| | | | | |
|---|---|---|---|---|
| **Prüfbericht-Nr.:** *Test report no.:* | **CN26FBZZ 003** | **Auftrags-Nr.:** *Order no.:* | 27243298 | Seite 1 von 26 *Page 1 of 26* |
| **Kunden-Referenz-Nr.:** *Client reference no.:* | N/A | **Auftragsdatum:** *Order date:* | 2026-06-23 | |
| **Auftraggeber:** *Client:* | **SHOKZ (SINGAPORE) PTE. LTD.** 11 NORTH BUONA VISTA DRIVE #16-09 THE METROPOLIS, SINGAPORE 138589, Singapore | | | |
| **Prüfgegenstand:** *Test item:* | OPENFIT 2 AI | | | |
| **Bezeichnung / Typ-Nr.:** *Identification / Type no.:* | SHOKZ T922 (Trademark: SHOKZ) | | | |
| **Auftrags-Inhalt:** *Order content:* | SAR Test Report | | | |
| **Prüfgrundlage:** *Test specification:* | FCC 47 CFR § 2.1093<br>IEEE Std 1528-2013<br>IC RSS-102 Issue 6: December 2023<br>IEC/IEEE 62209-1528: 2020<br>Published RF exposure KDB procedures | | | |
| **Wareneingangsdatum:** *Date of sample receipt:* | 2026-06-22 | Refer to photos document | | |
| **Prüfmuster-Nr.:** *Test sample no:* | A004314451-012 | | | |
| **Prüfzeitraum:** *Testing period:* | 2026-07-10 | | | |
| **Ort der Prüfung:** *Place of testing:* | TÜV Rheinland (Shenzhen) Co., Ltd. | | | |
| **Prüflaboratorium:** *Testing laboratory:* | TÜV Rheinland (Shenzhen) Co., Ltd. | | | |
| **Prüfergebnis*:** *Test result*:* | Pass | | | |

| | | | |
|---|---|---|---|
| **geprüft von:** tested by: | x | **genehmigt von:** *authorized by:* | x |
| **Datum:** *Date:* 2026-08-03 | Signed by: Harry W. C. Wu | **Ausstellungsdatum:** *Issue date:* 2026-08-03 | Signed by: Alex Lan |
| **Stellung** / Position: | Project Manager | **Stellung** / Position: | Authorizer |

**Sonstiges /** *Other:* FCC ID: 2BCD6-T922

**Zustand des Prüfgegenstandes bei Anlieferung:** *Condition of the test item at delivery:* Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

| | | | | |
|---|---|---|---|---|
| * Legende: | P(ass) = entspricht o.g. Prüfgrundlage(n) | F(ail) = entspricht nicht o.g. Prüfgrundlage(n) | N/A = nicht anwendbar | N/T = nicht getestet |
| ** Legend:* | *P(ass) = passed a.m. test specification(s)* | *F(ail) = failed a.m. test specification(s)* | *N/A = not applicable* | *N/T = not tested* |

**Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.**
*This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.*

## Anmerkungen
*Remarks*

| | |
|---|---|
| **1** | Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben.<br>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.<br><br>*The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system.*<br>*Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.* |
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| **3** | Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben.<br>Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.<br><br>*Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report.*<br>*Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.* |
| **4** | Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnisen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2023, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezueglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.<br><br>*The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the “Zero Guard Band Rule” and “Simple Acceptance” in accordance with ILAC G8:2019 and IEC Guide 115:2023, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.* |

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**Appendix A: SAR Plots of System Verification**

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**Appendix D: Photographs of EUT and setup**

# 1. General Information

## 1.1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for the EUT are as follows:

| Mode | Highest Reported Head $SAR_{1g}$ (0 cm Gap) (W/kg) |
|---|---|
| **Bluetooth** | **0.09** |

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6W/kg as averaged over any 1 gram of tissue; 10-gram SAR for Product Specific 10g SAR, limit: 4.0W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992/ IC RSS-102 Issue 6:2023, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

## 1.2. Equipment Under Test (EUT) Information

### 1.2.1. General Information

| | |
|---|---|
| **Equipment Name** | OPENFIT 2 AI |
| **FCC ID** | 2BCD6-T922 |
| **Brand Name** | SHOKZ |
| **Model Name** | SHOKZ T922 |
| **Antenna Type** | Integral Antenna, -3.67 dBi (Provided by the Client) |
| **EUT Stage** | Production Unit |

### 1.2.2. Wireless Technologies

| | |
|---|---|
| **Wireless Technology and Frequency Range** | BR & EDR mode: 2402 MHz ~ 2480 MHz<br>Bluetooth LE 1M: 2402 MHz ~ 2480 MHz<br>Bluetooth LE 2M: 2404 MHz ~ 2478 MHz |
| **Uplink Modulations** | Bluetooth® GFSK, π/4-DQPSK, 8-DPSK, LE 1M&2M |

**Note:**

1. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

# 2. Test Sites

## 2.1. Test Facilities

**TÜV Rheinland (Shenzhen) Co., Ltd.**

2-3F, 101 & 102, No.2, Nuclear Power Industrial Park, Fuming Community, Fucheng Street, Longhua District, Shenzhen 518000, People's Republic of China

A2LA Cert. No.: 5162.01

FCC Registration No.: CN1260

IC Registration No.: 25069

## 2.2. Ambient Condition

| | |
|---|---|
| Ambient Temperature | 22.5°C |
| Relative Humidity | 56% |

## 2.3. List of Test and Measurement Instruments

| Equipment | Manufacturer | Model | SN | Cal. Date | Cal. Interval |
|---|---|---|---|---|---|
| System Validation Dipole | SPEAG | D2450V2 | 1014 | Jun. 06, 2024 | 3 years |
| Dosimetric E-Field Probe | SPEAG | EX3DV4 | 7506 | Nov. 28, 2025 | 1 year |
| Data Acquisition Electronics | SPEAG | DAE4 | 1725 | Nov. 21, 2025 | 1 year |
| Signal Analyzer | R&S | FSV 7 | 103665 | Sep. 23, 2025 | 1 year |
| Vector Network Analyzer | R&S | ZNB 8 | 107040 | Sep. 23, 2025 | 1 year |
| Dielectric assessment Kit | SPEAG | DAK-3.5 | 1269 | Oct. 09, 2024 | 3 years |
| Signal Generator | R&S | SMB 100A | 180840 | Sep. 23, 2025 | 1 year |
| EPM Series Power Meter | Keysight | N1914A | MY58240005 | Oct. 27, 2025 | 1 year |
| Power Sensor | Keysight | N8481H | MY58250002 | Oct. 27, 2025 | 1 year |
| Power Sensor | Keysight | N8481H | MY58250006 | Oct. 27, 2025 | 1 year |
| DC Power Supply | Topward | 3303D | 809332 | Oct. 27, 2025 | 1 year |
| Coaxial Directional Couper | Keysight | 773D | MY52180552 | Oct. 27, 2025 | 1 year |
| Coaxial Directional Couper | shhuaxiang | DTO-0.4/3.9-10 | 18052101 | Oct. 27, 2025 | 1 year |
| Coaxial attenuator | Keysight | 8491A | MY52463219 | Oct. 27, 2025 | 1 year |
| Coaxial attenuator | Keysight | 8491A | MY52463210 | Oct. 27, 2025 | 1 year |
| Coaxial attenuator | Keysight | 8491A | MY52463222 | Oct. 27, 2025 | 1 year |
| Digital Thermometer | LKM | DTM3000 | 3116 | Oct. 27, 2025 | 1 year |
| Power Amplifier Mini circuit | mini-circuits | ZHL-42W | SN002101809 | N/A | N/A |
| Power Amplifier Mini circuit | mini-circuits | ZVE-8G | SN070501814 | N/A | N/A |
| PHANTOM | SPEAG | ELI V8.0 | 2094 | N/A | N/A |
| PHANTOM | SPEAG | SAM-Twin V8.0 | 1961 | N/A | N/A |

# 3. Measurement Uncertainty

| Source of Uncertainty | Tolerance (± %) | Probability Distribution | Divisor | Ci (1g) | Ci (10g) | Standard Uncertainty (1g) | Standard Uncertainty (10g) | Vi Veff |
|---|---|---|---|---|---|---|---|---|
| **Measurement System Errors** | | | | | | | | |
| Probe Calibration | ±13.3% | Normal (k=2) | 2 | 1 | 1 | ± 6.65 % | ± 6.65 % | ∞ |
| Probe Calibration Drift | ±1.7% | Rectangular | √3 | 1 | 1 | ±1.0% | ±1.0% | ∞ |
| Probe Linearity | ±4.7% | Rectangular | √3 | 1 | 1 | ±2.7% | ±2.7% | ∞ |
| Broadband Signal | ±3.0% | Rectangular | √3 | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Probe Isotropy | ±7.6% | Rectangular | √3 | 1 | 1 | ±4.4% | ±4.4% | ∞ |
| Other Probe + Electronic | ±0.7% | Normal | 1 | 1 | 1 | ±0.7% | ±0.7% | ∞ |
| RF Ambient | ±1.8% | Normal | 1 | 1 | 1 | ±1.8% | ±1.8% | ∞ |
| Probe Positioning | ±0.006mm | Normal | 1 | 0.14 | 0.14 | ±0.10% | ±0.10% | ∞ |
| Data Processing | ±1.2% | Normal | 1 | 1 | 1 | ±1.2% | ±1.2% | ∞ |
| **Phantom and Device Errors** | | | | | | | | |
| Conductivity (meas.)[DAK] | ±2.5% | Normal | 1 | 0.78 | 0.71 | ±2.0% | ±1.8% | 100 |
| Conductivity (temp.)[BB] | ±3.3% | Rectangular | √3 | 0.78 | 0.71 | ±1.5% | ±1.4% | ∞ |
| Phantom Permittivity | ±14.0% | Rectangular | √3 | 0 | 0 | ±0% | ±0% | ∞ |
| Distance DUT – TSL | ±2.0% | Normal | 1 | 2 | 2 | ±4.0% | ±4.0% | ∞ |
| Device Positioning | ±2.4%/±2.8% | Normal | 1 | 1 | 1 | ±2.8% | ±2.8% | 30 |
| Device Holder | ±3.4%/±3.5% | Normal | 1 | 1 | 1 | ±3.5% | ±3.5% | 30 |
| DUT Modulation[m] | ±2.4% | Rectangular | √3 | 1 | 1 | ±1.4% | ±1.4% | ∞ |
| Time-average SAR | ±1.7% | Rectangular | √3 | 1 | 1 | ±1.0% | ±1.0% | ∞ |
| DUT drift | ±2.5% | Normal | 1 | 1 | 1 | ±2.5% | ±2.5% | 30 |
| Val Antenna Unc.[val] | ±0.0% | Normal | 1 | 1 | 1 | ±0% | ±0% | |
| Unc. Input Power[val] | ±0.0% | Normal | 1 | 1 | 1 | ±0% | ±0% | |
| **Correction to the SAR results** | | | | | | | | |
| C(ε,σ) | ±1.9% | Normal | 1 | 1 | 0.84 | ±1.9% | ±1.6% | |
| SAR scaling[p] | ±0.0% | Rectangular | √3 | 1 | 1 | ±0% | ±0% | |
| **Combined Standard Uncertainty (K = 1)** | | | | | | ±12.54% | ±12.44% | |
| **Expanded Uncertainty (K = 2)** | | | | | | **±25.1%** | **±24.9%** | |

**Uncertainty budget for frequency range 300 MHz to 3 GHz**

# 4. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528- 2013, the following FCC Published RF exposure KDB procedures & manufacturer KDB inquiries:

- KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r0
- KDB 865664 D02 RF Exposure Reporting v01r02
- KDB 447498 D04 Interim General RF Exposure Guidance v01
- IC RSS-102 Issue 6: December 2023 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
- IEC/IEEE 62209-1528:2020 Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)

In addition to the above, the following information was used:

- TCB workshop April, 2019; Page 19, Tissue Simulating Liquids(TSL)

# 5. SAR Measurement System

## 5.1. Definition of Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

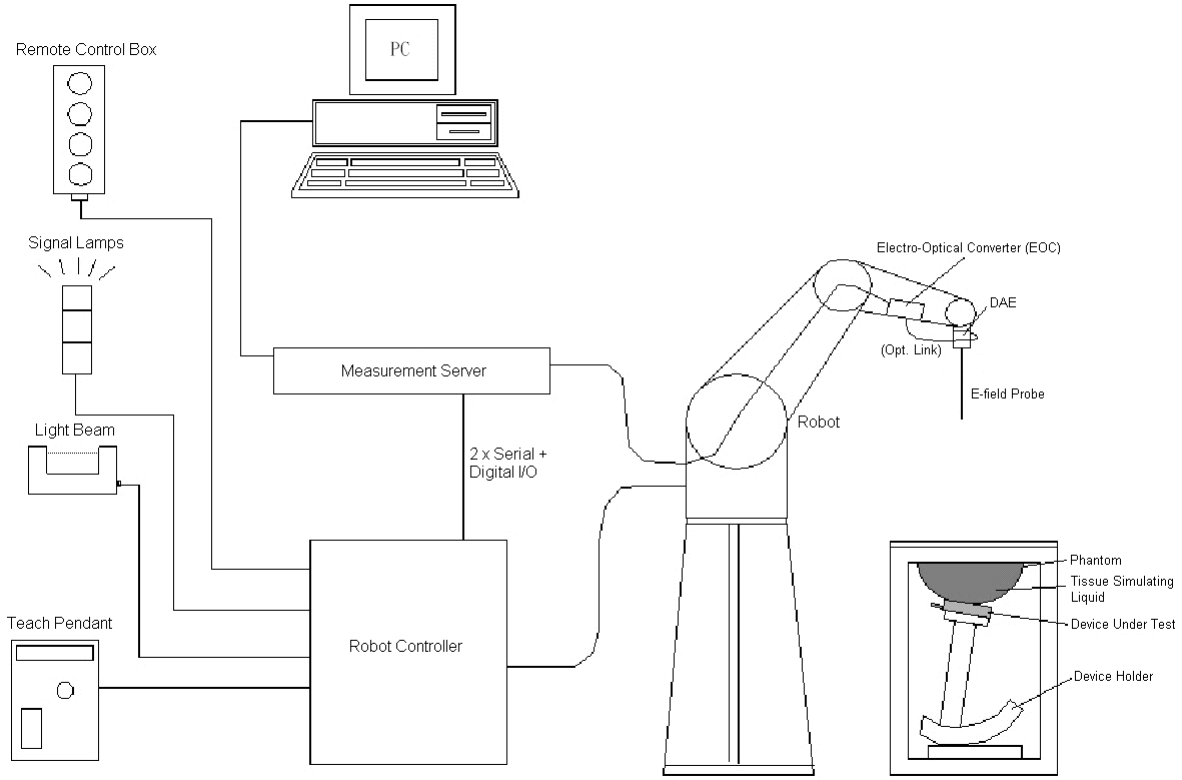
SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be related to the electrical field in the tissue by

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^2}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

## 5.2. SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.




**DASY System Setup**

### 5.2.1.Robot

The DASY system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

**DASY**

### 5.2.2. Probes

The SAR measurement is conducted with the dosimetric probe. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

| | | |
|---|---|---|
| **Model** | EX3DV4 | |
| **Construction** | Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE). | |
| **Frequency** | 4 MHz – 10 GHz<br>Linearity: ±0.2 dB (30 MHz – 10 GHz) | |
| **Directivity** | ±0.1 dB in TSL (rotation around probe axis)<br>±0.3 dB in TSL (rotation normal to probe axis) | |
| **Dynamic Range** | 10 µW/g – >100 mW/g<br>Linearity: ±0.2 dB (noise: typically <1 µW/g) | |
| **Dimensions** | Overall length: 337 mm (tip: 20 mm)<br>Tip diameter: 2.5 mm (body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm | |

### 5.2.3.Data Acquisition Electronics (DAE)

| | | |
|---|---|---|
| **Model** | DAE4 | |
| **Construction** | Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop. | |
| **Measurement Range** | -100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV) | |
| **Input Offset Voltage** | < 5µV (with auto zero) | |
| **Input Bias Current** | < 50 fA | |
| **Dimensions** | 60 x 60 x 68 mm | |

### 5.2.4. Phantoms

| | | |
|---|---|---|
| **Model** | Twin SAM | |
| **Construction** | The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEC/IEEE 62209-1528. It enables the dosimetric evaluation of left and right hand phone usage as well as body-mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot. | |
| **Material** | Vinylester, glass fiber reinforced (VE-GF) | |
| **Shell Thickness** | 2 ± 0.2 mm (6 ± 0.2 mm at ear point) | |
| **Dimensions** | Length: 1000 mm<br>Width: 500 mm<br>Height: adjustable feet | |
| **Filling Volume** | approx. 25 liters | |

| | | |
|---|---|---|
| **Model** | ELI | |
| **Construction** | The ELI phantom is used for compliance testing of handheld and body-mounted wireless devices in the frequency range of 4 MHz to 10 GHz. ELI is fully compatible with the IEC/IEEE 62209-1528 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all of SPEAG's dosimetric probes and dipoles. | |
| **Material** | Vinylester, glass fiber reinforced (VE-GF) | |
| **Shell Thickness** | 2.0 ± 0.2 mm (bottom plate) | |
| **Dimensions** | Major axis: 600 mm<br>Minor axis: 400 mm | |
| **Filling Volume** | approx. 30 liters | |

### 5.2.5. Device Holder

| | | |
|---|---|---|
| **Model** | Mounting Device | |
| **Construction** | In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). | |
| **Material** | POM | |

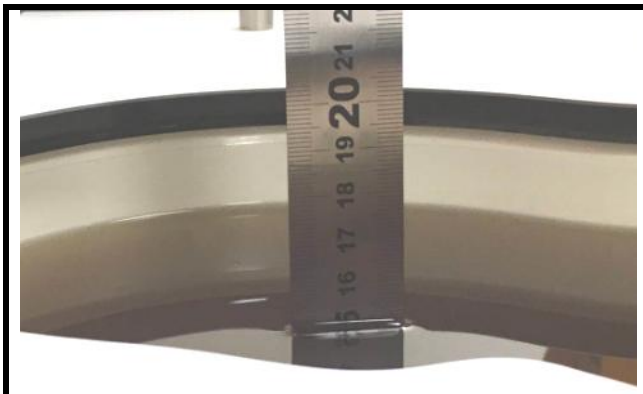
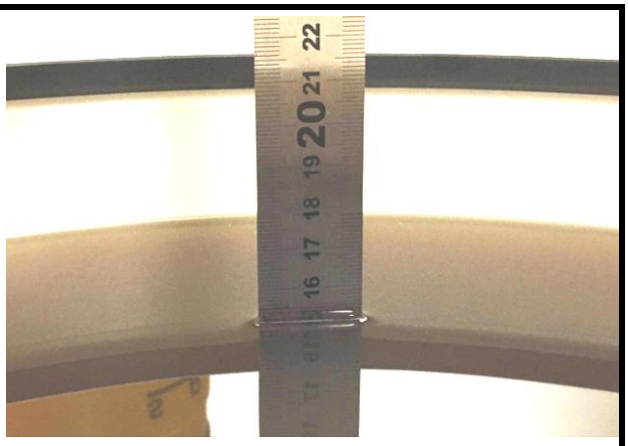
| | | |
|---|---|---|
| **Model** | Laptop Extensions Kit | |
| **Construction** | Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-1528 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. | |
| **Material** | POM, Acrylic glass, Foam | |

### 5.2.6.System Validation Dipoles

| | | |
|---|---|---|
| **Model** | D-Serial | |
| **Construction** | Symmetrical dipole with l/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions. | |
| **Frequency** | 750 MHz to 5800 MHz | |
| **Return Loss** | > 20 dB | |
| **Power Capability** | > 100 W (f < 1GHz), > 40 W (f > 1GHz) | |

### 5.2.7. Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed.

| | |
|---|---|
|  |  |
| **Photo of Liquid Height for Head Position** | **Photo of Liquid Height for Body Position** |

The dielectric properties of the head tissue simulating liquids are defined in IEEE 1528. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using a dielectric assessment kit and a network analyzer.

**Targets of Tissue Simulating Liquid**

| Frequency (MHz) | Target Permittivity | Range of ±5% | Target Conductivity | Range of ±5% |
|---|---|---|---|---|
| **For Head** | | | | |
| 750 | 41.9 | 39.8 ~ 44.0 | 0.89 | 0.85 ~ 0.93 |
| 835 | 41.5 | 39.4 ~ 43.6 | 0.90 | 0.86 ~ 0.95 |
| 900 | 41.5 | 39.4 ~ 43.6 | 0.97 | 0.92 ~ 1.02 |
| 1450 | 40.5 | 38.5 ~ 42.5 | 1.20 | 1.14 ~ 1.26 |
| 1640 | 40.3 | 38.3 ~ 42.3 | 1.29 | 1.23 ~ 1.35 |
| 1750 | 40.1 | 38.1 ~ 42.1 | 1.37 | 1.30 ~ 1.44 |
| 1800 | 40.0 | 38.0 ~ 42.0 | 1.40 | 1.33 ~ 1.47 |
| 1900 | 40.0 | 38.0 ~ 42.0 | 1.40 | 1.33 ~ 1.47 |
| 2000 | 40.0 | 38.0 ~ 42.0 | 1.40 | 1.33 ~ 1.47 |
| 2300 | 39.5 | 37.5 ~ 41.5 | 1.67 | 1.59 ~ 1.75 |
| 2450 | 39.2 | 37.2 ~ 41.2 | 1.80 | 1.71 ~ 1.89 |
| 2600 | 39.0 | 37.1 ~ 41.0 | 1.96 | 1.86 ~ 2.06 |
| 3500 | 37.9 | 36.0 ~ 39.8 | 2.91 | 2.76 ~ 3.06 |
| 5200 | 36.0 | 34.2 ~ 37.8 | 4.66 | 4.43 ~ 4.89 |
| 5300 | 35.9 | 34.1 ~ 37.7 | 4.76 | 4.52 ~ 5.00 |
| 5500 | 35.6 | 33.8 ~ 37.4 | 4.96 | 4.71 ~ 5.21 |
| 5600 | 35.5 | 33.7 ~ 37.3 | 5.07 | 4.82 ~ 5.32 |
| 5800 | 35.3 | 33.5 ~ 37.1 | 5.27 | 5.01 ~ 5.53 |

The following table gives the recipes for tissue simulating liquids.

**Recipes of Tissue Simulating Liquid**

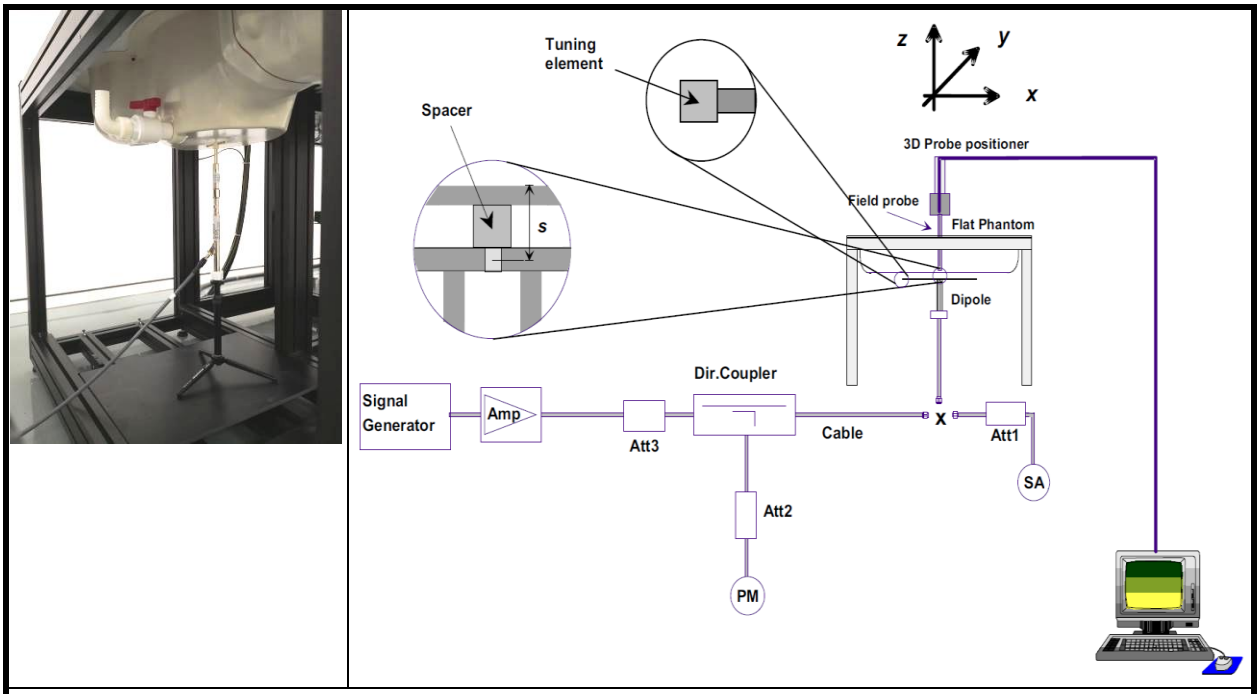
| Tissue Type | Bactericide | DGBE | HEC | NaCl | Sucrose | Triton X-100 | Water | Diethylene Glycol Mono-hexylether |
|---|---|---|---|---|---|---|---|---|
| H750 | 0.2 | - | 0.2 | 1.5 | 56.0 | - | 42.1 | - |
| H835 | 0.2 | - | 0.2 | 1.5 | 57.0 | - | 41.1 | - |
| H900 | 0.2 | - | 0.2 | 1.4 | 58.0 | - | 40.2 | - |
| H1450 | - | 43.3 | - | 0.6 | - | - | 56.1 | - |
| H1640 | - | 45.8 | - | 0.5 | - | - | 53.7 | - |
| H1750 | - | 47.0 | - | 0.4 | - | - | 52.6 | - |
| H1800 | - | 44.5 | - | 0.3 | - | - | 55.2 | - |
| H1900 | - | 44.5 | - | 0.2 | - | - | 55.3 | - |
| H2000 | - | 44.5 | - | 0.1 | - | - | 55.4 | - |
| H2300 | - | 44.9 | - | 0.1 | - | - | 55.0 | - |
| H2450 | - | 45.0 | - | 0.1 | - | - | 54.9 | - |
| H2600 | - | 45.1 | - | 0.1 | - | - | 54.8 | - |
| H3500 | - | 8.0 | - | 0.2 | - | 20.0 | 71.8 | - |
| H5G | - | - | - | - | - | 17.2 | 65.5 | 17.3 |

**Simulating Head Liquid (HBBL600-6000MHz), Manufactured by SPEAG:**

| Water (% by weight) | Esters, Emulsifiers, Inhibitors (% by weight) | Sodium salt (% by weight) |
|---|---|---|
| 50 - 65% | 10 - 30% | 8 - 25% |

### 5.2.8.SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.




**System Verification Setup**

The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The spectrum analyzer measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 2 GHz, 100 mW is used for 2.1 GHz to 6 GHz) at the dipole connector and the power meter is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

# 6. SAR Measurement Procedure

According to the SAR test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transmit maximum output power
(b) Measure conducted output power through RF cable
(c) Place the EUT in the specific position of phantom
(d) Perform SAR testing steps on the DASY system
(e) Record the SAR value

## 6.1. Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. According to KDB 865664 D01, the resolution for Area and Zoom scan is specified in the table below.

| Items | <= 2 GHz | 2-3 GHz | 3-4 GHz | 4-5 GHz | 5-6 GHz |
|---|---|---|---|---|---|
| Area Scan (Δx, Δy) | <= 15 mm | <= 12 mm | <= 12 mm | <= 10 mm | <= 10 mm |
| Zoom Scan (Δx, Δy) | <= 8 mm | <= 5 mm | <= 5 mm | <= 4 mm | <= 4 mm |
| Zoom Scan (Δz) | <= 5 mm | <= 5 mm | <= 4 mm | <= 3 mm | <= 2 mm |
| Zoom Scan Volume | >= 30 mm | >= 30 mm | >= 28 mm | >= 25 mm | >= 22 mm |

**Note:**
When zoom scan is required and report SAR is <= 1.4 W/kg, the zoom scan resolution of Δx / Δy (2-3GHz: <= 8 mm, 3-4GHz: <= 7 mm, 4-6GHz: <= 5 mm) may be applied.

## 6.2. Volume Scan Procedure

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

## 6.3. Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

## 6.4. Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

## 6.5. SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard’s method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

# 7. SAR Measurement Evaluation

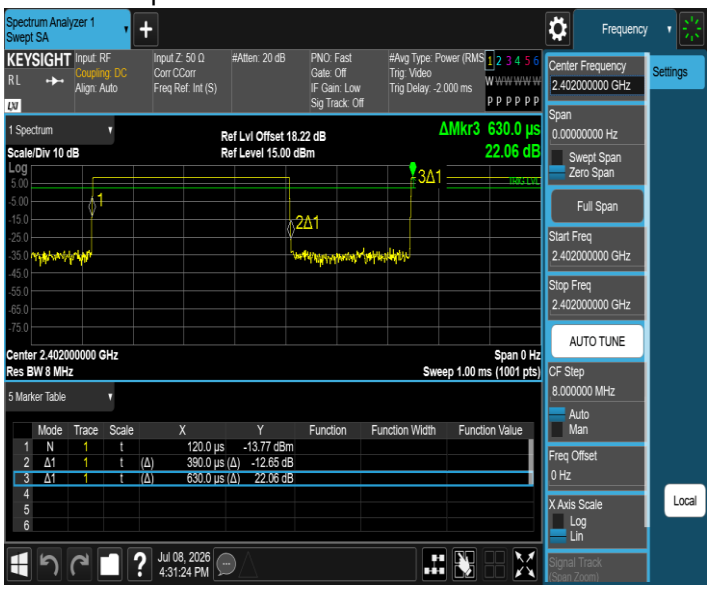
## 7.1. EUT Configuration and Setting

**<Considerations Related to Bluetooth for Setup and Testing>**

This device has installed Bluetooth engineering testing software which can provide continuous transmitting RF signal. During Bluetooth SAR testing, this device was operated to transmit continuously at the maximum transmission duty with specified transmission mode, operating frequency, lowest data rate, and maximum output power.

The Bluetooth duty cycle is 57.8% as following figure, according to 2016 Oct TCB workshop for Bluetooth SAR scaling need further consideration and the maximum duty cycle is 100%. therefore the actual duty cycle will be scaled up to100% for Bluetooth reported SAR calculation

The BLE_2M duty cycle is 61.9% as following figure, according to 2016 Oct TCB workshop for Bluetooth SAR scaling need further consideration and the maximum duty cycle is 100%. therefore the actual duty cycle will be scaled up to100% for Bluetooth reported SAR calculation



## 7.2. EUT Testing Position

### 7.2.1. Head Exposure Conditions

This device is a Bluetooth headset that are used in the head position, SAR evaluation is required on inside of the headset, at 0 mm separation from a flat phantom.

## 7.3. Tissue Verification

The measuring results for tissue simulating liquid are shown as below.

| Test Date | Tissue Type | Frequency (MHz) | Measured Conductivity (σ) | Measured Permittivity ($\varepsilon_r$) | Target Conductivity (σ) | Target Permittivity ($\varepsilon_r$) | Conductivity Deviation (%) | Permittivity Deviation (%) |
|---|---|---|---|---|---|---|---|---|
| Jul. 10, 2026 | H2450 | 2450 | 1.844 | 39.407 | 1.80 | 39.20 | 2.44 | 0.53 |
| | | 2402 | 1.793 | 39.597 | 1.76 | 39.29 | 1.99 | 0.78 |
| | | 2441 | 1.834 | 39.447 | 1.79 | 39.21 | 2.34 | 0.60 |
| | | 2480 | 1.876 | 39.280 | 1.83 | 39.16 | 2.40 | 0.31 |

**Note:**

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within ±5% of the target values. Liquid temperature during the SAR testing must be within ±2 ℃.

## 7.4. System Validation

The SAR measurement system was validated according to procedures in KDB 865664 D01. The validation status in tabulated summary is as below.

| Test Date | Probe S/N | Calibration Point | | Measured Conductivity (σ) | Measured Permittivity ($\varepsilon_r$) | Validation for CW | | | Validation for Modulation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Sensitivity Range | Probe Linearity | Probe Isotropy | Modulation Type | Duty Factor | PAR |
| Jul. 10, 2026 | 7506 | Head | 2450 | 1.844 | 39.407 | Pass | Pass | Pass | GFSK | N/A | Pass |

## 7.5. System Verification

The measuring result for system verification is tabulated as below.

| Test Date | Frequency (MHz) | 1W Target SAR-1g (W/kg) | Measured SAR-1g (W/kg) | Normalized to 1W SAR-1g (W/kg) | Deviation (%) | Dipole S/N | Probe S/N | DAE S/N |
|---|---|---|---|---|---|---|---|---|
| Jul. 10, 2026 | 2450 | 53.40 | 5.23 | 52.30 | -2.06 | 1014 | 7506 | 1557 |

**Note:**

Comparing to the reference SAR value provided by SPEAG, the validation data should be within its specification of 10 %. The result indicates the system check can meet the variation criterion and the plots can be referred to Appendix A of this report.

# 8. SAR Measurement Evaluation

## 8.1. Maximum Conducted Power

The maximum conducted average power (Unit: dBm) and including tune-up tolerance is shown as below.

**<Left>**

| Mode | Bluetooth GFSK | | |
|---|---|---|---|
| **Channel / Frequency (MHz)** | **0 (2402)** | **39 (2441)** | **78 (2480)** |
| Average Power | 14.33 | 14.12 | 13.69 |
| Targeted Power | **14.5** | | |
| **Mode** | **Bluetooth 8DPSK** | | |
| **Channel / Frequency (MHz)** | **0 (2402)** | **39 (2441)** | **78 (2480)** |
| Average Power | 11.54 | 11.40 | 10.96 |
| Targeted Power | **12.0** | | |
| **Mode** | **Bluetooth LE 1M** | | |
| **Channel / Frequency (MHz)** | **0 (2402)** | **19 (2440)** | **39 (2480)** |
| Average Power | 7.59 | 7.48 | 7.07 |
| Targeted Power | **8.0** | | |
| **Mode** | **Bluetooth LE 2M** | | |
| **Channel / Frequency (MHz)** | **1 (2404)** | **19 (2440)** | **38 (2478)** |
| Average Power | 7.57 | 7.51 | 7.12 |
| Targeted Power | **8.0** | | |

**<Right>**

| Mode | Bluetooth GFSK | | |
|---|---|---|---|
| **Channel / Frequency (MHz)** | **0 (2402)** | **39 (2441)** | **78 (2480)** |
| Average Power | **13.81** | 13.63 | 13.14 |
| Targeted Power | **14.0** | | |
| **Mode** | **Bluetooth 8DPSK** | | |
| **Channel / Frequency (MHz)** | **0 (2402)** | **39 (2441)** | **78 (2480)** |
| Average Power | 11.03 | 10.91 | 10.45 |
| Targeted Power | **11.5** | | |
| **Mode** | **Bluetooth LE 1M** | | |
| **Channel / Frequency (MHz)** | **0 (2402)** | **19 (2440)** | **39 (2480)** |
| Average Power | 7.43 | 7.33 | 6.99 |
| Targeted Power | **8.0** | | |
| **Mode** | **Bluetooth LE 2M** | | |
| **Channel / Frequency (MHz)** | **1 (2404)** | **19 (2440)** | **38 (2478)** |
| Average Power | 7.51 | 7.44 | 7.03 |
| Targeted Power | **8.0** | | |

## 8.2. SAR Testing Results

### 8.2.1. SAR Test Reduction Considerations

**<KDB 447498 D01, General RF Exposure Guidance>**

Testing of other required channels within the operating mode of a frequency band is not required when the reported SAR for the mid-band or highest output power channel is:

(1) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz

(2) ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz

(3) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

### 8.2.2. SAR Results for Head Exposure Condition (Separation Distance is 0 cm Gap)

| Plot No. | Band | Mode | Test Position | Ch. | Sample | Duty Cycle | Max. Tune-up Power (dBm) | Measured Conducted Power (dBm) | Scaling Factor | Power Drift (dB) | Measured SAR-1g (W/kg) | Scaled SAR-1g (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BT | DH5 | Inside | 0 | Left | 57.8% | 14.5 | 14.33 | 1.04 | -0.06 | 0.046 | **0.08** |
| 2 | BT | DH5 | Inside | 0 | Right | 57.8% | 14.0 | 13.81 | 1.04 | -0.01 | 0.049 | **0.09** |
| | BT | DH5 | Inside | 39 | Right | 57.8% | 14.0 | 13.63 | 1.09 | 0.06 | 0.042 | 0.08 |
| | BT | DH5 | Inside | 78 | Right | 57.8% | 14.0 | 13.14 | 1.22 | 0.01 | 0.039 | 0.08 |
| | BLE | 1M | Inside | 38 | Right | 61.9% | 8.0 | 7.43 | 1.14 | 0.05 | 0.013 | 0.02 |

Only record the worst data of left earbud.

**8.2.3.SAR Measurement Variability**

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 1.10, the highest SAR configuration for either head or body tissue-equivalent medium may be used to perform the repeated measurement. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

Since all the measured SAR are less than 0.8 W/kg, the repeated measurement is not required.

**Test Engineer：** Warren Xiong,

# Appendixes

**All attachments are integral parts of this test report. This applies especially to the following appendix:**

**Appendix A: SAR Plots of System Verification**

The plots for system verification with largest deviation for each SAR system combination are shown as follows.

**Appendix B: SAR Plots of SAR Measurement**

The SAR plots for highest measured SAR in each exposure configuration, wireless mode and frequency band combination, and measured SAR > 1.5 W/kg are shown as follows.

**Appendix C: Calibration Certificate for probe and Dipole**

**Appendix D: Photographs of EUT and setup**

# Appendix A: SAR Plots of System Verification

Test Laboratory: TÜV Rheinland (Shenzhen) Co., Ltd. Date: 2026/7/10

## System Check-D2450V2_H2450

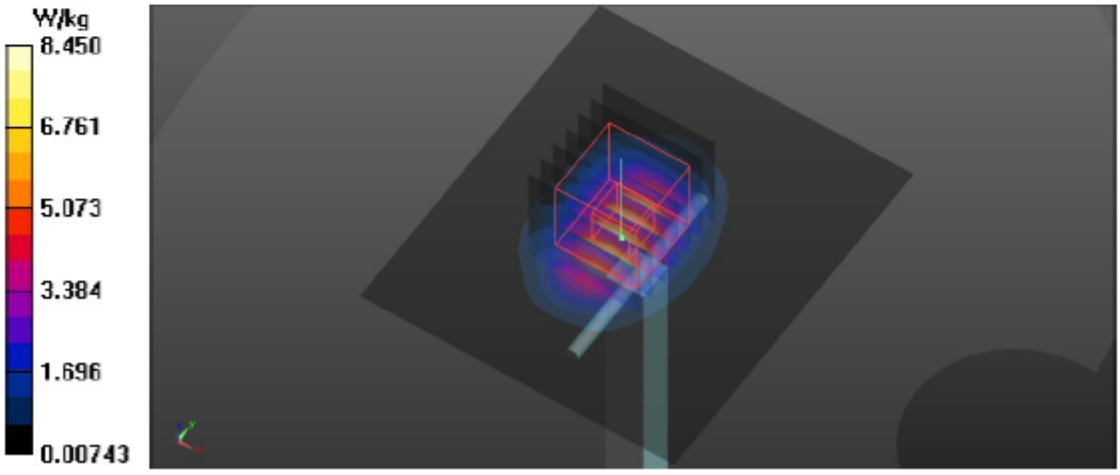
**DUT: Dipole 2450 MHz D2450V2 SN:1014**

Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: H2450 Medium parameters used: f = 2450 MHz; $\sigma$ = 1.844 S/m; $\varepsilon_r$ = 39.407; $\rho$ = 1000 kg/m$^3$

DASY5 Configuration:
- Probe: EX3DV4 - SN7506; ConvF(6.77, 7.28, 6.72) @ 2450 MHz; Calibrated: 2025/11/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1557; Calibrated: 2025/11/21
- Phantom: SAM 1; Type: QD 000 P40 CB; Serial: 1961
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Pin=100 mW/Area Scan (71x81x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.45 W/kg

**Pin=100 mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 68.49 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 9.74 W/kg
**SAR(1 g) = 5.23 W/kg; SAR(10 g) = 2.53 W/kg**
Smallest distance from peaks to all points 3 dB below = 8.9 mm
Ratio of SAR at M2 to SAR at M1 = 54.7%
Maximum value of SAR (measured) = 8.25 W/kg



# Appendix B: SAR Plots of SAR Measurement

Test Laboratory: TÜV Rheinland (Shenzhen) Co., Ltd. Date: 2026/7/10

**P01 BT_DH5_Inside_Ch0_Left**

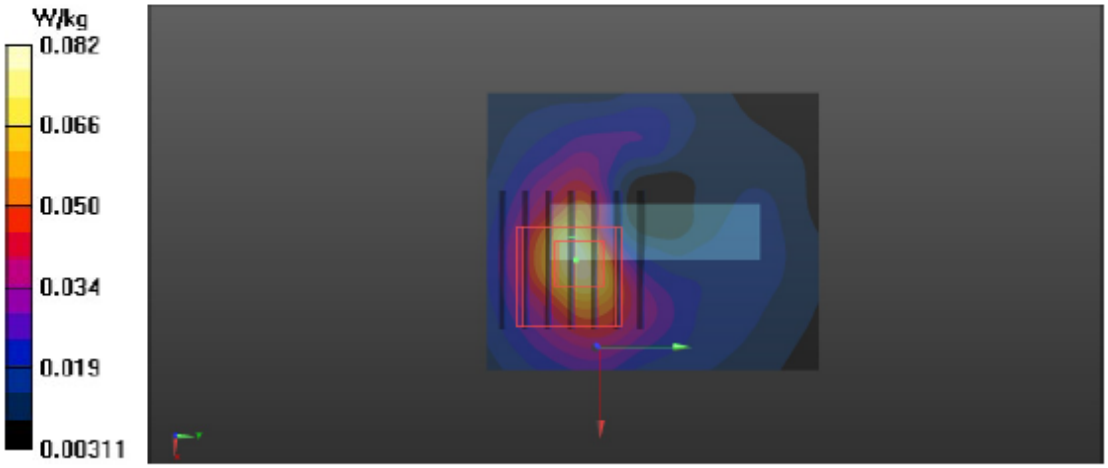
**DUT: EUT**

Communication System: UID 0, BT; Frequency: 2402 MHz;Duty Cycle: 1:1
Medium: H2450 Medium parameters used: f = 2402 MHz; $\sigma$ = 1.793 S/m; $\varepsilon_r$ = 39.597; $\rho$ = 1000 kg/m$^3$

DASY5 Configuration:
- Probe: EX3DV4 - SN7506; ConvF(6.77, 7.28, 6.72) @ 2402 MHz; Calibrated: 2025/11/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1557; Calibrated: 2025/11/21
- Phantom: SAM 1; Type: QD 000 P40 CB; Serial: 1961
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**- Area Scan (51x61x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0815 W/kg

**- Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.915 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.135 W/kg
**SAR(1 g) = 0.046 W/kg; SAR(10 g) = 0.022 W/kg**
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 33.1%
Maximum value of SAR (measured) = 0.0838 W/kg



Test Laboratory: TÜV Rheinland (Shenzhen) Co., Ltd. Date: 2026/7/10

## P02 BT_DH5_Inside_Ch0_Right

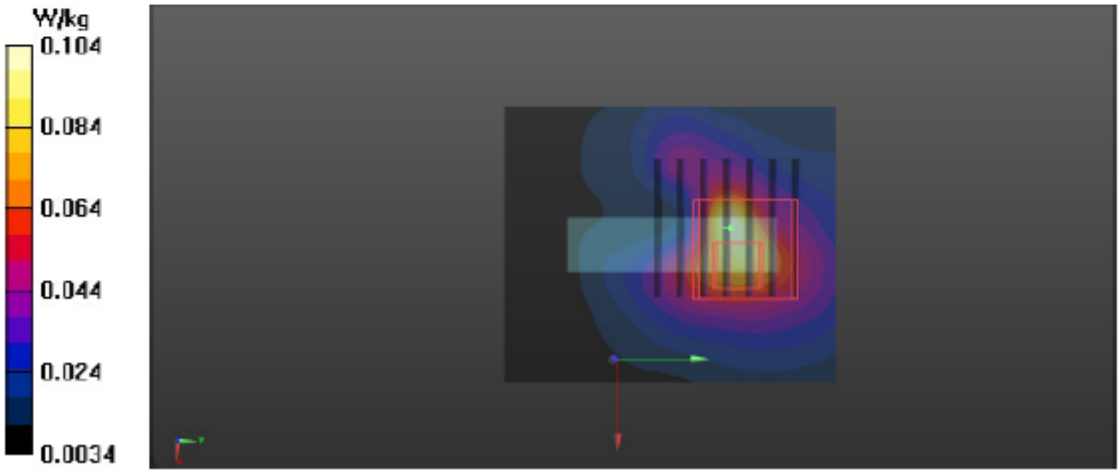
### DUT: EUT

Communication System: UID 0, BT; Frequency: 2402 MHz;Duty Cycle: 1:1
Medium: H2450 Medium parameters used: f = 2402 MHz; $\sigma$ = 1.793 S/m; $\varepsilon_r$ = 39.597; $\rho$ = 1000 kg/m$^3$

DASY5 Configuration:
- Probe: EX3DV4 - SN7506; ConvF(6.77, 7.28, 6.72) @ 2402 MHz; Calibrated: 2025/11/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1557; Calibrated: 2025/11/21
- Phantom: SAM 1; Type: QD 000 P40 CB; Serial: 1961
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**- Area Scan (51x61x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.104 W/kg

**- Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.720 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.167 W/kg
**SAR(1 g) = 0.049 W/kg; SAR(10 g) = 0.023 W/kg**
Smallest distance from peaks to all points 3 dB below = 5.7 mm
Ratio of SAR at M2 to SAR at M1 = 20.2%
Maximum value of SAR (measured) = 0.111 W/kg



# Appendix C: Calibration Certificate for probe and Dipole

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

**S** Schweizerischer Kalibrierdienst
**C** Service suisse d'étalonnage
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** TUV
Shenzhen

**Certificate No.** D2450V2-1014_Jun24

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D2450V2 - SN:1014 |
| Calibration procedure(s) | QA CAL-05.v12<br>Calibration Procedure for SAR Validation Sources between 0.7-3 GHz |
| Calibration date: | June 06, 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)°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 |

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

Issued: June 7, 2024

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**Accreditation No.: SCS 0108**

**Glossary:**

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

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

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

**Additional Documentation:**

c) DASY System Handbook

**Methods Applied and Interpretation of Parameters:**

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The 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 ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 39.2 | 1.80 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 38.0 ± 6 % | 1.88 mho/m ± 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 | 13.7 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **53.4 W/kg ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 6.35 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **25.0 W/kg ± 16.5 % (k=2)** |

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

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 54.1 Ω + 0.5 jΩ |
| Return Loss | - 28.0 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: 06.06.2024

Test Laboratory: SPEAG, Zurich, Switzerland

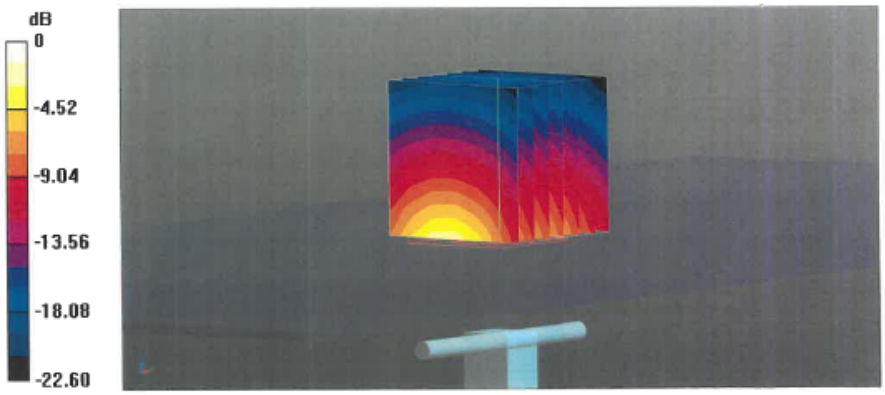
**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:1014**

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma$ = 1.88 S/m; $\varepsilon_r$ = 38.0; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

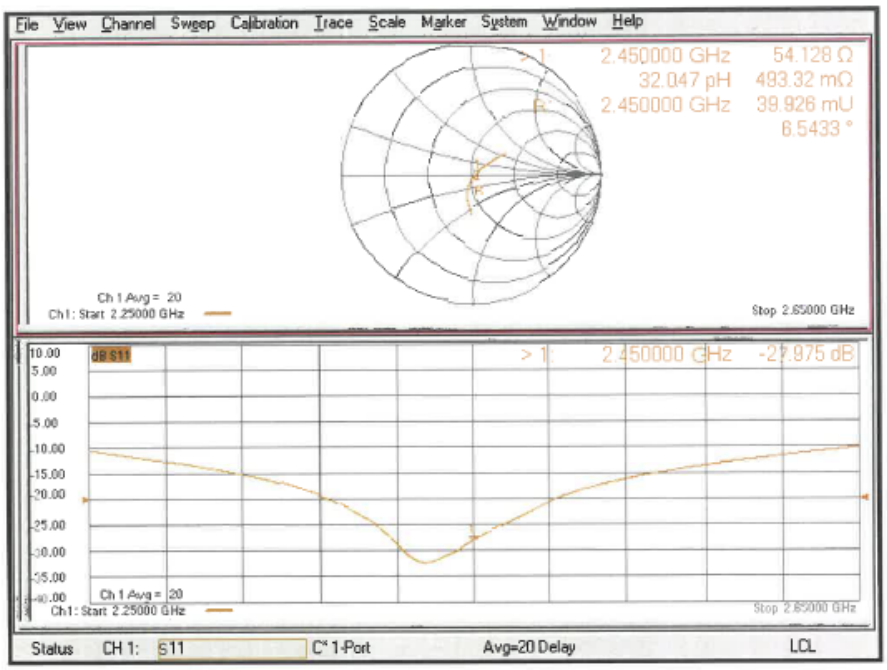
- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.05.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**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 = 117.3 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 27.4 W/kg
**SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.35 W/kg**
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 50.4%
Maximum value of SAR (measured) = 22.0 W/kg




0 dB = 22.0 W/kg = 13.41 dBW/kg

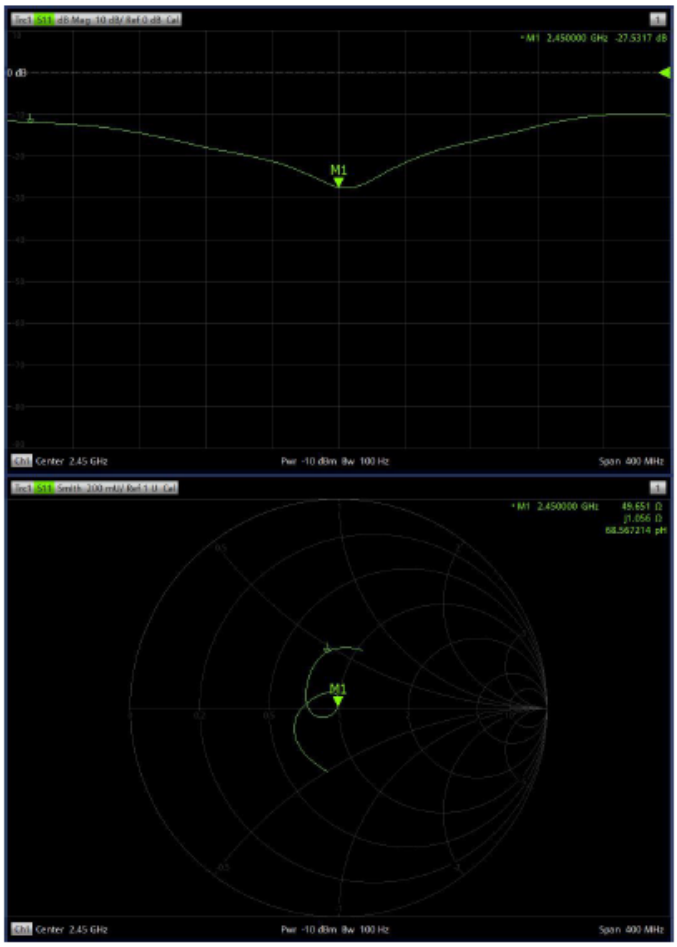
**Impedance Measurement Plot for Head TSL**



Justification for Extended SAR Dipole Calibrations

| Dipole | Date of Measurement | Return Loss (dB) | Delta (%) | Impedance (ohm) | Delta (ohm) |
|---|---|---|---|---|---|
| Head 2450MHz | Jun 06, 2024 | -28.00 | -1.68 | 54.10 | -4.45 |
| | Jun 09, 2025 | -27.53 | | 49.65 | |

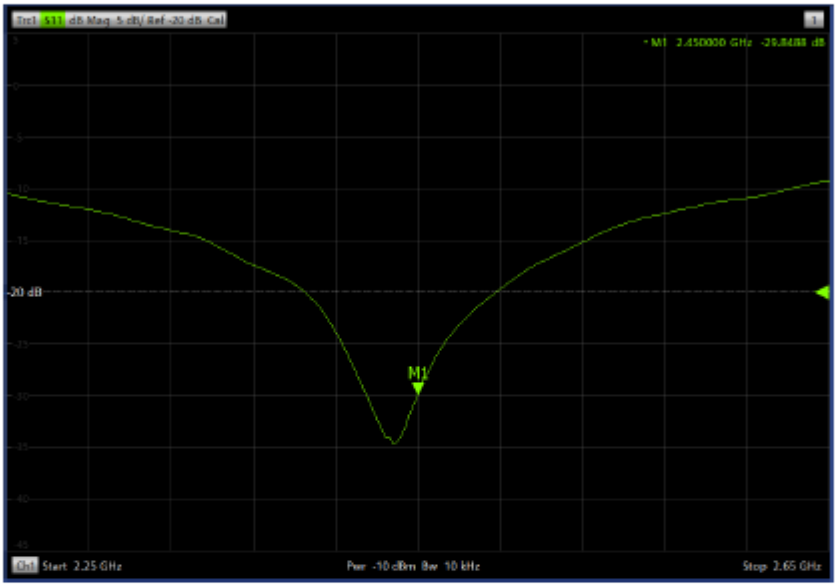
Note: The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification results meet the requirement of extended calibration.

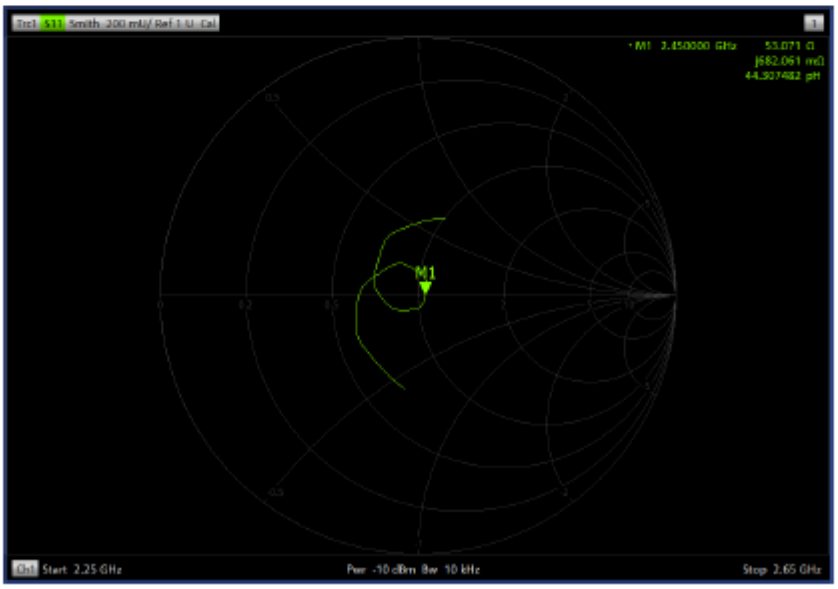


Justification for Extended SAR Dipole Calibrations

| Dipole | Date of Measurement | Return Loss (dB) | Delta (%) | Impedance (ohm) | Delta (ohm) |
|---|---|---|---|---|---|
| Head 2450MHz | Jun 06, 2024 | -28.00 | 6.79 | 54.10 | -1.00 |
| | Jun 01, 2026 | -29.90 | | 53.10 | |

Note: The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification results meet the requirement of extended calibration.



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Accreditation No.: **SCS 0108**

| | | | |
|---|---|---|---|
| Client | TUV<br>Shenzhen | Certificate No. | EX-7506_Nov25 |

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | EX3DV4 - SN:7506 |
| Calibration procedure(s) | QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6, QA CAL-25.v8, QA CAL-48.v2<br>Calibration procedure for dosimetric E-field probes |
| Calibration date | November 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Calibration Date (Certificate No.) | Sched. Cal. |
|---|---|---|---|
| Power Sensor R&S NRP40T | SN: 101861 | 29-Apr-25 (No. 2025-001450) | Apr-26 |
| N-type mismatch combination | SN: L1119 | 26-Mar-25 (No. 217-04292) | Mar-26 |
| OCP DAK-12 | SN: 1016 | 16-Sept-25 (No. OCP-DAK12-1016_Sep25) | Sep-26 |
| OCP DAK-3.5 | SN: 1249 | 16-Sept-25 (No. OCP-DAK3.5-1249_Sep25) | Sep-26 |
| Reference Probe EX3DV4 | SN: 7349 | 10-Jan-25 (No. EX3-7349_Jan25) | Jan-26 |
| DAE4 | SN: 1301 | 30-Oct-25 (No. DAE4-1301_Oct25) | Oct-26 |

| Secondary Standards | ID | Check Date (in house) | Sched. Check |
|---|---|---|---|
| ACAP 2020 Setup 1 | SN: L1404 | 01-Oct-25 (No. IHCK_ACAP2020-1_Oct25) | Oct-26 |
| OCP DAK-12 | SN: 1029 | 27-Feb-25 (No. OCP-DAK12-1029_Feb25) | Feb-26 |
| OCP DAK-3.5 | SN: 1336 | 09-Dec-24 (No. OCP-DAK3.5-1336_Dec24) | Dec-25 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by | Krešimir Franjić | Laboratory Technician | |
| Approved by | Sven Kühn | Technical Manager | |

Issued: December 02, 2025

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**Accreditation No.: SCS 0108**

## Glossary

| | |
|---|---|
| TSL | tissue simulating liquid |
| NORMx,y,z | sensitivity in free space |
| ConvF | sensitivity in TSL / NORMx,y,z |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A, B, C, D | modulation dependent linearization parameters |
| Polarization $\varphi$ | $\varphi$ rotation around probe axis |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

## Calibration is Performed According to the Following Standards:

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

## Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the $E^2$-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. DCP does not depend on frequency nor media.
- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ±50 MHz to ±100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

## Parameters of Probe: EX3DV4 - SN:7506

### Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc ($k = 2$) |
|---|---|---|---|---|
| Norm ($\mu$V/(V/m)$^2$) [A] | 0.50 | 0.63 | 0.53 | ±10.1% |
| DCP (mV) [B] | 105.9 | 102.9 | 107.7 | ±4.7% |

### Calibration Results for Modulation Response

| UID | Communication System Name | | A dB | B dB$\sqrt{\mu V}$ | C | D dB | VR mV | Max dev. | Max Unc[E] $k = 2$ |
|---|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.00 | 0.00 | 1.00 | 0.00 | 128.3 | ±1.0% | ±4.7% |
| | | Y | 0.00 | 0.00 | 1.00 | | 124.7 | | |
| | | Z | 0.00 | 0.00 | 1.00 | | 136.8 | | |

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

[A] The uncertainties of Norm X,Y,Z do not affect the $E^2$-field uncertainty inside TSL (see Page 5).
[B] Linearization parameter uncertainty for maximum specified field strength.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

## Parameters of Probe: EX3DV4 - SN:7506

### Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Triangular |
| Connector Angle | -17.6° |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disabled |
| Probe Overall Length | 337 mm |
| Probe Body Diameter | 12 mm |
| Tip Length | 9 mm |
| Tip Diameter | 2.5 mm |
| Probe Tip to Sensor X Calibration Point | 1 mm |
| Probe Tip to Sensor Y Calibration Point | 1 mm |
| Probe Tip to Sensor Z Calibration Point | 1 mm |
| Recommended Measurement Distance from Surface | 1.4 mm |

**Note:** Measurement distance from surface can be increased to 3–4 mm for an *Area Scan* job.

## Parameters of Probe: EX3DV4 - SN:7506

### Calibration Parameter Determined in HSL

| f (MHz)[C] | Relative Permittivity[F] | Conductivity[F] (S/m) | ConvF X | ConvF Y | ConvF Z | Alpha[G] | Depth[G] (mm) | Unc[H] ($k = 2$) |
|---|---|---|---|---|---|---|---|---|
| 450 | 43.5 | 0.87 | 10.56 | 10.56 | 10.56 | 0.16 | 1.30 | ±13.3% |
| 750 | 41.9 | 0.89 | 9.08 | 9.77 | 9.02 | 0.38 | 1.27 | ±11.0% |
| 835 | 41.5 | 0.90 | 8.77 | 9.44 | 8.71 | 0.38 | 1.27 | ±11.0% |
| 900 | 41.5 | 0.97 | 8.81 | 9.48 | 8.75 | 0.37 | 1.27 | ±11.0% |
| 1450 | 40.5 | 1.20 | 7.59 | 8.17 | 7.54 | 0.37 | 1.27 | ±11.0% |
| 1750 | 40.1 | 1.37 | 7.58 | 8.16 | 7.53 | 0.36 | 1.27 | ±11.0% |
| 1900 | 40.0 | 1.40 | 7.33 | 7.89 | 7.28 | 0.36 | 1.27 | ±11.0% |
| 2100 | 39.8 | 1.49 | 7.40 | 7.97 | 7.35 | 0.36 | 1.27 | ±11.0% |
| 2300 | 39.5 | 1.67 | 7.09 | 7.64 | 7.05 | 0.36 | 1.27 | ±11.0% |
| 2450 | 39.2 | 1.80 | 6.77 | 7.28 | 6.72 | 0.36 | 1.27 | ±11.0% |
| 2600 | 39.0 | 1.96 | 6.90 | 7.43 | 6.85 | 0.35 | 1.27 | ±11.0% |
| 3500 | 37.9 | 2.91 | 6.22 | 6.70 | 6.18 | 0.34 | 1.27 | ±13.1% |
| 3700 | 37.7 | 3.12 | 6.14 | 6.61 | 6.10 | 0.34 | 1.27 | ±13.1% |
| 5250 | 35.9 | 4.71 | 5.18 | 5.57 | 5.14 | 0.30 | 1.27 | ±13.1% |
| 5600 | 35.5 | 5.07 | 4.76 | 5.13 | 4.73 | 0.27 | 1.27 | ±13.1% |
| 5800 | 35.3 | 5.27 | 4.66 | 5.02 | 4.63 | 0.26 | 1.27 | ±13.1% |

[C] Frequency validity above 300 MHz of ±100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ±50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ±10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4–9 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.

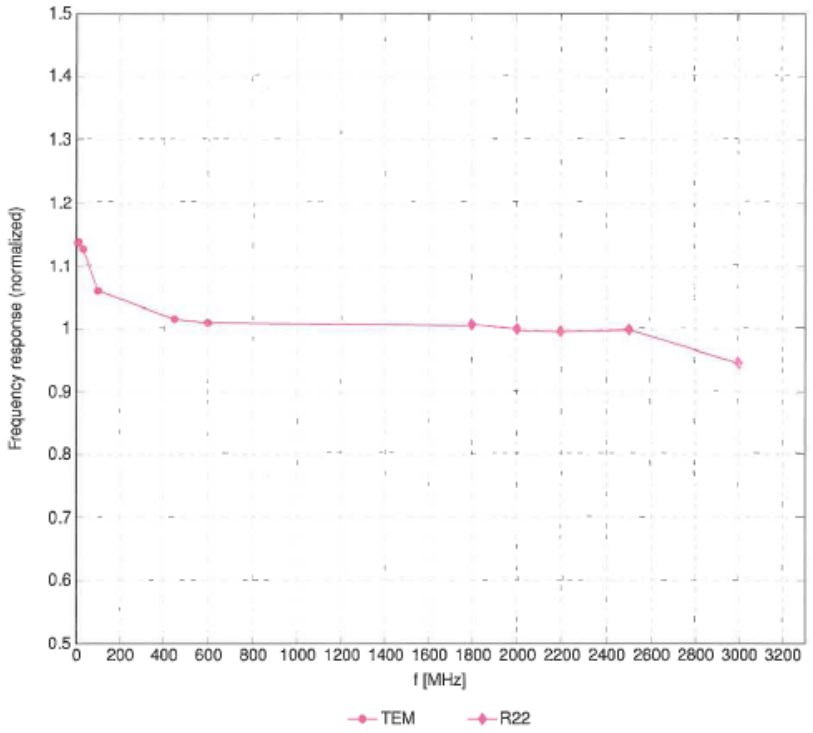
[F] The probes are calibrated using tissue simulating liquids (TSL) that deviate for $\varepsilon$ and $\sigma$ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10% if SAR correction is applied.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz and below ±2% for frequencies between 3–6 GHz at any distance larger than half the probe tip diameter from the boundary.

[H] The stated uncertainty is the total calibration uncertainty ($k = 2$) of Norm-ConvF. This is equivalent to the uncertainty component with the symbol CF in Table 9 of IEC/IEEE 62209-1528:2020.

**Frequency Response of E-Field**

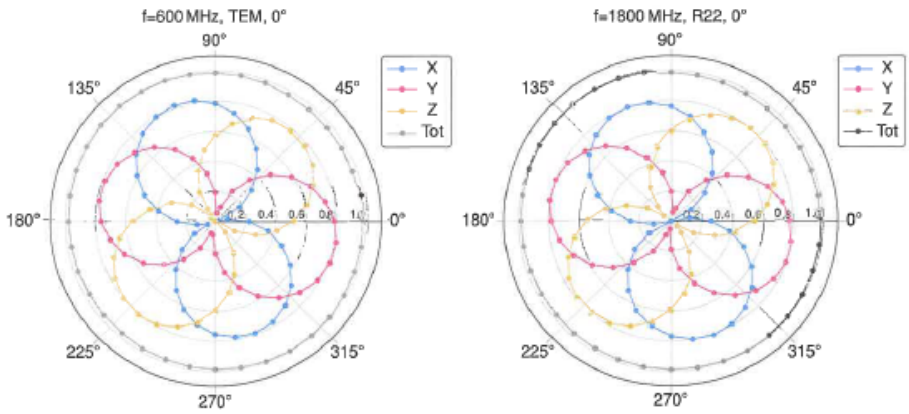
**(TEM-Cell:ifi110 EXX, Waveguide:R22)**

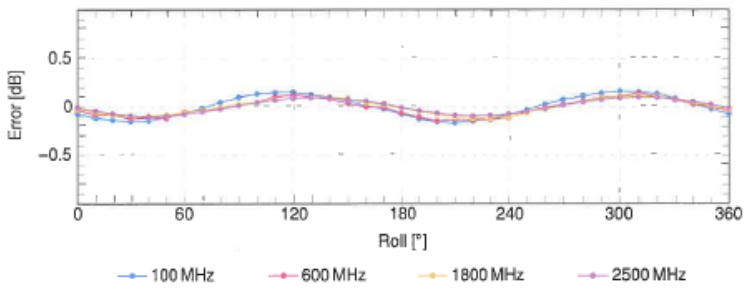



Uncertainty of Frequency Response of E-field: ±6.3% (k=2)

EX3DV4 - SN:7506 November 28, 2025

**Receiving Pattern ($\phi$), $\vartheta = 0°$**

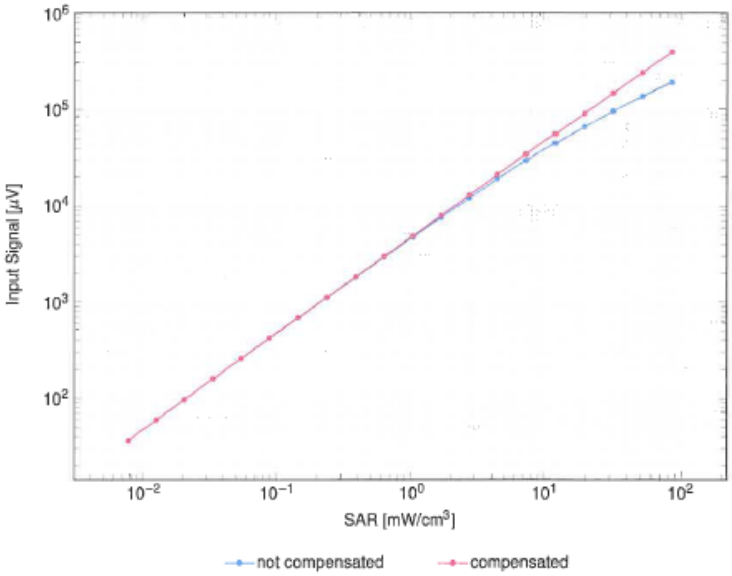


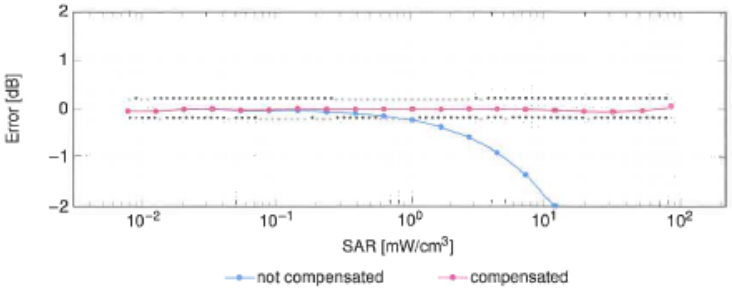




Uncertainty of Axial Isotropy Assessment: ±0.5% (k=2)

## Dynamic Range f(SAR$_{HSL}$)

(TEM cell, $f_{eval}$ = 1900 MHz)



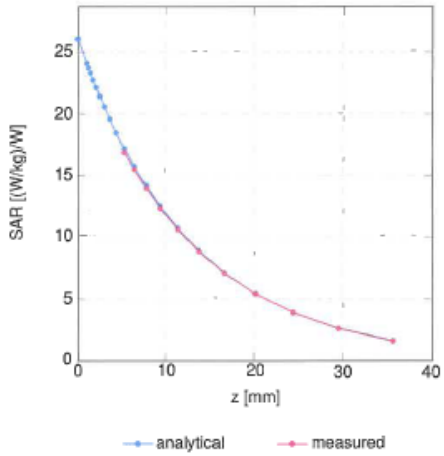




Uncertainty of Linearity Assessment: ±0.6% (k=2)

EX3DV4 - SN:7506 November 28, 2025

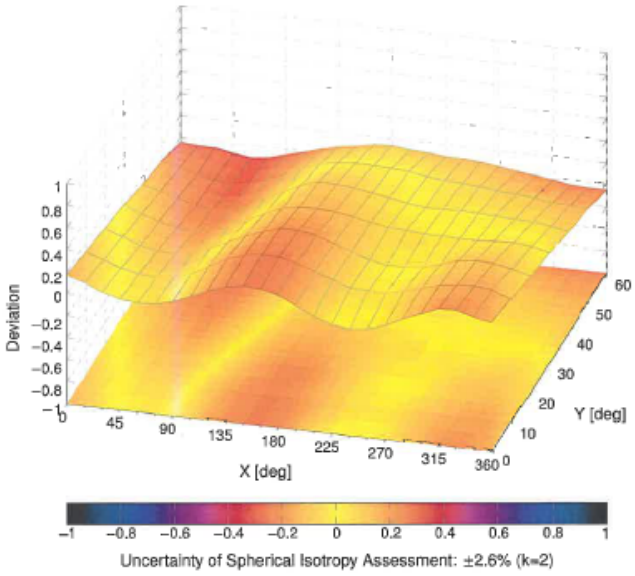
## Conversion Factor Assessment

f=1900 MHz, WGLS R22 (H_convF)




## Deviation from Isotropy in Liquid

Error ($\phi$,$\theta$), f = 900 MHz



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# IMPORTANT NOTICE

## USAGE OF THE DAE4 SN: 1557

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
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Accreditation No.: **SCS 0108**

Client **TUV**
Shenzhen

Certificate No: **DAE4-1557_Nov25**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | DAE4 - SD 000 D04 BN - SN: 1557 |
| Calibration procedure(s) | QA CAL-06.v30<br>Calibration procedure for the data acquisition electronics (DAE) |
| Calibration date: | November 21, 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 | 15-Aug-25 (No:43873) | Aug-26 |
| **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 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Adrian Gehring | Laboratory Technician | |
| Approved by: | Sven Kühn | Technical Manager | |

Issued: November 21, 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 = | 6.1μV , | 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** | 405.018 ± 0.02% (k=2) | 404.685 ± 0.02% (k=2) | 404.774 ± 0.02% (k=2) |
| **Low Range** | 3.97335 ± 1.50% (k=2) | 4.00450 ± 1.50% (k=2) | 3.99031 ± 1.50% (k=2) |

## Connector Angle

| | |
|---|---|
| **Connector Angle** to be used in DASY system | 53.0 ° ± 1 ° |

## Appendix (Additional assessments outside the scope of SCS0108)

### 1. DC Voltage Linearity

| High Range | | Reading (µV) | Difference (µV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 199998.31 | 1.33 | 0.00 |
| Channel X | + Input | 20003.74 | 1.06 | 0.01 |
| Channel X | - Input | -19999.34 | 3.07 | -0.02 |
| Channel Y | + Input | 199997.16 | 0.64 | 0.00 |
| Channel Y | + Input | 20001.43 | -0.92 | -0.00 |
| Channel Y | - Input | -20002.80 | -0.08 | 0.00 |
| Channel Z | + Input | 199995.57 | -1.35 | -0.00 |
| Channel Z | + Input | 20000.82 | -1.71 | -0.01 |
| Channel Z | - Input | -20003.65 | -1.08 | 0.01 |

| Low Range | | Reading (µV) | Difference (µV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 2001.41 | 0.32 | 0.02 |
| Channel X | + Input | 202.63 | 1.35 | 0.67 |
| Channel X | - Input | -197.49 | 1.03 | -0.52 |
| Channel Y | + Input | 2000.80 | 0.11 | 0.01 |
| Channel Y | + Input | 200.88 | -0.03 | -0.01 |
| Channel Y | - Input | -199.25 | -0.33 | 0.16 |
| Channel Z | + Input | 2001.05 | 0.15 | 0.01 |
| Channel Z | + Input | 200.22 | -0.93 | -0.46 |
| Channel Z | - Input | -199.63 | -0.97 | 0.49 |

### 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 | -0.43 | -2.26 |
| | - 200 | 4.78 | 2.92 |
| Channel Y | 200 | 4.69 | 4.03 |
| | - 200 | -5.16 | -5.42 |
| Channel Z | 200 | 2.76 | 3.12 |
| | - 200 | -5.15 | -5.32 |

### 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 | - | -1.18 | -2.55 |
| Channel Y | 200 | 5.19 | - | 0.35 |
| Channel Z | 200 | 9.84 | 2.32 | - |

## 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 | 15807 | 16519 |
| Channel Y | 15756 | 14788 |
| Channel Z | 16032 | 15932 |

## 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

| | Average (µV) | min. Offset (µV) | max. Offset (µV) | Std. Deviation (µV) |
|---|---|---|---|---|
| Channel X | 1.27 | 0.32 | 2.35 | 0.35 |
| Channel Y | 1.09 | 0.04 | 1.74 | 0.30 |
| Channel Z | -0.23 | -0.99 | 0.72 | 0.33 |

## 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 |