Sporton

Client



Schweizerischer Kalibrierdienst

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S

S Swiss Calibration Service

Accreditation No.: SCS 0108

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

#### Certificate No: D2300V2-1088\_Jul21

#### CALIBRATION CERTIFICATE Object D2300V2 - SN:1088 QA CAL-05.v11 Calibration procedure(s) Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration date: July 13, 2021 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Power meter NRP SN: 104778 09-Apr-21 (No. 217-03291/03292) Apr-22 Power sensor NRP-Z91 SN: 103244 09-Apr-21 (No. 217-03291) Apr-22 Power sensor NRP-Z91 09-Apr-21 (No. 217-03292) SN: 103245 Apr-22 Reference 20 dB Attenuator SN: BH9394 (20k) 09-Apr-21 (No. 217-03343) Apr-22 Type-N mismatch combination SN: 310982 / 06327 09-Apr-21 (No. 217-03344) Apr-22 Reference Probe EX3DV4 SN: 7349 28-Dec-20 (No. EX3-7349 Dec20) Dec-21 DAE4 SN: 601 02-Nov-20 (No. DAE4-601 Nov20) Nov-21 Secondary Standards ID # Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: MY41092317 07-Oct-15 (in house check Oct-20) In house check: Oct-22 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-20) In house check: Oct-22 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-20) In house check: Oct-21 Name Function Signature Calibrated by: Michael Weber Laboratory Technician Approved by: Katja Pokovic **Technical Manager** Issued: July 27, 2021 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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

### Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

c) DASY System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
  of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

#### **Measurement Conditions**

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

| DASY Version                 | DASY52                 | V52.10.4    |
|------------------------------|------------------------|-------------|
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 2300 MHz ± 1 MHz       |             |

Head TSL parameters The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 39.5         | 1.67 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 38.5 ± 6 %   | 1.72 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 | 12.7 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 49.7 W/kg ± 17.0 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
| SAR measured  | 250 mW input power | 6.11 W/kg                |

| SAR measured                        | 250 mW input power | 6.11 W/kg                |
|-------------------------------------|--------------------|--------------------------|
| SAR for nominal Head TSL parameters | normalized to 1W   | 24.1 W/kg ± 16.5 % (k=2) |

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

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 50.6 Ω - 3.5 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 29.1 dB       |

#### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.170 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

| ٢ | anufactured by | SPEAG |
|---|----------------|-------|
|   |                |       |

#### DASY5 Validation Report for Head TSL

Date: 13.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN:1088

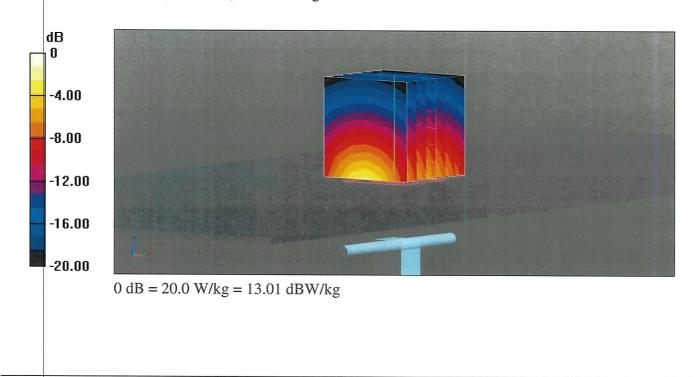
Communication System: UID 0 - CW; Frequency: 2300 MHz Medium parameters used: f = 2300 MHz;  $\sigma = 1.72$  S/m;  $\varepsilon_r = 38.5$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY 52 Configuration:

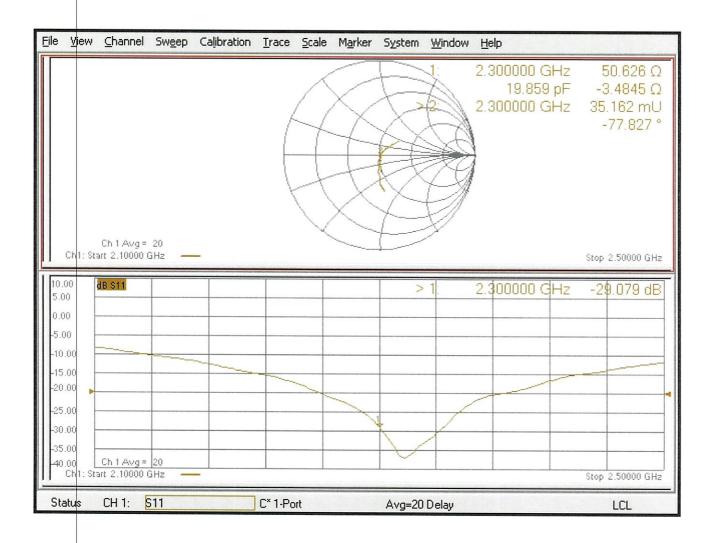
- Probe: EX3DV4 SN7349; ConvF(7.98, 7.98, 7.98) @ 2300 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 116.7 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 23.3 W/kg SAR(1 g) = 12.7 W/kg; SAR(10 g) = 6.11 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 54.6% Maximum value of SAR (measured) = 20.0 W/kg



#### Impedance Measurement Plot for Head TSL





#### D2300V2, serial no. 1088 Extended Dipole Calibrations

Referring to KDB 450824, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

#### <Justification of the extended calibration>

|                             |                  |           | D <b>2300</b> V2 – serial no. <b>1</b> 0 | 088         |                           |             |
|-----------------------------|------------------|-----------|--|-------------|---------------------------|-------------|
|                             | 2300MHZ          |           |  |             |                           |             |
| Date of Measurement         | Return-Loss (dB) | Delta (%) | Real Impedance (ohm)                     | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 07.13.2021<br>(Cal. Report) | -29.079          |           | 50.626                                   |             | -3.4845                   |             |
| 07.12.2022<br>(extended)    | -31.845          | 9.51      | 48.295                                   | 2.331       | -3.0620                   | -0.4225     |

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



511 Log Mag 10.00dB/ Ref 0.000dB [F1] >1 2.3000000 GHz -31.845 dB 0.000 IFBW 70 kHz Stop 2.5 GHz Cor Start 2.1 GHz r1 S11 Smith (R+jX) Scale 1.000U [F1 Del] >1 2.3000000 GHz 48.295 Ω -3.0620 Ω 22.599 pF Stop 2.5 GHz Cor 1 Start 2.1 GHz IFBW 70 kHz

<Dipole Verification Data> - D2300 V2, serial no. 1088 (Data of Measurement : 07.12.2022) 2300 MHz - Head



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#### Client Sporton

#### Certificate No: D2600V2-1008\_Aug21

| Object  | D2600V2 - SN:1  | 008   |   |
|---|---|---|---|
| Calibration procedure(s)  | QA CAL-05.v11<br>Calibration Proc   | edure for SAR Validation Source   | s between 0.7-3 GHz   |
| Calibration date:   | August 17, 2021   |   |   |
| the measurements and the uncer  | tainties with confidence p  | ional standards, which realize the physical un<br>robability are given on the following pages ar<br>ry facility: environment temperature (22 ± 3)%  | nd are part of the certificate.   |
|   |   |   |   |
| Primary Standards   | ID #  | Cal Date (Certificate No.)  | Scheduled Calibration   |
| Power meter NRP   | ID #<br>SN: 104778  | Cal Date (Certificate No.)<br>09-Apr-21 (No. 217-03291/03292)   | Scheduled Calibration   |
| Power meter NRP   |   | 09-Apr-21 (No. 217-03291/03292)   | Apr-22  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91   | SN: 104778  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)  | Apr-22<br>Apr-22  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | SN: 104778<br>SN: 103244  | 09-Apr-21 (No. 217-03291/03292)   | Apr-22<br>Apr-22<br>Apr-22  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination  | SN: 104778<br>SN: 103244<br>SN: 103245  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21  |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check   |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22   |
| 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  | SN: 104778<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   | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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   | SN: 104778<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   | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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                                    | SN: 104778<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: US37292783<br>SN: MY41092317                       | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22 |
| 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                                    | SN: 104778<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: MY41092317<br>SN: 100972<br>SN: US41080477         | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)             | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22 |
| 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 | SN: 104778<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: MY41092317<br>SN: 100972<br>SN: US41080477<br>Name | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)<br>Function | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22 |
| 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 | SN: 104778<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: MY41092317<br>SN: 100972<br>SN: US41080477         | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)             | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22 |
| Power meter NRP   | SN: 104778<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: MY41092317<br>SN: 100972<br>SN: US41080477<br>Name | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)<br>Function | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22 |

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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#### 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: D2600V2-1008\_Aug21

Accreditation No.: SCS 0108

### **Measurement Conditions**

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

| DASY Version                 | DASY52                 | VE0 40 4    |
|------------------------------|------------------------|-------------|
| Extrapolation                | Advanced Extrapolation | V52.10.4    |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      | with Spacer |
| 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 %   | 2.04 mho/m ± 6 %   |
| Head TSL temperature change during test | < 0.5 °C        |              | 2.04 1110/11 ± 6 % |

### 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                                  | 44.510                   |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                                    | 14.9 W/kg                |
|   |   | 58.0 W/kg ± 17.0 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSI                 | condition   |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL<br>SAR measured | condition   | Vage during in a second  |
|   | condition<br>250 mW input power<br>normalized to 1W | 6.56 W/kg                |

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

### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 10.0.0.0.0.0    | _ |
|--------------------------------------|-----------------|---|
| Return Loss                          | 49.2 Ω - 3.0 jΩ |   |
|                                      | - 30.0 dB       |   |

## General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.153 ns  |
|----------------------------------|-----------|
|                                  | 1.155 fts |

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 according to the Standard. No excessive force must be caption to the antenna is the second are not affected by this change. The overall dipole length is still to be excessive force must be caption to the standard.

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

### Additional EUT Data

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

### DASY5 Validation Report for Head TSL

Date: 17.08.2021

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1008

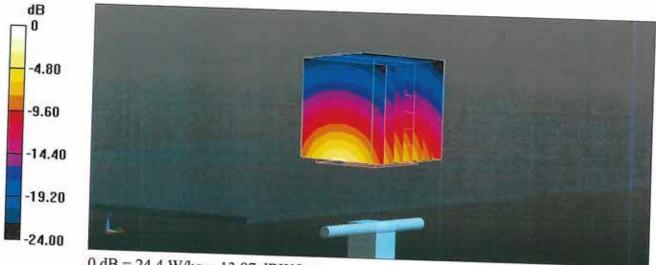
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz;  $\sigma$  = 2.04 S/m;  $\epsilon_r$  = 37.4;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020 •
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001 ٠
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

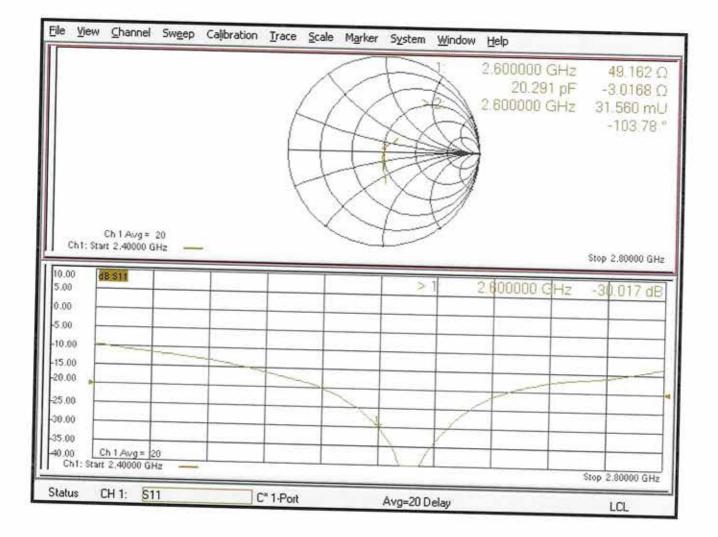
# Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 119.8 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 29.9 W/kg SAR(1 g) = 14.9 W/kg; SAR(10 g) = 6.56 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 49.9% Maximum value of SAR (measured) = 24.4 W/kg



0 dB = 24.4 W/kg = 13.87 dBW/kg

## Impedance Measurement Plot for Head TSL





#### D2600V2, serial no. 1008 Extended Dipole Calibrations

Referring to KDB 450824, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

#### <Justification of the extended calibration>

| D <b>2600</b> V2 – serial no. <b>1008</b> |                  |           |                      |             |                           |             |
|---|------------------|-----------|----------------------|-------------|---------------------------|-------------|
|   |                  | 2600MHZ   |                      |             |                           |             |
| Date of Measurement                       | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 08.17.2021                                | -30.017          |           | 49.162               |             | -3.0168                   |             |
| (Cal. Report)                             | 00.011           |           | 10.102               |             | 0.0100                    |             |
| 08.16.2022                                | -25.072          | -16.47    | 46.926               | 2.236       | -5.6571                   | 2.6403      |
| (extended)                                | -23.072          | -10.47    | 40.920               | 2.230       | -5.0571                   | 2.0403      |

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



511 Log Mag 10.00dB/ Ref 0.000dB [F1] 50.00 >1 2.6000000 GHz -25.072 dB 20.00 0.000 뷳 IFBW 70 kHz Stop 2.8 GHz Cor 1 Start 2.4 GHz 1 S11 Smith (R+jX) Scale 1.000U [F1 Del] >1 2.6000000 GHz 46.926 Ω -5.6571 Ω 10.821 pF 1 Start 2.4 GHz Stop 2.8 GHz Cor IFBW 70 kHz

<Dipole Verification Data> - D2600 V2, serial no. 1008 (Data of Measurement : 08.16.2022) 2600 MHz - Head



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Accreditation No.: SCS 0108

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#### Client Sporton

#### Certificate No: D2600V2-1078\_Jun22

## **CALIBRATION CERTIFICATE**

|  | D2600V2 - SN:10   | 078  |   |
|--|---|--|---|
| Calibration procedure(s)   | QA CAL-05.v11<br>Calibration Proce  | edure for SAR Validation Sources   | between 0.7-3 GHz   |
| Calibration date:  | June 23, 2022   |  |   |
| The measurements and the uncert  | ainties with confidence p   | onal standards, which realize the physical uni<br>robability are given on the following pages an<br>ry facility: environment temperature (22 ± 3)°C  | d are part of the certificate.  |
| Calibration Equipment used (M&TE   | an a  |  |   |
| NAME OF A DECK   |   |  |   |
| and a second design of the   | ID#   | Cal Date (Certificate No.)   | Scheduled Calibration   |
| ower meter NRP   | SN: 104778  | 04-Apr-22 (No. 217-03525/03524)  | Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91  | SN: 104778<br>SN: 103244  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)   | Apr-23<br>Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91   | SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)  | Apr-23<br>Apr-23<br>Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)  | Apr-23<br>Apr-23  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>ype-N mismatch combination  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)   | Apr-23<br>Apr-23<br>Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>ype-N mismatch combination<br>eference Probe EX3DV4   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 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>31-Dec-21 (No. EX3-7349_Dec21)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 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>31-Dec-21 (No. EX3-7349_Dec21)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check   |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Sype-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Recondary Standards<br>Power meter E4419B  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22   |
| 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  | SN: 104778<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   | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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>Power sensor HP 8481A<br>Power sensor HP 8481A   | SN: 104778<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   | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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>Regenerator R&S SMT-06  | SN: 104778<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: WY41093315   | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22                           |
| 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   | SN: 104778<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<br>SN: 100972                           | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |
| 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  | SN: 104778<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<br>SN: 100972<br>SN: US41080477         | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)<br>Function | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |
| 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<br>Calibrated by: | SN: 104778<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<br>SN: 100972<br>SN: US41080477<br>Name | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)             | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |



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#### Glossary:

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

#### Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

c) DASY System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
  of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss: This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

#### Measurement Conditions

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

| DASY Version                 | DASY52                 | V52.10.4    |
|------------------------------|------------------------|-------------|
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 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 | 37.8 ± 6 %   | 2.01 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              | 14.1 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 55.4 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 | 6.29 W/kg                |

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

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 49.2 Ω - 7.3 jΩ |  |  |
|--------------------------------------|-----------------|--|--|
| Return Loss                          | - 22.6 dB       |  |  |

#### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.153 ns |  |
|----------------------------------|----------|--|
|----------------------------------|----------|--|

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

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

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

#### Additional EUT Data

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

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

Date: 23.06.2022

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1078

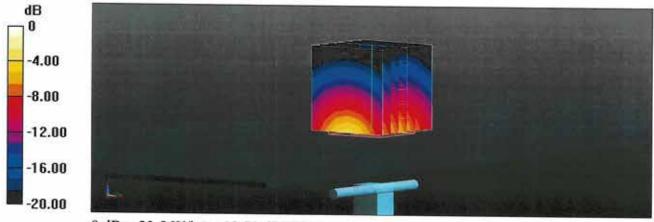
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz;  $\sigma$  = 2.01 S/m;  $\epsilon_r$  = 37.8;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

#### DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- 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 = 117.7 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 28.0 W/kg SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.29 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 50.5% Maximum value of SAR (measured) = 23.5 W/kg



0 dB = 23.5 W/kg = 13.71 dBW/kg

### Impedance Measurement Plot for Head TSL

|  |   |                            |       | k | 6 | $\langle \rangle$ | Ę | -AA |     | 300000<br>8.393<br>300000 | 39 pF | -7<br>73 | 49.200 (<br>7.2926 (<br>.755 mL<br>.92.053 |
|--|---|----------------------------|-------|---|---|-------------------|---|-----|-----|---------------------------|-------|----------|--|
|  |   | Ch 1 Avg =                 |       | Ę | ł |                   |   |     |     |                           |       |          |  |
| _  | un I: Șta   | art 2.40000 (              | GHz — | _ |   | _                 |   | _   | _   | _                         | _     | Stop     | 2.80000 GH                                 |
| -  |   |                            |       |   |   |                   |   |     |     |                           |       |          |  |
| 5.00   |   | BSIL                       |       |   |   |                   | > | 1   | 2.8 | 00000                     | GHz   | -2.      | 2.644 dE                                   |
| 5.01<br>0.01   |   | JBSIL                      |       |   |   |                   | > | 1   | 2.6 | 00000                     | GHz   | -2:      | 2.644 dE                                   |
| 5.01<br>0.01<br>5.0  |   | 3B S11                     |       |   |   |                   | > | 1   | 2.6 | 00000                     | GHz   | -2:      | 2.644 dE                                   |
| 5.0(<br>5.0(<br>5.0)<br>10.)<br>15.)                                 | ) -<br>) -<br>0 -<br>00 -                                       | 11 S ST                    |       |   |   |                   | > | 1   | 2.6 | 00000                     | GHz   | -2:      | 2.644 dE                                   |
| 5.0(<br>5.0)<br>5.0<br>10,)<br>15,)<br>20,)                          | )<br>0<br>00<br>00<br>00  | 38 ST1                     |       |   |   |                   | > | 1   | 2.6 | 00000                     | GHz   | -2       | 2.644 dE                                   |
| 5.0(<br>0.0)<br>5.0<br>10,)<br>15,)<br>20,)<br>25,)                  | ) -<br>) -<br>00 -<br>00 -<br>00 -                              | BB ST1                     |       |   |   |                   | ~ | 1   | 2.6 | 00000                     | GHz   | -2:      | 2.644 dE                                   |
| 10.0<br>5.0<br>5.0<br>5.0<br>10,<br>15,<br>20,<br>25,<br>30,         | )   | 38 311                     |       |   |   |                   | ~ |     | 2.6 | 00000                     | GHz   | -2       | 2.644 dE                                   |
| 5.0(<br>0.0)<br>5.0<br>10)<br>15)<br>20)<br>25)<br>30,<br>35)<br>40) | ) -<br>) -<br>0 -<br>00 -<br>00 -<br>00 -<br>00 -<br>00 -<br>00 | Ch 1 Avg =<br>nt 2.40000 ( | 20    |   |   |                   | ~ |     | 2.6 | 00000                     | GHz   | -23      | 2.644 dE                                   |



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#### Client Sporton

| Certificate No:     | D2600 | 0V2-1                             | 089 | Mar22    |
|---------------------|-------|-----------------------------------|-----|----------|
| o or an o de o reor |       | Contraction of the local distance | 000 | ITTO ALL |

## CALIBRATION CERTIFICATE

|  | D2600V2 - SN:1  | 089   |   |
|--|---|---|---|
| Calibration procedure(s)   | QA CAL-05.v11<br>Calibration Proce  | edure for SAR Validation Sources  | s between 0.7-3 GHz   |
| Calibration date:  | March 24, 2022  |   |   |
| The measurements and the uncert  | ainties with confidence p   | onal standards, which realize the physical uni robability are given on the following pages an<br>ry facility: environment temperature $(22 \pm 3)^{\circ}$  | d are part of the certificate.  |
| Primary Standards  | ID #  | Cal Date (Certificate No.)  | Scheduled Calibration   |
| Power meter NRP  | SN: 104778  | 09-Apr-21 (No. 217-03291/03292)   | Apr-22  |
|  |   |   |   |
| ower sensor NRP-Z91  | SN: 103244  | 09-Apr-21 (No. 217-03291)   | Apr-22  |
|  | SN: 103245  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)  | Apr-22<br>Apr-22  |
| Power sensor NRP-Z91<br>Reference 20 dB Attenuator   |   |   |   |
| Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination  | SN: 103245  | 09-Apr-21 (No. 217-03292)   | Apr-22  |
| Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination<br>Reference Probe EX3DV4  | SN: 103245<br>SN: BH9394 (20k)  | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)  | Apr-22<br>Apr-22  |
| Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination<br>Reference Probe EX3DV4  | SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)   | Apr-22<br>Apr-22<br>Apr-22  |
| Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4  | SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>31-Dec-21 (No. EX3-7349_Dec21)   | Apr-22<br>Apr-22<br>Apr-22<br>Dec-22<br>Nov-22  |
| Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards   | SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>31-Dec-21 (No. EX3-7349_Dec21)<br>01-Nov-21 (No. DAE4-601_Nov21)   | Apr-22<br>Apr-22<br>Apr-22<br>Dec-22  |
| 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  | SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783   | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>31-Dec-21 (No. EX3-7349_Dec21)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)  | Apr-22<br>Apr-22<br>Apr-22<br>Dec-22<br>Nov-22<br>Scheduled Check   |
| 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   | SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475   | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>31-Dec-21 (No. 217-03344)<br>31-Dec-21 (No. EX3-7349_Dec21)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Dec-22<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22   |
| 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  | 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<br>SN: 100972                   | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>31-Dec-21 (No. EX3-7349_Dec21)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Dec-22<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Fype-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  | 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                                 | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>31-Dec-21 (No. EX3-7349_Dec21)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)   | Apr-22<br>Apr-22<br>Apr-22<br>Dec-22<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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 | 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<br>SN: 100972                   | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>31-Dec-21 (No. EX3-7349_Dec21)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)                                      | Apr-22<br>Apr-22<br>Apr-22<br>Dec-22<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22 |
| 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  | 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<br>SN: 100972<br>SN: US41080477 | 09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>31-Dec-21 (No. 2X3-7349_Dec21)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20) | Apr-22<br>Apr-22<br>Apr-22<br>Dec-22<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22                           |

#### Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: SCS 0108

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

#### Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

c) DASY System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss: This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the . nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

#### **Measurement Conditions**

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

| DASYES                 | 1/20 / 0 /   |
|------------------------|--|
| DASY52                 | V52.10.4   |
| Advanced Extrapolation |  |
| Modular Flat Phantom   |  |
| 10 mm                  | with Spacer  |
| dx, dy, dz = 5 mm      |  |
| 2600 MHz ± 1 MHz       |  |
|                        | Modular Flat Phantom<br>10 mm<br>dx, dy, dz = 5 mm |

#### 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 | 37.2 ± 6 %   | 2.02 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   | 55.4 W/kg ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 6.24 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.6 W/kg ± 16.5 % (k=2) |

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

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 50.0 Ω - 5.9 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 24.6 dB       |  |

#### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.146 ns |  |
|----------------------------------|----------|--|
|----------------------------------|----------|--|

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

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

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

#### Additional EUT Data

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

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

Date: 24.03.2022

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1089

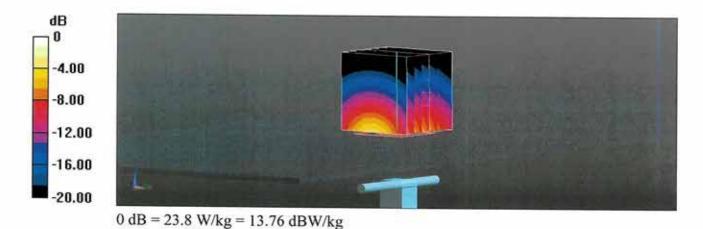
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz;  $\sigma = 2.02$  S/m;  $\epsilon_r = 37.2$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 118.0 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 28.8 W/kg **SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.24 W/kg** Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 49.3% Maximum value of SAR (measured) = 23.8 W/kg



### Impedance Measurement Plot for Head TSL

|  |  |              |       |   |   |                   | /            | -          | J             | 2.60 | 0000  | GHz | 5              | 0.018 (    |
|--|--|--------------|-------|---|---|-------------------|--------------|------------|---------------|------|-------|-----|----------------|------------|
|  |  |              |       |   |   | 1                 | $\checkmark$ | $\Box$     | A             |      | 10.34 |     |                | 9160 (     |
|  |  |              |       |   |   | 6 1               | $\sim$       | The        | 2             | 2.60 | 00000 | GHz |                | 047 ml     |
|  |  |              |       |   | 1 | 4                 |              | $\swarrow$ | XX            |      |       |     | -              | 86,440     |
|  |  |              |       |   |   |                   |              | 12-E       | 2XC           | 1    |       |     |                |            |
|  |  |              |       |   |   | 6                 | 1-           | T          | 70            | 1    |       |     |                |            |
|  |  |              |       |   | F | -1                | X            | r          | +A            |      |       |     |                |            |
|  |  |              |       |   | 1 | $\langle \rangle$ | $\times$ $^$ | 1-         | 51            |      |       |     |                |            |
|  |  |              |       |   |   | V                 | ~            | $\sum$     | $\mathcal{M}$ |      |       |     |                |            |
|  |  | Ch 1 Avg =   | 20    |   |   |                   |              | 5          |               |      |       |     |                |            |
|  |  |              |       |   |   |                   |              |            |               |      |       |     | - 1929 (Ph. 5) |            |
| 3  | Ch1: St  | tart 2.40000 | GHz — | - |   |                   |              | 94 U       |               | _    |       | _   | Stop           | 2.80000 GI |
| 0.0  | 00 [   | dB \$11      | GHz — | - | _ | T                 | _            |            | 1             | 2 4  | 0000  | dus |                |            |
| 0.(<br>5.0   | 00   | 4            | GHz — | - |   | -                 |              | >          | 1             | 2.80 | 0000  | GHz |                | 2.80000 GI |
| 0.0<br>5.0   | 0  | 4            | GHz — |   |   |                   |              | >          | 1             | 2.80 | 0000  | GHz |                |            |
| 0.0<br>5.0<br>5.0  | 00<br>0<br>0                                     | 4            | GHz — |   |   |                   |              | >          | 1             | 2.80 | 00000 | GHz |                |            |
| 0.0<br>5.0<br>5.0<br>5.0   | 00<br>0<br>0<br>0<br>0                           | 4            | GH2 - |   |   |                   |              | >          | 1             | 2.60 | 10000 | GHz |                |            |
| 0.0<br>5.0<br>5.0<br>10.   | 00<br>0<br>0<br>0<br>0<br>00                     | 4            | GH2 - |   |   |                   |              | >          | 1             | 2.60 | 10000 | GHz |                |            |
| 10.0<br>5.0<br>10.<br>15.<br>20.                                   | 00<br>0<br>0<br>0<br>0<br>0<br>00                | 4            | GHz   |   |   |                   |              | >          | 1             | 2.80 | 10000 | GHz |                |            |
| 10.0<br>5.0<br>10.<br>15.<br>20.                                   | 00<br>0<br>0<br>0<br>0<br>0<br>00                | 4            |       |   |   |                   |              | ~          |               | 2.80 | 10000 | GHz |                |            |
| 0.0<br>5.0<br>5.0<br>10.<br>15.<br>20.<br>25.                      | 00<br>0<br>0<br>0<br>0<br>00<br>00<br>00         | 4            |       |   |   |                   |              | ~          |               | 2.80 | 00000 | GHz |                |            |
| 0.0<br>5.0<br>5.0<br>10.<br>15.<br>20.<br>25.<br>30.<br>35.        | 00<br>0<br>0<br>00<br>00<br>00<br>00<br>00<br>00 | dB 511       |       |   |   |                   |              |            |               | 2.80 | 00000 | GHz |                |            |
| 10.0<br>5.0<br>5.0<br>10.<br>15.<br>20.<br>25.<br>30.<br>35.<br>40 | 00<br>0<br>0<br>00<br>00<br>00<br>00<br>00<br>00 | 4            | 20    |   |   |                   |              |            |               | 2.80 | 00000 | GHz | -2             |            |



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Accreditation No.: SCS 0108

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Client Sporton Certificate No: D3500V2-1014\_Jan22

### CALIBRATION CERTIFICATE

| Object                              | D3500V2 - SN:1              | 014  |                                    |
|-------------------------------------|-----------------------------|--|------------------------------------|
| Calibration procedure(s)            | QA CAL-22.v6                |  |                                    |
|                                     | Calibration Proc            | edure for SAR Validation Source                    | s between 3-10 GHz                 |
| Calibration date:                   | January 17, 202             | 2  |                                    |
| This calibration cortificate docume | ete the transition of the   |  |                                    |
| The measurements and the uncer      | his the traceability to hal | ional standards, which realize the physical ur     | nits of measurements (SI).         |
|                                     | and an addition of          | probability are given on the following pages a     | to are part of the certificate.    |
| All calibrations have been conduct  | ed in the closed laborato   | ry facility: environment temperature (22 $\pm$ 3)° | 0                                  |
|                                     |                             | $(22 \pm 3)$                                       | C and numidity < 70%.              |
| Calibration Equipment used (M&TI    | E critical for calibration) |  |                                    |
|                                     |                             |  |                                    |
| Primary Standards                   | ID #                        | Cal Date (Certificate No.)                         | Scheduled Calibration              |
| Power meter NRP                     | SN: 104778                  | 09-Apr-21 (No. 217-03291/03292)                    | Apr-22                             |
| Power sensor NRP-Z91                | SN: 103244                  | 09-Apr-21 (No. 217-03291)                          | Apr-22<br>Apr-22                   |
| ower sensor NRP-Z91                 | SN: 103245                  | 09-Apr-21 (No. 217-03292)                          | Apr-22                             |
| Reference 20 dB Attenuator          | SN: BH9394 (20k)            | 09-Apr-21 (No. 217-03343)                          | Apr-22                             |
| ype-N mismatch combination          | SN: 310982 / 06327          | 09-Apr-21 (No. 217-03344)                          | Apr-22                             |
| Reference Probe EX3DV4              | SN: 3503                    | 31-Dec-21 (No. EX3-3503_Dec21)                     | Dec-22                             |
| DAE4                                | SN: 601                     | 01-Nov-21 (No. DAE4-601_Nov21)                     | Nov-22                             |
| econdary Standards                  | ID #                        | Check Date (in house)                              | Scheduled Check                    |
| ower meter E4419B                   | SN: GB39512475              | 30-Oct-14 (in house check Oct-20)                  | In house check: Oct-22             |
| ower sensor HP 8481A                | SN: US37292783              | 07-Oct-15 (in house check Oct-20)                  | In house check: Oct-22             |
| ower sensor HP 8481A                | SN: MY41093315              | 07-Oct-15 (in house check Oct-20)                  | In house check: Oct-22             |
| IF generator R&S SMT-06             | SN: 100972                  | 15-Jun-15 (in house check Oct-20)                  | In house check: Oct-22             |
| letwork Analyzer Agilent E8358A     | SN: US41080477              | 31-Mar-14 (in house check Oct-20)                  | In house check: Oct-22             |
|                                     | Name                        | Function   | Signature                          |
| alibrated by:                       | Michael Weber               | Laboratory Technician                              |                                    |
|                                     |                             |  | MARX                               |
|                                     |                             |  |                                    |
| pproved by:                         | Sven Kühn                   | Deputy Manager                                     |                                    |
| pproved by:                         | Sven Kühn                   | Deputy Manager                                     | M. MELT<br>S.C.                    |
| pproved by:                         | Sven Kühn                   | Deputy Manager                                     | Si Lik<br>Issued: January 20, 2022 |





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#### Glossary:

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

### Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

c) DASY System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss: This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

#### **Measurement Conditions**

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

| DASY Version                 | DASY52                     | V52.10.4                         |
|------------------------------|----------------------------|----------------------------------|
| Extrapolation                | Advanced Extrapolation     |                                  |
| Phantom                      | Modular Flat Phantom       |                                  |
| Distance Dipole Center - TSL | 10 mm                      | with Spacer                      |
| Zoom Scan Resolution         | dx, dy = 4 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 3500 MHz ± 1 MHz           |                                  |

#### Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 37.9         | 2.91 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 37.2 ± 6 %   | 2.91 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | <u> </u>     |                  |

#### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 6.75 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 67.2 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 2.52 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 25.1 W/kg ± 19.5 % (k=2) |

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

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 54.7 Ω - 4.4 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 24.2 dB       |  |

#### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.133 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

| SPEAG |       |
|-------|-------|
| _     | SPEAG |

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

Date: 17.01.2022

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1014

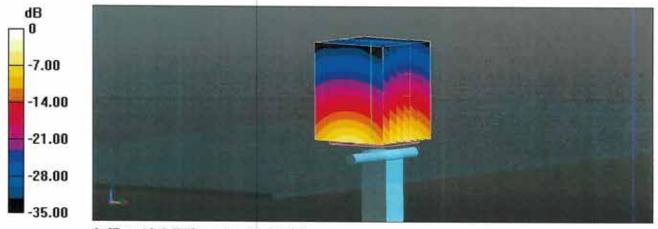
Communication System: UID 0 - CW; Frequency: 3500 MHz Medium parameters used: f = 3500 MHz;  $\sigma = 2.91$  S/m;  $\epsilon_r = 37.2$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.91, 7.91, 7.91) @ 3500 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- 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=100 mW, d=10mm, f=3500MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.66 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 18.5 W/kg SAR(1 g) = 6.75 W/kg; SAR(10 g) = 2.52 W/kg Smallest distance from peaks to all points 3 dB below = 8.4 mm Ratio of SAR at M2 to SAR at M1 = 74.5% Maximum value of SAR (measured) = 13.0 W/kg



0 dB = 13.0 W/kg = 11.12 dBW/kg

### Impedance Measurement Plot for Head TSL

| jle                      | View                | Channel                                | Sweep     | Calibration | Irace | Scale | Marker                                 | System | ₩indow | Help                          |      |           |   |
|--------------------------|---------------------|--|-----------|-------------|-------|-------|--|--------|--------|-------------------------------|------|-----------|---|
|                          |                     |  |           |             | Ę     |       | XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |        | A      | 3.500000<br>10.26<br>3.500000 | 2 pF | -4<br>61. | 4.658 Ω<br>4314 Ω<br>375 mU<br>41 147 ° |
| 10.0<br>5.0<br>0.0       | 00                  | Ch 1 Avg =<br>art 3.30000 (<br>dB \$11 | 20<br>3Hz |             |       |       |  | >      | 1      | 3.500000 (                    | 3Hz  |           | .70000 GHz<br>240 dB                    |
| 5.0                      | .00                 |  |           |             |       |       |  |        |        |                               | -    |           |   |
| -15<br>-20<br>-25<br>-30 | .00 <b>,</b><br>.00 |  |           | -           |       |       |  |        |        |                               |      | _         |   |



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S Swiss Calibration Service

Accreditation No.: SCS 0108

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Client Sporton

Certificate No: D3500V2-1036 Mar22

### CALIBRATION CERTIFICATE

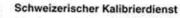
| Object   | D3500V2 - SN:1  | 036   |   |
|--|---|---|---|
| Calibration procedure(s)   | QA CAL-22.v6<br>Calibration Procedure for SAR Validation Sources between 3-10 GHz   |   |   |
| Calibration date:  | March 23, 2022  |   |   |
| The measurements and the uncert  | ainties with confidence p<br>ed in the closed laborato  | ional standards, which realize the physical un<br>probability are given on the following pages ar<br>ny facility: environment temperature ( $22 \pm 3$ )°(  | nd are part of the certificate.   |
|  |   |   |   |
| Primary Standards  | ID #  | Cal Date (Certificate No.)  | Scheduled Calibration   |
| the second s   | ID #<br>SN: 104778  | Cal Date (Certificate No.)<br>09-Apr-21 (No. 217-03291/03292)   | Scheduled Calibration<br>Apr-22   |
| Power meter NRP<br>Power sensor NRP-Z91  |   |   |   |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91  | SN: 104778  | 09-Apr-21 (No. 217-03291/03292)   | Apr-22  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator  | SN: 104778<br>SN: 103244  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)  | Apr-22<br>Apr-22  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)   | Apr-22<br>Apr-22<br>Apr-22  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination<br>Reference Probe EX3DV4   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination<br>Reference Probe EX3DV4   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22  |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>01-Nov-21 (No. DAE4-601_Nov21)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Mar-23<br>Nov-22  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>08-Mar-22 (No. EX3-3503_Mar22)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Mar-23<br>Nov-22<br>Scheduled Check   |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Mar-23<br>Nov-22  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475   | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Mar-23<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22   |
| 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                                 | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783   | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Mar-23<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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                                 | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315                                 | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Mar-23<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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                                 | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972                   | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)                                      | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Mar-23<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22 |
| Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by: | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477 | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>01-Nov-21 (No. DAE4-601_Nov21)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20) | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Mar-23<br>Nov-22<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22 |

#### Calibration Laboratory of Schmid & Partner

Glossary

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





- s Service suisse d'étalonnage
- C Servizio svizzero di taratura
- S Swiss Calibration Service

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

Accreditation No.: SCS 0108

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

### Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

c) DASY System Handbook

#### Methods Applied and Interpretation of Parameters:

- · Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss: This parameter is measured with the source positioned under the liquid filled • phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- · SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

### **Measurement Conditions**

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

| DASY Version                 | DASY52                     | V52.10.4                         |
|------------------------------|----------------------------|----------------------------------|
| Extrapolation                | Advanced Extrapolation     | TOL: TOL: TOL                    |
| Phantom                      | Modular Flat Phantom       | 7                                |
| Distance Dipole Center - TSL | 10 mm                      | with Spacer                      |
| Zoom Scan Resolution         | dx, dy = 4 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 3500 MHz ± 1 MHz           |                                  |

## **Head TSL parameters**

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 37.9         | 2.91 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 37.4 ± 6 %   | 2.94 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  | 100 mW input power              | 6.78 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 67.4 W/kg ± 19.9 % (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>100 mW input power | 2.52 W/kg                |

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

### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 52.3 Ω - 1.8 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 30.9 dB       |  |

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

| Electrical Delay (one direction) | 1.140 ns |
|----------------------------------|----------|
|                                  |          |

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

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

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

### Additional EUT Data

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

### DASY5 Validation Report for Head TSL

Date: 23.03.2022

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1036

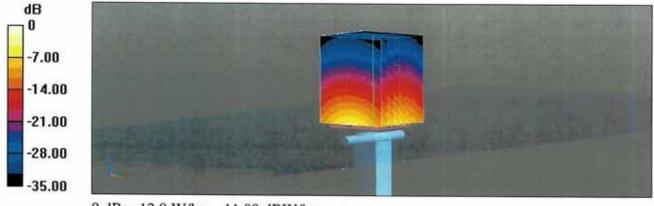
Communication System: UID 0 - CW; Frequency: 3500 MHz Medium parameters used: f = 3500 MHz;  $\sigma = 2.94$  S/m;  $\epsilon_r = 37.4$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.91, 7.91, 7.91) @ 3500 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

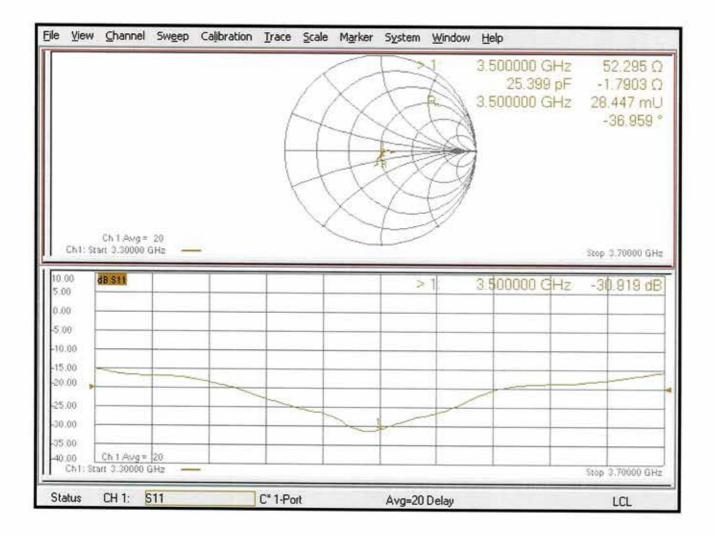
# Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3500MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 72.91 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 18.5 W/kg SAR(1 g) = 6.78 W/kg; SAR(10 g) = 2.52 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 74.5% Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.09 dBW/kg

### Impedance Measurement Plot for Head TSL



Sporton

Client



Schweizerischer Kalibrierdienst

- Service suisse d'étalonnage
- С Servizio svizzero di taratura

s

S Swiss Calibration Service

Accreditation No.: SCS 0108

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

### Certificate No: D3700V2-1006\_Jun22

# CALIBRATION CERTIFICATE

| Object  | D3700V2 - SN:10   | 006   | and the Party of the  |
|---|---|---|---|
| Calibration procedure(s)  | QA CAL-22.v6<br>Calibration Proce   | dure for SAR Validation Sources   | between 3-10 GHz  |
| Calibration date:   | June 20, 2022   |   |   |
|   |   | onal standards, which realize the physical uni  |   |
|   |   | obability are given on the following pages an   |   |
| All calibrations have been conducte   | ed in the closed laborator  | y facility: environment temperature (22 ± 3)°C  | C and humidity < 70%.   |
| Calibration Equipment used (M&TE  | critical for calibration)   |   |   |
|   |   |   |   |
| rimary Standards  | ID#   | Cal Date (Certificate No.)  | Seheduled Coliberation  |
|   | ID #  | Cal Date (Certificate No.)  | Scheduled Calibration   |
| ower meter NRP  | SN: 104778  | 04-Apr-22 (No. 217-03525/03524)   | Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91   | SN: 104778<br>SN: 103244  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)  | Apr-23<br>Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91  | SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)   | Apr-23<br>Apr-23<br>Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>leference 20 dB Attenuator<br>ype-N mismatch combination  | SN: 104778<br>SN: 103244<br>SN: 103245  | 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)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503  | 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>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23  |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 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>08-Mar-22 (No. EX3-3503_Mar22)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>May-23<br>Scheduled Check   |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 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>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22   |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475   | 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>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>May-23  |
| 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>Becondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783   | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>08-Mar-22 (No. 217-03528)<br>07-Oct-14 (in house check Oct-20) | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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                                    | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315   | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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                                    | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972                           | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22                           |
| 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 | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477         | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)<br>02-May-22 (No. DAE4-601_May22)<br>03-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>031-Mar-14 (in house check Oct-20)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>Signature              |
| Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:    | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477<br>Name | 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>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)<br>Function   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |



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#### 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: D3700V2-1006\_Jun22

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 = 4 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 3700 MHz ± 1 MHz           |                                  |

## **Head TSL parameters**

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 37.7         | 3.12 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 37.0 ± 6 %   | 3.07 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | 1040         |                  |

### SAR result with Head TSL

|   | SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                          |
|---|---|--------------------|--------------------------|
|   | SAR measured  | 100 mW input power | 6.56 W/kg                |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL condition | SAR for nominal Head TSL parameters                     | normalized to 1W   | 65.6 W/kg ± 19.9 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL condition | SAD   |                    |                          |
|   | SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |

| (10 3) 011000 101                   | oonandon           |                          |
|-------------------------------------|--------------------|--------------------------|
| SAR measured                        | 100 mW input power | 2.38 W/kg                |
| SAR for nominal Head TSL parameters | normalized to 1W   | 23.7 W/kg ± 19.5 % (k=2) |

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

### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 50.6 Ω - 10.0 jΩ |  |
|--------------------------------------|------------------|--|
| Return Loss                          | - 20.0 dB        |  |

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

| Electrical Delay (one direction) | 1.137 ns |  |
|----------------------------------|----------|--|
|----------------------------------|----------|--|

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

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

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

# Additional EUT Data

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

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

Date: 20.06.2022

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1006

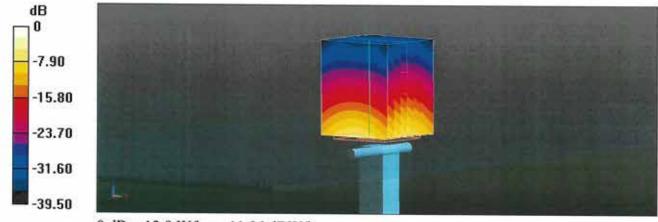
Communication System: UID 0 - CW; Frequency: 3700 MHz Medium parameters used: f = 3700 MHz;  $\sigma = 3.07$  S/m;  $\epsilon_r = 37$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.73, 7.73, 7.73) @ 3700 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- 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=100 mW, d=10mm, f=3700MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 68.96 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 18.6 W/kg SAR(1 g) = 6.56 W/kg; SAR(10 g) = 2.38 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 73.4% Maximum value of SAR (measured) = 12.8 W/kg



0 dB = 12.8 W/kg = 11.06 dBW/kg

# Impedance Measurement Plot for Head TSL

|  |               |       |   | L | 4   | $\langle$ | Ę |   |     | 00000<br>4.283<br>00000 | 32 pF | 99   | 50.626 (<br>10.043 (<br>1501 m |
|--|---------------|-------|---|---|-----|-----------|---|---|-----|-------------------------|-------|------|--------------------------------|
|  | Ch 1 Avg =    | 20    |   | E | F X |           |   | Ì |     |                         |       |      | 80.734                         |
|  | WHIT COULD    |       |   |   |     |           |   |   |     |                         |       |      |                                |
| -  | Start 3.50000 | GHz — | - | _ | -   | _         | _ | _ | _   |                         | _     | Stop | 3.90000 GH                     |
| Ch1: 1<br>0.00<br>5.00   | Start 3.50000 | GHz — |   |   |     |           | > | 1 | 3.7 | 00000                   | GHz   | -    | 3.90000 GI<br>1.043 di         |
| 0.00<br>5.00<br>0.00   | Start 3.50000 | GHz — |   |   |     |           | > | 1 | 3.7 | 00000                   | GHz   | -    |                                |
| 0.00<br>5.00   | Start 3.50000 | GH2   |   |   |     |           | > | 1 | 3.7 | 00000                   | GHz   | -    |                                |
| 0.00<br>5.00<br>0.00<br>5.00<br>10.00<br>15.00                   | Start 3.50000 | GHz   |   |   |     |           | > | 1 | 3.7 | 00000                   | GHz   | -    |                                |
| 0.00<br>5.00<br>0.00<br>5.00<br>10.00<br>15.00<br>20.00          | Start 3.50000 | GHz   |   |   |     | 1         | 2 |   | 3.7 | 00000                   | GHz   | -    |                                |
| 0.00<br>5.00<br>5.00<br>5.00<br>10.00<br>15.00<br>20.00          | Start 3.50000 | GHz   |   |   |     |           | 2 |   | 3.7 | 00000                   | CHz   | -    |                                |
| 0.00<br>5.00<br>5.00<br>5.00<br>10.00<br>15.00<br>20.00<br>25.00 | Start 3.50000 |       |   |   |     |           | > |   | 3.7 | 00000                   | GHz   | -    |                                |
| 0.00<br>5.00<br>5.00<br>5.00<br>10.00<br>15.00<br>20.00          | Start 3.50000 |       |   |   |     |           | > |   | 3.7 | 00000                   | GHz   | -    |                                |

Sporton

Client



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Certificate No: D3700V2-1022 Jul21

# **CALIBRATION CERTIFICATE**

| Dbject   | D3700V2 - SN:10   | 022  |   |
|--|---|--|---|
| Calibration procedure(s)   | QA CAL-22.v6<br>Calibration Proce   | edure for SAR Validation Sources   | between 3-10 GHz  |
| Calibration date:  | July 14, 2021   |  |   |
| The measurements and the uncert  | ainties with confidence p<br>ad in the closed laborato  | ional standards, which realize the physical un robability are given on the following pages an<br>ry facility: environment temperature ( $22 \pm 3$ )°(   | d are part of the certificate.  |
| Primary Standards  | ID #  | Cal Date (Certificate No.)   | Scheduled Calibration   |
|  |   |  |   |
|  | SN: 104778  | 09-Apr-21 (No. 217-03291/03292)  | Apr-22  |
| ower sensor NRP-Z91  | SN: 103244  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)   | Apr-22<br>Apr-22  |
| wer sensor NRP-Z91<br>wer sensor NRP-Z91   | SN: 103244<br>SN: 103245  |  | C 2012 C 2012 C   |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator  | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)  | Apr-22  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>pe-N mismatch combination   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)   | Apr-22<br>Apr-22  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>/pe-N mismatch combination<br>eference Probe EX3DV4   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)   | Apr-22<br>Apr-22<br>Apr-22  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>ype-N mismatch combination<br>eference Probe EX3DV4   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22  |
| Yower sensor NRP-Z91<br>Yower sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Ype-N mismatch combination<br>Reference Probe EX3DV4<br>PAE4   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>leference 20 dB Attenuator<br>ype-N mismatch combination<br>leference Probe EX3DV4<br>AE4<br>econdary Standards<br>ower meter E4419B   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>ype-N mismatch combination<br>eference Probe EX3DV4<br>AE4<br>econdary Standards<br>ower meter E4419B<br>ower sensor HP 8481A   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check   |
| Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Pype-N mismatch combination<br>Reference Probe EX3DV4<br>PAE4<br>Recondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22   |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>ype-N mismatch combination<br>eference Probe EX3DV4<br>AE4<br>econdary Standards<br>ower meter E4419B<br>ower sensor HP 8481A<br>ower sensor HP 8481A<br>F generator R&S SMT-06   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41092317<br>SN: 100972                           | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>ype-N mismatch combination<br>eference Probe EX3DV4<br>AE4<br>econdary Standards<br>ower meter E4419B<br>ower sensor HP 8481A<br>ower sensor HP 8481A<br>F generator R&S SMT-06   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41092317   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. 217-0344)<br>30-Dec-20 (No. 217-0344)<br>30-Oct-14 (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20) | Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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>Regenerator R&S SMT-06   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41092317<br>SN: 100972                           | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-21 |
| 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>Recondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference R&S SMT-06<br>Network Analyzer Agilent E8358A  | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41092317<br>SN: 100972<br>SN: US41080477         | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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 E44198<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A<br>Calibrated by: | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41092317<br>SN: 100972<br>SN: US41080477<br>Name | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)<br>Function  | Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-21 |

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### 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.
- 0 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%.

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 = 4 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 3700 MHz ± 1 MHz           |                                  |

# Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 37.7         | 3.12 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 37.7 ± 6 %   | 3.12 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | 1 - MAR - 1  | 3444             |

# SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 6.82 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 68.2 W/kg ± 19.9 % (k=2) |
|   | 72.67              |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|   |                    |                          |

| \$AR measured                       | 100 mW input power | 2.47 W/kg                |
|-------------------------------------|--------------------|--------------------------|
| SAR for nominal Head TSL parameters | normalized to 1W   | 24.7 W/kg ± 19.5 % (k=2) |

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

### Antenna Parameters with Head TSL

| mpedance, transformed to feed point | 51.2 Ω - 4.0 jΩ |  |
|-------------------------------------|-----------------|--|
| Return Loss                         | - 27.7 dB       |  |

### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.125 ns |  |
|----------------------------------|----------|--|
|----------------------------------|----------|--|

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

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

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

# Additional EUT Data

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

# **DASY5** Validation Report for Head TSL

Date: 14.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1022

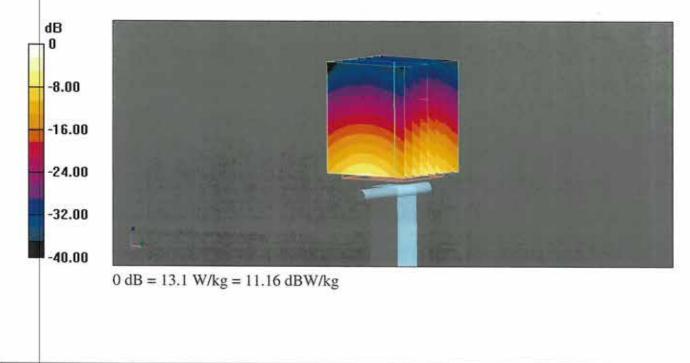
Communication System: UID 0 - CW; Frequency: 3700 MHz Medium parameters used: f = 3700 MHz;  $\sigma = 3.12$  S/m;  $\epsilon_r = 37.7$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

### DASY52 Configuration:

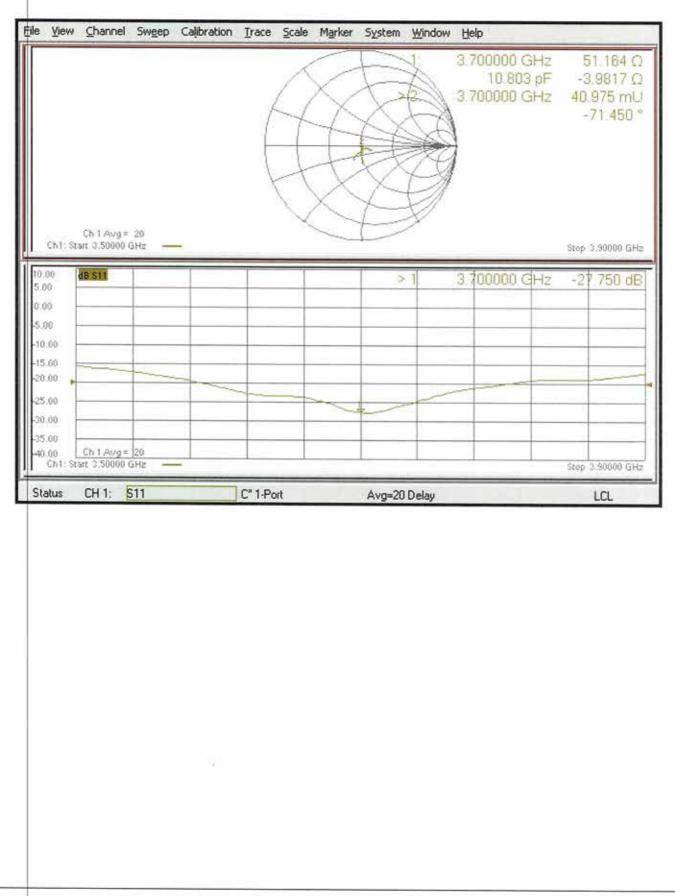
- Probe: EX3DV4 SN3503; ConvF(7.73, 7.73, 7.73) @ 3700 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

# Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3700MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 72.98 V/m; Power Drift = -0.08 dB Peak \$AR (extrapolated) = 19.2 W/kg SAR(1 g) = 6.82 W/kg; SAR(10 g) = 2.47 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 72.8% Maximum value of SAR (measured) = 13.1 W/kg



# Impedance Measurement Plot for Head TSL





# D3700V2, serial no. 1022 Extended Dipole Calibrations

Referring to KDB 450824, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

#### <Justification of the extended calibration>

| D <b>3700</b> V2 – serial no. <b>1022</b> |                  |           |                      |             |                           |             |  |
|---|------------------|-----------|----------------------|-------------|---------------------------|-------------|--|
|   | 3700MHZ          |           |                      |             |                           |             |  |
| Date of Measurement                       | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |  |
| 07.14.2021<br>(Cal. Report)               | -27.75           |           | 51.164               |             | -3.9817                   |             |  |
| 07.13.2022<br>(extended)                  | -24.914          | 10.21     | 54.098               | -2.934      | -5.305                    | 1.3233      |  |

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



r1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1] 3.7000000 GHz -24.914 dB >1 0.000 -30.00 1 Start 3.5 GHz IFBW 70 kHz Stop 3.9 GHz Cor 1 S11 Smith (R+jX) Scale 1.000U [F1 Del] >1 3.7000000 GHz 54.098 Ω -5.3050 Ω 8.1083 pF 1 Start 3.5 GHz IFBW 70 kHz Stop 3.9 GHz Cor

<Dipole Verification Data> - D3700 V2, serial no. 1022 (Data of Measurement : 07.13.2022) 3700 MHz - Head



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Client Sporton Certificate No: D3900V2-1017\_Apr22

# **CALIBRATION CERTIFICATE**

| Object   | D3900V2 - SN:1  | 017   |   |
|--|---|---|---|
| Calibration procedure(s)   | QA CAL-22.v6<br>Calibration Procedure for SAR Validation Sources between 3-10 GHz |   |   |
| Calibration date:  | April 22, 2022  |   |   |
| This calibration certificate documen<br>The measurements and the uncerta | its the traceability to nati<br>ainties with confidence p                         | onal standards, which realize the physical un<br>robability are given on the following pages an | its of measurements (SI).<br>d are part of the certificate. |
|  |   | ry facility: environment temperature (22 ± 3)°(   |   |
| Calibration Equipment used (M&TE   | critical for calibration)   |   |   |
| Primary Standards  | ID#   | Cal Date (Certificate No.)  | Scheduled Calibration                                       |
| Power meter NRP  | SN: 104778  | 04-Apr-22 (No. 217-03525/03524)   | Apr-23  |
| Power sensor NRP-Z91   | SN: 103244  | 04-Apr-22 (No. 217-03524)   | Apr-23  |
| Power sensor NRP-Z91   | SN: 103245  | 04-Apr-22 (No. 217-03525)   | Apr-23  |
| Reference 20 dB Attenuator   | SN: BH9394 (20k)  | 04-Apr-22 (No. 217-03527)   | Apr-23  |
| Type-N mismatch combination  | SN: 310982 / 06327  | 04-Apr-22 (No. 217-03528)   | Apr-23  |
| Reference Probe EX3DV4   | SN: 3503  | 08-Mar-22 (No. EX3-3503_Mar22)  | Mar-23  |
| DAE4   | SN: 601   | 01-Nov-21 (No. DAE4-601_Nov21)  | Nov-22  |
| Secondary Standards  | ID #  | Check Date (in house)   | Scheduled Check   |
| Power meter E4419B   | SN: GB39512475  | 30-Oct-14 (in house check Oct-20)   | In house check: Oct-22                                      |
| Power sensor HP 8481A  | SN: US37292783  | 07-Oct-15 (in house check Oct-20)   | In house check: Oct-22                                      |
| Power sensor HP 8481A  | SN: MY41093315  | 07-Oct-15 (in house check Oct-20)   | In house check: Oct-22                                      |
| RF generator R&S SMT-06  | SN: 100972  | 15-Jun-15 (in house check Oct-20)   | In house check: Oct-22                                      |
| Network Analyzer Agilent E8358A  | SN: US41080477  | 31-Mar-14 (in house check Oct-20)   | In house check: Oct-22                                      |
|  | Name  | Function  | Signature   |
| Calibrated by:   | Joanna Lleshaj  | Laboratory Technician   | Aplesy  |
|  | No. New York, Market and Co.  |   | dhuy<br>S.h   |
| Approved by:   | Other LAND IN   |   |   |
| Approved by:   | Sven Kühn   | Deputy Manager  | S.W   |



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