

## ***Appendix D - Calibration Certificate for Dipole***



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Accreditation No.: **SCS 0108**

Client **Eurofins E&E Wireless**  
**New Taipei City**

Certificate No. **D2450V2-1087\_Jun24**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN:1087**

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

Calibration date: **June 14, 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 ( $22 \pm 3$ )°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         | 26-Mar-24 (No. 217-04036/04037) | Mar-25                |
| Power sensor NRP-Z91        | SN: 103244         | 26-Mar-24 (No. 217-04036)       | Mar-25                |
| Power sensor NRP-Z91        | SN: 103245         | 26-Mar-24 (No. 217-04037)       | Mar-25                |
| Reference 20 dB Attenuator  | SN: BH9394 (20k)   | 26-Mar-24 (No. 217-04046)       | Mar-25                |
| Type-N mismatch combination | SN: 310982 / 06327 | 26-Mar-24 (No. 217-04047)       | Mar-25                |
| Reference Probe EX3DV4      | SN: 7349           | 03-Nov-23 (No. EX3-7349_Nov23)  | Nov-24                |
| DAE4                        | SN: 601            | 22-May-24 (No. DAE4-601_May24)  | May-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: **Claudio Leubler**      Name: **Claudio Leubler**      Function: **Laboratory Technician**

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

Signature

Issued: June 17, 2024

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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 dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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

## Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | 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 | 37.9 $\pm$ 6 % | 1.86 mho/m $\pm$ 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 | 13.6 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 53.2 W/kg $\pm$ 17.0 % (k=2) |

|                                                         |                    |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
| SAR measured                                            | 250 mW input power | 6.30 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.9 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 | 52.2 $\Omega$ + 3.9 j $\Omega$ |
| Return Loss                          | - 27.2 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.162 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: 14.06.2024

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:1087**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.86$  S/m;  $\epsilon_r = 37.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.05.2024
- 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 = 115.9 V/m; Power Drift = 0.09 dB

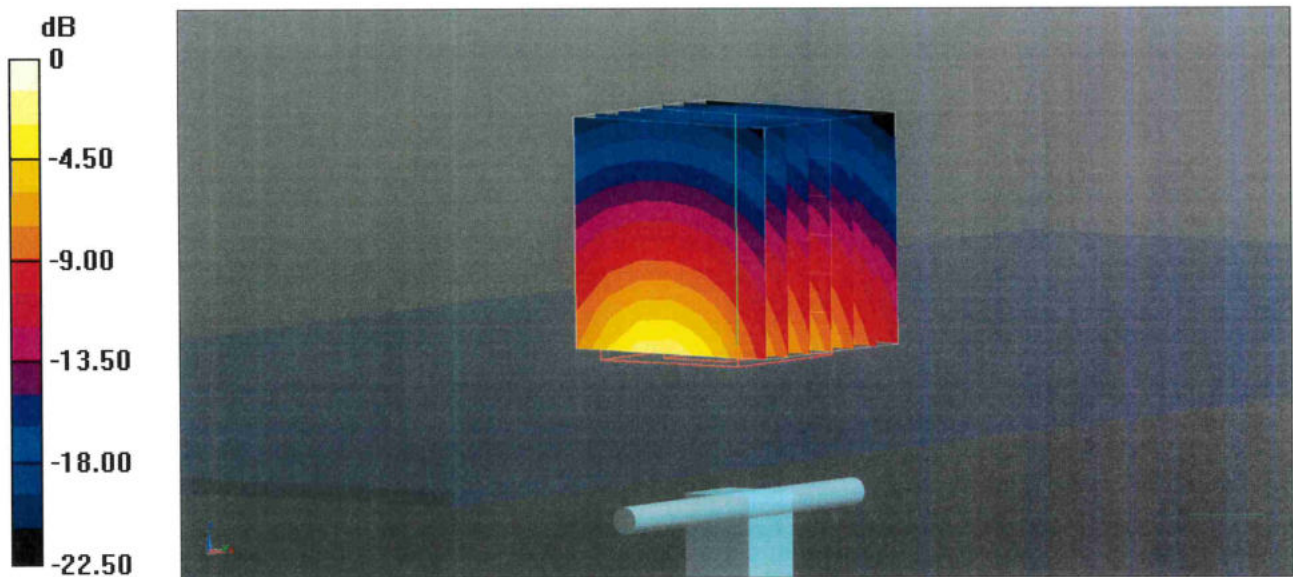
Peak SAR (extrapolated) = 27.1 W/kg

**SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.30 W/kg**

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

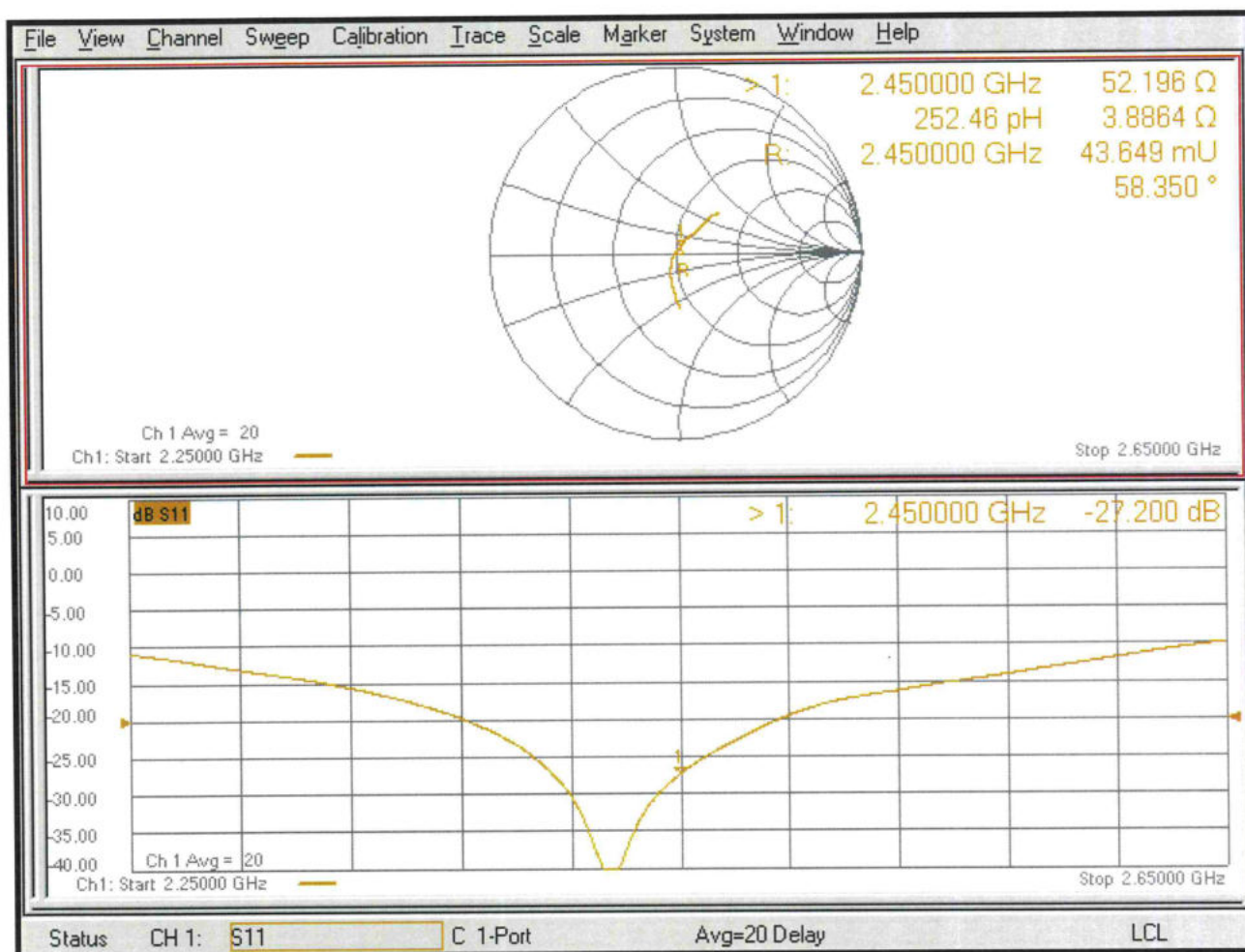
Ratio of SAR at M2 to SAR at M1 = 50.8%

Maximum value of SAR (measured) = 21.6 W/kg



0 dB = 21.6 W/kg = 13.34 dBW/kg

## Impedance Measurement Plot for Head TSL





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Accreditation No.: **SCS 0108**

Client **Eurofins E&E Wireless**  
 New Taipei City

Certificate No. **D6.5GHzV2-1081\_Jun24**

## CALIBRATION CERTIFICATE

Object **D6.5GHzV2 - SN:1081**

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

Calibration date: **June 11, 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 ( $22 \pm 3$ )°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         | 12-Jun-23 (No. EX3-7405_Jun23) | Jun-24                |
| 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 Oct-22) | In house check: Oct-25 |

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

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

Signature

*Leif Klysner*

*i. A. S. Kühn*

Issued: June 12, 2024

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Accreditation No.: **SCS 0108**

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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.

### Additional Documentation:

- b) 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.

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

## Head TSL parameters

The following parameters and calculations were applied.

|                                                | <b>Temperature</b>  | <b>Permittivity</b> | <b>Conductivity</b>  |
|------------------------------------------------|---------------------|---------------------|----------------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C             | 34.5                | 6.07 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 34.3 $\pm$ 6 %      | 6.22 mho/m $\pm$ 6 % |
| <b>Head TSL temperature change during test</b> | < 0.5 °C            | ----                | ----                 |

## SAR result with Head TSL

|                                                             |                    |                                               |
|-------------------------------------------------------------|--------------------|-----------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                               |
| SAR measured                                                | 100 mW input power | 28.8 W/kg                                     |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>288 W/kg <math>\pm</math> 24.7 % (k=2)</b> |

|                                                             |                    |                                                |
|-------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 8 cm<sup>3</sup> (8 g) of Head TSL</b> | Condition          |                                                |
| SAR measured                                                | 100 mW input power | 6.51 W/kg                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>65.0 W/kg <math>\pm</math> 24.4 % (k=2)</b> |

|                                                               |                    |                                                |
|---------------------------------------------------------------|--------------------|------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                                |
| SAR measured                                                  | 100 mW input power | 5.33 W/kg                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>53.2 W/kg <math>\pm</math> 24.4 % (k=2)</b> |

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

### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 45.3 $\Omega$ - 1.7 j $\Omega$ |
| Return Loss                          | - 25.6 dB                      |

### APD (Absorbed Power Density)

| APD averaged over 1 cm <sup>2</sup> | Condition          |                                                           |
|-------------------------------------|--------------------|-----------------------------------------------------------|
| APD measured                        | 100 mW input power | 287 W/m <sup>2</sup>                                      |
| APD measured                        | normalized to 1W   | <b>2870 W/m<sup>2</sup> <math>\pm</math> 29.2 % (k=2)</b> |

| APD averaged over 4 cm <sup>2</sup> | condition          |                                                           |
|-------------------------------------|--------------------|-----------------------------------------------------------|
| APD measured                        | 100 mW input power | 130 W/m <sup>2</sup>                                      |
| APD measured                        | normalized to 1W   | <b>1300 W/m<sup>2</sup> <math>\pm</math> 28.9 % (k=2)</b> |

\*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-1081, 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: 1081 | -        |

Exposure Conditions

| Phantom<br>Section, TSL | Position, Test<br>Distance<br>[mm] | Band | Group,<br>UID | Frequency<br>[MHz] | Conversion<br>Factor | TSL Cond.<br>[S/m] | TSL<br>Permittivity |
|-------------------------|------------------------------------|------|---------------|--------------------|----------------------|--------------------|---------------------|
| Flat, HSL               | 5.00                               | Band | CW,           | 6500               | 5.50                 | 6.22               | 34.3                |

Hardware Setup

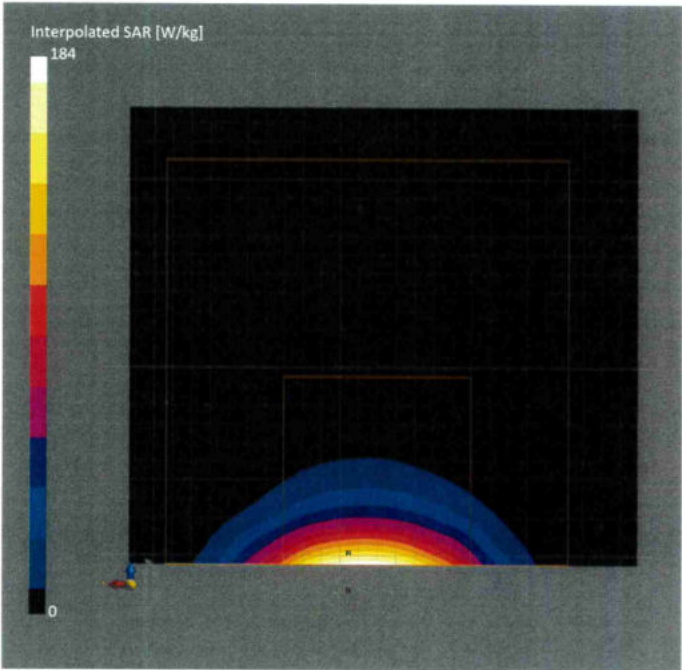
| Phantom                | TSL             | Probe, Calibration Date     | DAE, Calibration Date  |
|------------------------|-----------------|-----------------------------|------------------------|
| MFP V8.0 Center - 1182 | HBBL600-10000V6 | EX3DV4 - SN7405, 2023-06-12 | DAE4 Sn908, 2024-03-27 |

Scan Setup

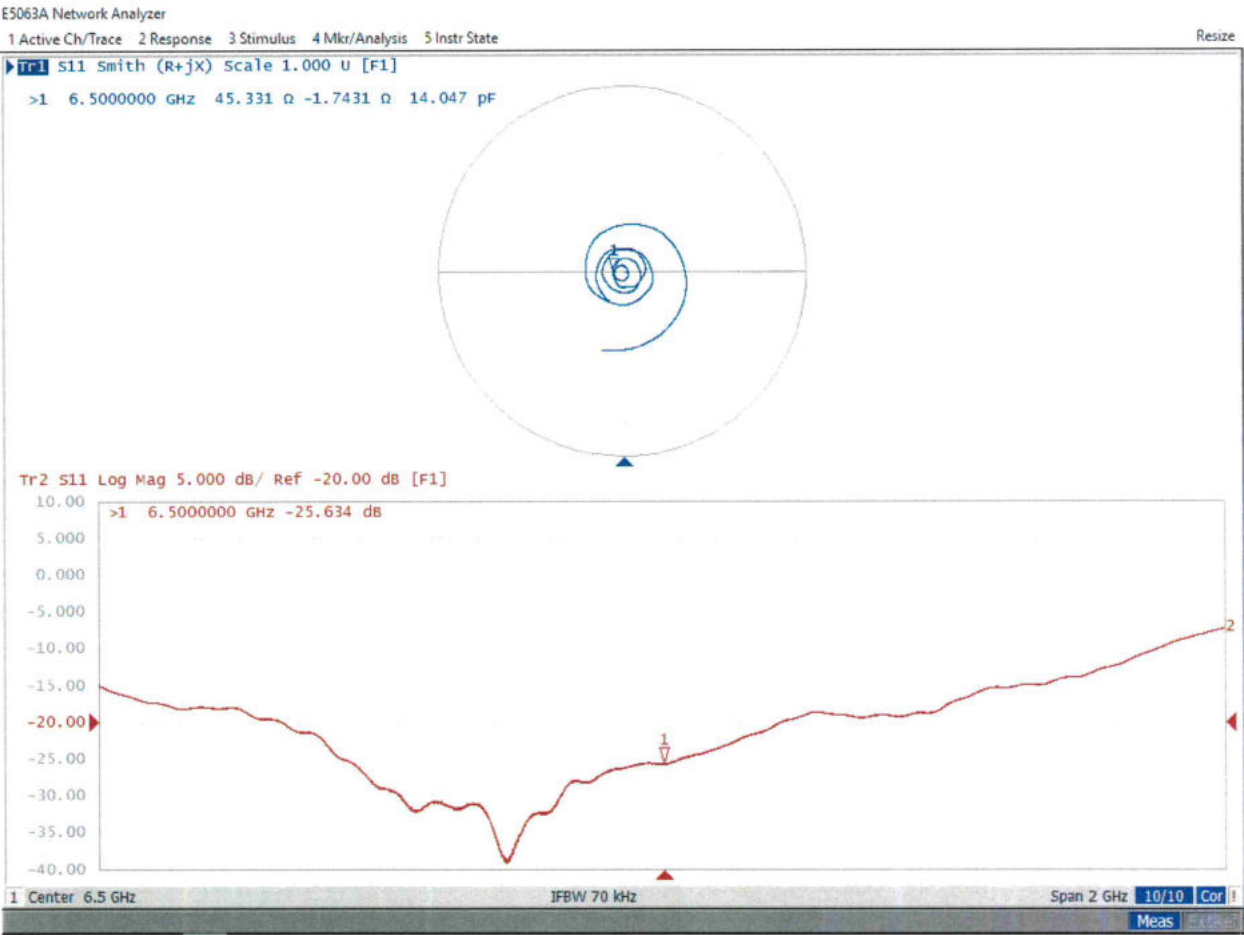
|                     | Zoom Scan          |
|---------------------|--------------------|
| Grid Extents [mm]   | 22.0 x 22.0 x 22.0 |
| Grid Steps [mm]     | 3.4 x 3.4 x 1.4    |
| Sensor Surface [mm] | 1.4                |
| Graded Grid         | Yes                |
| Grading Ratio       | 1.4   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

Measurement Results

|                     | Zoom Scan         |
|---------------------|-------------------|
| Date                | 2024-06-11, 13:30 |
| psSAR1g [W/Kg]      | 28.8              |
| psSAR8g [W/Kg]      | 6.51              |
| psSAR10g [W/Kg]     | 5.33              |
| Power Drift [dB]    | 0.03              |
| Power Scaling       | Disabled          |
| Scaling Factor [dB] |                   |
| TSL Correction      | No correction     |
| M2/M1 [%]           | 50.3              |
| Dist 3dB Peak [mm]  | 4.8               |



Impedance Measurement Plot for Head TSL





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Accreditation No.: **SCS 0108**

Client **Eurofins E&E Wireless**  
**New Taipei City**

Certificate No. **5G-Veri10-1060\_Sep24**

## CALIBRATION CERTIFICATE

Object **5G Verification Source 10 GHz - SN: 1060**

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

Calibration date: **September 17, 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  |
|----------------------------------|----------------|-----------------------------------|------------------------|
| Reference Probe EUmmWV3          | SN: 9374       | 28-Aug-24 (No. EUmm-9374_Aug24)   | Aug-25                 |
| DAE4ip                           | SN: 1602       | 08-Nov-23 (No. DAE4ip-1602_Nov23) | Nov-24                 |
| Secondary Standards              | ID #           | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMF100A         | SN: 100184     | 29-Nov-23 (in house check Nov-23) | In house check: Nov-24 |
| Power sensor R&S NRP18S-10       | SN: 101258     | 29-Nov-23 (in house check Nov-23) | In house check: Nov-24 |
| Network Analyzer Keysight E5063A | SN: MY54504221 | 31-Oct-19 (in house check Oct-22) | In house check: Oct-25 |

Calibrated by: **Joanna Lleshaj**      Name: **Joanna Lleshaj**      Function: **Laboratory Technician**

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

Signature

Issued: September 18, 2024

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## Glossary

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

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:* E field is measured in two x-y-plane (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 (1cm<sup>2</sup> and 4cm<sup>2</sup>) 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/m<sup>2</sup>) averaged over the surface area of 1 cm<sup>2</sup> and 4cm<sup>2</sup> 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 GHz $\pm$ 10 MHz           |      |

## Calibration Parameters, 10 GHz

### Circular Averaging

| Distance Horn Aperture to Measured Plane | <i>Prad</i> <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Avg Power Density<br>Avg (psPDn+, psPDtot+, psPDmod+) (W/m <sup>2</sup> ) |                   | Uncertainty (k = 2) |
|------------------------------------------|-------------------------------|-------------------|---------------------|---------------------------------------------------------------------------|-------------------|---------------------|
|                                          |                               |                   |                     | 1 cm <sup>2</sup>                                                         | 4 cm <sup>2</sup> |                     |
| 10 mm                                    | 93.3                          | 153               | 1.27 dB             | 60.6                                                                      | 56.5              | 1.28 dB             |

| Distance Horn Aperture to Measured Plane | <i>Prad</i> <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Power Density<br>psPDn+, psPDtot+, psPDmod+ (W/m <sup>2</sup> ) |                   | Uncertainty (k = 2) |
|------------------------------------------|-------------------------------|-------------------|---------------------|-----------------------------------------------------------------|-------------------|---------------------|
|                                          |                               |                   |                     | 1 cm <sup>2</sup>                                               | 4 cm <sup>2</sup> |                     |
| 10 mm                                    | 93.3                          | 153               | 1.27 dB             | 60.4, 60.6, 60.8                                                | 56.2, 56.5, 56.7  | 1.28 dB             |

### Square Averaging

| Distance Horn Aperture to Measured Plane | <i>Prad</i> <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Avg Power Density<br>Avg (psPDn+, psPDtot+, psPDmod+) (W/m <sup>2</sup> ) |                   | Uncertainty (k = 2) |
|------------------------------------------|-------------------------------|-------------------|---------------------|---------------------------------------------------------------------------|-------------------|---------------------|
|                                          |                               |                   |                     | 1 cm <sup>2</sup>                                                         | 4 cm <sup>2</sup> |                     |
| 10 mm                                    | 93.3                          | 153               | 1.27 dB             | 60.5                                                                      | 56.4              | 1.28 dB             |

| Distance Horn Aperture to Measured Plane | <i>Prad</i> <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Power Density<br>psPDn+, psPDtot+, psPDmod+ (W/m <sup>2</sup> ) |                   | Uncertainty (k = 2) |
|------------------------------------------|-------------------------------|-------------------|---------------------|-----------------------------------------------------------------|-------------------|---------------------|
|                                          |                               |                   |                     | 1 cm <sup>2</sup>                                               | 4 cm <sup>2</sup> |                     |
| 10 mm                                    | 93.3                          | 153               | 1.27 dB             | 60.3, 60.5, 60.7                                                | 56.1, 56.4, 56.6  | 1.28 dB             |

### Max Power Density

| Distance Horn Aperture to Measured Plane | <i>Prad</i> <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Max Power Density<br>Sn, Stot,  Stot  (W/m <sup>2</sup> ) | Uncertainty (k = 2) |
|------------------------------------------|-------------------------------|-------------------|---------------------|-----------------------------------------------------------|---------------------|
| 10 mm                                    | 93.3                          | 153               | 1.27 dB             | 61.9, 62.0, 62.2                                          | 1.28 dB             |

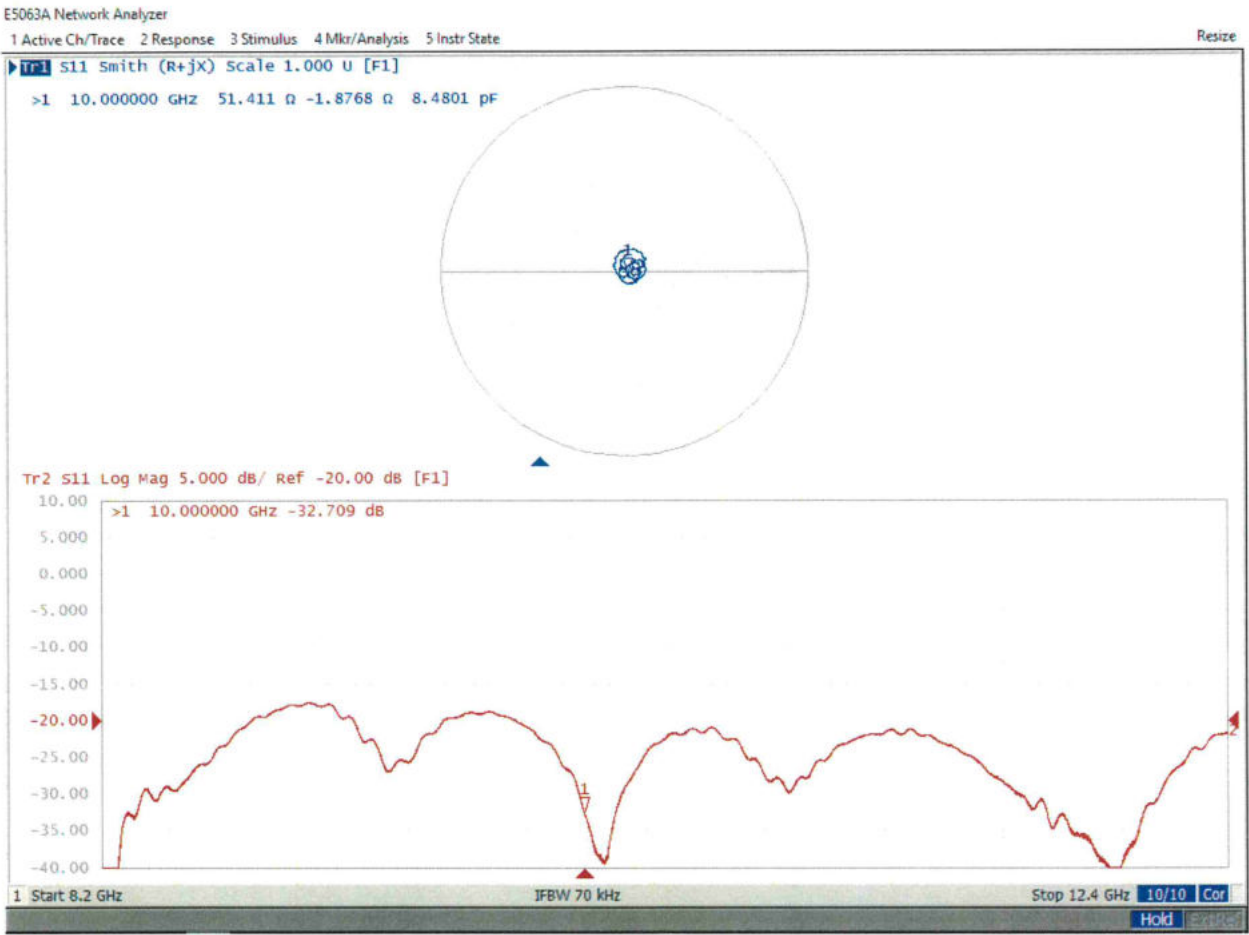
<sup>1</sup> Assessed ohmic and mismatch loss plus numerical offset: 0.30 dB

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.4 $\Omega$ - 1.9 j $\Omega$ |
| Return Loss                          | - 32.7 dB                      |

Impedance Measurement Plot



DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Device under Test Properties

| Name, Manufacturer            | Dimensions [mm]       | IMEI     | DUT Type |
|-------------------------------|-----------------------|----------|----------|
| 5G Verification Source 10 GHz | 100.0 x 100.0 x 172.0 | SN: 1060 | -        |

Exposure Conditions

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

Hardware Setup

| Phantom               | Medium | Probe, Calibration Date               | DAE, Calibration Date     |
|-----------------------|--------|---------------------------------------|---------------------------|
| mmWave Phantom - 1002 | Air    | EUmmWV3 - SN9374_F1-55GHz, 2024-08-28 | DAE4ip Sn1602, 2023-11-08 |

Scan Setup

| Sensor Surface [mm] | 5G Scan               |
|---------------------|-----------------------|
| MAIA                | 10.0<br>MAIA not used |

Measurement Results

| Date                   | 5G Scan            |
|------------------------|--------------------|
| Avg. Area [cm²]        | 2024-09-17, 16:32  |
| Avg. Type              | 1.00               |
| psPDn+ [W/m²]          | Circular Averaging |
| psPDtot+ [W/m²]        | 60.4               |
| psPDmod+ [W/m²]        | 60.6               |
| Max(Sn) [W/m²]         | 60.8               |
| Max(Stot) [W/m²]       | 61.9               |
| Max( Stot ) [W/m²]     | 62.0               |
| E <sub>max</sub> [V/m] | 62.2               |
| Power Drift [dB]       | 153                |
|                        | -0.04              |



DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Device under Test Properties

| Name, Manufacturer            | Dimensions [mm]       | IMEI     | DUT Type |
|-------------------------------|-----------------------|----------|----------|
| 5G Verification Source 10 GHz | 100.0 x 100.0 x 172.0 | SN: 1060 | -        |

Exposure Conditions

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

Hardware Setup

| Phantom               | Medium | Probe, Calibration Date               | DAE, Calibration Date     |
|-----------------------|--------|---------------------------------------|---------------------------|
| mmWave Phantom - 1002 | Air    | EUmmWV3 - SN9374_F1-55GHz, 2024-08-28 | DAE4ip Sn1602, 2023-11-08 |

Scan Setup

| Sensor Surface [mm] | 5G Scan               |
|---------------------|-----------------------|
| MAIA                | 10.0<br>MAIA not used |

Measurement Results

|                        | 5G Scan            |
|------------------------|--------------------|
| Date                   | 2024-09-17, 16:32  |
| Avg. Area [cm²]        | 4.00               |
| Avg. Type              | Circular Averaging |
| psPDn+ [W/m²]          | 56.2               |
| psPDtot+ [W/m²]        | 56.5               |
| psPDmod+ [W/m²]        | 56.7               |
| Max(Sn) [W/m²]         | 61.9               |
| Max(Stot) [W/m²]       | 62.0               |
| Max( Stot ) [W/m²]     | 62.2               |
| E <sub>max</sub> [V/m] | 153                |
| Power Drift [dB]       | -0.04              |



DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Device under Test Properties

| Name, Manufacturer            | Dimensions [mm]       | IMEI     | DUT Type |
|-------------------------------|-----------------------|----------|----------|
| 5G Verification Source 10 GHz | 100.0 x 100.0 x 172.0 | SN: 1060 | -        |

Exposure Conditions

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

Hardware Setup

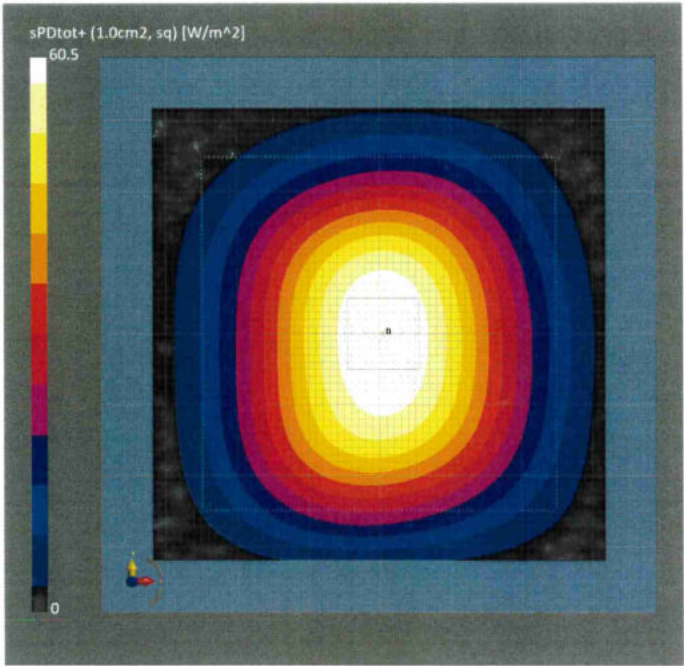
| Phantom               | Medium | Probe, Calibration Date               | DAE, Calibration Date     |
|-----------------------|--------|---------------------------------------|---------------------------|
| mmWave Phantom - 1002 | Air    | EUmmWV3 - SN9374_F1-55GHz, 2024-08-28 | DAE4ip Sn1602, 2023-11-08 |

Scan Setup

| Sensor Surface [mm] | 5G Scan               |
|---------------------|-----------------------|
| MAIA                | 10.0<br>MAIA not used |

Measurement Results

|                        | 5G Scan           |
|------------------------|-------------------|
| Date                   | 2024-09-17, 16:32 |
| Avg. Area [cm²]        | 1.00              |
| Avg. Type              | Square Averaging  |
| psPDn+ [W/m²]          | 60.3              |
| psPDtot+ [W/m²]        | 60.5              |
| psPDmod+ [W/m²]        | 60.7              |
| Max(Sn) [W/m²]         | 61.9              |
| Max(Stot) [W/m²]       | 62.0              |
| Max( Stot ) [W/m²]     | 62.2              |
| E <sub>max</sub> [V/m] | 153               |
| Power Drift [dB]       | -0.04             |



DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Device under Test Properties

| Name, Manufacturer            | Dimensions [mm]       | IMEI     | DUT Type |
|-------------------------------|-----------------------|----------|----------|
| 5G Verification Source 10 GHz | 100.0 x 100.0 x 172.0 | SN: 1060 | -        |

Exposure Conditions

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

Hardware Setup

| Phantom               | Medium | Probe, Calibration Date               | DAE, Calibration Date     |
|-----------------------|--------|---------------------------------------|---------------------------|
| mmWave Phantom - 1002 | Air    | EUmmWV3 - SN9374_F1-55GHz, 2024-08-28 | DAE4ip Sn1602, 2023-11-08 |

Scan Setup

| Sensor Surface [mm] | 5G Scan               |
|---------------------|-----------------------|
| MAIA                | 10.0<br>MAIA not used |

Measurement Results

| Date                   | 5G Scan                   |
|------------------------|---------------------------|
| Avg. Area [cm²]        | 2024-09-17, 16:32<br>4.00 |
| Avg. Type              | Square Averaging          |
| psPDn+ [W/m²]          | 56.1                      |
| psPDtot+ [W/m²]        | 56.4                      |
| psPDmod+ [W/m²]        | 56.6                      |
| Max(Sn) [W/m²]         | 61.9                      |
| Max(Stot) [W/m²]       | 62.0                      |
| Max( Stot ) [W/m²]     | 62.2                      |
| E <sub>max</sub> [V/m] | 153                       |
| Power Drift [dB]       | -0.04                     |

