

### Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

|                                                | Temperature   | Permittivity | Conductivity   |
|------------------------------------------------|---------------|--------------|----------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C       | 35.5         | 5.07 mho/m     |
| <b>Measured Head TSL parameters</b>            | (22.0 ±0.2)°C | 35.4 ±6%     | 4.98 mho/m ±6% |
| <b>Head TSL temperature change during test</b> | < 0.5 °C      |              |                |

### SAR result with Head TSL at 5600 MHz

| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                          |
|-------------------------------------------------------------|--------------------|--------------------------|
| SAR for nominal Head TSL parameters                         | 20 dBm input power | 8.28 W/kg                |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | 82.8 W/kg ±19.9% (k = 2) |

| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | Condition          |                          |
|---------------------------------------------------------------|--------------------|--------------------------|
| SAR for nominal Head TSL parameters                           | 20 dBm input power | 2.38 W/kg                |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | 23.8 W/kg ±19.5% (k = 2) |

### Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

|                                                | Temperature   | Permittivity | Conductivity   |
|------------------------------------------------|---------------|--------------|----------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C       | 35.3         | 5.27 mho/m     |
| <b>Measured Head TSL parameters</b>            | (22.0 ±0.2)°C | 35.1 ±6%     | 5.20 mho/m ±6% |
| <b>Head TSL temperature change during test</b> | < 0.5 °C      |              |                |

### SAR result with Head TSL at 5800 MHz

| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                          |
|-------------------------------------------------------------|--------------------|--------------------------|
| SAR for nominal Head TSL parameters                         | 20 dBm input power | 7.99 W/kg                |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | 79.9 W/kg ±19.9% (k = 2) |

| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | Condition          |                          |
|---------------------------------------------------------------|--------------------|--------------------------|
| SAR for nominal Head TSL parameters                           | 20 dBm input power | 2.29 W/kg                |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | 22.9 W/kg ±19.5% (k = 2) |

**Appendix (Additional assessments outside the scope of SCS 0108)****Antenna Parameters with Head TSL at 5250 MHz**

|             |                                |
|-------------|--------------------------------|
| Impedance   | 48.2 $\Omega$ + 3.2 j $\Omega$ |
| Return Loss | -28.5 dB                       |

**Antenna Parameters with Head TSL at 5600 MHz**

|             |                                |
|-------------|--------------------------------|
| Impedance   | 56.8 $\Omega$ – 1.2 j $\Omega$ |
| Return Loss | -23.8 dB                       |

**Antenna Parameters with Head TSL at 5800 MHz**

|             |                                |
|-------------|--------------------------------|
| Impedance   | 53.8 $\Omega$ – 1.7 j $\Omega$ |
| Return Loss | -27.9 dB                       |

**General Antenna Parameters and Design**

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.195 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 |
|-----------------|-------|

D5GHzV2 - SN: 1341

December 12, 2024

System Performance Check Report

Summary

|                  |                 |     |             |
|------------------|-----------------|-----|-------------|
| Dipole           | Frequency [MHz] | TSL | Power [dBm] |
| D5GHzV2 – SN1341 | 5250            | HSL | 20          |

Exposure Conditions

|                      |                    |      |            |                                 |                   |                        |                  |
|----------------------|--------------------|------|------------|---------------------------------|-------------------|------------------------|------------------|
| Phantom Section, TSL | Test Distance [mm] | Band | Group, UID | Frequency [MHz], Channel Number | Conversion Factor | TSL Conductivity [S/m] | TSL Permittivity |
| Flat                 | 10                 |      | CW, 0--    | 5250, 0                         | 5.58              | 4.60                   | 36.0             |

Hardware Setup

|                 |                    |                             |                           |
|-----------------|--------------------|-----------------------------|---------------------------|
| Phantom         | TSL, Measured Date | Probe, Calibration Date     | DAE, Calibration Date     |
| MFP V8.0 Center | HSL, 2024-12-12    | EX3DV4 – SN7349, 2024-06-03 | DAE4ip Sn1836, 2024-10-28 |

Scans Setup

|                     |                 |
|---------------------|-----------------|
|                     | Zoom Scan       |
| Grid Extents [mm]   | 22 x 22 x 22    |
| Grid Steps [mm]     | 4.0 x 4.0 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                | 2024-12-12          |
| psSAR1g [W/Kg]      | 7.91                |
| psSAR10g [W/Kg]     | 2.24                |
| Power Drift [dB]    | 0.00                |
| Power Scaling       | Disabled            |
| Scaling Factor [dB] |                     |
| TSL Correction      | Positive / Negative |



0 dB = 32.4 W/Kg

D5GHzV2 - SN: 1341

December 12, 2024

System Performance Check Report

Summary

|                  |                 |     |             |
|------------------|-----------------|-----|-------------|
| Dipole           | Frequency [MHz] | TSL | Power [dBm] |
| D5GHzV2 - SN1341 | 5600            | HSL | 20          |

Exposure Conditions

|                      |                    |      |            |                                 |                   |                        |                  |
|----------------------|--------------------|------|------------|---------------------------------|-------------------|------------------------|------------------|
| Phantom Section, TSL | Test Distance [mm] | Band | Group, UID | Frequency [MHz], Channel Number | Conversion Factor | TSL Conductivity [S/m] | TSL Permittivity |
| Flat                 | 10                 |      | CW, 0--    | 5600, 0                         | 5.03              | 4.98                   | 35.4             |

Hardware Setup

|                 |                    |                             |                           |
|-----------------|--------------------|-----------------------------|---------------------------|
| Phantom         | TSL, Measured Date | Probe, Calibration Date     | DAE, Calibration Date     |
| MFP V8.0 Center | HSL, 2024-12-12    | EX3DV4 - SN7349, 2024-06-03 | DAE4ip Sn1836, 2024-10-28 |

Scans Setup

|                     |                 |
|---------------------|-----------------|
|                     | Zoom Scan       |
| Grid Extents [mm]   | 22 x 22 x 22    |
| Grid Steps [mm]     | 4.0 x 4.0 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                | 2024-12-12          |
| psSAR1g [W/Kg]      | 8.28                |
| psSAR10g [W/Kg]     | 2.38                |
| Power Drift [dB]    | 0.00                |
| Power Scaling       | Disabled            |
| Scaling Factor [dB] |                     |
| TSL Correction      | Positive / Negative |



0 dB = 36.0 W/Kg

D5GHzV2 - SN: 1341

December 12, 2024

System Performance Check Report

Summary

|                  |                 |     |             |
|------------------|-----------------|-----|-------------|
| Dipole           | Frequency [MHz] | TSL | Power [dBm] |
| D5GHzV2 - SN1341 | 5800            | HSL | 20          |

Exposure Conditions

|                      |                    |      |            |                                 |                   |                        |                  |
|----------------------|--------------------|------|------------|---------------------------------|-------------------|------------------------|------------------|
| Phantom Section, TSL | Test Distance [mm] | Band | Group, UID | Frequency [MHz], Channel Number | Conversion Factor | TSL Conductivity [S/m] | TSL Permittivity |
| Flat                 | 10                 |      | CW, 0--    | 5800, 0                         | 5.08              | 5.20                   | 35.1             |

Hardware Setup

|                 |                    |                             |                           |
|-----------------|--------------------|-----------------------------|---------------------------|
| Phantom         | TSL, Measured Date | Probe, Calibration Date     | DAE, Calibration Date     |
| MFP V8.0 Center | HSL, 2024-12-12    | EX3DV4 - SN7349, 2024-06-03 | DAE4ip Sn1836, 2024-10-28 |

Scans Setup

|                     |                 |
|---------------------|-----------------|
|                     | Zoom Scan       |
| Grid Extents [mm]   | 22 x 22 x 22    |
| Grid Steps [mm]     | 4.0 x 4.0 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

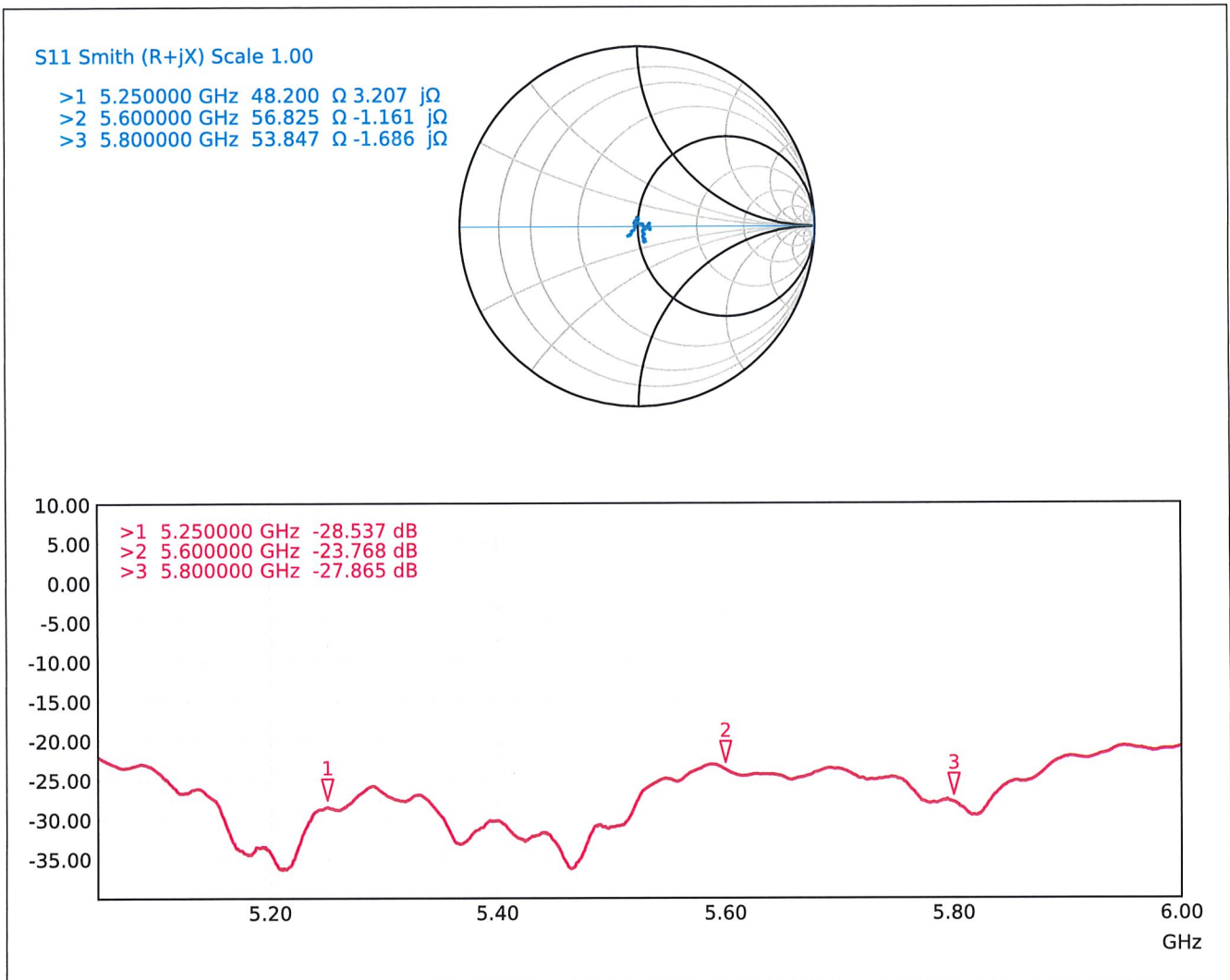
|                     |                     |
|---------------------|---------------------|
|                     | Zoom Scan           |
| Date                | 2024-12-12          |
| psSAR1g [W/Kg]      | 7.99                |
| psSAR10g [W/Kg]     | 2.29                |
| Power Drift [dB]    | -0.02               |
| Power Scaling       | Disabled            |
| Scaling Factor [dB] |                     |
| TSL Correction      | Positive / Negative |



0 dB = 36.7 W/Kg

D5GHzV2 - SN: 1341

December 12, 2024

**Impedance Measurement Plot for Head TSL**

**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

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

Accreditation No.: SCS 0108

Client

Sporton  
Shenzhen

Certificate No.

5G-Veri10-2002\_Feb25/2

**CALIBRATION CERTIFICATE (Replacement of No: 5G-Veri10-2002\_Feb25)**

Object

5G Verification Source 10 GHz - SN: 2002

Calibration procedure(s)

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

Calibration date

February 20, 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 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 24, 2025                                                                                          |                |                       |           |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                |                       |           |

**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

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

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

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 (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.

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

## Calibration Parameters, 10 GHz

### Circular Averaging

| Distance Horn Aperture to Measurement Plane | Prad <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Avg Power Density<br>Avg ( psPDn+, psPDtot+, psPDmod+ )<br>(W/m <sup>2</sup> ) |                  | Uncertainty (k = 2) |
|---------------------------------------------|------------------------|-------------------|---------------------|--------------------------------------------------------------------------------|------------------|---------------------|
|                                             |                        |                   |                     | 1cm <sup>2</sup>                                                               | 4cm <sup>2</sup> |                     |
| 10 mm                                       | 138.0                  | 286               | 1.27 dB             | 213                                                                            | 169              | 1.28 dB             |

| Distance Horn Aperture to Measurement Plane | Prad <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Power Density<br>psPDn+, psPDtot+, psPDmod+<br>(W/m <sup>2</sup> ) |                  | Uncertainty (k = 2) |
|---------------------------------------------|------------------------|-------------------|---------------------|--------------------------------------------------------------------|------------------|---------------------|
|                                             |                        |                   |                     | 1cm <sup>2</sup>                                                   | 4cm <sup>2</sup> |                     |
| 10 mm                                       | 138.0                  | 286               | 1.27 dB             | 212, 213, 215                                                      | 167, 168, 172    | 1.28 dB             |

### Square Averaging

| Distance Horn Aperture to Measurement Plane | Prad <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Avg Power Density<br>Avg ( psPDn+, psPDtot+, psPDmod+ )<br>(W/m <sup>2</sup> ) |                  | Uncertainty (k = 2) |
|---------------------------------------------|------------------------|-------------------|---------------------|--------------------------------------------------------------------------------|------------------|---------------------|
|                                             |                        |                   |                     | 1cm <sup>2</sup>                                                               | 4cm <sup>2</sup> |                     |
| 10 mm                                       | 138.0                  | 286               | 1.27 dB             | 213                                                                            | 168              | 1.28 dB             |

| Distance Horn Aperture to Measurement Plane | Prad <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Power Density<br>psPDn+, psPDtot+, psPDmod+<br>(W/m <sup>2</sup> ) |                  | Uncertainty (k = 2) |
|---------------------------------------------|------------------------|-------------------|---------------------|--------------------------------------------------------------------|------------------|---------------------|
|                                             |                        |                   |                     | 1cm <sup>2</sup>                                                   | 4cm <sup>2</sup> |                     |
| 10 mm                                       | 138.0                  | 286               | 1.27 dB             | 212, 213, 215                                                      | 166, 167, 172    | 1.28 dB             |

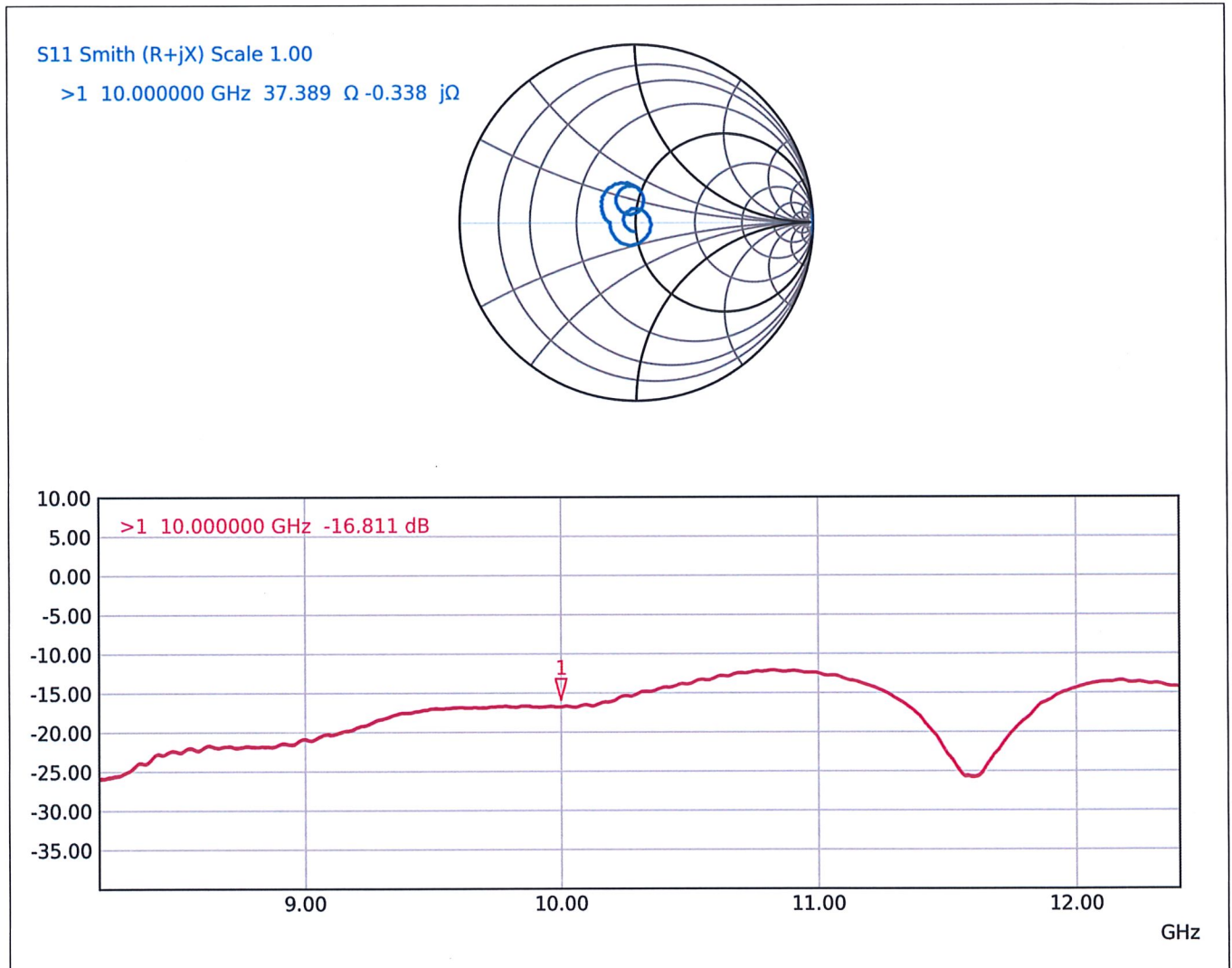
### Max Power Density

| Distance Horn Aperture to Measurement Plane | Prad <sup>1</sup> (mW) | Max E-field (V/m) | Uncertainty (k = 2) | Max Power Density Sn, Stot,  Stot  (W/m <sup>2</sup> ) | Uncertainty (k = 2) |
|---------------------------------------------|------------------------|-------------------|---------------------|--------------------------------------------------------|---------------------|
| 10 mm                                       | 138.0                  | 286               | 1.27 dB             | 231, 232, 232                                          | 1.28 dB             |

<sup>1</sup> 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 | 37.4 $\Omega$ – 0.3 j $\Omega$ |
| Return Loss                          | -16.8 dB                       |

**Impedance Measurement Plot**

5G Verification Source 10 GHz - SN: 2002

February 20, 2025

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: 2002 | -        |

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                            | 2025-02-20         |
| Avg. Area [cm <sup>2</sup> ]    | 1.00               |
| Avg. Type                       | Circular Averaging |
| psPDn+ [W/m <sup>2</sup> ]      | 212                |
| psPDtot+ [W/m <sup>2</sup> ]    | 213                |
| psPDmod+ [W/m <sup>2</sup> ]    | 215                |
| Max(Sn) [W/m <sup>2</sup> ]     | 231                |
| Max(Stot) [W/m <sup>2</sup> ]   | 232                |
| Max( Stot ) [W/m <sup>2</sup> ] | 232                |
| E <sub>max</sub> [V/m]          | 286                |
| Power Drift [dB]                | 0.0                |

