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COMOSAR E-FIELD PROBE CALIBRATION REPORT

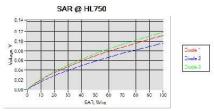
Ref: ACR.261.11.23.BES.A

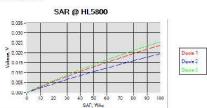
Report No.: S24020200806001

The below table summarize the ConvF for the calibrated liquid. The curves give examples for the measured SAR depending on the voltage in some liquid.

<u>Liquid</u>	Frequency (MHz*)	<u>ConvF</u>
HL750	750	2.37
HL850	835	2.32
HL900	900	2.23
HL1800	1800	2.45
HL1900	1900	2.63
HL2000	2000	2.83
HL2300	2300	2.81
HL2450	2450	2.85
HL2600	2600	2.65
HL3300	3300	2.21
HL3500	3500	2.20
HL3700	3700	2.11
HL3900	3900	2.40
HL4200	4200	2.40
HL4600	4600	2.33
HL4900	4900	2.37
HL5200	5200	2.07
HL5400	5400	2.11
HL5600	5600	2.20
HL5800	5800	2.04

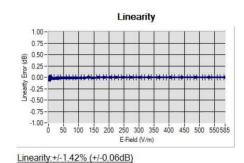
(*) Frequency validity is +/-50MHz below 600MHz, +/-100MHz from 600MHz to 6GHz and +/-700MHz above 6GHz

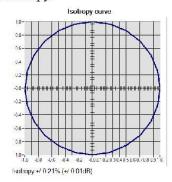




VERIFICATION RESULTS

The figures below represent the measured linearity and axial isotropy for this probe. The probe specification is +/-0.2 dB for linearity and +/-0.15 dB for axial isotropy.





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Report No.: S24020200806001



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.11.23.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet							
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date			
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.			
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024			
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2023			
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027			
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025			
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.			
Fluoroptic Thermometer	LumaSense Luxtron 812	94264	09/2022	09/2025			
Coaxial cell	MVG	SN 32/16 COAXCELL_1	Validated. No cal required.	Validated. No cal required.			
Wa∨eguide	MVG	SN 32/16 WG2_1	Validated. No cal validated. No cal required.				
Liquid transition	MVG		Validated. No cal required.	Validated. No cal required.			

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.11.23.BES.A

Wa∨eguide	MVG	SN 32/16 WG4_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G900_1	Validated. No cal required.	Validated. No cal required.
Wa∨eguide	MVG	SN 32/16 WG6_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG8_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800B_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800H_1	Validated. No cal required.	Validated. No cal required.
Wa∨eguide	MVG	SN 32/16 WG10_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_3G500_1	Validated. No cal required.	Validated. No cal required.
Wa∨eguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_5G000_1	Validated. No cal required.	Validated. No cal required.
Wa∨eguide	MVG	SN 32/16 WG14_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_7G000_1	Validated. No cal required.	Validated. No cal required.
emperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024









SAR Reference Dipole Calibration Report

Ref: ACR.53.23.24.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: 750 MHZ SERIAL NO.: SN 03/15DIP0G750-355

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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Report No.: S24020200806001



SAR REFERENCE DIPOLE CALIBRATION REPORT

REF: ACR.53.23.24.BES.A

	Name	Function	Date	Signature
Prepared by:	Pedro Ruiz	Measurement Responsible	2/22/2024	fedurfluig
Checked & approved by:	Jérôme Luc	Technical Manager	2/22/2024	J=5
Authorized by:	Yann Toutain	Laboratory Director	2/27/2024	Yann TOUTANN

Yann Signature numérique de Yann Toutain ID Date : 2024.02.27 08:54:37 +01'00'

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

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

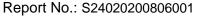


REF: ACR. 53.23.24.BES.A

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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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SAR REFERENCE DIPOLE CALIBRATION REPORT

REF : ACR 53 23 24 BES A

Report No.: S24020200806001

MEASUREMENT METHOD

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.

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.

SAR REQUIREMENTS 4.3

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.

MEASUREMENT UNCERTAINTY 5

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.

S11 PARAMETER 5.2

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

Report No.: S24020200806001

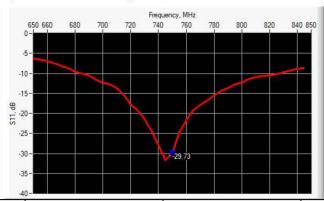
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm l		mm	d mm		
Measured	Required	Measured	Required	Measured	Required
70 70	176.00 +/- 2%	8	100.00 +/- 2%		6.35 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



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

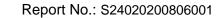
6.3 SAR

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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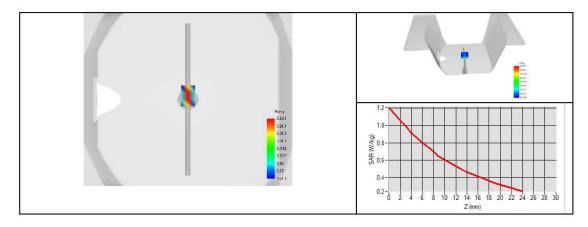


SAR REFERENCE DIPOLE CALIBRATION REPORT

REF: ACR.53.23.24.BES.A

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







SAR REFERENCE DIPOLE CALIBRATION REPORT

REF: ACR.53.23.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet								
Equipment Manufacturer / Identification No. Curr Description Model Calibrati				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



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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Report No.: S24020200806001



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	feduralis
Checked & approved by:	Jérôme Luc	Technical Manager	2/22/2024	JE
Authorized by:	Yann Toutain	Laboratory Director	2/27/2024	Yann TOUTAAN

Yann Signature numérique de Yann Toutain ID

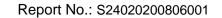
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Date: 2024.02.27
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	Customer Name		
	SHENZHEN NTEK		
Distribution	TESTING		
Distribution :	TECHNOLOGY		
	CO., LTD.		

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

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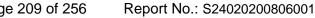


SAR REFERENCE DIPOLE CALIBRATION REPORT

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	6.3	SAR	6
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Ref : ACR. 53.24.24.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 835 MHz REFERENCE DIPOLE			
Manufacturer	MVG			
Model	SID835			
Serial Number	SN 03/15DIP0G835-347			
Product Condition (new / used)	Used			

PRODUCT DESCRIPTION

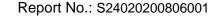
3.1 GENERAL INFORMATION

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 24 24 BES A

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

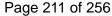
The estimated expanded uncertainty (k=2) in calibration for the S11 parameter in linear is ± -0.08 with respect to measurement conditions.

5.3 <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 \pm 19% with respect to measurement conditions.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR 53 24 24 BES A

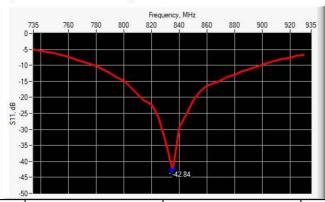
6 CALIBRATION RESULTS

6.1 <u>MECHANICAL DIMENSIONS</u>

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
70 70	161.00 +/- 2%	8	89.80 +/- 2%		3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



l	Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
	835	-42.84	-20	$50.5\Omega + 0.5j\Omega$

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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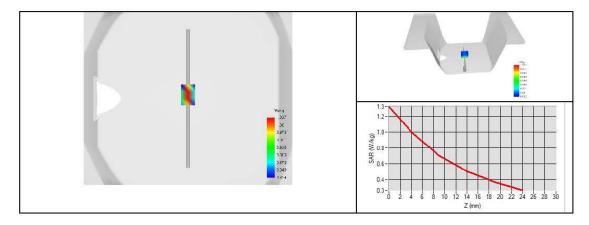


SAR REFERENCE DIPOLE CALIBRATION REPORT

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	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
835 MHz	0.94	9.40	9.56	0.63	6.28	6.22



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Report No.: S24020200806001



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR. 53.24.24.BES.A

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		







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.



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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.26.24.BES.A

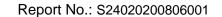
	Name	Function	Date	Signature
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Issue	Name	Date	Modifications
A	Pedro Ruiz	2/22/2024	Initial release

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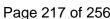


SAR REFERENCE DIPOLE CALIBRATION REPORT

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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 1800 MHz REFERENCE DIPOLE		
Manufacturer	MVG		
Model	SID1800		
Serial Number	SN 03/15DIP1G800-349		
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