APPENDIX 2 : System validation

1. Validation uncertainty

The uncertainty budget has been determined for the DASY5 measurement system according to the SPEAG documents[2] and is given in the following Table

<300MHz-6GHz>

Error Description	Uncertainty value ± %	Probability distribution	divisor	(ci) 1g	Standard Uncertainty (1g)	vi or veff
Measurement System						
Probe calibration	±6.55	Normal	1	1	±6.55	∞
Axial isotropy of the probe	±4.7	Rectangular	√3	1	±2.7	∞
Spherical isotropy of the probe	±9.6	Rectangular	0	0	0	∞
Boundary effects	±1.0	Rectangular	√3	1	±1.2	∞
Probe linearity	±4.7	Rectangular	√3	1	±2.7	∞
Detection limit	±1.0	Rectangular	√3	1	±0.6	∞
Readout electronics	±0.3	Normal	1	1	±0.3	∞
Response time	0	Rectangular	√3	1	0	∞
Integration time	0	Rectangular	√3	1	0	∞
RF ambient Noise	±1.0	Rectangular	√3	1	±1.7	∞
RF ambient Reflections	±1.0	Rectangular	√3	1	±1.7	∞
Probe Positioner	±0.8	Rectangular	√3	1	±0.5	∞
Probe positioning	±6.7	Rectangular	√3	1	±3.9	∞
Algorithms for Max.SAR Eval.	±2.0	Rectangular	√3	1	±1.2	∞
Dipole						
Deviation of exp.dipole	±5.5	Rectangular	√3	1	±3.2	∞
Dipole Axis to Liquid Distance	±2.0	Rectangular	√3	1	±1.2	∞
Input power and SAR drift meas.	±3.4	Rectangular	√3	1	±2.7	∞
Phantom and Setup						
Phantom uncertainty	±4.0	Rectangular	√3	1	±2.3	∞
SAR correction	±1.9	Rectangular	√3	1	±1.1	
Liquid conductivity (target)	±5.0	Rectangular	√3	0.78	±2.3	∞
Liquid conductivity (meas.)	4.8	Rectangular	1	0.26	±1.3	∞
Liquid permittivity (target)	±5.0	Rectangular	√3	0.78	±2.3	∞
Liquid permittivity (meas.)	-4.5	Rectangular	1	0.23	±1.0	∞
Combined Standard Uncertainty					**±10.99**	
Expanded Uncertainty (k=2)					**±22.0**	

2. System validation result for Body 900MHz

Simulated Tissue Liquid Parameter confirmation

DIELECTRIC PARAMETERS MEASUREMENT RESULTS										
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value*1	Measured	Deviation [%]	Limit [%]
30-Sep	24	52	MSL 900	24.5	900	εr	55.0	52.9	-3.8	+/-5
						σ [mho/m]	1.05	1.03	-1.9	+/-5
13-Oct	24	50	MSL 900	23.5	900	εr	55.0	53.0	-3.6	+/-5
						σ [mho/m]	1.05	1.02	-2.9	+/-5
8-Nov	24	51	MSL 900	23.5	900	εr	55.0	53.3	-3.1	+/-5
						σ [mho/m]	1.05	1.10	4.8	+/-5

εr: Relative Permittivity / σ : Coductivity

*1 The Target value is a parameter defined in FCC OET 65 .

DIELECTRIC PARAMETERS MEASUREMENT RESULTS										
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value*2	Measured	Deviation [%]	Limit*3 [%]
30-Sep	24	52	MSL 900	24.5	900	εr	53.6	52.9	-1.3	+/-6
						σ [mho/m]	1.05	1.03	-1.9	+/-6
13-Oct	24	50	MSL 900	23.5	900	εr	53.6	53.0	-1.1	+/-6
						σ [mho/m]	1.05	1.02	-2.9	+/-6
8-Nov	24	51	MSL 900	23.5	900	εr	53.6	53.3	-0.6	+/-6
						σ [mho/m]	1.05	1.10	4.8	+/-6

εr: Relative Permittivity / σ : Coductivity

*2 The target value is the calibrated dipole Body TSL parameters. (D900V2 SN:155, Measured Body TSL parameters)

*3 The limit is for deviation provided by manufacture.

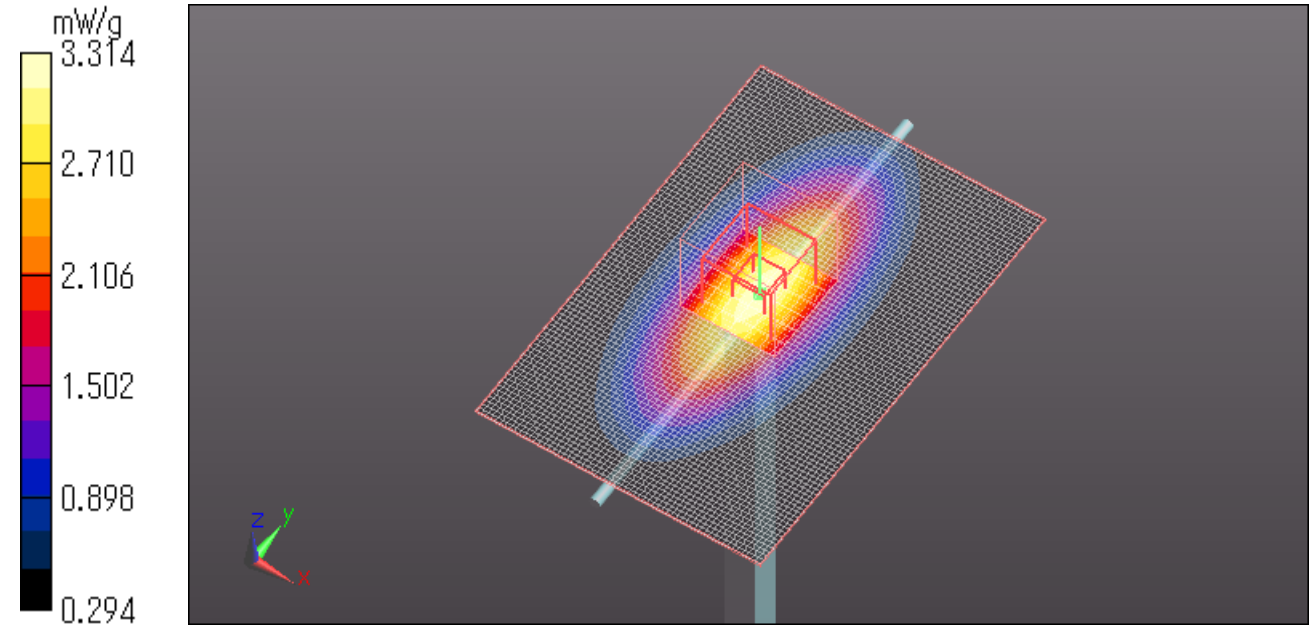
System validation result

SYSTEM VALIDATION						
Date	Frequency [MHz]	SAR 1g [W/kg]				
		Forward Power 250mW Measured	Conversion 1W Calculation	Target 1W *1	Deviation [%]	Limit [%]
30-Sep	900.00	2.62	10.48	10.90	-3.9	+/-10
13-Oct	900.00	2.63	10.52	10.90	-3.5	+/-10
8-Nov	900.00	2.66	10.64	10.90	-2.4	+/-10

*1 The taget value is the parameter defined in 1g SAR (normalized to 1W) in manufacturer calibrated dipole (D900V2 SN:155)

Body 900MHz System Validation DATA / Dipole900MHz / Forward Conducted Power : 250mW
Communication System: CW; Communication System Band: D900 (900.0 MHz); Frequency: 900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 1.03 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV3 - SN3507; ConvF(10.18, 10.18, 10.18); Calibrated: 2011/03/16
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2011/07/20
Phantom: ELI 4.0; Type: QDOVA001BA
Measurement SW: DASY52, Version 52.6 (1);

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.313 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.685 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.917 W/kg
SAR(1 g) = 2.62 mW/g; SAR(10 g) = 1.71 mW/g
Maximum value of SAR (measured) = 3.314 mW/g
Date: 2011/9/30
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 24.5 degree.C.



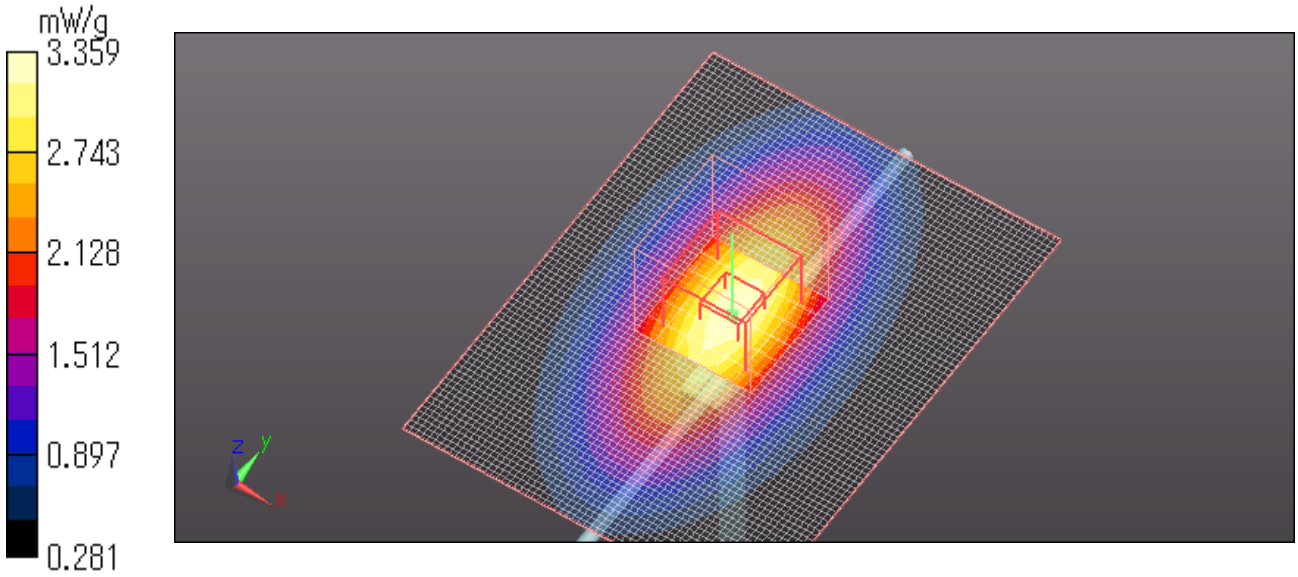
Body 900MHz System Validation DATA / Dipole900MHz / Forward Conducted Power : 250mW

Communication System: CW; Communication System Band: D900 (900.0 MHz); Frequency: 900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 1.02 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3540; ConvF(10.05, 10.05, 10.05); Calibrated: 2011/07/21
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2011/07/20
Phantom: ELI 4.0; Type: QDOVA001BA
Measurement SW: DASY52, Version 52.6 (1);

Area Scan (61x131x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.315 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.812 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 4.001 W/kg
SAR(1 g) = 2.63 mW/g; SAR(10 g) = 1.72 mW/g
Maximum value of SAR (measured) = 3.359 mW/g

Date: 2011/10/13
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



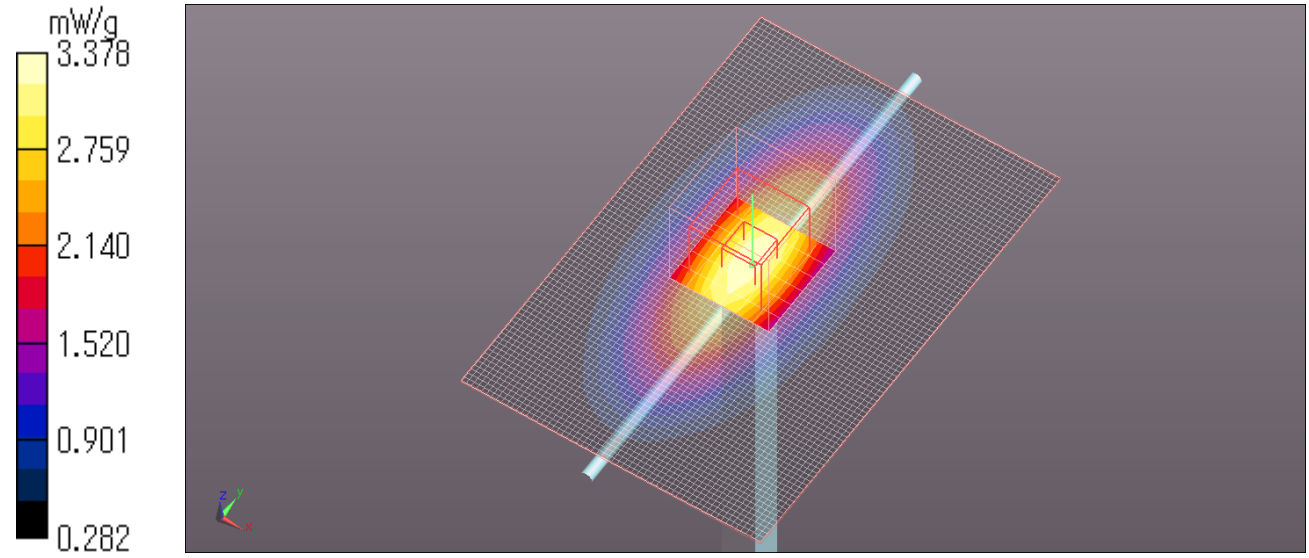
Body 900MHz System Validation DATA / Dipole900MHz / Forward Conducted Power : 250mW
Communication System: CW; Communication System Band: D900 (900.0 MHz); Frequency: 900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 1.1 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3540; ConvF(10.05, 10.05, 10.05); Calibrated: 2011/07/21
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2011/07/20
Phantom: ELI 4.0; Type: QDOVA001BA
Measurement SW: DASY52, Version 52.6 (1);

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.362 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.040 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.980 W/kg

SAR(1 g) = 2.66 mW/g; SAR(10 g) = 1.73 mW/g
Maximum value of SAR (measured) = 3.378 mW/g

Date: 2011/11/08
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



3. System Validation Dipole (D900V2,S/N: 155)

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

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

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

Accreditation No.: SCS 108

Client: UL Japan (PTT)

Certificate No: D900V2-155_Dec10

CALIBRATION CERTIFICATE

Object: D900V2 - SN: 155

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

Calibration date: December 06, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 7, 2010

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

Certificate No: D900V2-155_Dec10 Page 1 of 9

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

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.2
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	22.2 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 6 %	0.95 mho/m ± 6 %
Head TSL temperature during test	(21.0 ± 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	2.70 mW / g
SAR normalized	normalized to 1W	10.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**10.9 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.73 mW / g
SAR normalized	normalized to 1W	6.92 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.98 mW /g ± 16.5 % (k=2)**

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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	53.6 ± 6 %	1.05 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 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	2.75 mW / g
SAR normalized	normalized to 1W	11.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**10.9 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.77 mW / g
SAR normalized	normalized to 1W	7.08 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**7.05 mW / g ± 16.5 % (k=2)**

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.0 Ω - 9.8 jΩ
Return Loss	- 20.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.4 Ω - 11.6 jΩ
Return Loss	- 18.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.393 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 01, 2002

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DASY5 Validation Report for Head TSL

Date/Time: 06.12.2010 10:26:37

Test Laboratory: SPEAG, Zurich, Switzerland

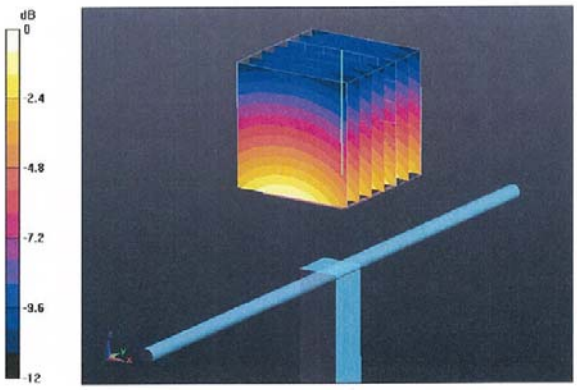
DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:155

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900
Medium parameters used: f = 900 MHz; σ = 0.95 mho/m; ε_r = 40.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.88, 5.88, 5.88); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.3 V/m; Power Drift = 0.025 dB
Peak SAR (extrapolated) = 4.1 W/kg
SAR(1 g) = 2.7 mW/g; SAR(10 g) = 1.73 mW/g
Maximum value of SAR (measured) = 3.16 mW/g



0 dB = 3.16mW/g

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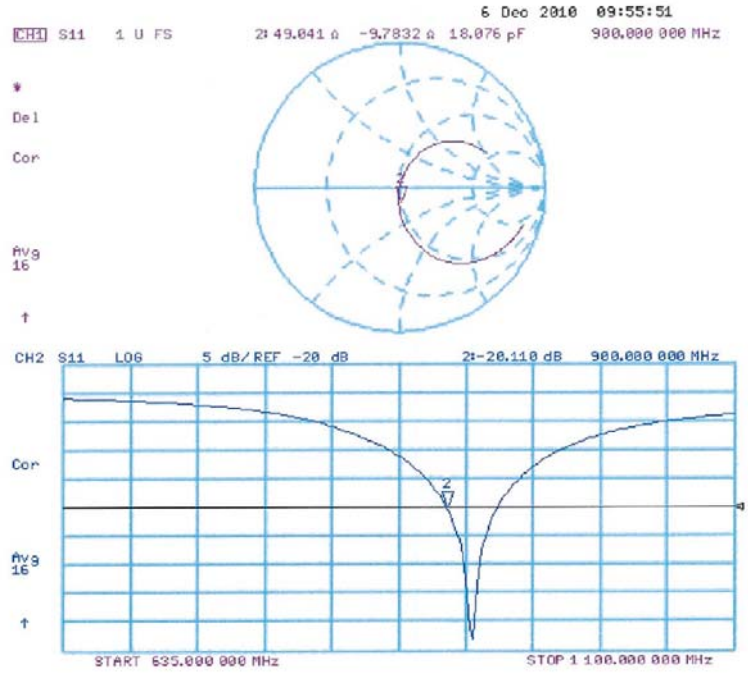
Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body

Date/Time: 06.12.2010 12:58:52

Test Laboratory: SPEAG, Zurich, Switzerland

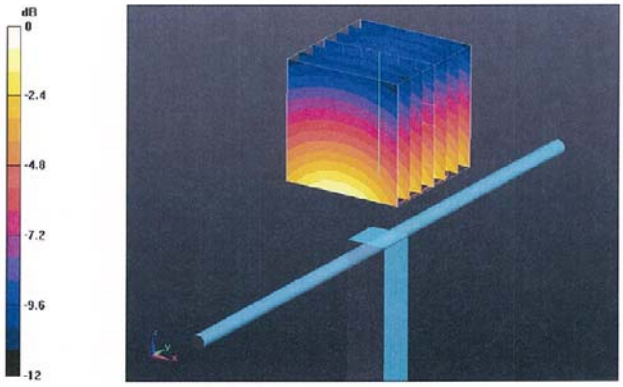
DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:155

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: M900
Medium parameters used: f = 900 MHz; σ = 1.05 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.81, 5.81, 5.81); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.3 V/m; Power Drift = -0.016 dB
Peak SAR (extrapolated) = 4.13 W/kg
SAR(1 g) = 2.75 mW/g; SAR(10 g) = 1.77 mW/g
Maximum value of SAR (measured) = 3.23 mW/g



0 dB = 3.23mW/g

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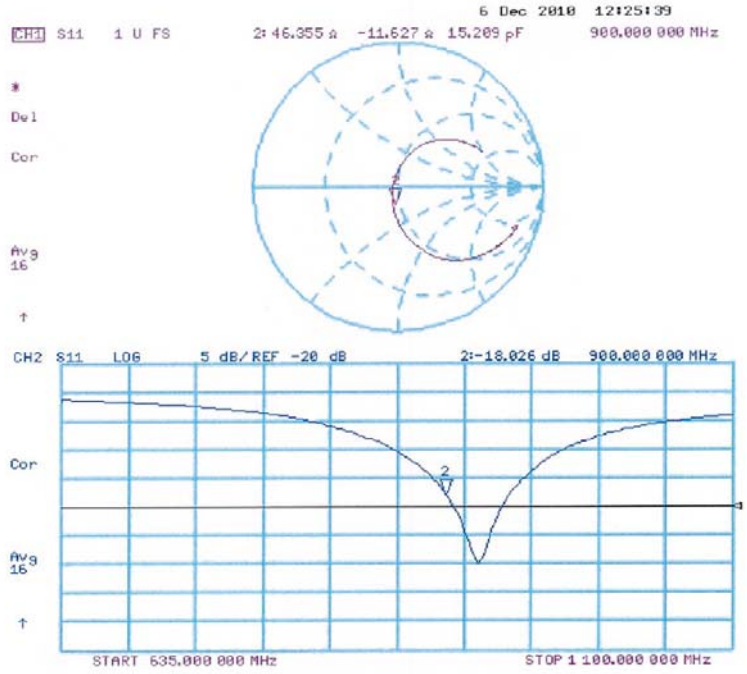
Impedance Measurement Plot for Body TSL



4. System validation result for Body1800MHz

Simulated Tissue Liquid Parameter confirmation

DIELECTRIC PARAMETERS MEASUREMENT RESULTS										
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value*1	Measured	Deviation [%]	Limit [%]
3-Oct	22.0	45	MSL 1800	22.5	1800	εr	53.3	51.1	-4.1	+/-5
						σ [mho/m]	1.52	1.48	-2.6	+/-5
14-Oct	24.0	59	MSL 1800	24.3	1800	εr	53.3	50.9	-4.5	+/-5
						σ [mho/m]	1.52	1.48	-2.6	+/-5
8-Nov	24.0	51	MSL 1800	23.5	1800	εr	53.3	51.9	-2.6	+/-5
						σ [mho/m]	1.52	1.49	-2.0	+/-5

εr: Relative Permittivity / σ : Coductivity

*1 The Target value is a parameter defined in FCC OET 65 .

DIELECTRIC PARAMETERS MEASUREMENT RESULTS										
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value*2	Measured	Deviation [%]	Limit*3 [%]
3-Oct	22.0	45	MSL 1800	22.5	1800	εr	52.9	51.1	-3.4	+/-6
						σ [mho/m]	1.45	1.48	2.1	+/-6
14-Oct	24.0	59	MSL 1800	24.3	1800	εr	52.9	50.9	-3.8	+/-6
						σ [mho/m]	1.45	1.48	2.1	+/-6
8-Nov	24.0	51	MSL 1800	23.5	1800	εr	52.9	51.9	-1.9	+/-6
						σ [mho/m]	1.45	1.49	2.8	+/-6

εr: Relative Permittivity / σ : Coductivity

System validation result

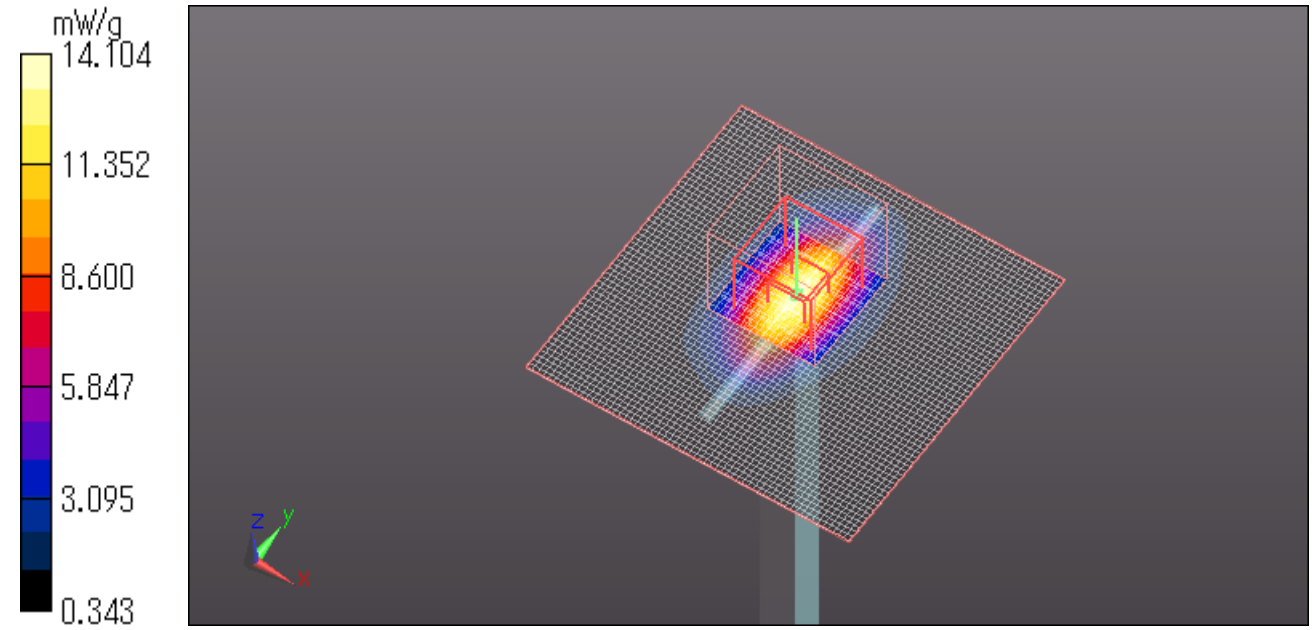
SYSTEM VALIDATION						
Date	Frequency [MHz]	SAR 1g [W/kg]				
		Forward Power 250mW Measured	Conversion 1W Calculation	Target 1W *1	Deviation	Limit
3-Oct	1800.00	10.00	40.00	38.40	4.2	+/-10
14-Oct	1800.00	10.20	40.80	38.40	6.2	+/-10
8-Nov	1800.00	10.40	41.60	38.40	8.3	+/-10

*1 The taget value is the parameter defined in 1g SAR (normalized to 1W) in manufacturer calibrated dipole (D1800V2 SN:2d04)

Body1800MHz System Validation DATA / Dipole1800MHz / Forward Conducted Power : 250mW
Communication System: CW; Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1800 MHz; σ = 1.48 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV3 - SN3507; ConvF(8.25, 8.25, 8.25); Calibrated: 2011/03/16
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2011/07/20
Phantom: ELI 4.0; Type: QDOVA001BA;
Measurement SW: DASY52, Version 52.6 (1);

Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.444 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.736 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 17.606 W/kg
SAR(1 g) = 10 mW/g; SAR(10 g) = 5.33 mW/g
Maximum value of SAR (measured) = 14.104 mW/g
Date: 2011/10/03
Ambient Temp. : 22.0 degree.C. Liquid Temp.; 22.5 degree.C.



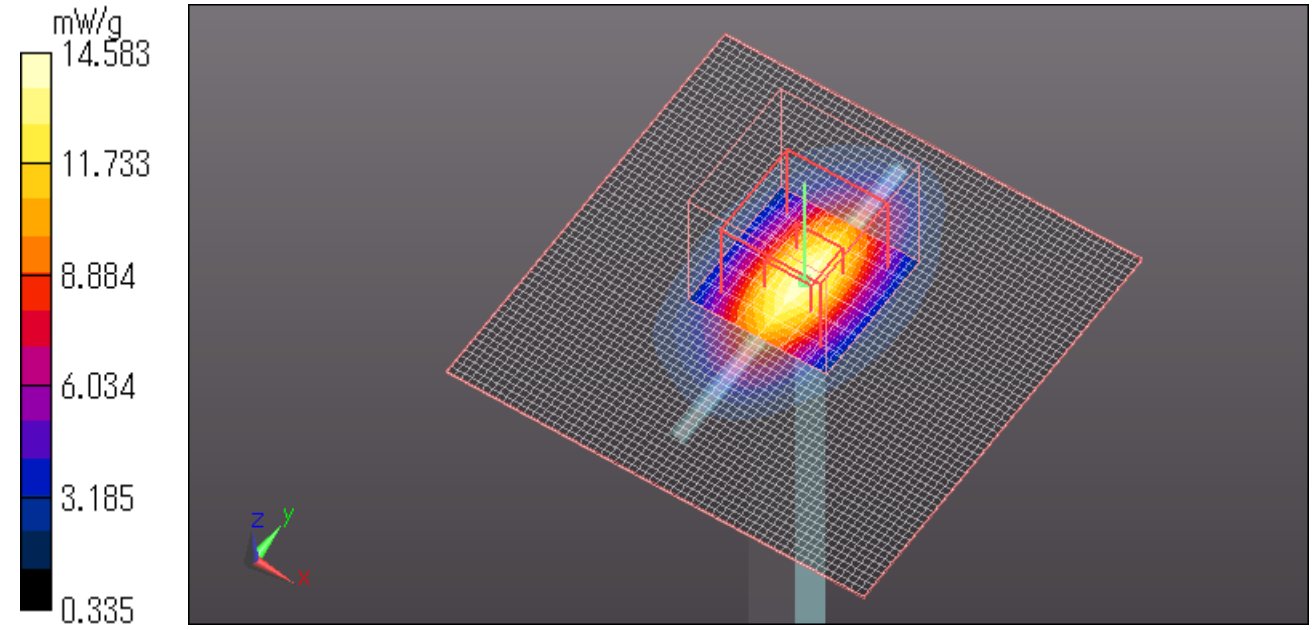
Body1800MHz System Validation DATA / Dipole1800MHz / Forward Conducted Power : 250mW

Communication System: CW; Communication System Band: D1800 (1800.0 MHz);
Frequency: 1800 MHz;Duty Cycle: 1:1

Communication System: CW; Communication System Band: D1800 (1800.0 MHz);
Frequency: 1800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1800 MHz; σ = 1.48 mho/m; ε_r = 50.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3540; ConvF(8, 8, 8); Calibrated: 2011/07/21
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2011/07/20
Phantom: ELI 4.0; Type: QDOVA001BA;
Measurement SW: DASY52, Version 52.6 (1);

Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.761 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.377 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 18.395 W/kg
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.38 mW/g
Maximum value of SAR (measured) = 14.583 mW/g
Date: 2011/10/14
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 24.3 degree.C.

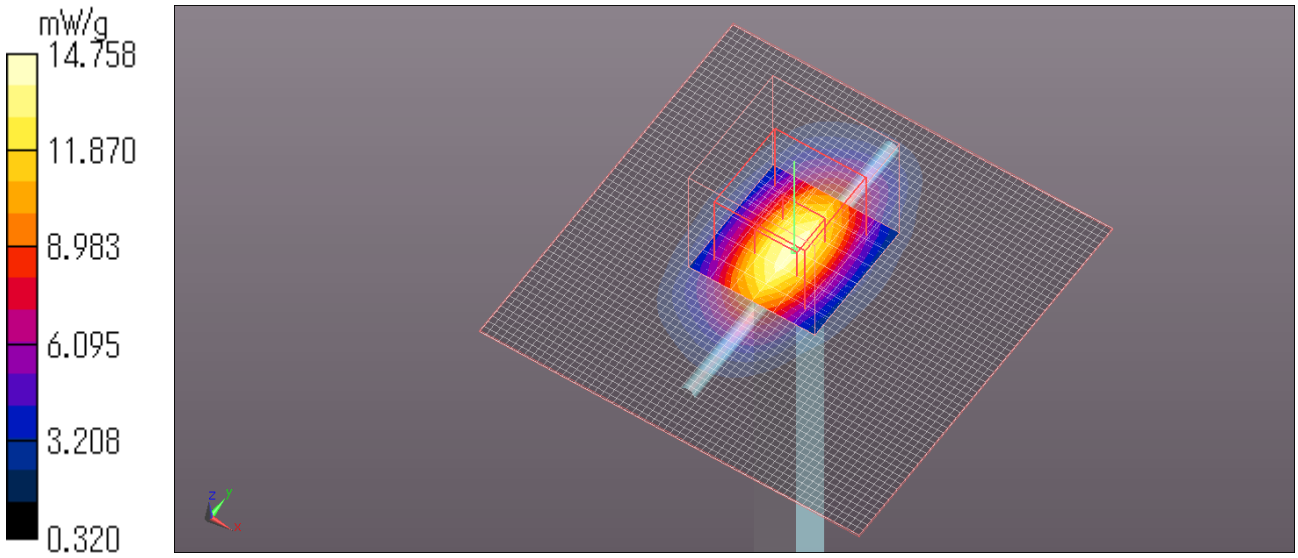


Body1800MHz System Validation DATA / Dipole1800MHz / Forward Conducted Power : 250mW
Communication System: CW; Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1800 MHz; σ = 1.49 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration

- Probe: EX3DV4 - SN3540; ConvF(8, 8, 8); Calibrated: 2011/07/21
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn509; Calibrated: 2011/07/20
- Phantom: ELI 4.0; Type: QDOVA001BA
- Measurement SW: DASY52, Version 52.6 (1);

Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.913 mW/g

Zoom Scan(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.1 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 18.726 W/kg
SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.47 mW/g
Maximum value of SAR (measured) = 14.758 mW/g
Date: 2011/11/08
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



5. System Validation Dipole (D1800V2,S/N: 2d04)

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

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

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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client: UL Japan (PTT)

Certificate No: D1800V2-2d040_Dec10

CALIBRATION CERTIFICATE

Object: D1800V2 - SN: 2d040

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

Calibration date: December 09, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 14, 2010

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

Certificate No: D1800V2-2d040_Dec10 Page 1 of 9

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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S Servizio svizzero di taratura
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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 MHz ± 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 ± 0.2) °C	39.6 ± 6 %	1.35 mho/m ± 6 %
Head TSL temperature during test	(21.0 ± 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	9.60 mW / g
SAR normalized	normalized to 1W	38.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**39.3 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (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	normalized to 1W	**20.4 mW /g ± 16.5 % (k=2)**

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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	(21.2 ± 0.2) °C	52.9 ± 6 %	1.45 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 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	9.34 mW / g
SAR normalized	normalized to 1W	37.4 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**38.4 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.98 mW / g
SAR normalized	normalized to 1W	19.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.2 mW / g ± 16.5 % (k=2)**

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.8 Ω - 1.9 jΩ
Return Loss	- 33.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.4 Ω - 2.2 jΩ
Return Loss	- 24.0 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: 07.12.2010 12:17:06

Test Laboratory: SPEAG, Zurich, Switzerland

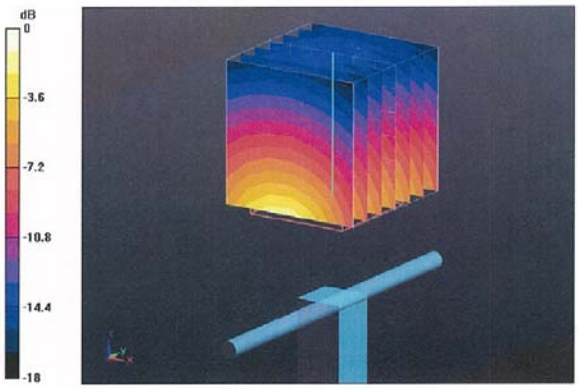
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d040

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 1800 MHz; σ = 1.34 mho/m; ε_r = 39.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.05, 5.05, 5.05); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.8 V/m; Power Drift = 0.039 dB
Peak SAR (extrapolated) = 17.5 W/kg
SAR(1 g) = 9.6 mW/g; SAR(10 g) = 5.04 mW/g
Maximum value of SAR (measured) = 11.9 mW/g



0 dB = 11.9mW/g

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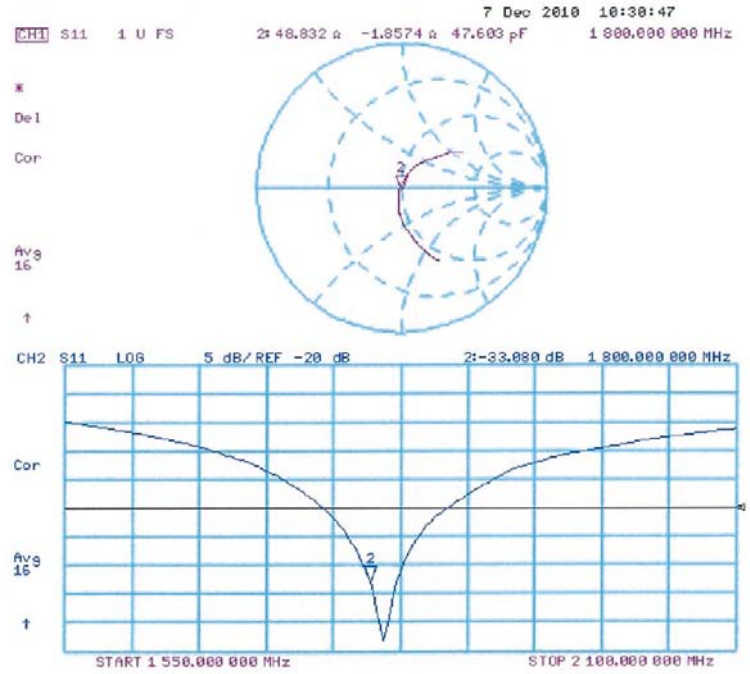
Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 09.12.2010 11:14:21

Test Laboratory: SPEAG, Zurich, Switzerland

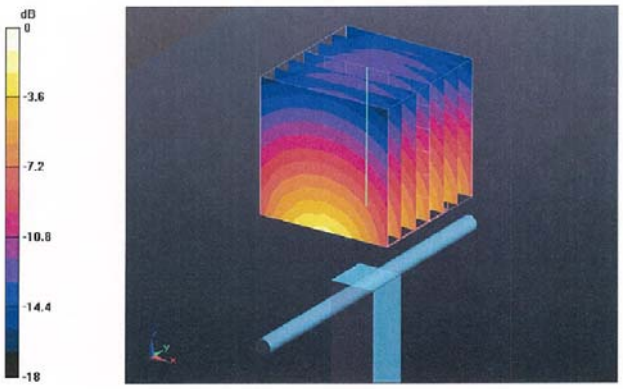
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d040

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 1800 MHz; σ = 1.45 mho/m; ε_r = 53.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.74, 4.74, 4.74); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.6 V/m; Power Drift = -0.025 dB
Peak SAR (extrapolated) = 16 W/kg
SAR(1 g) = 9.34 mW/g; SAR(10 g) = 4.98 mW/g
Maximum value of SAR (measured) = 11.8 mW/g



0 dB = 11.8mW/g

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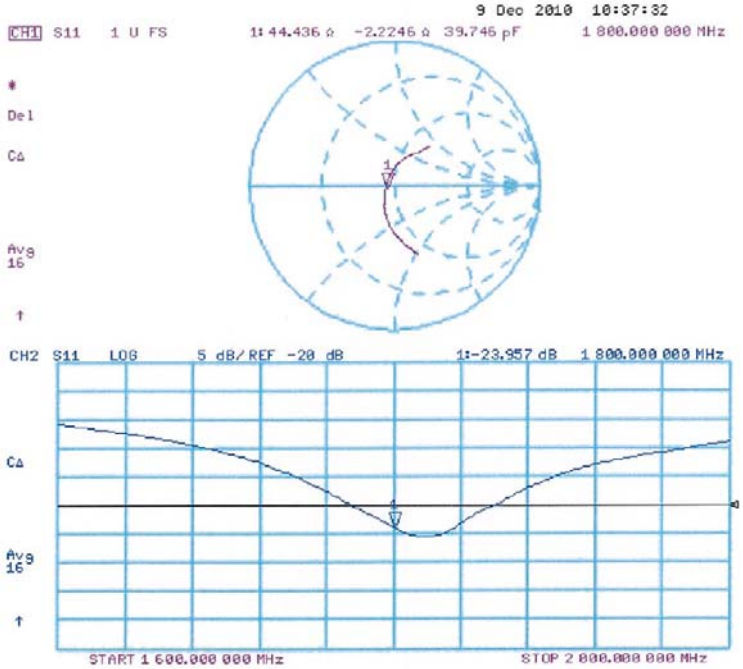
Impedance Measurement Plot for Body TSL



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