

Report No. : TESA2204000033EN Rev: 01 Page: 1 of 34

Appendix C

Phantom Description

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tional & Partner Engineering 40	S	p	е	a	g	_
		_			_	

Zexphautatiesse 43, 8004 Zurich, Switzerland Ptone +41 44 245 9700, File +41 44 245 9779 info@speaks.com. Mito /Weive Apiezo.com

Certificate of Conformity / First Article Inspection

item	Oval Flat Phantom ELI 5.0	
Type No	QD OVA 002 A	
Series No	1106 and higher	
Manufacturer	Untersee Composites Knebelstrasse 8, CH-8268 Mannenbach, Switzerland	-

Tests

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

Test	Requirement	Details	Units tested
Shape	Internal dimensions, depth and sagging are compatible with standards	Bottom elliptical 600 × 400 mm, Depth 190 mm, dimension compliant with [1] for t > 375 MHz	Prototypes
Material thickness	Bottom: 2 Gnim +/- 0 2mm	dimension compliant with [3] for f > 800 MHz	al
Material parameters	rel. permittivity $2 = 5$, loss tangent ≤ 0.05 , at $f \leq 6$. 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.

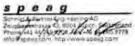
Standards

- OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 81-01
 IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices. Measurement
- Techniques, December 2003 [3] IEC 62209–1 ed1.0, "Human exposure to radio frequency fields from trans-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; 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



Dec No 381- QD OVA 002 A - A

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System Validation from Original Equipment Supplier

Client AU CALIBRATION Object Calibration Procedure(s)		TE	21-60241
	D245		
	D245		
Calibration Procedure(s)		0V2 - SN: 835	
		Main at	
		11-003-01	
and the second sec	Gallo	ration Procedures for dipole validation kits	
Calibration date:	June	22, 2021	
ages and are part of the all calibrations have bee uumidity<70%.	certificate.	traceability to national standards, which re d the uncertainties with confidence probability the closed laboratory facility: environment	are given on the followin
rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV	ID # 106277 104291	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084)	Sep-21 Sep-21 Apr-22
rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV DAE4	ID # 106277 104291 4 SN 3846 SN 549	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002)	Sep-21 Sep-21
rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV DAE4 Secondary Standards	ID # 106277 104291 4 SN 3846 SN 549 ID #	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.)	Sep-21 Sep-21 Apr-22
Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV DAE4 Secondary Standards Signal Generator E4438C	ID # 106277 104291 4 SN 3846 SN 549 ID # ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21 (CTTL-SPEAG, No.Z21-60084) 08-Jan-21 (CTTL-SPEAG, No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Sep-21 Sep-21 Apr-22 Jan-22
rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV DAE4 Secondary Standards Signal Generator E4438C	ID # 106277 104291 4 SN 3846 SN 549 ID # ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.)	Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration
Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV DAE4 Secondary Standards Signal Generator E44380 NetworkAnalyzer E50710	ID # 106277 104291 4 SN 3846 SN 549 ID # ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21 (CTTL-SPEAG, No.Z21-60084) 08-Jan-21 (CTTL-SPEAG, No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV DAE4 Secondary Standards Signal Generator E44380 NetworkAnalyzer E50710	ID # 106277 104291 4 SN 3846 SN 549 ID # 6 MY49071430 6 MY46110673	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22
Calibration Equipment use Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C alibrated by: eviewed by:	ID # 106277 104291 4 SN 3846 SN 549 ID # ID # MY49071430 MY46110673 Name	Cal Date (Callbrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21 (CTTL-SPEAG,No.Z21-60084) 08-Jan-21 (CTTL-SPEAG,No.Z21-60002) Cal Date (Callbrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22 Jan-22

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	man option
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	39.3±6%	1.78 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.7 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	(in the second
SAR measured	2:50 mW input power	5.96 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg ± 18.7 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.70+3.65i0
Return Loss	- 24.9dB

General Antenna Parameters and Design

Physical Phy	
Electrical Delay (one direction)	1.072 ns
	0.014 113

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

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	
manufactured by	SPEAG
	OFEAG

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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China

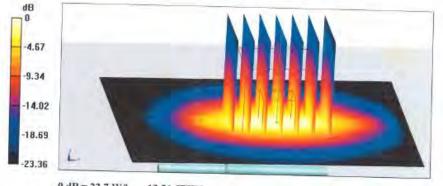
Date: 06.22.2021

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 835 Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz; $\sigma = 1.784 \text{ S/m}$; $\varepsilon_r = 39.31$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Center Section DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(7.45, 7.45, 7.45) @ 2450 MHz; Calibrated: 2021-04-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn549; Calibrated: 2021-01-08
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.68 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 28.5 W/kg SAR(1 g) = 13.1 W/kg; SAR(10 g) = 5.96 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 45.4% Maximum value of SAR (measured) = 22.7 W/kg



0 dB = 22.7 W/kg = 13.56 dBW/kg

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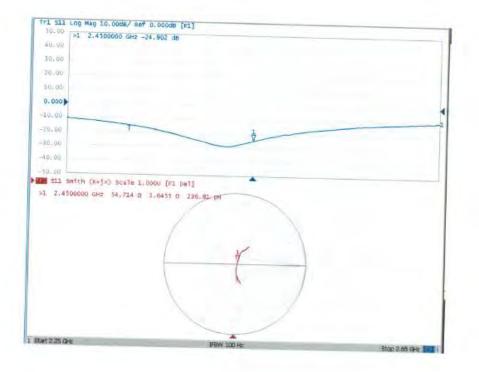
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Impedance Measurement Plot for Head TSL



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Accredited by the Swiss Accreditation The Swiss Accreditation Service Multilateral Agreement for the rec	is one of the signatorie	s to the EA	Accreditation No.: SCS 0108
lient SGS (Auden)		Certificate N	o: D5GHzV2-1023_Jan22
CALIBRATION C	ERTIFICAT	E	
Dbject	D5GHzV2 - SN:1	023	
Calibration procedure(s)	QA CAL-22.v6 Calibration Proce	edure for SAR Validation Source	s between 3-10 GHz
Calibration date:	January 27, 2022	2	
		robability are given on the following pages ar	
II calibrations have been conducte	ed in the closed laborator critical for calibration)	y facility: environment temperature $(22 \pm 3)^n$	C and humidity < 70%.
Il calibrations have been conducte Calibration Equipment used (M&TE Primary Standards	ed in the closed laborator critical for calibration)	y facility: environment temperature (22 ± 3)" Cal Date (Certificate No.)	C and humidity < 70%. Scheduled Calibration
I calibrations have been conducte alibration Equipment used (M&TE rimary Standards ower meter NRP	ed in the closed laborator critical for calibration)	y facility: environment temperature (22 ± 3)" Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292)	C and humidity < 70%. Scheduled Calibration Apr-22
Il calibrations have been conducte alibration Equipment used (M&TE rimary Standards ower meter NRP ower sensor NRP-Z91	ed in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244	y facility: environment temperature (22 ± 3)* Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22
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Calibration Laboratory of Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst Service suisse d'étalonnage

C Servizio svizzero di taratura

S Swiss Calibration Service

Accreditation No.: SCS 0108

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

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,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 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	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	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 following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.87 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 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 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	2.40 W/kg

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

the second of the second se	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		

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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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

Manufactured by	00510
Manufactured by	SPEAG

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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; $\sigma = 4.52 \text{ S/m}$; $\epsilon_r = 34.9$; $\rho = 1000 \text{ kg/m}^3$, 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; σ = 5.02 S/m; ϵ_r = 34.2; ρ = 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: 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=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

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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 = 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



0 dB = 20.1 W/kg = 13.03 dBW/kg

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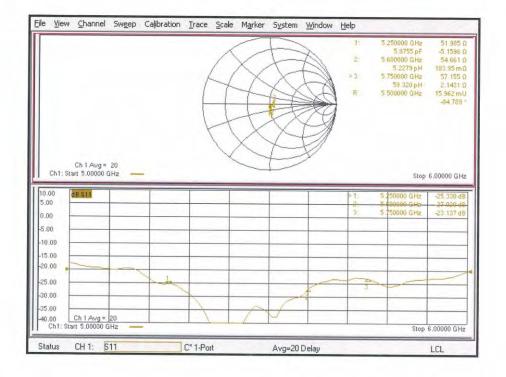
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Impedance Measurement Plot for Head TSL



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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates Certificate No: D6.5GHzV2-1006_A CALIBRATION CERTIFICATE Object D6.5GHzV2 - SN:1006 Calibration procedure(s) QA CAL-22.v6 Calibration Procedure for SAR Validation Sources between 3-10 GHz 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 calibration Equipment used (M&T critical for calibration) Scheduled Calibration Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Power sensor NRP-291 SN: 103244 09-Apr-21 (No. 217-03291) Apr-22 Power sensor NRP-291 SN: 103245 09-Apr-21 (No. 217-03292) Apr-22 Power sensor NRP-291 SN: 103245 09-Apr-21 (No. 217-03293) Apr-22 Power sensor NRP-291 SN: 103245 09-Apr-21 (No. 217-03293) Apr-22 Power sensor NRP-291 SN: 103245 09-Apr-21 (No	alibration Laboratory chmid & Partner Engineering AG sughausstrasse 43, 8004 Zurich,			S Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura S Swiss Calibration Service
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NE		Name	Function	Signature
Approved by: Katja Pokovic Technical Manager	Calibrated by:	Jeton Kastrati	Laboratory Technicia	st110
	Approved by:	Katja Pokovic	Technical Manager	N.KS
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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_Aug21

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Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	34.5	6.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.6 ± 6 %	6.11 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	29.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	291 W/kg ± 24.7 % (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	5.39 W/kg

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.7 Ω - 6.6 jΩ	
Return Loss	- 21.7 dB	

APD (Absorbed Power Density)

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

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DASY6 Validation Report for Head TSL

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

Name, Manuf	acturer Di	mensions	[mm] IN	EI	DUT Typ	e	
D6.5GHz	1	6.0 x 6.0 x	300.0 SN	: 1006			
Exposure Con	ditions						
Phantom	Position, Test	Band	Group,	Frequency	Conversion	TSL Cond.	TSL
Section, TSL	Distance [mm]		UID	[MHz]	Factor	[S/m]	Permittivity
Flat, HSL	5.00	Band	CW,	6500	5.75	6.11	33.6
Hardware Set	un						
Phantom	TS	SL		Probe, Calik	pration Date	DAF, Calib	ration Date
MFP V8.0 Cent	ter - 1182 H	BBL600-10	000V6		7405, 2020-12-30		08, 2021-06-24
Scan Setup				Measureme	nt Results		
			Zoom Scan				Zoom Sca
Grid Extents			22.0 x 22.0 x 22.0	Date		20	021-08-26, 10:5
Grid Steps [m			3.4 x 3.4 x 1.4	psSAR1g [\	N/Kg]		29.
Sensor Surfac	ce [mm]		1.4	psSAR10g	[W/Kg]		5.3
Graded Grid			Yes	Power Drif	t [dB]		0.03
Grading Ratio	0		1.4	Power Scal	ling		Disable
MAIA			N/A	Scaling Fac	tor [dB]		
Surface Deter	eneri		VMS + 6p	TSL Correc	tion		No correction
Scan Method			Measured	M2/M1 [%]		50.
				Dist 3dB Pe	eak [mm]		4.



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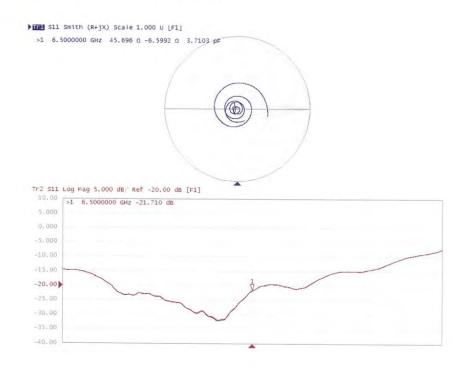
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Report No. : TESA2204000033EN Rev: 01 Page: 21 of 34

Impedance Measurement Plot for Head TSL



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ccredited by the Swiss Accreditation he Swiss Accreditation Service in Iultilateral Agreement for the rec	s one of the signatorie	es to the EA	accreditation No.: SCS 0108
lient SGS (Auden)			lo: D7GHzV2-1007_Aug21
CALIBRATION C	ERTIFICATE		
Object	D7GHzV2 - SN:1	1007	
Calibration procedure(s)	QA CAL-22.v6 Calibration Proce	edure for SAR Validation Source	s between 3-10 GHz
Calibration date:	August 26, 2021		
	ainties with confidence p	probability are given on the following pages a	
The measurements and the uncert All calibrations have been conducto Calibration Equipment used (M&TE	ainties with confidence p ad in the closed laborato E critical for calibration)	ry facility: environment temperature (22 \pm 3)	°C and humidity < 70%.
The measurements and the uncert All calibrations have been conductor Calibration Equipment used (M&TE Primary Standards	ainties with confidence p ad in the closed laborato E critical for calibration)	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.)	°C and humidity < 70%. Scheduled Calibration
The measurements and the uncert All calibrations have been conductor Calibration Equipment used (M&TE Primary Standards Power meter NRP	ainties with confidence p ad in the closed laborato E critical for calibration) ID # SN: 104778	ry facility: environment temperature (22 ± 3) <u>Cal Date (Certificate No.)</u> 09-Apr-21 (No. 217-03291/03292)	°C and humidity < 70%. Scheduled Calibration Apr-22
The measurements and the uncert All calibrations have been conductor Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91	ainties with confidence p ad in the closed laborato E critical for calibration) ID # SN: 104778 SN: 103244	ry facility: environment temperature (22 ± 3) <u>Cal Date (Certificate No.)</u> 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291)	°C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22
The measurements and the uncert All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91	ainties with confidence p ad in the closed laborato E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03291)	°C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22
The measurements and the uncert All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor R&S NRP33T	ainties with confidence p ad in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103967	ry facility: environment temperature (22 ± 3) <u>Cal Date (Certificate No.)</u> 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 08-Apr-21 (No. 217-03293)	°C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
The measurements and the uncert All calibrations have been conducts Calibration Equipment used (M&TE Primary Standards Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor R&S NRP33T Reference 20 dB Attenuator	ainties with confidence p ad in the closed laborato E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103967 SN: BH9394 (20k)	ry facility: environment temperature (22 ± 3) <u>Cal Date (Certificate No.)</u> 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03293) 09-Apr-21 (No. 217-03343)	°C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
The measurements and the uncert All calibrations have been conducto Calibration Equipment used (M&TE Primary Standards Power sensor NRP-291 Power sensor NRP-291 Power sensor N&S-291 Power sensor R&S NRP33T Reference 20 dB Attenuator Type-N mismatch combination	ainties with confidence p ad in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103967	ry facility: environment temperature (22 ± 3) <u>Cal Date (Certificate No.)</u> 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 08-Apr-21 (No. 217-03293)	°C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
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The measurements and the uncert All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor R&S NRP33T Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	ainties with confidence p ad in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 103245 SN: 100967 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7405 SN: 908 ID #	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03293) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 30-Dec-20 (No. EX3-7405_Dec20) 24-Jun-21 (No. DAE4-908_Jun21) Check Date (in house)	°C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Jun-22 Scheduled Check
The measurements and the uncert All calibrations have been conducto Calibration Equipment used (M&TE Primary Standards Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor R&S NRP33T Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards RF generator Anapico APSIN20G	ainties with confidence p ad in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 100967 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7405 SN: 908	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 08-Apr-21 (No. 217-03293) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 30-Dec-20 (No. EX3-7405_Dec20) 24-Jun-21 (No. DAE4-908_Jun21)	°C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Jun-22
The measurements and the uncert All calibrations have been conducto Calibration Equipment used (M&TE Primary Standards Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor R&S NRP33T Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards RF generator Anapico APSIN20G	ainties with confidence p ad in the closed laborato critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 103245 SN: 103967 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7405 SN: 908 ID # SN: 669	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 08-Apr-21 (No. 217-03293) 09-Apr-21 (No. 217-03243) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 30-Dec-20 (No. EX3-7405_Dec20) 24-Jun-21 (No. DAE4-908_Jun21) Check Date (in house) 28-Mar-17 (in house check Dec-18) 10-May-12 (in house check Dec-18)	°C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Jun-22 Scheduled Check In house check: Dec-21 In house check: Dec-21
The measurements and the uncert All calibrations have been conducto Calibration Equipment used (M&TE Primary Standards Power sensor NRP-291 Power sensor NRP-291 Power sensor NRP-291 Power sensor R&S NRP33T Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards RF generator Anapico APSIN20G Network Analyzer R&S ZVL13	ainties with confidence p ad in the closed laborato critical for calibration) ID # SN: 104778 SN: 103245 SN: 103245 SN: 103245 SN: 100967 SN: BH9394 (20k) SN: 310982 / 06327 SN: 908 ID # SN: 669 SN: 101093	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 08-Apr-21 (No. 217-03293) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 30-Dec-20 (No. EX3-7405_Dec20) 24-Jun-21 (No. DAE4-908_Jun21) Check Date (in house) 28-Mar-17 (in house check Dec-18)	°C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Jun-22 Scheduled Check In house check: Dec-21
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Calibration Laboratory of Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland



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Swiss Calibration Service

Accreditation No.: SCS 0108

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

b) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- · Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.
- The absorbed power density (APD): The absorbed power density is evaluated according to Samaras T, Christ A, Kuster N, "Compliance assessment of the epithelial or absorbed power density above 6 GHz using SAR measurement systems", Bioelectromagnetics, 2021 (submitted). The additional evaluation uncertainty of 0.55 dB (rectangular distribution) is considered.

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

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Measurement Conditions

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

DASY Version	DASY6	V16.0	
Extrapolation	Advanced Extrapolation		
Phantom	Modular Flat Phantom		
Distance Dipole Center - TSL	5 mm	with Spacer	
Zoom Scan Resolution	dx, dy = 3.4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)	
Frequency	7000 MHz ± 1 MHz		

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	33.9	6.65 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	32.7 ± 6 %	6.71 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	27.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	275 W/kg ± 24.7 % (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	4.78 W/kg

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.9 Ω - 3.8 jΩ	
Return Loss	- 26.6 dB	

APD (Absorbed Power Density)

APD averaged over 1 cm ²	Condition	
APD measured	100 mW input power	274 W/m ²
APD measured	normalized to 1W	2740 W/m ² ± 29.2 % (k=2)
ADD successed succes 4 serv ²	condition	
APD averaged over 4 cm ²	condition	10-11-1 Ø
APD averaged over 4 cm ² APD measured	condition 100 mW input power	119 W/m 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
	0.12110

Certificate No: D7GHzV2-1007_Aug21

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DASY6 Validation Report for Head TSL

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

Name, Manufa	cturer Di	mensions	[mm]	IMEI	DUT Ty	pe	
D7GHz	14	1.0 x 6.0 x	297.0	SN: 1007			
Exposure Cond	itions						
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	6.09	6.71	32.7

Hardware Setup

Probe, Calibration Date Phantom TSL MFP V8.0 Center - 1182 HBBL600-10000V6 EX3DV4 - SN7405, 2020-12-30

Measurement Results

DAE, Calibration Date DAE4 Sn908, 2021-06-24

Scan Setup

	Zoom Scan
Grid Extents [mm]	22.0 x 22.0 x 22.0
Grid Steps [mm]	3.0 x 3.0 x 1.4
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.4
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

Zoom Scan	
22.0 x 22.0	Date
0 x 3.0 x 1.4	psSAR1g [W/Kg]
1.4	psSAR10g [W/Kg]
Yes	Power Drift [dB]
1.4	Power Scaling
N/A	Scaling Factor [dB]
VMS + 6p	TSL Correction
Measured	M2/M1 [%]
	Dist 3dB Peak [mm]

2021-08-26, 14:14 27.7 4.78 0.05 Disabled

Zoom Scan

No correction 46.9 4.6



Certificate No: D7GHzV2-1007_Aug21

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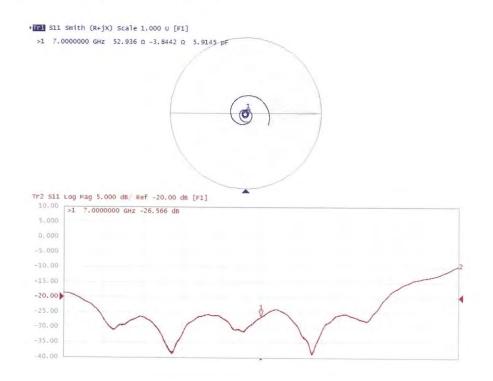
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Report No. : TESA2204000033EN Rev: 01 Page: 27 of 34

Impedance Measurement Plot for Head TSL



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Accredited by the Swiss Accredita The Swiss Accreditation Servic Aultilateral Agreement for the r	e is one of the signat	tories to the EA	creditation No.: SCS 0108
Client SGS (Auden)		Certificate No:	5G-Veri10-1021_Jan22
CALIBRATION	CERTIFICA	ATE	
Object	5G Verificatio	on Source 10 GHz - SN: 1021	
Calibration procedure(s)	QA CAL-45.v Calibration pr	3 rocedure for sources in air above 6 GH	Hz
Calibration date:	January 24, 2	2022	
This calibration certificate docurr The measurements and the unce	nents the traceability to ertainties with confider	o national standards, which realize the physical units ice probability are given on the following pages and	of measurements (SI). are part of the certificate.
		pratory facility: environment temperature (22 \pm 3)°C a	and humidity < 70%.
Calibration Equipment used (M&	in the second seco		And the second second
Primary Standards Reference Probe EUmmWV3	ID # SN: 9374	Cal Date (Certificate No.)	Scheduled Calibration
DAE4ip	SN: 1602	2021-12-21(No. EUmmWV3-9374_Dec21) 2021-06-25 (No. DAE4ip-1602_Jun21)	Dec-22 Jun-22
	ID #	Check Date (in house)	Scheduled Check
Secondary Standards			
Secondary Standards			
Secondary Standards	Name	Function	Signature
	Name Leif Klysner	Function Laboratory Technician	Signature Sef Ilfr
Secondary Standards Calibrated by: Approved by:			Signature Saf Ilfr

Certificate No: 5G-Veri10-1021_Jan22

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Accreditation No.: SCS 0108

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Glossary

CW

Continuous wave

Calibration is Performed According to the Following Standards

- Internal procedure QA CAL-45-5Gsources
- IEC TR 63170 ED1, "Measurement procedure for the evaluation of power density related to human exposure to radio frequency fields from wireless communication devices operating between 6 GHz and 100 GHz", January 2018

Methods Applied and Interpretation of Parameters

- Coordinate System: z-axis in the waveguide horn boresight, x-axis is in the direction of the E-field, y-axis normal to the others in the field scanning plane parallel to the horn flare and horn flange.
- Measurement Conditions: (1) 10 GHz: The radiated power is the forward power to the horn antenna minus ohmic and mismatch loss. The forward power is measured prior and after the measurement with a power sensor. During the measurements, the horn is directly connected to the cable and the antenna ohmic and mismatch losses are determined by farfield measurements. (2) 30, 45, 60 and 90 GHz: The verification sources are switched on for at least 30 minutes. Absorbers are used around the probe cub and at the ceiling to minimize reflections.
- Horn Positioning: The waveguide horn is mounted vertically on the flange of the waveguide source to allow vertical positioning of the EUmmW probe during the scan. The plane is parallel to the phantom surface. Probe distance is verified using mechanical gauges positioned on the flare of the horn.
- E- field distribution: E field is measured in two x-y-plane (10mm, 10mm + λ /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/m^2) 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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Measurement Conditions

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

DASY Version	cDASY6 Module mmWave	V2.4
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

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m ²)		Uncertainty (k = 2)
		1. T		1 cm ²	4 cm ²	
10 mm	86.1	148	1.27 dB	55.2	51.7	1.28 dB

Square Averaging

Distance Horn Aperture to Measured Plane	Prad ¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg (psPD psPD	er Density n+, psPDtot+, mod+) /m ²)	Uncertainty (k = 2)
	-			1 cm ²	4 cm ²	
10 mm	86.1	148	1.27 dB	55.2	51.5	1.28 dB

¹ Assessed ohmic and mismatch loss plus numerical offset: 0.55 dB

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148

0.01

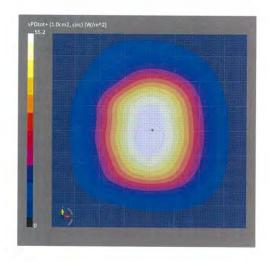
DASY Report

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

Device under Test Pro	operties				
Name, Manufacturer	Dimensions [mm	1]	IMEI	DUT Type	
5G Verification Source 10 G	Hz 100.0 x 100.0 x 3	172.0	SN: 1021		
Exposure Conditions					
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	cw	10000.0, 10000	1.0
Hardware Setup					
Phantom	Medium		Probe, Calibr	ation Date	DAE, Calibration Date
mmWave Phantom - 1002	Air			SN9374_F1-55GHz,	DAE4ip Sn1602, 2021-06-25
Scan Setup			Measurem	ent Results	
		5G S	can		5G Scan
Grid Extents [mm]		120.0 x 12	0.0 Date		2022-01-24, 11:01
Grid Steps [lambda]		0.25 x C	.25 Avg. Area [c	:m²]	1.00
Sensor Surface [mm]		1	.0.0 psPDn+ [W/		55.0
MAIA		MAIA not u	sed psPDtot+ (V psPDmod+)		55.2 55.4

Emax [V/m]

Power Drift [dB]



Certificate No: 5G-Veri10-1021_Jan22

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DASY Report

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

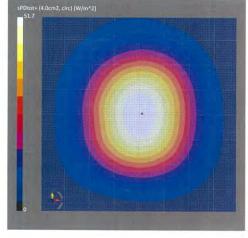
Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type	
5G Verification Source 10 G	Hz 100.0 x 100.0 x 1	.72.0	SN: 1021		
Exposure Conditions					
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	CW	10000.0, 10000	1.0
Hardware Setup					
Phantom	Medium		Probe, Calib	ration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air		EUmmWV3	- SN9374_F1-55GHz,	DAE4ip Sn1602,
			2021-12-21		2021-06-25
Scan Setup			Measurer	ment Results	

Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA

56 120.0 x 0.25 x MAIA not

	Measurement Results
G Scan	
120.0	Date
x 0.25	Avg. Area [cm ²]
10.0	psPDn+ [W/m ²]
t used	psPDtot+ [W/m ²] psPDmod+ [W/m ²]
	E _{max} [V/m]
	Power Drift [dB]
	and the second second

5G Scan 2022-01-24, 11:01 4.00 51.5 51.7 51.8 148 0.01



Certificate No: 5G-Veri10-1021_Jan22

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DASY Report

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

Device under Test Pro Name, Manufacturer	Dimensions [mm	1	IMEI	DUT Type	
G Verification Source 10 G	Hz 100.0 x 100.0 x 1	172.0	SN: 1021	-	
Exposure Conditions					
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	CW	10000.0, 10000	1.0
Hardware Setup					
Phantom mmWave Phantom - 1002	Medium Air			bration Date - SN9374_F1-55GHz, L	DAE, Calibration Date DAE4ip Sn1602, 2021-06-25
Scan Setup				ment Results	
		5G S			5G Scan
Grid Extents [mm] Grid Steps [lambda]		120.0 x 12 0.25 x 0		171	2022-01-24, 11:01
Sensor Surface [mm]			0.25 Avg. Area 10.0 psPDn+ [V		1.00 55.0
MAIA		MAIA not u			55.2
			psPDmod+		55.4
			E _{max} [V/m]		148
			Power Drit	ft [dB]	0.01
	sPDtot+ (1.0 55.2	cm2, sq) [W/m^2]			

Certificate No: 5G-Veri10-1021_Jan22

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DASY Report

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

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type	
5G Verification Source 1	10 GHz 100.0 x 100.0 x 1	172.0	SN: 1021	-	
Exposure Condition	ns				
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 mmWave Phantom - 1002 Air

Scan Setup

Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA

5G Scan 120.0 x 120.0 0.25 x 0.25 10.0 MAIA not used

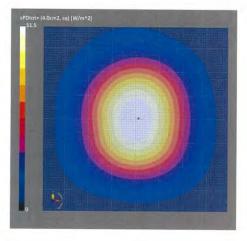
Probe, Calibration D	ate
EUmmWV3 - SN9374	_F1-55GHz,
2021-12-21	

DAE, Calibration Date DAE4ip Sn1602, 2021-06-25

Measurement Results

Emax [V/m]

5G Scar 2022-01-24, 11:01 Avg. Area [cm²] 4.00 psPDn+ [W/m²] psPDtot+ [W/m²] psPDmod+ [W/m²] 51.3 51.5 51.7 148 Power Drift [dB] 0.01



Certificate No: 5G-Veri10-1021_Jan22

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- End of report -

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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