

## SAR Compliance Test Report

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                         |                                                                                                                     |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------|
| Test report no.:                                 | Oulu_SAR_0540_04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Date of report:         | 2005-11-10                                                                                                          |
| Template version:                                | 4a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Number of pages:        | 56                                                                                                                  |
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| Tested device:                                   | RM-49                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                         |                                                                                                                     |
| FCC ID:                                          | PYARM-49                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | IC:                     | 661V-RM49                                                                                                           |
| Supplement reports:                              | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                         |                                                                                                                     |
| Testing has been carried out in accordance with: | <b>47CFR §2.1093</b><br>Radiofrequency Radiation Exposure Evaluation: Portable Devices<br><br><b>FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)</b><br>Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields<br><br><b>RSS-102</b><br>Evaluation Procedure for Mobile and Portable Radio Transmitters with Respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields<br><br><b>IEEE 1528 - 2003</b><br>IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques |                         |                                                                                                                     |
| Documentation:                                   | The documentation of the testing performed on the tested devices is archived for 15 years at TCC Nokia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                         |                                                                                                                     |
| Test results:                                    | <b>The tested device complies with the requirements in respect of all parameters subject to the test.</b> The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory.                                                                                                                                                                                                                                                                                                                                                                                                             |                         |                                                                                                                     |

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## 1. SUMMARY OF SAR TEST REPORT

### 1.1 Test Details

|                                        |                                                              |
|----------------------------------------|--------------------------------------------------------------|
| Period of test                         | 2005-10-21 to 2005-10-28                                     |
| SN, HW and SW numbers of tested device | SN: 004400/70/169542/9; HW: 1304; SW: 05w38.2.0; DUT#: 30485 |
| Batteries used in testing              | BL-5C; DUT#'s: 30433, 30486, 30487, 30488                    |
| Headsets used in testing               | HS-6; DUT#: 30435                                            |
| Other accessories used in testing      | MMC card MU-1; DUT#:30489                                    |
| State of sample                        | Prototype unit                                               |
| Notes                                  |                                                              |

### 1.2 Maximum Results

The maximum measured SAR values for Head configuration and Body Worn configuration are given in section 1.2.1 and 1.2.2 respectively. The device conforms to the requirements of the standard(s) when the maximum measured SAR value is less than or equal to the limit.

#### 1.2.1 Head Configuration

| Mode                       | Position    | Measured SAR value (1g avg) | Scaled* SAR value (1g avg) | SAR limit (1g avg) | Result        |
|----------------------------|-------------|-----------------------------|----------------------------|--------------------|---------------|
| 2-slot GPRS1900            | Left, Tilt  | 0.98 W/kg                   | <b>1.10 W/kg</b>           | 1.6 W/kg           | <b>PASSED</b> |
| WLAN2450                   | Left, Cheek | 0.40 W/kg                   | <b>0.45 W/kg</b>           | 1.6 W/kg           | <b>PASSED</b> |
| WLAN2450 + 2-slot GPRS1900 | Left, Cheek | 1.06 W/kg                   | <b>1.19 W/kg</b>           | 1.6 W/kg           | <b>PASSED</b> |

#### 1.2.2 Body Worn Configuration

| Mode                       | Separation distance | Measured SAR value (1g avg) | Scaled* SAR value (1g avg) | SAR limit (1g avg) | Result        |
|----------------------------|---------------------|-----------------------------|----------------------------|--------------------|---------------|
| 2-slot GPRS1900            | 1.5 cm              | 0.86 W/kg                   | <b>0.96 W/kg</b>           | 1.6 W/kg           | <b>PASSED</b> |
| WLAN2450                   | 1.5 cm              | 0.19 W/kg                   | <b>0.21 W/kg</b>           | 1.6 W/kg           | <b>PASSED</b> |
| WLAN2450 + 2-slot GPRS1900 | 1.5 cm              | 1.02 W/kg                   | <b>1.14 W/kg</b>           | 1.6 W/kg           | <b>PASSED</b> |

\*SAR values are scaled up by 12% to cover measurement drift.

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### 1.2.3 Maximum Drift

| Maximum drift covered by 12% scaling up of the SAR values | Maximum drift during measurements |
|-----------------------------------------------------------|-----------------------------------|
| 0.5 dB                                                    | 0.19 dB                           |

### 1.2.4 Measurement Uncertainty

|                                |               |
|--------------------------------|---------------|
| Expanded Uncertainty (k=2) 95% | $\pm 27.4 \%$ |
|--------------------------------|---------------|

## 2. DESCRIPTION OF THE DEVICE UNDER TEST

|                      |                                   |
|----------------------|-----------------------------------|
| Device category      | Portable                          |
| Exposure environment | General population / uncontrolled |

|                                   |             |              |               |             |             |
|-----------------------------------|-------------|--------------|---------------|-------------|-------------|
| Modes and Bands of Operation      | GSM<br>1900 | GPRS<br>1900 | EGPRS<br>1900 | BT          | WLAN        |
| Modulation Mode                   | GMSK        | GMSK         | 8PSK          | GFSK        |             |
| Duty Cycle                        | 1/8         | 1/8 or 2/8   | 1/8 or 2/8    |             | 1           |
| Transmitter Frequency Range (MHz) | 1850 - 1910 | 1850 - 1910  | 1850 - 1910   | 2402 – 2480 | 2412 – 2462 |

Outside of USA and Canada, the transmitter of the device is capable of operating also in GSM900, GSM1800 and WCDMA2100 which are not part of this filing.

This device has Push to Talk/Voice-over-IP capability for use at the ear. Therefore, SAR for 2-slot GPRS mode was evaluated against the head profile of the phantom

EGPRS mode was not measured, because maximum averaged output power is lower in EGPRS mode than in GPRS mode.

### 2.1 Picture of the Device



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## 2.2 Description of the Antenna

The device has an internal patch antenna.

## 3. TEST CONDITIONS

### 3.1 Temperature and Humidity

|                           |              |
|---------------------------|--------------|
| Ambient temperature (°C): | 22.0 to 24.0 |
| Ambient humidity (RH %):  | 30 to 45     |

### 3.2 Test Signal, Frequencies and Output Power

The device was put into operation by using a call tester. Communication between the device and the call tester was established by air link.

The device output power was set to maximum power level for all tests; a fully charged battery was used for every test sequence.

In all operating bands the measurements were performed on lowest, middle and highest channels.

The radiated output power of the device was measured by a separate test laboratory on the same unit as used for SAR testing.

## 4. DESCRIPTION OF THE TEST EQUIPMENT

### 4.1 Measurement System and Components

The measurements were performed using an automated near-field scanning system, DASY4 software version 4.5, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland. The SAR extrapolation algorithm used in all measurements was the 'advanced extrapolation' algorithm.

The following table lists calibration dates of SPEAG components:

| Test Equipment                 | Serial Number | Calibration interval | Calibration expiry |
|--------------------------------|---------------|----------------------|--------------------|
| DAE4                           | 555           | 12 months            | 2006-02            |
| E-field Probe ET3DV6           | 1765          | 12 months            | 2006-02            |
| Dipole Validation Kit, D1900V2 | 5d030         | 24 months            | 2007-02            |
| Dipole Validation Kit, D2450V2 | 729           | 24 months            | 2007-02            |

Additional test equipment used in testing:

| Test Equipment             | Model                    | Serial Number | Calibration interval | Calibration expiry |
|----------------------------|--------------------------|---------------|----------------------|--------------------|
| Signal Generator           | HP 8657B                 | 3630U08114    | 12 months            | 2006-02            |
| Amplifier                  | Amplifier Research 5S1G4 | 306024        | -                    | -                  |
| Power Meter                | R&S NRT                  | 101143        | 12 months            | 2006-02            |
| Power Sensor               | R&S NRT-Z43              | 100239        | 12 months            | 2006-02            |
| Power Meter                | E4416A                   | GB41291465    | 12 months            | 2006-02            |
| Power Sensor               | E9323A                   | US40411045    | 12 months            | 2006-02            |
| Thermometer                | Fluke 51 II              | 84350048      | 12 months            | 2006-02            |
| Thermometer                | Fluke 52 II              | 82810048      | 12 months            | 2006-02            |
| Network Analyzer           | HP 8753D                 | 3410A08934    | 12 months            | 2006-02            |
| Dielectric Probe Kit       | Agilent 85070D           | US01440162    | -                    | -                  |
| Radio Communication Tester | CMU 200                  | 100084        | 12 months            | 2006-05            |
| Radio Communication Tester | CMU 200                  | 106354        | 12 months            | 2006-04            |

#### 4.1.1 Isotropic E-field Probe ET3DV6

|                                  |                                                                                                                                                                                                                              |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Construction</b>              | Symmetrical design with triangular core<br>Built-in optical fiber for surface detection system<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., butyl diglycol) |
| <b>Calibration</b>               | Calibration certificate in Appendix C                                                                                                                                                                                        |
| <b>Frequency</b>                 | 10 MHz to 3 GHz (dosimetry); Linearity: $\pm 0.2$ dB (30 MHz to 3 GHz)                                                                                                                                                       |
| <b>Optical Surface Detection</b> | $\pm 0.2$ mm repeatability in air and clear liquids over diffuse reflecting surfaces                                                                                                                                         |
| <b>Directivity</b>               | $\pm 0.2$ dB in HSL (rotation around probe axis)<br>$\pm 0.4$ dB in HSL (rotation normal to probe axis)                                                                                                                      |
| <b>Dynamic Range</b>             | 5 $\mu$ W/g to > 100 mW/g; Linearity: $\pm 0.2$ dB                                                                                                                                                                           |
| <b>Dimensions</b>                | Overall length: 330 mm<br>Tip length: 16 mm<br>Body diameter: 12 mm<br>Tip diameter: 6.8 mm<br>Distance from probe tip to dipole centers: 2.7 mm                                                                             |
| <b>Application</b>               | General dosimetry up to 3 GHz<br>Compliance tests of mobile phones<br>Fast automatic scanning in arbitrary phantoms                                                                                                          |

#### 4.2 Phantoms

The phantom used for all tests i.e. for both system checking and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The phantom conforms to the requirements of IEEE 1528 - 2003.

System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

The SPEAG device holder (see Section 5.1) was used to position the device in all tests whilst a tripod was used to position the validation dipoles against the flat section of phantom.

### 4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEEE 1528 - 2003 and FCC Supplement C to OET Bulletin 65. All tests were carried out using simulants whose dielectric parameters were within  $\pm 5\%$  of the recommended values. All tests were carried out within 24 hours of measuring the dielectric parameters.

The depth of the tissue simulant was  $15.0 \pm 0.5$  cm measured from the ear reference point during system checking and device measurements.

#### 4.3.1 Tissue Simulant Recipes

The following recipes were used for Head and Body tissue simulants:

##### 1900MHz band

| Ingredient      | Head<br>(% by weight) | Body<br>(% by weight) |
|-----------------|-----------------------|-----------------------|
| Deionised Water | 54.50                 | 70.25                 |
| Tween 20        | 45.23                 | 29.41                 |
| Salt            | 0.27                  | 0.34                  |

##### 2450MHz band

| Ingredient      | Head<br>(% by weight) | Body<br>(% by weight) |
|-----------------|-----------------------|-----------------------|
| Deionised Water | 56.0                  | 70.2                  |
| Tween 20        | 44.0                  | 29.62                 |
| Salt            | -                     | 0.18                  |

#### 4.3.2 System Checking

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyser. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system checking results (dielectric parameters and SAR values) are given in the table below.

### System checking, head tissue stimulant

| $f$ [MHz] | Description       | SAR [W/kg],<br>1g | Dielectric Parameters |                | Temp<br>[°C] |
|-----------|-------------------|-------------------|-----------------------|----------------|--------------|
|           |                   |                   | $\epsilon_r$          | $\sigma$ [S/m] |              |
| 1900      | Reference result  | 9.76              | 39.5                  | 1.46           |              |
|           | $\pm 10\%$ window | 8.78 – 10.74      |                       |                |              |
|           | 2005-10-21        | 9.78              | 40.9                  | 1.41           | 22.6         |
| 2450      | Reference result  | 14.2              | 39.9                  | 1.78           |              |
|           | $\pm 10\%$ window | 12.8 – 15.6       |                       |                |              |
|           | 2005-10-27        | 14.5              | 39.8                  | 1.87           | 22.3         |

### System checking, body tissue simulant

| $f$ [MHz] | Description       | SAR [W/kg],<br>1g | Dielectric Parameters |                | Temp<br>[°C] |
|-----------|-------------------|-------------------|-----------------------|----------------|--------------|
|           |                   |                   | $\epsilon_r$          | $\sigma$ [S/m] |              |
| 1900      | Reference result  | 9.94              | 52.2                  | 1.57           |              |
|           | $\pm 10\%$ window | 8.95 – 10.93      |                       |                |              |
|           | 2005-10-24        | 9.80              | 53.5                  | 1.50           | 21.9         |
| 2450      | Reference result  | 13.4              | 52.3                  | 2.01           |              |
|           | $\pm 10\%$ window | 12.1 – 14.7       |                       |                |              |
|           | 2005-10-26        | 14.1              | 51.4                  | 2.04           | 22.0         |

Plots of the system checking scans are given in Appendix A.

#### 4.3.3 Tissue Simulants used in the Measurements

##### Head tissue simulant measurements

| $f$ [MHz] | Description       | Dielectric Parameters |                | Temp [°C] |
|-----------|-------------------|-----------------------|----------------|-----------|
|           |                   | $\epsilon_r$          | $\sigma$ [S/m] |           |
| 1880      | Recommended value | 40.0                  | 1.40           | 22.0      |
|           | $\pm 5\%$ window  | 38.0 – 42.0           | 1.33 – 1.47    |           |
|           | 2005-10-21        | 40.9                  | 1.39           |           |
| 2442      | Recommended value | 39.2                  | 1.79           | 22.0      |
|           | $\pm 5\%$ window  | 37.3 – 41.2           | 1.70 – 1.88    |           |
|           | 2005-10-27        | 39.8                  | 1.86           |           |

##### Body tissue simulant measurements

| $f$ [MHz] | Description       | Dielectric Parameters |                | Temp [°C] |
|-----------|-------------------|-----------------------|----------------|-----------|
|           |                   | $\epsilon_r$          | $\sigma$ [S/m] |           |
| 1880      | Recommended value | 53.3                  | 1.52           | 22.0      |
|           | $\pm 5\%$ window  | 50.6 – 56.0           | 1.44 – 1.60    |           |
|           | 2005-10-24        | 53.6                  | 1.49           |           |
| 2442      | Recommended value | 52.7                  | 1.94           | 22.0      |
|           | $\pm 5\%$ window  | 50.1 – 55.3           | 1.85 – 2.04    |           |
|           | 2005-10-26        | 51.4                  | 2.03           |           |

## 5. DESCRIPTION OF THE TEST PROCEDURE

### 5.1 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the Dasy system.



Device holder supplied by SPEAG

A Nokia designed spacer (illustrated below) was used to position the device within the SPEAG holder. The spacer positions the device so that the holder has minimal effect on the test results but still holds the device securely. The spacer was removed before the tests.



Nokia spacer

## 5.2 Test Positions

### 5.2.1 Against Phantom Head

Measurements were made in “cheek” and “tilt” positions on both the left hand and right hand sides of the phantom.

The positions used in the measurements were according to IEEE 1528 - 2003 "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques".



Photo of the device in “cheek” position



Photo of the device in “tilt” position

### 5.2.2 Body Worn Configuration

The device was placed in the SPEAG holder using the Nokia spacer and placed below the flat section of the phantom. The distance between the device and the phantom was kept at the separation distance indicated in the photo below using a separate flat spacer that was

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removed before the start of the measurements. The device was oriented with its antenna facing the phantom since this orientation gives higher results.



Photo of the device positioned for Body SAR measurement.  
The spacer was removed for the tests.

### 5.3 Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan, a minimum of 5x5x7 points covering a volume of at least 30x30x30mm, was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

### 5.4 SAR Averaging Methods

The maximum SAR value was averaged over a cube of tissue using interpolation and extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy4 are all based on the modified Quadratic Shepard's method (Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).

The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighbouring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.

In the zoom scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

## 6. MEASUREMENT UNCERTAINTY

Table 6.1 – Measurement uncertainty evaluation

| Uncertainty Component                                                           | Section in IEEE 1528 | Tol. (%) | Prob Dist | Div | $C_i$           | $C_i \cdot U_i$ (%) | $V_i$ |
|---------------------------------------------------------------------------------|----------------------|----------|-----------|-----|-----------------|---------------------|-------|
| <b>Measurement System</b>                                                       |                      |          |           |     |                 |                     |       |
| Probe Calibration                                                               | E2.1                 | ±5.8     | N         | 1   | 1               | ±5.8                | ∞     |
| Axial Isotropy                                                                  | E2.2                 | ±4.7     | R         | √3  | $(1-c_p)^{1/2}$ | ±1.9                | ∞     |
| Hemispherical Isotropy                                                          | E2.2                 | ±9.6     | R         | √3  | $(c_p)^{1/2}$   | ±3.9                | ∞     |
| Boundary Effect                                                                 | E2.3                 | ±8.3     | R         | √3  | 1               | ±4.8                | ∞     |
| Linearity                                                                       | E2.4                 | ±4.7     | R         | √3  | 1               | ±2.7                | ∞     |
| System Detection Limits                                                         | E2.5                 | ±1.0     | R         | √3  | 1               | ±0.6                | ∞     |
| Readout Electronics                                                             | E2.6                 | ±1.0     | N         | 1   | 1               | ±1.0                | ∞     |
| Response Time                                                                   | E2.7                 | ±0.8     | R         | √3  | 1               | ±0.5                | ∞     |
| Integration Time                                                                | E2.8                 | ±2.6     | R         | √3  | 1               | ±1.5                | ∞     |
| RF Ambient Conditions - Noise                                                   | E6.1                 | ±3.0     | R         | √3  | 1               | ±1.7                | ∞     |
| RF Ambient Conditions - Reflections                                             | E6.1                 | ±3.0     | R         | √3  | 1               | ±1.7                | ∞     |
| Probe Positioner Mechanical Tolerance                                           | E6.2                 | ±0.4     | R         | √3  | 1               | ±0.2                | ∞     |
| Probe Positioning with respect to Phantom Shell                                 | E6.3                 | ±2.9     | R         | √3  | 1               | ±1.7                | ∞     |
| Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation | E5.2                 | ±3.9     | R         | √3  | 1               | ±2.3                | ∞     |
| <b>Test sample Related</b>                                                      |                      |          |           |     |                 |                     |       |
| Test Sample Positioning                                                         | E4.2.1               | ±6.0     | N         | 1   | 1               | ±6.0                | 11    |
| Device Holder Uncertainty                                                       | E4.1.1               | ±5.0     | N         | 1   | 1               | ±5.0                | 7     |
| Output Power Variation - SAR drift measurement                                  | 6.6.3                | ±0.0     | R         | √3  | 1               | ±0.0                | ∞     |
| <b>Phantom and Tissue Parameters</b>                                            |                      |          |           |     |                 |                     |       |
| Phantom Uncertainty (shape and thickness tolerances)                            | E3.1                 | ±4.0     | R         | √3  | 1               | ±2.3                | ∞     |
| Conductivity Target - tolerance                                                 | E3.2                 | ±5.0     | R         | √3  | 0.64            | ±1.8                | ∞     |
| Conductivity - measurement uncertainty                                          | E3.3                 | ±5.5     | N         | 1   | 0.64            | ±3.5                | 5     |
| Permittivity Target - tolerance                                                 | E3.2                 | ±5.0     | R         | √3  | 0.6             | ±1.7                | ∞     |
| Permittivity - measurement uncertainty                                          | E3.3                 | ±2.9     | N         | 1   | 0.6             | ±1.7                | 5     |
| <b>Combined Standard Uncertainty</b>                                            |                      |          | RSS       |     |                 | ±13.7               | 148   |
| <b>Coverage Factor for 95%</b>                                                  |                      |          | k=2       |     |                 |                     |       |
| <b>Expanded Uncertainty</b>                                                     |                      |          |           |     |                 | ±27.4               |       |

## 7. RESULTS

The measured Head SAR values for the test device are tabulated below:

### 1900MHz Head SAR results

| Option used:<br>MMC, front cover,<br>etc | Test configuration                                                       |       | SAR, averaged over 1g (W/kg) |                      |                      |
|------------------------------------------|--------------------------------------------------------------------------|-------|------------------------------|----------------------|----------------------|
|                                          |                                                                          |       | Ch 512<br>1850.2 MHz         | Ch 661<br>1880.0 MHz | Ch 810<br>1909.8 MHz |
| <b>GSM1900</b>                           | <b>Power</b>                                                             |       | <b>28.4dBm</b>               | <b>28.5 dBm</b>      | <b>28.3 dBm</b>      |
| With MMC card                            | Right                                                                    | Cheek |                              | 0.64                 |                      |
| <b>2-slot GPRS1900</b>                   | <b>Power</b>                                                             |       | <b>25.9 dBm</b>              | <b>26.3 dBm</b>      | <b>25.6 dBm</b>      |
| With MMC card                            | Left                                                                     | Cheek |                              | 0.66                 |                      |
|                                          |                                                                          | Tilt  | <b>0.97</b>                  | 0.86                 | 0.71                 |
|                                          | Right                                                                    | Cheek |                              | 0.78                 |                      |
|                                          |                                                                          | Tilt  |                              | 0.81                 |                      |
| Without MMC card                         | Left                                                                     | Tilt  | <b>0.98</b>                  |                      |                      |
| Without MMC card                         | Highest SAR value<br>measurement in this band<br>repeated with BT active |       | 0.95                         |                      |                      |

### 2450MHz Head SAR results

| Option used:<br>MMC, front cover,<br>etc | Test configuration |       | SAR, averaged over 1g (W/kg) |                    |                     |
|------------------------------------------|--------------------|-------|------------------------------|--------------------|---------------------|
|                                          |                    |       | Ch 1<br>2412.0 MHz           | Ch 6<br>2437.0 MHz | Ch 11<br>2462.0 MHz |
| <b>WLAN2450</b>                          | <b>Power</b>       |       | <b>24.2 dBm</b>              | <b>24.7 dBm</b>    | <b>24.2 dBm</b>     |
| With MMC card                            | Left               | Cheek | 0.32                         | <b>0.37</b>        | 0.31                |
|                                          |                    | Tilt  |                              | 0.08               |                     |
|                                          | Right              | Cheek |                              | 0.18               |                     |
|                                          |                    | Tilt  |                              | 0.11               |                     |
| Without MMC card                         | Left               | Cheek |                              | <b>0.40</b>        |                     |

### Combined Head SAR results

| Test Configuration  | Max. 1g SAR results (W/kg) |                 | Combined 1g SAR<br>values (W/kg) |
|---------------------|----------------------------|-----------------|----------------------------------|
|                     | WLAN2450                   | 2-slot GPRS1900 | WLAN2450 +<br>2-slot GPRS1900    |
| <b>Left, Cheek</b>  | 0.40                       | 0.66            | <b>1.06</b>                      |
| <b>Left, Tilt</b>   | 0.08                       | 0.98            | 1.06                             |
| <b>Right, Cheek</b> | 0.18                       | 0.78            | 0.96                             |
| <b>Right, Tilt</b>  | 0.11                       | 0.81            | 0.92                             |

The measured Body SAR values for the test device are tabulated below:

**1900MHz Body SAR results**

| Option used:<br>MMC, front cover,<br>etc | Test configuration                                                 | SAR, averaged over 1g (W/kg) |                      |                      |
|------------------------------------------|--------------------------------------------------------------------|------------------------------|----------------------|----------------------|
|                                          |                                                                    | Ch 512<br>1850.2 MHz         | Ch 661<br>1880.0 MHz | Ch 810<br>1909.8 MHz |
| 2-slot GPRS1900                          | Power                                                              | 25.9 dBm                     | 26.3 dBm             | 25.6 dBm             |
| With MMC card                            | Without headset                                                    | 0.78                         | 0.79                 | 0.78                 |
|                                          | Headset HS-6                                                       | 0.84                         | <b>0.86</b>          | 0.82                 |
| Without MMC card                         | Headset HS-6                                                       |                              | 0.82                 |                      |
| With MMC card                            | Highest SAR value measurement in this mode repeated with BT active |                              | 0.71                 |                      |

**2450MHz Body SAR results**

| Option used:<br>MMC, front cover,<br>etc | Test configuration | SAR, averaged over 1g (W/kg) |                    |                     |
|------------------------------------------|--------------------|------------------------------|--------------------|---------------------|
|                                          |                    | Ch 1<br>2412.0 MHz           | Ch 6<br>2437.0 MHz | Ch 11<br>2462.0 MHz |
| WLAN2450                                 | Power              | 24.2 dBm                     | 24.7 dBm           | 24.2 dBm            |
| With MMC card                            | Without headset    | 0.09                         | 0.13               | <b>0.19</b>         |
|                                          | Headset HS-6       | 0.09                         | 0.14               | 0.16                |
| Without MMC card                         | Without headset    |                              |                    | <b>0.19</b>         |

**Combined Body SAR results**

| Test configuration | Max. 1g SAR results (W/kg) |                 | Combined 1g SAR values (W/kg) |
|--------------------|----------------------------|-----------------|-------------------------------|
|                    | WLAN2450                   | 2-slot GPRS1900 | WLAN2450 + 2-slot GPRS1900    |
| Without headset    | 0.19                       | 0.79            | 0.98                          |
| Headset HS-6       | 0.16                       | 0.86            | <b>1.02</b>                   |

Plots of the Measurement scans are given in Appendix B.

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## APPENDIX A: SYSTEM CHECKING SCANS

Date/Time: 21.10.2005 11:13:06

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: D1900V2; Serial: D1900V2 - SN:5d030**

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

Medium: HSL1900 Medium parameters used (interpolated):  $f = 1900$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(5.13, 5.13, 5.13); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**d=10mm, Pin=250mW, t=22.6 C/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (interpolated) = 12.3 mW/g

**d=10mm, Pin=250mW, t=22.6 C/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

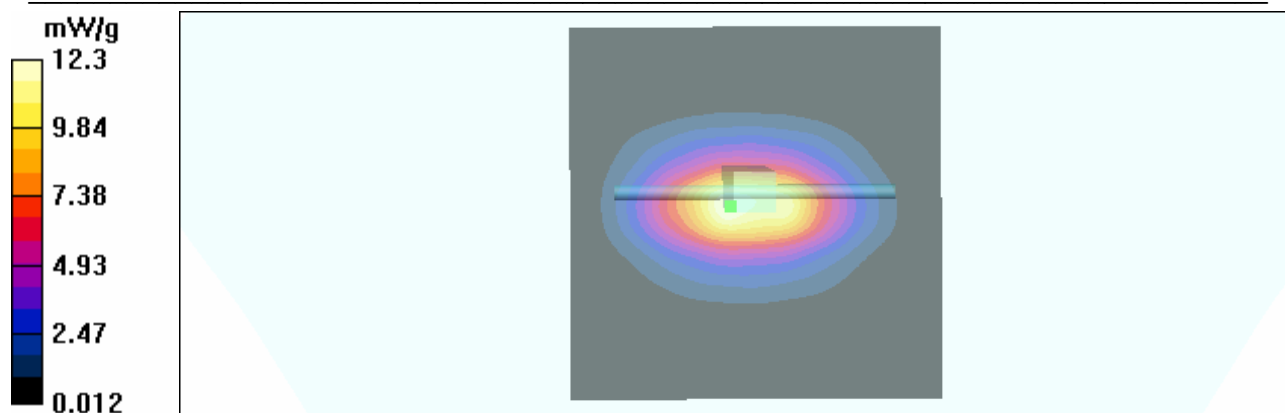
Reference Value = 91.5 V/m; Power Drift = -0.062 dB

Peak SAR (extrapolated) = 16.8 W/kg

**SAR(1 g) = 9.78 mW/g; SAR(10 g) = 5.19 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation!](#)

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



Date/Time: 27.10.2005 15:14:52

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: D2450V2; Serial: D2450V2 - SN:729**

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

Medium: HSL2450 Medium parameters used (interpolated):  $f = 2450$  MHz;  $\sigma = 1.87$  mho/m;  $\epsilon_r = 39.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**d=10mm, Pin=250mW, t=22.0 C/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.6 V/m; Power Drift = -0.073 dB

Peak SAR (extrapolated) = 31.3 W/kg

**SAR(1 g) = 14.5 mW/g; SAR(10 g) = 6.7 mW/g**

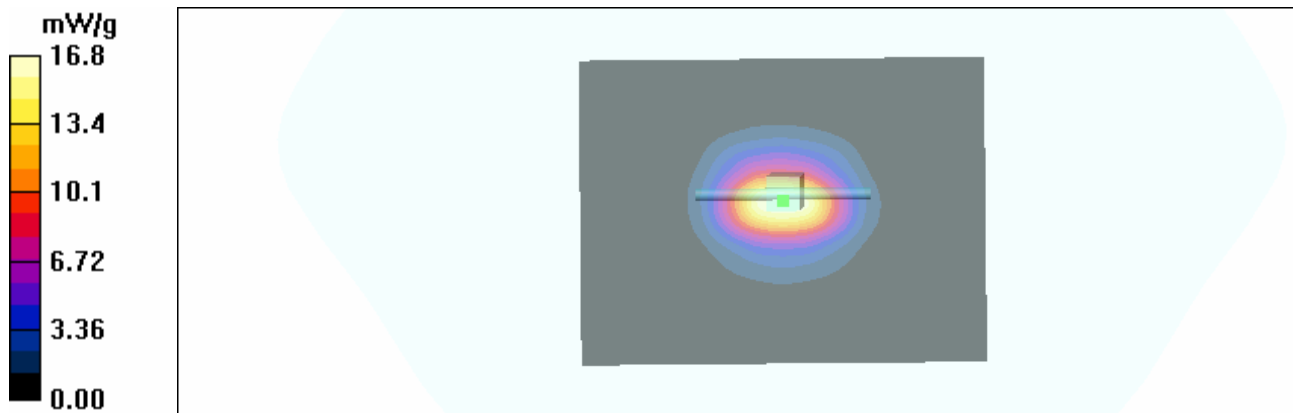
[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (measured) = 16.3 mW/g

**d=10mm, Pin=250mW, t=22.0 C/Area Scan (61x81x1):** Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (interpolated) = 16.8 mW/g



Date/Time: 24.10.2005 10:46:44

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: D1900V2;Serial: D1900V2 - SN:5d030**

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

Medium: BSL1900 Medium parameters used (interpolated):  $f = 1900$  MHz;  $\sigma = 1.5$  mho/m;  $\epsilon_r = 53.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.67, 4.67, 4.67); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**d=10mm, Pin=250mW, t=21.9 C/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation!](#)

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

**d=10mm, Pin=250mW, t=21.9 C/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

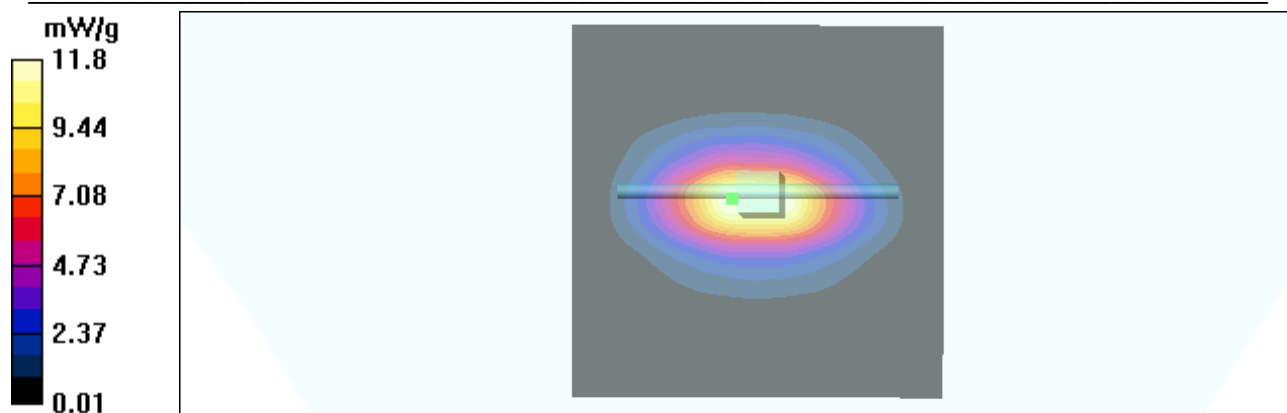
Reference Value = 89.2 V/m; Power Drift = -0.033 dB

Peak SAR (extrapolated) = 16.9 W/kg

**SAR(1 g) = 9.8 mW/g; SAR(10 g) = 5.22 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (measured) = 11.0 mW/g



Date/Time: 26.10.2005 17:38:24

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: D2450V2; Serial: D2450V2 - SN:729**

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

Medium: BSL2450 Medium parameters used (interpolated):  $f = 2450$  MHz;  $\sigma = 2.04$  mho/m;  $\epsilon_r = 51.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.35, 4.35, 4.35); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**d=10mm, Pin=250mW, t=22.0 C/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.7 V/m; Power Drift = -0.173 dB

Peak SAR (extrapolated) = 31.6 W/kg

**SAR(1 g) = 14.1 mW/g; SAR(10 g) = 6.49 mW/g**

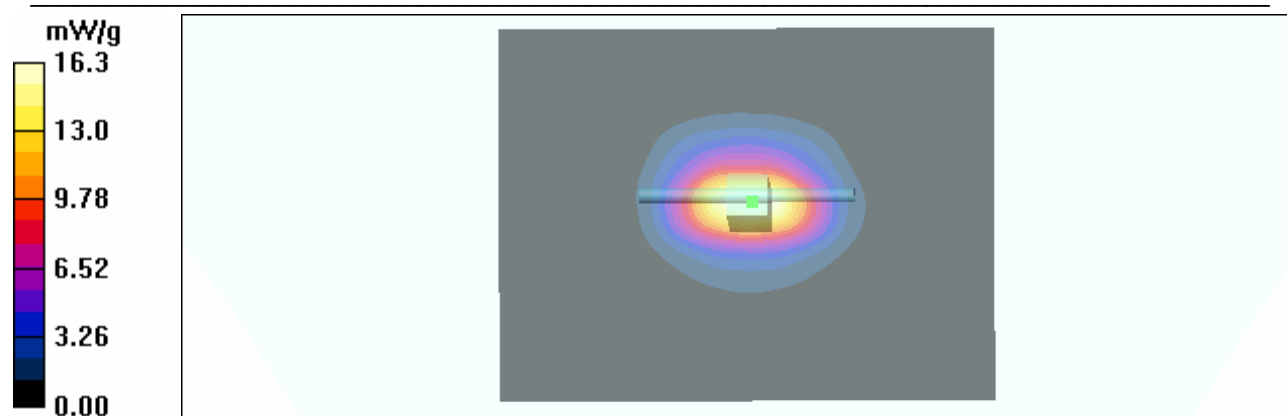
[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (measured) = 15.8 mW/g

**d=10mm, Pin=250mW, t=22.0 C/Area Scan (61x81x1):** Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (interpolated) = 16.3 mW/g



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## APPENDIX B: MEASUREMENT SCANS

Date/Time: 21.10.2005 16:37:54

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49;Serial: 004400701695429**

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: HSL1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.39$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(5.13, 5.13, 5.13); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Cheek position - Middle,  $t=22.0$  C,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:**

Measurement grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm

Reference Value = 18.4 V/m; Power Drift = -0.072 dB

Peak SAR (extrapolated) = 1.30 W/kg

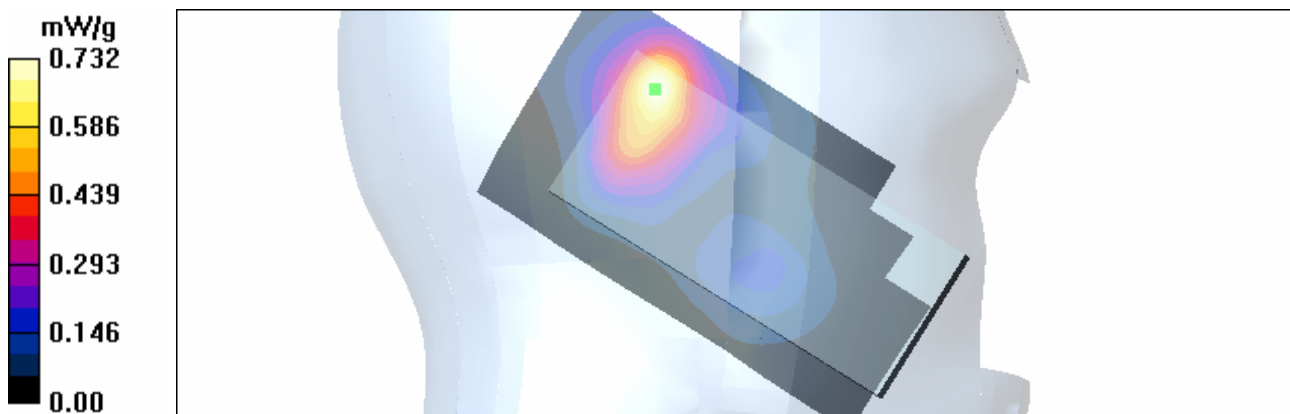
**SAR(1 g) = 0.643 mW/g; SAR(10 g) = 0.326 mW/g**

Maximum value of SAR (measured) = 0.750 mW/g

**Cheek position - Middle,  $t=22.0$  C,/Area Scan (51x91x1): Measurement grid:**

$dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (interpolated) = 0.732 mW/g



Date/Time: 21.10.2005 17:04:57

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49;Serial: 004400701695429**

Communication System: 2-slot GPRS 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.2

Medium: HSL1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.39$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(5.13, 5.13, 5.13); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Cheek position - Middle,  $t=22.0$  C,/Area Scan (51x91x1):** Measurement grid:

$dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (interpolated) = 0.690 mW/g

**Cheek position - Middle,  $t=22.0$  C,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:**

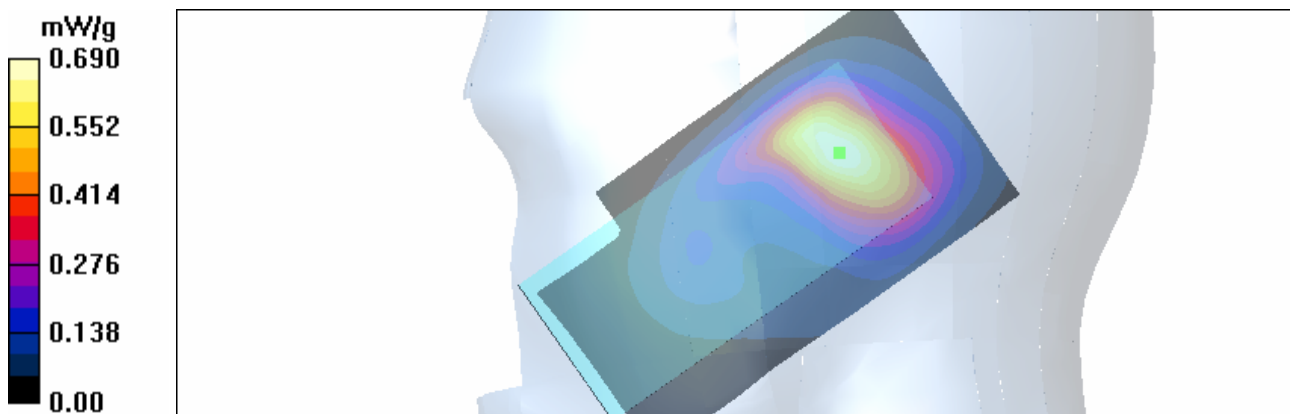
Measurement grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm

Reference Value = 21.4 V/m; Power Drift = -0.132 dB

Peak SAR (extrapolated) = 1.07 W/kg

**SAR(1 g) = 0.662 mW/g; SAR(10 g) = 0.371 mW/g**

Maximum value of SAR (measured) = 0.745 mW/g



Date/Time: 21.10.2005 18:19:11

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49; Serial: 004400701695429; without MMC card**

Communication System: 2-slot GPRS 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:4.2

Medium: HSL1900 Medium parameters used (interpolated):  $f = 1850.2 \text{ MHz}$ ;  $\sigma = 1.37 \text{ mho/m}$ ;  $\epsilon_r = 41$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(5.13, 5.13, 5.13); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Tilt position - Low,  $t=21.9 \text{ C}$ ,/Area Scan (51x91x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (interpolated) = 1.18 mW/g

**Tilt position - Low,  $t=21.9 \text{ C}$ ,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:  $dx=7.5\text{mm}$ ,  $dy=7.5\text{mm}$ ,  $dz=5\text{mm}$

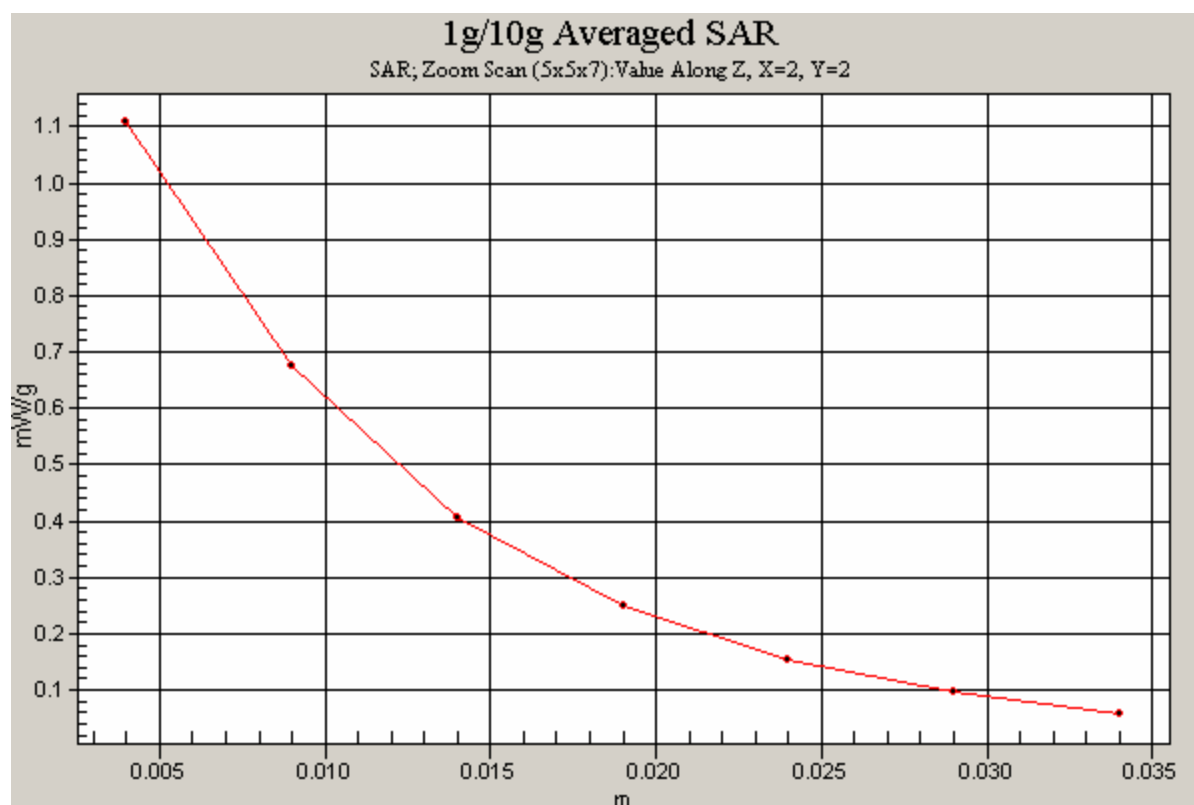
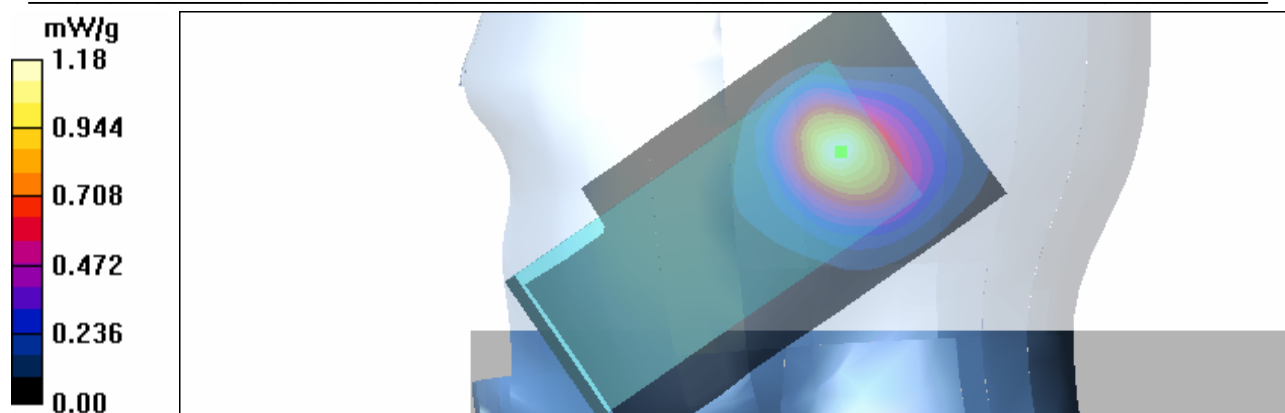
Reference Value = 29.6 V/m; Power Drift = -0.177 dB

Peak SAR (extrapolated) = 1.57 W/kg

**SAR(1 g) = 0.976 mW/g; SAR(10 g) = 0.540 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (measured) = 1.11 mW/g



Date/Time: 21.10.2005 14:00:01

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49;Serial: 004400701695429**

Communication System: 2-slot GPRS 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.2

Medium: HSL1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.39$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(5.13, 5.13, 5.13); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Cheek position - Middle,  $t=22.2$  C,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:**

Measurement grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm

Reference Value = 19.6 V/m; Power Drift = -0.055 dB

Peak SAR (extrapolated) = 1.57 W/kg

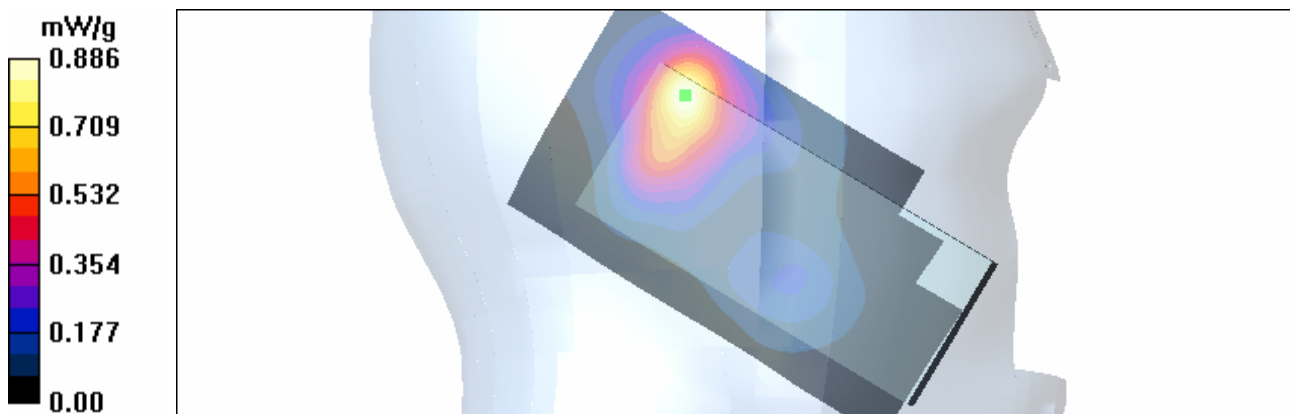
**SAR(1 g) = 0.780 mW/g; SAR(10 g) = 0.392 mW/g**

Maximum value of SAR (measured) = 0.914 mW/g

**Cheek position - Middle,  $t=22.2$  C,/Area Scan (51x91x1):** Measurement grid:

$dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (interpolated) = 0.886 mW/g



Date/Time: 21.10.2005 14:26:57

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49;Serial: 004400701695429**

Communication System: 2-slot GPRS 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.2

Medium: HSL1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.39$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(5.13, 5.13, 5.13); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Tilt position - Middle,  $t=22.2$  C,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement

grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm

Reference Value = 24.5 V/m; Power Drift = -0.068 dB

Peak SAR (extrapolated) = 1.45 W/kg

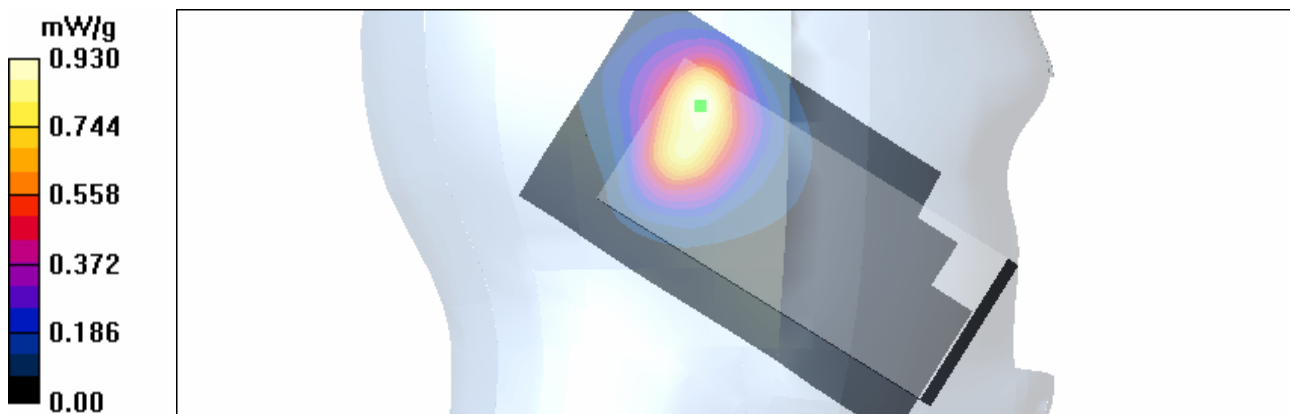
**SAR(1 g) = 0.813 mW/g; SAR(10 g) = 0.445 mW/g**

Maximum value of SAR (measured) = 0.890 mW/g

**Tilt position - Middle,  $t=22.2$  C,/Area Scan (51x91x1):** Measurement grid:  $dx=15$ mm,

$dy=15$ mm

Maximum value of SAR (interpolated) = 0.930 mW/g



Date/Time: 28.10.2005 13:12:04

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49;Serial: 004400701695429; without MMC card**

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 39.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Cheek position - Middle,  $t=21.6$  C, worst case extrapolation/Area Scan (51x91x1):**

Measurement grid:  $dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (interpolated) = 0.399 mW/g

**Cheek position - Middle,  $t=21.6$  C, worst case extrapolation/Zoom Scan (7x7x7)**

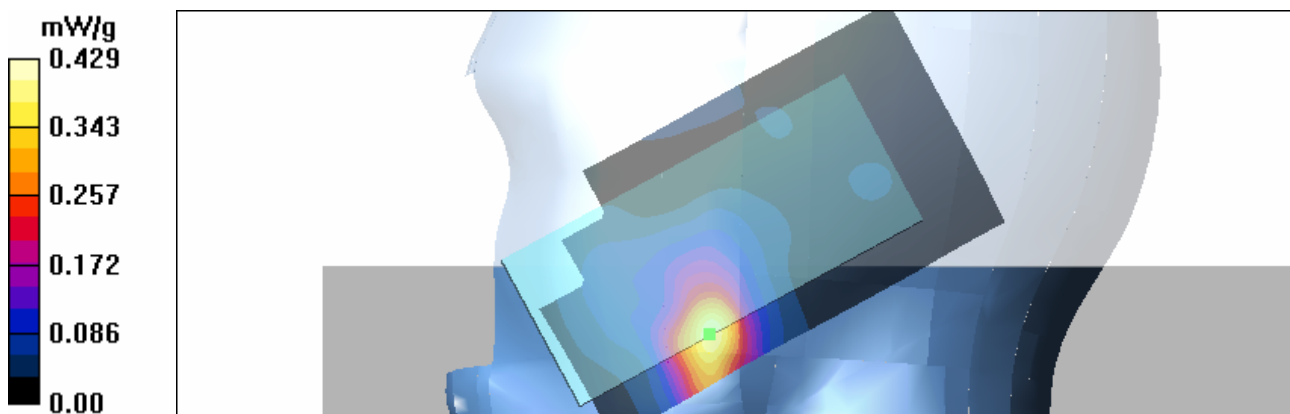
**(7x7x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

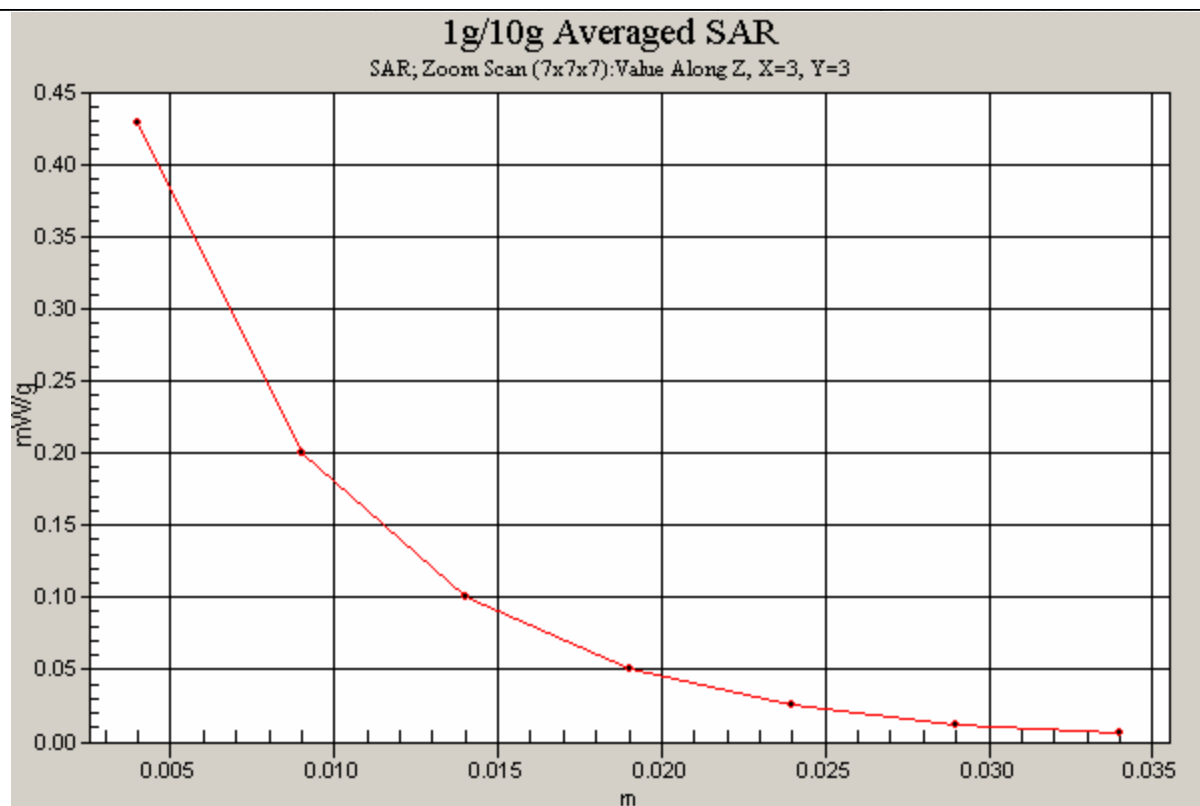
Reference Value = 4.10 V/m; Power Drift = -0.015 dB

Peak SAR (extrapolated) = 0.931 W/kg

**SAR(1 g) = 0.403 mW/g; SAR(10 g) = 0.182 mW/g**

Maximum value of SAR (measured) = 0.429 mW/g





Date/Time: 28.10.2005 10:58:40

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49;Serial: 004400701695429**

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 39.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Tilt position - Middle,  $t=21.9$  C, worst case extrapolation/Zoom Scan (7x7x7)**

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

Reference Value = 6.28 V/m; Power Drift = -0.129 dB

Peak SAR (extrapolated) = 0.155 W/kg

**SAR(1 g) = 0.077 mW/g; SAR(10 g) = 0.039 mW/g**

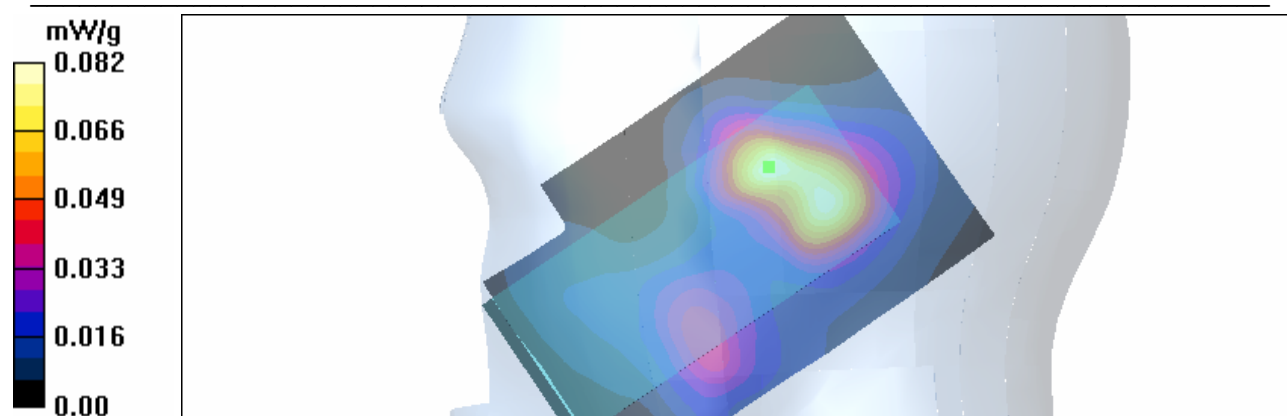
**Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.**

Maximum value of SAR (measured) = 0.084 mW/g

**Tilt position - Middle,  $t=21.9$  C, worst case extrapolation/Area Scan (61x91x1):**

Measurement grid:  $dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (interpolated) = 0.082 mW/g



Date/Time: 28.10.2005 09:47:18

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49;Serial: 004400701695429**

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 39.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Cheek position - Middle,  $t=22.0$  C, worst case extrapolation/Zoom Scan (7x7x7)**

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

Reference Value = 3.28 V/m; Power Drift = -0.194 dB

Peak SAR (extrapolated) = 0.398 W/kg

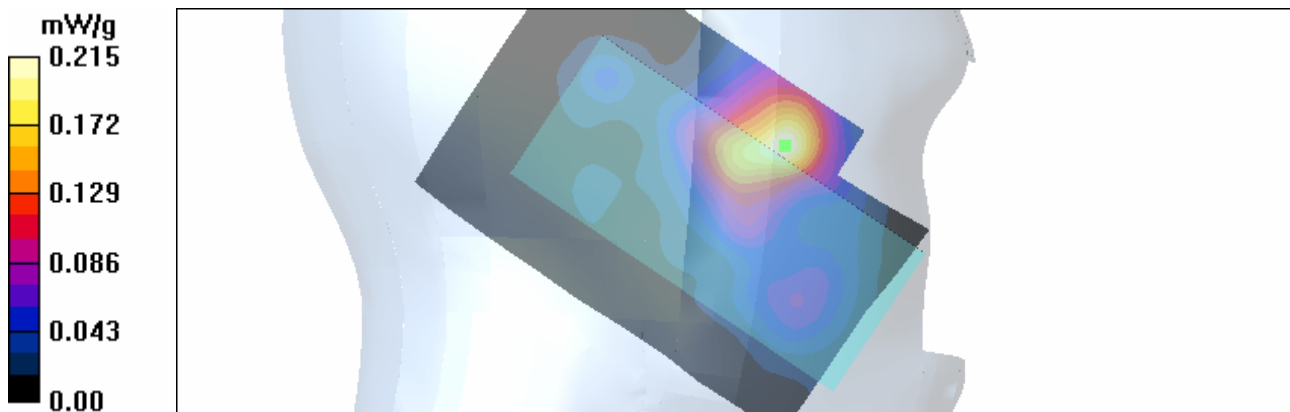
**SAR(1 g) = 0.180 mW/g; SAR(10 g) = 0.093 mW/g**

Maximum value of SAR (measured) = 0.195 mW/g

**Cheek position - Middle,  $t=22.0$  C, worst case extrapolation/Area Scan (61x91x1):**

Measurement grid:  $dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (interpolated) = 0.215 mW/g



Date/Time: 28.10.2005 10:17:08

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49;Serial: 004400701695429**

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 39.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Tilt position - Middle,  $t=22.0$  C, worst case extrapolation/Area Scan (61x91x1):**

Measurement grid:  $dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (interpolated) = 0.124 mW/g

**Tilt position - Middle,  $t=22.0$  C, worst case extrapolation/Zoom Scan (7x7x7)**

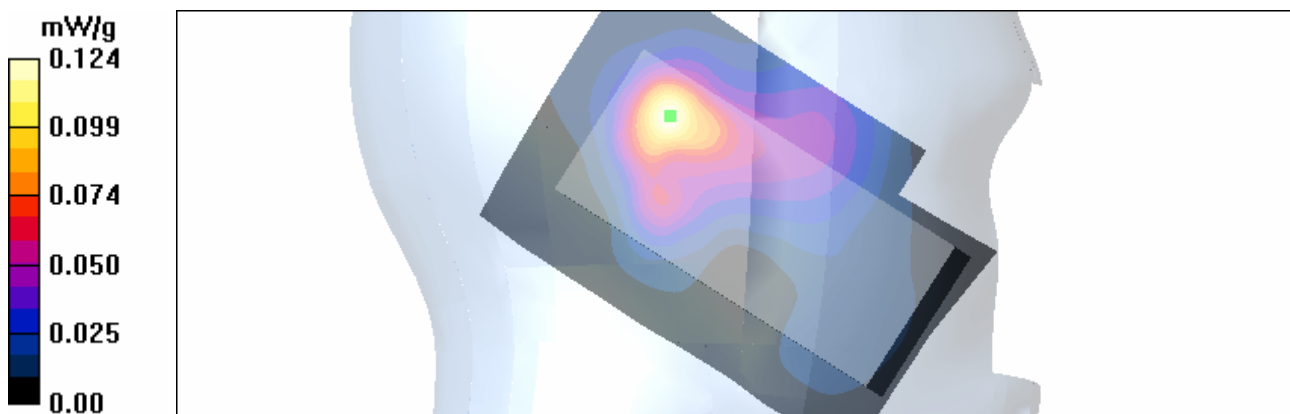
**(7x7x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 6.56 V/m; Power Drift = -0.018 dB

Peak SAR (extrapolated) = 0.235 W/kg

**SAR(1 g) = 0.111 mW/g; SAR(10 g) = 0.053 mW/g**

Maximum value of SAR (measured) = 0.126 mW/g



Date/Time: 24.10.2005 11:28:17 Date/Time: 24.10.2005 11:34:19

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49; Serial: 004400701695429; without headset**

Communication System: 2-slot GPRS 1900; Frequency: 1880 MHz; Duty Cycle: 1:4.2

Medium: BSL1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.49$  mho/m;  $\epsilon_r = 53.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

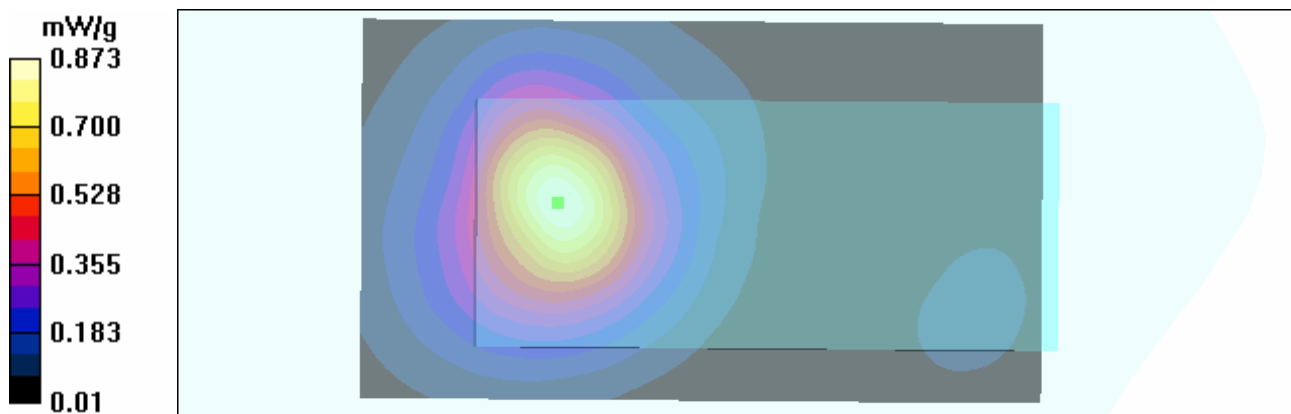
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.67, 4.67, 4.67); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Body worn - Middle,  $t=21.9$  C, /Area Scan (51x91x1):** Measurement grid:  $dx=15$ mm,  $dy=15$ mm  
Maximum value of SAR (interpolated) = 0.873 mW/g

**Body worn - Middle,  $t=21.9$  C, /Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm  
Reference Value = 21.9 V/m; Power Drift = 0.014 dB  
Peak SAR (extrapolated) = 1.25 W/kg  
**SAR(1 g) = 0.785 mW/g; SAR(10 g) = 0.464 mW/g**  
Maximum value of SAR (measured) = 0.862 mW/g



Date/Time: 24.10.2005 12:20:42

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49;Serial: 004400701695429; with headset HS-6**

Communication System: 2-slot GPRS 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.2

Medium: BSL1900 Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.49$  mho/m;  $\epsilon_r = 53.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.67, 4.67, 4.67); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Body worn - Middle,  $t=21.7$  C,/Area Scan (51x91x1):** Measurement grid:  $dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (interpolated) = 0.958 mW/g

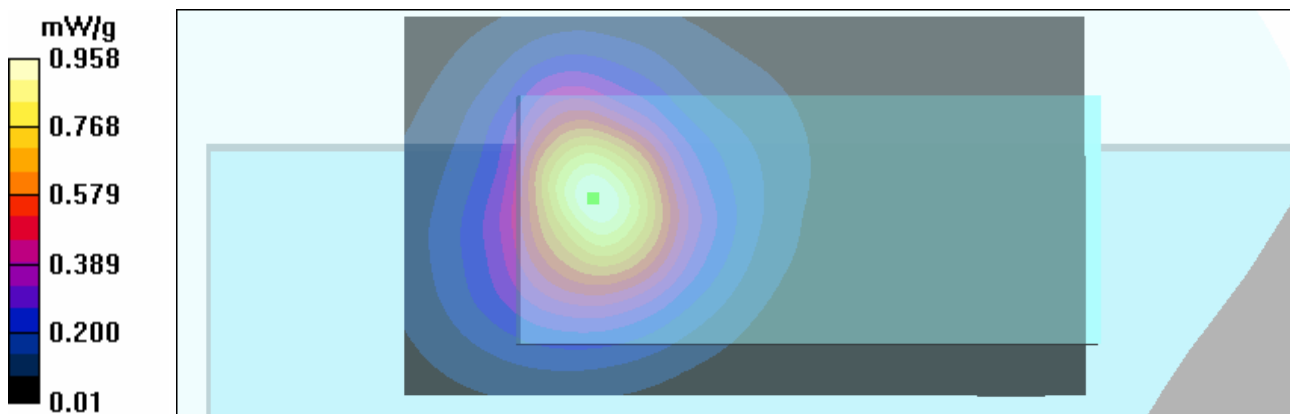
**Body worn - Middle,  $t=21.7$  C,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm

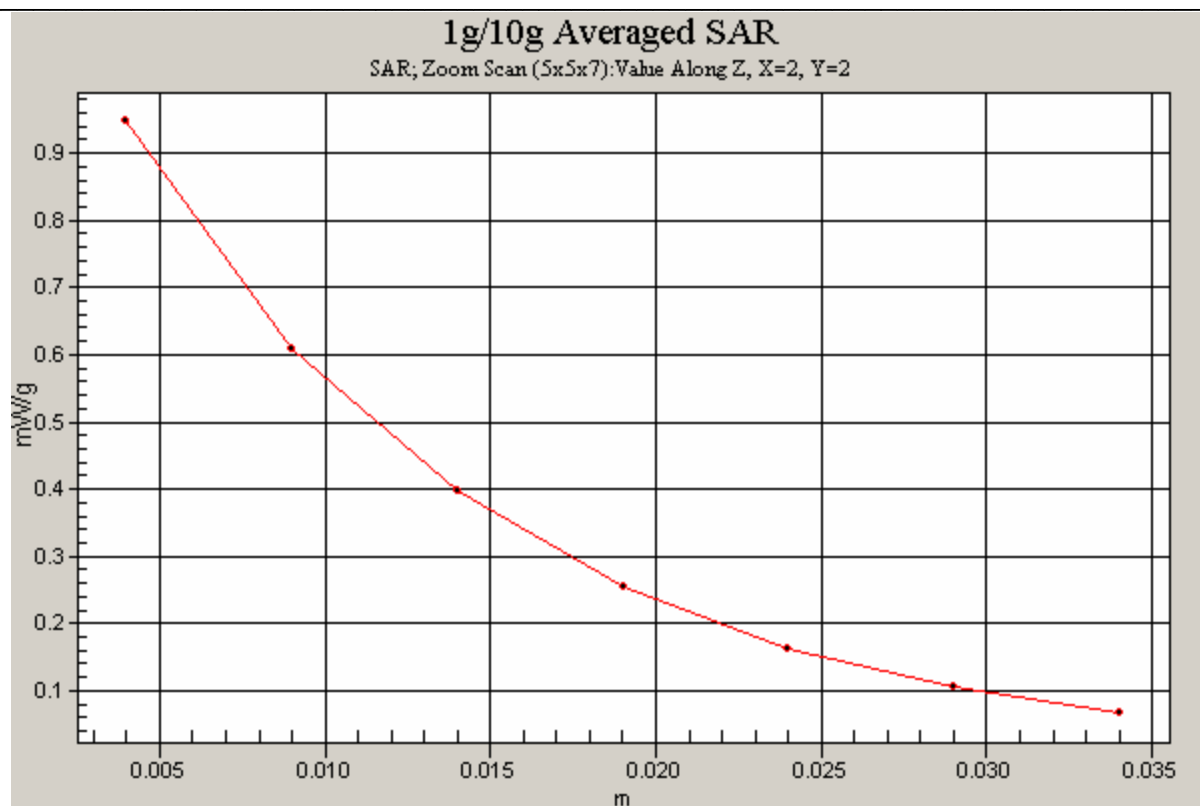
Reference Value = 23.2 V/m; Power Drift = -0.045 dB

Peak SAR (extrapolated) = 1.40 W/kg

**SAR(1 g) = 0.856 mW/g; SAR(10 g) = 0.497 mW/g**

Maximum value of SAR (measured) = 0.947 mW/g





Date/Time: 27.10.2005 15:05:54

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49; Serial: 004400701695429; without MMC card; without headset**

Communication System: WLAN; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: BSL2450 Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 2.06$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.35, 4.35, 4.35); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Body worn - High,  $t=21.4$  C, worst case extrapolation/Area Scan (51x91x1):**

Measurement grid:  $dx=15$ mm,  $dy=15$ mm

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (interpolated) = 0.196 mW/g

**Body worn - High,  $t=21.4$  C, worst case extrapolation/Zoom Scan (5x5x7)**

**(5x5x7)/Cube 0:** Measurement grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm

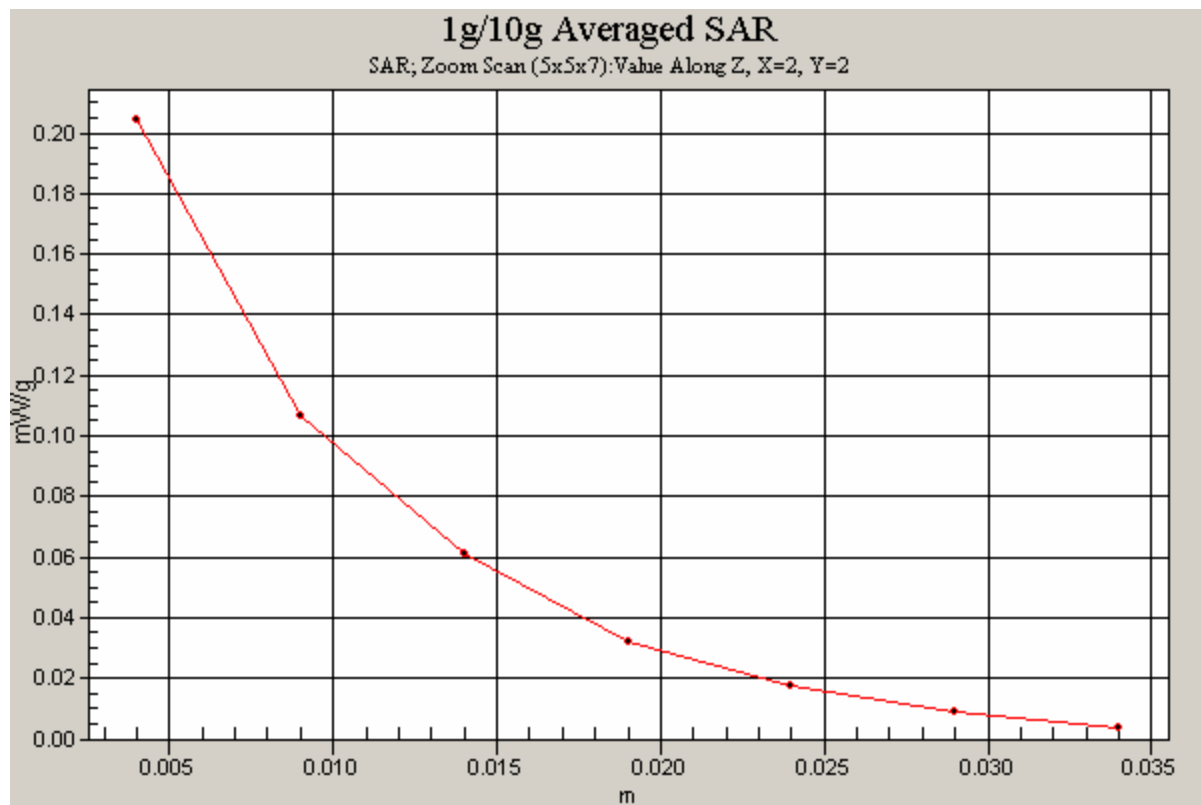
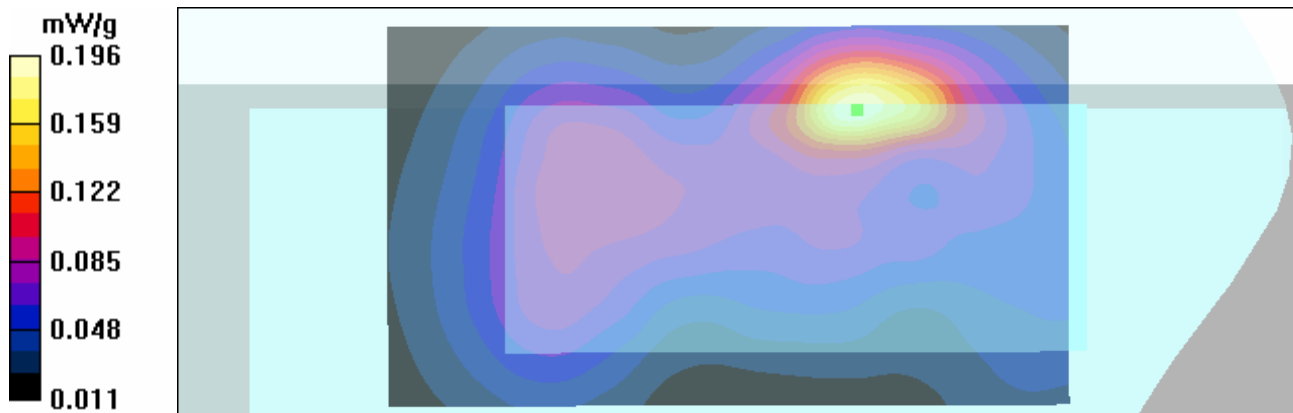
Reference Value = 6.51 V/m; Power Drift = -0.016 dB

Peak SAR (extrapolated) = 0.409 W/kg

**SAR(1 g) = 0.185 mW/g; SAR(10 g) = 0.090 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (measured) = 0.205 mW/g



Date/Time: 27.10.2005 14:32:03

Test Laboratory: TCC Nokia, Oulu Laboratory

**Type: RM-49; Serial: 004400701695429; with headset HS-6**

Communication System: WLAN; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: BSL2450 Medium parameters used (interpolated):  $f = 2462$  MHz;  $\sigma = 2.06$  mho/m;  $\epsilon_r = 51.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.35, 4.35, 4.35); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

**Body worn - High,  $t=21.3$  C, worst case extrapolation/Area Scan (51x91x1):**

Measurement grid:  $dx=15$ mm,  $dy=15$ mm

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (interpolated) = 0.164 mW/g

**Body worn - High,  $t=21.3$  C, worst case extrapolation/Zoom Scan (5x5x7)**

**(5x5x7)/Cube 0:** Measurement grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm

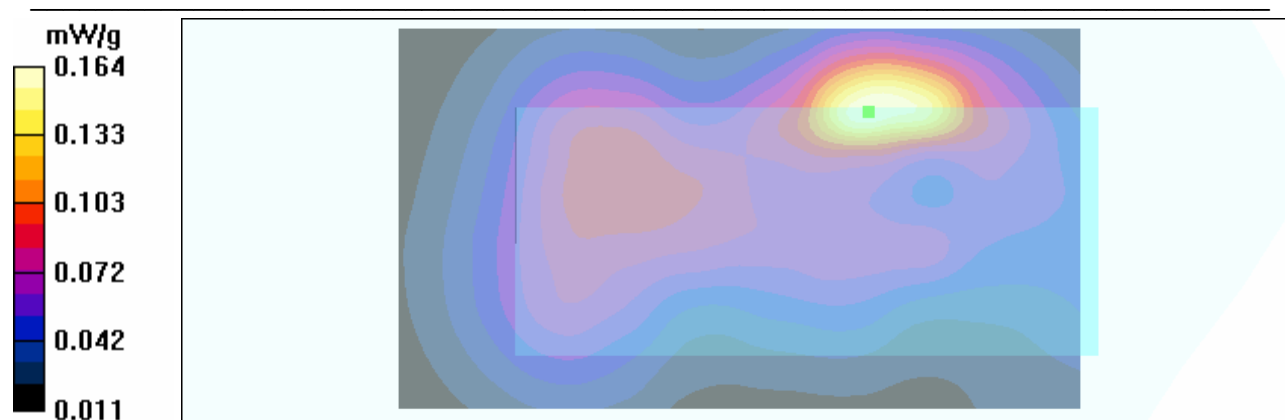
Reference Value = 6.27 V/m; Power Drift = 0.023 dB

Peak SAR (extrapolated) = 0.338 W/kg

**SAR(1 g) = 0.156 mW/g; SAR(10 g) = 0.076 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation!](#)

Maximum value of SAR (measured) = 0.171 mW/g



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**APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)**



Accredited by the Swiss Federal Office of Metrology and Accreditation  
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 **Nokia Oulu**

Certificate No: **ET3-1765\_Feb05**

## CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1765**

Calibration procedure(s) **QA CAL-01.v5  
Calibration procedure for dosimetric E-field probes**

Calibration date: **February 24, 2005**

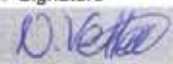
Condition of the calibrated item **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID #            | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration  |
|----------------------------|-----------------|-------------------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 5-May-04 (METAS, No. 251-00388)           | May-05                 |
| Power sensor E4412A        | MY41495277      | 5-May-04 (METAS, No. 251-00388)           | May-05                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 10-Aug-04 (METAS, No. 251-00403)          | Aug-05                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 3-May-04 (METAS, No. 251-00389)           | May-05                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 10-Aug-04 (METAS, No. 251-00404)          | Aug-05                 |
| Reference Probe ES3DV2     | SN: 3013        | 7-Jan-05 (SPEAG, No. ES3-3013_Jan05)      | Jan-06                 |
| DAE4                       | SN: 617         | 19-Jan-05 (SPEAG, No. DAE4-617_Jan05)     | Jan-06                 |
| Secondary Standards        | ID #            | Check Date (in house)                     | Scheduled Check        |
| Power sensor HP 8481A      | MY41092180      | 18-Sep-02 (SPEAG, in house check Oct-03)  | In house check: Oct 05 |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (SPEAG, in house check Dec-03)   | In house check: Dec-05 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (SPEAG, in house check Nov-04)  | In house check: Nov 05 |

Calibrated by: **Name** Nico Vetterli **Function** Laboratory Technician **Signature** 

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

Issued: February 25, 2005

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

## DASY - Parameters of Probe: ET3DV6 SN:1765

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

|       |                     |                                     |
|-------|---------------------|-------------------------------------|
| NormX | <b>1.61</b> ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | <b>1.86</b> ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | <b>1.94</b> ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |

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

|       |              |
|-------|--------------|
| DCP X | <b>93</b> mV |
| DCP Y | <b>93</b> mV |
| DCP Z | <b>93</b> mV |

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

Please see Page 8.

### Boundary Effect

**TSL                      900 MHz      Typical SAR gradient: 5 % per mm**

|                                           |                              |               |               |
|-------------------------------------------|------------------------------|---------------|---------------|
| Sensor Center to Phantom Surface Distance |                              | <b>3.7 mm</b> | <b>4.7 mm</b> |
| SAR <sub>be</sub> [%]                     | Without Correction Algorithm | 8.7           | 4.4           |
| SAR <sub>bm</sub> [%]                     | With Correction Algorithm    | 0.6           | 0.1           |

**TSL                      1750 MHz      Typical SAR gradient: 10 % per mm**

|                                           |                              |               |               |
|-------------------------------------------|------------------------------|---------------|---------------|
| Sensor Center to Phantom Surface Distance |                              | <b>3.7 mm</b> | <b>4.7 mm</b> |
| SAR <sub>be</sub> [%]                     | Without Correction Algorithm | 13.1          | 8.4           |
| SAR <sub>bm</sub> [%]                     | With Correction Algorithm    | 0.6           | 0.1           |

### Sensor Offset

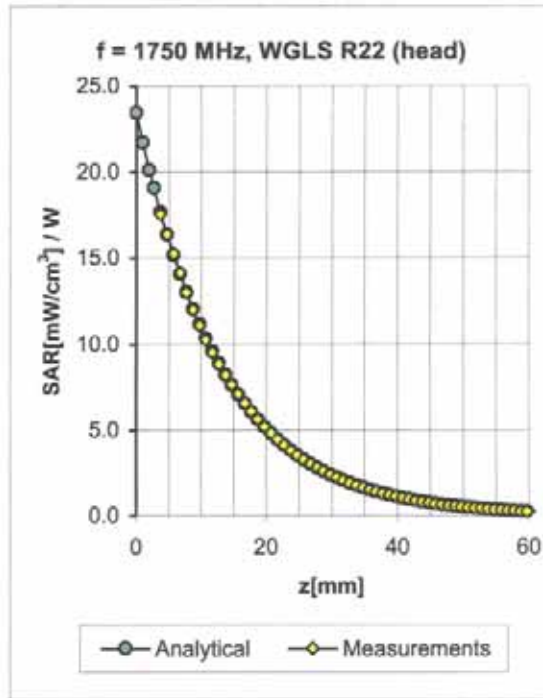
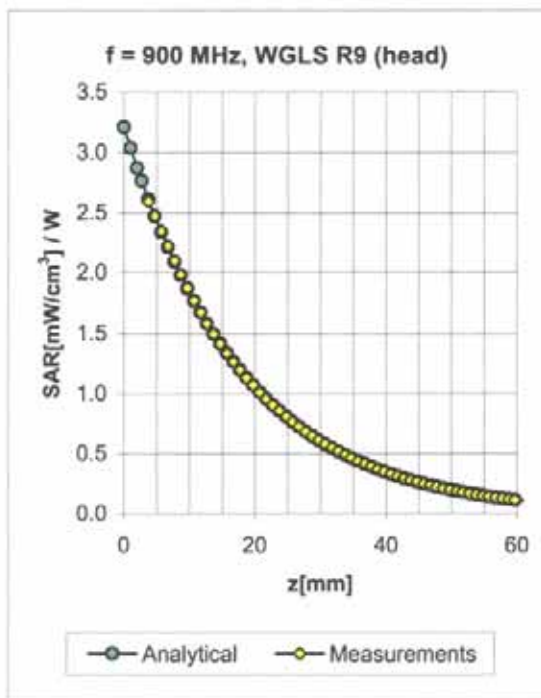
Probe Tip to Sensor Center                      **2.7 mm**

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

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

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

## Conversion Factor Assessment



| f [MHz] | Validity [MHz] <sup>c</sup> | TSL  | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty  |
|---------|-----------------------------|------|--------------|--------------|-------|-------|--------------------|
| 835     | ± 50 / ± 100                | Head | 41.5 ± 5%    | 0.90 ± 5%    | 1.22  | 1.42  | 6.72 ± 11.0% (k=2) |
| 900     | ± 50 / ± 100                | Head | 41.5 ± 5%    | 0.97 ± 5%    | 1.28  | 1.37  | 6.43 ± 11.0% (k=2) |
| 1750    | ± 50 / ± 100                | Head | 40.1 ± 5%    | 1.37 ± 5%    | 0.68  | 2.14  | 5.21 ± 11.0% (k=2) |
| 1900    | ± 50 / ± 100                | Head | 40.0 ± 5%    | 1.40 ± 5%    | 0.65  | 2.30  | 5.13 ± 11.0% (k=2) |
| 1950    | ± 50 / ± 100                | Head | 40.0 ± 5%    | 1.40 ± 5%    | 0.60  | 2.48  | 4.89 ± 11.0% (k=2) |
| 2450    | ± 50 / ± 100                | Head | 39.2 ± 5%    | 1.80 ± 5%    | 0.72  | 2.21  | 4.55 ± 11.8% (k=2) |
| 835     | ± 50 / ± 100                | Body | 55.2 ± 5%    | 0.97 ± 5%    | 1.24  | 1.45  | 6.32 ± 11.0% (k=2) |
| 900     | ± 50 / ± 100                | Body | 55.0 ± 5%    | 1.05 ± 5%    | 1.17  | 1.50  | 6.00 ± 11.0% (k=2) |
| 1750    | ± 50 / ± 100                | Body | 53.4 ± 5%    | 1.49 ± 5%    | 0.60  | 2.64  | 4.75 ± 11.0% (k=2) |
| 1900    | ± 50 / ± 100                | Body | 53.3 ± 5%    | 1.52 ± 5%    | 0.60  | 2.71  | 4.67 ± 11.0% (k=2) |
| 1950    | ± 50 / ± 100                | Body | 53.3 ± 5%    | 1.52 ± 5%    | 0.66  | 2.42  | 4.50 ± 11.0% (k=2) |
| 2450    | ± 50 / ± 100                | Body | 52.7 ± 5%    | 1.95 ± 5%    | 0.78  | 1.95  | 4.35 ± 11.8% (k=2) |

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

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**APPENDIX D: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORT(S)**



Accredited by the Swiss Federal Office of Metrology and Accreditation  
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 **Nokia Oulu 2**

Certificate No: **D1900V2-5d030\_Feb05**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d030**

Calibration procedure(s) **QA CAL-05.v6  
Calibration procedure for dipole validation kits**

Calibration date: **February 18, 2005**

Condition of the calibrated item **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID #             | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration  |
|----------------------------|------------------|-------------------------------------------|------------------------|
| Power meter EPM E442       | GB37480704       | 12-Oct-04 (METAS, No. 251-00412)          | Oct-05                 |
| Power sensor HP 8481A      | US37292783       | 12-Oct-04 (METAS, No. 251-00412)          | Oct-05                 |
| Reference 20 dB Attenuator | SN: 5086 (20g)   | 10-Aug-04 (METAS, No 251-00402)           | Aug-05                 |
| Reference 10 dB Attenuator | SN: 5047.2 (10r) | 10-Aug-04 (METAS, No 251-00402)           | Aug-05                 |
| Reference Probe ET3DV6     | SN 1507          | 26-Oct-04 (SPEAG, No. ET3-1507_Oct04)     | Oct-05                 |
| DAE4                       | SN 601           | 07-Jan-05 (SPEAG, No. DAE4-601_Jan05)     | Jan-06                 |
| Secondary Standards        | ID #             | Check Date (in house)                     | Scheduled Check        |
| Power sensor HP 8481A      | MY41092317       | 18-Oct-02 (SPEAG, in house check Oct-03)  | In house check: Oct-05 |
| RF generator R&S SML-03    | 100698           | 27-Mar-02 (SPEAG, in house check Dec-03)  | In house check: Dec-05 |
| Network Analyzer HP 8753E  | US37390585 S4206 | 18-Oct-01 (SPEAG, in house check Nov-04)  | In house check: Nov 05 |

Calibrated by: **Name** **Function**  
**Mike Meili** **Laboratory Technician**

**Signature**

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

Issued: February 25, 2005

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

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d030**

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

Medium: HSL 1800 MHz;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.46$  mho/m;  $\epsilon_r = 39.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(4.96, 4.96, 4.96); Calibrated: 26.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.01.2005
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 11; Postprocessing SW: SEMCAD, V1.8 Build 144

**Pin = 250 mW; d = 10 mm/Area Scan (81x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 11.2 mW/g

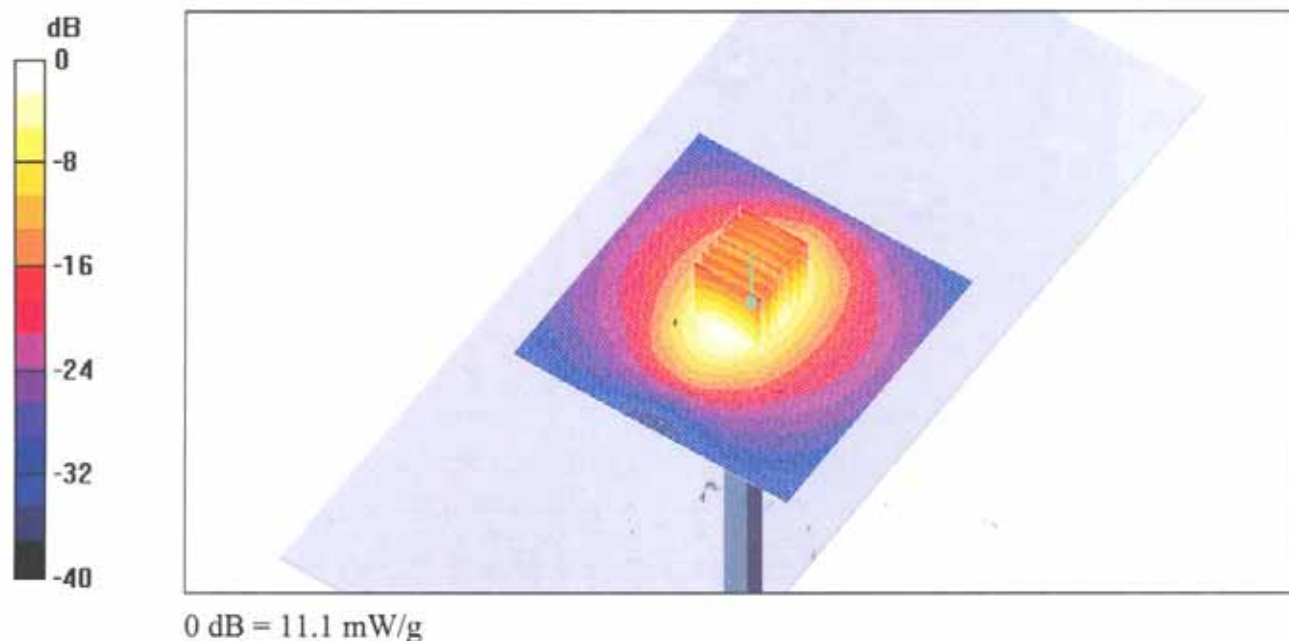
**Pin = 250 mW; d = 10 mm/Zoom Scan 2 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.4 V/m; Power Drift = 0.020 dB

Peak SAR (extrapolated) = 17.1 W/kg

**SAR(1 g) = 9.76 mW/g; SAR(10 g) = 5.09 mW/g**

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



Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d030**

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

Medium: Muscle 1800 MHz;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.57$  mho/m;  $\epsilon_r = 52.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

**DASY4 Configuration:**

- Probe: ET3DV6 - SN1507; ConvF(4.43, 4.43, 4.43); Calibrated: 26.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.01.2005
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 13; Postprocessing SW: SEMCAD, V1.8 Build 142

**Pin = 250 mW; d = 10 mm/Area Scan (81x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 11.5 mW/g

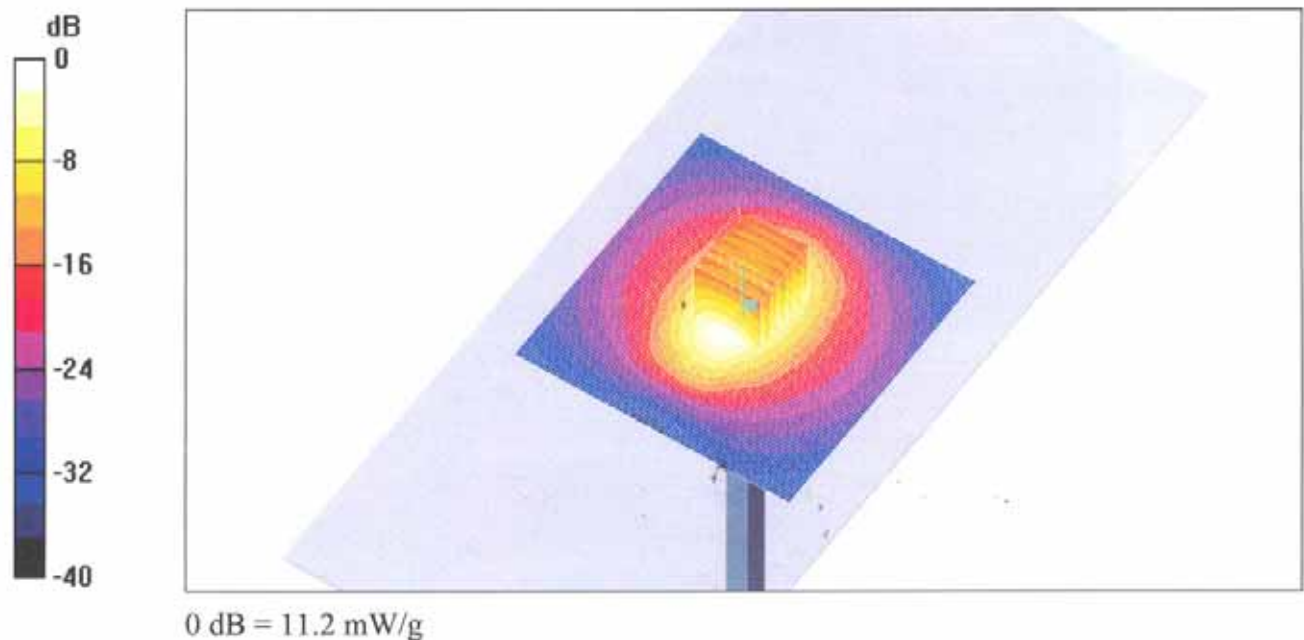
**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.4 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 16.7 W/kg

**SAR(1 g) = 9.94 mW/g; SAR(10 g) = 5.3 mW/g**

Maximum value of SAR (measured) = 11.2 mW/g





Accredited by the Swiss Federal Office of Metrology and Accreditation  
 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 **Nokia Oulu 2**

Certificate No: **D2450V2-729\_Feb05**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 729**

Calibration procedure(s) **QA CAL-05.v6**  
**Calibration procedure for dipole validation kits**

Calibration date: **February 10, 2005**

Condition of the calibrated item **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID #             | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration  |
|----------------------------|------------------|-------------------------------------------|------------------------|
| Power meter EPM E442       | GB37480704       | 12-Oct-04 (METAS, No. 251-00412)          | Oct-05                 |
| Power sensor HP 8481A      | US37292783       | 12-Oct-04 (METAS, No. 251-00412)          | Oct-05                 |
| Reference 20 dB Attenuator | SN: 5086 (20g)   | 10-Aug-04 (METAS, No 251-00402)           | Aug-05                 |
| Reference 10 dB Attenuator | SN: 5047.2 (10r) | 10-Aug-04 (METAS, No 251-00402)           | Aug-05                 |
| Reference Probe ES3DV2     | SN 3025          | 29-Oct-04 (SPEAG, No. ES3-3025_Oct04)     | Oct-05                 |
| DAE4                       | SN 601           | 07-Jan-05 (SPEAG, No. DAE4-601_Jan05)     | Jan-06                 |
| Secondary Standards        | ID #             | Check Date (in house)                     | Scheduled Check        |
| Power sensor HP 8481A      | MY41092317       | 18-Oct-02 (SPEAG, in house check Oct-03)  | In house check: Oct-05 |
| RF generator R&S SML-03    | 100698           | 27-Mar-02 (SPEAG, in house check Dec-03)  | In house check: Dec-05 |
| Network Analyzer HP 8753E  | US37390585 S4206 | 18-Oct-01 (SPEAG, in house check Nov-04)  | In house check: Nov-05 |

Calibrated by: **Mike Meili** **Laboratory Technician**

Signature

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

Issued: February 11, 2005

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

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN729**

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

Medium: HSL U10 BB;

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.78$  mho/m;  $\epsilon_r = 39.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 29.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.07.2004
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 11; Postprocessing SW: SEMCAD, V1.8 Build 142

**Pin = 250 mW; d = 10 mm/Area Scan (81x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 16.7 mW/g

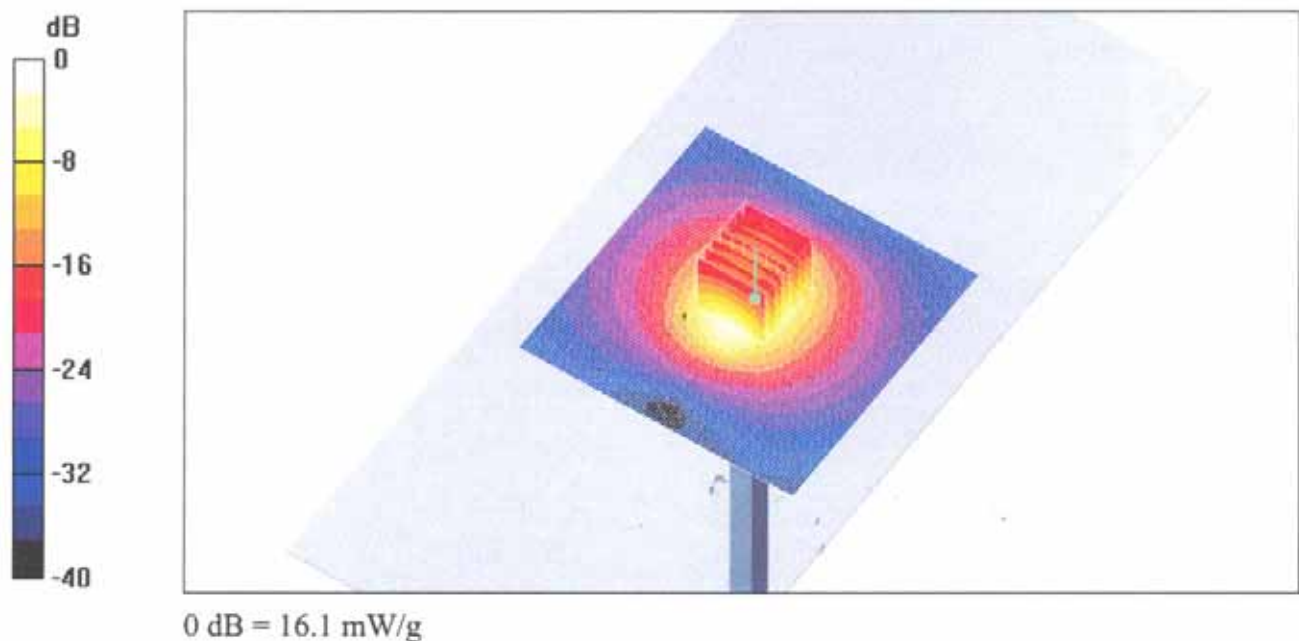
**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.1 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 28.9 W/kg

**SAR(1 g) = 14.2 mW/g; SAR(10 g) = 6.6 mW/g**

Maximum value of SAR (measured) = 16.1 mW/g



Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN729**

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

Medium: M2450;

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.01$  mho/m;  $\epsilon_r = 52.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.13, 4.13, 4.13); Calibrated: 29.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.07.2004
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 11; Postprocessing SW: SEMCAD, V1.8 Build 142

**Pin = 250 mW; d = 10 mm/Area Scan (81x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 15.7 mW/g

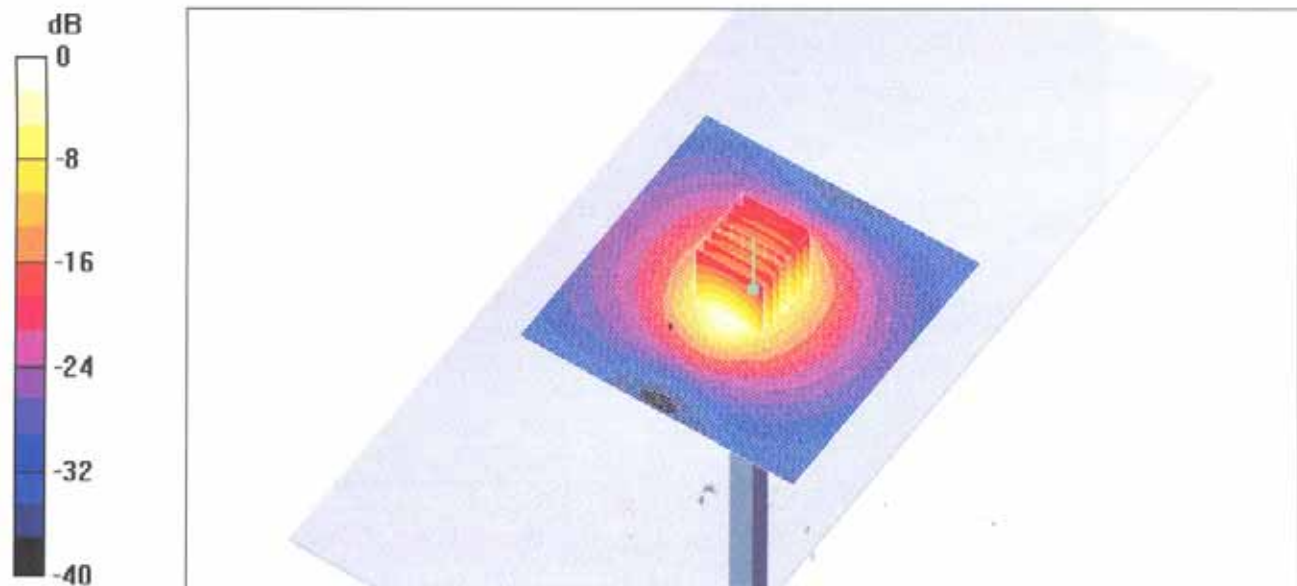
**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 86.7 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 27.3 W/kg

**SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.19 mW/g**

Maximum value of SAR (measured) = 15.2 mW/g



0 dB = 15.2 mW/g