

# 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

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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# System Validation from Original Equipment Supplier

Engineering AG eughausstrasse 43, 8004 Zurich	y of n, Switzerland	Secure Secure	Service suisse d'étalonnage Servizio svizzero di taratura
Accredited by the Swiss Accreditat The Swiss Accreditation Service Aultilateral Agreement for the re	is one of the signatorie	es to the EA	ccreditation No.: SCS 0108
Client SGS-TW (Aude	n)	Certificate N	o: D2450V2-727_Apr22
CALIBRATION C	ERTIFICATI		
Object	D2450V2 - SN:7	27	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validation Sources	s between 0.7-3 GHz
Calibration date:	April 25, 2022		
The measurements and the uncer	rtainties with confidence p	ional standards, which realize the physical ur probability are given on the following pages ar ny facility: environment temperature (22 ± 3)°	nd are part of the certificate.
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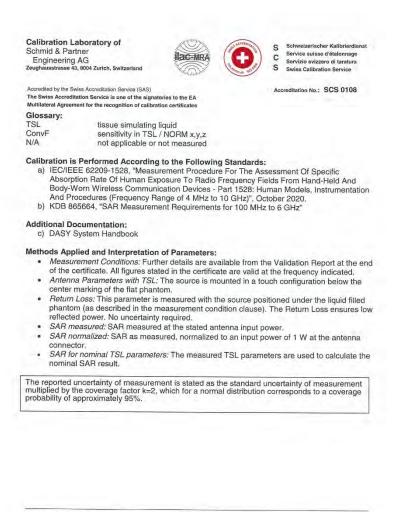
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#### **Measurement Conditions**

DASY Version	DASY52	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	2450 MHz ± 1 MHz	

#### Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.8 ± 6 %	1.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.8 W/kg ± 17.0 % (k=2)
SAB averaged over 10 cm <sup>3</sup> (10 g) of Head TSI	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 250 mW input power	6.34 W/kg

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### Report No. : TESA2301000032ES Page: 5 of 34

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.7 Ω + 3.0 jΩ
Return Loss	- 24.4 dB

#### General Antenna Parameters and Design

ectrical Delay (one direction)	1.149 ns
--------------------------------	----------

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is diractly 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	ODEL O
inanulactured by	SPEAG

Certificate No: D2450V2-727\_Apr22

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

Date: 25.04.2022

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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: (x = 5mm, dy = 5mm, dz = 5mm)Reference Value = 115.6 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 26.5 W/kg SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.34 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 51% Maximum value of SAR (measured) = 22.1 W/kg

3.20				
.80				
7.60				
			1000	
2.00		-		
0 dB = 22.1 W/kg = 13.45 dBW/kg	= 22.1 W/kg = 1	3.45 dBW/kg	-	

Certificate No: D2450V2-727\_Apr22

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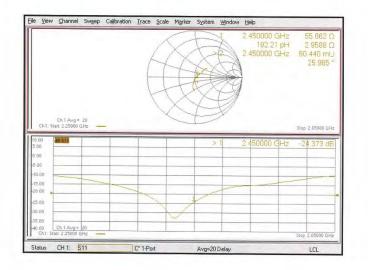
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Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-727\_Apr22

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Engineering AG	/ of		Service suisse d'étalonnage Servizio svizzero di taratura
Zeughausstrasse 43, 8004 Zurich	, Switzerland	The address of the state	Swiss Calibration Service
Accredited by the Swiss Accreditat The Swiss Accreditation Service Multilateral Agreement for the re	is one of the signatori	es to the EA	Accreditation No.: SCS 0108
Client SGS-TW (Auder	n)	Certificate N	lo: D5GHzV2-1349_Mar22
CALIBRATION C	ERTIFICATI	E	
Object	D5GHzV2 - SN:	1349	
Calibration procedure(s)	QA CAL-22.v6 Calibration Proce	edure for SAR Validation Source	s between 3-10 GHz
Calibration date:	March 22, 2022		
the measurements and the uncent	annies with confidence p	probability are given on the following pages a	nd are part of the certificate.
All calibrations have been conduct Calibration Equipment used (M&TE	ed in the closed laborato	ry facility: environment temperature (22 $\pm$ 3)	'C and humidity < 70%.
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards	ed in the closed laborato E critical for calibration)	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.)	C and humidity < 70%. Scheduled Calibration
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP	ed in the closed laborato	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292)	C and humidity < 70%. Scheduled Calibration Apr-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291	ed in the closed laborato critical for calibration) ID # SN: 104778	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291)	'C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91	ed in the closed laborato E critical for calibration) ID # SN: 104778 SN: 103244	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22
	ed in the closed laborato E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	ed in the closed laborato = critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 8H9394 (20k)	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	ed in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH3394 (20k) SN: 310982 / 06327	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	ed in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 310394 (20k) SN: 310992 (06327 SN: 3503	Cal Date (Certificate No.)       09-Apr-21 (No. 217-03291/03292)       09-Apr-21 (No. 217-03291)       09-Apr-21 (No. 217-033291)       09-Apr-21 (No. 217-03343)       09-Apr-21 (No. 217-03344)       09-Apr-22 (No. EX3-5503_Mar22)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Mar-23
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	ed in the closed laborato E critical for calibration) ID # SN: 104778 SN: 103245 SN: 103245 SN: 310982 / 06327 SN: 3503 SN: 601	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 08-Mar-22 (No. EX3-3503_Mar22) 01-Nov-21 (No. DAE4-601_Nov21)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Mar-23 Nov-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A	ed in the closed laborato E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID #	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03342) 09-Apr-21 (No. 217-03343) 09-Apr-22 (No. EX3-3503_Mar22) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Mar-23 Nov-22 Scheduled Check
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A	ed in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 31092 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: W341093315	Cal Date (Certificate No.)       09-Apr-21 (No. 217-03291/03292)       09-Apr-21 (No. 217-03291)       09-Apr-21 (No. 217-03292)       09-Apr-21 (No. 217-03343)       09-Apr-21 (No. 217-03343)       09-Apr-21 (No. 217-03342)       01-Nov-21 (No. DAE4-601_Nov21)       Check Date (in house)       30-Oct-14 (in house check Oct-20)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Mar-23 Nov-22 Scheduled Check In house check: Oct-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N misatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ed in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310342 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WS47093315 SN: 100972	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 08-Mar-22 (No. EX3-3503_Mar22) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Mar-23 Nov-22 Scheduled Check In house check: Cot-22 In house check: Cot-22
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All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination	ed in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310342 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WS47093315 SN: 100972	Cal Date (Certificate No.)       09-Apr-21 (No. 217-03291/03292)       09-Apr-21 (No. 217-03291)       09-Apr-21 (No. 217-03291)       09-Apr-21 (No. 217-033291)       09-Apr-21 (No. 217-0334)       09-Apr-21 (No. DAE4-601_Nov21)       Check Date (in house)       30-Oct-14 (in house check Oct-20)       07-Oct-15 (in house check Oct-20)       07-Oct-15 (in house check Oct-20)       15-Jun-15 (in house check Oct-20)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Mar-23 Nov-22 Scheduled Check In house check: Oct-22 In house check:
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N misatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ed in the closed laborato E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (206) SN: 310982 / 06327 SN: 310982 / 06327 SN: 501 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: US31080477 SN: US41080477	Cal Date (Certificate No.)       09-Apr-21 (No. 217-03291/03292)       09-Apr-21 (No. 217-03291)       09-Apr-21 (No. 217-03292)       09-Apr-21 (No. 217-03343)       09-Apr-21 (No. 217-03343)       09-Apr-21 (No. 217-03342)       01-Nov-21 (No. DAE4-601_Nov21)       Check Date (in house)       30-Oct-14 (in house check Oct-20)       07-Oct-15 (in house check Oct-20)       07-Oct-15 (in house check Oct-20)       07-Oct-15 (in house check Oct-20)       31-Mar-14 (in house check Oct-20)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Mar-23 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22

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### Report No.: TESA2301000032ES Page: 9 of 34

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



Schweizerischer Kalibrierdier S Service suisse d'étalonnage С Servizio svizzero di taratura 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.v.z
N/A	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 Mar22

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### **Measurement Conditions**

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	

### 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	35.1 ± 6 %	4.55 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	8.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.8 W/kg ± 19.9 % (k=2)
PAD averaged area 10 - 1 / 40 - 1 / 11 - 1701		5 ( ,
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

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

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

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

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	83.4 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	2.37 W/kg

Certificate No: D5GHzV2-1349\_Mar22

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### Report No. : TESA2301000032ES Page: 11 of 34

#### Head TSL parameters at 5750 MHz The following parameters and calculations were applied

	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	34.4 ± 6 %	5.05 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	8.15 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	2.29 W/kg

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

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

Impedance, transformed to feed point	49.7 Ω - 0.6 jΩ
Return Loss	- 43.0 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	52.5 Ω + 3.7 jΩ
Return Loss	- 27.3 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	54.4 Ω + 6.2 jΩ	
Return Loss	- 22.7 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

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

Date: 22.03.2022

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 Medium parameters used: f = 5250 MHz;  $\sigma = 4.55 \text{ S/m}$ ;  $\varepsilon_r = 35.1$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used: f = 5600 MHz;  $\sigma = 4.9 \text{ S/m}$ ;  $\varepsilon_r = 34.6$ ;  $\rho = 1000 \text{ kg/m}^3$ Medium parameters used: f = 5750 MHz;  $\sigma = 5.05 \text{ S/m}$ ;  $\varepsilon_r = 34.4$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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 = 78.77 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 28.5 W/kg SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.31 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 70.2% Maximum value of SAR (measured) = 18.6 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 = 78.29 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 31.7 W/kg SAR(1 g) = 8.40 W/kg; SAR(10 g) = 2.37 W/kg Smallest distance from peaks to all points 3 dB below = 7.4 mm Ratio of SAR at M2 to SAR at M1 = 67.4% Maximum value of SAR (measured) = 20.0 W/kg

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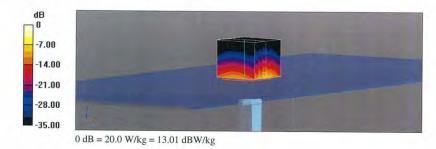
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Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 75.83 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 32.5 W/kg SAR(1 g) = 8.15 W/kg; SAR(10 g) = 2.29 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mmRatio of SAR at M2 to SAR at M1 = 65.8%Maximum value of SAR (measured) = 19.7 W/kg



Certificate No: D5GHzV2-1349\_Mar22

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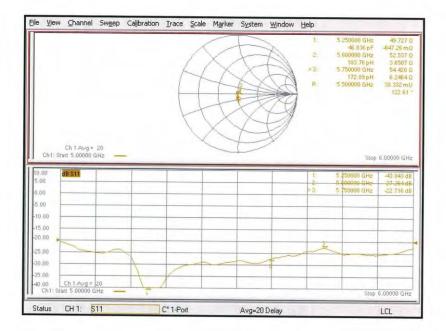
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### Impedance Measurement Plot for Head TSL



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Calibration Laboratory Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, 5			S Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura S swiss Calibration Service
Accredited by the Swiss Accreditation The Swiss Accreditation Service is Multilateral Agreement for the reco	one of the signatorie		Accreditation No.: SCS 0108
Client SGS (Auden)	-		ate No: D6.5GHzV2-1006_Aug22
CALIBRATION CI	ERTIFICAT	E	
Object	D6.5GHzV2 - SN	J:1006	
	QA CAL-22.v6 Calibration Proc	edure for SAR Validation So	urces between 3-10 GHz
Calibration date:	August 23, 2022		
	d in the closed laborato	robability are given on the following party facility: environment temperature (22	
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor R&S NRP33T	SN: 100967	01-Apr-22 (No. 217-03526)	Apr-23
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Mismatch combination	SN: 84224 / 360D	26-Apr-21 (No. 217-03353)	Apr-24
Reference Probe EX3DV4 DAE4	SN: 7405 SN: 908	02-Jun-22 (No. EX3-7405_Jun22) 27-Jun-22 (No. DAE4-908_Jun22)	Jun-23 Jun-23
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator Anapico APSIN20G Network Analyzer Keysight E5063A	SN: 827 SN:MY54504221	18-Dec-18 (in house check Dec-21) 31-Oct-19 (in house check Oct-19)	In house check: Dec-23 In house check: Oct-22
	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	Seef The
Approved by:	Sven Kühn	Technical Manager	5.0
This calibration certificate shall not b	e reproduced except ir	full without written approval of the labo	Issued: August 28, 2022

Certificate No: D6.5GHzV2-1006\_Aug22 Page 1 of 6

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Accreditation No.: SCS 0108

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Glossary: TSL

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

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

 a) 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 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.
- 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%.

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#### Measurement Conditions

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

DASY Version	DASY6	V16.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	5 mm	with Spacer
Zoom Scan Resolution	dx, dy = 3.4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	6500 MHz ± 1 MHz	

#### 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	34.5 ± 6 %	6.19 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	29.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	292 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	6.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	65.8 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	5.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.8 W/kg ± 24.4 % (k=2)

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#### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.7 Ω - 6.7 jΩ		
Return Loss	- 21.6 dB		

#### APD (Absorbed Power Density)

APD averaged over 1 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	291 W/m <sup>2</sup>
APD measured	normalized to 1W	2910 W/m <sup>2</sup> ± 29.2 % (k=2)
	1444	
APD averaged over 4 cm <sup>2</sup>	condition	
APD averaged over 4 cm <sup>2</sup> APD measured	condition 100 mW input power	132 W/m <sup>2</sup>

\*The reported APD values have been derived using 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

Manufactured by	SPEAG

Certificate No: D6.5GHzV2-1006\_Aug22

Page 4 of 6

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### Report No. : TESA2301000032ES Page: 20 of 34

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

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

	Test Properties	Section 1	2.1.2	Course of Courses				
Name, Manufa		imensions	F	IMEI	DUT Typ	e		
D6.5GHz	1	6.0 x 6.0 x	300.0	SN: 1006				
Exposure Con	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,	6500	5.50	6.19	34.5	
Hardware Set	an							
Phantom		SL		Probe, Calil	oration Date	DAE, Calib	oration Date	
MFP V8.0 Cent	ter - 1182 H	BBL600-10	000V6	EX3DV4 - SI	17405, 2022-06-02	DAE4 Sn9	08, 2022-06-27	
Scan Setup				Measureme	ent Results			
			Zoom Sc	an			Zoom Scan	
Grid Extents	[mm]		22.0 x 22.0 x 22	.0 Date		2	022-08-23, 10:39	
Grid Steps [m	nm]		3.4 x 3.4 x 1	.4 psSAR1g [	W/Kg]		29.2	
Sensor Surfac	ce [mm]		1	.4 psSAR8g [\	W/Kg]		6.58	
Graded Grid			Y	es psSAR10g	[W/Kg]		5.38	
Grading Ratio	0		1	.4 Power Drif	ft [dB]		0.01	
MAIA			N	A Power Sca	ling		Disabled	
Surface Dete	ction		VMS +	5p Scaling Fac	ctor [dB]			
Scan Method			Measur	ed TSL Correc	tion		No correction	
				M2/M1 [%	5]		50.6	
				Dist 3dB P	eak [mm]		4.8	



Certificate No: D6.5GHzV2-1006\_Aug22

Page 5 of 6

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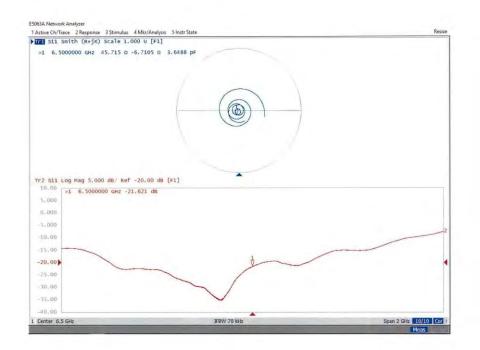
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Impedance Measurement Plot for Head TSL



Certificate No: D6.5GHzV2-1006 Aug22

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### Report No. : TESA2301000032ES Page: 22 of 34

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ccredited by the Swiss Accreditation he Swiss Accreditation Service is	one of the signatorie		Accreditation No.: SCS 0108
ultilateral Agreement for the reco lient SGS (Auden)	gnition of calibration		No: D7GHzV2-1007_Aug2
ALIBRATION CE	RTIFICAT	E	
Dbject	D7GHzV2 - SN:1	007	
	QA CAL-22.v6 Calibration Proce	edure for SAR Validation Sourc	ces between 3-10 GHz
Calibration date:	August 24, 2022		
		onal standards, which realize the physical robability are given on the following pages	
All calibrations have been conducted	in the closed laborato	ry facility: environment temperature (22 $\pm$	3)°C and humidity < 70%.
Calibration Equipment used (M&TE e	critical for calibration)		
Primary Standards	10#	Cal Date (Certificate No.)	Scheduled Calibration
ower sensor R&S NRP33T	SN: 100967	01-Apr-22 (No. 217-03526)	Apr-23
eference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
lismatch combination	SN: 84224 / 360D	26-Apr-21 (No. 217-03353)	Apr-24
Reference Probe EX3DV4	SN: 7405	02-Jun-22 (No. EX3-7405_Jun22)	Jun-23
AE4	SN: 908	27-Jun-22 (No. DAE4-908_Jun22)	Jun-23
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
RF generator Anapico APSIN20G	SN: 827	18-Dec-18 (in house check Dec-21)	In house check: Dec-23
Network Analyzer Keysight E5063A	SN:MY54504221	31-Oct-19 (in house check Oct-19)	In house check: Oct-22
	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	Settler
Approved by:	Sven Kühn	Technical Manager	S.L
			Issued: August 28, 2022

Certificate No: D7GHzV2-1007\_Aug22

Calibration Laboratory of

Engineering AG eughausstrasse 43, 8004 Zurich, Switzerland

Schmid & Partner

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### Report No. : TESA2301000032ES Page: 23 of 34

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



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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA

#### Glossary

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

Multilateral Agreement for the recognition of calibration certificates

#### 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 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.
- 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 Aug22

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#### **Measurement Conditions**

DASY Version	DASY6	V16.0
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	33.6 ± 6 %	6.81 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	27.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	278 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	6.03 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	60.2 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	4.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	49.3 W/kg ± 24.4 % (k=2)

Certificate No: D7GHzV2-1007\_Aug22

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### Appendix

Antenna Parameters with Head TSL

52.1 Ω - 6.1 <u>j</u> Ω		
- 24.0 dB	-	

APD (Absorbed Power Density)

APD averaged over 1 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	277 W/m <sup>2</sup>
APD measured	normalized to 1W	2770 W/m2 ± 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	121 W/m <sup>2</sup>

\*The reported APD values have been derived using 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

Manufactured by	SPEAG

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4.2

# **DASY6 Validation Report for Head TSL**

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

Device under	<b>Test Properties</b>							
Name, Manuf	acturer D	imensions	[mm] IN	IEI	DUT Typ	e		
D7GHz	1	L4.0 x 6.0 x	297.0 SN	1: 1007	-			
Exposure Con	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	6.81	33.6	
Hardware Set	up							
Phantom	TS	a.		Probe, Cali	bration Date	DAE. Calib	oration Date	
MFP V8.0 Cen	ter - 1182 HE	3BL600-100	000V6		N7405, 2022-06-02		08, 2022-06-27	
Scan Setup				Measureme	ent Results			
			Zoom Scan				Zoom Scan	
Grid Extents	[mm]		22.0 x 22.0 x 22.0	Date		2	022-08-24, 09:46	
Grid Steps [n	nm]		3.0 x 3.0 x 1.2	psSAR1g [	W/Kg]		27.8	
Sensor Surfa	ce [mm]		1.4	psSAR8g [	W/Kg]		6.03	
Graded Grid			Yes	psSAR10g	[W/Kg]		4.94	
Grading Ratio	0		1.2	Power Dri	ft [dB]		0.05	
MAIA			N/A	Power Sca	ling		Disabled	
Surface Dete	ction		VMS + 6p	Scaling Fai	ctor [dB]			
Scan Method	1		Measured	TSL Correc	tion		No correction	
				M2/M1 [%	6]		52.1	

Dist 3dB Peak [mm]



Certificate No: D7GHzV2-1007\_Aug22

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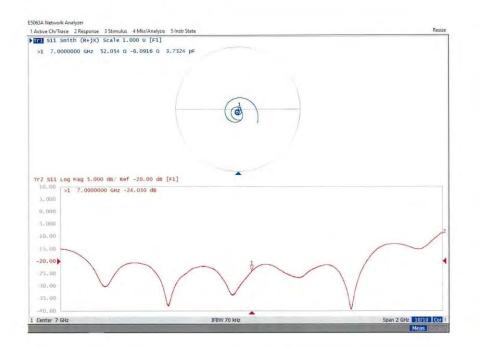
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#### Impedance Measurement Plot for Head TSL



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ccredited by the Swiss Accreditat he Swiss Accreditation Service	is one of the signat	tories to the EA	reditation No.: SCS 0108
Aultilateral Agreement for the re			
Sus-In (Aude			5G-Veri10-1021_Jan23
CALIBRATION O	CERTIFICA	ATE	
Object	5G Verificatio	on Source 10 GHz - SN: 1021	
Calibration procedure(s)	QA CAL-45.v Calibration pr	4 ocedure for sources in air above 6 GH	łz
Calibration date:	January 19, 2	2023	
This calibration certificate docume The measurements and the uncer	ents the traceability to tainties with confiden	national standards, which realize the physical units ce probability are given on the following pages and	of measurements (SI). are part of the certificate
		1	and part of the oorthoate.
All calibrations have been conduc		ratory facility: environment temperature (22 $\pm$ 3)°C a	und humidity < 70%.
All calibrations have been conduc Calibration Equipment used (M&T	E critical for calibratio	on)	
All calibrations have been conduc Calibration Equipment used (M&T Primary Standards		on) Cal Date (Certificate No.)	Scheduled Calibration
All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Reference Probe EUmmWV3	E critical for calibratio	on)	
All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Reference Probe EUmmWV3 DAE4ip	E critical for calibratio	on) Cal Date (Certificate No.) 2023-01-03(No. EUmmWV3-9374_Jan23) 2022-06-27 (No. DAE4ip-1602_Jun22)	Scheduled Calibration Jan-24 Jun-23
All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Reference Probe EUmmWV3 DAE4ip Secondary Standards RF generator R&S SMF100A	E critical for calibratio ID # SN: 9374 SN: 1602 ID # SN: 100184	on) Cal Date (Certificate No.) 2023-01-03(No. EUmmWV3-9374_Jan23)	Scheduled Calibration Jan-24
All calibrations have been conduc	E critical for calibratio	on) Cal Date (Certificate No.) 2023-01-03(No, EUmmWV3-9374_Jan23) 2022-06-27 (No, DAE4ip-1602_Jun22) Check Date (in house)	Scheduled Calibration Jan-24 Jun-23 Scheduled Check
All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Reference Probe EUmmWV3 DAE4ip Secondary Standards RF generator R&S SMF100A	E critical for calibratio ID # SN: 9374 SN: 1602 ID # SN: 100184	on) Cal Date (Certificate No.) 2023-01-03(No. EUmmWV3-9374_Jan23) 2022-06-27 (No. DAE4ip-1602_Jun22) Check Date (in house) 19-May-22 (in house check Nov-22)	Scheduled Calibration Jan-24 Jun-23 Scheduled Check In house check: Nov-23
All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Reference Probe EUmmWV3 DAE4ip Secondary Standards RF generator R&S SMF100A Power sensor R&S NRP18S-10	E critical for calibratio ID # SN: 9374 SN: 1602 ID # SN: 100184	on) Cal Date (Certificate No.) 2023-01-03(No. EUmmWV3-9374_Jan23) 2022-06-27 (No. DAE4ip-1602_Jun22) Check Date (in house) 19-May-22 (in house check Nov-22)	Scheduled Calibration Jan-24 Jun-23 Scheduled Check In house check: Nov-23
All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Reference Probe EUmmWV3 DAE4ip Secondary Standards RF generator R&S SMF100A Power sensor R&S NRP18S-10	E critical for calibratio 1D # SN: 9374 SN: 1602 1D # SN: 100184 SN: 101258	on) Cal Date (Certificate No.) 2023-01-03(No. EUmmWV3-9374_Jan23) 2022-06-27 (No. DAE4ip-1602_Jun22) Check Date (in house) 19-May-22 (in house check Nov-22) 31-May-22 (in house check Nov-22)	Scheduled Calibration Jan-24 Jun-23 Scheduled Check In house check: Nov-23 In house check: Nov-23 Signature
All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Reference Probe EUmmWV3 DAE4ip Secondary Standards RF generator R&S SMF100A	E critical for calibratio ID # SN: 9374 SN: 1602 ID # SN: 100184 SN: 101258 Name	on) Cal Date (Certificate No.) 2023-01-03(No. EUmmWV3-9374_Jan23) 2022-06-27 (No. DAE4ip-1602_Jun22) Check Date (in house) 19-May-22 (in house check Nov-22) 31-May-22 (in house check Nov-22) Function	Scheduled Calibration Jan-24 Jun-23 Scheduled Check In house check: Nov-23 In house check: Nov-23

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



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

Accreditation No.: SCS 0108

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Glossary 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 far-field 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
- Hom 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  $(W/m^2)$  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%.

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#### **Measurement Conditions**

DASY Version	DASY8 Module mmWave	V3.2.2
Phantom	5G Phantom	
Distance Horn Aperture - plane	10 mm	
XY Scan Resolution	dx, dy = 7.5 mm	
Number of measured planes	2 (10mm, 10mm + \/4)	
Frequency	10 GHz ± 10 MHz	

#### Calibration Parameters, 10 GHz

Distance Horn Aperture to Measured Plane	Prad <sup>1</sup> (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			1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	86.1	152	1.27 dB	61.5	55.6	1.28 dB
Distance Horn Aperture to Measured Plane	Prad <sup>1</sup> (mW)	Max E-field (V/m)	Uncertainty (k = 2)	psPDn+, psPDf	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)	
	1			1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	86.1	152	1.27 dB	61.4, 61.5, 61.6	55.4, 55.6, 55.9	1.28 dB

#### Square Averaging

Distance Horn Aperture to Measured Plane	Prad <sup>1</sup> (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	86.1	152	1.27 dB	61.5	55.5	1.28 dB
Distance Horn Aperture to Measured Plane	Prad <sup>1</sup> (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	86.1	152	1.27 dB	61.4, 61.4, 61.6	55.3, 55.4, 55.8	1.28 dB

#### Max Power Density

Distance Horn Aperture to Measured Plane	Prad <sup>1</sup> (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Max Power Density Sn, Stot,  Stot  (W/m <sup>2</sup> )	Uncertainty (k = 2)
10 mm	86.1	152	1.27 dB	63.8, 63.9, 63.9	1.28 dB

<sup>1</sup> Assessed ohmic and mismatch loss plus numerical offset: 0.55 dB

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#### **DASY Report**

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Name, Manufacturer 5G Verification Source 10 GH	Dimensions [mn Hz 100.0 x 100.0 x 1		IMEI SN: 1021	DUT Type	
Exposure Conditions					
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	cw	10000.0, 10000	1.0
Hardware Setup					
Phantom	Medium		Probe, Calib	pration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air			- SN9374 F1-55GHz,	DAE4ip Sn1602, 2022-06-27
Scan Setup				ment Results	
Grid Extents [mm]		5G S			5G Scan
Grid Extents [mm] Grid Steps [lambda]		120.0 x 12 0.25 x 0		111	2023-01-19, 16:42
Sensor Surface [mm]			0.25 Avg. Area 10.0 Avg. Type	[cm,]	1.00
MAIA		MAIA not u		//m²]	Circular Averaging 61.4
			psPDtot+		61.5
			psPDmod-	+ [W/m <sup>2</sup> ]	61.6
			Max(Sn) [\		63.8
			Max(Stot)	[W/m <sup>2</sup> ]	63.9
			Max( Stot Emax [V/m]		63.9
			Power Drif		152
				(00)	0.00
	sPDiote (1.0				

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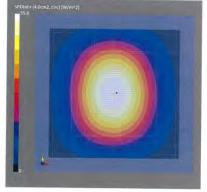
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### **DASY Report**

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Name, Manufacturer	Dimensions [mn	n]	IMEI	DUT Type	
5G Verification Source 10 G	iHz 100.0 x 100.0 x	172.0	SN: 1021	-	
xposure Conditions					
hantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
-G -	10.0 mm	Validation band	cw	10000.0, 10000	1.0
lardware Setup					
hantom	Medium		Probe, Calib	ration Date	DAE, Calibration Date
nmWave Phantom - 1002	Air			SN9374_F1-55GHz,	DAE4ip Sn1602, 2022-06-27
ican Setup			Measuren	nent Results	
		56.5	can		1.1.1

Grid Steps [lambda] Sensor Surface [mm] MAIA	0.25 x 0.25 10.0 MAIA not used	Avg. Area [cm <sup>2</sup> ] Avg. Type psPDnt+ [W/m <sup>2</sup> ] psPDtot+ [W/m <sup>2</sup> ] Max(Sn) [W/m <sup>2</sup> ] Max(Stot) [W/m <sup>2</sup> ] Max(Stot) [W/m <sup>2</sup> ] E <sub>max</sub> [V/m] Power Drift [dB]	2023-01-19, 16-42 4.00 Circular Averaging 55.4 55.6 55.9 63.8 63.9 63.9 152 0 cc
		Power Drift [dB]	152



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#### **DASY Report**

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Device under Test Pro Name, Manufacturer 5G Verification Source 10 G	Dimensions [mr		IMEI SN: 1021	DUT Type	
Exposure Conditions Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz] Channel Number	
6G -	10.0 mm	Validation band	cw	10000.0, 10000	1.0
lardware Setup					
Phantom nmWave Phantom - 1002	Medium Air		EUm	e <b>, Calibration Date</b> mWV3 - SN9374_F1-55GHz, 3-01-03	DAE, Calibration Date DAE4ip Sn1602, 2022-06-27
ican Setup			Me	asurement Results	
Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA	sPDint+ () 2 5.4	565 120.0 × 12 0.25 × 0 MAIA not u	20.0 Da 0.25 Avy 10.0 Avy ised psf psf Ma Ma Ma Ema	te 5-Area [cm <sup>2</sup> ] 5-Type Din+[W/m <sup>2</sup> ] Dinte(W/m <sup>2</sup> ] Dinte(W/m <sup>2</sup> ] KfStot][W/m <sup></sup>	56 Scan 2023-01-19, 16-42 1000 Square Averaging 61.4 61.6 63.8 63.9 63.9 152 0.00

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### **DASY Report**

Measurement Report for 5G Verification Source 10 GHz UID 0 - Chappel 10000 (10000 0000-

Name, Manufacturer 5G Verification Source 10 G	Dimensions [mn iHz 100.0 x 100.0 x		IMEI 5N: 1021	DUT Type	
Exposure Conditions Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency (MHz), Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	cw	10000.0, 10000	1.0
Hardware Setup Phantom mmWave Phantom - 1002	Medium Air		Probe, Calib EUmmWV3 2023-01-03	ration Date - SN9374_F1-55GHz,	DAE, Calibration Date DAE4ip Sn1602, 2022-06-27
Scan Setup		5G S		nent Results	5G Sc
Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA		120.0 x 12 0.25 x 0 1 MAIA not u	0.25 Avg. Area [ 10.0 Avg. Type	/m²] N/m²] [W/m²] W/m²] W/m²] ) [W/m²]	2023-01-19, 16- 4. Square Averagi 55 55 63 63 63 63 63 11 1
	5-Pitriet + 4.0 55.4	(m2, (q) (W/m^2)			

# - End of report -

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