

# FCC SAR EVALUATION REPORT

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

Product Name: Mobile Phone

Model No.: GQ3292

Armor Mini 4, Armor Mini 4T, Armor Mini 4 Pro,  
Serial Model: Armor Mini 4T Pro, Armor Mini 4 Ultra,  
Armor Mini 4T Ultra

Brand Name: ulefone

Report No.: AiTSZ-250424044FW4

FCC ID: 2AOWK-3292

**Prepared for**

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## TEST RESULT CERTIFICATION

**Applicant's name** .....: Shenzhen Gotron Electronic CO.,LTD.  
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**Manufacturer's Name** .....: Shenzhen Gotron Electronic CO.,LTD.  
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### Product description

Product name .....: Mobile Phone  
Trademark .....: ulefone  
Model and/or type reference ...: GQ3292  
Serial Model.....: Armor Mini 4, Armor Mini 4T, Armor Mini 4 Pro, Armor Mini 4T Pro, Armor Mini 4 Ultra, Armor Mini 4T Ultra  
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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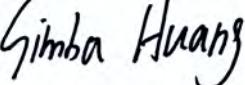
### Date of Test

Date (s) of performance of tests .....: Apr. 25, 2025 ~ May 05, 2025

Date of Issue .....: May 20, 2025

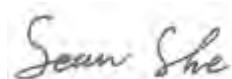
Test Result .....: **Pass**

Reviewed by:



Simba Huang

Approved by:



Sean She

※※ Revision History ※※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	May 20, 2025	Sean She

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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

#### HEAD AND 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 Head (Separation distance of 0mm)	1-g Body&Hotspot (Separation distance of 5mm)	Max SAR Summation
GSM1900	0.179	0.349	Head: 0.465 Body: 0.784 Hotspot: 0.784
LTE band 7	0.360	0.679	
Bluetooth	0.105	0.105	

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	Mobile Phone		
Model Name	GQ3292		
Family Model	Armor Mini 4, Armor Mini 4T, Armor Mini 4 Pro, Armor Mini 4T Pro, Armor Mini 4 Ultra, Armor Mini 4T Ultra		
Model Difference	All the model are the same circuit and RF module, except the model names.		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna Type	PIFA Antenna		
Power rating:	DC 3.70V 2100mAh/7.77Wh Rechargeable Li-ion battery		
Hardware version	N/A		
Software version	N/A		
Device Operating Configurations			
Supporting Mode(s)	GSM1900, LTEBand7, Bluetooth		
Test Modulation	GSM(GMSK/8PSK), LTE(QPSK/16QAM), Bluetooth(GFSK, $\pi/4$ -DQPSK, 8DPSK)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM 1900	1850-1910	1930-1990
	LTE Band 7	2500-2570	2620-2690
	Bluetooth	2402-2480	
GPRS Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
EGPRS Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
Power Class	1, tested with power level 0(GSM 1900)		
	3, tested with power control all Max.(LTE Band 7)		

#### 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
KDB 865664 D02 RF Exposure Reporting
KDB 447498 D01 General RF Exposure Guidance
KDB 248227 D01 802.11 Wi-Fi SAR
KDB 941225 D05 SAR for LTE Devices
KDB 941225 D06 Hotspot SAR
KDB 648474 D04 Handset SAR

#### 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**

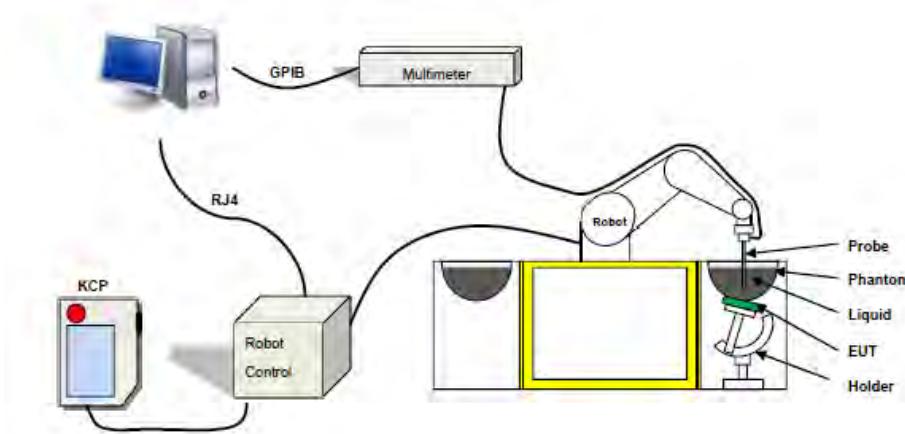
The 3m Semi-anechoic chamber of Guangdong Asia Hongke Test Technology Limited has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 31737

**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  $\pm 0.03$  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  $\pm 0.03$  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.

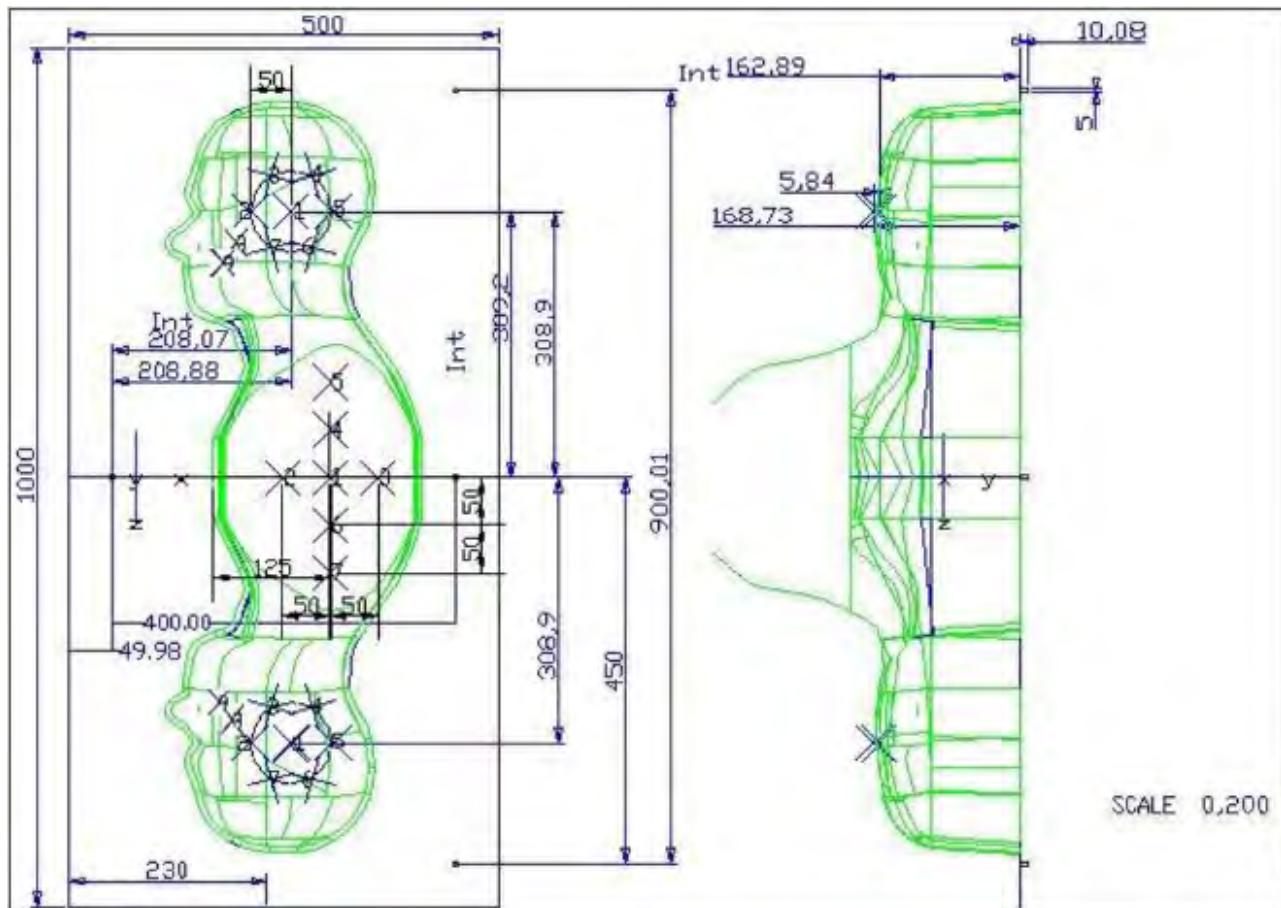
## 2.4. Phantoms

For the measurements the 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

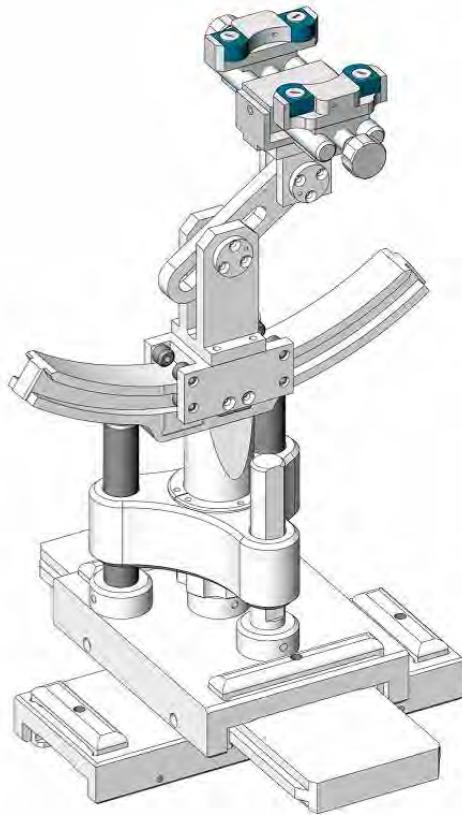
## 2.5. Technical Data



Left Head(mm)		Right Head(mm)		Flat Part(mm)	
2	2.02	2	2.08	1	2.09
3	2.05	3	2.06	2	2.06
4	2.07	4	2.07	3	2.08
5	2.08	5	2.08	4	2.10
6	2.05	6	2.07	5	2.10
7	2.05	7	2.05	6	2.07
8	2.07	8	2.06	7	2.07
9	2.08	9	2.06	-	-

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  $\pm 0.5$  mm would produce a SAR uncertainty of  $\pm 20\%$ . 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
<input checked="" type="checkbox"/>	MVG	E FIELD PROBE	SSE2	EPGO 0523-403	Sep. 11, 2024	Sep. 10, 2025
<input type="checkbox"/>	MVG	750 MHz Dipole	SID750	SN 03/15 DIP 0G750-355	Feb. 21, 2024	Feb. 20, 2027
<input type="checkbox"/>	MVG	835 MHz Dipole	SID835	SN 03/15 DIP 0G835-347	Feb. 21, 2024	Feb. 20, 2027
<input type="checkbox"/>	MVG	900 MHz Dipole	SID900	SN 03/15 DI P 0G900-348	Feb. 21, 2024	Feb. 20, 2027
<input type="checkbox"/>	MVG	1800 MHz Dipole	SID1800	SN 03/15 DIP 1G800-349	Feb. 21, 2024	Feb. 20, 2027
<input checked="" type="checkbox"/>	MVG	1900 MHz Dipole	SID1900	SN 03/15 DIP 1G900-350	Feb. 21, 2024	Feb. 20, 2027
<input type="checkbox"/>	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Feb. 21, 2024	Feb. 20, 2027
<input type="checkbox"/>	MVG	2300 MHz Dipole	SID2300	SN 03/16 DIP 2G300-358	Feb. 21, 2024	Feb. 20, 2027
<input type="checkbox"/>	MVG	2450 MHz Dipole	SID2450	SN 03/15 DIP 2G450-352	Feb. 21, 2024	Feb. 20, 2027
<input checked="" type="checkbox"/>	MVG	2600 MHz Dipole	SID2600	SN 03/15 DIP 2G600-356	Feb. 21, 2024	Feb. 20, 2027
<input type="checkbox"/>	MVG	5000 MHz Dipole	SWG5500	SN 13/14 WGA 33	Feb. 21, 2024	Feb. 20, 2027
<input checked="" type="checkbox"/>	MVG	Liquid measurement Kit	SCLMP	SN 21/15 OCPG 72	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	MVG	Power Amplifier	N.A	AMPLISAR_28/14_003	NCR	NCR
<input checked="" type="checkbox"/>	KEITHLEY	Millivoltmeter	2000	4072790	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	R&S	Universal radio communication tester	CMU200	117858	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	R&S	Wideband radio communication tester	CMW500	116581	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	HP	Network Analyzer	8753D	3410J01136	Jul. 01, 2024	Jun. 30, 2025

<input checked="" type="checkbox"/>	Agilent	PSG Analog Signal Generator	E8257D	MY51110112	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	Agilent	Power meter	E4419B	MY45102538	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	Agilent	Power meter	E4419B	MY45102140	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	Agilent	Power meter	E4419B	MY45102215	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	JFW	attenuator	50FPE-006	4360846-494-4	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	JFW	attenuator	50FPE-006	4360846-492-1	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	JFW	attenuator	50FPE-006	4360846-490-6	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	Agilent	Power sensor	E9301A	MY41495644	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	Agilent	Power sensor	E9301A	US39212148	Jul. 01, 2024	Jun. 30, 2025
<input checked="" type="checkbox"/>	MCLI/USA	Directional Coupler	CB11-20	0D2L51502	Jul. 17, 2024	Jul. 16, 2027
<input checked="" type="checkbox"/>	MVG	SAR Phantom	SSM2	SN 24/11 SAM87	NCR	NCR
<input checked="" type="checkbox"/>	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.

		$\leq 3$ GHz	$> 3$ GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		$5 \pm 1$ 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		$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
		$\leq 2$ GHz: $\leq 15$ mm $2 - 3$ GHz: $\leq 12$ mm	$3 - 4$ GHz: $\leq 12$ mm $4 - 6$ GHz: $\leq 10$ mm
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$		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: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$		$\leq 2$ GHz: $\leq 8$ mm $2 - 3$ GHz: $\leq 5$ mm*	$3 - 4$ GHz: $\leq 5$ mm* $4 - 6$ GHz: $\leq 4$ mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		$3 - 4$ GHz: $\leq 4$ mm $4 - 5$ GHz: $\leq 3$ mm $5 - 6$ GHz: $\leq 2$ mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface $\Delta z_{\text{Zoom}}(n>1)$ : between subsequent points	$\leq 4$ mm $\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$
Minimum zoom scan volume	x, y, z	$\geq 30$ mm	$3 - 4$ GHz: $\geq 28$ mm $4 - 5$ GHz: $\geq 25$ mm $5 - 6$ GHz: $\geq 22$ mm
Note: $\delta$ 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 <u>reported</u> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ 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 determinate 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 installed 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 if 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.

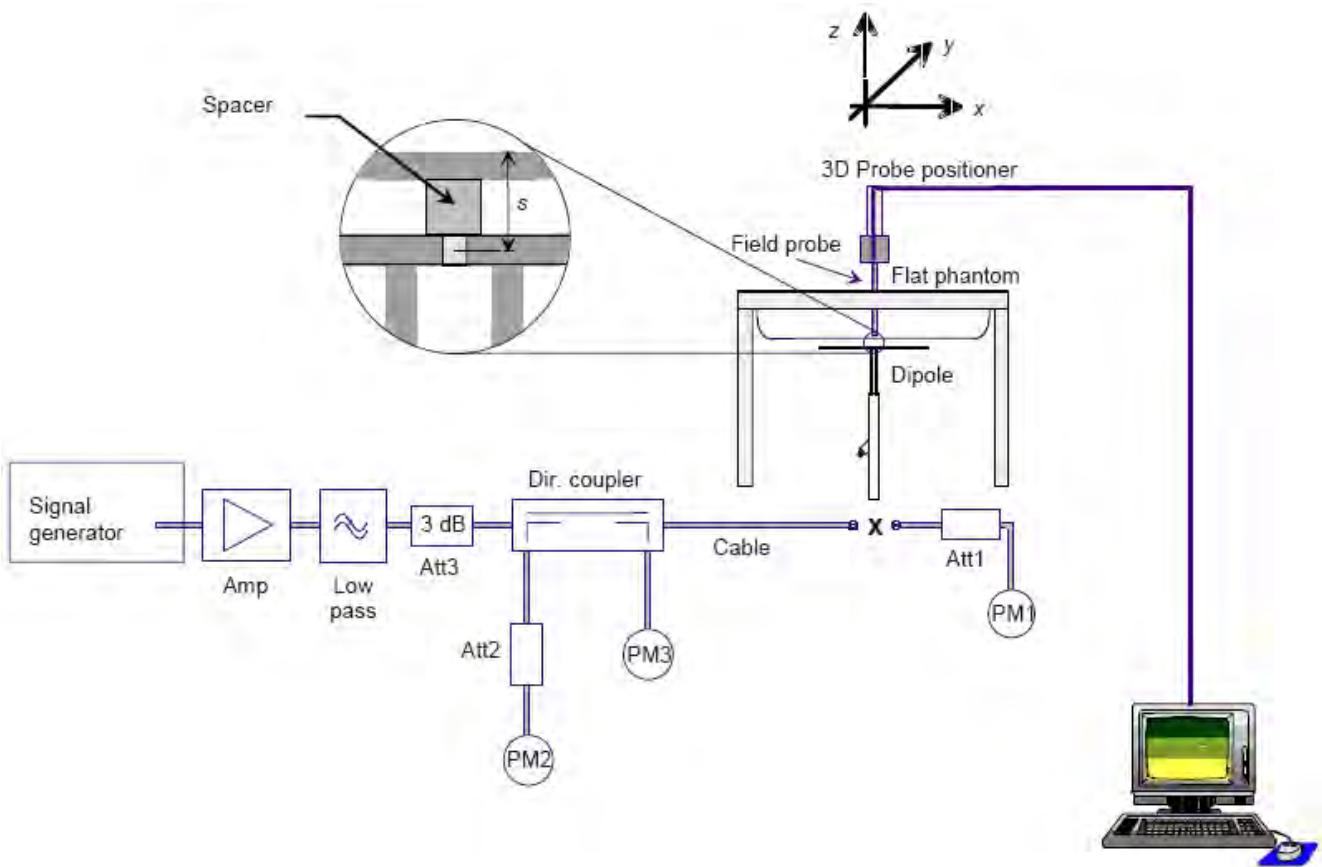
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		$\epsilon_r$ ( $\pm 5\%$ )	$\sigma$ (S/m) ( $\pm 5\%$ )	$\epsilon_r$	$\sigma$ (S/m)		
Head 1900	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	41.42	1.39	21.4 °C	Apr. 25, 2025
Head 2600	2600	39.01 (37.06~40.96)	1.96 (1.86~2.06)	39.43	1.99	21.2 °C	May 05, 2025

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 100mW (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)	
1900MHz	100	4.154	2.153	41.54	21.53	39.69	20.92	4.66%	2.92%	Apr. 25, 2025
2600MHz	100	5.433	2.523	54.33	25.23	54.16	24.85	0.31%	1.53%	May 05, 2025

## 5. SAR measurement variabilit

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  $< 0.80 \text{ W/kg}$ ; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.80 \text{ W/kg}$ , 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  $\geq 1.45 \text{ W/kg}$  ( $\sim 10\%$  from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5 \text{ W/kg}$  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. Ear and handset reference point

Figure 7.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled "M" , the left ear reference point (ERP) is marked "LE" , and the right ERP is marked "RE" .



Fig 7.1.1 Front, back, and side views of SAM phantom

### 7.2. Definition of the cheek position

1. Define two imaginary lines on the handset, the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width  $w_t$  of the handset at the level of the acoustic output (point A in Figure 7.2.1 and Figure 7.2.2), and the midpoint of the width  $w_b$  of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 7.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 7.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.

2. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 7.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.

3. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP

4. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.

5. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.

6. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 7.2.3. The actual rotation angles should be documented in the test report.

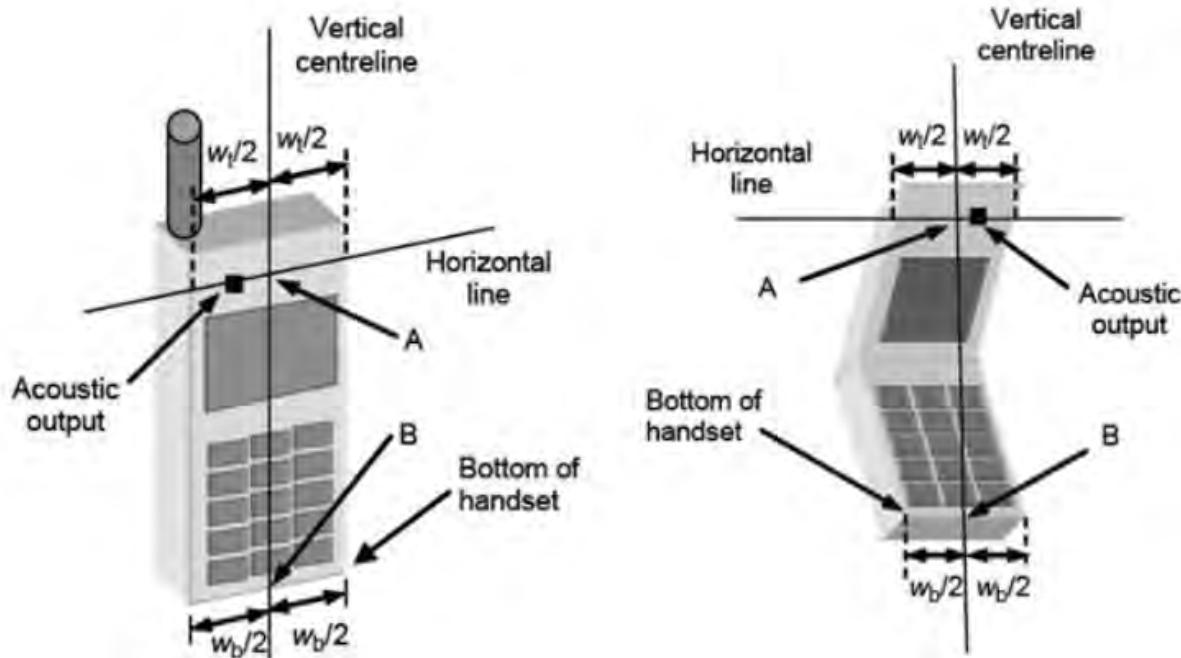


Fig 7.2.1 Handset vertical and horizontal reference lines—fixed case

Fig 7.2.2 Handset vertical and horizontal reference lines—“clam-shell case”

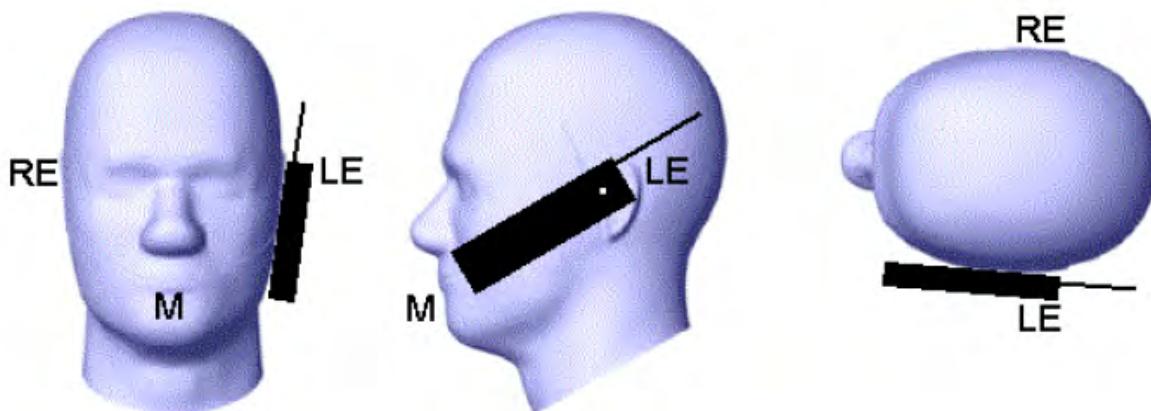


Fig 7.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

### 7.3. Definition of the tilt position

1. While maintaining the orientation of the handset, retract the handset parallel to the reference plane far enough away from the phantom to enable a rotation of the device by 15 degree.
2. Rotate the Handset around the horizontal line by 15 degree (see Figure 7.3.1).
3. While maintaining the orientation of the handset, move the handset towards the phantom on a line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, e.g., the antenna with the back of the phantom head, the angle of the handset shall be reduced. In this case, the tilt position is obtained if any part of the handset is in contact with the pinna as well as a second part of the handset is in contact with the phantom, e.g., the antenna with the back of the head.



Figure 7.3.1 – Tilt position of the wireless device on the left side of SAM

### 7.4. Body Worn Accessory

1. Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 7.4.1). Per KDB 648474 D04, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is < 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.
2. Accessories for body-worn operation configurations are divided into two categories: those that do

not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

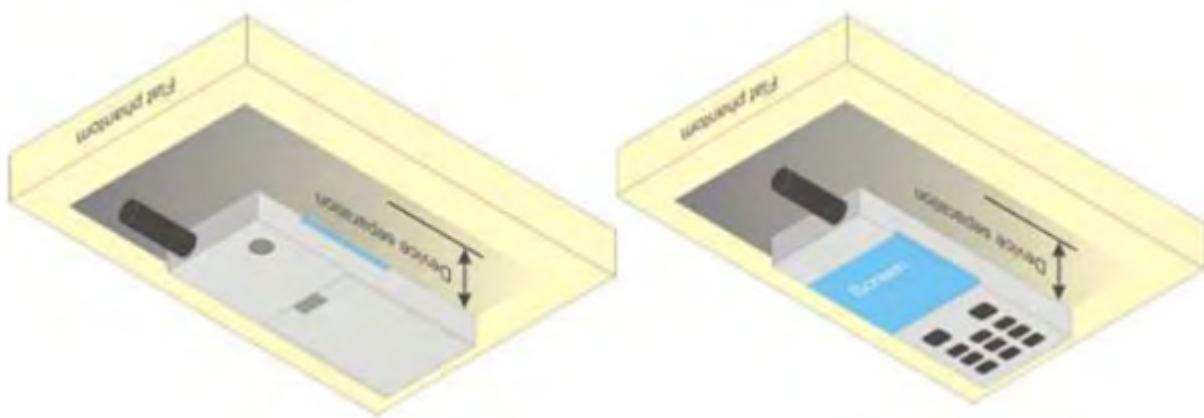


Figure 7.4.1 – Test positions for body-worn devices

## 7.5. Wireless Router Devices

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WLAN simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 where SAR test considerations for handsets ( $L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$ ) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WLAN transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WLAN transmitter according to FCC KDB Publication 447498 D01 publication procedures. The —Portable Hotspot|| feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

## 8. RF Output Power

### 8.1. GSM Conducted Power

Band GSM1900	Burst-Averaged output Power (dBm)				Factor	Frame-Averaged output Power (dBm)			
	Tune-up (dBm)	512	661	810		Tune-up	512	661	810
Tx Channel									
Frequency (MHz)		1850.2	1880	1909.8					
GSM (GMSK)	30.50	29.95	29.87	30.15	/	/	/	/	/
GPRS(GMSK,1 Tx slot)	30.50	30.10	29.96	30.21	-9.03	21.47	21.07	20.93	21.18
GPRS(GMSK,2 Tx slot)	28.00	27.92	27.66	27.65	-6.02	21.98	21.90	21.64	21.63
GPRS(GMSK,3 Tx slot)	26.50	26.29	26.10	26.06	-4.26	22.24	22.03	21.84	21.80
GPRS(GMSK,4 Tx slot)	24.50	24.19	23.92	23.96	-3.01	21.49	21.18	20.91	20.95
GPRS(EDGE,1 Tx slot)	27.00	26.89	26.96	26.62	-9.03	17.97	17.86	17.93	17.59
GPRS(EDGE,2 Tx slot)	25.50	25.15	25.29	24.96	-6.02	19.48	19.13	19.27	18.94
GPRS(EDGE,3 Tx slot)	23.00	22.56	22.59	22.47	-4.26	18.74	18.30	18.33	18.21
GPRS(EDGE,4 Tx slot)	21.00	20.71	20.70	20.66	-3.01	17.99	17.70	17.69	17.65

**Note:**

Remark: GPRS, CS4 coding scheme. EGPRS, MCS5 coding scheme.

Multi-Slot Class 8, Support Max 4 downlink, 1 uplink, 5 working link

Multi-Slot Class 10, Support Max 4 downlink, 2 uplink, 5 working link

Multi-Slot Class 12, Support Max 4 downlink, 4 uplink, 5 working link

SAR testing was performed on the maximum frame-averaged power mode.

The frame-averaged power is linearly proportion to the slot number configured and it is linearly scaled the maximum

Burst-averaged power based on time slots. The calculated method is shown as below:

Frame-averaged power = Burst averaged power (1 TX Slot) – 9.03 dB

Frame-averaged power = Burst averaged power (2 TX Slots) – 6.02 dB

Frame-averaged power = Burst averaged power (3 TX Slots) - 4.26 dB

Frame-averaged power = Burst averaged power (4 TX Slots) – 3.01 dB

## 8.2. LTE Conducted Power

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 36.521-1 specification. A summary of these configurations are illustrated below:

Test Parameters for Channel Bandwidths			
Downlink Configuration		Uplink Configuration	
Ch BW	N/A for Max UE output power testing	Mod'n	RB allocation
1.4MHz			
1.4MHz		QPSK	1 FDD 1 TDD
3MHz		QPSK	5 5
3MHz		QPSK	1 1
5MHz		QPSK	4 4
5MHz		QPSK	1 1
10MHz		QPSK	8 8
10MHz		QPSK	1 1
15MHz		QPSK	12 12
15MHz		QPSK	1 1
20MHz		QPSK	16 16
20MHz		QPSK	1 1
		QPSK	18 18

Note 1: Test Channel Bandwidths are checked separately for each E-UTRA band, the applicable channel bandwidths are specified in Table 5.4.2.1-1.

Note 2: For E-UTRA bands not applied with Note 2 in Table 6.2.2.3-1:

- The 1 RB allocation shall be tested at RB#0 for low and mid range, RB #max for high range test frequency.
- The RBstart of non-1RB allocation shall be RB #0 for low and mid range, RB# (max +1 - RB allocation) for high range test frequency.

Note 3: For E-UTRA bands applied with Note 2 in Table 6.2.2.3-1:

- If the test channel bandwidth is larger than 4MHz, then the 1 RB allocation shall be tested at both RB #0 and RB #max.
- If the test channel bandwidth is smaller or equal to 4MHz, then the 1 RB allocation shall be tested at RB #0.
- If the test channel bandwidth = (FUL\_high - FUL\_low) specified by the operating band, then only one frequency range shall be tested and the 1 RB allocation shall be tested at RB #0, RB # $\lceil \frac{N_{RB}^{UL}}{2} \rceil$  and RB #max.
- For non-1RB allocation, test frequency is middle range, and the RBstart shall be RB #0.

## 2. LTE Conducted Power Results

### LTE output list

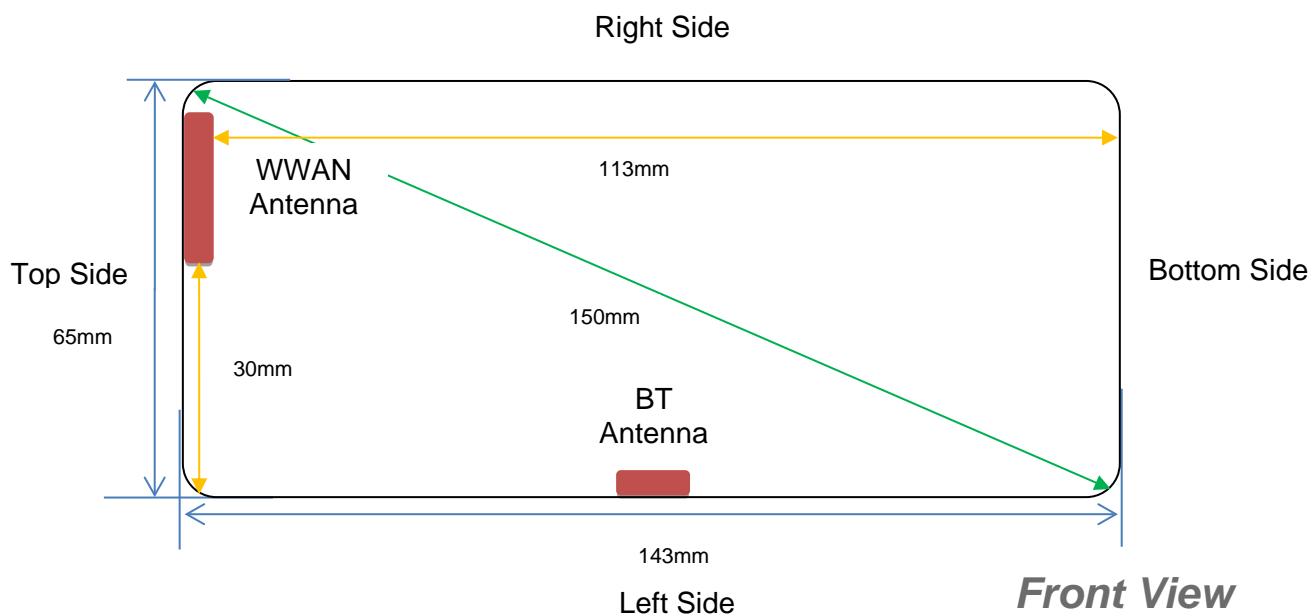
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20775/2502.5	21100/2535	21425/2567.5
LTE Band 7	5MHz	QPSK	1	0	24.00	23.87	23.88	23.73
			1	12	24.00	23.83	23.83	23.71
			1	24	24.00	23.91	23.84	23.77
			12	0	23.00	22.96	22.91	22.74
			12	6	23.00	22.92	22.84	22.77
			12	11	23.00	22.98	22.85	22.71
			25	0	23.00	22.98	22.88	22.71
		16QAM	1	0	23.50	23.04	22.71	21.74
			1	12	23.50	22.98	22.78	21.77
			1	24	23.50	23.08	22.82	21.82
			12	0	22.00	21.97	21.90	21.72
			12	6	22.00	21.91	22.00	21.75
			12	11	22.00	21.96	21.95	21.73
			25	0	22.50	22.01	21.88	21.83
LTE Band 7	10MHz	QPSK	RB Configuration	RB Size	RB Offset	Tune-up (dBm)		
			RB Configuration			20800/2505	21100/2535	21400/2565
			1	0	24.00	23.94	23.80	23.74
			1	24	24.00	23.92	23.83	23.78
			1	49	24.00	23.94	23.85	23.85
			25	0	23.50	22.84	22.82	22.59
			25	12	23.50	23.04	22.85	22.72
		16QAM	25	24	23.50	22.98	22.77	22.68
			50	0	23.00	22.98	22.75	22.62
			1	0	23.50	23.09	22.26	22.75
			1	24	23.50	23.01	22.19	22.76
			1	49	23.50	23.06	22.38	22.77
			25	0	22.50	21.87	21.94	21.76
			25	12	22.50	21.98	21.98	21.75
LTE Band 7	15MHz	QPSK	25	24	22.50	22.03	21.87	21.80
			50	0	22.50	22.10	21.84	21.81
		Modulation	RB Configuration	RB Size	RB Offset	Tune-up (dBm)		
			RB Configuration			20825/2507.5	21100/2535	21375/2562.5
		16QAM	1	0	24.00	23.81	23.81	23.75
			1	37	24.00	23.87	23.75	23.79
			1	74	24.00	23.92	23.83	23.78
			36	0	23.00	22.98	22.87	22.79
			36	18	23.00	22.84	22.76	22.69
			36	37	23.00	22.95	22.90	22.76
			75	0	23.00	22.84	22.79	22.66

			36	37	22.50	22.05	21.86	21.86
			75	0	22.50	22.03	21.82	21.78
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20850/2510	21100/2535	21350/2560
			1	0	24.50	23.84	23.86	23.95
LTE Band 7	20MHz	QPSK	1	49	24.50	23.84	23.82	23.96
			1	99	24.50	23.95	23.84	24.02
			50	0	23.00	22.90	22.85	22.78
			50	24	23.00	22.94	22.82	22.73
			50	49	23.00	22.86	22.86	22.72
			100	0	23.00	22.96	22.73	22.76
			1	0	24.00	22.76	23.68	23.00
		16QAM	1	49	24.00	22.80	23.60	23.06
			1	99	24.00	22.85	23.64	23.08
			50	0	22.50	22.03	21.82	21.80
			50	24	22.50	22.00	21.80	21.83
			50	49	22.50	22.01	21.85	21.72
			100	0	22.00	21.89	21.84	21.79

### 8.3. BT Output Power

BR+EDR	Output Power (dBm)				
	Data Rates	Tune-up (dBm)	Channel		
			0CH	39CH	78CH
	1M	2.00	1.15	1.75	1.65
	2M	3.00	2.60	2.88	2.53
	3M	4.00	3.00	3.19	2.58

## 9. Antenna Location



Antenna information:

Distance of The Antenna to the EUT surface and edge (mm)						
Antennas	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
WWAN	≤25mm	≤25mm	>25mm	≤25mm	≤25mm	>25mm
BT	≤25mm	≤25mm	≤25mm	>25mm	>25mm	>25mm

Positions for SAR tests						
Antennas	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
WWAN	Yes	Yes	NO	Yes	Yes	NO
BT	Yes	Yes	Yes	NO	NO	NO

## 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  $\leq 50$  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  $\leq 7.5$  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	P <sub>max</sub> (dBm)	P <sub>max</sub> (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
Bluetooth	4.00	2.51	5	2.480	0.8	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  $\leq 50$  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	P <sub>max</sub> (dBm)	P <sub>max</sub> (mW)	Distance (mm)	f (GHz)	x	Estimated SAR (W/kg)
Bluetooth	Head	4.00	2.51	5	2.48	7.5	0.105
Bluetooth	Body	4.00	2.51	5	2.48	7.5	0.105
Bluetooth	Hotspot	4.00	2.51	5	2.48	7.5	0.105

NOTE: Estimated SAR calculation for Bluetooth

## 11. SAR Measurement Results

< GSM 1900 >

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Left Cheek	661/1880	GPRS(GMSK 3TS)	0.163	0.128	-1.95	26.10	26.50	0.179	2025/4/25	1#
Left Tilt 15 Degree	661/1880	GPRS(GMSK 3TS)	0.089	0.070	-0.61	26.10	26.50	0.098	2025/4/25	
Right Cheek	661/1880	GPRS(GMSK 3TS)	0.149	0.115	-3.92	26.10	26.50	0.163	2025/4/25	
Right Tilt 15 Degree	661/1880	GPRS(GMSK 3TS)	0.069	0.052	-1.16	26.10	26.50	0.076	2025/4/25	

Test Position of Hotspot with 5mm	Test channel /Freq.	Test 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	661/1880	GPRS(GMSK 3TS)	0.204	0.133	-0.31	26.10	26.50	0.224	2025/4/25	
Back Side	661/1880	GPRS(GMSK 3TS)	0.318	0.210	-3.71	26.10	26.50	0.349	2025/4/25	2#
Right Side	661/1880	GPRS(GMSK 3TS)	0.144	0.093	2.32	26.10	26.50	0.158	2025/4/25	
Top Side	661/1880	GPRS(GMSK 3TS)	0.165	0.106	-3.29	26.10	26.50	0.181	2025/4/25	

< LTE Band 7 >

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
1RB										
Left	21100/2535	20M	0.309	0.223	-1.84	23.84	24.50	0.360	2025/5/5	3#

Cheek		QPSK(1,99)								
Left Tilt 15 Degree	21100/2535	20M QPSK(1,99)	0.158	0.114	3.29	23.84	24.50	0.184	2025/5/5	
Right Cheek	21100/2535	20M QPSK(1,99)	0.283	0.204	0.87	23.84	24.50	0.329	2025/5/5	
Right Tilt 15 Degree	21100/2535	20M QPSK(1,99)	0.128	0.091	3.96	23.84	24.50	0.149	2025/5/5	

## 50%RB

Left Cheek	21100/2535	20M QPSK(50,24)	0.167	0.129	3.13	22.82	23.00	0.174	2025/5/5	
Left Tilt 15 Degree	21100/2535	20M QPSK(50,24)	0.091	0.062	-4.56	22.82	23.00	0.095	2025/5/5	
Right Cheek	21100/2535	20M QPSK(50,24)	0.143	0.103	-1.37	22.82	23.00	0.149	2025/5/5	
Right Tilt 15 Degree	21100/2535	20M QPSK(50,24)	0.070	0.054	-4.61	22.82	23.00	0.073	2025/5/5	

Test Position of Hotspot with 5mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						

## 1RB

Front Side	21100/2535	20M QPSK(1,99)	0.372	0.274	-2.10	23.84	24.50	0.433	2025/5/5	
Back Side	21100/2535	20M QPSK(1,99)	0.583	0.430	-4.34	23.84	24.50	0.679	2025/5/5	4#
Right Side	21100/2535	20M QPSK(1,99)	0.248	0.179	2.56	23.84	24.50	0.289	2025/5/5	
Top Side	21100/2535	20M QPSK(1,99)	0.310	0.224	2.89	23.84	24.50	0.361	2025/5/5	

## 50%RB

Front Side	21100/2535	20M QPSK(50,24)	0.194	0.157	-2.50	22.82	23.00	0.202	2025/5/5	
Back Side	21100/2535	20M QPSK(50,24)	0.338	0.250	-1.26	22.82	23.00	0.352	2025/5/5	

Right Side	21100/2535	20M QPSK(50,24)	0.143	0.100	2.73	22.82	23.00	0.149	2025/5/5	
Top Side	21100/2535	20M QPSK(50,24)	0.172	0.121	-0.09	22.82	23.00	0.179	2025/5/5	

## 12. Simultaneous Transmission Analysis

Per KDB 447498 D01, simultaneous transmission SAR is compliant if,

1) Scalar SAR summation < 1.6W/kg.

2) SPLSR =  $(\text{SAR}_1 + \text{SAR}_2)^{1.5}$  / (min. separation distance, mm), and the peak separation distance is

determined from the square root of  $[(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2]$ , where

$(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$  are the coordinates of the extrapolated peak SAR locations in the zoom scan.

If SPLSR  $\leq 0.04$ , simultaneously transmission SAR measurement is not necessary.

No.	Simultaneous Tx	Head	Body-worn	Hotspot
1	WWAN+Bluetooth	Yes	Yes	Yes

Exposure Position		WWAN Band	DSS Band	Simultaneous Tx SAR(W/Kg)
		SAR(W/Kg)	SAR(W/Kg)	
Head	Left Cheek	0.360	0.105	0.465
	Left Tilt 15 Degree	0.184	0.105	0.289
	Right Cheek	0.329	0.105	0.434
	Right Tilt 15 Degree	0.149	0.105	0.254
Body&Hotspot	Front Side	0.433	0.105	0.538
	Back Side	0.679	0.105	0.784
	Left Side	/	0.105	0.105
	Right Side	0.289	/	0.289
	Top Side	0.361	/	0.361
	Bottom Side	/	/	/

Note : The Simultaneous Tx is calculated based on the same configuration and test position.

## Appendix A. Photo documentation

Refer to appendix Test Setup photo---SAR

## Appendix B. System Check Plots

### Table of contents

**MEASUREMENT 1 System Performance Check - 1900MHz**

**MEASUREMENT 2 System Performance Check - 2600MHz**

# MEASUREMENT 1

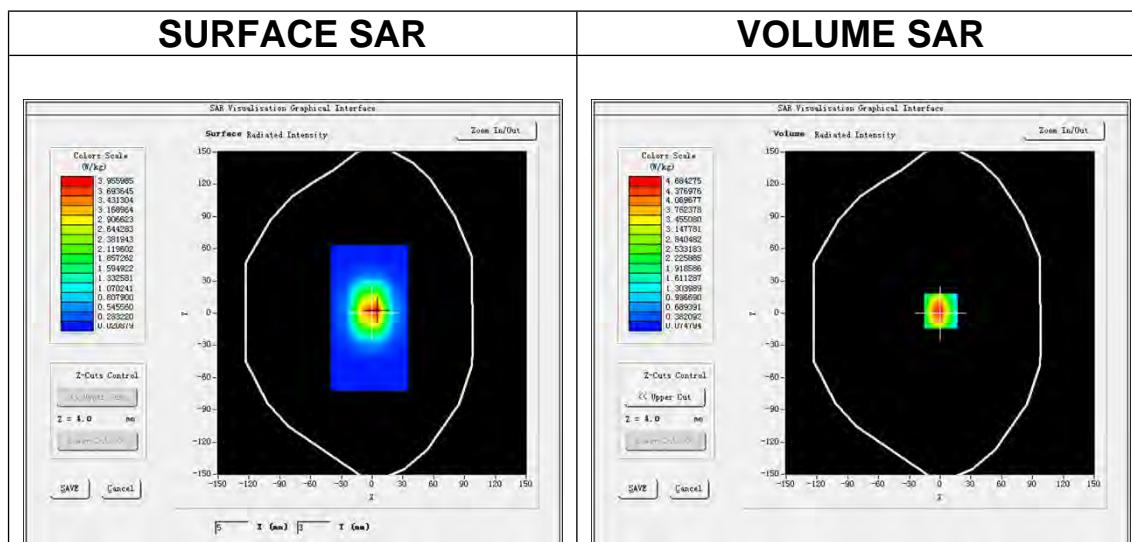
Date of measurement: 25/4/2025

## A. Experimental conditions.

<u>Area Scan</u>	$dx=15\text{mm}$ $dy=15\text{mm}$ , $h= 5.00 \text{ mm}$
<u>ZoomScan</u>	$5\times 5\times 7, dx=8\text{mm}$ $dy=8\text{mm}$ $dz=5\text{mm}$
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW1900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.05</u>

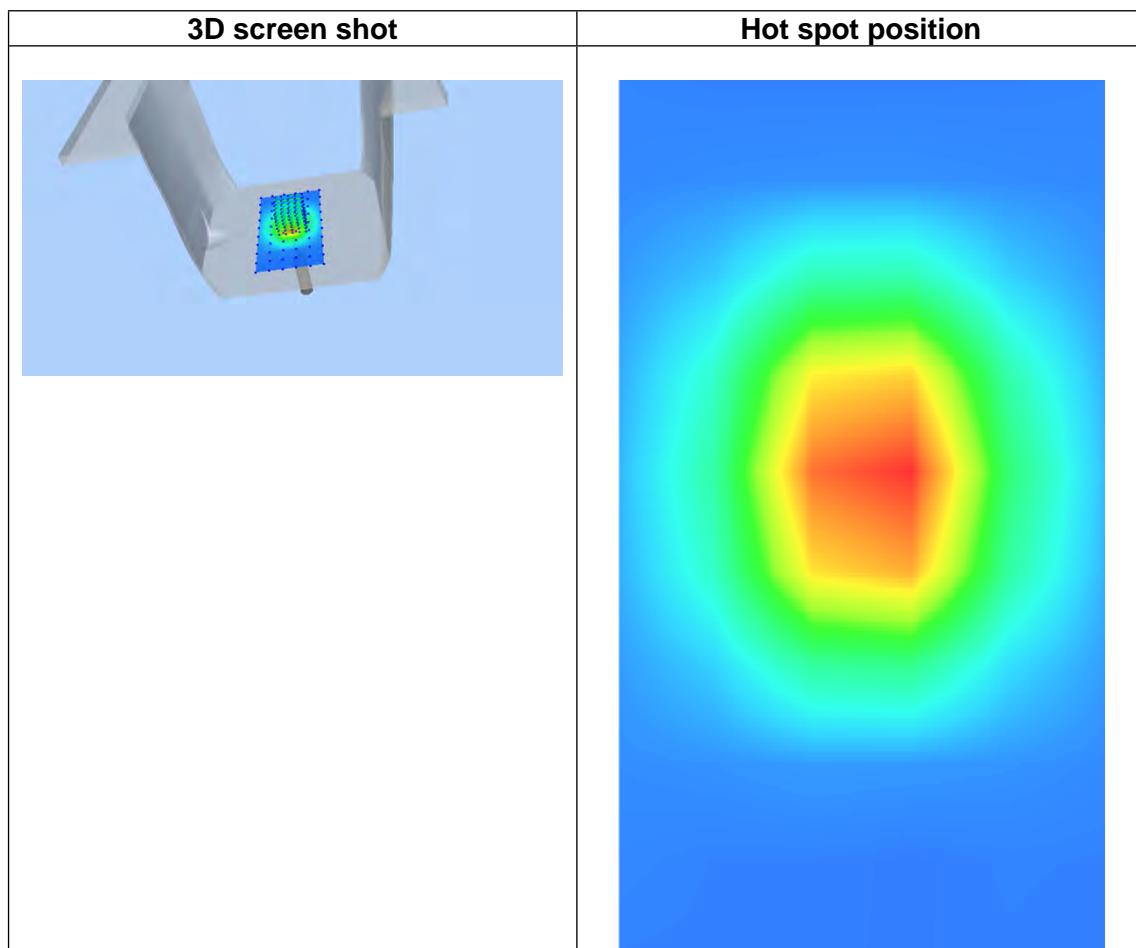
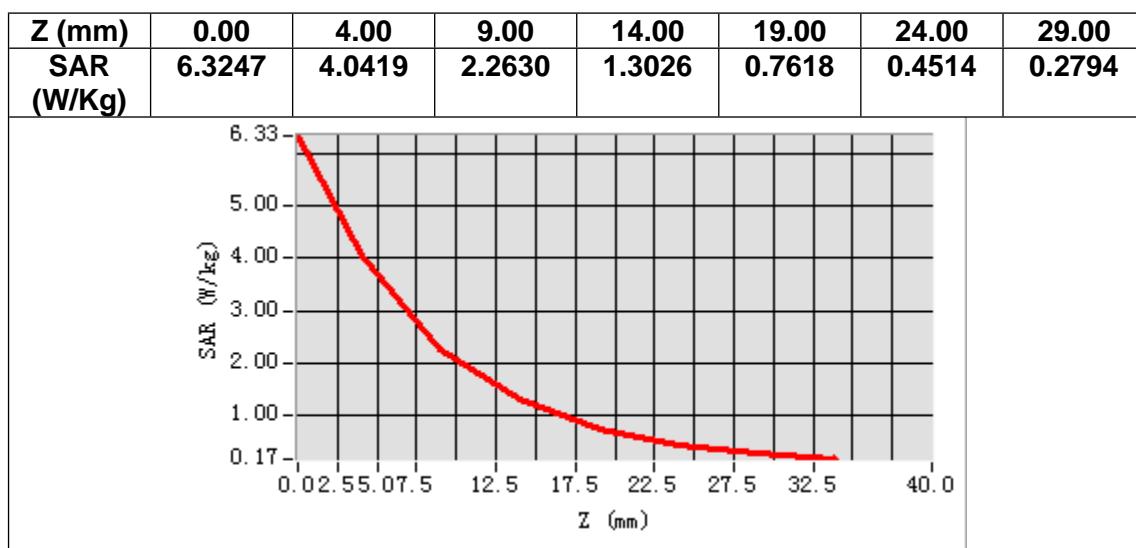
## B. SAR Measurement Results

<b>Frequency (MHz)</b>	1900.000000
<b>Relative permittivity (real part)</b>	41.420140
<b>Relative permittivity (imaginary part)</b>	12.570123
<b>Conductivity (S/m)</b>	1.390503
<b>Variation (%)</b>	-0.440000



**Maximum location: X=1.00, Y=2.00**  
**SAR Peak: 7.65 W/kg**

<b>SAR 10g (W/Kg)</b>	2.153165
<b>SAR 1g (W/Kg)</b>	4.153568



## MEASUREMENT 2

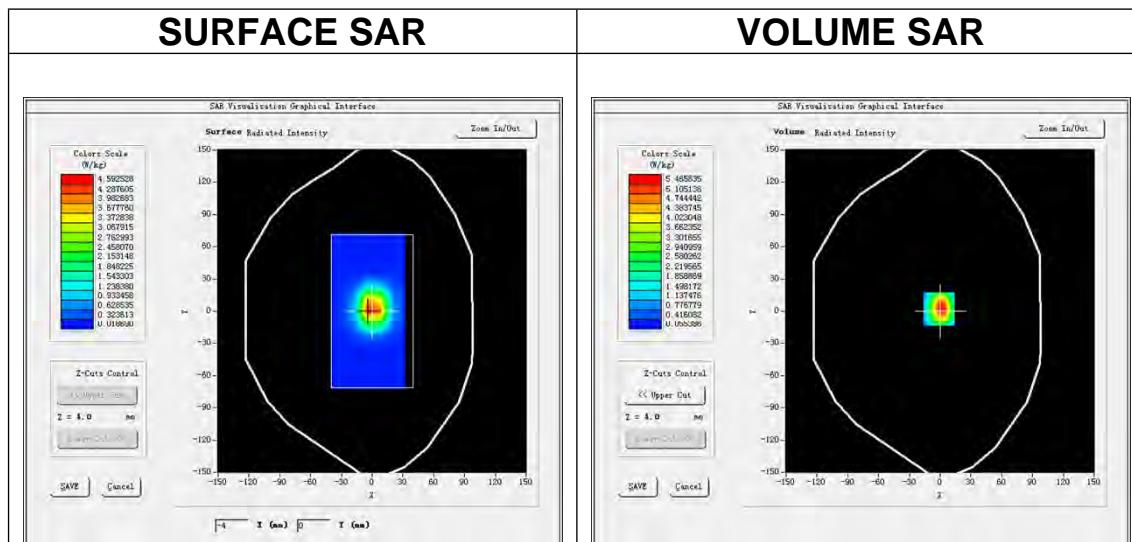
Date of measurement: 5/5/2025

### A. Experimental conditions.

<u>Area Scan</u>	$dx=12\text{mm}$ $dy=12\text{mm}$ , $h= 5.00\text{ mm}$
<u>ZoomScan</u>	$7\times7\times7, dx=5\text{mm}$ $dy=5\text{mm}$ $dz=5\text{mm}$
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW2600</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.35</u>

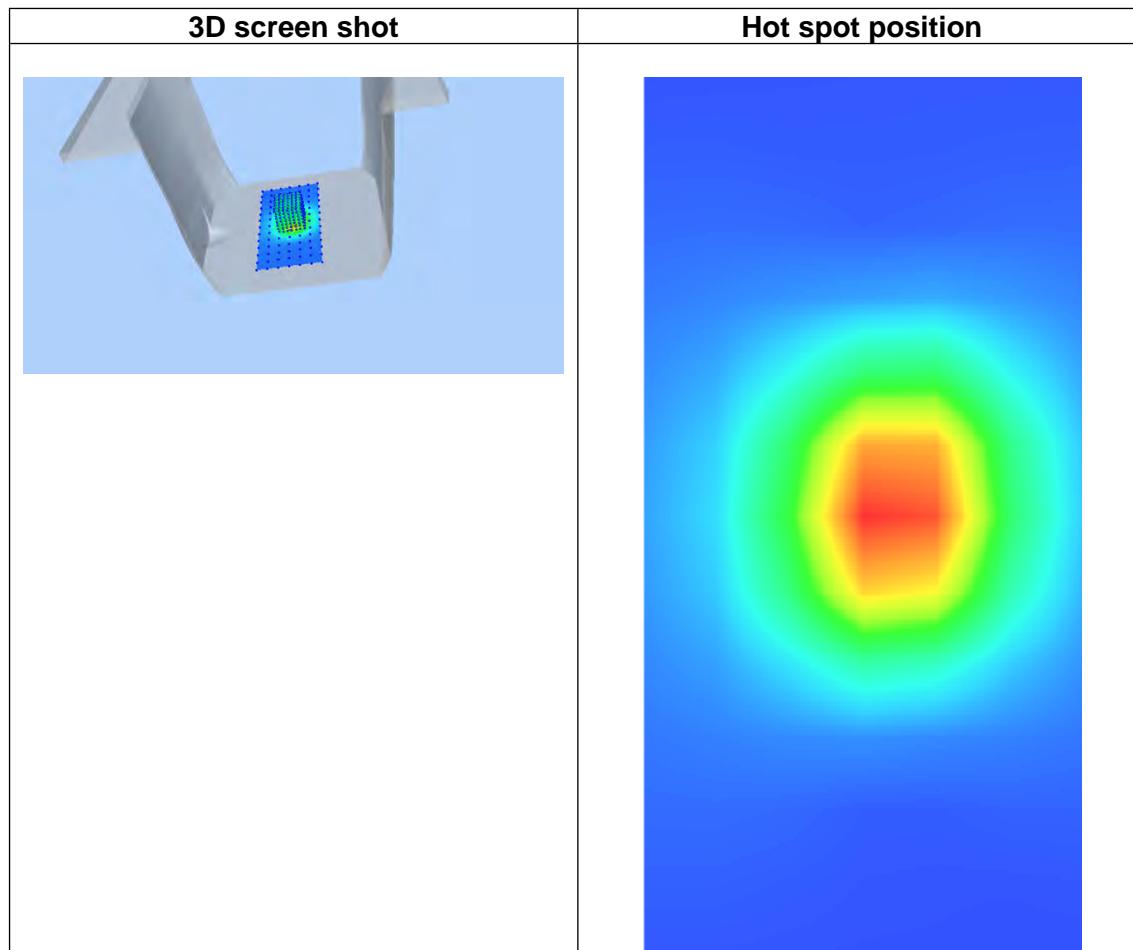
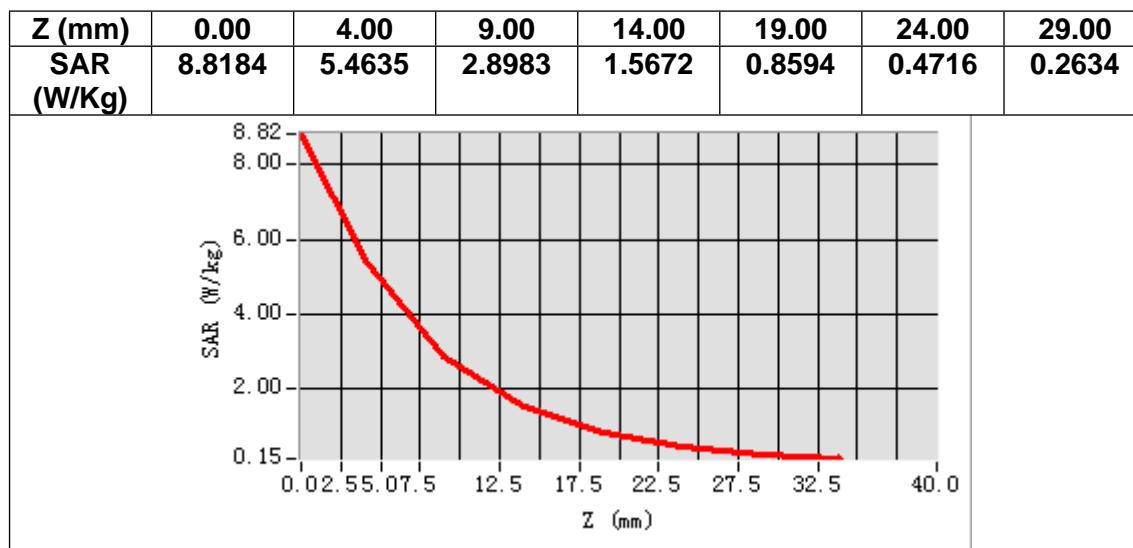
### B. SAR Measurement Results

<b>Frequency (MHz)</b>	2600.000000
<b>Relative permittivity (real part)</b>	39.432362
<b>Relative permittivity (imaginary part)</b>	13.768602
<b>Conductivity (S/m)</b>	1.988798
<b>Variation (%)</b>	-3.980000



**Maximum location: X=-1.00, Y=2.00**  
**SAR Peak: 9.07 W/kg**

<b>SAR 10g (W/Kg)</b>	2.523157
<b>SAR 1g (W/Kg)</b>	5.432595



## Appendix C. SAR Test Plots

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**MEASUREMENT 1 GSM 1900 Head**

**MEASUREMENT 2 GSM 1900 Body**

**MEASUREMENT 3 LTE Band 7 Head**

**MEASUREMENT 4 LTE Band 7 Body**

# MEASUREMENT 1

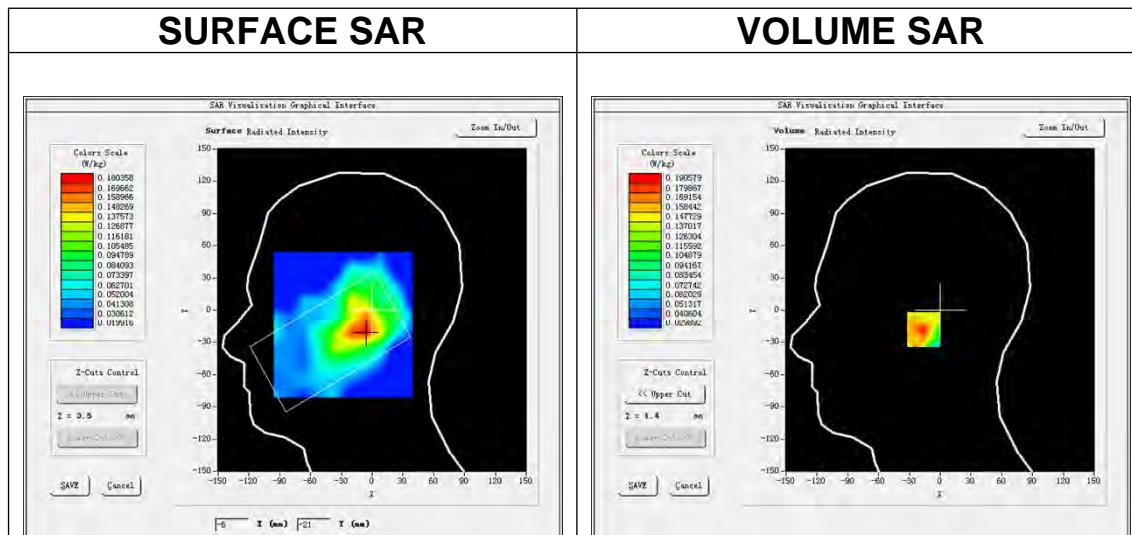
Date of measurement: 25/4/2025

## A. Experimental conditions.

<u>Area Scan</u>	$dx=15\text{mm}$ $dy=15\text{mm}$ , $h= 5.00\text{ mm}$
<u>ZoomScan</u>	$5\times 5\times 7$ , $dx=8\text{mm}$ $dy=8\text{mm}$ $dz=5\text{mm}$
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>GSM1900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 2.7)</u>
<u>ConvF</u>	<u>2.05</u>

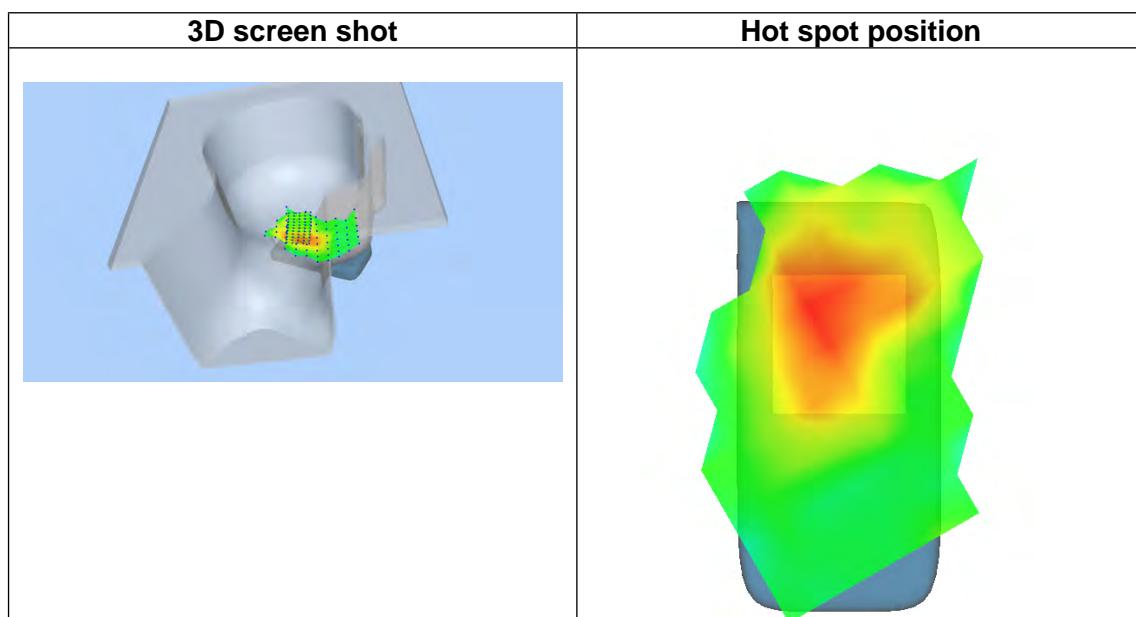
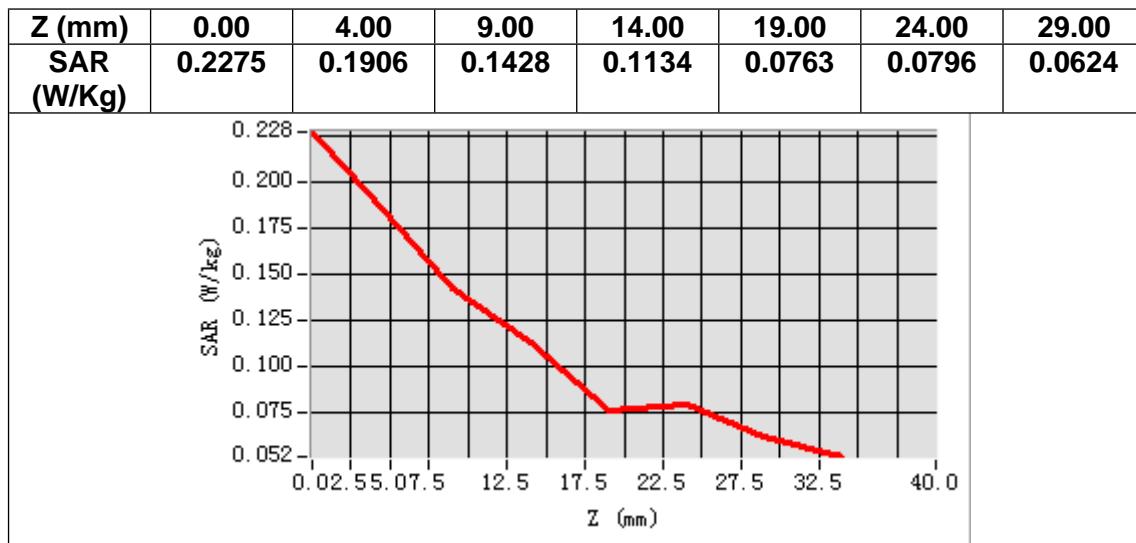
## B. SAR Measurement Results

<b>Frequency (MHz)</b>	1880.000000
<b>Relative permittivity (real part)</b>	40.000000
<b>Relative permittivity (imaginary part)</b>	13.408000
<b>Conductivity (S/m)</b>	1.400391
<b>Variation (%)</b>	-1.950000



**Maximum location: X=-8.00, Y=-18.00**  
**SAR Peak: 0.27 W/kg**

<b>SAR 10g (W/Kg)</b>	0.128488
<b>SAR 1g (W/Kg)</b>	0.163118



## MEASUREMENT 2

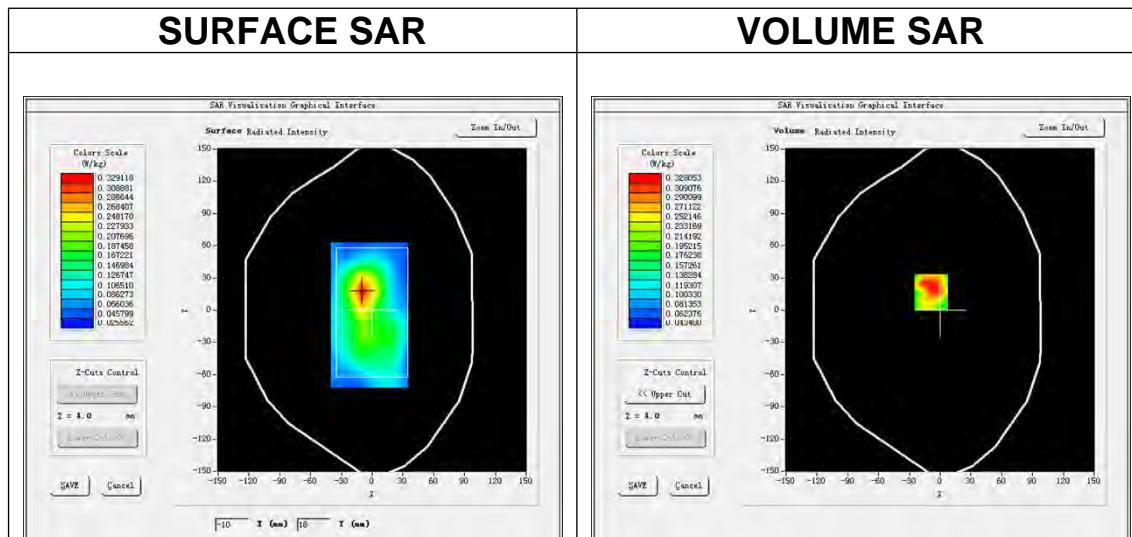
Date of measurement: 25/4/2025

### A. Experimental conditions.

<u>Area Scan</u>	<u><math>dx=15\text{mm}</math> <math>dy=15\text{mm}</math>, <math>h= 5.00\text{ mm}</math></u>
<u>ZoomScan</u>	<u><math>5\times 5\times 7</math>, <math>dx=8\text{mm}</math> <math>dy=8\text{mm}</math> <math>dz=5\text{mm}</math></u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>GSM1900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 2.7)</u>
<u>ConvF</u>	<u>2.05</u>

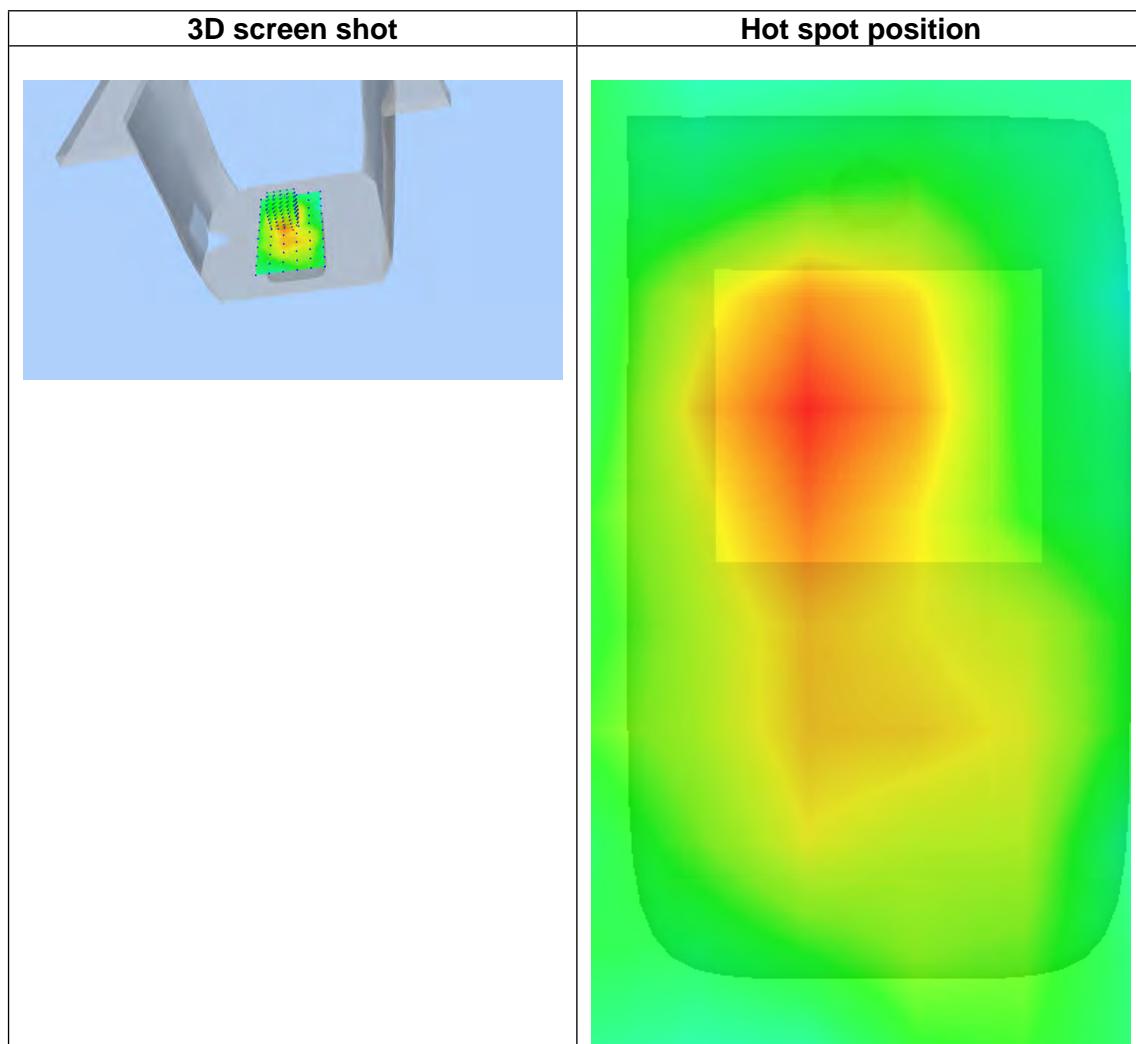
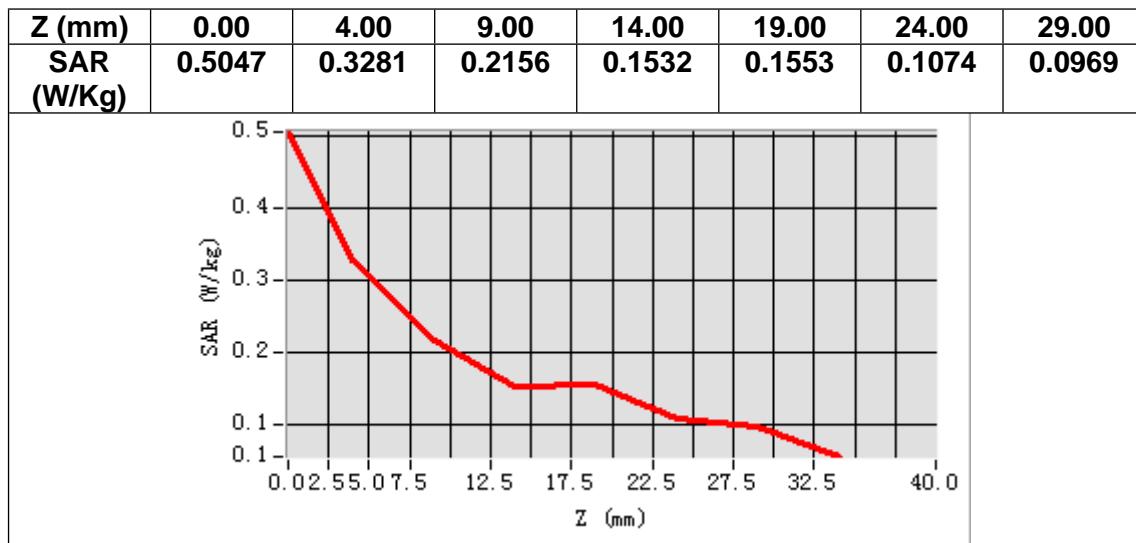
### B. SAR Measurement Results

<b>Frequency (MHz)</b>	1880.000000
<b>Relative permittivity (real part)</b>	40.000000
<b>Relative permittivity (imaginary part)</b>	13.408000
<b>Conductivity (S/m)</b>	1.400391
<b>Variation (%)</b>	-3.710000



**Maximum location: X=-9.00, Y=17.00**  
**SAR Peak: 0.50 W/kg**

<b>SAR 10g (W/Kg)</b>	0.209504
<b>SAR 1g (W/Kg)</b>	0.318142



## MEASUREMENT 3

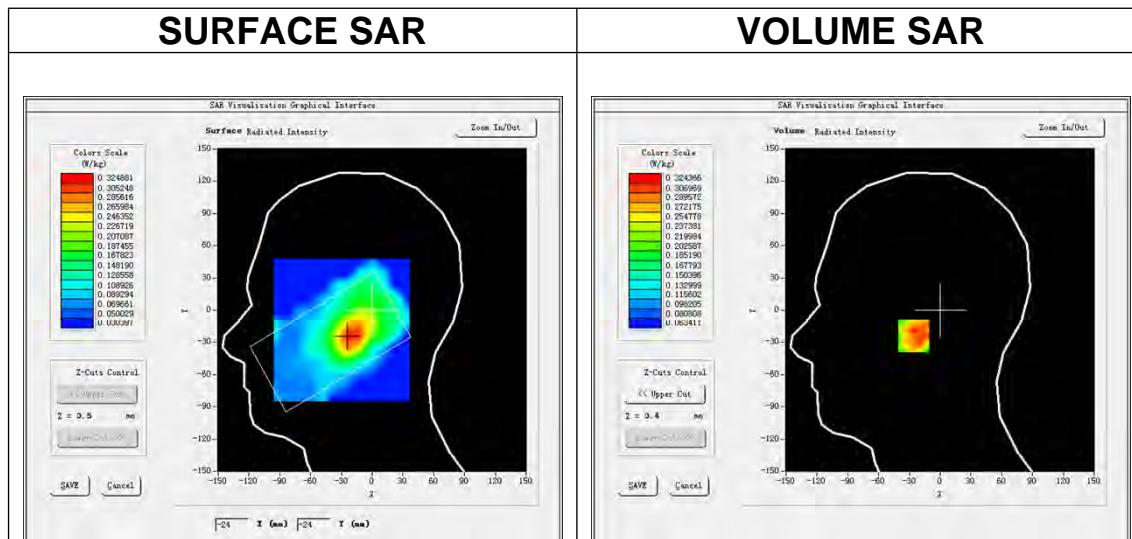
Date of measurement: 5/5/2025

### A. Experimental conditions.

<u>Area Scan</u>	$dx=12\text{mm}$ $dy=12\text{mm}$ , $h= 5.00 \text{ mm}$
<u>ZoomScan</u>	$7 \times 7 \times 7$ , $dx=5\text{mm}$ $dy=5\text{mm}$ $dz=5\text{mm}$
<u>Phantom</u>	Left head
<u>Device Position</u>	Cheek
<u>Band</u>	LTE band 7
<u>Channels</u>	Middle
<u>Signal</u>	LTE (Crest factor: 1.0)
<u>ConvF</u>	2.35

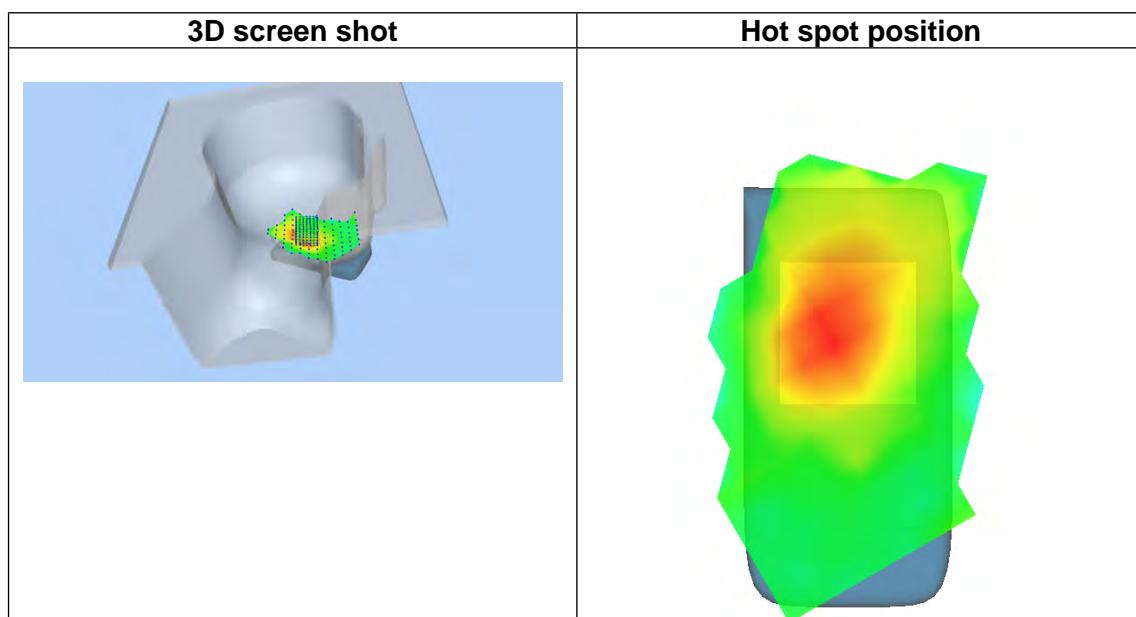
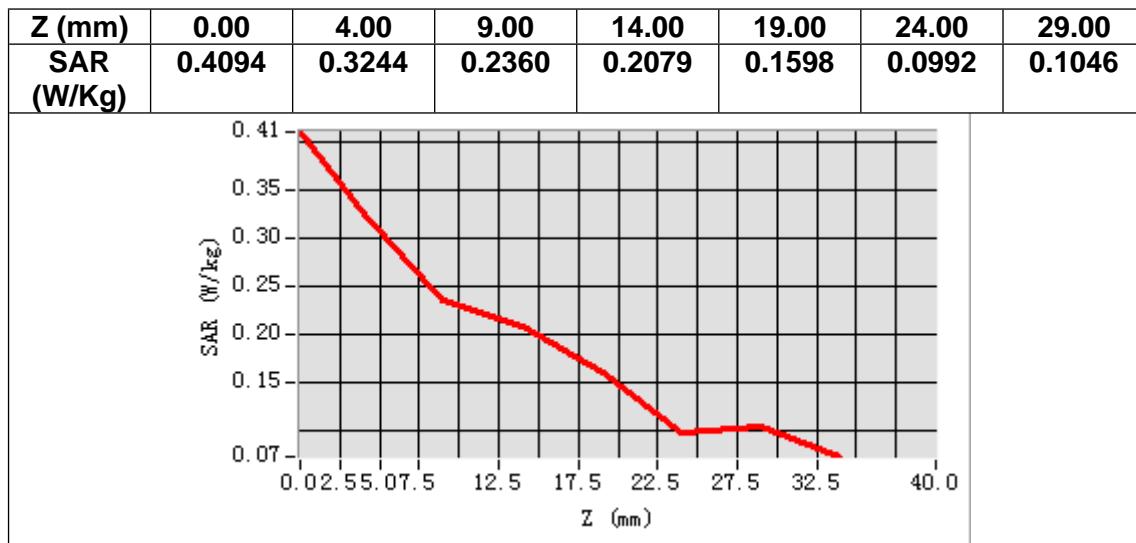
### B. SAR Measurement Results

<b>Frequency (MHz)</b>	2535.000000
<b>Relative permittivity (real part)</b>	39.086666
<b>Relative permittivity (imaginary part)</b>	13.418333
<b>Conductivity (S/m)</b>	1.889749
<b>Variation (%)</b>	-1.840000



**Maximum location: X=-21.00, Y=-24.00**  
**SAR Peak: 0.48 W/kg**

<b>SAR 10g (W/Kg)</b>	0.222883
<b>SAR 1g (W/Kg)</b>	0.309384



## MEASUREMENT 4

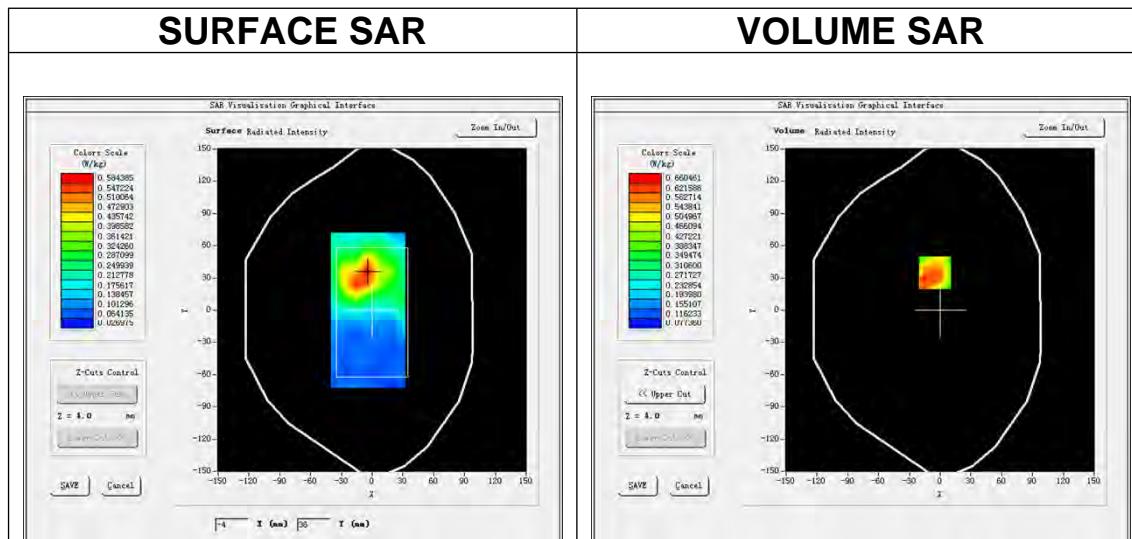
Date of measurement: 5/5/2025

### A. Experimental conditions.

<u>Area Scan</u>	<u><math>dx=12\text{mm}</math> <math>dy=12\text{mm}</math>, <math>h= 5.00\text{ mm}</math></u>
<u>ZoomScan</u>	<u><math>7\times 7\times 7</math>, <math>dx=5\text{mm}</math> <math>dy=5\text{mm}</math> <math>dz=5\text{mm}</math></u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 7</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.35</u>

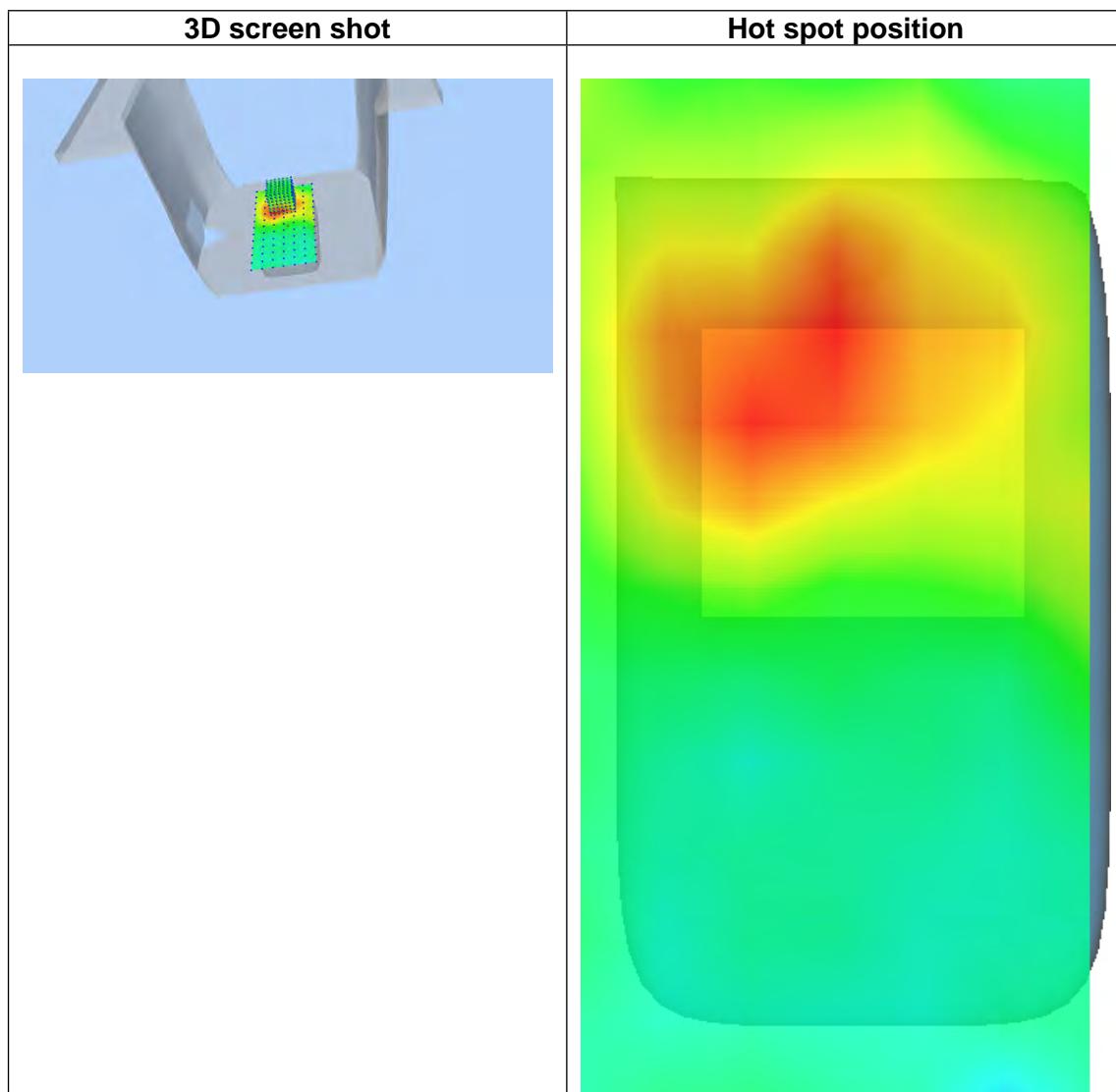
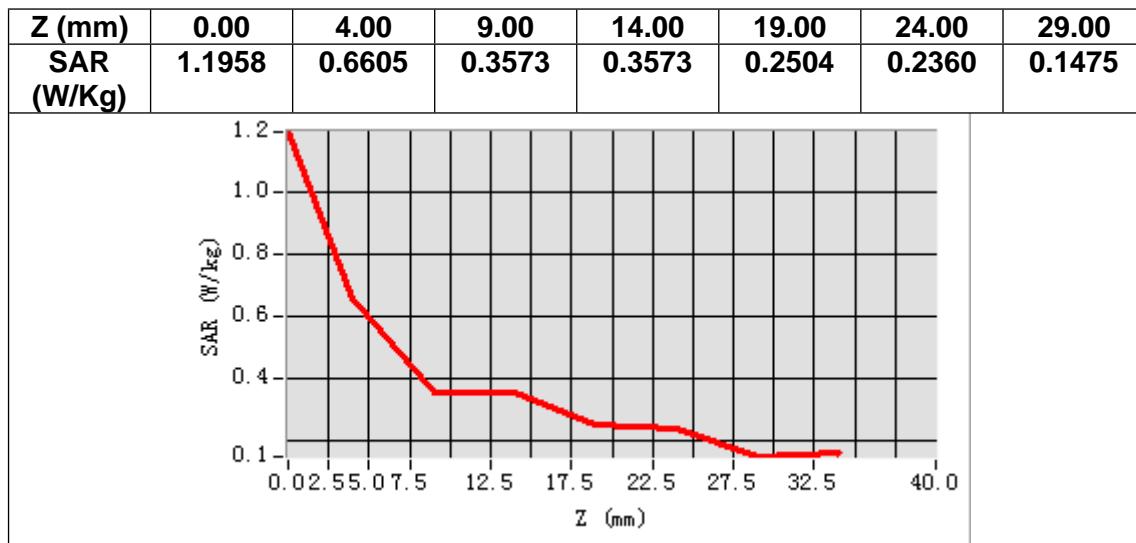
### B. SAR Measurement Results

<b>Frequency (MHz)</b>	2535.000000
<b>Relative permittivity (real part)</b>	39.086666
<b>Relative permittivity (imaginary part)</b>	13.418333
<b>Conductivity (S/m)</b>	1.889749
<b>Variation (%)</b>	-4.340000



**Maximum location: X=-5.00, Y=35.00**  
**SAR Peak: 0.96 W/kg**

<b>SAR 10g (W/Kg)</b>	0.429618
<b>SAR 1g (W/Kg)</b>	0.582884



## Appendix D. Calibration Certificate

<b>Table of contents</b>
E Field Probe - EPGO0523-403
1900 MHz Dipole - SN 03/15 DIP 1G900-350
2600 MHz Dipole - SN 03/15 DIP 2G600-356



## 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: 09/11/2024



Accreditations #2-6789  
Scope available on [www.cofrac.fr](http://www.cofrac.fr)

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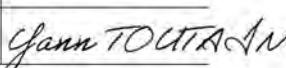
### Summary:

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	09/10/2024	
Checked by :	Jérôme Luc	Technical Manager	09/10/2024	
Approved by :	Yann Toutain	Laboratory Director	09/11/2024	

	Customer Name
Distribution :	Shenzhen Asia Hongke

Issue	Name	Date	Modifications
A	Jérôme Luc	9/11/2024	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 EPGO0523-403
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: $R1=0.199 \text{ M}\Omega$ Dipole 2: $R2=0.218 \text{ M}\Omega$ Dipole 3: $R3=0.210 \text{ M}\Omega$

**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.



## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref. ACR 307 3.24 BES A

### 3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

### 3.4 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°).

### 3.1 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:

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

where

SAR <sub>uncertainty</sub>	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
$\Delta_{step}$	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
$\delta$	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;
$\Delta \text{SAR}_{be}$	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<sub>uncertainty</sub>[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).



## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR 307 3.24-BES 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 an E-field probe calibration using the waveguide technique. 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.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	Uncertainty value (%)	Probability Distribution	Divisor	ci	Standard Uncertainty (%)
Expanded uncertainty 95 % confidence level $k = 2$					14 %

**5 CALIBRATION MEASUREMENT RESULTS**

Calibration Parameters	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

**5.1 SENSITIVITY IN AIR**

Normx dipole 1 ( $\mu$ V/(V/m) $^2$ )	Normy dipole 2 ( $\mu$ V/(V/m) $^2$ )	Normz dipole 3 ( $\mu$ V/(V/m) $^2$ )
1.26	0.87	0.77

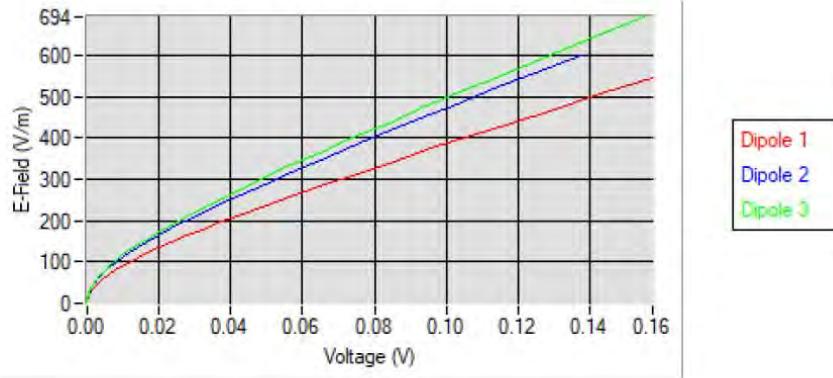
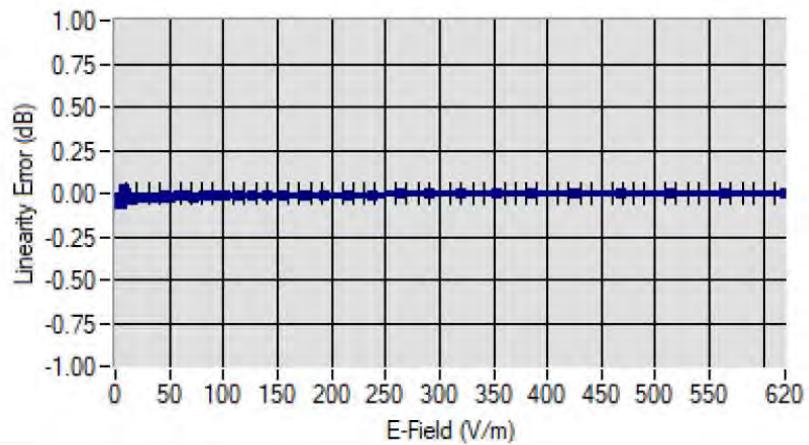
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
113	108	113

Calibration curves  $e_i=f(V)$  ( $i=1,2,3$ ) allow to obtain E-field value using the formula:

$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$

**COMOSAR E-FIELD PROBE CALIBRATION REPORT**

Ref: ACR 307.3.24.BES A

**Calibration curves****5.2 LINEARITY****Linearity**Linearity: +/-1.42% (+/-0.06dB)



## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR 307 3.24-BES A

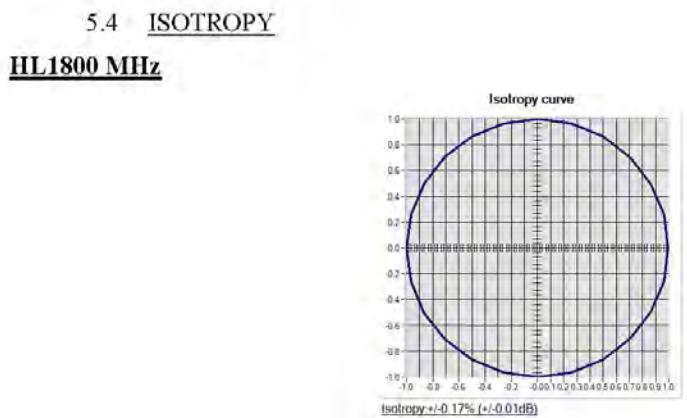
5.3 SENSITIVITY IN LIQUID

<u>Liquid</u>	<u>Frequency (MHz +/- 100MHz)</u>	<u>ConvF</u>
HL600	600	1.62
HL750	750	1.65
HL850	835	1.66
HL900	900	1.77
HL1500	1500	2.09
HL1750	1750	2.09
HL1800	1800	2.05
HL1900	1900	2.05
HL2000	2000	2.41
HL2100	2100	2.36
HL2300	2300	2.55
HL2450	2450	2.38
HL2600	2600	2.35
HL3300	3300	2.04
HL3500	3500	1.98
HL3700	3700	2.11
HL3900	3900	2.54
HL4200	4200	2.22
HL4600	4600	2.40
HL4900	4900	2.33
HL5200	5200	2.30
HL5400	5400	2.30
HL5600	5600	2.29
HL5800	5800	2.27

LOWER DETECTION LIMIT: 8mW/kg

**COMOSAR E-FIELD PROBE CALIBRATION REPORT**

Ref: ACR.307.3.24.BES.A





## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR 307.3.24-BES A

**6 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	08/2024	08/2027
Network Analyzer	Agilent 8753ES	MY40003210	10/2021	10/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2024	05/2027
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Multimeter	Keithley 2000	1160271	02/2024	02/2027
Signal Generator	Rohde & Schwarz SMB	106589	04/2024	04/2027
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	06/2024	06/2027
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2021	11/2024
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. 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.
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.

Page: 10/11

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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR 307.3.24-BES A

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.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2024	06/2027



## SAR Reference Dipole Calibration Report

Ref: ACR.53.27.24.BLS 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 REFERENCE DIPOLE**  
**FREQUENCY: 1900MHZ**  
**SERIAL NO.: SN 03/15 DIP1G900-350**

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

Calibration date: 02/21/2024



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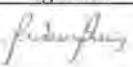
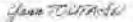
### Summary:

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



## SAR REFERENCE DIPOLE CALIBRATION REPORT

REF: ACR.33.07.24.BES.A

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

Yann  
Toutain ID  
Signature  
numérique de  
Yann Toutain ID  
Date: 2024.02.27  
08:56:45 +01'00'

	Customer Name
Distribution :	Shenzhen Asia Hongke

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

Page: 2/8

Template: ACR.DD007.07.MVG.H1.INS1P\_SAR Reference Report 01  
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## SAR REFERENCE DIPOLE CALIBRATION REPORT

REF. ACR.53/2724.BES.A

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

REF. ACR.53.27.24.BES.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 1900 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID1900
Serial Number	SN 03/15DIP1G900-350
Product Condition (new / used)	Used

**3 PRODUCT DESCRIPTION****3.1 GENERAL INFORMATION**

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.

**Figure 1 – MVG COMOSAR Validation Dipole**



## SAR REFERENCE DIPOLE CALIBRATION REPORT

REF. ACR.53.2724.BES.A

**4 MEASUREMENT METHOD****4.1 MECHANICAL REQUIREMENTS**

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

**4.2 S11 PARAMETER REQUIREMENTS**

The dipole used for SAR system validation measurements and checks must have a S11 of -20 dB or better. The S11 measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

**4.3 SAR REQUIREMENTS**

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore-mentioned standards.

**5 MEASUREMENT UNCERTAINTY****5.1 MECHANICAL DIMENSIONS**

For the measurement in the range 0-300mm, the estimated expanded uncertainty (k=2) in calibration for the dimension measurement in mm is +/-0.20 mm with respect to measurement conditions.

For the measurement in the range 300-450mm, the estimated expanded uncertainty (k=2) in calibration for the dimension measurement in mm is +/-0.44 mm with respect to measurement conditions.

**5.2 S11 PARAMETER**

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

**5.3 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.

Page: 5/8

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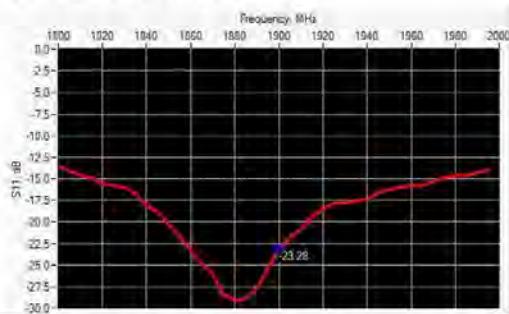


## SAR REFERENCE DIPOLE CALIBRATION REPORT

REF. ACR.53.2724.BES.A

**6 CALIBRATION RESULTS****6.1 MECHANICAL DIMENSIONS**

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	68.00 +/- 2%	-	39.50 +/- 2%	-	3.60 +/- 2%

**6.2 S11 PARAMETER****6.2.1 S11 parameter in Head Liquid**

Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
1900	-23.28	-20	$46.2\Omega + 5.4j\Omega$

**6.3 SAR**

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

**6.3.1 SAR with Head Liquid**

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

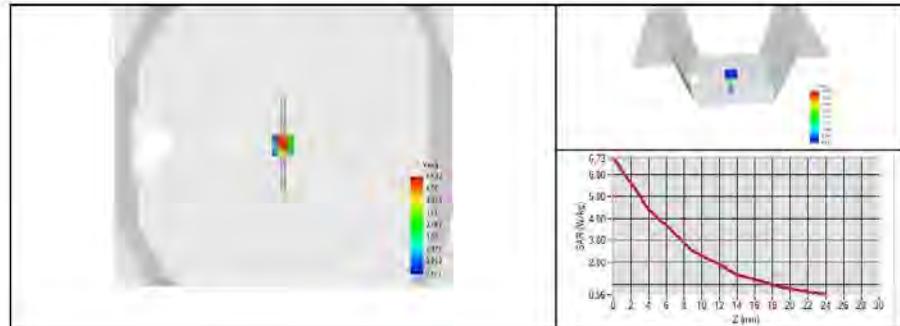


## SAR REFERENCE DIPOLE CALIBRATION REPORT

REF. ACR.53.2724.BE.SA

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: $\epsilon_s'$ : 42.5 sigma : 1.39
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8\text{mm}/dy=8\text{mm}$
Zoon Scan Resolution	$dx=8\text{mm}/dy=8\text{mm}/dz=5\text{mm}$
Frequency	1900 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
1900 MHz	3.97	39.69	39.70	2.09	20.92	20.50





## SAR REFERENCE DIPOLE CALIBRATION REPORT

REF. ACR.53.2724.BES.A

## 7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3623-EPGO-429	11/2023	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

Page: 8/8

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## SAR Reference Dipole Calibration Report

Ref: ACR\_53\_30\_24\_BLS 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 REFERENCE DIPOLE**  
**FREQUENCY: 2600MHZ**  
**SERIAL NO.: SN 03/15 DIP2G600-356**

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon  
29280 PLOUZANE - FRANCE

Calibration date: 02/21/2024



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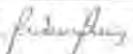
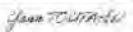
#### Summary:

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



## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.33.3024.BES.A

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

Yann  
Toutain  
ID

Signature  
numérique de  
Yann Toutain ID  
Date: 2024.02.27  
08:58:12 +01'00'

	Customer Name
Distribution:	Shenzhen Asia Hongke

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



## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.30/24.BES.A

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.53.30/24.BES.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 2600 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2600
Serial Number	SN 03/15DIP2G600-356
Product Condition (new / used)	Used

**3 PRODUCT DESCRIPTION****3.1 GENERAL INFORMATION**

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.

**Figure 1 – MVG COMOSAR Validation Dipole**



## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.53.3024.EES.A

**4 MEASUREMENT METHOD****4.1 MECHANICAL REQUIREMENTS**

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

**4.2 S11 PARAMETER REQUIREMENTS**

The dipole used for SAR system validation measurements and checks must have a S11 of -20 dB or better. The S11 measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

**4.3 SAR REQUIREMENTS**

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore-mentioned standards.

**5 MEASUREMENT UNCERTAINTY****5.1 MECHANICAL DIMENSIONS**

For the measurement in the range 0-300mm, the estimated expanded uncertainty (k=2) in calibration for the dimension measurement in mm is +/-0.20 mm with respect to measurement conditions.

For the measurement in the range 300-450mm, the estimated expanded uncertainty (k=2) in calibration for the dimension measurement in mm is +/-0.44 mm with respect to measurement conditions.

**5.2 S11 PARAMETER**

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

**5.3 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.

Page: 5/8

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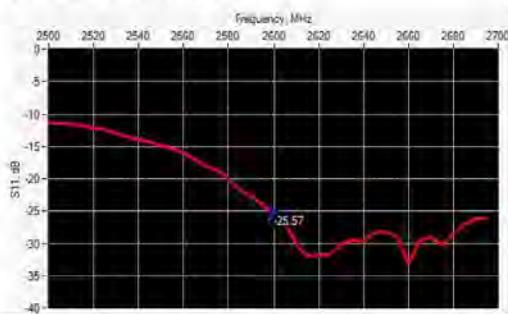


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR 53.30/24-BES-A

**6 CALIBRATION RESULTS****6.1 MECHANICAL DIMENSIONS**

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	48.50 +/- 2%	-	28.80 +/- 2%	-	3.60 +/- 2%

**6.2 S11 PARAMETER****6.2.1 S11 parameter in Head Liquid**

Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2600	-25.57	-20	54.5Ω - 3.2jΩ

**6.3 SAR**

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

**6.3.1 SAR with Head Liquid**

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

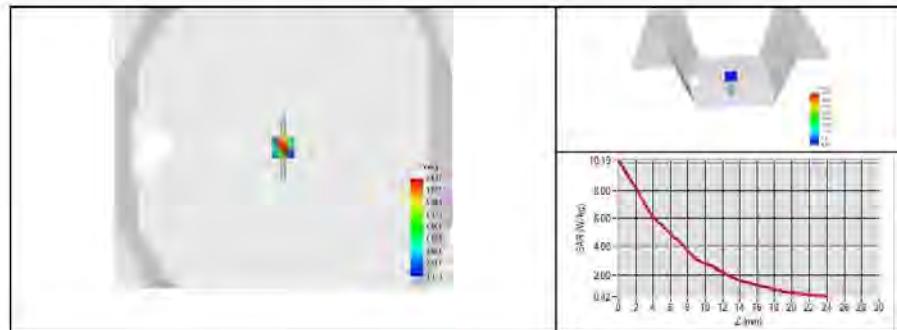


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR 53.30/24-BES-A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: $\epsilon_{\text{pr}}' = 41.3$ sigma = 1.95
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	2600 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
2600 MHz	5.42	54.16	55.30	2.49	24.85	24.60





## SAR REFERENCE DIPOLE CALIBRATION REPORT

SAR-AIT-21-004361A

## 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	N/A	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3523-EPGO-429	11/2023	11/2024
Multimeter	Keithley 2000	#013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY82340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	08/2021	08/2024

## Appendix E. Justification of the extended calibration

If dipoles are verified in return loss (<-20dB, within 20% of prior calibration for below 3GHz, and <-8dB, within 20% of prior calibration for 5GHz to 6GHz), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

<Head 1900MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-23.28	-	46.2	-	Feb. 21, 2024
-23.518	1.02	46.516	0.316	Feb. 20, 2025

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

<Head 2600MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-25.57	-	54.5	-	Feb. 21, 2024
-25.248	1.26	54.653	0.153	Feb. 20, 2025

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

※※END OF THE REPORT※※