

# **Appendix C**

# **Phantom Description**

Schmid & Partner Engineering AG



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# Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 5.0	
Type No	QD OVA 002 A	
Series No	1108 and higher	
Manufacturer	Untersee Composites Knebelstrasse 8, CH-8268 Mannenbach, Switzerland	

#### Tests

Complete tests were made on the prototype units QD OVA 001 A, pre-series units QD OVA 001 B as well as on some series units QD OVA 001 B. Some tests are made on all series units QD OVA 002 A.

Test	Requirement	Details	Units tested
Shape	Internal dimensions, depth and sagging are compatible with standards	Bottom elliptical 600 x 400 mm, Depth 190 mm, dimension compliant with [1] for f > 375 MHz	Prototypes
Material thickness	Bottom: 2.0mm +/- 0.2mm	dimension compliant with [3] for f > 800 MHz	all
Material parameters	rel. permittivity 2 – 5, loss tangent ≤ 0.05, at f ≤ 6 GHz	rel. permittivity 3.5 +/- 0.5 loss tangent ≤ 0.05	Material samples
Material resistivity	Compatibility with tissue simulating liquids .	Compatible with SPEAG liquids. **	Phantoms, Material sample
Sagging	Sagging of the flat section in tolerance when filled with tissue simulating liquid.	within tolerance for filling height up to 155 mm	Prototypes, samples

Note: Compatibility restrictions apply certain liquid components mentioned in the standard, containing e.g. DGBE, DGMHE or Triton X-100. Observe technical note on material compatibility.

Standards

- OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01
   IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific
- Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement
- [3] IEC 62209–1 ed.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices Human models, instrumentation, and procedures Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)\*, 2005-02-18
- IEC 62209–2 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices Human models, instrumentation, and procedures Part 2: [4] 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)", 2010-03-30

#### Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of body-worn SAR measurements and system performance checks as specified in [1 - 4]and further standards

25.7.2011 Date

Signature / Stamp



Doc No 881 - QD OVA 002 A - A

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# System Validation from Original Equipment Supplier

corredited by the Swiss Accreditation he Swiss Accreditation Service fulfilateral Agreement for the rec	is one of the signatorie	s to the EA	correditation No.: SCS 0108
CALIBRATION C	2	Constant Local	o. D750V3-1015_Aug19
CALIBRATION C	LATIFICATI	•	
Object	D750V3 - SN:10	15	
Calibration procedure(s)	QA CAL 05 v11		
	Calibration Proce	edure for SAR Validation Sources	s between 0.7-3 GHz
	August 20, 2010		
Calibration date:	August 23, 2019		
	ed in the closed laborato	robability are given on the following pages as ny facility: environment temperature (22 $\pm$ 3) <sup>4</sup>	
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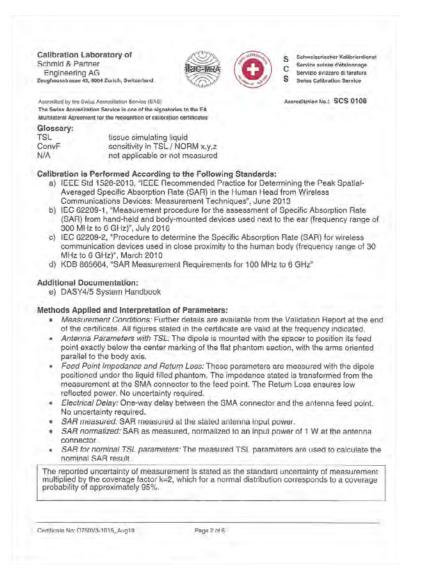
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#### Measurement Conditions

DASY Version	DASY5	V52 10 2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

### Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.7 + 6 %	0.90 mhn/m ± 6 %
Head TSL temperature change during test	< 0,5 °C	فيت	-

### 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	2.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8,60 W/kg ± 17.0 % (k=2)
	T	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL SAR measured	condition 250 mW Input power	1.42 W/kg

Certificate No: D750V3-1015\_Aug19

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Impedance, transformed to feed point		53.1 Ω - 0.6 JΩ	
Return Loss		- 30.4 dB	
Electrical Delay (one direction) After long term use with 100W radiated power, only The tilpole is made of standard semirigid coaxial cal second arm of the dipole. The antenna is therefore a are added it tha dipole arms in order to improve me Measurement Conditions" paragraph. The SAR dat according to the Standard. No excessive force must be applied to the dipole an feedpoint may be damaged.	ble. The center condu- short-circuited for DC- tching when loaded a a are not affected by	ctor of the feeding line is directly conn signals. On some of the dipoles, smal coording to the position as explained this change. The overall dipole length	nected to th II end caps in tho is still
Additional EUT Data			
Manufactured by		00510	
Luminorio A		SPEAG	
		SPEAG	1

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Date: 23.08.2019

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

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MIIz; Type: D750V3; Serial: D750V3 - SN:1015

Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz;  $\sigma$  = 0.9 S/m;  $\epsilon_r$  = 42,7;  $\rho$  = 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(10.07, 10.07, 10.07) @ 750 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- · Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 4.9 (tront); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

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 = 59.91 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.25 W/kg SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.42 W/kg Maximum value of SAR (measured) = 2.89 W/kg

2.00 0 dB = 2.89 W/ke = 4.61 dBW/ky

Page 5 of 6

Certificate No: D750V3-1015\_Aug19

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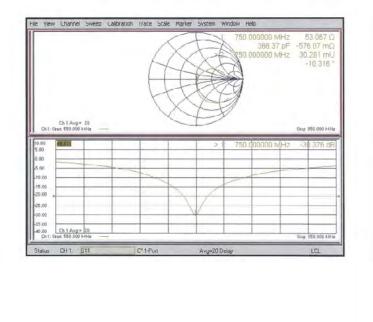
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Report No. :E5/2019/B0009 Rev: 01 Page: 7 of 31

Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1015_Aug19	Page 6 of 6	
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Accredited by the Swiss Accreditati The Swiss Accreditation Service Multilateral Acreement for the res	is one of the signatorie	se to the EA	accreditation No.: SCS 0108
Client SGS-TW (Auder			lo: D835V2-4d063_Aug19
CALIBRATION C	ERTIFICATE	E	
Object	D835V2 - SN:4d	063	-
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validation Source	s between 0.7-3 GHz
Calibration date:	August 23, 2019		
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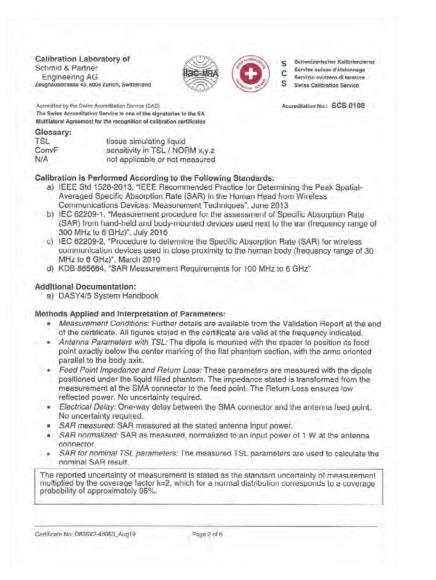
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#### Measurement Conditions

DAST	system	configuration	as tar a	is not	given	on page
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DASY Version	DASY5	V52.10.2
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 ± 1 MHz	

#### Head TSL parameters

	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	42.5±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	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.57 W/kg ± 17.0 % (k=2)
04D	T STANG	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL. SAR measured	condition 250 mW input power	1.57 W/kg

Certificate No: D835V2-4d063\_Aug19

Page 3 of 6

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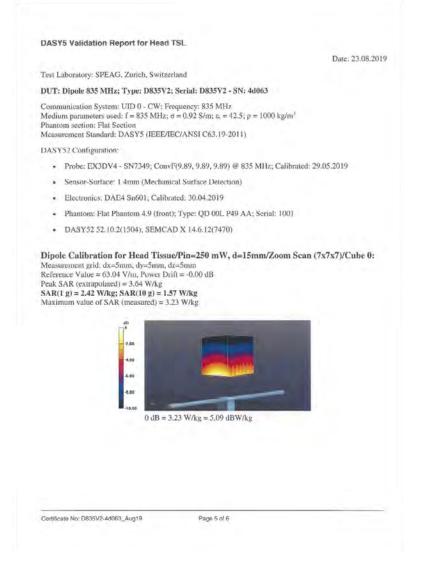


Antenna Parameters with Head TSL		
Impedance, transformed to feed point	50.6 Ω 2.2 jΩ	-
Return Loss	- 32.8 dB	
The dipole is made of standard semirigid coaxial cab second arm of the dipole. The antenna is therefore a are added to the dipole arms in order to improve mat "Measurement Conditions" paragraph. The SAR data according to the Standard.	1.391 ms a slight warming of the dipole near the feedpoint can be m le. The center conductor of the feeding line is directly cor hort-circuited for DC-signals. On some of the dipoles, sin ohing when backed according to the position as explaines a are not affected by this change. The overall dipole langt is, because they might bend or the soldered connections	nnected to t all end caps d in the h is still
Additional EUT Data	SPEAG	

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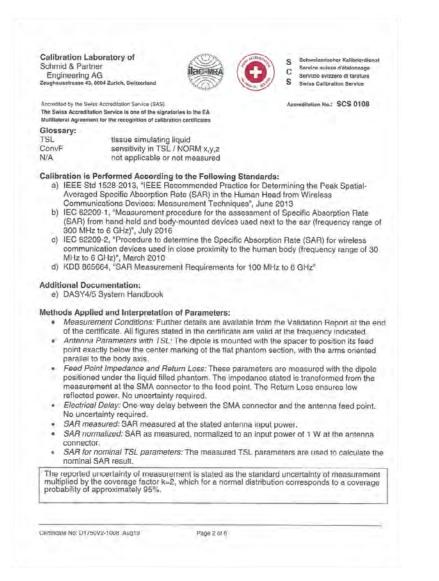
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CALIBRATION C			
Dbject	D1750V2 - SN:10	008	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validation Source	s between 0.7-3 GHz
Calibration date:	August 23, 2019		
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# Report No. :E5/2019/B0009 Rev: 01 Page: 15 of 31



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#### Measurement Conditions

DASY Version	DASY5	V52 10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

# Head TSL parameters

The folk wing parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 6 %	1.36 mho/m ± 6 %
Hoad 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	9 13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.8 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL SAR measured	condition 250 mW input power	4.83 W/kg

Certificate No: D1750V2-1008\_Aug19

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Impedance, transformed to feed point         40.0 0 + 0.6 jú           Return Loss         -38.5 dB           Seneral Antenna Parameters and Design         1.222 ns           Electrical Delay (one direction)         1.222 ns           fter long term use with 100W radiated power, only a elight warning of the dipole near the feedpoint can be measured.           ne dipole is made of standard semiring coaxial cable. The center conductor of the feeding line is directly connected to D1 measured to the dipole arms in order to improve matching when loaded according to the position as explained in the diverse arms in the dipole abort-ficiult of the Cosings. On some of the dipole length is still coording to the Standard.           conditions "paragraph This SAR data are not attacted by this change. The overall dipole length is still coording to the Standard.           o excessive force must be applied to the dipole arms, because they might bend or the soldared connections near the explorint may be damaged.           Additional EUT Date           Manulactured by         SPEAG	Intenna Parameters with Head TSL			
Electrical Delay (one direction)  Electrical Delay (one direction)  1.222 ns  ter long term use with 100W radiated power, only a elight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semiripid coaxial cable. The center conductor of the feeding line is directly connected to th scond arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end cape re added to the dipole arms in order to improve matching when leaded according to the specific many appliend in the Assuratement Conditions' paragraph. The SAR data are not altheated by this chance. The overall dipole length is still coording to the Standard. o excessive fource must be applied to the dipole arms, because they might bend or the soldered connections near the tedpoint may be damaged.	Impedance, transformed to feed point		49.0 Ω + 0.6 JΩ	
Electrical Delay (one direction)         1.222 ns           Iter long term use with 100W radiated power, only a elight warming of the dipole near the feedpoint can be measured.           the dipole is made of standard semingid coaxial cable. The center conductor of the feedpoint is directly connected to th           readed to the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps           readed to the dipole arms in order to improve matching when loaded according to the position an explained in the dipole arms order to improve matching when loaded according to the position an explained in the dipole arms, because they might bend or the soldered connections near the sedpoint may be damaged.           additional EUT Date	Return Loss		- 38.5 dB	
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Manufactured by SPEAG	dditional EUT Data			
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Date: 23.08.2019

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

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MIIz; Type: D1750V2; Serial: D1750V2 - SN:1008

Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz;  $\alpha$  = 1.36 S/m;  $\epsilon_r$  = 40.8; p = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

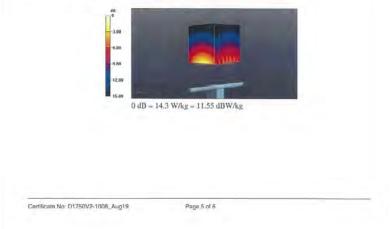
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601: Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

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 = 106.5 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 17.0 W/kgSAR(1 g) = 9.13 W/kg; SAR(10 g) = 4.83 W/kgMaximum value of SAR (measured) = 14.3 W/kg



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

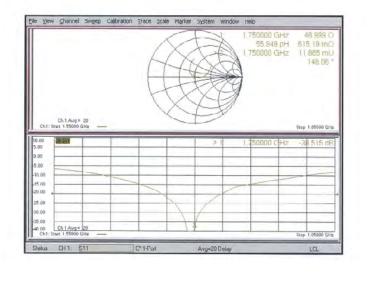
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Impedance Measurement Plot for Head TSL



Page 6 of 6

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Itilateral Agreement for the rec			
ent SGS-TW (Auden	)	Certificate N	o: D1900V2-5d173_Apr19
ALIBRATION CI	ERTIFICATE		
bject	D1900V2 - SN:50	1173	
Calibration procedure(s)	QA CAL-05.v11		
	Calibration Proce	dure for SAR Validation Source	s between 0.7-3 GHz
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Certificate No: D1900V2-5d173\_Apr19

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



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Swiss Calibration Service

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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	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 1528-2013, "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 Version	DASY5	V52.10.2
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 ± 1 MHz	

# Head TSL parameters

The following parameters and calculations were applied.

Q.,	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	40.6 ± 6 %	1.38 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	9.92 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	40.2 W/kg ± 17.0 % (k=2)	
SAB averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition		
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 250 mW input power	5.22 W/kg	

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

## Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.3 Ω + 5.1 jΩ
Return Loss	- 25.3 dB

# General Antenna Parameters and Design

As a second seco	
Electrical Delay (one direction)	1.201 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
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# **DASY5 Validation Report for Head TSL**

Date: 23.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d173

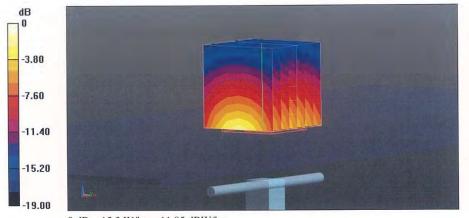
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.38 S/m;  $\epsilon_r$  = 40.6;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.26, 8.26, 8.26) @ 1900 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

# 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 = 110.1 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 18.1 W/kg SAR(1 g) = 9.92 W/kg; SAR(10 g) = 5.22 W/kg Maximum value of SAR (measured) = 15.3 W/kg



0 dB = 15.3 W/kg = 11.85 dBW/kg

Certificate No: D1900V2-5d173\_Apr19

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# Impedance Measurement Plot for Head TSL

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Certificate No: D1900V2-5d173\_Apr19

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lient SGS-TW (Auder	1)	Certificate No	o: D2600V2-1005_Jan19
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**Calibration Laboratory of** Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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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

# Gloceany

choosally.	
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 1528-2013, "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	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

# Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.3 ± 6 %	2.03 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	7776	

# 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	14.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	55.3 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 250 mW input power	6.27 W/kg

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

# Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω - 4.0 jΩ
Return Loss	- 27.7 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.157 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
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# **DASY5 Validation Report for Head TSL**

Date: 28.01.2019

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1005

Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz;  $\sigma = 2.03 \text{ S/m}$ ;  $\epsilon_r = 37.3$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.74, 7.74, 7.74) @ 2600 MHz; Calibrated: 31.12.2018
- . Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

# 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 = 118.2 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 28.9 W/kg SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.27 W/kg Maximum value of SAR (measured) = 23.9 W/kg



0 dB = 23.9 W/kg = 13.78 dBW/kg

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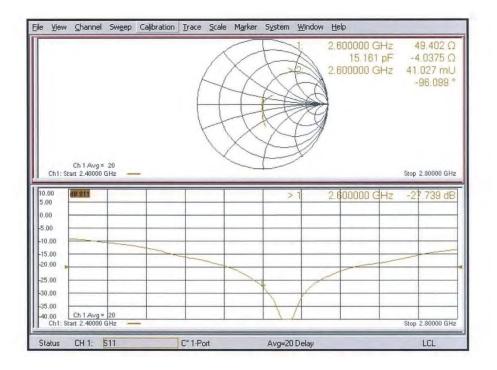
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# Impedance Measurement Plot for Head TSL



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# - End of report -

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