

CE SAR EVALUATION REPORT

**In accordance with the requirements of
EN50360, EN50566, EN62209-1/-2, EN62479 and COUNCIL
RECOMMENDATION 1999/519/EC**

Product Name : Smart Phone

Trademark : OUKITEL

Model Name : WP200 Pro

Family Model : WP200, WP200 S, WP200 Plus, WP200
Ultra, WP200 TITAN, WP200 GT,
WP210, WP210 S, WP210 Pro, WP210
Plus, WP210 Ultra, WP210 GT

Report No. : S24110702503001

Prepared for

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TEST RESULT CERTIFICATION

Applicant's name.....: SHENZHEN YUNJI INTELLIGENT TECHNOLOGY CO.,LTD
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202, Building A2, Silicon Valley Power Intelligent Terminal Industrial
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Street, Longhua District, Shenzhen

Product description
Product name.....: Smart Phone
Trademark: OUKITEL
Model and/or type reference ..: WP200 Pro
Family Model.....: WP200, WP200 S, WP200 Plus, WP200 Ultra, WP200 TITAN, WP200
GT, WP210,WP210 S,WP210 Pro,WP210 Plus,WP210 Ultra,WP210
GT
EN 50360:2017;
EN 50566:2017;

Standards.....: EN 62209-1:2016;
EN 62209-2:2010;
EN 62479:2010;

This device described above has been tested by Shenzhen NTEK. In accordance with the measurement methods and procedures specified in EN62209. Testing has shown that this device is capable of compliance with localized specific absorption rate (SAR) specified in COUNCIL 1999/519/EC. 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 S241107025009

Date of Test

Date (s) of performance of tests..... Oct. 27, 2024 ~ Nov. 30, 2024

Date of Issue Jan. 07, 2025

Test Result **Pass**

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※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Jan. 07, 2025	Owen xiao

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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	10.0	20.0

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	2.0	4.0

NOTE: **Whole-Body SAR** is averaged over the entire body, **partial-body SAR** is averaged over any 10 gram of tissue defined as a tissue volume in the shape of a cube.

SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Occupational/Controlled Environments:

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

General Population/Uncontrolled Environments:

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

NOTE

HEAD AND TRUNK LIMIT

2.0 W/kg AND MEMBER LIMIT 4.0 W/kg

APPLIED TO THIS EUT

1.2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for WP200 Pro are as follows.

RF Exposure Conditions	Max SAR Value(W/kg)		
	10-g Head	10-g Body & Hotspot (Separation distance of 5mm)	10-g Member DAS (See note ³) (Separation distance of 0mm)
	0.433	0.919	2.650
Max Simultaneous Tx	1.062	0.919	2.999

NOTE: 1. The Max Simultaneous Tx is calculated based on the same configuration and test position.

2. This device is in compliance with Specific Absorption Rate (SAR) for general population / uncontrolled exposure limits (2.0 W/kg for head and body, 4.0 W/kg for member) specified in COUNCIL RECOMMENDATION 1999/519/EC, and had been tested in accordance with the measurement methods and procedures specified in EN 62209-1:2016 & EN 62209-2:2010.

3. The member DAS, It is only an assessment required by the ANFR (Sell to France).

1.3. EUT Description

Device Information	
Product Name	Smart Phone
Trademark	OUKITEL
Model Name	WP200 Pro
Family Model	WP200, WP200 S, WP200 Plus, WP200 Ultra, WP200 TITAN, WP200 GT, WP210, WP210 S, WP210 Pro, WP210 Plus, WP210 Ultra, WP210 GT
Model Difference	All models are the same circuit and RF module, except for model names.
Device Phase	Identical Prototype
Exposure Category	General population / Uncontrolled environment
Antenna Type	IFA Antenna
Battery Information	Phone: DC 3.87V, 8800mAh, 34.056Wh Watch: DC 3.8V, 150mAh, 0.57Wh
Hardware version	G3382P-ME-V1.1
Software version	V04
Device Operating Configurations	
Supporting Mode(s)	GSM 900/1800, WCDMA Band 1/8, LTE Band1/3/7/8/20/38/40, SA n78 WLAN 2.4G/5G, Bluetooth, GPS, FM, NFC
Test Modulation	GSM(GMSK/8PSK), WCDMA(QPSK), LTE(QPSK/16-QAM), NR(DFT-s-OFDM:PI/2 BPSK/QPSK/16-QAM/64QAM/256QAM CP-OFDM:QPSK/16-QAM/64QAM/256QAM), WLAN(DSSS/OFDM),

	Bluetooth(GFSK, $\pi/4$ -DQPSK, 8DPSK) , GPS(BPSK),FM(FM) ,NFC(ASK)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM 900	880-915	925-960
	GSM 1800	1710-1785	1805-1880
	WCDMA Band 1	1920-1980	2110-2170
	WCDMA Band 8	880-915	925-960
	LTE Band 1	1920-1980	2110-2170
	LTE Band 3	1710-1785	1805-1880
	LTE Band 7	2500-2570	2620-2690
	LTE Band 8	880- 915	925- 960
	LTE Band 20	832-862	791-821
	LTE Band 38	2570-2620	
	LTE Band 40	2300-2400	
	NR n78	3300-3800	
	WLAN 2.4G	2412-2472	
	WLAN 5.2G	5180-5240	
	WLAN 5.8G	5745-5825	
	Bluetooth	2402-2480	
	NFC	13.56	
	FM	N/A	87.5-108
	GPS	N/A	1575.42
GPRS Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
EGPRS Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
Power Class	4, tested with power level 5(GSM 900)		
	1, tested with power level 0(GSM 1800)		
	3, tested with power control "all 1"(WCDMA Band 1)		
	3, tested with power control "all 1"(WCDMA Band 8)		
	3, tested with power control all Max.(LTE Band 1)		
	3, tested with power control all Max.(LTE Band 3)		
	3, tested with power control all Max.(LTE Band 7)		
	3, tested with power control all Max.(LTE Band 8)		
	3, tested with power control all Max.(LTE Band 20)		
	3, tested with power control all Max.(LTE Band 38)		
	3, tested with power control all Max.(LTE Band 40)		

3, tested with power control all Max.(NR SA 78)

1.4. Test specification(s)

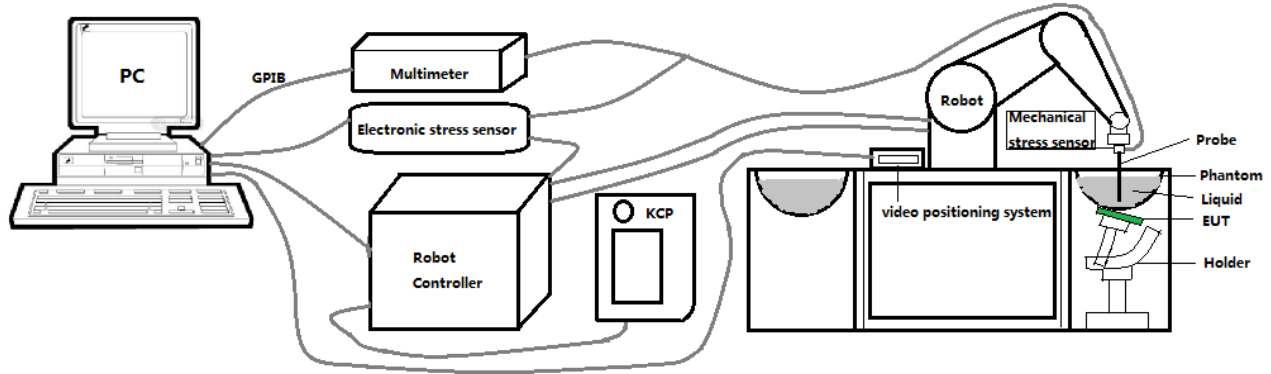
EN 50360:2017	Product standard to demonstrate the compliance of wireless communication devices, with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 300 MHz to 6 GHz: devices used next to the ear
EN 50566:2017	Product standard to demonstrate the compliance of wireless communication devices with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 30 MHz to 6 GHz: hand-held and body mounted devices in close proximity to the human body
EN 62209-1:2016	Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1: Devices used next to the ear (Frequency range of 300 MHz to 6 GHz)
EN 62209-2:2010	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30MHz to 6GHz Handheld and Body-Mounted Devices used in close proximity to the body
EN 62479:2010	Assessment of the compliance of low-power electronic and electrical equipment with the restrictions related to human exposure to electromagnetic fields(10 MHz to 300 GHz)

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 $\pm 10\%$. The spherical isotropy shall be evaluated and within ± 0.25 dB. The sensitivity parameters (Norm X, Norm Y, and Norm Z), the diode compression parameter (DCP) and the conversion factor (Conv F) of the probe are tested. The calibration data can be referred to appendix D of this report.

2.4. SAM phantoms

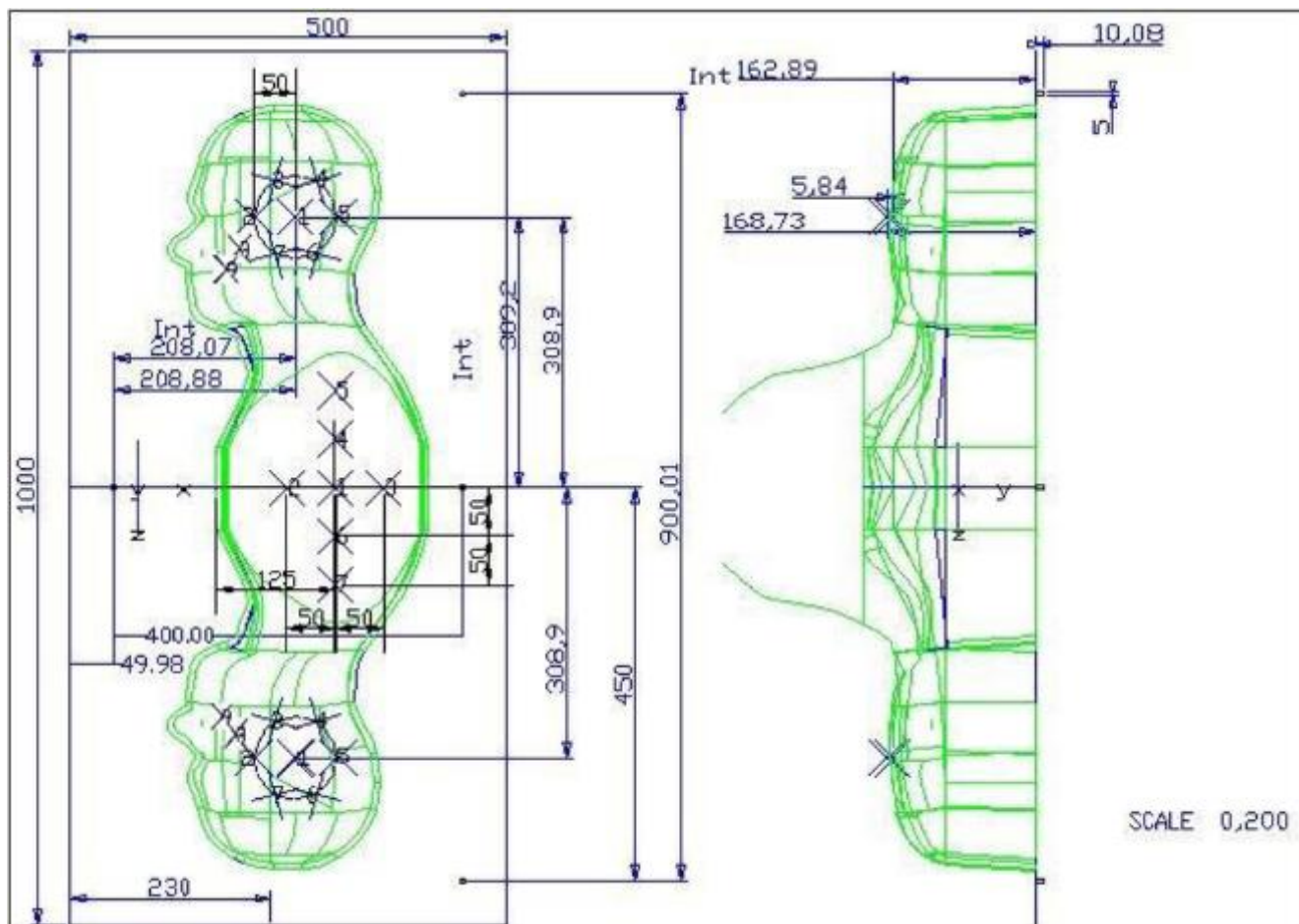
Photo of SAM phantom SN 16/15 SAM119



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 $\pm$ 0.2 mm	27 liters	Length:1000 mm Width:500 mm Height:200 mm	Gelcoat with fiberglass	3.4	0.02

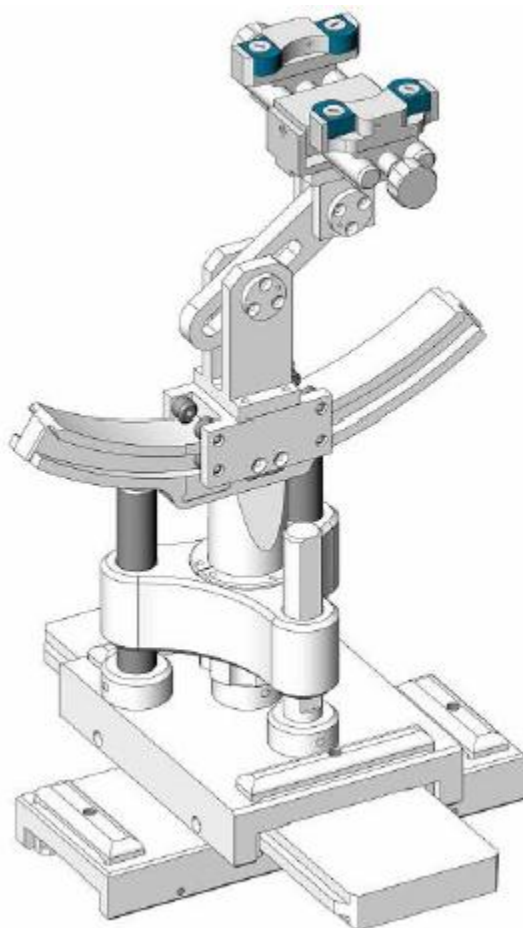


Serial Number	Left Head(mm)		Right Head(mm)		Flat Part(mm)	
SN 16/15 SAM119	2	2.02	2	2.08	1	2.09
	3	2.05	3	2.06	2	2.06
	4	2.07	4	2.07	3	2.08
	5	2.08	5	2.08	4	2.10
	6	2.05	6	2.07	5	2.10
	7	2.05	7	2.05	6	2.07
	8	2.07	8	2.06	7	2.07
	9	2.08	9	2.06	-	-

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

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	4024-EPGO-442	Oct. 04, 2024	Oct. 03, 2025
☐	MVG	750 MHz Dipole	SID750	SN 03/15 DIP 0G750-355	Feb. 22, 2024	Feb. 21, 2027
☐	MVG	835 MHz Dipole	SID835	SN 03/15 DIP 0G835-347	Feb. 22, 2024	Feb. 21, 2027
☒	MVG	900 MHz Dipole	SID900	SN 03/15 DIP 0G900-348	Feb. 22, 2024	Feb. 21, 2027
☒	MVG	1800 MHz Dipole	SID1800	SN 03/15 DIP 1G800-349	Feb. 22, 2024	Feb. 21, 2027
☐	MVG	1900 MHz Dipole	SID1900	SN 03/15 DIP 1G900-350	Feb. 22, 2024	Feb. 21, 2027
☒	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Feb. 22, 2024	Feb. 21, 2027
☒	MVG	2300 MHz Dipole	SID2300	SN 03/16 DIP 2G300-358	Feb. 22, 2024	Feb. 21, 2027
☒	MVG	2450 MHz Dipole	SID2450	SN 03/15 DIP 2G450-352	Feb. 22, 2024	Feb. 21, 2027
☒	MVG	2600 MHz Dipole	SID2600	SN 03/15 DIP 2G600-356	Feb. 22, 2024	Feb. 21, 2027
☒	MVG	3300 MHz Dipole	SID3300	SN 09/12 DIP 3G300-359	May. 18 2024	May. 17 2027
☒	MVG	3500 MHz Dipole	SID3500	SN 09/12 DIP 3G500-360	Oct. 15, 2022	Oct. 14, 2025
☒	MVG	3700 MHz Dipole	SID3700	SN 09/12 DIP 3G/700-361	Oct. 15 2022	Oct. 14 2025
☐	MVG	4200 MHz Dipole	SID4200	SN 03/21 DIP 3G/700-361	May. 18 2024	May. 17 2027
☒	MVG	5000 MHz Dipole	SWG5500	SN 13/14 WGA 33	Feb. 22, 2024	Feb. 21, 2027
☒	MVG	Liquid measurement Kit	SCLMP	SN 21/15 OCPG 72	NCR	NCR
☒	MVG	Power	N.A	AMPLISAR_28/14_003	NCR	NCR

		Amplifier				
☒	KEITHLEY	Millivoltmeter	2000	4072790	NCR	NCR
☒	R&S	Universal radio communication tester	CMU200	105747	Apr. 26, 2024	Apr. 25, 2025
☒	R&S	Wideband radio communication tester	CMW500	103917	Apr. 26, 2024	Apr. 25, 2025
☒	HP	Network Analyzer	E5071C	N/A	Oct. 15, 2024	Oct. 14, 2025
☒	Agilent	MXG Vector Signal Generator	N5182A	MY47070317	Apr. 25, 2024	Apr. 24, 2025
☒	Agilent	Power meter	E4419B	MY45102538	Apr. 25, 2024	Apr. 24, 2025
☒	Agilent	Power sensor	E9301A	MY41495644	May 30, 2024	May 29, 2025
☒	Agilent	Power sensor	E9301A	US39212148	Apr. 25, 2024	Apr. 24, 2025
☒	MCLI/USA	Directional Coupler	CB11-20	0D2L51502	Apr. 26, 2024	Apr. 25, 2027
☒	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

Measurement Software

Manufacturer	Software Name	Software Version
SATIMO	OpenSAR	V4_02_31

3. SAR Measurement Procedures

The measurement procedures are as follows:

- (a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the middle channel.
- (b) Keep EUT to radiate maximum output power or 100% duty factor (if applicable)
- (c) Measure output power through RF cable and power meter.
- (d) Place the EUT in the positions as setup photos demonstrates.
- (e) Set scan area, grid size and other setting on the OPENSAR software.
- (f) Measure SAR transmitting at the middle channel for all applicable exposure positions.
- (g) Identify the exposure position and device configuration resulting the highest SAR
- (h) Measure SAR at the lowest and highest channels at the worst exposure position and device configuration.

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).

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 $\pm 5\%$, the SAR will be retested.

4. System Verification Procedure

4.1. Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% of weight)	Head Tissue								
Frequency Band (MHz)	750	835	900	1800	1900	2000	2450	2600	5000
Water	34.40	34.40	34.40	55.36	55.36	71.88	71.88	71.88	65.53
NaCl	0.79	0.79	0.79	0.35	0.35	0.16	0.16	0.16	0.00
1,2-Propanediol	64.81	64.81	64.81	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	17.24
DGBE	0.00	0.00	0.00	13.84	13.84	7.99	7.99	7.99	0.00

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 if the dielectric parameters are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values.

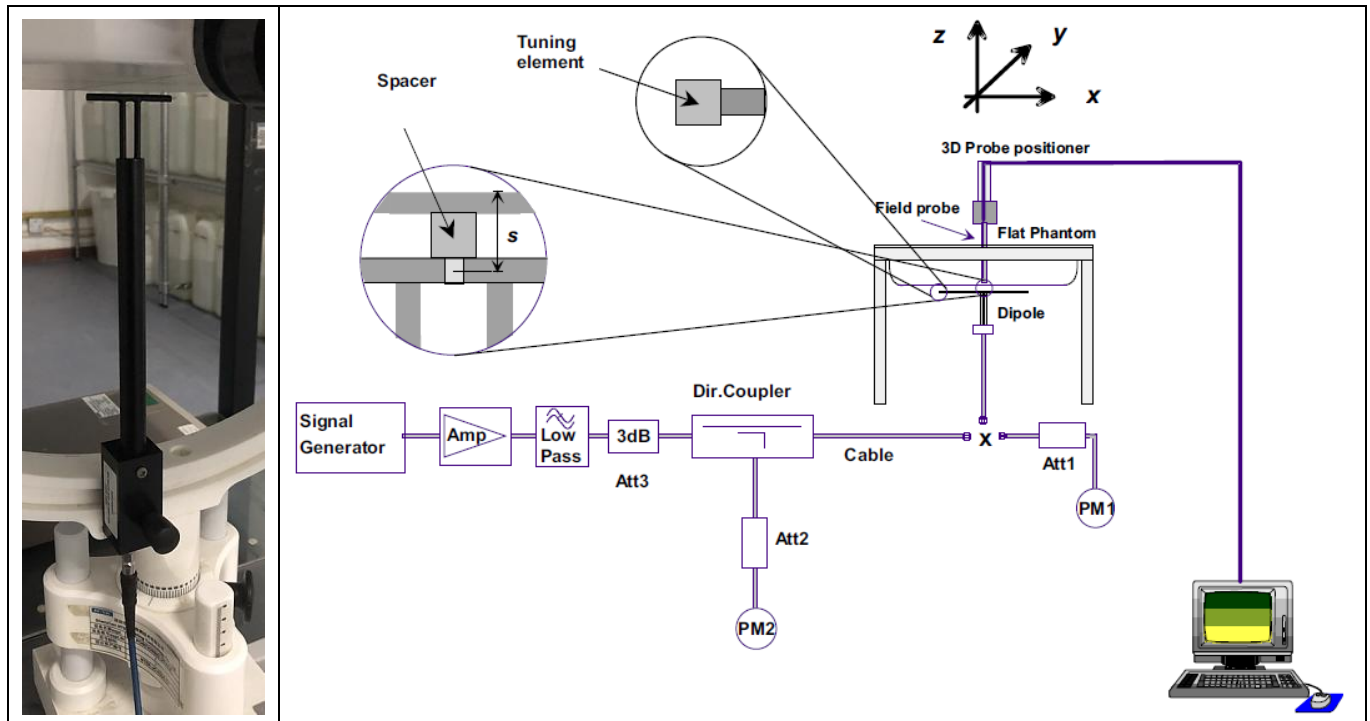
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		ϵ_r ($\pm 5\%$)	σ (S/m) ($\pm 5\%$)	ϵ_r	σ (S/m)		
Head 900	900	41.50 (39.43~43.58)	0.97 (0.92~1.02)	41.42	1.00	21.9 °C	Nov. 23, 2024
Head 1800	1800	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.08	1.39	21.4 °C	Nov. 21, 2024
Head 2000	2000	40.00 (38.00~42.00)	1.40 (1.33~1.47)	38.71	1.44	21.6 °C	Nov. 22, 2024
Head 2300	2300	39.47 (37.50~41.44)	1.66 (1.58~1.74)	39.41	1.62	21.5 °C	Nov. 29, 2024
Head 2450	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	37.96	1.80	21.2 °C	Nov. 18, 2024
Head 2600	2600	39.01 (37.06~40.96)	1.96 (1.86~2.06)	38.88	1.98	21.4 °C	Nov. 25, 2024
Head 3300	3300	38.14 (36.04~39.82)	2.71 (2.77~3.05)	39.33	2.61	21.0 °C	Dec. 03, 2024
Head 3500	3500	37.93 (36.04~39.82)	2.91 (2.77~3.05)	37.57	2.82	21.6 °C	Nov. 28, 2024
Head 3700	3700	37.70 (35.82~39.59)	3.12 (2.97~3.27)	37.04	3.04	21.8 °C	Dec. 02, 2024
Head 5200	5200	36.00 (34.20~37.80)	4.66 (4.43~4.89)	34.61	4.53	21.9 °C	Nov. 19, 2024
Head 5800	5800	35.30 (33.54~37.07)	5.27 (5.01~5.53)	34.03	5.17	21.4 °C	Nov. 30, 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 $\pm 10\%$. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance verification can meet the variation criterion and the plots can be referred to Appendix B of this report.

System Verification	Target SAR (1W)		Measured SAR			Measured SAR		Liquid Temp.	Test Date
	(±10%)					(Normalized to 1W)			
	1-g (W/Kg)	10-g (W/Kg)	Input Power	1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)		
900MHz	10.63 (9.57~11.69)	7.01 (6.31~7.71)	18 dBm	0.653	0.421	10.45	6.74	21.9 °C	Nov. 23, 2024
1800MHz	37.06 (33.35~40.77)	20.01 (18.01~22.01)	18 dBm	2.380	1.232	38.08	19.71	21.4 °C	Nov. 21, 2024
2000MHz	38.27 (34.44~42.10)	19.79 (17.81~21.77)	18 dBm	2.440	1.162	39.04	18.59	21.6 °C	Nov. 22, 2024
2300MHz	50.63 (45.57~55.69)	23.51 (21.16~25.86)	18 dBm	3.001	1.418	48.02	22.69	21.5 °C	Nov. 29, 2024
2450MHz	50.05 (45.05~55.06)	23.80 (21.42~26.18)	18 dBm	3.347	1.404	53.55	22.46	21.2 °C	Nov. 18, 2024
2600MHz	54.16 (48.74~59.58)	24.85 (22.37~27.34)	20 dBm	5.709	2.368	57.09	23.68	21.4 °C	Nov. 25, 2024
3300MHz	67.61 (60.85~74.37)	26.04 (23.44~28.64)	20 dBm	6.223	2.543	62.23	25.43	21.0 °C	Dec. 03, 2024
3500MHz	67.18 (60.47~73.89)	24.50 (22.05~26.95)	20 dBm	6.924	2.493	69.24	24.93	21.6 °C	Nov. 28, 2024
3700MHz	66.30 (59.67~72.93)	24.16 (22.96~26.57)	20 dBm	6.269	2.450	62.69	24.50	21.8 °C	Dec. 02, 2024
5200MHz	162.59 (146.33~178.85)	56.21 (50.59~61.83)	18 dBm	9.747	3.356	155.95	53.70	21.9 °C	Nov. 19, 2024
5800MHz	182.20 (163.98~200.42)	61.32 (55.19~67.45)	20 dBm	19.246	6.543	192.46	65.43	21.4 °C	Nov. 30, 2024

5. SAR Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in IEEE 1528: 2003. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Uncertainty Component	Tol. (±%)	Prob. Dist.	Div.	Ci (1 g)	Ci (10 g)	1 g Ui (±%)	10 g Ui (±%)	Vi
Measurement System ☐								
Probe Calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	$\sqrt{3}$	0.97	0.97	1.98	1.98	∞
Hemispherical Isotropy	5.9	R	$\sqrt{3}$	0.28	0.28	0.96	0.96	∞
Boundary Effect	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System Detection Limits	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	3	N	1	1	1	3.00	3.00	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Response Time	0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF Ambient Conditions - Noise	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Conditions - Reflections	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe Positioner Mechanical Tolerance	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe Positioning with respect to Phantom Shell	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Test sample Related								
Test Sample Positioning	2.6	N	1	1	1	2.60	2.60	11
Device Holder Uncertainty	3	N	1	1	1	3.00	3.00	7
Output Power Variation - SAR drift measurement	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
SAR scaling	2	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and Tissue Parameters ☐								
Phantom Uncertainty (shape and thickness tolerances)	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviation (in permittivity and conductivity)	2	N	1	1	0.84	2.00	1.68	∞
Liquid Conductivity (temperature uncertainty)	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid conductivity - measurement uncertainty	1.59	N	1	0.23	0.26	0.37	0.41	99

Liquid permittivity (temperature uncertainty)	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid permittivity - measurement uncertainty	1.65	N	1	0.23	0.26	0.38	0.43	99
Combined Standard Uncertainty		RSS				10.19	10.02	
Expanded Uncertainty (95% Confidence interval)		k				20.38	20.04	

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.

- 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.

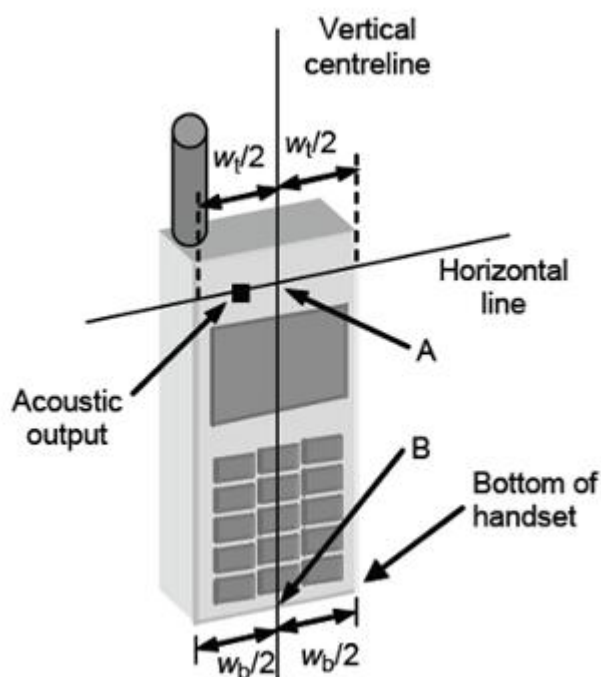


Fig 6.2.1 Handset vertical and horizontal reference lines—"fixed case"

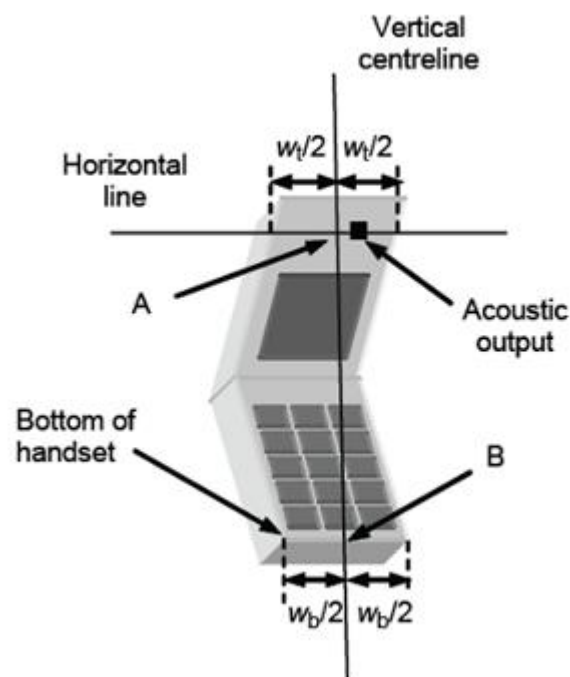


Fig 6.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

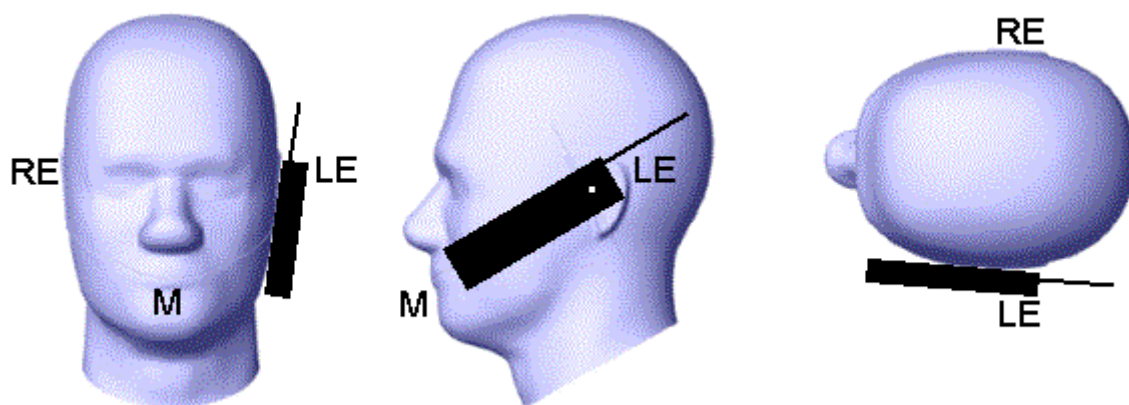


Fig 6.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

6.3. Definition of the tilt position

- 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.

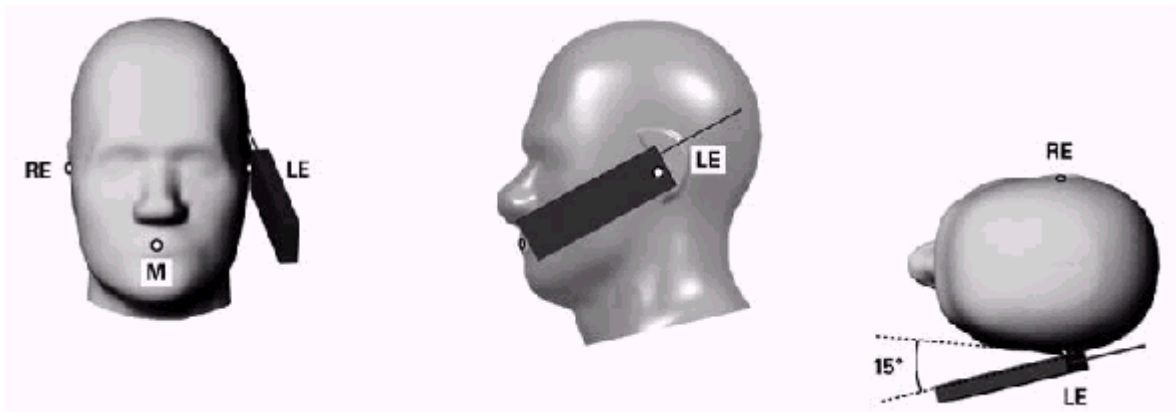


Figure 6.3.1 – Tilt position of the wireless device on the left side of SAM

6.4. Body-worn device

A typical example of a body-worn device is a mobile phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer. The device shall be positioned as intended at the distance to the outer surface of the phantom that corresponds to the specified distance (See figure 6.1). Adjust the distance between the device surface and the flat phantom to 5mm.

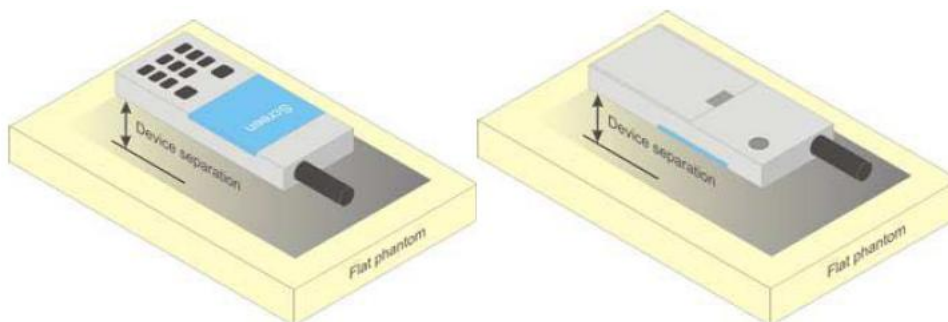


Figure 6.1 – Test positions for Body-worn device

7. RF Output Power

7.1. GSM Conducted Power

Band GSM900	Burst-Averaged output Power (dBm)				Frame-Averaged output Power (dBm)			
Tx Channel	Tune-up	975	38	124	Tune-up	975	38	124
Frequency (MHz)		880.2	897.6	914.8		880.2	897.6	914.8
GSM (GMSK)	32.00	31.74	31.88	31.75	22.97	22.71	22.85	22.72
GPRS(GMSK,1 Tx slot)	32.00	31.80	31.95	31.80	22.97	22.77	22.92	22.77
GPRS(GMSK,2 Tx slot)	31.50	31.18	31.40	31.19	25.48	25.16	25.38	25.17
GPRS(GMSK,3 Tx slot)	30.00	29.70	29.89	29.72	25.74	25.44	25.63	25.46
GPRS(GMSK,4 Tx slot)	29.00	28.52	28.70	28.53	25.99	25.51	25.69	25.52
EGPRS(8PSK,1 Tx slot)	27.00	26.50	26.12	25.40	17.97	17.47	17.09	16.37
EGPRS(8PSK,2 Tx slot)	26.50	26.06	25.63	24.93	20.48	20.04	19.61	18.91
EGPRS(8PSK,3 Tx slot)	23.50	23.49	23.09	22.50	19.24	19.23	18.83	18.24
EGPRS(8PSK,4 Tx slot)	22.50	22.13	21.76	21.29	19.49	19.12	18.75	18.28
Band GSM1800	Burst-Averaged output Power (dBm)				Frame-Averaged output Power (dBm)			
Tx Channel	Tune-up	512	698	885	Tune-up	512	698	885
Frequency (MHz)		1710.2	1747.4	1784.8		1710.2	1747.4	1784.8
GSM (GMSK)	30.00	29.48	29.64	29.68	20.97	20.45	20.61	20.65
GPRS(GMSK,1 Tx slot)	30.00	29.47	29.64	29.66	20.97	20.44	20.61	20.63
GPRS(GMSK,2 Tx slot)	29.50	28.92	29.11	29.11	23.48	22.90	23.09	23.09
GPRS(GMSK,3 Tx slot)	27.50	27.27	27.34	27.43	23.24	23.01	23.08	23.17
GPRS(GMSK,4 Tx slot)	26.50	26.19	26.35	26.38	23.49	23.18	23.34	23.37
EGPRS(8PSK,1 Tx slot)	26.50	26.14	25.81	26.27	17.47	17.11	16.78	17.24
EGPRS(8PSK,2 Tx slot)	26.00	25.68	25.31	25.79	19.98	19.66	19.29	19.77
EGPRS(8PSK,3 Tx slot)	25.00	24.81	24.46	24.91	20.74	20.55	20.20	20.65
EGPRS(8PSK,4 Tx slot)	24.50	24.20	23.95	24.32	21.49	21.19	20.94	21.31

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 Tx Slot) - 9.03 dB

Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6.02 dB

Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB

Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3.01 dB

7.2. WCDMA Conducted Power

WCDMA Band1	Burst-Averaged output Power (dBm)			
Tx Channel	Tune-up (dBm)	9612	9750	9888
Frequency (MHz)		1922.4	1950	1977.6
RMC12.2K	22.00	21.13	21.34	21.56
HSDPA Sub 1	22.50	22.21	22.25	22.23
HSDPA Sub 2	22.00	21.55	21.81	21.77
HSDPA Sub 3	21.00	20.70	20.80	20.86
HSDPA Sub 4	21.00	20.54	20.49	20.69
HSUPA Sub 1	22.50	22.00	22.01	22.02
HSUPA Sub 2	22.50	21.98	22.11	22.10
HSUPA Sub 3	21.00	20.87	20.93	20.89
HSUPA Sub 4	22.50	22.15	22.19	22.18
HSUPA Sub 5	22.00	21.55	21.64	21.45
WCDMA Band 8	Burst-Averaged output Power (dBm)			
Tx Channel	Tune-up	2712	2788	2863
Frequency (MHz)		882.4	897.6	912.6
RMC12.2K	22.50	22.32	22.35	22.41
HSDPA Sub 1	21.50	21.28	21.32	21.37
HSDPA Sub 2	21.50	20.94	20.92	21.05
HSDPA Sub 3	20.00	19.82	19.96	19.85
HSDPA Sub 4	20.00	19.99	19.91	19.85
HSUPA Sub 1	21.50	20.08	21.17	21.18
HSUPA Sub 2	21.50	21.27	21.30	21.37
HSUPA Sub 3	20.50	19.47	20.20	20.16
HSUPA Sub 4	21.50	21.30	21.31	21.36
HSUPA Sub 5	21.00	20.45	20.63	20.70

7.3. LTE Conducted Power

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Tune-up	Power (dBm)
Band1	5	18025	1	#0	QPSK	24.00	23.73
Band1	5	18025	8	#0	QPSK	24.00	23.75
Band1	5	18025	25	#0	QPSK	24.00	22.69
Band1	5	18300	1	#0	QPSK	24.00	23.65
Band1	5	18300	8	#0	QPSK	24.00	23.65
Band1	5	18300	25	#0	QPSK	24.00	22.63
Band1	5	18575	1	#0	QPSK	24.00	23.51
Band1	5	18575	8	#0	QPSK	24.00	23.49
Band1	5	18575	25	#0	QPSK	24.00	22.45
Band1	20	18100	1	#0	QPSK	24.00	23.67
Band1	20	18100	18	#0	QPSK	24.00	23.64
Band1	20	18100	100	#0	QPSK	24.00	22.75
Band1	20	18300	1	#0	QPSK	24.00	23.61
Band1	20	18300	18	#0	QPSK	24.00	23.59
Band1	20	18300	100	#0	QPSK	24.00	22.56
Band1	20	18500	1	#0	QPSK	24.00	23.47
Band1	20	18500	18	#0	QPSK	24.00	23.51
Band1	20	18500	100	#0	QPSK	24.00	22.55
Band20	5	24175	1	#0	QPSK	25.00	24.70
Band20	5	24175	8	#0	QPSK	25.00	24.65
Band20	5	24175	25	#0	QPSK	25.00	23.65
Band20	5	24300	1	#0	QPSK	25.00	24.51
Band20	5	24300	8	#0	QPSK	25.00	24.51
Band20	5	24300	25	#0	QPSK	25.00	23.43
Band20	5	24425	1	#0	QPSK	25.00	24.62
Band20	5	24425	8	#0	QPSK	25.00	24.68
Band20	5	24425	25	#0	QPSK	25.00	23.66
Band20	20	24250	1	#0	QPSK	25.00	24.62
Band20	20	24250	18	#0	QPSK	25.00	24.62
Band20	20	24250	100	#0	QPSK	25.00	23.42
Band20	20	24300	1	#0	QPSK	25.00	24.64
Band20	20	24300	18	#0	QPSK	25.00	24.52
Band20	20	24300	100	#0	QPSK	25.00	23.48
Band20	20	24350	1	#0	QPSK	25.00	24.49
Band20	20	24350	18	#0	QPSK	25.00	24.47

Band20	20	24350	100	#0	QPSK	25.00	23.52
Band3	1.4	19207	1	#0	QPSK	24.00	23.30
Band3	1.4	19207	5	#0	QPSK	24.00	23.32
Band3	1.4	19207	6	#0	QPSK	24.00	22.32
Band3	1.4	19575	1	#0	QPSK	24.00	23.51
Band3	1.4	19575	5	#0	QPSK	24.00	23.50
Band3	1.4	19575	6	#0	QPSK	24.00	22.51
Band3	1.4	19943	1	#0	QPSK	24.00	23.54
Band3	1.4	19943	5	#0	QPSK	24.00	23.54
Band3	1.4	19943	6	#0	QPSK	24.00	22.55
Band3	5	19225	1	#0	QPSK	24.00	23.34
Band3	5	19225	8	#0	QPSK	24.00	23.39
Band3	5	19225	25	#0	QPSK	24.00	22.37
Band3	5	19575	1	#0	QPSK	24.00	23.55
Band3	5	19575	8	#0	QPSK	24.00	23.57
Band3	5	19575	25	#0	QPSK	24.00	22.47
Band3	5	19925	1	#0	QPSK	24.00	23.53
Band3	5	19925	8	#0	QPSK	24.00	23.57
Band3	5	19925	25	#0	QPSK	24.00	22.56
Band3	20	19300	1	#0	QPSK	24.00	23.23
Band3	20	19300	18	#0	QPSK	24.00	23.32
Band3	20	19300	100	#0	QPSK	24.00	22.48
Band3	20	19575	1	#0	QPSK	24.00	23.40
Band3	20	19575	18	#0	QPSK	24.00	23.42
Band3	20	19575	100	#0	QPSK	24.00	22.45
Band3	20	19850	1	#0	QPSK	24.00	23.49
Band3	20	19850	18	#0	QPSK	24.00	23.43
Band3	20	19850	100	#0	QPSK	24.00	22.46
Band38	5	37775	1	#0	QPSK	24.00	23.77
Band38	5	37775	8	#0	QPSK	24.00	23.79
Band38	5	37775	25	#0	QPSK	24.00	22.70
Band38	5	38000	1	#0	QPSK	24.00	23.83
Band38	5	38000	8	#0	QPSK	24.00	23.84
Band38	5	38000	25	#0	QPSK	24.00	22.79
Band38	5	38225	1	#0	QPSK	24.00	23.76
Band38	5	38225	8	#0	QPSK	24.00	23.77
Band38	5	38225	25	#0	QPSK	24.00	22.73
Band38	20	37850	1	#0	QPSK	24.00	23.70
Band38	20	37850	18	#0	QPSK	24.00	23.67

Band38	20	37850	100	#0	QPSK	24.00	22.71
Band38	20	38000	1	#0	QPSK	24.00	23.64
Band38	20	38000	18	#0	QPSK	24.00	23.64
Band38	20	38000	100	#0	QPSK	24.00	22.71
Band38	20	38150	1	#0	QPSK	24.00	23.76
Band38	20	38150	18	#0	QPSK	24.00	23.75
Band38	20	38150	100	#0	QPSK	24.00	22.72
Band40	5	38675	1	#0	QPSK	24.00	23.60
Band40	5	38675	8	#0	QPSK	24.00	23.60
Band40	5	38675	25	#0	QPSK	24.00	22.49
Band40	5	39150	1	#0	QPSK	24.00	23.84
Band40	5	39150	8	#0	QPSK	24.00	23.83
Band40	5	39150	25	#0	QPSK	24.00	22.72
Band40	5	39625	1	#0	QPSK	24.00	23.80
Band40	5	39625	8	#0	QPSK	24.00	23.87
Band40	5	39625	25	#0	QPSK	24.00	22.77
Band40	20	38750	1	#0	QPSK	24.00	23.51
Band40	20	38750	18	#0	QPSK	24.00	23.47
Band40	20	38750	100	#0	QPSK	24.00	22.53
Band40	20	39150	1	#0	QPSK	24.00	23.85
Band40	20	39150	18	#0	QPSK	24.00	23.73
Band40	20	39150	100	#0	QPSK	24.00	22.74
Band40	20	39550	1	#0	QPSK	24.00	23.50
Band40	20	39550	18	#0	QPSK	24.00	23.51
Band40	20	39550	100	#0	QPSK	24.00	22.59
Band7	5	20775	1	#0	QPSK	24.00	23.23
Band7	5	20775	8	#0	QPSK	24.00	23.29
Band7	5	20775	25	#0	QPSK	24.00	22.25
Band7	5	21100	1	#0	QPSK	24.00	23.45
Band7	5	21100	8	#0	QPSK	24.00	23.52
Band7	5	21100	25	#0	QPSK	24.00	22.47
Band7	5	21425	1	#0	QPSK	24.00	23.77
Band7	5	21425	8	#0	QPSK	24.00	23.75
Band7	5	21425	25	#0	QPSK	24.00	22.68
Band7	20	20850	1	#0	QPSK	24.00	23.23
Band7	20	20850	18	#0	QPSK	24.00	23.20
Band7	20	20850	100	#0	QPSK	24.00	22.28
Band7	20	21100	1	#0	QPSK	24.00	23.36
Band7	20	21100	18	#0	QPSK	24.00	23.39

Band7	20	21100	100	#0	QPSK	24.00	22.47
Band7	20	21350	1	#0	QPSK	24.00	23.52
Band7	20	21350	18	#0	QPSK	24.00	23.49
Band7	20	21350	100	#0	QPSK	24.00	22.53
Band8	1.4	21457	1	#0	QPSK	24.50	24.31
Band8	1.4	21457	5	#0	QPSK	24.50	24.34
Band8	1.4	21457	6	#0	QPSK	24.50	23.34
Band8	1.4	21625	1	#0	QPSK	24.50	24.41
Band8	1.4	21625	5	#0	QPSK	24.50	24.46
Band8	1.4	21625	6	#0	QPSK	24.50	23.44
Band8	1.4	21793	1	#0	QPSK	24.50	24.43
Band8	1.4	21793	5	#0	QPSK	24.50	24.47
Band8	1.4	21793	6	#0	QPSK	24.50	23.49
Band8	5	21475	1	#0	QPSK	24.50	24.37
Band8	5	21475	8	#0	QPSK	24.50	24.34
Band8	5	21475	25	#0	QPSK	24.50	23.38
Band8	5	21625	1	#0	QPSK	24.50	24.48
Band8	5	21625	8	#0	QPSK	24.50	24.49
Band8	5	21625	25	#0	QPSK	24.50	23.48
Band8	5	21775	1	#0	QPSK	24.50	24.42
Band8	5	21775	8	#0	QPSK	24.50	24.46
Band8	5	21775	25	#0	QPSK	24.50	23.48
Band8	10	21500	1	#0	QPSK	24.50	24.39
Band8	10	21500	12	#0	QPSK	24.50	24.31
Band8	10	21500	50	#0	QPSK	24.50	23.39
Band8	10	21625	1	#0	QPSK	24.50	24.49
Band8	10	21625	12	#0	QPSK	24.50	24.48
Band8	10	21625	50	#0	QPSK	24.50	23.46
Band8	10	21750	1	#0	QPSK	24.50	24.38
Band8	10	21750	12	#0	QPSK	24.50	24.40
Band8	10	21750	50	#0	QPSK	24.50	23.43

7.4. SA Conducted Power

Band	SCS (kHz)	Bandwidth (MHz)	UL Channel	RB Allocation	Modulation	Tune-up	Power (dBm)
n78	30	10	620334	12@6	DFT_BPSK	26.00	25.81
n78	30	10	620334	1@1	DFT_BPSK	26.00	25.74
n78	30	10	620334	1@22	DFT_BPSK	26.00	25.71

n78	30	10	620334	12@6	DFT_QPSK	26.00	25.80
n78	30	10	620334	1@1	DFT_QPSK	26.00	25.77
n78	30	10	620334	1@22	DFT_QPSK	26.00	25.71
n78	30	10	636666	12@6	DFT_BPSK	26.00	25.71
n78	30	10	636666	1@1	DFT_BPSK	26.00	25.66
n78	30	10	636666	1@22	DFT_BPSK	26.00	25.71
n78	30	10	636666	12@6	DFT_QPSK	26.00	25.71
n78	30	10	636666	1@1	DFT_QPSK	26.00	25.64
n78	30	10	636666	1@22	DFT_QPSK	26.00	25.69
n78	30	10	653000	12@6	DFT_BPSK	26.00	25.11
n78	30	10	653000	1@1	DFT_BPSK	26.00	25.13
n78	30	10	653000	1@22	DFT_BPSK	26.00	25.10
n78	30	10	653000	12@6	DFT_QPSK	26.00	25.14
n78	30	10	653000	1@1	DFT_QPSK	26.00	25.09
n78	30	10	653000	1@22	DFT_QPSK	26.00	25.08
n78	30	50	621668	64@32	DFT_BPSK	26.00	25.72
n78	30	50	621668	1@1	DFT_BPSK	26.00	25.59
n78	30	50	621668	1@131	DFT_BPSK	26.00	25.54
n78	30	50	621668	64@32	DFT_QPSK	26.00	25.70
n78	30	50	621668	1@1	DFT_QPSK	26.00	25.56
n78	30	50	621668	1@131	DFT_QPSK	26.00	25.50
n78	30	50	636666	64@32	DFT_BPSK	26.00	25.67
n78	30	50	636666	1@1	DFT_BPSK	26.00	25.69
n78	30	50	636666	1@131	DFT_BPSK	26.00	25.29
n78	30	50	636666	64@32	DFT_QPSK	26.00	25.68
n78	30	50	636666	1@1	DFT_QPSK	26.00	25.67
n78	30	50	636666	1@131	DFT_QPSK	26.00	25.24
n78	30	50	651666	64@32	DFT_BPSK	26.00	25.23
n78	30	50	651666	1@1	DFT_BPSK	26.00	25.96
n78	30	50	651666	1@131	DFT_BPSK	26.00	25.90
n78	30	50	651666	64@32	DFT_QPSK	26.00	25.25
n78	30	50	651666	1@1	DFT_QPSK	26.00	25.95
n78	30	50	651666	1@131	DFT_QPSK	26.00	25.92
n78	30	100	623334	135@67	DFT_BPSK	26.00	25.68
n78	30	100	623334	1@1	DFT_BPSK	26.00	24.96
n78	30	100	623334	1@271	DFT_BPSK	26.00	24.64
n78	30	100	623334	135@67	DFT_QPSK	26.00	25.69
n78	30	100	623334	1@1	DFT_QPSK	26.00	24.94
n78	30	100	623334	1@271	DFT_QPSK	26.00	24.62

n78	30	100	636666	135@67	DFT_BPSK	26.00	25.69
n78	30	100	636666	1@1	DFT_BPSK	26.00	25.02
n78	30	100	636666	1@271	DFT_BPSK	26.00	24.74
n78	30	100	636666	135@67	DFT_QPSK	26.00	25.70
n78	30	100	636666	1@1	DFT_QPSK	26.00	25.00
n78	30	100	636666	1@271	DFT_QPSK	26.00	24.70
n78	30	100	650000	135@67	DFT_BPSK	26.00	25.44
n78	30	100	650000	1@1	DFT_BPSK	26.00	25.28
n78	30	100	650000	1@271	DFT_BPSK	26.00	25.50
n78	30	100	650000	135@67	DFT_QPSK	26.00	25.33
n78	30	100	650000	1@1	DFT_QPSK	26.00	25.25
n78	30	100	650000	1@271	DFT_QPSK	26.00	25.49

7.5. WLAN & Bluetooth Output Power

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)
802.11b	1	2412	14.50	14.30
	7	2442	14.50	13.06
	13	2472	14.50	12.62
802.11g	1	2412	13.00	12.81
	7	2442	13.00	11.79
	13	2472	13.00	11.63
802.11n (HT20)	1	2412	12.00	11.57
	7	2442	12.00	10.64
	13	2472	12.00	10.76
802.11n (HT40)	3	2422	11.50	11.22
	7	2442	11.50	10.48
	11	2462	11.50	11.07

NOTE: Power measurement results of WLAN 2.4G.

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)
802.11a	36	5180	10.50	10.36
	40	5200	10.50	9.55
	48	5240	10.50	9.37
802.11n HT20	36	5180	10.50	10.08
	40	5200	10.50	9.11
	48	5240	10.50	9.22

802.11n HT40	38	5190	8.50	8.27
	46	5230	8.50	7.39
802.11ac VHT20	36	5180	8.50	8.03
	40	5200	8.50	7.76
	48	5240	8.50	7.16
802.11ac VHT40	38	5190	8.50	8.36
	46	5230	8.50	7.54
802.11ac VHT80	42	5210	8.50	8.25
802.11ax 20	36	5180	11.00	10.53
	40	5200	11.00	9.67
	48	5240	11.00	9.97
802.11ax 40	38	5190	11.00	10.71
	46	5230	11.00	10.45
802.11ax 80	42	5210	10.50	10.36

NOTE: Power measurement results of WLAN 5.2G.

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)
802.11a	149	5745	5.50	5.45
	157	5785	5.50	5.19
	165	5825	5.50	4.27
802.11n HT20	149	5745	5.00	4.54
	157	5785	5.00	4.00
	165	5825	5.00	4.12
802.11n HT40	151	5755	5.50	5.40
	159	5795	5.50	5.15
802.11ac VHT20	149	5745	5.00	4.75
	157	5785	5.00	4.23
	165	5825	5.00	4.22
802.11ac VHT40	151	5755	6.00	5.51
	159	5795	6.00	5.09
802.11ac VHT80	155	5775	5.00	4.78
802.11ax 20	149	5745	5.00	4.75
	157	5785	5.00	4.23
	165	5825	5.00	4.22
802.11ax 40	151	5755	6.00	5.51
	159	5795	6.00	5.09

802.11ax 80	155	5775	5.00	4.78
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NOTE: Power measurement results of WLAN 5.8G.

BR+EDR	Data Rates	Tune - up(dBm)	Output Power (dBm)
	GFSK DH5	4.00	3.69
	Pi/4 DQPSK DH5	2.00	1.49
	8DPSK DH5	1.00	0.81

BLE	Channel	Tune - up	Output Power (dBm)	
			1M	2M
	0CH	1.50	4.32	4.02
	19CH	4.00	3.50	3.06
	39CH	3.00	2.40	1.92

NOTE: Power measurement results of Bluetooth. Refer to EN 62479, the available power of this EUT is 4.00dBm (2.51mW), the power is less than the low-power exclusion level defined in 4.2 (P max: 20mW), So Bluetooth stand-alone SAR is not required

7.6. NFC Output Power

NFC	Frequency (MHz)	H-Field(dBuA/m)@3m	Output Power (dBm)	Output Power (mW)	Limits (mW)
	13.56MHz	33.29	0.09	1.02	20

NOTE: Power measurement results of Bluetooth. Refer to EN 62479, the available power of this EUT is 1.02 dBm (0.09mW), the power is less than the low-power exclusion level defined in 4.2 (P max: 20mW), So Bluetooth stand-alone SAR is not required

8. Assessment of the compliance of low power equipment

According to EN 62479 Clause 4.1& 4.2, these require does not apply to the receivers that has no transmit. So, GPS and FM is compliance.

9. SAR Results

9.1. SAR measurement results

9.1.1. SAR measurement Result of GSM900

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	38/897.6	GPRS(GMSK 4TS)	0	0.545	0.404	1.94	28.70	29.00	0.433	2024/11/23
Left Tilt 15 Degree	38/897.6	GPRS(GMSK 4TS)	0	0.320	0.228	-3.78	28.70	29.00	0.244	2024/11/23
Right Cheek	38/897.6	GPRS(GMSK 4TS)	0	0.545	0.400	1.72	28.70	29.00	0.429	2024/11/23
Right Tilt 15 Degree	38/897.6	GPRS(GMSK 4TS)	0	0.271	0.197	2.85	28.70	29.00	0.211	2024/11/23
Left Cheek	975/880.2	GPRS(GMSK 4TS)	0	0.521	0.380	-2.11	28.52	29.00	0.424	2024/11/23
Left Cheek	124/914.8	GPRS(GMSK 4TS)	0	0.495	0.356	2.84	28.53	29.00	0.397	2024/11/23
Extremity										
Front Side	38/897.6	GPRS(GMSK 4TS)	0	1.581	0.884	1.14	28.70	29.00	0.947	2024/11/23
Bottom Side	38/897.6	GPRS(GMSK 4TS)	0	2.823	1.661	0.94	28.70	29.00	1.780	2024/11/23
Left Side	38/897.6	GPRS(GMSK 4TS)	0	0.113	0.066	-2.09	28.70	29.00	0.071	2024/11/23
Right Side	38/897.6	GPRS(GMSK 4TS)	0	1.722	1.013	3.29	28.70	29.00	1.085	2024/11/23
Top Side	38/897.6	GPRS(GMSK 4TS)	0	0.141	0.080	-2.52	28.70	29.00	0.086	2024/11/23
Back Side	38/897.6	GPRS(GMSK 4TS)	0	1.637	0.915	2.95	28.70	29.00	0.980	2024/11/23
Bottom Side	975/880.2	GPRS(GMSK 4TS)	0	2.738	1.579	-1.93	28.52	29.00	1.764	2024/11/23
Bottom	124/914.8	GPRS(GMSK 4TS)	0	2.597	1.467	-0.28	28.53	29.00	1.635	2024/11/23

Side		4TS)								
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Bottom Side	38/897.6	GPRS(GMSK 4TS)	5	0.847	0.473	0.06	28.70	29.00	0.507	2024/11/23

9.1.2. SAR measurement Result of GSM1800

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	698/1747.4	GPRS(GMSK 4TS)	0	0.081	0.052	2.41	26.35	26.50	0.054	2024/11/21
Left Tilt 15 Degree	698/1747.4	GPRS(GMSK 4TS)	0	0.046	0.029	2.36	26.35	26.50	0.030	2024/11/21
Right Cheek	698/1747.4	GPRS(GMSK 4TS)	0	0.074	0.047	-2.43	26.35	26.50	0.049	2024/11/21
Right Tilt 15 Degree	698/1747.4	GPRS(GMSK 4TS)	0	0.035	0.022	-2.36	26.35	26.50	0.023	2024/11/21
Left Cheek	512/1710.2	GPRS(GMSK 4TS)	0	0.074	0.047	2.34	26.19	26.50	0.050	2024/11/21
Left Cheek	885/1784.8	GPRS(GMSK 4TS)	0	0.074	0.046	4.80	26.38	26.50	0.047	2024/11/21
Extremity										
Front Side	698/1747.4	GPRS(GMSK 4TS)	0	0.187	0.076	-1.11	26.35	26.50	0.079	2024/11/21
Left Side	698/1747.4	GPRS(GMSK 4TS)	0	0.287	0.122	-1.08	26.35	26.50	0.126	2024/11/21
Back Side	698/1747.4	GPRS(GMSK 4TS)	0	0.224	0.091	-3.94	26.35	26.50	0.094	2024/11/21
Right Side	698/1747.4	GPRS(GMSK 4TS)	0	0.034	0.014	2.14	26.35	26.50	0.014	2024/11/21
Top Side	698/1747.4	GPRS(GMSK 4TS)	0	0.212	0.090	2.30	26.35	26.50	0.093	2024/11/21
Bottom Side	698/1747.4	GPRS(GMSK 4TS)	0	0.003	0.001	0.65	26.35	26.50	0.001	2024/11/21
Left Side	512/1710.2	GPRS(GMSK 4TS)	0	0.258	0.110	-3.76	26.19	26.50	0.118	2024/11/21

Left Side	885/1784.8	GPRS(GMSK 4TS)	0	0.287	0.116	2.70	26.38	26.50	0.119	2024/11/21
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Left Side	698/1747.4	GPRS(GMSK 4TS)	5	0.095	0.040	3.24	26.35	26.50	0.041	2024/11/21

9.1.3. SAR measurement Result of WCDMA Band 1

Test Position	Test channel /Freq	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	9750/1950	RMC12.2K	0	0.196	0.113	-0.22	21.34	22.00	0.132	2024/11/22
Left Tilt 15 Degree	9750/1950	RMC12.2K	0	0.103	0.058	2.55	21.34	22.00	0.068	2024/11/22
Right Cheek	9750/1950	RMC12.2K	0	0.171	0.096	-4.56	21.34	22.00	0.112	2024/11/22
Right Tilt 15 Degree	9750/1950	RMC12.2K	0	0.089	0.051	4.98	21.34	22.00	0.059	2024/11/22
Left Cheek	9612/1922.4	RMC12.2K	0	0.170	0.093	-0.49	21.13	22.00	0.114	2024/11/22
Left Cheek	9888/1977.6	RMC12.2K	0	0.173	0.095	-0.64	21.56	22.00	0.105	2024/11/22
Extremity										
Front Side	9750/1950	RMC12.2K	0	0.889	0.344	-2.23	21.34	22.00	0.400	2024/11/22
Left Side	9750/1950	RMC12.2K	0	1.347	0.543	-3.88	21.34	22.00	0.632	2024/11/22
Back Side	9750/1950	RMC12.2K	0	1.051	0.411	-3.34	21.34	22.00	0.478	2024/11/22
Right Side	9750/1950	RMC12.2K	0	0.189	0.072	-2.41	21.34	22.00	0.084	2024/11/22
Top Side	9750/1950	RMC12.2K	0	0.997	0.398	-2.36	21.34	22.00	0.463	2024/11/22
Bottom Side	9750/1950	RMC12.2K	0	0.067	0.027	-0.58	21.34	22.00	0.031	2024/11/22
Left Side	9612/1922.4	RMC12.2K	0	1.239	0.499	-2.78	21.13	22.00	0.610	2024/11/22
Left Side	9888/1977.6	RMC12.2K	0	1.334	0.527	3.28	21.56	22.00	0.583	2024/11/22

Body & Hotspot with 5mm (Worst-case position for 0mm)

Left Side	9750/1950	RMC12.2K	5	0.458	0.175	1.76	21.34	22.00	0.204	2024/11/22
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9.1.4. SAR measurement Result of WCDMA Band 8

Test Position	Test channel /Freq	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	2788/897.6	RMC12.2K	0	0.236	0.177	-1.51	22.35	22.50	0.183	2024/11/23
Left Tilt 15 Degree	2788/897.6	RMC12.2K	0	0.122	0.089	-0.97	22.35	22.50	0.092	2024/11/23
Right Cheek	2788/897.6	RMC12.2K	0	0.235	0.171	4.75	22.35	22.50	0.177	2024/11/23
Right Tilt 15 Degree	2788/897.6	RMC12.2K	0	0.105	0.076	-4.09	22.35	22.50	0.079	2024/11/23
Left Cheek	2712/882.4	RMC12.2K	0	0.224	0.168	4.54	22.32	22.50	0.175	2024/11/23
Left Cheek	2863/912.6	RMC12.2K	0	0.208	0.156	-0.42	22.41	22.50	0.159	2024/11/23
Extremity										
Front Side	2788/897.6	RMC12.2K	0	2.004	0.887	2.38	22.35	22.50	0.918	2024/11/23
Bottom Side	2788/897.6	RMC12.2K	0	3.579	1.651	0.25	22.35	22.50	1.709	2024/11/23
Left Side	2788/897.6	RMC12.2K	0	0.322	0.141	-1.55	22.35	22.50	0.146	2024/11/23
Right Side	2788/897.6	RMC12.2K	0	2.183	0.997	1.36	22.35	22.50	1.032	2024/11/23
Top Side	2788/897.6	RMC12.2K	0	0.179	0.081	-2.55	22.35	22.50	0.084	2024/11/23
Back Side	2788/897.6	RMC12.2K	0	2.040	0.932	3.68	22.35	22.50	0.965	2024/11/23
Bottom Side	2712/882.4	RMC12.2K	0	3.579	1.601	-2.35	22.32	22.50	1.669	2024/11/23
Bottom Side	2863/912.6	RMC12.2K	0	3.400	1.568	-2.50	22.41	22.50	1.601	2024/11/23

Body & Hotspot with 5mm (Worst-case position for 0mm)

Bottom Side	2788/897.6	RMC12.2K	5	1.217	0.545	-0.28	22.35	22.50	0.564	2024/11/23
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9.1.5. SAR measurement Result of LTE Band 1

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	18300/1950	20M QPSK(1,0)	0	0.276	0.164	0.24	23.61	24.00	0.179	2024/11/22
Left Tilt 15 Degree	18300/1950	20M QPSK(1,0)	0	0.156	0.089	3.71	23.61	24.00	0.097	2024/11/22
Right Cheek	18300/1950	20M QPSK(1,0)	0	0.258	0.153	-0.53	23.61	24.00	0.167	2024/11/22
Right Tilt 15 Degree	18300/1950	20M QPSK(1,0)	0	0.123	0.070	-2.53	23.61	24.00	0.077	2024/11/22
Left Cheek	18100/1930	20M QPSK(1,0)	0	0.253	0.146	1.02	23.67	24.00	0.158	2024/11/22
Left Cheek	18500/1970	20M QPSK(1,0)	0	0.246	0.140	-3.83	23.47	24.00	0.158	2024/11/22
Extremity										
Front Side	18300/1950	20M QPSK(1,0)	0	0.587	0.214	0.83	23.61	24.00	0.234	2024/11/22
Top Side	18300/1950	20M QPSK(1,0)	0	1.068	0.398	-0.07	23.61	24.00	0.435	2024/11/22
Left Side	18300/1950	20M QPSK(1,0)	0	0.374	0.137	-2.97	23.61	24.00	0.150	2024/11/22
Right Side	18300/1950	20M QPSK(1,0)	0	0.128	0.047	1.35	23.61	24.00	0.051	2024/11/22
Back Side	18300/1950	20M QPSK(1,0)	0	0.673	0.238	-2.02	23.61	24.00	0.260	2024/11/22
Bottom Side	18300/1950	20M QPSK(1,0)	0	0.043	0.016	3.04	23.61	24.00	0.018	2024/11/22
Top Side	18100/1930	20M QPSK(1,0)	0	1.004	0.355	1.63	23.67	24.00	0.383	2024/11/22

Top Side	18500/1970	20M QPSK(1,0)	0	1.025	0.371	-2.25	23.47	24.00	0.419	2024/11/22
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Top Side	18300/1950	20M QPSK(1,0)	5	0.363	0.130	-3.47	23.61	24.00	0.142	2024/11/22

9.1.6. SAR measurement Result of LTE Band 3

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	19575/1747.5	20M QPSK(1,0)	0	0.079	0.049	-0.62	23.40	24.00	0.056	2024/11/21
Left Tilt 15 Degree	19575/1747.5	20M QPSK(1,0)	0	0.044	0.026	3.83	23.40	24.00	0.030	2024/11/21
Right Cheek	19575/1747.5	20M QPSK(1,0)	0	0.069	0.042	-1.69	23.40	24.00	0.048	2024/11/21
Right Tilt 15 Degree	19575/1747.5	20M QPSK(1,0)	0	0.032	0.019	-2.48	23.40	24.00	0.022	2024/11/21
Left Cheek	19300/1720	20M QPSK(1,0)	0	0.071	0.042	3.07	23.23	24.00	0.050	2024/11/21
Left Cheek	19850/1775	20M QPSK(1,0)	0	0.069	0.041	-2.54	23.49	24.00	0.046	2024/11/21
Extremity										
Front Side	19575/1747.5	20M QPSK(1,0)	0	0.160	0.063	2.83	23.40	24.00	0.072	2024/11/21
Top Side	19575/1747.5	20M QPSK(1,0)	0	0.291	0.119	0.30	23.40	24.00	0.137	2024/11/21
Left Side	19575/1747.5	20M QPSK(1,0)	0	0.096	0.047	0.60	23.40	24.00	0.054	2024/11/21
Right Side	19575/1747.5	20M QPSK(1,0)	0	0.038	0.015	1.19	23.40	24.00	0.017	2024/11/21
Back Side	19575/1747.5	20M QPSK(1,0)	0	0.178	0.069	2.03	23.40	24.00	0.079	2024/11/21
Bottom Side	19575/1747.5	20M QPSK(1,0)	0	0.012	0.010	-3.52	23.40	24.00	0.011	2024/11/21
Top Side	19300/1720	20M	0	0.268	0.110	2.76	23.23	24.00	0.131	2024/11/21

		QPSK(1,0)								
Top Side	19850/1775	20M QPSK(1,0)	0	0.291	0.115	3.32	23.49	24.00	0.129	2024/11/21
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Top Side	19575/1747.5	20M QPSK(1,0)	5	0.102	0.041	1.25	23.40	24.00	0.047	2024/11/21

9.1.7. SAR measurement Result of LTE Band 7

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	21100/2535	20M QPSK(1,0)	0	0.353	0.182	0.60	23.36	24.00	0.211	2024/11/25
Left Tilt 15 Degree	21100/2535	20M QPSK(1,0)	0	0.189	0.096	-1.95	23.36	24.00	0.111	2024/11/25
Right Cheek	21100/2535	20M QPSK(1,0)	0	0.599	0.262	-2.23	23.36	24.00	0.304	2024/11/25
Right Tilt 15 Degree	21100/2535	20M QPSK(1,0)	0	0.301	0.151	1.07	23.36	24.00	0.175	2024/11/25
Right Cheek	20850/2510	20M QPSK(1,0)	0	0.335	0.169	-2.01	23.23	24.00	0.202	2024/11/25
Right Cheek	21350/2560	20M QPSK(1,0)	0	0.546	0.239	-3.16	23.52	24.00	0.267	2024/11/25
Extremity										
Front Side	21100/2535	20M QPSK(1,0)	0	2.217	0.724	-0.40	23.36	24.00	0.839	2024/11/25
Top Side	21100/2535	20M QPSK(1,0)	0	6.719	2.287	-0.28	23.36	24.00	2.650	2024/11/25
Left Side	21100/2535	20M QPSK(1,0)	0	1.613	0.544	2.88	23.36	24.00	0.630	2024/11/25
Right Side	21100/2535	20M QPSK(1,0)	0	0.538	0.176	-2.25	23.36	24.00	0.204	2024/11/25
Back Side	21100/2535	20M QPSK(1,0)	0	2.688	0.878	0.54	23.36	24.00	1.017	2024/11/25
Bottom Side	21100/2535	20M QPSK(1,0)	0	0.269	0.089	-1.78	23.36	24.00	0.103	2024/11/25

Top Side	20850/2510	20M QPSK(1,0)	0	6.383	2.129	-3.35	23.23	24.00	2.542	2024/11/25
Top Side	21350/2560	20M QPSK(1,0)	0	6.316	2.042	-0.35	23.52	24.00	2.281	2024/11/25
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Top Side	21100/2535	20M QPSK(1,0)	5	2.352	0.793	2.20	23.36	24.00	0.919	2024/11/25

9.1.8. SAR measurement Result of LTE Band 8

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	21625/897.5	10M QPSK(1,0)	0	0.356	0.267	2.16	24.49	24.50	0.268	2024/11/23
Left Tilt 15 Degree	21625/897.5	10M QPSK(1,0)	0	0.200	0.149	-1.93	24.49	24.50	0.149	2024/11/23
Right Cheek	21625/897.5	10M QPSK(1,0)	0	0.343	0.252	0.66	24.49	24.50	0.253	2024/11/23
Right Tilt 15 Degree	21625/897.5	10M QPSK(1,0)	0	0.158	0.113	-3.73	24.49	24.50	0.113	2024/11/23
Left Cheek	21500/885	10M QPSK(1,0)	0	0.303	0.225	2.72	24.39	24.50	0.231	2024/11/23
Left Cheek	21750/910	10M QPSK(1,0)	0	0.338	0.254	1.91	24.38	24.50	0.261	2024/11/23
Extremity										
Front Side	21625/897.5	10M QPSK(1,0)	0	3.097	1.326	-0.23	24.49	24.50	1.329	2024/11/23
Bottom Side	21625/897.5	10M QPSK(1,0)	0	5.339	2.357	-0.94	24.49	24.50	2.362	2024/11/23
Left Side	21625/897.5	10M QPSK(1,0)	0	0.320	0.134	-2.38	24.49	24.50	0.134	2024/11/23
Right Side	21625/897.5	10M QPSK(1,0)	0	3.310	1.417	-1.10	24.49	24.50	1.420	2024/11/23
Top Side	21625/897.5	10M QPSK(1,0)	0	0.053	0.023	-0.76	24.49	24.50	0.023	2024/11/23
Back	21625/897.5	10M	0	2.990	1.307	-0.32	24.49	24.50	1.310	2024/11/23

Side		QPSK(1,0)								
Bottom Side	21500/885	10M QPSK(1,0)	0	5.072	2.239	1.77	24.39	24.50	2.296	2024/11/23
Bottom Side	21750/910	10M QPSK(1,0)	0	5.049	2.211	-0.65	24.38	24.50	2.273	2024/11/23
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Bottom Side	21625/897.5	10M QPSK(1,0)	5	1.602	0.700	-2.49	24.49	24.50	0.702	2024/11/23

9.1.9. SAR measurement Result of LTE Band 20

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	24300/847	20M QPSK(1,0)	0	0.284	0.220	0.66	24.64	25.00	0.239	2024/11/23
Left Tilt 15 Degree	24300/847	20M QPSK(1,0)	0	0.167	0.128	-3.74	24.64	25.00	0.139	2024/11/23
Right Cheek	24300/847	20M QPSK(1,0)	0	0.278	0.213	-4.85	24.64	25.00	0.231	2024/11/23
Right Tilt 15 Degree	24300/847	20M QPSK(1,0)	0	0.124	0.091	1.00	24.64	25.00	0.099	2024/11/23
Left Cheek	24250/842	20M QPSK(1,0)	0	0.268	0.203	1.94	24.62	25.00	0.222	2024/11/23
Left Cheek	24350/852	20M QPSK(1,0)	0	0.250	0.184	2.59	24.49	25.00	0.207	2024/11/23
Extremity										
Front Side	24300/847	20M QPSK(1,0)	0	2.318	1.018	-2.86	24.64	25.00	1.106	2024/11/23
Bottom Side	24300/847	20M QPSK(1,0)	0	3.863	1.731	-0.54	24.64	25.00	1.881	2024/11/23
Left Side	24300/847	20M QPSK(1,0)	0	0.155	0.066	-3.80	24.64	25.00	0.072	2024/11/23
Right Side	24300/847	20M QPSK(1,0)	0	2.318	1.028	2.17	24.64	25.00	1.117	2024/11/23
Top Side	24300/847	20M QPSK(1,0)	0	0.193	0.084	-1.48	24.64	25.00	0.091	2024/11/23

Back Side	24300/847	20M QPSK(1,0)	0	2.241	0.974	-2.33	24.64	25.00	1.058	2024/11/23
Bottom Side	24250/842	20M QPSK(1,0)	0	3.708	1.628	-2.35	24.62	25.00	1.777	2024/11/23
Bottom Side	24350/852	20M QPSK(1,0)	0	3.554	1.545	2.31	24.49	25.00	1.738	2024/11/23
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Bottom Side	24300/847	20M QPSK(1,0)	5	1.275	0.548	1.40	24.64	25.00	0.595	2024/11/23

9.1.10. SAR measurement Result of LTE Band 38

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	38000/2595	20M QPSK(1,0)	0	0.170	0.082	-2.30	23.64	24.00	0.089	2024/11/25
Left Tilt 15 Degree	38000/2595	20M QPSK(1,0)	0	0.099	0.046	1.58	23.64	24.00	0.050	2024/11/25
Right Cheek	38000/2595	20M QPSK(1,0)	0	0.310	0.136	1.00	23.64	24.00	0.148	2024/11/25
Right Tilt 15 Degree	38000/2595	20M QPSK(1,0)	0	0.158	0.073	1.02	23.64	24.00	0.079	2024/11/25
Right Cheek	37850/2580	20M QPSK(1,0)	0	0.293	0.124	-1.70	23.70	24.00	0.133	2024/11/25
Right Cheek	38150/2610	20M QPSK(1,0)	0	0.274	0.105	-1.70	23.76	24.00	0.111	2024/11/25
Extremity										
Front Side	38000/2595	20M QPSK(1,0)	0	0.908	0.297	-1.88	23.64	24.00	0.323	2024/11/25
Top Side	38000/2595	20M QPSK(1,0)	0	2.929	0.976	-0.89	23.64	24.00	1.060	2024/11/25
Left Side	38000/2595	20M QPSK(1,0)	0	0.703	0.232	2.94	23.64	24.00	0.252	2024/11/25
Right Side	38000/2595	20M QPSK(1,0)	0	0.146	0.048	-0.93	23.64	24.00	0.052	2024/11/25

Back Side	38000/2595	20M QPSK(1,0)	0	1.201	0.396	3.77	23.64	24.00	0.430	2024/11/25
Bottom Side	38000/2595	20M QPSK(1,0)	0	0.176	0.056	2.45	23.64	24.00	0.061	2024/11/25
Top Side	37850/2580	20M QPSK(1,0)	0	2.870	0.928	1.94	23.70	24.00	0.994	2024/11/25
Top Side	38150/2610	20M QPSK(1,0)	0	2.753	0.871	-1.60	23.76	24.00	0.920	2024/11/25
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Top Side	38000/2595	20M QPSK(1,0)	5	0.967	0.306	-2.93	23.64	24.00	0.332	2024/11/25

9.1.11. SAR measurement Result of LTE Band 40

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	39150/2350	20M QPSK(1,0)	0	0.132	0.065	-2.05	23.85	24.00	0.067	2024/11/29
Left Tilt 15 Degree	39150/2350	20M QPSK(1,0)	0	0.074	0.036	3.58	23.85	24.00	0.037	2024/11/29
Right Cheek	39150/2350	20M QPSK(1,0)	0	0.216	0.101	0.16	23.85	24.00	0.105	2024/11/29
Right Tilt 15 Degree	39150/2350	20M QPSK(1,0)	0	0.125	0.062	3.52	23.85	24.00	0.064	2024/11/29
Right Cheek	38750/2310	20M QPSK(1,0)	0	0.199	0.091	0.36	23.51	24.00	0.102	2024/11/29
Right Cheek	39550/2390	20M QPSK(1,0)	0	0.124	0.060	-0.93	23.50	24.00	0.067	2024/11/29
Extremity										
Front Side	39150/2350	20M QPSK(1,0)	0	0.523	0.183	0.93	23.85	24.00	0.189	2024/11/29
Top Side	39150/2350	20M QPSK(1,0)	0	1.539	0.556	-0.35	23.85	24.00	0.576	2024/11/29
Left Side	39150/2350	20M QPSK(1,0)	0	0.339	0.121	2.35	23.85	24.00	0.125	2024/11/29

9.1.12. SAR measurement Result of SA n78

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	636666/3549.99	30kHz 100M QPSK(1,1)	0	0.656	0.259	0.51	25.00	26.00	0.326	2024/11/28
Left Tilt 15 Degree	636666/3549.99	30kHz 100M QPSK(1,1)	0	0.390	0.148	-0.25	25.00	26.00	0.186	2024/11/28
Right Cheek	636666/3549.99	30kHz 100M QPSK(1,1)	0	0.618	0.232	2.85	25.00	26.00	0.292	2024/11/28
Right Tilt 15 Degree	636666/3549.99	30kHz 100M QPSK(1,1)	0	0.293	0.113	2.40	25.00	26.00	0.142	2024/11/28
Left Cheek	623334/3350.01	30kHz 100M QPSK(1,1)	0	0.566	0.217	1.58	24.94	26.00	0.277	2024/11/28
Left Cheek	650000/3750	30kHz 100M QPSK(1,1)	0	0.618	0.234	-3.23	25.25	26.00	0.278	2024/11/28
Extremity										

Front Side	636666/3549.99	30kHz 100M QPSK(1,1)	0	1.159	0.401	-3.82	25.00	26.00	0.505	2024/11/28
Left Side	636666/3549.99	30kHz 100M QPSK(1,1)	0	1.587	0.549	0.45	25.00	26.00	0.691	2024/11/28
Back Side	636666/3549.99	30kHz 100M QPSK(1,1)	0	0.079	0.027	-1.91	25.00	26.00	0.034	2024/11/28
Right Side	636666/3549.99	30kHz 100M QPSK(1,1)	0	0.032	0.011	0.04	25.00	26.00	0.014	2024/11/28
Top Side	636666/3549.99	30kHz 100M QPSK(1,1)	0	0.524	0.179	-1.76	25.00	26.00	0.225	2024/11/28
Bottom Side	636666/3549.99	30kHz 100M QPSK(1,1)	0	0.032	0.011	-0.57	25.00	26.00	0.014	2024/11/28
Left Side	623334/3350.01	30kHz 100M QPSK(1,1)	0	1.508	0.522	2.14	24.94	26.00	0.666	2024/11/28
Left Side	650000/3750	30kHz 100M QPSK(1,1)	0	1.524	0.511	-3.11	25.25	26.00	0.607	2024/11/28
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Left Side	636666/3549.99	30kHz 100M QPSK(1,1)	5	1.000	0.329	-2.74	25.00	26.00	0.414	2024/11/28

9.1.13. SAR measurement Result of WLAN 2.4G

Test Position	Test channel /Freq.	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	7/2442	802.11 b	0	0.324	0.147	-1.31	13.06	14.50	0.205	2024/11/18
Left Tilt 15 Degree	7/2442	802.11 b	0	0.180	0.078	-1.25	13.06	14.50	0.109	2024/11/18
Right Cheek	7/2442	802.11	0	0.134	0.052	2.79	13.06	14.50	0.072	2024/11/18

		b								
Right Tilt 15 Degree	7/2442	802.11 b	0	0.071	0.028	2.22	13.06	14.50	0.039	2024/11/18
Left Cheek	1/2412	802.11 b	0	0.295	0.131	1.18	14.30	14.50	0.137	2024/11/18
Left Cheek	13/2472	802.11 b	0	0.307	0.132	1.10	12.62	14.50	0.204	2024/11/18
Extremity										
Back Side	7/2442	802.11 b	0	0.157	0.064	-0.13	13.06	14.50	0.089	2024/11/18
Front Side	7/2442	802.11 b	0	0.924	0.391	1.28	13.06	14.50	0.545	2024/11/18
Left Side	7/2442	802.11 b	0	0.028	0.012	0.17	13.06	14.50	0.017	2024/11/18
Right Side	7/2442	802.11 b	0	0.249	0.100	0.00	13.06	14.50	0.139	2024/11/18
Top Side	7/2442	802.11 b	0	0.185	0.076	-3.43	13.06	14.50	0.106	2024/11/18
Bottom Side	7/2442	802.11 b	0	0.055	0.022	-3.68	13.06	14.50	0.031	2024/11/18
Front Side	1/2412	802.11 b	0	0.859	0.353	-3.30	14.30	14.50	0.370	2024/11/18
Front Side	13/2472	802.11 b	0	0.841	0.338	-2.90	12.62	14.50	0.521	2024/11/18
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Front Side	7/2442	802.11 b	5	0.582	0.241	-0.69	13.06	14.50	0.336	2024/11/18

9.1.14. SAR measurement Result of WLAN 5.2G

Test Position	Test channel /Freq	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	38/5190	802.11 ax 40	0	0.254	0.128	-2.03	10.71	11.00	0.137	2024/11/19
Left Tilt 15 Degree	38/5190	802.11 ax 40	0	0.135	0.067	2.26	10.71	11.00	0.072	2024/11/19
Right Cheek	38/5190	802.11 ax 40	0	0.120	0.057	-4.00	10.71	11.00	0.061	2024/11/19

Right Tilt 15 Degree	38/5190	802.11 ax 40	0	0.061	0.030	-4.21	10.71	11.00	0.032	2024/11/19
Left Cheek	46/5230	802.11 ax 40	0	0.218	0.109	1.01	10.45	11.00	0.124	2024/11/19
Extremity										
Back Side	38/5190	802.11 ax 40	0	0.167	0.055	-1.09	10.71	11.00	0.059	2024/11/19
Front Side	38/5190	802.11 ax 40	0	0.506	0.174	4.15	10.71	11.00	0.186	2024/11/19
Left Side	38/5190	802.11 ax 40	0	0.051	0.017	-2.88	10.71	11.00	0.018	2024/11/19
Right Side	38/5190	802.11 ax 40	0	0.445	0.153	-0.60	10.71	11.00	0.164	2024/11/19
Top Side	38/5190	802.11 ax 40	0	0.314	0.105	-0.80	10.71	11.00	0.112	2024/11/19
Bottom Side	38/5190	802.11 ax 40	0	0.015	0.013	3.39	10.71	11.00	0.014	2024/11/19
Front Side	46/5230	802.11 ax 40	0	0.471	0.157	2.55	10.45	11.00	0.178	2024/11/19
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Front Side	38/5190	802.11 ax 40	5	0.314	0.107	-3.19	10.71	11.00	0.114	2024/11/19

9.1.15. SAR measurement Result of WLAN 5.8G

Test Position	Test channel /Freq	Mode	Separation distance (mm)	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 10-g (W/Kg)	Date
				1-g	10-g					
Head										
Left Cheek	151/5755	802.11 ac VHT40	0	0.829	0.271	-3.71	5.51	6.00	0.303	2024/11/30
Left Tilt 15 Degree	151/5755	802.11 ac VHT40	0	0.721	0.226	-0.35	5.51	6.00	0.253	2024/11/30
Right Cheek	151/5755	802.11 ac VHT40	0	0.198	0.069	-2.62	5.51	6.00	0.077	2024/11/30
Right Tilt 15 Degree	151/5755	802.11 ac	0	0.093	0.023	3.14	5.51	6.00	0.026	2024/11/30

		VHT40								
Left Cheek	149/5745	802.11 ac VHT40	0	0.728	0.238	-3.88	5.09	6.00	0.293	2024/11/30
Extremity										
Back Side	151/5755	802.11 ac VHT40	0	0.625	0.173	-1.24	5.51	6.00	0.194	2024/11/30
Front Side	151/5755	802.11 ac VHT40	0	1.689	0.492	2.89	5.51	6.00	0.551	2024/11/30
Left Side	151/5755	802.11 ac VHT40	0	0.253	0.073	-1.60	5.51	6.00	0.082	2024/11/30
Right Side	151/5755	802.11 ac VHT40	0	1.486	0.420	0.27	5.51	6.00	0.470	2024/11/30
Top Side	151/5755	802.11 ac VHT40	0	1.081	0.312	-3.28	5.51	6.00	0.349	2024/11/30
Bottom Side	151/5755	802.11 ac VHT40	0	0.068	0.019	-2.72	5.51	6.00	0.021	2024/11/30
Front Side	149/5745	802.11 ac VHT40	0	1.537	0.434	2.72	5.09	6.00	0.535	2024/11/30
Body & Hotspot with 5mm (Worst-case position for 0mm)										
Front Side	151/5755	802.11 ac VHT40	5	1.081	0.315	-1.86	5.51	6.00	0.353	2024/11/30

9.2. Simultaneous Transmission Analysis

Refer to EN 62209-2:2010 Annex K, the secondary transmitter SAR test exclusion thresholds are determined by:

$$P_{\text{available}} = P_{\text{th},m} \left(\frac{\text{SAR}_{\text{lim}} - \text{SAR}_1}{\text{SAR}_{\text{lim}}} \right)$$

$P_{\text{th},m}$ is the threshold exclusion power level taken from Annex B of EN 62479.

Mode	P_{max}	P_{max}	$P_{\text{th},m}$	SAR_{lim}	SAR_1	Calculation	Simultaneous
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	(dBm)	(mW)	(mW)	(W/Kg)	(W/Kg)	Result (mW)	Transmission Exclusion
Bluetooth	4.00	2.51	20	2	0.919	10.81	YES
Bluetooth	4.00	2.51	40	4	2.65	13.5	YES
NFC	1.02	20.00	20	2	0.919	10.81	YES
NFC	1.02	20.00	40	4	2.65	13.5	YES

9.3. Exposure Conditions

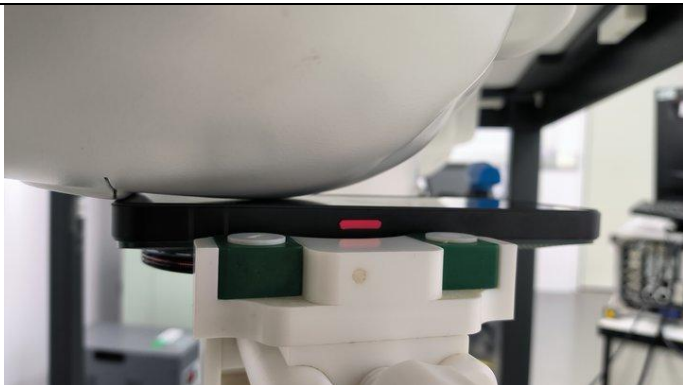
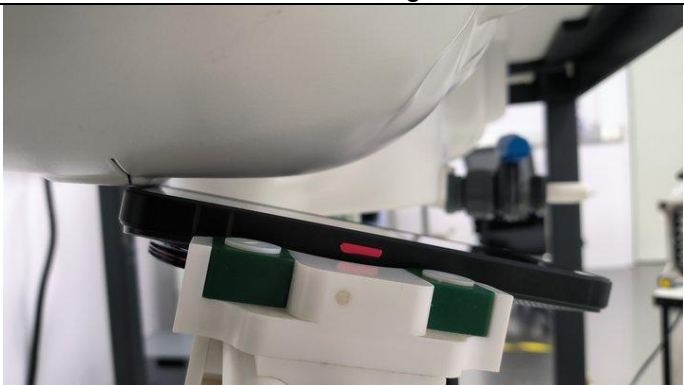
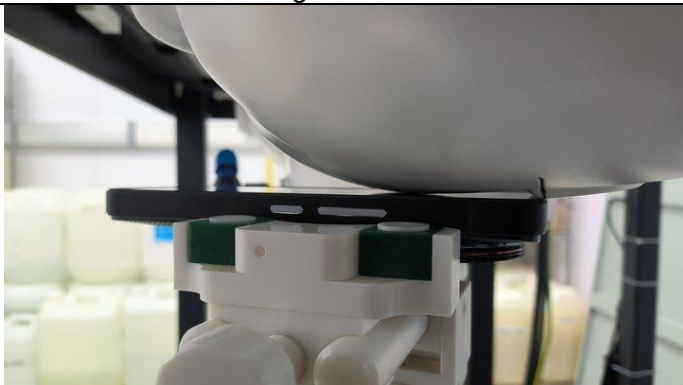
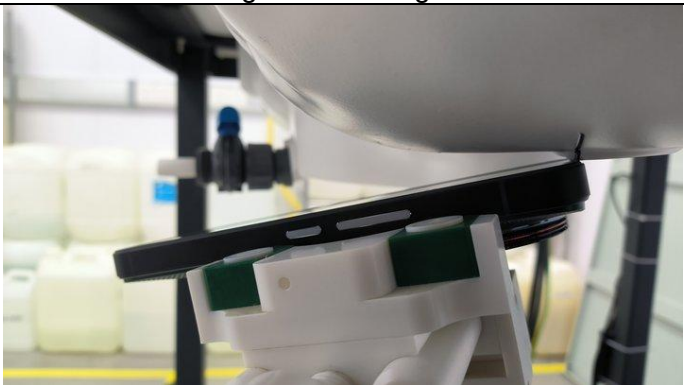
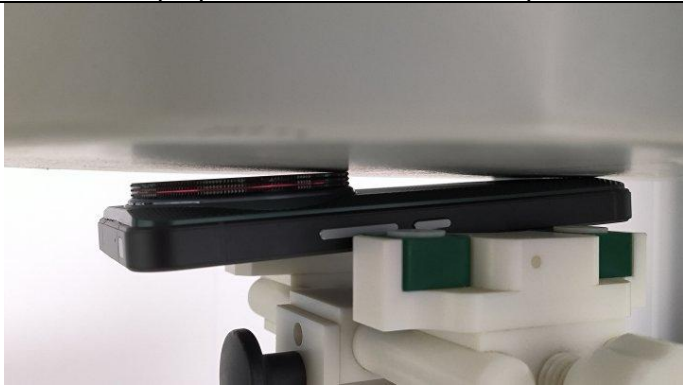
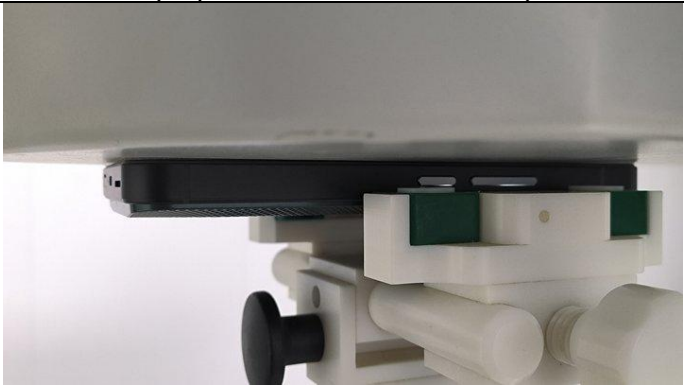
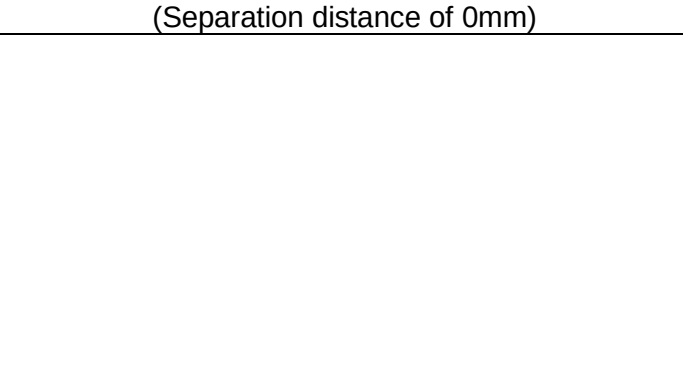
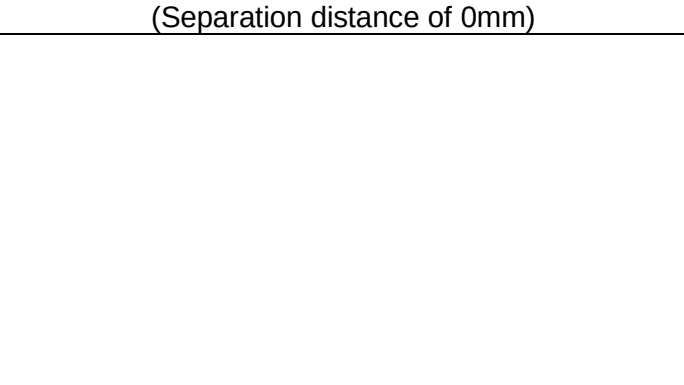
Exposure Position		TLE Band 20	SA n78	WLAN Band	Simultaneous Tx SAR(W/Kg)
		SAR(W/Kg)	SAR(W/Kg)	SAR(W/Kg)	
Head	Left Cheek	0.239	0.326	0.303	0.868
	Left Tilt 15 Degree	0.139	0.186	0.253	0.578
	Right Cheek	0.231	0.292	0.077	0.600
	Right Tilt 15 Degree	0.099	0.142	0.039	0.280
Member	Front Side	1.106	0.505	0.551	2.162
	Back Side	1.058	0.034	0.194	1.286
	Left Side	0.072	0.691	0.082	0.845
	Right Side	1.117	0.014	0.470	1.601
	Top Side	0.091	0.225	0.349	0.665
	Bottom Side	1.881	0.014	0.031	1.926
Body&Hotspot	Front Side	/	/	0.353	0.353
	Left Side	0.204	/	/	0.204
	Top Side	0.919	/	/	0.919
	Bottom Side	0.702	0.595	/	1.297

Exposure Position		WWAN Band	WLAN Band	Simultaneous Tx SAR(W/Kg)
		SAR(W/Kg)	SAR(W/Kg)	
Head	Left Cheek	0.433	0.303	0.736
	Left Tilt 15 Degree	0.244	0.253	0.497
	Right Cheek	0.429	0.077	0.506
	Right Tilt 15 Degree	0.211	0.039	0.250
Member	Front Side	1.329	0.551	1.880
	Back Side	1.310	0.194	1.504
	Left Side	0.691	0.082	0.773
	Right Side	1.420	0.470	1.890
	Top Side	2.650	0.349	2.999
	Bottom Side	2.362	0.031	2.393
Body&Hotspot	Front Side	/	0.353	0.353
	Left Side	0.204	/	0.204
	Top Side	0.919	/	0.919
	Bottom Side	0.702	/	0.702

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

10. Appendix A. Photo documentation

Test Positions

Left Cheek	Left Tilt 15 Degree
	
Right Cheek	Right Tilt 15 Degree
	
Front Side (Separation distance of 0mm)	Back Side (Separation distance of 0mm)
	
Left Side (Separation distance of 0mm)	Right Side (Separation distance of 0mm)
	



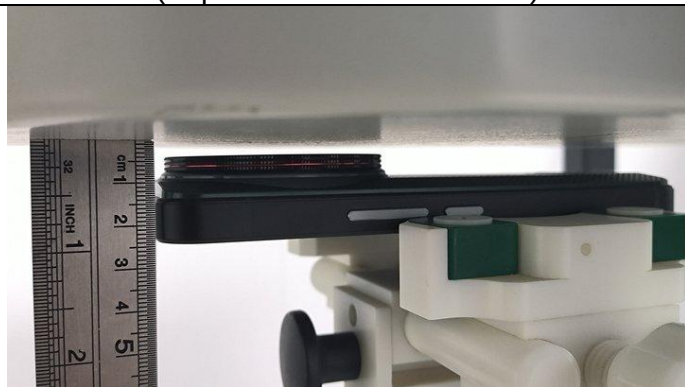
Top Side
(Separation distance of 0mm)



Bottom Side
(Separation distance of 0mm)



Back Side
(Separation distance of 5mm)



11. Appendix B. System Check Plots

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MEASUREMENT 1 System Performance Check - 900MHz
MEASUREMENT 2 System Performance Check - 1800MHz
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MEASUREMENT 6 System Performance Check - 2600MHz
MEASUREMENT 7 System Performance Check - 3300MHz
MEASUREMENT 8 System Performance Check - 3500MHz
MEASUREMENT 9 System Performance Check - 3700MHz
MEASUREMENT 10 System Performance Check - 5200MHz
MEASUREMENT 11 System Performance Check - 5800MHz

MEASUREMENT 1

Date of measurement: 23/11/2024

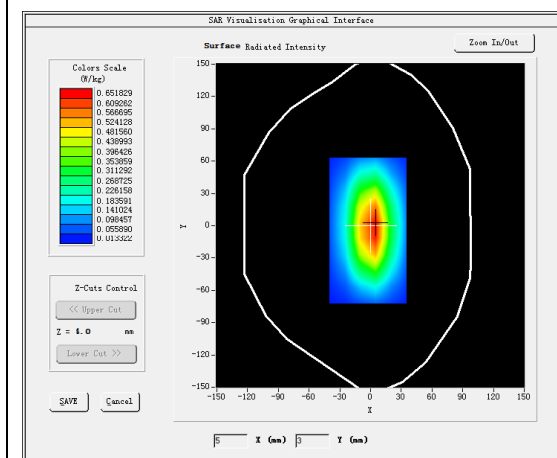
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.24</u>

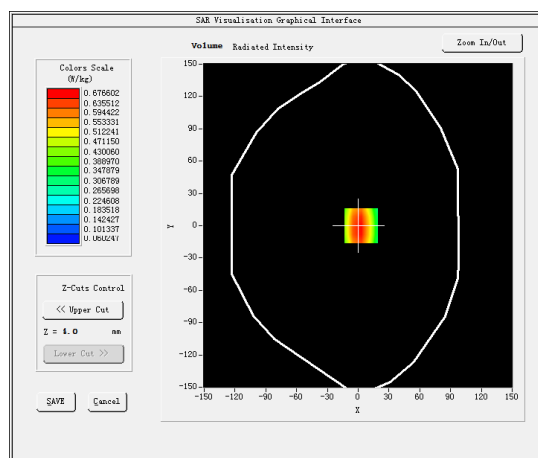
B. SAR Measurement Results

Frequency (MHz)	900.000000
Relative permittivity (real part)	41.415106
Relative permittivity (imaginary part)	19.964881
Conductivity (S/m)	0.998244
Variation (%)	-0.270000

SURFACE SAR



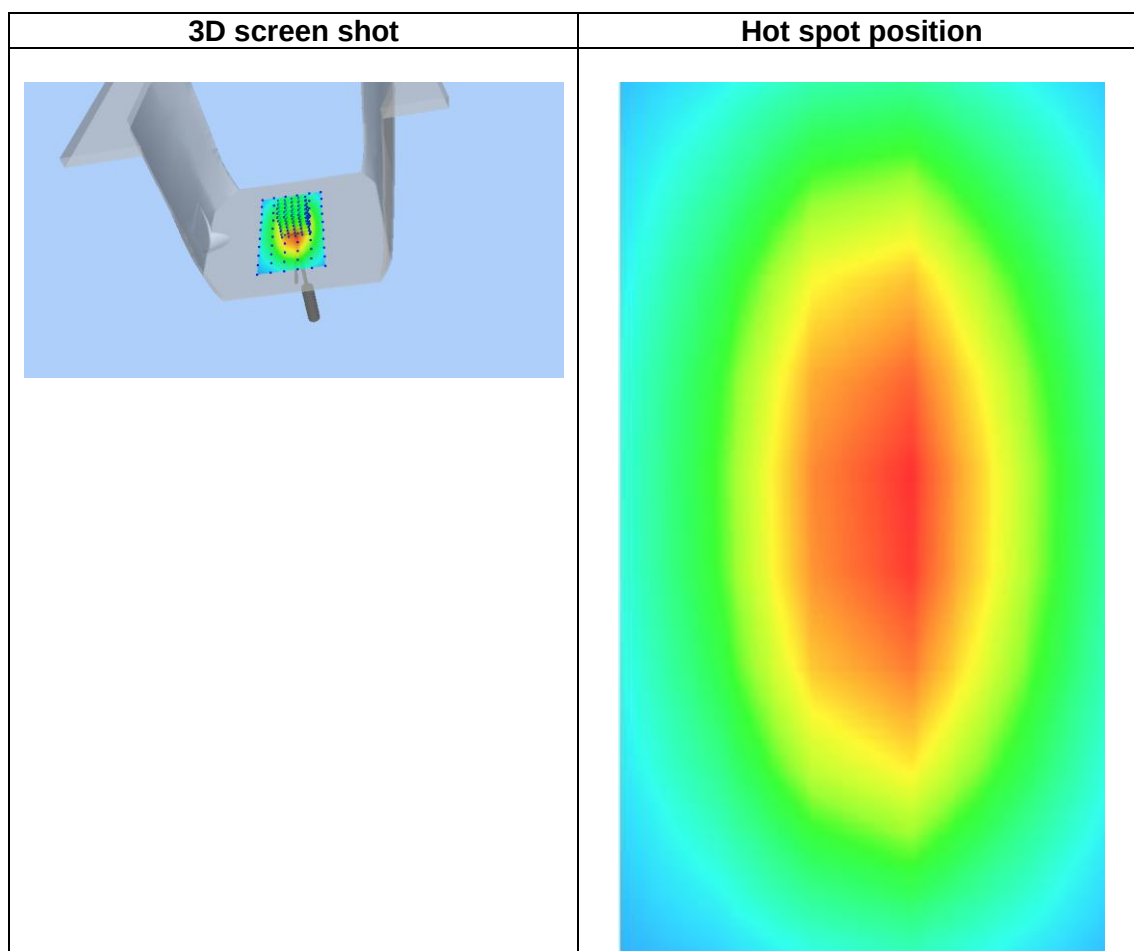
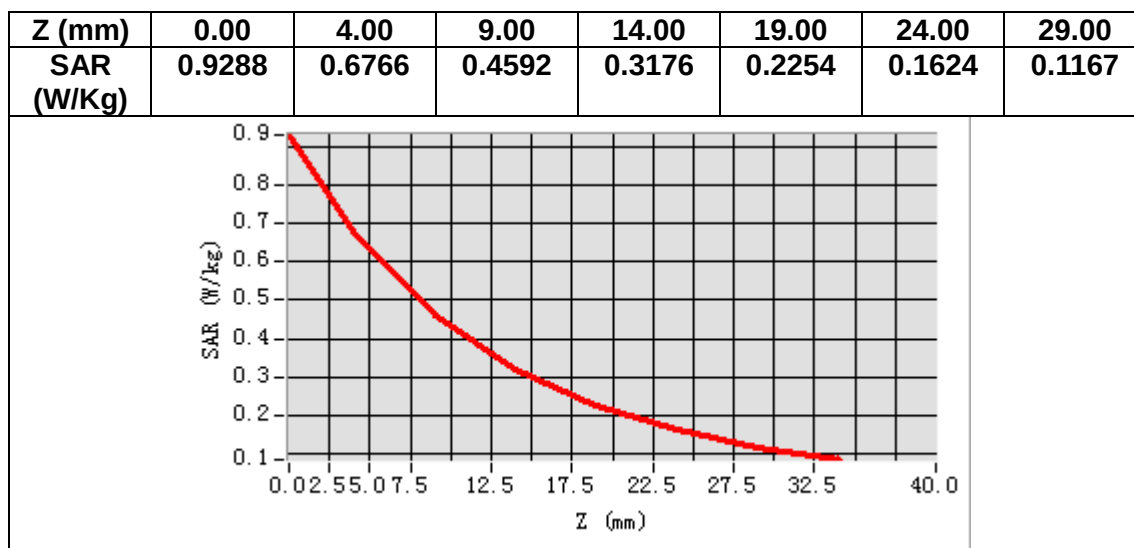
VOLUME SAR



Maximum location: X=3.00, Y=0.00

SAR Peak: 0.94 W/kg

SAR 10g (W/Kg)	0.420623
SAR 1g (W/Kg)	0.653382



MEASUREMENT 2

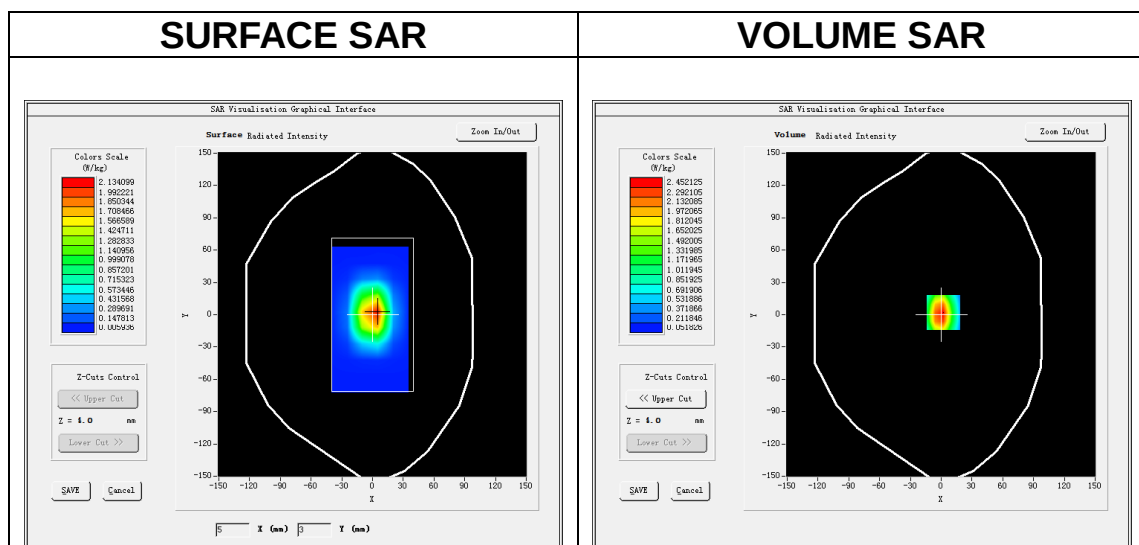
Date of measurement: 21/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW1800</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.51</u>

B. SAR Measurement Results

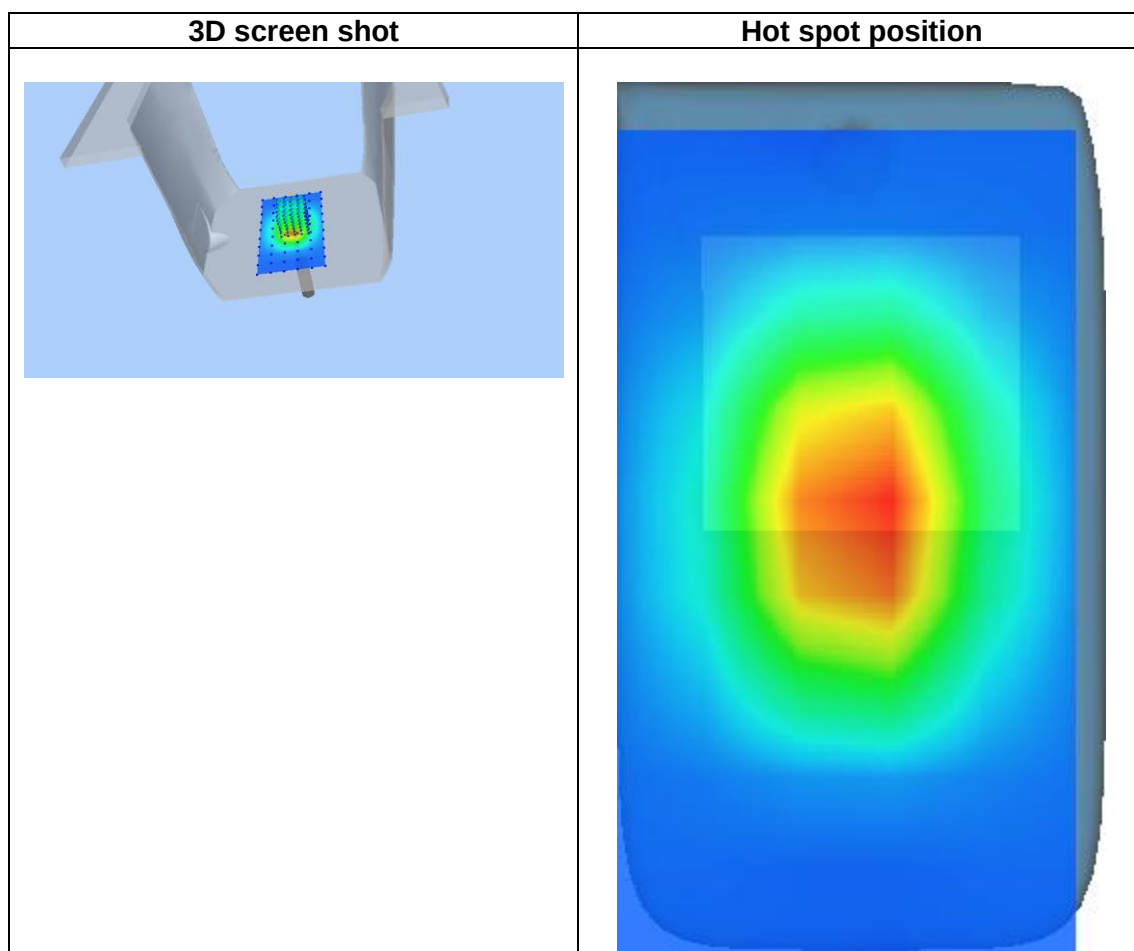
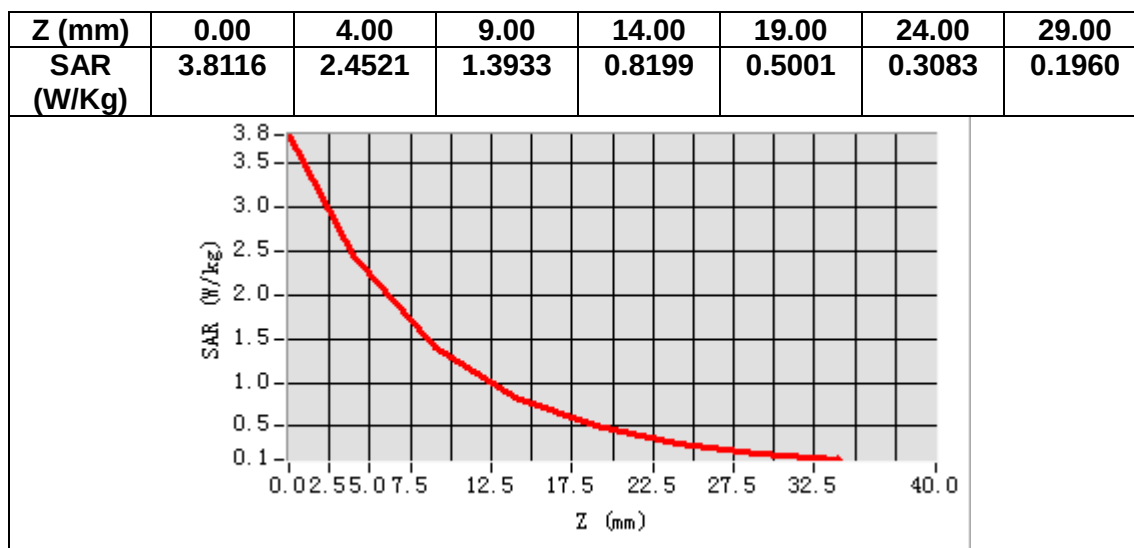
Frequency (MHz)	1800.000000
Relative permittivity (real part)	39.077704
Relative permittivity (imaginary part)	13.865005
Conductivity (S/m)	1.386501
Variation (%)	-0.110000



Maximum location: X=2.00, Y=2.00

SAR Peak: 3.95 W/kg

SAR 10g (W/Kg)	1.231630
SAR 1g (W/Kg)	2.380187



MEASUREMENT 3

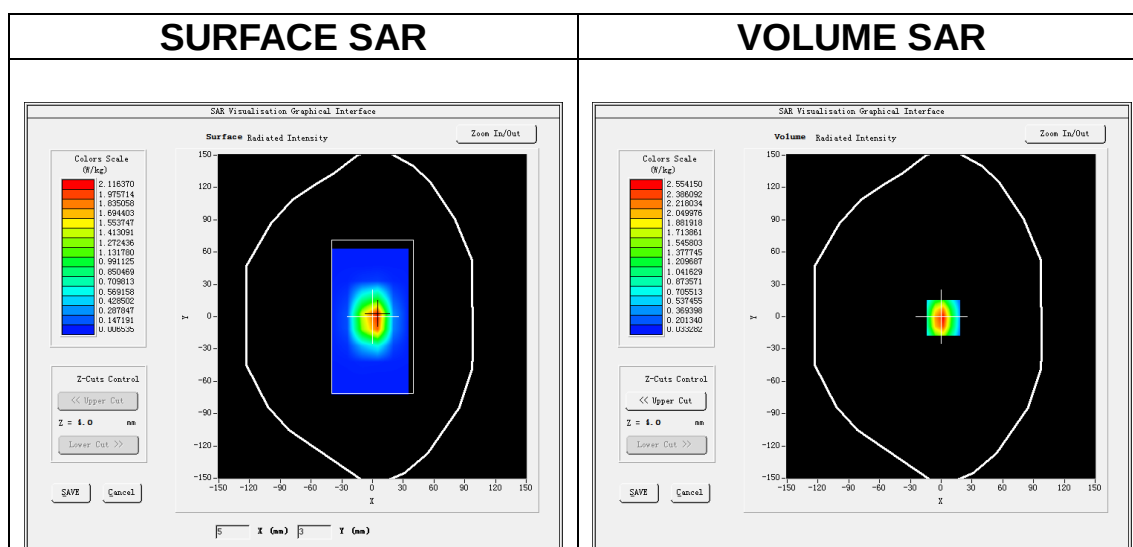
Date of measurement: 22/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW2000</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.64</u>

B. SAR Measurement Results

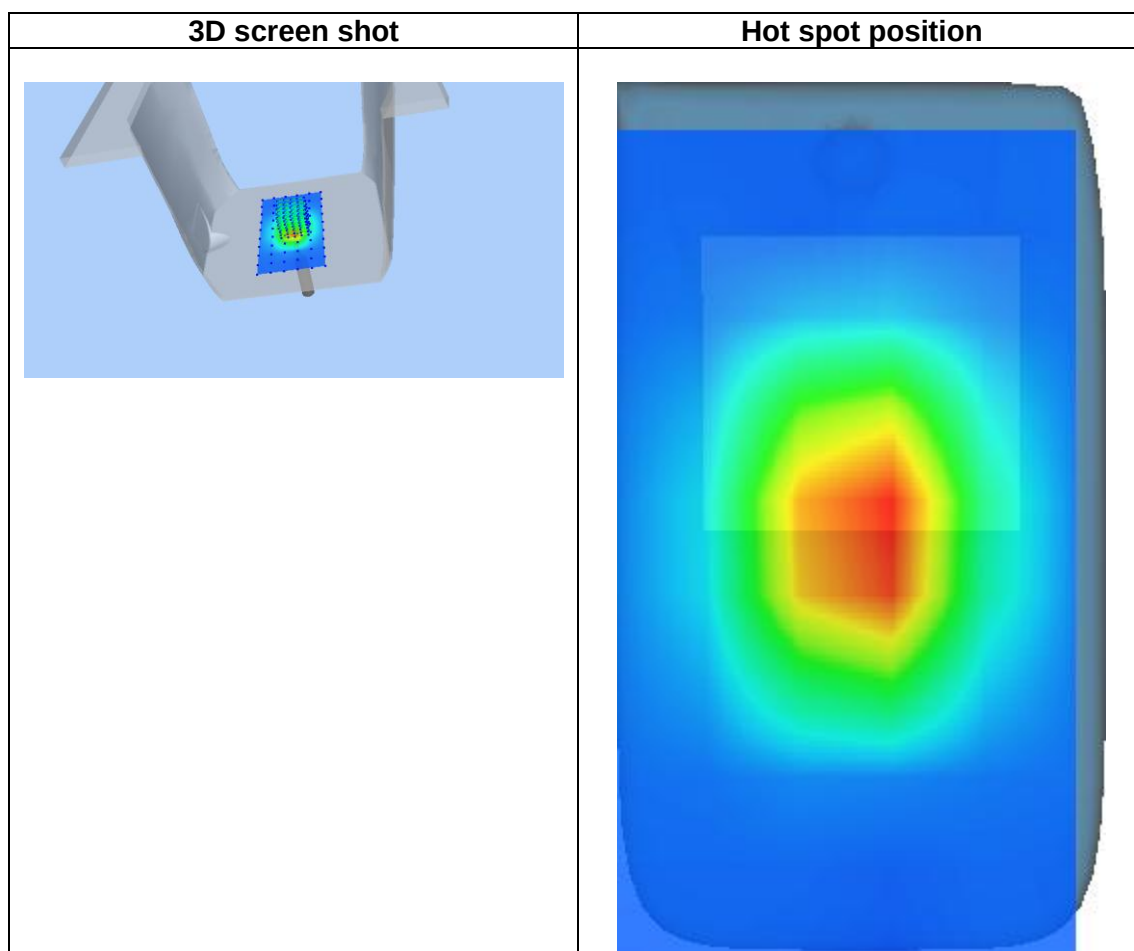
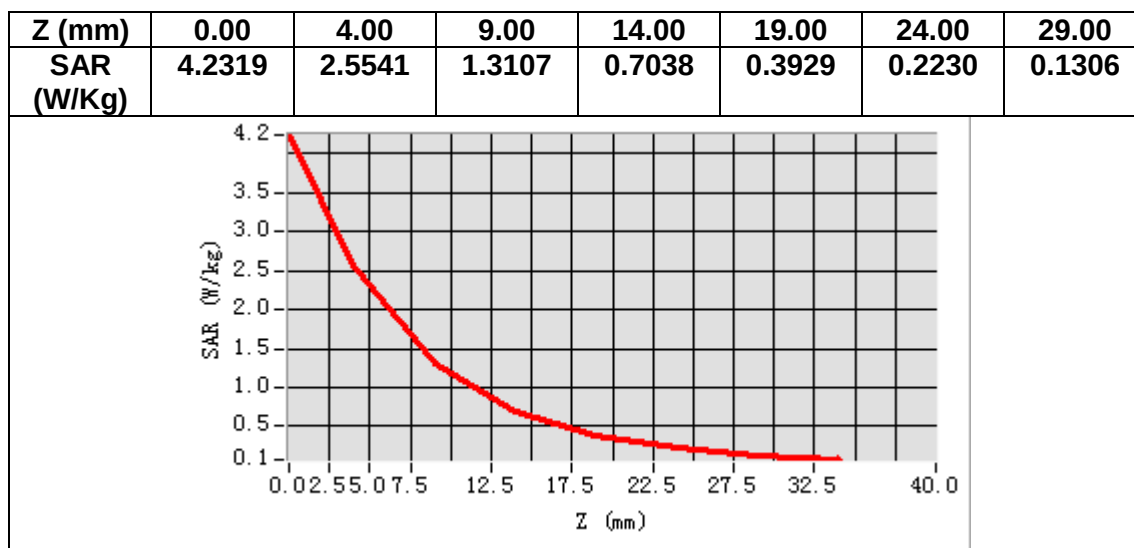
Frequency (MHz)	2000.000000
Relative permittivity (real part)	38.710816
Relative permittivity (imaginary part)	12.937350
Conductivity (S/m)	1.437483
Variation (%)	-0.160000



Maximum location: X=2.00, Y=-1.00

SAR Peak: 4.33 W/kg

SAR 10g (W/Kg)	1.162303
SAR 1g (W/Kg)	2.440286



MEASUREMENT 4

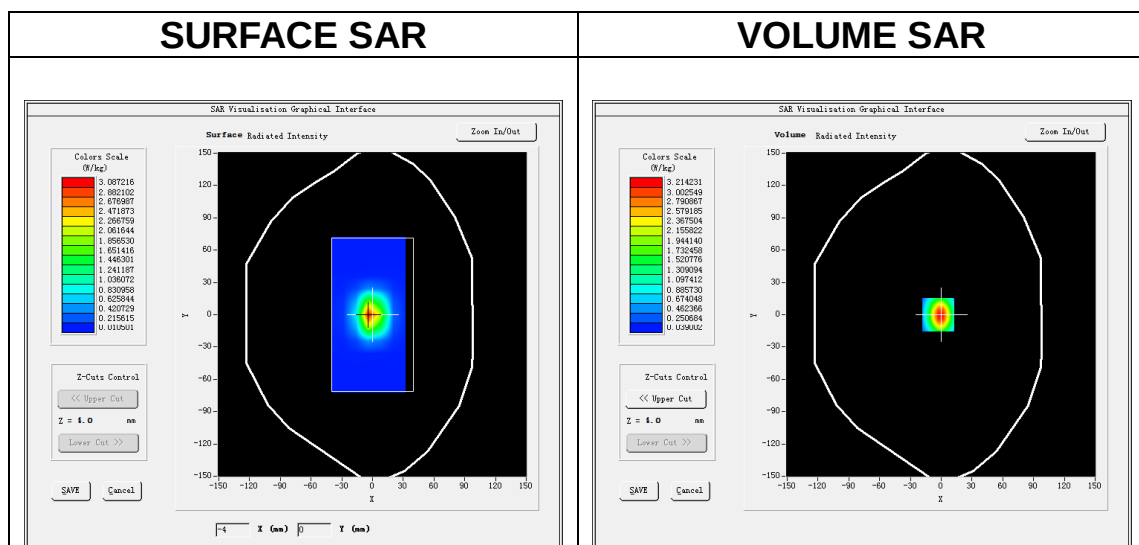
Date of measurement: 29/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW2300</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.73</u>

B. SAR Measurement Results

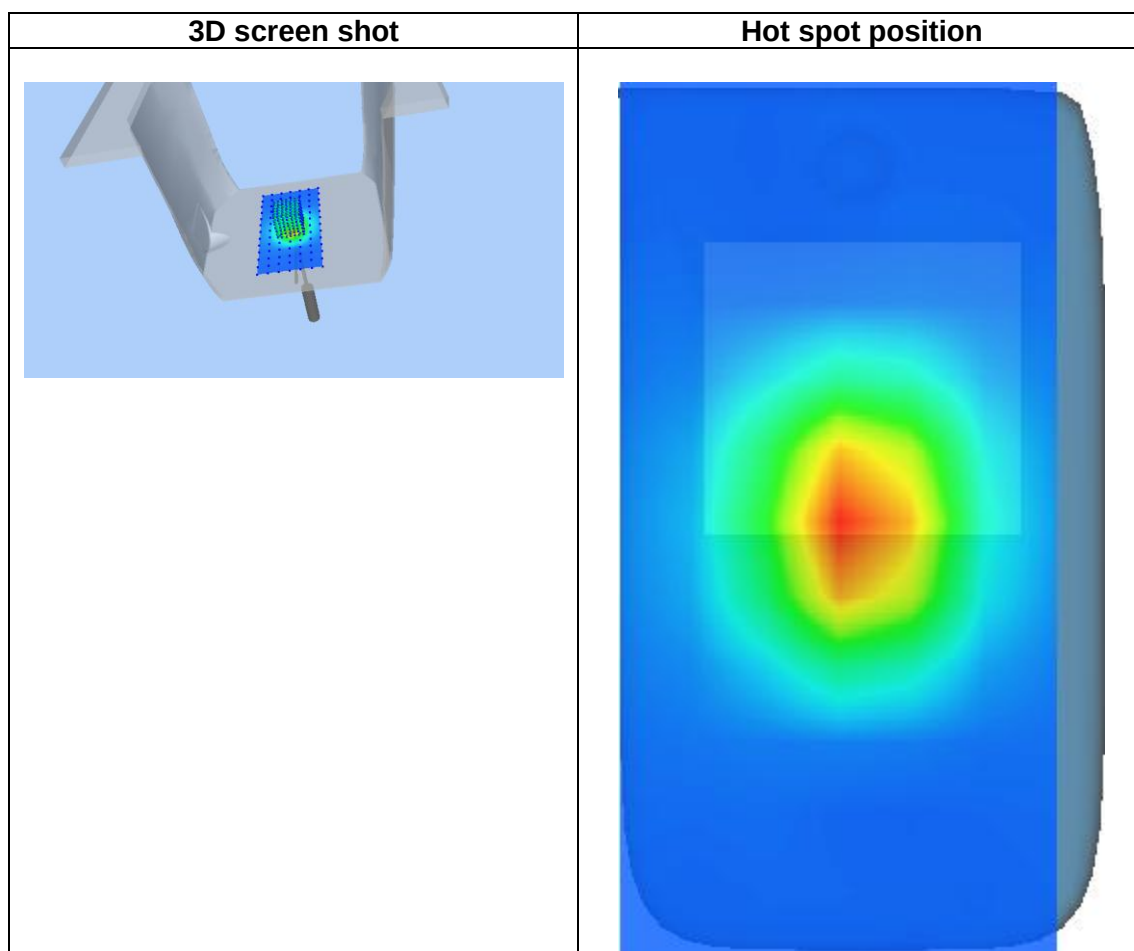
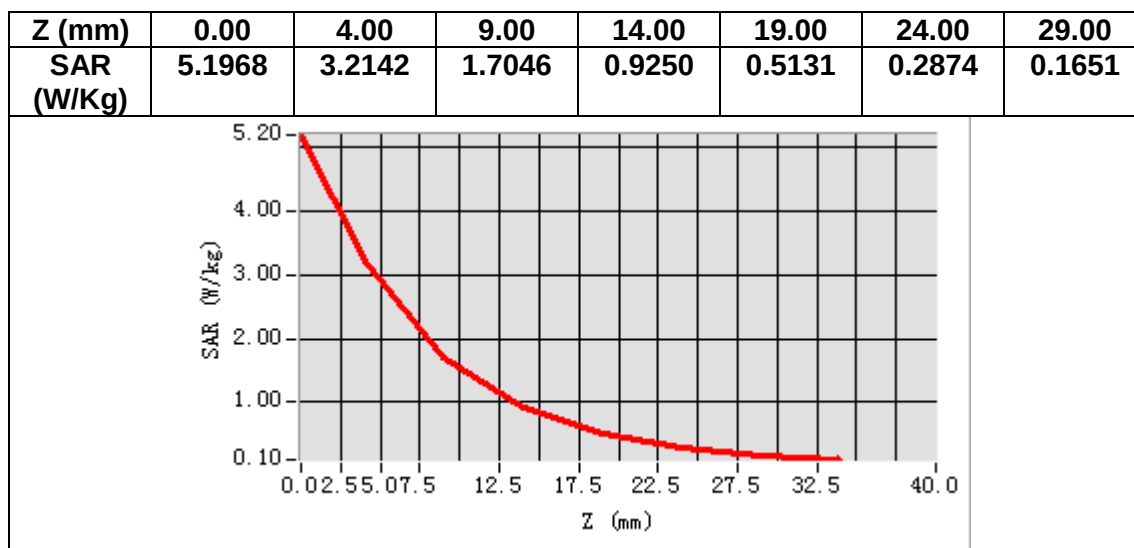
Frequency (MHz)	2300.000000
Relative permittivity (real part)	39.405731
Relative permittivity (imaginary part)	12.667461
Conductivity (S/m)	1.618620
Variation (%)	-0.420000



Maximum location: X=-3.00, Y=0.00

SAR Peak: 5.32 W/kg

SAR 10g (W/Kg)	1.418309
SAR 1g (W/Kg)	3.001488



MEASUREMENT 5

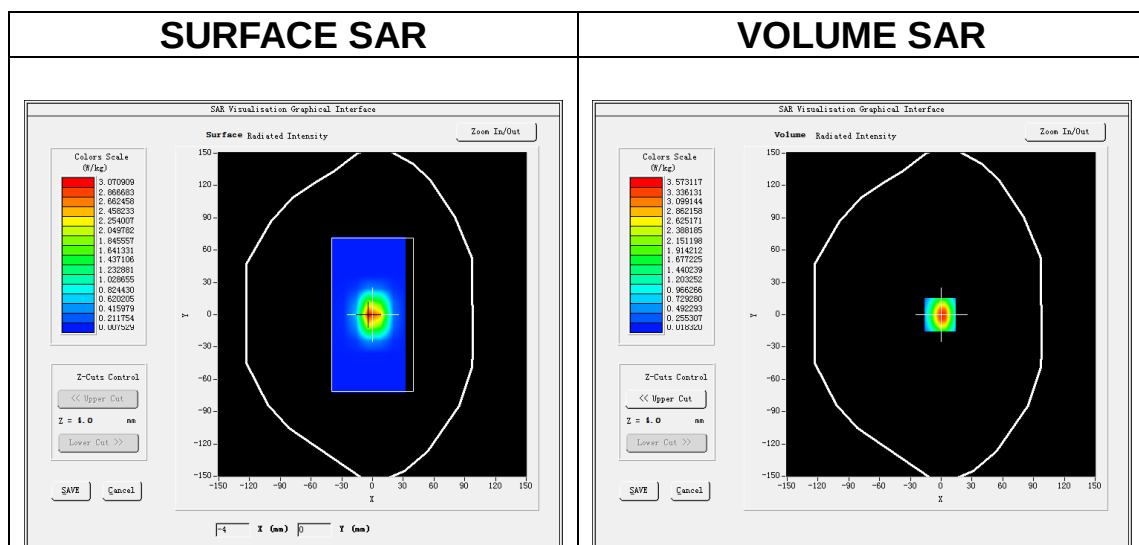
Date of measurement: 18/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW2450</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.74</u>

B. SAR Measurement Results

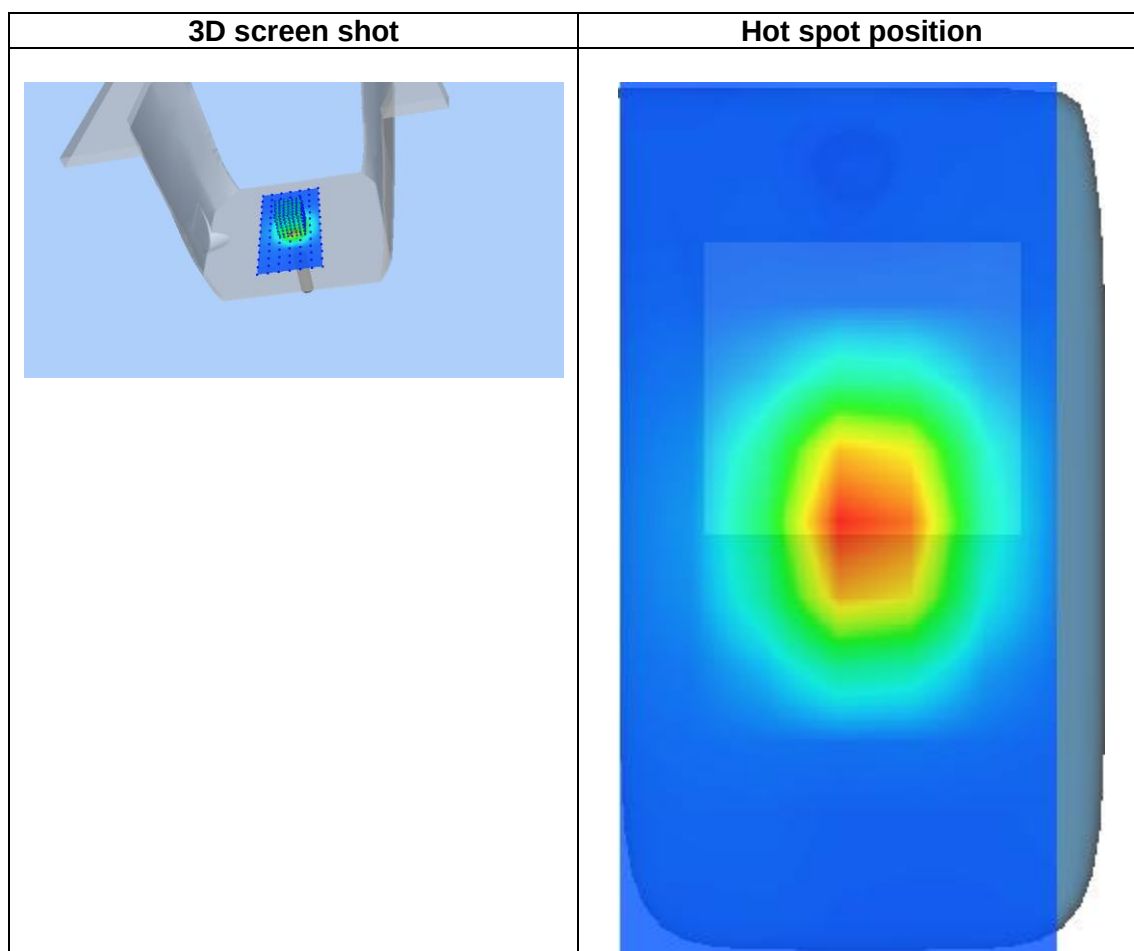
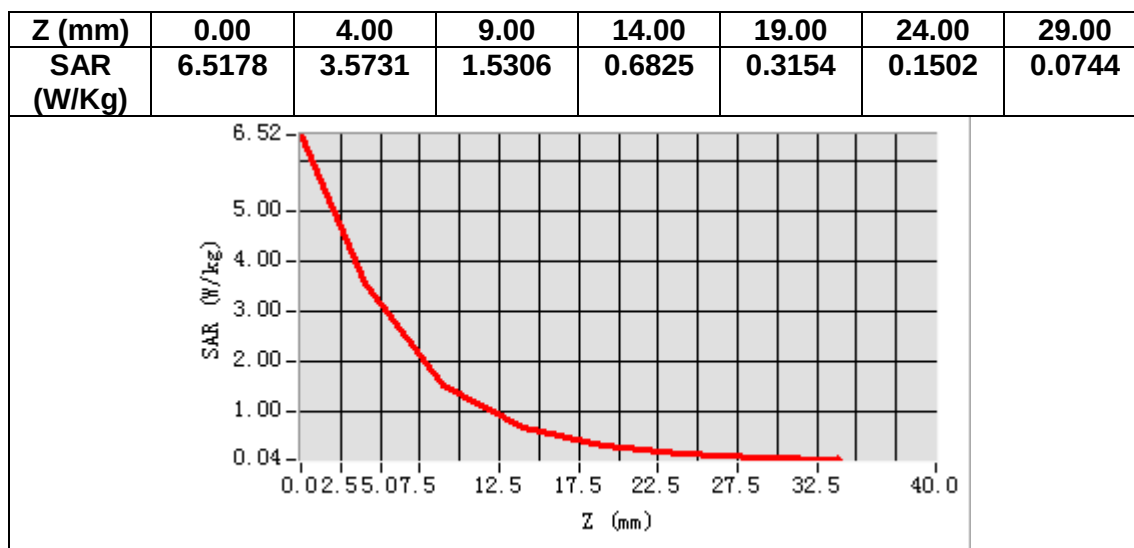
Frequency (MHz)	2450.000000
Relative permittivity (real part)	37.962009
Relative permittivity (imaginary part)	13.205487
Conductivity (S/m)	1.797414
Variation (%)	-0.130000



Maximum location: X=-1.00, Y=0.00

SAR Peak: 6.57 W/kg

SAR 10g (W/Kg)	1.404082
SAR 1g (W/Kg)	3.347366



MEASUREMENT 6

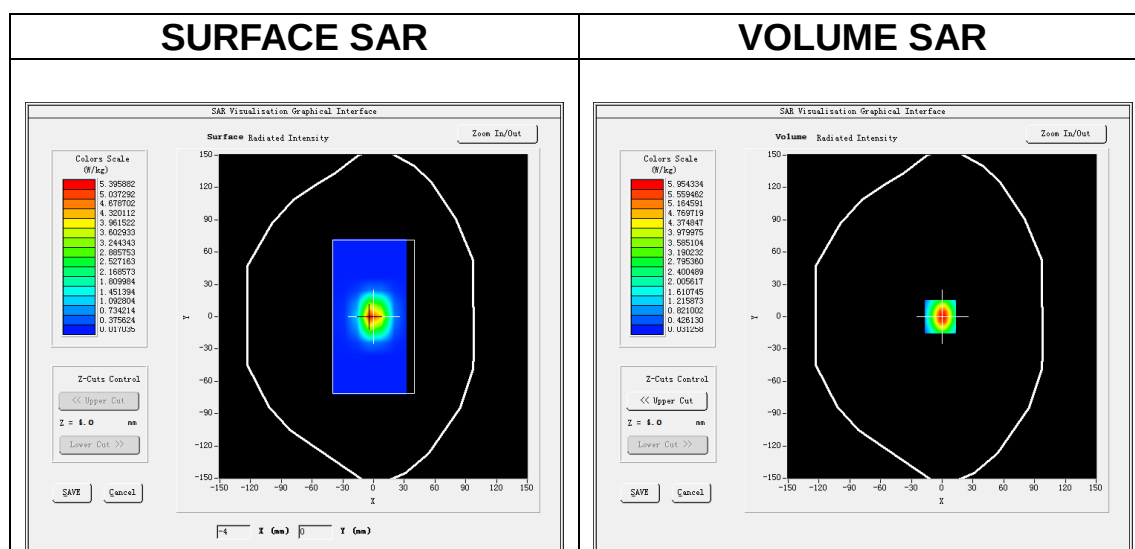
Date of measurement: 25/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW2600</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.51</u>

B. SAR Measurement Results

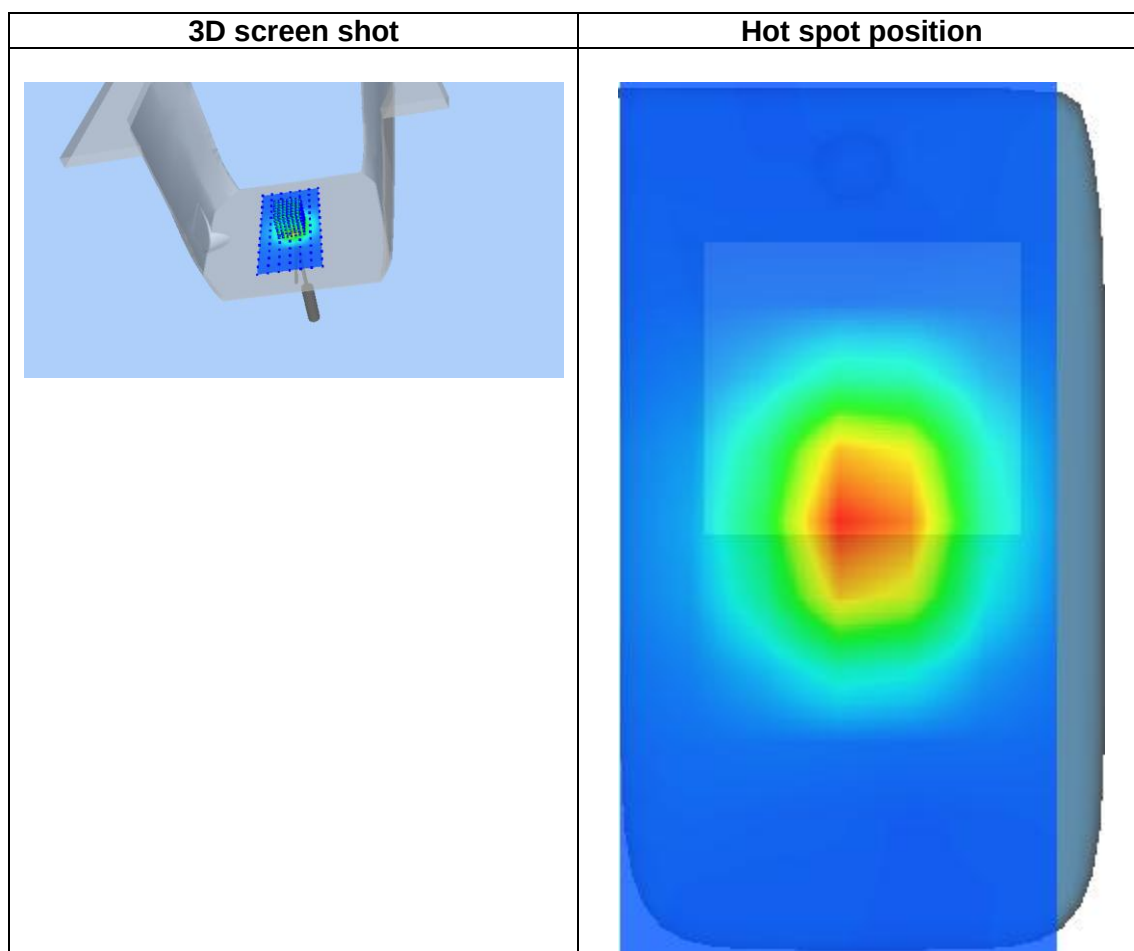
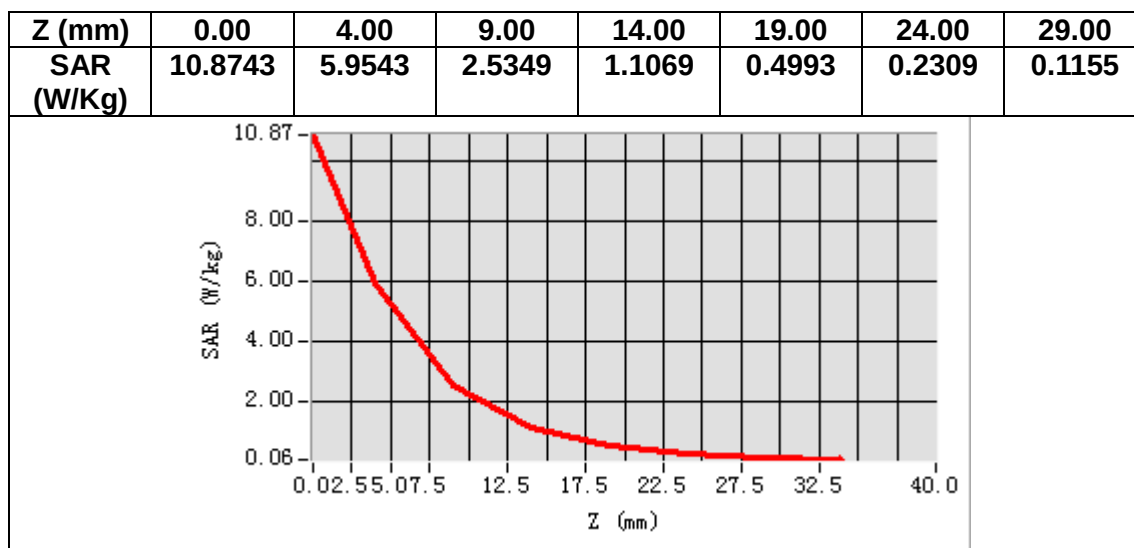
Frequency (MHz)	2600.000000
Relative permittivity (real part)	38.878441
Relative permittivity (imaginary part)	13.731472
Conductivity (S/m)	1.983435
Variation (%)	-0.680000



Maximum location: X=-2.00, Y=0.00

SAR Peak: 11.17 W/kg

SAR 10g (W/Kg)	2.367676
SAR 1g (W/Kg)	5.709248



MEASUREMENT 7

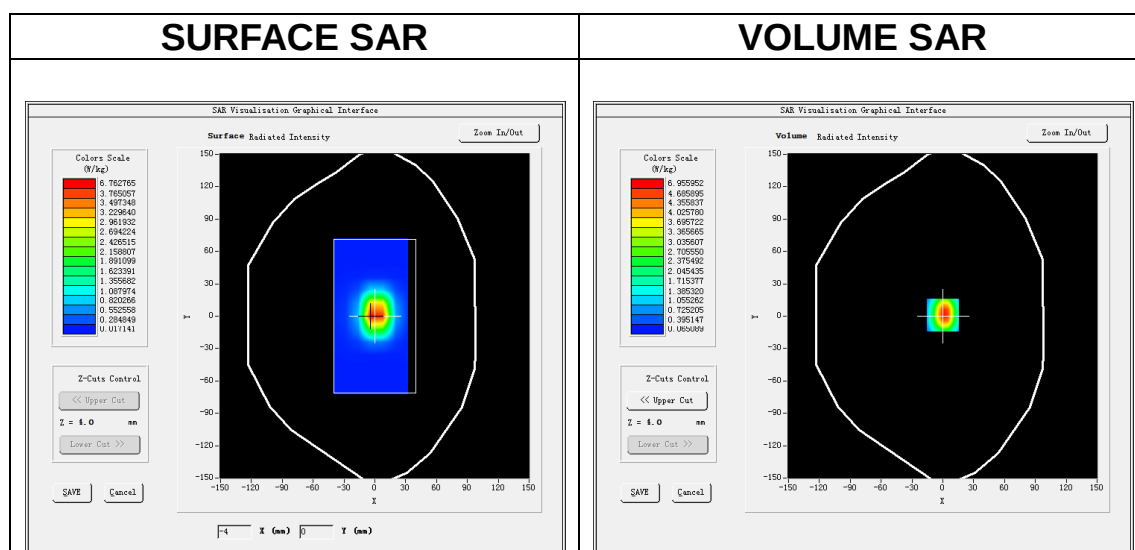
Date of measurement: 3/12/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW3300</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.11</u>

B. SAR Measurement Results

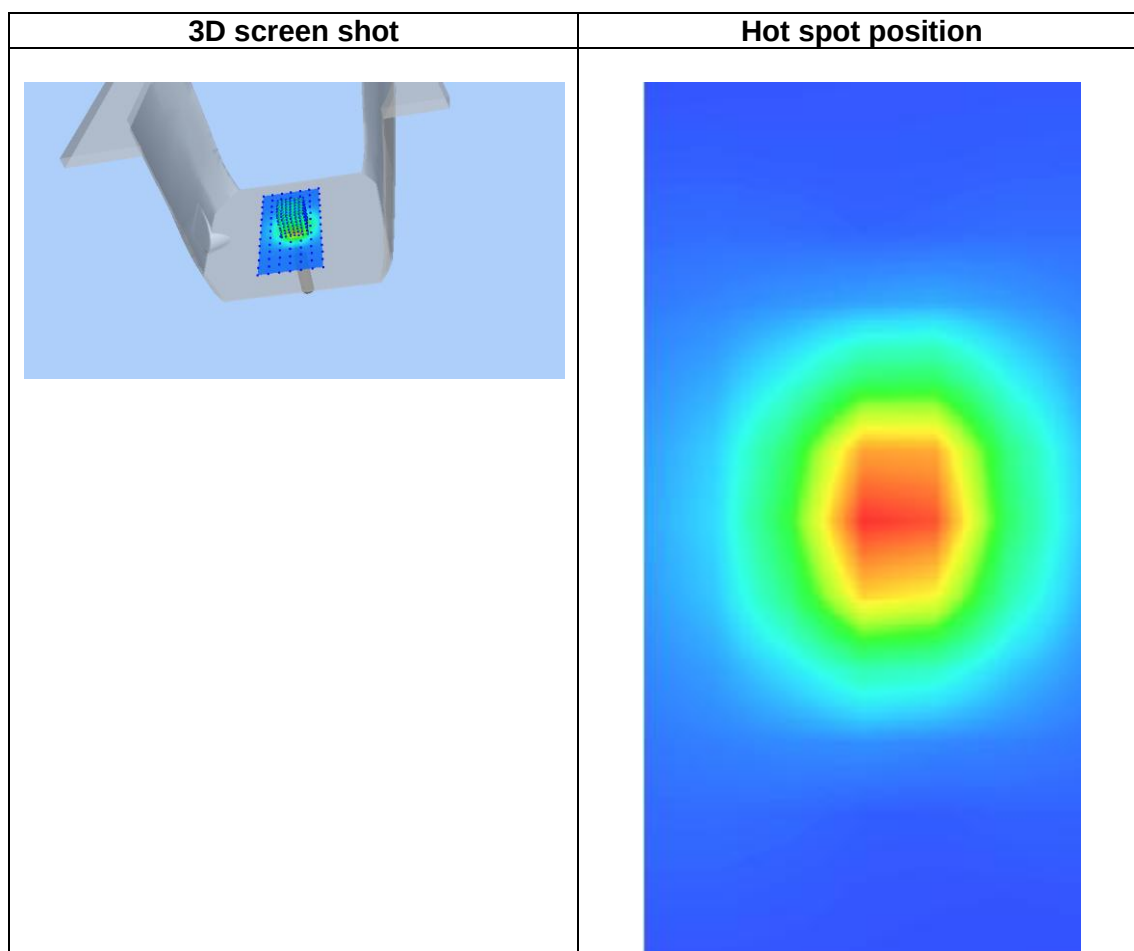
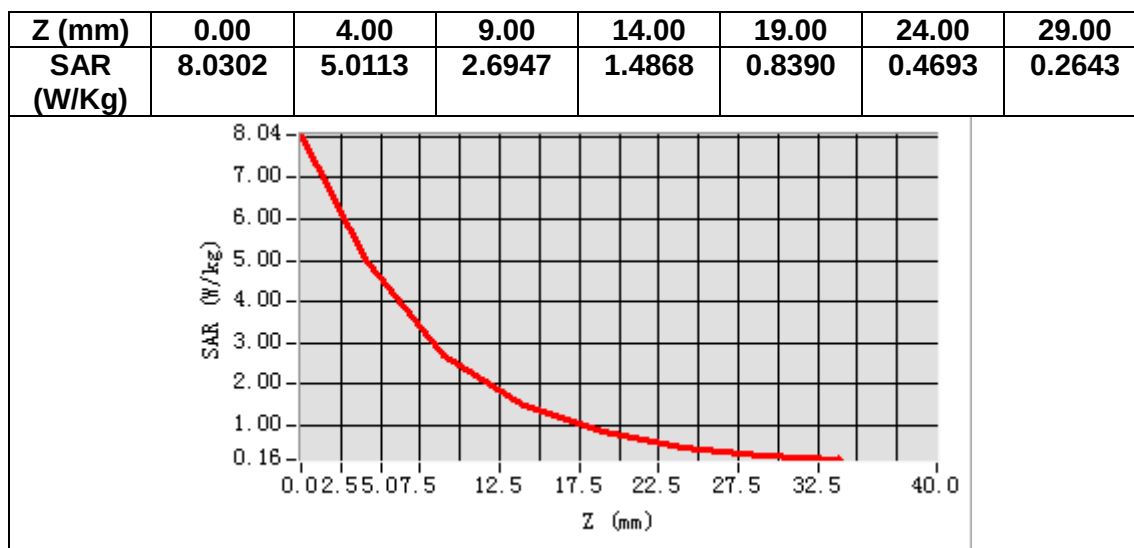
Frequency (MHz)	3300.000000
Relative permittivity (real part)	39.327558
Relative permittivity (imaginary part)	14.233032
Conductivity (S/m)	2.609389
Variation (%)	-1.990000



Maximum location: X=0.00, Y=1.00

SAR Peak: 8.14 W/kg

SAR 10g (W/Kg)	2.543215
SAR 1g (W/Kg)	6.223159



MEASUREMENT 8

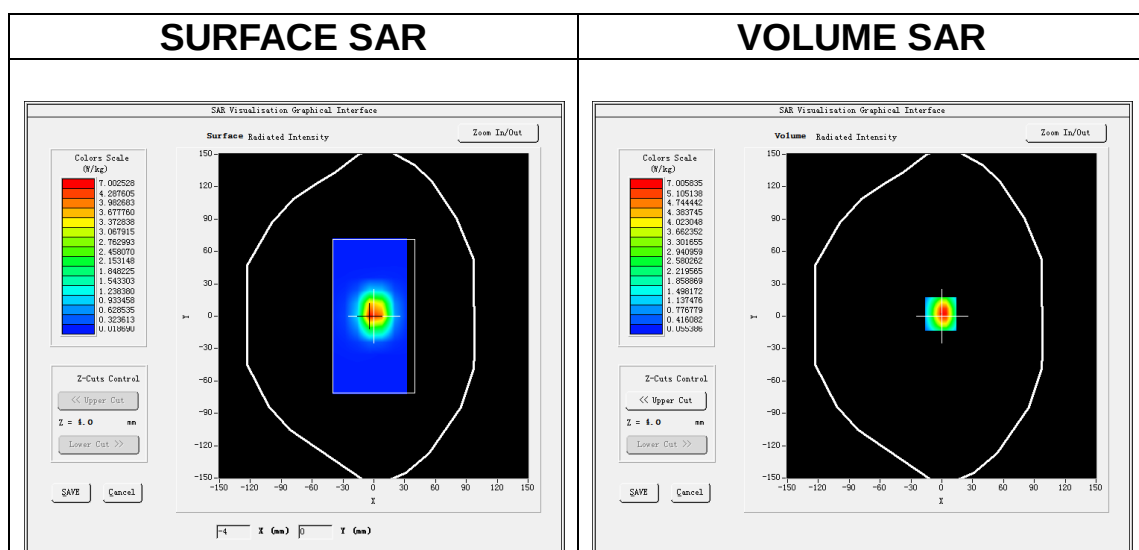
Date of measurement: 28/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW3500</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.15</u>

B. SAR Measurement Results

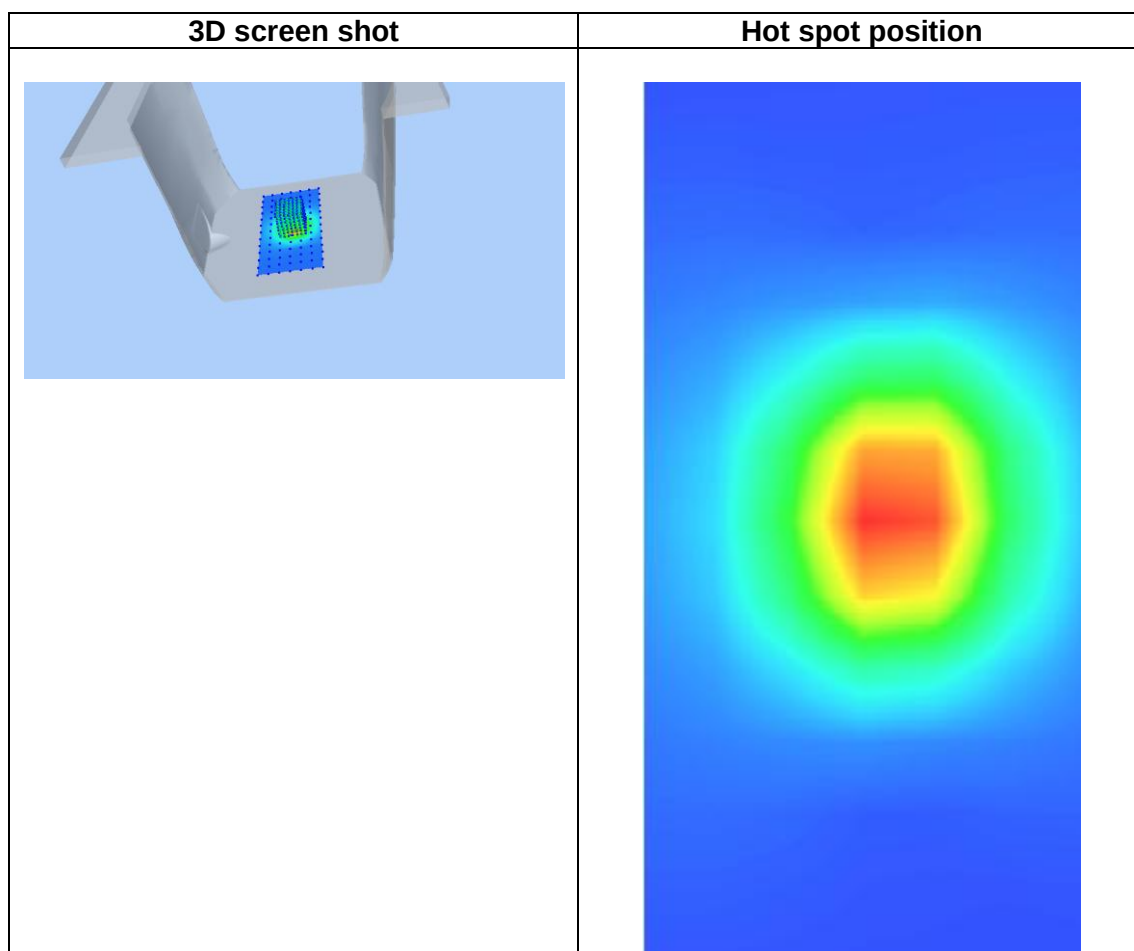
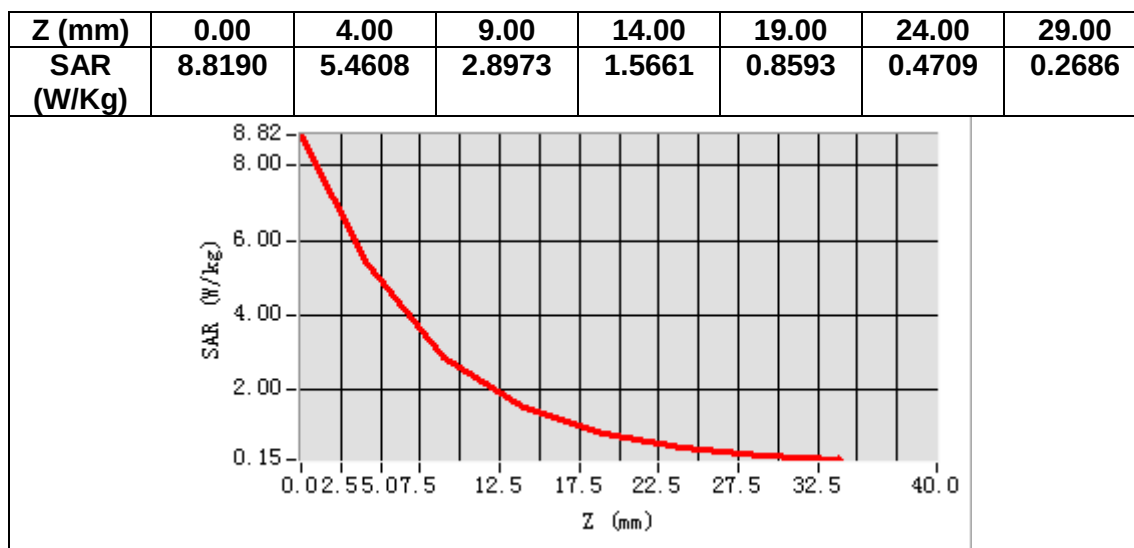
Frequency (MHz)	3500.000000
Relative permittivity (real part)	37.569071
Relative permittivity (imaginary part)	14.509588
Conductivity (S/m)	2.821309
Variation (%)	2.390000



Maximum location: X=-1.00, Y=2.00

SAR Peak: 9.07 W/kg

SAR 10g (W/Kg)	2.493215
SAR 1g (W/Kg)	6.923897



MEASUREMENT 9

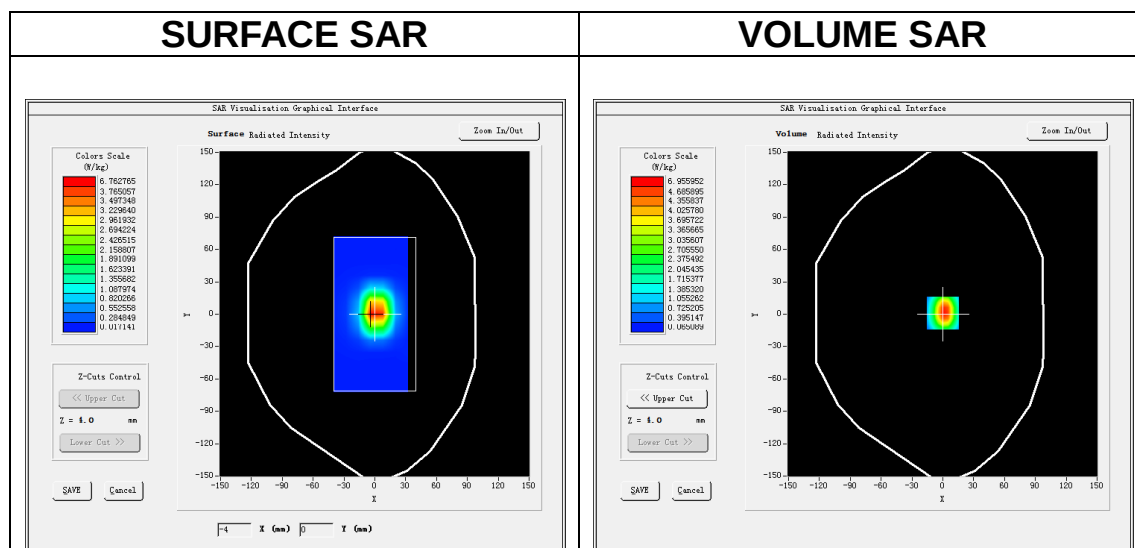
Date of measurement: 2/12/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW3700</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.08</u>

B. SAR Measurement Results

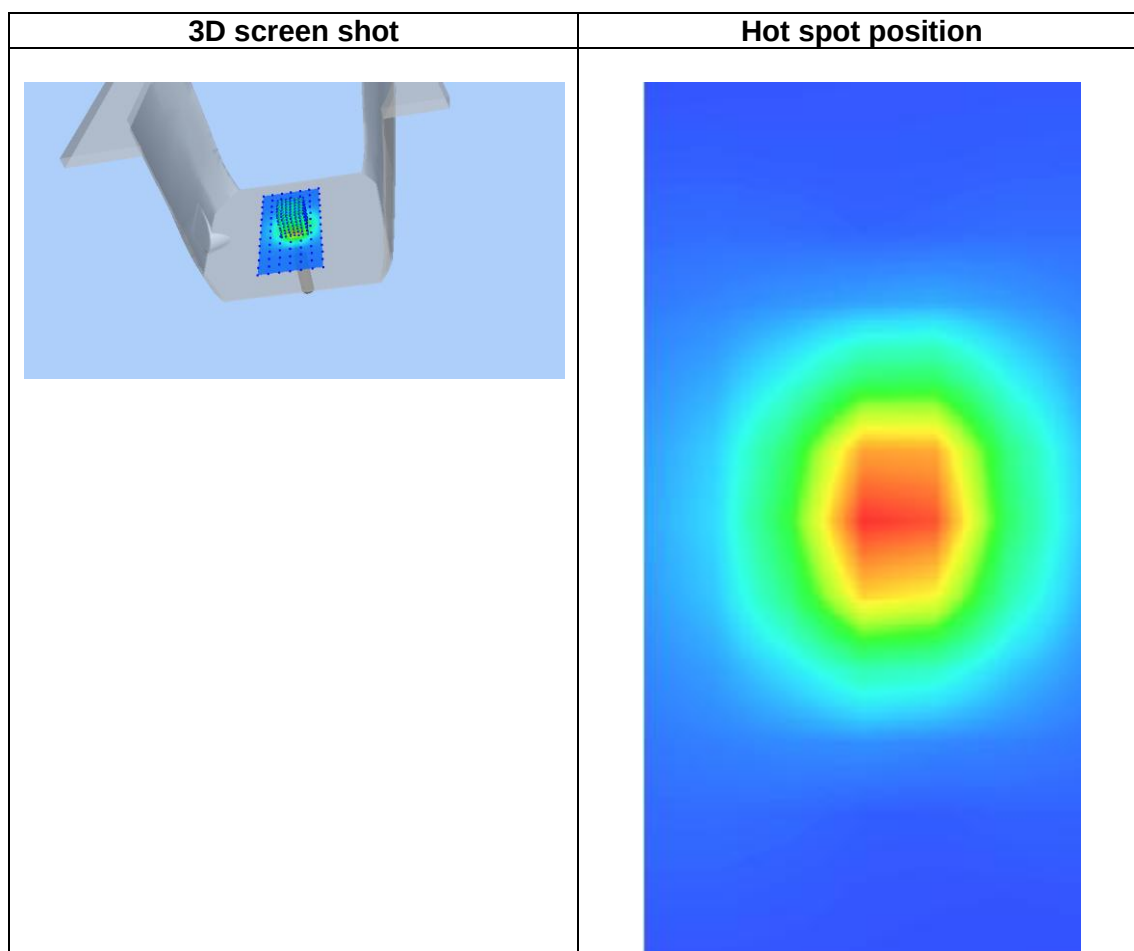
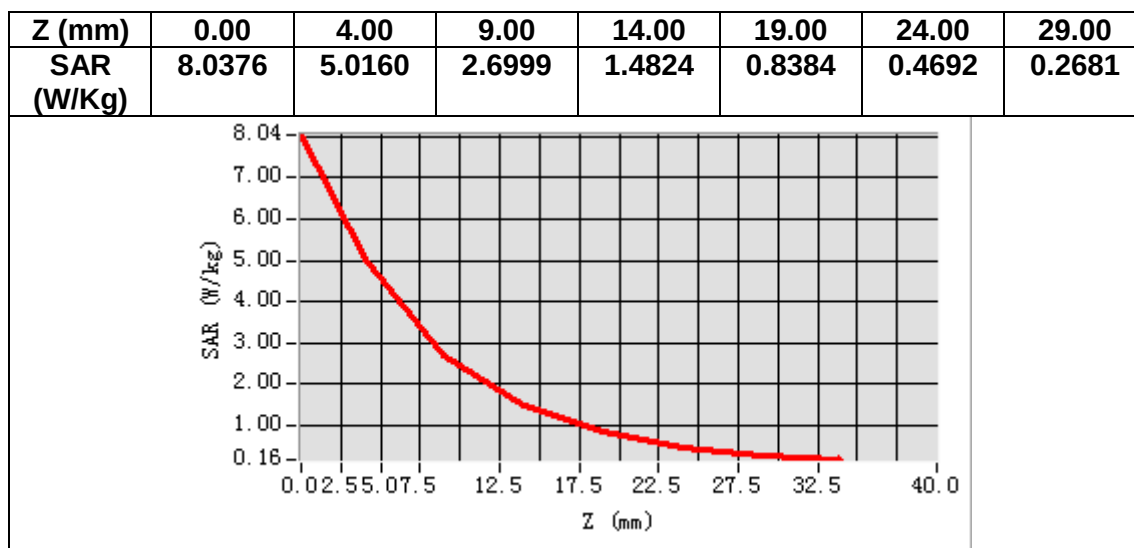
Frequency (MHz)	3700.000000
Relative permittivity (real part)	37.039241
Relative permittivity (imaginary part)	14.809466
Conductivity (S/m)	3.044168
Variation (%)	-2.010000



Maximum location: X=0.00, Y=1.00

SAR Peak: 8.14 W/kg

SAR 10g (W/Kg)	2.449846
SAR 1g (W/Kg)	6.269488



MEASUREMENT 10

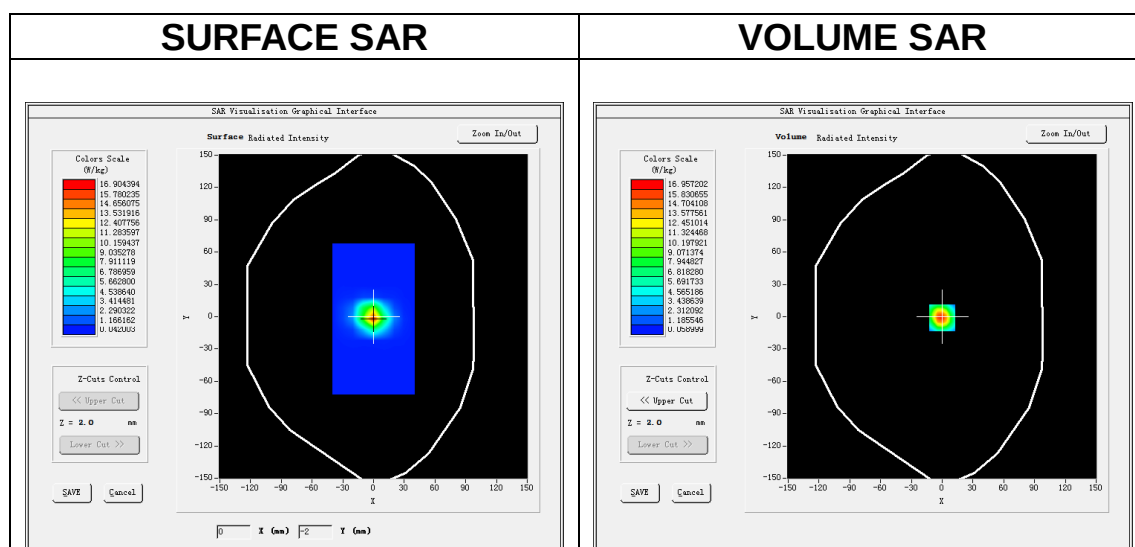
Date of measurement: 19/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW5200</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.89</u>

B. SAR Measurement Results

Frequency (MHz)	5200.000000
Relative permittivity (real part)	34.612485
Relative permittivity (imaginary part)	15.678512
Conductivity (S/m)	4.529348
Variation (%)	-1.780000

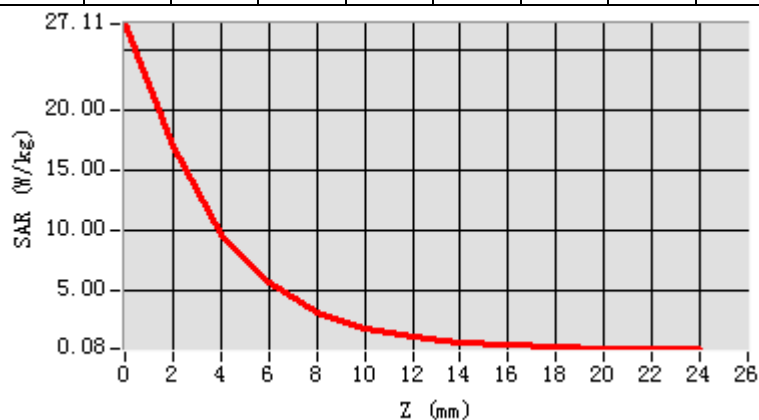


Maximum location: X=0.00, Y=-1.00

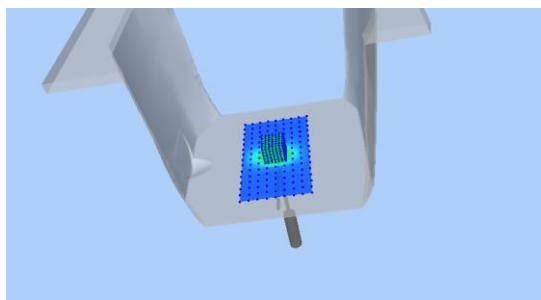
SAR Peak: 28.22 W/kg

SAR 10g (W/Kg)	3.355712
SAR 1g (W/Kg)	9.746747

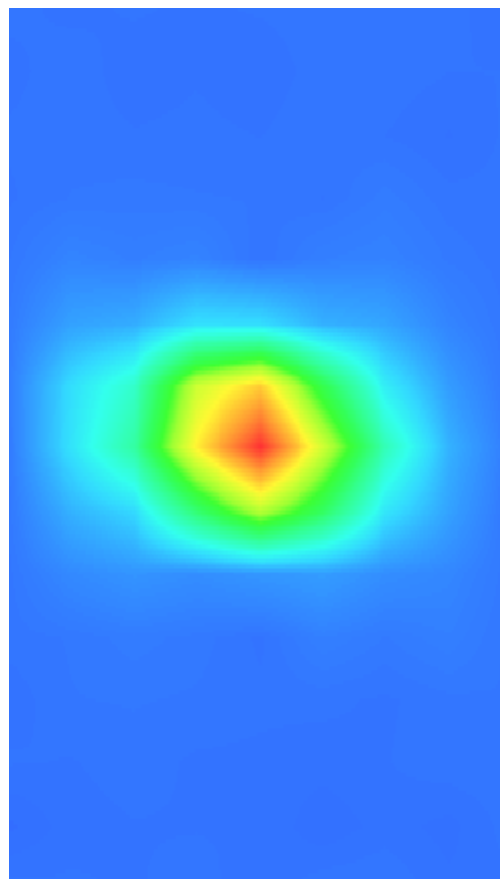
Z (m m)	0.00	2.00	4.00	6.00	8.00	10.0 0	12.0 0	14.0 0	16.0 0	18.0 0	20.0 0	22.0 0
SAR (W/ Kg)	27.1 143	16.9 572	9.55 30	5.52 60	3.13 80	1.78 27	1.02 74	0.60 75	0.35 86	0.23 44	0.16 54	0.12 08



3D screen shot



Hot spot position



MEASUREMENT 11

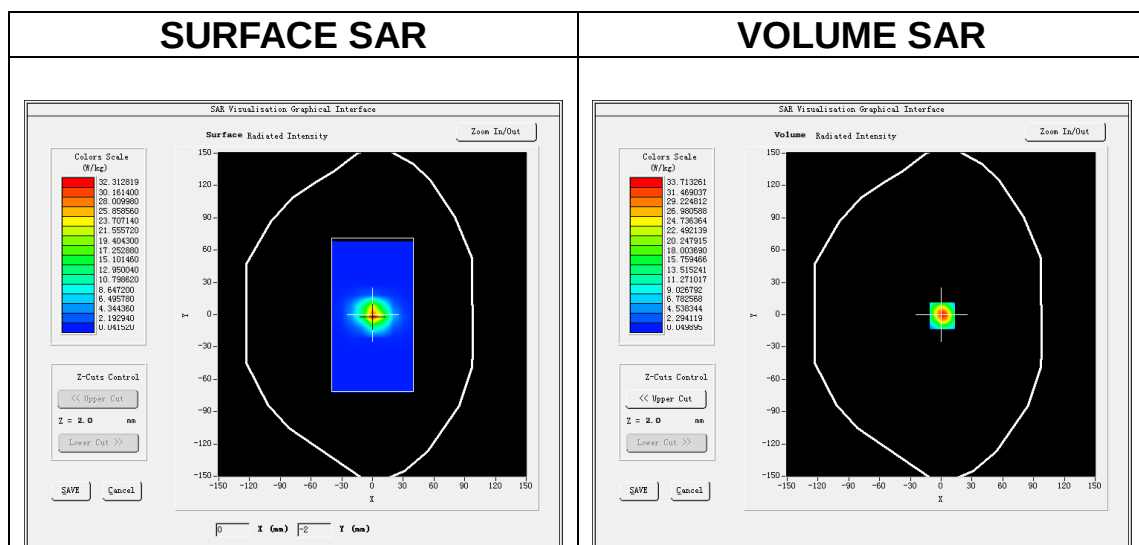
Date of measurement: 30/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW5800</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.90</u>

B. SAR Measurement Results

Frequency (MHz)	5800.000000
Relative permittivity (real part)	34.030204
Relative permittivity (imaginary part)	16.052683
Conductivity (S/m)	5.172531
Variation (%)	-0.760000

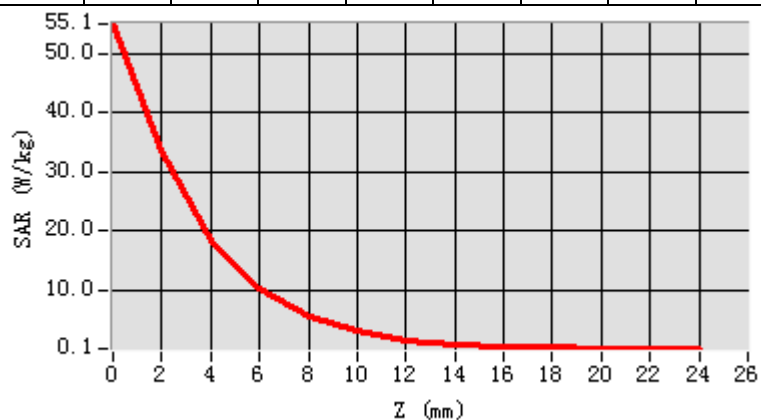


Maximum location: X=1.00, Y=-1.00

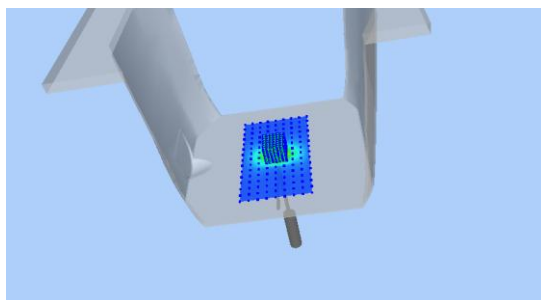
SAR Peak: 57.73 W/kg

SAR 10g (W/Kg)	6.542945
SAR 1g (W/Kg)	19.246353

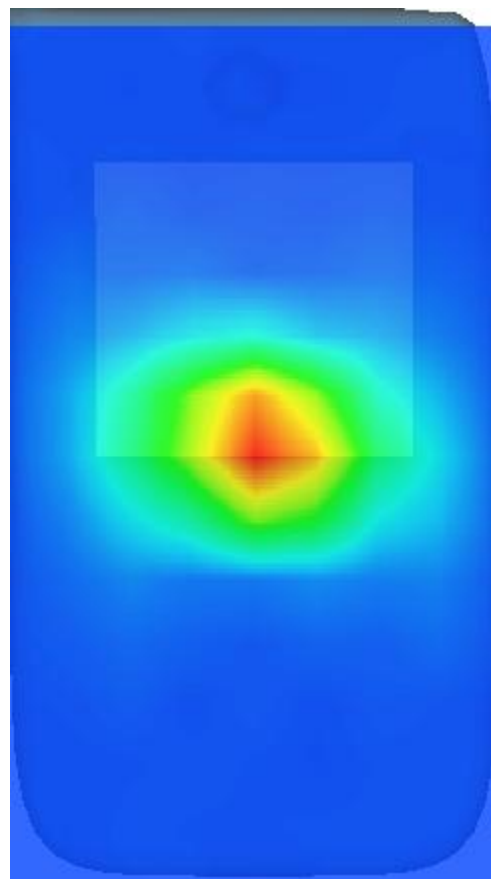
Z (m m)	0.00	2.00	4.00	6.00	8.00	10.0 0	12.0 0	14.0 0	16.0 0	18.0 0	20.0 0	22.0 0
SAR (W/ Kg)	55.0 870	33.7 133	18.2 706	10.1 046	5.45 54	2.99 03	1.61 25	0.89 17	0.51 75	0.29 85	0.19 33	0.12 67



3D screen shot



Hot spot position



12. Appendix C. Plots of High SAR Measurement

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MEASUREMENT 29 SA n78 Head
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MEASUREMENT 1

Date of measurement: 23/11/2024

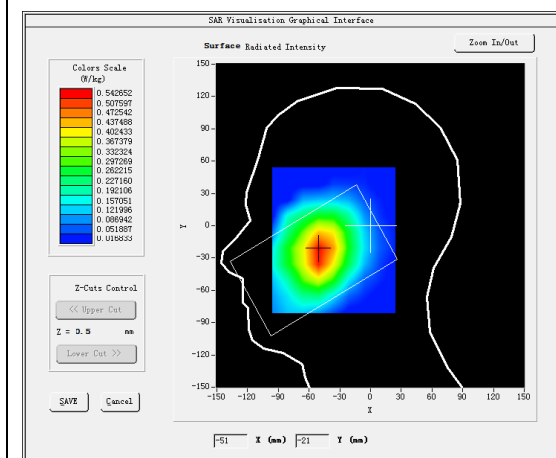
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>GSM900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 2.0)</u>
<u>ConvF</u>	<u>2.24</u>

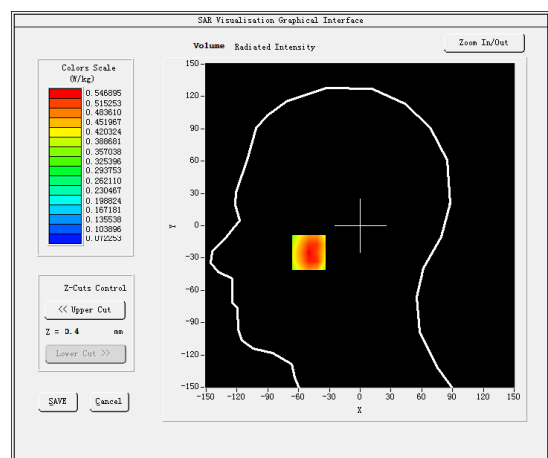
B. SAR Measurement Results

Frequency (MHz)	897.600000
Relative permittivity (real part)	41.495464
Relative permittivity (imaginary part)	20.018702
Conductivity (S/m)	0.998266
Variation (%)	1.940000

SURFACE SAR



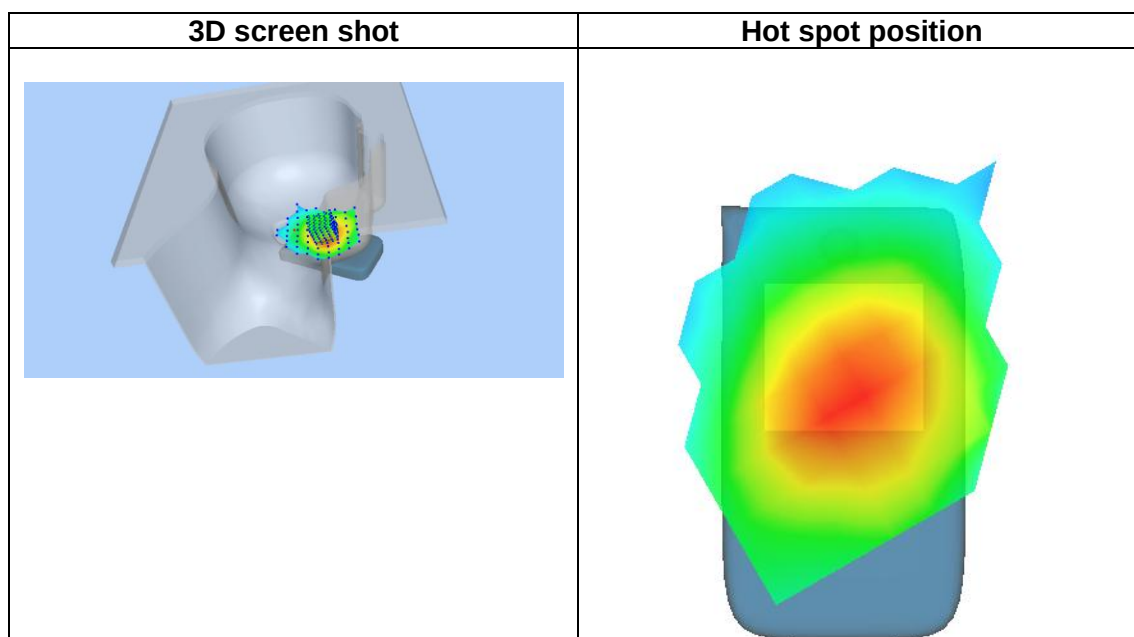
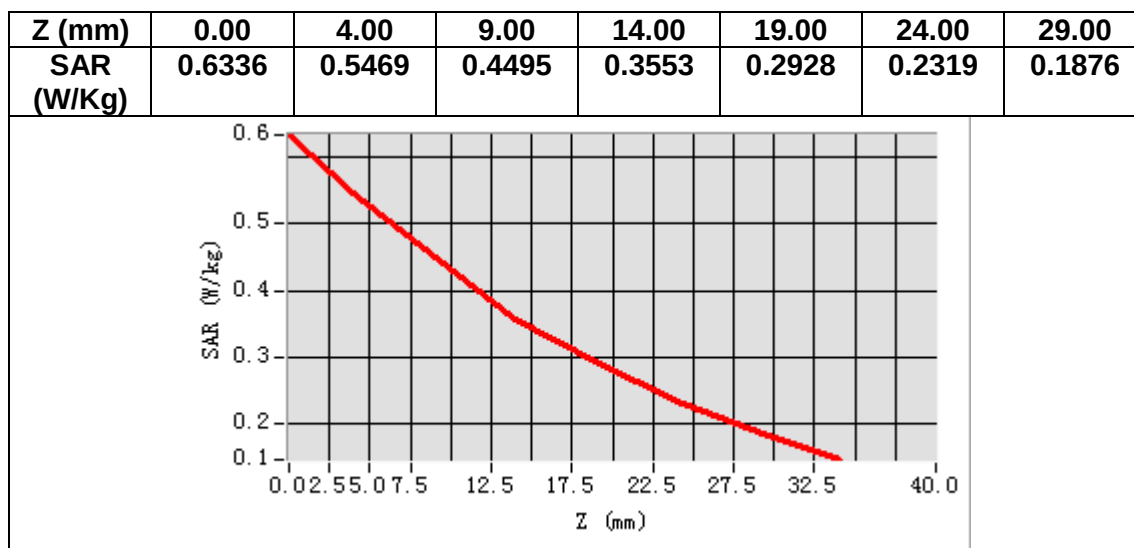
VOLUME SAR



Maximum location: X=-50.00, Y=-25.00

SAR Peak: 0.70 W/kg

SAR 10g (W/Kg)	0.404092
SAR 1g (W/Kg)	0.544598



MEASUREMENT 2

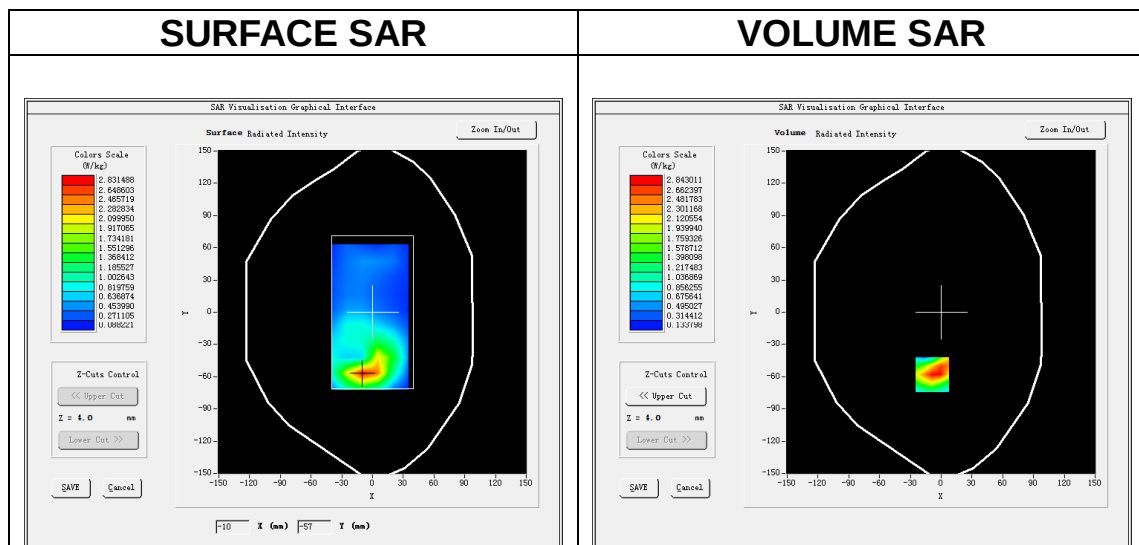
Date of measurement: 23/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>GSM900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 2.0)</u>
<u>ConvF</u>	<u>2.24</u>

B. SAR Measurement Results

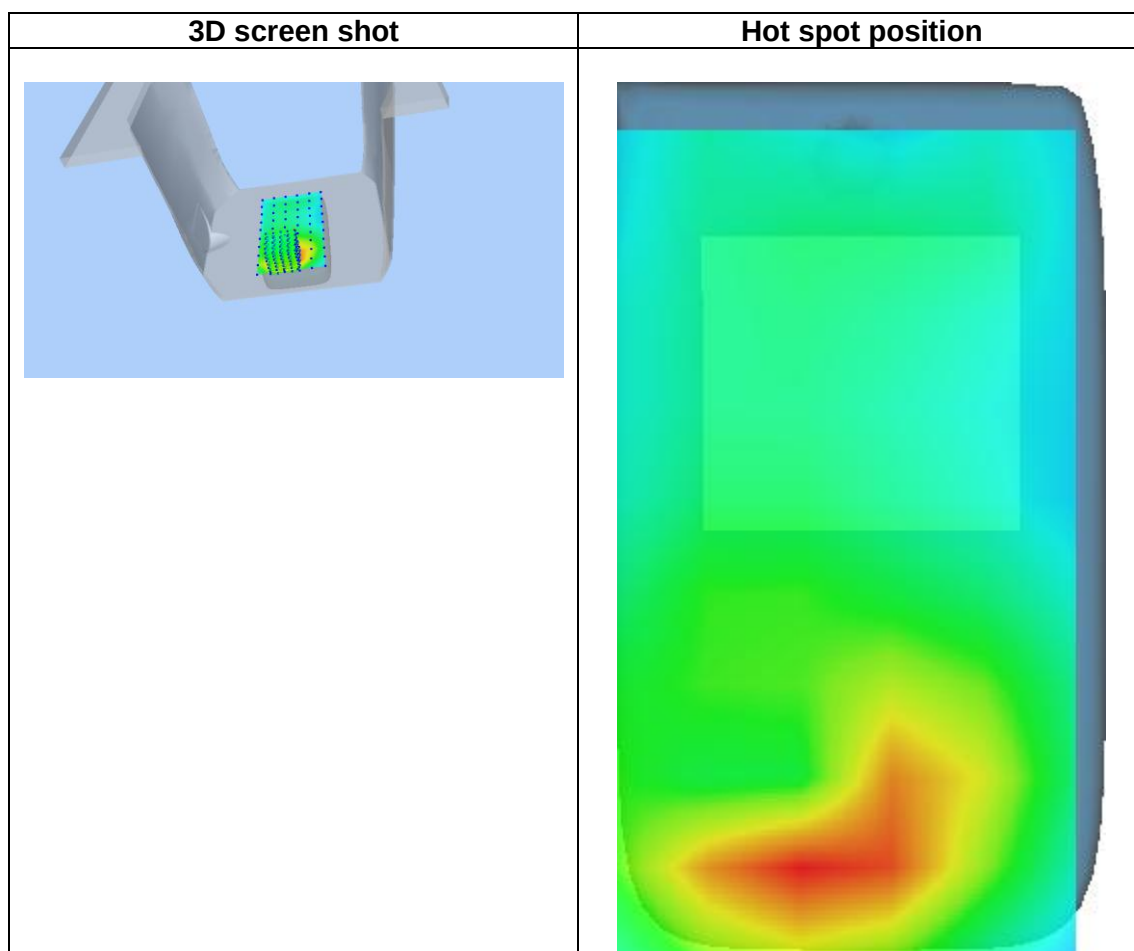
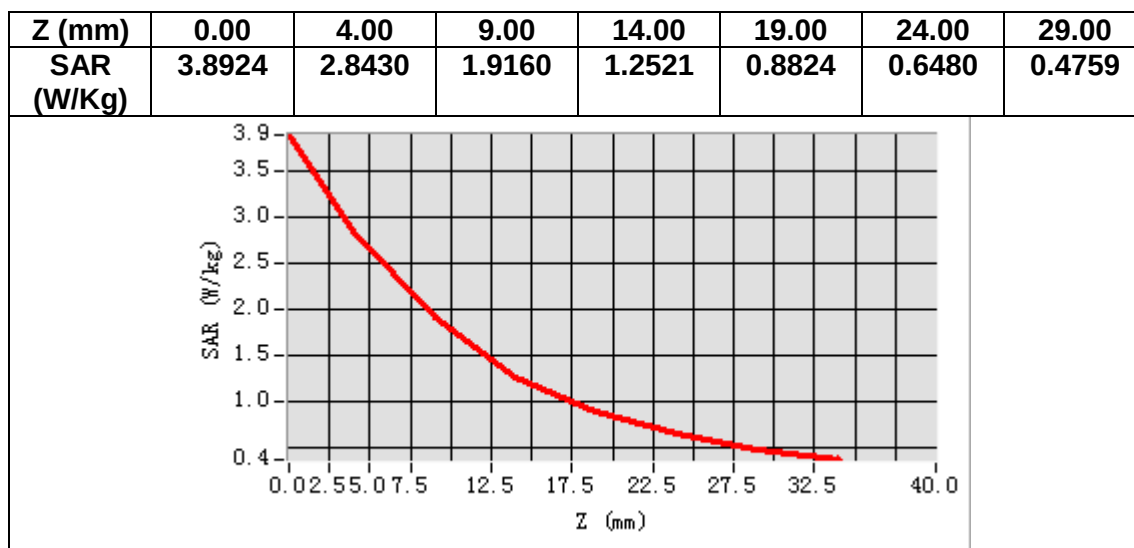
Frequency (MHz)	897.600000
Relative permittivity (real part)	41.495464
Relative permittivity (imaginary part)	20.018702
Conductivity (S/m)	0.998266
Variation (%)	0.940000



Maximum location: X=-9.00, Y=-58.00

SAR Peak: 4.37 W/kg

SAR 10g (W/Kg)	1.661151
SAR 1g (W/Kg)	2.823172



MEASUREMENT 3

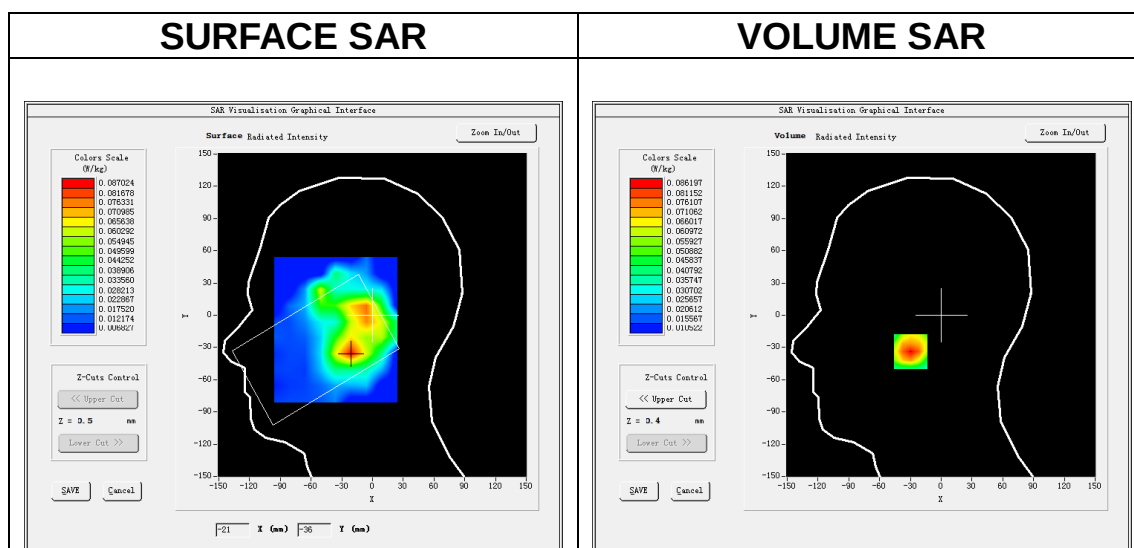
Date of measurement: 21/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>GSM1800</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 2.0)</u>
<u>ConvF</u>	<u>2.51</u>

B. SAR Measurement Results

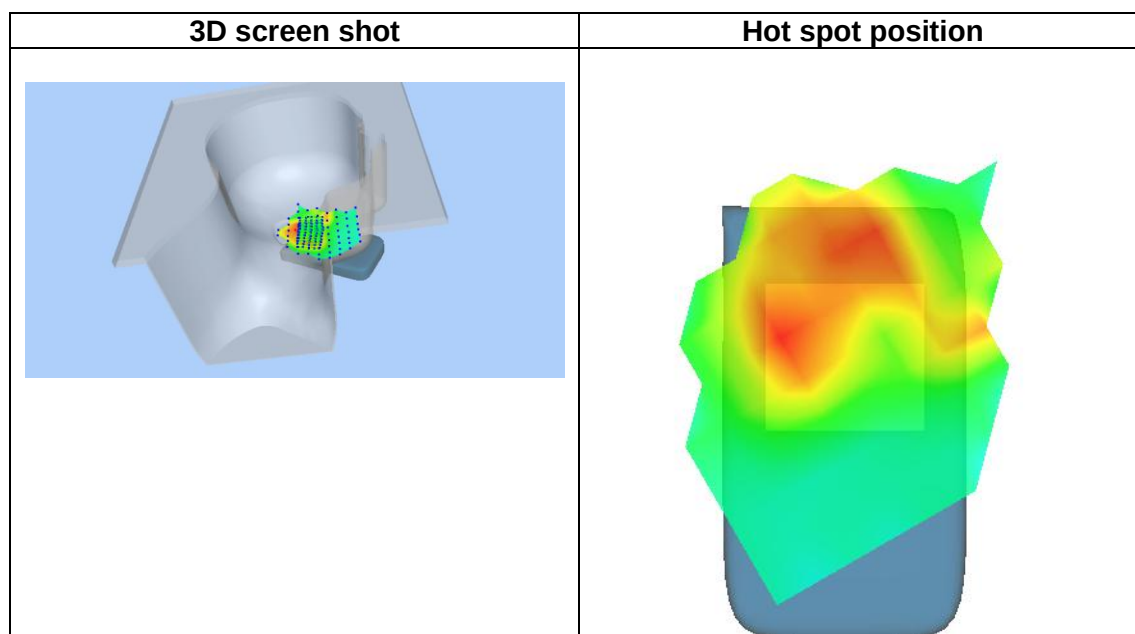
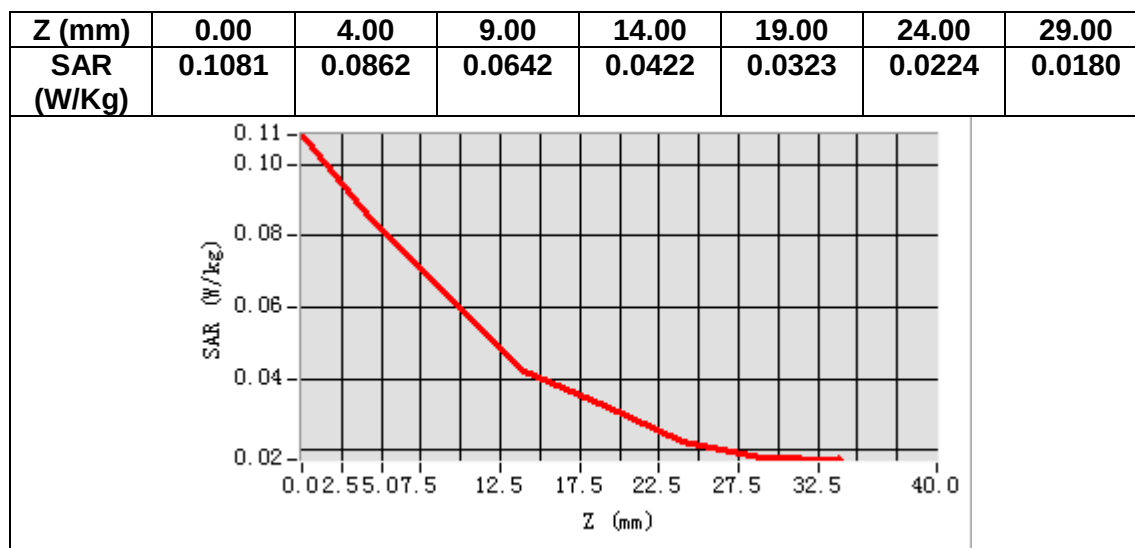
Frequency (MHz)	1747.400000
Relative permittivity (real part)	39.432163
Relative permittivity (imaginary part)	13.832885
Conductivity (S/m)	1.342866
Variation (%)	2.410000



Maximum location: X=-21.00, Y=-34.00

SAR Peak: 0.11 W/kg

SAR 10g (W/Kg)	0.052400
SAR 1g (W/Kg)	0.081309



MEASUREMENT 4

Date of measurement: 21/11/2024

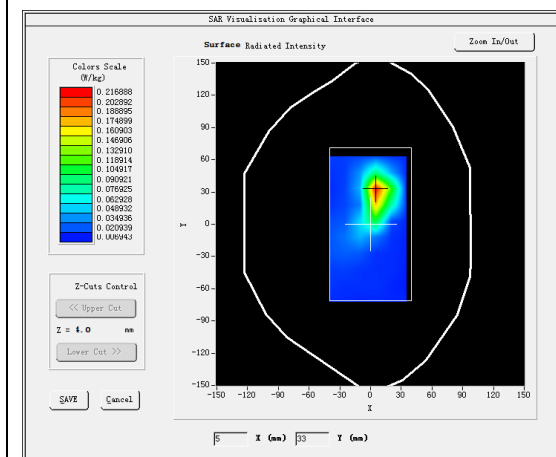
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>GSM1800</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 2.0)</u>
<u>ConvF</u>	<u>2.51</u>

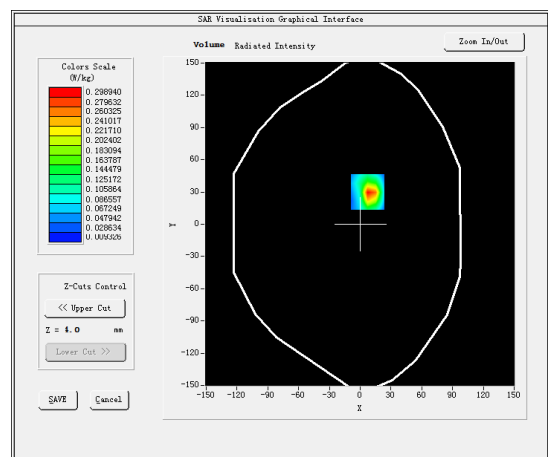
B. SAR Measurement Results

Frequency (MHz)	1747.400000
Relative permittivity (real part)	39.432163
Relative permittivity (imaginary part)	13.832885
Conductivity (S/m)	1.342866
Variation (%)	-1.080000

SURFACE SAR



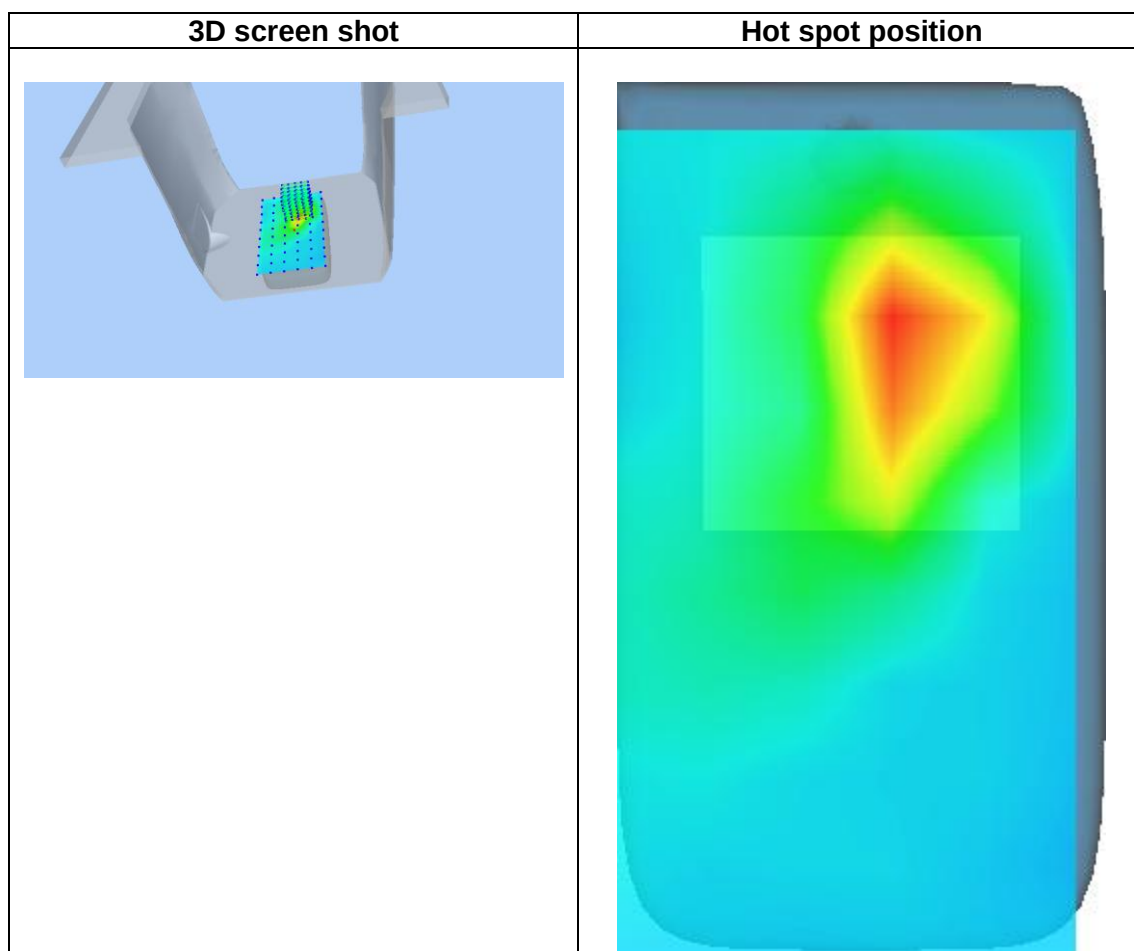
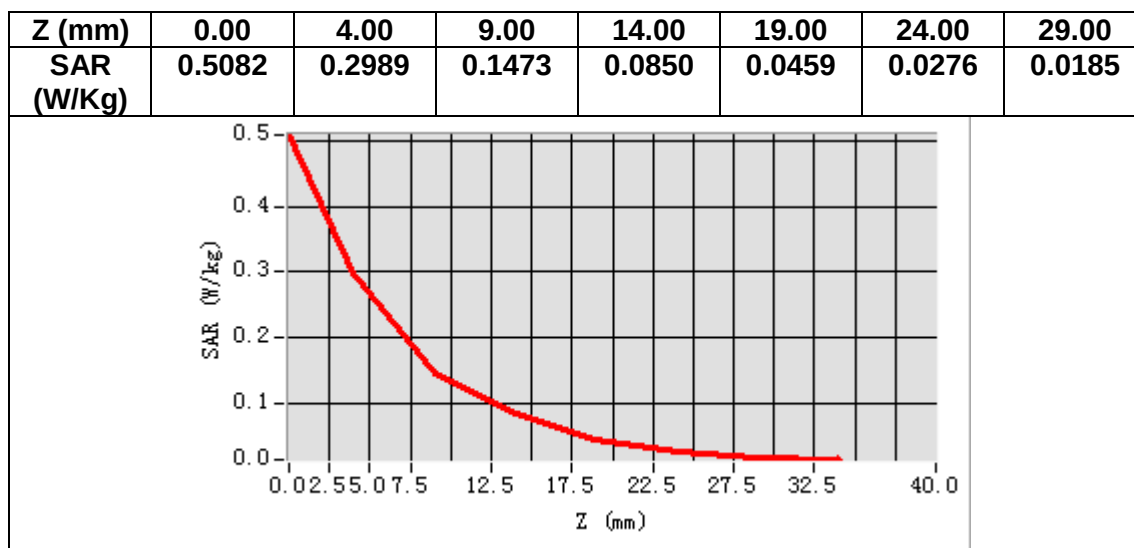
VOLUME SAR



Maximum location: X=7.00, Y=30.00

SAR Peak: 0.56 W/kg

SAR 10g (W/Kg)	0.121937
SAR 1g (W/Kg)	0.287488



MEASUREMENT 5

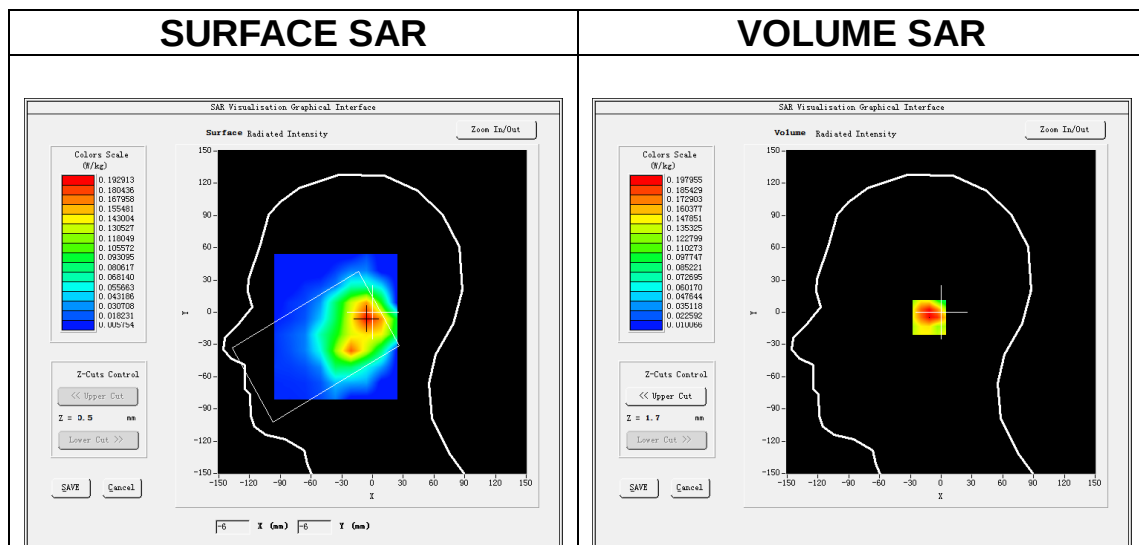
Date of measurement: 22/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>Band1_ UMTS</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.64</u>

B. SAR Measurement Results

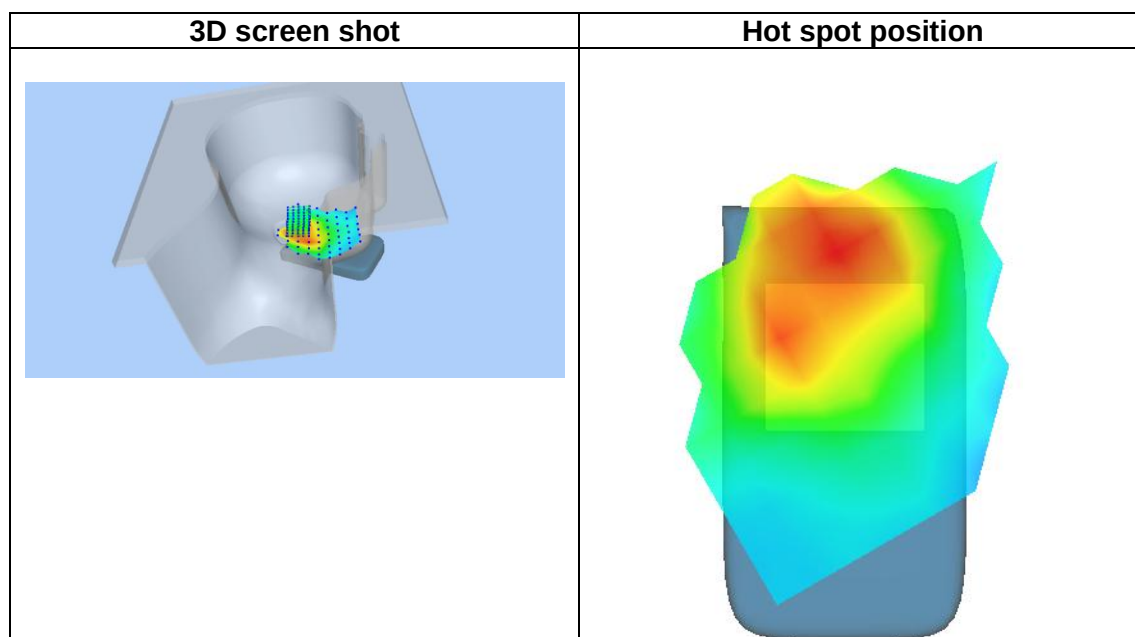
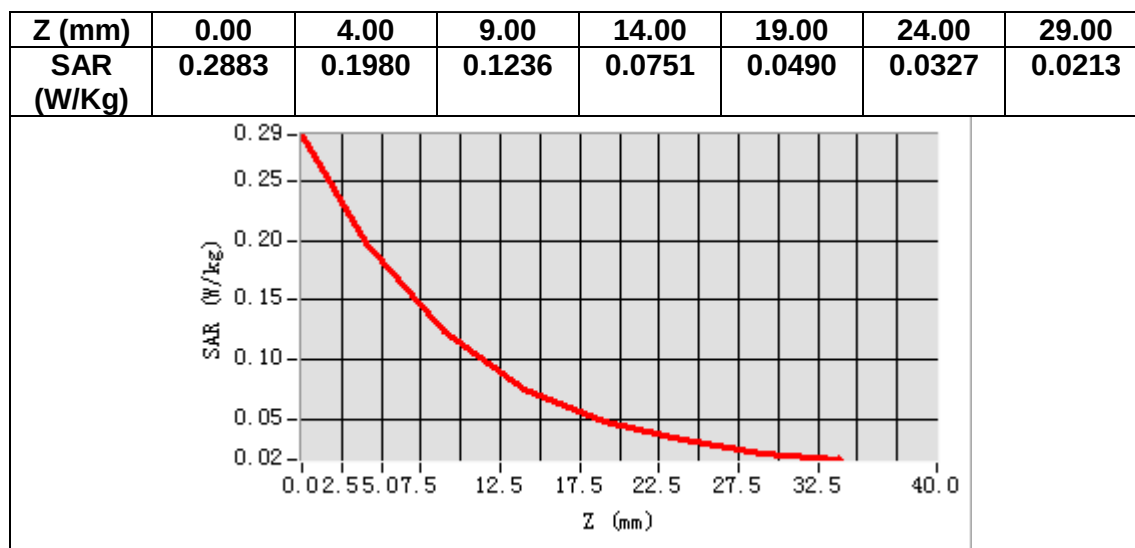
Frequency (MHz)	1950.000000
Relative permittivity (real part)	38.843918
Relative permittivity (imaginary part)	12.897650
Conductivity (S/m)	1.397245
Variation (%)	-0.220000



Maximum location: X=-5.00, Y=-5.00

SAR Peak: 0.31 W/kg

SAR 10g (W/Kg)	0.112593
SAR 1g (W/Kg)	0.195502



MEASUREMENT 6

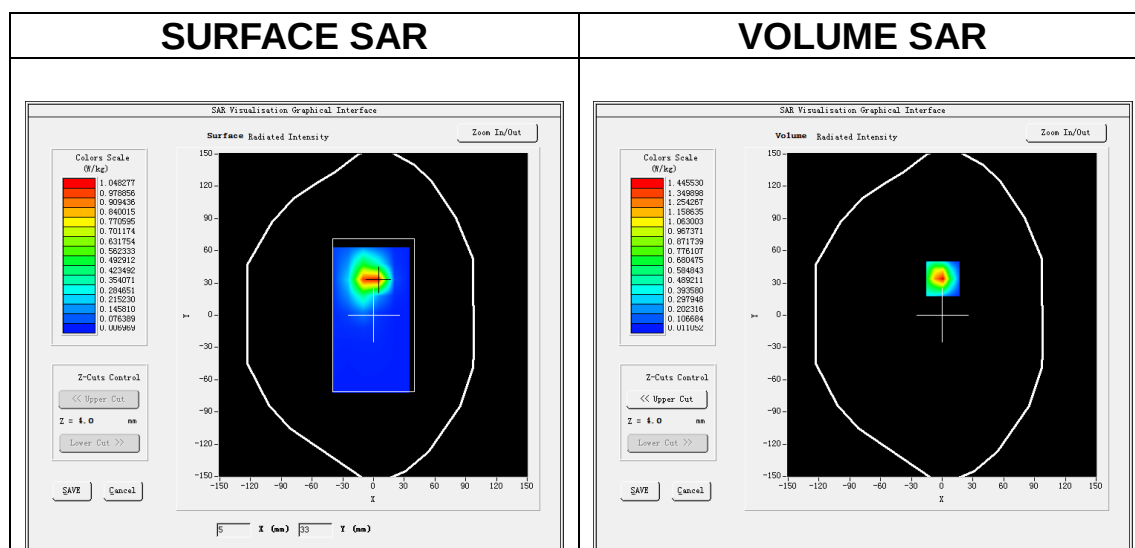
Date of measurement: 22/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>Band1_ UMTS</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.64</u>

B. SAR Measurement Results

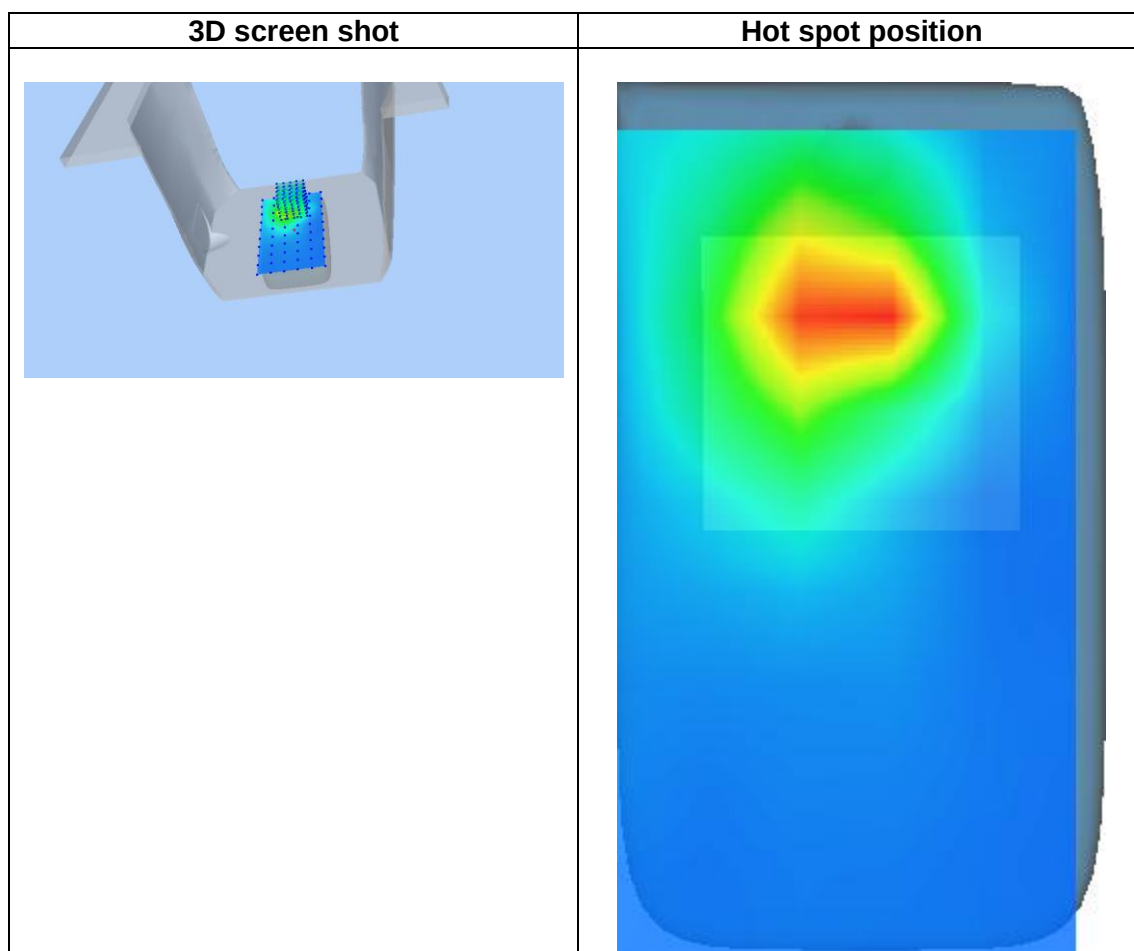
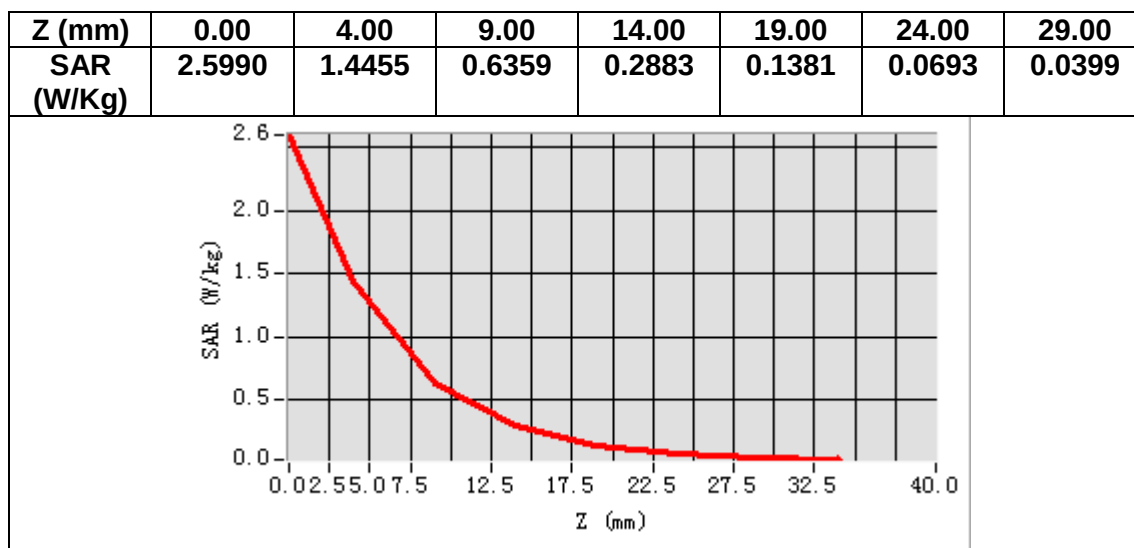
Frequency (MHz)	1950.000000
Relative permittivity (real part)	38.843918
Relative permittivity (imaginary part)	12.897650
Conductivity (S/m)	1.397245
Variation (%)	-3.880000



Maximum location: X=1.00, Y=34.00

SAR Peak: 2.67 W/kg

SAR 10g (W/Kg)	0.543121
SAR 1g (W/Kg)	1.347500



MEASUREMENT 7

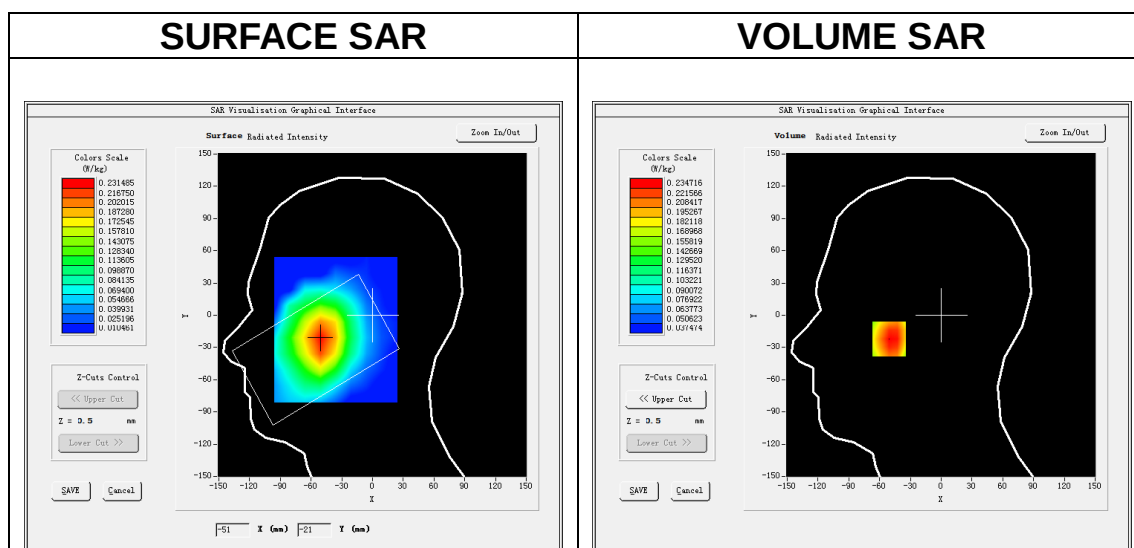
Date of measurement: 23/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>Band8_WCDMA900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.24</u>

B. SAR Measurement Results

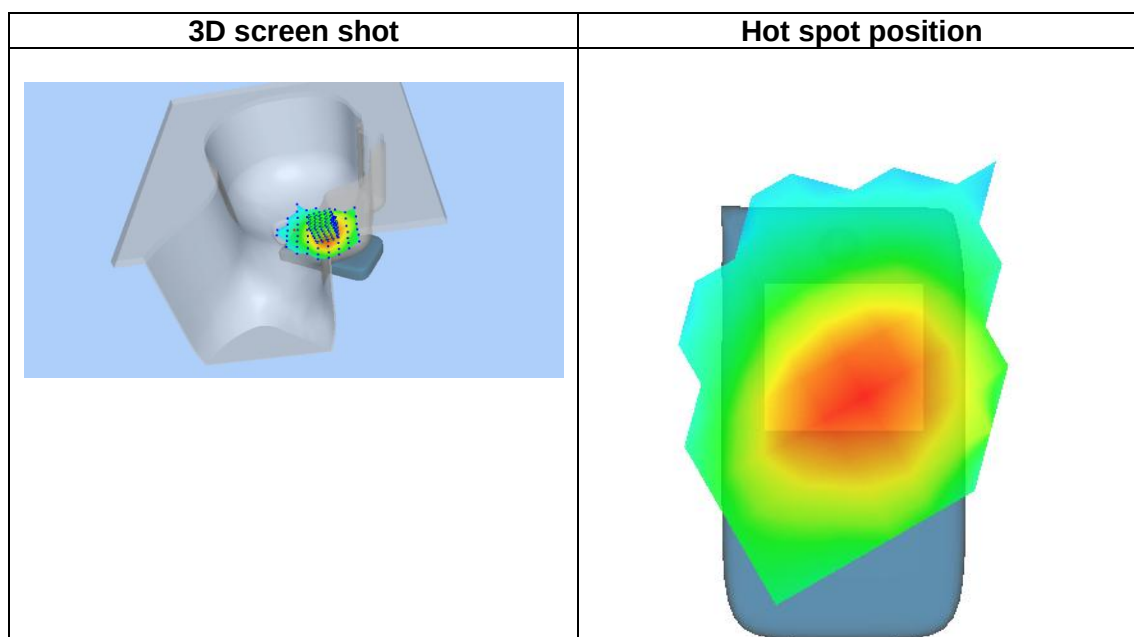
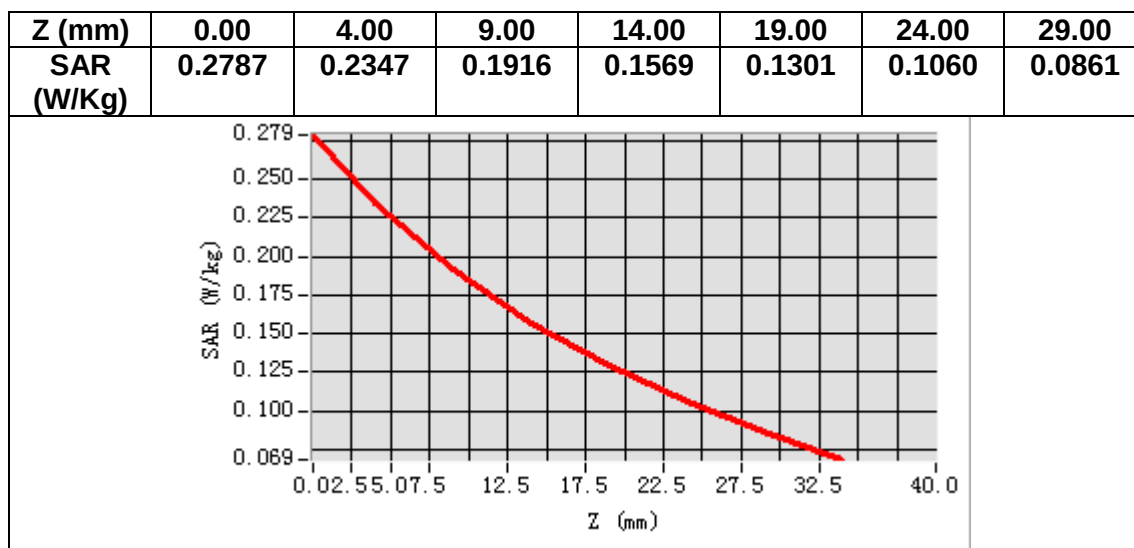
Frequency (MHz)	897.600000
Relative permittivity (real part)	41.495464
Relative permittivity (imaginary part)	20.018702
Conductivity (S/m)	0.998266
Variation (%)	-1.510000



Maximum location: X=-51.00, Y=-22.00

SAR Peak: 0.29 W/kg

SAR 10g (W/Kg)	0.176851
SAR 1g (W/Kg)	0.235727



MEASUREMENT 8

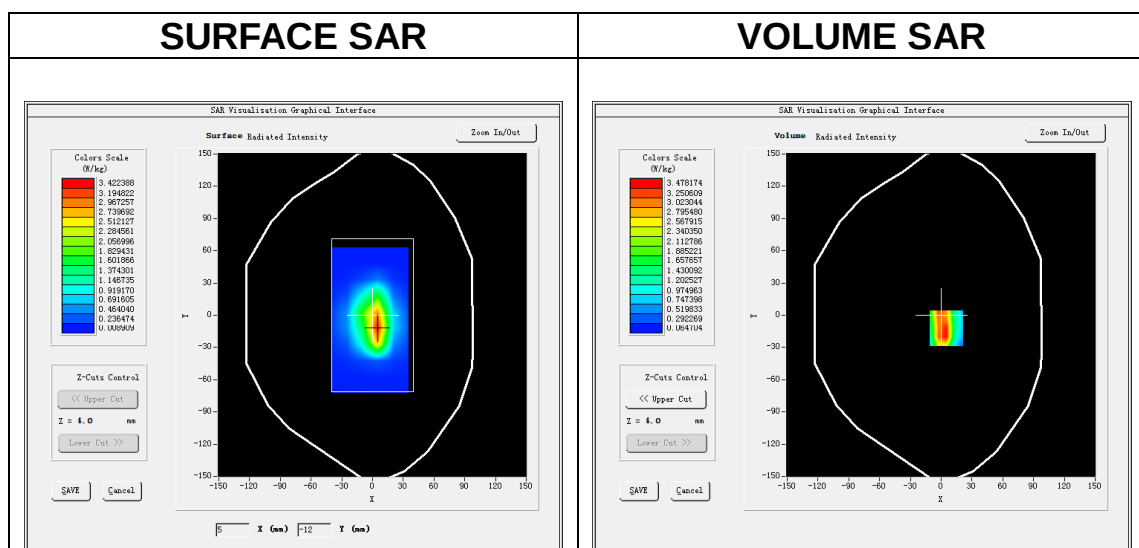
Date of measurement: 23/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>Band8_WCDMA900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.24</u>

B. SAR Measurement Results

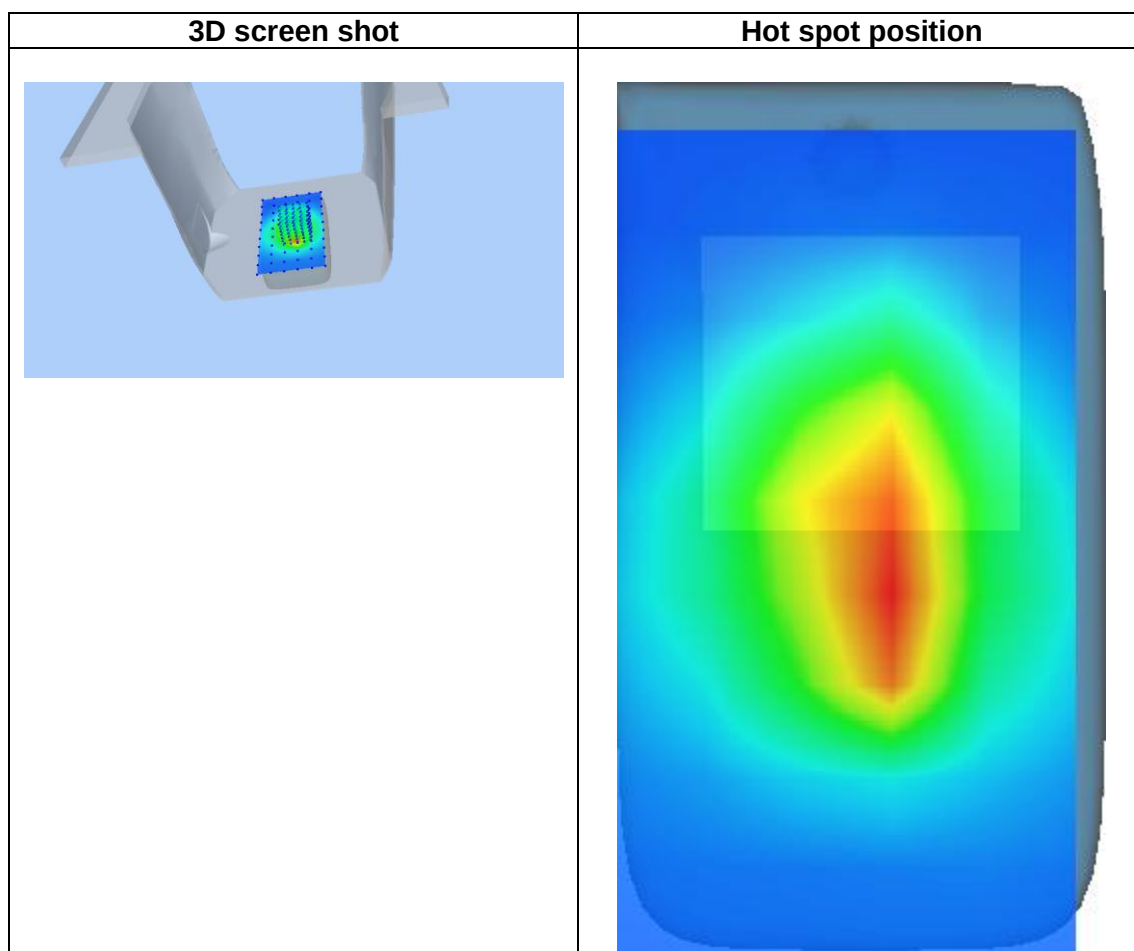
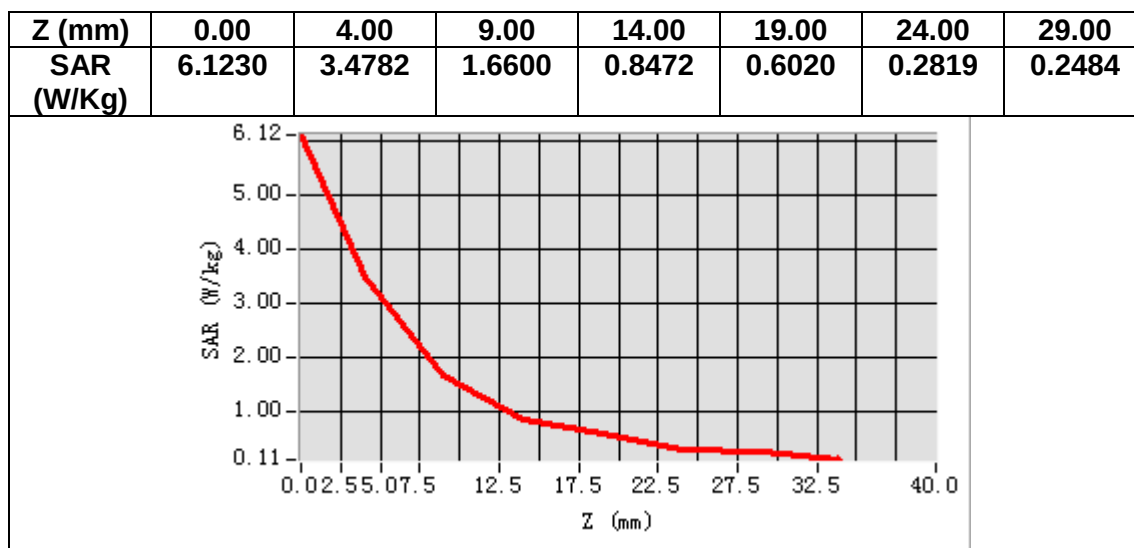
Frequency (MHz)	897.600000
Relative permittivity (real part)	41.495464
Relative permittivity (imaginary part)	20.018702
Conductivity (S/m)	0.998266
Variation (%)	0.250000



Maximum location: X=5.00, Y=-12.00

SAR Peak: 6.69 W/kg

SAR 10g (W/Kg)	1.650954
SAR 1g (W/Kg)	3.578931



MEASUREMENT 9

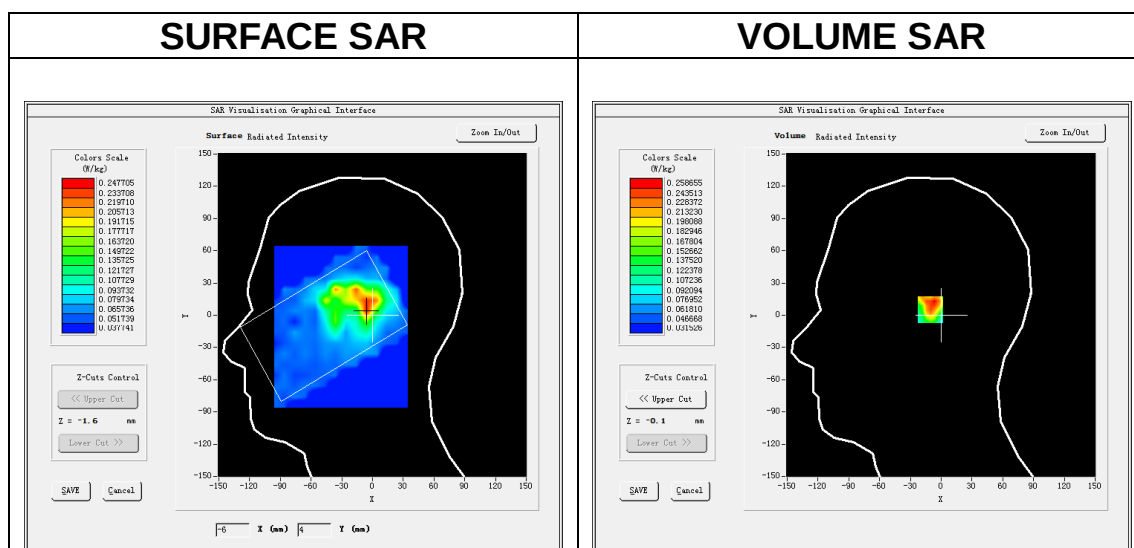
Date of measurement: 19/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>IEEE 802.11ax U-NII</u>
<u>Channels</u>	<u>Low</u>
<u>Signal</u>	<u>IEEE802.11ax (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.89</u>

B. SAR Measurement Results

Frequency (MHz)	5190.000000
Relative permittivity (real part)	34.526783
Relative permittivity (imaginary part)	15.484935
Conductivity (S/m)	4.464822
Variation (%)	-2.030000

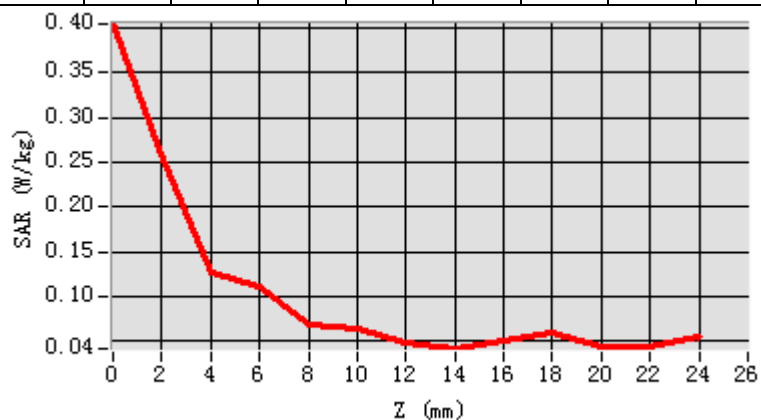


Maximum location: X=-6.00, Y=5.00

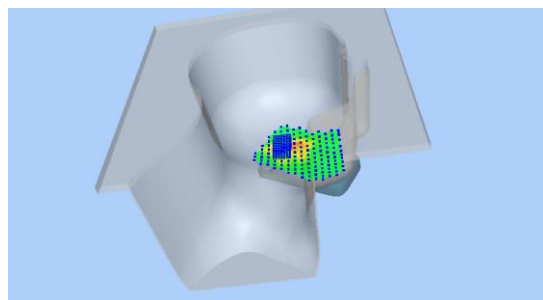
SAR Peak: 0.62 W/kg

SAR 10g (W/Kg)	0.128158
SAR 1g (W/Kg)	0.253638

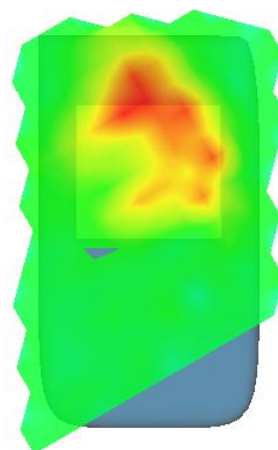
Z (m m)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
SAR (W/ Kg)	0.40 49	0.25 87	0.12 60	0.11 13	0.06 89	0.06 42	0.04 84	0.04 17	0.04 98	0.06 01	0.04 49	0.04 34



3D screen shot



Hot spot position



MEASUREMENT 10

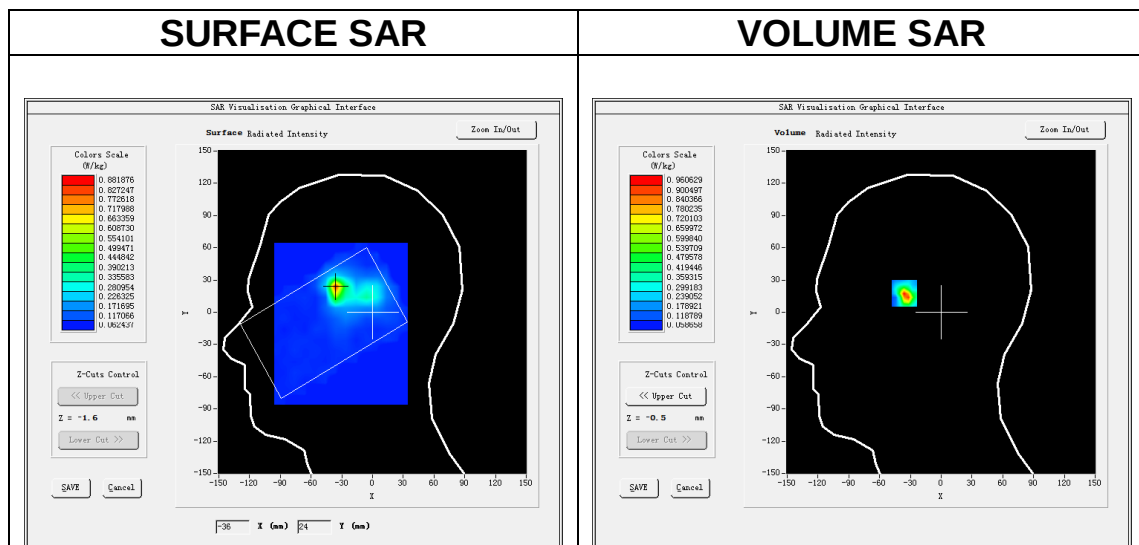
Date of measurement: 30/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>IEEE 802.11ac U-NII</u>
<u>Channels</u>	<u>Low</u>
<u>Signal</u>	<u>IEEE802.11ac (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.90</u>

B. SAR Measurement Results

Frequency (MHz)	5755.000000
Relative permittivity (real part)	34.206982
Relative permittivity (imaginary part)	16.034456
Conductivity (S/m)	5.126248
Variation (%)	-3.710000

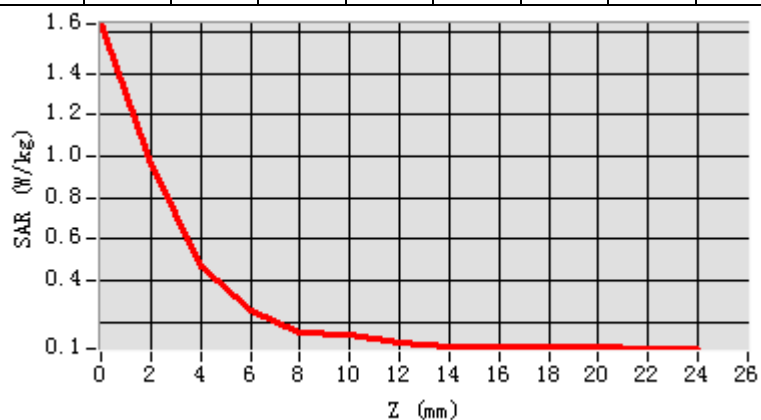


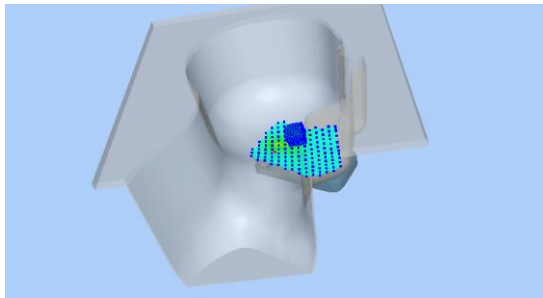
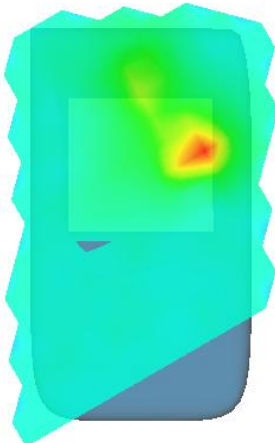
Maximum location: X=-36.00, Y=23.00

SAR Peak: 2.64 W/kg

SAR 10g (W/Kg)	0.270514
SAR 1g (W/Kg)	0.829304

Z (m m)	0.00	2.00	4.00	6.00	8.00	10.0 0	12.0 0	14.0 0	16.0 0	18.0 0	20.0 0	22.0 0
SAR (W/ Kg)	1.63 79	0.96 06	0.47 15	0.25 66	0.15 14	0.13 48	0.09 68	0.08 00	0.07 83	0.07 82	0.07 66	0.07 40



3D screen shot	Hot spot position
	

MEASUREMENT 11

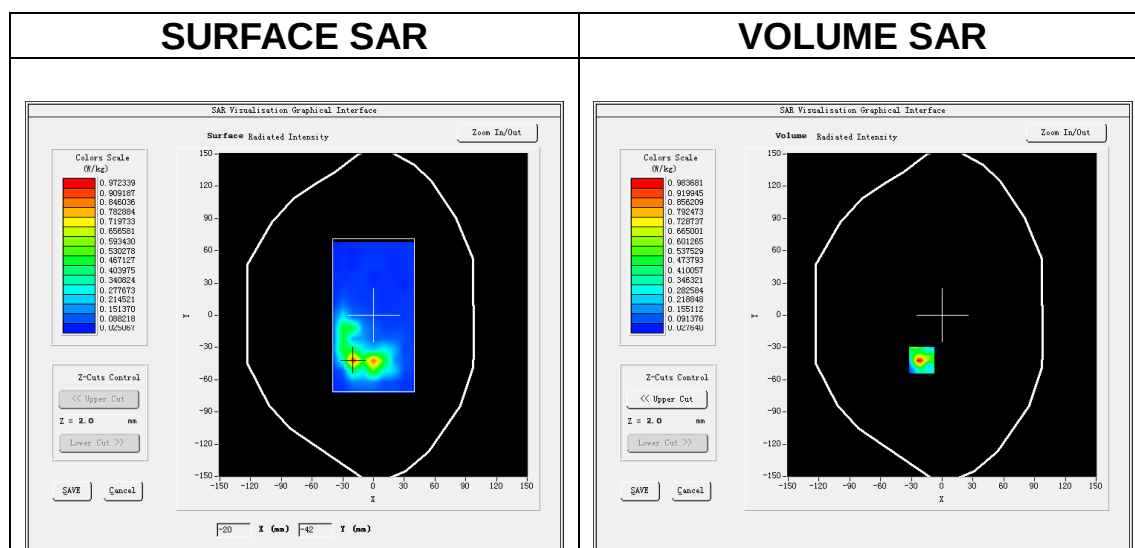
Date of measurement: 19/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11ax U-NII</u>
<u>Channels</u>	<u>Low</u>
<u>Signal</u>	<u>IEEE802.11ax (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.89</u>

B. SAR Measurement Results

Frequency (MHz)	5190.000000
Relative permittivity (real part)	34.526783
Relative permittivity (imaginary part)	15.484935
Conductivity (S/m)	4.464822
Variation (%)	4.150000

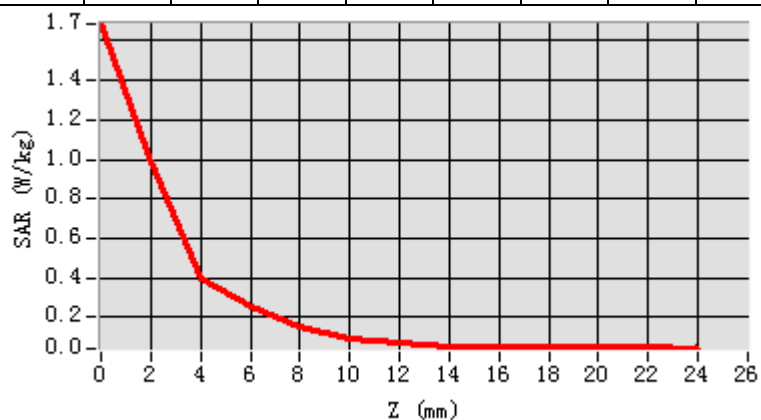


Maximum location: X=-20.00, Y=-42.00

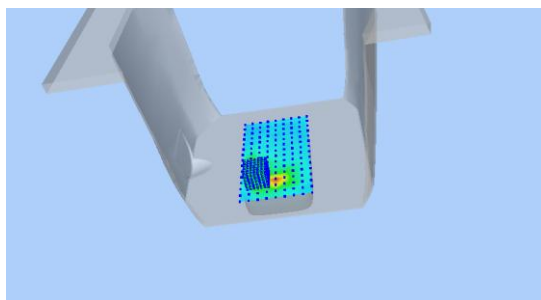
SAR Peak: 1.84 W/kg

SAR 10g (W/Kg)	0.173989
SAR 1g (W/Kg)	0.505733

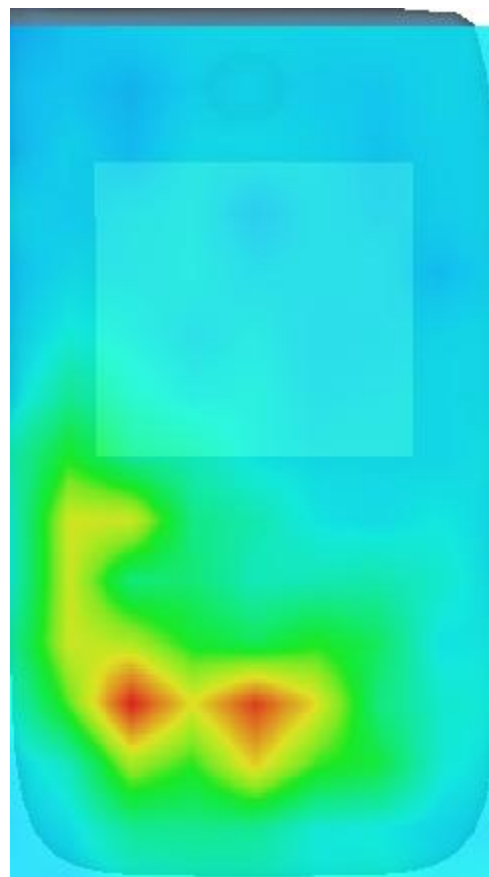
Z (m m)	0.00	2.00	4.00	6.00	8.00	10.0 0	12.0 0	14.0 0	16.0 0	18.0 0	20.0 0	22.0 0
SAR (W/ Kg)	1.68 63	0.98 37	0.39 74	0.25 24	0.14 93	0.09 13	0.07 20	0.05 12	0.05 42	0.04 89	0.04 92	0.05 19



3D screen shot



Hot spot position



MEASUREMENT 12

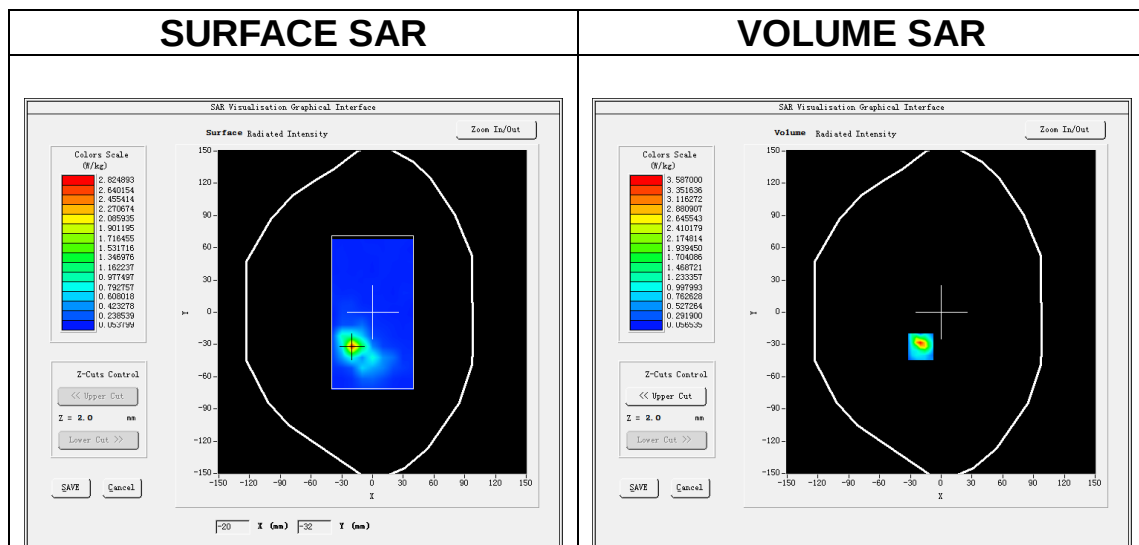
Date of measurement: 30/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11ac U-NII</u>
<u>Channels</u>	<u>Low</u>
<u>Signal</u>	<u>IEEE802.11ac (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.90</u>

B. SAR Measurement Results

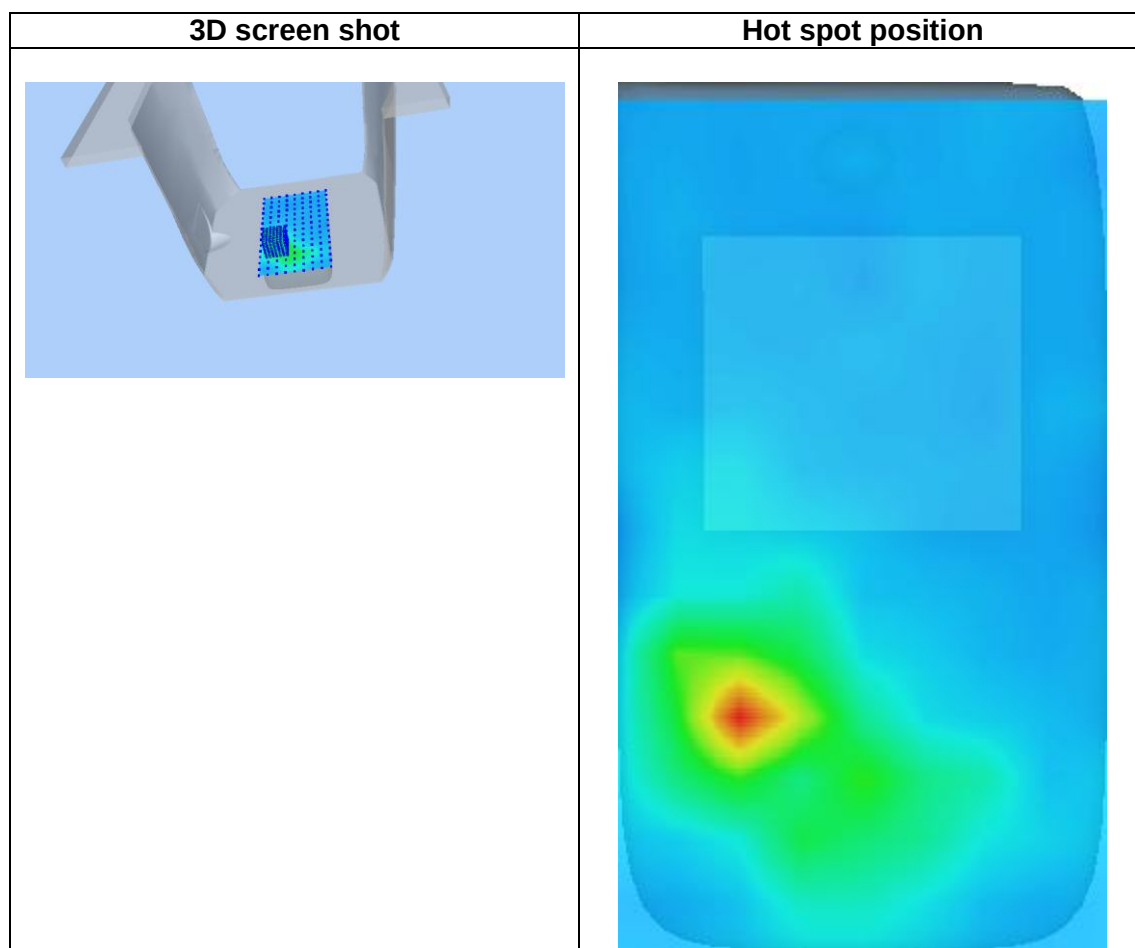
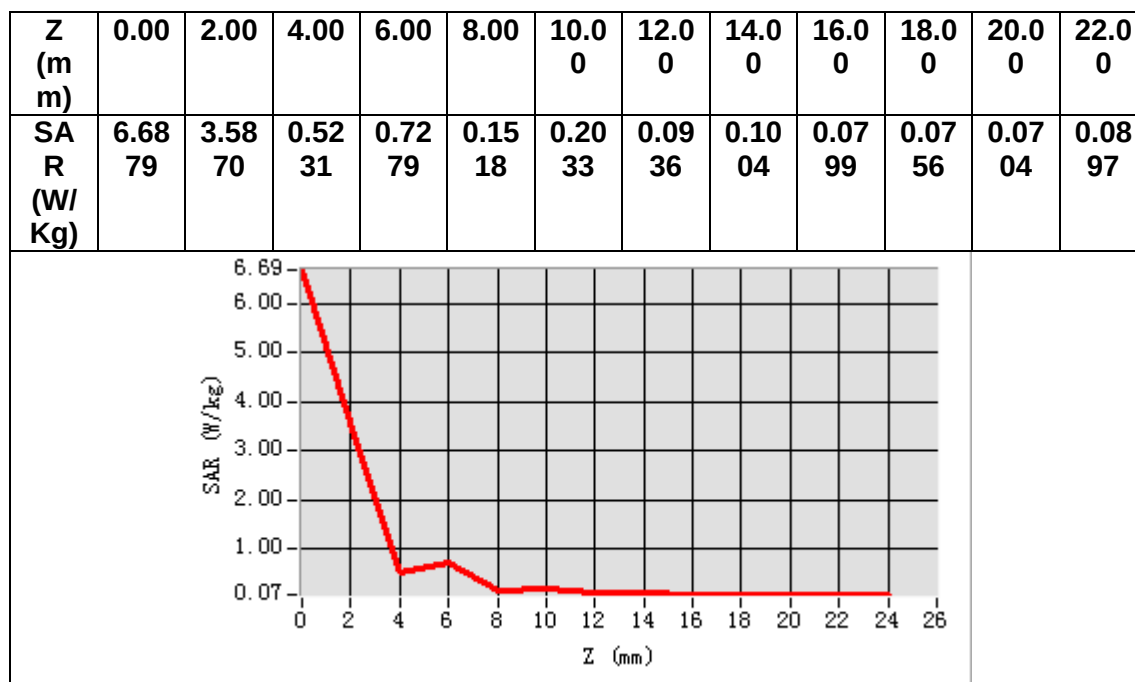
Frequency (MHz)	5755.000000
Relative permittivity (real part)	34.206982
Relative permittivity (imaginary part)	16.034456
Conductivity (S/m)	5.126248
Variation (%)	2.890000



Maximum location: X=-20.00, Y=-32.00

SAR Peak: 6.82 W/kg

SAR 10g (W/Kg)	0.492389
SAR 1g (W/Kg)	1.688904



MEASUREMENT 13

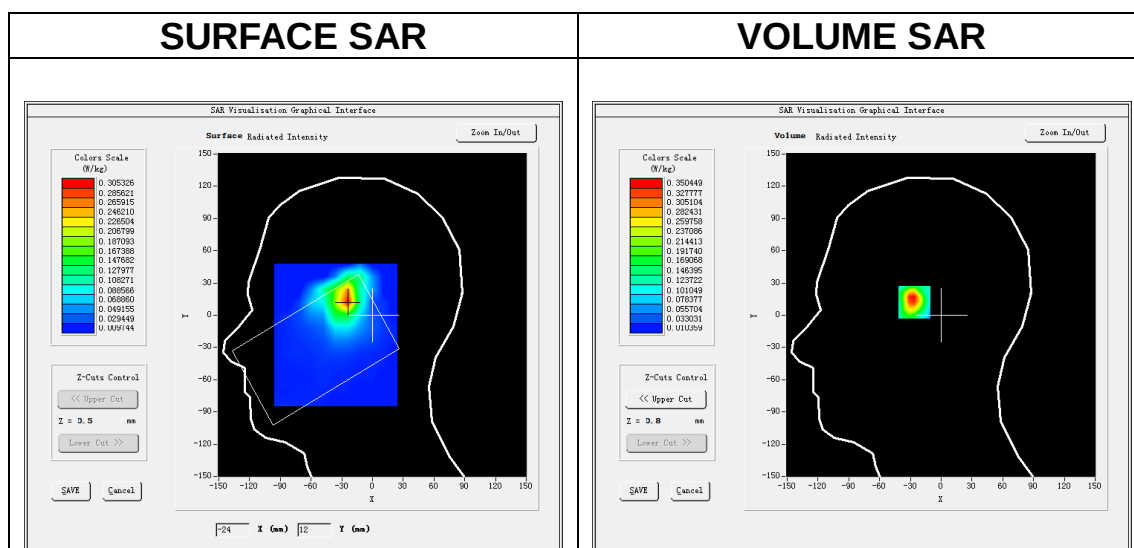
Date of measurement: 18/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>IEEE 802.11b ISM</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>IEEE802.11b (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.74</u>

B. SAR Measurement Results

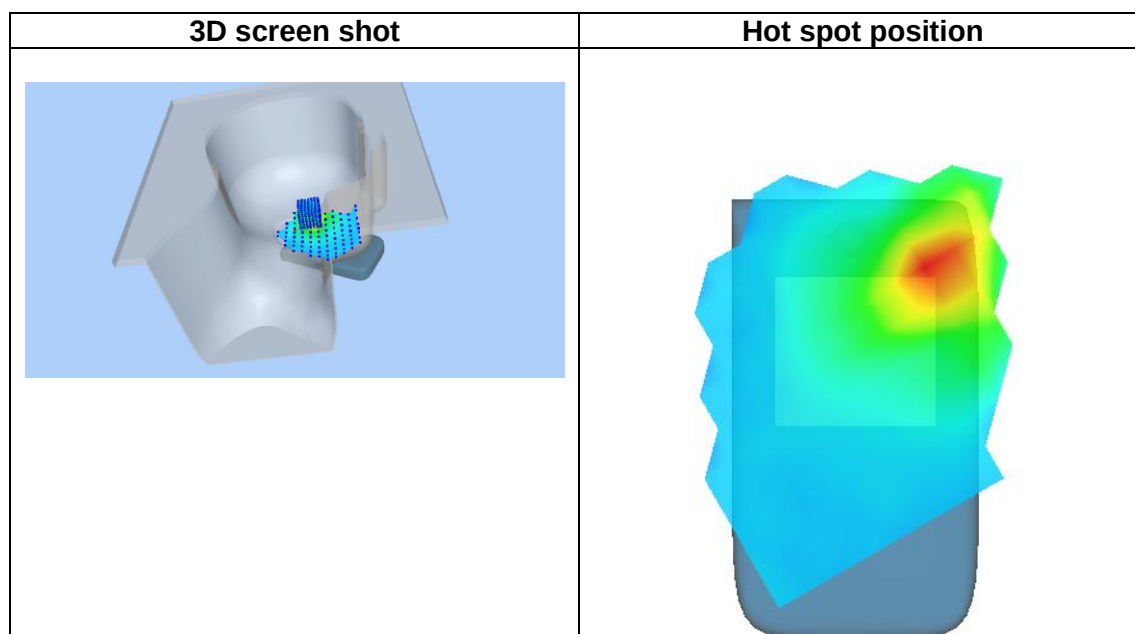
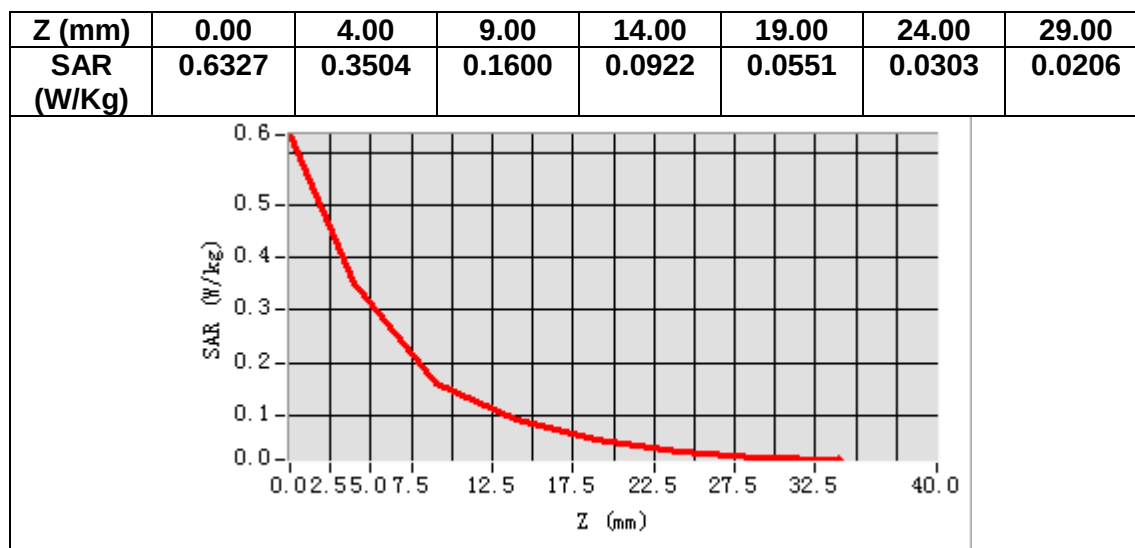
Frequency (MHz)	2442.000000
Relative permittivity (real part)	38.037312
Relative permittivity (imaginary part)	13.198987
Conductivity (S/m)	1.790663
Variation (%)	-1.310000



Maximum location: X=-25.00, Y=14.00

SAR Peak: 0.59 W/kg

SAR 10g (W/Kg)	0.147098
SAR 1g (W/Kg)	0.324213



MEASUREMENT 14

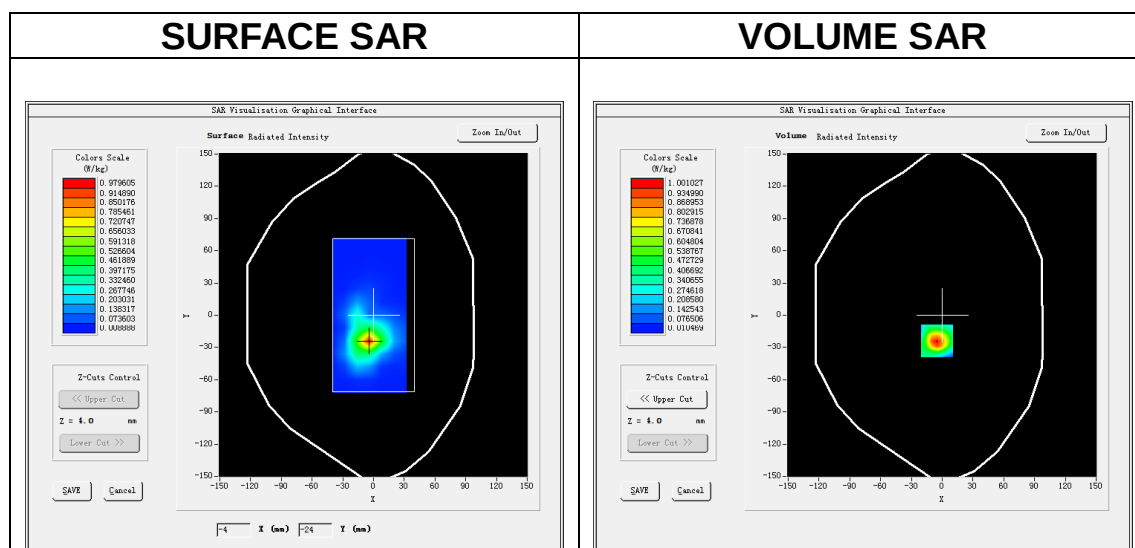
Date of measurement: 18/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11b ISM</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>IEEE802.11b (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.74</u>

B. SAR Measurement Results

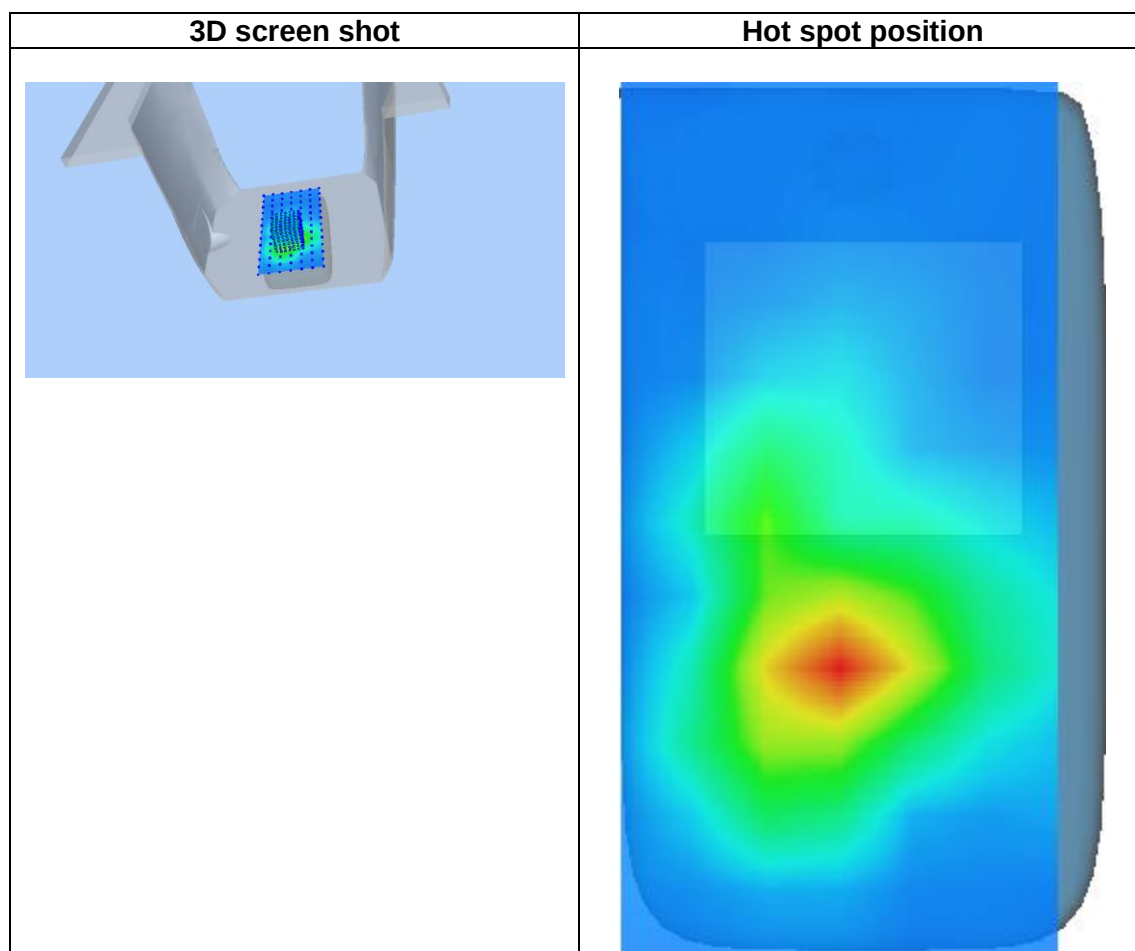
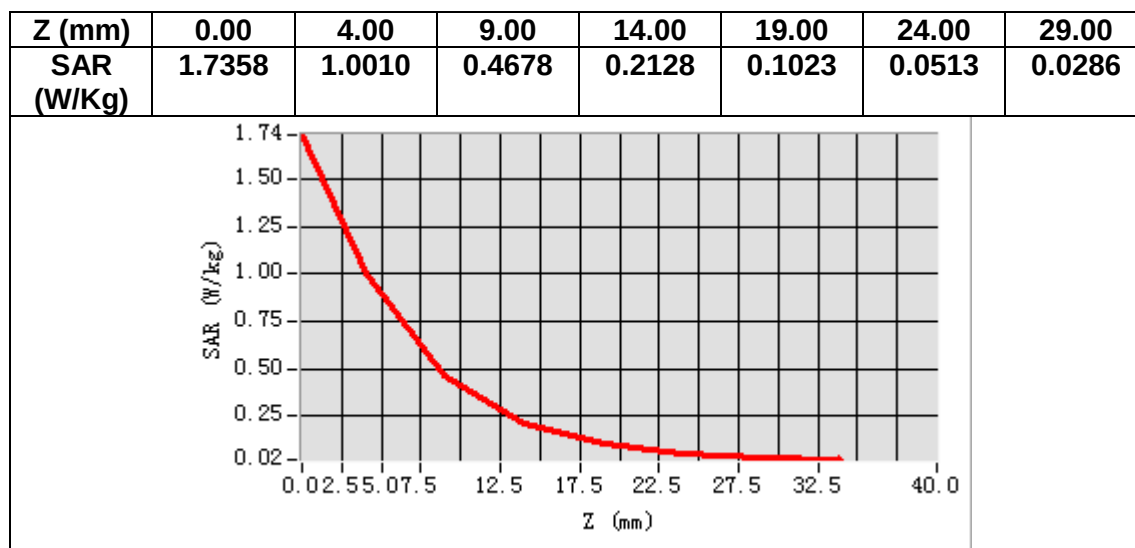
Frequency (MHz)	2442.000000
Relative permittivity (real part)	38.037312
Relative permittivity (imaginary part)	13.198987
Conductivity (S/m)	1.790663
Variation (%)	1.280000



Maximum location: X=-5.00, Y=-24.00

SAR Peak: 1.80 W/kg

SAR 10g (W/Kg)	0.390990
SAR 1g (W/Kg)	0.924372



MEASUREMENT 15

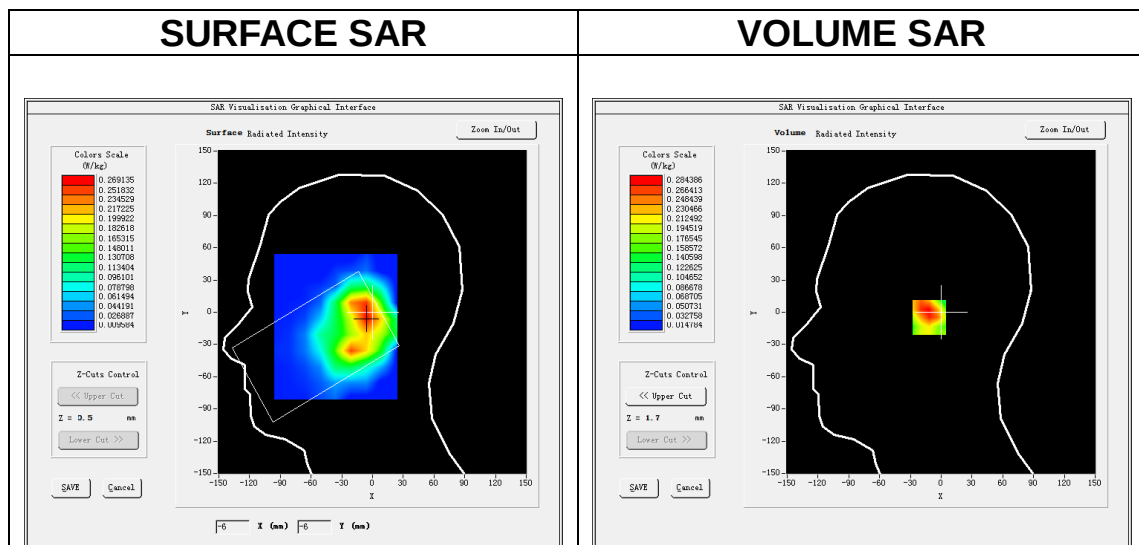
Date of measurement: 22/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 1</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.64</u>

B. SAR Measurement Results

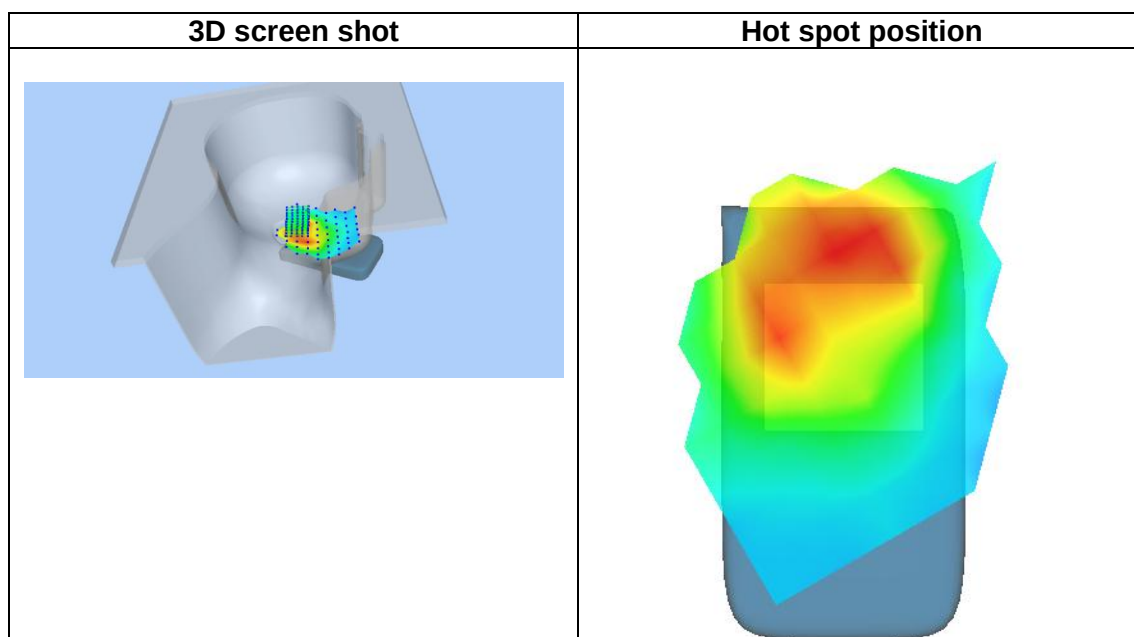
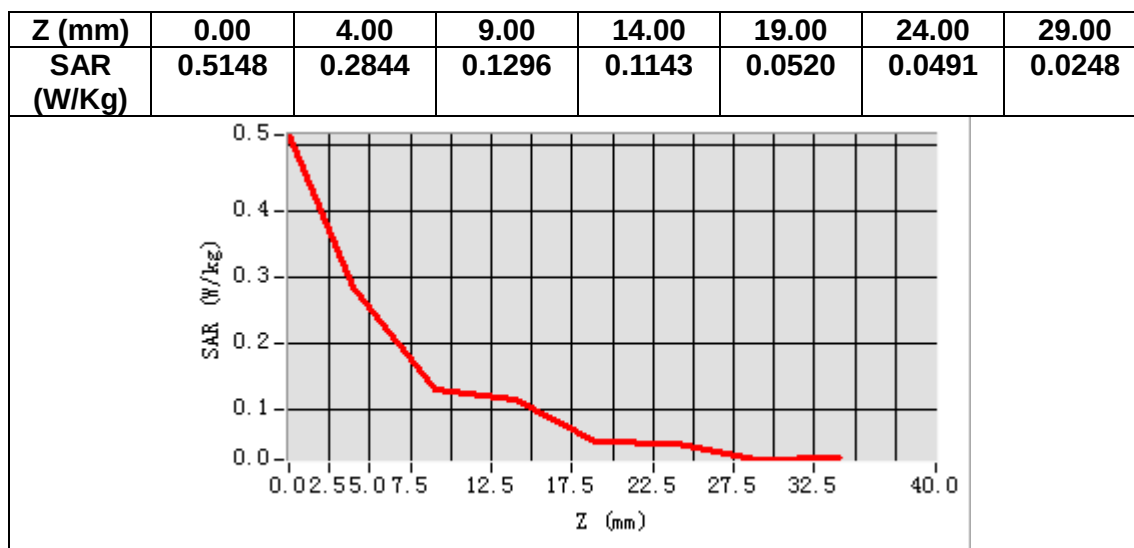
Frequency (MHz)	1950.000000
Relative permittivity (real part)	38.843918
Relative permittivity (imaginary part)	12.897650
Conductivity (S/m)	1.397245
Variation (%)	0.240000



Maximum location: X=-5.00, Y=-5.00

SAR Peak: 0.42 W/kg

SAR 10g (W/Kg)	0.164118
SAR 1g (W/Kg)	0.275620



MEASUREMENT 16

Date of measurement: 22/11/2024

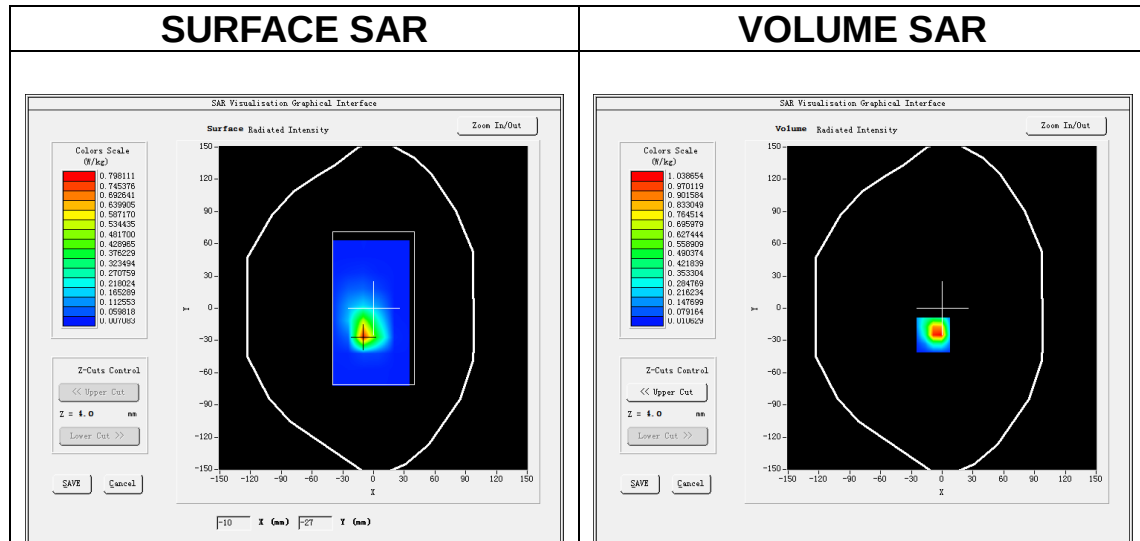
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 1</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.64</u>

B. SAR Measurement Results

Frequency (MHz)	1950.000000
Relative permittivity (real part)	38.843918
Relative permittivity (imaginary part)	12.897650
Conductivity (S/m)	1.397245
Variation (%)	-0.070000

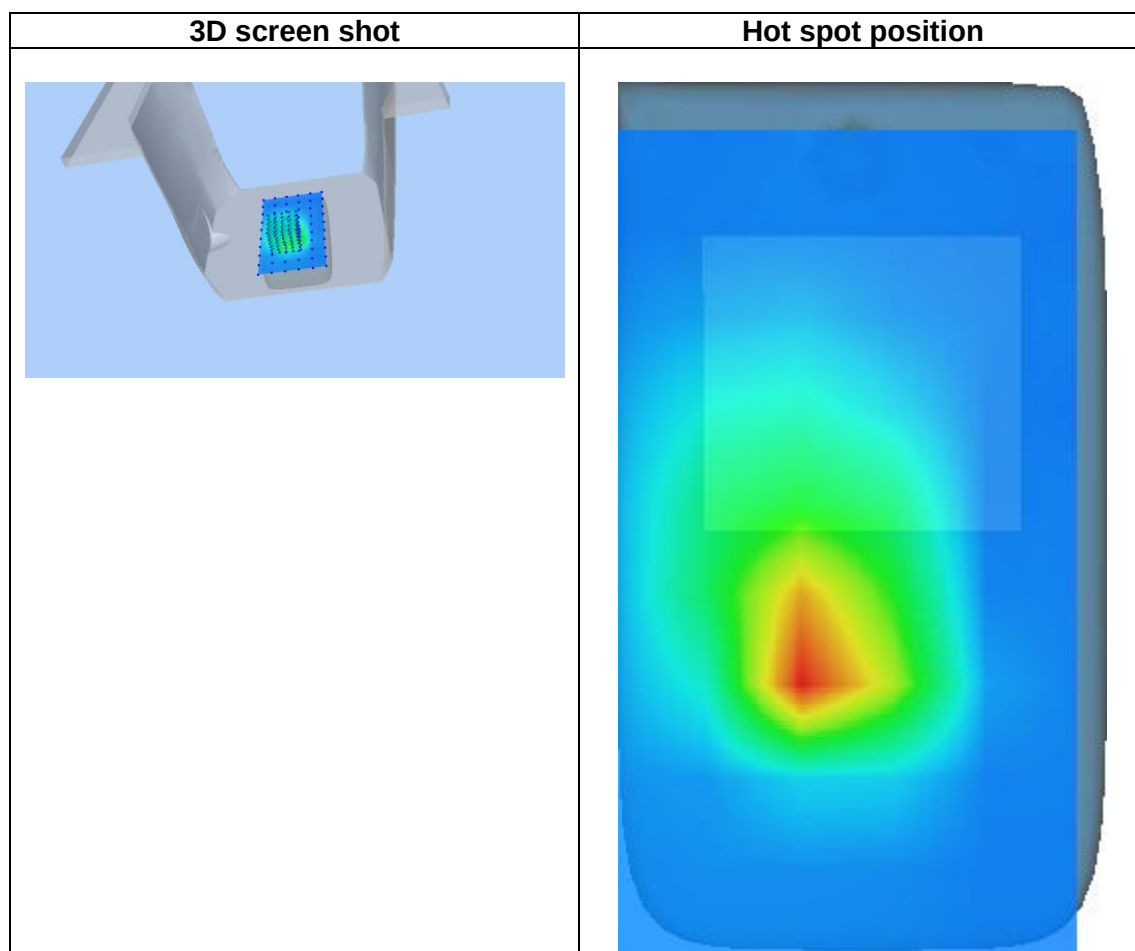
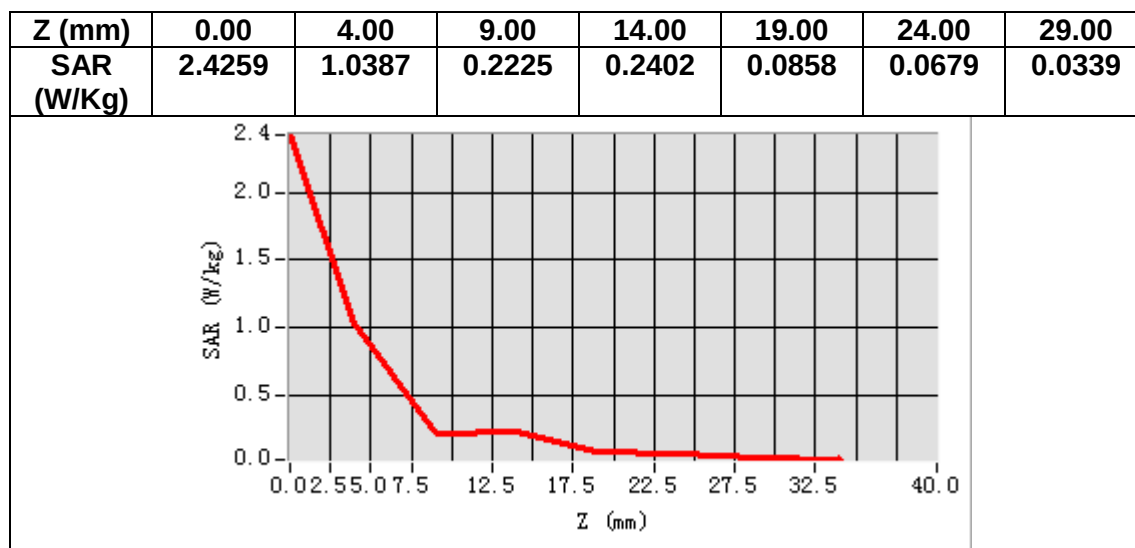
SURFACE SAR



Maximum location: X=-9.00, Y=-25.00

SAR Peak: 2.18 W/kg

SAR 10g (W/Kg)	0.397839
SAR 1g (W/Kg)	1.067560



MEASUREMENT 17

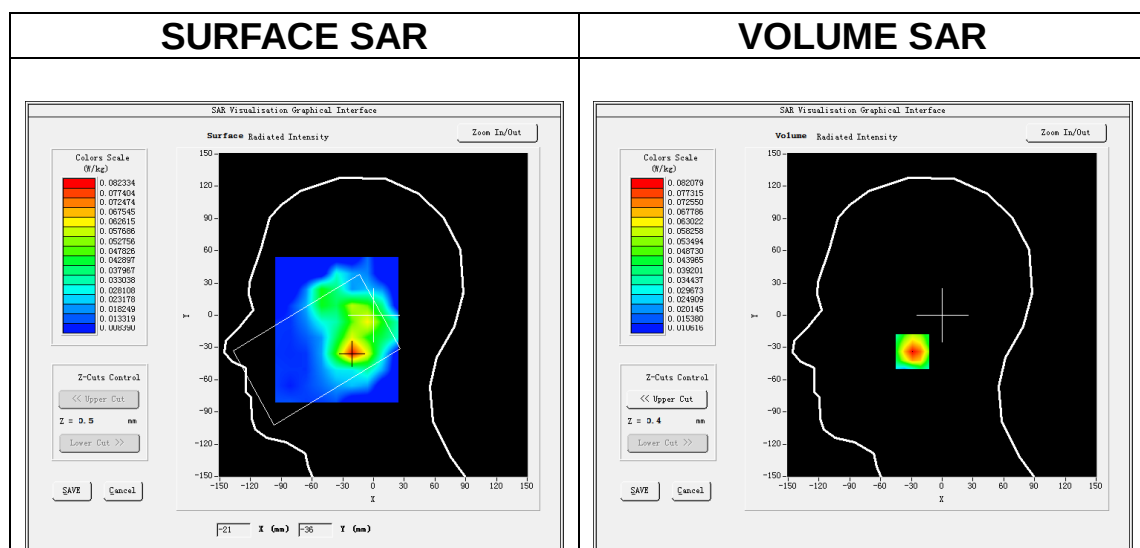
Date of measurement: 21/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 3</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.51</u>

B. SAR Measurement Results

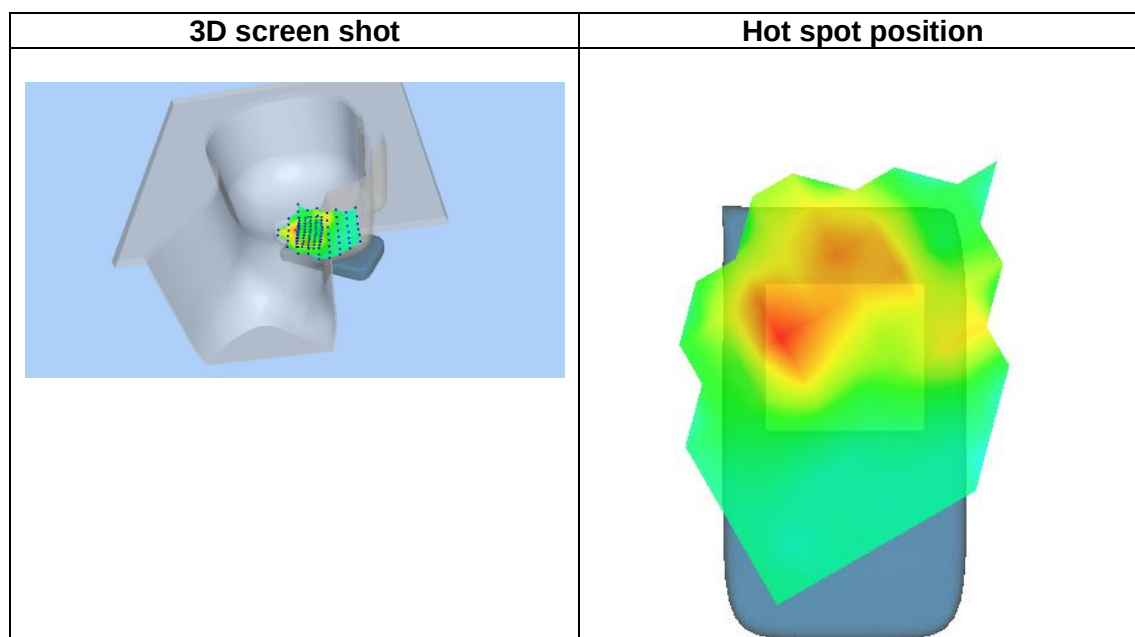
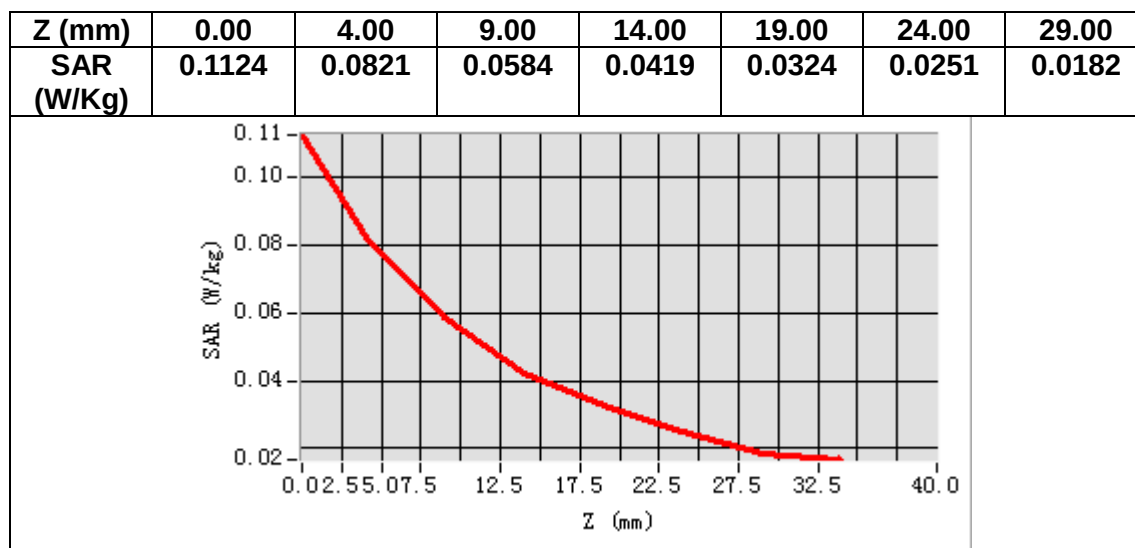
Frequency (MHz)	1747.500000
Relative permittivity (real part)	39.431602
Relative permittivity (imaginary part)	13.831405
Conductivity (S/m)	1.342415
Variation (%)	-0.620000



Maximum location: X=-20.00, Y=-34.00

SAR Peak: 0.12 W/kg

SAR 10g (W/Kg)	0.049236
SAR 1g (W/Kg)	0.079319



MEASUREMENT 18

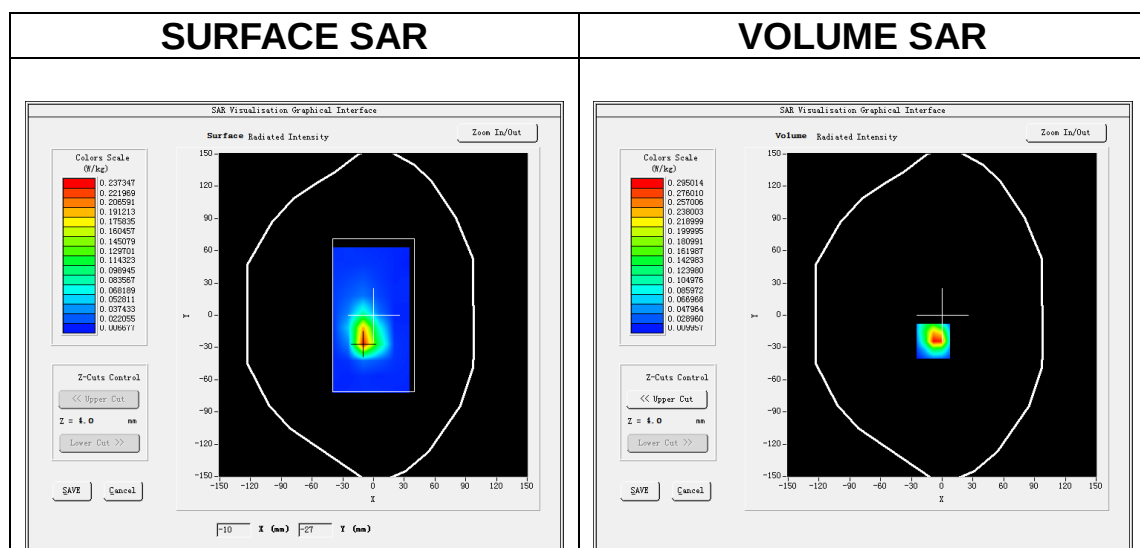
Date of measurement: 21/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 3</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.51</u>

B. SAR Measurement Results

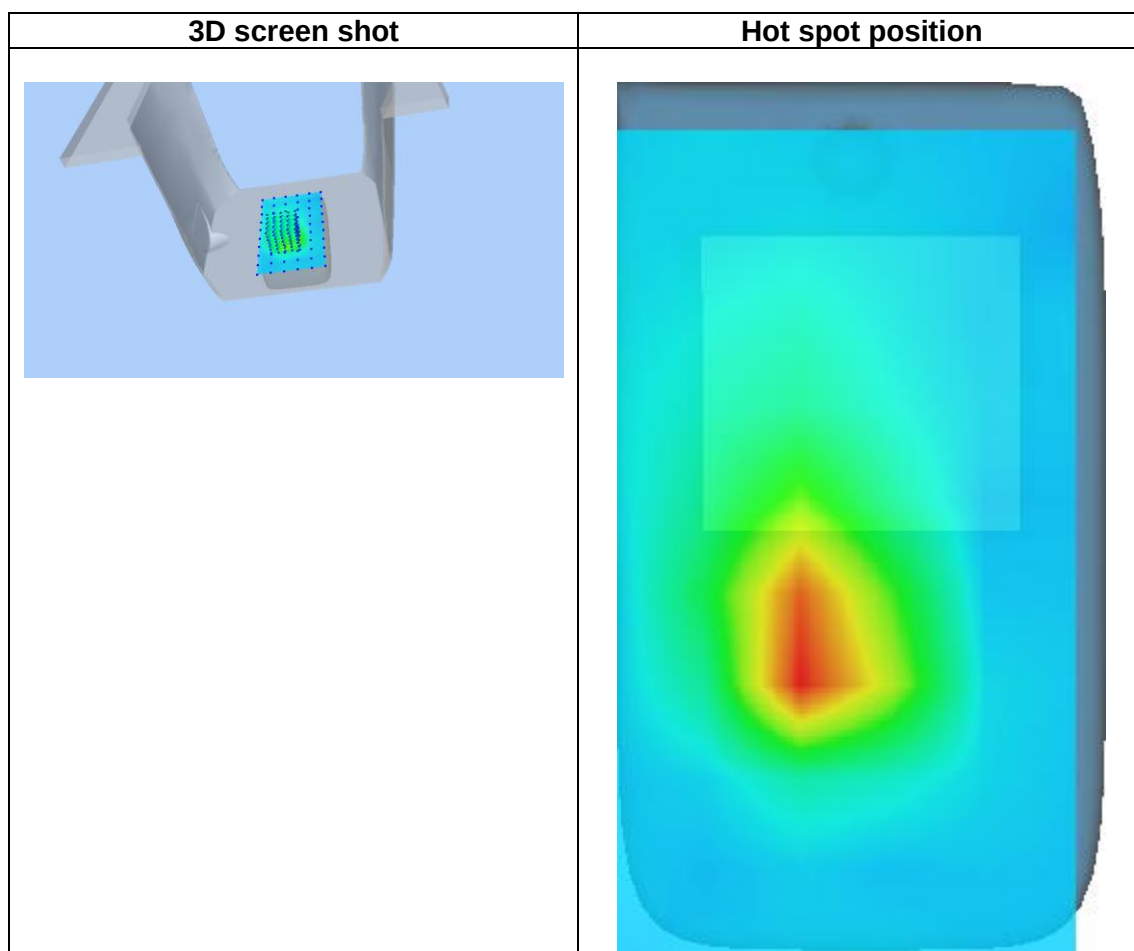
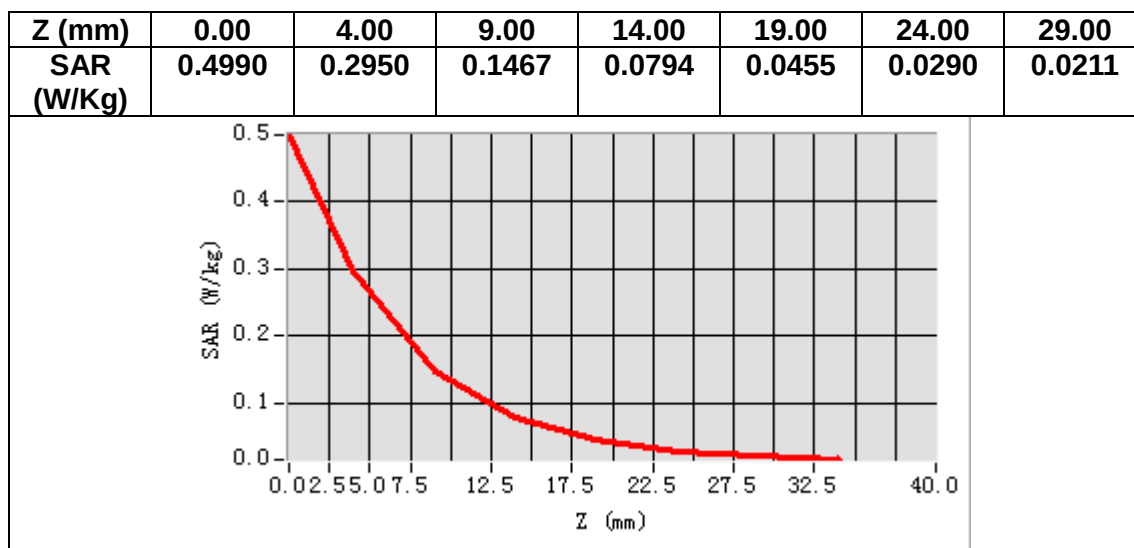
Frequency (MHz)	1747.500000
Relative permittivity (real part)	39.431602
Relative permittivity (imaginary part)	13.831405
Conductivity (S/m)	1.342415
Variation (%)	0.300000



Maximum location: X=-9.00, Y=-24.00

SAR Peak: 0.58 W/kg

SAR 10g (W/Kg)	0.118554
SAR 1g (W/Kg)	0.290557



MEASUREMENT 19

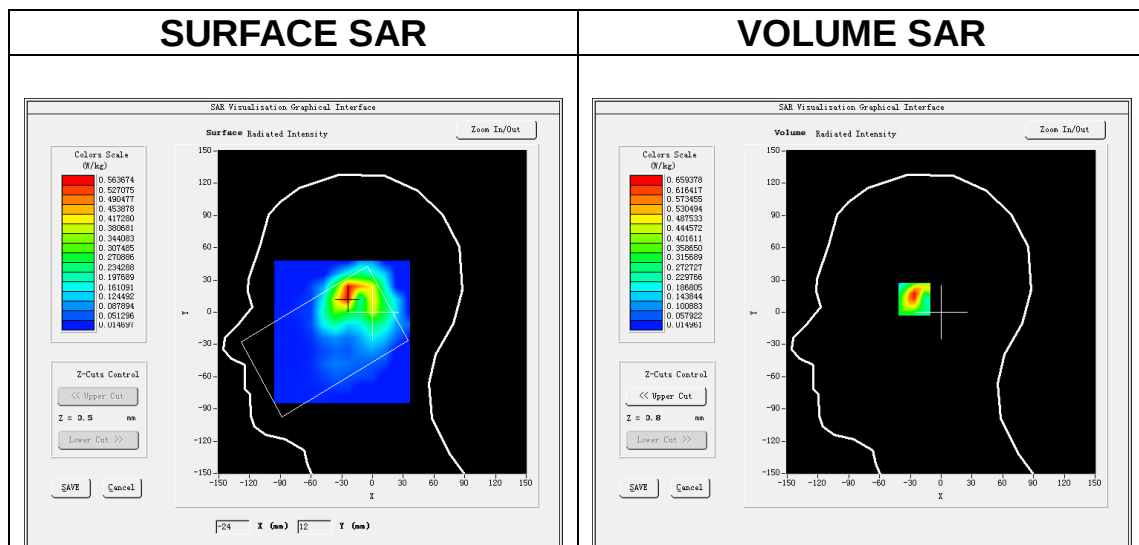
Date of measurement: 25/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Right head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 7</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.51</u>

B. SAR Measurement Results

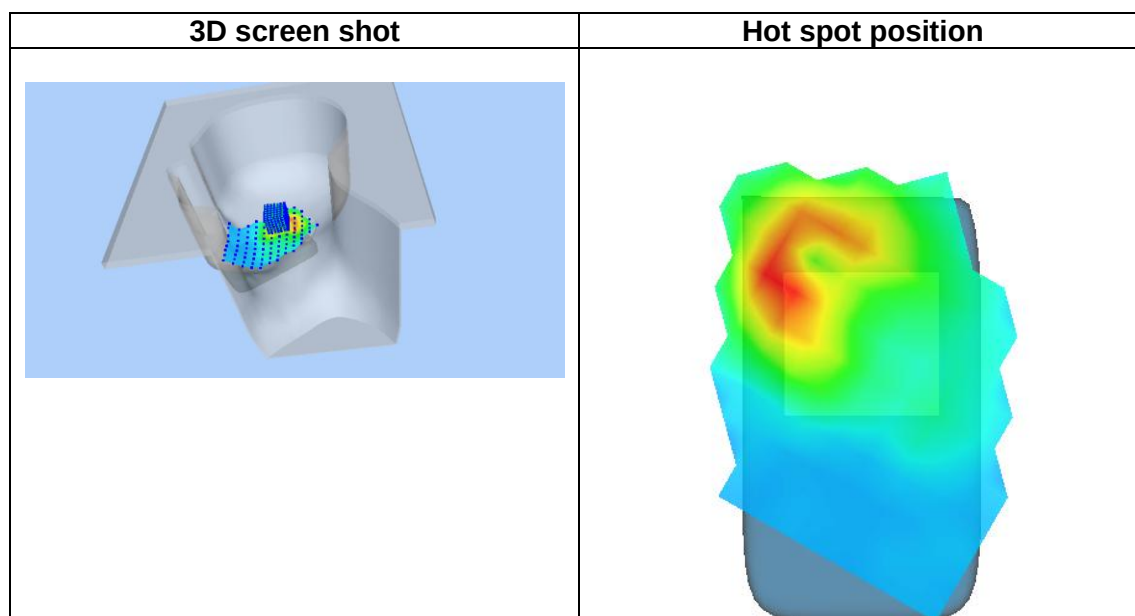
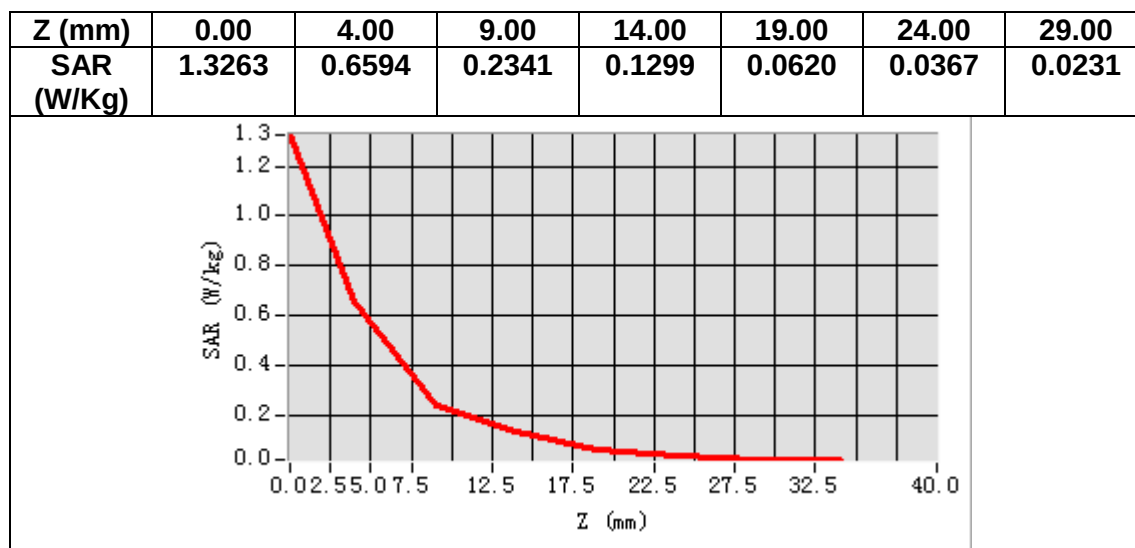
Frequency (MHz)	2535.000000
Relative permittivity (real part)	39.213741
Relative permittivity (imaginary part)	13.599372
Conductivity (S/m)	1.915245
Variation (%)	-2.230000



Maximum location: X=-25.00, Y=14.00

SAR Peak: 1.18 W/kg

SAR 10g (W/Kg)	0.261728
SAR 1g (W/Kg)	0.598987



MEASUREMENT 20

Date of measurement: 25/11/2024

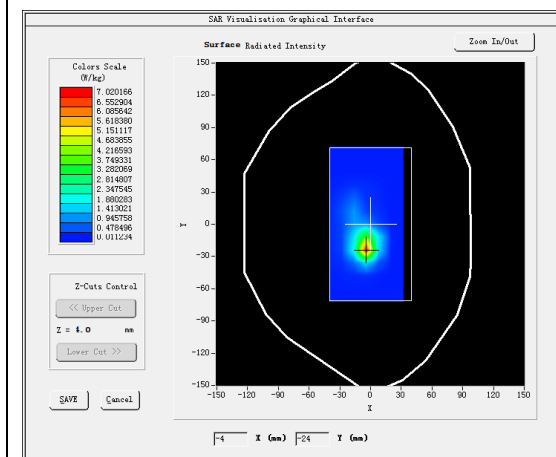
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 7</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.51</u>

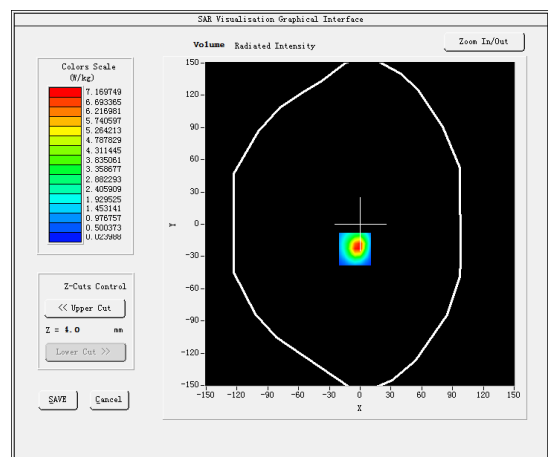
B. SAR Measurement Results

Frequency (MHz)	2535.000000
Relative permittivity (real part)	39.213741
Relative permittivity (imaginary part)	13.599372
Conductivity (S/m)	1.915245
Variation (%)	-0.280000

SURFACE SAR



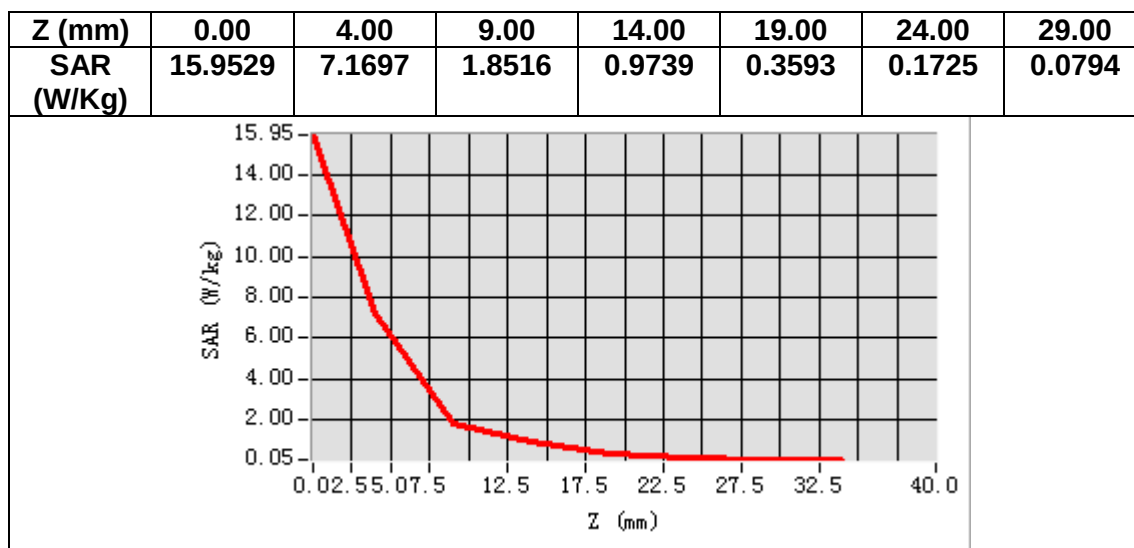
VOLUME SAR



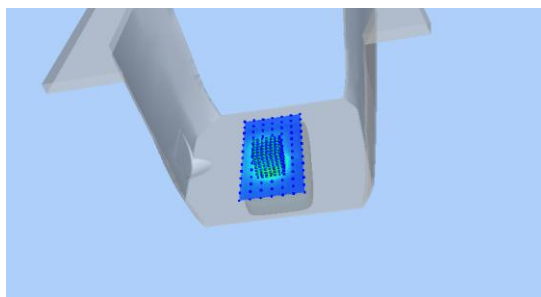
Maximum location: X=-5.00, Y=-23.00

SAR Peak: 15.05 W/kg

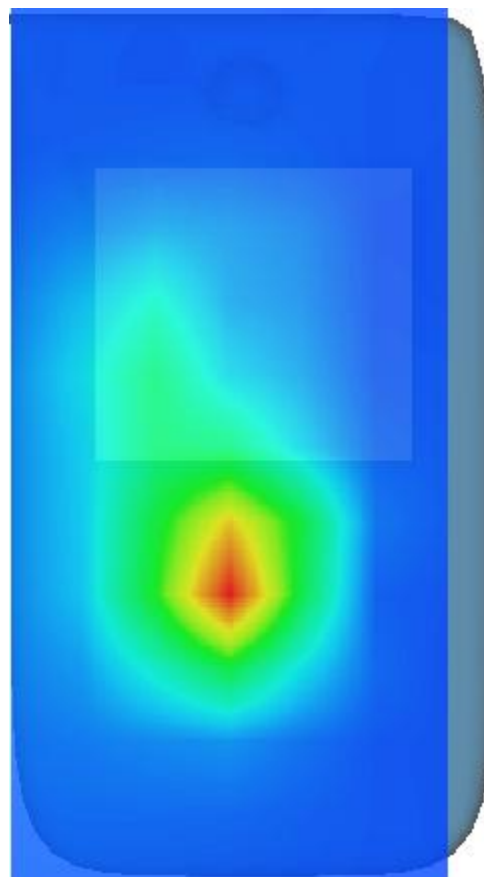
SAR 10g (W/Kg)	2.287021
SAR 1g (W/Kg)	6.719453



3D screen shot



Hot spot position



MEASUREMENT 21

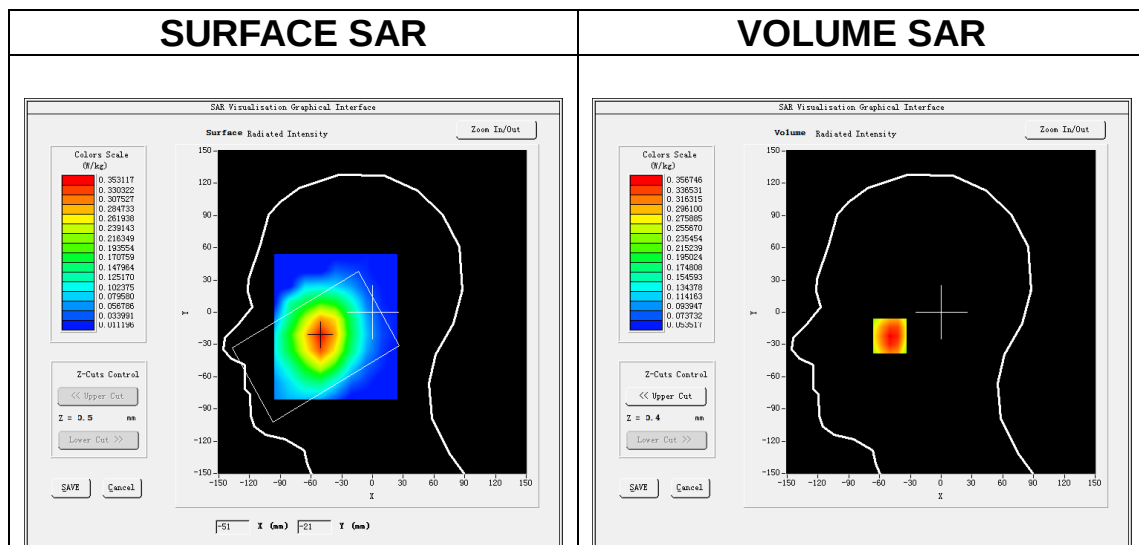
Date of measurement: 23/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 8</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.24</u>

B. SAR Measurement Results

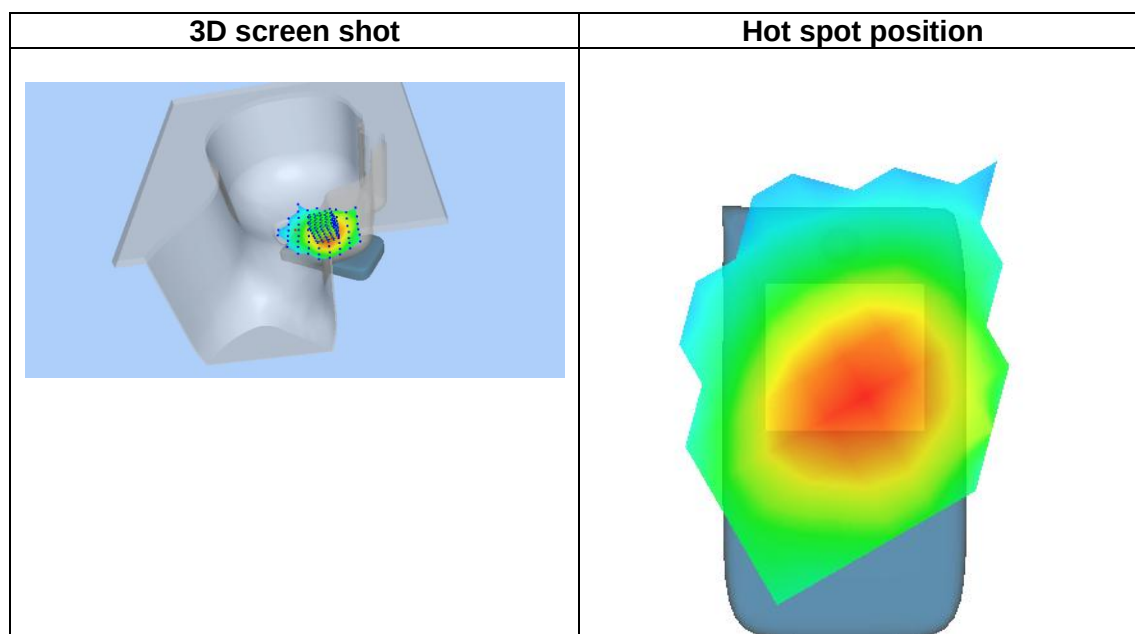
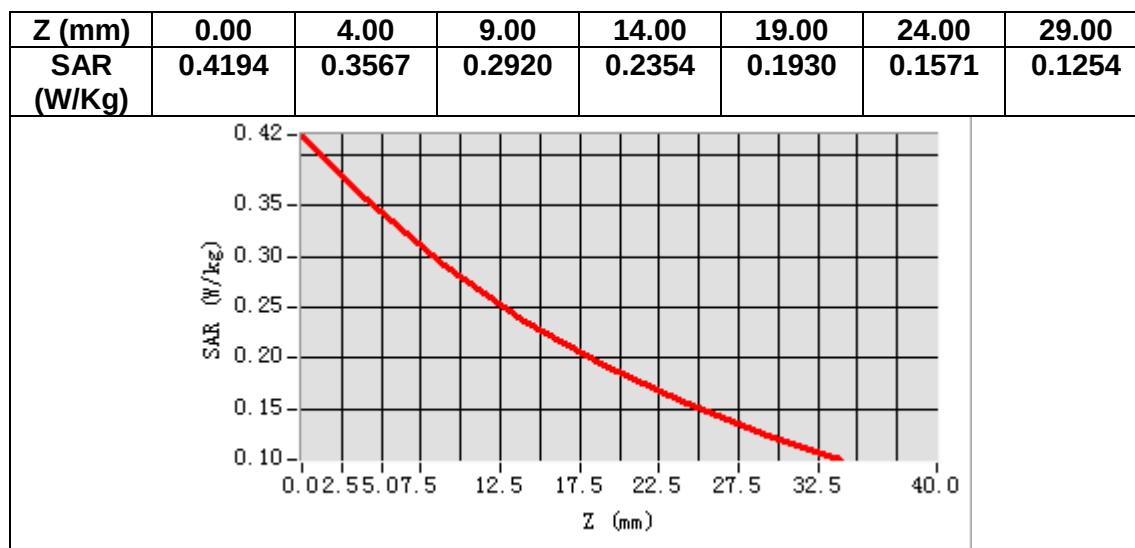
Frequency (MHz)	897.500000
Relative permittivity (real part)	41.510105
Relative permittivity (imaginary part)	19.979280
Conductivity (S/m)	0.995634
Variation (%)	2.160000



Maximum location: X=-50.00, Y=-22.00

SAR Peak: 0.44 W/kg

SAR 10g (W/Kg)	0.266631
SAR 1g (W/Kg)	0.355538



MEASUREMENT 22

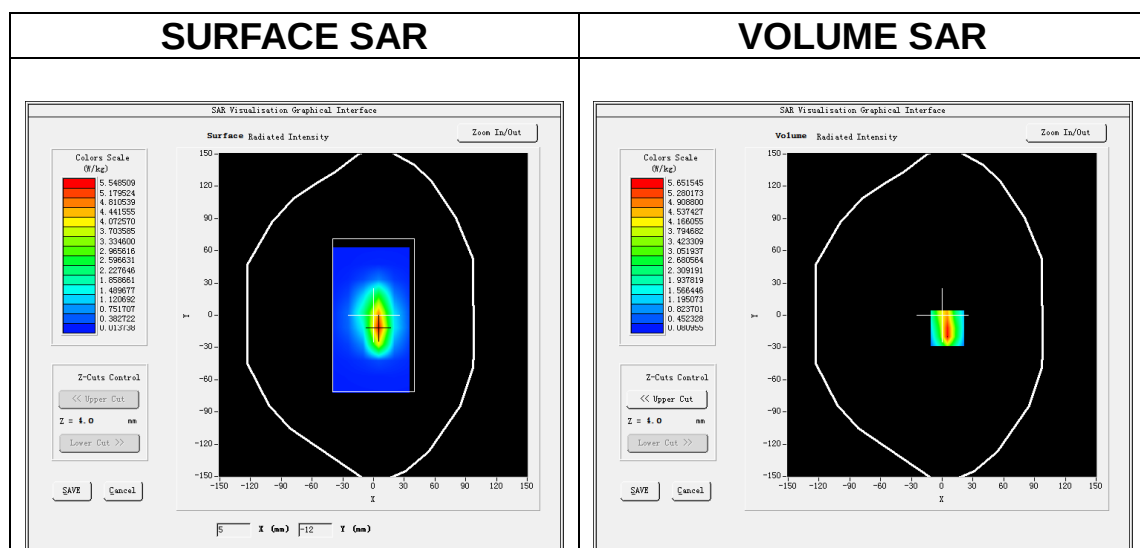
Date of measurement: 23/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 8</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.24</u>

B. SAR Measurement Results

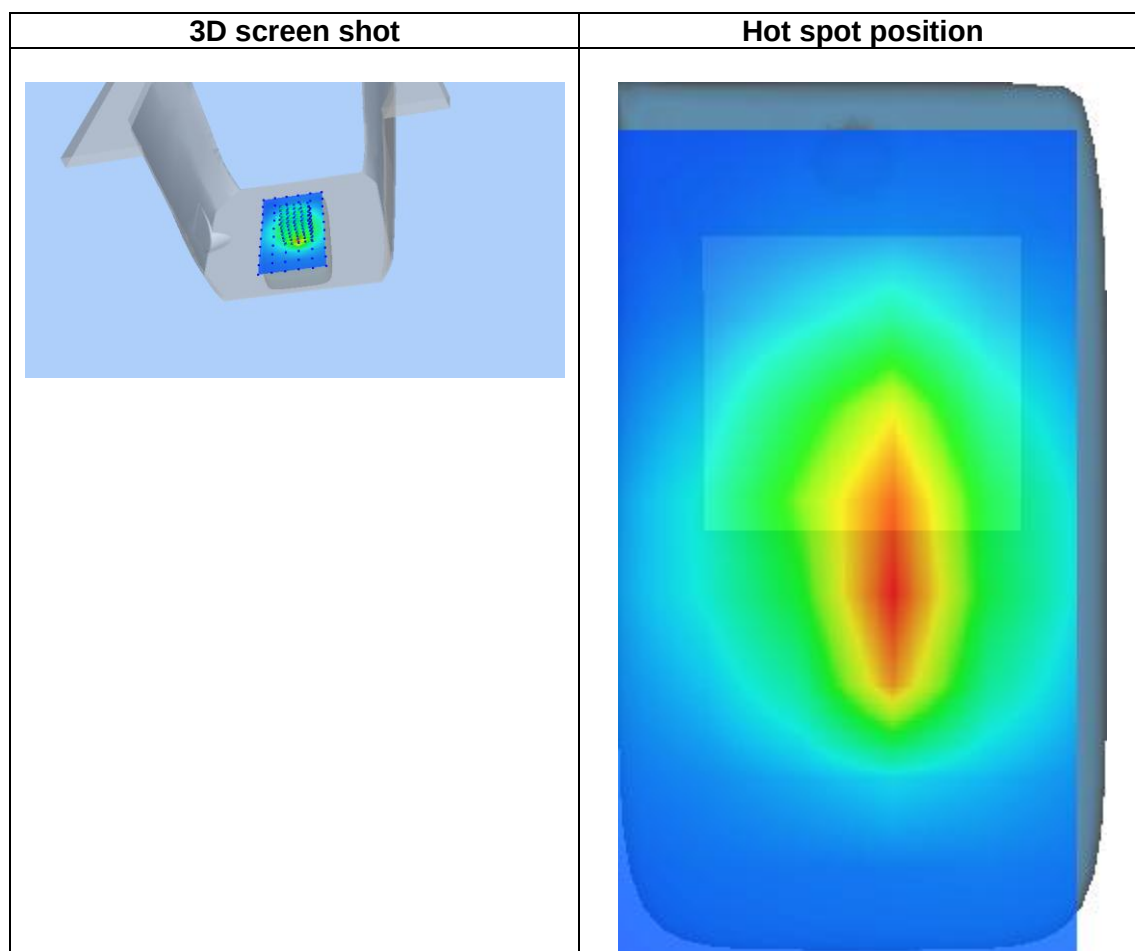
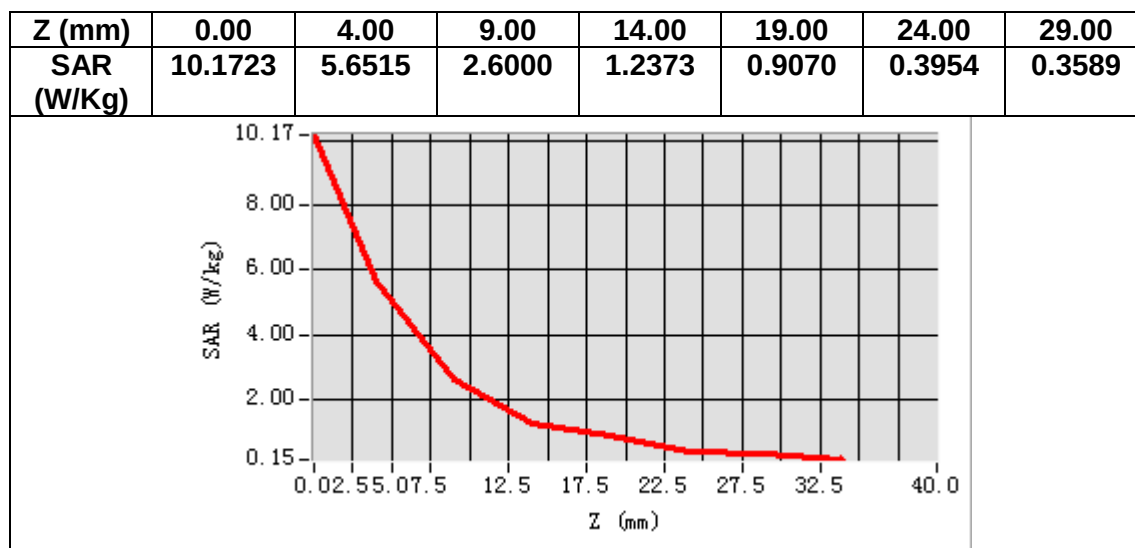
Frequency (MHz)	897.500000
Relative permittivity (real part)	41.510105
Relative permittivity (imaginary part)	19.979280
Conductivity (S/m)	0.995634
Variation (%)	-0.940000



Maximum location: X=5.00, Y=-12.00

SAR Peak: 10.52 W/kg

SAR 10g (W/Kg)	2.356569
SAR 1g (W/Kg)	5.338751



MEASUREMENT 23

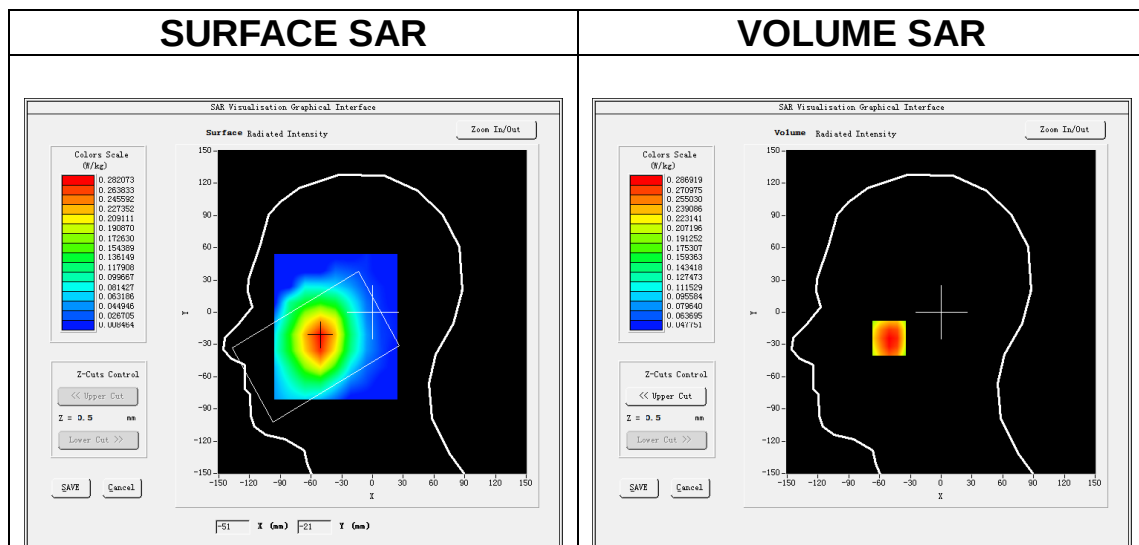
Date of measurement: 23/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 20</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.24</u>

B. SAR Measurement Results

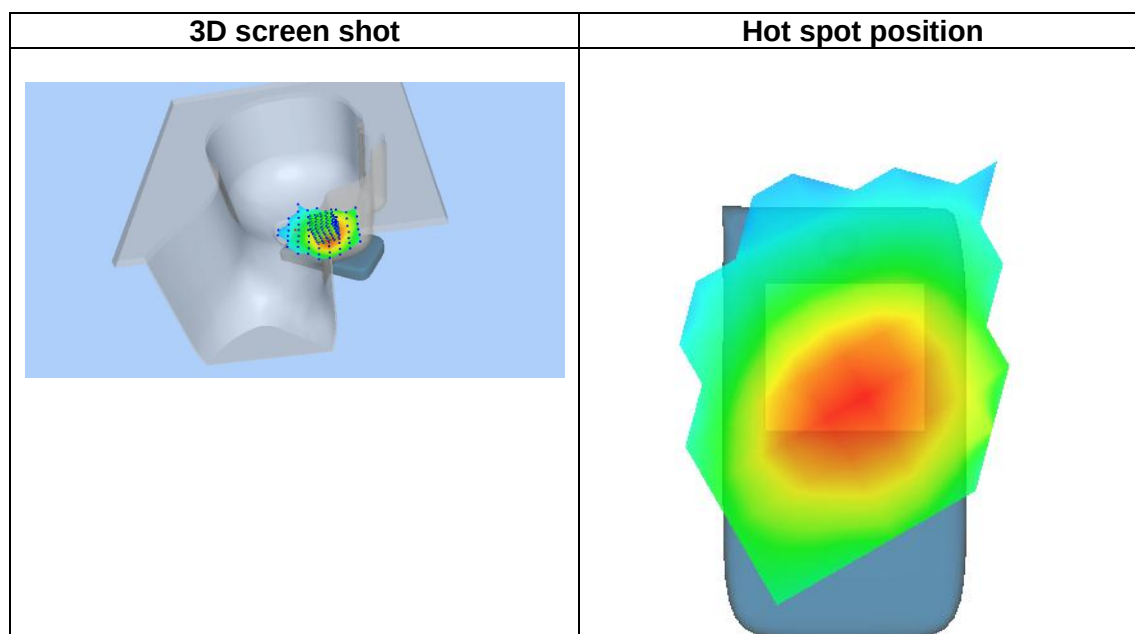
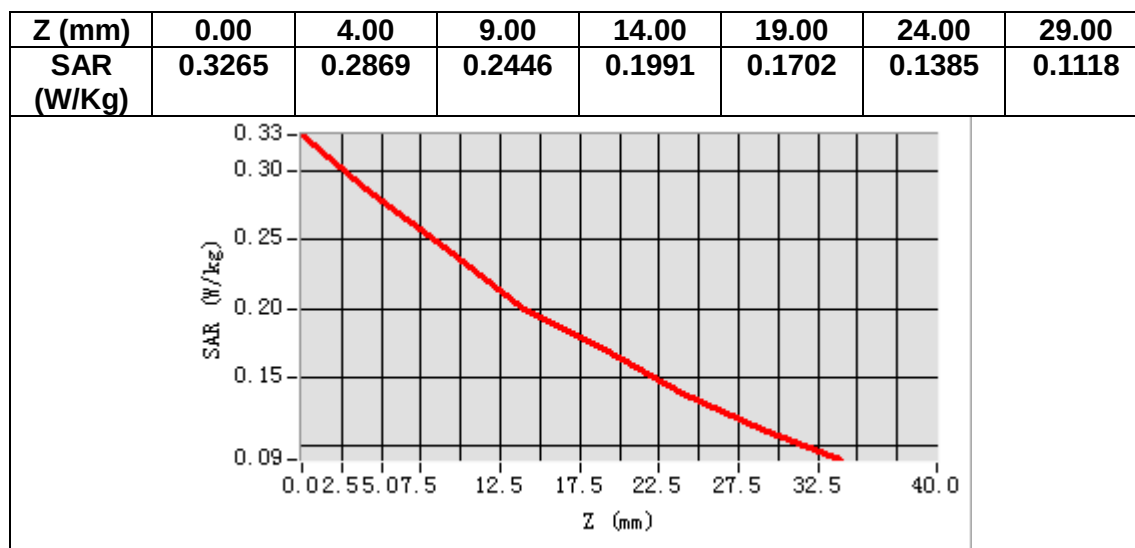
Frequency (MHz)	847.000000
Relative permittivity (real part)	42.128906
Relative permittivity (imaginary part)	19.764381
Conductivity (S/m)	0.930024
Variation (%)	0.660000



Maximum location: X=-51.00, Y=-24.00

SAR Peak: 0.35 W/kg

SAR 10g (W/Kg)	0.219530
SAR 1g (W/Kg)	0.283652



MEASUREMENT 24

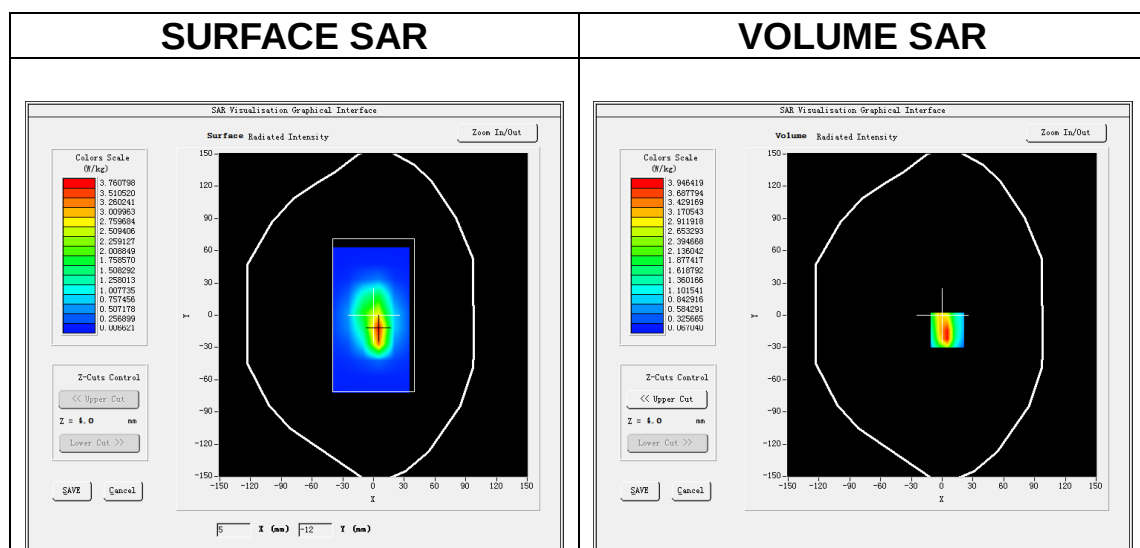
Date of measurement: 23/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 20</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.24</u>

B. SAR Measurement Results

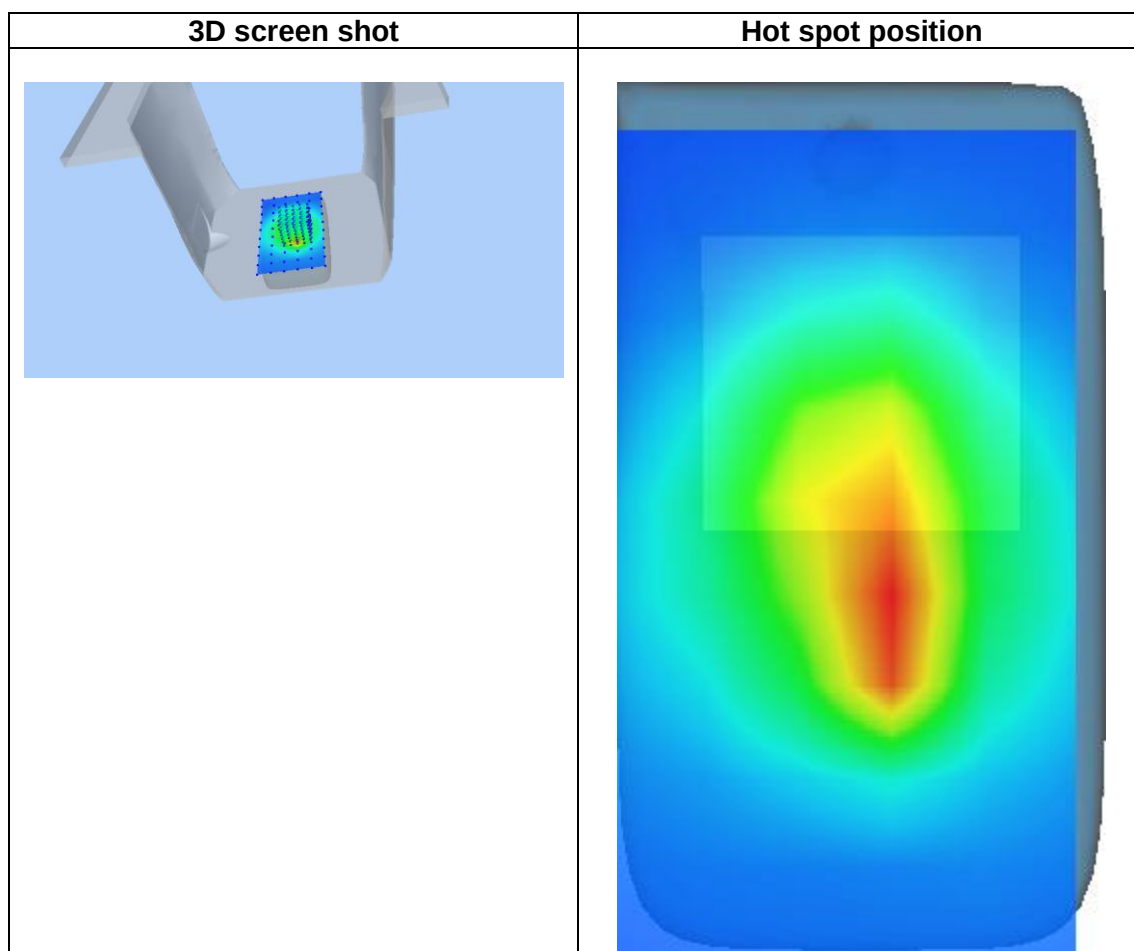
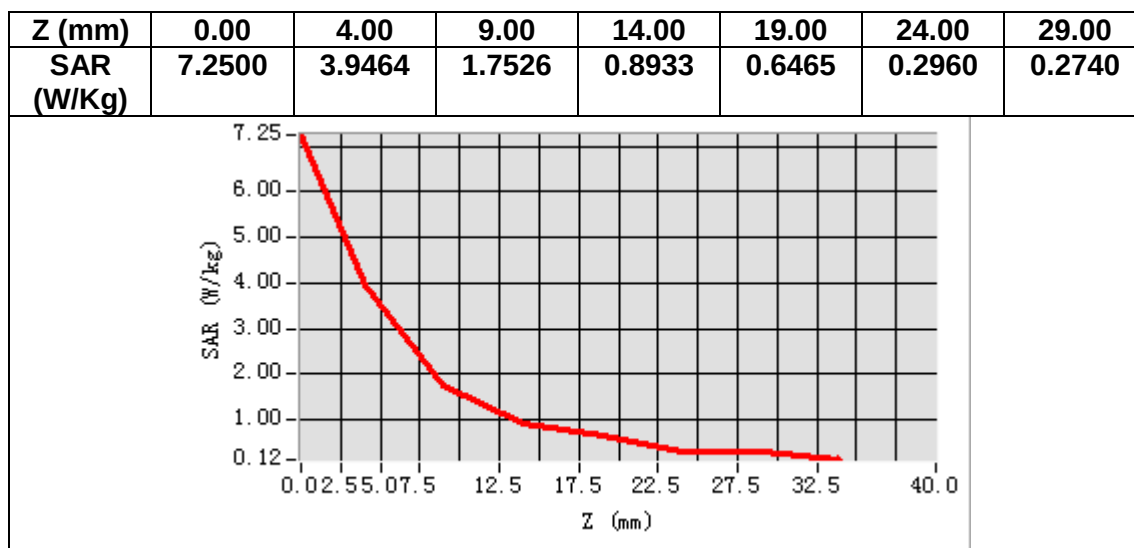
Frequency (MHz)	847.000000
Relative permittivity (real part)	42.128906
Relative permittivity (imaginary part)	19.764381
Conductivity (S/m)	0.930024
Variation (%)	-0.540000



Maximum location: X=5.00, Y=-14.00

SAR Peak: 7.50 W/kg

SAR 10g (W/Kg)	1.731483
SAR 1g (W/Kg)	3.862639



MEASUREMENT 25

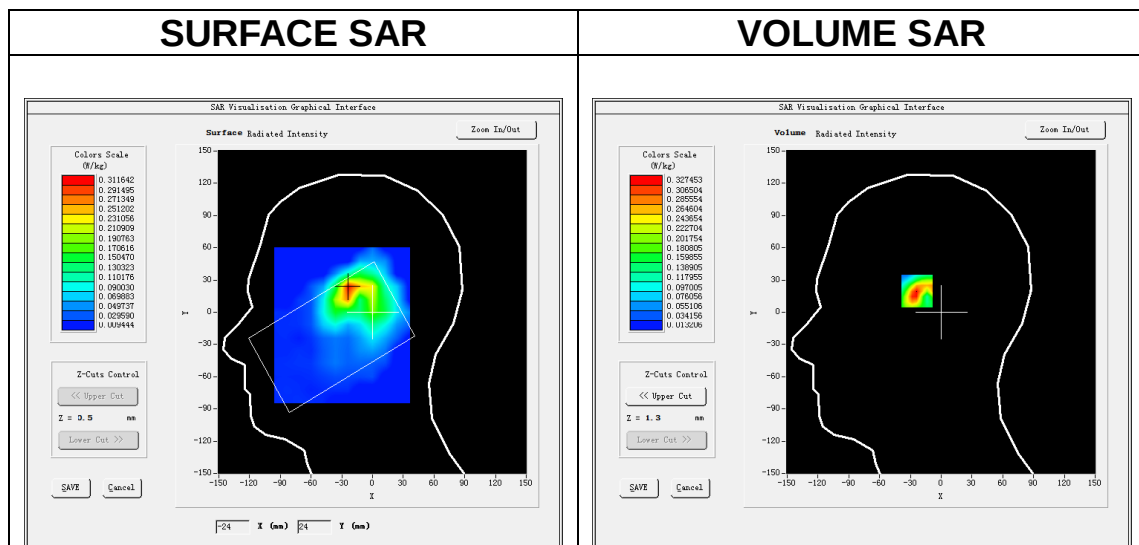
Date of measurement: 25/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Right head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 38</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.6)</u>
<u>ConvF</u>	<u>2.51</u>

B. SAR Measurement Results

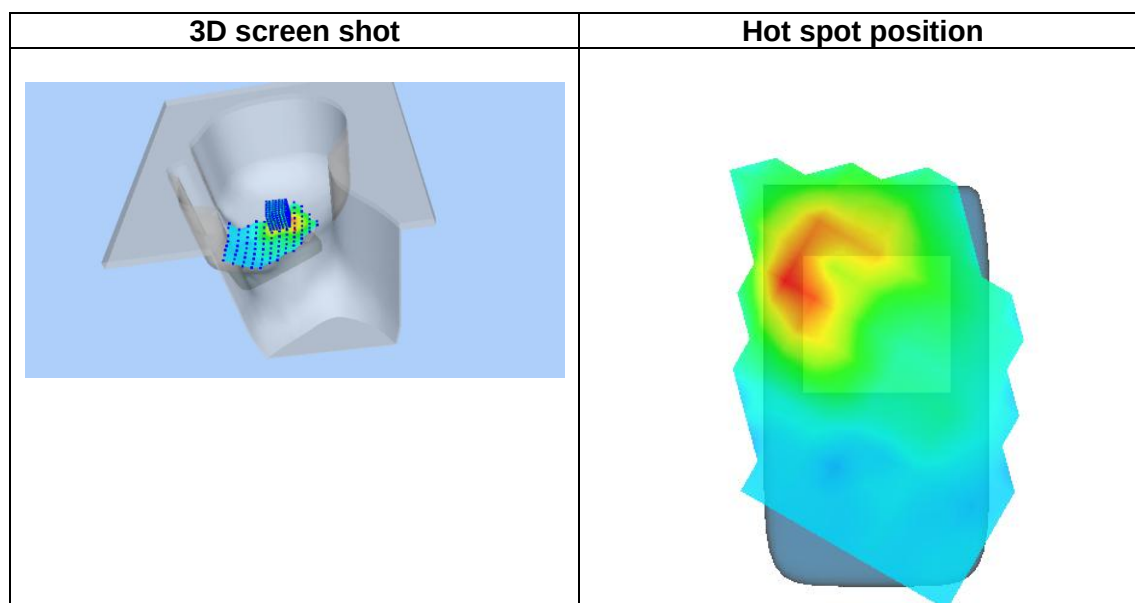
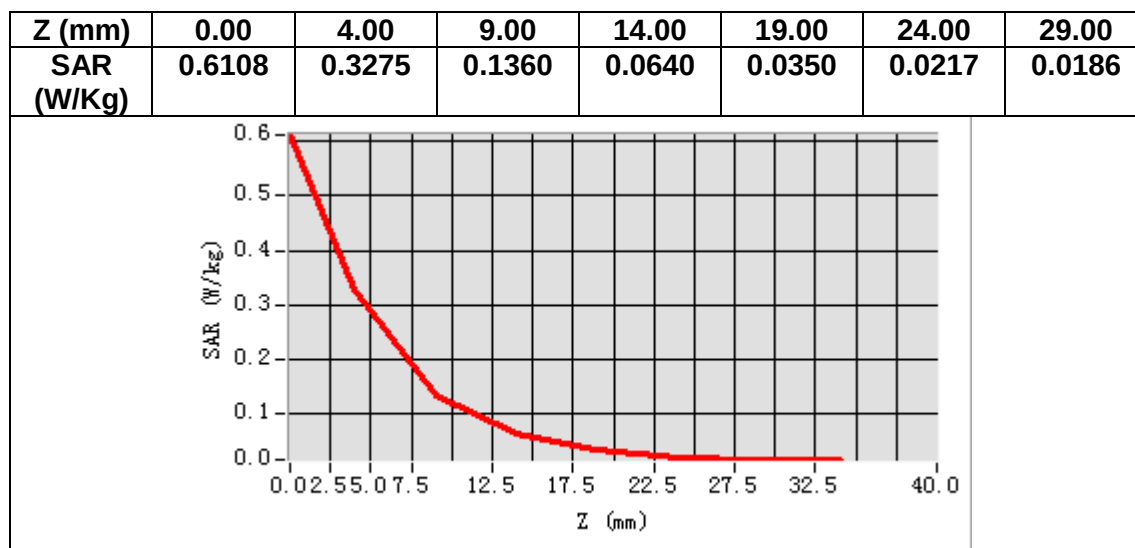
Frequency (MHz)	2595.000000
Relative permittivity (real part)	38.845840
Relative permittivity (imaginary part)	13.813172
Conductivity (S/m)	1.991399
Variation (%)	1.000000



Maximum location: X=-23.00, Y=22.00

SAR Peak: 0.61 W/kg

SAR 10g (W/Kg)	0.136215
SAR 1g (W/Kg)	0.309628



MEASUREMENT 26

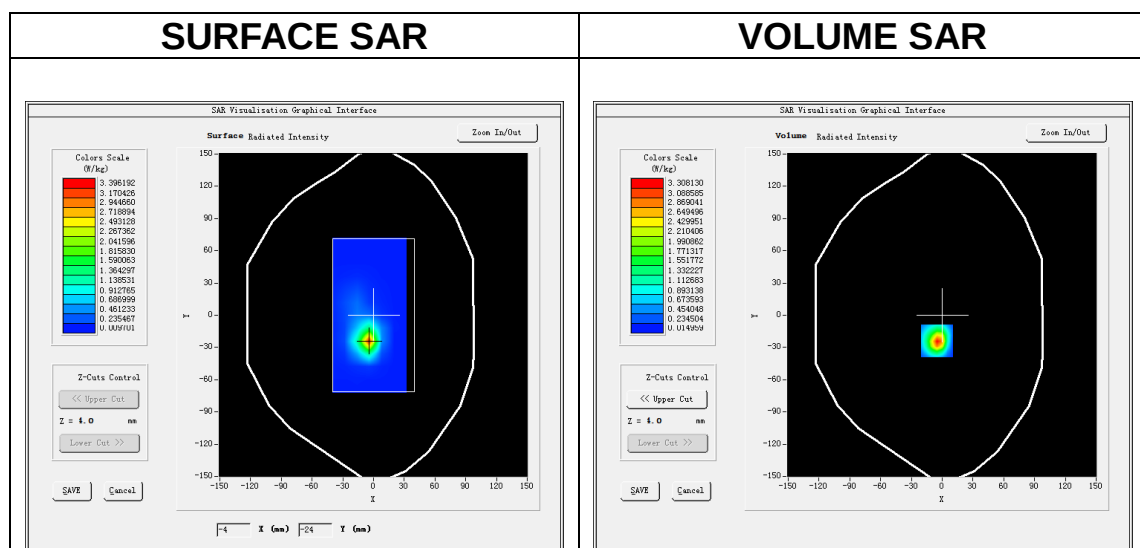
Date of measurement: 25/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 38</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.6)</u>
<u>ConvF</u>	<u>2.51</u>

B. SAR Measurement Results

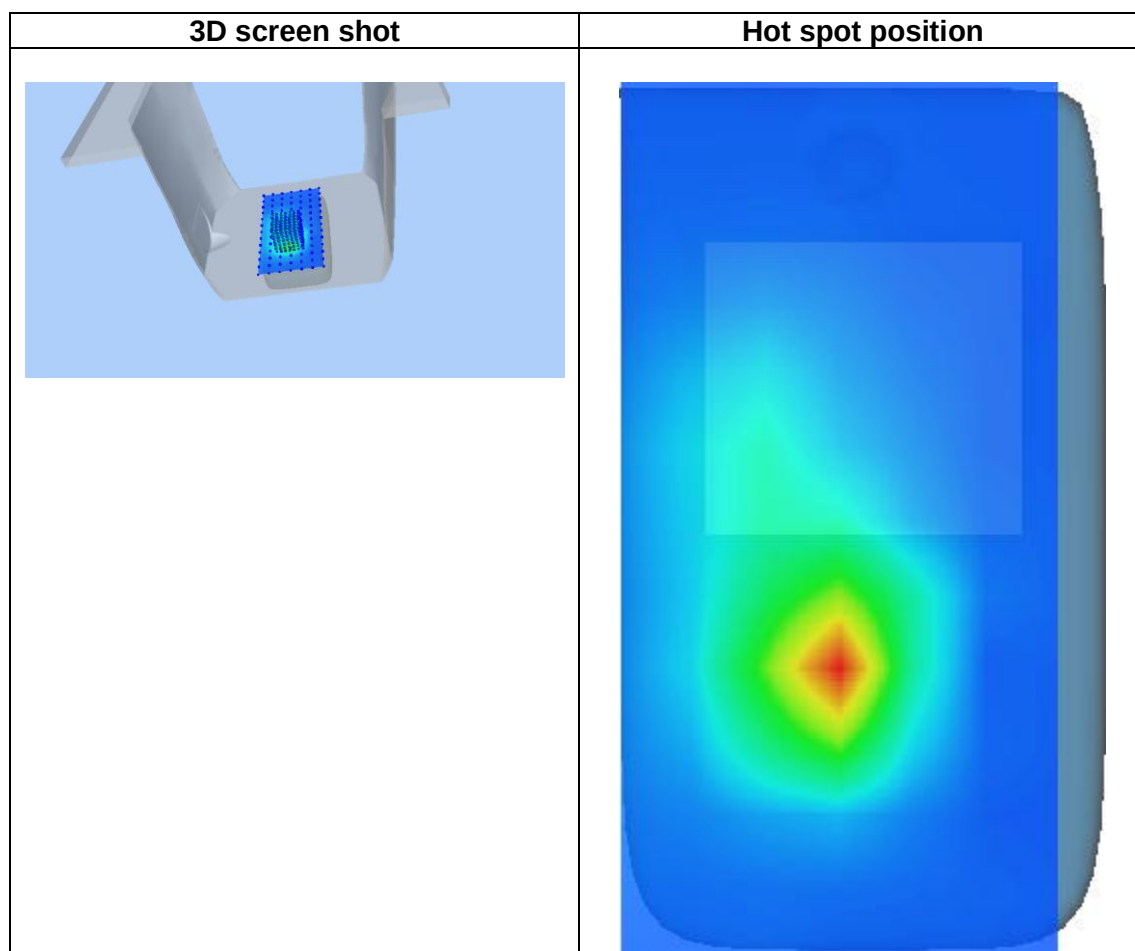
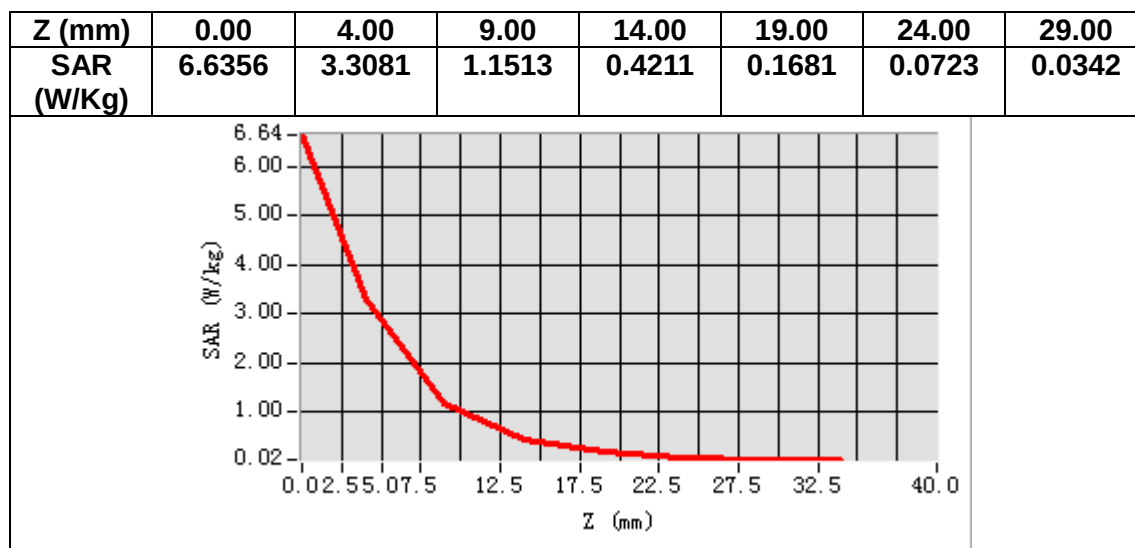
Frequency (MHz)	2595.000000
Relative permittivity (real part)	38.845840
Relative permittivity (imaginary part)	13.813172
Conductivity (S/m)	1.991399
Variation (%)	-0.890000



Maximum location: X=-5.00, Y=-24.00

SAR Peak: 6.66 W/kg

SAR 10g (W/Kg)	0.976342
SAR 1g (W/Kg)	2.928932



MEASUREMENT 27

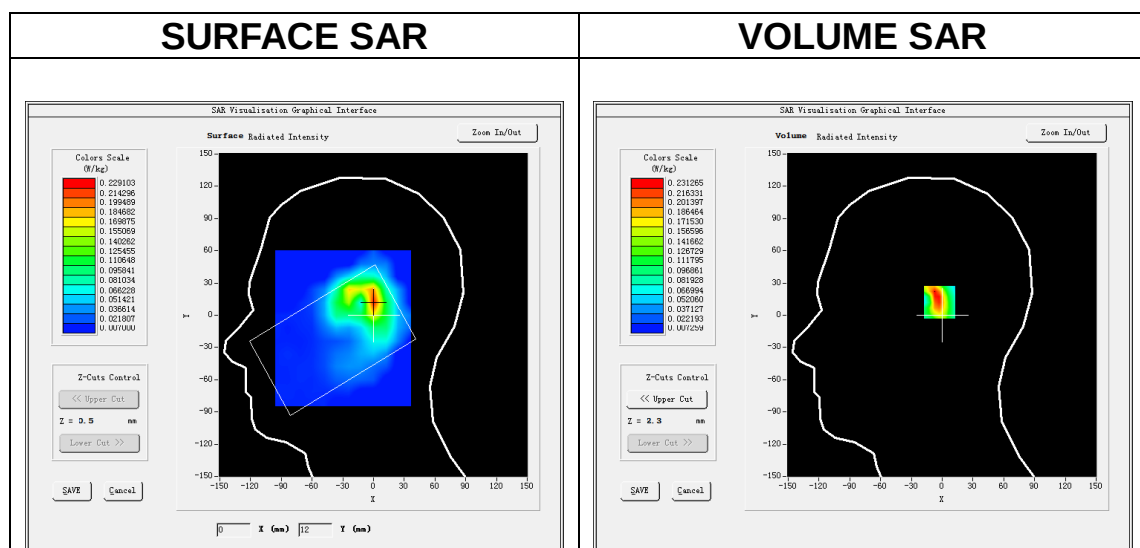
Date of measurement: 29/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Right head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 40</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.6)</u>
<u>ConvF</u>	<u>2.73</u>

B. SAR Measurement Results

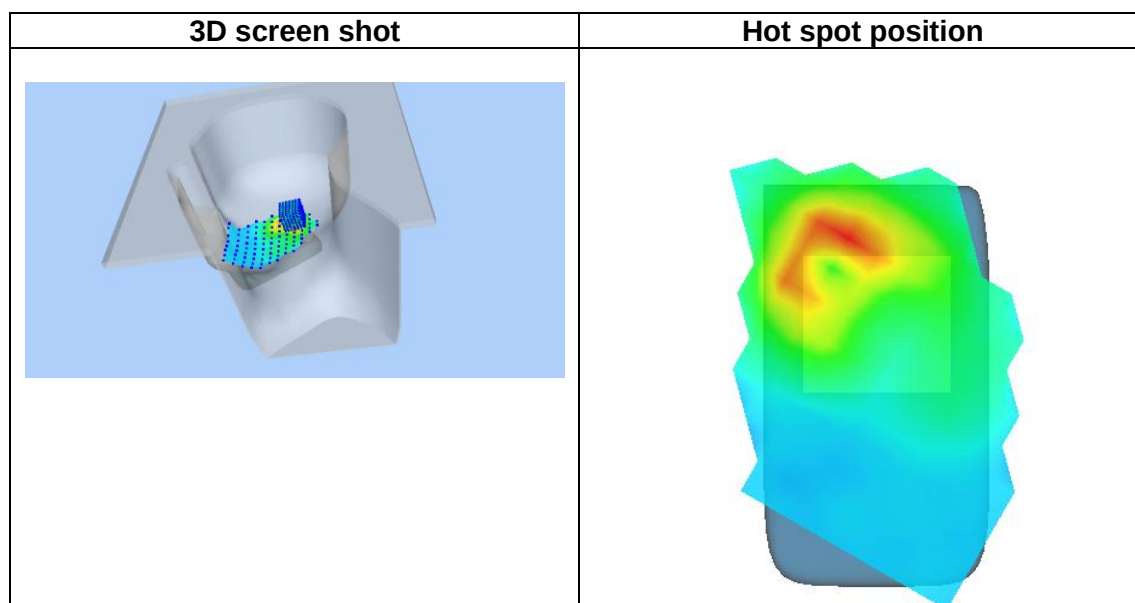
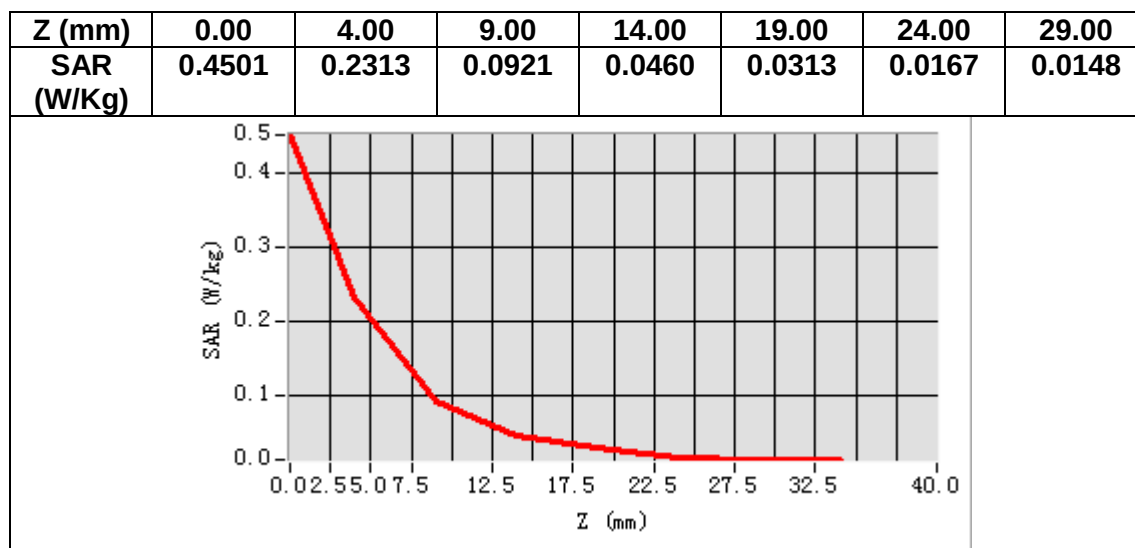
Frequency (MHz)	2350.000000
Relative permittivity (real part)	39.236031
Relative permittivity (imaginary part)	12.943761
Conductivity (S/m)	1.689880
Variation (%)	0.160000



Maximum location: X=1.00, Y=12.00

SAR Peak: 0.44 W/kg

SAR 10g (W/Kg)	0.100937
SAR 1g (W/Kg)	0.216393



MEASUREMENT 28

Date of measurement: 29/11/2024

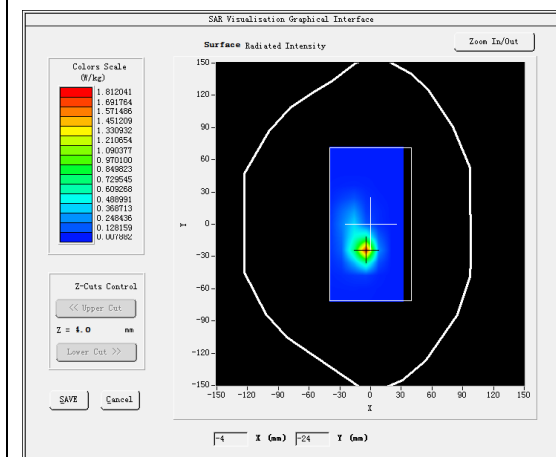
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 40</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.6)</u>
<u>ConvF</u>	<u>2.73</u>

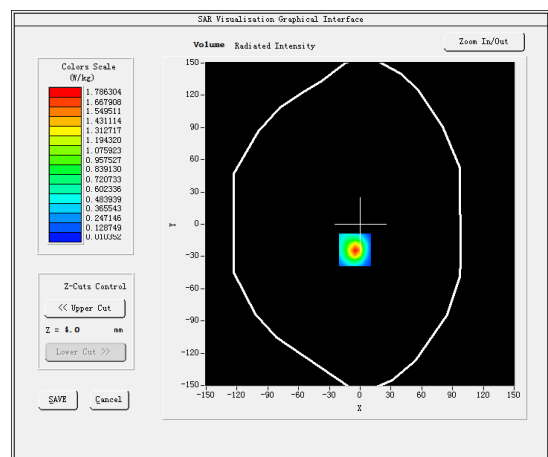
B. SAR Measurement Results

Frequency (MHz)	2350.000000
Relative permittivity (real part)	39.236031
Relative permittivity (imaginary part)	12.943761
Conductivity (S/m)	1.689880
Variation (%)	-0.350000

SURFACE SAR



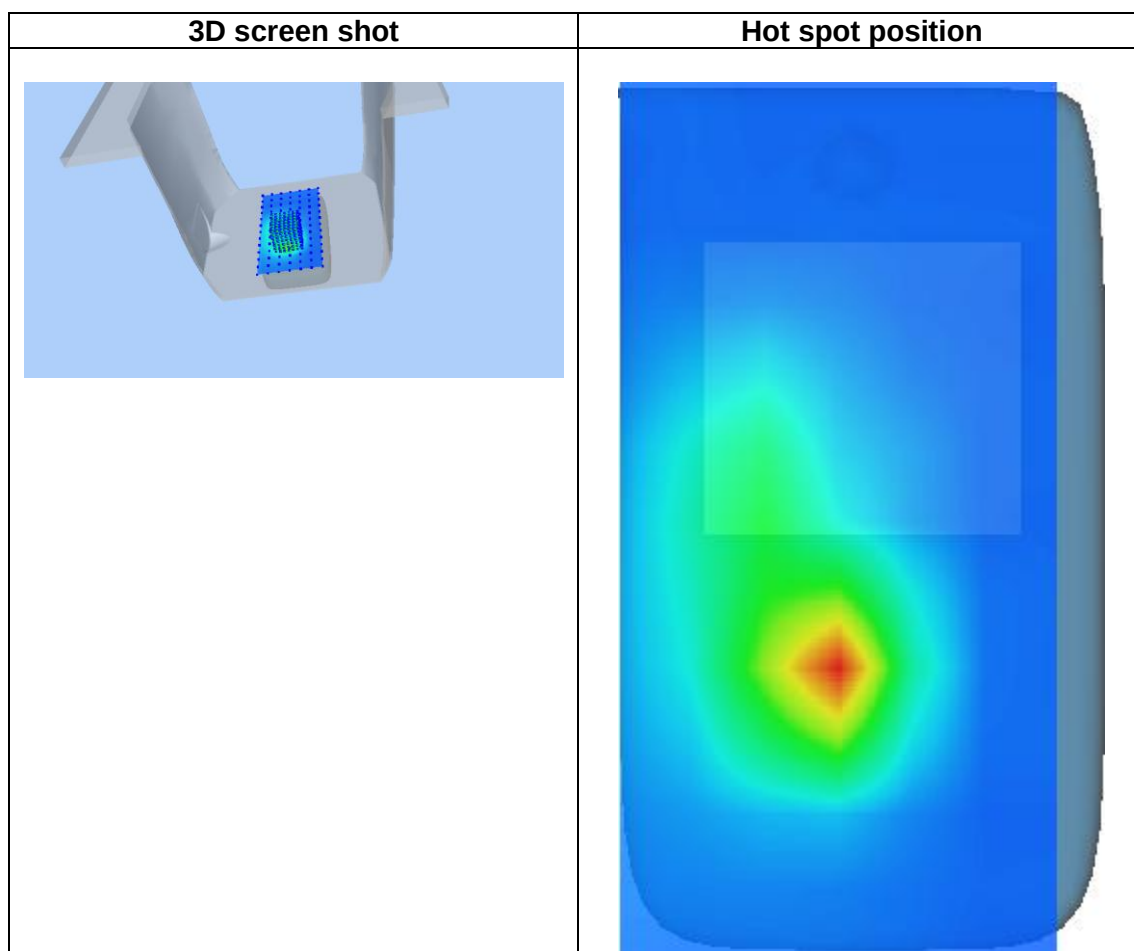
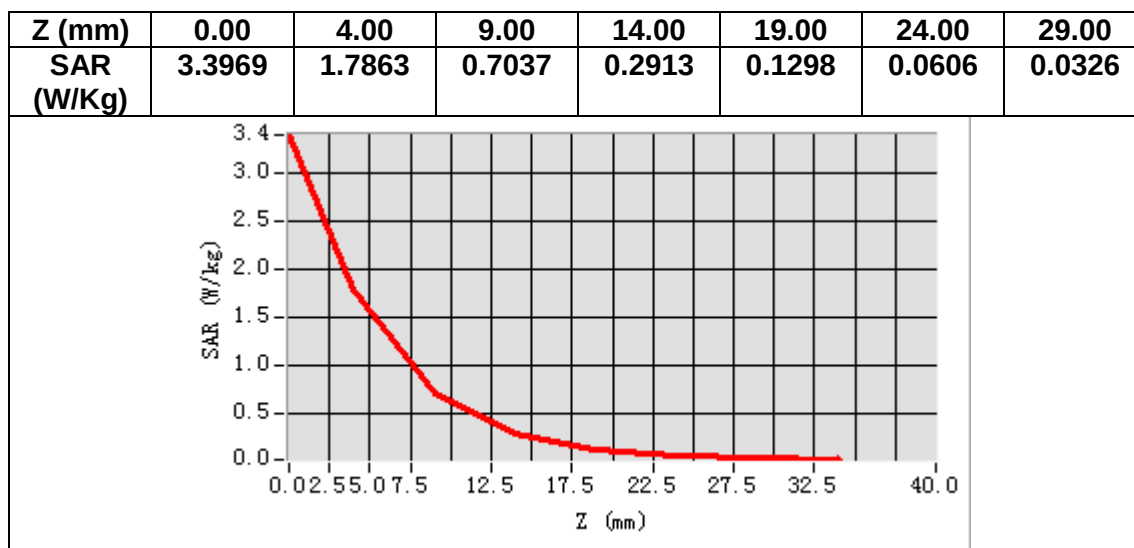
VOLUME SAR



Maximum location: X=-5.00, Y=-24.00

SAR Peak: 3.38 W/kg

SAR 10g (W/Kg)	0.555690
SAR 1g (W/Kg)	1.539270



MEASUREMENT 29

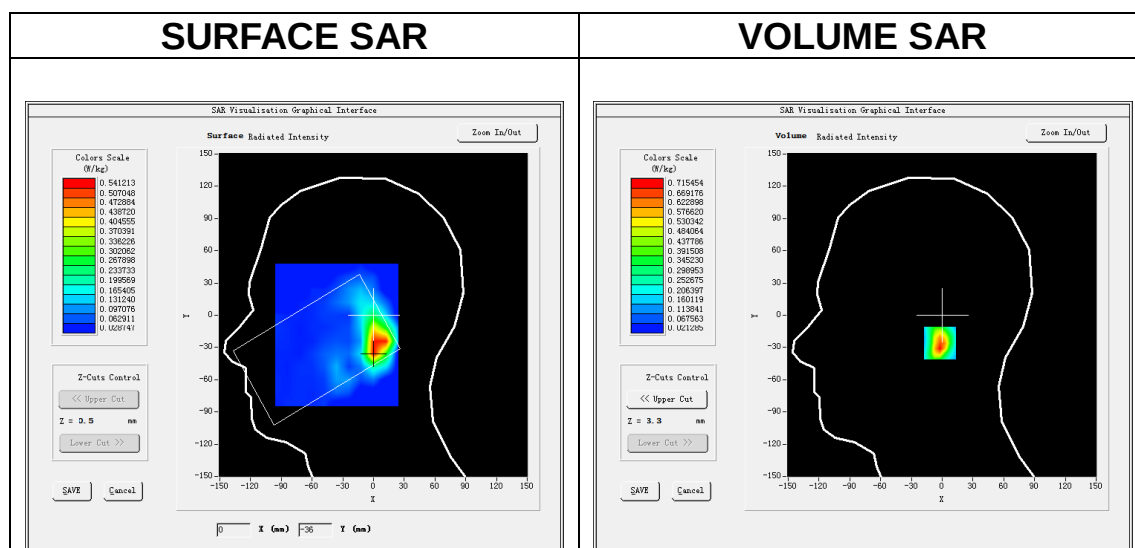
Date of measurement: 28/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>SA_n78</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>(Crest factor: 1.6)</u>
<u>ConvF</u>	<u>2.15</u>

B. SAR Measurement Results

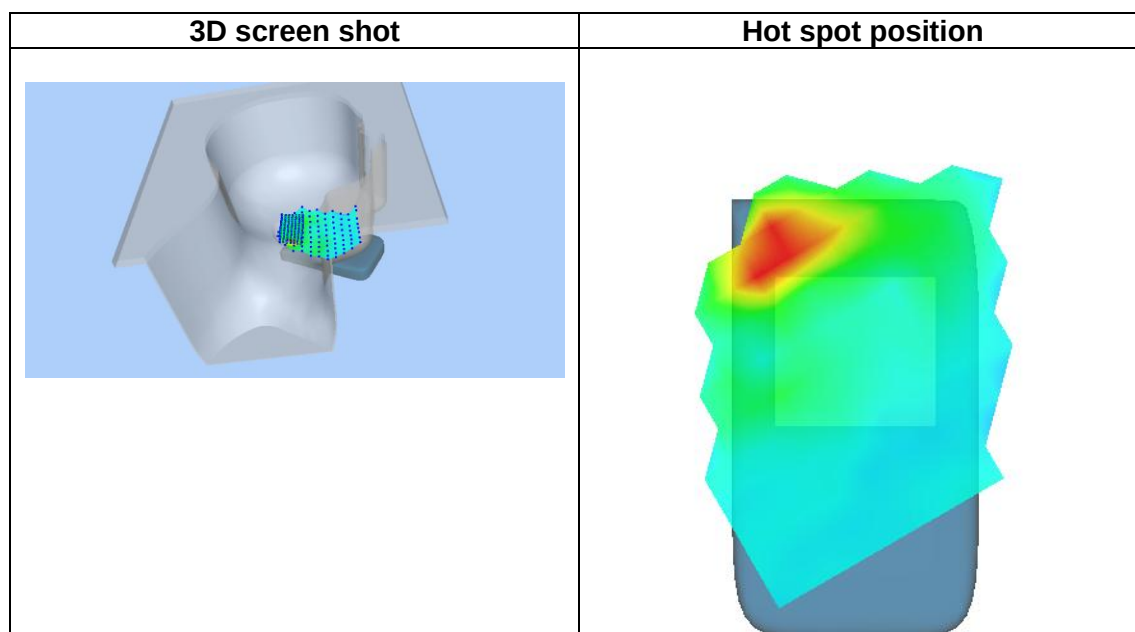
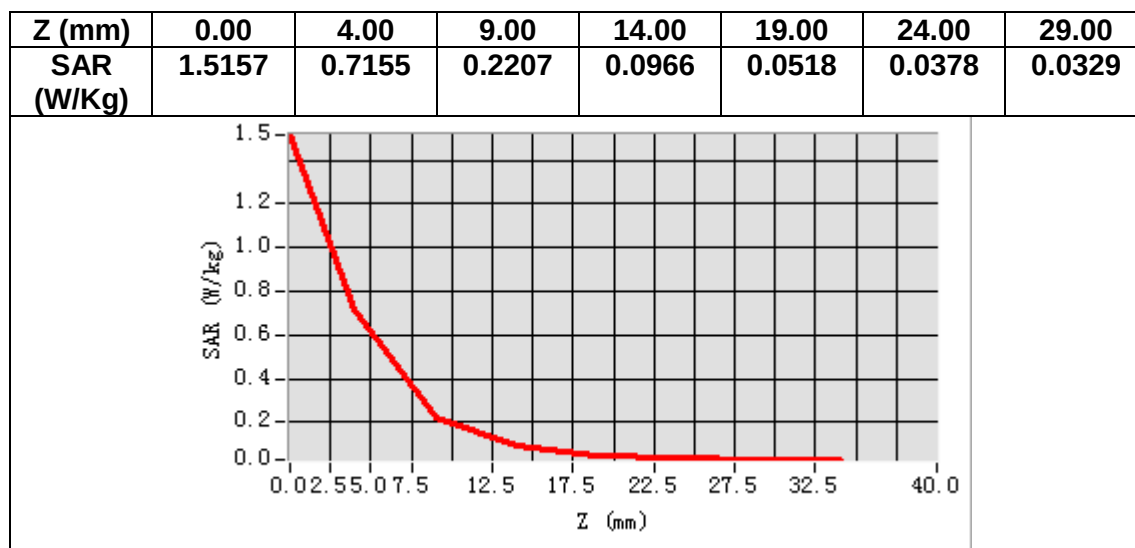
Frequency (MHz)	3549.990000
Relative permittivity (real part)	37.242344
Relative permittivity (imaginary part)	14.573976
Conductivity (S/m)	2.874304
Variation (%)	0.510000



Maximum location: X=5.00, Y=-26.00

SAR Peak: 1.46 W/kg

SAR 10g (W/Kg)	0.259037
SAR 1g (W/Kg)	0.656336



MEASUREMENT 30

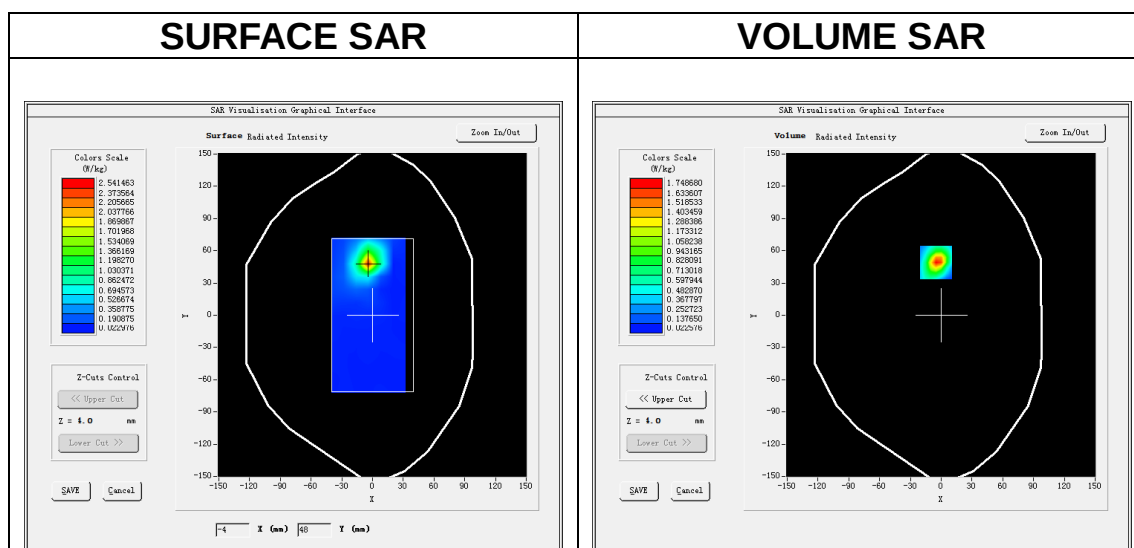
Date of measurement: 28/11/2024

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>SA_n78</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>(Crest factor: 1.6)</u>
<u>ConvF</u>	<u>2.15</u>

B. SAR Measurement Results

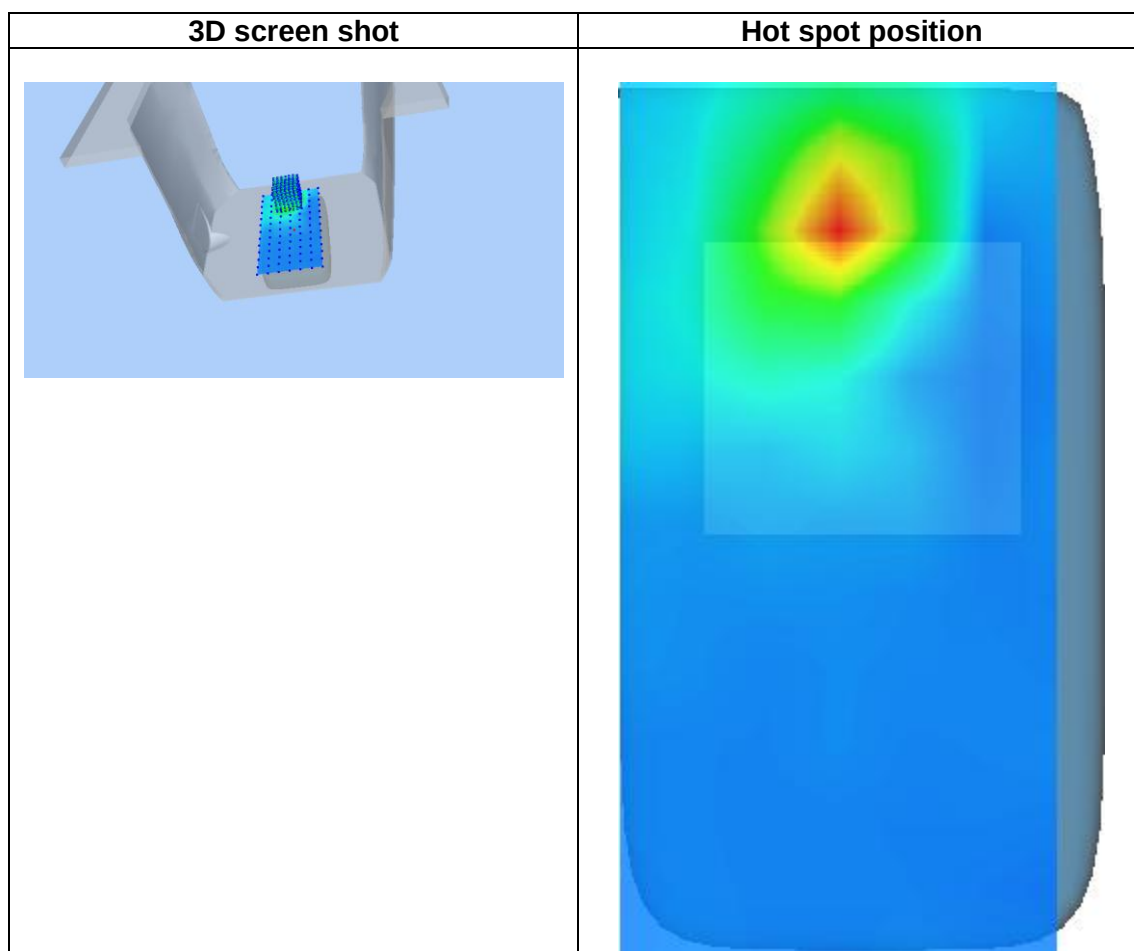
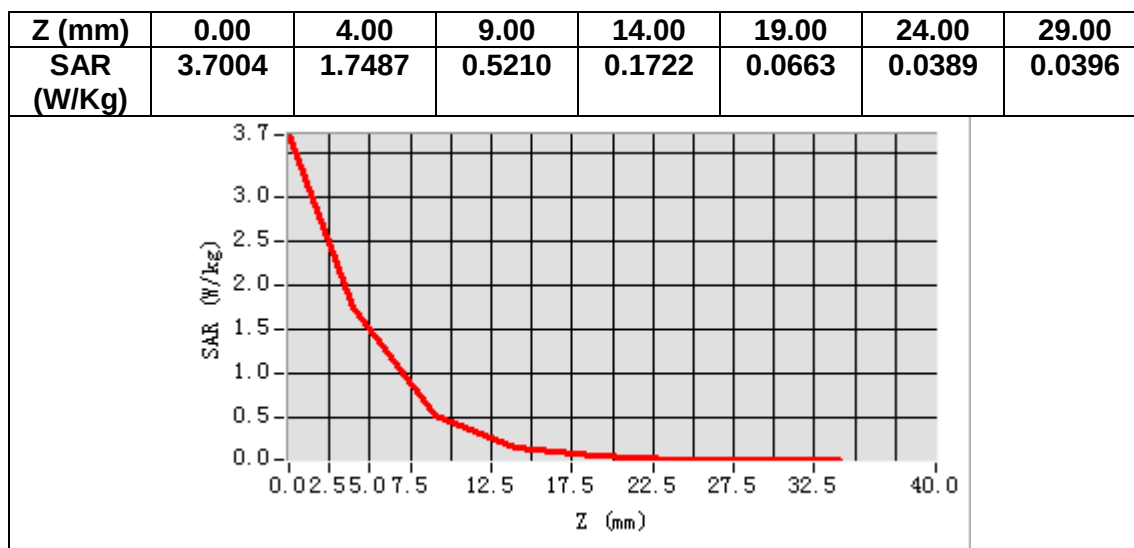
Frequency (MHz)	3549.990000
Relative permittivity (real part)	37.242344
Relative permittivity (imaginary part)	14.573976
Conductivity (S/m)	2.874304
Variation (%)	0.450000



Maximum location: X=-5.00, Y=49.00

SAR Peak: 3.72 W/kg

SAR 10g (W/Kg)	0.548893
SAR 1g (W/Kg)	1.587365



13. Appendix D. Calibration Certificate

Table of contents
E Field Probe - 4024-EPGO-442
900 MHz Dipole - SN 03/15 DIP 0G900-348
1800 MHz Dipole - SN 03/15 DIP 1G800-349
2000 MHz Dipole - SN 03/15 DIP 2G000-351
2300 MHz Dipole - SN 03/16 DIP 2G300-358
2450 MHz Dipole - SN 03/15 DIP 2G450-352
2600 MHz Dipole - SN 03/15 DIP 2G600-356
3300 MHz Dipole - SN 03/21 DIP 3G300-359
3500 MHz Dipole - SN 09/12 DIP 3G500-360
3700 MHz Dipole - SN 09/12 DIP 3G700-361
5000-6000 MHz Dipole - SN 13/14 WGA 33

DocuSign Envelope ID: 223C1A7C-4751-4B95-8502-1618DC0951E3

**COMOSAR E-Field Probe Calibration Report**

Ref : ACR.278.12.24.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 DOSIMETRIC E-FIELD PROBE
SERIAL NO.: 4024-EPGO-442**

Calibrated at MVG**Z.I. de la pointe du diable**

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

Calibration date: 10/04/2024

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

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

Summary:

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

Docusign Envelope ID: 223C1A7C-4751-4B95-8502-1618DC0951E3



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.278.12.24.BES.A

	Name	Function	Date	Signature
Prepared by :	Cyrille ONNEE	Measurement Responsible	10/4/2024	
Checked & approved by:	Pedro Ruiz	Technical Manager	10/4/2024	
Authorized by:	Pedro Ruiz	Laboratory Director	10/4/2024	

Assinado por:
Pedro RUIZ
29093B31C46F428...

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

Issue	Name	Date	Modifications
A	Cyrille ONNEE	10/4/2024	Initial release

Docusign Envelope ID: 223C1A7C-4751-4B95-8502-1618DC0951E3



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref. ACR.278.12.24.BES.A

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DocuSign Envelope ID: 223C1A7C-4751-4B95-8502-1618DC0951E3



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.278.12.24.BES.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	4024-EPGO-442
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-7.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.206 MΩ Dipole 2: R2=0.223 MΩ Dipole 3: R3=0.235 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.

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.278.12.24.BES.A

3.2 LINEARITY

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

3.3 ISOTROPY

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

3.4 BOUNDARY EFFECT

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

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

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

where

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

The measured worst case boundary effect SARuncertainty[%] for scanning distances larger than 4mm is 1.0% Limit, 2%).

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3.5 PROBE MODULATION RESPONSE

MVG's probe were evaluated experimentally with various modulated signal and the deviation from CW response were found neglectable in the used power range of the probe. So the correction to taking into account the linearization parameters for different modulation is null, therefore the CW factor given in this report can be used whatever the measured modulation

4 MEASUREMENT UNCERTAINTY

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

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

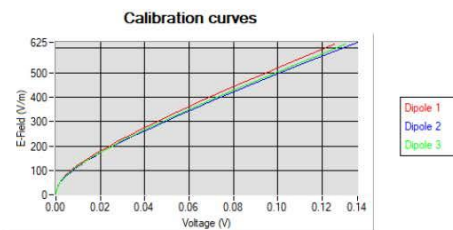
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

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

5.1 CALIBRATION IN AIR

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



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

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

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.278.12.24.BES.A

where

V_i =voltage readings on the 3 channels of the probe

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

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

Normx dipole 1 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normy dipole 2 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normz dipole 3 ($\mu\text{V}/(\text{V}/\text{m})^2$)
0.73	0.79	0.78

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
105	109	103

5.2 CALIBRATION IN LIQUID

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

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

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

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

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:

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

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:

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

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.278.12.24.BES.A

where

a=the larger cross-sectional of the waveguide

b=the smaller cross-sectional of the waveguide

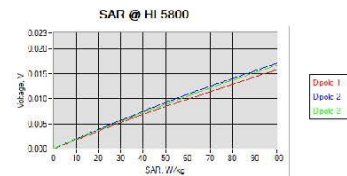
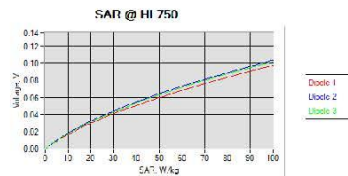
δ =the skin depth for the liquid in the waveguide

Pw=the power delivered to the liquid

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

Liquid	Frequency (MHz*)	ConvF
HL750	750	2.42
HL850	835	2.34
HL900	900	2.24
HL1800	1800	2.51
HL1900	1900	2.57
HL2000	2000	2.64
HL2300	2300	2.73
HL2450	2450	2.74
HL2600	2600	2.51
HL3300	3300	2.11
HL3500	3500	2.15
HL3700	3700	2.08
HL3900	3900	2.27
HL4200	4200	2.39
HL4600	4600	2.30
HL4900	4900	2.13
HL5200	5200	1.89
HL5400	5400	1.97
HL5600	5600	1.88
HL5800	5800	1.90

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



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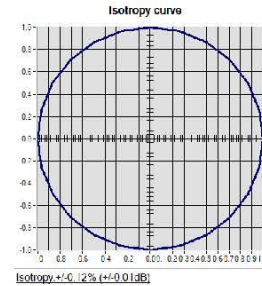
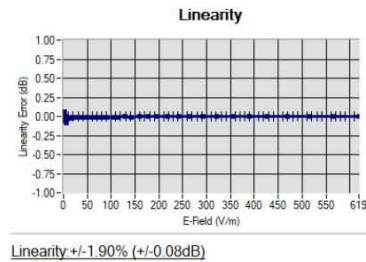


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref. ACR.278.12.24.BES.A

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.



7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2026
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
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	06/2026
USB Sensor	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.

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.278.12.24.BES.A

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	44235403	02/2024	02/2027



SAR Reference Dipole Calibration Report

Ref : ACR.53.25.24.BES.A

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**BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE**

FREQUENCY: 900 MHZ

SERIAL NO.: SN 03/15DIP0G900-348

Calibrated at MVG

Z.I. de la pointe du diable

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

Calibration date: 21/02/2024



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Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.25.24.BES.A

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

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Toutain ID

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

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.25.24.BES.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.25.24.BES.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 900 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID900
Serial Number	SN 03/15DIP0G900-348
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.25.24.BES.A

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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

4.2 S11 PARAMETER REQUIREMENTS

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

4.3 SAR REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

5.1 MECHANICAL DIMENSIONS

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

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

5.2 S11 PARAMETER

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

5.3 SAR

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

The estimated expanded uncertainty ($k=2$) in calibration for the 1g and 10g SAR measurement in W/kg is $\pm 19\%$ with respect to measurement conditions.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

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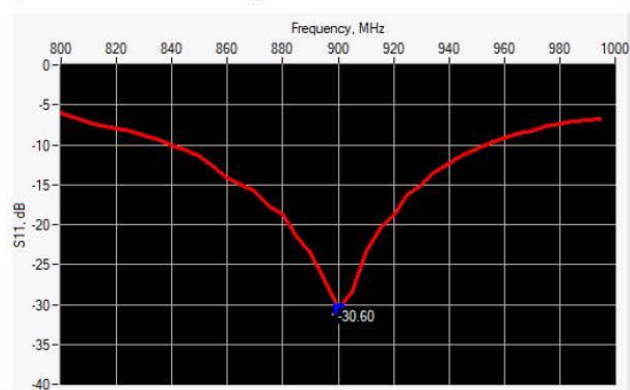
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	149.00 +/- 2%	-	83.30 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
900	-30.60	-20	$51.5\Omega + 2.6j\Omega$

6.3 SAR

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

6.3.1 SAR with Head Liquid

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

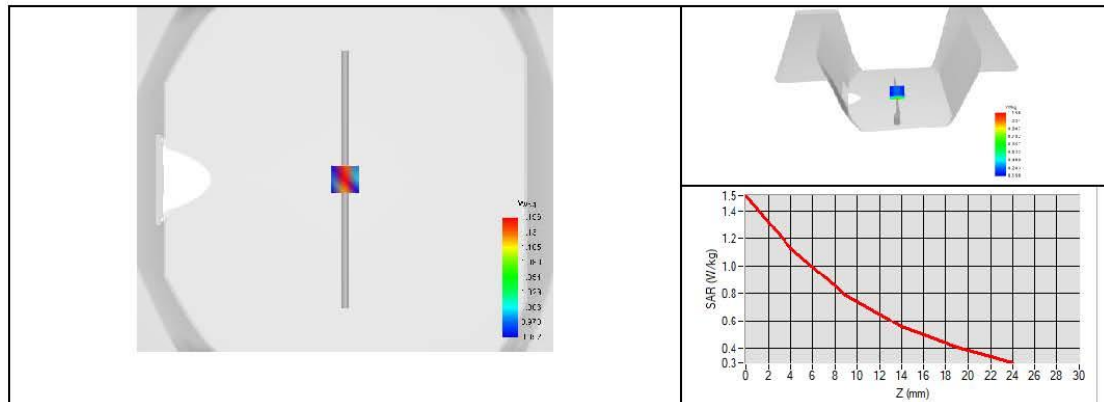


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.25.24.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: $\epsilon_{ps}' : 44.6$ $\sigma : 0.92$
Distance between dipole center and liquid	15.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
900 MHz	1.06	10.63	10.90	0.70	7.01	6.99





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.25.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3523-EPGO-429	11/2023	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024



SAR Reference Dipole Calibration Report

Ref : ACR.53.26.24.BES.A

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**BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE**

FREQUENCY: 1800 MHZ

SERIAL NO.: SN 03/15DIP1G800-349

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

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Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.26.24.BES.A

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

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Toutain ID

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

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.26.24.BES.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.26.24.BES.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID1800
Serial Number	SN 03/15DIP1G800-349
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.26.24.BES.A

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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

4.2 S11 PARAMETER REQUIREMENTS

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

4.3 SAR REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

5.1 MECHANICAL DIMENSIONS

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

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

5.2 S11 PARAMETER

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

5.3 SAR

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

The estimated expanded uncertainty ($k=2$) in calibration for the 1g and 10g SAR measurement in W/kg is $\pm 19\%$ with respect to measurement conditions.

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Template_ACR.DDD.N.YY.MVGB.ISSUE_SAR Reference Dipole vL

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.26.24.BES.A

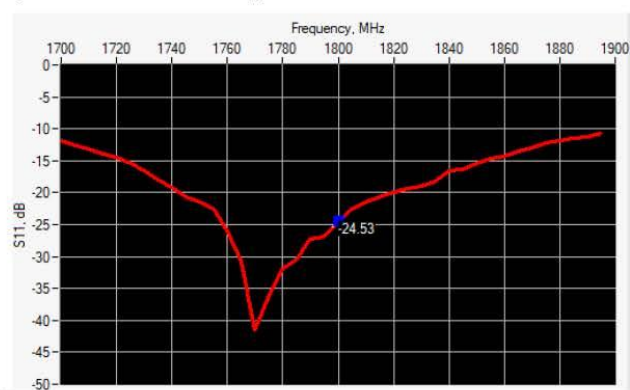
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	72.00 +/- 2%	-	41.70 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
1800	-24.53	-20	$44.8\Omega + 2.0j\Omega$

6.3 SAR

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

6.3.1 SAR with Head Liquid

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

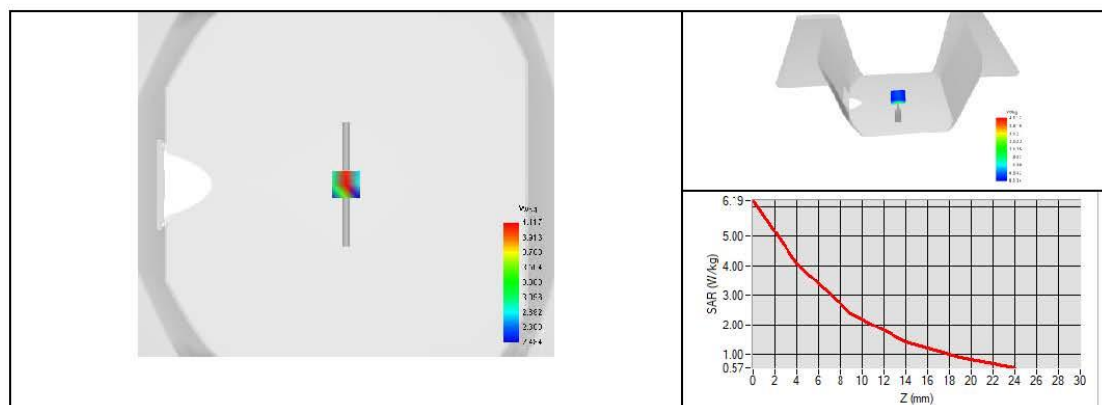


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.26.24.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: $\epsilon_p' : 42.7$ $\sigma : 1.36$
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
1800 MHz	3.71	37.06	38.40	2.00	20.01	20.10





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.26.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3523-EPGO-429	11/2023	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024



SAR Reference Dipole Calibration Report

Ref : ACR.53.28.24.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: 2000 MHZ

SERIAL NO.: SN 03/15DIP2G000-351

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

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Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.28.24.BES.A

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

Yann
Toutain IDSignature numérique
de Yann Toutain ID
Date : 2024.02.27
08:57:13 +01'00'

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

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.28.24.BES.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.28.24.BES.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2000 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2000
Serial Number	SN 03/15DIP2G000-351
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.28.24.BES.A

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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

4.2 S11 PARAMETER REQUIREMENTS

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

4.3 SAR REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

5.1 MECHANICAL DIMENSIONS

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

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

5.2 S11 PARAMETER

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

5.3 SAR

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

The estimated expanded uncertainty (k=2) in calibration for the 1g and 10g SAR measurement in W/kg is +/-19% with respect to measurement conditions.

Page: 5/8

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.28.24.BES.A

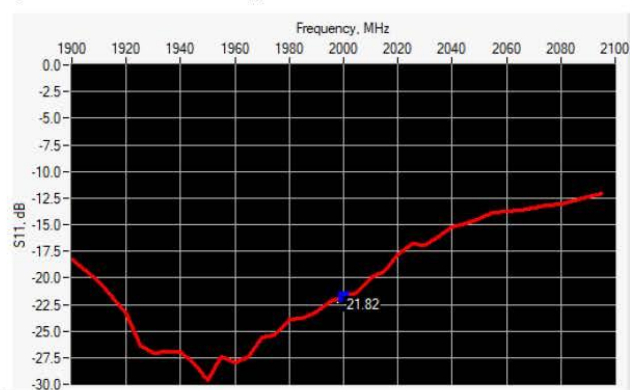
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	64.50 +/- 2%	-	37.50 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2000	-21.82	-20	$58.3\Omega + 2.9j\Omega$

6.3 SAR

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

6.3.1 SAR with Head Liquid

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

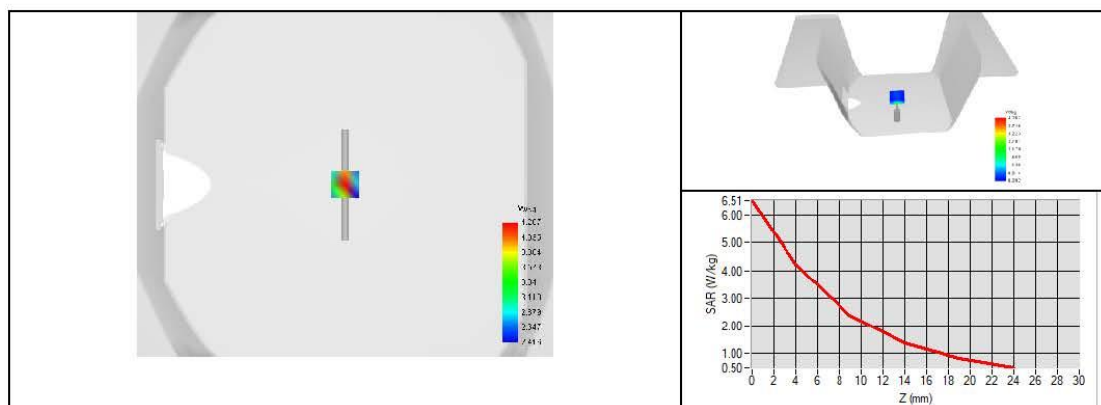


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.28.24.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: $\epsilon_{ps}' : 42.6$ $\sigma : 1.46$
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=5mm/dy=5mm/dz=5mm$
Frequency	2000 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
2000 MHz	3.83	38.27	41.10	1.98	19.79	21.10





SAR Reference Dipole Calibration Report

Ref : ACR.53.32.24.BES.A

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**BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE**

FREQUENCY: 2300 MHZ

SERIAL NO.: SN 03/16DIP2G300-358

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
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Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.32.24.BES.A

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

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Toutain ID

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Yann Toutain ID
Date : 2024.02.27
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	Customer Name
Distribution :	SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.32.24.BES.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.32.24.BES.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2300 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2300
Serial Number	SN 03/16DIP2G300-358
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.32.24.BES.A

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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

4.2 S11 PARAMETER REQUIREMENTS

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

4.3 SAR REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

5.1 MECHANICAL DIMENSIONS

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

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

5.2 S11 PARAMETER

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

5.3 SAR

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

The estimated expanded uncertainty ($k=2$) in calibration for the 1g and 10g SAR measurement in W/kg is $\pm 19\%$ with respect to measurement conditions.

Page: 5/8

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Ref.: ACR.53.32.24.BES.A

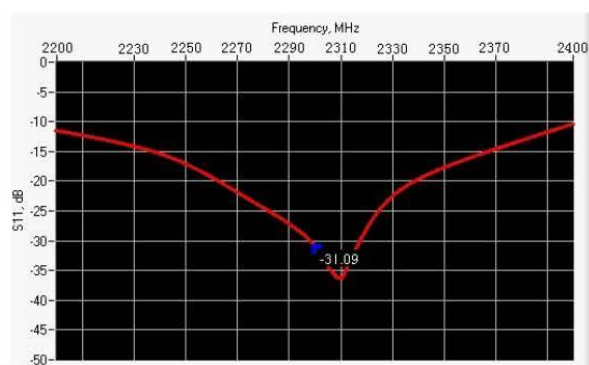
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	55.50 +/- 2%	-	32.60 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2300	-31.09	-20	56.3Ω - 2.9jΩ

6.3 SAR

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

6.3.1 SAR with Head Liquid

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

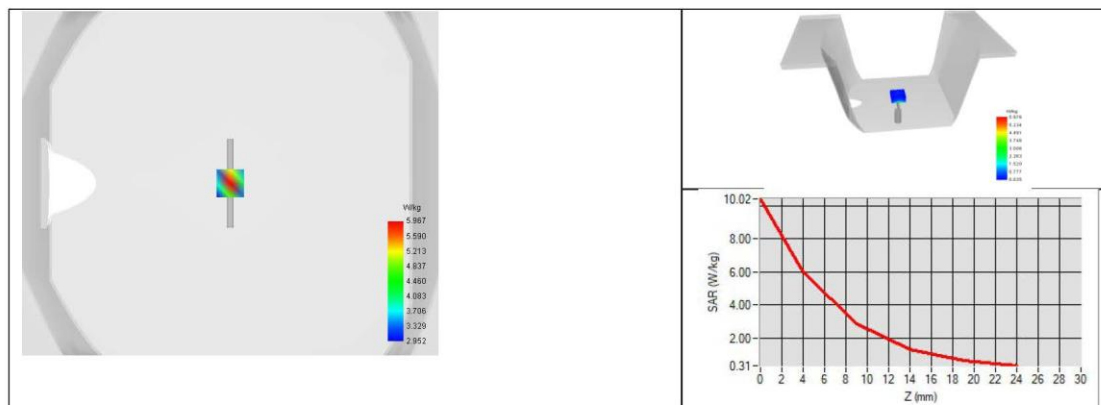


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.32.24.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: eps' : 42.0 sigma : 1.80
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2300 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
2300 MHz	5.06	50.63	48.70	2.35	23.51	23.30





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.32.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3523-EPGO-429	11/2023	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

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Ref.: ACR.53.28.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3523-EPGO-429	11/2023	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024



SAR Reference Dipole Calibration Report

Ref : ACR.53.29.24.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: 2450 MHZ

SERIAL NO.: SN 03/15DIP2G450-352

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
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Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.29.24.BES.A

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

Yann
Toutain ID

Signature
numérique de
Yann Toutain ID
Date : 2024.02.27
08:57:39 +01'00'

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

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2450 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2450
Serial Number	SN 03/15DIP2G450-352
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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

4.2 S11 PARAMETER REQUIREMENTS

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

4.3 SAR REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

5.1 MECHANICAL DIMENSIONS

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

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

5.2 S11 PARAMETER

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

5.3 SAR

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

The estimated expanded uncertainty (k=2) in calibration for the 1g and 10g SAR measurement in W/kg is +/-19% with respect to measurement conditions.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

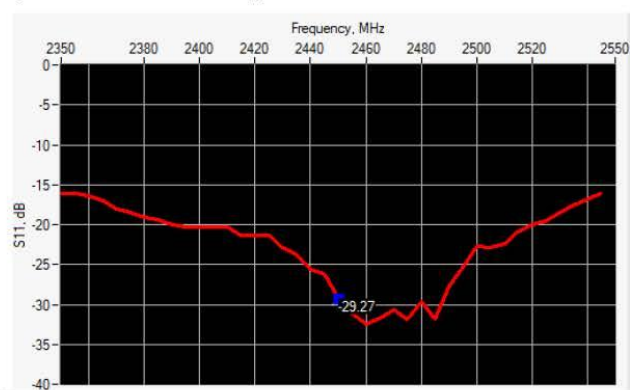
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	51.50 +/- 2%	-	30.40 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2450	-29.27	-20	$53.6\Omega + 0.1j\Omega$

6.3 SAR

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

6.3.1 SAR with Head Liquid

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

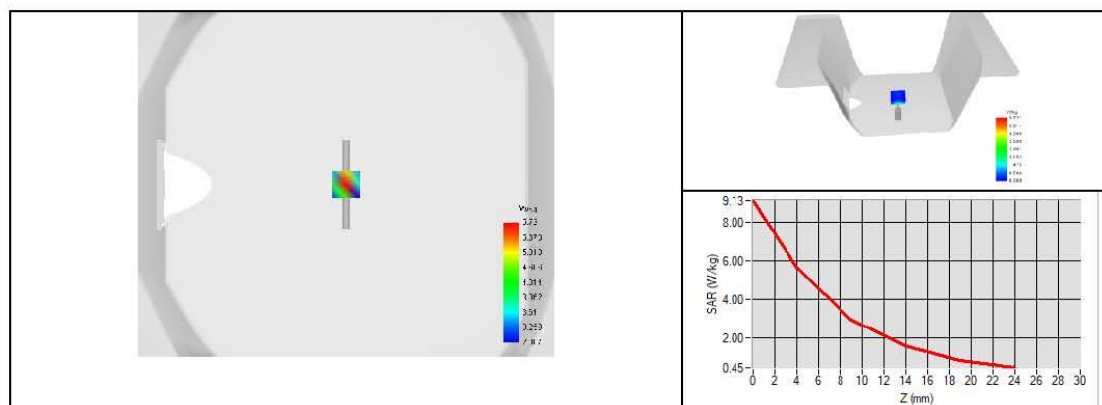


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.29.24.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: $\epsilon_{ps}' : 42.1$ $\sigma : 1.83$
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=5mm/dy=5mm/dz=5mm$
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
2450 MHz	5.00	50.05	52.40	2.38	23.80	24.00





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3523-EPGO-429	11/2023	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024



SAR Reference Dipole Calibration Report

Ref : ACR.53.30.24.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: 2600 MHZ

SERIAL NO.: SN 03/15DIP2G600-356

Calibrated at MVG

Z.I. de la pointe du diable

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

Calibration date: 02/21/2024



Accreditations #2-6789 and #2-6814
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Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref : ACR.53.30.24.BES.A

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

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

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.30.24.BES.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.30.24.BES.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2600 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2600
Serial Number	SN 03/15DIP2G600-356
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.30.24.BES.A

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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

4.2 S11 PARAMETER REQUIREMENTS

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

4.3 SAR REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

5.1 MECHANICAL DIMENSIONS

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

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

5.2 S11 PARAMETER

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

5.3 SAR

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

The estimated expanded uncertainty ($k=2$) in calibration for the 1g and 10g SAR measurement in W/kg is $\pm 19\%$ with respect to measurement conditions.

Page: 5/8

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.30.24.BES.A

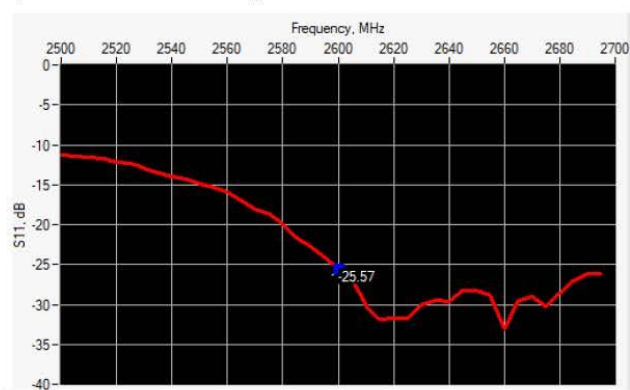
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

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

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2600	-25.57	-20	$54.5\Omega - 3.2j\Omega$

6.3 SAR

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

6.3.1 SAR with Head Liquid

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



SAR Reference Dipole Calibration Report

Ref : ACR.53.33.24.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: 3300 MHZ

SERIAL NO.: SN 03/21DIP3G300-359

Calibrated at MVG

Z.I. de la pointe du diable

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

Calibration date: 5/18/2024



Accreditations #2-6789 and #2-6814
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Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.33.24.BES.A

	Name	Function	Date	Signature
Prepared by :	Pedro Ruiz	Measurement Responsible	5/18/2024	
Checked & approved by:	Jérôme Luc	Technical Manager	5/18/2024	
Authorized by:	Yann Toutain	Laboratory Director	5/19/2024	

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

Issue	Name	Date	Modifications
A	Pedro Ruiz	5/19/2024	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.33.24.BES.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.33.24.BES.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 3300 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID3300
Serial Number	SN 03/21 DIP 3G300-359
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.33.24.BES.A

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.08 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
0 - 300	0.20 mm
300 - 450	0.44 mm



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.33.24.BES.A

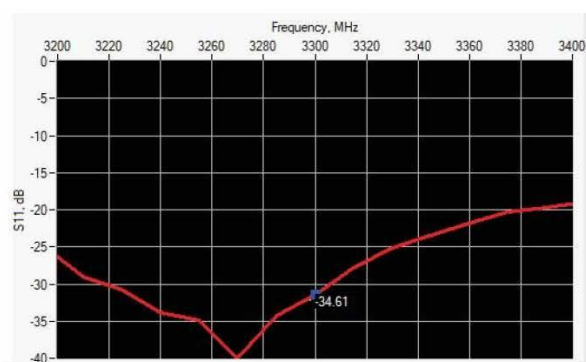
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	19 % (SAR)
10 g	19 % (SAR)

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
3300	-34.61	-20	$50.7 \Omega + 2.6 j\Omega$



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.33.24.BES.A

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3300	-	39.65	-	25.41	-	3.63
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3900	-		-		-	
4200	-		-		-	
4600	-		-		-	
4900	-		-		-	

7 VALIDATION MEASUREMENT

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.33.24.BES.A

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 10 %		0.87 $\pm$ 10 %	
450	43.5 $\pm$ 10 %		0.87 $\pm$ 10 %	
750	41.9 $\pm$ 10 %		0.89 $\pm$ 10 %	
835	41.5 $\pm$ 10 %		0.90 $\pm$ 10 %	
900	41.5 $\pm$ 10 %		0.97 $\pm$ 10 %	
1450	40.5 $\pm$ 10 %		1.20 $\pm$ 10 %	
1500	40.4 $\pm$ 10 %		1.23 $\pm$ 10 %	
1640	40.2 $\pm$ 10 %		1.31 $\pm$ 10 %	
1750	40.1 $\pm$ 10 %		1.37 $\pm$ 10 %	
1800	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
1900	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
1950	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2000	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2100	39.8 $\pm$ 10 %		1.49 $\pm$ 10 %	
2300	39.5 $\pm$ 10 %		1.67 $\pm$ 10 %	
2450	39.2 $\pm$ 10 %		1.80 $\pm$ 10 %	
2600	39.0 $\pm$ 10 %		1.96 $\pm$ 10 %	
3000	38.5 $\pm$ 10 %		2.40 $\pm$ 10 %	
3300	38.2 $\pm$ 10 %	37.8	2.71 $\pm$ 10 %	2.85
3500	37.9 $\pm$ 10 %		2.91 $\pm$ 10 %	
3700	37.7 $\pm$ 10 %		3.12 $\pm$ 10 %	
3900	37.5 $\pm$ 10 %		3.32 $\pm$ 10 %	
4200	37.1 $\pm$ 10 %		3.63 $\pm$ 10 %	
4600	36.7 $\pm$ 10 %		4.04 $\pm$ 10 %	
4900	36.3 $\pm$ 10 %		4.35 $\pm$ 10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Page: 8/11

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.33.24.BES.A

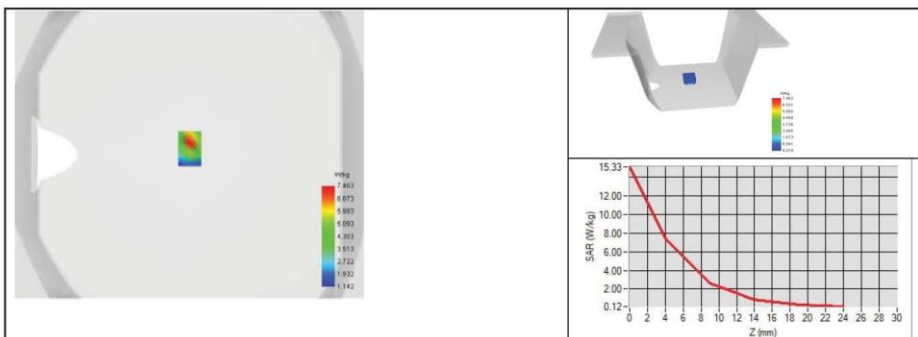
Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: $\epsilon_s' : 37.8$ $\sigma : 2.85$
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=5mm/dy=5mm/dz=4mm$
Frequency	3300 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3300	-	67.61 (6.76)	-	26.04 (2.60)
3500	67.1		25	
3700	67.4		24.2	
3900	-		-	
4200	-		-	
4600	-		-	
4900	-		-	



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.53.33.24.BES.A





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR 53.33.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3523-EPGO-429	11/2023	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024



SAR Reference Dipole Calibration Report

Ref : ACR.139.15.20.SATU.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: 3500 MHZ
SERIAL NO.: SN 09/12 DIP 3G500-360

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



10/15/2022

Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.15.20.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	10/15/2022	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	10/15/2022	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	10/15/2022	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	10/15/2022	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.15.20.SATU.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.15.20.SATU.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 3500 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID3500
Serial Number	SN 09/12 DIP 3G500-360
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.15.20.SATU.A

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, FCC KDBs, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %



SAR REFERENCE DIPOLE CALIBRATION REPORT

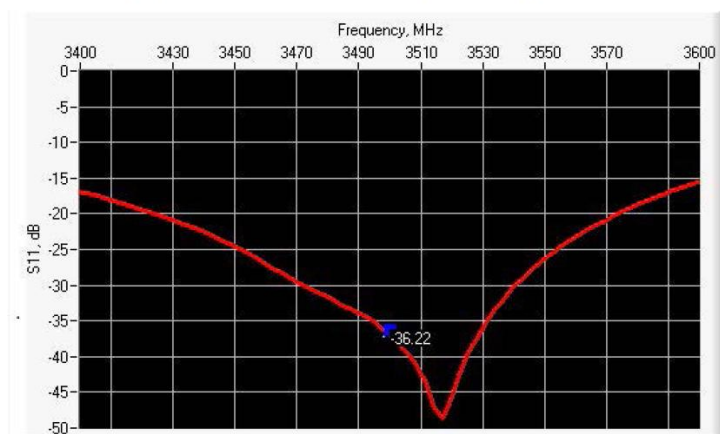
Ref: ACR.139.15.20.SATU.A

10 g

20.1 %

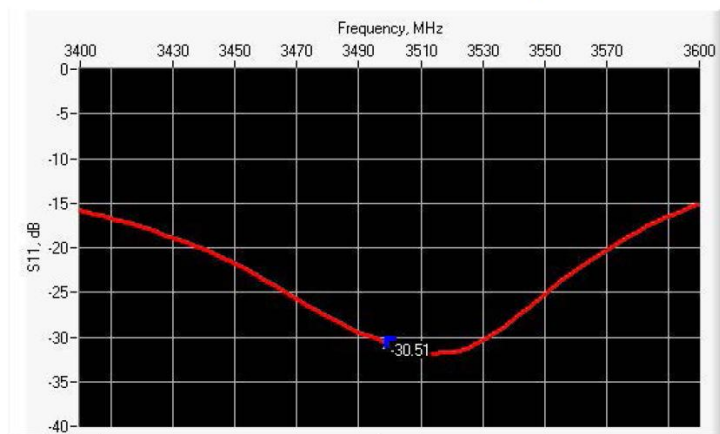
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
3500	-36.22	-20	$48.9 \Omega + 1.1 j\Omega$

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
3500	-30.51	-20	$52.2 \Omega + 2.0 j\Omega$

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	$420.0 \pm 1 \%$		$250.0 \pm 1 \%$		$6.35 \pm 1 \%$	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.15.20.SATU.A

450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3400	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.	PASS	26.4 ±1 %.	PASS	3.6 ±1 %.	PASS
3800	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

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

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

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1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3400	38.0 ±5 %		2.81 ±5 %	
3500	37.9 ±5 %	PASS	2.91 ±5 %	PASS

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 37.9 sigma : 2.95
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	3500 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	

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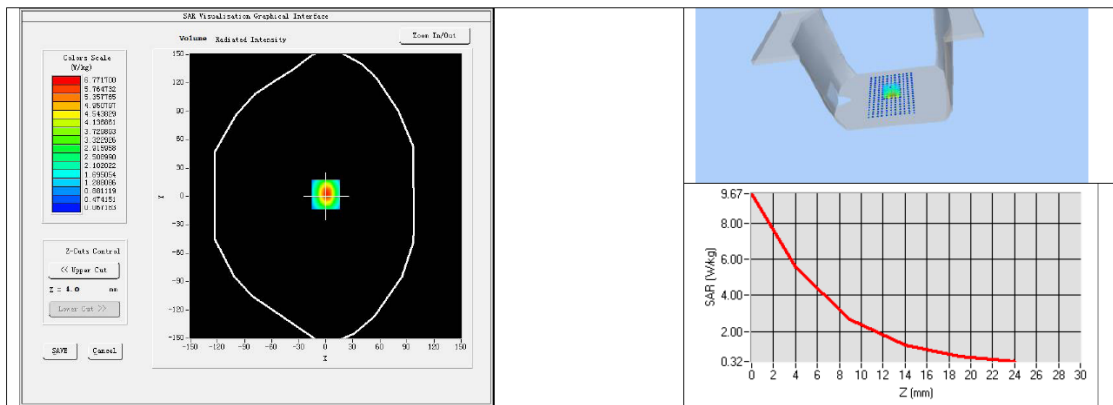
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Ref: ACR.139.15.20.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3400	66.4		25.1	
3500	67.1	67.18 (6.72)	25	24.50 (2.45)



7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ± 5 %		0.80 ± 5 %	
300	58.2 ± 5 %		0.92 ± 5 %	
450	56.7 ± 5 %		0.94 ± 5 %	
750	55.5 ± 5 %		0.96 ± 5 %	
835	55.2 ± 5 %		0.97 ± 5 %	
900	55.0 ± 5 %		1.05 ± 5 %	
915	55.0 ± 5 %		1.06 ± 5 %	
1450	54.0 ± 5 %		1.30 ± 5 %	
1610	53.8 ± 5 %		1.40 ± 5 %	
1800	53.3 ± 5 %		1.52 ± 5 %	
1900	53.3 ± 5 %		1.52 ± 5 %	
2000	53.3 ± 5 %		1.52 ± 5 %	
2100	53.2 ± 5 %		1.62 ± 5 %	
2450	52.7 ± 5 %		1.95 ± 5 %	

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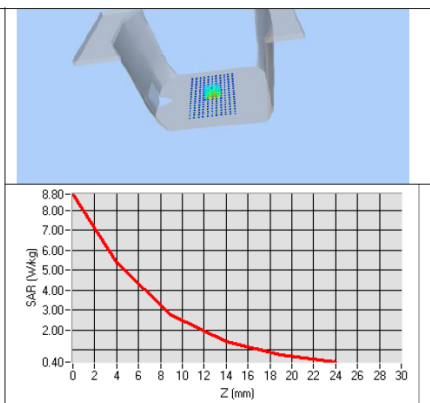
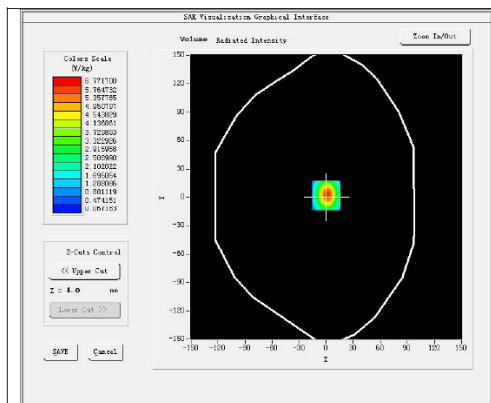
Ref: ACR.139.15.20.SATU.A

3400	51.5 ±5 %		3.20 ±5 %	
3500	51.3 ±5 %	PASS	3.31 ±5 %	PASS
3800	50.9 ±5 %		3.66 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 51.4 sigma : 3.40
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	3500 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
3500	59.22(5.92)	23.80 (2.38)





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.15.20.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2020	02/2023
Calipers	Carrera	CALIPER-01	01/2020	01/2023
Reference Probe	MVG	EPG122 SN 18/11	06/2022	06/2023
Multimeter	Keithley 2000	1188656	01/2020	01/2023
Signal Generator	Agilent E4438C	MY49070581	01/2020	01/2023
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2020	01/2023
Power Sensor	HP ECP-E26A	US37181460	01/2020	01/2023
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	11/2019	11/2022

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SAR Reference Dipole Calibration Report

Ref : ACR.139.16.20.SATU.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: 3700 MHZ
SERIAL NO.: SN 09/12 DIP 3G700-361

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



10/15/2022

Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.16.20.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	10/15/2022	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	10/15/2022	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	10/15/2022	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	10/15/2022	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.16.20.SATU.A

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7.4	SAR Measurement Result With Body Liquid	10
8	List of Equipment	11



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.16.20.SATU.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 3700 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID3700
Serial Number	SN 09/12 DIP 3G700-361
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.16.20.SATU.A

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, FCC KDBs, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %

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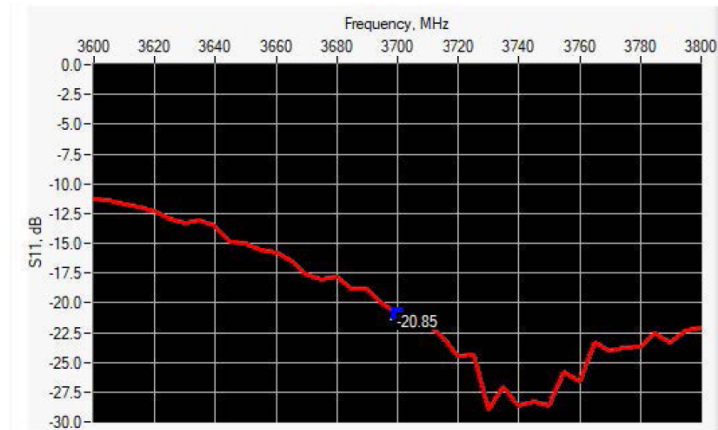
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.16.20.SATU.A

10 g	20.1 %
------	--------

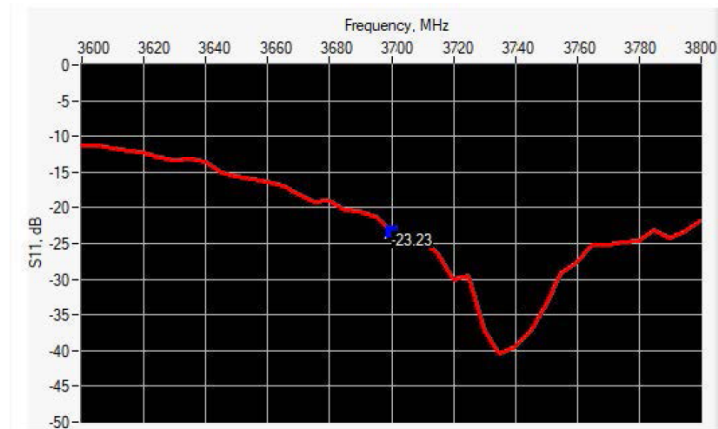
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
3700	-20.85	-20	54.9 Ω - 8.3 j Ω

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
3700	-23.23	-20	50.6 Ω - 7.0 j Ω

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 $\pm$ 1 %.		250.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.16.20.SATU.A

450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3400	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3600	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.	PASS	26.4 ±1 %.	PASS	3.6 ±1 %.	PASS

7 VALIDATION MEASUREMENT

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

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	

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1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
3400	38.0 ±5 %		2.81 ±5 %	
3600	37.8 ±5 %		3.02 ±5 %	
3700	37.7 ±5 %	PASS	3.12 ±5 %	PASS

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_{ps} : 37.8 σ : 3.25
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=5mm/dy=5mm/dz=5mm$
Frequency	3700 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	

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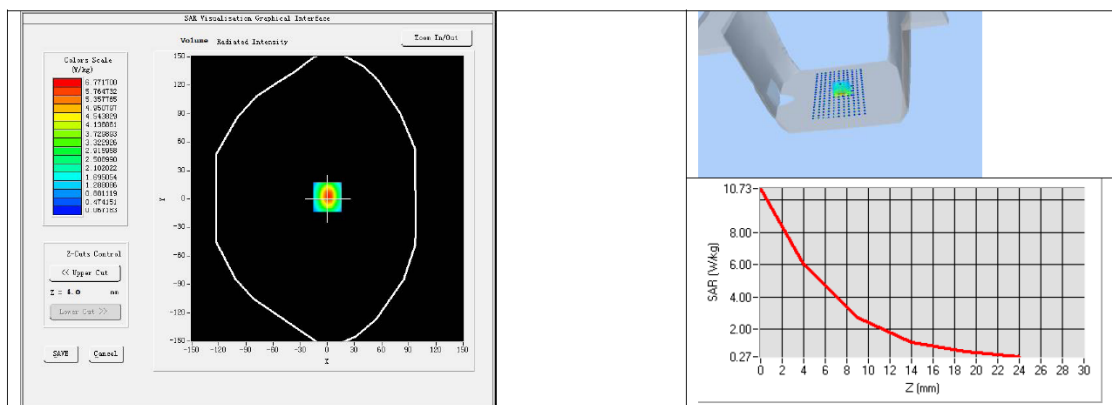
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1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3400	66.4		25.1	
3600	67.3		24.6	
3700	67.4	66.30 (6.63)	24.2	24.16 (2.42)



7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 $\pm$ 5 %		0.80 $\pm$ 5 %	
300	58.2 $\pm$ 5 %		0.92 $\pm$ 5 %	
450	56.7 $\pm$ 5 %		0.94 $\pm$ 5 %	
750	55.5 $\pm$ 5 %		0.96 $\pm$ 5 %	
835	55.2 $\pm$ 5 %		0.97 $\pm$ 5 %	
900	55.0 $\pm$ 5 %		1.05 $\pm$ 5 %	
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 5 %		1.40 $\pm$ 5 %	
1800	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
1900	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2000	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2100	53.2 $\pm$ 5 %		1.62 $\pm$ 5 %	

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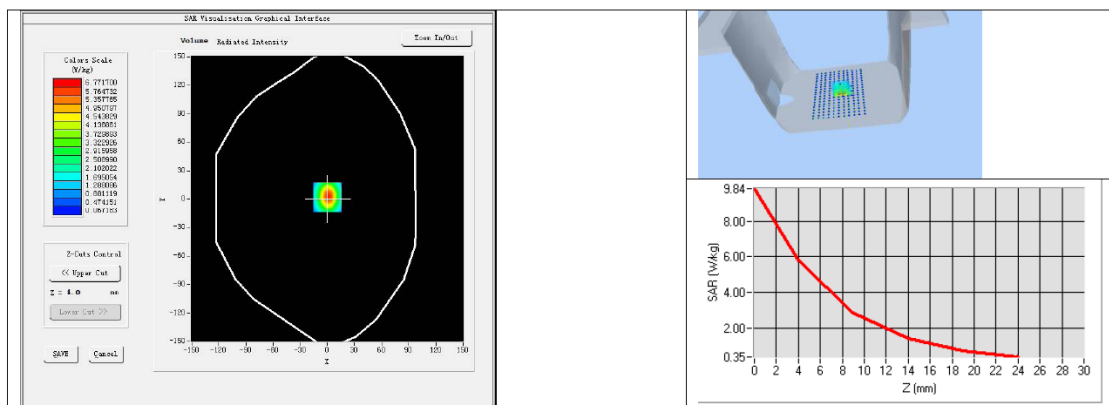
Ref: ACR.139.16.20.SATU.A

2300	52.9 ±5 %		1.81 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3400	51.5 ±5 %		3.20 ±5 %	
3600	51.2 ±5 %		3.43 ±5 %	
3700	51.1 ±5 %	PASS	3.55 ±5 %	PASS
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 51.3 sigma : 3.56
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	3700 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
3700	62.36 (6.24)	23.56 (2.35)



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Ref: ACR.139.16.20.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2020	02/2023
Calipers	Carrera	CALIPER-01	01/2020	01/2023
Reference Probe	MVG	EPG122 SN 18/11	06/2022	06/2023
Multimeter	Keithley 2000	1188656	01/2020	01/2023
Signal Generator	Agilent E4438C	MY49070581	01/2020	01/2023
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2020	01/2023
Power Sensor	HP ECP-E26A	US37181460	01/2020	01/2023
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	11/2019	11/2022



SAR Reference Waveguide Calibration Report

Ref : ACR.53.31.24.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 WAVEGUIDE**

FREQUENCY: 5000-6000 MHZ

SERIAL NO.: SN 13/14 WGA 33

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
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Summary:

This document presents the method and results from an accredited SAR reference waveguide calibration performed at MVG, using the COMOSAR test bench. The test results covered by accreditation are traceable to the International System of Units (SI).



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref : ACR.53.31.24.BES.A

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

Yann
Toutain ID

Signature
numérique de Yann
Toutain ID
Date : 2024.02.27
08:58:45 +01'00'

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

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



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref.: ACR.53.31.24.BES.A

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SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference waveguides used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 5000-6000 MHz REFERENCE WAVEGUIDE
Manufacturer	MVG
Model	SWG5500
Serial Number	SN 13/14 WGA 33
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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

4.2 S11 PARAMETER REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a S11 of -8 dB or better. The S11 measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref.: ACR.53.31.24.BES.A

4.3 SAR REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

5.1 MECHANICAL DIMENSIONS

The estimated expanded uncertainty ($k=2$) in calibration for the dimension measurement in mm is ± 0.20 mm with respect to measurement conditions.

5.2 S11 PARAMETER

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

5.3 SAR

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

The estimated expanded uncertainty ($k=2$) in calibration for the 1g and 10g SAR measurement in W/kg is $\pm 19\%$ with respect to measurement conditions.

6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

Frequency (MHz)	L (mm)		W (mm)		L _r (mm)		W _r (mm)	
	Required	Measured	Required	Measured	Required	Measured	Required	Measured
5800	40.39 $\pm$ 0.13	-	20.19 $\pm$ 0.13	-	81.03 $\pm$ 0.13	-	61.98 $\pm$ 0.13	-

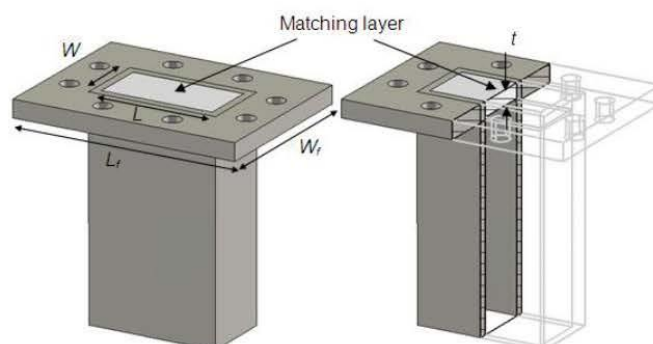
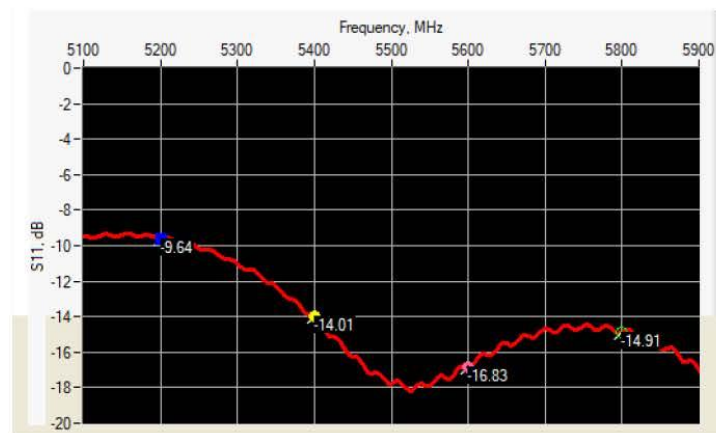


Figure 1: Validation Waveguide Dimensions



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref.: ACR.53.31.24.BES.A

6.2 S11 PARAMETER6.2.1 S11 parameter In Head Liquid

Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
5200	-9.64	-8	$25.80 \Omega - 6.58 j\Omega$
5400	-14.01	-8	$51.53 \Omega + 20.60 j\Omega$
5600	-16.83	-8	$44.12 \Omega - 12.35 j\Omega$
5800	-14.91	-8	$38.53 \Omega + 11.21 j\Omega$

6.3 SAR

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference waveguide meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed with the matching layer placed in the open end of the waveguide, with the waveguide and matching layer in direct contact with the phantom shell.

6.3.1 SAR With Head Liquid

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



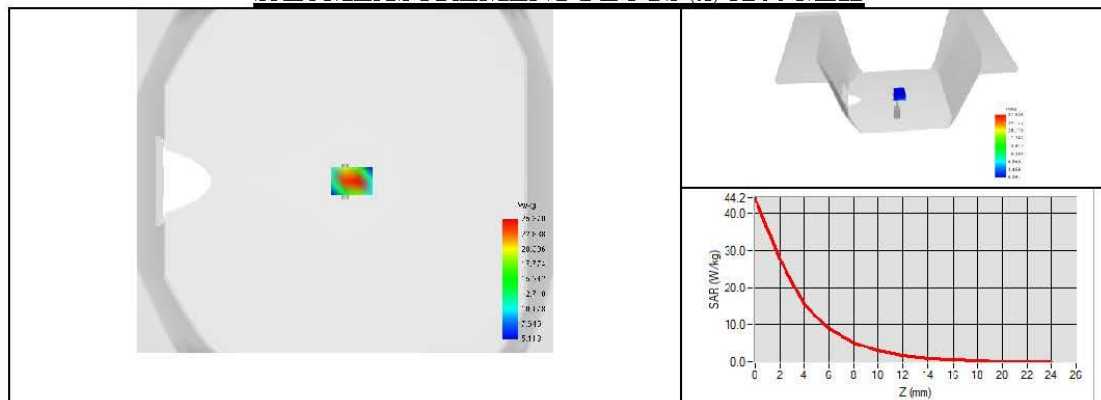
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref : ACR.53.31.24.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values 5200 MHz: eps' :34.16 sigma : 4.42 Head Liquid Values 5400 MHz: eps' :33.63 sigma : 4.64 Head Liquid Values 5600 MHz: eps' :33.12 sigma : 4.87 Head Liquid Values 5800 MHz: eps' :32.57 sigma : 5.12
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency (MHz)	1 g SAR (W/kg)			10 g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
5200	16.26	162.59	159.00	5.62	56.21	56.90
5400	15.98	159.81	166.40	5.50	55.00	58.43
5600	17.91	179.15	173.80	6.10	61.01	59.97
5800	18.22	182.20	181.20	6.13	61.32	61.50

SAR MEASUREMENT PLOTS @ 5200 MHz

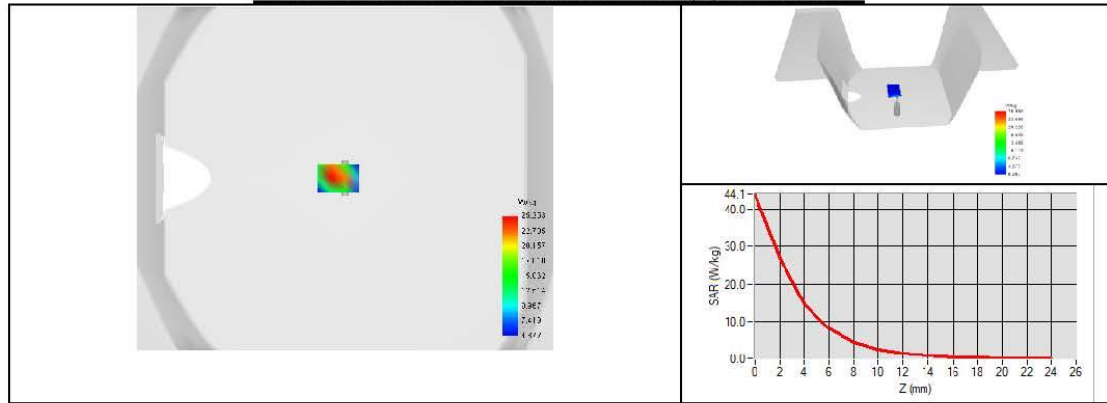




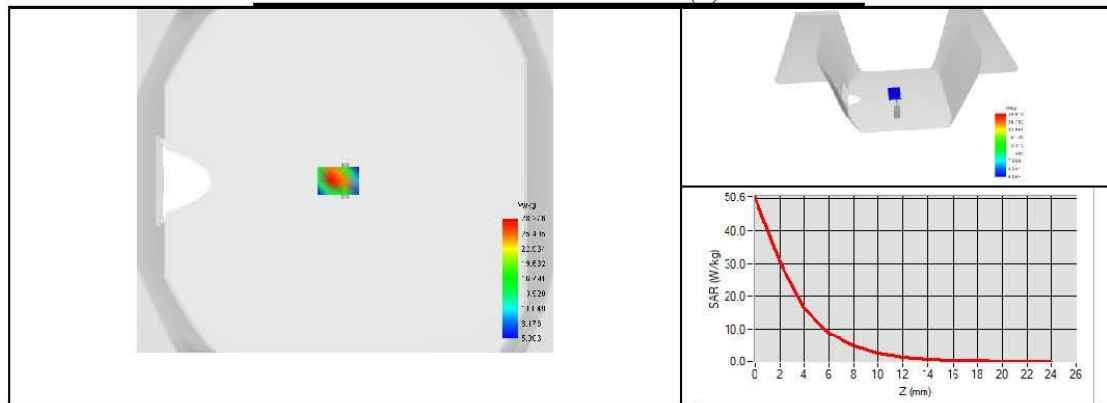
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref.: ACR.53.31.24.BES.A

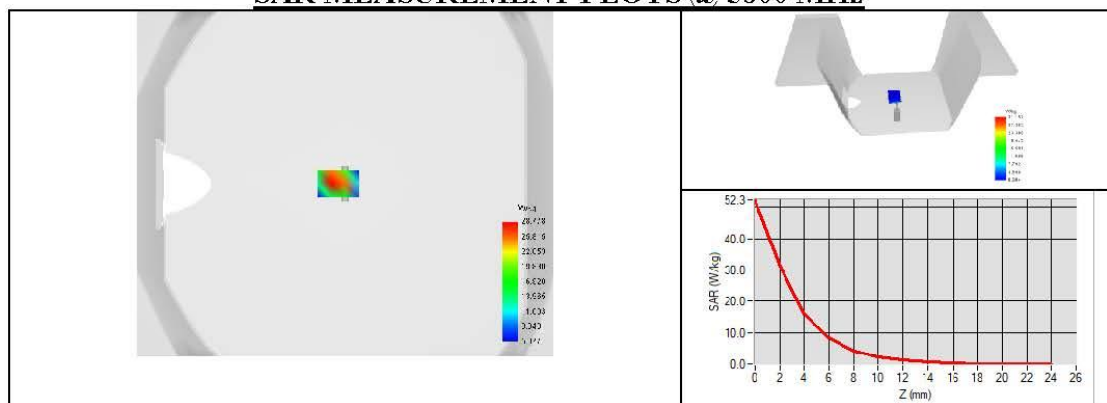
SAR MEASUREMENT PLOTS @ 5400 MHz



SAR MEASUREMENT PLOTS @ 5600 MHz



SAR MEASUREMENT PLOTS @ 5800 MHz





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7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3623-EPGO-431	11/2023	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

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