

EX3DV4-SN:7514 August 27, 2018

#### DASY/EASY - Parameters of Probe: EX3DV4 - SN:7514

#### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)
150	52.3	0.76	12.79	12.79	12.79	0.00	1.00	± 13.3 %
300	45.3	0.87	11.57	11.57	11.57	0.07	1.20	± 13.3 %
450	43.5	0.87	10.68	10.68	10.68	0.14	1.20	± 13.3 %
750	41.9	0.89	9.47	9.47	9.47	0.45	0.89	± 12.0 %
835	41.5	0.90	9.09	9.09	9.09	0.53	0.85	± 12.0 %
900	41.5	0.97	9.03	9.03	9.03	0.49	0.85	± 12.0 %
1450	40.5	1.20	8.24	8.24	8.24	0.35	0.80	± 12.0 %
1640	40.2	1.31	8.22	8.22	8.22	0.38	0.81	± 12.0 %
1750	40.1	1.37	8.10	8.10	8.10	0.36	0.83	± 12.0 %
1810	40.0	1.40	7.82	7.82	7.82	0.35	0.81	± 12.0 %
1900	40.0	1.40	7.73	7.73	7.73	0.31	0.80	± 12.0 %
2000	40.0	1.40	7.64	7.64	7.64	0.30	0.84	± 12.0 %
2100	39.8	1.49	7.57	7.57	7.57	0.27	0.85	± 12.0 %
2300	39.5	1.67	7.42	7.42	7.42	0.31	0.80	± 12.0 %
2450	39.2	1.80	6.95	6.95	6.95	0.38	0.98	± 12.0 %
2600	39.0	1.96	6.92	6.92	6.92	0.25	1.05	± 12.0 %
3500	37.9	2.91	6.78	6.78	6.78	0.79	0.64	± 13.1 %
3700	37.7	3.12	6.61	6.61	6.61	0.42	0.93	± 13.1 %
5200	36.0	4.66	5.05	5.05	5.05	0.40	1.80	± 13.1 %
5250	35.9	4.71	5.02	5.02	5.02	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.99	4.99	4.99	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.59	4.59	4.59	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.41	4.41	4.41	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.47	4.47	4.47	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.42	4.42	4.42	0.40	1.80	± 13.1 %

<sup>&</sup>lt;sup>c</sup> Frequency validity above 300 MHz 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. Frequency validity below at 150 MHz is ± 50 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

F At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated transit frequency parameters.

the ConvF uncertainty for indicated target tissue parameters.

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:7514

#### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)
150	61.9	0.80	12.43	12.43	12.43	0.00	1.00	± 13.3 %
300	58.2	0.92	11.39	11.39	11.39	0.05	1.20	± 13.3 %
450	56.7	0.94	11.34	11.34	11.34	0.08	1.20	± 13.3 %
750	55.5	0.96	9.68	9.68	9.68	0.31	1.04	± 12.0 %
835	55.2	0.97	9.47	9.47	9.47	0.46	0.80	± 12.0 %
900	55.0	1.05	9.34	9.34	9.34	0.46	0.83	± 12.0 %
1450	54.0	1.30	8.02	8.02	8.02	0.31	0.80	± 12.0 %
1640	53.7	1.42	7.85	7.85	7.85	0.42	0.81	± 12.0 %
1750	53.4	1.49	7.82	7.82	7.82	0.39	0.83	± 12.0 %
1810	53.3	1.52	7.69	7.69	7.69	0.32	0.92	± 12.0 %
1900	53.3	1.52	7.53	7.53	7.53	0.35	0.83	± 12.0 %
2000	53.3	1.52	7.45	7.45	7.45	0.39	0.80	± 12.0 %
2100	53.2	1.62	7.39	7.39	7.39	0.32	0.94	± 12.0 %
2300	52.9	1.81	7.25	7.25	7.25	0.37	0.85	± 12.0 %
2450	52.7	1.95	7.13	7.13	7.13	0.32	0.97	± 12.0 %
2600	52.5	2.16	7.06	7.06	7.06	0.24	1.10	± 12.0 %
3500	51.3	3.31	6.85	6.85	6.85	0.00	1.00	± 13.1 %
3700	51.0	3.55	6.75	6.75	6.75	0.00	1.00	± 13.1 %
5200	49.0	5.30	4.59	4.59	4.59	0.50	1.90	± 13.1 %
5250	48.9	5.36	4.54	4.54	4.54	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.49	4.49	4.49	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.17	4.17	4.17	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.00	4.00	4.00	0.50	1.90	± 13.1 %
5750	48.3	5.94	3.98	3.98	3.98	0.50	1.90	± 13.1 %
5800	48.2	6.00	3.94	3.94	3.94	0.50	1.90	± 13.1 %

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Frequency validity above 300 MHz of  $\pm$  100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to  $\pm$  50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below at 150 MHz is  $\pm$  50 MHz. Above 5 GHz frequency validity can be extended to  $\pm$  110 MHz.

At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to  $\pm$  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  $\pm$  5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

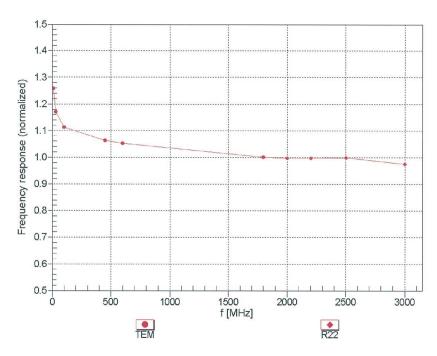
Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than  $\pm$  1% for frequencies below 3 GHz and below  $\pm$  2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter 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: ± 6.3% (k=2)

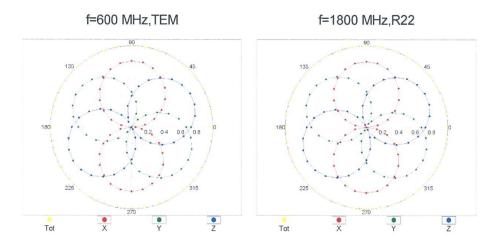
Certificate No: EX3-7514\_Aug18

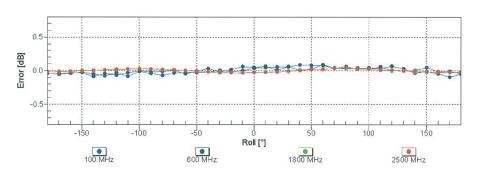
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### Receiving Pattern ( $\phi$ ), $\vartheta = 0^{\circ}$





Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

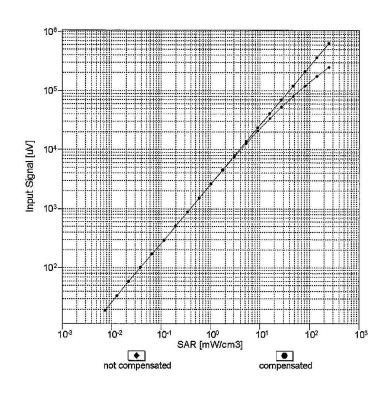
Certificate No: EX3-7514\_Aug18

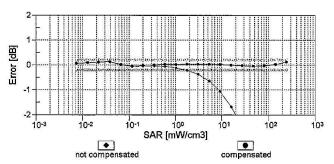


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### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)





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

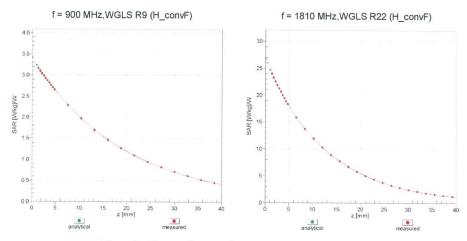
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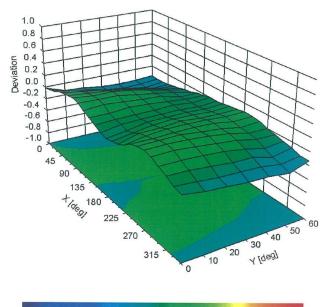
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#### **Conversion Factor Assessment**



## **Deviation from Isotropy in Liquid**

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



-1.0 -0.8 -0.6 -0.4 -0.2 0.0 0.2 0.4 0.6 0.8 1.0 Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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August 27, 2018

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7514

#### **Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	-19.8
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	1.4 mm

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### **ANNEX H** Dipole Calibration Certificate

#### 835 MHz Dipole Calibration Certificate

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





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

Accreditation No.: SCS 0108

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

Client

CTTL (Auden)

Certificate No: D835V2-4d069 Jul18

CALIBRATION C	ERTIFICATE				
Object	D835V2 - SN:4d069				
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz				
Calibration date:	July 23, 2018				
		ional standards, which realize the physical ur robability are given on the following pages ar	The state of the s		
All calibrations have been conducte	ed in the closed laborato	ry 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 NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19		
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19		
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19		
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19		
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19		
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18		
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18		
Secondary Standards	ID#	Check Date (in house)	Scheduled Check		
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18		
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18		
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18		
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18		
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18		
		F	Signature		
	Name	Function			
Calibrated by:	Name Manu Seitz	Function  Laboratory Technician			
Calibrated by: Approved by:			All My		

Certificate No: D835V2-4d069\_Jul18

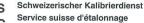
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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#### Glossary:

TSL

tissue simulating liquid

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

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

- a) 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
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### **Additional Documentation:**

e) 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%.

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#### **Measurement Conditions**

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

DASY Version	DASY5	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	60 <b>-</b> 10 4 10 7
Frequency	835 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	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.7 ± 6 %	0.92 mho/m ± 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	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.40 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.06 W/kg ± 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 ± 0.2) °C	55.2 ± 6 %	0.99 mho/m ± 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	9.53 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.28 W/kg ± 16.5 % (k=2)

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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### **Antenna Parameters with Head TSL**

Impedance, transformed to feed point	50.8 Ω - 2.1 jΩ
Return Loss	- 33.0 dB

#### **Antenna Parameters with Body TSL**

Impedance, transformed to feed point	46.1 Ω - 5.2 jΩ	
Return Loss	- 23.4 dB	

#### **General Antenna Parameters and Design**

The state of the s	7-2-2-20
Electrical Delay (one direction)	1.396 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	November 09, 2007	

Certificate No: D835V2-4d069\_Jul18

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#### **DASY5 Validation Report for Head TSL**

Date: 16.07.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d069

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

Medium parameters used: f = 835 MHz;  $\sigma$  = 0.92 S/m;  $\epsilon_r$  = 40.7;  $\rho$  = 1000 kg/m³

Phantom section: Flat Section

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

#### DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(9.9, 9.9, 9.9) @ 835 MHz; Calibrated: 30.12.2017

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 26.10.2017

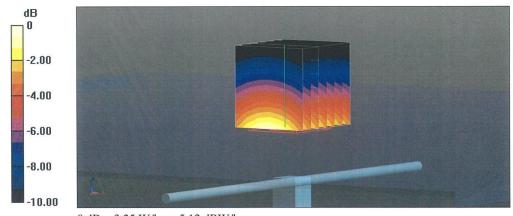
• Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001

• DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

#### 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 = 62.65 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.70 W/kg

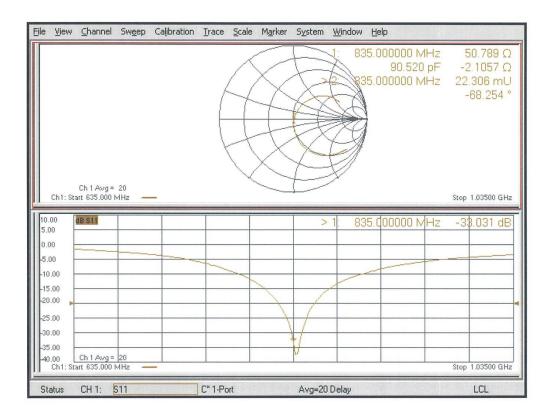
SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.54 W/kgMaximum value of SAR (measured) = 3.25 W/kg



0 dB = 3.25 W/kg = 5.12 dBW/kg



#### Impedance Measurement Plot for Head TSL



Certificate No: D835V2-4d069\_Jul18

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#### **DASY5 Validation Report for Body TSL**

Date: 23.07.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d069

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

Medium parameters used: f = 835 MHz;  $\sigma = 0.99$  S/m;  $\varepsilon_r = 55.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

#### DASY52 Configuration:

• Probe: EX3DV4 - SN7349; ConvF(10.05, 10.05, 10.05) @ 835 MHz; Calibrated: 30.12.2017

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 26.10.2017

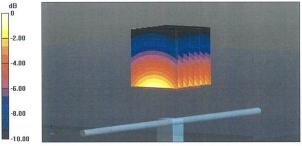
Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

• DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 60.75 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 3.59 W/kg

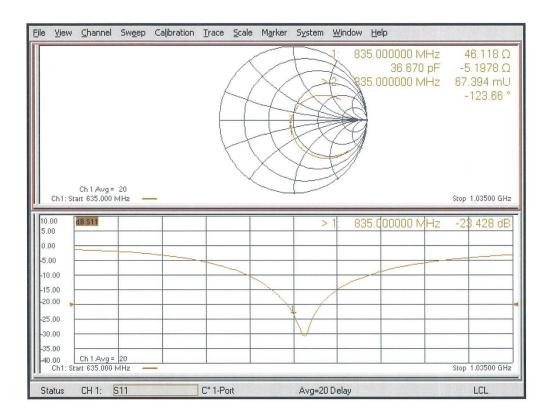
SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.59 W/kgMaximum value of SAR (measured) = 3.22 W/kg



0 dB = 3.22 W/kg = 5.08 dBW/kg



#### Impedance Measurement Plot for Body TSL



Certificate No: D835V2-4d069\_Jul18



#### 1900 MHz Dipole Calibration Certificate

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





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Swiss Calibration Service

Accreditation No.: SCS 0108

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Client

CTTL (Auden)

Certificate No: D1900V2-5d101 Jul18

CALIBRATION C	ENTIFICATI		
Object	D1900V2 - SN:5d101		
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz		
Calibration date:	July 24, 2018		
This calibration certificate docume The measurements and the uncert	nts the traceability to nat	tional standards, which realize the physical ur probability are given on the following pages ar	nits of measurements (SI).
		bry facility: environment temperature $(22 \pm 3)^\circ$	
Calibration Equipment used (M&TI			
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A RF generator R&S SMT-06	Security Strategies and Security		In house check: Oct-18
Power sensor HP 8481A RF generator R&S SMT-06	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check; Oct-18
Power sensor HP 8481A RF generator R&S SMT-06	Security Strategies and Security	31-Mar-14 (in house check Oct-17)  Function	Signature
Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: US41080477	,	
Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: US41080477  Name  Manu Seitz	Function Laboratory Technician	
Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: US41080477 Name	Function	

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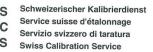
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#### Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland







Accreditation No.: SCS 0108

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

#### Glossary:

TSL

tissue simulating liquid

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

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

- a) 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
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### **Additional Documentation:**

e) 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%.

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