# **APPENDIX C CALIBRATION CERTIFICATES**

Schweizerischer Kalibrierdienst S Calibration Laboratory of Service suisse d'étalonnage Schmid & Partner С Servizio svizzero di taratura ilac-MRA **Engineering AG** Swiss Calibration Service S Zeughausstrasse 43, 8004 Zurich, Switzerland Accredited by the Swiss Accreditation Service (SAS) Accreditation No.: SCS 0108 The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates Client BACL Certificate No. EX-7896\_Nov24 Sunnvvale, USA **CALIBRATION CERTIFICATE** Object EX3DV4 - SN:7896 QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6, Calibration procedure(s) QA CAL-25.v8 Calibration procedure for dosimetric E-field probes Calibration date November 07, 2024 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22±3) °C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards Cal Date (Certificate No.) Scheduled Calibration ID Power meter NRP2 SN: 104778 26-Mar-24 (No. 217-04036/04037) Mar-25 Power sensor NRP-Z91 SN: 103244 26-Mar-24 (No. 217-04036) Mar-25 23-Sep-24 (OCP-DAK3.5-1249\_Sep24) OCP DAK-3.5 (weighted) SN: 1249 Sep-25 24-Sep-24 (OCP-DAK12-1016\_Sep24) OCP DAK-12 Sep-25 SN: 1016 26-Mar-24 (No. 217-04046) SN: CC2552 (20x) Mar-25 Reference 20 dB Attenuator DAE4 SN: 660 23-Feb-24 (No. DAE4-660\_Feb24) Feb-25 Reference Probe EX3DV4 SN: 7349 03-Jun-24 (No. EX3-7349\_Jun24) Jun-25 Secondary Standards Check Date (in house) Scheduled Check SN: GB41293874 06-Apr-16 (in house check Jun-24) In house check: Jun-26 Power meter E4419B Power sensor E4412A SN: MY41498087 06-Apr-16 (in house check Jun-24) In house check: Jun-26 Power sensor E4412A SN: 000110210 06-Apr-16 (in house check Jun-24) In house check: Jun-26 RF generator HP 8648C SN: US3642U01700 04-Aug-99 (in house check Jun-24) In house check: Jun-26 Network Analyzer E8358A SN: US41080477 31-Mar-14 (in house check Sep-24) In house check: Sep-26 Signature Name Function Joanna Lleshaj Calibrated by Laboratory Technician Approved by Sven Kühn **Technical Manager** Issued: November 08, 2024 This calibration certificate shall not be reproduced except in full without written approval of the laboratory. Certificate No: EX-7896 Nov24 Page 1 of 10

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



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

Accreditation No.: SCS 0108

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

#### Glossary

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta$ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

#### 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"

#### Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization ∂ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. DCP
  does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D are numerical linearization parameters assessed based on the data of
  power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum
  calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \le 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx, y, z \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch
  antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

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#### Parameters of Probe: EX3DV4 - SN:7896

#### **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k = 2)
Norm (µV/(V/m) <sup>2</sup> ) A	0.67	0.58	0.62	±10.1%
DCP (mV) <sup>B</sup>	106.2	106.2	106.0	±4.7%

#### **Calibration Results for Modulation Response**

UID	Communication System Name		A dB	B dBõV	С	D dB	VR mV	Max dev.	Max Unc <sup>E</sup> k=2
0	CW	X	0.00	0.00	1.00	0.00	125.1	±1.5%	±4.7%
		Y.	0.00	0.00	1.00		132,2		l 1
		Z	0.00	0.00	1.00		120.5		

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%.

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).
 <sup>B</sup> Linearization parameter uncertainty for maximum specified tiek strength.
 <sup>E</sup> Uncertainty is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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# Parameters of Probe: EX3DV4 - SN:7896

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	28.7°
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Note: Measurement distance from surface can be increased to 3-4 mm for an Area Scan job.

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### Parameters of Probe: EX3DV4 - SN:7896

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity <sup>F</sup> (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc <sup>H</sup> (k = 2)
750	41.9	0.89	8.72	9.14	9.15	0.35	1.27	±11.0%
900	41.5	0.97	8.08	8.47	8.48	0.35	1.27	±11.0%
1750	40.1	1.37	7.20	7.55	7.56	0.35	1.27	±11.0%
1900	40.0	1.40	6.96	7.29	7.30	0.35	1.27	±11.0%
2300	39.5	1.67	6.79	7.12	7.13	0.35	1.27	±11.0%
2450	39.2	1.80	6.54	6.85	6.86	0.35	1.27	±11.0%
2600	39.0	1.96	6.60	6.92	6.93	0.35	1.27	±11.0%
3300	38.2	2.71	5.83	6.12	6.12	0.36	1.27	±13.1%
3500	37.9	2.91	5.91	6.19	6.20	0.36	1.27	±13.1%
3700	37.7	3.12	5.92	6.20	6.21	0.36	1.27	±13.1%
3900	37.5	3.32	5.79	6.07	6.07	0.36	1.27	±13.1%
5250	35.9	4.71	4.86	5.09	5.09	0.32	1.27	±13.1%
5600	35.5	5.07	4.52	4.74	4.74	0.28	1.27	±13.1%
5800	35.3	5.27	4.56	4.78	4.78	0.27	1.27	±13.1%

<sup>C</sup> Frequency validity above 300 MHz of ±100 MHz only applies for DASY v4.4 and higher (see Page 2), else It is restricted to ±50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ±10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4–9 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±101 MHz. <sup>F</sup> The probes are calibrated using tissue simulating liquits (TSL) that deviate for z and *x* by less than ±5% from the target values (lypically better than ±3%) and are valid for TSL with deviations of up to ±10% if SAR correction is applied. <sup>G</sup> Alpha/Depth are determined during calibration. SPE-RG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz and below ±2% to frequencies between 3–6 GHz at any distance larger than half the probe tip diameter from the boundary. <sup>H</sup> The stated uncertainty is the total calibration uncertainty (k = 2) of Norm-ConvF. This is equivalent to the uncertainty component with the symbol CF in Table 9 of IEC/IEEE 62209-1528:2020.

Table 9 of IEC/(EEE 62209-1528:2020.

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#### Parameters of Probe: EX3DV4 - SN:7896

Calibration Parameter Determined in Head Tissue Simulating Media

f (M	iHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity <sup>F</sup> (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc <sup>H</sup> ( <i>k</i> = 2)
65	500	34.5	6.07	4.74	4.96	4.97	0.20	1.27	±18.6%

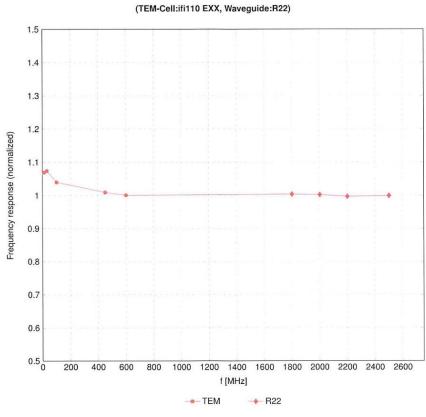
<sup>C</sup> Frequency validity at 6.5 GHz is -600/+700 MHz, and ±700 MHz at or above 7 GHz. The uncertainty is the RSS of the ConvF uncertainty at calibration trequency and the uncertainty for the indicated frequency band.
 <sup>F</sup> The probes are calibrated using lissue simulating liquids (TSL) that deviate for *e* and *o* by less than ±10% from the target values (typically better than ±6%) and are valid for TSL with deviations of up to ±10%.
 <sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz; below ±2% for frequencies between 3-6 GHz; and below ±4% for frequencies between 6-10 GHz at any distance target than half the probe tip clameter from the boundary.
 <sup>H</sup> The stated uncertainty is the total calibration uncertainty (k = 2) of Norm-ConvF. This is equivalent to the uncertainty component with the symbol CF in TELE 0-4 (FOR FEE CONFE CONFE).

Table 9 of IEC/IEEE 62209-1528:2020.

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# Frequency Response of E-Field (TEM-Cell:ffi110 EXX, Waveguide:R22)

Uncertainty of Frequency Response of E-field: ±6.3% (k=2)

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EX3DV4 - SN:7896

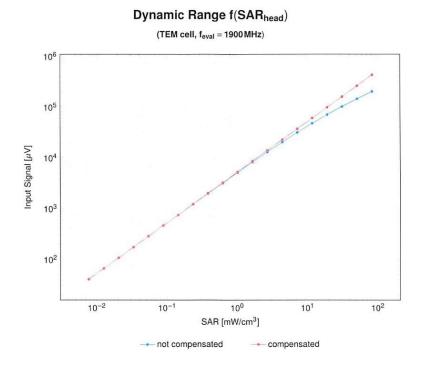
f=600 MHz, TEM, 0° f=1800 MHz, R22, 0° 90° 90° X Y Z X 135° 45 135° 45° Y Ζ Tot . . Tot 180° 0.4 0.6 0.8 1.0 0.4 0.6 0.8 0° 0° 180° 225 315° 225 315° 270° 270° 0.5 Error [dB] 0 -0.5 0 60 120 180 240 300 360 Roll [°] ----- 100 MHz 🔸 600 MHz ----- 1800 MHz ---- 2500 MHz Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

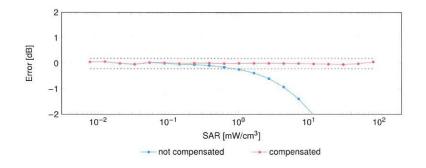
# Receiving Pattern ( $\phi$ ), $\vartheta = 0^{\circ}$

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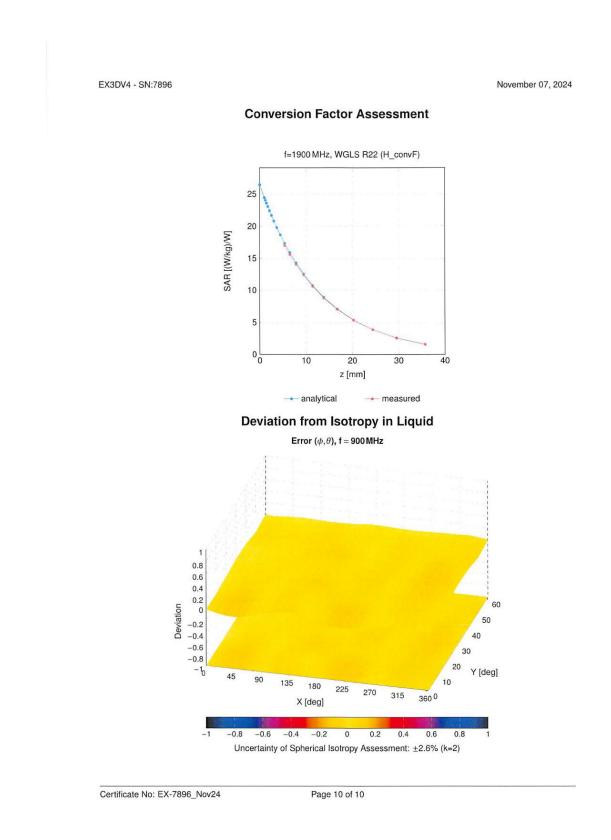




Uncertainty of Linearity Assessment: ±0.6% (k=2)

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Calibration Laboratory Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich,			Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service
Accredited by the Swiss Accreditati The Swiss Accreditation Service Multilateral Agreement for the rea	is one of the signatorie		Accreditation No.: SCS 0108
Client BACL USA Sunnyvale, USA		Certificate No	o. D750V3-1229_Mar23
CALIBRATION C	ERTIFICATI	E	
Object	D750V3 - SN:12	29	
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	edure for SAR Validation Source	es between 0.7-3 GHz
Calibration date:	March 24, 2023		i s
	ed in the closed laborator	robability are given on the following pages $\epsilon$ y facility: environment temperature (22 $\pm$ 3)	
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards	ed in the closed laborator critical for calibration)	robability are given on the following pages $a$ y facility: environment temperature ( $22 \pm 3$ ) Cal Date (Certificate No.)	and are part of the certificate. °C and humidity < 70%. Scheduled Calibration
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All calibrations have been conducts Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 103245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03528)           10-Jan-23 (No. EX3-7349_Jan23)           19-Dec-22 (No. DAE4-601_Dec22)           Check Date (in house)           30-Oct-14 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)           15-Jun-15 (in house check Oct-22)           31-Mar-14 (in house check Oct-22)	and are part of the certificate. °C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24
All calibrations have been conducts Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03526)           04-Apr-22 (No. 217-03528)           10-Jan-23 (No. EX3-7349_Jan23)           19-Dec-22 (No. DAE4-601_Dec22)           Check Date (in house)           30-Oct-14 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)           15-Jun-15 (in house check Oct-22)	and are part of the certificate. °C and humidity < 70%. <u>Scheduled Calibration</u> Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Jan-24 Dec-23 <u>Scheduled Check</u> In house check: Oct-24 In house check: Oct-24 Signature
All calibrations have been conducts Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ed in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 310982 / 06327 SN: 00372 SN: 00972 SN: US41080477 Name	Cal Date (Certificate No.)         04-Apr-22 (No. 217-03525/03524)         04-Apr-22 (No. 217-03524)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03528)         10-Jan-23 (No. EX3-7349_Jan23)         19-Dec-22 (No. DAE4-601_Dec22)         Check Date (in house)         30-Oct-14 (in house check Oct-22)         07-Oct-15 (in house check Oct-22)         15-Jun-15 (in house check Oct-22)         31-Mar-14 (in house check Oct-22)	and are part of the certificate. °C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24
All calibrations have been conducts Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by: Approved by:	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 103245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 310982 / 06327 SN: 310982 / 06327 SN: 0601 ID # SN: GB39512475 SN: US37292783 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477 Name Michael Weber Sven Kühn	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           10-Jan-23 (No. EX3-7349_Jan23)           19-Dec-22 (No. DAE4-601_Dec22)           Check Date (in house)           30-Oct-14 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)           07-Oct-15 (in house check Oct-22)           15-Jun-15 (in house check Oct-22)           31-Mar-14 (in house check Oct-22)           Function           Laboratory Technician	and are part of the certificate. °C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24 Signature

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



Schweizerischer Kalibrierdienst S 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%.

Certificate No: D750V3-1229 Mar23

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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	and a second
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

# **Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.0 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.41 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	1.38 W/kg

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

## Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.3 Ω - 1.0 jΩ	
Return Loss	- 29.5 dB	

# **General Antenna Parameters and Design**

Electrical Delay (one direction)	1.033 ns
----------------------------------	----------

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

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

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

# Additional EUT Data

Manufactured by	SPEAG
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# DASY5 Validation Report for Head TSL

Date: 24.03.2023

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1229

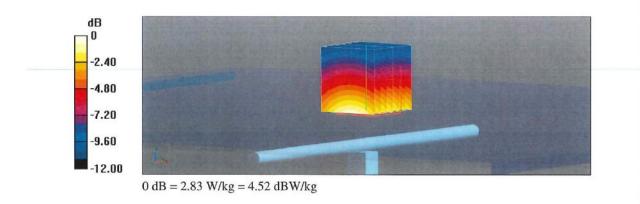
Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz;  $\sigma$  = 0.9 S/m;  $\epsilon_r$  = 41;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.11, 10.11, 10.11) @ 750 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

# Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

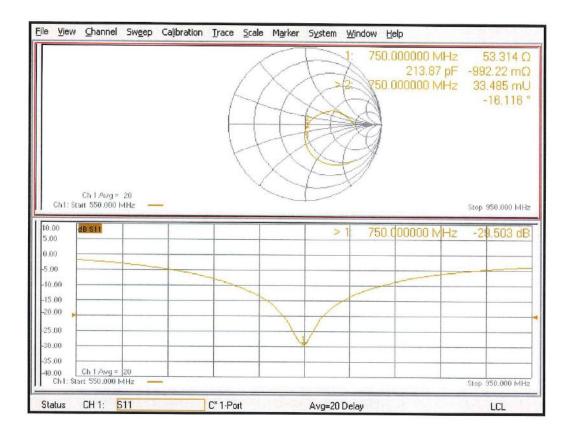
Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 59.57 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 3.20 W/kg **SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.38 W/kg** Smallest distance from peaks to all points 3 dB below = 17 mm Ratio of SAR at M2 to SAR at M1 = 66.2% Maximum value of SAR (measured) = 2.83 W/kg



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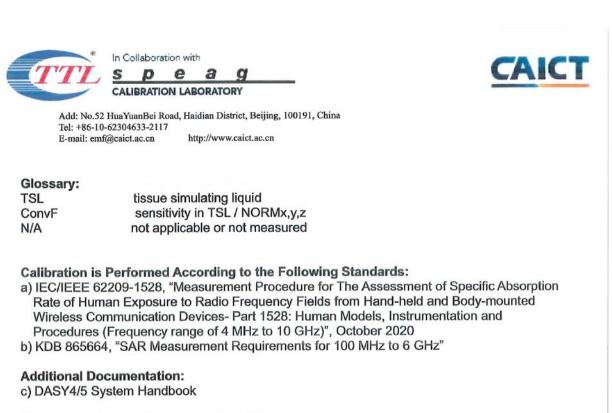
# Impedance Measurement Plot for Head TSL



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Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.cn	http://www.caic		
Client BACL			3J02Z80061
CALIBITATION CI			
Object	D900V	2 - SN: 132	
Calibration Procedure(s)		-003-01 tion Procedures for dipole validation kits	
Calibration date:	Septen	nber 26, 2023	
All calibrations have been	conducted in t	he closed laboratory facility, environment	temperature (22+3)or and
humidity<70%.		he closed laboratory facility: environment	temperature (22±3)℃ and
humidity<70%. Calibration Equipment used			temperature (22±3)°C and Scheduled Calibration
humidity<70%. Calibration Equipment used	(M&TE critical f	or calibration) Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183)	
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	(M&TE critical fo ID # 106276 101369	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183)	Scheduled Calibration May-24 May-24
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4	(M&TE critical for ID # 106276 101369 SN 3617	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Scheduled Calibration May-24 May-24 Mar-24
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	(M&TE critical fo ID # 106276 101369	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183)	Scheduled Calibration May-24 May-24
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID #	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107)	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration Jan-24
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107)	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration Jan-24
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fe ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104)	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23 (CTTL-SPEAG,No.Z23-60161) 11-Jan-23 (CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104) Function	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fe ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104) Function SAR Test Engineer	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24



#### 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%.

Certificate No: 23J02Z80061

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In Collaboration with

S P CALIBRATION LABORATORY



Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.cn http://www.caict.ac.cn

#### **Measurement Conditions**

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 MHz ± 1 MHz	

#### **Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 6 %	0.96 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

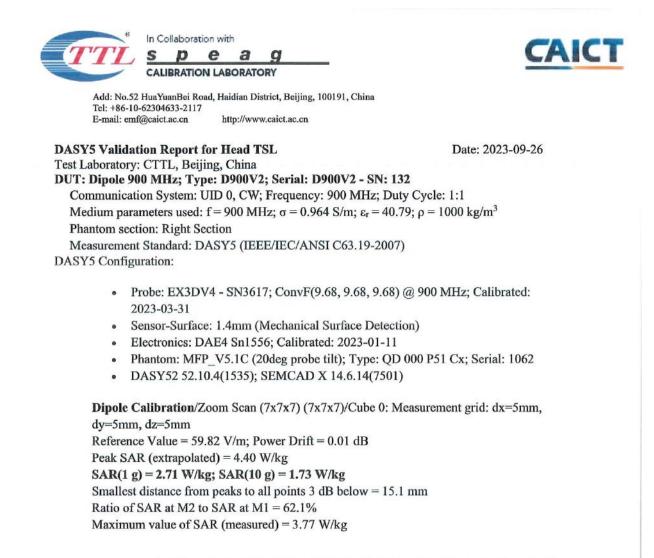
# SAR result with Head TSL

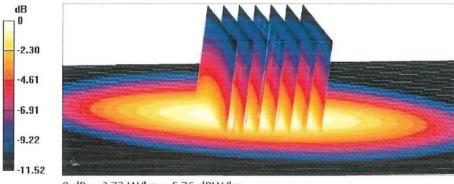
SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.71 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	10.8 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.73 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.93 W/kg ± 18.7 % (k=2)

Certificate No: 23J02Z80061

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	ATION LABORATORY	
Add: No.52 HuaYuanl Tel: +86-10-62304633 E-mail: emf@caict.ac.		1, China
Appendix (Addition Antenna Parameter	al assessments outside th s with Head TSL	e scope of CNAS L0570)
Impedance, transform	ed to feed point	47.7Ω- 7.43jΩ
Return Loss		- 22.0dB
General Antenna Pa	arameters and Design	
Electrical Delay (one of	lirection)	1.307 ns
The dipole is made of st onnected to the second f the dipoles, small end ccording to the positior ffected by this change. Io excessive force mus onnections near the fea	d arm of the dipole. The antenna I caps are added to the dipole an a sexplained in the "Measurem The overall dipole length is still a t be applied to the dipole arms, b ed-point may be damaged.	The center conductor of the feeding line is directly is therefore short-circuited for DC-signals. On some ms in order to improve matching when loaded ent Conditions" paragraph. The SAR data are not according to the Standard. because they might bend or the soldered
The dipole is made of st onnected to the second f the dipoles, small end ccording to the positior ffected by this change. Io excessive force mus onnections near the fea	d arm of the dipole. The antenna I caps are added to the dipole an a sexplained in the "Measurem The overall dipole length is still a t be applied to the dipole arms, b ed-point may be damaged.	is therefore short-circuited for DC-signals. On some ms in order to improve matching when loaded ent Conditions" paragraph. The SAR data are not according to the Standard.
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The dipole is made of st onnected to the second of the dipoles, small end ccording to the positior ffected by this change. Io excessive force mus onnections near the fee Additional EUT Data	d arm of the dipole. The antenna I caps are added to the dipole an a sexplained in the "Measurem The overall dipole length is still a t be applied to the dipole arms, b ed-point may be damaged.	is therefore short-circuited for DC-signals. On some ms in order to improve matching when loaded ent Conditions" paragraph. The SAR data are not according to the Standard. because they might bend or the soldered
The dipole is made of st onnected to the second f the dipoles, small end ccording to the positior ffected by this change. Io excessive force mus onnections near the fee	d arm of the dipole. The antenna I caps are added to the dipole an a sexplained in the "Measurem The overall dipole length is still a t be applied to the dipole arms, b ed-point may be damaged.	is therefore short-circuited for DC-signals. On some ms in order to improve matching when loaded ent Conditions" paragraph. The SAR data are not according to the Standard. because they might bend or the soldered SPEAG
The dipole is made of st onnected to the second f the dipoles, small end ccording to the positior ffected by this change. Io excessive force mus onnections near the fee	d arm of the dipole. The antenna I caps are added to the dipole an a sexplained in the "Measurem The overall dipole length is still a t be applied to the dipole arms, b ed-point may be damaged.	is therefore short-circuited for DC-signals. On some ms in order to improve matching when loaded ent Conditions" paragraph. The SAR data are not according to the Standard. because they might bend or the soldered SPEAG
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The dipole is made of st onnected to the second f the dipoles, small end ccording to the positior ffected by this change. Io excessive force mus onnections near the fee	d arm of the dipole. The antenna I caps are added to the dipole an a sexplained in the "Measurem The overall dipole length is still a t be applied to the dipole arms, b ed-point may be damaged.	is therefore short-circuited for DC-signals. On some ms in order to improve matching when loaded ent Conditions" paragraph. The SAR data are not according to the Standard. because they might bend or the soldered SPEAG

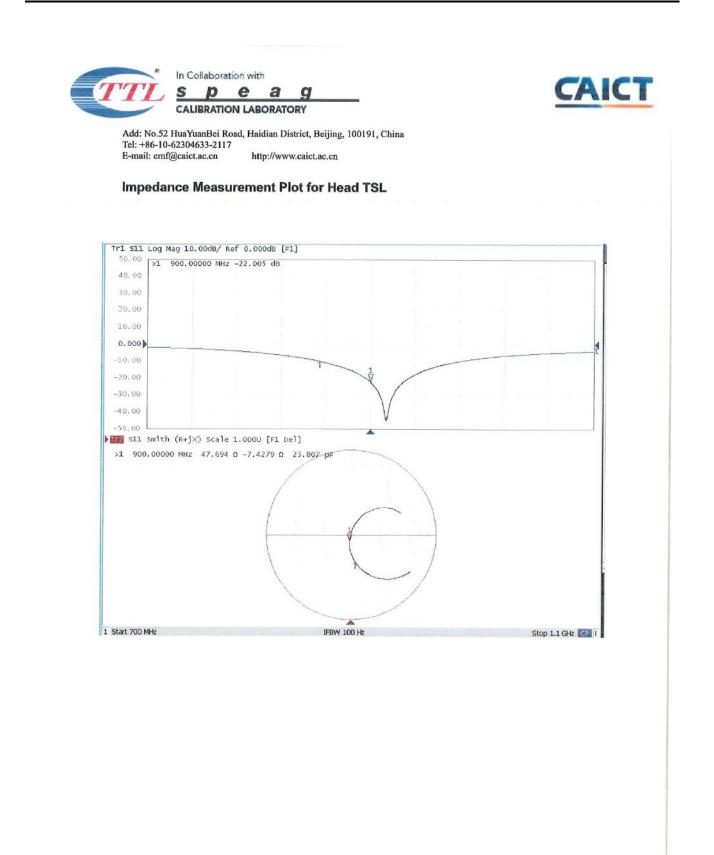




0 dB = 3.77 W/kg = 5.76 dBW/kg

Certificate No: 23J02Z80061

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Calibration Laboratory Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich			Service suisse d'étalonnage Servizio svizzero di taratura
Accredited by the Swiss Accreditat The Swiss Accreditation Service Multilateral Agreement for the re	is one of the signatorie		Accreditation No.: SCS 0108
Client BACL Sunnyvale USA			D1750V2-1199_Mar23
CALIBRATION C	ERTIFICAT	E	
Object	D1750V2 - SN:1	199	
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	edure for SAR Validation Source	s between 0.7-3 GHz
Calibration date:	March 27, 2023		
The measurements and the uncert	ainties with confidence p ed in the closed laborator	ional standards, which realize the physical un robability are given on the following pages ar ry facility: environment temperature (22 ± 3)%	nd are part of the certificate.
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#### Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA 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	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

# Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.8 ± 6 %	1.33 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.0 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	4.69 W/kg

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	46.9 Ω + 3.8 jΩ	
Return Loss	- 26.0 dB	

#### **General Antenna Parameters and Design**

Electrical Delay (one direction)	1 211 ns
	1.211113

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

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

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

#### **Additional EUT Data**

Manufactured by	SPEAG

Certificate No: D1750V2-1199\_Mar23

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# DASY5 Validation Report for Head TSL

Date: 27.03.2023

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1199

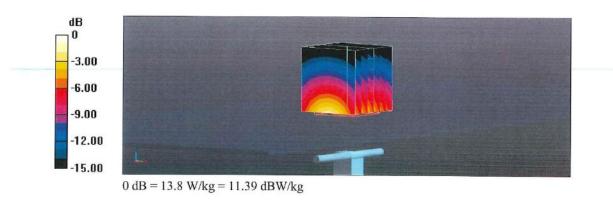
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz;  $\sigma$  = 1.33 S/m;  $\epsilon_r$  = 38.8;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

# DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

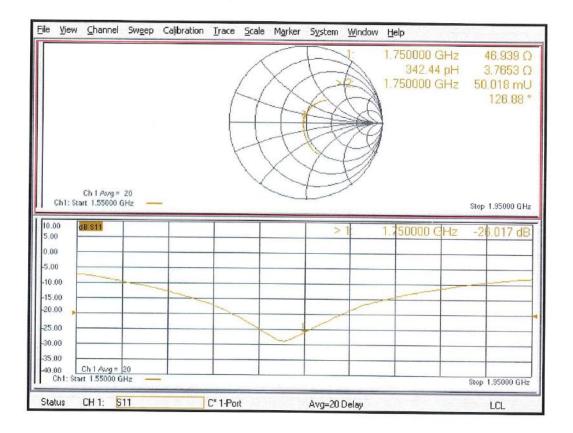
Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 104.8 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 16.3 W/kg SAR(1 g) = 8.89 W/kg; SAR(10 g) = 4.69 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.5% Maximum value of SAR (measured) = 13.8 W/kg



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# Impedance Measurement Plot for Head TSL



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E-mail: emf@caict.ac.cn	http://www.caic		3-60084
CALIBRATION CI	ERTIFICAT	Έ	
Object	D1900	/2 - SN: 5d231	
Calibration Procedure(s)	FE-711	-003-01	-
		tion Procedures for dipole validation kits	
Calibration date:		ry 17, 2023	A DATA DATA
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	asurements and	traceability to national standards, which rea the uncertainties with confidence probability	50 ST
All calibrations have been humidity<70%.	conducted in t	he closed laboratory facility: environment	temperature (22±3)°C and
			×
Calibration Equipment used Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Primary Standards Power Meter NRP2	ID # 106276	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103)	May-23
Primary Standards Power Meter NRP2 Power sensor NRP6A	ID # 106276 101369	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103)	May-23 May-23
Primary Standards Power Meter NRP2	ID # 106276	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103)	May-23
Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4	ID # 106276 101369 SN 7464	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 19-Jan-23 (CTTL-SPEAG,No.Z22-60565) 11-Jan-23(CTTL-SPEAG,No.Z23-60034)	May-23 May-23 Jan-24 Jan-24
Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 106276 101369 SN 7464 SN 1556	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 19-Jan-23 (CTTL-SPEAG,No.Z22-60565) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.)	May-23 May-23 Jan-24 Jan-24 Scheduled Calibration
Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4	ID # 106276 101369 SN 7464 SN 1556 ID # MY49070393	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 19-Jan-23 (CTTL-SPEAG,No.Z22-60565) 11-Jan-23(CTTL-SPEAG,No.Z23-60034)	May-23 May-23 Jan-24 Jan-24
Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 7464 SN 1556 ID # MY49070393	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 19-Jan-23 (CTTL-SPEAG,No.Z22-60565) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 17-May-23 (CTTL, No.J22X03157)	May-23 May-23 Jan-24 Jan-24 Scheduled Calibration May-24
Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106276 101369 SN 7464 SN 1556 ID # MY49070393 MY46110673	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 19-Jan-23 (CTTL-SPEAG,No.Z22-60565) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 17-May-23 (CTTL, No.J22X03157) 10-Jan-23 (CTTL, No. J23X00104)	May-23 May-23 Jan-24 Jan-24 Scheduled Calibration May-24 Jan-24
Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 7464 SN 1556 ID # MY49070393 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 19-Jan-23 (CTTL-SPEAG,No.Z22-60565) 11-Jan-23 (CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 17-May-23 (CTTL, No.J22X03157) 10-Jan-23 (CTTL, No. J23X00104) Function	May-23 May-23 Jan-24 Jan-24 Scheduled Calibration May-24 Jan-24
Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106276 101369 SN 7464 SN 1556 ID # MY49070393 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 19-Jan-23 (CTTL-SPEAG,No.Z22-60565) 11-Jan-23 (CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) Cal Date (Calibrated by, Certificate No.) 17-May-23 (CTTL, No.J22X03157) 10-Jan-23 (CTTL, No. J23X00104) Function SAR Test Engineer	May-23 May-23 Jan-24 Jan-24 Scheduled Calibration May-24 Jan-24

•

Tel: +86-	i2 HuaYuanBei Road, Haidian District, Beijing, 100191, China 0-62304633-2117 tl@chinattl.com http://www.caict.ac.cn
Glossary:	
TSL ConvF	tissue simulating liquid sensitivity in TSL / NORMx,y,z
N/A	not applicable or not measured
Calibration i	s Performed According to the Following Standards:
a) IEC/IEEE ( Rate of Hu Wireless C	52209-1528, "Measurement Procedure for The Assessment of Specific Absorption man Exposure to Radio Frequency Fields from Hand-held and Body-mounted communication Devices- Part 1528: Human Models, Instrumentation and
Procedures b) KDB 8656	6 (Frequency range of 4 MHz to 10 GHz)", October 2020 64, "SAR Measurement Requirements for 100 MHz to 6 GHz"
	ocumentation:
c) DASY4/5 S	System Handbook
Methods Ap	blied and Interpretation of Parameters:
<ul> <li>Measurel of the cer</li> <li>Antenna</li> </ul>	nent Conditions: Further details are available from the Validation Report at the end tificate. All figures stated in the certificate are valid at the frequency indicated. Parameters with TSL: The dipole is mounted with the spacer to position its feed
	ctly below the center marking of the flat phantom section, with the arms oriented the body axis.
<ul> <li>Feed Poi positione measure</li> </ul>	nt Impedance and Return Loss: These parameters are measured with the dipole d under the liquid filled phantom. The impedance stated is transformed from the ment at the SMA connector to the feed point. The Return Loss ensures low
<ul> <li>Electrical No uncer</li> </ul>	power. No uncertainty required. <i>Delay:</i> One-way delay between the SMA connector and the antenna feed point. tainty required.
<ul> <li>SAR mea</li> </ul>	sured: SAR measured at the stated antenna input power.
	nalized: SAR as measured, normalized to an input power of 1 W at the antenna
	nominal TSL parameters: The measured TSL parameters are used to calculate the SAR result.
The repor	ted uncertainty of measurement is stated as the standard uncertainty of
Measurem Correspon	ent multiplied by the coverage factor k=2, which for a normal distribution ds to a coverage probability of approximately 95%.

TR-EM-SA005

Add: No.52 HuaYuanBei Road, Haidia Tel: +86-10-62304633-2117				CAI
leasurement Conditions DASY system configuration, as far as				
DASY Version		DASY52		52.10.4
Extrapolation	Advar	nced Extrapolation		
Phantom	Triple Flat Phantom 5.1C			
Distance Dipole Center - TSL		10 mm		with Spacer
Zoom Scan Resolution	dx	, dy, dz = 5 mm		
Frequency	19	00 MHz ±1 MHz		
lead TSL parameters The following parameters and calculat	tions were	applied. Temperature	Permittivity	Conductivity
Nominal Head TSL parameters		22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters		(22.0 ±0.2) ℃	39.0 ±6 %	1.39 mho/m ±6 %
	uring test	<1.0 °C		

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.9 W/kg ±18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.8 W/kg ±18.7 % (k=2)

Certificate No: Z23-60084

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	n LABORATORY ad, Haidian District, Beijing, 100191, http://www.caict.ac.cn	China
		( ON A O L OFTO)
Appendix (Additional as	ssessments outside the	scope of CNAS L0570)
Antenna Parameters wit	th Head TSL	
Impedance, transformed to	feed point	50.3Ω+ 4.99jΩ
Return Loss		- 26.1dB
General Antenna Param	eters and Design	
Electrical Delay (one direction	on)	1.105 ns
connected to the second arm of the dipoles, small end cap according to the position as e affected by this change. The	of the dipole. The antenna is s are added to the dipole arm explained in the "Measuremen overall dipole length is still ad applied to the dipole arms, be	the center conductor of the feeding line is directly therefore short-circuited for DC-signals. On som is in order to improve matching when loaded at Conditions" paragraph. The SAR data are not coording to the Standard. coause they might bend or the soldered
connected to the second arm of the dipoles, small end cap according to the position as e affected by this change. The No excessive force must be connections near the feed-po	of the dipole. The antenna is s are added to the dipole arm explained in the "Measuremen overall dipole length is still ad applied to the dipole arms, be	therefore short-circuited for DC-signals. On son is in order to improve matching when loaded nt Conditions" paragraph. The SAR data are not ccording to the Standard.
connected to the second arm of the dipoles, small end cap according to the position as e affected by this change. The No excessive force must be a connections near the feed-por Additional EUT Data	of the dipole. The antenna is s are added to the dipole arm explained in the "Measuremen overall dipole length is still ad applied to the dipole arms, be	a therefore short-circuited for DC-signals. On som is in order to improve matching when loaded nt Conditions" paragraph. The SAR data are not coording to the Standard. iccause they might bend or the soldered

Add: No.52 HuaYuanBei Road, Haidia Tel: +86-10-62304633-2117		
E-mail: cttl@chinattl.com http	p://www.caict.ac.cn	
<b>DASY5 Validation Report for Hea</b> Test Laboratory: CTTL, Beijing, Ch		Date: 2023-02-17
DUT: Dipole 1900 MHz; Type: D1		: 5d231
Communication System: UID 0,	CW; Frequency: 1900 MHz	
Medium parameters used: $f = 190$	00 MHz; $\sigma = 1.393$ S/m; $\varepsilon_r = 38$ .	.96; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Right Section Measurement Standard: DASY5	(IFFF/IEC/ANSI C63 19-2007)	
DASY5 Configuration:		
<ul> <li>Probe: EX3DV4 - SN</li> </ul>	N7464; ConvF(8.13, 8.13, 8.13)	@ 1900 MHz: Calibrated:
2023-01-19	(1404, CORVI (0.15, 0.15, 0.15)	(g 1) ou mill, cunomou
	nm (Mechanical Surface Detection	on)
	n1556; Calibrated: 2023-01-11	000 DC1 CL CL 1 10/0
	1C (20deg probe tilt); Type: QD 35); SEMCAD X 14.6.14(7501)	
• DASY52 52.10.4(15:	55), SEMCAD A 14.0.14(7501)	
-	Scan (7x7x7) (7x7x7)/Cube 0: M	easurement grid: dx=5mm,
dy=5mm, dz=5mm	D 0 0011D	
Reference Value = $100.8 \text{ V/r}$ Peak SAR (extrapolated) = $1$		
SAR(1 g) = 10 W/kg; SAR(		
	is to all points 3 dB below = $10 \text{ m}$	nm
Ratio of SAR at M2 to SAR		
Maximum value of SAR (me	easured) = $15.7 \text{ W/kg}$	
-3.49		MA LUMP MARK
-6.98		
-10.46		
-13.95	Contraction of the local division of the loc	
13.35		
-17.44		
0 dB = 15.7 W/	//kg = 11.96 dBW/kg	

9
Stop 2.1 GHz 😋 🛙

Bay Area Compliance Laboratories Corp. (Shenzhen)

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

Client BACL

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



S Schweizerischer Kalibrierdienst

C Service suisse d'étalonnage

Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

# Certificate No. D2600V2-1207\_Mar23

Object	D2600V2 - SN:12	207	
Calibration procedure(s)	QA CAL-05.v12	dure for SAR Validation Sources	hotwoon 0.7.2 CHz
	Calibration Proce	dure for SAR validation Sources	between 0.7-5 GHz
Calibration date:	March 27, 2023		
The measurements and the uncerta	ainties with confidence pr	onal standards, which realize the physical uni robability are given on the following pages an y facility: environment temperature (22 ± 3)°C	d are part of the certificate.
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
Power sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Type-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
Reference Probe EX3DV4	SN: 7349	10-Jan-23 (No. EX3-7349_Jan23)	Jan-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23
	ID #	Check Date (in house)	Scheduled Check
Secondary Standards	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Secondary Standards Power meter E4419B	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
		07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power meter E4419B	SN: MY41093315		In house check: Oct-24
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A			In house check: Oct-24
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24 Signature
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 100972 SN: US41080477	15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22) Function	Signature
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 100972 SN: US41080477 Name	15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22) Function	

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



S Schweizerischer Kalibrierdienst Service suisse d'étalonnage 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%.

Certificate No: D2600V2-1207\_Mar23

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#### **Measurement Conditions**

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

DASY Version	DASY52	V52.10.4	
Extrapolation	Advanced Extrapolation		
Phantom	Modular Flat Phantom		
Distance Dipole Center - TSL	10 mm	with Spacer	
Zoom Scan Resolution	dx, dy, dz = 5 mm		
Frequency	2600 MHz ± 1 MHz		

### **Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.4 ± 6 %	1.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	14.0 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	55.2 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	6.26 W/kg	

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.9 Ω - 0.7 jΩ
Return Loss	- 27.4 dB

#### **General Antenna Parameters and Design**

	1111-11-11-11-11-11-11-11-11-11-11-11-1	
Electrical Delay (one direction)	 1.139 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
-----------------	-------

Certificate No: D2600V2-1207\_Mar23

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# DASY5 Validation Report for Head TSL

Date: 27.03.2023

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1207

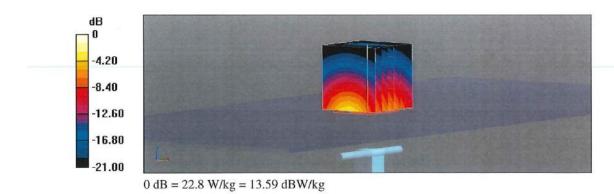
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz;  $\sigma$  = 1.97 S/m;  $\epsilon_r$  = 37.4;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

### DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.68, 7.68, 7.68) @ 2600 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

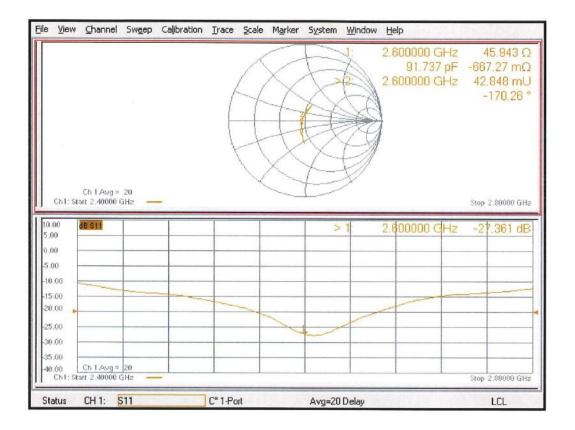
Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 118.1 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 27.1 W/kg SAR(1 g) = 14.0 W/kg; SAR(10 g) = 6.26 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 51.5% Maximum value of SAR (measured) = 22.8 W/kg



Certificate No: D2600V2-1207\_Mar23

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### Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1207\_Mar23

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# APPENDIX D RETURN LOSS&IMPEDANCE MEASUREMENT

# **Equipment Details:**

Description:	Dipole
Manufacturer:	Speag
Model Number:	D750V3
Serial Number:	1229
Calibration Date:	2024/03/26
Calibrated By:	Bob Lu
Signature:	Bob Lu

All Calibration have been conducted in the closed laboratory facility: Lab Temperature 18°C-25°C and humidity < 70%

# The calibration methods and procedures used were as detailed in:

KDB Publication Number: "KDB865664 D01 SAR Measurement 100 MHz to 6 GHz"

1. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.

2. The measurement of real or imaginary parts of impedance does not deviate more than  $5\Omega$  from the previous measurement.

# **Calibrated Equipment:**

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2023/06/08	2024/06/07
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

# **Test Data:**

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
	Return Loss	27.796 dB	29.503 dB	-5.786%	±20%;≥20dB	Pass	
750	Head	Real Impedance	49.557 Ω	53.314 Ω	3.757 Ω	$\leq$ 5 $\Omega$	Pass
		Imaginary Impedance	-5.432 Ω	-0.992 Ω	4.44 Ω	$\leq$ 5 $\Omega$	Pass

Bay Area Compliance Laboratories Corp. (Shenzhen)



### Dipole, 750MHz, 1229

Description:	Dipole
Manufacturer:	Speag
Model Number:	D900V2
Serial Number:	132
Calibration Date:	2024/09/26
Calibrated By:	Bob Lu
Signature:	Bob Lu

All Calibration have been conducted in the closed laboratory facility: Lab Temperature 18°C-25°C and humidity < 70%

# The calibration methods and procedures used were as detailed in:

KDB Publication Number: "KDB865664 D01 SAR Measurement 100 MHz to 6 GHz"

1. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.

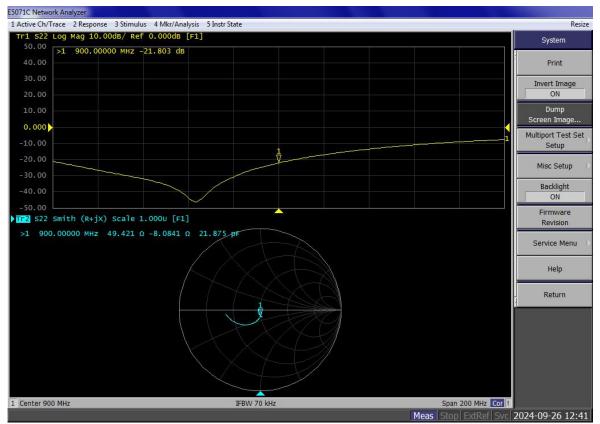
2. The measurement of real or imaginary parts of impedance does not deviate more than  $5\Omega$  from the previous measurement.

### **Calibrated Equipment:**

Equipment	Equipment Model		Calibration Date	Calibration Due Date
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2024/05/21 2025/05/	
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

### **Test Data:**

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
	Return Loss	21.803 dB	22.005 dB	-0.92%	±20%;≥20dB	Pass	
900	Head	Real Impedance	49.421 Ω	47.694 Ω	1.727 Ω	$\leq$ 5 $\Omega$	Pass
		Imaginary Impedance	-8.084 Ω	-7.428 Ω	0.656 Ω	$\leq$ 5 $\Omega$	Pass



#### Dipole, 900MHz, 132

Description:	Dipole
Manufacturer:	Speag
Model Number:	D1750V2
Serial Number:	1199
Calibration Date:	2024/03/26
Calibrated By:	Bob Lu
Signature:	Bob Lu

All Calibration have been conducted in the closed laboratory facility: Lab Temperature  $18^{\circ}\text{C}-25^{\circ}\text{C}$  and humidity < 70%

# The calibration methods and procedures used were as detailed in:

KDB Publication Number: "KDB865664 D01 SAR Measurement 100 MHz to 6 GHz"

1. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.

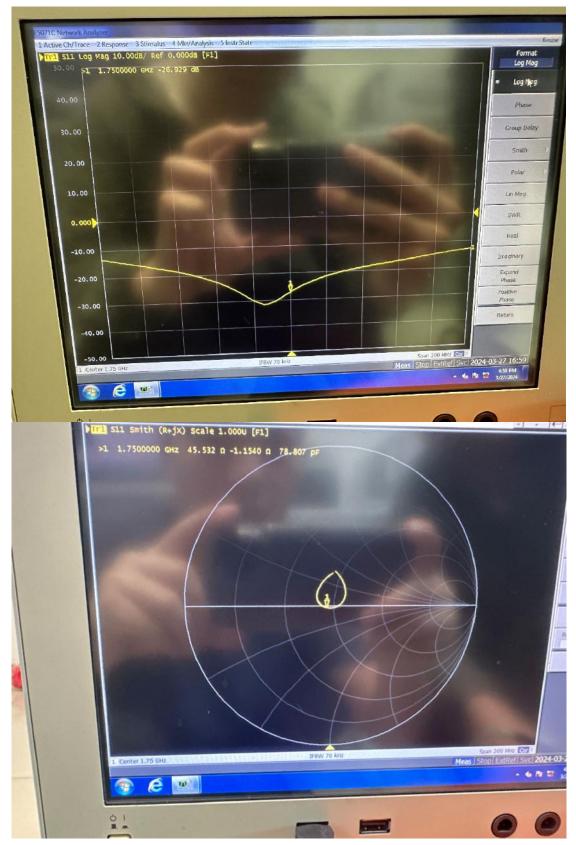
2. The measurement of real or imaginary parts of impedance does not deviate more than  $5\Omega$  from the previous measurement.

### **Calibrated Equipment:**

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2023/06/08	2024/06/07
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

### **Test Data:**

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
		Return Loss	26.929 dB	26.017 dB	3.505%	±20%;≥20dB	Pass
1750	Head	Real Impedance	45.532 Ω	46.939 Ω	1.407 Ω	$\leq$ 5 $\Omega$	Pass
	Imaginary Impedance	-1.154 Ω	3.765 Ω	4.919 Ω	$\leq$ 5 $\Omega$	Pass	



Dipole, 1750MHz, 1199

Description:	Dipole
Manufacturer:	Speag
Model Number:	D1900V2
Serial Number:	5d231
Calibration Date:	2024/02/01
Calibrated By:	Bob Lu
Signature:	Bob Lu

All Calibration have been conducted in the closed laboratory facility: Lab Temperature 18°C-25°C and humidity < 70%

# The calibration methods and procedures used were as detailed in:

KDB Publication Number: "KDB865664 D01 SAR Measurement 100 MHz to 6 GHz"

1. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.

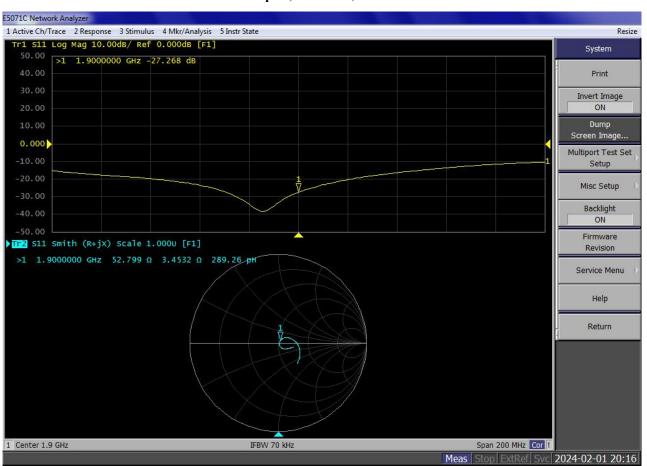
2. The measurement of real or imaginary parts of impedance does not deviate more than  $5\Omega$  from the previous measurement.

### **Calibrated Equipment:**

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2023/06/08	2024/06/07
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

### **Test Data:**

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
		Return Loss	27.268 dB	26.067 dB	4.607 %	±20%;≥20dB	Pass
1900	Head	Real Impedance	52.799 Ω	50.307 Ω	2.492 Ω	$\leq$ 5 $\Omega$	Pass
	Imaginary Impedance	3.453 Ω	4.985 Ω	-1.532 Ω	$\leq$ 5 $\Omega$	Pass	



#### Dipole, 1900MHz, 5d231

Description:	Dipole
Manufacturer:	Speag
Model Number:	D1900V2
Serial Number:	5d231
Calibration Date:	2025/02/01
Calibrated By:	Bob Lu
Signature:	Bob Lu

All Calibration have been conducted in the closed laboratory facility: Lab Temperature 18°C-25°C and humidity < 70%

# The calibration methods and procedures used were as detailed in:

KDB Publication Number: "KDB865664 D01 SAR Measurement 100 MHz to 6 GHz"

1. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.

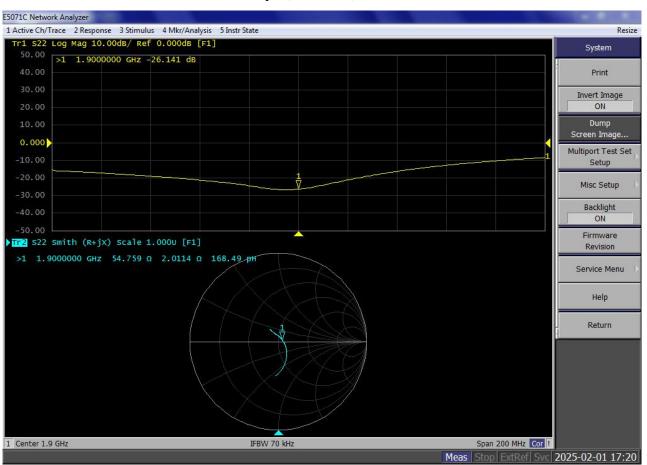
2. The measurement of real or imaginary parts of impedance does not deviate more than  $5\Omega$  from the previous measurement.

### **Calibrated Equipment:**

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2024/05/21	2025/05/20
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

### **Test Data:**

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
		Return Loss	26.141 dB	26.067 dB	0.284 %	±20%;≥20dB	Pass
1900	Head	Real Impedance	54.759 Ω	50.307 Ω	4.452 Ω	$\leq$ 5 $\Omega$	Pass
	Imaginary Impedance	2.011 Ω	4.985 Ω	-2.974 Ω	$\leq$ 5 $\Omega$	Pass	



#### Dipole, 1900MHz, 5d231

Description:	Dipole
Manufacturer:	Speag
Model Number:	D2600V2
Serial Number:	1207
Calibration Date:	2024/03/26
Calibrated By:	Bob Lu
Signature:	Bob Lu

All Calibration have been conducted in the closed laboratory facility: Lab Temperature  $18^{\circ}$ C-25°C and humidity < 70%

# The calibration methods and proc30.9edures used were as detailed in:

KDB Publication Number: "KDB865664 D01 SAR Measurement 100 MHz to 6 GHz"

1. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.

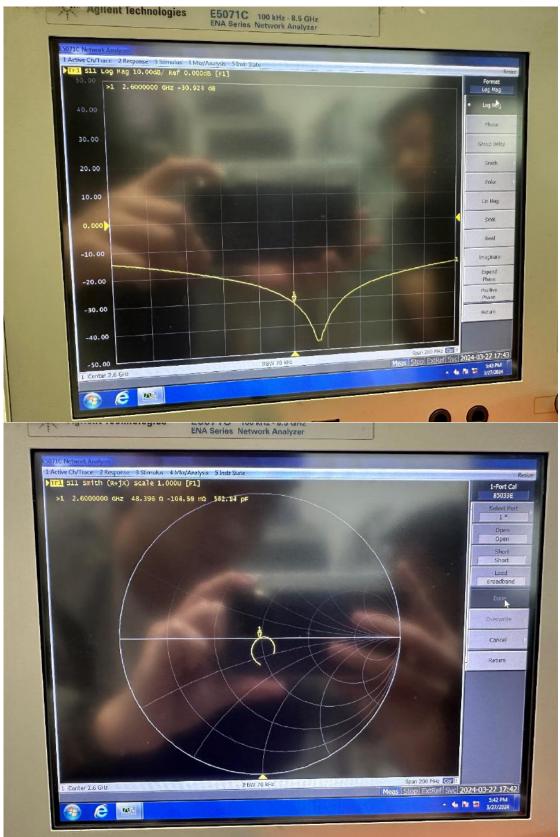
2. The measurement of real or imaginary parts of impedance does not deviate more than  $5\Omega$  from the previous measurement.

### **Calibrated Equipment:**

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Simulated Tissue Liquid Head	HBBL600-10000V6	2200808-2	Each Time	
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Network Analyzer	E5071C	SER MY46519680	2023/06/08	2024/06/07
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

### **Test Data:**

Frequency (MHz)	Simulated Liquid	Parameter	Measured Value	Target Value	Deviation	Reference Range	Results
		Return Loss	30.923 dB	27.361 dB	13.019%	±20%;≥20dB	Pass
2600	Head	Real Impedance	48.396 Ω	45.943 Ω	2.453 Ω	$\leq$ 5 $\Omega$	Pass
	Imaginary Impedance	-0.109 Ω	-0.667 Ω	0.558 Ω	$\leq$ 5 $\Omega$	Pass	



Dipole, 2600MHz, 1207