

APPENDIX 3 : Test instruments

1. Equipment used

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|-------------|------------------------------|-------------------------------|-----------------------|------------|-------------|---------------------------------------|
| MPM-01 | Power Meter | Agilent | E4417A | GB41290639 | SAR | 2008/02/06 * 12 |
| MPSE-01 | Power Sensor | Agilent | E9300B | US40010300 | SAR | 2008/02/04 * 12 |
| MPSE-03 | Power sensor | Agilent | E9327A | US40440576 | SAR | 2008/02/09 * 12 |
| MAT-20 | Attenuator(10dB)(above 1GHz) | HIROSE ELECTRIC CO.,LTD. | AT-110 | - | SAR | 2009/01/16 * 12 |
| MAT-22 | Attenuator(10dB) DC-18GHz | Orient Microwave | BX10-0476-00 | - | SAR | 2008/03/04 * 12 |
| MAT-15 | Attenuator(30dB) | Agilent | 8498A | US40010300 | SAR | 2008/02/21 * 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-11 | Dual Directional Coupler | Hewlett Packard | 778D | 16605 | SAR | Pre Check |
| 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 |
| MPB-03 | Dosimetric E-Field Probe | Schmid&Partner Engineering AG | EX3DV3 | 3507 | SAR | 2008/01/25 * 12 |
| MRENT-76 | Dosimetric E-Field Probe | Schmid&Partner Engineering AG | ET3DV6 | 1741 | SAR | 2008/09/17 * 12 |
| MDAE-01 | Data Acquisition Electronics | Schmid&Partner Engineering AG | DAE3 V1 | 509 | SAR | 2008/07/10 * 12 |
| MSTW-16 | DASY4 | Schmid&Partner Engineering AG | DASY4 V4.7 Build71 | - | SAR | - |
| MRENT-10 | Dipole Antenna | Schmid&Partner Engineering AG | D900V2 | 031 | SAR | 2007/11/12 * 24 |
| MRENT-48 | Dipole Antenna | Schmid&Partner Engineering AG | D1800V2 | 214 | SAR | 2007/07/10 * 24 |
| MDA-06 | Dipole Antenna | Schmid&Partner Engineering AG | D1800V2 | 2d040 | SAR | 2008/12/16 * 24 |
| MDA-07 | Dipole Antenna | Schmid&Partner Engineering AG | D2450V2 | 713 | SAR | 2008/09/08 * 24 |
| MDPK-01 | Dielectric probe kit | Agilent | 85070D | - | SAR | Pre Check |
| MPS-01 | SAM Phantom | Schmid&Partner Engineering AG | SAM Twin Phantom V4.0 | 1196 | SAR | Pre Check |
| MOS-05 | Thermo-Hygrometer | Custom | CTH-190 | 810201 | SAR | 2008/04/03 * 12 |
| MOS-10 | Digital thermometer | HANNA | Checktemp-2 | MOS-10 | SAR | 2009/01/15 * 12 |
| - | Head 900MHz | - | - | - | Daily check | Target value \pm 5% |
| - | Body 900MHz | - | - | - | Daily check | Target value \pm 5% |
| - | Head 1800MHz | - | - | - | Daily check | Target value \pm 5% |
| - | Body 1800MHz | - | - | - | Daily check | Target value \pm 5% |
| - | SAR room | - | - | - | Daily check | Ambient Noise<0.012W/kg |

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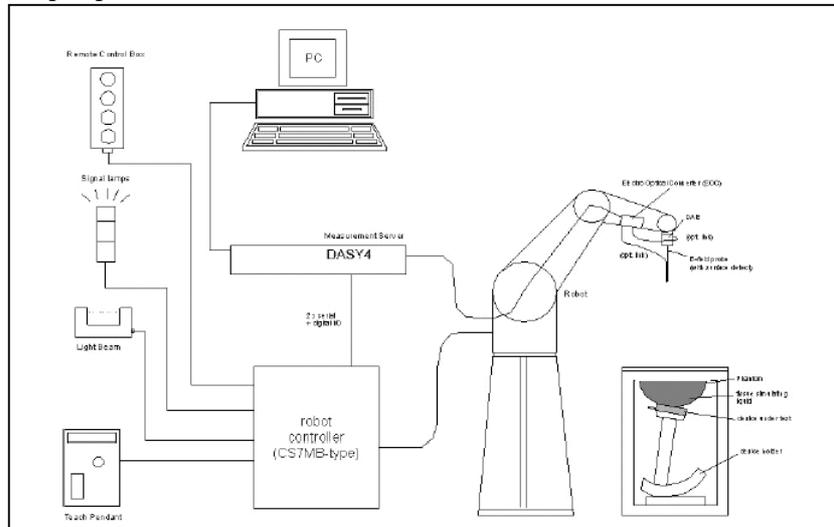
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2. Dosimetry assessment setup

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 EX3DV3, SN: 3507 & ET3DV6 SN: 1741(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.

3. Configuration and peripherals



The DASYS4 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. DASYS4 software.
9. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
10. The SAM twin phantom enabling testing left-hand and right-hand usage.
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

4.2.1 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(S/N 3507):

Basic Broad Band Calibration in air : 10-3000 MHz

Conversion Factors(Head and Body): 450MHz,900 MHz,1810MHz,2000MHz,2450MHz

5.2GHz,5.3GHz,5.5GHz,5.6GHz,5.8GHz

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:

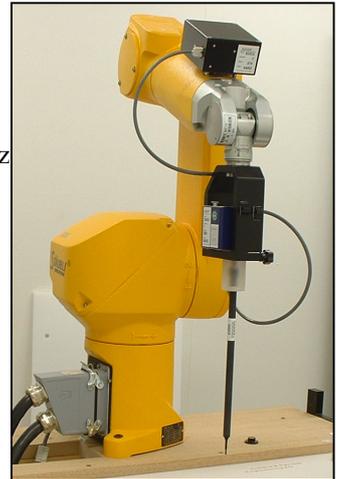
Overall length: 330 mm (Tip: 20 mm)

Tip diameter: 2.5mm (Body: 12 mm)

Typical distance from probe tip to dipole centers: 1 mm

Application:

Highprecision 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

4.2.2 ET3DV6 Probe Specification

Construction:

Symmetrical design with triangular core

Built-in optical fiber for surface detection System

Built-in shielding against static charges

PEEK enclosure material (resistant to organic solvents, e.g., glycol ether)

Calibration (SN:1741):

Conversion Factors (CF) for
1750MHz (Head and Body)

Frequency:

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

Directivity:

+/-0.2 dB in brain tissue (rotation around probe axis)

+/-0.4 dB in brain tissue (rotation normal probe axis)

Dimensions:

Overall length: 330 mm (Tip: 16 mm)

Tip length: 16 mm

Body diameter: 12 mm (Body: 12 mm)

Tip diameter: 6.8 mm

Distance from probe tip to dipole centers: 2.7 mm

Application:

General dosimetric up to 3 GHz

Compliance tests of mobile phones

Fast automatic scanning in arbitrary phantoms



Inside view of
ET3DV6 E-field Probe

SAM Twin Phantom

Construction:

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC EN 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness:

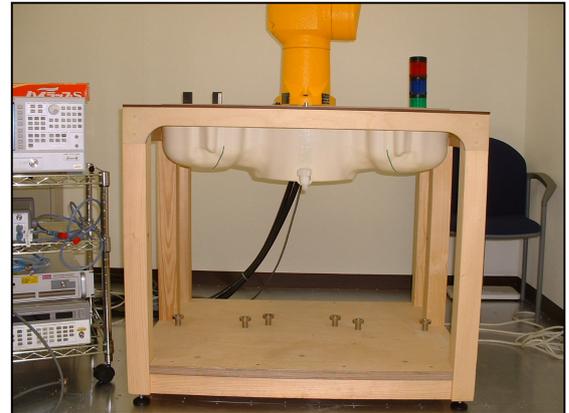
2 +/-0.2 mm

Filling Volume:

Approx. 25 liters

Dimensions:

(H x L x W): 810 x 1000 x 500 mm



SAM Twin Phantom

Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

* Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations.

To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



Device Holder

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 / ET3DV6 |
| Serial No. | : | 3507 / 1741 |
| 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 | : | SAM Twin Phantom V4.0 |
| Shell Material | : | Fiberglass |
| Thickness | : | 2.0 +/-0.2 mm |
| Volume | : | Approx. 25 liters |
| Manufacture | : | Schimid & Partner Engineering AG |

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6. 900MHz Simulated Tissues Composition

| Ingredient | MiXTURE(%) | |
|------------|-------------|---------------|
| | Head 900MHz | Muscle 900MHz |
| Water | 40.29 | 50.75 |
| Sugar | 57.90 | 48.21 |
| Cellulose | 0.24 | 0.00 |
| Salt | 1.38 | 0.94 |
| Preventol | 0.18 | 0.10 |

7. 900MHz 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 Head 900 MHz

Type of liquid : Head 900 MHz

Ambient temperature (deg.c.) : 24.5

Relative Humidity (%) : 40

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | |
|---|-----------|---------------------|-------|------------------------------------|-----------------|----------|---------------|-----------|
| Date | Frequency | Liquid Temp [deg.c] | | Parameters | Target Value *1 | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 12-Dec | 835 | 22.0 | 22.0 | Relative Permittivity ϵ_r | 41.5 | 41.4 | -0.2 | +/-5 |
| | | | | Coductivity σ [mho/m] | 0.90 | 0.88 | -2.2 | +/-5 |
| 12-Dec | 900 | 22.0 | 22.0 | Relative Permittivity ϵ_r | 41.5 | 40.7 | -1.9 | +/-5 |
| | | | | Coductivity σ [mho/m] | 0.97 | 0.95 | -2.1 | +/-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 | | | | | |
| 12-Dec | 900 | 22.0 | 22.0 | Relative Permittivity ϵ_r | 39.5 | 40.7 | 3.0 | +/-10 |
| | | | | Coductivity σ [mho/m] | 0.94 | 0.95 | 1.1 | +/-10 |

*2 The target value is the calibrated dipole Head TSL parameters. (D900V2 SN:031)

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7-c Muscle 900MHz

Type of liquid : Muscle 900 MHz
 Ambient temperature (deg.c) : 24.5
 Relative Humidity (%) : 38

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | |
|---|-----------|---------------------|-------|------------------------------------|----------------|----------|---------------|-----------|
| Date | Frequency | Liquid Temp [deg.c] | | Parameters | Target Value*1 | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 16-Dec | 900 | 22.5 | 22.5 | Relative Permittivity ϵ_r | 55.0 | 54.8 | -0.4 | +/-5 |
| | | | | Conductivity σ [mho/m] | 1.05 | 1.07 | 1.9 | +/-5 |
| 16-Dec | 835 | 22.5 | 22.5 | Relative Permittivity ϵ_r | 55.2 | 55.6 | 0.7 | +/-5 |
| | | | | Conductivity σ [mho/m] | 0.97 | 0.99 | 2.1 | +/-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 | | | | | |
| 16-Dec | 900 | 22.5 | 22.5 | Relative Permittivity ϵ_r | 54.3 | 54.8 | 0.9 | +/-10 |
| | | | | Conductivity σ [mho/m] | 1.06 | 1.07 | 0.9 | +/-10 |

*2 The target value is the calibrated dipole Body TSL parameters. (D900V2 SN:031)

8. 900MHz System validation data

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of +/-10%. The validation results are in the table below. Please refer to APPENDIX3.

Frequency : **900MHz**
 Liquid depth (cm) : **15.0**
 Ambient temperature (deg.c.) : **24.5(12 to 16-Dec)**
 Relative Humidity (%) : **40(12-Dec), 38(16-Dec)**
 Dipole : **D900V2 SN:031**
 Power : **250mW**

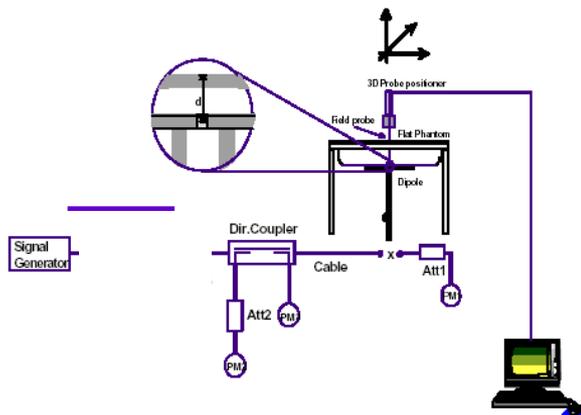
| SYSTEM PERFORMANCE CHECK | | | | | | | | | | | |
|--------------------------|-----------------|----------------------|-------|------------------------------------|----------|-------------------------------|----------|--|----------|---------------|-----------|
| Date | Liquid (900MHz) | | | | | | | System dipole validation target & measured | | | |
| | Type | 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 | | |
| 12-Dec | Head | 22.5 | 22.5 | 41.5 | 40.7 | 0.90 | 0.95 | 2.7 | 2.55 | -5.6 | +/-10 |

*1 The target values is a 1g SAR value defined in IEEE Standard 1528.

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | | |
|--------------------------|-----------------|----------------------|-------|------------------------------------|----------|-------------------------------|----------|--|----------|---------------|-----------|
| Date | Liquid (900MHz) | | | | | | | System dipole validation target & measured | | | |
| | Type | 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*2 | Measured | | |
| 12-Dec | Head | 22.5 | 22.5 | 39.5 | 40.7 | 0.94 | 0.95 | 2.68 | 2.55 | -4.9 | +/-10 |
| 16-Dec | Body | 22.5 | 22.5 | 54.3 | 54.8 | 1.06 | 1.07 | 2.74 | 2.84 | 3.6 | +/-10 |

*2 The target value is a manufacturer calibrated dipole 1g SAR value. (D900V2 SN:031)

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



900MHz System performance check setup

Test system for the system performance check setup diagram

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9. 900MHz Validation Measurement data

Head / 900MHz System Validation / Forward Conducted Power : 250mW

Dipole 900 MHz; Type: D900V2; Serial: 031

Communication System: CW; Frequency: 900 MHz; Crest factor: 1

Medium: HSL900 Medium parameters used: $f = 900$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 40.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(11.05, 11.05, 11.05); Calibrated: 2008/01/25

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

- Phantom: SAM 1196

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

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

Maximum value of SAR (interpolated) = 3.19 mW/g

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

Reference Value = 58.6 V/m; Power Drift = -0.017 dB

Peak SAR (extrapolated) = 3.94 W/kg

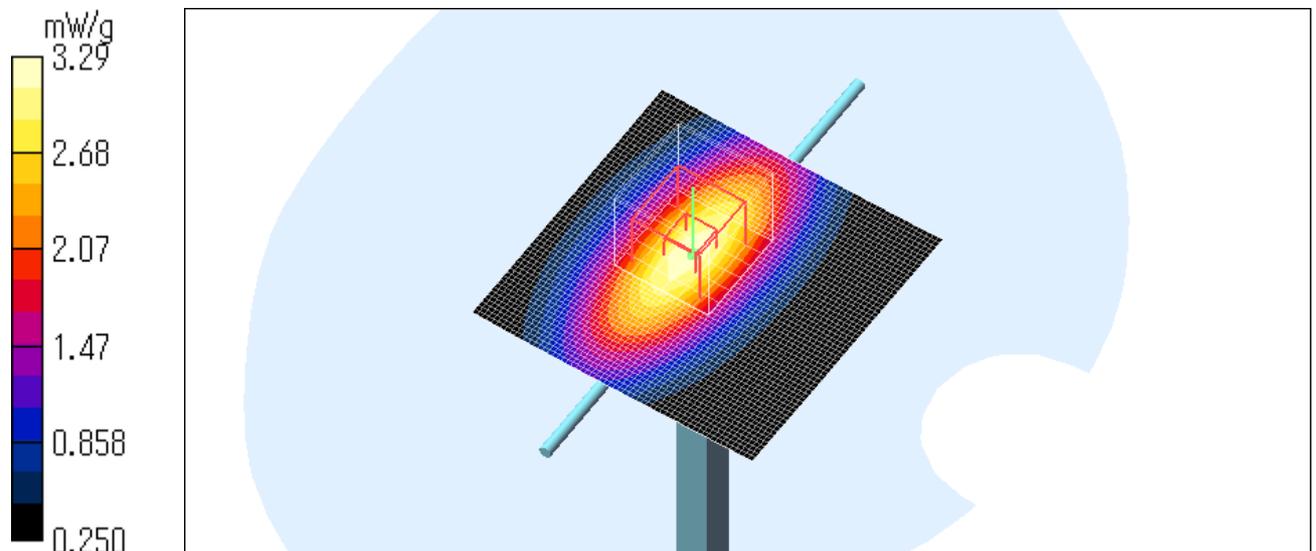
SAR(1 g) = 2.55 mW/g; SAR(10 g) = 1.64 mW/g

Maximum value of SAR (measured) = 3.29 mW/g

Test Date = 12/12/08

Ambient Temperature = 24.5 degree.c

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



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Body / 900MHz System Validation / Forward Conducted Power : 250mW

Dipole 900 MHz; Type: D900V2; Serial: 031

Communication System: CW; Frequency: 900 MHz; Crest factor: 1

Medium: M900 Medium parameters used: $f = 900$ MHz; $\sigma = 1.07$ mho/m; $\epsilon_r = 54.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(10.43, 10.43, 10.43); Calibrated: 2008/01/25

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

- Phantom: SAM 1196

- 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) = 3.62 mW/g

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

Reference Value = 57.5 V/m; Power Drift = -0.055 dB

Peak SAR (extrapolated) = 4.34 W/kg

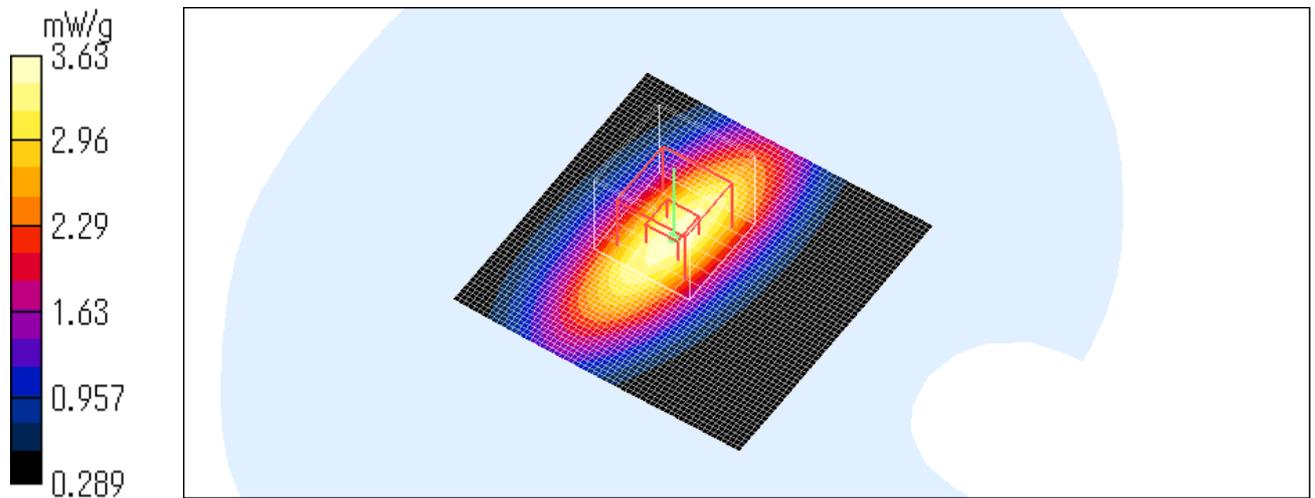
SAR(1 g) = 2.84 mW/g; SAR(10 g) = 1.84 mW/g

Maximum value of SAR (measured) = 3.63 mW/g

Test Date = 12/16/08

Ambient Temperature = 24.5 degree.c

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



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10. 1800MHz Simulated Tissues Composition

| Ingredient | MiXTURE(%) | |
|------------|--------------|----------------|
| | Head 1800MHz | Muscle 1800MHz |
| Water | 55.24 | 70.17 |
| DGMBE | 44.45 | 29.44 |
| Salt | 0.31 | 0.39 |

Note:DGMBE(Diethyleneglycol-monobuthyl ether)

11. 1800MHz Validation Measurement**Simulated tissue liquid parameter****11-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.

11-b Head 1800MHz for PCS 1900 mode

Type of liquid : **Head 1800 MHz**

Ambient temperature (deg.c.) : **24.5**

Relative Humidity (%) : **38**

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | |
|---|-----------|---------------------|-------|------------------------------------|--------------------|----------|---------------|-----------|
| Date | Frequency | Liquid Temp [deg.c] | | Parameters | Target Value *1 | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 11-Dec | 1800 | 23.0 | 23.0 | Relative Permittivity ϵ_r | 40.0 | 40.6 | 1.5 | +/-5 |
| | | | | Coductivity σ [mho/m] | 1.40 | 1.44 | 2.9 | +/-5 |
| 11-Dec | 1880 | 23.0 | 23.0 | Relative Permittivity ϵ_r | 40.0 | 39.0 | -2.5 | +/-5 |
| | | | | Coductivity σ [mho/m] | 1.40 | 1.47 | 5.0 | +/-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 | | | | | |
| 11-Dec | 1800 | 23.0 | 23.0 | Relative Permittivity ϵ_r | 39.6 | 40.6 | 2.5 | +/-10 |
| | | | | Coductivity σ [mho/m] | 1.41 | 1.44 | 2.1 | +/-10 |

*2 The target value is the calibrated dipole Head TSL parameters. (D1800V2 SN:214)

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11-c Head 1800MHz for WCDMA IV modeType of liquid : **Head 1800 MHz**Ambient temperature (deg.c) : **24.0**Relative Humidity (%) : **42**

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | |
|---|-----------|---------------------|-------|------------------------------------|--------------------|----------|---------------|-----------|
| Date | Frequency | Liquid Temp [deg.c] | | Parameters | Target Value *1 | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 30-Jan | 1800 | 22.3 | 22.3 | Relative Permittivity ϵ_r | 40.0 | 39.8 | -0.5 | +/-5 |
| | | | | Conductivity σ [mho/m] | 1.40 | 1.36 | -2.9 | +/-5 |
| 30-Jan | 1732 | 22.3 | 22.3 | Relative Permittivity ϵ_r | 40.1 | 40.0 | -0.2 | +/-5 |
| | | | | Conductivity σ [mho/m] | 1.36 | 1.34 | -1.5 | +/-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 | | | | | |
| 30-Jan | 1800 | 22.3 | 22.3 | Relative Permittivity ϵ_r | 38.8 | 39.8 | 2.6 | +/-10 |
| | | | | Conductivity σ [mho/m] | 1.40 | 1.36 | -2.9 | +/-10 |

*2 The target value is the calibrated dipole Head TSL parameters. (D1800V2 SN:2d040)

Decision on Simulated Tissues of 1732MHz

In the current standards (OET 65 Supplement C), the dielectric parameters suggested for head and body tissue simulating liquid are given at 1610MHz and 1800MHz. As an intermediate solution, dielectric parameters for the frequencies between 1610 to 1800 MHz were obtained using linear interpolation.

Therefore the dielectric parameters of 1732MHz were decided as following.

(1732MHz Head Tissue/ Relative Permittivity ϵ_r : **40.1**, Conductivity σ : **1.36**)

(1732MHz Body Tissue/ Relative Permittivity ϵ_r : **53.5**, Conductivity σ : **1.48**)

| f (MHz) | Head Tissue | | Body Tissue | | Reference |
|---------|-------------|---------|-------------|---------|--------------|
| | r | [mho/m] | r | [mho/m] | |
| 1610 | 40.3 | 1.29 | 53.8 | 1.40 | Standard |
| 1800 | 40.0 | 1.40 | 53.3 | 1.52 | Standard |
| 1732 | 40.11 | 1.36 | 53.48 | 1.48 | Interpolated |

Standard and interpolated dielectric parameters for head and body tissue simulating liquid.

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11-d Muscle 1800MHz for PCS 1900 modeType of liquid : **Muscle 1800 MHz**Ambient temperature (deg.c.) : **24.5**Relative Humidity (%) : **38**

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | |
|---|-----------|---------------------|-------|------------------------------------|--------------|----------|---------------|-----------|
| Date | Frequency | Liquid Temp [deg.c] | | Parameters | Target Value | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 15-Dec | 1800 | 23.5 | 23.5 | Relative Permittivity ϵ_r | 53.3 | 54.2 | 1.7 | +/-5 |
| | | | | Conductivity σ [mho/m] | 1.52 | 1.54 | 1.3 | +/-5 |
| 15-Dec | 1880 | 23.5 | 23.5 | Relative Permittivity ϵ_r | 53.3 | 54.2 | 1.7 | +/-5 |
| | | | | Conductivity σ [mho/m] | 1.52 | 1.59 | 4.6 | +/-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-Dec | 1800 | 23.5 | 23.5 | Relative Permittivity ϵ_r | 54.5 | 54.2 | -0.6 | +/-5 |
| | | | | Conductivity σ [mho/m] | 1.48 | 1.54 | 4.1 | +/-5 |

*2 The target value is the calibrated dipole Body TSL parameters. (D1800V2 SN:214)

11-e Muscle 1800MHz for WCDMA IV modeType of liquid : **Muscle 1800 MHz**Ambient temperature (deg.c.) : **24.0**Relative Humidity (%) : **40**

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | |
|---|-----------|---------------------|-------|------------------------------------|-----------------|----------|---------------|-----------|
| Date | Frequency | Liquid Temp [deg.c] | | Parameters | Target Value *1 | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 29-Jan | 1800 | 22.0 | 22.0 | Relative Permittivity ϵ_r | 53.3 | 54.2 | 1.7 | +/-5 |
| | | | | Conductivity σ [mho/m] | 1.52 | 1.53 | 0.7 | +/-5 |
| 29-Jan | 1732 | 22.0 | 22.0 | Relative Permittivity ϵ_r | 53.5 | 54.5 | 1.9 | +/-5 |
| | | | | Conductivity σ [mho/m] | 1.48 | 1.45 | -2.0 | +/-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 | | | | | |
| 29-Jan | 1800 | 22.0 | 22.0 | Relative Permittivity ϵ_r | 55.3 | 54.2 | -2.0 | +/-5 |
| | | | | Conductivity σ [mho/m] | 1.48 | 1.53 | 3.4 | +/-5 |

*2 The target value is the calibrated dipole Body TSL parameters. (D1800V2 SN:2d040)

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12. 1800MHz System validation data

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of +/-10%. The validation results are in the table below. Please refer to APPENDIX3.

12-a 1800MHz System validation for PCS1900 mode

Frequency : 1800MHz
Liquid depth (cm) : 15.0
Ambient temperature (deg.c.) : 24.5(11 and 15-Dec)
Relative Humidity (%) : 40(11-Dec), 38(15-Dec)
Dipole : D1800V2 SN:214
Power : 250mW

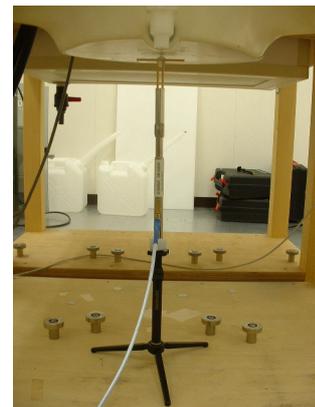
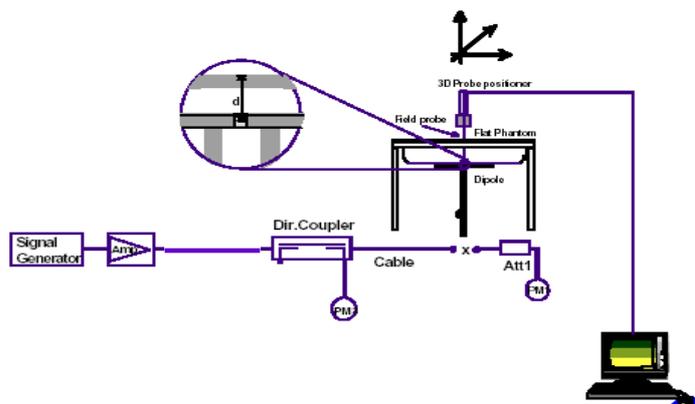
| Date | Liquid (1800MHz) | | | | | | System dipole validation target & measured | | | | |
|--------|------------------|----------------------|-------|------------------------------------|----------|-------------------------------|--|---------------|----------|---------------|-----------|
| | Type | 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 | | |
| 11-Dec | Head | 23.5 | 23.5 | 40.0 | 40.6 | 1.40 | 1.44 | 9.53 | 9.82 | 3.0 | +/-10 |

*1 The target values is a 1g SAR value defined in IEEE Standard 1528.

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | | |
|--------------------------|------------------|----------------------|-------|------------------------------------|----------|-------------------------------|--|---------------|----------|---------------|-----------|
| Date | Liquid (1800MHz) | | | | | | System dipole validation target & measured | | | | |
| | Type | 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*2 | Measured | | |
| 11-Dec | Head | 23.5 | 23.5 | 39.6 | 40.6 | 1.41 | 1.44 | 9.45 | 9.82 | 3.9 | +/-10 |
| 15-Dec | Body | 23.5 | 23.5 | 54.5 | 54.2 | 1.48 | 1.54 | 9.40 | 10.1 | 7.4 | +/-10 |

*2 The target value is a manufacturer calibrated dipole 1g SAR value. (D1800V2 SN:214)

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



1800MHz System performance check setup

Test system for the system performance check setup diagram

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12-b 1800MHz System validation for WCDMA IV mode

Frequency : 1800MHz
Liquid depth (cm) : 15.0
Ambient temperature (deg.c.) : 24.0(29 and 30-Jan)
Relative Humidity (%) : 40(29-Jan), 42(30-Jan)
Dipole : D1800V2 SN:2d040
Power : 250mW

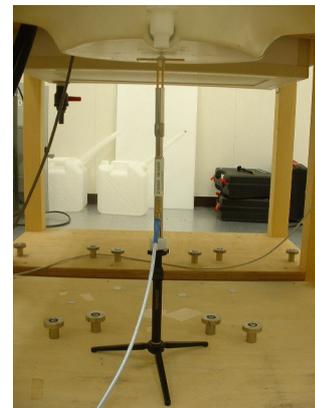
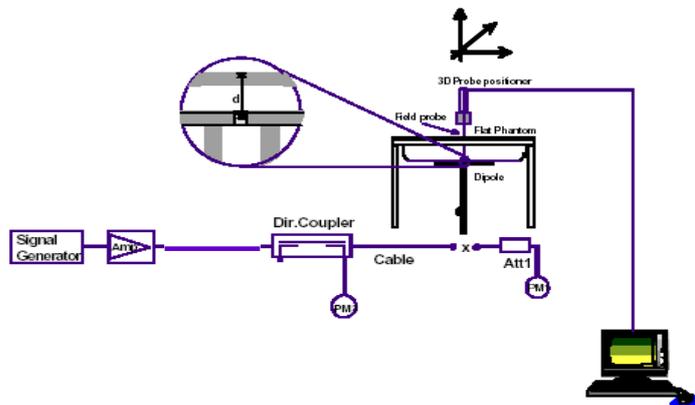
| Date | Liquid (1800MHz) | | | | | | | System dipole validation target & measured | | | |
|--------|------------------|----------------------|-------|------------------------------------|----------|-------------------------------|----------|--|----------|---------------|-----------|
| | Type | Liquid 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 | | |
| 30-Jan | Head | 22.3 | 22.3 | 40.0 | 39.8 | 1.40 | 1.36 | 9.53 | 9.12 | -4.3 | +/-10 |

*1 The target values is a 1g SAR value defined in IEEE Standard 1528.

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | | |
|--------------------------|------------------|----------------------|-------|------------------------------------|----------|-------------------------------|----------|--|----------|---------------|-----------|
| Date | Liquid (1800MHz) | | | | | | | System dipole validation target & measured | | | |
| | Type | 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*2 | Measured | | |
| 30-Jan | Head | 22.0 | 22.0 | 38.8 | 39.8 | 1.40 | 1.36 | 9.62 | 9.12 | -5.2 | +/-10 |
| 29-Jan | Body | 22.3 | 22.3 | 55.3 | 54.2 | 1.48 | 1.53 | 9.45 | 9.85 | 4.2 | +/-10 |

*2 The target value is a manufacturer calibrated dipole 1g SAR value. (D1800V2 SN:2d040)

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



1800MHz System performance check setup

Test system for the system performance check setup diagram

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13. 1800MHz Validation Measurement data

13-a 1800MHz Validation Measurement data for PCS 1900mode

HEAD /1800MHz System Validation / Forward Conducted Power : 250mW

Dipole 1800 MHz; Type: D1800V2; Serial: 214

Communication System: CW; Frequency: 1800 MHz; Crest factor: 1

Medium: HSL1800 Medium parameters used: $f = 1800$ MHz; $\sigma = 1.44$ mho/m; $\epsilon_r = 40.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(8.86, 8.86, 8.86); Calibrated: 2008/01/25

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

- Phantom: SAM 1196

- 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) = 14.8 mW/g

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

Reference Value = 97.2 V/m; Power Drift = 0.076 dB

Peak SAR (extrapolated) = 18.3 W/kg

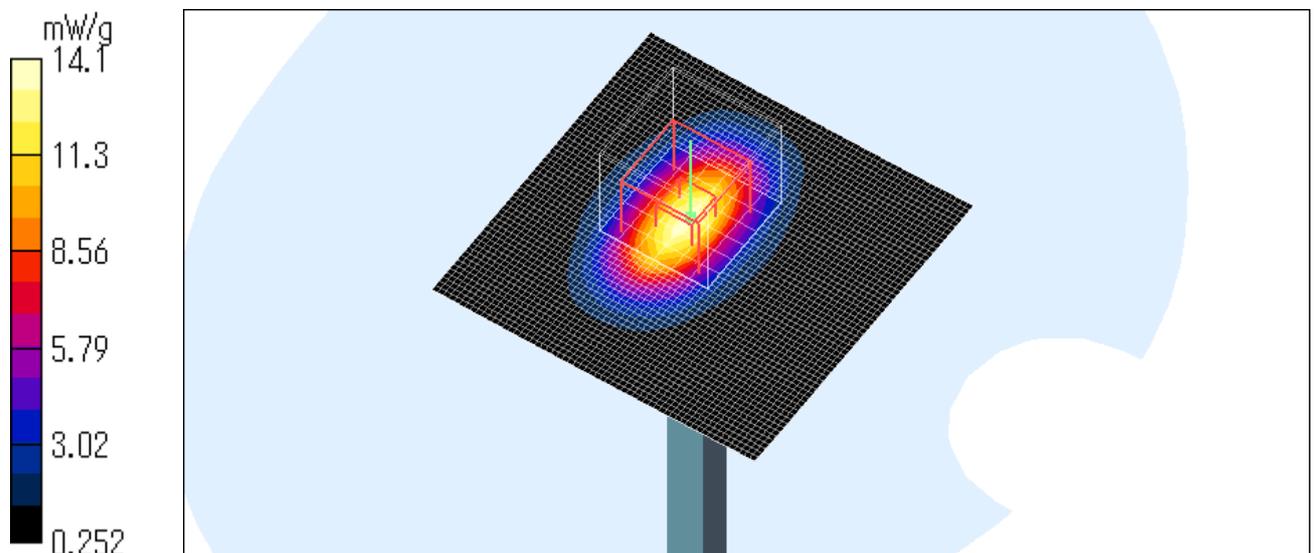
SAR(1 g) = 9.82 mW/g; SAR(10 g) = 5.12 mW/g

Maximum value of SAR (measured) = 14.1 mW/g

Test Date = 12/11/08

Ambient Temperature = 24.5 degree.c

Liquid Temperature = Before 23.5 degree.C , After 23.5 degree.C



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Body/ 1800MHz System Validation / Forward Conducted Power : 250mW

Dipole 1800 MHz; Type: D1800V2; Serial: 214

Communication System: CW; Frequency: 1800 MHz; Crest factor: 1

Medium: M1800 Medium parameters used: $f = 1800$ MHz; $\sigma = 1.54$ mho/m; $\epsilon_r = 54.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(8.82, 8.82, 8.82); Calibrated: 2008/01/25

- 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) = 15.2 mW/g

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

Reference Value = 97.1 V/m; Power Drift = 0.003 dB

Peak SAR (extrapolated) = 18.2 W/kg

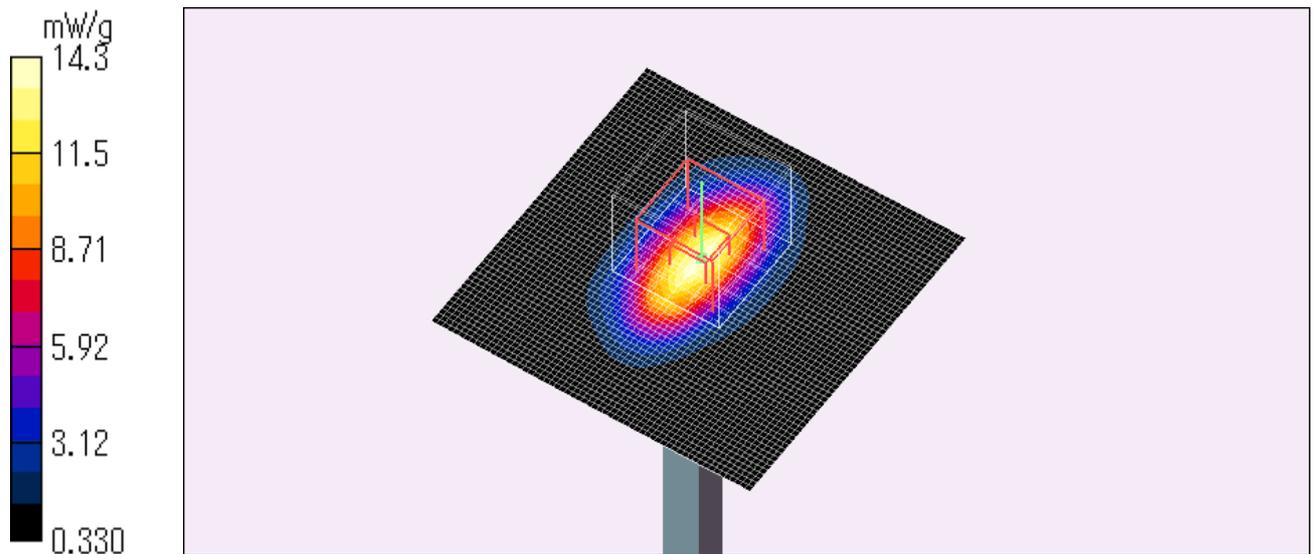
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.36 mW/g

Maximum value of SAR (measured) = 14.3 mW/g

Test Date = 12/15/08

Ambient Temperature = 24.5 degree.c

Liquid Temperature = Before 23.5 degree.C , After 23.5 degree.C



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13-b 1800MHz Validation Measurement data for WCDMA IV mode

HEAD /1800MHz System Validation / Forward Conducted Power : 250mW

Communication System: CW; Frequency: 1800 MHz; Crest factor: 1

Medium: HSL1800 Medium parameters used: $f = 1800 \text{ MHz}$; $\sigma = 1.36 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1741; ConvF(5.4, 5.4, 5.4); Calibrated: 2008/09/17

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Phantom: SAM 1196

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

Area Scan (61x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 10.9 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 90.0 V/m; Power Drift = -0.003 dB

Peak SAR (extrapolated) = 16.3 W/kg

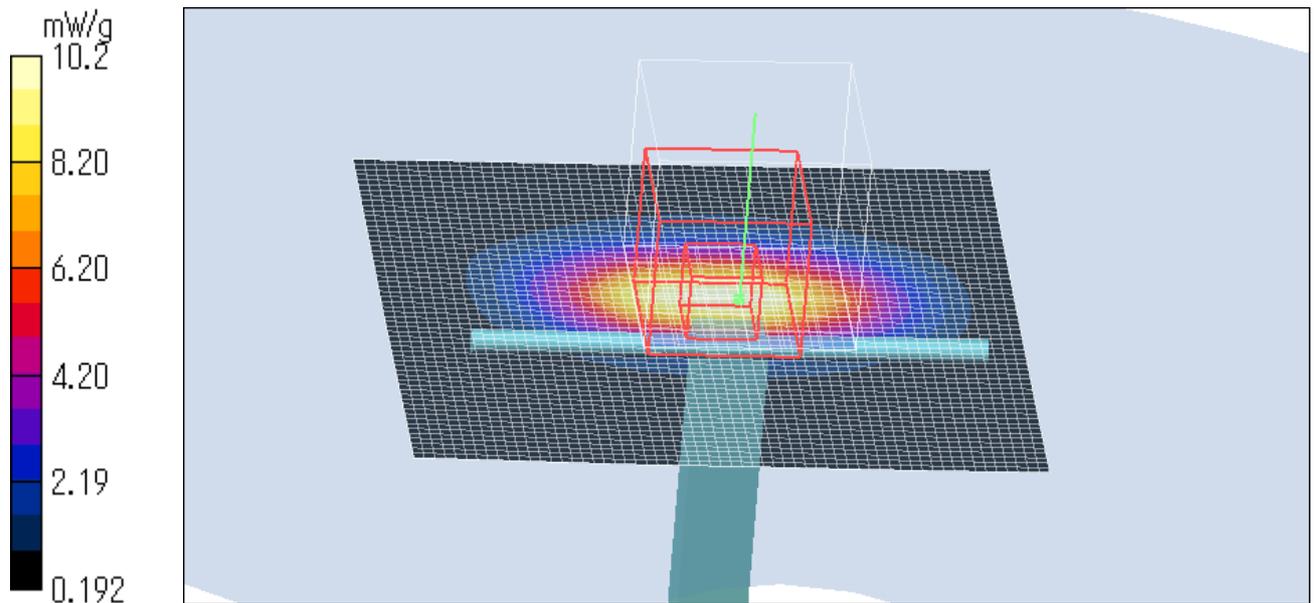
SAR(1 g) = 9.12 mW/g; SAR(10 g) = 4.83 mW/g

Maximum value of SAR (measured) = 10.2 mW/g

Test Date = 01/30/09

Ambient Temperature = 24.0 degree.c

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



Body /1800MHz System Validation / Forward Conducted Power : 250mW

Communication System: CW; Frequency: 1800 MHz; Crest factor: 1

Medium: M1800 Medium parameters used: $f = 1800$ MHz; $\sigma = 1.53$ mho/m; $\epsilon_r = 54.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1741; ConvF(4.74, 4.74, 4.74); Calibrated: 2008/09/17

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Phantom: SAM 1196

- 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) = 12.2 mW/g

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

Reference Value = 88.8 V/m; Power Drift = -0.013 dB

Peak SAR (extrapolated) = 17.5 W/kg

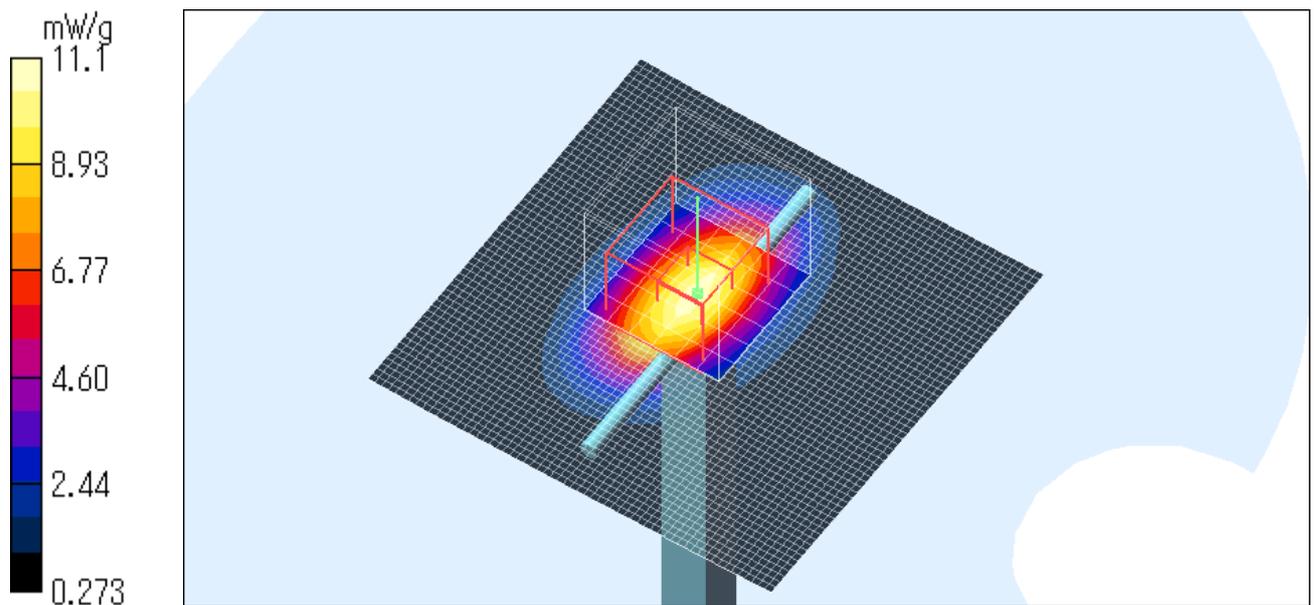
SAR(1 g) = 9.85 mW/g; SAR(10 g) = 5.26 mW/g

Maximum value of SAR (measured) = 11.1 mW/g

Test Date = 01/29/09

Ambient Temperature = 24.0 degree.c

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



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14. Validation of frequency offset

The validation performed at the SAR of a test device test was performed in the Dipole1800MHz, and the verified frequency was 1800MHz. This frequency is outside the range from the test device frequency range. Therefore, we performed the system validation at offset frequency, since the return loss of dipole was -15dB or better according to the KDB 450824

The verified frequency using Dipole 1800MHz were 1880MHz and 1732MHz.

As the result, the verified SAR of 1880MHz and 1732MHz were within 15% of manufacture's calibrated target. So, the 1880MHz and 1732MHz validation were confirm measurement accuracy according to the tissue dielectric medium, probe calibration and other system operating parameters used to measure the SAR of a test device.

System validation of frequency offset (1880MHz)

Frequency : 1880MHz
Dipole : D1800V2 SN:214
Power : 250mW

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | | |
|--------------------------|------|----------------------|-------|------------------------------------|----------|-------------------------------|----------|--|----------|---------------|-----------|
| Frequency [MHz] | Type | Liquid (1800MHz) | | | | | | 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 | | |
| 1880 | Head | 23.5 | 23.5 | 40.0 | 39.0 | 1.40 | 1.47 | 9.53 | 9.32 | -2.2 | +/-15 |
| 1880 | Body | 23.5 | 23.5 | 53.3 | 54.2 | 1.52 | 1.59 | - | 9.71 | - | - |

*1 The target values is a 1g SAR value (1800MHz) defined in IEEE Standard 1528.

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | | |
|--------------------------|------|----------------------|-------|------------------------------------|----------|-------------------------------|----------|--|----------|---------------|-----------|
| Frequency [MHz] | Type | Liquid (1800MHz) | | | | | | 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*2 | Measured | | |
| 1880 | Head | 23.5 | 23.5 | 39.6 | 39.0 | 1.41 | 1.47 | 9.45 | 9.32 | -1.4 | +/-15 |
| 1880 | Body | 23.5 | 23.5 | 54.5 | 54.2 | 1.48 | 1.59 | 9.40 | 9.71 | 3.3 | +/-15 |

*2 The target values is a parameter defined in manufacture's calibrated

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

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System validation of frequency offset (1732MHz)

Frequency : 1732MHz
 Dipole : D1800V2 SN:2d040
 Power : 250mW

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | | |
|--------------------------|------|----------------------|-------|------------------------------------|----------|-------------------------------|----------|--|----------|---------------|-----------|
| Frequency [MHz] | Type | Liquid (1800MHz) | | | | | | 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 | | |
| 1732 | Head | 22.3 | 22.3 | 40.1 | 40.0 | 1.36 | 1.34 | 9.53 | 9.70 | 1.8 | +/-15 |
| 1732 | Body | 22.0 | 22.0 | 53.5 | 54.5 | 1.48 | 1.45 | - | 9.80 | - | |

*1 The target values is a 1g SAR value (1800MHz) defined in IEEE Standard 1528.

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | | |
|--------------------------|------|----------------------|-------|------------------------------------|----------|-------------------------------|----------|--|----------|---------------|-----------|
| Frequency [MHz] | Type | Liquid (1800MHz) | | | | | | 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*2 | Measured | | |
| 1732 | Head | 22.3 | 22.3 | 38.8 | 40.0 | 1.40 | 1.34 | 9.62 | 9.70 | 0.8 | +/-15 |
| 1732 | Body | 22.0 | 22.0 | 55.3 | 54.5 | 1.48 | 1.45 | 9.45 | 9.80 | 3.7 | +/-15 |

*2 The target values is a parameter defined in manufacture's calibrated
 Note: Please refer to Attachment for the result representation in plot format

Test system for the system performance check setup diagram

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HEAD 1880MHz System Validation / Dipole 1800 MHz / Forward Conducted Power : 250mW

Dipole 1800 MHz; Type: D1800V2; Serial:214

Communication System: CW; Frequency: 1880 MHz; Crest factor: 1

Medium: HSL1800 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.47$ mho/m; $\epsilon_r = 39.0$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(8.86, 8.86, 8.86); Calibrated: 2008/01/25

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

- Phantom: SAM 1196

- 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) = 14.8 mW/g

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

Reference Value = 95.2 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 17.1 W/kg

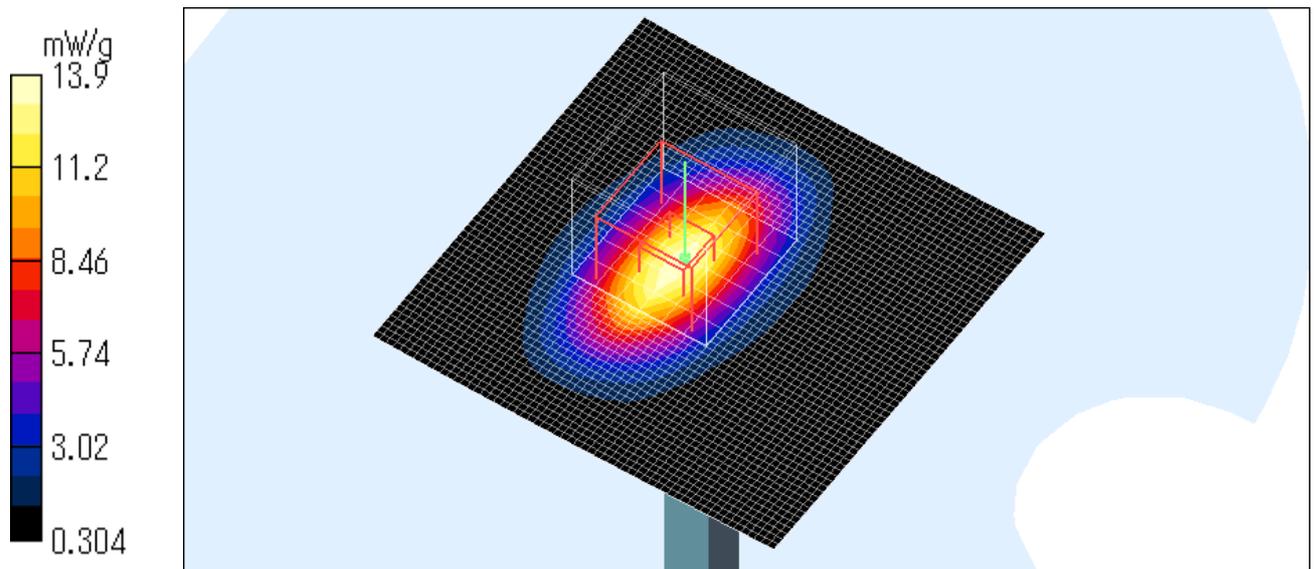
SAR(1 g) = 9.32 mW/g; SAR(10 g) = 4.94 mW/g

Maximum value of SAR (measured) = 13.9 mW/g

Test Date = 12/11/08

Ambient Temperature = 24.5 degree.c

Liquid Temperature = Before 23.5 degree.C , After 23.5 degree.C



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Body 1880MHz System Validation / Dipole 1800 MHz / Forward Conducted Power : 250mW

Dipole 1800 MHz; Type: D1800V2; Serial: 214

Communication System: CW; Frequency: 1880 MHz; Crest factor: 1

Medium: M1800 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.59$ mho/m; $\epsilon_r = 54.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(8.82, 8.82, 8.82); Calibrated: 2008/01/25

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

- Phantom: SAM 1196

- 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) = 14.4 mW/g

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

Reference Value = 97.7 V/m; Power Drift = -0.061 dB

Peak SAR (extrapolated) = 17.2W/kg

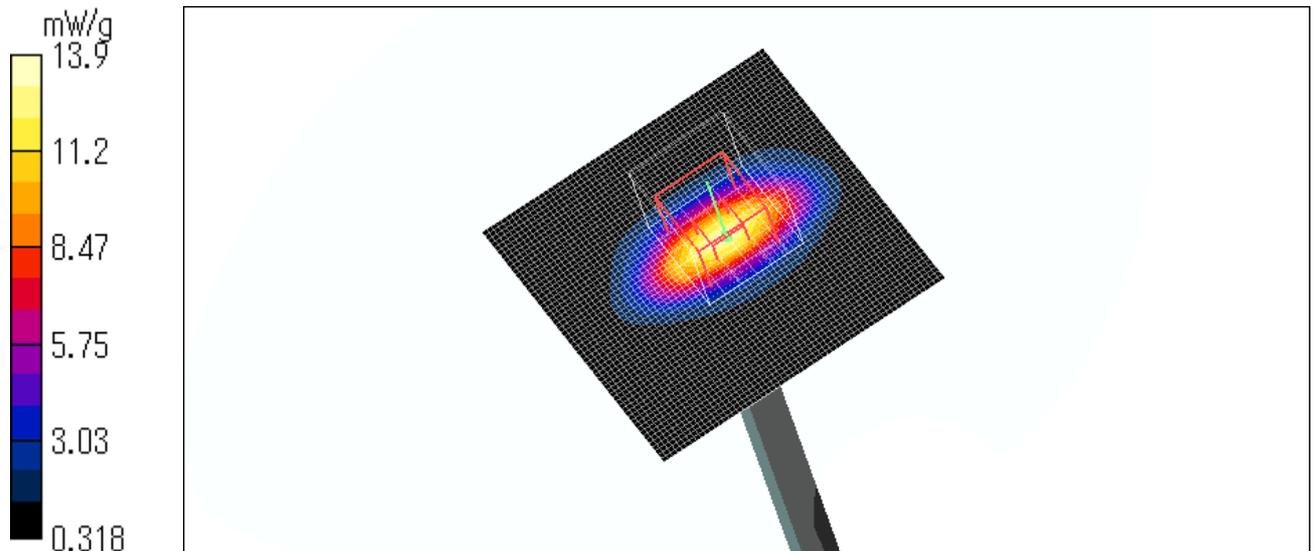
SAR(1 g) = 9.71 mW/g; SAR(10 g) = 5.14 mW/g

Maximum value of SAR (measured) = 13.9 mW/g

Test Date = 12/15/08

Ambient Temperature = 24.5 degree.c

Liquid Temperature = Before 23.5 degree.C , After 23.5 degree.C



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HEAD 1732MHz System Validation / Dipole 1800 MHz / Forward Conducted Power : 250mW

Dipole 1800 MHz; Type: D1800V2; Serial:2d040

Communication System: CW; Frequency: 1732 MHz; Crest factor: 1

Medium: HSL1800 Medium parameters used: $f = 1732$ MHz; $\sigma = 1.34$ mho/m; $\epsilon_r = 40$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1741; ConvF(5.4, 5.4, 5.4); Calibrated: 2008/09/17

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Phantom: SAM 1196

- 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) = 11.8 mW/g

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

Reference Value = 92.7 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 17.2 W/kg

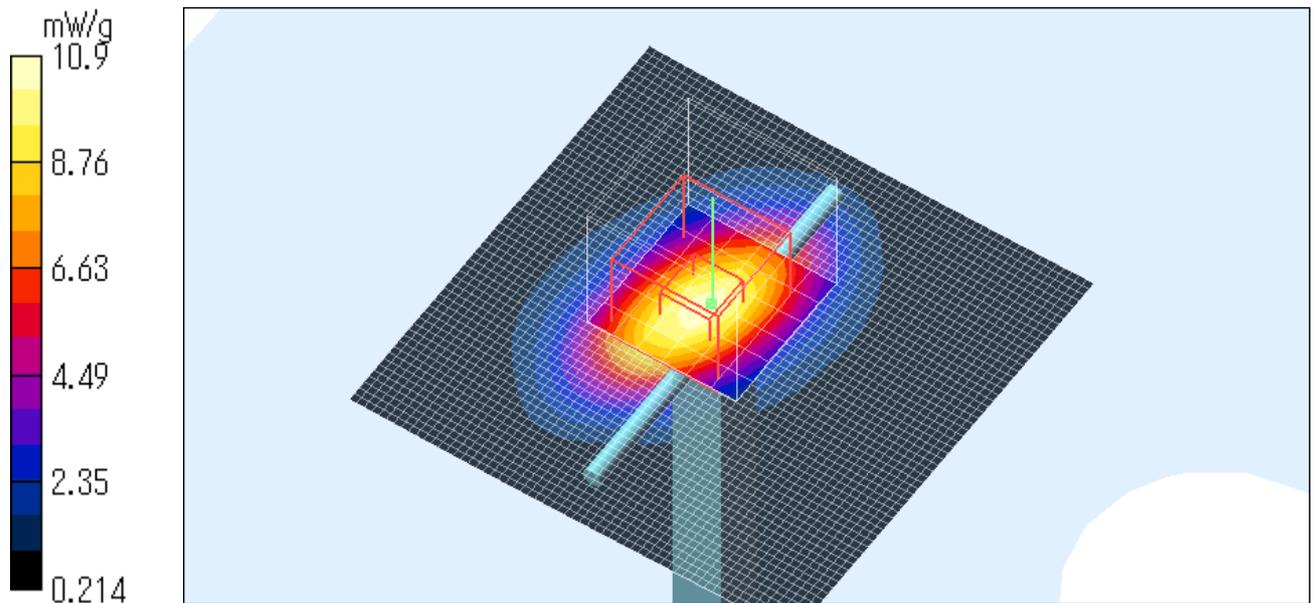
SAR(1 g) = 9.7 mW/g; SAR(10 g) = 5.16 mW/g

Maximum value of SAR (measured) = 10.9 mW/g

Test Date = 01/30/09

Ambient Temperature = 24.0 degree.c

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



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Body 1732MHz System Validation / Dipole 1800 MHz / Forward Conducted Power : 250mW

Dipole 1800 MHz; Type: D1800V2; Serial:2d040

Communication System: CW; Frequency: 1732 MHz; Crest factor: 1

Medium: M1800 Medium parameters used (interpolated): $f = 1732$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 54.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1741; ConvF(4.74, 4.74, 4.74); Calibrated: 2008/09/17

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Phantom: SAM 1196

- 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) = 12.0 mW/g

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

Reference Value = 91.2 V/m; Power Drift = -0.021 dB

Peak SAR (extrapolated) = 17.4 W/kg

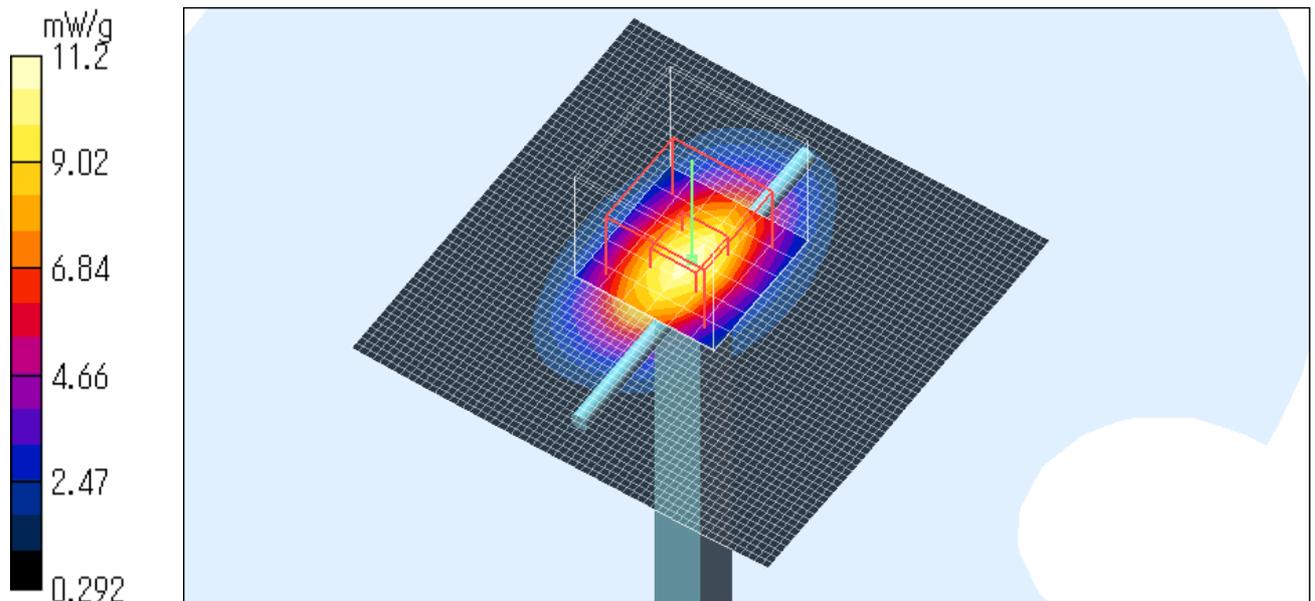
SAR(1 g) = 9.8 mW/g; SAR(10 g) = 5.25 mW/g

Maximum value of SAR (measured) = 11.2 mW/g

Test Date = 01/29/09

Ambient Temperature = 24.0 degree.c

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



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15. 2450MHz Simulated Tissues Composition

| Ingredient | MiXTURE(%) | |
|------------|--------------|----------------|
| | Head 2450MHz | Muscle 2450MHz |
| Water | 55.0 | 68.64 |
| DGMBE | 45.0 | 31.37 |

Note:DGMBE(Diethylenglycol-monobuthyl ether)

16. 2450MHz Validation Measurement

Simulated tissue liquid parameter

16-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.

16-b Muscle 2450 MHz

Type of liquid : **Muscle 2450 MHz**
Ambient temperature (deg.c.) : **24.5**
Relative Humidity (%) : **39**
Liquid depth (cm) : **15.0**

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | |
|---|-----------|---------------------|-------|------------------------------------|--------------|----------|---------------|-----------|
| Date | Frequency | Liquid Temp [deg.c] | | Parameters | Target Value | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 17-Dec | 2450 | 23.5 | 23.5 | Relative Permittivity ϵ_r | 52.7 | 50.6 | -4.0 | +/-5 |
| | | | | Coductivity σ [mho/m] | 1.95 | 2.03 | 4.1 | +/-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 | Measured | Deviation [%] | Limit [%] |
| | | Before | After | | | | | |
| 17-Dec | 2450 | 23.5 | 23.5 | Relative Permittivity ϵ_r | 50.6 | 50.6 | 0.0 | +/-10 |
| | | | | Coductivity σ [mho/m] | 1.96 | 2.03 | 3.6 | +/-10 |

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

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17. 2450MHz System validation data

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of +/-10%. The validation results are in the table below. Please refer to APPENDIX3.

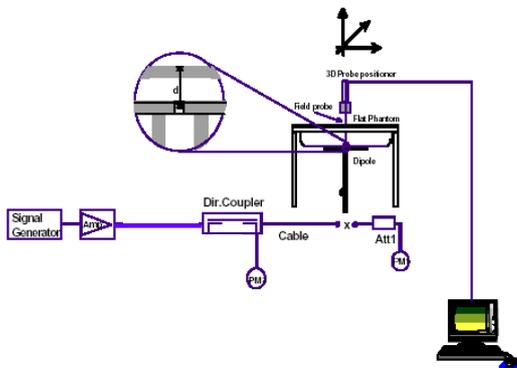
System validation of 2450MHz

Type of liquid : Muscle 2450MHz
Frequenc : 2450MHz
Ambient temperature (deg.c.) : 24.5
Relative Humidity (%) : 39
Dipole : D2450V2 SN:713
Power : 250mW

| SYSTEM PERFORMANCE CHECK | | | | | | | | | | |
|--------------------------|----------------------|-------|---------------------------------------|----------|----------------------------------|----------|--|----------|---------------|-----------|
| Date | Liquid (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*2 | Measured | | |
| 17-Dec | 23.5 | 23.5 | 50.6 | 50.6 | 1.96 | 2.03 | 12.1 | 13.3 | 9.9 | +/-10 |

*2 The target value is a manufacturer calibrated dipole Body 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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18. 2450MHz Validation Measurement data

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

Dipole 2450 MHz;

Type: D2450V2; Serial:713

Communication System: CW; Frequency: 2450 MHz; Crest factor: 1

Medium: M2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 2.03$ mho/m; $\epsilon_r = 50.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3507; ConvF(7.9, 7.9, 7.9); Calibrated: 2008/01/25

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

- Phantom: SAM 1196

- 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) = 22.4 mW/g

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

Reference Value = 97.7 V/m; Power Drift = 0.085 dB

Peak SAR (extrapolated) = 27.5 W/kg

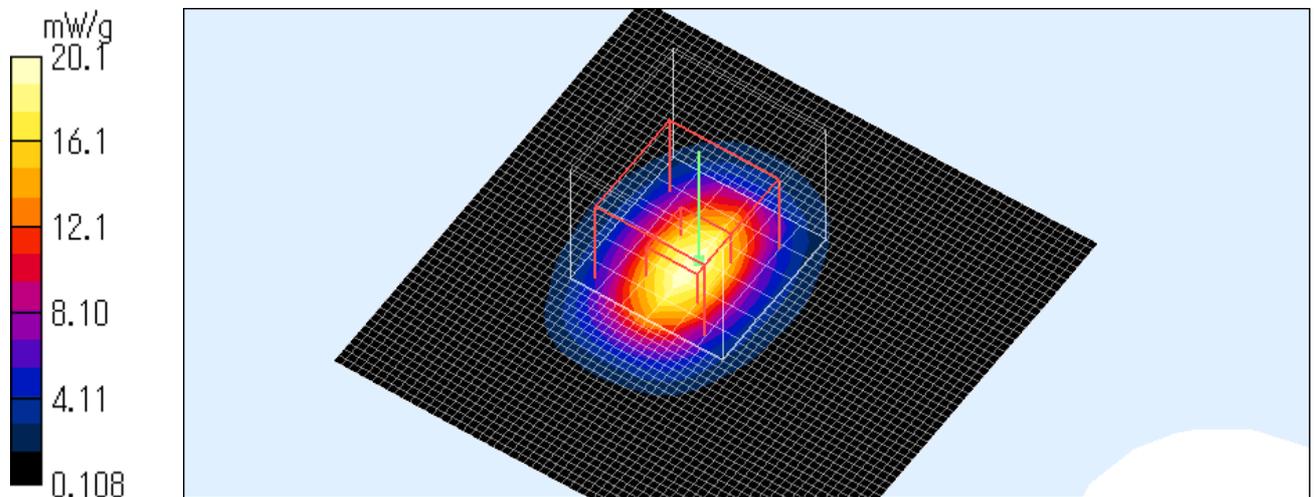
SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.11 mW/g

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

Test Date = 12/17/08

Ambient Temperature = 24.5 degree.c

Liquid Temperature = Before 23.5 degree.C , After 23.5 degree.C



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19. 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 \pm % | 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 | |

20. System Validation Dipole (D900V2,S/N: 031)

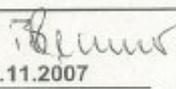
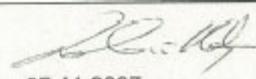
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s p e a g

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 info@speag.com, http://www.speag.com

**CUSTOMER
 COPY**

DIPOLE REPAIR REPORT – SPEAG Production Center

| | | | |
|---|---|--|--|
| PRODUCT | | D900V2 DIPOLE | |
| SERIAL Nr.: | SN:031 | IN DATE: | 7-Nov-2007 |
| CUSTOMER: | | MTT | |
| DIPOLE REPAIR | WORK DESCRIPTION | | WORKING TIME (h) |
| MATERIAL | | | |
| Dipole Arm | fixed <input checked="" type="checkbox"/> | exchanged <input type="checkbox"/> | re-soldered <input type="checkbox"/> 0.50 hours |
| Dipole Connector | fixed <input type="checkbox"/> | exchanged <input type="checkbox"/> | cleaned <input checked="" type="checkbox"/> hours |
| Gold Plating | fixed <input type="checkbox"/> | exchanged <input type="checkbox"/> | new gold plating <input type="checkbox"/> hours |
| Housing | fixed <input type="checkbox"/> | exchanged <input type="checkbox"/> | new label..... <input checked="" type="checkbox"/> hours |
| Disassemble/clean | fixed <input type="checkbox"/> | exchanged <input type="checkbox"/> | new color mark <input type="checkbox"/> hours |
|: | fixed <input type="checkbox"/> | exchanged <input type="checkbox"/> | hours |
|: | fixed <input type="checkbox"/> | exchanged <input type="checkbox"/> | hours |
| Analysis: | | | hours |
| Final Assembly: | | | 0.50 hours |
| Total hours | | | 1.00 hours |
| COMMENTS: The bent dipole arms were adjusted and straightened and the connector was cleaned as well. A new label was applied. After this repair the dipole will be newly calibrated. | | | |
| CONDUCTED BY:  | | APPROVED BY:  | |
| DATE: 07.11.2007 | | DATE: 07.11.2007 | |
| REPAIR COST: | | | |
| MATERIAL COST: | 0.00 | USD <input checked="" type="checkbox"/> | Euro <input type="checkbox"/> |
| REPAIR: | 100.00 | USD <input checked="" type="checkbox"/> | Euro <input type="checkbox"/> |
| TOTAL COST: No cost | | QUOTATION #: _____ | |
| APPROVED BY:  | | | |
| DATE: 07.11.2007 | | | |

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S Swiss Calibration Service

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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 **MTT**

Certificate No: **D900V2-031_Nov07**

CALIBRATION CERTIFICATE

Object: **D900V2 - SN: 031**

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

Calibration date: **November 12, 2007**

Condition of the calibrated item: **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|-----------------------------|------------------|---|-----------------------|
| Power meter EPM-442A | GB37480704 | 04-Oct-07 (METAS, No. 217-00736) | Oct-08 |
| Power sensor HP 8481A | US37292783 | 04-Oct-07 (METAS, No. 217-00736) | Oct-08 |
| Reference 20 dB Attenuator | SN: 5088 (20g) | 07-Aug-07 (METAS, No 217-00718) | Aug-08 |
| Reference 10 dB Attenuator | SN: 5047.2 (10r) | 07-Aug-07 (METAS, No 217-00718) | Aug-08 |
| Reference Probe ET3DV6 (HF) | SN 1507 | 26-Oct-07 (SPEAG, No. ET3-1507_Oct07) | Oct-08 |
| DAE4 | SN 601 | 30-Jan-07 (SPEAG, No. DAE4-601_Jan07) | Jan-08 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------|------------------|--|------------------------|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (SPEAG, in house check Oct-07) | In house check: Oct-09 |
| RF generator R&S SMT-06 | 100005 | 04-Aug-99 (SPEAG, in house check Oct-07) | In house check: Oct-09 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (SPEAG, in house check Oct-07) | In house check: Oct-08 |

| | | | |
|----------------|------------------------------|-----------------------------------|---------------|
| Calibrated by: | Name Mike Meili | Function Laboratory Technician | Signature |
| Approved by: | Name Katja Pokovic | Technical Manager | |

Issued: November 14, 2007

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:

- 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 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 | DASY4 | V4.7 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom V4.9 | |
| Distance Dipole Center - TSL | 15 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 900 MHz ± 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|----------------------------------|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 41.5 | 0.97 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 39.6 ± 6 % | 0.94 mho/m ± 6 % |
| Head TSL temperature during test | (21.6 ± 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 | 2.68 mW / g |
| SAR normalized | normalized to 1W | 10.7 mW / g |
| SAR for nominal Head TSL parameters ¹ | normalized to 1W | 10.6 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|----------------------------|
| SAR measured | 250 mW input power | 1.72 mW / g |
| SAR normalized | normalized to 1W | 6.88 mW / g |
| SAR for nominal Head TSL parameters ¹ | normalized to 1W | 6.80 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 | 55.0 | 1.05 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 54.3 ± 6 % | 1.06 mho/m ± 6 % |
| Body TSL temperature during test | (21.6 ± 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 | 2.74 mW / g |
| SAR normalized | normalized to 1W | 11.0 mW / g |
| SAR for nominal Body TSL parameters ² | normalized to 1W | 10.8 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|----------------------------|
| SAR measured | 250 mW input power | 1.78 mW / g |
| SAR normalized | normalized to 1W | 7.12 mW / g |
| SAR for nominal Body TSL parameters ² | normalized to 1W | 7.05 mW / g ± 16.5 % (k=2) |

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

Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.4 Ω - 3.5 j Ω |
| Return Loss | - 28.9 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 45.0 Ω - 5.9 j Ω |
| Return Loss | - 21.8 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.397 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 | January 15, 1998 |

DASY4 Validation Report for Head TSL

Date/Time: 07.11.2007 14:44:34

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:031

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: HSL 900 MHz;

Medium parameters used: $f = 900$ MHz; $\sigma = 0.939$ mho/m; $\epsilon_r = 39.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(5.93, 5.93, 5.93); Calibrated: 26.10.2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0:

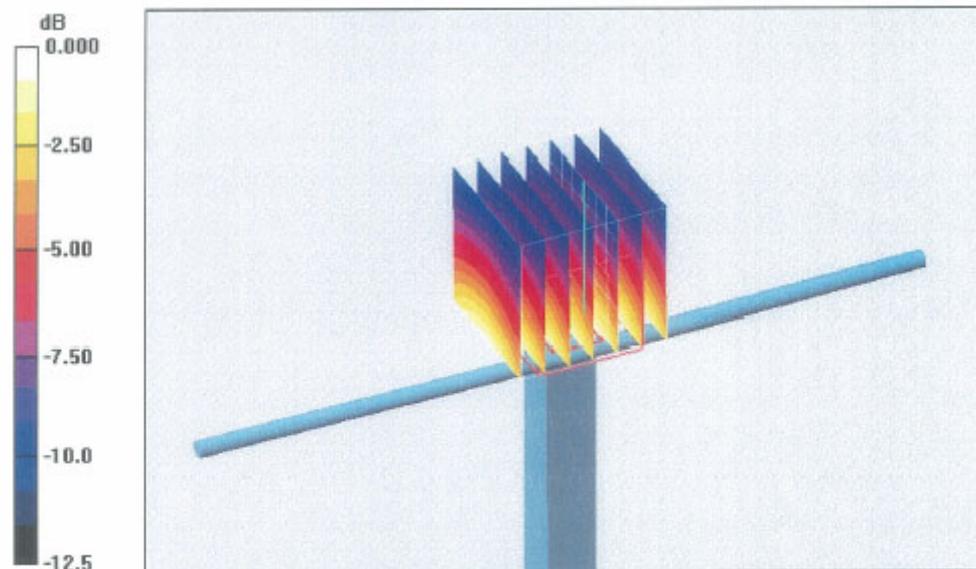
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.3 V/m; Power Drift = 0.041 dB

Peak SAR (extrapolated) = 3.99 W/kg

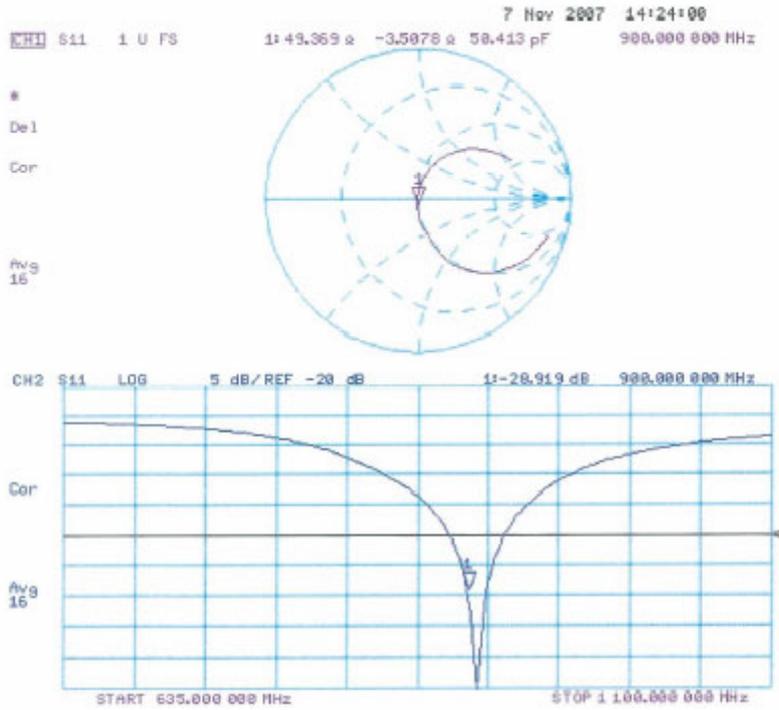
SAR(1 g) = 2.68 mW/g; SAR(10 g) = 1.72 mW/g

Maximum value of SAR (measured) = 2.90 mW/g



0 dB = 2.90mW/g

Impedance Measurement Plot for Head TSL



DASY4 Validation Report for Body TSL

Date/Time: 12.11.2007 14:28:09

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:031

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: MSL900;

Medium parameters used: $f = 900$ MHz; $\sigma = 1.06$ mho/m; $\epsilon_r = 54.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); CoevF(5.57, 5.57, 5.57); Calibrated: 26.10.2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0:

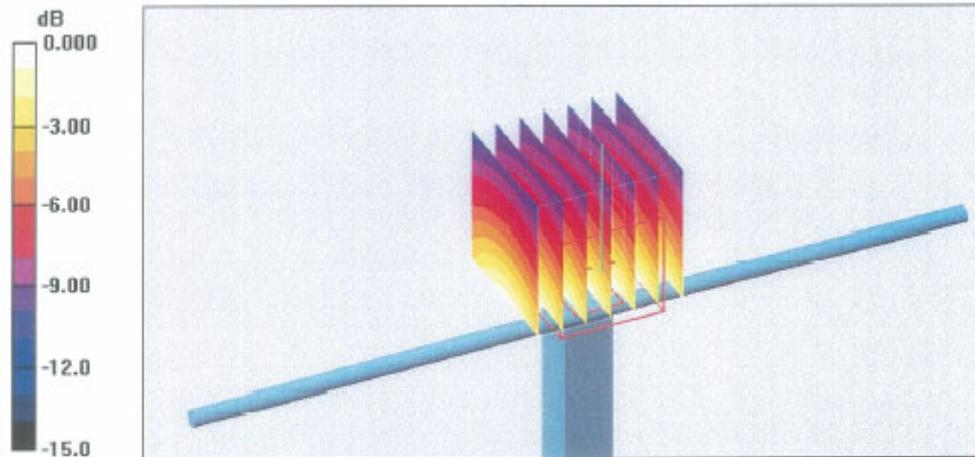
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.2 V/m; Power Drift = 0.001 dB

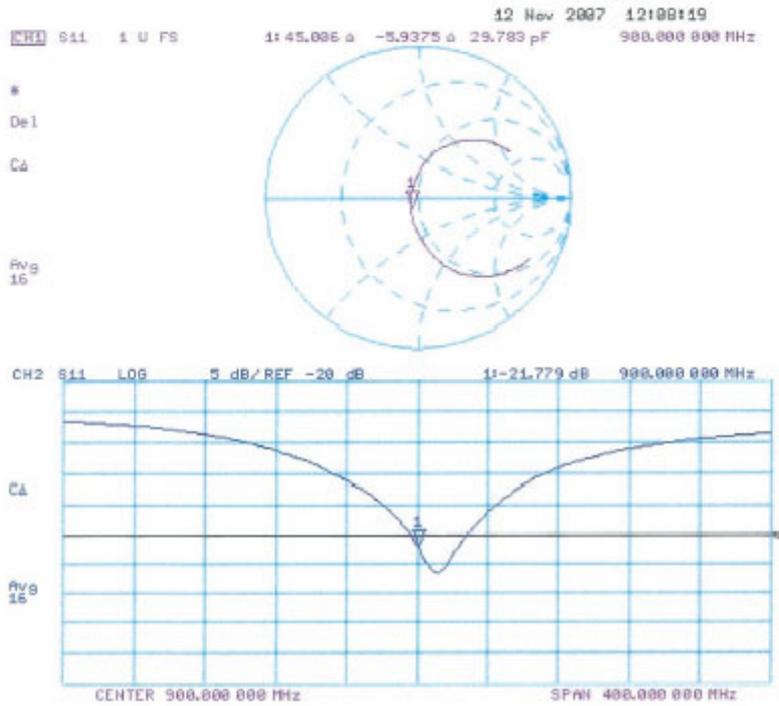
Peak SAR (extrapolated) = 3.96 W/kg

SAR(1 g) = 2.74 mW/g; SAR(10 g) = 1.78 mW/g

Maximum value of SAR (measured) = 2.97 mW/g



Impedance Measurement Plot for Body TSL



21. System Validation Dipole (D1800V2,S/N: 214)

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



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Accreditation No.: SCS 108

Client MTT

Certificate No: D1800V2-214_Jul07

| CALIBRATION CERTIFICATE | | | |
|---|--|---|-----------------------------------|
| Object | D1800V2 - SN: 214 | | |
| Calibration procedure(s) | QA CAL-05.v7 Calibration procedure for dipole validation kits | | |
| Calibration date: | July 10 2007 | | |
| Condition of the calibrated item | In Tolerance | | |
| This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. | | | |
| All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. | | | |
| Calibration Equipment used (M&TE critical for calibration) | | | |
| Primary Standards | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
| Power meter EPM-442A | GB37480704 | 03-Oct-06 (METAS, No. 217-00608) | Oct-07 |
| Power sensor HP 8481A | US37292783 | 03-Oct-06 (METAS, No. 217-00608) | Oct-07 |
| Reference 20 dB Attenuator | SN: 5086 (20g) | 10-Aug-06 (METAS, No 217-00591) | Aug-07 |
| Reference 10 dB Attenuator | SN: 5047.2 (10r) | 10-Aug-06 (METAS, No 217-00591) | Aug-07 |
| Reference Probe ET3DV6 | SN: 1507 | 19-Oct-06 (SPEAG, No. ET3-1507_Oct06) | Oct-07 |
| DAE4 | SN 601 | 30-Jan-07 (SPEAG, No. DAE4-601_Jan07) | Jan-08 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (SPEAG, in house check Oct-05) | In house check: Oct-07 |
| RF generator Agilent E4421B | MY41000675 | 11-May-05 (SPEAG, in house check Nov-05) | In house check: Nov-07 |
| Netzwerk Analyser HP 8753E | US37390585 S4206 | 18-Oct-01 (SPEAG, in house check Oct-06) | In house check: Oct-07 |
| Calibrated by: | Name Mike Melli | Function Laboratory Technician | Signature <i>M. Melli</i> |
| Approved by: | Name Katja Pokovic | Function Technical Manager | Signature <i>Katja Pokovic</i> |
| | | | Issued: July 11, 2007 |
| 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 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 | DASY4 | V4.7 |
| 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 | 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 | 39.6 \pm 6 % | 1.41 mho/m \pm 6 % |
| Head TSL temperature during test | (22.2 \pm 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 | 9.45 mW /g |
| SAR normalized | normalized to 1W | 37.8 mW /g |
| SAR for nominal Head TSL parameters ¹ | normalized to 1W | 37.5 mW / g \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 5.03 mW /g |
| SAR normalized | normalized to 1W | 20.1 mW /g |
| SAR for nominal Head TSL parameters ¹ | normalized to 1W | 20.0 mW / g \pm 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 | 53.3 | 1.52 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 54.6 ± 6 % | 1.48 mho/m ± 6 % |
| Body TSL temperature during test | (22.4 ± 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 | 9.40 mW /g |
| SAR normalized | normalized to 1W | 37.6 mW /g |
| SAR for nominal Body TSL parameters ² | normalized to 1W | 38.7 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 5.14 mW /g |
| SAR normalized | normalized to 1W | 20.6 mW /g |
| SAR for nominal Body TSL parameters ² | normalized to 1W | 20.9 mW / g ± 16.5 % (k=2) |

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

Appendix**Antenna Parameters with Head TSL**

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 45.4 Ω - 5.4 j Ω |
| Return Loss | - 22.6 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 41.1 Ω - 5.7 j Ω |
| Return Loss | - 18.7 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.189 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 | January 15, 1998 |

DASY4 Validation Report for Head TSL

Date/Time: 10.07.2007 12:23:42

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:214

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB;

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.41$ mho/m; $\epsilon_r = 39.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(5.03, 5.03, 5.03); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

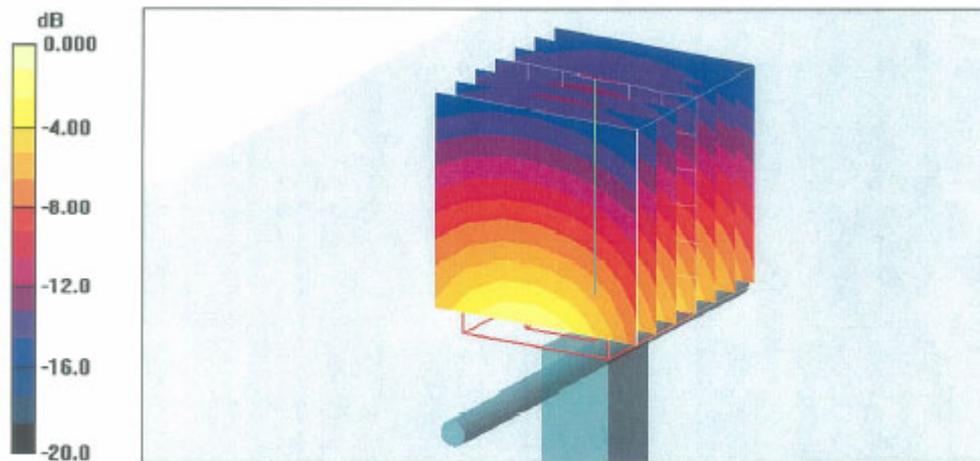
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.1 V/m; Power Drift = 0.028 dB

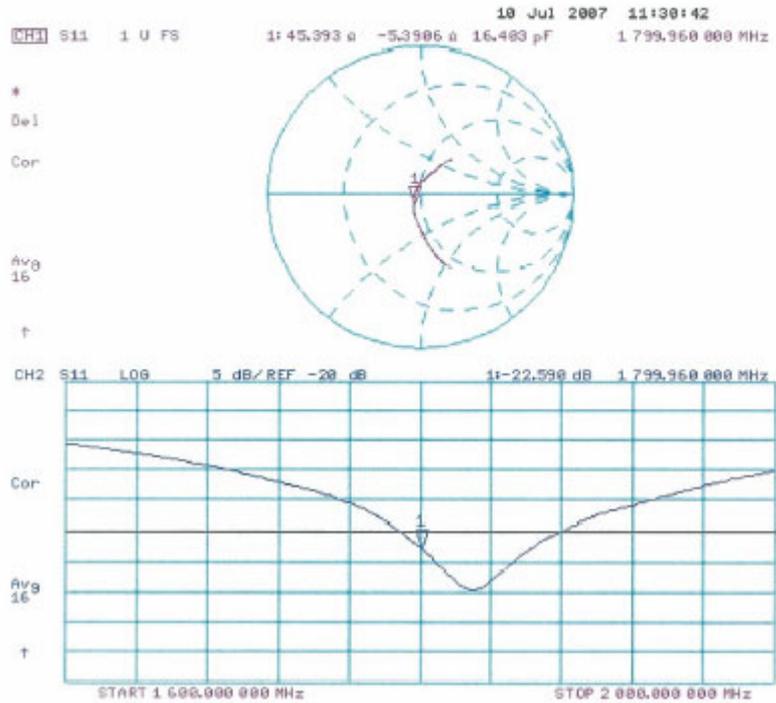
Peak SAR (extrapolated) = 16.0 W/kg

SAR(1 g) = 9.45 mW/g; SAR(10 g) = 5.03 mW/g

Maximum value of SAR (measured) = 10.6 mW/g



Impedance Measurement Plot for Head TSL



DASY4 Validation Report for Body TSL

Date/Time: 10.07.2007 15:50:25

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:214

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB;

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.48$ mho/m; $\epsilon_r = 54.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.47, 4.47, 4.47); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

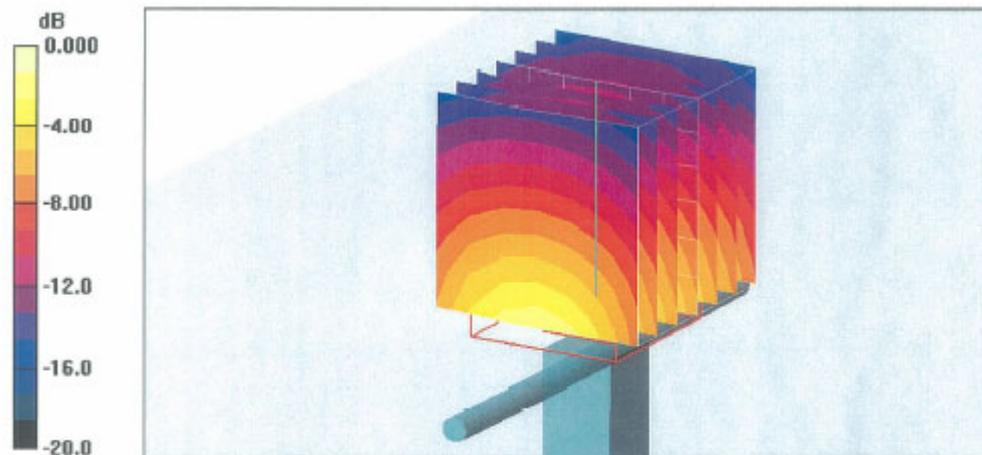
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.9 V/m; Power Drift = -0.003 dB

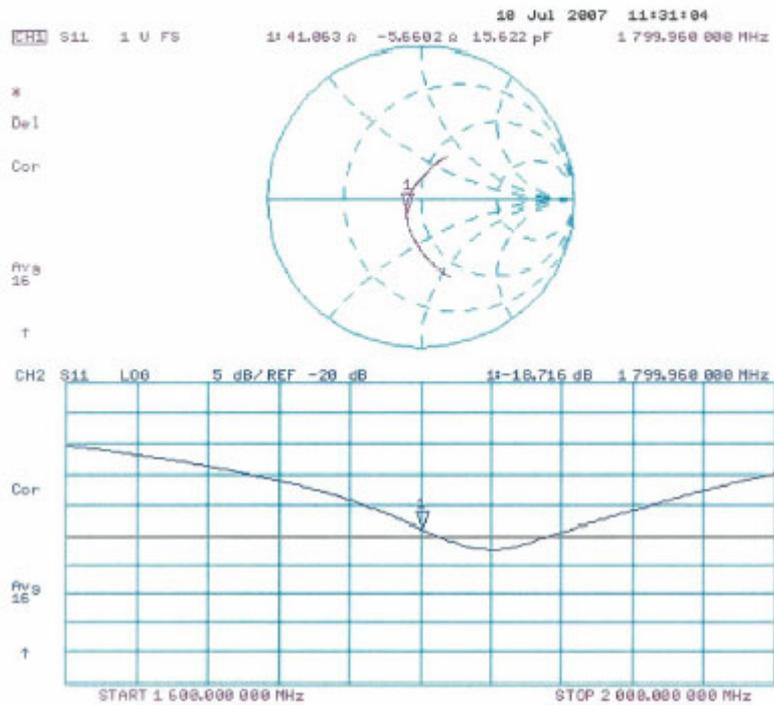
Peak SAR (extrapolated) = 15.2 W/kg

SAR(1 g) = 9.4 mW/g; SAR(10 g) = 5.14 mW/g

Maximum value of SAR (measured) = 10.7 mW/g



Impedance Measurement Plot for Body TSL



22. System Validation Dipole (D1800V2,S/N: 2d040)

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Accreditation No.: **SCS 108**

Client **UL Japan (PTT)**

Certificate No: **D1800V2-2d040_Dec08**

| CALIBRATION CERTIFICATE | | | |
|---|--|--|------------------------------|
| Object | D1800V2 - SN: 2d040 | | |
| Calibration procedure(s) | QA-CAL-05.v7 Calibration procedure for dipole validation kits | | |
| Calibration date: | December 16, 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 (Calibrated by, Certificate No.) | Scheduled Calibration |
| Power meter EPM-442A | GB37480704 | 08-Oct-08 (No. 217-00898) | Oct-09 |
| Power sensor HP 8481A | US37292783 | 08-Oct-08 (No. 217-00898) | Oct-09 |
| Reference 20 dB Attenuator | SN: 5086 (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-08) | In house check: Oct-09 |
| Calibrated by: | Name Jeton Kasirali | Function Laboratory Technician | Signature |
| Approved by: | Name Katja Pokovic | Function Technical Manager | Signature |
| | | | Issued: December 17, 2008 |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. | | | |

Certificate No: D1800V2-2d040_Dec08

Page 1 of 9

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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 | V5.0 |
| 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 | 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 | 38.8 \pm 6 % | 1.40 mho/m \pm 6 % |
| Head TSL temperature during test | (22.0 \pm 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 | 9.62 mW /g |
| SAR normalized | normalized to 1W | 38.5 mW /g |
| SAR for nominal Head TSL parameters ¹ | normalized to 1W | 37.8 mW / g \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 5.04 mW /g |
| SAR normalized | normalized to 1W | 20.2 mW /g |
| SAR for nominal Head TSL parameters ¹ | normalized to 1W | 19.9 mW / g \pm 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 | 53.3 | 1.52 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 55.2 ± 6 % | 1.48 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 | 9.45 mW /g |
| SAR normalized | normalized to 1W | 37.8 mW /g |
| SAR for nominal Body TSL parameters ² | normalized to 1W | 39.1 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|----------------------------|
| SAR measured | 250 mW input power | 5.07 mW /g |
| SAR normalized | normalized to 1W | 20.3 mW /g |
| SAR for nominal Body TSL parameters ² | normalized to 1W | 20.7 mW / g ± 16.5 % (k=2) |

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

Appendix**Antenna Parameters with Head TSL**

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.2 Ω - 2.3 j Ω |
| Return Loss | - 30.6 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 44.0 Ω - 2.6 j Ω |
| Return Loss | - 23.1 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.205 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 | March 27, 2002 |

DASY5 Validation Report for Head TSL

Date/Time: 11.12.2008 11:16:35

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: SN:2d040

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.96, 4.96, 4.96); 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: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; dip = 10 mm, scan at 3.4mm 2/Zoom Scan (dist=3.4mm, probe 0deg)

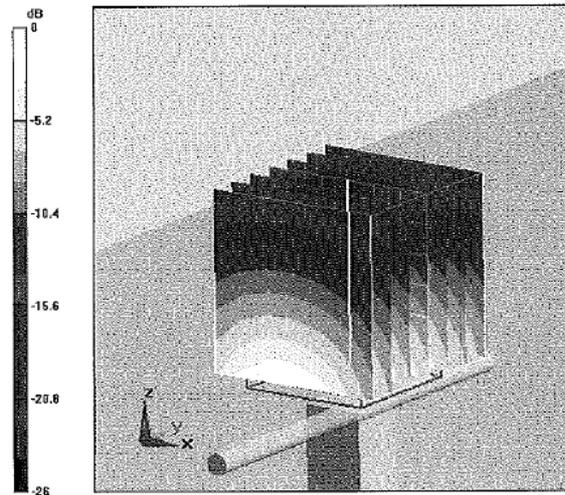
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.1 V/m; Power Drift = 0.040 dB

Peak SAR (extrapolated) = 17.8 W/kg

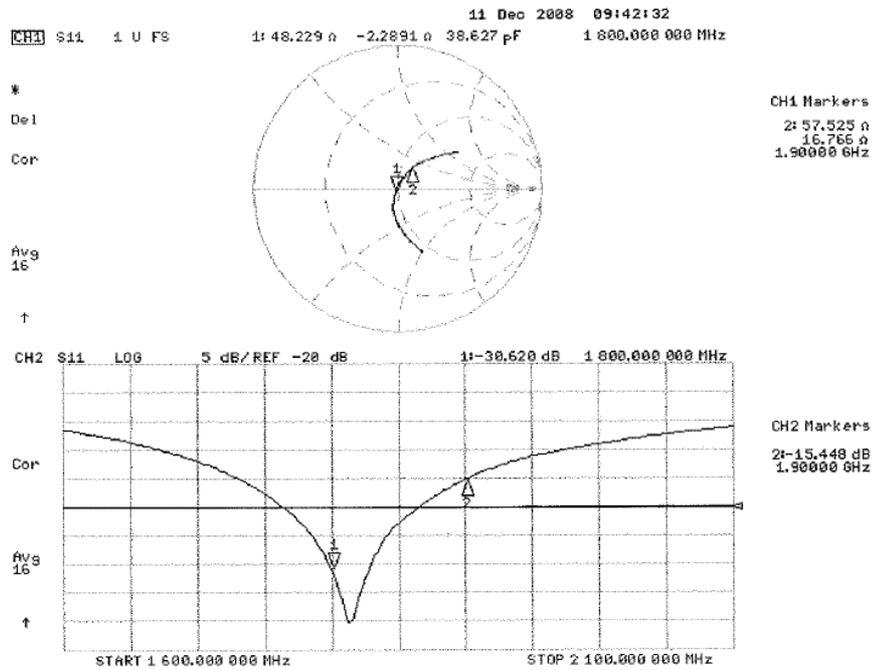
SAR(1 g) = 9.62 mW/g; SAR(10 g) = 5.04 mW/g

Maximum value of SAR (measured) = 11.3 mW/g



0 dB = 11.3mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 16.12.2008 10:47:45

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: SN:2d040

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.48$ mho/m; $\epsilon_r = 55.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.64, 4.64, 4.64); 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 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; dip = 10 mm, scan at 3.4mm/Zoom Scan (dist=3.4mm, probe 0deg)

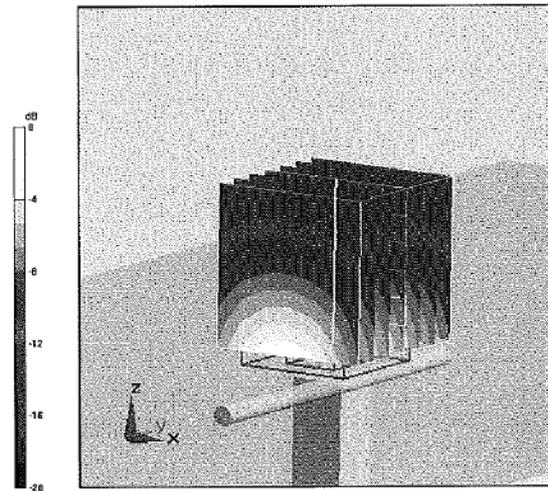
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 90.6 V/m; Power Drift = 0.00409 dB

Peak SAR (extrapolated) = 16.4 W/kg

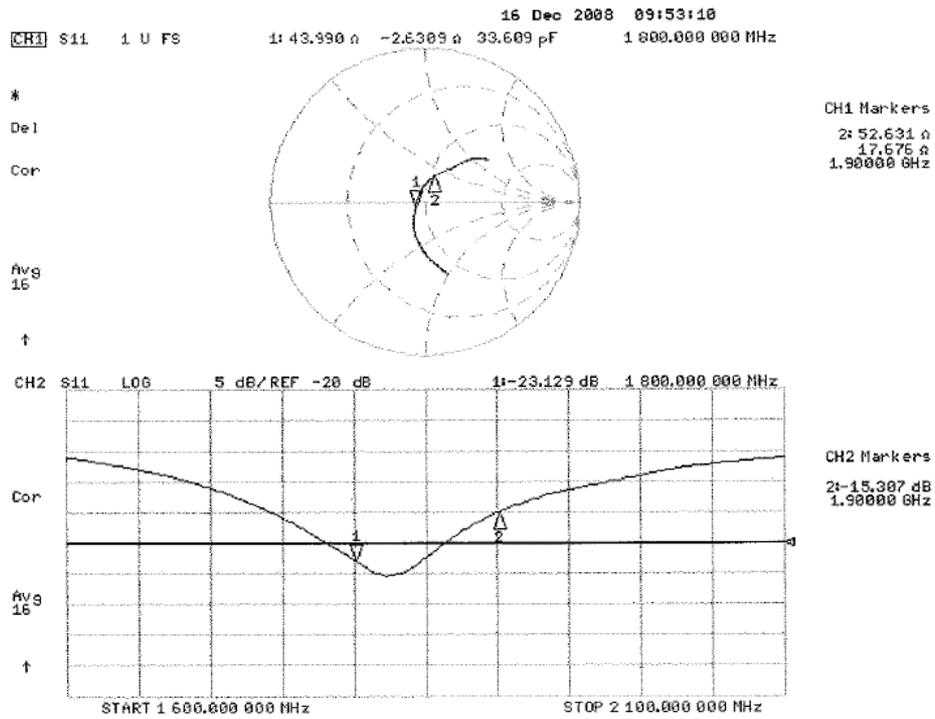
SAR(1 g) = 9.45 mW/g; SAR(10 g) = 5.07 mW/g

Maximum value of SAR (measured) = 11.4 mW/g



0 dB = 11.4mW/g

Impedance Measurement Plot for Body TSL



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

**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 (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 |

Calibrated by: **Jeton Kastrioti** (Name) **Laboratory Technician** (Function) *[Signature]* (Signature)

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

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.

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 \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 | 39.8 \pm 6 % | 1.80 mho/m \pm 6 % |
| Head TSL temperature during test | (22.0 \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 | 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 \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (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 \pm 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 cm³ (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 cm³ (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"

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 |

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: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 119; SEMCAD X Version 13.2 Build 87

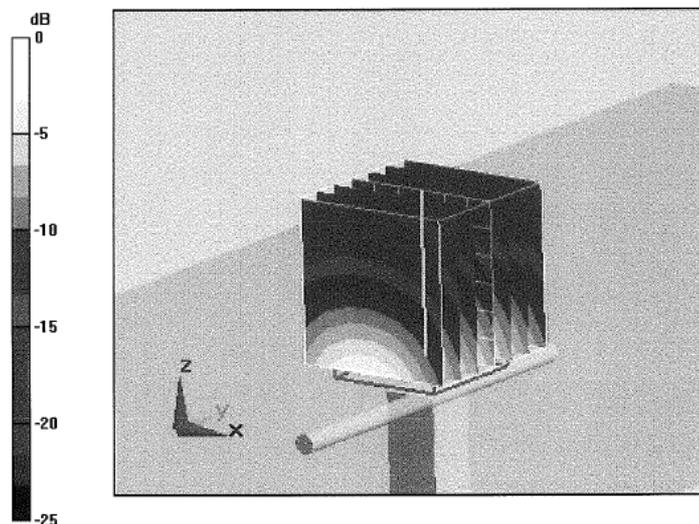
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 26.7 W/kg

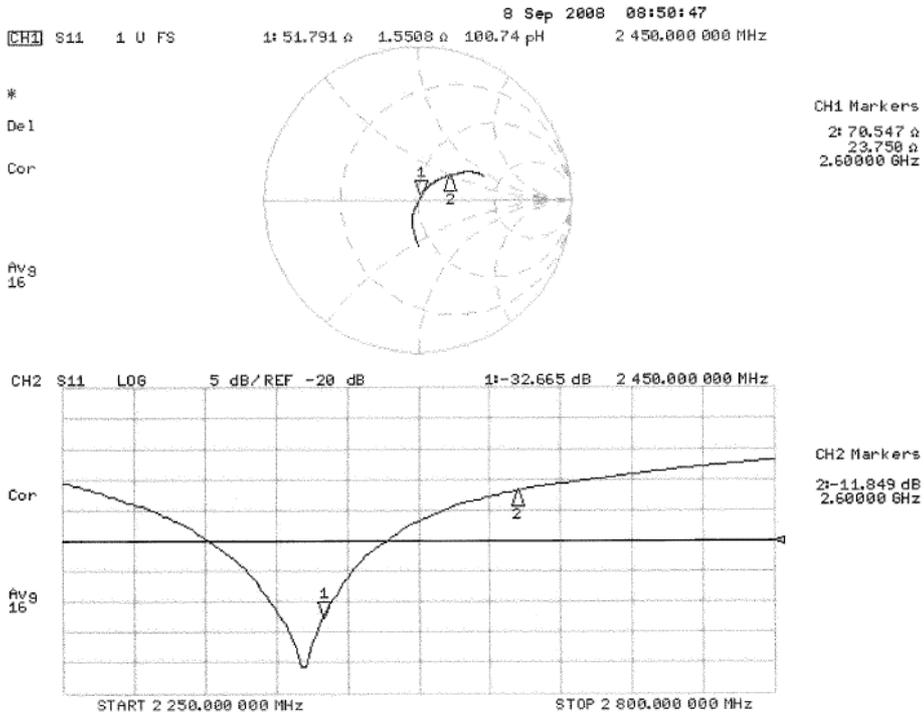
SAR(1 g) = 12.7 mW/g; SAR(10 g) = 5.91 mW/g

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



0 dB = 15.3mW/g

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

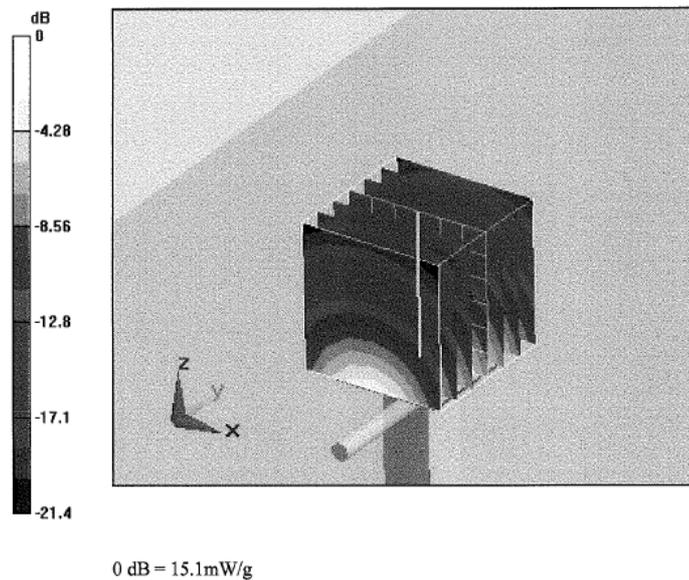
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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



Impedance Measurement Plot for Body TSL

