# CONCLUSION

This page summarizes the results of the performed dosimetric evaluation. The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the device could be found in Appendix E.

## SAR Body & Head Test Data

### Environmental Conditions

| | |
|---|---|
| Ambient Temperature: | 22° C |
| Relative Humidity: | 50% |
| ATM Pressure: | 1018 mbar |

* *Testing was performed by Eric Hong on 2006-09-02.*

**802.11b mode:**

| EUT position | Frequency (MHz) | Test Type | Liquid | Phantom | Accessories | Measured (mw/g) | Limit (mw/g) | Plot # |
|---|---|---|---|---|---|---|---|---|
| Right Head Touch | 2412 | Head | Head | Right | None | 0.963 | 1.6 | 3 |
| Right Head Tilt | 2412 | Head | Head | Right | None | 0.343 | 1.6 | 4 |
| Right Head Touch | 2437 | Head | Head | Right | None | 0.874 | 1.6 | 5 |
| Right Head Tilt | 2437 | Head | Head | Right | None | 0.321 | 1.6 | 6 |
| Right Head Touch | 2462 | Head | Head | Right | None | 0.800 | 1.6 | 7 |
| Right Head Tilt | 2462 | Head | Head | Right | None | 0.289 | 1.6 | 8 |
| Left Head Touch | 2412 | Head | Head | Left | None | 0.981 | 1.6 | 9 |
| Left Head Tilt | 2412 | Head | Head | Left | None | 0.498 | 1.6 | 10 |
| Left Head Touch | 2437 | Head | Head | Left | None | 0.887 | 1.6 | 11 |
| Left Head Tilt | 2437 | Head | Head | Left | None | 0.415 | 1.6 | 12 |
| Left Head Touch | 2462 | Head | Head | Left | None | 0.856 | 1.6 | 13 |
| Left Head Tilt | 2462 | Head | Head | Left | None | 0.454 | 1.6 | 14 |
| 1.5 cm Separation form phantom | 2437 | Body-worn | Body | fat | None | 0.258 | 1.6 | 15 |

**802.11g mode:**

| EUT position | Frequency (MHz) | Test Type | Liquid | Phantom | Accessories | Measured (mw/g) | Limit (mw/g) | Plot # |
|---|---|---|---|---|---|---|---|---|
| Right Head Touch | 2412 | Head | Head | Right | None | 0.991 | 1.6 | 16 |
| Right Head Tilt | 2412 | Head | Head | Right | None | 0.448 | 1.6 | 17 |
| Right Head Touch | 2437 | Head | Head | Right | None | 0.865 | 1.6 | 18 |
| Right Head Tilt | 2437 | Head | Head | Right | None | 0.329 | 1.6 | 19 |
| Right Head Touch | 2462 | Head | Head | Right | None | 0.971 | 1.6 | 20 |
| Right Head Tilt | 2462 | Head | Head | Right | None | 0.369 | 1.6 | 21 |
| Left Head Touch | 2412 | Head | Head | Left | None | 0.974 | 1.6 | 22 |
| Left Head Tilt | 2412 | Head | Head | Left | None | 0.517 | 1.6 | 23 |
| Left Head Touch | 2437 | Head | Head | Left | None | 0.762 | 1.6 | 24 |
| Left Head Tilt | 2437 | Head | Head | Left | None | 0.438 | 1.6 | 25 |
| Left Head Touch | 2462 | Head | Head | Left | None | 0.705 | 1.6 | 26 |
| Left Head Tilt | 2462 | Head | Head | Left | None | 0.369 | 1.6 | 27 |
| 1.5 cm Separation form phantom | 2437 | Body-worn | Body | fat | None | 0.218 | 1.6 | 28 |

# APPENDIX A – MEASUREMENT UNCERTAINTY

The uncertainty budget has been determined for the DASY4 measurement system and is given in the following Table.

**DASY4 Uncertainty Budget**
**According to IEEE 1528 [1]**

| Error Description | Uncertainty value | Prob. Dist. | Div. | ($c_i$) 1g | ($c_i$) 10g | Std. Unc. (1g) | Std. Unc. (10g) | ($v_i$) $v_{eff}$ |
|---|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | | |
| Probe Calibration | ±5.9% | N | 1 | 1 | 1 | ±5.9% | ±5.9% | ∞ |
| Axial Isotropy | ±4.7% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±1.9% | ±1.9% | ∞ |
| Hemispherical Isotropy | ±9.6% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±3.9% | ±3.9% | ∞ |
| Boundary Effects | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Linearity | ±4.7% | R | $\sqrt{3}$ | 1 | 1 | ±2.7% | ±2.7% | ∞ |
| System Detection Limits | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Readout Electronics | ±0.3% | N | 1 | 1 | 1 | ±0.3% | ±0.3% | ∞ |
| Response Time | ±0.8% | R | $\sqrt{3}$ | 1 | 1 | ±0.5% | ±0.5% | ∞ |
| Integration Time | ±2.6% | R | $\sqrt{3}$ | 1 | 1 | ±1.5% | ±1.5% | ∞ |
| RF Ambient Conditions | ±3.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Probe Positioner | ±0.4% | R | $\sqrt{3}$ | 1 | 1 | ±0.2% | ±0.2% | ∞ |
| Probe Positioning | ±2.9% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Max. SAR Eval. | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| **Test Sample Related** | | | | | | | | |
| Device Positioning | ±2.9% | N | 1 | 1 | 1 | ±2.9% | ±2.9% | 145 |
| Device Holder | ±3.6% | N | 1 | 1 | 1 | ±3.6% | ±3.6% | 5 |
| Power Drift | ±5.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.9% | ±2.9% | ∞ |
| **Phantom and Setup** | | | | | | | | |
| Phantom Uncertainty | ±4.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.3% | ±2.3% | ∞ |
| Liquid Conductivity (target) | ±5.0% | R | $\sqrt{3}$ | 0.64 | 0.43 | ±1.8% | ±1.2% | ∞ |
| Liquid Conductivity (meas.) | ±2.5% | N | 1 | 0.64 | 0.43 | ±1.6% | ±1.1% | ∞ |
| Liquid Permittivity (target) | ±5.0% | R | $\sqrt{3}$ | 0.6 | 0.49 | ±1.7% | ±1.4% | ∞ |
| Liquid Permittivity (meas.) | ±2.5% | N | 1 | 0.6 | 0.49 | ±1.5% | ±1.2% | ∞ |
| Combined Std. Uncertainty | | | | | | ±10.8% | ±10.6% | 330 |
| **Expanded STD Uncertainty** | | | | | | **±21.6%** | **±21.1%** | |

## DASY4 Uncertainty Budget
**According to CENELEC EN 50361 [2]**

| Error Description | Uncertainty value | Prob. Dist. | Div. | ($c_i$) 1g | ($c_i$) 10g | Std. Unc. (1g) | Std. Unc. (10g) | ($v_i$) $v_{eff}$ |
|---|---|---|---|---|---|---|---|---|
| **Measurement Equipment** | | | | | | | | |
| Probe Calibration | ±5.9% | N | 1 | 1 | 1 | ±5.9% | ±5.9% | ∞ |
| Axial Isotropy | ±4.7% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±1.9% | ±1.9% | ∞ |
| Spherical Isotropy | ±9.6% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±3.9% | ±3.9% | ∞ |
| Probe Linearity | ±4.7% | R | $\sqrt{3}$ | 1 | 1 | ±2.7% | ±2.7% | ∞ |
| Detection Limit | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Boundary Effects | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Readout Electronics | ±0.3% | N | 1 | 1 | 1 | ±0.3% | ±0.3% | ∞ |
| Response Time | ±0.8% | N | 1 | 1 | 1 | ±0.8% | ±0.8% | ∞ |
| Noise | ±0% | N | 1 | 1 | 1 | ±0% | ±0% | ∞ |
| Integration Time | ±2.6% | N | 1 | 1 | 1 | ±2.6% | ±2.6,% | ∞ |
| **Mechanical Constraints** | | | | | | | | |
| Scanning System | ±0.4% | R | $\sqrt{3}$ | 1 | 1 | ±0.2% | ±0.2% | ∞ |
| Phantom Shell | ±4.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.3% | ±2.3% | ∞ |
| Probe Positioning | ±2.9% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Device Positioning | ±2.9% | N | 1 | 1 | 1 | ±2.9% | ±2.9% | 145 |
| **Physical Parameters** | | | | | | | | |
| Liquid Conductivity (target) | ±5.0% | R | $\sqrt{3}$ | 0.7 | 0.5 | ±2.0% | ±1.4% | ∞ |
| Liquid Conductivity (meas.) | ±4.3% | R | $\sqrt{3}$ | 0.7 | 0.5 | ±1.7% | ±1.2% | ∞ |
| Liquid Permittivity (target) | ±5.0% | R | $\sqrt{3}$ | 0.6 | 0.5 | ±1.7% | ±1.4% | ∞ |
| Liquid Permittivity (meas.) | ±4.3% | R | $\sqrt{3}$ | 0.6 | 0.5 | ±1.5% | ±1.2% | ∞ |
| Power Drift | ±5.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.9% | ±2.9% | ∞ |
| RF Ambient Conditions | ±3.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| **Post-Processing** | | | | | | | | |
| Extrap. and Integration | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Combined Std. Uncertainty | | | | | | ± 10.9% | ± 10.6% | 18125 |
| **Expanded Std. Uncertainty** | | | | | | **±21.7%** | **±12.1%** | |

# APPENDIX B – PROBE CALIBRATION CERTIFICATES

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

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

Accredited by the Swiss 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: Bay Area

Certificate No: ET3-1604_May06

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object: | ET3DV6 - SN: 1604 |
| Calibration procedure(s): | QA CAL-01.v5 and QA CAL-12.v4<br>Calibration procedure for dosimetric E-field probes |
| Calibration date: | May 2, 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter E4419B | GB41293874 | 5-Apr-06 (METAS, No. 251-00557) | Apr-07 |
| Power sensor E4412A | MY41495277 | 5-Apr-06 (METAS, No. 251-00557) | Apr-07 |
| Power sensor E4412A | MY41496087 | 5-Apr-06 (METAS, No. 251-00557) | Apr-07 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 11-Aug-05 (METAS, No. 251-00496) | Aug-06 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 4-Apr-06 (METAS, No. 251-00558) | Apr-07 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 11-Aug-05 (METAS, No. 251-00500) | Aug-06 |
| Reference Probe ES3DV2 | SN: 3013 | 2-Jan-06 (SPEAG, No. ES3-3013_Jan06) | Jan-07 |
| DAE4 | SN: 654 | 2-Feb-06 (SPEAG, No. DAE4-654_Feb06) | Feb-07 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (SPEAG, in house check Nov-05) | In house check: Nov-07 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (SPEAG, in house check Nov-05) | In house check: Nov 06 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Katja Pokovic | Technical Manager | |
| Approved by: | Niels Kuster | Quality Manager | |

Issued: May 3, 2005

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

Certificate No: ET3-1604_May06 Page 1 of 9

**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

Accreditation No.: **SCS 108**

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

**Glossary:**

| | |
|---|---|
| TSL | tissue simulating liquid |
| NORMx,y,z | sensitivity in free space |
| ConF | sensitivity in TSL / NORMx,y,z |
| DCP | diode compression point |
| Polarization φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis |

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

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) 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

**Methods Applied and Interpretation of Parameters:**

- *NORMx,y,z*: Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the $E^2$-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

# Probe ET3DV6

## SN:1604

| | |
|---|---|
| Manufactured: | July 30, 2001 |
| Last calibrated: | March 18, 2005 |
| Recalibrated: | May 2, 2006 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

**ET3DV6 SN:1604** **May 2, 2006**

# DASY - Parameters of Probe: ET3DV6 SN:1604

## Sensitivity in Free Space[A] Diode Compression[B]

| | | | | |
|---|---|---|---|---|
| NormX | 1.87 ± 10.1% | $\mu V/(V/m)^2$ | DCP X | 93 mV |
| NormY | 1.80 ± 10.1% | $\mu V/(V/m)^2$ | DCP Y | 93 mV |
| NormZ | 1.91 ± 10.1% | $\mu V/(V/m)^2$ | DCP Z | 93 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 | | 3.7 mm | 4.7 mm |
|---|---|---|---|
| $SAR_{be}$ [%] | Without Correction Algorithm | 7.9 | 4.1 |
| $SAR_{be}$ [%] | With Correction Algorithm | 0.1 | 0.2 |

**TSL** **1810 MHz** **Typical SAR gradient: 10 % per mm**

| Sensor Center to Phantom Surface Distance | | 3.7 mm | 4.7 mm |
|---|---|---|---|
| $SAR_{be}$ [%] | Without Correction Algorithm | 7.0 | 4.1 |
| $SAR_{be}$ [%] | With Correction Algorithm | 0.1 | 0.3 |

## Sensor Offset

| | |
|---|---|
| Probe Tip to Sensor Center | 2.7 mm |

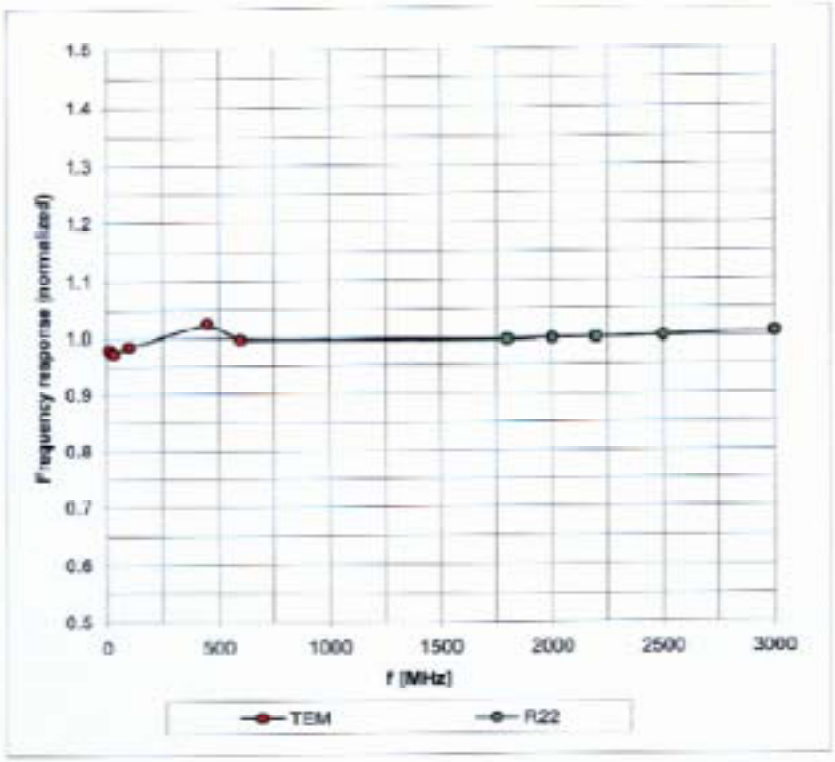
**The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.**

[A] The uncertainties of NormX,Y,Z do not affect the $E^2$-field uncertainty inside TSL (see Page 6).
[B] Numerical linearization parameter: uncertainty not required.

**ET3DV6 SN:1604** **May 2, 2006**

## Frequency Response of E-Field

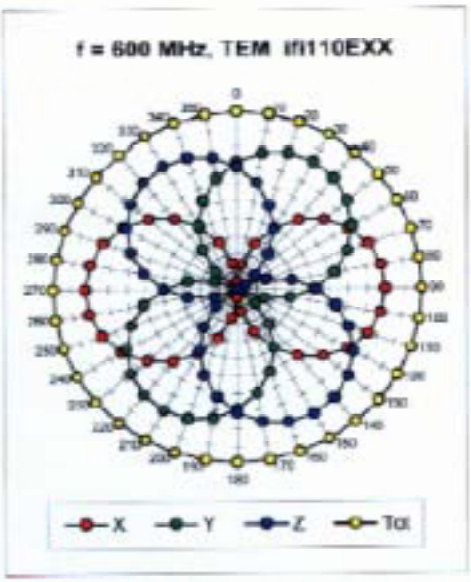
**(TEM-Cell:ifi110 EXX, Waveguide: R22)**

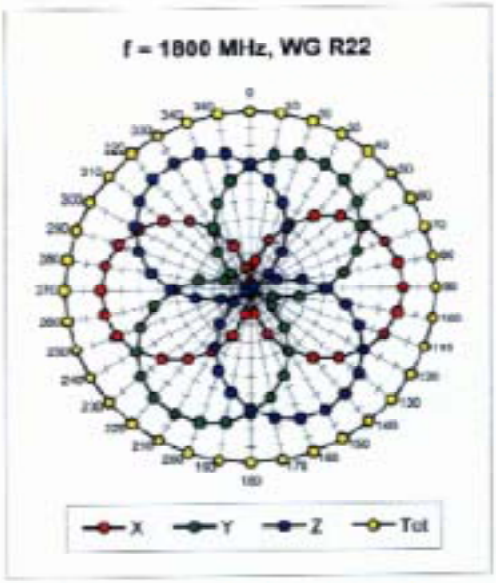


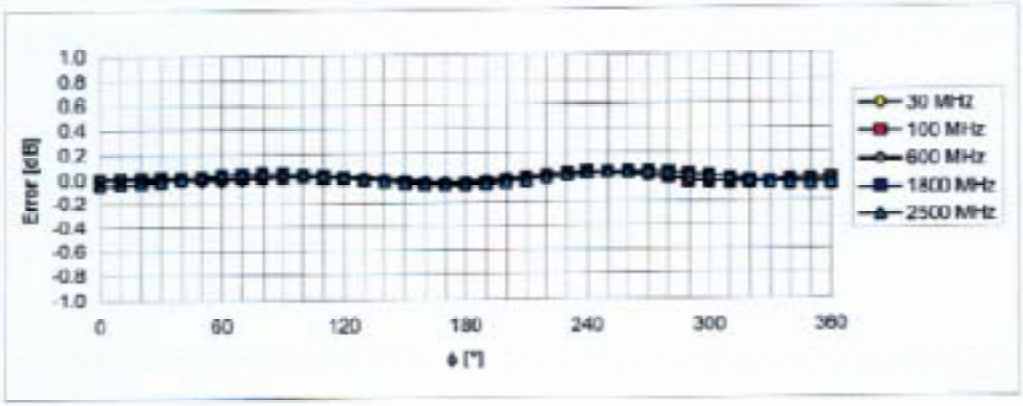

**Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)**

**ET3DV6 SN:1604** **May 2, 2006**

## Receiving Pattern ($\phi$), $\vartheta$ = 0°



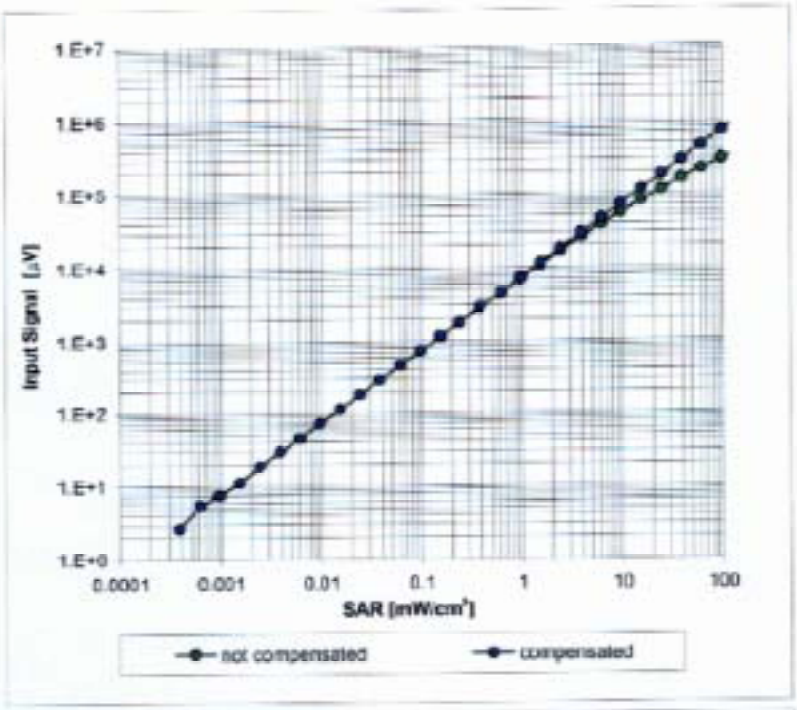

**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

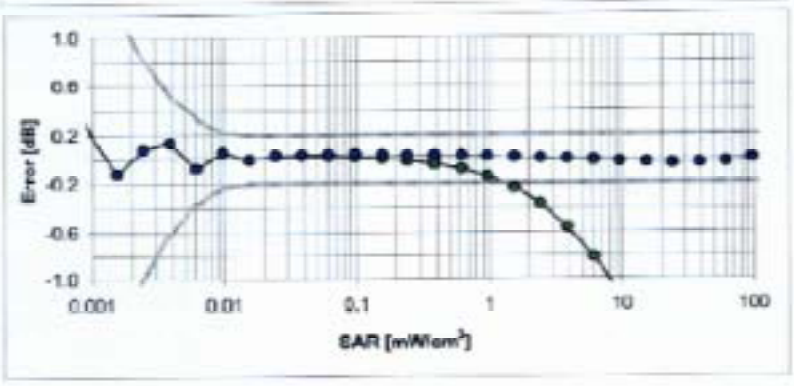
Certificate No: ET3-1604_May06 Page 6 of 9

**ET3DV6 SN:1604** **May 2, 2006**

## Dynamic Range f($SAR_{head}$)

**(Waveguide R22, f = 1800 MHz)**



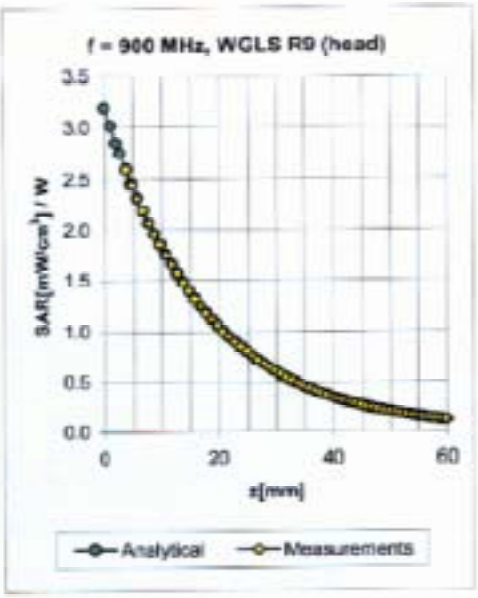



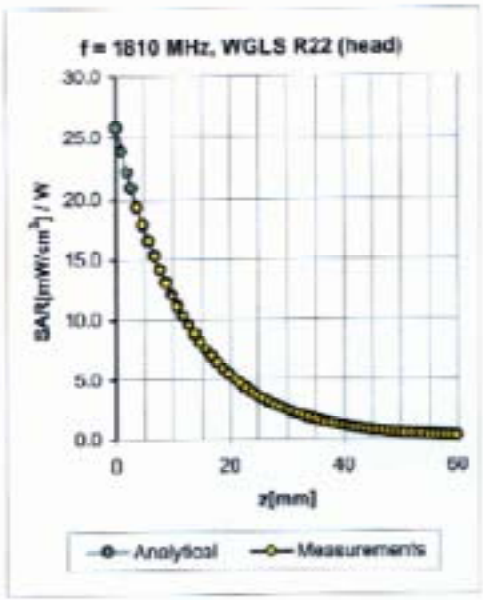

**Uncertainty of Linearity Assessment: ± 0.6% (k=2)**

Certificate No: ET3-1604_May06 Page 7 of 9

**ET3DV6 SN:1604** **May 2, 2006**

# Conversion Factor Assessment




| f [MHz] | Validity [MHz][C] | TSL | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty |
|---|---|---|---|---|---|---|---|
| 450 | ± 50 / ± 100 | Head | 43.5 ± 5% | 0.87 ± 5% | 0.26 | 2.94 | 7.14 ± 13.3% (k=2) |
| 900 | ± 50 / ± 100 | Head | 41.5 ± 5% | 0.97 ± 5% | 0.56 | 1.81 | 6.60 ± 11.0% (k=2) |
| 1810 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.50 | 2.59 | 5.29 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Head | 39.2 ± 5% | 1.80 ± 5% | 0.68 | 1.85 | 4.60 ± 11.8% (k=2) |
| | | | | | | | |
| 450 | ± 50 / ± 100 | Body | 56.7 ± 5% | 0.94 ± 5% | 0.25 | 4.44 | 7.42 ± 13.3% (k=2) |
| 900 | ± 50 / ± 100 | Body | 55.0 ± 5% | 1.05 ± 5% | 0.47 | 2.08 | 6.27 ± 11.0% (k=2) |
| 1810 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.56 | 2.66 | 4.88 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Body | 52.7 ± 5% | 1.95 ± 5% | 0.66 | 1.95 | 4.27 ± 11.8% (k=2) |

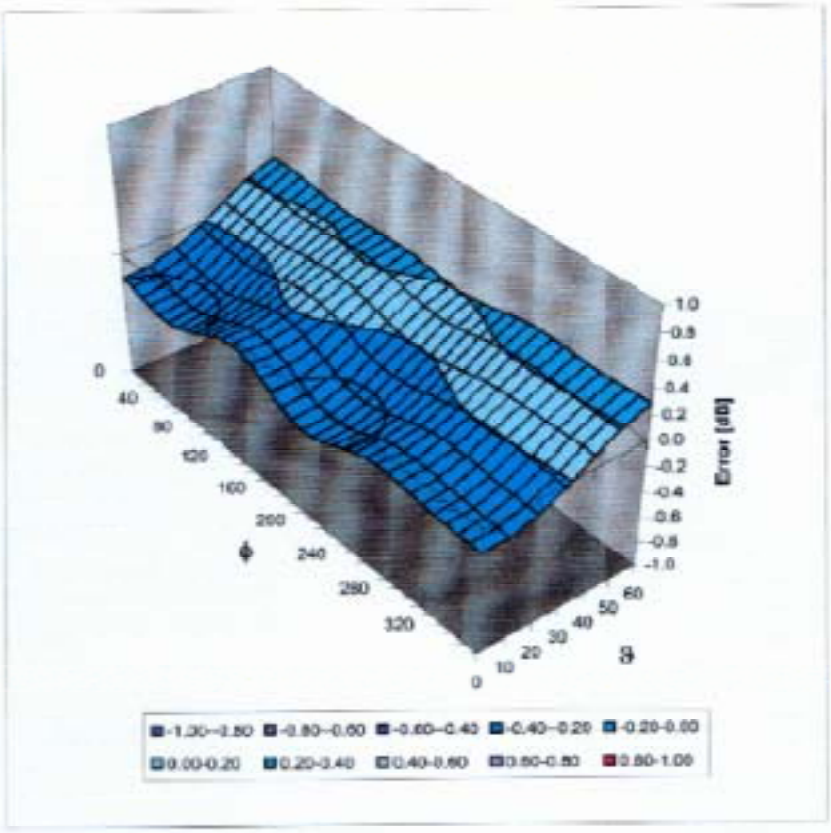
[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Certificate No: ET3-1604_May06 Page 8 of 9

**ET3DV6 SN:1604** **May 2, 2006**

## Deviation from Isotropy in HSL

**Error (ϕ, ϑ), f = 900 MHz**




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

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

s p e a g

# Additional Conversion Factors

**for Dosimetric E-Field Probe**

| | |
|---|---|
| Type: | **ET3DV6** |
| Serial Number: | **1604** |
| Place of Assessment: | **Zurich** |
| Date of Assessment: | **May 4, 2006** |
| Probe Calibration Date: | **May 2, 2006** |

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1810 MHz.

Assessed by:

Schmid & Partner Engineering AG

s p e a g

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

# Dosimetric E-Field Probe ET3DV6 SN:1604

Conversion factor (± standard deviation)

| | | | |
|---|---|---|---|
| **f = 300 MHz** | ConvF | **8.05 ± 9%** | $\varepsilon_r$ = 45.3 ± 5%<br>$\sigma$ = 0.87 ± 5% mho/m<br>(head tissue) |
| **f = 300 MHz** | ConvF | **8.07 ± 9%** | $\varepsilon_r$ = 58.2 ± 5%<br>$\sigma$ = 0.92 ± 5% mho/m<br>(body tissue) |

**Important Note:**

**For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.**

**Please see also Section 4.7 of the DASY4 Manual.**

## NCL CALIBRATION LABORATORIES

Calibration File No: DC-713
Project Number: BACL-CAL-D-2450-5249

# CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

BACL Validation Dipole

Manufacturer: APREL Laboratories
Part number: D-2450-S-1
Frequency: 2450 MHz
Serial No: BCL-141

Customer: Bay Area Compliance Laboratory

Calibrated: 28th August 2006
Released on: 28th August 2006

Released By: _____

**NCL CALIBRATION LABORATORIES**

61 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

**NCL Calibration Laboratories**
Division of APREL Laboratories.

## Conditions

Dipole BCL-141 was received from customer in good condition for re-calibration, SMA connector required cleaning prior to calibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C
**Temperature of the Tissue:** 21 °C +/- 0.5°C

**We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.**

**D. Brooks**
**Member of Engineering Staff**
**(Calibration Engineer)**

This page has been reviewed for content and attested to by signature within this document

**NCL Calibration Laboratories**
Division of APREL Laboratories.

## Calibration Results Summary

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

### Mechanical Dimensions

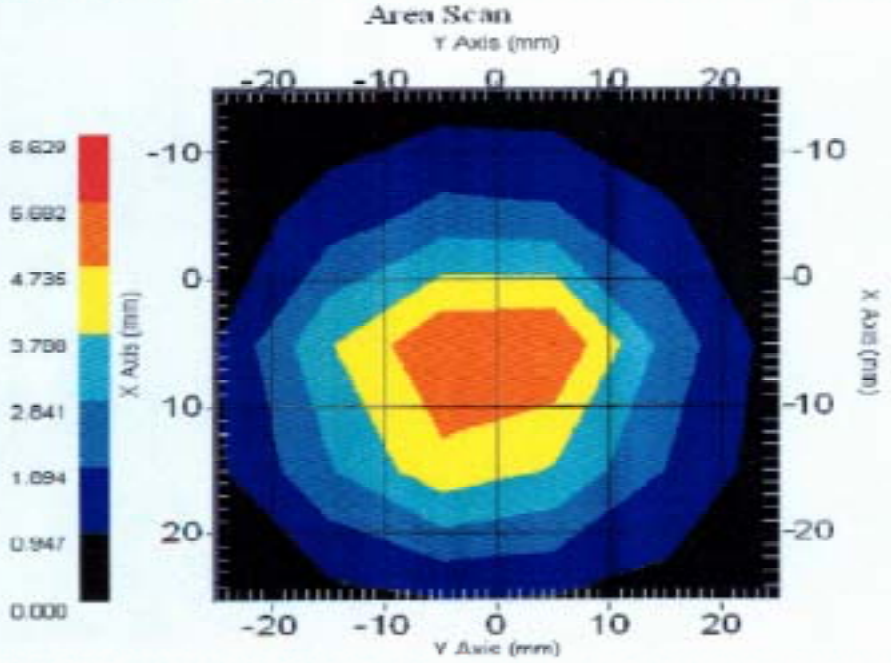
**Length:** 51.5 mm
**Height:** 30.4 mm

### Electrical Specification

**SWR:** 1.095 U to 1.397 U
**Return Loss:** -26.77 dB to –15.52 dB
**Impedance:** 47.81 Ω to 63.37 Ω

### System Validation Results

| Frequency | 1 Gram | 10 Gram | Peak |
|---|---|---|---|
| 2450 MHz | 5.31 | 2.44 | 10.18 |




3

This page has been reviewed for content and attested to by signature within this document.

**NCL Calibration Laboratories**
Division of APREL Laboratories.

## Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole BCL-141. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

## References

SSI-TP-018-ALSAS Dipole Calibration Procedure
SSI-TP-016 Tissue Calibration Procedure
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

## Conditions

Dipole BCL-141 was received from customer in good condition for re-calibration, SMA connector required cleaning prior to calibration.

| | |
|---|---|
| **Ambient Temperature of the Laboratory:** | 22 °C +/- 0.5°C |
| **Temperature of the Tissue:** | 20 °C +/- 0.5°C |

4

This page has been reviewed for content and attested to by signature within this document.

**NCL Calibration Laboratories**
Division of APREL Laboratories.

## Dipole Calibration Results

### Mechanical Verification

| APREL Length | APREL Height | Measured Length | Measured Height |
|---|---|---|---|
| 51.5 mm | 30.4 mm | 51.6 mm | 30.5 mm |

### Tissue Validation

| Head Tissue 2450 MHz | Measured |
|---|---|
| Dielectric constant, $\varepsilon_r$ | 39.2 |
| Conductivity, $\sigma$ [S/m] | 1.80 |

5

This page has been reviewed for content and attested to by signature within this document.