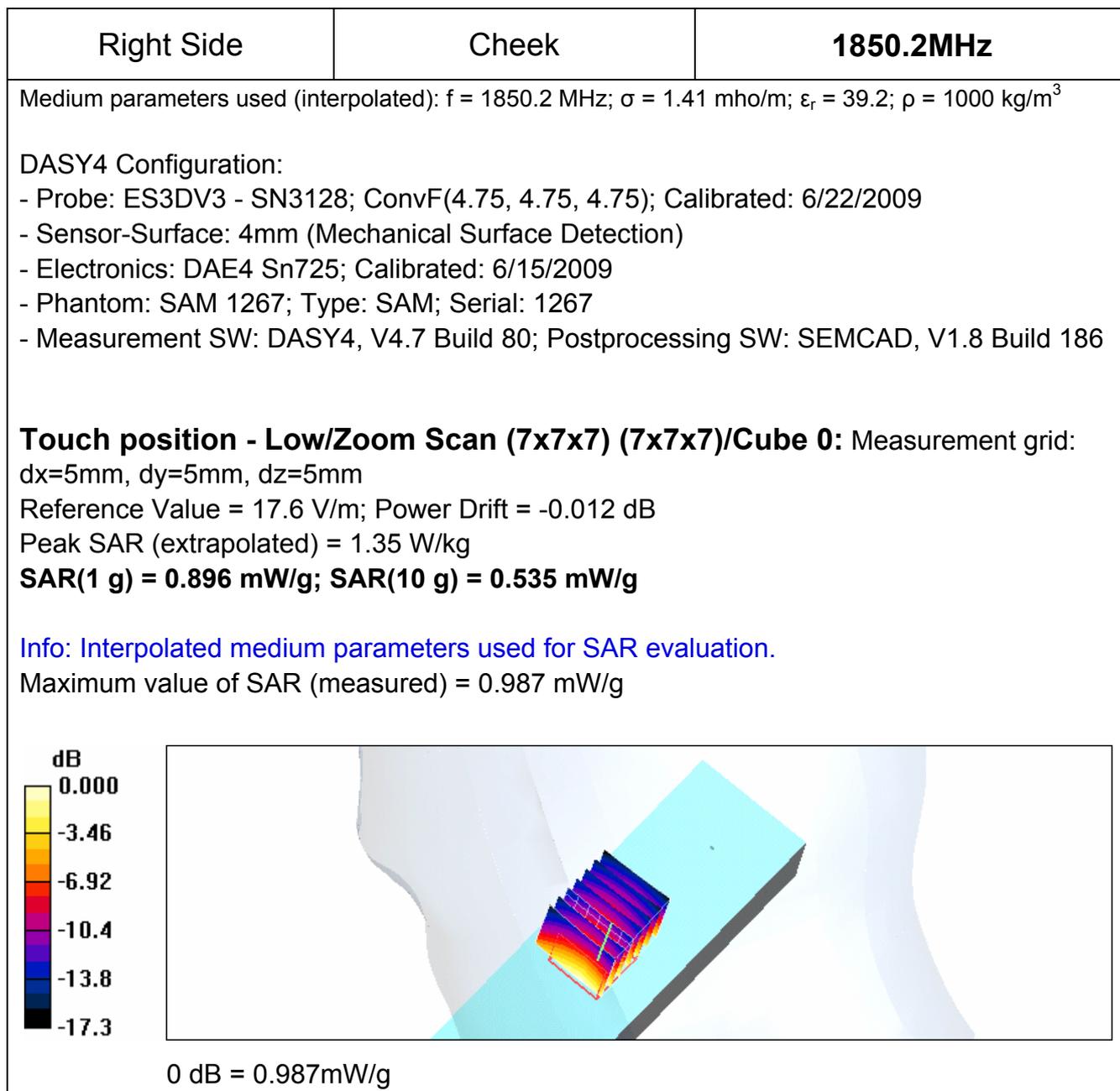


Fig18 SAR Test result

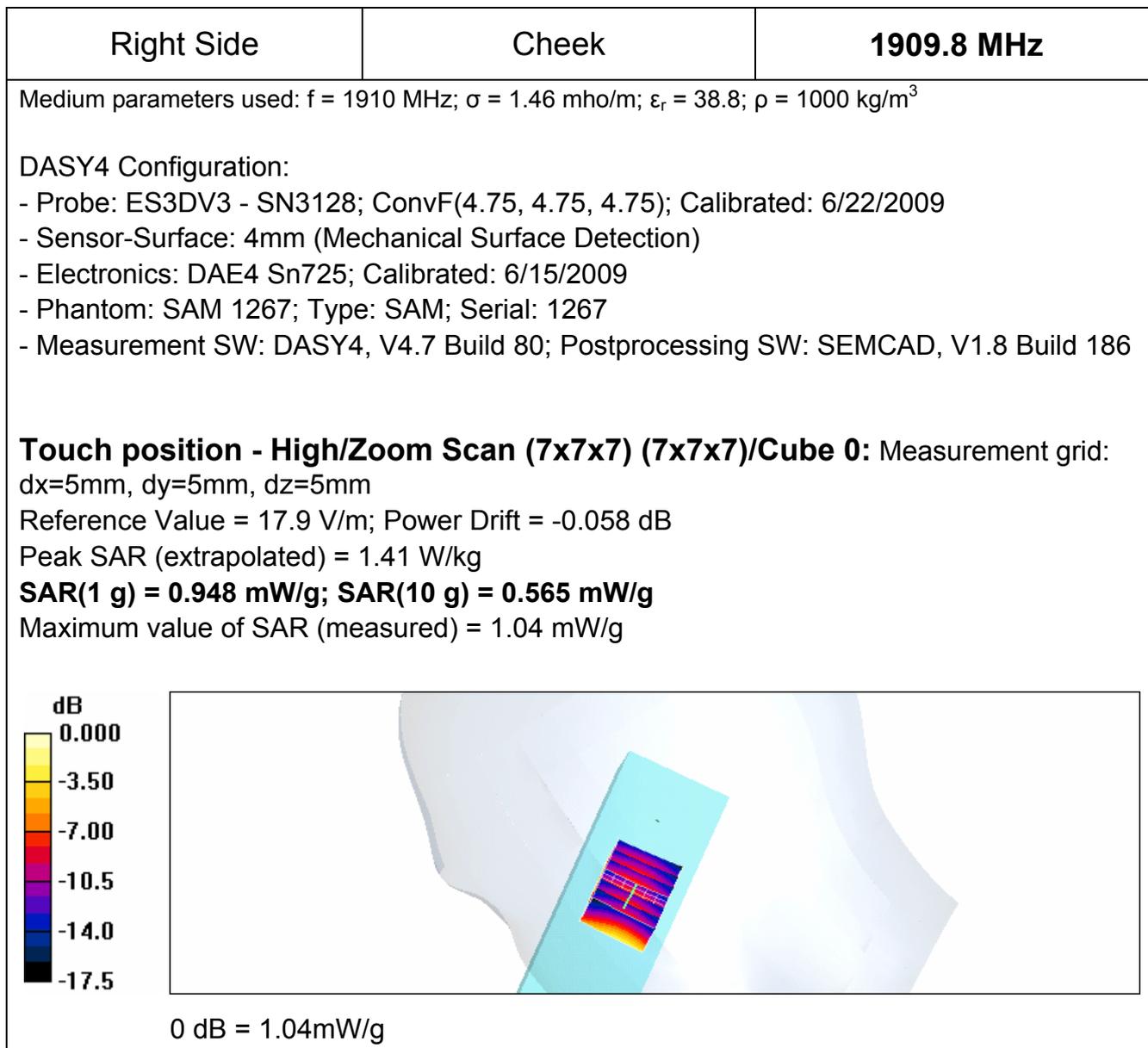


Fig19 SAR Test result

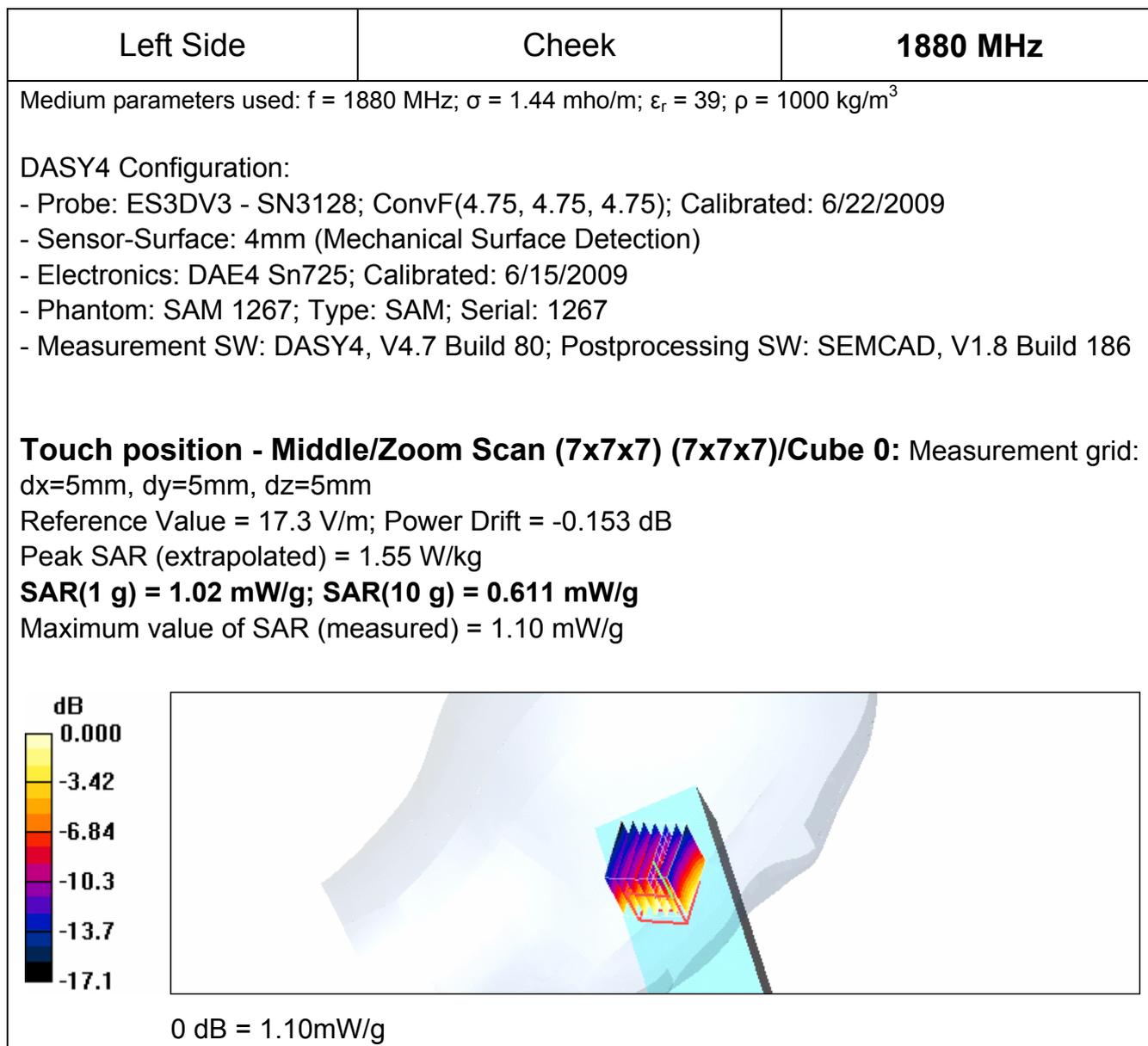


Fig20 SAR Test result

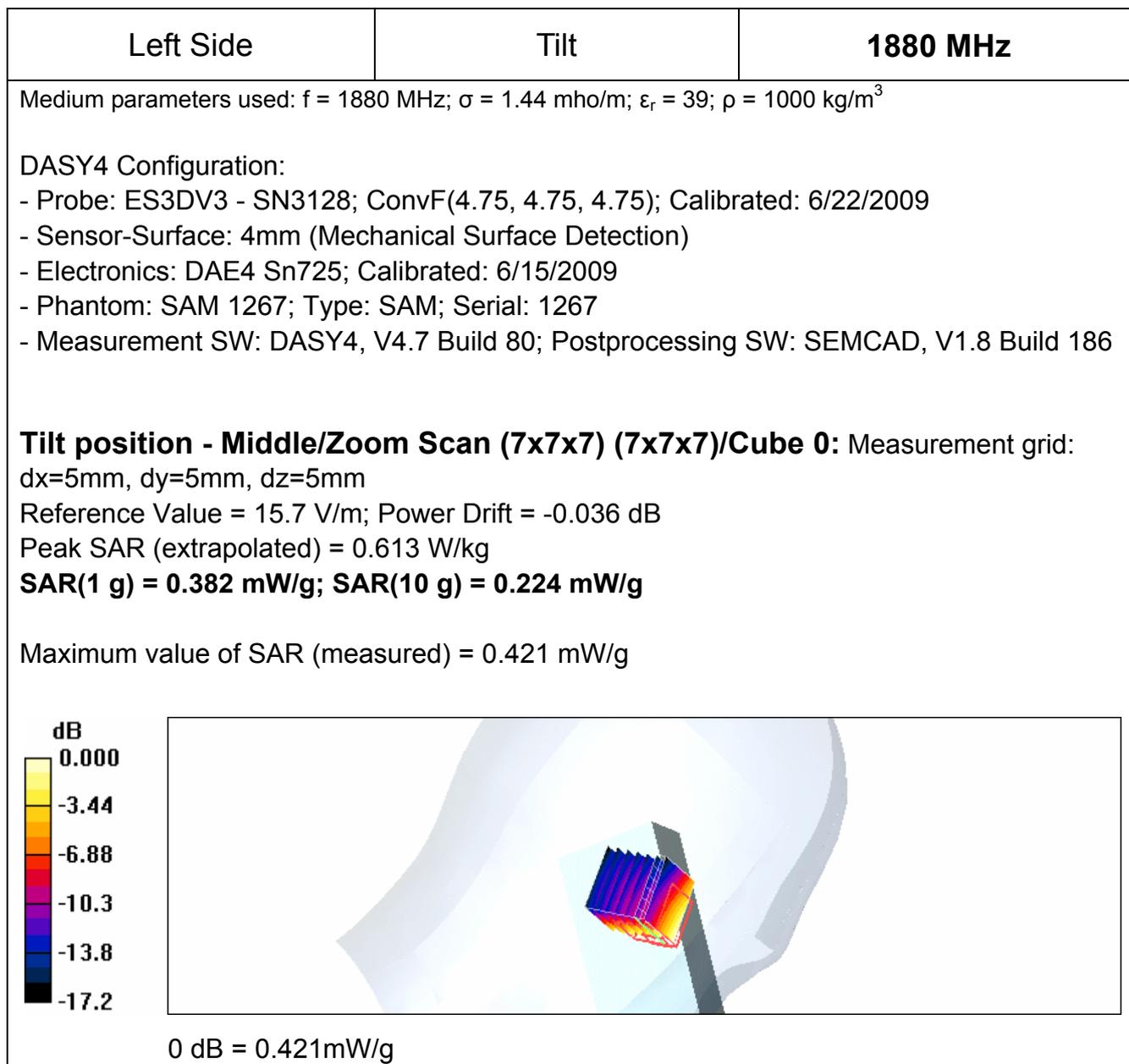


Fig21 SAR Test result

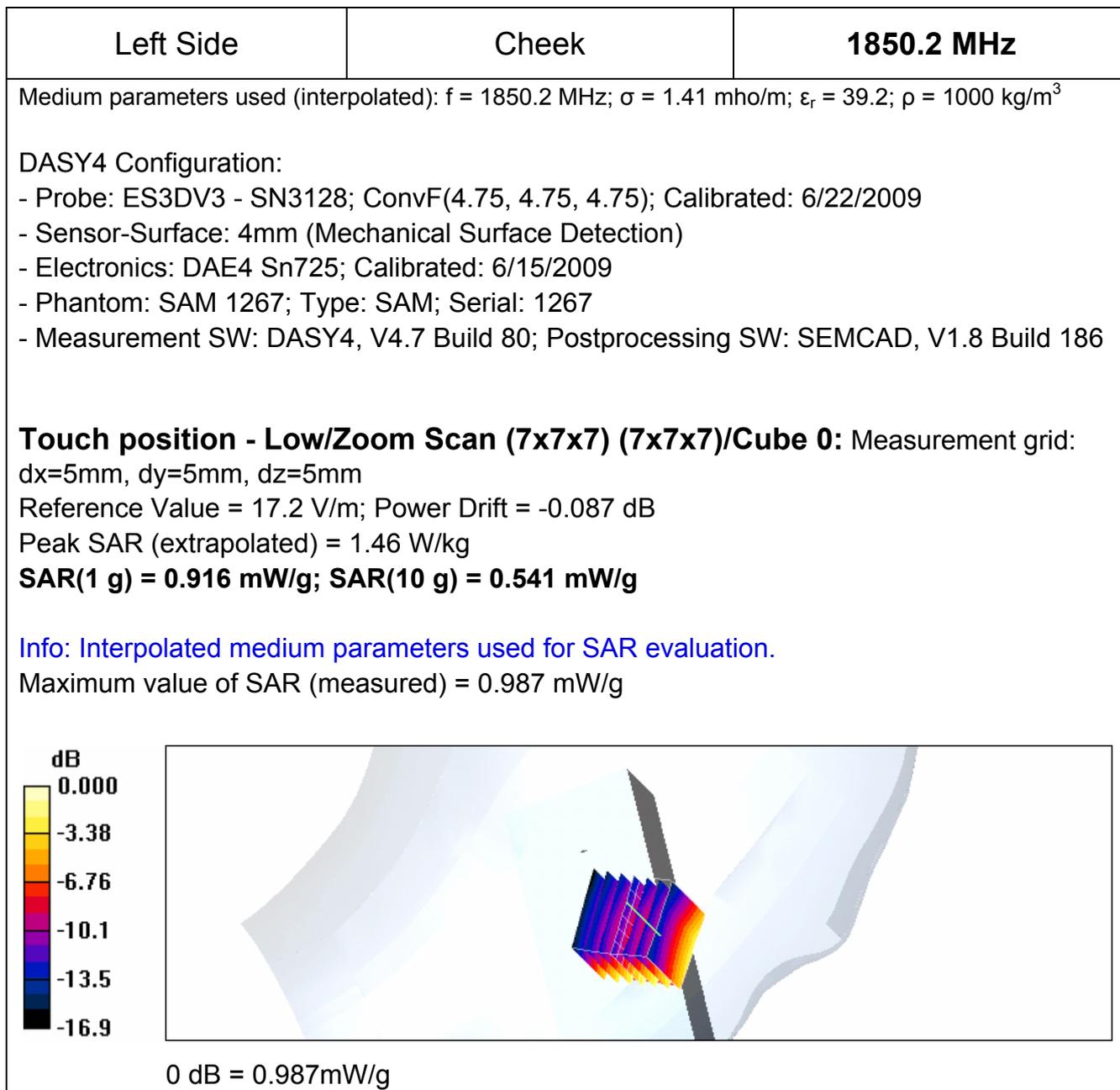


Fig22 SAR Test result

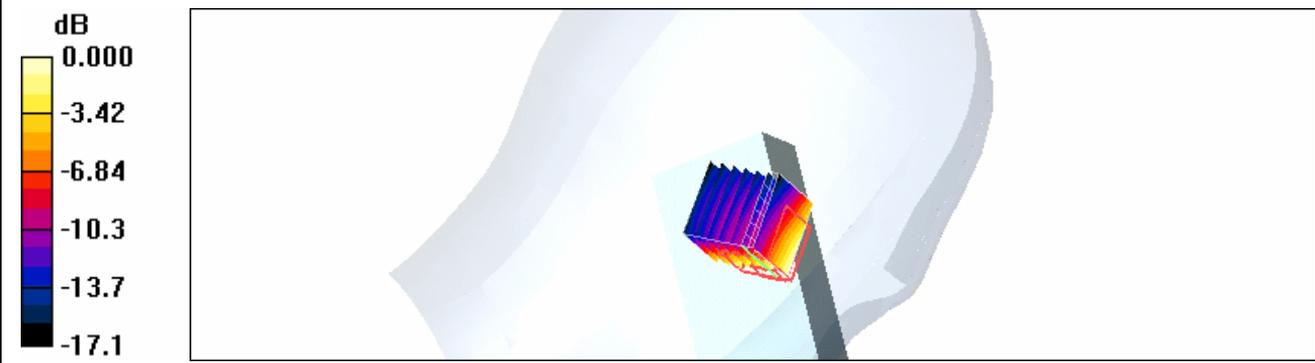
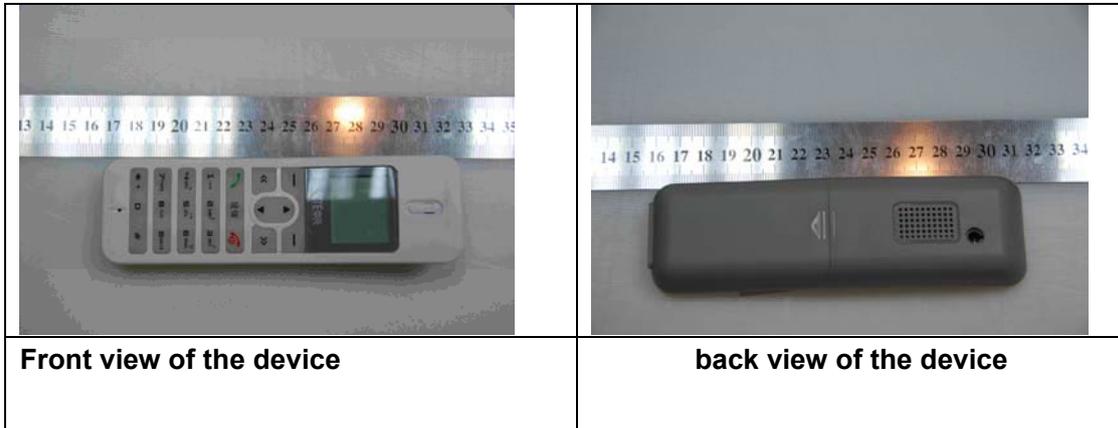
Left Side	Cheek	1909.8MHz
<p>Medium parameters used: $f = 1910 \text{ MHz}$; $\sigma = 1.46 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$</p> <p>DASY4 Configuration:</p> <ul style="list-style-type: none">- Probe: ES3DV3 - SN3128; ConvF(4.75, 4.75, 4.75); Calibrated: 6/22/2009- Sensor-Surface: 4mm (Mechanical Surface Detection)- Electronics: DAE4 Sn725; Calibrated: 6/15/2009- Phantom: SAM 1267; Type: SAM; Serial: 1267- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186 <p>Touch position - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$ Reference Value = 17.3 V/m; Power Drift = 0.042 dB Peak SAR (extrapolated) = 1.57 W/kg SAR(1 g) = 0.982 mW/g; SAR(10 g) = 0.577 mW/g Maximum value of SAR (measured) = 1.07 mW/g</p> <div data-bbox="129 1070 1444 1433"></div> <p data-bbox="316 1451 571 1489">0 dB = 1.07mW/g</p>		

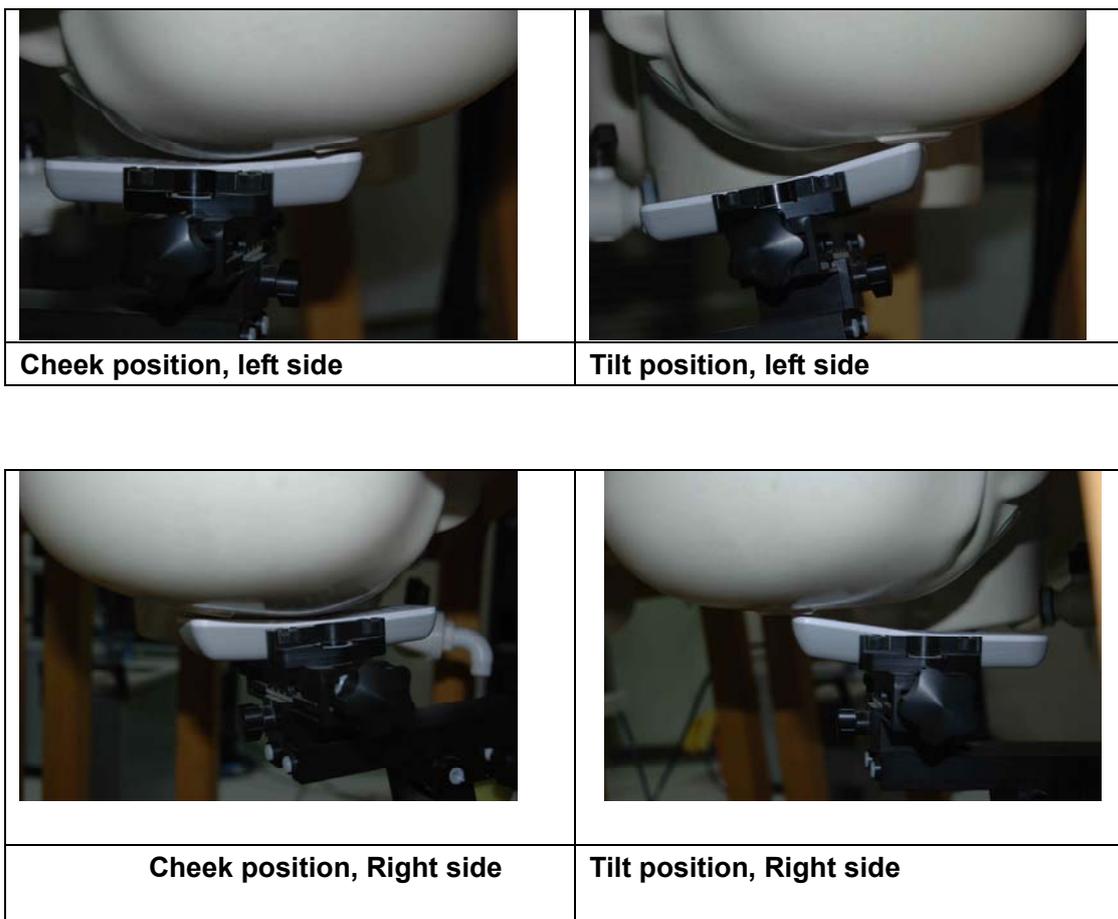
Fig23 SAR Test result

7.8 Pictures of the device under test

Fig39-46 show the device under test

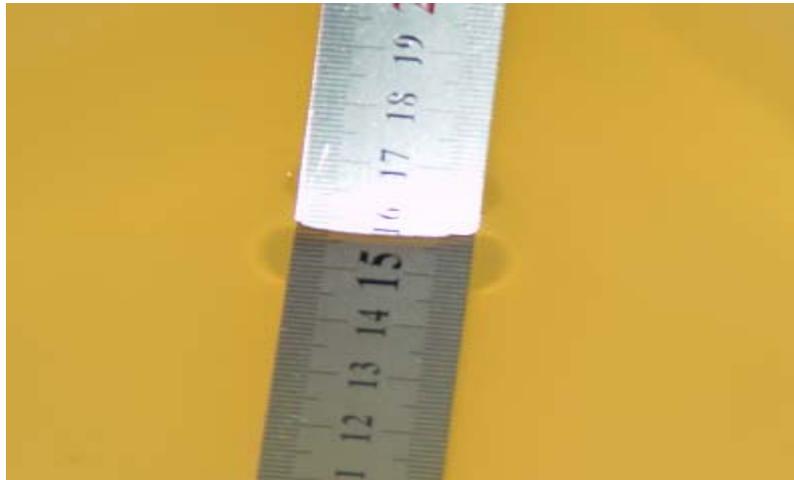


7.9 Test Positions for the Device under test



7.10 Picture to demonstrate the required liquid depth

the liquid depth in the used SAM phantoms



Liquid depth for SAR Measurement

Calibration Laboratory of
 Schmid & Partner
 Engineering AG
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Accreditation No.: **SCS 108**

Client **SRMC (PTT)**

Certificate No: **ES3-3128_Jun09**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3128**

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

Calibration date: **June 22, 2009**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: June 22, 2009

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Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}*: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). *NORM_{x,y,z}* are only intermediate values, i.e., the uncertainties of *NORM_{x,y,z}* does not effect the E^2 -field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z}* = *NORM_{x,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*.
- DCP_{x,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 *NORM_{x,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.

ES3DV3 SN:3128

June 22, 2009

Probe ES3DV3

SN:3128

Manufactured:	July 11, 2006
Last calibrated:	January 24, 2007
Recalibrated:	June 22, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ES3DV3 SN:3128

June 22, 2009

DASY - Parameters of Probe: ES3DV3 SN:3128

Sensitivity in Free Space^A

NormX	1.26 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.36 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.32 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression^B

DCP X	92 mV
DCP Y	94 mV
DCP Z	94 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	9.7	5.5
SAR _{be} [%]	With Correction Algorithm	0.7	0.5

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	8.9	5.2
SAR _{be} [%]	With Correction Algorithm	0.8	0.6

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 E²-field uncertainty inside TSL (see Page 8).

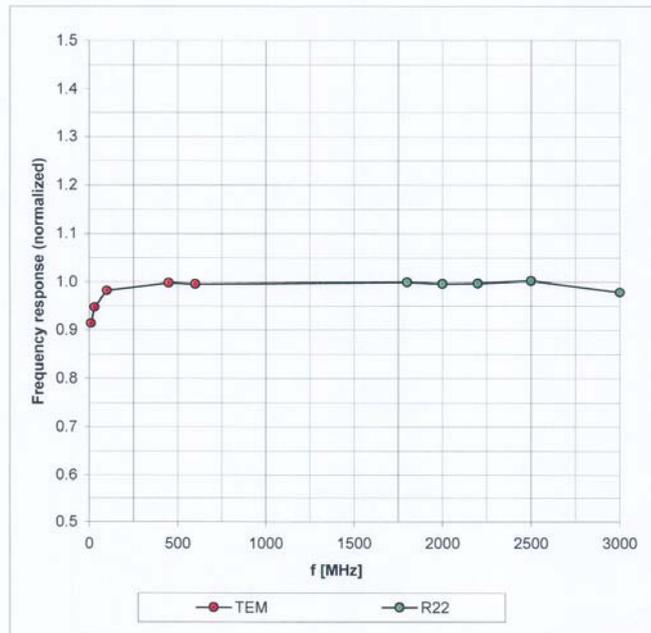
^B Numerical linearization parameter: uncertainty not required.

ES3DV3 SN:3128

June 22, 2009

Frequency Response of E-Field

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

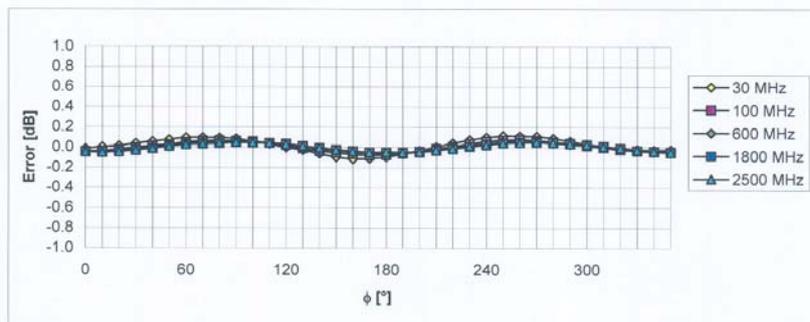
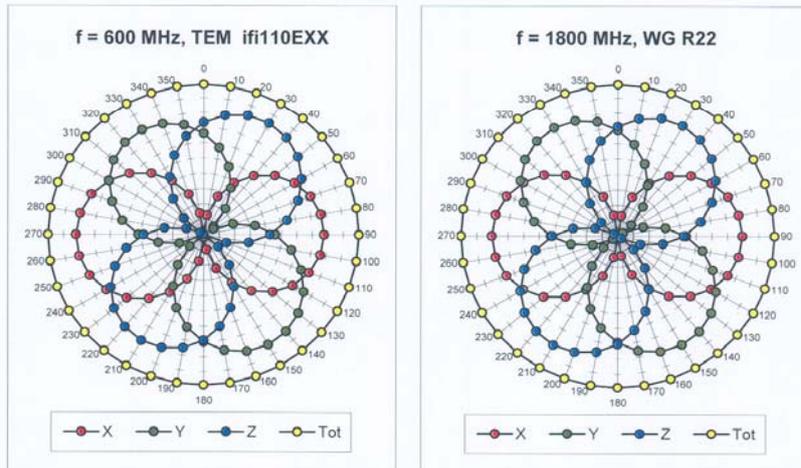


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

ES3DV3 SN:3128

June 22, 2009

Receiving Pattern (ϕ), $\vartheta = 0^\circ$

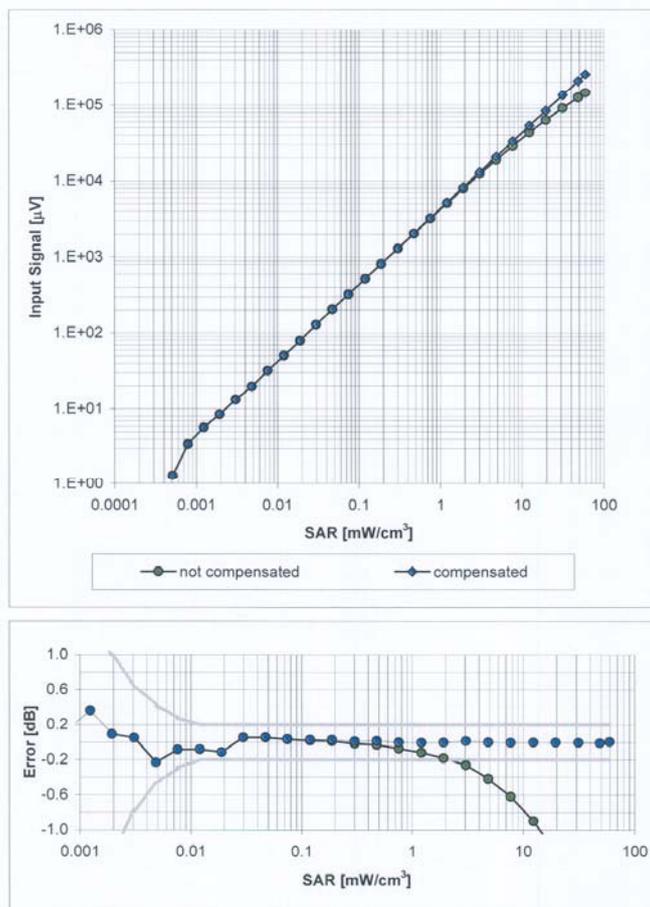


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

ES3DV3 SN:3128

June 22, 2009

Dynamic Range $f(SAR_{head})$ (Waveguide R22, $f = 1800$ MHz)

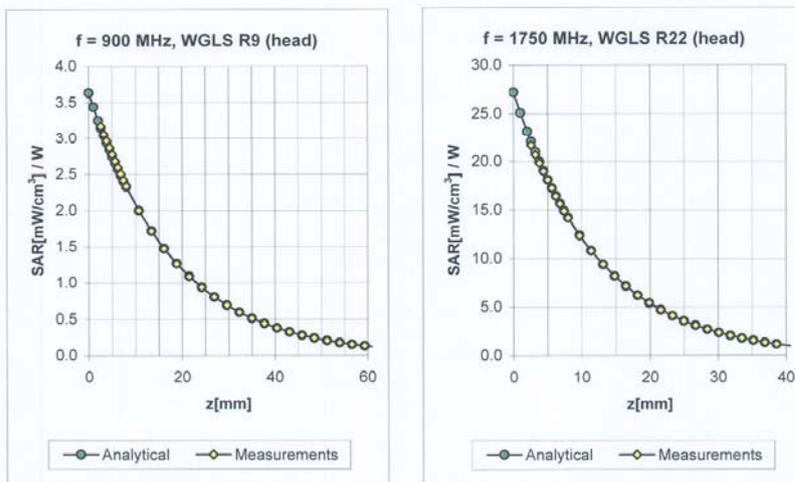


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

ES3DV3 SN:3128

June 22, 2009

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%	0.94	1.06	5.68 ± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.83	1.11	5.52 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.52	1.43	4.93 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.52	1.46	4.75 ± 11.0% (k=2)
2000	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.42	1.60	4.69 ± 11.0% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.74	1.21	5.72 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.79	1.15	5.58 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.37	1.93	4.60 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.36	2.06	4.40 ± 11.0% (k=2)
2000	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.38	2.04	4.46 ± 11.0% (k=2)

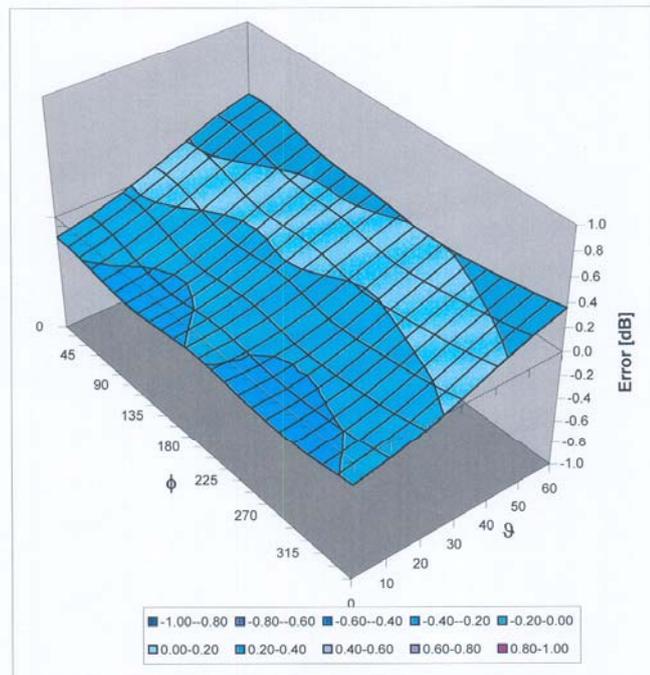
^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ES3DV3 SN:3128

June 22, 2009

Deviation from Isotropy in HSL

Error (ϕ, ϑ), $f = 900$ MHz



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

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Accreditation No.: **SCS 108**

Client **SRMC (PTT)**

Certificate No: **DAE4-725_Jun09**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 725**

Calibration procedure(s) **QA CAL-06.v12
 Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **June 15, 2009**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	30-Sep-08 (No: 7673)	Sep-09
Keithley Multimeter Type 2001	SN: 0810278	30-Sep-08 (No: 7670)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	05-Jun-09 (in house check)	In house check: Jun-10

	Name	Function	Signature
Calibrated by:	Daniel Hess	Technician	<i>D. Hess</i>
Approved by:	Fin Bornholt	R&D Director	<i>F. Bornholt</i>

Issued: June 18, 2009

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Accreditation No.: SCS 108

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV
Low Range: 1LSB = 61nV, full range = -1.....+3mV

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

Calibration Factors	X	Y	Z
High Range	404.179 \pm 0.1% (k=2)	404.931 \pm 0.1% (k=2)	404.498 \pm 0.1% (k=2)
Low Range	3.90830 \pm 0.7% (k=2)	3.98545 \pm 0.7% (k=2)	3.98641 \pm 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	236 $^{\circ}$ \pm 1 $^{\circ}$
---	-----------------------------------

Appendix

1. DC Voltage Linearity

High Range	Input (μV)	Reading (μV)	Error (%)
Channel X + Input	200000	199999.9	0.00
Channel X + Input	20000	20008.43	0.04
Channel X - Input	20000	-19998.02	-0.01
Channel Y + Input	200000	200000	0.00
Channel Y + Input	20000	20006.27	0.03
Channel Y - Input	20000	-20001.56	0.01
Channel Z + Input	200000	200000	0.00
Channel Z + Input	20000	20005.16	0.03
Channel Z - Input	20000	-20002.80	0.01

Low Range	Input (μV)	Reading (μV)	Error (%)
Channel X + Input	2000	2000	0.00
Channel X + Input	200	199.84	-0.08
Channel X - Input	200	-199.88	-0.06
Channel Y + Input	2000	1999.9	0.00
Channel Y + Input	200	199.32	-0.34
Channel Y - Input	200	-200.12	0.06
Channel Z + Input	2000	2000.1	0.00
Channel Z + Input	200	199.14	-0.43
Channel Z - Input	200	-201.59	0.80

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	10.11	9.02
	- 200	-7.46	-8.62
Channel Y	200	-10.61	-10.93
	- 200	10.67	9.94
Channel Z	200	-3.58	-3.89
	- 200	2.46	2.29

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	-	2.29	0.66
Channel Y	200	1.63	-	4.98
Channel Z	200	-0.38	-0.06	-

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	16213	14897
Channel Y	16224	15636
Channel Z	16106	16320

5. Input Offset Measurement

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

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	-0.29	-1.24	1.43	0.33
Channel Y	-2.73	-3.64	-1.66	0.39
Channel Z	-1.10	-2.27	-0.24	0.35

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2001	200.5
Channel Y	0.2000	201.5
Channel Z	0.2000	200.0

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: **D835V2-4d023_Jun08**

CALIBRATION CERTIFICATE

Object: **D835V2 - SN: 4d023**

Calibration procedure(s): **QA CAL-05.v7
 Calibration procedure for dipole validation kits**

Calibration date: **June 17, 2008**

Condition of the calibrated item: **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Reference 20 dB Attenuator	SN: 5086 (20g)	07-Aug-07 (METAS, No 217-00718)	Aug-08
Type-N mismatch combination	SN: 5047.2 / 06327	08-Aug-07 (No. 217-00721)	Aug-08
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	14-Mar-08 (No. DAE4-601_Mar08)	Mar-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	04-Aug-99 (SPEAG, in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Oct-08

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

Issued: June 17, 2008

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Glossary:

TSL tissue simulating liquid
ConvF sensitivity in TSL / NORM x,y,z
N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	0.88 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 mW / g
SAR normalized	normalized to 1W	9.48 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	9.46 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 mW / g
SAR normalized	normalized to 1W	6.24 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	6.21 mW / g ± 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.42 mW / g
SAR normalized	normalized to 1W	9.68 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	9.36 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.60 mW / g
SAR normalized	normalized to 1W	6.40 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	6.24 mW / g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.9 Ω - 2.6 j Ω
Return Loss	-25.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.3 Ω - 4.5 j Ω
Return Loss	- 27.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.390 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 04, 2005

DASY4 Validation Report for Head TSL

Date/Time: 16.06.2008 10:59:00

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d023

Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL 900 MHz;

Medium parameters used: $f = 835$ MHz; $\sigma = 0.88$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(5.97, 5.97, 5.97); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; ;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

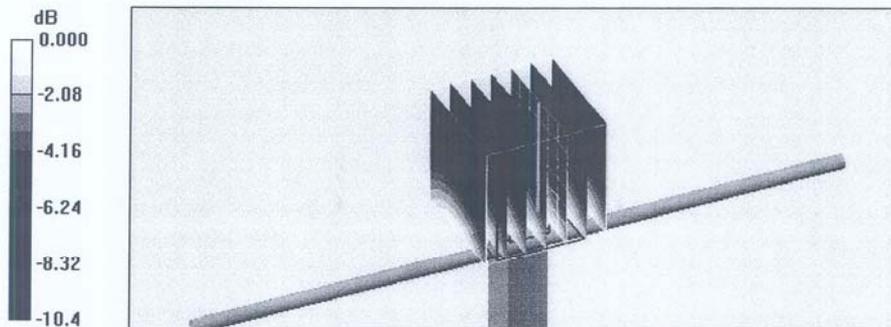
Pin=250mW; dip=15mm; dist=3.4mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.5 V/m; Power Drift = -0.056 dB

Peak SAR (extrapolated) = 3.48 W/kg

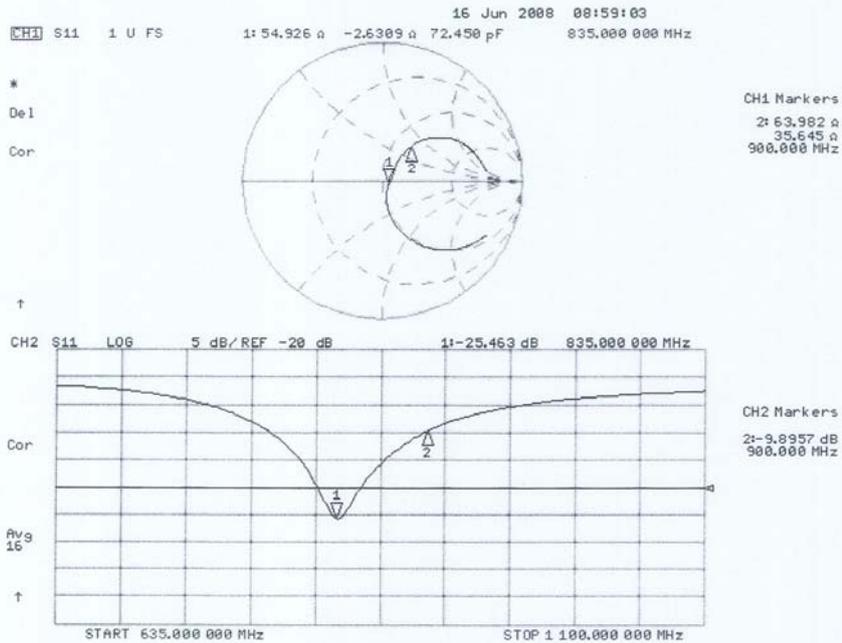
SAR(1 g) = 2.37 mW/g; SAR(10 g) = 1.56 mW/g

Maximum value of SAR (measured) = 2.68 mW/g



0 dB = 2.68mW/g

Impedance Measurement Plot for Head TSL



DASY4 Validation Report for Body TSL

Date/Time: 06.06.2008 12:44:11

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d023

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900;

Medium parameters used: $f = 835$ MHz; $\sigma = 0.99$ mho/m; $\epsilon_r = 53.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(5.9, 5.9, 5.9); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; ;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

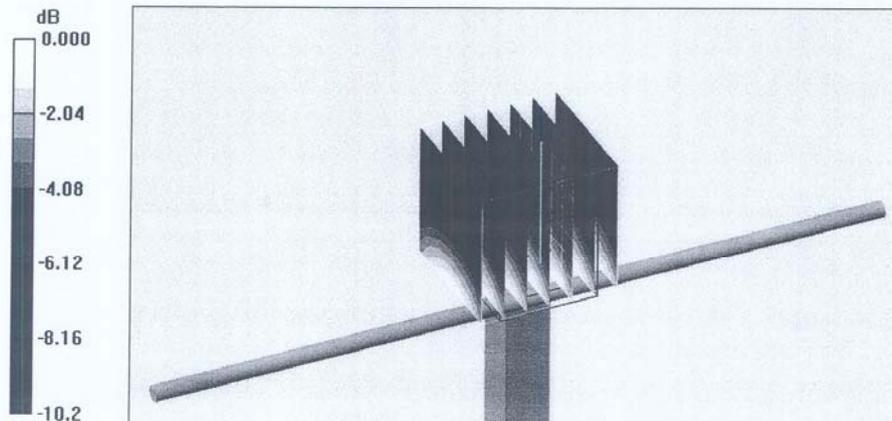
Pin = 250mW, d = 15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.7 V/m; Power Drift = 0.008 dB

Peak SAR (extrapolated) = 3.49 W/kg

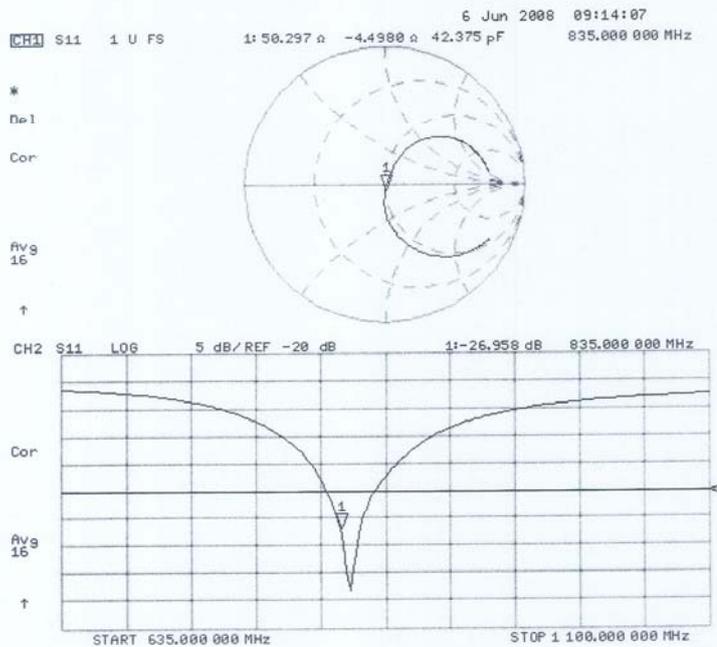
SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.6 mW/g

Maximum value of SAR (measured) = 2.73 mW/g



0 dB = 2.73mW/g

Impedance Measurement Plot for Body TSL



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



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **SRMC (PTT)**

Certificate No: **D1900V2-5d113_Aug09**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d113**

Calibration procedure(s) **QA CAL-05.v7
 Calibration procedure for dipole validation kits**

Calibration date: **August 05, 2009**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Approved by: **Name** Katja Pokovic **Function** Technical Manager **Signature**

Issued: August 12, 2009

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

Calibration Laboratory of
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 6 %	1.45 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	250 mW input power	10.2 mW / g
SAR normalized	normalized to 1W	40.8 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	40.1 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.32 mW / g
SAR normalized	normalized to 1W	21.3 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	21.1 mW / g ± 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.5 Ω + 5.5 j Ω
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 24, 2009

DASY5 Validation Report for Head TSL

Date/Time: 05.08.2009 14:47:20

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d113

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U11 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 40.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; dip = 10 mm, scan at 3.0 mm/Zoom Scan (dist=3.0 mm, probe 0deg)

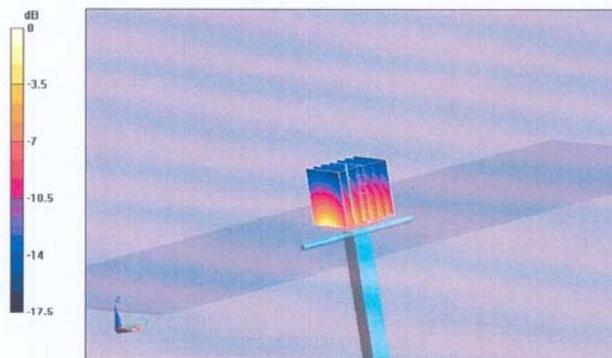
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.4 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 18.6 W/kg

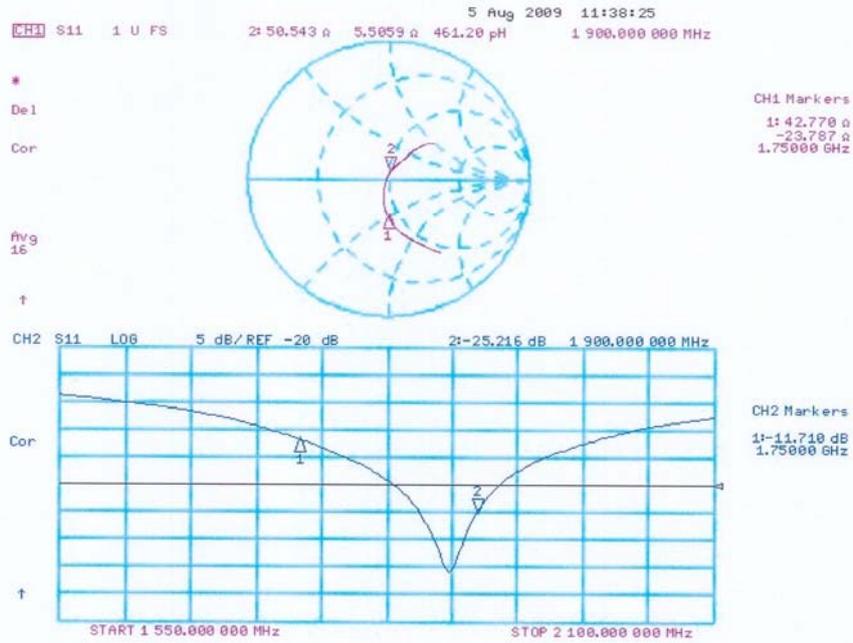
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.32 mW/g

Maximum value of SAR (measured) = 12.5 mW/g



0 dB = 12.5mW/g

Impedance Measurement Plot for Head TSL



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