

UID	Rev	Communication System Name	Group	PAR (dB)	Unc ^E k = 2
10859	AAF	CP-OFDM, 40.0 MHz, QPSK, 60 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	8.34	±9.6
10860	AAE	CP-OFDM, 50.0 MHz, QPSK, 60 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	8.41	±9.6
10861	AAF	CP-OFDM, 60.0 MHz, QPSK, 60 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	8.40	±9.6
10863	AAF	CP-OFDM, 80.0 MHz, QPSK, 60 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	8.41	±9.6
10864	AAE	CP-OFDM, 90.0 MHz, QPSK, 60 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	8.37	±9.6
10865	AAF	CP-OFDM, 100.0 MHz, QPSK, 60 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	8.41	±9.6
10866	AAF	DFT-s-OFDM, 100.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.68	±9.6
10868	AAF	DFT-s-OFDM, 100.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.89	±9.6
10869	AAE	DFT-s-OFDM, 100.0 MHz, QPSK, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	5.75	±9.6
10870	AAE	DFT-s-OFDM, 100.0 MHz, QPSK, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	5.86	±9.6
10871	AAE	DFT-s-OFDM, 100.0 MHz, 16QAM, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	5.75	±9.6
10872	AAE	DFT-s-OFDM, 100.0 MHz, 16QAM, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	6.52	±9.6
10873	AAE	DFT-s-OFDM, 100.0 MHz, 64QAM, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	6.61	±9.6
10874	AAE	DFT-s-OFDM, 100.0 MHz, 64QAM, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	6.65	±9.6
10875	AAE	CP-OFDM, 100.0 MHz, QPSK, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	7.78	±9.6
10876	AAE	CP-OFDM, 100.0 MHz, QPSK, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	8.39	±9.6
10877	AAE	CP-OFDM, 100.0 MHz, 16QAM, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	7.95	±9.6
10878	AAE	CP-OFDM, 100.0 MHz, 16QAM, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	8.41	±9.6
10879	AAE	CP-OFDM, 100.0 MHz, 64QAM, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	8.12	±9.6
10880	AAE	CP-OFDM, 100.0 MHz, 64QAM, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	8.38	±9.6
10881	AAE	DFT-s-OFDM, 50.0 MHz, QPSK, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	5.75	±9.6
10882	AAE	DFT-s-OFDM, 50.0 MHz, QPSK, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	5.96	±9.6
10883	AAE	DFT-s-OFDM, 50.0 MHz, 16QAM, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	6.57	±9.6
10884	AAE	DFT-s-OFDM, 50.0 MHz, 16QAM, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	6.53	±9.6
10885	AAE	DFT-s-OFDM, 50.0 MHz, 64QAM, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	6.61	±9.6
10886	AAE	DFT-s-OFDM, 50.0 MHz, 64QAM, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	6.65	±9.6
10887	AAE	CP-OFDM, 50.0 MHz, QPSK, 120 kHz, 99.9% DC, 1 RB	5G NR FR2 TDD	7.78	±9.6
10888	AAE	CP-OFDM, 50.0 MHz, QPSK, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	8.35	±9.6
10889	AAE	CP-OFDM, 50.0 MHz, 16QAM, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	8.02	±9.6
10890	AAE	CP-OFDM, 50.0 MHz, 16QAM, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	8.40	±9.6
10891	AAE	CP-OFDM, 50.0 MHz, 64QAM, 120 kHz, 100.0% DC, 1 RB	5G NR FR2 TDD	8.13	±9.6
10892	AAE	CP-OFDM, 50.0 MHz, 64QAM, 120 kHz, 100.0% DC, 100% RB	5G NR FR2 TDD	8.41	±9.6
10897	AAE	DFT-s-OFDM, 5.0 MHz, QPSK, 30 kHz, 99.9% DC, 1 RB	5G NR FR1 TDD	5.66	±9.6
10898	AAC	DFT-s-OFDM, 10.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.67	±9.6
10899	AAB	DFT-s-OFDM, 15.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.67	±9.6
10900	AAC	DFT-s-OFDM, 20.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.68	±9.6
10901	AAB	DFT-s-OFDM, 25.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.68	±9.6
10902	AAC	DFT-s-OFDM, 30.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.68	±9.6
10903	AAD	DFT-s-OFDM, 40.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.68	±9.6
10904	AAC	DFT-s-OFDM, 50.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.68	±9.6
10905	AAD	DFT-s-OFDM, 60.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.68	±9.6
10906	AAD	DFT-s-OFDM, 80.0 MHz, QPSK, 30 kHz, 100.0% DC, 1 RB	5G NR FR1 TDD	5.68	±9.6
10907	AAE	DFT-s-OFDM, 5.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.78	±9.6
10908	AAC	DFT-s-OFDM, 10.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.93	±9.6
10909	AAB	DFT-s-OFDM, 15.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.96	±9.6
10910	AAC	DFT-s-OFDM, 20.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.83	±9.6
10911	AAB	DFT-s-OFDM, 25.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.93	±9.6
10912	AAC	DFT-s-OFDM, 30.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.84	±9.6
10913	AAD	DFT-s-OFDM, 40.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.84	±9.6
10914	AAC	DFT-s-OFDM, 50.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.85	±9.6
10915	AAD	DFT-s-OFDM, 60.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.83	±9.6
10916	AAD	DFT-s-OFDM, 80.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.87	±9.6
10917	AAD	DFT-s-OFDM, 100.0 MHz, QPSK, 30 kHz, 100.0% DC, 50% RB	5G NR FR1 TDD	5.94	±9.6
10918	AAE	DFT-s-OFDM, 5.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.86	±9.6
10919	AAC	DFT-s-OFDM, 10.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.86	±9.6
10920	AAB	DFT-s-OFDM, 15.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.87	±9.6
10921	AAC	DFT-s-OFDM, 20.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.84	±9.6
10922	AAB	DFT-s-OFDM, 25.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.82	±9.6
10923	AAC	DFT-s-OFDM, 30.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.84	±9.6
10924	AAD	DFT-s-OFDM, 40.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.84	±9.6
10925	AAC	DFT-s-OFDM, 50.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.95	±9.6
10926	AAD	DFT-s-OFDM, 60.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.84	±9.6
10927	AAD	DFT-s-OFDM, 80.0 MHz, QPSK, 30 kHz, 100.0% DC, 100% RB	5G NR FR1 TDD	5.94	±9.6
10928	AAD	DFT-s-OFDM, 5.0 MHz, QPSK, 15 kHz, 1 RB	5G NR FR1 FDD	5.52	±9.6
10929	AAD	DFT-s-OFDM, 10.0 MHz, QPSK, 15 kHz, 1 RB	5G NR FR1 FDD	5.52	±9.6
10930	AAC	DFT-s-OFDM, 15.0 MHz, QPSK, 15 kHz, 1 RB	5G NR FR1 FDD	5.52	±9.6

UID	Rev	Communication System Name	Group	PAR (dB)	Unc ^E k = 2
10931	AAC	DFT-s-OFDM, 20.0 MHz, QPSK, 15 kHz, 1 RB	5G NR FR1 FDD	5.51	±9.6
10932	AAC	DFT-s-OFDM, 25.0 MHz, QPSK, 15 kHz, 1 RB	5G NR FR1 FDD	5.51	±9.6
10933	AAC	DFT-s-OFDM, 30.0 MHz, QPSK, 15 kHz, 1 RB	5G NR FR1 FDD	5.51	±9.6
10934	AAC	DFT-s-OFDM, 40.0 MHz, QPSK, 15 kHz, 1 RB	5G NR FR1 FDD	5.51	±9.6
10935	AAD	DFT-s-OFDM, 50.0 MHz, QPSK, 15 kHz, 1 RB	5G NR FR1 FDD	5.51	±9.6
10936	AAD	DFT-s-OFDM, 5.0 MHz, QPSK, 15 kHz, 50% RB	5G NR FR1 FDD	5.90	±9.6
10937	AAD	DFT-s-OFDM, 10.0 MHz, QPSK, 15 kHz, 50% RB	5G NR FR1 FDD	5.77	±9.6
10938	AAC	DFT-s-OFDM, 15.0 MHz, QPSK, 15 kHz, 50% RB	5G NR FR1 FDD	5.90	±9.6
10939	AAC	DFT-s-OFDM, 20.0 MHz, QPSK, 15 kHz, 50% RB	5G NR FR1 FDD	5.82	±9.6
10940	AAC	DFT-s-OFDM, 25.0 MHz, QPSK, 15 kHz, 50% RB	5G NR FR1 FDD	5.89	±9.6
10941	AAC	DFT-s-OFDM, 30.0 MHz, QPSK, 15 kHz, 50% RB	5G NR FR1 FDD	5.83	±9.6
10942	AAC	DFT-s-OFDM, 40.0 MHz, QPSK, 15 kHz, 50% RB	5G NR FR1 FDD	5.85	±9.6
10943	AAD	DFT-s-OFDM, 50.0 MHz, QPSK, 15 kHz, 50% RB	5G NR FR1 FDD	5.95	±9.6
10944	AAD	DFT-s-OFDM, 5.0 MHz, QPSK, 15 kHz, 100% RB	5G NR FR1 FDD	5.81	±9.6
10945	AAD	DFT-s-OFDM, 10.0 MHz, QPSK, 15 kHz, 100% RB	5G NR FR1 FDD	5.85	±9.6
10946	AAC	DFT-s-OFDM, 15.0 MHz, QPSK, 15 kHz, 100% RB	5G NR FR1 FDD	5.83	±9.6
10947	AAC	DFT-s-OFDM, 20.0 MHz, QPSK, 15 kHz, 100% RB	5G NR FR1 FDD	5.87	±9.6
10948	AAC	DFT-s-OFDM, 25.0 MHz, QPSK, 15 kHz, 100% RB	5G NR FR1 FDD	5.94	±9.6
10949	AAC	DFT-s-OFDM, 30.0 MHz, QPSK, 15 kHz, 100% RB	5G NR FR1 FDD	5.87	±9.6
10950	AAC	DFT-s-OFDM, 40.0 MHz, QPSK, 15 kHz, 100% RB	5G NR FR1 FDD	5.94	±9.6
10951	AAD	DFT-s-OFDM, 50.0 MHz, QPSK, 15 kHz, 100% RB	5G NR FR1 FDD	5.92	±9.6
10978	AAA	BDR, 1.0 MHz, 76.7% DC	ULLA	1.16	±9.6
10979	AAA	HDR4, 2.0 MHz, 25.1% DC	ULLA	8.58	±9.6
10980	AAA	HDR8, 4.0 MHz, 16.5% DC	ULLA	10.32	±9.6
10981	AAA	HDRp4, 2.0 MHz, 89.0% DC	ULLA	3.19	±9.6
10982	AAA	HDRp8, 4.0 MHz, 90.3% DC	ULLA	3.43	±9.6
11013	AAB	EHT320, MCS1 (272.0 Mbps), 100.0% DC	WLAN	8.47	±9.6
11014	AAB	EHT320, MCS2 (408.0 Mbps), 100.0% DC	WLAN	8.45	±9.6
11015	AAB	EHT320, MCS3 (544.0 Mbps), 100.0% DC	WLAN	8.44	±9.6
11016	AAB	EHT320, MCS4 (817.0 Mbps), 100.0% DC	WLAN	8.44	±9.6
11017	AAB	EHT320, MCS5 (1089.0 Mbps), 100.0% DC	WLAN	8.41	±9.6
11018	AAB	EHT320, MCS6 (1225.0 Mbps), 100.0% DC	WLAN	8.40	±9.6
11019	AAB	EHT320, MCS7 (1361.0 Mbps), 100.0% DC	WLAN	8.29	±9.6
11020	AAB	EHT320, MCS8 (1633.0 Mbps), 100.0% DC	WLAN	8.27	±9.6
11021	AAB	EHT320, MCS9 (1815.0 Mbps), 100.0% DC	WLAN	8.46	±9.6
11022	AAB	EHT320, MCS10 (2042.0 Mbps), 100.0% DC	WLAN	8.36	±9.6
11023	AAB	EHT320, MCS11 (2269.0 Mbps), 100.0% DC	WLAN	8.09	±9.6
11024	AAB	EHT320, MCS12 (2450.0 Mbps), 100.0% DC	WLAN	8.42	±9.6
11025	AAB	EHT320, MCS13 (2722.0 Mbps), 100.0% DC	WLAN	8.37	±9.6
11026	AAB	EHT320, MCS0 (136.0 Mbps), 100.0% DC	WLAN	8.39	±9.6

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Client: **STS (Shenzhen)**

Certificate No: **25J02Z000524**

CALIBRATION CERTIFICATE

Object **DAE3 - SN: 428**

Calibration Procedure(s) **FF-Z11-002-01**
Calibration Procedure for the Data Acquisition Electronics (DAEx)

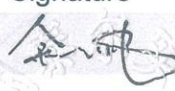
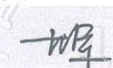
Calibration date: **September 08, 2025**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22 ± 3) $^{\circ}\text{C}$ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	11-Jun-25 (CTTL, No.25J02X004977)	Jun-26

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Jun	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: September 10, 2025

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn <http://www.caict.ac.cn>

Glossary:

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.



Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = $6.1\mu\text{V}$, full range = $-100\dots+300\text{ mV}$

Low Range: 1LSB = 61nV , full range = $-1\dots+3\text{mV}$

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	$404.480 \pm 0.15\% (k=2)$	$404.830 \pm 0.15\% (k=2)$	$404.597 \pm 0.15\% (k=2)$
Low Range	$3.95732 \pm 0.7\% (k=2)$	$3.95225 \pm 0.7\% (k=2)$	$3.91659 \pm 0.7\% (k=2)$

Connector Angle

Connector Angle to be used in DASY system	$258.5^\circ \pm 1^\circ$
---	---------------------------



SAR Reference Dipole Calibration Report

Ref : ACR.262.4.23.MVGB.A

SHENZHEN STS TEST SERVICES CO., LTD.
1/F., BUILDING 2, ZHUOKE SCIENCE PARK, No.190,
CHONGQING ROAD, FUYONG STREET,
BAO' AN DISTRICT, SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 750 MHZ
SERIAL NO.: SN 30/14 DIP0G750-331

Calibrated at MVG
Z.I. de la pointe du diable
Technopôle Brest Iroise - 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE

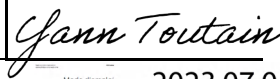
Calibration date: 07/04/2023



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

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>	Jérôme LUC	Technical Manager	7/04/2023	
<i>Checked by :</i>	Jérôme LUC	Technical Manager	7/04/2023	
<i>Approved by :</i>	Yann Toutain	Laboratory Director	7/04/2023	

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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	Jérôme LUC	7/04/2023	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 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 750 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID750
Serial Number	SN 30/14 DIP0G750-331
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 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.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions 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.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

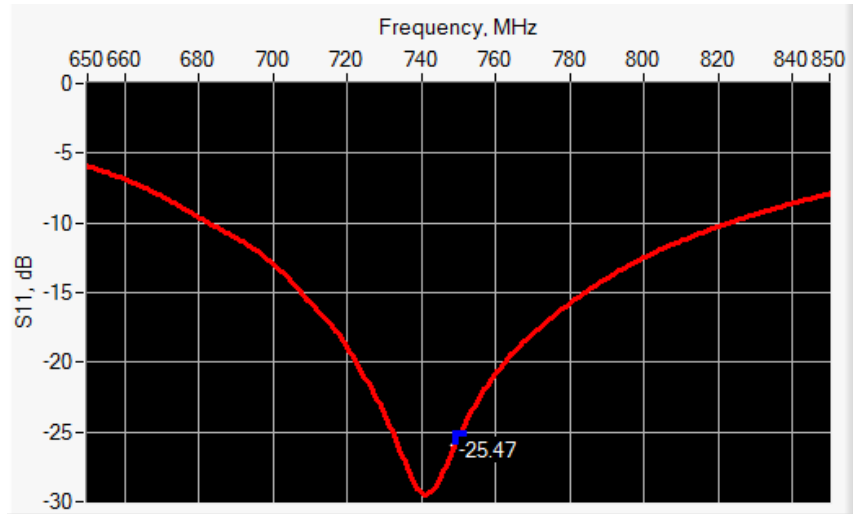
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

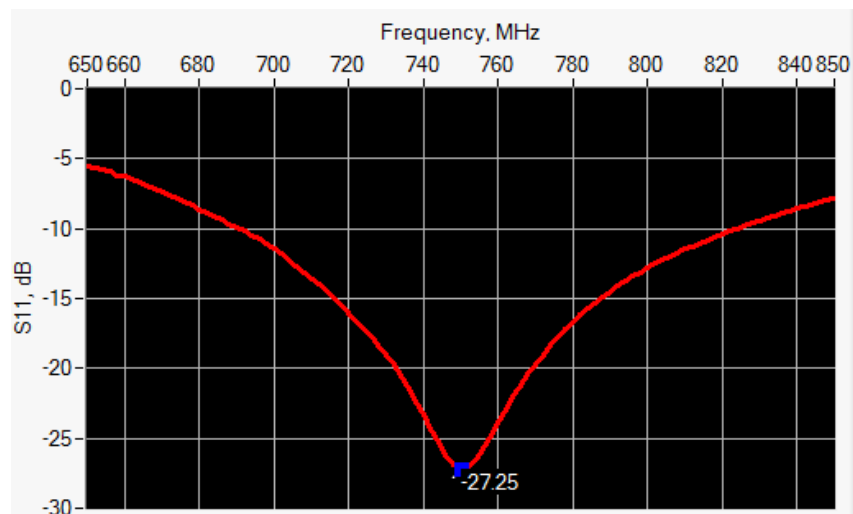
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-25.47	-20	55.2 Ω + 1.5 j Ω

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-27.25	-20	51.4 Ω + 4.1 j Ω

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
750	176.0 $\pm$ 1 %.	PASS	100.0 $\pm$ 1 %.	PASS	6.35 $\pm$ 1 %.	PASS
835	161.0 $\pm$ 1 %.		89.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	

900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 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.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
750	41.9 ±5 %	PASS	0.89 ±5 %	PASS
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	

2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

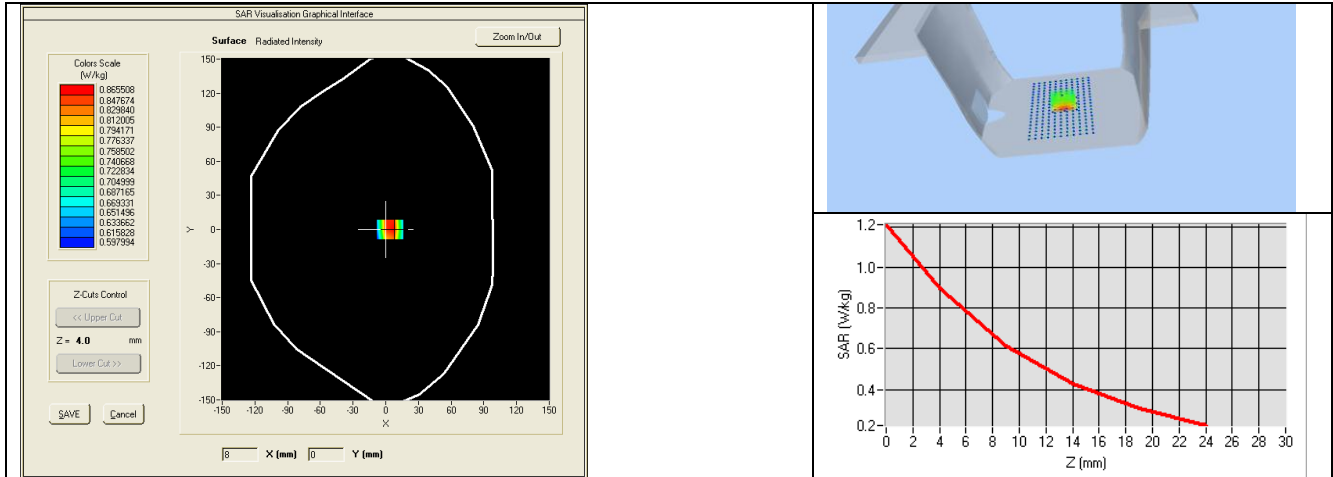
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 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 V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_{ps}' : 42.1 sigma : 0.89
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	750 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)	
	required	measured	required	measured
750	8.49	8.49 (0.85)	5.55	5.53 (0.55)
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	

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



7.3 BODY LIQUID MEASUREMENT

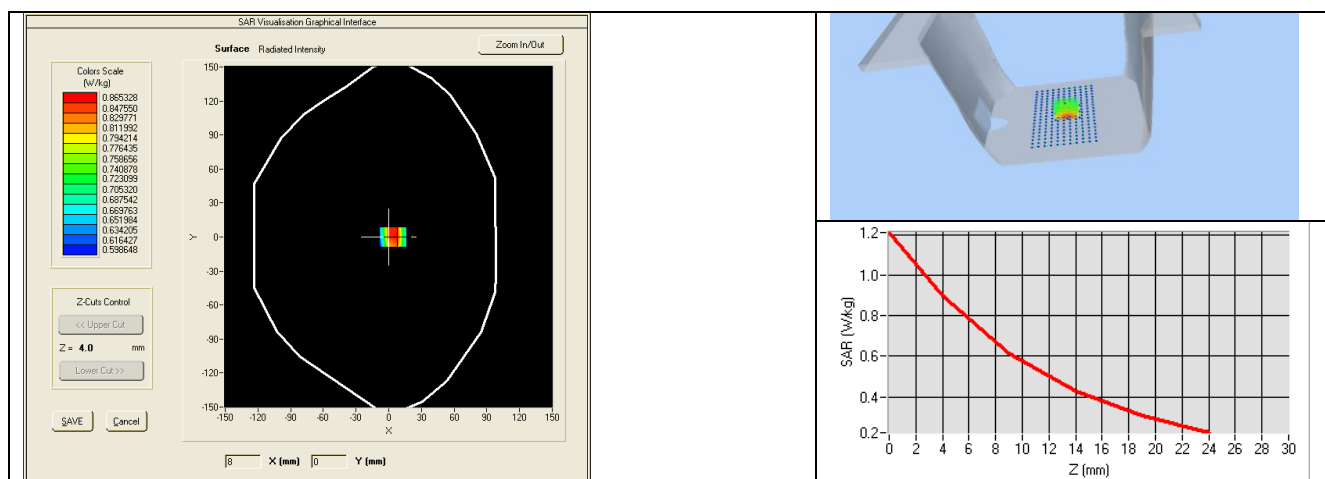
Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
750	55.5 $\pm$ 5 %	PASS	0.96 $\pm$ 5 %	PASS
835	55.2 $\pm$ 5 %		0.97 $\pm$ 5 %	
900	55.0 $\pm$ 5 %		1.05 $\pm$ 5 %	
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 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}' : 56.6 sigma : 0.99
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	750 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
750	8.82 (0.88)	5.74 (0.57)



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.262.5.23.MVGB.A

SHENZHEN STS TEST SERVICES CO., LTD.
1/F., BUILDING B, ZHUOKE SCIENCE PARK, No.190,
CHONGQING ROAD, FUYONG STREET,
BAO' AN DISTRICT, SHENZHEN, GUANGDONG CHINA
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 835 MHZ
SERIAL NO.: SN 30/14 DIP0G835-332

Calibrated at MVG
Z.I. de la pointe du diable
Technopôle Brest Iroise - 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE

Calibration date: 07/04/2023



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

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>	Jérôme LUC	Technical Manager	7/04/2023	
<i>Checked by :</i>	Jérôme LUC	Technical Manager	7/04/2023	
<i>Approved by :</i>	Yann Toutain	Laboratory Director	7/04/2023	

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<i>Distribution :</i>	Shenzhen STS Test Services Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Jérôme LUC	7/04/2023	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 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 30/14 DIP0G835-332
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 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.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions 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.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

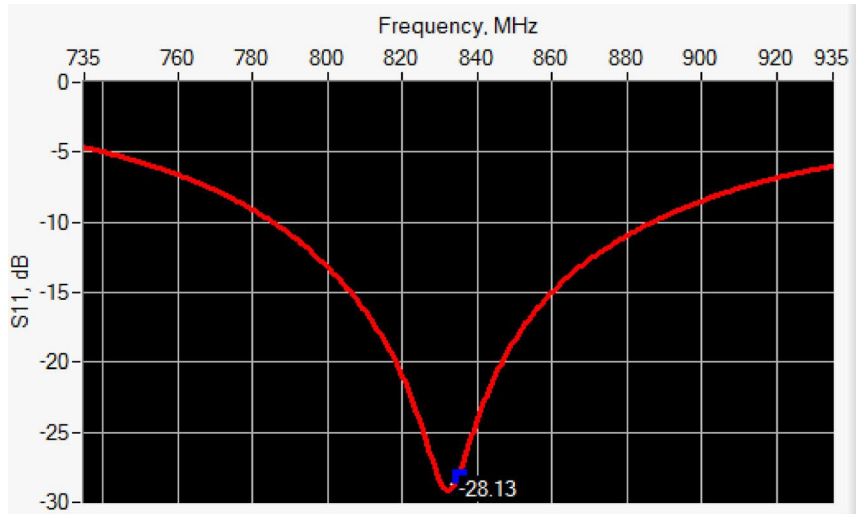
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

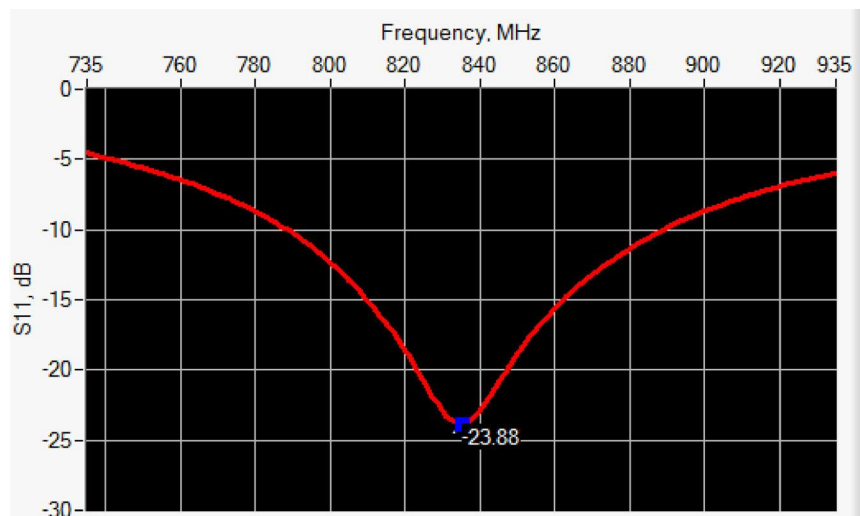
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-28.13	-20	$51.4 \Omega + 3.6 j\Omega$

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-23.88	-20	$49.2 \Omega + 6.3 j\Omega$

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
750	176.0 ± 1 %.		100.0 ± 1 %.		6.35 ± 1 %.	
835	161.0 ± 1 %.	PASS	89.8 ± 1 %.	PASS	3.6 ± 1 %.	PASS

900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 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.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %	PASS	0.90 ±5 %	PASS
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	

2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

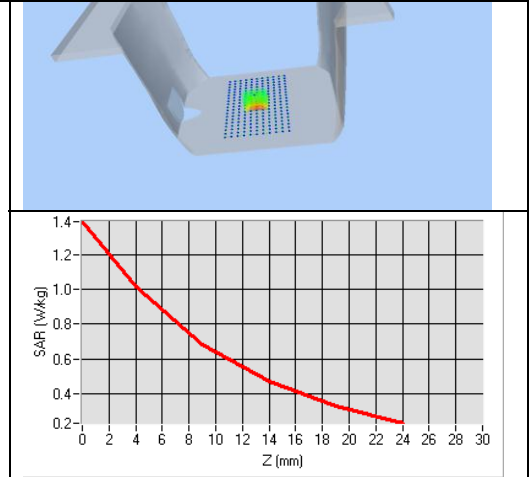
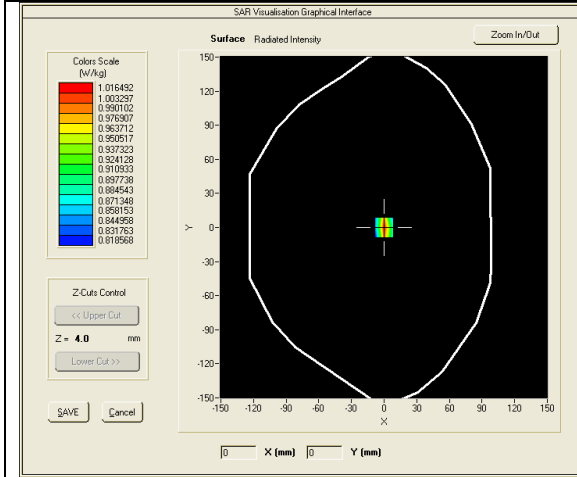
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 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 V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_{ps}' : 42.3 sigma : 0.92
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)	
	required	measured	required	measured
750	8.49		5.55	
835	9.56	9.63 (0.96)	6.22	6.15 (0.62)
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	

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



7.3 BODY LIQUID MEASUREMENT

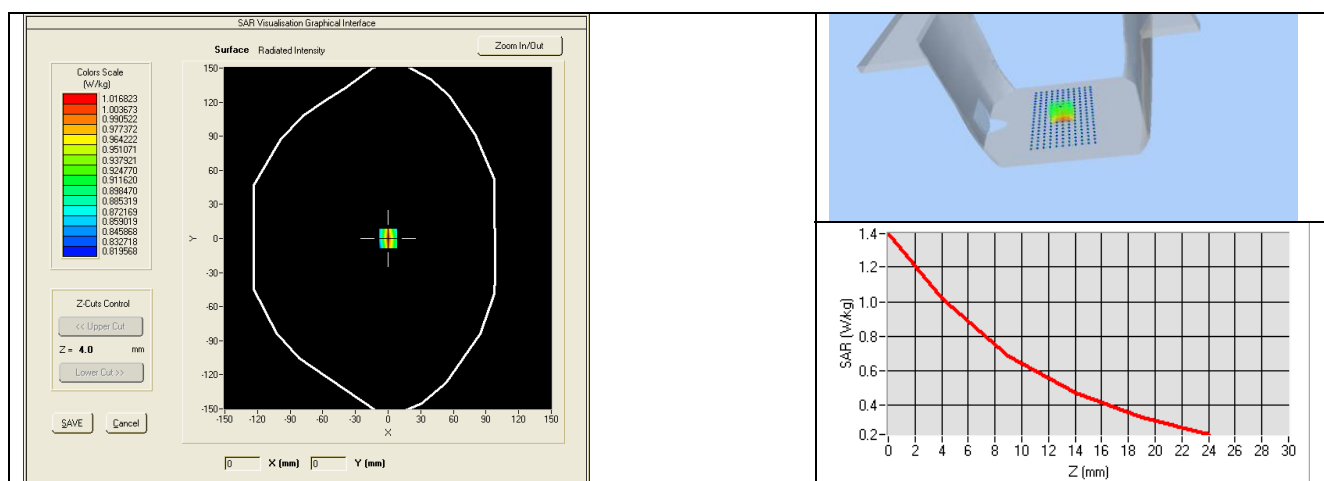
Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
750	55.5 $\pm$ 5 %		0.96 $\pm$ 5 %	
835	55.2 $\pm$ 5 %	PASS	0.97 $\pm$ 5 %	PASS
900	55.0 $\pm$ 5 %		1.05 $\pm$ 5 %	
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 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: eps' : 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



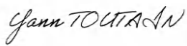
Accreditations #2-6789 and #2-6814
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Summary:

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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	<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

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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 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 +/-19% with respect to measurement conditions.

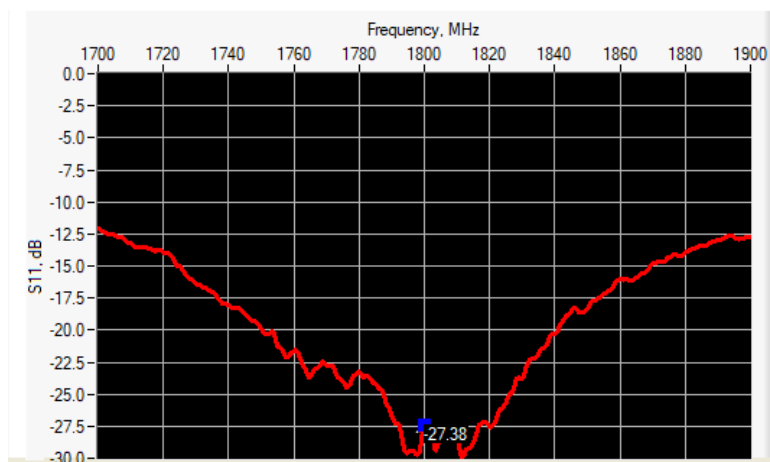
6 CALIBRATION RESULTS

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%

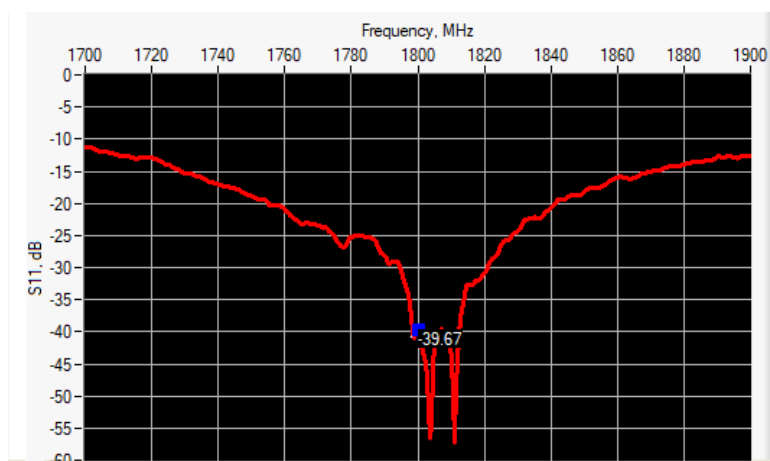
6.2 S11 PARAMETER

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

