

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 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%.

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 |
| Distance Dipole Center - TSL | 15 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 450 MHz \pm 1 MHz | |

HSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|------------------------------------|---------------------|----------------|----------------------|
| Nominal HSL parameters | 22.0 °C | 43.5 | 0.87 mho/m |
| Measured HSL parameters | (22.0 \pm 0.2) °C | 42.6 \pm 6 % | 0.88 mho/m \pm 6 % |
| HSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with HSL

| | | |
|--|--------------------|--|
| SAR averaged over 1 cm ³ (1 g) of HSL | Condition | |
| SAR measured | 250 mW input power | 1.16 W/kg |
| SAR for nominal HSL parameters | normalized to 1W | 4.58 W/kg \pm 18.1 % (k=2) |

| | | |
|--|--------------------|--|
| SAR averaged over 10 cm ³ (10 g) of HSL | condition | |
| SAR measured | 250 mW input power | 0.776 W/kg |
| SAR for nominal HSL parameters | normalized to 1W | 3.07 W/kg \pm 17.6 % (k=2) |

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

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $58.4 \Omega + 0.4 j\Omega$ |
| Return Loss | - 22.3 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.354 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 |
|-----------------|-------|

DASY5 Validation Report for HSL

Date: 07.07.2025

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1096

Communication System: UID 0 - CW; Frequency: 450 MHz

Medium parameters used: $f = 450$ MHz; $\sigma = 0.88$ S/m; $\epsilon_r = 42.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.79, 10.79, 10.79) @ 450 MHz; Calibrated: 06.01.2025
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 18.10.2024
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2034
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 39.07 V/m; Power Drift = 0.01 dB

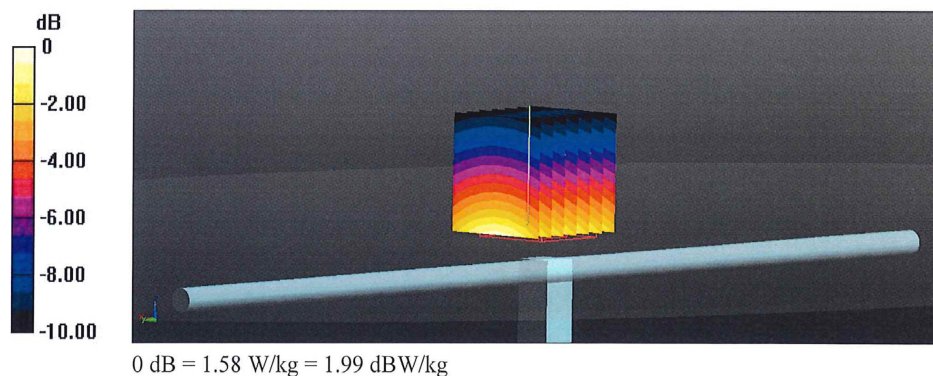
Peak SAR (extrapolated) = 1.82 W/kg

SAR(1 g) = 1.16 W/kg; SAR(10 g) = 0.776 W/kg

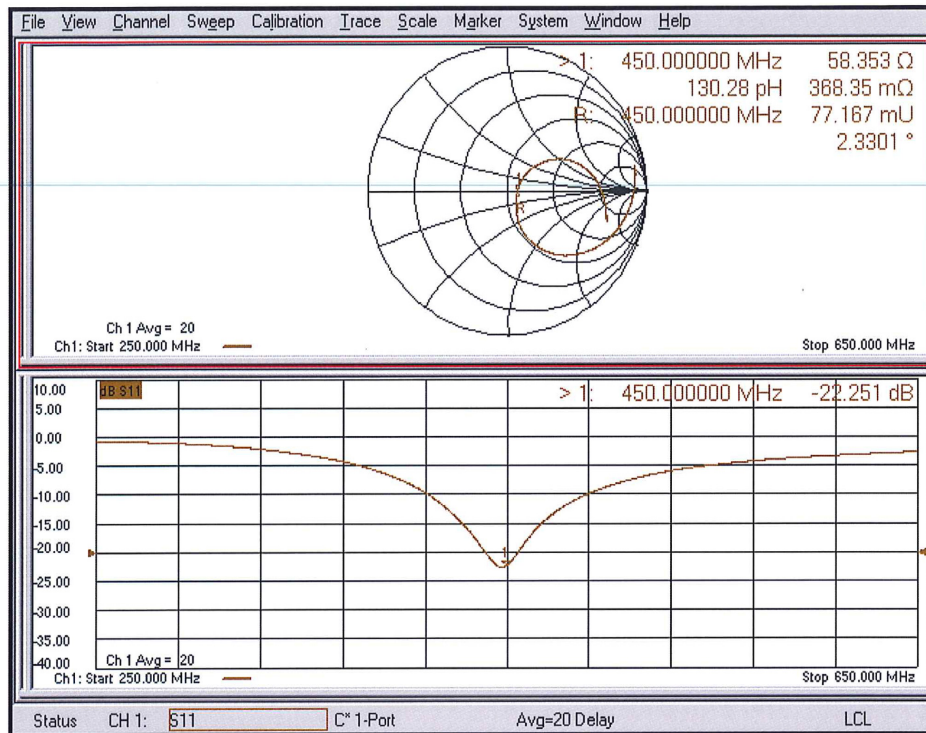
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm)

Ratio of SAR at M2 to SAR at M1 = 64%

Maximum value of SAR (measured) = 1.58 W/kg



Impedance Measurement Plot for HSL



**** END OF REPORT ****