

APPENDIX 2 : SAR Measurement data

1. Evaluation procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the E-field at a fixed location above the ear point or central position of flat phantom was used as a reference value for assessing the power drop.

Step 2: The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the antenna of EUT and the horizontal grid spacing was 15 mm x 15 mm . Based on these data, the area of the maximum absorption was determined by spline interpolation.

Step 3: Around this point found in the Step 2 (area scan) , a volume of 30mm x 30mm x 30mm was assessed by measuring 7 x 7 x 7 points. And for any secondary peaks found in the Step2 which are within 2dB of maximum peak (level more than ambient noise (≥ 0.012 W/kg)) and not with this Step3 (Zoom scan) is repeated. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

(1). The data at the surface were extrapolated, since the center of the dipoles is 2.7mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm [4]. A polynomial of the fourth order was calculated through the points in z-axes.

This polynomial was then used to evaluate the points between the surface and the probe tip.

(2). The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the "Not a knot"-condition (in x, y and z-directions) [4], [5]. The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.

(3). All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the E-field at the same location as in Step 1.

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2. Measurement data (SAR 2450MHz)

PSP-3001 (Normal battery) / Body/ Front/ 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12

- Sensor-Surface: 2mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0

- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.313 mW/g

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

Reference Value = 4.61 V/m; Power Drift = -0.186 dB

Peak SAR (extrapolated) = 0.398 W/kg

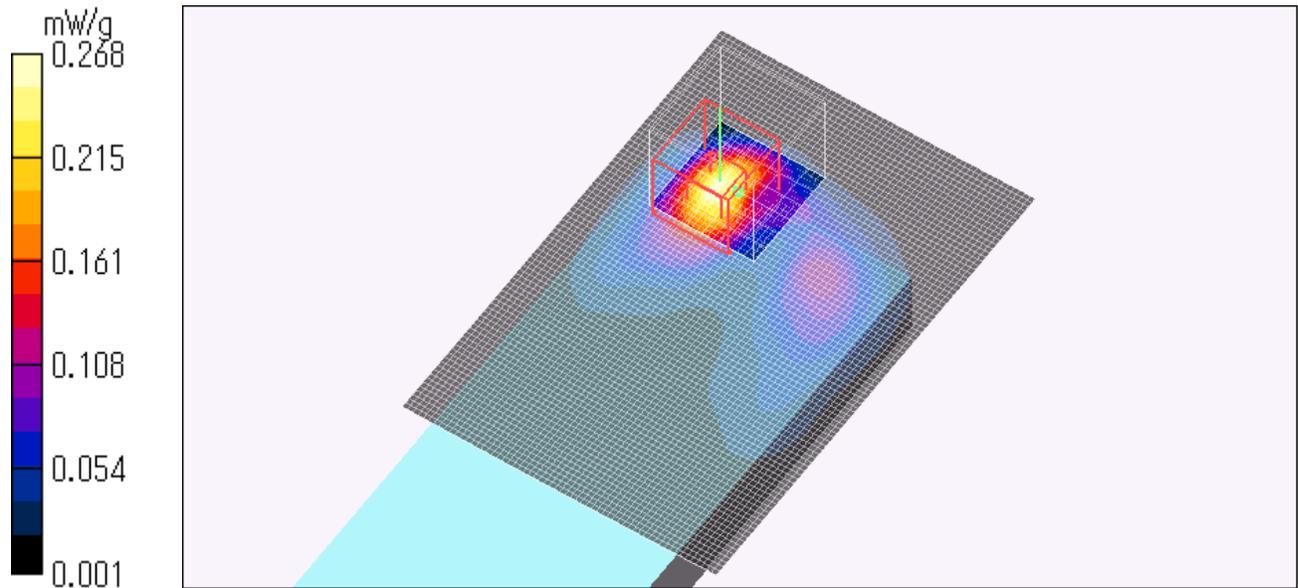
SAR(1 g) = 0.168 mW/g; SAR(10 g) = 0.072 mW/g

Maximum value of SAR (measured) = 0.268 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.0 degree.C , After 22.0 degree.C



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PSP-3001 (Normal battery) / Body/ Rear/ 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.222 mW/g

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

Reference Value = 2.17 V/m; Power Drift = 0.189 dB

Peak SAR (extrapolated) = 0.337 W/kg

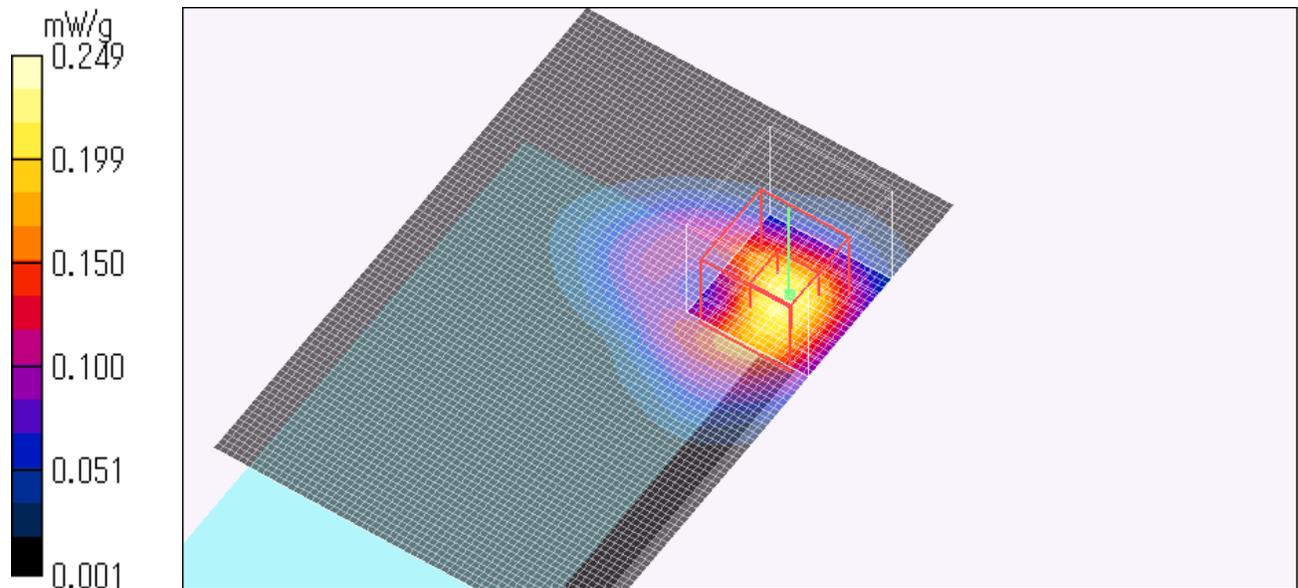
SAR(1 g) = 0.167 mW/g; SAR(10 g) = 0.080 mW/g

Maximum value of SAR (measured) = 0.249 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.0 degree.C , After 22.0 degree.C



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PSP-3001 (Normal battery) / Body/ Left side / 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.112 mW/g

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

Reference Value = 7.81 V/m; Power Drift = -0.201 dB

Peak SAR (extrapolated) = 0.171 W/kg

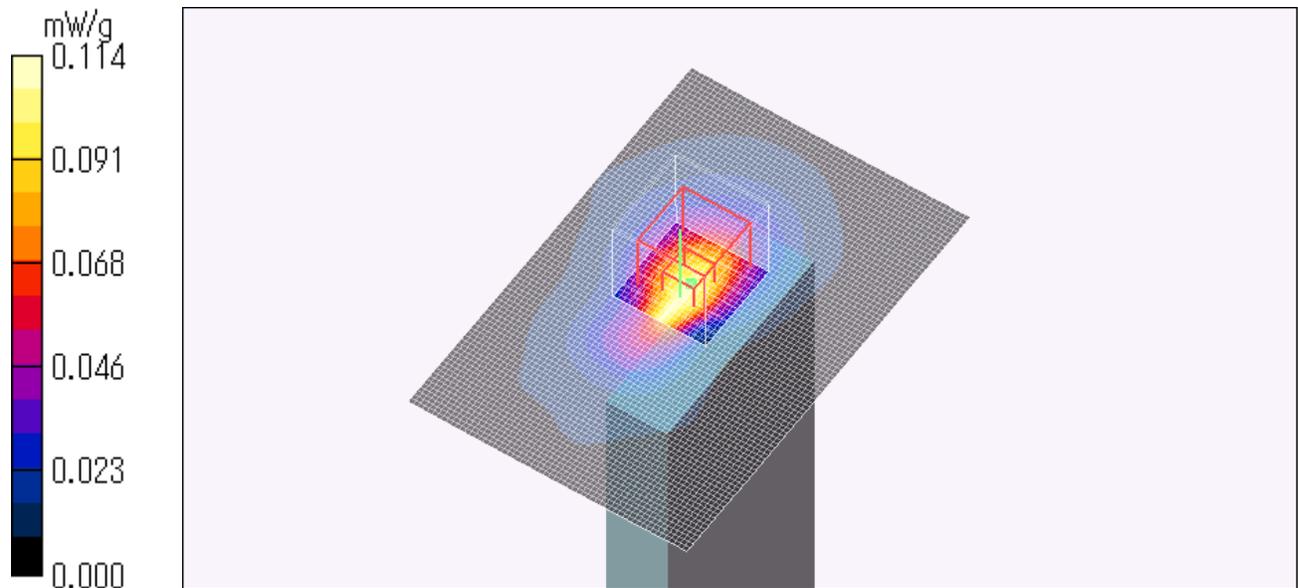
SAR(1 g) = 0.074 mW/g; SAR(10 g) = 0.036 mW/g

Maximum value of SAR (measured) = 0.114 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.0 degree.C , After 22.0 degree.C



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PSP-3001 (Normal battery) / Body/ Right side / 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.006 mW/g

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

Reference Value = 1.23 V/m; Power Drift = 0.177 dB

Peak SAR (extrapolated) = 0.006 W/kg

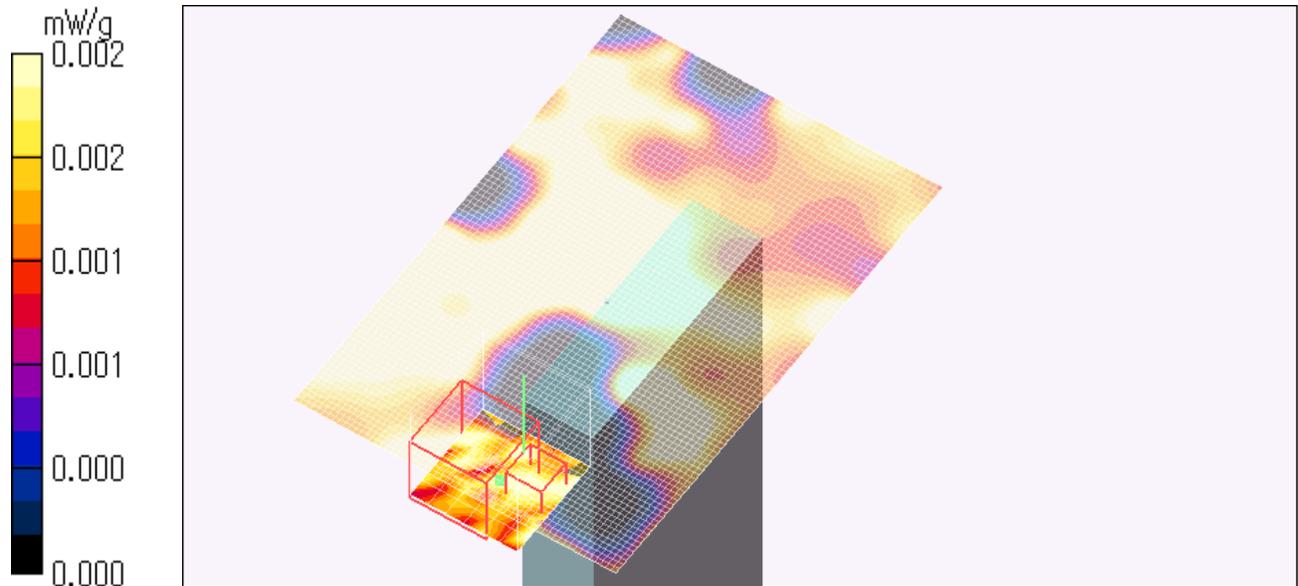
SAR(1 g) = 0.00105 mW/g; SAR(10 g) = 0.000429 mW/g

Maximum value of SAR (measured) = 0.002 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.0 degree.C , After 22.0 degree.C



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PSP-3001 (Normal battery) / Body/ Top / 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.098 mW/g

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

Reference Value = 6.75 V/m; Power Drift = 0.019 dB

Peak SAR (extrapolated) = 0.130 W/kg

SAR(1 g) = 0.065 mW/g; SAR(10 g) = 0.031 mW/g

Maximum value of SAR (measured) = 0.097 mW/g

Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.75 V/m; Power Drift = 0.019 dB

Peak SAR (extrapolated) = 0.117 W/kg

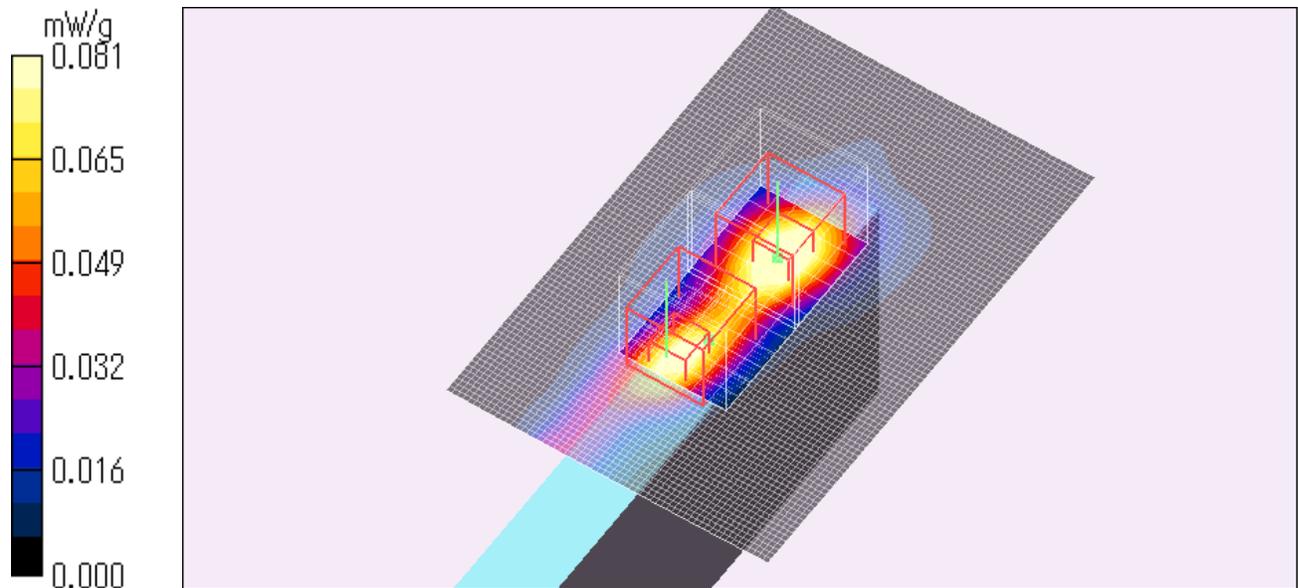
SAR(1 g) = 0.055 mW/g; SAR(10 g) = 0.025 mW/g

Maximum value of SAR (measured) = 0.081 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.0 degree.C , After 22.0 degree.C



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PSP-3001 (Normal battery) / Body/ Bottom / 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12

- Sensor-Surface: 2mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0

- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.048 mW/g

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

Reference Value = 4.81 V/m; Power Drift = -0.136 dB

Peak SAR (extrapolated) = 0.064 W/kg

SAR(1 g) = 0.031 mW/g; SAR(10 g) = 0.015 mW/g

Maximum value of SAR (measured) = 0.047 mW/g

Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.81 V/m; Power Drift = -0.136 dB

Peak SAR (extrapolated) = 0.053 W/kg

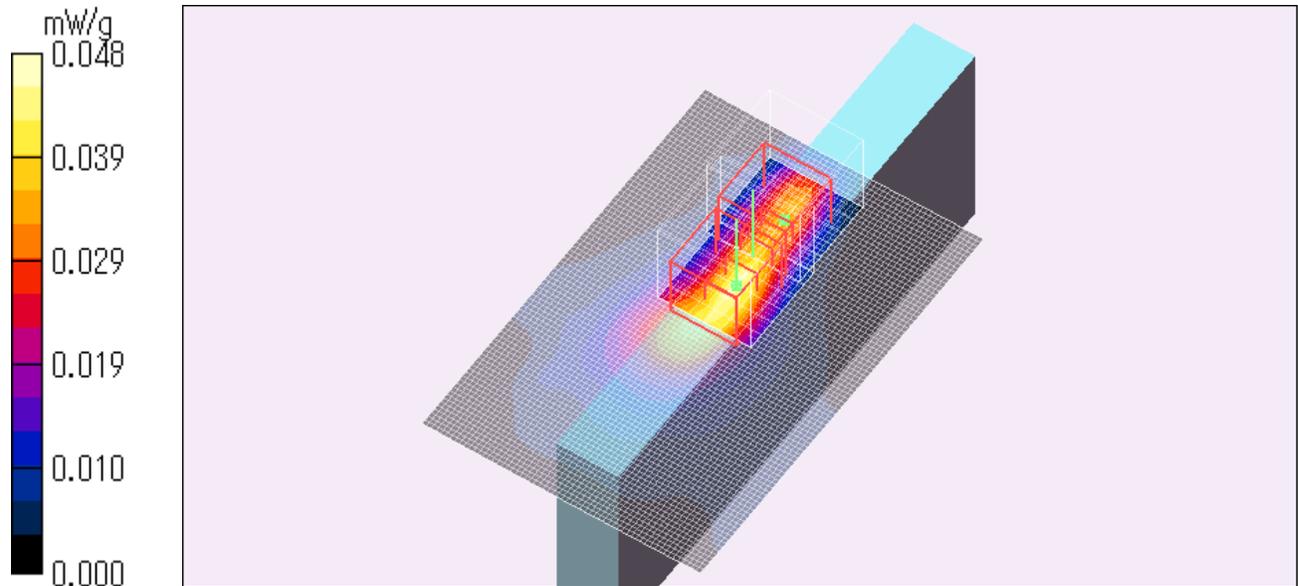
SAR(1 g) = 0.025 mW/g; SAR(10 g) = 0.012 mW/g

Maximum value of SAR (measured) = 0.039 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.0 degree.C , After 22.3 degree.C



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PSP-3001 (Normal battery) / Body/ Front/ 11b CCK(11Mbps)/ 2412MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12

- Sensor-Surface: 2mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0

- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.244 mW/g

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

Reference Value = 4.35 V/m; Power Drift = 0.152 dB

Peak SAR (extrapolated) = 0.357 W/kg

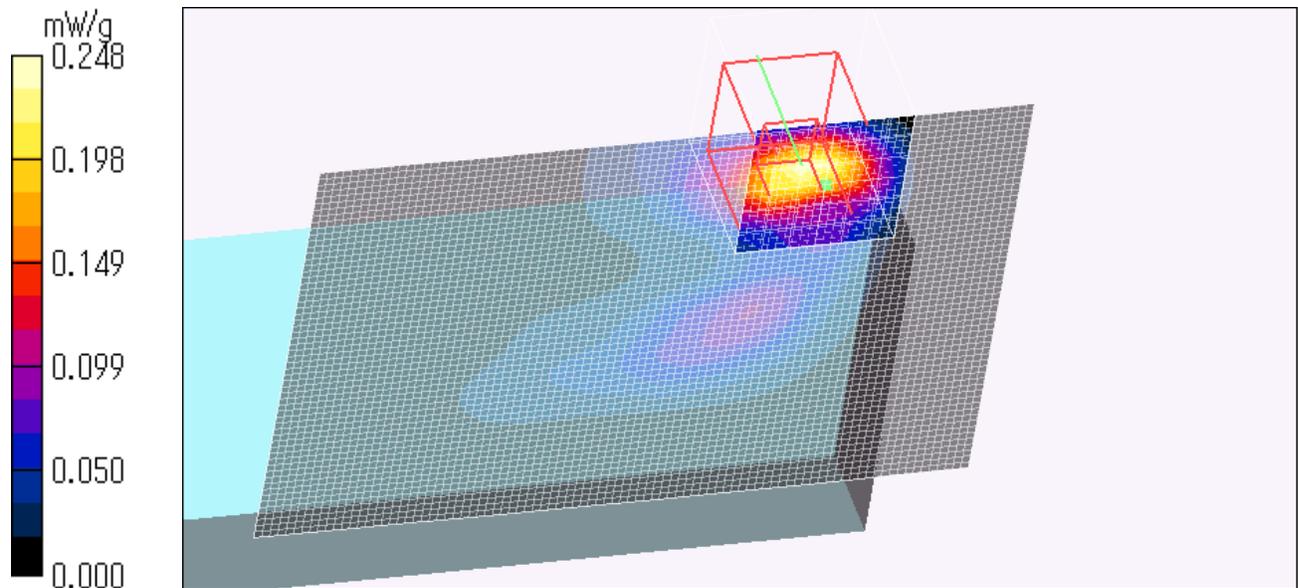
SAR(1 g) = 0.153 mW/g; SAR(10 g) = 0.065 mW/g

Maximum value of SAR (measured) = 0.248 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.3 degree.C , After 22.3 degree.C



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PSP-3001 (Normal battery) / Body/ Front/ 11b CCK(11Mbps)/ 2462MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.254 mW/g

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

Reference Value = 4.80 V/m; Power Drift = -0.085 dB

Peak SAR (extrapolated) = 0.378 W/kg

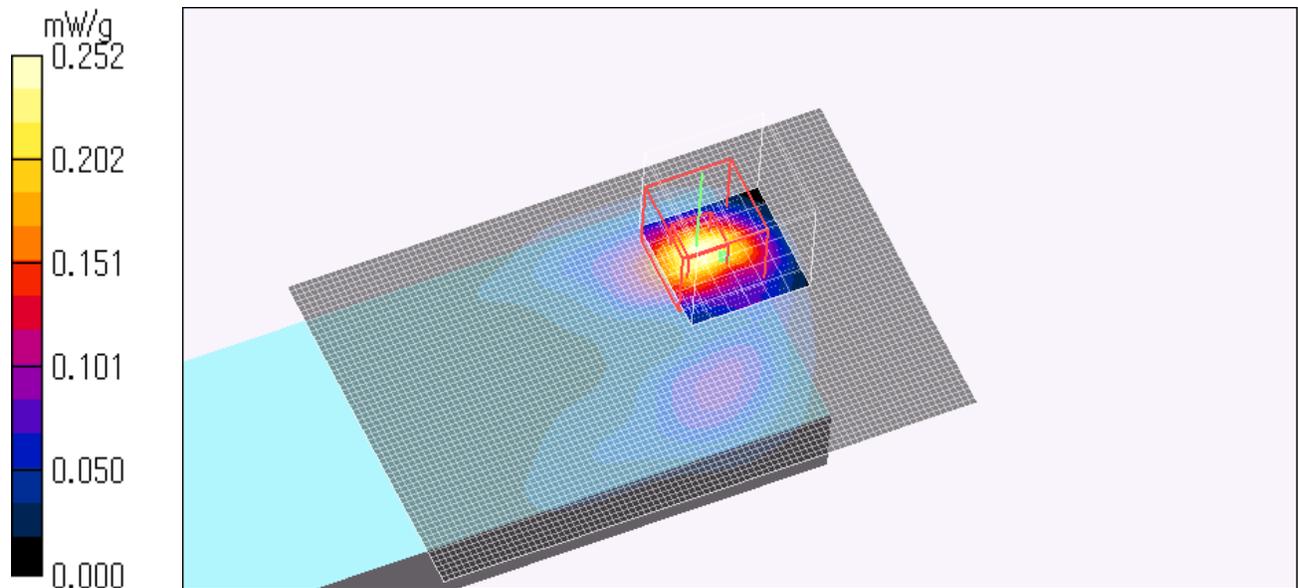
SAR(1 g) = 0.159 mW/g; SAR(10 g) = 0.067 mW/g

Maximum value of SAR (measured) = 0.252 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.3 degree.C , After 22.5 degree.C



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PSP-3001 (Option battery) / Body/ Front/ 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12

- Sensor-Surface: 2mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0

- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.298 mW/g

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

Reference Value = 3.64 V/m; Power Drift = 0.120 dB

Peak SAR (extrapolated) = 0.457 W/kg

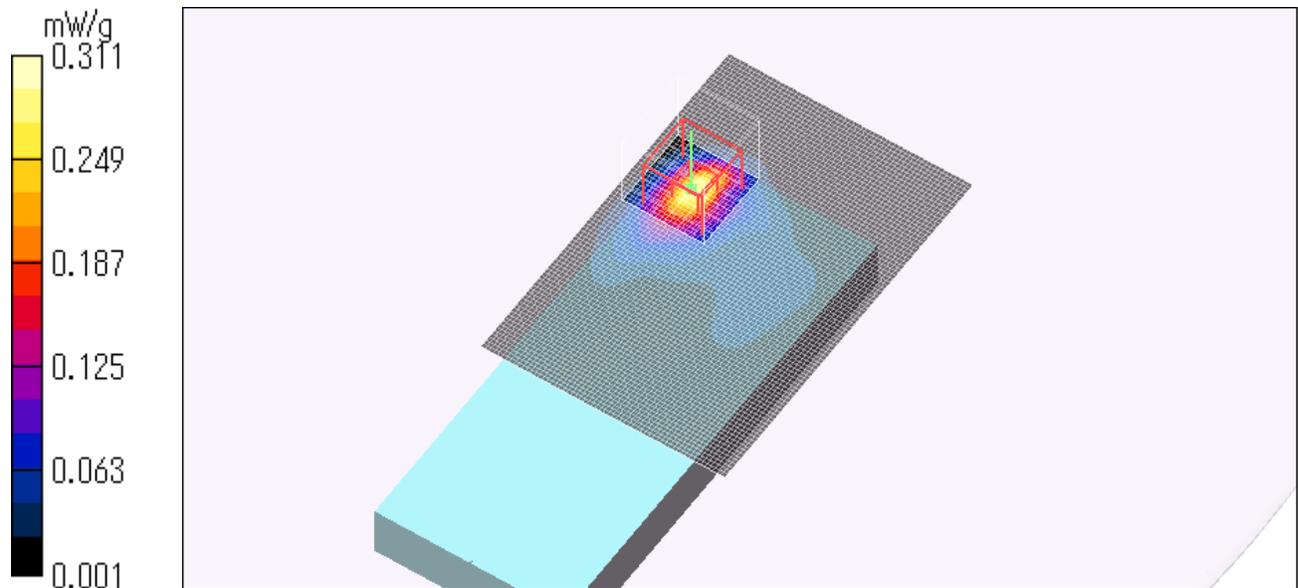
SAR(1 g) = 0.190 mW/g; SAR(10 g) = 0.079 mW/g

Maximum value of SAR (measured) = 0.311 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.4 degree.C , After 22.4 degree.C



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Z-axis scan at max SAR location

PSP-3001 (Option battery) / Body/ Front/ 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

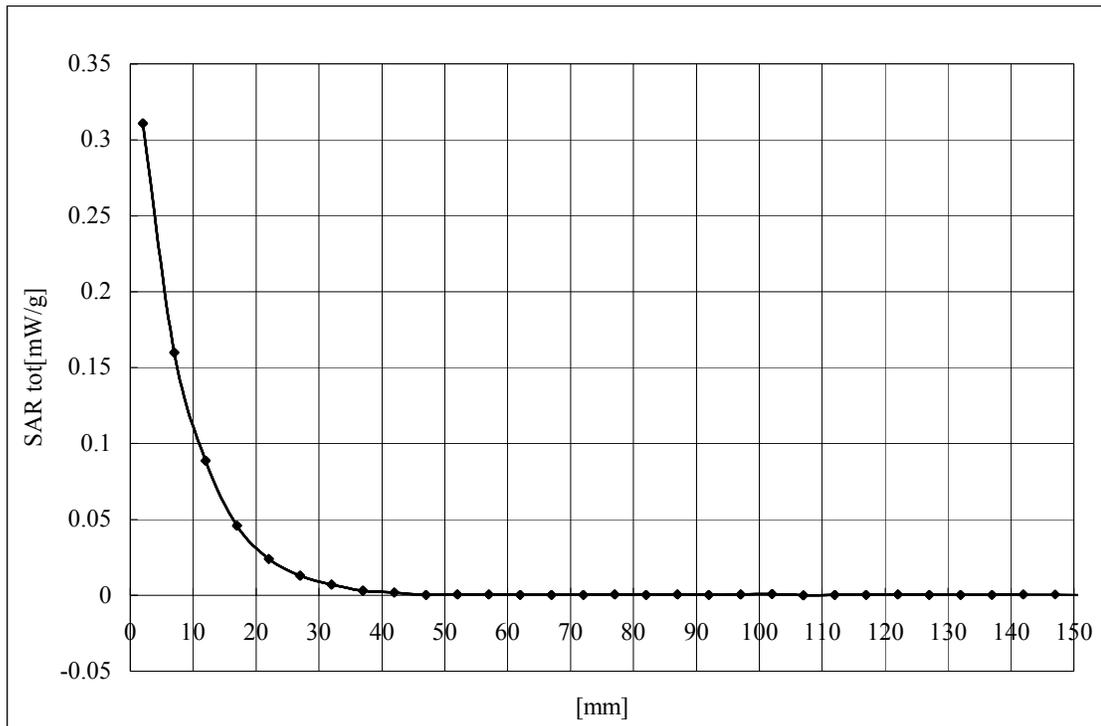
DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12

- Sensor-Surface: 2mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0

- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184



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PSP-3001 (Normal battery) / Body/ Front 5mm / 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12

- Sensor-Surface: 2mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0

- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.140 mW/g

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

Reference Value = 4.70 V/m; Power Drift = 0.082 dB

Peak SAR (extrapolated) = 0.133 W/kg

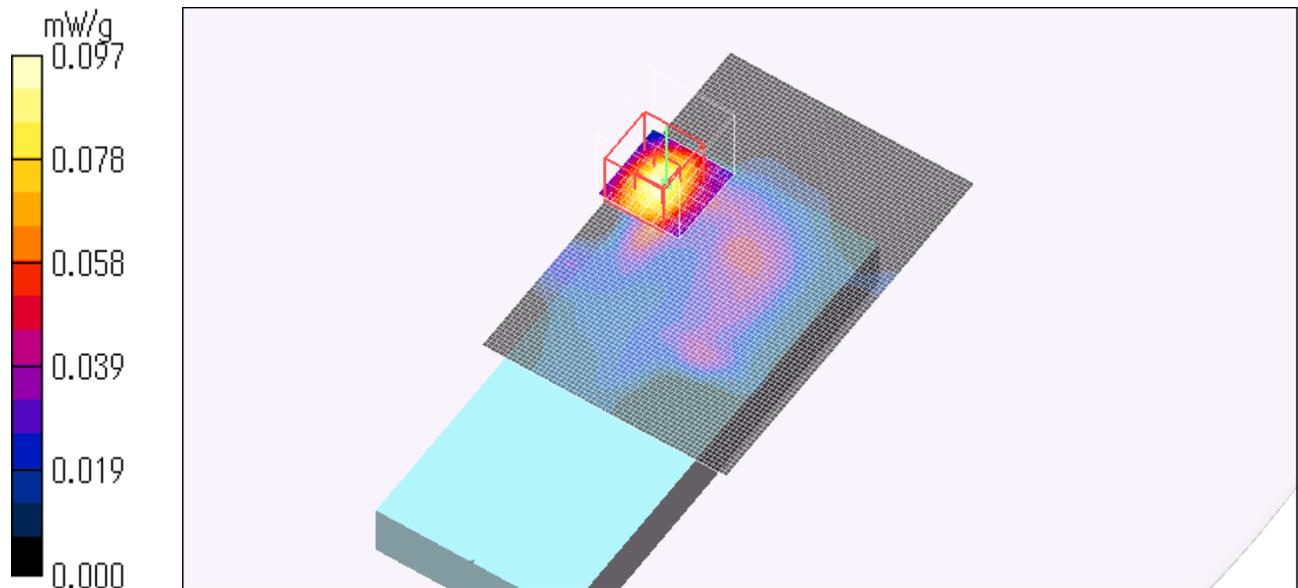
SAR(1 g) = 0.066 mW/g; SAR(10 g) = 0.032 mW/g

Maximum value of SAR (measured) = 0.097 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.4 degree.C , After 22.4 degree.C



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PSP-3001 (Normal battery) / Body/ Front 10mm / 11b CCK(11Mbps)/ 2437MHz

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.039 mW/g

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

Reference Value = 3.32 V/m; Power Drift = 0.163 dB

Peak SAR (extrapolated) = 0.053 W/kg

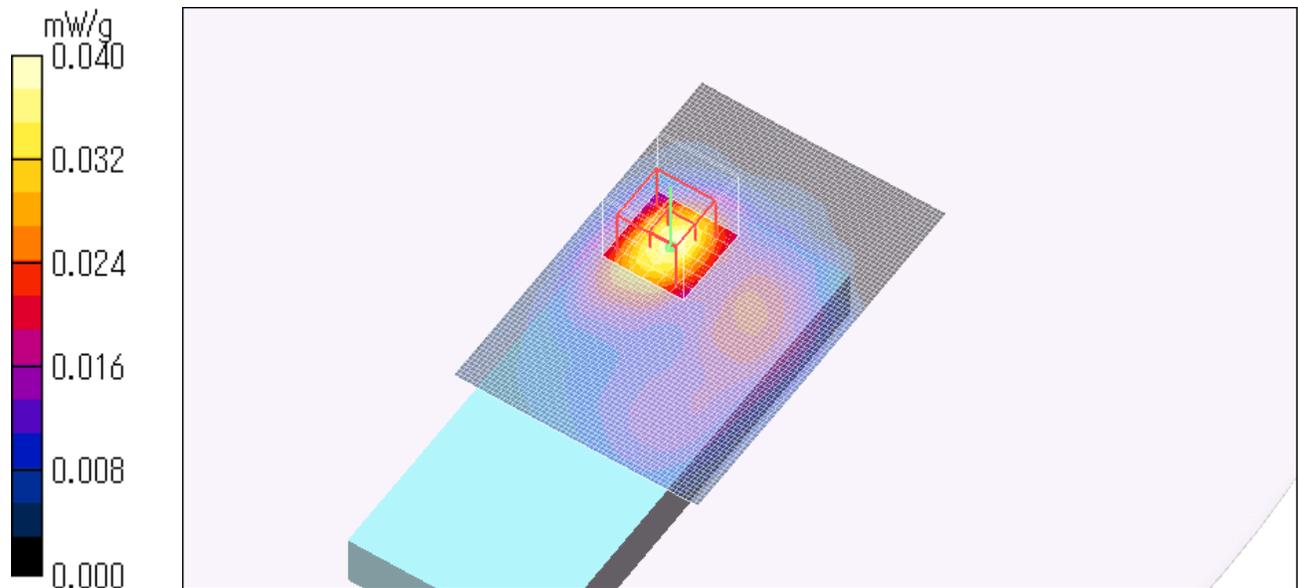
SAR(1 g) = 0.028 mW/g; SAR(10 g) = 0.015 mW/g

Maximum value of SAR (measured) = 0.040 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.4 degree.C , After 22.4 degree.C



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APPENDIX 3 : Test instruments

1. Equipment used

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|--------------|------------------------------|-------------------------------|---------------------|------------|-------------|---------------------------------------|
| MPM-08 | Power Meter | Anritsu | ML2495A | 6K00003338 | AT | 2008/09/24 * 12 |
| MPSE-11 | Power sensor | Anritsu | MA2411B | 011737 | AT | 2008/09/24 * 12 |
| MAT-22 | Attenuator(10dB) DC-18GHz | Orient Microwave | BX10-0476-00 | - | AT | 2009/03/24 * 12 |
| MPM-01 | Power Meter | Agilent | E4417A | GB41290639 | SAR | 2009/02/17 * 12 |
| MPSE-01 | Power Sensor | Agilent | E9300B | US40010300 | SAR | 2009/02/17 * 12 |
| MPSE-03 | Power sensor | Agilent | E9327A | US40440576 | SAR | 2009/02/17 * 12 |
| MAT-15 | Attenuator(30dB) | Agilent | 8498A | US40010300 | SAR | 2009/02/24 * 12 |
| MSG-10 | Signal Generator | Agilent | N5181A | MY47421098 | SAR | 2008/06/16 * 12 |
| MRFA-02 | RF Power Amplifier | OPHIR | 5056F | 1005 | SAR | 2008/07/01 * 12 |
| MHDC-12 | Dual Directional Coupler | Hewlett Packard | 772D | 2839A0016 | SAR | Pre Check |
| MNA-01 | Network Analyzer | Agilent/HP | E8358A | US41080381 | SAR | 2008/08/21 * 12 |
| MDPK-01 | Dielectric probe kit | Agilent | 85070D | - | SAR | Pre Check |
| MNCK-01 | Type N Calibration Kit | Agilent | 85032F | MY41495257 | SAR | 2008/08/20 * 12 |
| MPB-03 | Dosimetric E-Field Probe | Schmid&Partner Engineering AG | EX3DV3 | 3507 | SAR | 2009/02/12 * 12 |
| MDAE-01 | Data Acquisition Electronics | Schmid&Partner Engineering AG | DAE3 V1 | 509 | SAR | 2008/07/10 * 12 |
| COTS-MSTW-16 | DASY4 | Schmid&Partner Engineering AG | DASY4 V4.7 Build71 | - | SAR | - |
| COTS-MSTW-17 | S-Parameter Network Analyzer | Agilent | - | - | SAR | - |
| MDA-07 | Dipole Antenna | Schmid&Partner Engineering AG | D2450V2 | 713 | SAR | 2008/09/08 * 24 |
| MPF-02 | 2mmOval Flat Phantom ERI 4.0 | Schmid&Partner Engineering AG | QD VA 001B (ERI4.0) | 1045 | SAR | Pre Check |
| MOS-05 | Thermo-Hygrometer | Custom | CTH-190 | 810201 | SAR | 2009/04/28 * 12 |
| MOS-10 | Digital thermometer | HANNA | Checktemp-2 | MOS-10 | SAR | 2009/01/15 * 12 |
| - | Muscle 2450MHz | - | - | - | Daily check | Target value \pm 5% |
| - | SAR room | - | - | - | Daily check | Ambient Noise<0.012W/kg |

Note: The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

2. Dosimetry assessment setup

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than +/- 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the dosimetry probe EX3DV4, SN: 3540 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [2] with accuracy of better than +/-10%. The spherical isotropy was evaluated with the procedure described in [3] and found to be better than +/-0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEEE P1528 and CENELEC EN50361.

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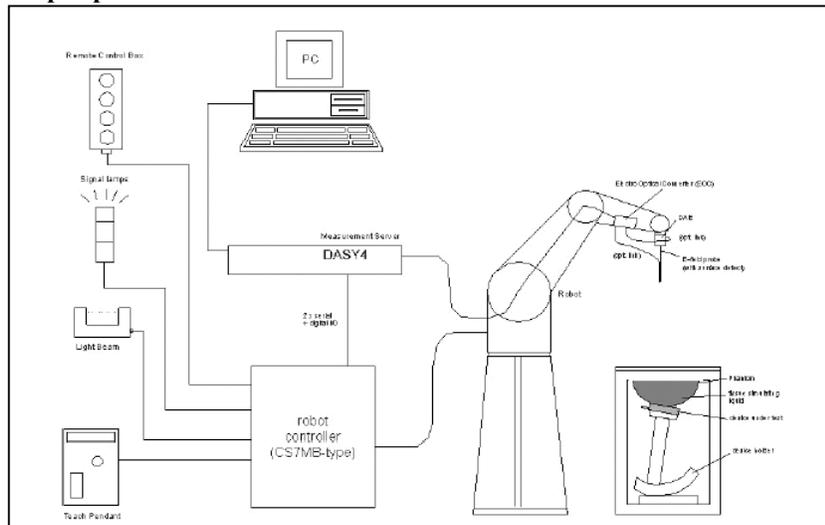
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3. Configuration and peripherals



The DASY4 system for performing compliance tests consist of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronic (DAE), which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4. The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection.
The EOC is connected to the measurement server.
5. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
6. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
7. A computer operating Windows 2000.
8. DASY4 software.
9. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
10. The Flat phantom enabling testing.
11. The device holder for handheld mobile phones.
12. Tissue simulating liquid mixed according to the given recipes.
13. Validation dipole kits allowing to validate the proper functioning of the system.

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4. System components

EX3DV3 Probe Specification

Construction:

Symmetrical design with triangular core
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., glycol ether)

Calibration:

Basic Broad Band calibration in air : 10-3000 MHz
Conversion Factors (Head and Body):
900 MHz, 1640MHz, 1810MHz, 2000MHz, 2450MHz,
5.2GHz, 5.5GHz and 5.8GHz (Head and Body)

Frequency:

10 MHz to > 6GHz; Linearity: +/-0.2 dB (30 MHz to 3 GHz)

Directivity:

+/-0.3 dB in HSL (rotation around probe axis)
+/-0.5 dB in tissue material (rotation normal probe axis)

Dynamic Range:

10uW/g to > 100 mW/g; Linearity: +/-0.2 dB (noise: typically < 1uW/g)

Dimensions:

Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5mm (Body: 12 mm)
Typical distance from probe tip to dipole centers: 1 mm

Application:

High precision dosimetric measurement in any exposure scenario
(e.g., very strong gradient fields). Only probe which enables compliance
testing for frequencies up to 6GHz with precision of better 30%.



EX3DV3 E-field Probe

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2mm Flat phantom ERI4.0

Description

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles.

Shell Thickness

2.0 ± 0.2 mm (sagging: <1%)

Filling Volume

approx. 30 liters

Dimensions

Major ellipse axis: 600 mm

Minor axis: 400 mm

Compatibilities

- Standard: IEC 62209 Part II (Draft 0.9 and higher) & FCC OET 65
- Software release: DASY 4.5 or higher
- SPEAG standard phantom table
- all SPEAG dosimetric probes and dipoles

Device Holder

For this measurement, the urethane foam was used as device holder.

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5. Test system specifications

Robot RX60L

| | | |
|----------------------|---|---|
| Number of Axes | : | 6 |
| Payload | : | 1.6 kg |
| Reach | : | 800mm |
| Repeatability | : | +/-0.025mm |
| Control Unit | : | CS7M |
| Programming Language | : | V+ |
| Manufacture | : | Stäubli Unimation Corp. Robot Model: RX60 |

DASY4 Measurement server

| | | |
|-------------|---|--|
| Features | : | 166MHz low power Pentium MMX 32MB chipdisk and 64MB RAM Serial link to DAE (with watchdog supervision) 16 Bit A/D converter for surface detection system Two serial links to robot (one for real-time communication which is supervised by watchdog) Ethernet link to PC (with watchdog supervision) Emergency stop relay for robot safety chain Two expansion slots for future applications |
| Manufacture | : | Schimid & Partner Engineering AG |

Data Acquisition Electronic (DAE)

| | | |
|----------------------|---|---|
| Features | : | Signal amplifier, multiplexer, A/D converter and control logic Serial optical link for communication with DASY4 embedded system (fully remote controlled) 2 step probe touch detector for mechanical surface detection and emergency robot stop (not in -R version) |
| Measurement Range | : | 1 μ V to > 200 mV (16 bit resolution and two range settings: 4mV, 400mV) |
| Input Offset voltage | : | < 1 μ V (with auto zero) |
| Input Resistance | : | 200 M Ω |
| Battery Power | : | > 10 h of operation (with two 9 V battery) |
| Dimension | : | 60 x 60 x 68 mm |
| Manufacture | : | Schimid & Partner Engineering AG |

Software

| | | |
|----------------------|---|-----------------------------------|
| Item | : | Dosimetric Assesment System DASY4 |
| Type No. | : | SD 000 401A, SD 000 402A |
| Software version No. | : | DASY4 V4.7 Build71 |
| Manufacture / Origin | : | Schimid & Partner Engineering AG |

E-Field Probe

| | | |
|--------------|---|---|
| Model | : | EX3DV3 |
| Serial No. | : | 3507 |
| Construction | : | Symmetrical design with triangular core |
| Frequency | : | 10 MHz to 6 GHz |
| Linearity | : | +/-0.2 dB (30 MHz to 3 GHz) |
| Manufacture | : | Schimid & Partner Engineering AG |

Phantom

| | | |
|-----------------|---|---|
| Type | : | 2mm |
| Shell Thickness | : | 2.0 \pm 0.2 mm (sagging: <1%) |
| Filling Volume | : | approx. 30 liters |
| Dimensions | : | Major ellipse axis: 600 mm Minor axis: 400 mm |
| Manufacture | : | Schimid & Partner Engineering AG |

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6. Simulated Tissues Composition of 2450MHz

| Ingredient | MIXTURE(%) |
|------------|----------------|
| | Muscle 2450MHz |
| Water | 69.83 |
| DGMBE | 30.2 |

Note:DGMBE(Diethyleneglycol-monobuthyl ether)

7. Validation Measurement

Simulated tissue liquid parameter

7-a Simulated Tissue Liquid Parameter confirmation

The dielectric parameters were checked prior to assessment using the HP85070D dielectric probe kit.
The dielectric parameters measurement are reported in each correspondent section.

7-b Muscle 2450 MHz

Type of liquid : **Muscle 2450 MHz**
Ambient temperature (deg.c.) : **23.5**
Relative Humidity (%) : **47**
Liquid depth (cm) : **15.0**

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | |
|---|-----------|---------------------|-------|------------------------------------|----------------|----------|---------------|-----------|
| Date | Frequency | Liquid Temp [deg.c] | | Parameters | Target Value*1 | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 15-May | 2450 | 22.0 | 22.0 | Relative Permittivity ϵ_r | 52.7 | 51.4 | -2.5 | +/-5 |
| | | | | Coductivity σ [mho/m] | 1.95 | 2.00 | 2.6 | +/-5 |

*1 The target values is a parameter defined in FCC OET 65.

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | |
|---|-----------|---------------------|-------|------------------------------------|----------------|----------|---------------|-----------|
| Date | Frequency | Liquid Temp [deg.c] | | Parameters | Target Value*2 | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 15-May | 2450 | 22.0 | 22.0 | Relative Permittivity ϵ_r | 50.6 | 51.4 | 1.6 | +/-10 |
| | | | | Coductivity σ [mho/m] | 1.96 | 2.00 | 2.0 | +/-10 |

*2 The target value is the calibrated dipole TSL parameters. (D2450V2 SN:713)

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8. System validation data

We performed the system validation based on FCC requirement, [The 1-g or 10-g SAR values measured using the required tissue dielectric parameters should be within 10% of manufacturer calibrated dipole SAR values. However these manufacturer calibrated dipole target SAR values should be substantially similar to those defined in IEEE Standard 1528.] and FCC permits [SAR system verification with the actual liquid used for DUT SAR measurement should be the default operating procedures.]

We confirmed the this dipole manufacture's validation date for head is within 5% against IEEE Standard 1528. so we can only use Body liquid validation data for our system verification

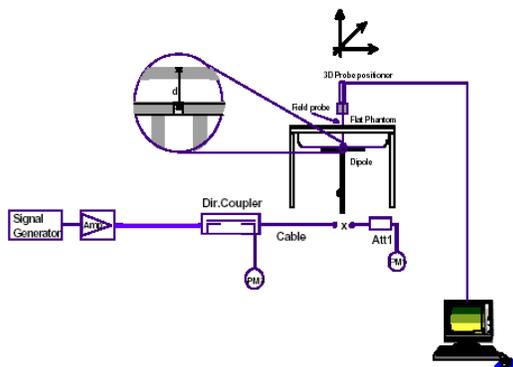
System validation of 2450MHz

Type of liquid : Muscle 2450MHz
Frequency : 2450MHz
Ambient temperature (deg.c.) : 23.5
Relative Humidity (%) : 47
Dipole : D2450V2 SN:713
Power : 250mW

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | |
|--------------------------|-------------------------|-------|------------------------------------|----------|-------------------------------|----------|--|----------|---------------|-----------|
| Date | Liquid (Muscle 2450MHz) | | | | | | System dipole validation target & measured | | | |
| | Liquid Temp [deg.c.] | | Relative Permittivity ϵ_r | | Conductivity σ [mho/m] | | SAR 1g [W/kg] | | Deviation [%] | Limit [%] |
| | Before | After | Target | Measured | Target | Measured | Target*1 | Measured | | |
| 15-May | 22.0 | 22.0 | 50.6 | 51.4 | 1.96 | 2.00 | 12.1 | 13.2 | 9.1 | +/-10 |

*1 The target value is a manufacturer calibrated dipole 1g SAR value. (D2450V2 SN:713)

Note: Please refer to Attachment for the result representation in plot format



2450MHz System performance check setup

Test system for the system performance check setup diagram

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9. Validation uncertainty

The uncertainty budget has been determined for the DASY4 measurement system according to the SPEAG documents[6][7] and is given in the following Table.

| Error Description | Uncertainty value ± % | Probability distribution | divisor | (ci) 1g | Standard Uncertainty (1g) | vi or veff |
|--------------------------------------|-----------------------|--------------------------|------------|---------|---------------------------|------------|
| Measurement System | | | | | | |
| Probe calibration | ±6.8 | Normal | 1 | 1 | ±6.8 | ∞ |
| Axial isotropy of the probe | ±4.7 | Rectangular | $\sqrt{3}$ | 1 | ±2.7 | ∞ |
| Spherical isotropy of the probe | ±9.6 | Rectangular | 0 | 0 | 0 | ∞ |
| Boundary effects | ±2.0 | Rectangular | $\sqrt{3}$ | 1 | ±1.2 | ∞ |
| Probe linearity | ±4.7 | Rectangular | $\sqrt{3}$ | 1 | ±2.7 | ∞ |
| Detection limit | ±1.0 | Rectangular | $\sqrt{3}$ | 1 | ±0.6 | ∞ |
| Readout electronics | ±0.3 | Normal | 1 | 1 | ±0.3 | ∞ |
| Response time | 0 | Rectangular | $\sqrt{3}$ | 1 | 0 | ∞ |
| Integration time | 0 | Rectangular | $\sqrt{3}$ | 1 | 0 | ∞ |
| RF ambient Noise | ±3.0 | Rectangular | $\sqrt{3}$ | 1 | ±1.7 | ∞ |
| RF ambient Reflections | ±3.0 | Rectangular | $\sqrt{3}$ | 1 | ±1.7 | ∞ |
| Probe Positioner | ±0.8 | Rectangular | $\sqrt{3}$ | 1 | ±0.5 | ∞ |
| Probe positioning | ±9.9 | Rectangular | 1 | 1 | ±5.7 | ∞ |
| Algorithms for Max.SAR Eval. | ±4.0 | Rectangular | $\sqrt{3}$ | 1 | ±2.3 | ∞ |
| Dipole | | | | | | |
| Dipole Axis to Liquid Distance | ±2.0 | Rectangular | $\sqrt{3}$ | 1 | ±1.2 | ∞ |
| Input power and SAR drift meas. | ±4.7 | Rectangular | $\sqrt{3}$ | 1 | ±2.7 | ∞ |
| Phantom and Setup | | | | | | |
| Phantom uncertainty | ±4.0 | Rectangular | $\sqrt{3}$ | 1 | ±2.3 | ∞ |
| Liquid conductivity (target) | ±5.0 | Rectangular | $\sqrt{3}$ | 0.64 | ±1.8 | ∞ |
| Liquid conductivity (meas.) | ±5.0 | Rectangular | 1 | 0.64 | ±3.2 | ∞ |
| Liquid permittivity (target) | ±5.0 | Rectangular | $\sqrt{3}$ | 0.6 | ±1.7 | ∞ |
| Liquid permittivity (meas.) | ±5.0 | Rectangular | 1 | 0.6 | ±3.0 | ∞ |
| Combined Standard Uncertainty | | | | | ±12.079 | |
| Expanded Uncertainty (k=2) | | | | | ±24.2 | |

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10. Validation Measurement data

System Validation / Dipole 2450 MHz / Forward Conducted Power : 250mW

Dipole 2450MHz; Type: D2450V2; Serial: 713

Crest factor:1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.68, 7.68, 7.68); Calibrated: 2009/02/12

- Sensor-Surface: 2mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0

- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 21.9 mW/g

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

Reference Value = 103.5 V/m; Power Drift = -0.003 dB

Peak SAR (extrapolated) = 26.7 W/kg

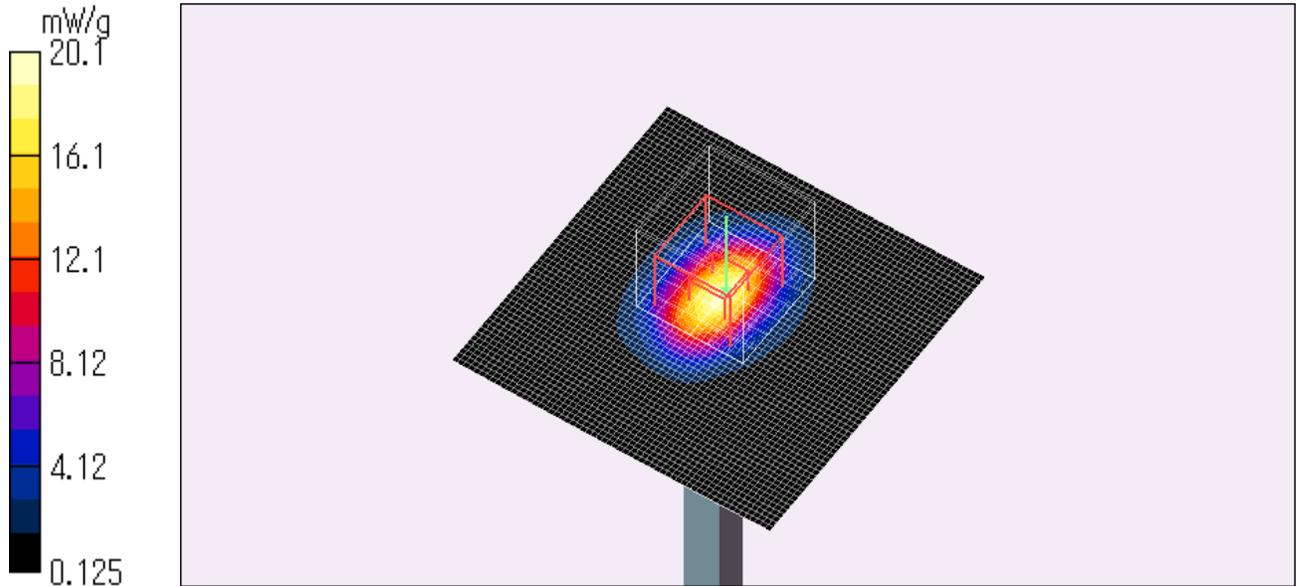
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.22 mW/g

Maximum value of SAR (measured) = 20.1 mW/g

Test Date = 05/15/09

Ambient Temperature = 23.5 degree.c

Liquid Temperature = Before 22.0 degree.C , After 22.0 degree.C



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11. System Validation Dipole (D2450V2,S/N: 713)

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Accreditation No.: **SCS 108**

Client **UL Japan (MTT)**

Certificate No: **D2450V2-713_Sep08**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 713**

Calibration procedure(s) **QA CAL-05.v7
 Calibration procedure for dipole validation kits**

Calibration date: **September 08, 2008**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A | GB37480704 | 04-Oct-07 (No. 217-00736) | Oct-08 |
| Power sensor HP 8481A | US37292783 | 04-Oct-07 (No. 217-00736) | Oct-08 |
| Reference 20 dB Attenuator | SN: S5086 (20g) | 01-Jul-08 (No. 217-00864) | Jul-09 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 01-Jul-08 (No. 217-00867) | Jul-09 |
| Reference Probe ES3DV2 | SN: 3025 | 28-Apr-08 (No. ES3-3025_Apr08) | Apr-09 |
| DAE4 | SN: 601 | 14-Mar-08 (No. DAE4-601_Mar08) | Mar-09 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-07) | In house check: Oct-09 |
| RF generator R&S SMT-06 | 100005 | 4-Aug-99 (in house check Oct-07) | In house check: Oct-09 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-07) | In house check: Oct-08 |

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

Issued: September 9, 2008

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:

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.

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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:

- 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

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

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Measurement Conditions

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

| | | |
|-------------------------------------|---------------------------|-------------|
| DASY Version | DASY5 | V5.0 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom V5.0 | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2450 MHz ± 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 39.2 | 1.80 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 39.8 ± 6 % | 1.80 mho/m ± 6 % |
| Head TSL temperature during test | (22.0 ± 0.2) °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|----------------------------------|
| SAR measured | 250 mW input power | 12.7 mW / g |
| SAR normalized | normalized to 1W | 50.8 mW / g |
| SAR for nominal Head TSL parameters ¹ | normalized to 1W | 51.2 mW /g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|----------------------------------|
| SAR measured | 250 mW input power | 5.91 mW / g |
| SAR normalized | normalized to 1W | 23.6 mW / g |
| SAR for nominal Head TSL parameters ¹ | normalized to 1W | 23.8 mW /g ± 16.5 % (k=2) |

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|----------------------------------|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 52.7 | 1.95 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 50.7 ± 6 % | 1.97 mho/m ± 6 % |
| Body TSL temperature during test | (22.5 ± 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 | 12.1 mW / g |
| SAR normalized | normalized to 1W | 48.4 mW / g |
| SAR for nominal Body TSL parameters ² | normalized to 1W | 47.1 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 5.68 mW / g |
| SAR normalized | normalized to 1W | 22.7 mW / g |
| SAR for nominal Body TSL parameters ² | normalized to 1W | 22.3 mW / g ± 16.5 % (k=2) |

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

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Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.8 Ω + 1.6 j Ω |
| Return Loss | - 32.7 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.2 Ω + 3.5 j Ω |
| Return Loss | - 28.1 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.159 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 |

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DASY5 Validation Report for Head TSL

Date/Time: 08.09.2008 12:47:07

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN713

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

Medium: HSL U10 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.8$ mho/m; $\epsilon_r = 39.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (front); Type: QD00P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 119; SEMCAD X Version 13.2 Build 87

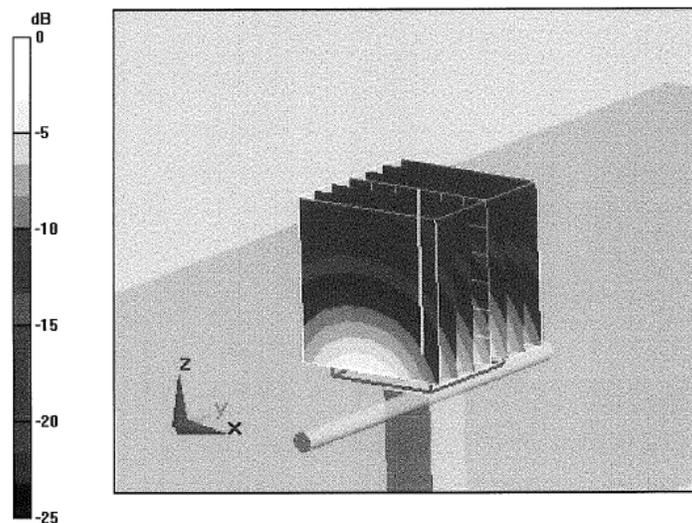
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.8 V/m; Power Drift = 0.012 dB

Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 12.7 mW/g; SAR(10 g) = 5.91 mW/g

Maximum value of SAR (measured) = 15.3 mW/g



0 dB = 15.3mW/g

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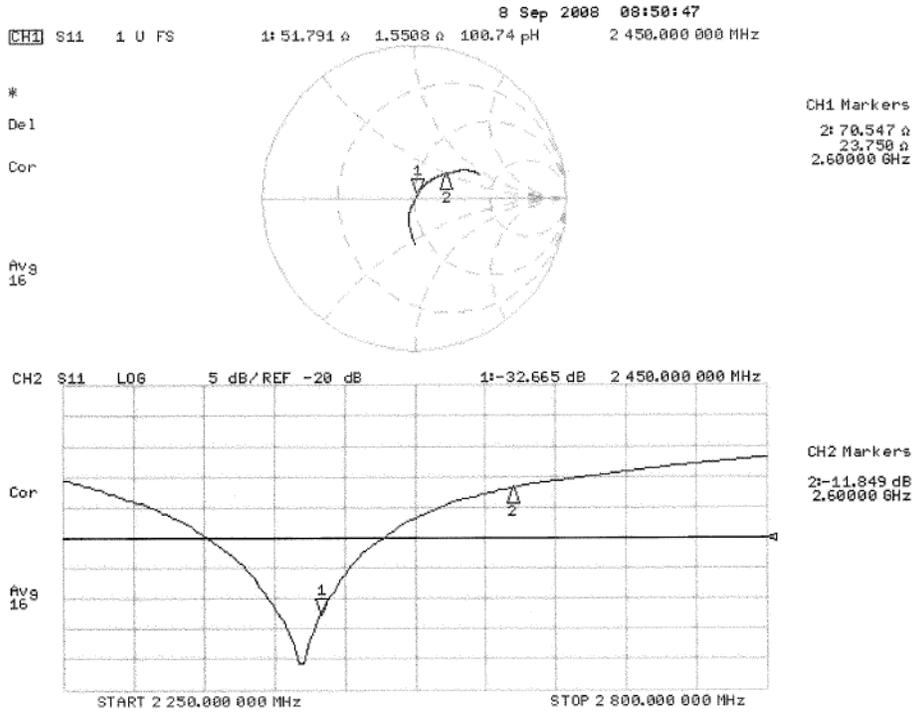
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Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 08.09.2008 15:47:52

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:713

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U10 BB
Medium parameters used: $f = 2450$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 50.6$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.07, 4.07, 4.07); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 119; SEMCAD X Version 13.2 Build 87

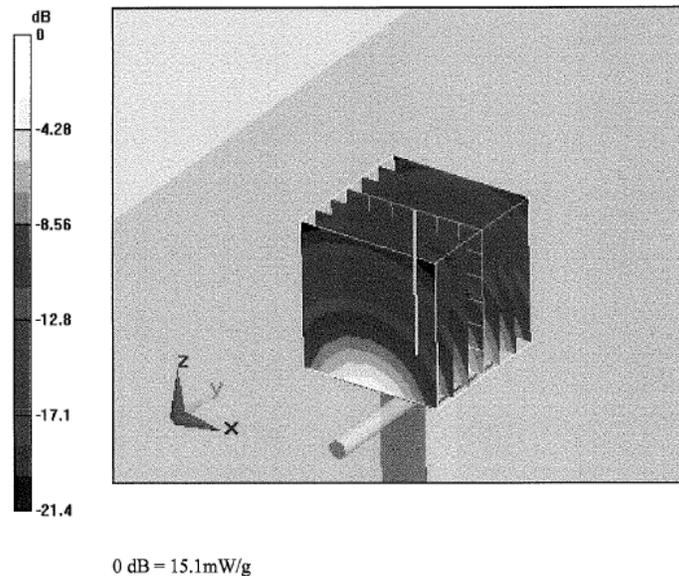
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 90.5 V/m; Power Drift = 0.00036 dB

Peak SAR (extrapolated) = 24 W/kg

SAR(1 g) = 12.1 mW/g; SAR(10 g) = 5.68 mW/g

Maximum value of SAR (measured) = 15.1 mW/g



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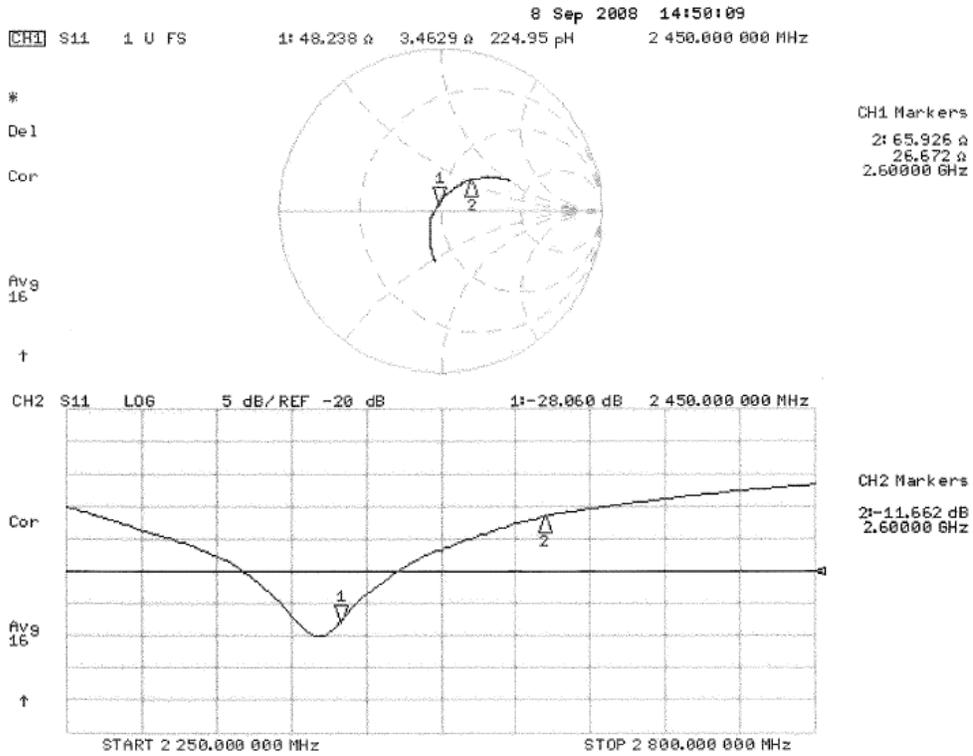
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Impedance Measurement Plot for Body TSL



12. Dosimetric E-Field Probe Calibration (EX3DV3,S/N: 3507)

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



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

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

Accreditation No.: **SCS 108**

Client **UL Japan (PTT)**

Certificate No. **EX3-3507_Feb09**

CALIBRATION CERTIFICATE

Object **EX3DV3 - SN:3507**

Calibration procedure(s) **QA-CAL-01-v6, QA-CAL-14-v3 and QA-CAL-23-v3
 Calibration procedure for dosimetric E-field probes**

Calibration date: **February 12, 2009**

Condition of the calibrated item **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 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 | 1-Apr-08 (No. 217-00788) | Apr-09 |
| Power sensor E4412A | MY41495277 | 1-Apr-08 (No. 217-00788) | Apr-09 |
| Power sensor E4412A | MY41498087 | 1-Apr-08 (No. 217-00788) | Apr-09 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 1-Jul-08 (No. 217-00865) | Jul-09 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 31-Mar-08 (No. 217-00787) | Apr-09 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 1-Jul-08 (No. 217-00866) | Jul-09 |
| Reference Probe ES3DV2 | SN: 3013 | 2-Jan-09 (No. ES3-3013_Jan09) | Jan-10 |
| DAE4 | SN: 660 | 9-Sep-08 (No. DAE4-660_Sep08) | Sep-09 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------|--------------|-----------------------------------|------------------------|
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (in house check Oct-07) | In house check: Oct-09 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-08) | In house check: Oct-09 |

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

Issued: February 12, 2009

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



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

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

Accreditation No.: SCS 108

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 |
| 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 effect 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 (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ 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.

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EX3DV3 SN:3507

February 12, 2009

Probe EX3DV3

SN:3507

Manufactured: December 15, 2003
Last calibrated: January 25, 2008
Recalibrated: February 12, 2009

Calibrated for DASYS Systems

(Note: non-compatible with DASYS2 system!)

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EX3DV3 SN:3507

February 12, 2009

DASY - Parameters of Probe: EX3DV3 SN:3507

| Sensitivity in Free Space ^A | | | Diode Compression ^B | |
|--|--------------|-----------------------|--------------------------------|-------|
| NormX | 0.67 ± 10.1% | μV/(V/m) ² | DCP X | 93 mV |
| NormY | 0.73 ± 10.1% | μV/(V/m) ² | DCP Y | 94 mV |
| NormZ | 0.70 ± 10.1% | μV/(V/m) ² | DCP Z | 93 mV |

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL 900 MHz Typical SAR gradient: 5 % per mm

| | | | |
|---|------------------------------|--------|--------|
| Sensor Center to Phantom Surface Distance | | 2.0 mm | 3.0 mm |
| SAR _{be} [%] | Without Correction Algorithm | 8.7 | 5.0 |
| SAR _{be} [%] | With Correction Algorithm | 0.7 | 0.4 |

TSL 1750 MHz Typical SAR gradient: 10 % per mm

| | | | |
|---|------------------------------|--------|--------|
| Sensor Center to Phantom Surface Distance | | 2.0 mm | 3.0 mm |
| SAR _{be} [%] | Without Correction Algorithm | 7.8 | 4.5 |
| SAR _{be} [%] | With Correction Algorithm | 0.8 | 0.6 |

Sensor Offset

Probe Tip to Sensor Center 1.0 mm

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

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).

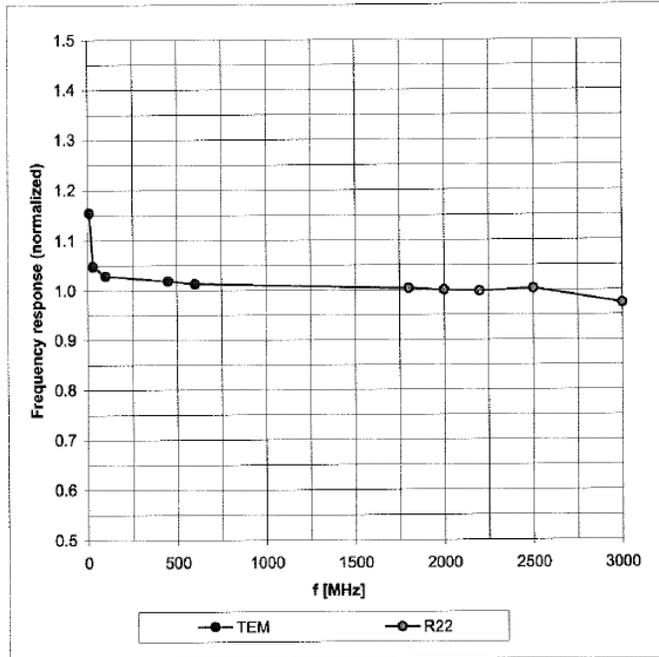
^B Numerical linearization parameter: uncertainty not required.

EX3DV3 SN:3507

February 12, 2009

Frequency Response of E-Field

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



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

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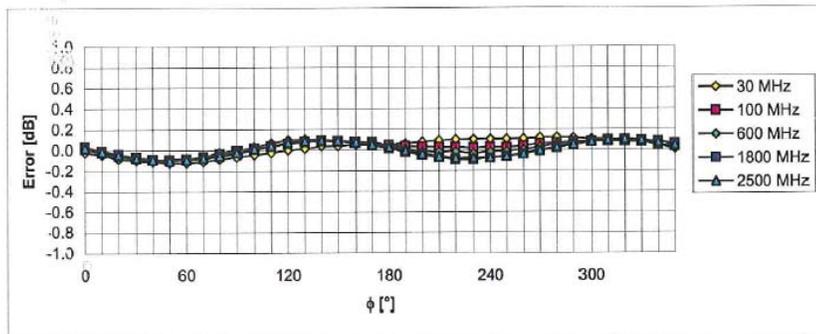
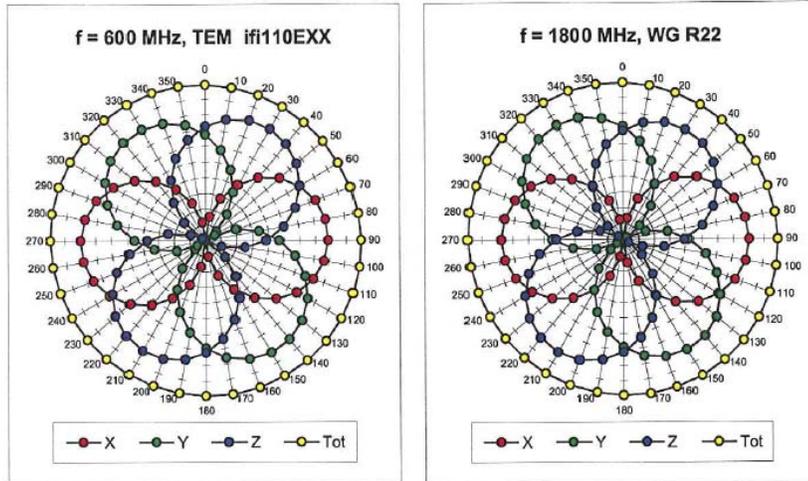
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EX3DV3 SN:3507

February 12, 2009

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

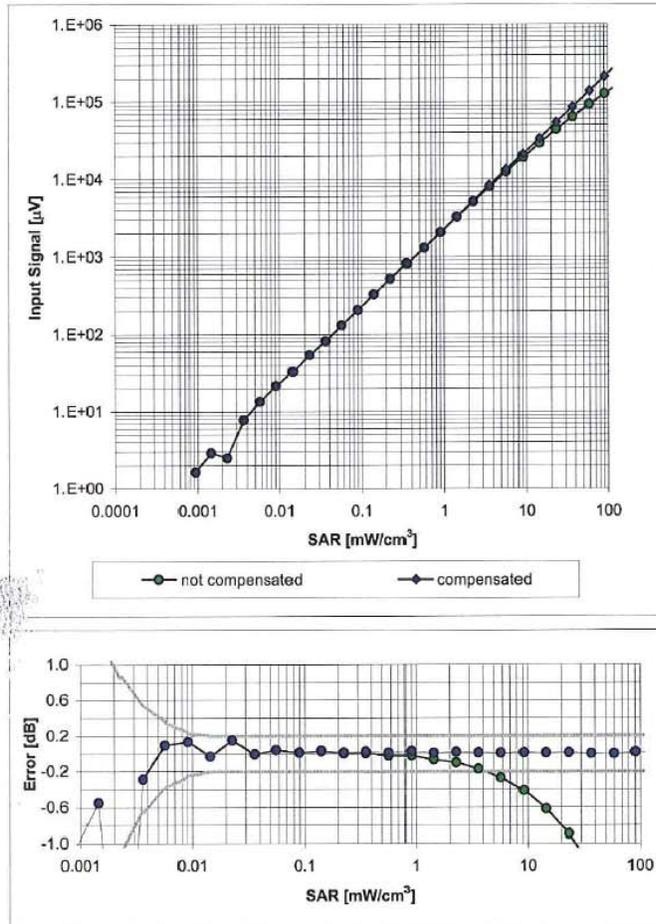


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

EX3DV3 SN:3507

February 12, 2009

Dynamic Range f(SAR_{head}) (Waveguide R22, f = 1800 MHz)



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

EX3DV3 SN:3507

February 12, 2009

Conversion Factor Assessment

| f [MHz] | Validity [MHz] ^c | TSL | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty |
|---------|-----------------------------|------|--------------|--------------|-------|-------|---------------------|
| 835 | ± 50 / ± 100 | Head | 41.5 ± 5% | 0.90 ± 5% | 0.45 | 0.79 | 10.39 ± 11.0% (k=2) |
| 900 | ± 50 / ± 100 | Head | 41.5 ± 5% | 0.97 ± 5% | 0.53 | 0.71 | 10.06 ± 11.0% (k=2) |
| 1640 | ± 50 / ± 100 | Head | 40.3 ± 5% | 1.29 ± 5% | 0.55 | 0.67 | 9.23 ± 11.0% (k=2) |
| 1750 | ± 50 / ± 100 | Head | 40.1 ± 5% | 1.37 ± 5% | 0.63 | 0.60 | 9.04 ± 11.0% (k=2) |
| 1810 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.99 | 0.48 | 8.71 ± 11.0% (k=2) |
| 1900 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.92 | 0.49 | 8.60 ± 11.0% (k=2) |
| 2000 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.84 | 0.51 | 8.42 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Head | 39.2 ± 5% | 1.80 ± 5% | 0.36 | 0.70 | 7.94 ± 11.0% (k=2) |
| 5200 | ± 50 / ± 100 | Head | 36.0 ± 5% | 4.66 ± 5% | 0.43 | 1.70 | 4.89 ± 13.1% (k=2) |
| 5300 | ± 50 / ± 101 | Head | 35.9 ± 5% | 4.76 ± 5% | 0.43 | 1.70 | 4.68 ± 13.1% (k=2) |
| 5500 | ± 50 / ± 100 | Head | 35.6 ± 5% | 4.96 ± 5% | 0.40 | 1.70 | 4.39 ± 13.1% (k=2) |
| 5600 | ± 50 / ± 101 | Head | 35.5 ± 5% | 5.07 ± 5% | 0.40 | 1.70 | 4.28 ± 13.1% (k=2) |
| 5800 | ± 50 / ± 100 | Head | 35.3 ± 5% | 5.27 ± 5% | 0.50 | 1.70 | 4.06 ± 13.1% (k=2) |
| | | | | | | | |
| 835 | ± 50 / ± 100 | Body | 55.2 ± 5% | 0.97 ± 5% | 0.45 | 0.78 | 10.31 ± 11.0% (k=2) |
| 900 | ± 50 / ± 100 | Body | 55.0 ± 5% | 1.05 ± 5% | 0.47 | 0.74 | 10.01 ± 11.0% (k=2) |
| 1640 | ± 50 / ± 100 | Body | 53.8 ± 5% | 1.40 ± 5% | 0.72 | 0.57 | 9.11 ± 11.0% (k=2) |
| 1750 | ± 50 / ± 100 | Body | 53.4 ± 5% | 1.49 ± 5% | 0.57 | 0.66 | 8.56 ± 11.0% (k=2) |
| 1810 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.33 | 0.87 | 8.42 ± 11.0% (k=2) |
| 1900 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.23 | 1.03 | 8.28 ± 11.0% (k=2) |
| 2000 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.28 | 0.93 | 8.44 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Body | 52.7 ± 5% | 1.95 ± 5% | 0.16 | 1.78 | 7.68 ± 11.0% (k=2) |
| 5200 | ± 50 / ± 100 | Body | 49.0 ± 5% | 5.30 ± 5% | 0.50 | 1.75 | 4.58 ± 13.1% (k=2) |
| 5300 | ± 50 / ± 100 | Body | 48.9 ± 5% | 5.42 ± 5% | 0.50 | 1.75 | 4.38 ± 13.1% (k=2) |
| 5500 | ± 50 / ± 100 | Body | 48.6 ± 5% | 5.65 ± 5% | 0.50 | 1.75 | 4.06 ± 13.1% (k=2) |
| 5600 | ± 50 / ± 100 | Body | 48.5 ± 5% | 5.77 ± 5% | 0.50 | 1.75 | 3.76 ± 13.1% (k=2) |
| 5800 | ± 50 / ± 100 | Body | 48.2 ± 5% | 6.00 ± 5% | 0.50 | 1.75 | 3.88 ± 13.1% (k=2) |

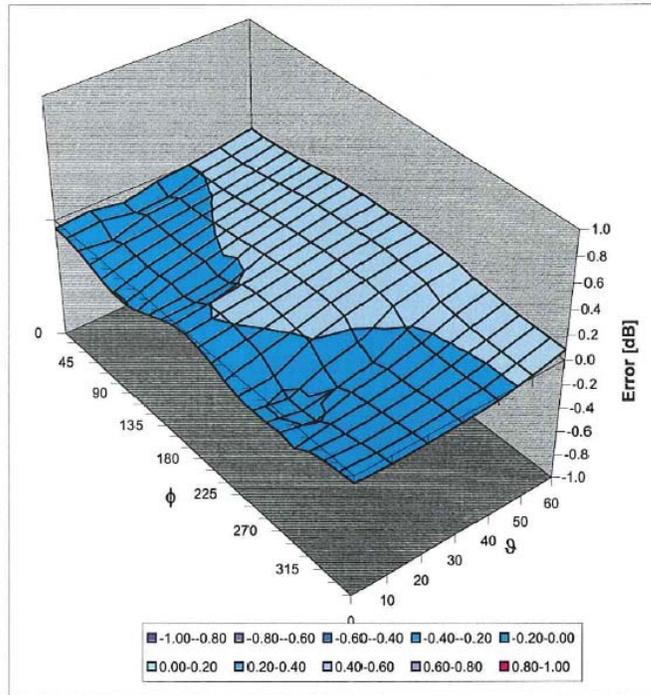
^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

EX3DV3 SN:3507

February 12, 2009

Deviation from Isotropy in HSL

Error (ϕ , θ), $f = 900$ MHz



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

13. References

- [1]ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.
- [2] Katja Pokovic, Thomas Schmid, and Niels Kuster, “Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies”, in ICECOM ‘97, Dubrovnik, October 15-17, 1997, pp. 120-124.
- [3] Katja Pokovic, Thomas Schmid, and Niels Kuster, “E_ field probe with improved isotropy in brain simulating liquids”, in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.
- [4] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.
- [5] W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992.
- [6]SPEAG uncertainty document for DASY 4 System from SPEAG (Shimid & Partner Engineering AG).
- [7]SPEAG uncertainty document for "the 5-6GHz Extension" from SPEAG (Shimid & Partner Engineering AG).