FCC SAR EVALUATION REPORT

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

Product Name： Rugged Tablet

Trademark： N/A

Model Name： TPC-GS0883T

Family Model： N/A

Report No.： S24032003504001

FCC ID： 2AQR9-TPC-GS0883T

Prepared for

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TEST RESULT CERTIFICATION

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Product description

Product name...............	Rugged Tablet
Trademark	N/A
Model Name	TPC-GS0883T
Family Model................	N/A
Standards....................	FCC 47 CFR Part 2(2.1093) IEEE Std 1528-2013 Published RF exposure KDB procedures

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

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Test Sample Number S240320035004

Date of Test

Date (s) of performance of tests... Mar. 24, 2024 ~ Mar. 27, 2024

Date of Issue .... May 21, 2024

Test Result .... **Pass**

Prepared By : *Jack Li*	Reviewed By : *Aaron Cheng*	Approved By : *Alex Li*
Jack Li (Project Engineer)	Aaron Cheng (Supervisor)	Alex Li (Manager)

※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	May 21, 2024	Jack Li

TABLE OF CONTENTS

1. General Information

1.1. RF exposure limits

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

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

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

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

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

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

General Population/Uncontrolled Environments:
Are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

NOTE TRUNK LIMIT 1.6 W/kg APPLIED TO THIS EUT

1.2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for TPC-GS0883T are as follows.

RF Exposure Conditions		Max Reported SAR Value(W/kg)
1-g Head		0.332
1-g Body (Separation distance of 0mm)		0.393
Max Simultaneous Tx	Head	0.513
	Body	0.555

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

1.3. EUT Description

Device Information			
Product Name	Rugged Tablet		
Trade Name	N/A		
Model Name	TPC-GS0883T		
Family Model	N/A		
FCC ID	2AQR9-TPC-GS0883T		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna Type	FPC Antenna		
Battery Information	DC 3.8V,9800mAh, 37.24Wh		
Hardware version	N/A		
Software version	N/A		
Device Operating Configurations			
Supporting Mode(s)	WLAN 2.4G/5G, Bluetooth		
Test Modulation	WLAN(DSSS/OFDM), Bluetooth(GFSK, π/4-DQPSK, 8DPSK)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WLAN 2.4G	2412-2462	
	WLAN 5.2G	5180-5240	
	WLAN 5.8G	5745-5825	
	Bluetooth	2402-2480	

1.4. Test specification(s)

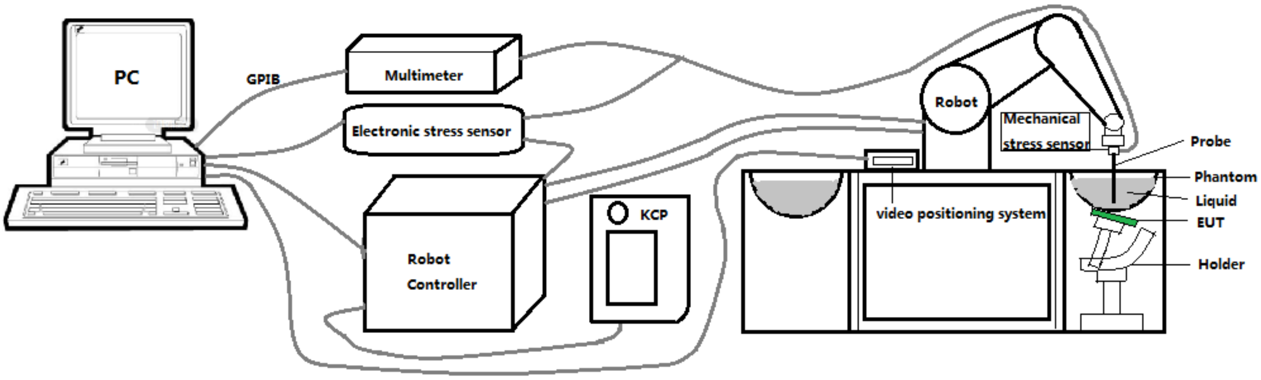
FCC 47 CFR Part 2(2.1093)
IEEE Std 1528-2013
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting
KDB 447498 D01 General RF Exposure Guidance
KDB 248227 D01 802.11 Wi-Fi SAR
KDB 616217 D04 SAR for laptop and tablets

1.5. Ambient Condition

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

2. SAR Measurement System

2.1. SATIMO SAR Measurement Set-up Diagram



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

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

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

2.2. Robot

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

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

2.3. E-Field 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 3423-EPGO-426 with following specifications is used

- Dynamic range: 0.01-100 W/kg
- Tip Diameter : 2.5 mm
- Distance between probe tip and sensor center: 1 mm
- Distance between sensor center and the inner phantom surface: 2 mm (repeatability better than ±1 mm).
- Probe linearity: ±0.06 dB
- Axial isotropy: ±0.01 dB
- Hemispherical Isotropy: ±0.01 dB
- Calibration range: 650MHz to 5900MHz for head & body simulating liquid.
- Lower detection limit: 8mW/kg

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 ±10%. The spherical isotropy shall be evaluated and within ±0.25dB. 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.

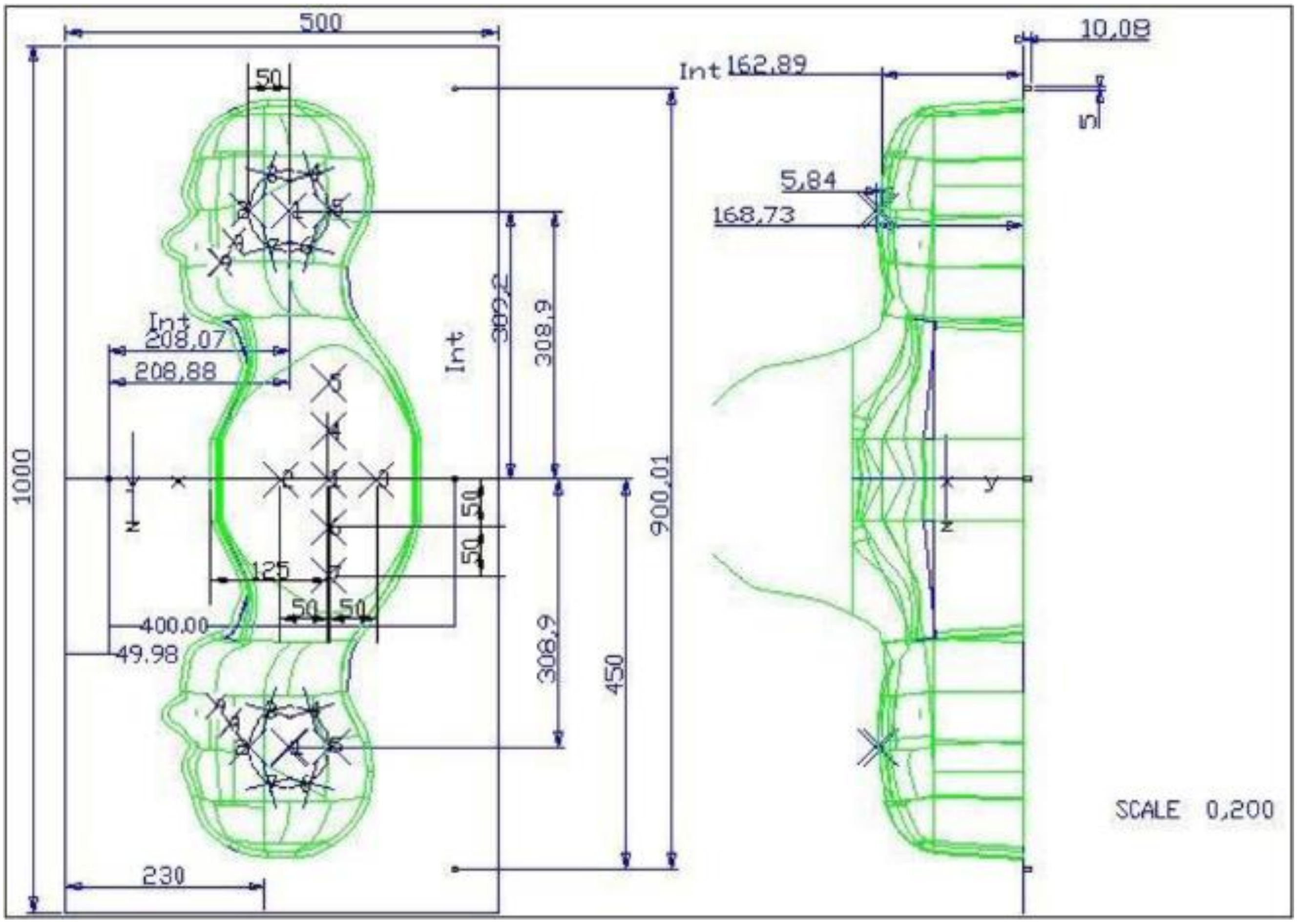
2.4. SAM phantoms

Photo of SAM phantom SN 16/15 SAM119

The SAM phantom is used to measure the SAR relative to people exposed to electro-magnetic field radiated by mobile phones.

2.4.1. Technical Data

Serial Number	Shell thickness	Filling volume	Dimensions	Positionner Material	Permittivity	Loss Tangent
SN 16/15 SAM119	2 mm ±0.2 mm	27 liters	Length:1000 mm Width:500 mm Height:200 mm	Gelcoat with fiberglass	3.4	0.02

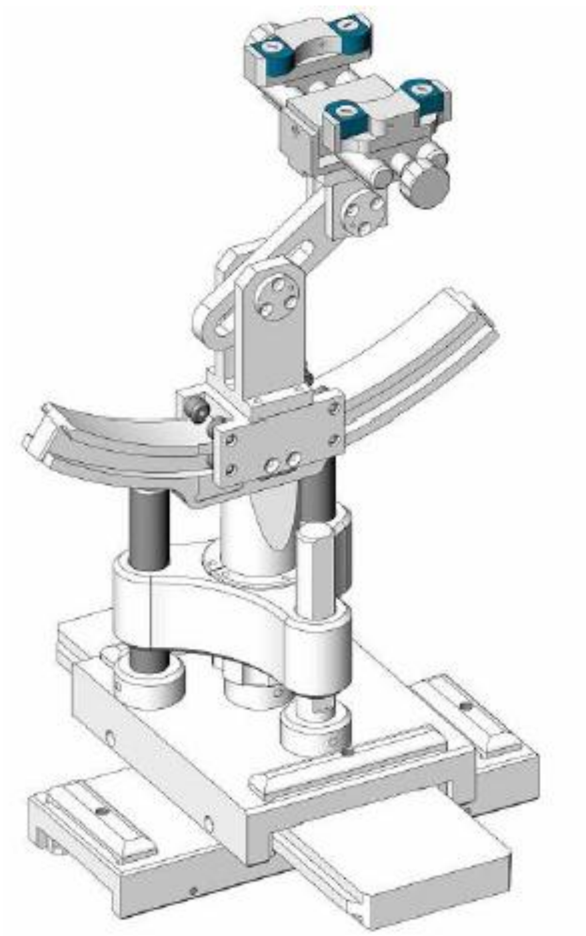


Serial Number	Left Head(mm)		Right Head(mm)		Flat Part(mm)	
SN 16/15 SAM119	2	2.02	2	2.08	1	2.09
	3	2.05	3	2.06	2	2.06
	4	2.07	4	2.07	3	2.08
	5	2.08	5	2.08	4	2.10
	6	2.05	6	2.07	5	2.10
	7	2.05	7	2.05	6	2.07
	8	2.07	8	2.06	7	2.07
	9	2.08	9	2.06	-	-

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

2.5. Device Holder

The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is lower than 1 degree.



Serial Number	Holder Material	Permittivity	Loss Tangent
SN 16/15 MSH100	Delrin	3.7	0.005

2.6. Test Equipment List

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

Devices used during the test described are marked ☒

	Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
					Last Cal.	Due Date
☒	MVG	E FIELD PROBE	SSE2	3423-EPGO-426	Sep. 18, 2023	Sep. 17, 2024
☐	MVG	750 MHz Dipole	SID750	SN 03/15 DIP 0G750-355	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	835 MHz Dipole	SID835	SN 03/15 DIP 0G835-347	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	900 MHz Dipole	SID900	SN 03/15 DIP 0G900-348	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	1800 MHz Dipole	SID1800	SN 03/15 DIP 1G800-349	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	1900 MHz Dipole	SID1900	SN 03/15 DIP 1G900-350	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	2300 MHz Dipole	SID2300	SN 03/16 DIP 2G300-358	Feb. 21, 2024	Feb. 20, 2027
☒	MVG	2450 MHz Dipole	SID2450	SN 03/15 DIP 2G450-352	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	2600 MHz Dipole	SID2600	SN 03/15 DIP 2G600-356	Feb. 21, 2024	Feb. 20, 2027
☒	MVG	5000 MHz Dipole	SWG5500	SN 13/14 WGA 33	Feb. 21, 2024	Feb. 20, 2027
☒	MVG	Liquid measurement Kit	SCLMP	SN 21/15 OCPG 72	NCR	NCR
☒	MVG	Power Amplifier	N.A	AMPLISAR_28/14_003	NCR	NCR
☒	KEITHLEY	Millivoltmeter	2000	4072790	NCR	NCR
☐	R&S	Universal radio communication tester	CMU200	117858	May 29, 2023	May 28, 2024
☐	R&S	Wideband radio communication tester	CMW500	103917	May 29, 2023	May 28, 2024
☒	HP	Network	8753D	3410J01136	May 29,	May 28,

		Analyzer			2023	2024
☒	Agilent	MXG Vector Signal Generator	N5182A	MY47070317	May 29, 2023	May 28, 2024
☒	Agilent	Power meter	E4419B	MY45102538	May 29, 2023	May 28, 2024
☒	Agilent	Power sensor	E9301A	MY41495644	May 29, 2023	May 28, 2024
☒	Agilent	Power sensor	E9301A	US39212148	May 29, 2023	May 28, 2024
☒	MCLI/USA	Directional Coupler	CB11-20	0D2L51502	Jul. 04, 2023	Jul. 03, 2024
☒	N/A	Thermometer	N/A	LES-085	Mar. 27, 2023	Mar. 26, 2026
☒	MVG	SAM Phantom	SSM2	SN 16/15 SAM119	NCR	NCR
☒	MVG	Device Holder	SMPPD	SN 16/15 MSH100	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 2450	Head 2450	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 5200	Head 5200	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 5800	Head 5800	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 WLAN/Bluetooth power measurement, use engineering software to configure EUT WLAN/Bluetooth 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 WLAN/Bluetooth output power.

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/Bluetooth 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.

<table>
<tr><th colspan="3"></th><th>$\leq$ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation 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.</td></tr>
</table>

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 using 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 form 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 define in the standard IEEE1528 and IEC62209.

3.5. Power Drift

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In OpenSAR measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in V/m. If the power drifts more than ±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									
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
Ingredients (% of weight)	Body Tissue									
Frequency Band (MHz)	750	835	900	1800	1900	2000	2450	2600	5200	5800
Water	50.30	50.30	50.30	69.91	69.91	71.88	71.88	71.88	79.54	79.54
NaCl	0.60	0.60	0.60	0.13	0.13	0.16	0.16	0.16	0.00	0.00
1,2-Propanediol	49.10	49.10	49.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	9.99	9.99	19.97	19.97	19.97	11.24	11.24
DGBE	0.00	0.00	0.00	19.97	19.97	7.99	7.99	7.99	9.22	9.22

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.

Photo of Liquid depth for Head Position	Photo of Liquid depth for Body Position
	

4.1.1. Tissue Dielectric Parameter Check Results

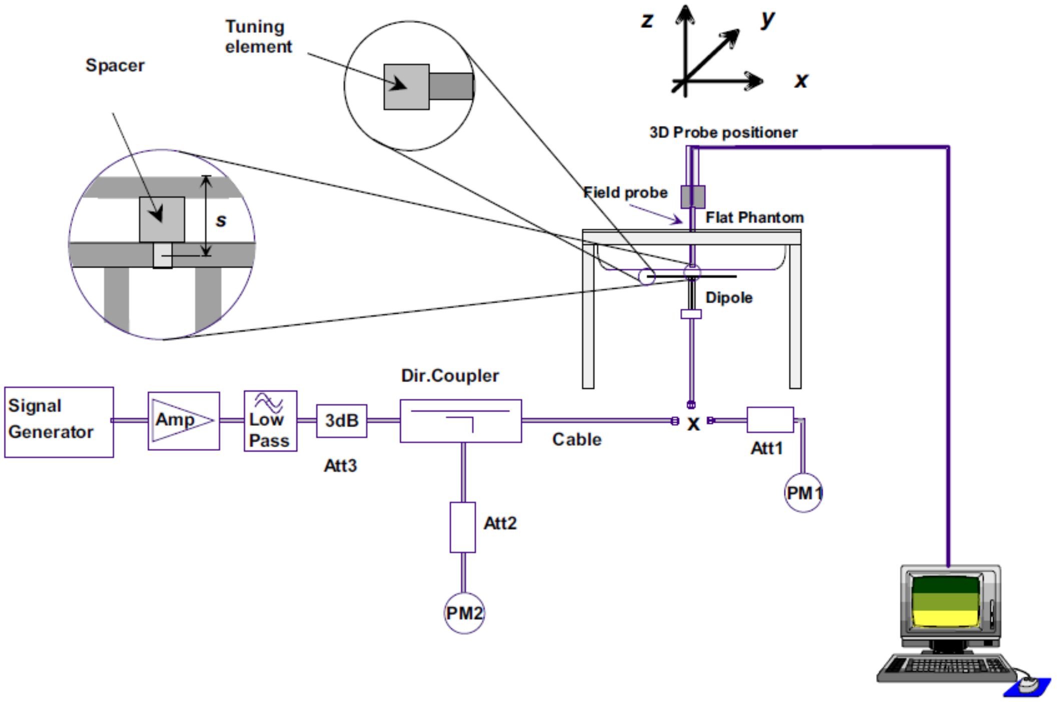
The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ±5% of the target values.

Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (±5%)	σ (S/m) (±5%)	εr	σ (S/m)		
Head 2450	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	37.57	1.76	21.7 °C	Mar. 24, 2024
Head 5200	5200	36.00 (34.20~37.80)	4.66 (4.43~4.89)	34.63	4.51	21.4 °C	Mar. 26, 2024
Head 5800	5800	35.30 (33.54~37.07)	5.27 (5.01~5.53)	34.06	5.20	21.7 °C	Mar. 27, 2024

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 ±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	Target SAR (1W) (±10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Delta (%)		Test Date
	1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)		1-g (±10%)	10-g (±10%)	
2450MHz	50.05 (45.05~55.06)	23.80 (21.42~26.18)	54.11	24.97	21.7 °C	8.11%	4.92%	Mar. 24, 2024
5200MHz	162.59 (146.33~178.85)	56.21 (50.59~61.83)	164.26	59.79	21.4 °C	1.03%	6.37%	Mar. 26, 2024
5800MHz	182.20 (163.98~200.42)	61.32 (55.19~67.45)	188.59	55.64	21.7 °C	3.51%	-9.26%	Mar. 27, 2024

5. SAR Measurement variability and uncertainty

5.1. SAR measurement variability

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

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

5.2. 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.

6. RF Exposure Positions

6.1. Ear and handset reference point

Figure 6.1.1 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 6.1.1 Front, back, and side views of SAM phantom

6.2. 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 6.2.1 and Figure 6.2.2), 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 6.2.1). 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 6.2.2), 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 6.2.3), 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 6.2.3. The actual rotation angles should be documented in the test report.

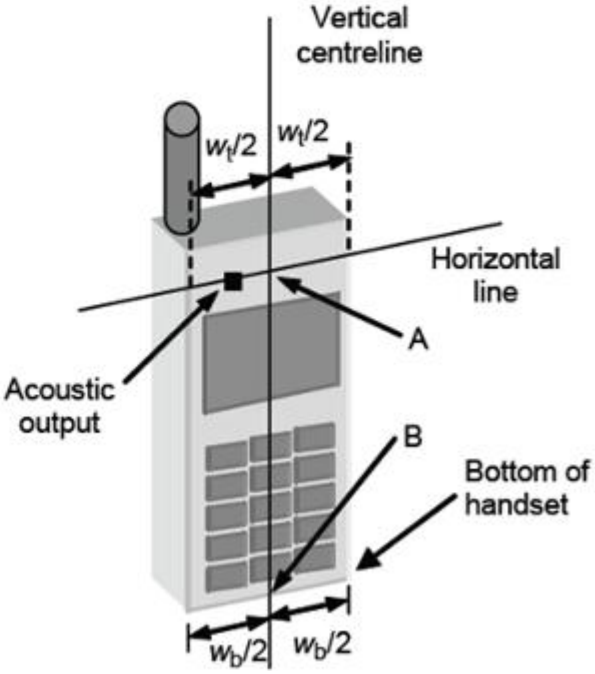


Fig 6.2.1 Handset vertical and horizontal reference lines—"fixed case

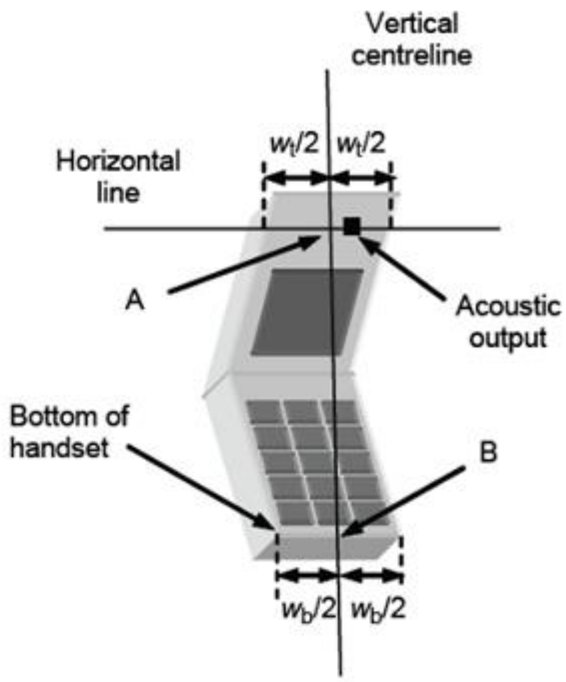


Fig 6.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

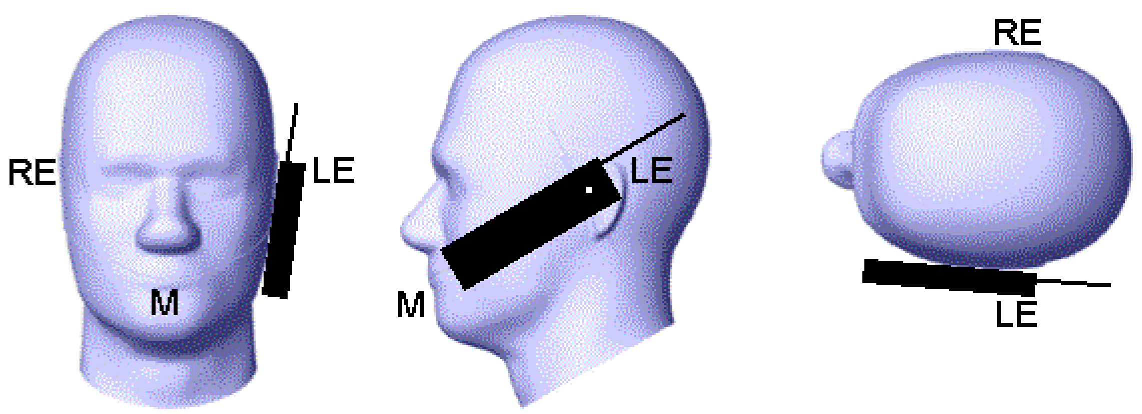


Fig 6.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

6.3. 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 6.3.1).
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.

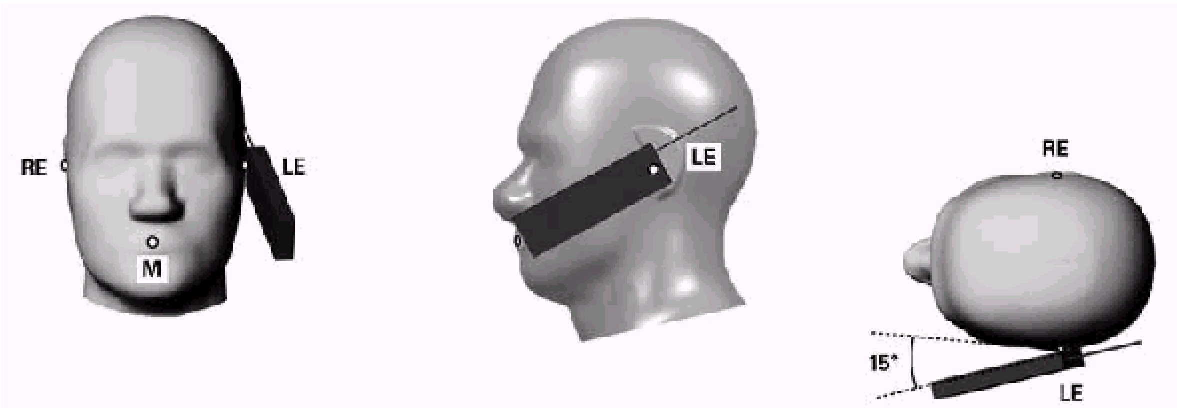


Figure 6.3.1 – Tilt position of the wireless device on the left side of SAM

6.3. Tablet PC host platform exposure conditions

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

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

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

7. RF Output Power

7.1. WLAN & Bluetooth Output Power

7.1.1. Output Power Results Of WLAN

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)ANT1	Tune-up	Output Power (dBm)ANT2	Tune-up	Output Power (dBm)MIMO
802.11b	1	2412	17.00	16.46	16.50	16.22	--	--
	6	2437	17.00	16.71	16.50	15.55	--	--
	11	2462	17.00	16.68	16.50	15.79	--	--
802.11g	1	2412	14.50	13.92	15.00	14.78	--	--
	6	2437	14.50	14.41	15.00	14.30	--	--
	11	2462	14.50	14.16	15.00	14.38	--	--
802.11n HT20	1	2412	12.50	12.14	13.00	12.87	15.00	14.16
	6	2437	12.50	12.48	13.00	12.16	15.00	14.26
	11	2462	12.50	12.28	13.00	12.37	15.00	14.53
802.11n HT40	3	2422	12.50	12.42	13.00	12.51	15.00	14.25
	6	2437	12.50	12.46	13.00	12.44	15.00	14.41
	9	2452	12.50	12.45	13.00	12.74	15.00	14.62
ax20	1	2412	13.00	12.24	13.00	12.91	15.00	14.52
	6	2437	13.00	12.62	13.00	12.36	15.00	14.50
	11	2462	13.00	12.39	13.00	12.62	15.00	14.73
ax40	3	2422	13.00	12.57	13.00	12.71	15.00	14.54
	6	2437	13.00	12.70	13.00	12.63	15.00	14.68
	9	2452	13.00	12.65	13.00	12.92	15.00	14.92

NOTE: Power measurement results of WLAN 2.4G.

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)ANT1	Tune-up	Output Power (dBm)ANT2	Tune-up	Output Power (dBm)MIMO
802.11a	36	5180	12.00	10.96	12.00	10.21	--	--
	40	5200	12.00	11.24	12.00	10.98	--	--
	48	5240	12.00	11.97	12.00	11.87	--	--
802.11n HT20	36	5180	12.00	10.77	10.00	9.91	13.00	11.69
	40	5200	12.00	10.99	11.00	10.77	13.00	12.06
	48	5240	12.00	11.83	12.00	11.70	13.00	12.34
802.11n HT40	38	5190	12.00	11.15	12.00	10.48	13.00	12.05
	46	5230	12.00	11.97	12.00	11.73	13.00	12.43
802.11ac	36	5180	12.00	10.78	10.00	9.92	13.00	11.76

VHT20	40	5200	12.00	11.17	11.00	10.77	13.00	12.03
	48	5240	12.00	11.89	12.00	11.67	13.00	12.40
802.11ac VHT40	38	5190	12.00	11.19	12.00	10.52	13.00	12.06
	46	5230	12.00	11.97	12.00	11.70	13.00	12.45
802.11ac VHT80	42	5210	11.50	11.20	11.00	10.96	13.00	12.01
ax20	36	5180	12.50	11.26	12.00	10.18	13.00	12.02
	40	5200	12.50	11.47	12.00	10.97	13.00	12.28
	48	5240	12.50	12.18	12.00	11.92	13.00	12.66
ax40	38	5190	12.50	11.55	12.00	10.75	13.00	12.29
	46	5230	12.50	12.32	12.00	11.89	13.00	12.70
ax80	42	5210	12.00	11.80	11.50	11.28	13.00	12.34

NOTE: Power measurement results of WLAN 5.2G.

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)ANT1	Tune-up	Output Power (dBm)ANT2	Tune-up	Output Power (dBm)MIMO
802.11a	149	5745	13.00	11.58	11.50	11.18	--	--
	157	5785	13.00	12.41	11.50	9.53	--	--
	165	5825	13.00	12.79	11.50	10.15	--	--
802.11n HT20	149	5745	13.00	11.41	12.00	10.98	13.50	12.75
	157	5785	13.00	12.21	12.00	11.17	13.50	13.03
	165	5825	13.00	12.59	12.00	11.79	13.50	13.18
802.11n HT40	151	5755	13.00	11.90	11.50	11.25	13.50	12.87
	159	5795	13.00	12.52	11.50	11.41	13.50	13.23
802.11ac VHT20	149	5745	13.00	11.37	12.00	11.02	13.50	12.67
	157	5785	13.00	12.20	12.00	11.13	13.50	13.05
	165	5825	13.00	12.63	12.00	11.82	13.50	13.25
802.11ac VHT40	151	5755	12.50	11.82	12.00	11.23	13.50	12.89
	159	5795	12.50	12.45	12.00	11.50	13.50	13.28
802.11ac VHT80	155	5775	12.00	11.96	11.50	11.08	13.50	12.86
ax20	149	5745	13.00	11.64	12.00	11.20	13.50	12.98
	157	5785	13.00	12.49	12.00	11.35	13.50	13.19
	165	5825	13.00	12.85	12.00	11.93	13.50	13.48
ax40	151	5755	13.00	12.01	12.00	11.33	13.50	13.19
	159	5795	13.00	12.75	12.00	11.66	13.50	13.47
ax80	155	5775	12.50	12.31	11.50	11.29	13.50	13.19

NOTE: Power measurement results of WLAN 5.8G.

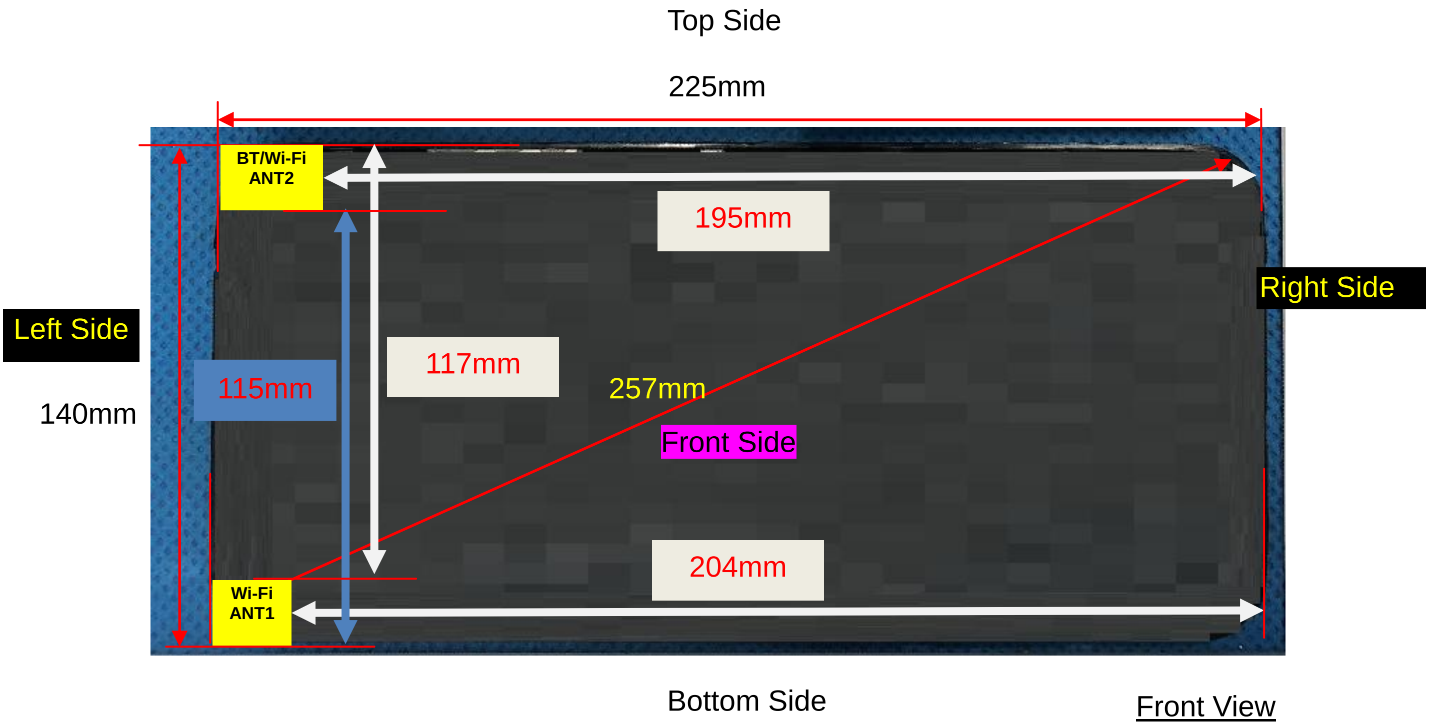
7.1.2. Output Power Results Of Bluetooth

BR+EDR	Output Power (dBm)				
	Channel	Tune-up	Data Rates		
			1M	2M	3M
	0CH	9.00	7.46	7.78	8.29
	39CH	9.00	8.21	7.96	8.31
	78CH	9.00	8.73	8.24	8.69

BLE	Channel	Tune-up	Output Power (dBm)	
			1M	2M
	0CH	1.00	0.72	0.74
	19CH	0.00	-0.03	-0.03
	39CH	2.00	1.24	1.25

NOTE: Power measurement results of Bluetooth.

8. Antenna Location



Note: Since the confidentiality request of EUT，the antenna location example diagram see as above.

Distance of the Antenna to the EUT surface/edge						
Antennas	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
WLAN & BT ANT2	5	5	5	195	5	115
WLAN ANT1	5	5	5	204	117	5

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

ANT2

Positions for SAR tests		
Test separation distances > 50 mm		
Exposure Positions	Tune-up Maximum power of WLAN 2.4G	
	16.50 dBm	44.67 mW
Right Side	Antenna to user(mm)	195
	SAR exclusion threshold(mW)	1546
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	115
	SAR exclusion threshold(mW)	746
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WLAN 5.2G	
	12.00 dBm	15.85 mW
Right Side	Antenna to user(mm)	195
	SAR exclusion threshold(mW)	1516
	SAR testing required?	NO

Bottom Side	Antenna to user(mm)	115
	SAR exclusion threshold(mW)	716
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WLAN 5.8G	
	12.00 dBm	15.85 mW
Right Side	Antenna to user(mm)	195
	SAR exclusion threshold(mW)	1512
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	115
	SAR exclusion threshold(mW)	712
	SAR testing required?	NO

NOTE: Refer to section 4.3.1 of KDB 447498 D01.

ANT1

Positions for SAR tests		
Test separation distances > 50 mm		
Exposure Positions	Tune-up Maximum power of WLAN 2.4G	
	17.00 dBm	50.12 mW
Right Side	Antenna to user(mm)	204
	SAR exclusion threshold(mW)	1636
	SAR testing required?	NO
Top Side	Antenna to user(mm)	117
	SAR exclusion threshold(mW)	766
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WLAN 5.2G	
	12.50 dBm	17.78 mW
Right Side	Antenna to user(mm)	204
	SAR exclusion threshold(mW)	1606
	SAR testing required?	NO
Top Side	Antenna to user(mm)	117
	SAR exclusion threshold(mW)	736
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WLAN 5.8G	
	13.00 dBm	19.95 mW
Right Side	Antenna to user(mm)	204
	SAR exclusion threshold(mW)	1602
	SAR testing required?	NO
Top Side	Antenna to user(mm)	117
	SAR exclusion threshold(mW)	732
	SAR testing required?	NO

NOTE: Refer to section 4.3.1 of KDB 447498 D01.

9. Stand-alone SAR test exclusion

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

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

- $f_{(GHZ)}$ 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_{max} (dBm)	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
Bluetooth	9.00	7.94	5	2.480	2.5	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:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] * [$\sqrt{f_{(GHZ)}}$/x] W/kg for test separation distances ≤ 50mm, 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_{max} (dBm)	P_{max} (mW)	Distance (mm)	f (GHz)	x	Estimated SAR (W/Kg)
Bluetooth	Head	9.00	7.94	5	2.48	7.5	0.332
Bluetooth	Body	9.00	7.94	5	2.48	7.5	0.332

NOTE: Estimated SAR calculation for Bluetooth

10. SAR Results

10.1. SAR measurement results

10.1.1. SAR measurement Result of WLAN 2.4G

ANT1

Test Position of Head	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Left	6/2437	802.11b	0.040	0.027	-2.16	16.71	17.00	0.043	2024/3/24	13#

Cheek										
Left Tilt 15 Degree	6/2437	802.11b	0.024	0.016	2.19	16.71	17.00	0.026	2024/3/24	
Right Cheek	6/2437	802.11b	0.037	0.024	-2.32	16.71	17.00	0.040	2024/3/24	
Right Tilt 15 Degree	6/2437	802.11b	0.019	0.017	-1.33	16.71	17.00	0.020	2024/3/24	

NOTE: Head SAR test results of WLAN2.4G

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	6/2437	802.11b	0.060	0.033	-0.62	16.71	17.00	0.064	2024/3/24	
Back Side	6/2437	802.11b	0.069	0.039	-3.99	16.71	17.00	0.074	2024/3/24	16#
Left Side	6/2437	802.11b	0.024	0.013	-3.67	16.71	17.00	0.026	2024/3/24	
Bottom Side	6/2437	802.11b	0.021	0.012	-2.96	16.71	17.00	0.022	2024/3/24	

NOTE: Body SAR test results of WLAN2.4G

ANT2

Test Position of Head	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Left Cheek	1/2412	802.11b	0.060	0.037	0.09	16.22	16.50	0.064	2024/3/24	14#
Left Tilt 15 Degree	1/2412	802.11b	0.023	0.015	0.94	16.22	16.50	0.025	2024/3/24	
Right Cheek	1/2412	802.11b	0.037	0.024	-2.93	16.22	16.50	0.039	2024/3/24	
Right Tilt 15 Degree	1/2412	802.11b	0.020	0.018	-0.13	16.22	16.50	0.021	2024/3/24	

NOTE: Head SAR test results of WLAN2.4G

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	1/2412	802.11b	0.108	0.055	-1.56	16.22	16.50	0.115	2024/3/24	
Back Side	1/2412	802.11b	0.176	0.089	4.96	16.22	16.50	0.188	2024/3/24	17#
Left Side	1/2412	802.11b	0.062	0.030	-2.03	16.22	16.50	0.066	2024/3/24	
Top Side	1/2412	802.11b	0.060	0.029	-3.94	16.22	16.50	0.064	2024/3/24	

NOTE: Body SAR test results of WLAN2.4G

MIMO

Test Position of Head	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Left Cheek	9/2452	ax40	0.061	0.037	0.39	14.92	15.00	0.062	2024/3/24	15#
Left Tilt 15 Degree	9/2452	ax40	0.024	0.016	-3.17	14.92	15.00	0.024	2024/3/24	
Right Cheek	9/2452	ax40	0.035	0.024	-3.58	14.92	15.00	0.036	2024/3/24	
Right Tilt 15 Degree	9/2452	ax40	0.018	0.016	-0.04	14.92	15.00	0.018	2024/3/24	

NOTE: Head SAR test results of WLAN2.4G

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	9/2452	ax40	0.120	0.057	-1.95	14.92	15.00	0.122	2024/3/24	

Back Side	9/2452	ax40	0.182	0.090	0.32	14.92	15.00	0.185	2024/3/24	18#
Left Side	9/2452	ax40	0.065	0.034	-2.43	14.92	15.00	0.066	2024/3/24	
Right Side	9/2452	ax40	0.012	0.007	-3.76	14.92	15.00	0.012	2024/3/24	
Top Side	9/2452	ax40	0.052	0.030	3.81	14.92	15.00	0.053	2024/3/24	
Bottom Side	9/2452	ax40	0.035	0.023	1.23	14.92	15.00	0.036	2024/3/24	

NOTE: Body SAR test results of WLAN2.4G

10.1.2. SAR measurement Result of WLAN5.2G

ANT1

Test Position of Head	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Left Cheek	46/5230	ax40	0.089	0.065	3.84	12.32	12.50	0.093	2024/3/26	1#
Left Tilt 15 Degree	46/5230	ax40	0.046	0.033	3.76	12.32	12.50	0.048	2024/3/26	
Right Cheek	46/5230	ax40	0.084	0.059	0.85	12.32	12.50	0.088	2024/3/26	
Right Tilt 15 Degree	46/5230	ax40	0.045	0.032	0.79	12.32	12.50	0.047	2024/3/26	

NOTE: Head SAR test results of WLAN5.2G

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	46/5230	ax40	0.084	0.050	0.71	12.32	12.50	0.088	2024/3/26	
Back Side	46/5230	ax40	0.115	0.072	-3.68	12.32	12.50	0.120	2024/3/26	7#
Left Side	46/5230	ax40	0.042	0.026	0.66	12.32	12.50	0.044	2024/3/26	

Bottom Side	46/5230	ax40	0.039	0.024	0.81	12.32	12.50	0.041	2024/3/26	

NOTE: Body SAR test results of WLAN5.2G

ANT2

Test Position of Head	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Left Cheek	48/5240	ax20	0.254	0.121	-1.13	11.92	12.00	0.259	2024/3/26	2#
Left Tilt 15 Degree	48/5240	ax20	0.050	0.035	-0.40	11.92	12.00	0.051	2024/3/26	
Right Cheek	48/5240	ax20	0.078	0.054	2.11	11.92	12.00	0.079	2024/3/26	
Right Tilt 15 Degree	48/5240	ax20	0.040	0.029	1.90	11.92	12.00	0.041	2024/3/26	

NOTE: Head SAR test results of WLAN5.2G

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	48/5240	ax20	0.258	0.095	0.77	11.92	12.00	0.263	2024/3/26	
Back Side	48/5240	ax20	0.386	0.142	-3.00	11.92	12.00	0.393	2024/3/26	8#
Left Side	48/5240	ax20	0.120	0.045	-0.18	11.92	12.00	0.122	2024/3/26	
Top Side	48/5240	ax20	0.117	0.042	1.98	11.92	12.00	0.119	2024/3/26	

NOTE: Body SAR test results of WLAN5.2G

MIMO

Test Position of Head	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g	Date	Plot
			1-g	10-g						

								(W/Kg)		
Left Cheek	46/5230	ax40	0.301	0.129	1.98	12.70	13.00	0.323	2024/3/26	3#
Left Tilt 15 Degree	46/5230	ax40	0.168	0.085	1.19	12.70	13.00	0.180	2024/3/26	
Right Cheek	46/5230	ax40	0.278	0.110	-2.44	12.70	13.00	0.298	2024/3/26	
Right Tilt 15 Degree	46/5230	ax40	0.154	0.079	3.83	12.70	13.00	0.165	2024/3/26	

NOTE: Head SAR test results of WLAN5.2G

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	46/5230	ax40	0.258	0.093	0.80	12.70	13.00	0.276	2024/3/26	
Back Side	46/5230	ax40	0.411	0.151	2.41	12.70	13.00	0.440	2024/3/26	9#
Left Side	46/5230	ax40	0.138	0.050	-1.52	12.70	13.00	0.148	2024/3/26	
Right Side	46/5230	ax40	0.048	0.029	0.14	12.70	13.00	0.051	2024/3/26	
Top Side	46/5230	ax40	0.124	0.042	1.02	12.70	13.00	0.133	2024/3/26	
Bottom Side	46/5230	ax40	0.098	0.058	0.25	12.70	13.00	0.105	2024/3/26	

NOTE: Body SAR test results of WLAN5.2G

10.1.3. SAR measurement Result of WLAN5.8G

ANT1

Test Position of Head	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Left	165/5825	ax20	0.175	0.094	2.77	12.85	13.00	0.181	2024/3/27	4#

Cheek										
Left Tilt 15 Degree	165/5825	ax20	0.097	0.050	3.86	12.85	13.00	0.100	2024/3/27	
Right Cheek	165/5825	ax20	0.152	0.079	-1.77	12.85	13.00	0.157	2024/3/27	
Right Tilt 15 Degree	165/5825	ax20	0.078	0.041	-1.53	12.85	13.00	0.081	2024/3/27	

NOTE: Head SAR test results of WLAN5.8G

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	165/5825	ax20	0.156	0.075	-3.84	12.85	13.00	0.161	2024/3/27	
Back Side	165/5825	ax20	0.215	0.105	-3.50	12.85	13.00	0.223	2024/3/27	10#
Left Side	165/5825	ax20	0.069	0.033	-1.32	12.85	13.00	0.071	2024/3/27	
Bottom Side	165/5825	ax20	0.066	0.032	0.48	12.85	13.00	0.068	2024/3/27	

NOTE: Body SAR test results of WLAN5.8G

ANT2

Test Position of Head	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Left Cheek	165/5825	ax20	0.157	0.091	4.67	11.93	12.00	0.160	2024/3/27	5#
Left Tilt 15 Degree	165/5825	ax20	0.103	0.053	-3.24	11.93	12.00	0.105	2024/3/27	
Right Cheek	165/5825	ax20	0.152	0.079	-2.09	11.93	12.00	0.154	2024/3/27	
Right Tilt 15	165/5825	ax20	0.083	0.043	1.41	11.93	12.00	0.084	2024/3/27	

Degree										

NOTE: Head SAR test results of WLAN5.8G

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	165/5825	ax20	0.138	0.064	2.63	11.93	12.00	0.140	2024/3/27	
Back Side	165/5825	ax20	0.205	0.098	-0.98	11.93	12.00	0.208	2024/3/27	11#
Left Side	165/5825	ax20	0.069	0.032	-1.09	11.93	12.00	0.070	2024/3/27	
Top Side	165/5825	ax20	0.063	0.030	-2.51	11.93	12.00	0.064	2024/3/27	

NOTE: Body SAR test results of WLAN5.8G

MIMO

Test Position of Head	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Left Cheek	165/5825	ax20	0.158	0.090	-4.16	13.48	13.50	0.159	2024/3/27	6#
Left Tilt 15 Degree	165/5825	ax20	0.100	0.054	-3.77	13.48	13.50	0.100	2024/3/27	
Right Cheek	165/5825	ax20	0.152	0.086	3.23	13.48	13.50	0.153	2024/3/27	
Right Tilt 15 Degree	165/5825	ax20	0.086	0.045	-1.65	13.48	13.50	0.086	2024/3/27	

NOTE: Head SAR test results of WLAN5.8G

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

0mm										
Front Side	165/5825	ax20	0.156	0.073	-0.38	13.48	13.50	0.157	2024/3/27	
Back Side	165/5825	ax20	0.219	0.102	4.52	13.48	13.50	0.220	2024/3/27	12#
Left Side	165/5825	ax20	0.087	0.045	1.58	13.48	13.50	0.087	2024/3/27	
Right Side	165/5825	ax20	0.030	0.026	-0.21	13.48	13.50	0.030	2024/3/27	
Top Side	165/5825	ax20	0.074	0.040	-1.93	13.48	13.50	0.074	2024/3/27	
Bottom Side	165/5825	ax20	0.065	0.037	1.72	13.48	13.50	0.065	2024/3/27	

NOTE: Body SAR test results of WLAN5.8G

10.2. Simultaneous Transmission Analysis

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

1) Scalar SAR summation < 1.6W/kg.

2) SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (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 ≤ 0.04, simultaneously transmission SAR measurement is not necessary.

Test Position		Scaled SAR_{MAX}		Σ1-g SAR (W/Kg)	SPLSR	Remark
		WLAN1	DSS			
Head	Left Cheek	0.181	0.332	0.513	N/A	N/A
	Left Tilt 15 Degree	0.100	0.332	0.432	N/A	N/A
	Right Cheek	0.157	0.332	0.489	N/A	N/A
	Right Tilt 15 Degree	0.081	0.332	0.413	N/A	N/A
Body	Front Side	0.161	0.332	0.493	N/A	N/A
	Back Side	0.223	0.332	0.555	N/A	N/A
	Left Side	0.071	0.332	0.403	N/A	N/A
	Right Side	N/A	N/A	N/A	N/A	N/A
	Top Side	N/A	0.332	0.332	N/A	N/A
	Bottom Side	0.068	N/A	0.068	N/A	N/A

NOTE:ANT1+ANT2=MIMO

11. Appendix A. Photo documentation

Refer to appendix Test Setup photo---SAR

12. Appendix B. System Check Plots

Table of contents

MEASUREMENT 1

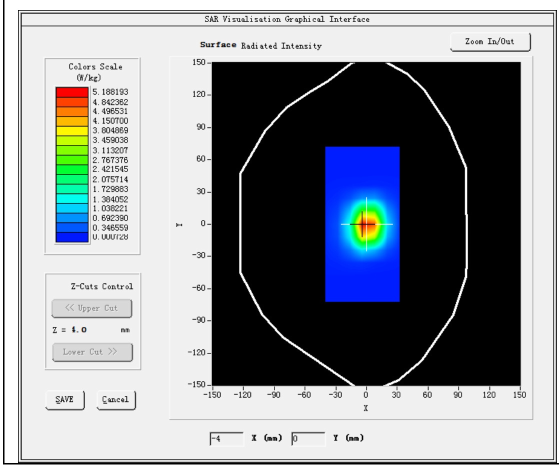
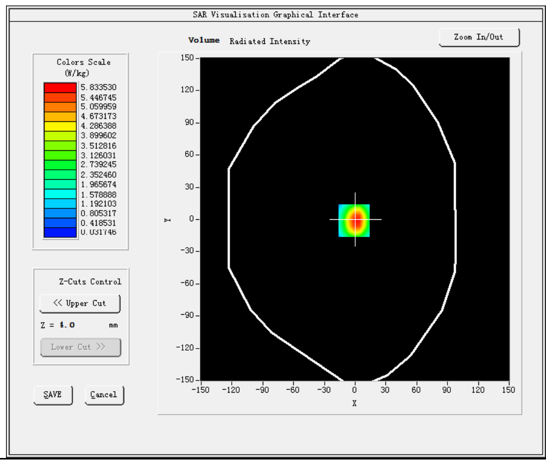
Date of measurement: 24/3/2024

A. Experimental conditions.

Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels	Middle
Signal	CW (Crest factor: 1.0)
ConvF	2.85

B. SAR Measurement Results

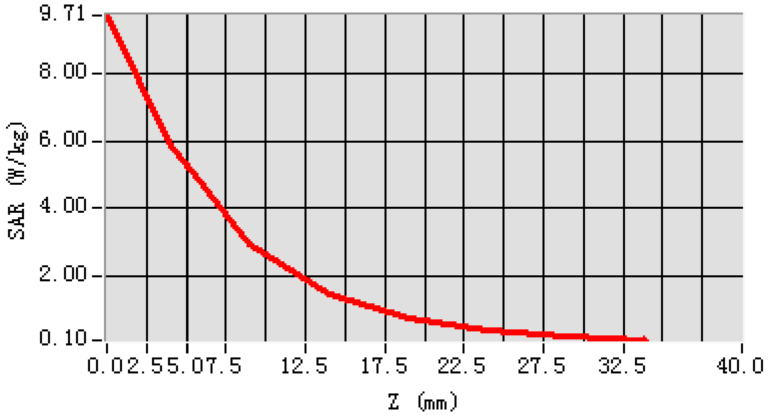
Frequency (MHz)	2450.000000
Relative permittivity (real part)	37.574635
Relative permittivity (imaginary part)	12.923236
Conductivity (S/m)	1.758996
Variation (%)	-3.640000

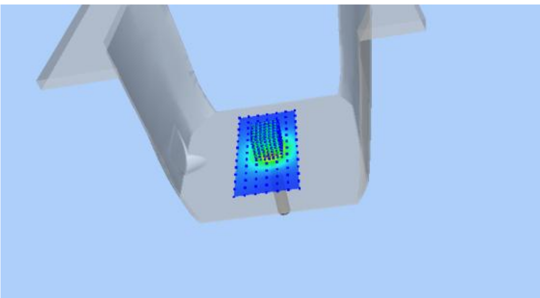
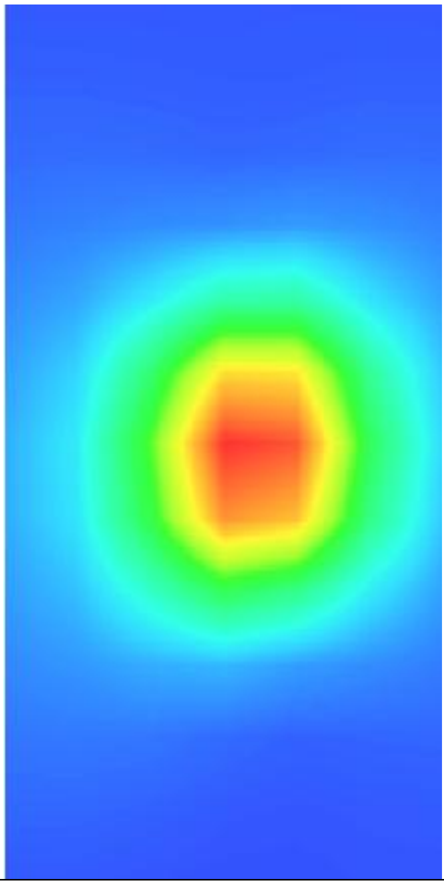
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-1.00, Y=-1.00
SAR Peak: 9.83 W/kg

SAR 10g (W/Kg)	2.497231
SAR 1g (W/Kg)	5.411129

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	9.7142	5.8385	2.9279	1.4635	0.7406	0.3749	0.1919



3D screen shot	Hot spot position
	

MEASUREMENT 2

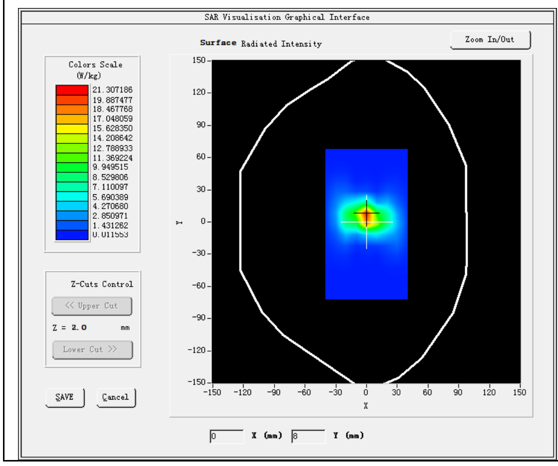
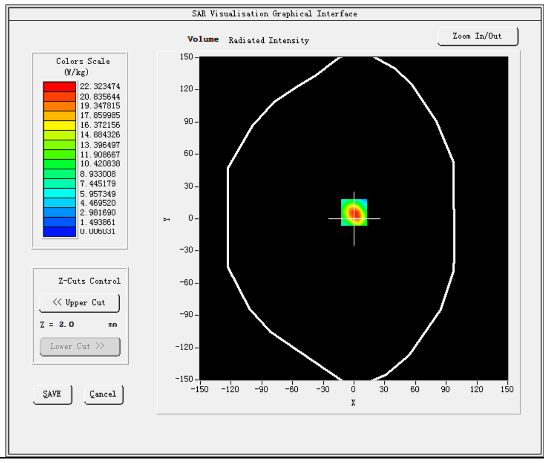
Date of measurement: 26/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Dipole
Band	CW5200
Channels	Middle
Signal	CW (Crest factor: 1.0)
ConvF	2.07

B. SAR Measurement Results

Frequency (MHz)	5200.000000
Relative permittivity (real part)	34.625906
Relative permittivity (imaginary part)	15.608512
Conductivity (S/m)	4.509126
Variation (%)	-2.960000

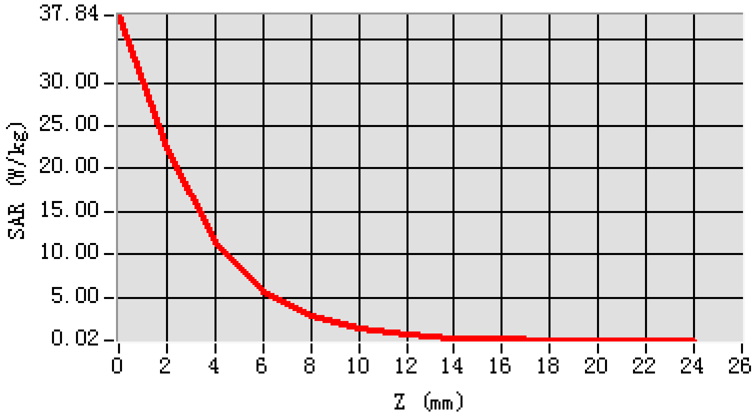
SURFACE SAR	VOLUME SAR
	

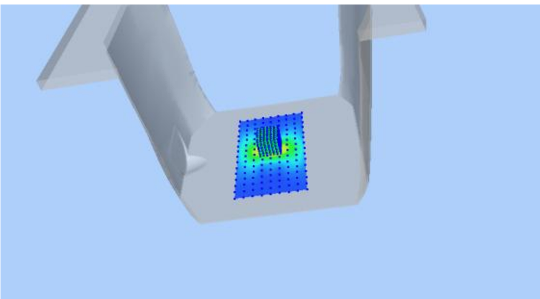
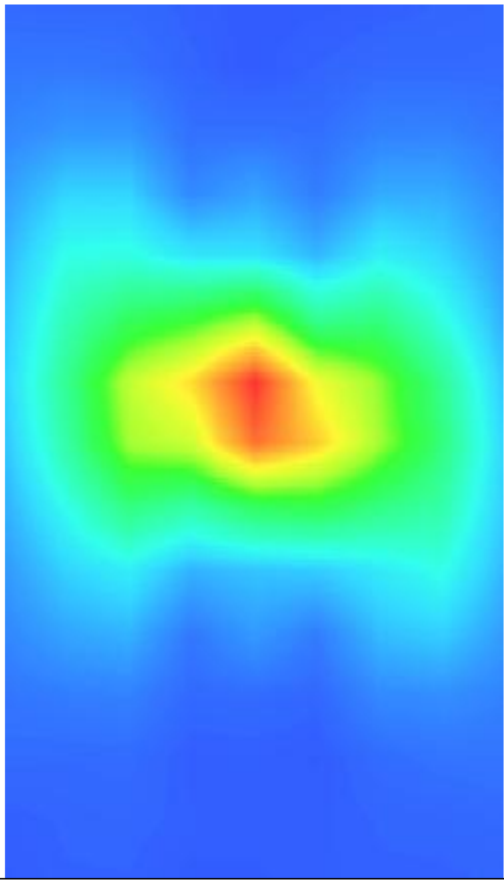
Maximum location: X=0.00, Y=6.00

SAR Peak: 40.06 W/kg

SAR 10g (W/Kg)	5.979168
SAR 1g (W/Kg)	16.426132

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	37.803	22.359	11.354	5.6688	2.8267	1.4093	0.7144	0.3661	0.1845	0.1085	0.0545	0.0326



3D screen shot	Hot spot position
	

MEASUREMENT 3

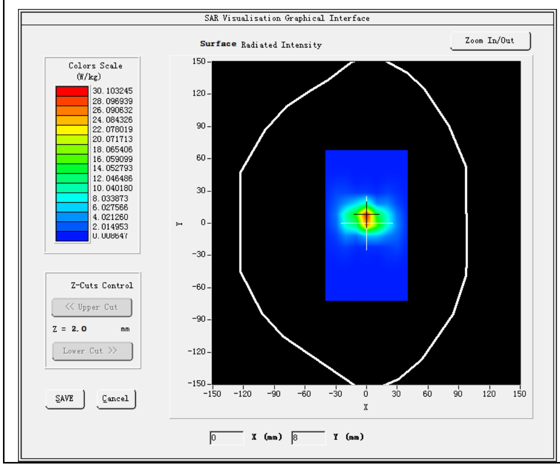
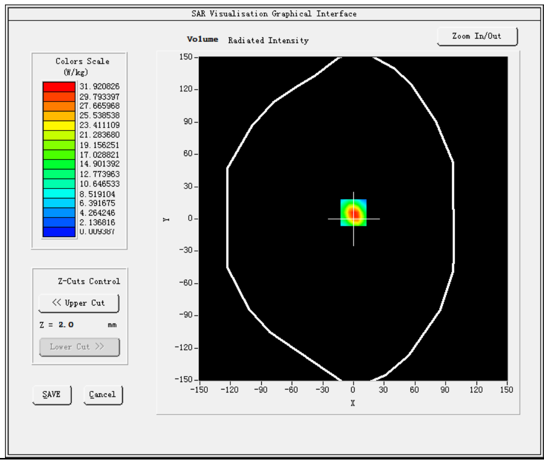
Date of measurement: 27/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Dipole
Band	CW5800
Channels	Middle
Signal	CW (Crest factor: 1.0)
ConvF	2.04

B. SAR Measurement Results

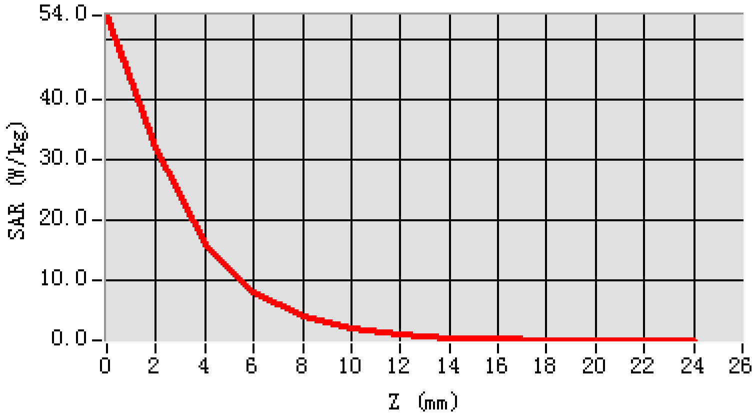
Frequency (MHz)	5800.000000
Relative permittivity (real part)	34.057056
Relative permittivity (imaginary part)	16.132741
Conductivity (S/m)	5.198328
Variation (%)	-2.800000

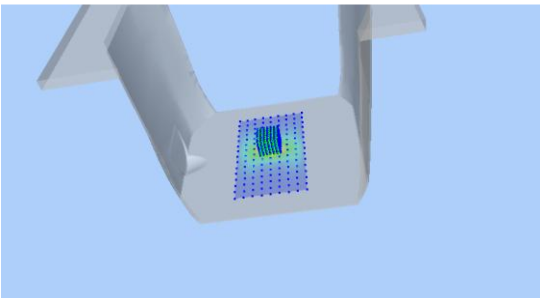
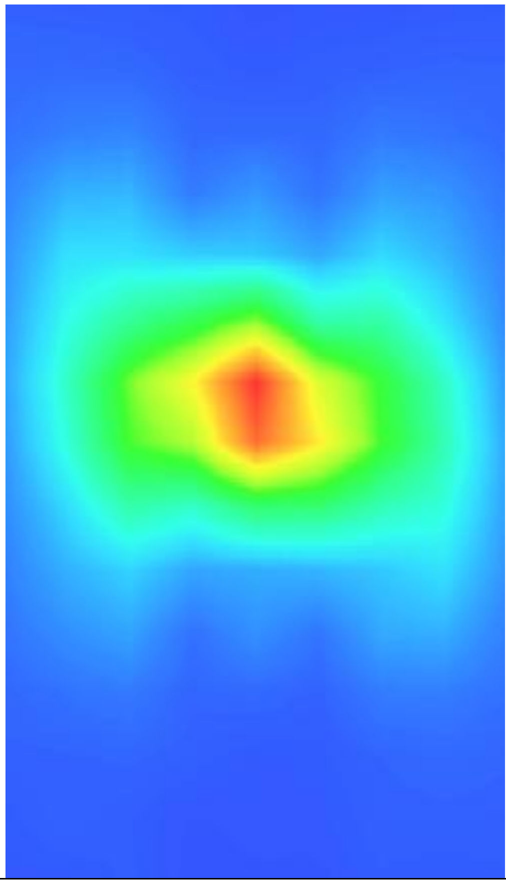
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=6.00
SAR Peak: 57.37 W/kg

SAR 10g (W/Kg)	5.564255
SAR 1g (W/Kg)	18.859047

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	54.052	31.953	16.184	8.1716	4.0876	2.0571	1.0382	0.5190	0.2707	0.1534	0.0711	0.0410



3D screen shot	Hot spot position
	

13. Appendix C. Plots of High SAR Measurement

Table of contents

MEASUREMENT 1

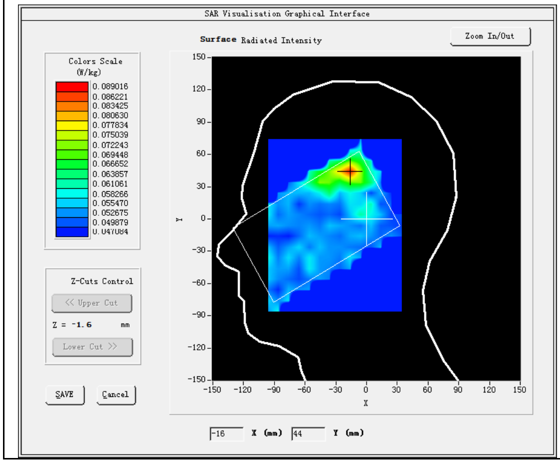
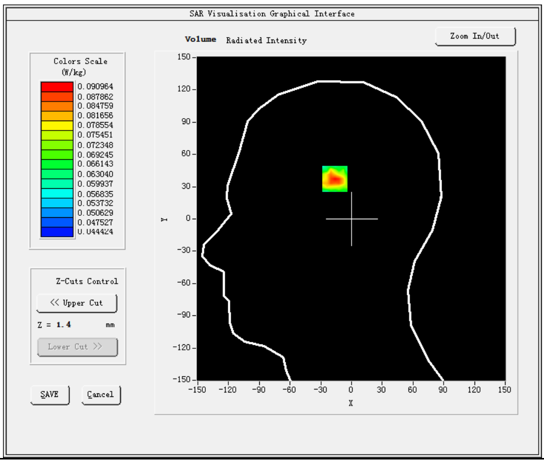
Date of measurement: 26/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.07

B. SAR Measurement Results

Frequency (MHz)	5230.000000
Relative permittivity (real part)	34.537863
Relative permittivity (imaginary part)	15.646192
Conductivity (S/m)	4.546088
Variation (%)	3.840000

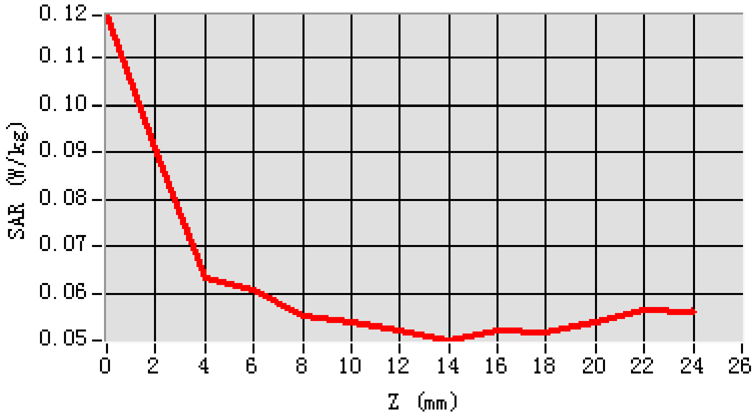
SURFACE SAR	VOLUME SAR
	

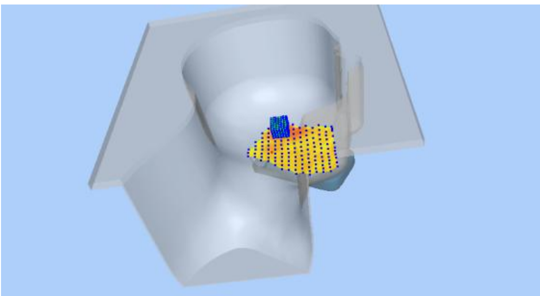
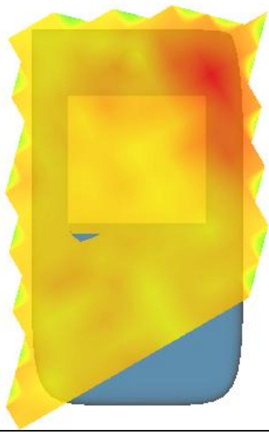
Maximum location: X=-16.00, Y=44.00

SAR Peak: 0.18 W/kg

SAR 10g (W/Kg)	0.064720
SAR 1g (W/Kg)	0.088840

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.1189	0.0910	0.0635	0.0607	0.0551	0.0542	0.0523	0.0502	0.0523	0.0519	0.0541	0.0564



3D screen shot	Hot spot position
	

MEASUREMENT 2

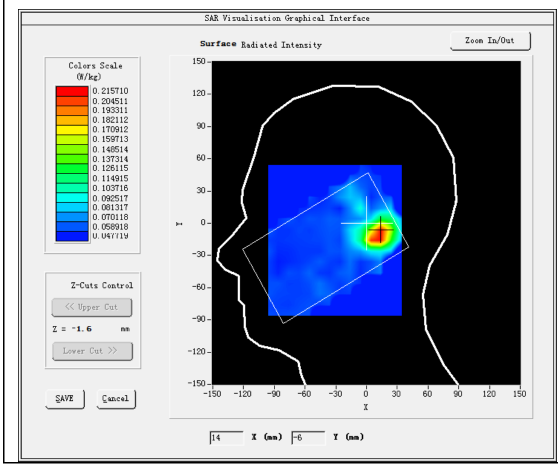
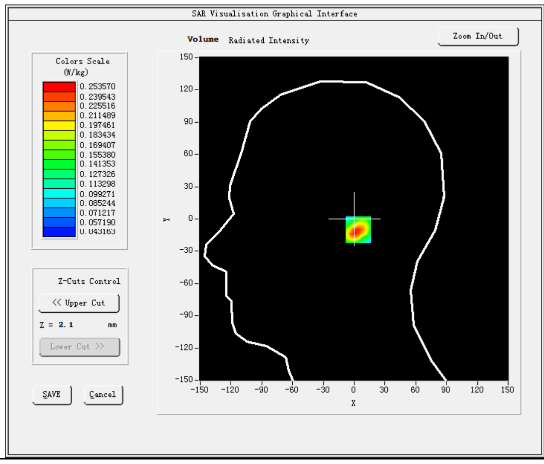
Date of measurement: 26/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.07

B. SAR Measurement Results

Frequency (MHz)	5240.000000
Relative permittivity (real part)	34.471382
Relative permittivity (imaginary part)	15.619897
Conductivity (S/m)	4.547126
Variation (%)	-1.130000

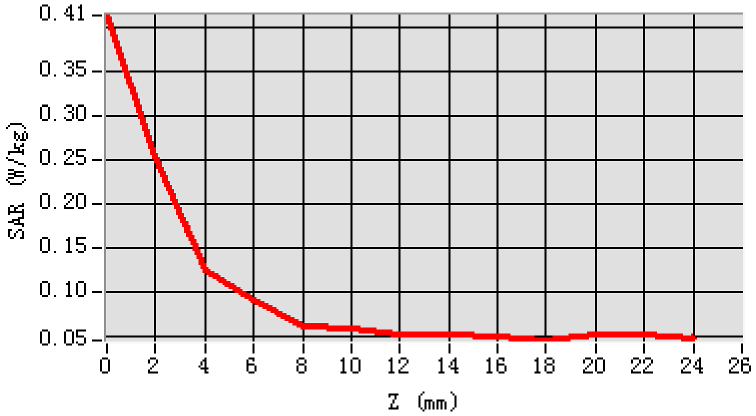
SURFACE SAR	VOLUME SAR
	

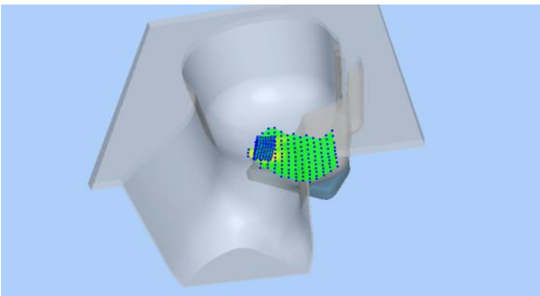
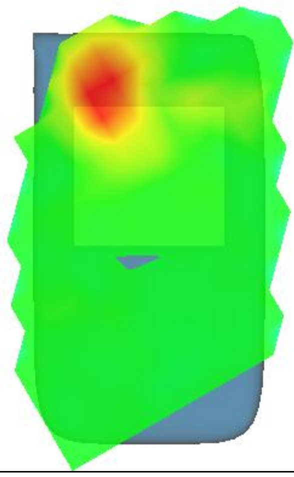
Maximum location: X=13.00, Y=-10.00

SAR Peak: 0.62 W/kg

SAR 10g (W/Kg)	0.120885
SAR 1g (W/Kg)	0.254074

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.4129	0.2536	0.1251	0.0917	0.0621	0.0604	0.0525	0.0518	0.0494	0.0459	0.0522	0.0518



3D screen shot	Hot spot position
	

MEASUREMENT 3

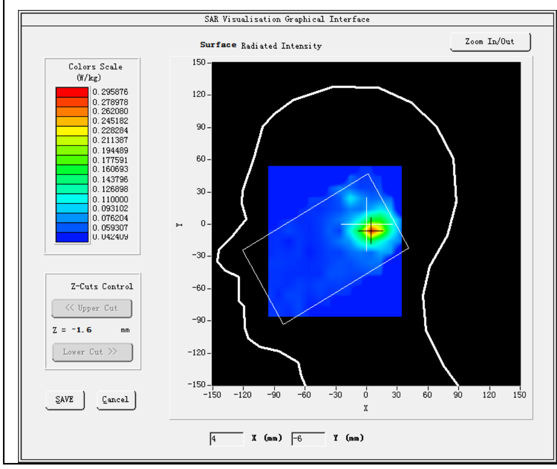
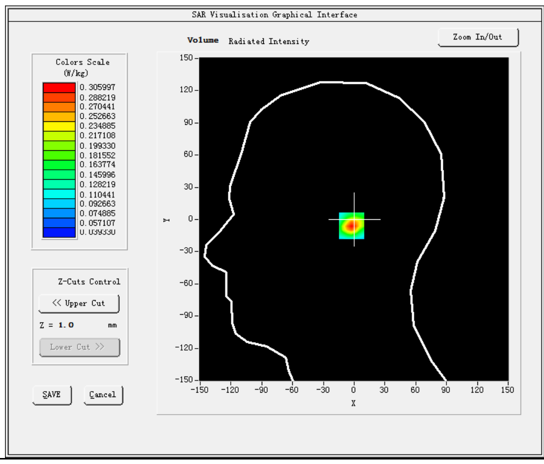
Date of measurement: 26/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.07

B. SAR Measurement Results

Frequency (MHz)	5230.000000
Relative permittivity (real part)	34.537863
Relative permittivity (imaginary part)	15.646192
Conductivity (S/m)	4.546088
Variation (%)	1.980000

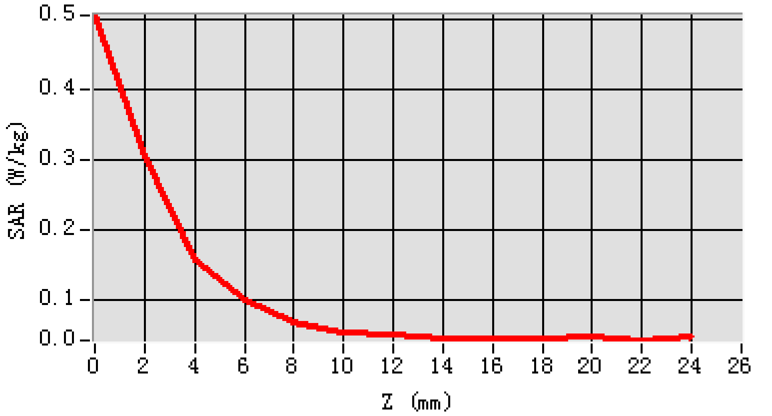
SURFACE SAR	VOLUME SAR
	

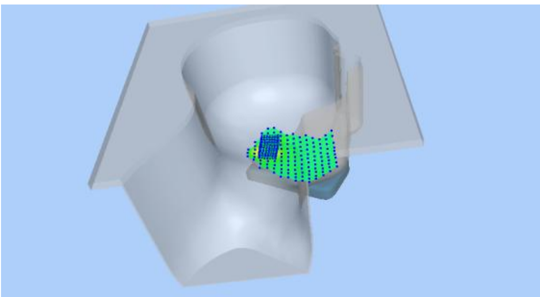
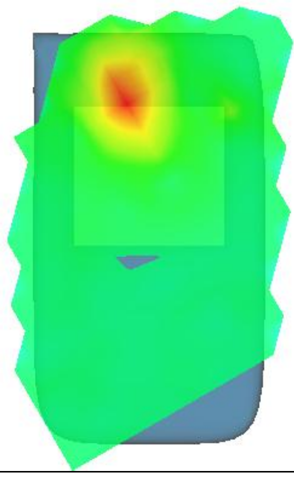
Maximum location: X=5.00, Y=-6.00

SAR Peak: 0.79 W/kg

SAR 10g (W/Kg)	0.129194
SAR 1g (W/Kg)	0.300933

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.5069	0.3060	0.1563	0.0991	0.0701	0.0553	0.0521	0.0473	0.0471	0.0466	0.0500	0.0433



3D screen shot	Hot spot position
	

MEASUREMENT 4

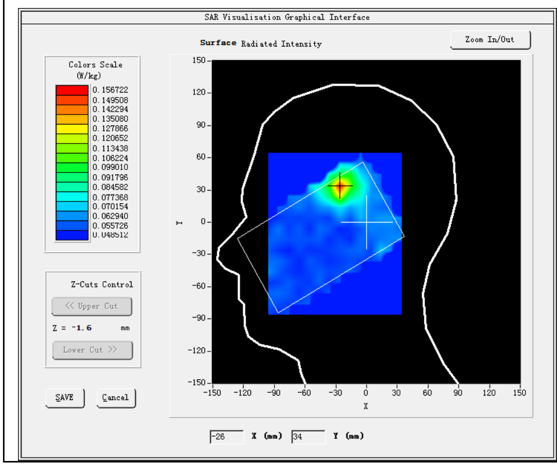
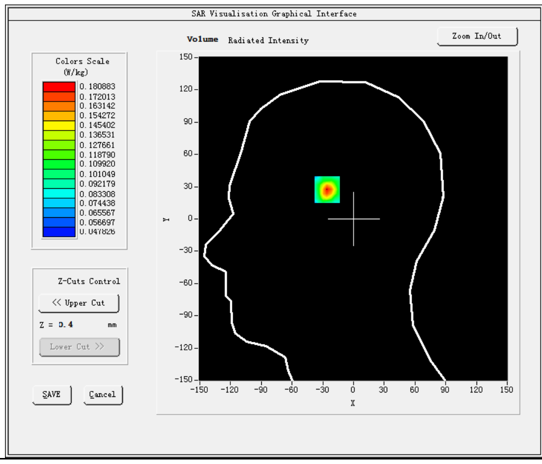
Date of measurement: 27/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.04

B. SAR Measurement Results

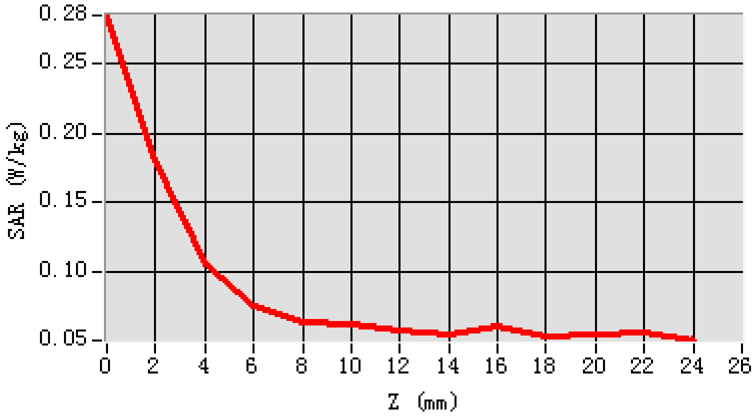
Frequency (MHz)	5825.000000
Relative permittivity (real part)	33.990967
Relative permittivity (imaginary part)	16.113672
Conductivity (S/m)	5.214563
Variation (%)	2.770000

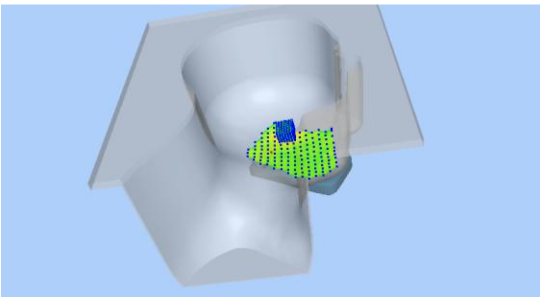
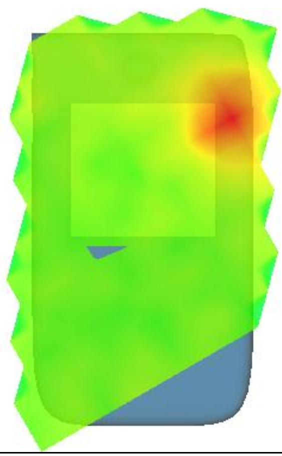
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-26.00, Y=33.00
SAR Peak: 0.43 W/kg

SAR 10g (W/Kg)	0.093669
SAR 1g (W/Kg)	0.175106

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.2849	0.1809	0.1050	0.0753	0.0634	0.0617	0.0583	0.0556	0.0605	0.0541	0.0546	0.0567



3D screen shot	Hot spot position
	

MEASUREMENT 5

Date of measurement: 27/3/2024

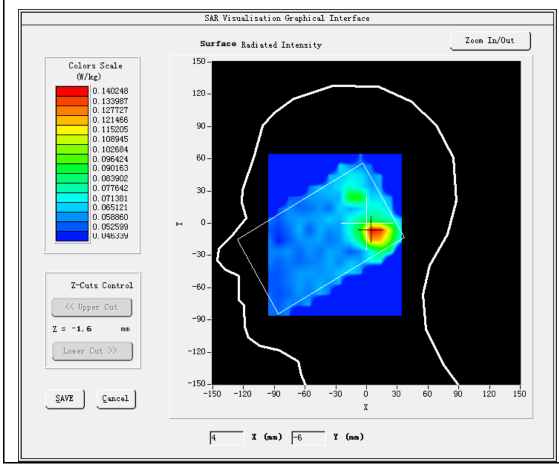
A. Experimental conditions.

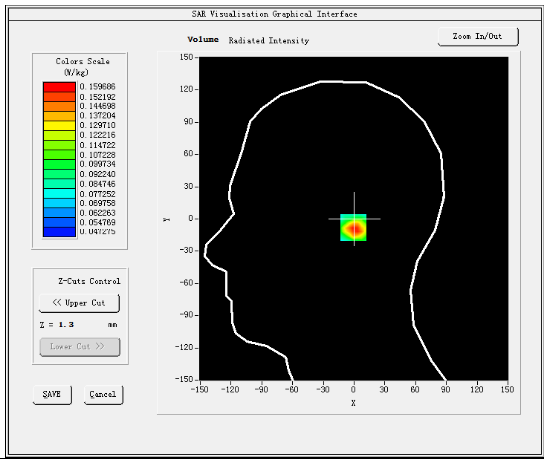
Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.04

B. SAR Measurement Results

Frequency (MHz)	5825.000000
Relative permittivity (real part)	33.990967
Relative permittivity (imaginary part)	16.113672
Conductivity (S/m)	5.214563
Variation (%)	4.670000

SURFACE SAR	VOLUME SAR

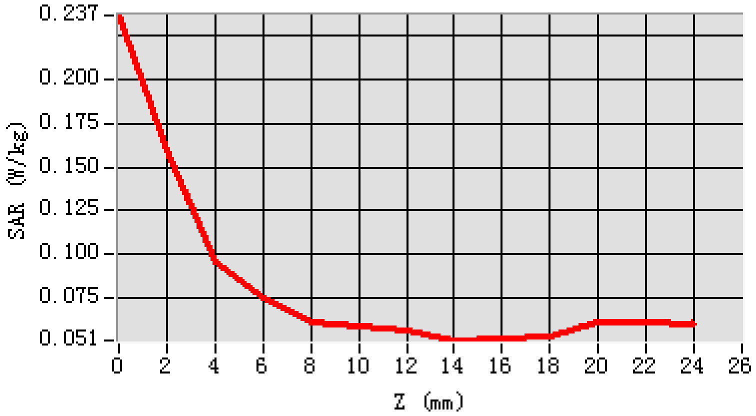


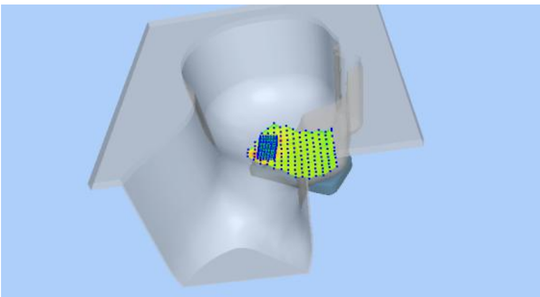
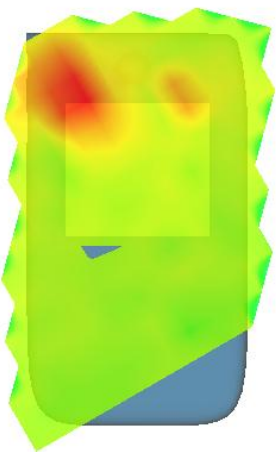


Maximum location: X=7.00, Y=-8.00
SAR Peak: 0.36 W/kg

SAR 10g (W/Kg)	0.090792
SAR 1g (W/Kg)	0.157047

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.2368	0.1597	0.0958	0.0744	0.0613	0.0588	0.0570	0.0508	0.0515	0.0530	0.0614	0.0608



3D screen shot	Hot spot position
	

MEASUREMENT 6

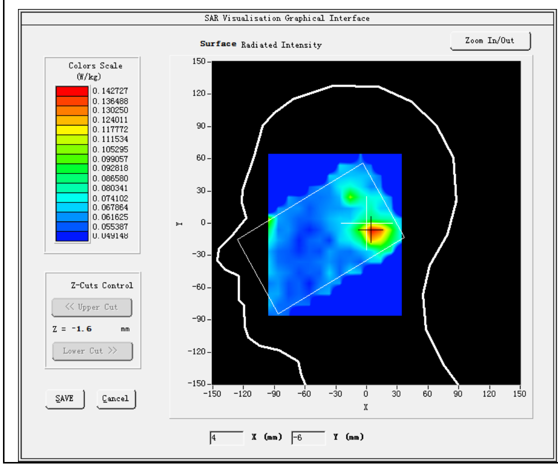
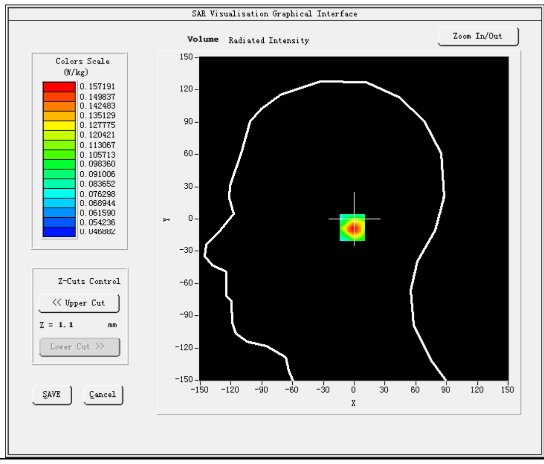
Date of measurement: 27/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.04

B. SAR Measurement Results

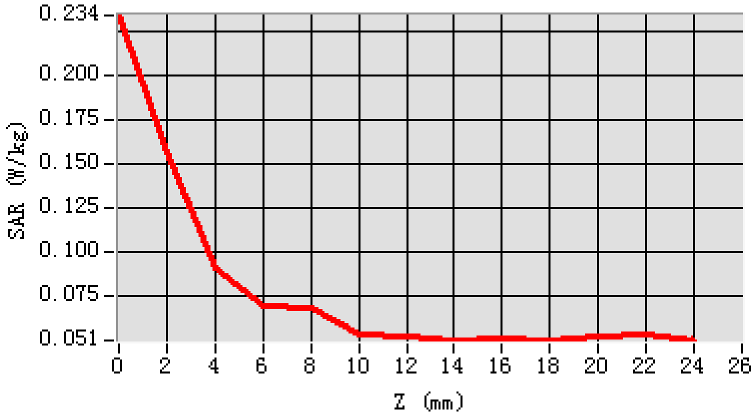
Frequency (MHz)	5825.000000
Relative permittivity (real part)	33.990967
Relative permittivity (imaginary part)	16.113672
Conductivity (S/m)	5.214563
Variation (%)	-4.160000

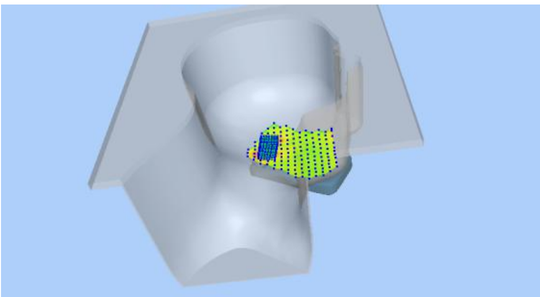
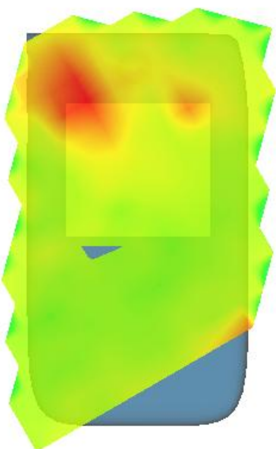
SURFACE SAR	VOLUME SAR
	

Maximum location: X=6.00, Y=-8.00
SAR Peak: 0.36 W/kg

SAR 10g (W/Kg)	0.090436
SAR 1g (W/Kg)	0.158280

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.2344	0.1572	0.0911	0.0700	0.0687	0.0541	0.0525	0.0510	0.0521	0.0510	0.0527	0.0538



3D screen shot	Hot spot position
	

MEASUREMENT 7

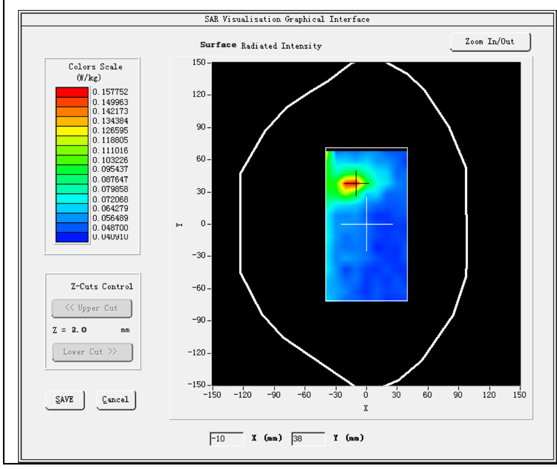
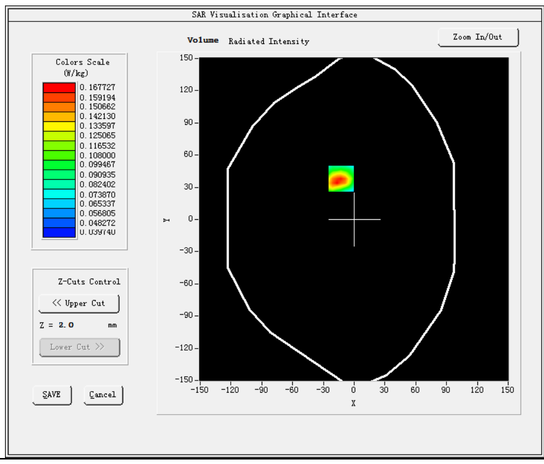
Date of measurement: 26/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.07

B. SAR Measurement Results

Frequency (MHz)	5230.000000
Relative permittivity (real part)	34.537863
Relative permittivity (imaginary part)	15.646192
Conductivity (S/m)	4.546088
Variation (%)	-3.680000

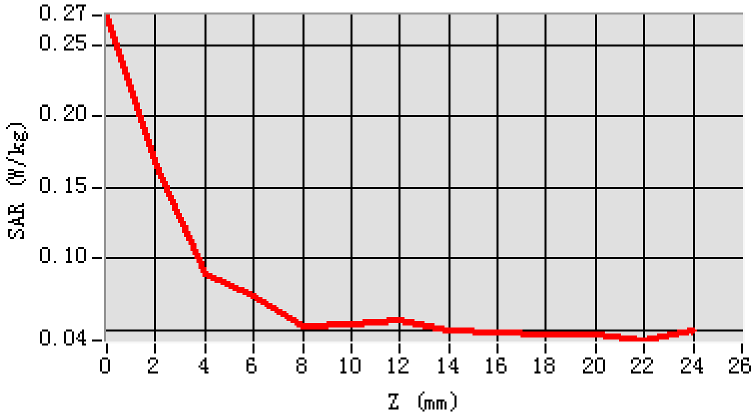
SURFACE SAR	VOLUME SAR
	

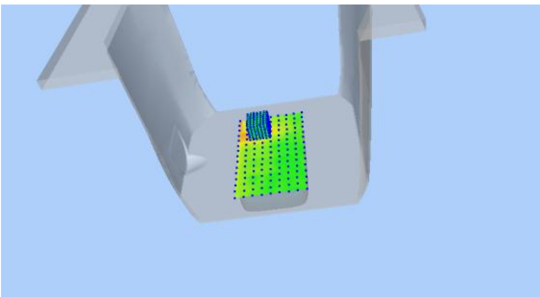
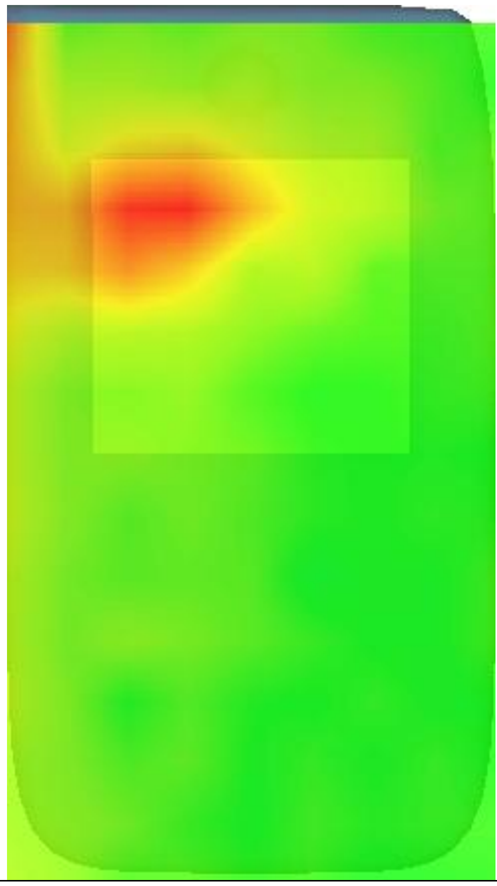
Maximum location: X=-13.00, Y=38.00

SAR Peak: 0.28 W/kg

SAR 10g (W/Kg)	0.071995
SAR 1g (W/Kg)	0.115040

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.2712	0.1677	0.0887	0.0729	0.0530	0.0533	0.0561	0.0497	0.0480	0.0473	0.0475	0.0425



3D screen shot	Hot spot position
	

MEASUREMENT 8

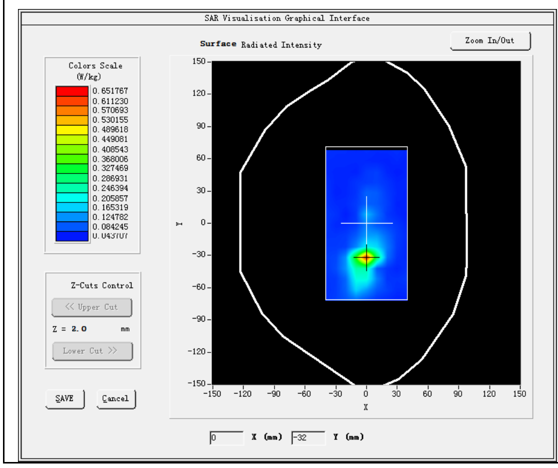
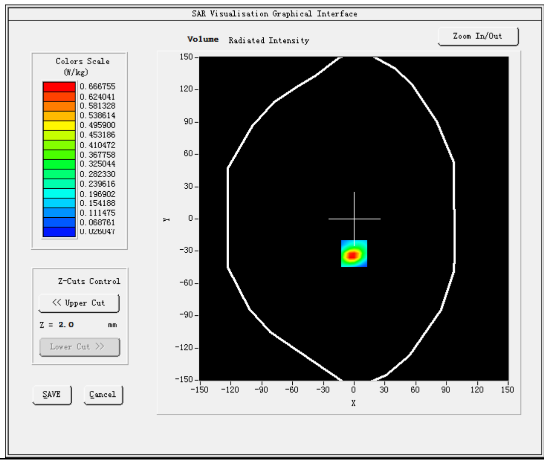
Date of measurement: 26/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.07

B. SAR Measurement Results

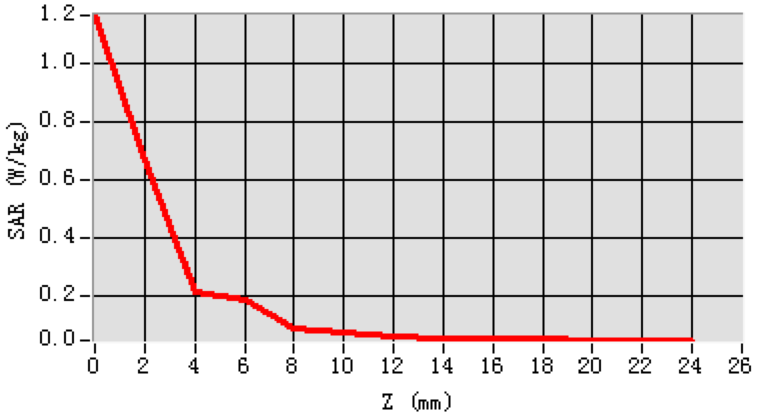
Frequency (MHz)	5240.000000
Relative permittivity (real part)	34.471382
Relative permittivity (imaginary part)	15.619897
Conductivity (S/m)	4.547126
Variation (%)	-3.000000

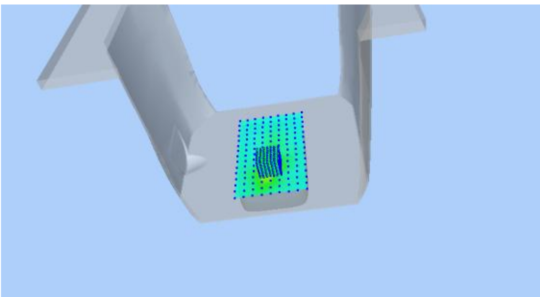
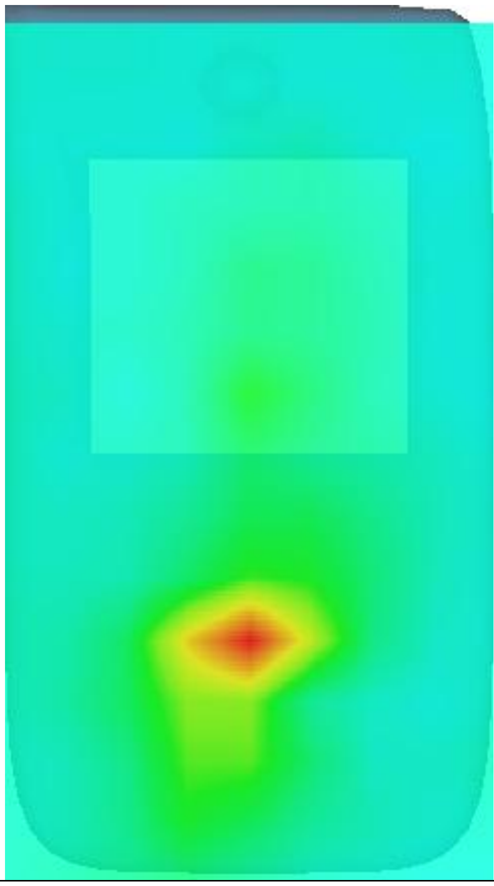
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=-32.00
SAR Peak: 1.26 W/kg

SAR 10g (W/Kg)	0.141978
SAR 1g (W/Kg)	0.385918

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	1.1647	0.6668	0.2149	0.1873	0.0871	0.0723	0.0599	0.0552	0.0498	0.0496	0.0462	0.0459



3D screen shot	Hot spot position
	

MEASUREMENT 9

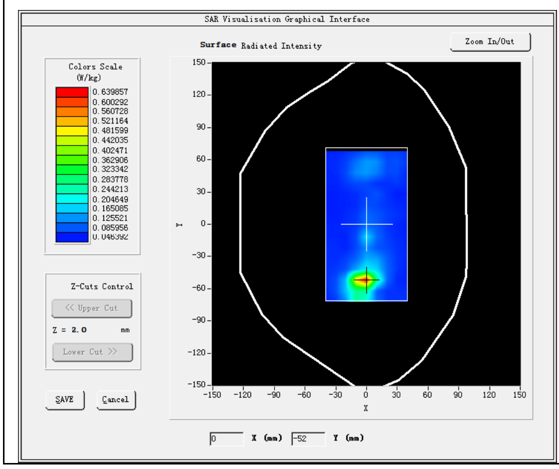
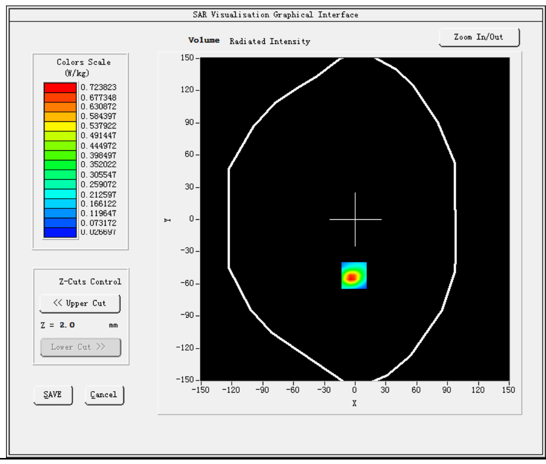
Date of measurement: 26/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.07

B. SAR Measurement Results

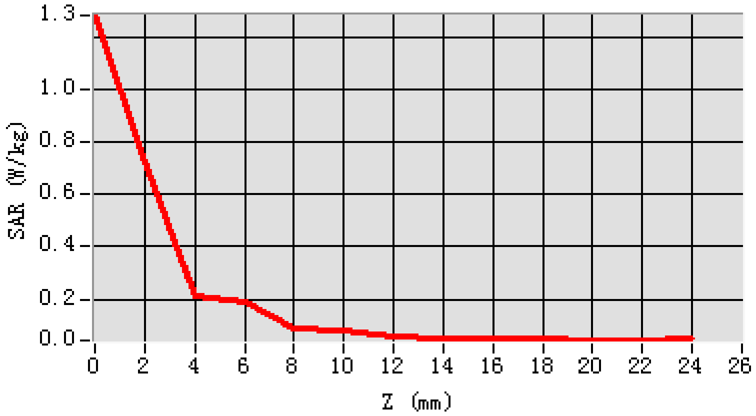
Frequency (MHz)	5230.000000
Relative permittivity (real part)	34.537863
Relative permittivity (imaginary part)	15.646192
Conductivity (S/m)	4.546088
Variation (%)	2.410000

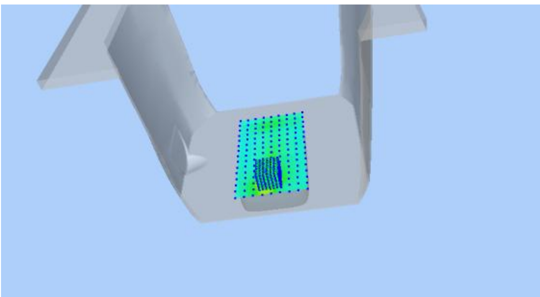
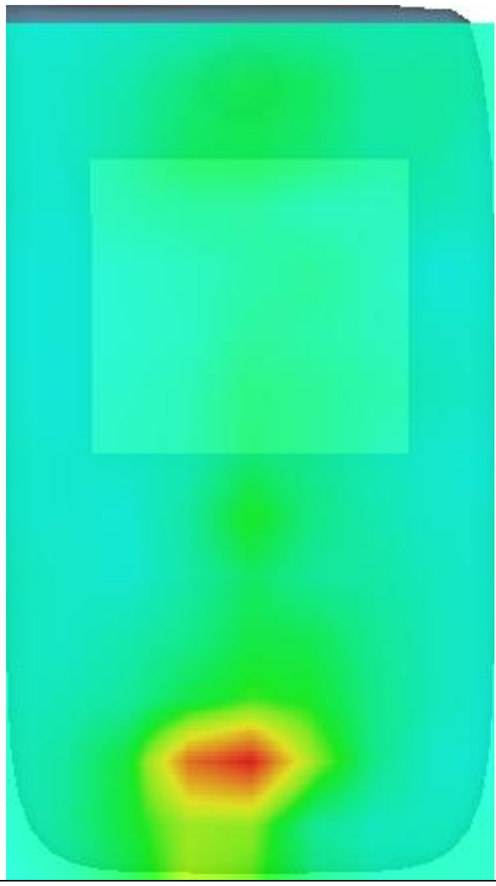
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-1.00, Y=-52.00
SAR Peak: 1.34 W/kg

SAR 10g (W/Kg)	0.151035
SAR 1g (W/Kg)	0.410981

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	1.2806	0.7238	0.2133	0.1918	0.0874	0.0815	0.0641	0.0527	0.0536	0.0539	0.0454	0.0491



3D screen shot	Hot spot position
	

MEASUREMENT 10

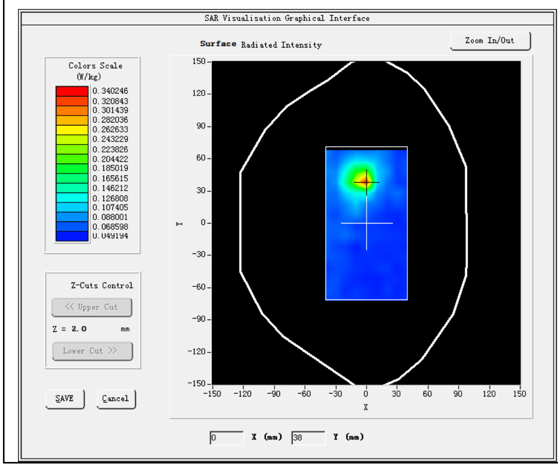
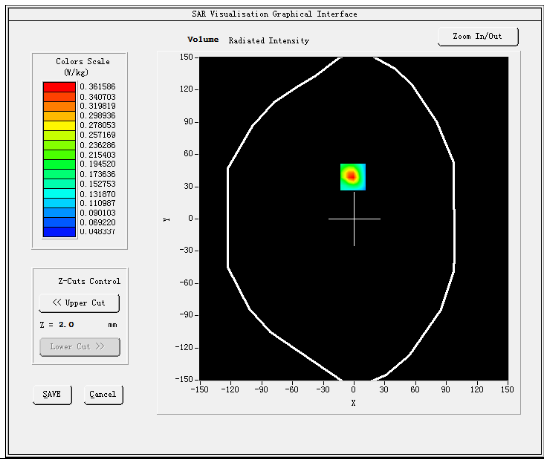
Date of measurement: 27/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.04

B. SAR Measurement Results

Frequency (MHz)	5825.000000
Relative permittivity (real part)	33.990967
Relative permittivity (imaginary part)	16.113672
Conductivity (S/m)	5.214563
Variation (%)	-3.500000

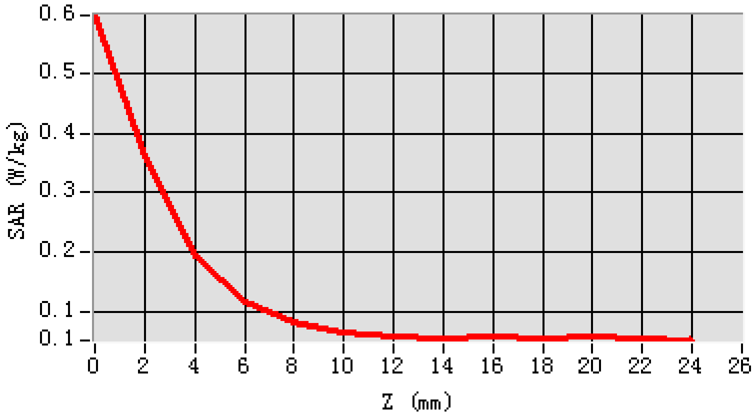
SURFACE SAR	VOLUME SAR
	

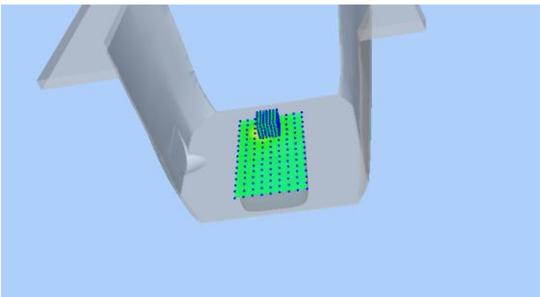
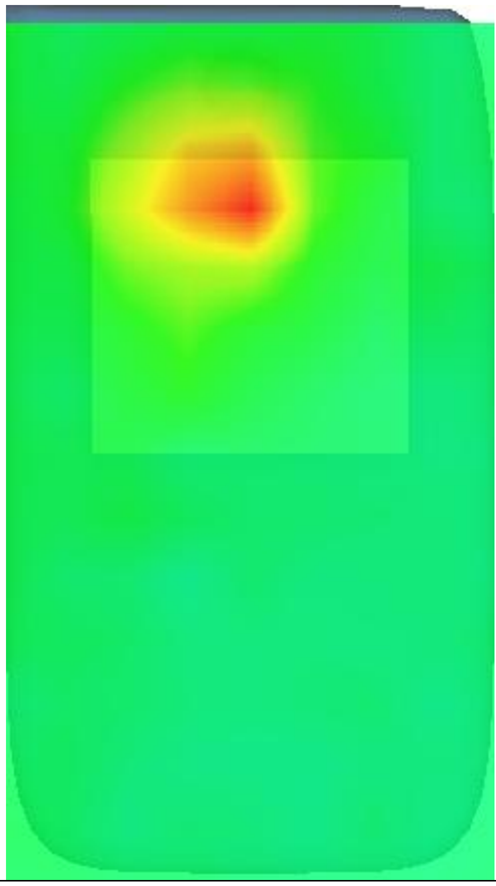
Maximum location: X=-1.00, Y=39.00

SAR Peak: 0.63 W/kg

SAR 10g (W/Kg)	0.105131
SAR 1g (W/Kg)	0.214888

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.5977	0.3616	0.1929	0.1152	0.0816	0.0654	0.0591	0.0571	0.0581	0.0557	0.0577	0.0549



3D screen shot	Hot spot position
	

MEASUREMENT 11

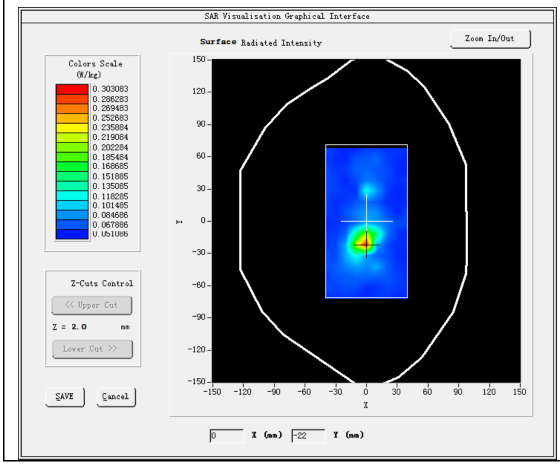
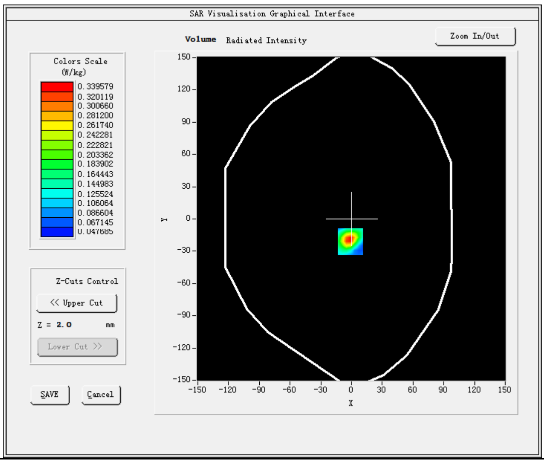
Date of measurement: 27/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.04

B. SAR Measurement Results

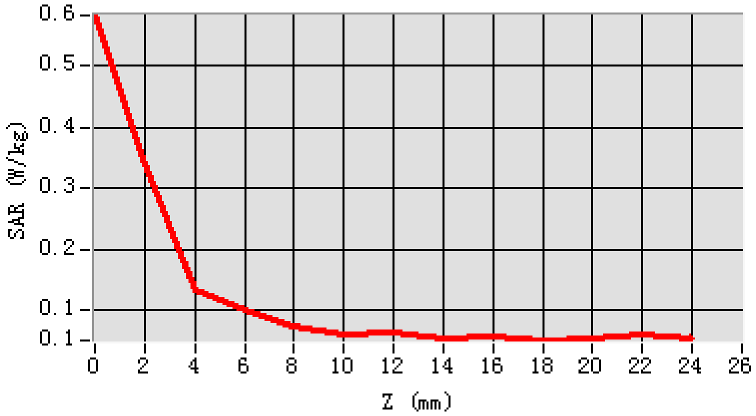
Frequency (MHz)	5825.000000
Relative permittivity (real part)	33.990967
Relative permittivity (imaginary part)	16.113672
Conductivity (S/m)	5.214563
Variation (%)	-0.980000

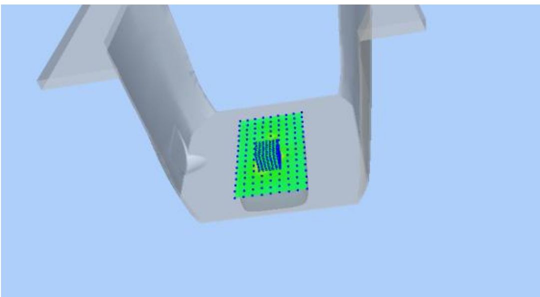
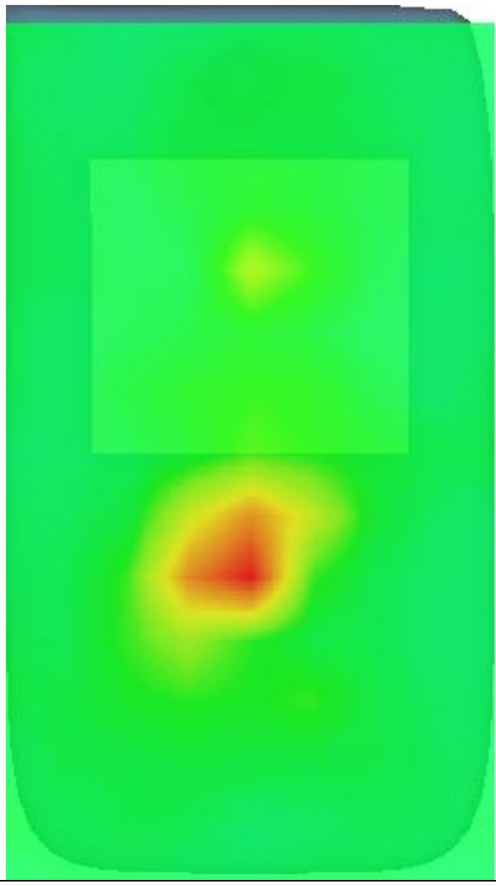
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-1.00, Y=-21.00
SAR Peak: 0.62 W/kg

SAR 10g (W/Kg)	0.098357
SAR 1g (W/Kg)	0.204888

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.5826	0.3396	0.1328	0.0999	0.0753	0.0624	0.0647	0.0566	0.0598	0.0520	0.0545	0.0621



3D screen shot	Hot spot position
	

MEASUREMENT 12

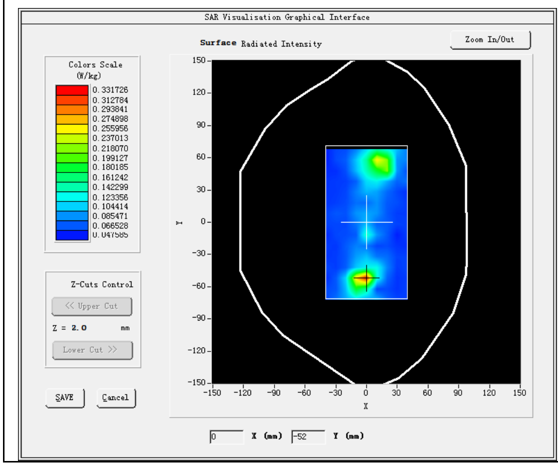
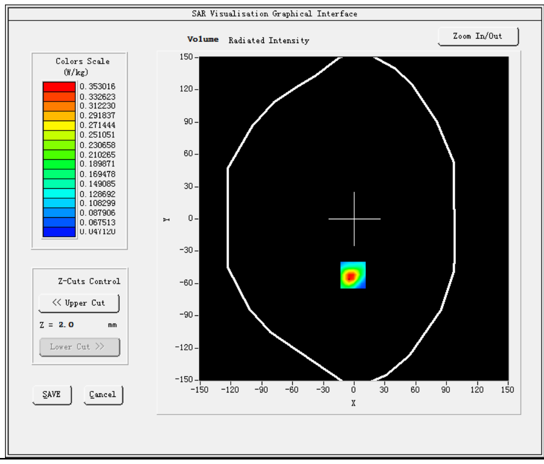
Date of measurement: 27/3/2024

A. Experimental conditions.

Area Scan	dx=10mm dy=10mm, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11ax U-NII
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.04

B. SAR Measurement Results

Frequency (MHz)	5825.000000
Relative permittivity (real part)	33.990967
Relative permittivity (imaginary part)	16.113672
Conductivity (S/m)	5.214563
Variation (%)	4.520000

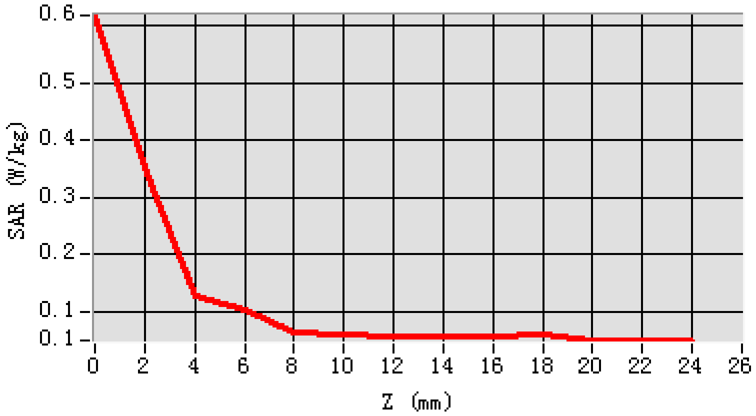
SURFACE SAR	VOLUME SAR
	

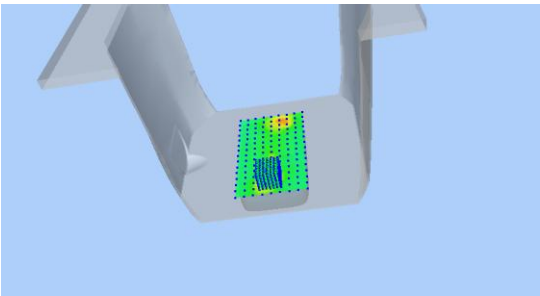
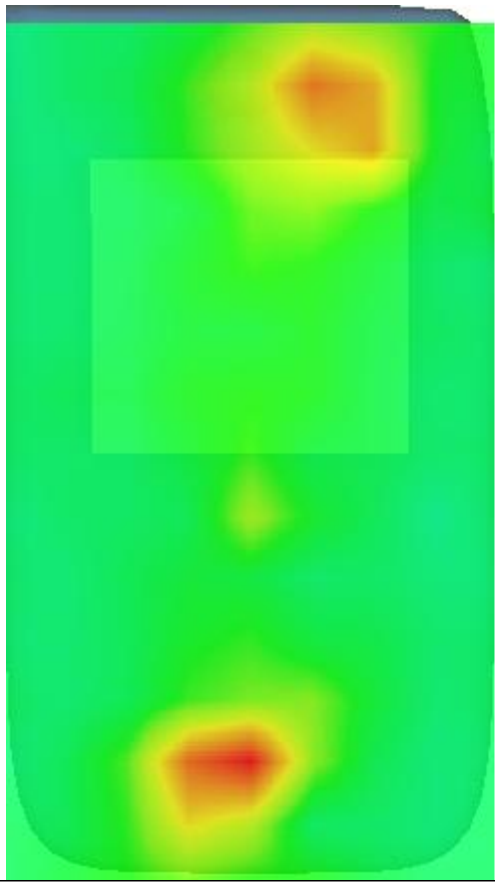
Maximum location: X=-1.00, Y=-52.00

SAR Peak: 0.66 W/kg

SAR 10g (W/Kg)	0.102367
SAR 1g (W/Kg)	0.218620

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	0.6173	0.3530	0.1295	0.1029	0.0650	0.0601	0.0564	0.0573	0.0587	0.0600	0.0523	0.0513



3D screen shot	Hot spot position
	

MEASUREMENT 13

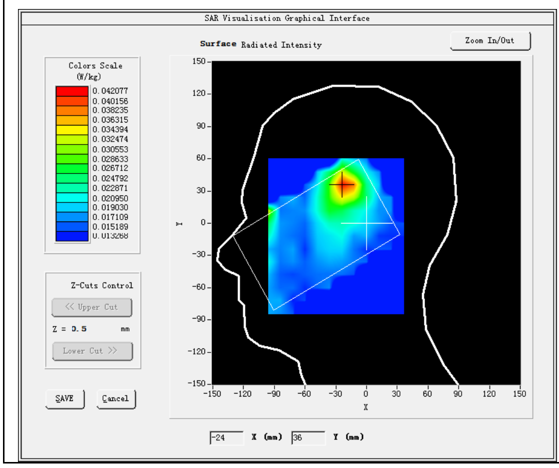
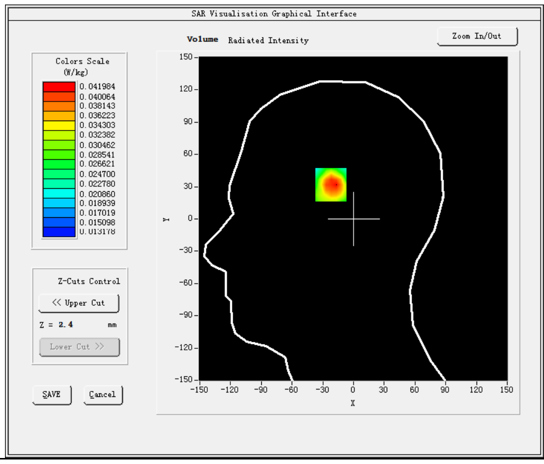
Date of measurement: 24/3/2024

A. Experimental conditions.

Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11b ISM
Channels	Middle
Signal	IEEE802.11b (Crest factor: 1.0)
ConvF	2.85

B. SAR Measurement Results

Frequency (MHz)	2437.000000
Relative permittivity (real part)	37.626736
Relative permittivity (imaginary part)	12.841736
Conductivity (S/m)	1.738628
Variation (%)	-2.160000

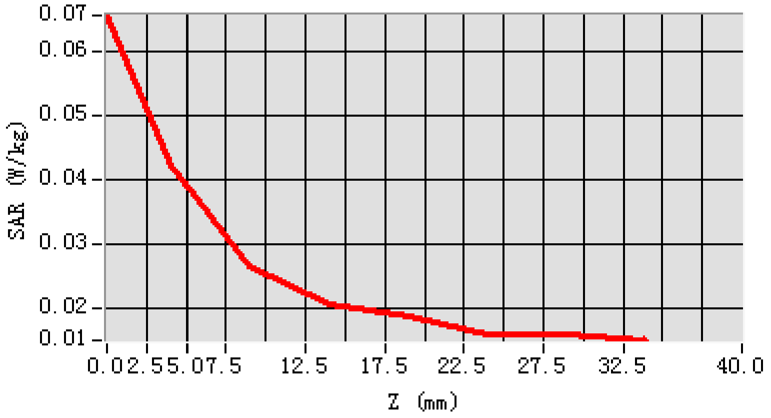
SURFACE SAR	VOLUME SAR
	

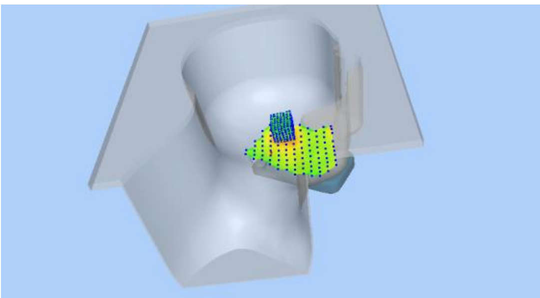
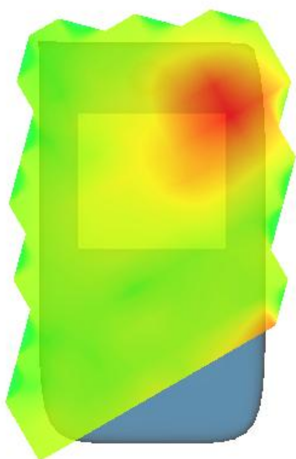
Maximum location: X=-22.00, Y=36.00

SAR Peak: 0.06 W/kg

SAR 10g (W/Kg)	0.026813
SAR 1g (W/Kg)	0.039649

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0655	0.0420	0.0264	0.0205	0.0185	0.0159	0.0157



3D screen shot	Hot spot position
	

MEASUREMENT 14

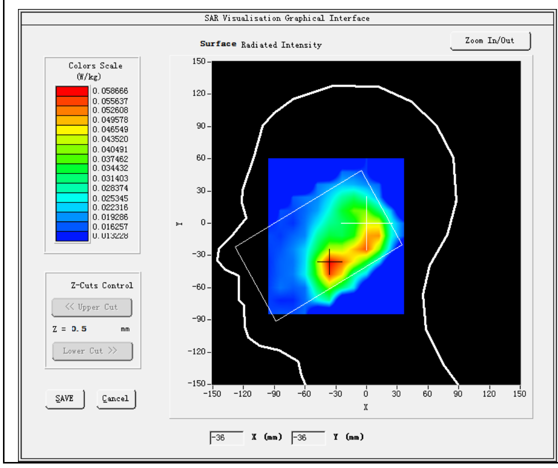
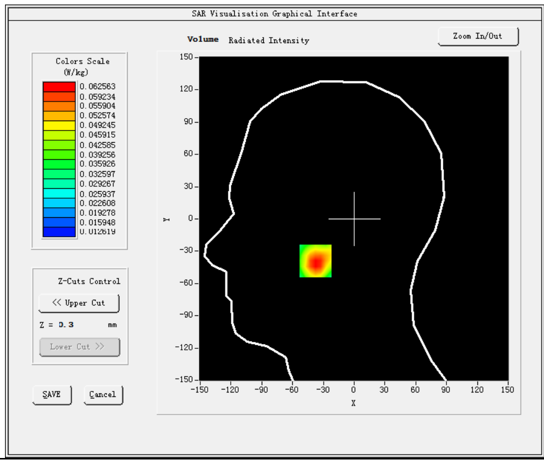
Date of measurement: 24/3/2024

A. Experimental conditions.

Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11b ISM
Channels	Low
Signal	IEEE802.11b (Crest factor: 1.0)
ConvF	2.85

B. SAR Measurement Results

Frequency (MHz)	2412.000000
Relative permittivity (real part)	37.671335
Relative permittivity (imaginary part)	12.872436
Conductivity (S/m)	1.724906
Variation (%)	0.090000

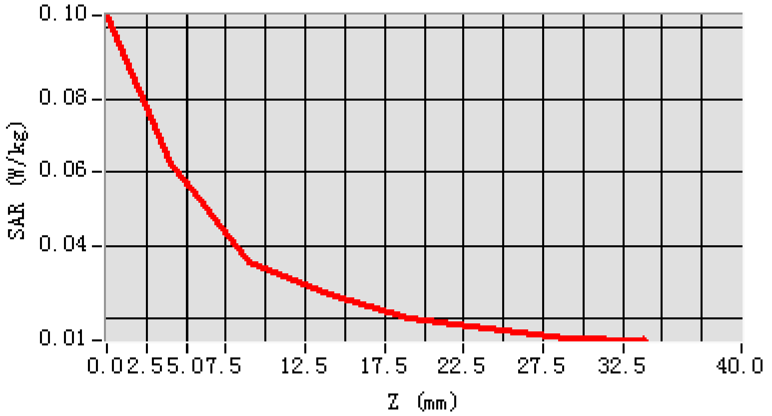
SURFACE SAR	VOLUME SAR
	

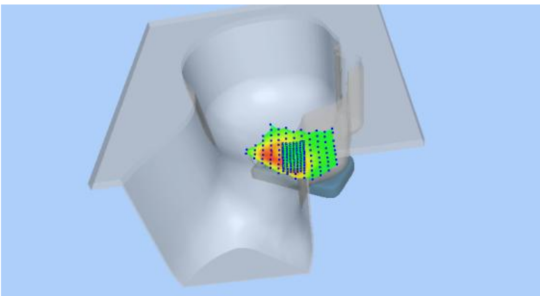
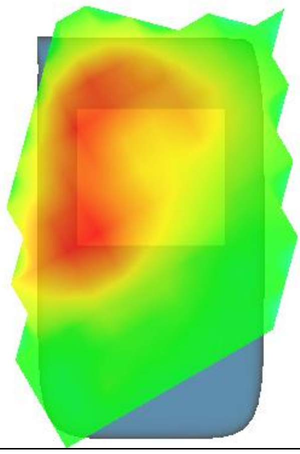
Maximum location: X=-34.00, Y=-39.00

SAR Peak: 0.10 W/kg

SAR 10g (W/Kg)	0.037198
SAR 1g (W/Kg)	0.060497

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1031	0.0626	0.0352	0.0263	0.0198	0.0171	0.0146



3D screen shot	Hot spot position
	

MEASUREMENT 15

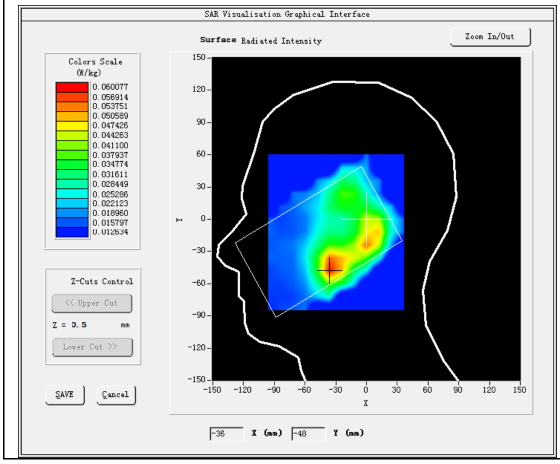
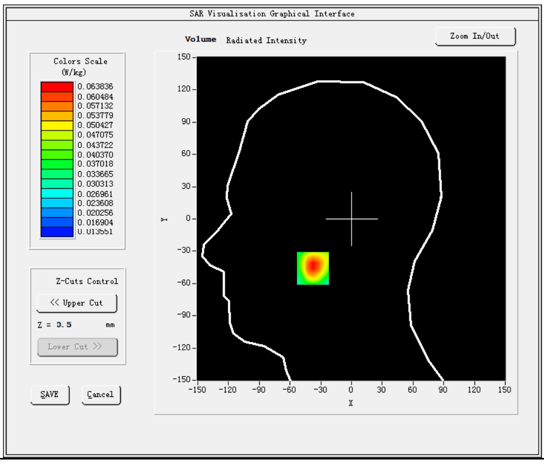
Date of measurement: 24/3/2024

A. Experimental conditions.

Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11ax
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.85

B. SAR Measurement Results

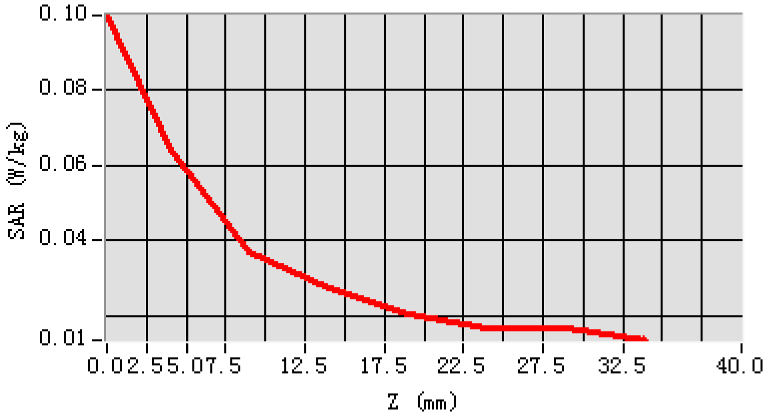
Frequency (MHz)	2452.000000
Relative permittivity (real part)	37.589335
Relative permittivity (imaginary part)	12.953636
Conductivity (S/m)	1.764573
Variation (%)	0.390000

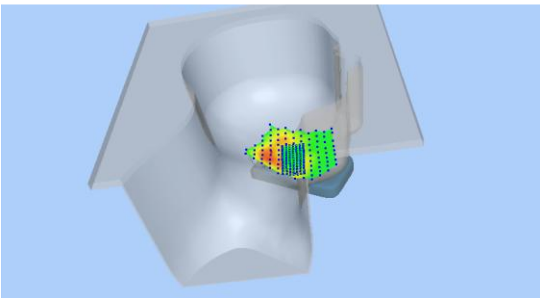
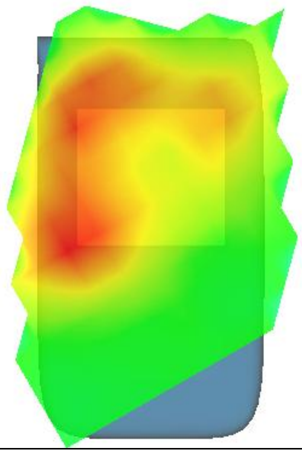
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-34.00, Y=-46.00
SAR Peak: 0.10 W/kg

SAR 10g (W/Kg)	0.037470
SAR 1g (W/Kg)	0.060920

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0994	0.0638	0.0370	0.0277	0.0207	0.0172	0.0170



3D screen shot	Hot spot position
	

MEASUREMENT 16

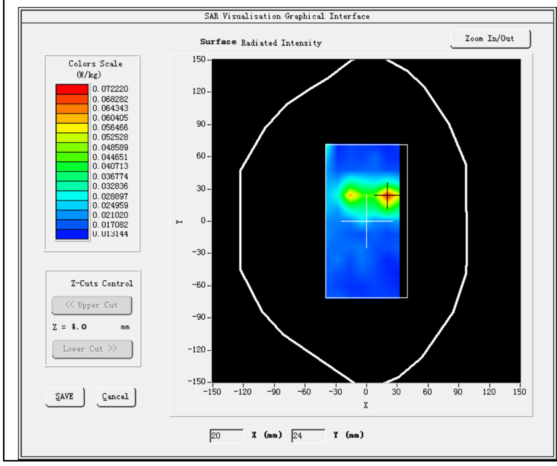
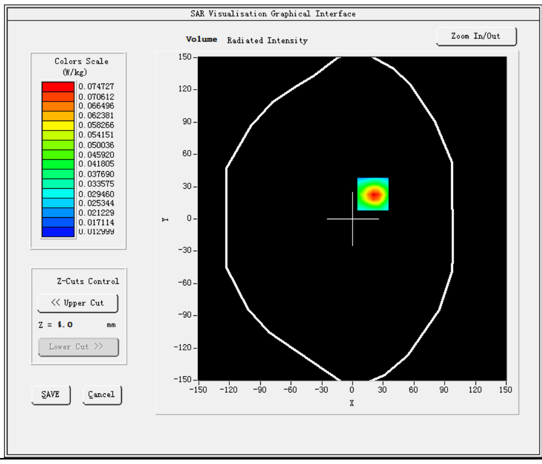
Date of measurement: 24/3/2024

A. Experimental conditions.

Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	Middle
Signal	IEEE802.11b (Crest factor: 1.0)
ConvF	2.85

B. SAR Measurement Results

Frequency (MHz)	2437.000000
Relative permittivity (real part)	37.626736
Relative permittivity (imaginary part)	12.841736
Conductivity (S/m)	1.738628
Variation (%)	-3.990000

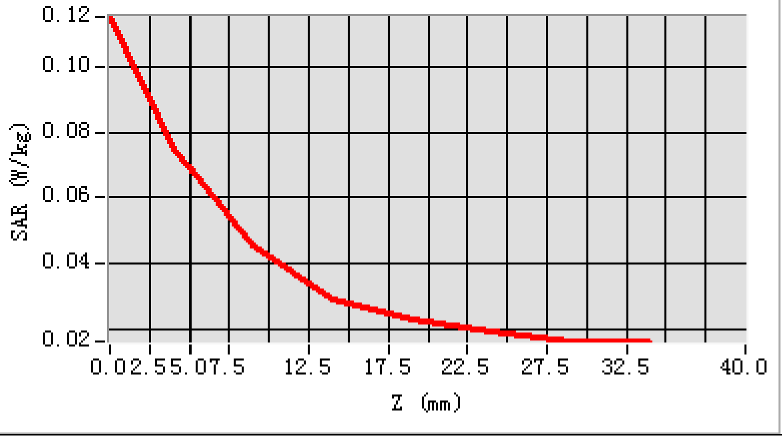
SURFACE SAR	VOLUME SAR
	

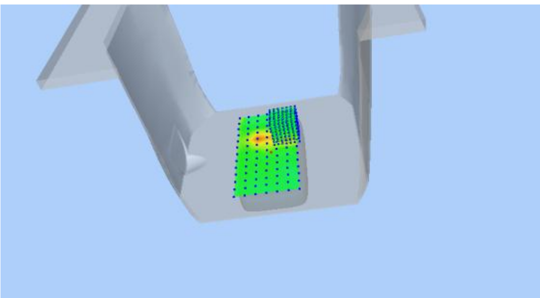
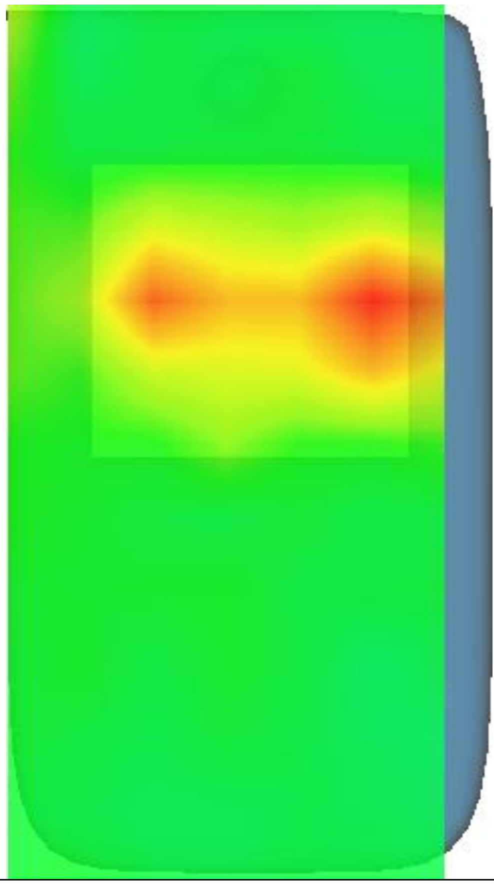
Maximum location: X=20.00, Y=23.00

SAR Peak: 0.12 W/kg

SAR 10g (W/Kg)	0.038583
SAR 1g (W/Kg)	0.068694

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1152	0.0747	0.0453	0.0294	0.0229	0.0191	0.0166



3D screen shot	Hot spot position
	

MEASUREMENT 17

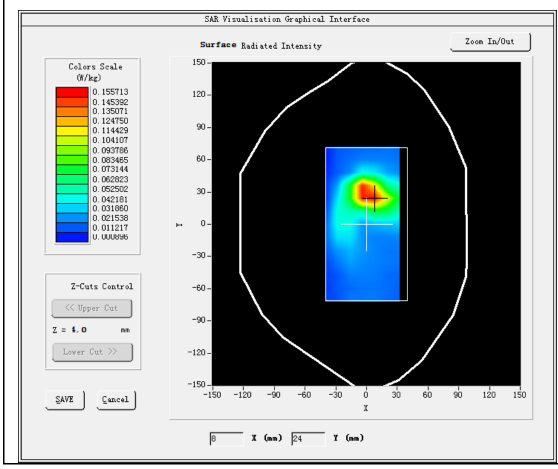
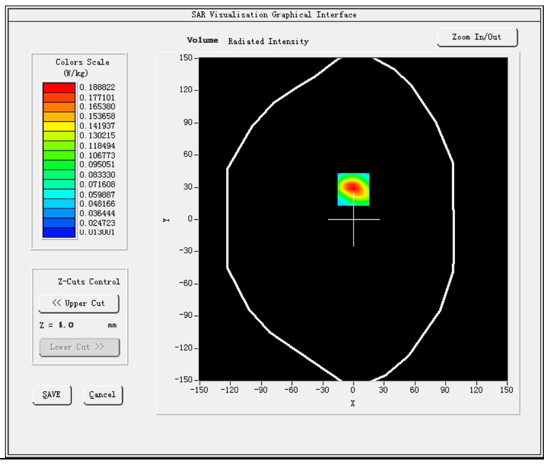
Date of measurement: 24/3/2024

A. Experimental conditions.

Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	Low
Signal	IEEE802.11b (Crest factor: 1.0)
ConvF	2.85

B. SAR Measurement Results

Frequency (MHz)	2412.000000
Relative permittivity (real part)	37.671335
Relative permittivity (imaginary part)	12.872436
Conductivity (S/m)	1.724906
Variation (%)	4.960000

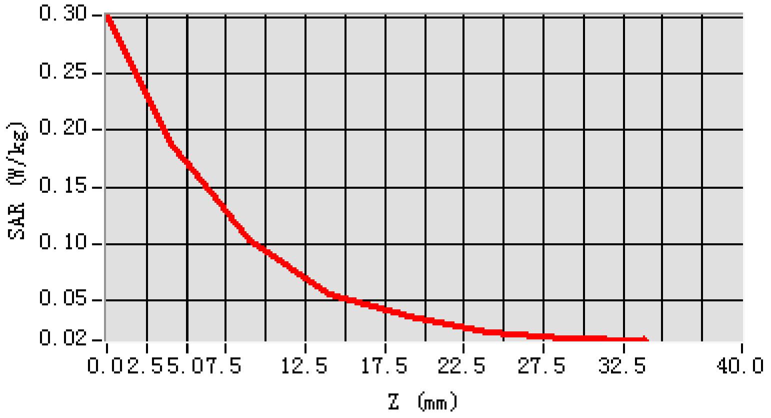
SURFACE SAR	VOLUME SAR
	

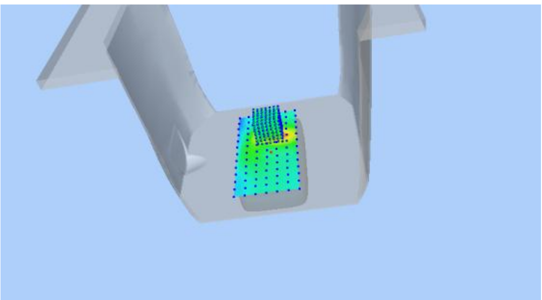
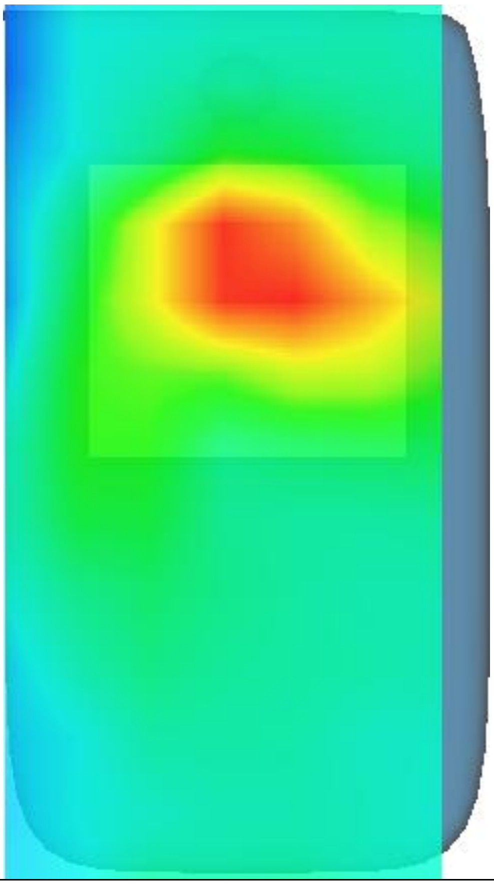
Maximum location: X=0.00, Y=28.00

SAR Peak: 0.30 W/kg

SAR 10g (W/Kg)	0.088935
SAR 1g (W/Kg)	0.176078

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.3012	0.1888	0.1038	0.0566	0.0360	0.0226	0.0171



3D screen shot	Hot spot position
	

MEASUREMENT 18

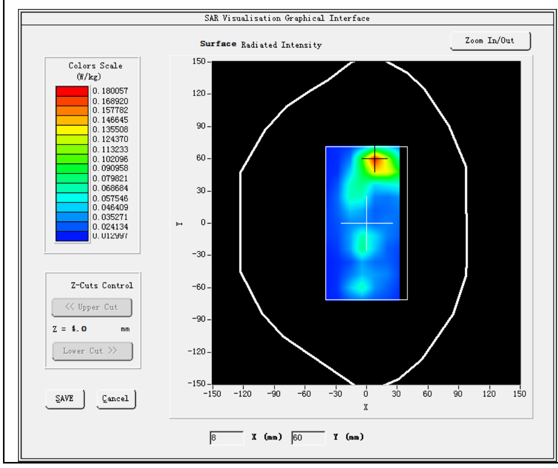
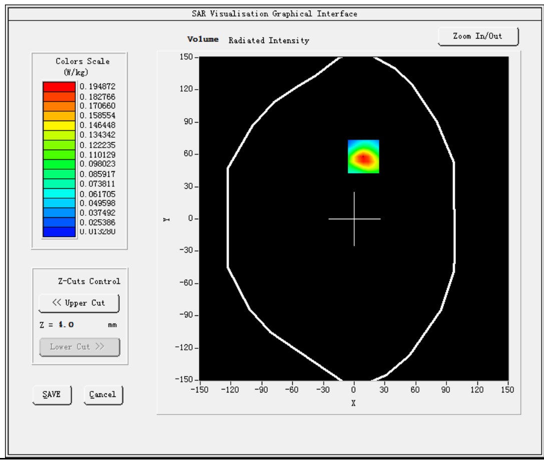
Date of measurement: 24/3/2024

A. Experimental conditions.

Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11ax
Channels	High
Signal	IEEE802.11ax (Crest factor: 1.0)
ConvF	2.85

B. SAR Measurement Results

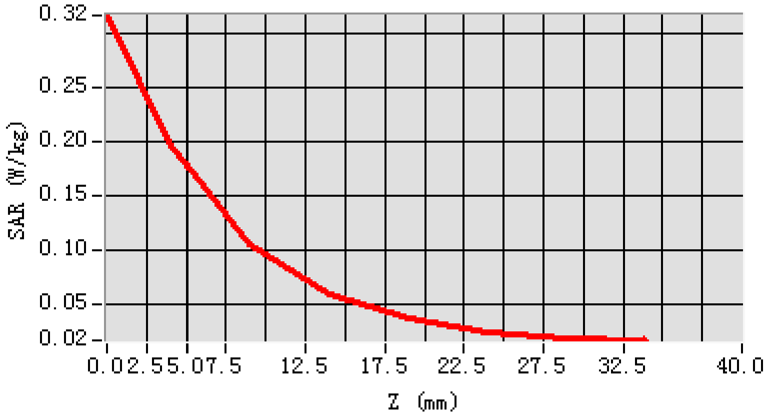
Frequency (MHz)	2452.000000
Relative permittivity (real part)	37.589335
Relative permittivity (imaginary part)	12.953636
Conductivity (S/m)	1.764573
Variation (%)	0.320000

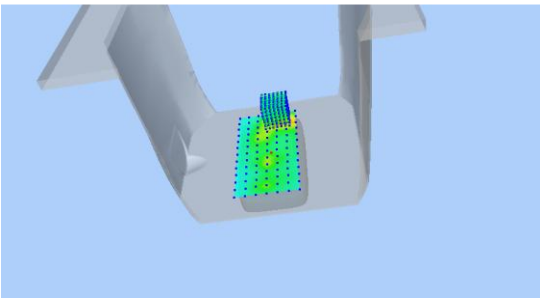
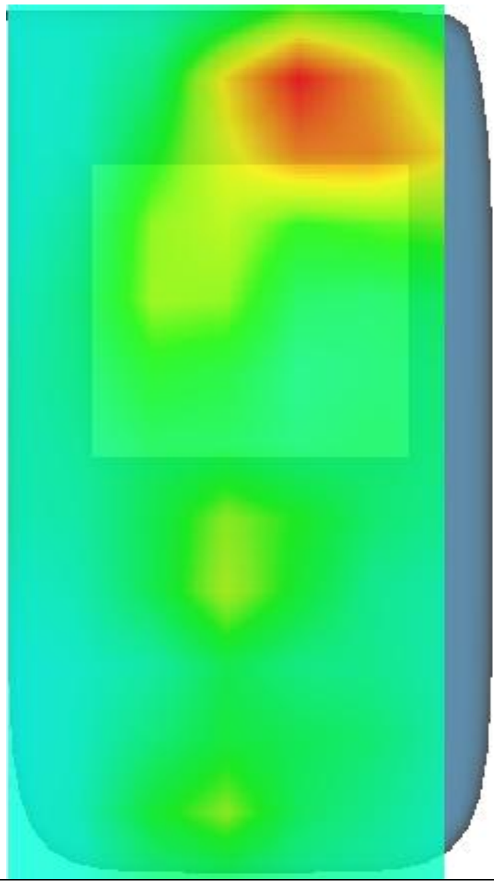
SURFACE SAR	VOLUME SAR
	

Maximum location: X=9.00, Y=58.00
SAR Peak: 0.32 W/kg

SAR 10g (W/Kg)	0.090094
SAR 1g (W/Kg)	0.181619

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.3158	0.1949	0.1050	0.0592	0.0362	0.0241	0.0172



3D screen shot	Hot spot position
	

14. Appendix D. Calibration Certificate

Table of contents

COMOSAR E-Field Probe Calibration Report

Ref : ACR.261.11.23.BES.A

SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.
BUILDING E, FENDA SCIENCE PARK, SANWEI COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: 3423-EPGO-426

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

Calibration date: 09/18/2023

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

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).

	Name	*Function*	*Date*	*Signature*
Prepared by :	Cyrille ONNEE	Measurement Responsible	9/18/2023	
Checked & approved by:	Jérôme Luc	Technical Manager	9/18/2023	
Authorized by:	Yann Toutain	Laboratory Director	9/19/2023	

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2023.09.19 09:08:14 +02'00'

	Customer Name
Distribution :	SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

Issue	*Name*	*Date*	*Modifications*
A	Cyrille ONNEE	9/18/2023	Initial release

TABLE OF CONTENTS

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	3423-EPGO-426
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-7.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.261 MΩ Dipole 2: R2=0.213 MΩ Dipole 3: R3=0.233 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

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

Figure 1 – *MVG COMOSAR Dosimetric E field Probe*

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

3 MEASUREMENT METHOD

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

3.1 SENSITIVITY

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

3.2 LINEARITY

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

3.3 ISOTROPY

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

3.4 BOUNDARY EFFECT

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

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

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

where

$\mathrm{SAR}_{uncertainty}$	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 SARuncertainty[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).

4 MEASUREMENT UNCERTAINTY

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

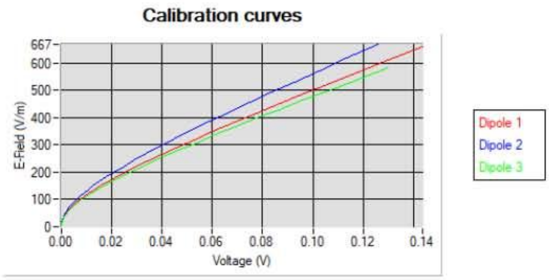
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-11% for the frequency range 150-450MHz.
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

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

5.1 CALIBRATION IN AIR

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



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

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

where
Vi=voltage readings on the 3 channels of the probe
DCPi=diode compression point given below for the 3 channels of the probe
Normi=dipole sensitivity given below for the 3 channels of the probe

Normx dipole 1 (µV/(V/m)²)	Normy dipole 2 (µV/(V/m)²)	Normz dipole 3 (µV/(V/m)²)
0.78	0.62	0.85

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
105	108	107

5.2 CALIBRATION IN LIQUID

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

$$ConvF = \frac{E^2_{liquid}}{E^2_{air}}$$

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

$$E^2_{liquid} = \frac{\rho\, SAR}{\sigma}$$

where
σ=the conductivity of the liquid
ρ=the volumetric density of the liquid
SAR=the SAR measured from the formula that depends on the setup used. The SAR formulas are given below

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

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

where
c=the specific heat for the liquid
dT/dt=the temperature rises over the time

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

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

where
a=the larger cross-sectional of the waveguide
b=the smaller cross-sectional of the waveguide
δ=the skin depth for the liquid in the waveguide
Pw=the power delivered to the liquid