FCC SAR EVALUATION REPORT

In accordance with the requirements of FCC 47 CFR Part 2(2.1093), ANSI/IEEE C95.1-1992 and IEEE Std 1528-2013

Product Name： Smart watch

Trademark： esenses

Model Name： KSW 90

Family Model： N/A

FCC ID： 2BBNN-KSW-90

Report No.： S24030606906001

Prepared for

BEDIGITAL S.A.

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Prepared by

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TEST RESULT CERTIFICATION

Applicant's name.................:	BEDIGITAL S.A.
Address ....:	Parque Industrial Santa Lucia Km 3.3 Via Funza Siberia Bodega 13A, Bogota, Colombia
Manufacturer's Name...........:	HK LAGENIO TECHNOLOGY CO., LIMITED.
Address ....:	FLAT 6 11/F CHEUNG HING BLDG540-544 NATHAN ROAD YAU MA TEIKL

Product description

Product name ....:	Smart watch
Trademark ....:	esenses
Model Name ....:	KSW 90
Family Model ....:	N/A
Standards..............................:	FCC 47 CFR Part 2(2.1093) ANSI/IEEE C95.1-1992;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) and ANSI/IEEE C95.1-1992. 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 S240306069006

Date of Test

Date (s) of performance of tests ....:	Mar. 08, 2024 ~ Mar. 22, 2024
Date of Issue..:	Mar. 29, 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	Mar. 29, 2024	Jack Li

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1. General Information

1.1. RF exposure limits

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

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

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

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

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

Occupational/Controlled Environments:

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

General Population/Uncontrolled Environments:

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

NOTE Face Limit 1.6 W/kg and Wristbands Limit 4.0W/kg APPLIED TO THIS EUT

1.2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for KSW 90 are as follows.

RF Exposure Conditions		Max Reported SAR Value(W/kg)
1-g Front-of-Face (Separation distance of 10mm)		0.862
10-g Back-of-Wristbands (Separation distance of 0mm)		0.793
Max Simultaneous Tx	1-g Front-of-Face	0.951
	10-g Back-of-Wristbands	0.861

Note: The Max Simultaneous Tx is calculated based on the same configuration and test position.
This device is in compliance with Specific Absorption Rate (SAR) for general population /uncontrolled exposure limits (1.6 W/kg for Face,4.0W/Kg for Wristbands) specified in FCC 47 CFR Part 2(2.1093) and ANSI/IEEE C95.1-1992, 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	Smart watch
Trade Name	esenses
Model Name	KSW 90
Family Model	N/A
FCC ID	2BBNN-KSW-90
Device Phase	Identical Prototype
Exposure Category	General population / Uncontrolled environment
Antenna Type	PIFA Antenna
Battery Information	DC 3.8V, 680mAh, 2.584Wh
Hard Ware Version	AC920-MB-V8.0A
Soft Ware Version	L11_21EB_AC920_80P
Device Operating Configurations	
Supporting Mode(s)	GSM 850/1900, WCDMA Band 2/5, LTE Band2/4/7 , WLAN 2.4G
Test Modulation	GSM(GMSK/8PSK), WCDMA(QPSK), LTE(QPSK/16QAM), WLAN(DSSS/OFDM)

Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM 850	824-849	869-894
	GSM 1900	1850-1910	1930-1990
	WCDMA Band 2	1850-1910	1930-1990
	WCDMA Band 5	824-849	869-894
	LTE Band 2	1850-1910	1930-1990
	LTE Band 4	1710-1755	2110-2155
	LTE Band 7	2500-2570	2620-2690
	WLAN 2.4G	2412-2462	
GPRS Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
EDGE Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
Power Class	4, tested with power level 5(GSM 850)		
	1, tested with power level 0(GSM 1900)		
	3, tested with power control “all 1”(WCDMA Band 2)		
	3, tested with power control “all 1”(WCDMA Band 5)		
	3, tested with power control all Max.(LTE Band 2)		
	3, tested with power control all Max.(LTE Band 4)		
	3, tested with power control all Max.(LTE Band 7)		

1.4. Test specification(s)

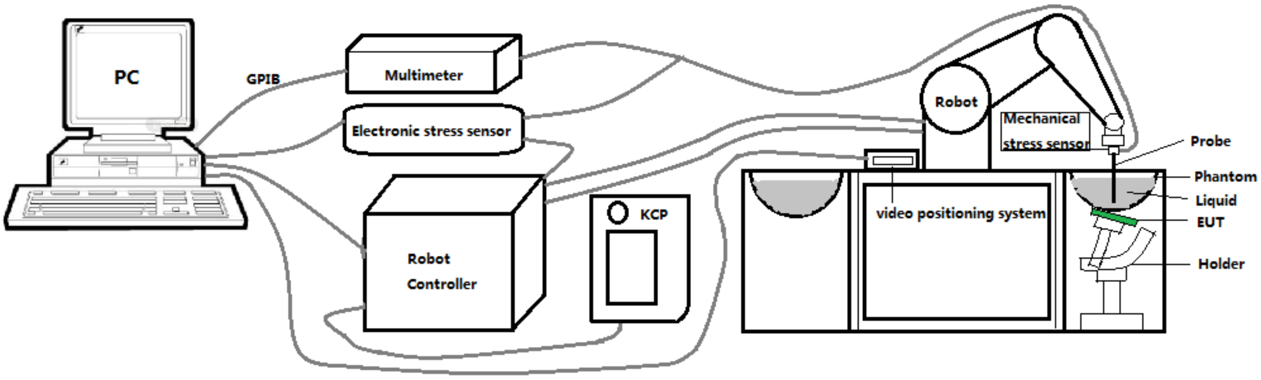
FCC 47 CFR Part 2(2.1093)
ANSI/IEEE C95.1-1992
IEEE Std 1528-2013
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting
KDB 447498 D01 General RF Exposure Guidance
KDB 248227 D01 802.11 Wi-Fi SAR
KDB 941225 D01 3G SAR Procedures
KDB 941225 D05 SAR for LTE Devices

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.

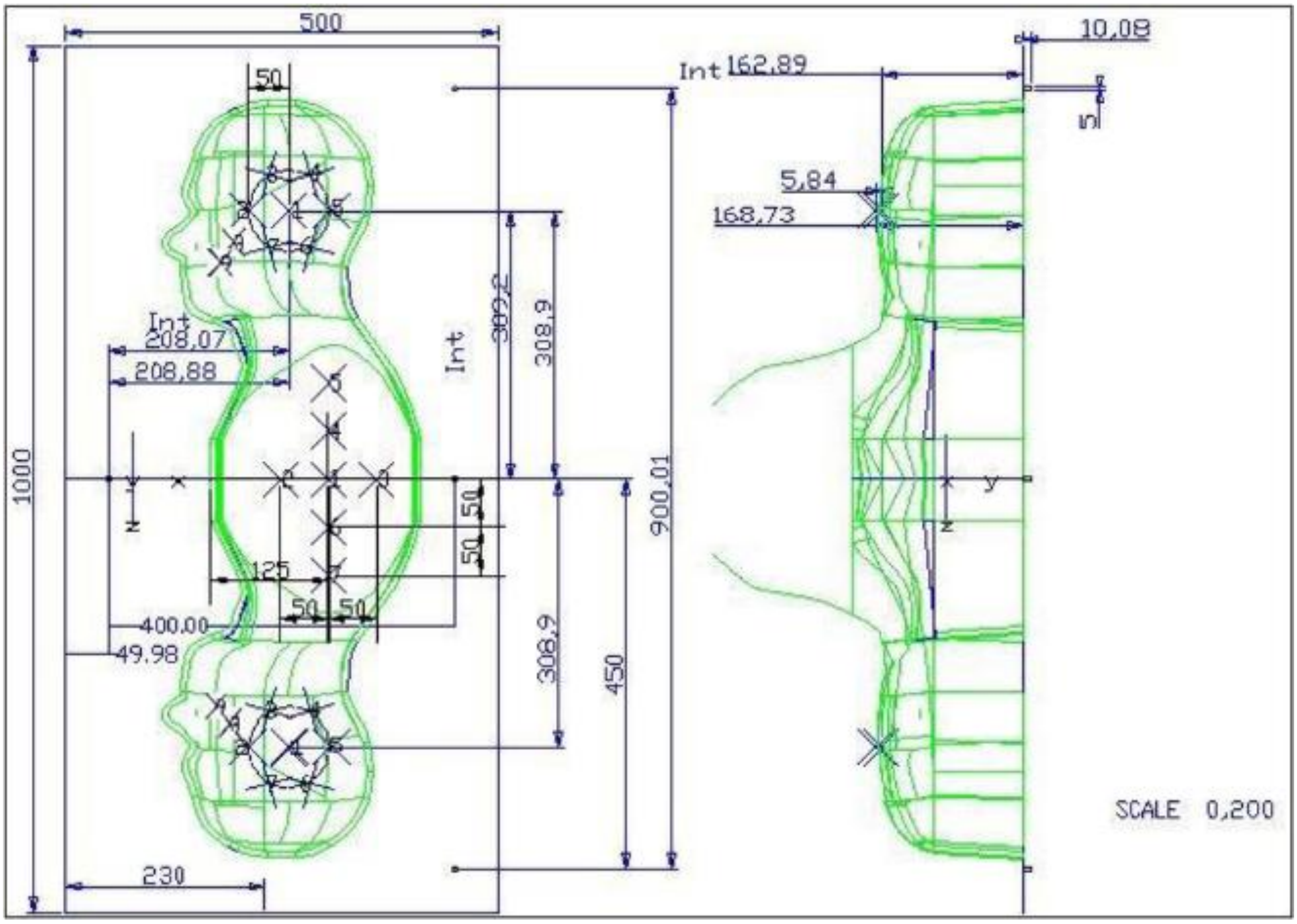
2.4. SAM phantoms

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

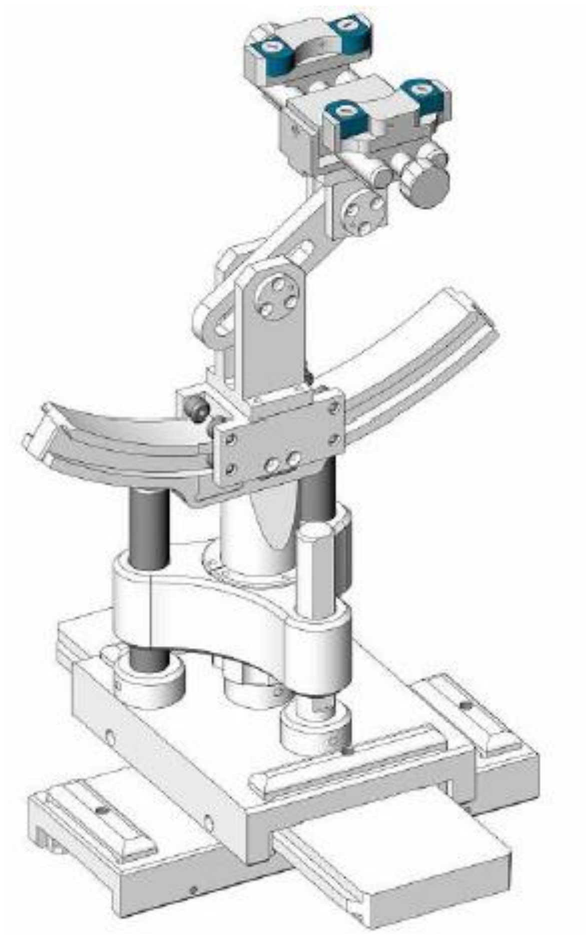


Serial Number	Left Head(mm)		Right Head(mm)		Flat Part(mm)	
SN 16/15 SAM119	2	2.02	2	2.08	1	2.09
	3	2.05	3	2.06	2	2.06
	4	2.07	4	2.07	3	2.08
	5	2.08	5	2.08	4	2.10
	6	2.05	6	2.07	5	2.10
	7	2.05	7	2.05	6	2.07
	8	2.07	8	2.06	7	2.07
	9	2.08	9	2.06	-	-

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 835	Head 835	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 1800	Head 1800	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 1900	Head 1900	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 2600	Head 2600	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.

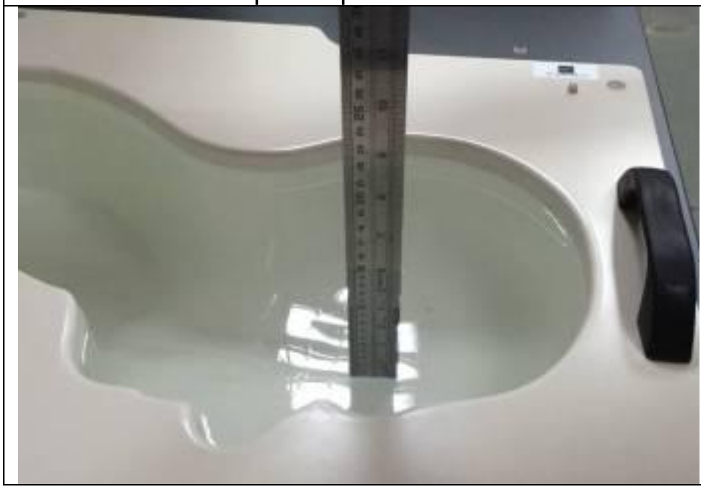
4. System Verification Procedure

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

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.

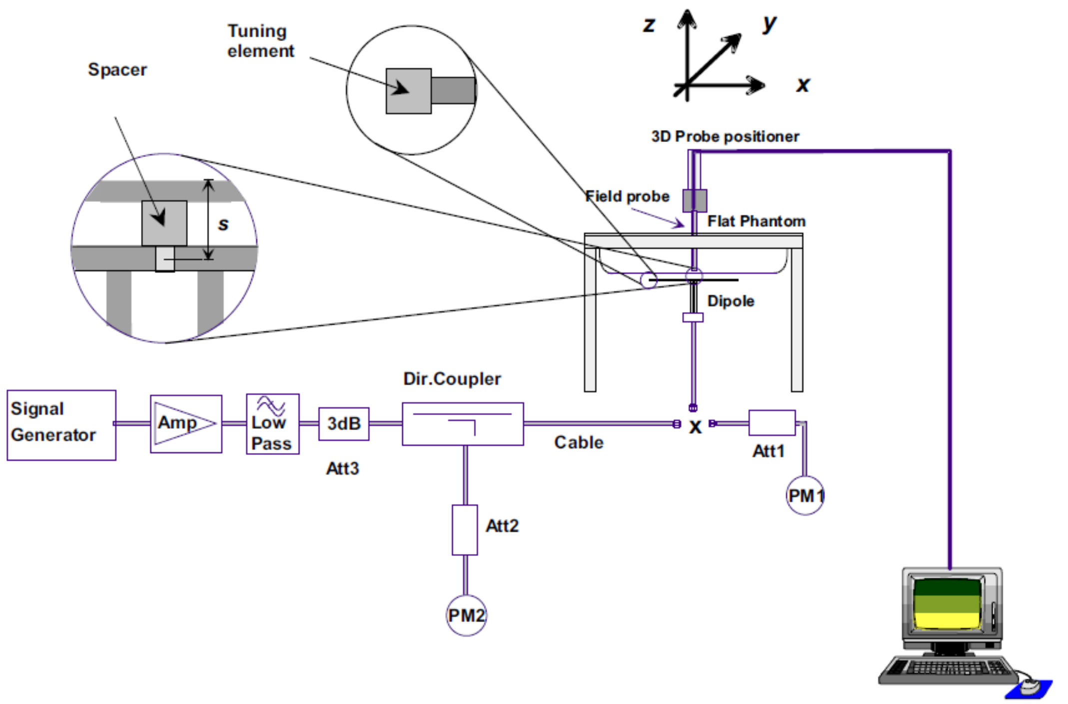
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (±5%)	σ (S/m) (±5%)	εr	σ (S/m)		
Head 850	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	41.15	0.89	21.5 °C	Mar. 20, 2024
Head 1800	1800	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.05	1.38	21.7 °C	Mar. 21, 2024
Head 1900	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	38.75	1.43	21.5 °C	Mar. 22, 2024
Head 2450	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	37.72	1.76	21.5 °C	Mar. 09, 2024
Head 2600	2600	39.01 (37.06~40.96)	1.96 (1.86~2.06)	38.78	1.96	21.4 °C	Mar. 08, 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%)	
835MHz	9.40 (8.46~10.34)	6.28 (5.65~6.91)	9.08	5.94	21.5 °C	-3.40%	-5.41%	Mar. 20, 2024
1800MHz	37.06 (33.35~40.77)	20.01 (18.01~22.01)	39.81	19.31	21.7 °C	7.42%	-3.50%	Mar. 21, 2024
1900MHz	39.69 (35.72~43.66)	20.92 (18.83~23.01)	37.38	20.59	21.5 °C	-5.82%	-1.58%	Mar. 22, 2024
2450MHz	50.05 (45.05~55.06)	23.80 (21.42~26.18)	49.98	26.00	21.5 °C	-0.14%	9.24%	Mar. 09, 2024
2600MHz	54.16 (48.74~59.58)	24.85 (22.37~27.34)	50.50	24.93	21.4 °C	-6.76%	0.32%	Mar. 08, 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. Wrist watch and wrist-worn transmitters

Refer to KDB 447498 D01. Transmitters that are built-in within a wrist watch or similar wrist-worn devices typically operate in speaker mode for voice communication, with the device worn on the wrist and positioned next to the mouth. Next to the mouth exposure requires 1-g SAR and the wrist-worn condition requires 10-g extremity SAR. The 10-g extremity and 1-g SAR test exclusions may be applied to the wrist and face exposure conditions. When SAR evaluation is required, next to the mouth use is evaluated with the front of the device positioned at 10 mm from a flat phantom filled with head tissue-equivalent medium. The wrist bands should be strapped together to represent normal use conditions. SAR for wrist exposure is evaluated with the back of the device positioned in direct contact against a flat phantom filled with body tissue-equivalent medium. The wrist bands should be unstrapped and touching the phantom.

7. RF Output Power

7.1. GSM Conducted Power

Band GSM850	Burst-Averaged output Power (dBm)				Frame-Averaged output Power (dBm)			
Tx Channel	Tune-up	128	189	251	Tune-up	128	189	251
Frequency (MHz)	(dBm)	824.2	836.4	848.8	(dBm)	824.2	836.4	848.8
GSM (GMSK)	33.50	33.01	33.24	33.07	24.47	23.98	24.21	24.04
GPRS(GMSK, 1 TS)	33.00	32.71	32.95	32.73	23.97	23.68	23.92	23.70
GPRS(GMSK, 2 TS)	32.00	31.29	31.56	31.39	25.98	25.27	25.54	25.37
GPRS(GMSK, 3 TS)	29.50	29.28	29.49	29.36	25.24	25.02	25.23	25.10
GPRS(GMSK, 4 TS)	27.50	26.99	27.22	27.06	24.49	23.98	24.21	24.05
EDGE(GMSK, 1 TS)	26.50	26.23	26.18	26.29	17.47	17.20	17.15	17.26
EDGE(GMSK, 2 TS)	26.50	26.05	26.45	26.07	20.48	20.03	20.43	20.05
EDGE(GMSK, 3 TS)	26.00	24.94	25.54	25.06	21.74	20.68	21.28	20.80
EDGE(GMSK, 4 TS)	23.50	22.71	23.09	23.08	20.49	19.70	20.08	20.07
Band GSM1900	Burst-Averaged output Power (dBm)				Frame-Averaged output Power (dBm)			
Tx Channel	Tune-up	512	661	810	Tune-up	512	661	810
Frequency (MHz)	(dBm)	1850.2	1880.0	1909.8	(dBm)	1850.2	1880.0	1909.8
GSM (GMSK)	30.00	29.85	29.66	29.46	20.97	20.82	20.63	20.43
GPRS(GMSK, 1 TS)	30.00	29.74	29.57	29.36	20.97	20.71	20.54	20.33
GPRS(GMSK, 2 TS)	28.50	28.17	27.86	27.53	22.48	22.15	21.84	21.51
GPRS(GMSK, 3 TS)	27.00	26.61	26.29	25.94	22.74	22.35	22.03	21.68
GPRS(GMSK, 4 TS)	25.00	24.51	24.16	23.80	21.99	21.50	21.15	20.79
EDGE(GMSK, 1 TS)	26.00	25.48	25.59	25.40	16.97	16.45	16.56	16.37
EDGE(GMSK, 2 TS)	26.00	25.54	25.24	25.79	19.98	19.52	19.22	19.77
EDGE(GMSK, 3 TS)	24.50	23.72	24.22	24.36	20.24	19.46	19.96	20.10
EDGE(GMSK, 4 TS)	22.50	22.18	22.24	22.12	19.49	19.17	19.23	19.11

Note: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.
The calculated method are shown as below:
Frame-averaged power = Maximum burst averaged power (1 TS) - 9.03 dB
Frame-averaged power = Maximum burst averaged power (2 TS) - 6.02 dB
Frame-averaged power = Maximum burst averaged power (3 TS) - 4.26 dB
Frame-averaged power = Maximum burst averaged power (4 TS) - 3.01 dB

7.2. WCDMA Conducted Power

Band	WCDMA Band 2			
Tx Channel	Tune-up	9262	9400	9538
Frequency (MHz)		1852.4	1880	1907.6

RMC 12.2Kbps	23.50	23.09	23.02	22.96
HSDPA Subtest-1	23.50	23.10	22.76	22.55
HSDPA Subtest-2	23.00	22.69	22.48	22.19
HSDPA Subtest-3	22.50	22.26	22.25	21.88
HSDPA Subtest-4	22.50	22.09	22.20	21.66
HSUPA Subtest-1	23.00	22.91	22.32	22.31
HSUPA Subtest-2	23.00	22.90	22.56	22.33
HSUPA Subtest-3	22.50	22.46	22.24	21.85
HSUPA Subtest-4	23.00	22.53	22.69	22.11
HSUPA Subtest-5	23.00	22.73	22.48	22.05
Band	WCDMA Band 5			
Tx Channel	Tune-up	4132	4182	4233
Frequency (MHz)		826.4	836.4	846.6
RMC 12.2Kbps	23.00	22.80	22.76	22.72
HSDPA Subtest-1	22.50	22.43	22.19	22.40
HSDPA Subtest-2	22.50	22.02	22.07	22.20
HSDPA Subtest-3	22.00	21.78	21.84	22.00
HSDPA Subtest-4	22.00	21.41	21.73	21.77
HSUPA Subtest-1	22.50	22.42	22.08	22.22
HSUPA Subtest-2	22.50	22.25	22.21	22.40
HSUPA Subtest-3	22.50	21.97	22.14	21.84
HSUPA Subtest-4	22.50	22.26	22.24	22.25
HSUPA Subtest-5	22.50	22.10	22.18	22.15

7.3. LTE Conducted Power

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18607/1850.7	18900/1880	19193/1909.3
LTE Band 2	1.4MHz	QPSK	1	0	24.00	23.15	23.60	23.74
			1	2	24.00	23.27	23.61	23.65
			1	5	24.00	23.30	23.58	23.64
			3	0	24.00	23.37	23.48	23.53
			3	1	24.00	23.36	23.51	23.44
			3	2	24.00	23.26	23.41	23.42

			6	0	22.50	22.22	22.30	22.34
		16QAM	1	0	23.00	22.87	22.09	22.33
			1	2	23.00	22.91	22.03	22.43
			1	5	23.00	22.64	21.96	22.24
			3	0	23.00	22.76	22.38	22.68
			3	1	23.00	22.78	22.45	22.71
			3	2	23.00	22.70	22.38	22.58
			6	0	21.50	21.17	21.23	21.27
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18615/1851.5	18900/1880	19185/1908.5
LTE Band 2	3MHz	QPSK	1	0	24.00	23.48	23.68	23.79
			1	7	24.00	23.32	23.63	23.84
			1	14	24.00	23.36	23.69	23.98
			8	0	23.00	22.43	22.39	22.52
			8	4	23.00	22.40	22.57	22.32
			8	7	23.00	22.34	22.49	22.43
			15	0	22.50	22.33	22.35	22.41
		16QAM	1	0	23.50	22.88	22.05	22.45
			1	7	23.50	23.04	21.99	22.38
			1	14	23.50	22.89	22.01	22.45
			8	0	22.00	21.58	21.53	21.65
			8	4	22.00	21.52	21.59	21.62
			8	7	22.00	21.47	21.51	21.57
			15	0	22.00	21.54	21.49	21.53
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18625/1852.5	18900/1880	19175/1907.5
LTE Band 2	5MHz	QPSK	1	0	24.00	23.75	23.76	23.73
			1	12	24.00	23.70	23.79	23.76
			1	24	24.00	23.67	23.74	23.74
			12	0	23.00	22.39	22.43	22.43
			12	6	23.00	22.30	22.55	22.58
			12	11	23.00	22.43	22.50	22.44
			25	0	22.50	22.42	22.39	22.44
		16QAM	1	0	23.00	22.38	22.59	22.55

Band	Band Width	Modulation	RB Size	RB Offset	Tune-up (dBm)	Channel/Frequency(MHz)		
			1	12	23.00	22.42	22.58	22.52
			1	24	23.00	22.55	22.48	22.51
			12	0	22.00	21.53	21.66	21.57
			12	6	22.00	21.57	21.56	21.60
			12	11	22.00	21.56	21.56	21.56
			25	0	22.00	21.65	21.68	21.68

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18650/1855	18900/1880	19150/1905
LTE Band 2	10MHz	QPSK	1	0	24.00	23.47	23.61	23.61
			1	24	24.00	23.46	23.50	23.61
			1	49	24.00	23.53	23.42	23.50
			25	0	23.00	22.41	22.57	22.57
			25	12	23.00	22.42	22.53	22.49
			25	24	23.00	22.40	22.34	22.49
			50	0	22.50	22.36	22.37	22.47
		16QAM	1	0	23.50	23.12	23.16	23.18
			1	24	23.50	22.86	23.08	23.03
			1	49	23.50	22.97	23.06	23.00
			25	0	22.00	21.43	21.55	21.60
			25	12	22.00	21.44	21.51	21.55
			25	24	22.00	21.44	21.47	21.50
			50	0	22.00	21.52	21.52	21.63

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18675/1857.5	18900/1880	19125/1902.5
LTE Band 2	15MHz	QPSK	1	0	24.00	23.56	23.71	23.91
			1	37	24.00	23.49	23.76	23.85
			1	74	24.00	23.62	23.75	23.72
			36	0	23.00	22.30	22.60	22.49
			36	18	23.00	22.56	22.43	22.46
			36	37	23.00	22.54	22.45	22.61
			75	0	23.00	22.50	22.52	22.44
		16QAM	1	0	23.50	22.97	22.61	22.60
			1	37	23.50	22.97	22.46	22.46
			1	74	23.50	23.09	22.50	22.56
			36	0	22.00	21.52	21.78	21.69

Band	Band Width	Modulation	RB Size	RB Offset	Tune-up (dBm)	18700/1860	18900/1880	19100/1900
			36	18	22.00	21.45	21.60	21.73
			36	37	22.00	21.45	21.63	21.63
			75	0	22.00	21.64	21.61	21.60
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18700/1860	18900/1880	19100/1900
LTE Band 2	20MHz	QPSK	1	0	24.00	23.74	23.87	23.85
			1	49	24.00	23.76	23.75	23.83
			1	99	24.00	23.89	23.73	23.81
			50	0	23.00	22.42	22.55	22.50
			50	24	23.00	22.56	22.61	22.54
			50	49	23.00	22.52	22.60	22.56
			100	0	23.00	22.55	22.60	22.53
		16QAM	1	0	23.00	22.50	22.31	22.10
			1	49	23.00	22.37	22.11	22.28
			1	99	23.00	22.60	22.07	22.13
			50	0	22.00	21.54	21.62	21.65
			50	24	22.00	21.59	21.54	21.71
			50	49	22.00	21.63	21.60	21.61
			100	0	22.00	21.69	21.61	21.79

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		19957/1710.7	20175/1732.5	20393/1754.3
LTE Band 4	1.4MHz	QPSK	1	0	24.50	22.99	23.84	23.93
			1	2	24.50	22.99	23.83	23.98
			1	5	24.50	22.98	23.67	24.02
			3	0	24.00	23.21	23.53	23.96
			3	1	24.00	23.19	23.64	23.86
			3	2	24.00	23.15	23.65	23.82
			6	0	23.00	22.03	22.42	22.79
		16QAM	1	0	23.00	22.13	21.74	22.85
			1	2	23.00	22.16	22.74	22.90
			1	5	23.00	22.09	22.67	22.91
			3	0	23.50	22.34	22.81	23.01
			3	1	23.50	22.01	22.94	23.13
			3	2	23.50	22.71	22.91	23.08
			6	0	22.50	22.03	21.47	21.70

Band	Band Width	Modulation	RB Configuration RB Size	RB Configuration RB Offset	Tune-up (dBm)	Channel/Frequency(MHz) 19965/1711.5	20175/1732.5	20385/1753.5
LTE Band 4	3MHz	QPSK	1	0	24.00	23.12	23.61	23.78
			1	7	24.00	23.26	23.58	23.91
			1	14	24.00	23.29	23.62	24.00
			8	0	23.00	22.02	22.64	22.84
			8	4	23.00	22.10	22.51	22.82
			8	7	23.00	22.17	22.63	22.89
			15	0	23.00	22.17	22.60	22.83
		16QAM	1	0	23.50	22.58	22.91	23.46
			1	7	23.50	22.63	22.97	23.45
			1	14	23.50	22.56	22.84	23.46
			8	0	22.50	21.29	21.78	22.02
			8	4	22.50	21.22	21.69	21.97
			8	7	22.50	21.28	21.74	22.06
			15	0	22.00	21.14	21.74	22.00

Band	Band Width	Modulation	RB Configuration RB Size	RB Configuration RB Offset	Tune-up (dBm)	Channel/Frequency(MHz) 19975/1712.5	20175/1732.5	20375/1752.5
LTE Band 4	5MHz	QPSK	1	0	24.50	23.42	23.95	23.94
			1	12	24.50	23.42	23.86	24.15
			1	24	24.50	23.54	23.98	24.18
			12	0	23.00	22.12	22.52	22.83
			12	6	23.00	22.07	22.63	22.78
			12	11	23.00	22.16	22.66	22.97
			25	0	23.00	22.11	22.47	22.94
		16QAM	1	0	23.00	22.15	22.69	22.92
			1	12	23.00	22.22	22.72	23.00
			1	24	23.00	22.25	22.52	22.96
			12	0	22.00	21.23	21.63	21.90
			12	6	22.00	21.28	21.72	21.96
			12	11	22.00	21.16	21.67	21.87
			25	0	22.50	21.36	21.86	22.06

Band	Band Width	Modulation	RB Configuration RB Size	RB Configuration RB Offset	Tune-up (dBm)	Channel/Frequency(MHz) 20000/1715	20175/1732.5	20350/1750

Band	Band Width	Modulation	RB Size	RB Offset	Tune-up (dBm)	Channel/Frequency(MHz)		
LTE Band 4	10MHz	QPSK	1	0	24.50	23.45	23.68	23.61
			1	24	24.50	23.47	23.62	23.70
			1	49	24.50	23.67	23.65	24.06
			25	0	23.00	22.19	22.60	22.60
			25	12	23.00	22.11	22.64	22.68
			25	24	23.00	22.23	22.58	22.90
			50	0	23.00	22.29	22.51	22.65
		16QAM	1	0	23.50	22.12	23.09	23.13
			1	24	23.50	22.18	23.21	23.29
			1	49	23.50	22.40	23.09	23.42
			25	0	22.00	21.36	21.54	21.70
			25	12	22.00	21.47	21.60	21.77
			25	24	22.00	21.54	21.61	21.81
			50	0	22.00	21.25	21.63	21.84

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20025/1717.5	20175/1732.5	20325/1747.5
LTE Band 4	15MHz	QPSK	1	0	24.50	23.46	23.60	23.73
			1	37	24.50	23.58	23.60	23.77
			1	74	24.50	23.89	23.64	24.11
			36	0	23.00	22.30	22.50	22.63
			36	18	23.00	22.37	22.59	22.68
			36	37	23.00	22.35	22.54	22.72
			75	0	23.00	22.25	22.63	22.70
		16QAM	1	0	23.50	22.16	23.18	22.69
			1	37	23.50	22.25	23.02	22.70
			1	74	23.50	22.56	23.07	22.89
			36	0	22.00	21.25	21.55	21.83
			36	18	22.00	21.48	21.52	21.75
			36	37	22.00	21.46	21.61	21.96
			75	0	22.00	21.34	21.59	21.67

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20050/1720	20175/1732.5	20300/1745
LTE Band 4	20MHz	QPSK	1	0	24.00	23.31	23.70	23.61
			1	49	24.00	23.70	23.77	23.73
			1	99	24.00	23.96	23.99	23.97
			50	0	23.00	22.13	22.48	22.53

			50	24	23.00	22.38	22.47	22.57
			50	49	23.00	22.46	22.47	22.80
			100	0	23.00	22.31	22.62	22.70
		16QAM	1	0	23.50	22.07	22.57	22.74
			1	49	23.50	22.42	22.77	22.69
			1	99	23.50	22.74	22.79	23.05
			50	0	22.00	21.21	21.64	21.66
			50	24	22.00	21.35	21.64	21.69
			50	49	22.00	21.59	21.73	21.76
			100	0	22.00	21.41	21.65	21.81

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20775/2502.5	21100/2535	21425/2567.5
LTE Band 7	5MHz	QPSK	1	0	24.00	22.91	23.49	22.03
			1	12	24.00	23.21	23.57	22.39
			1	24	24.00	23.19	22.82	22.90
			12	0	23.00	22.26	22.61	22.19
			12	6	23.00	22.37	22.50	22.31
			12	11	23.00	22.34	22.43	22.17
			25	0	23.00	22.31	22.55	22.15
		16QAM	1	0	23.00	22.36	22.63	21.91
			1	12	23.00	22.31	22.64	22.48
			1	24	23.00	22.35	22.51	22.05
			12	0	22.00	21.45	21.59	21.47
			12	6	22.00	21.46	21.66	21.53
			12	11	22.00	21.43	21.66	21.39
			25	0	22.00	21.64	21.85	21.61

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20800/2505	21100/2535	21400/2565
LTE Band 7	10MHz	QPSK	1	0	24.00	23.05	23.51	22.86
			1	24	24.00	23.21	23.17	22.04
			1	49	24.00	23.27	22.81	22.28
			25	0	23.00	22.32	22.46	21.96
			25	12	23.00	22.29	22.60	22.07
			25	24	23.00	22.42	22.46	22.23

			50	0	22.50	22.23	22.47	22.07
		16QAM	1	0	23.50	22.97	23.11	21.94
			1	24	23.50	23.34	23.15	22.10
			1	49	23.50	22.90	23.03	22.37
			25	0	22.00	21.43	21.62	21.56
			25	12	22.00	21.37	21.64	21.50
			25	24	22.00	21.42	21.55	21.47
			50	0	22.00	21.50	21.68	21.56
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20825/2507.5	21100/2535	21375/2562.5
LTE Band 7	15MHz	QPSK	1	0	24.00	23.27	23.71	22.09
			1	37	24.00	23.35	23.26	22.90
			1	74	24.00	23.24	22.49	22.05
			36	0	23.00	22.33	22.71	22.01
			36	18	23.00	22.34	22.64	21.90
			36	37	23.00	22.25	22.59	22.01
			75	0	23.00	22.21	22.65	21.97
		16QAM	1	0	23.50	22.92	22.67	22.13
			1	37	23.50	23.02	22.66	22.00
			1	74	23.50	22.89	22.69	22.20
			36	0	22.00	21.33	21.70	21.65
			36	18	22.00	21.39	21.67	21.62
			36	37	22.00	21.37	21.47	21.55
			75	0	22.00	21.52	21.58	21.54
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20850/2510	21100/2535	21350/2560
LTE Band 7	20MHz	QPSK	1	0	24.00	23.07	23.55	22.86
			1	49	24.00	23.22	22.89	22.66
			1	99	24.00	23.32	22.54	22.38
			50	0	23.00	22.41	22.51	21.69
			50	24	23.00	22.37	22.64	21.71
			50	49	23.00	22.26	22.54	21.99
			100	0	22.50	22.39	22.45	21.79
		16QAM	1	0	23.00	22.53	22.69	21.89
			1	49	23.00	22.42	22.72	21.66

			1	99	23.00	22.40	22.70	22.40
			50	0	22.00	21.49	21.71	21.60
			50	24	22.00	21.23	21.70	21.64
			50	49	22.00	21.36	21.44	21.61
			100	0	22.00	21.18	21.61	21.62

7.4. WLAN Output Power

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)
802.11b	1	2412	14.50	13.49
	6	2437	14.50	14.18
	11	2462	14.50	13.66
802.11g	1	2412	12.00	10.96
	6	2437	12.00	11.97
	11	2462	12.00	11.45
802.11n HT20	1	2412	9.50	8.52
	6	2437	9.50	9.46
	11	2462	9.50	9.16

NOTE: Power measurement results of WLAN 2.4G.

8. SAR Results

8.1. SAR measurement results

8.1.1. SAR measurement Result of GSM850

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date
			1g	10g					
Front-of-Face with 10mm	189/836.4	GPRS(GMSK 2TS)	0.045	0.030	-0.32	31.56	32.00	0.050	2024/3/20

Note: Front-of-Face SAR test of GSM850

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 10g (W/Kg)	Date
			1g	10g					
Back-of-Wristbands with 0mm	189/836.4	GPRS(GMSK 2TS)	0.100	0.064	-3.07	31.56	32.00	0.071	2024/3/20

Note: Back-of-Wristbands SAR test of GSM850

8.1.2. SAR measurement Result of GSM1900

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date
			1g	10g					
Front-of-Face with 10mm	661/1880	GPRS(GMSK 3TS)	0.383	0.199	-4.89	26.29	27.00	0.451	2024/3/22

Note: Front-of-Face SAR test of GSM1900

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 10g (W/Kg)	Date
			1g	10g					
Back-of-Wristbands with 0mm	661/1880	GPRS(GMSK 3TS)	0.495	0.255	1.85	26.29	27.00	0.300	2024/3/22

Note: Back-of-Wristbands SAR test of GSM1900

8.1.3. SAR measurement Result of WCDMA Band 2

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date
			1g	10g					
Front-of-Face with 10mm	9400/1880	RMC12.2K	0.644	0.330	1.66	23.02	23.50	0.719	2024/3/22

Note: Front-of-Face SAR test of WCDMA Band 2

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 10g (W/Kg)	Date
			1g	10g					
Back-of-Wristbands with 0mm	9400/1880	RMC12.2K	0.888	0.453	2.00	23.02	23.50	0.506	2024/3/22

Note: Back-of-Wristbands SAR test of WCDMA Band 2

8.1.4. SAR measurement Result of WCDMA Band 5

Test Position	Test	Test Mode	SAR Value	Power	Conducted	Tune-up	Scaled	Date

	channel /Freq.		(W/kg) 1g	10g	Drift (±5%)	power (dBm)	power (dBm)	SAR 1g (W/Kg)	
Front-of-Face with 10mm	4182/836.4	RMC12.2K	0.073	0.045	-1.00	22.76	23.00	0.077	2024/3/20

Note: Front-of-Face SAR test of WCDMA Band 5

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 10g (W/Kg)	Date
			1g	10g					
Back-of-Wristbands with 0mm	4182/836.4	RMC12.2K	0.129	0.079	2.25	22.76	23.00	0.083	2024/3/20

Note: Back-of-Wristbands SAR test of WCDMA Band 5

8.1.5. SAR measurement Result of LTE Band 2

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date
			1g	10g					
1RB									
Front-of-Face with 10mm	18900/1880	20M QPSK(1,99)	0.810	0.402	-1.84	23.73	24.00	0.862	2024/3/22
Front-of-Face with 10mm	18700/1860	20M QPSK(1,49)	0.783	0.476	-1.77	23.89	24.00	0.803	2024/3/22
Front-of-Face with 10mm	19100/1900	20M QPSK(1,49)	0.766	0.457	-0.83	23.81	24.00	0.800	2024/3/22
Front-of-Face with 10mm Repeated	18900/1880	20M QPSK(1,49)	0.806	0.400	0.12	23.73	24.00	0.858	2024/3/22
50%RB									
Front-of-Face with 10mm	18900/1880	20M QPSK(50,24)	0.438	0.228	3.50	22.61	23.00	0.479	2024/3/22
100%RB									
Front-of-Face with 10mm	18900/1880	20M QPSK(100,0)	0.365	0.156	1.20	22.60	23.00	0.400	2024/3/22

Note: Front-of-Face SAR test of LTE Band 2

Test	Test	Test Mode	SAR Value	Power	Conducted	Tune-up	Scaled	Date

Position	channel /Freq.		(W/kg) 1g	10g	Drift (±5%)	power (dBm)	power (dBm)	SAR 10g (W/Kg)	
1RB									
Back-of-Wristbands with 0mm	18900/1880	20M QPSK(1,99)	1.005	0.530	0.00	23.73	24.00	0.564	2024/3/22
50%RB									
Back-of-Wristbands with 0mm	18900/1880	20M QPSK(50,24)	0.523	0.299	-3.31	22.61	23.00	0.327	2024/3/22

Note: Back-of-Wristbands SAR test of LTE Band 2

8.1.6. SAR measurement Result of LTE Band 4

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date
			1g	10g					
1RB									
Front-of-Face with 10mm	20175/1732.5	20M QPSK(1,99)	0.789	0.448	-1.69	23.99	24.00	0.791	2024/3/21
50%RB									
Front-of-Face with 10mm	20175/1732.5	20M QPSK(50,49)	0.407	0.268	3.34	22.47	23.00	0.460	2024/3/21

Note: Front-of-Face SAR test of LTE Band 4

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 10g (W/Kg)	Date
			1g	10g					
1RB									
Back-of-Wristbands with 0mm	20175/1732.5	20M QPSK(1,99)	1.104	0.617	-0.48	23.99	24.00	0.618	2024/3/21
50%RB									
Back-of-Wristbands with 0mm	20175/1732.5	20M QPSK(50,49)	0.637	0.310	0.68	22.47	23.00	0.350	2024/3/21

Note: Back-of-Wristbands SAR test of LTE Band 4

8.1.7. SAR measurement Result of LTE Band 7

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date
			1g	10g					
1RB									
Front-of-Face with 10mm	21100/2535	20M QPSK(1,0)	0.651	0.185	-4.74	23.55	24.00	0.722	2024/3/08
50%RB									
Front-of-Face with 10mm	21100/2535	20M QPSK(50,24)	0.340	0.107	3.21	22.64	23.00	0.369	2024/3/08

Note: Front-of-Face SAR test of LTE Band 7

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 10g (W/Kg)	Date
			1g	10g					
1RB									
Back-of-Wristbands with 0mm	21100/2535	20M QPSK(1,0)	1.517	0.715	3.37	23.55	24.00	0.793	2024/3/08
50%RB									
Back-of-Wristbands with 0mm	21100/2535	20M QPSK(50,24)	0.836	0.391	-0.22	22.64	23.00	0.425	2024/3/08

Note: Back-of-Wristbands SAR test of LTE Band 7

8.1.8. SAR measurement Result of WLAN 2.4G

Test Position	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date
			1g	10g					
Front-of-Face with 10mm	6/2437	802.11b	0.083	0.048	2.34	14.18	14.50	0.089	2024/3/09

Note: Front-of-Face SAR test of WLAN 2.4G.

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

Back-of-Wristbands with 0mm	6/2437	802.11b	0.124	0.063	1.25	14.18	14.50	0.068	2024/3/09

Note: Back-of-Wristbands SAR test of WLAN 2.4G.

8.2. 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
	WWAN	DTS			
Front-of-Face	0.862	0.089	0.951	N/A	N/A

NOTE: Front-of-Face 1-g SAR Simultaneous Tx Combination of WWAN and DTS.

Test Position	Scaled SAR_{MAX}		Σ10-g SAR (W/Kg)	SPLSR	Remark
	WWAN	DTS			
Back-of-Wristbands	0.793	0.068	0.861	N/A	N/A

NOTE: Back-of-Wristbands 10-g SAR Simultaneous Tx Combination of WWAN and DTS.

9. Appendix A. Photo documentation

Refer to appendix Test Setup photo---SAR

10. Appendix B. System Check Plots

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MEASUREMENT 1 System Performance Check - 835MHz
MEASUREMENT 2 System Performance Check - 1800MHz
MEASUREMENT 3 System Performance Check - 1900MHz
MEASUREMENT 4 System Performance Check - 2450MHz
MEASUREMENT 5 System Performance Check - 2600MHz

MEASUREMENT 1

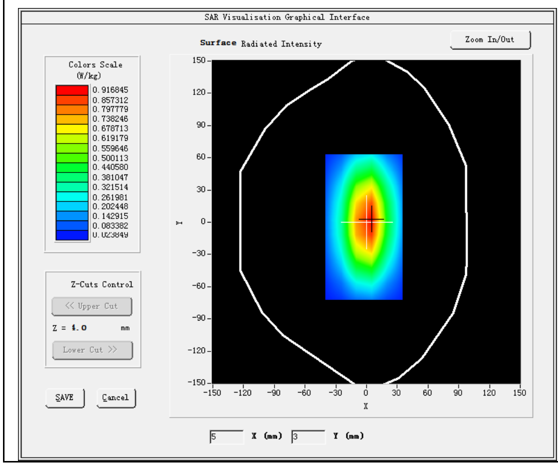
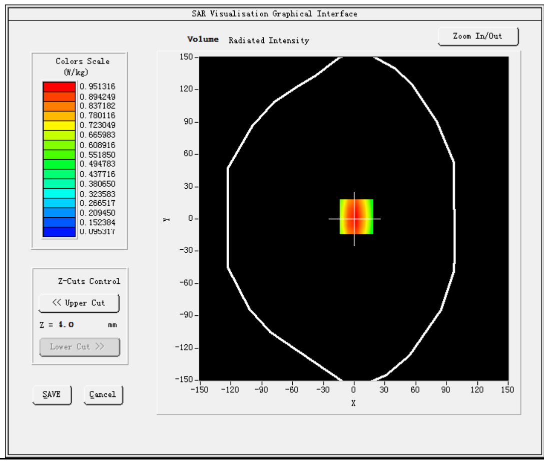
Date of measurement: 20/3/2024

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW835
Channels	Middle
Signal	CW (Crest factor: 1.0)
ConvF	2.32

B. SAR Measurement Results

Frequency (MHz)	835.000000
Relative permittivity (real part)	41.145239
Relative permittivity (imaginary part)	19.192538
Conductivity (S/m)	0.890321
Variation (%)	-2.700000

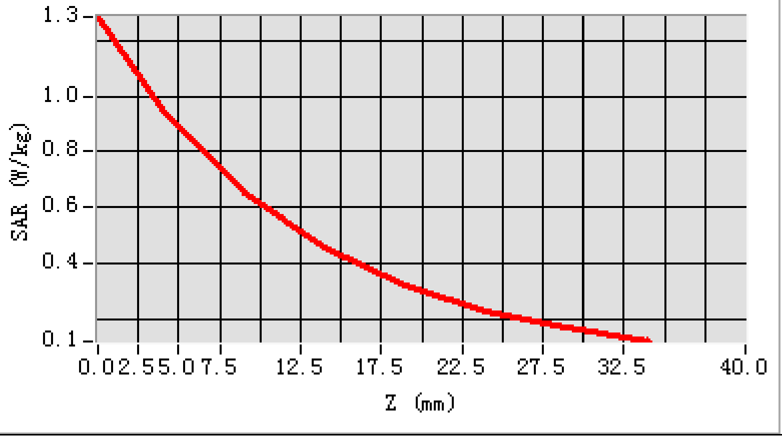
SURFACE SAR	VOLUME SAR
	

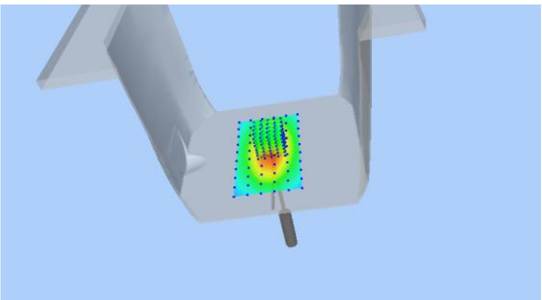
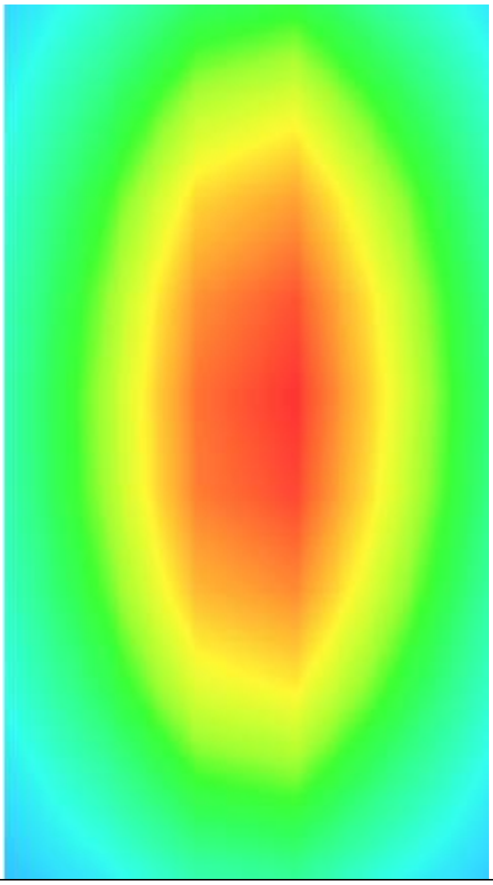
Maximum location: X=2.00, Y=2.00

SAR Peak: 1.29 W/kg

SAR 10g (W/Kg)	0.594143
SAR 1g (W/Kg)	0.908214

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.2826	0.9535	0.6595	0.4597	0.3247	0.2354	0.1700



3D screen shot	Hot spot position
	

MEASUREMENT 2

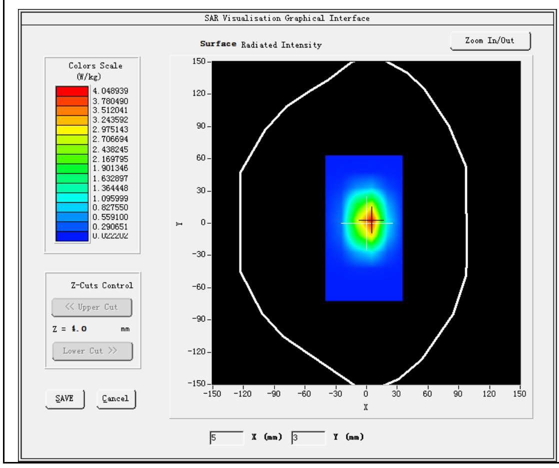
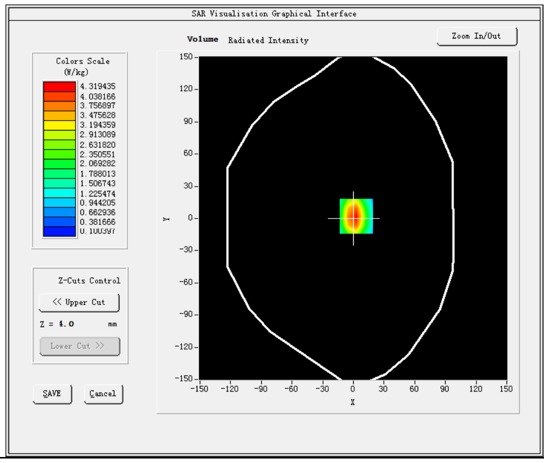
Date of measurement: 21/3/2024

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW1800
Channels	Middle
Signal	CW (Crest factor: 1.0)
ConvF	2.45

B. SAR Measurement Results

Frequency (MHz)	1800.000000
Relative permittivity (real part)	39.048883
Relative permittivity (imaginary part)	13.801505
Conductivity (S/m)	1.380151
Variation (%)	-2.750000

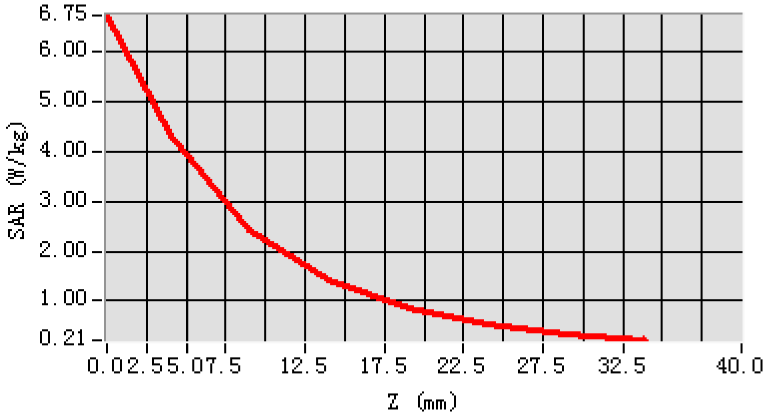
SURFACE SAR	VOLUME SAR
	

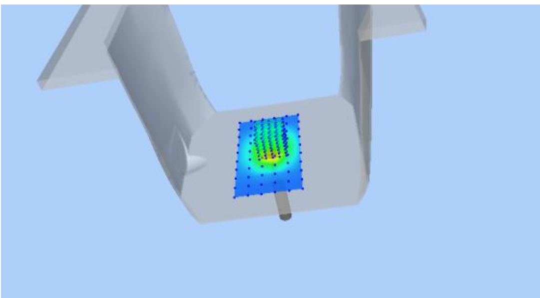
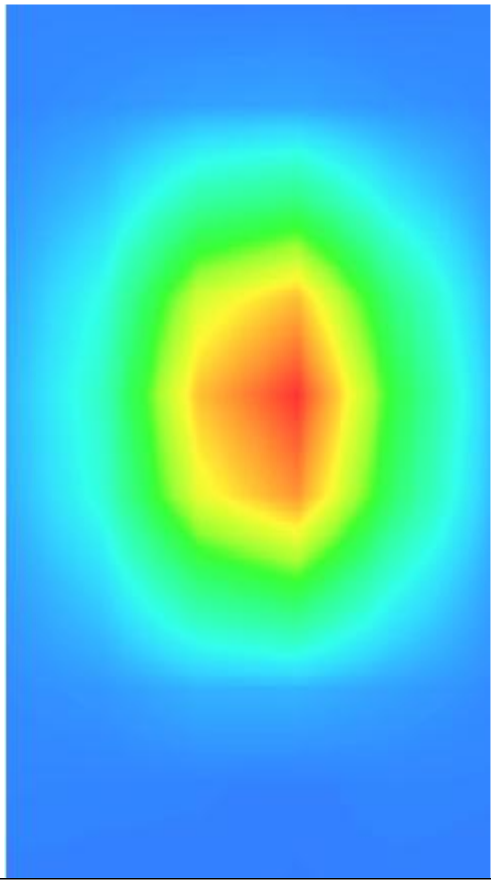
Maximum location: X=3.00, Y=2.00

SAR Peak: 6.82 W/kg

SAR 10g (W/Kg)	1.931354
SAR 1g (W/Kg)	3.981378

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	6.7492	4.3108	2.4372	1.4278	0.8592	0.5249	0.3295



3D screen shot	Hot spot position
	

MEASUREMENT 3

Date of measurement: 22/3/2024

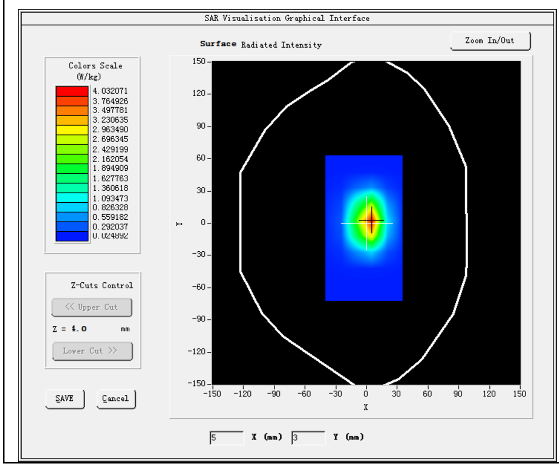
A. Experimental conditions.

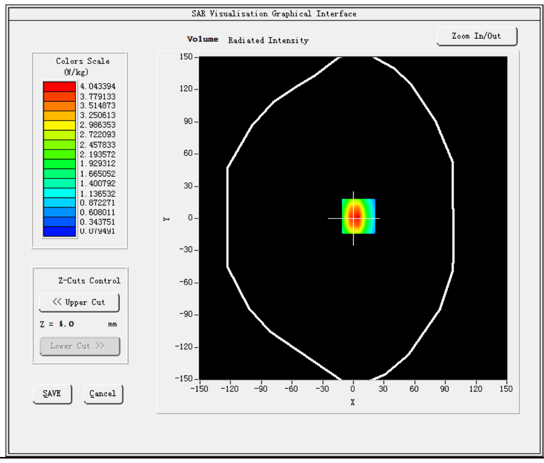
Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW1900
Channels	Middle
Signal	CW (Crest factor: 1.0)
ConvF	2.63

B. SAR Measurement Results

Frequency (MHz)	1900.000000
Relative permittivity (real part)	38.753002
Relative permittivity (imaginary part)	13.581850
Conductivity (S/m)	1.433640
Variation (%)	-2.770000

SURFACE SAR	VOLUME SAR



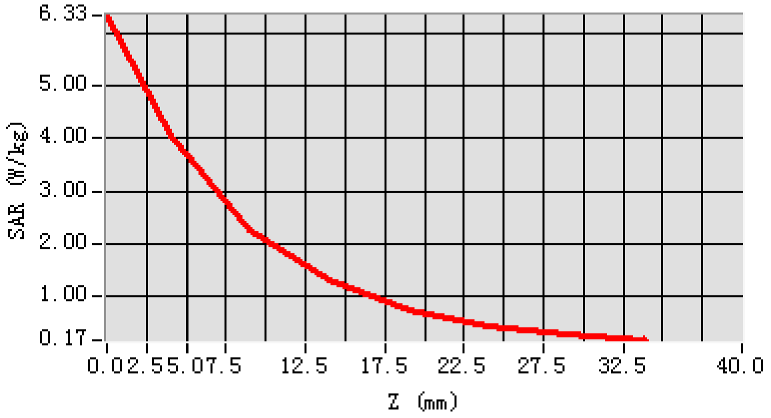


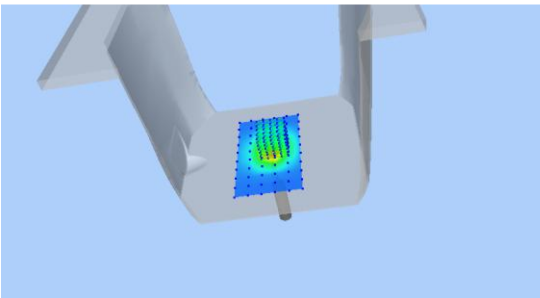
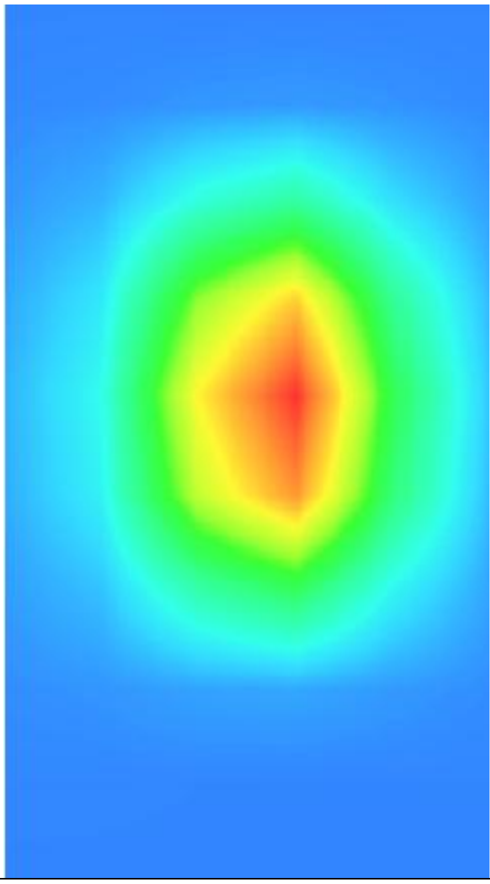
Maximum location: X=5.00, Y=2.00

SAR Peak: 6.70 W/kg

SAR 10g (W/Kg)	2.059195
SAR 1g (W/Kg)	3.738347

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	6.3276	4.0498	2.2677	1.3047	0.7651	0.4534	0.2788



3D screen shot	Hot spot position
	

MEASUREMENT 4

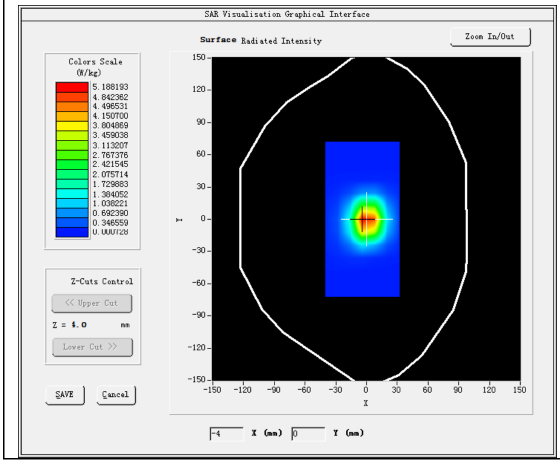
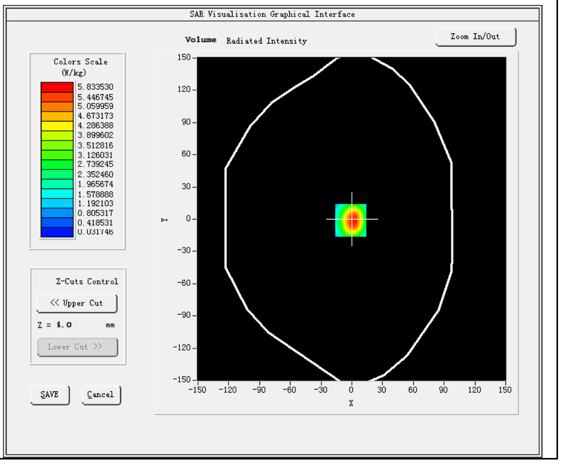
Date of measurement: 9/3/2024

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)	37.722156
Relative permittivity (imaginary part)	12.903236
Conductivity (S/m)	1.756274
Variation (%)	-1.530000

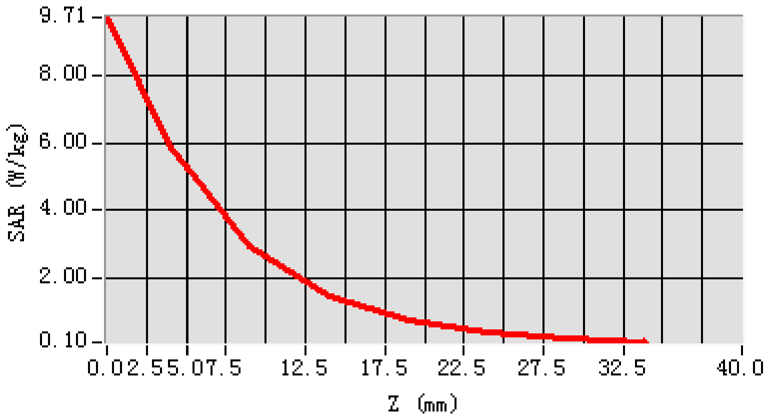
SURFACE SAR	VOLUME SAR
	

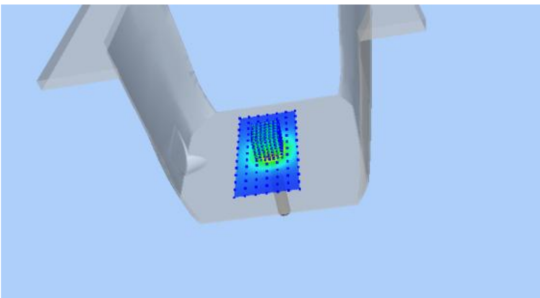
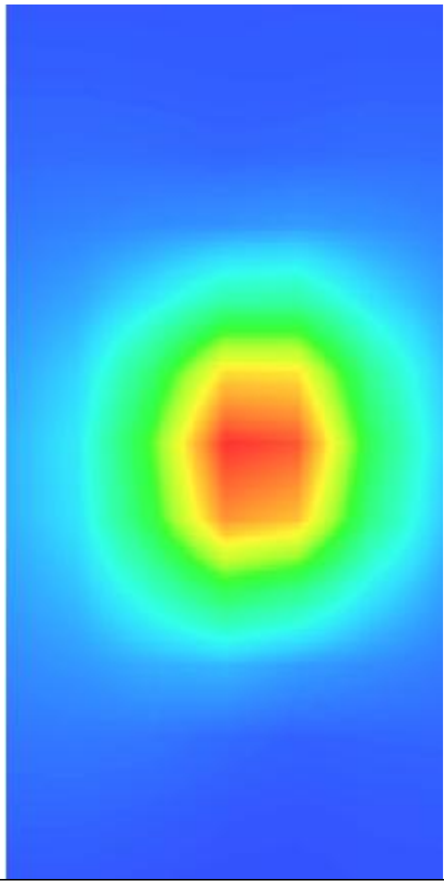
Maximum location: X=-1.00, Y=-1.00

SAR Peak: 9.83 W/kg

SAR 10g (W/Kg)	2.600153
SAR 1g (W/Kg)	4.998021

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	9.7108	5.8358	2.9287	1.4690	0.7482	0.3720	0.1999



3D screen shot	Hot spot position
	

MEASUREMENT 5

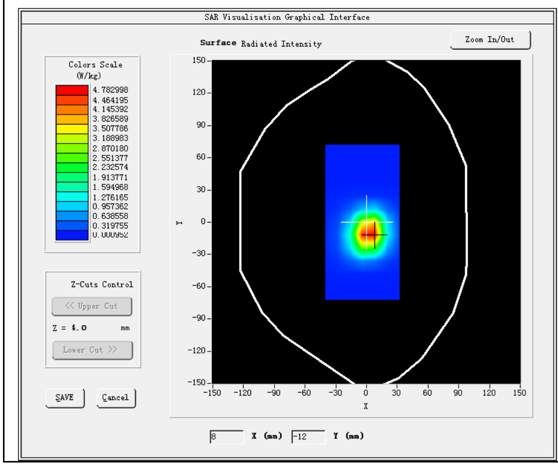
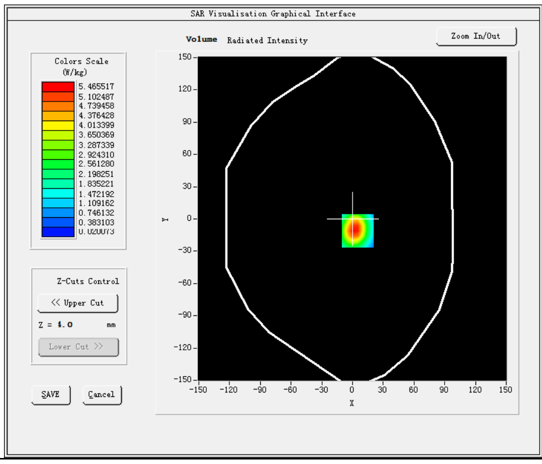
Date of measurement: 8/3/2024

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	CW2600
Channels	Middle
Signal	CW (Crest factor: 1.0)
ConvF	2.65

B. SAR Measurement Results

Frequency (MHz)	2600.000000
Relative permittivity (real part)	38.781242
Relative permittivity (imaginary part)	13.559332
Conductivity (S/m)	1.958570
Variation (%)	0.840000

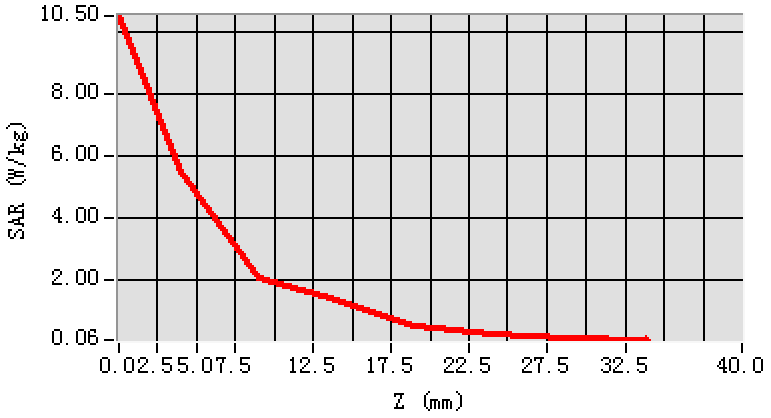
SURFACE SAR	VOLUME SAR
	

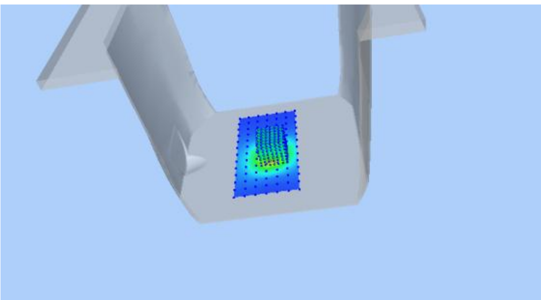
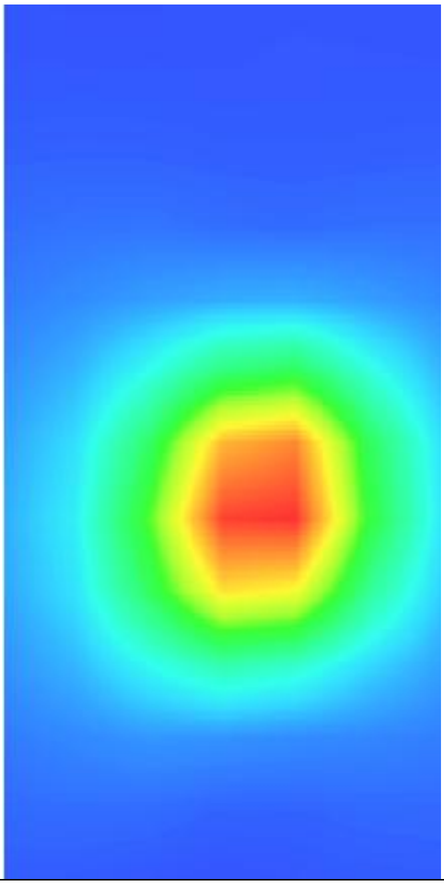
Maximum location: X=5.00, Y=-11.00

SAR Peak: 9.43 W/kg

SAR 10g (W/Kg)	2.493156
SAR 1g (W/Kg)	5.050208

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	10.558	5.4602	2.0864	1.3328	0.5039	0.2837	0.1286



3D screen shot	Hot spot position
	

11. Appendix C. Plots of High SAR Measurement

Table of contents

MEASUREMENT 1

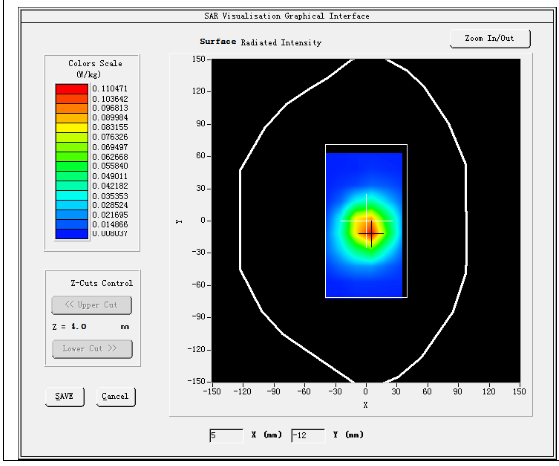
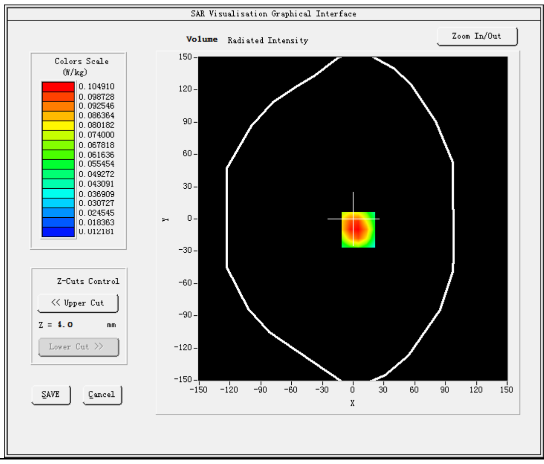
Date of measurement: 20/3/2024

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	GSM850
Channels	Middle
Signal	TDMA (Crest factor: 4.0)
ConvF	2.32

B. SAR Measurement Results

Frequency (MHz)	836.400000
Relative permittivity (real part)	41.154320
Relative permittivity (imaginary part)	19.199738
Conductivity (S/m)	0.892148
Variation (%)	-3.070000

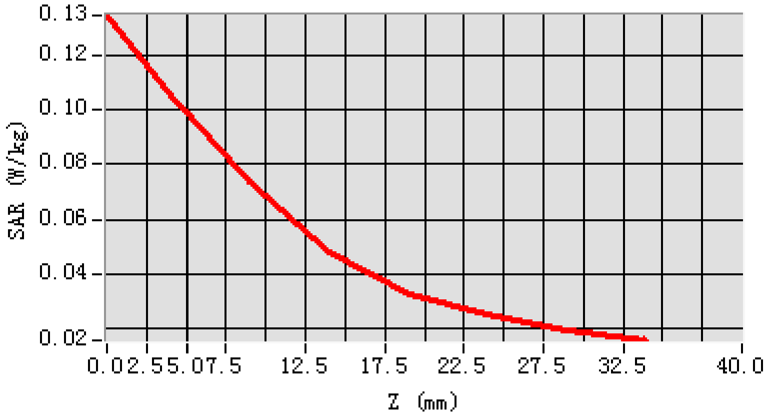
SURFACE SAR	VOLUME SAR
	

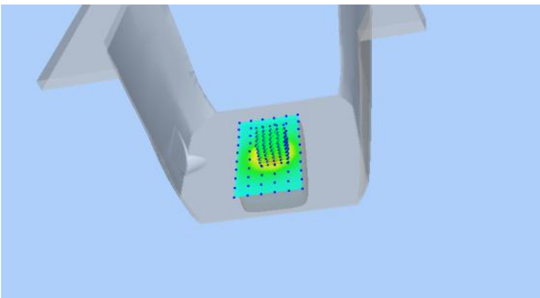
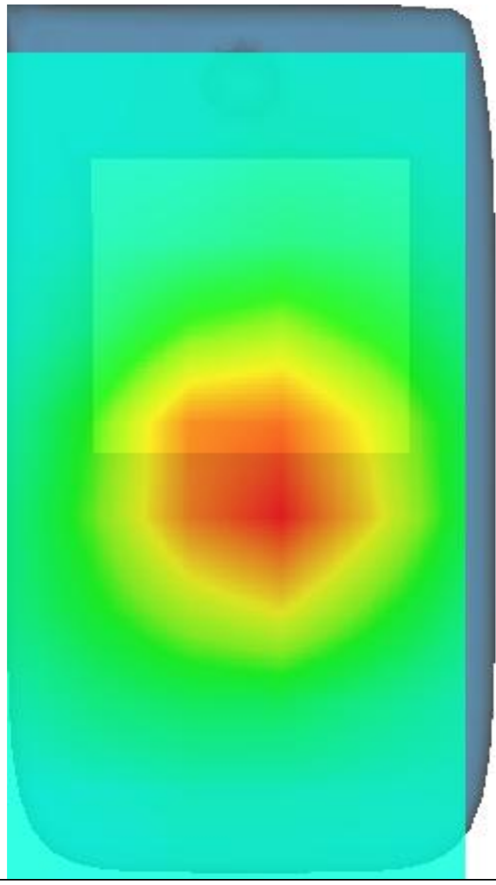
Maximum location: X=5.00, Y=-10.00

SAR Peak: 0.15 W/kg

SAR 10g (W/Kg)	0.063513
SAR 1g (W/Kg)	0.100075

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1346	0.1049	0.0739	0.0481	0.0328	0.0250	0.0190



3D screen shot	Hot spot position
	

MEASUREMENT 2

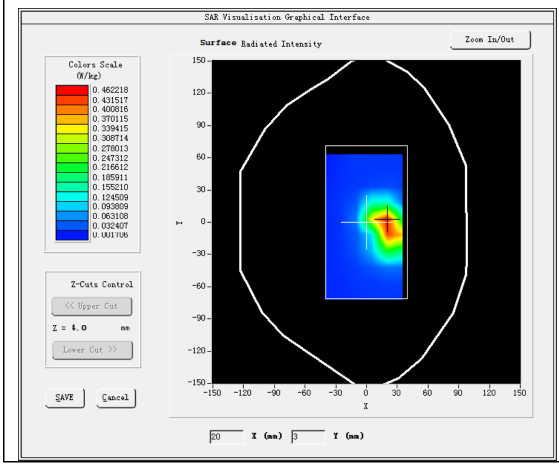
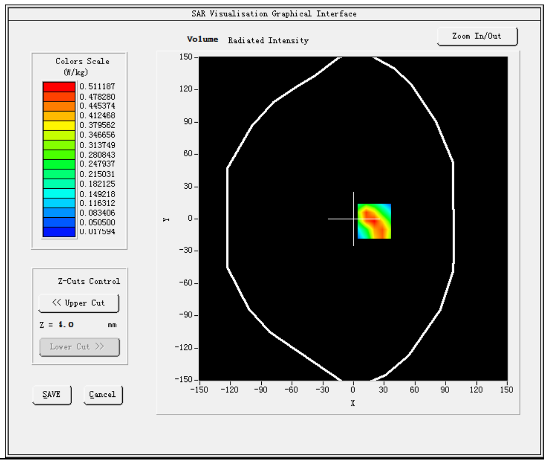
Date of measurement: 22/3/2024

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	GSM1900
Channels	Middle
Signal	TDMA (Crest factor: 2.7)
ConvF	2.63

B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.828300
Relative permittivity (imaginary part)	13.629750
Conductivity (S/m)	1.423552
Variation (%)	1.850000

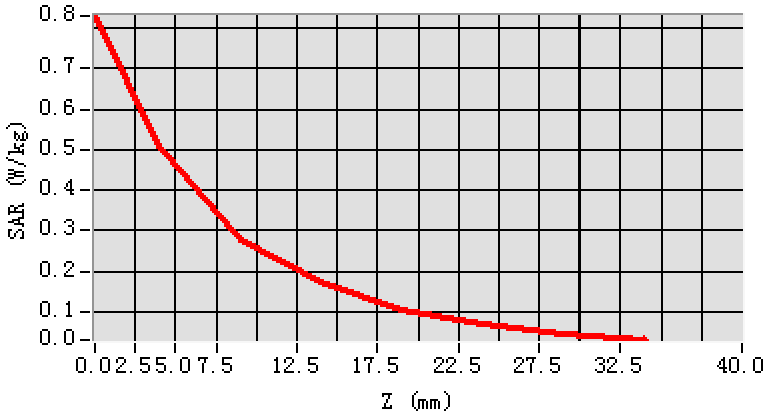
SURFACE SAR	VOLUME SAR
	

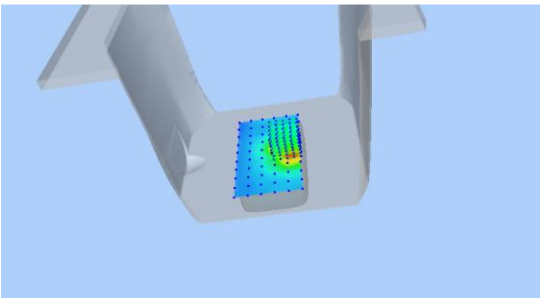
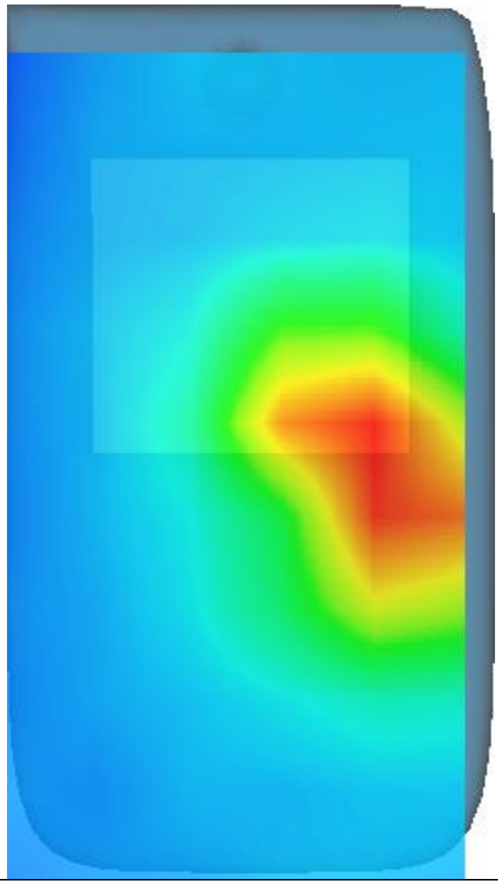
Maximum location: X=20.00, Y=-2.00

SAR Peak: 0.83 W/kg

SAR 10g (W/Kg)	0.254858
SAR 1g (W/Kg)	0.494759

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.8308	0.5112	0.2754	0.1711	0.1043	0.0681	0.0452



3D screen shot	Hot spot position
	

MEASUREMENT 3

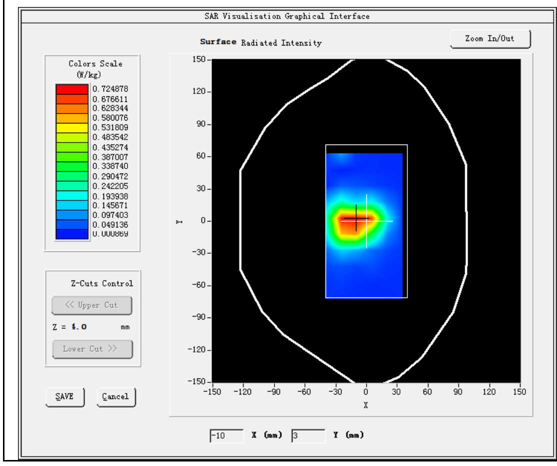
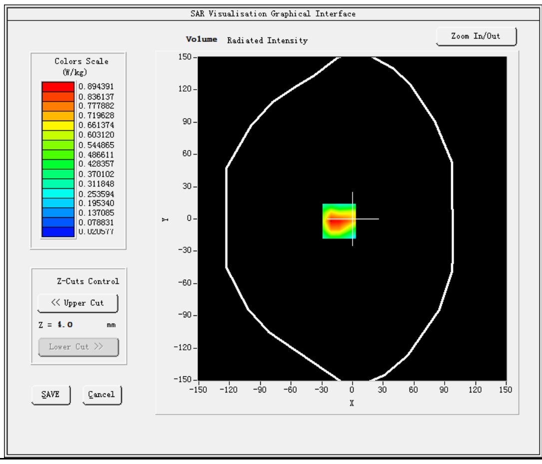
Date of measurement: 22/3/2024

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band2_WCDMA1900
Channels	Middle
Signal	WCDMA (Crest factor: 1.0)
ConvF	2.63

B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.828300
Relative permittivity (imaginary part)	13.629750
Conductivity (S/m)	1.423552
Variation (%)	2.000000

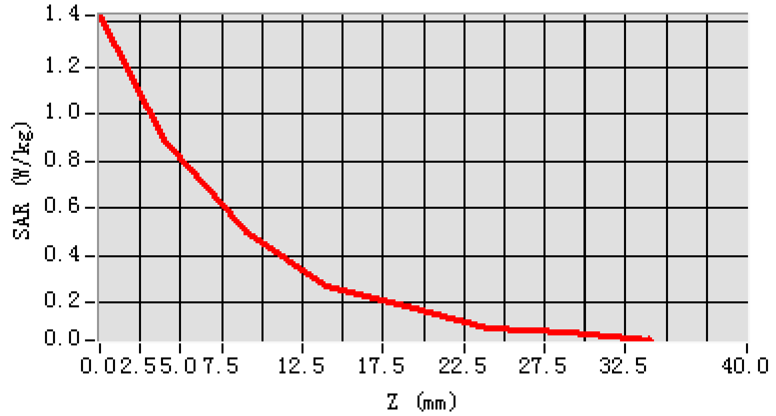
SURFACE SAR	VOLUME SAR
	

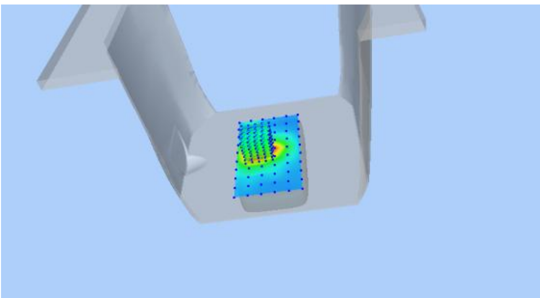
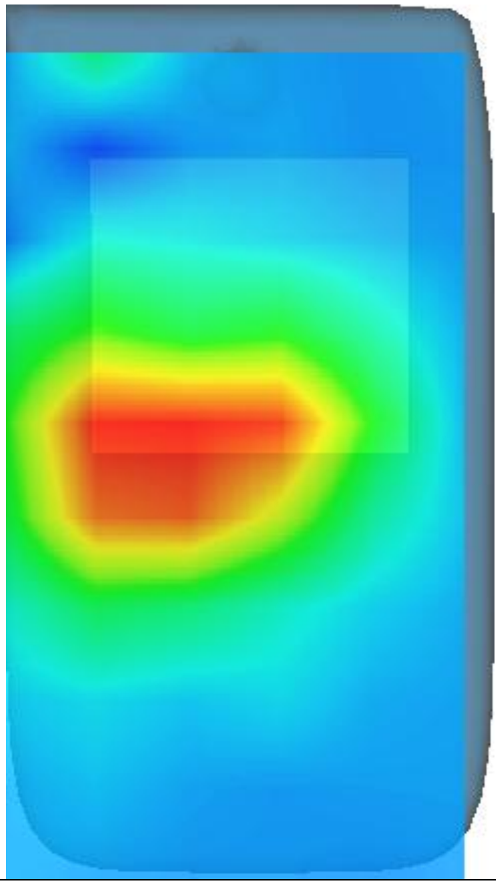
Maximum location: X=-13.00, Y=-2.00

SAR Peak: 1.50 W/kg

SAR 10g (W/Kg)	0.453066
SAR 1g (W/Kg)	0.887885

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.4221	0.8944	0.4953	0.2683	0.1809	0.0921	0.0696



3D screen shot	Hot spot position
	

MEASUREMENT 4

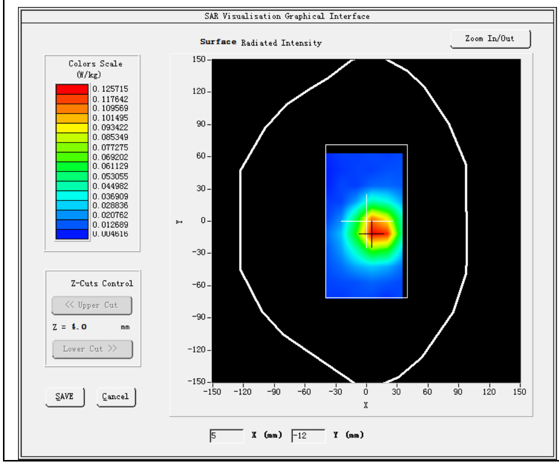
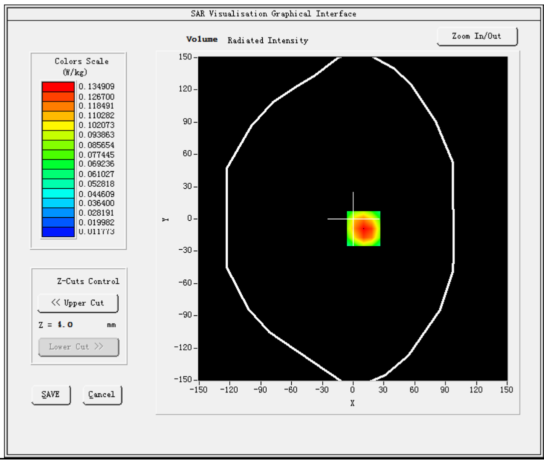
Date of measurement: 20/3/2024

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band5_WCDMA850
Channels	Middle
Signal	WCDMA (Crest factor: 1.0)
ConvF	2.32

B. SAR Measurement Results

Frequency (MHz)	836.400000
Relative permittivity (real part)	41.154320
Relative permittivity (imaginary part)	19.199738
Conductivity (S/m)	0.892148
Variation (%)	2.250000

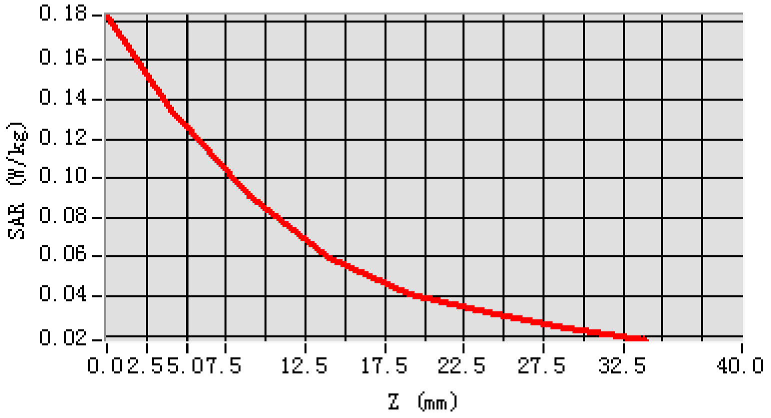
SURFACE SAR	VOLUME SAR
	

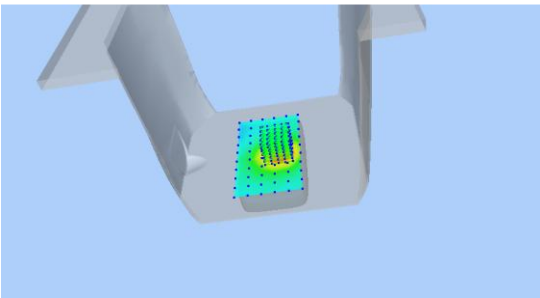
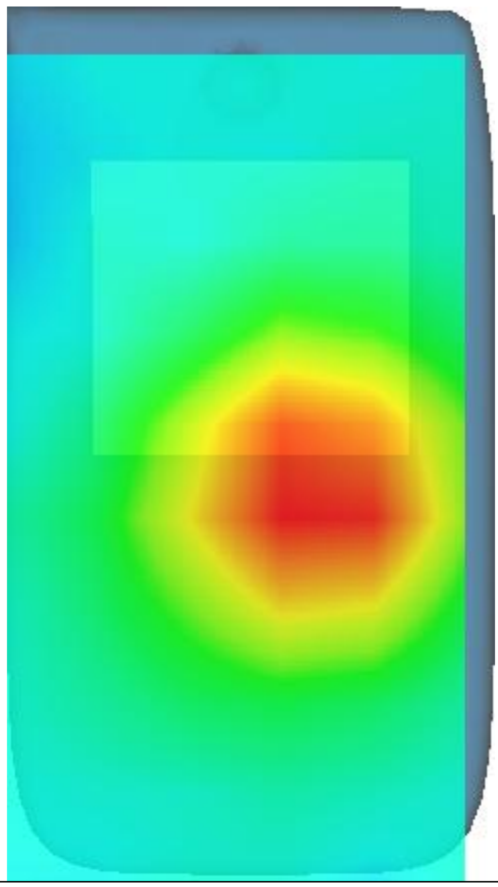
Maximum location: X=10.00, Y=-9.00

SAR Peak: 0.19 W/kg

SAR 10g (W/Kg)	0.079385
SAR 1g (W/Kg)	0.128808

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1828	0.1349	0.0908	0.0596	0.0414	0.0315	0.0239



3D screen shot	Hot spot position
	

MEASUREMENT 5

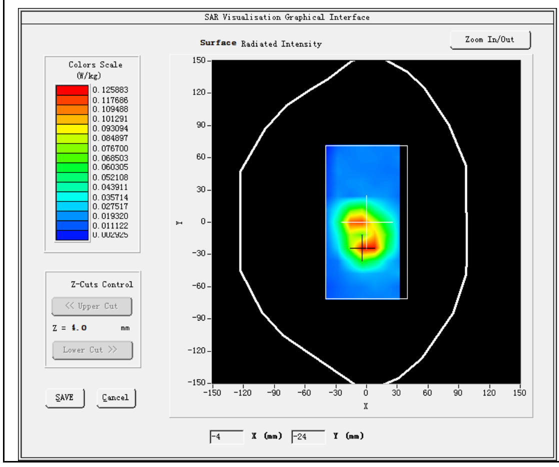
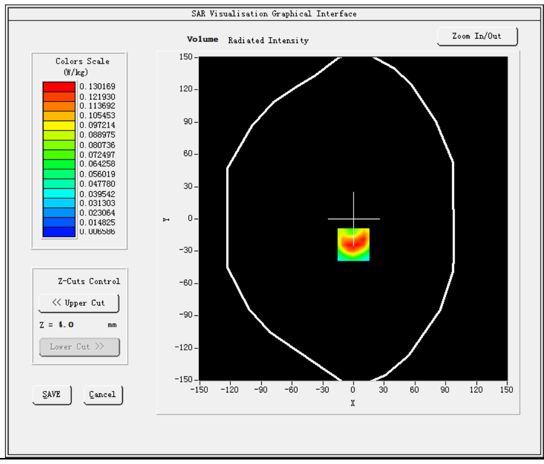
Date of measurement: 9/3/2024

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)	37.774258
Relative permittivity (imaginary part)	12.821736
Conductivity (S/m)	1.735921
Variation (%)	1.250000

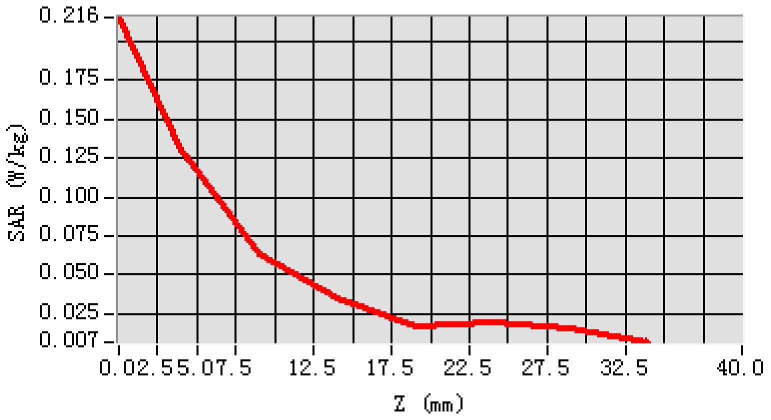
SURFACE SAR	VOLUME SAR
	

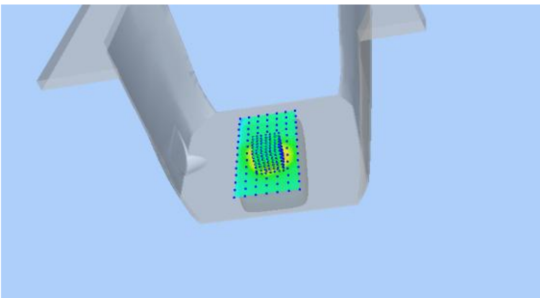
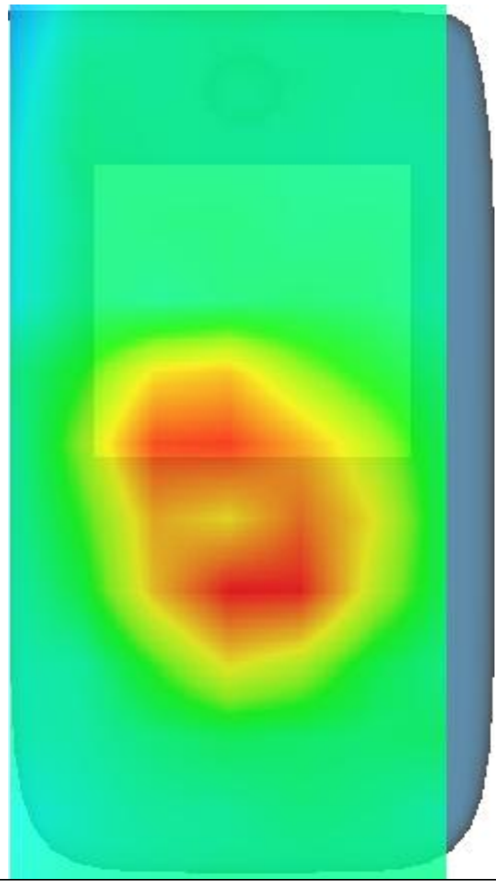
Maximum location: X=0.00, Y=-24.00

SAR Peak: 0.23 W/kg

SAR 10g (W/Kg)	0.063328
SAR 1g (W/Kg)	0.124000

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.2156	0.1302	0.0634	0.0345	0.0174	0.0198	0.0154



3D screen shot	Hot spot position
	

MEASUREMENT 6

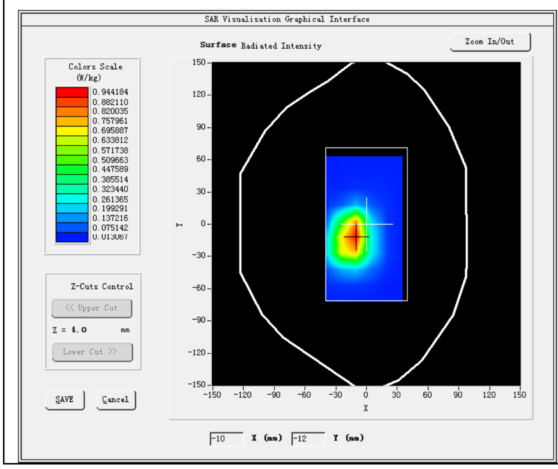
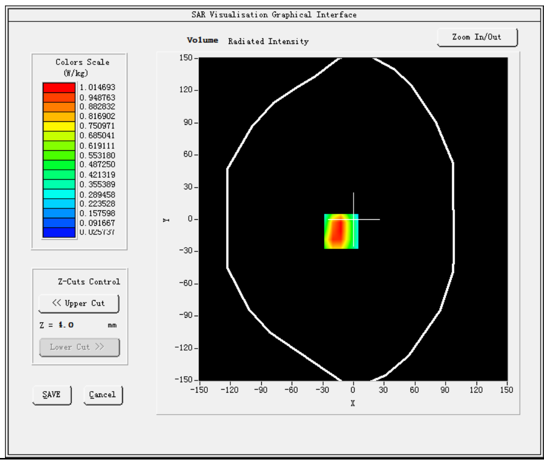
Date of measurement: 22/3/2024

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 2
Channels	Middle
Signal	LTE (Crest factor: 1.0)
ConvF	2.63

B. SAR Measurement Results

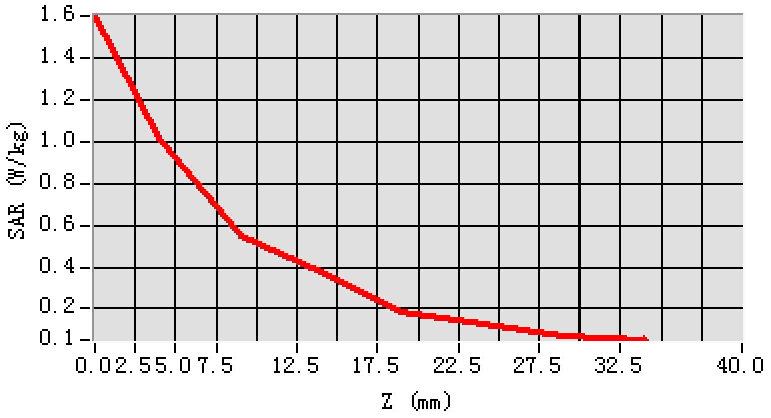
Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.828300
Relative permittivity (imaginary part)	13.629750
Conductivity (S/m)	1.423552
Variation (%)	0.000000

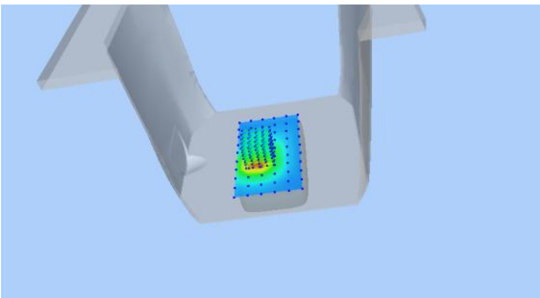
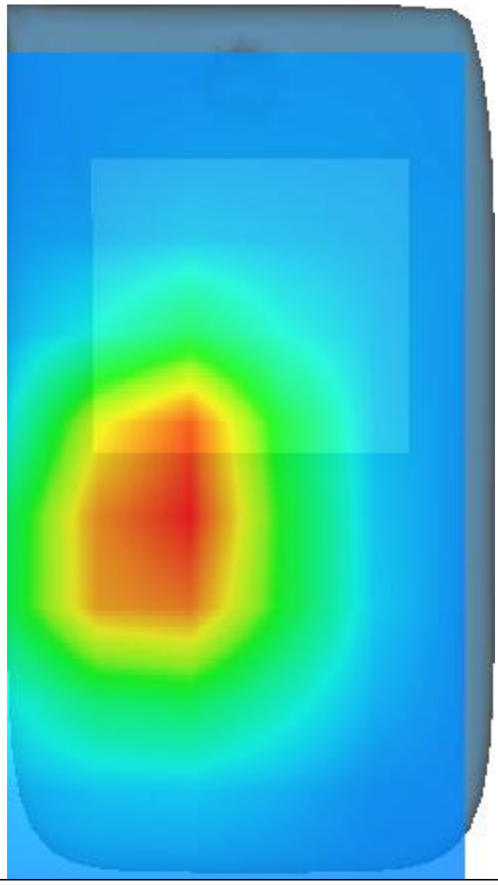
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-12.00, Y=-11.00
SAR Peak: 1.63 W/kg

SAR 10g (W/Kg)	0.530395
SAR 1g (W/Kg)	1.004859

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.6019	1.0147	0.5535	0.3728	0.1814	0.1314	0.0668



3D screen shot	Hot spot position
	

MEASUREMENT 7

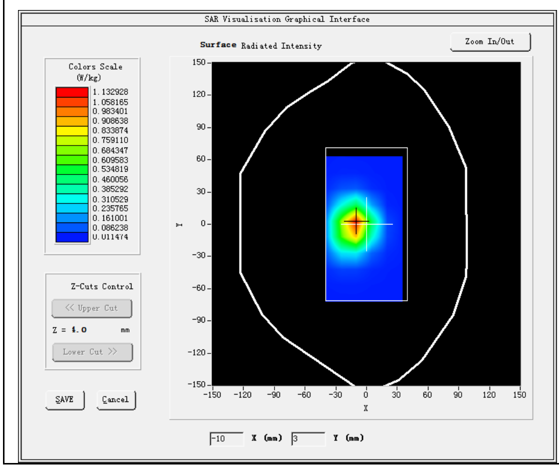
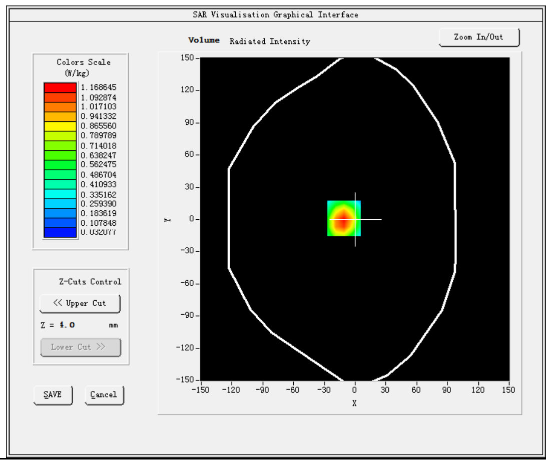
Date of measurement: 21/3/2024

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 4
Channels	Middle
Signal	LTE (Crest factor: 1.0)
ConvF	2.45

B. SAR Measurement Results

Frequency (MHz)	1732.500000
Relative permittivity (real part)	39.516483
Relative permittivity (imaginary part)	13.738655
Conductivity (S/m)	1.322346
Variation (%)	-0.480000

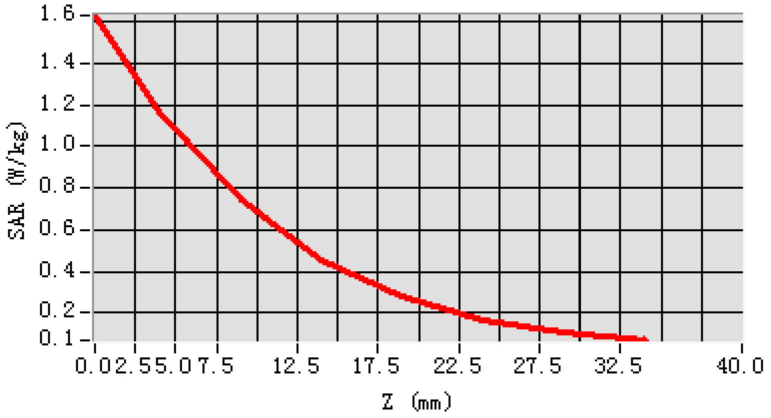
SURFACE SAR	VOLUME SAR
	

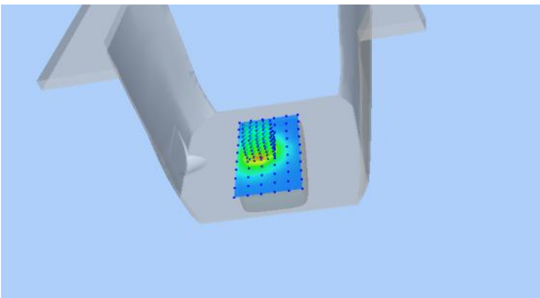
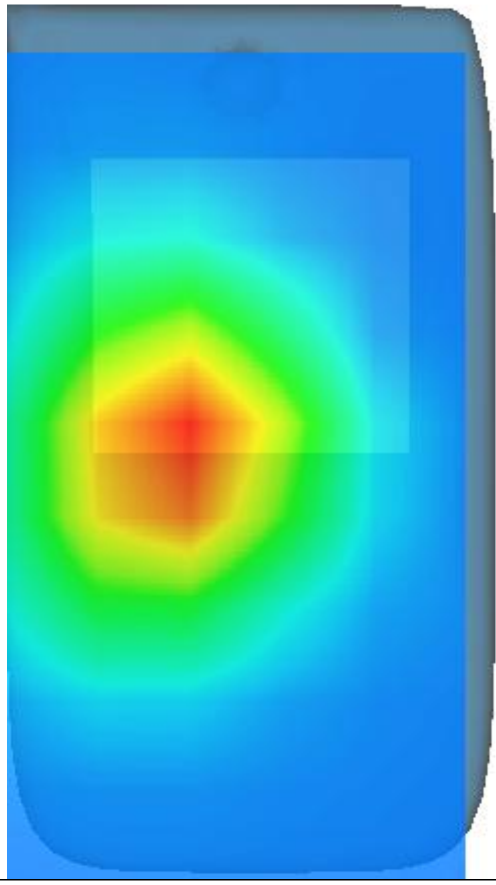
Maximum location: X=-11.00, Y=1.00

SAR Peak: 1.68 W/kg

SAR 10g (W/Kg)	0.616700
SAR 1g (W/Kg)	1.103992

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.6299	1.1686	0.7467	0.4580	0.2786	0.1698	0.1080



3D screen shot	Hot spot position
	

MEASUREMENT 8

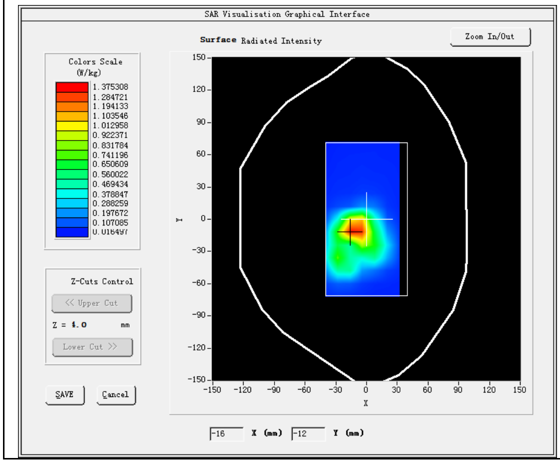
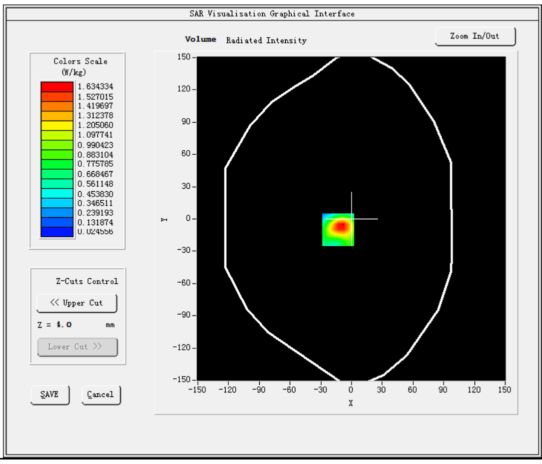
Date of measurement: 8/3/2024

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	LTE band 7
Channels	Middle
Signal	LTE (Crest factor: 1.0)
ConvF	2.65

B. SAR Measurement Results

Frequency (MHz)	2535.000000
Relative permittivity (real part)	39.116543
Relative permittivity (imaginary part)	13.427232
Conductivity (S/m)	1.891002
Variation (%)	3.370000

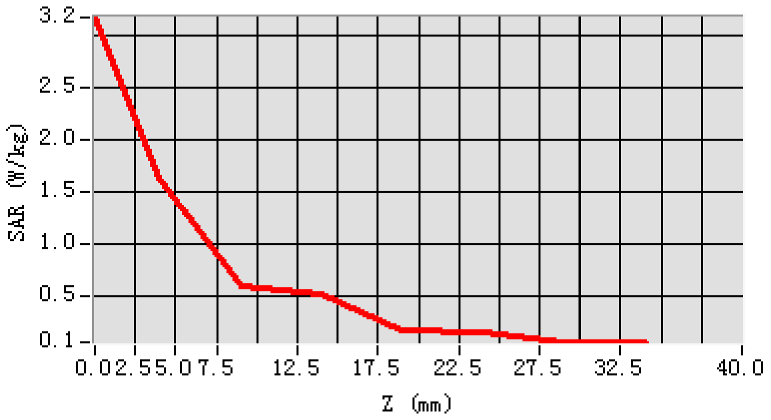
SURFACE SAR	VOLUME SAR
	

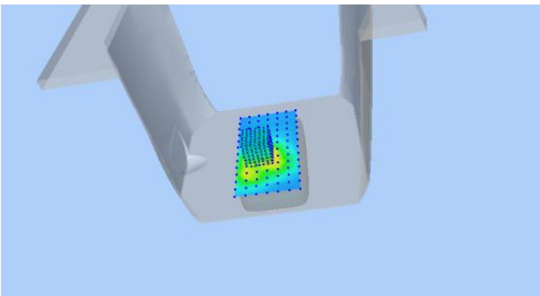
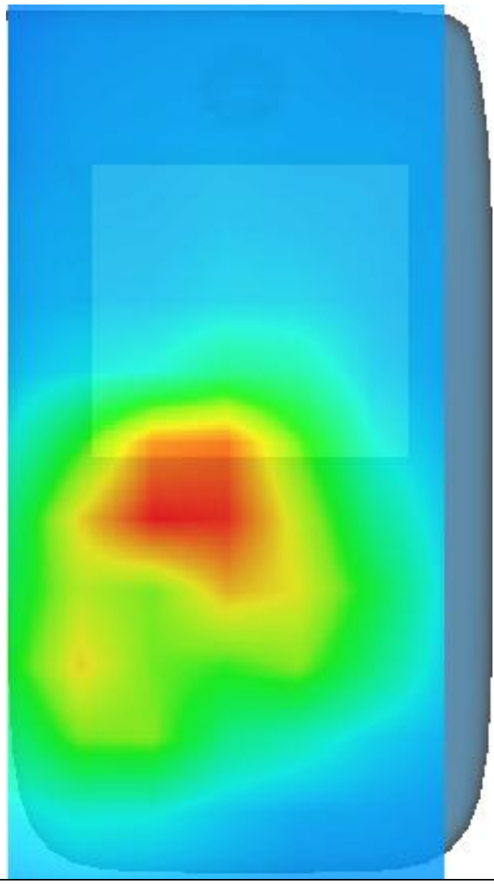
Maximum location: X=-13.00, Y=-10.00

SAR Peak: 2.54 W/kg

SAR 10g (W/Kg)	0.714882
SAR 1g (W/Kg)	1.516766

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	3.1828	1.6343	0.6031	0.5199	0.1671	0.1505	0.0563



3D screen shot	Hot spot position
	

12. Appendix D. Calibration Certificate

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

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:

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

where

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

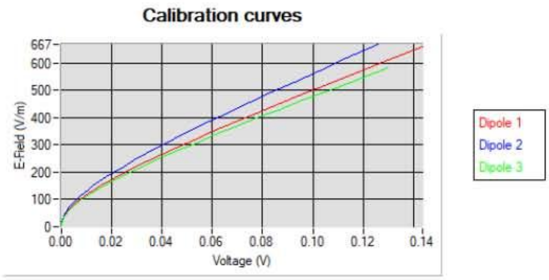
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-11% for the frequency range 150-450MHz.
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

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.

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

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 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
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.

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

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

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

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

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

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

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

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

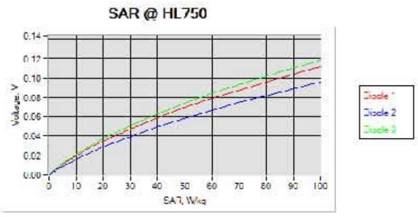
$$SAR = \frac{4Pw}{ab\delta}e^{\frac{-2z}{\delta}}$$

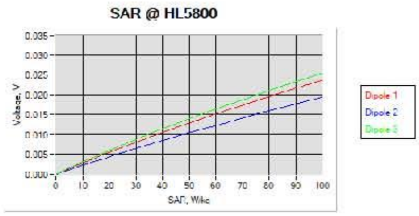
where
a=the larger cross-sectional of the waveguide
b=the smaller cross-sectional of the waveguide
δ=the skin depth for the liquid in the waveguide
Pw=the power delivered to the liquid

The below table summarize the ConvF for the calibrated liquid. The curves give examples for the measured SAR depending on the voltage in some liquid.

Liquid	Frequency (MHz*)	ConvF
HL750	750	2.37
HL850	835	2.32
HL900	900	2.23
HL1800	1800	2.45
HL1900	1900	2.63
HL2000	2000	2.83
HL2300	2300	2.81
HL2450	2450	2.85
HL2600	2600	2.65
HL3300	3300	2.21
HL3500	3500	2.20
HL3700	3700	2.11
HL3900	3900	2.40
HL4200	4200	2.40
HL4600	4600	2.33
HL4900	4900	2.37
HL5200	5200	2.07
HL5400	5400	2.11
HL5600	5600	2.20
HL5800	5800	2.04

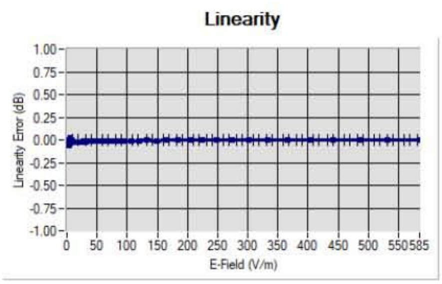
(*) Frequency validity is +/-50MHz below 600MHz, +/-100MHz from 600MHz to 6GHz and +/-700MHz above 6GHz



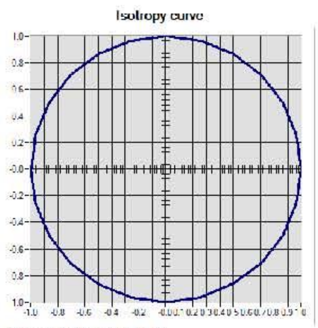


6 VERIFICATION RESULTS

The figures below represent the measured linearity and axial isotropy for this probe. The probe specification is +/-0.2 dB for linearity and +/-0.15 dB for axial isotropy.



Linearity:+/-1.42% (+/-0.06dB)



Isotropy:+/-0.21% (+/-0.01dB)

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2023
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Fluoroptic Thermometer	LumaSense Luxtron 812	94264	09/2022	09/2025
Coaxial cell	MVG	SN 32/16 COAXCELL_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG2_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G600_1	Validated. No cal required.	Validated. No cal required.

Waveguide	MVG	SN 32/16 WG4_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G900_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG6_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG8_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800B_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800H_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG10_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_3G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_5G000_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG14_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_7G000_1	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

SAR Reference Dipole Calibration Report

Ref : ACR.53.24.24.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 REFERENCE DIPOLE
FREQUENCY: 835 MHZ
SERIAL NO.: SN 03/15DIP0G835-347

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

Calibration date: 02/21/2024

Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr

Summary:

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