

FCC SAR EVALUATION REPORT

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

Product Name: Tablet PC

Model No.: Tab 20 Kids

Serial Model: KIDO 2

HVIN: Tab 20 Kids, KIDO 2

Brand Name: Blackview/OSCAL

Report No.: AiTSZ-251230018FW5

FCC ID: 2BSW8-TAB20KIDS

Prepared for

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TEST RESULT CERTIFICATION

Applicant's name: HONG KONG LELEGAO TECHNOLOGY CO.,LIMITED
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Manufacturer's Name: Shenzhen Doke Electronic Co., LTD
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Product description

Product name: Tablet PC
Trademark: Blackview/OSCAL
Model and/or type reference ...: Tab 20 Kids
Serial Model.....: KIDO 2
 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-251230018-1

Date of Test

Date (s) of performance of tests: Jan. 08, 2026 ~ Jan. 19, 2026
Date of Issue: Jan. 20, 2026
Test Result: **Pass**

Reviewed by: Ken Zou
 Ken Zou

Approved by: Jack Li
 Jack Li



※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Jan. 20, 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)	Max SAR Summation
2.4GHz WLAN	0.381	N/A
5.2GHz WLAN	0.670	
5.8GHz WLAN	0.673	

NOTE: The Max SAR Summation is calculated based on the same configuration and test position.

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	Tablet PC		
Model Name	Tab 20 Kids		
Family Model	KIDO 2		
Model different	PCB board, structure and internal of these model(s) are the same, So no additional models were tested		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna Type	PIFA antenna		
Battery Information	DC 3.8V 6600mAh 25.08Wh by Rechargeable Li-ion battery		
Hardware version	W30-T310		
Software version	N/A		
Device Operating Configurations			
Supporting Mode(s)	WLAN 2.4G/5G, Bluetooth		
Test Modulation	WLAN(DSSS/OFDM), Bluetooth(GFSK, $\pi/4$ -DQPSK, 8DPSK)		
Device Class	B		
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
KDB 616217 D04 SAR for laptop and tablets v01r02

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

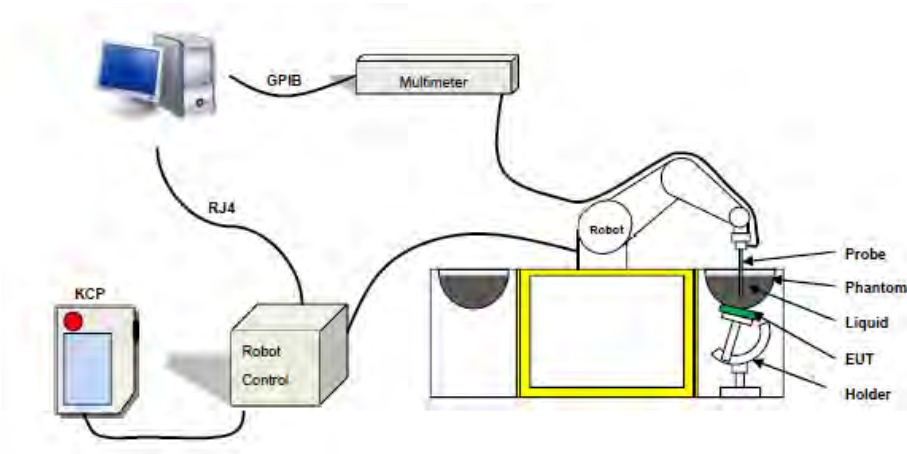
The 3m Semi-anechoic chamber of Guangdong Asia Hongke Test Technology Limited has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 31737c

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 EPGO 0523-403 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 6 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 Elliptical 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. The Elliptical phantom has elliptic shape. The Elliptical phantom provide one reference point on its top part to position the probe tip correctly. The phantom set-up includes a cover, which prevents the evaporation of the liquid.



Elliptical

2.5. Technical Data

Overall thickness	2±0.2mm
Internal Dimensions (Bottom part)	600 mm (L) x 400 mm (W) 170 mm (H)
External Dimensions	1000 mm (L) x 500 mm (W) x 280 mm (H)
Maximum volume	35 L
Material	Fiberglass based
Relative permittivity	3.4
Loss tangent	0.02

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.

Material properties: the positioning system is made of PETP. This material offers a low permittivity of 3.2 and low loss, with a loss tangent of 0.005 to minimize the influence of the DUT on measurement results.

Mechanical properties: 2 rows of rail to cover easily the surface of the phantom. The fixing plate is perfectly adapted to larger devices, such as a PC which can be positioned in all configurations.

Accuracy and precision: graduated scale available on each axis. The DUT is fixed with a specific adaptable grip.

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	EPGO 0523-403	Sep. 09, 2025	Sep. 08, 2026
☐	MVG	750 MHz Dipole	SID750	SN 07/14 DIP 0G750-302	Feb. 21, 2025	Feb. 20, 2028
☐	MVG	835 MHz Dipole	SID835	SN 07/14 DIP 0G835-303	Feb. 21, 2025	Feb. 20, 2028
☐	MVG	900 MHz Dipole	SID900	SN 03/15 DIP 0G900-348	Feb. 21, 2025	Feb. 20, 2028
☐	MVG	1800 MHz Dipole	SID1800	SN 07/14 DIP 1G800-301	Feb. 21, 2025	Feb. 20, 2028
☐	MVG	1900 MHz Dipole	SID1900	SN 38/18 DIP 1G900-466	Feb. 21, 2025	Feb. 20, 2028
☐	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Feb. 21, 2025	Feb. 20, 2028
☐	MVG	2300 MHz Dipole	SID2300	SN 38/18 DIP 2G300-467	Feb. 21, 2025	Feb. 20, 2028
☒	MVG	2450 MHz Dipole	SID2450	SN 07/14 DIP 2G450-306	Feb. 21, 2025	Feb. 20, 2028
☐	MVG	2600 MHz Dipole	SID2600	SN 38/18 DIP 2G600-468	Feb. 21, 2025	Feb. 20, 2028
☐	MVG	3500 MHz Dipole	SID3500	SN 0622-DIP3G500-647	May 20, 2025	May 19, 2028
☐	MVG	3700 MHz Dipole	SID3700	SN 0622-DIP3G700-648	May 21, 2025	May 20, 2028
☐	MVG	3900 MHz Dipole	SID3900	SN 0622-DIP3G900-649	May 21, 2025	May 20, 2028
☒	MVG	5000 MHz Dipole	SWG5500	SN 49/16 WGA 43	Feb. 21, 2025	Feb. 20, 2028
☒	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
☒	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	Elliptical Phantom	SSM2	SN 20/11 ELLI20	NCR	NCR
☒	MVG	Device Holder	SMPPD	SN 24/11 LSH15	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 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.

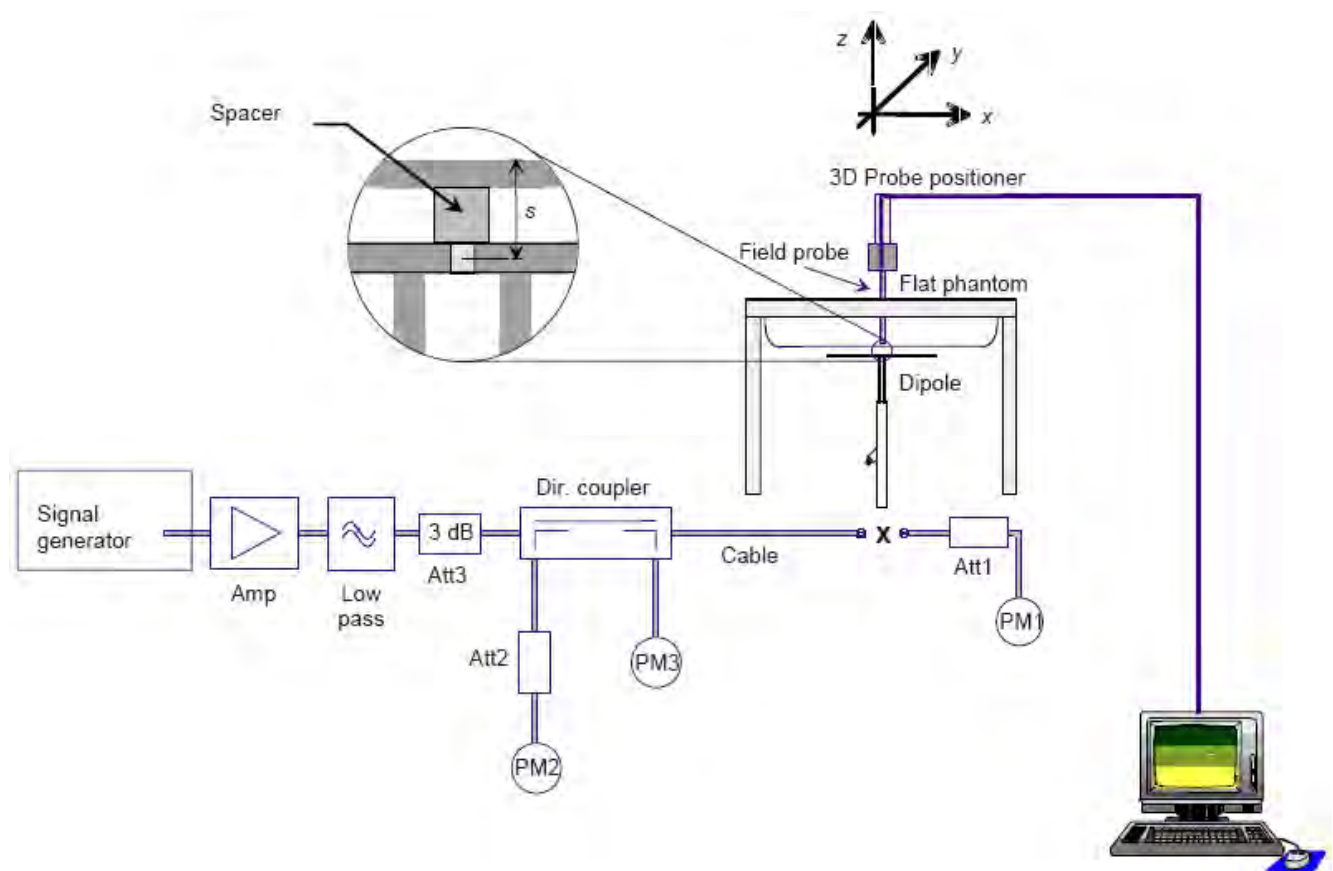
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		ϵ_r ($\pm 5\%$)	σ (S/m) ($\pm 5\%$)	ϵ_r	σ (S/m)		
Head 2450	2412	39.27 (37.30~41.23)	1.77 (1.68~1.85)	39.22	1.77	21.4 °C	Jan. 08, 2026
Head 2450	2437	39.22 (37.26~41.18)	1.79 (1.70~1.88)	39.23	1.79	21.4 °C	Jan. 08, 2026
Head 2450	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	41.04	1.80	21.4 °C	Jan. 08, 2026
Head 2450	2462	39.18 (37.22~41.14)	1.81 (1.72~1.90)	39.23	1.81	21.4 °C	Jan. 08, 2026
Head 5200	5180	36.02 (34.22~37.82)	4.64 (4.41~4.87)	36.00	4.64	21.6 °C	Jan. 15, 2026
Head 5200	5200	36.00 (34.20~37.80)	4.66 (4.43~4.89)	36.00	4.66	21.6 °C	Jan. 15, 2026
Head 5200	5240	35.96 (34.16~37.76)	4.70 (4.47~4.94)	36.00	4.70	21.6 °C	Jan. 15, 2026
Head 5800	5745	35.36 (33.59~37.12)	5.22 (4.95~5.48)	35.31	5.22	21.7 °C	Jan. 19, 2026
Head 5800	5785	35.32 (33.55~37.08)	5.26 (4.99~5.52)	35.30	5.25	21.7 °C	Jan. 19, 2026
Head 5800	5800	35.30 (33.54~37.07)	5.27 (5.01~5.53)	35.30	5.27	21.7 °C	Jan. 19, 2026
Head 5800	5825	35.28 (33.51~37.04)	5.30 (5.03~5.56)	35.29	5.30	21.7 °C	Jan. 19, 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 25mW (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	50.05	23.80	3.58%	-0.88%	Jan. 08, 2026
5200MHz	25	3.678	1.303	147.12	52.12	162.59	56.21	-9.51%	-7.28%	Jan. 15, 2026
5800MHz	25	4.106	1.406	164.21	56.23	182.2	61.32	-9.87%	-8.30%	Jan. 19, 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 ($\sim 10\%$ 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

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

7. RF Exposure Positions

7.1. Tablet PC host platform exposure conditions

Refer to KDB616217 D04, when the modular approach is used, transmitters and modules must be initially tested for standalone operations in generic host conditions according to the following minimum test separation distance and antenna installation requirements for incorporation in the tablet platform. The separation distance required for incorporation in qualified hosts is described in KDB 447498; item 5) of section 4.1 and item 1) of section 5.2.2 etc.

- ≤ 5 mm between the antenna and user for both back surface and edge exposure conditions
- the antennas used by the host must have been tested for equipment approval or qualify for SAR test exclusion
- the antenna polarization, physical orientation, rotation and installation configurations used by the host must have been tested for compliance or qualify for test exclusion
- when the *SAR Test Exclusion Threshold* in KDB 447498 applies, a *test separation distance of 5 mm* is required to determine test exclusion for the tablet platform

The antennas embedded in tablets are typically ≤ 5 mm from the outer housing. The required antenna to user test separation distance is a “not to exceed test” distance required to apply the modular approach. Instead of the typical zero gap tablet edge test requirement between the edge of a tablet and the user, when an antenna has been tested at ≤ 5 mm according to the modular approach it can be incorporated into tablets with at least twice the tested distance from the outer housing of the tablet edge; otherwise, the tablet edge zero gap test requirement applies. When the dedicated host approach is applied, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom.

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	15.00	14.04
	6	2437	15.00	14.50
	11	2462	13.00	12.22
802.11g	1	2412	15.00	14.75
	6	2437	16.00	15.63
	11	2462	13.00	12.25
802.11n (HT20)	1	2412	15.00	14.19
	6	2437	16.00	15.23
	11	2462	13.00	12.84
802.11n (H40)	3	2422	15.00	14.64
	6	2437	15.00	14.90
	9	2452	13.00	12.81

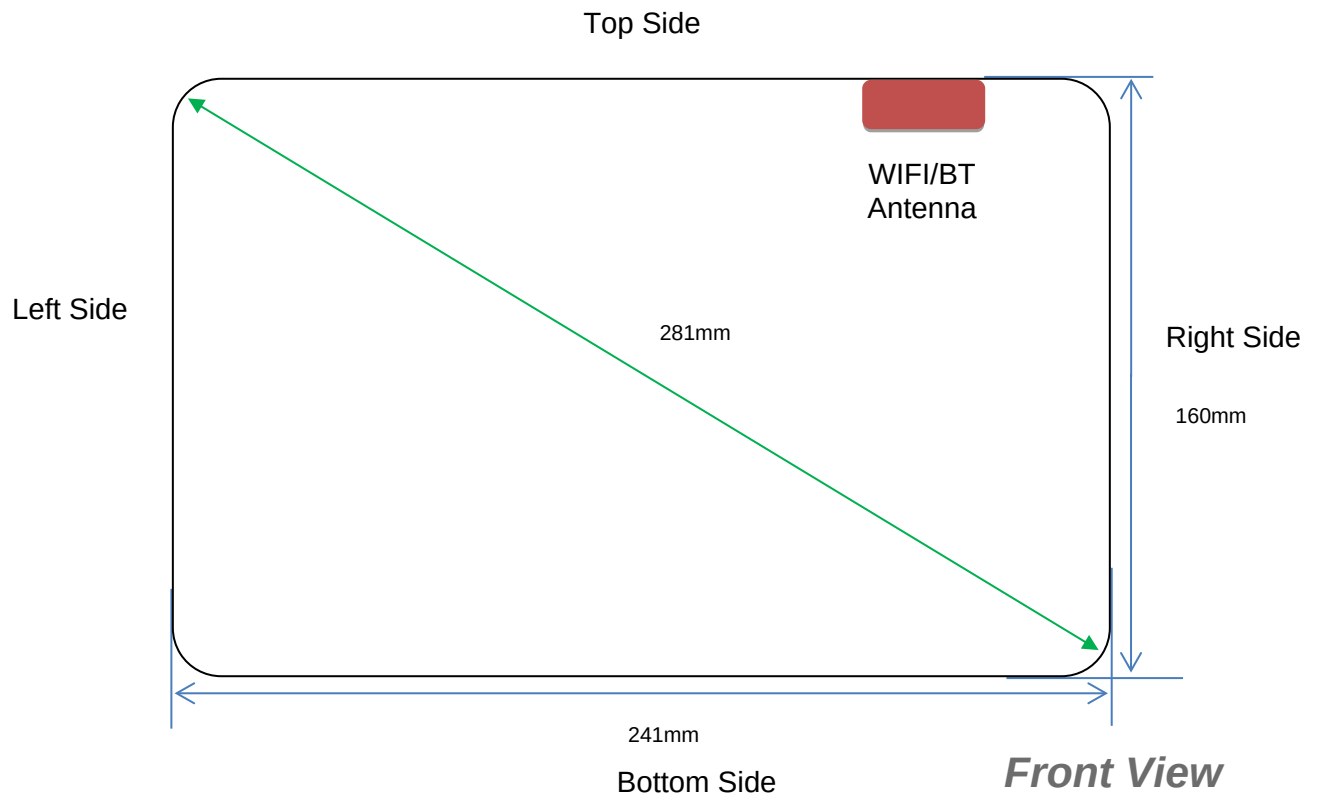
Mode	Frequency (MHz)	Tune-Up (dBm)	Output Power (dBm)
802.11A	5180	11.50	9.78
	5200	11.50	9.72
	5240	11.50	11.09
802.11N20SISO	5180	8.00	7.30
	5200	8.00	7.41
	5240	10.00	9.08
802.11N40SISO	5190	11.00	9.74
	5230	11.00	10.79
802.11AC20SISO	5180	11.50	10.02
	5200	11.50	9.93
	5240	11.50	11.36
802.11AC40SISO	5190	9.00	7.55
	5230	9.00	8.70
802.11AC80SISO	5210	8.00	7.75

Mode	Frequency (MHz)	Tune-Up (dBm)	Output Power (dBm)
802.11A	5745	11.00	10.42
	5785	10.00	9.30
	5825	8.00	7.78
802.11N20SISO	5745	11.00	10.75
	5785	10.00	9.59
	5825	9.00	8.91
802.11N40SISO	5755	11.00	10.02
	5795	10.00	9.35
802.11AC20SISO	5745	11.00	10.72
	5785	11.00	10.06
	5825	9.00	8.61
802.11AC40SISO	5755	10.50	10.20
	5795	10.50	9.37
802.11AC80SISO	5775	10.00	9.87

BR+EDR	Output Power (dBm)				
	Channel	Tune-up (dBm)	Data Rates		
			1M	2M	3M
	0CH	5.00	4.61	3.18	3.52
	39CH	5.00	4.53	3.10	3.40
	78CH	4.50	4.32	2.79	3.10

Mode	Channel	Tune-up (dBm)	Output Power (dBm)
BLE1M	CH00	0.00	-0.52
	CH19	0.00	-0.19
	CH39	0.00	-0.29
BLE2M	CH00	0.00	-0.48
	CH19	0.00	-0.13
	CH39	0.00	-0.23

9. Antenna Location



Antenna information:

Distance of The Antenna to the EUT surface and edge (mm)					
Antennas	Back Side	Top Side	Bottom Side	Left Side	Right Side
BT/WLAN	5	5	147	170	48

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

Positions for SAR tests		
Test separation distances > 50 mm		
Exposure Positions	Tune-up Maximum power of WLAN 2.4G/Bluetooth	
	16.00 dBm / 5.00 dBm	39.81 mW / 3.16 mW
Left Side	Antenna to user(mm)	170
	SAR exclusion threshold(mW)	1296
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	147
	SAR exclusion threshold(mW)	1066
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WLAN 5.2G	
	11.50 dBm	14.13 mW
Left Side	Antenna to user(mm)	170
	SAR exclusion threshold(mW)	1266
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	147
	SAR exclusion threshold(mW)	1036
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WLAN 5.8G	
	11.00 dBm	12.59 mW
Left Side	Antenna to user(mm)	170
	SAR exclusion threshold(mW)	1262
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	147
	SAR exclusion threshold(mW)	1032
	SAR testing required?	NO

NOTE: Refer to section 4.3.1 of KDB 447498 D01.

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	5.00	3.16	5	2.480	1.0	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:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})/x}] \leq 7.5$ W/kg for test separation distances ≤ 50 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	5.00	3.16	5	2.48	7.5	0.132

NOTE: Estimated SAR calculation for Bluetooth.

11. 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						
Back Side	6/2437	802.11b	0.340	0.190	-0.69	14.50	15.00	0.381	2026/1/8	#3
Back Side	6/2437	802.11g	0.335	0.187	0.54	15.63	16.00	0.365	2026/1/8	
Right Side	6/2437	802.11b	0.105	0.057	0.18	14.50	15.00	0.118	2026/1/8	
Top Side	6/2437	802.11b	0.148	0.079	3.03	14.50	15.00	0.166	2026/1/8	

< 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						
Back Side	48/5240	802.11AC20	0.649	0.366	3.12	11.36	11.50	0.670	2026/1/15	#1
Right Side	48/5240	802.11AC20	0.195	0.107	2.72	11.36	11.50	0.201	2026/1/15	
Top Side	48/5240	802.11AC20	0.264	0.141	-3.53	11.36	11.50	0.273	2026/1/15	

< 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						
Back Side	149/5745	802.11N20	0.635	0.375	-3.91	10.75	11.00	0.673	2026/1/19	#2
Right Side	149/5745	802.11N20	0.204	0.116	0.75	10.75	11.00	0.216	2026/1/19	
Top Side	149/5745	802.11N20	0.272	0.161	3.99	10.75	11.00	0.288	2026/1/19	

12. Simultaneous Transmission Analysis

WiFi and Bluetooth cannot be used simultaneously.

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: 8/1/2026

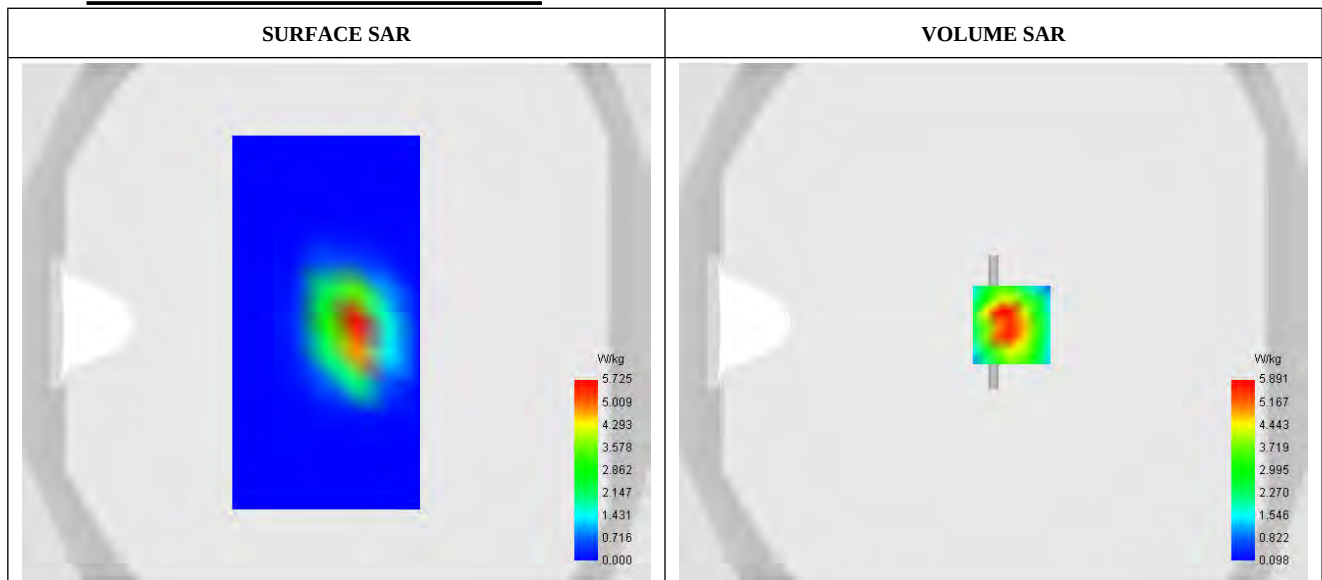
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	2.85
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



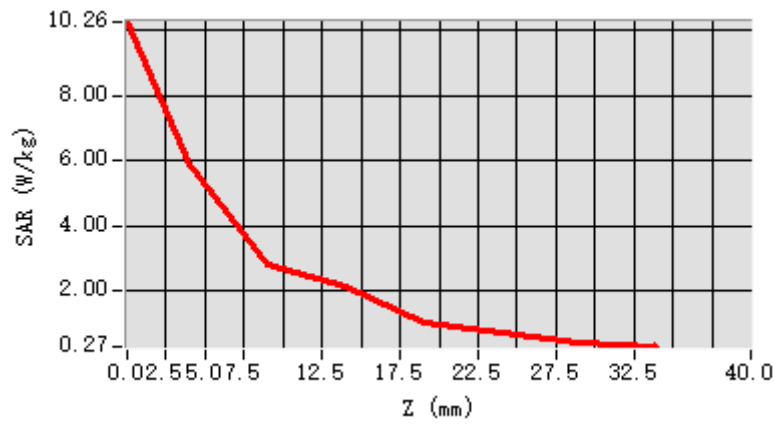
Maximum location: X=7.00, Y=-1.00 ; SAR Peak: 8.99 W/kg

D. SAR 1g & 10g

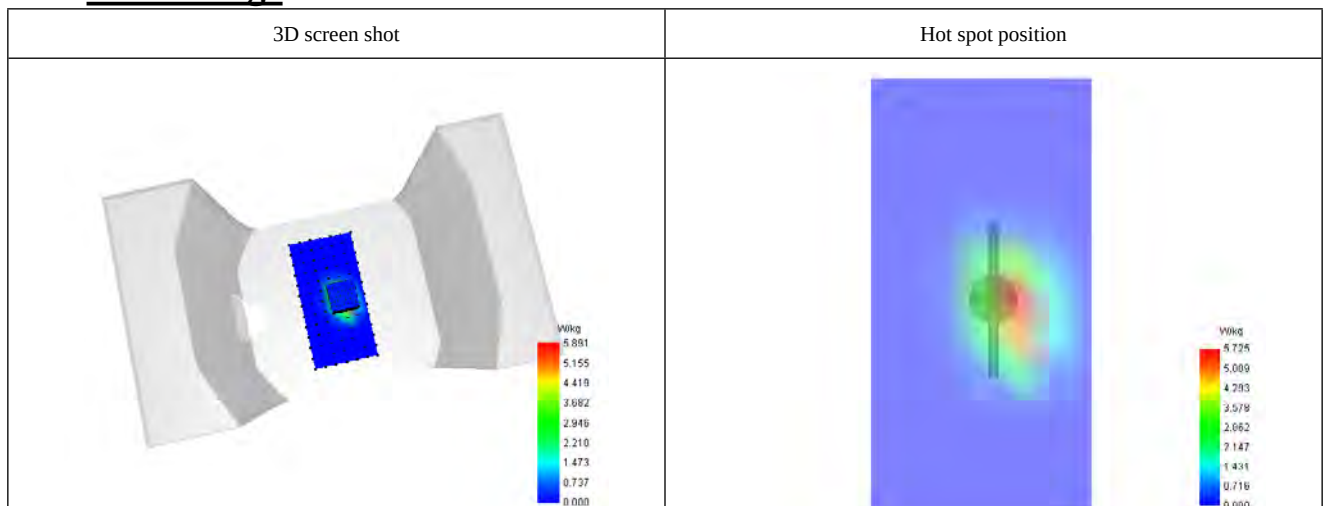
SAR 10g (W/Kg)	2.359
SAR 1g (W/Kg)	5.184
Variation (%)	-3.040
Horizontal validation criteria: minimum distance (mm)	10.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	47.564081

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: 15/1/2026

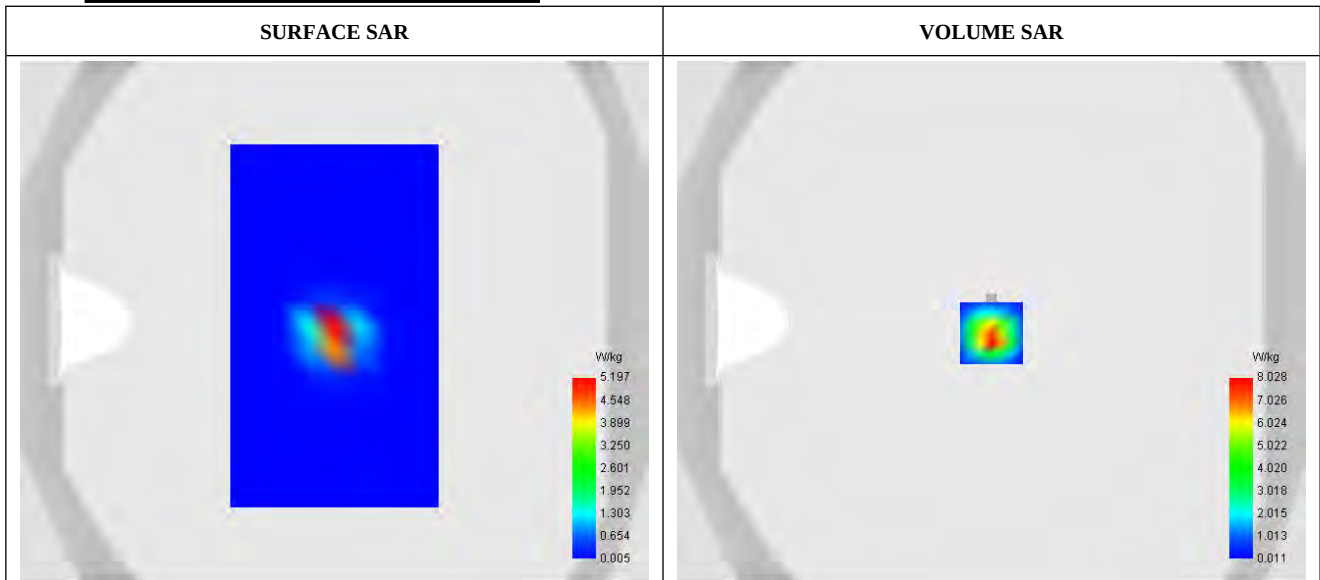
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	1.97
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



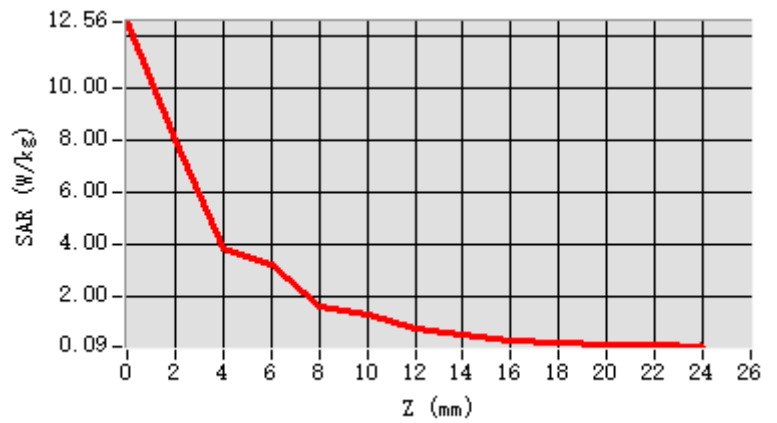
Maximum location: X=0.00, Y=-5.00 ; SAR Peak: 13.42 W/kg

D. SAR 1g & 10g

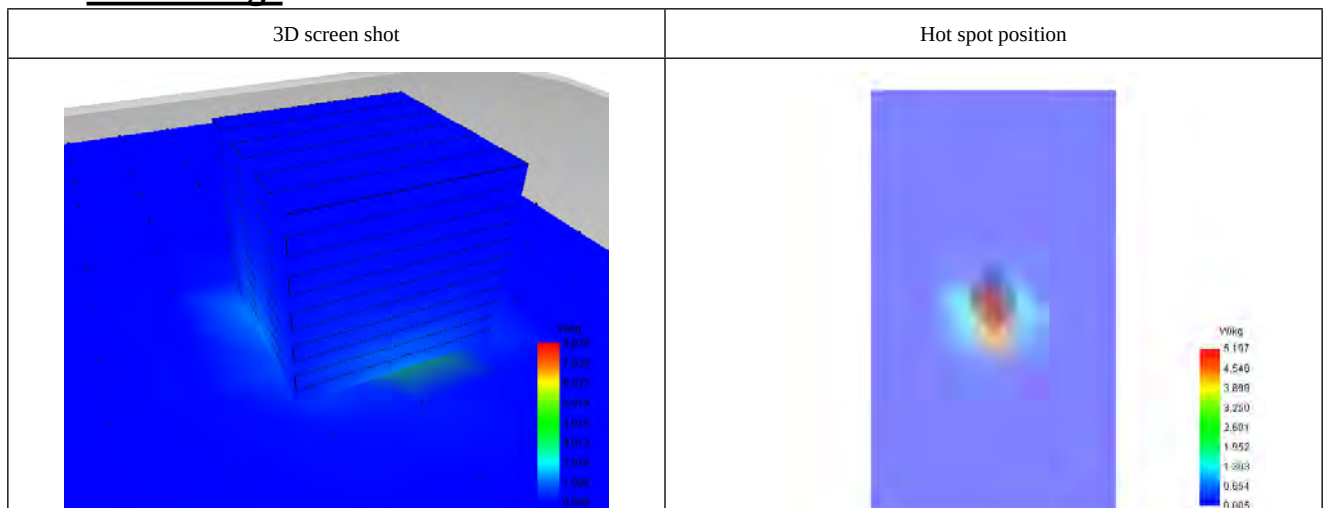
SAR 10g (W/Kg)	1.303
SAR 1g (W/Kg)	3.678
Variation (%)	4.620
Horizontal validation criteria: minimum distance (mm)	4.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	48.169909

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	24.00
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	0.126



F. 3D Image



#3

Date of measurement: 19/1/2026

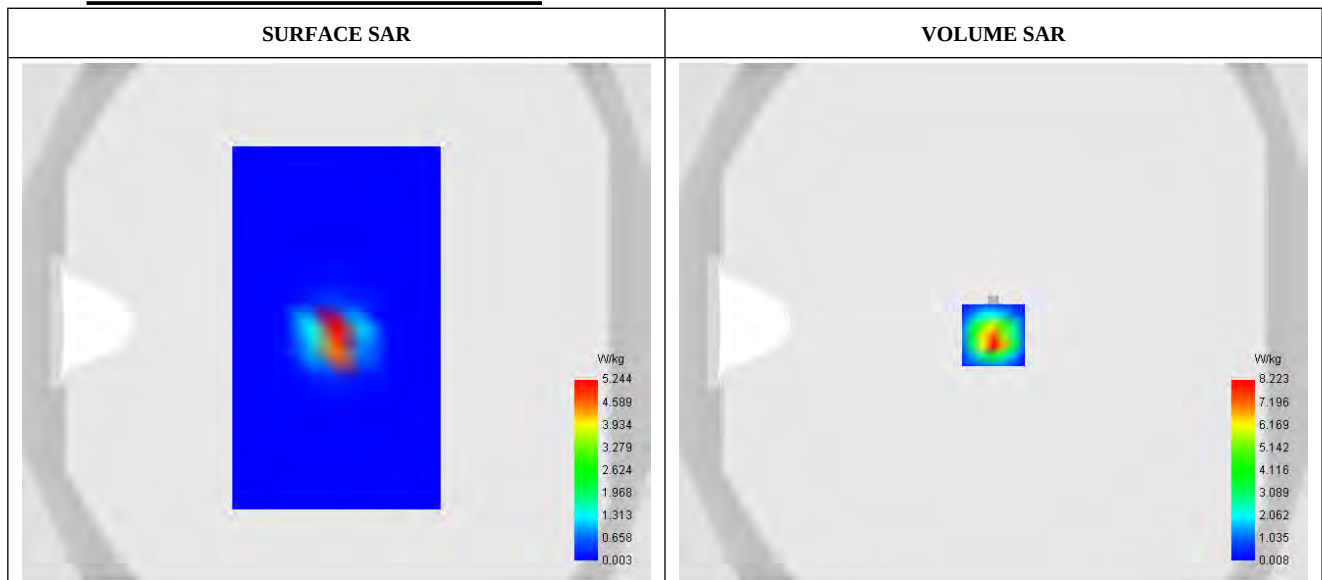
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	1.94
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



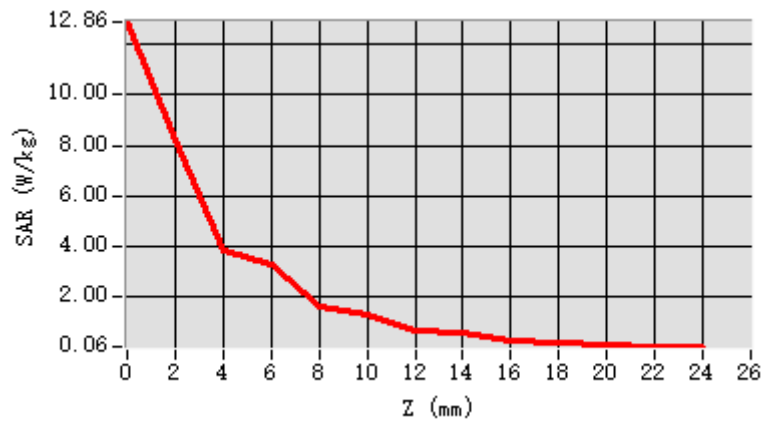
Maximum location: X=0.00, Y=-5.00 ; SAR Peak: 13.82 W/kg

D. SAR 1g & 10g

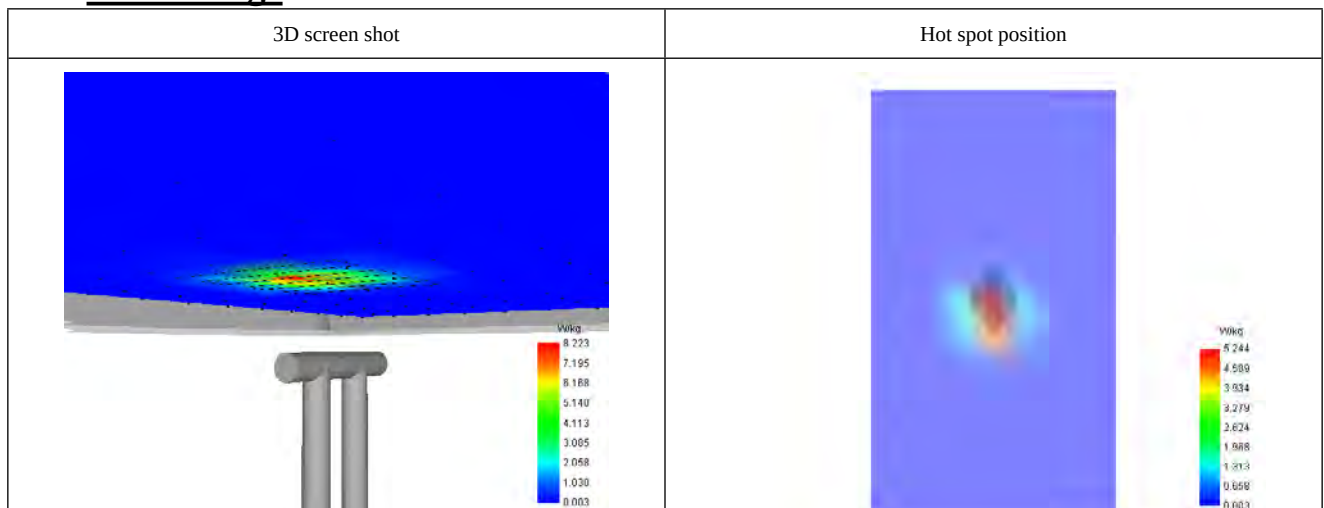
SAR 10g (W/Kg)	1.406
SAR 1g (W/Kg)	4.106
Variation (%)	1.050
Horizontal validation criteria: minimum distance (mm)	4.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	47.257692

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: 15/1/2026

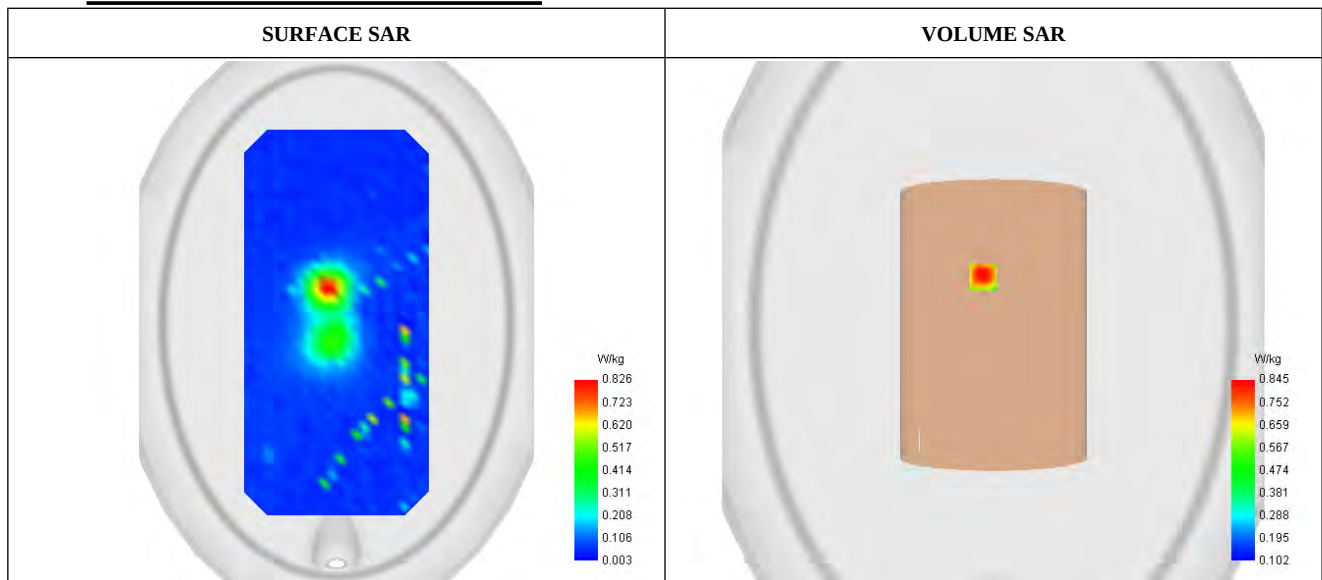
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	1.97
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	ELLI
Device Position	Body
Band	U-NII-1
Channels/Frequency	High (48)/ frequency 5240.000 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5240.000
Relative permittivity (real part)	36.000
Relative permittivity (imaginary part)	16.150
Conductivity (S/m)	4.701

C. SAR Surface and Volume



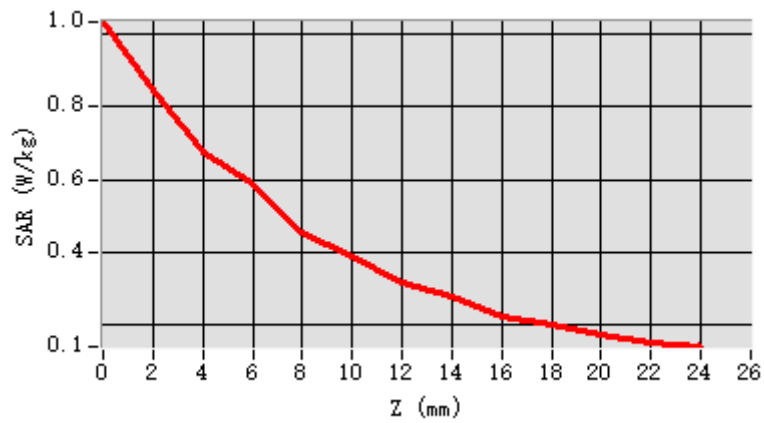
Maximum location: X=-9.00, Y=41.00 ; SAR Peak: 1.08 W/kg

D. SAR 1g & 10g

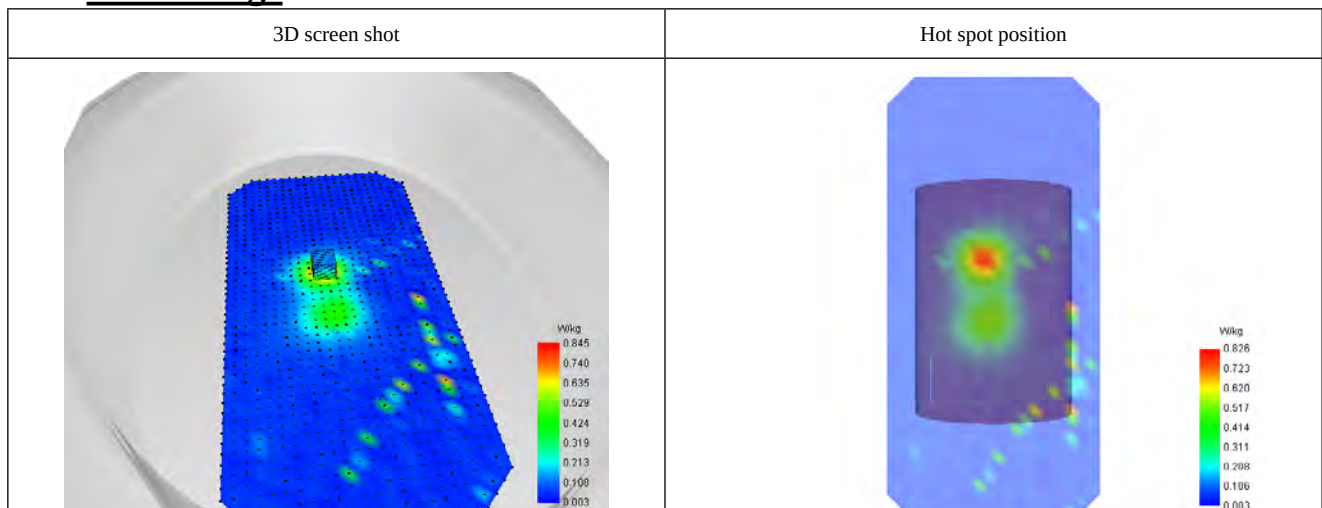
SAR 10g (W/Kg)	0.366
SAR 1g (W/Kg)	0.649
Variation (%)	3.120
Horizontal validation criteria: minimum distance (mm)	13.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	79.644970

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)	1.033	0.845	0.673	0.585	0.453	0.387	0.320	0.281	0.224	0.201	0.175	0.153



F. 3D Image



#2

Date of measurement: 19/1/2026

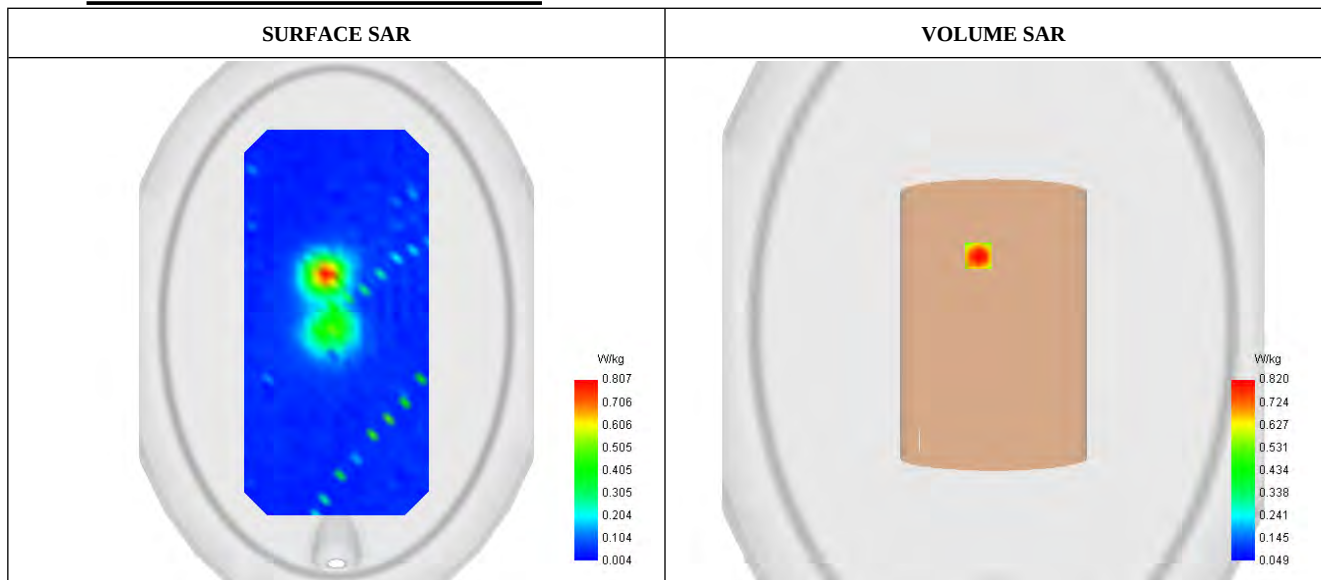
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	1.94
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	ELLI
Device Position	Body
Band	U-NII-3
Channels/Frequency	Low (149)/ frequency 5745.000 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5745.000
Relative permittivity (real part)	35.312
Relative permittivity (imaginary part)	16.352
Conductivity (S/m)	5.219

C. SAR Surface and Volume



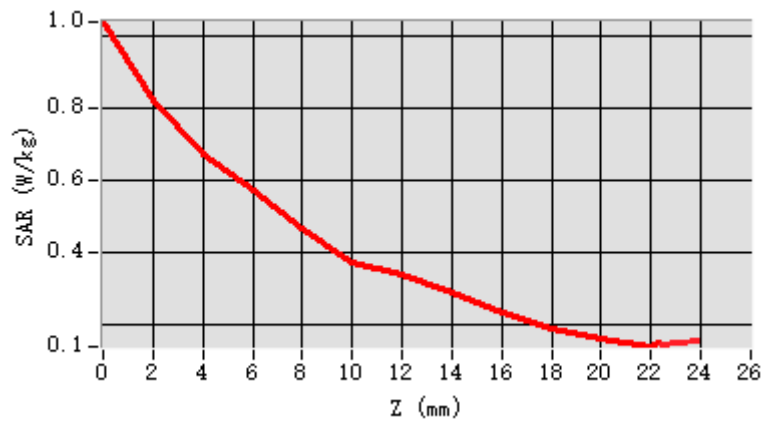
Maximum location: X=-14.00, Y=60.00 ; SAR Peak: 1.00 W/kg

D. SAR 1g & 10g

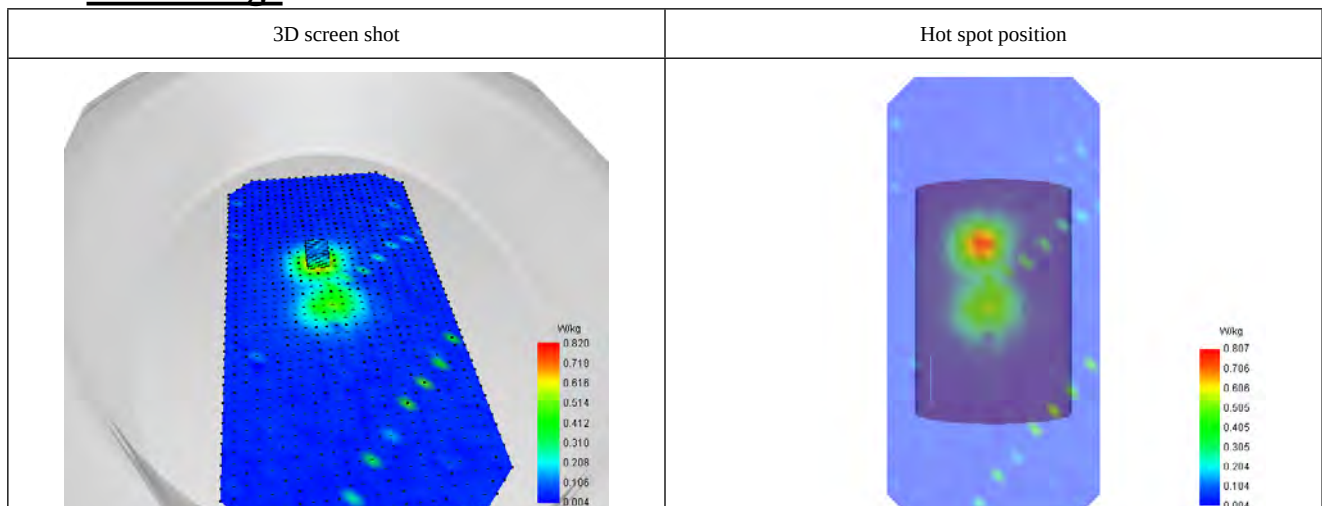
SAR 10g (W/Kg)	0.375
SAR 1g (W/Kg)	0.635
Variation (%)	-3.910
Horizontal validation criteria: minimum distance (mm)	14.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	82.073171

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)	1.039	0.820	0.673	0.570	0.467	0.373	0.338	0.288	0.230	0.185	0.158	0.137



F. 3D Image



#3

Date of measurement: 8/1/2026

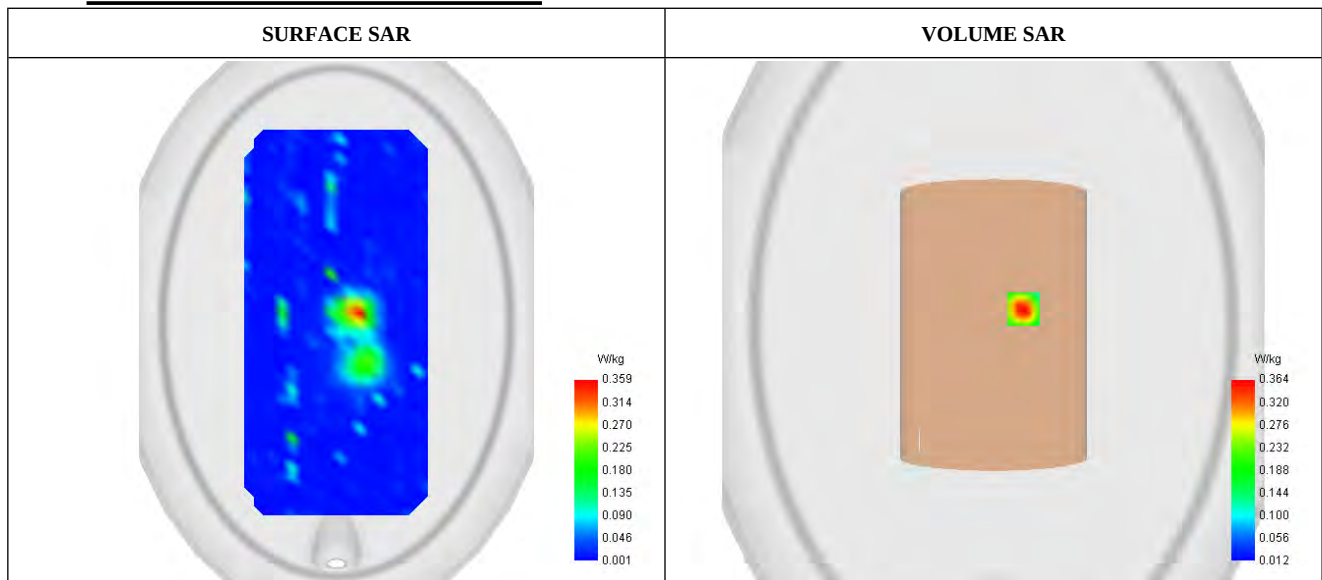
A. Experimental conditions.

Probe	0523-EPGO-403
ConvF	2.85
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	ELLI
Device Position	Body
Band	ISM
Channels/Frequency	Middle (6)/ frequency 2437.000 Mhz

B. Permittivity

Middle TX Frequency (MHz)	2437.000
Relative permittivity (real part)	39.226
Relative permittivity (imaginary part)	13.207
Conductivity (S/m)	1.788

C. SAR Surface and Volume



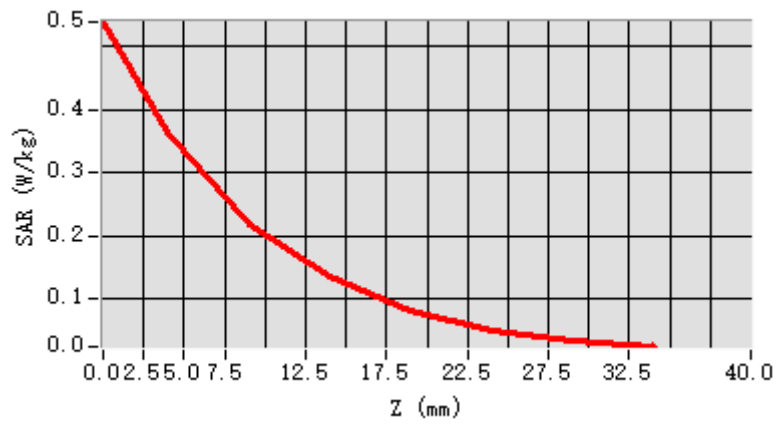
Maximum location: X=27.00, Y=12.00 ; SAR Peak: 0.55 W/kg

D. SAR 1g & 10g

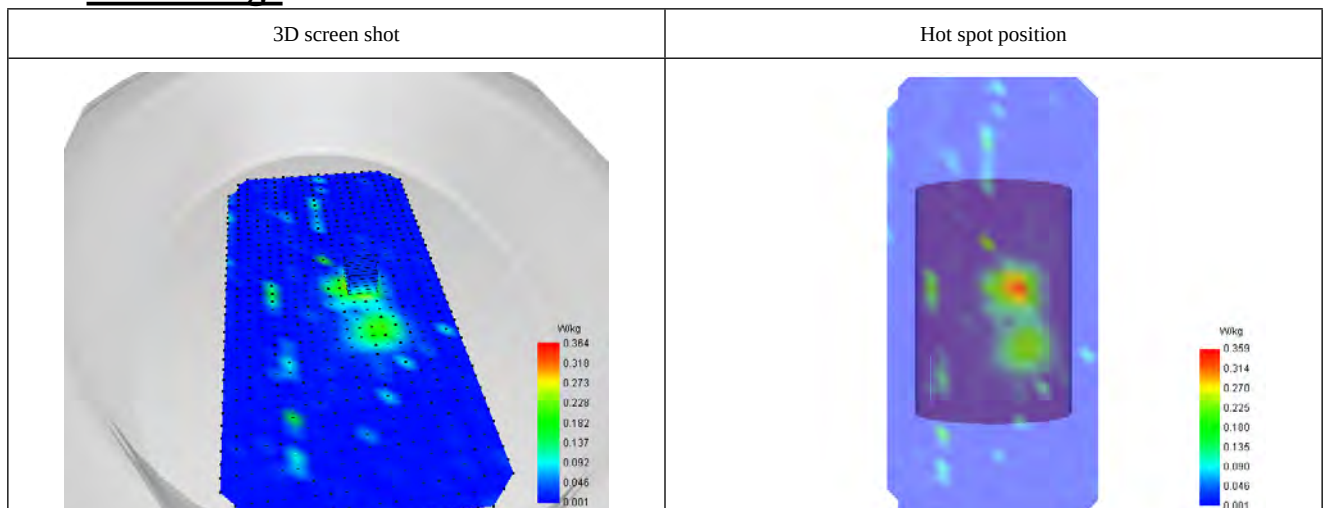
SAR 10g (W/Kg)	0.190
SAR 1g (W/Kg)	0.340
Variation (%)	-0.690
Horizontal validation criteria: minimum distance (mm)	15.811388
Vertical validation criteria: SAR ratio M2/M1 (%)	59.890110

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.538	0.364	0.218	0.135	0.082	0.050	0.034



F. 3D Image



Appendix D. Calibration Certificate

Table of contents
E Field Probe - EPGO0523-403
2450 MHz Dipole - SN 07/14 DIP 2G450-306
5000-6000 MHz Dipole - SN 49/16 WGA 43



COMOSAR E-Field Probe Calibration Report

Ref : ACR.307.3.24.BES.A

**GUANGDONG ASIA HONGKE TEST
TECHNOLOGY CO., LTD**
NO.1/F,BUILDING B1, JUNFENG INDUSTRIAL PARK,
CHONGQING ROAD, HEPING COMMUNITY,
FUHAIHAI STREET, BAO'AN DISTRICT,SHENZHEN,
GUANGDONG 518055, P.R.CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 39/21 EPGO0523-403

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

Calibration date: 09/09/2025



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

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Summary:

This document presents the method and results from an accredited COMOSAR 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).



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Le Gall	Measurement Responsible	09/08/2025	
Checked by :	Jérôme Luc	Technical Manager	09/08/2025	
Approved by :	Yann Toutain	Laboratory Director	09/09/2025	

	Customer Name
Distribution :	Shenzhen Asia Hongke

Issue	Name	Date	Modifications
A	Jérôme Luc	9/09/2025	Initial release



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 39/21 EPG00523-403
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-7GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.199 M Ω Dipole 2: R2=0.218 M Ω Dipole 3: R3=0.210 M Ω

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 affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 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.

3.2 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.

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A

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.

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:

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

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., $\delta \approx 14$ 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%).



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A

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

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.

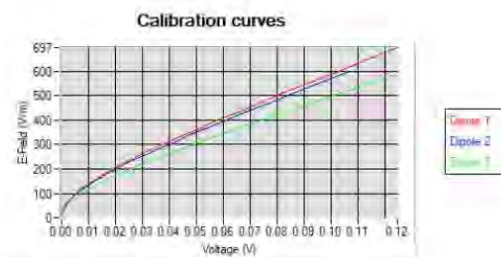
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

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.

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

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A

where

V_i =voltage readings on the 3 channels of the probe

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

Normi=dipole sensitivity given below for the 3 channels of the probe

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 ($\mu\text{V}/(\text{V}/\text{m})^2$)
0.57	0.61	0.81

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
102	100	97

5.2 CALIBRATION IN LIQUID

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

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

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

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

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:

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

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:

$$SAR = \frac{4P_{1W}}{ab\delta} e^{-\frac{2z}{\delta}}$$

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A

where

a=the larger cross-sectional of the waveguide

b=the smaller cross-sectional of the waveguide

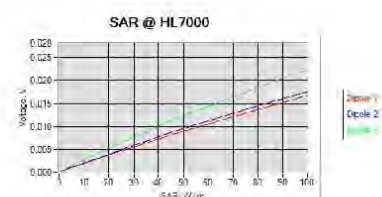
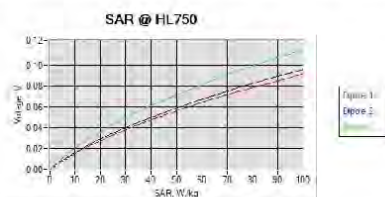
δ =the skin depth for the liquid in the waveguide

Pw=the power delivered to the liquid

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
HL750	750	2.65
HL835	835	2.49
HL900	900	2.51
HL1500	1500	2.52
HL1800	1800	2.60
HL1900	1900	2.82
HL2000	2000	2.89
HL2300	2300	2.87
HL2450	2450	2.85
HL2600	2600	2.68
HL3300	3300	2.28
HL3500	3500	2.26
HL3700	3700	2.15
HL3900	3900	2.22
HL4200	4200	2.48
HL4600	4600	2.45
HL5250	5250	1.97
HL5400	5400	1.92
HL5600	5600	1.89
HL5750	5750	1.94
HL6500	6500	1.87
HL7000	7000	2.19

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



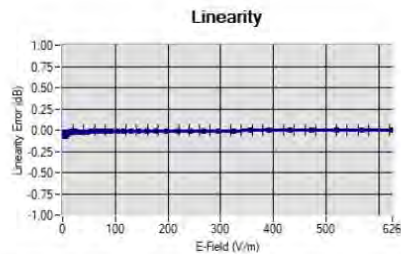
6 VERIFICATION RESULTS

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.

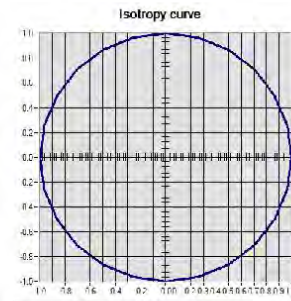


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A



Linearity $\pm 1.74\%$ ($\pm 0.08\text{dB}$)





COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2026
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2027
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	183277	05/2022	05/2026
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2026
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	09/2025
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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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.307.3.24.BES.A

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



SAR Reference Dipole Calibration Report

Ref : ACR.287.8.14.SATU.A

**GUANGDONG ASIA HONGKE TEST
TECHNOLOGY CO., LTD**
NO.1/F,BUILDING B1, JUNFENG INDUSTRIAL PARK,
CHONGQING ROAD, HEPING COMMUNITY,
FUHAIHAI STREET, BAO'AN DISTRICT,SHENZHEN,
GUANGDONG 518055, P.R.CHINA

SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 2450 MHZ

SERIAL NO.: SN 07/14 DIP 2G450-306

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144



02/21/2025

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	02/22/2025	
<i>Checked by :</i>	Jérôme LUC	Product Manager	02/22/2025	
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	02/22/2025	

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen Asia Hongke

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	02/22/2025	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

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 2450 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID2450
Serial Number	SN 07/14 DIP 2G450-306
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo'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 – Satimo COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

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 %

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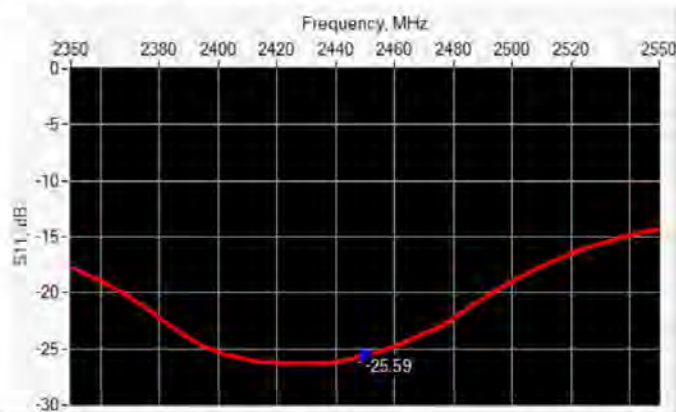


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.S.14.SATU.A

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-25.59	-20	44.7 Ω - 1.1 j Ω

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 $\pm$ 1 %.		250.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
450	290.0 $\pm$ 1 %.		166.7 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
750	176.0 $\pm$ 1 %.		100.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
835	161.0 $\pm$ 1 %.		89.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
900	149.0 $\pm$ 1 %.		83.3 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1450	89.1 $\pm$ 1 %.		51.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1500	80.5 $\pm$ 1 %.		50.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1640	79.0 $\pm$ 1 %.		45.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1750	75.2 $\pm$ 1 %.		42.9 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1800	72.0 $\pm$ 1 %.		41.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1900	68.0 $\pm$ 1 %.		39.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1950	66.3 $\pm$ 1 %.		38.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2000	64.5 $\pm$ 1 %.		37.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2100	61.0 $\pm$ 1 %.		35.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2300	55.5 $\pm$ 1 %.		32.6 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2450	51.5 $\pm$ 1 %.	PASS	30.4 $\pm$ 1 %.	PASS	3.6 $\pm$ 1 %.	PASS
2600	48.5 $\pm$ 1 %.		28.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3000	41.5 $\pm$ 1 %.		25.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3500	37.0 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3700	34.7 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR-287.8.14.SATU.A

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
300	45.3 $\pm$ 5 %		0.87 $\pm$ 5 %	
450	43.5 $\pm$ 5 %		0.87 $\pm$ 5 %	
750	41.9 $\pm$ 5 %		0.89 $\pm$ 5 %	
835	41.5 $\pm$ 5 %		0.90 $\pm$ 5 %	
900	41.5 $\pm$ 5 %		0.97 $\pm$ 5 %	
1450	40.5 $\pm$ 5 %		1.20 $\pm$ 5 %	
1500	40.4 $\pm$ 5 %		1.23 $\pm$ 5 %	
1640	40.2 $\pm$ 5 %		1.31 $\pm$ 5 %	
1750	40.1 $\pm$ 5 %		1.37 $\pm$ 5 %	
1800	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1900	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1950	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2000	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %	PASS	1.80 $\pm$ 5 %	PASS
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 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_r : 39.0 sigma : 1.77
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm

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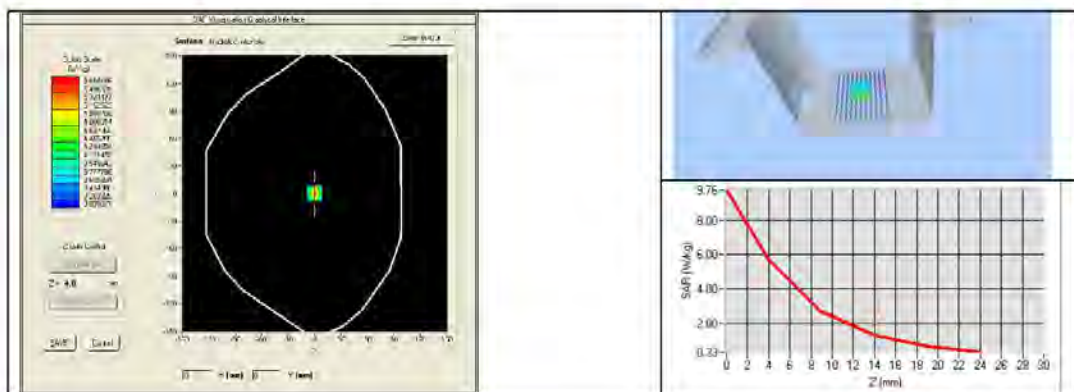


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2450 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
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
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	53.89 (5.39)	24	24.15 (2.42)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	





SAR REFERENCE DIPOLE CALIBRATION REPORT

ReE ACR 287.8.14.SATU A

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 $\pm$ 5 %		0.80 $\pm$ 5 %	
300	58.2 $\pm$ 5 %		0.92 $\pm$ 5 %	
450	56.7 $\pm$ 5 %		0.94 $\pm$ 5 %	
750	55.5 $\pm$ 5 %		0.96 $\pm$ 5 %	
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 %	PASS	1.95 $\pm$ 5 %	PASS
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 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %		5.77 $\pm$ 10 %	
5800	48.2 $\pm$ 10 %		6.00 $\pm$ 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}' : 53.0 σ : 1.93
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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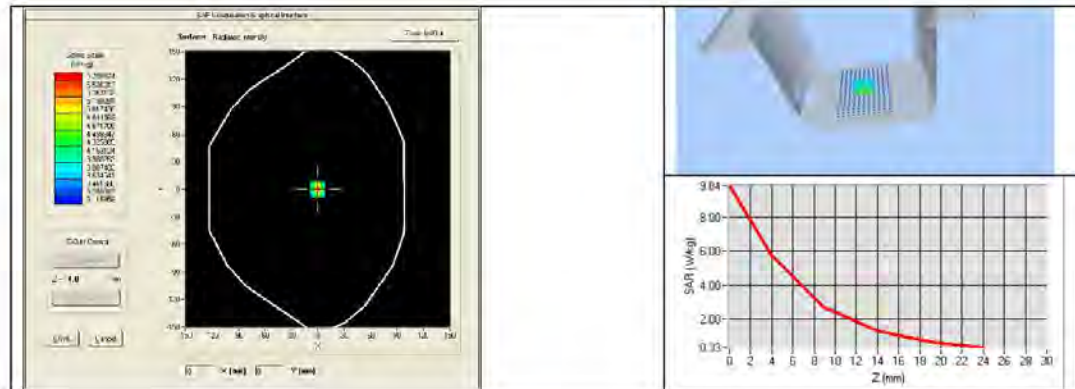
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Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2450	54.65 (5.46)	24.58 (2.46)





SAR REFERENCE DIPOLE CALIBRATION REPORT

ReE ACR 287.8.14.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	Satimo	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	08/2022	08/2025
Calipers	Carrera	CALIPER-01	12/2023	12/2026
Reference Probe	Satimo	EPG122 SN 18/11	10/2024	10/2025
Multimeter	Keithley 2000	1188656	12/2022	12/2025
Signal Generator	Agilent E4438C	MY49070581	12/2022	12/2025
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2022	12/2025
Power Sensor	HP ECP-E26A	US37181460	12/2022	12/2025
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	11-661-9	8/2022	8/2025



SAR Reference Waveguide Calibration Report

Ref : ACR.53.31.25.BES.A

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TECHNOLOGY CO., LTD**
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CHONGQING ROAD, HEPING COMMUNITY,
FUHAIHAI STREET, BAO'AN DISTRICT,SHENZHEN,
GUANGDONG 518055, P.R.CHINA
S ATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 5000-6000 MHZ
SERIAL NO.: SN 49/16 WGA 43

Calibrated at MVG US
2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 02/21/2025

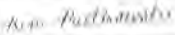
Summary:

This document presents the method and results from an accredited SAR reference waveguide calibration performed in MVG USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	02/22/2025	
<i>Checked by :</i>	Jérôme LUC	Product Manager	02/22/2025	
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	02/22/2025	

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen Asia Hongke

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	02/22/2025	Initial release



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

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SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528 and CEI/IEC 62209 standards for reference waveguides 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 5000-6000 MHz REFERENCE WAVEGUIDE
Manufacturer	MVG
Model	SWG5500
Serial Number	SN 49/16 WGA 43
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Waveguides are built in accordance to the IEEE 1528 and CEI/IEC 62209 standards.

4 MEASUREMENT METHOD

The IEEE 1528 and CEI/IEC 62209 standards provide requirements for reference waveguides 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 waveguide used for SAR system validation measurements and checks must have a return loss of -8 dB or better. The return loss measurement shall be performed with matching layer placed in the open end of the waveguide, with the waveguide and matching layer in direct contact with the phantom shell as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE 1528 and CEI/IEC 62209 standards specify the mechanical dimensions of the validation waveguide, the specified dimensions are as shown in Section 6.2. Figure 1 shows how the dimensions relate to the physical construction of the waveguide.



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

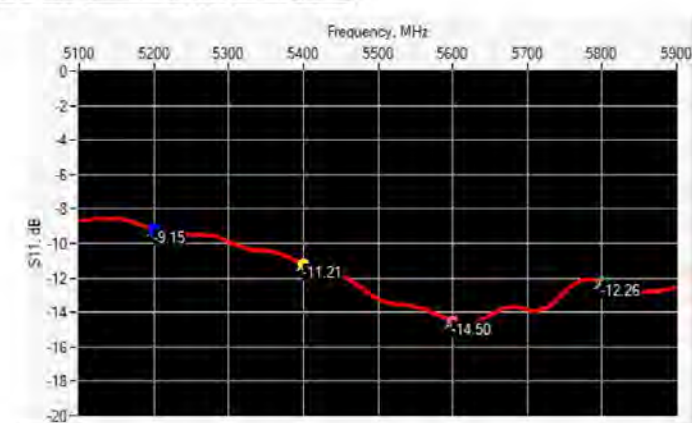
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528 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 IN HEAD LIQUID



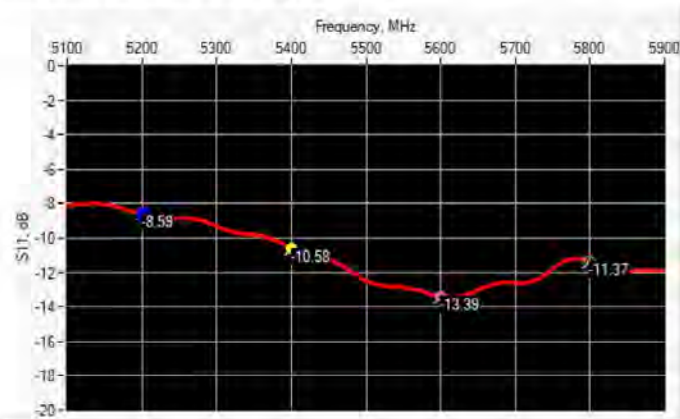


SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
5200	-9.15	-8	$20.57 \Omega + 11.55 j\Omega$
5400	-11.21	-8	$75.27 \Omega + 4.08 j\Omega$
5600	-14.50	-8	$33.91 \Omega - 8.72 j\Omega$
5800	-12.26	-8	$53.07 \Omega + 23.41 j\Omega$

6.2 RETURN LOSS IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
5200	-8.59	-8	$19.38 \Omega + 13.50 j\Omega$
5400	-10.58	-8	$77.13 \Omega + 1.81 j\Omega$
5600	-13.39	-8	$30.95 \Omega - 7.75 j\Omega$
5800	-11.37	-8	$54.79 \Omega + 25.47 j\Omega$

6.3 MECHANICAL DIMENSIONS

Frequency (MHz)	L (mm)		W (mm)		L _t (mm)		W _t (mm)		T (mm)	
	Required	Measured	Required	Measured	Required	Measured	Required	Measured	Required	Measured
5200	40.39 ± 0.13	PASS	20.19 ± 0.13	PASS	81.03 ± 0.13	PASS	61.98 ± 0.13	PASS	5.3*	PASS
5800	40.39 ± 0.13	PASS	20.19 ± 0.13	PASS	81.03 ± 0.13	PASS	61.98 ± 0.13	PASS	4.3*	PASS

* The tolerance for the matching layer is included in the return loss measurement.



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

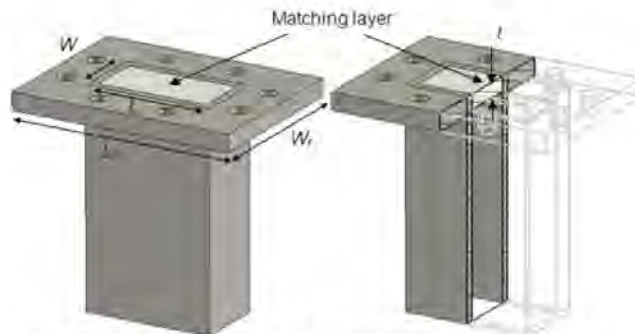


Figure 1: Validation Waveguide Dimensions

7 VALIDATION MEASUREMENT

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference waveguide meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed with the matching layer placed in the open end of the waveguide, with the waveguide and matching layer in direct contact with the phantom shell.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
5000	36.2 $\pm$ 10 %		4.45 $\pm$ 10 %	
5100	36.1 $\pm$ 10 %		4.56 $\pm$ 10 %	
5200	36.0 $\pm$ 10 %	PASS	4.66 $\pm$ 10 %	PASS
5300	35.9 $\pm$ 10 %		4.76 $\pm$ 10 %	
5400	35.8 $\pm$ 10 %	PASS	4.86 $\pm$ 10 %	PASS
5500	35.6 $\pm$ 10 %		4.97 $\pm$ 10 %	
5600	35.5 $\pm$ 10 %	PASS	5.07 $\pm$ 10 %	PASS
5700	35.4 $\pm$ 10 %		5.17 $\pm$ 10 %	
5800	35.3 $\pm$ 10 %	PASS	5.27 $\pm$ 10 %	PASS
5900	35.2 $\pm$ 10 %		5.38 $\pm$ 10 %	
6000	35.1 $\pm$ 10 %		5.48 $\pm$ 10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

At those frequencies, the target SAR value can not be generic. Hereunder is the target SAR value defined by MVG, within the uncertainty for the system validation. All SAR values are normalized to 1 W net power. In bracket, the measured SAR is given with the used input power.

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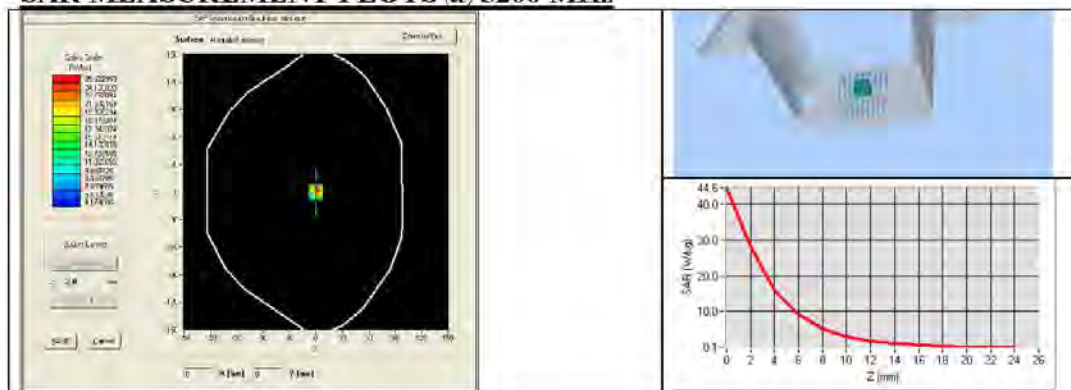
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values 5200 MHz: eps' :35.64 sigma : 4.67 Head Liquid Values 5400 MHz: eps' :36.44 sigma : 4.87 Head Liquid Values 5600 MHz: eps' :36.66 sigma : 5.17 Head Liquid Values 5800 MHz: eps' :35.31 sigma : 5.31
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency (MHz)	1 g SAR (W/kg)		10 g SAR (W/kg)	
	required	measured	required	measured
5200	159.00	165.77 (16.58)	56.90	57.20 (5.72)
5400	166.40	173.20 (17.32)	58.43	59.22 (5.92)
5600	173.80	179.61 (17.96)	59.97	60.98 (6.10)
5800	181.20	186.77 (18.68)	61.50	62.84 (6.28)

SAR MEASUREMENT PLOTS @ 5200 MHz

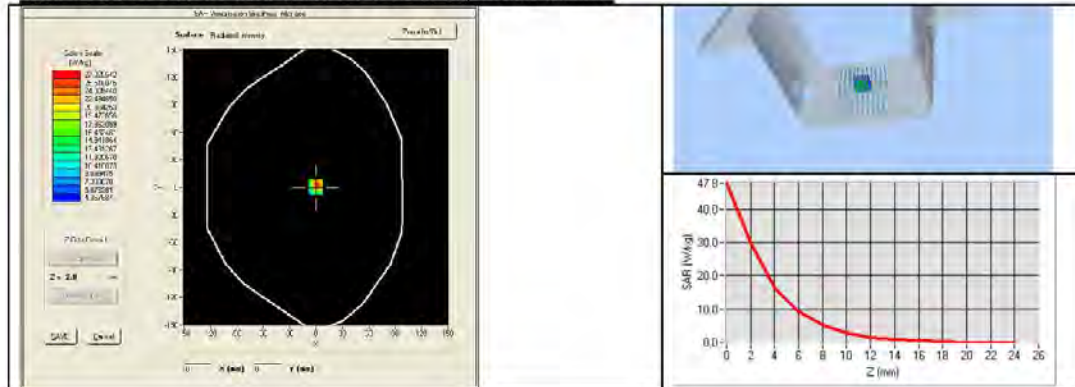




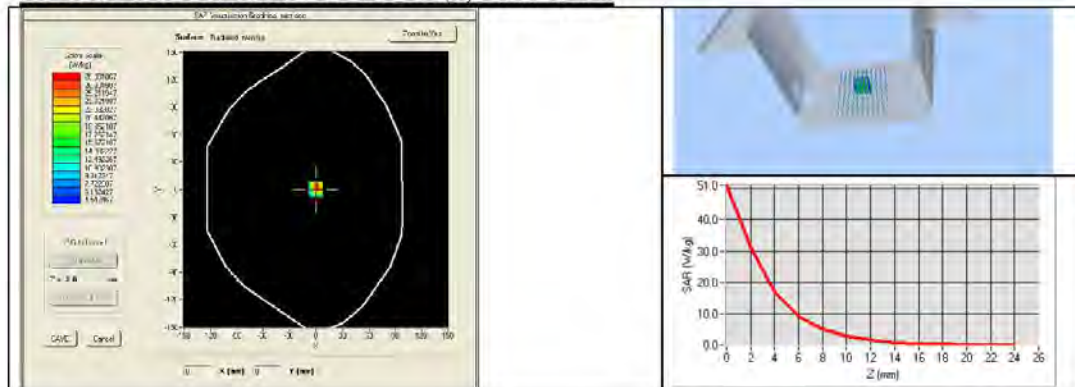
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

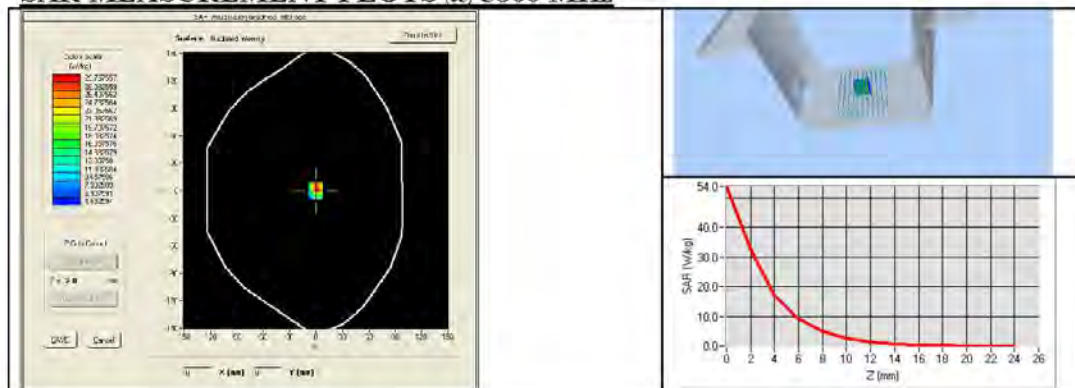
SAR MEASUREMENT PLOTS @ 5400 MHz



SAR MEASUREMENT PLOTS @ 5600 MHz



SAR MEASUREMENT PLOTS @ 5800 MHz





SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
5200	49.0 $\pm$ 10 %	PASS	5.30 $\pm$ 10 %	PASS
5300	48.9 $\pm$ 10 %		5.42 $\pm$ 10 %	
5400	48.7 $\pm$ 10 %	PASS	5.53 $\pm$ 10 %	PASS
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %	PASS	5.77 $\pm$ 10 %	PASS
5800	48.2 $\pm$ 10 %	PASS	6.00 $\pm$ 10 %	PASS

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 5200 MHz: ϵ_r : 48.64 sigma : 5.51 Body Liquid Values 5400 MHz: ϵ_r : 46.52 sigma : 5.77 Body Liquid Values 5600 MHz: ϵ_r : 46.79 sigma : 5.77 Body Liquid Values 5800 MHz: ϵ_r : 47.04 sigma : 6.10
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

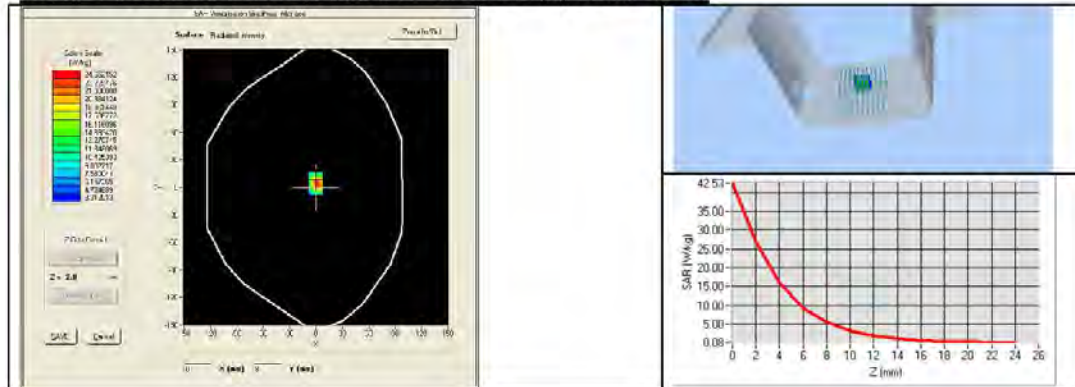
Frequency (MHz)	1 g SAR (W/kg)	10 g SAR (W/kg)
	measured	measured
5200	159.09 (15.91)	56.13 (5.61)
5400	164.56 (16.46)	57.31 (5.73)
5600	172.25 (17.23)	59.72 (5.97)
5800	177.77 (17.78)	61.06 (6.11)



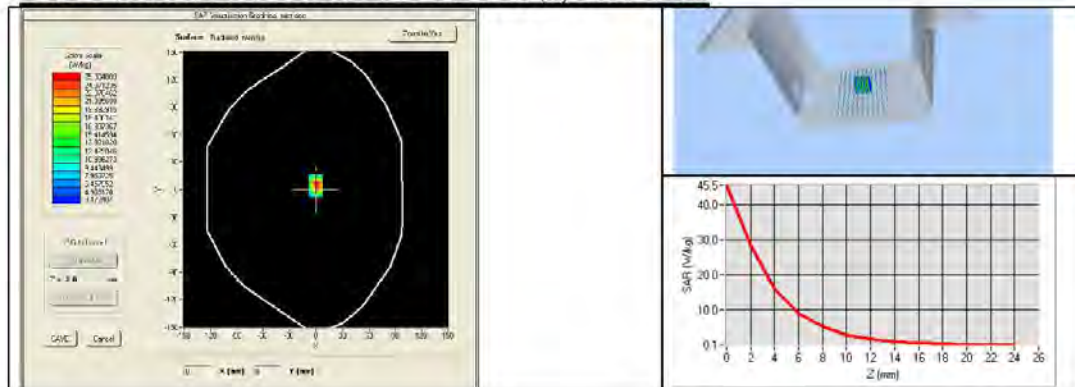
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

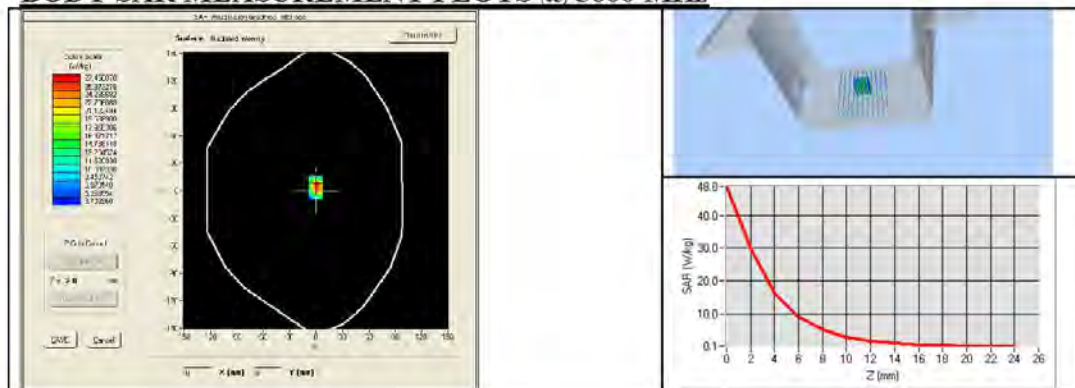
BODY SAR MEASUREMENT PLOTS @ 5200 MHz



BODY SAR MEASUREMENT PLOTS @ 5400 MHz



BODY SAR MEASUREMENT PLOTS @ 5600 MHz

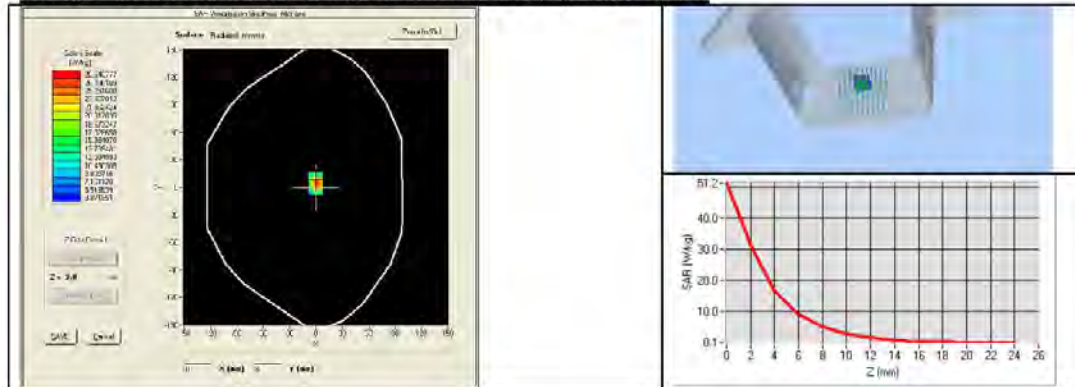




SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

BODY SAR MEASUREMENT PLOTS @ 5800 MHz





SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.53.31.25.BES.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat 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	08/2022	08/2025
Calipers	Carrera	CALIPER-01	12/2023	12/2026
Reference Probe	MVG	EPG122 SN 18/11	10/2024	10/2025
Multimeter	Keithley 2000	1188656	12/2022	12/2025
Signal Generator	Agilent E4438C	MY49070581	12/2022	12/2025
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2022	12/2025
Power Sensor	HP ECP-E26A	US37181460	12/2022	12/2025
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	150798832	8/2022	8/2025

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