



REF: ACR. 53.23.24.BES. A.

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.

DEVICE UNDER TEST

Device Under Test				
Device Type	COMOSAR 750 MHz REFERENCE DIPOLE			
Manufacturer	MVG			
Model	SID750			
Serial Number	SN 03/15DIP0G750-355			
Product Condition (new / used)	Used			

PRODUCT DESCRIPTION

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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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 REOUIREMENTS

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.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

REF: ACR. 53.23.24.BES. A

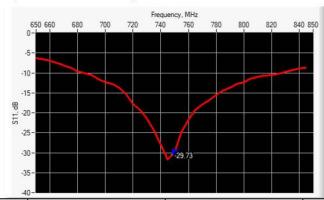
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L	L mm h mm		mm	d mm	
Measured	Required	Measured	Required	Measured	Required
<u></u>	176.00 +/- 2%		100.00 +/- 2%	=	6.35 +/- 2%

6.2 <u>S11 PARAMETER</u>

6.2.1 S11 parameter in Head Liquid



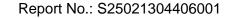
- 15	Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
	750	-29.73	-20	$52.5\Omega + 2.2j\Omega$

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.

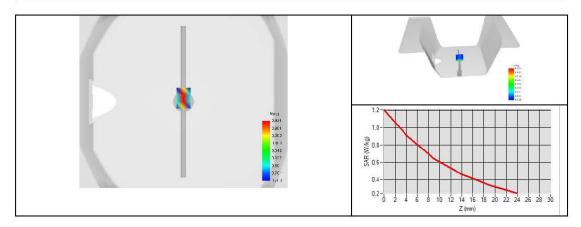




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Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: eps': 45.0 sigma: 0.87
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	750 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	
750 MHz	0.86	8.60	8.49	0.58	5.78	5.55	





REF: ACR.53.23.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet					
Equipment Manufacturer / Description 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.53.24.24.BES.A

SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

BUILDING E, FENDA SCIENCE PARK, SANWEI COMMUNITY, XIXIANG STREET, BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 835 MHZ

SERIAL NO.: SN 03/15DIP0G835-347

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.





SAR REFERENCE DIPOLE CALIBRATION REPORT

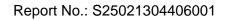
Ref: ACR 53.24.24 BES.A

	Name	Function	Date	Signature
Prepared by:	Pedro Ruiz	Measurement Responsible	2/22/2024	feduraling
Checked & approved by:	Jérôme Luc	Technical Manager	2/22/2024	J\$
Authorized by:	Yann Toutain	Laboratory Director	2/27/2024	Yann TOUTAAN

Signature numérique de Yann Toutain ID Yann Toutain ID Date: 2024.02.27 08:55:11 +01'00'

Customer Name SHENZHEN NTEK **TESTING** Distribution: **TECHNOLOGY** CO., LTD.

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





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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 835 MHz REFERENCE DIPOLE			
Manufacturer	MVG			
Model	SID835			
Serial Number	SN 03/15DIP0G835-347			
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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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

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5 MEASUREMENT UNCERTAINTY

5.1 <u>MECHANICAL DIMENSIONS</u>

For the measurement in the range 0-300mm, the estimated expanded uncertainty (k=2) in calibration for the dimension measurement in mm is \pm 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.

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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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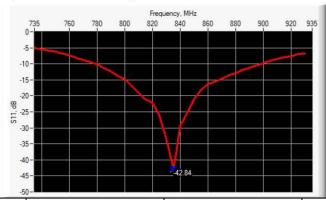
6 CALIBRATION RESULTS

6.1 <u>MECHANICAL DIMENSIONS</u>

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
<u> </u>	161.00 +/- 2%	=	89.80 +/- 2%		3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



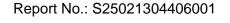
Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
835	-42.84	-20	50.5Ω + 0.5iΩ

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.

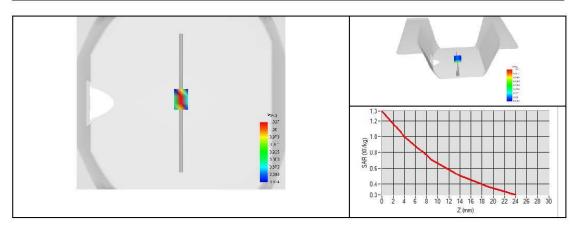




Ref: ACR.53.24.24.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: eps': 44.8 sigma: 0.90
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency		lg SAR (W/kg)	j	.0g SAR (W/kg	SAR (W/kg)	
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W	
835 MHz	0.94	9.40	9.56	0.63	6.28	6.22	







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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 cal required.			
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.			
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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.			
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024			



SAR Reference Dipole Calibration Report

Ref: ACR.53.26.24.BES.A

SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

BUILDING E, FENDA SCIENCE PARK, SANWEI COMMUNITY, XIXIANG STREET, BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 1800 MHZ

SERIAL NO.: SN 03/15DIP1G800-349

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.





SAR REFERENCE DIPOLE CALIBRATION REPORT

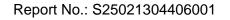
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	Name	Function	Date	Signature
Prepared by:	Pedro Ruiz	Measurement Responsible	2/22/2024	feduraling
Checked & approved by:	Jérôme Luc	Technical Manager	2/22/2024	JE
Authorized by:	Yann Toutain	Laboratory Director	2/27/2024	Gann TOUTAAN

Signature Yann numérique de Yann Toutain ID Toutain ID Date: 2024.02.27 08:56:12 +01'00'

Customer Name SHENZHEN NTEK **TESTING** Distribution: **TECHNOLOGY** CO., LTD.

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





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Report No.: S25021304406001

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



Ref: ACR 53 2624 BES A

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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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.

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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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Ref: ACR.53.26.24.BES.A

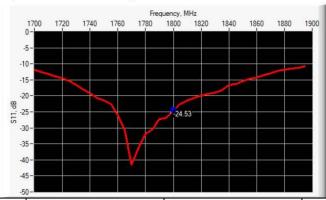
6 CALIBRATION RESULTS

6.1 <u>MECHANICAL DIMENSIONS</u>

L mm		h mm d mm		mm	
Measured	Required	Measured	Required	Measured	Required
	72.00 +/- 2%	9	41.70 +/- 2%		3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



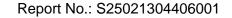
Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
1800	-24.53	-20	$44.8\Omega + 2.0$ j Ω

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.





Ref: ACR.53.26.24.BES.A

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	

