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Appendix C

Phantom Description

Schmid & Partner Engineering AG

a

Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 44 245 9700, Fax +41 44 245 9779 info@speag.com, http://www.speag.com

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	

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.

- [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 Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003
- [3] 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:
- 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: 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)^a, 2010-03-30

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

25.7.2011

Signature / Stamp

Doc No 881 - QD OVA 002 A - A

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System Validation from Original Equipment Supplier

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





S Schweizerischer Kallbrierdienst Service suisse d'étalonnage Servizio svizzero di taratura

Swiss Calibration Service

Accreditation No.: SCS 0108

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

Client SG

SGS-TW (Auden)

Certificate No: D750V3-1015_Aug20

Object	D750V3 - SN:1015		
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	August 13, 2020		
		onal standards, which realize the physical un robability are given on the following pages an	
All calibrations have been conducted	ed in the closed laborator	ry facility; environment temperature (22 ± 3)°C	C and humidity < 70%.
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
ower sensor NHP-Z91			4
	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Power sensor NRP-Z91	SN: 103245 SN: BH9394 (20k)	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106)	Apr-21
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	SN: BH9394 (20k) SN: 310982 / 06327	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104)	Apr-21 Apr-21
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20)	Apr-21 Apr-21 Jun-21
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: BH9394 (20k) SN: 310982 / 06327	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104)	Apr-21 Apr-21
Power sensor NRP-Z91 Reference 20 dB Attenuator	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20)	Apr-21 Apr-21 Jun-21
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-501_Dec19)	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-501_Dec19) Check Date (in house)	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-501_Dec19) Check Date (in house)	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18)	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-501_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-501_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18)	Apr-21 Apr-21 Jun-21 Dec-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: 100972 SN: US41080477	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-501_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 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-19)	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-M mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-501_Dec19) Check Date (in house) 30-Oct-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)	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A PF generator R&S SMT-06	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: 100972 SN: US41080477	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-501_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 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-19)	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: 100972 SN: US41080477	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-501_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 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-19)	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name Jeffrey Katzman	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-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-19) Function Laboratory Technician	Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20

Certificate No: D750V3-1015_Aug20

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Glossary:

TSL tissue simulating liquid ConvF N/A

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

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
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions

DASY Version	DASY5	V52.10.4
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

ng 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	42,4 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.48 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1,40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.53 W/kg ± 16.5 % (k=2)

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.7 Ω - 0.5 jΩ
Return Loss	- 31.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.038 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
Inditidation by	

Certificate No: D750V3-1015_Aug20

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DASY5 Validation Report for Head TSL

Date: 13.08.2020

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; $\sigma = 0.91 \text{ S/m}$; $\varepsilon_r = 42.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(9,97, 9.97, 9.97) @ 750 MHz; Calibrated: 29.06.2020

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

Electronics: DAE4 Sn601; Calibrated: 27.12.2019

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

DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 59.36 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.22 W/kg

SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.4 W/kg

Smallest distance from peaks to all points 3 dB below = 18.4 mm

Ratio of SAR at M2 to SAR at M1 = 66.8% Maximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 4.55 dBW/kg

Certificate No: D750V3-1015_Aug20

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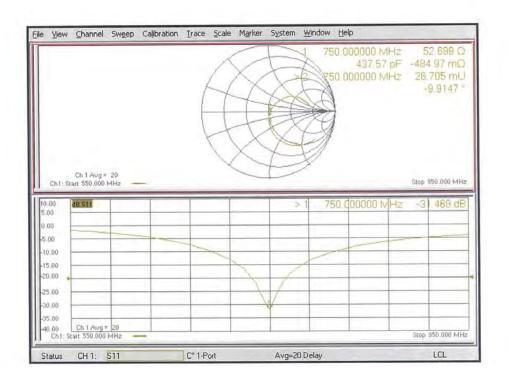
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Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1015_Aug20 Page 6 of 6

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





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S 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

CCC TW (Auden)

Certificate No: D835V2-4d063 Aug20

ALIDITATION OF	RTIFICATE		
Dbject	D835V2 - SN:4d063		
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	August 13, 2020		
The measurements and the uncerta All calibrations have been conducted	ainties with confidence particles with confidence particles with confidence particles with the closed laborator	onal standards, which realize the physical uni robability are given on the following pages an ry facility: environment temperature $(22 \pm 3)^{\circ}$ C	d are part of the certificate.
Calibration Equipment used (M&TE Primary Standards	critical for calibration)	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Carried Landson Control Control	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Reference 20 dB Attenuator		31-Mar-20 (No. 217-03104)	Apr-21
Manual des malada y Managara	SN: 310982 / 06327	31-Mai-50 (MO. 517-0310-1)	
Type-N mismatch combination	SN: 310982 / 06327 SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
Type-N mismatch combination Reference Probe EX3DV4			Jun-21 Dec-20
Type-N mismatch combination Reference Probe EX3DV4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Dec-20 Scheduled Check
Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: 7349 SN: 601	29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19)	Dec-20 Scheduled Check In house check: Oct-20
Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783	29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18)	Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E44198 Power sensor HP 8481A Power sensor HP 8481A	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18)	Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-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-19) Function	Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 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-19)	Scheduled Check In house check: Oct-20
Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-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-19) Function	Scheduled Check In house check: Oct-20

Certificate No: D835V2-4d063_Aug20

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





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

Swiss Calibration Service

Accreditation No.: SCS 0108

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Glossary:

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

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
- 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_Aug20

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Measurement Conditions

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

ASY system configuration, as far as not	given on page 1.	16-6145-2
DASY Version	DASY5	V52.10.4
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.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.2 ± 6 %	0.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm2 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.52 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.21 W/kg ± 16.5 % (k=2)

Certificate No: D835V2-4d063_Aug20

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0 Ω - 2.0 jΩ
Return Loss	- 34.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1,392 ns
Electrical point (ellectric)	11911

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
Wildingtoned by	

Certificate No: D835V2-4d063_Aug20

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DASY5 Validation Report for Head TSL

Date: 13.08.2020

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; $\sigma = 0.93 \text{ S/m}$; $\varepsilon_r = 42.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(9.69, 9.69, 9.69) @ 835 MHz; Calibrated: 29.06.2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 27.12.2019

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

DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

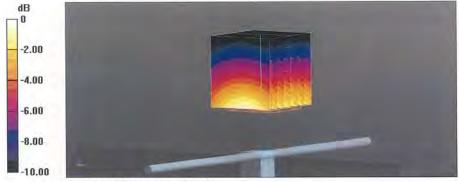
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 62.56 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 3.61 W/kg

SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.58 W/kg

Smallest distance from peaks to all points 3 dB below = 17 mm

Ratio of SAR at M2 to SAR at M1 = 67.4% Maximum value of SAR (measured) = 3.19 W/kg



0 dB = 3.19 W/kg = 5.04 dBW/kg

Certificate No: D835V2-4d063_Aug20

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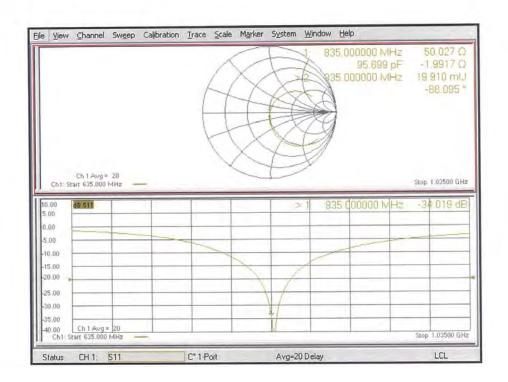
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Impedance Measurement Plot for Head TSL



Certificate No: D835V2-4d063_Aug20 Page 6 of 6

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Multilateral Agreement for the recognition of calibration certificates

Multilateral Agreement for the recognition of calibration certificates

Client SGS-TW (Auden)

Certificate No: D1750V2-1008_Aug20

CALIBRATION CERTIFICATE Object D1750V2 - SN:1008 Calibration procedure(s) QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration date: August 14, 2020 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 Cal Date (Certificate No.) Scheduled Calibration Power meter NRP SN: 104778 01-Apr-20 (No. 217-03100/03101) Apr-21 Power sensor NRP-Z91 SN: 103244 01-Apr-20 (No. 217-03100) Apr-21 Power sensor NRP-Z91 SN: 103245 01-Apr-20 (No. 217-03101) Apr-21 Reference 20 dB Attenuator SN: BH9394 (20k) 31-Mar-20 (No. 217-03106) Apr-21 Type-N mismatch combination SN: 310982 / 06327 31-Mar-20 (No. 217-03104) Apr-21 Reference Probe EX3DV4 SN: 7349 29-Jun-20 (No. EX3-7349 Jun20) Jun-21 DAF4 SN: 601 27-Dec-19 (No. DAE4-601_Dec19). Dec-20 Secondary Standards Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Feb-19) In house check: Oct-20 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-18) In house check: Oct-20 Power sensor HP 8481A SN: MY41092317 07-Oct-15 (in house check Oct-18) In house check: Oct-20 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-18) In house check: Oct-20 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-19) In house check: Oct-20 Name Calibrated by: Claudio Leubler Laboratory Technician Katja Pokovic Approved by: Technical Manager Issued: August 14, 2020 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Certificate No: D1750V2-1008_Aug20

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





S Schweizerischer Kalibrierdienst
Service suisse d'étalonnage
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S 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:

- 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
- EC 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: D1750V2-1008_Aug20

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Measurement Conditions

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1,37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	1.35 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.0 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.68 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	18.9 W/kg ± 16.5 % (k=2)

Certificate No: D1750V2-1008_Aug20

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.2 Ω + 1,4 jΩ	
Return Loss	- 34.9 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1,221 ns
The state of the s	0.000

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
	1122

Certificate No: D1750V2-1008_Aug20

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DASY5 Validation Report for Head TSL

Date: 14.08.2020

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; $\sigma = 1.35 \text{ S/m}$; $\varepsilon_r = 40.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.58, 8.58, 8.58) @ 1750 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 103.4 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 16.6 W/kg

SAR(1 g) = 8.89 W/kg; SAR(10 g) = 4.68 W/kg

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 55%

Maximum value of SAR (measured) = 13.3 W/kg



0 dB = 13.3 W/kg = 11.24 dBW/kg

Certificate No: D1750V2-1008_Aug20

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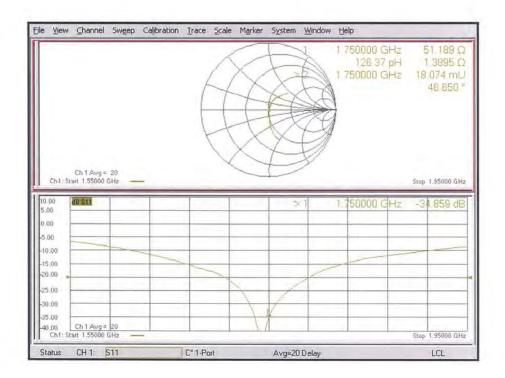
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Impedance Measurement Plot for Head TSL



Certificate No: D1750V2-1008_Aug20

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





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Accreditation No.: SCS 0108

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SGS-TW (Auden)

Certificate No: D1900V2-5d173_Apr20

	RTIFICATE		
Object	D1900V2 - SN:50	1173	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	April 22, 2020		
The measurements and the uncerta	ainties with confidence p	onal standards, which realize the physical un robability are given on the following pages ar y facility: environment temperature $(22 \pm 3)^{n}$	nd are part of the certificate.
Calibration Equipment used (M&TE Primary Standards	critical for calibration)	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
ype-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
ypo is mainator combination	SN: 7349	31-Dec-19 (No. EX3-7349_Dec19)	Dec-20
Reference Probe EX3DV4	SN: 601	27-Dec-19 (No. DAE4-601_Dec19)	Dec-20
Reference Probe EX3DV4 DAE4 Secondary Standards	ID#	Check Date (in house)	Scheduled Check
DAE4 Secondary Standards	ID# SN: GB39512475	Check Date (in house) 30-Oct-14 (in house check Feb-19)	In house check; Oct-20
DAE4 Secondary Standards Power meter E4419B		30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18)	In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A	SN: GB39512475	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18)	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB39512475 SN: US37292783 SN: MY41092317	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	30-Oct-14 (in house check Feb-19) 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-19) Function	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	30-Oct-14 (in house check Feb-19) 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-19)	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
DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	30-Oct-14 (in house check Feb-19) 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-19) Function	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

Certificate No: D1900V2-5d173 Apr20

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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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Glossary:

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

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 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
- 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_Apr20

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Measurement Conditions

DASV system configuration, as far as not given on page 1

DASY Version	DASY5	V52.10.4
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.

	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	41.1 ± 6 %	1.39 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	244	

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.4 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.5 W/kg ± 16.5 % (k=2)

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.6 Ω + 5.1 jΩ	
Return Loss	-25.9 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured by	SPEAG

Certificate No: D1900V2-5d173_Apr20

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DASY5 Validation Report for Head TSL

Date: 22.04.2020

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; $\sigma = 1.39$ S/m; $\epsilon_r = 41.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.6, 8.6, 8.6) @ 1900 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 108.3 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 18.1 W/kg SAR(1 g) = 9.75 W/kg; SAR(10 g) = 5.10 W/kgSmallest distance from peaks to all points 3 dB below = 9.8 mm Ratio of SAR at M2 to SAR at M1 = 54.5%Maximum value of SAR (measured) = 15.2 W/kg



0 dB = 15.2 W/kg = 11.82 dBW/kg

Certificate No: D1900V2-5d173 Apr20

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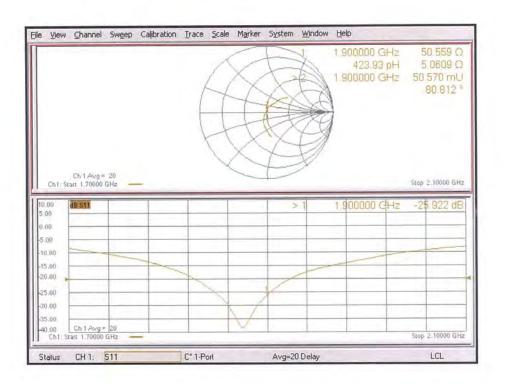
台灣檢驗科技股份有限公司



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Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d173_Apr20 Page 6 of 6

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





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Accreditation No.: SCS 0108

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SGS-TW (Auden)

Certificate No: D2300V2-1023_Aug20

CALIBRATION CE	III IOAIL		
Object	D2300V2 - SN:10	23	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	August 13, 2020		
The measurements and the uncertain	aintles with confidence po	onal standards, which realize the physical un robability are given on the following pages an y facility: environment temperature (22 ± 3)°C	d are part of the certificate.
Calibration Equipment used (M&TE		y laumy, environment temperature (22.2.3)	Sala homony - 10 of
Primary Standards	ID W	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19)	Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Jun-21 Dec-20
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475 SN: US37292783 SN: MY41092317	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Aglient E8358A	SN: 100972 SN: US41080477	15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19)	In house check: Oct-20
Power sensor HP 8481A RF generator R&S SMT-06			In house check: Oct-20 Signature
Power sensor HP 8481A RF generator R&S SMT-06	SN: US41080477	31-Mar-14 (in house check Oct-19)	,
Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Aglient E8358A	SN: US41080477 Name	31-Mar-14 (in house check Oct-19) Function	,

Certificate No: D2300V2-1023_Aug20

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Glossary:

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

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
 - 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_Aug20

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Measurement Conditions

DASY Version	DASY5	V52,10.4
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

The following parameters and calculations were applied.

is following parameters and serverising their app	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	39.4 ± 6 %	1.68 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	1000	Same?

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	49.0 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5,93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.7 W/kg ± 16.5 % (k=2)

Certificate No: D2300V2-1023_Aug20

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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 - 2.4 jΩ
Return Loss	- 31.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.172 ns

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

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

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

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL

Date: 13.08.2020

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2300 MHz

Medium parameters used: f = 2300 MHz; $\sigma = 1.68$ S/m; $\epsilon_r = 39.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(7.82, 7.82, 7.82) @ 2300 MHz; Calibrated: 29.06.2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 27.12.2019

Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

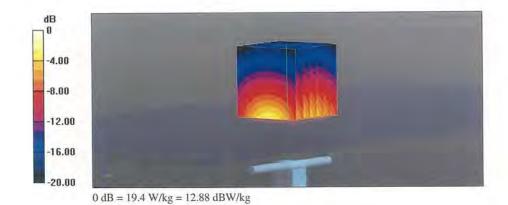
DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 115.2 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 23.1 W/kg SAR(1 g) = 12.3 W/kg; SAR(10 g) = 5.93 W/kg

Smallest distance from peaks to all points 3 dB below = 9.2 mm

Ratio of SAR at M2 to SAR at M1 = 53.8% Maximum value of SAR (measured) = 19.4 W/kg



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Certificate No: D2300V2-1023_Aug20

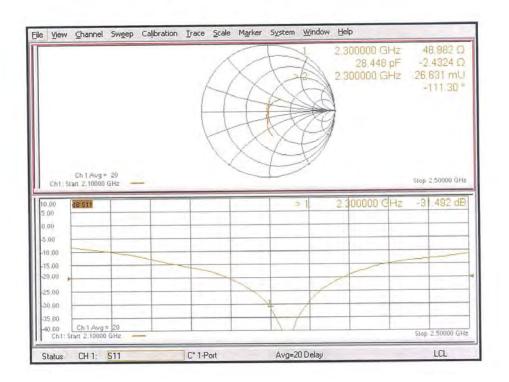
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Impedance Measurement Plot for Head TSL



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SGS-TW (Auden) Certificate No: D2600V2-1005_Jan20 CALIBRATION CERTIFICATE D2600V2 - SN:1005 Calibration procedure(s) QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration date: January 29, 2020 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 Cal Date (Certificate No.) Scheduled Calibration SN: 104778 03-Apr-19 (No. 217-02892/02893) Apr-20 Power sensor NRP-Z91 SN: 103244 03-Apr-19 (No. 217-02892) Apr-20 Power sensor NRP-Z91 SN: 103245 03-Apr-19 (No. 217-02893) Apr-20 Reference 20 dB Attenuator SN: 5058 (20k) 04-Apr-19 (No. 217-02894) Apr-20 SN: 5047.2 / 06327 04-Apr-19 (No. 217-02895) Type-N mismatch combination Apr-20 Reference Probe EX3DV4 SN: 7349 31-Dec-19 (No. EX3-7349_Dec19) Dec-20 DAE4 SN: 601 27-Dec-19 (No. DAE4-601_Dec19) Dec-20 Secondary Standards ID II Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Feb-19) In house check: Oct-20 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-18) In house check: Oct-20 Power sensor HP 8481A SN: MY41092317 07-Oct-15 (in house check Oct-18) In house check: Oct-20 15-Jun-15 (in house check Oct-18) In house check: Oct-20 RF generator R&S SMT-06 SN: 100972 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-19) In house check: Oct-20 Function Calibrated by: Claudio Leubler Laboratory Technician Technical Manager Katia Pokovic Approved by: Issued: January 30, 2020 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D2600V2-1005 Jan20

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Glossary:

TSL

tissue simulating liquid

ConvF N/A

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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 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
- 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_Jan20

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Measurement Conditions

DASY system configuration, as far as not given on page

DASY Version	DASY5	V52.10.3
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	38.7 ± 6 %	2.03 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	1990	

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	57.3 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.5 W/kg ± 16.5 % (k=2)

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.3 Ω - 4.6 jΩ	
Return Loss	- 26.1 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.156 ns

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

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

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

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL

Date: 29.01.2020

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; $\sigma = 2.03 \text{ S/m}$; $\varepsilon_r = 38.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(7.69, 7.69, 7.69) @ 2600 MHz; Calibrated: 31.12.2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics; DAE4 Sn601; Calibrated: 27.12.2019

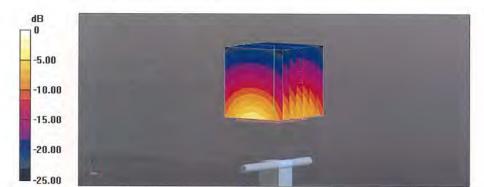
Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

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 = 120.5 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 29.7 W/kg SAR(1 g) = 14.6 W/kg; SAR(10 g) = 6.45 W/kgSmallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 49.2%

Maximum value of SAR (measured) = 24.5 W/kg



0 dB = 24.5 W/kg = 13.89 dBW/kg

Certificate No: D2600V2-1005_Jan20

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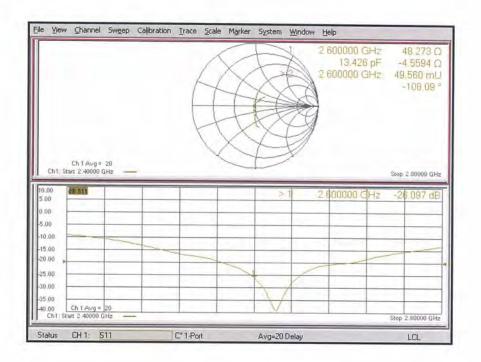
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Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1005_Jan20

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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

Client SGS-TW (Auden)

Certificate No: D3500V2-1009_Aug20

Object	D3500V2 - SN:1009		
Calibration procedure(s)	QA CAL-22.v5 Calibration Procedure for SAR Validation Sources between 3-10 GHz		
Calibration date:	August 12, 2020		
The measurements and the uncertainty	ainties with confidence pr	onal standards, which realize the physical unicobability are given on the following pages and y facility: environment temperature $(22 \pm 3)^{\circ}$ C	d are part of the certificate.
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
OMEL SELISOLIALIT -531		01-Apr-20 (No. 217-03101)	Apr-21
	SN: 103245		
Power sensor NRP-Z91	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Power sensor NRP-Z91 Reference 20 dB Attenuator	SN: BH9394 (20k) SN: 310982 / 06327	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104)	Apr-21 Apr-21
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19)	Apr-21 Apr-21 Mar-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: BH9394 (20k) SN: 310982 / 06327	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104)	Apr-21 Apr-21
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19)	Apr-21 Apr-21 Mar-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19)	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house)	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19)	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18)	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18)	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Aglient E8358A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 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-19) Function	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: US41080477	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-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)	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name Jeton Kastrati	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 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-19) Function Laboratory Technician	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check In house check: Oct-20
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A PF generator R&S SMT-06 Network Analyzer Aglient E8358A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 25-Mar-19 (No. EX3-3503_Mar19) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 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-19) Function	Apr-21 Apr-21 Mar-20 Dec-20 Scheduled Check In house check: Oct-20

Certificate No: D3500V2-1009_Aug20

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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:

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

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
- 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: D3500V2-1009_Aug20

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Measurement Conditions

DASY5	V52.10.4
Advanced Extrapolation	
Modular Flat Phantom	
10 mm	with Spacer
dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
3500 MHz ± 1 MHz	
	Advanced Extrapolation Modular Flat Phantom 10 mm dx, dy = 4 mm, dz = 1.4 mm

Head TSL parameters

ne following parameters and calculations were appri	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.9	2,91 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.9 ± 6 %	2,90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.56 W/kg
SAR for nominal Head TSI, parameters	normalized to 1W	25.5 W/kg ± 19.5 % (k=2)

Certificate No: D3500V2-1009_Aug20

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54,9 Ω - 3.5 jΩ
To come the control of the control o	- 24.8 dB
Return Loss	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.133 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
33.000	

Certificate No: D3500V2-1009_Aug20

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DASY5 Validation Report for Head TSL

Date: 12.08.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1009

Communication System: UID 0 - CW; Frequency: 3500 MHz

Medium parameters used: f = 3500 MHz; $\sigma = 2.9$ S/m; $\varepsilon_r = 36.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.91, 7.91, 7.91) @ 3500 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3500MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.77 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 18.5 W/kg

SAR(1 g) = 6.8 W/kg; SAR(10 g) = 2.56 W/kg

Smallest distance from peaks to all points 3 dB below = 8.2 mm

Ratio of SAR at M2 to SAR at M1 = 74.5%

Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Certificate No: D3500V2-1009_Aug20

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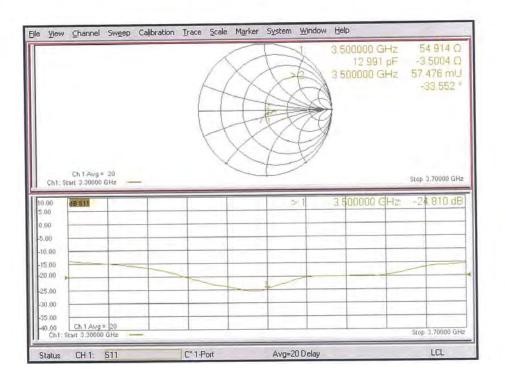
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Impedance Measurement Plot for Head TSL



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The Swiss Accreditation Service is one of the signatories to the EA

Multilateral Agreement for the recognition of calibration certificates Accreditation No.: SCS 0108 Client SGS-TW (Auden) Certificate No: D3700V2-1057_Nov19 **CALIBRATION CERTIFICATE** D3700V2 - SN:1057 QA CAL-22.v4 Calibration Procedure for SAR Validation Sources between 3-6 GHz Calibration procedure(s) This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (5 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certific 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 Cal Date (Certificate No.) Scheduled Calibration SN: 104778 SN: 103244 SN: 103245 Cal Date (Certificate No.)
03-Apr-19 (No. 217-02892)
03-Apr-19 (No. 217-02892)
03-Apr-19 (No. 217-02893)
04-Apr-19 (No. 217-02894)
04-Apr-19 (No. 217-02894)
04-Apr-19 (No. 217-02894)
03-Apr-19 (No. EX3-3503_Mar19)
30-Apr-19 (No. DAE4-601_Apr19) Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator SN: 5058 (20k) Type-N mismatch combination SN: 5047.2 / 06327 Reference Probe EX3DV4 DAE4 Apr-20 ID # SN: GB39512475 Scheduled Check In house check: Oct-20 Secondary Standards Power meter E4419B Check Date (in house) Check Date (in house check Feb-19)
30-Oct-14 (in house check Feb-19)
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-19) Power sensor HP 8481A Power sensor HP 8481A SN: US37292783 SN: MY41092317 RF generator R&S SMT-06 SN: 100972 vork Analyzer Agilent E8358/ SN: US41080477 Jeton Kastrati Laboratory Technician Approved by: Katja Pokovic Technical Manager Issued: November 4, 2019 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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





Schweizerischer Kalibrierdie C

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 certific

Glossary:

tissue simulating liquid sensitivity in TSL / NORM x,y,z TSI ConvF 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

 - IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Hate (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 MHz to 6 GHz)" March 2010.
 - 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
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions

DASY Version	DASY5	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3700 MHz ± 1 MHz	

Head TSL parameters

ving parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 °C	37.7	3.12 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.2 ± 6 %	3.06 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.6 W/kg ± 19.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	51.0	3.55 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.7 ± 6 %	3.55 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	6.48 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	64.4 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 100 mW input power	2.32 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.8 Ω - 0.6 jΩ	
Return Loss	- 32.8 dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$46.2 \Omega + 0.4 j\Omega$
Return Loss	- 28.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1,138 ns
Electrical Delay (one direction)	1.138 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.

naccording 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: D3700V2-1057_Nov19

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DASY5 Validation Report for Head TSL

Date: 04.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1057

Communication System: UID 0 - CW; Frequency: 3700 MHz Medium parameters used: f = 3700 MHz; σ = 3.06 S/m; ϵ_r = 37.2; ρ = 1000 kg/m³

Phantom section: Flat Section

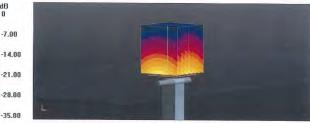
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.5, 7.5, 7.5) @ 3700 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front): Type: OD 000 P50 AA: Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm/Zoom Scan, dist=1.4mm

Dipote Calibration for Head Tissue/Pin=100 mW, d=10mm/
(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.43 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 19.6 W/kg
SAR(1 g) = 6.79 W/kg; SAR(10 g) = 2.46 W/kg
Salt (1 g) = 6.79 W/kg; SAR(10 g) = 2.46 W/kg
Smallest distance from peaks to all points 3 dB below = 8 mm
Ratio of SAR at M2 to SAR at M1 = 73.1%
Maximum value of SAR (measured) = 13.3 W/kg



0 dB = 13.3 W/kg = 11.25 dBW/kg

Certificate No: D3700V2-1057_Nov19

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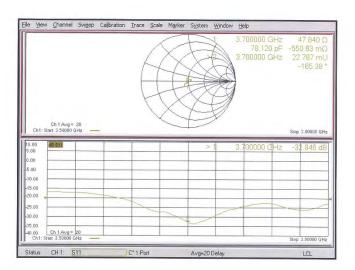
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Impedance Measurement Plot for Head TSL



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Certificate No: D3700V2-1057_Nov19

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DASY5 Validation Report for Body TSL

Date: 04.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1057

Communication System: UID 0 - CW; Frequency: 3700 MHz Medium parameters used: f = 3700 MHz; σ = 3.55 S/m; ϵ_r = 49.7; ρ = 1000 kg/m³

Phantom section: Flat Section

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

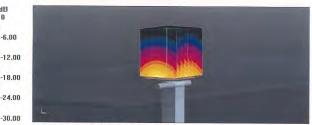
DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.1, 7.1, 7.1) @ 3700 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- · Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: OD 000 P50 AA; Serial: 1002
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Body Tissue/Pin=100 mW, d=10mm/Zoom Scan , dist=1.4mm

Oby Instact Print of mw, d=10mm/ (6x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 64.71 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 17.8 W/kg SAR(1 g) = 6.48 W/kg; SAR(1 g) = 2.32 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 74.7% Maximum value of SAR (measured) = 12.7 W/kg

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



0 dB = 12.7 W/kg = 11.04 dBW/kg

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

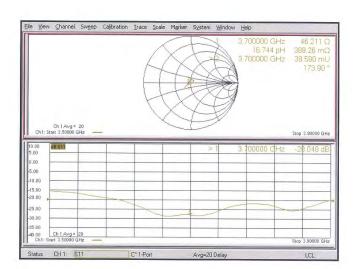
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Impedance Measurement Plot for Body TSL



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- End of report -

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