

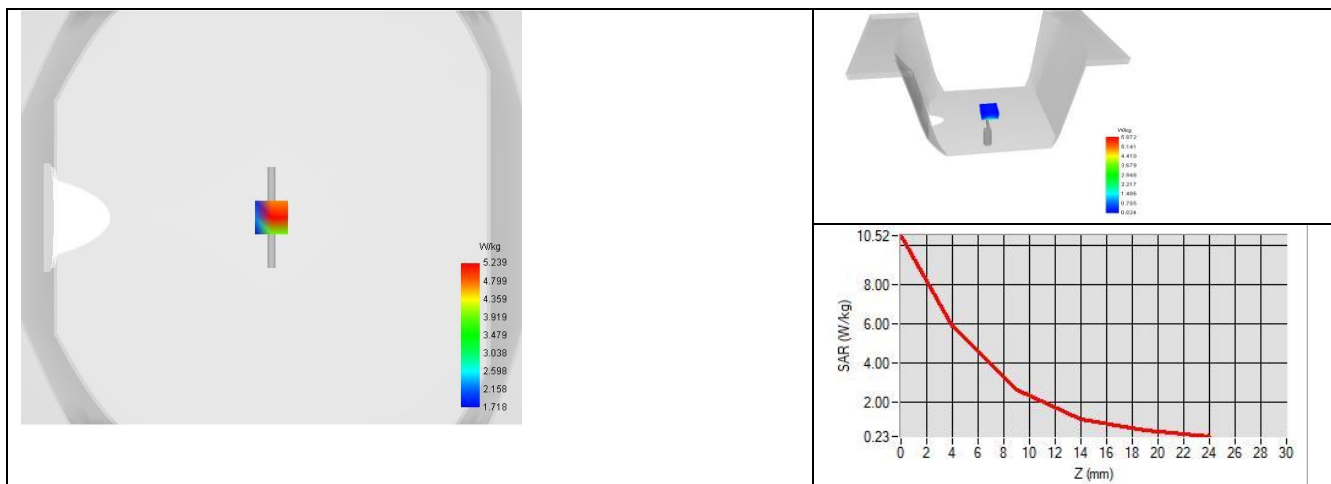
### 7.3 BODY LIQUID MEASUREMENT

| Frequency<br>MHz | Relative permittivity ( $\epsilon_r'$ ) |          | Conductivity ( $\sigma$ ) S/m |          |
|------------------|-----------------------------------------|----------|-------------------------------|----------|
|                  | required                                | measured | required                      | measured |
| 150              | 61.9 $\pm$ 10 %                         |          | 0.80 $\pm$ 10 %               |          |
| 300              | 58.2 $\pm$ 10 %                         |          | 0.92 $\pm$ 10 %               |          |
| 450              | 56.7 $\pm$ 10 %                         |          | 0.94 $\pm$ 10 %               |          |
| 750              | 55.5 $\pm$ 10 %                         |          | 0.96 $\pm$ 10 %               |          |
| 835              | 55.2 $\pm$ 10 %                         |          | 0.97 $\pm$ 10 %               |          |
| 900              | 55.0 $\pm$ 10 %                         |          | 1.05 $\pm$ 10 %               |          |
| 915              | 55.0 $\pm$ 10 %                         |          | 1.06 $\pm$ 10 %               |          |
| 1450             | 54.0 $\pm$ 10 %                         |          | 1.30 $\pm$ 10 %               |          |
| 1610             | 53.8 $\pm$ 10 %                         |          | 1.40 $\pm$ 10 %               |          |
| 1800             | 53.3 $\pm$ 10 %                         |          | 1.52 $\pm$ 10 %               |          |
| 1900             | 53.3 $\pm$ 10 %                         |          | 1.52 $\pm$ 10 %               |          |
| 2000             | 53.3 $\pm$ 10 %                         |          | 1.52 $\pm$ 10 %               |          |
| 2100             | 53.2 $\pm$ 10 %                         |          | 1.62 $\pm$ 10 %               |          |
| 2300             | 52.9 $\pm$ 10 %                         |          | 1.81 $\pm$ 10 %               |          |
| 2450             | 52.7 $\pm$ 10 %                         |          | 1.95 $\pm$ 10 %               |          |
| 2600             | 52.5 $\pm$ 10 %                         | 52.7     | 2.16 $\pm$ 10 %               | 2.36     |
| 3000             | 52.0 $\pm$ 10 %                         |          | 2.73 $\pm$ 10 %               |          |
| 3300             | 51.6 $\pm$ 10 %                         |          | 3.08 $\pm$ 10 %               |          |
| 3500             | 51.3 $\pm$ 10 %                         |          | 3.31 $\pm$ 10 %               |          |
| 3700             | 51.0 $\pm$ 10 %                         |          | 3.55 $\pm$ 10 %               |          |
| 3900             | 50.8 $\pm$ 10 %                         |          | 3.78 $\pm$ 10 %               |          |
| 4200             | 50.4 $\pm$ 10 %                         |          | 4.13 $\pm$ 10 %               |          |
| 4600             | 49.8 $\pm$ 10 %                         |          | 4.60 $\pm$ 10 %               |          |
| 4900             | 49.4 $\pm$ 10 %                         |          | 4.95 $\pm$ 10 %               |          |
| 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 $\pm$ 10 %                         |          | 5.65 $\pm$ 10 %               |          |
| 5600             | 48.5 $\pm$ 10 %                         |          | 5.77 $\pm$ 10 %               |          |
| 5800             | 48.2 $\pm$ 10 %                         |          | 6.00 $\pm$ 10 %               |          |

#### 7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

|                                           |                                                          |
|-------------------------------------------|----------------------------------------------------------|
| Software                                  | OPENSAR V5                                               |
| Phantom                                   | SN 13/09 SAM68                                           |
| Probe                                     | SN 41/18 EPG0333                                         |
| Liquid                                    | Body Liquid Values: $\epsilon_{ps}'$ : 52.7 sigma : 2.36 |
| Distance between dipole center and liquid | 10.0 mm                                                  |
| Area scan resolution                      | $dx=8mm/dy=8mm$                                          |
| Zoon Scan Resolution                      | $dx=5mm/dy=5mm/dz=5mm$                                   |
| Frequency                                 | 2600 MHz                                                 |
| Input power                               | 20 dBm                                                   |
| Liquid Temperature                        | 20 +/- 1 °C                                              |
| Lab Temperature                           | 20 +/- 1 °C                                              |
| Lab Humidity                              | 30-70 %                                                  |

| Frequency<br>MHz | 1 g SAR (W/kg/W) | 10 g SAR (W/kg/W) |
|------------------|------------------|-------------------|
|                  | measured         | measured          |
| 2600             | 55.05 (5.50)     | 23.21 (2.32)      |





## 8 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                   | Agilent 8753ES          | MY40003210         | 10/2021                                       | 10/2024                                       |
| Network Analyzer – Calibration kit | Rohde & Schwarz ZV-Z235 | 101223             | 05/2021                                       | 05/2024                                       |
| Network Analyzer – Calibration kit | HP 85033D               | 3423A08186         | 06/2021                                       | 06/2027                                       |
| Calipers                           | Mitutoyo                | SN 0009732         | 10/2021                                       | 10/2024                                       |
| Reference Probe                    | MVG                     | SN 41/18 EPGO333   | 10/2021                                       | 10/2024                                       |
| Multimeter                         | Keithley 2000           | 1160271            | 02/2021                                       | 02/2024                                       |
| Signal Generator                   | Rohde & Schwarz SMB     | 106589             | 04/2021                                       | 04/2024                                       |
| 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                        | 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. |
| Temperature / Humidity Sensor      | Testo 184 H1            | 44225320           | 06/2021                                       | 06/2024                                       |



## 校准证书

CALIBRATION CERTIFICATE



证书编号:  
Certificate No.

S424079462

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### 客户信息

Customer Information

客户名称:  
Name

信恒检测技术(深圳)有限公司

客户地址:  
Address

深圳市宝安区松岗街道潭头社区潭头工业城二区1栋厂房101.201.301

### 被校测量 器具信息

Information of  
Instrument under  
Calibration

仪器名称:  
Description

Coaxial mechanical calibration parts同轴机械校准件

型号规格:  
Model/Type

50Ω 35mm 9G

制造厂商:  
Manufacturer

南京普纳科技设备有限公司

出厂编号:  
Serial No.

/

管理编号:  
Asset No.

BTF-EM-068

接收日期:  
Received Date

2024 / 10 / 25

接收状态:  
As Received

正常/Normal

结论:  
Conclusion

参照检测/校准结果使用。

The test or calibration results are referred to evaluate the validity of instrument measurement.



扫一扫查真伪

证书有效性声明:

- 1、证书首页盖有证书章
- 2、证书须有唯一防伪码
- 3、扫描信息与证书一致

校准日期: 2024 / 10 / 25  
Cal. Date

签发日期: 2024 / 10 / 30  
Issue Date

建议复校日期: 2025 / 10 / 24  
Next Cal. Date

校准: 刘金辉  
Calibrated by

核验: 何聪  
Inspected by

签发: 杨帆  
Approved by ( 总经理助理 )



# 校准说明

## CALIBRATION DIRECTIONS

证书编号：S424079462  
Certificate No.

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- 本公司实验室经中国合格评定国家认可委员会审核，符合ISO/IEC17025《检测和校准实验室能力的通用要求》的要求，认可证书号：No.L3103。  
This laboratory is accredited to ISO/IEC 17025《Requirements for the competence of Testing and Calibration Laboratories》,CNAS Accreditation Certificate No.L3103.
- 本证书中的校准结果均可溯源至国际单位制（SI）单位。  
The calibration results in this certificate are traceable to International System of Units(SI)
- 对本次校准若有异议，委托方应于收到被校件之日起十五日内向本公司提出。  
If there is any objection concerning the calibration, the Client should inform the issuing company within 15 days from the date of the device under test return to the client.
- 未经本公司许可，不得部分复印、摘用或篡改本证书的内容。  
This report may not be reproduced, except in full, without the written approval of CCIC (ShenZhen) Metrology & Testing Service Co.,Ltd.
- 本证书校准结果只与被校准仪器有关，带'\*'号的校准项目或参数不在本公司实验室认可范围内。  
The results reported here in apply only to the calibrated equipment, Calibration items or parameter with '\*' is beyond the scope of our laboratory accreditation.
- 本次校准的技术依据：  
Procedures for the Calibration:

参照 JJF 1495-2014《矢量网络分析仪校准规范》 C.S. for Vector network analyzer

JJF(军工)76-2014《微波二端口器件校准规范》 C.S. for Two-port Microwave Devices

- 本次校准所使用的主要标准器具：  
Standards Used in the Calibration:

| 器具名称/型号规格<br>Instrument Description/Model | 编号<br>Asset No. | 证书编号<br>Certificate No. | 有效期<br>Due Date | 计量特性<br>Metrological Characteristic                                           | 溯源机构<br>Traceability institutions |
|-------------------------------------------|-----------------|-------------------------|-----------------|-------------------------------------------------------------------------------|-----------------------------------|
| 网络分析仪/Vector Network Analyzer<br>E5071C   | CCIC-WX-1024    | JL2402278931            | 2025/02/05      | Sij模值: $U=0.12\text{dB}$ ; Sij相位: $U=0.9^\circ$ ; VSWR: $U=0.030$ ; ( $k=2$ ) | 深圳计量院                             |
| N型校准套件/Type-N Calibration Kit<br>85054B   | CCIC-WX-1006    | GFJGJL100222007<br>8220 | 2025/04/28      | Reflection: $U=0.02$ ( $k=2$ ); Phase: $U=1^\circ$ ( $k=2$ );                 | 二〇三所                              |

- 校准地点和环境条件：

Place and environmental conditions:

地点：客户现场 实验室

Place of Calibration

温度：(22.5 ~ 23)℃

Temperature

相对湿度：(55 ~ 60)%

Relative Humidity



校准结果

CALIBRATION RESULT

证书编号：S424079462  
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1、外观及正常性检查：正常  
Check on Appearance and Function: Pass

2、50Ω负载驻波比  
50Ω load VSWR

| 频率        | 实测值      |
|-----------|----------|
| Frequency | Measured |
| (MHz)     | /        |
| 10        | 1.004    |
| 50        | 1.005    |
| 100       | 1.007    |
| 200       | 1.006    |
| 500       | 1.007    |
| 1000      | 1.011    |
| 2000      | 1.012    |
| 3000      | 1.018    |
| 4000      | 1.021    |
| 5000      | 1.023    |
| 6000      | 1.023    |
| 7000      | 1.019    |
| 8000      | 1.016    |
| 9000      | 1.017    |

3、开路反射  
Open circuit reflex

| 频率        | 实测值      |
|-----------|----------|
| Frequency | Measured |
| (MHz)     | /        |
| 10        | 1.000    |
| 50        | 1.000    |
| 100       | 1.000    |
| 200       | 1.000    |



# 校准结果

## CALIBRATION RESULT

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|      |       |
|------|-------|
| 500  | 1.000 |
| 1000 | 1.000 |
| 2000 | 0.999 |
| 3000 | 0.998 |
| 4000 | 0.995 |
| 5000 | 0.993 |
| 6000 | 0.991 |
| 7000 | 0.989 |
| 8000 | 0.987 |
| 9000 | 0.987 |

### 4、开路相位

Open phase

| 频率        | 实测值      |
|-----------|----------|
| Frequency | Measured |
| (MHz)     | (°)      |
| 10        | -0.22    |
| 50        | -1.12    |
| 100       | -2.23    |
| 200       | -4.42    |
| 500       | -11.10   |
| 1000      | -22.27   |
| 2000      | -44.37   |
| 3000      | -67.00   |
| 4000      | -89.40   |
| 5000      | -111.91  |
| 6000      | -134.79  |
| 7000      | -157.98  |
| 8000      | 179.05   |
| 9000      | 155.91   |

### 5、短路反射



# 校准结果

## CALIBRATION RESULT

证书编号：S424079462  
Certificate No.

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### Short circuit reflex

| 频率        | 实测值      |
|-----------|----------|
| Frequency | Measured |
| (MHz)     | /        |
| 10        | 0.999    |
| 50        | 0.998    |
| 100       | 0.997    |
| 200       | 0.996    |
| 500       | 0.994    |
| 1000      | 0.990    |
| 2000      | 0.988    |
| 3000      | 0.988    |
| 4000      | 0.988    |
| 5000      | 0.988    |
| 6000      | 0.990    |
| 7000      | 0.992    |
| 8000      | 0.990    |
| 9000      | 0.992    |

### 6、短路相位

#### Short phase

| 频率        | 实测值      |
|-----------|----------|
| Frequency | Measured |
| (MHz)     | (°)      |
| 10        | 179.74   |
| 50        | 178.69   |
| 100       | 177.44   |
| 200       | 175.02   |
| 500       | 167.80   |
| 1000      | 155.90   |
| 2000      | 132.22   |



# 校准结果

## CALIBRATION RESULT

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|      |        |
|------|--------|
| 3000 | 108.77 |
| 4000 | 89.80  |
| 5000 | 62.70  |
| 6000 | 40.54  |
| 7000 | 18.00  |
| 8000 | -4.05  |
| 9000 | -26.09 |

### 说明(Notes)

#### 1、本次校准的测量不确定度

#### Measurement Uncertainty in Calibration

#### 1.1 依据JJF 1059.1-2012 测量不确定度评定与表示

Conform JJF 1059.1-2012 *Evaluation and Expression of Uncertainty in Measurement*.

#### 1.2 本次测量结果的扩展不确定度 ( $k=2$ )

#### The Expanded Uncertainty of the Measurement Results

|                                   |                   |
|-----------------------------------|-------------------|
| —— 反射系数相位(Reflective Phase)       | $U = 1.7^{\circ}$ |
| —— 反射系数模值 (Reflective Properties) | $U = 0.029$       |

以下空白

End of Report



## Dielectric Probe Calibration Report

Ref : ACR.41.5.25.BES.A

**BTF TESTING LAB (SHENZHEN) CO., LTD.**  
**F101,201 AND 301, BUILDING 1, BLOCK 2, TANTOU**  
**INDUSTRIAL PARK, TANTOU COMMUNITY**  
**SONGGANG STREET, BAO'AN DISTRICT, SHENZHEN,**  
**CHINA**

**MVG LIMESAR DIELECTRIC PROBE**

**FREQUENCY: 0.15-7.5 GHZ**

**SERIAL NO.: SN 06/22 OCPG 88**

**Calibrated at MVG**

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

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

**29280 PLOUZANE - FRANCE**

**Calibration date: 02/05/2025**



Accreditations #2-6789  
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 Dielectric Probe calibration performed at MVG, using the LIMESAR test bench. The test results covered by accreditation are traceable to the International System of Units (SI).



## SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref: ACR.41.5.25.BES.A

|                                   | <i>Name</i>       | <i>Function</i>   | <i>Date</i> | <i>Signature</i>                                                                    |
|-----------------------------------|-------------------|-------------------|-------------|-------------------------------------------------------------------------------------|
| <i>Prepared by :</i>              | Pedro Ruiz        | Technical Manager | 2/10/2025   |  |
| <i>Checked &amp; approved by:</i> | Pedro Ruiz        | Technical Manager | 2/10/2025   |  |
| <i>Authorized by:</i>             | Geraldine Toutain | Quality Manager   | 2/10/2025   |                                                                                     |

DocuSigned by:  
**Géraldine TOUTAIN**  
 A1C9AC91CB5441A...

|                       | <i>Customer Name</i>                       |
|-----------------------|--------------------------------------------|
| <i>Distribution :</i> | BTF Testing Lab<br>(Shenzhen) Co.,<br>Ltd. |

| <i>Issue</i> | <i>Name</i> | <i>Date</i> | <i>Modifications</i> |
|--------------|-------------|-------------|----------------------|
| A            | Pedro Ruiz  | 2/10/2025   | Initial release      |
|              |             |             |                      |
|              |             |             |                      |
|              |             |             |                      |



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5 Measurement Uncertainty ..... 5

6 Calibration Results..... 5

    6.1 Liquid complex Permittivity Measurement ..... 5

7 List of Equipment ..... 7



## 1 INTRODUCTION

This document contains a summary of the suggested methods and requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for liquid permittivity measurements 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                    | LIMESAR DIELECTRIC PROBE |
| Manufacturer                   | MVG                      |
| Model                          | SCLMP                    |
| Serial Number                  | SN 06/22 OCPG 88         |
| Product Condition (new / used) | Used                     |

## 3 PRODUCT DESCRIPTION

### 3.1 GENERAL INFORMATION

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



**Figure 1** – MVG LIMESAR Dielectric Probe



## 4 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards outline techniques for dielectric property measurements. The LIMESAR test bench employs one of the methods outlined in the standards, using a contact probe or open-ended coaxial transmission-line probe and vector network analyzer. The standards recommend the measurement of two reference materials that have well established and stable dielectric properties to validate the system, one for the calibration and one for checking the calibration. The LIMESAR test bench uses De-ionized water as the reference for the calibration and either Ethanediol or Methanol as the reference for checking the calibration. The following measurements were performed to verify that the product complies with the fore-mentioned standards.

### 4.1 LIQUID COMPLEX PERMITTIVITY MEASUREMENTS

The complex permittivity of a liquid with known dielectric properties was measured and the measurement results compared to the values provided in the fore mentioned standards.

## 5 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 a SAR probe calibration using the waveguide or calorimetric cell technique depending on the frequency.

The estimated expanded uncertainty (k=2) in calibration for relative permittivity is +/-10% with respect to measurement conditions.

The estimated expanded uncertainty (k=2) in calibration for conductivity (S/m) is +/-8.2% with respect to measurement conditions.

## 6 CALIBRATION RESULTS

### Measurement Condition

|                    |             |
|--------------------|-------------|
| Software           | LIMESAR     |
| Liquid Temperature | 20 +/- 1 °C |
| Lab Temperature    | 20 +/- 1 °C |
| Lab Humidity       | 30-70 %     |

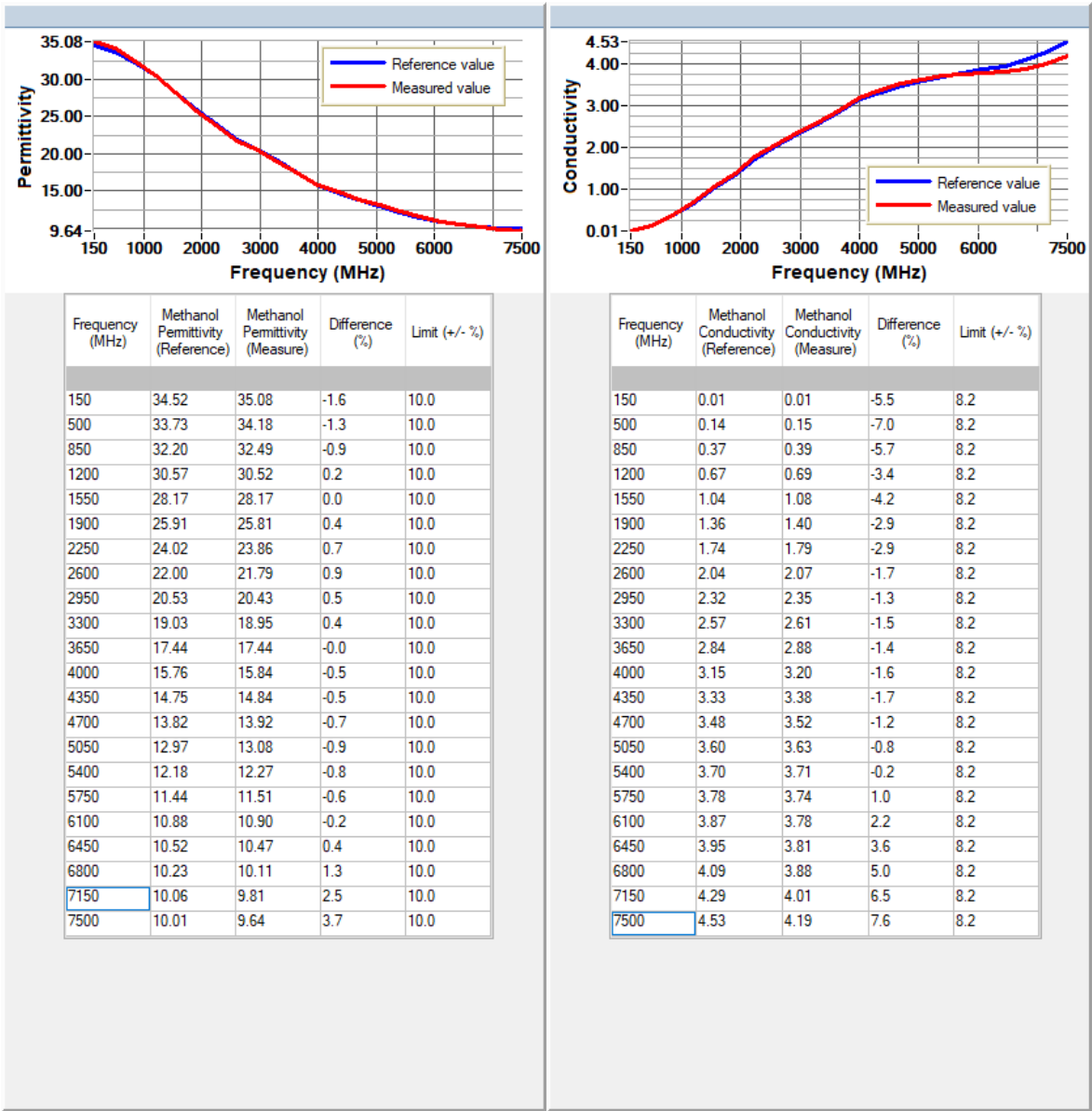
### 6.1 LIQUID COMPLEX PERMITTIVITY MEASUREMENT

A liquid of known characteristics (methanol or ethanediol) is measured with the probe and the results (complex permittivity  $\epsilon' + j\epsilon''$ ) are compared with the reference values for this liquid.



SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref: ACR.41.5.25.BES.A





## SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref: ACR.41.5.25.BES.A

## 7 LIST OF EQUIPMENT

| Equipment Summary Sheet            |                         |                    |                             |                             |
|------------------------------------|-------------------------|--------------------|-----------------------------|-----------------------------|
| Equipment Description              | Manufacturer / Model    | Identification No. | Current Calibration Date    | Next Calibration Date       |
| LIMESAR Test Bench                 | Version 3               | NA                 | Validated. No cal required. | Validated. No cal required. |
| Liquid measurement probe           | MVG                     | SN 35/10 OCPG37    | 01/2025                     | 02/2026                     |
| Network Analyzer                   | Rohde & Schwarz ZVM     | 100203             | 08/2021                     | 08/2026                     |
| Network Analyzer – Calibration kit | Rohde & Schwarz ZV-Z235 | 101223             | 07/2022                     | 07/2027                     |
| Temperature / Humidity Sensor      | Testo 184 H1            | 44235403           | 10/2024                     | 10/2027                     |