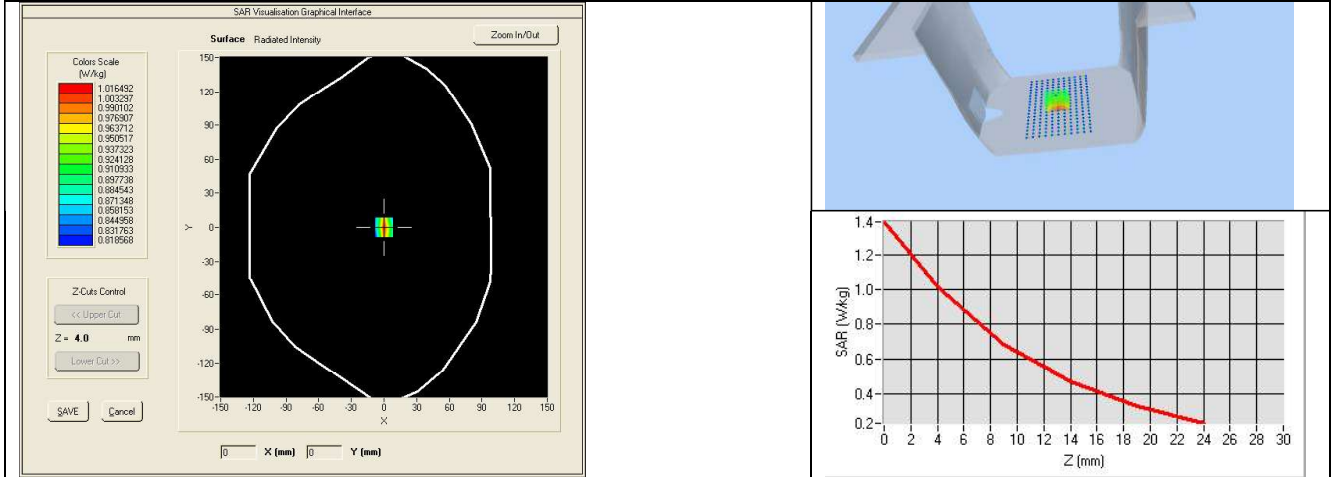


2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

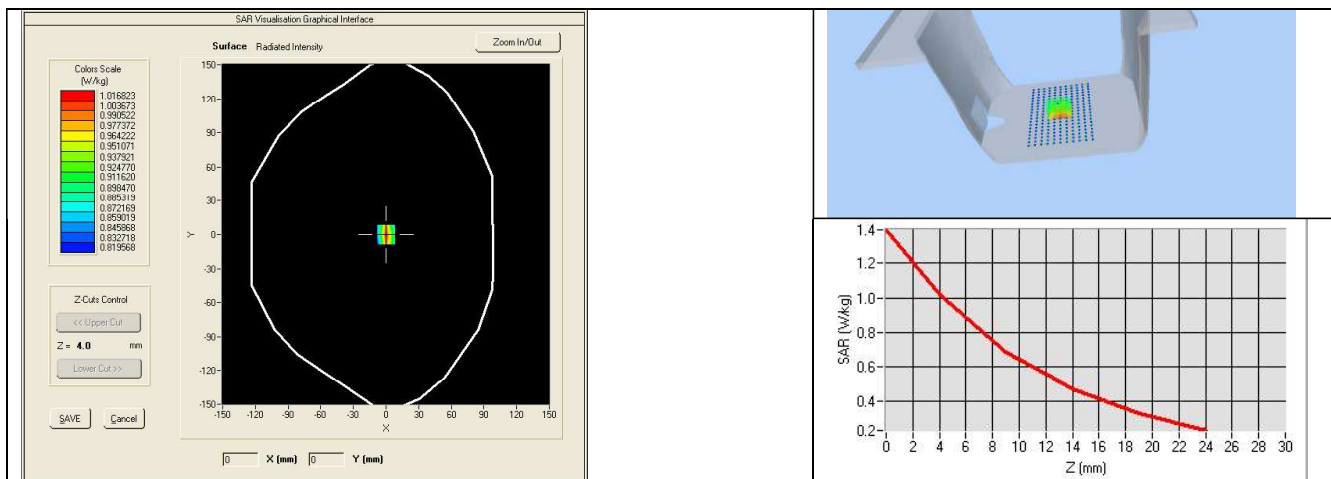
Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
750	55.5 $\pm$ 5 %		0.96 $\pm$ 5 %	
835	55.2 $\pm$ 5 %	PASS	0.97 $\pm$ 5 %	PASS
900	55.0 $\pm$ 5 %		1.05 $\pm$ 5 %	
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 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: ϵ_{ps}' : 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 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
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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 & approved by:</i>	Jérôme Luc	Technical Manager	12/20/2023	
<i>Authorized by:</i>	Yann Toutain	Laboratory Director	12/21/2023	

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Toutain
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Date : 2023.12.21
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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	Pedro Ruiz	12/20/2023	Initial release

TABLE OF CONTENTS

1	Introduction.....	4
2	Device Under Test	4
3	Product Description	4
3.1	General Information	4
4	Measurement Method	5
4.1	Mechanical Requirements	5
4.2	S11 parameter Requirements	5
4.3	SAR Requirements	5
5	Measurement Uncertainty	5
5.1	Mechanical dimensions	5
5.2	S11 Parameter	5
5.3	SAR	5
6	Calibration Results.....	6
6.1	Mechanical Dimensions	6
6.2	S11 parameter	6
6.3	SAR	7
7	List of Equipment	9

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 ± 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 $\pm 19\%$ with respect to measurement conditions.

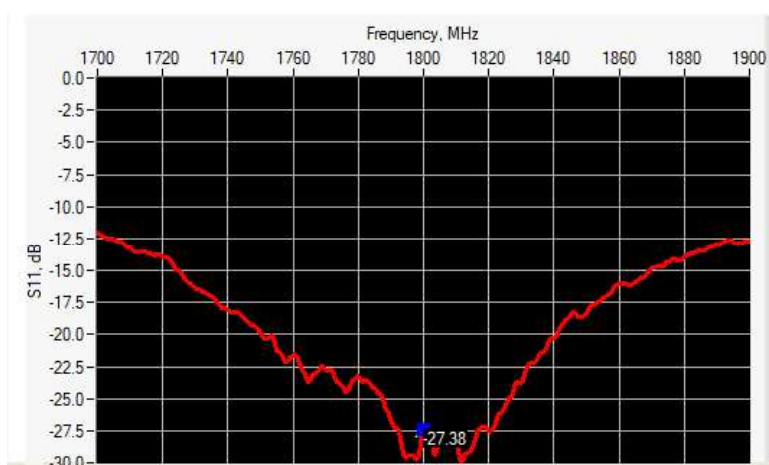
6 CALIBRATION RESULTS

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%

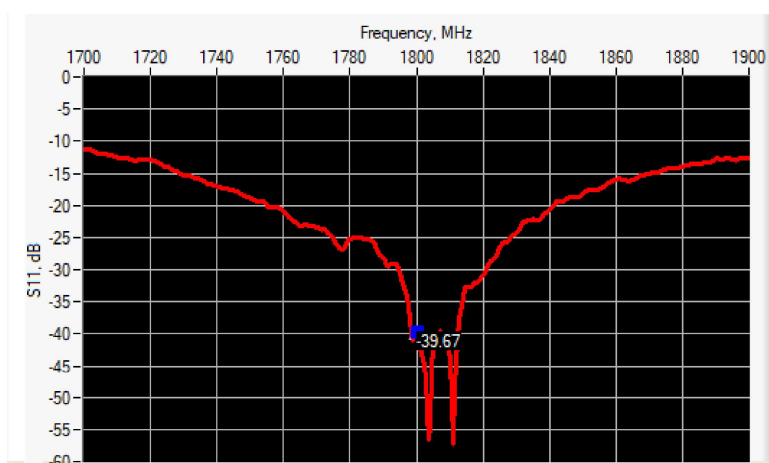
6.2 S11 PARAMETER

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	$51.0\Omega + 0.0j\Omega$

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.

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: eps' : 43.5 sigma : 1.40
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 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
1800 MHz	3.80	37.95	38.40	2.05	20.49	20.10

