

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



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

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

Accreditation No.: SCS 0108

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:

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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%.

Measurement Conditions

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

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
EUT Positioning	Touch Position	
Zoom Scan Resolution	$dx, dy = 4.0$ mm, $dz = 1.4$ mm	Graded Ratio = 1.4 (Z direction)
Frequency	150 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	52.3	0.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	$51.1 \pm 6 \%$	$0.77 \text{ mho/m} \pm 6 \%$
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	1 W input power	3.78 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$3.72 \text{ W/kg} \pm 18.4 \%$ (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	1 W input power	2.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$2.52 \text{ W/kg} \pm 18.0 \%$ (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	61.9	0.80 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	$62.1 \pm 6 \%$	$0.81 \text{ mho/m} \pm 6 \%$
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	1 W input power	3.82 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	$3.79 \text{ W/kg} \pm 18.4 \%$ (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	1 W input power	2.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	$2.56 \text{ W/kg} \pm 18.0 \%$ (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	44.5 Ω - 4.4 j Ω
Return Loss	- 22.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 Ω - 6.1 j Ω
Return Loss	- 22.9 dB

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 08.11.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: CLA150; Type: CLA150; Serial: CLA150 - SN: 4020

Communication System: UID 0 - CW; Frequency: 150 MHz

Medium parameters used: $f = 150 \text{ MHz}$; $\sigma = 0.77 \text{ S/m}$; $\epsilon_r = 51.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(12.51, 12.51, 12.51) @ 150 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 26.01.2022
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

CLA Calibration for HSL-LF Tissue/CLA150, touch configuration, Pin=1W/Zoom Scan,**dist=1.4mm (8x10x8)/Cube 0:** Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$

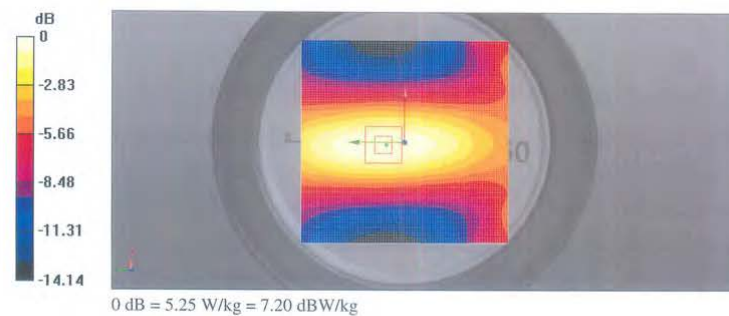
Reference Value = 78.91 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 6.94 W/kg

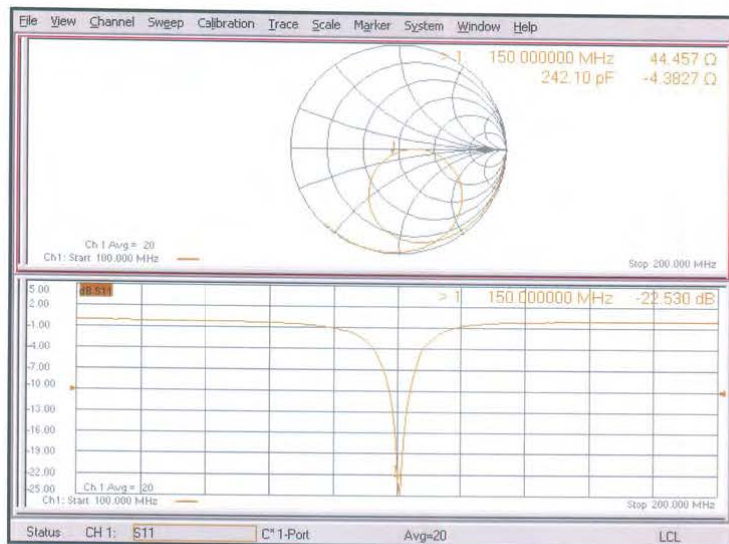
SAR(1 g) = 3.78 W/kg; SAR(10 g) = 2.56 W/kgSmallest distance from peaks to all points 3 dB below: Larger than measurement grid ($> 14 \text{ mm}$)

Ratio of SAR at M2 to SAR at M1 = 81.3%

Maximum value of SAR (measured) = 5.25 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.11.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: CLA150; Type: CLA150; Serial: CLA150 - SN: 4020

Communication System: UID 0 - CW; Frequency: 150 MHz

Medium parameters used: $f = 150 \text{ MHz}$; $\sigma = 0.81 \text{ S/m}$; $\epsilon_r = 62.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(11.56, 11.56, 11.56) @ 150 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 26.01.2022
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

CLA Calibration for MSL-LF Tissue/CLA150, touch configuration, Pin=1W/Zoom Scan,**dist=1.4mm (8x10x8)/Cube 0:** Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$

Reference Value = 80.25 V/m; Power Drift = -0.04 dB

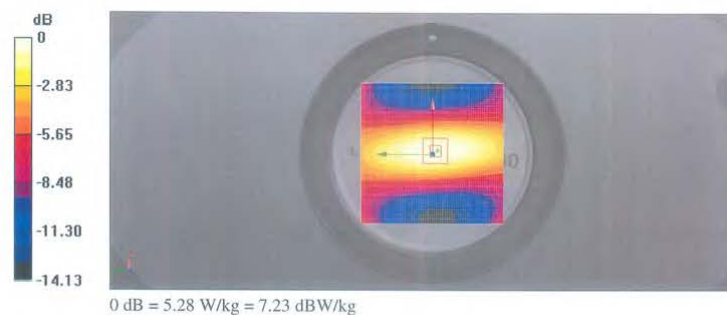
Peak SAR (extrapolated) = 7.04 W/kg

SAR(1 g) = 3.82 W/kg; SAR(10 g) = 2.58 W/kg

Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 14 mm)

Ratio of SAR at M2 to SAR at M1 = 81.2%

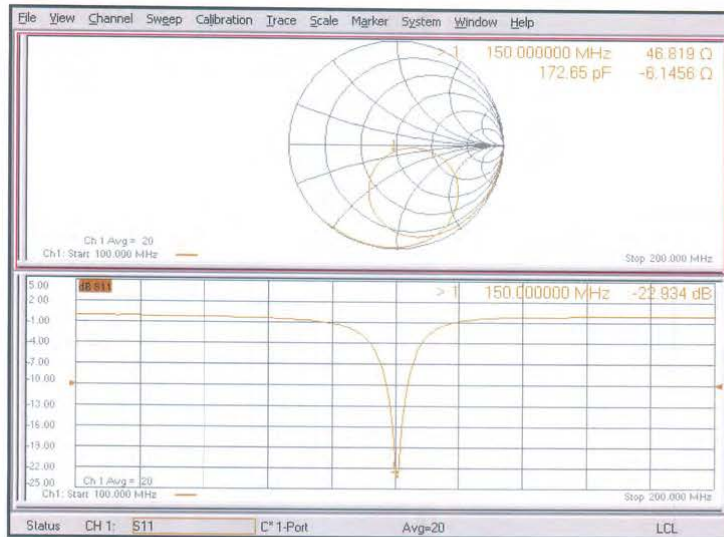
Maximum value of SAR (measured) = 5.28 W/kg



Certificate No: CLA150-4020_Nov22

Page 7 of 8

Impedance Measurement Plot for Body TSL



APPENDIX E - RETURN LOSS AND IMPEDANCE MEASUREMENT**CLA150 - SN:4020 Extended Dipole Calibrations**

Referring to KDB 865664 D01, if dipoles are verified in return loss(< -20dB, within 20% of prior calibration), and in impedance(within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

Test Equipment Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Simulated Tissue 150 MHz Head	TS-150H	2409015001	Each Time	/
Oval Flat Phantom	ELI V8.0	2051	NCR	NCR
Network Analyzer	E5071C	MY46519680	2023/07/16	2024/07/15
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

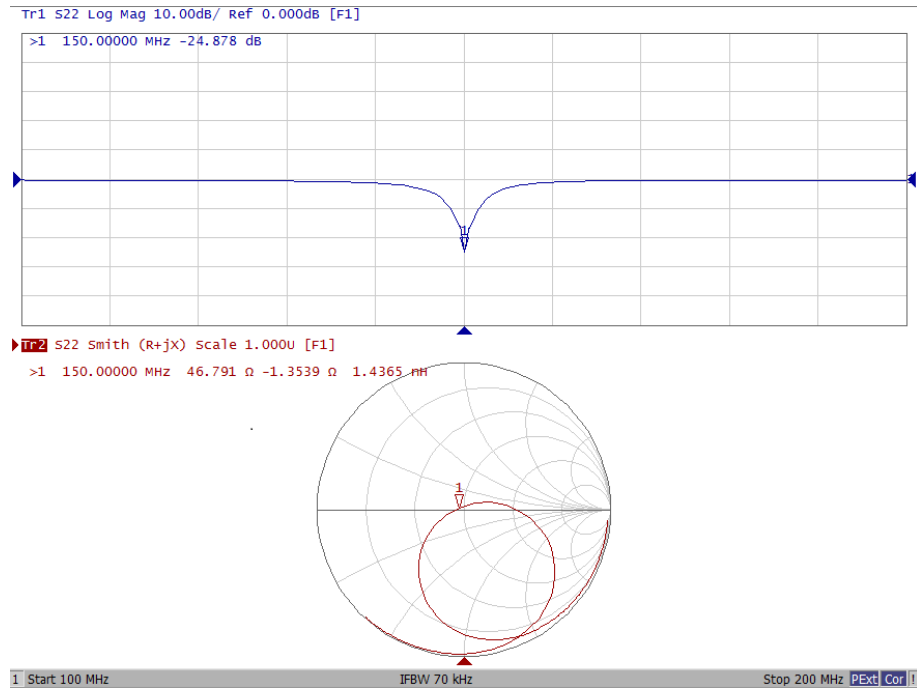
Justification of the extended calibration

CLA150 - SN:4020						
150MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2022/11/16 (Cal. Report)	-22.5	/	44.5	/	-4.4	/
2023/11/15 (Extended)	-24.9	10.7	46.8	2.3	-1.4	3

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Loop Verification Data> CLA150 - SN:4020 (Date of Measurement: 2023/11/15)

150MHz - Head



	Name	Tilt	Signature
Calibrated By:	Mark Dong	SAR Engineer	Mark Dong
Approved By:	Brave Lu	SAR Supervisor	Brave Lu

CLA150 - SN:4020 Extended Dipole Calibrations

Referring to KDB 865664 D01, if dipoles are verified in return loss(< -20dB, within 20% of prior calibration), and in impedance(within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

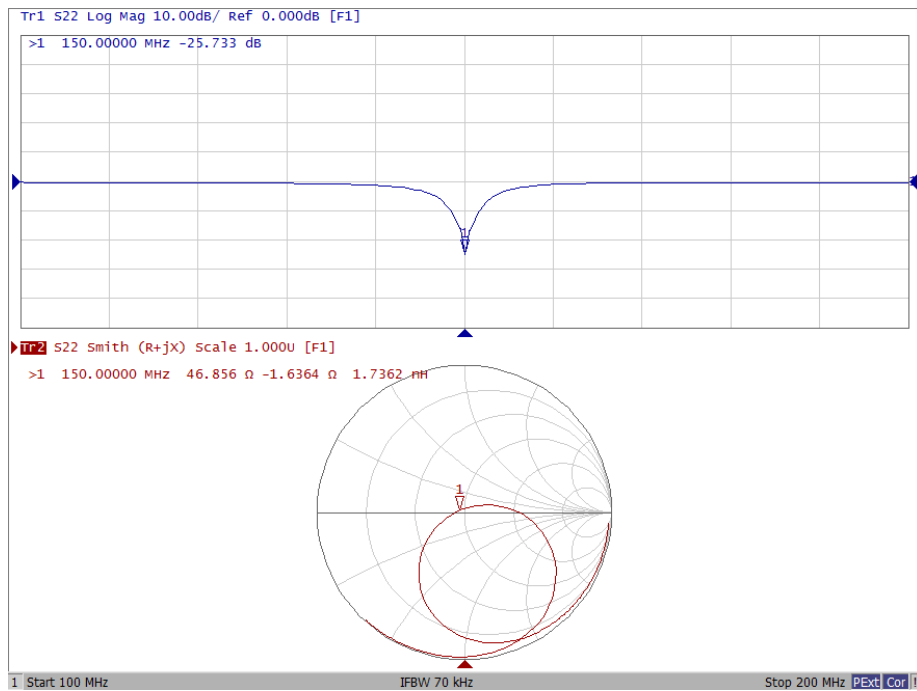
Test Equipment Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Simulated Tissue 150 MHz Head	TS-150H	2409015001	Each Time	/
Oval Flat Phantom	ELI V8.0	2051	NCR	NCR
Network Analyzer	E5071C	MY46519680	2024/07/11	2025/07/10
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

Justification of the extended calibration

CLA150 - SN:4020						
150MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2022/11/16 (Cal. Report)	-22.5	/	44.5	/	-4.4	/
2024/11/15 (Extended)	-25.7	14.2	46.9	2.4	-1.6	2.8

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Loop Verification Data> CLA150 - SN:4020 (Date of Measurement: 2024/11/15)**150MHz - Head**

	Name	Tilt	Signature
Calibrated By:	Mark Dong	SAR Engineer	Mark Dong
Approved By:	Brave Lu	SAR Supervisor	Brave Lu

***** END OF REPORT *****