



Ref : ACR.53.26.24.BES.A

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 SN 03/15DIP1G800-349				
Product Condition (new / used)	Used			

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





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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 <u>SAR</u>

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.





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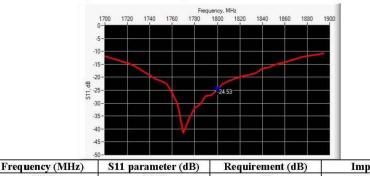
CALIBRATION RESULTS

MECHANICAL DIMENSIONS

L mm		h	mm	d mm	
Measured	Required	Measured	Required	Measured	Required
	72.00 +/- 2%	-	41.70 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Impedance 1800 -24.53 $44.8\Omega + 2.0j\Omega$

6.3 <u>SAR</u>

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.

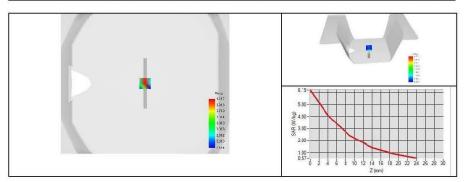




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Software	OPENSAR V5		
Phantom	SN 13/09 SAM68		
Probe	3523-EPGO-429		
Liquid	Head Liquid Values: eps': 42.7 sigma: 1.36		
Distance between dipole center and liquid	10.0 mm		
Area scan resolution	dx=8mm/dy=8mm		
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm		
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	3.71	37.06	38.40	2.00	20.01	20.10







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7 LIST OF EQUIPMENT

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	





SAR Reference Dipole Calibration Report

Ref: ACR.53.27.24.BES.A

GUANGDONG ASIA HONGKE TEST TECHNOLOGY CO., LTD

NO.1/F,BUILDING B1, JUNFENG INDUSTRIAL PARK, CHONGQING ROAD, HEPING COMMUNITY, FUHAIHAI STREET, BAO'AN DISTRICT,SHENZHEN, GUANGDONG 518055, P.R.CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 1900MHZ SERIAL NO.: SN 03/15 DIP1G900-350

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 02/21/2024



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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.





REF : ACR 53:27.24.BES.A

	Name	Function	Date	Signature
Prepared by :	Pedro Ruiz	Measurement Responsible	2/22/2024	fedunthing
Checked & approved by:	Jérôme Luc	Technical Manager	2/22/2024	JES
Authorized by:	Yann Toutain	Laboratory Director	2/27/2024	Gann TOUTAGN

Yann Signature numérique de Yann Toutain ID Date: 2024.02.27 08:56:45 + 01'00'

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Distribution :	Shenzhen	
Distribution.	Asia Hongke	

Issue	Name	Date	Modifications
A	Pedro Ruiz	2/22/2024	Initial release





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1 INTRODUCTION

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2 DEVICE UNDER TEST

Device Under Test				
Device Type	COMOSAR 1900 MHz REFERENCE DIPOLE			
Manufacturer	MVG			
Model	SID1900			
Serial Number	SN 03/15DIP1G900-350			
Product Condition (new / used)	Used			

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





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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

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.

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The estimated expanded uncertainty (k=2) in calibration for the S11 parameter in linear is +/-0.08 with respect to measurement conditions.

5.3 <u>SAR</u>

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.

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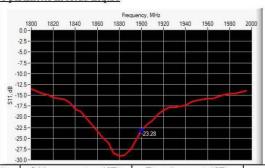
CALIBRATION RESULTS

MECHANICAL DIMENSIONS

L mm		h	h mm		nm
Measured	Required	Measured	Required	Measured	Required
	68.00 +/- 2%	=	39.50 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
1900	-23.28	-20	$46.2\Omega + 5.4j\Omega$

6.3 <u>SAR</u>

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.

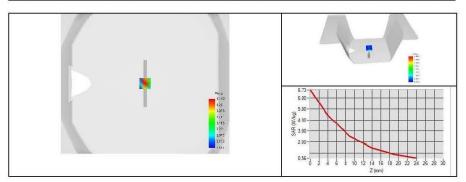




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Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: eps': 42.5 sigma: 1.39
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1900 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			1	g)	
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
1900 MHz	3.97	39.69	39.70	2.09	20.92	20.50







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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 ca required.				
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No ca 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				
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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				





SAR Reference Dipole Calibration Report

Ref: ACR.53.29.24.BES.A

GUANGDONG ASIA HONGKE TEST TECHNOLOGY CO., LTD

NO.1/F,BUILDING B1, JUNFENG INDUSTRIAL PARK, CHONGQING ROAD, HEPING COMMUNITY, FUHAIHAI STREET, BAO'AN DISTRICT,SHENZHEN, GUANGDONG 518055, P.R.CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 2450MHZ SERIAL NO.: SN 03/15 DIP2G450-352

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 02/21/2024



Accreditations #2-6789 and #2-6814 Scope available on 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.





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6	Name	Function	Date	Signature
Prepared by :	Pedro Ruiz	Measurement Responsible	2/22/2024	feduntary
Checked & approved by:	Jérôme Luc	Technical Manager	2/22/2024	Jes
Authorized by:	Yann Toutain	Laboratory Director	2/27/2024	Gann TOUTACKN

Yann Signature numérique de Yann Toutain ID Date : 2024.02.27 08:57:39 +01'00'

Customer Name Shenzhen Distribution: Asia Hongke

Issue	Name	Date	Modifications
A	Pedro Ruiz	2/22/2024	Initial release
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1 INTRODUCTION

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2 DEVICE UNDER TEST

Device Under Test				
Device Type	COMOSAR 2450 MHz REFERENCE DIPOLE			
Manufacturer	MVG			
Model	SID2450			
Serial Number	SN 03/15DIP2G450-352			
Product Condition (new / used) Used				

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





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MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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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.

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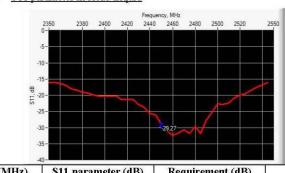
CALIBRATION RESULTS

MECHANICAL DIMENSIONS

L mm		h	mm	d i	mm
Measured	Required	Measured	Required	Measured	Required
5	51.50 +/- 2%	-	30.40 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz) S11 parameter (dB) Requirement (dB) Impedance 2450 -29.27 -20 $53.6\Omega + 0.1j\Omega$

6.3 <u>SAR</u>

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.

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Ref : ACR. 53.29.24.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: eps': 42.1 sigma: 1.83
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	2450 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			1	3)	
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
2450 MHz	5.00	50.05	52.40	2.38	23.80	24.00

