## China Certification ICT Co., Ltd (Dongguan)

## Report No.: 2403Y36748E-20

# **APPENDIX C CALIBRATION CERTIFICATES**

Schweizerischer Kalibrierdienst S Calibration Laboratory of Service suisse d'étalonnage С Schmid & Partner Servizio svizzero di taratura ac-MR/ **Engineering AG** S Swiss Calibration Service Zeughausstrasse 43, 8004 Zurich, Switzerland 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 Certificate No. EX-7329\_Mar24 BACL Client Shenzhen CALIBRATION CERTIFICATE EX3DV4 - SN:7329 Object 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 March 27, 2024 Calibration date This calibration certificate documents the traceability to nationa 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) Cal Date (Certificate No.) Scheduled Calibration Primary Standards ID SN: 104778 30-Mar-23 (No. 217-03804/03805) Mar-24 Power meter NRP2 34-Mar-23 (No. 217-03804) Mar-24 Power sensor NRP-Z91 SN: 103244 OCP DAK-3.5 (weighted) 0i-Oct-23 (OCP-DAK3.5-1249\_Oct23) SN: 1249 Oct-24 OCP DAK-12 SN: 1016 05-Oct-23 (OCP-DAK12-1016\_Oct23) Oct-24 Reference 20 dB Attenuator SN: CC2552 (20x) 34-Mar-23 (No. 217-03809) Mar-24 21-Feb-24 (No. DAE4-660\_Feb24) Feb-25 DAE4 SN: 660 01-Nov-23 (No. EX3-7349\_Nov23) Nov-24 Reference Probe EX3DV4 SN: 7349 Scheduled Check Cteck Date (in house) Secondary Standards ID In house check: Jun-24 SN: GB41293874 06-Apr-16 (in house check Jun-22) Power meter E4419B Power sensor E4412A SN: MY41498087 06-Apr-16 (in house check Jun-22) In house check: Jun-24 Power sensor E4412A SN: 000110210 06-Apr-16 (in house check Jun-22) In house check: Jun-24 SN: US3642U01700 RF generator HP 8648C 04-Aug-99 (in house check Jun-22) In house check: Jun-24 In house check: Oct-24 Network Analyzer E8358A 3 -Mar-14 (in house check Oct-22) SN: US41080477 Name Function Signature Laboratory Technician Joanna Lleshai Calibrated by Sven Kůhn Technical Manager Approved by Issued: March 27, 2024 This calibration certificate shall not be reproduced except in full, without written approval of the laboratory.

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



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- S Schweizerischer Kalibrierdienst C 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                    | diade 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 8         | $\vartheta$ 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 ≤ 900MHz in TEM-cell; f > 1800MHz: 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 *t* ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for *t* > 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 DASY4 version 4.4 and higher which allows extending the validity from ±50 MHz to ±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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EX3DV4 - SN:7329

March 27, 2024

## Parameters of Probe: EX3DV4 - SN:7329

## **Basic Calibration Parameters**

|                    | Sensor X | Sensor Y | Sensor Z | Unc (k = 2) |
|--------------------|----------|----------|----------|-------------|
| Norm (µV/(V/m)2) A | 0.51     | 0.41     | 0.62     | ±10.1%      |
| DCP (mV) B         | 99.8     | 102.9    | 106.5    | ±4.7%       |

## **Calibration Results for Modulation Response**

| UID | Communication System Name |   | A<br>dB | B<br>dBõV | с    | D<br>dB | VR<br>mV | Max<br>dev. | Max<br>Unc <sup>E</sup><br>k = 2 |
|-----|---------------------------|---|---------|-----------|------|---------|----------|-------------|----------------------------------|
| 0   | CW                        | X | 0.00    | 0.00      | 1.00 | 0.00    | 141.4    | ±1.4%       | ±4.7%                            |
|     |                           | Y | 0.00    | 0.00      | 1.00 |         | 139.4    |             |                                  |
|     |                           | Z | 0.00    | 0.00      | 1.00 |         | 136.0    |             |                                  |

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%.

A The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-lield uncertainty inside TSL (see Page 5). <sup>B</sup> Linearization parameter uncertainty for maximum specified field 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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EX3DV4 - SN:7329

March 27, 2024

## Parameters of Probe: EX3DV4 - SN:7329

## **Other Probe Parameters**

| Sensor Arrangement                            | Triangular |
|---|------------|
| Connector Angle                               | -29.0°     |
| 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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EX3DV4 - SN:7329

March 27, 2024

## Parameters of Probe: EX3DV4 - SN:7329

#### Calibration Parameter Determined in Head Tissue Simulating Media

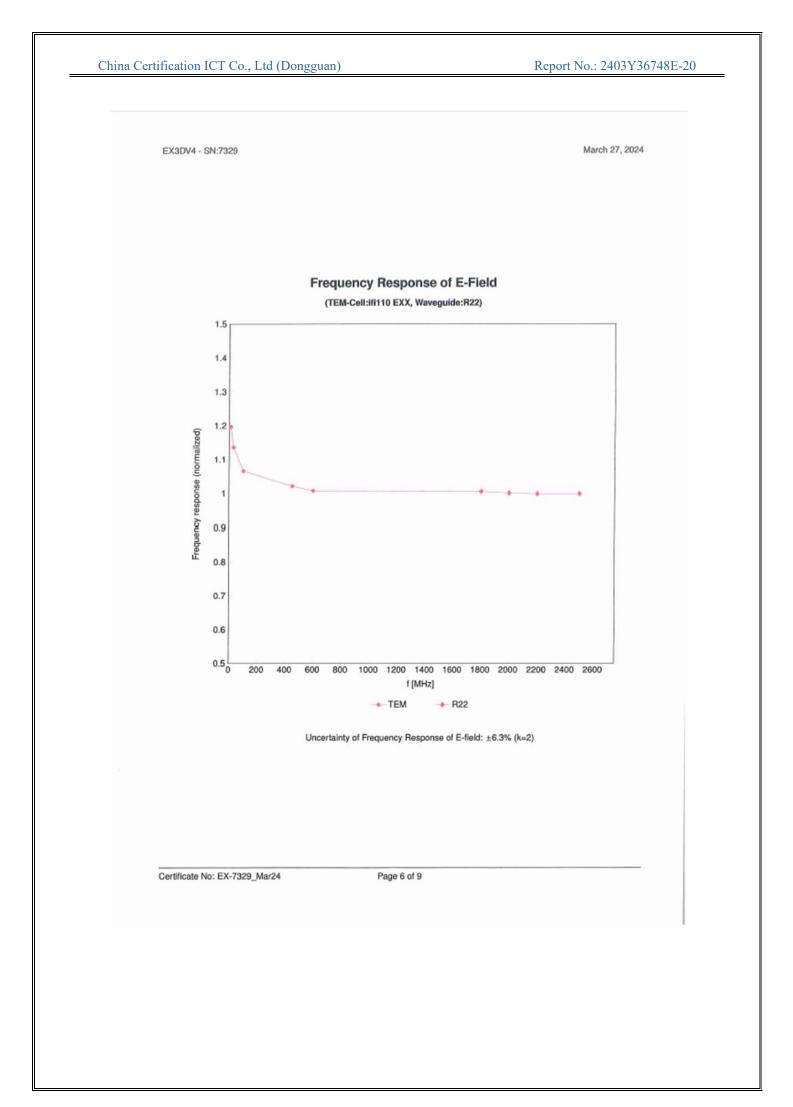
| f (MHz) <sup>C</sup> | Relative<br>Permittivity <sup>F</sup> | Conductivity <sup>F</sup><br>(S/m) | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup><br>(mm) | Unc<br>(k = 2) |
|----------------------|---------------------------------------|------------------------------------|---------|---------|---------|--------------------|----------------------------|----------------|
| 750                  | 41.9                                  | 0.89                               | 8.79    | 10.07   | 9.05    | 0.38               | 1.27                       | ±11.0%         |
| 900                  | 41.5                                  | 0.97                               | 8.42    | 9.50    | 8.93    | 0.37               | 1.27                       | ±11.0%         |
| 1750                 | 40.1                                  | 1.37                               | 7.56    | 8.56    | 7.71    | 0.27               | 1.27                       | ±11.0%         |
| 1900                 | 40.0                                  | 1.40                               | 7.37    | 8.32    | 7.54    | 0.29               | 1.27                       | ±11.0%         |
| 2300                 | 39.5                                  | 1.67                               | 7.21    | 8.13    | 7.41    | 0.30               | 1.27                       | ±11.0%         |
| 2450                 | 39.2                                  | 1.80                               | 7.05    | 7.92    | 7.22    | 0.29               | 1.27                       | ±11.0%         |
| 2600                 | 39.0                                  | 1.96                               | 6.91    | 7.77    | 7.08    | 0.29               | 1.27                       | ±11.0%         |
| 5250                 | 35.9                                  | 4.71                               | 4.96    | 5.61    | 5.16    | 0.38               | 1.53                       | ±13.1%         |
| 5600                 | 35.5                                  | 5.07                               | 4.38    | 4.98    | 4.56    | 0.35               | 1.74                       | ±13.1%         |
| 5750                 | 35.4                                  | 5.22                               | 4.54    | 5.16    | 4.70    | 0.35               | 1.83                       | ±13.1%         |

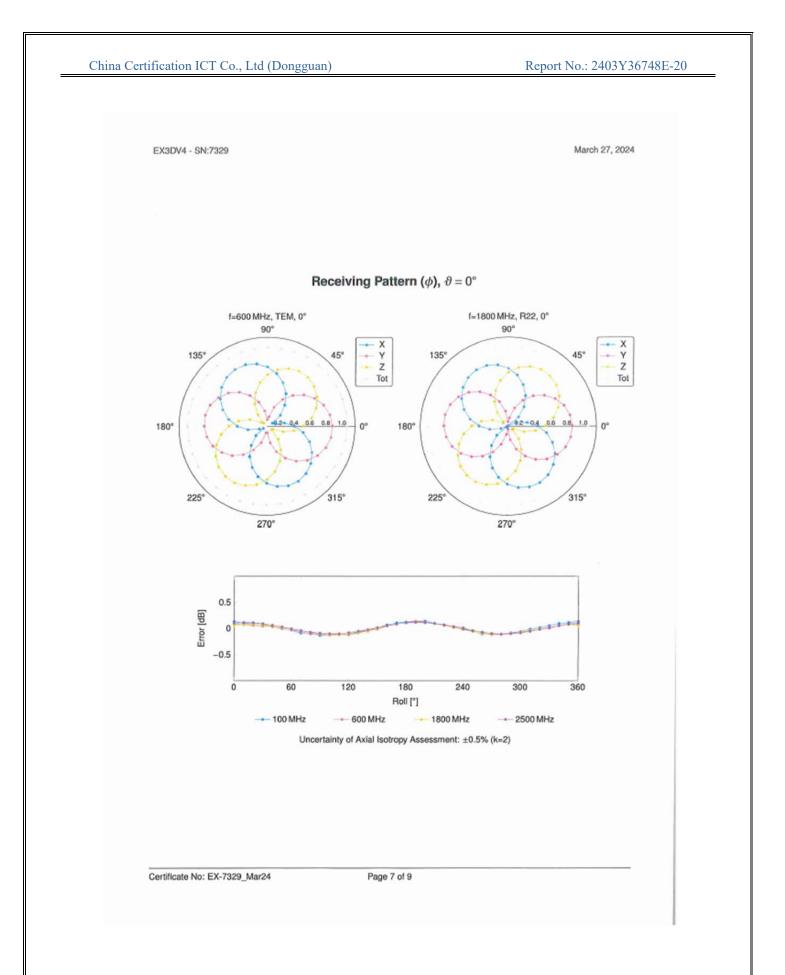
<sup>C</sup> Frequency validity above 300 MHz of ±100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ±50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 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 ±110 MHz. <sup>F</sup> The probes are calibrated using tissue simulating liquids (TSL) that deviate for *e* and *o* by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10% it SAR correction is applied.

than ±1% for frequencies below 3 GHz and below ±2% for frequencies between 3–6 GHz at any distance larger than half the probe tip diameter from the boundary.

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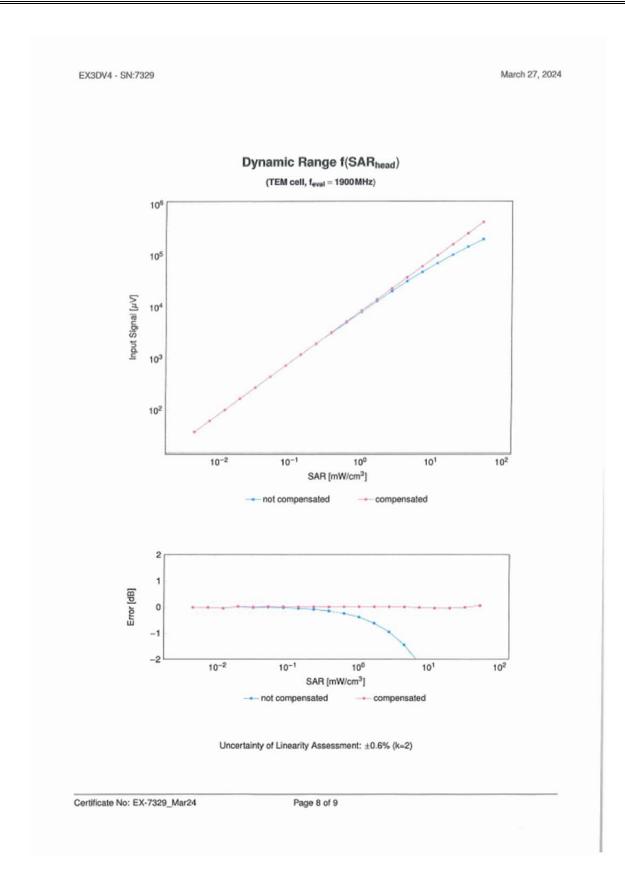
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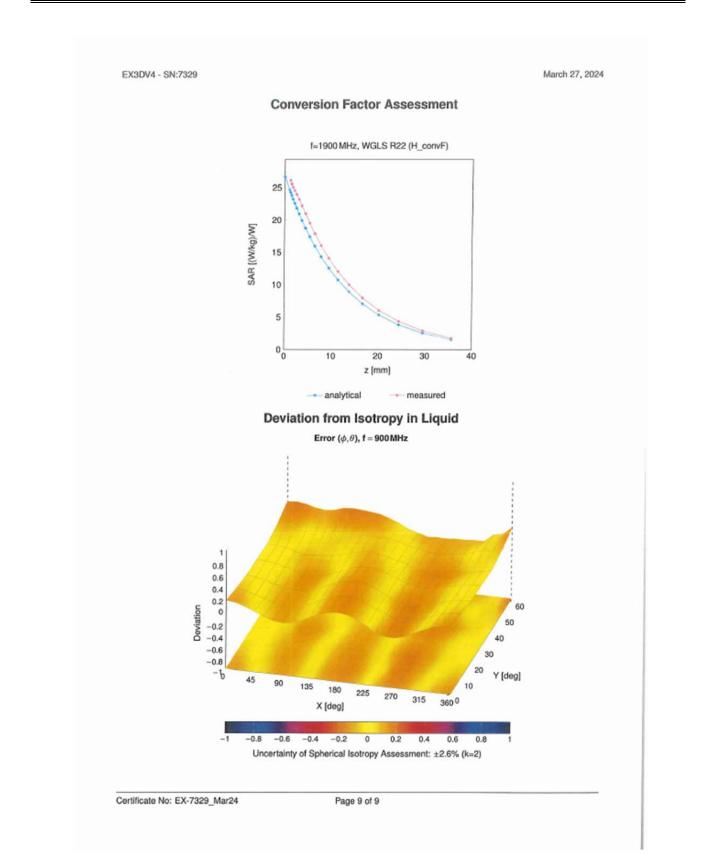
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## China Certification ICT Co., Ltd (Dongguan)

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# **DIPOLE CALIBRATION CERTIFICATES**

| Calibration Laboratory<br>Schmid & Partner<br>Engineering AG<br>Reughausstrasse 43, 8004 Zurich  |  |  | Service suisse d'étalonnage<br>Servizio svizzero di taratura<br>Swiss Calibration Service   |
|--|--|--|---|
| Accredited by the Swiss Accreditat<br>The Swiss Accreditation Service<br>Multilateral Agreement for the re   | is one of the signatorio   |  | Accreditation No.: SCS 0108   |
| Client BACL USA  |  | Certificate No   | D900V2-1d217_Mar23  |
| Sunnyvale, USA   |  |  | DOOVE THEFT_MANDO   |
| CALIBRATION C  | ERTIFICAT  | E  |   |
| Object   | D900V2 - SN:1d   | 217  |   |
| Calibration procedure(s)   | QA CAL-05.v12<br>Calibration Proce   | edure for SAR Validation Source  | s between 0.7-3 GHz   |
|  |  |  |   |
| Calibration date:  | March 24, 2023   |  |   |
| The measurements and the uncert  | nts the traceability to nati<br>ainties with confidence p  | onal standards, which realize the physical un<br>robability are given on the following pages ar<br>y facility: environment temperature $(22 \pm 3)^n$  | nd are part of the certificate.   |
| The measurements and the uncert<br>All calibrations have been conduct  | nts the traceability to nati<br>ainties with confidence p<br>ed in the closed laborator  | robability are given on the following pages ar   | nd are part of the certificate.   |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards   | nts the traceability to nati<br>ainties with confidence p<br>ed in the closed laborator<br>E critical for calibration)   | robability are given on the following pages ar<br>ry facility: environment temperature (22 ± 3) <sup>n</sup><br><u>Cal Date (Certificate No.)</u>  | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration   |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TF<br>Primary Standards<br>Power meter NRP  | Its the traceability to nati<br>ainties with confidence p<br>ed in the closed laborator<br>critical for calibration)<br>ID #<br>SN: 104778   | robability are given on the following pages ar<br>ry facility: environment temperature (22 ± 3) <sup>n</sup><br><u>Cal Date (Certificate No.)</u><br>04-Apr-22 (No. 217-03525/03524)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23   |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91  | nts the traceability to nati<br>ainties with confidence p<br>ed in the closed laborator<br>E critical for calibration)   | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03525/)  | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration   |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards   | Ints the traceability to nati<br>ainties with confidence p<br>ed in the closed laborator<br>critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244  | robability are given on the following pages ar<br>ry facility: environment temperature (22 ± 3) <sup>n</sup><br><u>Cal Date (Certificate No.)</u><br>04-Apr-22 (No. 217-03525/03524)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23   |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards<br>Power sensor NRP-291<br>Power sensor NRP-291<br>Reference 20 dB Attenuator<br>Type-N mismatch combination  | ID #<br>SN: 104278<br>SN: 104278<br>SN: 104244<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245   | robability are given on the following pages ar<br>y facility: environment temperature (22 ± 3)*1<br>Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)  | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23   |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards<br>Power sensor NRP-291<br>Power sensor NRP-291<br>Power sensor NRP-291<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4  | ID #<br>SN: 104778<br>SN: 104778<br>SN: 104778<br>SN: 104244<br>SN: 103244<br>SN: 103245<br>SN: 819394 (20k)<br>SN: 310982 / 06327<br>SN: 7349   | robability are given on the following pages ar<br>y facility: environment temperature (22 ± 3)*1<br>Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>10-Jan-23 (No. EX3-7349_Jan23)  | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24   |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards<br>Power sensor NRP-291<br>Power sensor NRP-291<br>Power sensor NRP-291<br>Reference 20 dB Attenuator<br>Type-N mismatch combination  | ID #<br>SN: 104278<br>SN: 104278<br>SN: 104244<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 103245   | robability are given on the following pages ar<br>y facility: environment temperature (22 ± 3)*1<br>Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)  | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23   |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-291<br>Power sensor NRP-291<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards  | Its the traceability to nati<br>ainties with confidence p<br>ed in the closed laborator<br>critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 10325<br>SN: 10325<br>SN: 10325<br>SN: 10325<br>SN: 10355<br>SN: 103555<br>SN: 103555<br>SN: 1035555<br>SN: 1035555<br>SN: 103555555<br>SN: 103555555555555555555555555555555555555 | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           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)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23<br>Scheduled Check  |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B  | Its the traceability to nati<br>ainties with confidence p<br>ed in the closed laborator<br>critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 601<br>ID #<br>SN: GB39512475  | 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. 217-03527)           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)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23<br>Scheduled Check<br>In house check: Oct-24  |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TT<br>Primary Standards<br>Power sensor NRP-291<br>Power sensor NRP-291<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A  | ID #<br>SN: 104778<br>SN: 104778<br>SN: 104778<br>SN: 103245<br>SN: 103245<br>SN: 310982 / 06327<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           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. 217-03527)           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)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23<br>Scheduled Check<br>In house check: Oct-24<br>In house check: Oct-24  |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power sensor HP 8481A<br>Power sensor HP 8481A   | ID #<br>SN: 104778<br>SN: 104778<br>SN: 104778<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 819394 (20k)<br>SN: 310982 / 06327<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           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. 217-03528)           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)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23<br>Scheduled Check<br>In house check: Oct-24  |
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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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        |
|-------|---------------------------------|
| 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: D900V2-1d217\_Mar23

## **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 | 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 | 40.5 ± 6 %   | 0.95 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              | 2.69 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 10.9 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<br>SAR measured | condition<br>250 mW input power | 1.72 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 | 50.3 Ω - 0.0 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 50.1 dB       |

## **General Antenna Parameters and Design**

| Electrical Delay (one direction) | 1.401 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 900 MHz; Type: D900V2; Serial: D900V2 - SN:1d217

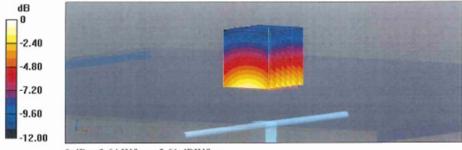
Communication System: UID 0 - CW; Frequency: 900 MHz Medium parameters used: f = 900 MHz;  $\sigma$  = 0.95 S/m;  $\epsilon_r$  = 40.5;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(9.62, 9.62, 9.62) @ 900 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=5mm Reference Value = 64.47 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 4.11 W/kg SAR(1 g) = 2.69 W/kg; SAR(10 g) = 1.72 W/kg Smallest distance from peaks to all points 3 dB below = 17.5 mm Ratio of SAR at M2 to SAR at M1 = 65.2% Maximum value of SAR (measured) = 3.64 W/kg

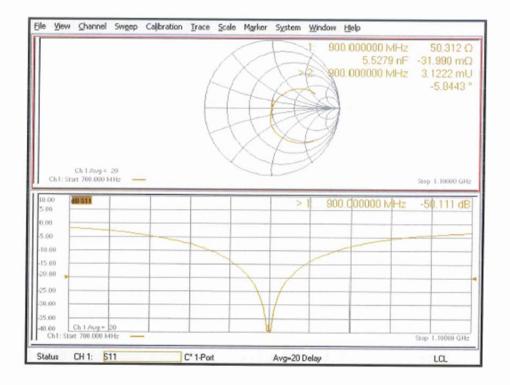


0 dB = 3.64 W/kg = 5.61 dBW/kg

Certificate No: D900V2-1d217\_Mar23

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Impedance Measurement Plot for Head TSL



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# D900V2 - SN:1d217 Extended Dipole Calibrations

Per FCC KDB 865664 D01, calibration intervals of up to 3 years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements.

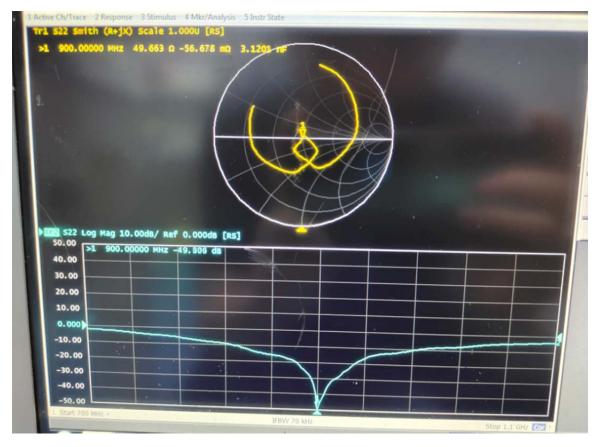
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.

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

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

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from calibration date.

| D900V2 - SN:1d217  |             |       |        |        |           |        |
|--|-------------|-------|--------|--------|-----------|--------|
| 900MHz Head  |             |       |        |        |           |        |
| Date of  | Return Loss | Delta | Real   | Delta  | Imaginary | Delta  |
| Measurement     (dB)     (%)     Impedence(Ω)     (Ω)     Impedence(Ω)     (Ω) |             |       |        |        |           | (Ω)    |
| 2023/3/24 -50.111 / 50.312 / -0.032  |             |       |        |        | /         |        |
| 2024/3/23  | -49.309     | 1.6   | 49.663 | -0.649 | -0.057    | -0.025 |



|                | Name      | Signature |
|----------------|-----------|-----------|
| Calibrated By: | Karl Gong | Karl Gong |

| Calibration Laboratory of<br>Schmid & Partner<br>Engineering AG       Image: Construction of the signatories to the Calibration Service (CAS)       Image: Construction of the signatories to the CA<br>Statistical Agreement for the recognition of calibration certificates       Image: Construction Service (CAS)       Image: Construction Service (CAS)         Construction of the signatories to the CAS<br>Mutilized Agreement for the recognition of calibration certificates       Image: Construction Service (CAS)       Image: Construction Service (CAS)         Construction Service is one of the signatories to the CA<br>Mutilized Calibration Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)         Construction Service is one of the signatories to the CA<br>Mutilized Calibration Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)         Construction Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)         Construction Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)         Construction Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)         Construction Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)       Image: Construction Service (CAS)         Construction Service (CAS)       Image: Construction Service (CAS) <th></th> <th></th> <th></th> <th></th>  |  |   |  |  |
|---|--|---|--|--|
| Engineering AG<br>Zeuglabusstrass 43,004 Zurich, Switzertand       Image: Support   |  | y of  | AND  | ,  |
| Accreditation for the function of the signatories to the EA<br>Multilateral Agreement for the recognition of calibration certificates<br>Client BACL<br>Sumpyrate USA<br>CALIBRATION CERTIFICATE<br>Object D1750V2-1200_Mar23<br>Calibration procedure(s) OA CAL-05.v12<br>Calibration Procedure for SAR Validation Sources between 0.7-3 GHz<br>Calibration procedure(s) OA CAL-05.v12<br>Calibration Procedure for SAR Validation Sources between 0.7-3 GHz<br>Calibration ate: March 27, 2023<br>This calibration shave been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.<br>Calibration shave been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.<br>Calibration Rev meter SN: 10072<br>Primary Slandards D8 (MATE critical for calibration)<br>Primary Slandards ID 8 Cal Date (Certificate No.) Scheduled Calibration<br>Prover sensor NRP-201 SN: 100726 (00627) 04-922 (No. 217.03525(0) 3524) Apr-23<br>Reference 20 dB Alternutar<br>SN: 310824 04-Apr-22 (No. 217.03525(1) Apr-23<br>Reference Probe EXBV4 SN: 104778 04-Apr-22 (No. 217.03525(1) Apr-23<br>Reference Probe EXBV4 SN: 104777 30-04-717 30-02-117.03527(1) Apr-23<br>Reference Probe EXBV4 SN: 104777 30-04-717 30-02-117.03527(1) Apr-23<br>Reference Probe EXBV4 SN: 104777 31-04-04-04-22 (No. 217.03527(1) Apr-23<br>Reference Probe EXBV4 SN: 104777 31-04-04-04-22 (No. 217.03527(1) Apr-23<br>Reference Probe EXBV4 SN: 104777 31-04-04-04-02-12.00-02-23<br>Reference Probe EXBV4 SN: 104777 31-04-04-04-02-02 DR-23<br>Reference Probe EXBV4 SN: 10572278 30-02-04-14 (In house |  |   | and the second sec | Servizio svizzero di taratura  |
| This calibration service is one of the signatories to the EA         Mutiliateral Agreement for the recognition of calibration certificates         Client       BACL         Summyvale USA         Object       D1750V2-1200_Mar23         Object       D1750V2 - SN:1200         Calibration procedure(s)       QA CAL-05, v12         Calibration procedure(s)       QA CAL-05, v12         Calibration Procedure for SAR Validation Sources between 0.7-3 GHz         Calibration ate:       March 27, 2023         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.         Al calibration shave been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.  | Zeughausstrasse 43, 8004 Zuric   | h, Switzerland  |  | Swiss Calibration Service  |
| Summyvale USA           CALIBRATION CERTIFICATE           Object         D1750V2 - SN:1200           Calibration procedure(s)         QA CAL-05,v12<br>Calibration Procedure for SAR Validation Sources between 0,7-3 GHz           Calibration date:         March 27, 2023           This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).<br>The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.           All calibration fave been conducted in the closed laboratory facility: environment temperature (22 ± 3)*C and humidity < 70%.  | The Swiss Accreditation Servic   | e is one of the signator  |  | Accreditation No.: SCS 0108  |
| Object         D1750V2 - SN:1200           Calibration procedure(s)         QA CAL-05.v12<br>Calibration Procedure for SAR Validation Sources between 0.7-3 GHz           Calibration procedure(s)         QA CAL-05.v12<br>Calibration Procedure for SAR Validation Sources between 0.7-3 GHz           Calibration date:         March 27, 2023           This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).<br>The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.           All calibration shave been conducted in the closed laboratory facility: environment temperature (22 ± 3)*C and humidity < 70%.  |  |   | Certificate No   | D1750V2-1200_Mar23   |
| Calibration procedure(s)       QA CAL-05, v12<br>Calibration Procedure for SAR Validation Sources between 0.7-3 GHz         Calibration date:       March 27, 2023         This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).<br>The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.         All calibration shave been conducted in the closed laboratory facility: environment temperature (22 ± 3)*C and humidity < 70%.   | CALIBRATION C  | CERTIFICAT  | E  |  |
| Calibration Procedure for SAR Validation Sources between 0,7-3 GHz           Calibration date:         March 27, 2023           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%.   | Object   | D1750V2 - SN:1  | 200  | New York and the second  |
| Calibration date:       March 27, 2023         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 procedure(s)   | QA CAL-05.v12   |  |  |
| 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 Proc  | edure for SAR Validation Source  | s between 0.7-3 GHz  |
| 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 date:  | March 27, 2022  |  | A CONTRACTOR OF A CONTRACTOR OF  |
| 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           Secondary Standards         ID #         Check Date (in house)         Scheduled Check           Power sensor HP 8481A         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: 10972         15-Jun-15 (in house check Oct-22)         In house check: Oct-24           RF generator R&S SMT-06         SN: US41080477         31-Mar-14 (in house check Oct-22)         In house check: Oct-24           Name         Function         Signature   | This calibration certificate docume<br>The measurements and the uncer  | nts the traceability to nat<br>tainties with confidence p   | robability are given on the following pages ar   | nd are part of the certificate.  |
| 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           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: 10972         15-Jun-15 (in house check Oct-22)         In house check: Oct-24           RF generator R&S SMT-06         SN: US41080477         31-Mar-14 (in house check Oct-22)         In house check: Oct-24           Name         Function         Signature  | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct  | nts the traceability to nat<br>tainties with confidence p<br>ed in the closed laborato  | robability are given on the following pages ar   | nd are part of the certificate.  |
| Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4SN: 10324504-Apr-22 (No. 217-03525)<br>O4-Apr-22 (No. 217-03527)Apr-23<br>Apr-23<br>Apr-23Secondary StandardsID #Check Date (in house)Dec-23Secondary StandardsID #Check Date (in house)Scheduled CheckPower sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06SN: GB39512475<br>SN: 1097230-Oct-14 (in house check Oct-22)In house check: Oct-24<br>In house check: Oct-24RF generator R&S SMT-06<br>Network Analyzer Agilent E8358ASN: US4108047731-Mar-14 (in house check Oct-22)In house check: Oct-24<br>In house check: Oct-24NameFunctionSignature<br>Laboratory TechnicianSignature<br>March  | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T   | nts the traceability to nat<br>tainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)   | robability are given on the following pages ar<br>ry facility: environment temperature $(22 \pm 3)^{\circ}$  | nd are part of the certificate.<br>C and humidity < 70%.   |
| Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 310982 / 06327<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 7349<br>SN: 60104-Apr-22 (No. 217-03528)<br>SN: CB39512475<br>SO-Ct-14 (in house)Apr-23<br>Apr-23<br>Scheduled CheckSecondary StandardsID #<br>Check Date (in house)Scheduled CheckPower meter E4419B<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358AID #<br>SN: US41080477Check Date (in house check Oct-22)<br>In house check Oct-22)In house check: Oct-24<br>In house check: Oct-24<br>In house check: Oct-24<br>In house check: Oct-24Calibrated by:NameFunction<br>Paulo PinaSignature<br>Laboratory Technician   | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards  | nts the traceability to nat<br>tainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)   | robability are given on the following pages ar<br>ry facility: environment temperature (22 ± 3)°(<br>Cal Date (Certificate No.)  | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration  |
| Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4SN: 310982 / 06327<br>SN: 7349<br>SN: 7349<br>SN: 60104-Apr-22 (No. 217-03528)<br>SN: CB3-7349_Jan23)<br>Apr-23<br>Jan-24<br>DaE-22 (No. DAE4-601_Dec22)Apr-23<br>Jan-24<br>Dec-23Secondary StandardsID #<br>Check Date (in house)<br>SN: GB39512475<br>Power meter E4419B<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358AID #<br>SN: US41080477<br>SN: US41080477<br>SN: US41080477<br>SN: US41080477Check Date (in house)<br>scheck Oct-22)Scheduled Check<br>In house check: Oct-24<br>In house check: Oct-24<br>SN: US41080477<br>SN: US41080477Calibrated by:NameFunction<br>Paulo PinaSignature<br>Laboratory TechnicianSignature<br>Mametchen<br>Calibrated by:  | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91   | Ints the traceability to natival tainties with confidence preventions with confidence prevention of the closed laborato of the closed laboration) ID # SN: 104778 SN: 103244  | Cal Date (Certificate No.)         04-Apr-22 (No. 217-03525/03524)         04-Apr-22 (No. 217-03524)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23  |
| Reference Probe EX3DV4<br>DAE4SN: 7349<br>SN: 60110-Jan-23 (No. EX3-7349_Jan23)<br>19-Dec-22 (No. DAE4-601_Dec22)Jan-24<br>Dec-23Secondary StandardsID #Check Date (in house)Scheduled CheckPower meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358ASN: GB39512475<br>SN: US3729278330-Oct-14 (in house check Oct-22)<br>(in house check Oct-22)In house check: Oct-24<br>In house check: Oct-24RF generator R&S SMT-06<br>Network Analyzer Agilent E8358ASN: US3129277<br>SN: US4108047715-Jun-15 (in house check Oct-22)<br>SN: US41080477In house check: Oct-24<br>SN: US41080477Calibrated by:NameFunction<br>Laboratory TechnicianSignature<br>MameLaboratory Technician   | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91   | ID #<br>SN: 104778<br>SN: 103245  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| DAE4     SN: 601     19-Dec-22 (No. DAE4-601_Dec22)     Dec-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: WY41093315     07-Oct-15 (in house check Oct-22)     In house check: Oct-24       Power sensor HP 8481A     SN: 100972     15-Jun-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       Calibrated by:     Name     Function     Signature       Paulo Pina     Laboratory Technician     March  | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)   | ad are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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: WY41093315       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         Calibrated by:       Paulo Pina       Laboratory Technician       Mame   | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination  | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | robability are given on the following pages ar<br>ry facility: environment temperature (22 ± 3)°(<br>Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)   | ad are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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: 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         Function         Signature           Calibrated by:         Paulo Pina         Laboratory Technician         March Laboratory   | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4  | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 310982 / 06327<br>SN: 7349  | robability are given on the following pages ar<br>ry facility: environment temperature (22 ± 3)°(<br>Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>10-Jan-23 (No. EX3-7349_Jan23)   | ad are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-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       Function       Signature         Calibrated by:       Paulo Pina       Laboratory Technician   | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4  | nts the traceability to nati<br>tainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | robability are given on the following pages ar         ry facility: environment temperature (22 ± 3)°(         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. 217-03527)         04-Apr-22 (No. 217-03528)         10-Jan-23 (No. EX3-7349_Jan23)         19-Dec-22 (No. DAE4-601_Dec22)  | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23  |
| RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A       SN: 100972<br>SN: US41080477       15-Jun-15 (in house check Oct-22)<br>31-Mar-14 (in house check Oct-22)       In house check: Oct-24<br>In house check: Oct-24         Name       Function       Signature         Paulo Pina       Laboratory Technician       Function   | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards   | nts the traceability to nat<br>tainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH3934 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #  | robability are given on the following pages ar         ry facility: environment temperature (22 ± 3)°(         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. 217-03527)         04-Apr-22 (No. 217-03528)         10-Jan-23 (No. EX3-7349_Jan23)         19-Dec-22 (No. DAE4-601_Dec22)         Check Date (in house)  | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23<br>Scheduled Check   |
| Network Analyzer Agilent E8358A     SN: US41080477     31-Mar-14 (in house check Oct-22)     In house check: Oct-24       Name     Function     Signature       Calibrated by:     Paulo Pina     Laboratory Technician   | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B   | nts the traceability to nati<br>tainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH3934 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475   | 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. 217-03527)           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)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23<br>Scheduled Check<br>In house check: Oct-24   |
| Calibrated by: Paulo Pina Euboratory Technician Signature   | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A  | nts the traceability to nati<br>tainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 103245<br>SN: 10982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525/03524)           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)   | Ad are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23<br>Scheduled Check<br>In house check: Oct-24<br>In house check: Oct-24   |
| Calibrated by: Paulo Pina Laboratory Technician   | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-291<br>Power sensor NRP-291<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06                                    | nts the traceability to nati<br>tainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315                                   | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525/03524)           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)   | A pr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-23<br>Scheduled Check<br>In house check: Oct-24<br>In house check: Oct-24<br>In house check: Oct-24   |
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| Approved by: Sven Kühn Technical Manager SLA  | This calibration certificate docume<br>The measurements and the uncer<br>All calibrations have been conduct<br>Calibration Equipment used (M&T<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A | nts the traceability to nati<br>tainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 103245<br>SN: 103245<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315<br>SN: 100972<br>SN: US41080477<br>Name | 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. 217-03527)           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)           15-Jun-15 (in house check Oct-22)           31-Mar-14 (in house check Oct-22)   | Ad are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23<br>Scheduled Check<br>In house check: Oct-24<br>In house check: Oct-24 |
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

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

Accreditation No.: SCS 0108

## **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              | 8.85 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 35.8 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<br>SAR measured | condition<br>250 mW input power | 4.67 W/kg                |

Certificate No: D1750V2-1200\_Mar23

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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 + 3.1 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 27.0 dB       |  |

## **General Antenna Parameters and Design**

| Electrical Delay (one direction) | 1.209 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: 27.03.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1200

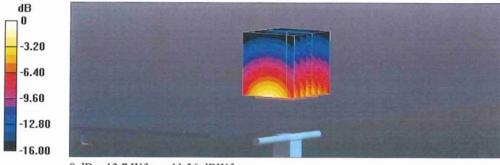
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz;  $\sigma$  = 1.33 S/m;  $\epsilon_r$  = 38.8;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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 = 104.6 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 16.3 W/kg SAR(1 g) = 8.85 W/kg; SAR(10 g) = 4.67 W/kg Smallest distance from peaks to all points 3 dB below = 10.4 mm Ratio of SAR at M2 to SAR at M1 = 54.4% Maximum value of SAR (measured) = 13.7 W/kg

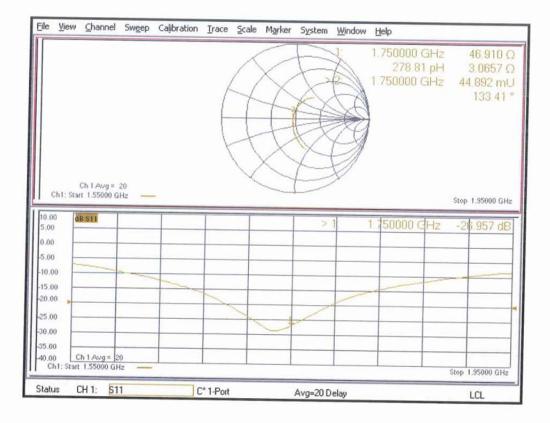


0 dB = 13.7 W/kg = 11.36 dBW/kg

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## Impedance Measurement Plot for Head TSL



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# D1750V2 - SN:1200 Extended Dipole Calibrations

Per FCC KDB 865664 D01, calibration intervals of up to 3 years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements.

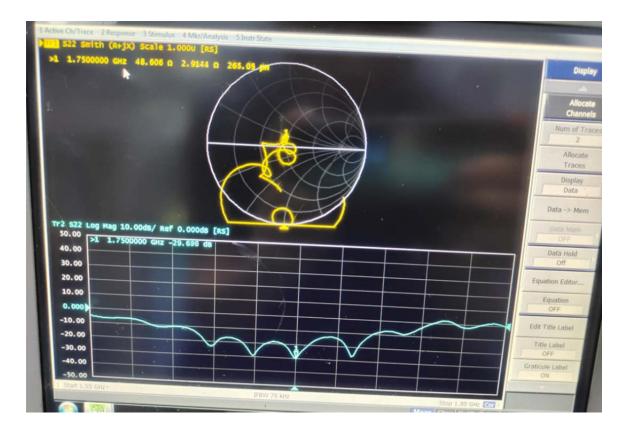
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.

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

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

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from calibration date.

| D1750V2 - SN:1200                                     |             |        |        |       |           |        |
|---|-------------|--------|--------|-------|-----------|--------|
| 1750MHz Head  |             |        |        |       |           |        |
| Date of   | Return Loss | Delta  | Real   | Delta | Imaginary | Delta  |
| Measurement (dB) (%) Impedence(Ω) (Ω) Impedence(Ω) (Ω |             |        |        |       |           | (Ω)    |
| 2023/3/27 -26.957 / 48.910 / 3.066                    |             |        |        |       | /         |        |
| 2024/3/26   | -29.696     | 10.161 | 48.606 | -3.04 | 2.914     | -0.152 |



|                | Name      | Signature |
|----------------|-----------|-----------|
| Calibrated By: | Karl Gong | Karl Gong |

| Calibration Laborator<br>Schmid & Partner<br>Engineering AG<br>Zeughausstrasse 43, 8004 Zuricl   |  |  | S Schweizerischer Kalibrierdienst<br>Service suisse d'étalonnage<br>Servizio svizzero di taratura<br>Swiss Calibration Service   |
|--|--|--|--|
| Accredited by the Swiss Accredita<br>The Swiss Accreditation Service<br>Multilateral Agreement for the re  | is one of the signator   | ies to the EA  | Accreditation No.: SCS 0108  |
| Client BACL<br>Sunnyvale, USA  |  | Certificate N  | o. D1900V2-5d251_Mar23   |
| CALIBRATION O  | ERTIFICAT  | E  |  |
| Object   | D1900V2 - SN:5   | id251  |  |
| Calibration procedure(s)   | QA CAL-05.v12<br>Calibration Proc  | edure for SAR Validation Source  | es between 0.7-3 GHz   |
|  |  |  |  |
|  |  | ional standards, which realize the physical u  |  |
| This calibration certificate docume<br>The measurements and the uncert   | nts the traceability to nat<br>ainties with confidence p<br>ed in the closed laborato  | ional standards, which realize the physical u robability are given on the following pages a ry facility: environment temperature (22 $\pm$ 3)  | and are part of the certificate.   |
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| This calibration certificate docume<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards   | nts the traceability to nat<br>ainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03524)           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)   | and are part of the certificate.<br>°C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23  |
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S C S

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        |
|-------|---------------------------------|
| 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: D1900V2-5d251\_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                    | 1900 MHz ± 1 MHz       |             |

## **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 | 39.0 ± 6 %   | 1.36 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              | 9.61 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 38.9 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<br>SAR measured | condition<br>250 mW input power | 5.04 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 | 49.5 Ω + 6.5 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 23.7 dB       |  |

## General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.191 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: 27.03.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d251

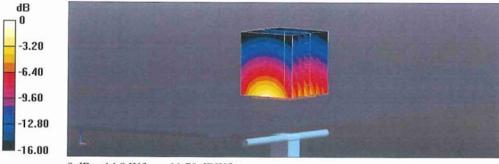
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz;  $\sigma = 1.36$  S/m;  $\varepsilon_r = 39$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.35, 8.35, 8.35) @ 1900 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 = 108.9 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 17.4 W/kg SAR(1 g) = 9.61 W/kg; SAR(10 g) = 5.04 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 55.4% Maximum value of SAR (measured) = 14.8 W/kg

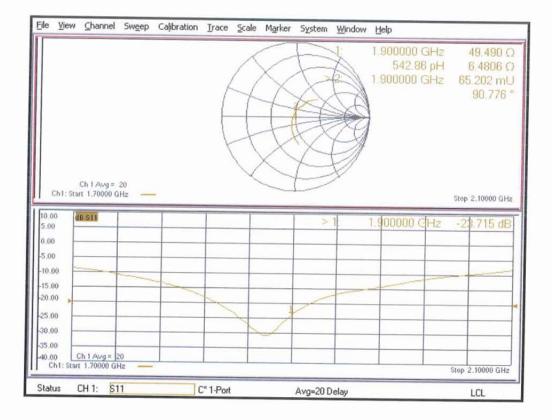


0 dB = 14.8 W/kg = 11.70 dBW/kg

Certificate No: D1900V2-5d251\_Mar23

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Impedance Measurement Plot for Head TSL



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# D1900V2 - SN:5d251 Extended Dipole Calibrations

Per FCC KDB 865664 D01, calibration intervals of up to 3 years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements.

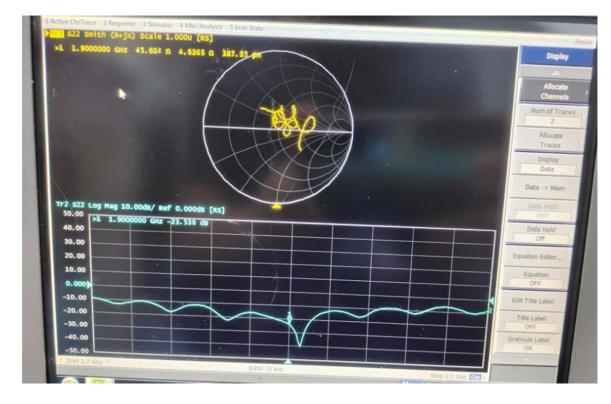
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.

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

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

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from calibration date.

|             |             |        | D1900V2 - SN:5d251 |        |              |        |
|-------------|-------------|--------|--------------------|--------|--------------|--------|
|             |             |        | 1900MHz Head       |        |              |        |
| Date of     | Return Loss | Delta  | Real               | Delta  | Imaginary    | Delta  |
| Measurement | (dB)        | (%)    | Impedence(Ω)       | (Ω)    | Impedence(Ω) | (Ω)    |
| 2023/3/27   | -23.715     | /      | 49.490             | /      | 6.481        | /      |
| 2024/3/26   | -23.536     | -0.755 | 45.694             | -3.796 | 4.627        | -1.854 |



|                | Name      | Signature |
|----------------|-----------|-----------|
| Calibrated By: | Karl Gong | Karl Gong |

| Calibration Laboratory<br>Schmid & Partner  | / of   | Anther and a second  | S Schweizerischer Kalibrierdienst  |
|---|--|--|--|
| Engineering AG<br>Zeughausstrasse 43, 8004 Zurich   | , Switzerland  |  | C Service suisse d'étalonnage<br>Servizio svizzero di taratura<br>S Swiss Calibration Service  |
| Accredited by the Swiss Accredital<br>The Swiss Accreditation Service<br>Multilateral Agreement for the re  | is one of the signatori  | es to the EA   | Accreditation No.: SCS 0108  |
| Client BACL   |  | Certificate N  | No. D2450V2-1102_Mar23   |
| Sunnyvale, USA  | EDTIFICAT  | _  |  |
| CALIBRATION C   | ERTIFICAT  | E  |  |
| Object  | D2450V2 - SN:1   | 102  |  |
| Calibration procedure(s)  | QA CAL-05.v12<br>Calibration Proce   | edure for SAR Validation Sourc   | es between 0.7-3 GHz   |
|   |  |  |  |
|   |  | onal standards, which realize the physical robability are given on the following pages   |  |
| This calibration certificate documer<br>The measurements and the uncert   | nts the traceability to nati<br>ainties with confidence p<br>ad in the closed laborato   |  | and are part of the certificate.   |
| This calibration certificate documen<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE   | nts the traceability to nati<br>ainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)  | robability are given on the following pages<br>ry facility: environment temperature ( $22 \pm 3$   | and are part of the certificate.   |
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| This calibration certificate documen<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards  | nts the traceability to nati<br>ainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)  | robability are given on the following pages<br>ry facility: environment temperature ( $22 \pm 3$   | and are part of the certificate.   |
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

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

Accreditation No.: SCS 0108

## **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                    | 2450 MHz ± 1 MHz       |             |

Head TSL parameters The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 39.2         | 1.80 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 38.0 ± 6 %   | 1.81 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              | 12.9 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 50.9 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<br>SAR measured | condition<br>250 mW input power | 6.07 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 | 53.9 Ω + 4.8 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 24.6 dB       |

## **General Antenna Parameters and Design**

| Electrical Delay (one direction) | 1.155 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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| China Certificat | ion ICT | Co., Ltd | (Dongguan) | ) |
|------------------|---------|----------|------------|---|
|------------------|---------|----------|------------|---|

## **DASY5 Validation Report for Head TSL**

Date: 27.03.2023

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:1102

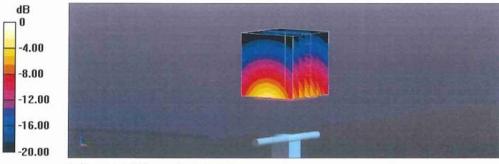
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz;  $\sigma$  = 1.81 S/m;  $\epsilon_r$  = 38;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.88, 7.88, 7.88) @ 2450 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=5mm Reference Value = 115.0 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 24.7 W/kg SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6.07 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 51.9% Maximum value of SAR (measured) = 20.7 W/kg

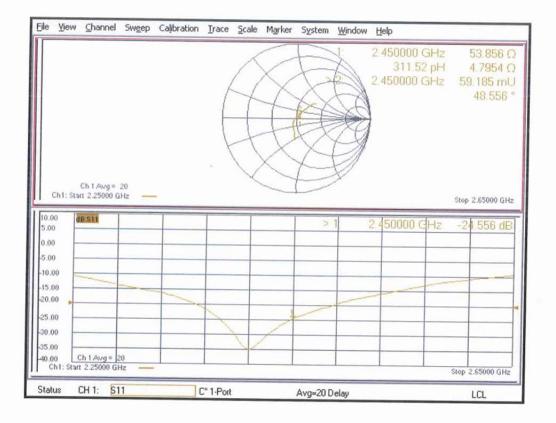


0 dB = 20.7 W/kg = 13.16 dBW/kg

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## Impedance Measurement Plot for Head TSL



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# D2450V2 - SN:1102 Extended Dipole Calibrations

Per FCC KDB 865664 D01, calibration intervals of up to 3 years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements.

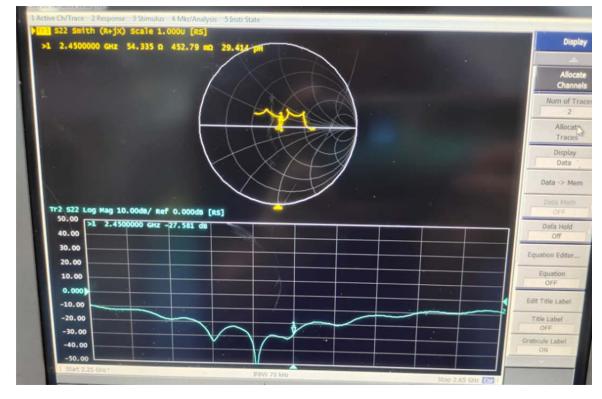
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.

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

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

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from calibration date.

|             |             |         | D2450V2 - SN:1102 |       |              |        |
|-------------|-------------|---------|-------------------|-------|--------------|--------|
|             |             |         | 2450MHz Head      |       |              |        |
| Date of     | Return Loss | Delta   | Real              | Delta | Imaginary    | Delta  |
| Measurement | (dB)        | (%)     | Impedence(Ω)      | (Ω)   | Impedence(Ω) | (Ω)    |
| 2023/3/27   | -24.556     | /       | 53.856            | /     | 4.795        | /      |
| 2024/3/26   | -27.581     | -27.581 | 54.335            | 0.479 | 0.453        | -4.342 |



|                | Name      | Signature |
|----------------|-----------|-----------|
| Calibrated By: | Karl Gong | Karl Gong |

| Calibration Laboratory  | y of  | antipularity and antereorga  | S Schweizerischer Kalibrierdienst  |
|---|---|--|--|
| Schmid & Partner<br>Engineering AG<br>Zeughausstrasse 43, 8004 Zurich   | Switzerland   |  | Service suisse d'étalonnage<br>Servizio svizzero di taratura   |
| Accredited by the Swiss Accredital  |   | Therein and the set  | Swiss Calibration Service<br>Accreditation No.: SCS 0108   |
| The Swiss Accreditation Service<br>Multilateral Agreement for the re  | is one of the signator  |  | Accelutation No.: 500 0100   |
| Client BACL<br>Sunnyvale, USA   |   | Certificate No   | D2600V2-1206_Mar23   |
| CALIBRATION C   | ERTIFICAT   | E  |  |
| Object  | D2600V2 - SN:1  | 206  |  |
| Calibration procedure(s)  | QA CAL-05.v12<br>Calibration Proc   | edure for SAR Validation Source  | s between 0.7-3 GHz  |
|   |   |  |  |
|   |   | ional standards, which realize the physical ur<br>probability are given on the following pages ar  |  |
| This calibration certificate document<br>The measurements and the uncert  | nts the traceability to nat<br>ainties with confidence p<br>ad in the closed laborato   | ional standards, which realize the physical ur probability are given on the following pages ar<br>ry facility: environment temperature $(22 \pm 3)^{\circ}$  | nd are part of the certificate.  |
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| This calibration certificate document<br>The measurements and the uncert<br>All calibrations have been conducted  | nts the traceability to nat<br>ainties with confidence p<br>ad in the closed laborato<br>E critical for calibration)  | probability are given on the following pages an  | nd are part of the certificate.  |
| This calibration certificate documen<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91   | nts the traceability to nat<br>ainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244  | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03524)  | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23  |
| This calibration certificate documen<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91   | nts the traceability to nat<br>ainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245  | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03525)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23  |
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| This calibration certificate documen<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91   | nts the traceability to nat<br>ainties with confidence p<br>ed in the closed laborato<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
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| This calibration certificate documen<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A   | nts the traceability to nat<br>ainties with confidence p<br>ad in the closed laborato<br>critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315   | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525/03524)           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)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Jan-24<br>Dec-23<br>Scheduled Check<br>In house check: Oct-24<br>In house check: Oct-24<br>In house check: Oct-24   |
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland Iac-MRA

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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        |
|-------|---------------------------------|
| 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: D2600V2-1206\_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              | 14.2 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 56.0 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<br>SAR measured | condition<br>250 mW input power | 6.36 W/kg                |

Certificate No: D2600V2-1206\_Mar23

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

### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 48.1 Ω + 1.3 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 32.7 dB       |  |

## General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.143 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: 27.03.2023

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1206

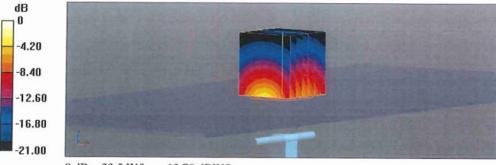
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz;  $\sigma$  = 1.97 S/m;  $\epsilon_r$  = 37.4;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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=5mm Reference Value = 118.2 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 27.7 W/kg **SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.36 W/kg** Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 51% Maximum value of SAR (measured) = 23.5 W/kg

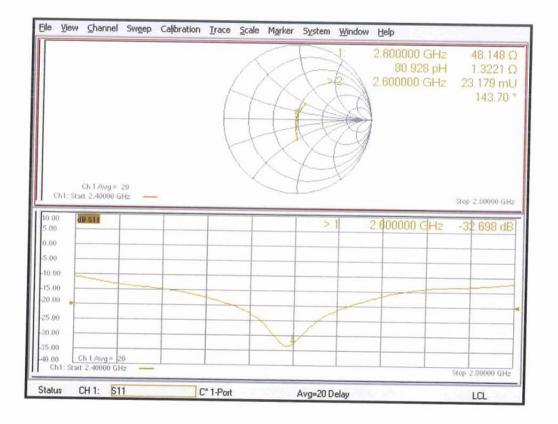


0 dB = 23.5 W/kg = 13.70 dBW/kg

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# Impedance Measurement Plot for Head TSL



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