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**APPENDIX D: PROBE & DIPOLE CALIBRATION DATA**



Document

## Appendix D for the BlackBerry® Smartphone Model RCN72UW SAR Report

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|-------------------------------------|--|---|------------------------------|-------------------------------|

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



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

Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**Client **RTS (RIM Testing Services)**Certificate No: **ES3-3225\_Dec09****CALIBRATION CERTIFICATE**Object **ES3DV3 - SN:3225**Calibration procedure(s) **QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2**  
**Calibration procedure for dosimetric E-field probes**Calibration date: **December 11, 2009**

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&amp;TE critical for calibration)

| Primary Standards          | ID #            | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 1-Apr-09 (No. 217-01030)          | Apr-10                 |
| Power sensor E4412A        | MY41495277      | 1-Apr-09 (No. 217-01030)          | Apr-10                 |
| Power sensor E4412A        | MY41498087      | 1-Apr-09 (No. 217-01030)          | Apr-10                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 31-Mar-09 (No. 217-01026)         | Mar-10                 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 31-Mar-09 (No. 217-01028)         | Mar-10                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 31-Mar-09 (No. 217-01027)         | Mar-10                 |
| Reference Probe ES3DV2     | SN: 3013        | 2-Jan-09 (No. ES3-3013_Jan09)     | Jan-10                 |
| DAE4                       | SN: 660         | 29-Sep-09 (No. DAE4-660_Sep09)    | Sep-10                 |
| 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-09) | In house check: Oct10  |

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

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

Issued: December 11, 2009

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

Certificate No: **ES3-3225\_Dec09**

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### Glossary:

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

### Calibration is Performed According to the Following Standards:

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

### Methods Applied and Interpretation of Parameters:

- $NORMx,y,z$ : Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide).  $NORMx,y,z$  are only intermediate values, i.e., the uncertainties of  $NORMx,y,z$  does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- $NORM(f)x,y,z = NORMx,y,z * frequency\_response$  (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- $DCPx,y,z$ : DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- $Ax,y,z; Bx,y,z; Cx,y,z; VRx,y,z; A, B, C$  are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  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  $NORMx,y,z * ConvF$  whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  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.



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**ES3DV3 SN:3225****December 11, 2009**

# Probe ES3DV3

## SN:3225

Manufactured: September 1, 2009  
Calibrated: December 11, 2009

**Calibrated for DASY Systems**

(Note: non-compatible with DASY2 system!)



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|-------------------------------------|--|---|------------------------------|-------------------------------|

**ES3DV3 SN:3225****December 11, 2009****DASY - Parameters of Probe: ES3DV3 SN:3225****Basic Calibration Parameters**

|   | <b>Sensor X</b> | <b>Sensor Y</b> | <b>Sensor Z</b> | <b>Unc (k=2)</b> |
|---|-----------------|-----------------|-----------------|------------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 1.26            | 1.22            | 1.32            | $\pm 10.1\%$     |
| DCP (mV) <sup>B</sup>                                     | 92.3            | 94.8            | 92.7            |                  |

**Modulation Calibration Parameters**

| <b>UID</b> | <b>Communication System Name</b> | <b>PAR</b> |   | <b>A</b><br><b>dB</b> | <b>B</b><br><b>dBuV</b> | <b>C</b> | <b>VR</b><br><b>mV</b> | <b>Unc<sup>E</sup></b><br><b>(k=2)</b> |
|------------|----------------------------------|------------|---|-----------------------|-------------------------|----------|------------------------|--|
| 10000      | CW                               | 0.00       | X | 0.00                  | 0.00                    | 1.00     | 300.0                  | $\pm 1.5\%$                            |

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 maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



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|-------------------------------------|--|---|------------------------------|-------------------------------|

**ES3DV3 SN:3225****December 11, 2009****DASY - Parameters of Probe: ES3DV3 SN:3225****Calibration Parameter Determined in Head Tissue Simulating Media**

| f [MHz] | Validity [MHz] <sup>c</sup> | Permittivity | Conductivity | ConvF X | ConvF Y | ConvF Z | Alpha | Depth Unc (k=2) |
|---------|-----------------------------|--------------|--------------|---------|---------|---------|-------|-----------------|
| 900     | ± 50 / ± 100                | 41.5 ± 5%    | 0.97 ± 5%    | 6.12    | 6.12    | 6.12    | 0.99  | 1.07 ± 11.0%    |
| 1810    | ± 50 / ± 100                | 40.0 ± 5%    | 1.40 ± 5%    | 5.14    | 5.14    | 5.14    | 0.46  | 1.60 ± 11.0%    |
| 1950    | ± 50 / ± 100                | 40.0 ± 5%    | 1.40 ± 5%    | 4.96    | 4.96    | 4.96    | 0.47  | 1.57 ± 11.0%    |
| 2450    | ± 50 / ± 100                | 39.2 ± 5%    | 1.80 ± 5%    | 4.53    | 4.53    | 4.53    | 0.41  | 1.89 ± 11.0%    |

<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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**ES3DV3 SN:3225****December 11, 20****DASY - Parameters of Probe: ES3DV3 SN:3225****Calibration Parameter Determined in Body Tissue Simulating Media**

| f [MHz] | Validity [MHz] <sup>c</sup> | Permittivity | Conductivity | ConvF X | ConvF Y | ConvF Z | Alpha | Depth Unc (k=2) |
|---------|-----------------------------|--------------|--------------|---------|---------|---------|-------|-----------------|
| 900     | ± 50 / ± 100                | 55.0 ± 5%    | 1.05 ± 5%    | 5.97    | 5.97    | 5.97    | 0.98  | 1.12 ± 11.0%    |
| 1810    | ± 50 / ± 100                | 53.3 ± 5%    | 1.52 ± 5%    | 4.90    | 4.90    | 4.90    | 0.35  | 2.07 ± 11.0%    |
| 1950    | ± 50 / ± 100                | 53.3 ± 5%    | 1.52 ± 5%    | 4.83    | 4.83    | 4.83    | 0.32  | 2.45 ± 11.0%    |
| 2450    | ± 50 / ± 100                | 52.7 ± 5%    | 1.95 ± 5%    | 4.32    | 4.32    | 4.32    | 0.74  | 1.27 ± 11.0%    |

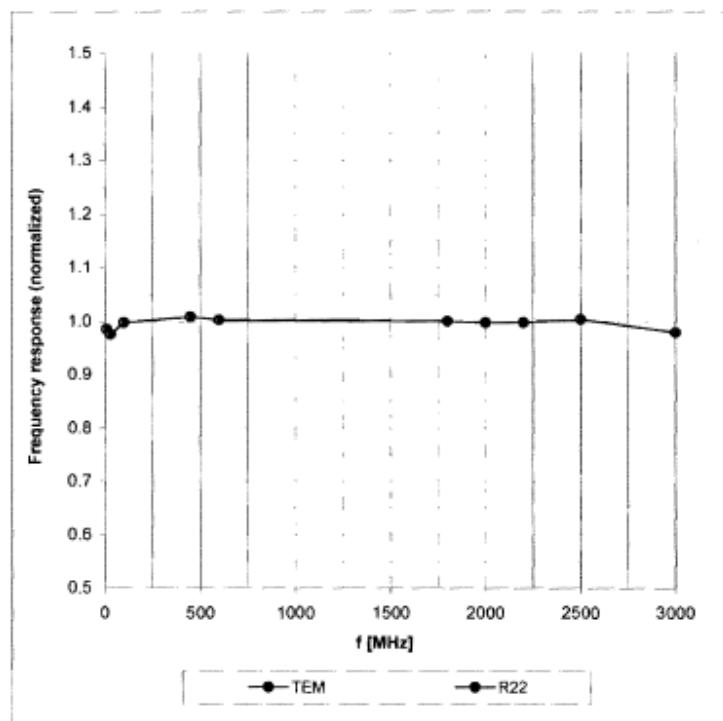
<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.



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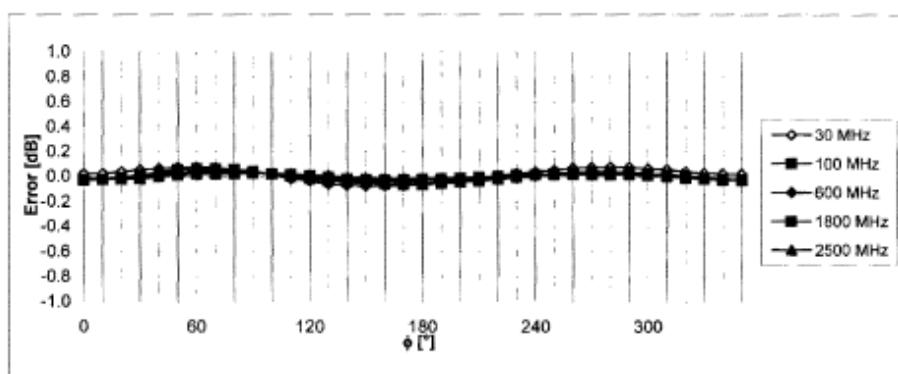
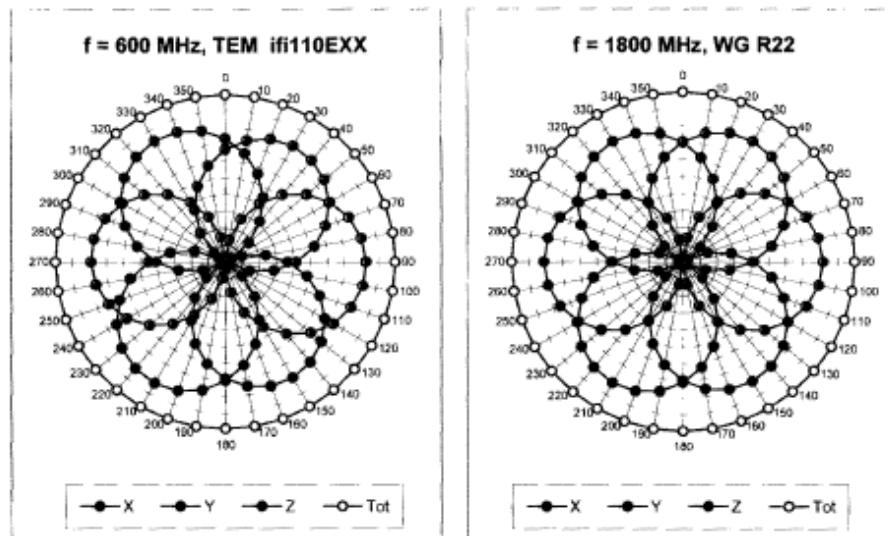
|                                     |  |   |                              |                               |
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|-------------------------------------|--|---|------------------------------|-------------------------------|

**ES3DV3 SN:3225****December 11, 2009****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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**ES3DV3 SN:3225****December 11, 2009**

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

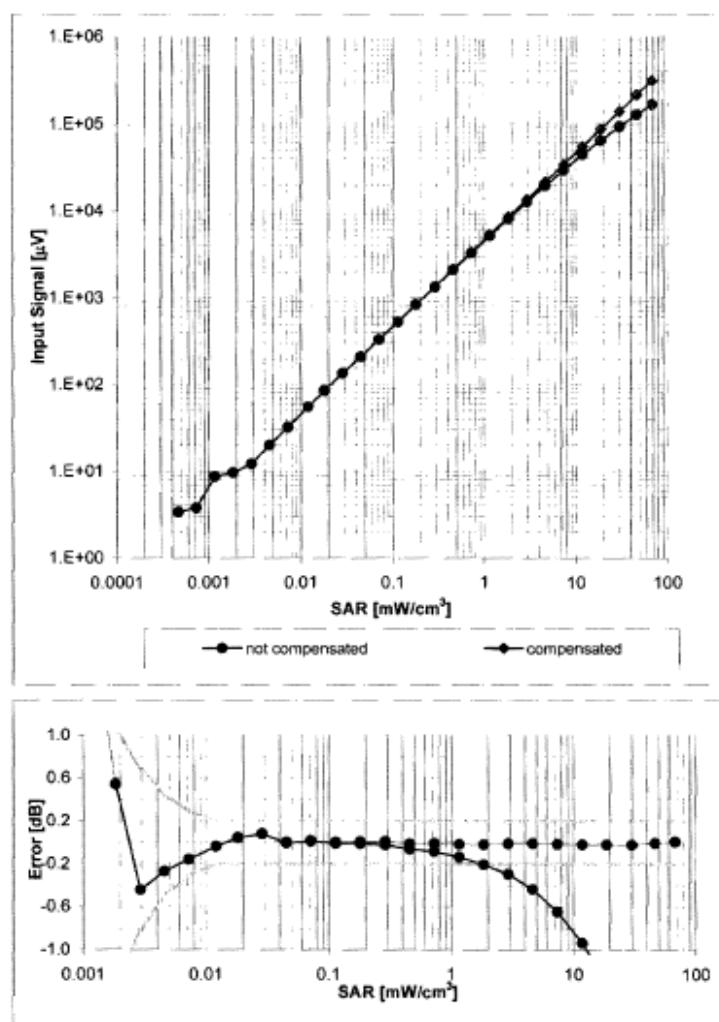


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

|                                     |  |   |                              |                               |
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**ES3DV3 SN:3225****December 11, 2009**

### Dynamic Range f(SAR<sub>head</sub>) (Waveguide R22, f = 1800 MHz)



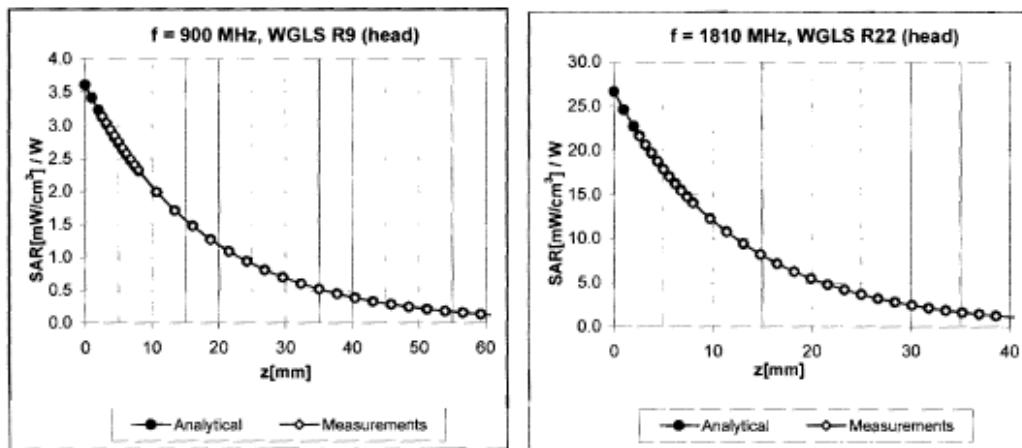
**Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )**

|                                     |  |   |                              |                               |
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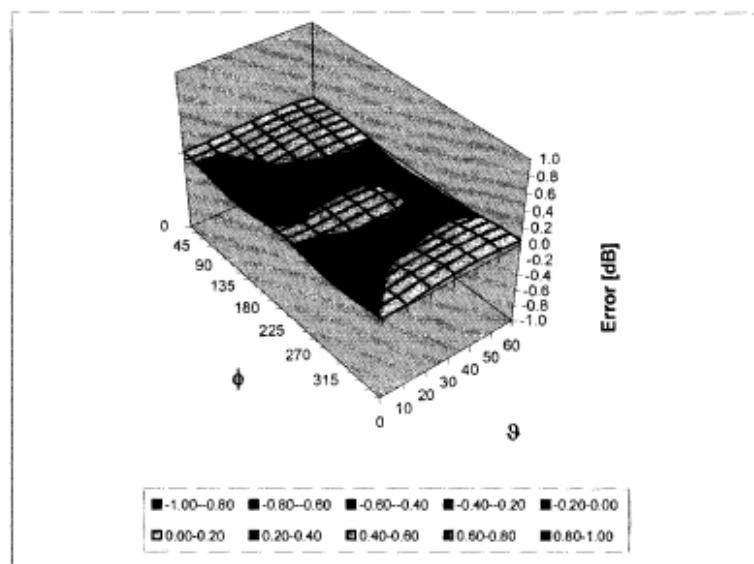
ES3DV3 SN:3225

December 11, 2009

## Conversion Factor Assessment



## Deviation from Isotropy in HSL

Error ( $\phi, \theta$ ), f = 900 MHzUncertainty of Spherical Isotropy Assessment:  $\pm 2.6\% (k=2)$



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|-------------------------------------|--|---|------------------------------|-------------------------------|

**ES3DV3 SN:3225****December 11, 2009****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                                    | 10 mm          |
| Tip Diameter                                  | 4.0 mm         |
| Probe Tip to Sensor X Calibration Point       | 2 mm           |
| Probe Tip to Sensor Y Calibration Point       | 2 mm           |
| Probe Tip to Sensor Z Calibration Point       | 2 mm           |
| Recommended Measurement Distance from Surface | 3 mm           |



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Accreditation No.: **SCS 108**Client **RTS ( RIM Testing Services)**Certificate No: **D835V2-446\_Jan09****CALIBRATION CERTIFICATE**Object **D835V2 - SN: 446**Calibration procedure(s) **QA CAL-05.v7**  
Calibration procedure for dipole validation kitsCalibration date: **January 05, 2009**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&amp;TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)     | Scheduled Calibration |
|-----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A        | GB37480704         | 08-Oct-08 (No. 217-00898)      | Oct-09                |
| Power sensor HP 8481A       | US37292783         | 08-Oct-08 (No. 217-00898)      | Oct-09                |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 01-Jul-08 (No. 217-00864)      | Jul-09                |
| Type-N mismatch combination | SN: 5047.2 / 08327 | 01-Jul-08 (No. 217-00867)      | Jul-09                |
| Reference Probe ES3DV2      | SN: 3025           | 28-Apr-08 (No. ES3-3025_Apr08) | Apr-09                |
| DAE4                        | SN: 601            | 14-Mar-08 (No. DAE4-601_Mar08) | Mar-09                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A     | MY41092317       | 18-Oct-02 (in house check Oct-07) | In house check: Oct-09 |
| RF generator R&S SMT-06   | 100005           | 4-Aug-99 (in house check Oct-07)  | In house check: Oct-09 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-08) | In house check: Oct-09 |

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

Issued: January 7, 2009

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Certificate No: **D835V2-446\_Jan09**

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Accreditation No.: **SCS 108**

#### **Glossary:**

|              |                                 |
|--------------|---------------------------------|
| <b>TSL</b>   | tissue simulating liquid        |
| <b>ConvF</b> | sensitivity in TSL / NORM x,y,z |
| <b>N/A</b>   | not applicable or not measured  |

#### **Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### **Additional Documentation:**

- DASY4/5 System Handbook

#### **Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.



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|                                     |  |   |                              |                               |
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| Author Data<br><b>Andrew Becker</b> | Dates of Test<br><b>June 10– June 24 &amp; July 15, 2010</b> | Test Report No<br><b>RTS-1689-1007-38</b> | FCC ID:<br><b>L6ARCN70UW</b> | IC ID<br><b>2503A-RCN70UW</b> |
|-------------------------------------|--|---|------------------------------|-------------------------------|

**Measurement Conditions**

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

|                              |                           |             |
|------------------------------|---------------------------|-------------|
| DASY Version                 | DASY5                     | V5.0        |
| Extrapolation                | Advanced Extrapolation    |             |
| Phantom                      | Modular Flat Phantom V4.9 |             |
| Distance Dipole Center - TSL | 15 mm                     | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm         |             |
| Frequency                    | 835 MHz ± 1 MHz           |             |

**Head TSL parameters**

The following parameters and calculations were applied.

|                                  | Temperature     | Permittivity | Conductivity     |
|----------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters      | 22.0 °C         | 41.5         | 0.90 mho/m       |
| Measured Head TSL parameters     | (22.0 ± 0.2) °C | 41.3 ± 6 %   | 0.91 mho/m ± 6 % |
| Head TSL temperature during test | (21.5 ± 0.2) °C | ---          | ---              |

**SAR result with Head TSL**

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                           |
|---|--------------------|---------------------------|
| SAR measured  | 250 mW input power | 2.40 mW / g               |
| SAR normalized  | normalized to 1W   | 9.60 mW / g               |
| SAR for nominal Head TSL parameters <sup>1</sup>        | normalized to 1W   | 9.50 mW /g ± 17.0 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                           |
| SAR measured  | 250 mW input power | 1.58 mW / g               |
| SAR normalized  | normalized to 1W   | 6.32 mW / g               |
| SAR for nominal Head TSL parameters <sup>1</sup>        | normalized to 1W   | 6.27 mW /g ± 16.5 % (k=2) |

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"



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| Author Data<br><b>Andrew Becker</b> | Dates of Test<br><b>June 10– June 24 &amp; July 15, 2010</b> | Test Report No<br><b>RTS-1689-1007-38</b> | FCC ID:<br><b>L6ARCN70UW</b> | IC ID<br><b>2503A-RCN70UW</b> |
|-------------------------------------|--|---|------------------------------|-------------------------------|

**Appendix****Antenna Parameters with Head TSL**

|                                      |  |
|--------------------------------------|--|
| Impedance, transformed to feed point | <b>49.8 <math>\Omega</math> - 6.9 <math>j\Omega</math></b> |
| Return Loss                          | <b>- 23.3 dB</b>   |

**General Antenna Parameters and Design**

|                                  |                 |
|----------------------------------|-----------------|
| Electrical Delay (one direction) | <b>1.385 ns</b> |
|----------------------------------|-----------------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

|                 |                         |
|-----------------|-------------------------|
| Manufactured by | <b>SPEAG</b>            |
| Manufactured on | <b>October 24, 2001</b> |

|   |  |   |                              |                               |
|---|--|---|------------------------------|-------------------------------|
|  <p>Document<br/> <b>Appendix D for the BlackBerry® Smartphone Model RCN72UW SAR Report</b></p> |  |   |                              | Page<br><b>17(36)</b>         |
| Author Data<br><b>Andrew Becker</b>   | Dates of Test<br><b>June 10– June 24 &amp; July 15, 2010</b> | Test Report No<br><b>RTS-1689-1007-38</b> | FCC ID:<br><b>L6ARCN70UW</b> | IC ID<br><b>2503A-RCN70UW</b> |

### DASY5 Validation Report for Head TSL

Date/Time: 05.01.2009 10:38:06

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:446

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

Medium: HSL 900 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.91$  mho/m;  $\epsilon_r = 41.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(5.97, 5.97, 5.97); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

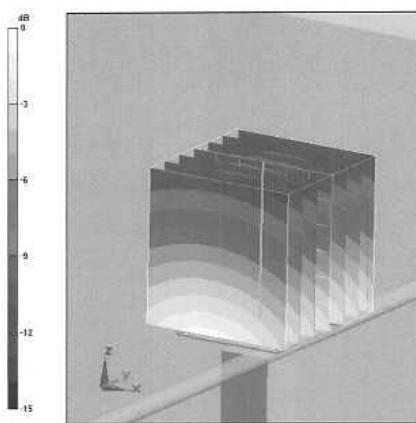
**Pin=250mW; dip=15mm; dist=3.4mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.7 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 3.54 W/kg

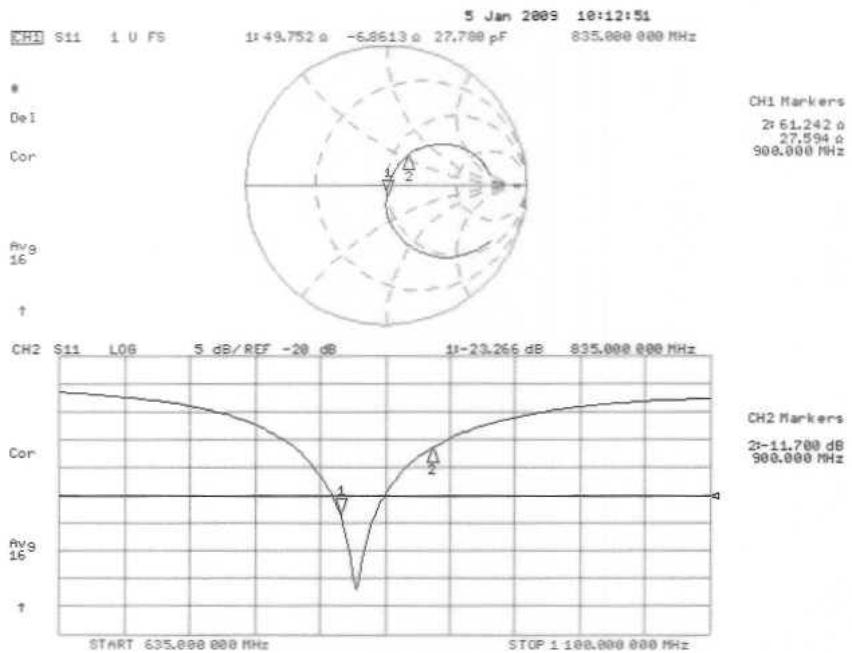
**SAR(1 g) = 2.4 mW/g; SAR(10 g) = 1.58 mW/g**

Maximum value of SAR (measured) = 2.7 mW/g



0 dB = 2.7mW/g

| Author Data          | Dates of Test                               | Test Report No          | FCC ID:           | IC ID                |
|----------------------|---|-------------------------|-------------------|----------------------|
| <b>Andrew Becker</b> | <b>June 10– June 24 &amp; July 15, 2010</b> | <b>RTS-1689-1007-38</b> | <b>L6ARCN70UW</b> | <b>2503A-RCN70UW</b> |

**Impedance Measurement Plot for Head TSL**




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| Author Data<br><b>Andrew Becker</b> | Dates of Test<br><b>June 10– June 24 &amp; July 15, 2010</b> | Test Report No<br><b>RTS-1689-1007-38</b> | FCC ID:<br><b>L6ARCN70UW</b> | IC ID<br><b>2503A-RCN70UW</b> |
|-------------------------------------|--|---|------------------------------|-------------------------------|

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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**Client **RTS (RIM Test Services)**Certificate No: **D1800V2-2d020\_Jan09****CALIBRATION CERTIFICATE**

|  |   |   |                        |
|--|---|---|------------------------|
| Object   | <b>D1800V2 - SN: 2d020</b>  |   |                        |
| Calibration procedure(s)   | <b>QA CAL-05.v7</b><br>Calibration procedure for dipole validation kits |   |                        |
| Calibration date:  | <b>January 06, 2009</b>   |   |                        |
| Condition of the calibrated item   | <b>In Tolerance</b>   |   |                        |
| <p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> |   |   |                        |
| Primary Standards  | ID #  | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration  |
| Power meter EPM-442A   | GB37480704  | 08-Oct-08 (No. 217-00888)                 | Oct-09                 |
| Power sensor HP 8481A  | US37292783  | 08-Oct-08 (No. 217-00886)                 | Oct-09                 |
| Reference 20 dB Attenuator   | SN: 5086 (20g)  | 01-Jul-08 (No. 217-00864)                 | Jul-09                 |
| Type-N mismatch combination  | SN: 5047.2 / 06327  | 01-Jul-08 (No. 217-00867)                 | Jul-09                 |
| Reference Probe ES3DV2   | SN: 3025  | 28-Apr-08 (No. ES3-3025_Apr08)            | Apr-09                 |
| DAE4   | SN: 601   | 14-Mar-08 (No. DAE4-601_Mar08)            | Mar-09                 |
| Secondary Standards  | ID #  | Check Date (in house)                     | Scheduled Check        |
| Power sensor HP 8481A  | MY41092317  | 18-Oct-02 (in house check Oct-07)         | In house check: Oct-09 |
| RF generator R&S SMT-06  | 100005  | 4-Aug-99 (in house check Oct-07)          | In house check: Oct-09 |
| Network Analyzer HP 8753E  | US37390585 S4206  | 18-Oct-01 (in house check Oct-06)         | In house check: Oct-09 |
| Calibrated by:   | Name<br>Jelon Kastrati  | Function<br>Laboratory Technician         | Signature<br>          |
| Approved by:   | Katja Pokovic   | Technical Manager                         |                        |
| Issued: January 7, 2009  |   |   |                        |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory.  |   |   |                        |

Certificate No: D1800V2-2d020\_Jan09

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| Author Data<br><b>Andrew Becker</b>   | Dates of Test<br><b>June 10– June 24 &amp; July 15, 2010</b> | Test Report No<br><b>RTS-1689-1007-38</b> | FCC ID:<br><b>L6ARCN70UW</b> | IC ID<br><b>2503A-RCN70UW</b> |

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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

**Glossary:**

|              |                                 |
|--------------|---------------------------------|
| <b>TSL</b>   | tissue simulating liquid        |
| <b>ConvF</b> | sensitivity in TSL / NORM x,y,z |
| <b>N/A</b>   | not applicable or not measured  |

**Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.



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|-------------------------------------|--|---|------------------------------|-------------------------------|

**Measurement Conditions**

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

|                                     |                                  |                    |
|-------------------------------------|----------------------------------|--------------------|
| <b>DASY Version</b>                 | <b>DASY5</b>                     | <b>V5.0</b>        |
| <b>Extrapolation</b>                | <b>Advanced Extrapolation</b>    |                    |
| <b>Phantom</b>                      | <b>Modular Flat Phantom V5.0</b> |                    |
| <b>Distance Dipole Center - TSL</b> | <b>10 mm</b>                     | <b>with Spacer</b> |
| <b>Zoom Scan Resolution</b>         | <b>dx, dy, dz = 5 mm</b>         |                    |
| <b>Frequency</b>                    | <b>1800 MHz ± 1 MHz</b>          |                    |

**Head TSL parameters**

The following parameters and calculations were applied.

|   | <b>Temperature</b>     | <b>Permittivity</b> | <b>Conductivity</b>     |
|---|------------------------|---------------------|-------------------------|
| <b>Nominal Head TSL parameters</b>      | <b>22.0 °C</b>         | <b>40.0</b>         | <b>1.40 mho/m</b>       |
| <b>Measured Head TSL parameters</b>     | <b>(22.0 ± 0.2) °C</b> | <b>39.5 ± 6 %</b>   | <b>1.40 mho/m ± 6 %</b> |
| <b>Head TSL temperature during test</b> | <b>(21.6 ± 0.2) °C</b> | —                   | —                       |

**SAR result with Head TSL**

| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | <b>condition</b>   |                                   |
|---|--------------------|-----------------------------------|
| SAR measured  | 250 mW input power | 9.57 mW /g                        |
| SAR normalized  | normalized to 1W   | 38.3 mW /g                        |
| SAR for nominal Head TSL parameters <sup>1</sup>            | normalized to 1W   | <b>38.2 mW / g ± 17.0 % (k=2)</b> |

| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | <b>condition</b>   |                                   |
|---|--------------------|-----------------------------------|
| SAR measured  | 250 mW input power | 5.04 mW /g                        |
| SAR normalized  | normalized to 1W   | 20.2 mW /g                        |
| SAR for nominal Head TSL parameters <sup>1</sup>              | normalized to 1W   | <b>20.1 mW / g ± 16.5 % (k=2)</b> |

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"



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|-------------------------------------|--|---|------------------------------|-------------------------------|

**Appendix****Antenna Parameters with Head TSL**

|                                      |                        |
|--------------------------------------|------------------------|
| Impedance, transformed to feed point | <b>45.3 Ω - 7.5 jΩ</b> |
| Return Loss                          | <b>- 20.6 dB</b>       |

**General Antenna Parameters and Design**

|                                  |                 |
|----------------------------------|-----------------|
| Electrical Delay (one direction) | <b>1.215 ns</b> |
|----------------------------------|-----------------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

|                 |                           |
|-----------------|---------------------------|
| Manufactured by | <b>SPEAG</b>              |
| Manufactured on | <b>September 07, 2001</b> |



| Author Data          | Dates of Test                               | Test Report No          | FCC ID:           | IC ID                |
|----------------------|---|-------------------------|-------------------|----------------------|
| <b>Andrew Becker</b> | <b>June 10– June 24 &amp; July 15, 2010</b> | <b>RTS-1689-1007-38</b> | <b>L6ARCN70UW</b> | <b>2503A-RCN70UW</b> |

### DASY5 Validation Report for Head TSL

Date/Time: 06.01.2009 11:22:58

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1800 MHz; Type: D1800V2; Serial: SN:2d020**

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB

Medium parameters used:  $f = 1800$  MHz;  $\sigma = 1.4$  mho/m;  $\epsilon_r = 39.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.96, 4.96, 4.96); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 1.3.4 Build 45

**Pin = 250 mW; dip = 10 mm, scan at 3.4mm 2/Zoom Scan (dist=3.4mm, probe 0deg)**

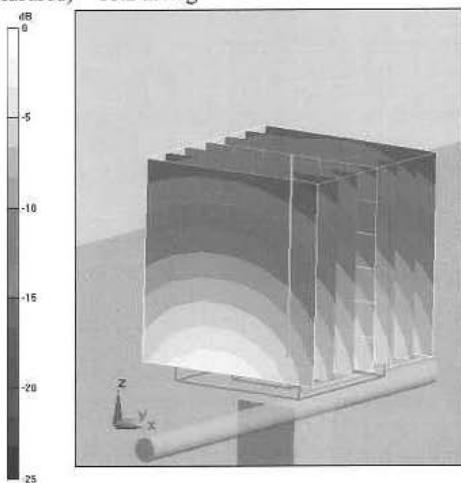
**(7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.8 V/m; Power Drift = 0.036 dB

Peak SAR (extrapolated) = 17.6 W/kg

SAR(1 g) = 9.57 mW/g; SAR(10 g) = 5.04 mW/g

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



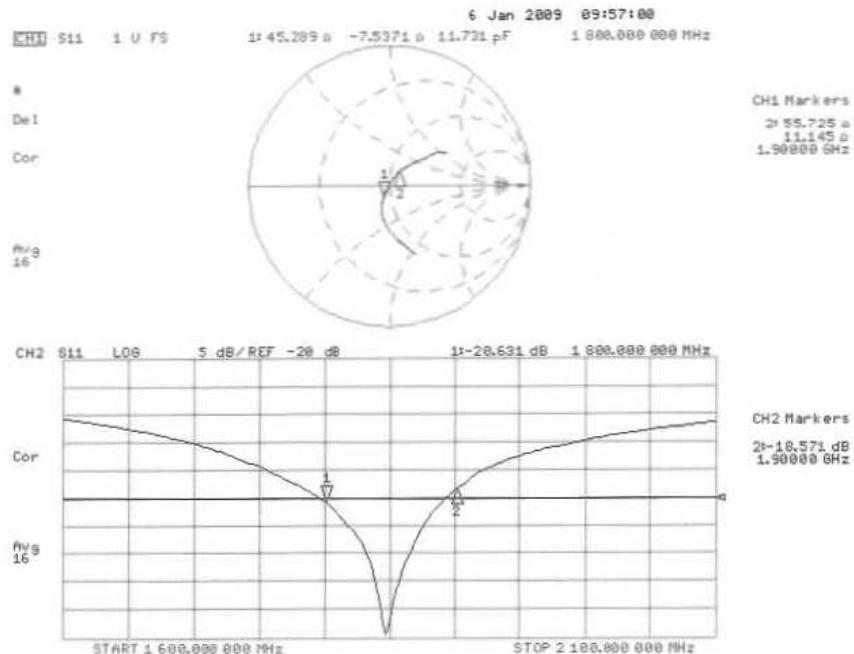
0 dB = 11.2mW/g



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| Author Data          | Dates of Test                               | Test Report No          | FCC ID:           | IC ID                |
|----------------------|---|-------------------------|-------------------|----------------------|
| <b>Andrew Becker</b> | <b>June 10– June 24 &amp; July 15, 2010</b> | <b>RTS-1689-1007-38</b> | <b>L6ARCN70UW</b> | <b>2503A-RCN70UW</b> |

**Impedance Measurement Plot for Head TSL**



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|-------------------------------------|--|---|------------------------------|-------------------------------|

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**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 **RTS (RIM Testing Services)**Certificate No: **D1900V2-545-Jan09****CALIBRATION CERTIFICATE**Object **D1900V2 - SN: 545**Calibration procedure(s) **QA CAL-05.v7**  
 Calibration procedure for dipole validation kitsCalibration date: **January 06, 2009**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&amp;TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration  |
|-----------------------------|--------------------|---|------------------------|
| Power meter EPM-442A        | GB37480704         | 08-Oct-08 (No. 217-00898)                 | Oct-09                 |
| Power sensor HP 8481A       | US37292783         | 08-Oct-08 (No. 217-00898)                 | Oct-09                 |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 01-Jul-08 (No. 217-00864)                 | Jul-09                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 01-Jul-08 (No. 217-00867)                 | Jul-09                 |
| Reference Probe ES3DV2      | SN: 3025           | 28-Apr-08 (No. ES3-3025_Apr08)            | Apr-09                 |
| DAE4                        | SN: 601            | 14-Mar-08 (No. DAE4-601_Mar08)            | Mar-09                 |
| Secondary Standards         | ID #               | Check Date (in house)                     | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-07)         | In house check: Oct-09 |
| RF generator R&S SMT-06     | 100005             | 4-Aug-99 (in house check Oct-07)          | In house check: Oct-09 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-08)         | In house check: Oct-09 |

|                |                       |  |               |
|----------------|-----------------------|--|---------------|
| Calibrated by: | <b>Jeton Kastrati</b> | Function<br><b>Laboratory Technician</b> | Signature<br> |
| Approved by:   | <b>Katja Pokovic</b>  | Function<br><b>Technical Manager</b>     | Signature<br> |

Issued: January 7, 2009

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|  |   |   |                              |                               |
|--|---|---|------------------------------|-------------------------------|
|  | Document<br><b>Appendix D for the BlackBerry® Smartphone Model RCN72UW SAR Report</b> | Page<br><b>26(36)</b>                     |                              |                               |
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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

**Glossary:**

|       |                                 |
|-------|---------------------------------|
| TSL   | tissue simulating liquid        |
| ConvF | sensitivity in TSL / NORM x,y,z |
| N/A   | not applicable or not measured  |

**Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz)", July 2001
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.



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| Author Data<br><b>Andrew Becker</b> | Dates of Test<br><b>June 10– June 24 &amp; July 15, 2010</b> | Test Report No<br><b>RTS-1689-1007-38</b> | FCC ID:<br><b>L6ARCN70UW</b> | IC ID<br><b>2503A-RCN70UW</b> |
|-------------------------------------|--|---|------------------------------|-------------------------------|

**Measurement Conditions**

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

|                              |                           |             |
|------------------------------|---------------------------|-------------|
| DASY Version                 | DASY5                     | V5.0        |
| Extrapolation                | Advanced Extrapolation    |             |
| Phantom                      | Modular Flat Phantom V5.0 |             |
| Distance Dipole Center - TSL | 10 mm                     | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm         |             |
| Frequency                    | 1900 MHz ± 1 MHz          |             |

**Head TSL parameters**

The following parameters and calculations were applied.

|                                  | Temperature     | Permittivity | Conductivity     |
|----------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters      | 22.0 °C         | 40.0         | 1.40 mho/m       |
| Measured Head TSL parameters     | (22.0 ± 0.2) °C | 39.2 ± 6 %   | 1.47 mho/m ± 6 % |
| Head TSL temperature during test | (21.0 ± 0.2) °C | —            | —                |

**SAR result with Head TSL**

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | condition          |                            |
|---|--------------------|----------------------------|
| SAR measured  | 250 mW input power | 10.2 mW / g                |
| SAR normalized  | normalized to 1W   | 40.8 mW / g                |
| SAR for nominal Head TSL parameters <sup>1</sup>      | normalized to 1W   | 39.5 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | Condition          |                            |
|---|--------------------|----------------------------|
| SAR measured  | 250 mW input power | 5.29 mW / g                |
| SAR normalized  | normalized to 1W   | 21.2 mW / g                |
| SAR for nominal Head TSL parameters <sup>1</sup>        | normalized to 1W   | 20.8 mW / g ± 16.5 % (k=2) |

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"



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## Appendix

**Antenna Parameters with Head TSL**

|                                      |                               |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | 49.9 $\Omega$ + 1.9 $j\Omega$ |
| Return Loss                          | -34.4 dB                      |

**General Antenna Parameters and Design**

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.197 ns |
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.  
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

|                 |                   |
|-----------------|-------------------|
| Manufactured by | SPEAG             |
| Manufactured on | November 15, 2001 |



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|-------------------------------------|--|---|------------------------------|-------------------------------|

**DASY5 Validation Report for Head TSL**

Date/Time: 06.01.2009 13:17:58

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:545**

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

Medium: HSL U10 BB

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.47$  mho/m;  $\epsilon_r = 39.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.9, 4.9, 4.9); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom: 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

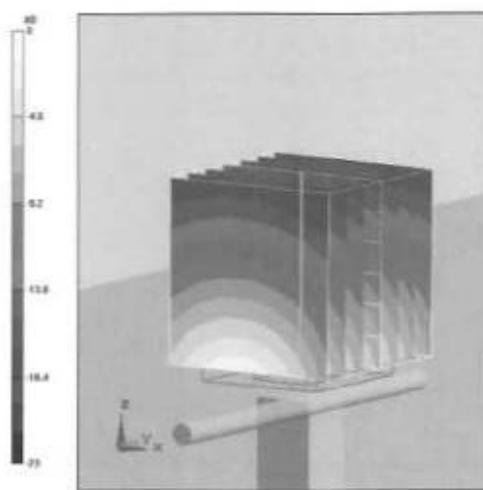
**Pin = 250 mW; dip = 10 mm, scan at 3.4mm/Zoom Scan (dist=3.4mm, probe 0deg)****(7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.5 V/m; Power Drift = -0.037 dB

Peak SAR (extrapolated) = 19 W/kg

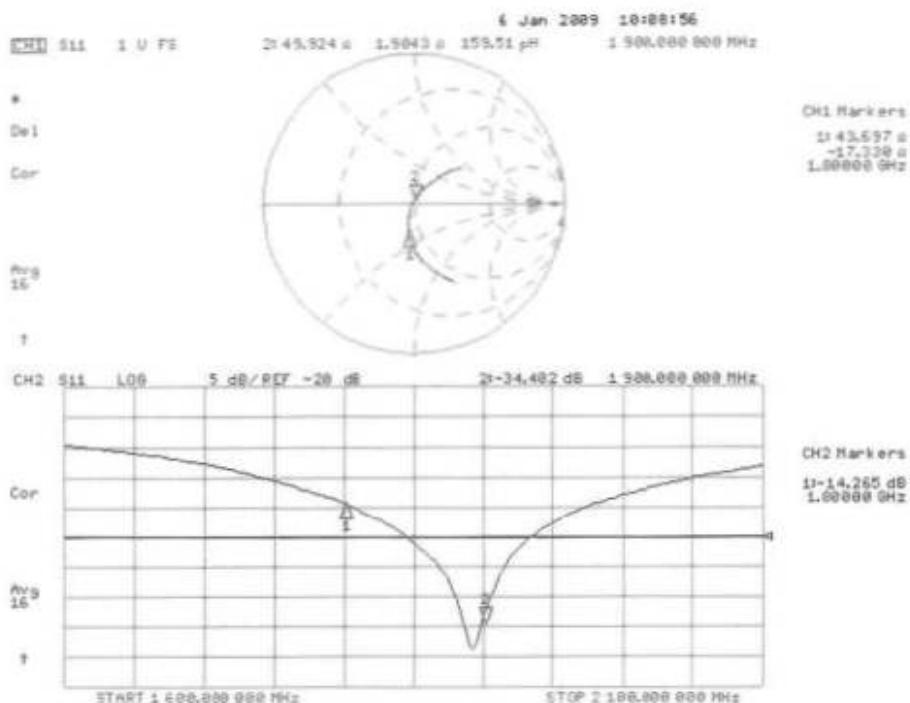
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.29 mW/g

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



0 dB = 12mW/g

| Author Data          | Dates of Test                               | Test Report No          | FCC ID:           | IC ID                |
|----------------------|---|-------------------------|-------------------|----------------------|
| <b>Andrew Becker</b> | <b>June 10– June 24 &amp; July 15, 2010</b> | <b>RTS-1689-1007-38</b> | <b>L6ARCN70UW</b> | <b>2503A-RCN70UW</b> |

**Impedance Measurement Plot for Head TSL**




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|-------------------------------------|--|---|------------------------------|-------------------------------|

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



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

Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**Client **RTS (RIM Testing Services)**Certificate No: **D2450V2-747 Nov09****CALIBRATION CERTIFICATE**

|   |   |  |                        |
|---|---|--|------------------------|
| Object  | <b>D2450V2 - SN: 747</b>  |  |                        |
| Calibration procedure(s)  | <b>QA CAL-05.v7</b><br>Calibration procedure for dipole validation kits |  |                        |
| Calibration date:   | <b>November 11, 2009</b>  |  |                        |
| <p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature <math>(22 \pm 3)^\circ\text{C}</math> and humidity <math>&lt; 70\%</math>.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> |   |  |                        |
| Primary Standards   | ID #  | Cal Date (Certificate No.)               | Scheduled Calibration  |
| Power meter EPM-442A  | GB37480704  | 06-Oct-09 (No. 217-01086)                | Oct-10                 |
| Power sensor HP 8481A   | US37292783  | 06-Oct-09 (No. 217-01086)                | Oct-10                 |
| Reference 20 dB Attenuator  | SN: 5086 (20g)  | 31-Mar-09 (No. 217-01025)                | Mar-10                 |
| Type-N mismatch combination   | SN: 5047.2 / 06327  | 31-Mar-09 (No. 217-01029)                | Mar-10                 |
| Reference Probe ES3DV3  | SN: 3205  | 26-Jun-09 (No. ES3-3205_Jun09)           | Jun-10                 |
| DAE4  | SN: 601   | 07-Mar-09 (No. DAE4-601_Mar09)           | Mar-10                 |
| 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-09)        | In house check: Oct-10 |
| Calibrated by:  | Name<br><b>Mike Meil</b>  | Function<br><b>Laboratory Technician</b> | Signature<br>          |
| Approved by:  | Name<br><b>Katja Pokovic</b>  | Function<br><b>Technical Manager</b>     | Signature<br>          |
| Issued: November 16, 2009   |   |  |                        |

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

Certificate No: D2450V2-747\_Nov09

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



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

Accredited by the Swiss Accreditation Service (SAS)  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

#### Glossary:

|       |                                 |
|-------|---------------------------------|
| TSL   | tissue simulating liquid        |
| ConvF | sensitivity in TSL / NORM x,y,z |
| N/A   | not applicable or not measured  |

#### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### Additional Documentation:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.



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|-------------------------------------|--|---|------------------------------|-------------------------------|

**Measurement Conditions**

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

|                                     |                           |             |
|-------------------------------------|---------------------------|-------------|
| <b>DASY Version</b>                 | DASY5                     | V5.2        |
| <b>Extrapolation</b>                | Advanced Extrapolation    |             |
| <b>Phantom</b>                      | Modular Flat Phantom V4.9 |             |
| <b>Distance Dipole Center - TSL</b> | 10 mm                     | with Spacer |
| <b>Zoom Scan Resolution</b>         | dx, dy, dz = 5 mm         |             |
| <b>Frequency</b>                    | 2450 MHz ± 1 MHz          |             |

**Head TSL parameters**

The following parameters and calculations were applied.

|   | <b>Temperature</b> | <b>Permittivity</b> | <b>Conductivity</b> |
|---|--------------------|---------------------|---------------------|
| <b>Nominal Head TSL parameters</b>      | 22.0 °C            | 39.2                | 1.80 mho/m          |
| <b>Measured Head TSL parameters</b>     | (22.0 ± 0.2) °C    | 39.1 ± 6 %          | 1.78 mho/m ± 6 %    |
| <b>Head TSL temperature during test</b> | (21.3 ± 0.2) °C    | ---                 | ---                 |

**SAR result with Head TSL**

| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                  |
|---|--------------------|----------------------------------|
| SAR measured  | 250 mW input power | 13.3 mW / g                      |
| SAR normalized  | normalized to 1W   | 53.2 mW / g                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>53.4 mW /g ± 17.0 % (k=2)</b> |

| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | Condition          |                                  |
|---|--------------------|----------------------------------|
| SAR measured  | 250 mW input power | 6.23 mW / g                      |
| SAR normalized  | normalized to 1W   | 24.9 mW / g                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>24.9 mW /g ± 16.5 % (k=2)</b> |



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|-------------------------------------|--|---|------------------------------|-------------------------------|

**Appendix****Antenna Parameters with Head TSL**

|                                      |  |
|--------------------------------------|--|
| Impedance, transformed to feed point | <b>51.9 <math>\Omega</math> + 0.9 <math>j\Omega</math></b> |
| Return Loss                          | <b>- 33.9 dB</b>   |

**General Antenna Parameters and Design**

|                                  |                 |
|----------------------------------|-----------------|
| Electrical Delay (one direction) | <b>1.161 ns</b> |
|----------------------------------|-----------------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

|                 |                          |
|-----------------|--------------------------|
| Manufactured by | <b>SPEAG</b>             |
| Manufactured on | <b>December 01, 2003</b> |

| Author Data          | Dates of Test                               | Test Report No          | FCC ID:           | IC ID                |
|----------------------|---|-------------------------|-------------------|----------------------|
| <b>Andrew Becker</b> | <b>June 10– June 24 &amp; July 15, 2010</b> | <b>RTS-1689-1007-38</b> | <b>L6ARCN70UW</b> | <b>2503A-RCN70UW</b> |

**DASY5 Validation Report for Head TSL**

Date/Time: 11.11.2009 15:04:10

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:747**

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

Medium: HSL U11 BB

 Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.79$  mho/m;  $\epsilon_r = 39.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

**Head/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

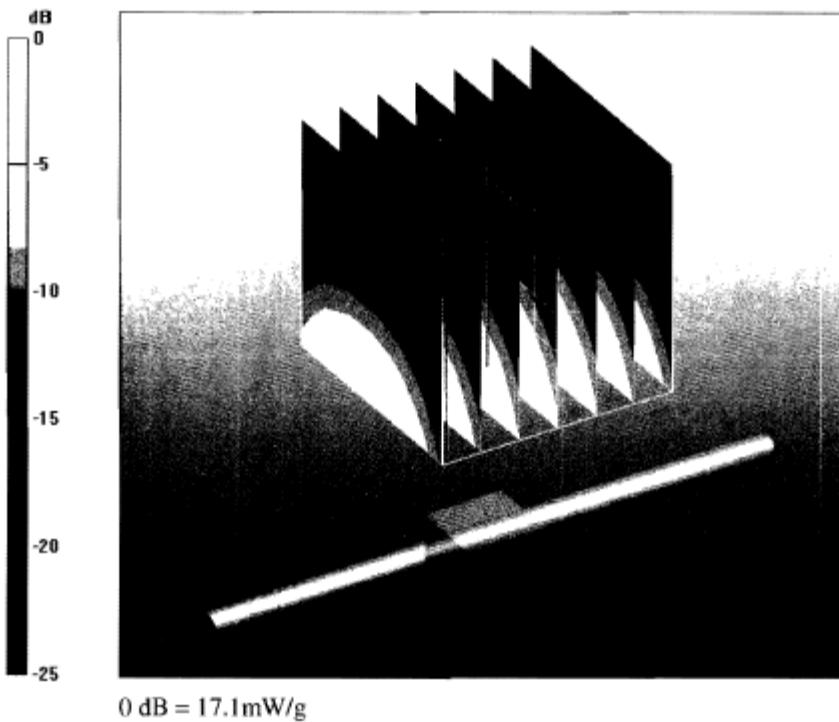
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.3 V/m; Power Drift = 0.067 dB

Peak SAR (extrapolated) = 27 W/kg

**SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.23 mW/g**

Maximum value of SAR (measured) = 17.1 mW/g





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**Impedance Measurement Plot for Head TSL**