

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



S Schweizerischer Kalibrierdienst
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Swiss Calibration Service

Accreditation No.: **SCS 0108**

Accredited by the Swiss Accreditation Service (SAS)

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Multilateral Agreement for the recognition of calibration certificates

Client **Sporton**
Kunshan City

Certificate No. **D2450V2-1095_Feb24**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:1095**

Calibration procedure(s) **QA CAL-05.v12**
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: **February 08, 2024**

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|---------------------------------|--------------------|-----------------------------------|------------------------|
| Power meter NRP2 | SN: 104778 | 30-Mar-23 (No. 217-03804/03805) | Mar-24 |
| Power sensor NRP-Z91 | SN: 103244 | 30-Mar-23 (No. 217-03804) | Mar-24 |
| Power sensor NRP-Z91 | SN: 103245 | 30-Mar-23 (No. 217-03805) | Mar-24 |
| Reference 20 dB Attenuator | SN: BH9394 (20k) | 30-Mar-23 (No. 217-03809) | Mar-24 |
| Type-N mismatch combination | SN: 310982 / 06327 | 30-Mar-23 (No. 217-03810) | Mar-24 |
| Reference Probe EX3DV4 | SN: 7349 | 03-Nov-23 (No. EX3-7349_Nov23) | Nov-24 |
| DAE4 | SN: 601 | 30-Jan-24 (No. DAE4-601_Jan24) | Jan-25 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check Oct-22) | In house check: Oct-24 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-22) | In house check: Oct-24 |
| Power sensor HP 8481A | SN: MY41093315 | 07-Oct-15 (in house check Oct-22) | In house check: Oct-24 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-22) | In house check: Oct-24 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-22) | In house check: Oct-24 |

Calibrated by: **Paulo Pina** Name: **Paulo Pina** Function: **Laboratory Technician**

Approved by: **Sven Kühn** Technical Manager

Signature

Issued: February 9, 2024

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

| | | |
|-------------------------------------|------------------------|-------------|
| DASY Version | DASY52 | V52.10.4 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2450 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|---------------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 39.2 | 1.80 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 38.2 \pm 6 % | 1.88 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 13.5 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 52.6 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 6.27 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.7 W/kg \pm 16.5 % (k=2) |

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

| | |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $51.3 \Omega + 6.1 j\Omega$ |
| Return Loss | - 24.3 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.147 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: 08.02.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:1095

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.88$ S/m; $\epsilon_r = 38.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; 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 = 116.2 V/m; Power Drift = 0.08 dB

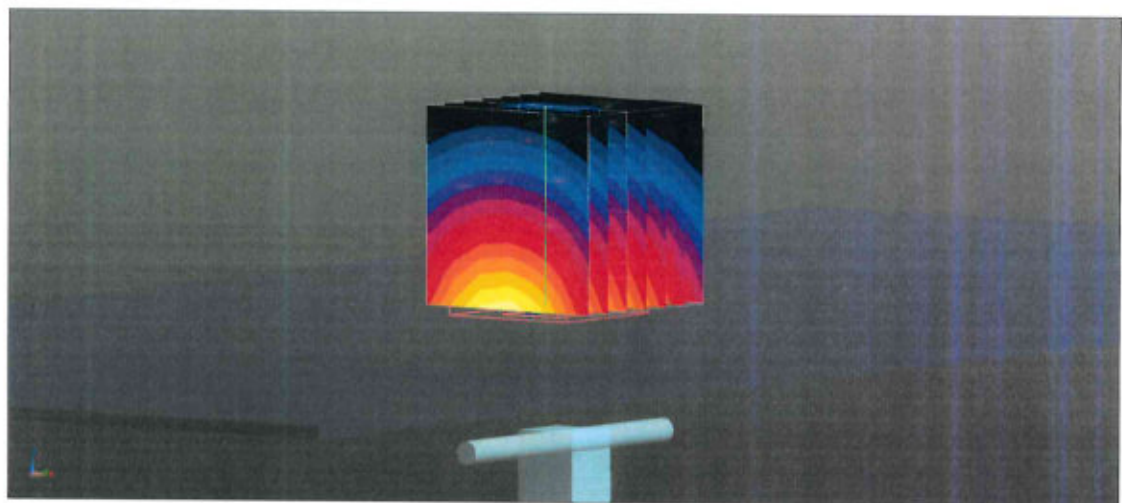
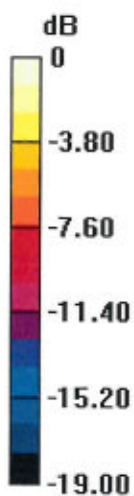
Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.27 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

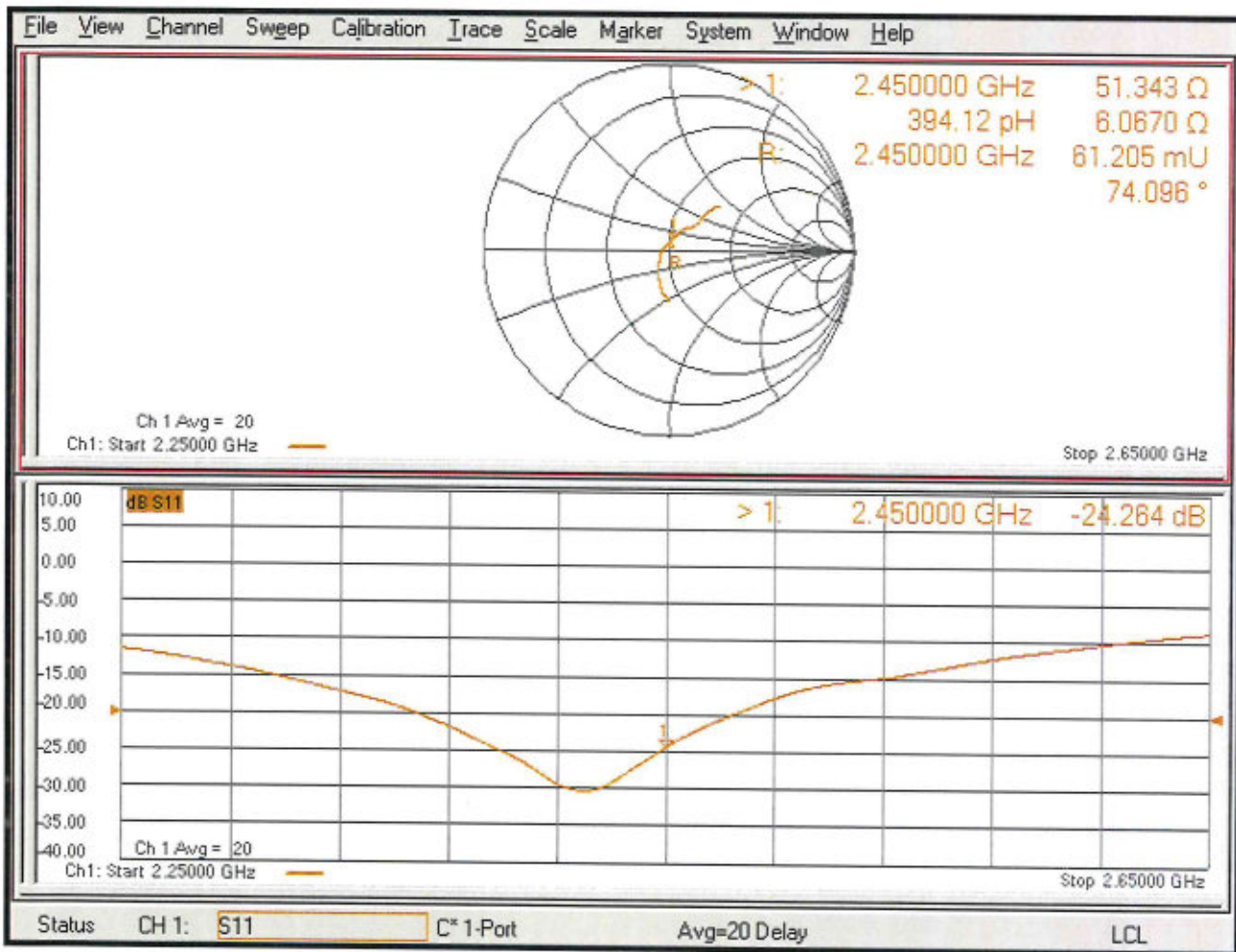
Ratio of SAR at M2 to SAR at M1 = 50.6%

Maximum value of SAR (measured) = 21.8 W/kg



0 dB = 21.8 W/kg = 13.38 dBW/kg

Impedance Measurement Plot for Head TSL



Appendix: Transfer Calibration at Four Validation Locations on SAM Head¹

Evaluation Condition

| | | |
|---------|------------------|-----------------------------|
| Phantom | SAM Head Phantom | For usage with cSAR3DV2-R/L |
|---------|------------------|-----------------------------|

SAR result with SAM Head (Top \cong C0)

| | | |
|---|------------------|------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR for nominal Head TSL parameters | normalized to 1W | 56.1 W/kg \pm 17.5 % (k=2) |

| | | |
|---|------------------|------------------------------|
| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
| SAR for nominal Head TSL parameters | normalized to 1W | 26.2 W/kg \pm 16.9 % (k=2) |

SAR result with SAM Head (Mouth \cong F90)

| | | |
|---|------------------|------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR for nominal Head TSL parameters | normalized to 1W | 57.2 W/kg \pm 17.5 % (k=2) |

| | | |
|---|------------------|------------------------------|
| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
| SAR for nominal Head TSL parameters | normalized to 1W | 27.5 W/kg \pm 16.9 % (k=2) |

SAR result with SAM Head (Neck \cong H0)

| | | |
|---|------------------|------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR for nominal Head TSL parameters | normalized to 1W | 53.9 W/kg \pm 17.5 % (k=2) |

| | | |
|---|------------------|------------------------------|
| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
| SAR for nominal Head TSL parameters | normalized to 1W | 25.1 W/kg \pm 16.9 % (k=2) |

SAR result with SAM Head (Ear \cong D90)

| | | |
|---|------------------|------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR for nominal Head TSL parameters | normalized to 1W | 34.5 W/kg \pm 17.5 % (k=2) |

| | | |
|---|------------------|------------------------------|
| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
| SAR for nominal Head TSL parameters | normalized to 1W | 17.5 W/kg \pm 16.9 % (k=2) |

¹ Additional assessments outside the current scope of SCS 0108

D2450V2, Serial No. 1095 Extended Dipole Calibrations

If dipoles are verified in return loss ($< -20\text{dB}$, 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.

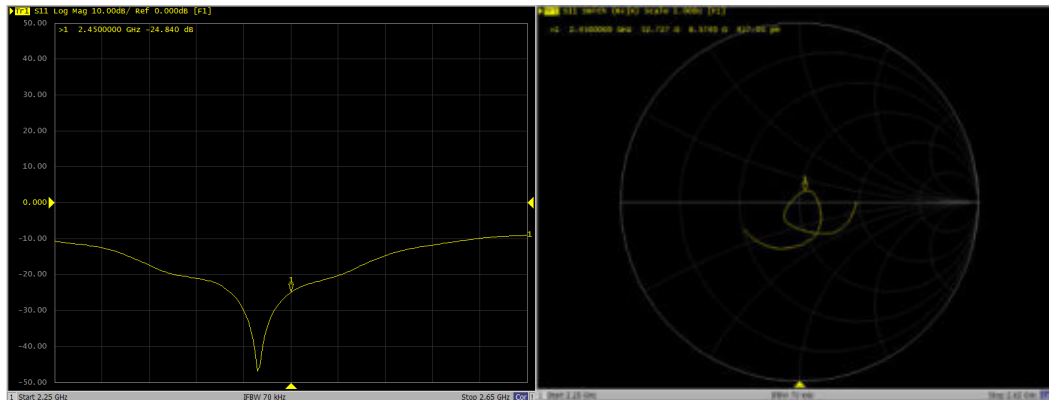
| D2450V2 – serial no. 1095 | | | | | | |
|---------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 2450 Head | | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2024.2.8 | -24.264 | | 51.343 | | 6.0670 | |
| 2025.2.7 | -24.840 | 2% | 52.727 | 1.384 | 6.5740 | 0.507 |

<Justification of the extended calibration>

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

Dipole Verification Data> D2450V2, serial no. 1095

2450MHz – Head-2025.2.7



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Client **Sporton**

Certificate No: **D5GHzV2-1113_Sep22**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1113**

Calibration procedure(s) **QA CAL-22.v6
Calibration Procedure for SAR Validation Sources between 3-10 GHz**

Calibration date: **September 23, 2022**

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 $(22 \pm 3)^{\circ}\text{C}$ 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 | 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 | 31-Aug-22 (No. DAE4-601_Aug22) | Aug-23 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check Oct-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 |

Calibrated by: **Leif Klysner** **Laboratory Technician**

Signature

Approved by: **Sven Kühn** **Technical Manager**

Issued: September 26, 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:

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

Additional Documentation:

- DASY System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

| | | |
|-------------------------------------|--|----------------------------------|
| DASY Version | DASY52 | V52.10.4 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom V5.0 | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy = 4.0 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency | 5250 MHz \pm 1 MHz 5600 MHz \pm 1 MHz 5750 MHz \pm 1 MHz | |

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.9 | 4.71 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 35.4 \pm 6 % | 4.60 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL at 5250 MHz

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 100 mW input power | 8.18 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 81.5 W/kg \pm 19.9 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 100 mW input power | 2.35 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.3 W/kg \pm 19.5 % (k=2) |

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.5 | 5.07 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 34.9 \pm 6 % | 4.95 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL at 5600 MHz

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 100 mW input power | 8.30 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 82.6 W/kg \pm 19.9 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 100 mW input power | 2.38 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.7 W/kg \pm 19.5 % (k=2) |

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.4 | 5.22 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 34.7 ± 6 % | 5.11 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL at 5750 MHz

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 8.12 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 80.8 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 100 mW input power | 2.32 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.0 W/kg ± 19.5 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.0 Ω - 6.2 j Ω |
| Return Loss | - 23.9 dB |

Antenna Parameters with Head TSL at 5600 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 55.2 Ω - 2.4 j Ω |
| Return Loss | - 25.3 dB |

Antenna Parameters with Head TSL at 5750 MHz

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.1 Ω - 1.1 j Ω |
| Return Loss | - 27.8 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.194 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: 23.09.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1113

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.6$ S/m; $\epsilon_r = 35.4$; $\rho = 1000$ kg/m³,Medium parameters used: $f = 5600$ MHz; $\sigma = 4.95$ S/m; $\epsilon_r = 34.9$; $\rho = 1000$ kg/m³,Medium parameters used: $f = 5750$ MHz; $\sigma = 5.11$ S/m; $\epsilon_r = 34.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 31.08.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 75.87 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 27.8 W/kg

SAR(1 g) = 8.18 W/kg; SAR(10 g) = 2.35 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

Ratio of SAR at M2 to SAR at M1 = 70.5%

Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm

Reference Value = 75.04 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 30.4 W/kg

SAR(1 g) = 8.30 W/kg; SAR(10 g) = 2.38 W/kg

Smallest distance from peaks to all points 3 dB below = 7.5 mm

Ratio of SAR at M2 to SAR at M1 = 67.9%

Maximum value of SAR (measured) = 19.3 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan,**dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 72.94 V/m; Power Drift = -0.02 dB

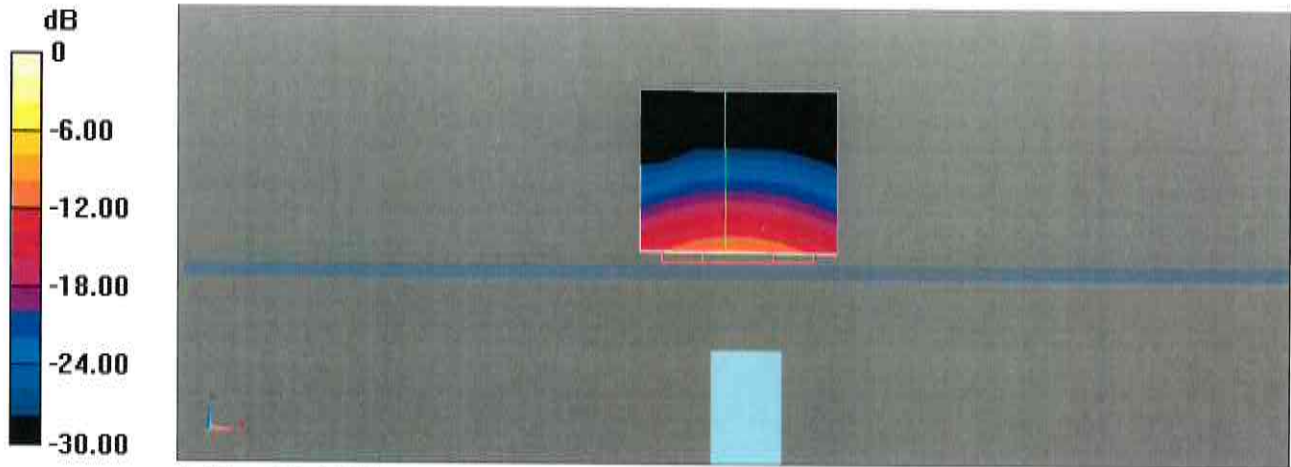
Peak SAR (extrapolated) = 31.7 W/kg

SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.32 W/kg

Smallest distance from peaks to all points 3 dB below = 7.5 mm

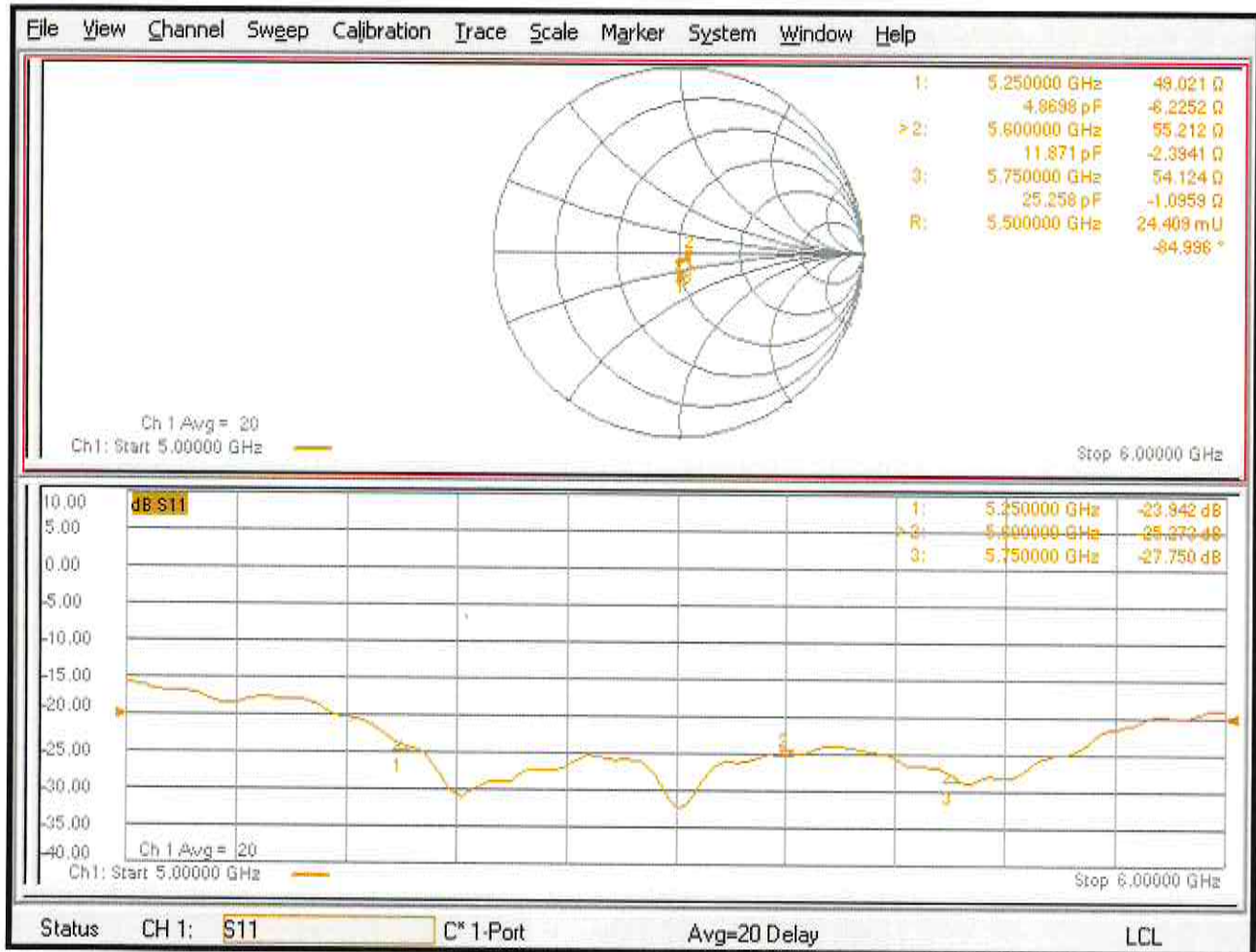
Ratio of SAR at M2 to SAR at M1 = 66%

Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 19.4 W/kg = 12.87 dBW/kg

Impedance Measurement Plot for Head TSL



D5GHzV2, Serial No. 1113 Extended Dipole Calibrations

If dipoles are verified in return loss ($< -20\text{dB}$, 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.

| D5GHzV2 – serial no. 1113 | | | | | | |
|---------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 5250 Head | | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2022/9/23 | -23.942 | | 49.021 | | -6.2252 | |
| 2023/9/22 | -26.63 | 11.23 | 46.533 | 2.488 | -4.0285 | -2.1967 |
| 2024/9/22 | -21.740 | -9.2 | 46.759 | 2.262 | -7.4819 | 1.2657 |

| D5GHzV2 – serial no. 1113 | | | | | | |
|---------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 5600 Head | | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2022/9/23 | -25.273 | | 55.212 | | -2.3941 | |
| 2023/9/22 | -23.746 | -6.04 | 57.759 | -2.547 | 1.4943 | -3.8884 |
| 2024/9/22 | -22.278 | -11.85 | 51.114 | 4.098 | -1.9900 | -0.4041 |

| D5GHzV2 – serial no. 1113 | | | | | | |
|---------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 5750 Head | | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2022/9/23 | -27.750 | | 54.124 | | -1.0959 | |
| 2023/9/22 | -31.350 | 12.97 | 50.097 | 4.027 | -3.1053 | 2.0094 |
| 2024/9/22 | -28.462 | 2.57 | 56.821 | -2.697 | -0.53015 | -0.56575 |

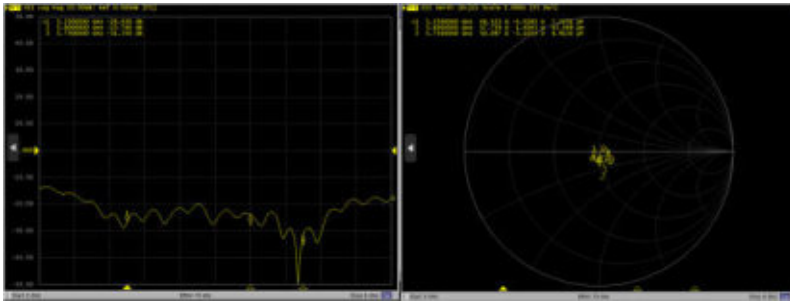
<Justification of the extended calibration>

The return loss is $< -20\text{dB}$, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration.

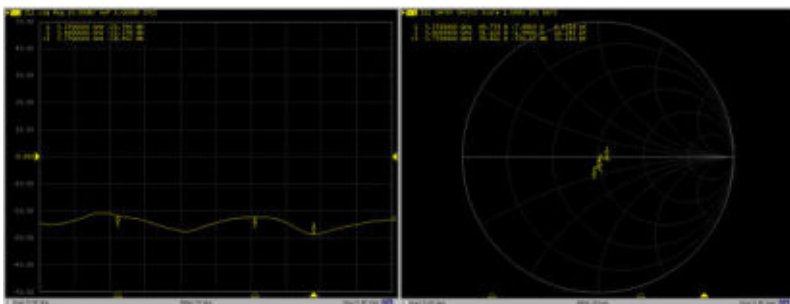
Therefore the verification result should support extended calibration.

Dipole Verification Data> D5GHzV2, serial no. 1113

5250MHz&5600MHz&5750MHz – Head – 2023.9.22



5250MHz&5600MHz&5750MHz – Head – 2024.9.22



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Client **Sporton**
Shenzhen

Certificate No. **D6.5GHzV2-1026_Jan25**

CALIBRATION CERTIFICATE

Object **D6.5GHzV2 - SN:1026**

Calibration procedure(s) **QA CAL-22.v7**
Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date: **January 28, 2025**

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------------|------------------|-----------------------------------|------------------------|
| Power sensor R&S NRP33T | SN: 100967 | 28-Mar-24 (No. 217-04038) | Mar-25 |
| Reference 20 dB Attenuator | SN: BH9394 (20k) | 26-Mar-24 (No. 217-04046) | Mar-25 |
| Mismatch combination | SN: 84224 / 360D | 28-Mar-24 (No. 217-04050) | Mar-25 |
| Reference Probe EX3DV4 | SN: 7405 | 01-Jul-24 (No. EX3-7405_Jul24) | Jul-25 |
| DAE4 | SN: 908 | 27-Mar-24 (No. DAE4-908_Mar24) | Mar-25 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| RF generator Anapico APSIN20G | SN: 827 | 18-Dec-18 (in house check Jan-24) | In house check: Jan-25 |
| Power sensor NRP-Z23 | SN: 100169 | 10-Jan-19 (in house check Jan-24) | In house check: Jan-25 |
| Power sensor NRP-18T | SN: 100950 | 28-Sep-22 (in house check Jan-24) | In house check: Jan-25 |
| Network Analyzer Keysight E5063A | SN:MY54504221 | 31-Oct-19 (in house check Sep-24) | In house check: Sep-26 |

| | | |
|----------------|-------------------------|-----------------------------------|
| Calibrated by: | Name Claudio Leubler | Function Laboratory Technician |
| Approved by: | Sven Kühn | Technical Manager |

Signature



Issued: January 29, 2025

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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:

- 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.

Additional Documentation:

- DASY System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The 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 absorbed power density (APD):** The absorbed power density is evaluated according to Samaras T, Christ A, Kuster N, "Compliance assessment of the epithelial or absorbed power density above 6 GHz using SAR measurement systems", Bioelectromagnetics, 2021 (submitted). The additional evaluation uncertainty of 0.55 dB (rectangular distribution) is considered.

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 | DASY6 | V16.2 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 5 mm | with Spacer |
| Zoom Scan Resolution | dx, dy = 3.4 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency | 6500 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 34.5 | 6.07 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 34.6 \pm 6 % | 6.14 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|---|
| SAR measured | 100 mW input power | 29.6 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 296 W/kg \pm 24.7 % (k=2) |

| SAR averaged over 8 cm³ (8 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 100 mW input power | 6.68 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 66.8 W/kg \pm 24.4 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 100 mW input power | 5.48 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 54.8 W/kg \pm 24.4 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 49.9 Ω - 4.5 j Ω |
| Return Loss | - 26.9 dB |

APD (Absorbed Power Density)

| APD averaged over 1 cm ² | Condition | |
|-------------------------------------|--------------------|---|
| APD measured | 100 mW input power | 296 W/m ² |
| APD measured | normalized to 1W | 2960 W/m² \pm 29.2 % (k=2) |

| APD averaged over 4 cm ² | condition | |
|-------------------------------------|--------------------|---|
| APD measured | 100 mW input power | 134 W/m ² |
| APD measured | normalized to 1W | 1340 W/m² \pm 28.9 % (k=2) |

*The reported APD values have been derived using the psSAR1g and psSAR8g.

General Antenna Parameters and Design

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 |
|-----------------|-------|

DASY6 Validation Report for Head TSL

Measurement Report for D6.5GHz-1026, UID 0 -, Channel 6500 (6500.0MHz)

Device under Test Properties

| Name, Manufacturer | Dimensions [mm] | IMEI | DUT Type |
|--------------------|--------------------|----------|----------|
| D6.5GHz | 16.0 x 6.0 x 300.0 | SN: 1026 | - |

Exposure Conditions

| Phantom Section, TSL | Position, Test Distance [mm] | Band | Group, UID | Frequency [MHz] | Conversion Factor | TSL Cond. [S/m] | TSL Permittivity |
|----------------------|------------------------------|------|------------|-----------------|-------------------|-----------------|------------------|
| Flat, HSL | 5.00 | Band | CW, | 6500 | 5.14 | 6.14 | 34.6 |

Hardware Setup

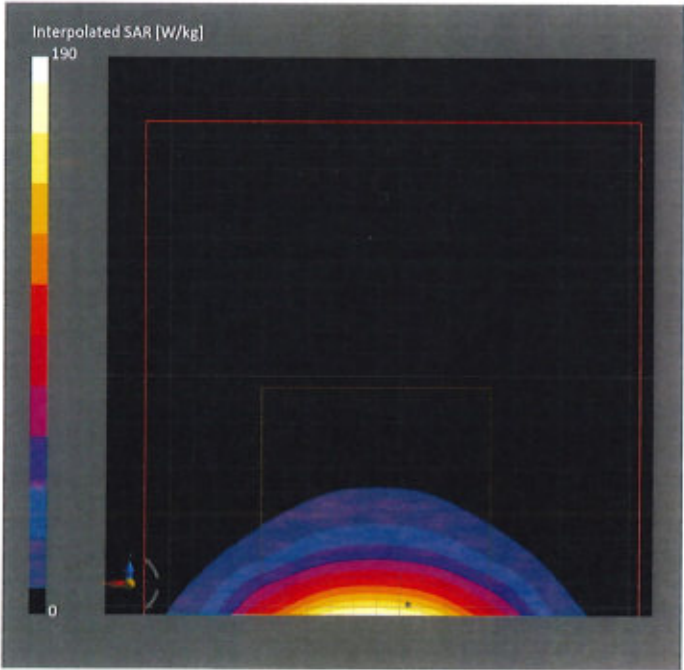
| Phantom | TSL | Probe, Calibration Date | DAE, Calibration Date |
|------------------------|-----------------|-----------------------------|------------------------|
| MFP V8.0 Center - 1182 | HBBL600-10000V6 | EX3DV4 - SN7405, 2024-07-01 | DAE4 Sn908, 2024-03-27 |

Scan Setup

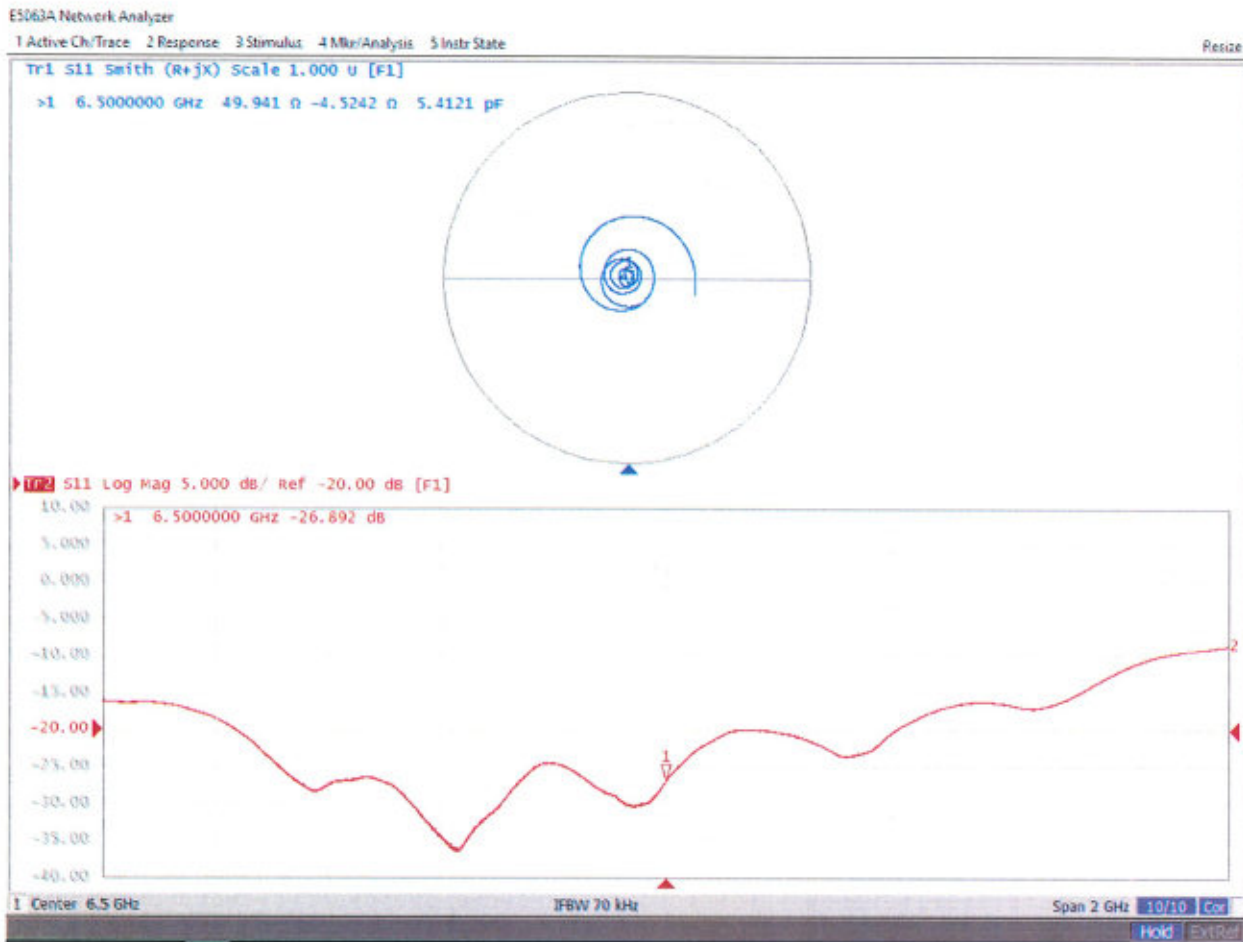
| | Zoom Scan |
|---------------------|--------------------|
| Grid Extents [mm] | 22.0 x 22.0 x 22.0 |
| Grid Steps [mm] | 3.4 x 3.4 x 1.4 |
| Sensor Surface [mm] | 1.4 |
| Graded Grid | Yes |
| Grading Ratio | 1.4 |
| MAIA | N/A |
| Surface Detection | VMS + 6p |
| Scan Method | Measured |

Measurement Results

| | Zoom Scan |
|---------------------|-------------------|
| Date | 2025-01-28, 10:51 |
| psSAR1g [W/Kg] | 29.6 |
| psSAR8g [W/Kg] | 6.68 |
| psSAR10g [W/Kg] | 5.48 |
| Power Drift [dB] | -0.00 |
| Power Scaling | Disabled |
| Scaling Factor [dB] | |
| TSL Correction | No correction |
| M2/M1 [%] | 49.6 |
| Dist 3dB Peak [mm] | 4.8 |



Impedance Measurement Plot for Head TSL



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Accreditation No.: **SCS 0108**

Client

Sporton
Kunshan City

Certificate No.

5G-Veri10-2005_Dec24/2

CALIBRATION CERTIFICATE (Replacement of No: 5G-Veri10-2005_Dec24)

Object 5G Verification Source 10 GHz - SN: 2005

Calibration procedure(s) QA CAL-45.v5
Calibration procedure for sources in air > 6 GHz

Calibration date December 4, 2024

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 $(22 \pm 3)^\circ\text{C}$ and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Cal |
|-------------------------------|----------|-----------------------------------|---------------|
| Reference Probe SPEAG EUmmWV3 | SN: 9374 | 28-Aug-24 (No. Eumm_9374_Aug24) | Aug-25 |
| DAE4ip | SN: 1602 | 06-Nov-24 (No. DAE4ip-1602_Nov24) | Nov-25 |

| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
|----------------------------------|----------------|--|-----------------|
| Signal Generator R&S SMF100A | SN: 100184 | 26-Nov-24 (No. 5G-Source-Cal-IHC-202411) | Nov-25 |
| Power Sensor R&S NRP18S-10 | SN: 101258 | 26-Nov-24 (No. 5G-Source-Cal-IHC-202411) | Nov-25 |
| Network Analyzer Keysight E5063A | SN: MY54504221 | 30-Sept-24 (No. 675-CAL18-S4489-Sep24) | Sep-26 |

| | Name | Function | Signature |
|---------------|----------------|-----------------------|-----------|
| Calibrated by | Joanna Lleshaj | Laboratory Technician | |
| Approved by | Sven Kühn | Technical Manager | |

Issued: March 4, 2025

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Accreditation No.: **SCS 0108****Glossary**

CW Continuous wave

Calibration is Performed According to the Following Standards

- Internal procedure QA CAL-45, Calibration procedure for sources in air above 6 GHz.
- IEC/IEEE 63195-1, "Assessment of power density of human exposure to radio frequency fields from wireless devices in close proximity to the head and body (frequency range of 6 GHz to 300 GHz)", May 2022

Methods Applied and Interpretation of Parameters

- *Coordinate System*: z-axis in the waveguide horn boresight, x-axis is in the direction of the E-field, y-axis normal to the others in the field scanning plane parallel to the horn flare and horn flange.
- *Measurement Conditions*: (1) 10 GHz: The radiated power is the forward power to the horn antenna minus ohmic and mismatch loss. The forward power is measured prior and after the measurement with a power sensor. During the measurements, the horn is directly connected to the cable and the antenna ohmic and mismatch losses are determined by far-field measurements. (2) 30, 45, 60 and 90 GHz: The verification sources are switched on for at least 30 minutes. Absorbers are used around the probe cub and at the ceiling to minimize reflections.
- *Horn Positioning*: The waveguide horn is mounted vertically on the flange of the waveguide source to allow vertical positioning of the EUMMW probe during the scan. The plane is parallel to the phantom surface. Probe distance is verified using mechanical gauges positioned on the flare of the horn.
- *E-field distribution*: The E-field is measured in two x-y-planes (10mm, 10mm + $\lambda/4$) with a vectorial E-field probe. The E-field value stated as calibration value represents the E-field-maxima and the averaged (1cm² and 4cm²) power density values at 10mm in front of the horn.
- *Field polarization*: Above the open horn, linear polarization of the field is expected. This is verified graphically in the field representation.

Calibrated Quantity

- Local peak E-field (V/m) and average of peak spatial components of the poynting vector (W/m²) averaged over the surface area of 1 cm² and 4cm² at the nominal operational frequency of the verification source. Both square and circular averaging results are listed.

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 | DASY8 Module mmWave | V3.2 |
| Phantom | 5G Phantom | |
| Distance Horn Aperture - plane | 10 mm | |
| Number of measured planes | 2 (10mm, 10mm + $\lambda/4$) | |
| Frequency | 10.0 GHz \pm 10 MHz | |

Calibration Parameters, 10 GHz

Circular Averaging

| Distance Horn Aperture to Measurement Plane | Prad ¹ (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m ²) | | Uncertainty (k = 2) |
|---|------------------------|-------------------|---------------------|--|------------------|---------------------|
| | | | | 1cm ² | 4cm ² | |
| 10 mm | 138.0 | 288 | 1.27 dB | 219 | 174 | 1.28 dB |

| Distance Horn Aperture to Measurement Plane | Prad ¹ (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Power Density psPDn+, psPDtot+, psPDmod+ (W/m ²) | | Uncertainty (k = 2) |
|---|------------------------|-------------------|---------------------|--|------------------|---------------------|
| | | | | 1cm ² | 4cm ² | |
| 10 mm | 138.0 | 288 | 1.27 dB | 218, 218, 220 | 172, 173, 177 | 1.28 dB |

Square Averaging

| Distance Horn Aperture to Measurement Plane | Prad ¹ (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m ²) | | Uncertainty (k = 2) |
|---|------------------------|-------------------|---------------------|--|------------------|---------------------|
| | | | | 1cm ² | 4cm ² | |
| 10 mm | 138.0 | 288 | 1.27 dB | 219 | 173 | 1.28 dB |

| Distance Horn Aperture to Measurement Plane | Prad ¹ (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Power Density psPDn+, psPDtot+, psPDmod+ (W/m ²) | | Uncertainty (k = 2) |
|---|------------------------|-------------------|---------------------|--|------------------|---------------------|
| | | | | 1cm ² | 4cm ² | |
| 10 mm | 138.0 | 288 | 1.27 dB | 218, 218, 220 | 171, 172, 177 | 1.28 dB |

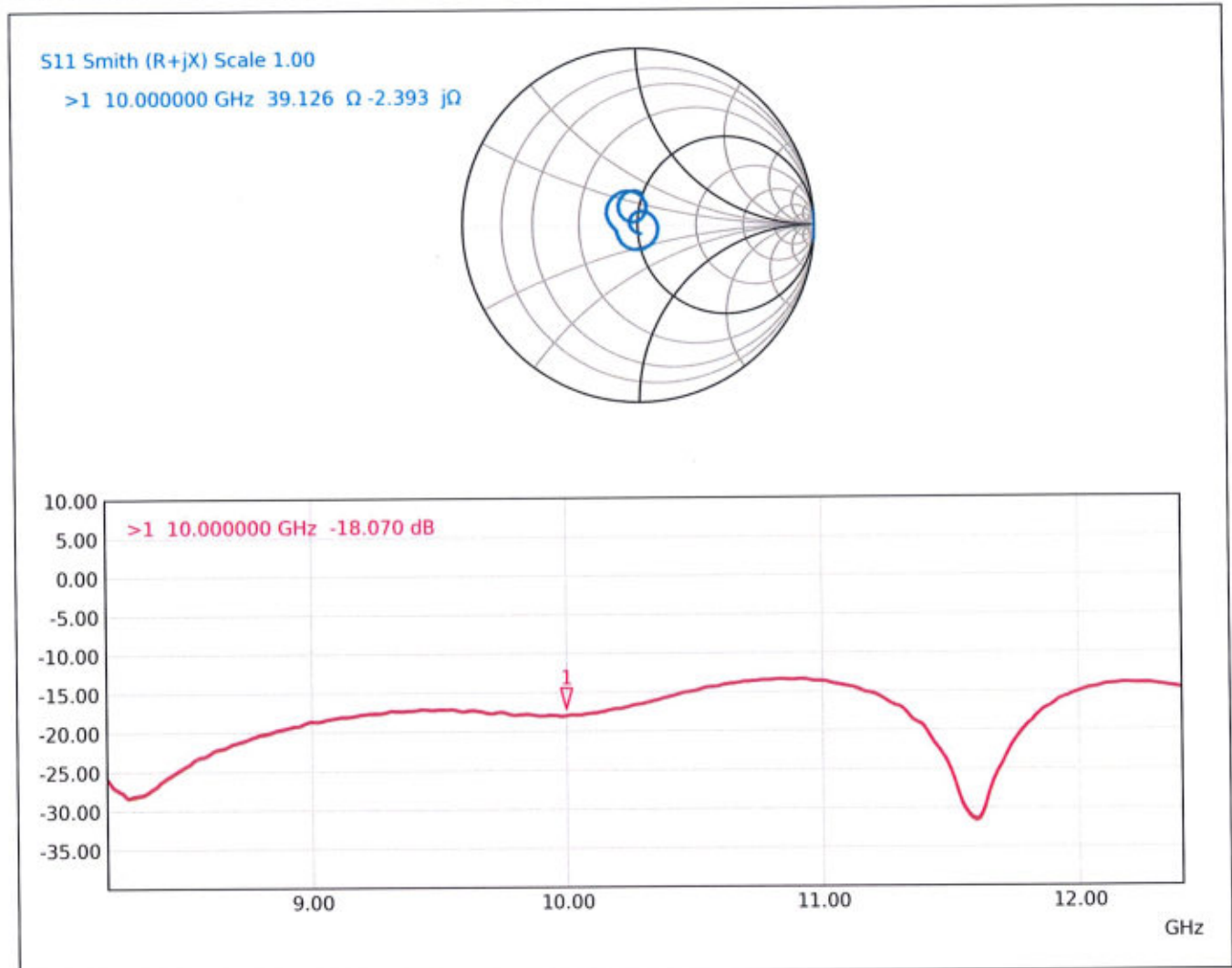
Max Power Density

| Distance Horn Aperture to Measurement Plane | Prad ¹ (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Max Power Density Sn, Stot, Stot (W/m ²) | Uncertainty (k = 2) |
|---|------------------------|-------------------|---------------------|--|---------------------|
| 10 mm | 138.0 | 288 | 1.27 dB | 237, 237, 237 | 1.28 dB |

¹ Assessed ohmic and mismatch loss plus numerical offset: 0.60 dB

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

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 39.1 Ω - 2.4 j Ω |
| Return Loss | -18.1 dB |

Impedance Measurement Plot

5G Verification Source 10 GHz - SN: 2005

December 4, 2024

DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 --, Channel 10000.0 (10000.0 MHz)

Device Under Test Properties

| Model, Manufacturer | Dimensions [mm] | IMEI | DUT Type |
|-------------------------------|-----------------------|----------|----------|
| 5G Verification Source 10 GHz | 100.0 x 100.0 x 100.0 | SN: 2005 | -- |

Exposure Conditions

| Phantom Section | Position, Test Distance [mm] | Band | Group, UID | Frequency [MHz], Channel Number | Conversion Factor |
|-----------------|------------------------------|-----------------|------------|---------------------------------|-------------------|
| 5G -- | 10.0 mm | Validation band | CW, 0-- | 10000.0, 10000 | 1.0 |

Hardware Setup

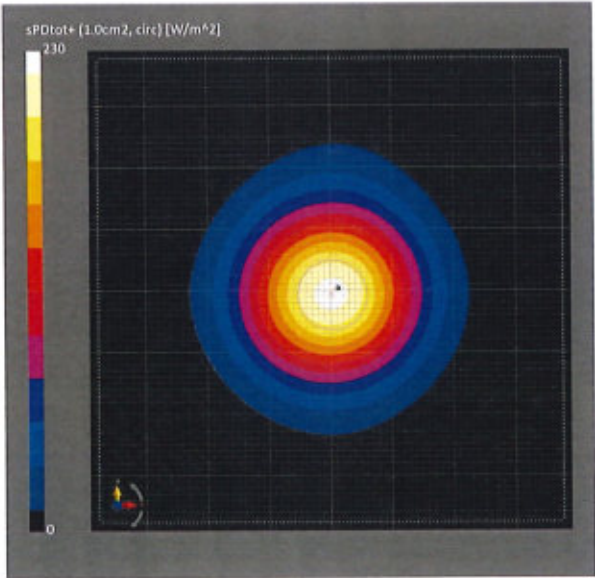
| Phantom | Medium | Probe, Calibration Date | DAE, Calibration Date |
|-------------------|--------|---|------------------------------|
| mmWave Phantom -- | Air -- | EUmmWV3 -- SN9374_F1--55GHz, 2024-08-28 | DAE4ip -- SN1602, 2024-11-06 |

Scans Setup

| | |
|---------------------|---------------|
| Sensor Surface [mm] | 10.0 |
| MAIA | MAIA not used |

Measurement Results

| | |
|---------------------------------|--------------------|
| Scan Type | 5G Scan |
| Date | 2024-12-04 |
| Avg. Area [cm ²] | 1.00 |
| Avg. Type | Circular Averaging |
| psPDn+ [W/m ²] | 218 |
| psPDtot+ [W/m ²] | 218 |
| psPDmod+ [W/m ²] | 220 |
| Max(Sn) [W/m ²] | 237 |
| Max(Stot) [W/m ²] | 237 |
| Max([Stot]) [W/m ²] | 237 |
| E _{max} [V/m] | 288 |
| Power Drift [dB] | 0.02 |



5G Verification Source 10 GHz - SN: 2005

December 4, 2024

DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 --, Channel 10000.0 (10000.0 MHz)

Device Under Test Properties

| Model, Manufacturer | Dimensions [mm] | IMEI | DUT Type |
|-------------------------------|-----------------------|----------|----------|
| 5G Verification Source 10 GHz | 100.0 x 100.0 x 100.0 | SN: 2005 | - |

Exposure Conditions

| Phantom Section | Position, Test Distance [mm] | Band | Group, UID | Frequency [MHz], Channel Number | Conversion Factor |
|-----------------|------------------------------|-----------------|------------|---------------------------------|-------------------|
| 5G -- | 10.0 mm | Validation band | CW, 0-- | 10000.0, 10000 | 1.0 |

Hardware Setup

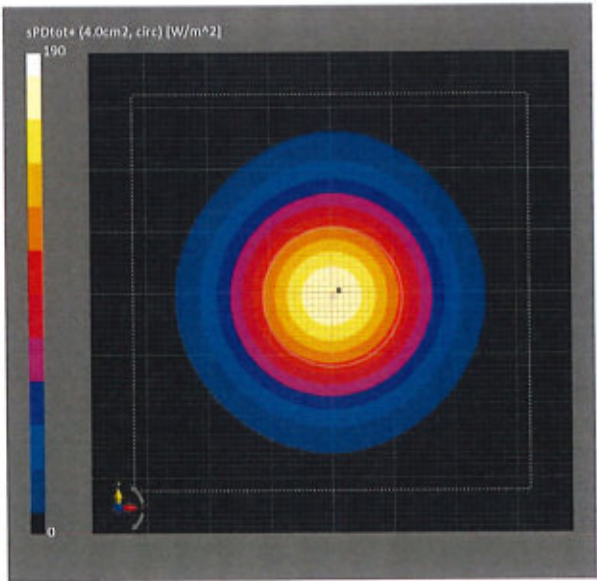
| Phantom | Medium | Probe, Calibration Date | DAE, Calibration Date |
|-------------------|--------|---|------------------------------|
| mmWave Phantom -- | Air -- | EUmmWV3 -- SN9374_F1--55GHz, 2024-08-28 | DAE4lp -- SN1602, 2024-11-06 |

Scans Setup

| | |
|---------------------|---------------|
| Sensor Surface [mm] | 10.0 |
| MAIA | MAIA not used |

Measurement Results

| | |
|---------------------------------|--------------------|
| Scan Type | 5G Scan |
| Date | 2024-12-04 |
| Avg. Area [cm ²] | 4.00 |
| Avg. Type | Circular Averaging |
| psPDn+ [W/m ²] | 172 |
| psPDtot+ [W/m ²] | 173 |
| psPDmod+ [W/m ²] | 177 |
| Max(Sn) [W/m ²] | 237 |
| Max(Stot) [W/m ²] | 237 |
| Max(Stot) [W/m ²] | 237 |
| E _{max} [V/m] | 288 |
| Power Drift [dB] | 0.02 |



5G Verification Source 10 GHz - SN: 2005

December 4, 2024

DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 --, Channel 10000.0 (10000.0 MHz)

Device Under Test Properties

| Model, Manufacturer | Dimensions [mm] | IMEI | DUT Type |
|-------------------------------|-----------------------|----------|----------|
| 5G Verification Source 10 GHz | 100.0 x 100.0 x 100.0 | SN: 2005 | - |

Exposure Conditions

| Phantom Section | Position, Test Distance [mm] | Band | Group, UID | Frequency [MHz], Channel Number | Conversion Factor |
|-----------------|------------------------------|-----------------|------------|---------------------------------|-------------------|
| 5G -- | 10.0 mm | Validation band | CW, 0-- | 10000.0, 10000 | 1.0 |

Hardware Setup

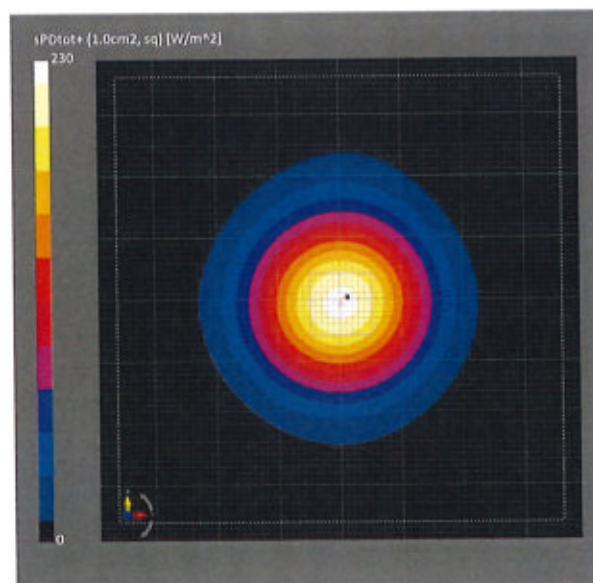
| Phantom | Medium | Probe, Calibration Date | DAE, Calibration Date |
|-------------------|--------|---|------------------------------|
| mmWave Phantom -- | Air -- | EUmmWV3 -- SN9374_F1 -- 55GHz, 2024-08-28 | DAE4ip -- SN1602, 2024-11-06 |

Scans Setup

| | |
|---------------------|---------------|
| Sensor Surface [mm] | 10.0 |
| MAIA | MAIA not used |

Measurement Results

| | |
|---------------------------------|------------------|
| Scan Type | 5G Scan |
| Date | 2024-12-04 |
| Avg. Area [cm ²] | 1.00 |
| Avg. Type | Square Averaging |
| psPDn+ [W/m ²] | 218 |
| psPDtot+ [W/m ²] | 218 |
| psPDmod+ [W/m ²] | 220 |
| Max(Sn) [W/m ²] | 237 |
| Max(Stot) [W/m ²] | 237 |
| Max(Stot) [W/m ²] | 237 |
| E _{max} [V/m] | 288 |
| Power Drift [dB] | 0.02 |



5G Verification Source 10 GHz - SN: 2005

December 4, 2024

DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 --, Channel 10000.0 (10000.0 MHz)

Device Under Test Properties

| Model, Manufacturer | Dimensions [mm] | IMEI | DUT Type |
|-------------------------------|-----------------------|----------|----------|
| 5G Verification Source 10 GHz | 100.0 x 100.0 x 100.0 | SN: 2005 | - |

Exposure Conditions

| Phantom Section | Position, Test Distance [mm] | Band | Group, UID | Frequency [MHz], Channel Number | Conversion Factor |
|-----------------|------------------------------|-----------------|------------|---------------------------------|-------------------|
| 5G -- | 10.0 mm | Validation band | CW, 0-- | 10000.0, 10000 | 1.0 |

Hardware Setup

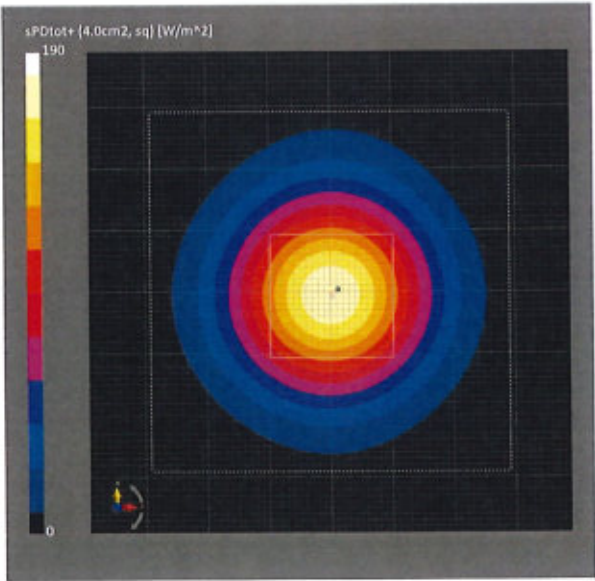
| Phantom | Medium | Probe, Calibration Date | DAE, Calibration Date |
|-------------------|--------|---|------------------------------|
| mmWave Phantom -- | Air -- | EUmmWV3 -- SN9374_F1--55GHz, 2024-08-28 | DAE4ip -- SN1602, 2024-11-06 |

Scans Setup

| | |
|---------------------|---------------|
| Sensor Surface [mm] | 10.0 |
| MAIA | MAIA not used |

Measurement Results

| | |
|---------------------------------|------------------|
| Scan Type | 5G Scan |
| Date | 2024-12-04 |
| Avg. Area [cm ²] | 4.00 |
| Avg. Type | Square Averaging |
| psPDn+ [W/m ²] | 171 |
| psPDtot+ [W/m ²] | 172 |
| psPDmod+ [W/m ²] | 177 |
| Max(Sn) [W/m ²] | 237 |
| Max(Stot) [W/m ²] | 237 |
| Max(Stot) [W/m ²] | 237 |
| E _{max} [V/m] | 288 |
| Power Drift [dB] | 0.02 |



IMPORTANT NOTICE

USAGE OF THE DAE4 SN: 1691

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention must be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the calibration procedure.

Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

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



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

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton**
Kunshan City

Certificate No: **DAE4-1691_Jun25**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BO - SN: 1691**

Calibration procedure(s) **QA CAL-06.v30**
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: **June 04, 2025**

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 |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 27-Aug-24 (No:40547) | Aug-25 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 23-Jan-25 (in house check) | In house check: Jan-26 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 23-Jan-25 (in house check) | In house check: Jan-26 |

Calibrated by: **Name** **Function**
Timo Rott **Laboratory Technician**

Signature

Approved by: **Sven Kühn** **Technical Manager**

Issued: June 4, 2025

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Glossary

| | |
|-----------------|---|
| DAE | data acquisition electronics |
| Connector angle | information used in DASY system to align probe sensor X to the robot coordinate system. |

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 405.095 \pm 0.02% (k=2) | 404.854 \pm 0.02% (k=2) | 404.949 \pm 0.02% (k=2) |
| Low Range | 3.99956 \pm 1.50% (k=2) | 3.99177 \pm 1.50% (k=2) | 3.99576 \pm 1.50% (k=2) |

Connector Angle

| | |
|---|-------------------|
| Connector Angle to be used in DASY system | 330.0 ° \pm 1 ° |
|---|-------------------|

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|------------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 199995.50 | -0.44 | -0.00 |
| Channel X | + Input | 20003.10 | 0.39 | 0.00 |
| Channel X | - Input | -20000.73 | 1.46 | -0.01 |
| Channel Y | + Input | 199994.12 | -1.77 | -0.00 |
| Channel Y | + Input | 20002.04 | -0.57 | -0.00 |
| Channel Y | - Input | -20000.07 | 2.36 | -0.01 |
| Channel Z | + Input | 199995.77 | -0.57 | -0.00 |
| Channel Z | + Input | 20001.33 | -1.23 | -0.01 |
| Channel Z | - Input | -20004.23 | -1.99 | 0.01 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|-----------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 2001.49 | 0.17 | 0.01 |
| Channel X | + Input | 201.99 | 0.46 | 0.23 |
| Channel X | - Input | -198.96 | -0.75 | 0.38 |
| Channel Y | + Input | 2001.07 | -0.13 | -0.01 |
| Channel Y | + Input | 201.35 | -0.00 | -0.00 |
| Channel Y | - Input | -199.76 | -1.40 | 0.71 |
| Channel Z | + Input | 2000.93 | -0.22 | -0.01 |
| Channel Z | + Input | 200.70 | -0.71 | -0.35 |
| Channel Z | - Input | -199.88 | -1.54 | 0.78 |

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|-----------------------------------|---|--|
| Channel X | 200 | -19.18 | -21.32 |
| | - 200 | 22.61 | 21.50 |
| Channel Y | 200 | -0.12 | -0.25 |
| | - 200 | -1.12 | -1.90 |
| Channel Z | 200 | -9.17 | -8.90 |
| | - 200 | 6.45 | 6.27 |

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | 1.43 | -3.46 |
| Channel Y | 200 | 6.12 | - | 2.18 |
| Channel Z | 200 | 8.91 | 4.52 | - |

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16258 | 13719 |
| Channel Y | 16068 | 16102 |
| Channel Z | 15952 | 16576 |

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 1.10 | -0.22 | 2.36 | 0.42 |
| Channel Y | -0.20 | -2.06 | 1.48 | 0.65 |
| Channel Z | -0.97 | -1.95 | -0.03 | 0.38 |

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9 |
| Supply (- Vcc) | -7.6 |

9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01 | +6 | +14 |
| Supply (- Vcc) | -0.01 | -8 | -9 |



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Client : **sporton**

Certificate No: **24J02Z000940**

CALIBRATION CERTIFICATE

Object **DAE4 - SN: 1650**

Calibration Procedure(s) **FF-Z11-002-01**
Calibration Procedure for the Data Acquisition Electronics (DAEx)


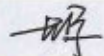

Calibration date: **November 25, 2024**

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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|------------------------|---------|--|-----------------------|
| Process Calibrator 753 | 1971018 | 11-Jun-24 (CTTL, No.24J02X005147) | Jun-25 |

| | Name | Function | Signature |
|----------------|-------------|--------------------|---|
| Calibrated by: | Yu Zongying | SAR Test Engineer |  |
| Reviewed by: | Lin Jun | SAR Test Engineer |  |
| Approved by: | Qi Dianyuan | SAR Project Leader |  |

Issued: November 25, 2024

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