



# OET 65

## TEST REPORT

**Product Name** Digital Portable Radio

**Model** PD782G U(1)

**FCC ID** YAMPD78XG-U1

**Client** Hytera Communications Co., Ltd.


**TA Technology (Shanghai) Co., Ltd.**

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA1111-1935SARR3

Page 2 of 71

**GENERAL SUMMARY**

<b>Product Name</b>	Digital Portable Radio	<b>Model</b>	PD782G U(1)
<b>FCC ID</b>	YAMPD78XG-U1	<b>Report No.</b>	RZA1111-1935SARR3
<b>Client</b>	Hytera Communications Co., Ltd.		
<b>Manufacturer</b>	Hytera Communications Co., Ltd.		
<b>Reference Standard(s)</b>	<p><b>IEEE Std C95.1, 1999:</b> IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz.</p> <p><b>IEEE Std 1528™-2003:</b> IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.</p> <p><b>SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438 June 19, 2002:</b> Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions.</p> <p><b>KDB 643646 D01 SAR Test for PTT Radios v01:</b> SAR Test Reduction Considerations for Occupational PTT Radios</p>		
<b>Conclusion</b>	<p>This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 7 of this test report are below limits specified in the relevant standards.</p> <p>General Judgment: <b>Pass</b></p> <div style="text-align: right;"><p>(Stamp) Date of issue: December 31<sup>st</sup>, 2011</p></div>		
<b>Comment</b>	The test result only responds to the measured sample.		

Approved by 杨伟中  
Director

Revised by 凌敏宝  
SAR Manager

Performed by 杨如蔚  
SAR Engineer

## TABLE OF CONTENT

1. General Information .....	5
1.1. Notes of the Test Report.....	5
1.2. Testing Laboratory .....	5
1.3. Applicant Information .....	6
1.4. Manufacturer Information .....	6
1.5. Information of EUT .....	7
1.6. The Maximum SAR <sub>1g</sub> Values and Power of each tested Mode .....	8
1.7. Test Date .....	8
2. Operational Conditions during Test .....	9
2.1. General Description of Test Procedures .....	9
2.2. Test Positions .....	9
2.2.1. Face-Held Configuration .....	9
2.2.2. Body-Worn Configuration .....	9
3. SAR Measurements System Configuration .....	10
3.1. SAR Measurement Set-up .....	10
3.2. DASY4 E-field Probe System .....	11
3.2.1. EX3DV4 Probe Specification .....	11
3.2.2. E-field Probe Calibration .....	12
3.3. Other Test Equipment .....	12
3.3.1. Device Holder for Transmitters .....	12
3.3.2. Phantom .....	13
3.4. Scanning Procedure .....	13
3.5. Data Storage and Evaluation .....	15
3.5.1. Data Storage.....	15
3.5.2. Data Evaluation by SEMCAD .....	15
3.6. System Check.....	18
3.7. Equivalent Tissues .....	20
4. Environmental Requirements .....	20
5. Characteristics of the Test .....	21
5.1. Applicable Limit Regulations .....	21
5.2. Applicable Measurement Standards .....	21
6. Conducted Output Power Measurement .....	22
6.1. Conducted Power Results .....	22
7. Test Results .....	23
7.1. Dielectric Performance.....	23
7.2. System Check Results.....	23
7.3. Summary of Measurement Results.....	24
8. Measurement Uncertainty .....	26
9. Main Test Instruments .....	28
ANNEX A: Test Layout .....	29
ANNEX B: System Check Results .....	30
ANNEX C: Graph Results .....	32
ANNEX D: Probe Calibration Certificate .....	45

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA1111-1935SARR3

Page 4 of 71

---

ANNEX E: D450V3 Dipole Calibration Certificate .....	56
ANNEX F: DAE4 Calibration Certificate .....	65
ANNEX G: The EUT Appearances and Test Configuration .....	70

## **1. General Information**

### **1.1. Notes of the Test Report**

**TA Technology (Shanghai) Co., Ltd.** guarantees the reliability of the data presented in this test report, which is the results of measurements and tests performed for the items under test on the date and under the conditions stated in this test report and is based on the knowledge and technical facilities available at TA Technology (Shanghai) Co., Ltd. at the time of execution of the test.

**TA Technology (Shanghai) Co., Ltd.** is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the items under test and the results of the test. This report only refers to the item that has undergone the test.

This report standalone dose not constitute or imply by its own an approval of the product by the certification Bodies or competent Authorities. This report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of **TA Technology (Shanghai) Co., Ltd.** and the Accreditation Bodies, if it applies.

If the electrical report is inconsistent with the printed one, it should be subject to the latter.

### **1.2. Testing Laboratory**

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# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 6 of 71

---

### 1.3. Applicant Information

Company: Hytera Communications Co., Ltd.

Address: HYT Tower, Hi-Tech Industrial Park North, Nanshan District, Shenzhen China.

City: Shenzhen

Postal Code: 518057

Country: P. R. China

Telephone: 0755-26972999

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### 1.4. Manufacturer Information

Company: Hytera Communications Co., Ltd.

Address: HYT Tower, Hi-Tech Industrial Park North, Nanshan District, Shenzhen China.

City: Shenzhen

Postal Code: 518057

Country: P. R. China

Telephone: 0755-26972999

Fax: 0755-86137130

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 7 of 71

### 1.5. Information of EUT

#### General Information

Device Type:	Portable Device
Exposure Category:	Controlled Environment /Occupational
State of Sample:	Prototype Unit
Product Name:	Digital Portable Radio
S/N:	/
Hardware Version:	H
Software Version:	DMR_SW_SUBSCRIBER_Portable_A4.00.10.001
Antenna Type:	External Antenna
Device Operating Configurations:	
Operating Mode(s):	400.5 MHz –469.5 MHz
Test Modulation:	FM (Analog), 4FSK(digital)
Operating Frequency Range(s):	400.5 MHz ~ 469.5 MHz(UHF)
Test Frequency:	400.5 MHz – 418MHz – 435.5MHz – 453MHz – 469.5MHz

#### Auxiliary Equipment Details

##### AE:Battery

Model: HD-PA2V

Manufacturer: Hytera Communications Co., Ltd.

S/N: /

Equipment Under Test (EUT) is Digital Portable Radio. SAR is tested for 400.5 - 469.5 MHz only. The EUT has one external antenna that is used for Tx/Rx.

The sample undergoing test was selected by the Client.

Components list please refer to documents of the manufacturer.

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA1111-1935SARR3

Page 8 of 71

**1.6. The Maximum SAR<sub>1g</sub> Values and Power of each tested Mode**

**Configuration**

Mode	Channel/f(MHz)	Position	SAR <sub>1g</sub> (W/kg) 50% PTT duty cycle
UHF	418	Face-held for 12.5 KHz	<b>2.516</b>
UHF	418	Body-Worn for 12.5 KHz	<b>4.626</b>

**Maximum Power**

Mode	Max Conducted Power (dBm)
Analog 12.5K UHF	<b>36.16</b>
Digital UHF	<b>36.16</b>

**1.7. Test Date**

The test is performed from November 23, 2011 to November 24, 2011.



## **2. Operational Conditions during Test**

### **2.1. General Description of Test Procedures**

The spatial peak SAR values were assessed for UHF (400.5 MHz, 418 MHz, 435.5MHz, 453MHz and 469.5MHz) systems. Battery and accessories shall be specified by the manufacturer. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. The antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the EUT.

### **2.2. Test Positions**

#### **2.2.1. Face-Held Configuration**

The front of the EUT towards phantom, the distance between the EUT frontside and the phantom was kept 25mm and the distance from EUT Antenna to the bottom of the Phantom is 43mm

#### **2.2.2. Body-Worn Configuration**

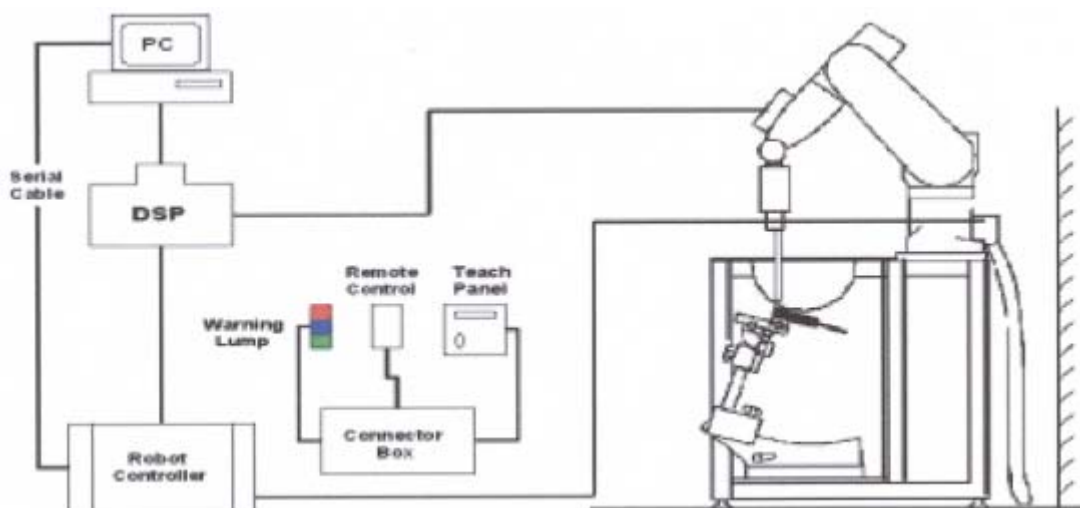
The front of the EUT towards ground, the distance between the EUT backside and the phantom was kept 15mm and the distance from EUT Antenna to the bottom of the Phantom is 24mm

### 3. SAR Measurements System Configuration

#### 3.1. SAR Measurement Set-up

The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to the EOC.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY4 measurement server.
- The DASY4 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003
- DASY4 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System validation dipoles allowing to validate the proper functioning of the system.



**Figure 1. SAR Lab Test Measurement Set-up**

### 3.2. DASY4 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

#### 3.2.1. EX3DV4 Probe Specification

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to > 6 GHz Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
Directivity	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 $\mu$ W/g to > 100 mW/g Linearity:  $\pm 0.2$ dB (noise: typically < 1 $\mu$ W/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.



**Figure 2. EX3DV4 E-field Probe**



**Figure 3. EX3DV4 E-field probe**

### 3.2.2. E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy was evaluated and found to be better than  $\pm 0.25\text{dB}$ . The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\text{SAR} = C \frac{\Delta T}{\Delta t}$$

Where:  $\Delta t$  = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

$\Delta T$  = Temperature increase due to RF exposure.

Or

$$\text{SAR} = \frac{|E|^2 \sigma}{\rho}$$

Where:

$\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density ( $\text{kg/m}^3$ ).

### 3.3. Other Test Equipment

#### 3.3.1. Device Holder for Transmitters

The DASY device holder is designed to cope with the different positions given in the standard.

It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material. The amount of dielectric material

has been reduced in the closest vicinity of the device, since measurements have suggested that the inference of the clamp on the test results could thus be lowered.



**Figure 4. Device Holder**

### 3.3.2. Phantom

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (Oval Flat) phantom defined in IEEE 1528-2003, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of wireless portable device usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness  $2 \pm 0.2$  mm

Filling Volume Approx. 30 liters

Dimensions 190×600×400 mm (H×L×W)



**Figure 5.ELI4 Phantom**

### 3.4. Scanning Procedure

The DASY4 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max.  $\pm 5$  %.
- The “surface check” measurement tests the optical surface detection system of the DASY4 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above  $\pm 0.1$ mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within  $\pm 30^\circ$ .)

- **Area Scan**

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged.

After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

- **Zoom Scan**

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

- **Spatial Peak Detection**

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY4 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

- **A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.**

### **3.5. Data Storage and Evaluation**

#### **3.5.1. Data Storage**

The DASY4 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DA4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

#### **3.5.2. Data Evaluation by SEMCAD**

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, $a_{i0}$ , $a_{i1}$ , $a_{i2}$
	- Conversion factor	ConvF <sub>i</sub>
	- Diode compression point	Dcp <sub>i</sub>
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	$\sigma$
	- Density	$\rho$

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY4 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot c f / d c p_i$$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

$U_i$  = input signal of channel i (i = x, y, z)

$cf$  = crest factor of exciting field (DASY parameter)

$dcp_i$  = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:  $E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$

H-field probes:  $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

$Norm_i$  = sensor sensitivity of channel i (i = x, y, z)  
[mV/(V/m)<sup>2</sup>] for E-field Probes

$ConvF$  = sensitivity enhancement in solution

$a_{ij}$  = sensor sensitivity factors for H-field probes

$f$  = carrier frequency [GHz]

$E_i$  = electric field strength of channel i in V/m

$H_i$  = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$SAR = (E_{tot}^2 \cdot \sigma) / (\rho \cdot 1000)$$



**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA1111-1935SARR3

Page 17 of 71

with **SAR** = local specific absorption rate in mW/g

**$E_{tot}$**  = total field strength in V/m

**$\sigma$**  = conductivity in [mho/m] or [Siemens/m]

**$\rho$**  = equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with  **$P_{pwe}$**  = equivalent power density of a plane wave in mW/cm<sup>2</sup>

**$E_{tot}$**  = total electric field strength in V/m

**$H_{tot}$**  = total magnetic field strength in A/m

### 3.6. System Check

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 398 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 7 and table 8.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ( $\pm 10\%$ ).

System check is performed regularly on all frequency bands where tests are performed with the DASY4 system.

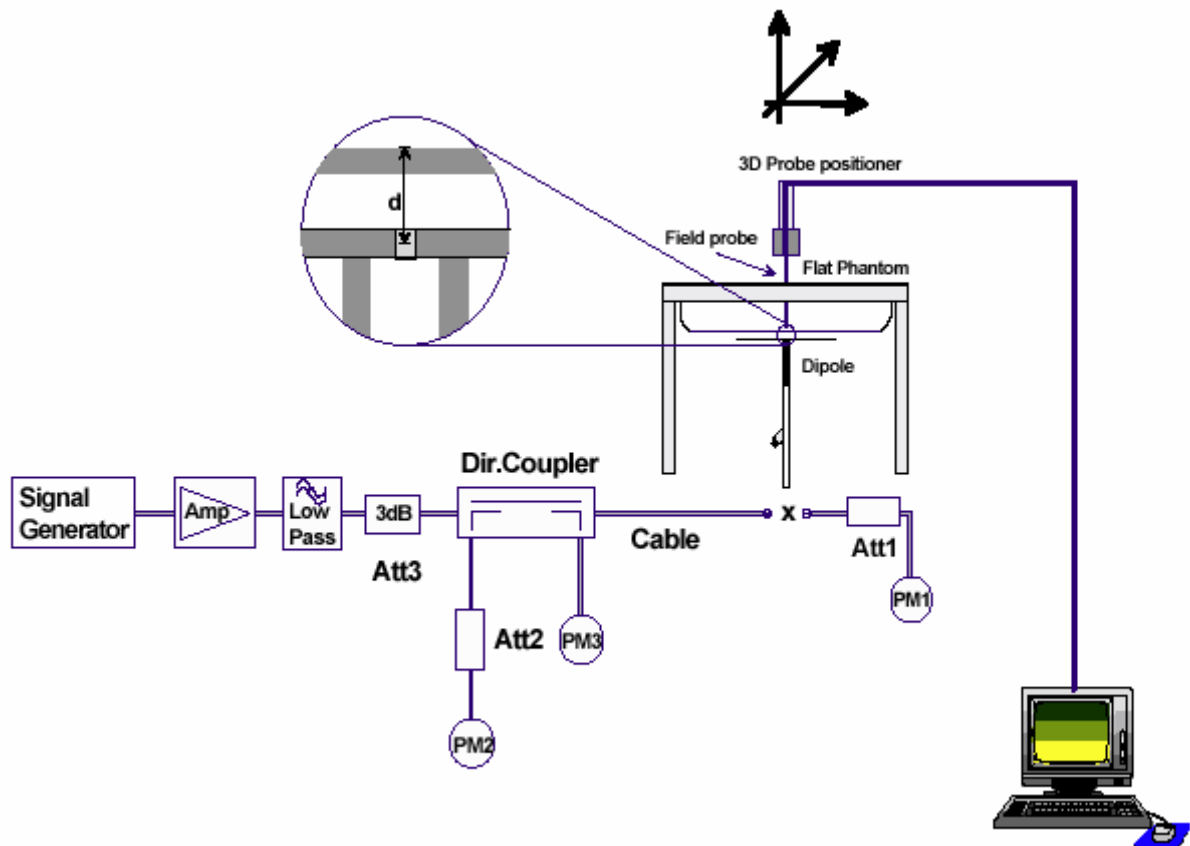


Figure 6. System Check Set-up

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA1111-1935SARR3

Page 19 of 71

**Justification for Extended SAR Dipole Calibrations**

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss ( $< -20$  dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 450824:

Dipole D450V3 SN: 1065				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
11/09/2010	-20.5	3.4%	59.2	1.4 $\Omega$
11/08/2011	-21.2		60.6	
Body Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
11/09/2010	-20.4	2.9%	56.5	1.6 $\Omega$
11/08/2011	-19.8		58.1	

### 3.7. Equivalent Tissues

The liquid is consisted of water, sugar, salt, Preventol and Cellulose. The liquid has previously been proven to be suited for worst-case. The Table 1 and Table 2 show the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the OET 65.

**Table 1: Composition of the Head Tissue Equivalent Matter**

MIXTURE%	FREQUENCY(Brain) 450MHz
Water	38.56
Sugar	56.32
Salt	3.95
Preventol	0.10
Cellulose	1.07
Dielectric Parameters Target Value	f=450MHz $\epsilon=43.5$ $\sigma=0.87$

**Table 2: Composition of the Body Tissue Equivalent Matter**

MIXTURE%	FREQUENCY(Body) 450MHz
Water	51.16
Sugar	46.78
Salt	1.49
Preventol	0.10
Cellulose	0.47
Dielectric Parameters Target Value	f=450MHz $\epsilon=56.7$ $\sigma=0.94$

## 4. Environmental Requirements

**Table 3: The requirements of the Ambient Conditions**

Temperature	Min. = 20°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 $\Omega$
Ambient noise is checked and found very low and in compliance with requirement of standards.	
Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

## **5. Characteristics of the Test**

### **5.1. Applicable Limit Regulations**

**IEEE Std C95.1, 1999:** IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz.

### **5.2. Applicable Measurement Standards**

**IEEE Std 1528™-2003:** IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

**SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438 June 19, 2002:** Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions.

**KDB 643646 D01 SAR Test for PTT Radios v01:** SAR Test Reduction Considerations for Occupational PTT Radios

## 6. Conducted Output Power Measurement

### 6.1. Conducted Power Results

**Table 4: Conducted Power Measurement Results**

<b>Analog 12.5K UHF</b>	<b>Conducted Power</b>				
	400.5 MHz	418MHz	435.5MHz	453MHz	469.5MHz
Test Result (dBm)	36.16	36.16	36.16	36.16	36.16
<b>Digital UHF</b>	<b>Conducted Power</b>				
	400.5 MHz	418MHz	435.5MHz	453MHz	469.5MHz
Test Result (dBm)	36.16	36.16	36.16	36.16	36.16

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 23 of 71

## 7. Test Results

### 7.1. Dielectric Performance

**Table 5: Dielectric Performance of Head Tissue Simulating Liquid**

Frequency	Description	Dielectric Parameters		Temp ℃
		$\epsilon_r$	$\sigma(\text{s/m})$	
450MHz (head)	Target value	43.50	0.87	/
	±5% window	41.33 — 45.68	0.83 — 0.91	
	Measurement value 2011-11-23	44.75	0.88	21.6

**Table 6: Dielectric Performance of Body Tissue Simulating Liquid**

Frequency	Description	Dielectric Parameters		Temp ℃
		$\epsilon_r$	$\sigma(\text{s/m})$	
450MHz (body)	Target value	56.70	0.94	/
	±5% window	53.87 — 59.54	0.89 — 0.99	
	Measurement value 2011-11-24	57.02	0.95	21.5

### 7.2. System Check Results

**Table 7: System Check for Head Tissue Simulating Liquid**

Frequency	Description	SAR(W/kg)		Dielectric Parameters		Temp ℃
		10g	1g	$\epsilon_r$	$\sigma(\text{s/m})$	
450MHz	Recommended value	1.25	1.87	44.2	0.86	/
	±10% window	1.13—1.38	1.68 — 2.06			
	Measurement value 2011-11-23	1.31	2.00	44.75	0.88	21.6

Note: 1. The graph results see ANNEX B.

2. Recommended Values used derive from the calibration certificate and 398 mW is used as feeding power to the calibrated dipole.

**Table 8: System Check for Body Tissue Simulating Liquid**

Frequency	Description	SAR(W/kg)		Dielectric Parameters		Temp ℃
		10g	1g	$\epsilon_r$	$\sigma(\text{s/m})$	
450MHz	Recommended value	1.18	1.77	54.1	0.90	/
	±10% window	1.06—1.30	1.59 — 1.95			
	Measurement value 2011-11-24	1.17	1.78	57.02	0.95	21.5

Note: 1. The graph results see ANNEX B.

2. Recommended Values used derive from the calibration certificate and 398 mW is used as feeding power to the calibrated dipole.

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 24 of 71

### 7.3. Summary of Measurement Results

#### 7.3.1. UHF

**Table 9: SAR Values (UHF)**

Limits	1 g Average (W/kg)		Power Drift (dB)	Graph Results
	8.0		± 0.21	
Frequency	Duty Cycle		Power Drift (dB)	
	100%	50%		
The EUT display towards phantom for 12.5 KHz (Face Held)				
400.5 MHz	3.630	1.815	-0.049	Figure 9
418 MHz	4.990	2.495	-0.036	Figure 10
435.5 MHz	4.370	2.185	-0.085	Figure 11
453MHz	3.880	1.940	0.117	Figure 12
469.5MHz	3.420	1.710	-0.090	Figure 13
The EUT display towards ground for 12.5 KHz (Body-Worn)				
400.5 MHz	8.810	4.405	-0.006	Figure 14
418 MHz	9.180	4.590	-0.034	Figure 15
435.5 MHz	7.960	3.980	-0.083	Figure 16
453MHz	7.230	3.615	0.002	Figure 17
469.5MHz	5.970	2.985	-0.016	Figure 18
The EUT display towards ground with Digital Channel (Body-Worn)				
418 MHz	3.880	1.940	-0.109	Figure 19



# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 25 of 71

**Table 10: SAR Values are scaled for the power drift**

Limits	1 g Average (W/kg)		Power Drift (dB)	+ Power Drift 10^(dB/10)	SAR 1g (W/kg) (include + power drift)	
	8.0		± 0.21			
Frequency	Duty Cycle		Power Drift(dB)		Duty Cycle	
	100%	50%		100%	50%	
The EUT display towards phantom for 12.5 KHz (Face Held)						
400.5 MHz	3.630	1.815	0.049	1.011	3.671	1.836
418 MHz	4.990	2.495	0.036	1.008	5.032	2.516
435.5 MHz	4.370	2.185	0.085	1.020	4.456	2.228
453MHz	3.880	1.940	0.117	1.027	3.986	1.993
469.5MHz	3.420	1.710	0.090	1.021	3.492	1.746
The EUT display towards ground for 12.5 KHz (Body-Worn)						
400.5 MHz	8.810	4.405	0.006	1.001	8.822	4.411
418 MHz	9.180	4.590	0.034	1.008	9.252	4.626
435.5 MHz	7.960	3.980	0.083	1.019	8.114	4.057
453MHz	7.230	3.615	0.002	1.000	7.233	3.617
469.5MHz	5.970	2.985	0.016	1.004	5.992	2.996
The EUT display towards ground with Digital Channel (Body-Worn)						
418 MHz	3.880	1.940	0.109	1.025	3.979	1.989

**Note: 1.** The value with blue color is the maximum SAR Value of each test band.

2. The Exposure category about EUT: controlled environment / Occupational, so the SAR limit is 8.0 W/kg averaged over any 1 gram of tissue.

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 26 of 71

### 8. Measurement Uncertainty

No.	source	Type	Uncertainty Value (%)	Probability Distribution	k	c <sub>i</sub>	Standard ncertainty $u_i$ (%)	Degree of freedom $V_{eff}$ or $V_i$
1	System repetivity	A	0.5	N	1	1	0.5	9
Measurement system								
2	-probe calibration	B	5.9	N	1	1	5.9	∞
3	-axial isotropy of the probe	B	4.7	R	$\sqrt{3}$	$\sqrt{0.5}$	1.9	∞
4	- Hemispherical isotropy of the probe	B	9.4	R	$\sqrt{3}$	$\sqrt{0.5}$	3.9	∞
6	-boundary effect	B	1.9	R	$\sqrt{3}$	1	1.1	∞
7	-probe linearity	B	4.7	R	$\sqrt{3}$	1	2.7	∞
8	- System detection limits	B	1.0	R	$\sqrt{3}$	1	0.6	∞
9	-readout Electronics	B	1.0	N	1	1	1.0	∞
10	-response time	B	0	R	$\sqrt{3}$	1	0	∞
11	-integration time	B	4.32	R	$\sqrt{3}$	1	2.5	∞
12	-noise	B	0	R	$\sqrt{3}$	1	0	∞
13	-RF Ambient Conditions	B	3	R	$\sqrt{3}$	1	1.73	∞
14	-Probe Positioner Mechanical Tolerance	B	0.4	R	$\sqrt{3}$	1	0.2	∞
15	-Probe Positioning with respect to Phantom Shell	B	2.9	R	$\sqrt{3}$	1	1.7	∞
16	-Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	B	3.9	R	$\sqrt{3}$	1	2.3	∞
Test sample Related								
17	-Test Sample Positioning	A	2.9	N	1	1	4.92	71
18	-Device Holder Uncertainty	A	4.1	N	1	1	4.1	5
19	-Output Power Variation - SAR drift measurement	B	5.0	R	$\sqrt{3}$	1	2.9	∞
Physical parameter								
20	-phantom	B	4.0	R	$\sqrt{3}$	1	2.3	∞

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 27 of 71

21	-liquid conductivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.64	1.8	$\infty$
22	-liquid conductivity (measurement uncertainty)	B	2.5	N	1	0.64	1.6	9
23	-liquid permittivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.6	1.7	$\infty$
24	-liquid permittivity (measurement uncertainty)	B	2.5	N	1	0.6	1.5	9
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					12.12	
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		N	k=2		24.24	

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA1111-1935SARR3

Page 28 of 71

## 9. Main Test Instruments

**Table 11: List of Main Instruments**

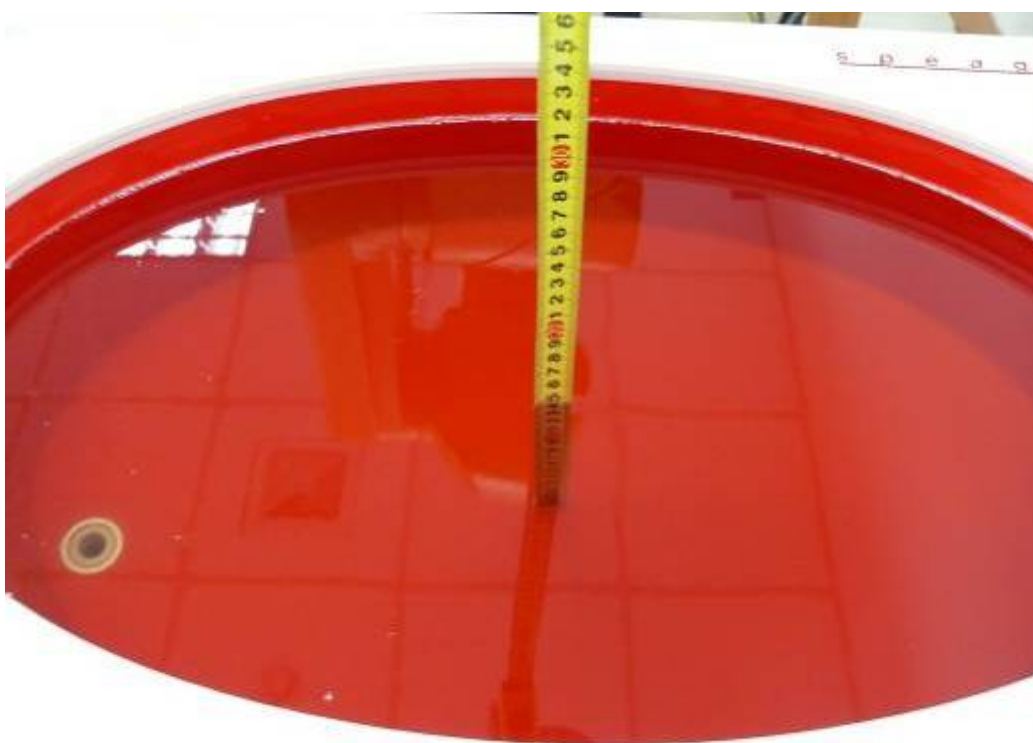
No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	Agilent 8753E	US37390326	September 12, 2011	One year
02	Dielectric Probe Kit	Agilent 85070E	US44020115	No Calibration Requested	
03	Power meter	Agilent E4417A	GB41291714	March 12, 2011	One year
04	Power sensor	Agilent N8481H	MY50350004	September 25, 2011	One year
05	Signal Generator	HP 8341B	2730A00804	September 12, 2011	One year
06	Amplifier	IXA-020	0401	No Calibration Requested	
07	E-field Probe	EX3DV4	3816	October 3, 2011	One year
08	DAE	DAE4	905	June 24, 2011	One year
09	Validation Kit 450MHz	D450V3	1065	November 9, 2010	Two years

\*\*\*\*\*END OF REPORT BODY\*\*\*\*\*

## ANNEX A: Test Layout



Picture 1: Specific Absorption Rate Test Layout



Picture 2: Liquid depth in the Flat Phantom (450 MHz, 15.4cm depth)

## ANNEX B: System Check Results

### System Performance Check at 450 MHz Head

**DUT: Dipole450 MHz; Type: D450V3; Serial: 1065**

Date/Time: 11/23/2011 1:06:21 PM

Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 450$  MHz;  $\sigma = 0.88$  mho/m;  $\epsilon_r = 44.75$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.6 °C

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(9.97, 9.97, 9.97) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**d=15mm, Pin=398mW/Area Scan (41x131x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.15 mW/g

**d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.2 V/m; Power Drift = -0.033 dB

Peak SAR (extrapolated) = 3.29 W/kg

**SAR(1 g) = 2.00 mW/g; SAR(10 g) = 1.31 mW/g**

Maximum value of SAR (measured) = 2.15 mW/g

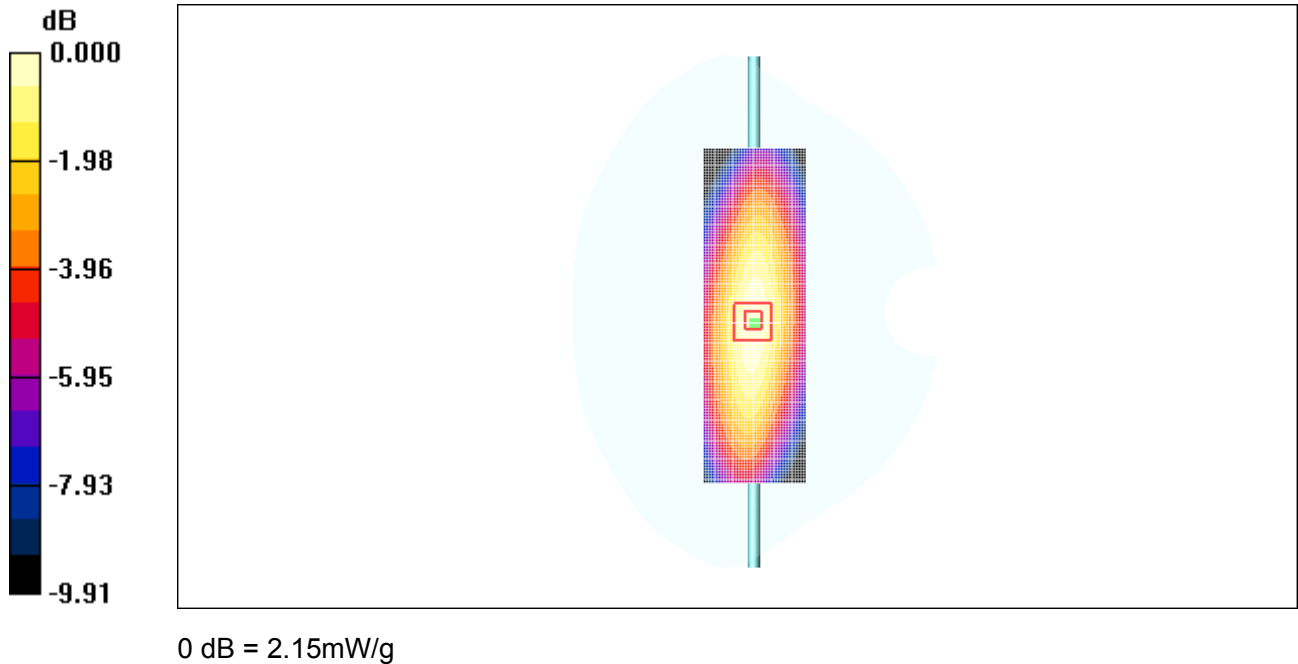


Figure 7 System Performance Check 450MHz 398mW

### System Performance Check at 450 MHz Body

**DUT: Dipole450 MHz; Type: D450V3; Serial: 1065**

Date/Time: 11/24/2011 4:10:21 PM

Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 450 \text{ MHz}$ ;  $\sigma = 0.95 \text{ mho/m}$ ;  $\epsilon_r = 57.02$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3^\circ\text{C}$       Liquid Temperature:  $21.5^\circ\text{C}$

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(10.83, 10.83, 10.83) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**d=15mm, Pin=398mW/Area Scan (61x221x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $1.9 \text{ mW/g}$

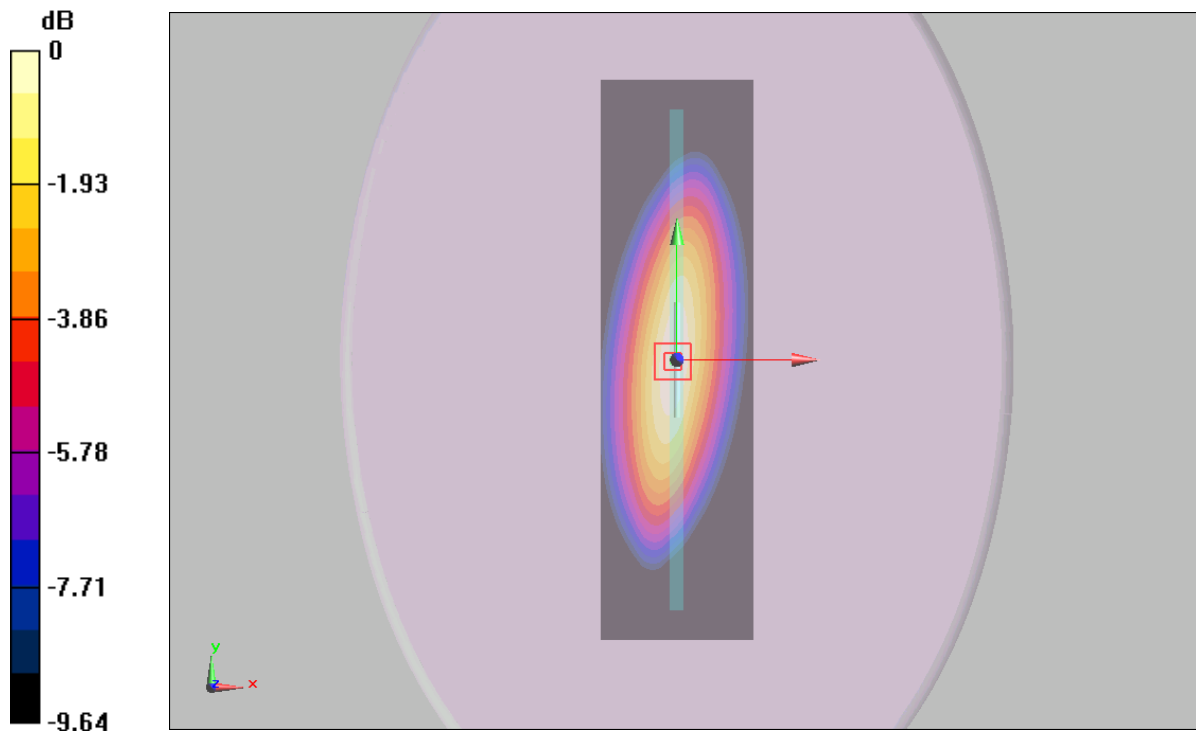
**d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $44.7 \text{ V/m}$ ; Power Drift =  $-0.014 \text{ dB}$

Peak SAR (extrapolated) =  $2.64 \text{ W/kg}$

**SAR(1 g) =  $1.78 \text{ mW/g}$ ; SAR(10 g) =  $1.17 \text{ mW/g}$**

Maximum value of SAR (measured) =  $1.89 \text{ mW/g}$



0 dB =  $1.89 \text{ mW/g}$

**Figure 8 System Performance Check 450MHz 398mW**

## ANNEX C: Graph Results

### Face Held for 12.5 KHz, Front towards Phantom 400.5 MHz

Date/Time: 11/23/2011 2:26:07 PM

Communication System: PTT 450; Frequency: 400.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 400.5$  MHz;  $\sigma = 0.836$  mho/m;  $\epsilon_r = 45.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(9.97, 9.97, 9.97) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Phantom 400.5 MHz/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.78 mW/g

**Towards Phantom 400.5 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 66.8 V/m; Power Drift = -0.049 dB

Peak SAR (extrapolated) = 4.82 W/kg

**SAR(1 g) = 3.63 mW/g; SAR(10 g) = 2.77 mW/g**

Maximum value of SAR (measured) = 3.79 mW/g

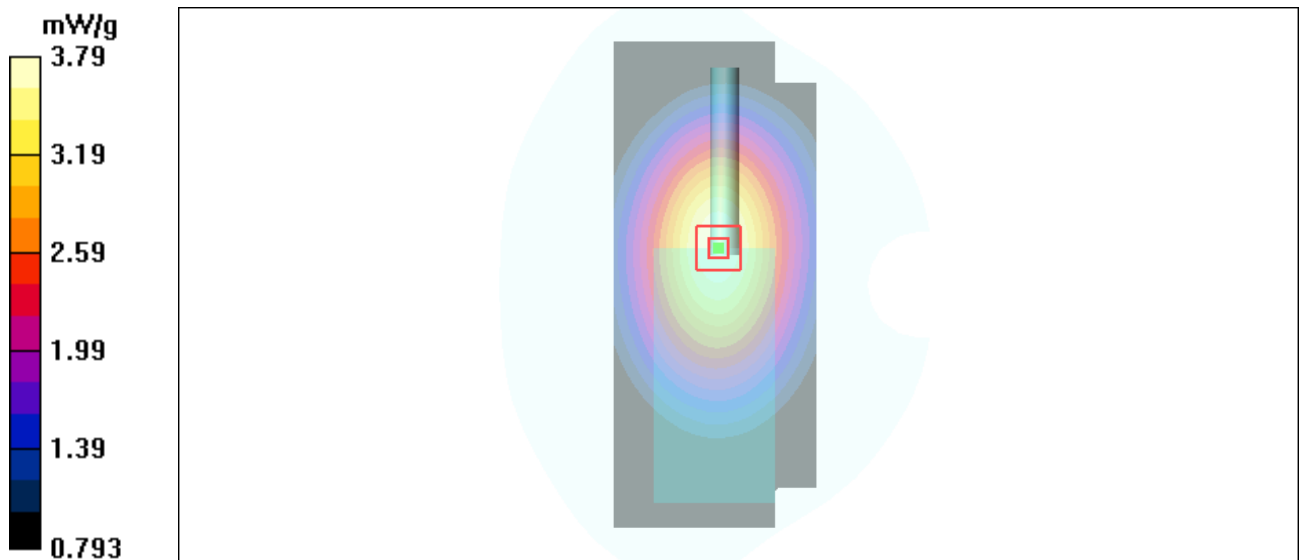


Figure 9 Face Held for 12.5 KHz, Front towards Phantom 400.5 MHz



### Face Held for 12.5 KHz, Front towards Phantom 418 MHz

Date/Time: 11/23/2011 2:40:14 PM

Communication System: PTT 450; Frequency: 418 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 418 \text{ MHz}$ ;  $\sigma = 0.852 \text{ mho/m}$ ;  $\epsilon_r = 45.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3^\circ\text{C}$       Liquid Temperature:  $21.5^\circ\text{C}$

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(9.97, 9.97, 9.97) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Phantom 418 MHz/Area Scan (51x121x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $5.23 \text{ mW/g}$

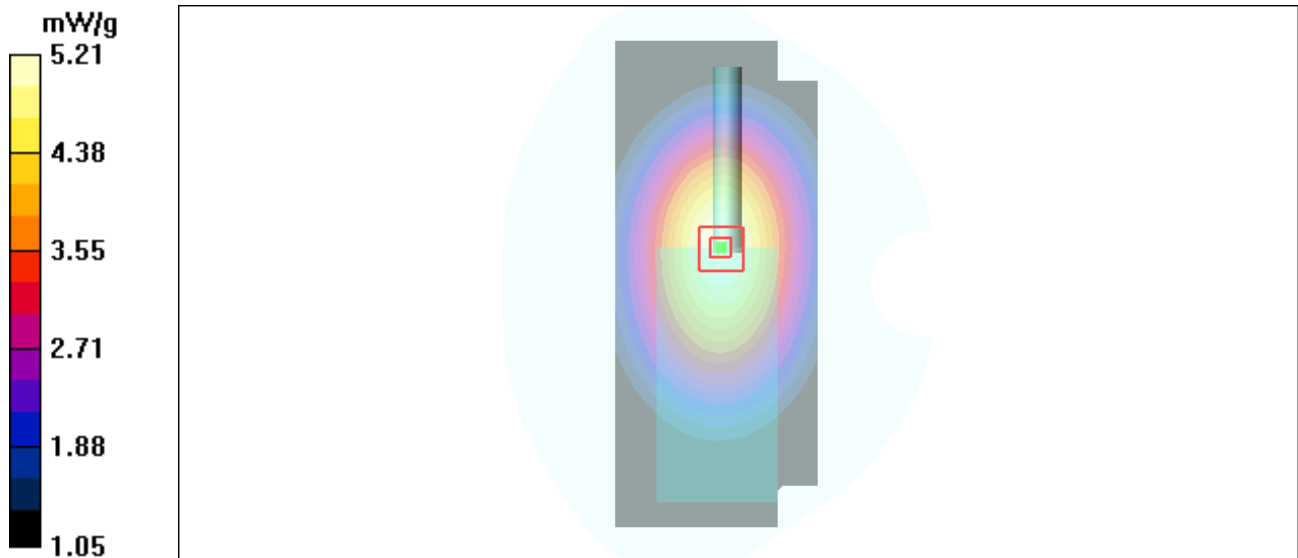
**Towards Phantom 418 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $77.8 \text{ V/m}$ ; Power Drift =  $-0.036 \text{ dB}$

Peak SAR (extrapolated) =  $6.61 \text{ W/kg}$

**SAR(1 g) =  $4.99 \text{ mW/g}$ ; SAR(10 g) =  $3.81 \text{ mW/g}$**

Maximum value of SAR (measured) =  $5.21 \text{ mW/g}$



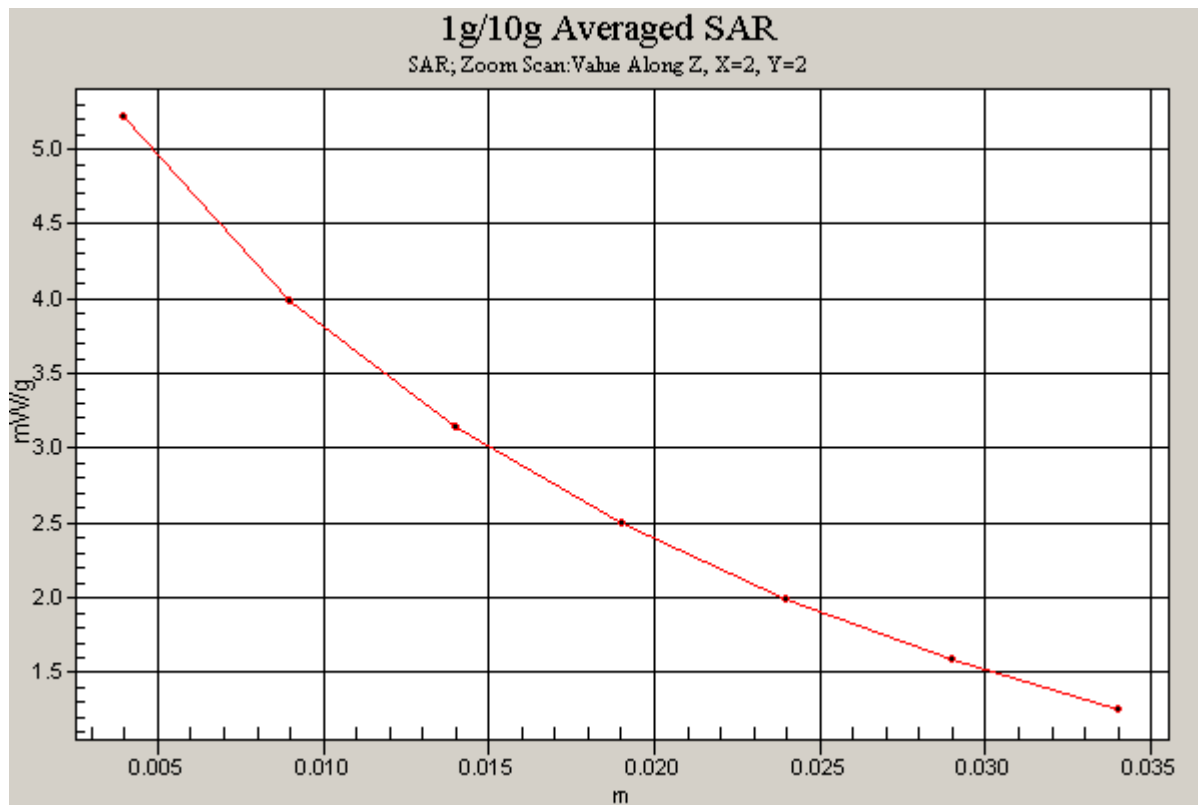


Figure 10 Face Held for 12.5 KHz, Front towards Phantom 418 MHz

**Face Held for 12.5 KHz, Front towards Phantom 435.5 MHz**

Date/Time: 11/23/2011 2:54:34 PM

Communication System: PTT 450; Frequency: 435.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 435.5$  MHz;  $\sigma = 0.868$  mho/m;  $\epsilon_r = 45$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(9.97, 9.97, 9.97) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Phantom 435.5 MHz/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 4.63 mW/g

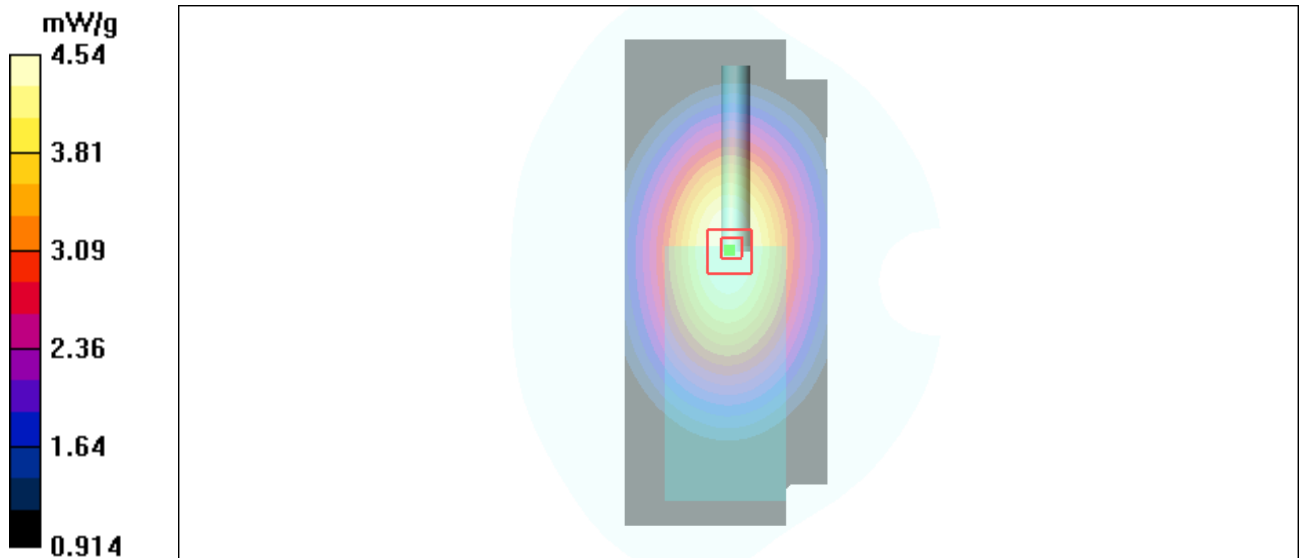
**Towards Phantom 435.5 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 73.1 V/m; Power Drift = -0.085 dB

Peak SAR (extrapolated) = 5.80 W/kg

**SAR(1 g) = 4.37 mW/g; SAR(10 g) = 3.34 mW/g**

Maximum value of SAR (measured) = 4.54 mW/g



**Figure 11 Face Held for 12.5 KHz, Front towards Phantom 435.5 MHz**

### Face Held for 12.5 KHz, Front towards Phantom 453 MHz

Date/Time: 11/23/2011 8:13:47 PM

Communication System: PTT 450; Frequency: 453 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 453 \text{ MHz}$ ;  $\sigma = 0.883 \text{ mho/m}$ ;  $\epsilon_r = 44.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3^\circ\text{C}$       Liquid Temperature:  $21.5^\circ\text{C}$

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(9.97, 9.97, 9.97) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Phantom 453 MHz/Area Scan (51x121x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $4.04 \text{ mW/g}$

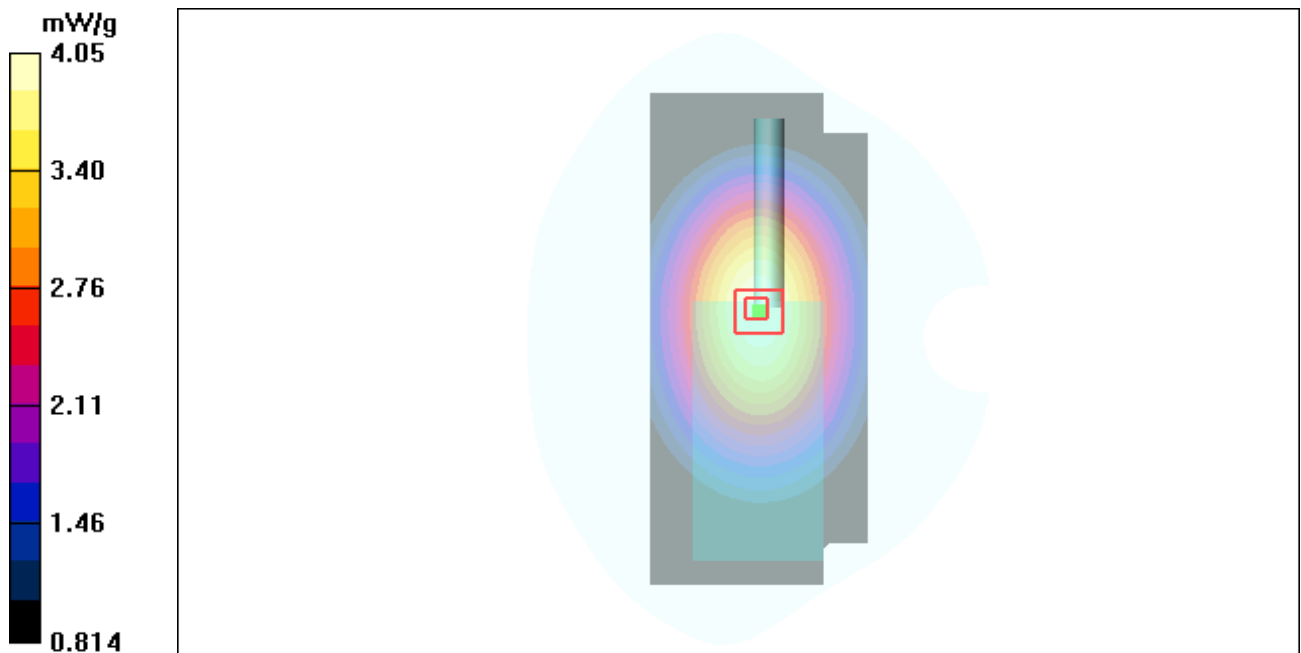
**Towards Phantom 453 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $67.4 \text{ V/m}$ ; Power Drift =  $0.117 \text{ dB}$

Peak SAR (extrapolated) =  $5.12 \text{ W/kg}$

**SAR(1 g) =  $3.88 \text{ mW/g}$ ; SAR(10 g) =  $2.97 \text{ mW/g}$**

Maximum value of SAR (measured) =  $4.05 \text{ mW/g}$



**Figure 12 Face Held for 12.5 KHz, Front towards Phantom 453 MHz**

### Face Held for 12.5 KHz, Front towards Phantom 469.5 MHz

Date/Time: 11/23/2011 8:28:09 PM

Communication System: PTT 450; Frequency: 469.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 469.5$  MHz;  $\sigma = 0.895$  mho/m;  $\epsilon_r = 44.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(9.97, 9.97, 9.97) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Phantom 469.5 MHz/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.63 mW/g

**Towards Phantom 469.5 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 64.1 V/m; Power Drift = -0.090 dB

Peak SAR (extrapolated) = 4.56 W/kg

**SAR(1 g) = 3.42 mW/g; SAR(10 g) = 2.6 mW/g**

Maximum value of SAR (measured) = 3.59 mW/g

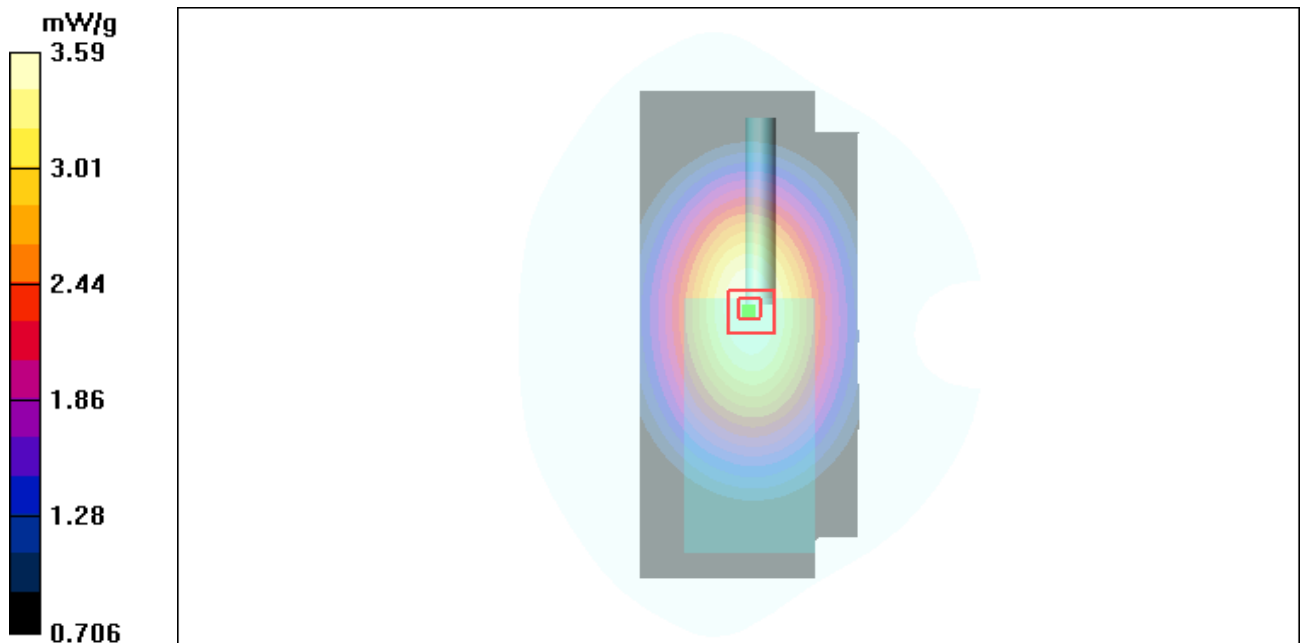


Figure 13 Face Held for 12.5 KHz, Front towards Phantom 469.5 MHz

### **Body-Worn for 12.5 KHz, Front towards Ground 400.5 MHz**

Date/Time: 11/24/2011 7:11:50 PM

Communication System: PTT 450; Frequency: 400.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 400.5$  MHz;  $\sigma = 0.906$  mho/m;  $\epsilon_r = 57.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(10.83, 10.83, 10.83) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Ground 400.5 MHz/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 9.19 mW/g

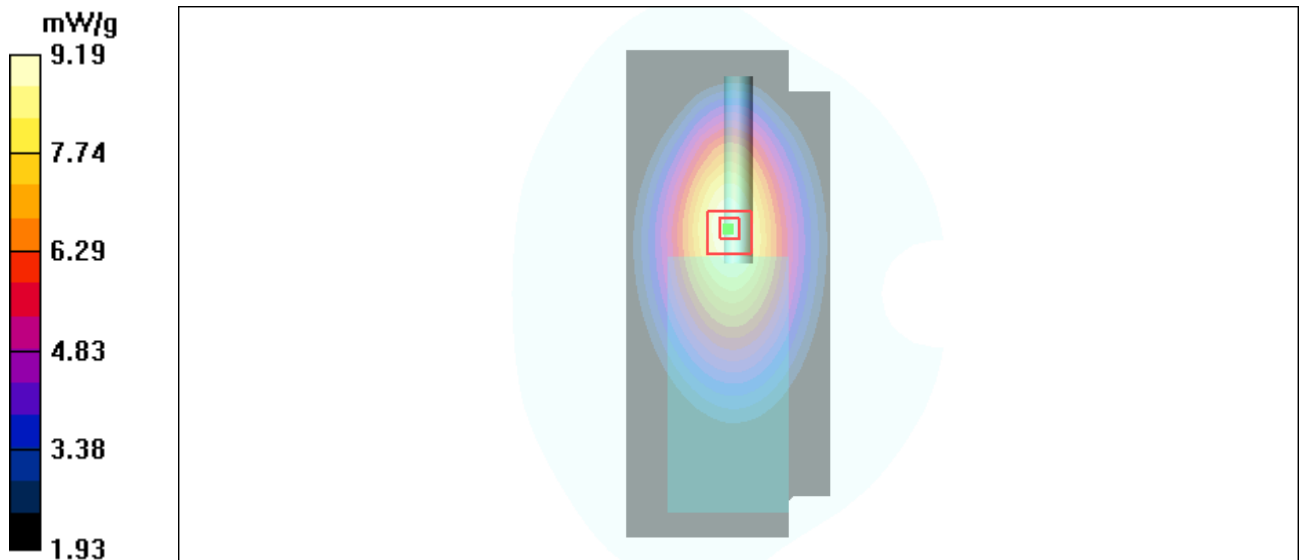
**Towards Ground 400.5 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.0 V/m; Power Drift = -0.006 dB

Peak SAR (extrapolated) = 12.0 W/kg

**SAR(1 g) = 8.81 mW/g; SAR(10 g) = 6.71 mW/g**

Maximum value of SAR (measured) = 9.19 mW/g



**Figure 14 Body-Worn for 12.5 KHz, Front towards Ground 400.5 MHz**

### **Body-Worn for 12.5 KHz, Front towards Ground 418 MHz**

Date/Time: 11/24/2011 7:26:05 PM

Communication System: PTT 450; Frequency: 418 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 418 \text{ MHz}$ ;  $\sigma = 0.928 \text{ mho/m}$ ;  $\epsilon_r = 57.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3^\circ\text{C}$       Liquid Temperature:  $21.5^\circ\text{C}$

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(10.83, 10.83, 10.83) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Ground 418 MHz/Area Scan (51x121x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $9.58 \text{ mW/g}$

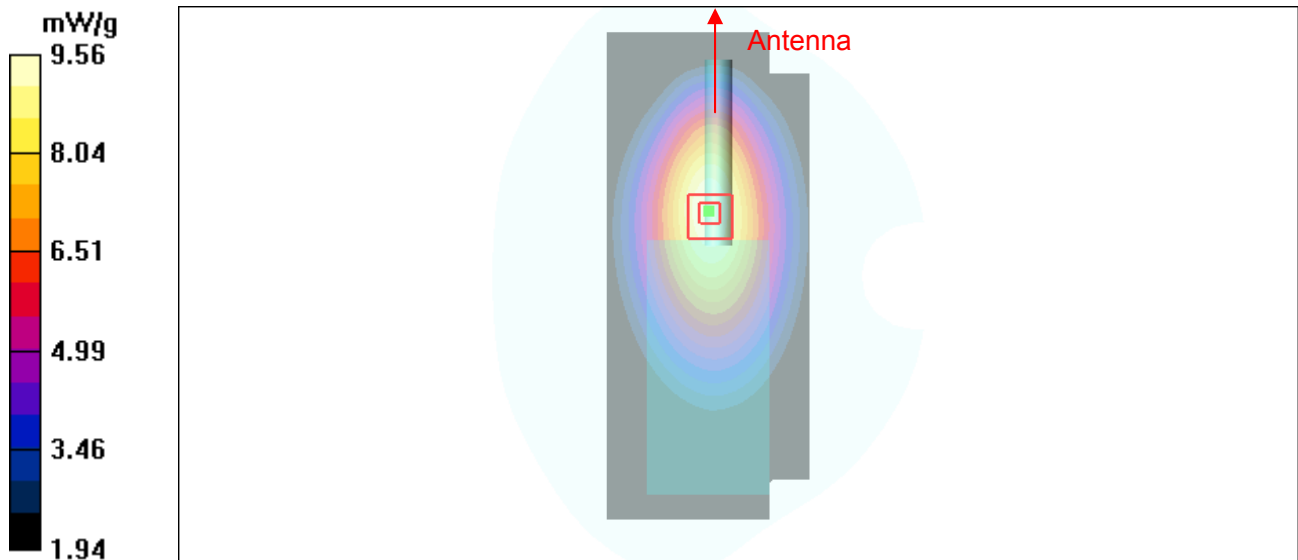
**Towards Ground 418 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $94.6 \text{ V/m}$ ; Power Drift =  $-0.034 \text{ dB}$

Peak SAR (extrapolated) =  $12.4 \text{ W/kg}$

**SAR(1 g) =  $9.18 \text{ mW/g}$ ; SAR(10 g) =  $7 \text{ mW/g}$**

Maximum value of SAR (measured) =  $9.56 \text{ mW/g}$



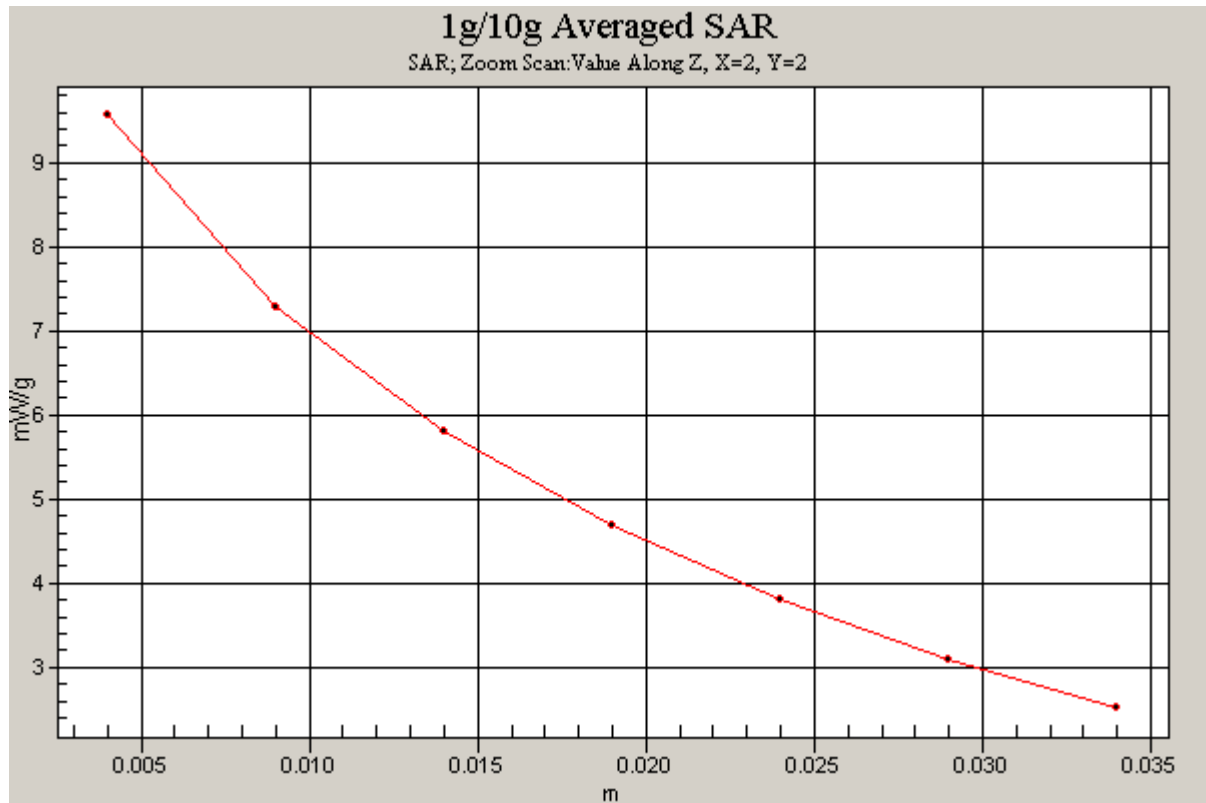


Figure 15 Body-Worn for 12.5 KHz, Front towards Ground 418 MHz



**Body-Worn for 12.5 KHz, Front towards Ground 435.5 MHz**

Date/Time: 11/24/2011 5:30:54 PM

Communication System: PTT 450; Frequency: 435.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 435.5$  MHz;  $\sigma = 0.939$  mho/m;  $\epsilon_r = 57.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(10.83, 10.83, 10.83) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Ground 435.5 MHz/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 8.51 mW/g

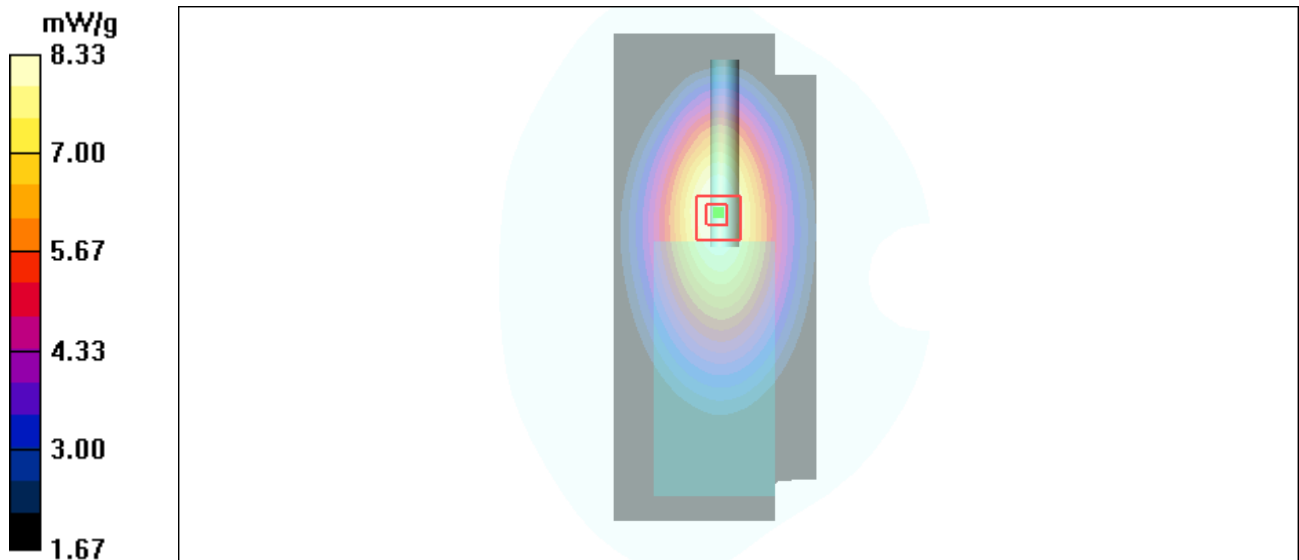
**Towards Ground 435.5 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.4 V/m; Power Drift = -0.083 dB

Peak SAR (extrapolated) = 10.8 W/kg

**SAR(1 g) = 7.96 mW/g; SAR(10 g) = 6.04 mW/g**

Maximum value of SAR (measured) = 8.33 mW/g



**Figure 16 Body-Worn for 12.5 KHz, Front towards Ground 435.5 MHz**

### **Body-Worn for 12.5 KHz, Front towards Ground 453 MHz**

Date/Time: 11/24/2011 5:45:51 PM

Communication System: PTT 450; Frequency: 453 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 453 \text{ MHz}$ ;  $\sigma = 0.945 \text{ mho/m}$ ;  $\epsilon_r = 57$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3^\circ\text{C}$       Liquid Temperature:  $21.5^\circ\text{C}$

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(10.83, 10.83, 10.83) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Ground 453 MHz/Area Scan (51x121x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $7.49 \text{ mW/g}$

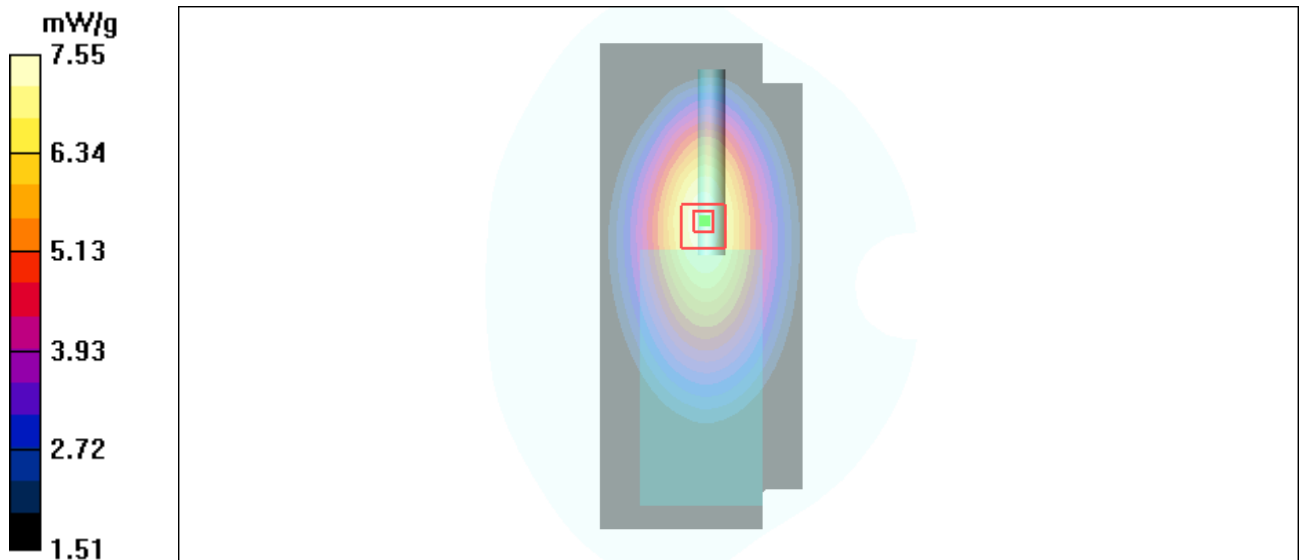
**Towards Ground 453 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $83.7 \text{ V/m}$ ; Power Drift =  $0.002 \text{ dB}$

Peak SAR (extrapolated) =  $9.85 \text{ W/kg}$

**SAR(1 g) =  $7.23 \text{ mW/g}$ ; SAR(10 g) =  $5.49 \text{ mW/g}$**

Maximum value of SAR (measured) =  $7.55 \text{ mW/g}$



**Figure 17 Body-Worn for 12.5 KHz, Front towards Ground for 12.5 KHz 453 MHz**

### **Body-Worn for 12.5 KHz, Front towards Ground 469.5 MHz**

Date/Time: 11/24/2011 6:40:24 PM

Communication System: PTT 450; Frequency: 469.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 469.5$  MHz;  $\sigma = 0.955$  mho/m;  $\epsilon_r = 56.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(10.83, 10.83, 10.83) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Ground 469.5 MHz/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 6.37 mW/g

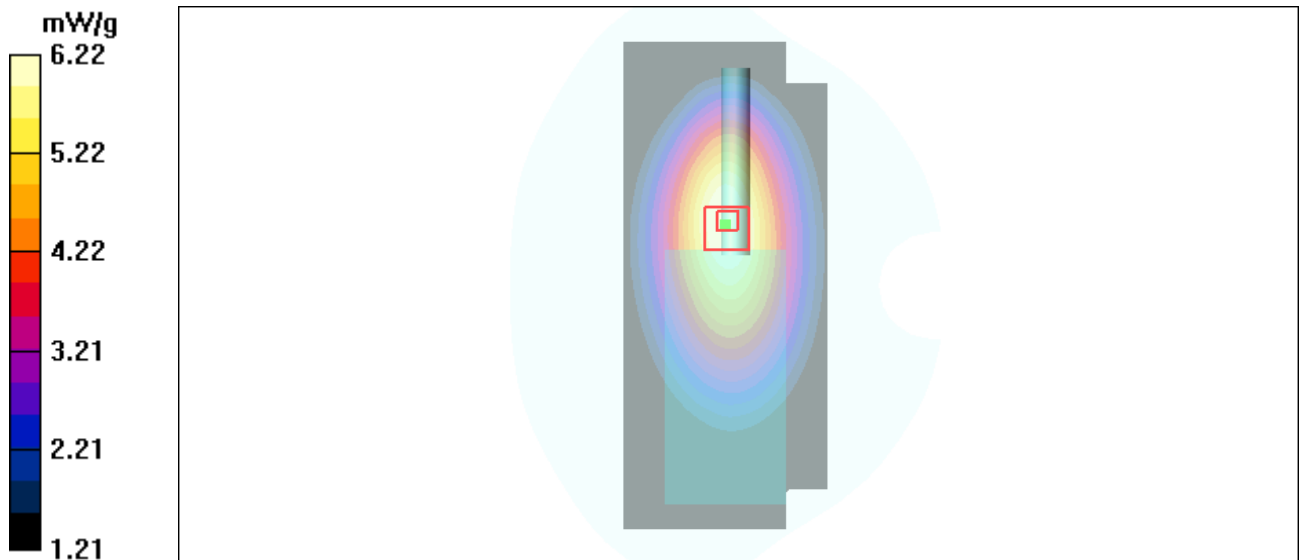
**Towards Ground 469.5 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 77.9 V/m; Power Drift = -0.016 dB

Peak SAR (extrapolated) = 8.15 W/kg

**SAR(1 g) = 5.97 mW/g; SAR(10 g) = 4.53 mW/g**

Maximum value of SAR (measured) = 6.22 mW/g



**Figure 18 Body-Worn for 12.5 KHz, Front towards Ground 469.5 MHz**

### **Body-Worn with Digital , Front towards Ground 418 MHz**

Date/Time: 11/24/2011 7:40:52 PM

Communication System: PTT 450; Frequency: 418 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 418 \text{ MHz}$ ;  $\sigma = 0.928 \text{ mho/m}$ ;  $\epsilon_r = 57.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3^\circ\text{C}$       Liquid Temperature:  $21.5^\circ\text{C}$

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3816; ConvF(10.83, 10.83, 10.83) Calibrated: 10/3/2011;

Electronics: DAE4 Sn905; Calibrated: 6/24/2011

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Towards Ground 418 MHz/Area Scan (51x121x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $4.01 \text{ mW/g}$

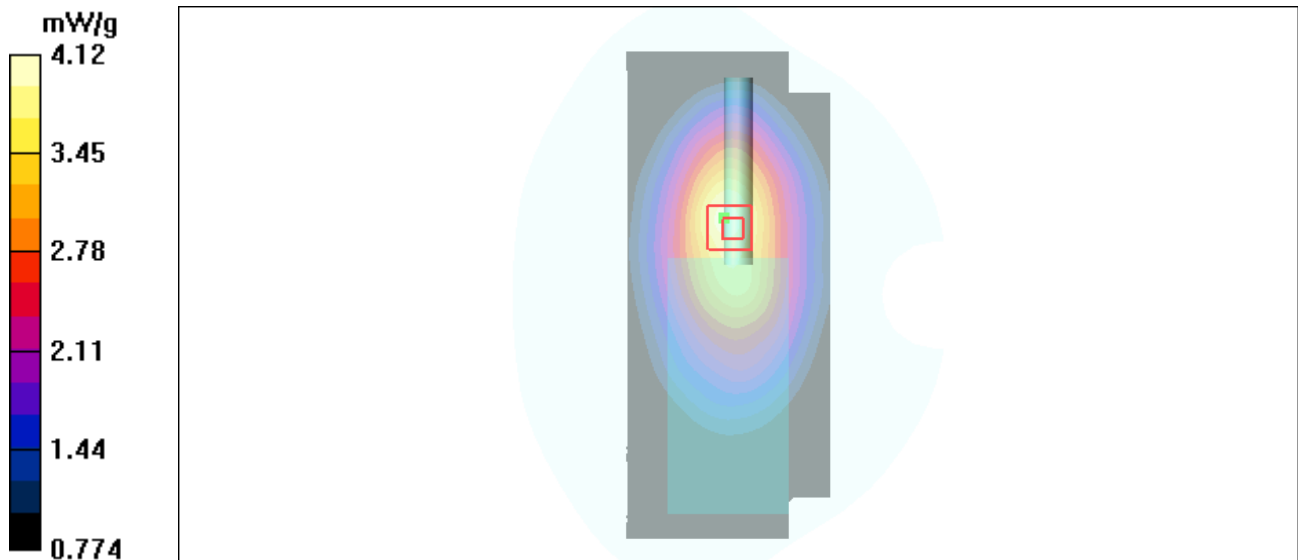
**Towards Ground 418 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $61.0 \text{ V/m}$ ; Power Drift =  $-0.109 \text{ dB}$

Peak SAR (extrapolated) =  $5.14 \text{ W/kg}$

**SAR(1 g) =  $3.88 \text{ mW/g}$ ; SAR(10 g) =  $2.96 \text{ mW/g}$**

Maximum value of SAR (measured) =  $4.12 \text{ mW/g}$



**Figure 19 Body-Worn with Digital, Front towards Ground 418 MHz**

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 45 of 71

### ANNEX D: Probe Calibration Certificate

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



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

Accredited by the Swiss 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: **TMC Shanghai (Auden)**

Certificate No.: **EX3-3816\_Oct11**

#### CALIBRATION CERTIFICATE

Object: **EX3DV4 - SN:3816**

Calibration procedure(s): **QA CAL-01.v8; QA CAL-12.v7; QA CAL-23.v4; QA CAL-25.v4**  
**Calibration procedure for dosimetric E-field probes**

Calibration date: **October 3, 2011**

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 ( $22 \pm 3$ °C and humidity < 70%.

Calibration Equipment used (M&E critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41496087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Name: Jelon Kastali, Function: Laboratory Technician, Signature: [Signature]**

Approved by: **Name: Katja Pokovic, Function: Technical Manager, Signature: [Signature]**

Issued: October 3, 2011

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

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



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

**Glossary:**

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\theta$	$\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ 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<sub>x,y,z</sub>:** Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* 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<sub>x,y,z</sub>:** DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR:** PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>:** A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- 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<sub>x,y,z</sub> \* 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  $\pm 50$  MHz to  $\pm 100$  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.

EX3DV4 – SN:3816

October 3, 2011

# Probe EX3DV4

## SN:3816

Manufactured: September 2, 2011  
Calibrated: October 3, 2011

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA1111-1935SARR3

Page 48 of 71

EX3DV4- SN:3816

October 3, 2011

**DASY/EASY - Parameters of Probe: EX3DV4 - SN:3816**

**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.48	0.56	0.61	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	99.8	102.2	102.1	

**Modulation Calibration Parameters**

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc <sup>C</sup> (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	111.3	$\pm 2.7 \%$
			Y	0.00	0.00	1.00	127.3	
			Z	0.00	0.00	1.00	127.7	

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%.

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the  $E^2$ -field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>C</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 49 of 71

EX3DV4--SN:3816

October 3, 2011

### DASY/EASY - Parameters of Probe: EX3DV4 - SN:3816

#### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity <sup>d</sup>	Conductivity (S/m) <sup>e</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	43.5	0.87	9.97	9.97	9.97	0.11	1.00	± 13.4 %
750	41.9	0.89	9.47	9.47	9.47	0.62	0.78	± 12.0 %
835	41.5	0.90	9.22	9.22	9.22	0.76	0.66	± 12.0 %
1450	40.5	1.20	8.58	8.58	8.58	0.65	0.77	± 12.0 %
1750	40.1	1.37	8.23	8.23	8.23	0.80	0.58	± 12.0 %
1900	40.0	1.40	7.90	7.90	7.90	0.80	0.57	± 12.0 %
2450	39.2	1.80	7.17	7.17	7.17	0.66	0.64	± 12.0 %
2600	39.0	1.96	7.06	7.06	7.06	0.64	0.67	± 12.0 %

<sup>c</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>d</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 50 of 71

EX3DV4-- SN:3816

October 3, 2011

### DASY/EASY - Parameters of Probe: EX3DV4 - SN:3816

#### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity <sup>r</sup>	Conductivity (S/m) <sup>r</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	10.83	10.83	10.83	0.02	1.00	± 13.4 %
750	55.5	0.96	9.50	9.50	9.50	0.80	0.70	± 12.0 %
835	55.2	0.97	9.38	9.38	9.38	0.68	0.69	± 12.0 %
1750	53.4	1.49	7.80	7.80	7.80	0.80	0.65	± 12.0 %
1900	53.3	1.52	7.51	7.51	7.51	0.80	0.65	± 12.0 %
2450	52.7	1.95	7.19	7.19	7.19	0.80	0.60	± 12.0 %
2600	52.5	2.16	7.14	7.14	7.14	0.80	0.59	± 12.0 %

<sup>c</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>r</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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Test Report

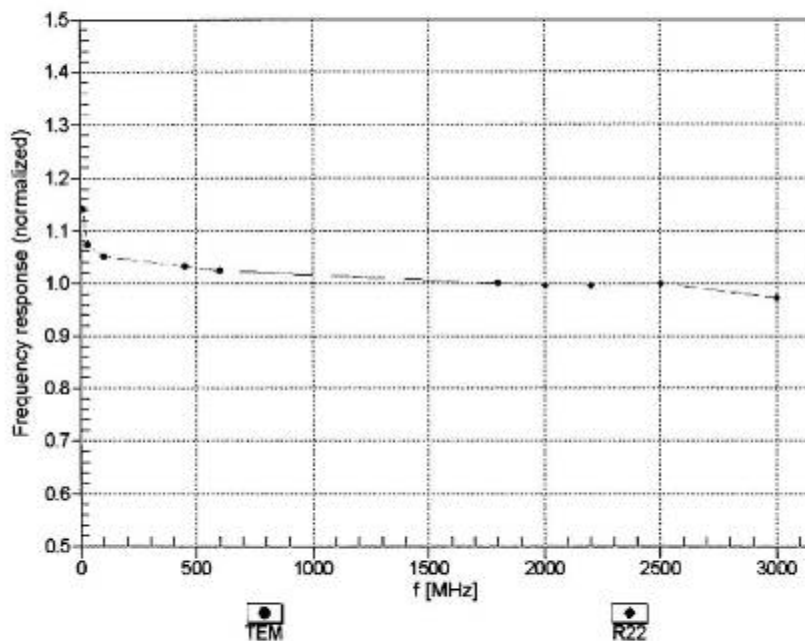
Report No. RZA1111-1935SARR3

Page 51 of 71

EX3DV4- SN:3816

October 3, 2011

**Frequency Response of E-Field**  
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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Test Report

Report No. RZA1111-1935SARR3

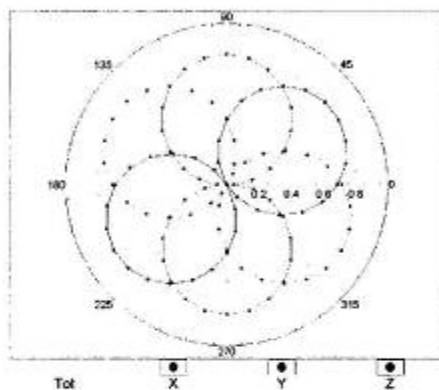
Page 52 of 71

EX3DV4- SN:3816

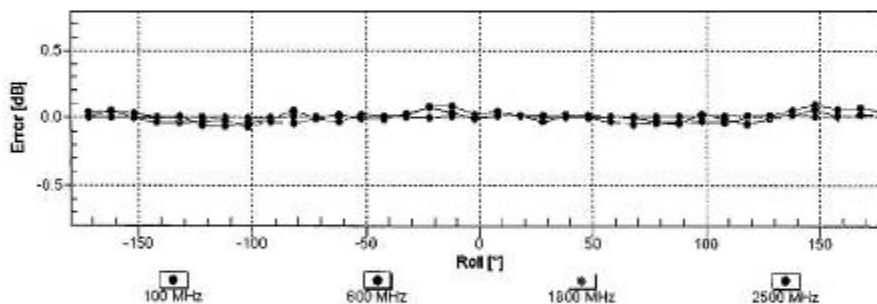
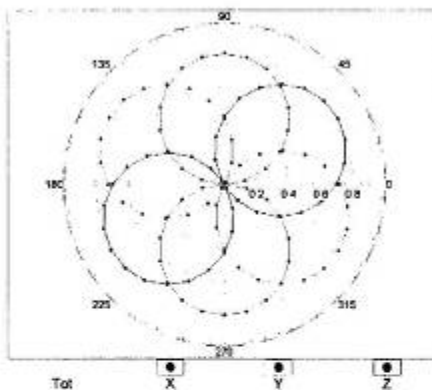
October 3, 2011

Receiving Pattern ( $\phi$ ),  $\theta = 0^\circ$

f=600 MHz, TEM



f=1800 MHz, R22



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

# TA Technology (Shanghai) Co., Ltd. Test Report

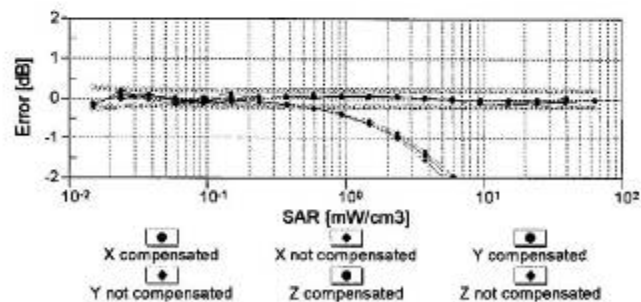
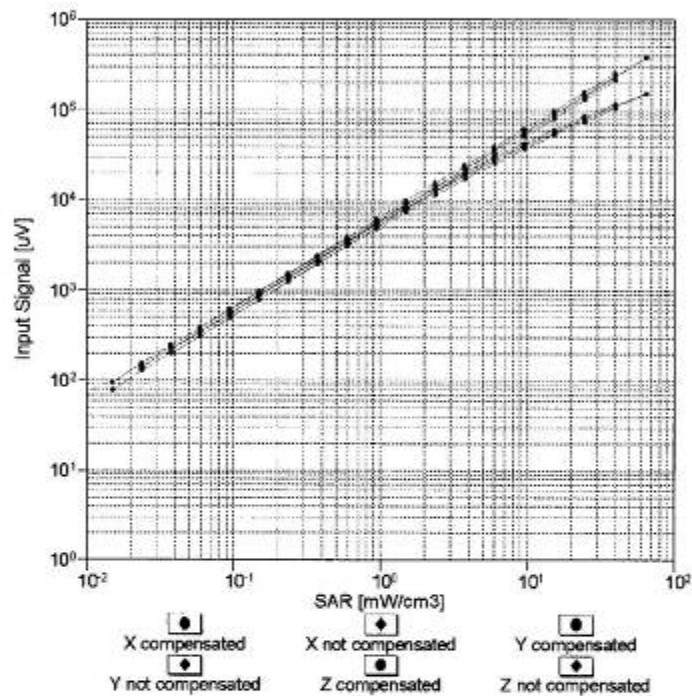
Report No. RZA1111-1935SARR3

Page 53 of 71

EX3DV4- SN:3816

October 3, 2011

## Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f = 900 MHz)

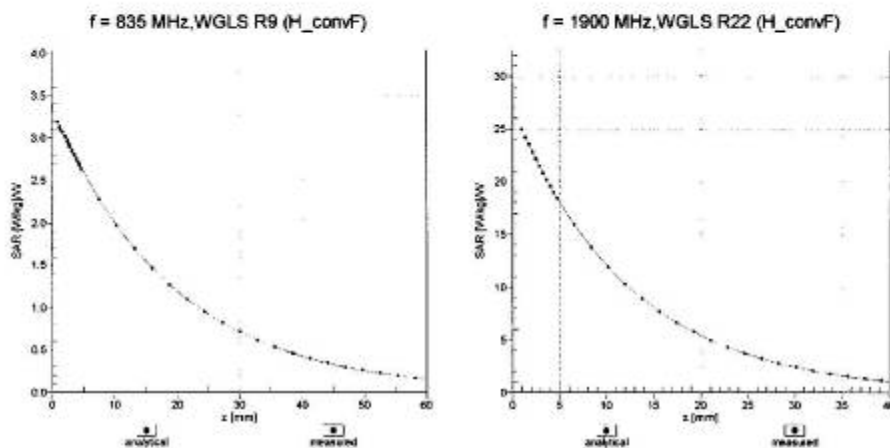


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

EX3DV4- SN:3816

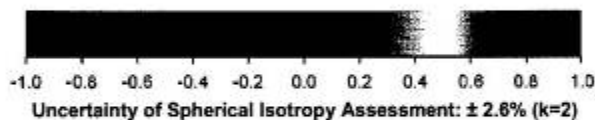
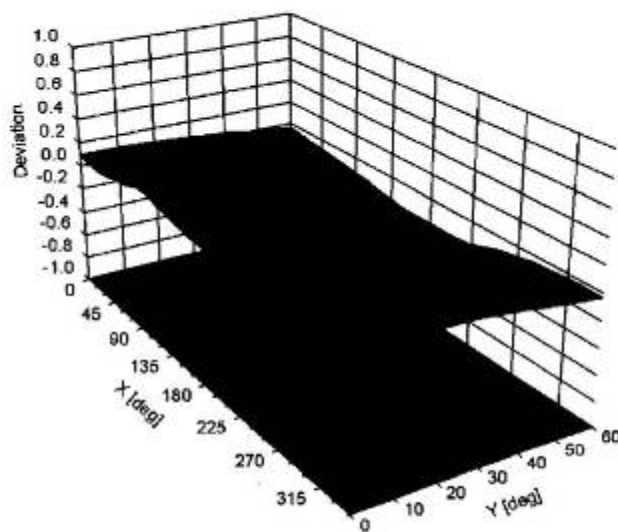
October 3, 2011

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi$ ,  $\theta$ ),  $f = 900$  MHz



# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 55 of 71

EX3DV4--SN:3816

October 3, 2011

### DASY/EASY - Parameters of Probe: EX3DV4 - SN:3816

#### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

TA Technology (Shanghai) Co., Ltd.  
Test Report

Report No. RZA1111-1935SARR3

Page 56 of 71

ANNEX E: D450V3 Dipole Calibration Certificate

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



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

Accredited by the Swiss 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 TA (Auden)

Certificate No: D450V3-1065\_Nov10

CALIBRATION CERTIFICATE

Object D450V3 - SN: 1065

Calibration procedure(s) QA CAL-15.v5  
Calibration Procedure for dipole validation kits below 800 MHz

Calibration date: November 09, 2010

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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01030)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01030)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01030)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-10 (No. 217-01026)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-10 (No. 217-01028)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-10 (No. 217-01029)	Mar-11
Reference Probe ET3DV6 (LF)	SN: 1507	03-Jul-10 (No. ET3-1507_Jul10)	Jul-11
DAE4	SN: 654	04-May-10 (No. DAE4-654_May10)	May-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-Aug-99 (in house check Oct-10)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: November 9, 2010

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# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 57 of 71

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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### Glossary:

TSL	tissue simulating liquid
ConF	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
- 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
- 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 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.

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 58 of 71

### Measurement Conditions

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

<b>DASY Version</b>	DASY5	V5.2
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	ELI4 Flat Phantom	Shell thickness: $2 \pm 0.2$ mm
<b>Distance Dipole Center - TSL</b>	15 mm	with Spacer
<b>Area Scan Resolution</b>	dx, dy = 15 mm	
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	450 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	43.5	-0.87 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	44.2 $\pm$ 6 %	0.86 mho/m $\pm$ 6 %
<b>Head TSL temperature during test</b>	(22.0 $\pm$ 0.2) °C	----	----

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	condition	
SAR measured	398 mW input power	1.87 mW / g
SAR normalized	normalized to 1W	4.70 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>4.76 mW / g <math>\pm</math> 18.1 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	398 mW input power	1.25 mW / g
SAR normalized	normalized to 1W	3.14 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>3.17 mW / g <math>\pm</math> 17.6 % (k=2)</b>

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 59 of 71

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.1 ± 6 %	0.90 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	condition	
SAR measured	398 mW input power	1.77 mW / g
SAR normalized	normalized to 1W	4.37 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>4.51 mW / g ± 18.1 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.18 mW / g
SAR normalized	normalized to 1W	2.94 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>3.03 mW / g ± 17.6 % (k=2)</b>

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 60 of 71

### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	59.2 $\Omega$ - 4.9 j $\Omega$
Return Loss	- 20.5 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	56.5 $\Omega$ - 7.9 j $\Omega$
Return Loss	- 20.4 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.354 ns
----------------------------------	----------

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 16, 2010

### DASY5 Validation Report for Head TSL

Date/Time: 09.11.2010 10:36:58

Test Laboratory: The name of your organization

**DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1065**

Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1

Medium: HSL450

Medium parameters used:  $f = 450 \text{ MHz}$ ;  $\sigma = 0.86 \text{ mho/m}$ ;  $\epsilon_r = 44.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(6.66, 6.66, 6.66); Calibrated: 03.07.2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 04.05.2010
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

**Pin=398mW /d=15mm /Area Scan (41x111x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.99 mW/g

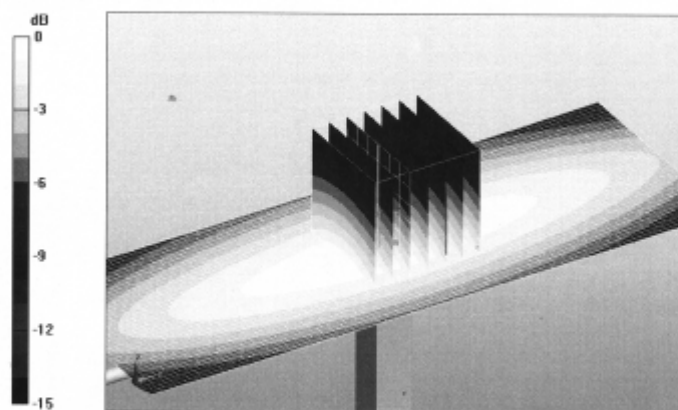
**Pin=398mW /d=15mm /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.3 V/m; Power Drift = -0.00664 dB

Peak SAR (extrapolated) = 2.81 W/kg

**SAR(1 g) = 1.87 mW/g; SAR(10 g) = 1.25 mW/g**

Maximum value of SAR (measured) = 2.01 mW/g



0 dB = 2.01mW/g

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Test Report

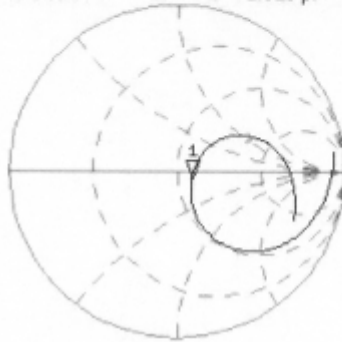
Report No. RZA1111-1935SARR3

Page 62 of 71

Impedance Measurement Plot for Head TSL

9 Nov 2010 10:19:27  
CH1 S11 1 U FS 1: 59.156  $\Omega$  -4.8770  $\Omega$  72.520 pF 450.000 000 MHz

\*  
De1  
Cor

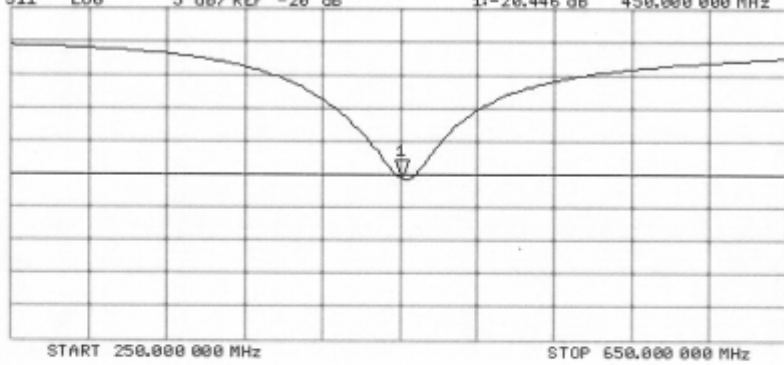


Avg  
16

CH2 S11 LOG 5 dB/REF -20 dB 1: -20.446 dB 450.000 000 MHz

Cor

Avg  
16



## DASY5 Validation Report for Body TSL

Date/Time: 09.11.2010 13:52:55

Test Laboratory: The name of your organization

**DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1065**

Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1

Medium: MSL450

Medium parameters used:  $f = 450 \text{ MHz}$ ;  $\sigma = 0.9 \text{ mho/m}$ ;  $\epsilon_r = 54.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(7.11, 7.11, 7.11); Calibrated: 03.07.2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 04.05.2010
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

**Pin=398mW /d=15mm /Area Scan (61x201x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.89 mW/g

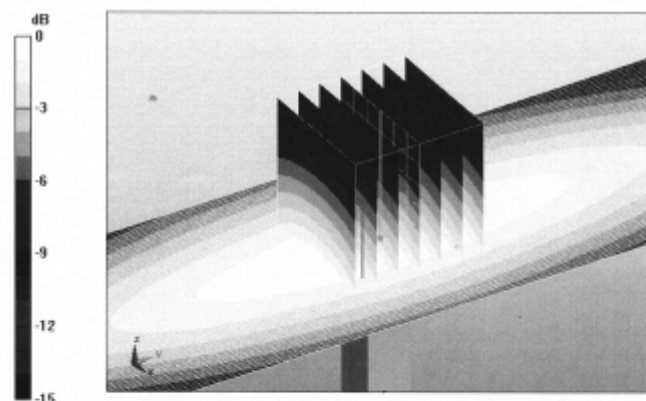
**Pin=398mW /d=15mm, /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 47.4 V/m; Power Drift = -0.016 dB

Peak SAR (extrapolated) = 2.7 W/kg

**SAR(1 g) = 1.77 mW/g; SAR(10 g) = 1.18 mW/g**

Maximum value of SAR (measured) = 1.89 mW/g



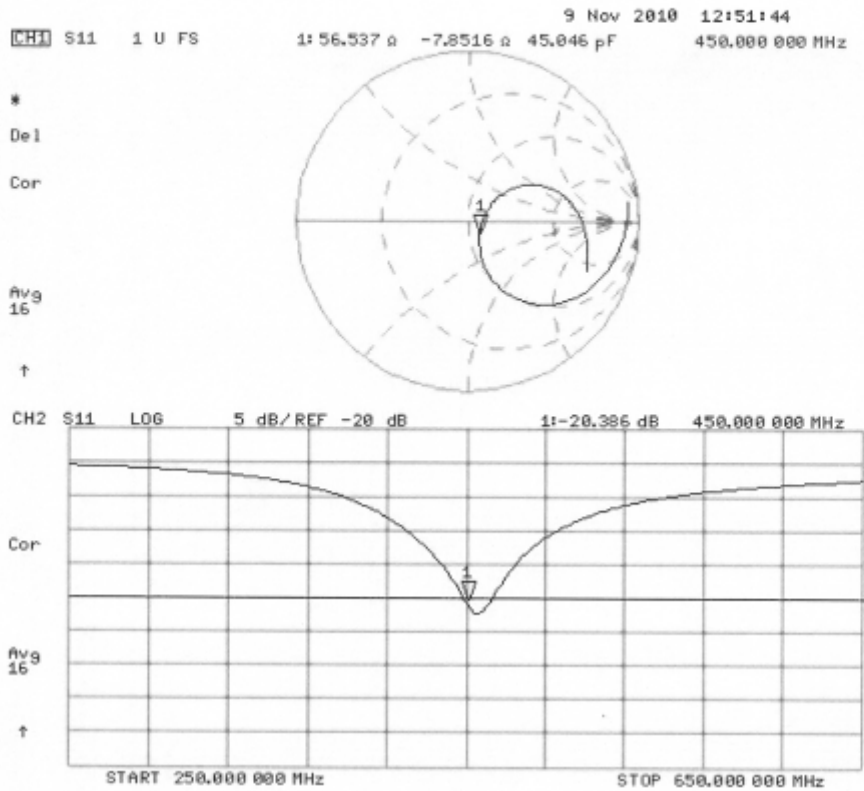
0 dB = 1.89mW/g

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Report No. RZA1111-1935SARR3

Page 64 of 71

Impedance Measurement Plot for Body TSL





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Report No. RZA1111-1935SARR3

Page 65 of 71

ANNEX F: DAE4 Calibration Certificate

Calibration Laboratory of  
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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S Servizio svizzero di taratura  
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Accreditation No.: SCS 108

Client: **Auden**

Certificate No: **DAE4-905\_Jun11**

**CALIBRATION CERTIFICATE**

Object: **DAE4 - SD 000 D04 BK - SN: 905**

Calibration procedure(s): **QA CAL-06.v23  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **June 24, 2011**

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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0610278	28-Sep-10 (No:10376)	Sep-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	08-Jun-11 (in house check)	In house check: Jun-12

Calibrated by: 

Name	Function	Signature
Dominique Steffen	Technician	

Approved by: 

Fin Bornholt	R&D Director
--------------	--------------

Issued: June 24, 2011

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## Test Report

Report No. RZA1111-1935SARR3

Page 66 of 71

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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:** Typical value for information: 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.

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 67 of 71

### DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ 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	404.723 $\pm$ 0.1% (k=2)	405.276 $\pm$ 0.1% (k=2)	404.851 $\pm$ 0.1% (k=2)
Low Range	3.97979 $\pm$ 0.7% (k=2)	4.00079 $\pm$ 0.7% (k=2)	3.99604 $\pm$ 0.7% (k=2)

### Connector Angle

Connector Angle to be used in DASY system	270.5 $^{\circ}$ $\pm$ 1 $^{\circ}$
---	-------------------------------------

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No. RZA1111-1935SARR3

Page 68 of 71

### Appendix

#### 1. DC Voltage Linearity

High Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	199999.3	-0.37	-0.00
Channel X + Input	20000.19	0.69	0.00
Channel X - Input	-19996.51	2.99	-0.01
Channel Y + Input	199999.5	1.19	0.00
Channel Y + Input	19998.36	-1.14	-0.01
Channel Y - Input	-19998.45	0.65	-0.00
Channel Z + Input	199996.8	-0.50	-0.00
Channel Z + Input	19998.70	-0.80	-0.00
Channel Z - Input	-19998.46	0.84	-0.00

Low Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2000.5	0.40	0.02
Channel X + Input	200.95	1.05	0.53
Channel X - Input	-198.80	1.30	-0.65
Channel Y + Input	1999.8	0.03	0.00
Channel Y + Input	200.33	0.33	0.16
Channel Y - Input	-199.66	0.24	-0.12
Channel Z + Input	1999.6	-0.40	-0.02
Channel Z + Input	200.48	0.58	0.29
Channel Z - Input	-199.45	0.75	-0.37

#### 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 ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	9.95	8.16
	- 200	-7.20	-8.32
Channel Y	200	8.57	8.27
	- 200	-9.34	-9.57
Channel Z	200	2.10	1.81
	- 200	-2.85	-3.06

#### 3. Channel separation

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

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	4.23	1.16
Channel Y	200	3.16	-	6.20
Channel Z	200	1.04	-1.10	-

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## Test Report

Report No. RZA1111-1935SARR3

Page 69 of 71

#### 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	15901	16812
Channel Y	16152	15842
Channel Z	16382	17155

#### 5. Input Offset Measurement

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

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	-0.02	-0.50	0.97	0.26
Channel Y	-0.92	-2.26	-0.45	0.25
Channel Z	-2.00	-3.19	-0.88	0.45

#### 6. Input Offset Current

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

#### 7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

#### 8. Low Battery Alarm Voltage (Typical values for information)

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

#### 9. Power Consumption (Typical values for information)

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

## ANNEX G: The EUT Appearances and Test Configuration

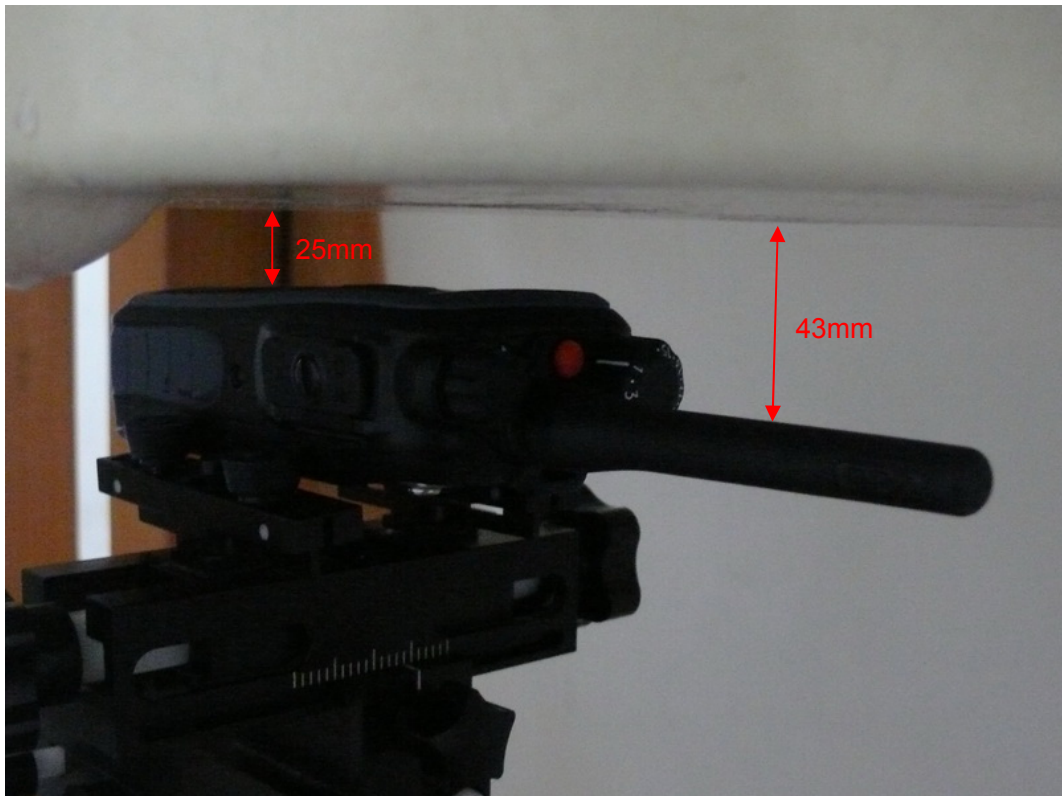


a: EUT



b: Battery

Picture 3: Constituents of the sample



Picture 4: Face-held, The EUT display towards phantom, the distance from EUT Antenna to the bottom of the Phantom is 43mm



Picture 5: Body-worn, The EUT display towards ground, the distance from EUT Antenna to the bottom of the Phantom is 24mm