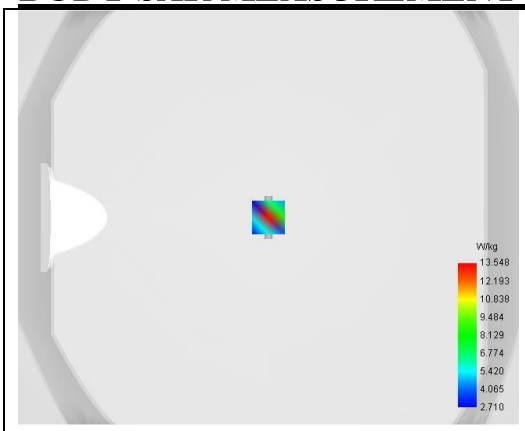
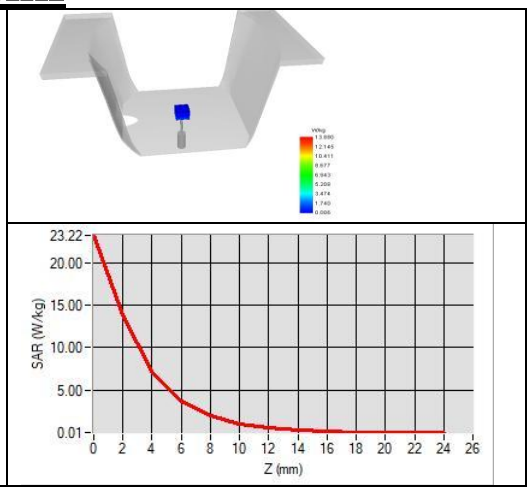
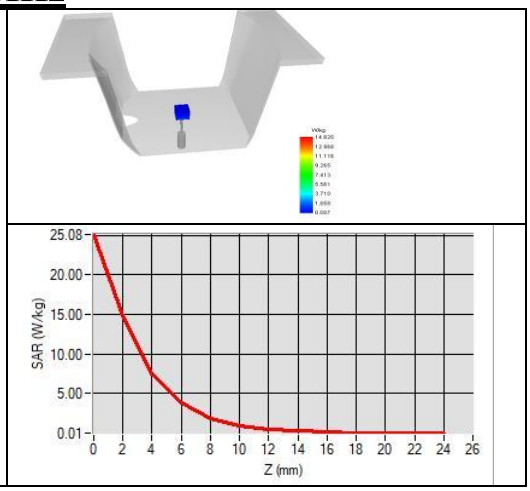
BODY SAR MEASUREMENT PLOTS @ 5200 MHz

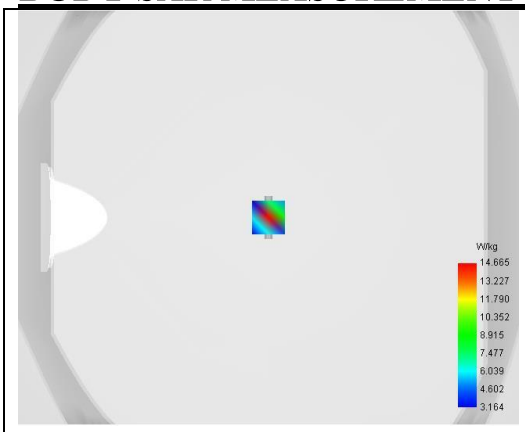


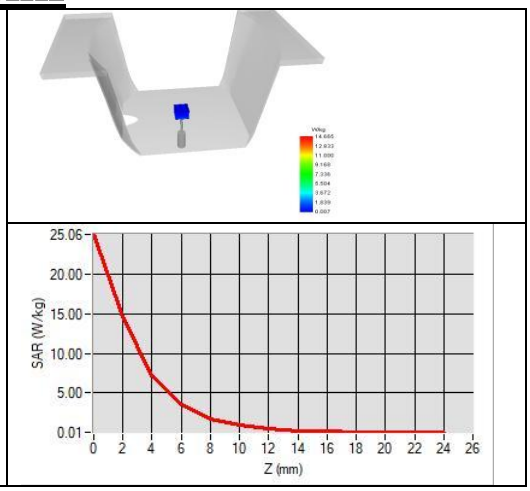


BODY SAR MEASUREMENT PLOTS @ 5400 MHz

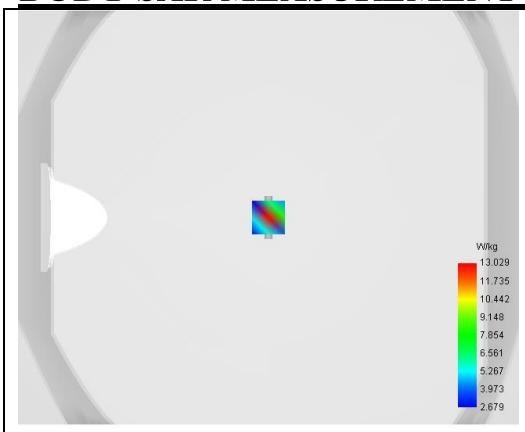


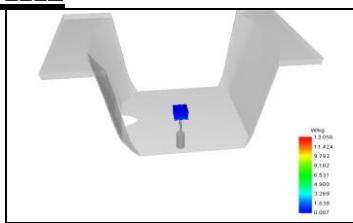
BODY SAR MEASUREMENT PLOTS @ 5600 MHz

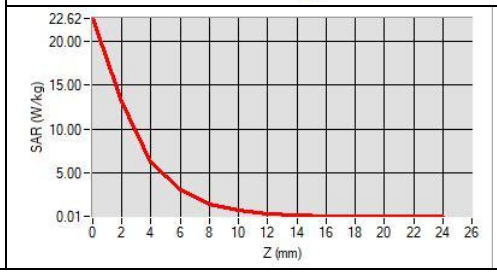




BODY SAR MEASUREMENT PLOTS @ 5800 MHz







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

Dielectric Probe Calibration Report

Ref : ACR.49.20.22.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: 0.4-6 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: 02/06/2023

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

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).

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme Luc	Technical Manager	2/6/2023	
Checked by :	Jérôme Luc	Technical Manager	2/6/2023	
Approved by :	Yann Toutain	Laboratory Director	2/6/2023	Yann TOUTAIN 2023.02.09 11:29:33 +01'00'

	Customer Name
Distribution :	BTF Testing Lab (Shenzhen) Co., Ltd.

Issue	*Name*	*Date*	*Modifications*
A	Jérôme Luc	2/6/2023	Initial release

TABLE OF CONTENTS

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)	New

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 DMS 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 PERMITTIVITY MEASUREMENTS

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

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 DIELECTRIC PERMITTIVITY MEASUREMENT

The following uncertainties apply to the Dielectric Permittivity measurement:

Uncertainty analysis of Permittivity Measurement					
ERROR SOURCES	**Uncertainty value (+/-%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (+/-%)**
Expanded uncertainty (confidence level of 95%, k = 2)					10 %

Uncertainty analysis of Conductivity Measurement					
ERROR SOURCES	**Uncertainty value (+/-%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (+/-%)**
Expanded uncertainty (confidence level of 95%, k = 2)					8.2%

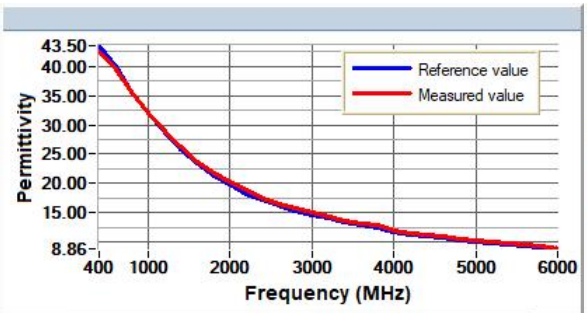
6 CALIBRATION MEASUREMENT RESULTS

Measurement Condition

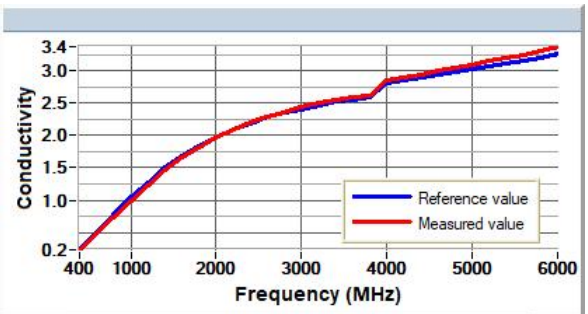
Software	LIMESAR
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

6.1 LIQUID PERMITTIVITY MEASUREMENT

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



Frequency (MHz)	Ethanediol Permittivity (Reference)	Ethanediol Permittivity (Measure)	Difference (%)	Limit (+/- %)
400	43.50	42.54	2.2	10.0
600	39.92	39.37	1.4	10.0
800	35.68	35.59	0.3	10.0
1000	31.98	32.06	-0.2	10.0
1200	28.77	29.01	-0.8	10.0
1400	25.86	26.26	-1.6	10.0
1600	23.36	23.78	-1.8	10.0
1800	21.33	21.68	-1.7	10.0
2000	19.78	20.42	-3.2	10.0
2200	18.27	18.78	-2.8	10.0
2400	17.17	17.48	-1.8	10.0
2600	16.16	16.49	-2.0	10.0
2800	15.29	15.74	-2.9	10.0
3000	14.60	14.97	-2.5	10.0
3200	14.03	14.31	-2.0	10.0
3400	13.49	13.75	-1.9	10.0
3600	12.95	13.24	-2.3	10.0
3800	12.53	12.83	-2.3	10.0
4000	11.62	11.89	-2.3	10.0
4200	11.28	11.53	-2.3	10.0
4400	10.97	11.23	-2.3	10.0
4600	10.68	10.91	-2.1	10.0
4800	10.40	10.60	-1.9	10.0
5000	10.11	10.29	-1.8	10.0
5200	9.85	10.01	-1.7	10.0
5400	9.59	9.73	-1.5	10.0
5600	9.35	9.48	-1.5	10.0
5800	9.14	9.22	-1.0	10.0
6000	8.86	8.95	-1.0	10.0



Frequency (MHz)	Ethanediol Conductivity (Reference)	Ethanediol Conductivity (Measure)	Difference (%)	Limit (+/- %)
400	0.24	0.23	3.5	8.2
600	0.50	0.47	6.9	8.2
800	0.78	0.74	5.4	8.2
1000	1.05	1.00	4.6	8.2
1200	1.27	1.23	3.4	8.2
1400	1.50	1.47	1.8	8.2
1600	1.69	1.66	1.8	8.2
1800	1.84	1.81	2.0	8.2
2000	1.97	1.96	0.4	8.2
2200	2.09	2.09	0.1	8.2
2400	2.19	2.21	-0.8	8.2
2600	2.29	2.29	0.1	8.2
2800	2.36	2.36	-0.1	8.2
3000	2.41	2.44	-1.2	8.2
3200	2.47	2.50	-1.5	8.2
3400	2.52	2.55	-1.0	8.2
3600	2.56	2.59	-1.3	8.2
3800	2.59	2.62	-1.3	8.2
4000	2.81	2.85	-1.5	8.2
4200	2.85	2.90	-1.8	8.2
4400	2.89	2.94	-1.7	8.2
4600	2.95	3.01	-2.1	8.2
4800	3.00	3.06	-2.1	8.2
5000	3.03	3.10	-2.3	8.2
5200	3.07	3.15	-2.6	8.2
5400	3.12	3.20	-2.7	8.2
5600	3.15	3.25	-3.0	8.2
5800	3.21	3.30	-3.0	8.2
6000	3.26	3.38	-3.5	8.2

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	11/2022	11/2023
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2021	10/2024
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