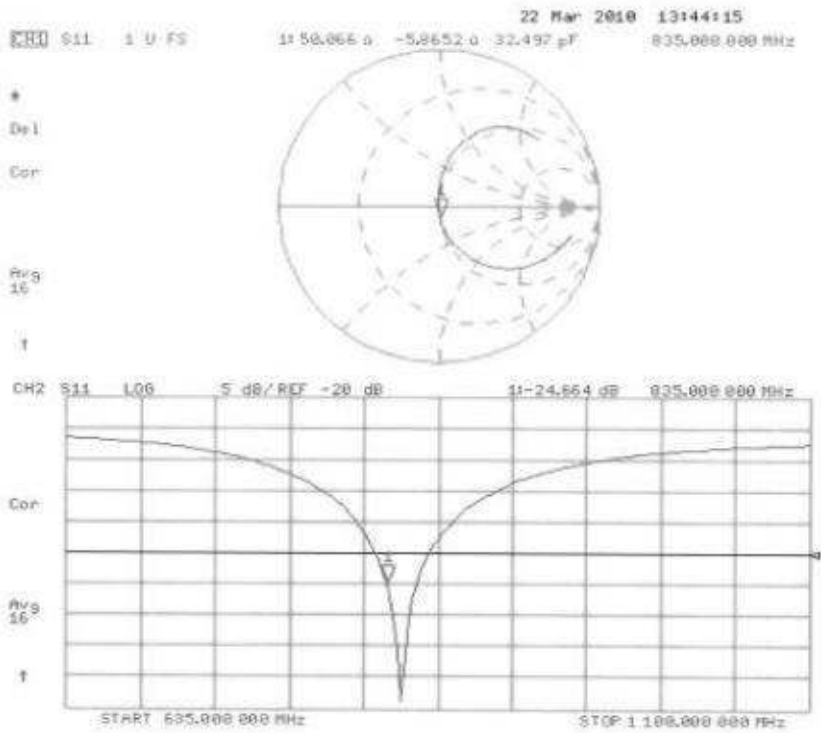




Impedance Measurement Plot for Body TSL



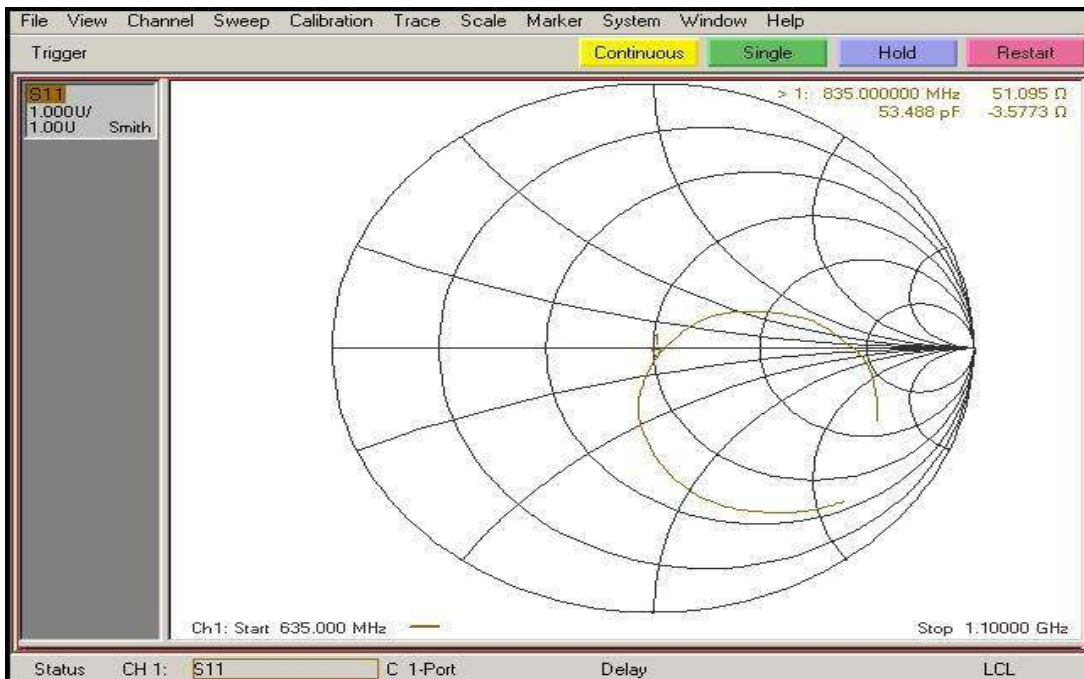


D835V2, serial no. 499 Extended Dipole Calibrations

Referring to KDB 450824, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

<Dipole Verification Data> - D835 V2, serial no. 499

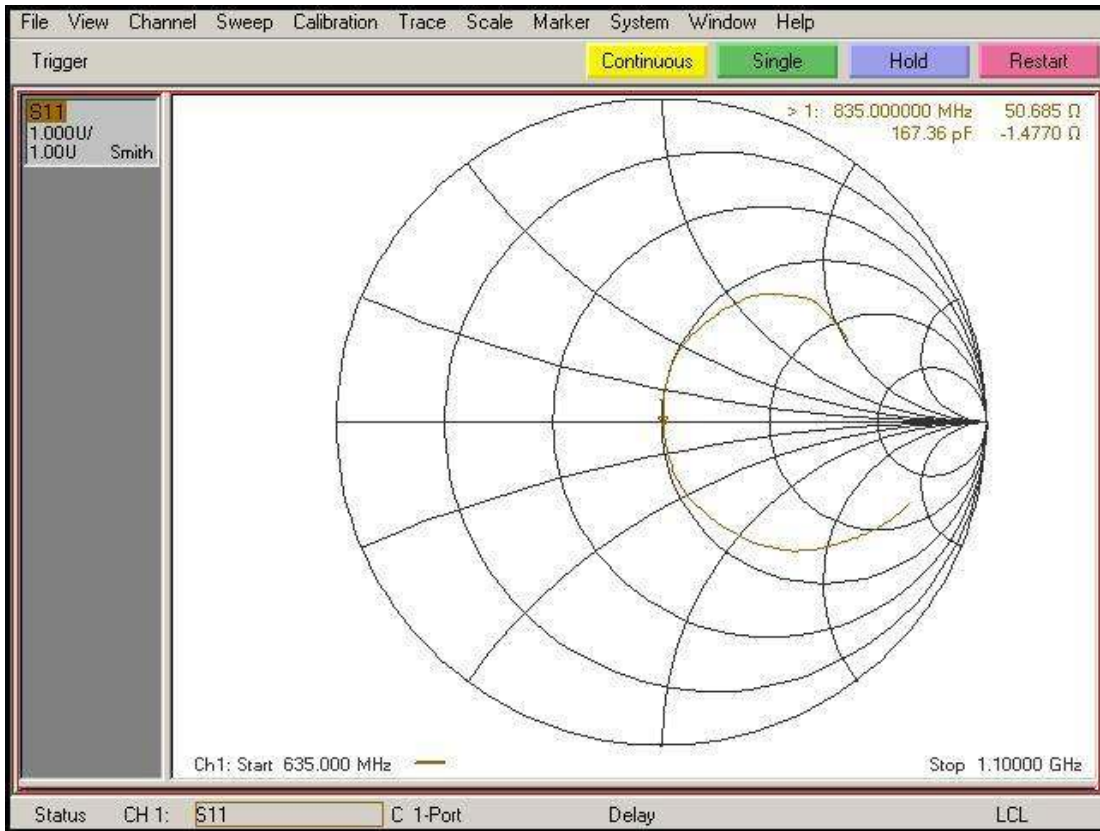
835 MHz - Head





FCC Test Report

835 MHz – Body



SPORTON INTERNATIONAL INC.

TEL : 886-3-327-3456

FAX : 886-3-328-4978



<Justification of the extended calibration>

| D835V2 – serial no. 499 | | | | | | | | | | | | |
|-------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| | 835 Head | | | | | | 835 Body | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 3.22.2010 | -28.352 | | 52.17 | | -3.2461 | | -24.664 | | 50.066 | | -5.8652 | |
| 3.22.2011 | -28.323 | 0.102 | 51.095 | 1.075 | -3.5773 | 0.331 | -24.665 | -0.004 | 50.685 | -0.619 | -1.477 | -4.388 |

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **D1800V2-2d052_Jun11**

CALIBRATION CERTIFICATE

Object **D1800V2 - SN: 2d052**

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

Calibration date: **June 16, 2011**

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 | 06-Oct-10 (No. 217-01266) | Oct-11 |
| Power sensor HP 8481A | US37292783 | 06-Oct-10 (No. 217-01266) | Oct-11 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-11 (No. 217-01367) | Apr-12 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371) | Apr-12 |
| Reference Probe ES3DV3 | SN: 3205 | 29-Apr-11 (No. ES3-3205_Apr11) | Apr-12 |
| DAE4 | SN: 601 | 8-Jun-11 (No. DAE4-601_Jun11) | Jun-12 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06 | 100005 | 4-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

Calibrated by: **Dimce Iliev** Laboratory Technician *D. Iliev*

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

Issued: June 16, 2011

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "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
- c) 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:

- d) 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 | V52.6.2 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 1800 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 | 39.1 \pm 6 % | 1.35 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 | 9.24 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 37.6 mW / g \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 4.88 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 19.7 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 | 52.4 \pm 6 % | 1.48 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 | 9.33 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 37.8 mW / g \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 4.93 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 19.8 mW / g \pm 16.5 % (k=2) |

Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 47.6 Ω - 4.7 j Ω |
| Return Loss | - 25.3 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 42.9 Ω - 4.9 j Ω |
| Return Loss | - 20.6 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.215 ns |
|----------------------------------|----------|

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

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

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

Additional EUT Data

| | |
|-----------------|---------------|
| Manufactured by | SPEAG |
| Manufactured on | July 05, 2002 |

DASY5 Validation Report for Head TSL

Date: 15.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d052

Communication System: CW; Frequency: 1800 MHz

Medium: HSL U12 BB

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.35$ mho/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.07, 5.07, 5.07); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

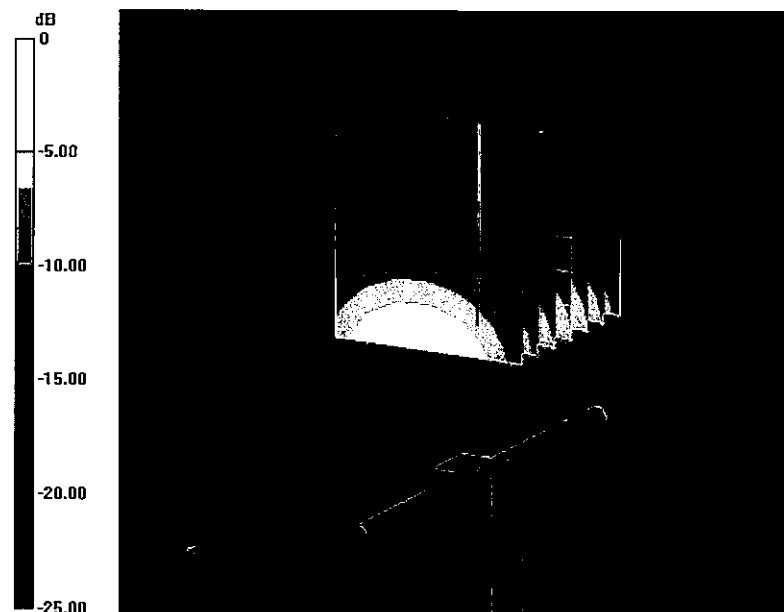
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.194 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 16.482 W/kg

SAR(1 g) = 9.24 mW/g; SAR(10 g) = 4.88 mW/g

Maximum value of SAR (measured) = 11.480 mW/g



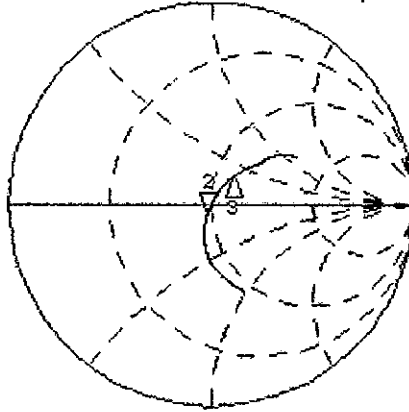
0 dB = 11.480mW/g

Impedance Measurement Plot for Head TSL

15 Jun 2011 15:34:51

CH1 S11 1 U FS 2: 47.600 Ω -4.7344 Ω 18.676 μ F 1 800.000 000 MHz

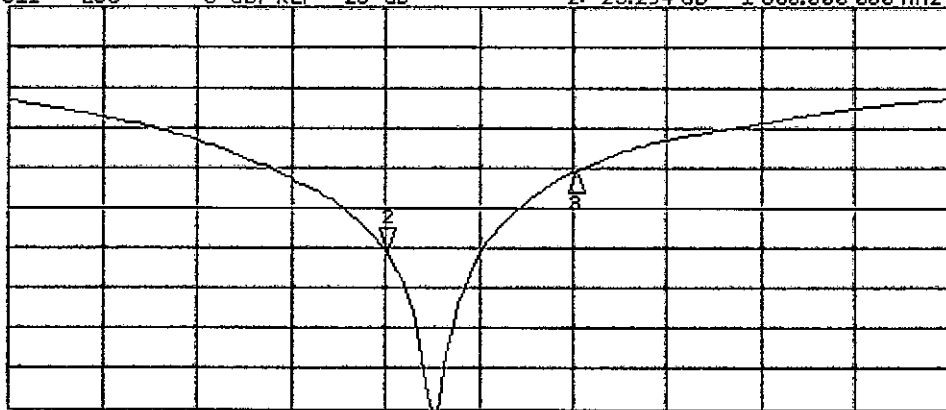
*
De l
CA
Avg
16
H1 d



CH1 Markers
3: 58.734 Ω
15.082 Ω
1.90000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 2: -25.294 dB 1 800.000 000 MHz

CA
Avg
16
H1 d



CH2 Markers
3: -15.570 dB
1.90000 GHz

START 1 600.000 000 MHz

STOP 2 100.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 16.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d052

Communication System: CW; Frequency: 1800 MHz

Medium: MSL U12 BB

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.48$ mho/m; $\epsilon_r = 52.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.74, 4.74, 4.74); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

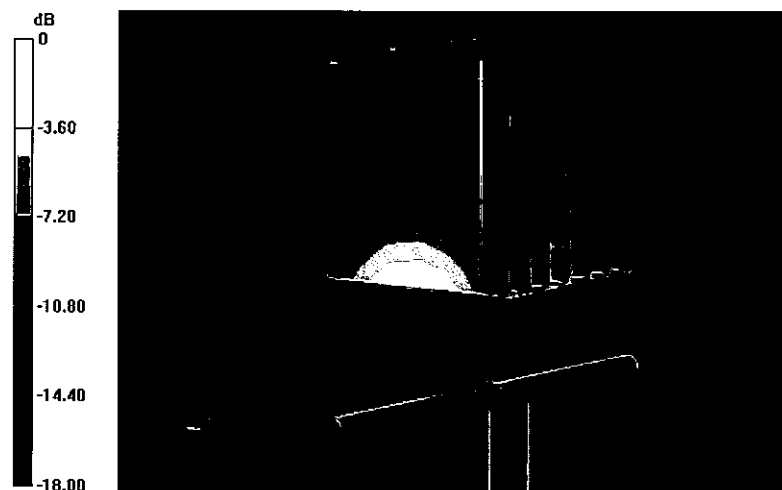
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.030 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 16.493 W/kg

SAR(1 g) = 9.33 mW/g; SAR(10 g) = 4.93 mW/g

Maximum value of SAR (measured) = 11.761 mW/g



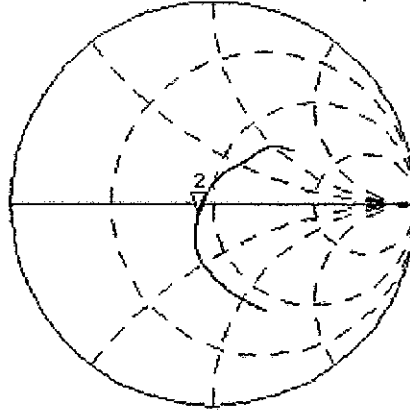
0 dB = 11.760mW/g

Impedance Measurement Plot for Body TSL

16 Jun 2011 09:31:14

[CH1] S11 1 U FS 2: 42.867 Ω -4.8848 Ω 18.101 pF 1 800.000 000 MHz

*
De1
Cor



Avg
15

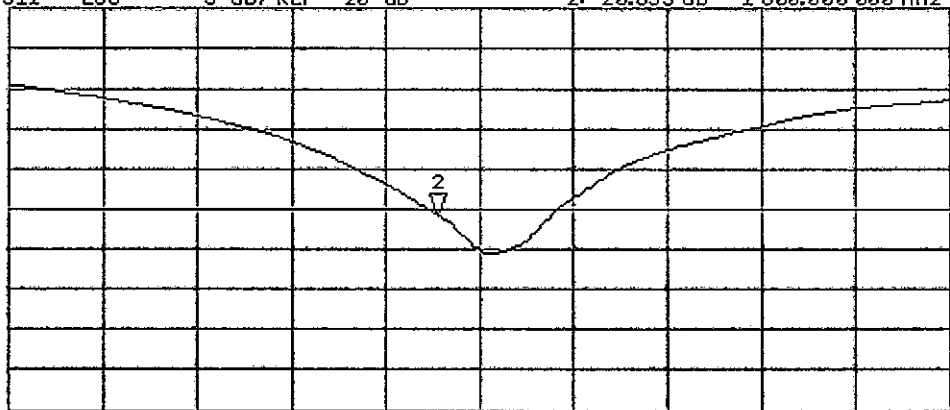
H1 d

CH2 S11 LOG 5 dB/REF -20 dB 2:-20.633 dB 1 800.000 000 MHz

Cor

Avg
15

H1 d



START 1 550.000 000 MHz

STOP 2 100.000 000 MHz



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



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Accreditation No.: SCS 108

Client Sporton (Auden)

Certificate No: D1900V2-5d041_Mar10

CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d041
Calibration procedure(s): QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date: March 23, 2010

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)

Table with 4 columns: Primary Standards, ID #, Cal Date (Certificate No.), Scheduled Calibration. Lists equipment like Power meter EPM-442A, Power sensor HP 8481A, Reference 20 dB Attenuator, etc.

Calibrated by: Name Dimce Iliev, Function Laboratory Technician, Signature [Handwritten]
Approved by: Name Katja Pokovic, Function Technical Manager, Signature [Handwritten]

Issued: March 23, 2010

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



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



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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:

- 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
- c) 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:

- d) 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 | V5.2 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom V5.0 | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 1900 MHz \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 | 41.1 \pm 6 % | 1.45 mho/m \pm 6 % |
| Head TSL temperature during test | (21.5 \pm 0.2) °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 10.1 mW / g |
| SAR normalized | normalized to 1W | 40.4 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 39.6 mW / g \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 5.25 mW / g |
| SAR normalized | normalized to 1W | 21.0 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 20.9 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 ± 0.2) °C | 54.9 ± 6 % | 1.58 mho/m ± 6 % |
| Body TSL temperature during test | (21.5 ± 0.2) °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 10.4 mW / g |
| SAR normalized | normalized to 1W | 41.6 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 40.0 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 5.57 mW / g |
| SAR normalized | normalized to 1W | 22.3 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 22.1 mW / g ± 16.5 % (k=2) |



Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.9 Ω + 5.9 j Ω |
| Return Loss | - 24.6 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 46.3 Ω + 5.7 j Ω |
| Return Loss | - 23.1 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.202 ns |
|----------------------------------|----------|

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

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

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

Additional EUT Data

| | |
|-----------------|---------------|
| Manufactured by | SPEAG |
| Manufactured on | July 04, 2003 |

DASY5 Validation Report for Head TSL

Date/Time: 23.03.2010 12:03:30

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d041

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

Medium: HSL U11 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 41.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.03.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

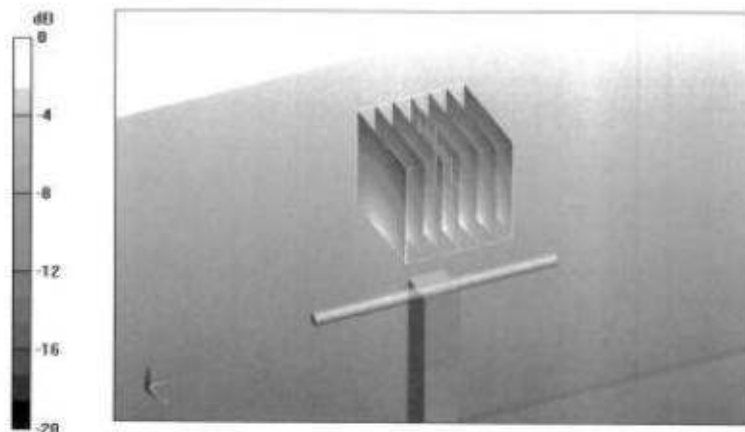
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.8 V/m; Power Drift = 0.040 dB

Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.25 mW/g

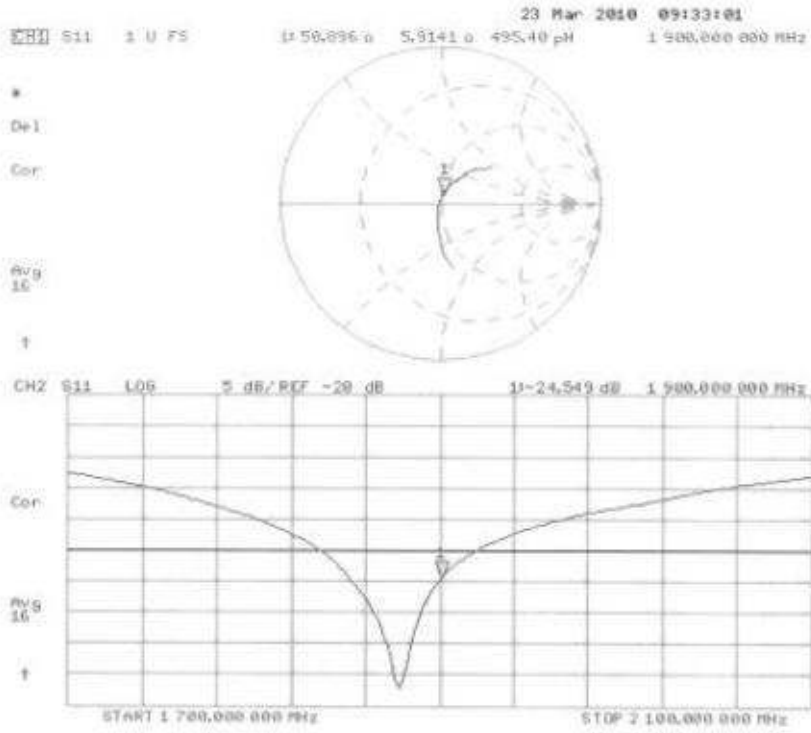
Maximum value of SAR (measured) = 12.7 mW/g



0 dB = 12.7mW/g



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body

Date/Time: 17.03.2010 12:43:32

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d041

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

Medium: MSL U11 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.58$ mho/m; $\epsilon_r = 55$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.03.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Pin250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement

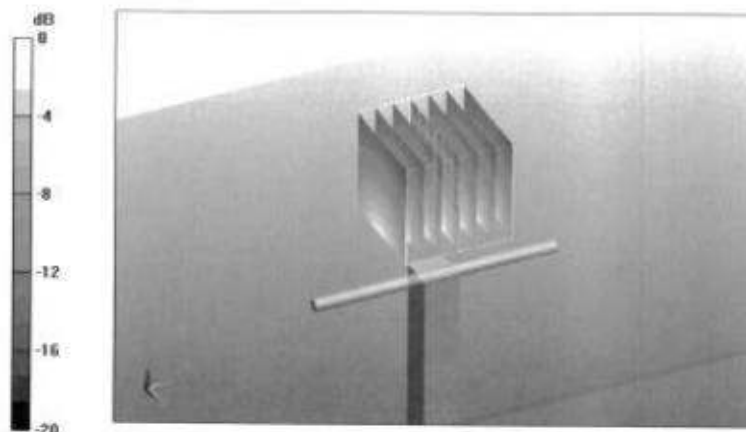
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.1 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 17.5 W/kg

SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.57 mW/g

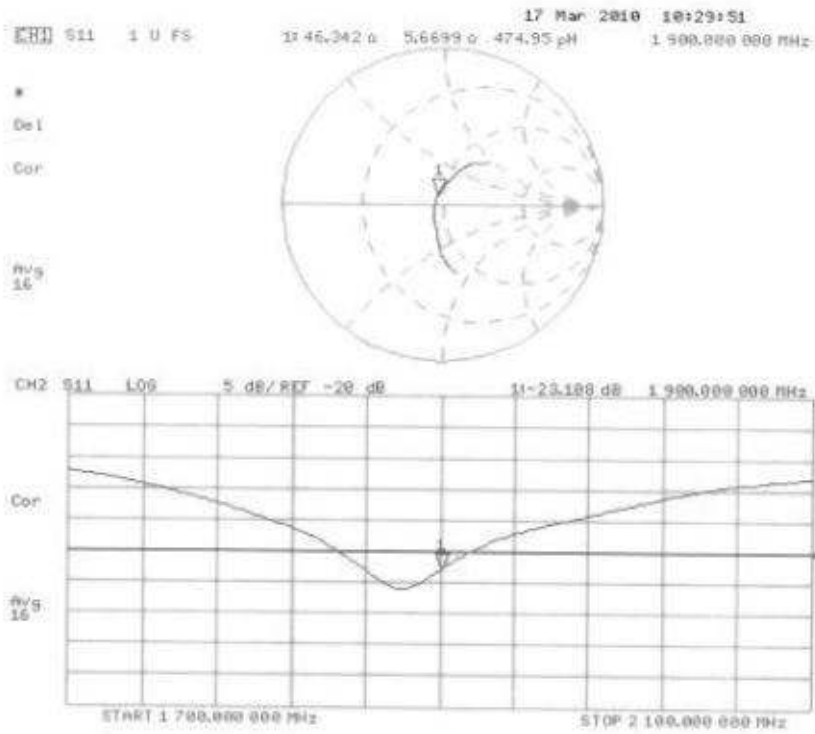
Maximum value of SAR (measured) = 13.1 mW/g



0 dB = 13.1mW/g



Impedance Measurement Plot for Body TSL



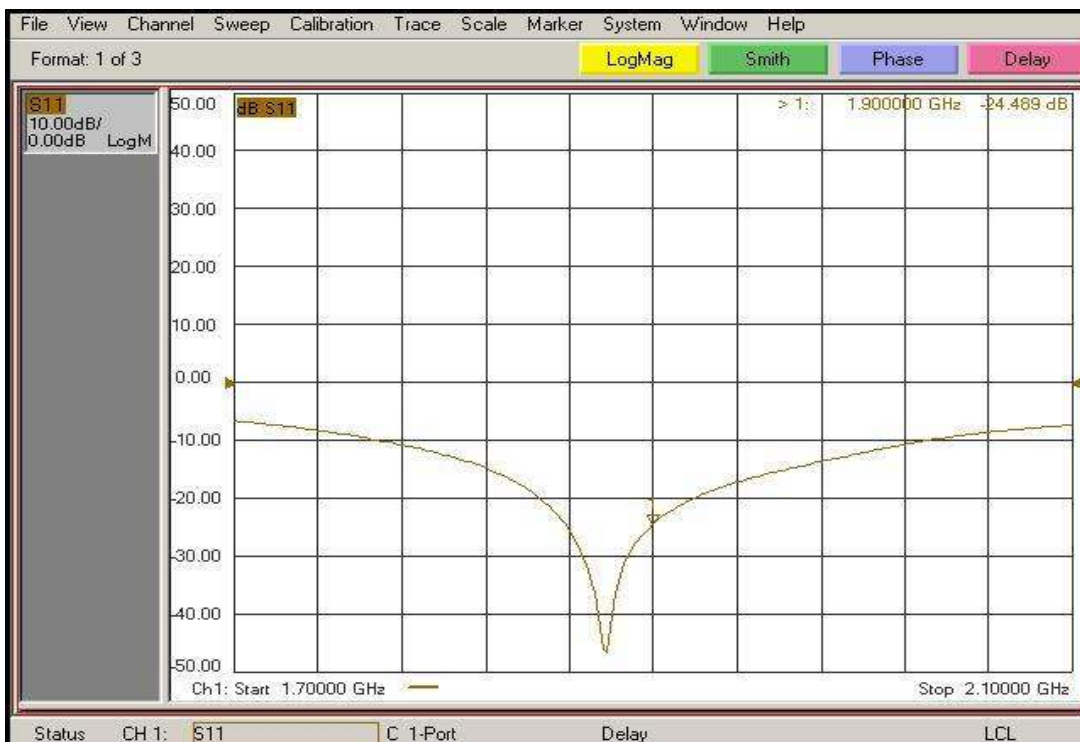
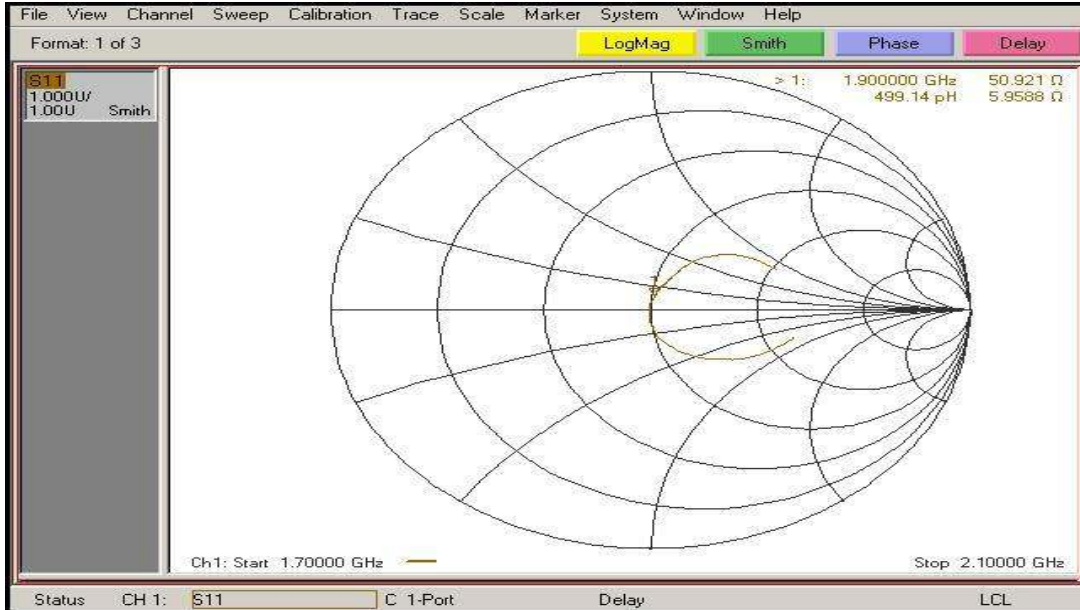


D1900V2, serial no. 5D041 Extended Dipole Calibrations

Referring to KDB 450824, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

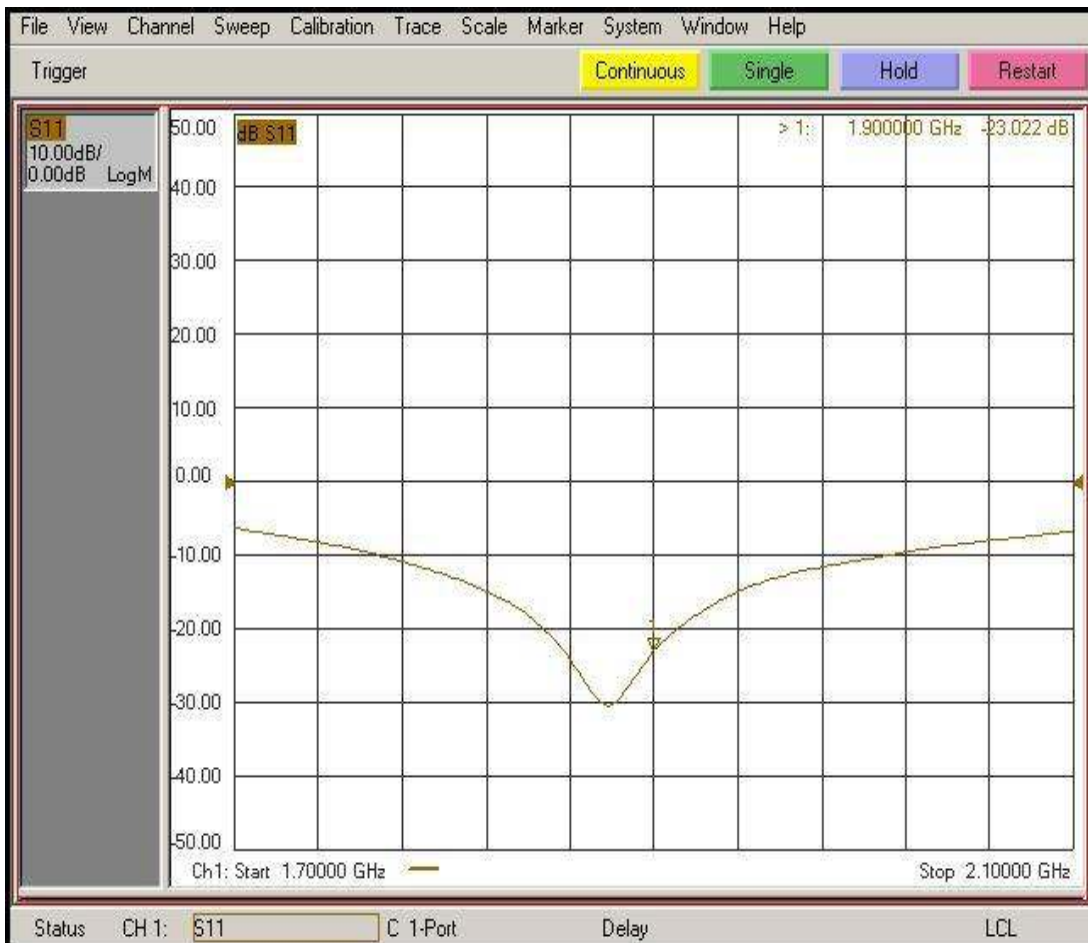
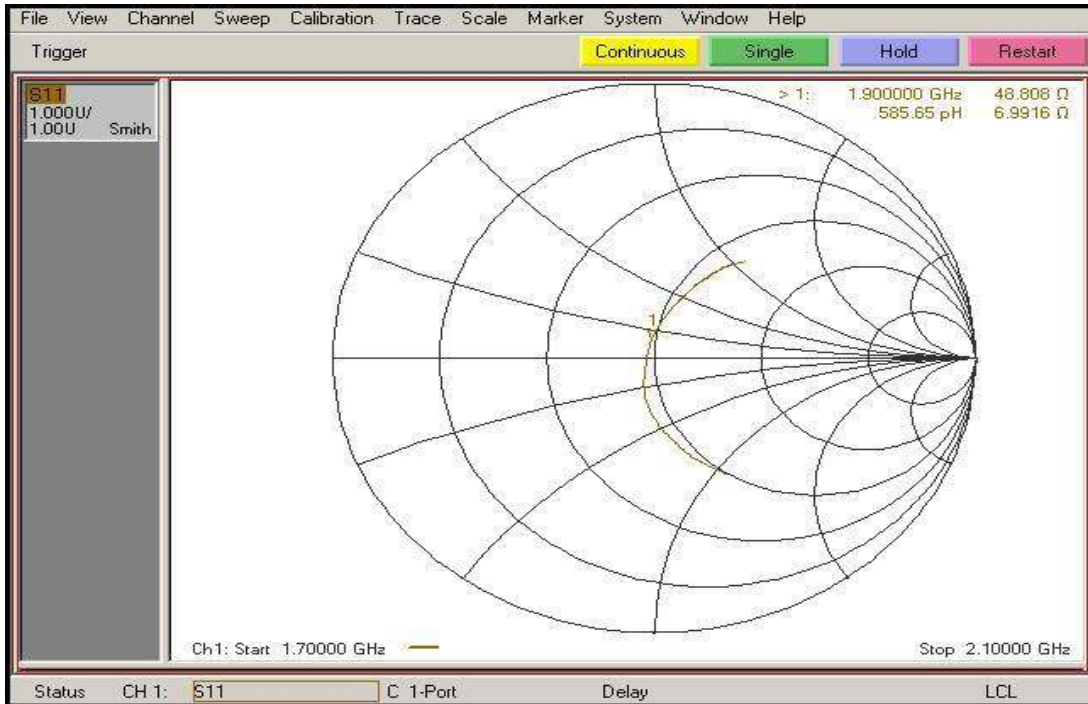
<Dipole Verification Data> - D1900 V2, serial no. 5D041

1900 MHz – Head





FCC Test Report



1900 MHz – Body

SPORTON INTERNATIONAL INC.

TEL : 886-3-327-3456

FAX : 886-3-328-4978



<Justification of the extended calibration>

| D1900V2 – serial no. 5D041 | | | | | | | | | | | | |
|----------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| | 1900 Head | | | | | | 1900 Body | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 3.23.2010 | -24.549 | | 50.896 | | 5.9141 | | -23.108 | | 46.342 | | 5.669 | |
| 3.23.2011 | -24.489 | 0.244 | 50.921 | -0.025 | 5.9588 | -0.045 | -23.022 | 0.372 | 48.808 | -2.466 | 6.991 | -1.322 |

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration.

Therefore the verification result should support extended calibration.



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **D2450V2-735_Jun11**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 735**

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

Calibration date: **June 22, 2011**

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 | 06-Oct-10 (No. 217-01266) | Oct-11 |
| Power sensor HP 8481A | US37292783 | 06-Oct-10 (No. 217-01266) | Oct-11 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-11 (No. 217-01367) | Apr-12 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371) | Apr-12 |
| Reference Probe ES3DV3 | SN: 3205 | 29-Apr-11 (No. ES3-3205_Apr11) | Apr-12 |
| DAE4 | SN: 601 | 8-Jun-11 (No. DAE4-601_Jun11) | Jun-12 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06 | 100005 | 4-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

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

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

Issued: June 22, 2011

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



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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

| | | |
|-------------------------------------|------------------------|-------------|
| DASY Version | DASY5 | V52.6.2 |
| 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 \pm 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 \pm 0.2) °C | 38.4 \pm 6 % | 1.72 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 | 13.1 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 53.3 mW / g \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 6.16 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.7 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 | 52.7 | 1.95 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 51.7 \pm 6 % | 1.93 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 | 12.8 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 51.2 mW / g \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 5.96 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 23.8 mW / g \pm 16.5 % (k=2) |

Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $54.3 \Omega + 2.8 j\Omega$ |
| Return Loss | - 26.1 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $51.0 \Omega + 5.2 j\Omega$ |
| Return Loss | - 25.7 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.153 ns |
|----------------------------------|----------|

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

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

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

Additional EUT Data

| | |
|-----------------|--------------|
| Manufactured by | SPEAG |
| Manufactured on | May 07, 2003 |

DASY5 Validation Report for Head TSL

Date: 22.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

D2450_735_H_110622_CL

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 735

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.72$ mho/m; $\epsilon_r = 38.4$; $\rho = 1000$ 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: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

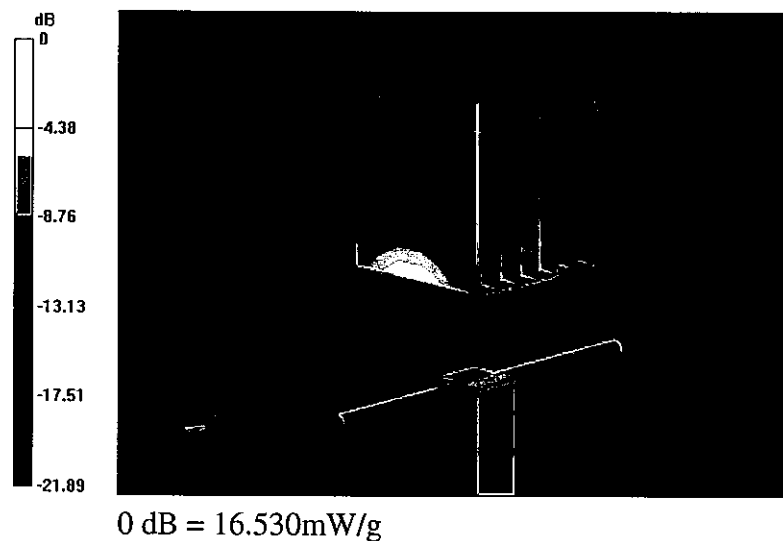
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.6 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 26.579 W/kg

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

Maximum value of SAR (measured) = 16.533 mW/g

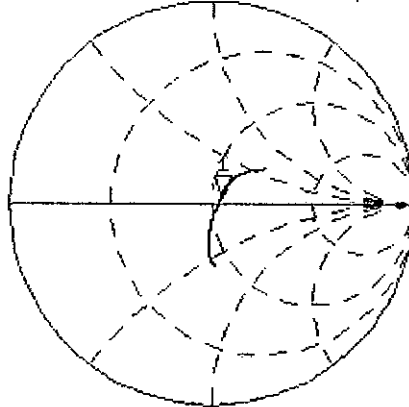


Impedance Measurement Plot for Head TSL

22 Jun 2011 09:39:03

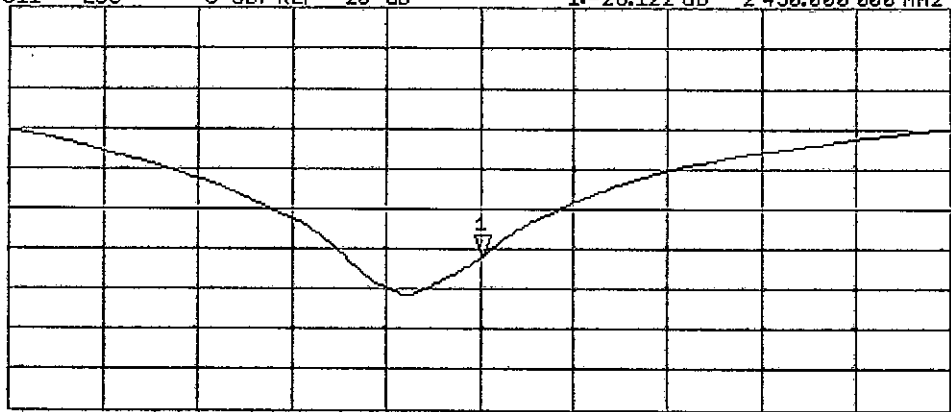
CH1 S11 1 U FS 1: 54.293 \angle 2.8438 \angle 184.73 pH 2 450.000 000 MHz

*
Del
Cor
Avg
16
H1d



CH2 S11 LOG 5 dB/REF -20 dB 1:-26.122 dB 2 450.000 000 MHz

Cor
Avg
16
H1d



DASY5 Validation Report for Body TSL

Date: 22.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

D2450_735_M_110622_CL

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 735

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.93$ mho/m; $\epsilon_r = 51.7$; $\rho = 1000$ 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: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

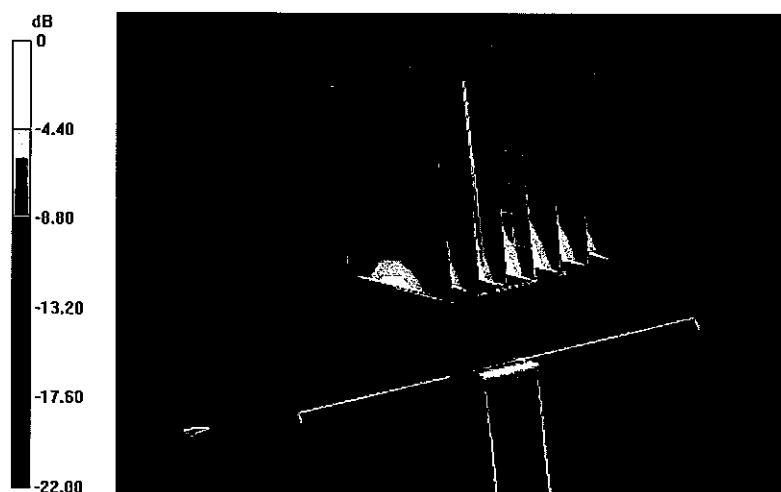
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.438 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 26.018 W/kg

SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.96 mW/g

Maximum value of SAR (measured) = 16.446 mW/g



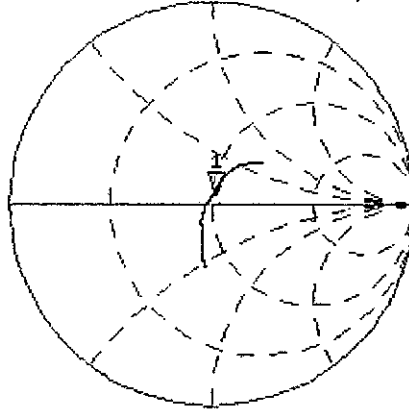
0 dB = 16.450mW/g

Impedance Measurement Plot for Body TSL

22 Jun 2011 09:40:27

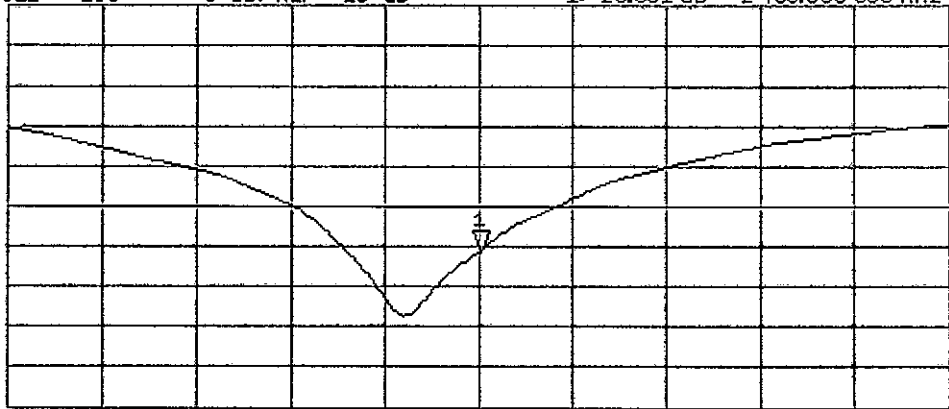
CH1 S11 1 U FS 1: 51.020 Ω 5.1641 Ω 335.46 pF 2 450.000 000 MHz

*
De1
Cor
Avg
15
H1d



CH2 S11 LOG 5 dB/REF -20 dB 1: -25.661 dB 2 450.000 000 MHz

Cor
Avg
15
H1d



CENTER 2 450.000 000 MHz

SPAN 400.000 000 MHz



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Client

ALPHEA

Certificate No: **D5GHz-1040_Jun11**

CALIBRATION CERTIFICATE

Object: **D5GHzV2 - SN: 1040**

Calibration procedure(s): **QA CAL-22 v1
Calibration procedure for dipole validation kits between 3-6 GHz**

Calibration date: **June 21, 2011**

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 | 06-Oct-10 (No. 217-01266) | Oct-11 |
| Power sensor HP 8481A | US37292783 | 06-Oct-10 (No. 217-01266) | Oct-11 |
| 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 EX3DV4 | SN: 3503 | 04-Mar-11 (No. EX3-3503_Mar11) | Mar-12 |
| DAE4 | SN: 601 | 8-Jun-11 (No. DAE4-601_Jun11) | Jun-12 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06 | 100005 | 4-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

Calibrated by: **Dimco Iliev** (Laboratory Technician) Signature: *[Signature]*

Approved by: **Katja Pokovic** (Technical Manager) Signature: *[Signature]*

Issued: June 21, 2011

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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 | V52.6.2 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom V5.0 | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy = 4.0 mm, dz = 1.4 mm | |
| Frequency | 5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz | |

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 36.0 | 4.66 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 35.8 ± 6 % | 4.50 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL at 5200 MHz

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 8.13 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 81.2 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 2.32 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.1 mW / g ± 16.5 % (k=2) |

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.6 | 4.96 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 35.2 ± 6 % | 4.82 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL at 5500 MHz

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 8.59 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 85.6 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 2.44 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.3 mW / g ± 16.5 % (k=2) |

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.3 | 5.27 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 34.8 ± 6 % | 5.08 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL at 5800 MHz

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 7.93 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 78.9 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 2.25 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 22.4 mW / g ± 16.5 % (k=2) |

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 49.0 | 5.30 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 49.0 ± 6 % | 5.41 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL at 5200 MHz

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 7.60 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 76.0 mW / g ± 18.1 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 2.13 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 21.3 mW / g ± 17.6 % (k=2) |

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 48.6 | 5.65 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 48.3 ± 6 % | 5.86 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL at 5500 MHz

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 8.18 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 81.7 mW / g ± 18.1 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 2.27 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 22.7 mW / g ± 17.6 % (k=2) |

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 48.2 | 6.00 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 47.8 ± 6 % | 6.21 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL at 5800 MHz

| SAR averaged over 1 cm³ (1 g) of Body TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 7.55 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 75.4 mW / g ± 18.1 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 100 mW input power | 2.10 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 21.0 mW / g ± 17.6 % (k=2) |

Appendix

Antenna Parameters with Head TSL at 5200 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.8 Ω - 6.9 j Ω |
| Return Loss | - 23.2 dB |

Antenna Parameters with Head TSL at 5500 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.9 Ω - 4.3 j Ω |
| Return Loss | - 26.8 dB |

Antenna Parameters with Head TSL at 5800 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.6 Ω - 1.6 j Ω |
| Return Loss | - 26.6 dB |

Antenna Parameters with Body TSL at 5200 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.0 Ω - 5.6 j Ω |
| Return Loss | - 25.0 dB |

Antenna Parameters with Body TSL at 5500 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 52.1 Ω - 2.5 j Ω |
| Return Loss | - 30.1 dB |

Antenna Parameters with Body TSL at 5800 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 56.0 Ω + 0.5 j Ω |
| Return Loss | - 24.9 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.203 ns |
|----------------------------------|----------|

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

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

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

Additional EUT Data

| | |
|-----------------|-------------------|
| Manufactured by | SPEAG |
| Manufactured on | December 30, 2005 |

DASY5 Validation Report for Head TSL

Date: 20.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHz; Serial: D5GHzV2 - SN: 1040

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz
Medium: HSL 502 A

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.5$ mho/m; $\epsilon_r = 35.8$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.82$ mho/m; $\epsilon_r = 35.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.08$ mho/m; $\epsilon_r = 34.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41), ConvF(4.91, 4.91, 4.91), ConvF(4.81, 4.81, 4.81); Calibrated: 04.03.2011
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.544 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 30.178 W/kg

SAR(1 g) = 8.13 mW/g; SAR(10 g) = 2.32 mW/g

Maximum value of SAR (measured) = 18.566 mW/g

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.669 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 34.025 W/kg

SAR(1 g) = 8.59 mW/g; SAR(10 g) = 2.44 mW/g

Maximum value of SAR (measured) = 20.159 mW/g

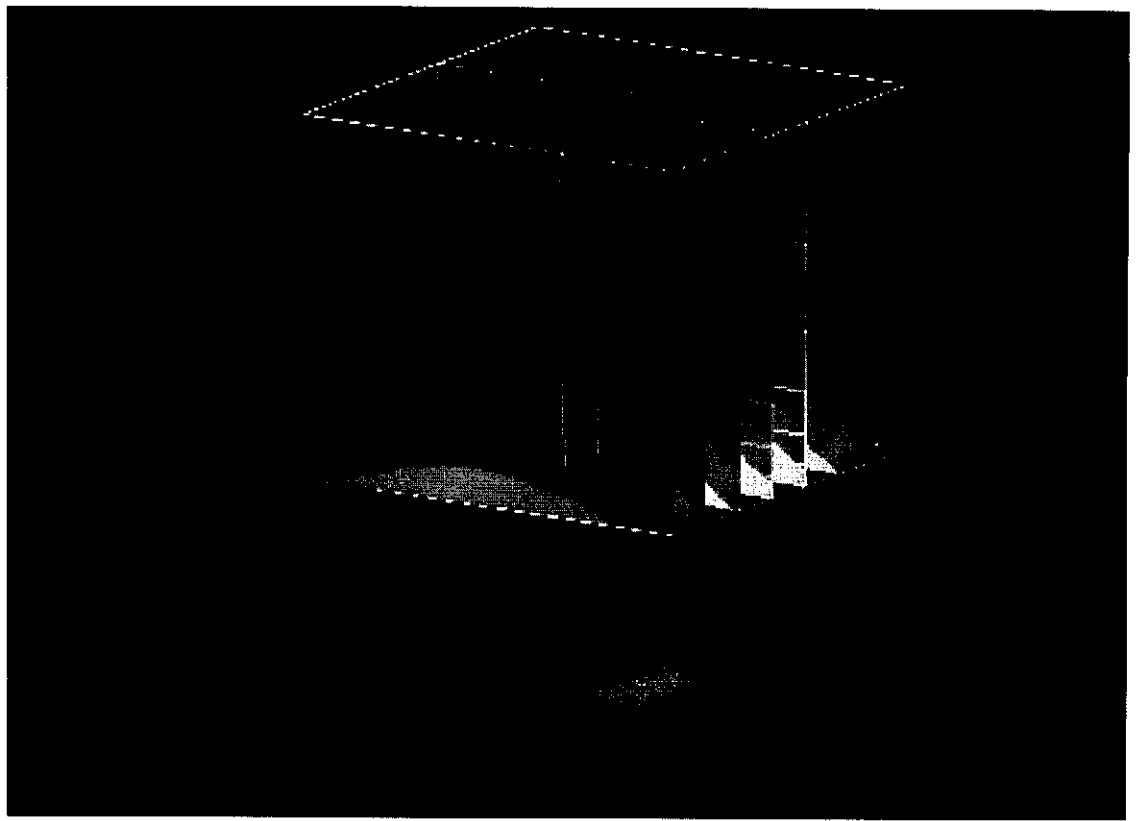
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 61.830 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 32.874 W/kg

SAR(1 g) = 7.93 mW/g; SAR(10 g) = 2.25 mW/g

Maximum value of SAR (measured) = 18.884 mW/g



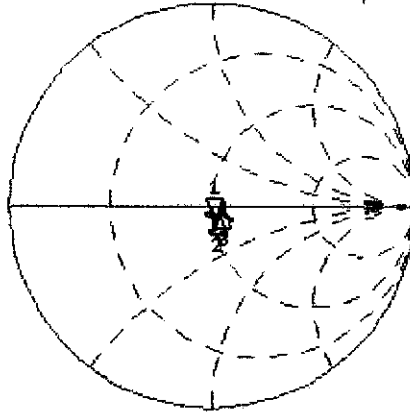
0 dB = 18.880mW/g

Impedance Measurement Plot for Head TSL

20 Jun 2011 09:11:58

CH1 S11 1 U FS 1: 49.848 Ω -6.8945 Ω 4.4393 pF 5 200.000 000 MHz

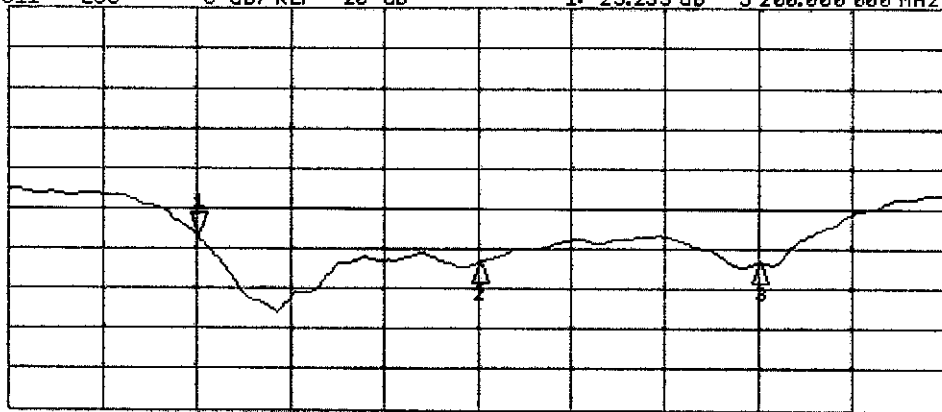
*
De1
Cor
Avg
16
H1d



CH1 Markers
2: 51.904 Ω
-4.2578 Ω
5.50000 GHz
3: 54.615 Ω
-1.5586 Ω
5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -23.233 dB 5 200.000 000 MHz

Cor
Avg
16
H1d



CH2 Markers
2: -26.793 dB
5.50000 GHz
3: -26.641 dB
5.80000 GHz

DASY5 Validation Report for Body TSL

Date: 21.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHz; Serial: D5GHzV2 - SN: 1040

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz
Medium: MSL 501

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.41$ mho/m; $\epsilon_r = 49$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 5.86$ mho/m; $\epsilon_r = 48.3$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 6.21$ mho/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91), ConvF(4.43, 4.43, 4.43), ConvF(4.38, 4.38, 4.38); Calibrated: 04.03.2011
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.999 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 29.005 W/kg

SAR(1 g) = 7.6 mW/g; SAR(10 g) = 2.13 mW/g

Maximum value of SAR (measured) = 17.369 mW/g

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 59.120 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 33.982 W/kg

SAR(1 g) = 8.18 mW/g; SAR(10 g) = 2.27 mW/g

Maximum value of SAR (measured) = 19.380 mW/g

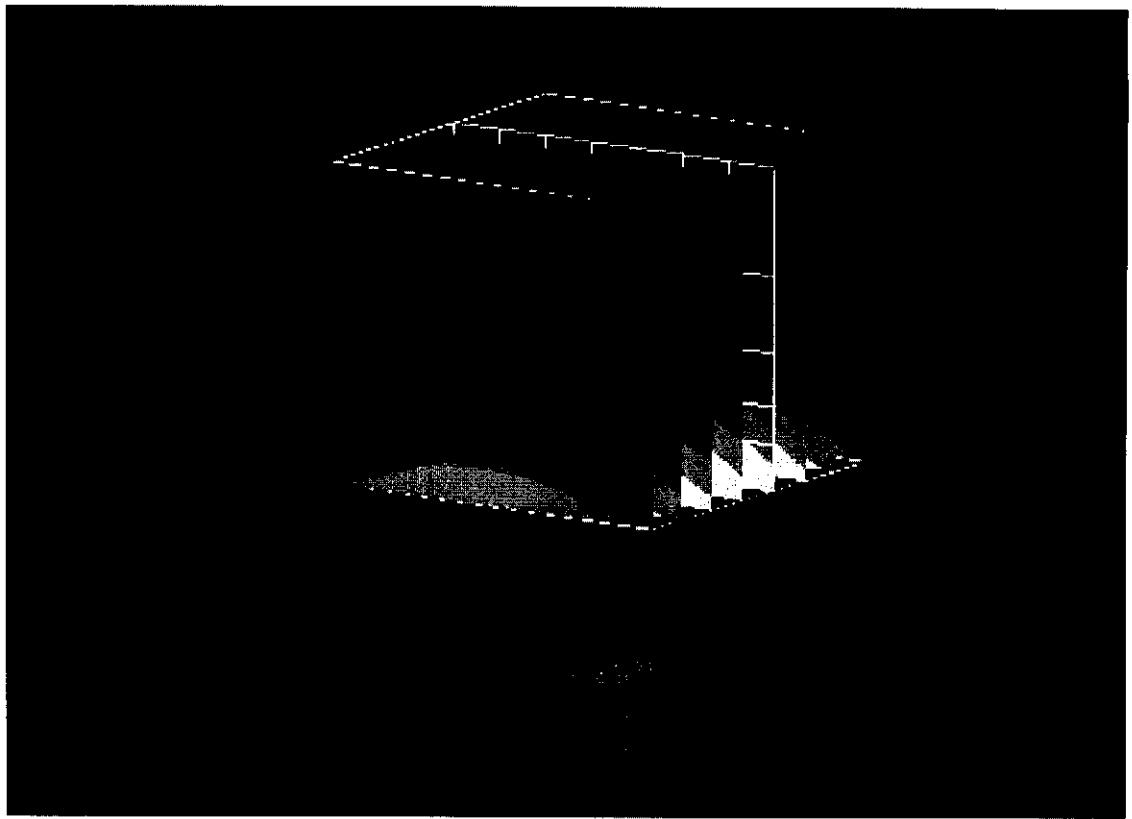
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 55.208 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 33.965 W/kg

SAR(1 g) = 7.55 mW/g; SAR(10 g) = 2.1 mW/g

Maximum value of SAR (measured) = 18.403 mW/g



0 dB = 18.400mW/g

Impedance Measurement Plot for Body TSL

21 Jun 2011 08:57:17

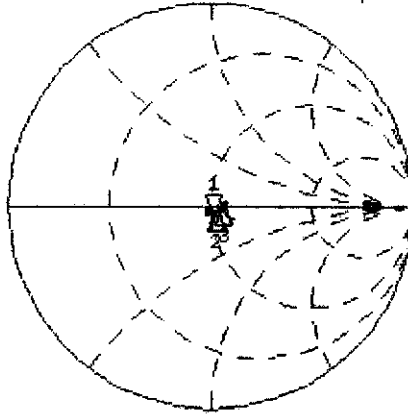
CH1 S11 1 U FS 1: 49.951 Ω -5.6484 Ω 5.4186 pF 5 200.000 000 MHz

*
De1

Cor

Avg
16

H1 d



CH1 Markers

2: 52.062 Ω
-2.4570 Ω
5.50000 GHz

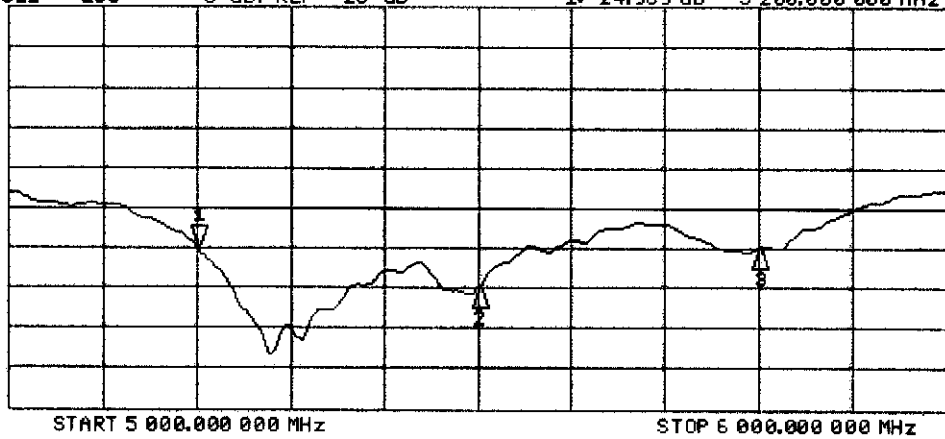
3: 56.018 Ω
0.5098 Ω
5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -24.969 dB 5 200.000 000 MHz

Cor

Avg
16

H1 d



CH2 Markers

2: -30.056 dB
5.50000 GHz

3: -24.888 dB
5.80000 GHz



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Amphenol CN (Auden)**

Certificate No: **DAE3-495_Apr11**

CALIBRATION CERTIFICATE

Object: **DAE3 - SD 000 D03 AD - SN: 495**

Calibration procedure(s): **QA CAL-06.v22
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **April 28, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 28-Sep-10 (No:10376) | Sep-11 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Calibrator Box VI.1 | SE UMS 006 AB 1004 | 07-Jun-10 (in house check) | In house check: Jun-11 |

| | | | |
|----------------|----------------------------------|--------------------------|---------------|
| Calibrated by: | Name Dominique Steffen | Function Technician | Signature |
| Approved by: | Name Fin Bornholt | Function R&D Director | Signature |

Issued: April 28, 2011

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

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

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

Low Range: 1LSB = 61nV, full range = -1.....+3mV

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

| Calibration Factors | X | Y | Z |
|---------------------|--------------------------|--------------------------|--------------------------|
| High Range | 404.324 \pm 0.1% (k=2) | 405.291 \pm 0.1% (k=2) | 405.622 \pm 0.1% (k=2) |
| Low Range | 3.95043 \pm 0.7% (k=2) | 3.97613 \pm 0.7% (k=2) | 3.95159 \pm 0.7% (k=2) |

Connector Angle

| | |
|---|-------------------------------------|
| Connector Angle to be used in DASY system | 227.5 $^{\circ}$ \pm 1 $^{\circ}$ |
|---|-------------------------------------|

Appendix

1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|------------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 199993.1 | -2.74 | -0.00 |
| Channel X | + Input | 20001.66 | 1.46 | 0.01 |
| Channel X | - Input | -19994.94 | 5.16 | -0.03 |
| Channel Y | + Input | 200006.0 | 1.16 | 0.00 |
| Channel Y | + Input | 20002.16 | 1.86 | 0.01 |
| Channel Y | - Input | -19997.98 | 2.02 | -0.01 |
| Channel Z | + Input | 200005.6 | 1.57 | 0.00 |
| Channel Z | + Input | 20003.05 | 3.05 | 0.02 |
| Channel Z | - Input | -19998.31 | 1.59 | -0.01 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|-----------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 2000.3 | 0.26 | 0.01 |
| Channel X | + Input | 199.66 | -0.24 | -0.12 |
| Channel X | - Input | -200.28 | -0.38 | 0.19 |
| Channel Y | + Input | 2001.0 | 1.06 | 0.05 |
| Channel Y | + Input | 200.75 | 0.85 | 0.42 |
| Channel Y | - Input | -202.12 | -2.12 | 1.06 |
| Channel Z | + Input | 1999.0 | -1.13 | -0.06 |
| Channel Z | + Input | 198.35 | -1.65 | -0.82 |
| Channel Z | - Input | -200.94 | -1.04 | 0.52 |

2. Common mode sensitivity

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

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | 2.91 | 1.12 |
| | - 200 | 0.15 | -1.40 |
| Channel Y | 200 | -0.69 | -0.74 |
| | - 200 | -0.12 | -0.47 |
| Channel Z | 200 | 2.83 | 2.71 |
| | - 200 | -4.22 | -4.44 |

3. Channel separation

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

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | 2.33 | 0.36 |
| Channel Y | 200 | 2.17 | - | 4.08 |
| Channel Z | 200 | 3.22 | -0.54 | - |

4. AD-Converter Values with inputs shorted

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

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 15791 | 16416 |
| Channel Y | 15742 | 16582 |
| Channel Z | 15883 | 16533 |

5. Input Offset Measurement

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

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | -1.87 | -3.03 | -0.77 | 0.45 |
| Channel Y | -1.74 | -2.98 | -0.06 | 0.56 |
| Channel Z | -1.44 | -2.79 | -0.14 | 0.61 |

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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

IMPORTANT NOTICE

USAGE OF THE DAE 3

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE3 unit is connected to a fragile 3-pin battery connector. Customer is responsible to apply utmost caution not to bend or damage the connector when changing batteries.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration the customer shall remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, Customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton TW (Auden)**

Certificate No: **DAE3-577_Jun11**

CALIBRATION CERTIFICATE

Object: **DAE3 - SD 000 D03 AA - SN: 577**

Calibration procedure(s): **QA CAL-06.v23
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **June 20, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 28-Sep-10 (No:10376) | Sep-11 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Calibrator Box V1.1 | SE UMS 006 AB 1004 | 08-Jun-11 (in house check) | In house check: Jun-12 |

| | Name | Function | Signature |
|----------------|-------------------|--------------|-----------|
| Calibrated by: | Dominique Steffen | Technician | |
| Approved by: | Fin Bomholt | R&D Director | |

Issued: June 20, 2011

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Accreditation No.: **SCS 108**

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

| Calibration Factors | X | Y | Z |
|---------------------|--------------------------|--------------------------|--------------------------|
| High Range | 404.381 \pm 0.1% (k=2) | 403.844 \pm 0.1% (k=2) | 404.277 \pm 0.1% (k=2) |
| Low Range | 3.93296 \pm 0.7% (k=2) | 3.93560 \pm 0.7% (k=2) | 3.95800 \pm 0.7% (k=2) |

Connector Angle

| | |
|---|-------------------------------------|
| Connector Angle to be used in DASY system | 101.5 $^{\circ}$ \pm 1 $^{\circ}$ |
|---|-------------------------------------|

Appendix

1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|------------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 199995.4 | -2.24 | -0.00 |
| Channel X | + Input | 20003.13 | 3.03 | 0.02 |
| Channel X | - Input | -19996.01 | 3.89 | -0.02 |
| Channel Y | + Input | 199996.5 | -0.01 | -0.00 |
| Channel Y | + Input | 20000.48 | 0.58 | 0.00 |
| Channel Y | - Input | -19998.50 | 2.10 | -0.01 |
| Channel Z | + Input | 199994.4 | -1.15 | -0.00 |
| Channel Z | + Input | 20003.30 | 3.40 | 0.02 |
| Channel Z | - Input | -19996.26 | 3.24 | -0.02 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|-----------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 2000.4 | 0.29 | 0.01 |
| Channel X | + Input | 200.33 | 0.43 | 0.21 |
| Channel X | - Input | -199.88 | -0.08 | 0.04 |
| Channel Y | + Input | 1999.9 | -0.31 | -0.02 |
| Channel Y | + Input | 200.45 | 0.55 | 0.28 |
| Channel Y | - Input | -200.38 | -0.58 | 0.29 |
| Channel Z | + Input | 1999.6 | -0.23 | -0.01 |
| Channel Z | + Input | 199.26 | -0.64 | -0.32 |
| Channel Z | - Input | -200.62 | -0.82 | 0.41 |

2. Common mode sensitivity

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

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | 15.32 | 13.45 |
| | - 200 | -13.16 | -14.40 |
| Channel Y | 200 | -5.58 | -5.70 |
| | - 200 | 4.51 | 4.52 |
| Channel Z | 200 | -1.42 | -1.57 |
| | - 200 | 0.56 | 0.17 |

3. Channel separation

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

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | 0.73 | -0.43 |
| Channel Y | 200 | 3.10 | - | 4.07 |
| Channel Z | 200 | 0.93 | -1.25 | - |

4. AD-Converter Values with inputs shorted

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

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 15973 | 16638 |
| Channel Y | 15856 | 15275 |
| Channel Z | 16211 | 16876 |

5. Input Offset Measurement

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

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | -0.94 | -2.52 | 0.28 | 0.54 |
| Channel Y | -1.05 | -1.87 | 0.16 | 0.43 |
| Channel Z | -0.85 | -1.57 | 1.34 | 0.39 |

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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



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



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Accreditation No.: SCS 108

Client Sporton (Auden)

Certificate No: DAE4-778_Oct10

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BJ - SN: 778
Calibration procedure(s): QA CAL-06.v22 Calibration procedure for the data acquisition electronics (DAE)
Calibration date: October 22, 2010

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)

Table with 4 columns: Standard Type, ID #, Date, and Check/Calibration Date. Includes entries for Keithley Multimeter and Calibrator Box.

Calibrated by: Eric Hainfeld, Technician
Approved by: Fin Bornholt, R&D Director

Issued: October 22, 2010

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

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Accreditation No.: **SCS 108**

Glossary

DAE data acquisition electronics
Connector angle information used in DAS Y system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

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



DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1µV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.....+3mV

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

| Calibration Factors | X | Y | Z |
|---------------------|----------------------|----------------------|----------------------|
| High Range | 404.679 ± 0.1% (k=2) | 403.480 ± 0.1% (k=2) | 405.025 ± 0.1% (k=2) |
| Low Range | 3.98633 ± 0.7% (k=2) | 3.96375 ± 0.7% (k=2) | 3.99940 ± 0.7% (k=2) |

Connector Angle

| | |
|---|--------------|
| Connector Angle to be used in DASY system | 64.5 ° ± 1 ° |
|---|--------------|



Appendix

1. DC Voltage Linearity

| High Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 200004.4 | 1.89 | 0.00 |
| Channel X + Input | 20001.11 | 1.41 | 0.01 |
| Channel X - Input | -19998.36 | 1.54 | -0.01 |
| Channel Y + Input | 199996.1 | 3.42 | 0.00 |
| Channel Y + Input | 19999.75 | 0.35 | 0.00 |
| Channel Y - Input | -19999.92 | -0.12 | 0.00 |
| Channel Z + Input | 200002.7 | 1.29 | 0.00 |
| Channel Z + Input | 19996.85 | -2.55 | -0.01 |
| Channel Z - Input | -20004.31 | -4.61 | 0.02 |

| Low Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2000.0 | 0.09 | 0.00 |
| Channel X + Input | 200.02 | 0.02 | 0.01 |
| Channel X - Input | -198.62 | 1.48 | -0.74 |
| Channel Y + Input | 1999.6 | -0.58 | -0.03 |
| Channel Y + Input | 199.13 | -0.57 | -0.29 |
| Channel Y - Input | -200.71 | -0.61 | 0.31 |
| Channel Z + Input | 2000.1 | -0.01 | -0.00 |
| Channel Z + Input | 198.96 | -1.14 | -0.57 |
| Channel Z - Input | -200.98 | -0.98 | 0.49 |

2. Common mode sensitivity

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

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | -5.28 | -6.07 |
| | -200 | 6.79 | 6.12 |
| Channel Y | 200 | -1.80 | -1.60 |
| | -200 | 0.97 | 0.35 |
| Channel Z | 200 | -9.76 | -9.86 |
| | -200 | 7.56 | 7.61 |

3. Channel separation

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

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | 1.86 | -0.66 |
| Channel Y | 200 | 2.28 | - | 2.89 |
| Channel Z | 200 | 1.68 | -0.15 | - |



4. AD-Converter Values with inputs shorted

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

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16056 | 16950 |
| Channel Y | 16153 | 13741 |
| Channel Z | 16441 | 16066 |

5. Input Offset Measurement

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

Input 10MΩ

| | Average (μV) | min. Offset (μV) | max. Offset (μV) | Std. Deviation (μV) |
|-----------|--------------|------------------|------------------|---------------------|
| Channel X | 0.32 | -2.35 | 2.08 | 0.55 |
| Channel Y | -1.83 | -2.96 | -0.72 | 0.47 |
| Channel Z | -1.93 | -3.00 | -0.90 | 0.45 |

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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



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Accreditation No.: **SCS 108**

Client **Sporton (Auden)**

Certificate No: **ET3-1787_May11**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1787**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-23.v4, QA CAL-25.v3
Calibration procedure for dosimetric E-field probes**

Calibration date: **May 20, 2011**

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: S5066 (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-10 (No. ES3-3013_Dec10) | Dec-11 |
| 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 | US3842U01700 | 4-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

| | Name | Function | Signature |
|----------------|----------------------|-----------------------|-----------|
| Calibrated by: | Jeton Kastali | Laboratory Technician | |
| Approved by: | Katja Pckovic | Technical Manager | |

Issued: May 23, 2011

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ 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}** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR**: VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- 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 ET3DV6

SN:1787

Manufactured: May 28, 2003
Calibrated: May 20, 2011

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

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1787

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 1.56 | 1.79 | 2.09 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 99.8 | 100.5 | 95.9 | |

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 | 131.5 | $\pm 3.0 \%$ |
| | | | Y | 0.00 | 0.00 | 1.00 | 105.0 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 114.9 | |

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: ET3DV6 - SN:1787

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 | 6.71 | 6.71 | 6.71 | 0.71 | 1.91 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 6.39 | 6.39 | 6.39 | 0.68 | 1.94 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 6.27 | 6.27 | 6.27 | 0.66 | 1.99 | ± 12.0 % |
| 1450 | 40.5 | 1.20 | 5.58 | 5.58 | 5.58 | 0.51 | 2.57 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 5.28 | 5.28 | 5.28 | 0.55 | 2.32 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 5.03 | 5.03 | 5.03 | 0.51 | 2.44 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 5.01 | 5.01 | 5.01 | 0.55 | 2.24 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 4.41 | 4.41 | 4.41 | 0.71 | 1.83 | ± 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: ET3DV6- SN:1787

Calibration Parameter Determined in Body Tissue Simulating Media

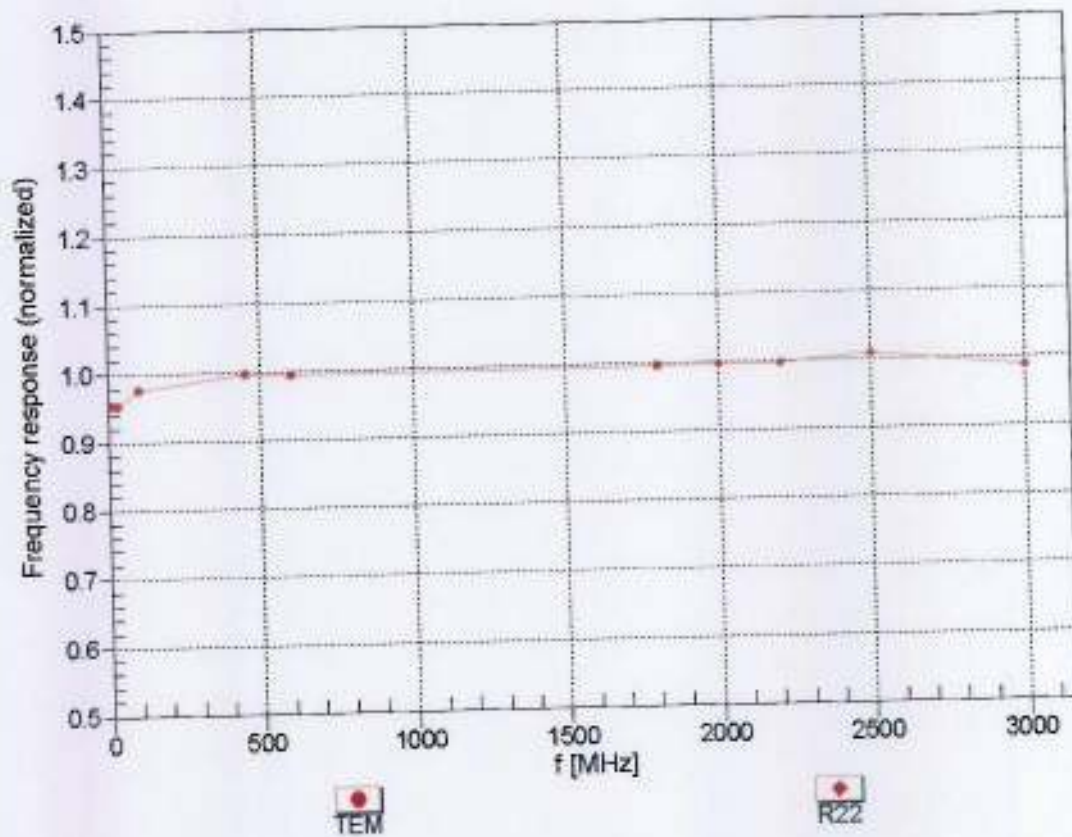
| f (MHz) ^c | Relative Permittivity ^f | Conductivity (S/m) ^f | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 55.5 | 0.96 | 6.35 | 6.35 | 6.35 | 0.76 | 1.83 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 6.22 | 6.22 | 6.22 | 0.67 | 2.02 | ± 12.0 % |
| 900 | 55.0 | 1.05 | 6.17 | 6.17 | 6.17 | 0.72 | 1.87 | ± 12.0 % |
| 1450 | 54.0 | 1.30 | 5.35 | 5.35 | 5.35 | 0.57 | 2.35 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 4.74 | 4.74 | 4.74 | 0.56 | 2.86 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 4.48 | 4.48 | 4.48 | 0.56 | 2.76 | ± 12.0 % |
| 2000 | 53.3 | 1.52 | 4.50 | 4.50 | 4.50 | 0.60 | 2.47 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 3.96 | 3.96 | 3.96 | 0.99 | 1.18 | ± 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

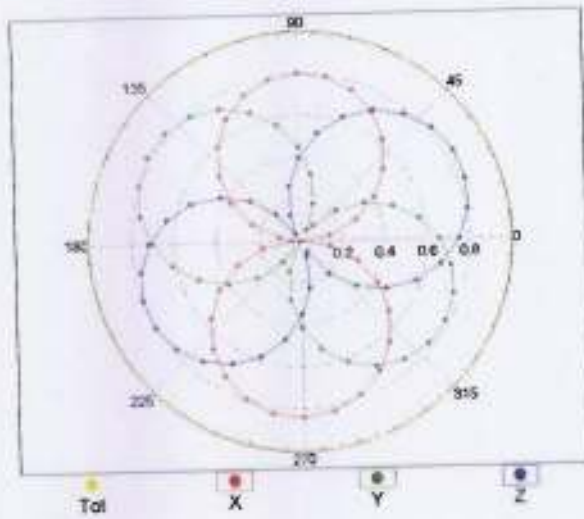
(TEM-Cell: ifi110 EXX, Waveguide: R22)



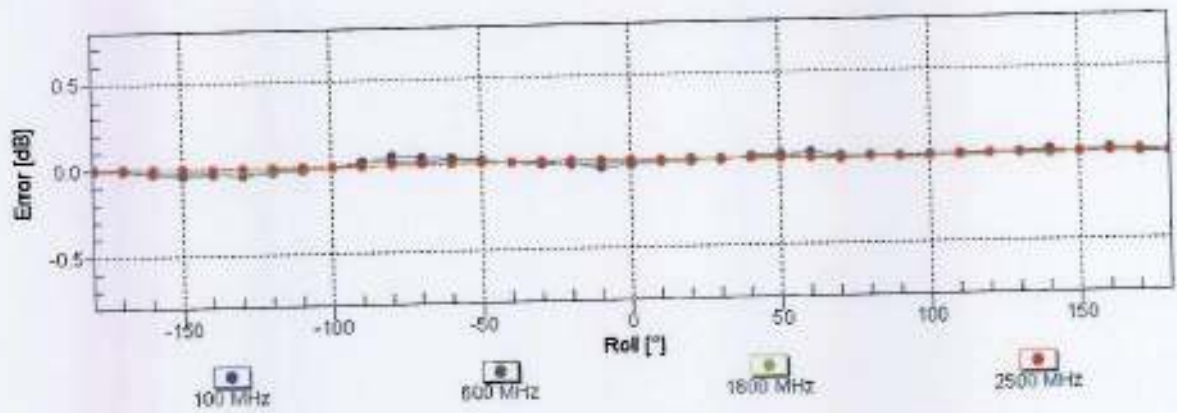
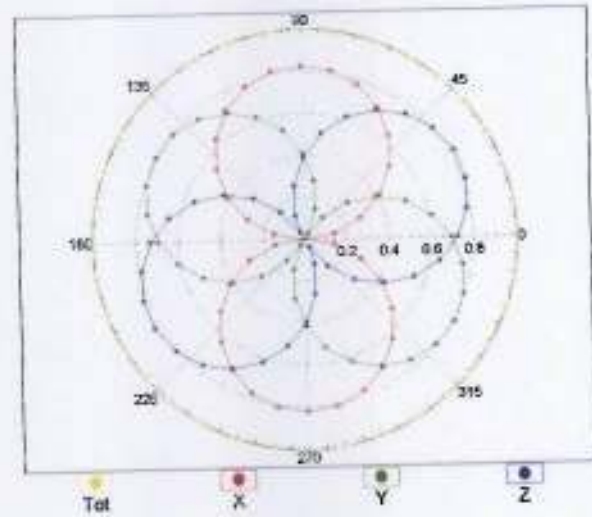
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz,TEM

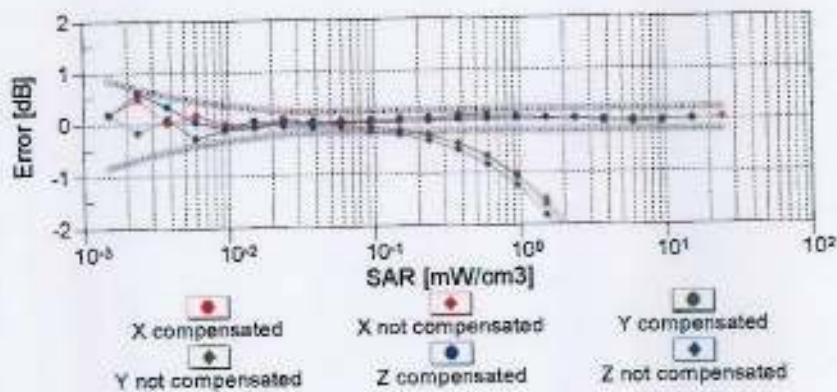
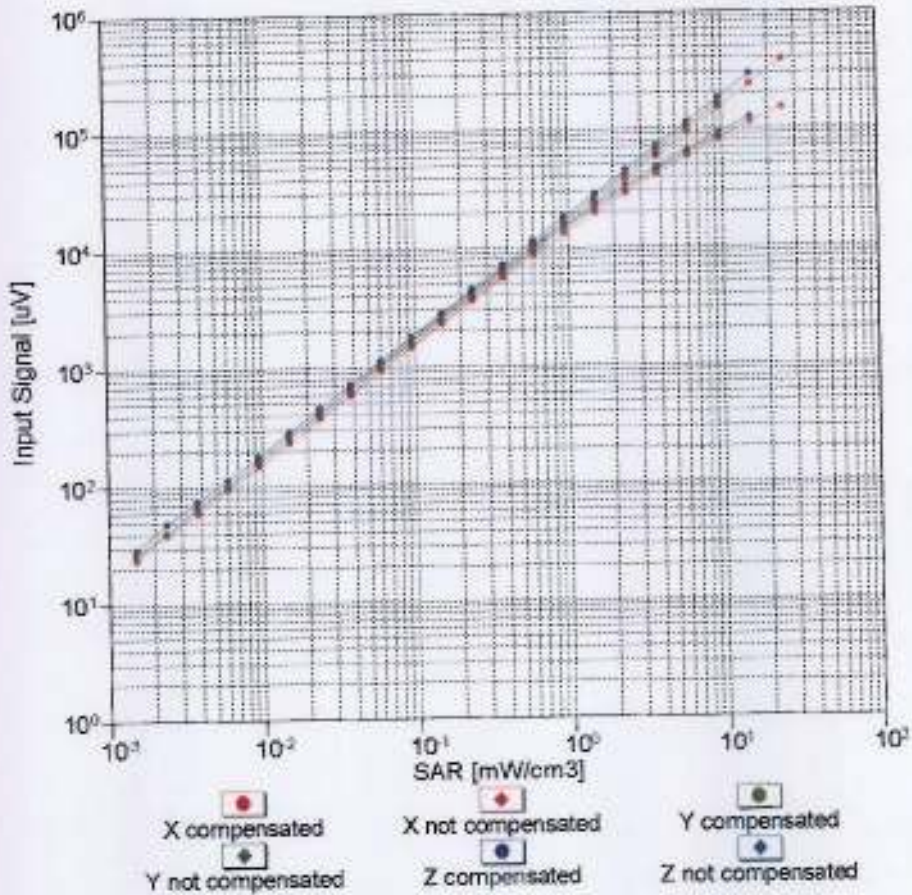


f=1800 MHz,R22



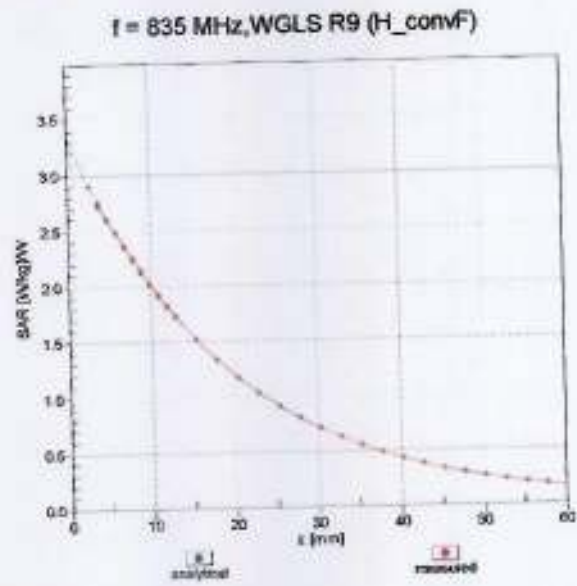
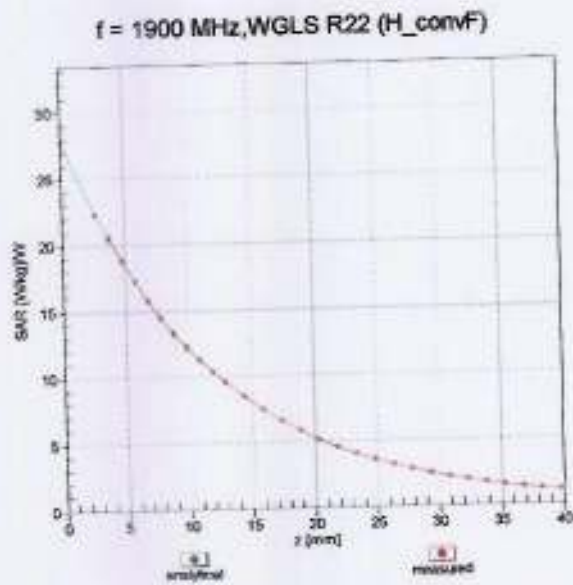
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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

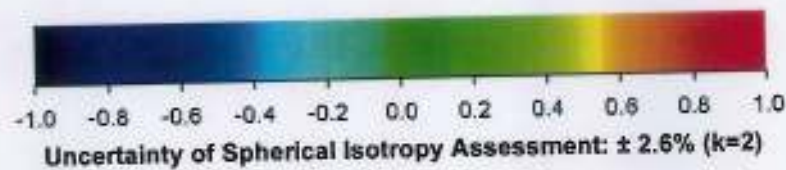
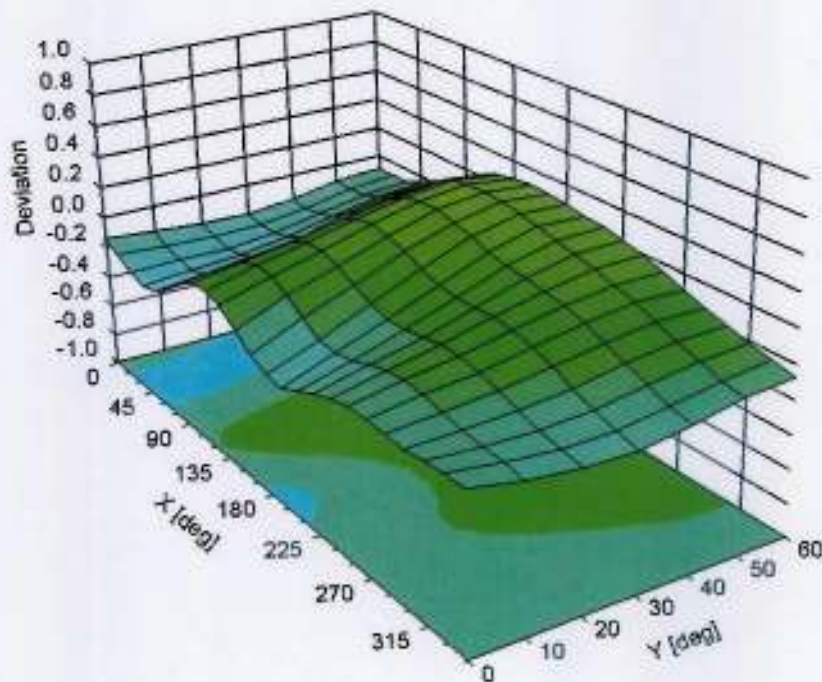


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



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



DASY/EASY - Parameters of Probe: ET3DV6 - SN:1787**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 | 6.8 mm |
| Probe Tip to Sensor X Calibration Point | 2.7 mm |
| Probe Tip to Sensor Y Calibration Point | 2.7 mm |
| Probe Tip to Sensor Z Calibration Point | 2.7 mm |
| Recommended Measurement Distance from Surface | 4 mm |



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Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **EX3-3578_Jun11**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3578**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes**

Calibration date: **June 21, 2011**

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-10 (No. ES3-3013_Dec10) | Dec-11 |
| 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 Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

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

Issued: June 21, 2011

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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:

- 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 EX3DV4

SN:3578

Manufactured: November 4, 2005
Calibrated: June 21, 2011

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3578

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.53 | 0.50 | 0.56 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 101.0 | 99.8 | 100.5 | |

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 | 117.4 | $\pm 1.7 \%$ |
| | | | Y | 0.00 | 0.00 | 1.00 | 116.2 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 123.2 | |

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: EX3DV4 - SN:3578

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 | 8.66 | 8.66 | 8.66 | 0.80 | 0.71 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 8.33 | 8.33 | 8.33 | 0.80 | 0.69 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 8.21 | 8.21 | 8.21 | 0.80 | 0.69 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 7.62 | 7.62 | 7.62 | 0.80 | 0.70 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 7.26 | 7.26 | 7.26 | 0.80 | 0.69 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 7.21 | 7.21 | 7.21 | 0.80 | 0.68 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 6.42 | 6.42 | 6.42 | 0.80 | 0.68 | ± 12.0 % |
| 5200 | 36.0 | 4.66 | 4.26 | 4.26 | 4.26 | 0.40 | 1.80 | ± 13.1 % |
| 5300 | 35.9 | 4.76 | 4.06 | 4.06 | 4.06 | 0.40 | 1.80 | ± 13.1 % |
| 5500 | 35.6 | 4.96 | 4.12 | 4.12 | 4.12 | 0.45 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 3.94 | 3.94 | 3.94 | 0.40 | 1.80 | ± 13.1 % |
| 5800 | 35.3 | 5.27 | 3.84 | 3.84 | 3.84 | 0.50 | 1.80 | ± 13.1 % |

^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: EX3DV4- SN:3578

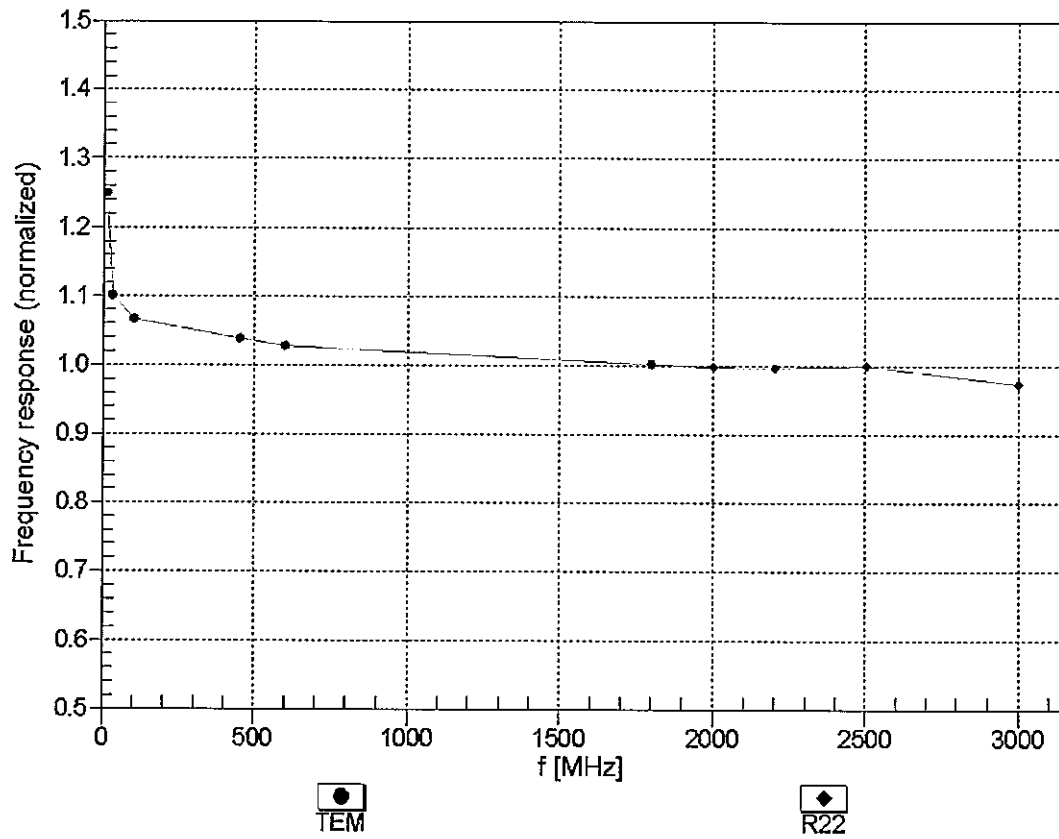
Calibration Parameter Determined in Body Tissue Simulating Media

| 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 | 8.77 | 8.77 | 8.77 | 0.80 | 0.75 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 8.45 | 8.45 | 8.45 | 0.80 | 0.75 | ± 12.0 % |
| 900 | 55.0 | 1.05 | 8.34 | 8.34 | 8.34 | 0.80 | 0.72 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 7.19 | 7.19 | 7.19 | 0.80 | 0.75 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 6.68 | 6.68 | 6.68 | 0.80 | 0.73 | ± 12.0 % |
| 2000 | 53.3 | 1.52 | 6.68 | 6.68 | 6.68 | 0.80 | 0.73 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 6.18 | 6.18 | 6.18 | 0.80 | 0.50 | ± 12.0 % |
| 5200 | 49.0 | 5.30 | 3.74 | 3.74 | 3.74 | 0.55 | 1.90 | ± 13.1 % |
| 5300 | 48.9 | 5.42 | 3.49 | 3.49 | 3.49 | 0.55 | 1.90 | ± 13.1 % |
| 5500 | 48.6 | 5.65 | 3.40 | 3.40 | 3.40 | 0.60 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 3.11 | 3.11 | 3.11 | 0.65 | 1.90 | ± 13.1 % |
| 5800 | 48.2 | 6.00 | 3.23 | 3.23 | 3.23 | 0.65 | 1.90 | ± 13.1 % |

^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.

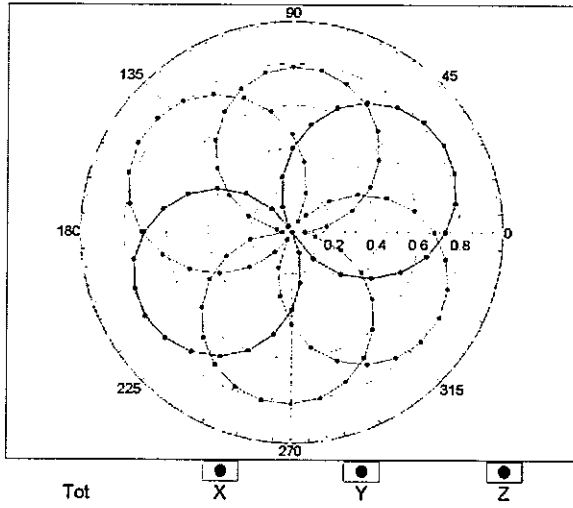
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



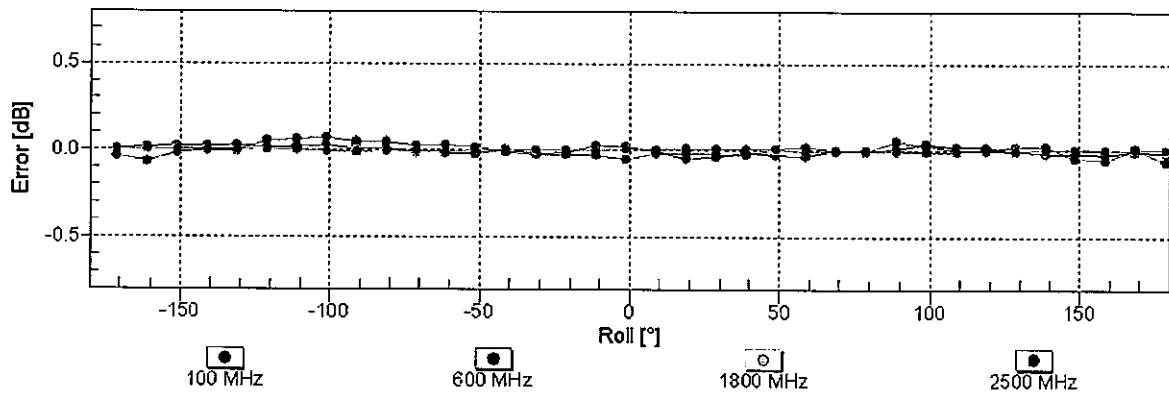
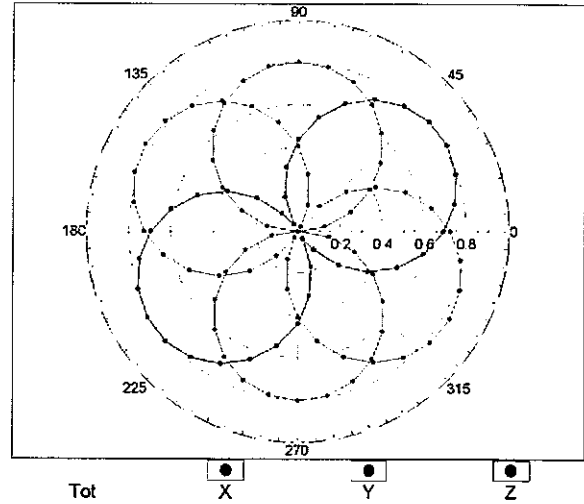
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

f=600 MHz, TEM

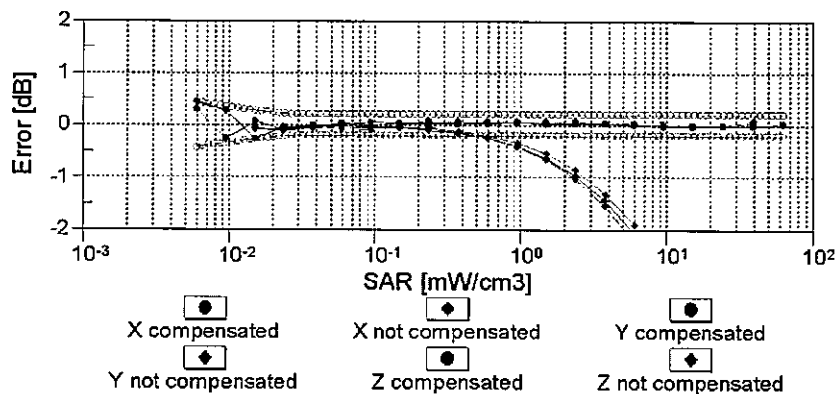
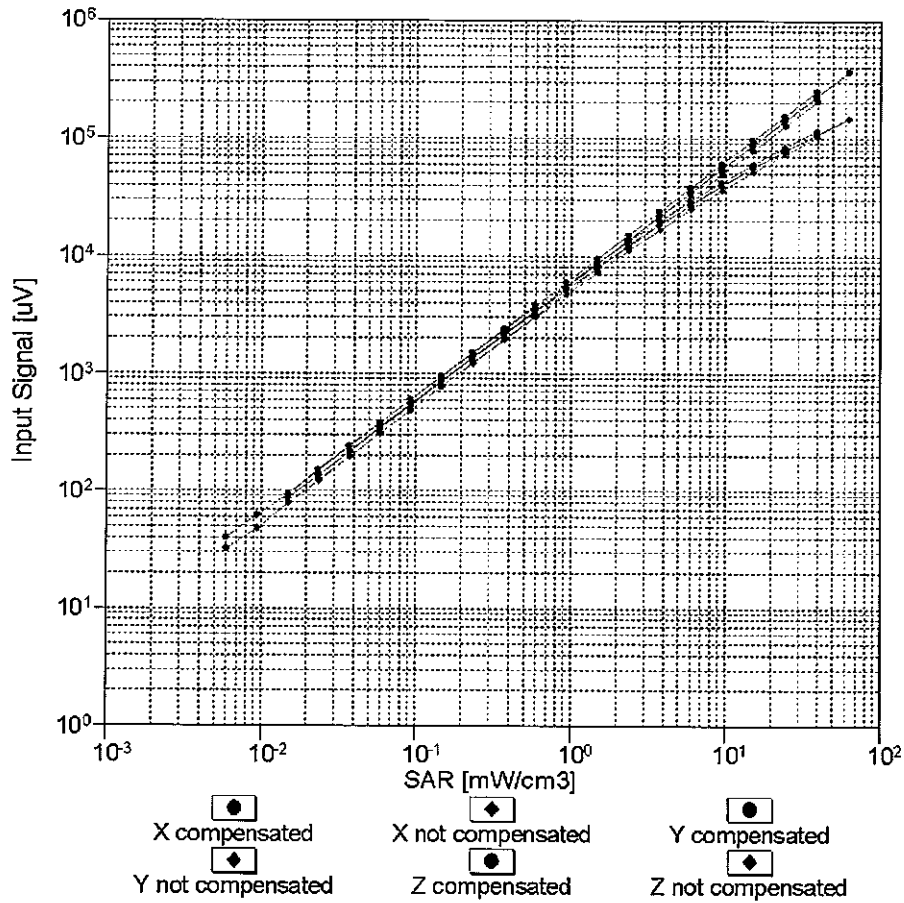


f=1800 MHz, R22



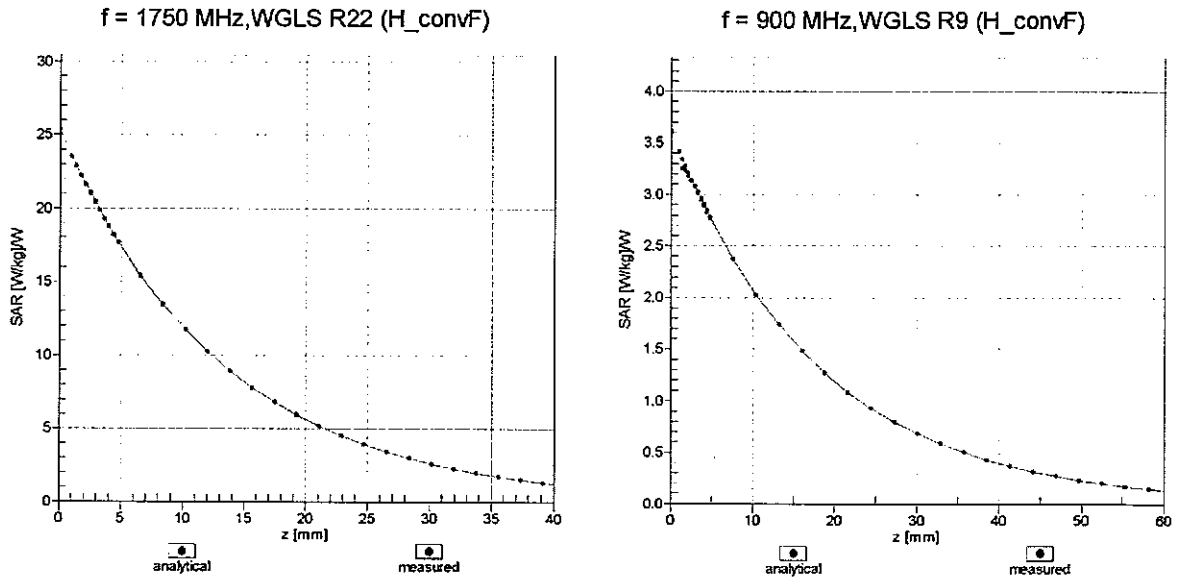
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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

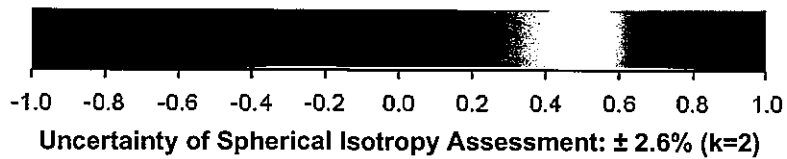
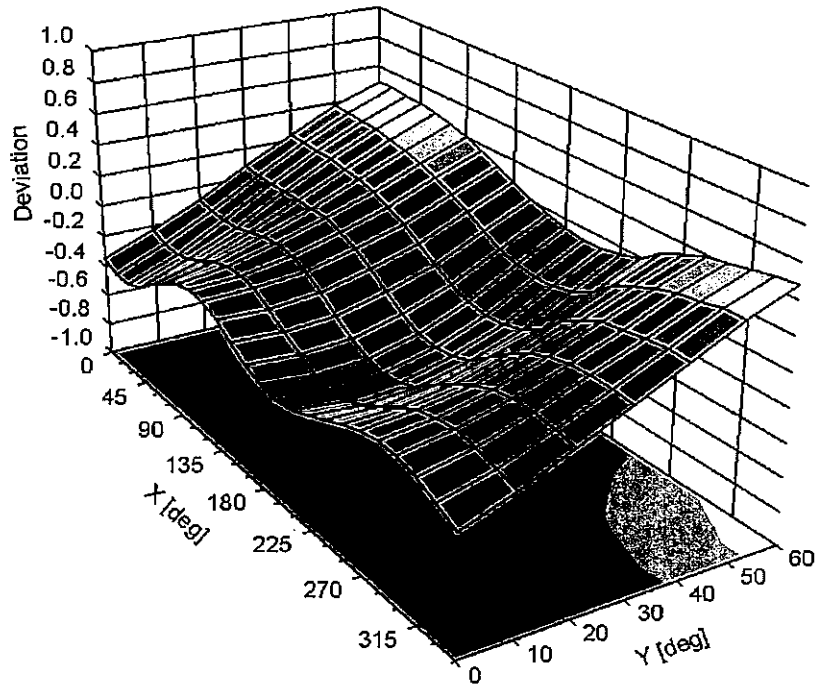


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



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



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3578**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 | 9 mm |
| Tip Diameter | 2.5 mm |
| Probe Tip to Sensor X Calibration Point | 1 mm |
| Probe Tip to Sensor Y Calibration Point | 1 mm |
| Probe Tip to Sensor Z Calibration Point | 1 mm |
| Recommended Measurement Distance from Surface | 2 mm |



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Accreditation No.: **SCS 108**

Client **Sporton (Auden)**

Certificate No: **EX3-3792_Jun11**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3792**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes**

Calibration date: **June 20, 2011**

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: S5066 (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-10 (No. ES3-3013_Dec10) | Dec-11 |
| 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 Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390565 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

| | Name | Function | Signature |
|----------------|---------------|-------------------|-----------------------|
| Calibrated by: | Katja Pokovic | Technical Manager | |
| Approved by: | Niels Kuster | Quality Manager | |
| | | | Issued: June 21, 2011 |

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ 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 EX3DV4

SN:3792

Manufactured: April 5, 2011
Calibrated: June 20, 2011

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3792

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.64 | 0.54 | 0.54 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 97.9 | 98.9 | 99.8 | |

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 | 134.2 | $\pm 2.7 \%$ |
| | | | Y | 0.00 | 0.00 | 1.00 | 123.8 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 122.9 | |

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 E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3792

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) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 835 | 41.5 | 0.90 | 8.93 | 8.93 | 8.93 | 0.80 | 0.67 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 8.69 | 8.69 | 8.69 | 0.75 | 0.71 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 8.06 | 8.06 | 8.06 | 0.75 | 0.62 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 7.76 | 7.76 | 7.76 | 0.76 | 0.60 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 7.68 | 7.68 | 7.68 | 0.80 | 0.57 | ± 12.0 % |
| 2300 | 39.5 | 1.67 | 7.27 | 7.27 | 7.27 | 0.73 | 0.61 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 6.92 | 6.92 | 6.92 | 0.70 | 0.62 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 6.85 | 6.85 | 6.85 | 0.62 | 0.68 | ± 12.0 % |
| 3500 | 37.9 | 2.91 | 6.74 | 6.74 | 6.74 | 0.34 | 1.03 | ± 13.1 % |
| 5200 | 36.0 | 4.66 | 4.95 | 4.95 | 4.95 | 0.35 | 1.80 | ± 13.1 % |
| 5300 | 35.9 | 4.76 | 4.71 | 4.71 | 4.71 | 0.35 | 1.80 | ± 13.1 % |
| 5500 | 35.6 | 4.96 | 4.66 | 4.66 | 4.66 | 0.40 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 4.23 | 4.23 | 4.23 | 0.45 | 1.80 | ± 13.1 % |
| 5800 | 35.3 | 5.27 | 4.42 | 4.42 | 4.42 | 0.43 | 1.80 | ± 13.1 % |

^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: EX3DV4- SN:3792

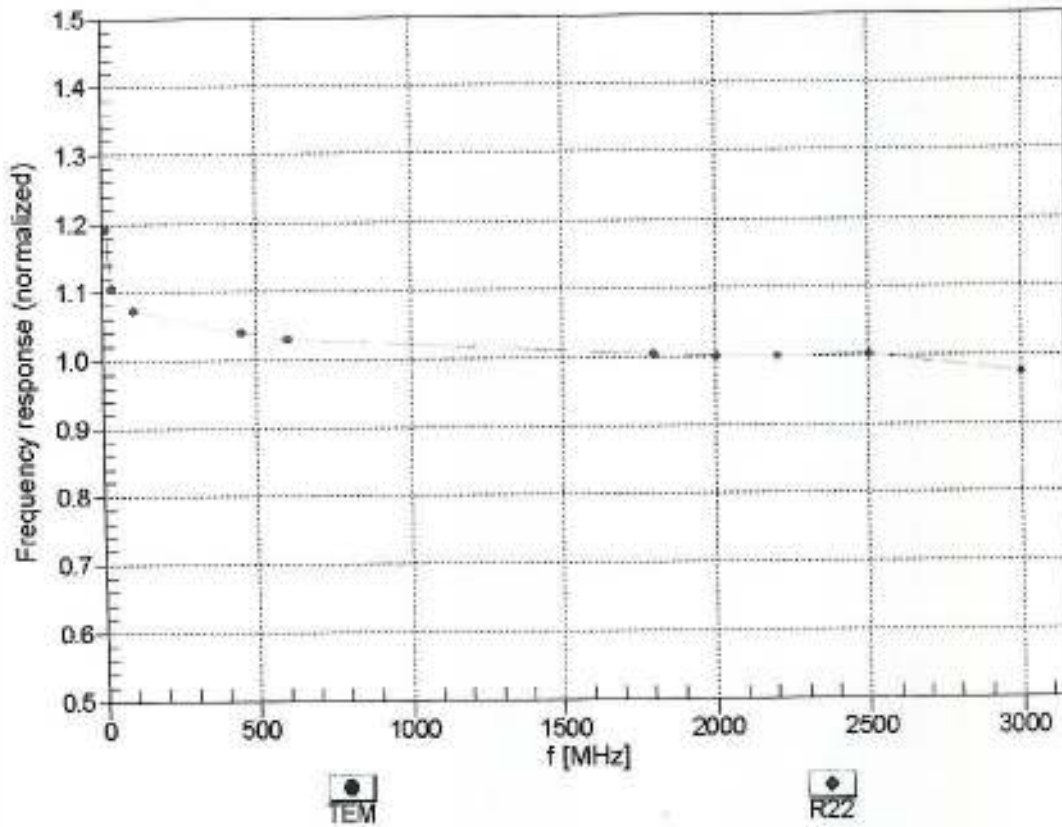
Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) ^c | Relative Permittivity ^f | Conductivity (S/m) ^f | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 835 | 55.2 | 0.97 | 9.02 | 9.02 | 9.02 | 0.80 | 0.72 | ± 12.0 % |
| 900 | 55.0 | 1.05 | 8.91 | 8.91 | 8.91 | 0.80 | 0.71 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 7.62 | 7.62 | 7.62 | 0.80 | 0.69 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 7.17 | 7.17 | 7.17 | 0.80 | 0.64 | ± 12.0 % |
| 2000 | 53.3 | 1.52 | 7.15 | 7.15 | 7.15 | 0.80 | 0.63 | ± 12.0 % |
| 2300 | 52.9 | 1.81 | 6.90 | 6.90 | 6.90 | 0.80 | 0.61 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 6.67 | 6.67 | 6.67 | 0.80 | 0.59 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 6.53 | 6.53 | 6.53 | 0.80 | 0.60 | ± 12.0 % |
| 3500 | 51.3 | 3.31 | 6.08 | 6.08 | 6.08 | 0.29 | 1.48 | ± 13.1 % |
| 5200 | 49.0 | 5.30 | 4.22 | 4.22 | 4.22 | 0.50 | 1.90 | ± 13.1 % |
| 5300 | 48.9 | 5.42 | 3.93 | 3.93 | 3.93 | 0.55 | 1.90 | ± 13.1 % |
| 5500 | 48.6 | 5.65 | 3.76 | 3.76 | 3.76 | 0.55 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 3.53 | 3.53 | 3.53 | 0.60 | 1.90 | ± 13.1 % |
| 5800 | 48.2 | 6.00 | 3.78 | 3.78 | 3.78 | 0.60 | 1.90 | ± 13.1 % |

^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.

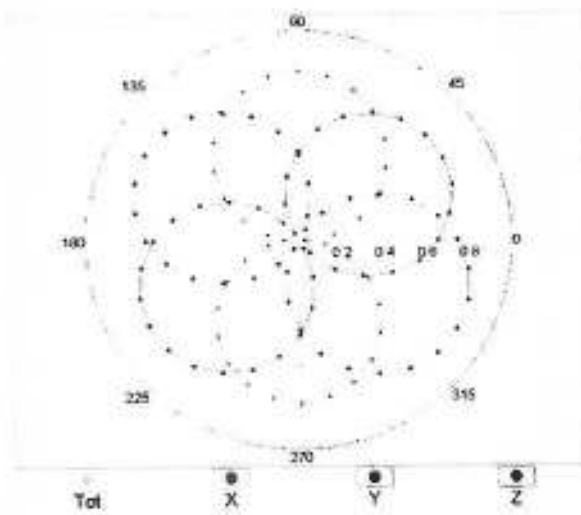
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



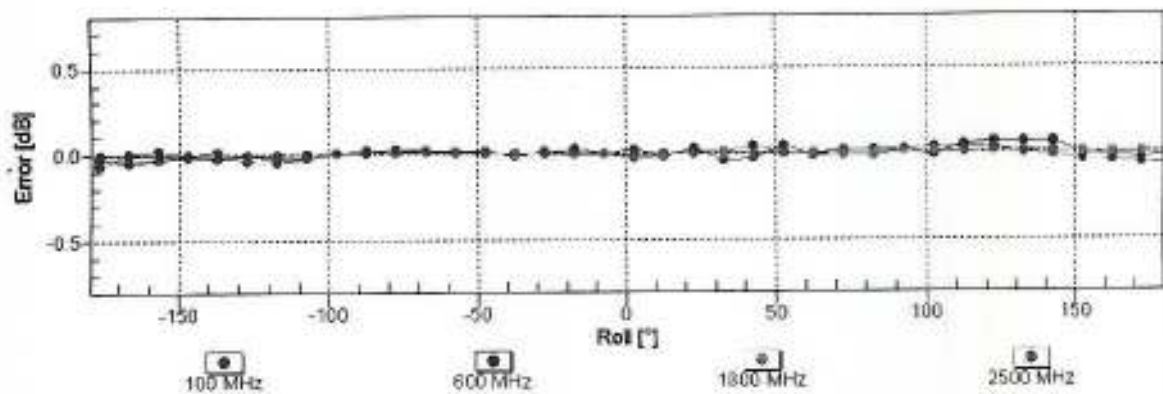
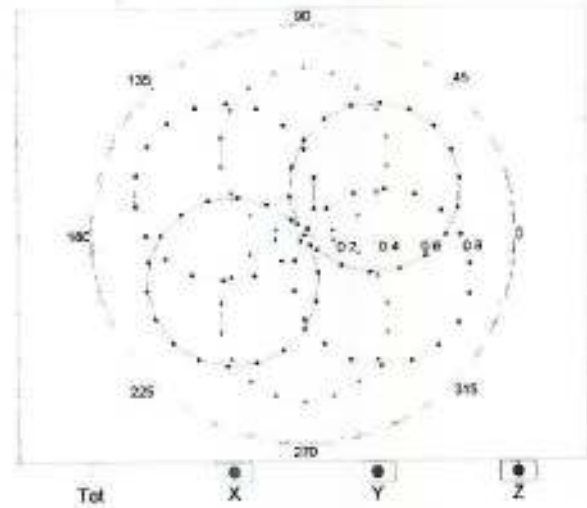
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz, TEM



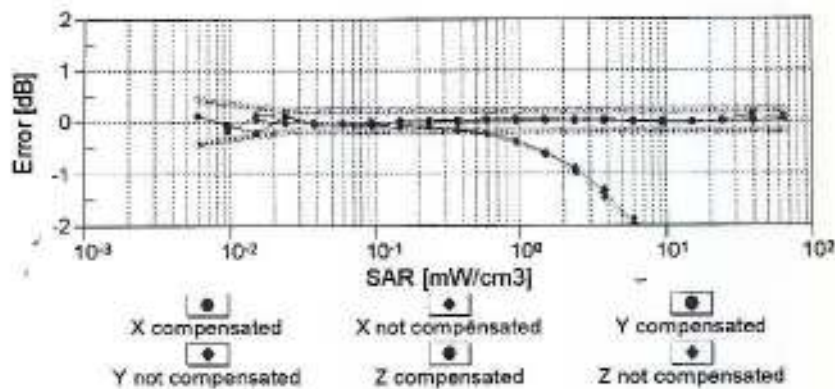
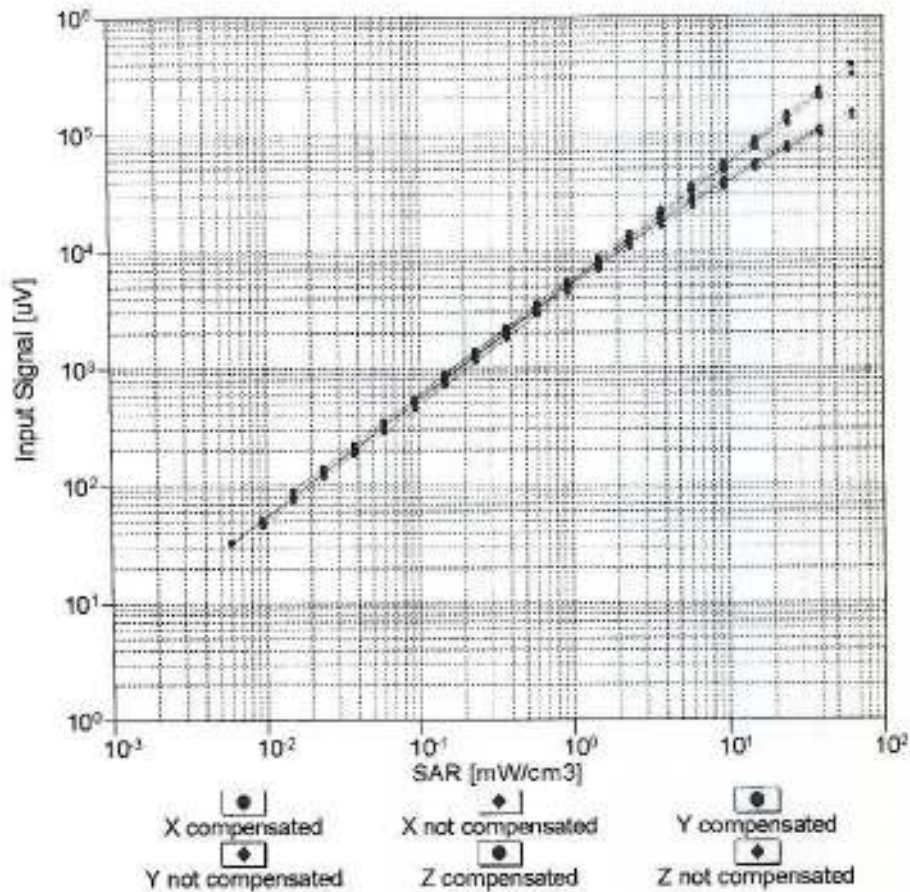
f=1800 MHz, R22



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

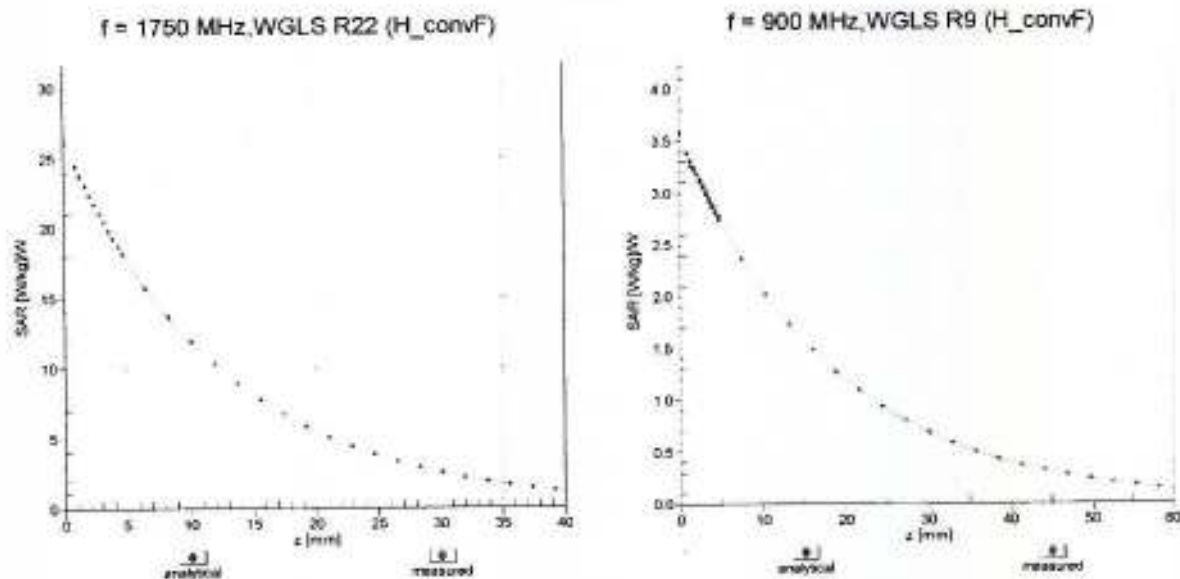
Dynamic Range f(SAR_{head})

(TEM cell , f = 900 MHz)

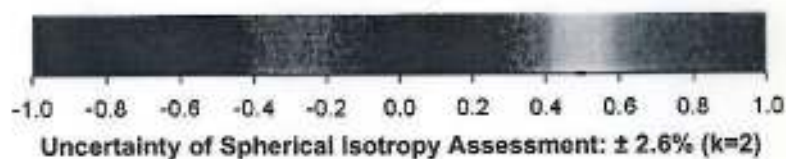
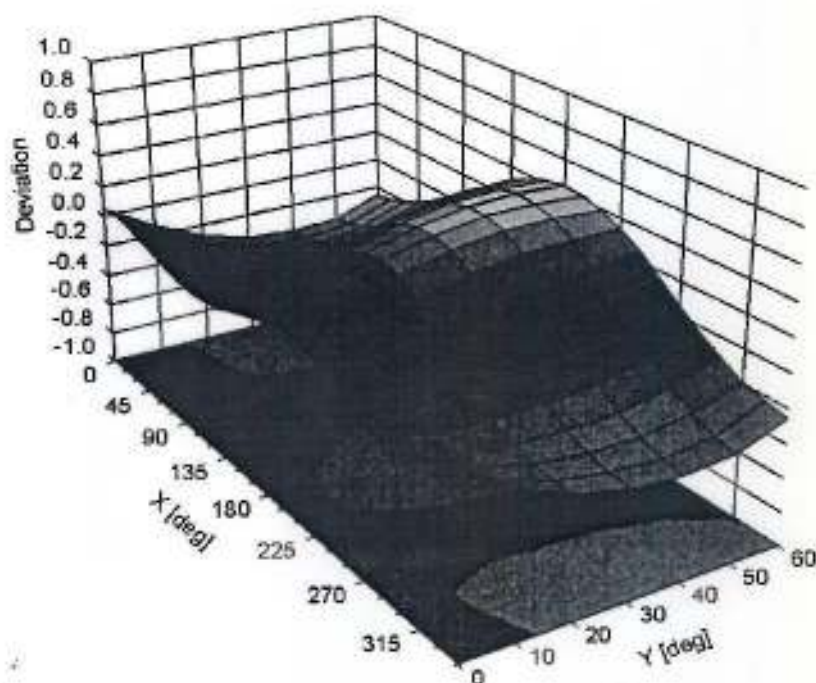


Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

Conversion Factor Assessment

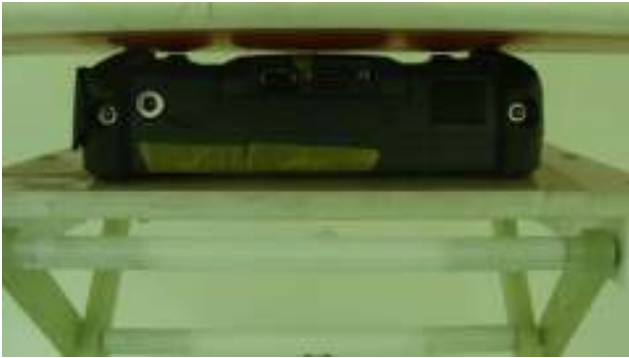


Deviation from Isotropy in Liquid Error (ϕ , θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3792**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 | 9 mm |
| Tip Diameter | 2.5 mm |
| Probe Tip to Sensor X Calibration Point | 1 mm |
| Probe Tip to Sensor Y Calibration Point | 1 mm |
| Probe Tip to Sensor Z Calibration Point | 1 mm |
| Recommended Measurement Distance from Surface | 2 mm |

Appendix D. Test Setup Photos**Bottom of Tablet****Secondary Landscape**



Appendix E. FCC 3G SAR Measurement Procedures

Conducted Output Power:

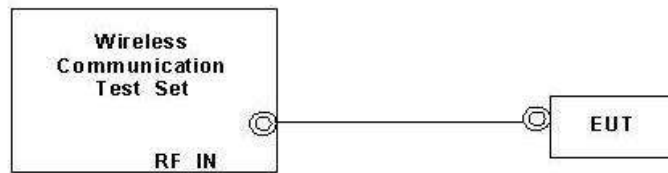
The EUT was tested according to the requirements of the FCC 3G procedures and the TS 34.121. The EUT's WCDMA and HSPA function is Release 6 version supporting HSDPA Category 10, and HSUPA Category 6. A detailed analysis of the output power for all WCDMA, HSPDA, and HSPA (HSUPA & HSDPA) modes is provided in the tables below. According to the FCC 3G procedures, handsets with both HSDPA and HSUPA should be tested according to Release 6 HSPA test procedures, and the function. Device was tested according to procedure KDB941225 - section Release 6 HSPA Data Devices as documented/evaluated in the following table. Power values for HSPA are configurations in WCDMA

| WCDMA SAR Test mode - Conducted Power | | | | | | | |
|---------------------------------------|--------------|-----------------|-------------|-------------|-----------------|--------------|--------------|
| Mode | Setup | Cell band (850) | | | PCS band (1900) | | |
| | | CH4132 | CH4182 | CH4233 | CH9262 | CH9400 | CH9538 |
| | | 826.4 (MHz) | 836.4 (MHz) | 846.6 (MHz) | 1852.4 (MHz) | 1880.0 (MHz) | 1907.6 (MHz) |
| WCDMA | RMC 12.2Kbps | 23.42 | 23.71 | 23.26 | 23.53 | 23.58 | 23.27 |
| HSDPA | Subtest 1 | 22.75 | 23.22 | 22.71 | 22.95 | 23.09 | 23.33 |
| | Subtest 2 | 22.83 | 23.37 | 23.14 | 22.99 | 23.07 | 23.01 |
| | Subtest 3 | 22.36 | 22.66 | 22.17 | 22.46 | 22.49 | 22.12 |
| | Subtest 4 | 22.38 | 22.21 | 22.12 | 22.44 | 22.46 | 22.09 |
| HSUPA | Subtest 1 | 22.48 | 22.25 | 22.55 | 23.05 | 22.61 | 22.14 |
| | Subtest 2 | 21.28 | 21.25 | 21.29 | 21.56 | 21.77 | 21.51 |
| | Subtest 3 | 21.46 | 21.64 | 20.91 | 21.41 | 21.99 | 21.45 |
| | Subtest 4 | 21.85 | 21.48 | 22.21 | 22.56 | 22.25 | 21.75 |
| | Subtest 5 | 22.32 | 22.27 | 22.54 | 22.87 | 23.01 | 22.62 |

| WCDMA SAR Test mode - Conducted Power | | | | |
|---------------------------------------|--------------|-----------------|-------------|-------------|
| Mode | Setup | Cell band (850) | | |
| | | CH4132 | CH4182 | CH4233 |
| | | 826.4(MHz) | 836.4 (MHz) | 846.6 (MHz) |
| WCDMA | RMC 12.2Kbps | 23.33 | 23.35 | 23.19 |
| HSDPA | Subtest 1 | 22.73 | 22.74 | 22.66 |
| | Subtest 2 | 22.75 | 22.74 | 22.63 |
| | Subtest 3 | 22.38 | 22.32 | 22.21 |
| | Subtest 4 | 22.33 | 22.28 | 22.18 |
| HSUPA | Subtest 1 | 21.67 | 21.54 | 21.43 |
| | Subtest 2 | 21.74 | 21.67 | 21.56 |
| | Subtest 3 | 20.90 | 21.19 | 20.99 |
| | Subtest 4 | 21.57 | 21.34 | 21.18 |
| | Subtest 5 | 20.75 | 20.70 | 20.64 |

WCDMA Setup Configuration:

- a. The EUT was connected to Base Station referred to the drawing of Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting
 - i. Data rates: Varied from RMC 12.2Kbps
 - ii. RMC Test Loop = Loop Mode 1
 - iii. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.



Setup Configuration

HSDPA Setup Configuration:

- a. The EUT was connected to Base Station referred to the drawing of Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
 - i. Set Gain Factors (β_c and β_d) and parameters were set according to each
 - ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
 - iii. Set RMC12.2Kbps + HSDPA mode.
 - iv. Set Cell Power = -86 dBm
 - v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
 - vi. Select HSDPA Uplink Parameters
 - vii. Set DeltaACK, DeltaNACK and DeltaCQI = 8
 - viii. Set Ack-Nack Repetition Factor to 3
 - ix. Set CQI Feedback Cycle (k) to 4 ms
 - x. Set CQI Repetition Factor to 2
 - xi. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

| Sub-test | β_c | β_d | β_d (SF) | β_c/β_d | β_{HS} (Note 1, Note 2) | CM (dB) (Note 3) | MPR (dB) (Note 3) |
|----------|-------------------|-------------------|-------------------|-------------------|-------------------------------------|---------------------|----------------------|
| 1 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 0.0 | 0.0 |
| 2 | 12/15 (Note 4) | 15/15 (Note 4) | 64 | 12/15 (Note 4) | 24/15 | 1.0 | 0.0 |
| 3 | 15/15 | 8/15 | 64 | 15/8 | 30/15 | 1.5 | 0.5 |
| 4 | 15/15 | 4/15 | 64 | 15/4 | 30/15 | 1.5 | 0.5 |

Note 1: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CQI} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and $\Delta_{NACK} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$, and $\Delta_{CQI} = 24/15$ with $\beta_{HS} = 24/15 * \beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d = 12/15, \beta_{HS}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

Setup Configuration

HSPA (HSUPA & HSPDA) Setup Configuration:

- a. The EUT was connected to Base Station referred to the drawing of Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting * :
 - i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
 - ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
 - iii. Set Cell Power = -86 dBm
 - iv. Set Channel Type = 12.2k + HSPA
 - v. Set UE Target Power
 - vi. Power Ctrl Mode= Alternating bits
 - vii. Set and observe the E-TFCI
 - viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
- d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

| Sub-test | β_c | β_d | β_d (SF) | β_c/β_d | β_{HS} (Note 1) | β_{ec} | β_{ed} (Note 5) (Note 6) | β_{ed} (SF) | β_{ed} (Codes) | CM (dB) (Note 2) | MPR (dB) (Note 2) | AG Index (Note 6) | E-TFCI |
|----------|----------------|----------------|----------------|-------------------|-----------------------|--------------|--|-------------------|----------------------|------------------|-------------------|-------------------|--------|
| 1 | 11/15 (Note 3) | 15/15 (Note 3) | 64 | 11/15 (Note 3) | 22/15 | 209/25 | 1309/225 | 4 | 1 | 1.0 | 0.0 | 20 | 75 |
| 2 | 6/15 | 15/15 | 64 | 6/15 | 12/15 | 12/15 | 94/75 | 4 | 1 | 3.0 | 2.0 | 12 | 67 |
| 3 | 15/15 | 9/15 | 64 | 15/9 | 30/15 | 30/15 | β_{ed1} : 47/15 β_{ed2} : 47/15 | 4 | 2 | 2.0 | 1.0 | 15 | 92 |
| 4 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 2/15 | 56/75 | 4 | 1 | 3.0 | 2.0 | 17 | 71 |
| 5 | 15/15 (Note 4) | 15/15 (Note 4) | 64 | 15/15 (Note 4) | 30/15 | 24/15 | 134/15 | 4 | 1 | 1.0 | 0.0 | 21 | 81 |

Note 1: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CCl} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15, \beta_{HS}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Setup Configuration

Note: For details settings in the Agilent 8960 test equipment, please refer to the user guide “ HSUPA Measurement Guide with 8960 V7.5.0 Release 7 (2007-06) Ver.: v.02.18”



| Call Setup Screen | | | |
|-----------------------|---|--------------------|----------------------------|
| Call Control | Active Cell Operating Mode | | Call Parms |
| Channel (UARFCN) Info | UE Information | | Cell Power |
| | INSI: INEI: Power Class: | | -86.00 |
| Cell Parameters | UE Expected Open Loop Transmit Power | | dBm/3.84 MHz |
| | Initial PRACH TX Power: -11.70 dBm Initial DPCCH TX Power: -0.56 dBm | | Channel Type |
| Generator Info | Uplink Parameters | | 12.2k + HSPA |
| | Value | | Paging Service |
| Uplink Parameters | PRACH Preambles | 64 | RB Test Mode |
| | PRACH Ramping Cycles (NMAX) | 2 | |
| UE Rep Neas | Available Subchannels (Bit Mask) | 000000000001 | HSPA Parameters |
| | Uplink DPCH Scrambling Code | 0 | |
| Close Menu | Uplink DPCH Bc/Bd Control | Manual | 34.121 Preset Call Configs |
| | Manual Uplink DPCH Bc | 11 | |
| 2 of 4 | Manual Uplink DPCH Bd | 15 | Channel (UARFCN) Parms |
| | Maximum Uplink Transmit Power Level | 21 dBm | |
| Active Cell | | Sys Type: UTRA FDD | |
| Idle | | | |
| IntRef | | Offset | |
| | | | 1 of 3 |

Example for HSPA Subtest 1, and other subtests following table, C11.1.3
(Gain Factors ($\beta_c = 11$ and $\beta_d = 15$))

| Call Setup Screen | | | |
|--------------------|--|--|---------------------------------|
| Call Control | Active Cell Operating Mode | | Serving Grant |
| Additional Screens | UE Information | | AG Mode |
| | INSI: INEI: Power Class: | | Single Shot |
| Cell Parameters | UE Expected Open Loop Transmit Power | | Single Shot AG |
| | Initial PRACH TX Power: -11.70 dBm Initial DPCCH TX Power: -0.56 dBm | | 20: (119/15)^2 |
| Generator Info | Call Processing Status | | Send Single Shot Absolute Grant |
| | Current Service Type: None MM Status: GMM State: Current DPCH | | Send Relative Grant Up |
| Uplink Parameters | Abs Single Shot AG Index 15: (67/15)^2 Index 16: (75/15)^2 Index 17: (84/15)^2 Index 18: (95/15)^2 Index 19: (106/15)^2 Index 20: (119/15)^2 | | Send Relative Grant Down |
| | HSUPA In UE Rep E-DCH Last Received Throughput: ACKs Transmit | | Return |
| Trig Output Setup | Active Cell | | |
| | Idle | | Sys Type: UTRA FDD |
| Sys Frame Clock | IntRef | | Offset |
| | | | |
| 2 of 4 | | | 1 of 2 |

Example: AG – Index = 20 for HSPA subtest 1



| Call Setup Screen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------------------|--|-------------------------------------|-------------|--------------------|------|-----------|------|-----|--------|--------|--------|----|----|-----|----|-----|------|-----|------|-----|------|----|----|-----|----|-----|------|-----|------|-----|------|----|----|-----|----|-----|------|-----|------|-----|------|----|----|-----|----|-----|------|-----|------|-----|------|----|----|-----|------|-----|------|-----|------|-----|------|----|----|-----|------|-----|------|-----|------|-----|------|----|----|-----|------|-----|------|-----|------|-----|------|----|----|-----|------|-----|------|-----|------|-----|------|-----|----|-----|------|-----|------|-----|------|-----|------|--|
| Screen Ctrl | Recorded E-TFCI Information | E-TFCI Record | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Channel (UARFCN) Info | E-TFCI Recording State | E-TFCI Rec Count | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Idle | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HSPA Information | Recorded E-TFCI Values | Start Recording E-TFCI Values | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E-TFCI Recording Information | <table border="1"> <tr><td>1:</td><td>75</td><td>11:</td><td>75</td><td>21:</td><td>----</td><td>31:</td><td>----</td><td>41:</td><td>----</td></tr> <tr><td>2:</td><td>75</td><td>12:</td><td>75</td><td>22:</td><td>----</td><td>32:</td><td>----</td><td>42:</td><td>----</td></tr> <tr><td>3:</td><td>75</td><td>13:</td><td>75</td><td>23:</td><td>----</td><td>33:</td><td>----</td><td>43:</td><td>----</td></tr> <tr><td>4:</td><td>75</td><td>14:</td><td>75</td><td>24:</td><td>----</td><td>34:</td><td>----</td><td>44:</td><td>----</td></tr> <tr><td>5:</td><td>75</td><td>15:</td><td>75</td><td>25:</td><td>----</td><td>35:</td><td>----</td><td>45:</td><td>----</td></tr> <tr><td>6:</td><td>75</td><td>16:</td><td>----</td><td>26:</td><td>----</td><td>36:</td><td>----</td><td>46:</td><td>----</td></tr> <tr><td>7:</td><td>75</td><td>17:</td><td>----</td><td>27:</td><td>----</td><td>37:</td><td>----</td><td>47:</td><td>----</td></tr> <tr><td>8:</td><td>75</td><td>18:</td><td>----</td><td>28:</td><td>----</td><td>38:</td><td>----</td><td>48:</td><td>----</td></tr> <tr><td>9:</td><td>75</td><td>19:</td><td>----</td><td>29:</td><td>----</td><td>39:</td><td>----</td><td>49:</td><td>----</td></tr> <tr><td>10:</td><td>75</td><td>20:</td><td>----</td><td>30:</td><td>----</td><td>40:</td><td>----</td><td>50:</td><td>----</td></tr> </table> | 1: | 75 | 11: | 75 | 21: | ---- | 31: | ---- | 41: | ---- | 2: | 75 | 12: | 75 | 22: | ---- | 32: | ---- | 42: | ---- | 3: | 75 | 13: | 75 | 23: | ---- | 33: | ---- | 43: | ---- | 4: | 75 | 14: | 75 | 24: | ---- | 34: | ---- | 44: | ---- | 5: | 75 | 15: | 75 | 25: | ---- | 35: | ---- | 45: | ---- | 6: | 75 | 16: | ---- | 26: | ---- | 36: | ---- | 46: | ---- | 7: | 75 | 17: | ---- | 27: | ---- | 37: | ---- | 47: | ---- | 8: | 75 | 18: | ---- | 28: | ---- | 38: | ---- | 48: | ---- | 9: | 75 | 19: | ---- | 29: | ---- | 39: | ---- | 49: | ---- | 10: | 75 | 20: | ---- | 30: | ---- | 40: | ---- | 50: | ---- | |
| 1: | 75 | 11: | 75 | 21: | ---- | 31: | ---- | 41: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2: | 75 | 12: | 75 | 22: | ---- | 32: | ---- | 42: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3: | 75 | 13: | 75 | 23: | ---- | 33: | ---- | 43: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4: | 75 | 14: | 75 | 24: | ---- | 34: | ---- | 44: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5: | 75 | 15: | 75 | 25: | ---- | 35: | ---- | 45: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6: | 75 | 16: | ---- | 26: | ---- | 36: | ---- | 46: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7: | 75 | 17: | ---- | 27: | ---- | 37: | ---- | 47: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8: | 75 | 18: | ---- | 28: | ---- | 38: | ---- | 48: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9: | 75 | 19: | ---- | 29: | ---- | 39: | ---- | 49: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10: | 75 | 20: | ---- | 30: | ---- | 40: | ---- | 50: | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Clear UE Info | 15/15 | Send Step Up TPC Bit Pattern | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Return | | Send Step Down TPC Bit Pattern | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | <table border="1"> <tr> <td><input type="checkbox"/> Background</td> <td>Active Cell</td> <td>Sys Type: UTRA FDD</td> </tr> <tr> <td></td> <td>Connected</td> <td></td> </tr> <tr> <td></td> <td>IntRef</td> <td>Offset</td> </tr> </table> | <input type="checkbox"/> Background | Active Cell | Sys Type: UTRA FDD | | Connected | | | IntRef | Offset | Return | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Background | Active Cell | Sys Type: UTRA FDD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Connected | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | IntRef | Offset | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Example: Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1



Reference:

- [1] 941225 D01 SAR test for 3G devices v02, SAR Measurement Procedures for 3G Devices CDMA 2000/Ev-Do/WCDMA/HSDPA/HSPA Oct. 2007 Laboratory Division Office of Engineering and Technology Federal Communications Commission
- [2.] TS 34.121 Universal Mobile Telecommunications System (UMTS); Terminal Conformance Specification, Radio Transmission and Reception (FDD)
- [3.] HSUPA Measurement Guide with 8960 V7.5.0 Release 7 (2007-06) Ver.: v.02.18



Appendix F. FCC 3G SAR Measurement Procedures

Conducted Output Power:

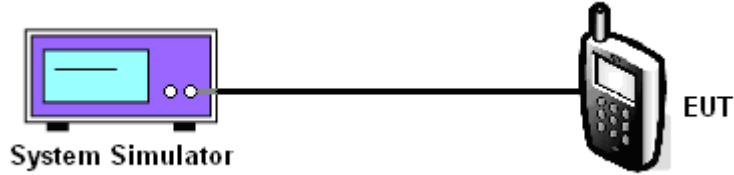
The EUT was tested according to the requirements of the FCC 3G procedures and the 3.1.2.3.4.

A detailed analysis of the output power verification is provided as the table below:

| Function Type | Reverse Traffic Channel | Test Mode | Radio Configuration | | Service Option | Data Rates (kbps) | Power Control | Low Ch | Mid. Ch | High Ch |
|-------------------|-------------------------|-----------|-------------------------------|-------------------------------|----------------|-------------------|---------------|--------|---------|---------|
| | | | Forward Traffic Channel (Fwd) | Reverse Traffic Channel (Rvs) | | | | 1013 | 384 | 777 |
| CDMA2000 Cellular | FCH | 1 | 1 | 1 | 55 | Full | All Up | 23.62 | 23.65 | 23.55 |
| | | 3 | 3 | 3 | 55 | Full | All Up | 23.61 | 23.60 | 23.53 |
| | + F-SCH | 3 | 3 | 3 | 32 | FCH:Full,SCH 9.6 | All Up | 23.71 | 23.58 | 23.65 |
| | +SCH | 3 | 3 | 3 | 32 | FCH:Full,SCH 9.6 | All Up | 23.64 | 23.58 | 23.71 |
| | EVDO Rev.0* | Subtype:0 | | | | RTAP 153.6 | All Up | 23.88 | 23.97 | 23.90 |
| | EVDO Rev.A* | Subtype:0 | | | | RETAP 4098 | All Up | 23.91 | 23.74 | 23.75 |

| Function Type | Reverse Traffic Channel | Test Mode | Radio Configuration | | Service Option | Data Rates (kbps) | Power Control | Low Ch | Mid. Ch | High Ch |
|---------------|-------------------------|-----------|-------------------------------|-------------------------------|----------------|-------------------|---------------|--------|---------|---------|
| | | | Forward Traffic Channel (Fwd) | Reverse Traffic Channel (Rvs) | | | | 25 | 600 | 1175 |
| CDMA2000 PCS | FCH | 1 | 1 | 1 | 55 | Full | All Up | 23.96 | 23.60 | 23.16 |
| | | 3 | 3 | 3 | 55 | Full | All Up | 23.81 | 23.54 | 23.16 |
| | + F-SCH | 3 | 3 | 3 | 32 | FCH:Full,SCH 9.6 | All Up | 23.84 | 23.53 | 23.10 |
| | +SCH | 3 | 3 | 3 | 32 | FCH:Full,SCH 9.6 | All Up | 23.76 | 23.46 | 23.17 |
| | EVDO Rev.0* | Subtype:0 | | | | RTAP 153.6 | All Up | 23.98 | 23.90 | 23.68 |
| | EVDO Rev.A* | Subtype:0 | | | | RETAP 4098 | All Up | 23.97 | 23.91 | 23.73 |

CDMA2000 Setup Configuration:



Setup Configuration

1. The EUT was connected to System Simulator, Agilent 8960. Refer to the drawing of Setup Configuration.
2. The RF path losses were compensated into the measurements.
3. A call was established between EUT and System Simulator with following setting:
 - a. For 1xRTT, set the Radio Configuration and the Service Option
 - b. For 1xEV-DO, set the Protocol Release and Data Rate
 - c. Set the Power Control to All Up Bits
4. The transmitted maximum output power was recorded.

| Call Setup Screen | | | | | | |
|-------------------|----------------------------|--|-------------------|-------|--------------------------|--------------|
| Call Control | Active Cell Operating Mode | | | | Call Parm | |
| Close Menu | Mobile Station Information | | | | Cell Power | |
| | ESN (Hex): | | | | -86.00 | |
| | ESN (Dec): | | | | dBm/1.23 MHz | |
| | NCC: | | | | Cell Band | |
| | NMC: | | | | US PCS | |
| | NSIN: | | | | Channel | |
| | Slot Class: | | | | 1175 | |
| | Slot Cycle Index: ---- | | | | Protocol Rev | |
| | Protocol Revision: | | | | 6 (IS-2000-0) | |
| | FCH Service Option Setup | | | Value | | Radio Config |
| Service Option f | | | S055 (Loopback) | | S055 (Loopback) | |
| Service Option f | | | S09 (Loopback) | | S055 (Loopback) | |
| Service Option f | | | S01 (Voice) | | S055 (Loopback) | |
| Service Option f | | | S02 (Loopback) | | S055 (Loopback) | |
| Service Option f | | | S03 (Voice) | | S055 (Loopback) | |
| Service Option f | | | S06 (SIS) | | S055 (Loopback) | |
| Service Option f | | | S055 (Loopback) | | S055 (Loopback) | |
| Service Option f | | | S068 (Voice) | | FCH Service Option Setup | |
| Active Cell | | | Sys Type: IS-2000 | | 1 of 4 | |
| Idle | | | | | | |
| IntRef | | | Offset | | | |

1xRTT setting for Radio Configuration 1 with Service Option 55



| Call Setup Screen | | | | | | |
|-------------------|----------------------------|-----------------|--------|-------------------|--------------------------|-----------------|
| Call Control | Active Cell Operating Mode | | | | Call Parm | |
| Close Menu | Mobile Station Information | | | | Cell Power | -86.00 |
| | ESN (Hex): | | | | dBm/1.23 MHz | |
| | ESN (Dec): | | | | Cell Band | US PCS |
| | NCC: | | | | Channel | 1175 |
| | NMC: | | | | Protocol Rev | 6 (IS-2000-0) |
| | NSIN: | | | | Radio Config | (Fud3, Rus3) |
| | Slot Class: | | | | FCH Service Option Setup | S055 (Loopback) |
| | Slot Cycle Index: ---- | | | | | |
| | Protocol Revision: | | | | | |
| | FCH Service Option Setup | | Value | | | |
| Service Option f | | Service Option | | | | |
| Service Option f | | S01 (Voice) | | S055 (Loopback) | | |
| Service Option f | | S02 (Loopback) | | S09 (Loopback) | | |
| Service Option f | | S03 (Voice) | | S055 (Loopback) | | |
| Service Option f | | S06 (SIS) | | S055 (Loopback) | | |
| | | S055 (Loopback) | | | | |
| | | S032 (+ F-SCH) | | | | |
| | | Active Cell | | Sys Type: IS-2000 | | |
| | | Idle | | | | |
| | | IntRef | Offset | | 1 of 4 | |

1xRTT setting for Radio Configuration 3 with Service Option 55

| Call Setup Screen | | | | | | |
|-------------------|----------------------------|-----------------|--------|-------------------|--------------------------|-----------------|
| Call Control | Active Cell Operating Mode | | | | Call Parm | |
| Close Menu | Mobile Station Information | | | | Cell Power | -86.00 |
| | ESN (Hex): | | | | dBm/1.23 MHz | |
| | ESN (Dec): | | | | Cell Band | US PCS |
| | NCC: | | | | Channel | 1175 |
| | NMC: | | | | Protocol Rev | 6 (IS-2000-0) |
| | NSIN: | | | | Radio Config | (Fud3, Rus3) |
| | Slot Class: | | | | FCH Service Option Setup | S055 (Loopback) |
| | Slot Cycle Index: ---- | | | | | |
| | Protocol Revision: | | | | | |
| | FCH Service Option Setup | | Value | | | |
| Service Option f | | Service Option | | | | |
| Service Option f | | S02 (Loopback) | | S09 (Loopback) | | |
| Service Option f | | S03 (Voice) | | S032 (+ SCH) | | |
| Service Option f | | S06 (SIS) | | S055 (Loopback) | | |
| | | S055 (Loopback) | | S055 (Loopback) | | |
| | | S032 (+ F-SCH) | | | | |
| | | S032 (+ SCH) | | | | |
| | | Active Cell | | Sys Type: IS-2000 | | |
| | | Idle | | | | |
| | | IntRef | Offset | | 1 of 4 | |

1xRTT setting for Radio Configuration 3 with Service Option 32



| Call Setup Screen | | | | | | |
|-----------------------|---|--|--------|--------|-----------------|--------|
| Call Control | Active Cell Operating Mode | | | | Call Params | |
| Operating Mode | Access Terminal Information (AT Reported) Session Seed: Hardware ID Type (Hex): Hardware ID (Hex): Hardware ID (Decimal): | | | | Rvs Power Ctrl | |
| Active Cell | | | | | Active bits | |
| Start Data Connection | Access Terminal Information (AN Assigned) UATI 024: ---- UATI Color Code: ---- MAC Index: ---- | | | | Pur Ctrl Step | |
| | | | | | 1.0 dB | |
| Close Session | Protocol Release Session App: 0 (1xEV-DO) Application Test Applica: A (1xEV-DO-A) Limited TAP: B (1xEV-DO-B) AT Directed: Z DRC Value Fi: ACK Channel: | | | | Call Drop Timer | |
| | | | | | On | |
| Handoff Setup | Active Cell: Idle Sys Type: IS-856 | | | | Call Limit Mode | |
| | | | | | Off | |
| AT Max Power | 23 dBm/1.23MHz | | | | Protocol Rel | |
| | | | | | 0 (1xEV-DO) | |
| 1 of 3 | | | IntRef | Offset | PLSub0 | RTAP |
| | | | | | | 2 of 3 |

1xEV-DO setting for Protocol Release (Rev.0 or Rev.A)

| Call Setup Screen | | | | | | |
|-----------------------|--|--|--------|--------|--------------------|--------|
| Call Control | Active Cell Operating Mode | | | | Call Params | |
| Operating Mode | Access Terminal Information (AT Reported) Session Seed: Hardware ID Type (Hex): Hardware ID (Hex): Hardware ID (Decimal): | | | | Cell Power | |
| Active Cell | | | | | -86.00 | |
| Start Data Connection | Access Terminal Information (AN Assigned) UATI 024: ---- UATI Color Code: ---- MAC Index: ---- | | | | dBm/1.23 MHz | |
| | | | | | Cell Band | |
| Close Session | RTAP Rate Session App: 9.6 kbps Application Test Applica: 19.2 kbps Limited TAP: 38.4 kbps AT Directed: 76.8 kbps DRC Value Fi: 153.6 kbps ACK Channel: | | | | US PCS | |
| | | | | | Channel | |
| Handoff Setup | Active Cell: Idle Sys Type: IS-856 | | | | 1175 | |
| | | | | | Application Config | |
| AT Max Power | 23 dBm/1.23MHz | | | | FTAP Rate | |
| | | | | | 307.2 kbps | |
| 1 of 3 | | | IntRef | Offset | PLSub0 | RTAP |
| | | | | | | 1 of 3 |

1xEV-DO setting for RTAP data rate (153.6 kbps)



| Call Setup Screen | | | | | | |
|-----------------------|--|--------------------|------------------|--------|--------------------|--------|
| Call Control | Active Cell Operating Mode | | | | Call Params | |
| Operating Mode | Access Terminal Information (AT Reported) | | | | Cell Power | |
| Active Cell | Session Seed: Hardware ID Type (Hex): Hardware ID (Hex): Hardware ID (Decimal): | | | | -86.00 | |
| | Access Terminal Information (AM Assigned) | | | | dBm/1.23 MHz | |
| Start Data Connection | UATI 024: ---- UATI Color Code: ---- MAC Index: ---- | | | | Cell Band | |
| | Application Configuration | | | | US PCS | |
| Close Session | Session App | R-Data Packet Size | Application | | Channel | |
| | Enhanced Te | 128 | AP | | 1175 | |
| Handoff Setup | AT Directed | 256 | Z | | Application Config | |
| | DRC Value Fi | 512 | : | | F-Traffic Format | |
| | ACK Channel | 768 | : | | 4 (1024,2,128) | |
| AT Max Power | Reverse Data | 1024 | : | | (307.2k, QPSK) | |
| 23 dBm/1.23MHz | Expected En | 1536 | ↓ Capacity | | R-Data Pkt Size | |
| | | | kbps | | 128 | |
| | | | | | bits | |
| | | Active Cell | Sys Type: IS-856 | | | |
| | | Idle | | | | |
| 1 of 3 | | | IntRef | Offset | PLSub0 | RETAP |
| | | | | | | 1 of 3 |

1xEV-DO setting for RETAP data rate (4096 kbps)



Reference:

- [1] SAR Measurement Procedures for 3G Devices CDMA 2000/Ev-Do/WCDMA/HSDPA, June 2006
Laboratory Division Office of Engineering and Technology Federal Communications Commission
- [2] 3.1.2.3.4 Maximum RF Output Power 3GPP2 C.S0033-0 Version 2.0, Date: 12 December 2003
Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access
Terminal