

FCC SAR EVALUATION REPORT

**In accordance with the requirements of
FCC 47 CFR Part 2(2.1093) and
IEEE Std 1528-2013**

Product Name: Ruune Magnetic AI Recorder Device

Model No.: IOHRNC1

Serial Model: N/A

Brand Name: Ruune

Report No.: AiTSZ-260602032FW1

FCC ID: 2BVR6-IOHRNC1

Prepared for

Internet of Humans Inc.

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Prepared by

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TEST RESULT CERTIFICATION

Applicant's name : Internet of Humans Inc.

Address : 2033 2nd Avenue 805 Seattle, WA, 98121 US

Manufacturer's Name : Internet of Humans Inc.

Address : 2033 2nd Avenue 805 Seattle, WA, 98121 US

Product description

Product name : Ruune Magnetic AI Recorder Device

Trademark : Ruune

Model and/or type reference : IOHRNC1

Serial Model..... : N/A

FCC 47 CFR Part 2(2.1093)

Standards : IEEE Std 1528-2013

Published RF exposure KDB procedures

This device described above has been tested by Guangdong Asia Hongke Test Technology Limited. In accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 and KDB 865664 D01. Testing has shown that this device is capable of compliance with localized specific absorption rate (SAR) specified in FCC 47 CFR Part 2(2.1093). The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

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Test Sample Number..... : AiTSZ-260602032-1

Date of Test

Date (s) of performance of tests..... : Jun. 02, 2026 ~ Jun. 10, 2026

Date of Issue..... : Jun. 22, 2026

Test Result..... : **Pass**

Reviewed by: _____

Ken Zou

Approved by: _____

Jack Li

※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Jun. 22, 2026	Jack Li

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1. General Information

1.1. RF exposure limits

(A).Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

(B).Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

NOTE: **Whole-Body SAR** is averaged over the entire body, **partial-body SAR** is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. **SAR for hands, wrists, feet and ankles** is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Occupational/Controlled Environments:

Are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

General Population/Uncontrolled Environments:

Are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

NOTE
TRUNK LIMIT
1.6 W/kg
APPLIED TO THIS EUT

1.2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing as follows.

Band	Max SAR Value Reported(W/kg)
	1-g Body (Separation distance of 0mm)
2.4GHz WLAN	0.316
5.2GHz WLAN	0.482
5.8GHz WLAN	0.533

NOTE: This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR Part 2(2.1093), and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 & KDB 865664 D01.

1.3. EUT Description

Device Information			
Product Name	Ruune Magnetic AI Recorder Device		
Model Name	IOHRNC1		
Family Model	N/A		
Model Difference	N/A		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna Type	Multilayer Antenna		
Battery Information	DC 3.87V, 130mAh, 0.51Wh by Rechargeable Li-ion battery		
Hardware version	V1.0		
Software version	V1.0		
Device Operating Configurations			
Supporting Mode(s)	WLAN 2.4G/5G, Bluetooth		
Test Modulation	WLAN(DSSS/OFDM), Bluetooth(GFSK)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WLAN 2.4G	2412-2462	
	WLAN 5.2G	5180-5240	
	WLAN 5.8G	5745-5825	
	Bluetooth	2402-2480	

1.4. Test specification(s)

FCC 47 CFR Part 2(2.1093)
IEEE Std 1528-2013
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
KDB 865664 D02 RF Exposure Reporting v01r02
KDB 447498 D01 General RF Exposure Guidance v06
KDB 248227 D01 802.11 Wi-Fi SAR v02r02

1.5. Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

1.6. Test Facility

Test Laboratory:

Guangdong Asia Hongke Test Technology Limited

B1/F, Building 11, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

The test facility is recognized, certified or accredited by the following organizations:

FCC-Registration No.: 251906 Designation Number: CN1376

Guangdong Asia Hongke Test Technology Limited has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

IC —Registration No.: 31737 CAB identifier: CN0165

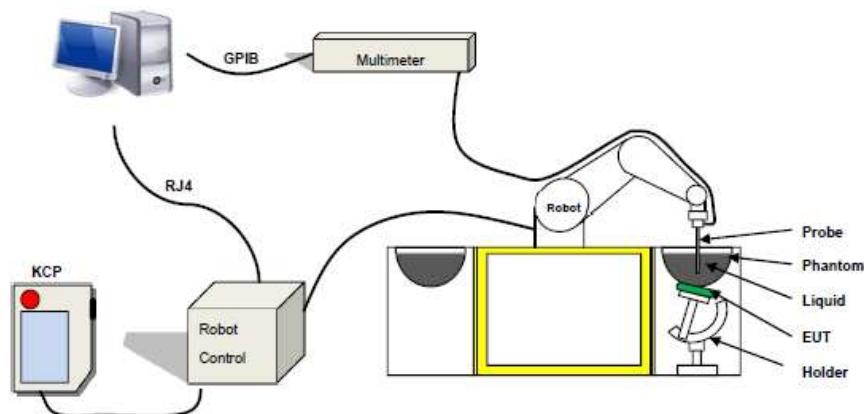
The 3m Semi-anechoic chamber of Guangdong Asia Hongke Test Technology Limited has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 31737

A2LA-Lab Cert. No.: 7133.01

Guangdong Asia Hongke Test Technology Limited has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

2. SAR Measurement System

2.1. SATIMO SAR Measurement Set-up Diagram



These measurements were performed with the automated near-field scanning system OPENSAR from SATIMO. The system is based on a high precision robot (working range: 901 mm), which positions the probes with a positional repeatability of better than ± 0.03 mm. The SAR measurements were conducted with dosimetric probe (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation.

The first step of the field measurement is the evaluation of the voltages induced on the probe by the device under test. Probe diode detectors are nonlinear. Below the diode compression point, the output voltage is proportional to the square of the applied E-field; above the diode compression point, it is linear to the applied E-field. The compression point depends on the diode, and a calibration procedure is necessary for each sensor of the probe.

The Keithley multimeter reads the voltage of each sensor and send these three values to the PC. The corresponding E field value is calculated using the probe calibration factors, which are stored in the working directory. This evaluation includes linearization of the diode characteristics. The field calculation is done separately for each sensor. Each component of the E field is displayed on the "Dipole Area Scan Interface" and the total E field is displayed on the "3D Interface"

2.2. Robot

The SATIMO SAR system uses the high precision robots from KUKA. For the 6-axis controller system, the robot controller version (KUKA) from KUKA is used. The KUKA robot series have many features that are important for our application:



- High precision (repeatability ± 0.03 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

2.3. Probe

This E-field detection probe is composed of three orthogonal dipoles linked to special Schottky diodes with low detection thresholds. The probe allows the measurement of electric fields in liquids such as the one defined in the IEEE and CENELEC standards.

For the measurements the Specific Dosimetric E-Field Probe 0523-EPGO-403 with following specifications is used.



- Probe Length: 330 mm
- Length of Individual Dipoles: 2 mm
- Maximum external diameter: 8 mm
- Probe Tip External Diameter: 2.5 mm
- Distance between dipole/probe extremity: 1 mm
- Dynamic range: 0.01-100 W/kg
- Probe linearity: 3%
- Axial Isotropy: < 0.10 dB
- Spherical Isotropy: < 0.10 dB
- Calibration range: 150 MHz to 7.5 GHz for head & body simulating liquid.
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°

2.3.1. E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy shall be evaluated and within $\pm 0.25\text{dB}$. The sensitivity parameters (Norm X, Norm Y, and Norm Z), the diode compression parameter (DCP) and the conversion factor (Conv F) of the probe are tested. The calibration data can be referred to appendix D of this report.

2.4. Phantoms

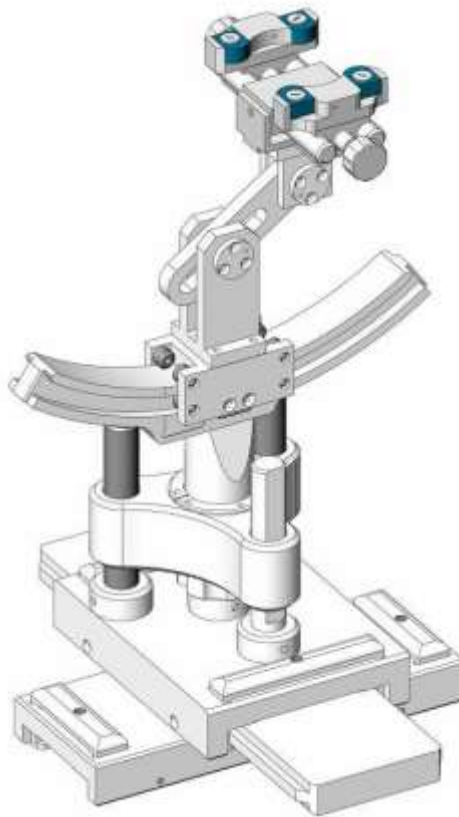
For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.



SAM

The test, based on ultrasonic system, allows measuring the thickness with an accuracy of 10 μm .

2.6. Device Holder



The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

2.7. Test Equipment List

This table gives a complete overview of the SAR measurement equipment.

Devices used during the test described are marked ☒

	Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
					Last Cal.	Due Date
☒	MVG	E FIELD PROBE	SSE2	0523-EPGO-403	Mar. 03, 2026	Mar. 02, 2027
☐	MVG	750 MHz Dipole	SID750	SN 2614 DIP0G750-325	Mar. 31, 2026	Mar. 30, 2029
☐	MVG	900 MHz Dipole	SID900	SN 1811-DIP0G900-151	Mar. 31, 2026	Mar. 30, 2029
☐	MVG	1800 MHz Dipole	SID1800	1811-DIP1G800-152	Mar. 31, 2026	Mar. 30, 2029
☐	MVG	1900 MHz Dipole	SID1900	1811-DIP1G900-153	Mar. 31, 2026	Mar. 30, 2029
☐	MVG	2000 MHz Dipole	SID2000	SN 1811-DIP2G000-154	Mar. 31, 2026	Mar. 30, 2029
☐	MVG	2300 MHz Dipole	SID2300	SN 1811-DIP2G300-157	Mar. 31, 2026	Mar. 30, 2029
☒	MVG	2450 MHz Dipole	SID2450	SN 1811-DIP2G450-155	Mar. 31, 2026	Mar. 30, 2029
☐	MVG	2600 MHz Dipole	SID2600	SN 2614-DIP2G600-326	Mar. 31, 2026	Mar. 30, 2029
☐	MVG	3500 MHz Dipole	SWG3500	SN 1811-DIP3G500-156	Apr. 01, 2026	Mar. 31, 2029
☒	MVG	5000 MHz Dipole	SWG5500	SN 2923-DIP5G000-730	Apr. 01, 2026	Mar. 31, 2029
☒	MVG	Liquid measurement Kit	SCLMP	SN 21/15 OCPG 72	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	MVG	Power Amplifier	N.A	AMPLISAR_28/14_003	NCR	NCR
☒	KEITHLEY	Millivoltmeter	2000	4072790	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026

☐	R&S	Wideband radio communication tester	CMW500	116581	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	HP	Network Analyzer	8753D	3410J01136	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	HP	Network Analyzer - calibration kit	N.A	3400J01116 3401J01110	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	Agilent	PSG Analog Signal Generator	E8257D	MY51110112	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	Agilent	Power meter	E4419B	MY45102538	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	Agilent	Power meter	E4419B	MY45102140	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	Agilent	Power meter	E4419B	MY45102215	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025

					Jun. 30, 2025	Jun. 29, 2026
☒	JFW	attenuator	50FPE-006	4360846-494-4	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	JFW	attenuator	50FPE-006	4360846-492-1	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	JFW	attenuator	50FPE-006	4360846-490-6	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	Agilent	Power sensor	E9301A	MY41495644	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	Agilent	Power sensor	E9301A	US39212148	Jul. 02, 2023	Jul. 01, 2024
					Jul. 01, 2024	Jun. 30, 2025
					Jun. 30, 2025	Jun. 29, 2026
☒	MCLI/USA	Directional Coupler	CB11-20	0D2L51502	Jul. 18, 2021	Jul. 17, 2024
					Jul. 17, 2024	Jul. 16, 2027
☒	N/A	Thermometer	N/A	LES-085	Sep. 23, 2024	Sep. 22, 2027
☒	MVG	SAR Phantom	SSM2	SN 24/11 SAM87	NCR	NCR
☒	MVG	Device Holder	SMPPD	SN 24/11 MSH73	NCR	NCR

3. SAR Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) For Wi-Fi/BT power measurement, use engineering software to configure EUT Wi-Fi/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band.
- (d) Connect EUT RF port through RF cable to the power meter, and measure Wi-Fi/BT output power.

<SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT Wi-Fi/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix A demonstrates.
- (c) Set scan area, grid size and other setting on the OPENSAR software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band.
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg.

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

3.1. Power Reference

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

3.2. Area scan & Zoom scan

The area scan is a 2D scan to find the hot spot location on the DUT. The zoom scan is a 3D scan

above the hot spot to calculate the 1g and 10g SAR value.

Measurement of the SAR distribution with a grid of 8 to 16 mm * 8 to 16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme. Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8 * 4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that will not be within the zoom scan of other peaks; additional peaks shall be measured only when the primary peak is within 2 dB of the SAR compliance limit (e.g., 1 W/kg for 1,6 W/kg 1 g limit, or 1,26 W/kg for 2 W/kg, 10 g limit).

Area scan & Zoom scan scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^{\circ} \pm 1^{\circ}$	$20^{\circ} \pm 1^{\circ}$
Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

3.3. Description of interpolation/extrapolation scheme

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimise measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is used to determine this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1 mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10 grams and 1 gram requires a very fine resolution in the three dimensional scanned data array.

3.4. Volumetric Scan

The volumetric scan consists to a full 3D scan over a specific area. This 3D scan is useful for multi Tx SAR measurement. Indeed, it is possible with OpenSAR to add, point by point, several volumetric scan to calculate the SAR value of the combined measurement as it is defined in the standard IEEE1528 and IEC62209.

3.5. Power Drift

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In OpenSAR measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in V/m. If the power drifts more than $\pm 5\%$, the SAR will be retested.

4. System Verification Procedure

4.1. Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% of weight)	Head Tissue									
	750	835	900	1800	1900	2000	2450	2600	5200	5800
Frequency Band (MHz)	750	835	900	1800	1900	2000	2450	2600	5200	5800
Water	34.40	34.40	34.40	55.36	55.36	57.87	57.87	57.87	65.53	65.53
NaCl	0.79	0.79	0.79	0.35	0.35	0.16	0.16	0.16	0.00	0.00
1,2-Propanediol	64.81	64.81	64.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	30.45	30.45	19.97	19.97	19.97	24.24	24.24
DGBE	0.00	0.00	0.00	13.84	13.84	22.00	22.00	22.00	10.23	10.23

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid depth from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm.



4.1.1. Tissue Dielectric Parameter Check Results

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values.

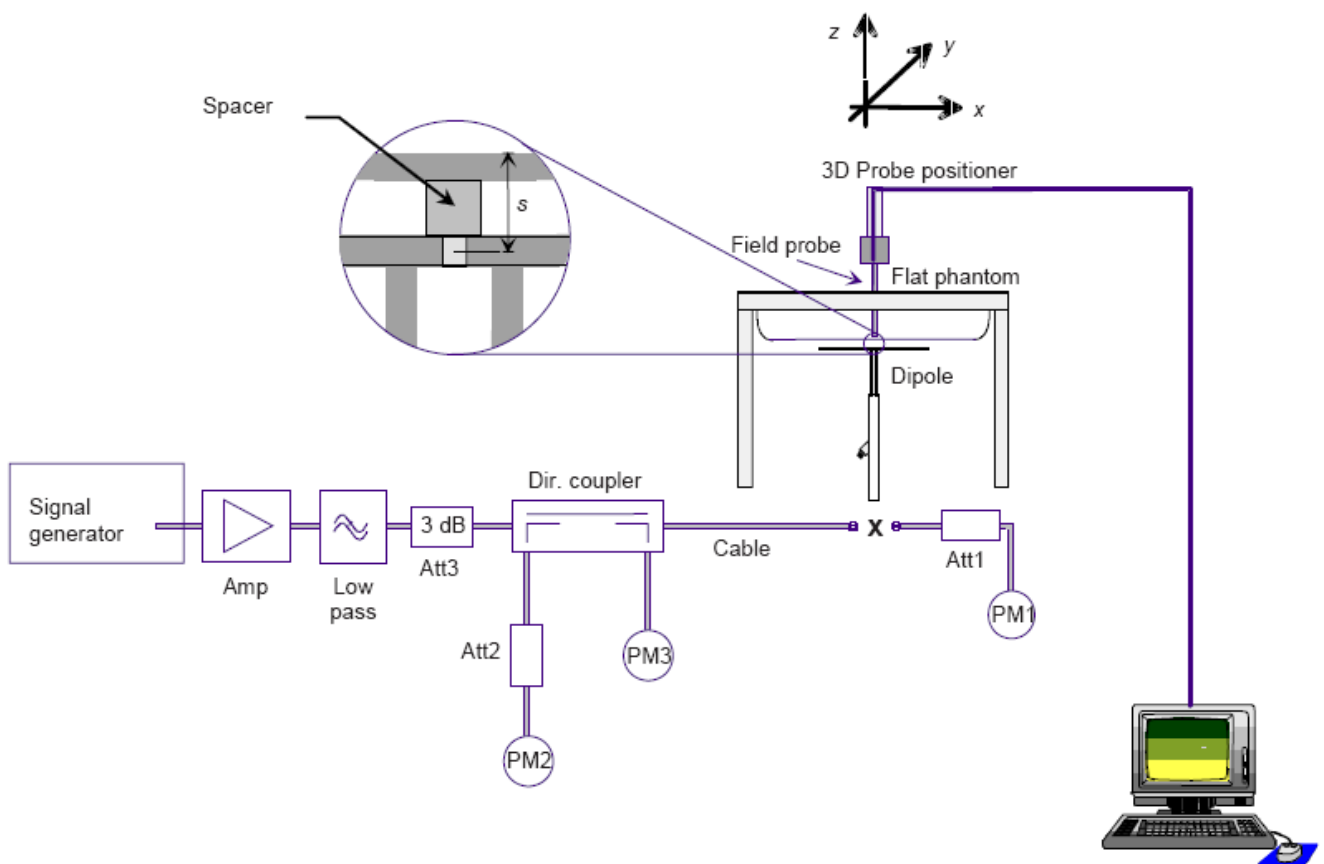
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		$\epsilon_r (\pm 5\%)$	$\sigma \text{ (S/m)} (\pm 5\%)$	ϵ_r	$\sigma \text{ (S/m)}$		
Head 2450	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	41.04	1.80	21.0 °C	Jun. 02, 2026
Head 2450	2437	39.22 (37.26~41.18)	1.79 (1.70~1.88)	39.23	1.79	21.0 °C	Jun. 02, 2026
Head 2450	2412	39.27 (37.30~41.23)	1.77 (1.68~1.85)	39.21	1.77	21.0 °C	Jun. 02, 2026
Head 2450	2462	39.18 (37.22~41.14)	1.81 (1.72~1.90)	39.18	1.81	21.0 °C	Jun. 02, 2026
Head 5200	5180	36.02 (34.22~37.82)	4.64 (4.41~4.87)	36.00	4.64	21.5 °C	Jun. 05, 2026
Head 5200	5200	36.00 (34.20~37.80)	4.66 (4.43~4.89)	36.00	4.66	21.5 °C	Jun. 05, 2026
Head 5200	5240	35.96 (34.16~37.76)	4.70 (4.47~4.94)	34.47	4.55	21.5 °C	Jun. 05, 2026
Head 5800	5755	35.35 (33.58~37.11)	5.23 (4.96~5.49)	35.31	5.23	21.3 °C	Jun. 10, 2026
Head 5800	5795	35.31 (33.54~37.07)	5.27 (5.00~5.53)	35.31	5.27	21.3 °C	Jun. 10, 2026
Head 5800	5800	35.30 (33.54~37.07)	5.27 (5.01~5.53)	35.30	5.27	21.3 °C	Jun. 10, 2026

NOTE: The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.

4.2. System Verification Procedure

The system verification is performed for verifying the accuracy of the complete measurement system and performance of the software. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 100mW (below 5GHz) or 50mW (above 5GHz). To adjust this power a power meter is used. The power sensor is connected to the cable before the system verification to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the system verification to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).

The system verification is shown as below picture:



4.2.1. System Verification Results

Comparing to the original SAR value provided by SATIMO, the verification data should be within its specification of $\pm 10\%$. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance verification can meet the variation criterion and the plots can be referred to Appendix B of this report.

System Verification	Power fed to reference dipole (mW)	Measured SAR Value		Measured SAR (Normalized to 1W)		Target SAR Value (1W)		Deviation (%)		Test Date
		1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)	
2450MHz	100	5.184	2.359	51.84	23.59	53.17	24.48	-2.50%	-3.64%	Jun. 02, 2026
5200MHz	50	3.678	1.203	73.56	24.06	77.82	22.53	-5.47%	6.79%	Jun. 05, 2026
5800MHz	50	4.106	1.206	82.11	24.12	78.72	22.83	4.31%	5.65%	Jun. 10, 2026

5. SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

6. SAR Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Symbol	Uncertainty Component	Prob. Dist.	Unc. $a(x_i)$	Div. q_i	$u(x_i) = a(x_i)/q_i$	C_i	$u(y) = C_i * u(x_i)$	v_i
Measurement system errors								
CF	Probe calibration	N ($k = 2$)	5.72	2	2.86	1	2.86	∞
CF _{drift}	Probe calibration drift	R	0.15	$\sqrt{3}$	0.09	1	0.09	∞
LIN	Probe linearity and detection limit	R	1.27	$\sqrt{3}$	0.73	1	0.73	∞
BBS	Broadband signal	R	0.12	$\sqrt{3}$	0.07	1	0.07	∞
ISO	Probe isotropy	R	0.16	$\sqrt{3}$	0.09	1	0.09	∞
DAE	Other probe and data acquisition errors	N	2.4	1	2.40	1	2.40	∞
AMB	RF ambient and noise	N	3.51	1	3.51	1	3.51	∞
Δ_{xyz}	Probe positioning errors	N	1.2	1	1.20	$2/\delta$	1.20	
DAT	Data processing errors	N	2.1	1	2.10	1	2.10	∞
Phantom and device (DUT or validation antenna) errors								
LIQ(σ)	Measurement of phantom conductivity(σ)	N	4.1	1	4.1	C_ϵ, C_σ	4.10	∞
LIQ(T_c)	Temperature effects (medium)	R	2.7	$\sqrt{3}$	1.56	C_ϵ, C_σ	1.56	∞
EPS	Shell permittivity	R	2.1	$\sqrt{3}$	1.21	See 8.4.2.3	0.30	∞
DIS	Distance between the radiating element of the DUT and the phantom medium	N	0.7	1	0.7	2	1.40	∞
D _{xyz}	Repeatability of positioning the DUT or source against the phantom	N	1.2	1	1.2	1	1.20	5
H	Device holder effects	N	3.8	1	3.8	1	3.80	
MOD	Effect of operating mode on probe sensitivity	R	3.42	$\sqrt{3}$	1.97	1	1.97	∞
TAS	Time-average SAR	R	1.8	$\sqrt{3}$	1.04	1	1.04	∞
RF _{drift}	Variation in SAR due to drift in output of DUT	N	4.5	1	4.5	1	4.50	
VAL	Validation antenna uncertainty (validation measurement only)	N	1.4	1	1.4	1	1.40	
P _{in}	Uncertainty in accepted power (validation measurement only)	N	2.4	1	2.4	1	2.40	
Corrections to the SAR result (if applied)								
C(ϵ', σ)	Phantom deviation from target (ϵ', σ)	N	3.7	1	3.7	1	3.70	
C(R)	SAR scaling	R	1.8	$\sqrt{3}$	1.04	1	1.04	
u(Δ SAR)	Combined uncertainty						10.84	
U	Expanded uncertainty and effective degrees of freedom					U =	21.68	

7. RF Exposure Positions

7.1. Generic device

The SAR evaluation shall be performed for surface of the DUT that are accessible during intended use, as indicated in Figure 7.1. Adjust the distance between the device surface and the flat phantom to 0mm.

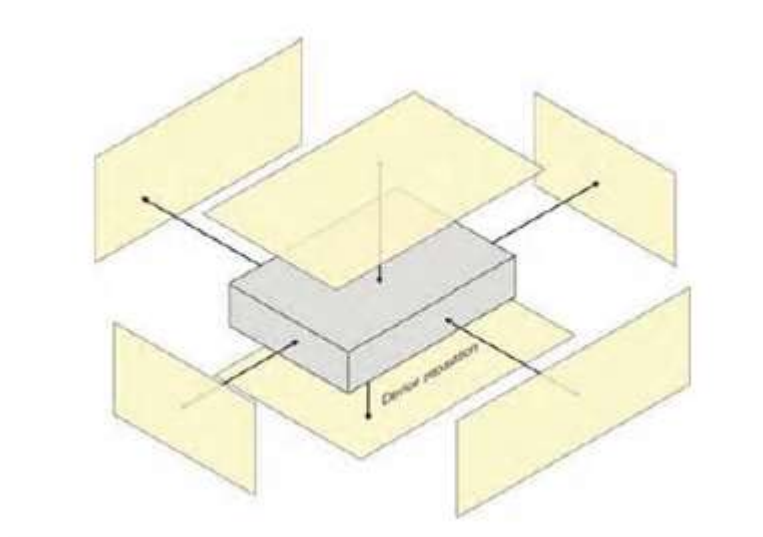


Figure 7.1 – Test positions for generic device

8. RF Output Power

8.1. Wi-Fi & BT Output Power

Mode	Channel	Frequency (MHz)	Tune-Up (dBm)	Output Power (dBm)
802.11b	1	2412	17.50	17.10
	6	2437	17.50	17.08
	11	2462	17.50	17.13
802.11g	1	2412	19.00	17.75
	6	2437	19.00	18.41
	11	2462	19.00	18.60
802.11n (HT20)	1	2412	19.00	18.10
	6	2437	19.00	18.65
	11	2462	19.00	18.63
802.11n (H40)	3	2422	20.00	19.23
	6	2437	20.00	19.50
	9	2452	20.00	19.99

Mode	Frequency (MHz)	Tune-Up (dBm)	Output Power (dBm)
802.11A	5180	17.50	17.01
	5200	17.50	17.22
	5240	17.50	17.47
802.11N20SISO	5180	17.50	17.49
	5200	17.50	16.91
	5240	17.50	17.36
802.11N40SISO	5190	14.00	13.82
	5230	14.00	13.90

Mode	Frequency (MHz)	Tune-Up (dBm)	Output Power (dBm)
802.11A	5745	18.50	17.91
	5785	18.50	18.17
	5825	18.50	18.22
802.11N20SISO	5745	19.00	18.23
	5785	19.00	17.88
	5825	19.00	18.83
802.11N40SISO	5755	20.00	19.49
	5795	20.00	19.50

Mode	Channel	Tune-up (dBm)	Output Power (dBm)
BLE1M	CH00	1.00	0.86
	CH19	1.00	0.51
	CH39	1.00	0.29
BLE2M	CH00	1.00	0.67
	CH19	1.00	0.30
	CH39	1.00	0.13

9. Antenna Location

Top Side

Left Side



WIFI/BT
Antenna

Right Side

Bottom Side

Front View

10. Stand-alone SAR test exclusion

Refer to FCC KDB 447498D01, the 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Mode	Pmax (dBm)	Pmax (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
Bluetooth	1.00	1.26	5	2.480	0.4	3	Yes

NOTE: Standalone SAR test exclusion for Bluetooth.

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}/x] \text{ W/kg}$ for test separation distances $\leq 50\text{mm}$, where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Mode	Position	Pmax (dBm)	Pmax (mW)	Distance (mm)	f (GHz)	x	Estimated SAR (W/kg)
Bluetooth	Body	1.00	1.26	5	2.48	7.5	0.053

NOTE: Estimated SAR calculation for Bluetooth.

11. Duty Cycle

The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{\text{target}} - P_{\text{measured}})/10}$$

$$\text{Scaling factor} = 10^{(P_{\text{target}} - P_{\text{measured}})/10}$$

$$\text{Reported SAR} = \text{Measured SAR} \times \text{Scaling factor}$$

Where

P_{target} is the power of manufacturing upper limit;

P_{measured} is the measured power;

Measured SAR is measured SAR at measured power which including power drift)

Reported SAR which including Power Drift and Scaling factor

Duty Cycle

Test Mode	Duty Cycle
WLAN	100%
Bluetooth	100%

12. SAR Measurement Results

< WLAN 2.4G >

Test Position of Body with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Front Side	11/2462	802.11b	0.178	0.115	3.47	17.13	17.50	0.194	2026/6/2	
Back Side	11/2462	802.11b	0.290	0.164	-3.19	17.13	17.50	0.316	2026/6/2	#3
Back Side	9/2452	802.11n (H40)	0.268	0.130	1.02	19.99	20.00	0.269	2026/6/2	
Left Side	11/2462	802.11b	0.166	0.108	3.25	17.13	17.50	0.181	2026/6/2	
Right Side	11/2462	802.11b	0.122	0.070	0.87	17.13	17.50	0.133	2026/6/2	
Top Side	11/2462	802.11b	0.087	0.041	1.14	17.13	17.50	0.095	2026/6/2	
Bottom Side	11/2462	802.11b	0.145	0.080	2.10	17.13	17.50	0.158	2026/6/2	

< WLAN 5.2G >

Test Position of Body with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Front Side	36/5180	802.11n HT20	0.239	0.192	0.47	17.49	17.50	0.240	2026/6/5	
Back Side	36/5180	802.11n HT20	0.481	0.214	0.31	17.49	17.50	0.482	2026/6/5	#1
Left Side	36/5180	802.11n HT20	0.201	0.170	1.02	17.49	17.50	0.201	2026/6/5	
Right Side	36/5180	802.11n HT20	0.187	0.153	-3.04	17.49	17.50	0.187	2026/6/5	
Top Side	36/5180	802.11n HT20	0.126	0.090	2.54	17.49	17.50	0.126	2026/6/5	
Bottom Side	36/5180	802.11n HT20	0.188	0.162	3.18	17.49	17.50	0.188	2026/6/5	

< WLAN 5.8G >

Test Position of Body with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Front Side	159/5795	802.11n	0.219	0.183	0.36	19.50	20.00	0.246	2026/6/10	

		HT40								
Back Side	159/5795	802.11n HT40	0.475	0.213	1.47	19.50	20.00	0.533	2026/6/10	#2
Left Side	159/5795	802.11n HT40	0.196	0.162	1.57	19.50	20.00	0.220	2026/6/10	
Right Side	159/5795	802.11n HT40	0.185	0.148	2.01	19.50	20.00	0.208	2026/6/10	
Top Side	159/5795	802.11n HT40	0.110	0.084	-3.68	19.50	20.00	0.123	2026/6/10	
Bottom Side	159/5795	802.11n HT40	0.174	0.150	2.34	19.50	20.00	0.195	2026/6/10	

Note:

- 1) When the reported SAR of the highest measured maximum output power channel for the Initial test configuration is ≤ 0.8 W/kg, no further SAR testing is required for other channels.
- 2) SAR is not required for the following 2.4 GHz OFDM conditions.
 - a) When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.
 - b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

13. Simultaneous Transmission Analysis

Note: WiFi and Bluetooth use the same antenna and cannot be transmitted at the same time.

Appendix A. Photo documentation

Refer to appendix Test Setup photo-SAR

Appendix B. System Check Plots

Table of contents
#1 System Performance Check - 2450MHz
#2 System Performance Check - 5200MHz
#3 System Performance Check - 5800MHz

#1

Date of measurement: 2/6/2026

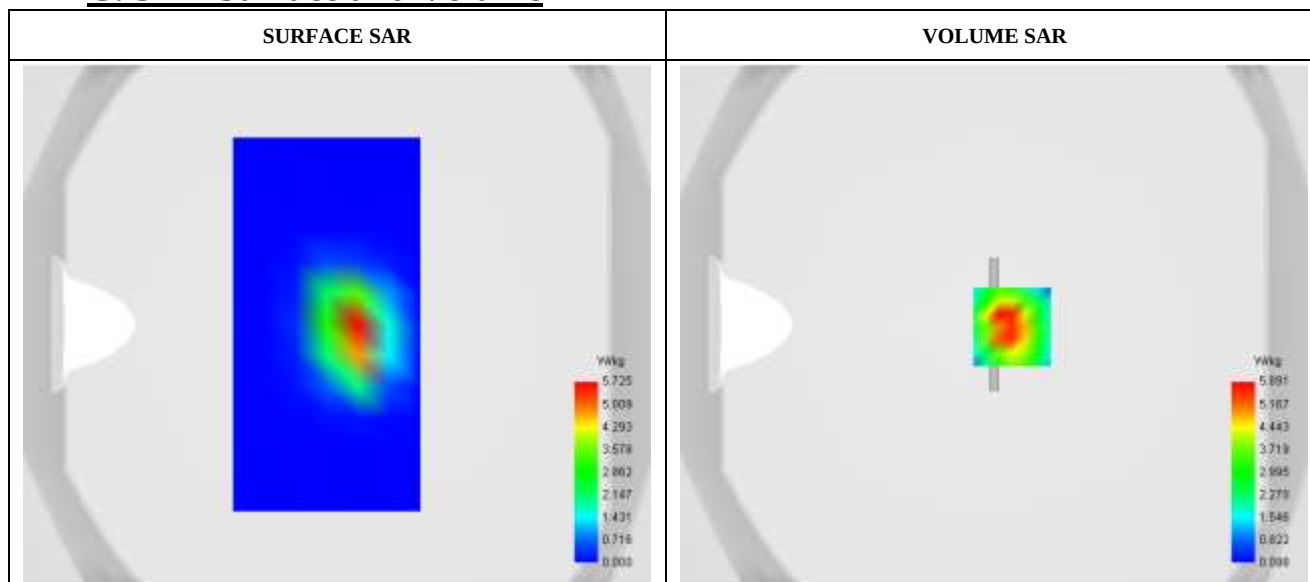
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	2.44
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels/Frequency	Middle

B. Permittivity

Middle TX Frequency (MHz)	2450.000
Relative permittivity (real part)	41.040
Relative permittivity (imaginary part)	13.220
Conductivity (S/m)	1.799

C. SAR Surface and Volume



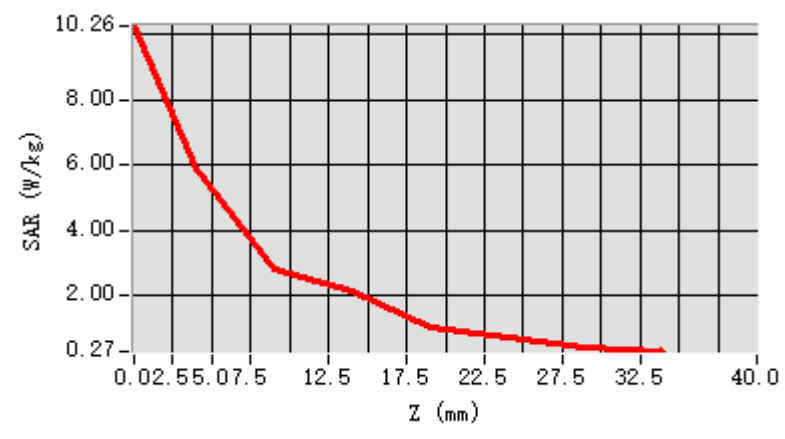
Maximum location: X=7.00, Y=-1.00 ; SAR Peak: 8.99 W/kg

D. SAR 1g & 10g

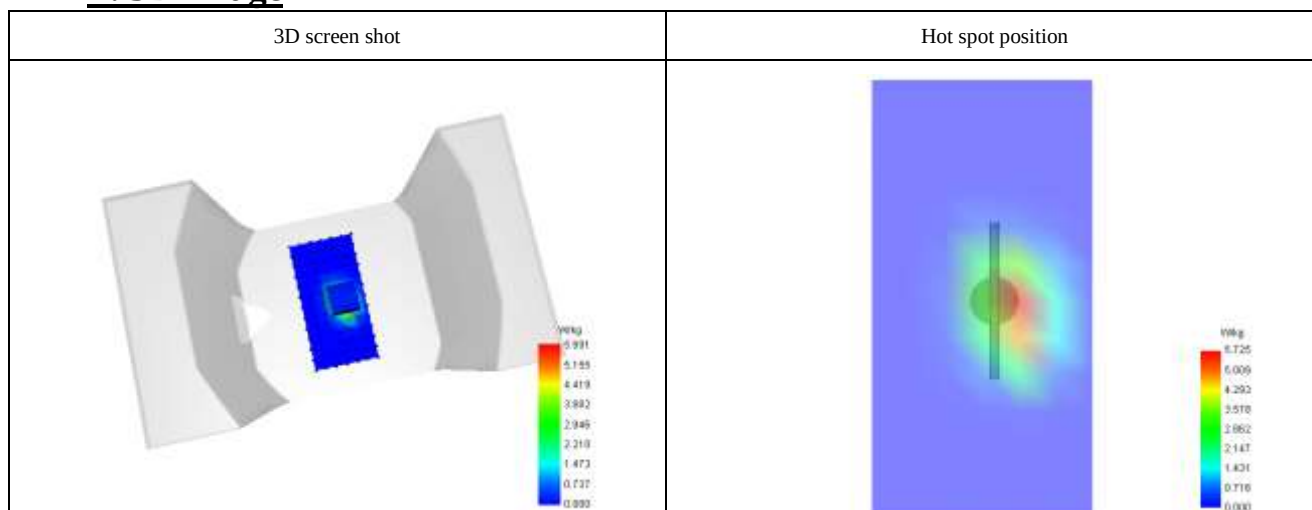
SAR 10g (W/Kg)	2.359
SAR 1g (W/Kg)	5.184
Variation (%)	-3.040
Horizontal validation criteria: minimum distance (mm)	10.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	47.564081

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	10.263	5.891	2.802	2.126	1.045	0.723	0.415



F. 3D Image



#2

Date of measurement: 5/6/2026

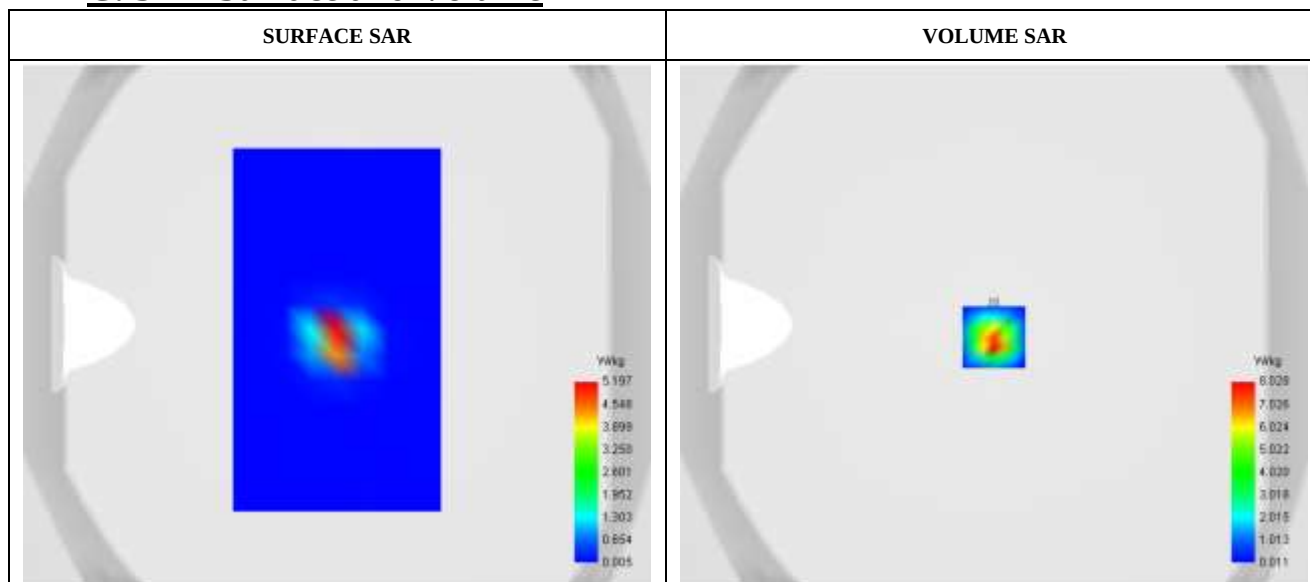
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	1.86
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	CW5200
Channels/Frequency	Middle

B. Permittivity

Middle TX Frequency (MHz)	5200.000
Relative permittivity (real part)	36.000
Relative permittivity (imaginary part)	16.130
Conductivity (S/m)	4.660

C. SAR Surface and Volume



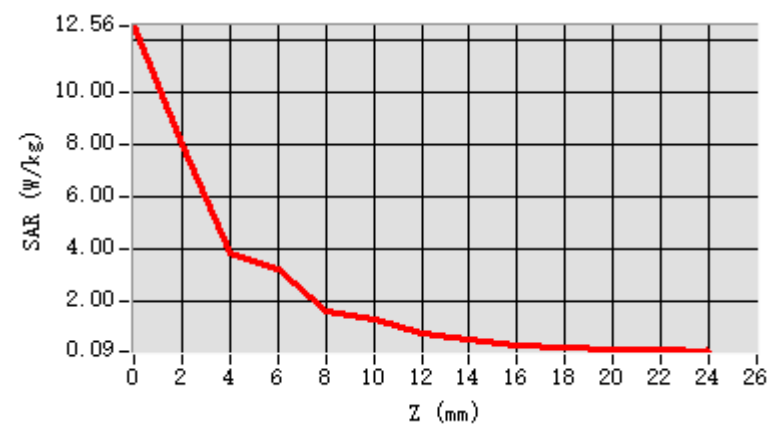
Maximum location: X=0.00, Y=-5.00 ; SAR Peak: 13.42 W/kg

D. SAR 1g & 10g

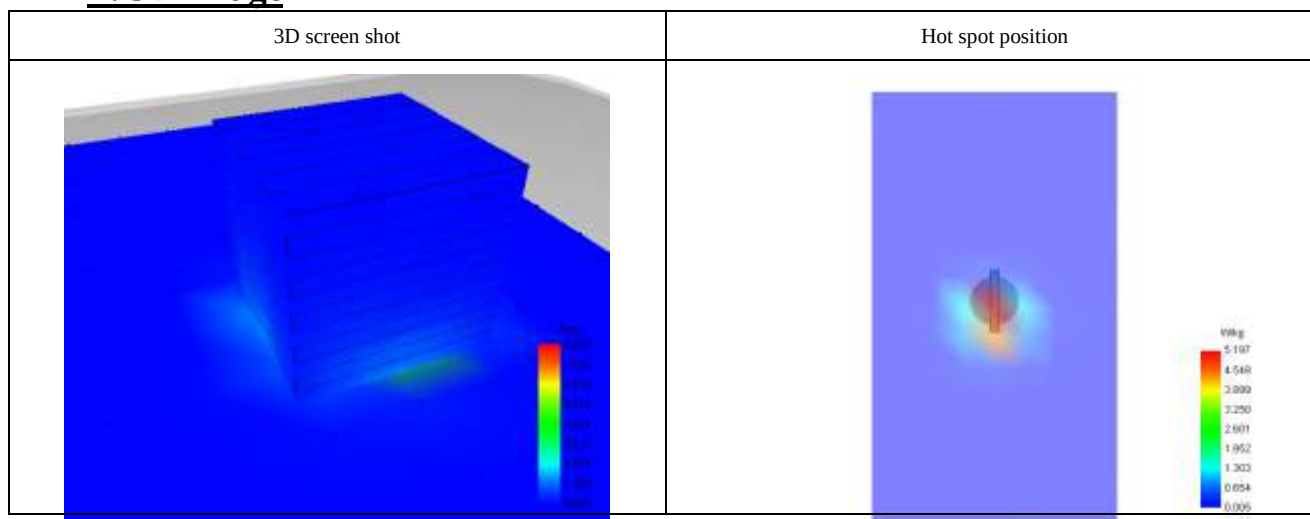
SAR 10g (W/Kg)	1.203
SAR 1g (W/Kg)	3.678
Variation (%)	4.620
Horizontal validation criteria: minimum distance (mm)	4.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	48.169909

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	12.564	8.028	3.867	3.214	1.625	1.324	0.785	0.581	0.314	0.263	0.145	0.126



F. 3D Image



#3

Date of measurement: 10/6/2026

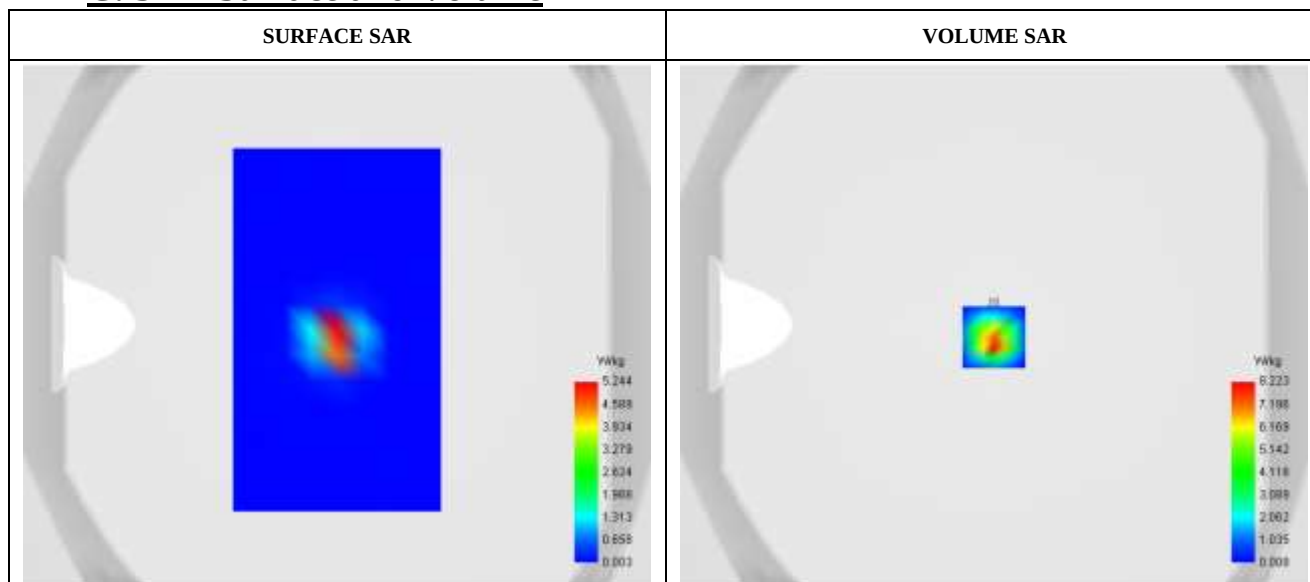
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	1.70
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	CW5800
Channels/Frequency	Middle

B. Permittivity

Middle TX Frequency (MHz)	5800.000
Relative permittivity (real part)	35.300
Relative permittivity (imaginary part)	16.360
Conductivity (S/m)	5.272

C. SAR Surface and Volume



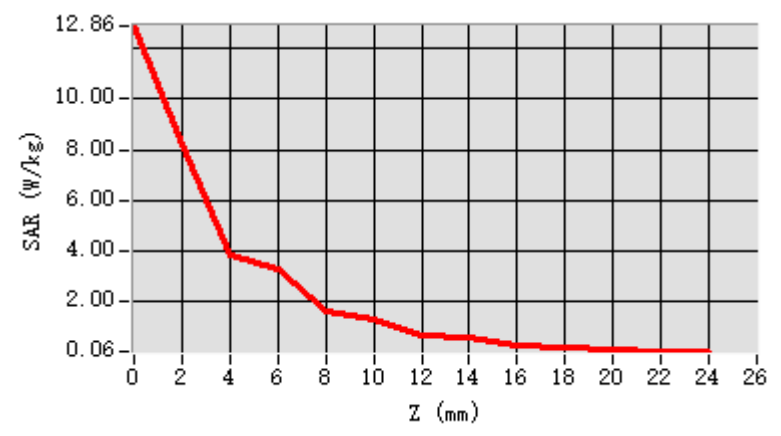
Maximum location: X=0.00, Y=-5.00 ; SAR Peak: 13.82 W/kg

D. SAR 1g & 10g

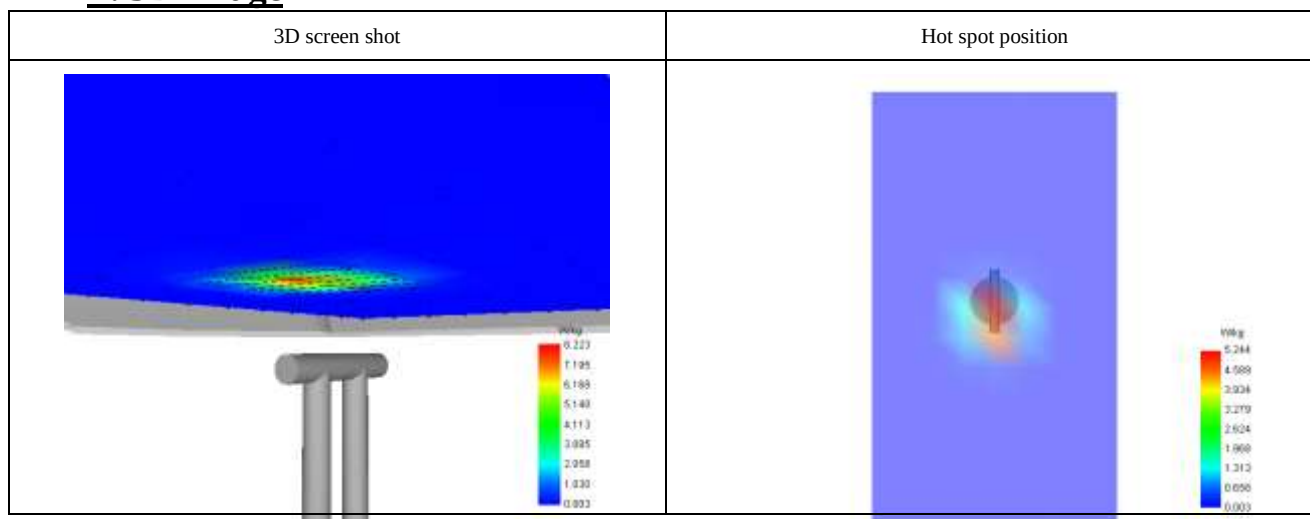
SAR 10g (W/Kg)	1.206
SAR 1g (W/Kg)	4.106
Variation (%)	1.050
Horizontal validation criteria: minimum distance (mm)	4.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	47.257692

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	12.863	8.223	3.886	3.302	1.611	1.337	0.671	0.582	0.287	0.232	0.129	0.083



F. 3D Image



Appendix C. SAR Test Plots

Table of contents
#1 WALN 5.2G Body
#2 WALN 5.8G Body
#3 WALN 2.4G Body

#1

Date of measurement: 5/6/2026

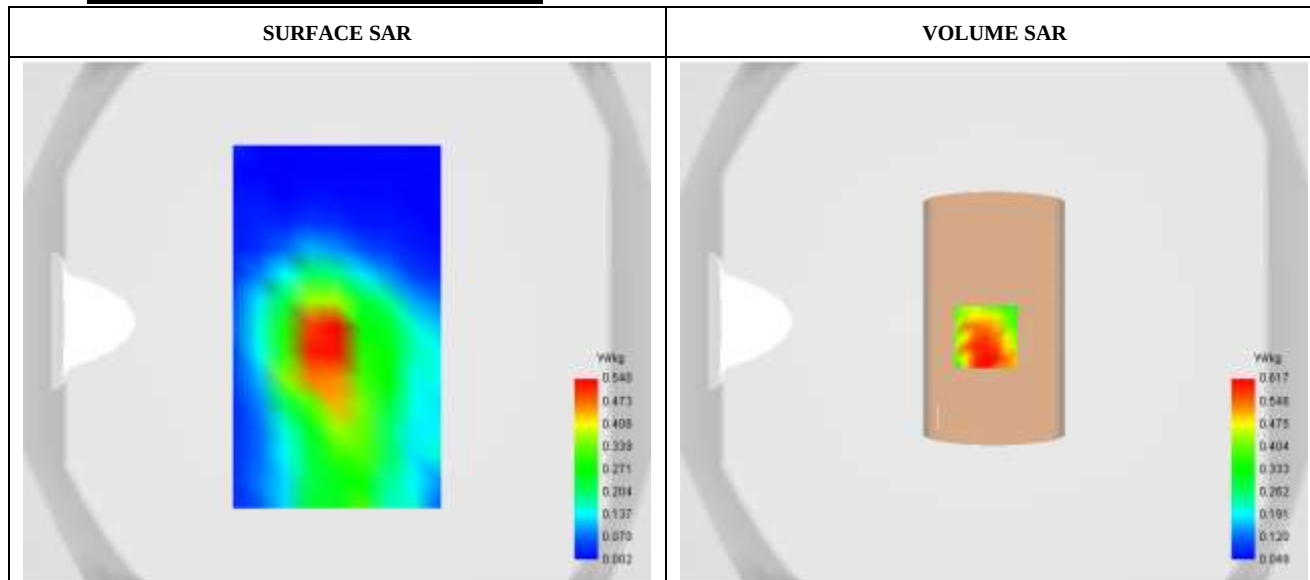
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	1.86
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-1
Channels/Frequency	Low (36)/ frequency 5180.000 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5180.000
Relative permittivity (real part)	36.000
Relative permittivity (imaginary part)	16.120
Conductivity (S/m)	4.639

C. SAR Surface and Volume



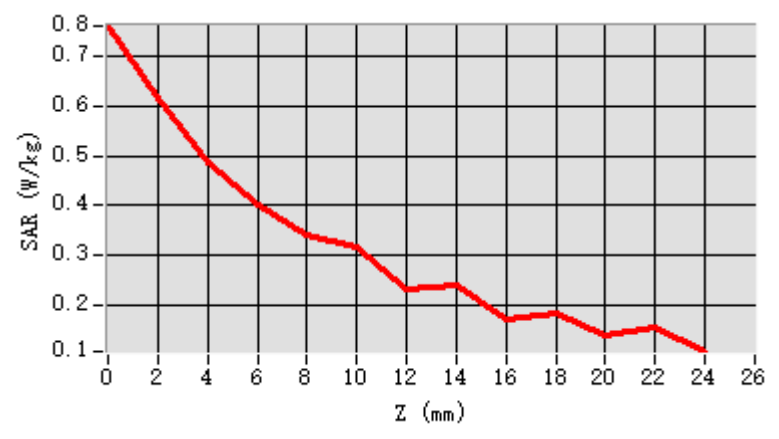
Maximum location: X=-3.00, Y=-6.00 ; SAR Peak: 0.84 W/kg

D. SAR 1g & 10g

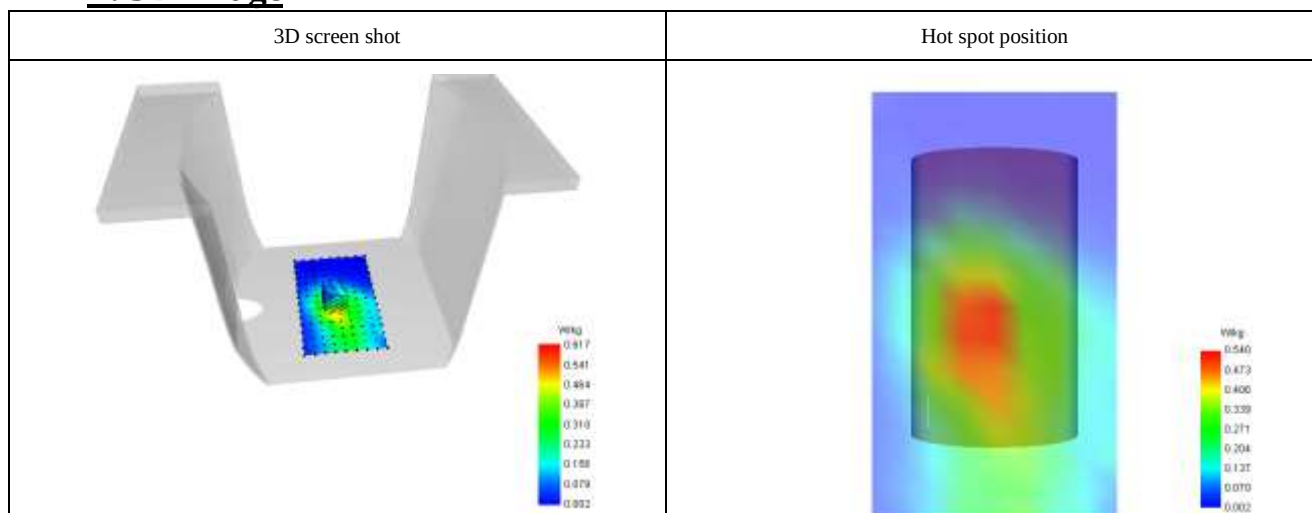
SAR 10g (W/Kg)	0.214
SAR 1g (W/Kg)	0.481
Variation (%)	0.310
Horizontal validation criteria: minimum distance (mm)	23.323808
Vertical validation criteria: SAR ratio M2/M1 (%)	78.606159

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.762	0.617	0.485	0.403	0.340	0.316	0.229	0.238	0.169	0.184	0.136	0.152



F. 3D Image



#2

Date of measurement: 10/6/2026

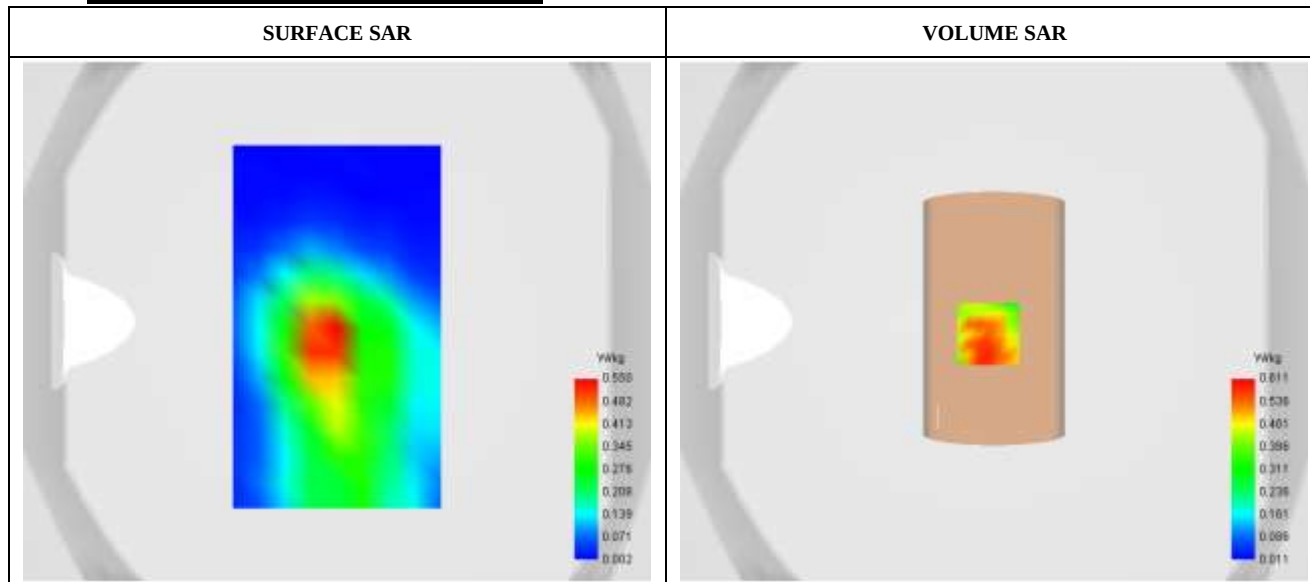
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	1.70
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-3
Channels/Frequency	High (159)/ frequency 5795.000 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5795.000
Relative permittivity (real part)	35.314
Relative permittivity (imaginary part)	16.355
Conductivity (S/m)	5.265

C. SAR Surface and Volume



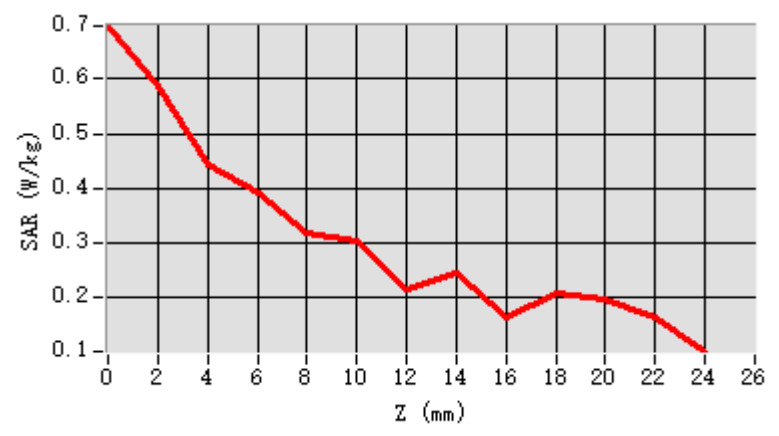
Maximum location: X=-2.00, Y=-5.00 ; SAR Peak: 1.04 W/kg

D. SAR 1g & 10g

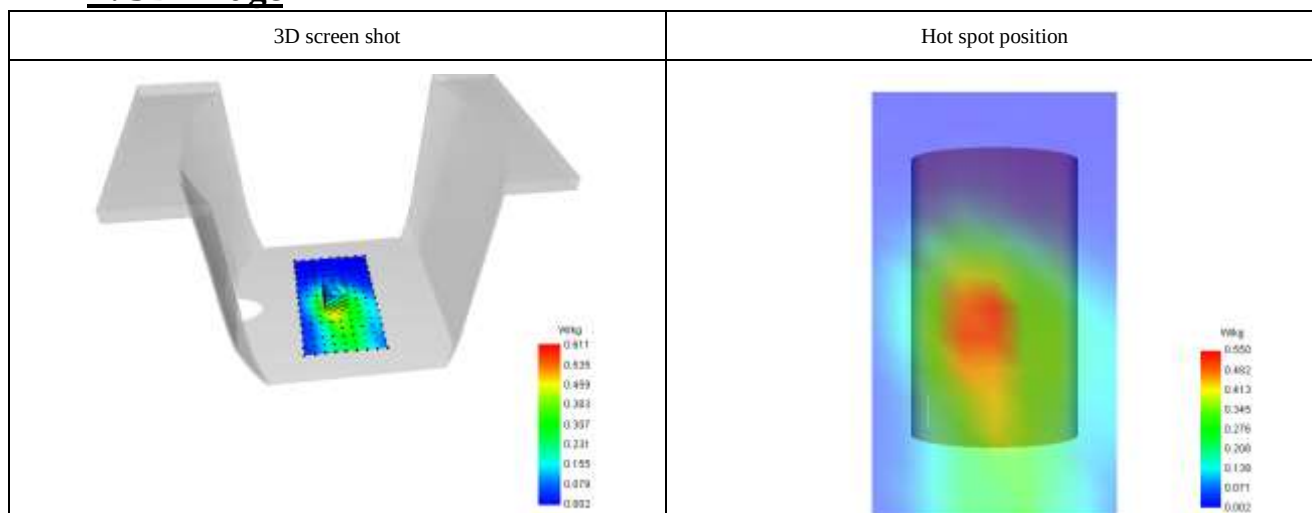
SAR 10g (W/Kg)	0.213
SAR 1g (W/Kg)	0.475
Variation (%)	1.470
Horizontal validation criteria: minimum distance (mm)	23.323808
Vertical validation criteria: SAR ratio M2/M1 (%)	75.340136

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00
SAR (W/Kg)	0.697	0.588	0.443	0.390	0.319	0.303	0.214	0.244	0.166	0.207	0.198	0.164	0.164



F. 3D Image



#3

Date of measurement: 2/6/2026

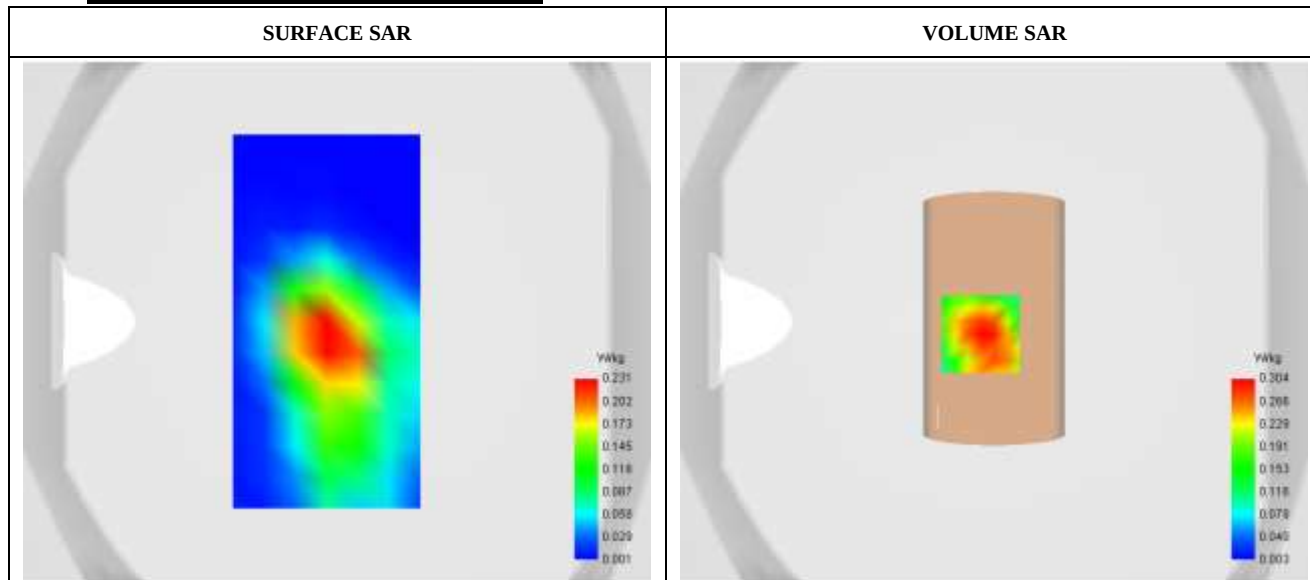
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	2.44
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	ISM
Channels/Frequency	Higher (11)/ frequency 2462.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	2462.00
Relative permittivity (real part)	39.184
Relative permittivity (imaginary part)	13.248
Conductivity (S/m)	1.812

C. SAR Surface and Volume



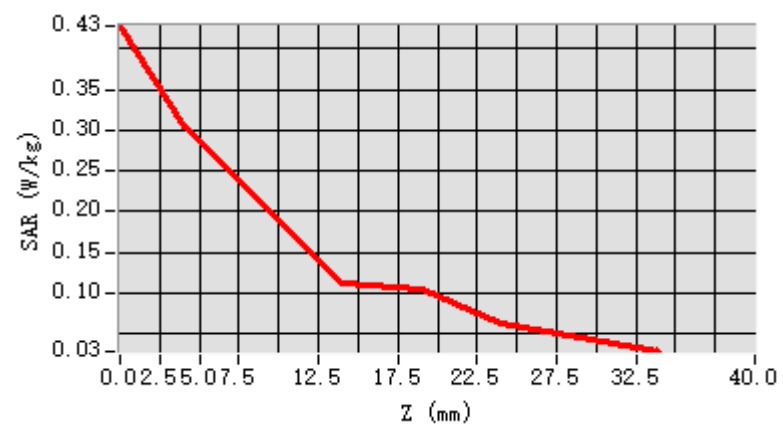
Maximum location: X=-5.00, Y=-5.00 ; SAR Peak: 0.46 W/kg

D. SAR 1g & 10g

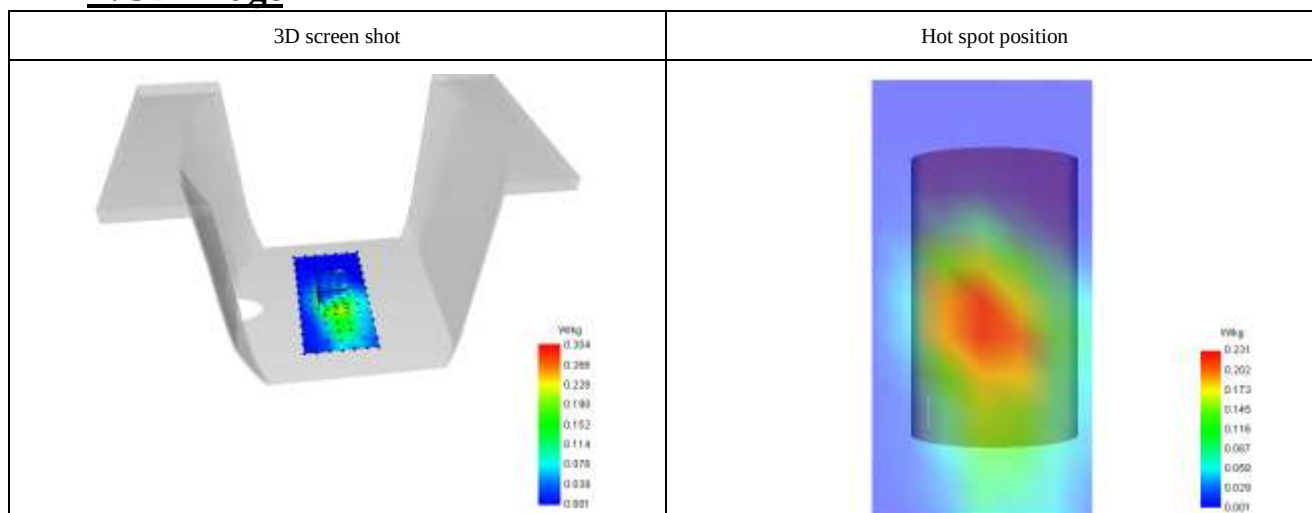
SAR 10g (W/Kg)	0.164
SAR 1g (W/Kg)	0.290
Variation (%)	-3.190
Horizontal validation criteria: minimum distance (mm)	15.811388
Vertical validation criteria: SAR ratio M2/M1 (%)	69.078947

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.428	0.304	0.210	0.113	0.104	0.062	0.045



F. 3D Image



Appendix D. Calibration Certificate

Table of contents
E Field Probe - 0523-EPGO-403
2450 MHz Dipole - SN 1811-DIP2G450-155
5000-6000 MHz Dipole - SN 2923-DIP5G000-730

Docusign Envelope ID: 441A23A1-88DE-4D96-BD64-561319DF94DB



COMOSAR E-Field Probe Calibration Report

Ref : ACR.100.4.26.PAR.A

**GUANGDONG ASIA HONGKE TEST
TECHNOLOGY CO.,LTD**
**NO. B1/F, BUILDING 11, JUNTENG INDUSTRIAL PARCK,
CHONGQING ROAD,HEPING COMMUNITY, FUHAI
STREET,**
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: 0523-EPGO-403

Calibrated at MVG
13 Rue du Zephyr
91140 Villejust - FRANCE
Calibration date: 03/03/2026



Scope available on <https://a2la.org/>

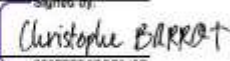
Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.100.4.26.PAR.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Pedro Ruiz	Technical Manager	4/10/2026	
<i>Checked & approved by:</i>	Pedro Ruiz	Technical Manager	4/10/2026	
<i>Authorized by:</i>	Christophe Barrot	Quality Manager	2026 April 13	 Signed by: Christophe BARROT 7587FED26CF948E

	<i>Customer Name</i>
<i>Distribution :</i>	Guangdong Asia Hongke Test Technology Co.,Ltd

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Pedro Ruiz	4/10/2026	Initial release

Docusign Envelope ID: 441A23A1-88DE-4D98-BD64-561319DF94DB



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.100.4.26.PAR.A

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR-100.4.26.PAR.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	0523-EPGO-403
Product Condition (new / used)	Used
Frequency Range of Probe	0.15 GHz-7.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.216 MΩ Dipole 2: R2=0.239 MΩ Dipole 3: R3=0.223 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Probe

Probe Length	330 mm
Length of Individual Dipoles	2 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.5 mm
Distance between dipoles / probe extremity	1 mm

3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their effect. All calibrations / measurements performed meet the fore-mentioned standards.

3.1 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards for frequency range 600-7500MHz and using the calorimeter cell method (transfer method) as outlined in the standards for frequency 150-450 MHz.

3.2 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

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3.3 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.4 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and $d_{be} + d_{step}$ along lines that are approximately normal to the surface:

$$SAR_{uncertainty} [\%] = \frac{\Delta SAR_{be}}{SAR_{be}} \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{(e^{-d_{be}/\delta} - e^{-(d_{be} + d_{step})/\delta})}{\delta/2} \quad \text{for } (d_{be} + d_{step}) < 10 \text{ mm}$$

where

$SAR_{uncertainty}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest <i>zoom-scan</i> measurement point, in millimetre
Δ_{step}	is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible
δ	is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e., $\delta \approx 14 \text{ mm}$ at 3 GHz;
ΔSAR_{be}	in percent of SAR is the deviation between the measured SAR value, at the distance d_{be} from the boundary, and the analytical SAR value.

The measured worst case boundary effect $SAR_{uncertainty}[\%]$ for scanning distances larger than 4mm is 1.0% (Limit ,2%).

3.5 PROBE MODULATION RESPONSE

MVG's probe were evaluated experimentally with various modulated signal and the deviation from CW response were found neglectable in the used power range of the probe. So the correction to taking into account the linearization parameters for different modulation is null, therefore the CW factor given in this report can be used whatever the measured modulation

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.100.4.26.PAR.A

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty associated with a SAR probe calibration using the waveguide or calorimetric cell technique depending on the frequency.

The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-11% for the frequency range 150-450MHz.

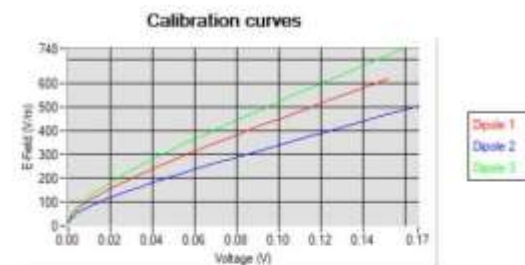
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

Ambient condition	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

5.1 CALIBRATION IN AIR

The following curve represents the measurement in waveguide of the voltage picked up by the probe toward the E-field generated inside the waveguide.



From this curve, the sensitivity in air is calculated using the below formula.

$$E^2 = \sum_{i=1}^3 \frac{V_i (1 + V_i / DCP_i)}{Norm_i}$$

where

V_i =voltage readings on the 3 channels of the probe

DCP_i =diode compression point given below for the 3 channels of the probe

$Norm_i$ =dipole sensitivity given below for the 3 channels of the probe

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

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Normx dipole 1 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normy dipole 2 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normz dipole 3 ($\mu\text{V}/(\text{V}/\text{m})^2$)
0.95	1.68	0.70

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
108	105	109

5.2 CALIBRATION IN LIQUID

The calorimeter cell or the waveguide is used to determine the calibration in liquid using the formula below.

$$\text{ConvF} = \frac{E_{\text{liquid}}^2}{E_{\text{air}}^2}$$

The E-field in the liquid is determined from the SAR measurement according to the below formula.

$$E_{\text{liquid}}^2 = \frac{\rho \text{ SAR}}{\sigma}$$

where

σ =the conductivity of the liquid

ρ =the volumetric density of the liquid

SAR=the SAR measured from the formula that depends on the setup used. The SAR formulas are given below

For the calorimeter cell (150-450 MHz), the formula is:

$$\text{SAR} = c \frac{dT}{dt}$$

where

c =the specific heat for the liquid

dT/dt =the temperature rises over the time

For the waveguide setup (600-75000 MHz), the formula is:

$$\text{SAR} = \frac{4P_W}{ab\delta} e^{-\frac{2z}{\delta}}$$

where

a =the larger cross-sectional of the waveguide

b =the smaller cross-sectional of the waveguide

δ =the skin depth for the liquid in the waveguide

P_W =the power delivered to the liquid

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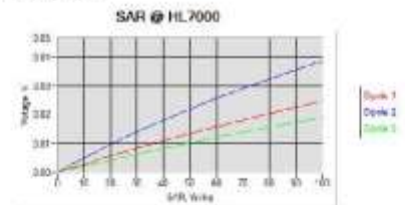
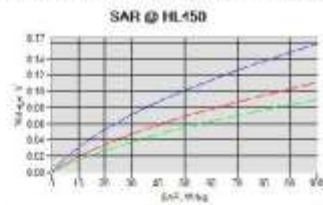
COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.100.4.26.PAR.A

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.

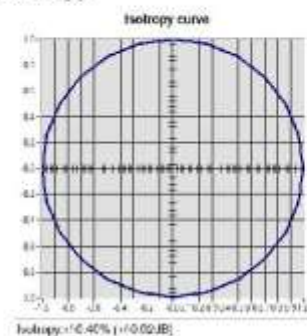
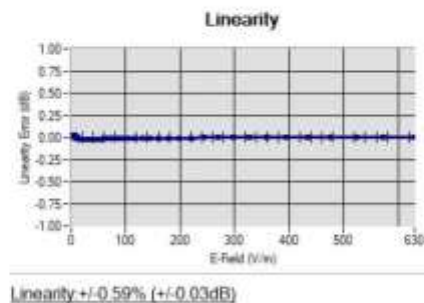
Liquid	Frequency (MHz [*])	ConvF
HL450	450	1.95
HL750	750	2.08
HL900	900	2.01
HL1800	1800	2.01
HL1900	1900	2.20
HL2000	2000	2.22
HL2300	2300	2.37
HL2450	2450	2.44
HL2600	2600	2.23
HL3300	3300	1.98
HL3500	3500	1.84
HL3700	3700	1.83
HL3900	3900	1.91
HL4200	4200	2.02
HL4600	4600	1.90
HL4900	4900	1.85
HL5200	5200	1.86
HL5400	5400	1.82
HL5600	5600	1.65
HL5800	5800	1.70
HL7000	7000	1.75

(*) Frequency validity is: +50MHz below 500MHz, +100MHz from 500MHz to 6GHz and +700MHz above 6GHz.



6 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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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.100.4.26.PAR.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 ZND	1328.5170K92-100497-kX	12/2025	08/2028
Network Analyzer – Calibration kit	Keysight 85052D	85052D MY61410029	06/2024	06/2027
Multimeter	Keithley 2000	4013982	02/2023	02/2027
Signal Generator	Rohde & Schwarz SMB	183277	05/2022	05/2027
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	01/2026	01/2029
USB Sensor	Keysight U2000A	SN: MY62340002	10/2024	10/2027
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	09/2026
Coaxial cell	MVG	SN 32/16 COAXCELL_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG2_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G600_1	Validated. No cal required.	Validated. No cal required.
Waveguide	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.
Waveguide	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.

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Waveguide	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.
Waveguide	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.
Waveguide	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.
Temperature / Humidity Sensor	Testo 184 H1	44235403	02/2024	02/2027

Docusign Envelope ID: 441A23A1-88DE-4D96-BD64-561319DF94DB



SAR Reference Dipole Calibration Report

Ref : ACR.100.10.26.PAR.A

**GUANGDONG ASIA HONGKE TEST
TECHNOLOGY CO.,LTD**
**NO. B1/F, BUILDING 11, JUNTENG INDUSTRIAL PARCK,
CHONGQING ROAD,HEPING COMMUNITY, FUHAI
STREET,**
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 2450 MHZ
SERIAL NO.: SN 1811-DIP2G450-155

Calibrated at MVG
13 Rue du Zephyr
91140 Villejust - FRANCE
Calibration date: 03/31/2026



Scope available on : <https://a2la.org/>

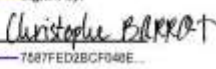
Summary:

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.

DocuSign Envelope ID: 441A23A1-88DE-4D98-BD64-561319DF94DB


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR 100.10.26.PAR.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Pedro Ruiz	Technical Manager	4/10/2026	
<i>Checked & approved by:</i>	Pedro Ruiz	Technical Manager	4/10/2026	
<i>Authorized by:</i>	Christophe Barrot	Quality Manager	2026 April 13	<i>Signed by:</i>  7587FED2BCF040E...

	<i>Customer Name</i>
<i>Distribution :</i>	Guangdong Asia Hongke Test Technology Co.,Ltd

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Pedro Ruiz	4/10/2026	Initial release

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR 100.10.26.PAR.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR 100.10.26.PAR.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 2450 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2450
Serial Number	SN 1811-DIP2G450-155
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, however, being built in accordance to relevant standards, it can be used in others SAR test benches as long as the final user take care that the prescribed S11 and SAR target value are met.



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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR 100.10.26.PAR.A

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 and using a prescribed spacer, 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
-	51.50 +/- 2%	-	30.40 +/- 2%	-	3.60 +/- 2%

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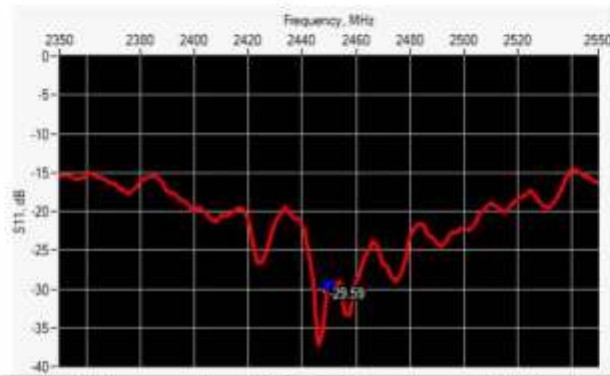


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR 100.10.26.PAR.A

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2450	-29.59	-20	$52.9\Omega + 1.5j\Omega$

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 by using a prescribed spacer.

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	4424-EPGO-443
Liquid	Head Liquid Values: ϵ_{ps} : 41.3 σ : 1.88
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 %

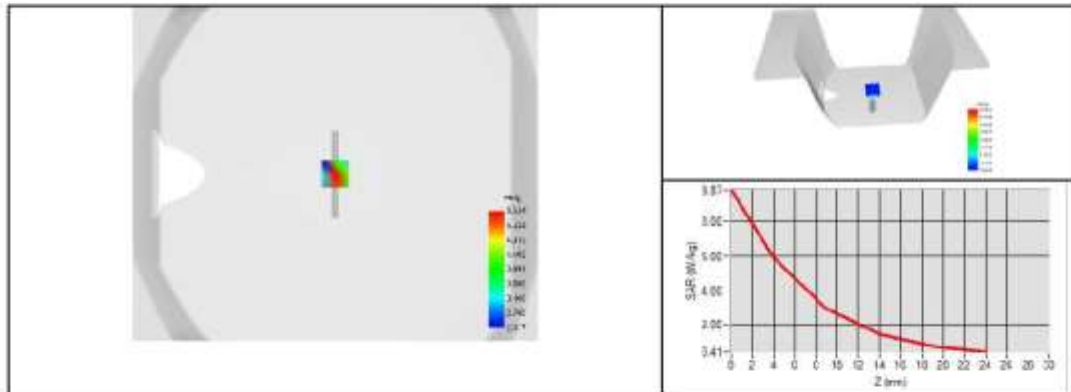
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Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
2450 MHz	5.32	53.17	52.40	2.45	24.48	24.00



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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.
Network Analyzer	Rohde & Schwarz ZND	1328.5170K92-100497-kX	12/2025	08/2028
Network Analyzer – Calibration kit	Keysight 85052D	85052D MY61410029	06/2024	06/2027
Calipers	Mitutoyo	SN 0009732	11/2022	11/2026
Reference Probe	MVG	4424-EPGO-443	05/2025	05/2026
Multimeter	Keithley 2000	4013982	02/2023	02/2027
Signal Generator	Rohde & Schwarz SMB	183277	05/2022	05/2027
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	01/2026	01/2029
USB Sensor	Keysight U2000A	SN: MY62340002	10/2024	10/2027
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	44235403	10/2024	10/2027

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SAR Reference Dipole Calibration Report

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**GUANGDONG ASIA HONGKE TEST
TECHNOLOGY CO.,LTD**
**NO. B1/F, BUILDING 11, JUNTENG INDUSTRIAL PARCK,
CHONGQING ROAD,HEPING COMMUNITY, FUHAI
STREET,**
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 5200-5800 MHZ
SERIAL NO.: SN 2923-DIP5G000-730

Calibrated at MVG
13 Rue du Zephyr
91140 Villejust - FRANCE
Calibration date: 04/01/2026



Scope available on : <https://n2la.org/>

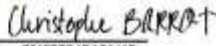
Summary:

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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	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Pedro Ruiz	Technical Manager	4/10/2026	
<i>Checked & approved by:</i>	Pedro Ruiz	Technical Manager	4/10/2026	
<i>Authorized by:</i>	Christophe Barrot	Quality Manager	2026 April 13	<i>signed by:</i>  7587FED2BCF04EE

	<i>Customer Name</i>
<i>Distribution :</i>	Guangdong Asia Hongke Test Technology Co.,Ltd

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Pedro Ruiz	4/10/2026	Initial release

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SAR REFERENCE DIPOLE CALIBRATION REPORT

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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 5200-5800 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID5000
Serial Number	SN 2923-DIP5G000-730
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, however, being built in accordance to relevant standards, it can be used in others SAR test benches as long as the final user take care that the prescribed S11 and SAR target value are met.



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

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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 and using a prescribed spacer, 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
-	20.60 +/- 2%	-	40.30 +/- 2%	-	3.60 +/- 2%

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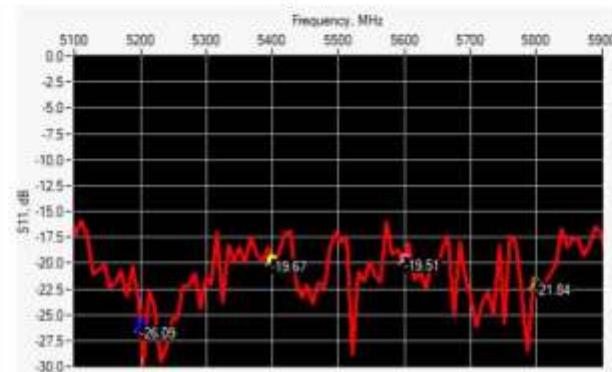


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6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
5200	-26.09	-20	$51.9\Omega + 2.2j\Omega$
5400	-19.67	-20	$57.5\Omega + 2.8j\Omega$
5600	-19.51	-20	$54.8\Omega + 4.6j\Omega$
5800	-21.84	-20	$53.7\Omega + 3.0j\Omega$

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 by using a prescribed spacer.

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	4424-EPGO-443
Liquid	Head Liquid Values @ 5200 MHz: ϵ_p : 34.4 sigma : 4.56 Head Liquid Values @ 5400 MHz: ϵ_p : 33.8 sigma : 4.78 Head Liquid Values @ 5600 MHz: ϵ_p : 33.3 sigma : 4.99 Head Liquid Values @ 5800 MHz: ϵ_p : 32.7 sigma : 5.22
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=4mm/dy=4mm/dz=2mm$

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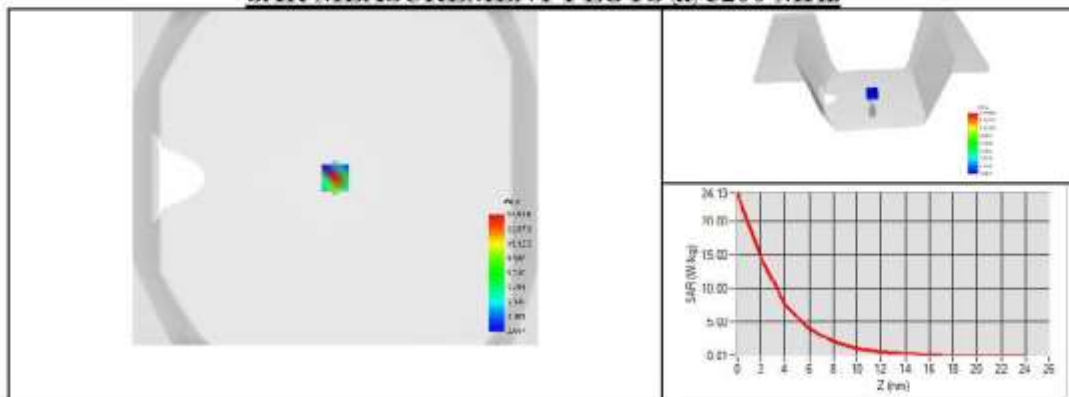
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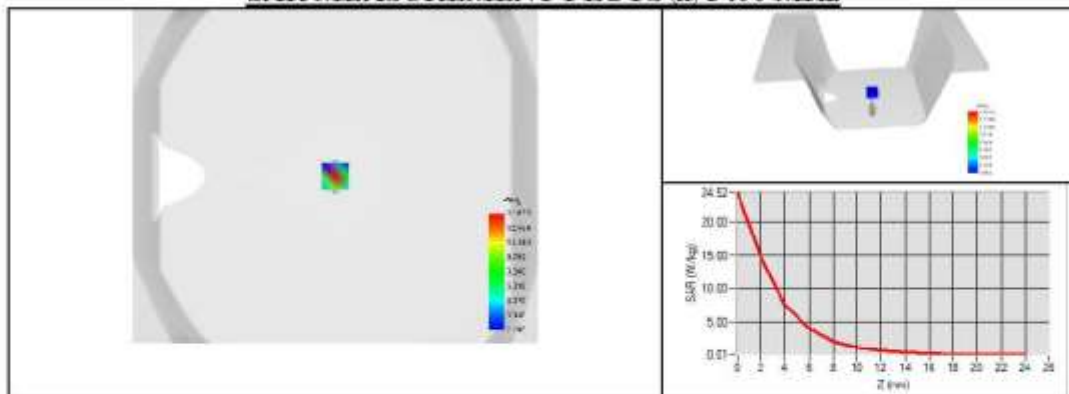
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

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
5200 MHz	7.78	77.82	76.50	2.25	22.53	21.60
5400 MHz	7.83	78.26	79.60	2.25	22.55	23.40
5600 MHz	7.85	78.55	78.30	2.28	22.77	23.20
5800 MHz	7.87	78.72	78.00	2.28	22.83	21.90

SAR MEASUREMENT PLOTS @ 5200 MHz



SAR MEASUREMENT PLOTS @ 5400 MHz



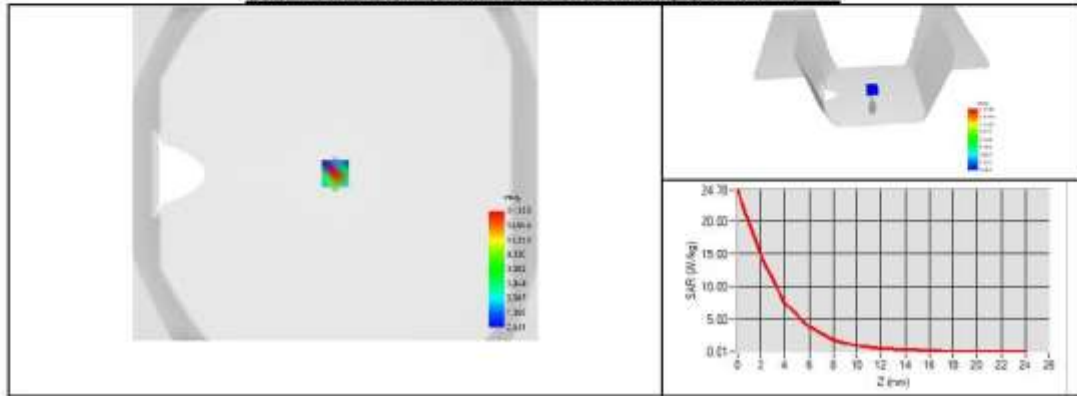
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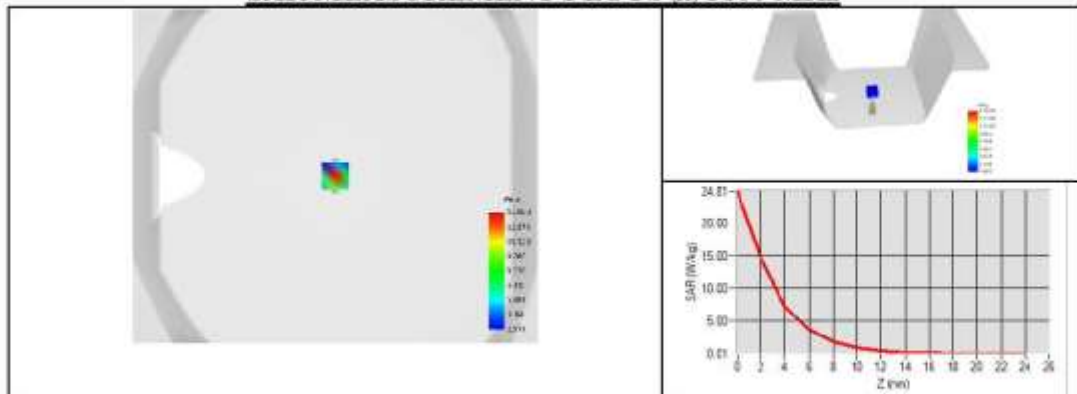
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SAR MEASUREMENT PLOTS @ 5600 MHz



SAR MEASUREMENT PLOTS @ 5800 MHz



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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.
Network Analyzer	Rohde & Schwarz ZND	1328.5170K92-100497-kX	12/2025	08/2028
Network Analyzer – Calibration kit	Keysight 85052D	85052D MY61410029	06/2024	06/2027
Calipers	Mitutoyo	SN 0009732	11/2022	11/2026
Reference Probe	MVG	4424-EPGO-443	05/2025	05/2026
Multimeter	Keithley 2000	4013982	02/2023	02/2027
Signal Generator	Rohde & Schwarz SMB	183277	05/2022	05/2027
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	01/2026	01/2029
USB Sensor	Keysight U2000A	SN: MY62340002	10/2024	10/2027
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	44235403	10/2024	10/2027

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