

## Attachment 1. Probe calibration data

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



**S** Schweizerischer Kalibrierdienst  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PTT**

Certificate No: **EX3-3745\_Apr14/2**

### CALIBRATION CERTIFICATE (Replacement of No: EX3-3745\_Apr14)

Object **EX3DV4 - SN:3745**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5,  
QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**



Calibration date: **April 15, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8848C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: April 24, 2014

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### Glossary:

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the  $E^2$ -field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>; A, B, C, D** are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).



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EX3DV4 – SN:3745

April 15, 2014

# Probe EX3DV4

## SN:3745

Manufactured: March 26, 2010  
Calibrated: April 15, 2014

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

EX3DV4- SN:3745

April 15, 2014

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3745

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.48	0.44	0.48	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	100.8	99.0	97.5	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	134.8	$\pm 2.7\%$
		Y	0.0	0.0	1.0		145.0	
		Z	0.0	0.0	1.0		147.8	
10010- CAA	SAR Validation (Square, 100ms, 10ms)	X	8.20	74.3	15.9	10.00	42.3	$\pm 0.9\%$
		Y	3.04	66.1	13.0		42.6	
		Z	2.97	61.9	11.2		50.3	
10011- CAB	UMTS-FDD (WCDMA)	X	3.47	67.5	18.7	2.91	143.5	$\pm 0.9\%$
		Y	3.12	64.8	16.8		135.6	
		Z	3.02	64.0	15.9		140.6	
10021- DAB	GSM-FDD (TDMA, GMSK)	X	4.35	75.0	18.6	9.39	126.1	$\pm 1.9\%$
		Y	1.94	63.6	13.2		81.3	
		Z	5.74	77.3	19.5		134.1	
10028- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	45.90	99.7	21.8	3.55	141.7	$\pm 1.7\%$
		Y	3.84	75.1	14.5		132.4	
		Z	2.54	66.4	10.7		150.0	
10062- CAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	10.42	68.9	21.6	8.68	134.8	$\pm 3.3\%$
		Y	10.08	68.0	20.9		124.5	
		Z	10.65	69.2	21.5		147.4	
10081- CAB	CDMA2000 (1xRTT, RC3)	X	4.09	66.5	18.7	3.97	140.1	$\pm 1.2\%$
		Y	3.91	65.2	17.6		148.5	
		Z	3.80	64.3	16.7		142.6	
10177- CAC	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	5.10	66.7	19.5	5.73	134.0	$\pm 1.7\%$
		Y	4.89	65.6	18.6		137.8	
		Z	5.02	65.5	18.3		137.4	
10237- CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	6.95	72.5	24.7	9.21	148.9	$\pm 3.5\%$
		Y	6.19	69.5	22.8		147.2	
		Z	7.00	71.2	23.4		129.7	
10274- CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	6.11	67.0	18.9	4.87	133.5	$\pm 1.7\%$
		Y	5.78	65.7	17.9		124.9	
		Z	5.86	65.6	17.7		136.2	
10291- AAB	CDMA2000, RC3, SO55, Full Rate	X	3.77	67.0	18.7	3.46	130.3	$\pm 0.9\%$
		Y	3.49	65.0	17.2		138.6	
		Z	3.41	64.2	16.4		132.8	
10292- AAB	CDMA2000, RC3, SO32, Full Rate	X	3.72	67.1	18.7	3.39	132.0	$\pm 0.9\%$
		Y	3.45	65.1	17.1		144.5	
		Z	3.34	64.0	16.2		134.1	

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10302-AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3 CTRL symbols)	X	12.42	73.2	27.5	12.57	127.0	±3.5 %
		Y	11.20	69.6	24.7		125.9	
		Z	13.11	74.6	28.1		135.8	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	3.10	70.0	19.4	1.71	137.6	±0.7 %
		Y	2.45	64.8	16.1		130.3	
		Z	2.33	63.5	14.8		139.4	
10316-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	10.24	68.8	21.4	8.36	137.3	±3.5 %
		Y	10.22	68.7	21.1		149.7	
		Z	10.25	68.5	21.0		140.8	
10317-AAA	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	10.26	68.9	21.4	8.36	139.5	±3.5 %
		Y	9.87	67.8	20.6		124.8	
		Z	10.30	68.7	21.0		143.4	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	5.12	69.1	19.1	3.76	145.9	±0.9 %
		Y	4.64	67.0	17.6		134.0	
		Z	4.59	65.9	16.9		148.4	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	5.03	69.1	19.2	3.77	142.2	±0.9 %
		Y	4.56	67.1	17.7		131.0	
		Z	4.59	66.2	17.0		145.7	

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the  $E^2$ -field uncertainty inside TSL (see Pages 6 and 7).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>C</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3745

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity <sup>f</sup>	Conductivity (S/m) <sup>g</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>g</sup>	Depth <sup>g</sup> (mm)	Unct. (k=2)
300	45.3	0.87	10.94	10.94	10.94	0.10	1.10	± 13.3 %
450	43.5	0.87	9.21	9.21	9.21	0.18	1.20	± 13.3 %
750	41.9	0.89	9.38	9.38	9.38	0.31	1.07	± 12.0 %
900	41.5	0.97	8.92	8.92	8.92	0.42	0.86	± 12.0 %
1450	40.5	1.20	8.10	8.10	8.10	0.77	0.61	± 12.0 %
1750	40.1	1.37	7.64	7.64	7.64	0.71	0.65	± 12.0 %
1950	40.0	1.40	7.12	7.12	7.12	0.76	0.61	± 12.0 %
2450	39.2	1.80	6.70	6.70	6.70	0.37	0.86	± 12.0 %
5250	35.9	4.71	4.68	4.68	4.68	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.34	4.34	4.34	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.23	4.23	4.23	0.40	1.80	± 13.1 %

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

<sup>f</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>g</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3745

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity <sup>e</sup>	Conductivity (S/m) <sup>f</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>g</sup>	Depth (mm) <sup>g</sup>	Unct. (k=2)
750	55.5	0.96	8.96	8.96	8.96	0.41	0.90	± 12.0 %
900	55.0	1.05	8.67	8.67	8.67	0.45	0.84	± 12.0 %
1450	54.0	1.30	7.60	7.60	7.60	0.56	0.73	± 12.0 %
1750	53.4	1.49	7.25	7.25	7.25	0.80	0.62	± 12.0 %
1950	53.3	1.52	7.21	7.21	7.21	0.58	0.71	± 12.0 %
2450	52.7	1.95	6.66	6.66	6.66	0.80	0.50	± 12.0 %
5250	48.9	5.36	4.19	4.19	4.19	0.40	1.90	± 13.1 %
5600	48.5	5.77	3.70	3.70	3.70	0.50	1.90	± 13.1 %
5800	48.2	6.00	3.88	3.88	3.88	0.50	1.90	± 13.1 %

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

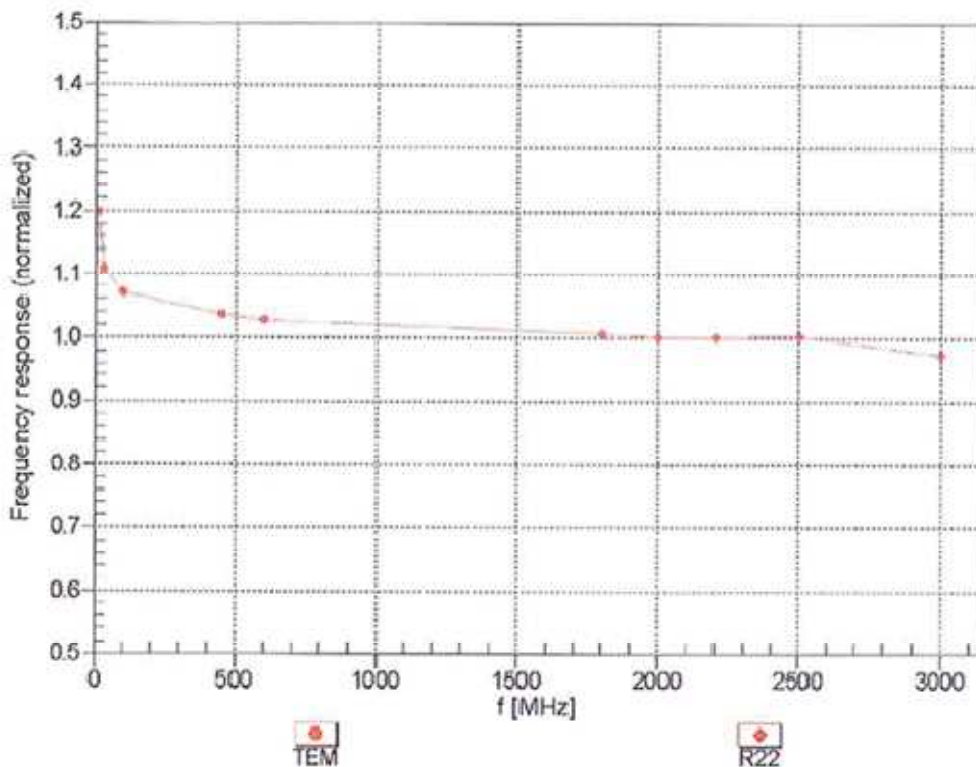
<sup>e</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>g</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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



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



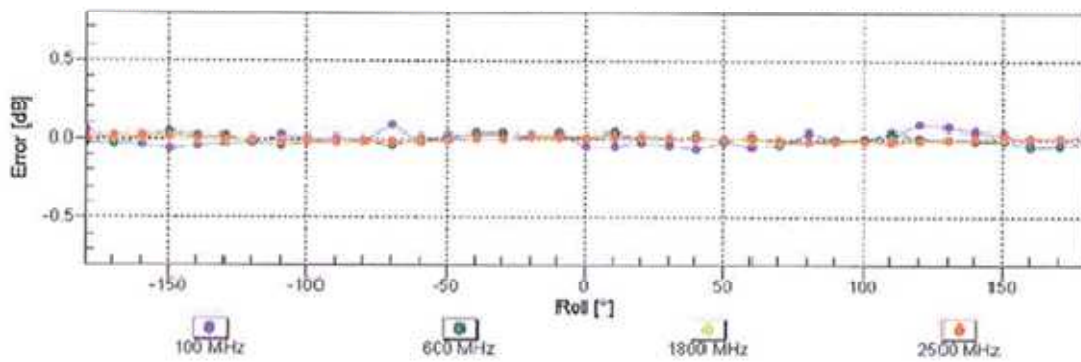
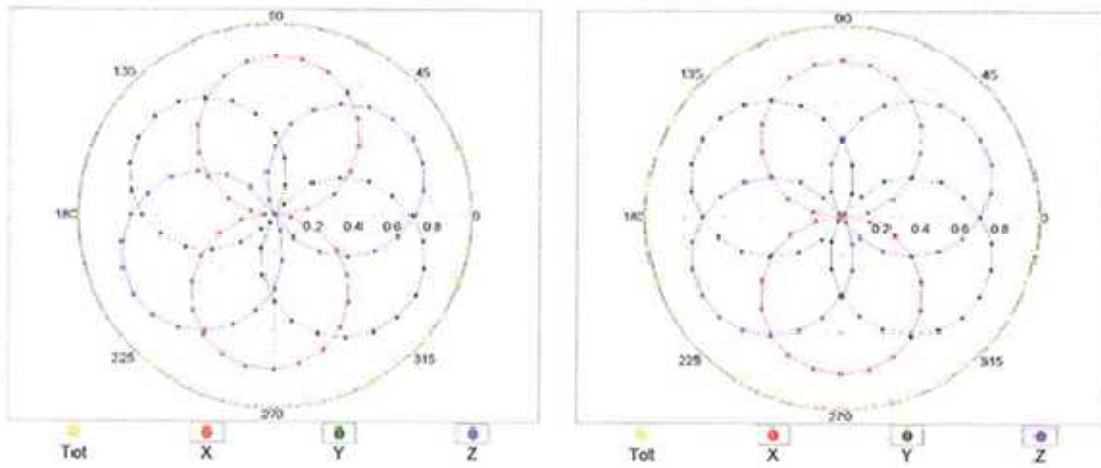
EX3DV4– SN:3745

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

f=600 MHz,TEM

f=1800 MHz,R22

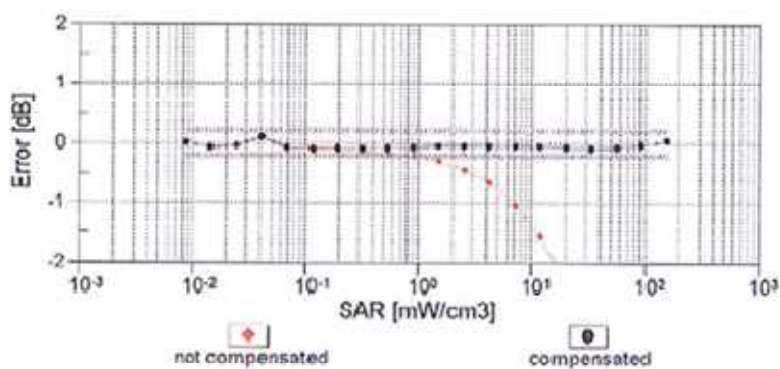
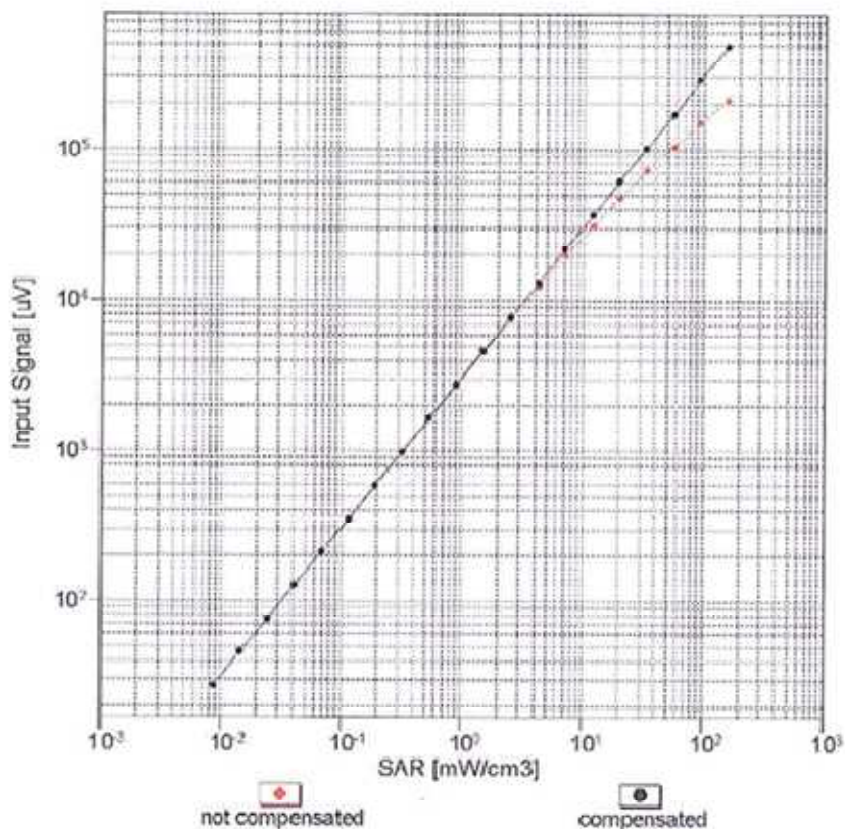


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

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### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)

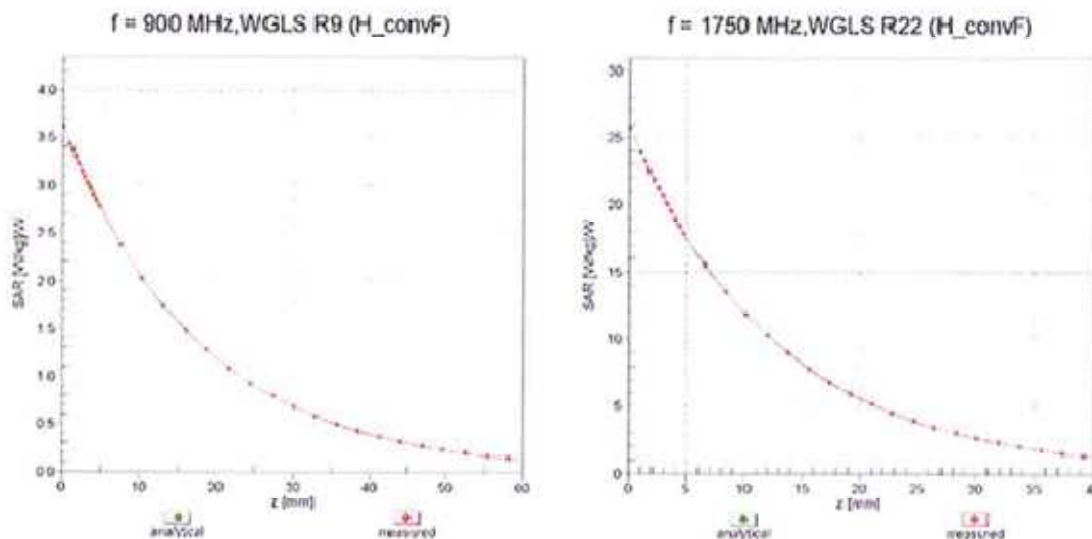


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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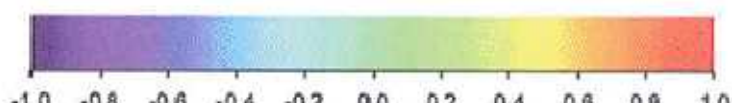
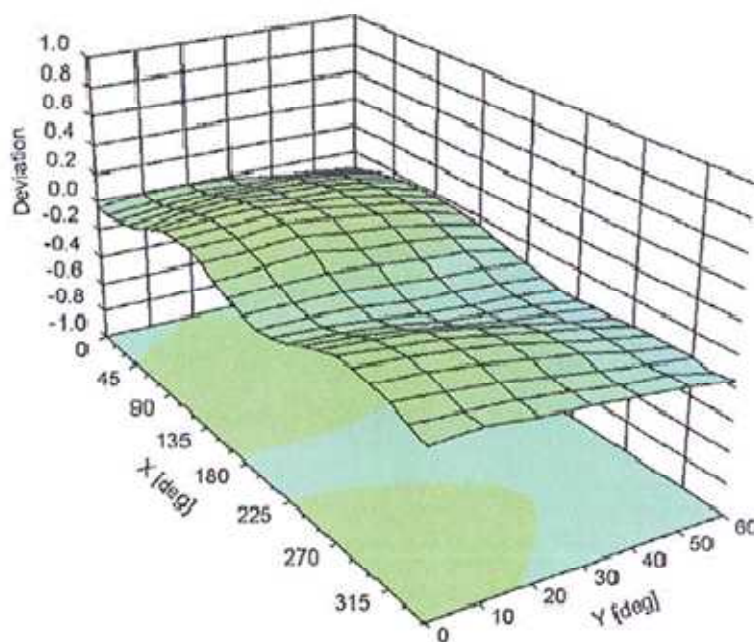
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### Conversion Factor Assessment



### Deviation from Isotropy in Liquid

Error ( $\phi$ ,  $\theta$ ), f = 900 MHz



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



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EX3DV4– SN:3745

April 15, 2014

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3745

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-119.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm



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## Attachment 2. Dipole calibration data

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Accreditation No.: SCS 108

Client **PTT**

Certificate No: D835V2-4d104\_Jun14

### CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d104**

Calibration procedure(s) **QA CAL-05.v9**  
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **June 12, 2014**

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&amp;TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Name** Leif Klyzner **Function** Laboratory Technician

Signature

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

Issued: June 16, 2014

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Certificate No: D835V2-4d104\_Jun14

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### Glossary:

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

### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

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

## Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.5 $\pm$ 6 %	0.94 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.18 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.93 W/kg $\pm$ 16.5 % (k=2)

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	55.2 $\pm$ 6 %	1.01 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.43 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.15 W/kg $\pm$ 16.5 % (k=2)

## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.3 $\Omega$ - 1.9 $j\Omega$
Return Loss	- 30.7 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7 $\Omega$ - 5.4 $j\Omega$
Return Loss	- 23.7 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.399 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	May 26, 2010



## DASY5 Validation Report for Head TSL

Date: 12.06.2014

Test Laboratory; SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d104**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.94$  S/m;  $\epsilon_r = 41.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

### DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

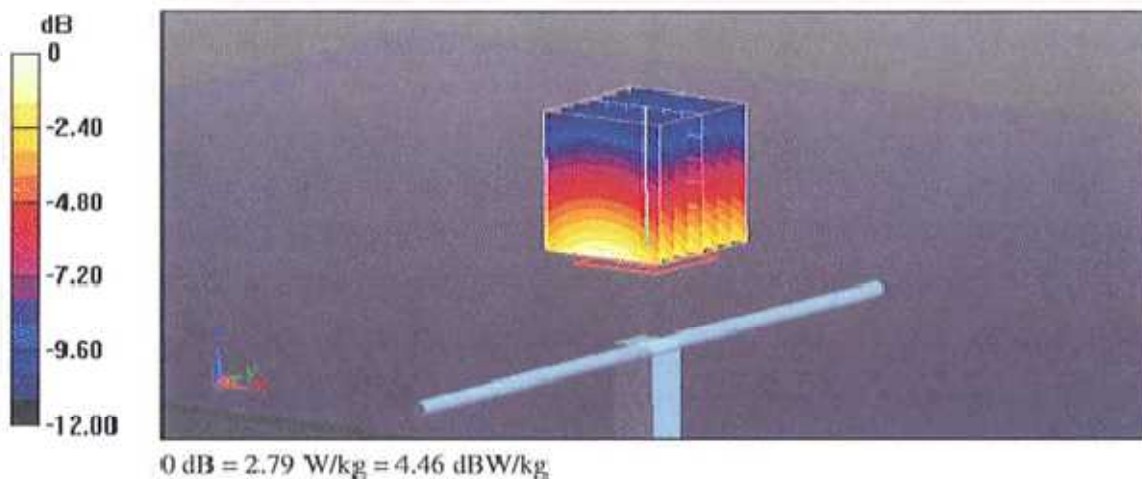
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.20 V/m; Power Drift = 0.01 dB

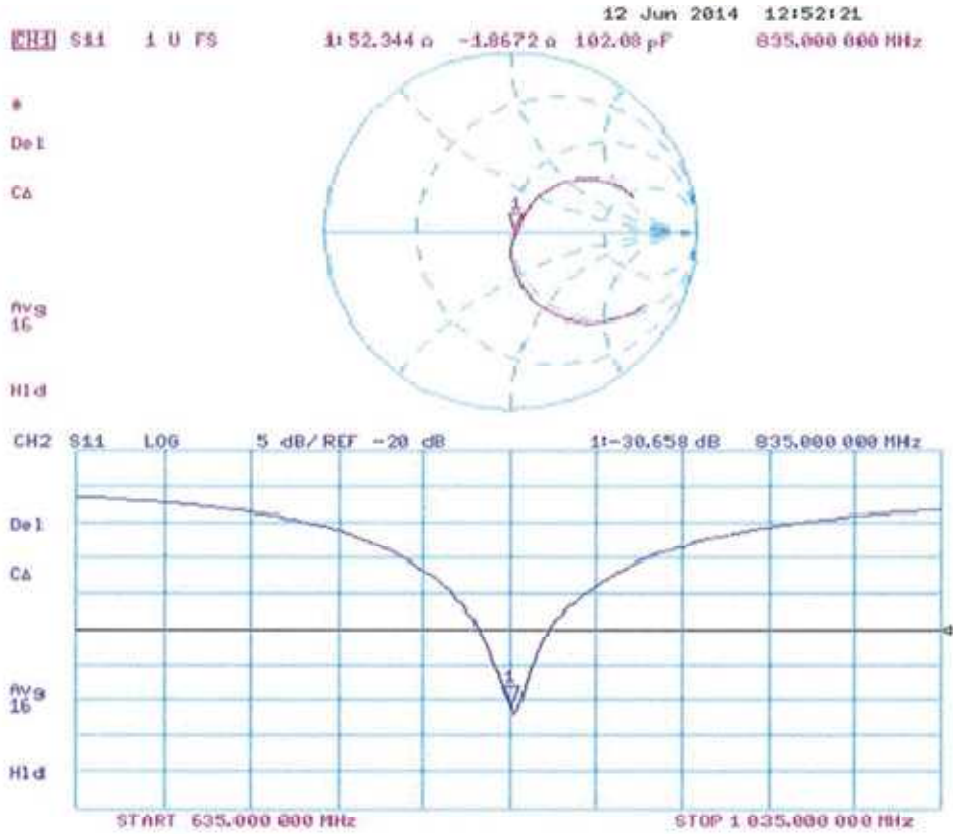
Peak SAR (extrapolated) = 3.58 W/kg

SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.52 W/kg

Maximum value of SAR (measured) = 2.79 W/kg



### Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 12.06.2014

Test Laboratory: The name of your organization

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d104**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 1.005 \text{ S/m}$ ;  $\epsilon_r = 55.2$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

### DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

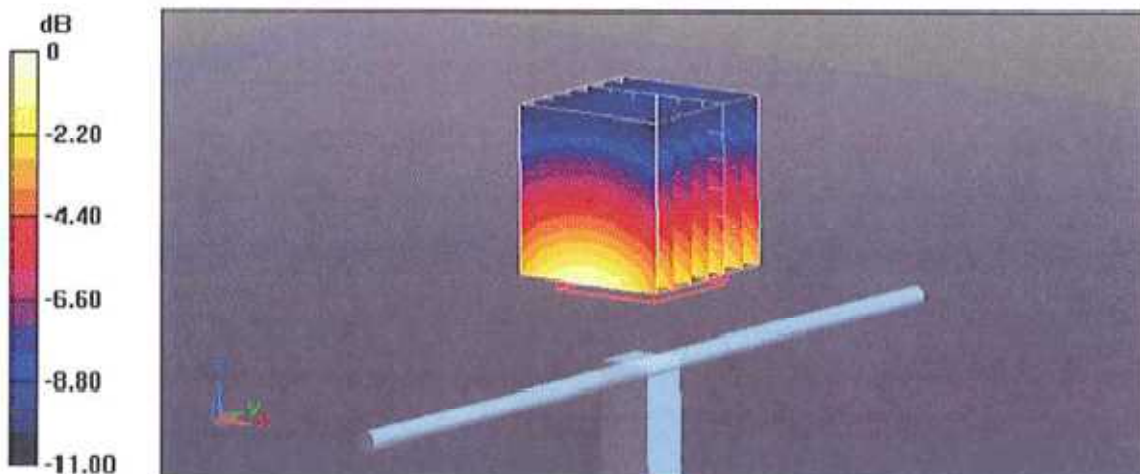
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 54.94 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.60 W/kg

**SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.57 W/kg**

Maximum value of SAR (measured) = 2.82 W/kg

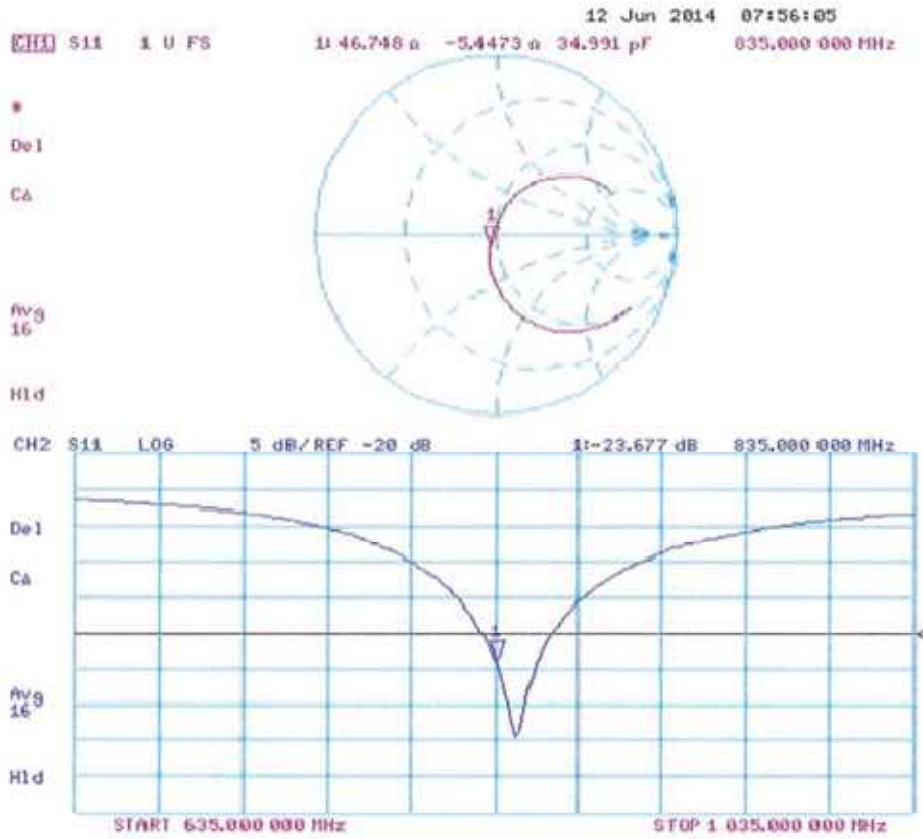


0 dB = 2.82 W/kg = 4.50 dBW/kg



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### Impedance Measurement Plot for Body TSL





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**Client **PTT**Certificate No: **D1900V2-5d129\_Jun14**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d129**

Calibration procedure(s) **QA CAL-05.v9**  
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **June 18, 2014**

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  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&amp;TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Doc13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4205	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

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

Signature  
*Israe El-Naouq*  
*Katja Pokovic*

Issued: **June 18, 2014**

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Certificate No: **D1900V2-5d129\_Jun14**

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108****Glossary:**

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

**Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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

### Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.5 $\pm$ 6 %	1.39 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.1 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.1 W/kg $\pm$ 16.5 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.5 $\pm$ 6 %	1.51 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.33 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.3 W/kg $\pm$ 16.5 % (k=2)

## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.0 $\Omega$ + 6.8 j $\Omega$
Return Loss	- 23.2 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.2 $\Omega$ + 6.0 j $\Omega$
Return Loss	- 23.4 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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 14, 2010



## DASY5 Validation Report for Head TSL

Date: 18.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d129**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.39$  S/m;  $\epsilon_r = 39.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

### DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

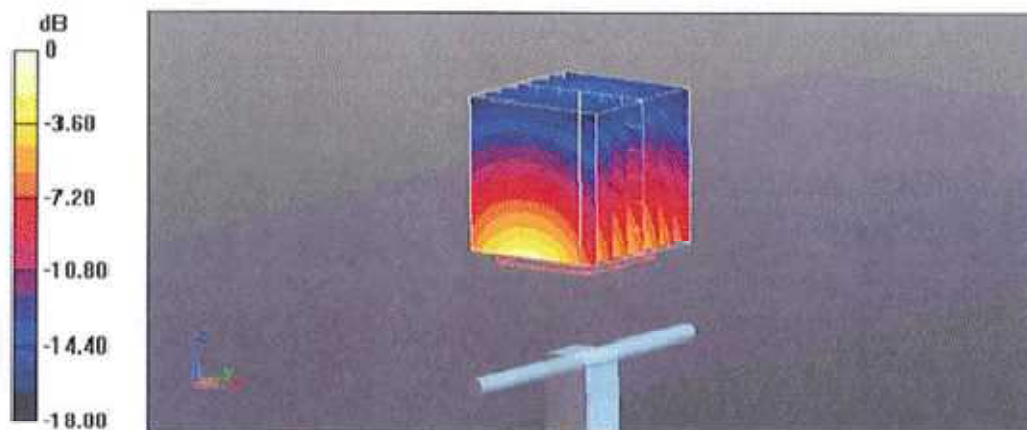
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 97.09 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 18.3 W/kg

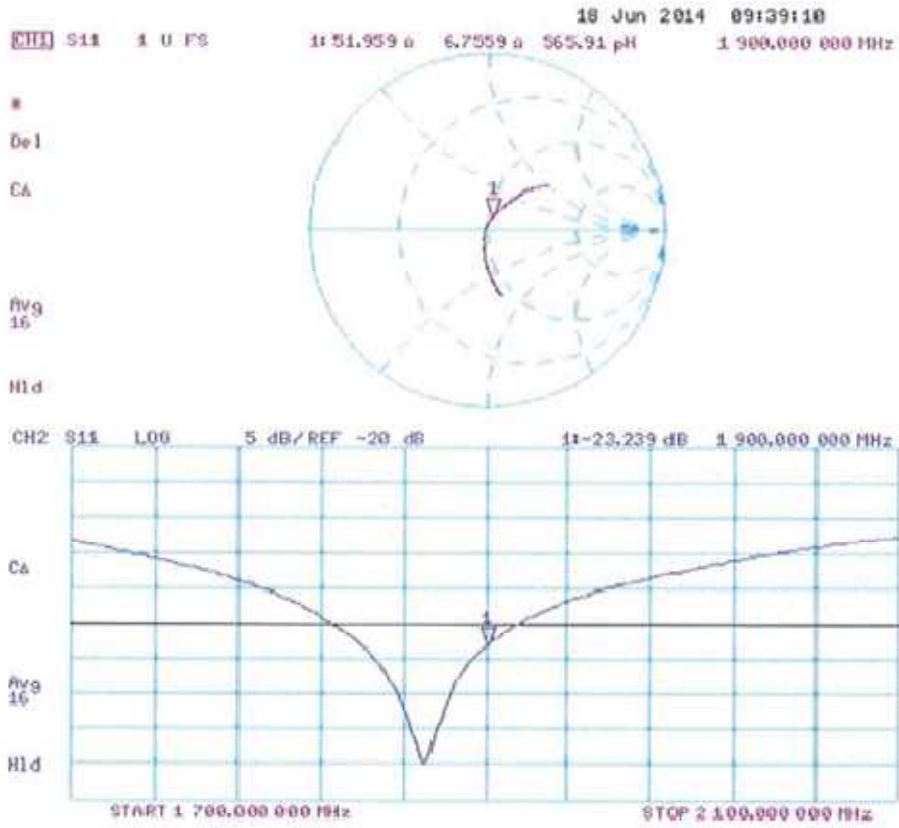
**SAR(1 g) = 10 W/kg; SAR(10 g) = 5.27 W/kg**

Maximum value of SAR (measured) = 12.4 W/kg



0 dB = 12.4 W/kg = 10.93 dBW/kg

### Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 18.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d129**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.51$  S/m;  $\epsilon_r = 52.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

### DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

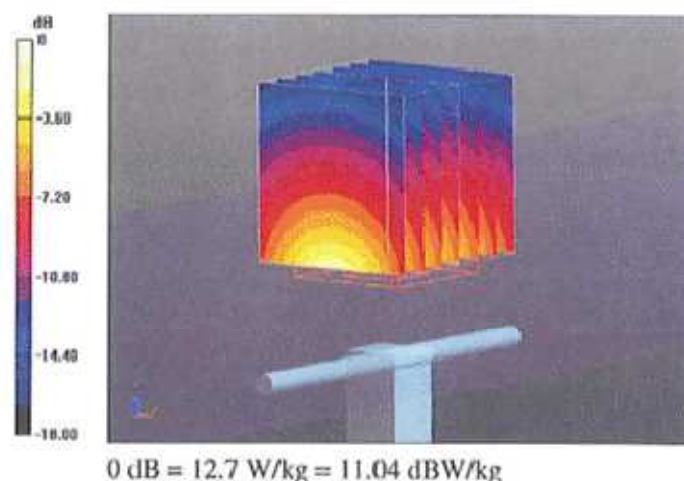
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.62 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 17.5 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.33 W/kg

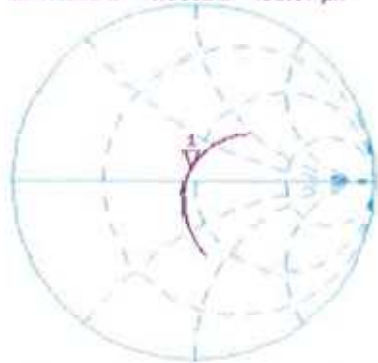
Maximum value of SAR (measured) = 12.7 W/kg



### Impedance Measurement Plot for Body TSL

18 Jun 2014 10:13:29  
S11 1 U F8 11-47.172  $\Omega$  5.9531  $\Omega$  498.67 pF 1 900.000 000 MHz

De1  
CA



AVG  
16

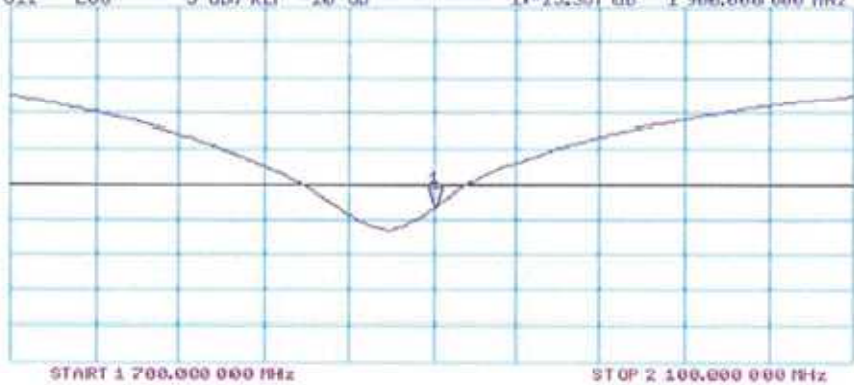
HI d

CH2 S11 LOG 5 dB/REF -20 dB 11-23.397 dB 1 900.000 000 MHz

CA

AVG  
16

HI d





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Accreditation No.: **SCS 108**Client **PTT**Certificate No: **D2450V2-894 Jun14**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 894**

Calibration procedure(s) **QA CAL-05.v9**  
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **June 13, 2014**

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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&amp;TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390595 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by:	Name <b>Loif Klisner</b>	Function Laboratory Technician	Signature 
Approved by:	Name <b>Katja Pokovic</b>	Technical Manager	

Issued: June 16, 2014

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

Certificate No: D2450V2-894\_Jun14

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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 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

## Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.4 $\pm$ 6 %	1.84 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.2 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.9 W/kg $\pm$ 16.5 % (k=2)

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.1 $\pm$ 6 %	2.03 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

## SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.0 W/kg $\pm$ 16.5 % (k=2)

## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.6 $\Omega$ + 1.6 j $\Omega$
Return Loss	- 26.7 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.6 $\Omega$ + 3.6 j $\Omega$
Return Loss	- 28.9 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2011



## DASY5 Validation Report for Head TSL

Date: 13.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT:** Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 894

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.84$  S/m;  $\epsilon_r = 38.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

### DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

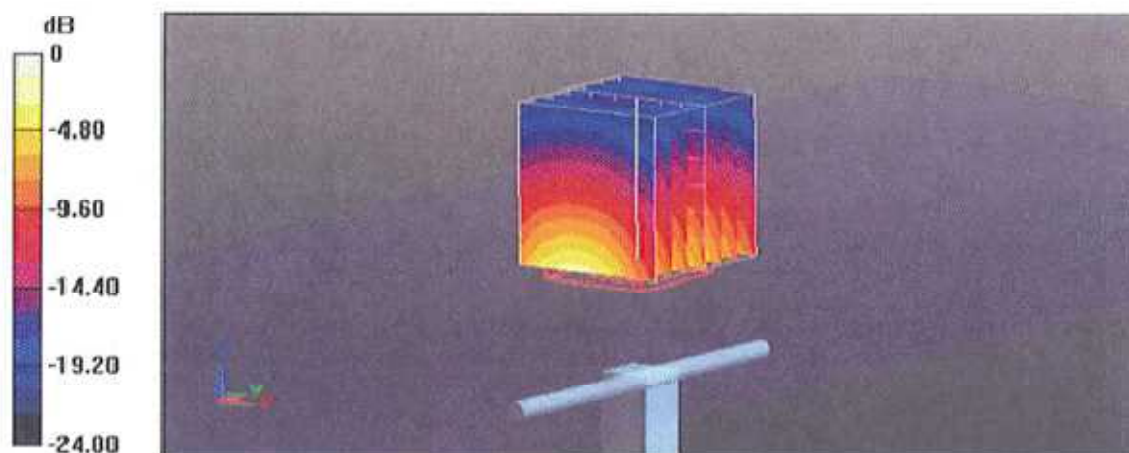
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.8 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 27.6 W/kg

**SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.28 W/kg**

Maximum value of SAR (measured) = 17.3 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg

### Impedance Measurement Plot for Head TSL

13 Jun 2014 11:47:20  
[CH1] S11 1 U FS 1: 54.562  $\alpha$  1.5781  $\alpha$  102.52  $\mu$ H 2 450,000 000 MHz

#

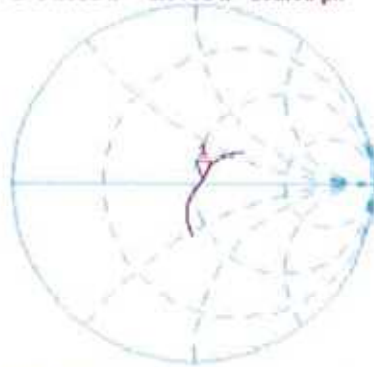
De1

Cor

Avg

16

H1d



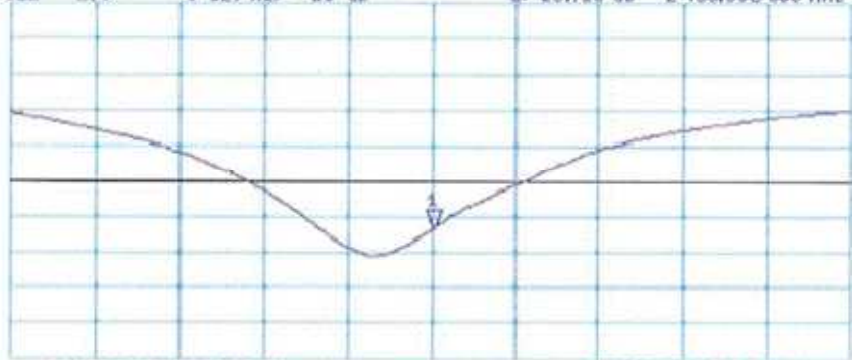
CH2 S11 LOG 5 dB/REF -20 dB 1: -26.715 dB 2 450,000 000 MHz

Cor

Avg

16

H1d



START 2 250,000 000 MHz

STOP 2 650,000 000 MHz

## DASY5 Validation Report for Body TSL

Date: 13.06.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 894**

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.03$  S/m;  $\epsilon_r = 51.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

### DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

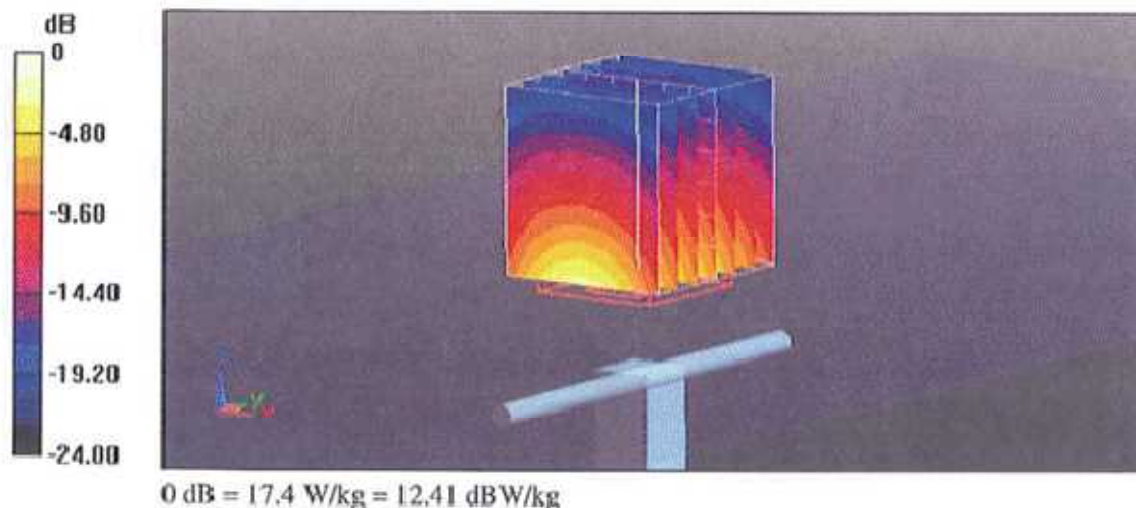
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.80 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 27.3 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.1 W/kg

Maximum value of SAR (measured) = 17.4 W/kg





Zacta

### Impedance Measurement Plot for Body TSL

