Justification for Extended SAR Dipole Calibrations

Instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements

KDB 865664 D01v01r04 requirements

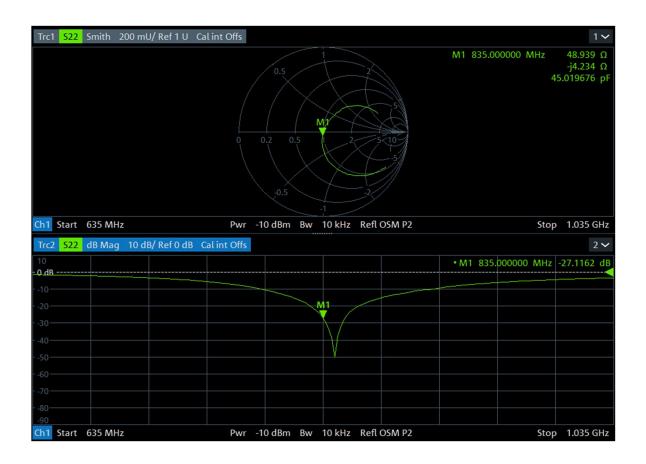
a) return loss : < - 20 dB, within 20% of previous measurement

b) impedance : within 5 Ω from previous measurement

| Dipole Antenna | Head/Body | Date of Measurement | Return Loss (dB) | Δ% | Impedance (Ω) | ΔΩ |
|-------------------|-----------|------------------------|------------------|-------|---------------|-------|
| | Head | 2022.03.24 | -29.354 | -7.62 | 50.196 | -1.26 |
| D835V2-SN : 4d194 | пеай | 2023.03.07 | -27.116 | -7.02 | 48.939 | -1.20 |

c) extrapolated peak SAR : within 10% of that reported in the calibration data

| Dipole Antenna | Head/Body | Date of Measurement | extrapolated peak SAR (W/kg) | Δ% |
|-------------------|-----------|------------------------|---------------------------------|------|
| | Llood | 2022.02.24 | 1.472 | 0 70 |
| D835V2-SN : 4d194 | Head | 2023.02.08 | 1.6 | 8.70 |





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 - Swiss Calibration Service

Accreditation No.: SCS 0108

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

Client UL Korea (Dymstec)

| Certificate No: D1750V2-1125_Nov22 | 2 |
|------------------------------------|---|
|------------------------------------|---|

CALIBRATION CERTIFICATE

| Object | D1750V2 - SN:1 | 125 | | | | | |
|--|-----------------------------|---|-----------------------------------|--|--|--|--|
| | | | | | | | |
| Calibration procedure(s) | OA CAL-05 v11 | QA CAL-05.v11 | | | | | |
| Procedure(3) | | | | | | | |
| | Calibration Proce | edure for SAR Validation Source | ces between 0.7-3 GHz | | | | |
| | | | | | | | |
| | | | | | | | |
| Calibration date: | November 30, 20 | 022 | | | | | |
| | | | | | | | |
| This calibration certificate documer | ate the tracebility to peti | | | | | | |
| The measurements and the uncert | ainties with confidence p | onal standards, which realize the physical robability are given on the following pages | units of measurements (SI). | | | | |
| | | and given on the following pages | and are part of the certificate. | | | | |
| All calibrations have been conducted | ed in the closed laborator | y facility: environment temperature (22 ± 3 | $3)^{\circ}C$ and humidity < 70%. | | | | |
| | | | | | | | |
| Calibration Equipment used (M&TE | critical for calibration) | | | | | | |
| Primary Standards | ID # | Cal Data (Cartificata Na.) | | | | | |
| Power meter NRP | SN: 104778 | Cal Date (Certificate No.) | Scheduled Calibration | | | | |
| Power sensor NRP-Z91 | SN: 103244 | 04-Apr-22 (No. 217-03525/03524) | Apr-23 | | | | |
| Power sensor NRP-Z91 | SN: 103245 | 04-Apr-22 (No. 217-03524) | Apr-23 | | | | |
| Reference 20 dB Attenuator | SN: BH9394 (20k) | 04-Apr-22 (No. 217-03525) | Apr-23 | | | | |
| Type-N mismatch combination | SN: 310982 / 06327 | 04-Apr-22 (No. 217-03527) | Apr-23 | | | | |
| Reference Probe EX3DV4 | weather weather and | 04-Apr-22 (No. 217-03528) | Apr-23 | | | | |
| DAE4 | SN: 7349 | 31-Dec-21 (No. EX3-7349_Dec21) | Dec-22 | | | | |
| DAE4 | SN: 601 | 31-Aug-22 (No. DAE4-601_Aug22) | Aug-23 | | | | |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check | | | | |
| Power meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check Oct-22) | In house check: Oct-24 | | | | |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-22) | In house check: Oct-24 | | | | |
| Power sensor HP 8481A | SN: MY41093315 | 07-Oct-15 (in house check Oct-22) | In house check: Oct-24 | | | | |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-22) | In house check: Oct-24 | | | | |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-22) | In house check: Oct-24 | | | | |
| | Name | Eurofice | | | | | |
| Calibrated by: | | Function | Signature | | | | |
| oundrated by. | Jeton Kastrati | Laboratory Technician | Jelle. | | | | |
| | | | V | | | | |
| Approved by: | Sven Kühn | Technical Manager | Fla. Str | | | | |
| | | | 2.00 | | | | |
| | | | Issued: December 2, 2022 | | | | |
| This calibration certificate shall not I | be reproduced except in | full without written approval of the laborate | rv. | | | | |





- S Schweizerischer Kalibrierdienst
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Swiss Calibration Service

Accreditation No.: SCS 0108

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

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 | 40.5 ± 6 % | 1.35 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|---------------------------------|--------------------------|
| SAR measured | 250 mW input power | 9.24 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 37.4 W/kg ± 17.0 % (k=2) |
| | | |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
| SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured | condition 250 mW input power | 4.89 W/kg |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 51.1 Ω + 4.1 jΩ |
|--------------------------------------|-----------------|
| Return Loss | - 27.6 dB |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1 000 |
|----------------------------------|----------|
| | 1.222 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 | SDEAG |
|-----------------|-------|
| | SFEAG |
| | |

DASY5 Validation Report for Head TSL

Date: 30.11.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1125

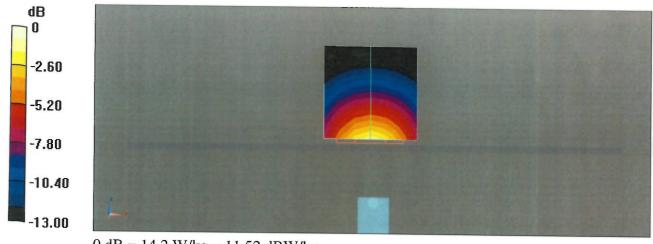
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; σ = 1.35 S/m; ϵ_r = 40.5; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 31.08.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

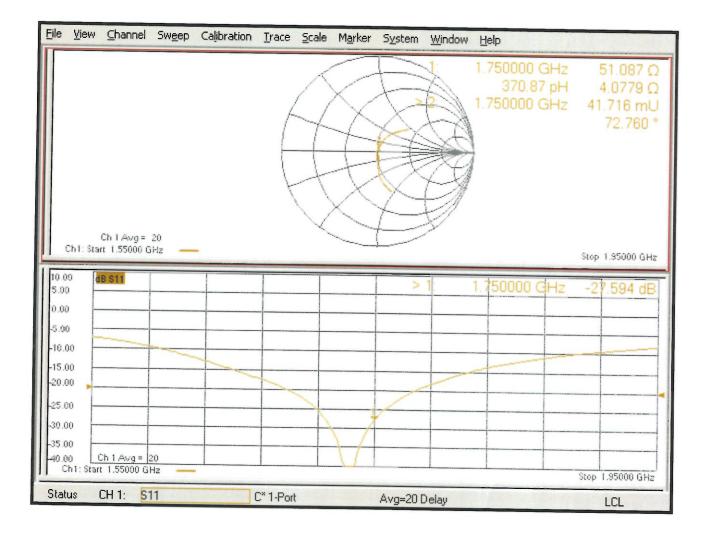
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 108.2 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 16.9 W/kg SAR(1 g) = 9.24 W/kg; SAR(10 g) = 4.89 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.9% Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg

Impedance Measurement Plot for Head TSL



Justification for Extended SAR Dipole Calibrations

Instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements

KDB 865664 D01v01r04 requirements

`

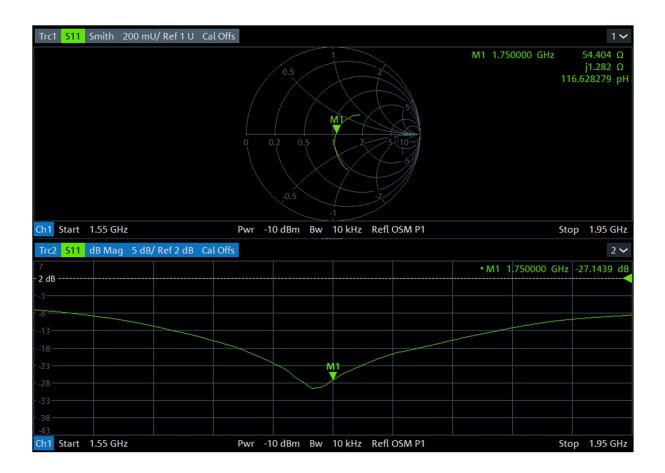
a) return loss : < - 20 dB, within 20% of previous measurement

b) impedance : within 5 Ω from previous measurement

| Dipole Antenna | Head/Body | Date of Measurement | Return Loss (dB) | Δ% | Impedance (Ω) | ΔΩ |
|-------------------|-----------|------------------------|------------------|-----|---------------|--------|
| D1750V2-SN : 1125 | Head | 2022.11.30 | -27.594 | 1 6 | 51.087 | -3.317 |
| | пеац | 2023.11.09 | -27.143 | 1.6 | 54.404 | -3.317 |

c) extrapolated peak SAR : within 10% of that reported in the calibration data

| Dipole Antenna | Head/Body | Date of Measurement | extrapolated peak SAR (W/kg) | Δ% |
|-------------------|-----------|------------------------|---------------------------------|------|
| | Llood | 2022.11.30 | 16.9 | 2 55 |
| D1750V2-SN : 1125 | Head | 2023.11.17 | 16.3 | 3.55 |



Client





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Accreditation No.: SCS 0108

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Certificate No: D1750V2-1180_Sep22

CALIBRATION CERTIFICATE

UL Korea (Dymstec)

| Object | D1750V2 - SN:1 | 1180 | |
|---|---|---|---|
| Calibration procedure(s) | QA CAL-05.v11 Calibration Proc | edure for SAR Validation Source | s between 0.7-3 GHz |
| | | | |
| Calibration date: | September 21, 2 | 2022 | |
| | | | |
| The measurements and the uncert | nts the traceability to nati tainties with confidence p | ional standards, which realize the physical ur probability are given on the following pages ar | nits of measurements (SI). |
| | | | |
| All calibrations have been conduct | ed in the closed laborato | ry facility: environment temperature (22 ± 3)° | C and humidity < 70%. |
| Calibration Equipment used (M&TE | E critical for calibration) | | |
| | | | |
| Primary Standards | ID # | Cal Date (Certificate No.) | Schedulad Calibration |
| Power meter NRP | ID # SN: 104778 | Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) | Scheduled Calibration |
| Power meter NRP Power sensor NRP-Z91 | | 04-Apr-22 (No. 217-03525/03524) | Apr-23 |
| Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 | SN: 104778 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) | Apr-23 Apr-23 |
| Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator | SN: 104778 SN: 103244 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) | Apr-23 Apr-23 Apr-23 |
| Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination | SN: 104778 SN: 103244 SN: 103245 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) | Apr-23 Apr-23 Apr-23 Apr-23 |
| Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) | Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 |
| Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) | Apr-23 Apr-23 Apr-23 Apr-23 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 31-Aug-22 (No. DAE4-601_Aug22) | Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Aug-23 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) | Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Aug-23 Scheduled Check |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-20) | Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Aug-23 Scheduled Check In house check: Oct-22 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) | Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Aug-23 Scheduled Check In house check: Oct-22 In house check: Oct-22 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) | Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Aug-23 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: US37292783 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) | Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Aug-23 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) | Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Aug-23 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477 | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) | Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Aug-23 |
| | SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477 Name | 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function | Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Aug-23 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 |



Schweizerischer Kalibrierdienst S

Service suisse d'étalonnage

С 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

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- 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 | 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 | 38.7 ± 6 % | 1.35 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm^3 (1 g) of Head TSL | Condition | |
|---|---------------------------------|--------------------------|
| SAR measured | 250 mW input power | 8.90 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 35.6 W/kg ± 17.0 % (k=2) |
| | | |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
| SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured | condition 250 mW input power | 4.72 W/kg |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 50.9 Ω - 0.6 jΩ |
|--------------------------------------|-----------------|
| Return Loss | - 39.2 dB |

General Antenna Parameters and Design

| Electrical Delay (and direction) | |
|----------------------------------|-----------|
| Electrical Delay (one direction) | 1.214 ns |
| | 1.2 14115 |

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

| Monufootured by | |
|-----------------|--------|
| Manufactured by | 0054.0 |
| | SPEAG |
| | |

DASY5 Validation Report for Head TSL

Date: 21.09.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1180

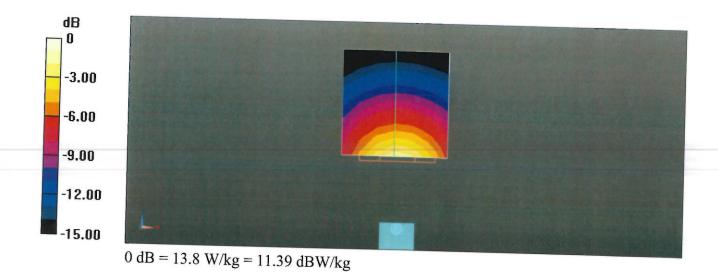
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; $\sigma = 1.35$ S/m; $\varepsilon_r = 38.7$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

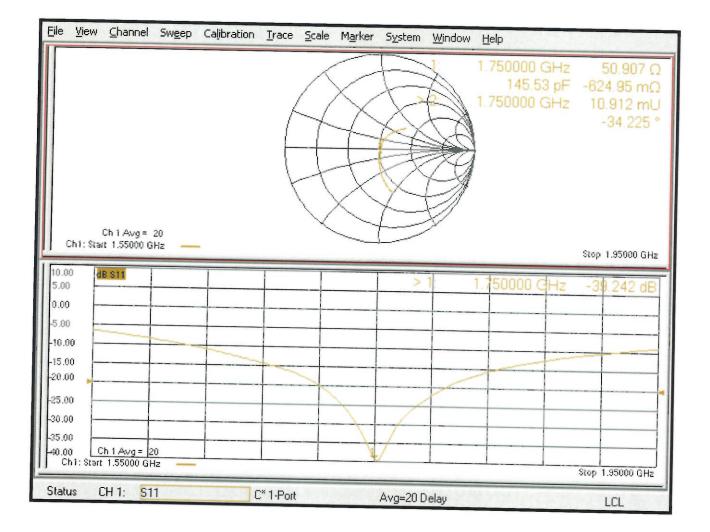
- Probe: EX3DV4 SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 31.08.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 106.1 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 16.3 W/kg SAR(1 g) = 8.9 W/kg; SAR(10 g) = 4.72 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.7% Maximum value of SAR (measured) = 13.8 W/kg



Impedance Measurement Plot for Head TSL



Justification for Extended SAR Dipole Calibrations

Instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements

KDB 865664 D01v01r04 requirements

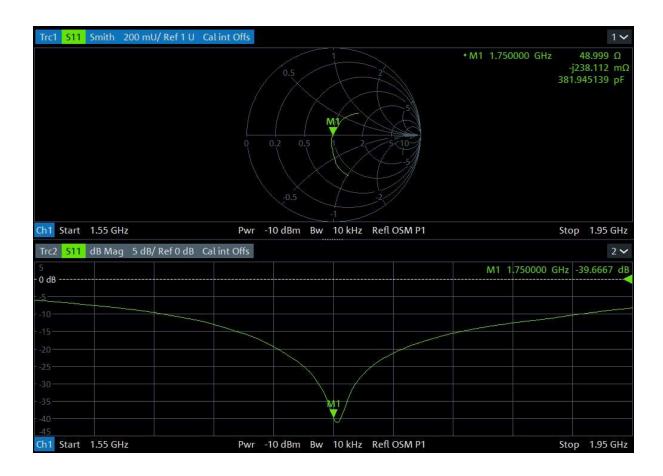
a) return loss : < - 20 dB, within 20% of previous measurement

b) impedance : within 5 Ω from previous measurement

| Dipole Antenna | Head/Body | Date of Measurement | Return Loss (dB) | Δ% | Impedance (Ω) | ΔΩ |
|-------------------|-----------|------------------------|------------------|-------|---------------|-------|
| D1750V2-SN : 1180 | Head | 2022.09.21 | -39.242 | -1.08 | 50.907 | 1.908 |
| D1750V2-SN . 1180 | пеай | 2023.09.14 | -39.667 | -1.08 | 48.999 | 1.908 |

c) 1g SAR : within 10% of that reported in the calibration data

| Dipole Antenna | Head/Body | Date of Measurement | 1g SAR (W/kg) | Δ% |
|--------------------|-----------|------------------------|---------------|------|
| D17E0V/2 CN - 1190 | Llood | 2022.09.21 | 3.56 | 0.04 |
| D1750V2-SN : 1180 | Head | 2023.09.20 | 3.53 | 0.84 |





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- S Swiss Calibration Service

Accreditation No.: SCS 0108

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Client UL Korea (Dymstec)

CALIDDATION OF

Certificate No: D1900V2-5d190_Nov22

| CALIBRATION C | ENTITIOAT | L 但 | | |
|---|---|------------------------------------|-------------------------------|--------------------------------|
| Dbject | D1900V2 - SN:5 | d190 | 7 | 7 12 |
| alibration procedure(s) | QA CAL-05.v11 Calibration Proce | edure for SAR Validatio | n Sources | s between 0.7-3 GHz |
| alibration date: | November 16, 20 |)22 | | |
| his calibration certificate documer he measurements and the uncerta Il calibrations have been conducte alibration Equipment used (M&TE | ainties with confidence p ed in the closed laborator | robability are given on the follov | ving pages an | d are part of the certificate. |
| imary Standards | D # | Cal Date (Certificate No.) | | Scheduled Calibration |
| ower meter NRP | SN: 104778 | 04-Apr-22 (No. 217-03525/03 | 3524) | Apr-23 |
| ower sensor NRP-Z91 | SN: 103244 | 04-Apr-22 (No. 217-03524) | <i>J</i> JJJJJJJJJJJJJ | Apr-23 |
| wer sensor NRP-Z91 | SN: 103245 | 04-Apr-22 (No. 217-03525) | | Apr-23 |
| ference 20 dB Attenuator | SN: BH9394 (20k) | 04-Apr-22 (No. 217-03527) | | Apr-23 |
| pe-N mismatch combination | SN: 310982 / 06327 | 04-Apr-22 (No. 217-03528) | | Apr-23 |
| eference Probe EX3DV4 | SN: 7349 | 31-Dec-21 (No. EX3-7349_D | ec21) | Dec-22 |
| AE4 | SN: 601 | 31-Aug-22 (No. DAE4-601_A | | Aug-23 |
| econdary Standards | ID # | Check Date (in house) | | Scheduled Check |
| ower meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check O | ct-22) | In house check: Oct-24 |
| ower sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check O | 5 C | In house check: Oct-24 |
| wer sensor HP 8481A | SN: MY41093315 | 07-Oct-15 (in house check Or | | In house check: Oct-24 |
| generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check O | | In house check: Oct-24 |
| twork Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check O | | In house check: Oct-24 |
| | Name | Function | | Signature |
| librated by: | Jeton Kastrati | Laboratory Techr | iician 🥿 | tle |
| proved by: | Sven Kühn | Technical Manag | er | 54 |
| | e reproduced except in t | | | Issued: November 18, 2022 |



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S Swiss Calibration Service

Accreditation No.: SCS 0108

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Glossary:

| RM x,y,z |
|----------|
| neasured |
| 1 |

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. 0
- 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 | DASY52 | V52.10.4 | |
|------------------------------|------------------------|--|--|
| Extrapolation | Advanced Extrapolation | ······································ | |
| Phantom | Modular Flat Phantom | <u> </u> | |
| Distance Dipole Center - TSL | 10 mm | with Spacer | |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | | |
| Frequency | 1900 MHz ± 1 MHz | <u> </u> | |

Head TSL parameters

The following parameters and calculations 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) °C | 39.2 ± 6 % | 1.38 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm ^{3} (1 g) of Head TSL | Condition | |
|---|---------------------------------|--------------------------|
| SAR measured | 250 mW input power | 9.88 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 39.7 W/kg ± 17.0 % (k=2) |
| | | |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
| SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured | condition 250 mW input power | 5.16 W/kg |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 53.8 Ω + 6.7 jΩ |
|--------------------------------------|-----------------|
| Return Loss | - 22.6 dB |

General Antenna Parameters and Design

| Electrical Delevision and the star | |
|------------------------------------|----------|
| Electrical Delay (one direction) | 1 207 |
| , (the unceach) | 1.207 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 | SPEAC |
|-----------------|-------|
| | SILAG |

DASY5 Validation Report for Head TSL

Date: 16.11.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d190

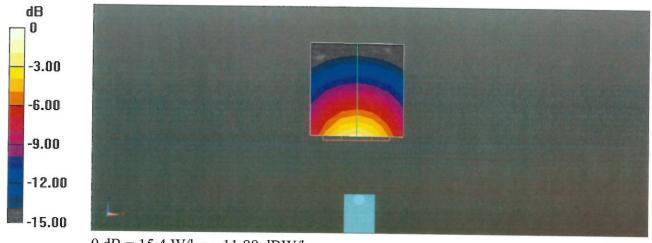
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ϵ_r = 39.2; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 31.08.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

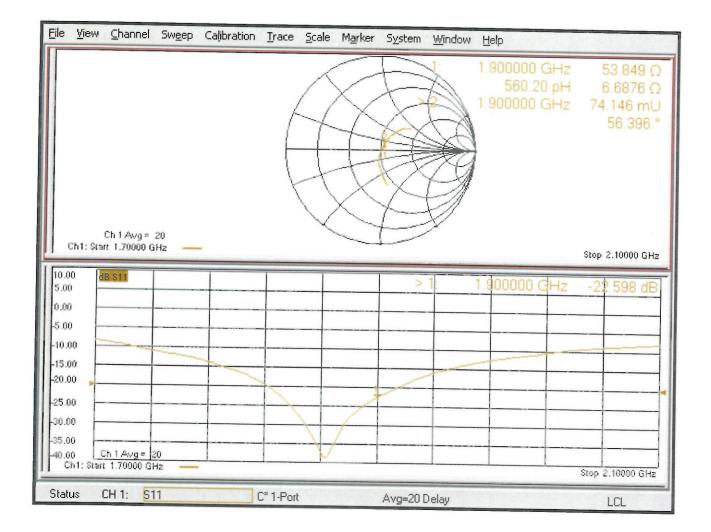
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm 2/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 110.1 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 18.3 W/kg SAR(1 g) = 9.88 W/kg; SAR(10 g) = 5.16 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.6% Maximum value of SAR (measured) = 15.4 W/kg



0 dB = 15.4 W/kg = 11.88 dBW/kg

Impedance Measurement Plot for Head TSL



Justification for Extended SAR Dipole Calibrations

Instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements

KDB 865664 D01v01r04 requirements

`

a) return loss : < - 20 dB, within 20% of previous measurement

b) impedance : within 5 Ω from previous measurement

| Dipole Antenna | Head/Body | Date of Measurement | Return Loss (dB) | Δ% | Impedance (Ω) | ΔΩ |
|--------------------|-----------|------------------------|------------------|------|---------------|--------|
| | Hood | 2022.11.16 | -22.598 | 0.89 | 53.849 | -0.974 |
| D1900V2-SN : 5d190 | Head | 2023.11.09 | -22.395 | | 54.823 | -0.974 |

c) extrapolated peak SAR : within 10% of that reported in the calibration data

| Dipole Antenna | Head/Body | Date of Measurement | extrapolated peak SAR (W/kg) | Δ% |
|--------------------|-----------|------------------------|---------------------------------|-------|
| | | 2022.11.16 | 18.3 | F 4C |
| D1900V2-SN : 5d190 | Head | 2023.11.13 | 19.3 | -5.46 |

