DAT-P-174/04-00 NO.L0447 Registration No.910917

# CONFORMANCE TEST REPORT FOR

## HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

Report No. : SRMC2010-H024-E0012

Product Name: CDMA 1X Digital Mobile Phone

Product Model: ZTE-C S200

Applicant: ZTE Corporation

Manufacture: ZTE Corporation

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

Supplement C (Edition 01-01)

FCC ID: Q78-ZTECS200


The State Radio Monitoring Center

State Radio Spectrum Monitoring and Testing Center

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## Executive Summary

The ZTE-C S200 is a CDMA 1X Digital Mobile Phone Operating in the 835MHz frequency range. The device has an internal integrated antenna .The system concepts used are the IS2000 standards.

The objective of the measurements done by SRMC (State radio monitoring center) was the dosimetric assessment of one device in the IS2000 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 ZTE-C S200 mobile phone is**

| Mode | CH/*f*(MHz) | Power | Limit (mW/g)/1g | Measured (mW/g) | Result |
|---|---|---|---|---|---|
| SO32 RC3 FCH-SCH Flat/towards ground | 1013/824.7MHz | 24.7dBm | 1.6 | **1.29** | PASS |

**Checked By:**................................... **Tested By:** ..................................

**This Test Report Is Issued By:**....................................

**Issued date:** ......**2010.03.01**..............

# 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

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## 1.5 Application details

Date of receipt of application: 2010-2-24

Date of receipt of test samples: 2010-3-1

Date of test: 2010-3-1

## 1.6 Information of Test Sample

| | |
|---|---|
| Name of EUT | CDMA 1X Digital Mobile Phone |
| FCC ID | ZTECS200 |
| IMEI | A000000BCF6E5A |
| Frequency range | Tx:824~849MHz<br>Rx:869~894MHz |
| Rated output power | 23~30 dBm |
| Modulation type | OQPSK |
| Duplex mode | FDD |
| Duplex spacing: | 45MHz |
| Antenna type | Fixed Internal |
| Power Supply | Battery or charger |
| Rated Power Supply Voltage | 3.7V |

## 1.7 Auxiliary Equipment (AE)

| AE No. | Name | Model | Manufacturer | Serial Number |
|---|---|---|---|---|
| AE 1 | Adapter | STC-A22O50I700USBA-Z | ZTE Corporation | --- |
| AE 2 | Battery | Li3709T42P3h453756 | ZTE Corporation | --- |

## 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 ZTE-C S200 is a CDMA 1X Digital Mobile Phone (Portable Device), operating in the 835MHz frequency range. The system concepts used are the IS2000 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 IS2000 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 σ and the mass density p of the biological tissue:

$$SAR = \frac{\sigma E_i^2}{\rho}$$

$$SAR = c_i \frac{dT}{dt}\bigg|_{t=0}$$

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 (δ)* ≤ 0,05 and ε ≤ 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 (δ)* ≤ 0, 05 and ε≤ 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). Philips ZTE-C S200 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

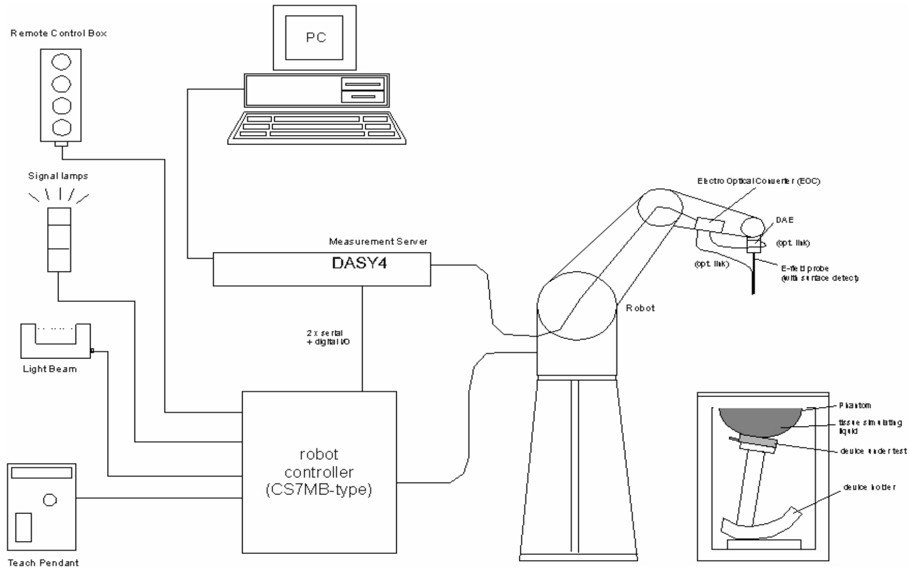



**Fig3. The DASY4 measurement system**


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

## 5.2Test Equipments:

| Name | | Serial Number | 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 | D900V2 | 171 | 2008.06 |
| System Validation Dipole | D1800V2 | 2d084 | 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 | E5515C | GB43194054 | 2009.8 |

**Table 1. Test Equipments lists**

## 5.3 Uncertainty Assessment

| **DASY4 Uncertainty Budget**<br>**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:

The Ambient Conditions during SAR Test Temp.: 23°C~24°C
Relative Humidity: 34.5% 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 7.2 of this report for the test mode used during testing.

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

## 6.4Test Results

**Mode: CDMA 835**

$f_L$(MHz)=824.70MHz $f_M$(MHz)=836.52MHz $f_H$(MHz)= 848.31MHz

SAR Values（Head, 835MHz Band SO55 RC3 FULL RATE）

| Limit of SAR (W/kg) | 1 g Average |
|---|---|
| | 1.6 |
| Test Case | Measurement Result ( mW/g) |
| | 1 g Average |
| Left hand, Touch cheek , $f_L$ | 0.87 |
| Left hand, Touch cheek, $f_M$ | 1.06 |
| Left hand, Touch cheek , $f_H$ | **1.20** |
| Left hand, Tilt 15 Degree, $f_M$ | 0.60 |
| Right hand, Touch cheek , $f_L$ | 0.82 |
| Right hand, Touch cheek, $f_M$ | 1.10 |
| Right hand, Touch cheek $f_H$ | 1.18 |
| Right hand, Tilt 15 Degree, $f_M$ | 0.57 |

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 | --- | --- | **1.20** |

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

**Table 3. SAR Results**

**Mode: CDMA 835**

$f_L$(MHz)=824.70MHz $f_M$(MHz)=836.52MHz $f_H$(MHz)= 848.31MHz

SAR Values（Body, 835MHz Band with headset SO32 RC3 FCH-SCH）

| **Limit of SAR (W/kg)** | | **1g Average** |
|---|---|---|
| | | **1.6** |
| **Test Case** | | **Measurement Result ( mW/g)** |
| | | **1g Average** |
| Towards ground | $f_H$ | 1.16 |
| Towards ground | $f_M$ | 1.11 |
| Towards ground | $f_L$ | **1.29** |

So, the maximum SAR is

| Phantom Configuration | SAR(mW/g) | | |
|---|---|---|---|
| | $f_L$(MHz) | $f_M$(MHz) | $f_H$(MHz) |
| Towards ground | **1.29** | --- | --- |

**Table 4. SAR Results**

# 7. Appendix

## 7.1 Administrative Data

Date of measurement: 2010-3-1

Data stored: SRMC2010-H024-E0012

## 7.2 Device under Test and Test Conditions

TYPE: ZTE-C S200

Date of receipt: 24. 2, 2010

IMEI: A000000BCF6E5A

Equipment class: Portable device

EUT status: production
Power Class: 23.0dBm
RF exposure environment: General Population
Power supply: Internal Battery (Other batteries not available)
Measurement Standards: IS2000
Method to establish a call: CDMA 2000 Base station simulator, using the air interface
Modulation: OQPSK
Tx: 824~849MHz
Rx: 869~894MHz
Used TX Channels: L: ch1013; M: ch384; H: ch777 (refer to the table 5)
Duty cycle: 1:1(100%)

**Head SAR Measurements**

SAR for head exposure configurations was measured in RC3 with the EUT configured to transmit at full rate using Loopback Service Option SO55. SAR for RC1 was not required when the maximum average output of each channel was less than ¼ dB higher than that measured in RC3. Otherwise, SAR was measured on the maximum output channel in RC1 using the exposure configuration that results in the highest SAR for that channel in RC3.

**Body SAR Measurements**

SAR for body exposure configurations was measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCHn) was not required when the maximum average output of each RF channel was less than ¼dB higher than that measured with FCH only. Otherwise, SAR was measured on the maximum output channel (FCH + SCHn) with FCH at full rate and SCH0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels were enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts.

Body SAR in RC1 was not required when the maximum average output of each channel was less than ¼dB higher than that measured in RC3. Otherwise, SAR was measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that resulted in the highest SAR for that channel in RC3.

**Note: All the procedures described above were followed according to FCC" SAR Measurement Procedure for 3G Devices, June 2006"**

Test communication setup meet as followings:

| | |
|---|---|
| Communication standard between mobile station and base station simulator | 3GPP2 C.S0011-B |
| Radio configuration | RC3(supporting CDMA 1X) |
| Date Rate | 9600bps |
| Service Options | SO55(Loop back mode) |
| Service Options | SO32(Test Date mode) |
| Multiplex Options | The mobile station does not support this service |

Base station Simulator: 8960

Test Parameter setup for maximum RF output power according to section 4.4.5 of 3GPP2 C.S0011-B:

**Parameters for Max. Power for RC1**

| Parameter | Units | Value |
|---|---|---|
| $I_{or}$ | dBm/1.23 MHz | -104 |
| $\frac{\text{Pilot } E_c}{I_{or}}$ | dB | -7 |
| $\frac{\text{Traffic } E_c}{I_{or}}$ | dB | -7.4 |

**Parameters for Max. Power for RC3**

| Parameter | Units | Value |
|---|---|---|
| $I_{or}$ | dBm/1.23 MHz | -86 |
| $\frac{\text{Pilot } E_c}{I_{or}}$ | dB | -7 |
| $\frac{\text{Traffic } E_c}{I_{or}}$ | dB | -7.4 |

**Mode: SO55 RC1Full rate**

| Carrier frequency (MHz) | Channel No. | RF Power Output (dBm) |
|---|---|---|
| 824.70 | 1013 | 22.7 |
| 836.52 | 384 | 23.2 |
| 848.31 | 777 | 22.5 |

**Mode: SO55 RC3 Full rate**

| Carrier frequency (MHz) | Channel No. | RF Power Output (dBm) |
|---|---|---|
| 824.70 | 1013 | 23.7 |
| 836.52 | 384 | 24.1 |
| 848.31 | 777 | 23.5 |

**Mode:SO32 RC3 FCH-SCH**

| Carrier frequency (MHz) | Channel No. | RF Power Output (dBm) |
|---|---|---|
| 824.70 | 1013 | 24.7 |
| 836.52 | 384 | 25.0 |
| 848.31 | 777 | 24.6 |

**Mode:SO32 RC3 FCH+SCH**

| Carrier frequency (MHz) | Channel No. | RF Power Output (dBm) |
|---|---|---|
| 824.70 | 1013 | 24.6 |
| 836.52 | 384 | 24.8 |
| 848.31 | 777 | 24.5 |

*RC Configuration tested at “all up” power control bit.

**Table5. Frequency and Measured power of EUT’s Tx channels**

For SAR test, the maximum power output is very important and essential; it is identical under the measurement uncertainty. It is proper to use typical Test Mode 3 (FW RC3, RVS RC3, SO55) as the worst case for SAR test.

Under the loop back mode between mobile station and 8960, the transmitter continuously emits with maximum power more strong than voice mode, so the SAR test was done with loop back mode.

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.

**835 MHz:**

40.29 % Water
57.90 % Sugar
1.38% NaCl salt
0.24% Cellulose
0.18% Preventol

### Body Tissue Simulant

The following recipes are provided in percentage by weight.

**835MHz:**

50.75 % Water
48.21 % Sugar
0.94% NaCl salt
0% Cellulose
0.10% Preventol

## 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。

| Head | | εr | σ[S/m] | Temperature | |
|---|---|---|---|---|---|
| | | | | Ambient [℃] | Liquid [℃] |
| 835MHz | Recommended Value | 41.5±2.1 | 0.9±0.045 | 15-30 | - |
| | Measured Value | 41.5 | 0.89 | 24.0 | 22.3 |

| Body | | εr | σ[S/m] | Temperature | |
|---|---|---|---|---|---|
| | | | | Ambient [℃] | Liquid [℃] |
| 835MHz | Recommended Value | 55.2±2.76 | 0.97±0.0485 | 15-30 | --- |
| | Measured Value | 53.7 | 0.99 | 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)

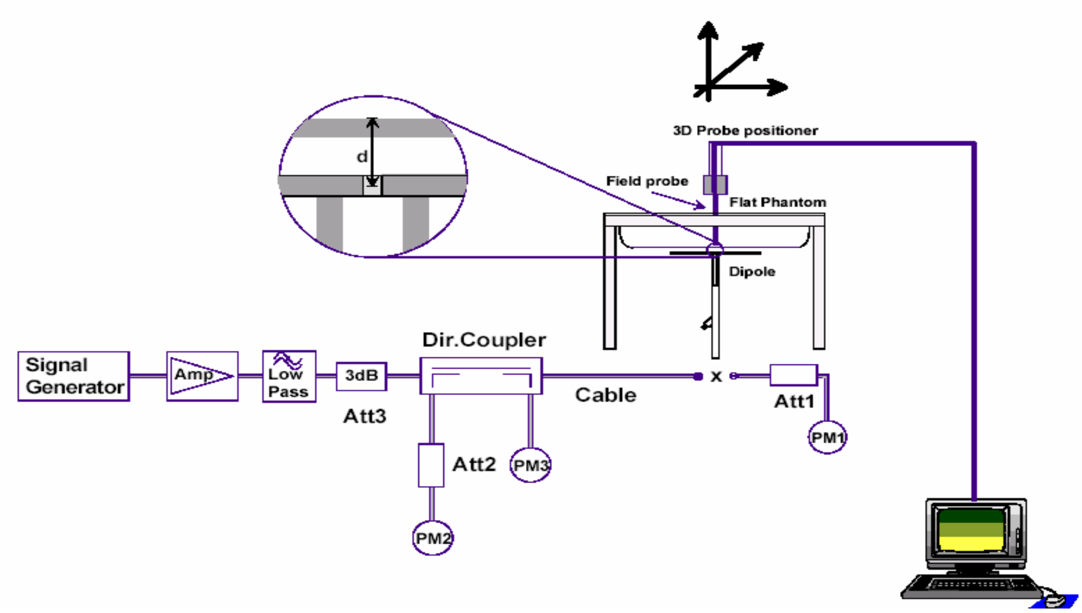



**Fig5.Setup for system performance Check**

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

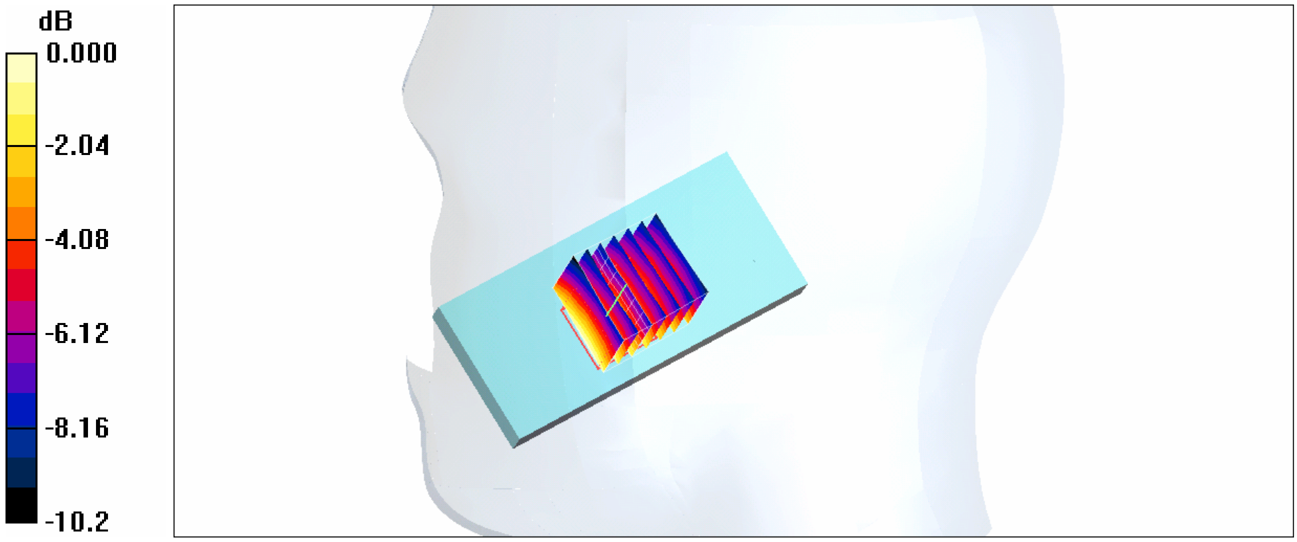
## 835MHz/Head

| Right Side | Cheek | **836.52MHz** |
|---|---|---|

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 RC3 S055/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.4 V/m; Power Drift = 0.122 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 1.1 mW/g; SAR(10 g) = 0.790 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.18 mW/g



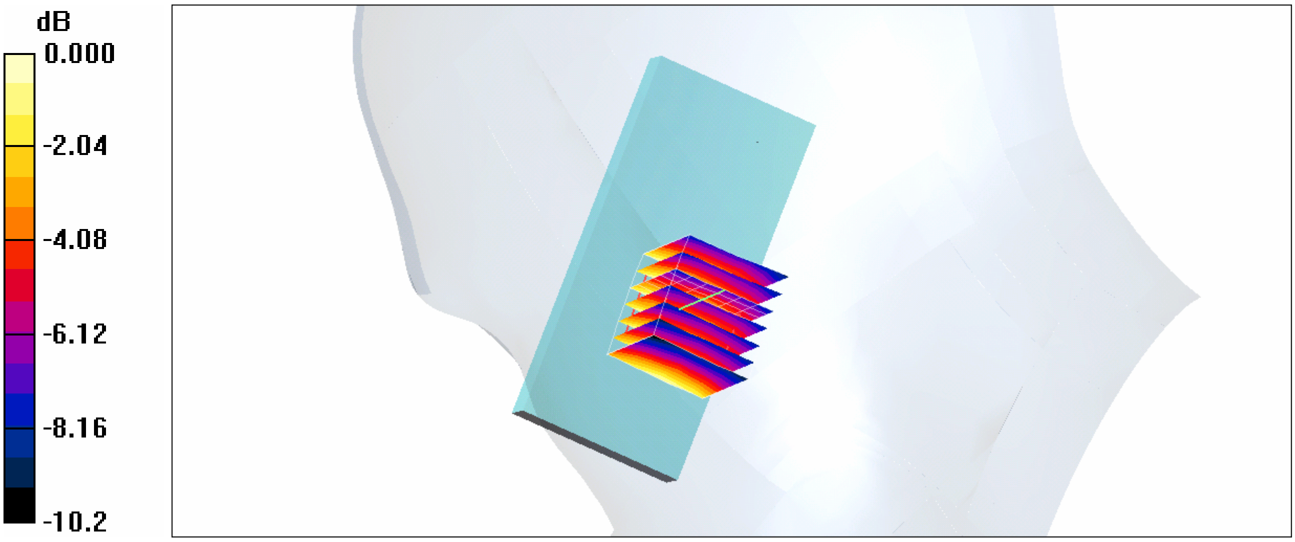

0 dB = 1.18mW/g

| Right Side | Cheek | **824.70MHz** |
|---|---|---|

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 - low/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.5 V/m; Power Drift = 0.161 dB
Peak SAR (extrapolated) = 1.07 W/kg
SAR(1 g) = 0.824 mW/g; SAR(10 g) = 0.600 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.880 mW/g



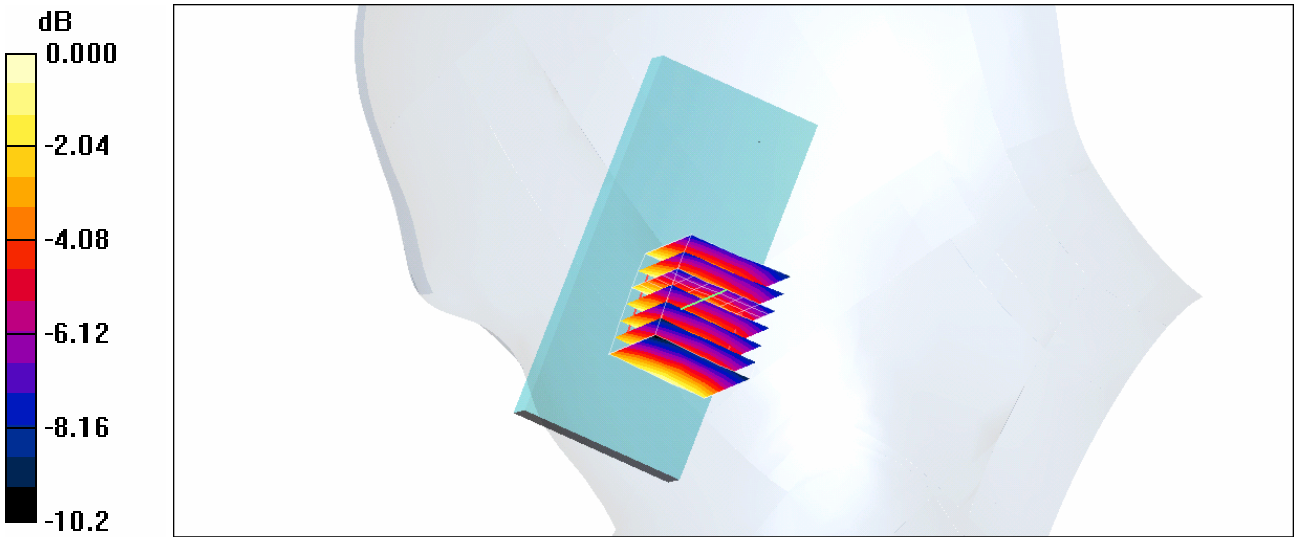

0 dB = 0.880mW/g

| Right Side | Cheek | **848.31MHz** |
|---|---|---|

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 - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.2 V/m; Power Drift = -0.093 dB
Peak SAR (extrapolated) = 3.06 W/kg
SAR(1 g) = 1.18 mW/g; SAR(10 g) = 0.485 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.14 mW/g



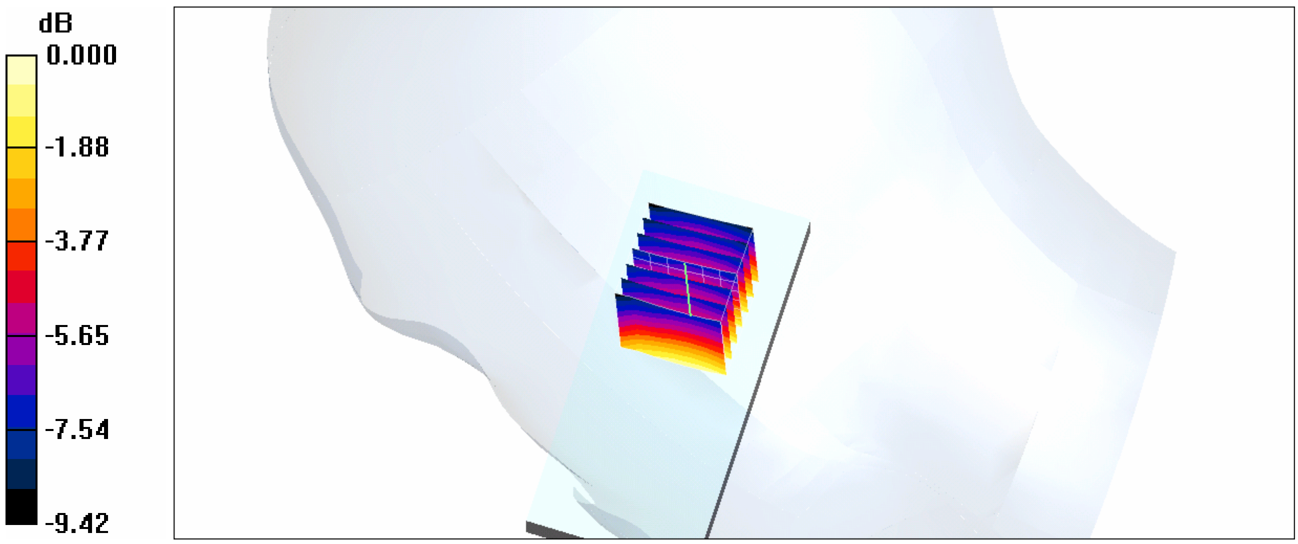

0 dB = 1.14 mW/g

| Right Side | Tilt | **836.52MHz** |
|---|---|---|

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

**Tilt position – middle RC3 SO55/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.6 V/m; Power Drift = 0.084 dB
Peak SAR (extrapolated) = 0.789 W/kg
SAR(1 g) = 0.573 mW/g; SAR(10 g) = 0.409 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.612 mW/g




0 dB = 0.612mW/g

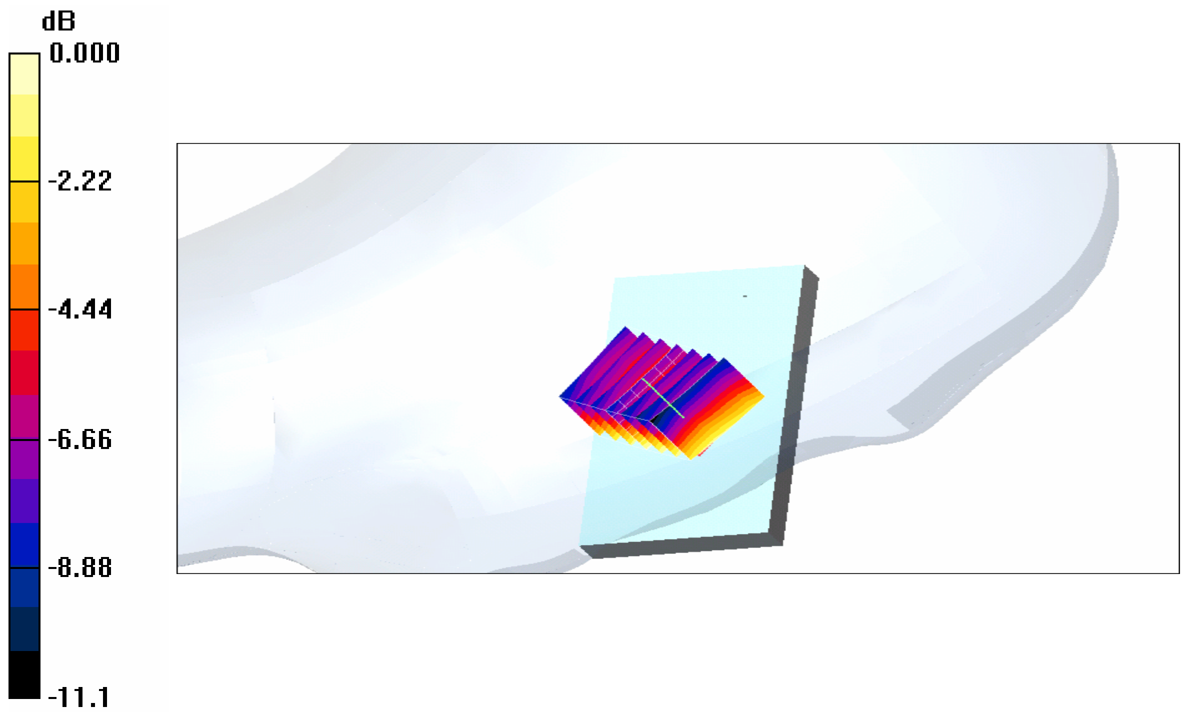
| Left Side | Cheek | 836.52 MHz |
|---|---|---|

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 RC3 S055/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.0 V/m; Power Drift = -0.060 dB
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.759 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.13 mW/g



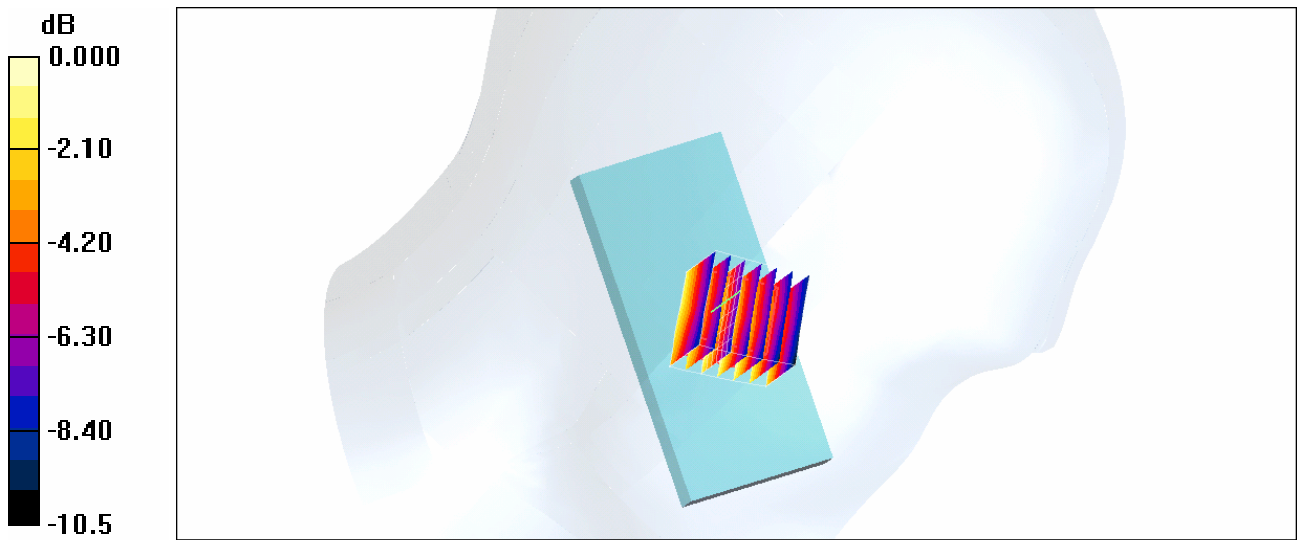

0 dB = 1.13mW/g

| Left Side | Cheek | 824.70MHz |
|---|---|---|

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 - low/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.9 V/m; Power Drift = -0.070 dB
Peak SAR (extrapolated) = 1.22 W/kg
SAR(1 g) = 0.874 mW/g; SAR(10 g) = 0.620 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.931 mW/g




0 dB = 0.931mW/g

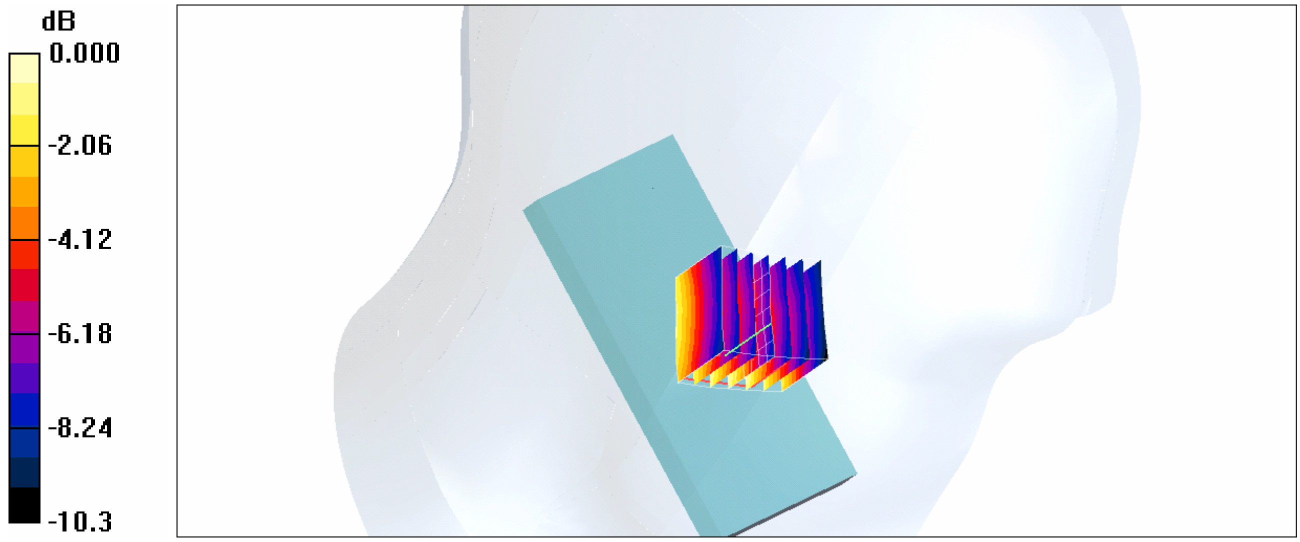
| Left Side | Cheek | 848.31 MHz |
|---|---|---|

Communication System: cdma 2000 835; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 848.31 MHz; $\sigma$ = 0.899 mho/m; $\varepsilon_r$ = 41.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section

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 - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.0 V/m; Power Drift = -0.142 dB
Peak SAR (extrapolated) = 1.62 W/kg
SAR(1 g) = 1.2 mW/g; SAR(10 g) = 0.847 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.28 mW/g




0 dB = 1.28mW/g

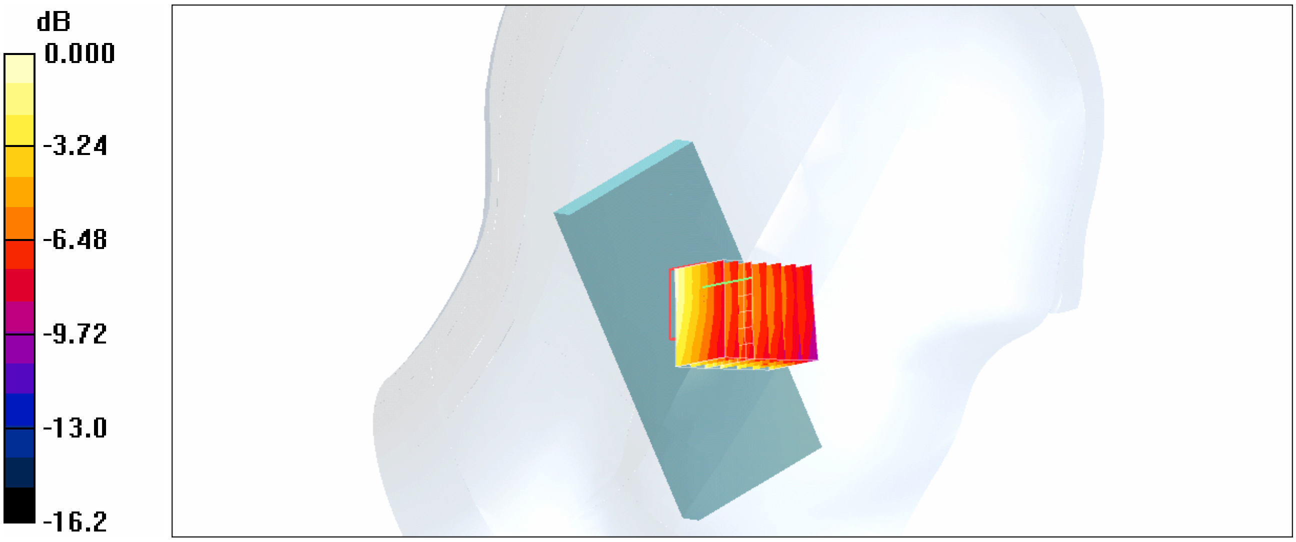
| Left Side | Tilt | 836.52 MHz |
|---|---|---|

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

**Tilt position - middle RC3 SO55/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.1 V/m; Power Drift = -0.084 dB
Peak SAR (extrapolated) = 0.796 W/kg
SAR(1 g) = 0.595 mW/g; SAR(10 g) = 0.421 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.636 mW/g




0 dB = 0.636mW/g

## 835MHz/ Body

| Towards ground | 836.52 MHz |
|---|---|

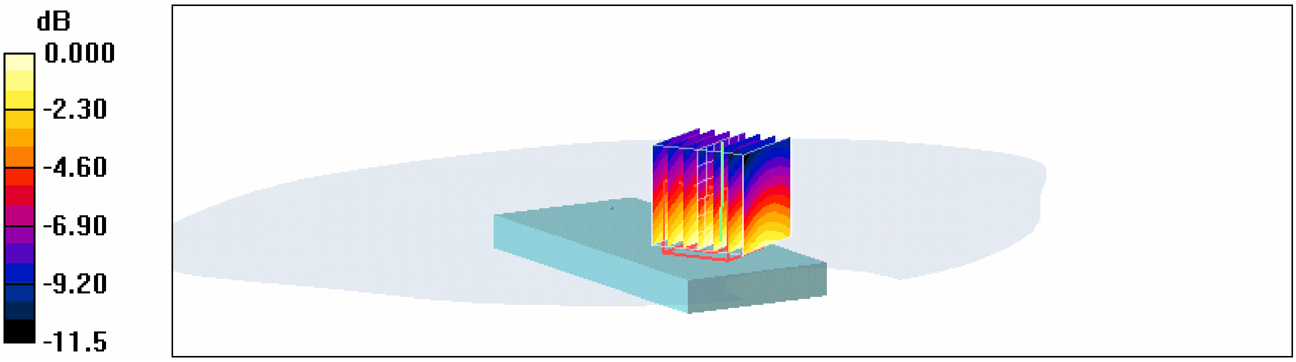
DASY4 Configuration:
- Probe: ES3DV3 - SN3128; ConvF(5.72, 5.72, 5.72); Calibrated: 6/22/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn725; Calibrated: 6/15/2009
- Phantom: SAM 1315; Type: SAM; Serial: 1315
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**towards ground-middle RC3 SO32 FCH/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.5 V/m; Power Drift = 0.163 dB
Peak SAR (extrapolated) = 1.54 W/kg
SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.793 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 1.19 mW/g




0 dB = 1.19mW/g

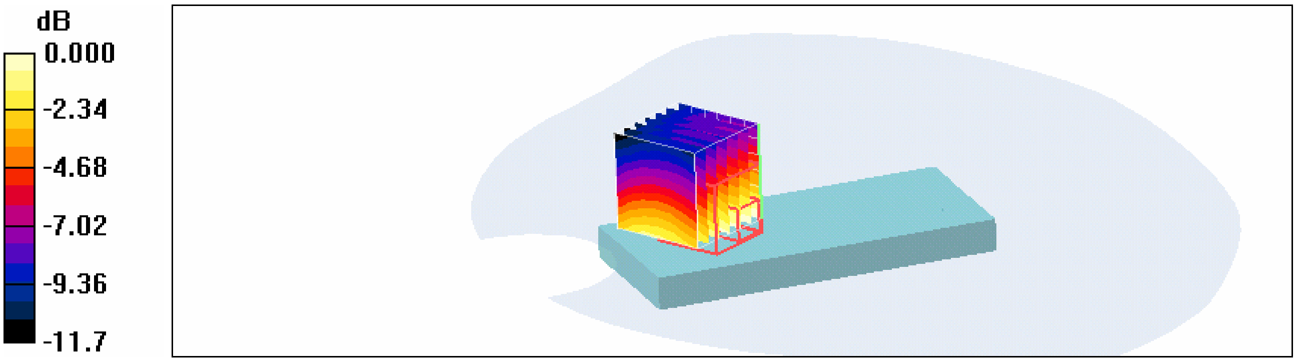
| Towards ground | 848.3 MHz |
|---|---|

DASY4 Configuration:
- Probe: ES3DV3 - SN3128; ConvF(5.72, 5.72, 5.72); 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 ground- High/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.3 V/m; Power Drift = -0.242 dB
Peak SAR (extrapolated) = 1.70 W/kg
SAR(1 g) = 1.16 mW/g; SAR(10 g) = 0.817 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 1.27 mW/g

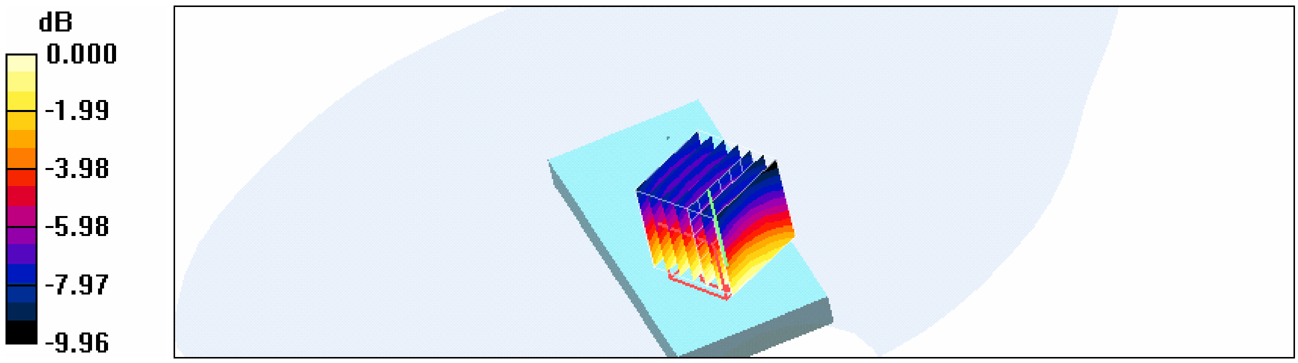



0 dB = 1.27mW/g

| Towards ground | 824.7MHz |
|---|---|

DASY4 Configuration:
- Probe: ES3DV3 - SN3128; ConvF(5.72, 5.72, 5.72); 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 - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.2 V/m; Power Drift = 0.184 dB
Peak SAR (extrapolated) = 1.78 W/kg
SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.922 mW/g
Maximum value of SAR (measured) = 1.38 mW/g



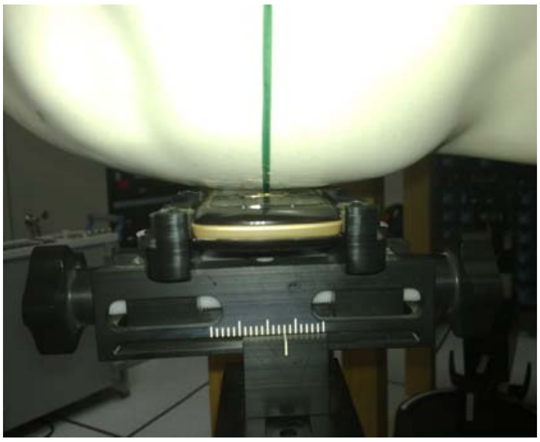

0 dB = 1.38mW/g

## 7.7 Pictures of the device under test

**Front view of the device**

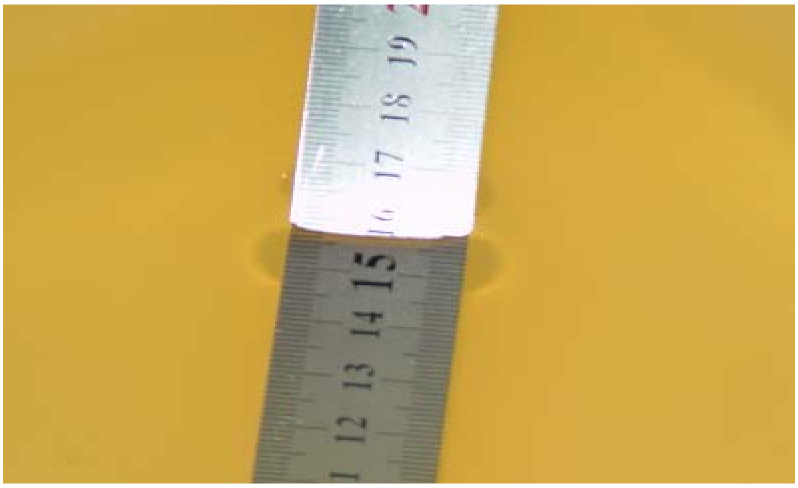
**back view of the device**

## 7.8 Test Positions for the Device under test

| | |
|---|---|
|  |  |
| **Cheek position, left side** | **Tilt position, left side** |
|  |  |
| **Cheek position, Right side** | **Tilt position, Right side** |
|  | |
| **Body position with a headset** | |

## 7.9 Picture to demonstrate the required liquid depth

the liquid depth in the used SAM phantoms



**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 8 and Table 9 .The target values were adopted from the IEEE1528. Table 7 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%. Measurement is made at temperature 24 °C, relative humidity 34.5%, Liquid temperature during the test: 22.3°C. System validation date: 2010.3.1

| | | $SAR_{1g}$ [w/kg] | $\varepsilon_r$ | σ[S/m] | Temperature | |
|---|---|---|---|---|---|---|
| | | | | | Ambient[℃] | Liquid[℃] |
| 835MHz | Target Value | 9.5 | 41.5±2.1 | 0.9±0.045 | 15-30 | --- |
| | Measured Value | 9.3 | 41.5 | 0.89 | 24.0 | 22.3 |

**All SAR values are normalized to 1W forward power**

**Table8: Validation results, 835 MHz**

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

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

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

Accreditation No.: **SCS 108**

Client **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<br>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

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

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Accreditation No.: **SCS 108**

**Glossary:**

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

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

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

**Methods Applied and Interpretation of Parameters:**

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

# 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!)

# DASY - Parameters of Probe: ES3DV3 SN:3128

## Sensitivity in Free Space[A]

| | | |
|---|---|---|
| NormX | **1.26** ± 10.1% | $\mu V/(V/m)^2$ |
| NormY | **1.36** ± 10.1% | $\mu V/(V/m)^2$ |
| NormZ | **1.32** ± 10.1% | $\mu V/(V/m)^2$ |

## 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

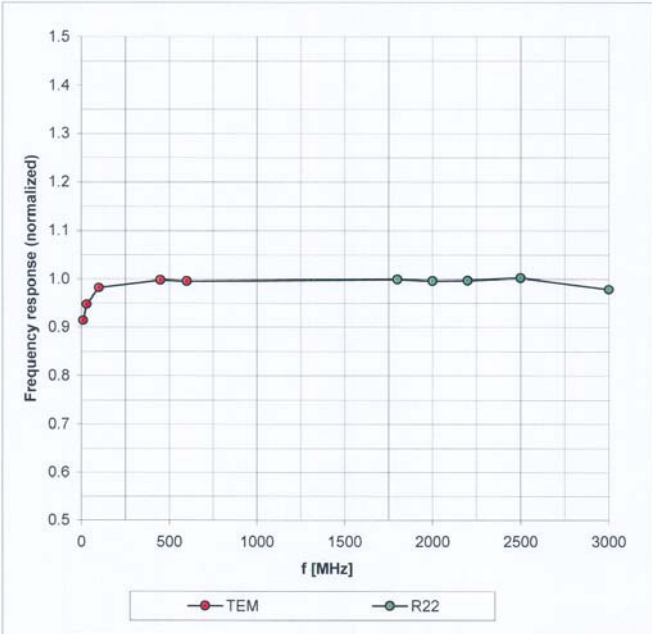
Probe Tip to Sensor Center **2.0** mm

**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 $E^2$-field uncertainty inside TSL (see Page 8).
[B] Numerical linearization parameter: uncertainty not required.

# Frequency Response of E-Field

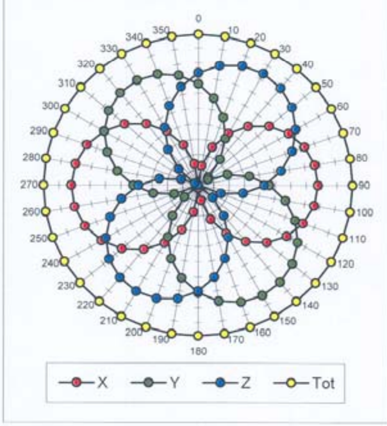
**(TEM-Cell:ifi110 EXX, Waveguide: R22)**



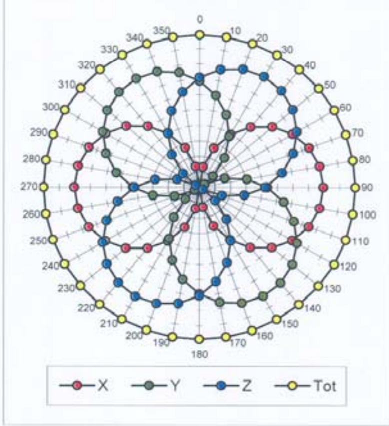

**Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)**

**ES3DV3 SN:3128** **June 22, 2009**

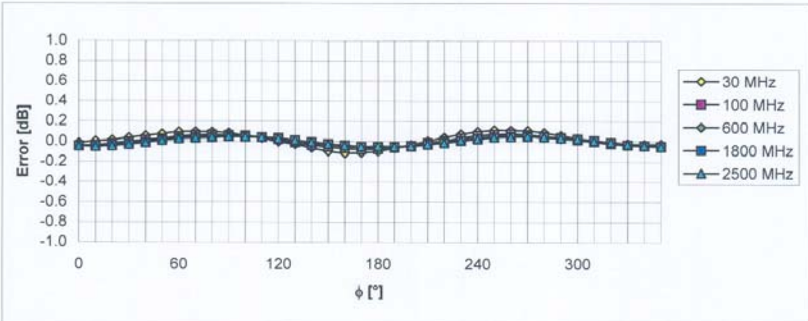
## Receiving Pattern (ϕ), ϑ = 0°



**f = 600 MHz, TEM ifi110EXX**



**f = 1800 MHz, WG R22**

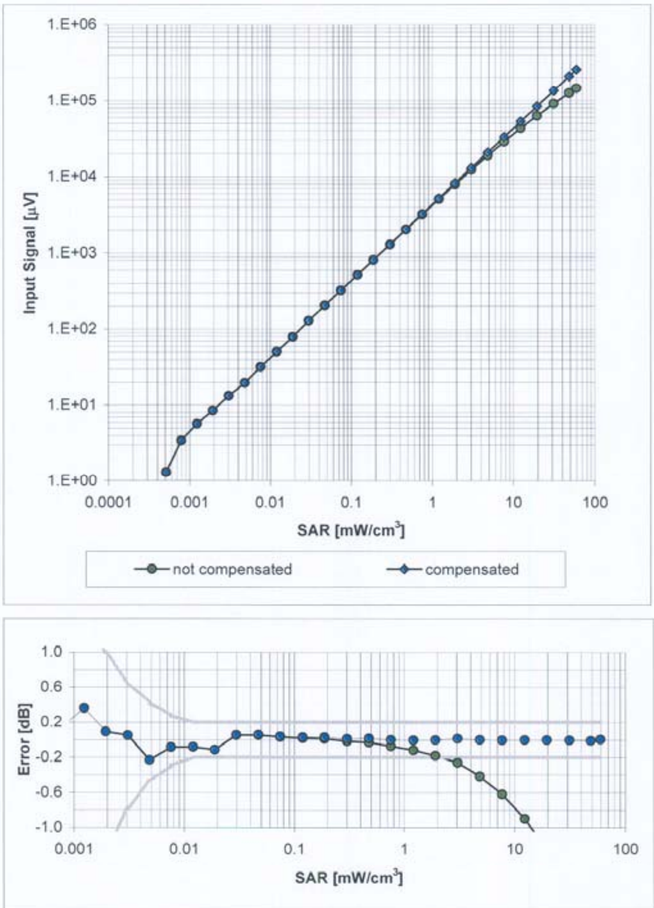



**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

**ES3DV3 SN:3128** **June 22, 2009**

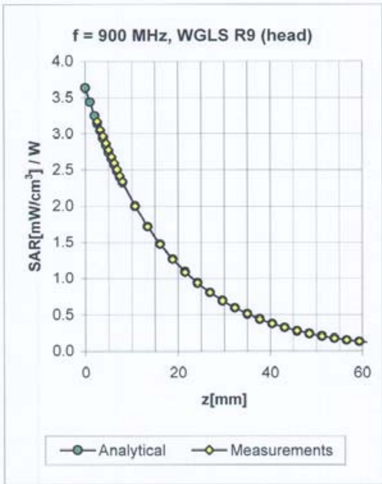
## Dynamic Range f($SAR_{head}$)

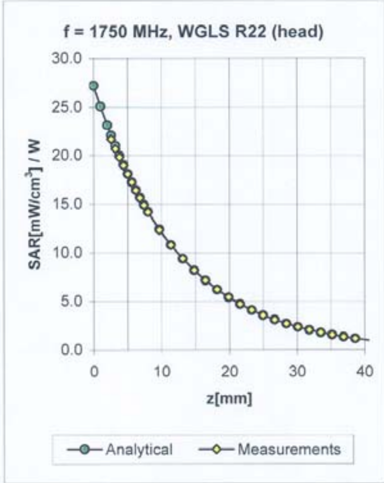
**(Waveguide R22, f = 1800 MHz)**




**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% | 0.94 | 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.

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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<br>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 | D. Hess |
| Approved by: | Fin Bomholt | R&D Director | i.V. [signature] |

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 = 6.1μV , 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** | 404.179 ± 0.1% (k=2) | 404.931 ± 0.1% (k=2) | 404.498 ± 0.1% (k=2) |
| **Low Range** | 3.90830 ± 0.7% (k=2) | 3.98545 ± 0.7% (k=2) | 3.98641 ± 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 | 199999.9 | 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 10MΩ

| | Average (μV) | min. Offset (μV) | max. Offset (μV) | Std. Deviation (μV) |
|---|---|---|---|---|
| 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 |

## 7.11 Certificate of conformity

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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<br>Hauptstr. 69<br>CH-8559 Fruthwilen<br>Switzerland |

**Tests**

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

| Test | Requirement | Details | Units tested |
|---|---|---|---|
| Shape | Compliance with the geometry according to the CAD model. | IT'IS CAD File (*) | First article, Samples |
| Material thickness | Compliant with the requirements according to the standards | 2mm +/- 0.2mm in specific areas;<br>6mm +/- 0.2mm at ERP | First article, Samples |
| Material parameters | Dielectric parameters for required frequencies | 200 MHz – 3 GHz<br>Relative permittivity < 5<br>Loss tangent < 0.05. | Material sample TP 104-5 |
| Material resistivity | The material has been tested to be compatible with the liquids defined in the standards 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

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