

Client: **STS (Shenzhen)**

Certificate No: **25J02Z000524**

## CALIBRATION CERTIFICATE

Object **DAE3 - SN: 428**

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

Calibration date: **September 08, 2025**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature( $22\pm 3$ ) $^{\circ}\text{C}$  and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------|------|------------------------------------------|-----------------------|
|-------------------|------|------------------------------------------|-----------------------|

|                        |         |                                   |        |
|------------------------|---------|-----------------------------------|--------|
| Process Calibrator 753 | 1971018 | 11-Jun-25 (CTTL, No.25J02X004977) | Jun-26 |
|------------------------|---------|-----------------------------------|--------|

|  | Name | Function | Signature |
|--|------|----------|-----------|
|--|------|----------|-----------|

|                |             |                   |                                                                                       |
|----------------|-------------|-------------------|---------------------------------------------------------------------------------------|
| Calibrated by: | Yu Zongying | SAR Test Engineer |  |
|----------------|-------------|-------------------|---------------------------------------------------------------------------------------|

|              |         |                   |                                                                                       |
|--------------|---------|-------------------|---------------------------------------------------------------------------------------|
| Reviewed by: | Lin Jun | SAR Test Engineer |  |
|--------------|---------|-------------------|---------------------------------------------------------------------------------------|

|              |             |                    |                                                                                       |
|--------------|-------------|--------------------|---------------------------------------------------------------------------------------|
| Approved by: | Qi Dianyuan | SAR Project Leader |  |
|--------------|-------------|--------------------|---------------------------------------------------------------------------------------|

Issued: September 10, 2025

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



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E-mail: [emf@caict.ac.cn](mailto:emf@caict.ac.cn) <http://www.caict.ac.cn>

### 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 report provide only calibration results for DAE, it does not contain other performance test results.



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## DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

| Calibration Factors | X                         | Y                         | Z                         |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range          | 404.480 $\pm$ 0.15% (k=2) | 404.830 $\pm$ 0.15% (k=2) | 404.597 $\pm$ 0.15% (k=2) |
| Low Range           | 3.95732 $\pm$ 0.7% (k=2)  | 3.95225 $\pm$ 0.7% (k=2)  | 3.91659 $\pm$ 0.7% (k=2)  |

## Connector Angle

|                                           |                  |
|-------------------------------------------|------------------|
| Connector Angle to be used in DASY system | 258.5° $\pm$ 1 ° |
|-------------------------------------------|------------------|



## SAR Reference Dipole Calibration Report

Ref : ACR.262.5.23.MVGB.A

**SHENZHEN STS TEST SERVICES CO., LTD.**  
**1/F., BUILDING B, ZHUOKE SCIENCE PARK, No.190,**  
**CHONGQING ROAD, FUYONG STREET,**  
**BAO' AN DISTRICT, SHENZHEN, GUANGDONG CHINA**  
**MVG COMOSAR REFERENCE DIPOLE**  
**FREQUENCY: 835 MHZ**  
**SERIAL NO.: SN 30/14 DIP0G835-332**

**Calibrated at MVG**  
**Z.I. de la pointe du diable**  
**Technopôle Brest Iroise - 295 avenue Alexis de Rochon**  
**29280 PLOUZANE - FRANCE**

**Calibration date: 07/04/2023**



Accreditations #2-6789 and #2-6814  
Scope available on [www.cofrac.fr](http://www.cofrac.fr)

### *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.

|                      | <i>Name</i>  | <i>Function</i>     | <i>Date</i> | <i>Signature</i>                                                                    |
|----------------------|--------------|---------------------|-------------|-------------------------------------------------------------------------------------|
| <i>Prepared by :</i> | Jérôme LUC   | Technical Manager   | 7/04/2023   |  |
| <i>Checked by :</i>  | Jérôme LUC   | Technical Manager   | 7/04/2023   |  |
| <i>Approved by :</i> | Yann Toutain | Laboratory Director | 7/04/2023   |  |

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|                       | <i>Customer Name</i>                 |
|-----------------------|--------------------------------------|
| <i>Distribution :</i> | Shenzhen STS Test Services Co., Ltd. |

| <i>Issue</i> | <i>Name</i> | <i>Date</i> | <i>Modifications</i> |
|--------------|-------------|-------------|----------------------|
| A            | Jérôme LUC  | 7/04/2023   | Initial release      |
|              |             |             |                      |
|              |             |             |                      |
|              |             |             |                      |

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## 1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 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 835 MHz REFERENCE DIPOLE |
| Manufacturer                   | MVG                              |
| Model                          | SID835                           |
| Serial Number                  | SN 30/14 DIP0G835-332            |
| Product Condition (new / used) | Used                             |

A yearly calibration interval is recommended.

## 3 PRODUCT DESCRIPTION

### 3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



**Figure 1 – MVG COMOSAR Validation Dipole**

## 4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 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.

### 4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

### 4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions 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.

## 5 MEASUREMENT UNCERTAINTY

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.

### 5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

| Frequency band | Expanded Uncertainty on Return Loss |
|----------------|-------------------------------------|
| 400-6000MHz    | 0.1 dB                              |

### 5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

| Length (mm) | Expanded Uncertainty on Length |
|-------------|--------------------------------|
| 3 - 300     | 0.05 mm                        |

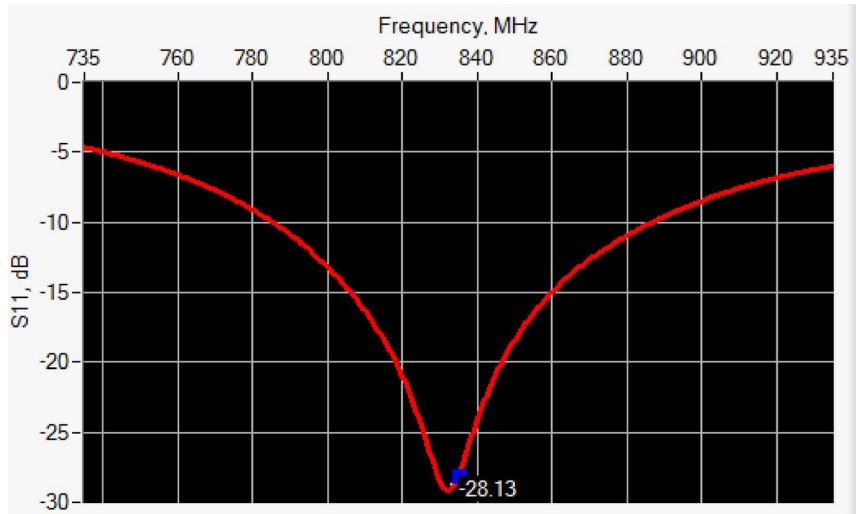
### 5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

| Scan Volume | Expanded Uncertainty |
|-------------|----------------------|
| 1 g         | 20.3 %               |
| 10 g        | 20.1 %               |

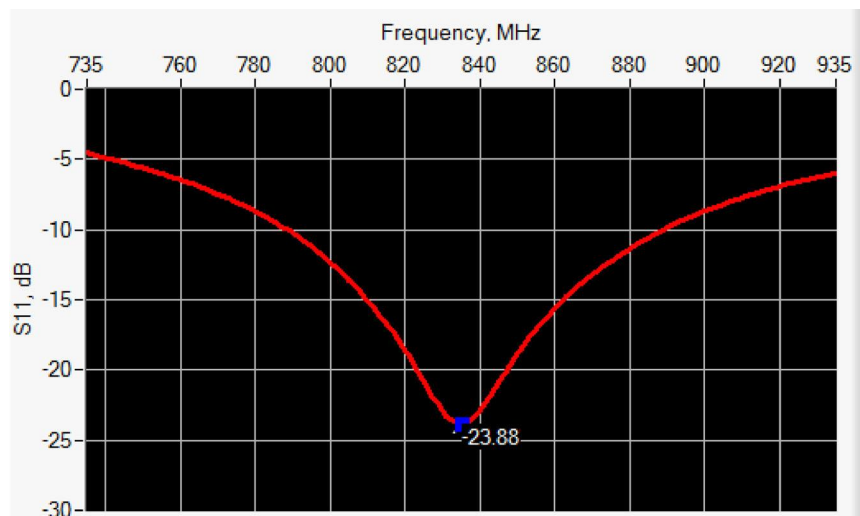
## 6 CALIBRATION MEASUREMENT RESULTS

### 6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



| Frequency (MHz) | Return Loss (dB) | Requirement (dB) | Impedance                   |
|-----------------|------------------|------------------|-----------------------------|
| 835             | -28.13           | -20              | $51.4 \Omega + 3.6 j\Omega$ |

### 6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



| Frequency (MHz) | Return Loss (dB) | Requirement (dB) | Impedance                   |
|-----------------|------------------|------------------|-----------------------------|
| 835             | -23.88           | -20              | $49.2 \Omega + 6.3 j\Omega$ |

### 6.3 MECHANICAL DIMENSIONS

| Frequency MHz | L mm         |          | h mm         |          | d mm        |          |
|---------------|--------------|----------|--------------|----------|-------------|----------|
|               | required     | measured | required     | measured | required    | measured |
| 750           | 176.0 ± 1 %. |          | 100.0 ± 1 %. |          | 6.35 ± 1 %. |          |
| 835           | 161.0 ± 1 %. | PASS     | 89.8 ± 1 %.  | PASS     | 3.6 ± 1 %.  | PASS     |

|      |             |  |            |  |           |  |
|------|-------------|--|------------|--|-----------|--|
| 900  | 149.0 ±1 %. |  | 83.3 ±1 %. |  | 3.6 ±1 %. |  |
| 1450 | 89.1 ±1 %.  |  | 51.7 ±1 %. |  | 3.6 ±1 %. |  |
| 1500 | 80.5 ±1 %.  |  | 50.0 ±1 %. |  | 3.6 ±1 %. |  |
| 1640 | 79.0 ±1 %.  |  | 45.7 ±1 %. |  | 3.6 ±1 %. |  |
| 1750 | 75.2 ±1 %.  |  | 42.9 ±1 %. |  | 3.6 ±1 %. |  |
| 1800 | 72.0 ±1 %.  |  | 41.7 ±1 %. |  | 3.6 ±1 %. |  |
| 1900 | 68.0 ±1 %.  |  | 39.5 ±1 %. |  | 3.6 ±1 %. |  |
| 1950 | 66.3 ±1 %.  |  | 38.5 ±1 %. |  | 3.6 ±1 %. |  |
| 2000 | 64.5 ±1 %.  |  | 37.5 ±1 %. |  | 3.6 ±1 %. |  |
| 2100 | 61.0 ±1 %.  |  | 35.7 ±1 %. |  | 3.6 ±1 %. |  |
| 2300 | 55.5 ±1 %.  |  | 32.6 ±1 %. |  | 3.6 ±1 %. |  |
| 2450 | 51.5 ±1 %.  |  | 30.4 ±1 %. |  | 3.6 ±1 %. |  |
| 2600 | 48.5 ±1 %.  |  | 28.8 ±1 %. |  | 3.6 ±1 %. |  |
| 3000 | 41.5 ±1 %.  |  | 25.0 ±1 %. |  | 3.6 ±1 %. |  |
| 3500 | 37.0 ±1 %.  |  | 26.4 ±1 %. |  | 3.6 ±1 %. |  |
| 3700 | 34.7 ±1 %.  |  | 26.4 ±1 %. |  | 3.6 ±1 %. |  |

## 7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 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.

### 7.1 HEAD LIQUID MEASUREMENT

| Frequency<br>MHz | Relative permittivity ( $\epsilon_r'$ ) |          | Conductivity ( $\sigma$ ) S/m |          |
|------------------|-----------------------------------------|----------|-------------------------------|----------|
|                  | required                                | measured | required                      | measured |
| 750              | 41.9 ±5 %                               |          | 0.89 ±5 %                     |          |
| 835              | 41.5 ±5 %                               | PASS     | 0.90 ±5 %                     | PASS     |
| 900              | 41.5 ±5 %                               |          | 0.97 ±5 %                     |          |
| 1450             | 40.5 ±5 %                               |          | 1.20 ±5 %                     |          |
| 1500             | 40.4 ±5 %                               |          | 1.23 ±5 %                     |          |
| 1640             | 40.2 ±5 %                               |          | 1.31 ±5 %                     |          |
| 1750             | 40.1 ±5 %                               |          | 1.37 ±5 %                     |          |
| 1800             | 40.0 ±5 %                               |          | 1.40 ±5 %                     |          |
| 1900             | 40.0 ±5 %                               |          | 1.40 ±5 %                     |          |
| 1950             | 40.0 ±5 %                               |          | 1.40 ±5 %                     |          |
| 2000             | 40.0 ±5 %                               |          | 1.40 ±5 %                     |          |

|      |           |  |           |  |
|------|-----------|--|-----------|--|
| 2100 | 39.8 ±5 % |  | 1.49 ±5 % |  |
| 2300 | 39.5 ±5 % |  | 1.67 ±5 % |  |
| 2450 | 39.2 ±5 % |  | 1.80 ±5 % |  |
| 2600 | 39.0 ±5 % |  | 1.96 ±5 % |  |
| 3000 | 38.5 ±5 % |  | 2.40 ±5 % |  |
| 3500 | 37.9 ±5 % |  | 2.91 ±5 % |  |

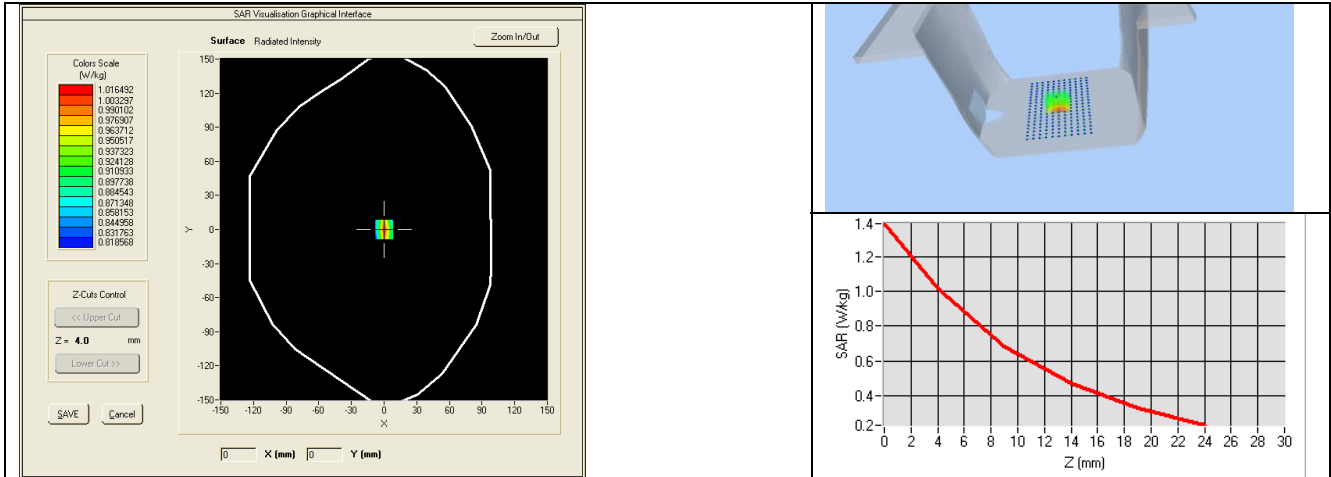
## 7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 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.

|                                           |                                                          |
|-------------------------------------------|----------------------------------------------------------|
| Software                                  | OPENSAR V4                                               |
| Phantom                                   | SN 20/09 SAM71                                           |
| Probe                                     | SN 18/11 EPG122                                          |
| Liquid                                    | Head Liquid Values: $\epsilon_{ps}'$ : 42.3 sigma : 0.92 |
| Distance between dipole center and liquid | 15.0 mm                                                  |
| Area scan resolution                      | $dx=8mm/dy=8mm$                                          |
| Zoon Scan Resolution                      | $dx=8mm/dy=8m/dz=5mm$                                    |
| Frequency                                 | 835 MHz                                                  |
| Input power                               | 20 dBm                                                   |
| Liquid Temperature                        | 21 °C                                                    |
| Lab Temperature                           | 21 °C                                                    |
| Lab Humidity                              | 45 %                                                     |

| Frequency<br>MHz | 1 g SAR (W/kg/W) |             | 10 g SAR (W/kg/W) |             |
|------------------|------------------|-------------|-------------------|-------------|
|                  | required         | measured    | required          | measured    |
| 750              | 8.49             |             | 5.55              |             |
| 835              | 9.56             | 9.63 (0.96) | 6.22              | 6.15 (0.62) |
| 900              | 10.9             |             | 6.99              |             |
| 1450             | 29               |             | 16                |             |
| 1500             | 30.5             |             | 16.8              |             |
| 1640             | 34.2             |             | 18.4              |             |
| 1750             | 36.4             |             | 19.3              |             |
| 1800             | 38.4             |             | 20.1              |             |
| 1900             | 39.7             |             | 20.5              |             |
| 1950             | 40.5             |             | 20.9              |             |
| 2000             | 41.1             |             | 21.1              |             |
| 2100             | 43.6             |             | 21.9              |             |
| 2300             | 48.7             |             | 23.3              |             |

|      |      |  |      |  |
|------|------|--|------|--|
| 2450 | 52.4 |  | 24   |  |
| 2600 | 55.3 |  | 24.6 |  |
| 3000 | 63.8 |  | 25.7 |  |
| 3500 | 67.1 |  | 25   |  |



## 7.3 BODY LIQUID MEASUREMENT

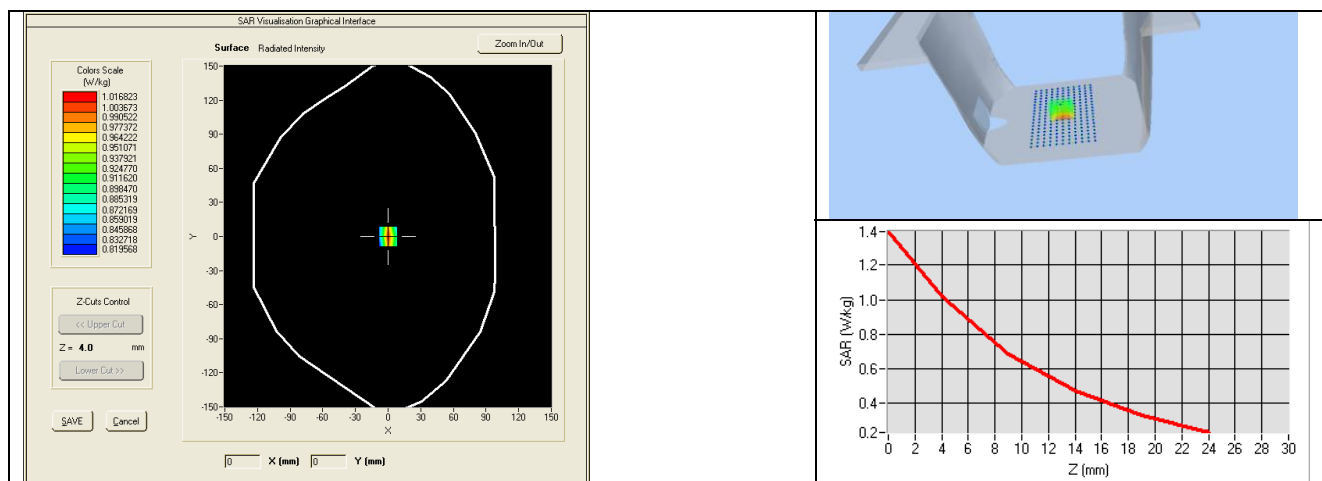
| Frequency<br>MHz | Relative permittivity ( $\epsilon_r'$ ) |          | Conductivity ( $\sigma$ ) S/m |          |
|------------------|-----------------------------------------|----------|-------------------------------|----------|
|                  | required                                | measured | required                      | measured |
| 750              | 55.5 $\pm$ 5 %                          |          | 0.96 $\pm$ 5 %                |          |
| 835              | 55.2 $\pm$ 5 %                          | PASS     | 0.97 $\pm$ 5 %                | PASS     |
| 900              | 55.0 $\pm$ 5 %                          |          | 1.05 $\pm$ 5 %                |          |
| 915              | 55.0 $\pm$ 5 %                          |          | 1.06 $\pm$ 5 %                |          |
| 1450             | 54.0 $\pm$ 5 %                          |          | 1.30 $\pm$ 5 %                |          |
| 1610             | 53.8 $\pm$ 5 %                          |          | 1.40 $\pm$ 5 %                |          |
| 1800             | 53.3 $\pm$ 5 %                          |          | 1.52 $\pm$ 5 %                |          |
| 1900             | 53.3 $\pm$ 5 %                          |          | 1.52 $\pm$ 5 %                |          |
| 2000             | 53.3 $\pm$ 5 %                          |          | 1.52 $\pm$ 5 %                |          |
| 2100             | 53.2 $\pm$ 5 %                          |          | 1.62 $\pm$ 5 %                |          |
| 2450             | 52.7 $\pm$ 5 %                          |          | 1.95 $\pm$ 5 %                |          |
| 2600             | 52.5 $\pm$ 5 %                          |          | 2.16 $\pm$ 5 %                |          |
| 3000             | 52.0 $\pm$ 5 %                          |          | 2.73 $\pm$ 5 %                |          |
| 3500             | 51.3 $\pm$ 5 %                          |          | 3.31 $\pm$ 5 %                |          |
| 5200             | 49.0 $\pm$ 10 %                         |          | 5.30 $\pm$ 10 %               |          |
| 5300             | 48.9 $\pm$ 10 %                         |          | 5.42 $\pm$ 10 %               |          |
| 5400             | 48.7 $\pm$ 10 %                         |          | 5.53 $\pm$ 10 %               |          |

|      |            |  |            |  |
|------|------------|--|------------|--|
| 5500 | 48.6 ±10 % |  | 5.65 ±10 % |  |
| 5600 | 48.5 ±10 % |  | 5.77 ±10 % |  |
| 5800 | 48.2 ±10 % |  | 6.00 ±10 % |  |

#### 7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

|                                           |                                              |
|-------------------------------------------|----------------------------------------------|
| Software                                  | OPENSAR V4                                   |
| Phantom                                   | SN 20/09 SAM71                               |
| Probe                                     | SN 18/11 EPG122                              |
| Liquid                                    | Body Liquid Values: eps' : 54.1 sigma : 0.97 |
| Distance between dipole center and liquid | 15.0 mm                                      |
| Area scan resolution                      | dx=8mm/dy=8mm                                |
| Zoon Scan Resolution                      | dx=8mm/dy=8m/dz=5mm                          |
| Frequency                                 | 835 MHz                                      |
| Input power                               | 20 dBm                                       |
| Liquid Temperature                        | 21 °C                                        |
| Lab Temperature                           | 21 °C                                        |
| Lab Humidity                              | 45 %                                         |

| Frequency<br>MHz | 1 g SAR (W/kg/W) | 10 g SAR (W/kg/W) |
|------------------|------------------|-------------------|
|                  | measured         | measured          |
| 835              | 9.93 (0.99)      | 6.35 (0.63)       |



## 8 LIST OF EQUIPMENT

| Equipment Summary Sheet         |                      |                    |                                               |                                               |
|---------------------------------|----------------------|--------------------|-----------------------------------------------|-----------------------------------------------|
| Equipment Description           | Manufacturer / Model | Identification No. | Current Calibration Date                      | Next Calibration Date                         |
| SAM Phantom                     | MVG                  | SN-20/09-SAM71     | Validated. No cal required.                   | Validated. No cal required.                   |
| COMOSAR Test Bench              | Version 3            | NA                 | Validated. No cal required.                   | Validated. No cal required.                   |
| Network Analyzer                | Rhode & Schwarz ZVA  | SN100132           | 02/2022                                       | 02/2025                                       |
| Calipers                        | Carrera              | CALIPER-01         | 01/2023                                       | 01/2026                                       |
| Reference Probe                 | MVG                  | EPG122 SN 18/11    | 10/2022                                       | 10/2023                                       |
| Multimeter                      | Keithley 2000        | 1188656            | 01/2023                                       | 01/2026                                       |
| Signal Generator                | Agilent E4438C       | MY49070581         | 01/2023                                       | 01/2026                                       |
| Amplifier                       | Aethercomm           | SN 046             | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Power Meter                     | HP E4418A            | US38261498         | 01/2023                                       | 01/2026                                       |
| Power Sensor                    | HP ECP-E26A          | US37181460         | 01/2023                                       | 01/2026                                       |
| Directional Coupler             | Narda 4216-20        | 01386              | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Temperature and Humidity Sensor | Control Company      | 15098832           | 11/2020                                       | 11/2023                                       |



## SAR Reference Dipole Calibration Report

Ref : ACR.354.29.23.BES.A

**SHENZHEN STS TEST SERVICES CO., LTD.**  
**1/F, BUILDING 2, ZHUOKE SCIENCE PARK, CHONGQING**  
**ROAD**  
**FUYONG, BAO' AN DISTRICT, SHENZHEN, CHINA**  
**MVG COMOSAR REFERENCE DIPOLE**  
**FREQUENCY: 1800 MHZ**  
**SERIAL NO.: 5023-DIP1G800-747**

**Calibrated at MVG**  
**Z.I. de la pointe du diable**  
**Technopôle Brest Iroise – 295 avenue Alexis de Rochon**  
**29280 PLOUZANE - FRANCE**

**Calibration date: 12/20/2023**



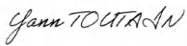
Accreditations #2-6789 and #2-6814  
Scope available on [www.cofrac.fr](http://www.cofrac.fr)

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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.



|                                   | <i>Name</i>  | <i>Function</i>         | <i>Date</i> | <i>Signature</i>                                                                    |
|-----------------------------------|--------------|-------------------------|-------------|-------------------------------------------------------------------------------------|
| <i>Prepared by :</i>              | Pedro Ruiz   | Measurement Responsible | 12/20/2023  |  |
| <i>Checked &amp; approved by:</i> | Jérôme Luc   | Technical Manager       | 12/20/2023  |  |
| <i>Authorized by:</i>             | Yann Toutain | Laboratory Director     | 12/21/2023  |  |

Yann  
Toutain  
ID

Signature  
numérique de  
Yann Toutain ID  
Date : 2023.12.21  
10:43:53 +01'00'

|                       | <i>Customer Name</i>                 |
|-----------------------|--------------------------------------|
| <i>Distribution :</i> | Shenzhen STS Test Services Co., Ltd. |

| <i>Issue</i> | <i>Name</i> | <i>Date</i> | <i>Modifications</i> |
|--------------|-------------|-------------|----------------------|
| A            | Pedro Ruiz  | 12/20/2023  | 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 1800 MHz REFERENCE DIPOLE |
| Manufacturer                   | MVG                               |
| Model                          | SID1800                           |
| Serial Number                  | 5023-DIP1G800-747                 |
| Product Condition (new / used) | New                               |

## 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**

## 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  $\pm 0.20$  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  $\pm 0.44$  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  $\pm 0.08$  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  $\pm 19\%$  with respect to measurement conditions.

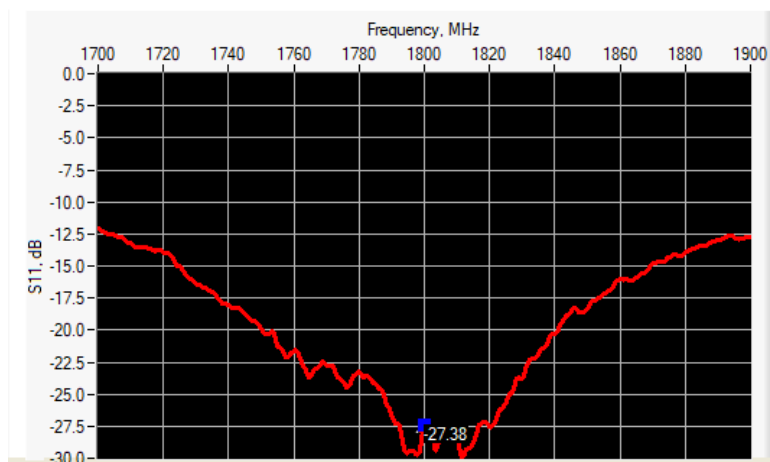
## 6 CALIBRATION RESULTS

### 6.1 MECHANICAL DIMENSIONS

| L mm     |              | h mm     |              | d mm     |             |
|----------|--------------|----------|--------------|----------|-------------|
| Measured | Required     | Measured | Required     | Measured | Required    |
| 72.40    | 72.00 +/- 2% | 42.03    | 41.70 +/- 2% | 3.59     | 3.60 +/- 2% |

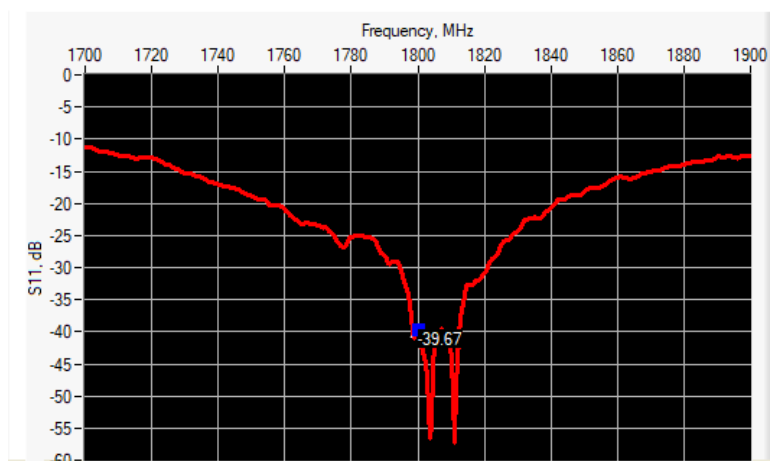
### 6.2 S11 PARAMETER

#### 6.2.1 S11 parameter in Head Liquid



| Frequency (MHz) | S11 parameter (dB) | Requirement (dB) | Impedance                 |
|-----------------|--------------------|------------------|---------------------------|
| 1800            | -27.38             | -20              | $50.2\Omega + 4.3j\Omega$ |

#### 6.2.2 S11 parameter in Body Liquid



| Frequency (MHz) | S11 parameter (dB) | Requirement (dB) | Impedance                 |
|-----------------|--------------------|------------------|---------------------------|
| 1800            | -39.67             | -20              | $51.0\Omega + 0.0j\Omega$ |