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## **Appendix C**

## **Phantom Description**

Schmid & Partner Engineering AG

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

### Certificate of Conformity / First Article Inspection

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

#### 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

- [1] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01
   [2] 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.

25.7.2011

Signature / Stamp

Doc No 881 - QD OVA 002 A - A

1 (1)

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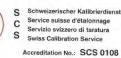


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# System Validation from Original Equipment Supplier

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





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Certificate No. D2450V2-727\_Apr23

Object	D2450V2 - SN:7	27	
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	edure for SAR Validation Sources	s between 0.7-3 GHz
Calibration date:	April 25, 2023		
The measurements and the uncert	aintles with confidence p	onal standards, which realize the physical unitrobability are given on the following pages an sy facility: environment temperature (22 $\pm$ 3)°C	d are part of the certificate.
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
	SN: BH9394 (20k)	20 May 22 (No. 247 00000)	Mar-24
		30-Mar-23 (No. 217-03809)	
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810)	Mar-24
Type-N mismatch combination Reference Probe EX3DV4			Mar-24 Jan-24
Type-N mismatch combination Reference Probe EX3DV4	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	
Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 310982 / 06327 SN: 7349	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23)	Jan-24 Dec-23
Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards Power meter E4419B	SN: 310982 / 06327 SN: 7349 SN: 601	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22)	Jan-24 Dec-23 Scheduled Check
Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards Power meter E4419B	SN: 310982 / 06327 SN: 7349 SN: 601	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) Check Date (in house) 30-Oct-14 (in house check Oct-22)	Jan-24 Dec-23 Scheduled Check In house check: Oct-24
Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) Check Date (in house)	Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24
Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) Check Date (in house 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22)	Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 310982 / 06327 SN: 7349 SN: 601 JD # SN: GB39512475 SN: US37292783 SN: MY41093315	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EXX-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) 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)	Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24
Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards Power meter E44198 Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) 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)	Jan-24 Dec-23 Scheduled Check In house check: Oct-24
Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards  Power meter E4419B  Power sensor HP 8481A  PF generator R&S SMT-08  Network Analyzer Agilent E8358A	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EXX-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) 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) Function	Jan-24 Dec-23 Scheduled Check In house check: Oct-24 Signature
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A  Calibrated by:	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB59512475 SN: US37292783 SN: MY41083315 SN: 100972 SN: US41080477 Name	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) Check Date (in house) 30-Oct-14 (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)	Jan-24 Dec-23 Scheduled Check In house check: Oct-24 Signature
Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB59512475 SN: US37292783 SN: MY41083315 SN: 100972 SN: US41080477 Name	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EXX-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) 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) Function	Jan-24 Dec-23 Scheduled Check In house check: Oct-24

Certificate No: D2450V2-727\_Apr23

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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. 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
- 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 Apr23

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#### 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	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	7,0,0,0,0
Frequency	2450 MHz ± 1 MHz	

### **Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	(2004)	

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.1 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.8 W/kg ± 16.5 % (k=2)

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.0 Ω + 2.1 jΩ
Return Loss	- 25.8 dB

### General Antenna Parameters and Design

AND THE RESERVE OF THE PARTY OF	
Electrical Delay (one direction)	1.148 ns
	1.170113

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: 25.04.2023

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;  $\sigma = 1.86$  S/m;  $\varepsilon_r = 37.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

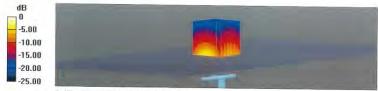
### DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.88, 7.88, 7.88) @ 2450 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- 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: dx=5mm, dy=5mm, dz=5mm Reference Value = 118.5 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 27.1 W/kg SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.28 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 50.2% Maximum value of SAR (measured) = 22.5 W/kg



0 dB = 22.5 W/kg = 13.52 dBW/kg

Certificate No: D2450V2-727\_Apr23

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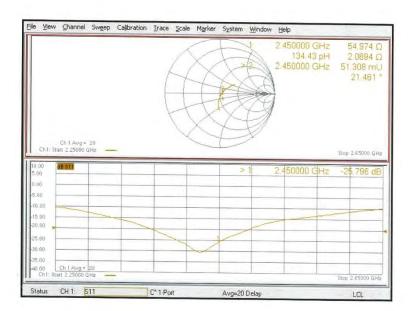
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#### Impedance Measurement Plot for Head TSL



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SGS (Auden) Certificate No: D5GHzV2-1023\_Jan23 **CALIBRATION CERTIFICATE** Object D5GHzV2 - SN:1023 Calibration procedure(s) Calibration Procedure for SAR Validation Sources between 3-10 GHz Calibration date January 19, 2023 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All callbrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Cal Date (Certificate No.) Scheduled Calibration 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) Power meter NRP SN: 104778 Apr-23 Power sensor NRP-Z91 Power sensor NRP-Z91 SN: 103244 Apr-23 SN: 103245 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) Apr-23 Reference 20 dB Attenuator Type-N mismatch combination SN: BH9394 (20k) Apr-23 SN: 310982 / 06327 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503\_Mar22) Apr-23 Reference Probe EX3DV4 SN: 3503 Mar-23 DAE4 SN: 601 19-Dec-22 (No. DAE4-601\_Dec22) Secondary Standards Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) In house check: Oct-24 Power sensor HP 8481A Power sensor HP 8481A SN: US37292783 In house check: Oct-24 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22) SN: MY41093315 In house check: Oct-24 RF generator R&S SMT-06 SN: 100972 In house check: Oct-24 work Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-22) In house check: Oct-24 Laboratory Technician Calibrated by: Jeton Kastrati Approved by: Sven Kühn Technical Manager Issued: January 20, 2023 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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Certificate No: D5GHzV2-1023 Jan23

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Glossary:

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

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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	35.6 ± 6 %	4.65 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	-

### SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 W/kg ± 19.5 % (k=2)

### 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	35.4 ± 6 %	5.03 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		1000

### SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	83.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.7 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1023\_Jan23

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#### Head TSL parameters at 5750 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.03 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	5.15 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	<del></del>	

### SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.6 W/kg ± 19.5 % (k=2)

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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	48.8 Ω - 8.7 ĵΩ	
Return Loss	- 21.1 dB	

### Antenna Parameters with Head TSL at 5600 MHz

npedance, transformed to feed point	53.1 Ω - 3.3 jΩ	
Return Loss	- 27.2 dB	

### Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	56.5 Ω + 0.1 jΩ
Return Loss	- 24.3 dB

### General Antenna Parameters and Design

And the residence of the second secon	
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: 19.01.2023

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium parameters used: f = 5250 MHz;  $\sigma$  = 4.65 S/m;  $\epsilon_r$  = 35.6;  $\rho$  = 1000 kg/m³ Medium parameters used: f = 5600 MHz;  $\sigma$  = 5.03 S/m;  $\epsilon_r$  = 35.4;  $\rho$  = 1000 kg/m³ Medium parameters used: f = 5750 MHz;  $\sigma$  = 5.15 S/m;  $\epsilon_r$  = 35.3;  $\rho$  = 1000 kg/m³ 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: 19.12.2022
- 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 = 75.49 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 27.5 W/kg SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.30 W/kgSmallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 70.9% 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 = 75.70 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 31.1 W/kg SAR(1 g) = 8.39 W/kg; SAR(10 g) = 2.37 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mmRatio of SAR at M2 to SAR at M1 = 68%Maximum value of SAR (measured) = 19.8 W/kg

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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 = 72.80 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 31.3 W/kgSAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.26 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mmRatio of SAR at M2 to SAR at M1 = 66.2%

Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 19.8 W/kg = 12.97 dBW/kg

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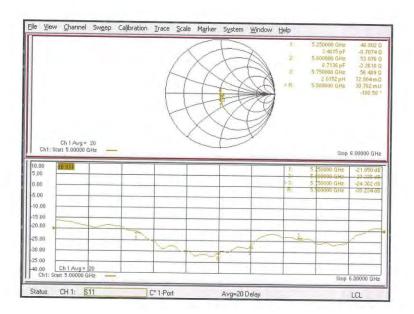
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### Impedance Measurement Plot for Head TSL



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CALIBRATION CE	RTIFICATI		
Object	D6.5GHzV2 - SN	I:1006	
	QA CAL-22.v6 Calibration Proce	edure for SAR Validation Sources	between 3-10 GHz
Calibration date:	August 23, 2022		
The measurements and the uncertain	nties with confidence p	onal standards, which realize the physical unitrobability are given on the following pages and ry facility: environment temperature (22 ± 3)°C	d are part of the certificate.
Calibration Equipment used (M&TE of			
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 Mismatch combination	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Reference Probe EX3DV4	SN: 84224 / 360D SN: 7405	26-Apr-21 (No. 217-03353) 02-Jun-22 (No. EX3-7405_Jun22)	Apr-24 Jun-23
DAE4	SN: 908	27-Jun-22 (No. DAE4-908_Jun22)	Jun-23
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Secondary Standards RF generator Anapico APSIN20G Network Analyzer Keysight E5063A	SN: 827	Check Date (in house) 18-Dec-18 (in house check Dec-21) 31-Oct-19 (in house check Oct-19)	Scheduled Check In house check: Dec-23 In house check: Oct-22
RF generator Anapico APSIN20G	SN: 827	18-Dec-18 (in house check Dec-21)	In house check: Dec-23
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 Signature
RF generator Anapico APSIN20G	SN: 827 SN:MY54504221 Name	18-Dec-18 (in house check Dec-21) 31-Oct-19 (in house check Oct-19) Function	In house check: Dec-23 In house check: Oct-22

Certificate No: D6.5GHzV2-1006\_Aug22

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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%.

Certificate No: D6.5GHzV2-1006 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 = 3.4  mm, dz = 1.4  mm	Graded Ratio = 1.4 (Z direction)
Frequency	6500 MHz ± 1 MHz	

### Head TSL parameters

	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 cm3 (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)

Certificate No: D6.5GHzV2-1006\_Aug22

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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/m²
APD measured	normalized to 1W	2910 W/m <sup>2</sup> ± 29.2 % (k=2)
THE MICHOGRAPH	707710000000000000000000000000000000000	
APD averaged over 4 cm <sup>2</sup>	condition	

APD measured 100 mW input power 132 W/m<sup>2</sup> APD measured normalized to 1W 1320 W/m2 ± 28.9 % (k=2)

### 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

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<sup>\*</sup>The reported APD values have been derived using psSAR8g



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

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

Device under Test Proper	rties		
Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
D6.5GHz	16.0 x 6.0 x 300.0	SN: 1006	*

Exposure Cond	ditions						
Phantom	Position, Test	Band	Group,	Frequency	Conversion	TSL Cond.	TSL
Section, TSL	Distance		UID	[MHz]	Factor	[S/m]	Permittivity
	[mm]						
Flat, HSL	5.00	Band	CW.	6500	5.50	6.19	34.5

Hardware Setup			
Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center - 1182	HBBL600-10000V6	EX3DV4 - SN7405, 2022-06-02	DAE4 Sn908, 2022-06-27

		September of the september of the	
Scan Setup		Measurement Results	
	Zoom Scan		Zoom Scan
Grid Extents [mm]	22.0 x 22.0 x 22.0	Date	2022-08-23, 10:39
Grid Steps [mm]	3.4 x 3.4 x 1.4	psSAR1g [W/Kg]	29.2
Sensor Surface [mm]	1.4	psSAR8g [W/Kg]	6.58
Graded Grid	Yes	psSAR10g [W/Kg]	5.38
Grading Ratio	1.4	Power Drift [dB]	0.01
MAIA	N/A	Power Scaling	Disabled
Surface Detection	VMS + 6p	Scaling Factor [dB]	
Scan Method	Measured	TSL Correction	No correction
		M2/M1 [%]	50.6
		Dist 3dB Peak [mm]	4.8



Certificate No: D6.5GHzV2-1006\_Aug22

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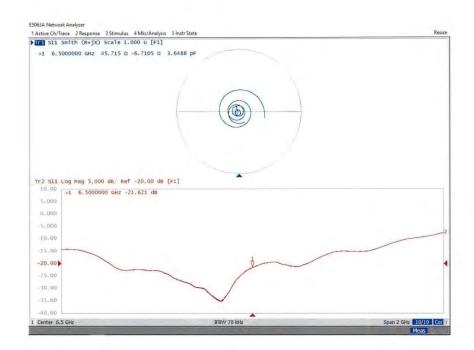
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#### Impedance Measurement Plot for Head TSL



Certificate No: D6.5GHzV2-1006 Aug22

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

Accreditation No.: SCS 0108

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

#### Certificate No: D7GHzV2-1007\_Aug22 SGS (Auden) **CALIBRATION CERTIFICATE** D7GHzV2 - SN:1007 Object QA CAL-22.v6 Calibration procedure(s) Calibration Procedure for SAR Validation Sources between 3-10 GHz Calibration date: August 24, 2022 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards Cal Date (Certificate No.) Scheduled Calibration Power 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 02-Jun-22 (No. EX3-7405\_Jun22) Reference Probe EX3DV4 SN: 7405 Jun-23 DAE4 27-Jun-22 (No. DAE4-908\_Jun22) ID# Secondary Standards Check Date (in house) Scheduled Check RF generator Anapico APSIN20G SN: 827 18-Dec-18 (in house check Dec-21) n house check: Dec-23 Network Analyzer Keysight E5063A SN:MY54504221 31-Oct-19 (in house check Oct-19) In house check: Oct-22 Calibrated by: Leif Klysner Laboratory Technician Technical Manager Issued: August 28, 2022 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

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Glossary:

TSL tissue simulating liquid sensitivity in TSL / NORM x,y,z ConvF 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
- · 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**

	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	- where	

### SAR result with Head TSL

SAR averaged over 1 cm3 (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)

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#### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1 Ω - 6.1 jΩ	
Return Loss	- 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 measured	100 mW input power	121 W/m²
APD measured	normalized to 1W	1210 W/m2 ± 28.9 % (k=2)

<sup>\*</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

SPEAG

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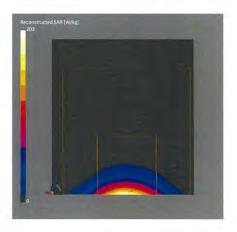


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### **DASY6 Validation Report for Head TSL**

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

Name, Manufa	acturer Di	mensions	[mm] IN	/IEI	DUT Typ	e	
D7GHz	14	4.0 x 6.0 x	297.0 SI	N: 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	6.81	33.6
Hardware Setu	qu						
Phantom	TSI			Probe, Calil	bration Date	DAE, Calib	ration Date
MFP V8.0 Cent	ter - 1182 HB	BL600-100	000V6	EX3DV4 - SI	N7405, 2022-06-02	DAE4 Sn9	08, 2022-06-27
Scan Setup				Measureme	ent Results		
			Zoom Scar				Zoom Scan
Grid Extents			22.0 x 22.0 x 22.0	Date		2	022-08-24, 09:46
Grid Steps [m			3.0 x 3.0 x 1.2	psSAR1g [	W/Kg]		27.8
Sensor Surfac	ce [mm]		1.4	psSAR8g [	W/Kg]		6.03
Graded Grid			Yes	psSAR10g	[W/Kg]		4.94
<b>Grading Ratio</b>			1.2	Power Drift	ft [dB]		0.05
MAIA			N/A	Power Sca	ling		Disabled
Surface Detec	ction		VMS + 6p				
Scan Method			Measured	TSL Correct	ction		No correction
				M2/M1 [%			52.1
				Dist 3dB P	eak [mm]		4.2



Certificate No: D7GHzV2-1007\_Aug22

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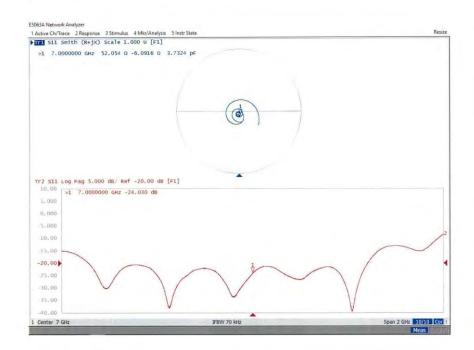
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### Impedance Measurement Plot for Head TSL



Certificate No: D7GHzV2-1007\_Aug22

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





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

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

Accreditation No.: SCS 0108

Client SGS-TW (Auden)

Certificate No: 5G-Veri10-1021 Jan23

	CERTIFICA	TE	
Object	5G Verificatio	n Source 10 GHz - SN: 1021	
Calibration procedure(s)	QA CAL-45.v4 Calibration pro	4 ocedure for sources in air above 6 GH:	z
Calibration date:	January 19, 2	023	
The measurements and the uncer	rtainties with confidence	national standards, which realize the physical units of ce probability are given on the following pages and a ratory facility: environment temperature $(22 \pm 3)^{\circ}$ C ar	re part of the certificate.
Calibration Equipment used (M&T Primary Standards	ID #	(Cal Date (Certificate No.)	Scheduled Calibration
Reference Probe EUmmWV3 DAE4ip	SN: 9374 SN: 1602	2023-01-03(No. EUmmWV3-9374_Jan23) 2022-06-27 (No. DAE4ip-1602_Jun22)	Jan-24 Jun-23
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
	SN: 100184	19-May-22 (in house check Nov-22)	In house check: Nov-23
TF generator R&S SMF100A Power sensor R&S NRP18S-10	SN: 101258	31-May-22 (in house check Nov-22)	In house check: Nov-23
Power sensor R&S NRP18S-10	Name	31-May-22 (in house check Nov-22)  Function	A. C.
The second secon		31-May-22 (in house check Nov-22)	In house check: Nov-23 Signature
Power sensor R&S NRP18S-10	Name	31-May-22 (in house check Nov-22)  Function	In house check: Nov-23

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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 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.
- 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 (1cm² and 4cm²) 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/m²) averaged over the surface area of 1 cm² and 4cm² 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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SGS Taiwan Ltd.



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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 + λ/4)	
Frequency	10 GHz ± 10 MHz	

### Calibration Parameters, 10 GHz

Circular Averaging

	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (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	61.5	55.6	1.28 dB

Distance Horn Aperture to Measured Plane	Prad¹ (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, 61.5, 61.6	55.4, 55.6, 55.9	1.28 dB

Square Averaging

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	1.19. 0.10. 0.000	PDtot+, psPDmod+)	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	Prad¹ (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	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Max Power Density Sn, Stot,  Stot  (W/m²)	Uncertainty (k = 2)
10 mm	86.1	152	1.27 dB	63.8, 63.9, 63.9	1.28 dB

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)

Device under Tes	t Properties				
Name, Manufacturer	Dimensions [m	m]	IMEI	DUT Type	
5G Verification Source	10 GHz 100.0 x 100.0 x	172.0	SN: 1021		
<b>Exposure Condition</b>	ons				
<b>Phantom Section</b>	Position, Test Distance	Band	Group,	Frequency [MHz],	<b>Conversion Factor</b>
	[mm]			Channel Number	
5G -	10.0 mm	Validation band	cw	10000.0.	1.0
				10000	1.0

Hardware Setup			
Phantom mmWave Phantom - 1002	Medium Air	Probe, Calibration Date EUmmWV3 - SN9374 F1-55GHz.	DAE, Calibration Date DAE4io Sn1602
		2023-01-03	2022-06-27

mmWave Phantom - 1002	Air		EUmmWV3 - SN9374_F1-55GHz, 2023-01-03	DAE, Calibration Date DAE4ip Sn1602, 2022-06-27
Scan Setup			Measurement Results	
		5G Scan		5G Scar
Grid Extents [mm]		120.0 x 120.0	Date	2023-01-19, 16:4:
Grid Steps [lambda]		0.25 x 0.25	Avg. Area [cm²]	1.00
Sensor Surface [mm]		10.0	Avg. Type	Circular Averagin
MAIA		MAIA not used	psPDn+ [W/m <sup>2</sup> ]	61.4
			psPDtot+ [W/m²]	61.5
			psPDmod+ [W/m²]	61.0
			Max(Sn) [W/m <sup>2</sup> ]	63.8
			Max(Stot) [W/m <sup>2</sup> ]	63.5
			Max( Stot ) [W/m <sup>2</sup> ]	63.9
			E <sub>max</sub> [V/m]	15:
			Power Drift [dB]	0.0



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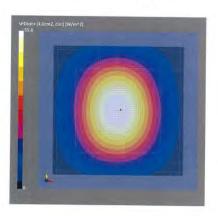


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### **DASY Report**

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

Device under Test Pro	operties				
Name, Manufacturer	Dimensions [mn	n]	IMEI	DUT Type	
5G Verification Source 10 C	5Hz 100.0 x 100.0 x	172.0	SN: 1021	-	
<b>Exposure Conditions</b>					
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		Broke Cal	ibration Date	And the second second
mmWave Phantom - 1002	Air			3 - SN9374_F1-55GHz,	DAE, Calibration Date DAE4ip Sn1602, 2022-06-27
Scan Setup			Measure	ement Results	
		5G S	can		5G Sca
Grid Extents [mm]		120.0 x 12	0.0 Date		2023-01-19, 16:4
Grid Steps [lambda]		0.25 x 0		[cm <sup>2</sup> ]	4.00
Sensor Surface [mm] MAIA			0.0 Avg. Type		Circular Averagin
IVIAIA		MAIA not us			55.
			psPDtot+		55.
			psPDmod Max(Sn)		55.9
			Max(Stot		63.1
				) [W/m²] t[] [W/m²]	63.5
			Emax [V/m		63.9
			Power Dr		152
					0.00



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#### **DASY Report**

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

roperties				
Dimensions [mm	1]	IMEI	DUT Type	
100.0 x 100.0 x	172.0	SN: 1021	-	
s				
Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
10.0 mm	Validation band	cw	10000.0, 10000	1.0
	GHz 100.0 x 100.0 x: s Position, Test Distance [mm]	Dimensions [mm] 100.0 × 100.0 × 172.0  S Position, Test Distance Band [mm]	Dimensions [mm]   IME    100.0 × 100.0 × 172.0   SN: 1021	Dimensions [mm]   IME    DUT Type

Hardware Setup			
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV3 - SN9374_F1-55GHz, 2023-01-03	DAE4ip Sn1602,
		2023-01-03	2022-06-27

mmWave Phantom - 1002	Air	EUmmWV3 - SN9374_F1-55GHz, 2023-01-03	DAE4ip Sn1602, 2022-06-27
Scan Setup		Measurement Results	
Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA	56 Scan 120.0 x 120.0 0.25 x 0.25 10.0 MAIA not used	Date  Avg. Area [cm²]  Avg. Type  psPDn+ [W/m²]  psPDtot+ [W/m²]  psPDtote+ [W/m²]  Max[Sn] [W/m²]  Max[Sn] [W/m²]  Max[Stot] [W/m²]  Max[Stot] [W/m²]  Pawer Drift [dB]	SG Scan 2023-01-19, 16:42 1.00 Square Averaging 61:4 61:6 63:8 63:9 63:9 152 0.00



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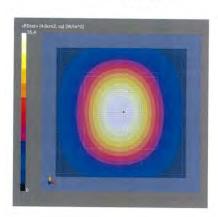
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#### **DASY Report** Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz) **Device under Test Properties** Name, Manufacturer 5G Verification Source 10 GHz Dimensions [mm] 100.0 x 100.0 x 172.0 DUT Type Exposure Conditions Position, Test Distance [mm] Frequency [MHz], Channel Number 10.0 mm Validation hand Hardware Setup Probe, Calibration Date DAE, Calibration Date mWave Phantom - 1002 EUmmWV3 - SN9374\_F1-55GHz, 2023-01-03 DAE4ip Sn1602, 2022-06-27 Scan Setup Measurement Results 120.0 x 120.0 0.25 x 0.25 10.0 Grid Extents [mm] Date Avg. Area [cm²] Avg. Type psPDn+ [W/m²] psPDtot+ [W/m²] psPDtot+ [W/m²] Max(Sn) [W/m²] Max(Stot) [W/m²] Max[Stot) [W/m²] Power Drift [dB] 2023-01-19, 16:42 Grid Steps [lambda] Sensor Surface [mm] MAIA 4.00 4.00 Square Averaging 55.3 55.4 55.8 63.9 63.9

MAIA not used



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# - End of report -

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