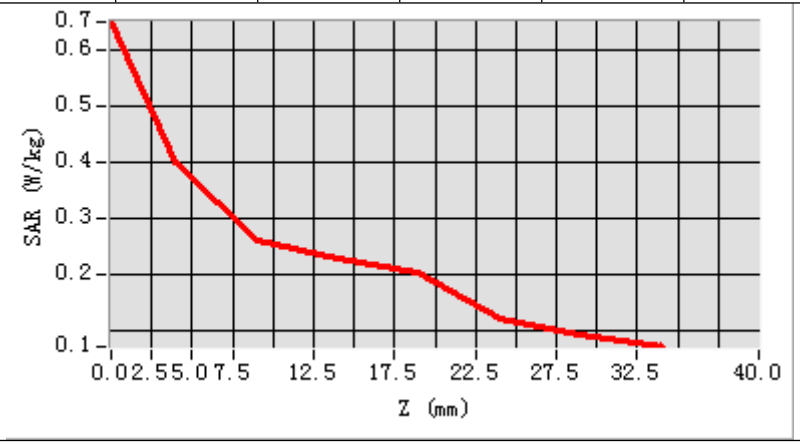
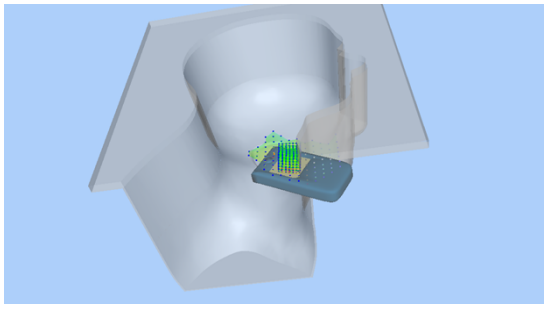
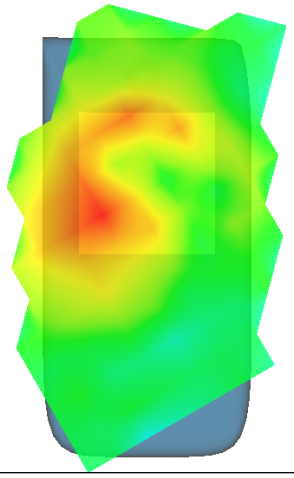
| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 | 24.00 | 29.00 |
|---|---|---|---|---|---|---|---|
| SAR (W/Kg) | 0.6514 | 0.4023 | 0.2626 | 0.2286 | 0.2035 | 0.1237 | 0.0947 |




| 3D screen shot | Hot spot position |
|---|---|
|  |  |

# MEASUREMENT 28

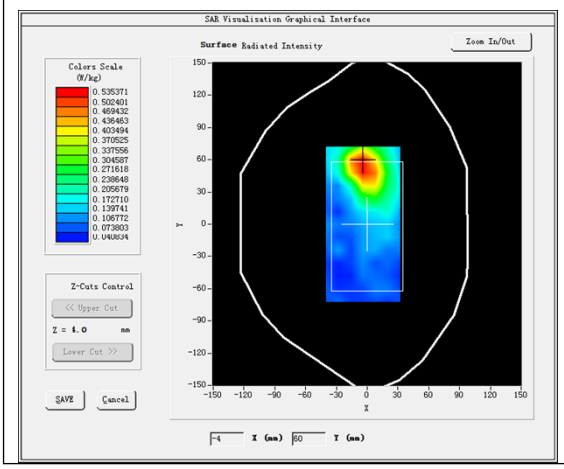
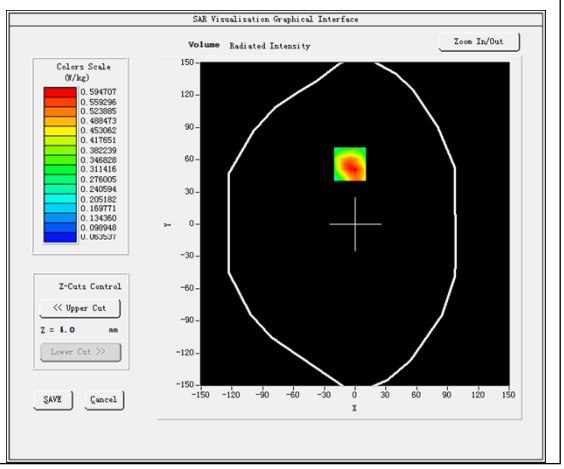
Date of measurement: 14/4/2025

## A. Experimental conditions.

| | |
|---|---|
| **Area Scan** | dx=12mm dy=12mm, h= 5.00 mm |
| **ZoomScan** | 7x7x7,dx=5mm dy=5mm dz=5mm |
| **Phantom** | Validation plane |
| **Device Position** | Body |
| **Band** | LTE band 41 |
| **Channels** | Middle |
| **Signal** | LTE (Crest factor: 1.0) |
| **ConvF** | 2.35 |

## B. SAR Measurement Results

| | |
|---|---|
| **Frequency (MHz)** | 2605.000000 |
| **Relative permittivity (real part)** | 39.009335 |
| **Relative permittivity (imaginary part)** | 13.553667 |
| **Conductivity (S/m)** | 0.287604 |
| **Variation (%)** | -2.630000 |

| SURFACE SAR | VOLUME SAR |
|---|---|
|  |  |

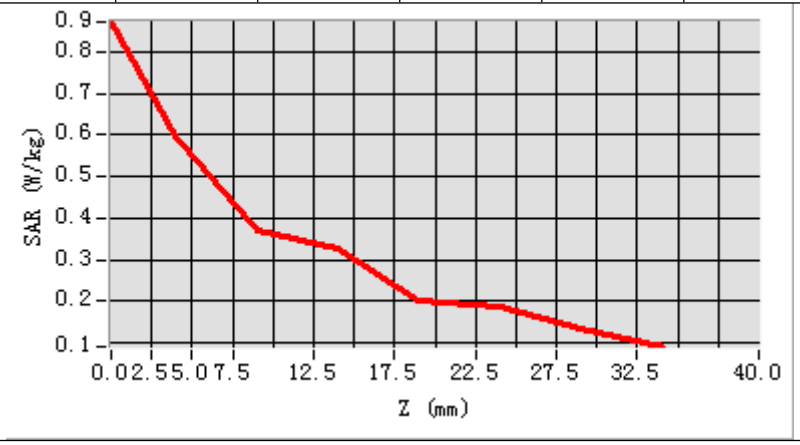


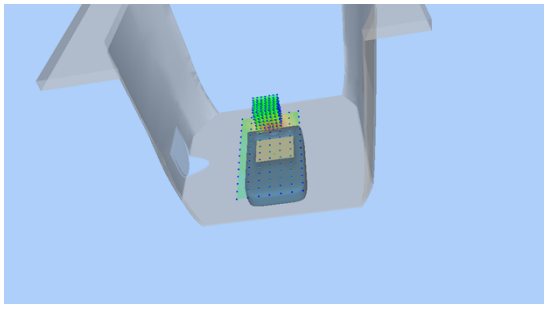


**Maximum location: X=-5.00, Y=56.00**
**SAR Peak: 0.82 W/kg**

| | |
|---|---|
| **SAR 10g (W/Kg)** | 0.374593 |
| **SAR 1g (W/Kg)** | 0.552400 |

| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 | 24.00 | 29.00 |
|---|---|---|---|---|---|---|---|
| SAR (W/Kg) | 0.8713 | 0.5947 | 0.3694 | 0.3251 | 0.2008 | 0.1870 | 0.1353 |




| 3D screen shot | Hot spot position |
|---|---|
|  | |

# MEASUREMENT 29

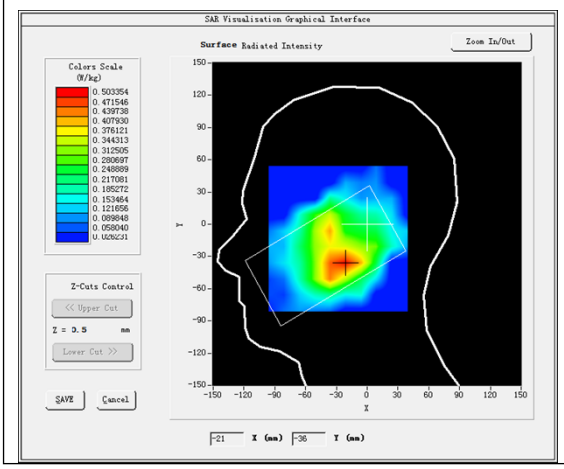
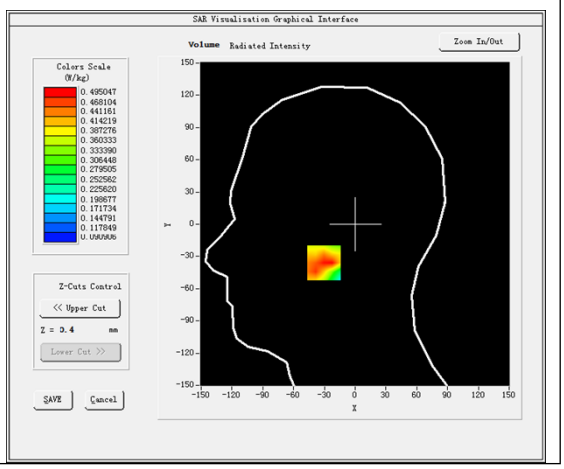
Date of measurement: 9/4/2025

## A. Experimental conditions.

| | |
|---|---|
| **Area Scan** | dx=15mm dy=15mm, h= 5.00 mm |
| **ZoomScan** | 5x5x7,dx=8mm dy=8mm dz=5mm |
| **Phantom** | Left head |
| **Device Position** | Cheek |
| **Band** | CUSTOM (LTEBand66) |
| **Channels** | Middle |
| **Signal** | (Crest factor: 1.0) |
| **ConvF** | 2.09 |

## B. SAR Measurement Results

| | |
|---|---|
| **Frequency (MHz)** | 1745.000000 |
| **Relative permittivity (real part)** | 40.104546 |
| **Relative permittivity (imaginary part)** | 14.103182 |
| **Conductivity (S/m)** | 1.367225 |
| **Variation (%)** | -4.380000 |

| SURFACE SAR | VOLUME SAR |
|---|---|
|  |  |

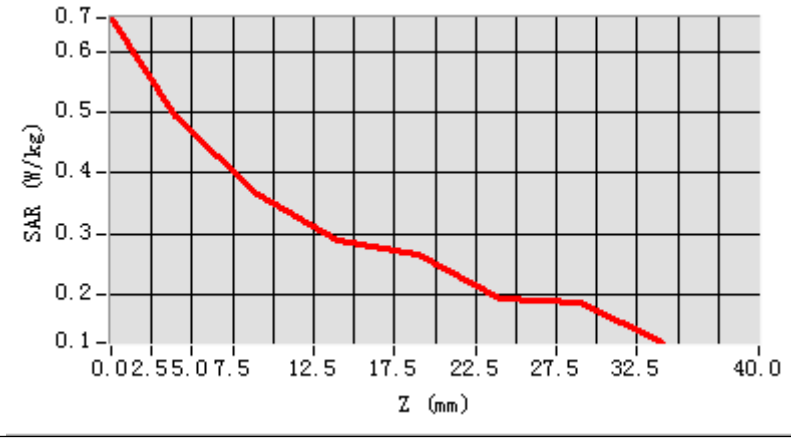


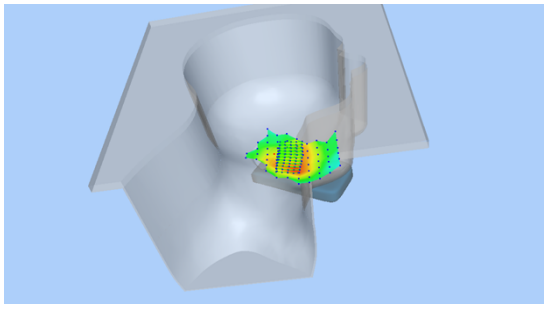
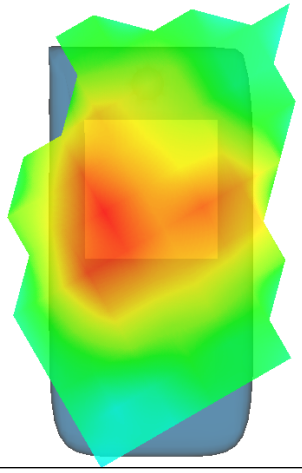


**Maximum location: X=-21.00, Y=-36.00**
**SAR Peak: 0.65 W/kg**

| | |
|---|---|
| **SAR 10g (W/Kg)** | 0.358814 |
| **SAR 1g (W/Kg)** | 0.476316 |

| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 | 24.00 | 29.00 |
|---|---|---|---|---|---|---|---|
| SAR (W/Kg) | 0.6577 | 0.4950 | 0.3643 | 0.2891 | 0.2659 | 0.1926 | 0.1858 |




| 3D screen shot | Hot spot position |
|---|---|
|  |  |

# MEASUREMENT 30

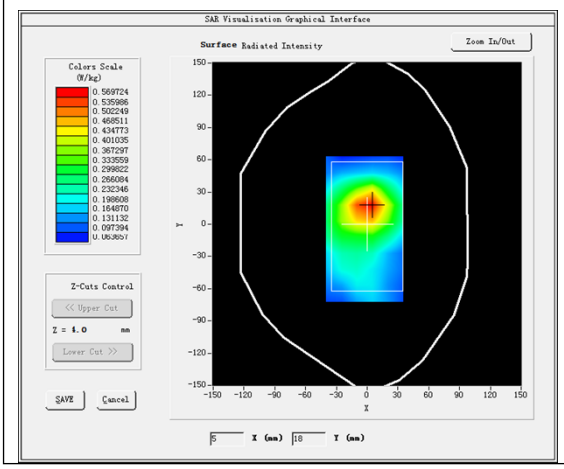
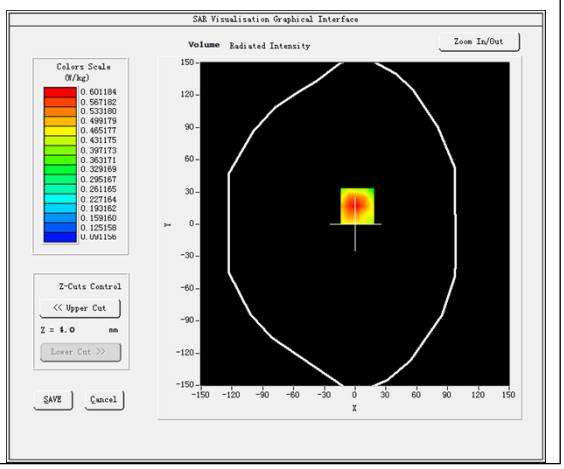
Date of measurement: 9/4/2025

## A. Experimental conditions.

| | |
|---|---|
| **Area Scan** | dx=15mm dy=15mm, h= 5.00 mm |
| **ZoomScan** | 5x5x7,dx=8mm dy=8mm dz=5mm |
| **Phantom** | Validation plane |
| **Device Position** | Body |
| **Band** | CUSTOM (LTEBand66) |
| **Channels** | Middle |
| **Signal** | (Crest factor: 1.0) |
| **ConvF** | 2.09 |

## B. SAR Measurement Results

| | |
|---|---|
| **Frequency (MHz)** | 1745.000000 |
| **Relative permittivity (real part)** | 40.104546 |
| **Relative permittivity (imaginary part)** | 14.103182 |
| **Conductivity (S/m)** | 1.367225 |
| **Variation (%)** | -2.470000 |

| SURFACE SAR | VOLUME SAR |
|---|---|
|  |  |

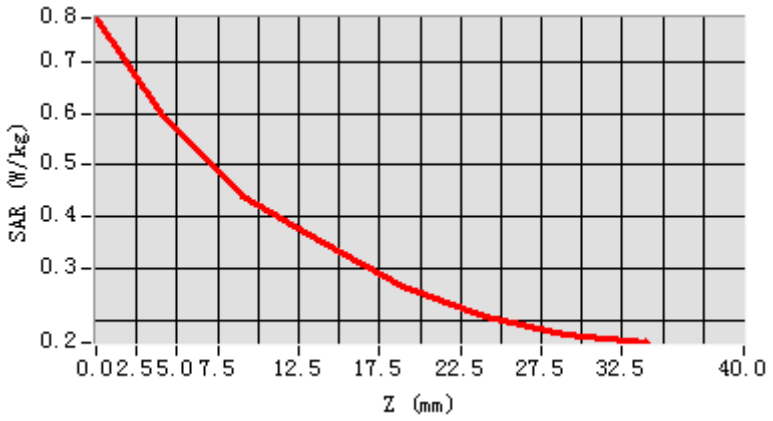


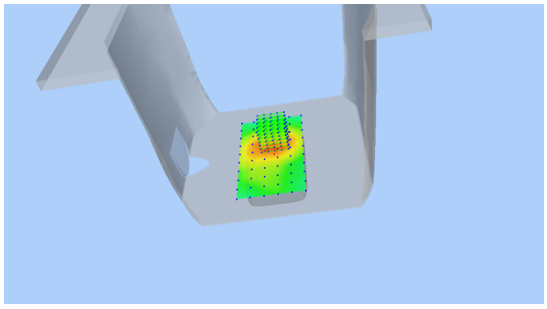
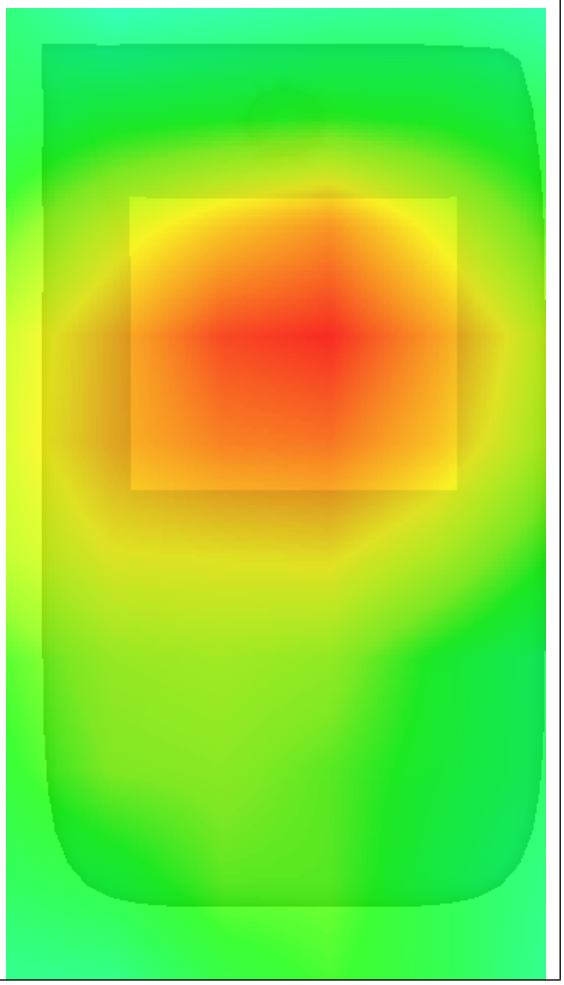


**Maximum location: X=2.00, Y=17.00**
**SAR Peak: 0.81 W/kg**

| | |
|---|---|
| **SAR 10g (W/Kg)** | 0.404761 |
| **SAR 1g (W/Kg)** | 0.583007 |

| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 | 24.00 | 29.00 |
|---|---|---|---|---|---|---|---|
| SAR (W/Kg) | 0.7849 | 0.6012 | 0.4390 | 0.3488 | 0.2641 | 0.2066 | 0.1736 |




| 3D screen shot | Hot spot position |
|---|---|
|  |  |

# MEASUREMENT 31

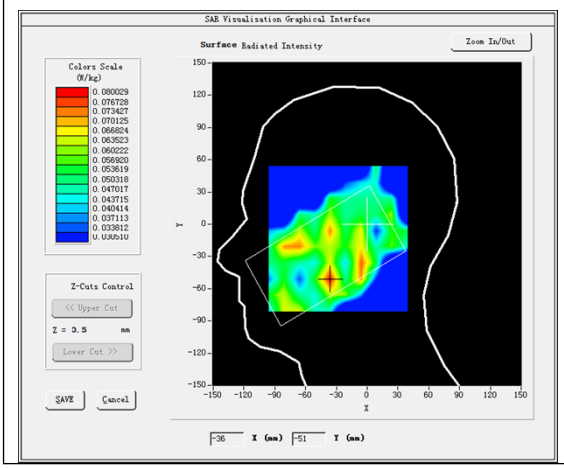
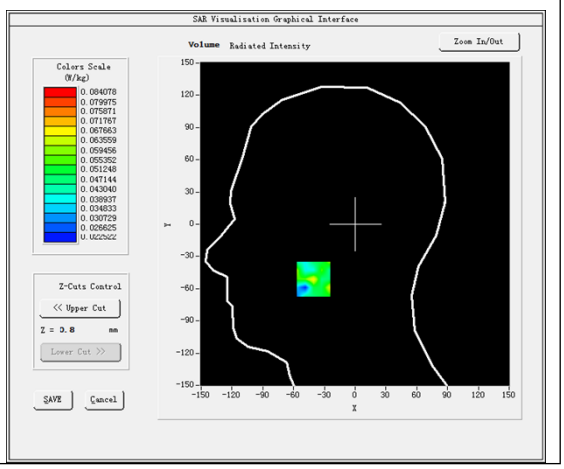
Date of measurement: 7/4/2025

## A. Experimental conditions.

| | |
|---|---|
| **Area Scan** | dx=15mm dy=15mm, h= 5.00 mm |
| **ZoomScan** | 5x5x7,dx=8mm dy=8mm dz=5mm |
| **Phantom** | Left head |
| **Device Position** | Cheek |
| **Band** | CUSTOM (LTEBand71) |
| **Channels** | Middle |
| **Signal** | (Crest factor: 1.0) |
| **ConvF** | 1.65 |

## B. SAR Measurement Results

| | |
|---|---|
| **Frequency (MHz)** | 683.000000 |
| **Relative permittivity (real part)** | 42.257332 |
| **Relative permittivity (imaginary part)** | 24.361601 |
| **Conductivity (S/m)** | 0.924387 |
| **Variation (%)** | -4.530001 |

| SURFACE SAR | VOLUME SAR |
|---|---|
|  |  |

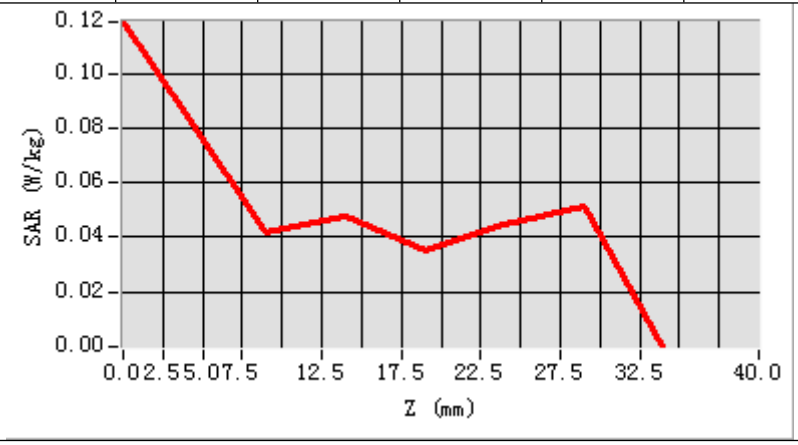


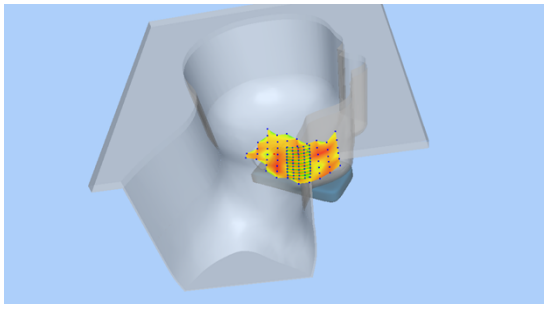
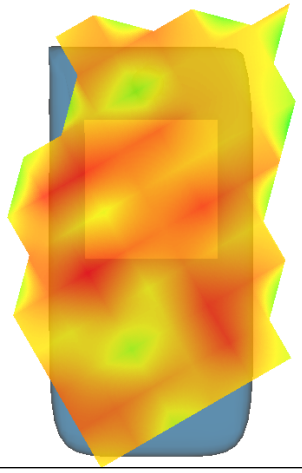


**Maximum location: X=-37.00, Y=-51.00**
**SAR Peak: 0.12 W/kg**

| | |
|---|---|
| **SAR 10g (W/Kg)** | 0.060600 |
| **SAR 1g (W/Kg)** | 0.078370 |

| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 | 24.00 | 29.00 |
|---|---|---|---|---|---|---|---|
| SAR (W/Kg) | 0.1188 | 0.0841 | 0.0414 | 0.0475 | 0.0353 | 0.0448 | 0.0514 |




| 3D screen shot | Hot spot position |
|---|---|
|  |  |

# MEASUREMENT 32

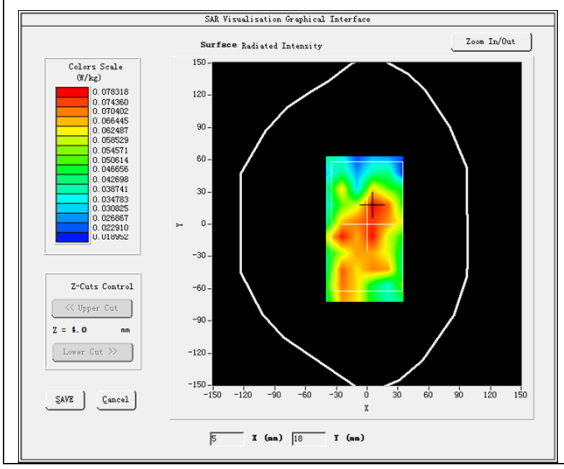
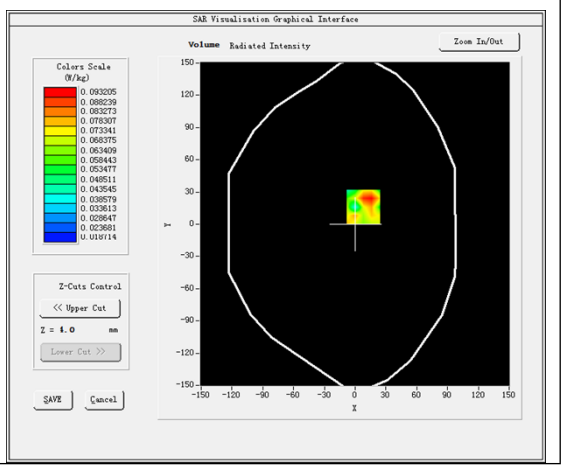
Date of measurement: 7/4/2025

## A. Experimental conditions.

| | |
|---|---|
| **Area Scan** | dx=15mm dy=15mm, h= 5.00 mm |
| **ZoomScan** | 5x5x7,dx=8mm dy=8mm dz=5mm |
| **Phantom** | Validation plane |
| **Device Position** | Body |
| **Band** | CUSTOM (LTEBand71) |
| **Channels** | Middle |
| **Signal** | (Crest factor: 1.0) |
| **ConvF** | 1.65 |

## B. SAR Measurement Results

| | |
|---|---|
| **Frequency (MHz)** | 683.000000 |
| **Relative permittivity (real part)** | 42.257332 |
| **Relative permittivity (imaginary part)** | 24.361601 |
| **Conductivity (S/m)** | 0.924387 |
| **Variation (%)** | -0.200000 |

| SURFACE SAR | VOLUME SAR |
|---|---|
|  |  |

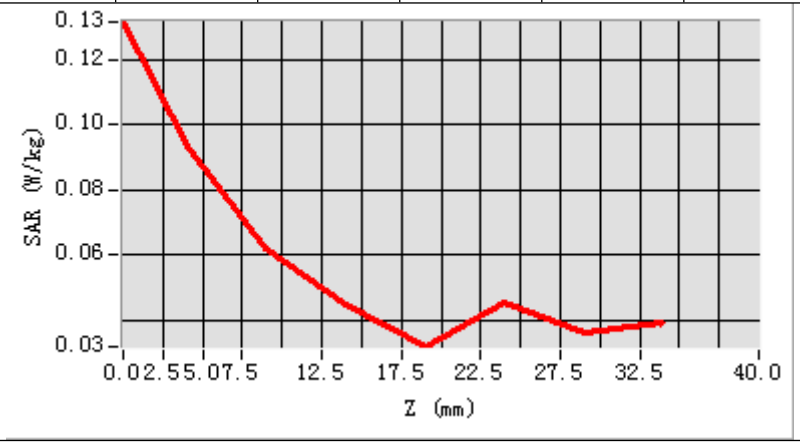


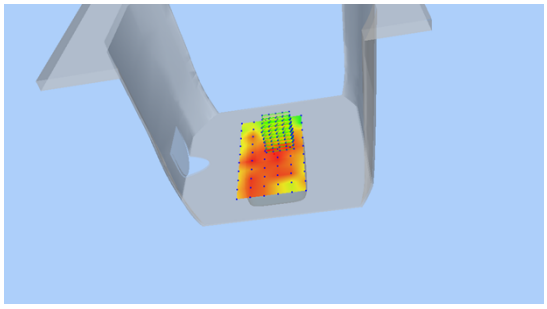
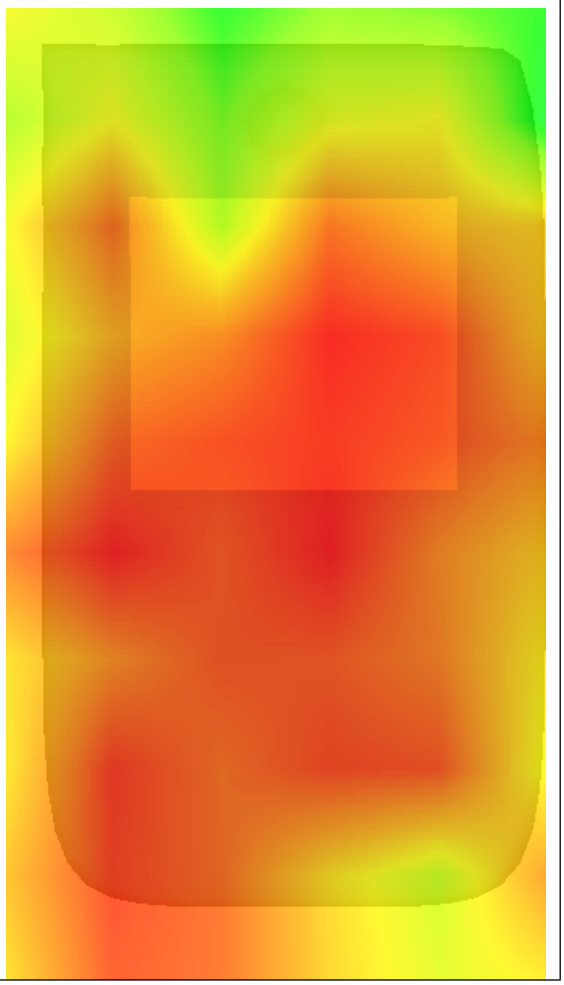


**Maximum location: X=8.00, Y=16.00**
**SAR Peak: 0.15 W/kg**

| | |
|---|---|
| **SAR 10g (W/Kg)** | 0.061349 |
| **SAR 1g (W/Kg)** | 0.091968 |

| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 | 24.00 | 29.00 |
|---|---|---|---|---|---|---|---|
| SAR (W/Kg) | 0.1314 | 0.0932 | 0.0624 | 0.0449 | 0.0320 | 0.0456 | 0.0364 |




| 3D screen shot | Hot spot position |
|---|---|
|  |  |

# Appendix D. Calibration Certificate

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| --- |
| E Field Probe - EPGO0523-403 |
| 750 MHz Dipole - SN 03/15 DIP 0G750-355 |
| 835 MHz Dipole - SN 03/15 DIP 0G835-347 |
| 1800 MHz Dipole - SN 03/15 DIP 1G800-349 |
| 1900 MHz Dipole - SN 03/15 DIP 1G900-350 |
| 2450 MHz Dipole - SN 03/15 DIP 2G450-352 |
| 2600 MHz Dipole - SN 03/15 DIP 2G600-356 |
| 5000-6000 MHz Dipole - SN 03/14 WGA33 |

# COMOSAR E-Field Probe Calibration Report

Ref : ACR.307.3.24.BES.A

## GUANGDONG ASIA HONGKE TEST TECHNOLOGY CO., LTD

**NO.1/F,BUILDING B1, JUNFENG INDUSTRIAL PARK, CHONGQING ROAD，HEPING COMMUNITY，FUHAIHAI STREET, BAO'AN DISTRICT,SHENZHEN, GUANGDONG 518055, P.R.CHINA**

## MVG COMOSAR DOSIMETRIC E-FIELD PROBE

**SERIAL NO.: SN 39/21 EPGO0523-403**

**Calibrated at MVG**

**Z.I. de la pointe du diable**

**Technopôle Brest Iroise – 295 avenue Alexis de Rochon**

**29280 PLOUZANE - FRANCE**

**Calibration date: 09/11/2024**

Accreditations #2-6789
Scope available on www.cofrac.fr

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*Summary:*

This document presents the method and results from an accredited COMOSAR E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).

| | *Name* | *Function* | *Date* | *Signature* |
|---|---|---|---|---|
| *Prepared by :* | Jérôme Le Gall | Measurement Responsible | 09/10/2024 | |
| *Checked by :* | Jérôme Luc | Technical Manager | 09/10/2024 | |
| *Approved by :* | Yann Toutain | Laboratory Director | 09/11/2024 | Yann TOUTAIN |

| | *Customer Name* |
|---|---|
| *Distribution :* | Shenzhen Asia Hongke |

| *Issue* | *Name* | *Date* | *Modifications* |
|---|---|---|---|
| A | Jérôme Luc | 9/11/2024 | Initial release |
| | | | |
| | | | |
| | | | |



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# 1 DEVICE UNDER TEST

| Device Under Test | |
|---|---|
| Device Type | COMOSAR DOSIMETRIC E FIELD PROBE |
| Manufacturer | MVG |
| Model | SSE2 |
| Serial Number | SN 39/21 EPGO0523-403 |
| Product Condition (new / used) | New |
| Frequency Range of Probe | 0.15 GHz-6GHz |
| Resistance of Three Dipoles at Connector | Dipole 1: R1=0.199 MΩ<br>Dipole 2: R2=0.218 MΩ<br>Dipole 3: R3=0.210 MΩ |

# 2 PRODUCT DESCRIPTION

## 2.1 GENERAL INFORMATION

**MVG's COMOSAR E field Probes are built in** accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards.

**Figure 1** – *MVG COMOSAR Dosimetric E field Probe*

| | |
|---|---|
| Probe Length | 330 mm |
| Length of Individual Dipoles | 2 mm |
| Maximum external diameter | 8 mm |
| Probe Tip External Diameter | 2.5 mm |
| Distance between dipoles / probe extremity | 1 mm |

# 3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

## 3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

## 3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.



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### 3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

### 3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

### 3.1 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and $d_{be}$ + $d_{step}$ along lines that are approximately normal to the surface:

$$\mathrm{SAR}_{\mathrm{uncertainty}}[\%] = \delta\mathrm{SAR}_{be}\,\frac{\left(d_{be}+d_{step}\right)^2}{2d_{step}}\,\frac{\left(e^{-d_{be}/(\delta/2)}\right)}{\delta/2} \quad \text{for } \left(d_{be}+d_{step}\right) < 10\ \mathrm{mm}$$

where

| | |
|---|---|
| $\mathrm{SAR}_{\mathrm{uncertainty}}$ | is the uncertainty in percent of the probe boundary effect |
| $d_{be}$ | is the distance between the surface and the closest *zoom-scan* measurement point, in millimetre |
| $\Delta_{step}$ | is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible |
| $\delta$ | is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e., $\delta \approx$ 14 mm at 3 GHz; |
| $\Delta\mathrm{SAR}_{be}$ | in percent of SAR is the deviation between the measured SAR value, at the distance $d_{be}$ from the boundary, and the analytical SAR value. |

The measured worst case boundary effect SARuncertainty[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).



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## 4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

| Uncertainty analysis of the probe calibration in waveguide | | | | | |
|---|---|---|---|---|---|
| **ERROR SOURCES** | **Uncertainty value (%)** | **Probability Distribution** | **Divisor** | **ci** | **Standard Uncertainty (%)** |
| **Expanded uncertainty**<br>95 % confidence level k = 2 | | | | | 14 % |

## 5 CALIBRATION MEASUREMENT RESULTS

| Calibration Parameters | |
|---|---|
| Liquid Temperature | 20 +/- 1 °C |
| Lab Temperature | 20 +/- 1 °C |
| Lab Humidity | 30-70 % |

### 5.1 SENSITIVITY IN AIR

| Normx dipole 1 (μV/(V/m)$^2$) | Normy dipole 2 (μV/(V/m)$^2$) | Normz dipole 3 (μV/(V/m)$^2$) |
|---|---|---|
| 1.26 | 0.87 | 0.77 |

| DCP dipole 1 (mV) | DCP dipole 2 (mV) | DCP dipole 3 (mV) |
|---|---|---|
| 113 | 108 | 113 |

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:

$$E = \sqrt{E_1^{\ 2} + E_2^{\ 2} + E_3^{\ 2}}$$



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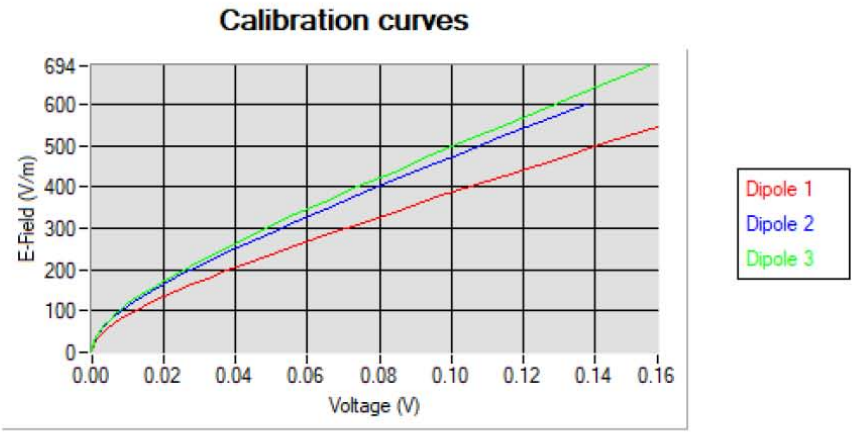
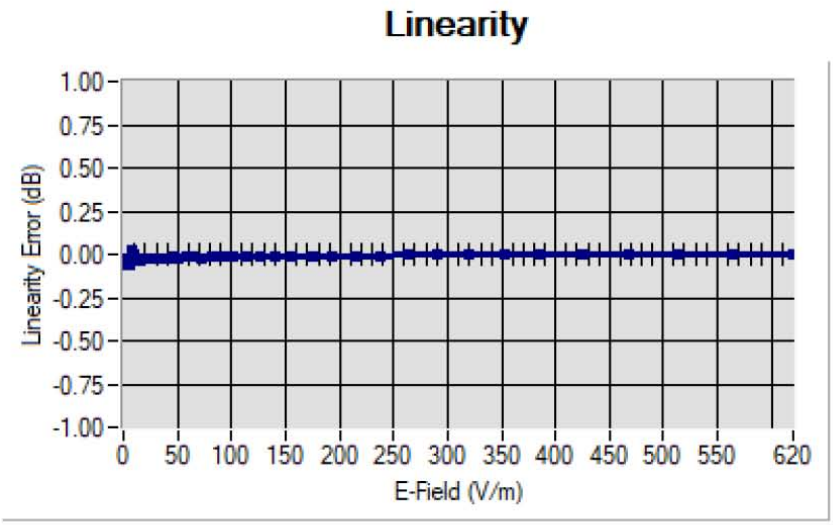



5.2 LINEARITY




Linearity:+/-1.42% (+/-0.06dB)



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## 5.3 SENSITIVITY IN LIQUID

| Liquid | Frequency (MHz +/- 100MHz) | ConvF |
|---|---|---|
| HL600 | 600 | 1.62 |
| HL750 | 750 | 1.65 |
| HL850 | 835 | 1.66 |
| HL900 | 900 | 1.77 |
| HL1500 | 1500 | 2.09 |
| HL1750 | 1750 | 2.09 |
| HL1800 | 1800 | 2.05 |
| HL1900 | 1900 | 2.05 |
| HL2000 | 2000 | 2.41 |
| HL2100 | 2100 | 2.36 |
| HL2300 | 2300 | 2.55 |
| HL2450 | 2450 | 2.38 |
| HL2600 | 2600 | 2.35 |
| HL3300 | 3300 | 2.04 |
| HL3500 | 3500 | 1.98 |
| HL3700 | 3700 | 2.11 |
| HL3900 | 3900 | 2.54 |
| HL4200 | 4200 | 2.22 |
| HL4600 | 4600 | 2.40 |
| HL4900 | 4900 | 2.33 |
| HL5200 | 5200 | 2.30 |
| HL5400 | 5400 | 2.30 |
| HL5600 | 5600 | 2.29 |
| HL5800 | 5800 | 2.27 |

LOWER DETECTION LIMIT: 8mW/kg



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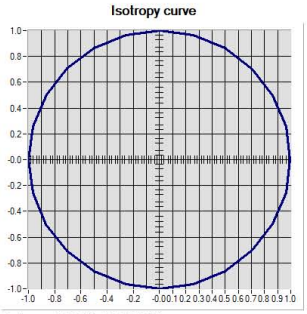
## 5.4 ISOTROPY

**HL1800 MHz**




Isotropy:+/-0.17% (+/-0.01dB)



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## 6 LIST OF EQUIPMENT

| Equipment Summary Sheet | | | | |
|---|---|---|---|---|
| **Equipment Description** | **Manufacturer / Model** | **Identification No.** | **Current Calibration Date** | **Next Calibration Date** |
| CALIPROBE Test Bench | Version 2 | NA | Validated. No cal required. | Validated. No cal required. |
| Network Analyzer | Rohde & Schwarz ZVM | 100203 | 08/2024 | 08/2027 |
| Network Analyzer | Agilent 8753ES | MY40003210 | 10/2021 | 10/2024 |
| Network Analyzer – Calibration kit | Rohde & Schwarz ZV-Z235 | 101223 | 05/2024 | 05/2027 |
| Network Analyzer – Calibration kit | HP 85033D | 3423A08186 | 06/2021 | 06/2027 |
| Multimeter | Keithley 2000 | 1160271 | 02/2024 | 02/2027 |
| Signal Generator | Rohde & Schwarz SMB | 106589 | 04/2024 | 04/2027 |
| Amplifier | MVG | MODU-023-C-0002 | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Power Meter | NI-USB 5680 | 170100013 | 06/2024 | 06/2027 |
| Power Meter | Rohde & Schwarz NRVD | 832839-056 | 11/2021 | 11/2024 |
| Directional Coupler | Krytar 158020 | 131467 | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Waveguide | MVG | SN 32/16 WG4_1 | Validated. No cal required. | Validated. No cal required. |
| Liquid transition | MVG | SN 32/16 WGLIQ_0G900_1 | Validated. No cal required. | Validated. No cal required. |
| Waveguide | MVG | SN 32/16 WG6_1 | Validated. No cal required. | Validated. No cal required. |
| Liquid transition | MVG | SN 32/16 WGLIQ_1G500_1 | Validated. No cal required. | Validated. No cal required. |
| Waveguide | MVG | SN 32/16 WG8_1 | Validated. No cal required. | Validated. No cal required. |
| Liquid transition | MVG | SN 32/16 WGLIQ_1G800B_1 | Validated. No cal required. | Validated. No cal required. |
| Liquid transition | MVG | SN 32/16 WGLIQ_1G800H_1 | Validated. No cal required. | Validated. No cal required. |
| Waveguide | MVG | SN 32/16 WG10_1 | Validated. No cal required. | Validated. No cal required. |
| Liquid transition | MVG | SN 32/16 WGLIQ_3G500_1 | Validated. No cal required. | Validated. No cal required. |



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| | | | | |
|---|---|---|---|---|
| Waveguide | MVG | SN 32/16 WG12_1 | Validated. No cal required. | Validated. No cal required. |
| Liquid transition | MVG | SN 32/16 WGLIQ_5G000_1 | Validated. No cal required. | Validated. No cal required. |
| Temperature / Humidity Sensor | Testo 184 H1 | 44225320 | 06/2024 | 06/2027 |



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# SAR Reference Dipole Calibration Report

Ref : ACR.53.23.24.BES.A

**GUANGDONG ASIA HONGKE TEST TECHNOLOGY CO., LTD**

**NO.1/F,BUILDING B1, JUNFENG INDUSTRIAL PARK, CHONGQING ROAD, HEPING COMMUNITY , FUHAIHAI STREET, BAO'AN DISTRICT,SHENZHEN, GUANGDONG 518055, P.R.CHINA**

**MVG COMOSAR REFERENCE DIPOLE**

**FREQUENCY: 750MHZ**

**SERIAL NO.: SN 03/15 DIP0G750-355**

**Calibrated at MVG**

**Z.I. de la pointe du diable**

**Technopôle Brest Iroise – 295 avenue Alexis de Rochon**

**29280 PLOUZANE - FRANCE**

**Calibration date: 02/21/2024**

Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr

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*Summary:*

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

| | *Name* | *Function* | *Date* | *Signature* |
|---|---|---|---|---|
| *Prepared by :* | Pedro Ruiz | Measurement Responsible | 2/22/2024 | |
| *Checked & approved by:* | Jérôme Luc | Technical Manager | 2/22/2024 | |
| *Authorized by:* | Yann Toutain | Laboratory Director | 2/27/2024 | |

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2024.02.27 08:54:37 +01'00'

| | *Customer Name* |
|---|---|
| *Distribution :* | Shenzhen Asia Hongke |

| *Issue* | *Name* | *Date* | *Modifications* |
|---|---|---|---|
| A | Pedro Ruiz | 2/22/2024 | Initial release |
| | | | |
| | | | |
| | | | |



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## 1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

## 2 DEVICE UNDER TEST

| Device Under Test | |
|---|---|
| Device Type | COMOSAR 750 MHz REFERENCE DIPOLE |
| Manufacturer | MVG |
| Model | SID750 |
| Serial Number | SN 03/15DIP0G750-355 |
| Product Condition (new / used) | Used |

## 3 PRODUCT DESCRIPTION

### 3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.

**Figure 1** – *MVG COMOSAR Validation Dipole*



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## 4 MEASUREMENT METHOD

### 4.1 MECHANICAL REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

### 4.2 S11 PARAMETER REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a S11 of -20 dB or better. The S11 measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

### 4.3 SAR REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore-mentioned standards.

## 5 MEASUREMENT UNCERTAINTY

### 5.1 MECHANICAL DIMENSIONS

For the measurement in the range 0-300mm, the estimated expanded uncertainty (k=2) in calibration for the dimension measurement in mm is +/-0.20 mm with respect to measurement conditions.

For the measurement in the range 300-450mm, the estimated expanded uncertainty (k=2) in calibration for the dimension measurement in mm is +/-0.44 mm with respect to measurement conditions.

### 5.2 S11 PARAMETER

The estimated expanded uncertainty (k=2) in calibration for the S11 parameter in linear is +/-0.08 with respect to measurement conditions.

### 5.3 SAR

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

The estimated expanded uncertainty (k=2) in calibration for the 1g and 10g SAR measurement in W/kg is +/-19% with respect to measurement conditions.



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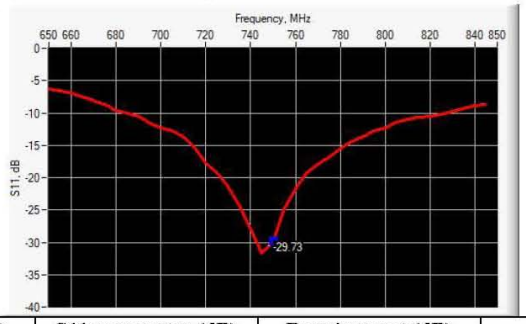
# 6 CALIBRATION RESULTS

## 6.1 MECHANICAL DIMENSIONS

| L mm | | h mm | | d mm | |
|---|---|---|---|---|---|
| **Measured** | **Required** | **Measured** | **Required** | **Measured** | **Required** |
| - | 176.00 +/- 2% | - | 100.00 +/- 2% | - | 6.35 +/- 2% |

## 6.2 S11 PARAMETER

### 6.2.1 S11 parameter in Head Liquid




| Frequency (MHz) | S11 parameter (dB) | Requirement (dB) | Impedance |
|---|---|---|---|
| 750 | -29.73 | -20 | 52.5Ω + 2.2jΩ |

## 6.3 SAR

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

### 6.3.1 SAR with Head Liquid

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.



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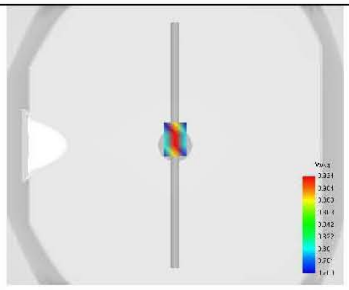
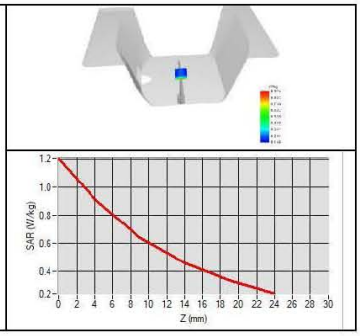
**SAR REFERENCE DIPOLE CALIBRATION REPORT**

REF : ACR.53.23.24.BES.A

| | |
|---|---|
| Software | OPENSAR V5 |
| Phantom | SN 13/09 SAM68 |
| Probe | 3523-EPGO-429 |
| Liquid | Head Liquid Values: eps' : 45.0 sigma : 0.87 |
| Distance between dipole center and liquid | 15.0 mm |
| Area scan resolution | dx=8mm/dy=8mm |
| Zoon Scan Resolution | dx=8mm/dy=8mm/dz=5mm |
| Frequency | 750 MHz |
| Input power | 20 dBm |
| Liquid Temperature | 20 +/- 1 °C |
| Lab Temperature | 20 +/- 1 °C |
| Lab Humidity | 30-70 % |

| Frequency | 1g SAR (W/kg) | | | 10g SAR (W/kg) | | |
|---|---|---|---|---|---|---|
| | Measured | Measured normalized to 1W | Target normalized to 1W | Measured | Measured normalized to 1W | Target normalized to 1W |
| 750 MHz | 0.86 | 8.60 | 8.49 | 0.58 | 5.78 | 5.55 |





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## 7 LIST OF EQUIPMENT

| Equipment Summary Sheet | | | | |
|---|---|---|---|---|
| **Equipment Description** | **Manufacturer / Model** | **Identification No.** | **Current Calibration Date** | **Next Calibration Date** |
| SAM Phantom | MVG | SN 13/09 SAM68 | Validated. No cal required. | Validated. No cal required. |
| COMOSAR Test Bench | Version 3 | NA | Validated. No cal required. | Validated. No cal required. |
| Network Analyzer | Rohde & Schwarz ZVM | 100203 | 08/2021 | 08/2024 |
| Network Analyzer – Calibration kit | Rohde & Schwarz ZV-Z235 | 101223 | 07/2022 | 07/2025 |
| Calipers | Mitutoyo | SN 0009732 | 11/2022 | 11/2025 |
| Reference Probe | MVG | 3523-EPGO-429 | 11/2023 | 11/2024 |
| Multimeter | Keithley 2000 | 4013982 | 02/2023 | 02/2026 |
| Signal Generator | Rohde & Schwarz SMB | 106589 | 03/2022 | 03/2025 |
| Amplifier | MVG | MODU-023-C-0002 | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Power Meter | NI-USB 5680 | 170100013 | 06/2021 | 06/2024 |
| Power Meter | Keysight U2000A | SN: MY62340002 | 10/2022 | 10/2025 |
| Directional Coupler | Krytar 158020 | 131467 | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Temperature / Humidity Sensor | Testo 184 H1 | 44225320 | 06/2021 | 06/2024 |



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# SAR Reference Dipole Calibration Report

Ref : ACR.53.24.24.BES.A

**GUANGDONG ASIA HONGKE TEST TECHNOLOGY CO., LTD**

**NO.1/F,BUILDING B1, JUNFENG INDUSTRIAL PARK, CHONGQING ROAD, HEPING COMMUNITY , FUHAIHAI STREET, BAO'AN DISTRICT,SHENZHEN, GUANGDONG 518055, P.R.CHINA**

**MVG COMOSAR REFERENCE DIPOLE**

**FREQUENCY: 835MHZ**

**SERIAL NO.: SN 03/15 DIP0G835-347**

**Calibrated at MVG**

**Z.I. de la pointe du diable**

**Technopôle Brest Iroise – 295 avenue Alexis de Rochon**

**29280 PLOUZANE - FRANCE**

**Calibration date: 02/21/2024**

Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr

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*Summary:*

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.