TCT 通测检测
TESTING CENTRE TECHNOLOGY

SAR TEST REPORT

FCC ID. ..... :	2A233-AR05	
Test Report No..... :	TCT241107E029	
Date of issue..... :	Nov. 15, 2024	
Testing laboratory ..... :	SHENZHEN TONGCE TESTING LAB	
Testing location/ address:	2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China	
Applicant's name..... :	Shenzhen Konkr Technology Co.,Ltd	
Address..... :	Room 215, Building 22, Maker Town, No. 4109, Liuxian Avenue, Pingshan Community, Taoyuan Street, Nanshan District, Shenzhen, China	
Manufacturer's name ... :	Shenzhen Konkr Technology Co.,Ltd	
Address..... :	Room 215, Building 22, Maker Town, No. 4109, Liuxian Avenue, Pingshan Community, Taoyuan Street, Nanshan District, Shenzhen, China	
Product Name..... :	Portable Gaming Computer (Tablet computer)	
Trade Mark ..... :	AYANEO	
Model/Type reference..... :	AYANEO Pocket Micro	
SAR Max. Values.....:	**0.27 W/Kg (1g) for Body-worn**	
Date of receipt of test item ..... :	Nov. 07, 2024	
Date (s) of performance of test..... :	Nov. 07, 2024- Nov. 15, 2024	
Tested by (+signature) ... :	Karl WANG	Karl Wang
Check by (+signature).... :	Beryl Zhao	Beryl Zhao
Approved by (+signature):	Tomsin	Tomsin [redacted]

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TABLE OF CONTENTS

1. General Product Information 3
1.1. EUT description 3
1.2. Model(s) list 3
2. Test standard 4
3. Facilities and Accreditations 4
3.1. Facilities 4
3.2. Location 4
4. Test Result Summary 5
5. RF Exposure Limit 6
6. SAR Measurement System Configuration 7
6.1. SAR Measurement Set-up 7
6.2. E-field Probe 8
6.3. Phantom 8
6.4. Device Holder 9
6.5. Data Storage and Evaluation 10
6.6. Position of the wireless device in relation to the phantom 11
6.7. Tissue Dielectric Parameters 14
6.8. Tissue-equivalent Liquid Properties 15
6.9. System Check 16
7. Measurement Procedure 17
8. Conducted Output Power 20
9. Exposure Position Consideration 23
9.1. EUT Antenna Location 23
9.2. Test Position Consideration 23
10. SAR Test Results Summary 24
10.1. Body-Worn 1g SAR Data 24
10.2. Measurement Uncertainty (150MHz-6GHz) 26
10.3. Test Equipment List 26
11. System Check Results 29
12. SAR Test Data 35
Appendix A: EUT Photos 45
Appendix B: Test Setup Photos 47
Appendix C: Probe Calibration Certificate 48
Appendix D: Dipole Calibration Report 66
Appendix E: SAR SYSTEM VALIDATION 90

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1. General Product Information

1.1. EUT description

Product Name.....:	Portable Gaming Computer（Tablet computer）
Model/Type reference.....:	AYANEO Pocket Micro
Sample Number.....:	TCT241107E029-0101/01
Rating(s).....:	Rechargeable Li-ion Battery DC 3.85V
Wi-Fi 2.4G	
Supported type.....:	802.11b/802.11g/802.11n
Modulation Type.....:	802.11b: DSSS; 802.11g/802.11n/:OFDM
Operation Frequency.....:	802.11b/802.11g/802.11n(HT20):2412MHz~2462MHz; 802.11n(HT40):2422MHz~2452MHz
Channel number.....:	802.11b/802.11g/802.11n(HT20):11; 802.11n(HT40)/:7
Channel separation.....:	5MHz
Bluetooth	
Bluetooth Version.....:	Supported 5.2
Modulation.....:	GFSK(1Mbps) , π/4-DQPSK(2Mbps) , 8-DPSK(3Mbps)
Operation Frequency.....:	2402MHz~2480MHz
Channel number.....:	79/40
Channel separation.....:	1MHz/2MHz
Wi-Fi 5G	
Operation Frequency.....:	Band 1: 5150 MHz -5250 MHz Band 3: 5725 MHz -5850 MHz
Channel Bandwidth.....:	802.11a: 20MHz 802.11n: 20MHz, 40MHz 802.11ac: 20MHz, 40MHz, 80MHz
Modulation Technology.....:	Orthogonal Frequency Division Multiplexing(OFDM)
Modulation Type.....:	256QAM, 64QAM, 16QAM, BPSK, QPSK

1.2. Model(s) list

None.

2. Test standard

The tests were performed according to following standards:
FCC 47 CFR §2.1093
IEEE1528-2013:Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate in the Human Head from Wireless Communications Devices: Measurement Techniques
KDB447498 D01:General RF Exposure Guidance v06
KDB865664 D01:SAR measurement 100MHz to 6GHz v01r04
KDB865664 D02:RF Exposure Reporting v01r02.
KDB248227 D01:802.11 wi-fi SAR v02r02
KDB690783 D01:SAR Listings on Grant v01r03
KDB941225 D07: UMPC Mini Tablet v01r02

3. Facilities and Accreditations

3.1. Facilities

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

- FCC - Registration No.: 645098
  SHENZHEN TONGCE TESTING LAB
  Designation Number: CN1205
  The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.
- IC - Registration No.: 10668A
  SHENZHEN TONGCE TESTING LAB
  CAB identifier: CN0031
  The testing lab has been registered by Innovation, Science and Economic Development Canada for radio equipment testing.

3.2. Location

SHENZHEN TONGCE TESTING LAB.
Address: 2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China
Environment Condition:

Temperature:	18°C ~25°C
Humidity:	35%~75% RH
Atmospheric Pressure:	1011 mbar

4. Test Result Summary

The maximum results of Specific Absorption Rate (SAR) found during test as bellows:
<Highest Reported standalone SAR Summary>

Exposure Position	Frequency Band	Reported SAR (W/kg)	Equipment Class	Highest Reported SAR (W/kg)
Body-worn 1-g SAR (5 mm Gap)	WLAN 2.4 GHz	**0.27**	DTS	**0.27**
	BLE	0.11		
	EDR	0.06	DSS	
	WLAN 5.2 GHz	0.22	NII	
	WLAN 5.8 GHz	0.25		

Note:

1. This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

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5. RF Exposure Limit

Type Exposure	SAR (W/kg)
	Uncontrolled Exposure Limit
Spatial Peak SAR (averaged over any 1 g of tissue)	1.60
Spatial Peak SAR (hands/wrists/feet/ankles averaged over 10g)	4.00
Spatial Peak SAR (averaged over the whole body)	0.08

Note:

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

6. SAR Measurement System Configuration

6.1. SAR Measurement Set-up

The OPENSAR system for performing compliance tests consist of the following items:

A standard high precision 6-axis robot (KUKA) with controller and software.

KUKA Control Panel (KCP)

A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with a Video Positioning System (VPS).

The stress sensor is composed with mechanical and electronic when the electronic part detects a change on the electro-mechanical switch; it sends an “Emergency signal” to the robot controller that to stop robot’s moves A computer operating Windows XP.

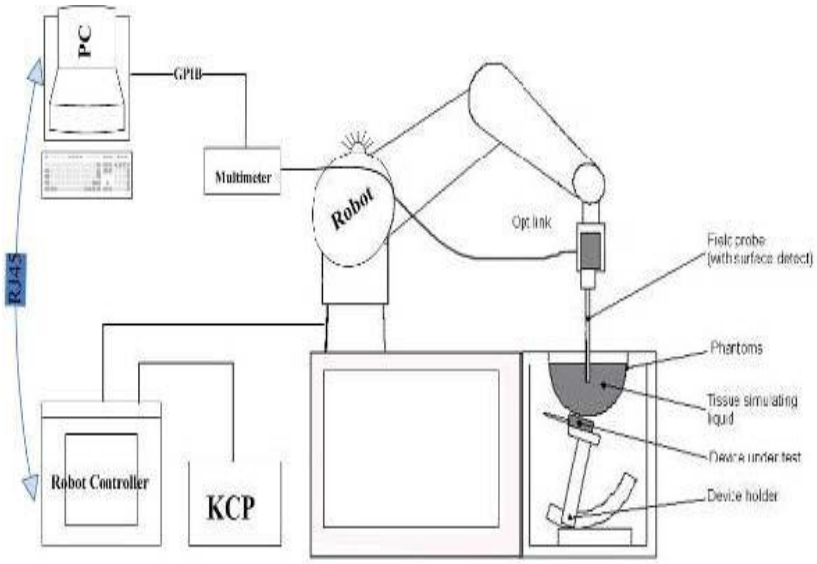
OPENSAR software Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

The SAM phantom enabling testing left-hand right-hand and body usage.

The Position device for handheld EUT

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles to validate the proper functioning of the system.



KUKA SAR Test Sysytem Configuration

6.2. E-field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by MVG).
The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.
This probe has a built in optical surface detection system to prevent from collision with phantom.

Probe Specification
Construction Symmetrical design with triangular core
Interleaved sensors
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration ISO/IEC 17025 calibration service available.

Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 25/22 EPGO375
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1:R1=0.197MΩ Dipole 2:R3=0.230MΩ Dipole 3:R3=0.208MΩ

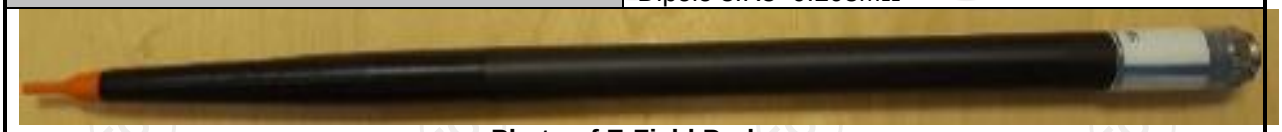
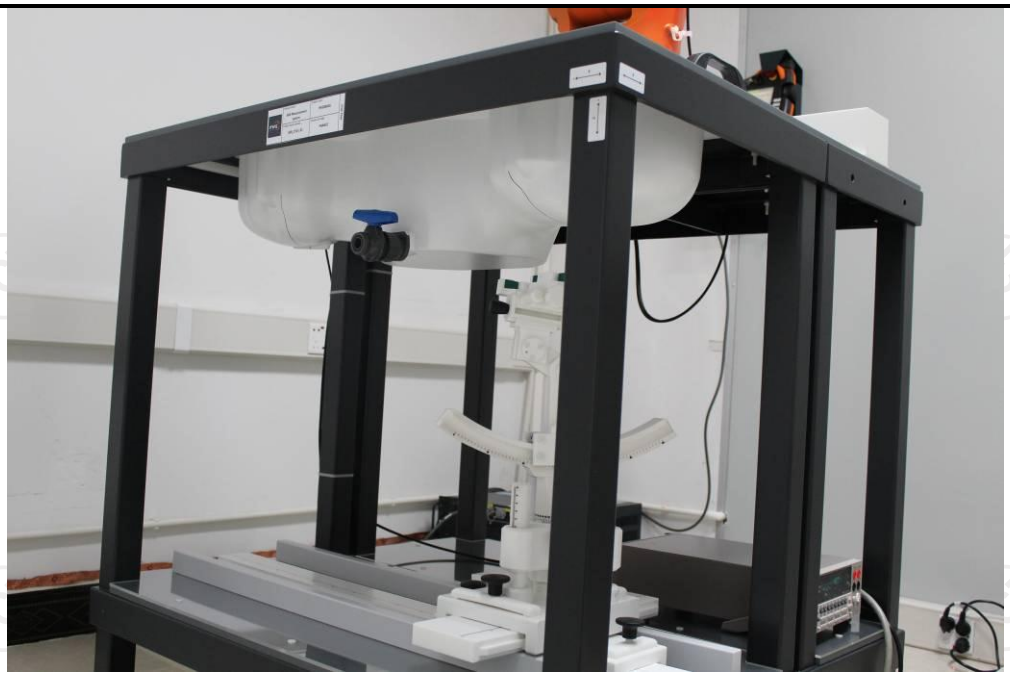


Photo of E-Field Probe

6.3. Phantom

The SAM Phantom SAM120 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is in compliance with the specification set in IEEE1528-2013.
The phantom enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region.
A cover prevents the evaporation of the liquid.
Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections.
Body SAR testing also used the flat section between the head profiles.

Name: COMOSAR IEEE SAM PHANTOM
S/N: SN 19/15 SAM 120
Manufacture: MVG

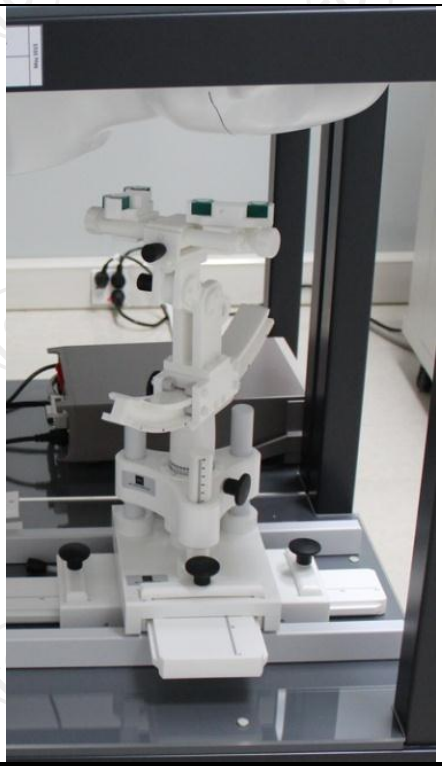


SAM Twin Phantom

6.4. Device Holder

In combination with the Generic Twin Phantom SAM120, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening.
The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications.
The device holder can be locked at different phantom locations (left head, right head, flat phantom).

COMOSAR Mobile phone positioning system



6.5. Data Storage and Evaluation

Data Storage

The OPENSAR software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation

The OPENSAR software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the OPENSAR components. In the direct measuring mode of the millimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$Vi = Ui + Ui2 \cdot c\,f / d\,c\,pi$$

With Vi = compensated signal of channel i (i = x, y, z)
Ui = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (MVG parameter)
dcpi = diode compression point (MVG parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: $Ei = (Vi / Normi \cdot ConvF)1/2$

H-field probes: $Hi = (Vi)1/2 \cdot (ai0 + ai1\,f + ai2f2) / f$

With Vi = compensated signal of channel i (i = x, y, z)
Normi = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)2] for E-field Probes
ConvF = sensitivity enhancement in solution
aij = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strength of channel i in V/m
Hi = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

Etot = (Ex2+ EY2+ Ez2)1/2

The primary field data are used to calculate the derived field units.

SAR = (Etot) 2 · σ / (ρ · 1000)

with SAR = local specific absorption rate in mW/g
Etot = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

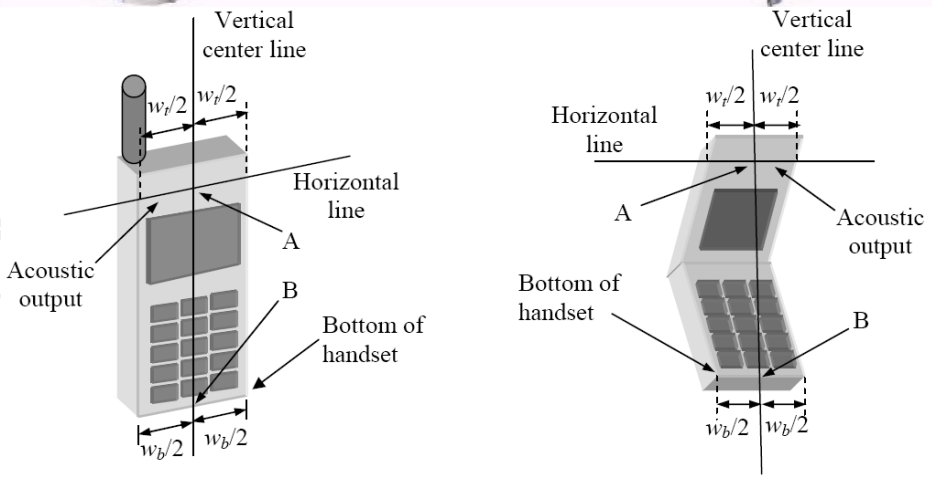
Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

6.6. Position of the wireless device in relation to the phantom

Handset Reference Points

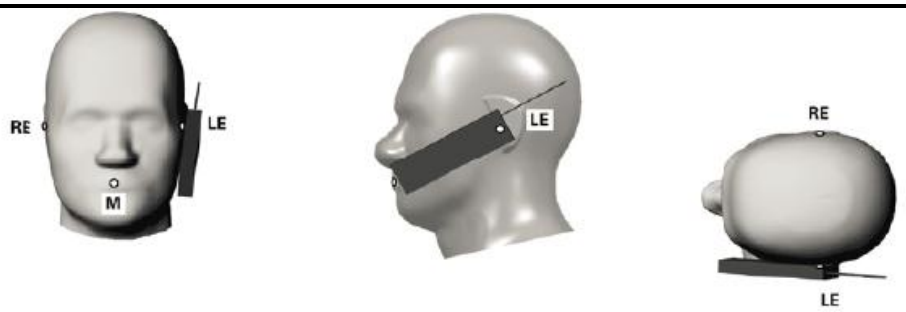
Ppwe = Etot2 / 3770 or Ppwe = Htot2 · 37.7

With Ppwe = equivalent power density of a plane wave in mW/cm2
Etot = total electric field strength in V/m
Htot = total magnetic field strength in A/m

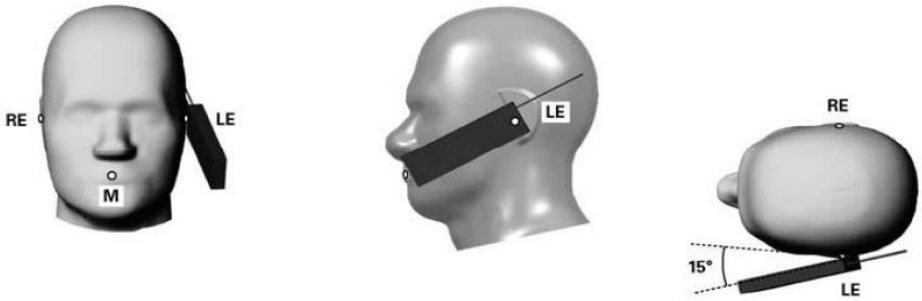


Wt Width of the handset at the level of the acoustic
Wb Width of the bottom of the handset
A Midpoint of the width wt of the handset at the level of the acoustic output
B Midpoint of the width wb of the bottom of the handset

Positioning for Cheek / Touch



Positioning for Ear / 15º Tilt



Body Worn Accessory Configurations
To position the device parallel to the phantom surface with either keypad up or down.
To adjust the device parallel to the flat phantom.
To adjust the distance between the device surface and the flat phantom to 15mm or holster surface and the flat phantom to 0 mm.

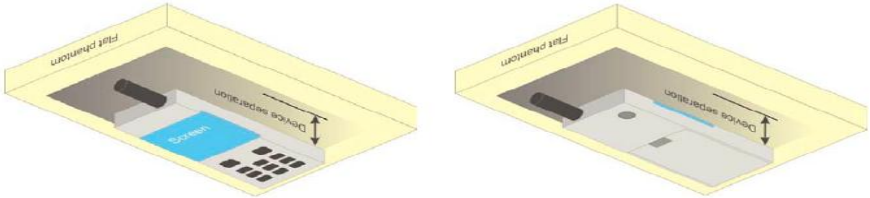


Illustration for Body Worn Position

Ireless Router（Hotspot）Configurations
Some battery-operated handsets have the capability to transmit and receive internet connectivity through simultaneous transmission of WIFI in conjunction with a separate licensed transmitter. The FCC has provided guidance in KDB Publication 941225 D06 where SAR test considerations for handsets (L x W ≥
9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges of the device with antennas 2.5 cm or closer to the edge of the device, 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 WIFI 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. Therefore, SAR must be evaluated for each frequency transmission and mode separately and summed with the WIFI transmitter according to KDB 648474 publication procedures. The “Portable Hotspot” feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

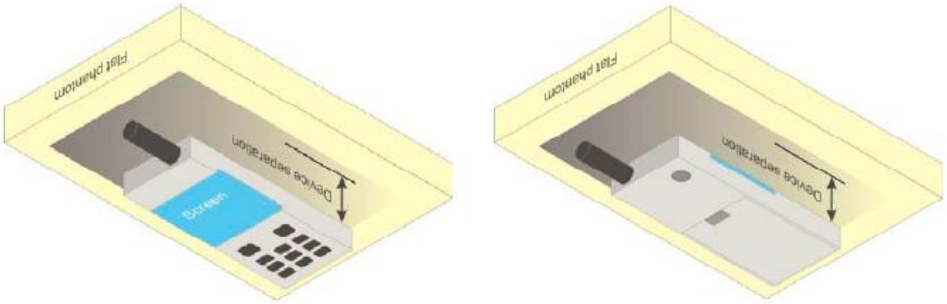
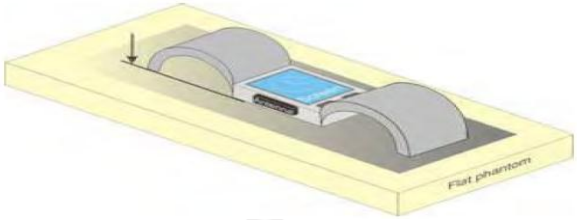


Illustration for Hotspot Position

Limb-worn device

A limb-worn device is a unit whose intended use includes being strapped to the arm or leg of the user while transmitting (except in idle mode). It is similar to a body-worn device. Therefore, the test positions of 6.1.4.4 also apply. The strap shall be opened so that it is divided into two parts as shown in Figure 9. The device shall be positioned directly against the phantom surface with the strap straightened as much as possible and the back of the device towards the phantom.

If the strap cannot normally be opened to allow placing in direct contact with the phantom surface, it may be necessary to break the strap of the device but ensuring to not damage the antenna.



Test position for limb-worn devices

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6.7. Tissue Dielectric Parameters

The liquid used for the frequency range of 100MHz-6G consisted of water, sugar, salt and Cellulose. The liquid has been previously proven to be suited for worst-case. The following Table shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.
The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the determine of the dielectric parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ±5% of the target values.
The following materials are used for producing the tissue-equivalent materials

Targets for tissue simulating liquid

Frequency (MHz)	Liquid Type	Liquid Type (σ)	± 5% Range	Permittivity (ε)	± 5% Range
300	Head	0.87	0.83~0.91	45.3	43.04~47.57
450	Head	0.87	0.83~0.91	43.5	41.33~45.68
835	Head	0.90	0.86~0.95	41.5	39.43~43.58
900	Head	0.97	0.92~1.02	41.5	39.43~43.58
1800-2000	Head	1.40	1.33~1.47	40.0	38.00~42.00
2450	Head	1.80	1.71~1.89	39.2	37.24~41.16
2600	Head	1.96	1.86~2.06	39.0	37.05~40.95
3000	Head	2.40	2.28~2.52	38.5	36.58~40.43
5200	Head	4.66	4.43~4.89	36.0	34.20~37.80
5800	Head	5.27	5.01~5.53	35.3	33.54~37.07

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)

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6.8. Tissue-equivalent Liquid Properties

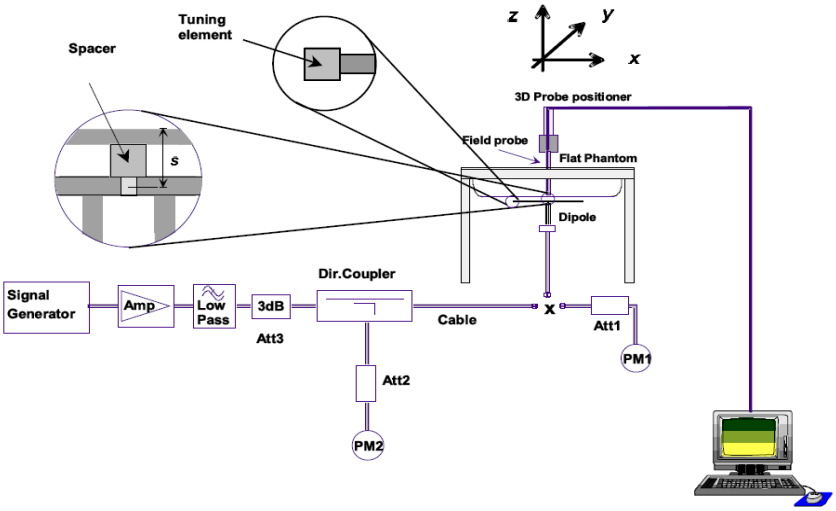
Test Date dd/mm/yy	Temp ℃	Tissue Type	Measured Frequency (MHz)	εr	σ(s/m)	Dev εr(%)	Dev σ(%)
11/11/2024	22℃	2450H	2437	38.20	1.72	-2.58	1.42
			2440	38.10	1.79	-2.83	4.07
			2441	38.10	1.80	-2.83	4.65
			2450	38.11	1.87	-2.78	3.89
11/13/2024	22℃	5200H	5200	36.24	4.67	0.67	0.21
			5230	35.84	4.58	-0.44	-2.35
11/14/2024	22℃	5800H	5795	36.14	5.05	-0.72	-3.90
			5800	35.78	5.07	1.36	-3.80

6.9. System Check

The SAR system must be validated against its performance specifications before it is deployed. When SAR probe and system component or software are changed, upgraded or recalibrated, these must be validated with the SAR system(s) that operates with such component. Reference dipoles are used with the required tissue-equivalent media for system validation.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).

System check is performed regularly on all frequency bands where tests are performed with the OPENSAR system.



System Check Set-up

Verification Results

Freq. (MHz)	Liquid Type	Measured Value in 100mW (W/kg)		Normalized to 1W (W/kg)		Target Value (W/kg)		Deviation (%)	
		1 g Average	10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average	10 g Average
2450	Head	5.14	2.51	51.40	25.10	53.26	24.15	-3.92	3.93
5200	Head	16.21	5.59	162.10	55.90	163.88	57.29	-1.09	-2.43
5800	Head	17.91	5.80	179.10	58.00	188.95	63.45	-5.21	-8.59

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

7. Measurement Procedure

Conducted power measurement

For WWAN power measurement, use base station simulator to configure EUT WWAN transition in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
Read the WWAN RF power level from the base station simulator.
For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band.
Connect EUT RF port through RF cable to the power meter or spectrum analyser, and measure WLAN/BT output power.

Conducted power measurement

Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
Place the EUT in positions as Appendix B demonstrates.
Set scan area, grid size and other setting on the MVG software.
Measure SAR results for the highest power channel on each testing position.
Find out the largest SAR result on these testing positions of each band.
Measure SAR results for other channels in worst SAR testing position if the Reported SAR or 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:

Power reference measurement
Area scan
Zoom scan
Power drift measurement

Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The MVG software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a “cube” measurement. The measured volume must include the 1g and 10 g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:
Extraction of the measured data (grid and values) from the Zoom Scan.

Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters).

Generation of a high-resolution mesh within the measured volume.

Interpolation of all measured values form the measurement grid to the high-resolution grid

Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface

Calculation of the averaged SAR within masses of 1g and 10g.

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Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement 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

Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r03 quoted below.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 mm ± 1 mm	½·δ·ln(2) mm ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
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 ≤ 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 1st 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	≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm	
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 IEEE Std 1528-2013 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB Publication 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.

Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD post-processor scan combine and subsequently superpose these measurement data to calculating the multiband SAR.

SAR Averaged Methods

In MVG, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1g and 10g cubes, the extrapolation distance should not be larger than 5 mm.

Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In MVG 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 dB. If the power drifts more than 5%, the SAR will be retested.

Power Drift measurement

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for

Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100KHz to 6GHz ,when the highest measurement 1-g SAR within a frequency band is <1.5W/kg, the extensive SAR measurement uncertainty analysis described IEEE Std 1528-2013 is not required in SAR report submitted for equipment approval.

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8. Conducted Output Power

WLAN 2.4G						
Mode	802.11b			802.11g		
Channel	1	6	11	1	6	11
Frequency	2412	2437	2462	2412	2437	2462
Average Power (dBm)	10.50	11.13	10.69	11.09	11.26	10.97
Mode	802.11n(HT20)			802.11n(HT40)		
Channel	1	6	11	3	6	9
Frequency	2412	2437	2462	2422	2437	2452
Average Power (dBm)	10.89	11.29	10.92	11.28	**11.46**	11.29

Bluetooth						
Mode	GFSK			Pi/4DQPSK		
Channel	0	39	78	0	39	78
Frequency	2402	2441	2480	2402	2441	2480
Average Power (dBm)	5.06	**5.98**	4.99	3.99	4.96	4.08
Mode	8DPSK			BLE(1M)		
Channel	0	39	78	0	20	39
Frequency	2402	2441	2480	2402	2440	2480
Average Power (dBm)	3.98	4.95	3.95	6.56	**7.40**	6.63
Mode	BLE(2M)					
Channel	0	20	39			
Frequency	2402	2440	2480			
Average Power (dBm)	5.40	7.39	6.27			

Note

1. Per KDB 248227 D01 v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. The output power of all data rate were prescan, just the worst case (the lowest data rate) of all mode were shown in report.

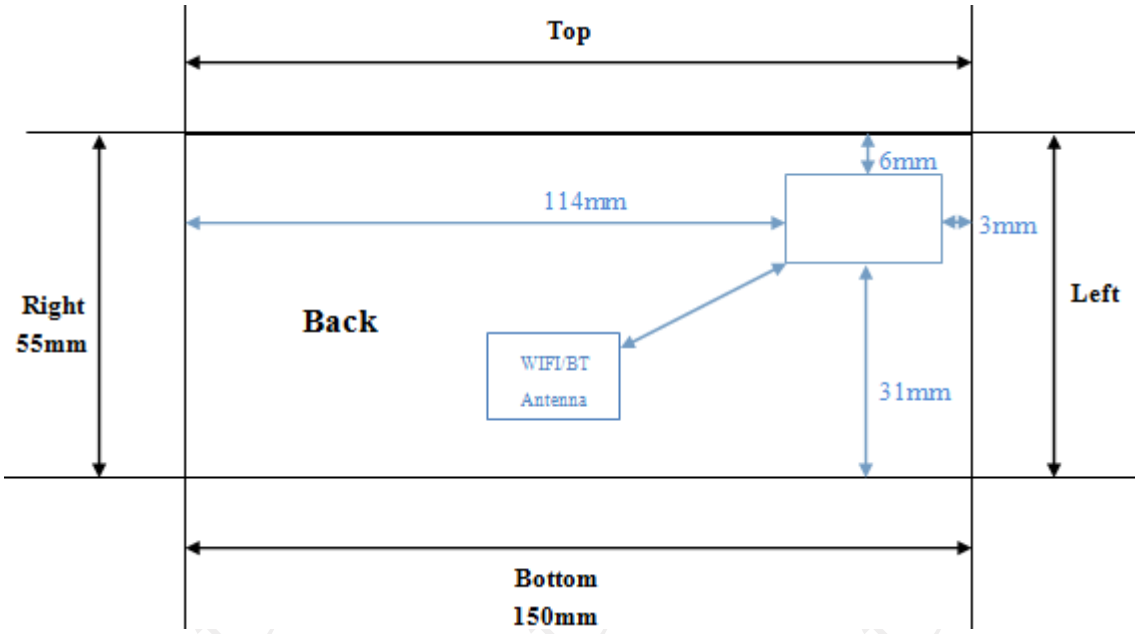
WLAN 5.2G						
Mode	IEEE 802.11a			IEEE 802.11n HT20		
Channel	36	40	48	36	40	48
Frequency	5180	5200	5240	5180	5200	5240
Average Power (dBm)	11.36	11.37	11.48	11.23	11.28	11.30
Mode	IEEE 802.11n HT40			IEEE 802.11ac VHT20		
Channel	38	46		36	40	48
Frequency	5190	5230		5180	5200	5240
Average Power (dBm)	11.46	**11.52**		11.28	11.30	11.25
Mode	IEEE 802.11ac VHT40			IEEE 802.11ac VHT80		
Channel	38	46		42		
Frequency	5190	5230		5210		
Average Power (dBm)	11.50	11.47		11.24		
WLAN 5.8G						
Mode	IEEE 802.11a			IEEE 802.11n HT20		
Channel	149	157	165	149	157	165
Frequency	5745	5785	5825	5745	5785	5825
Average Power (dBm)	10.26	10.37	10.44	10.25	10.42	10.36
Mode	IEEE 802.11n HT40			IEEE 802.11ac VHT20		
Channel	151	159		149	157	165
Frequency	5755	5795		5745	5785	5825
Average Power (dBm)	10.34	**10.59**		10.19	10.39	10.32
Mode	IEEE 802.11ac VHT40			IEEE 802.11ac VHT80		
Channel	151	159		155		
Frequency	5755	5795		5775		
Average Power (dBm)	10.35	10.53		10.12		

Note

1. Per KDB 248227 D01 v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. The output power of all data rate were prescan , just the worst case (the lowest data rate) of all mode were shown in report

9. Exposure Position Consideration

9.1. EUT Antenna Location



9.2. Test Position Consideration

Test Positions						
Mode	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
WIFI/ BT	Yes	Yes	Yes	**No**	**No**	Yes

Note:

1. Basing on KDB941225 D07 articular DUT edges were not required to be evaluated for SAR if the antenna-to-edge distance is greater than 2.5cm

10. SAR Test Results Summary

10.1. Body-Worn 1g SAR Data

Band	Mode	Test Position with 5mm	CH.	Freq. (MHz)	Ave. Power (dBm)	Tune-Up Limit (dBm)	Power Drift (%)	Meas. SAR1g (W/kg)	Scaling Factor	Reported SAR1g (W/kg)	Limit (W/Kg)
2.4G	802.11n	Back	6	2437	11.46	11.50	-1.78	0.27	1.009	**0.27**	**1.60**
		Front	6	2437	11.46	11.50	-1.95	0.16	1.009	0.16	
		Left	6	2437	11.46	11.50	0.66	0.05	1.009	0.05	
		Top	6	2437	11.46	11.50	-2.03	0.05	1.009	0.05	
5.2G	802.11n	Back	46	5230	11.52	12.00	-1.62	0.20	1.117	**0.22**	
		Front	46	5230	11.52	12.00	-1.58	0.12	1.117	0.13	
		Left	46	5230	11.52	12.00	2.30	0.05	1.117	0.06	
		Top	46	5230	11.52	12.00	0.94	0.03	1.117	0.03	
5.8G	802.11n	Back	159	5795	10.59	11.00	0.75	0.23	1.099	**0.25**	
		Front	159	5795	10.59	11.00	-1.98	0.12	1.099	0.13	
		Left	159	5795	10.59	11.00	2.30	0.05	1.099	0.05	
		Top	159	5795	10.59	11.00	0.79	0.06	1.099	0.07	

BT	GFSK	Back	39	2441	5.98	6.00	-1.57	0.06	1.005	**0.06**	**1.60**
		Front	39	2441	5.98	6.00	-1.95	0.02	1.005	0.02	
		Left	39	2441	5.98	6.00	/	<0.01	/	<0.01	
		Top	39	2441	5.98	6.00	/	<0.01	/	<0.01	
	BLE	Back	20	2440	7.40	7.50	-1.80	0.11	1.023	**0.11**	
		Front	20	2440	7.40	7.50	-1.59	0.07	1.023	0.07	
		Left	20	2440	7.40	7.50	0.30	0.02	1.023	0.02	
		Top	20	2440	7.40	7.50	-1.98	0.02	1.023	0.02	

Note:

1. Per KDB 447498 D01 v06, for each exposure position, if the highest output power channel Reported SAR ≤ 0.8W/kg, other channels SAR testing is not necessary.
2. Per KDB 447498 D01 v06, body-worn use is evaluated with the device positioned at 0 mm from a flat phantom filled with head tissue-equivalent medium.
3. Per KDB 447498 D01 v06, the report SAR is measured SAR value adjusted for maximum tune-up tolerance. Scaling Factor=10^[(tune-up limit power(dBm) - Ave.power power (dBm))/10], where tune-up limit is the maximum rated power among all production units.
   Reported SAR(W/kg)=Measured SAR (W/kg)*Scaling Factor.
4. Per KDB865664D01 v01r04 perform a second repeated measurement only the ratio of largest to smallest SAR for the original and first repeated measurement is >1.20 or when the original or repeated measurement is ⩾1.45W/kg.
5. Perform a second measurement only if the original, first and second repeated measurement is ⩾1.5w/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurement is >1.20.
6. Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg

10.2. Measurement Uncertainty (150MHz-6GHz)

Uncertainty Component	Description	Uncertainty Value(%)	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. 1g(%)	Std. Unc. 10g(%)	v
Measurement system									
Probe calibration	7.2.1	5.8	N	1	1	1	5.8	5.8	∞
Axial isotropy	7.2.1.1	3.5	R	$\sqrt{3}$	$(1-C_p)^{1/2}$	$(1-C_p)^{1/2}$	1.43	1.43	∞
Hemispherical isotropy	7.2.1.1	5.9	R	$\sqrt{3}$	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
Boundary Effects	7.2.1.4	1.00	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	7.2.1.2	4.70	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	7.2.1.2	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation Response	7.2.1.3	3	N	1	1	1	3.00	3.00	∞
Readout Electronics	7.2.1.5	0.5	N	1	1	1	0.50	0.50	∞
Response Time	7.2.1.6	0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	7.2.1.7	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF Ambient Conditions-Noise	7.2.3.7	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Conditions-Reflection	7.2.3.7	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioned mechanical Tolerance	7.2.2.1	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	7.2.2.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation interpolation and integration algorithms for Max.SAR evaluation	7.2.4	2.3	R	1	1	1	1.33	1.33	∞
Test sample related									
Test sample positioning	7.2.2.4.4	2.6	N	1	1	1	2.60	2.60	∞
Device holder uncertainty	7.2.2.4.2 7.2.2.4.3	3	N	1	1	1	3.00	3.00	∞
output power variation-SAR drift measurement	7.2.3.6	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
SAR scaling	7.2.5	2	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and tissue parameters									
Phantom uncertainty (shape and thickness tolerances)	7.2.2.2	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
uncertainty in SAR correction for deviation (in permittivity and conductivity)	7.2.6	2	N	1	1	0.84	2.00	1.68	∞
Liquid conductivity (temperature uncertainty)	7.2.3.5	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid conductivity -measurement uncertainty	7.2.3.3	4	N	1	0.23	0.26	0.92	1.04	∞
Liquid permittivity (temperature uncertainty)	7.2.3.5	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid permittivity measurement uncertainty	7.2.3.4	5	N	1	0.23	0.26	1.15	1.30	∞
Combined standard uncertainty			RSS				10.83	10.54	
Expanded uncertainty (95%CONFIDENCEINTERVAL			k				21.26	21.08	

UNCERTAINTY FOR PERFORMANCE CHECK									
Uncertainty Component	Description	Uncertainty Value(%)	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. 1g(%)	Std. Unc. 10g(%)	v
Measurement system									
Probe calibration	7.2.1	5.8	N	1	1	1	5.8	5.8	∞
Axial isotropy	7.2.1.1	3.5	R	$\sqrt{3}$	$(1-C_p)^{1/2}$	$(1-C_p)^{1/2}$	1.43	1.43	∞
Hemispherical isotropy	7.2.1.1	5.9	R	$\sqrt{3}$	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
Boundary Effects	7.2.1.4	1.00	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	7.2.1.2	4.70	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	7.2.1.2	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation Response	7.2.1.3	3	N	1	1	1	0.00	0.00	∞
Readout Electronics	7.2.1.5	0.5	N	1	1	1	0.50	0.50	∞
Response Time	7.2.1.6	0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	7.2.1.7	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF Ambient Conditions-Noise	7.2.3.7	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Conditions-Reflection	7.2.3.7	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioned mechanical Tolerance	7.2.2.1	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	7.2.2.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation interpolation and integration algorithms for Max.SAR evaluation	7.2.4	2.3	R	1	1	1	1.33	1.33	∞
Dipole									
Deviation of experimental source from numerical source		4	N	1	1	1	4.00	4.00	∞
Input power and SAR drift measurement	7.2.3.6	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole axis to liquid distance		2	R	$\sqrt{3}$	1	1			∞
Phantom and tissue parameters									
Phantom uncertainty (shape and thickness tolerances)	7.2.2.2	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
uncertainty in SAR correction for deviation (in permittivity and conductivity)	7.2.6	2	N	1	1	0.84	2.00	1.68	∞
Liquid conductivity (temperature uncertainty)	7.2.3.5	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid conductivity -measurement uncertainty	7.2.3.3	4	N	1	0.23	0.26	0.92	1.04	∞
Liquid permittivity (temperature uncertainty)	7.2.3.5	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid permittivity measurement uncertainty	7.2.3.4	5	N	1	0.23	0.26	1.15	1.30	∞
Combined standard uncertainty			RSS				10.15	10.05	
Expanded uncertainty (95%CONFIDENCEINTERVAL			k				20.29	20.10	

10.3. Test Equipment List

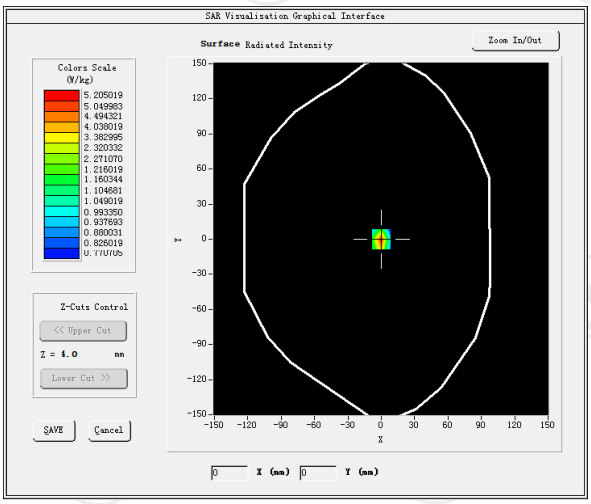
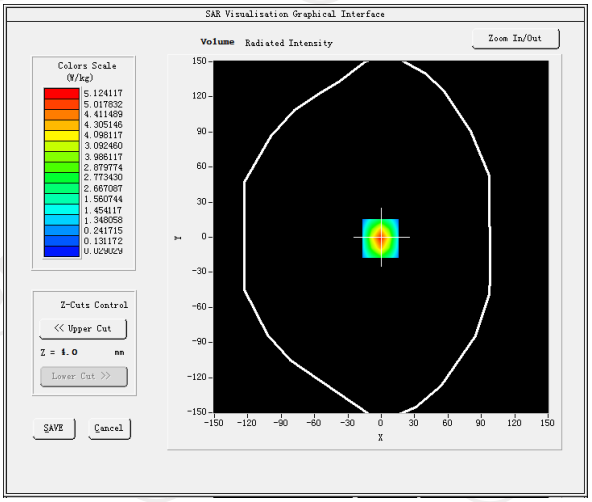
Test Equipment	Manufacturer	Model	Serial Number	Calibration	
				Calibration Date (D.M.Y)	Calibration Due (D.M.Y)
PC	Lenovo	H3050	N/A	N/A	N/A
Signal Generator	Angilent	N5182A	MY47070282	Jun. 27, 2024	Jun. 26, 2025
Multimeter	Keithley	Multimeter 2000	4078275	Jun. 27, 2024	Jun. 26, 2025
Network Analyzer	Agilent	8753E	US38432457	Jun. 27, 2024	Jun. 26, 2025
Wireless Communication Test Set	R & S	CMU200	111382	Jun. 27, 2024	Jun. 26, 2025
Wideband Radio Communication Tester	R&S	CMW500	114220	Jun. 27, 2024	Jun. 26, 2025
Power Meter	Agilent	E4418B	GB43312526	Jun. 27, 2024	Jun. 26, 2025
Power Meter	Agilent	E4416A	MY45101555	Jun. 27, 2024	Jun. 26, 2025
Power Meter	Agilent	N1912A	MY50001018	Jun. 27, 2024	Jun. 26, 2025
Power Sensor	Agilent	E9301A	MY41497725	Jun. 27, 2024	Jun. 26, 2025
Power Sensor	Agilent	E9327A	MY44421198	Jun. 27, 2024	Jun. 26, 2025
Power Sensor	Agilent	E9323A	MY53070005	Jun. 27, 2024	Jun. 26, 2025
Power Amplifier	PE	PE15A4019	112342	N/A	N/A
Directional Coupler	Agilent	722D	MY52180104	N/A	N/A
Attenuator1	Chensheng	FF779	134251	N/A	N/A
Attenuator2	Chensheng	FF779	134251	N/A	N/A
Attenuator3	Chensheng	FF779	134251	N/A	N/A
E-Field PROBE	MVG	SSE2	SN 25/22 EPGO375	Jun. 29, 2024	Jun. 28, 2025
DIPOLE 2450	MVG	SID 2450	SN 16/15 DIP 2G450-374	Jun. 05, 2024	Jun. 04, 2027
DIPOLE 5000-6000	MVG	SWG 5500	SN 13/14 WGA 32	May. 15, 2024	May. 14, 2025
Limesar Dielectric Probe	MVG	SCLMP	SN 19/15 OCPG71	Jun. 05, 2024	Jun. 04, 2025
Communication Antenna	MVG	ANTA59	SN 39/14 ANTA59	N/A	N/A
Mobile Phone Position Device	MVG	MSH101	SN 19/15 MSH101	N/A	N/A
Dummy Probe	MVG	DP66	SN 13/15 DP66	N/A	N/A
SAM PHANTOM	MVG	SAM120	SN 19/15 SAM120	N/A	N/A
PHANTOM TABLE	MVG	TABP101	SN 19/15 TABP101	N/A	N/A
Robot TABLE	MVG	TABP61	SN 19/15 TABP61	N/A	N/A
6 AXIS ROBOT	KUKA	KR6-R900	501822	N/A	N/A

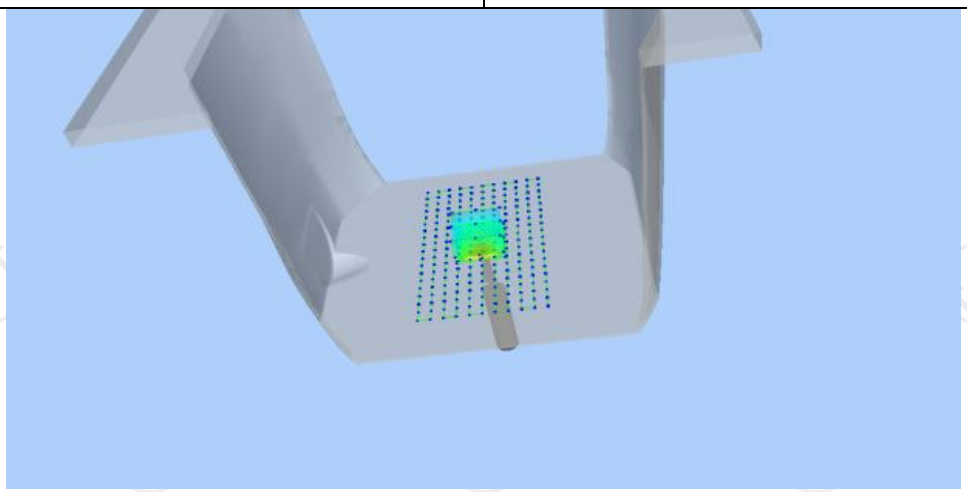
Note: *1.N/A means this equipment no need to calibrate*
2.Each Time means this device need to calibrate every use time
3. The dipole was not damaged properly repaired.
4. The measured SAR deviates from the calibrated SAR value by less than 10%
5. The most recent return-loss result meets the required 20 dB minimum return-loss requirement
6. The most recent measurement of the real or imaginary parts of the impedance deviates by less than 5 Ω from the previous measurement.

11. System Check Results

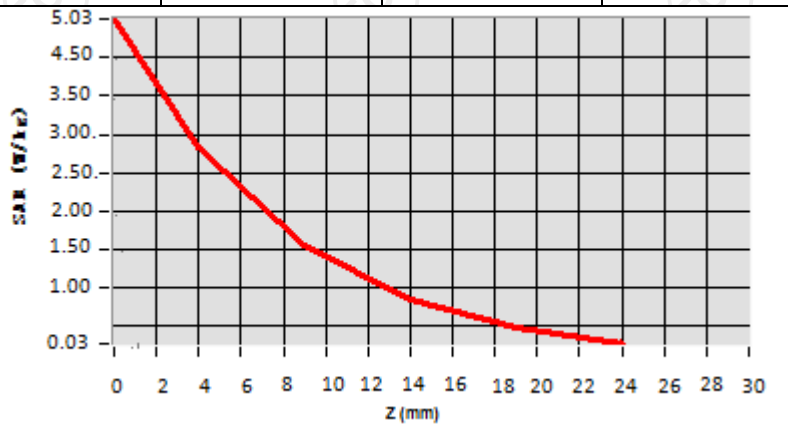
Date of measurement: 11/11/2024 Test mode: 2450MHz (Head)
Product Description: Validation
Dipole Model: SID2450
E-Field Probe: SSE2 (SN 25/22 EPGO375)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	2.31
Frequency (MHz)	2450.000000
Relative permittivity (real part)	38.112647
Relative permittivity (imaginary part)	13.546980
Conductivity (S/m)	1.874294
Variation (%)	1.030000
SAR 10g (W/Kg)	**2.508459**
SAR 1g (W/Kg)	**5.142079**

SURFACE SAR	**VOLUME SAR**
	



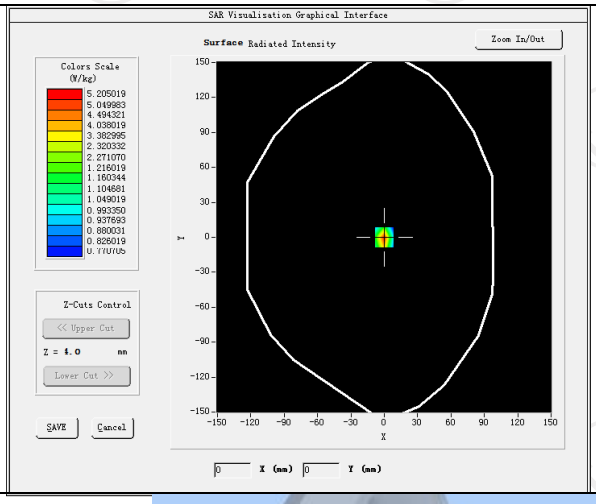
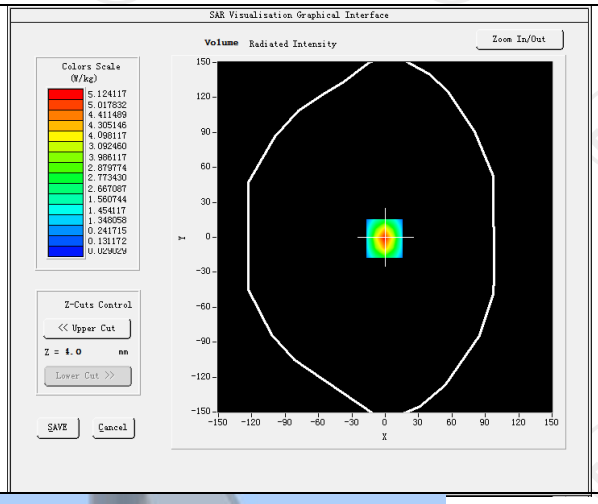
Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.0262	2.7584	1.5026	0.8252	0.4125

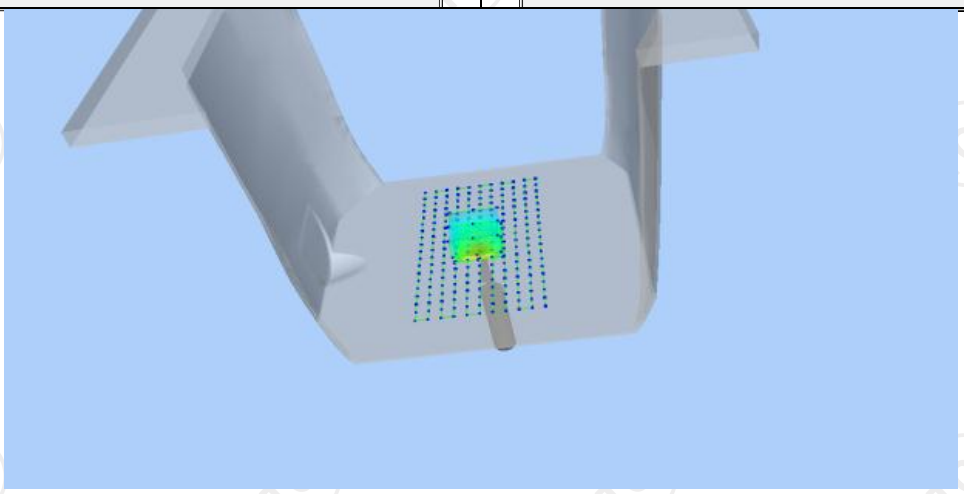


Hot spot position

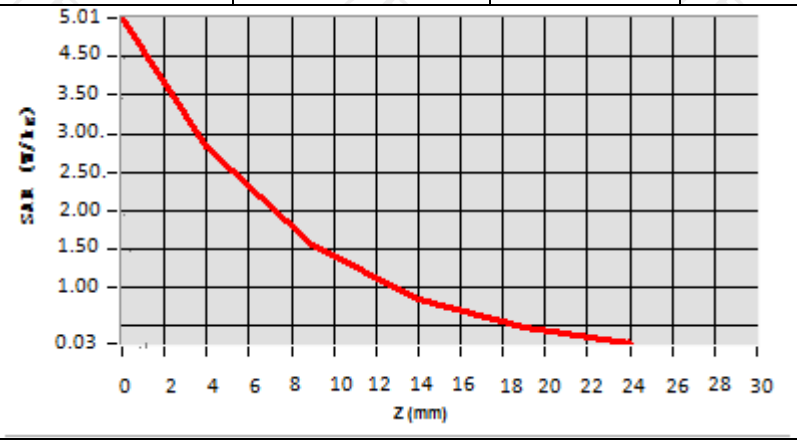
Date of measurement: 11/13/2024 Test mode: 5200MHz (Head)
Product Description: Validation
Dipole Model: SID5200
E-Field Probe: SSE2 (SN 25/22 EPGO375)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	2.01
Frequency (MHz)	5200.000000
Relative permittivity (real part)	36.242018
Relative permittivity (imaginary part)	13.679428
Conductivity (S/m)	4.667125
Variation (%)	-0.980000
SAR 10g (W/Kg)	**5.592581**
SAR 1g (W/Kg)	**16.208912**

SURFACE SAR	**VOLUME SAR**
	



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.0132	2.7584	1.5026	0.8252	0.4125

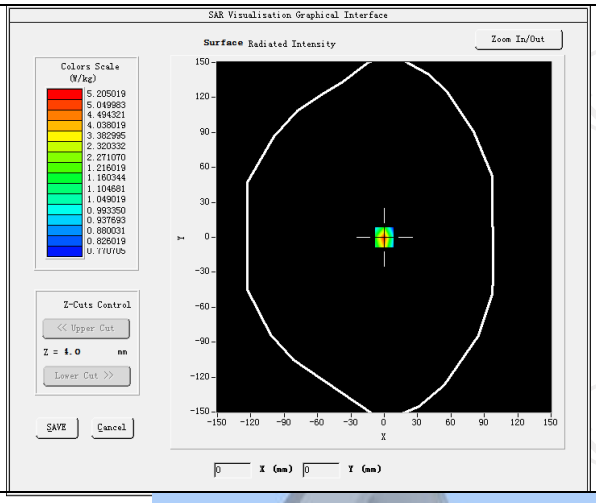
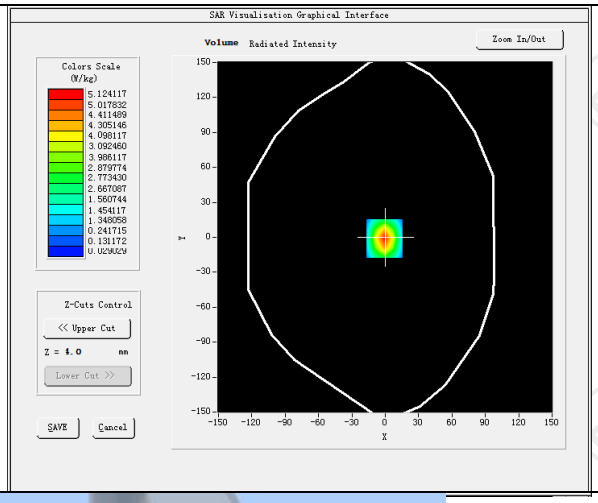


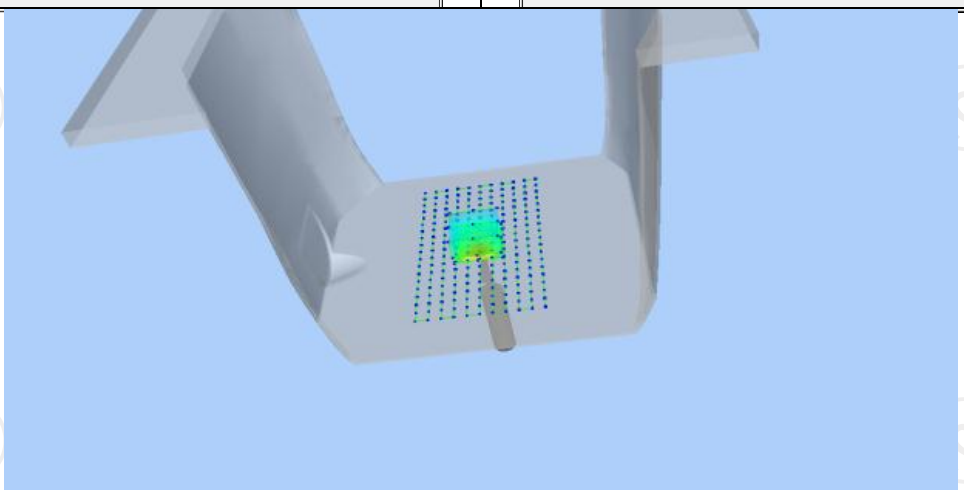
Hot spot position

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

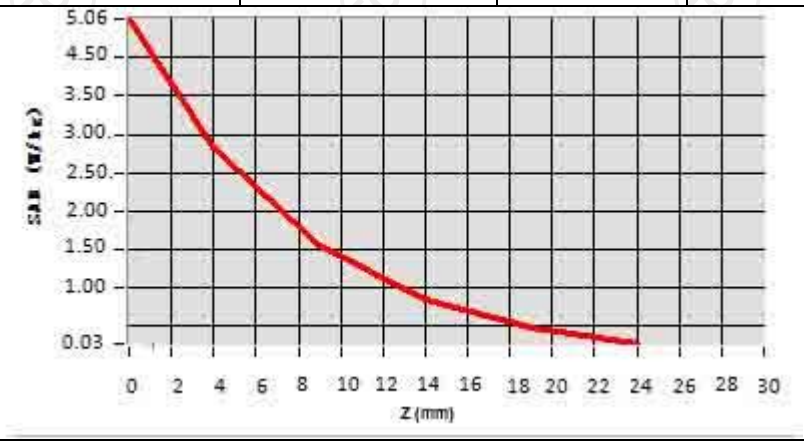
Date of measurement: 11/14/2024 Test mode: 5800MHz (Head)
Product Description: Validation
Dipole Model: SID5800
E-Field Probe: SSE2 (SN 25/22 EPGO375)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	2.06
Frequency (MHz)	5800.000000
Relative permittivity (real part)	35.782647
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	5.072614
Variation (%)	1.630000
SAR 10g (W/Kg)	**5.801258**
SAR 1g (W/Kg)	**17.907812**

SURFACE SAR	**VOLUME SAR**
	



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.0622	2.8054	1.5421	0.8321	0.4130



Hot spot position

12. SAR Test Data

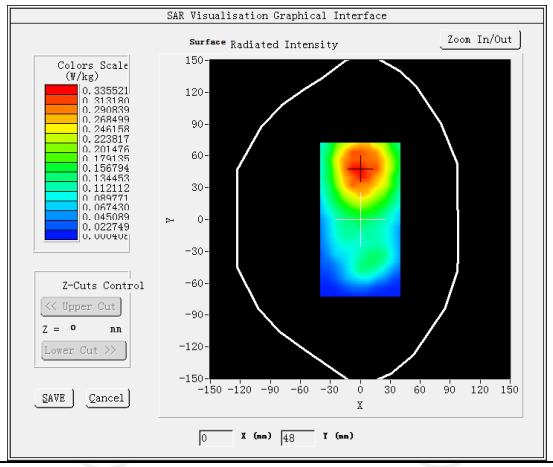
2.4G

MEASUREMENT 1

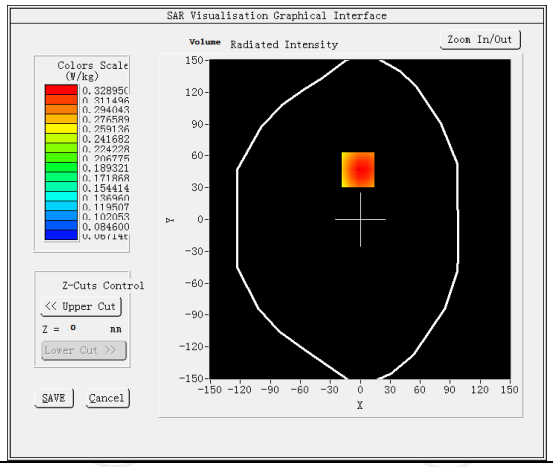
Middle Band SAR (Channel 6): Date: 11/11/2024

Frequency (MHz)	2437.000000
Relative permittivity (real part)	38.202204
Relative permittivity (imaginary part)	13.341421
Conductivity (S/m)	1.720321
Variation (%)	-1.780000
Crest Factor	1.0
Probe Conversion factor	2.31
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(5mm)
Band	IEEE 802.11n ISM

SURFACE SAR

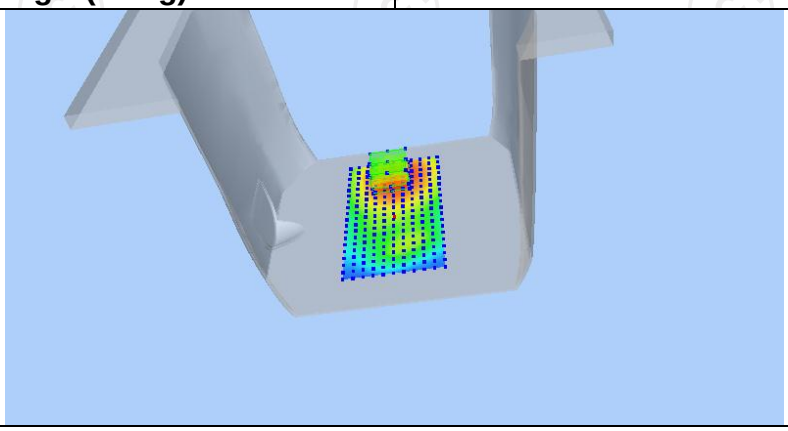


VOLUME SAR

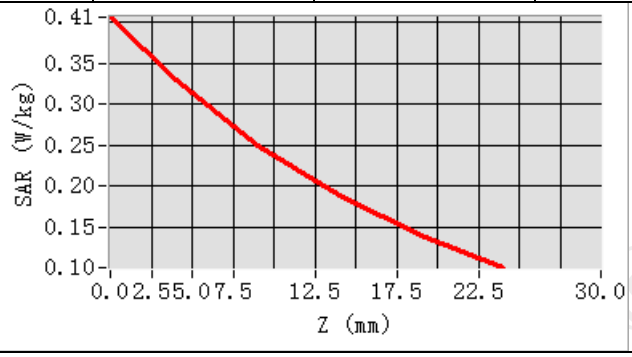


Maximum location: X=-2.00, Y=47.00SAR Peak: 0.41 W/kg

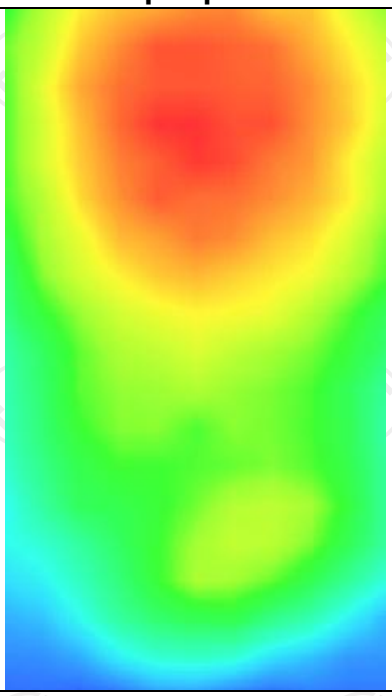
SAR 10g (W/Kg)	0.185614
SAR 1g (W/Kg)	0.272154



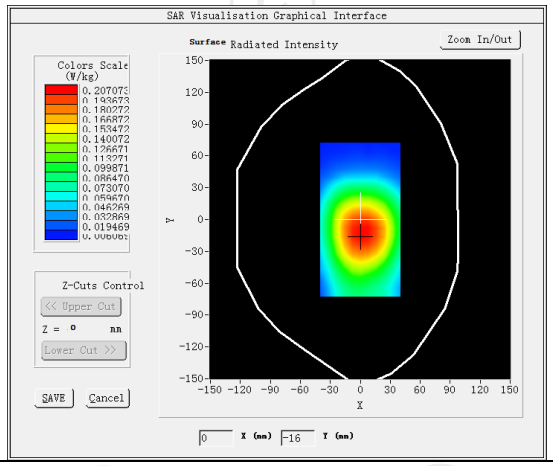
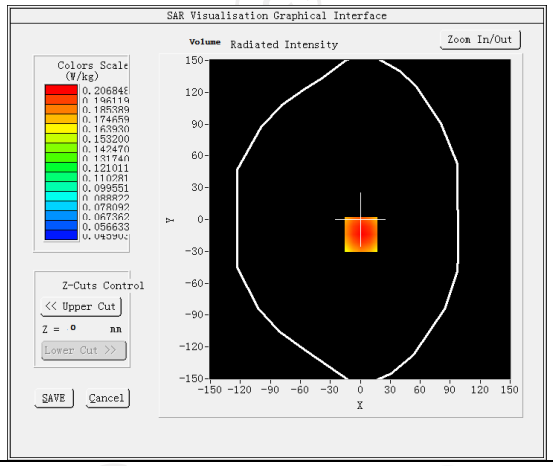
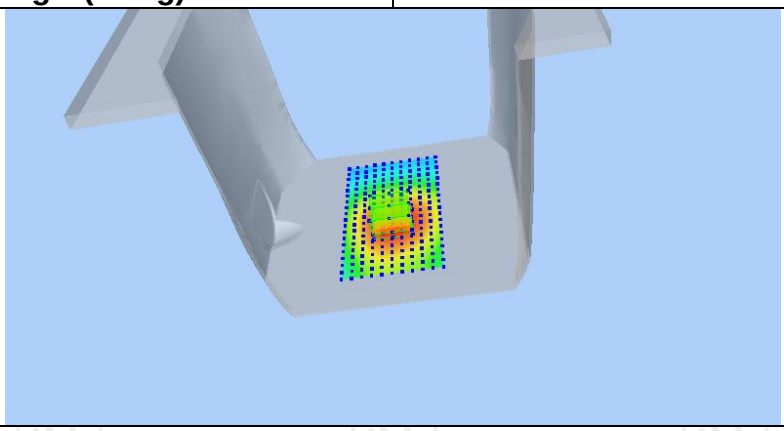
Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.4060	0.3290	0.2505	0.1889	0.1406



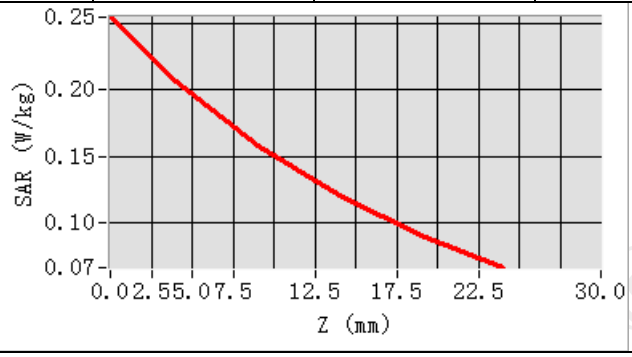
Hot spot position



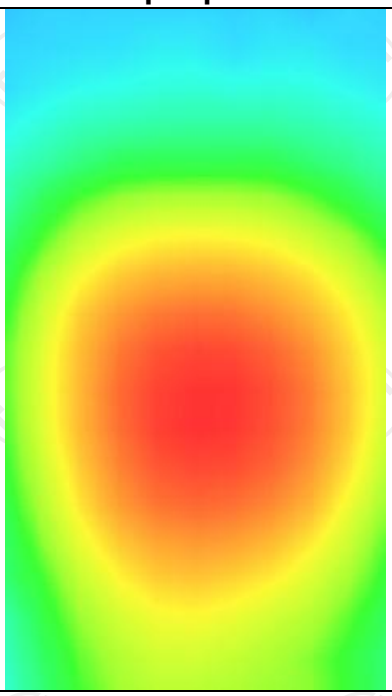
5.2G

MEASUREMENT 1	
SAR (Channel 46):	Date: 11/13/2024
Frequency (MHz)	5230.000000
Relative permittivity (real part)	35.842384
Relative permittivity (imaginary part)	16.261421
Conductivity (S/m)	4.575302
Variation (%)	-1.620000
Crest Factor	1.0
Probe Conversion factor	2.01
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=10mm dy=10mm, h= 5.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete/ndx=4mm dy=4mm, h= 2.00 mm
Phantom	Validation plane
Device Position	Body back(5mm)
Band	IEEE 802.11n ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=1.00, Y=-14.00 SAR Peak: 0.26W/kg	
SAR 10g (W/Kg)	0.145729
SAR 1g (W/Kg)	0.199618
	

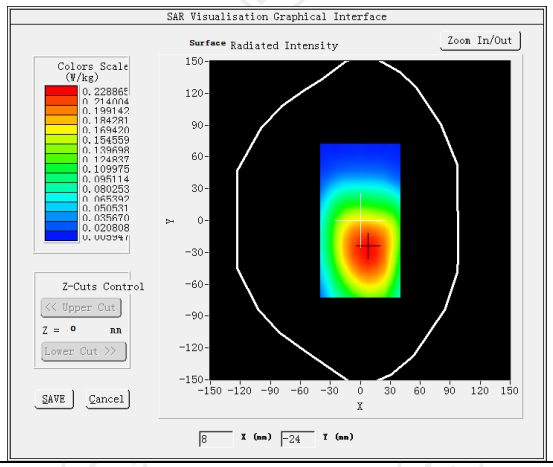
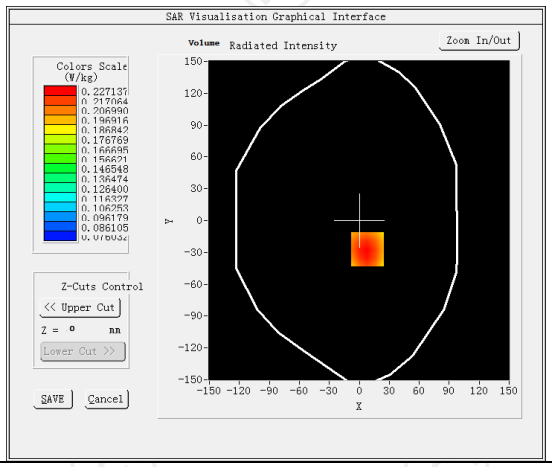
Z (mm)	0.00	2.00	7.00	12.00	17.00
SAR (W/Kg)	0.2547	0.2068	0.1582	0.1202	0.0904

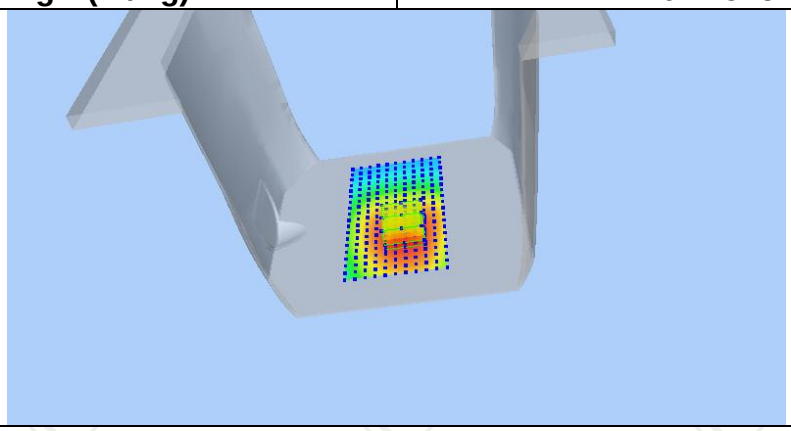


Hot spot position

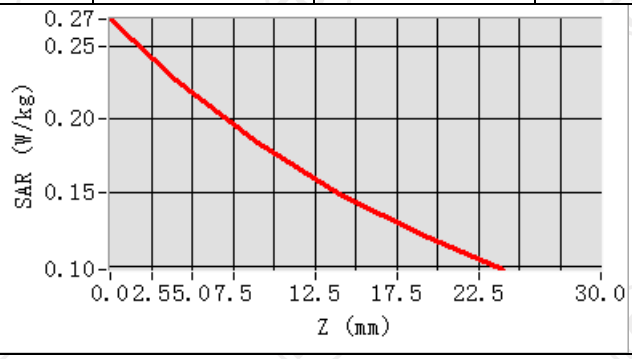


5.8G

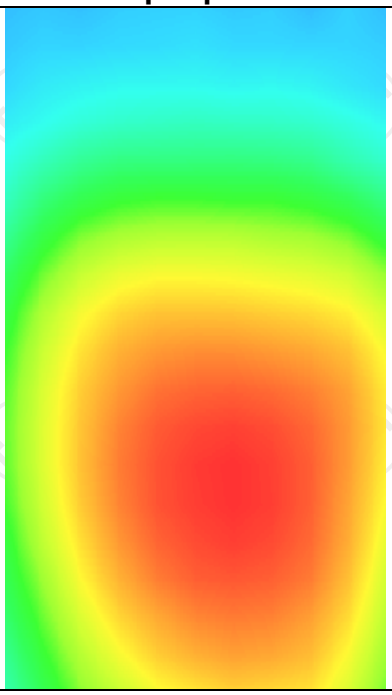
MEASUREMENT 1	
SAR (Channel 159):	Date: 11/14/2024
Frequency (MHz)	5795.000000
Relative permittivity (real part)	36.144301
Relative permittivity (imaginary part)	16.479201
Conductivity (S/m)	5.053031
Variation (%)	0.750000
Crest Factor	1.0
Probe Conversion factor	2.06
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=10mm dy=10mm, h= 5.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete/ndx=4mm dy=4mm, h= 2.00 mm
Phantom	Validation plane
Device Position	Body back(5mm)
Band	IEEE 802.11n ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=8.00, Y=-27.00 SAR Peak: 0.27 W/kg	
SAR 10g (W/Kg)	0.174452
SAR 1g (W/Kg)	0.225282



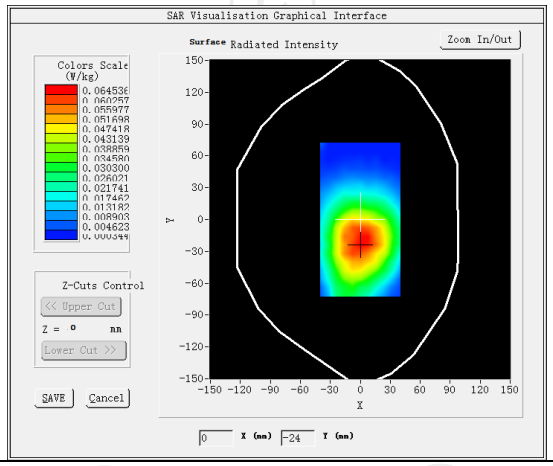
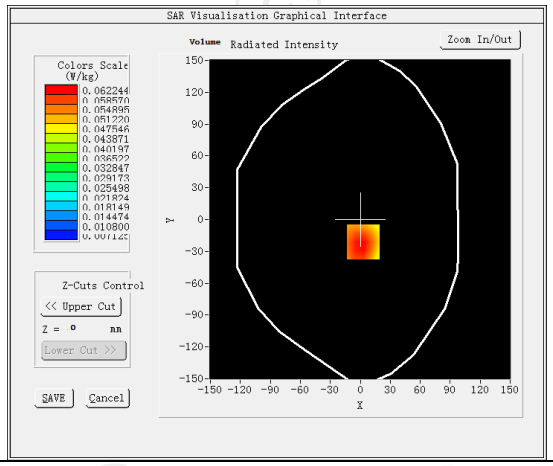
Z (mm)	0.00	2.00	7.00	12.00	17.00
SAR (W/Kg)	0.2685	0.2271	0.1840	0.1493	0.1212

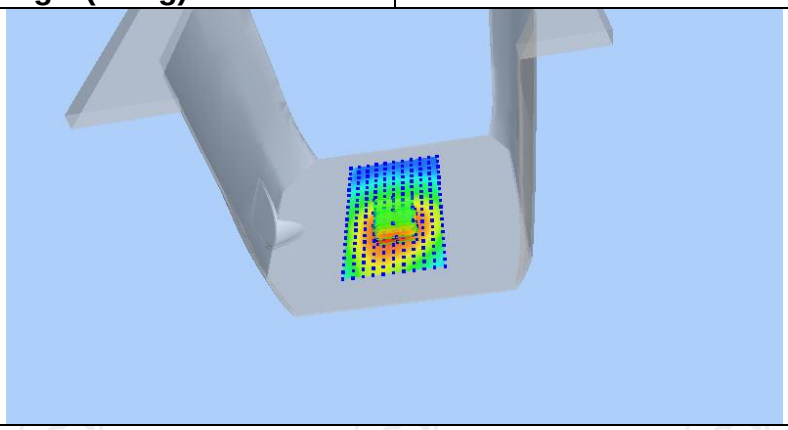


Hot spot position

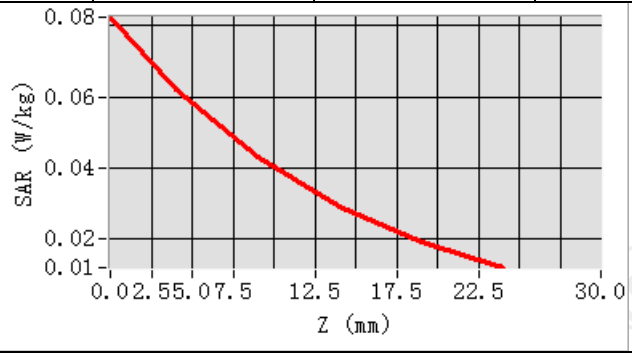


BT

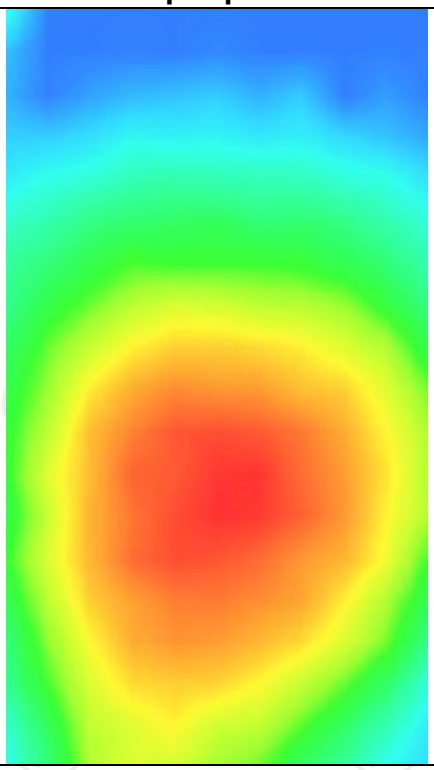
MEASUREMENT 1	
Middle Band SAR(Channel 39):	Date: 11/11/2024
Frequency (MHz)	2441.000000
Relative permittivity (real part)	38.098230
Relative permittivity (imaginary part)	13.341412
Conductivity (S/m)	1.798152
Variation (%)	-1.570000
Crest Factor	1.0
Probe Conversion factor	2.31
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(5mm)
Band	Bluetooth GFSK
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=3.00, Y=-21.00 SAR Peak: 0.08 W/kg	
SAR 10g (W/Kg)	0.040294
SAR 1g (W/Kg)	0.060027



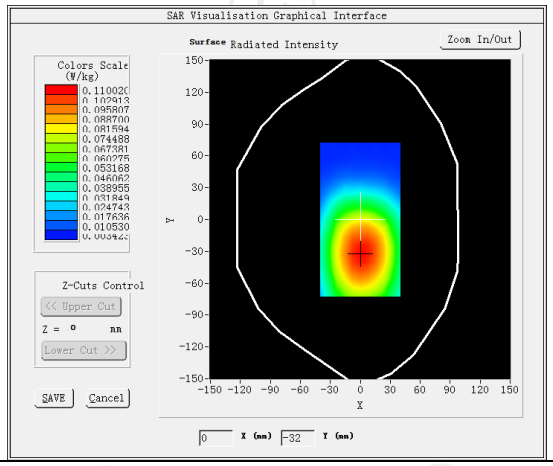
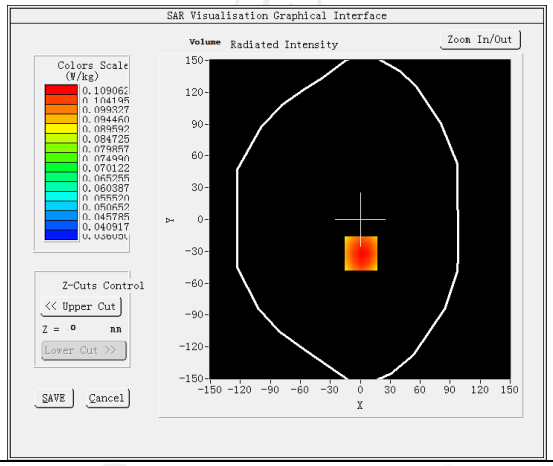
Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.0825	0.0622	0.0430	0.0292	0.0193

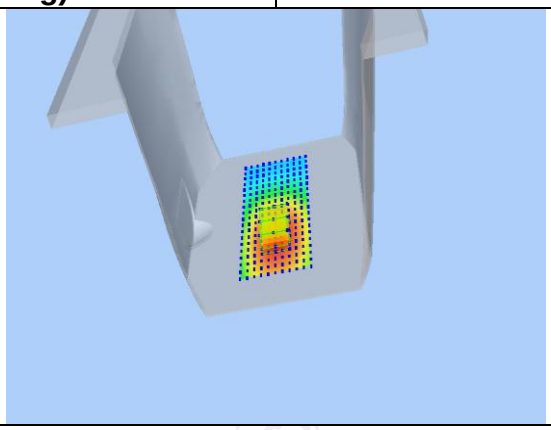


Hot spot position

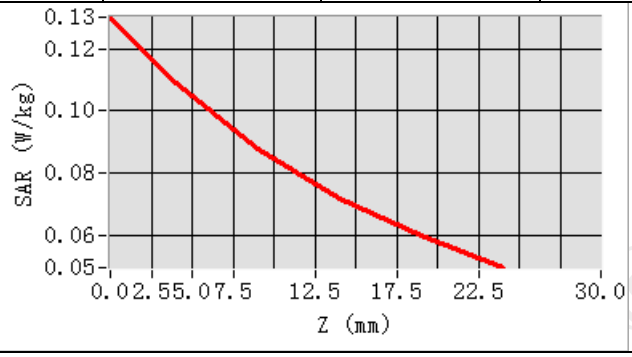


BLE

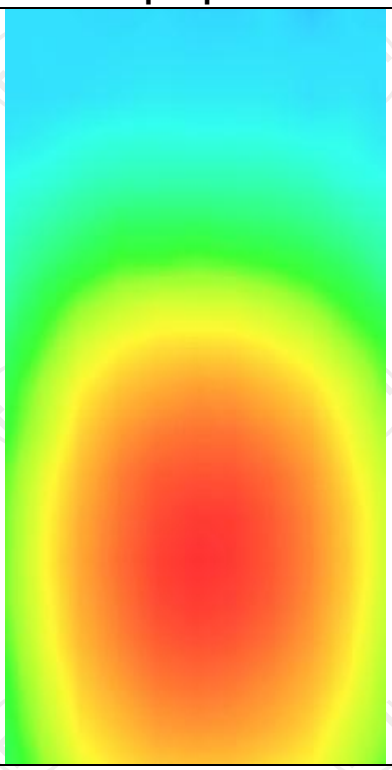
MEASUREMENT 1	
Middle Band SAR(Channel 20):	Date: 11/11/2024
Frequency (MHz)	2440.000000
Relative permittivity (real part)	38.098230
Relative permittivity (imaginary part)	13.341412
Conductivity (S/m)	1.793378
Variation (%)	-1.800000
Crest Factor	1.0
Probe Conversion factor	2.31
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(5mm)
Band	Bluetooth BLE
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=1.00, Y=-32.00 SAR Peak: 0.13 W/kg	
SAR 10g (W/Kg)	0.082739
SAR 1g (W/Kg)	0.105890



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR(W/Kg)	0.1302	0.1091	0.0880	0.0720	0.0597



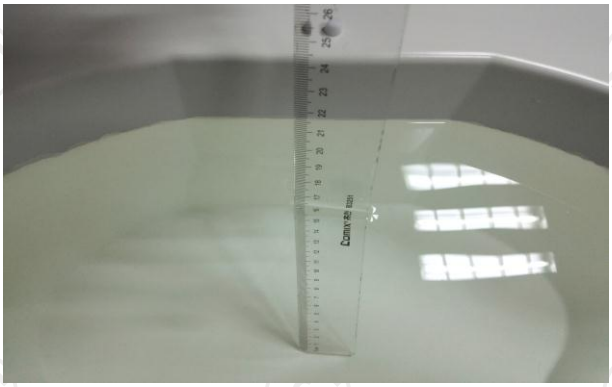
Hot spot position



Appendix A: EUT Photos

Liquid depth

The Body Liquid of 2450MHz (15.3cm)



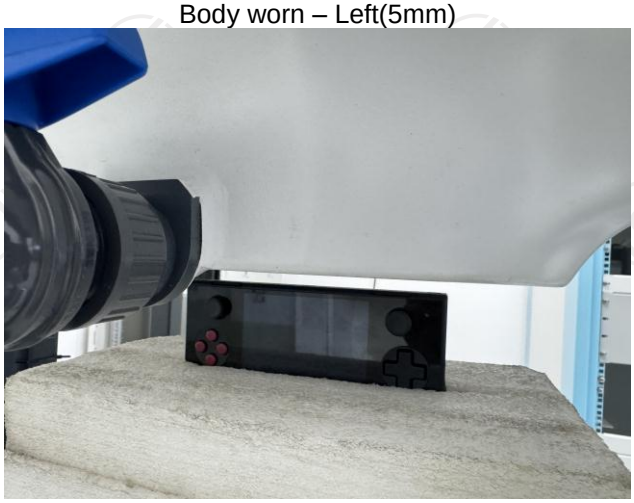
The Body Liquid of 5000-6000MHz (16.5cm)

Appendix B: Test Setup Photos

Body worn – Back (5mm)

Body worn – Left(5mm)

Body worn –Front (5mm)



Body worn – Top (5mm)

Appendix C: Probe Calibration Certificate

COMOSAR E-FIELD Probe

COMOSAR E-Field Probe Calibration Report

Ref : ACR.180.7.22.BES.B

SHENZHEN TONGCE TESTING LAB

2101 & 2201, ZHENCHANG FACTORY RENSHAN INDUSTRIAL ZONE, FUHAI SUBDISTRICT, BAO'AN DISTRICT SHENZHEN, GUANGDONG, 518103, PEOPLE'S REPUBLIC OF CHINA

MVG COMOSAR DOSIMETRIC E-FIELD PROBE

SERIAL NO.: SN 25/22 EPGO375

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 06/29/2024

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

The use of the Cofrac brand and the accreditation references is prohibited from any reproduction.

Summary:

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

COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.7.22.BES.B

	Name	Function	Date	Signature
Prepared by :	Jérôme Le Gall	Measurement Responsible	6/30/2024	
Checked & approved by:	Jérôme Luc	Technical Manager	6/30/2024	
Authorized by:	Yann Toutain	Laboratory Director	7/05/2024	Yann TOUTAIN

	Customer Name
Distribution :	Shenzhen Tongce Testing Lab

Issue	Name	Date	Modifications
A	Jérôme Le Gall	6/30/2024	Initial release

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TABLE OF CONTENTS

1 Device Under Test 4
2 Product Description 4
2.1 General Information 4
3 Measurement Method 4
3.1 Linearity 4
3.2 Sensitivity 4
3.3 Lower Detection Limit 5
3.4 Isotropy 5
3.1 Boundary Effect 5
4 Measurement Uncertainty 6
5 Calibration Measurement Results 6
5.1 Sensitivity in air 6
5.2 Linearity 7
5.3 Sensitivity in liquid 8
5.4 Isotropy 9
6 List of Equipment 10

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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 25/22 EPGO375
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.197 MΩ Dipole 2: R2=0.230 MΩ Dipole 3: R3=0.208 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

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

Figure 1 – *MVG COMOSAR Dosimetric E field Probe*

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

3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their 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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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:

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

where

$\mathrm{SAR}_{\mathrm{uncertainty}}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest *zoom-scan* 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;
$\Delta\mathrm{SAR}_{be}$	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 uncertainty[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).

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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 (µV/(V/m)^2)	Normy dipole 2 (µV/(V/m)^2)	Normz dipole 3 (µV/(V/m)^2)
0.64	0.53	0.44

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
106	108	109

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

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

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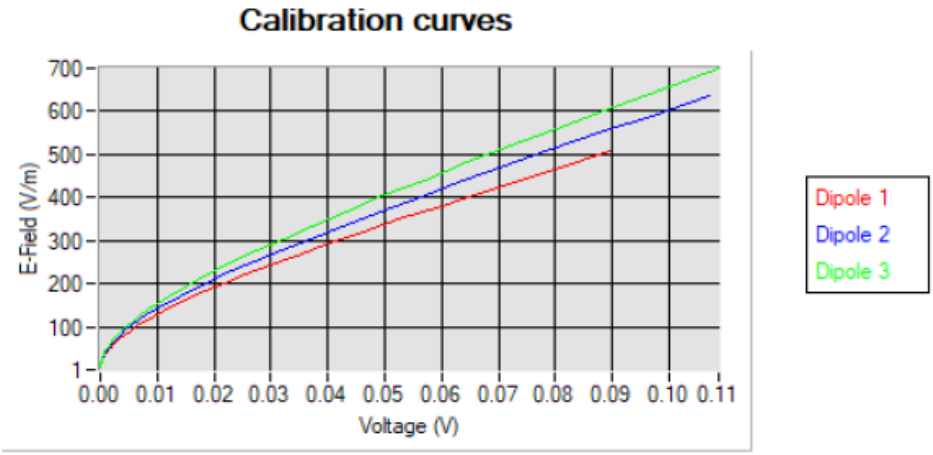
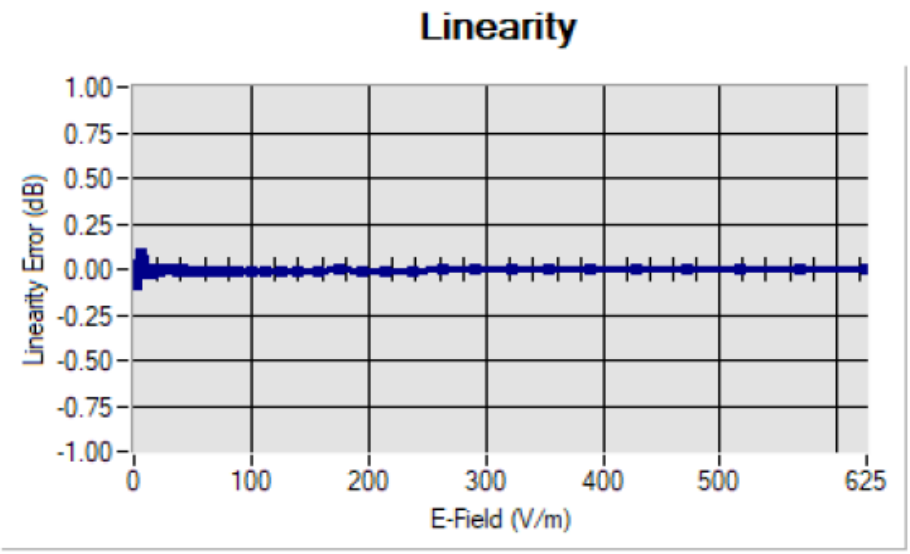


5.2 LINEARITY



Linearity:+/-1.94% (+/-0.09dB)

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5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	ConvF
HL750	750	1.71
BL750	750	1.78
HL900	900	1.91
BL900	900	1.96
HL1800	1800	2.08
BL1800	1800	2.16
HL2000	2000	2.03
BL2000	2000	2.10
HL2450	2450	2.31
BL2450	2450	2.37
HL2600	2600	2.16
BL2600	2600	2.23
HL3500	3500	2.21
BL3500	3500	2.28
HL3700	3700	3.45
BL3700	3700	3.15
HL4600	4600	3.30
BL4600	4600	3.70
HL5200	5200	2.01
BL5200	5200	2.08
HL5600	5600	2.07
BL5600	5600	2.12
HL5800	5800	2.06
BL5800	5800	2.13

LOWER DETECTION LIMIT: 7mW/kg

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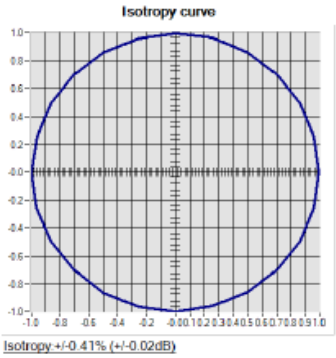
5.4 ISOTROPY

HL1800 MHz



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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	10/2023	10/2026
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Multimeter	Keithley 2000	1160271	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	06/2024	06/2027
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2023	11/2026
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.
Waveguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.

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