

# SAR TEST REPORT

|                      |                                                        |
|----------------------|--------------------------------------------------------|
| Equipment Under Test | Edison                                                 |
| Model Name           | MB865                                                  |
| Company Name         | Motorola Mobility, Inc.                                |
| Company Address      | 600 North U.S. Highway 45, Libertyville, IL 60048-5343 |
| Date of Receipt      | 2011.11.03                                             |
| Date of Test(s)      | 2011.11.04                                             |
| Date of Issue        | 2011.11.24                                             |

Standards:

## FCC OET Bulletin 65 supplement C, IEEE/ANSI C95.1, C95.3, IEEE 1528

In the configuration tested, the EUT complied with the standards specified above.

### Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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Tested by : Ricky Huang  
Asst. Supervisor

Date : 2011.11.24

Approved by : Nick Hsu  
Supervisor

Date : 2011.11.24

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## Version

| Report Number    | Revision | Date       | Memo                             |
|------------------|----------|------------|----------------------------------|
| ES/2011/50006-01 | 00       | 2011/11/08 | Initial creation of test report. |
| ES/2011/50006-01 | 01       | 2011/11/24 | 1 <sup>st</sup> modification.    |
|                  |          |            |                                  |
|                  |          |            |                                  |
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|                  |          |            |                                  |

**This test report contains a reference to the previous version test report that it replaces.**

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# 1. General Information

## 1.1 Testing Laboratory

|                                                        |                        |
|--------------------------------------------------------|------------------------|
| SGS Taiwan Ltd. Electronics & Communication Laboratory |                        |
| 134, Wu Kung Road, Wuku industrial zone                |                        |
| Taipei county, Taiwan, R.O.C.                          |                        |
| Telephone                                              | +886-2-2299-3279       |
| Fax                                                    | +886-2-2298-0488       |
| Internet                                               | http://www.tw.sgs.com/ |

## 1.2 Details of Applicant

|                 |                                                        |
|-----------------|--------------------------------------------------------|
| Company Name    | Motorola Mobility, Inc.                                |
| Company Address | 600 North U.S. Highway 45, Libertyville, IL 60048-5343 |
| Contact Person  | Doug Hammers                                           |
| TEL             | +1-847-523-1644                                        |
| Fax             | +1-847-523-4538                                        |
| E-mail          | doug.hammers@motorola.com                              |

## 1.3 Description of EUT

|                   |                                                                |
|-------------------|----------------------------------------------------------------|
| EUT Name          | Edison                                                         |
| Model Name        | MB865                                                          |
| IMEI Code         | 356378040035586                                                |
| FCC ID            | IHDT56MV1                                                      |
| Mode of Operation | GSM/GPRS/EDGE/WCDMA/HSDPA/<br>HSUPA/WLAN802.11 b/g/n(H20) band |

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| Definition                  | Production unit |                            |                   |                 |                                  |
|-----------------------------|-----------------|----------------------------|-------------------|-----------------|----------------------------------|
| Duty Cycle                  | GSM             | GPRS/ EDGE                 |                   | WCDMA           | WLAN<br>802.11<br>b/g/n(H20)     |
|                             | 1/8.3           | 1/2;1/4.1;<br>1/2.76;1/8.3 |                   | 1               | 1                                |
|                             |                 | MS Class B                 |                   |                 |                                  |
| TX Frequency Range<br>(MHz) | GSM850          | GSM1900                    | WCDMA<br>Band II  | WCDMA<br>Band V | WLAN<br>802.11<br>b/g/n<br>(H20) |
|                             | 824.2-<br>848.8 | 1850.2-<br>1909.8          | 1852.4-<br>1907.6 | 826.4-<br>846.6 | 2412-<br>2462                    |
| Channel Number<br>(ARFCN)   | GSM850          | GSM1900                    | WCDMA<br>Band II  | WCDMA<br>Band V | WLAN<br>802.11<br>b/g/n<br>(H20) |
|                             | 128-<br>251     | 512-<br>810                | 9262-<br>9538     | 4132-<br>4233   | 1-11                             |
| VOIP Function               | Yes             |                            |                   |                 |                                  |

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|                            |                      |
|----------------------------|----------------------|
| Max. SAR Measured<br>(1 g) | <b>GSM850</b>        |
|                            | Body_Lapdock mode    |
|                            | <b>1.10mW/g</b>      |
|                            | <b>GSM1900</b>       |
|                            | Body_Lapdock mode    |
|                            | <b>0.172 mW/g</b>    |
|                            | <b>WCDMA Band II</b> |
|                            | Body_Lapdock mode    |
|                            | <b>0.395mW/g</b>     |
|                            | <b>WCDMA Band V</b>  |
|                            | Body_Lapdock mode    |
|                            | <b>0.64mW/g</b>      |
|                            | <b>WLAN802.11 b</b>  |
|                            | Body_Lapdock mode    |
|                            | <b>0.209mW/g</b>     |

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### #. GSM/GPRS/EDGE conducted power table:

| GSM850 | Burst average power | Source-based time- averaged |
|--------|---------------------|-----------------------------|
| CH 128 | 33.30               | 24.27                       |
| CH 190 | 33.30               | 24.27                       |
| CH 251 | 33.20               | 24.17                       |

| Burst average power         |        |        |        |        |
|-----------------------------|--------|--------|--------|--------|
| GPRS850                     | 1Dn1UP | 1Dn2UP | 1Dn3UP | 1Dn4UP |
| CH 128                      | 33.20  | 31.00  | 29.00  | 27.00  |
| CH 190                      | 33.30  | 31.00  | 29.00  | 27.10  |
| CH 251                      | 33.20  | 31.00  | 29.00  | 27.00  |
| Source-based time- averaged |        |        |        |        |
| GPRS850                     | 1Dn1UP | 1Dn2UP | 1Dn3UP | 1Dn4UP |
| CH 128                      | 24.17  | 24.98  | 24.74  | 23.99  |
| CH 190                      | 24.27  | 24.98  | 24.98  | 24.09  |
| CH 251                      | 24.17  | 24.98  | 24.98  | 23.99  |

| Burst average power         |        |        |        |        |
|-----------------------------|--------|--------|--------|--------|
| EDGE850                     | 1Dn1UP | 1Dn2UP | 1Dn3UP | 1Dn4UP |
| CH 128                      | 27.80  | 25.80  | 23.70  | 21.70  |
| CH 190                      | 27.80  | 25.90  | 23.70  | 21.70  |
| CH 251                      | 27.80  | 25.80  | 23.70  | 21.70  |
| Source-based time- averaged |        |        |        |        |
| EDGE850                     | 1Dn1UP | 1Dn2UP | 1Dn3UP | 1Dn4UP |
| CH 128                      | 18.77  | 19.78  | 19.44  | 18.69  |
| CH 190                      | 18.77  | 19.88  | 19.44  | 18.69  |
| CH 251                      | 18.77  | 19.78  | 19.44  | 18.69  |

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### #. GSM/GPRS/EGPRS conducted power table:

| GSM1900 | Burst average power | Source-based time-averaged |
|---------|---------------------|----------------------------|
| CH 512  | 30.70               | 21.67                      |
| CH 661  | 30.70               | 21.67                      |
| CH 810  | 30.90               | 21.87                      |

| Burst average power         |        |        |        |        |
|-----------------------------|--------|--------|--------|--------|
| GPRS1900                    | 1Dn1UP | 1Dn2UP | 1Dn3UP | 1Dn4UP |
| CH 512                      | 30.70  | 28.80  | 26.70  | 24.70  |
| CH 661                      | 30.70  | 28.70  | 26.70  | 24.70  |
| CH 810                      | 30.90  | 28.90  | 26.80  | 24.90  |
| Source-based time- averaged |        |        |        |        |
| GPRS1900                    | 1Dn1UP | 1Dn2UP | 1Dn3UP | 1Dn4UP |
| CH 512                      | 21.67  | 22.26  | 22.44  | 21.69  |
| CH 661                      | 21.67  | 22.68  | 22.44  | 21.69  |
| CH 810                      | 21.87  | 22.80  | 22.54  | 21.89  |

| Burst average power         |        |        |        |        |
|-----------------------------|--------|--------|--------|--------|
| EDGE1900                    | 1Dn1UP | 1Dn2UP | 1Dn3UP | 1Dn4UP |
| CH 512                      | 26.90  | 25.00  | 22.90  | 20.90  |
| CH 661                      | 26.90  | 25.00  | 23.00  | 21.00  |
| CH 810                      | 27.10  | 25.10  | 23.10  | 21.20  |
| Source-based time- averaged |        |        |        |        |
| EDGE1900                    | 1Dn1UP | 1Dn2UP | 1Dn3UP | 1Dn4UP |
| CH 512                      | 17.87  | 18.89  | 18.64  | 17.89  |
| CH 661                      | 17.87  | 18.89  | 18.74  | 17.99  |
| CH 810                      | 18.07  | 19.08  | 18.84  | 18.19  |

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### #. WCDMA Band II & V HSDPA/HSUPA conducted power table:

|       |         | WCDMA Band II Channel |       |       | WCDMA Band V Channel |       |       |
|-------|---------|-----------------------|-------|-------|----------------------|-------|-------|
| Mode  | Subtest | 9262                  | 9400  | 9538  | 4132                 | 4183  | 4233  |
| Rel99 | R99     | 23.83                 | 23.73 | 23.63 | 23.78                | 23.91 | 23.72 |
| HSDPA | 1       | 24                    | 23.62 | 23.49 | 23.57                | 23.77 | 23.84 |
|       | 2       | 23.71                 | 23.59 | 23.48 | 23.71                | 23.8  | 23.59 |
|       | 3       | 23.52                 | 23.17 | 22.96 | 23.11                | 23.29 | 23.35 |
|       | 4       | 23.59                 | 23.18 | 23.08 | 23.16                | 23.33 | 23.41 |
| HSUPA | 1       | 23.75                 | 23.71 | 23.57 | 23.74                | 23.84 | 23.64 |
|       | 2       | 21.8                  | 21.78 | 21.61 | 21.8                 | 21.92 | 21.68 |
|       | 3       | 22.81                 | 22.73 | 22.65 | 22.78                | 22.9  | 22.72 |
|       | 4       | 21.93                 | 21.83 | 21.65 | 21.85                | 21.98 | 21.76 |
|       | 5       | 23.64                 | 23.57 | 23.48 | 23.6                 | 23.67 | 23.53 |

### #. WLAN802.11 b/g/n(H20) conducted power table:

| WLAN802.11 b          | 2412  | 2437  | 2462  |
|-----------------------|-------|-------|-------|
| Peak power            | 18.17 | 18.32 | 18.74 |
| Avg power             | 15.74 | 15.77 | 16.22 |
| WLAN802.11 g          | 2412  | 2437  | 2462  |
| Peak power            | 18.88 | 18.35 | 18.32 |
| Avg power             | 15.5  | 14.73 | 14.84 |
| WLAN802.11 n<br>(20M) | 2412  | 2437  | 2462  |
| Peak power            | 18.8  | 18.12 | 18.23 |
| Avg power             | 15.34 | 14.49 | 14.68 |

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## 1.4 Test Environment

Ambient Temperature :  $22 \pm 2^{\circ}\text{C}$

Tissue Simulating Liquid:  $22 \pm 2^{\circ}\text{C}$

## 1.5 Operation description

### General:

1. The EUT is controlled by using a Radio Communication Tester (R&S CMU200), and the communication between the EUT and the tester is established by air link.
2. Measurements are performed respectively on the lowest, middle and highest channels of the operating band(s). The EUT is set to maximum power level during all tests, and at the beginning of each test the battery is fully charged.
3. During the SAR testing, the DASY4 system checks power drift by comparing the e-field strength of one specific location measured at the beginning with that measured at the end of the SAR testing.
4. We will test it by dividing into 1 configurations:  
Configuration 1:Lapdock mode.

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**SAR evaluation considerations for handsets with multiple transmitters:**

5. When the maximum transmitter and antenna output power are  $\leq 60/f(\text{GHz})$  (mW) SAR evaluation is typically not required for FCC or TCB approval (BT power= 11.73dBm)
6. According to KDB248227-SAR is not required for 802.11 g/HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.
7. According to section 6.3.1 and 6.3.1.2 of KDB941225 D03 to exclude SAR test requirements for EDGE modes due to the source-based time-averaged output power (page 7's conducted power table) for edge mode is lower than that in the GPRS mode.
8. According to KDB941225 D01 to exclude SAR test requirements for HSPA modes due to the maximum average output power of HSPA active is less than 1/4 dB higher than that measured without HSPA using 12.2kbps RMC.

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9. The highest 1-g SAR for WLAN is 0.209 W/kg(Lapdock mode) and the highest 1-g SAR for WWAN is 1.10W/kg(Lapdock mode). The sum of 1-g for simultaneous transmitting WLAN and WWAN antenna pair is  $0.209 + 1.10 = 1.309 \text{ W/kg} < 1.6 \text{ W/kg}$ . Simultaneous SAR evaluation is not required.

• **Simultaneous Operation Modes Summary Table:**

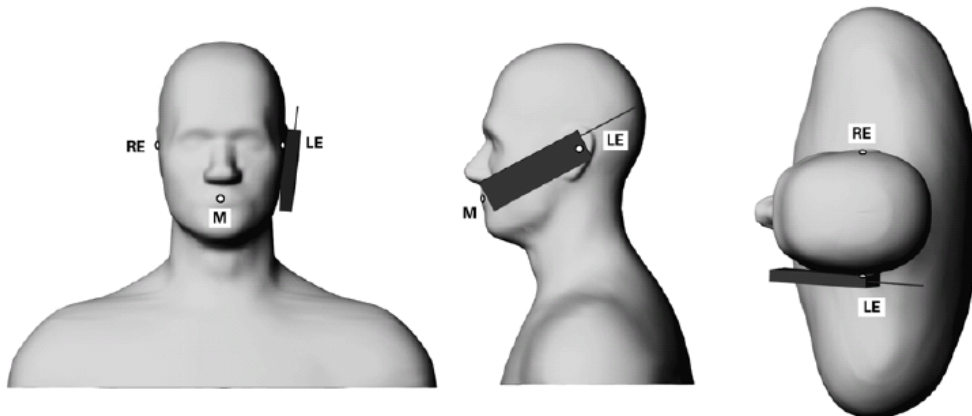
| Description of Simultaneous Transmission Capabilities Supported |               |           |                |               |
|-----------------------------------------------------------------|---------------|-----------|----------------|---------------|
| Configuration                                                   | Head Adjacent | Body Worn | Mobile Hotspot | Configuration |
| GSM + Wi-Fi                                                     | N             | N         | N              | GSM + Wi-Fi   |
| GSM + BT                                                        | N             | N         | N              | GSM + BT      |
| GPRS + Wi-Fi                                                    | N             | Y         | Y              | GPRS + Wi-Fi  |
| GPRS + BT                                                       | N             | N         | N              | GPRS + BT     |
| EDGE + Wi-Fi                                                    | N             | N         | N              | EDGE + Wi-Fi  |
| EDGE + BT                                                       | N             | N         | N              | EDGE + BT     |
| WCDMA + Wi-Fi                                                   | N             | Y         | Y              | WCDMA + Wi-Fi |
| WCDMA + BT                                                      | N             | N         | N              | WCDMA + BT    |
| HSPA + Wi-Fi                                                    | N             | N         | N              | HSPA + Wi-Fi  |
| HSPA + BT                                                       | N             | N         | N              | HSPA + BT     |

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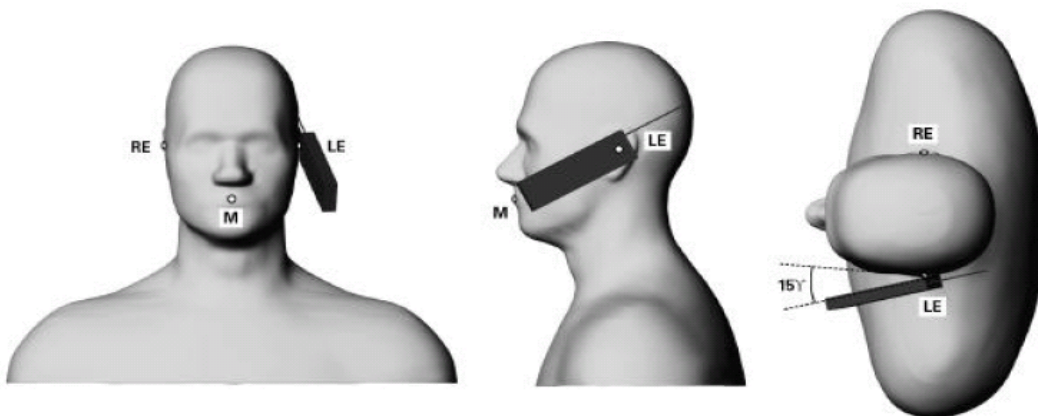
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## 1.6 Positioning Procedure



Phone position 1, “cheek” or “touch” position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning



Phone position 2, “tilted position.” The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning

Cheek/Touch Position:

the handset was brought toward the mouth of the head phantom by pivoting against the ear reference point until any point of the mouthpiece or keypad touched the phantom.

Ear/Tilt Position:

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With the phone aligned in the Cheek/Touch position, the handset was tilted away from the mouth with respect to the test device reference point by 15 degrees.

## 1.7 EVALUATION PROCEDURES

The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. The extraction of the measured data (grid and values) from the Zoom Scan.
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. The generation of a high-resolution mesh within the measured volume
4. The interpolation of all measured values from the measurement grid to the high-resolution grid
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. The calculation of the averaged SAR within masses of 1g and 10g.

The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated. The angle between the probe axis and the surface normal line is less than 30 degree.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extreme of the SAR distribution. The uncertainty on the locations of the extreme is less than 1/20 of the grid size. Only local maximum within -2 dB of the global maximum are searched and passed for the Cube Scan measurement. In the Cube Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest

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measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5mm.

The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 7x7x7 scans.

The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 30x30x30mm contains about 30g of tissue. The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume. In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is moved around until the highest averaged SAR is found.

If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

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## 1.8 The SAR Measurement System

A photograph of the SAR measurement System is given in Fig. a. This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (SPEAG DASY 4 professional system ). A Model EX3DV4 field probe is used to determine the internal electric fields. The SAR can be obtained from the equation  $SAR = \sigma (|E_i|^2) / \rho$  where  $\sigma$  and  $\rho$  are the conductivity and mass density of the tissue-simulant.

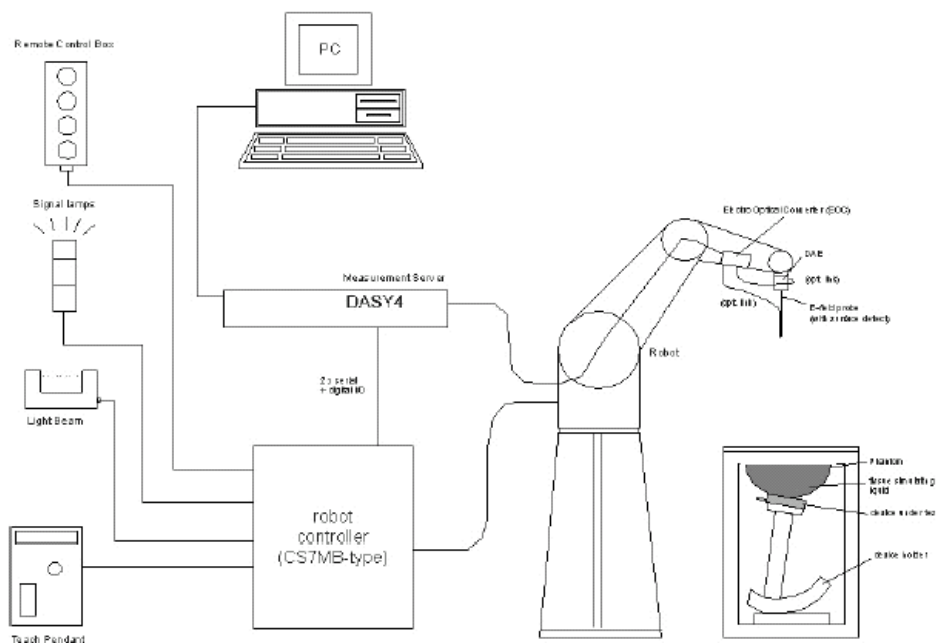


Fig.a The block diagram of SAR system

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

- A standard high precision 6-axis robot (Staubli RX family) with controller, teach pendant and software. An arm extension is 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.

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- A data acquisition electronics (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.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
  - A computer operating Windows 2000 or Windows XP.
  - DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
  - The SAM twin phantom enabling testing left-hand and right-hand usage.
  - The device holder for handheld mobile phones.
  - Tissue simulating liquid mixed according to the given recipes.
  - Validation dipole kits allowing to validate the proper functioning of the system.

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## 1.9 System Components

### EX3DV4E-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:   | Basic Broad Band Calibration in air<br>Conversion Factors (CF) for HSL835/1900/2450MHz<br>Additional CF for other liquids and frequencies upon request                                                     |                                                                                     |
|                |                                                                                                                                                                                                            | E-Field Probe                                                                       |
| Frequency:     | 10 MHz to > 6 GHz; Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)                                                                                                                                               |                                                                                     |
| Directivity:   | $\pm 0.3$ dB in HSL (rotation around probe axis)<br>$\pm 0.5$ dB in tissue material (rotation normal to probe axis)                                                                                        |                                                                                     |
| Dynamic Range: | 10 $\mu$ W/g to > 100 mW/g;<br>Linearity: $\pm 0.2$ dB (noise: typically < 1 $\mu$ W/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). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%. |                                                                                     |

E-Field Probe

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## SAM PHANTOM V4.0C

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                    |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Construction:    | <p>The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209.</p> <p>It enables the dosimetric evaluation of left and right hand phone 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.</p> |                                                                                    |
| Shell Thickness: | 2 ± 0.2 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| Filling Volume:  | Approx. 25 liters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                    |
| Dimensions:      | Height: 251 mm;<br>Length: 1000 mm;<br>Width: 500 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                    |

## DEVICE HOLDER

|              |                                                                                                                                                                                                       |                                                                                                           |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Construction | <p>The device holder (Supporter) for Notebook is made by POM (polyoxymethylene resin) , which is non-metal and non-conductive.</p> <p>The height can be adjusted to fit varies kind of notebooks.</p> |  <p>Device Holder</p> |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|

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## 1.10 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig. b. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within  $\pm 5\%$  from the target SAR values.

These tests were done at 835/1900/2450 MHz. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1. During the tests, the ambient temperature of the laboratory was in the range  $22.1^{\circ}\text{C}$ , the relative humidity was in the range 62% and the liquid depth above the ear reference points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

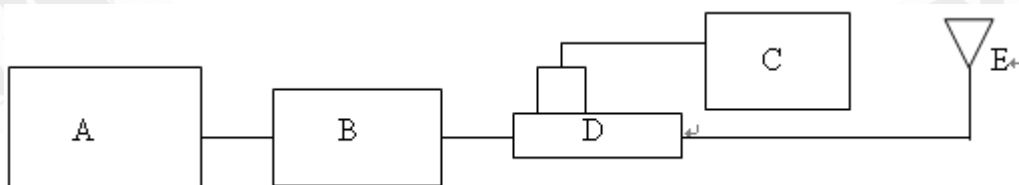


Fig.b The block diagram of system verification

- A. Agilent Model 8648D Signal Generator
- B. Mini circuits Model ZHL-42 Amplifier
- C. Agilent Model U2001B Power Sensor
- D. Agilent Model 778D/777D Dual directional coupling
- E. Reference dipole antenna



Photograph of the dipole Antenna

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| Validation Kit        | Frequency (MHz)    | Target SAR (1g)<br>(Pin=250mW) | Measured SAR (1g) | Measured Date |
|-----------------------|--------------------|--------------------------------|-------------------|---------------|
| D835V2<br>S/N: 4d063  | 835 MHz<br>(Body)  | 2.43 mW/g                      | 2.36mW/g          | 2011-11-04    |
| D1900V2<br>S/N: 5d027 | 1900 MHz<br>(Body) | 9.93 mW/g                      | 9.9mW/g           | 2011-11-04    |
| D2450V2<br>S/N: 727   | 2450 MHz<br>(Body) | 12.7 mW/g                      | 12.3mW/g          | 2011-11-04    |

Table 1. System validation (follow manufacture target value)

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### 1.11 Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this Head-simulant fluid were measured by using the HP Model 85070D Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with HP 8753D Network Analyzer (30 KHz-6000MHz).

All dielectric parameters of tissue simulates were measured within 24 hours of SAR measurements. The depth of the tissue simulant iin the flat section of the phantom was 15cm±5mm during all tests. (Appendix Fig .2)

| Frequency (MHz) | Tissue type | Measurement date/<br>Limits | Dielectric Parameters |                |                                   |
|-----------------|-------------|-----------------------------|-----------------------|----------------|-----------------------------------|
|                 |             |                             | $\epsilon_r$          | $\sigma$ (S/m) | Simulated Tissue Temperature(° C) |
| 835             | Body        | Measured, 2011-11-04        | 54.3                  | 0.998          | 21.7                              |
|                 |             | Recommended Limits          | 51.21-56.60           | 0.95-1.05      | 20-24                             |
| 1900            | Body        | Measured, 2011-11-04        | 51.4                  | 1.57           | 21.7                              |
|                 |             | Recommended Limits          | 48.55-53.66           | 1.44-1.60      | 20-24                             |
| 2450            | Body        | Measured, 2011-11-04        | 51.1                  | 1.97           | 21.7                              |
|                 |             | Recommended Limits          | 48.07-53.13           | 1.81-2.01      | 20-24                             |

Table 2. Dielectric Parameters of Tissue Simulant Fluid

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The composition of the brain tissue simulating liquid:

| Ingredient       | 850MHz<br>(Body) | 1900MHz<br>(Body) | 2450MHz<br>(Body) |
|------------------|------------------|-------------------|-------------------|
| DGMBE            | X                | 300.67g           | 301.7ml           |
| Water            | 631.68 g         | 716.56 g          | 698.3ml           |
| Salt             | 11.72 g          | 4.0 g             | X                 |
| Preventol<br>D-7 | 1.2 g            | X                 | X                 |
| Cellulose        | X                | X                 | X                 |
| Sugar            | 600 g            | X                 | X                 |
| Total<br>amount  | 1 L<br>(1.0kg)   | 1 L<br>(1.0kg)    | 1 L<br>(1.0kg)    |

Table 3. Recipes for tissue simulating liquid

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### 1.12 Test Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ("SAR") in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1-1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100 kHz to 6 GHz. Portable devices that transmit at frequencies above 6 GHz are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter.

Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 GHz should be made at a minimum distance of 5 cm from the radiating source.

(1) Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube).

Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or

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by specific training or education through appropriate means, such as an RF safety program in a work environment.

(2) Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube).

Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube).

General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure.

Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section.(Table .6)

| Human Exposure                               | Uncontrolled Environment<br>General Population | Controlled Environment<br>Occupational |
|----------------------------------------------|------------------------------------------------|----------------------------------------|
| Spatial Peak SAR<br>(Brain)                  | 1.60 m W/g                                     | 8.00 m W/g                             |
| Spatial Average SAR<br>(Whole Body)          | 0.08 m W/g                                     | 0.40 m W/g                             |
| Spatial Peak SAR<br>(Hands/Feet/Ankle/Wrist) | 4.00 m W/g                                     | 20.00 m W/g                            |

Table 4. RF exposure limits

Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

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## 2. Summary of Results

### GSM 850 MHz

| Band        | Mode                          | EUT<br>Position | Test<br>Configuration | Averaged SAR over 1g (W/kg) |               |               | SAR<br>Limit 1g<br>(W/kg) |
|-------------|-------------------------------|-----------------|-----------------------|-----------------------------|---------------|---------------|---------------------------|
|             |                               |                 |                       | CH 128                      | CH 190        | CH 251        |                           |
|             |                               |                 |                       | 824.20<br>MHz               | 836.60<br>MHz | 848.80<br>MHz |                           |
| GPRS<br>850 | (Multi-class 10)<br>Body Worn |                 | Lapdock               | 0.785                       | 0.914         | 1.10          | 1.6                       |

### GSM 1900 MHz

| Band         | Mode                          | EUT<br>Position | Test<br>Configuration | Averaged SAR over 1g (W/kg) |                |                | SAR<br>Limit 1g<br>(W/kg) |
|--------------|-------------------------------|-----------------|-----------------------|-----------------------------|----------------|----------------|---------------------------|
|              |                               |                 |                       | CH 512                      | CH 661         | CH 810         |                           |
|              |                               |                 |                       | 1850.20<br>MHz              | 1880.00<br>MHz | 1909.80<br>MHz |                           |
| GPRS<br>1900 | (Multi-class 10)<br>Body Worn |                 | Lapdock               | —                           | 0.172          | —              | 1.6                       |

### WCDMA Band II

| Band             | Mode                    | EUT<br>Position | Test<br>Configuration | Averaged SAR over 1g (W/kg) |                |                | SAR<br>Limit 1g<br>(W/kg) |
|------------------|-------------------------|-----------------|-----------------------|-----------------------------|----------------|----------------|---------------------------|
|                  |                         |                 |                       | CH 9262                     | CH 9400        | CH 9538        |                           |
|                  |                         |                 |                       | 1852.4<br>MHz               | 1880.00<br>MHz | 1907.60<br>MHz |                           |
| WCDMA<br>BAND II | (R99 mode)<br>Body Worn |                 | Lapdock               | —                           | 0.395          | —              | 1.6                       |

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### WCDMA Band V

| Band            | Mode                    | EUT<br>Position | Test<br>Configuration | Averaged SAR over 1g (W/kg) |               |               | SAR<br>Limit 1g<br>(W/kg) |
|-----------------|-------------------------|-----------------|-----------------------|-----------------------------|---------------|---------------|---------------------------|
|                 |                         |                 |                       | CH 4132                     | CH 4183       | CH 4233       |                           |
|                 |                         |                 |                       | 826.40<br>MHz               | 836.60<br>MHz | 846.60<br>MHz |                           |
| WCDMA<br>BAND V | (R99 mode)<br>Body Worn |                 | Lapdock               | —                           | 0.64          | —             | 1.6                       |

### WLAN802.11 b

| Band             | Mode      | EUT<br>Position | Test<br>Configuration | Averaged SAR over 1g (W/kg) |          |          | SAR<br>Limit 1g<br>(W/kg) |
|------------------|-----------|-----------------|-----------------------|-----------------------------|----------|----------|---------------------------|
|                  |           |                 |                       | CH 1                        | CH 6     | CH 11    |                           |
|                  |           |                 |                       | 2412 MHz                    | 2437 MHz | 2462 MHz |                           |
| WLAN<br>802.11 b | Body Worn |                 | Lapdock               | —                           | 0.209    | —        | 1.6                       |

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### 3. Instruments List

| Manufacturer                    | Device                                       | Type                 | Serial number | Date of last calibration |
|---------------------------------|----------------------------------------------|----------------------|---------------|--------------------------|
| Schmid & Partner Engineering AG | Dosimetric E-Field Probe                     | EX3DV4               | 3703          | Aug.25.2011              |
| Schmid & Partner Engineering AG | 835 /1900 /2450 MHz System Validation Dipole | D835V2               | 4d063         | May.25.2011              |
|                                 |                                              | D1900V2              | 5d027         | Apr.19.2011              |
|                                 |                                              | D2450V2              | 727           | Apr.19.2011              |
| Schmid & Partner Engineering AG | Data acquisition Electronics                 | DAE4                 | 547           | Aug.29.2011              |
| Schmid & Partner Engineering AG | Software                                     | DASY 4 V4.7 Build 80 | N/A           | Calibration not required |
| Schmid & Partner Engineering AG | Phantom                                      | SAM                  | N/A           | Calibration not required |
| HP                              | Network Analyzer                             | 8753D                | 3410A05547    | Mar.16.2011              |
| HP                              | Dielectric Probe Kit                         | 85070D               | US01440168    | Calibration not required |
| Agilent                         | Dual-directional coupler                     | 778D                 | 50313         | Aug.19.2011              |
|                                 |                                              | 777D                 | 50114         | Aug.18.2011              |
| Agilent                         | RF Signal Generator                          | 8648D                | 3847M00432    | Jun.01.2011              |
| Agilent                         | Power Sensor                                 | U2001B               | MY48100169    | Apr.30.2011              |
| R&S                             | Radio Communication Test                     | CMU200               | 113505        | May.31.2011              |

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## 4. Measurements

Date: 2011/11/4

### Lapdock\_CH128

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:4.1  
Medium: Muscle 900 MHz Medium parameters used (interpolated):  $f = 824.2 \text{ MHz}$ ;  $\sigma = 0.986 \text{ mho/m}$ ;  $\epsilon_r = 54.4$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(8.87, 8.87, 8.87); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**BODY/Area Scan (61x101x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.975 mW/g

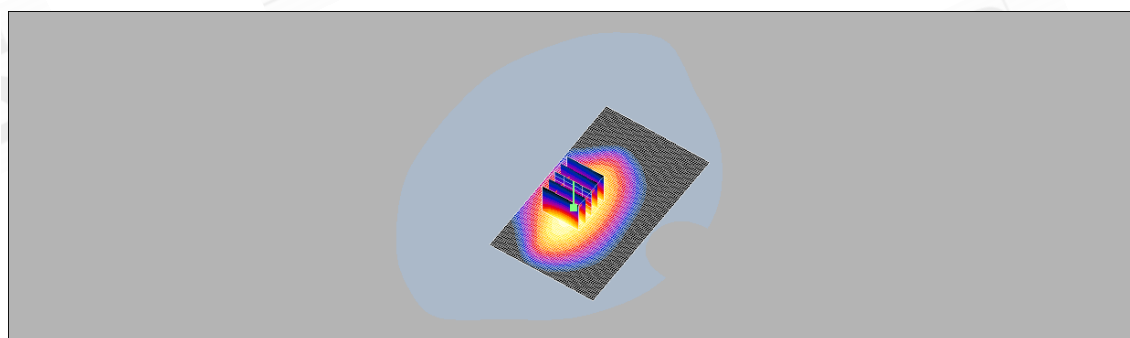
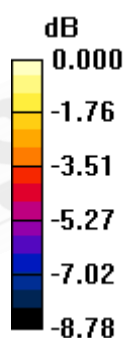
**BODY/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 23.5 V/m; Power Drift = -0.030 dB

Peak SAR (extrapolated) = 1.12 W/kg

**SAR(1 g) = 0.785 mW/g; SAR(10 g) = 0.547 mW/g**

Maximum value of SAR (measured) = 0.965 mW/g

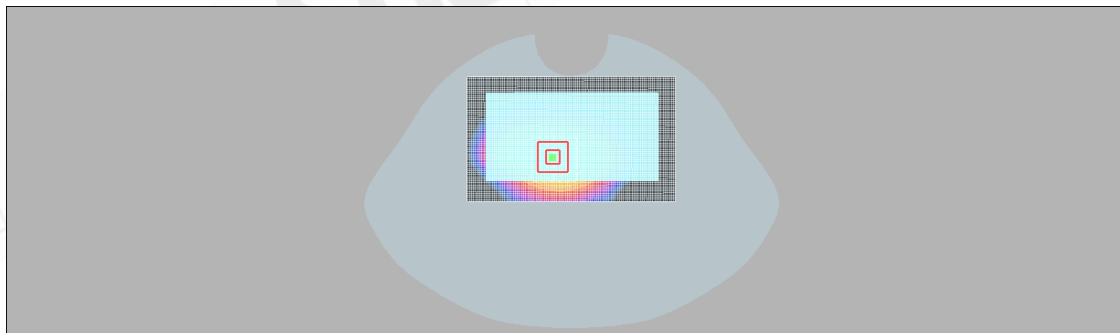
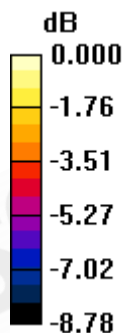


0 dB = 0.965mW/g

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0 dB = 0.965mW/g

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## Lapdock\_CH190

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:4.1

Medium: Muscle 900 MHz Medium parameters used:  $f = 837 \text{ MHz}$ ;  $\sigma = 1 \text{ mho/m}$ ;  $\epsilon_r = 54.3$ ;  
 $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(8.87, 8.87, 8.87); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**BODY/Area Scan (71x101x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.14 mW/g

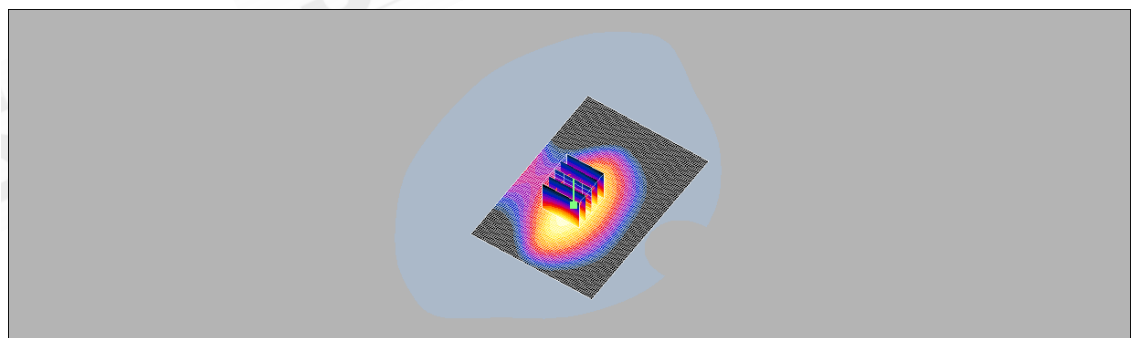
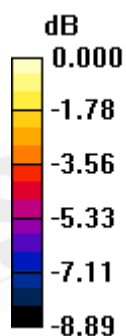
**BODY/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  
 $dz=5\text{mm}$

Reference Value = 25.1 V/m; Power Drift = -0.135 dB

Peak SAR (extrapolated) = 1.31 W/kg

**SAR(1 g) = 0.914 mW/g; SAR(10 g) = 0.634 mW/g**

Maximum value of SAR (measured) = 1.12 mW/g

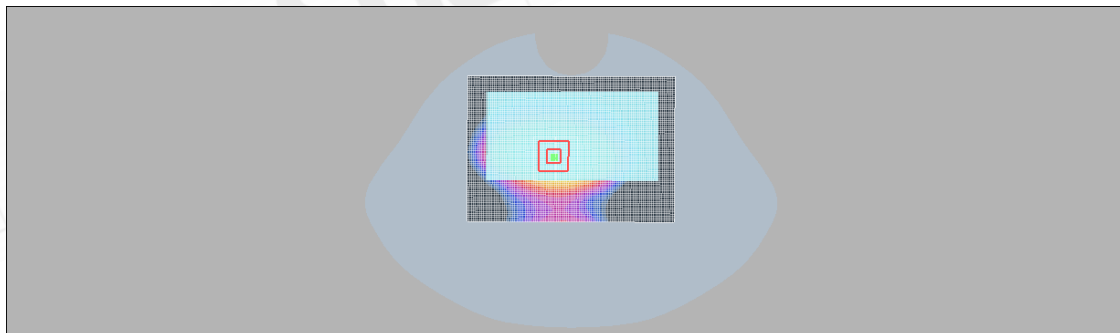
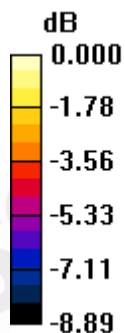


0 dB = 1.12mW/g

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0 dB = 1.12mW/g

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## Lapdock\_CH251

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:4.1

Medium: Muscle 900 MHz Medium parameters used:  $f = 849 \text{ MHz}$ ;  $\sigma = 1.01 \text{ mho/m}$ ;  $\epsilon_r = 54.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(8.87, 8.87, 8.87); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**BODY/Area Scan (61x101x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.37 mW/g

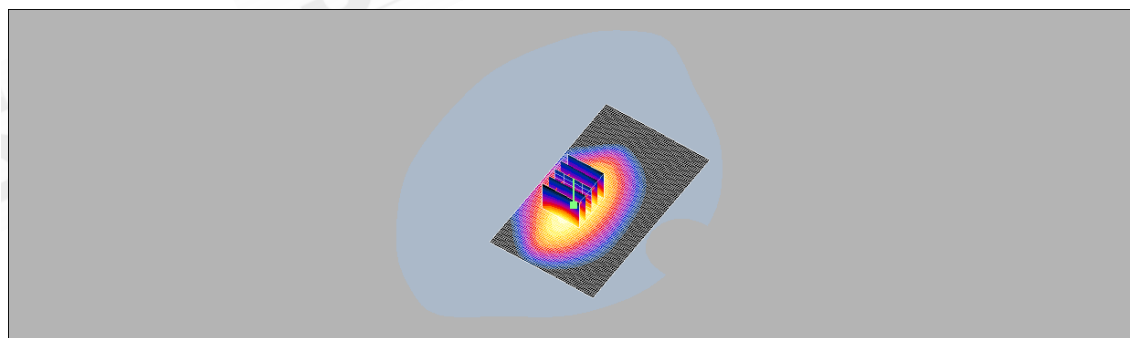
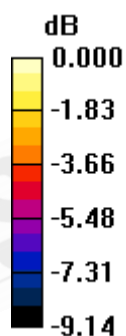
**BODY/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 26.6 V/m; Power Drift = 0.052 dB

Peak SAR (extrapolated) = 1.58 W/kg

**SAR(1 g) = 1.10 mW/g; SAR(10 g) = 0.757 mW/g**

Maximum value of SAR (measured) = 1.36 mW/g

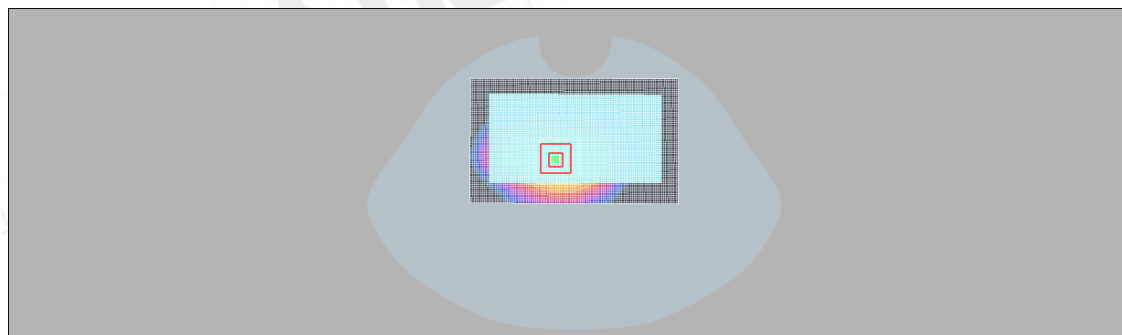
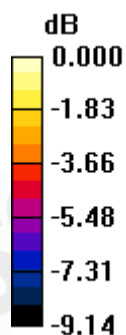


0 dB = 1.36mW/g

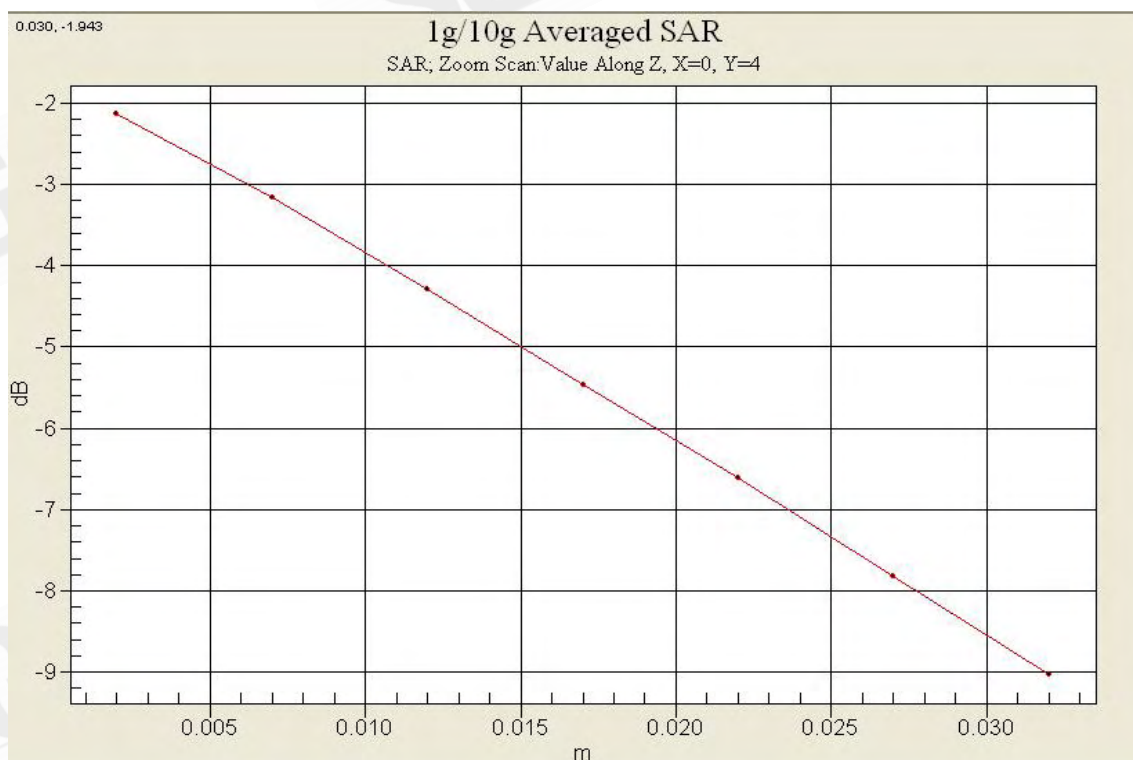
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0 dB = 1.36mW/g



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## Lapdock\_CH661

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:4.1

Medium: M1800 & 1900 Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.55 \text{ mho/m}$ ;  $\epsilon_r = 51.6$ ;  
 $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(6.97, 6.97, 6.97); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**BODY/Area Scan (71x101x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $0.294 \text{ mW/g}$

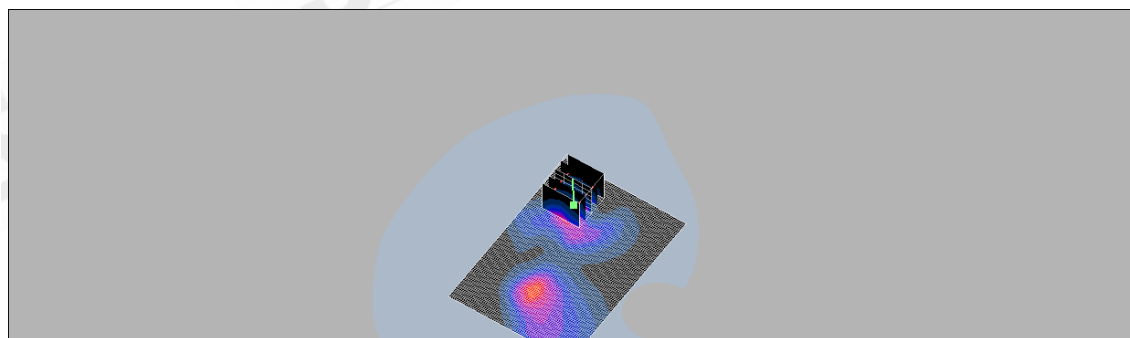
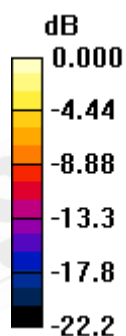
**BODY/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  
 $dz=5\text{mm}$

Reference Value =  $3.42 \text{ V/m}$ ; Power Drift =  $-0.161 \text{ dB}$

Peak SAR (extrapolated) =  $0.327 \text{ W/kg}$

**SAR(1 g) =  $0.172 \text{ mW/g}$ ; SAR(10 g) =  $0.082 \text{ mW/g}$**

Maximum value of SAR (measured) =  $0.254 \text{ mW/g}$

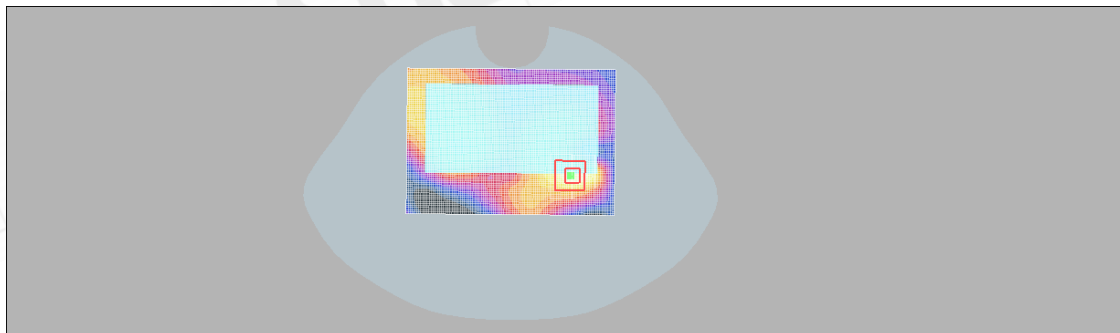
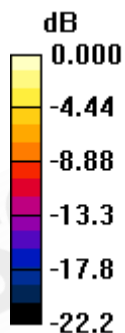


0 dB =  $0.254 \text{ mW/g}$

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0 dB = 0.254mW/g

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## Lapdock\_CH9400

Communication System: WCDMA BAND2; Frequency: 1880 MHz; Duty Cycle: 1:1  
Medium: M1800 & 1900 Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.55 \text{ mho/m}$ ;  $\epsilon_r = 51.6$ ;  
 $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section

### DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(6.97, 6.97, 6.97); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**BODY/Area Scan (71x101x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
Maximum value of SAR (interpolated) =  $0.575 \text{ mW/g}$

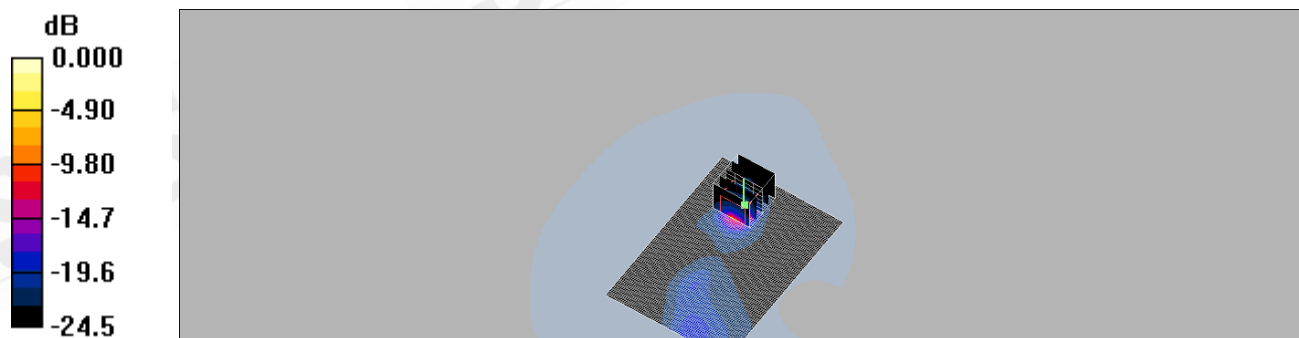
**BODY/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  
 $dz=5\text{mm}$

Reference Value =  $4.14 \text{ V/m}$ ; Power Drift =  $-0.183 \text{ dB}$

Peak SAR (extrapolated) =  $0.788 \text{ W/kg}$

**SAR(1 g) =  $0.395 \text{ mW/g}$ ; SAR(10 g) =  $0.186 \text{ mW/g}$**

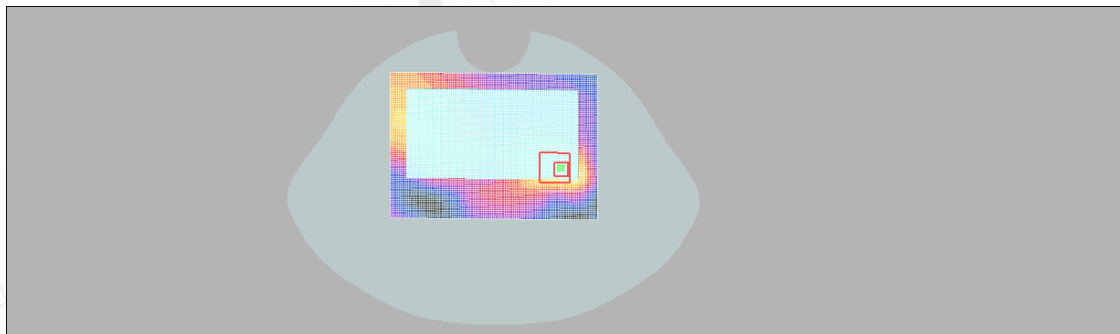
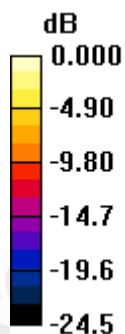
Maximum value of SAR (measured) =  $0.641 \text{ mW/g}$



0 dB =  $0.641 \text{ mW/g}$

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0 dB = 0.641mW/g

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Date: 2011/11/4

## Lapdock\_CH4183

Communication System: WCDMA BAND5; Frequency: 836.6 MHz; Duty Cycle: 1:1  
Medium: Muscle 900 MHz Medium parameters used:  $f = 837 \text{ MHz}$ ;  $\sigma = 1 \text{ mho/m}$ ;  $\epsilon_r = 54.3$ ;  
 $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section

### DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(8.87, 8.87, 8.87); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**BODY/Area Scan (61x101x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
Maximum value of SAR (interpolated) =  $0.797 \text{ mW/g}$

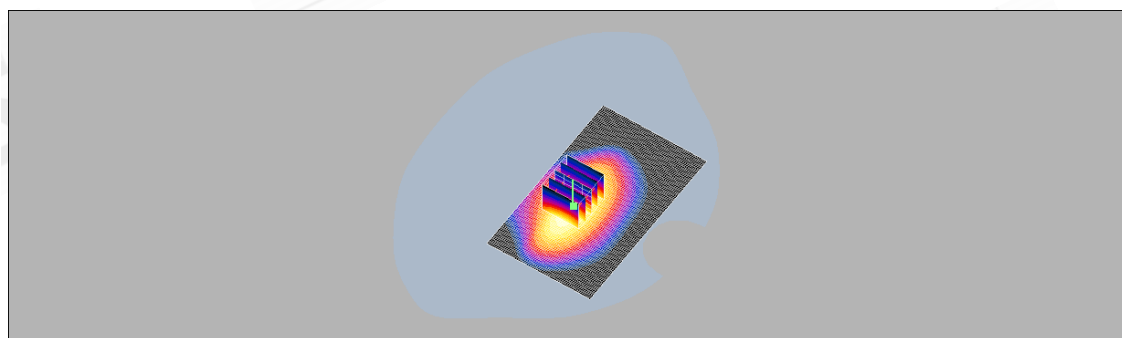
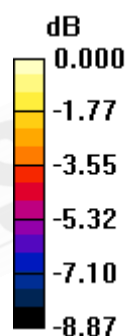
**BODY/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  
 $dz=5\text{mm}$

Reference Value =  $20.8 \text{ V/m}$ ; Power Drift =  $-0.120 \text{ dB}$

Peak SAR (extrapolated) =  $0.920 \text{ W/kg}$

**SAR(1 g) =  $0.640 \text{ mW/g}$ ; SAR(10 g) =  $0.444 \text{ mW/g}$**

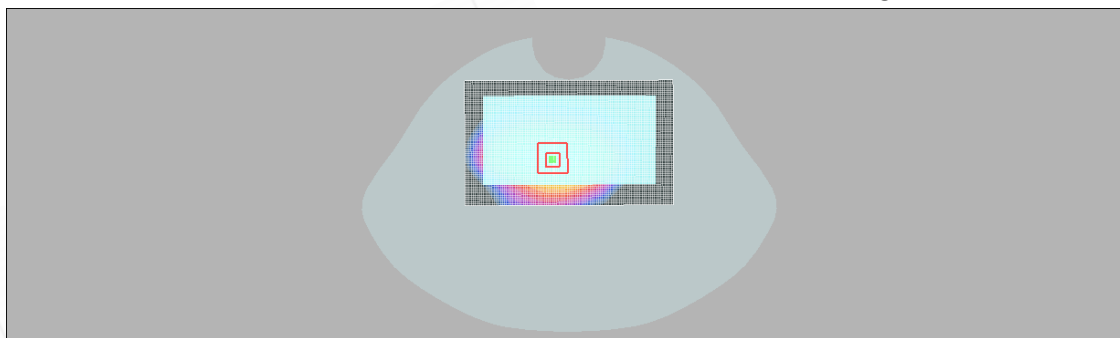
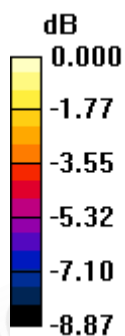
Maximum value of SAR (measured) =  $0.790 \text{ mW/g}$



0 dB =  $0.790 \text{ mW/g}$

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0 dB = 0.790mW/g

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Date: 2011/11/4

## Lapdock\_WLAN802.11b\_CH6

Communication System: WiFi b\_FCC; Frequency: 2437 MHz; Duty Cycle: 1:1  
Medium: Muscle 2450 Medium parameters used:  $f = 2437 \text{ MHz}$ ;  $\sigma = 1.94 \text{ mho/m}$ ;  $\epsilon_r = 51.3$ ;  
 $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section

### DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(6.62, 6.62, 6.62); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**BODY/Area Scan (61x101x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
Maximum value of SAR (interpolated) = 0.342 mW/g

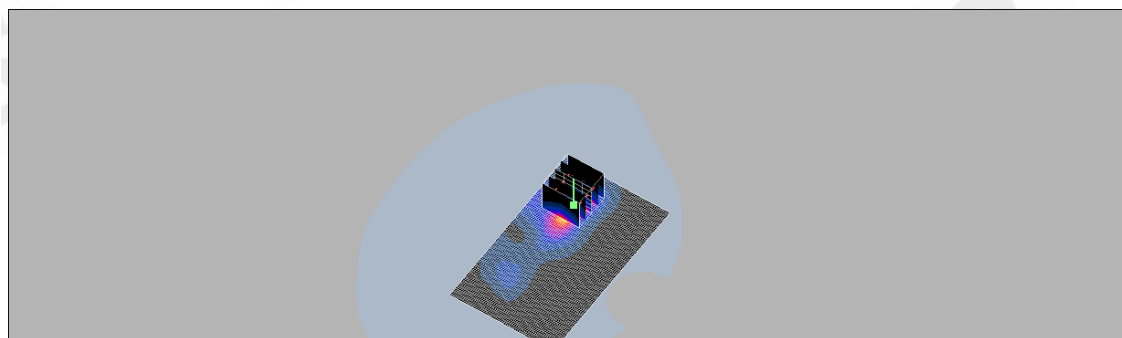
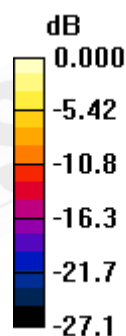
**BODY/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  
 $dz=5\text{mm}$

Reference Value = 3.29 V/m; Power Drift = -0.116 dB

Peak SAR (extrapolated) = 0.429 W/kg

**SAR(1 g) = 0.209 mW/g; SAR(10 g) = 0.096 mW/g**

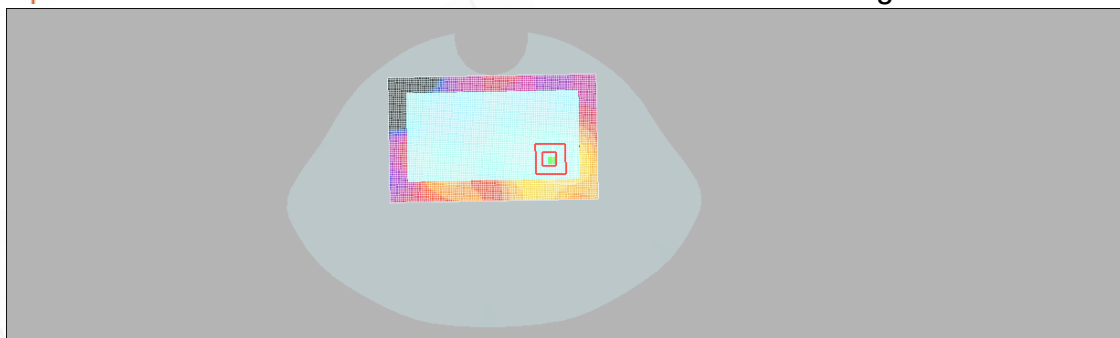
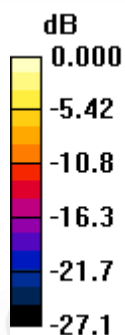
Maximum value of SAR (measured) = 0.311 mW/g



0 dB = 0.311mW/g

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0 dB = 0.311mW/g

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## 5. System Verification

Date: 2011/11/4

### DUT: Dipole 835 MHz;

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

Medium: Muscle 900 MHz Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.998 \text{ mho/m}$ ;  $\epsilon_r = 54.3$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

### DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(8.87, 8.87, 8.87); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Pin=250mW/Area Scan (61x61x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$ 

Maximum value of SAR (interpolated) = 2.55 mW/g

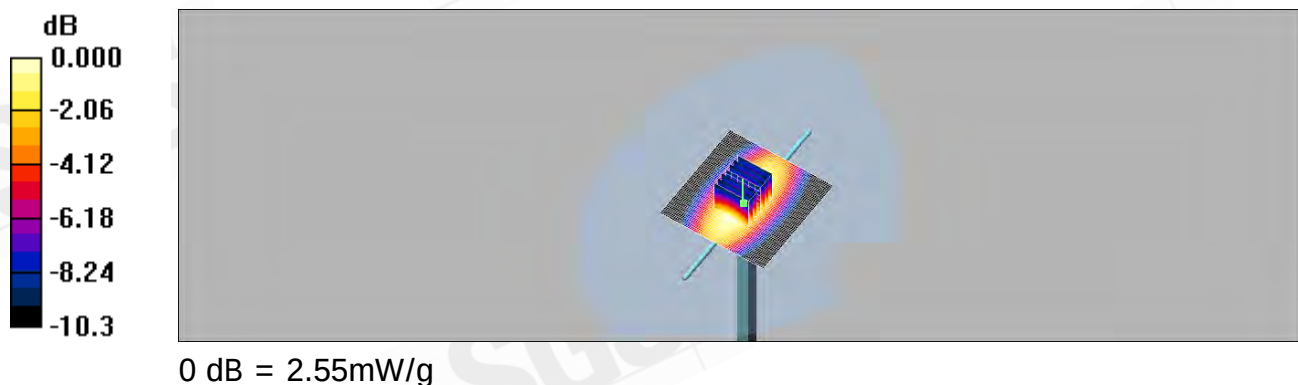
**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 50.5 V/m; Power Drift = -0.009 dB

Peak SAR (extrapolated) = 3.54 W/kg

**SAR(1 g) = 2.36 mW/g; SAR(10 g) = 1.59 mW/g**

Maximum value of SAR (measured) = 2.55 mW/g



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Date: 2011/11/4

## DUT: Dipole 1900 MHz;

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

Medium: M1800 & 1900 Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\sigma = 1.57 \text{ mho/m}$ ;  $\epsilon_r = 51.4$ ;  
 $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

### DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(6.97, 6.97, 6.97); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Pin=250mW/Area Scan (51x61x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 12.6 mW/g

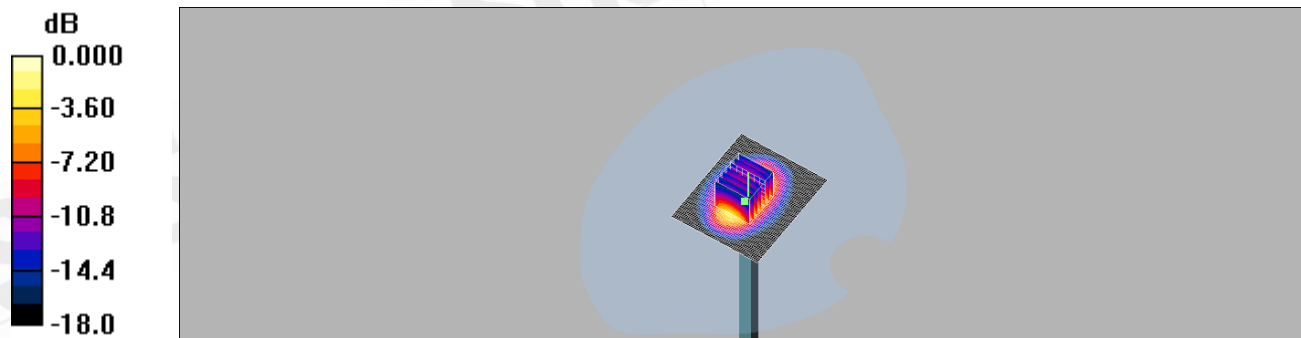
**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  
 $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 83.7 V/m; Power Drift = 0.029 dB

Peak SAR (extrapolated) = 18.5 W/kg

**SAR(1 g) = 9.9 mW/g; SAR(10 g) = 5.2 mW/g**

Maximum value of SAR (measured) = 11.1 mW/g



0 dB = 11.1mW/g

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Date: 2011/11/4

# DUT: Dipole 2450 MHz;

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: Muscle 2450 Medium parameters used:  $f = 2450 \text{ MHz}$ ;  $\sigma = 1.97 \text{ mho/m}$ ;  $\epsilon_r = 51.1$ ;  
 $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

## DASY4 Configuration:

- Probe: EX3DV4 - SN3703; ConvF(6.62, 6.62, 6.62); Calibrated: 2011/8/25
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2011/8/29
- Phantom: SAM1; Type: SAM 4.0; Serial: TP:1419
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Pin=250mW/Area Scan (51x61x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 16.2 mW/g

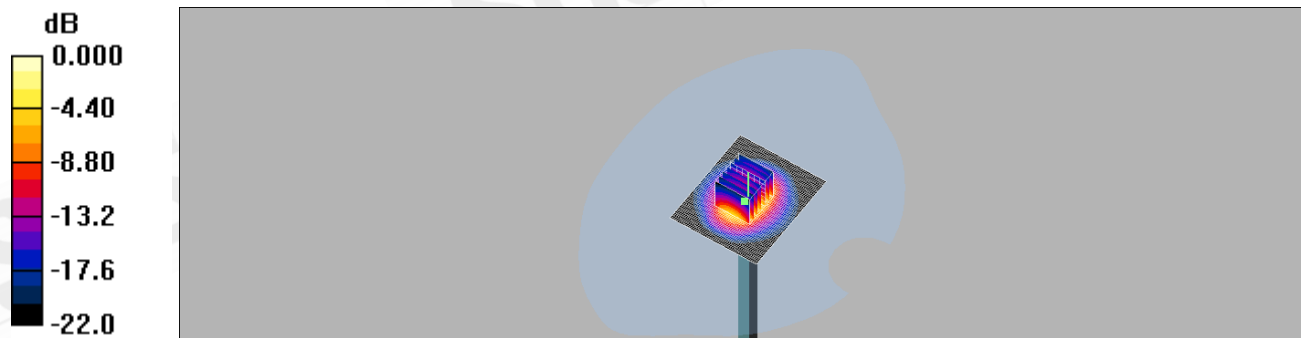
**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  
 $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 85.2 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 25.6 W/kg

**SAR(1 g) = 12.3 mW/g; SAR(10 g) = 5.69 mW/g**

Maximum value of SAR (measured) = 14.2 mW/g



0 dB = 14.2mW/g

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## 6. DAE &amp; Probe Calibration certificate

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Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



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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 **SGS-TW**

Certificate No: **DAE4-547\_Aug11**

### CALIBRATION CERTIFICATE

Object **DAE4 - SD/000 D04 BJ - SN: 547**

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

Calibration date: **August 29, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards             | ID #               | Cal Date (Certificate No.) | Scheduled Calibration  |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278        | 28-Sep-10 (No:10376)       | Sep-11                 |
| Secondary Standards           | ID #               | Check Date (in house)      | Scheduled Check        |
| Calibrator Box V1.1           | SE UMS 006 AB 1004 | 08-Jun-11 (in house check) | In house check: Jun-12 |

|                |                   |              |           |
|----------------|-------------------|--------------|-----------|
|                | Name              | Function     | Signature |
| Calibrated by: | Dominique Steffen | Technician   |           |
| Approved by:   | Fin Bornholt      | R&D Director |           |

Issued: August 29, 2011

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

Certificate No: DAE4-547\_Aug11

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client SGS-TW (Auden)

Certificate No: EX3-3703\_Aug11

## CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3703

Calibration procedure(s) QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4  
Calibration procedure for dosimetric E-field probes

Calibration date: August 25, 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:          | Katja Pokovic | Technical Manager |           |
| Approved by:            | Niels Kuster  | Quality Manager   |           |
| Issued: August 25, 2011 |               |                   |           |

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Certificate No: EX3-3703\_Aug11

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Accreditation No.: SCS 108

## Glossary:

|                          |                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| TSL                      | tissue simulating liquid                                                                                                                                |
| NORM <sub>x,y,z</sub>    | sensitivity in free space                                                                                                                               |
| ConvF                    | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                              |
| DCP                      | diode compression point                                                                                                                                 |
| CF                       | crest factor (1/duty_cycle) of the RF signal                                                                                                            |
| A, B, C                  | modulation dependent linearization parameters                                                                                                           |
| Polarization $\varphi$   | $\varphi$ rotation around probe axis                                                                                                                    |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ is normal to probe axis |

## Calibration is Performed According to the Following Standards:

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

## Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Certificate No: EX3-3703\_Aug11

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EX3DV4 – SN:3703

August 25, 2011

## Probe EX3DV4

SN:3703

Manufactured: July 21, 2009  
Calibrated: August 25, 2011Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

Certificate No: EX3-3703\_Aug11

Page 3 of 11

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EX3DV4- SN:3703

August 25, 2011

**DASY/EASY - Parameters of Probe: EX3DV4 - SN:3703****Basic Calibration Parameters**

|                                       | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---------------------------------------|----------|----------|----------|-----------|
| Norm ( $\mu V/(V/m)^2$ ) <sup>A</sup> | 0.46     | 0.47     | 0.50     | ± 10.1 %  |
| DCP (mV) <sup>B</sup>                 | 98.6     | 96.4     | 97.9     |           |

**Modulation Calibration Parameters**

| UID   | Communication System Name | PAR  |   | A<br>dB | B<br>dB | C<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-------|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 10000 | CW                        | 0.00 | X | 0.00    | 0.00    | 1.00    | 108.6    | ±1.9 %                    |
|       |                           |      | Y | 0.00    | 0.00    | 1.00    | 112.0    |                           |
|       |                           |      | Z | 0.00    | 0.00    | 1.00    | 115.8    |                           |

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 Pages 5 and 6).

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

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

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EX3DV4- SN:3703

August 25, 2011

**DASY/EASY - Parameters of Probe: EX3DV4 - SN:3703****Calibration Parameter Determined in Head Tissue Simulating Media**

| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 9.01    | 9.01    | 9.01    | 0.61  | 0.74       | ± 12.0 %    |
| 835                  | 41.5                               | 0.90                            | 8.63    | 8.63    | 8.63    | 0.65  | 0.72       | ± 12.0 %    |
| 900                  | 41.5                               | 0.97                            | 8.53    | 8.53    | 8.53    | 0.69  | 0.68       | ± 12.0 %    |
| 1750                 | 40.1                               | 1.37                            | 8.07    | 8.07    | 8.07    | 0.72  | 0.65       | ± 12.0 %    |
| 1900                 | 40.0                               | 1.40                            | 7.74    | 7.74    | 7.74    | 0.70  | 0.65       | ± 12.0 %    |
| 2000                 | 40.0                               | 1.40                            | 7.65    | 7.65    | 7.65    | 0.69  | 0.65       | ± 12.0 %    |
| 2450                 | 39.2                               | 1.80                            | 6.81    | 6.81    | 6.81    | 0.64  | 0.68       | ± 12.0 %    |
| 2600                 | 39.0                               | 1.96                            | 6.68    | 6.68    | 6.68    | 0.54  | 0.77       | ± 12.0 %    |

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

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

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EX3DV4- SN:3703

August 25, 2011

**DASY/EASY - Parameters of Probe: EX3DV4- SN:3703****Calibration Parameter Determined in Body Tissue Simulating Media**

| f (MHz) <sup>c</sup> | Relative Permittivity <sup>f</sup> | Conductivity (S/m) <sup>f</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 8.88    | 8.88    | 8.88    | 0.69  | 0.74       | ± 12.0 %    |
| 835                  | 55.2                               | 0.97                            | 8.87    | 8.87    | 8.87    | 0.75  | 0.68       | ± 12.0 %    |
| 900                  | 55.0                               | 1.05                            | 8.70    | 8.70    | 8.70    | 0.76  | 0.66       | ± 12.0 %    |
| 1750                 | 53.4                               | 1.49                            | 7.41    | 7.41    | 7.41    | 0.80  | 0.65       | ± 12.0 %    |
| 1900                 | 53.3                               | 1.52                            | 6.97    | 6.97    | 6.97    | 0.80  | 0.63       | ± 12.0 %    |
| 2000                 | 53.3                               | 1.52                            | 7.14    | 7.14    | 7.14    | 0.80  | 0.62       | ± 12.0 %    |
| 2450                 | 52.7                               | 1.95                            | 6.62    | 6.62    | 6.62    | 0.80  | 0.60       | ± 12.0 %    |
| 2600                 | 52.5                               | 2.16                            | 6.56    | 6.56    | 6.56    | 0.80  | 0.59       | ± 12.0 %    |
| 5200                 | 49.0                               | 5.30                            | 4.00    | 4.00    | 4.00    | 0.45  | 1.95       | ± 13.1 %    |
| 5300                 | 48.9                               | 5.42                            | 3.79    | 3.79    | 3.79    | 0.50  | 1.95       | ± 13.1 %    |
| 5600                 | 48.5                               | 5.77                            | 3.28    | 3.28    | 3.28    | 0.65  | 1.95       | ± 13.1 %    |
| 5800                 | 48.2                               | 6.00                            | 3.55    | 3.55    | 3.55    | 0.60  | 1.95       | ± 13.1 %    |

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

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

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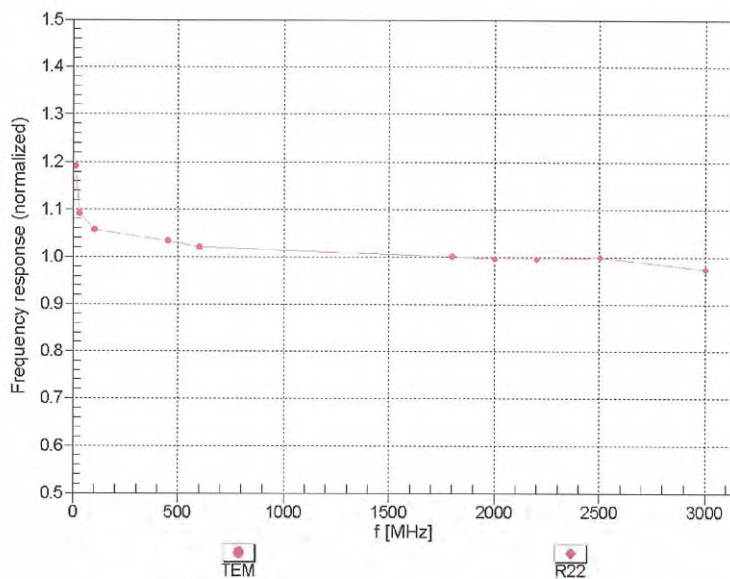
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EX3DV4-SN:3703

August 25, 2011

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

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

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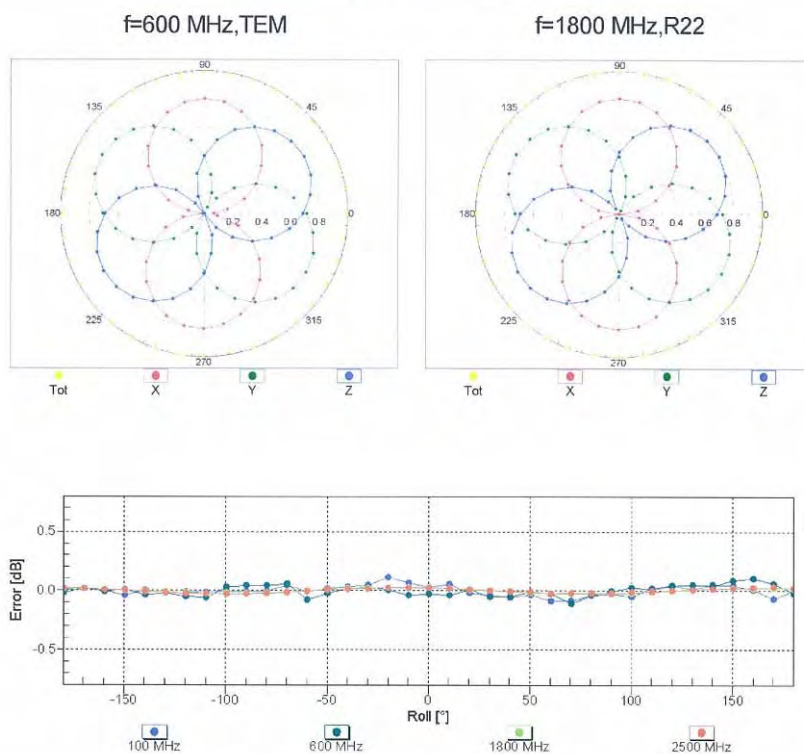
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EX3DV4- SN:3703

August 25, 2011

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



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

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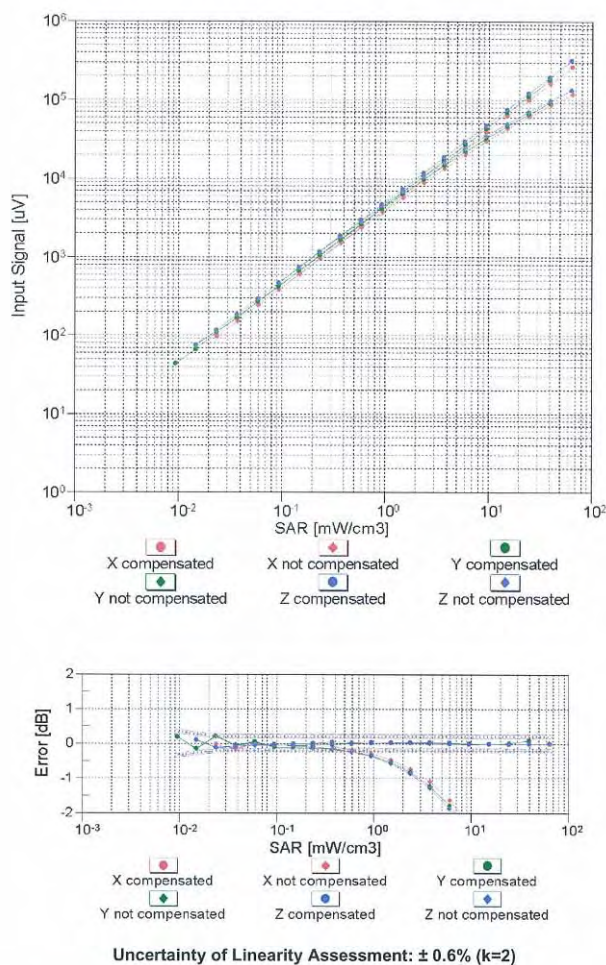
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EX3DV4-SN:3703

August 25, 2011

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



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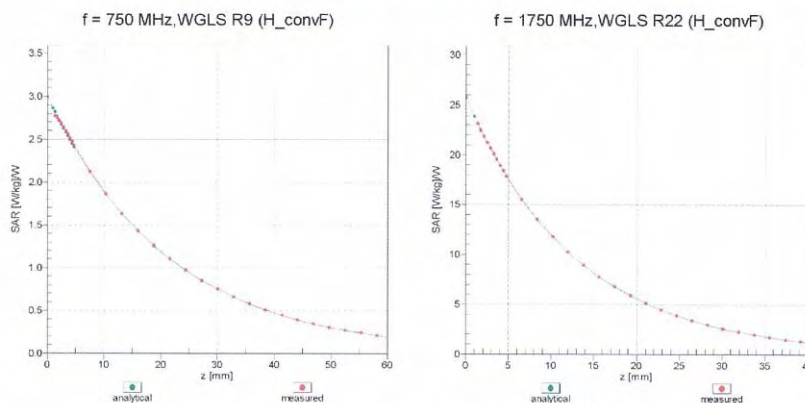
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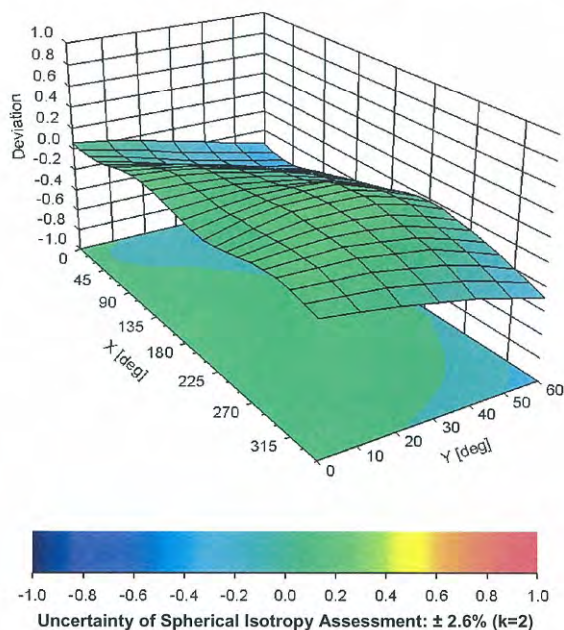
EX3DV4- SN:3703

August 25, 2011

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid Error ( $\phi$ , $\theta$ ), $f = 900 \text{ MHz}$



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EX3DV4- SN:3703

August 25, 2011

**DASY/EASY - Parameters of Probe: EX3DV4 - SN:3703****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           |

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## 7. Uncertainty Budget

| <b>DASY4 Uncertainty Budget</b><br>According to IEEE P1528 [1] |                   |             |            |              |               |                |                 |                     |
|----------------------------------------------------------------|-------------------|-------------|------------|--------------|---------------|----------------|-----------------|---------------------|
| Error Description                                              | Uncertainty value | Prob. Dist. | Div.       | ( $c_i$ ) 1g | ( $c_i$ ) 10g | Std. Unc. (1g) | Std. Unc. (10g) | ( $v_i$ ) $v_{eff}$ |
| <b>Measurement System</b>                                      |                   |             |            |              |               |                |                 |                     |
| Probe Calibration                                              | ±4.8 %            | N           | 1          | 1            | 1             | ±4.8 %         | ±4.8 %          | ∞                   |
| Axial Isotropy                                                 | ±4.7 %            | R           | $\sqrt{3}$ | 0.7          | 0.7           | ±1.9 %         | ±1.9 %          | ∞                   |
| Hemispherical Isotropy                                         | ±9.6 %            | R           | $\sqrt{3}$ | 0.7          | 0.7           | ±3.9 %         | ±3.9 %          | ∞                   |
| Boundary Effects                                               | ±1.0 %            | R           | $\sqrt{3}$ | 1            | 1             | ±0.6 %         | ±0.6 %          | ∞                   |
| Linearity                                                      | ±4.7 %            | R           | $\sqrt{3}$ | 1            | 1             | ±2.7 %         | ±2.7 %          | ∞                   |
| System Detection Limits                                        | ±1.0 %            | R           | $\sqrt{3}$ | 1            | 1             | ±0.6 %         | ±0.6 %          | ∞                   |
| Readout Electronics                                            | ±1.0 %            | N           | 1          | 1            | 1             | ±1.0 %         | ±1.0 %          | ∞                   |
| Response Time                                                  | ±0.8 %            | R           | $\sqrt{3}$ | 1            | 1             | ±0.5 %         | ±0.5 %          | ∞                   |
| Integration Time                                               | ±2.6 %            | R           | $\sqrt{3}$ | 1            | 1             | ±1.5 %         | ±1.5 %          | ∞                   |
| RF Ambient Conditions                                          | ±3.0 %            | R           | $\sqrt{3}$ | 1            | 1             | ±1.7 %         | ±1.7 %          | ∞                   |
| Probe Positioner                                               | ±0.4 %            | R           | $\sqrt{3}$ | 1            | 1             | ±0.2 %         | ±0.2 %          | ∞                   |
| Probe Positioning                                              | ±2.9 %            | R           | $\sqrt{3}$ | 1            | 1             | ±1.7 %         | ±1.7 %          | ∞                   |
| Max. SAR Eval.                                                 | ±1.0 %            | R           | $\sqrt{3}$ | 1            | 1             | ±0.6 %         | ±0.6 %          | ∞                   |
| <b>Test Sample Related</b>                                     |                   |             |            |              |               |                |                 |                     |
| Device Positioning                                             | ±2.9 %            | N           | 1          | 1            | 1             | ±2.9 %         | ±2.9 %          | 875                 |
| Device Holder                                                  | ±3.6 %            | N           | 1          | 1            | 1             | ±3.6 %         | ±3.6 %          | 5                   |
| Power Drift                                                    | ±5.0 %            | R           | $\sqrt{3}$ | 1            | 1             | ±2.9 %         | ±2.9 %          | ∞                   |
| <b>Phantom and Setup</b>                                       |                   |             |            |              |               |                |                 |                     |
| Phantom Uncertainty                                            | ±4.0 %            | R           | $\sqrt{3}$ | 1            | 1             | ±2.3 %         | ±2.3 %          | ∞                   |
| Liquid Conductivity (target)                                   | ±5.0 %            | R           | $\sqrt{3}$ | 0.64         | 0.43          | ±1.8 %         | ±1.2 %          | ∞                   |
| Liquid Conductivity (meas.)                                    | ±2.5 %            | N           | 1          | 0.64         | 0.43          | ±1.6 %         | ±1.1 %          | ∞                   |
| Liquid Permittivity (target)                                   | ±5.0 %            | R           | $\sqrt{3}$ | 0.6          | 0.49          | ±1.7 %         | ±1.4 %          | ∞                   |
| Liquid Permittivity (meas.)                                    | ±2.5 %            | N           | 1          | 0.6          | 0.49          | ±1.5 %         | ±1.2 %          | ∞                   |
| Combined Std. Uncertainty                                      |                   |             |            |              |               | ±10.3 %        | ±10.0 %         | 331                 |
| <b>Expanded STD Uncertainty</b>                                |                   |             |            |              |               | <b>±20.6 %</b> | <b>±20.1 %</b>  |                     |

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## 8. Phantom description

Schmid &amp; Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland  
Phone +41 1 245 9700, Fax +41 1 245 9779  
info@speag.com, http://www.speag.com

## Certificate of Conformity / First Article Inspection

|              |                                                              |
|--------------|--------------------------------------------------------------|
| Item         | SAM Twin Phantom V4.0                                        |
| Type No      | QD 000 P40 C                                                 |
| Series No    | TP-1150 and higher                                           |
| Manufacturer | SPEAG<br>Zeughausstrasse 43<br>CH-8004 Zurich<br>Switzerland |

## Tests

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

| Test                        | Requirement                                                                                                                                                                                      | Details                                                                  | Units tested                                |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------|
| Dimensions                  | Compliant with the geometry according to the CAD model.                                                                                                                                          | IT'IS CAD File (*)                                                       | First article, Samples                      |
| Material thickness of shell | Compliant with the requirements according to the standards                                                                                                                                       | 2mm +/- 0.2mm in flat and specific areas of head section                 | First article, Samples, TP-1314 ff.         |
| Material thickness at ERP   | Compliant with the requirements according to the standards                                                                                                                                       | 6mm +/- 0.2mm at ERP                                                     | First article, All items                    |
| Material parameters         | Dielectric parameters for required frequencies                                                                                                                                                   | 300 MHz – 6 GHz:<br>Relative permittivity < 5,<br>Loss tangent < 0.05    | Material samples                            |
| Material resistivity        | The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe technical Note for material compatibility. | DEGMBE based simulating liquids                                          | Pre-series, First article, Material samples |
| Sagging                     | Compliant with the requirements according to the standards. Sagging of the flat section when filled with tissue simulating liquid.                                                               | < 1% typical < 0.8% if filled with 155mm of HSL900 and without DUT below | Prototypes, Sample testing                  |

## Standards

- [1] CENELEC EN 50361
- [2] IEEE Std 1528-2003
- [3] IEC 62209 Part I
- [4] FCC OET Bulletin 65, Supplement C, Edition 01-01

(\*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

## Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standards [1] to [4].

Date 07.07.2005

s p e a g

Signature / Stamp

Schmid & Partner Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland  
Phone +41 1 245 9700, Fax +41 1 245 9779  
info@speag.com, http://www.speag.com

Doc No. 881 – QD 000 P40 C – F

Page 1 (1)

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## 9. System Validation from Original equipment supplier

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 SGS-TW (Auden)

Certificate No: D835V2-4d063\_May11

### CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d063

Calibration procedure(s) QA CAL-05.v8  
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: May 25, 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 EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Reference 20 dB Attenuator  | SN: S5086 (20b)    | 29-Mar-11 (No. 217-01367)         | Apr-12                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)         | Apr-12                 |
| Reference Probe ES3DV3      | SN: 3205           | 29-Apr-11 (No. ES3-3205_Apr11)    | Apr-12                 |
| DAE4                        | SN: 601            | 10-Jun-10 (No. DAE4-601_Jun10)    | Jun-11                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06     | 100005             | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

Calibrated by: Name Claudio Leubler Function Laboratory Technician

Approved by: Katja Pokovic Technical Manager

Issued: May 25, 2011

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Certificate No: D835V2-4d063\_May11

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**DASY5 Validation Report for Body TSL**

Date: 25.05.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d063**

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

Medium: MSL900

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 1 \text{ mho/m}$ ;  $\epsilon_r = 53.9$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

**DASY5 Configuration:**

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

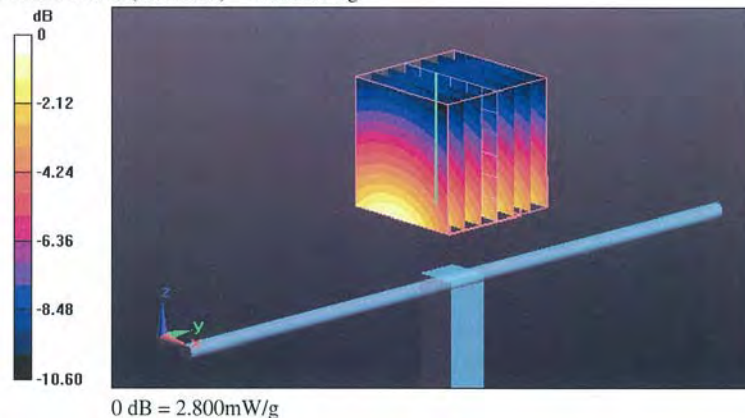
**Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Cube 0:**Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 54.297 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.530 W/kg

**SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.6 mW/g**

Maximum value of SAR (measured) = 2.804 mW/g



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



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Accredited by the Swiss Accreditation Service (SAS)

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client SGS TW (Auden)

Certificate No: D1900V2-5d027\_Apr11

## CALIBRATION CERTIFICATE

Object D1900V2 - SN: 5d027

Calibration procedure(s) QA CAL-05.v8  
Calibration procedure for dipole validation kits

Calibration date: April 19, 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 EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 29-Mar-11 (No. 217-01368)      | Apr-12                |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)      | Apr-12                |
| Reference Probe ES3DV3      | SN: 3205           | 30-Apr-10 (No. ES3-3205_Apr10) | Apr-11                |
| DAE4                        | SN: 601            | 10-Jun-10 (No. DAE4-601_Jun10) | Jun-11                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A     | MY41092317       | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06   | 100005           | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

Calibrated by: Name Claudio Leubler Function Laboratory Technician

Approved by: Katja Pokovic Technical Manager

Issued: April 19, 2011

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

Certificate No: D1900V2-5d027\_Apr11

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## DASY5 Validation Report for Body TSL

Date/Time: 19.04.2011 12:53:51

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d027**

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

Medium: MSL U12 BB

Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\sigma = 1.52 \text{ mho/m}$ ;  $\epsilon_r = 51.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2829)

**Pin=250 mW, Cube 0:**

Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 96.170 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 17.156 W/kg

**SAR(1 g) = 9.93 mW/g; SAR(10 g) = 5.18 mW/g**

Maximum value of SAR (measured) = 12.615 mW/g



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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **SGS TW (Auden)**

Certificate No: D2450V2- 727\_Apr11

### CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 727**

Calibration procedure(s) **QA CAL-05.v8  
Calibration procedure for dipole validation kits**

Calibration date: **April 19, 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 EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 29-Mar-11 (No. 217-01368)      | Apr-12                |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)      | Apr-12                |
| Reference Probe ES3DV3      | SN: 3205           | 30-Apr-10 (No. ES3-3205_Apr10) | Apr-11                |
| DAE4                        | SN: 601            | 10-Jun-10 (No. DAE4-601_Jun10) | Jun-11                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A     | MY41092317       | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06   | 100005           | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

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

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

Issued: April 19, 2011

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

Certificate No: D2450V2-727\_Apr11

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**DASY5 Validation Report for Body TSL**

Date/Time: 19.04.2011 14:37:11

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:727**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used:  $f = 2450 \text{ MHz}$ ;  $\sigma = 1.91 \text{ mho/m}$ ;  $\epsilon_r = 50.6$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

**DASY5 Configuration:**

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2829)

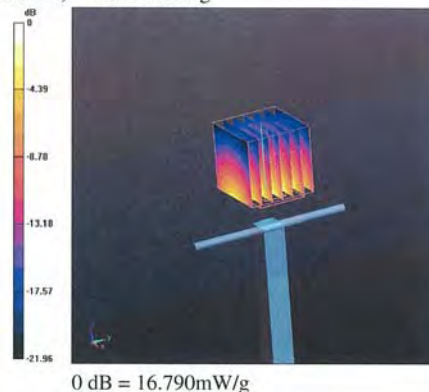
**Pin=250 mW, Cube 0:**Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 96.949 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 26.888 W/kg

**SAR(1 g) = 12.7 mW/g; SAR(10 g) = 5.84 mW/g**

Maximum value of SAR (measured) = 16.794 mW/g

**End of 1<sup>st</sup> part of report**

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