



Report No.: RZA2010-0812




# TEST REPORT

|              |  |
|--------------|--|
| Product Name | Two-Way Radio                                  |
| Model        | 289G   |
| FCC ID       | T4K-QZQX289G                                   |
| Client       | Qixiang Electron Science & Technology Co.,Ltd. |

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



## GENERAL SUMMARY

|                              |  |                   |              |
|------------------------------|--|-------------------|--------------|
| <b>Product Name</b>          | Two-Way Radio  | <b>Model</b>      | 289G         |
| <b>FCC ID</b>                | T4K-QZQX289G   | <b>Report No.</b> | RZA2010-0812 |
| <b>Client</b>                | Qixiang Electron Science & Technology Co.,Ltd.   |                   |              |
| <b>Manufacturer</b>          | Qixiang Electron Science & Technology 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>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>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> |                   |              |
| <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;"> <br/>             (Stamp)<br/> <b>Date of issue: Nov 26<sup>th</sup>, 2010</b> </div>  |                   |              |
| <b>Comment</b>               | The test result only responds to the measured sample.  |                   |              |

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## **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.

### **1.2. Testing laboratory**

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|------------|--|
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### 1.3. Applicant Information

Company: Qixiang Electron Science & Technology Co.,Ltd.  
Address: Qixiang Building, Tangxi Industrial Zone,Luojiang District,  
City: QuanZhou  
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Country: China  
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### 1.4. Manufacturer Information

Company: Qixiang Electron Science & Technology Co.,Ltd.  
Address: Qixiang Building, Tangxi Industrial Zone,Luojiang District,  
City: QuanZhou  
Postal Code: 362011  
Country: China  
Telephone: 013505942500  
Fax: 059522656927

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## 1.5. Information of EUT

### General information

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| Device type :                     | portable device                       |
| Exposure category:                | Controlled environment / Occupational |
| SN:                               | /                                     |
| Device operating configurations : |                                       |
| Operating mode(s):                | 400.025 – 479.975 MHz                 |
| Test Modulation:                  | FM                                    |
| Operating frequency range(s)      | transmitter frequency range           |
| UHF                               | 400.025MHz ~ 479.975MHz               |
| Test channel                      | 400.025MHz – 439.975MHz –479.975MHz   |
| Hardware version:                 | /                                     |
| Software version:                 | /                                     |
| Antenna type:                     | External antenna                      |

Equipment Under Test (EUT) is a Two-Way Radio with external antenna. SAR is tested for 400.025 - 479.975 MHz only.

The sample undergoing test was selected by the Client.

Components list please refer to documents of the manufacturer.

## 1.6. Test Date

The test is performed on Nov 24, 2010.

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

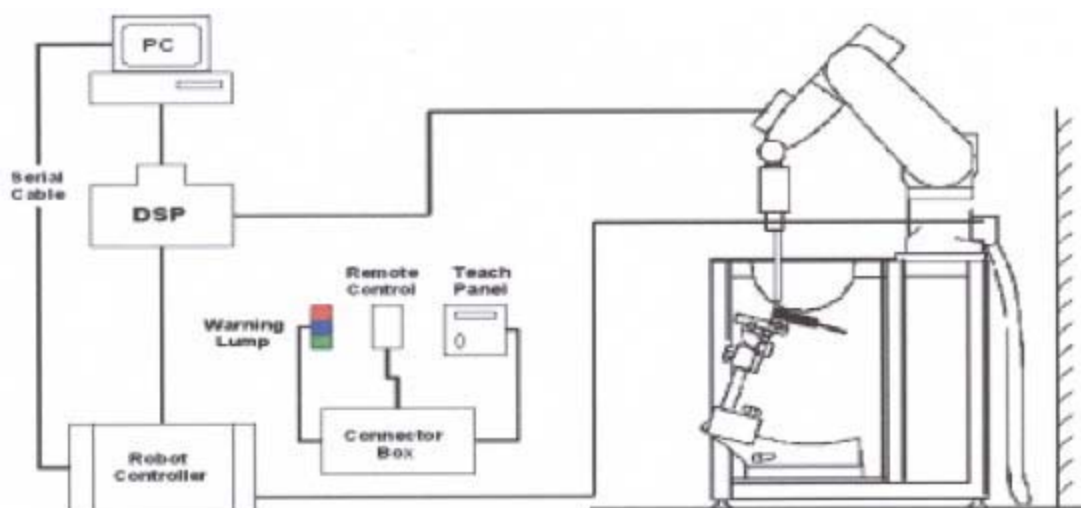
The spatial peak SAR values were assessed for the lowest, middle and highest channels defined by UHF (400.025MHz, 439.975MHz, and 479.975 MHz) systems UHF, Battery and accessories shall be those specified by the manufacturer. The battery shall be fully charged before each measurement and there shall be no external connections.

### 3. SAR Measurements System Configuration

#### 3.1. SAR Measurement Set-up

The DASY5 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 DASY5 measurement server.
- The DASY5 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
- DASY5 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**

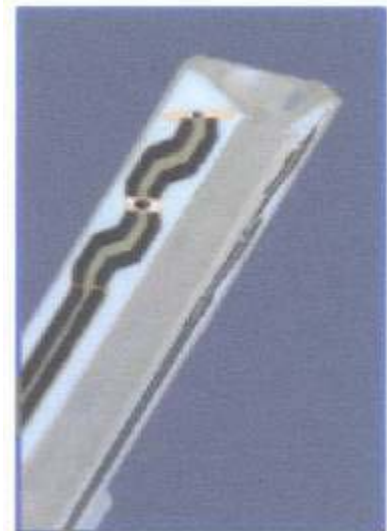


### 3.2. DASY5 E-field Probe System

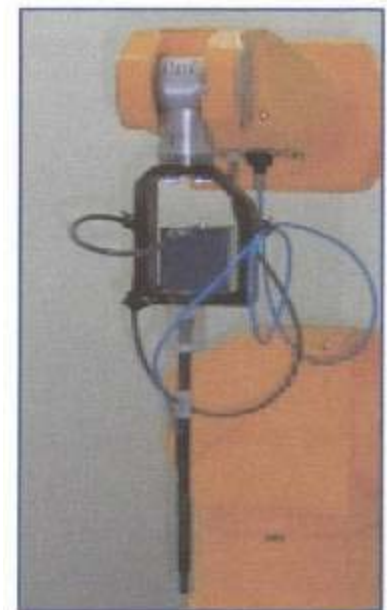
The SAR measurements were conducted with the dosimetric probe ET3DV6 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

#### 3.2.1. ET3DV6 Probe Specification

|                   |  |
|-------------------|--|
| Construction      | Symmetrical design with triangular core<br>Built-in optical fiber for surface detection<br>System (ET3DV6 only) Built-in shielding<br>against static charges PEEK enclosure<br>material (resistant to organic solvents,<br>e.q., glycol) |
| Calibration       | In air from 10 MHz to 3 GHz<br>In brain and muscle simulating tissue at<br>frequencies of 450MHz, 900MHz, 1750<br>MHz, 1950MHz and 2450 MHz.<br>(accuracy $\pm$ 8%)<br>Calibration for other liquids and<br>frequencies upon request     |
| Frequency         | 10 MHz to 2.5 GHz; Linearity: $\pm$ 0.2 dB<br>(30 MHz to 2.5 GHz)  |
| Directivity       | $\pm$ 0.2 dB in brain tissue<br>(rotation around probe axis)<br>$\pm$ 0.4 dB in brain tissue<br>(rotation around probe axis)   |
| Dynamic Range     | 5u W/g to > 100mW/g; Linearity: $\pm$ 0.2dB  |
| Surface Detection | $\pm$ 0.2 mm repeatability in air and clear<br>liquids over diffuse reflecting surface<br>(ET3DV6 only)  |
| Dimensions        | Overall length: 330mm<br>Tip length: 16mm<br>Body diameter: 12mm<br>Tip diameter: 6.8mm<br>Distance from probe tip to dipole<br>centers: 2.7mm   |
| Application       | General dosimetry up to 2.5GHz<br>Compliance tests of mobile phones<br>Fast automatic scanning in arbitrary<br>phantoms  |



**Figure 2 ET3DV6 E-field Probe**



**Figure 3 ET3DV6 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. Generic Twin Phantom**

### 3.4. Scanning procedure

The DASY5 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 DASY5 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 DASY5 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 DASY5 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 ".DA5". 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             | Norm <sub>i</sub> , a <sub>i0</sub> , a <sub>i1</sub> , a <sub>i2</sub> |
|                    | - Conversion factor       | ConvF <sub>i</sub>  |
|                    | - Diode compression point | Dcp <sub>i</sub>  |
| Device parameters: | - Frequency               | f   |
|                    | - Crest factor            | cf  |
| Media parameters:  | - Conductivity            | σ   |
|                    | - Density                 | ρ   |

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 DASY5 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.

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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.

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

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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 DASY5 system.

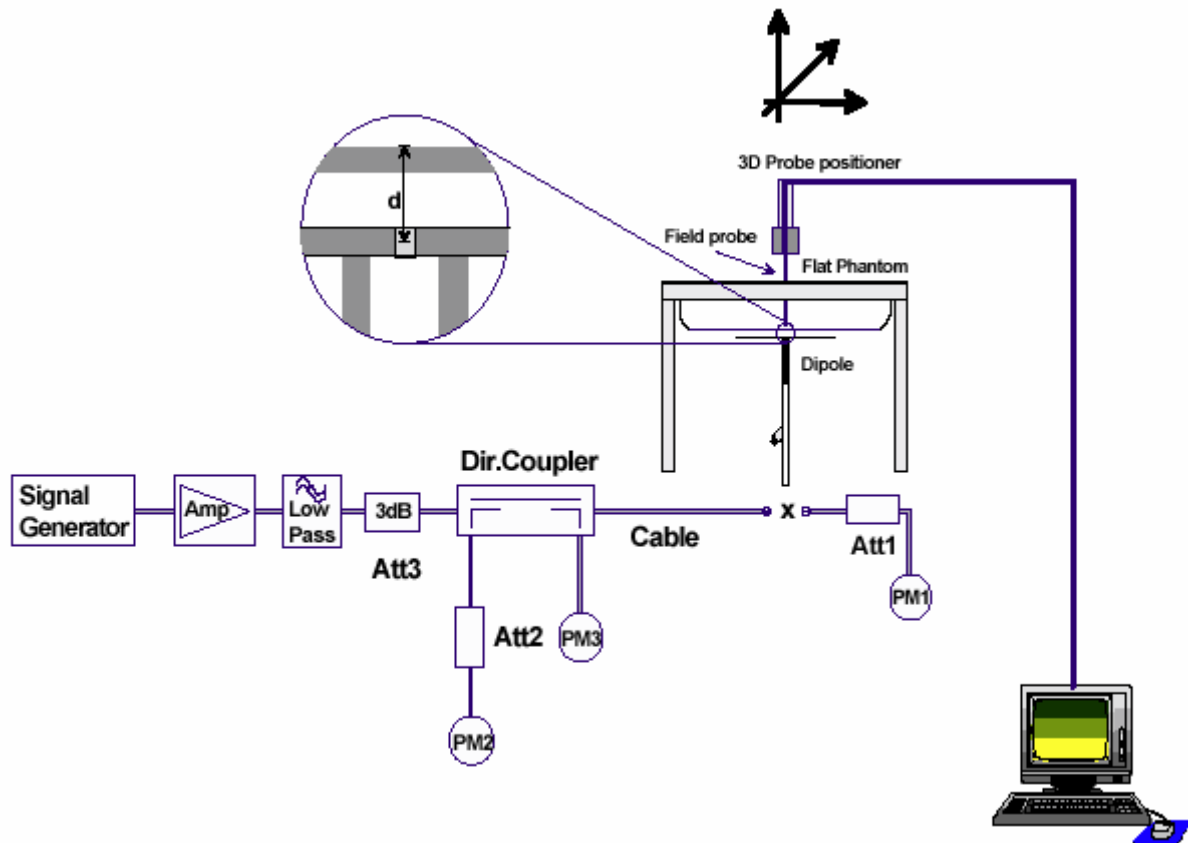


Figure 6. System Check Set-up



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### 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<br>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<br>Target Value | f=450MHz $\epsilon=56.7$ $\sigma=0.94$ |

## 4. Laboratory Environment

**Table 3: The Ambient Conditions during Test**

|   |                           |
|---|---------------------------|
| 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.

It specifies the maximum exposure limit of 8.0 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

### **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.

## 6. Conducted Output Power Measurement

### 6.1. Conducted Power Results

**Table 4: Conducted Power Measurement Results**

| <b>12.5 kHz</b>   | <b>Conducted Power</b> |            |            |
|-------------------|------------------------|------------|------------|
|                   | 400.025MHz             | 439.975MHz | 479.975MHz |
| Before test (dBm) | 37.16                  | 37.23      | 37.18      |
| After test (dBm)  | 37.22                  | 37.25      | 37.16      |
| <b>25 kHz</b>     | <b>Conducted Power</b> |            |            |
|                   | 400.025MHz             | 439.975MHz | 479.975MHz |
| Before test (dBm) | 37.21                  | 37.17      | 37.20      |
| After test (dBm)  | 37.18                  | 37.16      | 37.21      |

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## 7. Test Results

### 7.1. Dielectric Performance

Table 5: Dielectric Performance of Head Tissue Simulating Liquid

| Frequency        | Description                     | Dielectric Parameters  |                     | Temp<br>℃ |
|------------------|---------------------------------|------------------------|---------------------|-----------|
|                  |                                 | $\epsilon_r$           | $\sigma(s/m)$       |           |
| 450MHz<br>(head) | Target value<br>±5% window      | 43.50<br>41.33 — 45.68 | 0.87<br>0.83 — 0.91 | /         |
|                  | Measurement value<br>2010-11-24 | 44.75                  | 0.88                | 21.8      |

Table 6: Dielectric Performance of Body Tissue Simulating Liquid

| Frequency        | Description                     | Dielectric Parameters  |                     | Temp<br>℃ |
|------------------|---------------------------------|------------------------|---------------------|-----------|
|                  |                                 | $\epsilon_r$           | $\sigma(s/m)$       |           |
| 450MHz<br>(body) | Target value<br>±5% window      | 56.70<br>53.87 — 59.54 | 0.94<br>0.89 — 0.99 | /         |
|                  | Measurement value<br>2010-11-24 | 57.02                  | 0.94                | 21.9      |

### 7.2. System Check Results

Table 7: System Check for Head tissue stimulant

| Frequency | Description                      | SAR(W/kg)         |                     | Dielectric Parameters |               | Temp<br>℃ |
|-----------|----------------------------------|-------------------|---------------------|-----------------------|---------------|-----------|
|           |                                  | 10g               | 1g                  | $\epsilon_r$          | $\sigma(s/m)$ |           |
| 450MHz    | Recommended value<br>±10% window | 1.25<br>1.13—1.38 | 1.87<br>1.68 — 2.06 | 44.2                  | 0.86          | /         |
|           | Measurement value<br>2010-11-24  | 1.32              | 2.02                | 44.75                 | 0.88          | 21.9      |

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 stimulant

| Frequency | Description                      | SAR(W/kg)         |                     | Dielectric Parameters |               | Temp<br>℃ |
|-----------|----------------------------------|-------------------|---------------------|-----------------------|---------------|-----------|
|           |                                  | 10g               | 1g                  | $\epsilon_r$          | $\sigma(s/m)$ |           |
| 450MHz    | Recommended value<br>±10% window | 1.18<br>1.06—1.30 | 1.77<br>1.59 — 1.95 | 54.1                  | 0.90          | /         |
|           | Measurement value<br>2010-11-24  | 1.18              | 1.76                | 57.02                 | 0.94          | 21.9      |

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.

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### 7.3. Summary of Measurement Results

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

| Frequency  | Channel | 1 g Average     |       | Power Drift (dB) | Graph Results |
|--|---------|-----------------|-------|------------------|---------------|
|  |         | Limits 8.0 W/kg |       | ± 0.21           |               |
|  |         | Duty cycle      |       | Power            |               |
|  |         | 100%            | 50%   | Drift(dB)        |               |
| The EUT display towards phantom for 25KHz(Face Held)               |         |                 |       |                  |               |
| 479.975 MHz  | High    | 10.000          | 5.000 | -0.082           | Figure 9      |
| 439.975 MHz  | Middle  | 10.300          | 5.150 | 0.000            | Figure 10     |
| 400.025 MHz  | Low     | 11.200          | 5.600 | -0.041           | Figure 11     |
| The EUT display towards ground with belt clip for 25KHz(Body-Worn) |         |                 |       |                  |               |
| 497.975 MHz  | High    | 9.790           | 4.895 | -0.057           | Figure 12     |
| 439.975 MHz  | Middle  | 10.200          | 5.100 | 0.088            | Figure 13     |
| 400.025 MHz  | Low     | 11.200          | 5.600 | -0.007           | Figure 14     |
| Worst case of 25kHz for 12.5kHz                                    |         |                 |       |                  |               |
| 400.025 MHz  | Low     | 10.700          | 5.350 | -0.002           | Figure 15     |

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

| Frequency   | Channel | 1 g Average     |       | Power Drift (dB) | + Power Drift<br>10^(dB/10) | SAR 1g(W/kg)<br>(include +power drift) |       |
|---|---------|-----------------|-------|------------------|-----------------------------|--|-------|
|   |         | Limits 8.0 W/kg |       | ± 0.21           |                             | Duty cycle                             |       |
|   |         | Duty cycle      |       | Power Drift(dB)  |                             | Duty cycle                             |       |
|   |         | 100%            | 50%   |                  |                             |  |       |
| The EUT display towards phantom for 25KHz(Face Held)                |         |                 |       |                  |                             |  |       |
| 479.975 MHz   | High    | 10.000          | 5.000 | -0.082           | 0.981                       | 9.810                                  | 4.905 |
| 439.975 MHz   | Middle  | 10.300          | 5.150 | 0.000            | 1.000                       | 10.300                                 | 5.150 |
| 400.025 MHz   | Low     | 11.200          | 5.600 | -0.041           | 0.991                       | 11.099                                 | 5.550 |
| The EUT display towards ground with belt clip for 25kHz (Body-Worn) |         |                 |       |                  |                             |  |       |
| 479.975 MHz   | High    | 9.790           | 4.895 | -0.057           | 0.987                       | 9.663                                  | 4.831 |
| 439.975 MHz   | Middle  | 10.200          | 5.100 | 0.088            | 1.020                       | 10.404                                 | 5.202 |
| 400.025 MHz   | Low     | 11.200          | 5.600 | -0.007           | 0.998                       | 11.178                                 | 5.589 |
| Worst case of 25KHz for 12.5KHz                                     |         |                 |       |                  |                             |  |       |
| 400.025 MHz   | Low     | 10.700          | 5.350 | -0.002           | 1.000                       | 10.700                                 | 5.350 |

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.

#### **7.4. Conclusion**

Localized Specific Absorption Rate (SAR) of this portable wireless device has been measured in all cases requested by the relevant standards cited in Clause 5.2 of this report. Maximum localized SAR is **5.589 W/kg** that is below exposure limits specified in the relevant standards cited in Clause 5.1 of this test report.

[illegible]

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|  |  |  |     |   |            |      |      |          |
|--|--|--|-----|---|------------|------|------|----------|
| 20   | -phantom                                       | B  | 4.0 | R | $\sqrt{3}$ | 1    | 2.3  | $\infty$ |
| 21   | -liquid conductivity (deviation from target)   | B  | 5.0 | R | $\sqrt{3}$ | 0.64 | 1.8  | $\infty$ |
| 22   | -liquid conductivity (measurement uncertainty) | B  | 5.0 | N | 1          | 0.64 | 3.2  | $\infty$ |
| 23   | -liquid permittivity (deviation from target)   | B  | 5.0 | R | $\sqrt{3}$ | 0.6  | 1.7  | $\infty$ |
| 24   | -liquid permittivity (measurement uncertainty) | B  | 5.0 | N | 1          | 0.6  | 3.0  | $\infty$ |
| Combined standard uncertainty                      |  | $u_c = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$ |     |   |            |      | 12.0 |          |
| Expanded uncertainty (confidence interval of 95 %) |  | $u_e = 2u_c$                               |     | N | k=2        |      | 24.0 |          |

## 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 13, 2010       | One year     |
| 02  | Dielectric Probe Kit  | Agilent 85070E | US44020115    | No Calibration Requested |              |
| 03  | Power meter           | Agilent E4417A | GB41291714    | March 13, 2010           | One year     |
| 04  | Power sensor          | Agilent 8481H  | MY41091316    | March 26, 2010           | One year     |
| 05  | Signal Generator      | HP 8341B       | 2730A00804    | September 13, 2010       | One year     |
| 06  | Amplifier             | IXA-020        | 0401          | No Calibration Requested |              |
| 07  | E-field Probe         | ET3DV6         | 1737          | November 20, 2010        | One year     |
| 08  | DAE                   | DAE4           | 871           | November 11, 2010        | One year     |
| 09  | Validation Kit 450MHz | D450V3         | 1065          | November 9, 2010         | One year     |

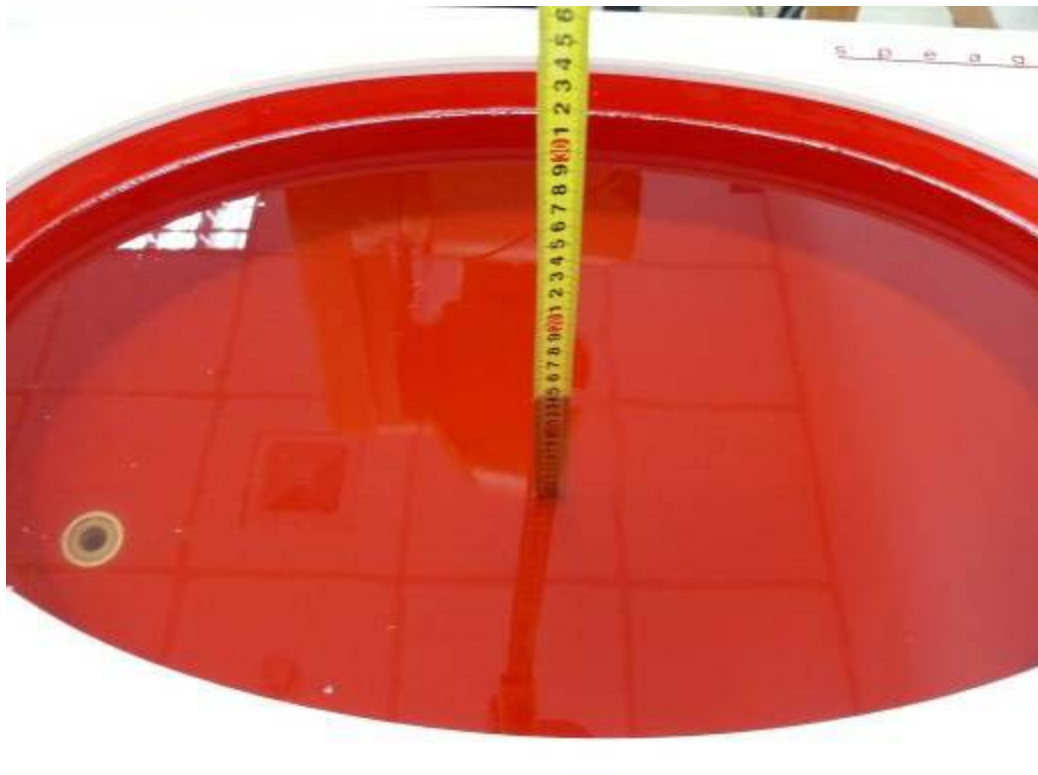
\*\*\*\*\*END OF REPORT BODY\*\*\*\*\*



## ANNEX A: Test Layout



Picture 1: Specific Absorption Rate Test Layout



Picture 2: Liquid depth in the Flat Phantom (450 MHz)  
(15.2cm deep)

## ANNEX B: System Check Results

### System Performance Check at 450 MHz Head

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

Date/Time: 11/24/2010 6:40:21 AM

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

Medium parameters used:  $f = 450 \text{ MHz}$ ;  $\sigma = 0.88 \text{ mho/m}$ ;  $\epsilon_r = 44.75$ ;  $\rho = 1000 \text{ kg/m}^3$

Probe: ET3DV6 - SN1737; ConvF(7.2, 7.2, 7.2) Calibrated: 11/20/2010;

Electronics: DAE4 Sn871; Calibrated: 11/11/2010

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

Reference Value = 52.2 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 3.29 W/kg

**SAR(1 g) = 2.02 mW/g; SAR(10 g) = 1.32 mW/g**

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

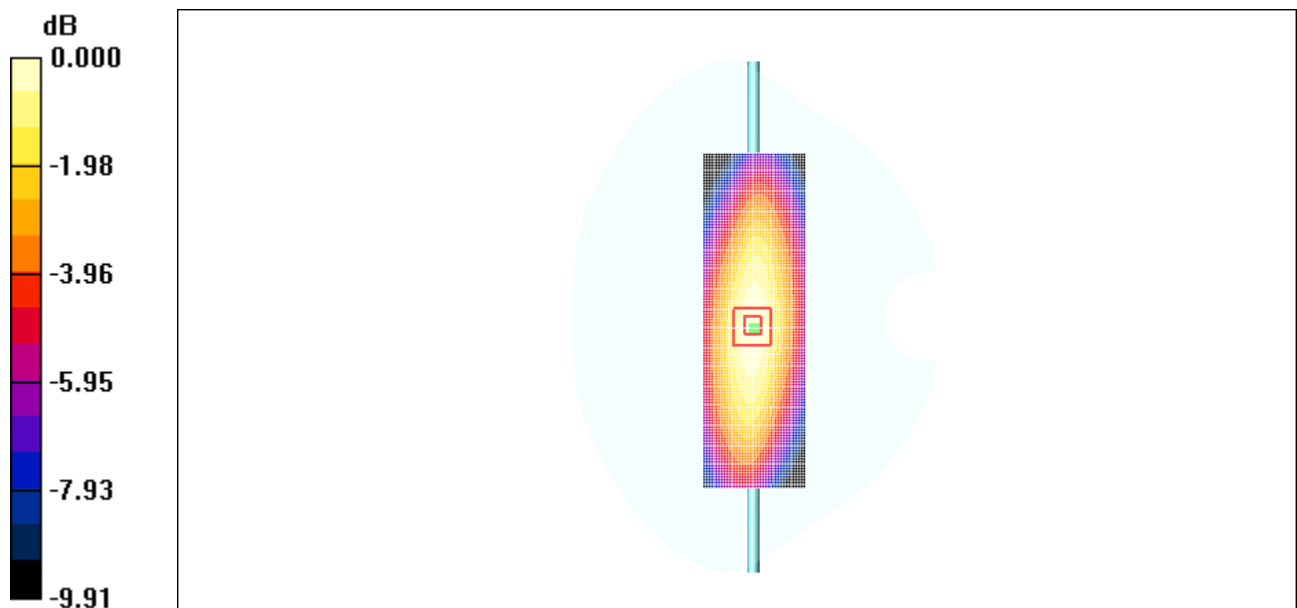


Figure 7 System Performance Check 450MHz 398mW

### System Performance Check at 450 MHz Body

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

Date/Time: 11/24/2010 7:41:21 AM

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

Medium parameters used:  $f = 450$  MHz;  $\sigma = 0.94$  mho/m;  $\epsilon_r = 57.02$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

DASY5 Configuration:

Probe: ET3DV6 - SN1737; ConvF(7.52, 7.52, 7.52) Calibrated: 11/20/2010;

Electronics: DAE4 Sn871; Calibrated: 11/11/2010

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

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

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

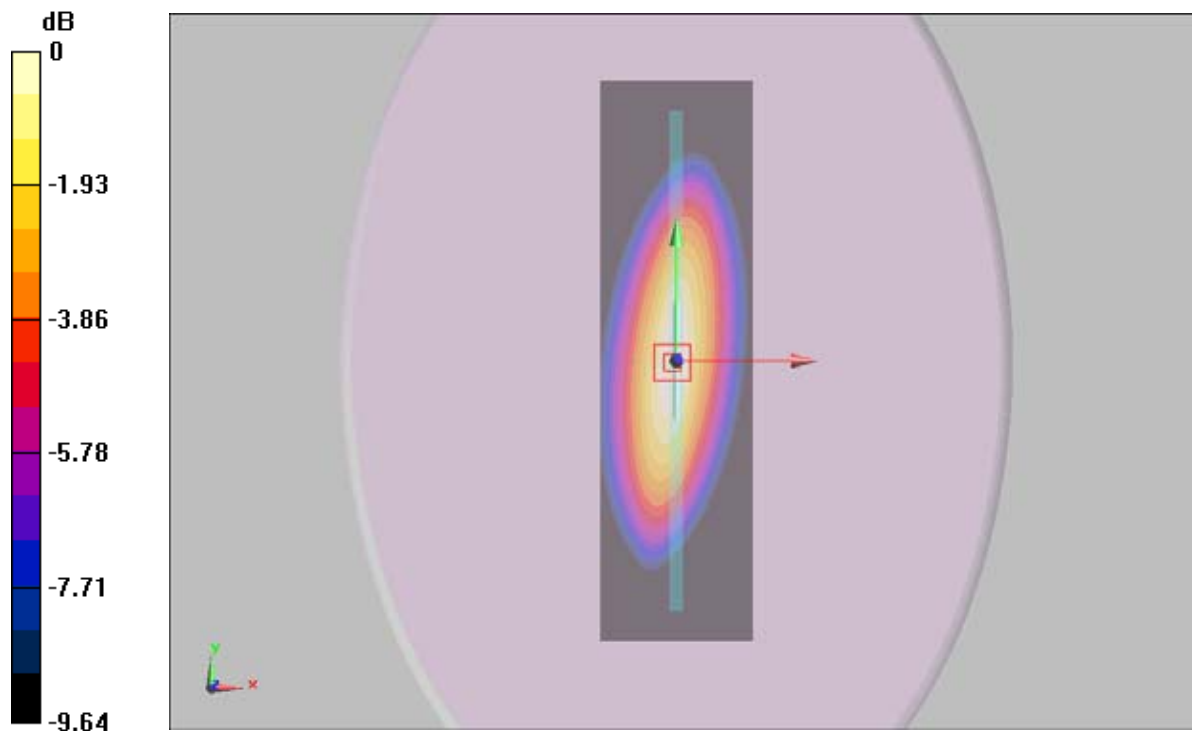
**d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 2.64 W/kg

**SAR(1 g) = 1.76 mW/g; SAR(10 g) = 1.18 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 for 25kHz, High

Date/Time: 11/24/2010 6:05:49 PM

Communication System: PTT 450; Frequency: 479.975 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 479.975 \text{ MHz}$ ;  $\sigma = 0.854 \text{ mho/m}$ ;  $\epsilon_r = 45.4$ ;  $\rho = 1000 \text{ kg/m}^3$

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

DASY5 Configuration:

Probe: ET3DV6 - SN1737; ConvF(7.2, 7.2, 7.2); Calibrated: 11/20/2010

Electronics: DAE4 Sn871; Calibrated: 11/11/2010

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Towards Phantom High/Area Scan (61x201x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $10.8 \text{ mW/g}$

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

Reference Value =  $109.4 \text{ V/m}$ ; Power Drift =  $-0.082 \text{ dB}$

Peak SAR (extrapolated) =  $14.9 \text{ W/kg}$

**SAR(1 g) =  $10 \text{ mW/g}$ ; SAR(10 g) =  $7.16 \text{ mW/g}$**

Maximum value of SAR (measured) =  $10.5 \text{ mW/g}$

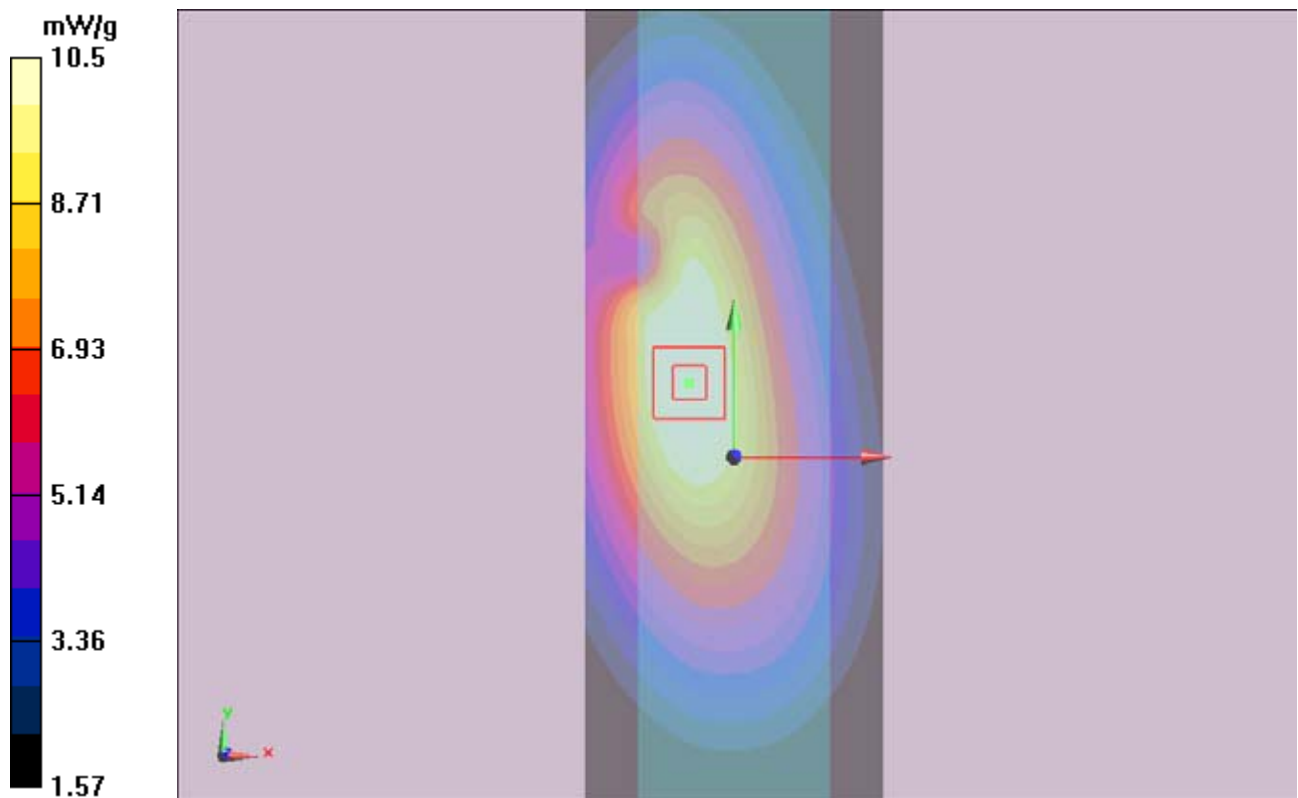


Figure 9 Face Held, Towards Phantom for 25KHz, 479.975 MHz

**Face Held, Front Towards Phantom for 25kHz, Middle**

Date/Time: 11/24/2010 9:18:26 AM

Communication System: PTT 450; Frequency: 439.975 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 439.975\text{MHz}$ ;  $\sigma = 0.846\text{ mho/m}$ ;  $\epsilon_r = 45.6$ ;  $\rho = 1000\text{ kg/m}^3$

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

DASY5 Configuration:

Probe: ET3DV6 - SN1737; ConvF(7.2, 7.2, 7.2); Calibrated: 11/20/2010

Electronics: DAE4 Sn871; Calibrated: 11/11/2010

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Towards Phantom Middle/Area Scan (61x201x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $10.8\text{ mW/g}$

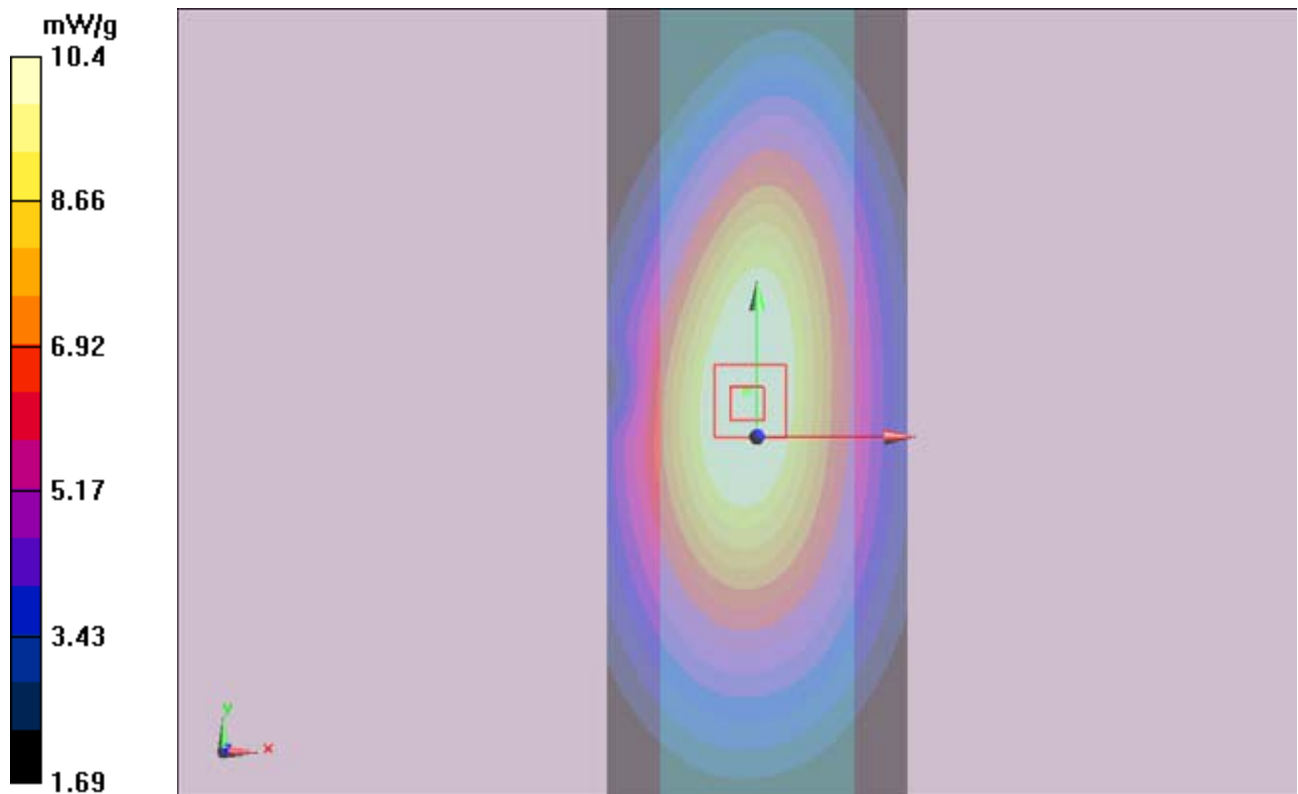
**Towards Phantom Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $115.4\text{ V/m}$ ; Power Drift =  $-0.000\text{ dB}$

Peak SAR (extrapolated) =  $26.6\text{ W/kg}$

**SAR(1 g) =  $10.3\text{ mW/g}$ ; SAR(10 g) =  $7.28\text{ mW/g}$**

Maximum value of SAR (measured) =  $10.4\text{ mW/g}$



**Figure 10 Face Held, Towards Phantom for 25KHz, 439.9750 MHz**

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### Face Held, Front Towards Phantom for 25kHz, Low

Date/Time: 11/24/2010 9:46:17 AM

Communication System: PTT 450; Frequency: 400.025 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 400.025 \text{ MHz}$ ;  $\sigma = 0.834 \text{ mho/m}$ ;  $\epsilon_r = 45.7$ ;  $\rho = 1000 \text{ kg/m}^3$

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

DASY5 Configuration:

Probe: ET3DV6 - SN1737; ConvF(7.2, 7.2, 7.2); Calibrated: 11/20/2010

Electronics: DAE4 Sn871; Calibrated: 11/11/2010

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Towards Phantom Low/Area Scan (61x201x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 12 mW/g

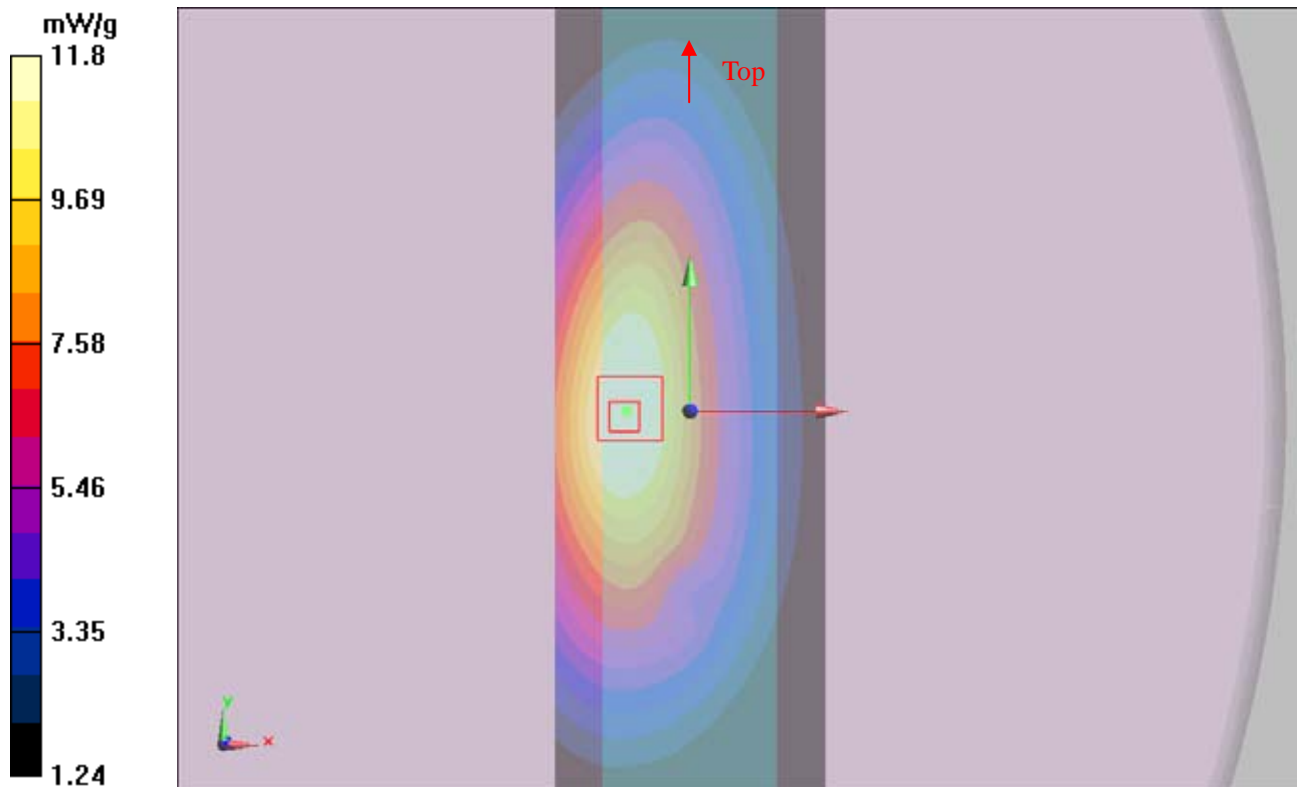
**Towards Phantom Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.0 V/m; Power Drift = -0.041 dB

Peak SAR (extrapolated) = 21.5 W/kg

**SAR(1 g) = 11.2 mW/g; SAR(10 g) = 8.04 mW/g**

Maximum value of SAR (measured) = 11.8 mW/g



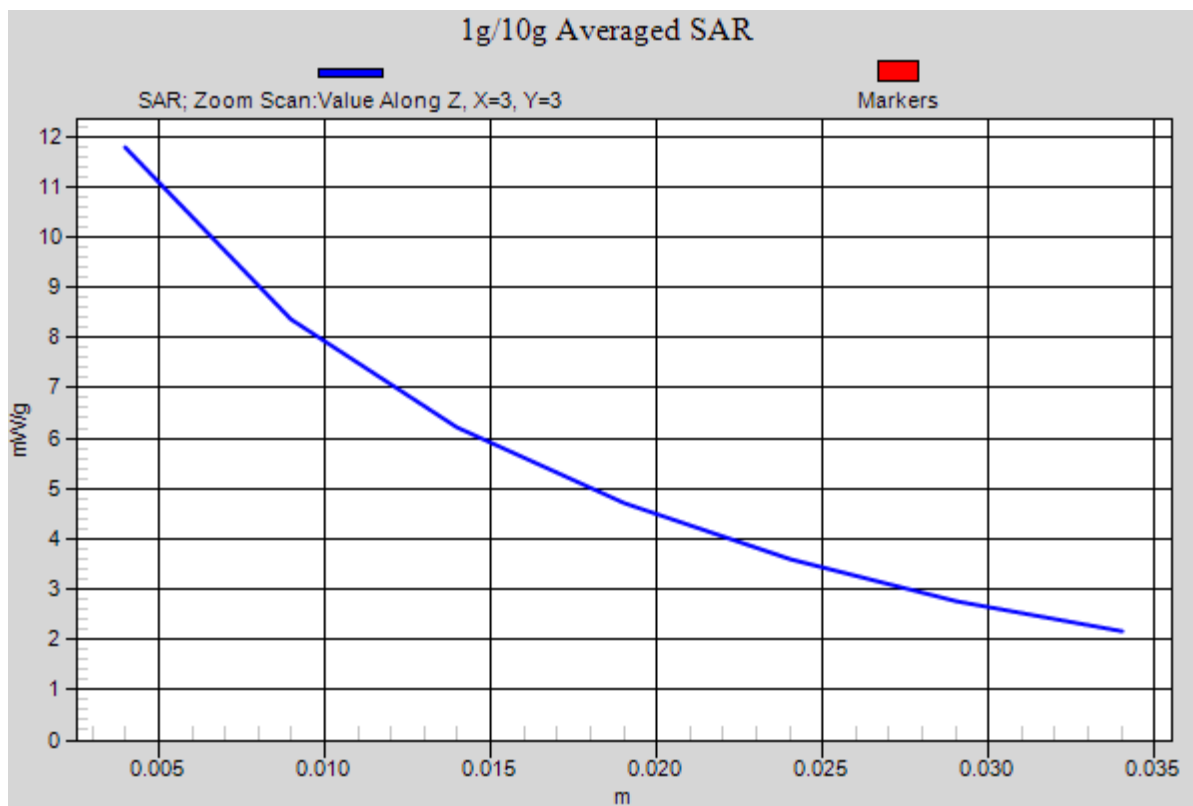


Figure 11 Face Held, Towards Phantom for 25kHz, 400.025 MHz

**Body-Worn, Front Towards Ground for 25kHz, Belt clip attach Phantom High**

Date/Time: 11/24/2010 5:36:38 PM

Communication System: PTT 450; Frequency: 479.975 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 479.975\text{ MHz}$ ;  $\sigma = 0.929\text{ mho/m}$ ;  $\epsilon_r = 57.4$ ;  $\rho = 1000\text{ kg/m}^3$

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

DASY5 Configuration:

Probe: ET3DV6 - SN1737; ConvF(7.52, 7.52, 7.52); Calibrated: 11/20/2010

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Towards Phantom High/Area Scan (61x201x1):** Measurement grid:  $dx=15\text{ mm}$ ,  $dy=15\text{ mm}$

Maximum value of SAR (interpolated) =  $10.9\text{ mW/g}$

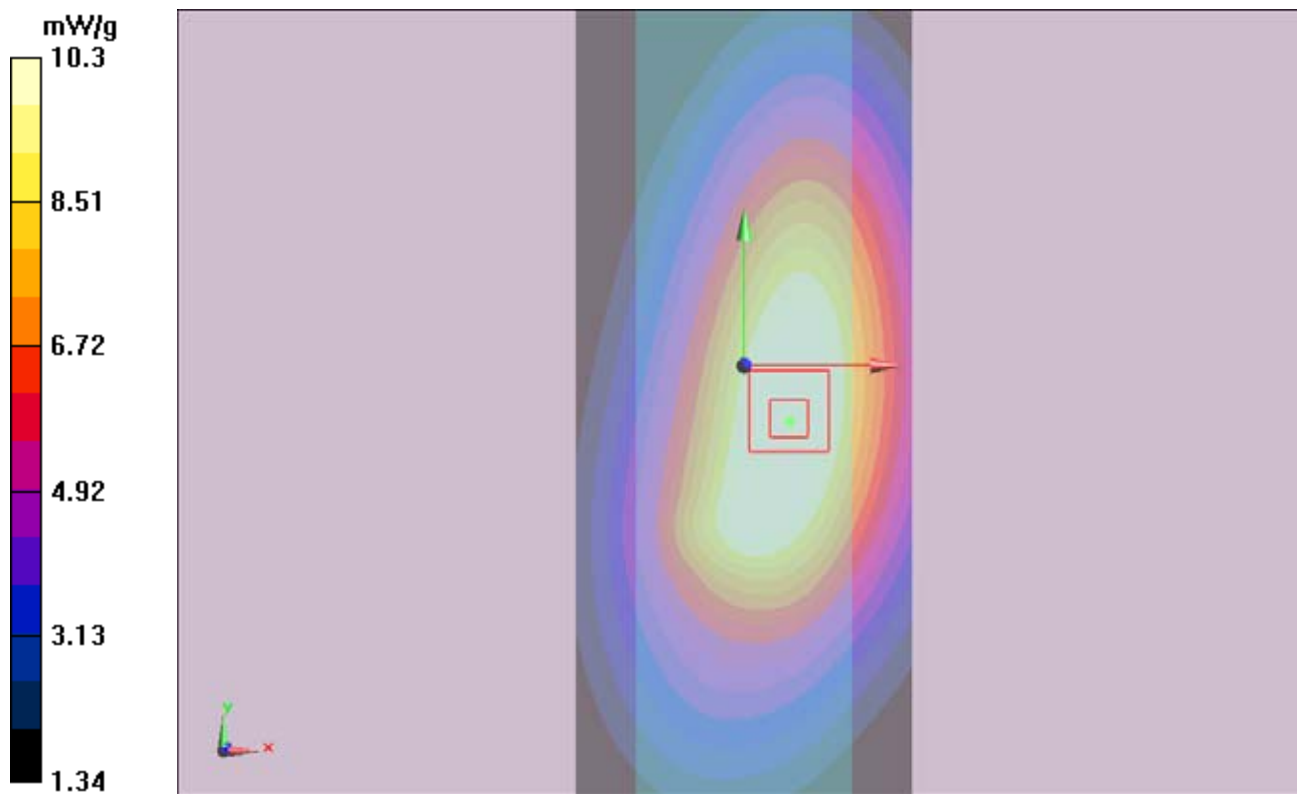
**Towards Phantom High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{ mm}$ ,  $dy=5\text{ mm}$ ,  $dz=5\text{ mm}$

Reference Value =  $106.0\text{ V/m}$ ; Power Drift =  $-0.057\text{ dB}$

Peak SAR (extrapolated) =  $14.6\text{ W/kg}$

**SAR(1 g) =  $9.79\text{ mW/g}$ ; SAR(10 g) =  $6.85\text{ mW/g}$**

Maximum value of SAR (measured) =  $10.3\text{ mW/g}$



**Figure 12 Body-Worn, Front Towards Ground for 25kHz, Belt clip attach Phantom 479.975MHz**



**Body-Worn, Front Towards Ground for 25KHz, Belt clip attach Phantom Middle**

Date/Time: 11/24/2010 10:34:19 AM

Communication System: PTT 450; Frequency: 439.975 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 439.975\text{MHz}$ ;  $\sigma = 0.918\text{ mho/m}$ ;  $\epsilon_r = 57.5$ ;  $\rho = 1000\text{ kg/m}^3$

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

DASY5 Configuration:

Probe: ET3DV6 - SN1737; ConvF(7.52, 7.52, 7.52); Calibrated: 11/20/2010

Electronics: DAE4 Sn871; Calibrated: 11/11/2010

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Towards Phantom Middle/Area Scan (61x201x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $11.5\text{ mW/g}$

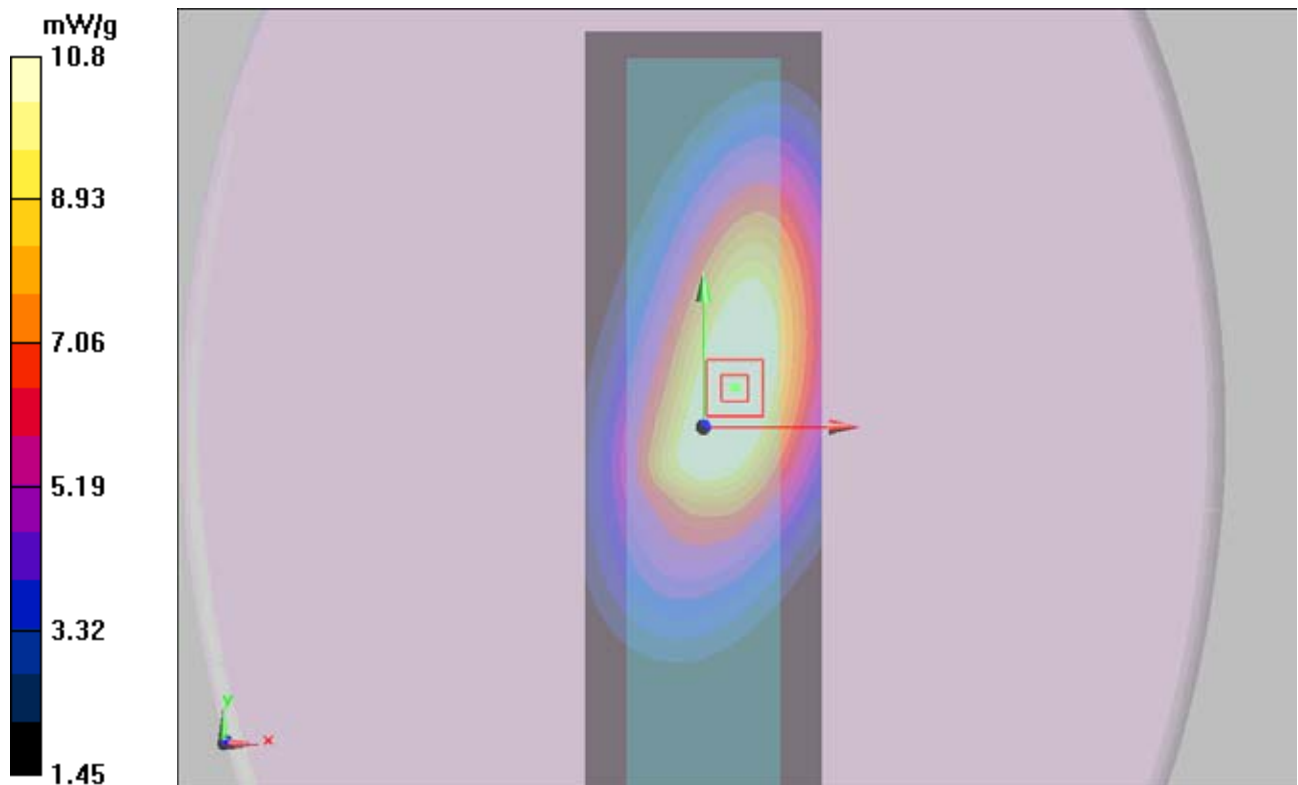
**Towards Phantom Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $94.8\text{ V/m}$ ; Power Drift =  $0.088\text{ dB}$

Peak SAR (extrapolated) =  $15.3\text{ W/kg}$

**SAR(1 g) =  $10.2\text{ mW/g}$ ; SAR(10 g) =  $7.24\text{ mW/g}$**

Maximum value of SAR (measured) =  $10.8\text{ mW/g}$



**Figure 13 Body-Worn, Front Towards Ground for 25KHz, Belt clip attach Phantom 439.975MHz**

**Body-Worn, Front Towards Ground for 25kHz, Belt clip attach Phantom Low**

Date/Time: 11/24/2010 11:52:12 AM

Communication System: PTT 450; Frequency: 400.025 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 400.025\text{MHz}$ ;  $\sigma = 0.906\text{ mho/m}$ ;  $\epsilon_r = 57.6$ ;  $\rho = 1000\text{ kg/m}^3$

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

DASY5 Configuration:

Probe: ET3DV6 - SN1737; ConvF(7.52, 7.52, 7.52); Calibrated: 11/20/2010

Electronics: DAE4 Sn871; Calibrated: 11/11/2010

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Towards Phantom Low/Area Scan (61x201x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $11.6\text{ mW/g}$

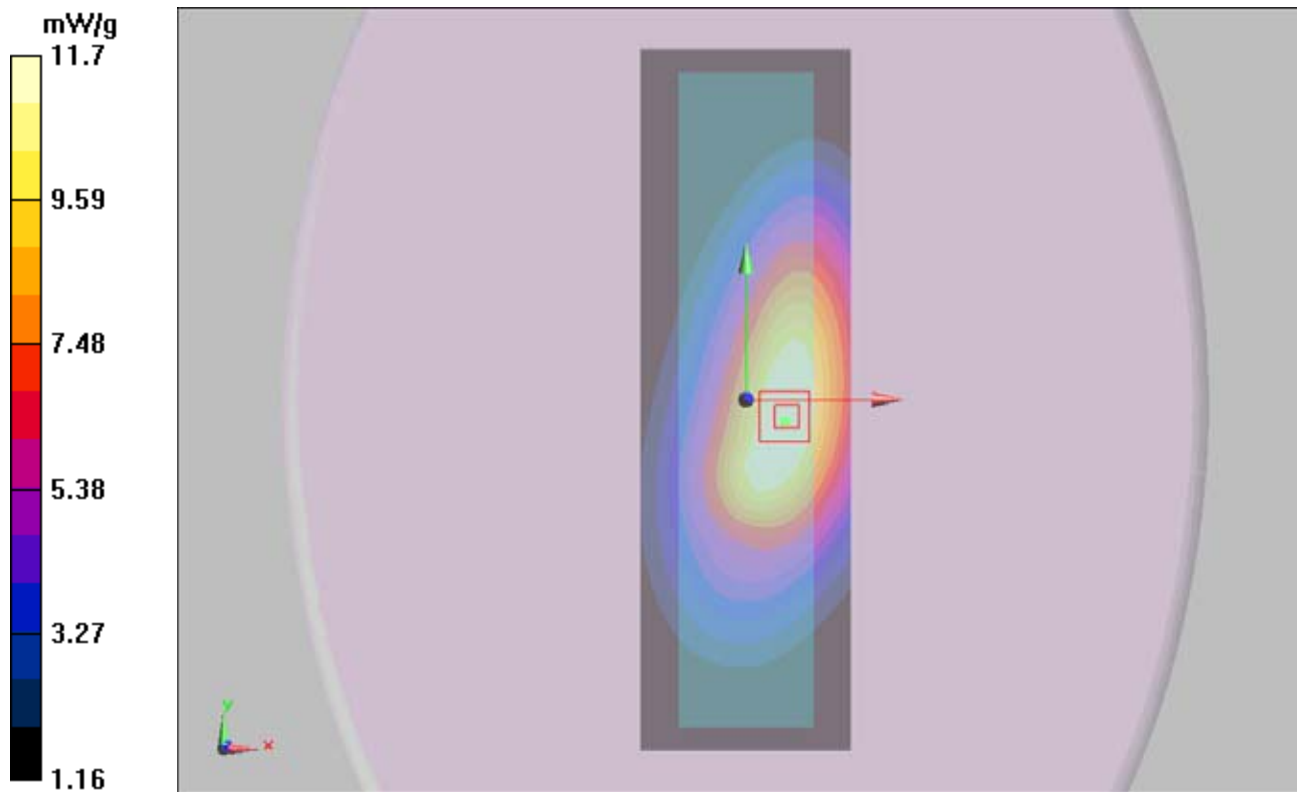
**Towards Phantom Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $100.2\text{ V/m}$ ; Power Drift =  $-0.007\text{ dB}$

Peak SAR (extrapolated) =  $16.6\text{ W/kg}$

**SAR(1 g) =  $11.2\text{ mW/g}$ ; SAR(10 g) =  $7.9\text{ mW/g}$**

Maximum value of SAR (measured) =  $11.7\text{ mW/g}$



**Figure 14 Body-Worn, Front Towards Ground for 25KHz, Belt clip attach Phantom 400.025MHz**

**Face Held, Front Towards Phantom for 12.5kHz, Low**

Date/Time: 11/24/2010 11:11:56 AM

Communication System: PTT 450; Frequency: 400.025 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 400.025\text{MHz}$ ;  $\sigma = 0.834\text{ mho/m}$ ;  $\epsilon_r = 45.7$ ;  $\rho = 1000\text{ kg/m}^3$

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

DASY5 Configuration:

Probe: ET3DV6 - SN1737; ConvF(7.2, 7.2, 7.2); Calibrated: 11/20/2010

Electronics: DAE4 Sn871; Calibrated: 11/11/2010

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Towards Phantom Low/Area Scan (61x201x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $11.5\text{ mW/g}$

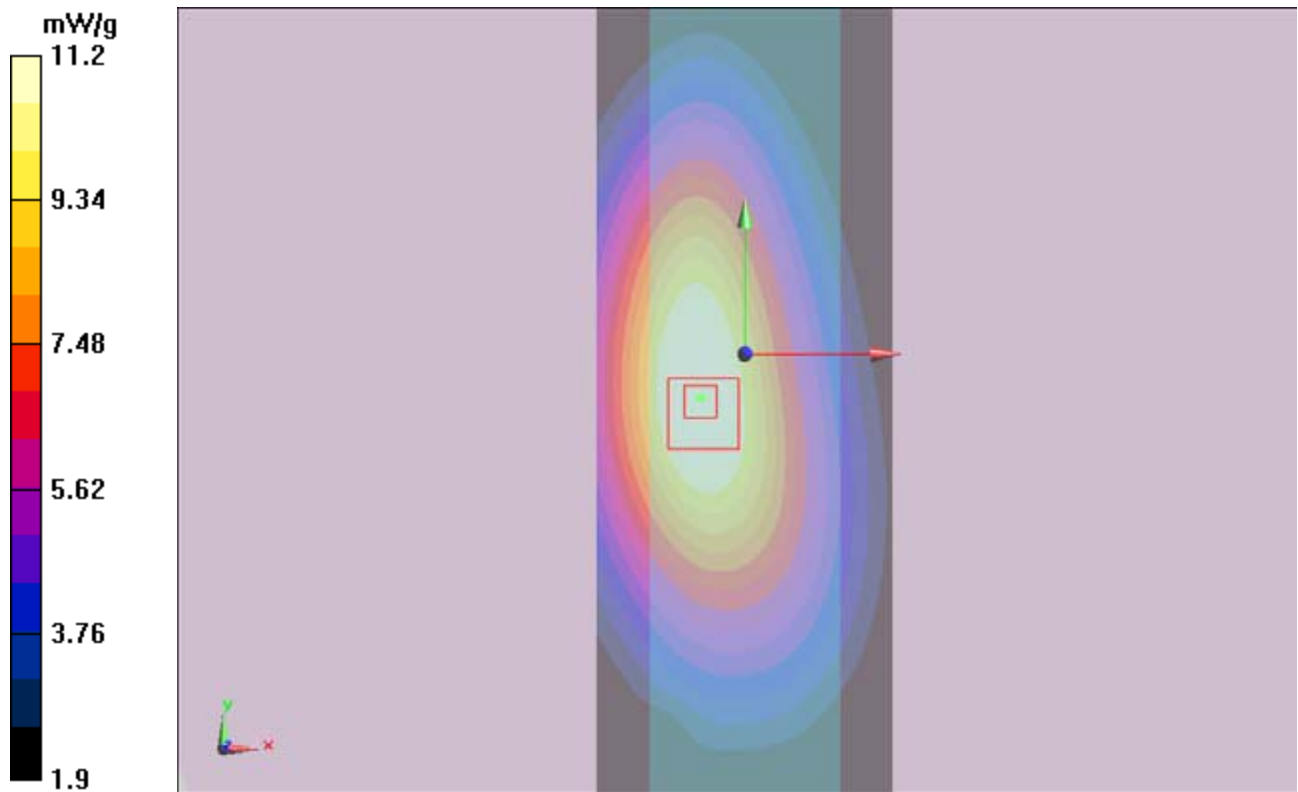
**Towards Phantom Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $109.7\text{ V/m}$ ; Power Drift =  $-0.002\text{ dB}$

Peak SAR (extrapolated) =  $15.3\text{ W/kg}$

**SAR(1 g) =  $10.7\text{ mW/g}$ ; SAR(10 g) =  $7.78\text{ mW/g}$**

Maximum value of SAR (measured) =  $11.2\text{ mW/g}$



**Figure 15 Face Held, Towards Phantom for 12.5 KHz, 400.025 MHz**

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ANNEX D: Probe Calibration Certificate



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E-mail: Info@emcite.com Http://www.emcite.com

Client **TA**

Certificate No: **ET3-1737\_Nov10**

**CALIBRATION CERTIFICATE**

Object **ET3DV6 - SN: 1737**

Calibration Procedure(s) **TMC-XZ-01-028  
Calibration procedure for dosimetric E-field probes**

Calibration date: **November 20, 2010**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards      | SN.        | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|------------------------|------------|---|-----------------------|
| Power Meter NRVD       | 101253     | 18-Jun-10 (TMC, No.JZ09-248)              | Jun-11                |
| Power sensor NRV-Z5    | 100333     | 18-Jun-10 (TMC, No. JZ08-248)             | Jun-11                |
| Reference Probe EX3DV4 | SN 3631    | 13-Dec-08(TMC, No.EX3-3631_Dec08)         | Dec-10                |
| DAE4                   | SN 777     | 09-Jul-10(TMC, No.DAE4-777_Jul09)         | Jul-11                |
| RF generator E4438C    | MY45092879 | 17-Jun-10(TMC, No.JZ09-302)               | Jun-11                |
| Network Analyzer 8753E | US38433212 | 02-Aug-10(TMC, No.JZ09-056)               | Aug-11                |

Calibrated by:

| Name    | Function          | Signature   |
|---------|-------------------|---|
| Lin Hao | SAR Test Engineer |  |

Reviewed by:

| Name        | Function           | Signature   |
|-------------|--------------------|---|
| Qi Dianyuan | SAR Project Leader |  |

Approved by:

| Name        | Function                          | Signature   |
|-------------|-----------------------------------|---|
| Lu Bingsong | Deputy Director of the laboratory |  |

Issued: November 20, 2010

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

Certificate No: ET3-1737\_Nov10

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### Glossary:

|                       |  |
|-----------------------|--|
| TSL                   | tissue simulating liquid   |
| NORM <sub>x,y,z</sub> | sensitivity in free space  |
| ConF                  | sensitivity in TSL / NORM <sub>x,y,z</sub>   |
| DCP                   | diode compression point  |
| Polarization $\phi$   | $\phi$ 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 300MHz to 3GHz)", February 2005

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>: Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900\text{MHz}$  in TEM-cell;  $f > 1800\text{MHz}$ : waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the  $E^2$ -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 (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800\text{MHz}$ ) and inside waveguide using analytical field distributions based on power measurements for  $f > 800\text{MHz}$ . The same setups are used for assessment of the parameters applied for boundary compensation (alpha,depth) of which typical uncertainty valued 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  $\pm 50\text{MHz}$  to  $\pm 100\text{MHz}$ .
- 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.

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### DASY – Parameters of Probe: ET3DV6 SN:1737

#### Sensitivity in Free Space<sup>A</sup>

#### Diode Compression<sup>B</sup>

|       |              |                 |       |      |
|-------|--------------|-----------------|-------|------|
| NormX | 1.42 ± 10.1% | $\mu V/(V/m)^2$ | DCP X | 93mV |
| NormY | 1.68 ± 10.1% | $\mu V/(V/m)^2$ | DCP Y | 94mV |
| NormZ | 1.63 ± 10.1% | $\mu V/(V/m)^2$ | DCP Z | 85mV |

#### Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8

#### Boundary Effect

TSL 900MHz Typical SAR gradient: 5% per mm

|  |        |        |
|--|--------|--------|
| Sensor Center to Phantom Surface Distance          | 3.7 mm | 4.7 mm |
| SAR <sub>be</sub> [%] Without Correction Algorithm | 10.7   | 6.9    |
| SAR <sub>be</sub> [%] With Correction Algorithm    | 0.3    | 0.4    |

TSL 1750MHz Typical SAR gradient: 10% per mm

|  |        |        |
|--|--------|--------|
| Sensor Center to Phantom Surface Distance          | 3.7 mm | 4.7 mm |
| SAR <sub>be</sub> [%] Without Correction Algorithm | 12.5   | 8.4    |
| SAR <sub>be</sub> [%] With Correction Algorithm    | 0.8    | 0.5    |

#### Sensor Offset

Probe Tip to Sensor Center 2.7 mm

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

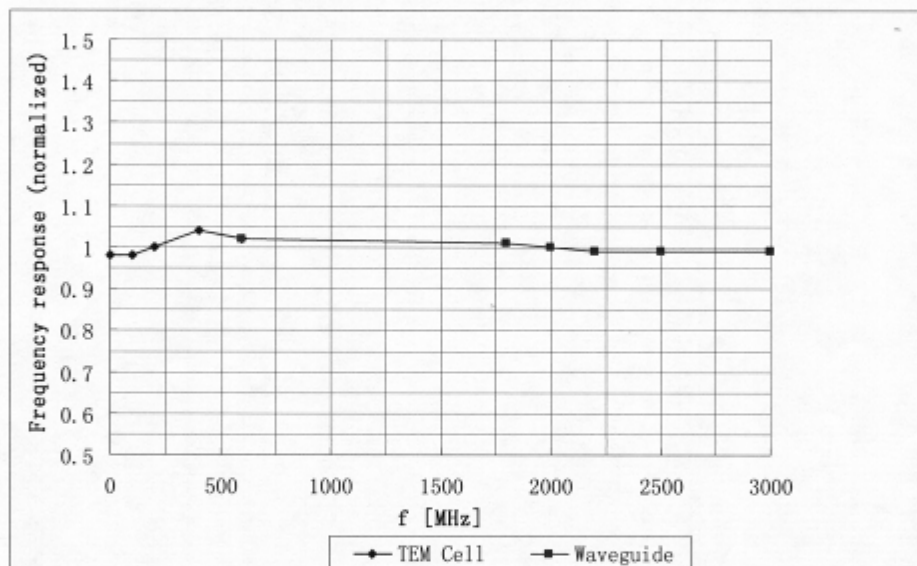
<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

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



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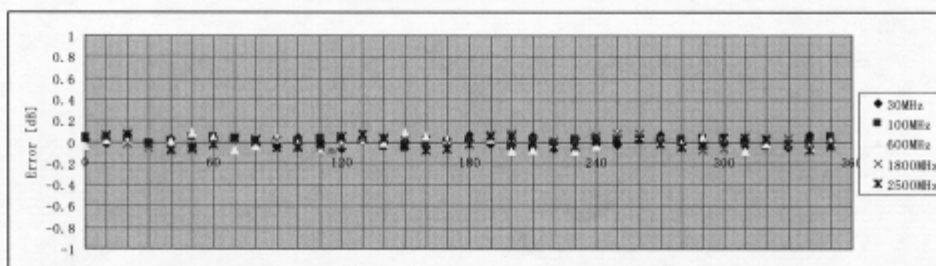
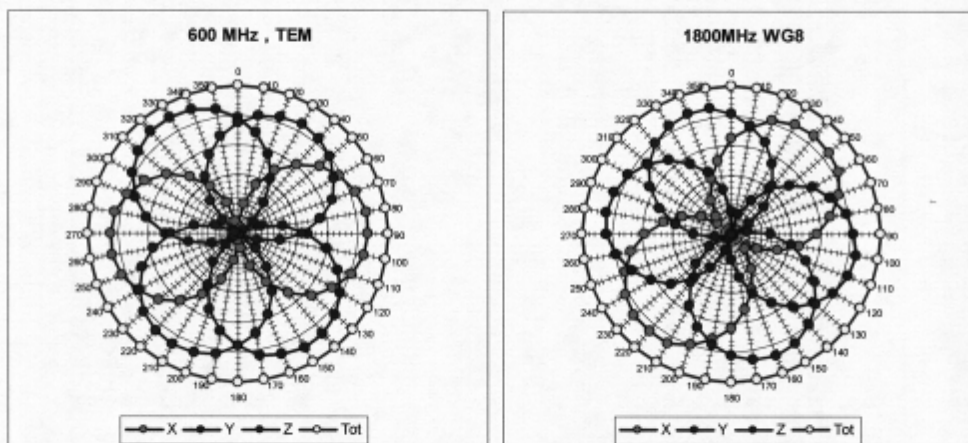
## Frequency Response of E-Field



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

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

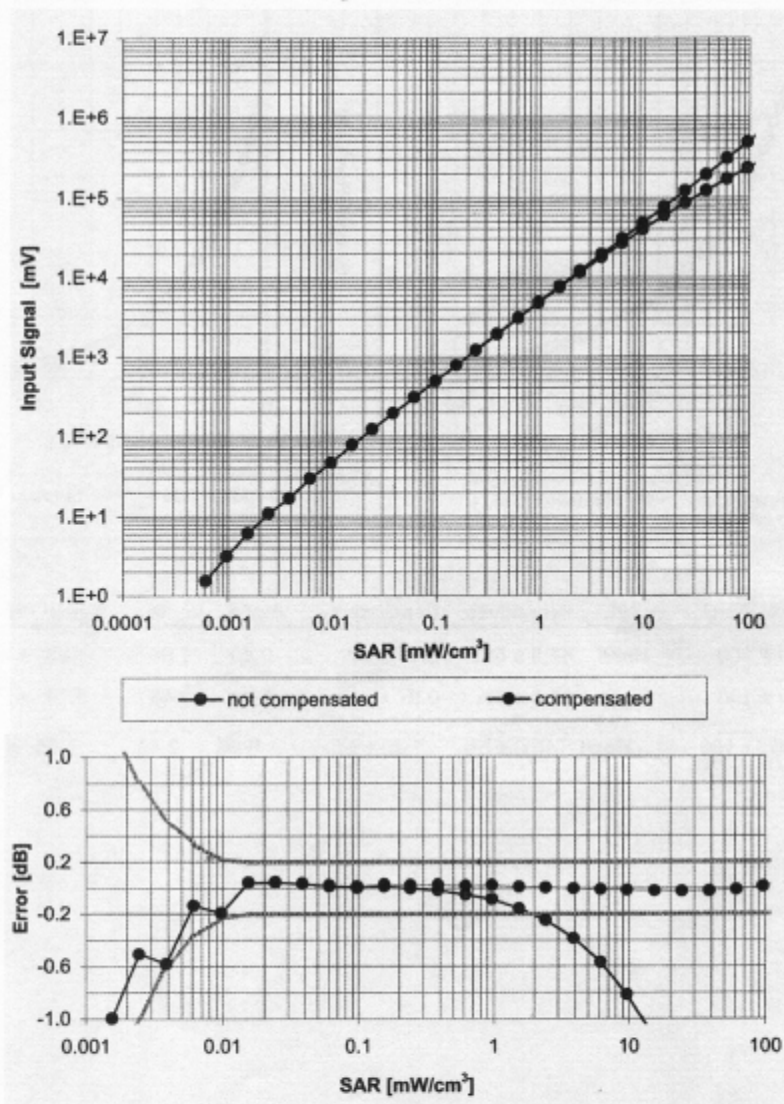


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )



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E-mail: Info@emcite.com Http://www.emcite.com

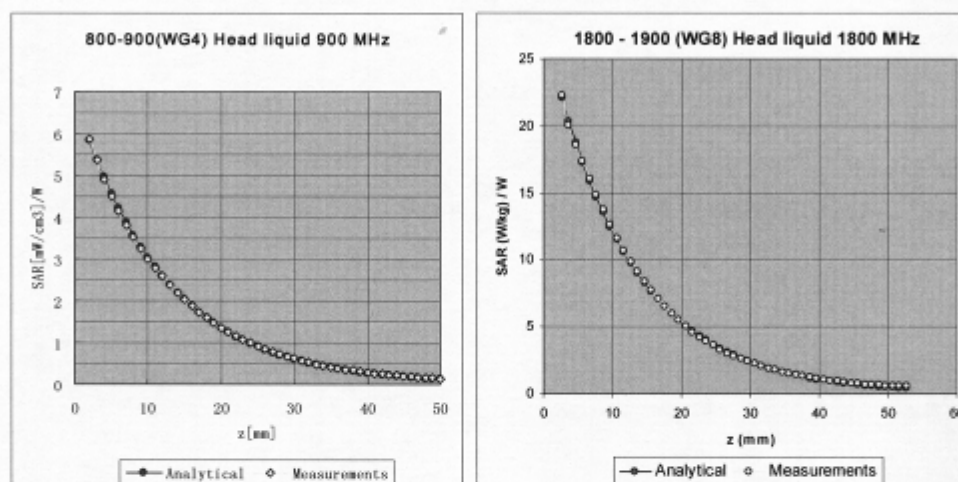
### Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide: WG8, $f = 1800 \text{ MHz}$ )



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

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## Conversion Factor Assessment



| f[MHz] | Validity[MHz] <sup>C</sup> | TSL  | Permittivity | Conductivity | Alpha | Depth | ConvF | Uncertainty  |
|--------|----------------------------|------|--------------|--------------|-------|-------|-------|--------------|
| 450    | ±50 / ±100                 | Head | 43.5±5%      | 0.87±5%      | 0.36  | 1.84  | 7.20  | ±13.3% (k=2) |
| 835    | ±50 / ±100                 | Head | 41.5±5%      | 0.90±5%      | 0.25  | 3.53  | 6.33  | ±11.0% (k=2) |
| 900    | ±50 / ±100                 | Head | 41.5±5%      | 0.97±5%      | 0.27  | 3.53  | 6.14  | ±11.0% (k=2) |
| 1750   | ±50 / ±100                 | Head | 40.0±5%      | 1.37±5%      | 0.56  | 2.77  | 5.35  | ±11.0% (k=2) |
| 1950   | ±50 / ±100                 | Head | 40.0±5%      | 1.40±5%      | 0.57  | 2.72  | 4.89  | ±11.0% (k=2) |
| 2450   | ±50 / ±100                 | Head | 39.2±5%      | 1.80±5%      | 0.51  | 1.60  | 4.39  | ±11.0% (k=2) |
|        |                            |      |              |              |       |       |       |              |
| 450    | ±50 / ±100                 | Body | 56.7±5%      | 0.94±5%      | 0.27  | 1.80  | 7.52  | ±13.3% (k=2) |
| 835    | ±50 / ±100                 | Body | 55.2±5%      | 0.97±5%      | 0.36  | 2.75  | 6.14  | ±11.0% (k=2) |
| 900    | ±50 / ±100                 | Body | 55.0±5%      | 1.05±5%      | 0.43  | 2.51  | 5.98  | ±11.0% (k=2) |
| 1750   | ±50 / ±100                 | Body | 53.4±5%      | 1.49±5%      | 0.99  | 1.74  | 4.84  | ±11.0% (k=2) |
| 1950   | ±50 / ±100                 | Body | 53.3±5%      | 1.52±5%      | 0.99  | 1.50  | 4.60  | ±11.0% (k=2) |
| 2450   | ±50 / ±100                 | Body | 52.7±5%      | 1.95±5%      | 0.98  | 1.42  | 3.91  | ±11.0% (k=2) |

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

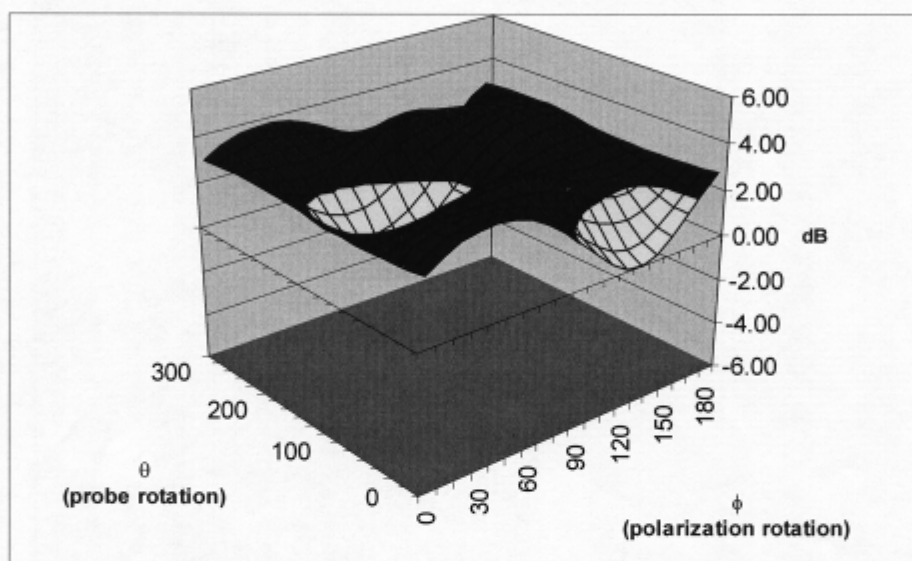
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**Deviation from Isotropy**  
**Error (  $\phi$ ,  $\theta$  ),  $f = 900$  MHz**



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

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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_Jul09)            | Jul-11                |
| DAE4                        | SN: 654            | 04-May-10 (No. DAE4-654_May09)            | May-11                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| RF generator HP 8648C     | US3642U01700     | 04-Aug-10 (in house check Oct-10) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-10 (in house check Oct-10) | In house check: Oct-10 |

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

Issued: November 9, 2010

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**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  
**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**

### 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.

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## Test Report

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### Measurement Conditions

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

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

### Head TSL parameters

The following parameters and calculations were applied.

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

### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | 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> |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | 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> |



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### 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

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### 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: 03.07.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 04.05.2009
- 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 (41x11x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 1.99 mW/g

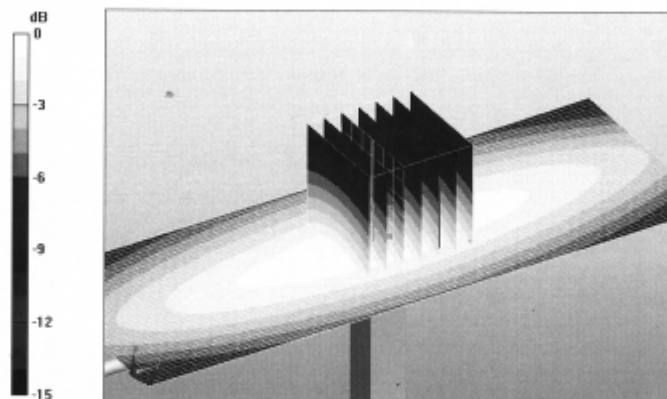
**Pin=398mW /d=15mm /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

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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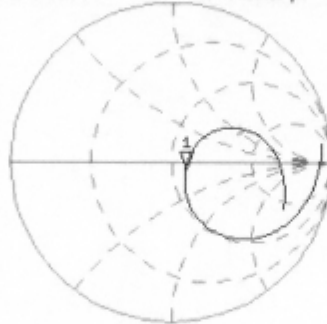
Impedance Measurement Plot for Head TSL

9 Nov 2009 10:19:27  
[CH1] S11 1 U FS 1: 59.156  $\Omega$  -4.8770  $\Omega$  72.520 pF 450.000 000 MHz

\*  
De1

Cor

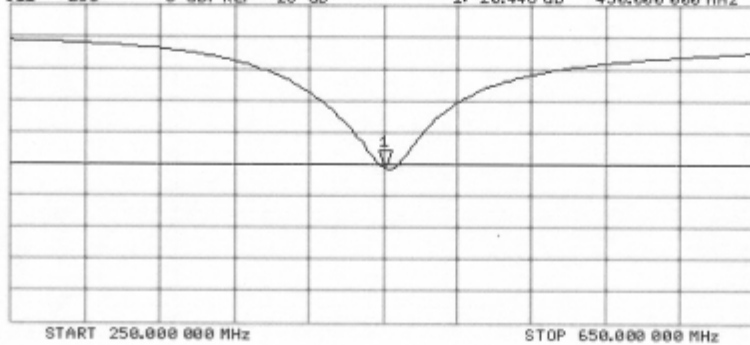
Avg  
16



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: 03.07.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 04.05.2009
- 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

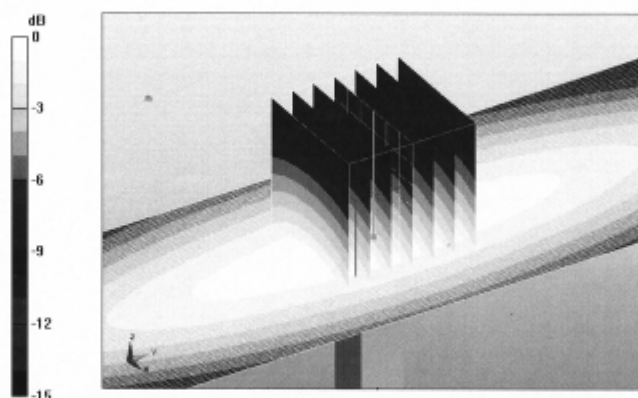
**Pin=398mW /d=15mm, /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

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



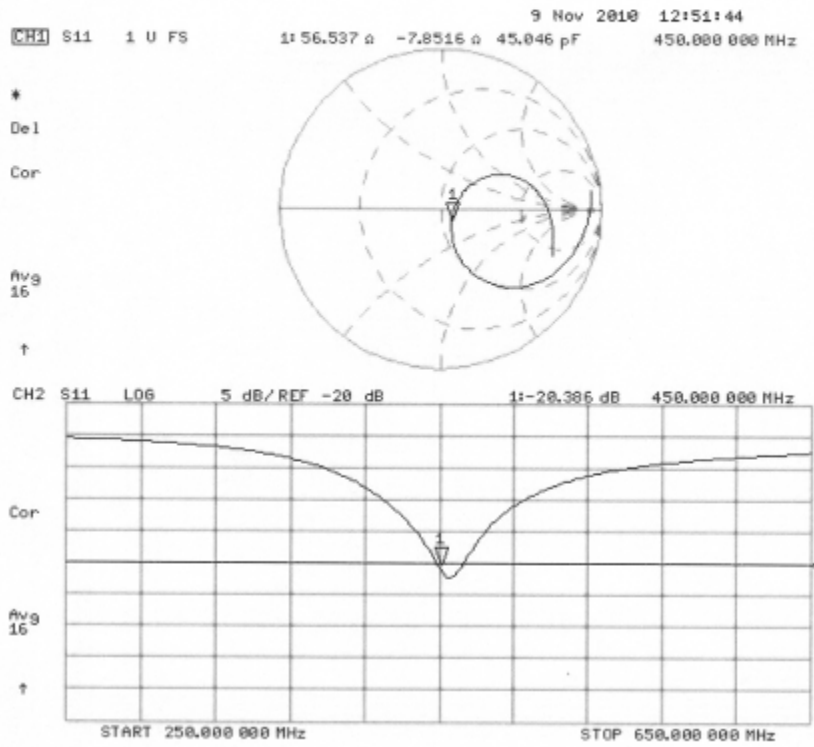
0 dB = 1.89mW/g

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Impedance Measurement Plot for Body TSL



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### ANNEX F: DAE4 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 – SH (Auden)**

Certificate No: **DAE4-871\_Nov10**

#### CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 871**

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

Calibration date: **November 11, 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  $(22 \pm 3)^{\circ}\text{C}$  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: 0810278        | 1-Oct-10 (No: 9055)        | Oct-11                 |
| Secondary Standards           | ID #               | Check Date (in house)      | Scheduled Check        |
| Calibrator Box V1.1           | SE UMS 006 AB 1004 | 05-Jun-10 (in house check) | In house check: Jun-11 |

Calibrated by: Name **Andrea Guntli** Function **Technician** Signature

Approved by: **Fin Bornholt** R&D Director

Issued: November 11, 2010

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

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**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**

### Glossary

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

### Methods Applied and Interpretation of Parameters

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

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### DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1  $\mu$ V, full range = -100...+300 mV

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

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

| Calibration Factors | X                        | Y                        | Z                        |
|---------------------|--------------------------|--------------------------|--------------------------|
| High Range          | 404.813 $\pm$ 0.1% (k=2) | 404.794 $\pm$ 0.1% (k=2) | 405.237 $\pm$ 0.1% (k=2) |
| Low Range           | 3.98191 $\pm$ 0.7% (k=2) | 3.98417 $\pm$ 0.7% (k=2) | 3.98912 $\pm$ 0.7% (k=2) |

### Connector Angle

|   |                  |
|---|------------------|
| Connector Angle to be used in DASY system | 90.0 ° $\pm$ 1 ° |
|---|------------------|

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### Appendix

#### 1. DC Voltage Linearity

| High Range        | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 199994.0                  | 1.84                         | 0.00      |
| Channel X + Input | 19999.85                  | 0.05                         | 0.00      |
| Channel X - Input | -19997.97                 | 1.83                         | -0.01     |
| Channel Y + Input | 200010.3                  | -3.71                        | -0.00     |
| Channel Y + Input | 19999.12                  | -0.48                        | -0.00     |
| Channel Y - Input | -20000.18                 | -0.78                        | 0.00      |
| Channel Z + Input | 200010.2                  | -2.80                        | -0.00     |
| Channel Z + Input | 19998.54                  | -0.86                        | -0.00     |
| Channel Z - Input | -19999.82                 | 0.00                         | 0.00      |

| Low Range         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2000.3                    | 0.22                         | 0.01      |
| Channel X + Input | 200.20                    | 0.30                         | 0.15      |
| Channel X - Input | -199.89                   | 0.21                         | -0.10     |
| Channel Y + Input | 1999.8                    | -0.13                        | -0.01     |
| Channel Y + Input | 200.06                    | -0.04                        | -0.02     |
| Channel Y - Input | -200.43                   | -0.73                        | 0.36      |
| Channel Z + Input | 1999.5                    | -0.57                        | -0.03     |
| Channel Z + Input | 199.58                    | -0.72                        | -0.36     |
| Channel Z - Input | -201.11                   | -1.01                        | 0.51      |

#### 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                            | 13.79  | 12.75                                       |
|           | - 200                          | -12.26                                       | -13.72                                      |
| Channel Y | 200                            | -11.82                                       | -11.47                                      |
|           | - 200                          | 10.67  | 10.68                                       |
| Channel Z | 200                            | -1.08  | -1.35                                       |
|           | - 200                          | 0.32   | 0.12  |

#### 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                | -                           | 3.36                        | 1.06                        |
| Channel Y | 200                | 1.52                        | -                           | 3.59                        |
| Channel Z | 200                | 2.55                        | 1.41                        | -                           |



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#### 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 | 15928            | 16288           |
| Channel Y | 16188            | 15745           |
| Channel Z | 15790            | 16219           |

#### 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 | 0.06               | -3.43                  | 1.18                   | 0.52                      |
| Channel Y | -0.71              | -2.66                  | 0.96                   | 0.57                      |
| Channel Z | -0.95              | -1.94                  | 0.04                   | 0.41                      |

#### 6. Input Offset Current

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

#### 7. Input Resistance

|           | Zeroing (MOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 0.1999         | 204.4            |
| Channel Y | 0.1999         | 203.6            |
| Channel Z | 0.1999         | 203.8            |

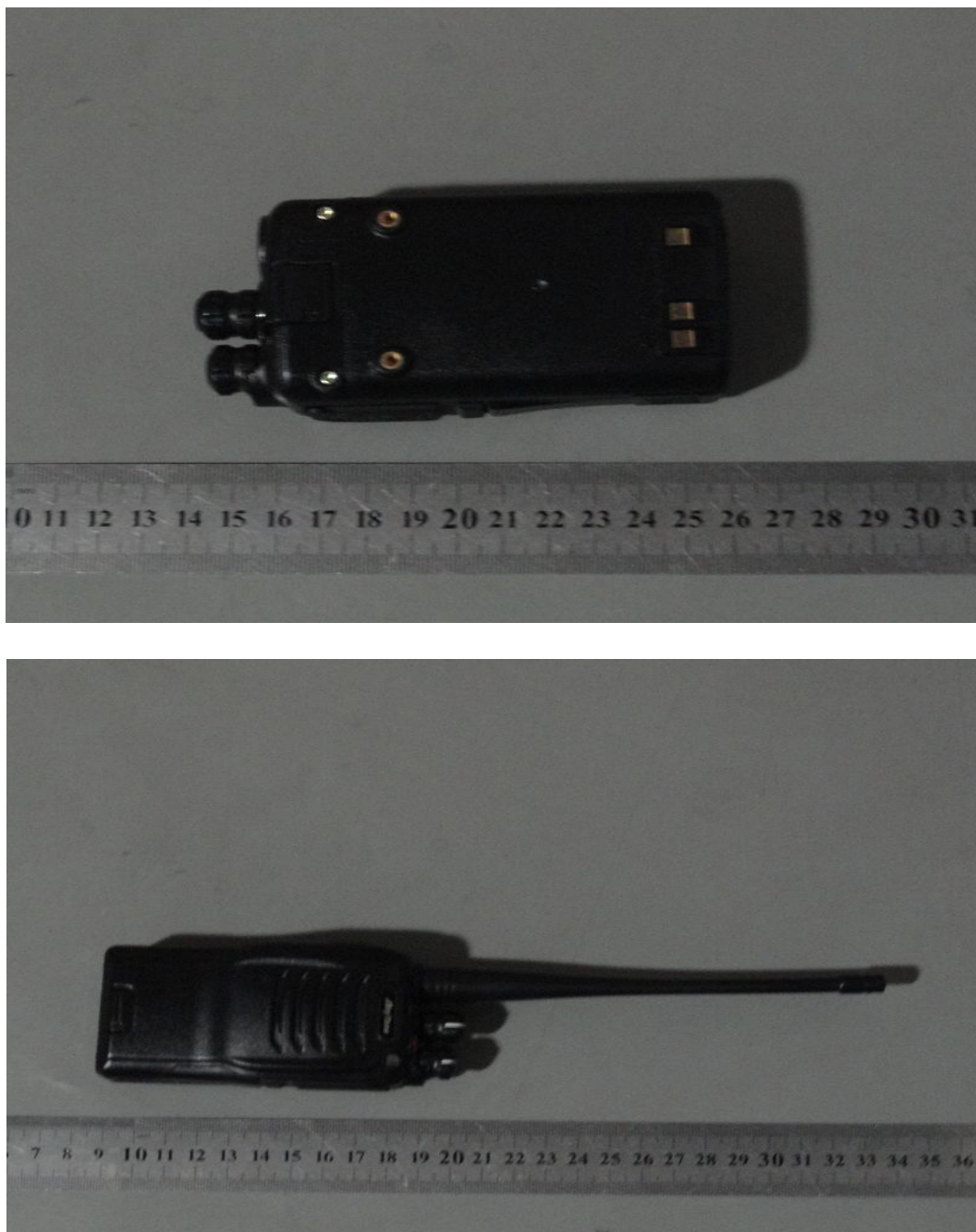
#### 8. Low Battery Alarm Voltage (verified during pre test)

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

#### 9. Power Consumption (verified during pre test)

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

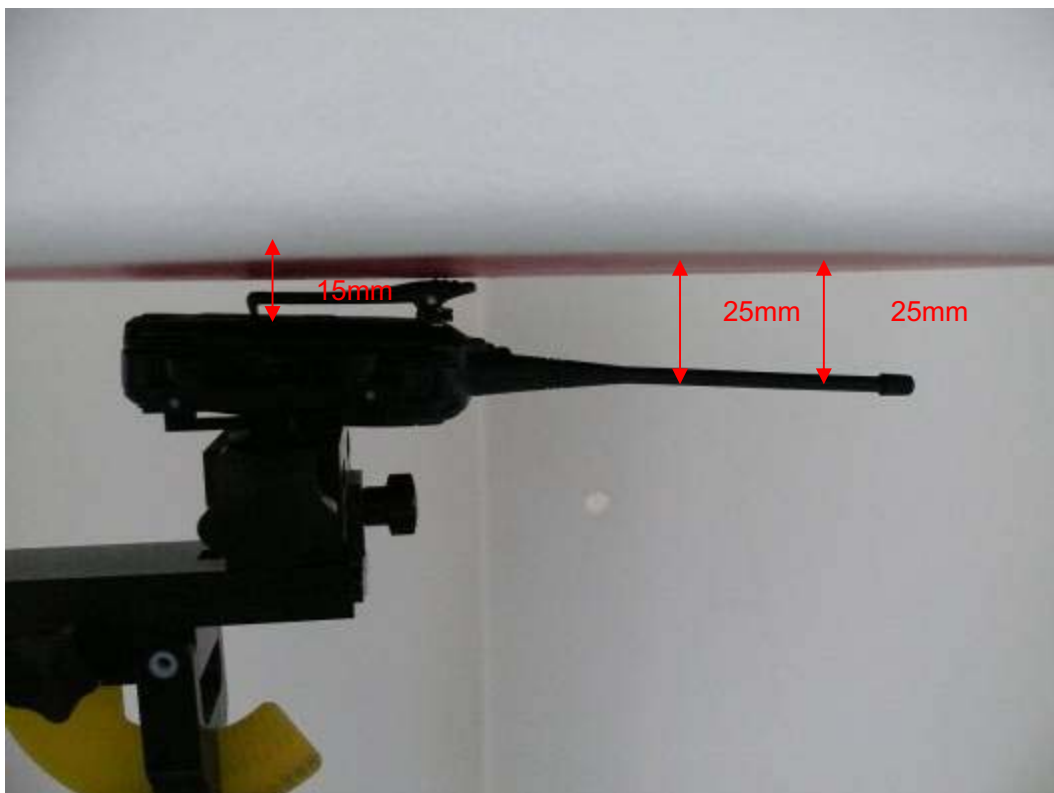
## ANNEX G: The EUT Appearances and Test Configuration



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 25mm



Picture 5: Body-worn, The EUT display towards ground, Belt clip attach the Phantom