

FCC SAR EVALUATION REPORT

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

Product Name : Tablet PC

Trademark : KRONO

Model Name : NET K7 PLUS

Family Model : NET

Report No. : S22081205203001

FCC ID : 2AU97-NETK7PLUS

Prepared for

Shenzhen Krono Digital Co., Ltd

1319, 13th Floor, SegPlaza, Huaqiangbei, Futian District, Shenzhen, Guangdong, China

Prepared by

Shenzhen NTEK Testing Technology Co., Ltd.

1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street,

Bao'an District, Shenzhen 518126 P.R.China.

Tel. 400-800-6106, 0755-2320 0050, 0755-2320 0090

Website: <http://www.ntek.org.cn>

TEST RESULT CERTIFICATION

Applicant's name: Shenzhen Krono Digital Co., Ltd
Address.....: 1319, 13th Floor, SegPlaza, Huaqiangbei, Futian District, Shenzhen, Guangdong, China

Manufacturer's Name.....: SHENZHEN TELCONN TECHNOLOGY CO.,LTD
Address.....: 3rd Floor, Building 41A st, Cui gang 5th Industry Park, Huai de South Road, Fu yong town, Bao an district, SHENZHEN, CHINA.

Product description

Product name.....: Tablet PC
Trademark: KRONO
Model Name: NET K7 PLUS
Family Model.....: NET

Standards: FCC 47 CFR Part 2(2.1093); ANSI/IEEE C95.1-1992
IEEE Std 1528-2013; Published RF exposure KDB procedures

This device described above has been tested by Shenzhen NTEK. In accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 and KDB 865664 D01. Testing has shown that this device is capable of compliance with localized specific absorption rate (SAR) specified in FCC 47 CFR Part 2(2.1093) and ANSI/IEEE C95.1-1992. The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

This report shall not be reproduced except in full, without the written approval of Shenzhen NTEK, this document may be altered or revised by Shenzhen NTEK, personal only, and shall be noted in the revision of the document.

Test Sample Number: S220812052001

Date of Test

Date (s) of performance of tests: Aug. 22, 2022 ~ Aug. 26, 2022

Date of Issue: Sep. 14, 2022

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

Prepared By : Jacob.chen
(Test Engineer) : (Jacob Chen)

Approved By : Alex
(Lab Manager) : (Alex Li)

※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Sep. 14, 2022	Jacob Chen

TABLE OF CONTENTS

1. General Information	6
1.1. RF exposure limits	6
1.2. Statement of Compliance.....	7
1.3. EUT Description	7
1.4. Test specification(s)	9
1.5. Ambient Condition	9
2. SAR Measurement System	10
2.1. SATIMO SAR Measurement Set-up Diagram	10
2.2. Robot	11
2.3. E-Field Probe	12
2.3.1. E-Field Probe Calibration.....	12
2.4. SAM phantoms	13
2.4.1. Technical Data	14
2.5. Device Holder	15
2.6. Test Equipment List	16
3. SAR Measurement Procedures	18
3.1. Power Reference.....	18
3.2. Area scan & Zoom scan	18
3.3. Description of interpolation/extrapolation scheme	20
3.4. Volumetric Scan	20
3.5. Power Drift	20
4. System Verification Procedure.....	21
4.1. Tissue Verification.....	21
4.1.1. Tissue Dielectric Parameter Check Results	22
4.2. System Verification Procedure	23
4.2.1. System Verification Results	24
5. SAR Measurement variability and uncertainty	25
5.1. SAR measurement variability	25
5.2. SAR measurement uncertainty.....	25
6. RF Exposure Positions	26
6.1. Tablet host platform exposure conditions	26
7. RF Output Power	27
7.1. GSM Conducted Power	27
7.2. WCDMA Conducted Power.....	28
7.3. WLAN & Bluetooth Output Power.....	28
7.3.1. Output Power Results Of WLAN	28
7.3.2. Output Power Results Of Bluetooth	29
8. Antenna Location.....	30
9. Stand-alone SAR test exclusion	33

- 10. SAR Results 35
 - 10.1. SAR measurement results 35
 - 10.1.1. SAR measurement Result of GSM850..... 35
 - 10.1.2. SAR measurement Result of GSM1900..... 36
 - 10.1.3. SAR measurement Result of WCDMA Band 2..... 37
 - 10.1.4. SAR measurement Result of WCDMA Band 5..... 37
 - 10.1.5. SAR measurement Result of WLAN 2.4G..... 38
 - 10.2. SAR Summation Scenario 39
- 11. Appendix A. Photo documentation 40
- 12. Appendix B. System Check Plots 40
- 13. Appendix C. Plots of High SAR Measurement 47
- 14. Appendix D. Calibration Certificate 68

1. General Information

1.1. RF exposure limits

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

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

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

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

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

Occupational/Controlled Environments:

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

General Population/Uncontrolled Environments:

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

NOTE
 HEAD AND TRUNK LIMIT
 1.6 W/kg
 APPLIED TO THIS EUT

1.2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for NET K7 PLUS are as follows.

RF Exposure Conditions		Equipment Class -Highest Reported SAR (W/kg)			
		PCE	DTS	NII	DSS
1-g Head		0.660	0.336	N/A	N/A
1-g Body (Separation distance of 0mm)		1.059	0.422	N/A	N/A
Max Simultaneous Tx	Head	0.996	0.996	N/A	0.848
	Body	1.481	1.481	N/A	1.247

Note: The Max Simultaneous Tx is calculated based on the same configuration and test position. This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR Part 2(2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 & KDB 865664 D01.

1.3. EUT Description

Device Information			
Product Name	Tablet PC		
Trade Name	KRONO		
Model Name	NET K7 PLUS		
Family Model	NET		
Model Difference	All models are the same circuit and RF module, except the Model name.		
FCC ID	2AU97-NETK7PLUS		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna	PIFA Antenna		
Battery Information	DC 3.7V, 3000mAh		
Hardware Version	RC-K717-TC		
Software Version	NET_K7_PLUS_20220902		
Device Operating Configurations			
Supporting Mode(s)	GSM 850/1900, WCDMA Band 2/5, WLAN 2.4G, Bluetooth		
Test Modulation	GSM(GMSK), WCDMA(QPSK), WLAN(DSSS/OFDM), Bluetooth(GFSK, $\pi/4$ -DQPSK, 8DPSK)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)

	GSM 850	824-849	869-894
	GSM 1900	1850-1910	1930-1990
	WCDMA Band 2	1850-1910	1930-1990
	WCDMA Band 5	824-849	869-894
	WLAN 2.4G	2412-2462	
	Bluetooth	2402-2480	
GPRS Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
Power Class	4, tested with power level 5(GSM 850)		
	1, tested with power level 0(GSM 1900)		
	3, tested with power control "all 1"(WCDMA Band 2)		
	3, tested with power control "all 1"(WCDMA Band 5)		

1.4. Test specification(s)

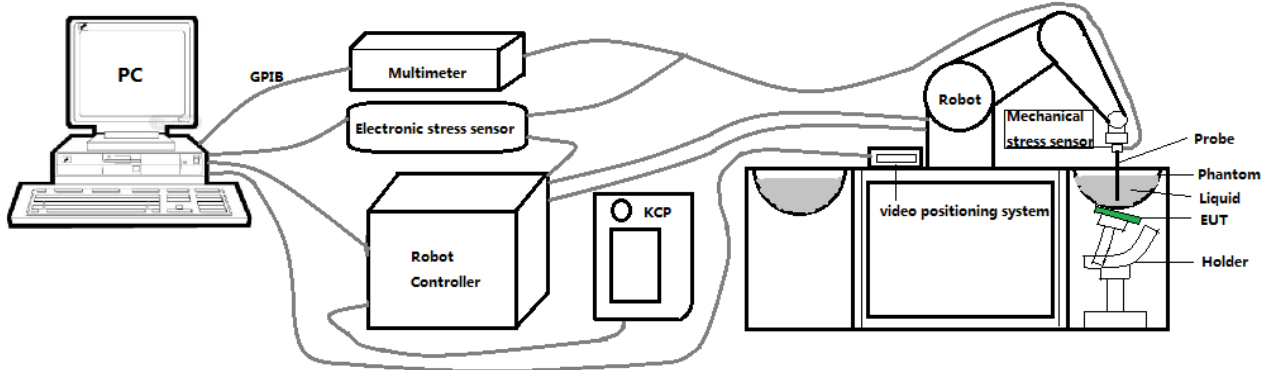
FCC 47 CFR Part 2(2.1093)
ANSI/IEEE C95.1-1992
IEEE Std 1528-2013
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting
KDB 447498 D01 General RF Exposure Guidance
KDB 248227 D01 802.11 Wi-Fi SAR
KDB 941225 D01 3G SAR Procedures
KDB 616217 D04 SAR for laptop and tablets

1.5. Ambient Condition

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

2. SAR Measurement System

2.1. SATIMO SAR Measurement Set-up Diagram



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

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

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

2.2. Robot

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



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

2.3. E-Field Probe

This E-field detection probe is composed of three orthogonal dipoles linked to special Schottky diodes with low detection thresholds. The probe allows the measurement of electric fields in liquids such as the one defined in the IEEE and CENELEC standards.

For the measurements the Specific Dosimetric E-Field Probe SN 08/16 EPGO287 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: ± 0.08 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

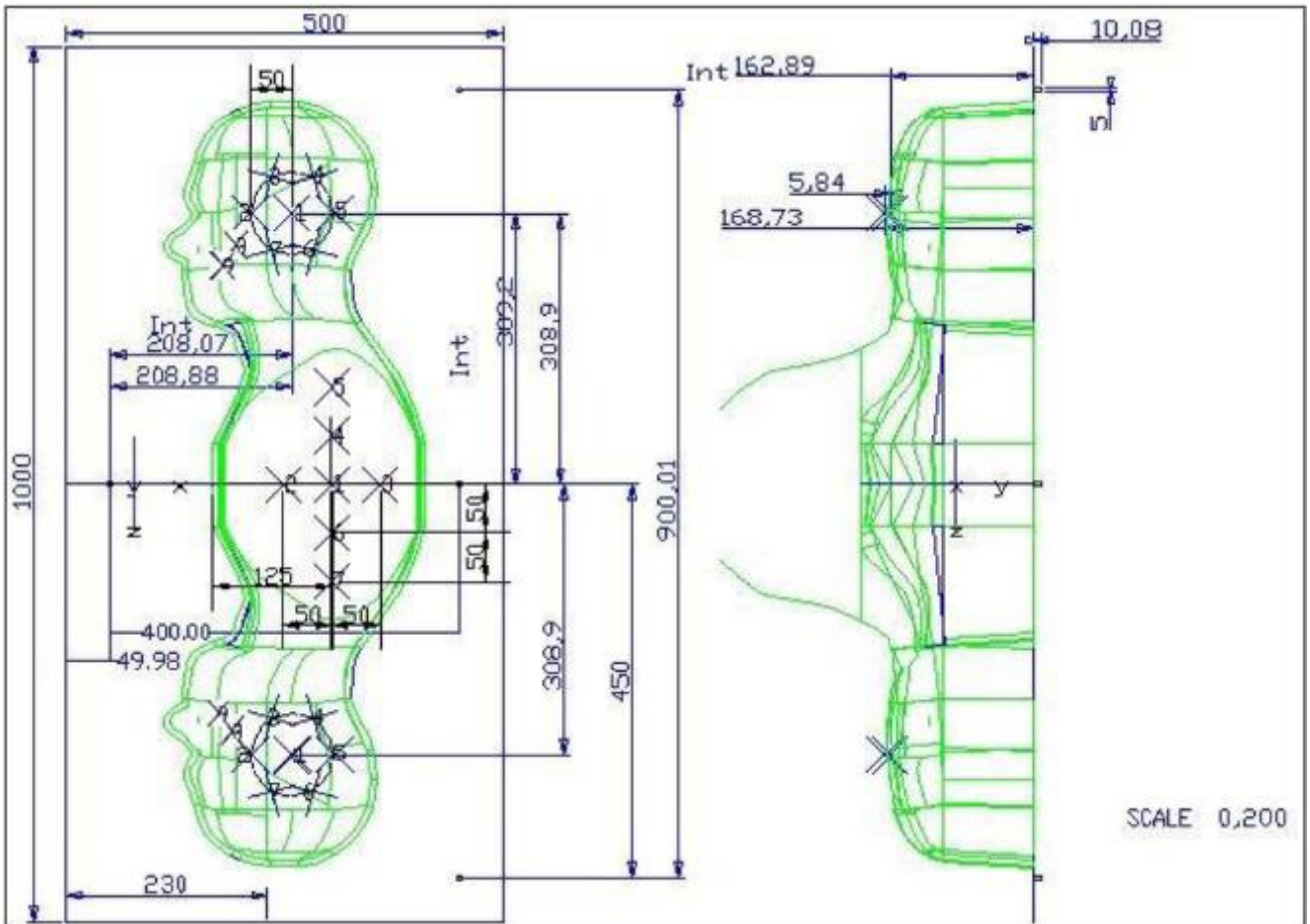
Photo of SAM phantom SN 16/15 SAM119



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

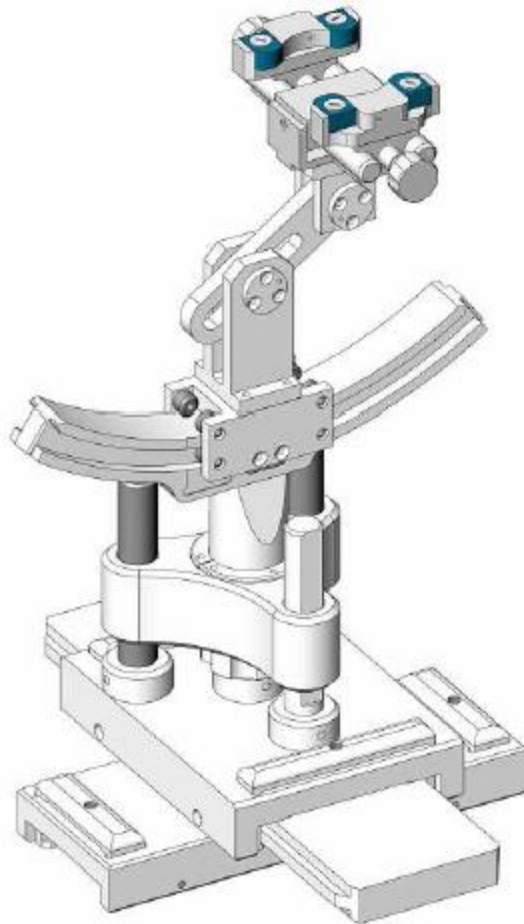


Serial Number	Left Head(mm)		Right Head(mm)		Flat Part(mm)	
	1	2	1	2	1	2
SN 16/15 SAM119	2	2.02	2	2.08	1	2.09
	3	2.05	3	2.06	2	2.06
	4	2.07	4	2.07	3	2.08
	5	2.08	5	2.08	4	2.10
	6	2.05	6	2.07	5	2.10
	7	2.05	7	2.05	6	2.07
	8	2.07	8	2.06	7	2.07
	9	2.08	9	2.06	-	-

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

2.5. Device Holder

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



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

2.6. Test Equipment List

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

Devices used during the test described are marked

	Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
					Last Cal.	Due Date
<input checked="" type="checkbox"/>	MVG	E FIELD PROBE	SSE2	SN 08/16 EPGO287	Feb. 01, 2022	Jan. 31, 2023
<input type="checkbox"/>	MVG	750 MHz Dipole	SID750	SN 03/15 DIP 0G750-355	Mar. 01, 2021	Feb. 28, 2024
<input checked="" type="checkbox"/>	MVG	835 MHz Dipole	SID835	SN 03/15 DIP 0G835-347	Mar. 01, 2021	Feb. 28, 2024
<input type="checkbox"/>	MVG	900 MHz Dipole	SID900	SN 03/15 DIP 0G900-348	Mar. 01, 2021	Feb. 28, 2024
<input type="checkbox"/>	MVG	1800 MHz Dipole	SID1800	SN 03/15 DIP 1G800-349	Mar. 01, 2021	Feb. 28, 2024
<input checked="" type="checkbox"/>	MVG	1900 MHz Dipole	SID1900	SN 03/15 DIP 1G900-350	Mar. 01, 2021	Feb. 28, 2024
<input type="checkbox"/>	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Mar. 01, 2021	Feb. 28, 2024
<input type="checkbox"/>	MVG	2300 MHz Dipole	SID2300	SN 03/16 DIP 2G300-358	Mar. 01, 2021	Feb. 28, 2024
<input checked="" type="checkbox"/>	MVG	2450 MHz Dipole	SID2450	SN 03/15 DIP 2G450-352	Mar. 01, 2021	Feb. 28, 2024
<input type="checkbox"/>	MVG	2600 MHz Dipole	SID2600	SN 03/15 DIP 2G600-356	Mar. 01, 2021	Feb. 28, 2024
<input type="checkbox"/>	MVG	5000 MHz Dipole	SWG5500	SN 13/14 WGA 33	Mar. 01, 2021	Feb. 28, 2024
<input checked="" type="checkbox"/>	MVG	Liquid measurement Kit	SCLMP	SN 21/15 OCPG 72	NCR	NCR
<input checked="" type="checkbox"/>	MVG	Power Amplifier	N.A	AMPLISAR_28/14_003	NCR	NCR
<input checked="" type="checkbox"/>	KEITHLEY	Millivoltmeter	2000	4072790	NCR	NCR
<input checked="" type="checkbox"/>	R&S	Universal radio communication tester	CMU200	117858	Jun. 17, 2022	Jun. 16, 2023
<input type="checkbox"/>	R&S	Wideband radio communication tester	CMW500	103917	Jun. 17, 2022	Jun. 16, 2023
<input checked="" type="checkbox"/>	HP	Network Analyzer	8753D	3410J01136	Jun. 17, 2022	Jun. 16, 2023

<input checked="" type="checkbox"/>	Agilent	MXG Vector Signal Generator	N5182A	MY47070317	Jun. 16, 2022	Jun. 15, 2023
<input checked="" type="checkbox"/>	Agilent	Power meter	E4419B	MY45102538	Jun. 17, 2022	Jun. 16, 2023
<input checked="" type="checkbox"/>	Agilent	Power sensor	E9301A	MY41495644	Jun. 17, 2022	Jun. 16, 2023
<input checked="" type="checkbox"/>	Agilent	Power sensor	E9301A	US39212148	Jun. 17, 2022	Jun. 16, 2023
<input checked="" type="checkbox"/>	MCLI/USA	Directional Coupler	CB11-20	0D2L51502	Jul. 17, 2020	Jul. 16, 2023

3. SAR Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) For WLAN/Bluetooth power measurement, use engineering software to configure EUT WLAN/Bluetooth continuously transmission, at maximum RF power in each supported wireless interface and frequency band.
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/Bluetooth output power.

<SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/Bluetooth continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix A demonstrates.
- (c) Set scan area, grid size and other setting on the OPENSAR software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band.
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg.

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

3.1. Power Reference

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

3.2. Area scan & Zoom scan

The area scan is a 2D scan to find the hot spot location on the DUT. The zoom scan is a 3D scan above the hot spot to calculate the 1g and 10g SAR value.

Measurement of the SAR distribution with a grid of 8 to 16 mm * 8 to 16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme. Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8 * 4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that will not be within the zoom scan of other peaks; additional peaks shall be measured only when the primary peak is within 2 dB of the SAR compliance limit (e.g., 1 W/kg for 1,6 W/kg 1 g limit, or 1,26 W/kg for 2 W/kg, 10 g limit).

Area scan & Zoom scan scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

		≤ 3 GHz	> 3 GHz	
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 ± 1 mm	½·δ·ln(2) ± 0.5 mm	
Maximum probe angle from probe axis to phantom surface normal at the measurement location		30° ± 1°	20° ± 1°	
Maximum area scan spatial resolution: Δx _{Area} , Δy _{Area}		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm	
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.		
Maximum zoom scan spatial resolution: Δx _{Zoom} , Δy _{Zoom}		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: Δz _{Zoom} (n)	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm	
	graded grid	Δz _{Zoom} (1): between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		Δz _{Zoom} (n>1): between subsequent points	≤ 1.5·Δz _{Zoom} (n-1)	
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm	

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

3.3. Description of interpolation/extrapolation scheme

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimise measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is used to determine these 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 of a full 3D scan over a specific area. This 3D scan is useful for multi Tx SAR measurement. Indeed, it is possible with OpenSAR to add, point by point, several volumetric scans to calculate the SAR value of the combined measurement as it is defined in the standard IEEE1528 and IEC62209.

3.5. Power Drift

All SAR testing is under the EUT installed with a full charged battery and transmit maximum output power. In OpenSAR measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in V/m. If the power drifts more than $\pm 5\%$, the SAR will be retested.

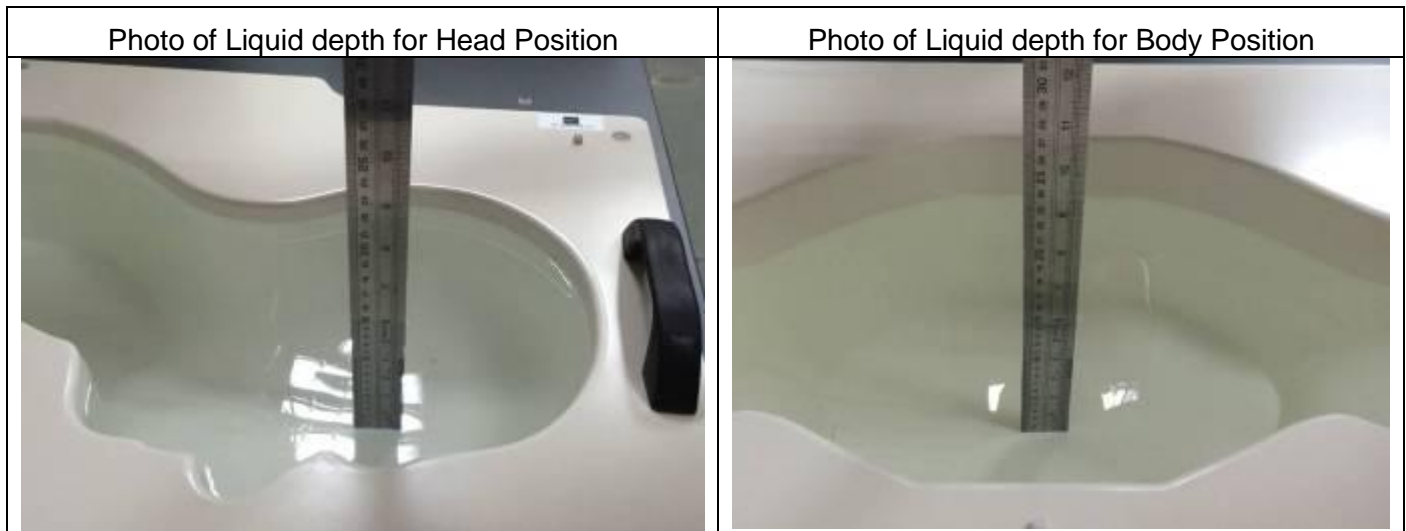
4. System Verification Procedure

4.1. Tissue Verification

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

Ingredients (% of weight)	Head Tissue									
	750	835	900	1800	1900	2000	2450	2600	5200	5800
Frequency Band (MHz)										
Water	34.40	34.40	34.40	55.36	55.36	57.87	57.87	57.87	65.53	65.53
NaCl	0.79	0.79	0.79	0.35	0.35	0.16	0.16	0.16	0.00	0.00
1,2-Propanediol	64.81	64.81	64.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	30.45	30.45	19.97	19.97	19.97	24.24	24.24
DGBE	0.00	0.00	0.00	13.84	13.84	22.00	22.00	22.00	10.23	10.23

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid depth from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm.



4.1.1. Tissue Dielectric Parameter Check Results

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric 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.

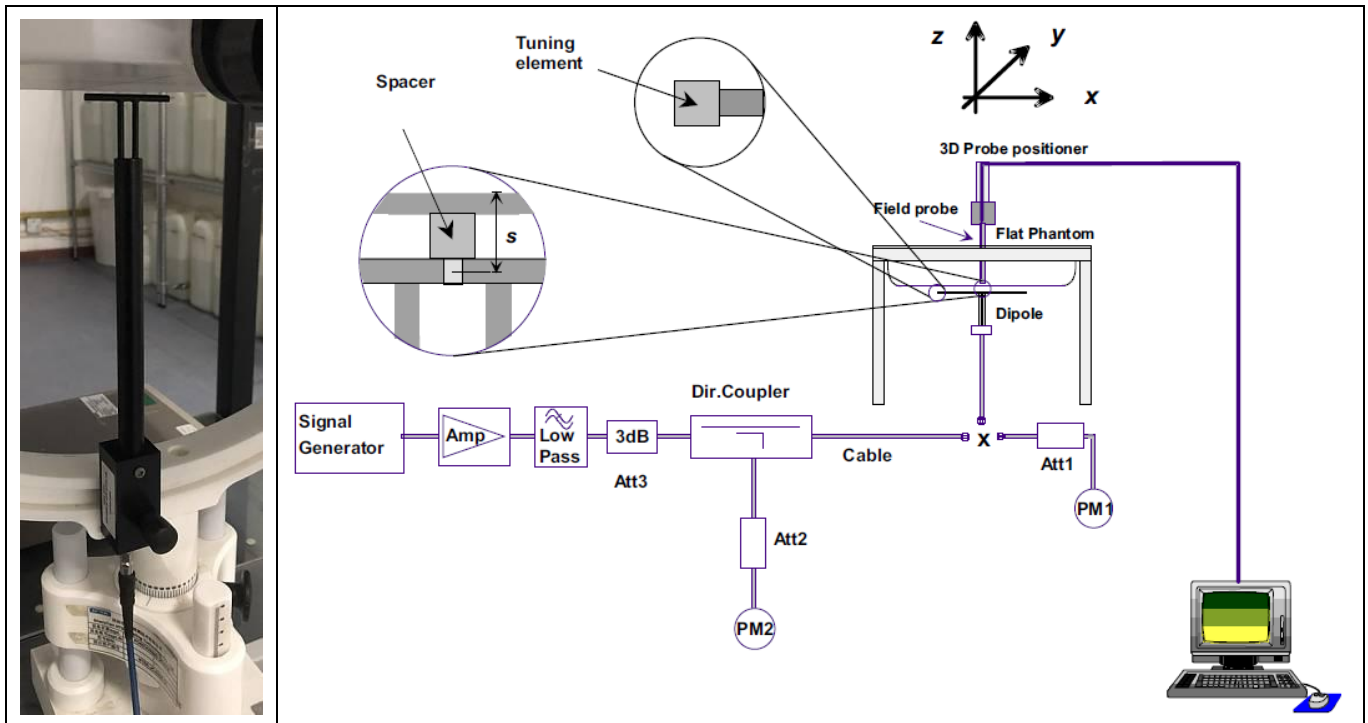
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		$\epsilon_r (\pm 5\%)$	σ (S/m) ($\pm 5\%$)	ϵ_r	σ (S/m)		
Head 850	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	41.63	0.92	21.7 °C	Aug. 25, 2022
Head 1900	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	38.31	1.46	21.2 °C	Aug. 26, 2022
Head 2450	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	37.67	1.77	21.6 °C	Aug. 22, 2022

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) ($\pm 10\%$)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)		
835MHz	9.84 (8.86~10.82)	6.22 (5.60~6.84)	9.76	6.74	21.7 °C	Aug. 25, 2022
1900MHz	40.37 (36.34~44.40)	20.48 (18.44~22.52)	41.64	19.22	21.2 °C	Aug. 26, 2022
2450MHz	53.69 (48.33~59.05)	23.94 (21.55~26.33)	48.94	22.90	21.6 °C	Aug. 22, 2022

5. SAR Measurement variability and uncertainty

5.1. SAR measurement variability

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

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

5.2. SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

6. RF Exposure Positions

6.1. Tablet host platform exposure conditions

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

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

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

7. RF Output Power

7.1. GSM Conducted Power

Band GSM850		Burst-Averaged output Power (dBm)			Frame-Averaged output Power (dBm)			
Tx Channel	Tune-up (dBm)	128	189	251	Tune-up	128	189	251
Frequency (MHz)		824.2	836.4	848.8	(dBm)	824.2	836.4	848.8
GSM Voice (GMSK)	34.00	33.53	33.68	33.58	24.97	24.50	24.65	24.55
GPRS(GMSK, 1 TS)	34.00	33.65	33.74	33.62	24.97	24.62	24.71	24.59
GPRS(GMSK, 2 TS)	34.00	33.43	33.52	33.40	27.98	27.41	27.50	27.38
GPRS(GMSK, 3 TS)	33.50	33.01	33.10	33.00	29.24	28.75	28.84	28.74
GPRS(GMSK, 4 TS)	33.00	32.72	32.80	32.77	29.99	29.71	29.79	29.76
Band GSM1900		Burst-Averaged output Power (dBm)			Frame-Averaged output Power (dBm)			
Tx Channel	Tune-up (dBm)	512	661	810	Tune-up	512	661	810
Frequency (MHz)		1850.2	1880.0	1909.8	(dBm)	1850.2	1880.0	1909.8
GSM Voice (GMSK)	31.00	30.46	30.45	30.54	21.97	21.43	21.42	21.51
GPRS(GMSK, 1 TS)	31.00	30.65	30.63	30.69	21.97	21.62	21.60	21.66
GPRS(GMSK, 2 TS)	30.50	30.43	30.35	30.34	24.48	24.41	24.33	24.32
GPRS(GMSK, 3 TS)	30.00	29.99	29.86	29.75	25.74	25.73	25.60	25.49
GPRS(GMSK, 4 TS)	30.00	29.76	29.60	29.45	26.99	26.75	26.59	26.44

Note: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.

The calculated method are shown as below:

Frame-averaged power = Maximum burst averaged power (1 TS) - 9.03 dB

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

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

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

7.2. WCDMA Conducted Power

WCDMA Band 2		Burst-Averaged output Power (dBm)			
Tx Channel	Tune-up	9262	9400	9538	
Frequency (MHz)		1852.4	1880	1907.6	
RMC12.2K	22.50	22.00	22.39	21.98	
HSDPA Sub 1	21.00	20.55	20.73	20.57	
HSDPA Sub 2	20.50	19.95	20.35	19.83	
HSDPA Sub 3	19.50	18.83	19.05	19.22	
HSDPA Sub 4	19.50	19.04	18.80	19.18	
HSUPA Sub 1	21.00	18.91	20.57	20.29	
HSUPA Sub 2	21.00	19.95	20.78	20.10	
HSUPA Sub 3	20.00	18.51	19.55	19.13	
HSUPA Sub 4	21.00	20.05	20.83	20.51	
HSUPA Sub 5	20.50	18.76	20.17	19.78	
WCDMA Band 5		Burst-Averaged output Power (dBm)			
Tx Channel	Tune-up	4132	4182	4233	
Frequency (MHz)		826.4	836.4	846.6	
RMC12.2K	23.50	23.30	23.23	23.13	
HSDPA Sub 1	22.50	22.31	22.21	22.17	
HSDPA Sub 2	22.00	21.90	21.88	21.85	
HSDPA Sub 3	21.00	20.91	20.88	20.54	
HSDPA Sub 4	21.00	20.81	20.86	20.43	
HSUPA Sub 1	22.50	20.83	22.11	22.06	
HSUPA Sub 2	22.50	22.25	22.17	22.10	
HSUPA Sub 3	21.50	20.35	20.63	21.04	
HSUPA Sub 4	22.50	22.42	22.25	22.21	
HSUPA Sub 5	22.00	21.38	21.56	21.57	

7.3. WLAN & Bluetooth Output Power

7.3.1. Output Power Results Of WLAN

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)
802.11b	1	2412	13.50	13.42
	6	2437	13.50	13.37
	11	2462	13.50	13.18
802.11g	1	2412	12.50	12.11

	6	2437	12.50	11.44
	11	2462	12.50	12.32
802.11n HT20	1	2412	12.50	12.16
	6	2437	12.50	11.70
	11	2462	12.50	11.19
802.11n HT40	3	2422	13.00	12.08
	6	2437	13.00	11.77
	9	2452	13.00	12.69

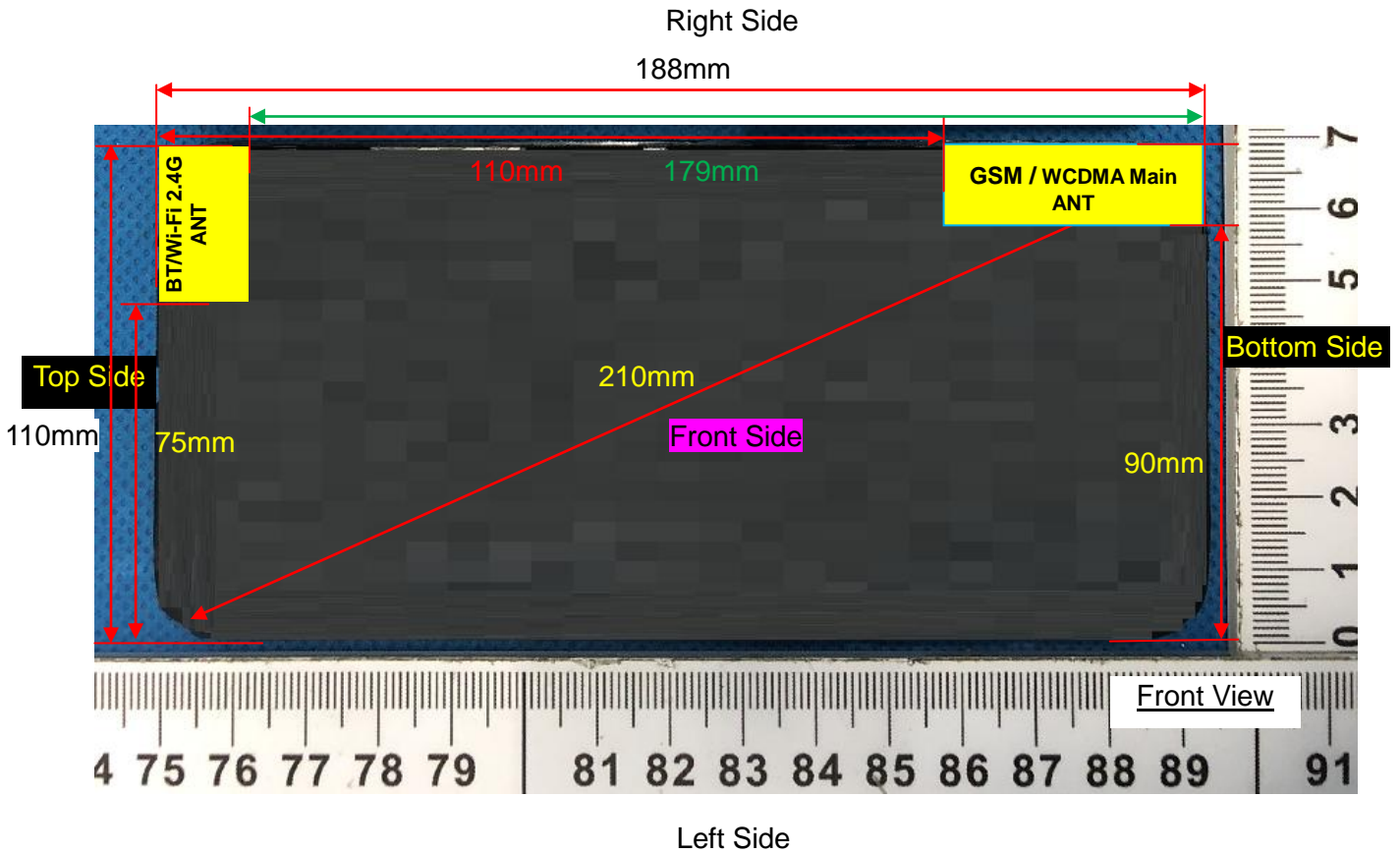
NOTE: Power measurement results of WLAN 2.4G.

7.3.2. Output Power Results Of Bluetooth

BR+EDR	Output Power (dBm)				
	Data Rates	Tune-up	Channel		
			0CH	39CH	78CH
	1M	5.000	4.73	3.96	4.24
	2M	6.000	4.84	5.92	5.16
	3M	6.500	5.03	6.21	5.42

BLE	Channel	Tune-up	Output Power (dBm)
	0CH	1.000	0.95
	19CH	1.500	1.44
	39CH	3.000	2.53

8. Antenna Location



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

Distance of the Antenna to the EUT surface/edge						
Antennas	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
WWAN Main	5	5	90	5	110	5
WLAN & Bluetooth	5	5	75	5	5	179

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

Positions for SAR tests		
Test separation distances ≤ 50 mm		
Exposure Positions	Tune-up Maximum power of WLAN 2.4G	
	13.50dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	7.03
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	7.03
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5

	SAR exclusion threshold	7.03
	SAR testing required?	YES
	Antenna to user(mm)	5
Top Side	SAR exclusion threshold	7.03
	SAR testing required?	YES
	Tune-up Maximum power of GSM 850	
Exposure Positions	34.00dBm	
	Antenna to user(mm)	5
Front Side	SAR exclusion threshold	463.17
	SAR testing required?	YES
	Antenna to user(mm)	5
Back Side	SAR exclusion threshold	463.17
	SAR testing required?	YES
	Antenna to user(mm)	5
Right Side	SAR exclusion threshold	463.17
	SAR testing required?	YES
	Antenna to user(mm)	5
Bottom Side	SAR exclusion threshold	463.17
	SAR testing required?	YES
	Tune-up Maximum power of GSM 1900	
Exposure Positions	31.00dBm	
	Antenna to user(mm)	5
Front Side	SAR exclusion threshold	347.97
	SAR testing required?	YES
	Antenna to user(mm)	5
Back Side	SAR exclusion threshold	347.97
	SAR testing required?	YES
	Antenna to user(mm)	5
Right Side	SAR exclusion threshold	347.97
	SAR testing required?	YES
	Antenna to user(mm)	5
Bottom Side	SAR exclusion threshold	347.97
	SAR testing required?	YES
	Tune-up Maximum power of GWCDMA Band 2	
Exposure Positions	22.50dBm	
	Antenna to user(mm)	5
Front Side	SAR exclusion threshold	49.15
	SAR testing required?	YES
	Antenna to user(mm)	5
Back Side	SAR exclusion threshold	49.15

	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	49.15
	SAR testing required?	YES
Bottom Side	Antenna to user(mm)	5
	SAR exclusion threshold	49.15
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of WCDMA Band 5	
	23.50dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	41.28
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	41.28
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	41.28
	SAR testing required?	YES
Bottom Side	Antenna to user(mm)	5
	SAR exclusion threshold	41.28
	SAR testing required?	YES

NOTE: Refer to section 4.3.1 of KDB 447498 D01.

Positions for SAR tests		
Test separation distances > 50 mm		
Exposure Positions	Tune-up Maximum power of WLAN 2.4G	
	13.50dBm	22.39mW
Left Side	Antenna to user(mm)	75
	SAR exclusion threshold(mW)	346
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	179
	SAR exclusion threshold(mW)	1386
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of GSM 850	
	34.00dBm	2511.89mW
Left Side	Antenna to user(mm)	90
	SAR exclusion threshold(mW)	387
	SAR testing required?	YES
Top Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	498

	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of GSM 1900	
	31.00dBm	1258.93mW
Left Side	Antenna to user(mm)	90
	SAR exclusion threshold(mW)	509
	SAR testing required?	YES
Top Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	709
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of WCDMA Band 2	
	22.50dBm	177.83mW
Left Side	Antenna to user(mm)	90
	SAR exclusion threshold(mW)	509
	SAR testing required?	NO
Top Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	709
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WCDMA Band 5	
	23.50dBm	223.87mW
Left Side	Antenna to user(mm)	90
	SAR exclusion threshold(mW)	387
	SAR testing required?	NO
Top Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	498
	SAR testing required?	NO

NOTE: Refer to section 4.3.1 of KDB 447498 D01.

9. Stand-alone SAR test exclusion

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

$$\left[\frac{\text{max. power of channel, including tune-up tolerance, mW}}{\text{min. test separation distance, mm}} \right] \cdot \left[\sqrt{f_{\text{(GHz)}}} \right] \leq 3.0$$
 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

- $f_{\text{(GHz)}}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

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

Mode	P _{max} (dBm)	P _{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
Bluetooth	6.50	4.47	5	2.480	1.41	3	Yes

NOTE: Standalone SAR test exclusion for Bluetooth

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] * [\sqrt{f_{\text{(GHz)}}/x}] \text{ W/kg}$ for test separation distances $\leq 50\text{mm}$, where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

When the minimum test separation distance is $< 5 \text{ mm}$, a distance of 5 mm is applied to determine SAR test exclusion.

Mode	Position	P _{max} (dBm)	P _{max} (mW)	Distance (mm)	f (GHz)	x	Estimated SAR (W/Kg)
Bluetooth	Head	6.50	4.47	5	2.48	7.5	0.188
Bluetooth	Body	6.50	4.47	5	2.48	7.5	0.188

NOTE: Estimated SAR calculation for Bluetooth.

10. SAR Results

10.1. SAR measurement results

10.1.1. SAR measurement Result of GSM850

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Left Cheek	189/836.4	GPRS(GMSK 4TS)	0.359	0.255	-1.10	32.80	33.00	0.376	2022/8/25	1#
Left Tilt 15 Degree	189/836.4	GPRS(GMSK 4TS)	0.192	0.131	-1.39	32.80	33.00	0.201	2022/8/25	
Right Cheek	189/836.4	GPRS(GMSK 4TS)	0.338	0.240	-3.15	32.80	33.00	0.354	2022/8/25	
Right Tilt 15 Degree	189/836.4	GPRS(GMSK 4TS)	0.177	0.119	3.70	32.80	33.00	0.185	2022/8/25	

NOTE: Head SAR test results of GSM850.

Test Position of Body with 0mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Front Side	189/836.4	GPRS(GMSK 4TS)	0.624	0.395	-1.93	32.80	33.00	0.653	2022/8/25	
Back Side	189/836.4	GPRS(GMSK 4TS)	1.011	0.660	-0.74	32.80	33.00	1.059	2022/8/25	2#
Back Side Repeated	189/836.4	GPRS(GMSK 4TS)	1.005	0.657	1.20	32.80	33.00	1.052	2022/8/25	
Left Side	189/836.4	GPRS(GMSK 4TS)	0.163	0.105	-3.40	32.80	33.00	0.171	2022/8/25	
Right Side	189/836.4	GPRS(GMSK 4TS)	0.367	0.228	1.48	32.80	33.00	0.384	2022/8/25	
Top Side	189/836.4	GPRS(GMSK 4TS)	0.105	0.069	-0.70	32.80	33.00	0.110	2022/8/25	
Bottom Side	189/836.4	GPRS(GMSK 4TS)	0.520	0.326	3.22	32.80	33.00	0.545	2022/8/25	

Back Side	128/824.2	GPRS(GMSK 4TS)	0.840	0.521	-0.15	32.72	33.00	0.896	2022/8/25	
Back Side	251/848.8	GPRS(GMSK 4TS)	0.863	0.563	-2.68	32.77	33.00	0.910	2022/8/25	

NOTE: Body SAR test results of GSM850

10.1.2. SAR measurement Result of GSM1900

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Left Cheek	661/1880	GPRS(GMSK 4TS)	0.602	0.320	-2.73	29.60	30.00	0.660	2022/8/26	3#
Left Tilt 15 Degree	661/1880	GPRS(GMSK 4TS)	0.333	0.177	3.66	29.60	30.00	0.365	2022/8/26	
Right Cheek	661/1880	GPRS(GMSK 4TS)	0.528	0.272	-2.46	29.60	30.00	0.579	2022/8/26	
Right Tilt 15 Degree	661/1880	GPRS(GMSK 4TS)	0.239	0.125	-0.30	29.60	30.00	0.262	2022/8/26	

NOTE: Head SAR test results of GSM1900

Test Position of Body with 0mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Front Side	661/1880	GPRS(GMSK 4TS)	0.420	0.224	1.86	29.60	30.00	0.461	2022/8/26	
Back Side	661/1880	GPRS(GMSK 4TS)	0.696	0.386	4.14	29.60	30.00	0.763	2022/8/26	4#
Left Side	661/1880	GPRS(GMSK 4TS)	0.095	0.052	0.60	29.60	30.00	0.104	2022/8/26	
Right Side	661/1880	GPRS(GMSK 4TS)	0.266	0.145	-3.70	29.60	30.00	0.292	2022/8/26	
Top Side	661/1880	GPRS(GMSK 4TS)	0.071	0.039	2.18	29.60	30.00	0.078	2022/8/26	
Bottom Side	661/1880	GPRS(GMSK 4TS)	0.365	0.200	1.18	29.60	30.00	0.400	2022/8/26	

NOTE: Body SAR test results of GSM1900

10.1.3. SAR measurement Result of WCDMA Band 2

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Left Cheek	9400/1880	RMC12.2K	0.244	0.134	0.48	22.39	22.50	0.250	2022/8/26	5#
Left Tilt 15 Degree	9400/1880	RMC12.2K	0.129	0.070	-0.35	22.39	22.50	0.132	2022/8/26	
Right Cheek	9400/1880	RMC12.2K	0.218	0.117	2.16	22.39	22.50	0.224	2022/8/26	
Right Tilt 15 Degree	9400/1880	RMC12.2K	0.109	0.059	-3.84	22.39	22.50	0.112	2022/8/26	

NOTE: Head SAR test results of WCDMA Band 2

Test Position of Body with 0mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Front Side	9400/1880	RMC12.2K	0.252	0.133	2.26	22.39	22.50	0.258	2022/8/26	
Back Side	9400/1880	RMC12.2K	0.387	0.208	-1.17	22.39	22.50	0.397	2022/8/26	6#
Right Side	9400/1880	RMC12.2K	0.123	0.065	3.64	22.39	22.50	0.126	2022/8/26	
Bottom Side	9400/1880	RMC12.2K	0.210	0.109	-2.32	22.39	22.50	0.215	2022/8/26	

NOTE: Body SAR test results of WCDMA Band 2

10.1.4. SAR measurement Result of WCDMA Band 5

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Left Cheek	4182/836.4	RMC12.2K	0.115	0.092	0.29	23.23	23.50	0.122	2022/8/25	7#

Left Tilt 15 Degree	4182/836.4	RMC12.2K	0.058	0.045	0.56	23.23	23.50	0.062	2022/8/25	
Right Cheek	4182/836.4	RMC12.2K	0.103	0.081	2.22	23.23	23.50	0.110	2022/8/25	
Right Tilt 15 Degree	4182/836.4	RMC12.2K	0.049	0.039	2.65	23.23	23.50	0.052	2022/8/25	

NOTE: Head SAR test results of WCDMA Band 5

Test Position of Body with Omm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Front Side	4182/836.4	RMC12.2K	0.192	0.125	-0.93	23.23	23.50	0.204	2022/8/25	
Back Side	4182/836.4	RMC12.2K	0.291	0.200	-0.83	23.23	23.50	0.310	2022/8/25	8#
Right Side	4182/836.4	RMC12.2K	0.102	0.067	1.82	23.23	23.50	0.109	2022/8/25	
Bottom Side	4182/836.4	RMC12.2K	0.165	0.110	2.11	23.23	23.50	0.176	2022/8/25	

NOTE: Body SAR test results of WCDMA Band 5

10.1.5. SAR measurement Result of WLAN 2.4G

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)	Date	Plot
			1g	10g						
Left Cheek	1/2412	802.11b	0.330	0.154	-0.59	13.42	13.50	0.336	2022/8/22	9#
Left Tilt 15 Degree	1/2412	802.11b	0.167	0.078	1.19	13.42	13.50	0.170	2022/8/22	
Right Cheek	1/2412	802.11b	0.281	0.126	-4.00	13.42	13.50	0.286	2022/8/22	
Right Tilt 15 Degree	1/2412	802.11b	0.134	0.061	2.12	13.42	13.50	0.136	2022/8/22	

NOTE: Head SAR test results of WLAN 2.4G

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

Position of Body with 0mm	channel /Freq.	Mode	(W/kg)		Drift (±5%)	power (dBm)	power (dBm)	SAR 1g (W/Kg)		
			1g	10g						
Front Side	1/2412	802.11b	0.384	0.156	-0.25	13.42	13.50	0.391	2022/8/22	
Back Side	1/2412	802.11b	0.414	0.254	2.38	13.42	13.50	0.422	2022/8/22	10#
Right Side	1/2412	802.11b	0.198	0.081	-2.39	13.42	13.50	0.202	2022/8/22	
Top Side	1/2412	802.11b	0.195	0.080	-0.73	13.42	13.50	0.199	2022/8/22	

NOTE: Body SAR test results of WLAN 2.4G

10.2. SAR Summation Scenario

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

- 1) Scalar SAR summation < 1.6W/kg.
- 2) $SPLSR = (SAR_1 + SAR_2)^{1.5} / (\text{min. separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR locations in the zoom scan. If $SPLSR \leq 0.04$, simultaneously transmission SAR measurement is not necessary.

Test Position		Scaled SAR _{MAX}		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		WWAN	DTS			
Head	Left Cheek	0.660	0.336	0.996	N/A	N/A
	Left Tilt 15 Degree	0.365	0.170	0.535	N/A	N/A
	Right Cheek	0.579	0.286	0.865	N/A	N/A
	Right Tilt 15 Degree	0.262	0.136	0.398	N/A	N/A
Hotspot	Front Side	0.653	0.391	1.044	N/A	N/A
	Back Side	1.059	0.422	1.481	N/A	N/A
	Left Side	0.171	N/A	0.171	N/A	N/A
	Right Side	0.384	0.202	0.586	N/A	N/A
	Top Side	0.110	0.199	0.309	N/A	N/A
	Bottom Side	0.545	N/A	0.545	N/A	N/A

Test Position	Scaled SAR _{MAX}	Σ 1-g SAR	SPLSR	Remark
---------------	---------------------------	-----------	-------	--------

		WWAN	DSS	(W/Kg)		
Head	Left Cheek	0.660	0.188	0.848	N/A	N/A
	Left Tilt 15 Degree	0.365	0.188	0.553	N/A	N/A
	Right Cheek	0.579	0.188	0.767	N/A	N/A
	Right Tilt 15 Degree	0.262	0.188	0.450	N/A	N/A
Hotspot	Front Side	0.653	0.188	0.841	N/A	N/A
	Back Side	1.059	0.188	1.247	N/A	N/A
	Left Side	0.171	N/A	0.171	N/A	N/A
	Right Side	0.384	0.188	0.572	N/A	N/A
	Top Side	0.110	0.188	0.298	N/A	N/A
	Bottom Side	0.545	N/A	0.545	N/A	N/A

11. Appendix A. Photo documentation

Refer to appendix Test Setup photo---SAR

12. Appendix B. System Check Plots

Table of contents
MEASUREMENT 1 System Performance Check - 835MHz
MEASUREMENT 2 System Performance Check - 1900MHz
MEASUREMENT 3 System Performance Check - 2450MHz

MEASUREMENT 1

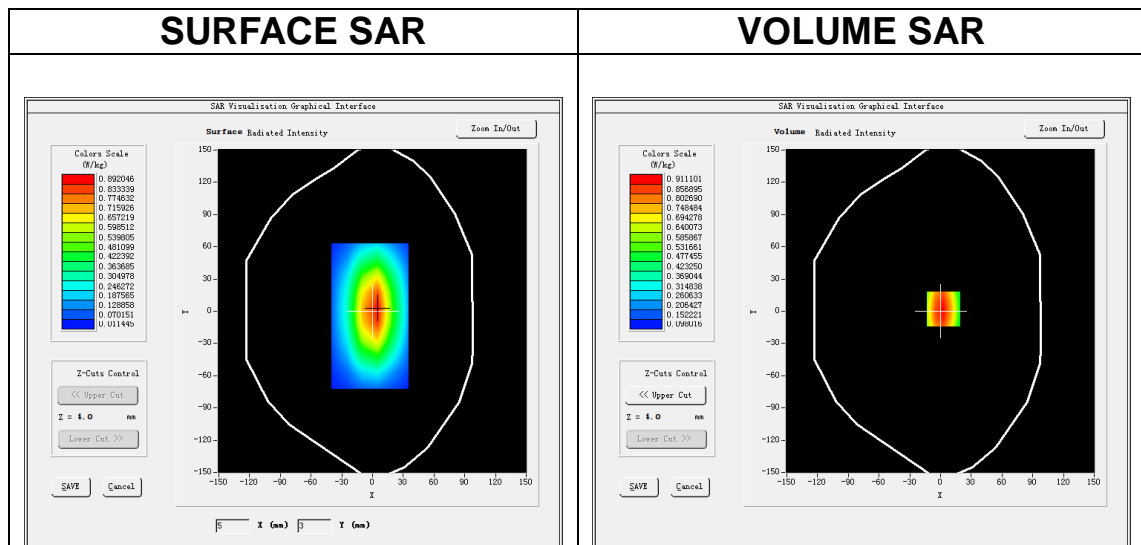
Date of measurement: 25/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Dipole</u>
Band	<u>CW835</u>
Channels	<u>Middle</u>
Signal	<u>CW (Crest factor: 1.0)</u>
ConvF	<u>1.50</u>

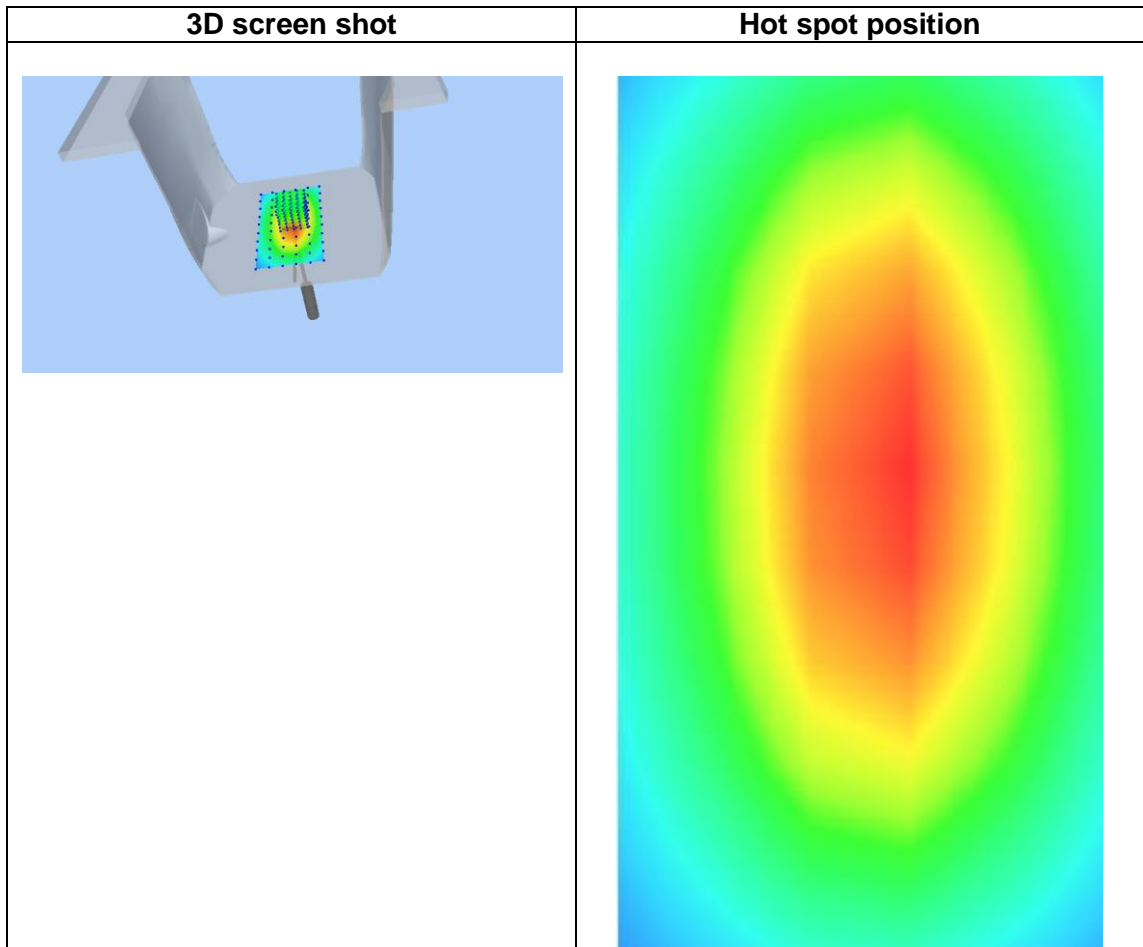
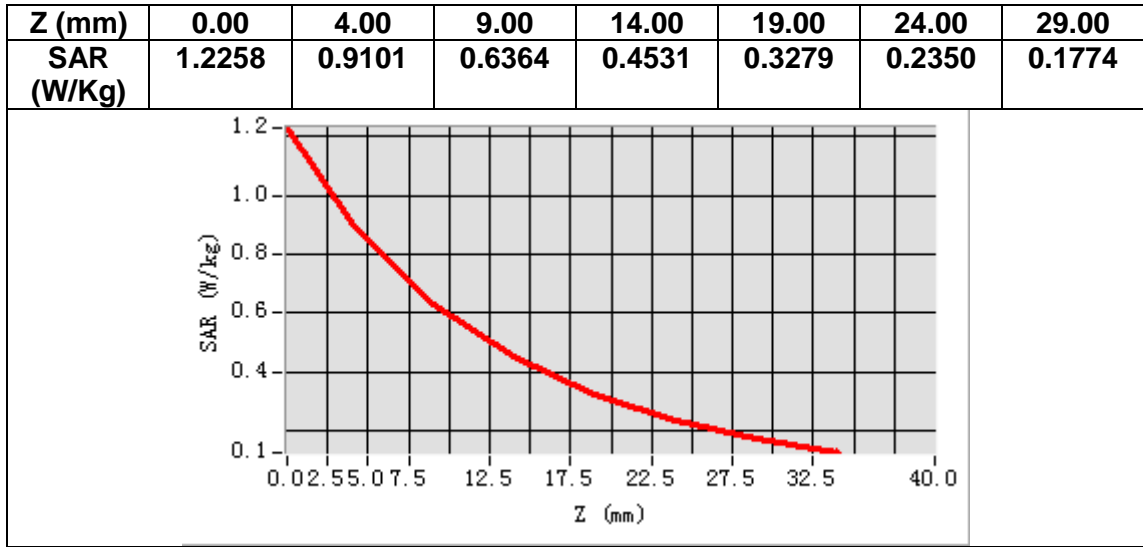
B. SAR Measurement Results

Frequency (MHz)	835.000000
Relative permittivity (real part)	41.626993
Relative permittivity (imaginary part)	19.865665
Conductivity (S/m)	0.921546
Variation (%)	1.260000



Maximum location: X=3.00, Y=2.00
SAR Peak: 1.23 W/kg

SAR 10g (W/Kg)	0.674142
SAR 1g (W/Kg)	0.976105



MEASUREMENT 2

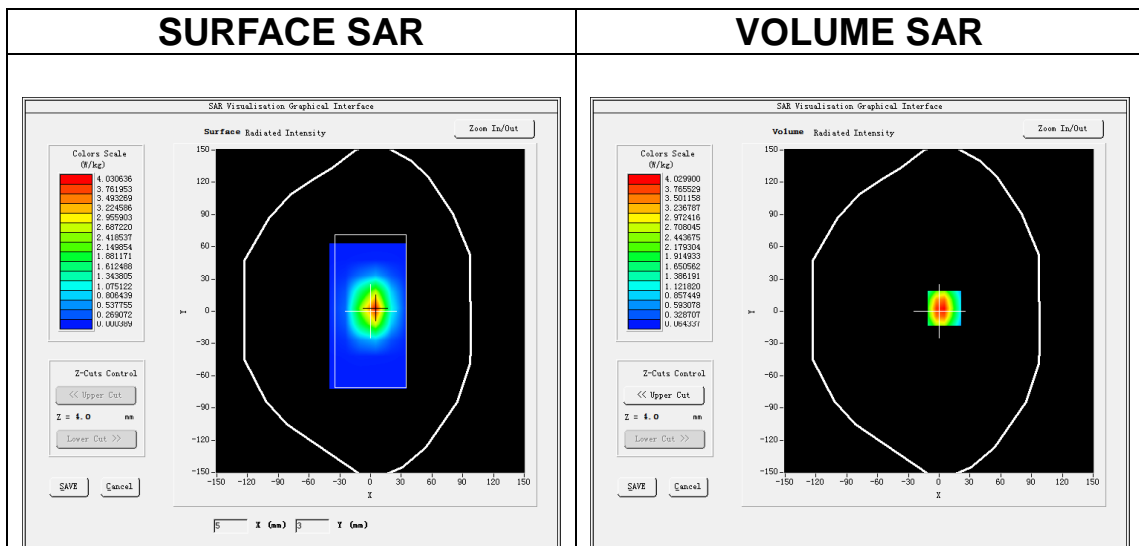
Date of measurement: 26/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Dipole</u>
Band	<u>CW1900</u>
Channels	<u>Middle</u>
Signal	<u>CW (Crest factor: 1.0)</u>
ConvF	<u>1.91</u>

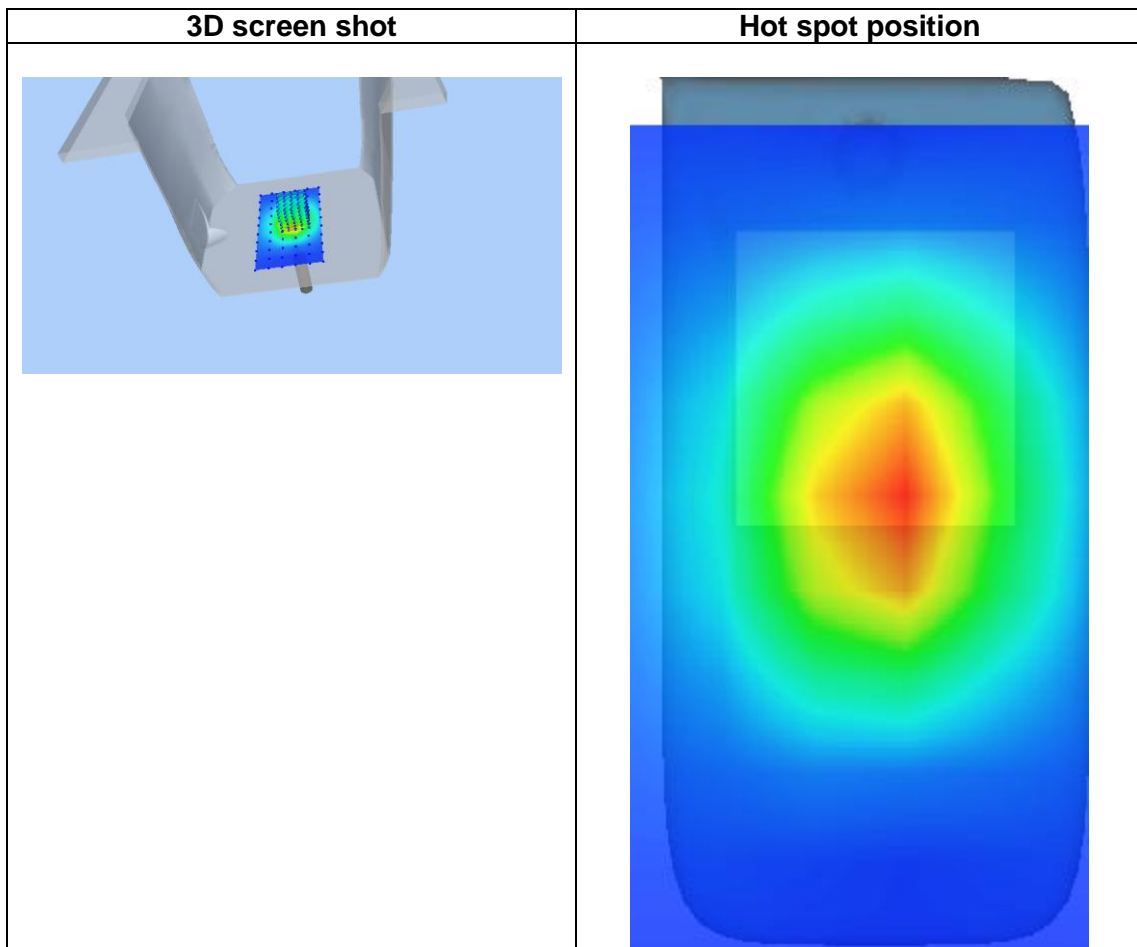
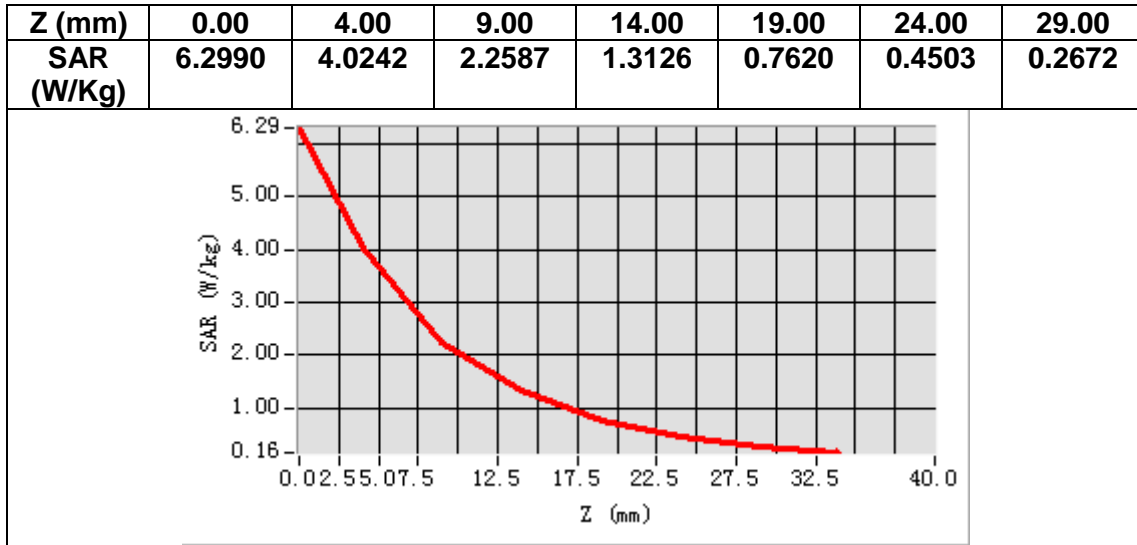
B. SAR Measurement Results

Frequency (MHz)	1900.000000
Relative permittivity (real part)	38.311252
Relative permittivity (imaginary part)	13.788911
Conductivity (S/m)	1.455496
Variation (%)	-2.640000



Maximum location: X=5.00, Y=3.00
SAR Peak: 6.57 W/kg

SAR 10g (W/Kg)	1.922042
SAR 1g (W/Kg)	4.164104



MEASUREMENT 3

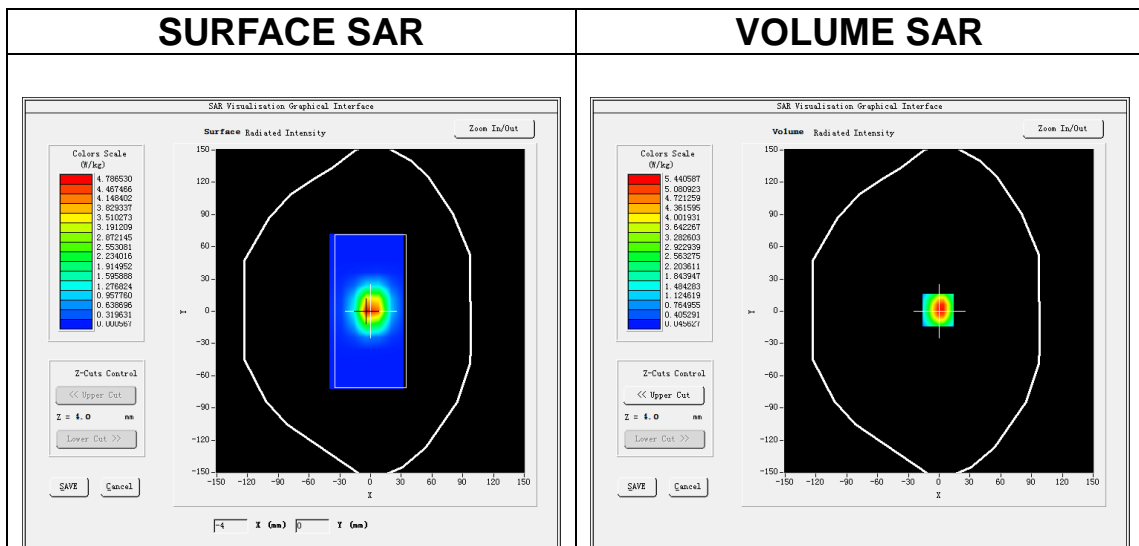
Date of measurement: 22/8/2022

A. Experimental conditions.

Area Scan	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
ZoomScan	<u>7x7x7, dx=5mm dy=5mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Dipole</u>
Band	<u>CW2450</u>
Channels	<u>Middle</u>
Signal	<u>CW (Crest factor: 1.0)</u>
ConvF	<u>1.98</u>

B. SAR Measurement Results

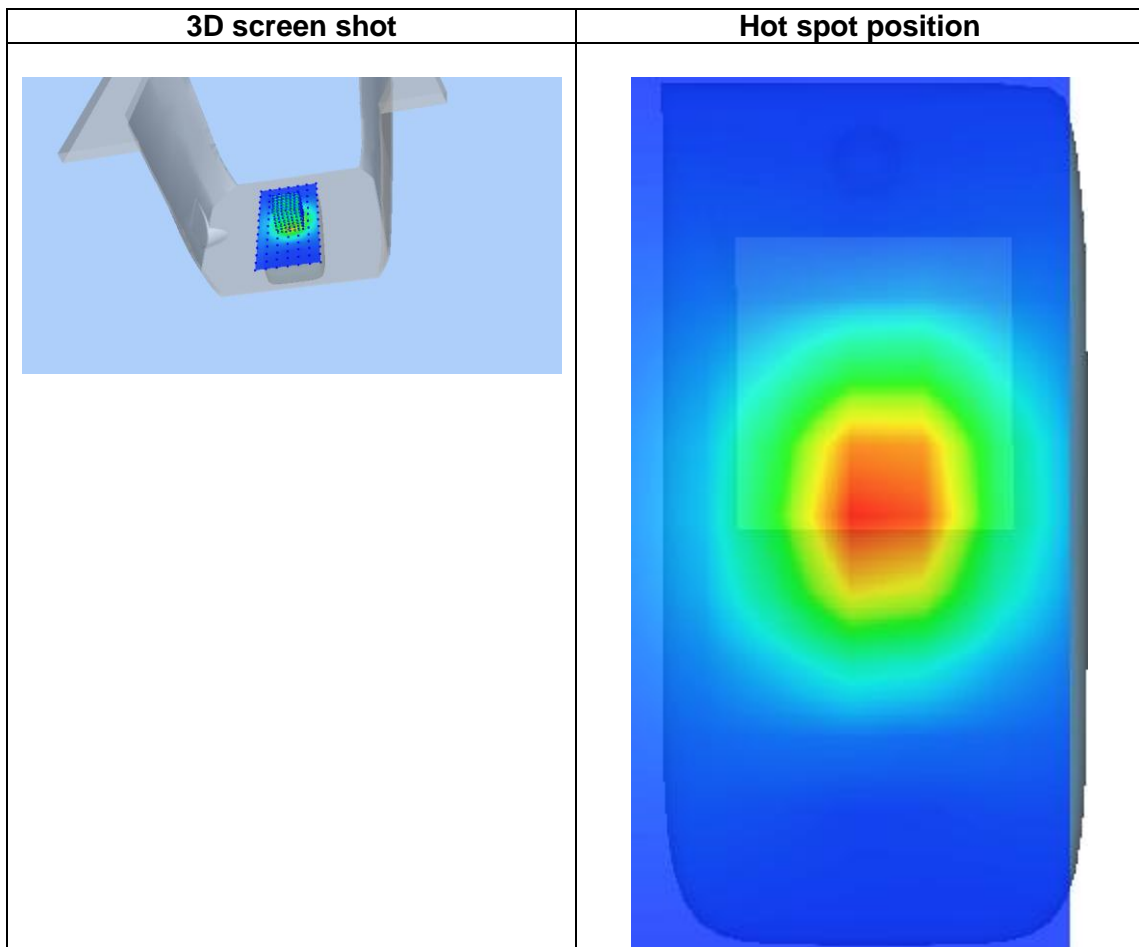
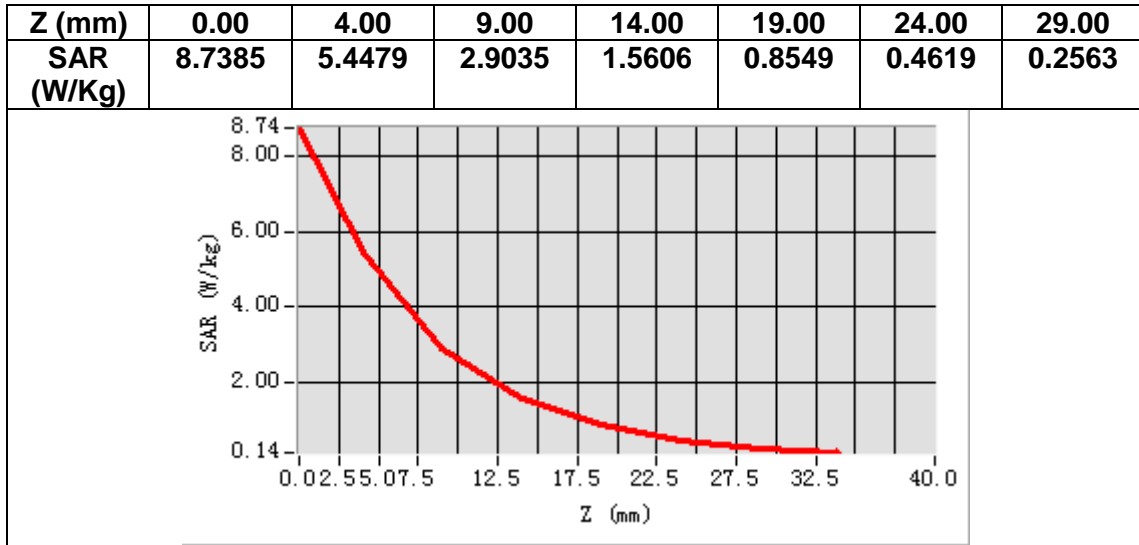
Frequency (MHz)	2450.000000
Relative permittivity (real part)	37.665495
Relative permittivity (imaginary part)	13.017508
Conductivity (S/m)	1.771827
Variation (%)	-2.350000



Maximum location: X=-1.00, Y=1.00

SAR Peak: 8.94 W/kg

SAR 10g (W/Kg)	2.290042
SAR 1g (W/Kg)	4.894310



13. Appendix C. Plots of High SAR Measurement

Table of contents
MEASUREMENT 1 GSM 850 Head
MEASUREMENT 2 GSM 850 Body
MEASUREMENT 3 GSM 1900 Head
MEASUREMENT 4 GSM 1900 Body
MEASUREMENT 5 WCDMA Band 2 Head
MEASUREMENT 6 WCDMA Band 2 Body
MEASUREMENT 7 WCDMA Band 5 Head
MEASUREMENT 8 WCDMA Band 5 Body
MEASUREMENT 9 WLAN 2.4G Head
MEASUREMENT 10 WLAN 2.4G Body

MEASUREMENT 1

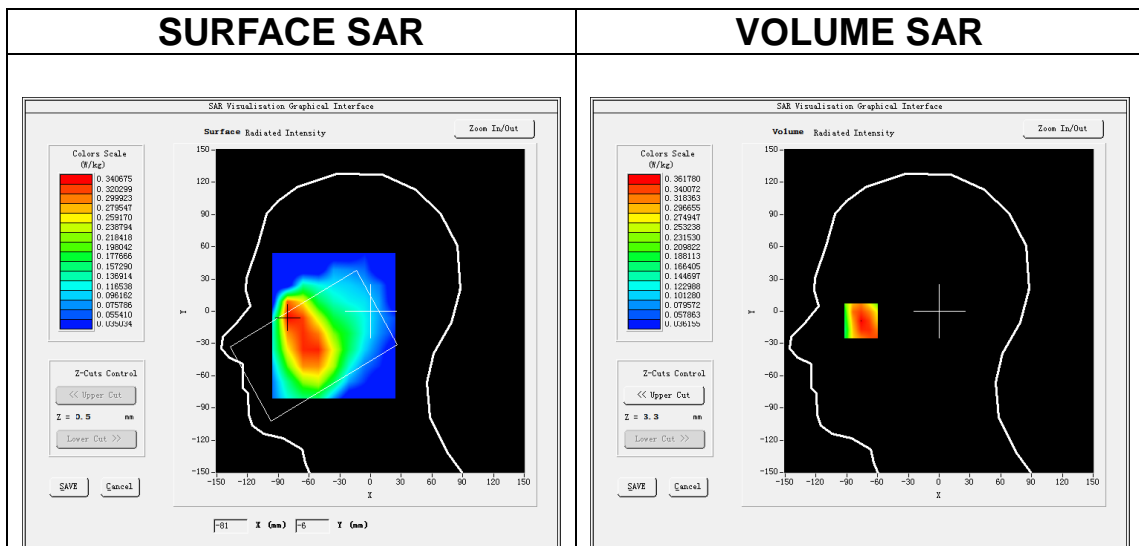
Date of measurement: 25/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>GSM850</u>
Channels	<u>Middle</u>
Signal	<u>TDMA (Crest factor: 2.0)</u>
ConvF	<u>1.50</u>

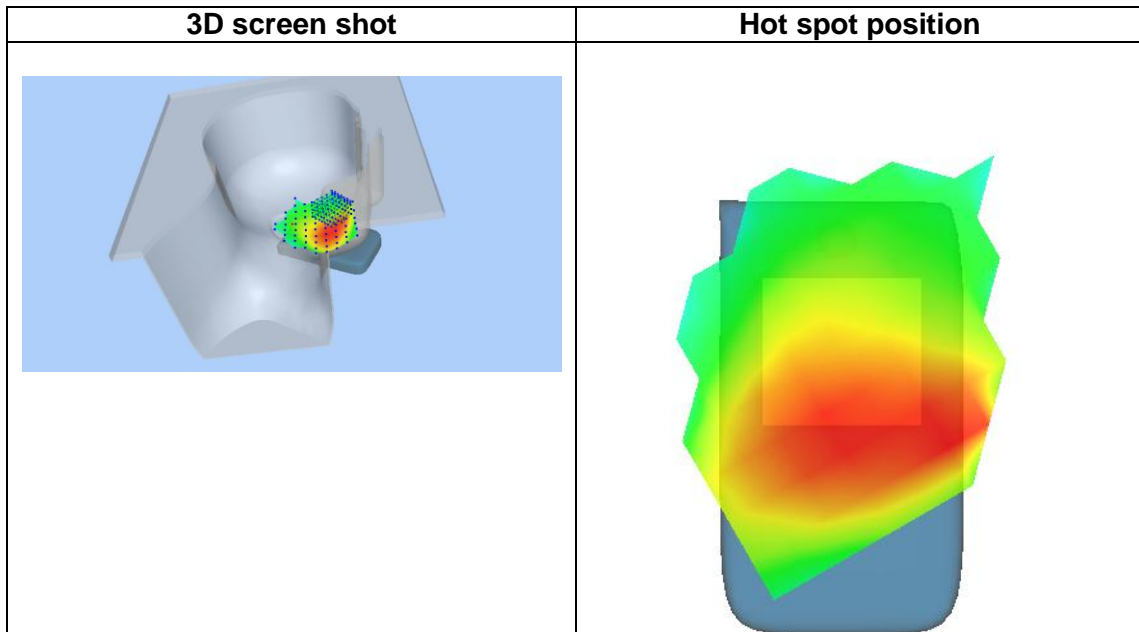
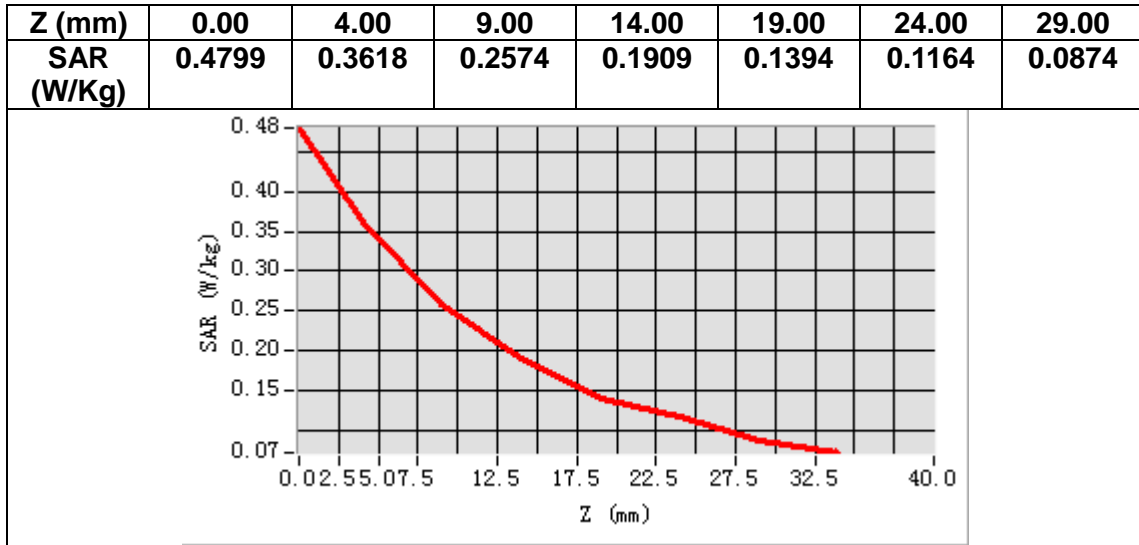
B. SAR Measurement Results

Frequency (MHz)	836.400000
Relative permittivity (real part)	41.542652
Relative permittivity (imaginary part)	19.891504
Conductivity (S/m)	0.924292
Variation (%)	-1.100000



Maximum location: X=-76.00, Y=-6.00
SAR Peak: 0.50 W/kg

SAR 10g (W/Kg)	0.254558
SAR 1g (W/Kg)	0.359358



MEASUREMENT 2

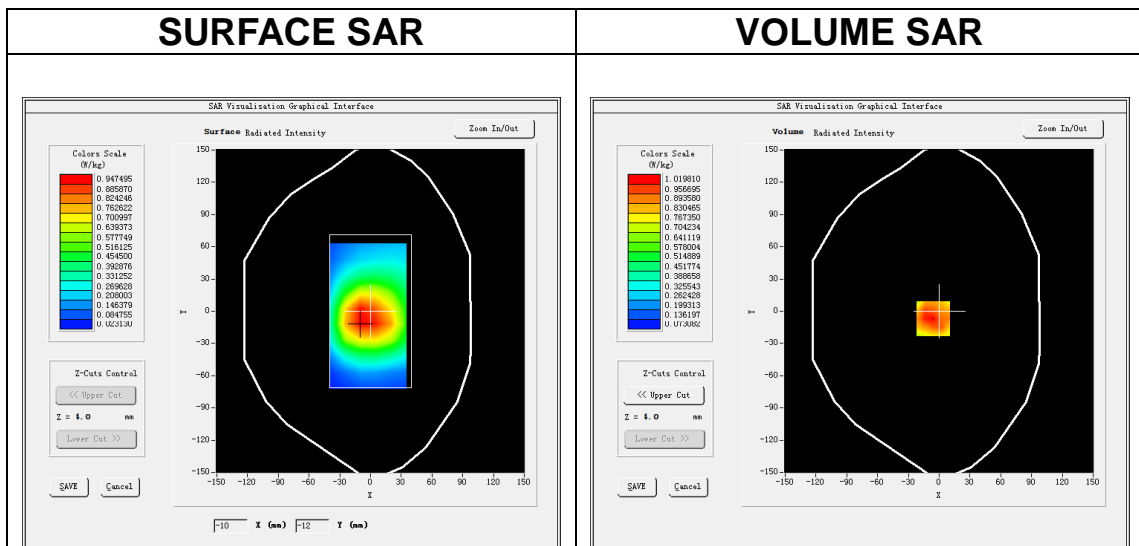
Date of measurement: 25/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body</u>
Band	<u>GSM850</u>
Channels	<u>Middle</u>
Signal	<u>TDMA (Crest factor: 2.0)</u>
ConvF	<u>1.50</u>

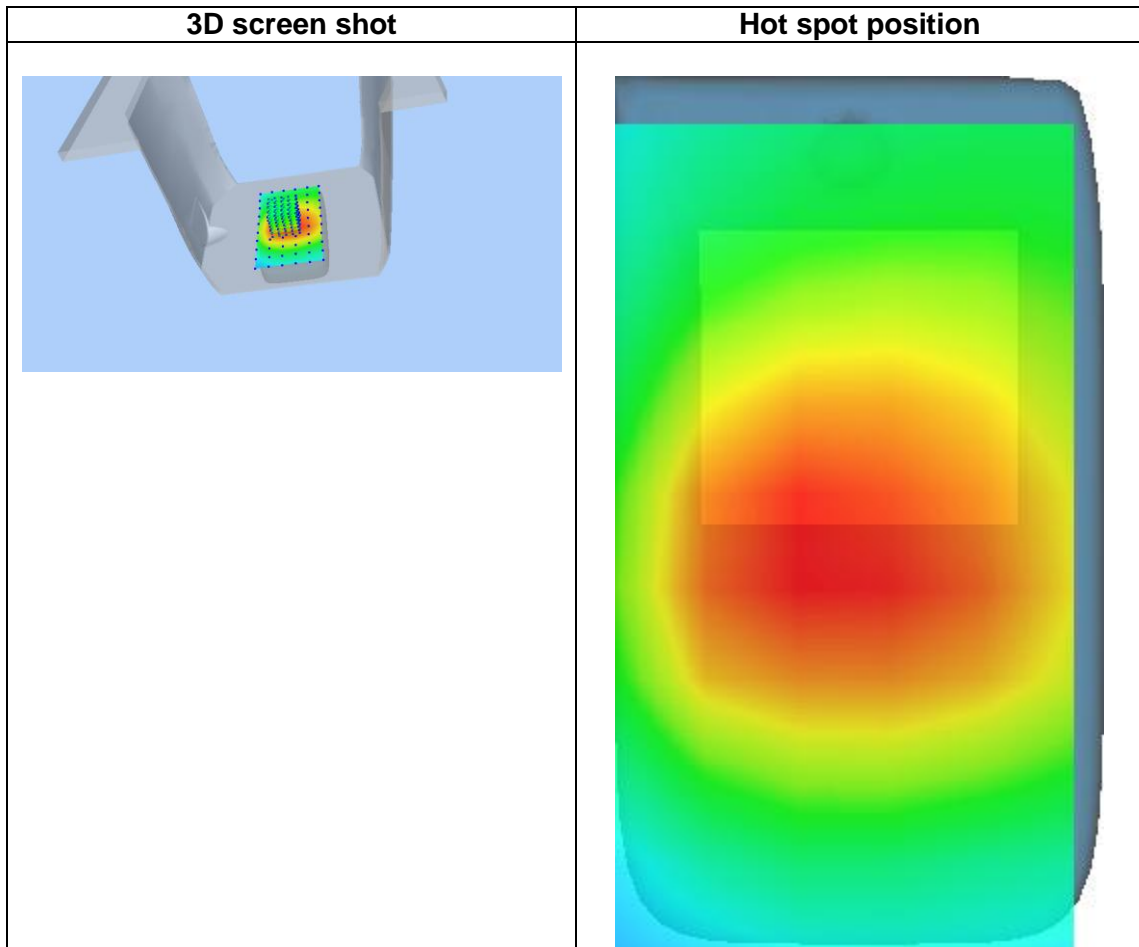
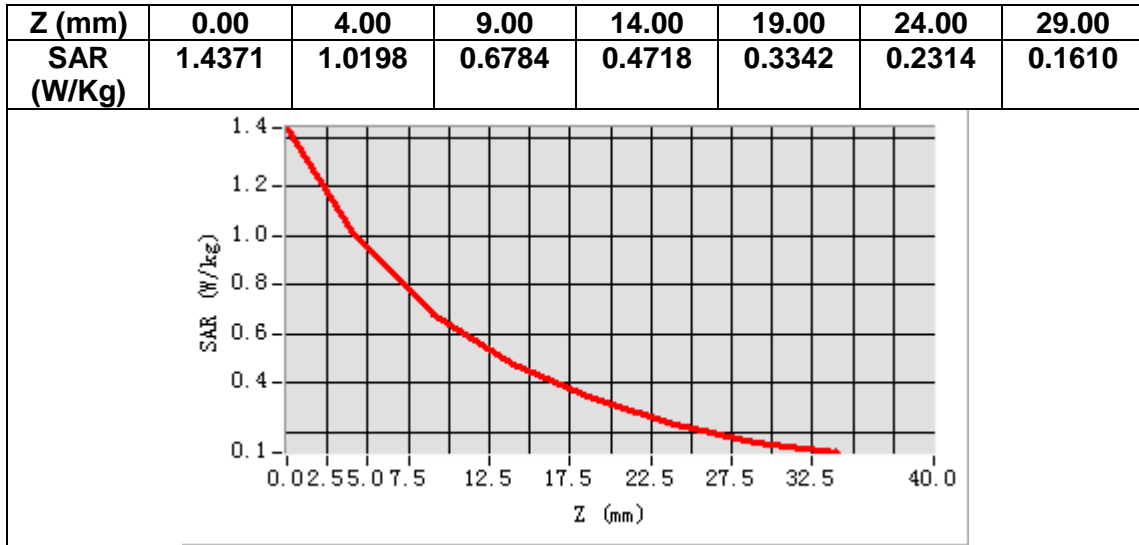
B. SAR Measurement Results

Frequency (MHz)	836.400000
Relative permittivity (real part)	41.542652
Relative permittivity (imaginary part)	19.891504
Conductivity (S/m)	0.924292
Variation (%)	-0.740000



Maximum location: X=-6.00, Y=-7.00
SAR Peak: 1.50 W/kg

SAR 10g (W/Kg)	0.659528
SAR 1g (W/Kg)	1.010658



MEASUREMENT 3

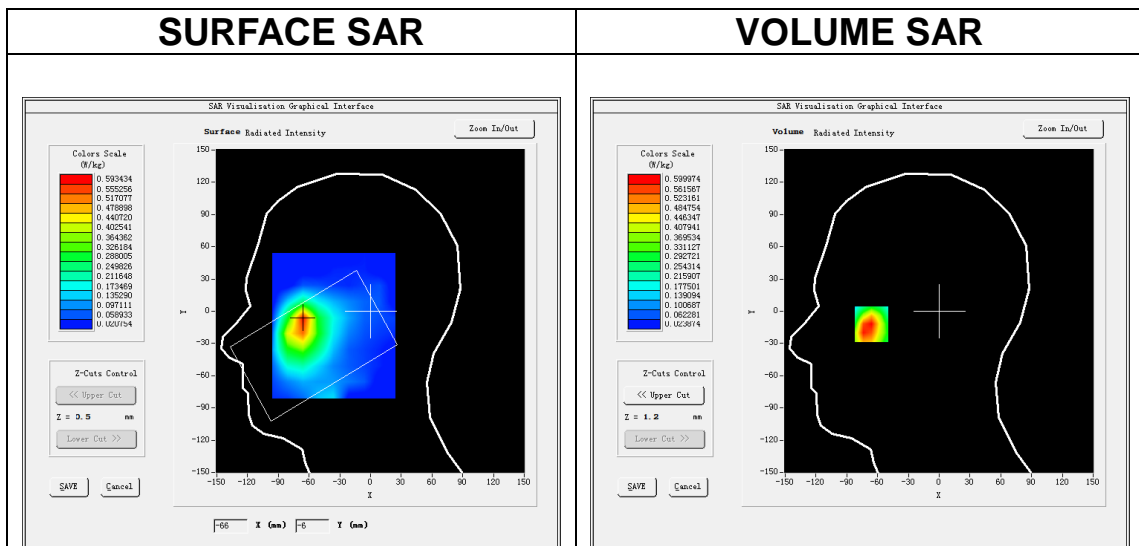
Date of measurement: 26/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>GSM1900</u>
Channels	<u>Middle</u>
Signal	<u>TDMA (Crest factor: 2.0)</u>
ConvF	<u>1.91</u>

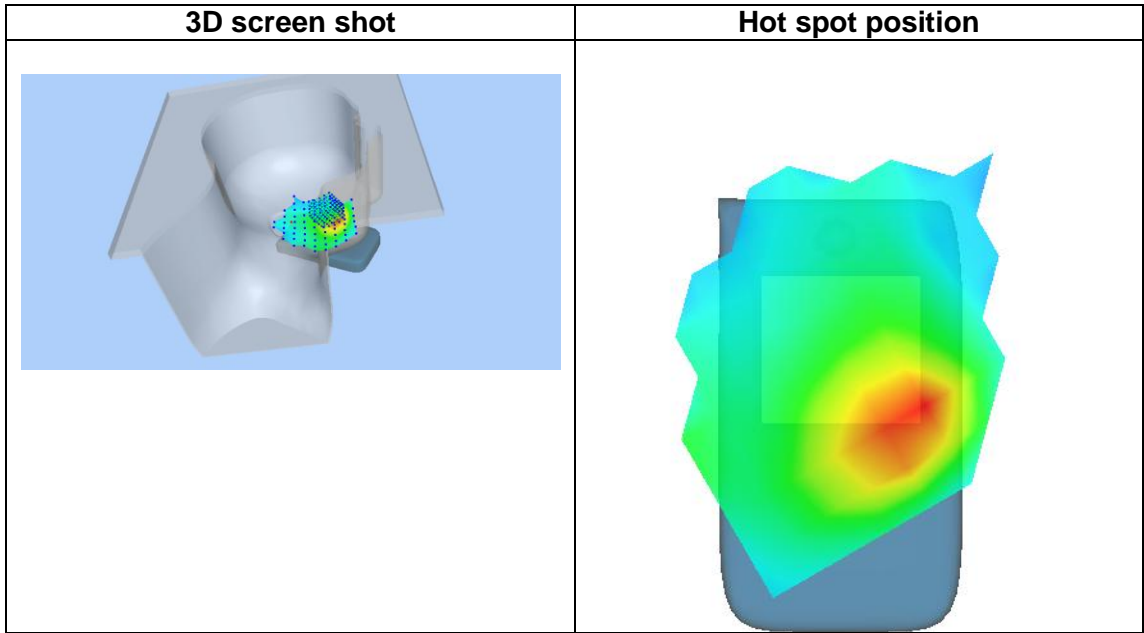
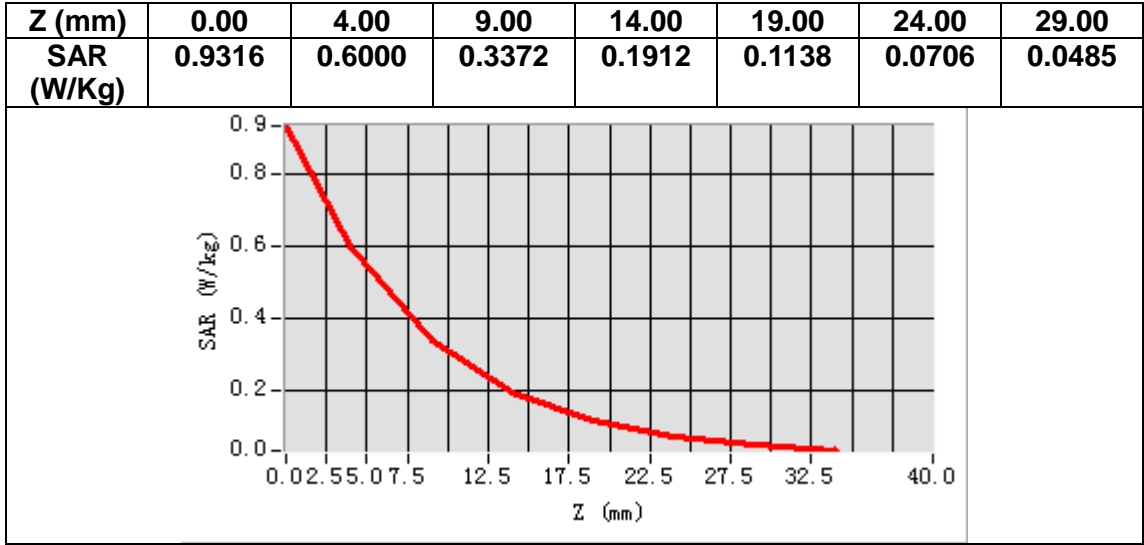
B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.397652
Relative permittivity (imaginary part)	13.806711
Conductivity (S/m)	1.442034
Variation (%)	-2.730000



Maximum location: X=-66.00, Y=-9.00
SAR Peak: 0.98 W/kg

SAR 10g (W/Kg)	0.319954
SAR 1g (W/Kg)	0.602355



MEASUREMENT 4

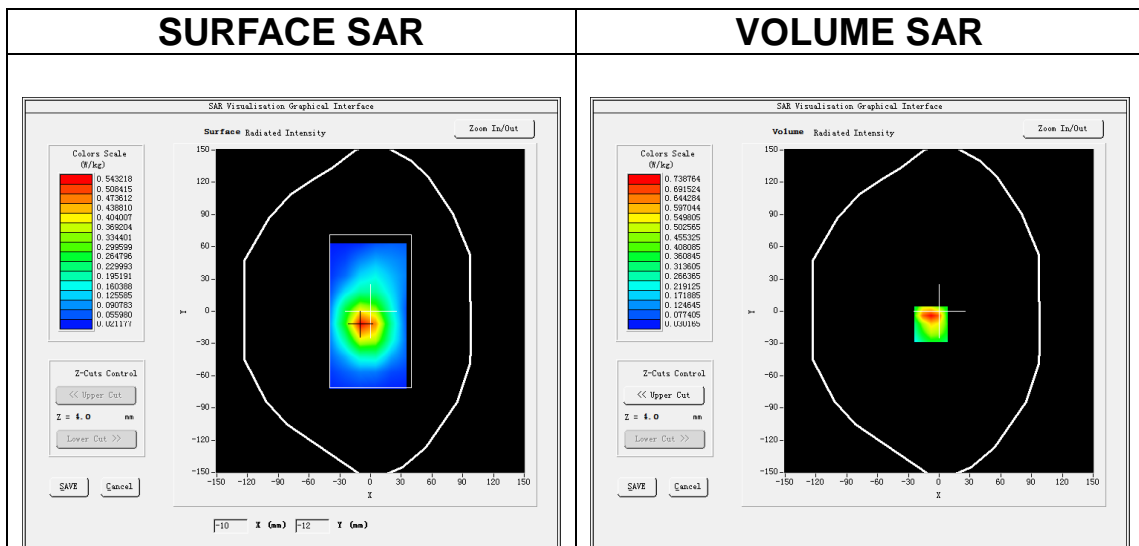
Date of measurement: 26/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body</u>
Band	<u>GSM1900</u>
Channels	<u>Middle</u>
Signal	<u>TDMA (Crest factor: 2.0)</u>
ConvF	<u>1.91</u>

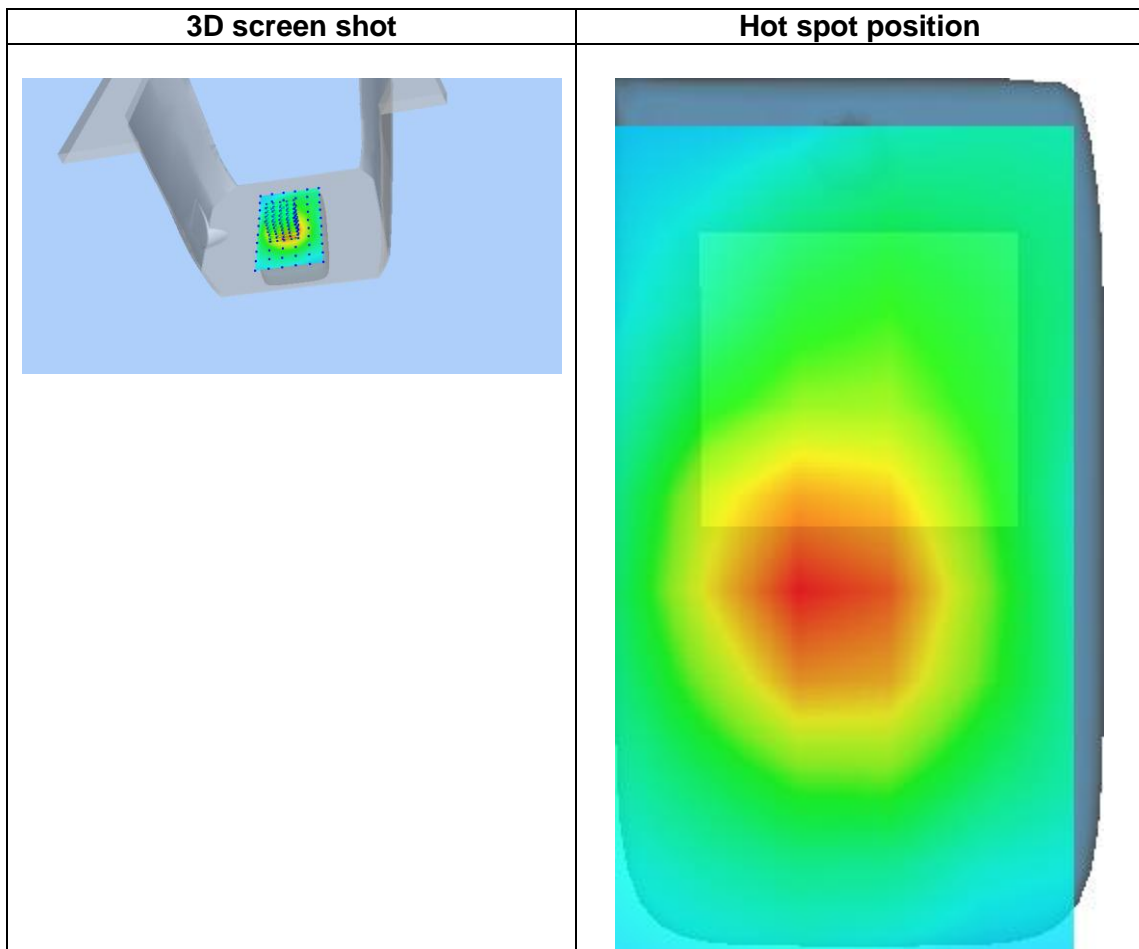
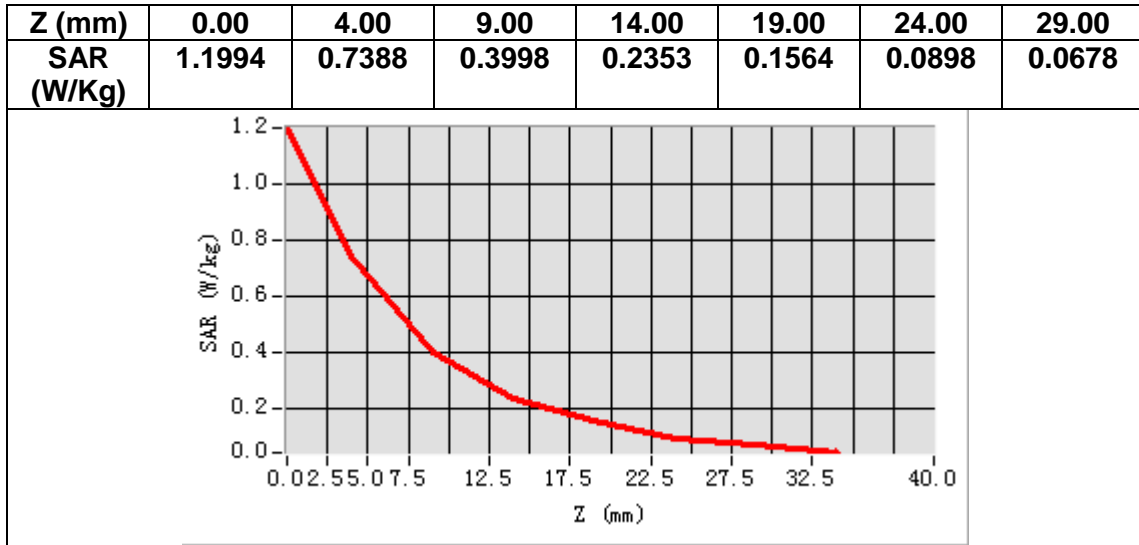
B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.397652
Relative permittivity (imaginary part)	13.806711
Conductivity (S/m)	1.442034
Variation (%)	4.140000



Maximum location: X=-8.00, Y=-12.00
SAR Peak: 1.21 W/kg

SAR 10g (W/Kg)	0.385952
SAR 1g (W/Kg)	0.695531



MEASUREMENT 5

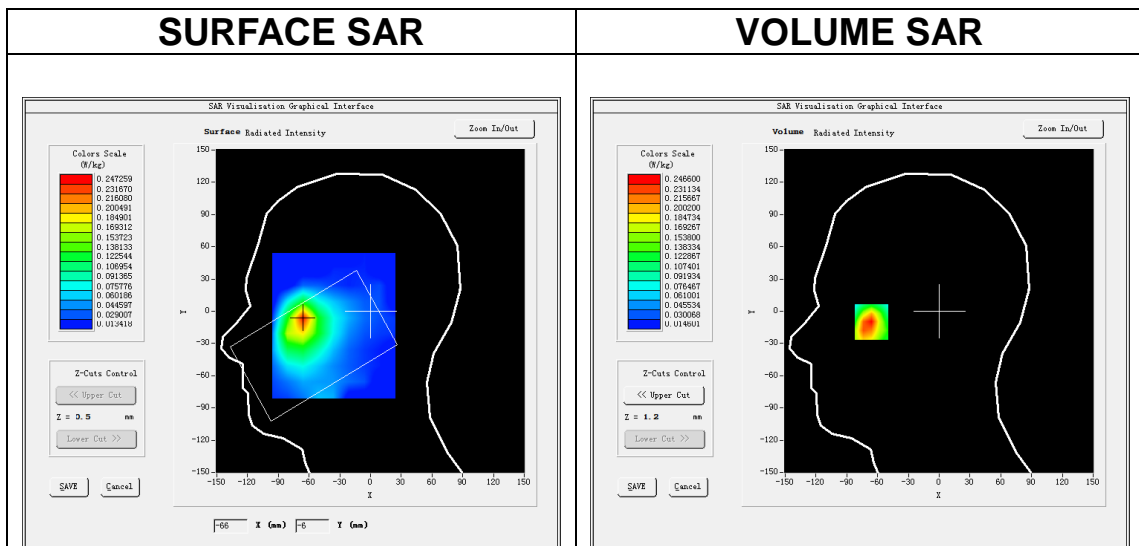
Date of measurement: 26/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>Band2_WCDMA1900</u>
Channels	<u>Middle</u>
Signal	<u>WCDMA (Crest factor: 1.0)</u>
ConvF	<u>1.91</u>

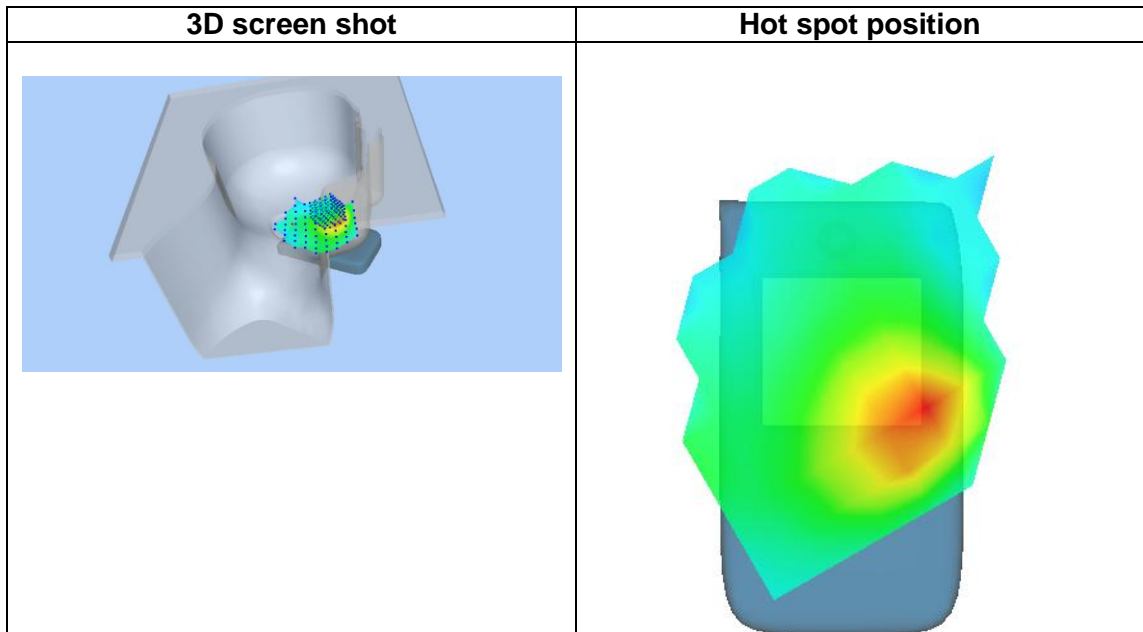
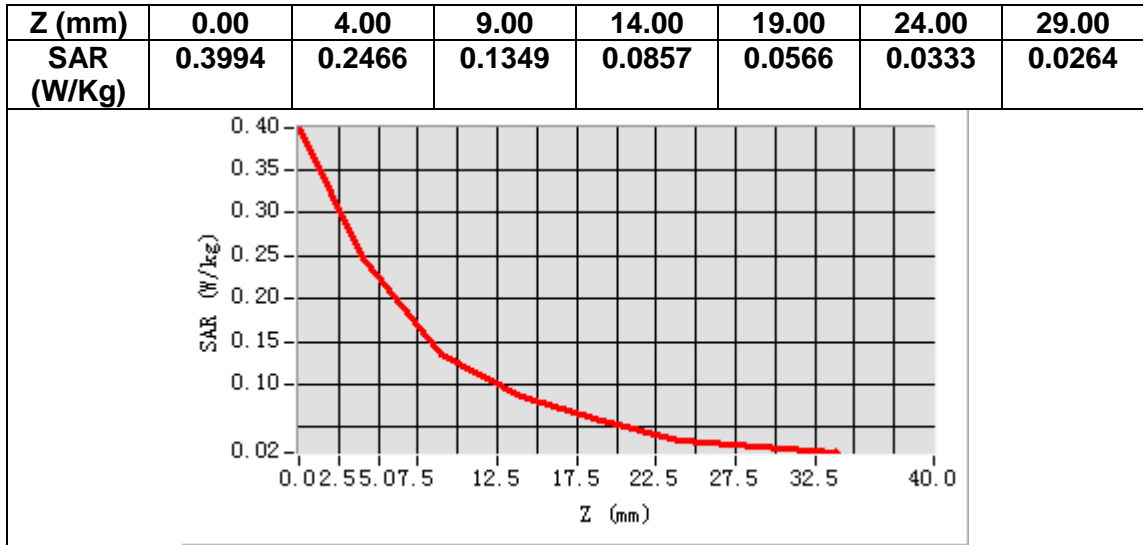
B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.397652
Relative permittivity (imaginary part)	13.806711
Conductivity (S/m)	1.442034
Variation (%)	0.480000



Maximum location: X=-66.00, Y=-7.00
SAR Peak: 0.40 W/kg

SAR 10g (W/Kg)	0.133508
SAR 1g (W/Kg)	0.243703



MEASUREMENT 6

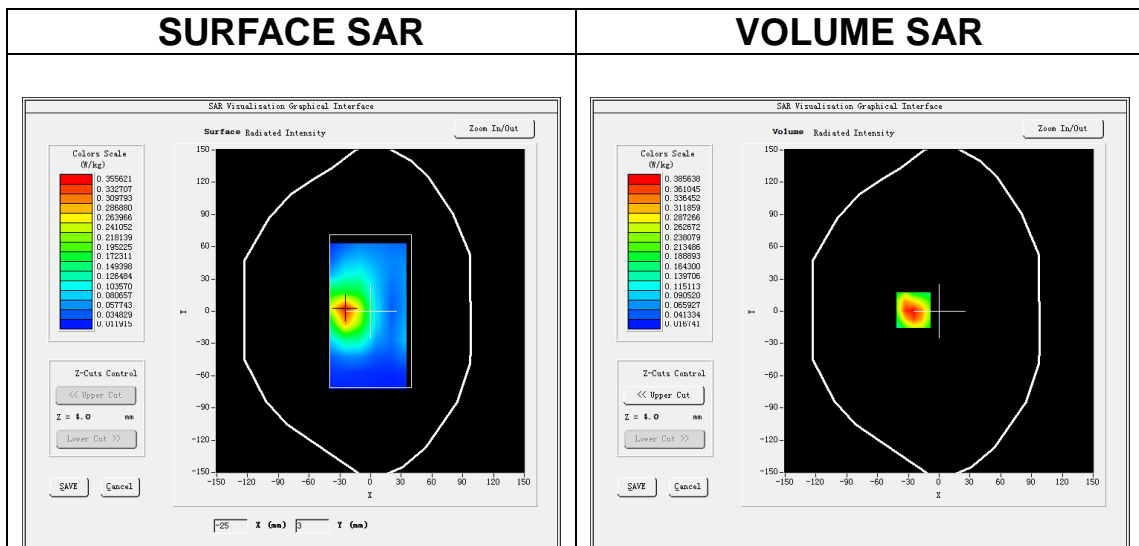
Date of measurement: 26/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body</u>
Band	<u>Band2_WCDMA1900</u>
Channels	<u>Middle</u>
Signal	<u>WCDMA (Crest factor: 1.0)</u>
ConvF	<u>1.91</u>

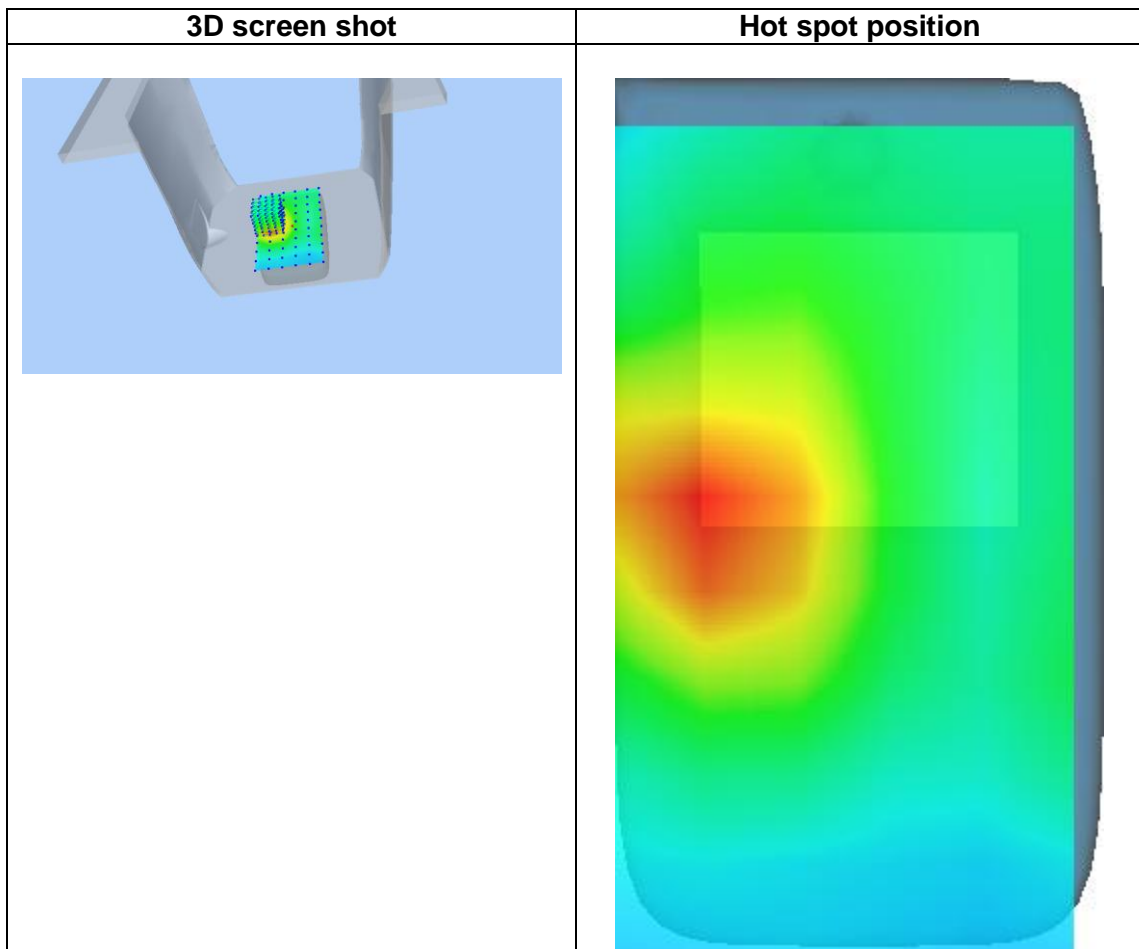
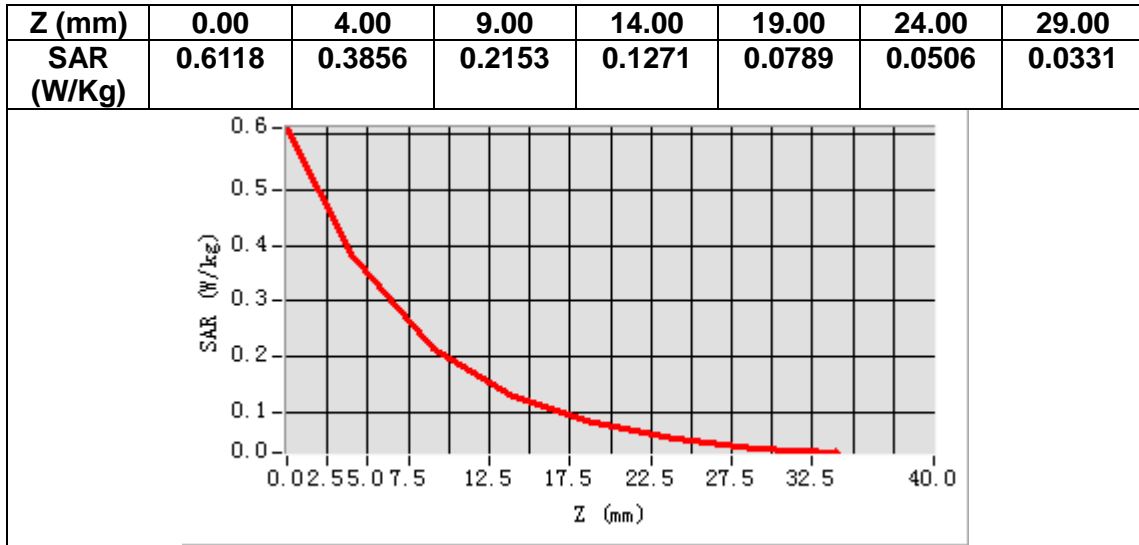
B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.397652
Relative permittivity (imaginary part)	13.806711
Conductivity (S/m)	1.442034
Variation (%)	-1.170000



Maximum location: X=-25.00, Y=1.00
SAR Peak: 0.63 W/kg

SAR 10g (W/Kg)	0.208260
SAR 1g (W/Kg)	0.386535



MEASUREMENT 7

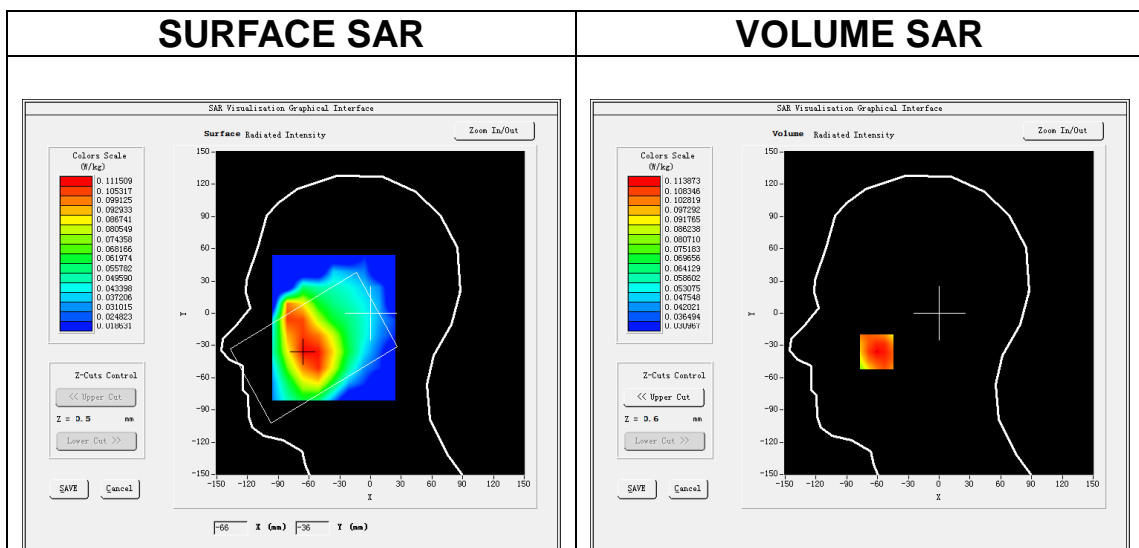
Date of measurement: 25/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>Band5_WCDMA850</u>
Channels	<u>Middle</u>
Signal	<u>WCDMA (Crest factor: 1.0)</u>
ConvF	<u>1.50</u>

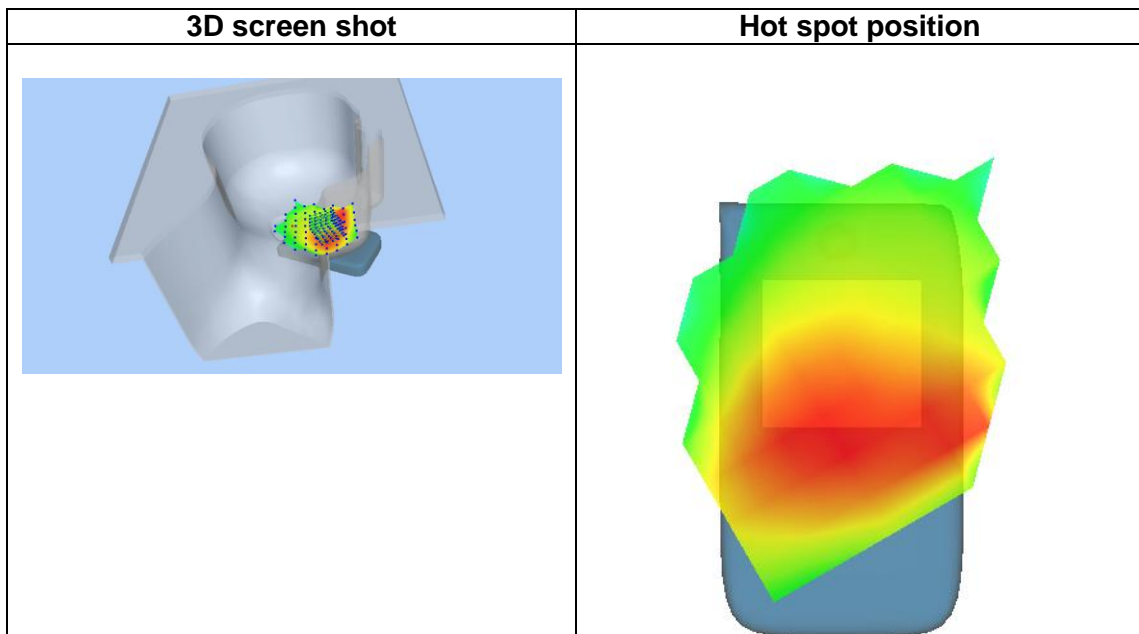
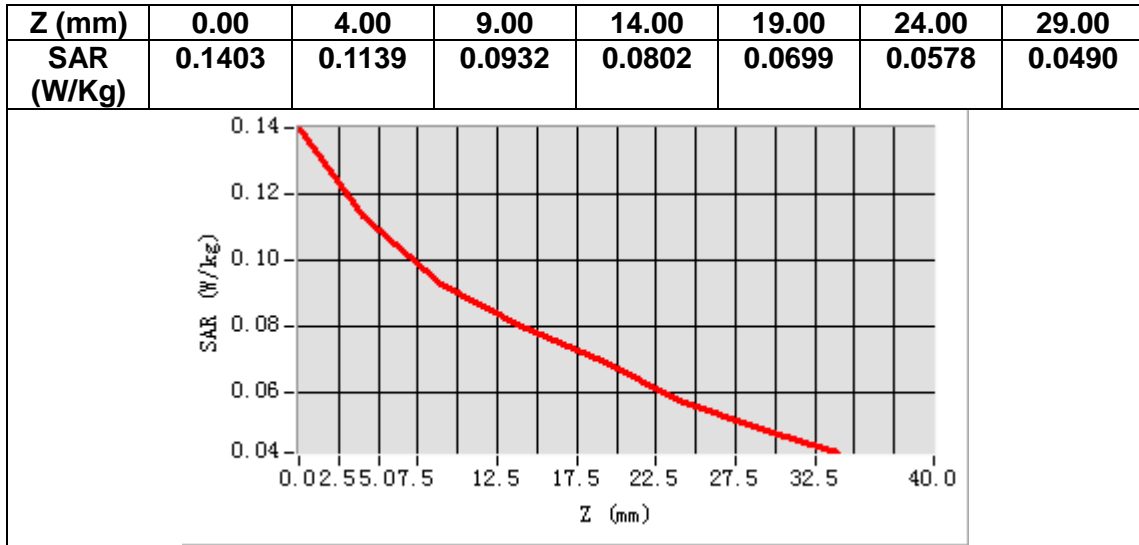
B. SAR Measurement Results

Frequency (MHz)	836.400000
Relative permittivity (real part)	41.542652
Relative permittivity (imaginary part)	19.891504
Conductivity (S/m)	0.924292
Variation (%)	0.290000



Maximum location: X=-61.00, Y=-36.00
SAR Peak: 0.14 W/kg

SAR 10g (W/Kg)	0.091789
SAR 1g (W/Kg)	0.115463



MEASUREMENT 8

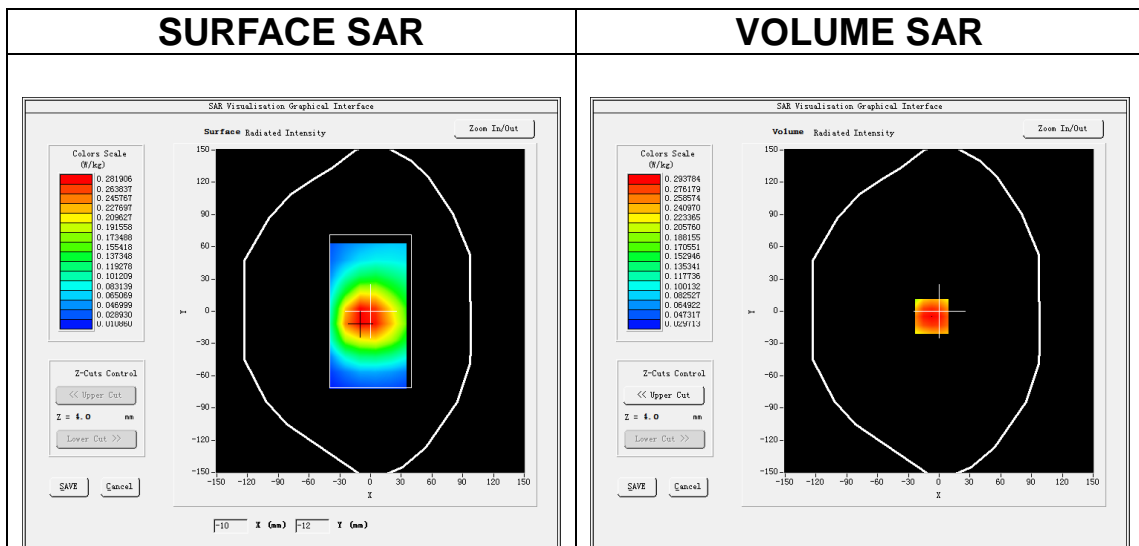
Date of measurement: 25/8/2022

A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body</u>
Band	<u>Band5_WCDMA850</u>
Channels	<u>Middle</u>
Signal	<u>WCDMA (Crest factor: 1.0)</u>
ConvF	<u>1.50</u>

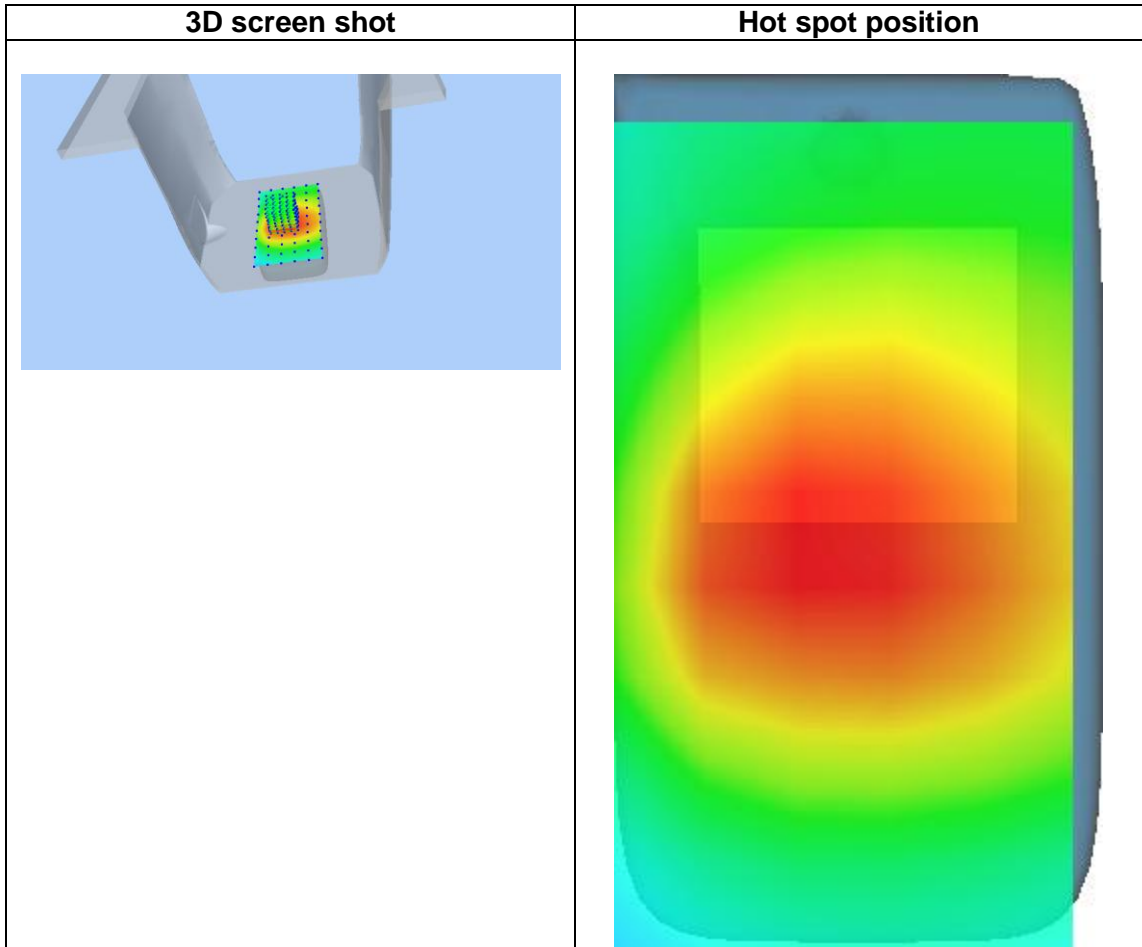
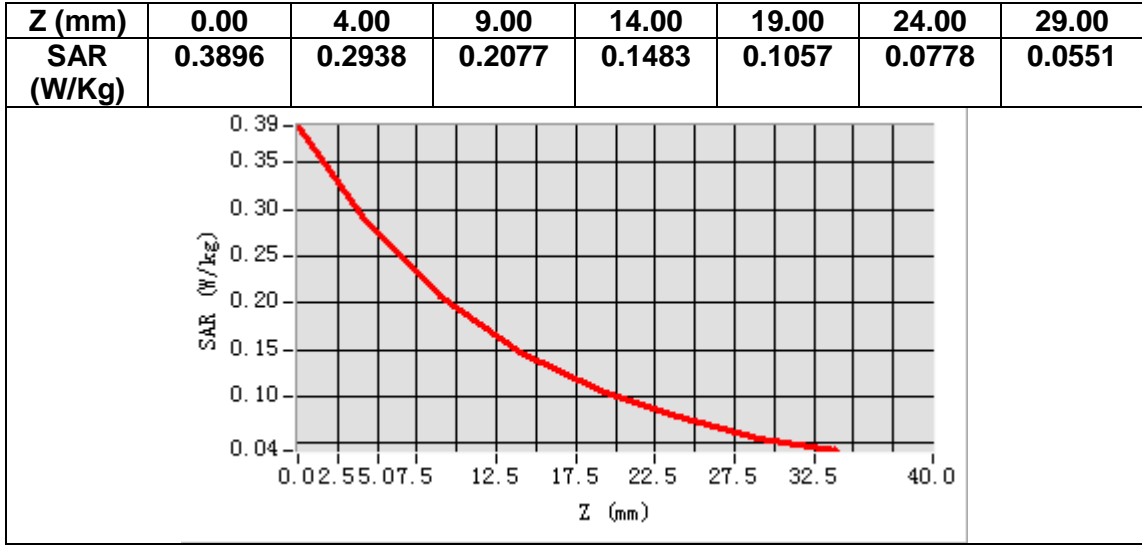
B. SAR Measurement Results

Frequency (MHz)	836.400000
Relative permittivity (real part)	41.542652
Relative permittivity (imaginary part)	19.891504
Conductivity (S/m)	0.924292
Variation (%)	-0.830000



Maximum location: X=-7.00, Y=-5.00
SAR Peak: 0.40 W/kg

SAR 10g (W/Kg)	0.200200
SAR 1g (W/Kg)	0.290565



MEASUREMENT 9

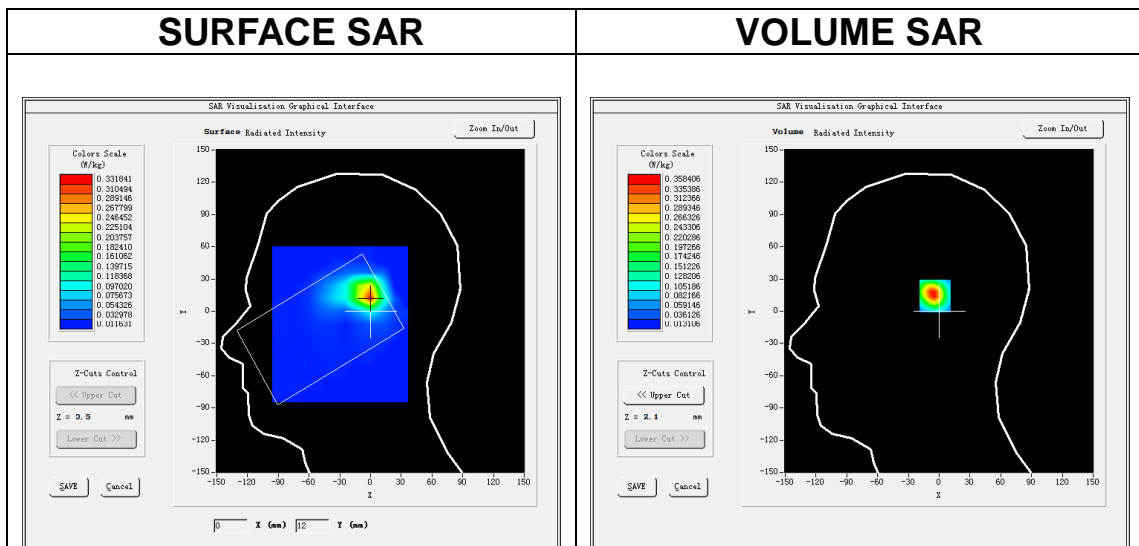
Date of measurement: 22/8/2022

A. Experimental conditions.

Area Scan	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
ZoomScan	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>IEEE 802.11b ISM</u>
Channels	<u>Low</u>
Signal	<u>IEEE802.11b (Crest factor: 1.0)</u>
ConvF	<u>1.98</u>

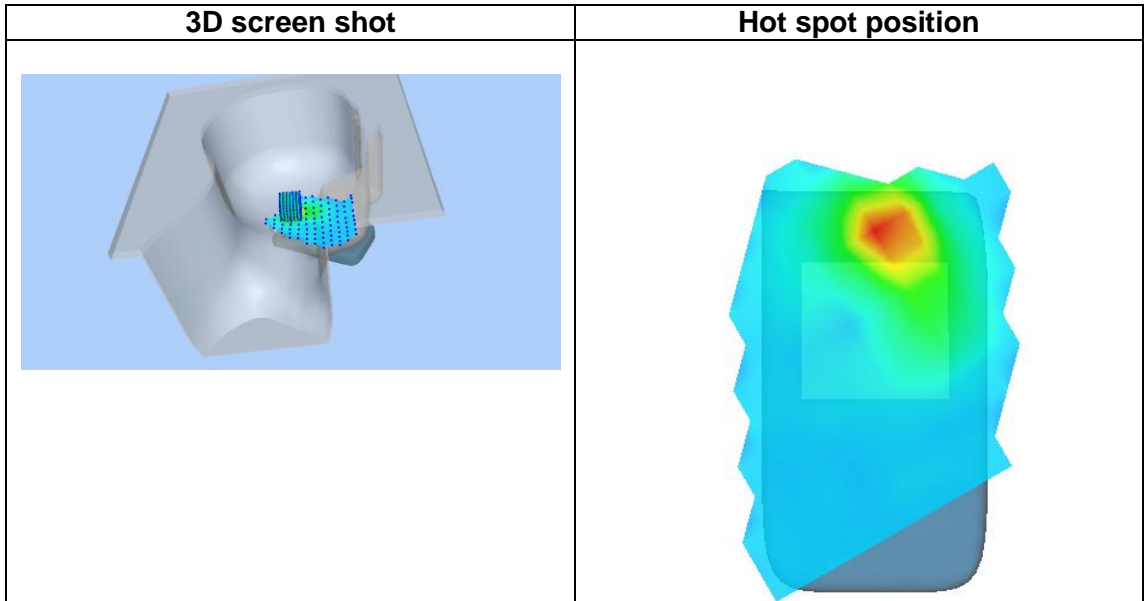
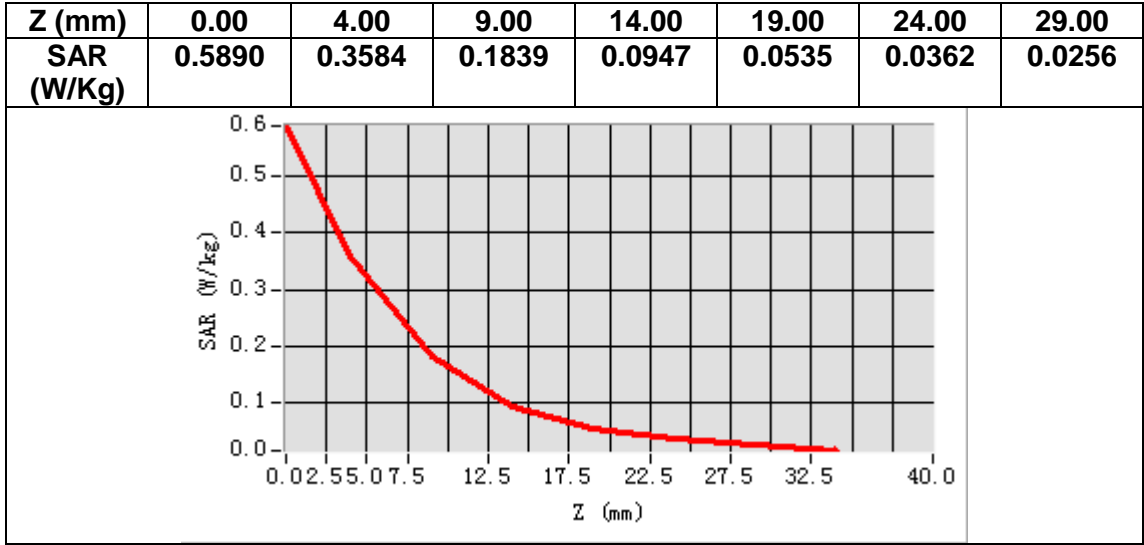
B. SAR Measurement Results

Frequency (MHz)	2412.000000
Relative permittivity (real part)	37.762195
Relative permittivity (imaginary part)	12.966708
Conductivity (S/m)	1.737539
Variation (%)	-0.590000



Maximum location: X=-1.00, Y=14.00
SAR Peak: 0.60 W/kg

SAR 10g (W/Kg)	0.153868
SAR 1g (W/Kg)	0.330306



MEASUREMENT 10

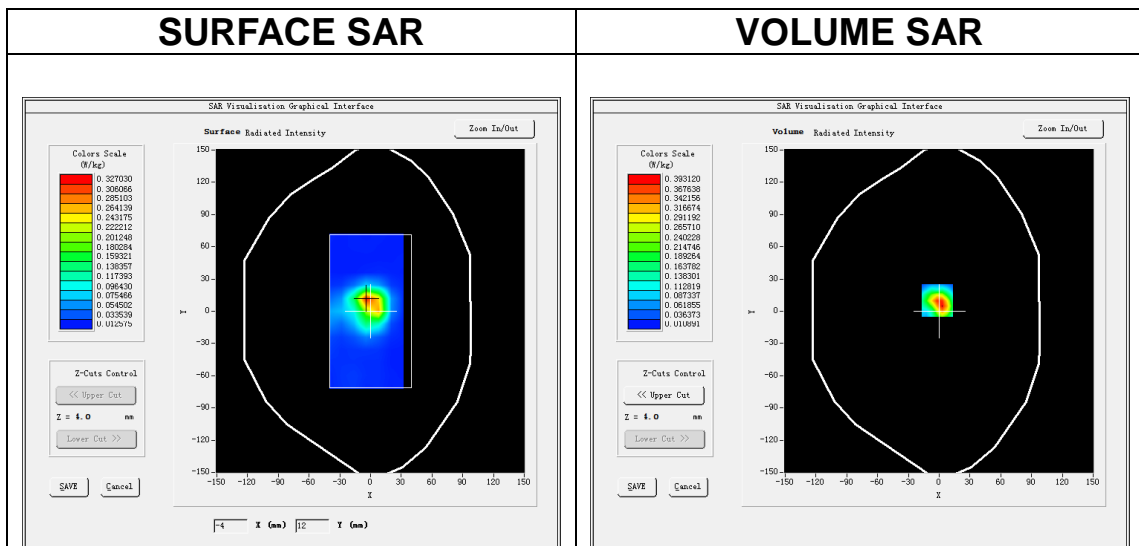
Date of measurement: 22/8/2022

A. Experimental conditions.

Area Scan	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
ZoomScan	<u>7x7x7, dx=5mm dy=5mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body</u>
Band	<u>IEEE 802.11b ISM</u>
Channels	<u>Low</u>
Signal	<u>IEEE802.11b (Crest factor: 1.0)</u>
ConvF	<u>1.98</u>

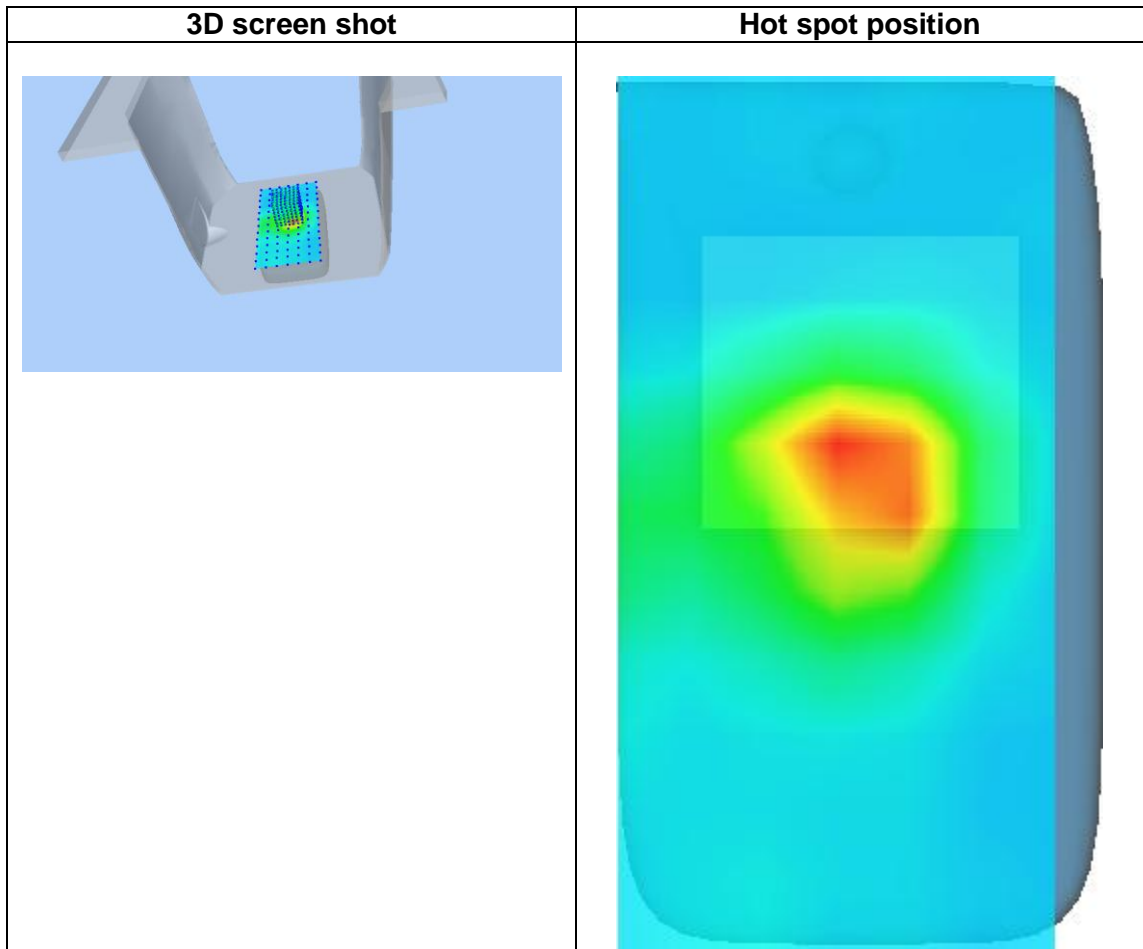
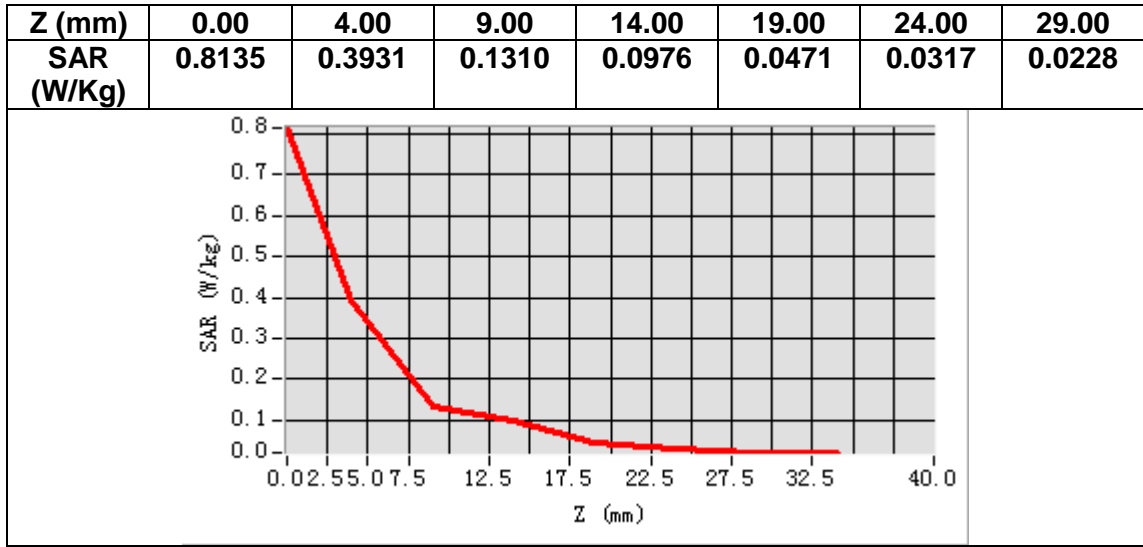
B. SAR Measurement Results

Frequency (MHz)	2412.000000
Relative permittivity (real part)	37.762195
Relative permittivity (imaginary part)	12.966708
Conductivity (S/m)	1.737539
Variation (%)	2.380000



Maximum location: X=-2.00, Y=10.00
SAR Peak: 0.67 W/kg

SAR 10g (W/Kg)	0.253556
SAR 1g (W/Kg)	0.413556



14. Appendix D. Calibration Certificate

Table of contents
E Field Probe - SN 08/16 EPGO287
835 MHz Dipole - SN 03/15 DIP 0G835-347
1900 MHz Dipole - SN 03/15 DIP 1G900-350
2450 MHz Dipole - SN 03/15 DIP 2G450-352
Extended Calibration Certificate



COMOSAR E-Field Probe Calibration Report

Ref : ACR.60.1.21.MVGB.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.: SN 08/16 EPGO287**

Calibrated at MVG

Z.I. de la pointe du diable

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

Calibration date: 02/01/2022



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

Summary:

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



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Luc	Technical Manager	2/1/2022	<i>JS</i>
Checked by :	Jérôme Luc	Technical Manager	2/1/2022	<i>JS</i>
Approved by :	Yann Toutain	Laboratory Director	2/1/2022	<i>Yann Toutain</i>

Mode d'emploi
2022.02.0
1 10:07:13
+01'00'

PHILIPS

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

Issue	Name	Date	Modifications
A	Jérôme Luc	2/1/2022	Initial release



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref. ACR.60.1.21.MVGB.A

TABLE OF CONTENTS

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



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 08/16 EPGO287
Product Condition (new / used)	Used
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.211 MΩ Dipole 2: R2=0.199 MΩ Dipole 3: R3=0.199 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG’s COMOSAR E field Probes are built in accordance to the IEEE 1528, FCC KDB865664 D01, CENELEC EN62209 and CEI/IEC 62209 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Dipole

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 IEEE 1528, FCC KDB865664 D01, CENELEC EN62209 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

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



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

3.3 LOWER DETECTION LIMIT

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

3.4 ISOTROPY

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

3.1 BOUNDARY EFFECT

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

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

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

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



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

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

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

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

5 CALIBRATION MEASUREMENT RESULTS

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

5.1 SENSITIVITY IN AIR

Normx dipole 1 (µV/(V/m) ²)	Normy dipole 2 (µV/(V/m) ²)	Normz dipole 3 (µV/(V/m) ²)
0.72	0.66	0.77

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
107	110	110

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

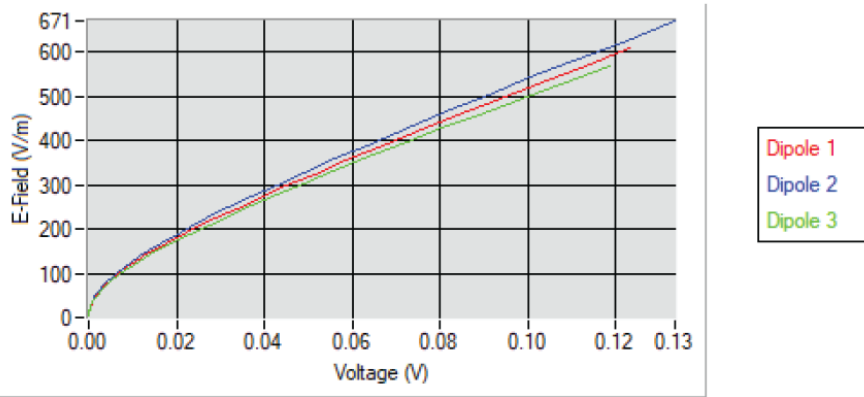
$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



COMOSAR E-FIELD PROBE CALIBRATION REPORT

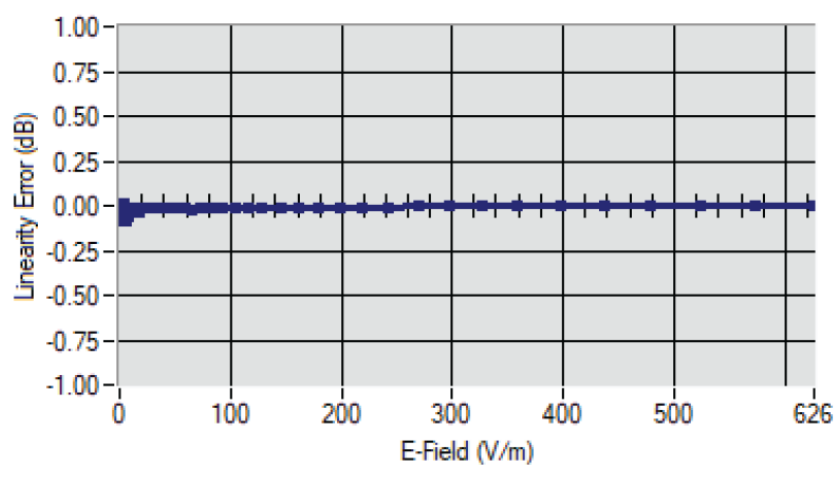
Ref: ACR.60.1.21.MVGB.A

Calibration curves



5.2 LINEARITY

Linearity



Linearity: +/- 1.90% (+/- 0.08dB)



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	ConvF
HL750	750	1.49
HL850	835	1.50
HL900	900	1.61
HL1800	1800	1.73
HL1900	1900	1.91
HL2000	2000	1.97
HL2300	2300	1.92
HL2450	2450	1.98
HL2600	2600	1.87
HL3300	3300	1.79
HL3500	3500	1.85
HL3700	3700	1.79
HL3900	3900	2.07
HL4200	4200	2.21
HL4600	4600	2.25
HL4900	4900	2.05
HL5200	5200	1.80
HL5400	5400	2.05
HL5600	5600	2.16
HL5800	5800	2.07

LOWER DETECTION LIMIT: 8mW/kg

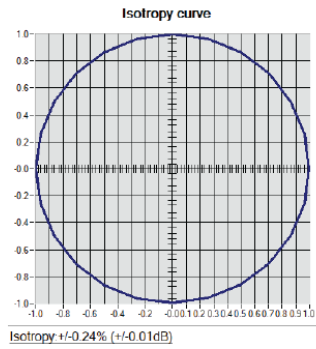


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

5.4 ISOTROPY

HL1800 MHz





COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat 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	Rohde & Schwarz ZVM	100203	05/2019	05/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	05/2019	05/2022
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44220687	05/2020	05/2023



SAR Reference Dipole Calibration Report

Ref : ACR.60.3.21.MVGB.A

SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 835 MHZ

SERIAL NO.: SN 03/15 DIP0G835-347

Calibrated at MVG

Z.I. de la pointe du diable

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

Calibration date: 03/01/2021



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

Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.3.21.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Luc	Technical Manager	3/1/2021	<i>JL</i>
Checked by :	Jérôme Luc	Technical Manager	3/1/2021	<i>JL</i>
Approved by :	Yann Toutain	Laboratory Director	3/1/2021	<i>Yann Toutain</i>

Made d'emploi 2021.03.01 13:09:12 +01'00'

PHILIPS

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

Issue	Name	Date	Modifications
A	Jérôme Luc	3/1/2021	Initial release