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Accreditation No.: **SCS 0108**

Client **Eurofins**

Certificate No: **D2450V2-722_Sep15**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 722**

Calibration procedure(s) **QA CAL-05.v9**
 Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **September 28, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A | GB37480704 | 07-Oct-14 (No. 217-02020) | Oct-15 |
| Power sensor HP 8481A | US37292783 | 07-Oct-14 (No. 217-02020) | Oct-15 |
| Power sensor HP 8481A | MY41092317 | 07-Oct-14 (No. 217-02021) | Oct-15 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 01-Apr-15 (No. 217-02131) | Mar-16 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 01-Apr-15 (No. 217-02134) | Mar-16 |
| Reference Probe EX3DV4 | SN: 7349 | 30-Dec-14 (No. EX3-7349_Dec14) | Dec-15 |
| DAE4 | SN: 601 | 17-Aug-15 (No. DAE4-601_Aug15) | Aug-16 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| RF generator R&S SMT-06 | 100972 | 15-Jun-15 (in house check Jun-15) | In house check: Jun-18 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

Calibrated by: Name **Jeton Kastrati** Function **Laboratory Technician**

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

Issued: September 28, 2015

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Accreditation No.: SCS 0108

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:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) 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
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- e) 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.

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%.

Measurement Conditions

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

| | | |
|-------------------------------------|------------------------|-------------|
| DASY Version | DASY5 | V52.8.8 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2450 MHz ± 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|--------------------|---------------------|---------------------|
| Nominal Head TSL parameters | 22.0 °C | 39.2 | 1.80 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 39.2 ± 6 % | 1.86 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| | | |
|---|--------------------|--------------------------|
| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 12.7 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 50.0 W/kg ± 17.0 % (k=2) |

| | | |
|---|--------------------|--------------------------|
| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
| SAR measured | 250 mW input power | 5.90 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.4 W/kg ± 16.5 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|--------------------|---------------------|---------------------|
| Nominal Body TSL parameters | 22.0 °C | 52.7 | 1.95 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 53.2 ± 6 % | 2.00 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| | | |
|---|--------------------|--------------------------|
| SAR averaged over 1 cm³ (1 g) of Body TSL | Condition | |
| SAR measured | 250 mW input power | 12.5 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 49.5 W/kg ± 17.0 % (k=2) |

| | | |
|---|--------------------|--------------------------|
| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
| SAR measured | 250 mW input power | 5.88 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 23.4 W/kg ± 16.5 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $51.7 \Omega + 9.2 j\Omega$ |
| Return Loss | - 20.8 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $46.3 \Omega + 8.6 j\Omega$ |
| Return Loss | - 20.2 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.152 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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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 | October 16, 2002 |

DASY5 Validation Report for Head TSL

Date: 28.09.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz ; Type: D2450V2; Serial: D2450V2 - SN: 722

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 1.86 \text{ S/m}$; $\epsilon_r = 39.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.67, 7.67, 7.67); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

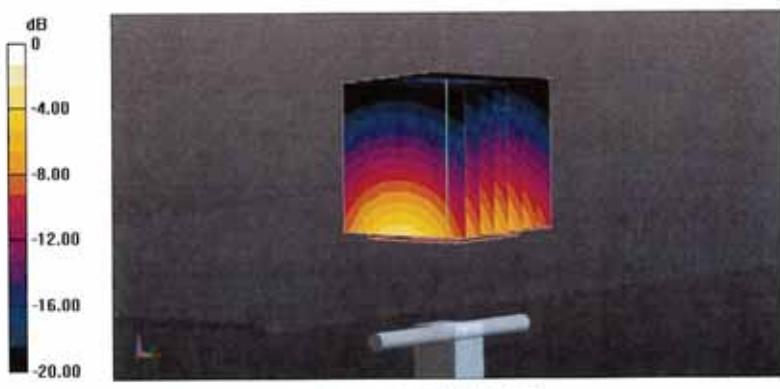
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 111.4 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 26.1 W/kg

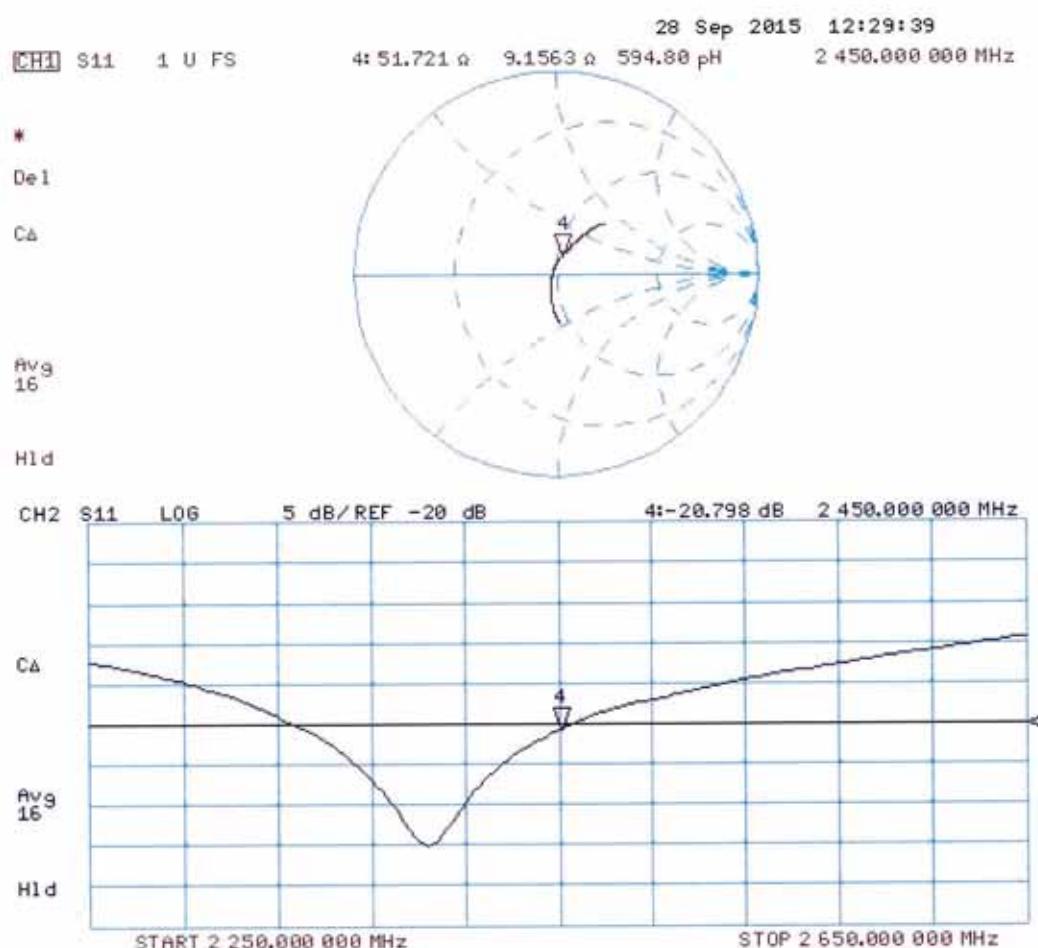
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.9 W/kg

Maximum value of SAR (measured) = 21.1 W/kg



0 dB = 21.1 W/kg = 13.24 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 28.09.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz ; Type: D2450V2; Serial: D2450V2 - SN: 722

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 2 \text{ S/m}$; $\epsilon_r = 53.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.53, 7.53, 7.53); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

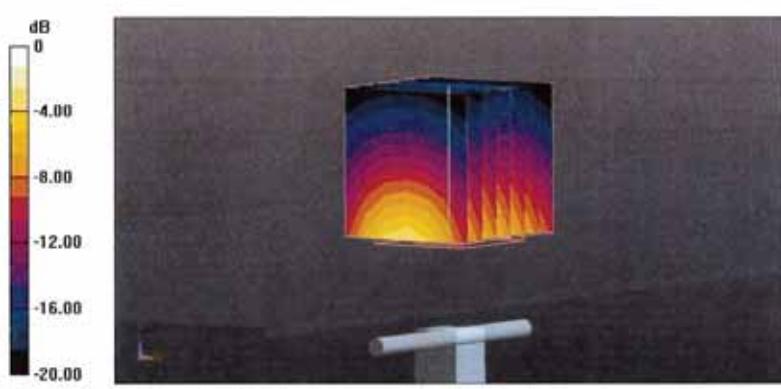
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 105.8 V/m; Power Drift = -0.01 dB

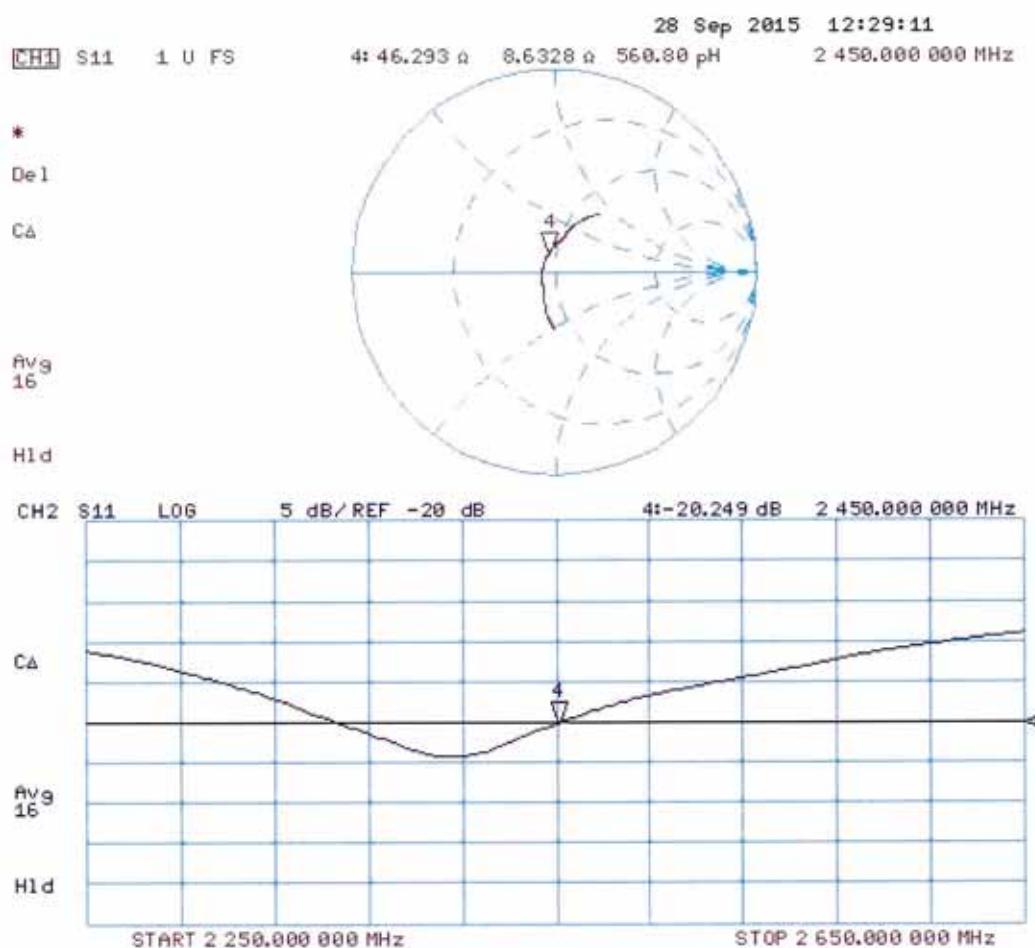
Peak SAR (extrapolated) = 24.7 W/kg

SAR(1 g) = 12.5 W/kg; SAR(10 g) = 5.88 W/kg

Maximum value of SAR (measured) = 20.5 W/kg



Impedance Measurement Plot for Body TSL





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Accreditation No.: SCS 0108

Client Eurofins

Certificate No: DAE3-522_Sep16

CALIBRATION CERTIFICATE

Object DAE3 - SD 000 D03 AA - SN: 522

Calibration procedure(s) QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: September 28, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 09-Sep-16 (No:19065) | Sep-17 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 05-Jan-16 (in house check) | In house check: Jan-17 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 05-Jan-16 (in house check) | In house check: Jan-17 |

Calibrated by: Name Eric Hainfeld Function Technician Signature

Approved by: Fin Bomholt Deputy Technical Manager

Issued: September 28, 2016

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Accreditation No.: SCS 0108

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V , full range = -100...+300 mV
Low Range: 1LSB = 61nV , full range = -1.....+3mV

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

| Calibration Factors | X | Y | Z |
|---------------------|------------------------------------|------------------------------------|------------------------------------|
| High Range | $404.445 \pm 0.02\% \text{ (k=2)}$ | $404.110 \pm 0.02\% \text{ (k=2)}$ | $404.959 \pm 0.02\% \text{ (k=2)}$ |
| Low Range | $3.95998 \pm 1.50\% \text{ (k=2)}$ | $3.93992 \pm 1.50\% \text{ (k=2)}$ | $3.99728 \pm 1.50\% \text{ (k=2)}$ |

Connector Angle

| | |
|---|--------------------------|
| Connector Angle to be used in DASY system | $56.0^\circ \pm 1^\circ$ |
|---|--------------------------|

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

| High Range | | Reading (μ V) | Difference (μ V) | Error (%) |
|------------|---------|--------------------|-----------------------|-----------|
| Channel X | + Input | 199998.65 | 1.51 | 0.00 |
| Channel X | + Input | 20003.67 | 1.49 | 0.01 |
| Channel X | - Input | -19998.57 | 1.81 | -0.01 |
| Channel Y | + Input | 199997.59 | -0.07 | -0.00 |
| Channel Y | + Input | 20000.66 | -1.46 | -0.01 |
| Channel Y | - Input | -19999.61 | 0.87 | -0.00 |
| Channel Z | + Input | 199997.76 | 0.55 | 0.00 |
| Channel Z | + Input | 19999.68 | -2.27 | -0.01 |
| Channel Z | - Input | -20000.13 | 0.36 | -0.00 |

| Low Range | | Reading (μ V) | Difference (μ V) | Error (%) |
|-----------|---------|--------------------|-----------------------|-----------|
| Channel X | + Input | 2002.77 | 0.92 | 0.05 |
| Channel X | + Input | 202.84 | 0.66 | 0.33 |
| Channel X | - Input | -196.58 | 1.09 | -0.55 |
| Channel Y | + Input | 2002.44 | 0.71 | 0.04 |
| Channel Y | + Input | 202.20 | 0.08 | 0.04 |
| Channel Y | - Input | -198.06 | -0.28 | 0.14 |
| Channel Z | + Input | 2002.08 | 0.42 | 0.02 |
| Channel Z | + Input | 200.37 | -1.61 | -0.80 |
| Channel Z | - Input | -199.14 | -1.33 | 0.67 |

2. Common mode sensitivity

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

| | Common mode Input Voltage (mV) | High Range Average Reading (μ V) | Low Range Average Reading (μ V) |
|-----------|-----------------------------------|--|---|
| Channel X | 200 | -3.54 | -5.21 |
| | - 200 | 6.25 | 4.83 |
| Channel Y | 200 | -0.35 | -0.64 |
| | - 200 | -0.21 | -0.07 |
| Channel Z | 200 | 15.29 | 15.53 |
| | - 200 | -18.32 | -18.03 |

3. Channel separation

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

| | Input Voltage (mV) | Channel X (μ V) | Channel Y (μ V) | Channel Z (μ V) |
|-----------|--------------------|----------------------|----------------------|----------------------|
| Channel X | 200 | - | 0.24 | -4.36 |
| Channel Y | 200 | 7.55 | - | 0.52 |
| Channel Z | 200 | 9.68 | 4.92 | - |

4. AD-Converter Values with inputs shorted

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

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 15770 | 16653 |
| Channel Y | 15724 | 15421 |
| Channel Z | 16050 | 15178 |

5. Input Offset Measurement

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

Input $10M\Omega$

| | Average (μV) | min. Offset (μV) | max. Offset (μV) | Std. Deviation (μV) |
|-----------|---------------------|-------------------------|-------------------------|----------------------------|
| Channel X | 1.44 | -0.31 | 2.82 | 0.59 |
| Channel Y | -0.40 | -1.67 | 0.99 | 0.60 |
| Channel Z | 0.67 | -1.25 | 2.04 | 0.58 |

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

8. Low Battery Alarm Voltage (Typical values for information)

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

9. Power Consumption (Typical values for information)

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

DAE REPAIR REPORT – SPEAG Production Center

| | | | |
|----------------------|--|---|-------------------------------------|
| PRODUCT | DAE4 - Data Acquisition Electronics | | |
| SERIAL Nr.: | 522 | IN DATE: | 16-Sep-2016 |
| CUSTOMER: | Eurofins | | |
| DAE REPAIR | | | |
| MATERIAL | WORK DESCRIPTION | | |
| Emergency stop: | fixed <input type="radio"/> | exchanged <input type="radio"/> | 6 new magnets <input type="radio"/> |
| DAE Connector: | fixed <input type="radio"/> | exchanged <input type="radio"/> | <input type="radio"/> |
| DAE Battery Cover: | fixed <input type="radio"/> | exchanged <input type="radio"/> | <input type="radio"/> |
| AD Converter Print: | fixed <input type="radio"/> | exchanged <input checked="" type="checkbox"/> | <input type="radio"/> |
| Battery Connector: | fixed <input type="radio"/> | exchanged <input type="radio"/> | <input type="radio"/> |
| Battery Con. PCB: | fixed <input type="radio"/> | exchanged <input type="radio"/> | <input type="radio"/> |
| DAE 3 - 4 upgrade | fixed <input type="radio"/> | installed <input type="radio"/> | <input type="radio"/> |
| Input PCB: | fixed <input type="radio"/> | exchanged <input type="radio"/> | <input type="radio"/> |
| DAE Bottom Cover | fixed <input type="radio"/> | exchanged <input type="radio"/> | <input type="radio"/> |
| Analysis: | | | |
| Final Assembly: | | | |
| Total hours | | | 2.50 hours |
| COMMENTS: | This DAE was returned for calibration. It failed the receiving inspection test. The input range of the Y channel (4.104) is too high (tolerance 3.9 - 4.1). The linearity of the channel wasn't affected. To re-establish full functionality of this DAE the ADC printed circuit board has been replaced. After this repair the DAE will get newly calibrated. | | |
| CONDUCTED BY: | <i>A. Gr</i> | APPROVED BY: | <i>S. Müller</i> |
| DATE: | <u>26-Sep-2016</u> | DATE: | <u>26-Sep-2016</u> |
| REPAIR COST: | | | |
| MATERIAL COST: | free | USD <input checked="" type="checkbox"/> | Euro <input type="radio"/> |
| REPAIR: | free | <input checked="" type="checkbox"/> | <input type="radio"/> |
| TOTAL COST: | free | QUOTATION #: - | |
| APPROVED BY: | <i>R. K.</i> | | |
| DATE: | <u>26-Sep-2016</u> | | |

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
SCS Swiss Calibration Service

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Accreditation No.: **SCS 0108**

Client **Eurofins**

Certificate No: **EX3-3893_Sep16**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3893**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5,
QA CAL-25.v6
Calibration procedure for dosimetric E-field probes**

Calibration date: **September 23, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|------------------|-----------------------------------|------------------------|
| Power meter NRP | SN: 104778 | 06-Apr-16 (No. 217-02288/02289) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103244 | 06-Apr-16 (No. 217-02288) | Apr-17 |
| Power sensor NRP-Z91 | SN: 103245 | 06-Apr-16 (No. 217-02289) | Apr-17 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 05-Apr-16 (No. 217-02293) | Apr-17 |
| Reference Probe ES3DV2 | SN: 3013 | 31-Dec-15 (No. ES3-3013_Dec15) | Dec-16 |
| DAE4 | SN: 660 | 23-Dec-15 (No. DAE4-660_Dec15) | Dec-16 |
| | | | |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-16) | In house check: Jun-18 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |

| | | | |
|----------------|-----------------------|-----------------------------------|---------------|
| Calibrated by: | Name Michael Weber | Function Laboratory Technician | Signature |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: September 28, 2016

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Accreditation No.: **SCS 0108**

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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, D | modulation dependent linearization parameters |
| 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., $\theta = 0$ is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) 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
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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 affect 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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR : PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- $Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z; A, B, C, D$ 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 ± 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.
- *Connector Angle*: The angle is assessed using the information gained by determining the $NORMx$ (no uncertainty required).

Probe EX3DV4

SN:3893

Manufactured: October 9, 2012
Calibrated: September 23, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3893

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.54 | 0.41 | 0.32 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 99.6 | 99.2 | 99.2 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB $\sqrt{\mu\text{V}}$ | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|---------|------------------------------|-----|---------|----------|---------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 172.7 | $\pm 2.5 \%$ |
| | | Y | 0.0 | 0.0 | 1.0 | | 172.1 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 191.4 | |

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 Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3893

Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 450 | 43.5 | 0.87 | 11.48 | 11.48 | 11.48 | 0.17 | 1.30 | ± 13.3 % |
| 750 | 41.9 | 0.89 | 11.10 | 11.10 | 11.10 | 0.53 | 0.80 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 10.44 | 10.44 | 10.44 | 0.48 | 0.80 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 8.94 | 8.94 | 8.94 | 0.26 | 0.80 | ± 12.0 % |
| 1810 | 40.0 | 1.40 | 8.60 | 8.60 | 8.60 | 0.35 | 0.80 | ± 12.0 % |
| 1950 | 40.0 | 1.40 | 8.39 | 8.39 | 8.39 | 0.37 | 0.80 | ± 12.0 % |
| 2150 | 39.7 | 1.53 | 8.33 | 8.33 | 8.33 | 0.35 | 0.80 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 7.76 | 7.76 | 7.76 | 0.34 | 0.85 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 7.63 | 7.63 | 7.63 | 0.34 | 0.85 | ± 12.0 % |
| 5200 | 36.0 | 4.66 | 5.22 | 5.22 | 5.22 | 0.40 | 1.80 | ± 13.1 % |
| 5500 | 35.6 | 4.96 | 4.98 | 4.98 | 4.98 | 0.45 | 1.80 | ± 13.1 % |
| 5800 | 35.3 | 5.27 | 4.69 | 4.69 | 4.69 | 0.50 | 1.80 | ± 13.1 % |

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3893

Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 450 | 56.7 | 0.94 | 11.99 | 11.99 | 11.99 | 0.10 | 1.20 | ± 13.3 % |
| 750 | 55.5 | 0.96 | 10.32 | 10.32 | 10.32 | 0.42 | 0.88 | ± 12.0 % |
| 900 | 55.0 | 1.05 | 10.35 | 10.35 | 10.35 | 0.43 | 0.80 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 8.52 | 8.52 | 8.52 | 0.41 | 0.80 | ± 12.0 % |
| 1810 | 53.3 | 1.52 | 8.34 | 8.34 | 8.34 | 0.35 | 0.92 | ± 12.0 % |
| 1950 | 53.3 | 1.52 | 8.48 | 8.48 | 8.48 | 0.34 | 0.91 | ± 12.0 % |
| 2150 | 53.1 | 1.66 | 8.30 | 8.30 | 8.30 | 0.34 | 0.99 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 7.90 | 7.90 | 7.90 | 0.37 | 0.90 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 7.59 | 7.59 | 7.59 | 0.36 | 0.90 | ± 12.0 % |
| 5200 | 49.0 | 5.30 | 4.55 | 4.55 | 4.55 | 0.50 | 1.90 | ± 13.1 % |
| 5500 | 48.6 | 5.65 | 4.17 | 4.17 | 4.17 | 0.50 | 1.90 | ± 13.1 % |
| 5800 | 48.2 | 6.00 | 4.03 | 4.03 | 4.03 | 0.60 | 1.90 | ± 13.1 % |

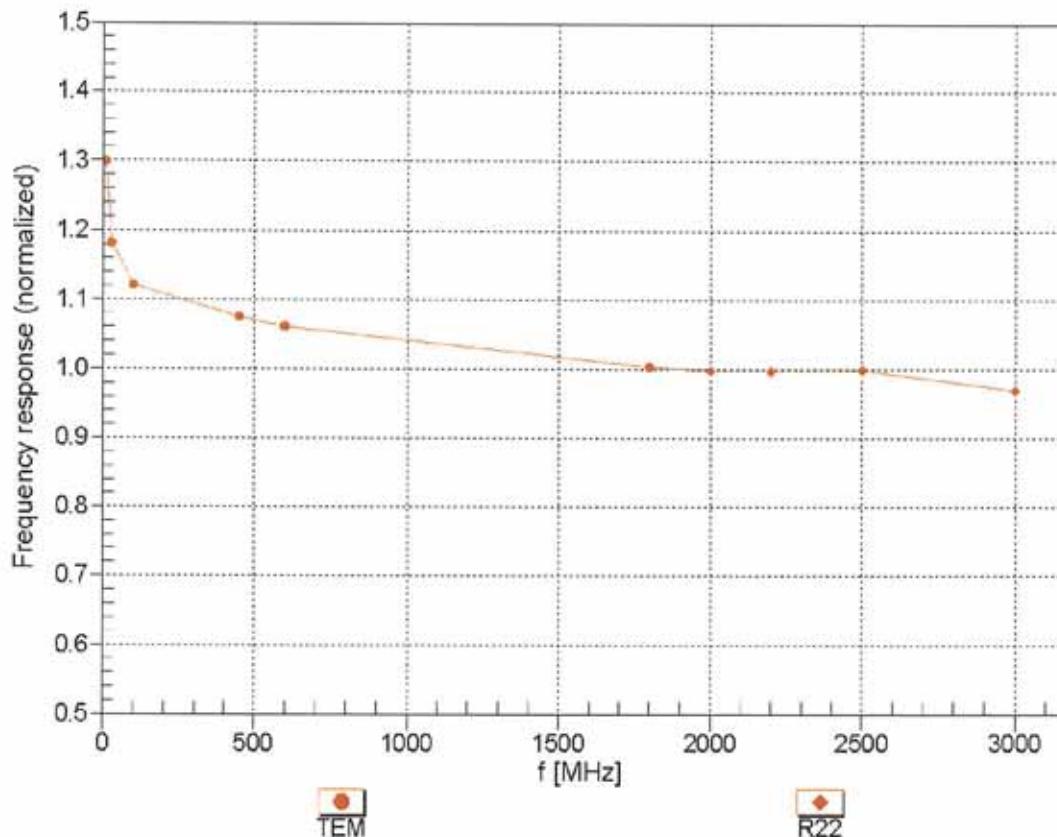
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

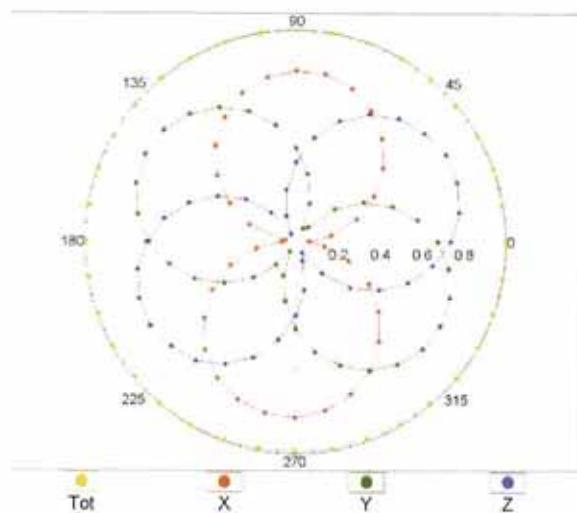
(TEM-Cell:ifi110 EXX, Waveguide: R22)



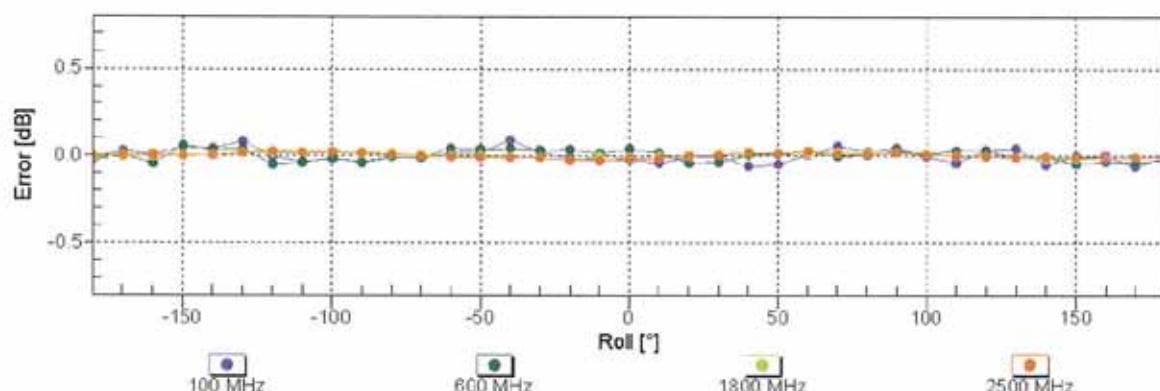
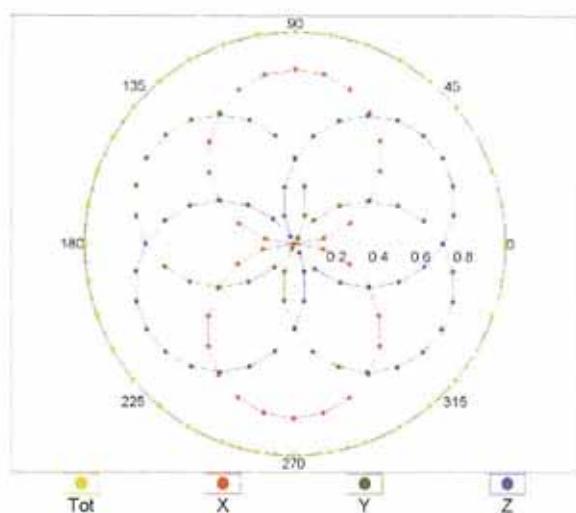
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

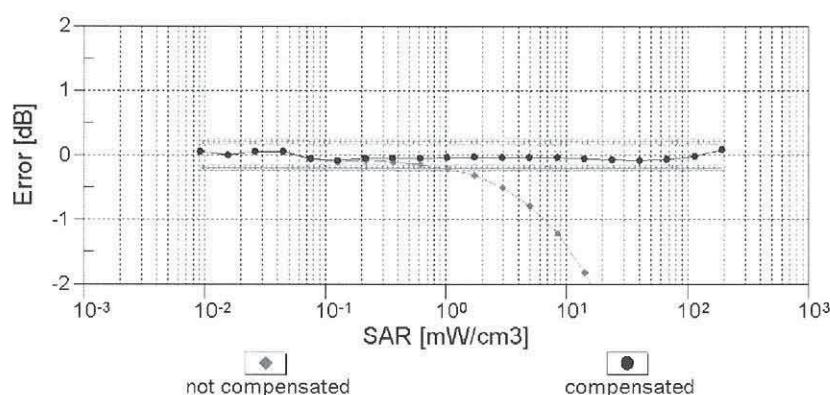
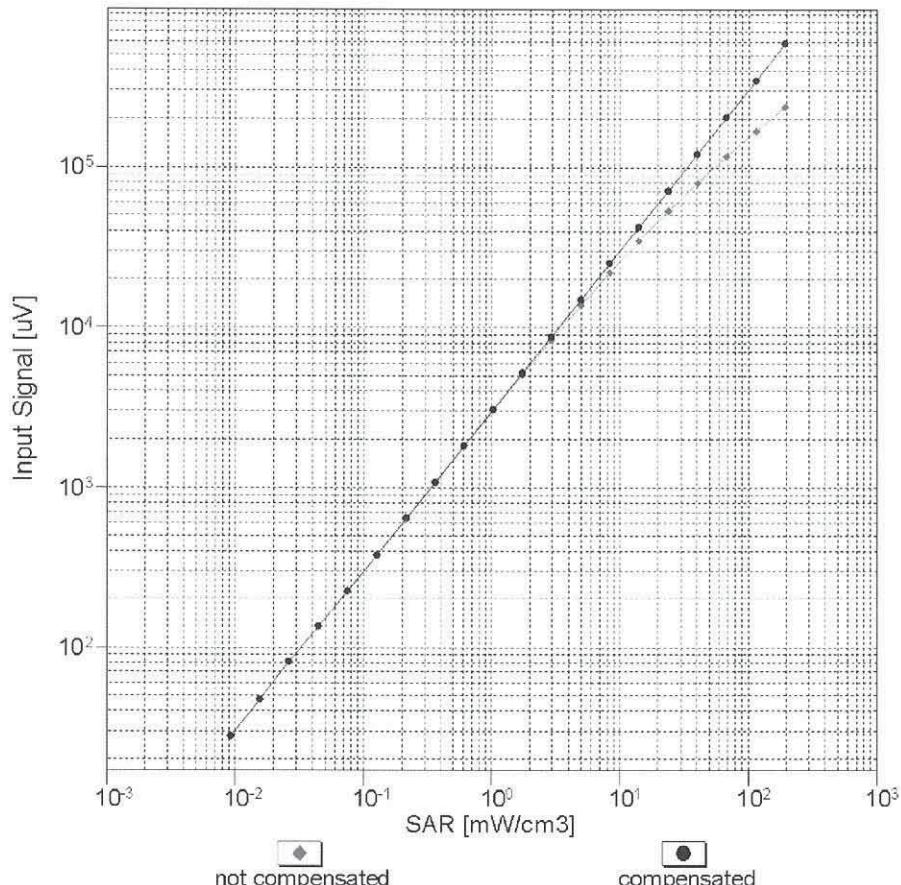
f=600 MHz, TEM



f=1800 MHz, R22

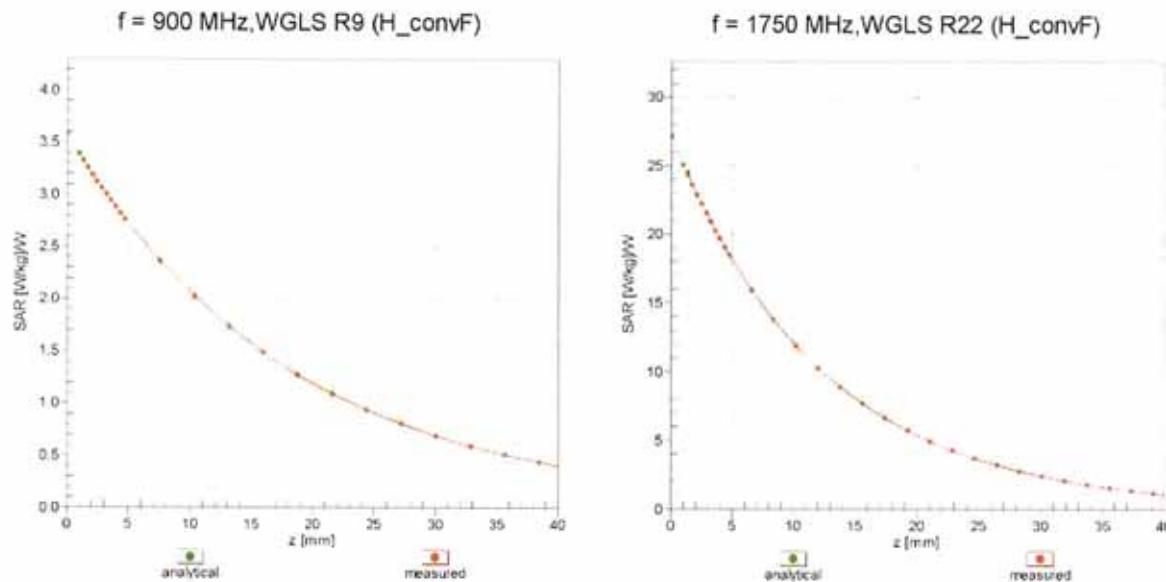
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range f(SAR_{head}) (TEM cell , f_{eval}= 1900 MHz)

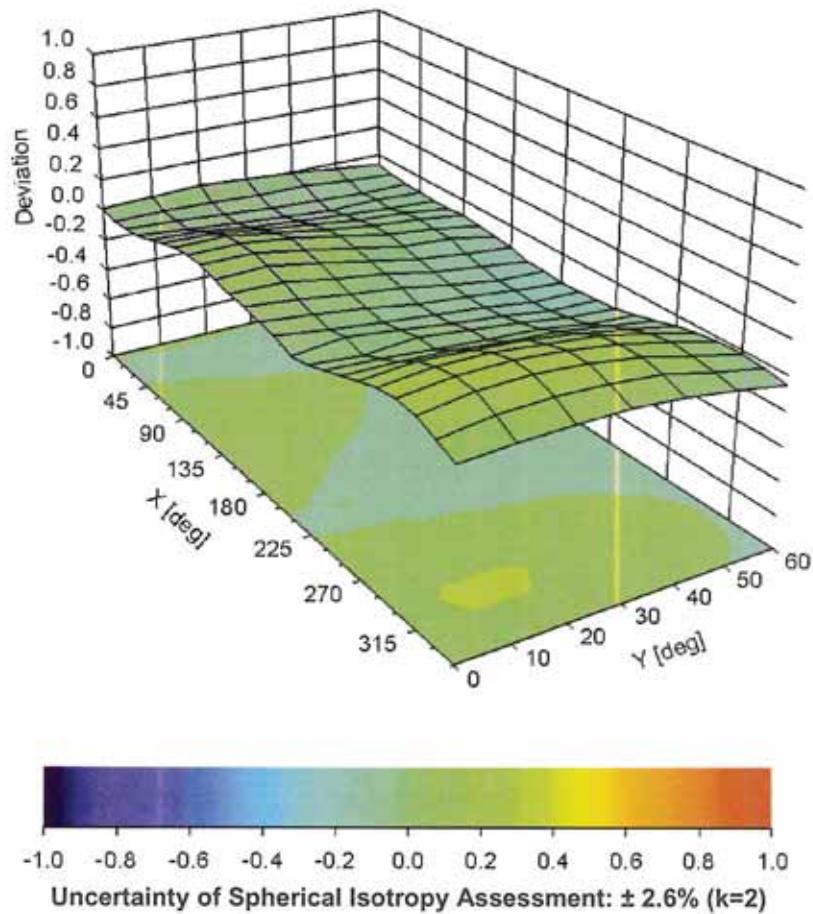


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ , 9), f = 900 MHz



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3893

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | -19.9 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disabled |
| Probe Overall Length | 337 mm |
| Probe Body Diameter | 10 mm |
| Tip Length | 9 mm |
| Tip Diameter | 2.5 mm |
| Probe Tip to Sensor X Calibration Point | 1 mm |
| Probe Tip to Sensor Y Calibration Point | 1 mm |
| Probe Tip to Sensor Z Calibration Point | 1 mm |
| Recommended Measurement Distance from Surface | 1.4 mm |

ANNEX B System Validation Reports

Test Report No.: G0M-1612-6168-TFC093SR-V01

Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

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Test Laboratory: Eurofins Product Service GmbH**System Performance Check - ELI Phantom - EX3DV4 - MSL - 900 MHz 12-01-2017****DUT: Dipole 900 MHz; Type: D900V2; Serial: 164**

Communication System: UID 0 - n/a, CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: Muscle 900 MHz Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 1.017 \text{ S/m}$; $\epsilon_r = 52.969$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

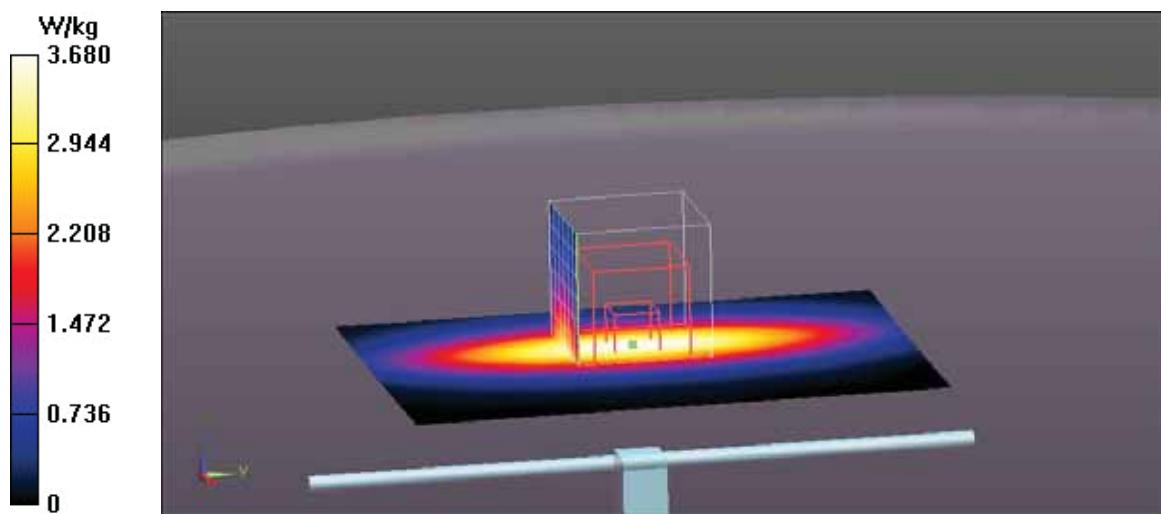
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(10.35, 10.35, 10.35); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
 Maximum value of SAR (interpolated) = 3.68 W/kg

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
 Reference Value = 58.928 V/m; Power Drift = 0.05 dB
 Peak SAR (extrapolated) = 4.28 W/kg
SAR(1 g) = 2.77 W/kg; SAR(10 g) = 1.79 W/kg
 Maximum value of SAR (measured) = 3.74 W/kg



Test Laboratory: Eurofins Product Service GmbH**System Performance Check - ELI Phantom - EX3DV4 - MSL - 900 MHz 13-01-2017****DUT: Dipole 900 MHz; Type: D900V2; Serial: 164**

Communication System: UID 0 - n/a, CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: Muscle 900 MHz Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 1.017 \text{ S/m}$; $\epsilon_r = 52.969$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

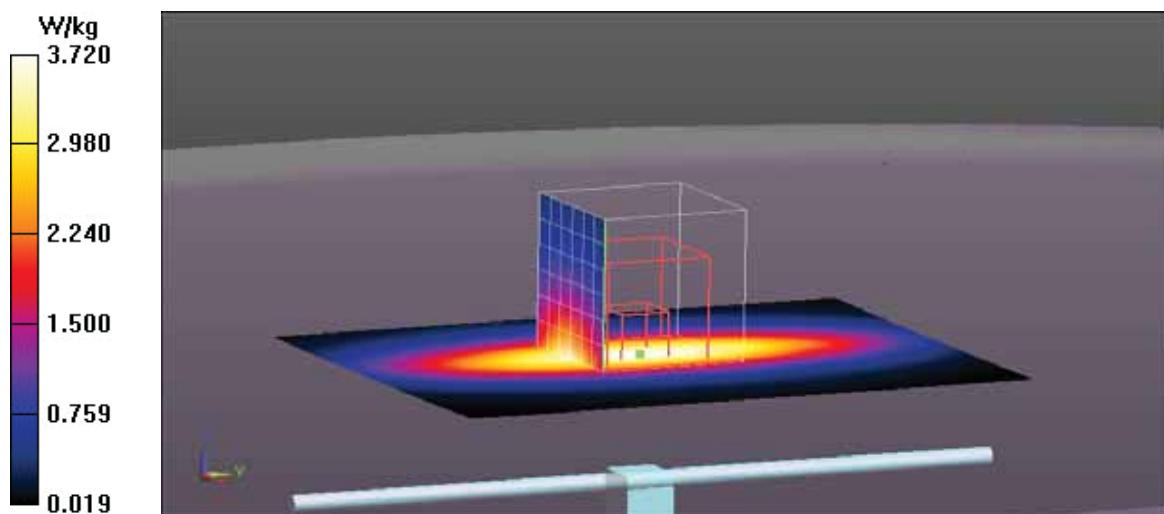
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(10.35, 10.35, 10.35); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
 Maximum value of SAR (interpolated) = 3.72 W/kg

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
 Reference Value = 62.431 V/m; Power Drift = -0.01 dB
 Peak SAR (extrapolated) = 4.31 W/kg
SAR(1 g) = 2.8 W/kg; SAR(10 g) = 1.82 W/kg
 Maximum value of SAR (measured) = 3.77 W/kg



Test Laboratory: Eurofins Product Service GmbH**System Performance Check - ELI Phantom - EX3DV4 - MSL - 900 MHz 17-01-2017****DUT: Dipole 900 MHz; Type: D900V2; Serial: 164**

Communication System: UID 0 - n/a, CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: Muscle 900 MHz Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 1.021 \text{ S/m}$; $\epsilon_r = 52.605$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

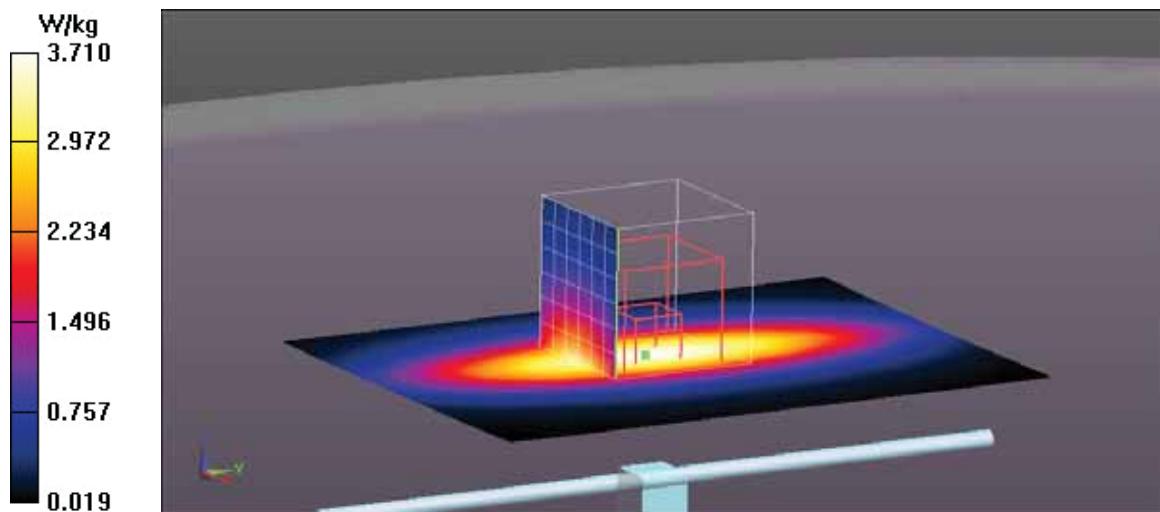
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(10.35, 10.35, 10.35); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
 Maximum value of SAR (interpolated) = 3.71 W/kg

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
 Reference Value = 62.807 V/m; Power Drift = -0.01 dB
 Peak SAR (extrapolated) = 4.24 W/kg
SAR(1 g) = 2.76 W/kg; SAR(10 g) = 1.79 W/kg
 Maximum value of SAR (measured) = 3.74 W/kg



Test Laboratory: Eurofins Product Service GmbH**System Performance Check - ELI Phantom - EX3DV6 - MSL - 1900 MHz 18-01-2017****DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d025**

Communication System: UID 0 - n/a, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: Muscle 1900 MHz Medium parameters used (interpolated): $f = 1900$ MHz; $\sigma = 1.495$ S/m; $\epsilon_r = 53.158$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(8.34, 8.34, 8.34); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Area Scan (61x61x1):

(EX-Probe)/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 16.3 W/kg

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

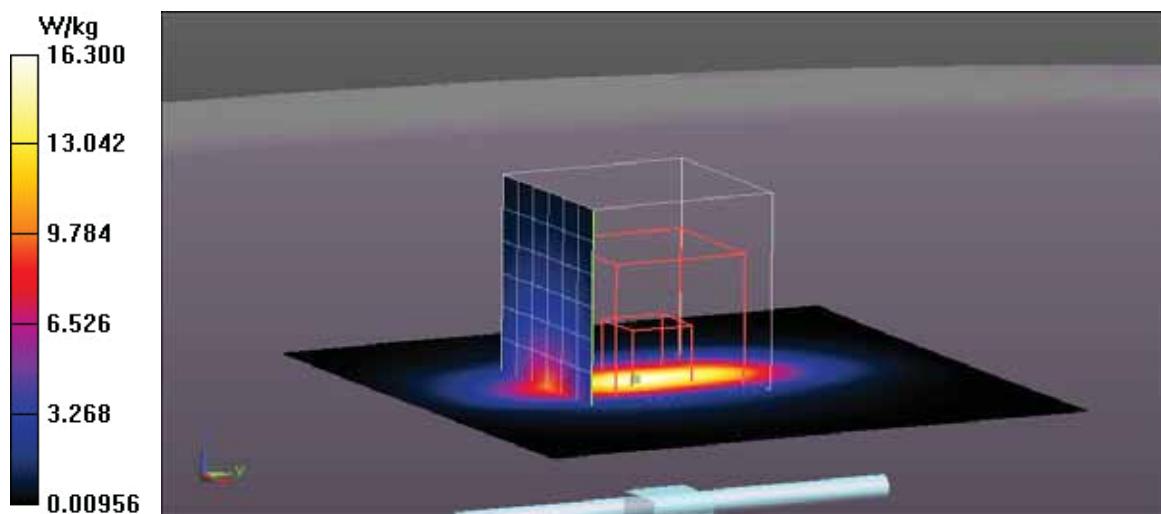
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.2 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.5 W/kg

Maximum value of SAR (measured) = 15.5 W/kg



Test Laboratory: Eurofins Product Service GmbH**System Performance Check - ELI Phantom - EX3DV6 - MSL - 1900 MHz 19-01-2017****DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d025**

Communication System: UID 0 - n/a, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: Muscle 1900 MHz Medium parameters used (interpolated): $f = 1900$ MHz; $\sigma = 1.495$ S/m; $\epsilon_r = 53.158$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(8.34, 8.34, 8.34); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Area Scan (61x61x1):

(EX-Probe)/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 16.1 W/kg

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

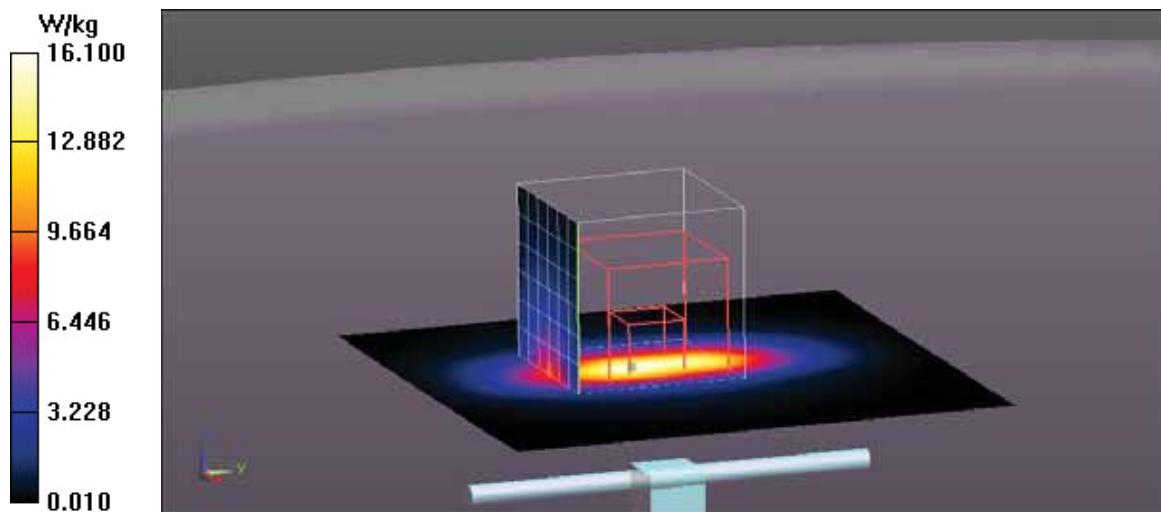
(EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.1 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.35 W/kg

Maximum value of SAR (measured) = 15.5 W/kg



Test Laboratory: Eurofins Product Service GmbH**System Performance Check - ELI Phantom - EX3DV6 - MSL - 2450 MHz 24-01-2017****DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 722**

Communication System: UID 0 - n/a, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: Muscle 2450 MHz Medium parameters used (interpolated): $f = 2450$ MHz; $\sigma = 2.014$ S/m; $\epsilon_r = 50.853$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(7.9, 7.9, 7.9); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Area Scan (61x61x1):

(EX-Probe)/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 22.1 W/kg

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

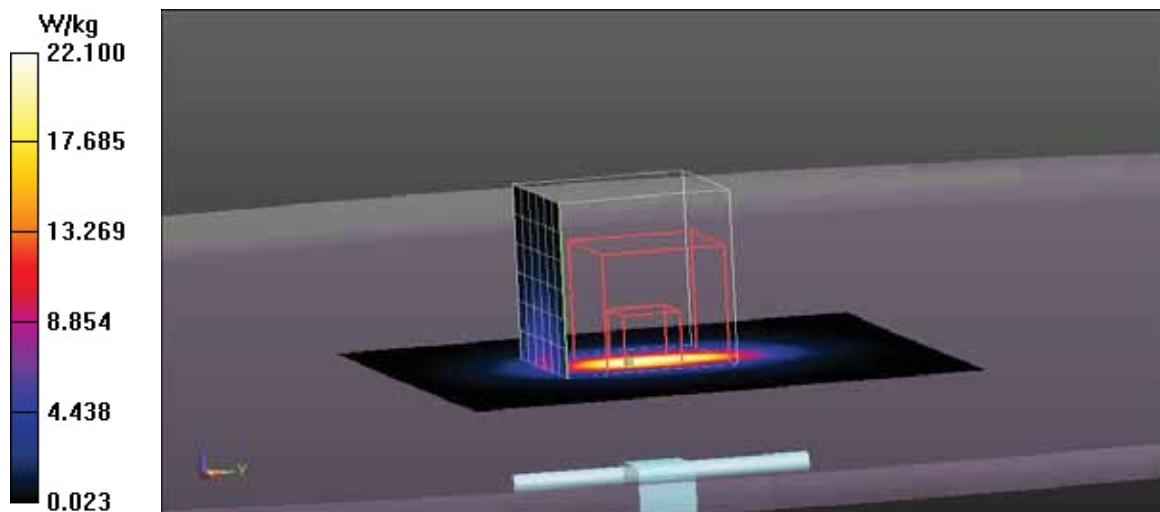
(EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 108.5 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 27.5 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.08 W/kg

Maximum value of SAR (measured) = 21.8 W/kg



Test Laboratory: Eurofins Product Service GmbH**System Performance Check - SAM Phantom - EX3DV4 - HSL - 900 MHz 10-01-2017****DUT: Dipole 900 MHz; Type: D900V2; Serial: 164**

Communication System: UID 0 - n/a, CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: Head 900 MHz Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 0.968 \text{ S/m}$; $\epsilon_r = 41.654$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(10.44, 10.44, 10.44); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: SAM 12; Type: TP-1217; Serial: QD000P40CA
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 3.71 W/kg

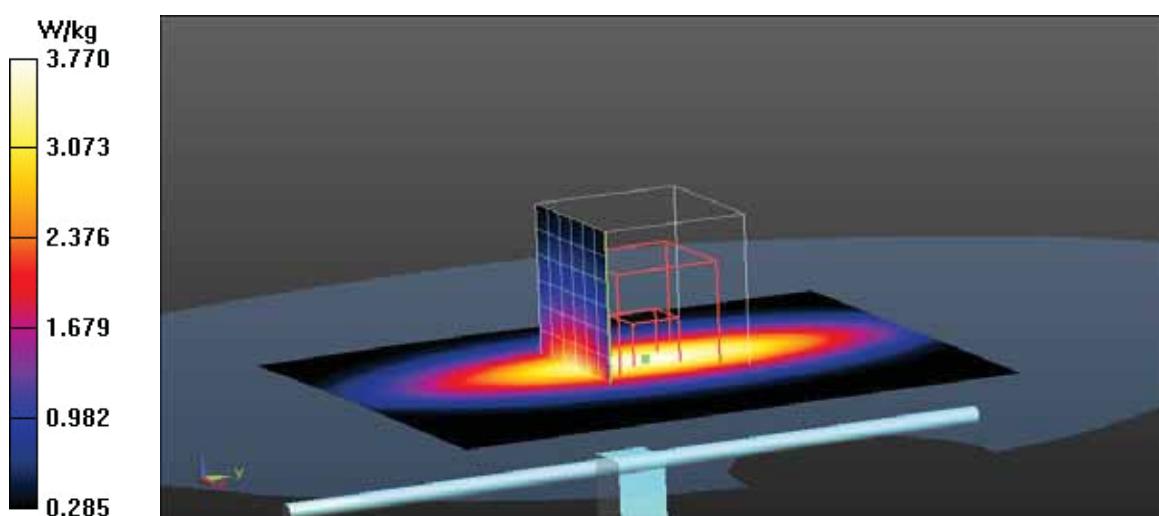
System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 64.992 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 4.30 W/kg

SAR(1 g) = 2.77 W/kg; SAR(10 g) = 1.77 W/kg

Maximum value of SAR (measured) = 3.77 W/kg



Test Laboratory: Eurofins Product Service GmbH**System Performance Check - SAM Phantom - EX3DV4 - HSL - 900 MHz 11-01-2017****DUT: Dipole 900 MHz; Type: D900V2; Serial: 164**

Communication System: UID 0 - n/a, CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: Head 900 MHz Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 0.968 \text{ S/m}$; $\epsilon_r = 41.654$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(10.44, 10.44, 10.44); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: SAM 12; Type: TP-1217; Serial: QD000P40CA
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 3.66 W/kg

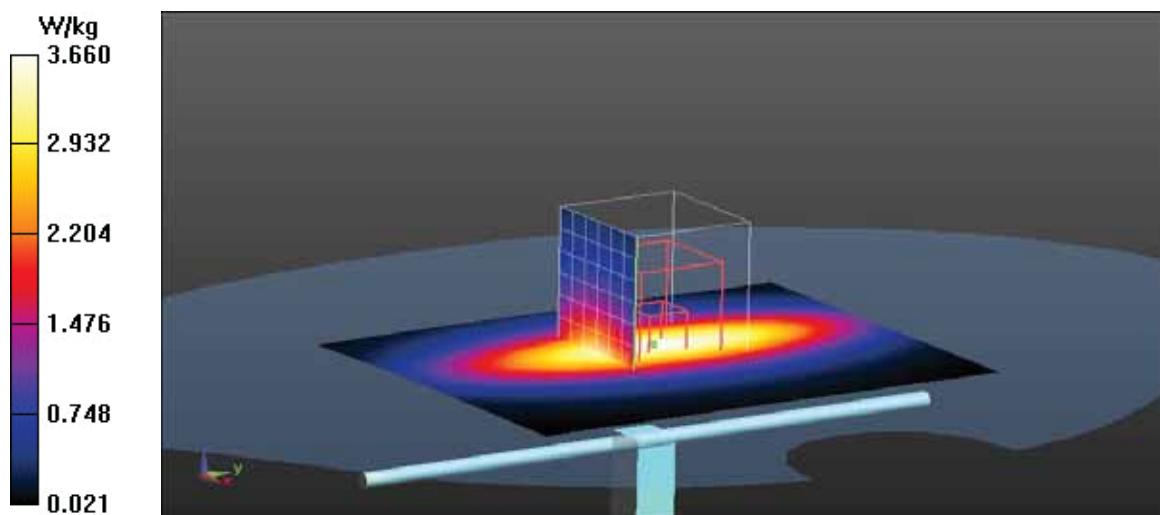
System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 63.649 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 4.18 W/kg

SAR(1 g) = 2.72 W/kg; SAR(10 g) = 1.75 W/kg

Maximum value of SAR (measured) = 3.67 W/kg



ANNEX C SAR Measurement Reports

Test Report No.: G0M-1612-6168-TFC093SR-V01

Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

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Test Laboratory: Eurofins Product Service GmbH**GPRS 850 - Ch. 128 - 2xSlot - BOTTOM 0mm****DUT: Asthma Monitor AM3; Type: AM3 Option G+; Serial: -**Communication System: UID 0 - n/a, GPRS 850 2xSlot; Frequency: 824.2 MHz; Duty Cycle: 1:4.14954
Medium: Muscle 900 MHz Medium parameters used (interpolated): $f = 824.2 \text{ MHz}$; $\sigma = 0.94 \text{ S/m}$; $\epsilon_r = 53.408$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(10.35, 10.35, 10.35); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Flat BOTTOM 0mm/Area Scan (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.793 W/kg

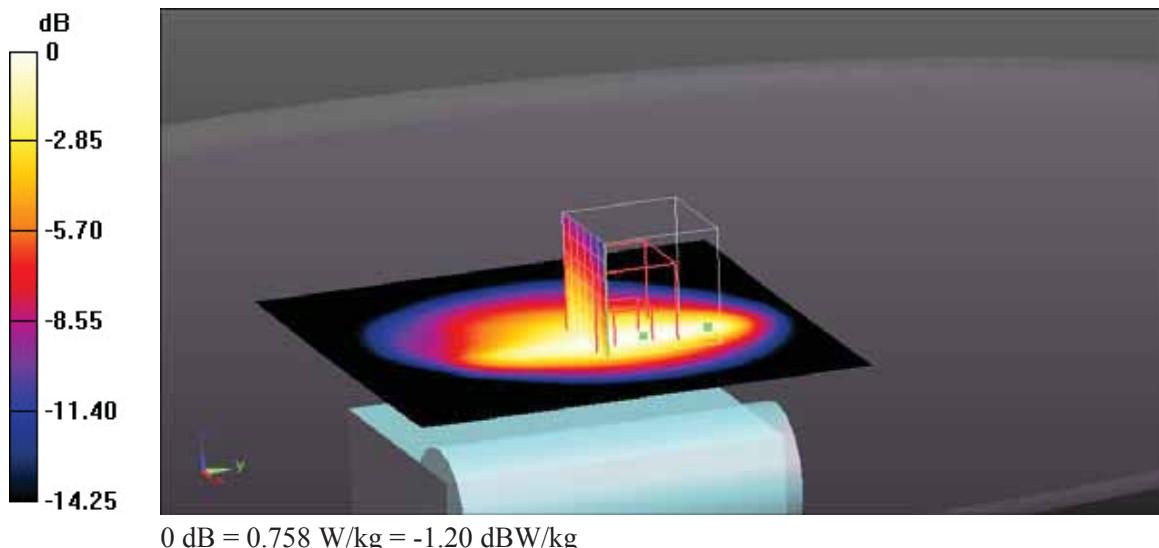
Configuration/Flat BOTTOM 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 25.431 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.905 W/kg

SAR(1 g) = 0.532 W/kg; SAR(10 g) = 0.345 W/kg

Maximum value of SAR (measured) = 0.758 W/kg



Test Laboratory: Eurofins Product Service GmbH**GSM 1900 - Ch. 661 - 2xSlot - BOTTOM 0mm****DUT: Asthma Monitor AM3; Type: AM3 Option G+; Serial: -**

Communication System: UID 0 - n/a, GPRS 1900 2xSlot; Frequency: 1880 MHz; Duty Cycle: 1:4.14954
 Medium: Muscle 1900 MHz Medium parameters used: $f = 1880$ MHz; $\sigma = 1.476$ S/m; $\epsilon_r = 53.211$; $\rho = 1000$

 kg/m^3

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(8.34, 8.34, 8.34); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Flat BOTTOM 0mm/Area Scan (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.146 W/kg

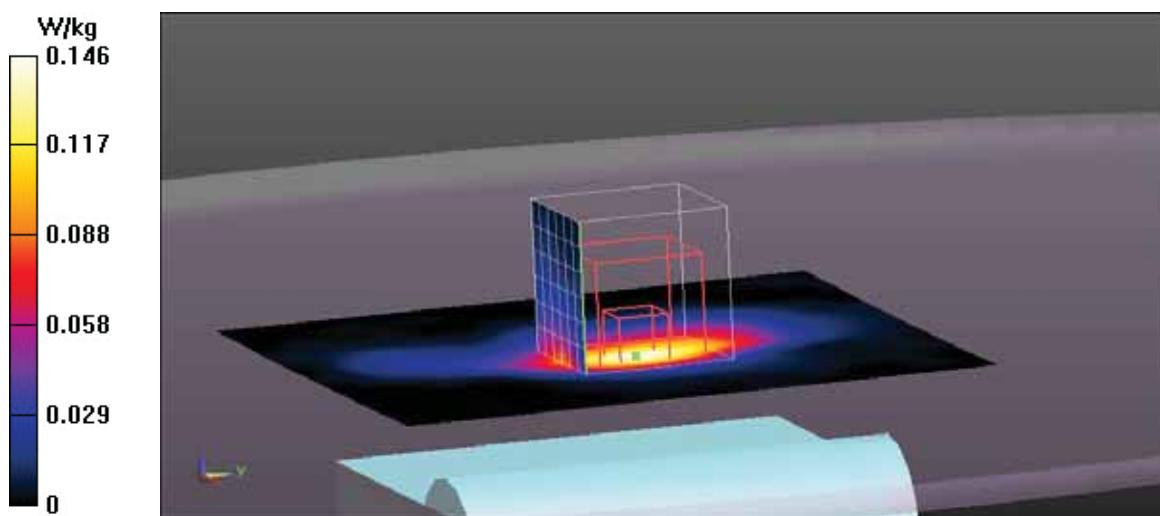
Configuration/Flat BOTTOM 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.505 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.172 W/kg

SAR(1 g) = 0.093 W/kg; SAR(10 g) = 0.054 W/kg

Maximum value of SAR (measured) = 0.140 W/kg



Test Laboratory: Eurofins Product Service GmbH**FDD V - Ch. 4182 - RMC-144kbps - BOTTOM 0mm****DUT: Asthma Monitor AM3; Type: AM3 Option G+; Serial: -**

Communication System: UID 0 - n/a, UMTS FDD V; Frequency: 836.6 MHz; Duty Cycle: 1:2.18776

Medium: Muscle 900 MHz Medium parameters used (interpolated): $f = 836.6 \text{ MHz}$; $\sigma = 0.953 \text{ S/m}$; $\epsilon_r = 53.613$;

$$\rho = 1000 \text{ kg/m}^3$$

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(10.35, 10.35, 10.35); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Flat BOTTOM 0mm/Area Scan (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 3.47 W/kg

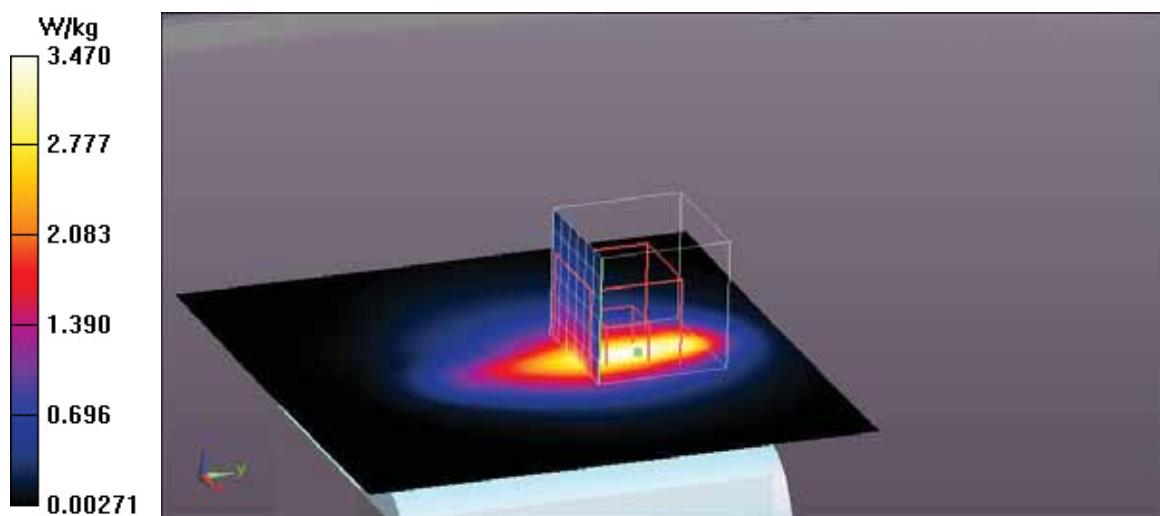
Configuration/Flat BOTTOM 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 51.397 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 4.22 W/kg

SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.22 W/kg

Maximum value of SAR (measured) = 3.38 W/kg



Test Laboratory: Eurofins Product Service GmbH**Bluetooth DH5 2402 MHz - BACK 0mm****DUT: Asthma Monitor AM3; Type: AM3 Option G+; Serial: -**

Communication System: UID 0 - n/a, BT 2.4GHz DH5; Frequency: 2402 MHz; Duty Cycle: 1:1.38388
 Medium: Muscle 2450 MHz Medium parameters used (interpolated): $f = 2402$ MHz; $\sigma = 1.941$ S/m; $\epsilon_r = 50.951$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(7.9, 7.9, 7.9); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Flat BACK 0mm/Area Scan (121x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0616 W/kg

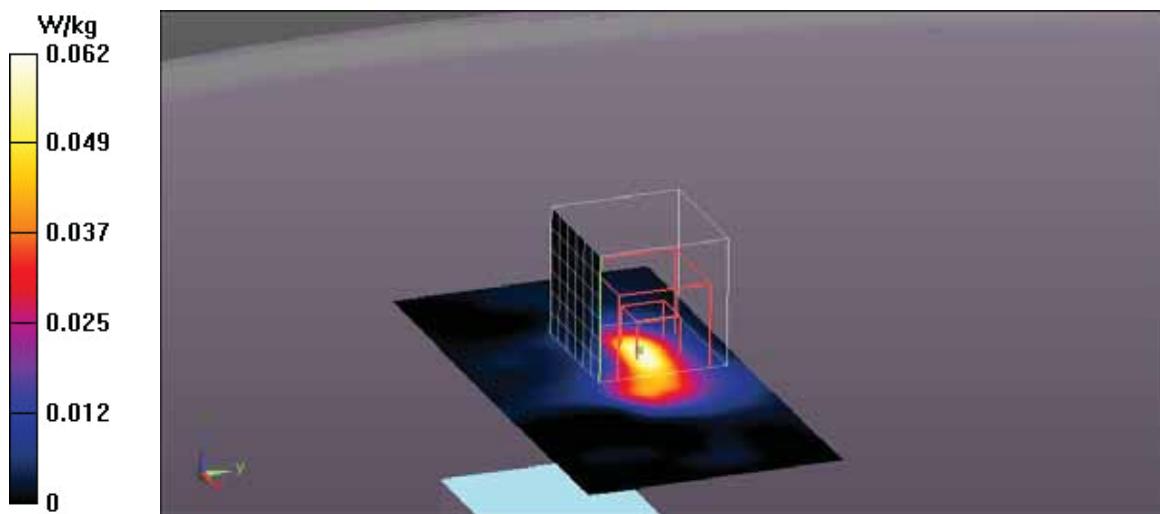
Configuration/Flat BACK 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.965 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 0.132 W/kg

SAR(1 g) = 0.041 W/kg; SAR(10 g) = 0.013 W/kg

Maximum value of SAR (measured) = 0.0820 W/kg



Test Laboratory: Eurofins Product Service GmbH**Bluetooth LE 2480 MHz - BACK 0mm****DUT: Asthma Monitor AM3; Type: AM3 Option G+; Serial: -**

Communication System: UID 0 - n/a, Bluetooth Low Energy; Frequency: 2480 MHz; Duty Cycle: 1:3.54813

Medium: Muscle 2450 MHz Medium parameters used: $f = 2480 \text{ MHz}$; $\sigma = 2.058 \text{ S/m}$; $\epsilon_r = 50.755$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(7.9, 7.9, 7.9); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Flat BACK 0mm/Area Scan (121x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0682 W/kg

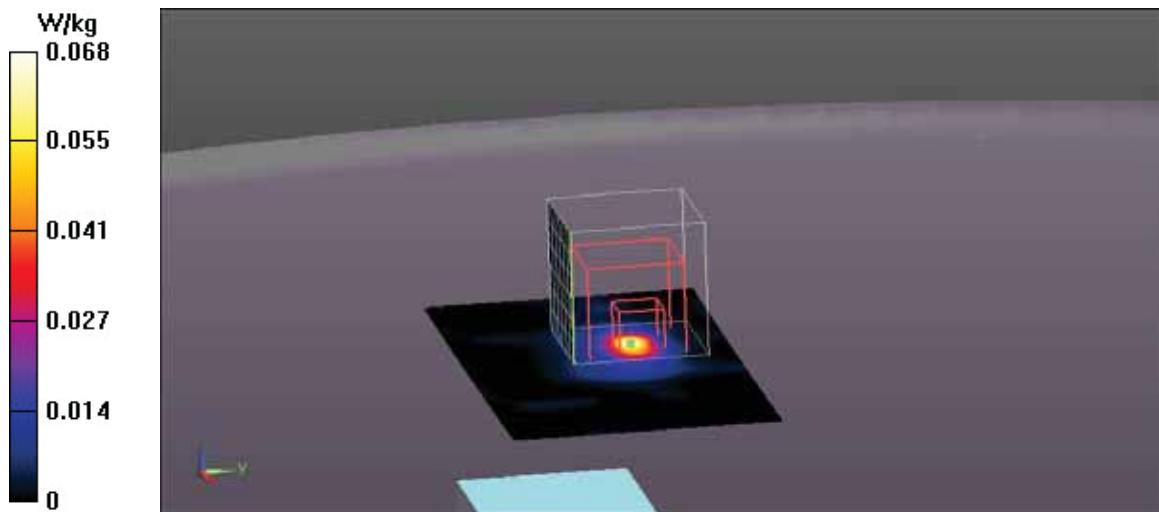
Configuration/Flat BACK 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.508 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.0910 W/kg

SAR(1 g) = 0.030 W/kg; SAR(10 g) = 0.00905 W/kg

Maximum value of SAR (measured) = 0.0578 W/kg



Test Laboratory: Eurofins Product Service GmbH**FDD II - Ch. 9263 - RMC-384kbps - BOTTOM 0mm****DUT: Asthma Monitor AM3; Type: AM3 Option G+; Serial: -**

Communication System: UID 0 - n/a, UMTS FDD II; Frequency: 1852.6 MHz; Duty Cycle: 1:2.18776
 Medium: Muscle 1900 MHz Medium parameters used (interpolated): $f = 1852.6$ MHz; $\sigma = 1.44$ S/m; $\epsilon_r = 53.329$; $\rho = 1000$ kg/m³
 Phantom section: Flat Section

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

DASY5.2 Configuration:

- Probe: EX3DV4 - SN3893; ConvF(8.34, 8.34, 8.34); Calibrated: 2016-09-23;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn522; Calibrated: 2016-09-28
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1013
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Flat BOTTOM 0mm/Area Scan (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 3.59 W/kg

Configuration/Flat BOTTOM 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 47.850 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 4.06 W/kg

SAR(1 g) = 2.28 W/kg; SAR(10 g) = 1.35 W/kg

Maximum value of SAR (measured) = 3.40 W/kg

