

Report No. : TESA2204000040EN Rev: 01 Page: 1 of 15

Appendix C

Phantom Description

Schmid & Partivel E

Engineering 40	 S	p	е	а	g	

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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 standarda	Bottom elliptical 600 × 400 mm, Depth 190 mm, dimension compliant with [1] for t > 375 MHz	Prototypes
Material thickness	Bottom: 2.0mm +/- 0.2mm	dimension compliant with [3] for f > 800 MHz	ali
Material parameters	rel. permittivity $2 - 5$, loss tangent ≤ 0.05 , at $1 \leq 6$. 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

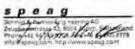
- OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01
 IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices. Measurement
- Techniques, December 2003 [3] IEC 62209-1 ed 1.0, "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
- Processing to the ear (frequency range of 300 MHz to 3 GHz)*, 2005-02-18
 EC 52209-2 ed.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices Human models, instrumentation, and procedures Parl 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



Doc No 581- QD OVA 002 A - A

Page 1111

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

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Page 1 of 6

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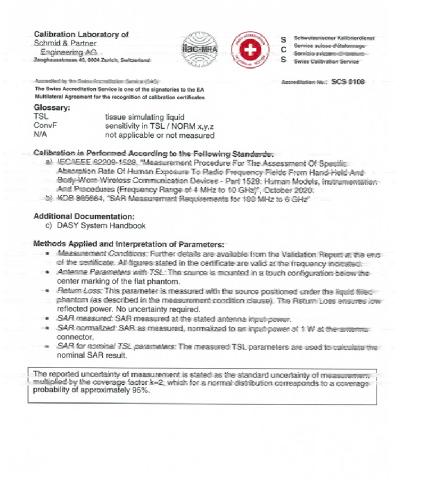
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Page 2 of 6

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Measurement Conditions

DASY system configuration, as far as not	given on page 1.	
DASY Version	DASY52	V:52.10.4
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

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		- 37.8±8% -	1.67 minute # 9.%
Head TSL temperature change during test	< 0.5 °C		

SAB result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 W/kg
SAR for coming Hand TSL presenters		52.8 Wikg = 17.0 % (k=2)
SAB supressed over 10 cm ³ (10 c) of Lland TCI	aanditian	
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured SAR for nomical Head TSL proceedings	condition 250 mW input power	6.34 W/kg

Certificate No: D2450V2-727_Apr22

Page 3 of 6

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

Antenna Parameters with Head TSL

Electrical Delay (one direction)

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

1.149 ns

General Antenna Parameters and Design

After long term use with 190W califated power, only a slight warning of the close near the feedpoint can be re

The dipole is made of standard semicipid costial cable. The center conductor of the Heading line is directly connected to the second arm of the dipole. The antenna is therefore short-circulad for DC-signals. On some of the dipoles, small one copy are added to the dipole arms in order to improve matching when leaded anoming 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.

according to the Standard. No experi sive force must be applied to the dipole arms, because they might bend or the soldered come feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

Certificate No: D2450V2-727_Apr22

Page 4 of 6

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Date: 25.04.2022

DASY5 Validation Report for Head TSL

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: 0245002; Seeial: 2245002 - 524 727

Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz, $\sigma = 1.87$ S/m, $s_r = 37.8$, $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; Cam/E(7.96, 7.96, 7.96); @ 2450 Miller; 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=259 mW, d=10mm/Zoom Scan (7x7x7)/Cabe@- $\label{eq:linear_line$



Certificate No: D2450V2-727 Apr22 Page 5 of 6

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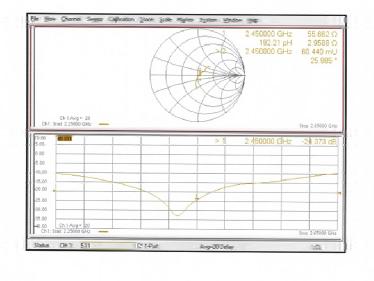
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Impedance Measurement Plot for Head TSL



D2450V2-727_Apr22	Page 6 of 6	

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Accredited by the Swiss Accreditat The Swiss Accreditation Service Multilateral Agreement for the re	is one of the signatorie	s to the EA	Accreditation No.: SCS 0108
Client SGS (Auden)			No: D5GHzV2-1023_Jan22
CALIBRATION C	ERTIFICATI	E	
Object	D5GHzV2 - SN:1	023	
Calibration procedure(s)	QA CAL-22.v6 Calibration Proce	dure for SAR Validation Source	es between 3-10 GHz
Calibration date:	January 27, 2022	2	
The measurements and the uncert All calibrations have been conduct	tainties with confidence p ted in the closed laborator	onal standards, which realize the physical u robability are given on the following pages a y facility: environment temperature (22 \pm 3)	and are part of the certificate.
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Accreditation No.: SCS 0108

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Multilateral Agreement for the recognition of calibration certificates Glossary: TSL ConvF

N/A

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

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- 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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Page 2 of 8

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Measurement Conditions

DASY

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	the second second second
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	34.9 ± 6 %	4.52 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 ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.0 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.34 W/kg

Head TSL parameters at 5600 MHz The follo ving para and calcula

	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	34.4 ± 6 %	4.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	

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SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.51 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.4 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.40 W/kg

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Page 3 of 8

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Head TSL parameters at 5750 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	5.02 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		100 million 100

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.0 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.31 W/kg

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Page 4 of 8

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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	52.0 Ω - 5.2 jΩ
Return Loss	- 25.3 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.7 Ω + 0.2 jΩ
Return Loss	- 27.0 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	57.2 Ω + 2.1 jΩ	
Return Loss	- 23.1 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured

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

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

Additional EUT Data

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Manufactured by	SPEAG
	OI ENO

Certificate No: D5GHzV2-1023 Jan22

Page 5 of 8

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DASY5 Validation Report for Head TSL

Date: 27.01.2022

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 MHz Medium parameters used: f = 5250 MHz; $\sigma = 4.52 \text{ S/m}$; $\varepsilon_r = 34.9$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: f = 5600 MHz; $\sigma = 4.87 \text{ S/m}$; $\varepsilon_r = 34.4$; $\rho = 1000 \text{ kg/m}^3$ Medium parameters used: f = 5750 MHz; $\sigma = 5.02 \text{ S/m}$; $\varepsilon_r = 34.2$; $\rho = 1000 \text{ kg/m}^3$ 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: 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) ٠

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 = 76.83 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 28.0 W/kg SAR(1 g) = 8.16 W/kg; SAR(10 g) = 2.34 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 70.7% 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 = 77.04 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 8.51 W/kg; SAR(10 g) = 2.40 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 68% Maximum value of SAR (measured) = 20.1 W/kg

Certificate No: D5GHzV2-1023 Jan22

Page 6 of 8

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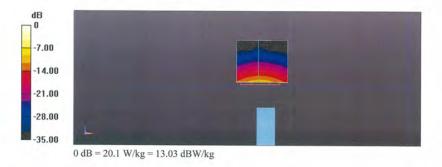
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Report No. : TESA2204000040EN Rev: 01 Page: 14 of 15

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 = 74.27 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 31.8 W/kg SAR(1 g) = 8.17 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 = 66.3% Maximum value of SAR (measured) = 19.8 W/kg



Certificate No: D5GHzV2-1023_Jan22

Page 7 of 8

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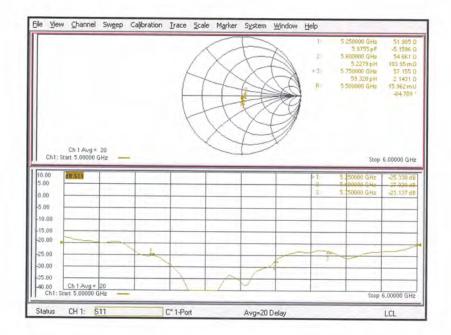
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Report No. : TESA2204000040EN Rev: 01 Page: 15 of 15

Impedance Measurement Plot for Head TSL



Certificate No: D5GHzV2-1023_Jan22

Page 8 of 8

- End of report -

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