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

This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.

SAR Reference Dipole Calibration Report

Ref : ACR.313.17.23.BES.A

WORLD STANDARDIZATION CERTIFICATION & TESTING GROUP CO .,LTD

BLOCK A, BAO SHI SCIENCE PARK,BAO SHI ROAD, BAO'AN DISTRICT

SHENZHEN 518108,P.R. CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 2600 MHZ

SERIAL NO.: 3723-DIP2G600-739

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 09/11/2023

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

The use of the Cofrac brand and the accreditation references is prohibited from any reproduction.

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 :	Cyrille ONNEE	Measurement Responsible	11/9/2023	
Checked & approved by:	Jérôme Luc	Technical Manager	11/9/2023	
Authorized by:	Yann Toutain	Laboratory Director	11/9/2023	

Yann Toutain ID
Signature numérique de Yann Toutain ID
Date : 2023.11.09 16:45:23 +01'00'

	Customer Name
Distribution :	World Standardization Certification & Testing Group Co .,Ltd

Issue	Name	Date	Modifications
A	Cyrille ONNEE	11/9/2023	Initial release

Template_ACR.DDD.N.YY.MVGB.ISSUE_SAR Reference Dipole vL
This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.

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 6
7 List of Equipment 8

This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.

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 2600 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2600
Serial Number	3723-DIP2G600-739
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.

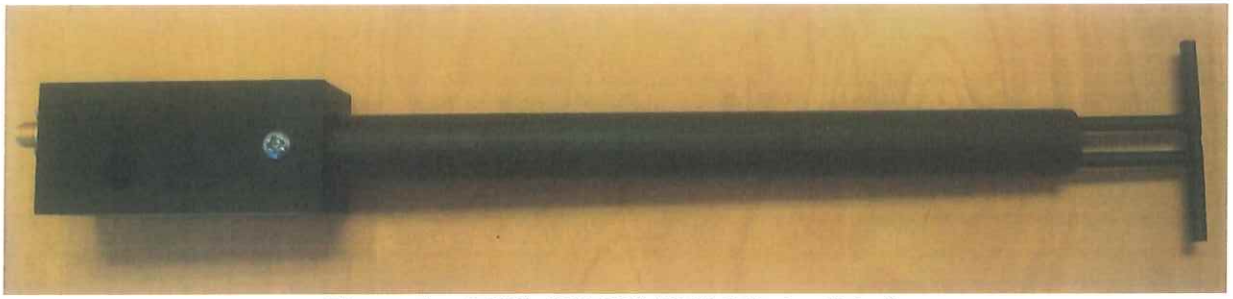


Figure 1 – *MVG COMOSAR Validation Dipole*

This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.

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.

This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.

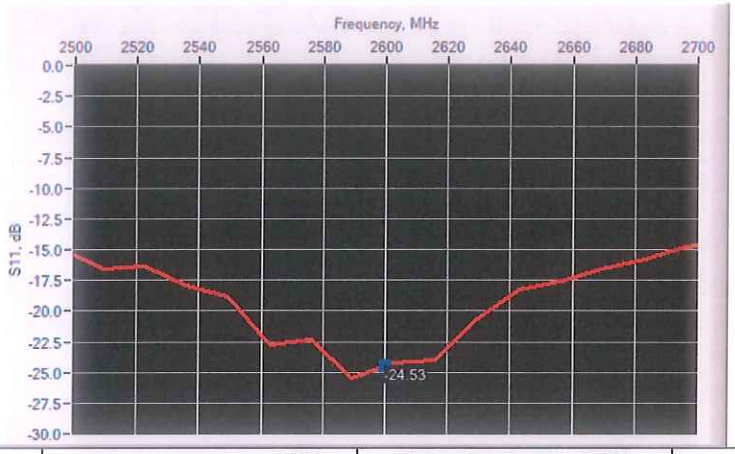
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
48.80	48.50 +/- 2%	29.07	28.80 +/- 2%	3.60	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2600	-24.53	-20	53.3Ω + 5.1jΩ

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.

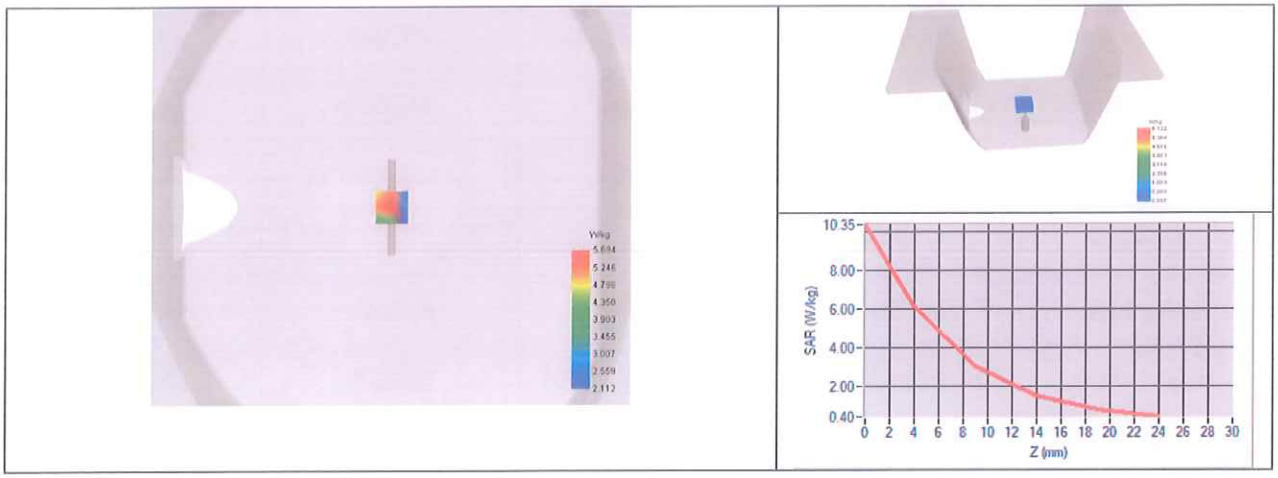
6.3.1 SAR with Head Liquid

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.

This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPGO333
Liquid	Head Liquid Values: eps' : 40.4 sigma : 2.05
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	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
2600 MHz	5.50	55.05	55.30	2.53	25.32	24.60



Template_ACR.DDD.N.YY.MVGB.ISSUE_SAR Reference Dipole vL
This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.

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

Template_ACR.DDD.N.YY.MVGB.ISSUE_SAR Reference Dipole vL
This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.

SAR Reference Dipole Calibration Report

Ref : ACR.353.22.23.BES.A

WORLD STANDARDIZATION CERTIFICATION & TESTING GROUP CO .,LTD

BLOCK A, BAO SHI SCIENCE PARK,BAO SHI ROAD, BAO'AN DISTRICT

SHENZHEN 518108,P.R. CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 5200-5800 MHZ

SERIAL NO.: 3723-DIP5G000-745

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 12/19/2023

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

The use of the Cofrac brand and the accreditation references is prohibited from any reproduction.

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	12/19/2023	
Checked & approved by:	Jérôme Luc	Technical Manager	12/19/2023	
Authorized by:	Yann Toutain	Laboratory Director	12/19/2023	

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2023.12.19 17:24:54 +01'00'

	Customer Name
Distribution :	World Standardization Certification & Testing Group Co .,Ltd

Issue	*Name*	*Date*	*Modifications*
A	Pedro Ruiz	12/19/2023	Initial release

Template_ACR.DDD.N.YY.MVGB.ISSUE_SAR Reference Dipole vL
This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.