

# Appendix C

## **Phantom Description**

Schmid & Partner Engineering AG

е a g s р

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#### Certificate of Conformity / First Article Inspection

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

#### Tests

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

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

Note: Compatibility restrictions apply certain liquid components mentioned in the standard.

containing e.g. DGBE, DGMHE or Triton X-100. Observe technical note on material compatibility

Standards

OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01
 IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific

- Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement 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 [4] 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)", 2010-03-30

#### Conformity

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

Date 25.7.2011

Signature / Stamp

speag Schmid & Partner-Engineering/AG Zeugbarestrasse 43, 8004 Zeich, Smithiand Phone/441 44/255 9708, Few-444 64 44 59779

Doc No 881 - QD OVA 002 A - A

1 (1) Page

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## System Validation from Original Equipment Supplier

	n, Switzerland		Servizio svizzero di taratura
Accredited by the Swiss Accreditation The Swiss Accreditation Service Multilateral Agreement for the re-	is one of the signatorie		Accreditation No.: SCS 0108
Client SGS Taoyuan City		Certificate No.	D2450V2-727_Apr24
CALIBRATION C	ERTIFICATI	E	
Object	D2450V2 - SN:7	27	
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	edure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	April 22, 2024		
		ry facility: environment temperature (22 $\pm$ 3)°(	C and humidity < 70%.
Calibration Equipment used (M&TE Primary Standards	E critical for calibration)	2 acility: environment temperature (22 ± 3)*6 Cal Date (Certificate No.)	C and humidity < 70%. Scheduled Calibration
Calibration Equipment used (M&TE Primary Standards Power meter NRP2	E critical for calibration)	Cal Date (Certificate No.) 26-Mar-24 (No. 217-04036/04037)	Scheduled Calibration Mar-25
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91	E critical for calibration) ID # SN: 104778 SN: 103244	Cal Date (Certificate No.) 26-Mar-24 (No. 217-04036/04037) 26-Mar-24 (No. 217-04036)	Scheduled Calibration Mar-25 Mar-25
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Date (Certificate No.) 26-Mar-24 (No. 217-04036/04037) 26-Mar-24 (No. 217-04036) 26-Mar-24 (No. 217-04037)	Scheduled Calibration Mar-25 Mar-25 Mar-25
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Atternuator	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	Cal Date (Certificate No.) 26-Mar-24 (No. 217-04036/04037) 26-Mar-24 (No. 217-04036) 26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH3394 (20k) SN: 310982 / 06327	Cal Date (Certificate No.) 26-Mar-24 (No. 217-04036/04037) 26-Mar-24 (No. 217-04036) 26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25 Mar-25
Calibration Equipment used (M&TE Primary Standards Dower meter NRP-2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	Cal Date (Certificate No.) 26-Mar-24 (No. 217-04036/04037) 26-Mar-24 (No. 217-04036) 26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310942 / 06327 SN: 7349	Cal Date (Certificate No.) 26-Mar-24 (No. 217-04036/04037) 26-Mar-24 (No. 217-04036) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 03-Nov-23 (No. EX3-7349_Nov23)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25 Mar-25 Nov-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	Cal Date (Certificate No.) 26-Mar-24 (No. 217-04036/04037) 26-Mar-24 (No. 217-04036) 26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04047) 26-Mar-24 (No. 217-04047) 03-Nov-23 (No. EX3-7349_Nov23) 30-Jan-24 (No. DAE4-601_Jan24)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25 Mar-25 Nov-24 Jan-25
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 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	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 66327 SN: 7349 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37282783	Cal Date (Certificate No.) 26-Mar-24 (No. 217-04036/04037) 26-Mar-24 (No. 217-04036) 26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04047) 28-Mar-24 (No. 217-04047) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25 Mar-25 Nov-24 Jan-25 Scheduled Check
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A	E critical for calibration) ID # SN: 103244 SN: 103244 SN: 103245 SN: 8H:9394 (20k) SN: 7349 SN: 601 ID # SN: 6039512475 SN: US375292783 SN: W141093315	Cal Date (Certificate No.)           26-Mar-24 (No. 217-04036/04037)           26-Mar-24 (No. 217-04036)           26-Mar-24 (No. 217-04047)           26-Mar-24 (No. 217-04047)           26-Mar-24 (No. 217-04047)           26-Mar-24 (No. 217-04047)           30-Nov-23 (No. EX3-7349_Nov23)           30-Jan-24 (No. DAE4-601_Jan24)           Check Date (in house)           30-Oct-14 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25 Nov-24 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 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	Critical for calibration) ID # SN: 104778 SN: 103244 SN: BH3394 (20k) SN: 310982 / 06327 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: W141093315 SN: 10972	Cal Date (Certificate No.)           26-Mar-24 (No. 217-04036/04037)         26-Mar-24 (No. 217-04036)           26-Mar-24 (No. 217-04037)         26-Mar-24 (No. 217-04046)           26-Mar-24 (No. 217-04047)         03-Nov-23 (No. EX3-7349_Nov23)           30-Jan-24 (No. 217-04047)         03-Nov-23 (No. EX3-7349_Nov23)           30-Jan-24 (No. DAE4-601_Jan24)         Check Date (in house)           30-Oct-14 (in house check Oct-22)         07-Oct-15 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)         15-Jun-15 (in house check Oct-22)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25 Nov-24 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 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	E critical for calibration) ID # SN: 103244 SN: 103244 SN: 103245 SN: 8H:9394 (20k) SN: 7349 SN: 601 ID # SN: 6039512475 SN: US375292783 SN: W141093315	Cal Date (Certificate No.)           26-Mar-24 (No. 217-04036/04037)           26-Mar-24 (No. 217-04036)           26-Mar-24 (No. 217-04047)           26-Mar-24 (No. 217-04047)           26-Mar-24 (No. 217-04047)           26-Mar-24 (No. 217-04047)           30-Nov-23 (No. EX3-7349_Nov23)           30-Jan-24 (No. DAE4-601_Jan24)           Check Date (in house)           30-Oct-14 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25 Nov-24 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP-2 Power sensor NRP-Z91 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	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 103245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 601 ID # SN: 6639512475 SN: US37292783 SN: US37292783 SN: US3729478 SN: US41080477 Name	Cal Date (Certificate No.)           26-Mar-24 (No. 217-04036/04037)           26-Mar-24 (No. 217-04036)           26-Mar-24 (No. 217-04037)           26-Mar-24 (No. 217-04046)           26-Mar-24 (No. 217-04047)           03-Nov-23 (No. EX3-7349_Nov23)           30-Jan-24 (No. DAE4-601_Jan24)           Check Date (in house)           30-Oct-14 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)           15-Jun-15 (in house check Oct-22)           31-Mar-14 (in house check Oct-22)	Scheduled Calibration Mar-25 Mar-25 Mar-25 Mar-25 Nov-24 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
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Certificate No: D2450V2-727\_Apr24

Page 1 of 6

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### Report No. : TESA2501000034E5 Page: 3 of 36

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



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#### Glossary:

TSL

N/A

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

Calibration is Performed According to the Following Standards: a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
 b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss: This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- . SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

Certificate No: D2450V2-727 Apr24

Page 2 of 6

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### Report No. : TESA2501000034E5 Page: 4 of 36

#### **Measurement Conditions**

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

DASY52	V52.10.4
Advanced Extrapolation	
Modular Flat Phantom	
10 mm	with Spacer
dx, dy, dz = 5 mm	
2450 MHz ± 1 MHz	
	DASY52 Advanced Extrapolation Modular Flat Phantom 10 mm dx, dy, dz = 5 mm

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.0 ± 6 %	1.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.7 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 250 mW input power	6.24 W/kg

Certificate No: D2450V2-727 Apr24

Page 3 of 6

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### Report No. : TESA2501000034E5 Page: 5 of 36

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.5 Ω + 0.4 jΩ	
Return Loss	- 24.2 dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 ns
	11110110

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

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

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

#### Additional EUT Data

Manufactured by	SPEAG
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Page 4 of 6

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### Report No. : TESA2501000034E5 Page: 6 of 36

Date: 22.04.2024

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

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz;  $\sigma = 1.87 \text{ S/m}$ ;  $\varepsilon_r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

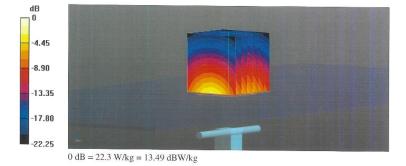
DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 03.11.2023
- . Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024 .
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

### 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 = 117.9 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 27.0 W/kg **SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.24 W/kg** Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 49.9% Maximum value of SAR (measured) = 22.3 W/kg





Certificate No: D2450V2-727 Apr24

Page 5 of 6

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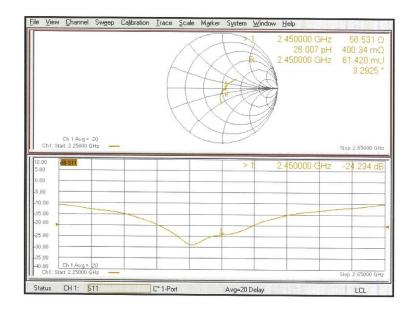
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Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-727 Apr24

Page 6 of 6

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### Report No. : TESA2501000034E5 Page: 8 of 36

Calibration Laboratory Schmid & Partner Engineering AG <sup>ceughausstrasse</sup> 43, 8004 Zurich,			Schweizerischer Kalibrierdienst     Service suisse d'étalonnage     Servizio svizzero di taratura     Swiss Calibration Service
Accredited by the Swiss Accreditation The Swiss Accreditation Service i Multilateral Agreement for the rec	s one of the signatorie		Accreditation No.: SCS 0108
Client SGS Taoyuan City		Certificate N	• D5GHzV2-1349_Mar24
CALIBRATION C	ERTIFICATE		
Object	D5GHzV2 - SN:1	349	
Calibration procedure(s)	QA CAL-22.v7 Calibration Proce	dure for SAR Validation Source	es between 3-10 GHz
Calibration date:	March 19, 2024		
Calibration Equipment used (M&TE	critical for calibration)	y facility: environment temperature (22 $\pm$ 3)	
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2 Power sensor NRP-Z91	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244 SN: 103245	30-Mar-23 (No. 217-03804)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809)	Mar-24 Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03809)	Mar-24 Mar-24
Reference Probe EX3DV4	SN: 3503	07-Mar-24 (No. EX3-3503 Mar24)	Mar-25
DAE4	SN: 601	30-Jan-24 (No. DAE4-601_Jan24)	Jan-25
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24
Calibrated by:	Name Claudio Leubler	Function Laboratory Technician	Signature
Approved by:	Sven Kühn	Technical Manager	Sila
This calibration certificate shall not	be reproduced except in	full without written approval of the laborate	Issued: March 20, 2024 rry.

Certificate No: D5GHzV2-1349\_Mar24

Page 1 of 9

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## Report No. : TESA2501000034E5 Page: 9 of 36

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



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Accreditation No.: SCS 0108

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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: TSI ConvF N/A

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

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

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020. b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss: This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

Certificate No: D5GHzV2-1349\_Mar24

Page 2 of 9

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### Report No. : TESA2501000034E5 Page: 10 of 36

#### **Measurement Conditions**

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz 5850 MHz ± 1 MHz	

#### Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.4 ± 6 %	4.57 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.08 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.9 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.31 W/kg

Certificate No: D5GHzV2-1349\_Mar24

Page 3 of 9

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### Report No. : TESA2501000034E5 Page: 11 of 36

#### Head TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

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#### SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.4 W/kg ± 19.9 % (k=2)
		,
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.35 W/kg

#### Head TSL parameters at 5750 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	5.13 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.08 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.8 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.30 W/kg

Certificate No: D5GHzV2-1349\_Mar24

Page 4 of 9

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### Report No. : TESA2501000034E5 Page: 12 of 36

#### Head TSL parameters at 5850 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.2	5.32 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	5.22 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

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#### SAR result with Head TSL at 5850 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.98 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.9 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.25 W/kg

Certificate No: D5GHzV2-1349\_Mar24

Page 5 of 9

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### Report No. : TESA2501000034E5 Page: 13 of 36

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

#### Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	46.8 Ω + 1.4 jΩ	
Return Loss	- 28.9 dB	

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	52.4 Ω + 4.7 jΩ	
Return Loss	- 25.7 dB	

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	52.6 Ω + 4.2 jΩ	
Return Loss	- 26.3 dB	

#### Antenna Parameters with Head TSL at 5850 MHz

Impedance, transformed to feed point	54.7 Ω + 1.3 jΩ	
Return Loss	- 26.6 dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.200 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

١	Manufactured by	SPEAG

Certificate No: D5GHzV2-1349\_Mar24

Page 6 of 9

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### Report No. : TESA2501000034E5 Page: 14 of 36

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

Date: 19.03.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1349

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5850 MHz

Medium parameters used: f = 5250 MHz;  $\sigma = 4.57 \text{ S/m}$ ;  $\varepsilon_r = 36.4$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used: f = 5600 MHz;  $\sigma = 4.97 \text{ S/m}$ ;  $\varepsilon_r = 35.8$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used: f = 5750 MHz;  $\sigma = 5.13 \text{ S/m}$ ;  $\varepsilon_r = 35.6$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used: f = 5850 MHz;  $\sigma$  = 5.22 S/m;  $\varepsilon_r$  = 35.5;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.39, 5.39, 5.39) @ 5250 MHz, ConvF(5, 5, 5) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz, ConvF(4.89, 4.89, 4.89) @ 5850 MHz; Calibrated: 07.03.2024
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601: Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 74.62 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 27.7 W/kg SAR(1 g) = 8.08 W/kg; SAR(10 g) = 2.31 W/kg Smallest distance from peaks to all points 3 dB below = 7.4 mm Ratio of SAR at M2 to SAR at M1 = 70.7%Maximum value of SAR (measured) = 18.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 73.67 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 30.7 W/kg SAR(1 g) = 8.23 W/kg; SAR(10 g) = 2.35 W/kgSmallest distance from peaks to all points 3 dB below = 7.4 mmRatio of SAR at M2 to SAR at M1 = 67.9%Maximum value of SAR (measured) = 19.2 W/kg

Certificate No: D5GHzV2-1349\_Mar24

Page 7 of 9

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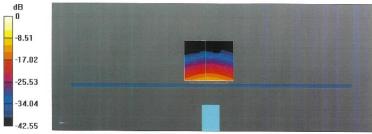


### Report No. : TESA2501000034E5 Page: 15 of 36

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 71.84 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 31.7 W/kg SAR(1 g) = 8.08 W/kg; SAR(10 g) = 2.3 W/kg Smallest distance from peaks to all points 3 dB below = 7.5 mm Ratio of SAR at M2 to SAR at M1 = 66% Maximum value of SAR (measured) = 19.4 W/kg

#### Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5850 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.98 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 32.2 W/kg SAR(1 g) = 7.98 W/kg; SAR(10 g) = 2.25 W/kg Smallest distance from peaks to all points 3 dB below = 7.5 mm Ratio of SAR at M2 to SAR at M1 = 65.2% Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.85 dBW/kg

Certificate No: D5GHzV2-1349\_Mar24

Page 8 of 9

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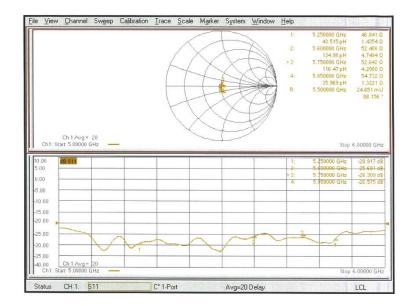
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#### Impedance Measurement Plot for Head TSL



Certificate No: D5GHzV2-1349\_Mar24

Page 9 of 9

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### Report No. : TESA2501000034E5 Page: 17 of 36

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ccredited by the Swiss Accreditation he Swiss Accreditation Service is ultilateral Agreement for the reco	one of the signatories	s to the EA	creditation No.: SCS 0108
lient SGS Taoyuan City		Certificate No	D6.5GHzV2-1006_Aug24
CALIBRATION CE	RTIFICATE	I	
Dbject	D6.5GHzV2 - SN	:1006	
	QA CAL-22.v7 Calibration Proce	dure for SAR Validation Source	es between 3-10 GHz
Calibration date:	August 15, 2024		
	nties with confidence pr	obability are given on the following pages a y facility: environment temperature $(22 \pm 3)$	and are part of the certificate.
The measurements and the uncertain All calibrations have been conducted Calibration Equipment used (M&TE (	nties with confidence pr	obability are given on the following pages a y facility: environment temperature (22 ± 3)	and are part of the certificate. °C and humidity < 70%.
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Calibration Laboratory of Schmid & Partner Engineering AG aughausstrasse 43, 8004 Zurich, Switzerland



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

Accreditation No.: SCS 0108

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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

N/A

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

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

 a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range Of 4 MHz To 10 GHz)", October 2020.

Additional Documentation: b) DASY 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 Return Loss ensures low reflected power. 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 absorbed power density (APD): The absorbed power density is evaluated according to Samaras T, Christ A, Kuster N, "Compliance assessment of the epithelial or absorbed power density above 6 GHz using SAR measurement systems", Bioelectromagnetics, 2021 (submitted). The additional evaluation uncertainty of 0.55 dB (rectangular distribution) is considered.

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: D6.5GHzV2-1006 Aug24

Page 2 of 6

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### Report No. : TESA2501000034E5 Page: 19 of 36

#### **Measurement Conditions**

given on page 1.		
DASY6	V16.2	
Advanced Extrapolation		
Modular Flat Phantom		
5 mm	with Spacer	
dx, dy = 3.4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)	
6500 MHz ± 1 MHz		
	DASY6 Advanced Extrapolation Modular Flat Phantom 5 mm dx, dy = 3.4 mm, dz = 1.4 mm	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	34.5	6.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	6.32 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	29.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	297 W/kg ± 24.7 % (k=2)
SAR averaged over 8 cm <sup>3</sup> (8 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.63 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	66.4 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	5.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	54.5 W/kg ± 24.4 % (k=2)

Certificate No: D6.5GHzV2-1006\_Aug24

Page 3 of 6

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### Report No. : TESA2501000034E5 Page: 20 of 36

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	46.9 Ω - 7.3 jΩ	
Return Loss	- 21.7 dB	

#### APD (Absorbed Power Density)

APD averaged over 1 cm <sup>2</sup>	Condition		
APD measured	100 mW input power	297 W/m <sup>2</sup>	
APD measured	normalized to 1W	2970 W/m <sup>2</sup> ± 29.2 % (k=2)	
APD averaged over 4 cm <sup>2</sup>	condition		
APD averaged over 4 cm <sup>2</sup> APD measured	condition 100 mW input power	133 W/m <sup>2</sup>	

\*The reported APD values have been derived using the psSAR1g and psSAR8g.

#### General Antenna Parameters and Design

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

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

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

#### Additional EUT Data

Manufactured by	SPEAG	
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Certificate No: D6.5GHzV2-1006\_Aug24

Page 4 of 6

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### Report No. : TESA2501000034E5 Page: 21 of 36

#### **DASY6 Validation Report for Head TSL**

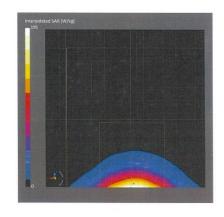
Measurement Report for D6.5GHz-1006, UID 0 -, Channel 6500 (6500.0MHz)

#### Device under Test Properties

DUT Type Name, Manufacturer Dimensions [mm] IMEI D6.5GHz 16.0 x 6.0 x 300.0 SN: 1006

Exposure Cond							
Phantom	Position, Test	Band	Group,	Frequency	Conversion	TSL Cond.	TSL
Section, TSL	Distance [mm]		UID	[MHz]	Factor	[S/m]	Permittivity
Flat, HSL	5.00	Band	CW,	6500	5.14	6.32	34.9
Hardware Seti Phantom	up	SL		Probe, Calil	bration Date	DAE, Calib	oration Date
MFP V8.0 Cent	ter - 1182 H	BBL600-10	0000V6	EX3DV4 - SI	N7405, 2024-07-01	DAE4 Sn9	08, 2024-03-27
Scan Setup				Measureme	ent Results		
			Zoom Scan				Zoom Scan
Grid Extents	[mm]		22.0 x 22.0 x 22.0	Date		2	024-08-15, 11:31
Crid Stone In	1001		24424414	meCAD1 = D	N//W-1		20.7

Ghu Extents [mm]	22.0 X 22.0 X 22.0	Date	2024-00-15, 11.51
Grid Steps [mm]	3.4 x 3.4 x 1.4	psSAR1g [W/Kg]	29.7
Sensor Surface [mm]	1.4	psSAR8g [W/Kg]	6.63
Graded Grid	Yes	psSAR10g [W/Kg]	5.43
Grading Ratio	1.4	Power Drift [dB]	-0.00
MAIA	N/A	Power Scaling	Disabled
Surface Detection	VMS+6p	Scaling Factor [dB]	
Scan Method	Measured	TSL Correction	No correction
		M2/M1 [%]	49.4
		Dist 3dB Peak [mm]	4.8



Certificate No: D6.5GHzV2-1006\_Aug24

Page 5 of 6

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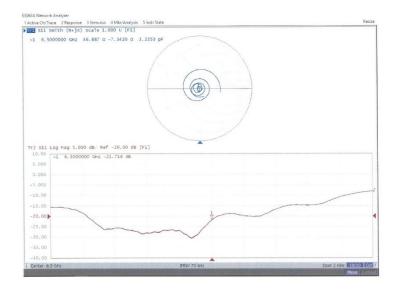
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#### Impedance Measurement Plot for Head TSL



Certificate No: D6.5GHzV2-1006\_Aug24

Page 6 of 6

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### Report No. : TESA2501000034E5 Page: 23 of 36

Calibration Laboratory of Schmid & Partner Engineering AG eughausstrasse 43, 8004 Zurich, S		Iac-MRA		Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service
ccredited by the Swiss Accreditation he Swiss Accreditation Service is Iultilateral Agreement for the reco	one of the signatories		Ac	creditation No.: SCS 0108
lient SGS Taoyuan City			Certificate No	D7GHzV2-1007_Aug24
CALIBRATION CE	RTIFICATE			
Dbject	07GHzV2 - SN:10	007		
	QA CAL-22.v7 Calibration Proce	dure for SAR V	alidation Source	es between 3-10 GHz
Calibration date:	August 15, 2024			
All calibrations have been conducted Calibration Equipment used (M&TE of Primary Standards Owers ensors R&S NRP33T Reference 20 dB Attenuator Vilsmatch combination Reference Probe EX3DV4 OAE4		Cal Date (Certifical 28-Mar-24 (No. 21 26-Mar-24 (No. 21 28-Mar-24 (No. 21 01-Jul-24 (No. 23 01-Jul-24 (No. EX 27-Mar-24 (No. DA	e No.) 7-04038) 7-04046) 7-04050) -7405_Jul24)	Scheduled Calibration Mar-25 Mar-25 Jul-25 Mar-25 Mar-25
Secondary Standards RF generator Anapico APSIN20G Power sensor NRP-Z23 Power sensor NRP-18T	ID # SN: 827 SN: 100169 SN: 100950	Check Date (in hou 18-Dec-18 (in hous 10-Jan-19 (in hous 28-Sep-22 (in hous	e check Jan-24) e check Jan-24)	Scheduled Check In house check: Jan-25 In house check: Jan-25 In house check: Jan-25
Vetwork Analyzer Keysight E5063A	SN:MY54504221	31-Oct-19 (in hous		In house check: Jan-25 In house check: Oct-25
Calibrated by:	Name Aidonia Georgiadou	Functi Labora	on Itory Technician	Signature
Approved by:	Sven Kühn	Techn	cal Manager	Car
This calibration certificate shall not b	e reproduced except in	full without written ap	proval of the laborate	Issued: August 16, 2024 ry.

Certificate No: D7GHzV2-1007\_Aug24

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### Report No. : TESA2501000034E5 Page: 24 of 36

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

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Accreditation No : SCS 0108

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

Glossary: TSL ConvF

N/A

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

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

 a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range Of 4 MHz To 10 GHz)", October 2020.

Additional Documentation: b) DASY 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 Return Loss ensures low reflected power. 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 absorbed power density (APD): The absorbed power density is evaluated according to Samaras T, Christ A, Kuster N, "Compliance assessment of the epithelial or absorbed power density . above 6 GHz using SAR measurement systems", Bioelectromagnetics, 2021 (submitted). The additional evaluation uncertainty of 0.55 dB (rectangular distribution) is considered.

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: D7GHzV2-1007 Aug24

Page 2 of 6

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### Report No. : TESA2501000034E5 Page: 25 of 36

#### Measurement Conditions

DASY system configuration, as far as no	t given on page 1.	1
DASY Version	DASY6	V16.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	5 mm	with Spacer
Zoom Scan Resolution	dx, dy = 3.0 mm, dz = 1.2 mm	Graded Ratio = 1.2 (Z direction)
Frequency	7000 MHz ± 1 MHz	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	33.9	6.65 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.0 ± 6 %	6.94 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	( <u></u> )	

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition		
SAR measured	100 mW input power	28.6 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	286 W/kg ± 24.7 % (k=2)	
SAR averaged over 8 cm <sup>3</sup> (8 g) of Head TSL	condition		
SAR measured	100 mW input power	6.16 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	61.6 W/kg ± 24.4 % (k=2)	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition		
SAR measured	100 mW input power	5.03 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	50.4 W/kg ± 24.4 % (k=2)	

Certificate No: D7GHzV2-1007\_Aug24

Page 3 of 6

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### Report No. : TESA2501000034E5 Page: 26 of 36

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1 Ω - 4.9 jΩ	
Return Loss	- 24.3 dB	

#### APD (Absorbed Power Density)

APD averaged over 1 cm <sup>2</sup>	Condition		
APD measured	100 mW input power	286 W/m <sup>2</sup>	
APD measured	normalized to 1W	2860 W/m2 ± 29.2 % (k=2)	
APD avaraged over 4 cm <sup>2</sup>	condition		
APD averaged over 4 cm <sup>2</sup>	condition		
APD averaged over 4 cm <sup>2</sup> APD measured	condition 100 mW input power	123 W/m <sup>2</sup>	

\* The reported APD values have been derived using the psSAR1g and psSAR8g

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

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

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

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

#### Additional EUT Data

SPEAG

Certificate No: D7GHzV2-1007 Aug24

Page 4 of 6

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### Report No. : TESA2501000034E5 Page: 27 of 36

#### DASY6 Validation Report for Head TSL

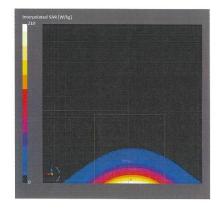
Measurement Report for D7GHz-1007, UID 0 -, Channel 7000 (7000.0MHz)

#### Device under Test Properties

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
D7GHz	14.0 x 6.0 x 297.0	SN: 1007	

Exposure Cond	ditions						
Phantom	Position, Test	Band	Group,	Frequency	Conversion	TSL Cond.	TSL
Section, TSL	Distance [mm]		UID	[MHz]	Factor	[S/m]	Permittivity
Flat, HSL	5.00	Band	CW,	7000	5.80	6.94	34.0
Hardware Setu	up						
Phantom	TS	iL		Probe, Cali	bration Date	DAE, Calib	oration Date
MFP V8.0 Cent	ter - 1182 HI	3BL600-100	000V6	EX3DV4 - SI	N7405, 2024-07-01	DAE4 Sn9	08, 2024-03-27
Scan Setup				Measureme	ent Results		
			70000 6				Zaams Caam

	Zoom Scan		Zoom Scan
Grid Extents [mm]	22.0 x 22.0 x 22.0	Date	2024-08-15, 12:48
Grid Steps [mm]	3.0 x 3.0 x 1.2	psSAR1g [W/Kg]	28.6
Sensor Surface [mm]	1.4	psSAR8g [W/Kg]	6.16
Graded Grid	Yes	psSAR10g [W/Kg]	5.03
Grading Ratio	1.2	Power Drift [dB]	0.07
MAIA	N/A	Power Scaling	Disabled
Surface Detection	VMS + 6p	Scaling Factor [dB]	
Scan Method	Measured	TSL Correction	No correction
		M2/M1 [%]	46.1
		Dist 3dB Peak [mm]	4.3



Certificate No: D7GHzV2-1007 Aug24

Page 5 of 6

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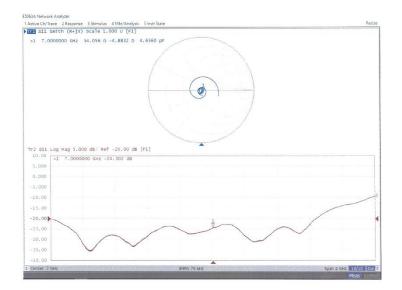
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#### Impedance Measurement Plot for Head TSL



Certificate No: D7GHzV2-1007\_Aug24

Page 6 of 6

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**Calibration Laboratory of** 

Schmid & Partner

Engineering AG

## Report No. : TESA2501000034E5 Page: 29 of 36

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<sup>ient</sup> SGS Taoyuan City	ginten er eanstation i		5G-Veri10-1070_Aug2
ALIBRATION CE	RTIFICATE		
Dbject	5G Verification S	Source 10 GHz - SN: 1070	
Calibration procedure(s)	QA CAL-45.v5 Calibration proce	edure for sources in air above 6 GF	Ηz
Calibration date:	August 16, 2024		
		ional standards, which realize the physical units robability are given on the following pages and	
All calibrations have been conducte	d in the closed laborato	bry facility: environment temperature (22 $\pm$ 3)°C	and humidity < 70%.
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Reference Probe EUmmWV3	SN: 9374	04-Dec-23 (No. EUmm-9374_Dec23)	Dec-24
DAE4ip	SN: 1602	08-Nov-23 (No. DAE4ip-1602_Nov23)	Nov-24
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMF100A	SN: 100184	29-Nov-23 (in house check Nov-23)	In house check: Nov-24
Power sensor R&S NRP18S-10	SN: 101258	29-Nov-23 (in house check Nov-23)	In house check: Nov-24
Network Analyzer Keysight E5063A	A SN: MY54504221	31-Oct-19 (in house check Oct-22)	In house check: Oct-25
	Name	Function	Signature
	Joanna Lleshaj	Laboratory Technician	Mallus
Calibrated by:			
Calibrated by: Approved by:	Sven Kühn	Technical Manager	Afeller Sax

ilac-MRA

Certificate No: 5G-Veri10-1070\_Aug24

Page 1 of 8

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## Report No. : TESA2501000034E5 Page: 30 of 36

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





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

Accreditation No.: SCS 0108

Glossary

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 CW Continuous wave

### Calibration is Performed According to the Following Standards

- Internal procedure QA CAL-45, Calibration procedure for sources in air above 6 GHz.
- IEC/IEEE 63195-1. "Assessment of power density of human exposure to radio frequency fields from wireless devices in close proximity to the head and body (frequency range of 6 GHz to 300 GHz)", May 2022

#### Methods Applied and Interpretation of Parameters

- Coordinate System: z-axis in the waveguide horn boresight, x-axis is in the direction of the E-field, y-axis normal to the others in the field scanning plane parallel to the horn flare and horn flange.
- Measurement Conditions: (1) 10 GHz: The radiated power is the forward power to the horn antenna minus ohmic and mismatch loss. The forward power is measured prior and after the measurement with a power sensor. During the measurements, the horn is directly connected to the cable and the antenna ohmic and mismatch losses are determined by farfield measurements. (2) 30, 45, 60 and 90 GHz: The verification sources are switched on for at least 30 minutes. Absorbers are used around the probe cub and at the ceiling to minimize reflections.
- Horn Positioning: The waveguide horn is mounted vertically on the flange of the waveguide source to allow vertical positioning of the EUmmW probe during the scan. The plane is parallel to the phantom surface. Probe distance is verified using mechanical gauges positioned on the flare of the horn.
- *E- field distribution:* E field is measured in two x-y-plane (10mm, 10mm +  $\lambda/4$ ) with a vectorial E-field probe. The E-field value stated as calibration value represents the E-fieldmaxima and the averaged (1cm<sup>2</sup> and 4cm<sup>2</sup>) power density values at 10mm in front of the horn.
- Field polarization: Above the open horn, linear polarization of the field is expected. This is verified graphically in the field representation.

#### **Calibrated Quantity**

Local peak E-field (V/m) and average of peak spatial components of the poynting vector (W/m<sup>2</sup>) averaged over the surface area of 1 cm<sup>2</sup> and 4cm<sup>2</sup> at the nominal operational frequency of the verification source. Both square and circular averaging results are listed.

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: 5G-Veri10-1070 Aug24

Page 2 of 8

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#### **Measurement Conditions**

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

DASY Version	DASY8 Module mmWave	V3.2
Phantom	5G Phantom	
Distance Horn Aperture - plane	10 mm	
Number of measured planes	2 (10mm, 10mm + λ/4)	
Frequency	10 GHz ± 10 MHz	

#### Calibration Parameters, 10 GHz

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m <sup>2</sup> )		Uncertainty (k = 2)
Measureu Flane				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	93.3	152	1.27 dB	60.3	56.2	1.28 dB
Distance Horn	Prad <sup>1</sup>	Max E-field	Uncertainty	Power	Density	Uncertainty
Aperture to Measured Plane	(mW)	(V/m)	(k = 2)	psPDn+, psPDtot+, psPDmod+ (W/m <sup>2</sup> )		(k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	93.3	152	1.27 dB	60.1, 60.3, 60.5	55.9. 56.2. 56.4	1.28 dB

#### **Square Averaging**

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m <sup>2</sup> )		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	93.3	152	1.27 dB	60.3 56.1		1.28 dB
Distance Horn	Prad <sup>1</sup>	Max E-field	Uncertainty	Power	Density	Uncertainty

Aperture to Measured Plane	(mW)	(V/m)	(k = 2)	psPDn+, psPDtot+, psPDmod+ (W/m <sup>2</sup> )		(k = 2)
				<b>1</b> cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	93.3	152	1.27 dB	60.1, 60.3, 60.4	55.8, 56.1, 56.3	1.28 dB

#### Max Power Density

Distance Horn Prad		Max E-field	Uncertainty	Max Power Density	Uncertainty
Aperture to Measured Plane	(mW)	(V/m)	(k = 2)	Sn, Stot,  Stot  (W/m²)	(k = 2)
10 mm	93.3	152	1.27 dB	61.8, 61.8, 62.0	1.28 dB

<sup>1</sup> Assessed ohmic and mismatch loss plus numerical offset: 0.30 dB

Certificate No: 5G-Veri10-1070\_Aug24

Page 3 of 8

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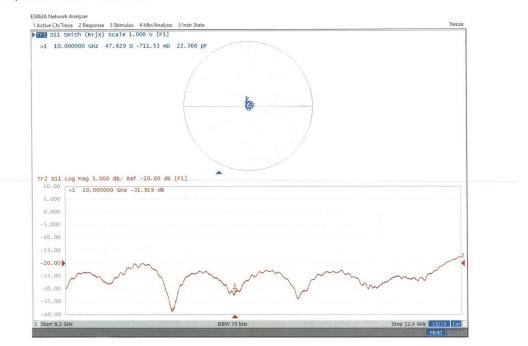


### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters

Impedance, transformed to feed point	47.6 Ω - 0.7 jΩ	
Return Loss	- 31.9 dB	

#### Impedance Measurement Plot



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Page 4 of 8

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