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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-5d149_Feb12**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d149**

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

Calibration date: **February 22, 2012**

*✓ KOK
4/11/12*

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 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Power sensor HP 8481A | US37292783 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Reference 20 dB Attenuator | SN: 5086 (20g) | 29-Mar-11 (No. 217-01368) | Apr-12 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371) | Apr-12 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Dec-11 (No. ES3-3205_Dec11) | Dec-12 |
| DAE4 | SN: 601 | 04-Jul-11 (No. DAE4-601_Jul11) | Jul-12 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06 | 100005 | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

Calibrated by: **Name** **Function** **Signature**
Israe El-Naouq **Laboratory Technician** *Israe El-Naouq*

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

Issued: February 23, 2012

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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.

Measurement Conditions

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

| | | |
|-------------------------------------|------------------------|-------------|
| DASY Version | DASY5 | V52.8.0 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 1900 MHz \pm 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 \pm 0.2) °C | 40.4 \pm 6 % | 1.40 mho/m \pm 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 | 9.80 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 39.3 mW / g \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 5.18 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 20.7 mW / g \pm 16.5 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|----------------|----------------------|
| Nominal Body TSL parameters | 22.0 °C | 53.3 | 1.52 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 53.0 \pm 6 % | 1.56 mho/m \pm 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 | 9.99 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 39.3 mW / g \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 5.23 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 20.7 mW / g \pm 16.5 % (k=2) |

Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 52.4 Ω + 5.5 j Ω |
| Return Loss | - 24.6 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.0 Ω + 6.7 j Ω |
| Return Loss | - 23.0 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.199 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 | March 11, 2011 |

DASY5 Validation Report for Head TSL

Date: 22.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d149

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

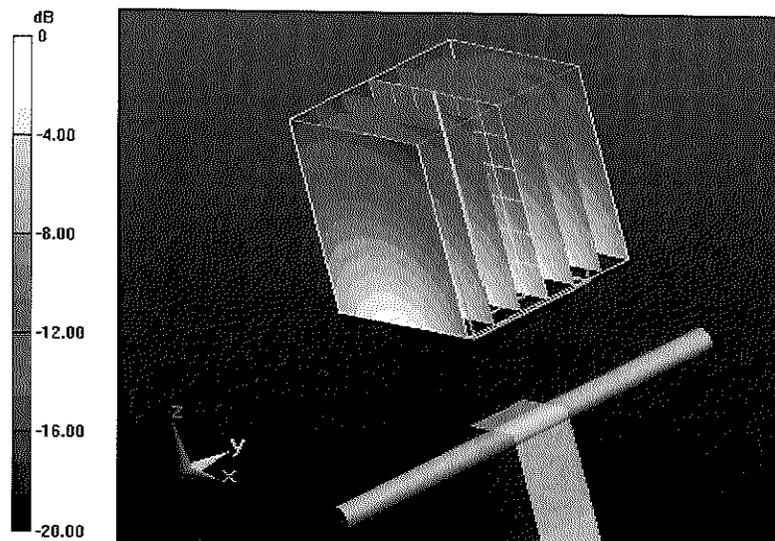
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.685 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 17.4710

SAR(1 g) = 9.8 mW/g; SAR(10 g) = 5.18 mW/g

Maximum value of SAR (measured) = 12.114 mW/g



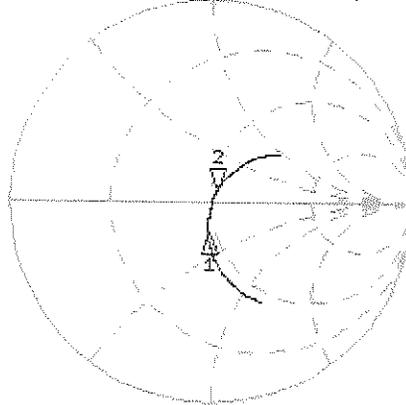
0 dB = 12.110mW/g = 21.66 dB mW/g

Impedance Measurement Plot for Head TSL

22 Feb 2012 09:56:56

CH1 S11 1 U FS 2: 52.387 Ω 5.5859 Ω 461.20 μ H 1 900.000 000 MHz

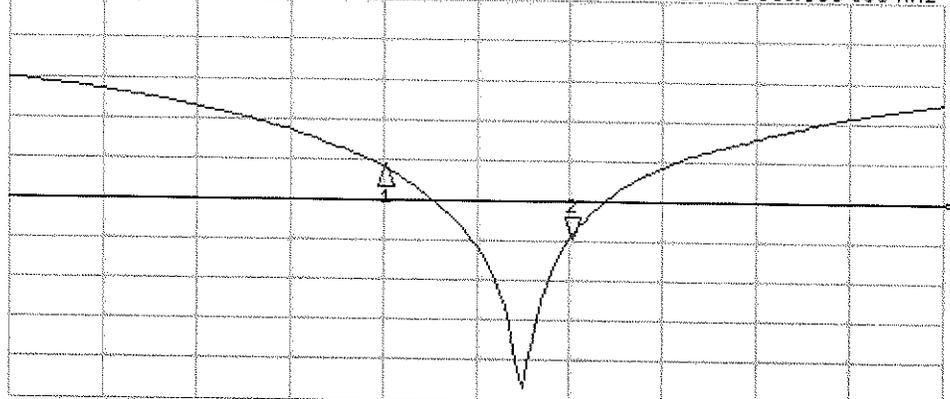
*
Del
Cor
Avg
16
H1 d



CH1 Markers
1: 46.287 Ω
-15.180 Ω
1.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 2:-24.647 dB 1 900.000 000 MHz

Cor
Avg
16
H1 d



CH2 Markers
1:-15.901 dB
1.80000 GHz

START 1 600.000 000 MHz STOP 2 100.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 06.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d149

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 53$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

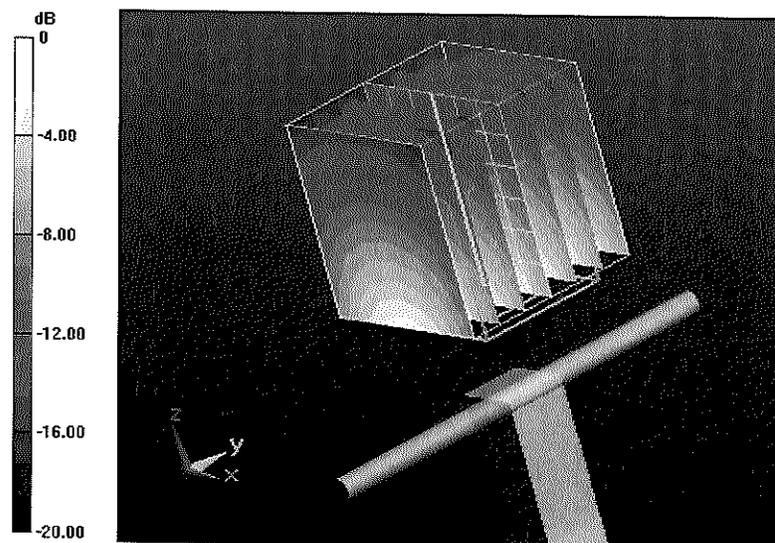
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.047 V/m; Power Drift = 0.0017 dB

Peak SAR (extrapolated) = 18.1310

SAR(1 g) = 9.99 mW/g; SAR(10 g) = 5.23 mW/g

Maximum value of SAR (measured) = 12.672 mW/g



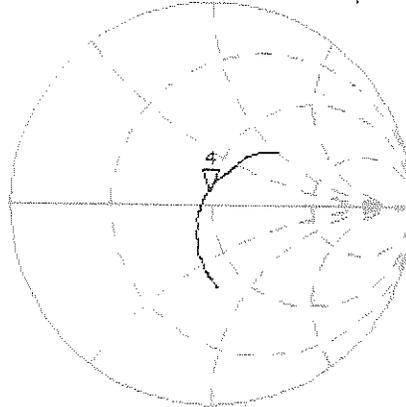
0 dB = 12.670mW/g = 22.06 dB mW/g

Impedance Measurement Plot for Body TSL

6 Feb 2012 12:15:29

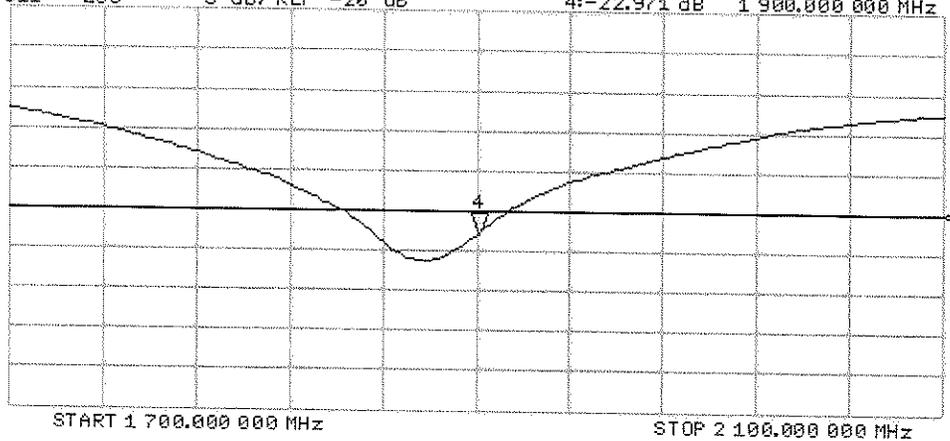
CH1 S11 1 U FS 4: 47.961 Ω 6.8680 Ω 558.55 μ H 1 900.000 000 MHz

*
Del
Ca
Avg
15
H1 d



CH2 S11 LOG 5 dB/REF -20 dB 4:-22.971 dB 1 900.000 000 MHz

Ca
Avg
15
H1 d



**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

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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D2450V2-719_Aug12**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 719**

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

Calibration date: **August 23, 2012**

*✓ KOK
9/17/12*

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 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Power sensor HP 8481A | US37292783 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 27-Mar-12 (No. 217-01530) | Apr-13 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 27-Mar-12 (No. 217-01533) | Apr-13 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Dec-11 (No. ES3-3205_Dec11) | Dec-12 |
| DAE4 | SN: 601 | 27-Jun-12 (No. DAE4-601_Jun12) | Jun-13 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06 | 100005 | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

Calibrated by: **Israe El-Naouq** Name: **Israe El-Naouq** Function: **Laboratory Technician**

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

Signature
Israe El-Naouq
Katja Pokovic

Issued: August 23, 2012

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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.

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 | V52.8.2 |
| 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 % | 1.81 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 13.2 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 52.7 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 6.19 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.7 mW / g ± 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 | 51.3 ± 6 % | 1.99 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 13.1 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 51.6 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 6.16 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 24.4 mW / g ± 16.5 % (k=2) |

Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $54.4 \Omega + 3.8 j\Omega$ |
| Return Loss | - 25.1 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $50.7 \Omega + 5.9 j\Omega$ |
| Return Loss | - 24.6 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.150 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 | September 10, 2002 |

DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.81$ mho/m; $\epsilon_r = 39.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

Dipole Calibration for Head Tissue/ $P_{in}=250$ mW, $d=10$ mm/Zoom Scan (7x7x7)/Cube 0:

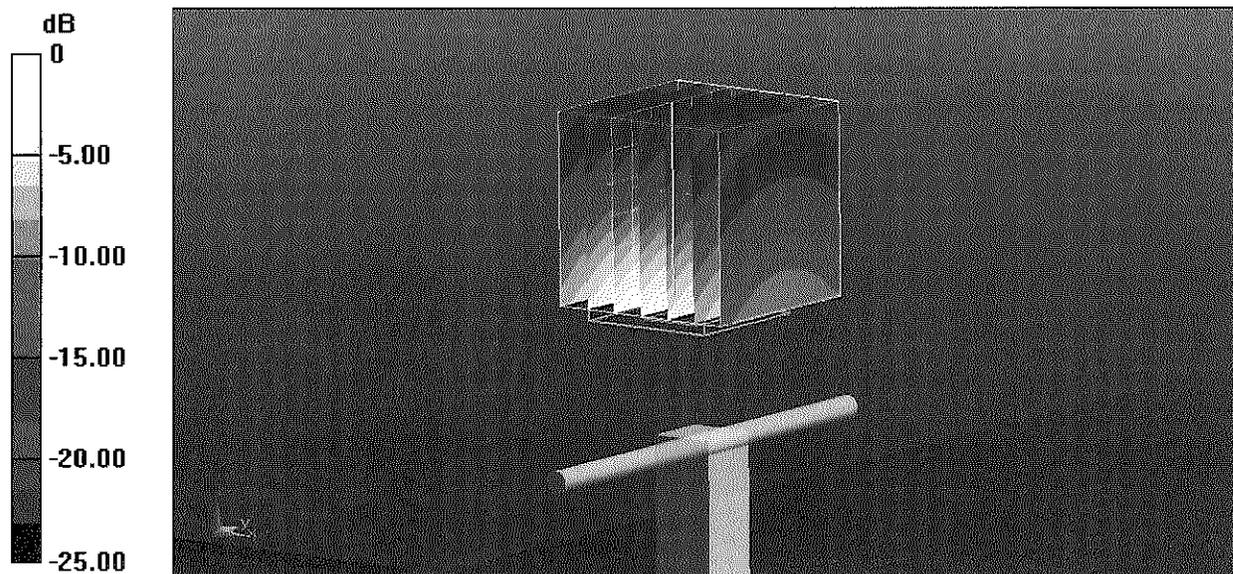
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 99.219 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 26.633 mW/g

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.19 mW/g

Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 24.35 dB W/kg

Impedance Measurement Plot for Head TSL

22 Aug 2012 15:39:08

CH1 S11 1 U FS

3: 54.416 Ω 3.7656 Ω 244.62 pF

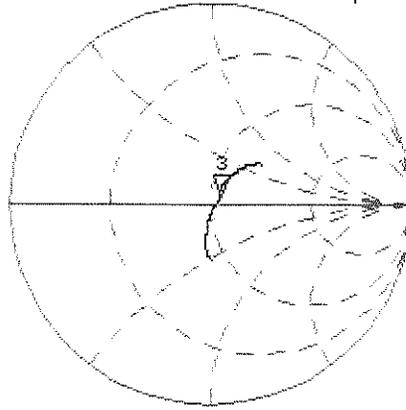
2 450.000 000 MHz

*
De1

CΔ

Avg
16

H1d



CH2 S11

L06

5 dB/REF -20 dB

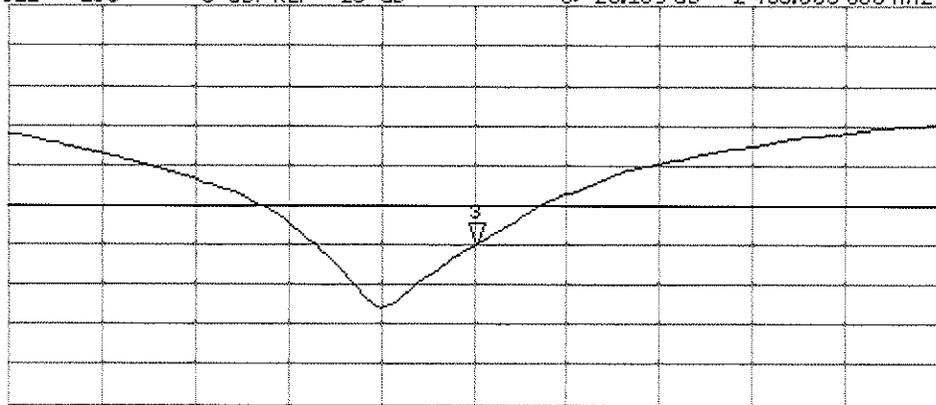
3: -25.109 dB

2 450.000 000 MHz

CΔ

Avg
16

H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 22.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

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

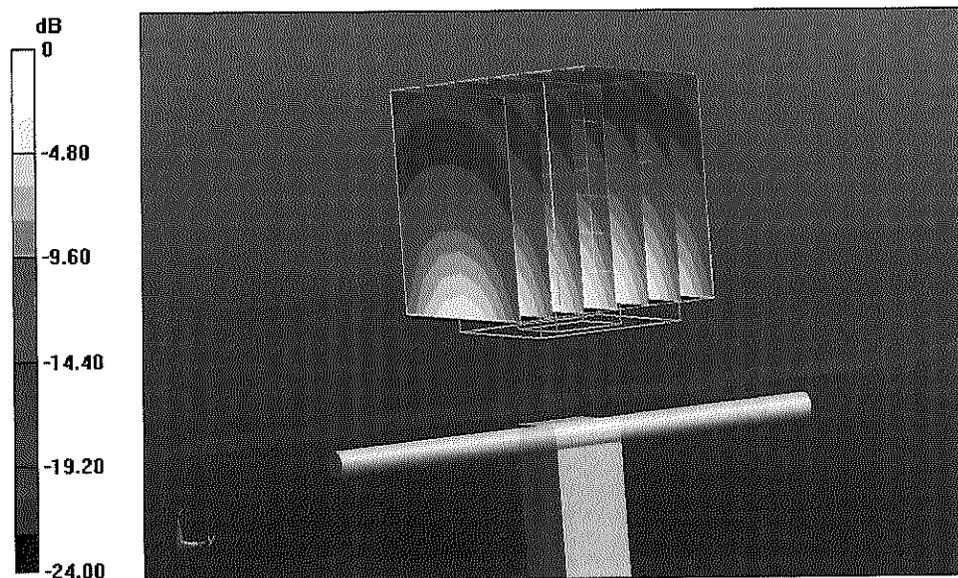
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.970 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 26.692 mW/g

SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.16 mW/g

Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 24.66 dB W/kg

Impedance Measurement Plot for Body TSL

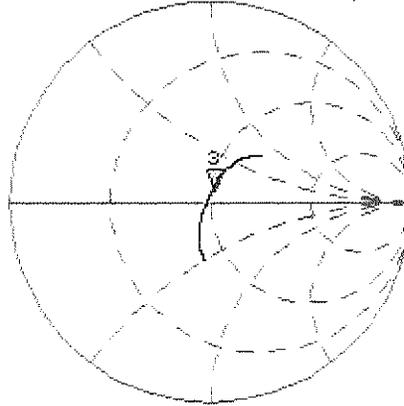
22 Aug 2012 15:38:22

CH1 S11 1 U FS

3: 50.709 Ω 5.8906 Ω 382.66 pF

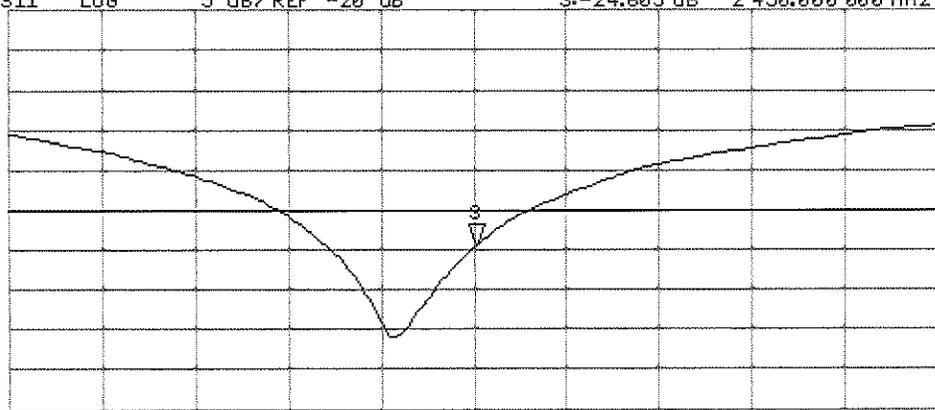
2 450.000 000 MHz

*
Del
CA
Avg
16
H1d



CH2 S11 LOG 5 dB/REF -20 dB 3: -24.605 dB 2 450.000 000 MHz

CA
Avg
16
H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3022_Aug12**

CALIBRATION CERTIFICATE

Object **ES3DV2 - SN:3022**

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

Calibration date: **August 28, 2012**

*✓
Kok
7/10*

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B | GB41293874 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Power sensor E4412A | MY41498087 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 27-Mar-12 (No. 217-01531) | Apr-13 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529) | Apr-13 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532) | Apr-13 |
| Reference Probe ES3DV2 | SN: 3013 | 29-Dec-11 (No. ES3-3013_Dec11) | Dec-12 |
| DAE4 | SN: 660 | 20-Jun-12 (No. DAE4-660_Jun12) | Jun-13 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (in house check Apr-11) | In house check: Apr-13 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

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

Issued: August 28, 2012

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Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

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 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., $\vartheta = 0$ is normal to probe axis |

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 NORM_{x,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 ES3DV2

SN:3022

Manufactured: April 15, 2003
Calibrated: August 28, 2012

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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 1.00 | 1.04 | 0.99 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 98.3 | 99.5 | 101.3 | |

Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 0 | CW | 0.00 | X | 0.00 | 0.00 | 1.00 | 133.3 | $\pm 2.7 \%$ |
| | | | Y | 0.00 | 0.00 | 1.00 | 140.3 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 178.9 | |

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 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: ES3DV2 - SN:3022

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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 41.9 | 0.89 | 6.30 | 6.30 | 6.30 | 0.30 | 1.72 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 6.03 | 6.03 | 6.03 | 0.35 | 1.63 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 5.07 | 5.07 | 5.07 | 0.32 | 1.89 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 4.86 | 4.86 | 4.86 | 0.40 | 1.57 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 4.23 | 4.23 | 4.23 | 0.59 | 1.44 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 4.10 | 4.10 | 4.10 | 0.67 | 1.37 | ± 12.0 % |

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

^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.

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

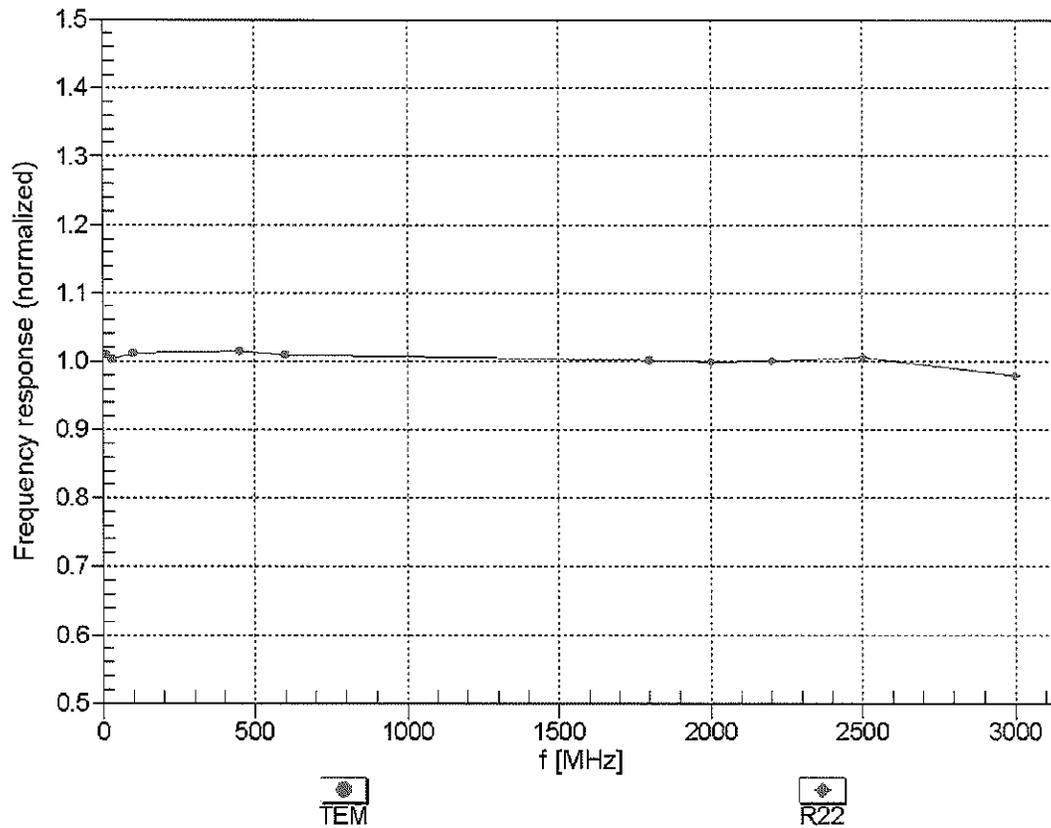
Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 55.5 | 0.96 | 6.07 | 6.07 | 6.07 | 0.23 | 2.09 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 6.02 | 6.02 | 6.02 | 0.47 | 1.44 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 4.70 | 4.70 | 4.70 | 0.46 | 1.55 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 4.43 | 4.43 | 4.43 | 0.36 | 1.87 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 3.97 | 3.97 | 3.97 | 0.65 | 1.06 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 3.80 | 3.80 | 3.80 | 0.54 | 0.75 | ± 12.0 % |

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

^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.

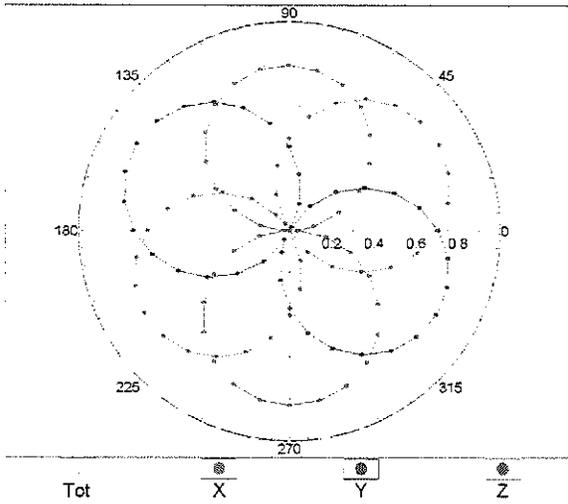
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



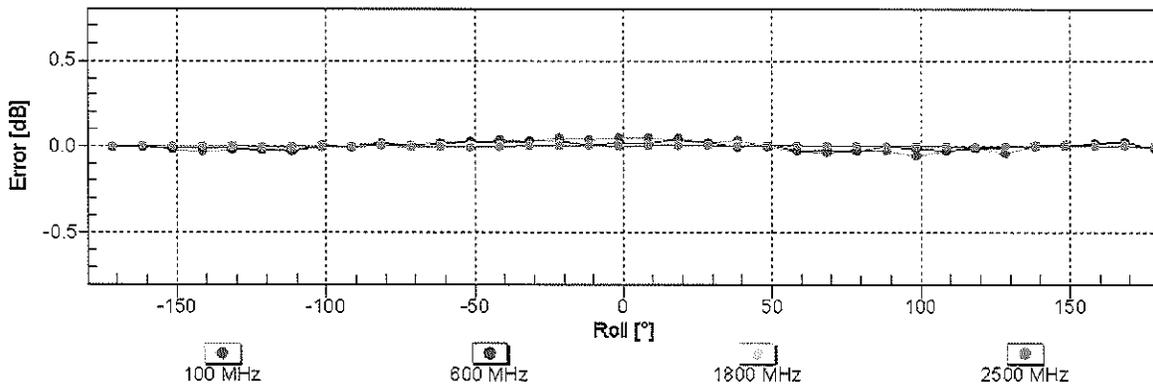
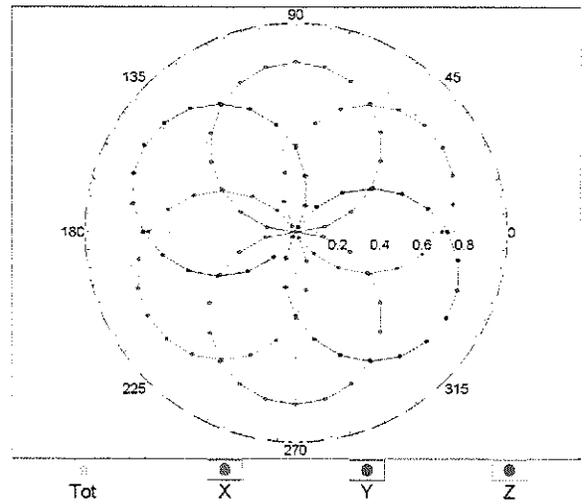
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

f=600 MHz, TEM

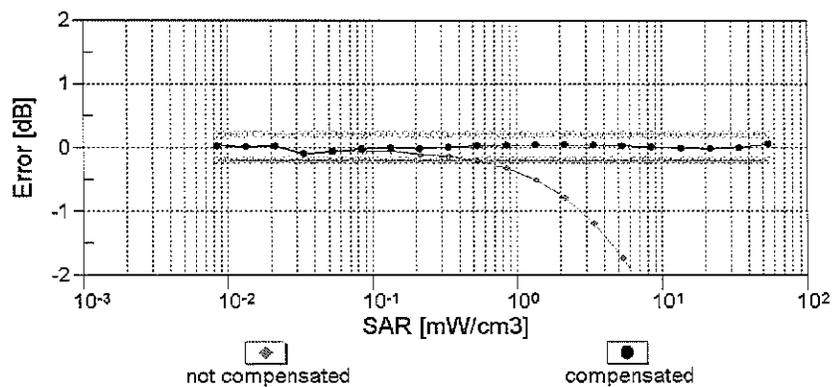
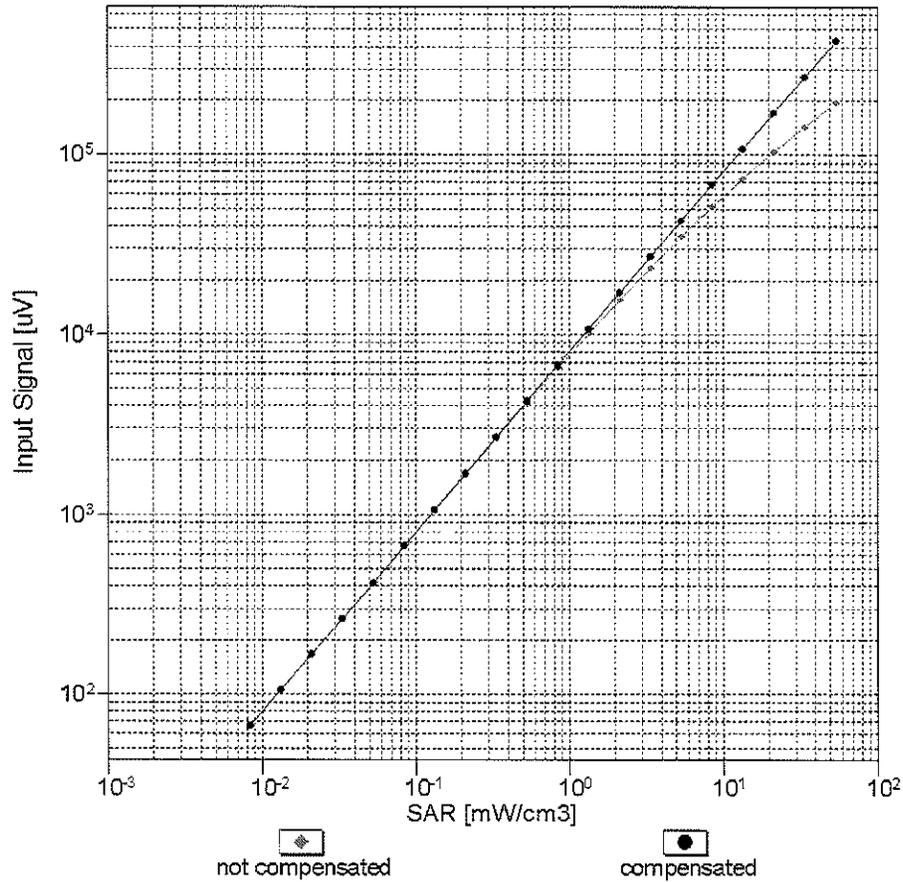


f=1800 MHz, R22



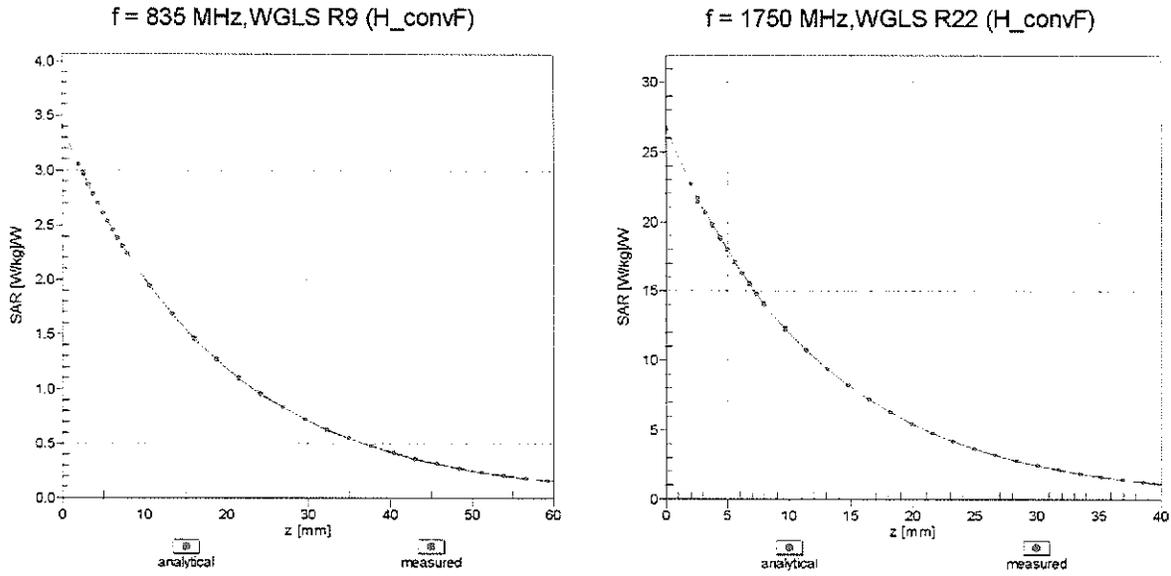
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$)



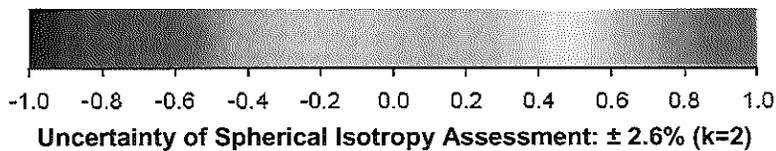
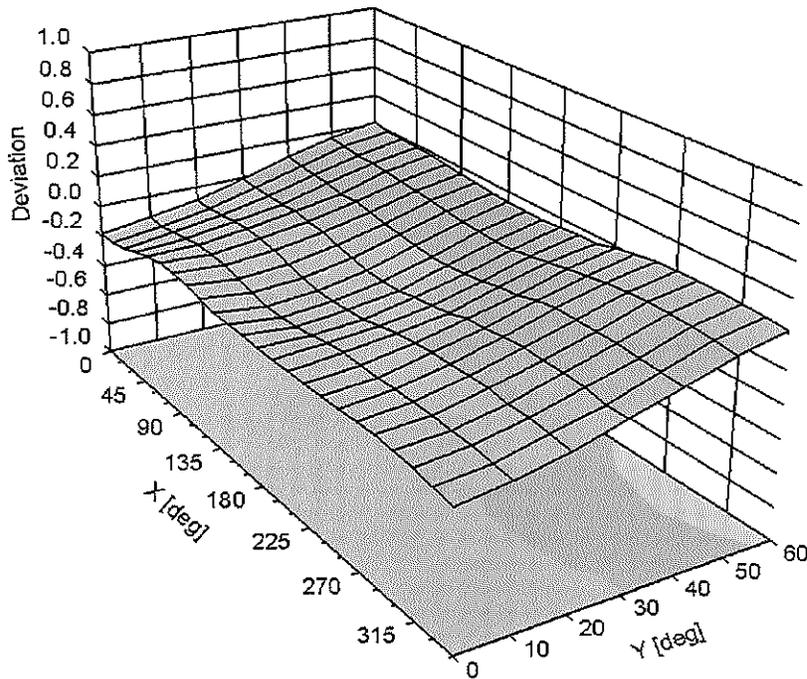
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 98.5 |
| 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 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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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3209_Mar12**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3209**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4
 Calibration procedure for dosimetric E-field probes**

Calibration date: **March 16, 2012**

✓
KOK
4/19/12

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B | GB41293874 | 31-Mar-11 (No. 217-01372) | Apr-12 |
| Power sensor E4412A | MY41498087 | 31-Mar-11 (No. 217-01372) | Apr-12 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 29-Mar-11 (No. 217-01369) | Apr-12 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-11 (No. 217-01367) | Apr-12 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 29-Mar-11 (No. 217-01370) | Apr-12 |
| Reference Probe ES3DV2 | SN: 3013 | 29-Dec-11 (No. ES3-3013_Dec11) | Dec-12 |
| DAE4 | SN: 654 | 3-May-11 (No. DAE4-654_May11) | May-12 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (in house check Apr-11) | In house check: Apr-13 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

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

Issued: March 19, 2012

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



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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 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., $\vartheta = 0$ 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) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORM_{x,y,z}*: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). *NORM_{x,y,z}* are only intermediate values, i.e., the uncertainties of *NORM_{x,y,z}* does not affect the E^2 -field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)_{x,y,z}* = *NORM_{x,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*.
- *DCP_{x,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
- *A_{x,y,z}*; *B_{x,y,z}*; *C_{x,y,z}*, *VR_{x,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 *NORM_{x,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 ES3DV3

SN:3209

Manufactured: October 14, 2008
Calibrated: March 16, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---------------------------------------|----------|----------|----------|-----------|
| Norm ($\mu V/(V/m)^2$) ^A | 1.36 | 1.34 | 1.15 | ± 10.1 % |
| DCP (mV) ^B | 98.2 | 97.4 | 98.7 | |

Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc ^E (k=2) |
|-------|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 10000 | CW | 0.00 | X | 0.00 | 0.00 | 1.00 | 119.2 | ±3.5 % |
| | | | Y | 0.00 | 0.00 | 1.00 | 89.3 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 111.5 | |

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%.

^A The uncertainties of NormX,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: ES3DV3 - SN:3209

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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 41.9 | 0.89 | 6.47 | 6.47 | 6.47 | 0.37 | 1.61 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 6.22 | 6.22 | 6.22 | 0.24 | 2.24 | ± 12.0 % |
| 1640 | 40.3 | 1.29 | 5.38 | 5.38 | 5.38 | 0.41 | 1.56 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 5.26 | 5.26 | 5.26 | 0.41 | 1.60 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 5.15 | 5.15 | 5.15 | 0.80 | 1.16 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 4.46 | 4.46 | 4.46 | 0.64 | 1.39 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 4.30 | 4.30 | 4.30 | 0.69 | 1.42 | ± 12.0 % |

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

^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.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

Calibration Parameter Determined in Body Tissue Simulating Media

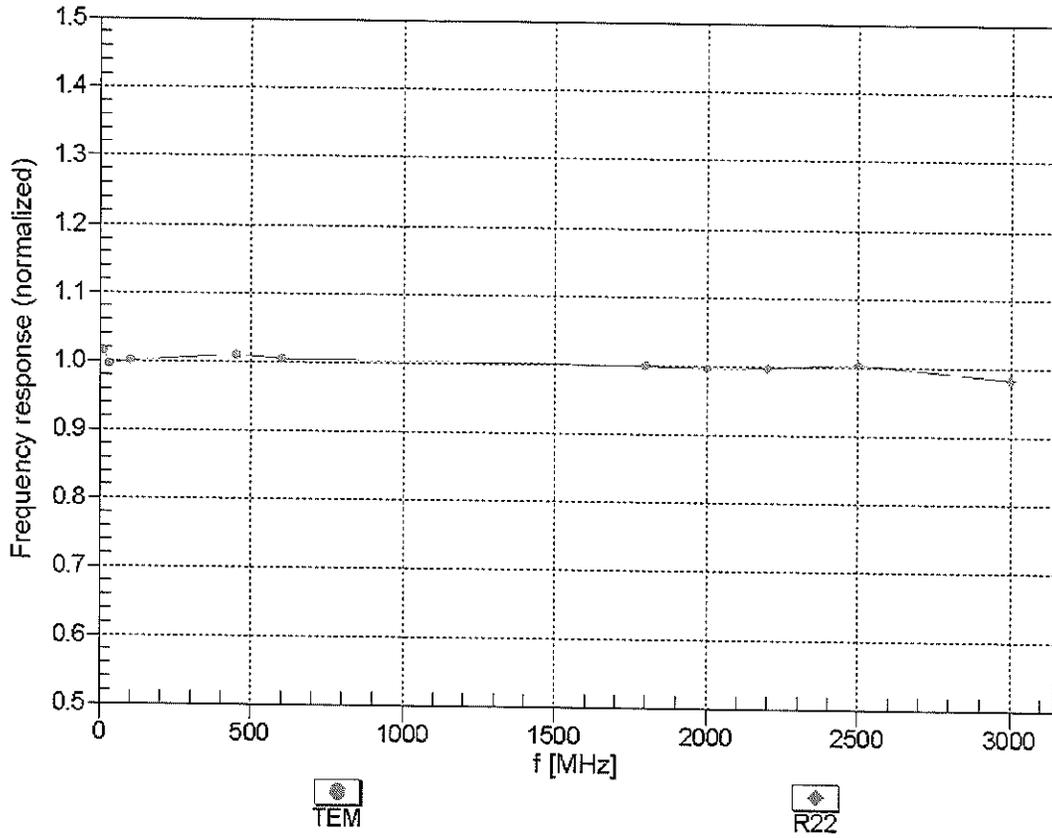
| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 450 | 56.7 | 0.94 | 7.11 | 7.11 | 7.11 | 0.07 | 1.00 | ± 13.4 % |
| 750 | 55.5 | 0.96 | 6.23 | 6.23 | 6.23 | 0.54 | 1.40 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 6.13 | 6.13 | 6.13 | 0.24 | 2.27 | ± 12.0 % |
| 1640 | 53.8 | 1.40 | 5.21 | 5.21 | 5.21 | 0.72 | 1.29 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 4.83 | 4.83 | 4.83 | 0.59 | 1.44 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 4.63 | 4.63 | 4.63 | 0.57 | 1.50 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 4.23 | 4.23 | 4.23 | 0.80 | 1.00 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 4.02 | 4.02 | 4.02 | 0.62 | 0.90 | ± 12.0 % |

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

^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.

Frequency Response of E-Field

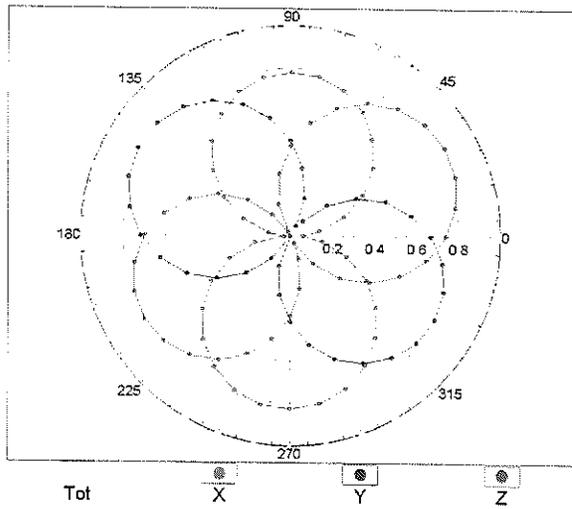
(TEM-Cell:ifi110 EXX, Waveguide: R22)



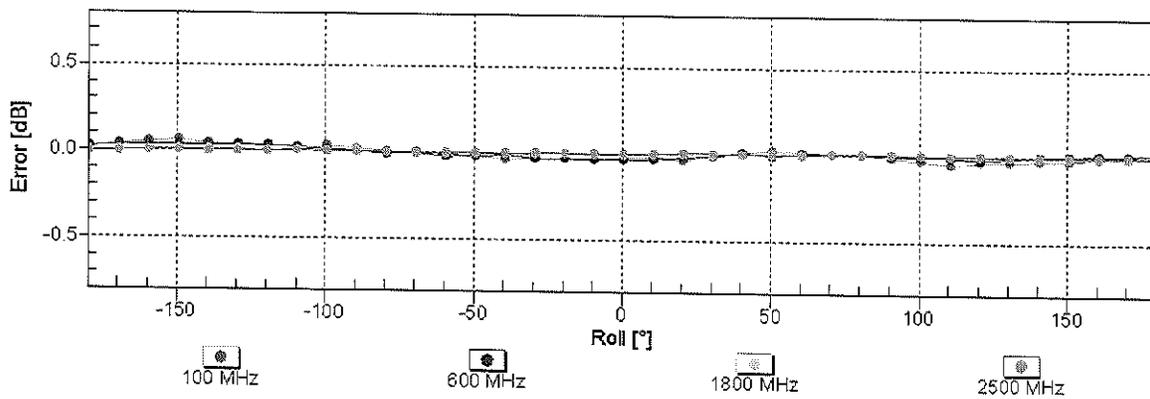
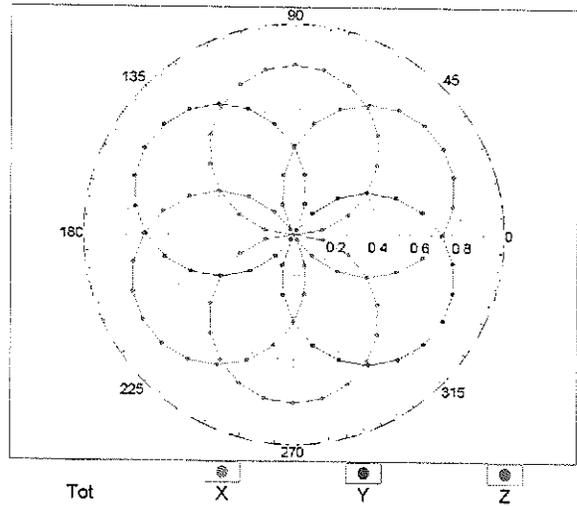
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz, TEM

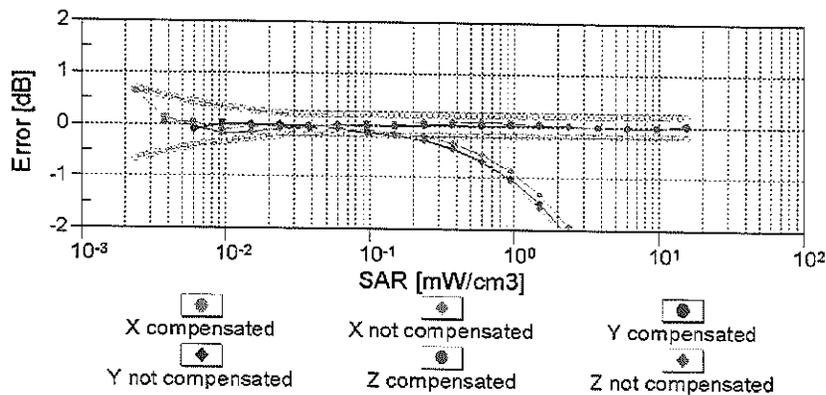
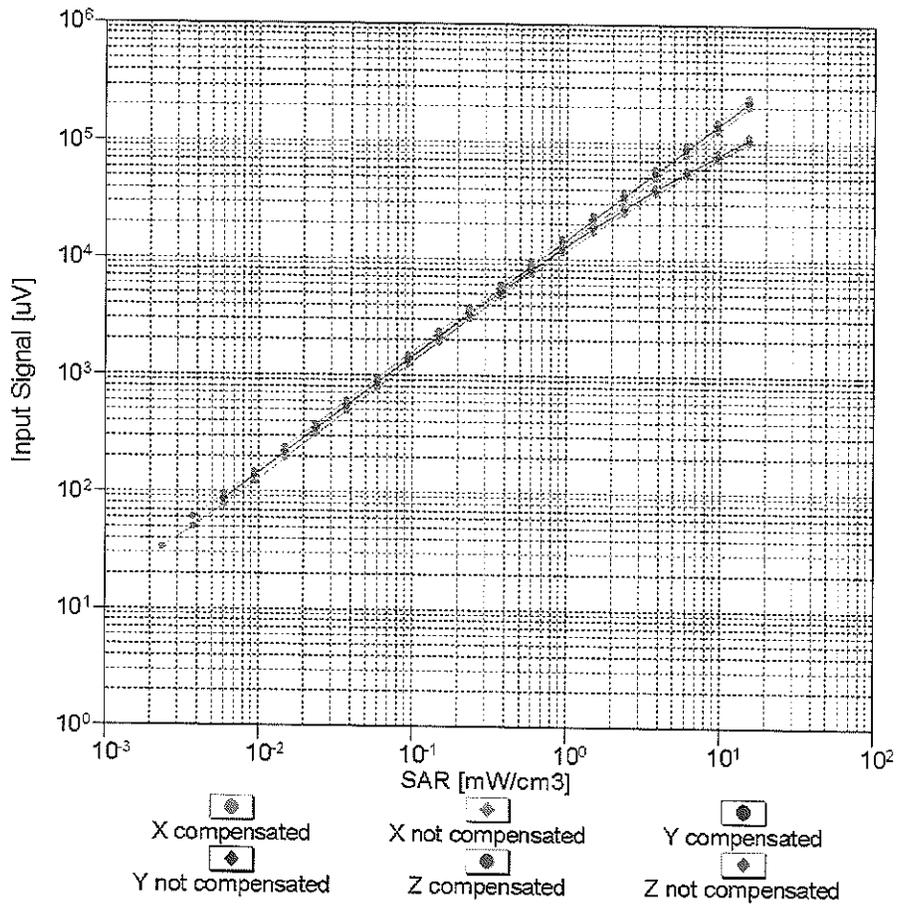


f=1800 MHz, R22



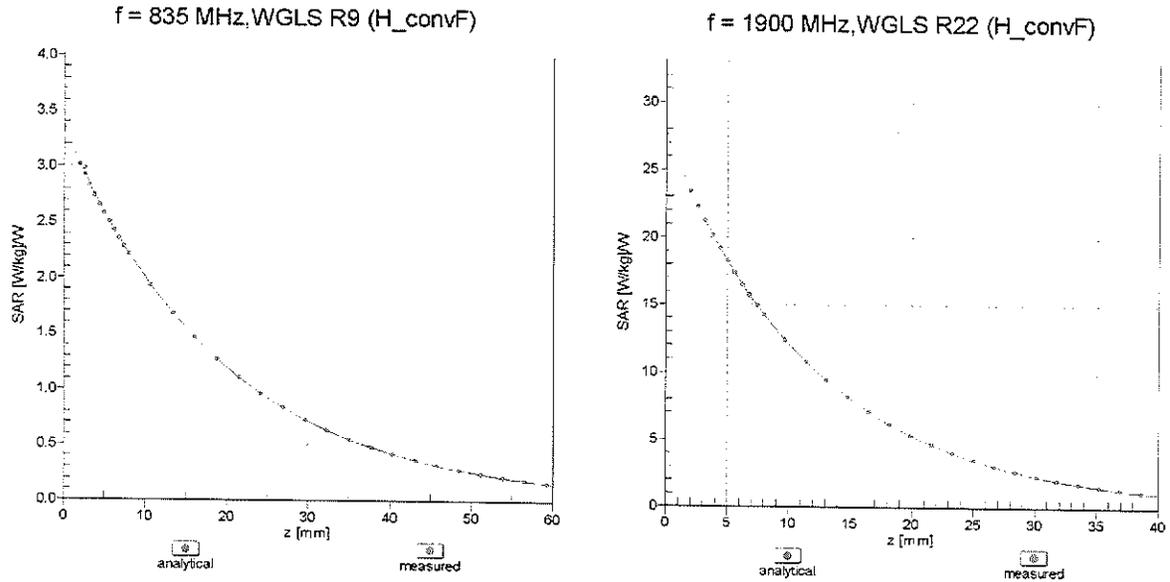
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range f(SAR_{head}) (TEM cell , f = 900 MHz)

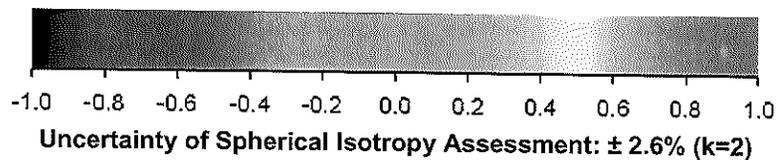
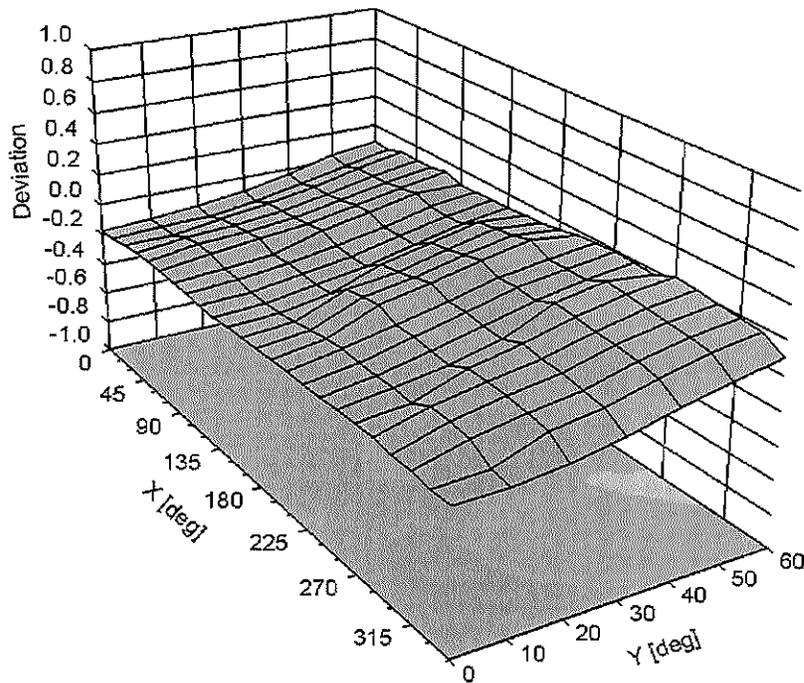


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



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



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209**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 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 **PC Test**

Certificate No: **ES3-3213_Apr12**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3213**

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

Calibration date: **April 24, 2012**

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)

✓ Kok 5/2/12

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B | GB41293874 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Power sensor E4412A | MY41498087 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 27-Mar-12 (No. 217-01531) | Apr-13 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529) | Apr-13 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532) | Apr-13 |
| Reference Probe ES3DV2 | SN: 3013 | 29-Dec-11 (No. ES3-3013_Dec11) | Dec-12 |
| DAE4 | SN: 660 | 10-Jan-12 (No. DAE4-660_Jan12) | Jan-13 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (in house check Apr-11) | In house check: Apr-13 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

| | | | |
|----------------|------------------------------|--|-----------------------------------|
| Calibrated by: | Name Dimce Iliev | Function Laboratory Technician | Signature <i>Dimce Iliev</i> |
| Approved by: | Name Katja Pokovic | Function Technical Manager | Signature <i>Katja Pokovic</i> |

Issued: April 25, 2012

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Accreditation No.: SCS 108

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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 | 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., $\vartheta = 0$ is normal to probe axis |

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 NORM_{x,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 ES3DV3

SN:3213

Manufactured: October 14, 2008
Calibrated: April 24, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 1.48 | 1.36 | 1.33 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 97.8 | 101.0 | 99.1 | |

Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 0 | CW | 0.00 | X | 0.00 | 0.00 | 1.00 | 125.2 | $\pm 2.5 \%$ |
| | | | Y | 0.00 | 0.00 | 1.00 | 127.5 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 169.0 | |

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 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: ES3DV3 - SN:3213

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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 41.9 | 0.89 | 6.32 | 6.32 | 6.32 | 0.50 | 1.38 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 6.07 | 6.07 | 6.07 | 0.41 | 1.57 | ± 12.0 % |
| 1640 | 40.3 | 1.29 | 5.36 | 5.36 | 5.36 | 0.64 | 1.24 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 5.22 | 5.22 | 5.22 | 0.57 | 1.39 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 5.02 | 5.02 | 5.02 | 0.63 | 1.32 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 4.43 | 4.43 | 4.43 | 0.80 | 1.22 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 4.26 | 4.26 | 4.26 | 0.72 | 1.36 | ± 12.0 % |

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

^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.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Calibration Parameter Determined in Body Tissue Simulating Media

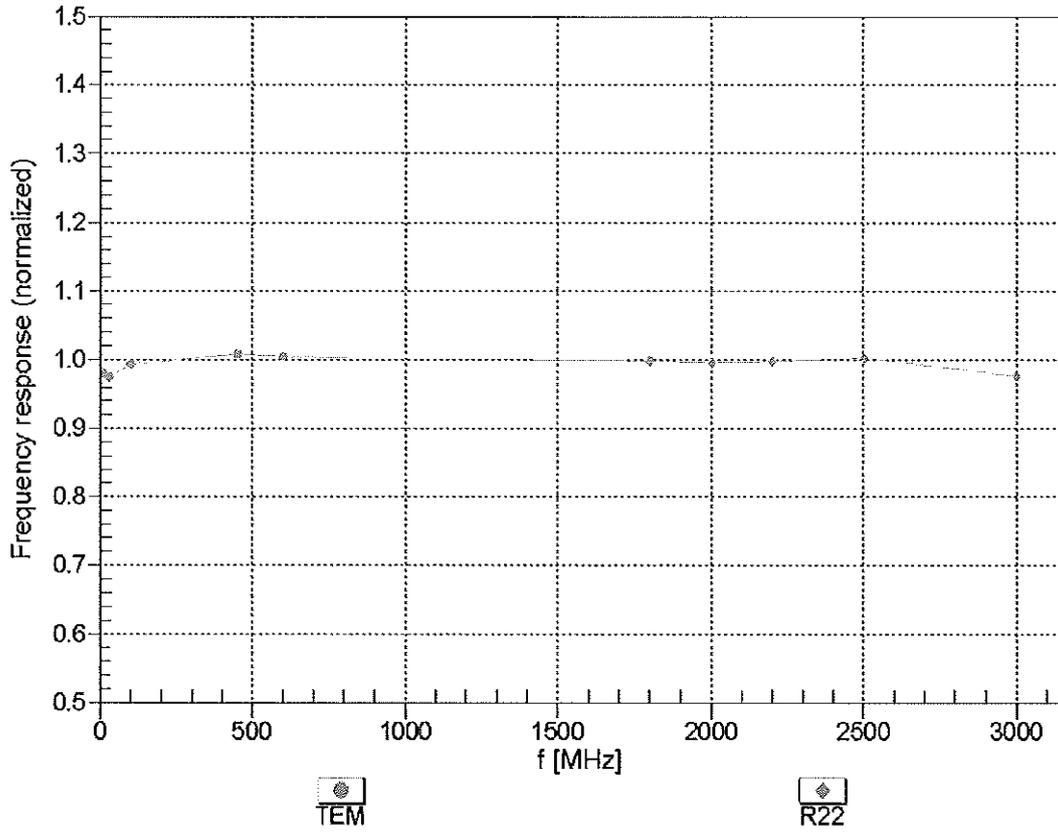
| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 55.5 | 0.96 | 6.19 | 6.19 | 6.19 | 0.31 | 1.96 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 6.07 | 6.07 | 6.07 | 0.38 | 1.73 | ± 12.0 % |
| 1640 | 53.8 | 1.40 | 5.13 | 5.13 | 5.13 | 0.35 | 2.07 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 4.68 | 4.68 | 4.68 | 0.54 | 1.56 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 4.50 | 4.50 | 4.50 | 0.69 | 1.37 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 4.11 | 4.11 | 4.11 | 0.80 | 1.04 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 3.91 | 3.91 | 3.91 | 0.63 | 0.92 | ± 12.0 % |

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

^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.

Frequency Response of E-Field

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

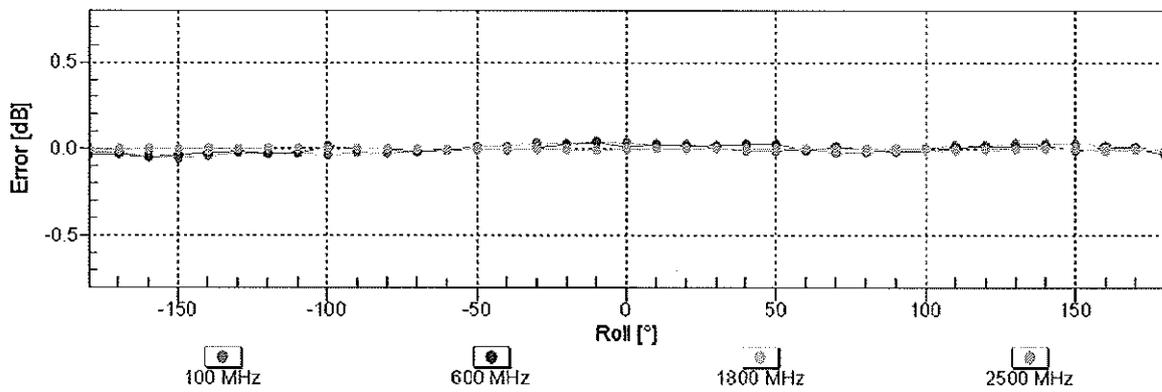
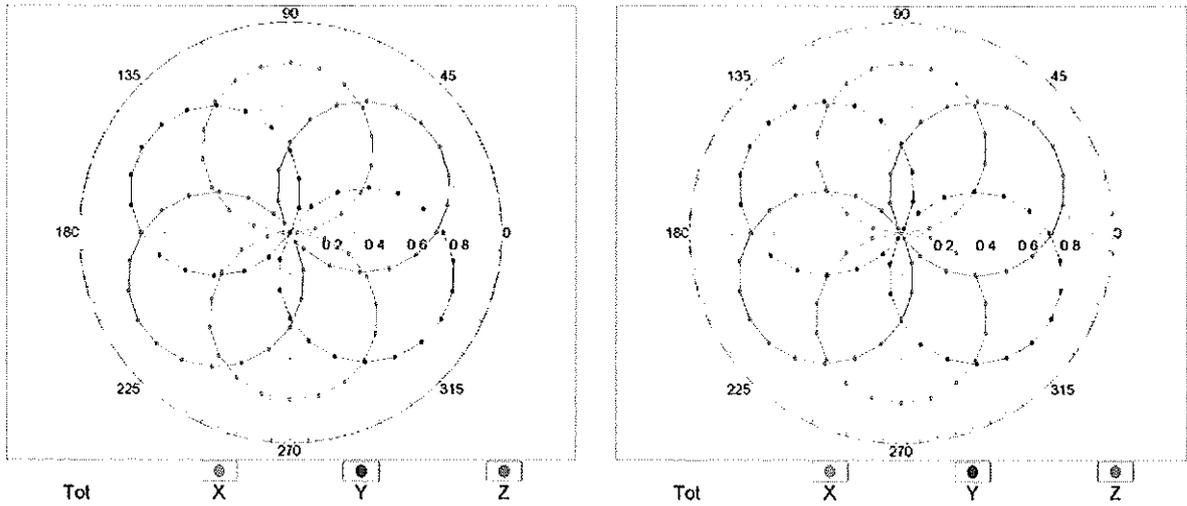


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

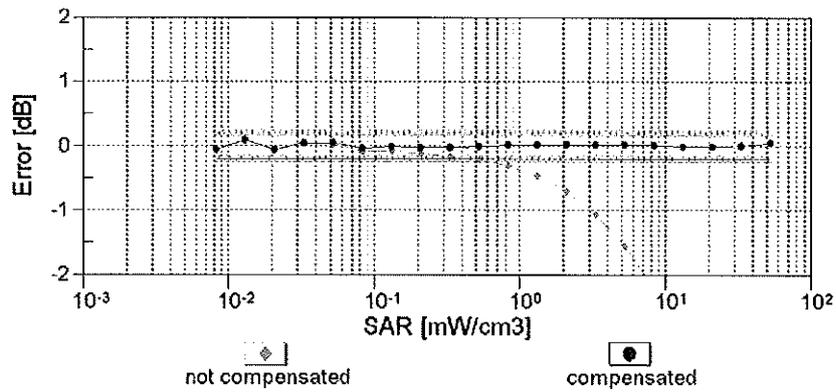
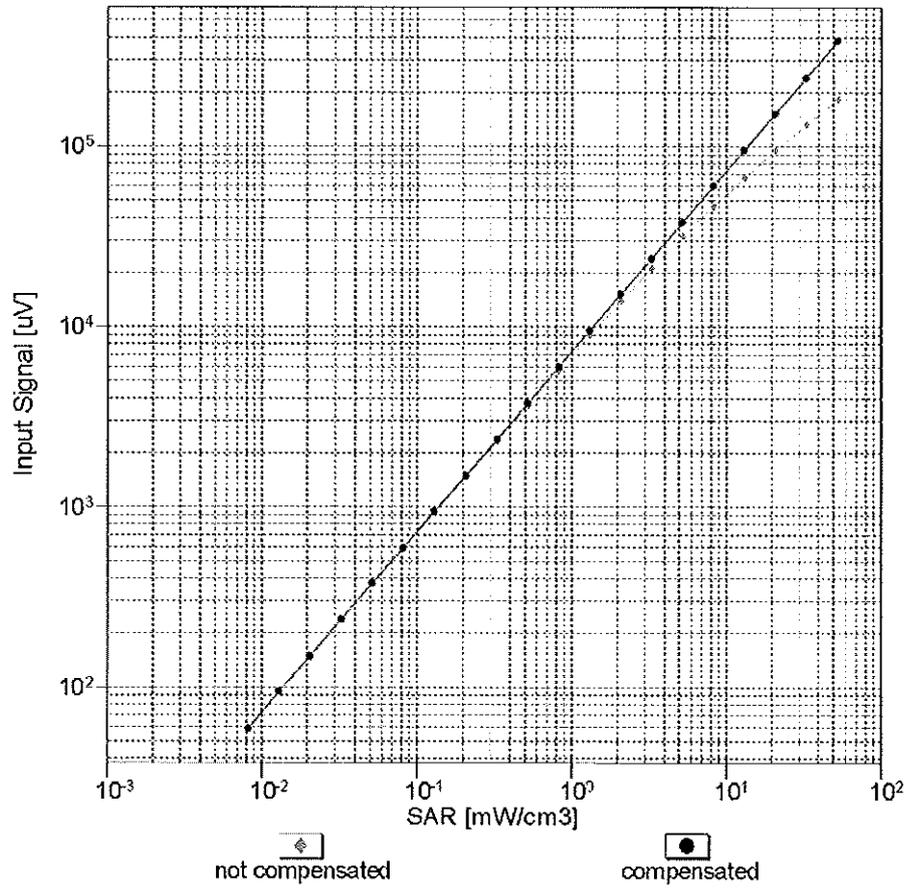
f=600 MHz,TEM

f=1800 MHz,R22



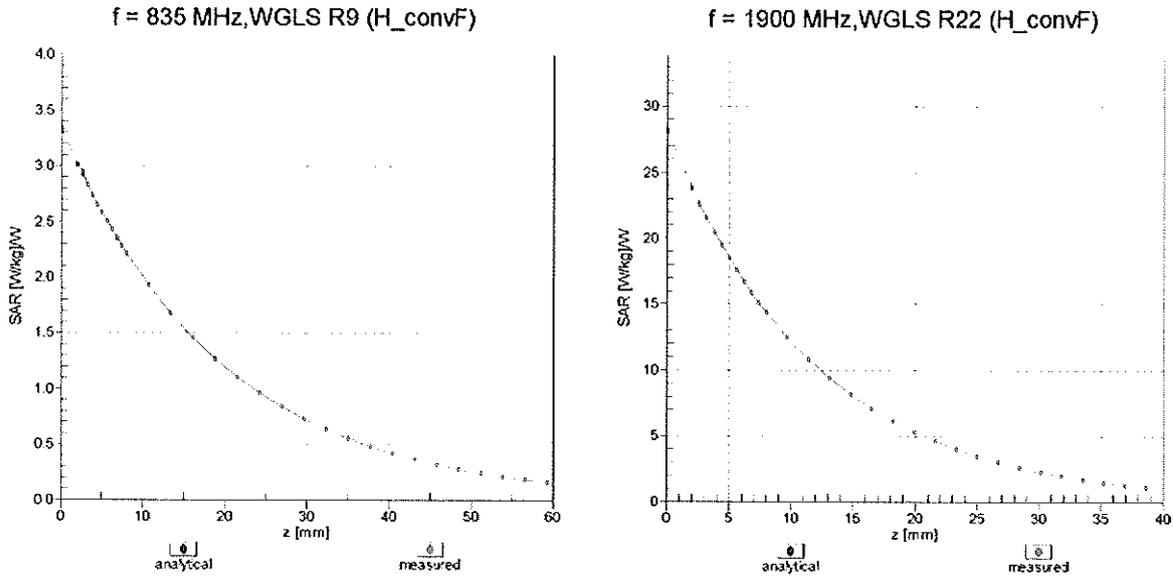
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(SAR_{head})$ (TEM cell , $f = 900$ MHz)

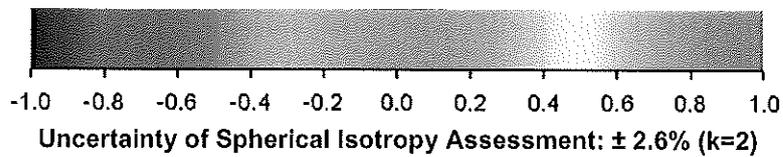
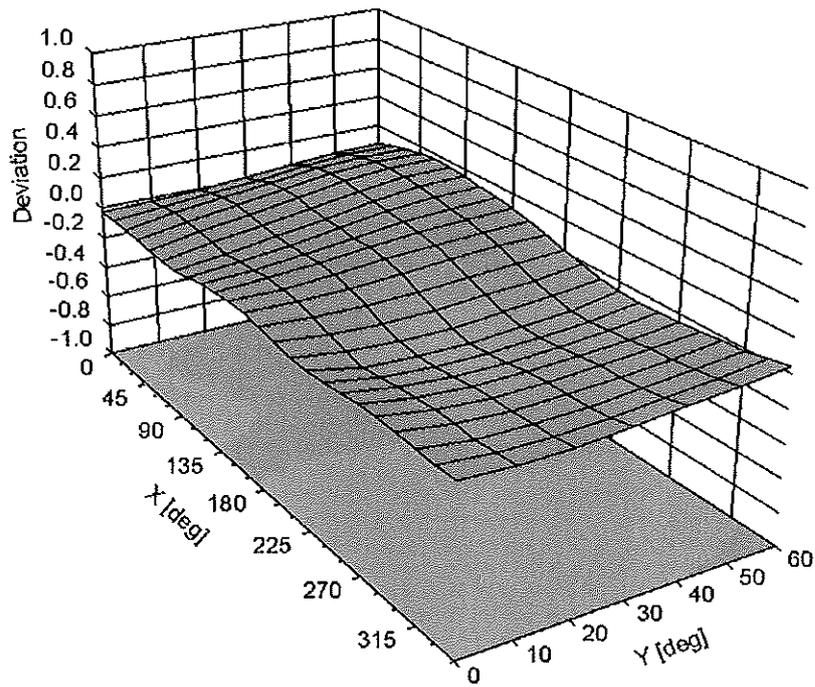


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



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



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213**Other Probe Parameters**

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 140.1 |
| 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 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 **PC Test**

Certificate No: **ES3-3263_May12**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3263**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes**

Calibration date: **May 18, 2012**

✓ Pok 6/5/12

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B | GB41293874 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Power sensor E4412A | MY41498087 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 27-Mar-12 (No. 217-01531) | Apr-13 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529) | Apr-13 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532) | Apr-13 |
| Reference Probe ES3DV2 | SN: 3013 | 29-Dec-11 (No. ES3-3013_Dec11) | Dec-12 |
| DAE4 | SN: 660 | 10-Jan-12 (No. DAE4-660_Jan12) | Jan-13 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (in house check Apr-11) | In house check: Apr-13 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

| | | | |
|----------------|-------------------------------|--|---------------------------------|
| Calibrated by: | Name Jeton Kastrali | Function Laboratory Technician | Signature <i>[Signature]</i> |
| Approved by: | Name Kalja Pokovic | Function Technical Manager | Signature <i>[Signature]</i> |

Issued: May 21, 2012

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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 | 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., $\vartheta = 0$ is normal to probe axis |

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 NORM_{x,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 ES3DV3

SN:3263

Manufactured: January 25, 2010
Calibrated: May 18, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 1.21 | 1.23 | 1.12 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 100.1 | 99.6 | 104.5 | |

Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 0 | CW | 0.00 | X | 0.00 | 0.00 | 1.00 | 153.9 | $\pm 4.4 \%$ |
| | | | Y | 0.00 | 0.00 | 1.00 | 159.2 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 150.3 | |

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 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: ES3DV3 - SN:3263

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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 41.9 | 0.89 | 6.40 | 6.40 | 6.40 | 0.32 | 1.73 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 6.16 | 6.16 | 6.16 | 0.40 | 1.54 | ± 12.0 % |
| 1640 | 40.3 | 1.29 | 5.46 | 5.46 | 5.46 | 0.53 | 1.37 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 5.30 | 5.30 | 5.30 | 0.47 | 1.50 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 5.09 | 5.09 | 5.09 | 0.55 | 1.35 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 4.45 | 4.45 | 4.45 | 0.77 | 1.27 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 4.34 | 4.34 | 4.34 | 0.76 | 1.34 | ± 12.0 % |

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

^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.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

Calibration Parameter Determined in Body Tissue Simulating Media

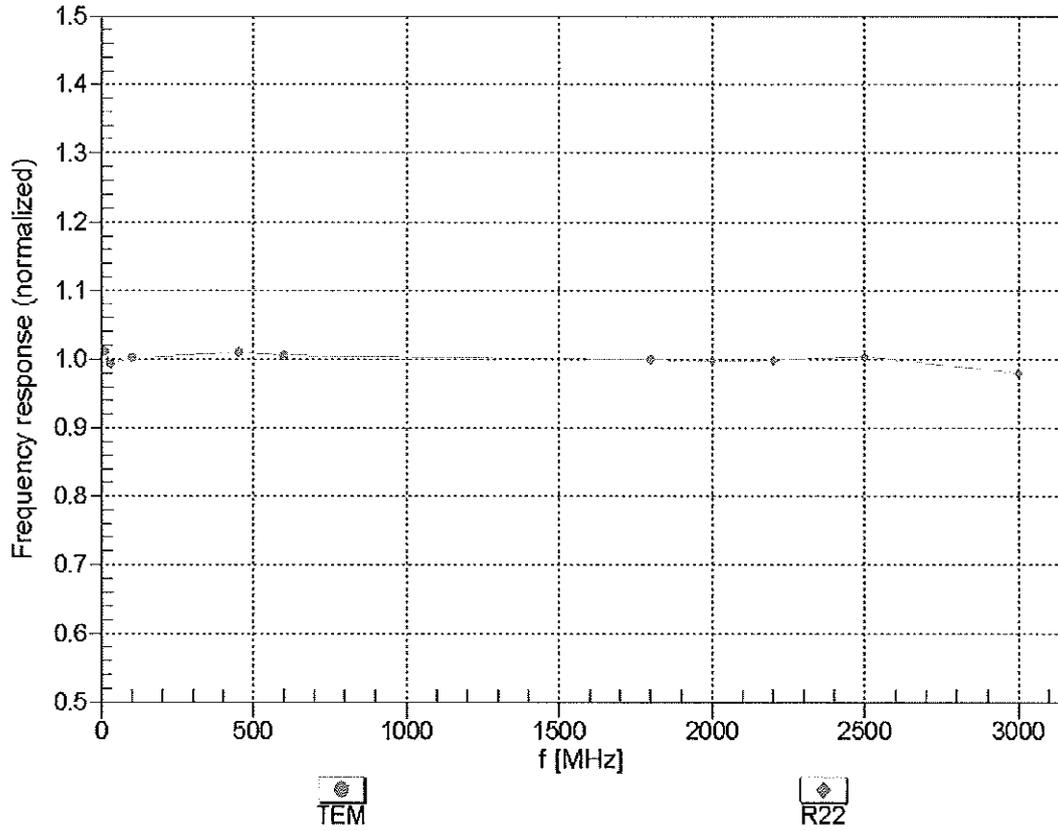
| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 450 | 56.7 | 0.94 | 7.05 | 7.05 | 7.05 | 0.08 | 1.15 | ± 13.4 % |
| 750 | 55.5 | 0.96 | 6.26 | 6.26 | 6.26 | 0.68 | 1.24 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 6.15 | 6.15 | 6.15 | 0.40 | 1.65 | ± 12.0 % |
| 1640 | 53.8 | 1.40 | 5.33 | 5.33 | 5.33 | 0.74 | 1.27 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 4.96 | 4.96 | 4.96 | 0.62 | 1.41 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 4.76 | 4.76 | 4.76 | 0.54 | 1.48 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 4.35 | 4.35 | 4.35 | 0.80 | 1.15 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 4.16 | 4.16 | 4.16 | 0.80 | 1.00 | ± 12.0 % |

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

^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.

Frequency Response of E-Field

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

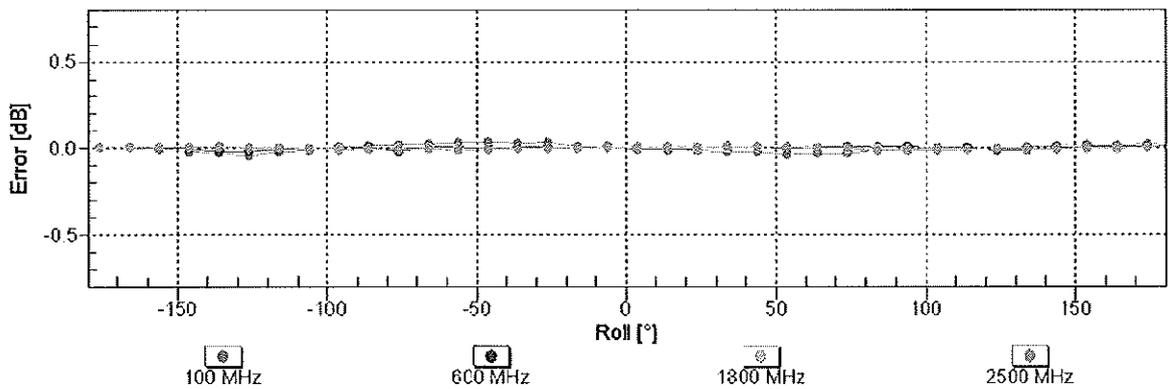
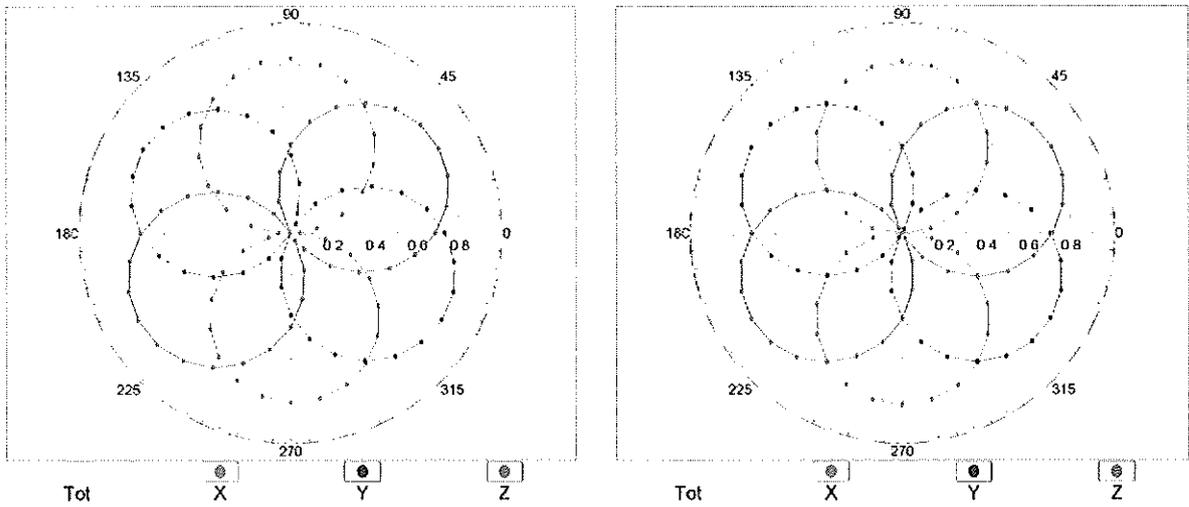


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

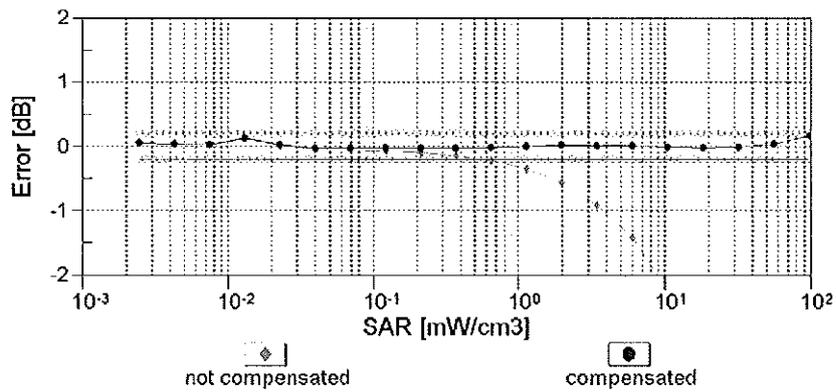
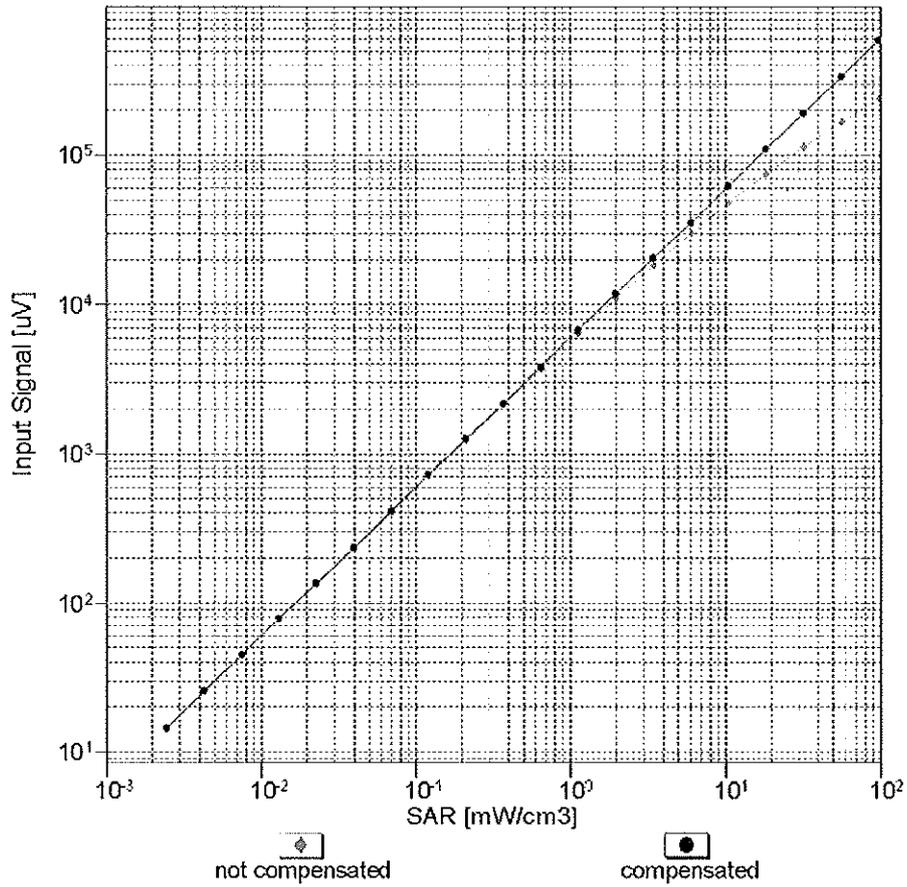
f=600 MHz,TEM

f=1800 MHz,R22



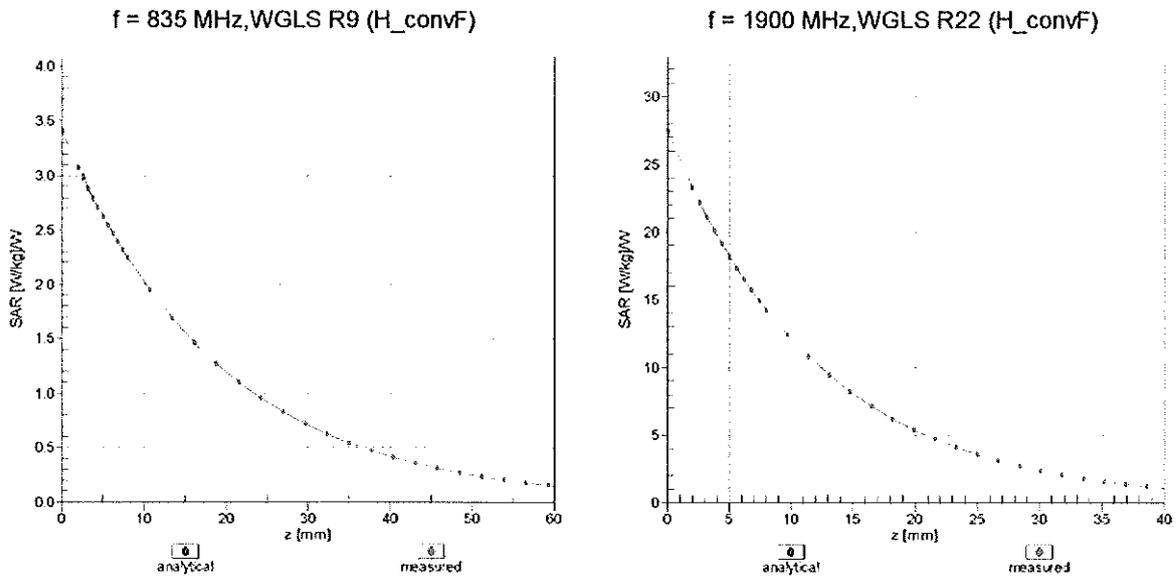
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f = 900 \text{ MHz}$)



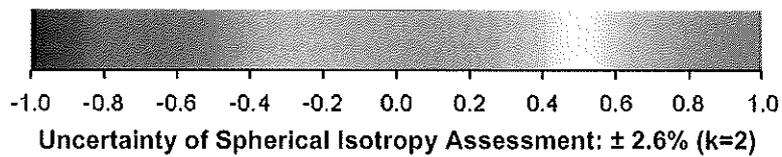
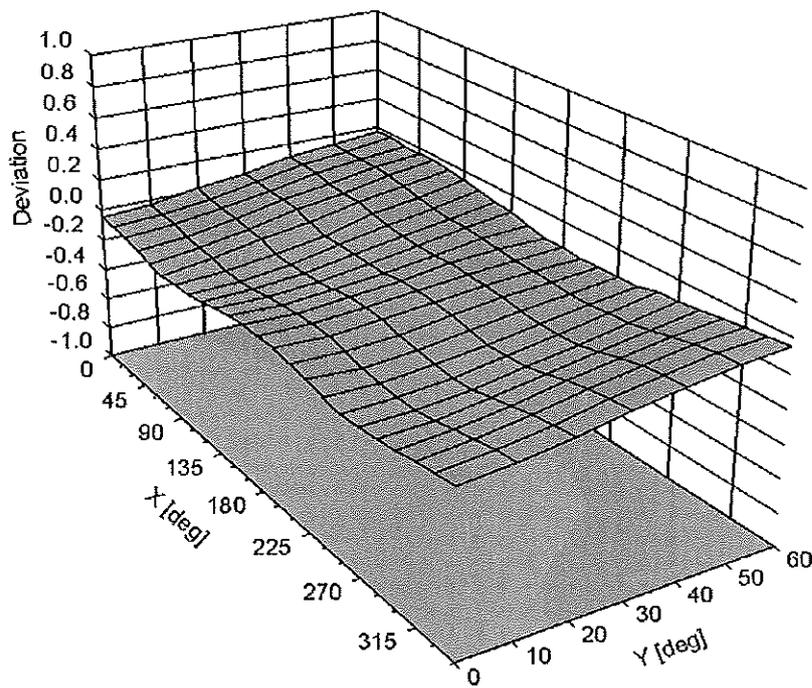
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 63.9 |
| 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 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 |

**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 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 **PC Test**

Certificate No: **ES3-3288_Sep12**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3288**

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

Calibration date: **September 20, 2012**

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)

*KOK
10/12/12*

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B | GB41293874 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Power sensor E4412A | MY41498087 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 27-Mar-12 (No. 217-01531) | Apr-13 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529) | Apr-13 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532) | Apr-13 |
| Reference Probe ES3DV2 | SN: 3013 | 29-Dec-11 (No. ES3-3013_Dec11) | Dec-12 |
| DAE4 | SN: 660 | 20-Jun-12 (No. DAE4-660_Jun12) | Jun-13 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (in house check Apr-11) | In house check: Apr-13 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-12 |

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

Issued: September 20, 2012

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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 |
| 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 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., $\vartheta = 0$ is normal to probe axis |

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 NORM_{x,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 ES3DV3

SN:3288

Manufactured: July 6, 2010
Calibrated: September 20, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3288

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.87 | 0.97 | 0.75 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 101.3 | 102.4 | 103.9 | |

Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|------|---|---------|---------|---------|----------|---------------------------|
| 0 | CW | 0.00 | X | 0.00 | 0.00 | 1.00 | 168.6 | $\pm 3.3 \%$ |
| | | | Y | 0.00 | 0.00 | 1.00 | 132.2 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 156.8 | |

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

^A The uncertainties of NormX,Y,Z do not affect the E^2 -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: ES3DV3 - SN:3288

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 | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 41.9 | 0.89 | 6.67 | 6.67 | 6.67 | 0.80 | 1.14 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 6.41 | 6.41 | 6.41 | 0.76 | 1.18 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 5.51 | 5.51 | 5.51 | 0.70 | 1.28 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 5.28 | 5.28 | 5.28 | 0.80 | 1.22 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 4.61 | 4.61 | 4.61 | 0.80 | 1.26 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 4.45 | 4.45 | 4.45 | 0.80 | 1.31 | ± 12.0 % |

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

^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.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3288

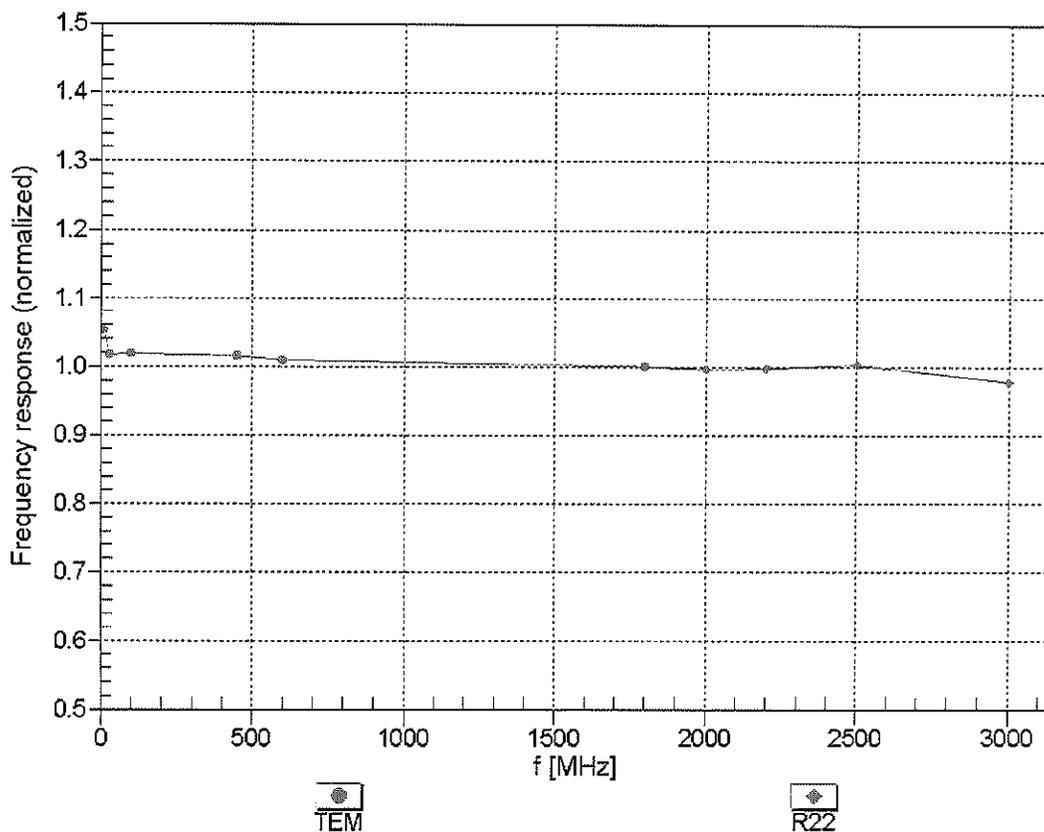
Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 55.5 | 0.96 | 6.44 | 6.44 | 6.44 | 0.62 | 1.31 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 6.31 | 6.31 | 6.31 | 0.38 | 1.78 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 5.18 | 5.18 | 5.18 | 0.64 | 1.43 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 4.89 | 4.89 | 4.89 | 0.50 | 1.64 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 4.35 | 4.35 | 4.35 | 0.74 | 1.23 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 4.09 | 4.09 | 4.09 | 0.80 | 1.07 | ± 12.0 % |

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

^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.

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

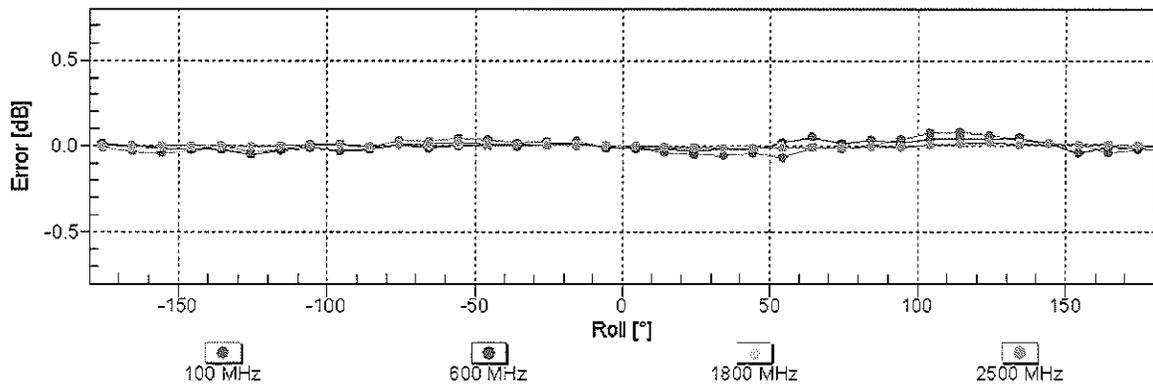
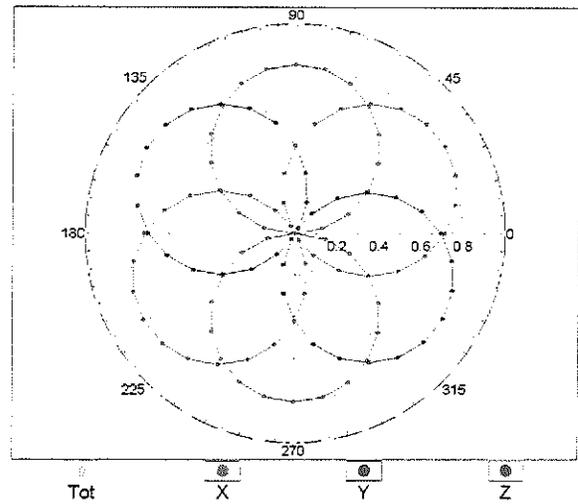
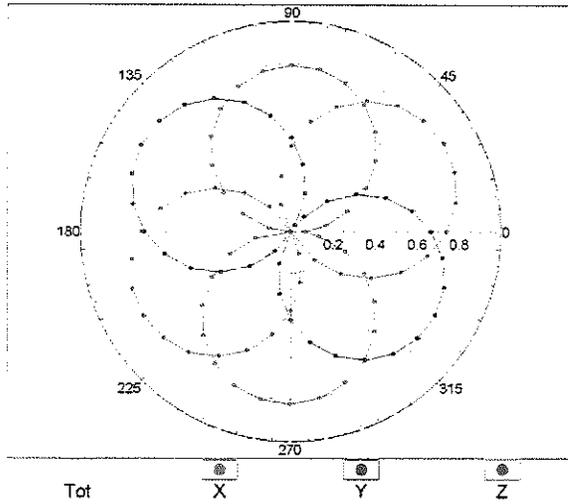


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

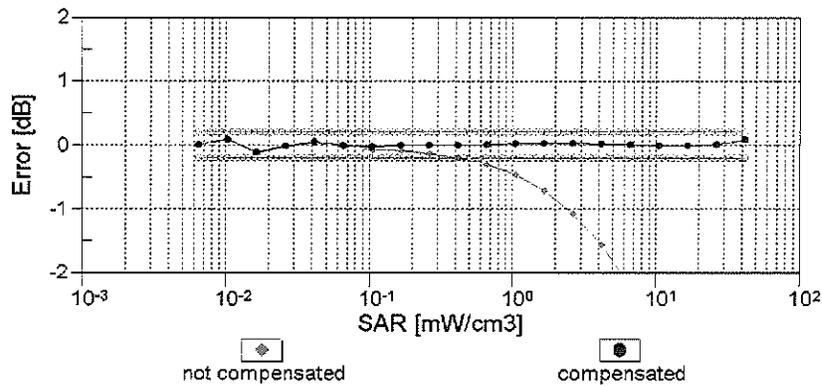
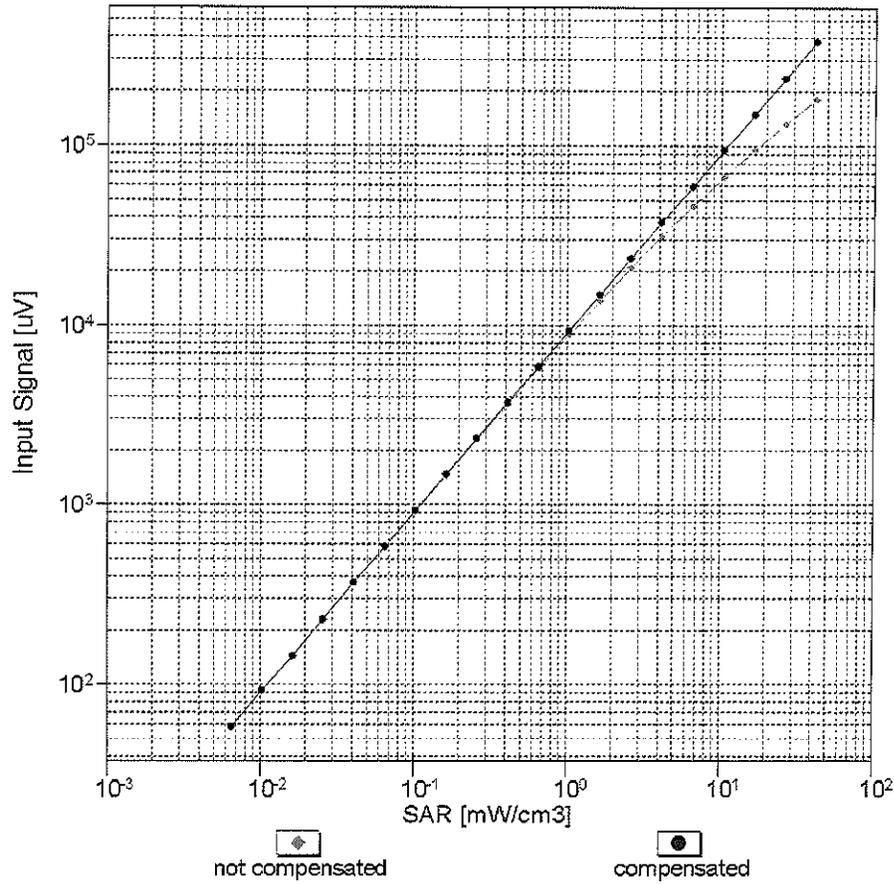
f=600 MHz,TEM

f=1800 MHz,R22



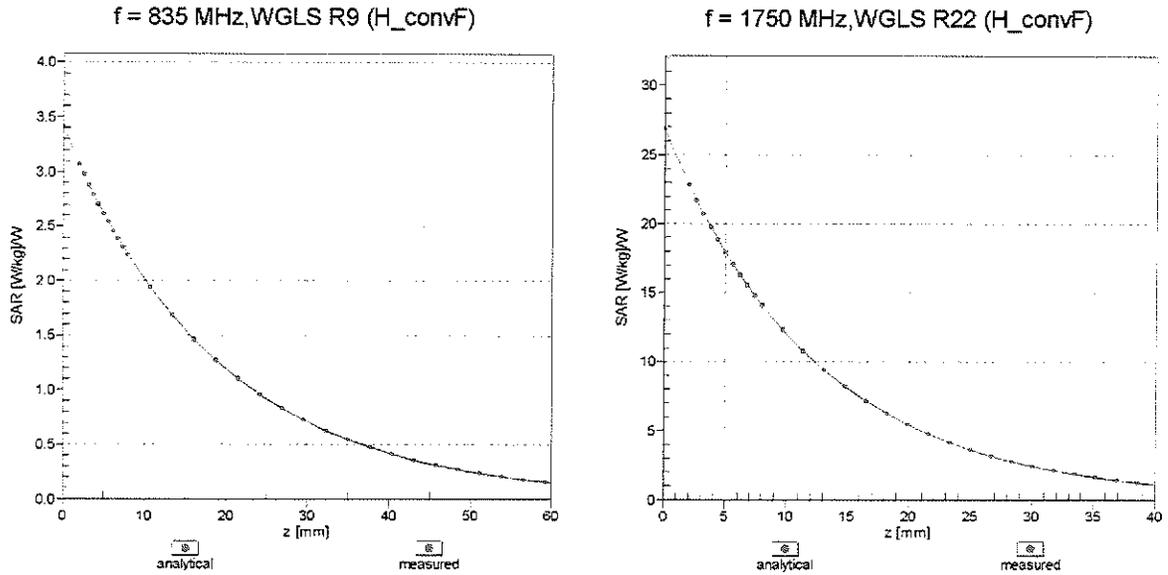
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range f(SAR_{head}) (TEM cell , f = 900 MHz)



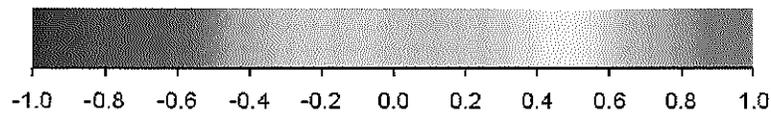
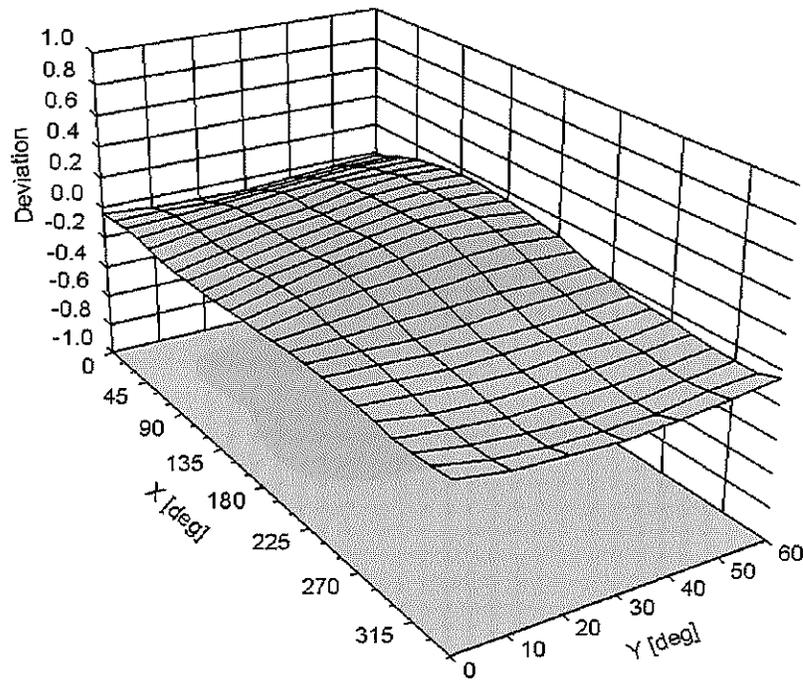
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ , θ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3288

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 54.3 |
| 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 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 |

APPENDIX 8 : SAR T=GGI 9 GD97 = =7 5 H=CBG

APPENDIX D: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue verification:

- 1) The network analyzer and probe system was configured and calibrated.
- 2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
- 3) The complex admittance with respect to the probe aperture was measured
- 4) The complex relative permittivity ϵ can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\epsilon_r\epsilon_0}{[\ln(b/a)]^2} \int_a^b \int_a^b \int_0^\pi \frac{\cos\phi' \exp[-j\omega r(\mu_0\epsilon_r'\epsilon_0)^{1/2}]}{r} d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho' \cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

**Table D-I
Composition of the Tissue Equivalent Matter**

| Frequency (MHz) | 835 | 835 | 1750 | 1750 | 1900 | 1900 | 2450 | 2450 |
|---------------------------|-------|-------|------|------|-------|-------|------------------|------|
| Tissue | Head | Body | Head | Body | Head | Body | Head | Body |
| Ingredients (% by weight) | | | | | | | | |
| Bactericide | 0.1 | 0.1 | | | | | See Next Page | |
| DGBE | | | 47 | 31 | 44.92 | 29.44 | | 26.7 |
| HEC | 1 | 1 | | | | | | |
| NaCl | 1.45 | 0.94 | 0.4 | 0.2 | 0.18 | 0.39 | | 0.1 |
| Sucrose | 57 | 44.9 | | | | | | |
| Water | 40.45 | 53.06 | 52.6 | 68.8 | 54.9 | 70.17 | | 73.2 |

| | | | | |
|------------------------------------|---|------------------------------|---|---------------------------------|
| FCC ID: A3LSGHT599 |  | SAR EVALUATION REPORT |  | Reviewed by: Quality Manager |
| Test Dates: 01/09/13 - 01/12/13 | DUT Type: Portable Handset | APPENDIX D: Page 1 of 1 | | |

2 Composition / Information on ingredients

The Item is composed of the following ingredients:

| | |
|---------|---|
| H2O | Water, 52 – 75% |
| C8H18O3 | Diethylene glycol monobutyl ether (DGBE), 25 – 48% (CAS-No. 112-34-5, EC-No. 203-961-6, EC-index-No. 603-096-00-8) Relevant for safety; Refer to the respective Safety Data Sheet*. |
| NaCl | Sodium Chloride, <1.0% |

Figure D-1
Composition of 2.4 GHz Head Tissue Equivalent Matter

Note: 2.4 GHz head liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

Measurement Certificate / Material Test

| | |
|--------------|--|
| Item Name | Head Tissue Simulating Liquid (HSL 2450) |
| Product No. | SL AAH 245 BA (Charge: 110718-3) |
| Manufacturer | SPEAG |

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe (type DAK).

Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

Test Condition

Ambient Condition 22°C; 30% humidity
TSL Temperature 23°C
Test Date 20-Jul-11

Additional Information

TSL Density 0.988 g/cm³
TSL Heat-capacity 3.680 kJ/(kg*K)

Results

| f (MHz) | Measured | | | Target | | Diff.to Target (%) | |
|-------------|-------------|--------------|-------------|-------------|-------------|--------------------|------------|
| | HP-e' | HP-o' | sigma | eps | sigma | Δ-eps | Δ-sigma |
| 1900 | 40.5 | 11.75 | 1.24 | 40.0 | 1.40 | 1.3 | -11.3 |
| 1925 | 40.4 | 11.84 | 1.27 | 40.0 | 1.40 | 1.1 | -9.4 |
| 1950 | 40.3 | 11.93 | 1.29 | 40.0 | 1.40 | 0.8 | -7.6 |
| 1975 | 40.2 | 12.01 | 1.32 | 40.0 | 1.40 | 0.6 | -5.7 |
| 2000 | 40.1 | 12.10 | 1.35 | 40.0 | 1.40 | 0.3 | -3.8 |
| 2025 | 40.0 | 12.19 | 1.37 | 40.0 | 1.42 | 0.2 | -3.4 |
| 2050 | 40.0 | 12.29 | 1.40 | 39.9 | 1.44 | 0.1 | -3.0 |
| 2075 | 39.9 | 12.39 | 1.43 | 39.9 | 1.47 | 0.0 | -2.5 |
| 2100 | 39.8 | 12.48 | 1.46 | 39.8 | 1.49 | -0.1 | -2.0 |
| 2125 | 39.7 | 12.59 | 1.49 | 39.8 | 1.51 | -0.3 | -1.5 |
| 2150 | 39.5 | 12.69 | 1.52 | 39.7 | 1.53 | -0.5 | -1.0 |
| 2175 | 39.4 | 12.77 | 1.55 | 39.7 | 1.56 | -0.6 | -0.6 |
| 2200 | 39.3 | 12.86 | 1.57 | 39.6 | 1.58 | -0.8 | -0.3 |
| 2225 | 39.2 | 12.94 | 1.60 | 39.6 | 1.60 | -1.0 | 0.1 |
| 2250 | 39.1 | 13.03 | 1.63 | 39.6 | 1.62 | -1.1 | 0.5 |
| 2275 | 39.0 | 13.10 | 1.66 | 39.5 | 1.64 | -1.3 | 0.9 |
| 2300 | 38.9 | 13.18 | 1.69 | 39.5 | 1.67 | -1.4 | 1.2 |
| 2325 | 38.8 | 13.25 | 1.71 | 39.4 | 1.69 | -1.6 | 1.4 |
| 2350 | 38.7 | 13.31 | 1.74 | 39.4 | 1.71 | -1.7 | 1.7 |
| 2375 | 38.6 | 13.39 | 1.77 | 39.3 | 1.73 | -1.9 | 2.1 |
| 2400 | 38.5 | 13.47 | 1.80 | 39.3 | 1.76 | -2.0 | 2.5 |
| 2425 | 38.4 | 13.54 | 1.83 | 39.2 | 1.78 | -2.1 | 2.8 |
| 2450 | 38.3 | 13.61 | 1.86 | 39.2 | 1.80 | -2.3 | 3.1 |
| 2475 | 38.2 | 13.69 | 1.89 | 39.2 | 1.83 | -2.5 | 3.2 |
| 2500 | 38.1 | 13.78 | 1.92 | 39.1 | 1.85 | -2.7 | 3.3 |
| 2525 | 38.0 | 13.85 | 1.95 | 39.1 | 1.88 | -2.8 | 3.4 |
| 2550 | 37.9 | 13.92 | 1.97 | 39.1 | 1.91 | -3.0 | 3.4 |
| 2575 | 37.8 | 13.99 | 2.00 | 39.0 | 1.94 | -3.2 | 3.5 |
| 2600 | 37.7 | 14.06 | 2.03 | 39.0 | 1.96 | -3.5 | 3.6 |
| 2625 | 37.6 | 14.14 | 2.06 | 39.0 | 1.99 | -3.6 | 3.7 |
| 2650 | 37.4 | 14.21 | 2.10 | 38.9 | 2.02 | -3.8 | 3.8 |
| 2675 | 37.3 | 14.26 | 2.12 | 38.9 | 2.05 | -4.0 | 3.8 |
| 2700 | 37.2 | 14.32 | 2.15 | 38.9 | 2.07 | -4.2 | 3.7 |

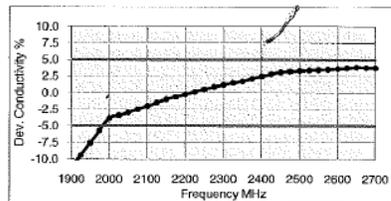
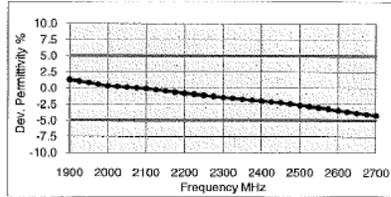


Figure D-2
2.4 GHz Head Tissue Equivalent Matter

| | | | | |
|------------------------------------|---|-----------------------|---|---------------------------------|
| FCC ID: A3LSGHT599 |  | SAR EVALUATION REPORT |  | Reviewed by: Quality Manager |
| Test Dates: 01/09/13 - 01/12/13 | DUT Type: Portable Handset | | | APPENDIX D: Page 2 of 2 |

APPENDIX 9: G5 F SYSTEM V5 @-8 5 H=C B

APPENDIX E: SAR SYSTEM VALIDATION

Per FCC KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2003 and FCC KDB 865664 D01 v01. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Table E-I
SAR System Validation Summary

| SAR SYSTEM # | FREQ. [MHz] | DATE | PROBE SN | PROBE TYPE | PROBE CAL. POINT | | COND. | PERM. | CW VALIDATION | | | MOD. VALIDATION | | |
|--------------|-------------|------------|----------|------------|------------------|------|--------------|------------------|---------------|-----------------|----------------|-----------------|-------------|------|
| | | | | | | | (σ) | (ϵ_r) | SENSI- TIVITY | PROBE LINEARITY | PROBE ISOTROPY | MOD. TYPE | DUTY FACTOR | PAR |
| D | 835 | 10/17/2012 | 3288 | ES3DV3 | 835 | Head | 0.899 | 42.07 | PASS | PASS | PASS | GMSK | PASS | N/A |
| E | 1750 | 10/16/2012 | 3263 | ES3DV3 | 1750 | Head | 1.386 | 38.47 | PASS | PASS | PASS | N/A | N/A | N/A |
| E | 1900 | 10/17/2012 | 3263 | ES3DV3 | 1900 | Head | 1.446 | 40.76 | PASS | PASS | PASS | GMSK | PASS | N/A |
| A | 2450 | 1/7/2013 | 3022 | ES3DV3 | 2450 | Head | 1.836 | 37.78 | PASS | PASS | PASS | OFDM | N/A | PASS |
| B | 835 | 10/15/2012 | 3209 | ES3DV3 | 835 | Body | 0.984 | 55.43 | PASS | PASS | PASS | GMSK | PASS | N/A |
| B | 1750 | 10/23/2012 | 3209 | ES3DV3 | 1750 | Body | 1.541 | 55.14 | PASS | PASS | PASS | N/A | N/A | N/A |
| G | 1900 | 10/17/2012 | 3213 | ES3DV3 | 1900 | Body | 1.406 | 40.09 | PASS | PASS | PASS | GMSK | PASS | N/A |
| A | 2450 | 1/7/2013 | 3022 | ES3DV3 | 2450 | Body | 1.937 | 50.36 | PASS | PASS | PASS | OFDM | N/A | PASS |

| | | | | |
|------------------------------------|---|------------------------------|---|---------------------------------|
| FCC ID: A3LSGHT599 |  | SAR EVALUATION REPORT |  | Reviewed by: Quality Manager |
| Test Dates: 01/09/13 - 01/12/13 | DUT Type: Portable Handset | APPENDIX E: Page 1 of 1 | | |