

# **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

- [1] 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
- [2] Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement
- Techniques, December 2003 IEC 62209–1 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices Human models, instrumentation, and procedures Part 1: [3] 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

Date 25.7.2011

Signature / Stamp



Doc No 881 - QD OVA 002 A - A

Page 1(1)

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# System Validation from Original Equipment Supplier

ccredited by the Swiss Accreditati			
he Swiss Accreditation Service Iultilateral Agreement for the re-	is one of the signatorie	s to the EA	ccreditation No.: SCS 0108
lient SGS-TW (Auder	n)	Certificate No	D750V3-1015_Aug19
CALIBRATION C	ERTIFICATE		
Object	D750V3 - SN:10	15	
Calibration procedure(s)	QA CAL-05.v11		
Sandrann processings)		edure for SAR Validation Sources	s between 0.7-3 GHz
Calibration date:	August 23, 2019		
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Calibration Laboratory of Schmid & Partner Engineering AG



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Glossary: TSL ConvF N/A

tissue simulating liquid 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 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 c)
- 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%.

Certificate No: D750V3-1015\_Aug19

Page 2 of 6

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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

The following parameters and calculations were applied.

	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 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	2.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.60 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	1.42 W/kg

Certificate No: D750V3-1015\_Aug19

Page 3 of 6

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Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω - 0.6 jΩ
Return Loss	- 30.4 dB

1.037 ns

#### General Antenna Parameters and Design

Electrical Delay (one direction)

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 poetlion 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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Page 4 of 6

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Date: 23.08.2019

## DASY5 Validation Report for Head TSL

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; 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

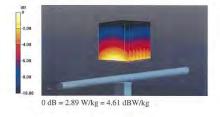
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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 (front); 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



Certificate No: D750V3-1015\_Aug19

Page 5 of 6

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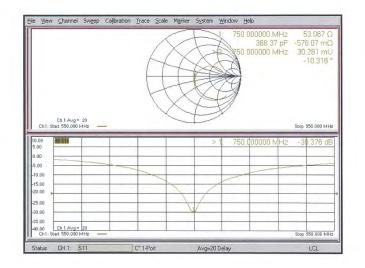
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Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1015\_Aug19

Page 6 of 6

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Accredited by the Swiss Accreditati The Swiss Accreditation Service Multilateral Agreement for the rec	Is one of the signatorie	es to the EA	Accreditation No.: SCS 0108
Client SGS-TW (Auder	ר)	Certificate I	lo: D835V2-4d063_Aug19
CALIBRATION C	ERTIFICATE	-	
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		-
This calibration certificate docume	nts the traceability to nat	ional standards, which realize the physical u	nits of measurements (SI).
		probability are given on the following pages a	
All calibrations have been conduct	ed in the closed laborato	ny facility: environment temperature (22 + 3)	9C and humidiky - 709
All calibrations have been conduct	ed in the closed laborato	ry facility: environment temperature (22 $\pm$ 3)	°C and humidity < 70%.
		ry facility: environment temperature (22 $\pm$ 3)	°C and humidity < 70%.
		iry facility: environment temperature (22 $\pm$ 3)	°C and humidity < 70%.
Calibration Equipment used (M&TE			
Calibration Equipment used (M&TE Primary Standards	E critical for calibration)	Cal Date (Certificate No.)	Scheduled Calibration
Calibration Equipment used (M&TE Primary Standards Power meter NRP	E critical for calibration)	Cal Date (Cerlificate No.) 03-Apr-19 (No. 217-02892/02893)	Scheduled Calibration
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291	E critical for calibration)	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892)	Scheduled Calibration Apr-20 Apr-20
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Date (Certificate No.) 03-Apr-19 (No. 217-0288/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02883)	Scheduled Calibration Apr-20 Apr-20 Apr-20
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Alternuator	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k)	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02862/02893) 03-Apr-19 (No. 217-02889) 03-Apr-19 (No. 217-02884) 0-A-Apr-19 (No. 217-02884)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20
Calibration Equipment used (M&TE Primary Standards Power meter NRP-291 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Altenuator Type-N mismatch combination	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5088 (20k) SN: 5047.2 / 06327	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02893) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20
Calibration Equipment used (M&TE Primary Standards Power enter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenutor Type-N mismatch combination Reference Probe EX3DV4	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7349	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02882/02893) 03-Apr-19 (No. 217-02882) 03-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 29-May-19 (No. EX3-7349, May19)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 May-20
Calibration Equipment used (M&TE Primary Standards Power enter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenutor Type-N mismatch combination Reference Probe EX3DV4	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5088 (20k) SN: 5047.2 / 06327	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02893) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type N mismatch combination Reference Probe EXSDV4 DAE4	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7349	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02882/02893) 03-Apr-19 (No. 217-02882) 03-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 29-May-19 (No. EX3-7349, May19)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 May-20
Calibration Equipment used (M&TE Primary Standards Power metor NRP Powers ensor NRP-291 Powers ensor NRP-291 Reference 204 BAttenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power metor E4419B	Critical for calibration) ID # SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5067.27 (6327 SN: 7349 SN: 601	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02882/02893) 03-Apr-19 (No. 217-02882) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 29-May-19 (No. EX3-7349, May19) 30-Apr-19 (No. DAE4-601, Apr19)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 May-20 Apr-20
Calibration Equipment used (M&TE Primary Standards Power metor NRP Powers ensor NRP-291 Powers ensor NRP-291 Reference 204 BAttenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power metor E4419B	E critical for calibration) ID # SN: 103778 SN: 103744 SN: 103245 SN: 5058 (20k) SN: 5058 (20k) SN: 5058 (20k) SN: 7349 SN: 601 ID #	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02862/02883) 03-Apr-19 (No. 217-02869) 03-Apr-19 (No. 217-02863) 04-Apr-19 (No. 217-02864) 04-Apr-19 (No. 217-02864) 29-May-19 (No. C237-30286) 30-Apr-19 (No. C23-7364, May19) 30-Apr-19 (No. C24-601, Apr19) Check Date (in house)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 May-20 May-20 Apr-20 Scheduled Check
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Reference 20 dB Altenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power smort PF 4847A	E critical for calibration) ID # SN: 103245 SN: 103244 SN: 103245 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 501 ID # ID #	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02892)02893) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02895) 29-May-19 (No. 217-02895) 29-May-19 (No. DAE4-601 Apr19) 30-Apr-19 (No. DAE4-601 Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Scheduled Check In house check: Oct-20
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 d& Altenuator Type-P mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E44198 Power assort PP 8481A Power sensor HP 8481A	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 5067.2 / 06327 SN: 5607 SN: 5601 ID # SN: 601 ID # SN: 630512475 SN: US37292783	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02862/02833) 03-Apr-19 (No. 217-02862) 03-Apr-19 (No. 217-02863) 04-Apr-19 (No. 217-02864) 04-Apr-19 (No. 217-02864) 29-May-16 (No. EX3-7349, May19) 36-Apr-19 (No. EX3-7349, May19) 36-Apr-19 (No. EX3-7349, May19) 20-Ch-15 (in house check Feb-19) 07-Ch-15 (in house check Cot-18)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 May-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
Calibration Equipment used (M&TE Primary Standards Power meler NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A	E critical for calibration) 1D # SN: 103244 SN: 103244 SN: 103244 SN: 50364 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 6041 ID # SN: 639512475 SN: UIS37292783 SN: UIS37292783 SN: UIS37292783	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02862/02883) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02896) 29-May-19 (No. 217-02896) 29-May-19 (No. 217-02896) 30-Apr-19 (No. 204-4-601 Apr18) Check Date (in house) 10-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Cot-18) 07-Oct-15 (in house check Cot-18)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 May-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
Calibration Equipment used (M&TE Primary Standards Power meler NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A	E ortilcal for calibration) ID # SN: 104778 SN: 103244 SN: 5058 (20k) SN: 1037292783 SN: W37292783 SN: W3729778 SN: W37292783 SN: W372978 SN: W37297878 SN: W372978 SN: W372978 SN: W3729	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02882/02883) 03-Apr-19 (No. 217-02882) 03-Apr-19 (No. 217-02883) 04-Apr-19 (No. 217-02884) 04-Apr-19 (No. 217-02895) 29-May-19 (No. DAE4-601. Apr19) 30-Apr-19 (No. DAE4-601. Apr19) Check Date (in house) 30-Ch-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
Calibration Equipment used (M&TE Primary Standards Power meater NRP Power sensor NRP-Z91 Reference 20 dB Altenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Ref generator R45 SMT-06 Network Analyzer Agilent E8358A	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 601 ID # SN: 603 ID # SN: 053512475 SN: US37292783 SN: W741092317 SN: W741092317 SN: US41080477 Name	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02862/02883) 03-Apr-19 (No. 217-02862) 03-Apr-19 (No. 217-02863) 04-Apr-19 (No. 217-02864) 04-Apr-19 (No. 217-02864) 28-May-16 (No. EX3-7349, May19) 30-Apr-19 (No. EX3-7349, May19) 30-Oct-15 (in house check Cot-18) 77-Oct-15 (in house check Cot-18) 31-Mar-14 (in house check Cot-18) Function	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Calibration Equipment used (M&TE Primary Standards Power meater NRP Power sensor NRP-Z91 Reference 20 dB Altenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Ref generator R45 SMT-06 Network Analyzer Agilent E8358A	E ortilcal for calibration) ID # SN: 104778 SN: 103244 SN: 5058 (20k) SN: 1037292783 SN: W37292783 SN: W372978 SN: W37297	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02882/02883) 03-Apr-19 (No. 217-02882) 03-Apr-19 (No. 217-02883) 04-Apr-19 (No. 217-02884) 04-Apr-19 (No. 217-02895) 29-May-19 (No. DAE4-601. Apr19) 30-Apr-19 (No. DAE4-601. Apr19) Check Date (in house) 30-Ch-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18)	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
Calibration Equipment used (M&TE Primary Standards Power meater NRP Power sensor NRP-Z91 Reference 20 dB Altenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Ref generator R45 SMT-06 Network Analyzer Agilent E8358A	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 601 ID # SN: 603 ID # SN: 053512475 SN: US37292783 SN: W741092317 SN: W741092317 SN: US41080477 Name	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02862/02883) 03-Apr-19 (No. 217-02862) 03-Apr-19 (No. 217-02863) 04-Apr-19 (No. 217-02864) 04-Apr-19 (No. 217-02864) 28-May-16 (No. EX3-7349, May19) 30-Apr-19 (No. EX3-7349, May19) 30-Oct-15 (in house check Cot-18) 77-Oct-15 (in house check Cot-18) 31-Mar-14 (in house check Cot-18) Function	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenutor Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 601 ID # SN: 603 ID # SN: 053512475 SN: US37292783 SN: W741092317 SN: W741092317 SN: US41080477 Name	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02862/02883) 03-Apr-19 (No. 217-02862) 03-Apr-19 (No. 217-02863) 04-Apr-19 (No. 217-02864) 04-Apr-19 (No. 217-02864) 28-May-16 (No. EX3-7349, May19) 30-Apr-19 (No. EX3-7349, May19) 30-Oct-15 (in house check Cot-18) 77-Oct-15 (in house check Cot-18) 31-Mar-14 (in house check Cot-18) Function	Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
Calibration Equipment used (M&T4 Primary Standards Power means NRP Power sensor NRP-291 Reference 20 80 Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power mether E44198 Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	E critical for calibration) ID # SN: 103245 SN: 103245 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 601 ID # SN: 6639512475 SN: 0639512475 SN: US37292783 SN: W741092317 SN: 100972 SN: 100972 SN: 100972 SN: 100972 SN: 100972 SN: 100972	Cal Date (Certificate No.) 03-Apr-19 (No. 217-02882/02883) 03-Apr-19 (No. 217-02889) 03-Apr-19 (No. 217-02889) 04-Apr-19 (No. 217-02884) 04-Apr-19 (No. 217-02884) 29-May-19 (No. 217-02884) 29-May-19 (No. C37-02885) 29-May-19 (No. C37-02865) 20-Apr-19 (No. C37-02865) 20-Apr-19 (No. C37-02865) 20-Apr-19 (No. C37-02865) 20-Apr-19 (No. C37-02865) 20-Apr-19 (No. C37-02865) 20-Apr-19 (No. C37-02865) 20-Ch-15 (in house check Cel-18) 15-Jun-15 (in house check Cel-18) 31-Mar-14 (in house check Cel-18)	Scheduled Caltration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-19

Certificate No: D835V2-4d063\_Aug19

Page 1 of 6

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editation No.: SCS 0108

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TSL ConvF N/A

tissue simulating liquid 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: Weasurement 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 6.612", June 2016
  - 300 MHz to 6 GHz)", July 2016 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 c)
  - 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%.

Certificate No: D835V2-4d063\_Aug19

Page 2 of 6

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Conductivity

#### 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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

#### Head TSL parameters

The following parameters and calculations were	applied.	
a figuration. The second second second second second	Temperature	Permittivity
Nominal Head TSL parameters	22.0 °C	41.5

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)
SAB averaged over 10 cm <sup>3</sup> (10 g) of Head TSI	condition	
SAR averaged over 10 cm <sup>3</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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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.6 Ω - 2.2 jΩ
Return Loss	- 32.8 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction) 1.391 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 leedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG

Certificate No: D835V2-4d063\_Aug19 Page 4 of 6

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Date: 23.08.2019

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

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d063

Communication System: UID 0 - CW; Frequency: 835 MHz Medium parameters used: f = 835 MHz;  $\sigma = 0.92$  S/m;  $\epsilon_r = 42.5$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section

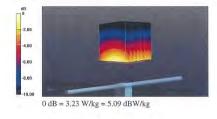
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(9.89, 9.89, 9.89) @ 835 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601: Calibrated: 30.04.2019
- Phantom: Flat Phantom 4.9 (front); 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 = 63.04 V/m; Power Drift = -0.00 dB

 $\begin{array}{l} \mbox{Peak SAR (extrapolated)} = 3.64 \ \mbox{W/kg} \\ \mbox{SAR(1 g)} = 2.42 \ \mbox{W/kg}; \mbox{SAR(10 g)} = 1.57 \ \mbox{W/kg} \end{array}$ Maximum value of SAR (measured) = 3.23 W/kg



Certificate No: D835V2-4d063\_Aug19

Page 5 of 6

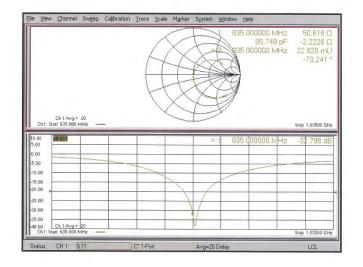
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Impedance Measurement Plot for Head TSL



Certificate No: D835V2-4d063\_Aug19

Page 6 of 6

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Accredited by the Swiss Accreditation The Swiss Accreditation Service Multilateral Agreement for the reco	is one of the signatorie	es to the EA	ccreditation No.: SCS 0108
Client SGS-TW (Auder	1)	Certificate N	o: D1750V2-1008_Aug19
CALIBRATION C	ERTIFICATE		
Object	D1750V2 - SN:1	008	
Calibration procedure(s)	QA CAL-05.v11		
		edure for SAR Validation Sources	s between 0.7-3 GHz
Calibration date:	August 23, 2019	4	
This calibration certificate documer	nts the traceability to nat	ional standards, which realize the physical u	nits of measurements (SI)
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			no are part of the certificate.
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Certificate No: D1750V2-1008\_Aug19

Page 1 of 6

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Calibration Laboratory of Schmid & Partner Engineering AG Zeud



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Accreditation No.: SCS 0108

credited 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 ConvF N/A

tissue simulating liquid 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-

- 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)".
- 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%.

Certificate No: D1750V2-1008\_Aug19

Page 2 of 6

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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	1
Zoom Scan Resolution	dx, dy, dz = 5 mm		
Frequency	1750 MHz + 1 MHz		

#### Head TSL parameters

The following parameters and calculations were applied

Contract of the second s	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 %
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	9.13 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>3</sup> (10 c) of Head TSI	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition 250 mW input power	4.83 W/kg

Certificate No: D1750V2-1008\_Aug19

Page 3 of 6

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Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.0 Ω + 0.6 jΩ
Return Loss	- 38.5 dB

1.222 ns

#### General Antenna Parameters and Design

Electrical Delay (one direction)

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 'Neasurement 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

Certificate No: D1750V2-1008\_Aug19

Page 4 of 6

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Date: 23.08.2019

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

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

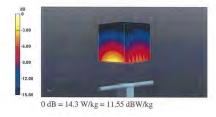
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

### 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=5 Reference Value = 106.5 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 17.0 W/kg

SAR(1 g) = 9.13 W/kg; SAR(10 g) = 4.83 W/kg Maximum value of SAR (measured) = 14.3 W/kg



Certificate No: D1750V2-1008\_Aug19

Page 5 of 6

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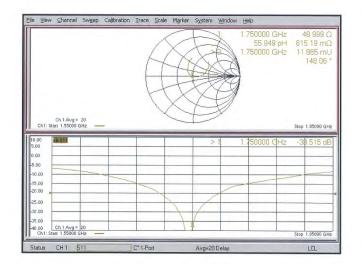
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Impedance Measurement Plot for Head TSL



Certificate No: D1750V2-1008\_Aug19

Page 6 of 6

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Certificate No: D1900V2-5d173\_Apr19

Page 1 of 6

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



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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

## 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%.

Certificate No: D1900V2-5d173\_Apr19

Page 2 of 6

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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.

3 -	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)
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	5.22 W/kg

Certificate No: D1900V2-5d173\_Apr19

Page 3 of 6

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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

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

Certificate No: D1900V2-5d173\_Apr19

Page 4 of 6

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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

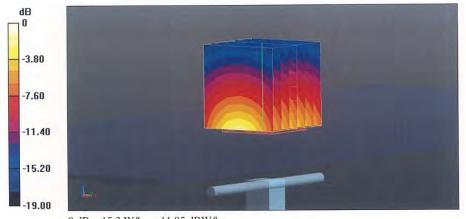
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.38 S/m;  $\epsilon_r$  = 40.6;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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

Page 5 of 6

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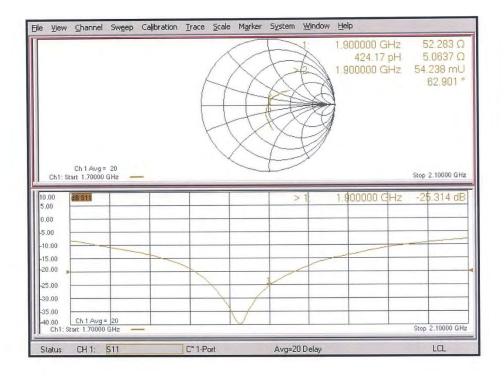
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Report No. : EN/2019/C0015 Rev: 01 Page: 25 of 52

## Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d173\_Apr19

Page 6 of 6

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	en)	Certificate No	: D2300V2-1023_Aug19
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Calibration date:	August 26, 2019		
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rtificate No: D2300V2-1023\_Aug19

Page 1 of 6

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f (886-2) 2298-0488

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



s Schweizerischer Kalibrierdienst Service suisse d'étalonnage C rvizio svizzero di taratu s ee Calibration Se

Accreditation No.: SCS 0108

dited 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:

TSI ConvF N/A

tissue simulating liquid 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%.

Certificate No: D2300V2-1023\_Aug19

Page 2 of 6

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#### Measurement Conditions

ASY 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	2300 MHz ± 1 MHz	

#### Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.4 ± 6 %	1.67 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	12.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	48.1 W/kg ± 17.0 % (k=2)
SAB averaged over 10 cm <sup>3</sup> (10 g) of Head TSI	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 250 mW input power	5.79 W/kg

Certificate No: D2300V2-1023\_Aug19

Page 3 of 6

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Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Electrical Delay (one direction)

Impedance, transformed to feed point	49.4 Ω - 2,8 jΩ
Return Loss	- 30.9 dB

1.172 ns

#### General Antenna Parameters and Design

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

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Manufactured by	SPEAG
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Certificate No: D2300V2-1023 Aug19

Page 4 of 6

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Date: 26.08.2019

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

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN:1023

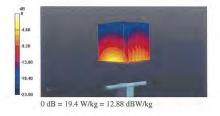
 $\begin{array}{l} \mbox{Communication System: UID 0 - CW; Frequency: 2300 MHz} \\ \mbox{Medium parameters used: } f = 2300 \mbox{ MHz}; \mbox{ } \sigma = 1.67 \mbox{ S/m}; \mbox{ } \epsilon_{r} = 38.4; \mbox{ } \rho = 1000 \mbox{ } kg/m^3 \end{array}$ 

Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.15, 8.15, 8.15) @ 2300 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 = 115.6 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 23.2 W/kg SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.79 W/kg Maximum value of SAR (measured) = 19.4 W/kg



Certificate No: D2300V2-1023\_Aug19

Page 5 of 6

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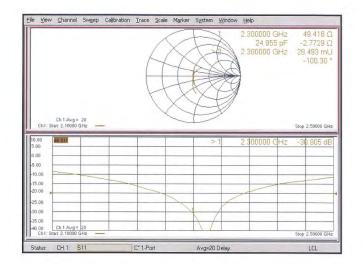
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Impedance Measurement Plot for Head TSL



Certificate No: D2300V2-1023\_Aug19

Page 6 of 6

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	h, Switzerland		<ul> <li>S Schweizerischer Kalibrierdienst</li> <li>Service suisse d'étalonnage</li> <li>Servizio svizzero di taratura</li> <li>S Swiss Calibration Service</li> </ul>
Accredited by the Swiss Accredite The Swiss Accreditation Service Multilateral Agreement for the r	e is one of the signatori		Accreditation No.: SCS 0108
Client SGS-TW (Aude			No: D2450V2-727_Apr19
Object	D2450V2 - SN:7		
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validation Sourc	es between 0.7-3 GHz
Calibration date:	April 24, 2019		
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Page 1 of 6

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Swiss Calibration Service

Accreditation No.: SCS 0108

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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:

- 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%.

Certificate No: D2450V2-727\_Apr19

Page 2 of 6

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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	2450 MHz ± 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 ± 0.2) °C	37.8 ± 6 %	1.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	فككد	

# 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	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.0 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	6.28 W/kg

Certificate No: D2450V2-727\_Apr19

Page 3 of 6

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

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.8 Ω + 2.9 jΩ	
Return Loss	- 24.2 dB	

# General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 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
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Page 4 of 6

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# **DASY5 Validation Report for Head TSL**

Date: 24.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:727

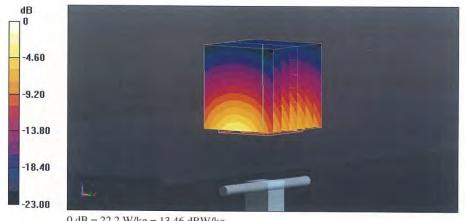
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz;  $\sigma = 1.87 \text{ S/m}$ ;  $\varepsilon_r = 37.8$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 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 = 116.3 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 26.9 W/kg SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.28 W/kg Maximum value of SAR (measured) = 22.2 W/kg



0 dB = 22.2 W/kg = 13.46 dBW/kg

Certificate No: D2450V2-727\_Apr19

Page 5 of 6

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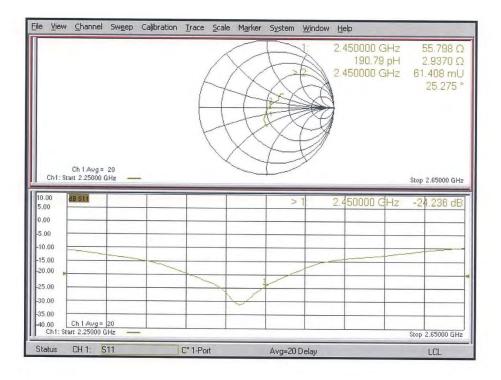
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f (886-2) 2298-0488



Report No. : EN/2019/C0015 Rev: 01 Page: 37 of 52

# Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-727\_Apr19

Page 6 of 6

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Accreditation Service is one of the signatories to the EA Autilational Agreement for the recognition of calibration certificates         Arriter SGS-TW (Auden)       Certificate No: D2600V2-1005_Jan1         CALIBERATION CERTIFICATE       D2600V2 - SN:1005         Calibration procedure(s)       QA CAL-05.v11 Calibration procedure(s)       QA CAL-05.v11 Calibration procedure(s)         Calibration certificate documents the traceability to national standards, which realize the physical units of measurements (sl). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence probability are given on the following pages and are part of the confidence prove sensor NPP-291 SN: 10324 04-Apr-18 (No. 217-02672) Apr-19 SN: 10324 04-Apr-18 (No. 217-02672) Apr-19 SN: 10324 04-Apr-18 (No. 217-02672) Apr-19 Dever and ref	Calibration Laboratory Schmid & Partner Engineering AG eughausstrasse 43, 8004 Zurich,			S Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura S Swiss Calibration Service
CALIBRATION CERTIFICATE         Deject       D2600V2 - SN:1005         Calibration procedure(s)       QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz         Calibration date:       January 28, 2019         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 calibration shave 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       D # Cal Date (Certificate No.) Scheduled Calibration Power sensor NRP-291         SN: 103245       04 Apr-18 (No. 217-02672)       Apr-19         Power sensor NRP-291       SN: 103245       04 Apr-18 (No. 217-02672)       Apr-19         SN: 5058 (20k)       04 Apr-18 (No. 217-02672)       Apr-19       SN: 5058 (20k)       Apr-19         SN: 5068 (20k)       04 Apr-18 (No. 217-02672)       Apr-19       SN: 5058 (20k)       Apr-19       SN: 5058 (20k)       Apr-19       SN: 5058 (20k)       Apr-19       SN: 5058 (20k)       Apr-19 (No. 217-02672)       Apr-19       SN: 5058 (20k)       Apr-19 (No. 217-02672)       Apr-19       SN: 5058 (20k)       Apr-19 (No. 217-02672)       Apr-19 (No. 217-02672)       <	he Swiss Accreditation Service i	s one of the signatorie		Accreditation No.: SCS 0108
Object         D2600V2 - SN:1005           Calibration procedure(s)         QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz           Calibration date:         January 28, 2019           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         D #         Cal Date (Certificate No.)         Scheduled Calibration           Power sensor NRP-291         SN: 104778         04-Apr-18 [No. 217-02672)         Apr-19           Power sensor NRP-291         SN: 103244         04-Apr-18 [No. 217-02672)         Apr-19           Power sensor NRP-291         SN: 103245         04-Apr-18 [No. 217-02682)         Apr-19           Reference 20 dB Attenuator         SN: 5047.2 / 06327         04-Apr-18 [No. 217-02682)         Apr-19           SN: 5047.2 / 06327         04-Apr-18 [No. 217-02682)         Apr-19           DAE4         SN: 5047.2 / 06327         04-Apr-18 [No. 217-02682)         Apr-19           SN: 5047.2 / 06327         04-Apr-18 [No. 217-02682)         Apr-19           D#         Chec			Laboration of the second	ficate No: D2600V2-1005_Jan19
Calibration procedure(s)       QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz         Calibration date:       January 28, 2019         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 calibration shave 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 sensor NRP-291       SN: 104778       04-Apr-18 (No. 217-02672)       Apr-19         Power sensor NRP-291       SN: 103244       04-Apr-18 (No. 217-02673)       Apr-19         Reference 20 dB Attenuator       SN: 5058 (20K)       04-Apr-18 (No. 217-02673)       Apr-19         Reference 20 dB Attenuator       SN: 5047.2 / 06327       04-Apr-18 (No. 217-02683)       Apr-19         SN: 5047.2 / 06327       04-Apr-18 (No. 217-02683)       Apr-19         DAE4       SN: 601       04-Oct-15 (In house check Cot-18)       Dec-18         DAE4       SN: 6037480704       07-Oct-15 (In house check Cot-18)       In house check: Oct-20         Power sensor HP 8481A       SN: 103727       15	CALIBRATION CI	ERTIFICATI		
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz         Calibration date:       January 28, 2019         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 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. 217-02672/02673)       Apr-19         Power sensor NRP-Z91       SN: 103245       04-Apr-18 (No. 217-02672/02673)       Apr-19         Reference 20 B Attenuator       SN: 503245       04-Apr-18 (No. 217-02672)       Apr-19         Reference Probe EX3DV4       SN: 5047.2 / 06327       04-Apr-18 (No. 217-02682)       Apr-19         Reference Probe EX3DV4       SN: 5047.2 / 06327       04-Apr-18 (No. 217-02682)       Apr-19         Reference Probe EX3DV4       SN: 601       04-Oct-18 (No. DAE4-601_Oct18)       Dec-19         Secondary Standards       D#       Check Date (in house)       Scheduled Check         Power sensor HP 8481A       SN: 0537292783       07-Oct-15 (in house chec	Object	D2600V2 - SN:1	005	
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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: 5058 (20k)     04-Apr-18 (No. 217-02682)     Apr-19       Reference Probe EX3DV4     SN: 7349     31-Dec-18 (No. EX3-7349_Dec18)     Dec-19       Secondary Standards     ID #     Check Date (in house)     Scheduled Check       Power meter EPM-442A     SN: GB37480704     07-Oct-15 (in house check Oct-18)     In house check: Oct-20       Power sensor HP 8481A     SN: 103272     15-Jun-15 (in house check Oct-18)     In house check: Oct-20       SN: 100972     15-Jun-15 (in house check Oct-18)     In house check: Oct-20       SN: 100972     15-Jun-15 (in house check Oct-18)     In house check: Oct-20       SN: 100972     15-Jun-15 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-M		the second in other data that a second second	the second se	
Reference 20 dB Attenuator       SN: 5058 (20k)       04-Apr-18 (No. 217-02682)       Apr-19         Sype-N mismatch combination       SN: 5047.2 / 06327       04-Apr-18 (No. 217-02683)       Apr-19         SN: 7349       31-Dec-18 (No. 217-02683)       Apr-19         SN: 601       04-Oct-18 (No. EX3-7349_Dec18)       Dec-19         Secondary Standards       ID #       Check Date (in house)       Scheduled Check         Power meter EPM-442A       SN: GB37480704       07-Oct-15 (in house check Oct-18)       In house check: Oct-20         Power sensor HP 8481A       SN: US37292783       07-Oct-15 (in house check Oct-18)       In house check: Oct-20         SN: 100972       15-Jun-15 (in house check Oct-18)       In house check: Oct-20       SN: 100972       SN: 100972         SN: US41080477       31-Mar-14 (in house check Oct-18)       In house check: Oct-20       SN: US41080477       In house check: Oct-19         Calibrated by:       Name       Function       Signature         Calibrated by:       Name       Function       Signature		a la construction de la construc		
Fype-N mismatch combination Reference Probe EX3DV4     SN: 5047.2 / 06327     04-Apr-18 (No. 217-02683)     Apr-19       SAE4     SN: 7349     31-Dec-18 (No. EX3-7349_Dec18)     Dec-19       SAE4     SN: 601     04-Oct-18 (No. DAE4-601_Oct18)     Oct-19       Secondary Standards     ID #     Check Date (in house)     Scheduled Check       Power meter EPM-442A     SN: GB37480704     07-Oct-15 (in house check Oct-18)     In house check: Oct-20       Power sensor HP 8481A     SN: US37292783     07-Oct-15 (in house check Oct-18)     In house check: Oct-20       SN: 100972     15-Jun-15 (in house check Oct-18)     In house check: Oct-20       SN: 100972     15-Jun-15 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     31-Mar-14 (in house check Oct-18)     In house check: Oct-20       SN: US41080477     10-Mar-14		the state of the state of the state of the		
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Approved by: Katja Pokovic Technical Manager	Calibrated by:	Manu Seitz	Laboratory Technicia	n and
100 /	Approved by:	Katja Pokovic	Technical Manager	flet
lanual lanuar 00,0010				Issued: January 28, 2019

Certificate No: D2600V2-1005\_Jan19

Page 1 of 6

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



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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

# Gloceary

chossary.	
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%.

Certificate No: D2600V2-1005 Jan19

Page 2 of 6

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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		

# 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

Certificate No: D2600V2-1005\_Jan19

Page 3 of 6

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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
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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	
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Certificate No: D2600V2-1005 Jan19

Page 4 of 6

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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;  $\sigma = 2.03 \text{ S/m}$ ;  $\varepsilon_r = 37.3$ ;  $\rho = 1000 \text{ kg/m}^3$ 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

Certificate No: D2600V2-1005 Jan19

Page 5 of 6

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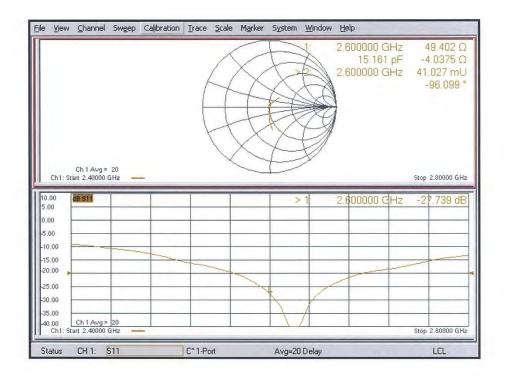
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Report No. : EN/2019/C0015 Rev: 01 Page: 43 of 52

# Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1005\_Jan19

Page 6 of 6

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lient SGS-TW (Auden	*	Survey	o: D5GHzV2-1023_Jan19
CALIBRATION C	ERTIFICATE		
Dbject	D5GHzV2 - SN:1	023	
Calibration procedure(s)	QA CAL-22.v4 Calibration Proce	dure for SAR Validation Sources	s between 3-6 GHz
Calibration date:	January 30, 2019	)	
All calibrations have been conducte	ed in the closed laborato	rv facility: environment temperature (22 ± 3)"	C and humidity < 70%.
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Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID #	Cal Date (Certificate No.) 04-Apr-18 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02682) 04-Apr-18 (No. 217-02683) 31-Dec-18 (No. EX3-3503_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-19 Dec-19 Oct-19 Scheduled Check
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: WY41092317	Cal Date (Certificate No.)           04-Apr-18 (No. 217-02672/02673)           04-Apr-18 (No. 217-02672)           04-Apr-18 (No. 217-02673)           04-Apr-18 (No. 217-02682)           04-Apr-18 (No. 217-02683)           31-Dec-18 (No. 217-02683)           31-Dec-18 (No. EX3-3503_Dec18)           04-Oct-18 (No. DAE4-601_Oct18)           Check Date (in house)           07-Oct-15 (in house check Oct-18)           07-Oct-15 (in house check Oct-18)           07-Oct-15 (in house check Oct-18)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-19 Dec-19 Oct-19 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
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Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination. Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: US37292783 SN: MY41092317 SN: US41080477 Name	Cal Date (Certificate No.)           04-Apr-18 (No. 217-02672/02673)           04-Apr-18 (No. 217-02672)           04-Apr-18 (No. 217-02673)           04-Apr-18 (No. 217-02683)           04-Apr-18 (No. 217-02683)           01-Dec-18 (No. 217-02683)           01-Dec-18 (No. DAE4-601_Oct18)           Check Date (in house)           07-Oct-15 (in house check Oct-18)           07-Oct-15 (in house check Oct-18)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-19 Oct-19 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: WY41092317 SN: 100972 SN: US41060477	Cal Date (Certificate No.)           04-Apr-18 (No. 217-02672/02673)           04-Apr-18 (No. 217-02672)           04-Apr-18 (No. 217-02683)           04-Apr-18 (No. 217-02682)           04-Apr-18 (No. 217-02683)           31-Dec-18 (No. EX3-3503_Dec18)           04-Oct-18 (No. DAE4-601_Oct18)           Check Date (in house)           07-Oct-15 (in house check Oct-18)           07-Oct-15 (in house check Oct-18)           07-Oct-15 (in house check Oct-18)           15-Jun-15 (in house check Oct-18)           31-Mar-14 (in house check Oct-18)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-19 Dec-19 Oct-19 Scheduled Check In house check: Oct-20 In house check: Oct-20
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination. Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: US37292783 SN: MY41092317 SN: US41080477 Name	Cal Date (Certificate No.)           04-Apr-18 (No. 217-02672/02673)           04-Apr-18 (No. 217-02672)           04-Apr-18 (No. 217-02673)           04-Apr-18 (No. 217-02683)           04-Apr-18 (No. 217-02683)           01-Dec-18 (No. 217-02683)           01-Dec-18 (No. DAE4-601_Oct18)           Check Date (in house)           07-Oct-15 (in house check Oct-18)           07-Oct-15 (in house check Oct-18)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-19 Dec-19 Oct-19 Scheduled Check In house check: Oct-20 In house check: Oct-20

Certificate No: D5GHzV2-1023\_Jan19

Page 1 of 9

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



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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

# Glossarv:

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
- 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%.

Certificate No: D5GHzV2-1023\_Jan19

Page 2 of 9

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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 V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

# Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.8 ± 6 %	4.49 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	The second second
SAR measured	100 mW input power	7.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.2 W/kg ± 19.9 % (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 100 mW input power	2.24 W/kg

Certificate No: D5GHzV2-1023\_Jan19

Page 3 of 9

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# Head TSL parameters at 5300 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.6 ± 6 %	4.59 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		يىن

# SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.6 W / kg ± 19.9 % (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 100 mW input power	2.34 W/kg

#### Head TSL parameters at 5600 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.2 ± 6 %	4.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	85.7 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL.	condition	
SAR measured	100 mW input power	2.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.4 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1023\_Jan19

Page 4 of 9

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#### Head TSL parameters at 5800 MHz The following parameters and calculations were applied

a construction of the second sec	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.9 ± 6 %	5.11 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	÷	

#### SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.4 W/kg ± 19.9 % (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 100 mW input power	2.26 W/kg

Certificate No: D5GHzV2-1023\_Jan19

Page 5 of 9

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

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.2 Ω - 8.5 jΩ
Return Loss	- 21.4 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	51.0 Ω - 3.9 jΩ	
Return Loss	- 28.0 dB	

# Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.9 Ω - 1.6 jΩ
Return Loss	- 26.2 dB

# Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.8 Ω + 1.3 jΩ	
Return Loss	- 25.0 dB	

# General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 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

Certificate No: D5GHzV2-1023\_Jan19

Page 6 of 9

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# **DASY5 Validation Report for Head TSL**

Date: 30.01.2019

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1023

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz Medium parameters used: f = 5200 MHz;  $\sigma = 4.49 \text{ S/m}$ ;  $\varepsilon_r = 36.8$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used: f = 5300 MHz;  $\sigma = 4.59 \text{ S/m}$ ;  $\varepsilon_r = 36.6$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used: f = 5600 MHz;  $\sigma = 4.9 \text{ S/m}$ ;  $\varepsilon_r = 36.2$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used: f = 5800 MHz;  $\sigma = 5.11 \text{ S/m}$ ;  $\varepsilon_r = 35.9$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.69, 5.69, 5.69) @ 5200 MHz, ConvF(5.45, 5.45, 5.45) @ 5300 ٠ MHz, ConvF(5, 5, 5) @ 5600 MHz, ConvF(4.96, 4.96, 4.96) @ 5800 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=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 75.39 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 28.7 W/kg SAR(1 g) = 7.89 W/kg; SAR(10 g) = 2.24 W/kg Maximum value of SAR (measured) = 18.0 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 76.71 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 29.9 W/kg SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.34 W/kg Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 76.95 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 32.9 W/kg SAR(1 g) = 8.55 W/kg; SAR(10 g) = 2.43 W/kg Maximum value of SAR (measured) = 20.1 W/kg

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Page 7 of 9

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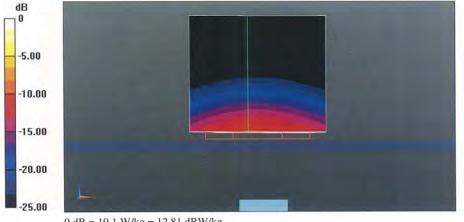
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Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 74.52 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 32.1 W/kg SAR(1 g) = 8.02 W/kg; SAR(10 g) = 2.26 W/kg Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 19.1 W/kg = 12.81 dBW/kg

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Page 8 of 9

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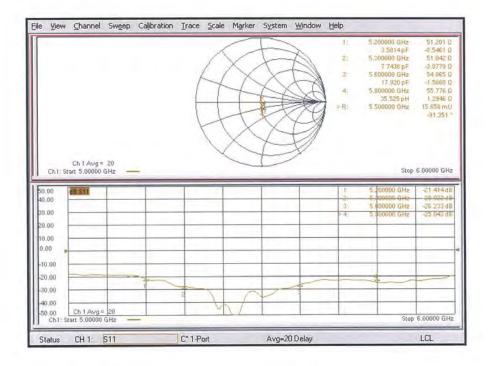
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Report No. : EN/2019/C0015 Rev: 01 Page: 52 of 52

# Impedance Measurement Plot for Head TSL



Certificate No: D5GHzV2-1023\_Jan19

Page 9 of 9

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