TESTING
No. L2264

# OET 65

# TEST REPORT

| | |
|---|---|
| **Product Name** | DIGITAL COVERT RADIO |
| **Model** | X1e U(1) |
| **FCC ID** | YAMX1EU1 |
| **Client** | Hytera Communications Co.,Ltd. |

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

# GENERAL SUMMARY

| | | | |
|---|---|---|---|
| **Product Name** | DIGITAL COVERT RADIO | **Model** | X1e U(1) |
| **FCC ID** | YAMX1EU1 | **Report No.** | RZA1203-0323SAR01R1 |
| **Client** | Hytera Communications Co.,Ltd. | | |
| **Manufacturer** | Hytera Communications Co.,Ltd. | | |
| **Reference Standard(s)** | **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.<br><br>**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.<br><br>**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.<br><br>**KDB 643646 D01 SAR Test for PTT Radios v01:** SAR Test Reduction Considerations for Occupational PTT Radios<br><br>**KDB 447498 D01 Mobile Portable RF Exposure v04:** Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies | | |
| **Conclusion** | 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.<br><br>General Judgment: **Pass**<br><br>(Stamp)<br>**Date of issue: April 15th, 2012** | | |
| **Comment** | The test result only responds to the measured sample. | | |

**Approved by**__________ **Revised by**__________ **Performed by**__________

Director SAR Manager SAR Engineer

# TABLE OF CONTENT

# 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.

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

## 1.2. Testing Laboratory

| | |
|---|---|
| Company: | TA Technology (Shanghai) Co., Ltd. |
| Address: | No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China |
| City: | Shanghai |
| Post code: | 201201 |
| Country: | P. R. China |
| Contact: | Yang Weizhong |
| Telephone: | +86-021-50791141/2/3 |
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| Website: | http://www.ta-shanghai.com |
| E-mail: | yangweizhong@ta-shanghai.com |

## 1.3. Applicant Information

| | |
|---|---|
| Company: | Hytera Communications Co.,Ltd. |
| Address: | Hytera Tower,Hi-Tech Industrial Park North, Nanshan District,Shenzhen China |
| City: | Shenzhen |
| Postal Code: | 518057 |
| Country: | P. R. China |
| Telephone: | +86-0755-26972999- 1210 |
| Fax: | +86 755 86137130 |

## 1.4. Manufacturer Information

| | |
|---|---|
| Company: | Hytera Communications Co.,Ltd. |
| Address: | Hytera Tower,Hi-Tech Industrial Park North, Nanshan District,Shenzhen China |
| City: | Shenzhen |
| Postal Code: | 518057 |
| Country: | P. R. China |
| Telephone: | +86-0755-26972999- 1210 |
| Fax: | 0755-86137130 |

## 1.5. Information of EUT

**General Information**

| | |
|---|---|
| Device Type: | Portable Device |
| Exposure Category: | Controlled Environment /Occupational |
| State of Sample: | Prototype Unit |
| Product Name: | DIGITAL COVERT RADIO |
| SN: | / |
| Hardware Version: | B0 |
| Software Version: | V4.00.10.001 |
| Antenna Type: | External Antenna |
| Device Operating Configurations: | |
| 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 |
| Note: 1. The test channels were selected in accordance with the procedures specified in FCC KDB 447498 D01 Mobile Portable RF Exposure v04 Section 6) c). | |

**Auxiliary Equipment Details**

| Auxiliary Name | Model | Description | Manufacturer: |
|---|---|---|---|
| Battery | BL1103 | 1100mAh/8.1hWh | Hytera Communications Co., Ltd. |
| Vest[1] | / | / | Hytera Communications Co., Ltd. |
| Note 1. Due to the form factor and remote-only PTT switch of this device, and the vest accessory shown in user manual, intended use conditions appear to include transmitting while held covertly in user's pocket. For such use conditions, SAR will be tested with front and back surfaces of device contacted with the flat phantom | | | |

Equipment Under Test (EUT) is a DIGITAL COVERT RADIO. SAR is tested for 400.5 - 469.5 MHz only. The EUT has one external antenna that is used for Tx/Rx, and the other is BT 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.

## 1.6. The Maximum $SAR_{1g}$ Values

| Mode | Frequency (MHz) | Position | $SAR_{1g}$ (W/kg) 50% PTT duty cycle |
|---|---|---|---|
| UHF | 435.5 | Face-held | **1.794** |
| UHF | 400.5 | Body-Worn | **6.579** |

## 1.7. Test Date

The test performed from April 9, 2012 to April 10, 2012.

# 2. SAR Measurements System Configuration

## 2.1. 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.

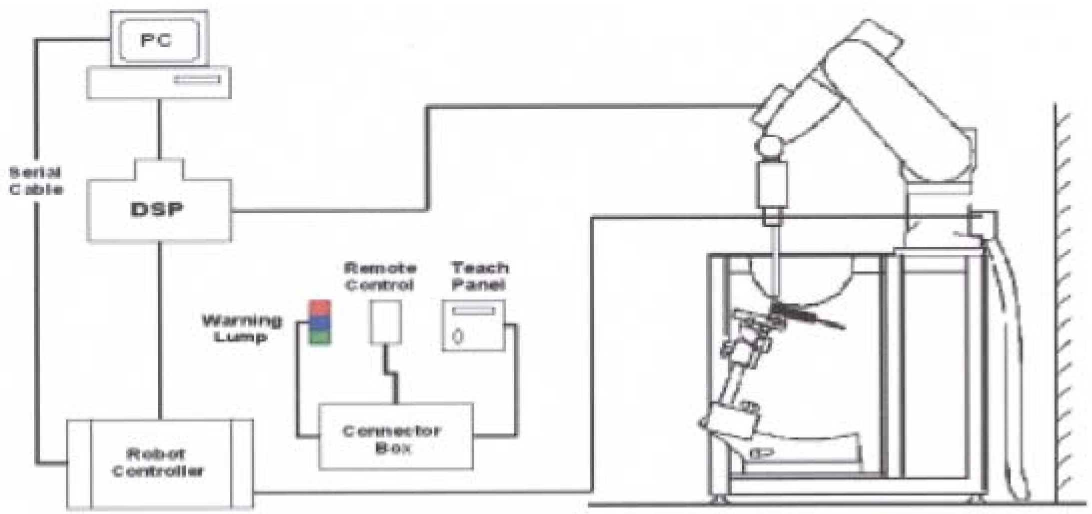



**Figure 1. SAR Lab Test Measurement Set-up**

## 2.2. 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.

### 2.2.1. EX3DV4 Probe Specification

Figure 2.EX3DV4 E-field Probe

| | |
|---|---|
| Construction | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| Calibration | ISO/IEC 17025 calibration service available |
| Frequency | 10 MHz to > 6 GHz<br>Linearity: ± 0.2 dB<br>(30 MHz to 6 GHz) |
| Directivity | ± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis) |
| Dynamic Range | 10 μW/g to > 100 mW/g Linearity:<br>± 0.2dB (noise: typically < 1 μW/g) |
| Dimensions | Overall length: 330 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>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).<br>Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%. |

Figure 3. EX3DV4 E-field probe

### 2.2.2. E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. 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 bellow 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.

$$\mathbf{SAR} = \mathbf{C}\frac{\Delta \mathrm{T}}{\Delta \mathrm{t}}$$

Where: $\Delta t$ = Exposure time (30 seconds),
C = Heat capacity of tissue (brain or muscle),
$\Delta T$ = Temperature increase due to RF exposure.
Or

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

Where:
σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m3).

## 2.3. Other Test Equipment

### 2.3.1. Device Holder for Transmitters

The DASY device holder is designed to cope with the die rent 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**

### 2.3.2. Phantom

Phantom for compliance testing of handheld andbody-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI isfully compatible with the IEC 62209-2 standard and all known tissuesimulating liquids. ELI has been optimized regarding its performance and can beintegrated into our standard phantom tables. A cover prevents evaporation ofthe liquid. Reference markings on the phantom allow installation of thecomplete setup, including all predefined phantom positions and measurementgrids, by teaching three points. The phantom is compatible with all SPEAGdosimetric probes and dipoles.

| | |
|---|---|
| Shell Thickness | 2±0.2 mm |
| Filling Volume | Approx. 30 liters |
| Dimensions | 190×600×0 mm (H x L x W) |

**Figure 5.ELI4 Phantom**

## 2.4. 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. ± 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 ± 0.1mm). 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 ± 30°.)

- 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.

## 2.5. Data Storage and Evaluation

### 2.5.1. 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.

### 2.5.2. 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 | $ConvF_i$ |
| | - Diode compression point | $Dcp_i$ |
| 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:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

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)$^2$] 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.

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

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$^3$

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$^2$

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

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

# 3. Laboratory Environment

**Table 1: The Requirements of the Ambient Conditions**

| | |
|---|---|
| Temperature | Min. = 18°C, Max. = 25 °C |
| Relative humidity | Min. = 30%, Max. = 70% |
| Ground system resistance | < 0.5 Ω |
| 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. | |

# 4. Tissue-equivalent Liquid

## 4.1. Tissue-equivalent Liquid Ingredients

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 2 and Table 3 show the detail solution. It’s satisfying the latest tissue dielectric parameters requirements proposed by the OET 65.

**Table 2: 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 ε=43.5 σ=0.87 |

**Table 3: 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 ε=56.7 σ=0.94 |

## 4.2. Tissue-equivalent Liquid Properties

**Table 4: Dielectric Performance of Head Tissue Simulating Liquid**

| Frequency | Description | Dielectric Parameters | | Temp |
|---|---|---|---|---|
| | | $\varepsilon_r$ | σ(s/m) | ℃ |
| **450MHz (head)** | Target value<br>±5% window | 43.50<br>41.33 — 45.68 | 0.87<br>0.83 — 0.91 | 22.0 |
| | Measurement value<br>2012-4-10 | 44.11 | 0.88 | 21.6 |

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

| Frequency | Description | Dielectric Parameters | | Temp |
|---|---|---|---|---|
| | | $\varepsilon_r$ | σ(s/m) | ℃ |
| **450MHz (body)** | Target value<br>±5% window | 56.70<br>53.87 — 59.54 | 0.94<br>0.89 — 0.99 | 22.0 |
| | Measurement value<br>2012-4-9 | 55.02 | 0.92 | 21.5 |

# 5. System Check

## 5.1. Description of 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 6 and table 7.

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

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

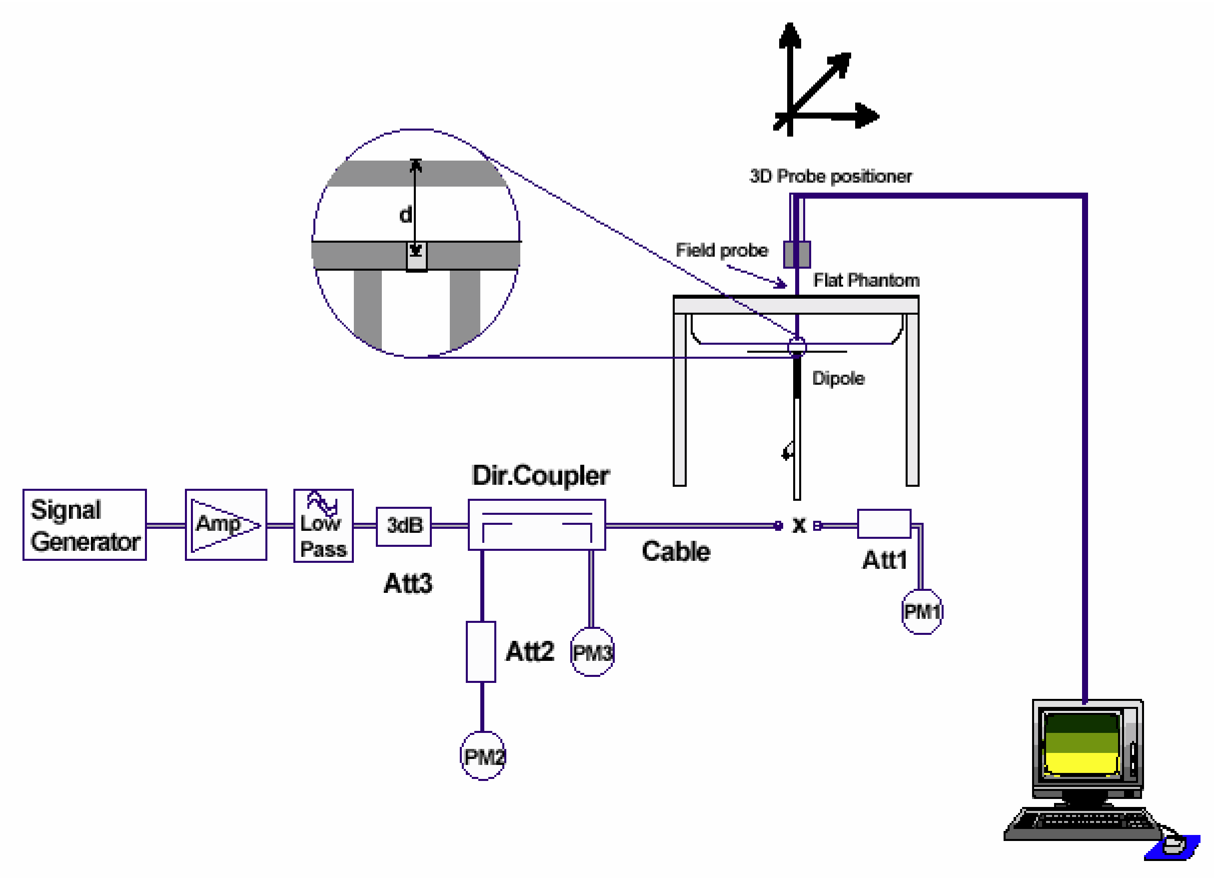



**Figure 6. System Check Set-up**

**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) | Δ % | Impedance (Ω) | ΔΩ |
| 11/09/2010 | -20.5 | 3.4% | 59.2 | 1.4Ω |
| 11/08/2011 | -21.2 | | 60.6 | |
| Body Liquid | | | | |
| Date of Measurement | Return Loss(dB) | Δ % | Impedance (Ω) | ΔΩ |
| 11/09/2010 | -20.4 | 2.9% | 56.5 | 1.6Ω |
| 11/08/2011 | -19.8 | | 58.1 | |

## 5.2. System Check Results

**Table 6: System Check for Head Tissue Simulating Liquid**

| Frequency | Test Date | Dielectric Parameters | | Temp | 398mW Measured $SAR_{1g}$ | 1W Normalized $SAR_{1g}$ | 1W Target $SAR_{1g}$ (±10% Deviation) |
|---|---|---|---|---|---|---|---|
| | | εr | σ(s/m) | (℃) | (W/kg) | | |
| **450MHz** | 2012-4-10 | 44.11 | 0.88 | 21.6 | 2.00 | 5.03 | 4.76 (4.28 ~ 5.24) |

Note: 1. The graph results see ANNEX B.
2. Target Value derives from the calibration certificate.

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

| Frequency | Test Date | Dielectric Parameters | | Temp | 398mW Measured $SAR_{1g}$ | 1W Normalized $SAR_{1g}$ | 1W Target $SAR_{1g}$ (±10% Deviation) |
|---|---|---|---|---|---|---|---|
| | | εr | σ(s/m) | (℃) | (W/kg) | | |
| **450MHz** | 2012-4-9 | 55.02 | 0.92 | 21.5 | 1.78 | 4.47 | 4.51 (4.06 ~ 4.96) |

Note: 1. The graph results see ANNEX B.
2. Target Value derives from the calibration certificate.

# 6. Operational Conditions during Test

## 6.1. 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.

## 6.2. Test Positions

### 6.2.1. 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 32mm.

### 6.2.2. Body-Worn Configuration

Due to the form factor and remote-only PTT switch of this device, and the vest accessory shown in user manual, intended use conditions appear to include transmitting while held covertly in user’s pocket. For such use conditions, SAR will be tested with front and back surfaces of device contacted with the flat phantom.

The front of the EUT towards phantom, the EUT directed tightly to touch the bottom of the flat phantom and the distance from EUT Antenna to the bottom of the Phantom is 10mm.

The front of the EUT towards ground, the EUT directed tightly to touch the bottom of the flat phantom and the distance from EUT Antenna to the bottom of the Phantom is 5mm.

# 7. Test Results

## 7.1. Conducted Power Results

**Table 8: Conducted Power Measurement Results**

| **Analog UHF (12.5KHz)** | **Conducted Power** | | | | |
|---|---|---|---|---|---|
| | 400.5 MHz | 418MHz | 435.5MHz | 453MHz | 469.5MHz |
| Test Result (dBm) | 36.38 | 36.14 | 36.13 | 36.28 | 36.28 |
| **Digital UHF** | **Conducted Power** | | | | |
| | 400.5 MHz | 418MHz | 435.5MHz | 453MHz | 469.5MHz |
| Test Result (dBm) | 36.37 | 36.20 | 36.17 | 36.30 | 36.32 |

## 7.2. SAR Test Results

### 7.2.1. 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 | 1.480 | 0.74 | -0.035 | Figure 9 |
| 418 MHz | 2.910 | 1.455 | 0.081 | Figure 10 |
| 435.5 MHz | 3.510 | 1.755 | -0.095 | Figure 11 |
| 453MHz | 1.880 | 0.94 | 0.000 | Figure 12 |
| 469.5MHz | 1.830 | 0.915 | 0.133 | Figure 13 |
| The EUT display towards ground for 12.5 KHz (Body-Worn) | | | | |
| 400.5 MHz | 13.100 | 6.55 | -0.019 | Figure 14 |
| 418 MHz | 6.810 | 3.405 | -0.064 | Figure 15 |
| 435.5 MHz | 3.500 | 1.75 | -0.015 | Figure 16 |
| 453MHz | 3.280 | 1.64 | 0.083 | Figure 17 |
| 469.5MHz | 6.230 | 3.115 | 0.117 | Figure 18 |
| The EUT display towards phantom for 12.5 KHz (Body-Worn) | | | | |
| 400.5 MHz | 9.520 | 4.76 | 0.042 | Figure 19 |
| 418 MHz | 9.040 | 4.52 | -0.079 | Figure 20 |
| 435.5 MHz | 4.520 | 2.26 | -0.044 | Figure 21 |
| 453MHz | 3.120 | 1.56 | 0.177 | Figure 22 |
| 469.5MHz | 4.640 | 2.32 | 0.129 | Figure 23 |
| Test Case of Body with Digital Channel(Towards Ground) | | | | |
| 400.5 MHz | 6.810 | 3.405 | 0.006 | Figure 24 |

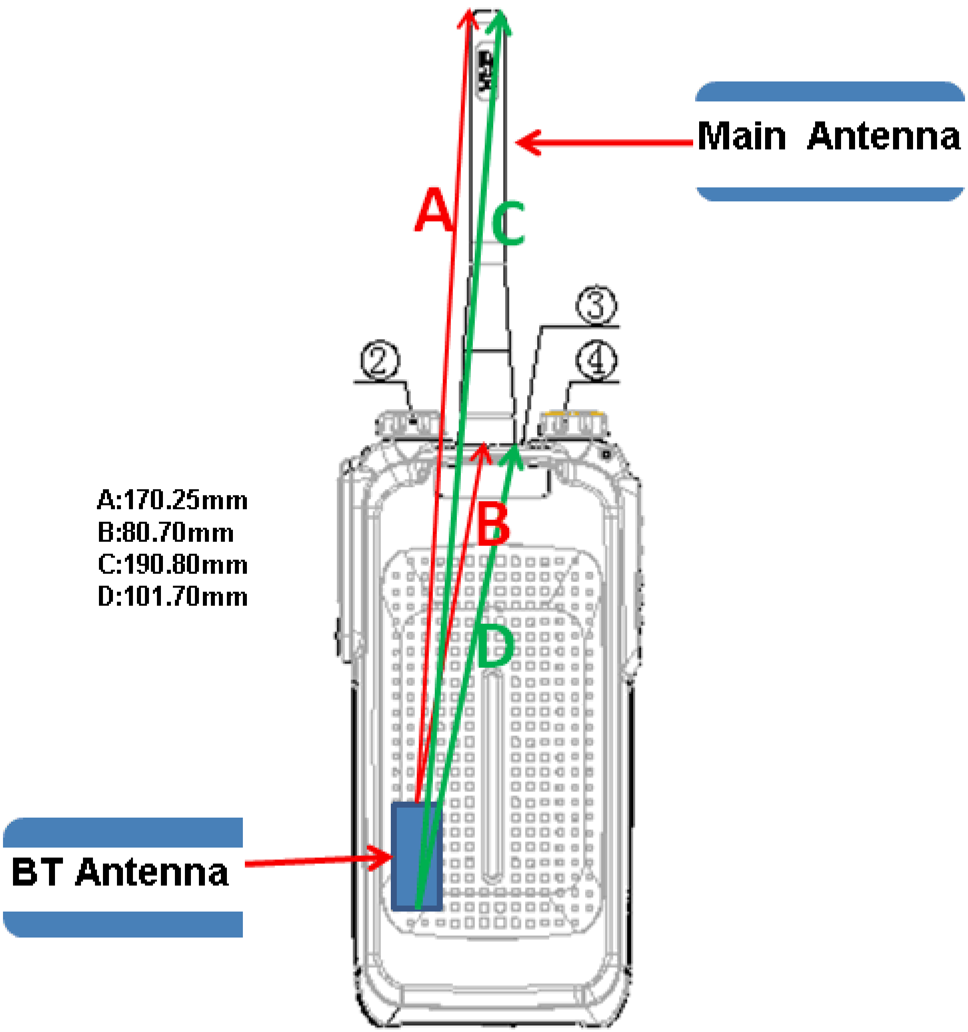
**Table 10: SAR Values are scaled for the power drift**

| 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 (Analog, Face Held)** | | | | | | |
| 400.5 MHz | 1.480 | 0.74 | 0.035 | 1.008 | 1.492 | 0.746 |
| 418 MHz | 2.910 | 1.455 | 0.081 | 1.019 | 2.965 | 1.482 |
| 435.5 MHz | 3.510 | 1.755 | 0.095 | 1.022 | 3.588 | 1.794 |
| 453MHz | 1.880 | 0.94 | 0.000 | 1.000 | 1.880 | 0.940 |
| 469.5MHz | 1.830 | 0.915 | 0.133 | 1.031 | 1.887 | 0.943 |
| **The EUT display towards ground for 12.5 KHz (Analog, Body-Worn)** | | | | | | |
| 400.5 MHz | 13.100 | 6.55 | 0.019 | 1.004 | 13.157 | 6.579 |
| 418 MHz | 6.810 | 3.405 | 0.064 | 1.015 | 6.911 | 3.456 |
| 435.5 MHz | 3.500 | 1.75 | 0.015 | 1.003 | 3.512 | 1.756 |
| 453MHz | 3.280 | 1.64 | 0.083 | 1.019 | 3.343 | 1.672 |
| 469.5MHz | 6.230 | 3.115 | 0.117 | 1.027 | 6.400 | 3.200 |
| **The EUT display towards phantom for 12.5 KHz (Analog, Body-Worn)** | | | | | | |
| 400.5 MHz | 9.520 | 4.76 | 0.042 | 1.010 | 9.613 | 4.806 |
| 418 MHz | 9.040 | 4.52 | 0.079 | 1.018 | 9.206 | 4.603 |
| 435.5 MHz | 4.520 | 2.26 | 0.044 | 1.010 | 4.566 | 2.283 |
| 453MHz | 3.120 | 1.56 | 0.177 | 1.042 | 3.250 | 1.625 |
| 469.5MHz | 4.640 | 2.32 | 0.129 | 1.030 | 4.780 | 2.390 |
| **Worst case position of Analog for Digital** | | | | | | |
| 400.5 MHz | 6.810 | 3.405 | 0.006 | 1.001 | 6.819 | 3.410 |

Note: 1.The value with blue color is the maximum SAR Value of each test band.
2. The SAR levels reported are based on 50% PTT duty factor including SAR droop.
3. The Exposure category about EUT: controlled environment/Occupational, so the SAR limit is 8.0 W/kg averaged over any 1 gram of tissue.

### 7.2.2. Bluetooth Function

The distance between BT antenna and main antenna is ＞5cm.




The output power of BT antenna is as following:

| Channel | Ch 0<br>2402 MHz | Ch 39<br>2441 MHz | Ch 78<br>2480 MHz |
|---|---|---|---|
| Average Conducted Output Power(dBm) | 2.0 | 2.0 | 2.0 |

**Output Power Thresholds for Unlicensed Transmitters**

| | 2.45 | 5.15 - 5.35 | 5.47 - 5.85 | GHz |
|---|---|---|---|---|
| $P_{Ref}$ | 12 | 6 | 5 | mW |
| Device output power should be rounded to the nearest mW to compare with values specified in this table. | | | | |

**Stand-alone SAR**

According to the output power measurement result and the distance between BT antenna and Main antenna we can draw the conclusion that:

Stand-alone SAR are not required for BT, because BT antenna is ＞5cm from other antennas and the output power of BT transmitter is ＜$2P_{Ref}$ =13.8dBm

**Simultaneous SAR**

Stand-alone SAR is not required for BT, so Simultaneous SAR is not required for BT antenna and main Antenna.

# 8. Measurement Uncertainty

| No. | source | Type | Uncertainty Value (%) | Probability Distribution | k | $c_i$ | 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 | 6.7 | N | 1 | 1 | 6.7 | ∞ |
| 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 | 2.9 | 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 | ∞ |
| 21 | -liquid conductivity (deviation from target) | B | 5.0 | R | $\sqrt{3}$ | 0.64 | 1.8 | ∞ |
| 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 | ∞ |
| 24 | -liquid permittivity (measurement uncertainty ) | B | 2.5 | N | 1 | 0.6 | 1.5 | 9 |
| Combined standard uncertainty | | $u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$ | | | | | 12.53 | |
| Expanded uncertainty (confidence interval of 95 %) | | $u_e = 2u_c$ | | N | k=2 | | 23.76 | |

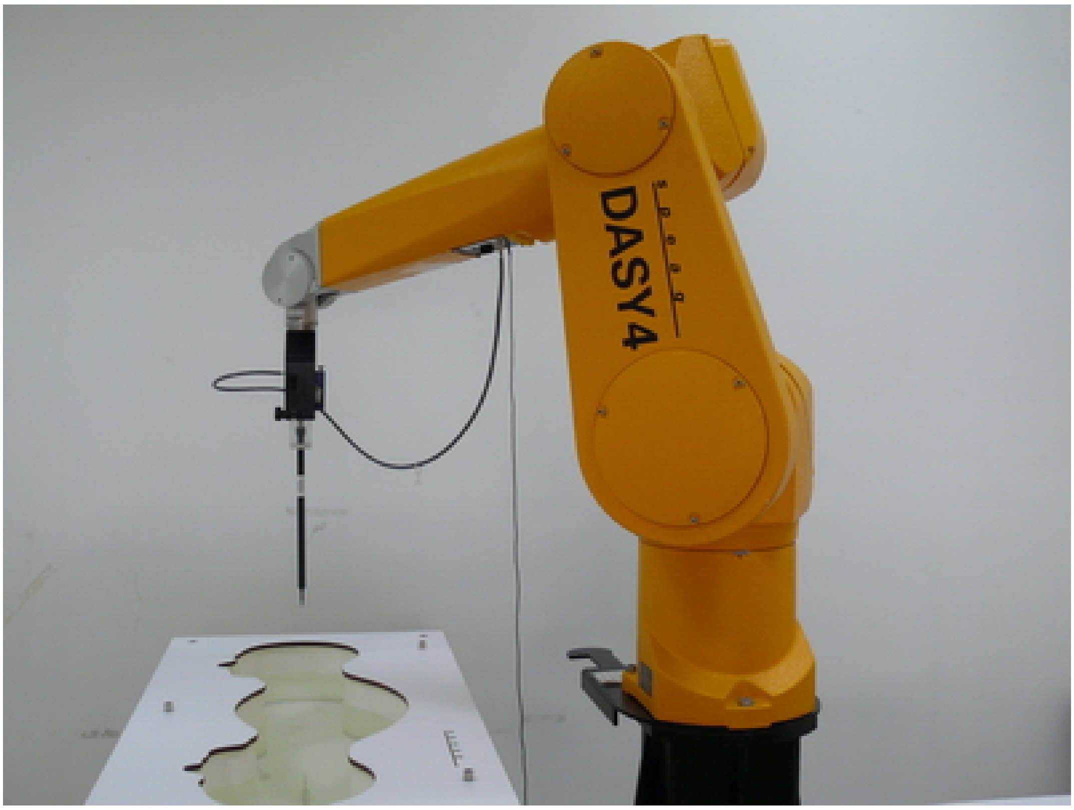
## 9. Main Test Instruments

**Table 11: List of Main Instruments**

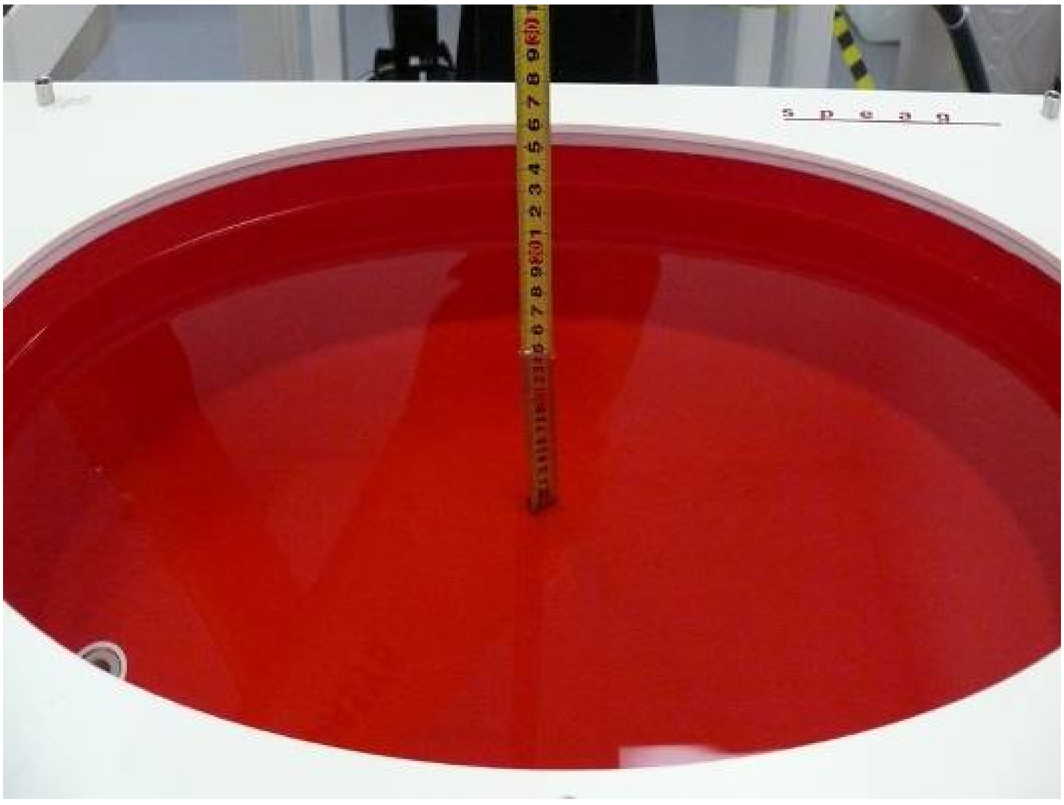
| No. | Name | Type | Serial Number | Calibration Date | Valid Period |
|---|---|---|---|---|---|
| 01 | Network analyzer | Agilent 8753E | US37390326 | September 12, 2011 | One year |
| 02 | Dielectric Probe Kit | Agilent 85070E | US44020115 | No Calibration Requested | |
| 03 | Power meter | Agilent E4417A | GB41291714 | March 11, 2012 | One year |
| 04 | Power sensor | Agilent N8481H | MY50350004 | September 25, 2011 | One year |
| 05 | Power sensor | E9327A | US40441622 | September 24, 2011 | One year |
| 06 | Signal Generator | HP 8341B | 2730A00804 | September 12, 2011 | One year |
| 07 | Amplifier | IXA-020 | 0401 | No Calibration Requested | |
| 08 | E-field Probe | EX3DV4 | 3816 | October 3, 2011 | One year |
| 09 | DAE | DAE4 | 871 | November 22, 2011 | One year |
| 10 | Validation Kit 450MHz | D450V3 | 1065 | November 9, 2010 | Two years |
| 11 | Dual directional coupler | 778D-012 | 5051P | August 21, 2011 | One year |
| 12 | Temperature Probe | JM222 | AA1009129 | March 15, 2012 | One year |
| 13 | Hygrothermograph | HTC-1 | TASH121602 | June 21, 2011 | One year |

*******END OF REPORT *******

## 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 TSL

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

Date/Time: 4/10/2012 11:35:21 AM

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

Medium parameters used: f = 450 MHz; σ = 0.88 mho/m; $\varepsilon_r$ = 44.11; ρ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.6℃

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

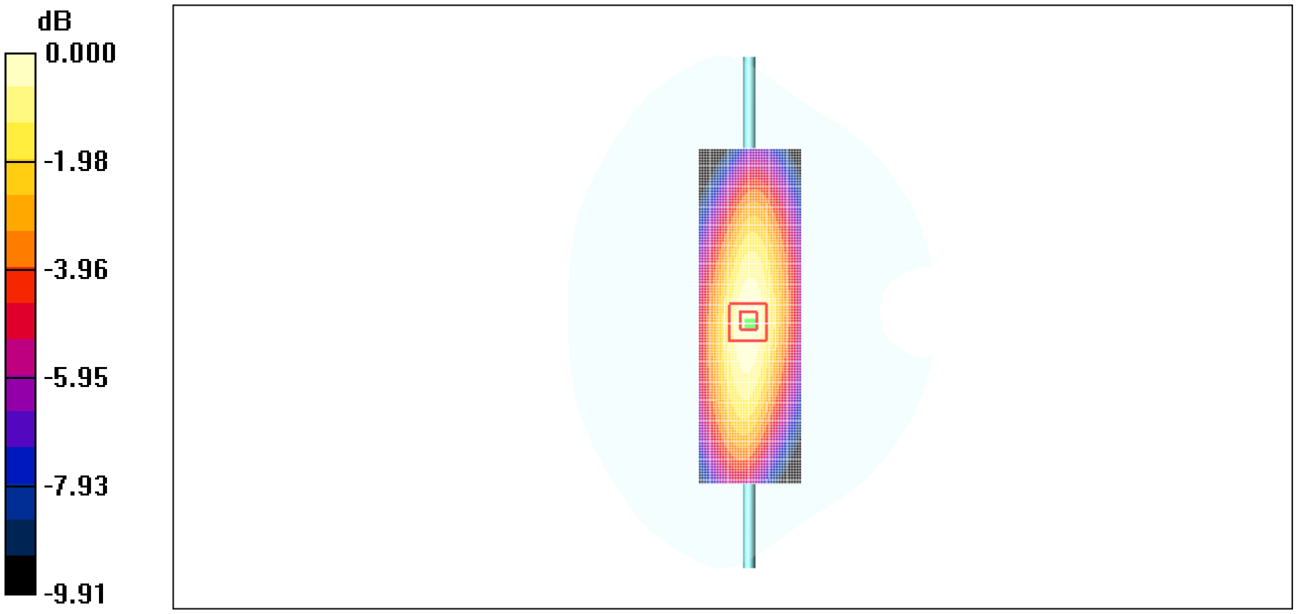
**d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

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




0 dB = 2.15mW/g

**Figure 7 System Performance Check 450MHz 398mW**

## System Performance Check at 450 MHz Body TSL

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

Date/Time: 4/9/2012 9:44:21 AM

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

Medium parameters used: f = 450 MHz; σ = 0.92mho/m; $\varepsilon_r$ = 55.02; ρ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.9 mW/g

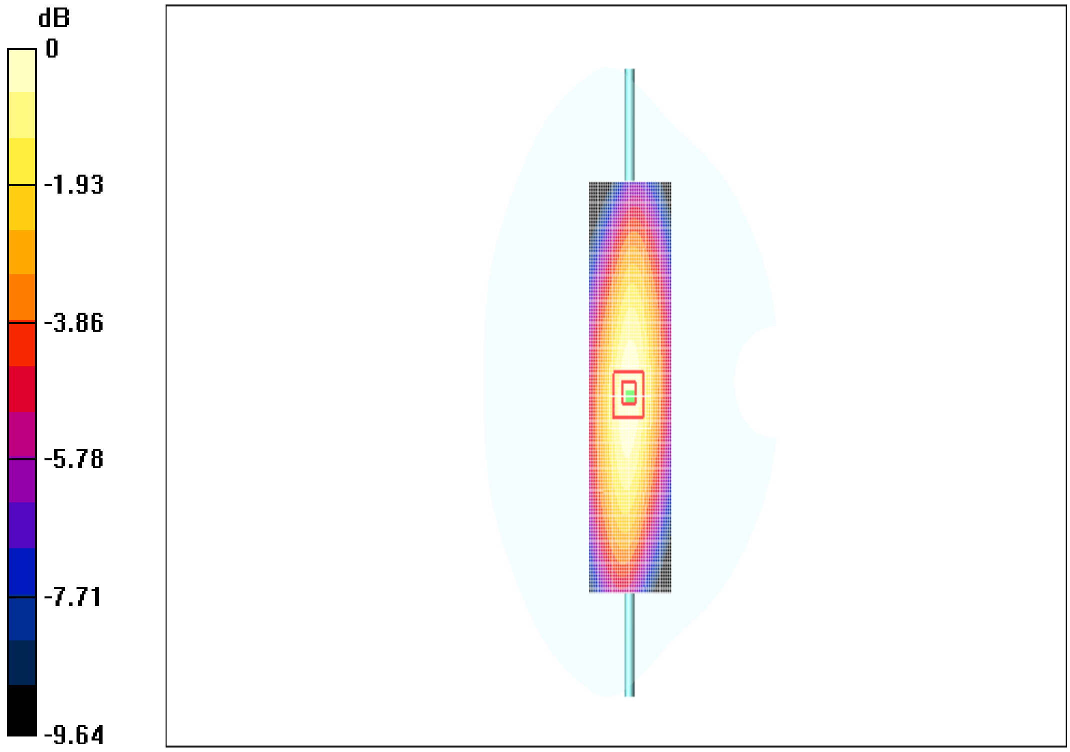
**d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 44.7 V/m; Power Drift = -0.014 dB

Peak SAR (extrapolated) = 2.64 W/kg

**SAR(1 g) = 1.78 mW/g; SAR(10 g) = 1.17 mW/g**

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




0 dB = 1.89mW/g

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

## ANNEX C: Graph Results

### Face Held, Front towards Phantom 400.5 MHz(12.5 KHz Channel Spacing)

Date/Time: 4/10/2012 1:10:57 PM

Communication System: PTT 400-470; Frequency: 400.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 400.5 MHz; $\sigma$ = 0.841 mho/m; $\varepsilon_r$ = 45.2; $\rho$ = 1000 kg/$m^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 1/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.56 mW/g

**Channel 1/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 42.5 V/m; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 2.03 W/kg

**SAR(1 g) = 1.48 mW/g; SAR(10 g) = 1.1 mW/g**

Maximum value of SAR (measured) = 1.55 mW/g

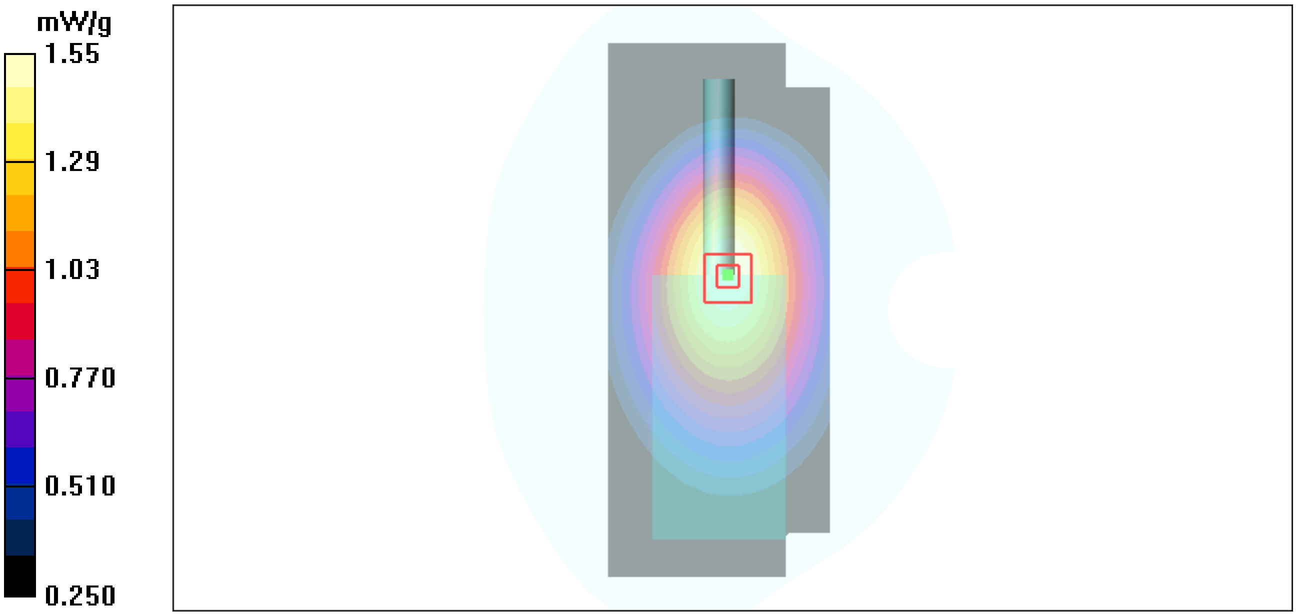



**Figure 9 Face Held, Front towards Phantom 400.5 MHz(12.5 KHz Channel Spacing)**

**Face Held, Front towards Phantom 418 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/10/2012 1:24:42 PM

Communication System: PTT 400-470; Frequency: 418 MHz;Duty Cycle: 1:1

Medium parameters used: f = 418 MHz; $\sigma$ = 0.856 mho/m; $\varepsilon_r$ = 44.8; $\rho$ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 2/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.05 mW/g

**Channel 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.3 V/m; Power Drift = 0.081 dB

Peak SAR (extrapolated) = 4.00 W/kg

**SAR(1 g) = 2.91 mW/g; SAR(10 g) = 2.16 mW/g**

Maximum value of SAR (measured) = 3.05 mW/g

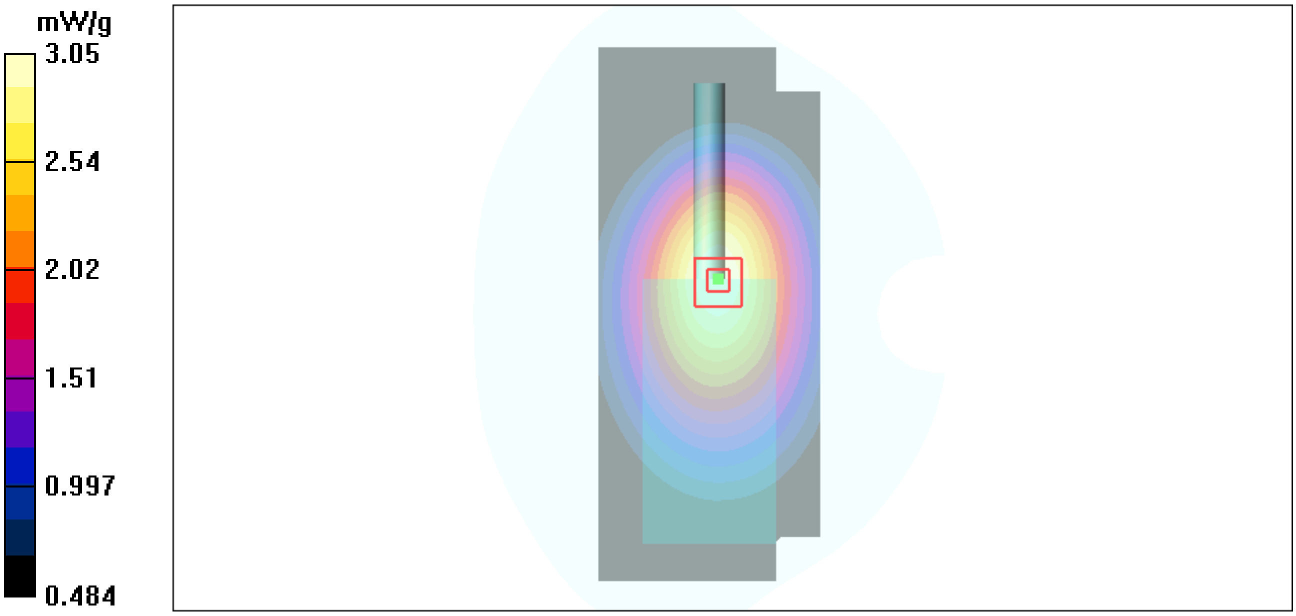



**Figure 10 Face Held, Front towards Phantom 418 MHz(12.5 KHz Channel Spacing)**

**Face Held, Front towards Phantom 435.5 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/10/2012 1:38:29 PM

Communication System: PTT 400-470; Frequency: 435.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 435.5 MHz; $\sigma$ = 0.871 mho/m; $\varepsilon_r$ = 44.4; $\rho$ = 1000 kg/$m^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 3/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.75 mW/g

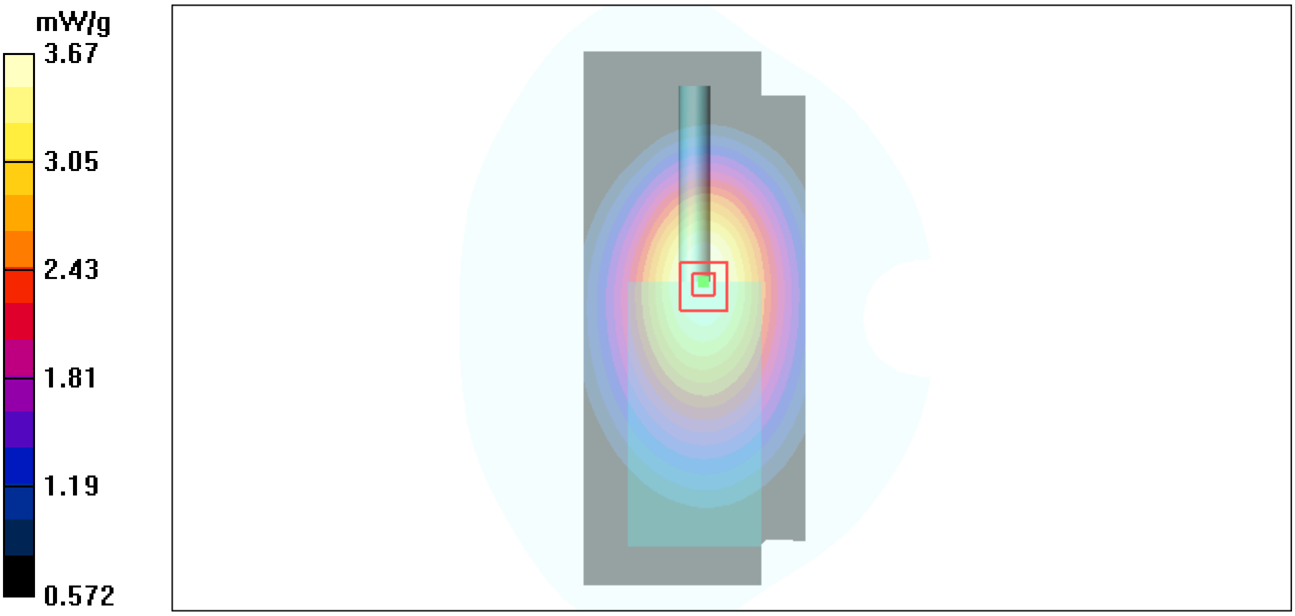
**Channel 3/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 65.1 V/m; Power Drift = -0.095 dB

Peak SAR (extrapolated) = 4.83 W/kg

**SAR(1 g) = 3.51 mW/g; SAR(10 g) = 2.6 mW/g**

Maximum value of SAR (measured) = 3.67 mW/g



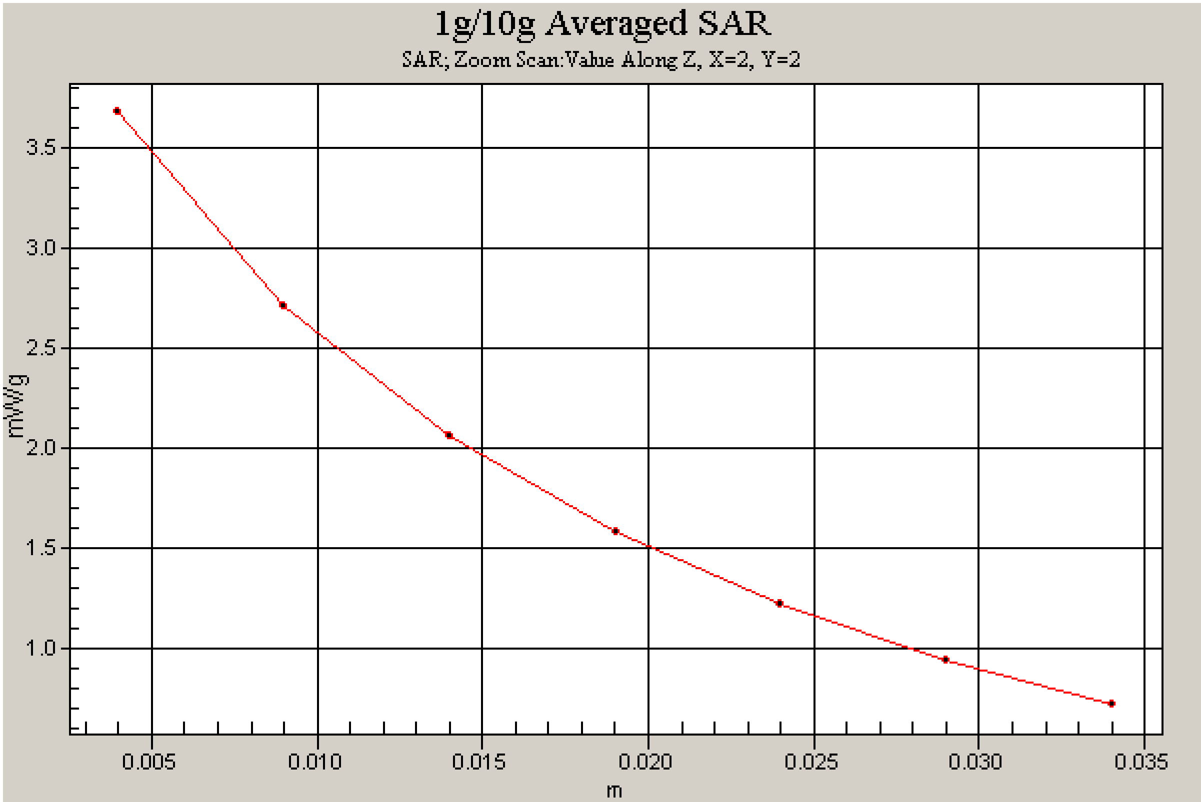



**Figure 11 Face Held, Front towards Phantom 435.5 MHz(12.5 KHz Channel Spacing)**

**Face Held, Front towards Phantom 453 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/10/2012 2:48:14 PM

Communication System: PTT 400-470; Frequency: 453 MHz;Duty Cycle: 1:1

Medium parameters used: f = 453 MHz; σ = 0.884 mho/m; $\varepsilon_r$ = 44; ρ = 1000 kg/$m^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 4/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

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

**Channel 4/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 46.8 V/m; Power Drift = 0.000 dB

Peak SAR (extrapolated) = 2.59 W/kg

**SAR(1 g) = 1.88 mW/g; SAR(10 g) = 1.38 mW/g**

Maximum value of SAR (measured) = 1.97 mW/g

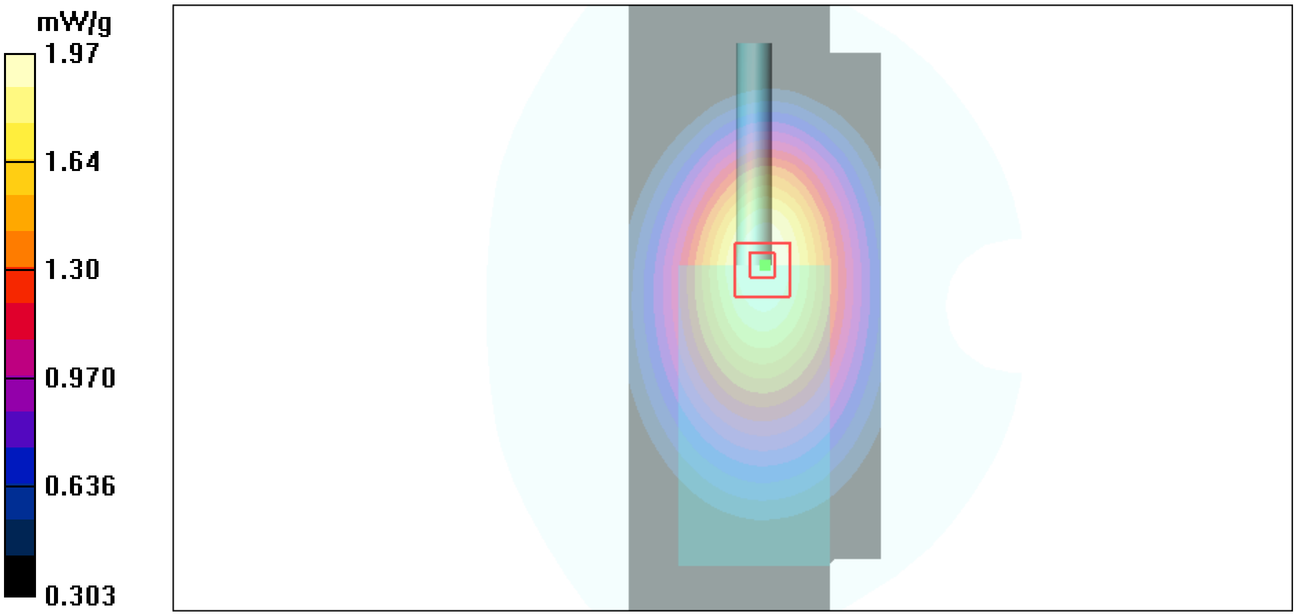



**Figure 12 Face Held, Front towards Phantom 453 MHz(12.5 KHz Channel Spacing)**

**Face Held, Front towards Phantom 469.5 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/10/2012 3:02:07 PM

Communication System: PTT 400-470; Frequency: 469.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 469.5 MHz; $\sigma$ = 0.9 mho/m; $\varepsilon_r$ = 43.7; $\rho$ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 5/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.91 mW/g

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

Reference Value = 45.3 V/m; Power Drift = 0.133 dB

Peak SAR (extrapolated) = 2.53 W/kg

**SAR(1 g) = 1.83 mW/g; SAR(10 g) = 1.34 mW/g**

Maximum value of SAR (measured) = 1.92 mW/g

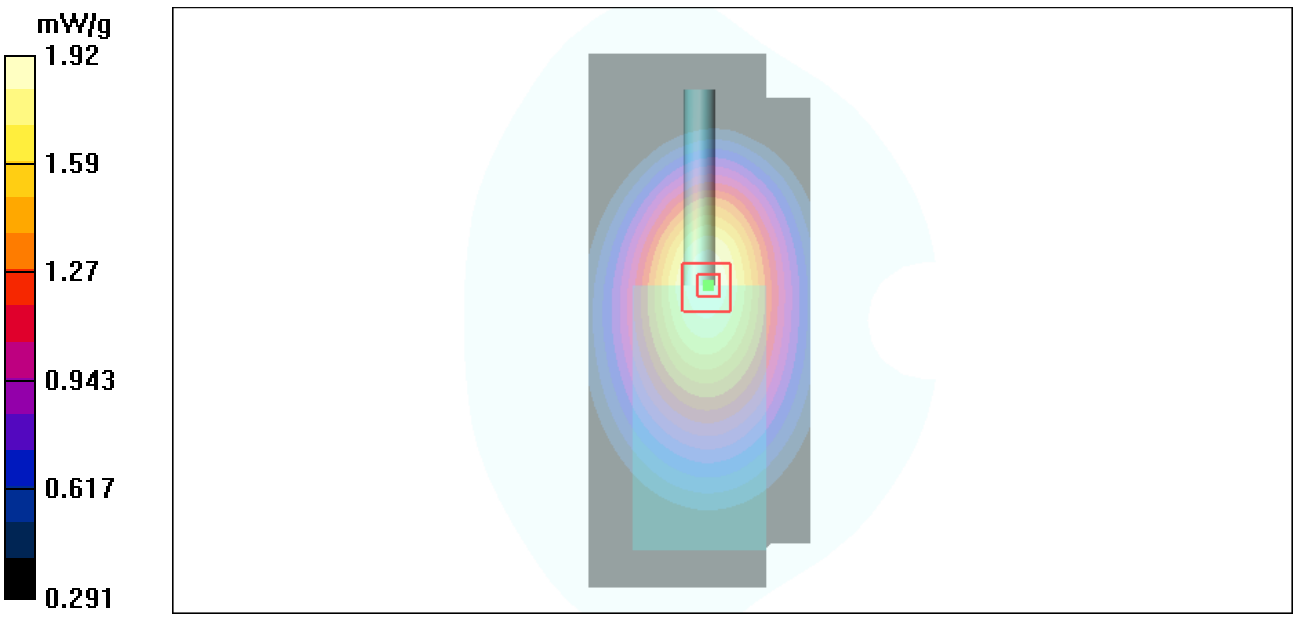



**Figure 13 Face Held, Front towards Phantom 469.5 MHz(12.5 KHz Channel Spacing)**

**Body-Worn, Front towards Ground 400.5 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/9/2012 12:05:27 PM

Communication System: PTT 400-470; Frequency: 400.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 400.5 MHz; $\sigma$ = 0.895 mho/m; $\varepsilon_r$ = 56.1; $\rho$ = 1000 kg/$m^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 1/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 14.0 mW/g

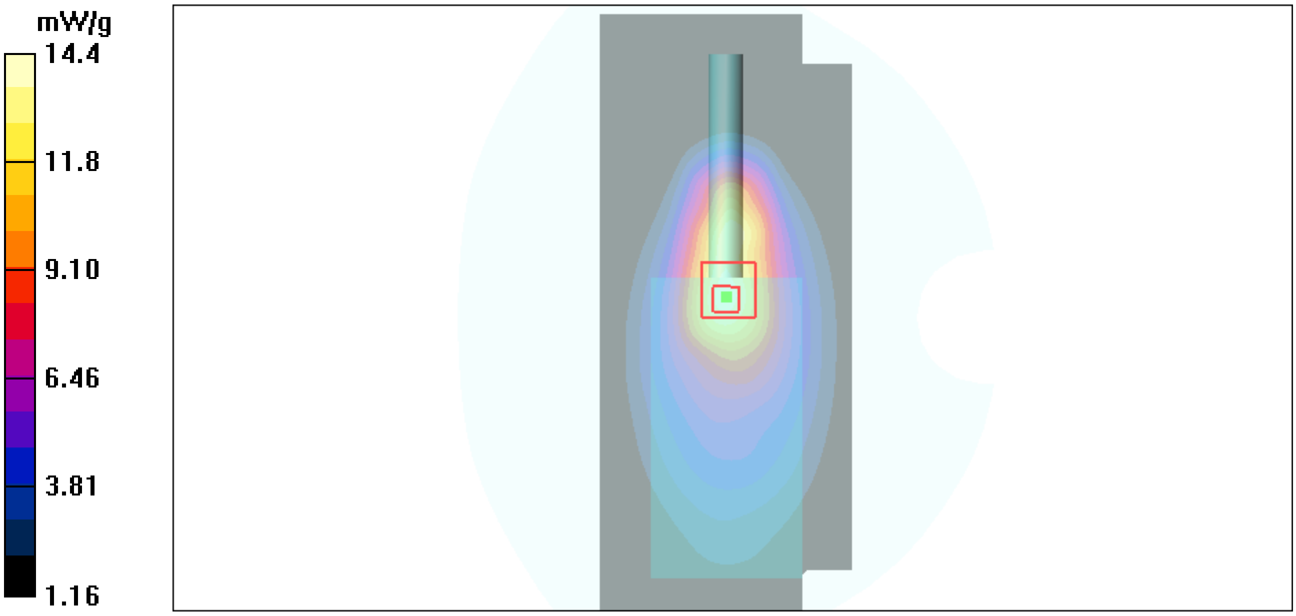
**Channel 1/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 130.3 V/m; Power Drift = -0.019 dB

Peak SAR (extrapolated) = 23.7 W/kg

**SAR(1 g) = 13.1 mW/g; SAR(10 g) = 8.4 mW/g**

Maximum value of SAR (measured) = 14.4 mW/g



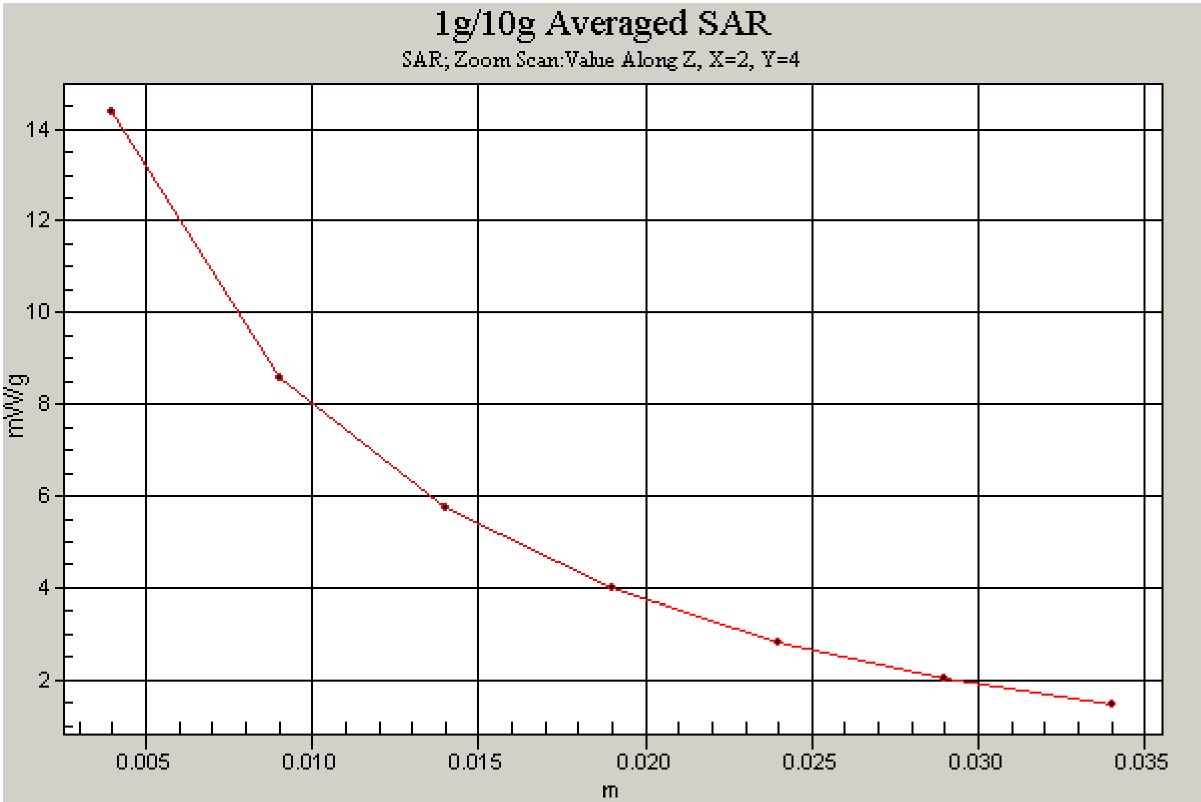



**Figure 14 Body-Worn, Front towards Ground 400.5 MHz(12.5 KHz Channel Spacing)**

## Body-Worn, Front towards Ground 418 MHz(12.5 KHz Channel Spacing)

Date/Time: 4/9/2012 12:24:48 PM

Communication System: PTT 400-470; Frequency: 418 MHz;Duty Cycle: 1:1

Medium parameters used: f = 418 MHz; $\sigma$ = 0.902 mho/m; $\varepsilon_r$ = 55.6; $\rho$ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 2 2/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 7.03 mW/g

**Channel 2 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.8 V/m; Power Drift = -0.064 dB

Peak SAR (extrapolated) = 13.3 W/kg

**SAR(1 g) = 6.81 mW/g; SAR(10 g) = 4.35 mW/g**

Maximum value of SAR (measured) = 7.74 mW/g

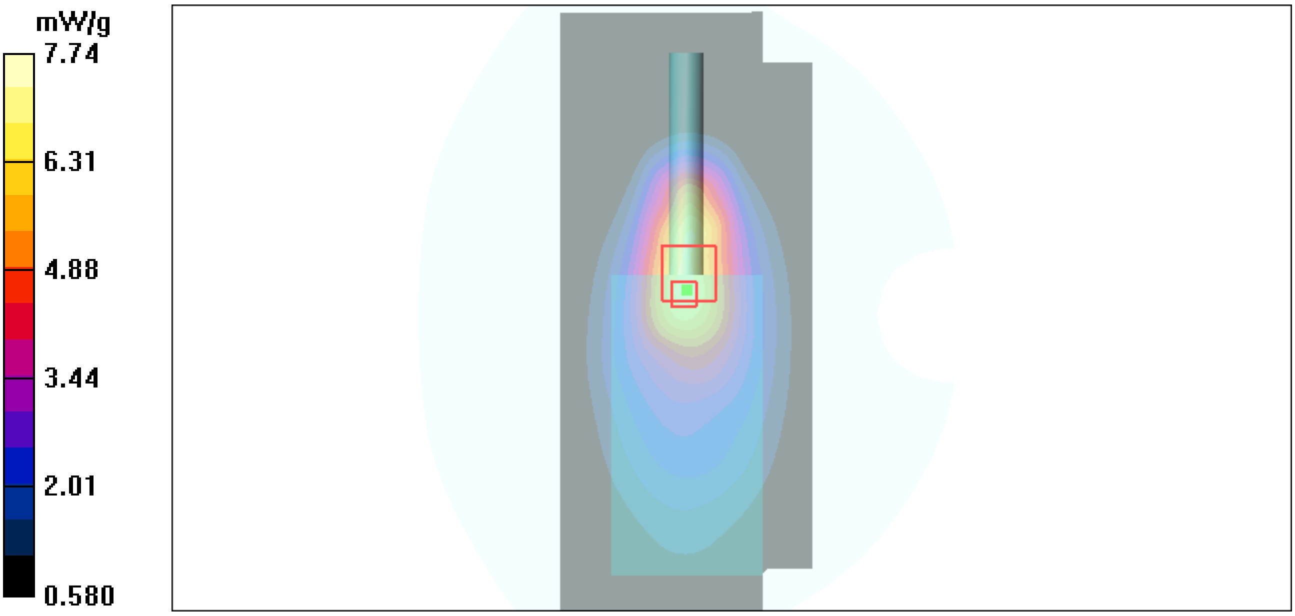



**Figure 15 Body-Worn, Front towards Ground 418 MHz(12.5 KHz Channel Spacing)**

**Body-Worn, Front towards Ground 435.5 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/9/2012 11:12:23 AM

Communication System: PTT 400-470; Frequency: 435.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 435.5 MHz; $\sigma$ = 0.915 mho/m; $\varepsilon_r$ = 55.3; $\rho$ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 3/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.43 mW/g

**Channel 3/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.6 V/m; Power Drift = -0.015 dB

Peak SAR (extrapolated) = 7.75 W/kg

**SAR(1 g) = 3.5 mW/g; SAR(10 g) = 2.06 mW/g**

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

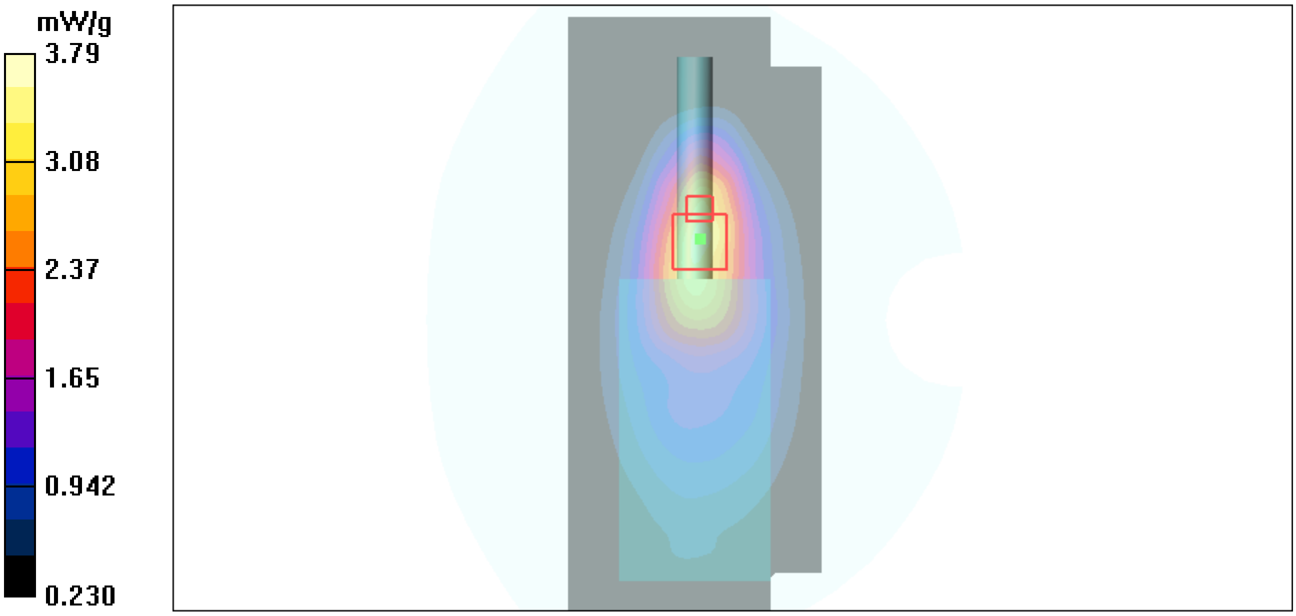



**Figure 16 Body-Worn, Front towards Ground 435.5 MHz(12.5 KHz Channel Spacing)**

**Body-Worn, Front towards Ground 453 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/9/2012 11:26:21 AM

Communication System: PTT 400-470; Frequency: 453 MHz;Duty Cycle: 1:1

Medium parameters used: f = 453 MHz; σ = 0.923 mho/m; $\varepsilon_r$ = 55; ρ = 1000 kg/$m^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 4/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.20 mW/g

**Channel 4/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 48.6 V/m; Power Drift = 0.083 dB

Peak SAR (extrapolated) = 7.19 W/kg

**SAR(1 g) = 3.28 mW/g; SAR(10 g) = 1.93 mW/g**

Maximum value of SAR (measured) = 3.51 mW/g

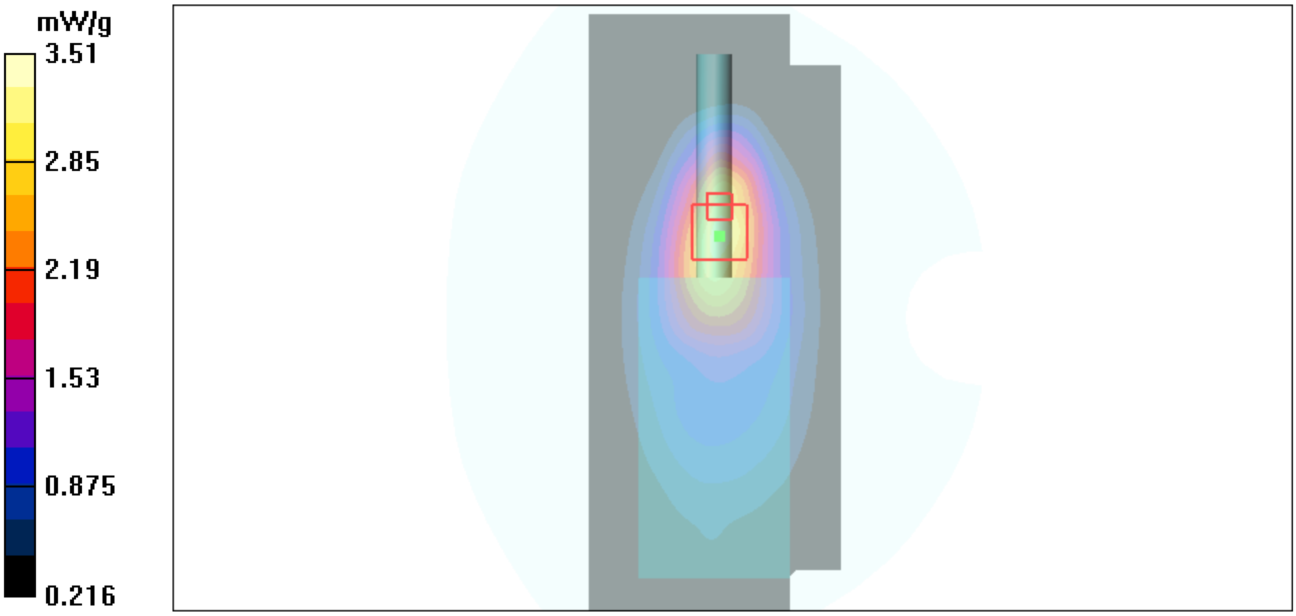



**Figure 17 Body-Worn, Front towards Ground for 12.5 KHz 453 MHz(12.5 KHz Channel Spacing)**

**Body-Worn, Front towards Ground 469.5 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/9/2012 2:11:11 PM

Communication System: PTT 400-470; Frequency: 469.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 469.5 MHz; σ = 0.935 mho/m; $\varepsilon_r$ = 54.8; ρ = 1000 kg/$m^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 5 2/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 6.09 mW/g

**Channel 5 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.5 V/m; Power Drift = 0.117 dB

Peak SAR (extrapolated) = 13.4 W/kg

**SAR(1 g) = 6.23 mW/g; SAR(10 g) = 3.62 mW/g**

Maximum value of SAR (measured) = 6.82 mW/g

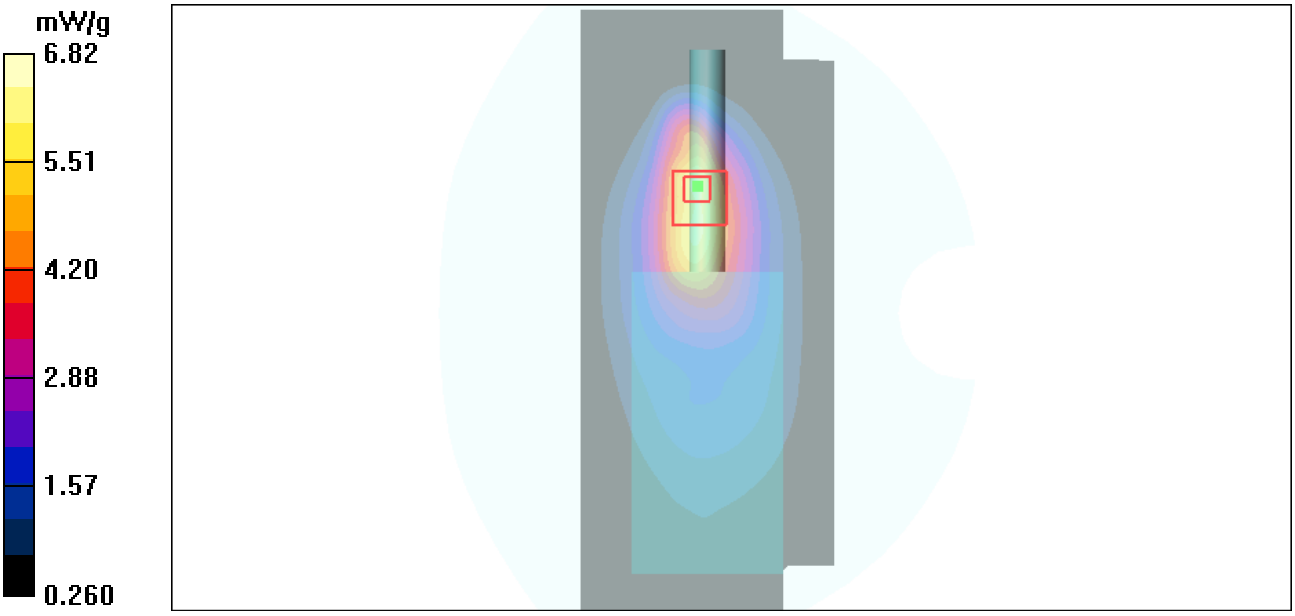



**Figure 18 Body-Worn, Front towards Ground 469.5 MHz(12.5 KHz Channel Spacing)**

**Body-Worn, Front towards Phantom 400.5 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/9/2012 2:56:37 PM

Communication System: PTT 400-470; Frequency: 400.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 400.5 MHz; $\sigma$ = 0.895 mho/m; $\varepsilon_r$ = 56.1; $\rho$ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 1/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 10.0 mW/g

**Channel 1/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.6 V/m; Power Drift = 0.042 dB

Peak SAR (extrapolated) = 16.2 W/kg

**SAR(1 g) = 9.52 mW/g; SAR(10 g) = 6.38 mW/g**

Maximum value of SAR (measured) = 10.1 mW/g

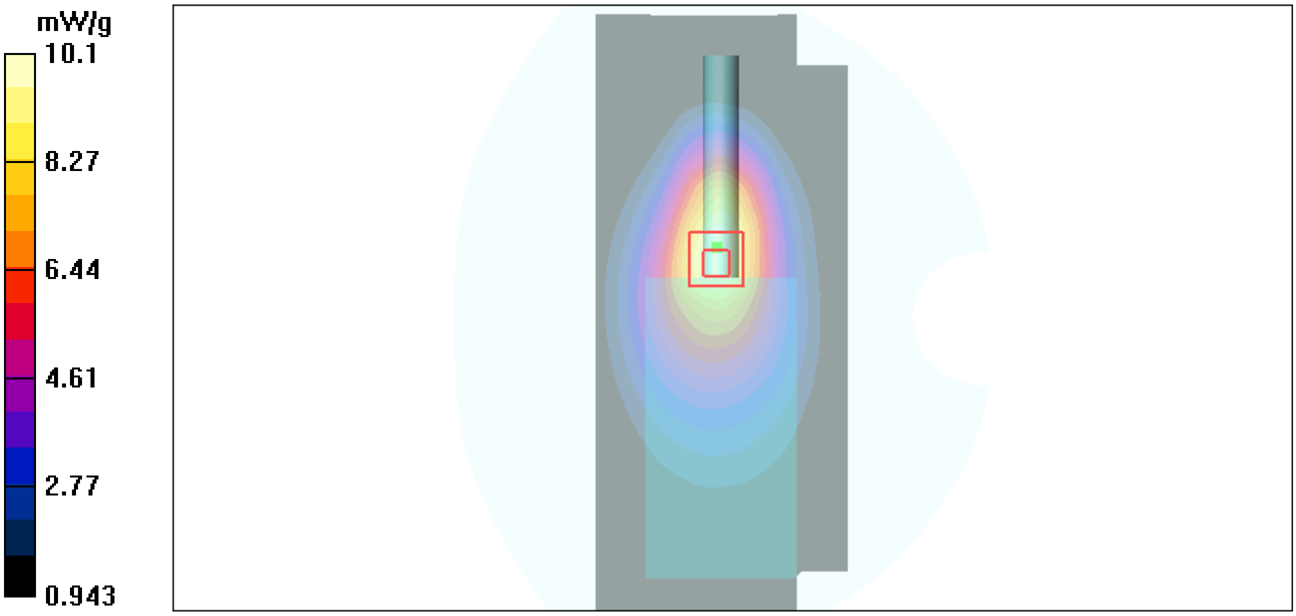



**Figure 19 Body-Worn, Front towards Phantom 400.5 MHz(12.5 KHz Channel Spacing)**

**Body-Worn, Front towards Phantom 418 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/9/2012 3:48:22 PM

Communication System: PTT 400-470; Frequency: 418 MHz;Duty Cycle: 1:1

Medium parameters used: f = 418 MHz; $\sigma$ = 0.902 mho/m; $\varepsilon_r$ = 55.6; $\rho$ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 2/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 9.88 mW/g

**Channel 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 82.0 V/m; Power Drift = -0.079 dB

Peak SAR (extrapolated) = 15.8 W/kg

**SAR(1 g) = 9.04 mW/g; SAR(10 g) = 6 mW/g**

Maximum value of SAR (measured) = 9.50 mW/g

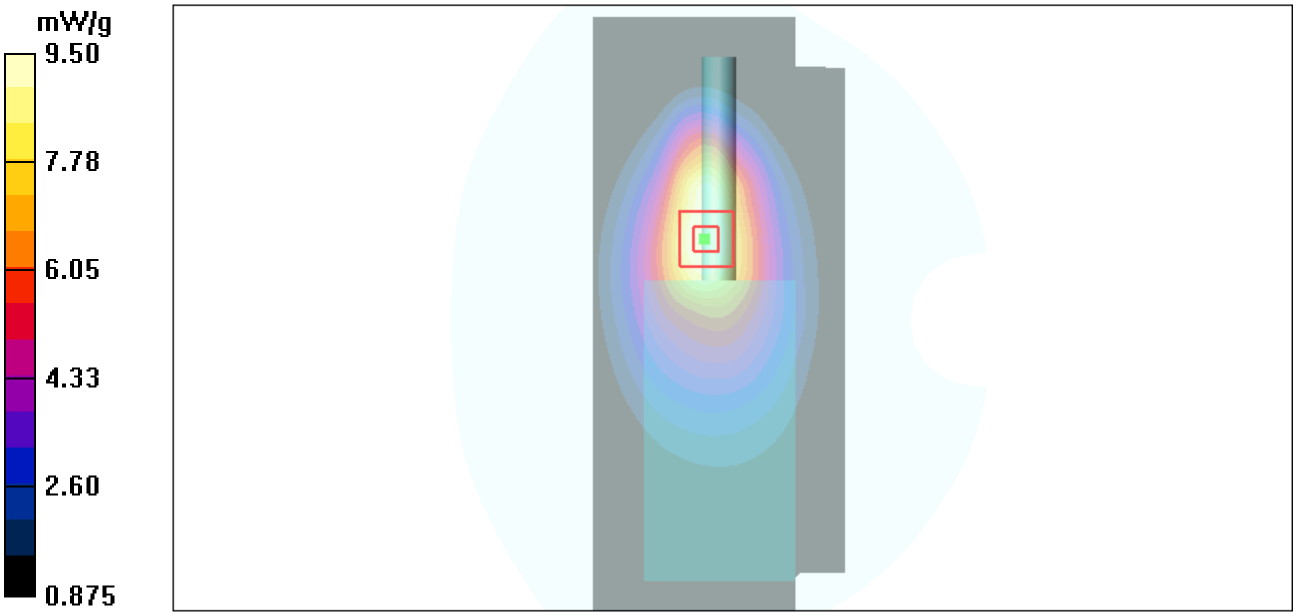



**Figure 20 Body-Worn, Front towards Phantom 418 MHz(12.5 KHz Channel Spacing)**

**Body-Worn, Front towards Phantom 435.5 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/9/2012 4:30:11 PM

Communication System: PTT 400-470; Frequency: 435.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 435.5 MHz; $\sigma$ = 0.915 mho/m; $\varepsilon_r$ = 55.3; $\rho$ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 3/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 4.81 mW/g

**Channel 3/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 61.6 V/m; Power Drift = -0.044 dB

Peak SAR (extrapolated) = 7.28 W/kg

**SAR(1 g) = 4.52 mW/g; SAR(10 g) = 3.02 mW/g**

Maximum value of SAR (measured) = 4.78 mW/g

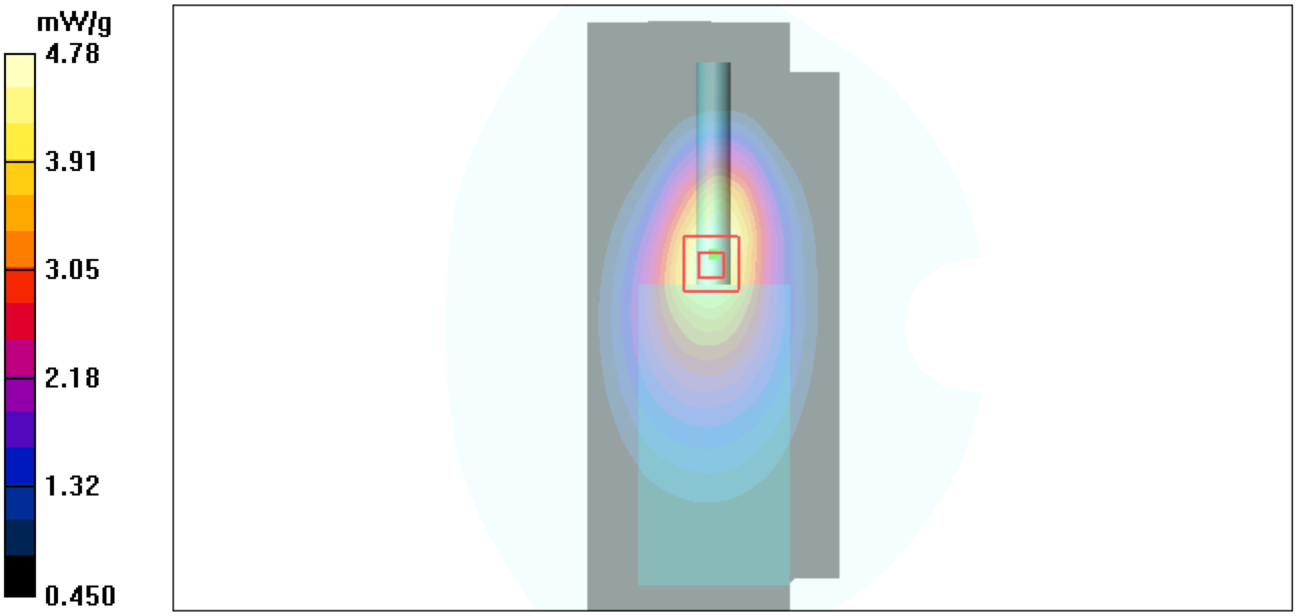



**Figure 21 Body-Worn, Front towards Phantom 435.5 MHz(12.5 KHz Channel Spacing)**

**Body-Worn, Front towards Phantom 453 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/9/2012 5:16:47 PM

Communication System: PTT 400-470; Frequency: 453 MHz;Duty Cycle: 1:1

Medium parameters used: f = 453 MHz; σ = 0.923 mho/m; $\varepsilon_r$ = 55; ρ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 4/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.27 mW/g

**Channel 4/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 49.2 V/m; Power Drift = 0.177 dB

Peak SAR (extrapolated) = 5.07 W/kg

**SAR(1 g) = 3.12 mW/g; SAR(10 g) = 2.07 mW/g**

Maximum value of SAR (measured) = 3.32 mW/g

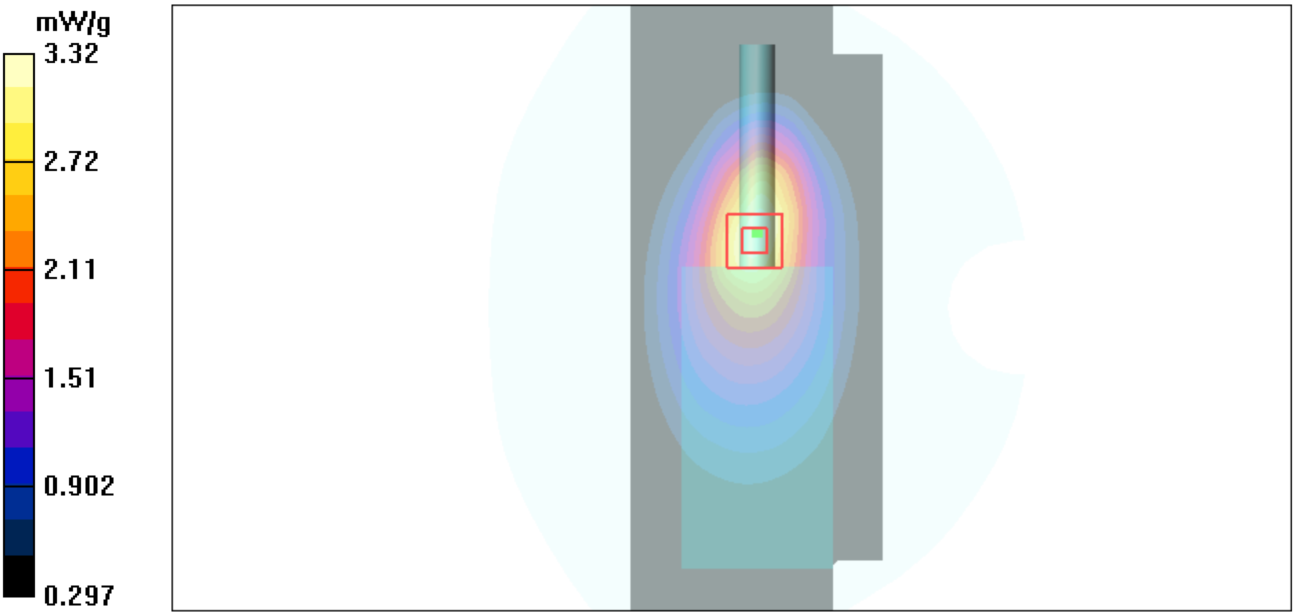



**Figure 22 Body-Worn, Front towards Phantom 453 MHz(12.5 KHz Channel Spacing)**

**Body-Worn, Front towards Phantom 469.5 MHz(12.5 KHz Channel Spacing)**

Date/Time: 4/9/2012 5:44:12 PM

Communication System: PTT 400-470; Frequency: 469.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 469.5 MHz; σ = 0.935 mho/m; $\varepsilon_r$ = 54.8; ρ = 1000 kg/$m^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 5/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 4.85 mW/g

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

Reference Value = 58.3 V/m; Power Drift = 0.129 dB

Peak SAR (extrapolated) = 7.58 W/kg

**SAR(1 g) = 4.64 mW/g; SAR(10 g) = 3.03 mW/g**

Maximum value of SAR (measured) = 4.94 mW/g

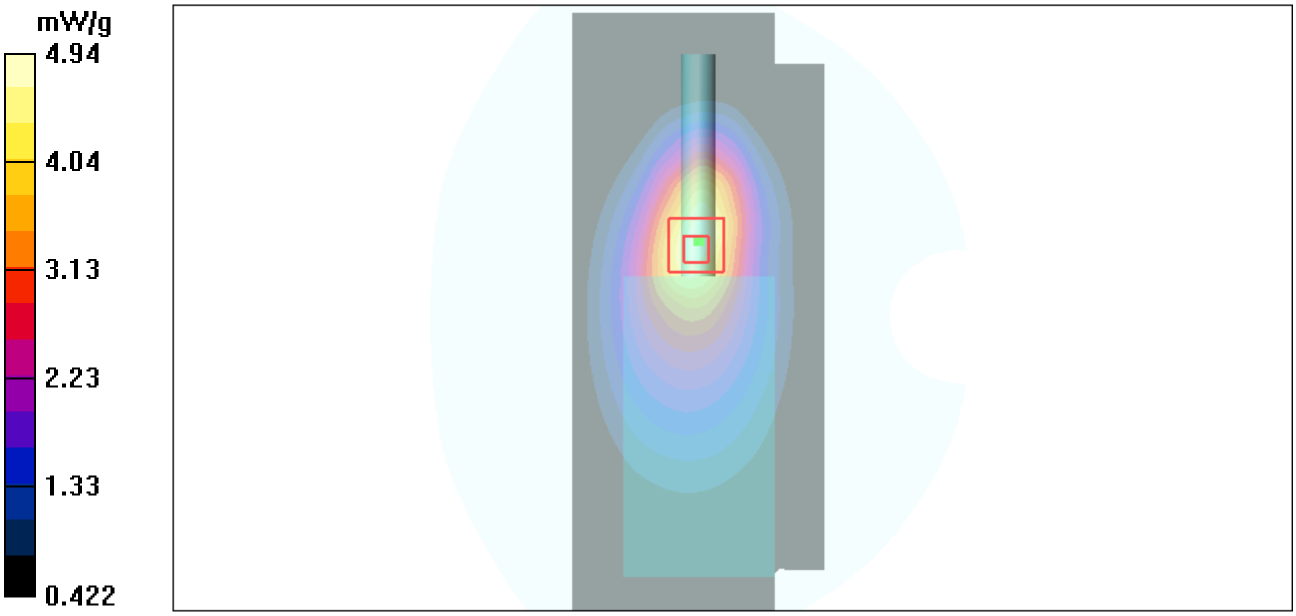



**Figure 23 Body-Worn, Front towards Phantom 469.5 MHz(12.5 KHz Channel Spacing)**

**Body-Worn for Digital, Front towards Ground 400.5 MHz**

Date/Time: 4/9/2012 6:30:04 PM

Communication System: PTT 400-470; Frequency: 400.5 MHz;Duty Cycle: 1:2

Medium parameters used (interpolated): f = 400.5 MHz; $\sigma$ = 0.895 mho/m; $\varepsilon_r$ = 56.1; $\rho$ = 1000 kg/m$^3$

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY4 Configuration:

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

Electronics: DAE4 Sn871; Calibrated: 11/22/2011

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

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

**Channel 1/Area Scan (51x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 6.82 mW/g

**Channel 1/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 74.9 V/m; Power Drift = 0.006 dB

Peak SAR (extrapolated) = 16.2 W/kg

**SAR(1 g) = 6.81 mW/g; SAR(10 g) = 4.01 mW/g**

Maximum value of SAR (measured) = 7.07 mW/g

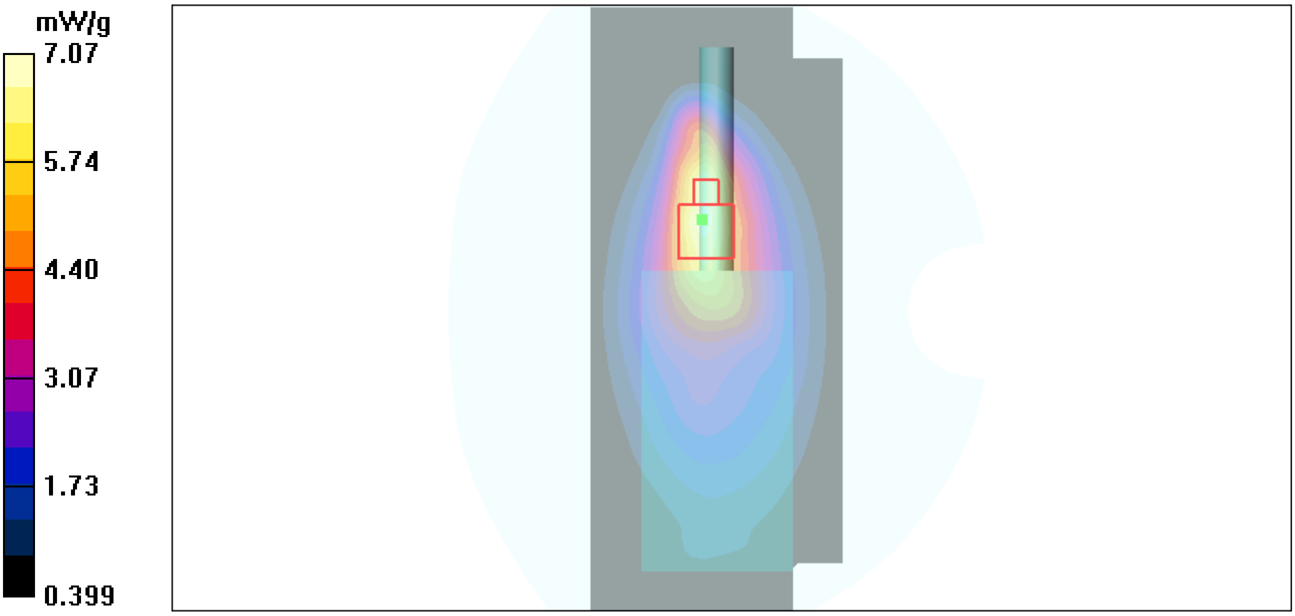



**Figure 24 Body-Worn for Digital, Front towards Ground 400.5 MHz**

## 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
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 ± 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 | 31-Mar-11 (No. 217-01372) | Apr-12 |
| Power sensor E4412A | MY41498087 | 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 |

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

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
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**S** Servizio svizzero di taratura
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**

## Glossary:

| | |
|---|---|
| TSL | tissue simulating liquid |
| NORMx,y,z | sensitivity in free space |
| ConvF | sensitivity in TSL / NORMx,y,z |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A, B, C | modulation dependent linearization parameters |
| 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 affect 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 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
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: 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 ≤ 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 EX3DV4

## SN:3816

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

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

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

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|---|---|---|---|
| Norm ($\mu V/(V/m)^2$)[A] | 0.48 | 0.56 | 0.61 | ± 10.1 % |
| DCP (mV)[B] | 99.8 | 102.2 | 102.1 | |

## Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc[E] (k=2) |
|---|---|---|---|---|---|---|---|---|
| 10000 | CW | 0.00 | X | 0.00 | 0.00 | 1.00 | 111.3 | ±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%.

[A] The uncertainties of NormX,Y,Z do not affect the $E^2$-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

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

| f (MHz) [C] | Relative Permittivity [F] | Conductivity (S/m) [F] | 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 % |

[C] 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.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) 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 (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

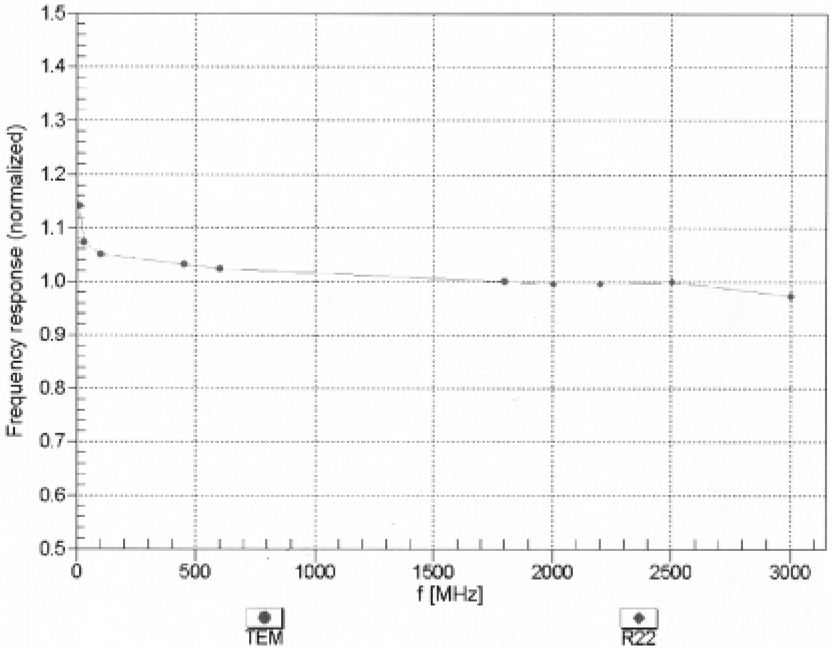
**Calibration Parameter Determined in Body Tissue Simulating Media**

| f (MHz) [C] | Relative Permittivity [F] | Conductivity (S/m) [F] | 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 % |

[C] 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.
[F] At frequencies below 3 GHz, the validity of tissue parameters ($\varepsilon$ 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 ($\varepsilon$ and $\sigma$) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

# Frequency Response of E-Field

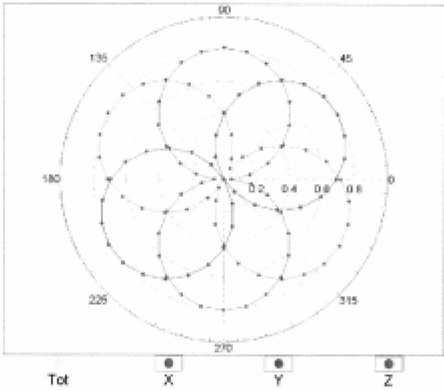
**(TEM-Cell:ifi110 EXX, Waveguide: R22)**



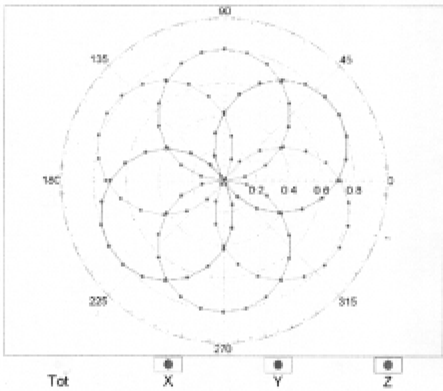

**Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)**

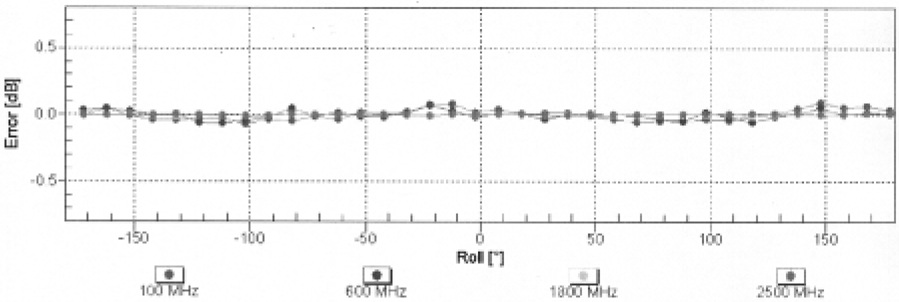
## Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



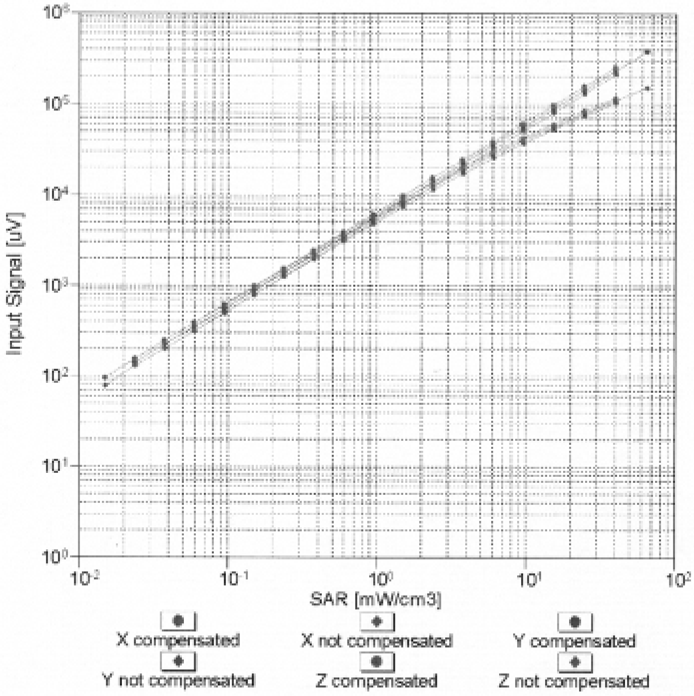

f=1800 MHz,R22

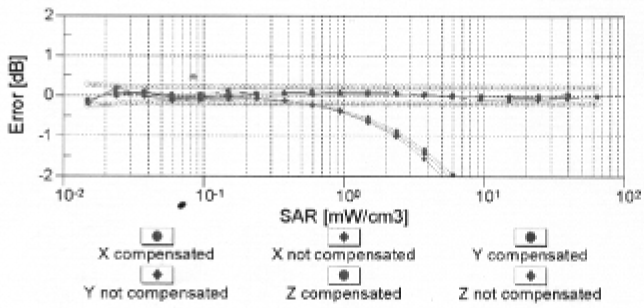



**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

## Dynamic Range f(SAR$_{head}$)
**(TEM cell , f = 900 MHz)**




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

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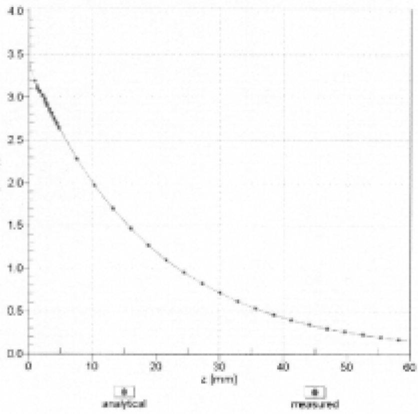
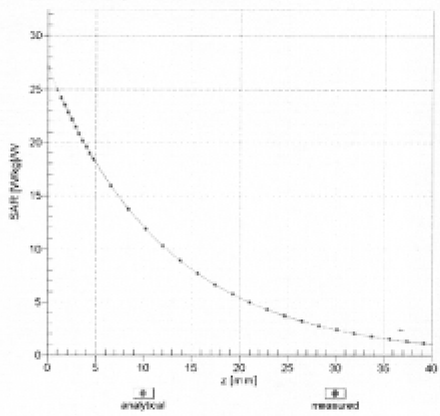
# Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

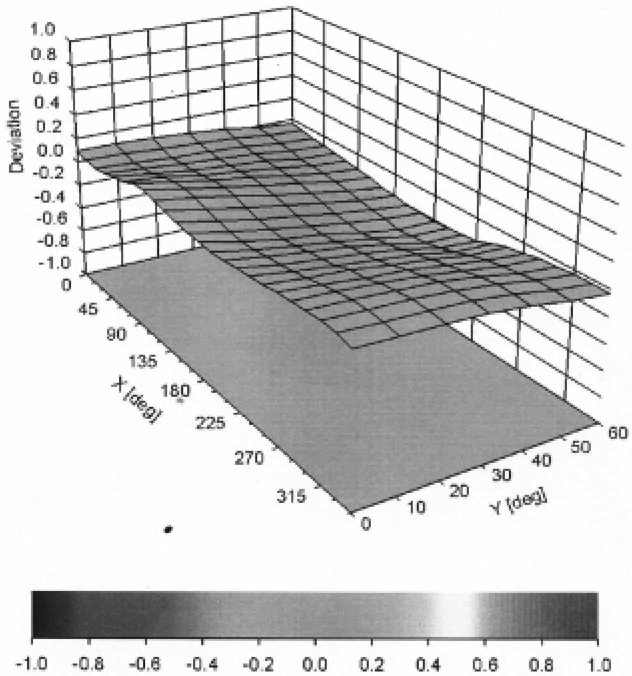



f = 1900 MHz,WGLS R22 (H_convF)




# Deviation from Isotropy in Liquid

**Error (ϕ, ϑ), f = 900 MHz**




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

# 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 |

# 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
C 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 ± 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 |

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

Issued: November 9, 2010