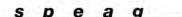


# **Appendix C**

# **Phantom Description**

Schmid & Partner Engineering AG



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.

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 IEC 62209–1 ed1.0, "Human exposure to radio frequency fields from hand-heid and body-mounted wireless communication devices Human models, instrumentation, and procedures Part 1: [3] Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)\*, 2005-02-18
- IEC 62209-2 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices Human models, instrumentation, and procedures Part 2: [4] 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 Date

Signature / Stamp



Doc No 881 - QD OVA 002 A - A

Page 1(1)

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# System Validation from Original Equipment Supplier

	ch, Switzerland	The delight the state S	Swiss Calibration Service
ccredited by the Swiss Accredit he Swiss Accreditation Servio ultilateral Agreement for the	ce is one of the signatorie	s to the EA	creditation No.: SCS 0108
lient SGS-TW (Aud	en)	Certificate No	: D2450V2-727_Apr18
CALIBRATION	CERTIFICATE		
Object	D2450V2 - SN:72	27	
Calibration procedure(s)	QA CAL-05.v10 Calibration proce	dure for dipole validation kits abc	ove 700 MHz
Calibration date:	April 24, 2018		
			d are part of the certificate.
All calibrations have been cond		ry facility: environment temperature (22 $\pm$ 3)°(	
All calibrations have been cond Calibration Equipment used (Ma	TE critical for calibration)	ry facility: environment temperature $(22 \pm 3)^{\circ}$	C and humidity < 70%.
All calibrations have been cond Calibration Equipment used (Ma Primary Standards	TE critical for calibration)	ry facility: environment temperature (22 ± 3)*( Cai Date (Certificate No.)	
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Certificate No: D2450V2-727\_Apr18

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



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

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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

Multilateral Agreement for the recognition of calibration certificates Glossary: TSL tissue simulating liquid sensitivity in TSL / NORM x,y,z ConvF not applicable or not measured N/A

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

# Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless c) communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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# **Measurement Conditions**

DASY s	ystem conf	guration,	as fai	as not	given c	n page 1.
					-	

DASY Version	DASY5	V52.10.0
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	38.3 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	1	1

#### 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	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.1 W/kg ± 17.0 % (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 250 mW input power	6.16 W/kg

# **Body TSL parameters**

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.5 ± 6 %	2.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

# SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.8 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 250 mW input power	6.00 W/kg

Certificate No: D2450V2-727 Apr18

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.2 Ω + 2.7 jΩ	
Return Loss	- 25.1 dB	

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.2 Ω + 5.6 jΩ	
Return Loss	- 25.0 dB	

# General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns

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

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

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

# Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 09, 2003

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# **DASY5 Validation Report for Head TSL**

Date: 24.04.2018

Test Laboratory: SPEAG, Zurich, Switzerland

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

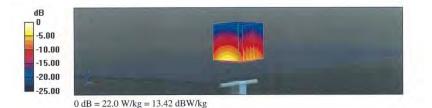
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz;  $\sigma = 1.86 \text{ S/m}$ ;  $\epsilon_r = 38.3$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.88, 7.88, 7.88); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017 .
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001 .
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417) .

# 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 = 116.0 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 26.7 W/kg SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.16 W/kg Maximum value of SAR (measured) = 22.0 W/kg



Certificate No: D2450V2-727\_Apr18

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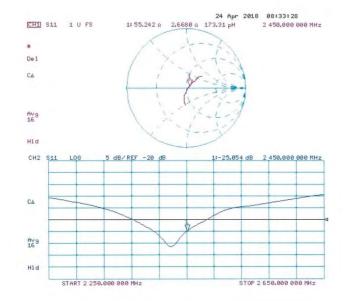
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Report No. :E5/2019/30024 Rev: 01 Page: 7 of 25

# Impedance Measurement Plot for Head TSL



Page 6 of 8 Certificate No: D2450V2-727\_Apr18

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# **DASY5 Validation Report for Body TSL**

Date: 24.04.2018

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;  $\sigma = 2.01 \text{ S/m}$ ;  $\epsilon_r = 52.5$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.01, 8.01, 8.01); Calibrated: 30.12.2017; .
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017 .
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

# Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 108.4 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 25.5 W/kg SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6 W/kg Maximum value of SAR (measured) = 21.1 W/kg



Certificate No: D2450V2-727\_Apr18 Page 7 of 8

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

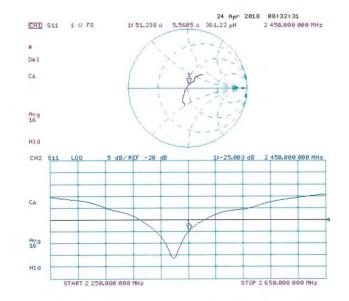
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# Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-727\_Apr18

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lient Auden		Certificate No	D5GHzV2-1040_Jun18
CALIBRATION C	ERTIFICATE		
Dbject	D5GHzV2 - SN:1	040	
Calibration procedure(s)	QA CAL-22.v3		
	Calibration proce	dure for dipole validation kits bet	ween 3-6 GHz
Calibration date:	June 28, 2018		
This calibration certificate docum	ents the traceability to nat	onal standards, which realize the physical un	its of measurements (SI).
The measurements and the unce	ertainties with confidence p	robability are given on the following peges an	d are part of the certificate
All calibrations have been condu	cted in the closed isborato	ry facility: environment temperature (22 ± 3)*	D and humidity < 70%.
All calibrations have been condu	cted in the closed laborato	ry facility: environment temperature $(22 \pm 3)^{\circ 0}$	C and humidity < 70%.
		ty facility: environment temperature $(22 \pm 3)^{eq}$	C and numidity < 70%.
Calibration Equipment used (M&	TE critical for calibration)		
Calibration Equipment used (M&	TE critical for calibration)	Cal Date (Certilicate No.)	Scheduled Calibration
Calibration Equipment used (M& Primary Standards Power meter NRP	TE critical for calibration)	Cal Date (Certilicate Np.) 04-Apr-16 (No. 217-02672/02673)	Scheduled Calibration Apr-19
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-Z91	TE critical for calibration) ID # SN: 104778 SN: 103244	Cal Date (Certificate No.) 04-Apt-16 (No. 217-02672/02673) 04-Apt-16 (No. 217-02672)	Scheduled Calibration Apr-19 Apr-19
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91	TE critical for calibration)	Cal Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-16 (No. 217-02672) 04-Apr-18 (No. 217-02673)	Scheduled Calibration Apr-19 Apr-19 Apr-19
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k)	Cal Date [Certificate No.) 04-Apri-18 (No. 217-02672)02673) 04-Apri-18 (No. 217-02672) 04-Apri-18 (No. 217-02673) 04-Apri-18 (No. 217-02682)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5058 (20k)	Cal Date (Certificate No.) 04-Apr-18 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02682) 04-Apr-18 (No. 217-02683)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N misimatch comeination Reference Proba EX3DV4	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k)	Cal Date [Certificate No.) 04-Apri-18 (No. 217-02672)02673) 04-Apri-18 (No. 217-02672) 04-Apri-18 (No. 217-02673) 04-Apri-18 (No. 217-02682)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch comeination Reference Probe EX3DV4 DAE4	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5056 (20k) SN: 5047 2 / 06327 SN: 5047 2 / 06327 SN: 5050 SN: 601	Cal Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 30-Dec-17 (No. EX3-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-16 Oct-18
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch comeination Reference Probe EX3DV4 DAE4 Secondary Standards	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5056 (20k) SN: 5047 2 / 06327 SN: 5603 SN: 601 ID #	Cal Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02682) 04-Apr-18 (No. 217-02683) 30-Dec-17 (No. EX3-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17) Check Date (in house)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-16 Oct-18 Scheduled Check
Calibration Equipment used (M& 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 EPM-442A	TE critical for calibration) D # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047 2 / 06327 SN: 5037 2 / 06327 SN: 601 D # SN: 6B37480704	Cal Date (Certificate No.) 04-Apr-16 (No. 217-02672) 02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 30-Dec-17 (No. EX3-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Oct-18 Scheduled Check In house check: Oct-18
Calibration Equipment used (M& 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 EPM-442A Power sensor HP B481A	TE critical for calibration) D # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5058 (20k) SN: 50547 2 / 06327 SN: 50547 2 / 06327 SN: 50547 2 / 06327 SN: 601 D # SN: 6837480704 SN: US37292783	Cal Date (Certificate No.)           04-Apt-16 (No. 217-02672) 02673)           04-Apt-18 (No. 217-02672)           04-Apt-18 (No. 217-02673)           04-Apt-18 (No. 217-02673)           04-Apt-18 (No. 217-02682)           04-Apt-18 (No. 217-02683)           30-Dec-17 (No. EX3-3503_Dec17)           26-Oct-17 (No. DAE4-601_Oct17)           Check Date (in house)           07-Oct-15 (in house check Oct-16)           07-Oct-15 (in house check Oct-16)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dec-18 Dec-18 Scheduled Check In house check: Oct-18 In house check: Oct-18
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch compination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP B481A Power sensor HP B481A	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 50472 (20k) SN: 50472 (20k) SN: 50472 (20k) SN: 601 ID # SN: GB37480704 SN: US37292783 SN. MY41092317	Cal Date (Certilicate No.)           04-Apr-16 (No. 217-02672)           04-Apr-18 (No. 217-02672)           04-Apr-18 (No. 217-02682)           04-Apr-18 (In house)           07-Oct-15 (In house check Oct-16)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dec-18 Scheduled Check In house check: Opt-18 In house check: Opt-18 In house check: Opt-18
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination References Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A DR generator RBS SMT-06	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 601 ID # SN: GB37460704 SN: US37292783 SN, MY41092317 SN: 100972	Cal Date (Certificate No.)           04-Apr-18 (No. 217-02672/02673)           04-Apr-18 (No. 217-02672)           04-Apr-18 (No. 217-02673)           04-Apr-18 (No. 217-02682)           04-Apr-18 (No. 217-02612)           04-Apr-18 (No. 217-02612)           04-Apr-18 (No. 217-02612)           07-Oct-15 (In house check Oct-16)           07-Oct-15 (In house check Oct-16)           15-Jun-15 (In house check Oct-16)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Calibration Equipment used (M8; Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Aftenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Powers ach PM 8481A RF generator RBS SMT-06	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 50472 (20k) SN: 50472 (20k) SN: 50472 (20k) SN: 601 ID # SN: GB37480704 SN: US37292783 SN. MY41092317	Cal Date (Certilicate No.)           04-Apr-16 (No. 217-02672)           04-Apr-18 (No. 217-02672)           04-Apr-18 (No. 217-02682)           04-Apr-18 (In house)           07-Oct-15 (In house check Oct-16)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dec-18 Dec-18 Scheduled Check In house check: Opt-18 In house check: Opt-18 In house check: Opt-18
Calibration Equipment used (M8; Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Aftenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Powers ach PM 8481A RF generator RBS SMT-06	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 601 ID # SN: GB37460704 SN: US37292783 SN, MY41092317 SN: 100972	Cal Date (Certificate No.)           04-Apr-18 (No. 217-02672/02673)           04-Apr-18 (No. 217-02672)           04-Apr-18 (No. 217-02673)           04-Apr-18 (No. 217-02682)           04-Apr-18 (No. 217-02612)           04-Apr-18 (No. 217-02612)           04-Apr-18 (No. 217-02612)           07-Oct-15 (In house check Oct-16)           07-Oct-15 (In house check Oct-16)           15-Jun-15 (In house check Oct-16)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch comeniation Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E	TE critical for calibration) D # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5058 (20k) SN: 6017 2 / 06327 SN: 3503 SN: 601 D # SN: GB37400704 SN: US37292783 SN, MY41092317 SN: 100972 SN: US37390585	Cal Date (Certificate No.) 04-Apr-16 (No. 217-02672) 02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02683) 30-Dec-17 (No. EX3-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-17)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18
Calibration Equipment used (Mg: Primary Standards Power reater NRP Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	TE critical for calibration) D # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5057 (206327 SN: 5037 (06327) SN: 601 D # SN: GB37480704 SN: US37292783 SN. WY41092317 SN: 100972 SN: US37390585 Name	Cal Date (Certificate No.) 04-Apt-18 (No. 217-02672) 02673) 04-Apt-18 (No. 217-02672) 04-Apt-18 (No. 217-02682) 04-Apt-18 (No. 217-02682) 04-Apt-18 (No. 217-02682) 04-Apt-18 (No. 217-02683) 30-Dec-17 (No. DAE4-601_Oct17) 26-Oct-17 (No. DAE4-601_Oct17) Oheck Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-17) Function	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18
Calibration Equipment used (M& Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Ahenuator Type-N mismatch comeination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Priver sensor HP 8481A Priver sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E Calibrated by:	TE critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5058 (20k) SN: 601 ID # SN: GB37490704 SN: US3729217 SN: 100972 SN: 100972 SN: US37390585 Name Jeton Kastrati	Cal Date (Certificate No.) 04-Apr-18 (No. 217-02672) 02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02683) 30-Dec-17 (No. 217-02683) 30-Dec-17 (No. EX3-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-16) Check Date Check Oct-16) 18-Oct-01 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-16 (in house check Oct-16) 07-Oct-16 (in house check Oct-16) 07-Oct-17 (In house check Oct-17) In house check Oct-17)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18

Certificate No: D5GHzV2-1040\_Jun18

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



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Accreditation No.: SCS 0108

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The Swiss Accreditati	on Service is one of the signatories to the EA
Multilateral Agreemen	t for the recognition of calibration certificates
Glossary:	
de la	And the second se

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) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010 d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

e) DASY4/5 System Handbook

# Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna 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 system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.1
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	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

# Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	4.55 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.8 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.27 W/kg

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# Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.0 ± 6 %	4.66 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.2 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	2.36 W/kg

# Head TSL parameters at 5500 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.7 ± 6 %	4.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.34 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	2.38 W/kg

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# 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	35.5 ± 6 %	4.97 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	8.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	85.3 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	2.45 W/kg

# Head TSL parameters at 5800 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	5.18 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

a applied

# SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm <sup>3</sup> (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	80.6 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.30 W/kg

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# Body TSL parameters at 5200 MHz

The following parameters and calculations were applied Conductivity Temperature Permittivity Nominal Body TSL parameters 22.0 °C 49.0 5.30 mho/m Measured Body TSL parameters (22.0 ± 0.2) °C 47.0 ± 6 % 5.45 mho/m ± 6 % Body TSL temperature change during test < 0.5 °C

# SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.2 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.11 W/kg

#### Body TSL parameters at 5300 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	5.58 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

# SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.70 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	76.4 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 1:00 mW input power	2.16 W/kg

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# Body TSL parameters at 5500 MHz

The following parameters and calculations were applied Temperature Permittivity Conductivity Nominal Body TSL parameters 22.0 °C 48.6 5.65 mho/m Measured Body TSL parameters (22.0 ± 0.2) °C 46.5 ± 6 % 5.85 mho/m ± 6 % Body TSL temperature change during test < 0.5 °C

# SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	81.9 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.28 W/kg

#### Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	5.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

# SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	81.5 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.29 W/kg

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# Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.0 ± 6 %	6.26 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

# SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.79 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	77.3 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.15 W/kg

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

# Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.5 Ω - 8.6 jΩ
Return Loss	- 21.3 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	49.3 Ω - 2.8 jΩ
Return Loss	- 30.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	50.2 Ω - 6.1 jΩ
Return Loss	- 24.4 dB

#### Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.8 Ω - 2.0 jΩ
Return Loss	- 23.6 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	54.4 Ω - 1.0 jΩ	
Return Loss	- 27.3 dB	

# Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.8 Ω - 7.7 jΩ	
Return Loss	- 22.3 dB	

# Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	49.1 Ω - 1.8 jΩ
Return Loss	- 34.1 dB

# Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	50.5 Ω - 4.8 jΩ
Return Loss	- 26.3 dB

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# Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	57.6 Ω - 2.4 jΩ
Return Loss	- 22.6 dB

# Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.1 Ω - 1.3 jΩ
Return Loss	- 26.0 dB

# General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 ns
----------------------------------	----------

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

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

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

# Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 30, 2005

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# DASY5 Validation Report for Head TSL

Date: 28.06.2018

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1040

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz Medium parameters used: f = 5200 MHz;  $\sigma = 4.55 \text{ S/m}$ ;  $\varepsilon_r = 36.1$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used: f = 5300 MHz;  $\sigma = 4.66 \text{ S/m}$ ;  $\epsilon_r = 36$ ;  $\rho = 1000 \text{ kg/m}^3$ Medium parameters used: f = 5500 MHz;  $\sigma = 4.86 \text{ S/m}$ ;  $\epsilon_r = 35.7$ ;  $\rho = 1000 \text{ kg/m}^3$ Medium parameters used: f = 5600 MHz;  $\sigma = 4.97 \text{ S/m}$ ;  $\epsilon_r = 35.5$ ;  $\rho = 1000 \text{ kg/m}^3$ Medium parameters used: f = 5800 MHz;  $\sigma = 5.18 \text{ S/m}$ ;  $\epsilon_r = 35.2$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.75, 5.75, 5.75) @ 5200 MHz, ConvF(5.5, 5.5, 5.5) @ 5300 MHz, ConvF(5.2, 5.2, 5.2) @ 5500 MHz, ConvF(5.05, 5.05, 5.05) @ 5600 MHz, ConvF(4.96, 4.96, 4.96) @ 5800 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601 (5GHz); Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 74.83 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 27.8 W/kg SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.27 W/kg Maximum value of SAR (measured) = 17.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 75.69 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 29.8 W/kg SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.36 W/kg Maximum value of SAR (measured) = 18.6 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 75.52 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 31.8 W/kg SAR(1 g) = 8.34 W/kg; SAR(10 g) = 2.38 W/kg Maximum value of SAR (measured) = 19.3 W/kg

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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 = 76.52 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 31.9 W/kg SAR(1 g) = 8.54 W/kg; SAR(10 g) = 2.45 W/kg Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm

(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 73.34 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 31.6 W/kg SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.3 W/kg

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



0 dB = 17.7 W/kg = 12.48 dBW/kg

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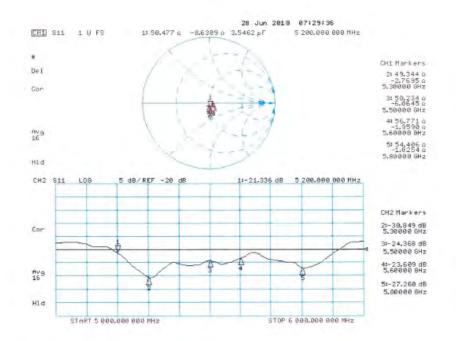
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# Impedance Measurement Plot for Head TSL



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# DASY5 Validation Report for Body TSL

Date: 27.06.2018

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1040

```
Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz,
Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; \sigma = 5.45 S/m; \varepsilon_r = 47; \rho = 1000 kg/m<sup>3</sup>,
Medium parameters used: f = 5300 MHz; \sigma = 5.58 S/m; \varepsilon_r = 46.8; \rho = 1000 kg/m<sup>3</sup>
Medium parameters used: f = 5500 \text{ MHz}; \sigma = 5.85 \text{ S/m}; \varepsilon_r = 46.5; \rho = 1000 \text{ kg/m}^3.
Medium parameters used: f = 5600 \text{ MHz}; \sigma = 5.99 \text{ S/m}; \epsilon_r = 46.3; \rho = 1000 \text{ kg/m}^3,
Medium parameters used: f = 5800 \text{ MHz}; \sigma = 6.26 \text{ S/m}; \varepsilon_r = 46; \rho = 1000 \text{ kg/m}^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
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DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.35, 5.35, 5.35) @ 5200 MHz, ConvF(5.15, 5.15, 5.15) @ 5300 MHz, ConvF(4.7, 4.7, 4.7) @ 5500 MHz, ConvF(4.65, 4.65, 4.65) @ 5600 MHz, ConvF(4.53, 4.53, 4.53) @ 5800 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601 (5GHz); Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 67.84 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 28.1 W/kg SAR(1 g) = 7.58 W/kg; SAR(10 g) = 2.11 W/kg Maximum value of SAR (measured) = 17.1 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 67.55 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 29.6 W/kg SAR(1 g) = 7.7 W/kg; SAR(10 g) = 2.16 W/kg Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.16 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 33.4 W/kg SAR(1 g) = 8.25 W/kg; SAR(10 g) = 2.28 W/kg Maximum value of SAR (measured) = 19.3 W/kg

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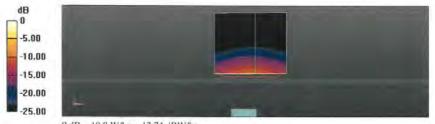


Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 68.09 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 34.0 W/kg SAR(1 g) = 8.21 W/kg; SAR(10 g) = 2.29 W/kg Maximum value of SAR (measured) = 19.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm

(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 63.60 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 33.5 W/kg

SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.15 W/kg Maximum value of SAR (measured) = 18.8 W/kg



0 dB = 18.8 W/kg = 12.74 dBW/kg

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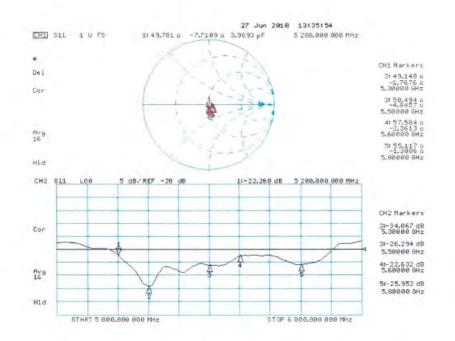
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# Impedance Measurement Plot for Body TSL





- End of report -

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