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： 4G LTE MIFI
Brand Name： LOGIC, iSWAG, UNONU
Model Name： ML22
Family Model： BOX, UM22L
Report No.： S23102001402001
FCC ID： O552204423

Prepared for

SWAGTEK

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Prepared by

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TEST RESULT CERTIFICATION

Applicant's name..................: SWAGTEK

Address ....: 10205 NW 19th Street STE101 Miami, FL 33172,United States

Manufacturer's Name...........: SWAGTEK

Address ....: 10205 NW 19th Street STE101 Miami, FL 33172,United States

Product description

Product name.........................: 4G LTE MIFI

Brand Name ....: LOGIC, iSWAG, UNONU

Model and/or type reference : ML22

Family Model..........................: BOX, UM22L

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.

Test Sample Number S231020014002

Date of Test

Date (s) of performance of tests............: Oct. 24, 2023 ~ Nov. 02, 2023

Date of Issue ....: Nov. 09, 2023

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

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

※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Nov. 09, 2023	Jack Li

TABLE OF CONTENTS

1. General Information

1.1. RF exposure limits

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

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

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

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

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

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

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

NOTE
TRUNK LIMIT
1.6 W/kg
APPLIED TO THIS EUT

1.2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for ML22 are as follows.

RF Exposure Conditions		Equipment Class -Highest Reported SAR (W/kg)			
		PCE	DTS	NII	DSS
1-g Hotspot (Separation distance of 10mm)		1.129	0.200	N/A	N/A
Max Simultaneous Tx	1-g Hotspot	1.507	1.507	N/A	N/A

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	4G LTE MIFI		
Brand Name	LOGIC, iSWAG, UNONU		
Model Name	ML22		
Family Model	BOX, UM22L		
Model Difference	All the model are the same circuit and RF module, except the model names.		
FCC ID	O552204423		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna Type	FPC Antenna		
Battery Information	DC 3.7V, 2600mAh, 9.62Wh		
HW Version	TZ7.821.196		
SW Version	ZLT ML22_V1.0		
Device Operating Configurations			
Supporting Mode(s)	WCDMA Band 2/4/5, LTE Band 2/4/5/7/41, WLAN 2.4G		
Test Modulation	WCDMA(QPSK), LTE(QPSK/16QAM), WLAN(DSSS/OFDM)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WCDMA Band 2	1850-1910	1930-1990
	WCDMA Band 4	1710-1755	2110-2155
	WCDMA Band 5	824-849	869-894
	LTE Band 2	1850-1910	1930-1990

	LTE Band 4	1710-1755	2110-2155
	LTE Band 5	824-849	869-894
	LTE Band 7	2500-2570	2620-2690
	LTE Band 41	2496-2690	
	WLAN 2.4G	2412-2462	
Power Class	3, tested with power control “all 1”(WCDMA Band 2)		
	3, tested with power control “all 1”(WCDMA Band 4)		
	3, tested with power control “all 1”(WCDMA Band 5)		
	3, tested with power control all Max.(LTE Band 2)		
	3, tested with power control all Max.(LTE Band 4)		
	3, tested with power control all Max.(LTE Band 5)		
	3, tested with power control all Max.(LTE Band 7)		
	3, tested with power control all Max.(LTE Band 41)		

1.4. Test specification(s)

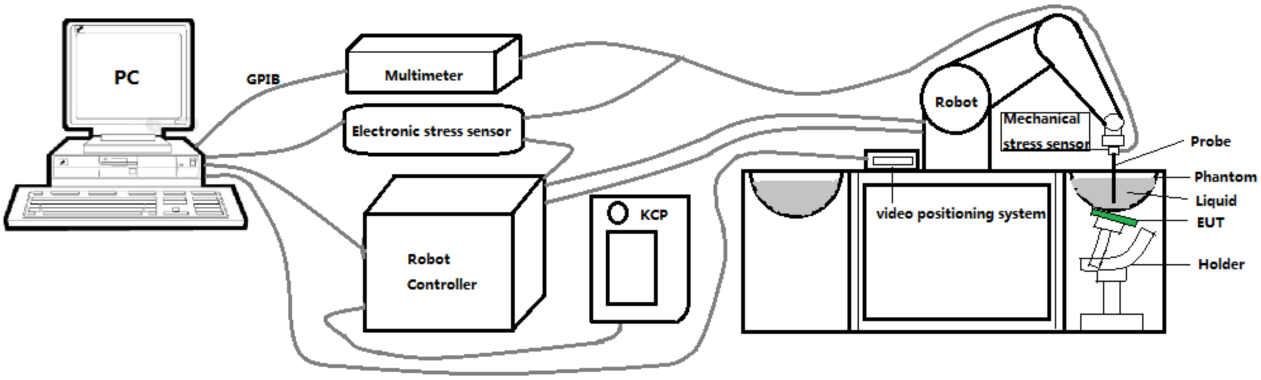
FCC 47 CFR Part 2(2.1093)
ANSI/IEEE C95.1-1992
IEEE Std 1528-2013
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting
KDB 447498 D01 General RF Exposure Guidance
KDB 248227 D01 802.11 Wi-Fi SAR
KDB 941225 D01 3G SAR Procedures
KDB 941225 D05 SAR for LTE Devices
KDB 941225 D06 Hotspot SAR

1.5. Ambient Condition

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

2. SAR Measurement System

2.1. SATIMO SAR Measurement Set-up Diagram



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

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

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

2.2. Robot

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

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

2.3. E-Field Probe

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

For the measurements the Specific Dosimetric E-Field Probe 3423-EPGO-426 with following specifications is used

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

Angle between probe axis (evaluation axis) and surface normal line: less than 30°.

2.3.1. E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ±10%. The spherical isotropy shall be evaluated and within ±0.25dB. The sensitivity parameters (Norm X, Norm Y, and Norm Z), the diode compression parameter (DCP) and the conversion factor (Conv F) of the probe are tested. The calibration data can be referred to appendix D of this report.

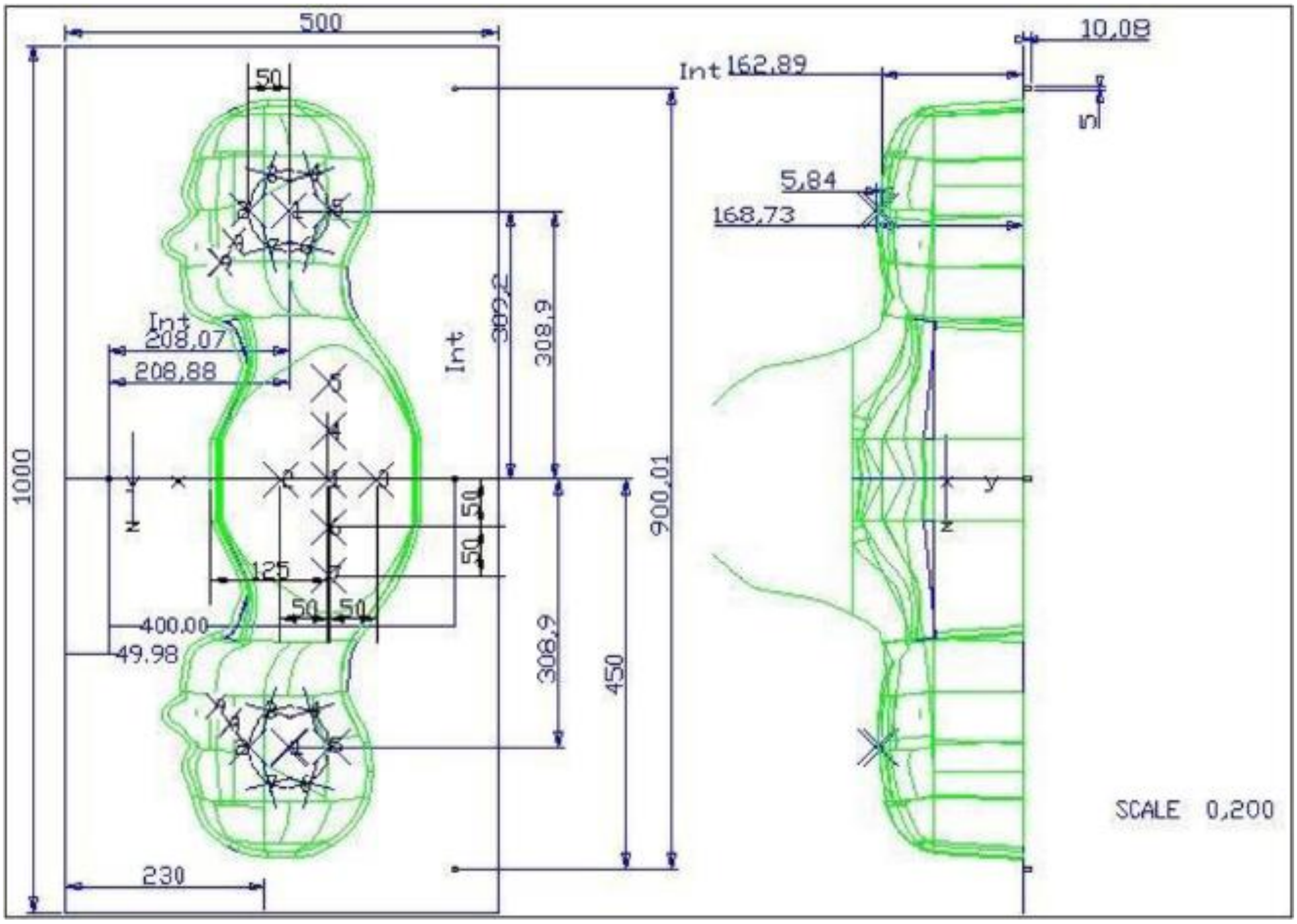
2.4. SAM phantoms

Photo of SAM phantom SN 16/15 SAM119

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

2.4.1. Technical Data

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

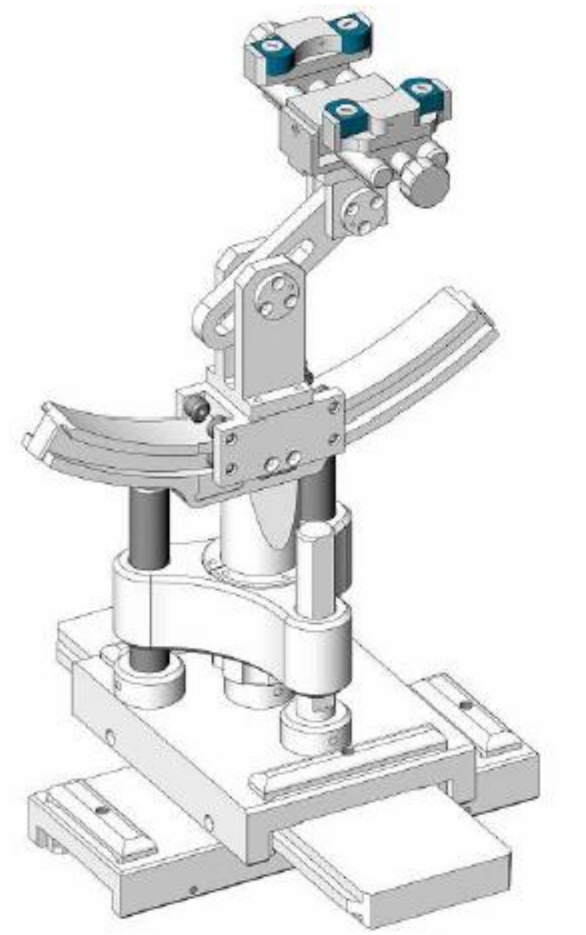


Serial Number	Left Head(mm)		Right Head(mm)		Flat Part(mm)	
SN 16/15 SAM119	2	2.02	2	2.08	1	2.09
	3	2.05	3	2.06	2	2.06
	4	2.07	4	2.07	3	2.08
	5	2.08	5	2.08	4	2.10
	6	2.05	6	2.07	5	2.10
	7	2.05	7	2.05	6	2.07
	8	2.07	8	2.06	7	2.07
	9	2.08	9	2.06	-	-

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

2.5. Device Holder

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



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

2.6. Test Equipment List

This table gives a complete overview of the SAR measurement equipment.
Devices used during the test described are marked ☒

	Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
					Last Cal.	Due Date
☒	MVG	E FIELD PROBE	SSE2	3423-EPGO-426	Sep. 18, 2023	Sep. 17, 2024
☒	MVG	750 MHz Dipole	SID750	SN 03/15 DIP 0G750-355	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	835 MHz Dipole	SID835	SN 03/15 DIP 0G835-347	Mar. 01, 2021	Feb. 28, 2024
☐	MVG	900 MHz Dipole	SID900	SN 03/15 DIP 0G900-348	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	1800 MHz Dipole	SID1800	SN 03/15 DIP 1G800-349	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	1900 MHz Dipole	SID1900	SN 03/15 DIP 1G900-350	Mar. 01, 2021	Feb. 28, 2024
☐	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	2450 MHz Dipole	SID2450	SN 03/15 DIP 2G450-352	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	2600 MHz Dipole	SID2600	SN 03/15 DIP 2G600-356	Mar. 01, 2021	Feb. 28, 2024
☐	MVG	5000 MHz Dipole	SWG5500	SN 13/14 WGA 33	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	Liquid measurement Kit	SCLMP	SN 21/15 OCPG 72	NCR	NCR
☒	MVG	Power Amplifier	N.A	AMPLISAR_28/14_003	NCR	NCR
☒	KEITHLEY	Millivoltmeter	2000	4072790	NCR	NCR
☒	R&S	Universal radio communication tester	CMU200	117858	May 29, 2023	May 28, 2024
☒	R&S	Wideband radio communication tester	CMW500	103917	May 29, 2023	May 28, 2024
☒	HP	Network Analyzer	8753D	3410J01136	May 29, 2023	May 28, 2024
☒	Agilent	MXG Vector	N5182A	MY47070317	May 29,	May 28,

		Signal Generator			2023	2024
☒	Agilent	Power meter	E4419B	MY45102538	May 29, 2023	May 28, 2024
☒	Agilent	Power sensor	E9301A	MY41495644	May 29, 2023	May 28, 2024
☒	Agilent	Power sensor	E9301A	US39212148	May 29, 2023	May 28, 2024
☒	MCLI/USA	Directional Coupler	CB11-20	0D2L51502	Jul. 04, 2023	Jul. 03, 2024
☒	N/A	Thermometer	N/A	LES-085	Mar. 27, 2023	Mar. 26, 2026
☒	MVG	SAM Phantom	SSM2	SN 16/15 SAM119	NCR	NCR
☒	MVG	Device Holder	SMPPD	SN 16/15 MSH100	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 750	Head 750	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 835	Head 835	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 1800	Head 1800	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 1900	Head 1900	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 2450	Head 2450	NCR	NCR
☒	Shenzhen Tianxu Communication	Human Simulating Liquid	Head 2600	Head 2600	NCR	NCR

	Technology Co., Ltd.					

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 Wi-Fi/BT power measurement, use engineering software to configure EUT Wi-Fi/BT 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 Wi-Fi/BT output power.

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT Wi-Fi/BT 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: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$	
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 using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1 mm step.
The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10 grams and 1 gram requires a very fine resolution in the three dimensional scanned data array.

3.4. Volumetric Scan

The volumetric scan consists to a full 3D scan over a specific area. This 3D scan is useful form multi Tx SAR measurement. Indeed, it is possible with OpenSAR to add, point by point, several volumetric scan to calculate the SAR value of the combined measurement as it is define in the standard IEEE1528 and IEC62209.

3.5. Power Drift

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

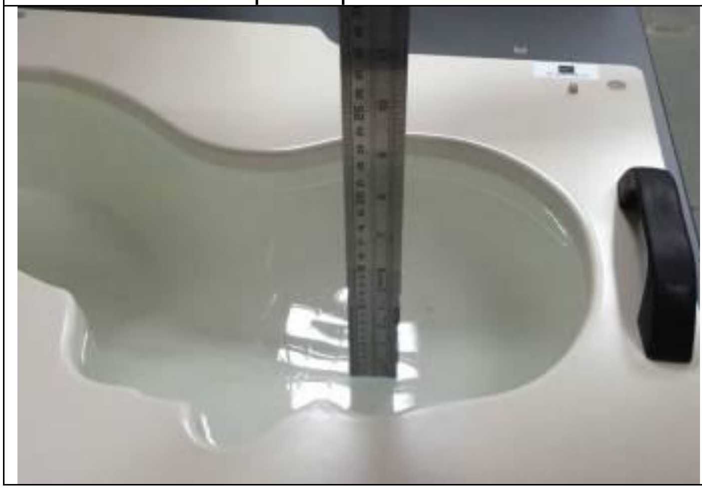
4. System Verification Procedure

4.1. Tissue Verification

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

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

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

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

4.1.1. Tissue Dielectric Parameter Check Results

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

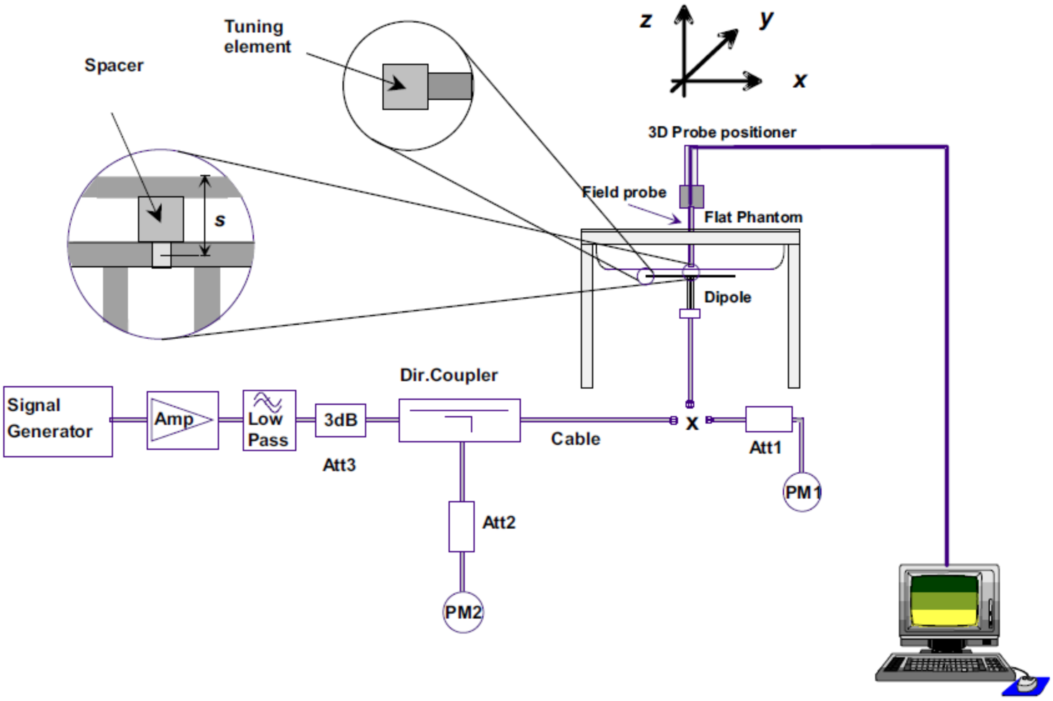
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (±5%)	σ (S/m) (±5%)	εr	σ (S/m)		
Head 750	750	41.96 (39.86~44.06)	0.89 (0.85~0.93）	42.33	0.93	21.7 °C	Oct. 26, 2023
Head 850	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	41.42	0.90	21.5 °C	Nov. 02, 2023
Head 1800	1800	40.00 (38.00~42.00)	1.40 (1.33~1.47)	40.06	1.43	21.7 °C	Oct. 31, 2023
Head 1900	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.02	1.44	21.2 °C	Oct. 24, 2023
Head 2450	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	38.73	1.80	21.5 °C	Oct. 28, 2023
Head 2600	2600	39.01 (37.06~40.96)	1.96 (1.86~2.06)	38.57	1.91	21.6 °C	Oct. 29, 2023

NOTE: The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.

4.2. System Verification Procedure

The system verification is performed for verifying the accuracy of the complete measurement system and performance of the software. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 100mW (below 5GHz) or 100mW (above 5GHz). To adjust this power a power meter is used. The power sensor is connected to the cable before the system verification to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the system verification to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).

The system verification is shown as below picture:



4.2.1. System Verification Results

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

System Verification	Target SAR (1W) (±10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)		
750MHz	8.53 (7.68~9.38)	5.56 (5.01~6.11)	9.10	5.49	21.7 °C	Oct. 26, 2023
835MHz	9.84 (8.86~10.82)	6.22 (5.60~6.84)	9.58	6.47	21.5 °C	Nov. 02, 2023
1800MHz	37.96 (34.17~41.75)	19.81 (17.83~21.79)	34.86	18.06	21.7 °C	Oct. 31, 2023
1900MHz	40.37 (36.34~44.40)	20.48 (18.44~22.52)	38.06	18.93	21.2 °C	Oct. 24, 2023
2450MHz	53.69 (48.33~59.05)	23.94 (21.55~26.33)	48.84	25.85	21.5 °C	Oct. 28, 2023
2600MHz	55.83 (50.25~61.41)	24.19 (21.78~26.60)	53.74	23.22	21.6 °C	Oct. 29, 2023

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. Wireless Router Devices

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WLAN simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined form general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WLAN transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WLAN transmitter according to FCC KDB Publication 447498 D01 publication procedures. The “Portable Hotspot” feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

7. RF Output Power

7.1. WCDMA Conducted Power

WCDMA Band 2	Burst-Averaged output Power (dBm)			
Tx Channel	Tune-up (dBm)	9262	9400	9538
Frequency (MHz)		1852.4	1880	1907.6
RMC12.2K	24.00	23.89	23.96	22.83
HSDPA Sub 1	25.00	25.00	24.64	23.41
HSDPA Sub 2	24.50	24.22	24.21	23.07
HSDPA Sub 3	23.50	23.43	23.17	22.15
HSDPA Sub 4	23.00	22.98	22.47	21.21
HSUPA Sub 1	23.50	22.83	23.42	22.59
HSUPA Sub 2	24.00	23.70	23.70	22.83
HSUPA Sub 3	22.50	22.33	22.45	21.82
HSUPA Sub 4	24.00	23.74	23.80	22.85
HSUPA Sub 5	23.50	22.77	23.11	22.03
WCDMA Band 4	Burst-Averaged output Power (dBm)			
Tx Channel	Tune-up (dBm)	1312	1413	1513
Frequency (MHz)		1712.4	1732.6	1752.6
RMC12.2K	25.00	24.98	24.97	24.93
HSDPA Sub 1	24.00	23.67	23.84	23.57
HSDPA Sub 2	23.50	22.84	23.48	23.11
HSDPA Sub 3	23.00	22.03	22.53	22.03
HSDPA Sub 4	22.50	21.55	22.20	21.74
HSUPA Sub 1	23.00	21.49	22.79	22.46
HSUPA Sub 2	23.50	22.03	23.16	22.74
HSUPA Sub 3	22.00	20.87	22.00	21.70
HSUPA Sub 4	23.50	22.07	23.22	22.90
HSUPA Sub 5	22.50	21.20	22.49	22.02
WCDMA Band 5	Burst-Averaged output Power (dBm)			
Tx Channel	Tune-up (dBm)	4132	4182	4233
Frequency (MHz)		826.4	836.4	846.6
RMC12.2K	23.00	22.85	22.65	22.56
HSDPA Sub 1	23.50	23.35	22.92	22.71
HSDPA Sub 2	23.00	22.83	22.58	22.48
HSDPA Sub 3	22.00	21.81	21.28	21.44

HSDPA Sub 4	21.50	21.05	21.11	21.06
HSUPA Sub 1	22.00	21.90	21.74	21.93
HSUPA Sub 2	22.50	22.37	22.03	22.09
HSUPA Sub 3	21.50	21.03	20.77	20.83
HSUPA Sub 4	22.50	22.35	22.14	22.21
HSUPA Sub 5	22.00	21.58	21.27	21.52

7.2. LTE Conducted Power

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18607/1850.7	18900/1880	19193/1909.3
LTE Band 2	1.4MHz	QPSK	1	0	22.50	21.99	22.49	21.38
			1	2	22.50	21.66	22.21	20.77
			1	5	22.50	21.78	22.20	20.77
			3	0	22.50	21.58	22.28	21.14
			3	1	22.50	21.56	22.18	20.87
			3	2	22.50	21.60	22.18	20.79
			6	0	22.00	21.09	21.65	20.48
		16QAM	1	0	22.00	21.34	21.98	20.97
			1	2	22.00	21.24	21.86	20.48
			1	5	22.00	21.46	21.85	20.54
			3	0	22.00	21.10	21.81	20.72
			3	1	22.00	21.12	21.76	20.49
			3	2	22.00	21.13	21.70	20.45
			6	0	21.50	20.57	21.22	20.18
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18615/1851.5	18900/1880	19185/1908.5
LTE Band 2	3MHz	QPSK	1	0	22.50	21.30	22.17	21.92
			1	7	22.50	20.89	21.51	20.62
			1	14	22.50	21.68	21.73	20.54
			8	0	21.50	20.64	21.26	20.75
			8	4	21.50	20.75	21.16	20.38
			8	7	21.50	20.89	21.10	20.39
			15	0	21.50	20.71	21.11	20.65
		16QAM	1	0	22.00	21.02	21.95	21.78
			1	7	22.00	20.78	21.14	20.56

			1	14	22.00	21.54	21.62	20.45
			8	0	21.00	20.22	20.90	20.53
			8	4	21.00	20.36	20.81	20.16
			8	7	21.00	20.50	20.78	19.89
			15	0	21.00	20.28	20.78	20.20

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18625/1852.5	18900/1880	19175/1907.5
LTE Band 2	5MHz	QPSK	1	0	23.00	21.25	21.86	22.71
			1	12	23.00	21.24	21.42	21.11
			1	24	23.00	21.76	21.57	21.35
			12	0	21.50	20.69	21.20	21.49
			12	6	21.50	20.82	21.02	20.80
			12	11	21.50	21.06	20.96	20.32
			25	0	21.50	20.89	21.09	20.95
		16QAM	1	0	22.50	20.81	21.43	22.28
			1	12	22.50	21.01	21.12	20.95
			1	24	22.50	21.51	21.23	20.52
			12	0	21.50	20.25	20.86	21.16
			12	6	21.50	20.41	20.70	20.48
			12	11	21.50	20.62	20.67	20.02
			25	0	21.00	20.46	20.78	20.64

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18650/1855	18900/1880	19150/1905
LTE Band 2	10MHz	QPSK	1	0	23.00	21.92	22.53	22.08
			1	24	23.00	21.38	21.61	21.44
			1	49	23.00	22.15	22.41	21.22
			25	0	21.50	21.01	21.24	20.92
			25	12	21.50	21.15	21.21	21.02
			25	24	21.50	21.15	21.19	20.28
			50	0	21.50	21.24	21.35	20.89
		16QAM	1	0	22.50	21.44	22.18	21.63
			1	24	22.50	20.94	21.26	21.12
			1	49	22.50	21.89	22.06	20.97
			25	0	21.00	20.46	20.76	20.46
			25	12	21.00	20.63	20.83	20.67
			25	24	21.00	20.89	20.82	19.95

			50	0	21.00	20.96	20.98	20.55

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18675/1857.5	18900/1880	19125/1902.5
LTE Band 2	15MHz	QPSK	1	0	22.50	21.71	22.25	21.57
			1	37	22.50	21.26	21.37	20.97
			1	74	22.50	21.66	21.93	20.98
			36	0	21.50	21.08	21.08	20.71
			36	18	21.50	20.96	20.99	20.64
			36	37	21.50	20.84	21.03	20.62
			75	0	21.50	21.05	21.20	20.46
		16QAM	1	0	22.00	21.43	21.88	21.15
			1	37	22.00	20.97	20.99	20.78
			1	74	22.00	21.65	21.85	20.01
			36	0	21.00	20.63	20.64	20.27
			36	18	21.00	20.51	20.65	20.21
			36	37	21.00	20.43	20.69	20.31
			75	0	21.00	20.62	20.86	20.05

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18700/1860	18900/1880	19100/1900
LTE Band 2	20MHz	QPSK	1	0	22.00	21.66	21.64	21.84
			1	49	22.00	21.13	21.44	21.17
			1	99	22.00	21.80	21.80	20.48
			50	0	21.50	21.12	21.00	20.60
			50	24	21.50	20.58	20.91	20.61
			50	49	21.50	20.63	20.95	21.12
			100	0	21.50	20.71	21.46	20.62
		16QAM	1	0	22.00	21.41	21.44	21.59
			1	49	22.00	20.96	21.62	20.93
			1	99	22.00	21.51	21.79	20.30
			50	0	21.00	20.70	20.81	20.27
			50	24	21.00	20.17	20.78	20.19
			50	49	21.00	20.22	20.83	20.69
			100	0	21.50	20.30	21.01	20.22

Band	Band Width	Modulation	RB Configuration	Tune-up (dBm)	Channel/Frequency(MHz)

			RB Size	RB Offset		19957/1710.7	20175/1732.5	20393/1754.3
LTE Band 4	1.4MHz	QPSK	1	0	22.50	22.08	22.42	22.11
			1	2	22.50	21.79	22.33	21.84
			1	5	22.50	21.86	22.48	21.93
			3	0	22.50	21.84	22.41	21.94
			3	1	22.50	21.76	22.39	21.86
			3	2	22.50	21.77	22.45	21.88
			6	0	22.00	21.21	21.91	21.39
		16QAM	1	0	22.50	21.52	22.21	21.68
			1	2	22.50	21.36	22.06	21.55
			1	5	22.50	21.46	22.25	21.59
			3	0	22.50	21.31	22.04	21.55
			3	1	22.50	21.27	22.03	21.45
			3	2	22.50	21.29	22.03	21.52
			6	0	22.00	20.59	21.53	20.95

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		19965/1711.5	20175/1732.5	20385/1753.5
LTE Band 4	3MHz	QPSK	1	0	23.00	22.20	22.42	22.54
			1	7	23.00	21.27	21.87	21.45
			1	14	23.00	22.05	22.53	22.18
			8	0	22.00	21.27	21.66	21.30
			8	4	22.00	21.16	21.66	21.21
			8	7	22.00	21.17	21.74	21.22
			15	0	22.00	21.09	21.64	21.19
		16QAM	1	0	22.50	21.68	22.19	21.90
			1	7	22.50	20.82	21.63	21.16
			1	14	22.50	21.59	22.24	21.80
			8	0	21.50	20.47	21.25	20.81
			8	4	21.50	20.43	21.27	20.79
			8	7	21.50	20.46	21.33	20.77
			15	0	21.50	20.39	21.20	20.73

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		19975/1712.5	20175/1732.5	20375/1752.5
LTE Band	5MHz	QPSK	1	0	22.50	21.70	22.16	22.25
			1	12	22.50	21.25	21.93	21.59

4			1	24	22.50	21.69	22.27	21.80
			12	0	22.00	20.91	21.57	21.38
			12	6	22.00	20.83	21.55	21.20
			12	11	22.00	20.98	21.68	21.21
			25	0	22.00	20.95	21.64	21.30
		16QAM	1	0	22.50	21.29	21.93	21.91
			1	12	22.50	20.98	21.69	21.28
			1	24	22.50	21.48	22.04	21.63
			12	0	21.50	20.27	21.15	20.89
			12	6	21.50	20.21	21.13	20.74
			12	11	21.50	20.38	21.29	20.77
			25	0	21.50	20.33	21.22	20.85
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20000/1715	20175/1732.5	20350/1750
LTE Band 4	10MHz	QPSK	1	0	23.00	22.27	22.72	22.78
			1	24	23.00	21.09	21.67	21.56
			1	49	23.00	22.34	22.91	22.53
			25	0	22.00	20.90	21.46	21.35
			25	12	22.00	20.91	21.48	21.38
			25	24	22.00	20.81	21.61	21.31
			50	0	22.00	21.15	21.61	21.54
		16QAM	1	0	23.00	21.72	22.49	22.49
			1	24	23.00	21.65	21.45	21.37
			1	49	23.00	22.19	22.58	22.22
			25	0	21.50	20.26	21.03	20.89
			25	12	21.50	20.28	21.05	20.91
			25	24	21.50	20.42	21.18	20.84
			50	0	21.50	20.54	21.18	21.08
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20025/1717.5	20175/1732.5	20325/1747.5
LTE Band 4	15MHz	QPSK	1	0	23.00	22.06	22.57	22.62
			1	37	23.00	21.17	21.71	21.63
			1	74	23.00	22.21	22.73	22.48
			36	0	22.00	21.07	21.61	21.45
			36	18	22.00	20.77	21.46	21.32
			36	37	22.00	21.07	21.83	21.50

			75	0	22.00	21.16	21.57	21.51
		16QAM	1	0	22.50	21.69	22.32	22.20
			1	37	22.50	20.78	21.49	21.47
			1	74	22.50	21.99	22.49	22.17
			36	0	21.50	20.44	21.20	21.00
			36	18	21.50	20.38	21.03	20.89
			36	37	21.50	20.62	21.44	21.05
			75	0	21.50	20.76	20.76	21.09

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20050/1720	20175/1732.5	20300/1745
LTE Band 4	20MHz	QPSK	1	0	23.00	21.93	22.48	22.52
			1	49	23.00	21.65	21.99	22.10
			1	99	23.00	22.51	22.88	22.61
			50	0	22.00	21.30	21.51	21.47
			50	24	22.00	20.97	21.44	21.55
			50	49	22.00	21.28	21.82	21.69
			100	0	22.00	21.45	21.52	21.76
		16QAM	1	0	23.00	21.58	22.26	22.14
			1	49	23.00	21.32	21.73	21.82
			1	99	23.00	22.36	22.74	22.33
			50	0	21.50	20.66	21.07	21.03
			50	24	21.50	20.52	21.00	21.11
			50	49	21.50	20.83	21.40	21.24
			100	0	21.50	20.99	21.09	21.33

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20407/824.7	20525/836.5	20643/848.3
LTE Band 5	1.4MHz	QPSK	1	0	22.50	22.07	22.30	21.88
			1	2	22.50	21.95	22.15	21.71
			1	5	22.50	22.07	22.22	21.79
			3	0	22.50	21.96	22.21	21.82
			3	1	22.50	21.94	22.17	21.74
			3	2	22.50	21.98	22.20	21.77
			6	0	22.00	21.43	21.68	21.39
		16QAM	1	0	22.00	21.76	21.90	21.79
			1	2	22.00	21.63	21.93	21.54

Band	Band Width	Modulation	RB Size	RB Offset	Tune-up (dBm)	Channel/Frequency(MHz)		
			1	5	22.00	21.96	21.95	21.69
			3	0	22.00	21.73	21.84	21.51
			3	1	22.00	21.69	21.71	21.43
			3	2	22.00	21.69	21.80	21.45
			6	0	21.50	21.22	21.29	20.98

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20415/825.5	20525/836.5	20635/847.5
LTE Band 5	3MHz	QPSK	1	0	22.50	21.92	22.04	21.94
			1	7	22.50	21.54	21.55	21.32
			1	14	22.50	22.10	22.06	21.67
			8	0	21.50	21.31	21.35	21.20
			8	4	21.50	21.34	21.34	21.11
			8	7	21.50	21.43	21.39	21.11
			15	0	21.50	21.31	21.31	21.10
		16QAM	1	0	22.00	21.77	21.93	21.79
			1	7	22.00	21.34	21.34	21.13
			1	14	22.00	21.93	21.95	21.63
			8	0	21.50	20.92	20.96	20.83
			8	4	21.50	20.97	20.93	20.74
			8	7	21.50	21.05	21.02	20.73
			15	0	21.00	20.90	20.89	20.70

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20425/826.5	20525/836.5	20625/846.5
LTE Band 5	5MHz	QPSK	1	0	22.50	22.14	22.27	22.08
			1	12	22.50	21.92	21.64	21.40
			1	24	22.50	22.35	22.08	21.58
			12	0	22.00	21.45	21.32	21.28
			12	6	22.00	21.44	21.26	21.04
			12	11	22.00	21.60	21.39	21.04
			25	0	22.00	21.50	21.35	21.16
		16QAM	1	0	22.50	21.71	21.92	21.73
			1	12	22.50	21.60	21.39	21.17
			1	24	22.50	22.08	21.83	21.38
			12	0	21.50	20.93	20.83	20.84
			12	6	21.50	20.95	20.77	20.61
			12	11	21.50	21.12	20.90	20.61

			RB Size	RB Offset	Tune-up (dBm)	20450/829	20525/836.5	20600/844
			25	0	21.50	21.02	20.87	20.74

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20450/829	20525/836.5	20600/844
LTE Band 5	10MHz	QPSK	1	0	23.00	22.27	22.61	22.76
			1	24	23.00	21.59	21.51	21.63
			1	49	23.00	22.52	22.66	22.15
			25	0	22.00	21.31	21.67	21.57
			25	12	22.00	21.37	21.34	21.48
			25	24	22.00	21.54	21.57	21.34
			50	0	22.00	21.48	21.56	21.64
		16QAM	1	0	23.00	21.94	22.44	22.64
			1	24	23.00	21.35	21.32	21.43
			1	49	23.00	22.34	22.62	21.88
			25	0	21.50	21.08	21.24	21.14
			25	12	21.50	21.13	20.92	21.04
			25	24	21.50	21.31	21.16	20.92
			50	0	21.50	21.27	21.14	21.21

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20775/2502.5	21100/2535	21425/2567.5
LTE Band 7	5MHz	QPSK	1	0	22.00	21.92	21.79	21.43
			1	12	22.00	21.61	21.37	20.96
			1	24	22.00	21.94	21.71	21.30
			12	0	21.50	21.29	21.11	20.69
			12	6	21.50	21.22	21.02	20.58
			12	11	21.50	21.33	21.12	20.68
			25	0	21.50	21.28	21.11	20.69
		16QAM	1	0	22.00	21.42	21.50	21.12
			1	12	22.00	21.19	21.16	20.79
			1	24	22.00	21.51	21.53	21.07
			12	0	21.00	20.75	20.63	20.27
			12	6	21.00	20.69	20.54	20.16
			12	11	21.00	20.82	20.64	20.26
			25	0	21.00	20.78	20.64	20.27
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		

			RB Size	RB Offset		20800/2505	21100/2535	21400/2565
LTE Band 7	10MHz	QPSK	1	0	22.50	22.14	22.32	22.10
			1	24	22.50	21.20	21.08	20.75
			1	49	22.50	22.13	22.34	21.80
			25	0	21.50	21.15	21.04	20.60
			25	12	21.50	21.09	20.92	20.58
			25	24	21.50	21.02	21.10	20.64
			50	0	21.50	21.25	21.13	20.80
		16QAM	1	0	22.50	21.75	21.98	21.72
			1	24	22.50	21.02	20.92	21.47
			1	49	22.50	21.92	22.06	21.53
			25	0	21.00	20.66	20.57	20.17
			25	12	21.00	20.62	20.45	20.15
			25	24	21.00	20.55	20.66	20.23
			50	0	21.00	20.78	20.68	20.40
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20825/2507.5	21100/2535	21375/2562.5
LTE Band 7	15MHz	QPSK	1	0	22.50	22.10	22.35	22.49
			1	37	22.50	21.11	21.13	20.69
			1	74	22.50	22.13	22.31	21.72
			36	0	21.50	21.22	21.15	21.11
			36	18	21.50	20.90	20.94	20.53
			36	37	21.50	21.16	21.22	20.72
			75	0	21.50	21.13	21.23	20.86
		16QAM	1	0	22.50	21.70	22.07	22.08
			1	37	22.50	20.80	20.98	20.53
			1	74	22.50	21.89	22.03	21.45
			36	0	21.00	20.74	20.70	20.68
			36	18	21.00	20.44	20.47	20.13
			36	37	21.00	20.68	20.75	20.30
			75	0	21.00	20.65	20.77	20.45
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20850/2510	21100/2535	21350/2560
LTE Band	20MHz	QPSK	1	0	23.00	22.14	22.51	22.47
			1	49	23.00	21.54	21.58	21.39

7			1	99	23.00	22.23	22.91	21.92
			50	0	22.00	21.61	21.42	21.41
			50	24	22.00	21.26	21.14	20.97
			50	49	22.00	21.54	21.45	20.96
			100	0	21.50	21.49	21.48	21.26
		16QAM	1	0	22.50	21.85	22.16	22.24
			1	49	22.50	21.42	21.32	21.11
			1	99	22.50	22.07	22.37	21.63
			50	0	21.50	21.02	20.90	20.90
			50	24	21.50	20.70	20.63	20.54
			50	49	21.50	20.97	20.94	20.53
			100	0	21.00	20.93	20.98	20.81

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		39675/2498.5	40620/2593	41565/2687.5
LTE Band 41	5MHz	QPSK	1	0	23.00	22.42	22.48	21.65
			1	12	23.00	22.07	22.18	21.96
			1	24	23/23/22	22.34	22.53	21.02
			12	0	22/22/21	21.73	21.85	20.87
			12	6	22/22/21	21.61	21.76	20.60
			12	11	23/22/21	22.04	21.88	20.52
			25	0	23/22/21	22.03	21.85	20.69
		16QAM	1	0	23/23/22	22.28	22.22	21.44
			1	12	22/22/21	21.99	21.63	20.75
			1	24	23/23/21	22.26	22.32	20.77
			12	0	22/22/21	21.60	21.41	20.43
			12	6	22/22/21	21.61	21.13	20.16
			12	11	22/22/21	21.70	21.42	20.08
			25	0	22/22/21	21.56	21.26	20.05

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		39700/2501	40620/2593	41540/2685
LTE Band 41	10MHz	QPSK	1	0	23.00	22.91	22.68	22.44
			1	24	22.00	21.73	21.71	21.91
			1	49	23/23/22	22.74	22.51	21.26
			25	0	22.00	21.74	21.64	21.10
			25	12	22.00	21.58	21.56	20.70

			25	24	22.00	21.63	21.63	20.51
			50	0	22.00	21.74	21.69	20.87
		16QAM	1	0	23.00	22.72	22.60	22.12
			1	24	22.00	21.48	21.68	21.52
			1	49	23/23/22	22.60	22.38	21.36
			25	0	21.50	21.29	20.98	20.47
			25	12	21.50	21.11	20.90	20.10
			25	24	22/21/20	21.17	20.97	19.90
			50	0	21.50	21.31	21.06	20.27

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		39725/2503.5	40620/2593	41515/2682.5
LTE Band 41	15MHz	QPSK	1	0	23.00	22.67	22.50	22.61
			1	37	22.00	21.55	21.73	21.11
			1	74	23/23/22	22.65	22.50	21.02
			36	0	22.00	21.65	21.59	21.42
			36	18	22.00	21.37	21.44	20.85
			36	37	22.00	21.43	21.54	20.56
			75	0	22.00	21.59	21.60	21.05
		16QAM	1	0	23.00	22.77	22.42	22.66
			1	37	22/23/23	21.23	22.91	22.62
			1	74	23.00	22.46	22.34	22.67
			36	0	22.00	21.27	21.15	20.86
			36	18	22/21/21	21.00	20.99	20.30
			36	37	22/22/21	21.06	21.96	20.03
			75	0	21.50	21.20	21.12	20.49

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		39750/2506	40620/2593	41490/2680
LTE Band 41	20MHz	QPSK	1	0	23.00	22.51	22.47	22.31
			1	49	22.00	21.77	21.89	21.56
			1	99	23/23/22	22.62	22.31	21.03
			50	0	22.00	21.59	21.61	21.76
			50	24	22.00	21.25	21.39	21.08
			50	49	22.00	21.54	21.59	20.71
			100	0	22.00	21.52	21.65	21.33
		16QAM	1	0	22.50	21.97	22.02	22.11
			1	49	22.50	21.25	21.79	21.44

			1	99	23/23/21	22.41	22.23	20.99
			50	0	21.50	21.20	21.00	21.14
			50	24	21.00	20.86	20.79	20.47
			50	49	21.50	21.02	21.00	20.12
			100	0	21.50	21.12	21.10	20.77

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)	
			RB Size	RB Offset		40115/2542.5	41165/2647.5
LTE Band 41	5MHz	QPSK	1	0	23.00	22.12	22.22
			1	12	23.00	22.09	22.01
			1	24	23.00	22.11	22.20
			12	0	22.00	21.20	21.21
			12	6	22.00	21.12	21.10
			12	11	22.00	21.24	21.25
			25	0	22.00	21.19	21.13
		16QAM	1	0	22.50	22.14	21.19
			1	12	23.00	22.20	22.27
			1	24	22.50	22.13	21.28
			12	0	21.00	20.46	20.38
			12	6	21.00	21.00	20.51
			12	11	21.00	21.00	20.44
			25	0	21.00	20.88	20.84
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)	
			RB Size	RB Offset		40140/2545	41140/2645
LTE Band 41	20MHz	QPSK	1	0	23.00	22.30	22.23
			1	49	22.00	21.27	21.29
			1	99	23.00	22.32	22.07
			50	0	22.00	21.19	21.16
			50	24	22.00	21.15	21.03
			50	49	22.00	21.22	21.20
			100	0	22.00	21.31	21.34
		16QAM	1	0	22.00	21.87	21.70
			1	49	22.00	21.20	21.24
			1	99	23.00	22.01	22.10
			50	0	21.00	20.80	20.71
			50	24	21.00	20.69	20.61

			50	49	21.00	20.50	20.45
			100	0	21.00	21.00	20.93

7.3. WLAN & Bluetooth Output Power

ANT1

Mode	Channel	Frequency (MHz)	Tune-up (dBm)	Output Power (dBm)
802.11b	1	2412	17.00	16.60
	6	2437	17.00	16.80
	11	2462	17.00	16.34
802.11g	1	2412	14.50	14.34
	6	2437	14.50	14.47
	11	2462	14.50	14.09
802.11n HT20	1	2412	12.50	12.24
	6	2437	12.50	12.48
	11	2462	12.50	12.06
802.11n HT40	3	2422	11.50	11.37
	6	2437	11.50	11.35
	9	2452	11.50	11.13

ANT2

Mode	Channel	Frequency (MHz)	Tune-up (dBm)	Output Power (dBm)
802.11b	1	2412	18.00	17.26
	6	2437	18.00	17.77
	11	2462	18.00	17.41
802.11g	1	2412	14.50	13.53
	6	2437	14.50	14.09
	11	2462	14.50	13.78
802.11n HT20	1	2412	13.00	12.26
	6	2437	13.00	12.47
	11	2462	13.00	12.57
802.11n HT40	3	2422	12.00	11.22
	6	2437	12.00	11.67
	9	2452	12.00	11.82

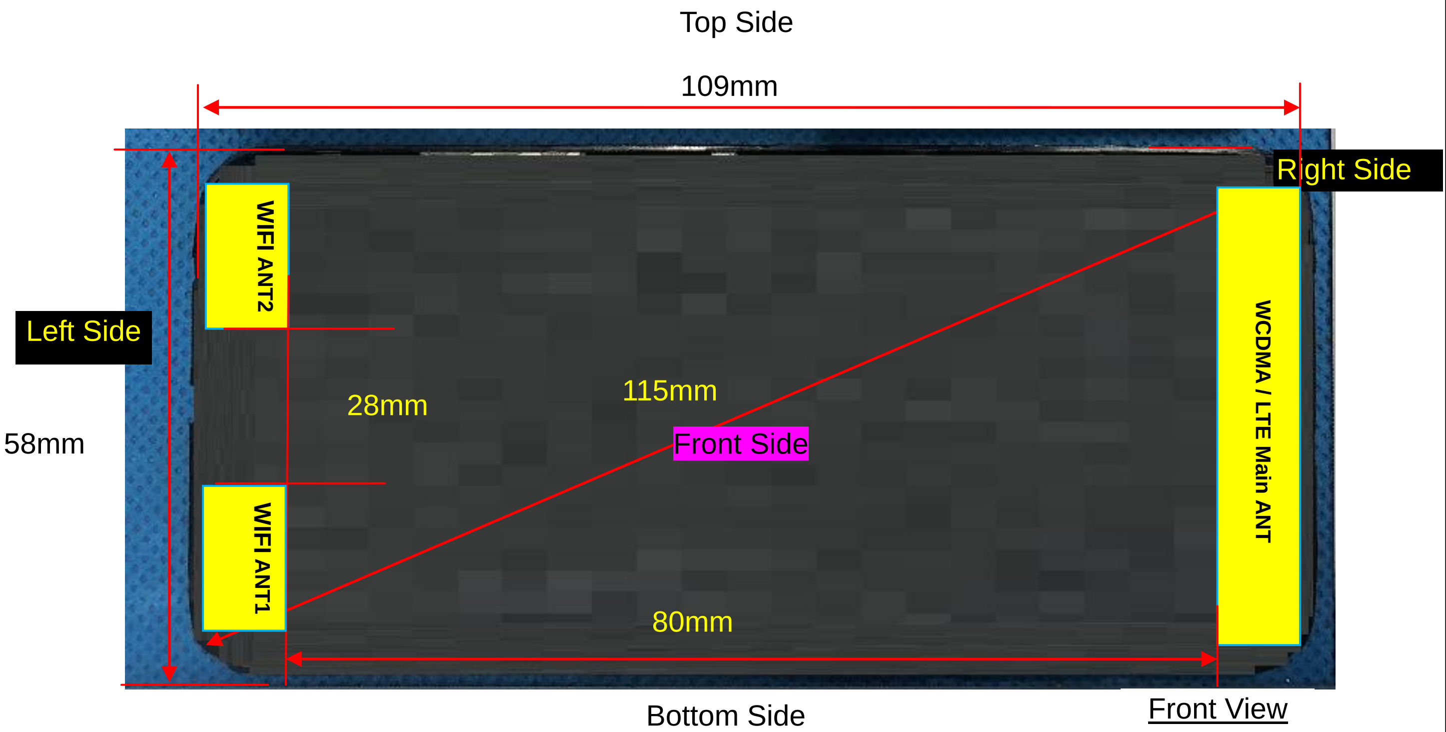
MIMO

Mode	Channel	Frequency (MHz)	Tune-up (dBm)	Output Power (dBm)
802.11n HT20	1	2412	16.00	14.79
	6	2437	16.00	15.20
	11	2462	16.00	14.76

802.11n HT40	3	2422	14.00	12.99
	6	2437	14.00	13.10
	9	2452	14.00	13.00

NOTE: Power measurement results of WLAN 2.4G.

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 ANT	≤ 25mm	≤ 25mm	> 25mm	≤ 25mm	≤ 25mm	≤ 25mm
WLAN 1	≤ 25mm	≤ 25mm	≤ 25mm	> 25mm	> 25mm	≤ 25mm
WLAN 2	≤ 25mm	≤ 25mm	≤ 25mm	> 25mm	≤ 25mm	> 25mm
Positions for SAR tests						
Antennas	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
WWAN Main ANT	Yes	Yes	NO	Yes	Yes	Yes
WLAN 1	Yes	Yes	Yes	NO	NO	Yes
WLAN 2	Yes	Yes	Yes	NO	Yes	NO

9. SAR Results

9.1. SAR measurement Result

9.1.1. SAR measurement Result of WCDMA Band 2

Test Position of Hotspot with 10mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	9400/1880	RMC12.2K	0.759	0.458	-3.91	23.96	24.00	0.766	2023/10/24	1#
Back Side	9400/1880	RMC12.2K	0.712	0.420	0.12	23.96	24.00	0.719	2023/10/24	
Right Side	9400/1880	RMC12.2K	0.420	0.223	0.41	23.96	24.00	0.424	2023/10/24	
Top Side	9400/1880	RMC12.2K	0.231	0.165	2.01	23.96	24.00	0.233	2023/10/24	
Bottom Side	9400/1880	RMC12.2K	0.205	0.142	0.65	23.96	24.00	0.207	2023/10/24	

NOTE: Hotspot SAR test results of WCDMA Band 2

9.1.2. SAR measurement Result of WCDMA Band 4

Test Position of Hotspot with 10mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	1413/1732.6	RMC12.2K	0.906	0.512	0.46	24.97	25.00	0.912	2023/10/31	
Back Side	1413/1732.6	RMC12.2K	0.856	0.421	0.23	24.97	25.00	0.862	2023/10/31	
Right Side	1413/1732.6	RMC12.2K	0.465	0.236	2.14	24.97	25.00	0.468	2023/10/31	
Top Side	1413/1732.6	RMC12.2K	0.420	0.210	1.45	24.97	25.00	0.423	2023/10/31	
Bottom Side	1413/1732.6	RMC12.2K	0.310	0.192	1.28	24.97	25.00	0.312	2023/10/31	
Front Side	1312/1712.4	RMC12.2K	1.124	0.710	0.17	24.98	25.00	1.129	2023/10/31	2#
Front Side	1513/1752.6	RMC12.2K	0.986	0.566	-0.29	24.93	25.00	1.002	2023/10/31	
FrontSide Repeated	1312/1712.4	RMC12.2K	1.123	0.685	0.23	24.98	25.00	1.128	2023/10/31	

NOTE: Hotspot SAR test results of WCDMA Band 4

9.1.3. SAR measurement Result of WCDMA Band 5

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

10mm										
Front Side	4182/836.4	RMC12.2K	0.722	0.399	-2.08	22.65	23.00	0.783	2023/11/02	3#
Back Side	4182/836.4	RMC12.2K	0.704	0.365	1.12	22.65	23.00	0.763	2023/11/02	
Right Side	4182/836.4	RMC12.2K	0.410	0.230	0.14	22.65	23.00	0.444	2023/11/02	
Top Side	4182/836.4	RMC12.2K	0.212	0.148	4.01	22.65	23.00	0.230	2023/11/02	
Bottom Side	4182/836.4	RMC12.2K	0.194	0.120	2.04	22.65	23.00	0.210	2023/11/02	

NOTE: Hotspot SAR test results of WCDMA Band 5

9.1.4. SAR measurement Result of LTE Band 2

Test Position of Hotspot with 10mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
1RB										
Front Side	18900/1880	20M QPSK(1,0)	0.475	0.290	-1.79	21.64	22.00	0.516	2023/10/24	
Back Side	18900/1880	20M QPSK(1,0)	0.476	0.284	-2.57	21.64	22.00	0.517	2023/10/24	6#
Right Side	18900/1880	20M QPSK(1,0)	0.212	0.150	0.26	21.64	22.00	0.230	2023/10/24	
Top Side	18900/1880	20M QPSK(1,0)	0.174	0.135	1.12	21.64	22.00	0.189	2023/10/24	
Bottom Side	18900/1880	20M QPSK(1,0)	0.150	0.102	0.36	21.64	22.00	0.163	2023/10/24	
50%RB										
Front Side	18900/1880	20M QPSK(50,0)	0.253	0.152	-1.12	21.00	21.50	0.284	2023/10/24	
Back Side	18900/1880	20M QPSK(50,0)	0.246	0.167	4.57	21.00	21.50	0.276	2023/10/24	
Right Side	18900/1880	20M QPSK(50,0)	0.114	0.076	4.78	21.00	21.50	0.128	2023/10/24	
Top Side	18900/1880	20M QPSK(50,0)	0.089	0.078	2.57	21.00	21.50	0.100	2023/10/24	
Bottom	18900/1880	20M QPSK(50,0)	0.080	0.061	-4.04	21.00	21.50	0.090	2023/10/24	

Side										

NOTE: Hotspot SAR test results of LTE Band 2

9.1.5. SAR measurement Result of LTE Band 4

Test Position of Hotspot with 10mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
1RB										
Front Side	20175/1732.5	20M QPSK(1,99)	0.342	0.209	0.94	22.88	23.00	0.352	2023/10/31	
Back Side	20175/1732.5	20M QPSK(1,99)	0.561	0.349	-0.95	22.88	23.00	0.577	2023/10/31	7#
Right Side	20175/1732.5	20M QPSK(1,99)	0.180	0.107	2.45	22.88	23.00	0.185	2023/10/31	
Top Side	20175/1732.5	20M QPSK(1,99)	0.170	0.101	1.24	22.88	23.00	0.175	2023/10/31	
Bottom Side	20175/1732.5	20M QPSK(1,99)	0.112	0.087	2.16	22.88	23.00	0.115	2023/10/31	
50%RB										
Front Side	20175/1732.5	20M QPSK(50,49)	0.184	0.116	2.63	21.82	22.00	0.192	2023/10/31	
Back Side	20175/1732.5	20M QPSK(50,49)	0.307	0.187	3.52	21.82	22.00	0.320	2023/10/31	
Right Side	20175/1732.5	20M QPSK(50,49)	0.099	0.054	0.93	21.82	22.00	0.103	2023/10/31	
Top Side	20175/1732.5	20M QPSK(50,49)	0.097	0.051	1.00	21.82	22.00	0.101	2023/10/31	
Bottom Side	20175/1732.5	20M QPSK(50,49)	0.067	0.048	4.51	21.82	22.00	0.070	2023/10/31	

NOTE: Hotspot SAR test results of LTE Band 4

9.1.6. SAR measurement Result of LTE Band 5

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

10mm										
1RB										
Front Side	20525/836.5	10M QPSK(1,0)	0.657	0.460	-1.13	22.61	23.00	0.719	2023/11/02	8#
Back Side	20525/836.5	10M QPSK(1,0)	0.620	0.421	0.20	22.61	23.00	0.678	2023/11/02	
Right Side	20525/836.5	10M QPSK(1,0)	0.312	0.215	1.00	22.61	23.00	0.341	2023/11/02	
Top Side	20525/836.5	10M QPSK(1,0)	0.320	0.223	2.04	22.61	23.00	0.350	2023/11/02	
Bottom Side	20525/836.5	10M QPSK(1,0)	0.245	0.184	3.02	22.61	23.00	0.268	2023/11/02	
50%RB										
Front Side	20525/836.5	10M QPSK(25,0)	0.390	0.272	2.76	21.67	22.00	0.421	2023/11/02	
Back Side	20525/836.5	10M QPSK(25,0)	0.370	0.238	-2.97	21.67	22.00	0.399	2023/11/02	
Right Side	20525/836.5	10M QPSK(25,0)	0.179	0.121	-3.03	21.67	22.00	0.193	2023/11/02	
Top Side	20525/836.5	10M QPSK(25,0)	0.179	0.130	2.01	21.67	22.00	0.193	2023/11/02	
Bottom Side	20525/836.5	10M QPSK(25,0)	0.138	0.109	-4.95	21.67	22.00	0.149	2023/11/02	

NOTE: Hotspot SAR test results of LTE Band 5

9.1.7. SAR measurement Result of LTE Band 7

Test Position of Hotspot with 10mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
1RB										
Front Side	21100/2535	20M QPSK(1,99)	0.455	0.255	0.02	22.91	23.00	0.465	2023/10/29	
Back Side	21100/2535	20M QPSK(1,99)	0.778	0.426	1.25	22.91	23.00	0.794	2023/10/29	9#
Right Side	21100/2535	20M QPSK(1,99)	0.332	0.157	-1.85	22.91	23.00	0.339	2023/10/29	
Top Side	21100/2535	20M QPSK(1,99)	0.127	0.079	1.37	22.91	23.00	0.130	2023/10/29	
Bottom Side	21100/2535	20M QPSK(1,99)	0.178	0.102	1.43	22.91	23.00	0.182	2023/10/29	

50%RB										
Front Side	21100/2535	20M QPSK(50,0)	0.237	0.130	2.30	21.42	22.00	0.271	2023/10/29	
Back Side	21100/2535	20M QPSK(50,0)	0.457	0.225	-2.54	21.42	22.00	0.522	2023/10/29	
Right Side	21100/2535	20M QPSK(50,0)	0.166	0.085	-4.20	21.42	22.00	0.190	2023/10/29	
Top Side	21100/2535	20M QPSK(50,0)	0.073	0.043	-0.07	21.42	22.00	0.083	2023/10/29	
Bottom Side	21100/2535	20M QPSK(50,0)	0.093	0.059	-4.87	21.42	22.00	0.106	2023/10/29	

NOTE: Hotspot SAR test results of LTE Band 7

9.1.8. SAR measurement Result of LTE Band 41

Test Position of Hotspot with 10mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
1RB										
Front Side	40620/2593	20M QPSK(1,99)	0.281	0.134	-2.39	22.31	23.00	0.329	2023/10/29	
Back Side	40620/2593	20M QPSK(1,99)	0.293	0.160	0.16	22.31	23.00	0.343	2023/10/29	10#
Right Side	40620/2593	20M QPSK(1,99)	0.090	0.047	-2.81	22.31	23.00	0.105	2023/10/29	
Top Side	40620/2593	20M QPSK(1,99)	0.099	0.051	3.08	22.31	23.00	0.116	2023/10/29	
Bottom Side	40620/2593	20M QPSK(1,99)	0.065	0.031	-2.40	22.31	23.00	0.076	2023/10/29	
50%RB										
Front Side	40620/2593	20M QPSK(50,0)	0.159	0.076	-2.71	21.61	22.00	0.174	2023/10/29	
Back Side	40620/2593	20M QPSK(50,0)	0.151	0.090	0.34	21.61	22.00	0.165	2023/10/29	
Right Side	40620/2593	20M QPSK(50,0)	0.049	0.028	-3.06	21.61	22.00	0.054	2023/10/29	
Top Side	40620/2593	20M QPSK(50,0)	0.055	0.028	-0.14	21.61	22.00	0.060	2023/10/29	
Bottom	40620/2593	20M QPSK(50,0)	0.034	0.018	4.56	21.61	22.00	0.037	2023/10/29	

Side										

NOTE: Hotspot SAR test results of LTE Band 41

9.1.9. SAR measurement Result of WLAN 2.4G

ANT1

Test Position of Hotspot with 10mm	Test channel /Freq	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	6/2437	802.11b	0.191	0.179	-1.58	16.80	17.00	0.200	2023/10/28	4#
Back Side	6/2437	802.11b	0.174	0.160	0.12	16.80	17.00	0.182	2023/10/28	
Left Side	6/2437	802.11b	0.142	0.085	0.10	16.80	17.00	0.149	2023/10/28	
Top Side	6/2437	802.11b	0.112	0.065	3.01	16.80	17.00	0.117	2023/10/28	

ANT2

Test Position of Hotspot with 10mm	Test channel /Freq	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	6/2437	802.11b	0.169	0.159	-0.05	17.77	18.00	0.178	2023/10/28	5#
Back Side	6/2437	802.11b	0.152	0.130	3.10	17.77	18.00	0.160	2023/10/28	
Left Side	6/2437	802.11b	0.125	0.101	0.54	17.77	18.00	0.132	2023/10/28	
Top Side	6/2437	802.11b	0.095	0.074	2.10	17.77	18.00	0.100	2023/10/28	

NOTE: Hotspot SAR test results of WLAN 2.4G

9.2. Simultaneous Transmission Analysis

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

1) Scalar SAR summation < 1.6W/kg.

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

Test Position		Scaled SAR_{MAX}			Σ1-g SAR (W/Kg)	SPLSR	Remark
		WWAN	WLAN 1	WLAN 2			
Hotspot	Front Side	1.129	0.200	0.178	1.507	N/A	N/A
	Back Side	0.862	0.182	0.160	1.204	N/A	N/A
	Left Side	N/A	0.149	0.132	0.281	N/A	N/A
	Right Side	0.468	N/A	N/A	0.468	N/A	N/A
	Top Side	0.423	N/A	N/A	0.423	N/A	N/A
	Bottom Side	0.312	0.117	0.100	0.529	N/A	N/A

10. Appendix A. Photo documentation

Refer to appendix Test Setup photo---SAR

11. Appendix B. System Check Plots

Table of contents

MEASUREMENT 1

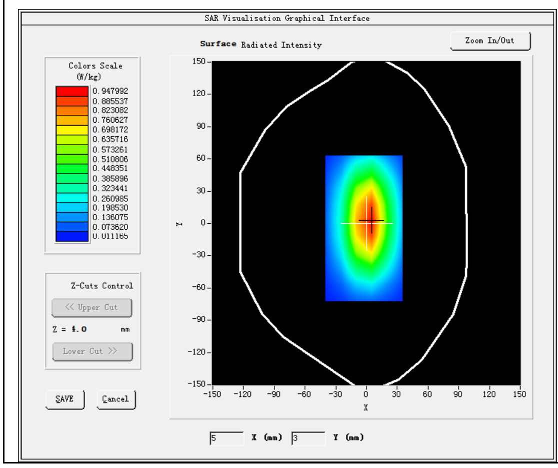
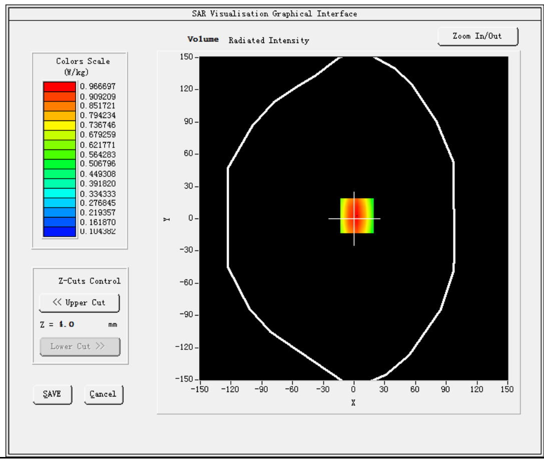
Date of measurement: 26/10/2023

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW750
Channels	Middle
Signal	CW (Crest factor: 1.0)
ConvF	2.37

B. SAR Measurement Results

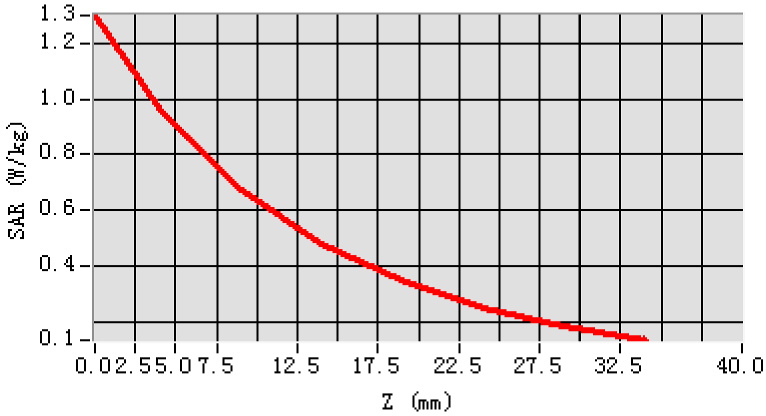
Frequency (MHz)	750.000000
Relative permittivity (real part)	42.327147
Relative permittivity (imaginary part)	22.234427
Conductivity (S/m)	0.926434
Variation (%)	2.170000

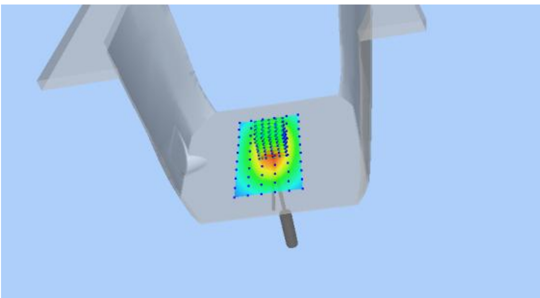
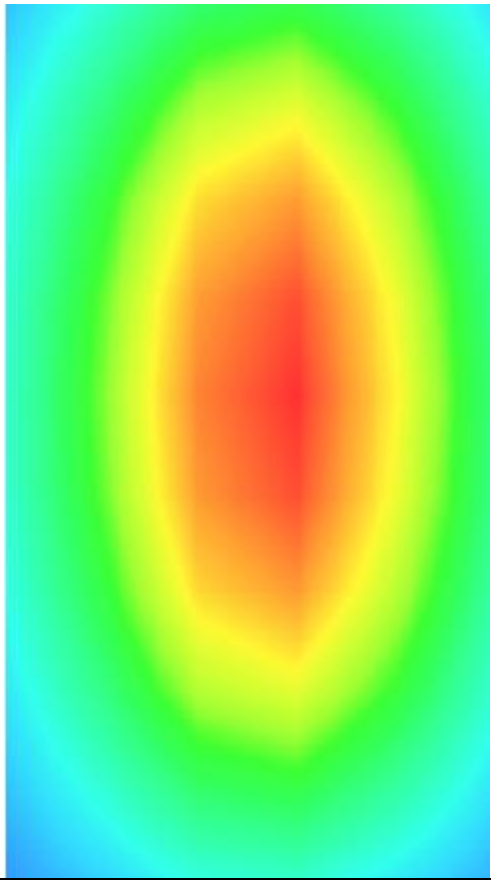
SURFACE SAR	VOLUME SAR
	

Maximum location: X=3.00, Y=3.00
SAR Peak: 1.30 W/kg

SAR 10g (W/Kg)	0.549171
SAR 1g (W/Kg)	0.910104

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.2934	0.9674	0.6775	0.4812	0.3409	0.2526	0.1838



3D screen shot	Hot spot position
	

MEASUREMENT 2

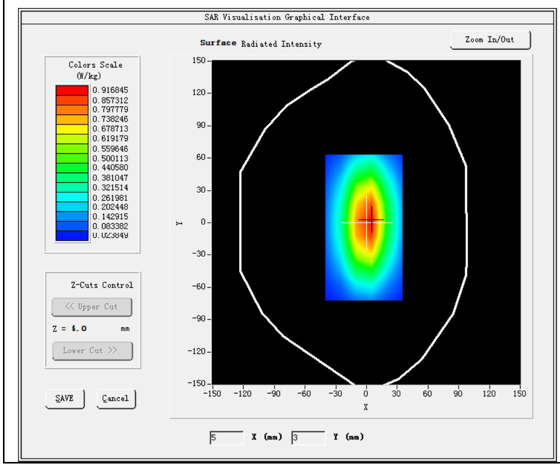
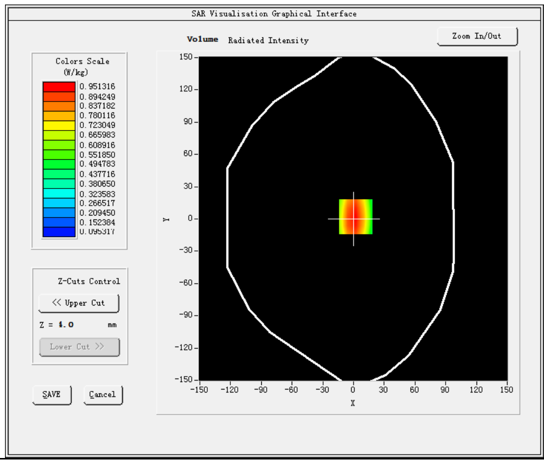
Date of measurement: 2/11/2023

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	835.000000
Relative permittivity (real part)	41.421516
Relative permittivity (imaginary part)	19.303838
Conductivity (S/m)	0.895484
Variation (%)	-0.380000

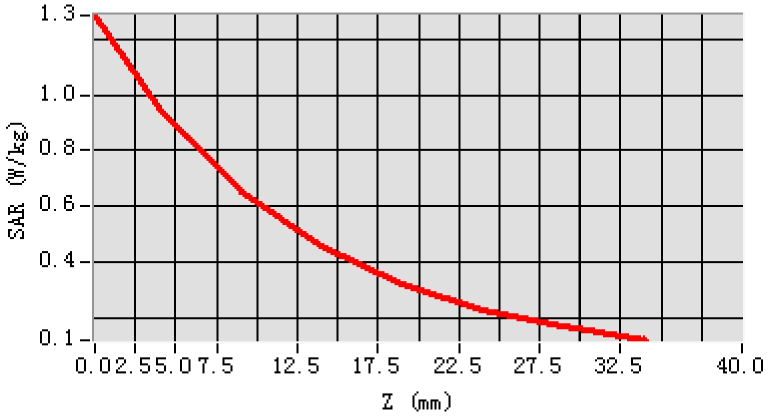
SURFACE SAR	VOLUME SAR
	

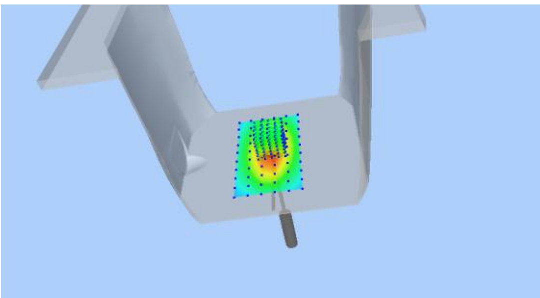
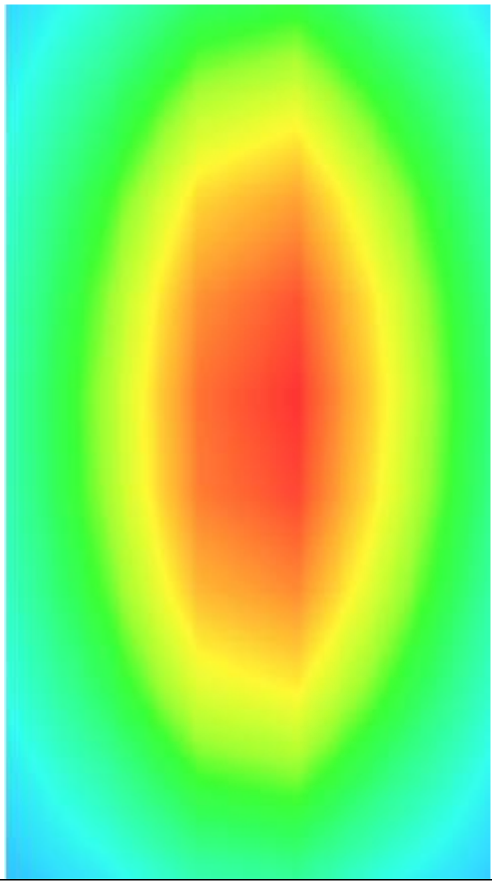
Maximum location: X=2.00, Y=2.00

SAR Peak: 1.29 W/kg

SAR 10g (W/Kg)	0.647257
SAR 1g (W/Kg)	0.958267

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.2850	0.9531	0.6537	0.4569	0.3285	0.2361	0.1793



3D screen shot	Hot spot position
	

MEASUREMENT 3

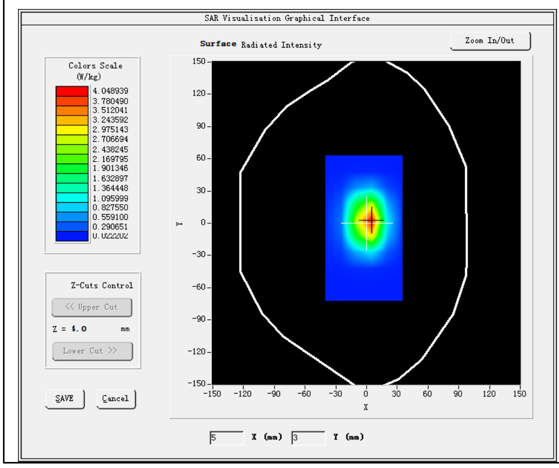
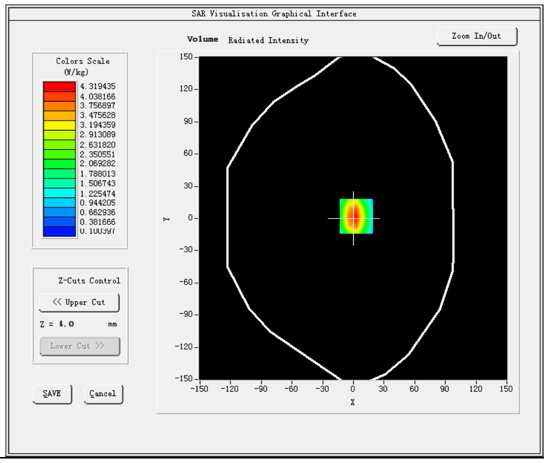
Date of measurement: 31/10/2023

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	1800.000000
Relative permittivity (real part)	40.056022
Relative permittivity (imaginary part)	14.318645
Conductivity (S/m)	1.431865
Variation (%)	-1.940000

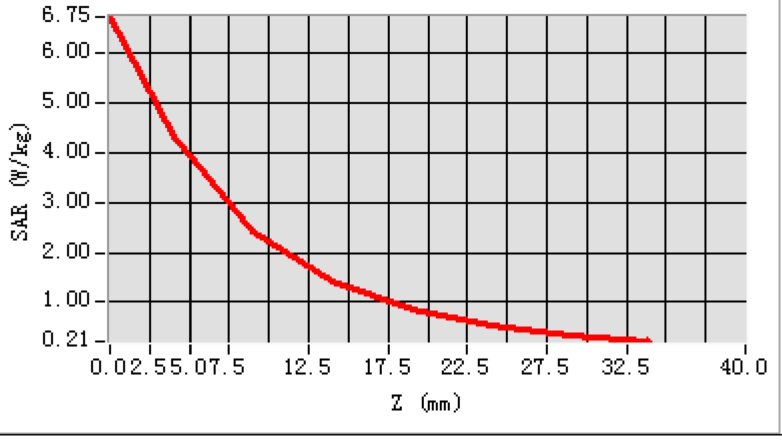
SURFACE SAR	VOLUME SAR
	

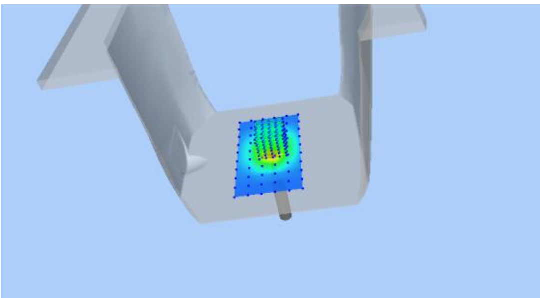
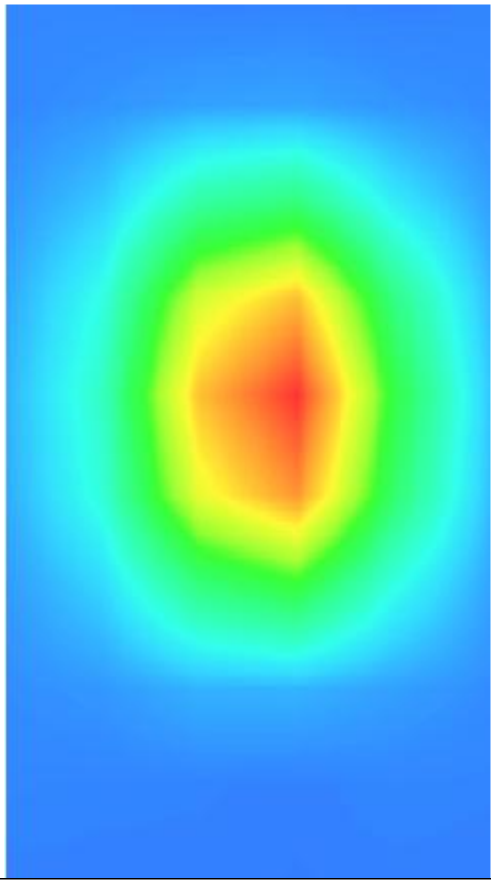
Maximum location: X=3.00, Y=2.00

SAR Peak: 6.82 W/kg

SAR 10g (W/Kg)	1.806013
SAR 1g (W/Kg)	3.486067

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	6.7455	4.3152	2.4343	1.4295	0.8554	0.5203	0.3216



3D screen shot	Hot spot position
	

MEASUREMENT 4

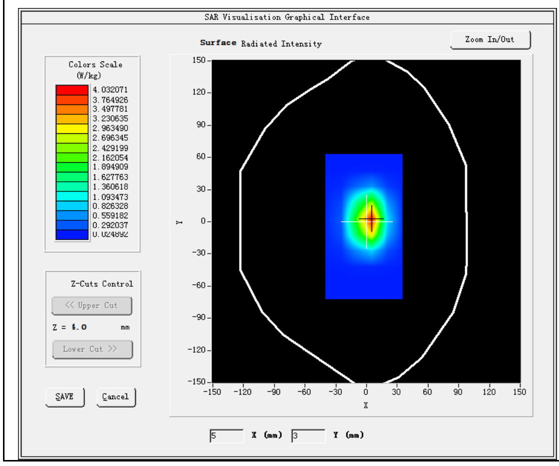
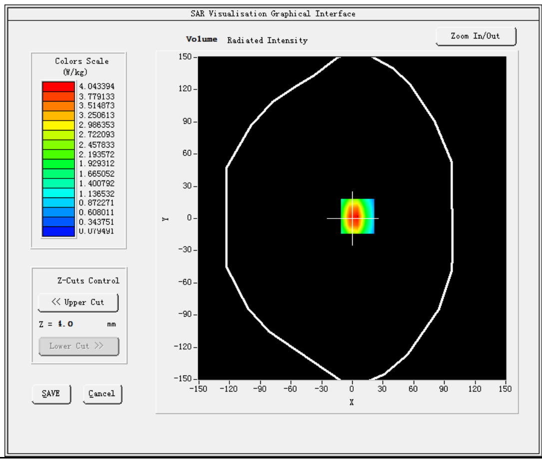
Date of measurement: 24/10/2023

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	1900.000000
Relative permittivity (real part)	39.022879
Relative permittivity (imaginary part)	13.628442
Conductivity (S/m)	1.438558
Variation (%)	-0.480000

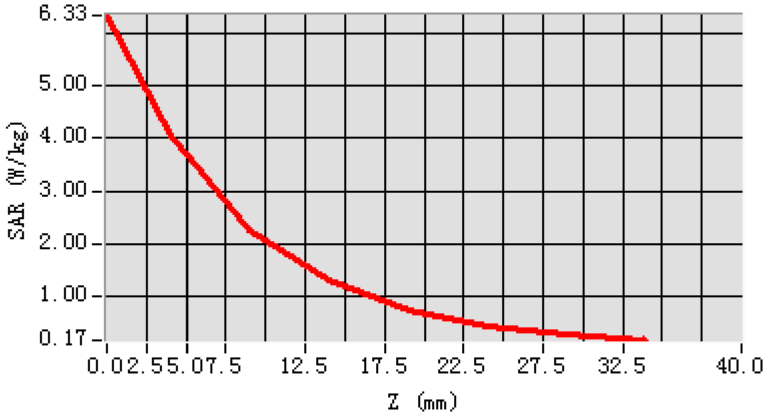
SURFACE SAR	VOLUME SAR
	

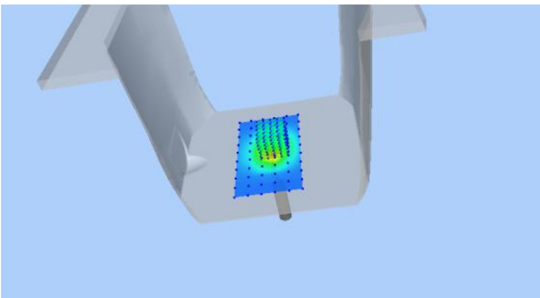
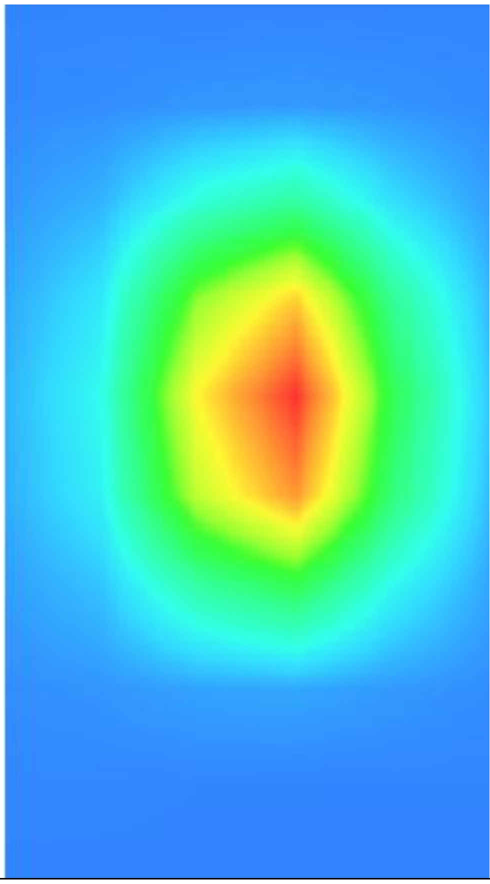
Maximum location: X=5.00, Y=2.00

SAR Peak: 6.70 W/kg

SAR 10g (W/Kg)	1.893344
SAR 1g (W/Kg)	3.806128

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	6.3243	4.0472	2.2608	1.3004	0.7677	0.4582	0.2748



3D screen shot	Hot spot position
	

MEASUREMENT 5

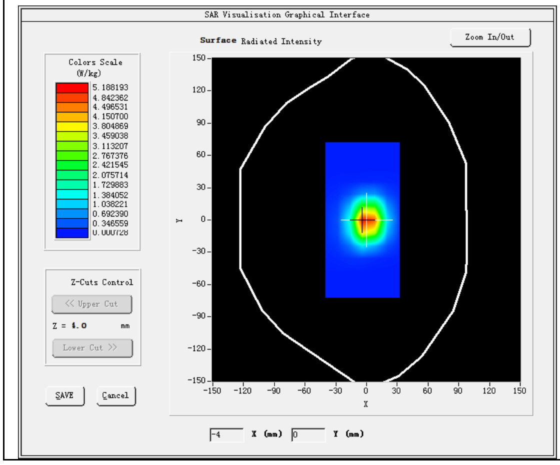
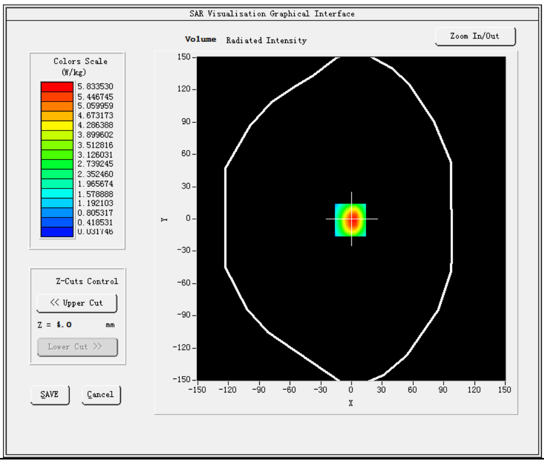
Date of measurement: 28/10/2023

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	2450.000000
Relative permittivity (real part)	38.728633
Relative permittivity (imaginary part)	13.215610
Conductivity (S/m)	1.798791
Variation (%)	0.350000

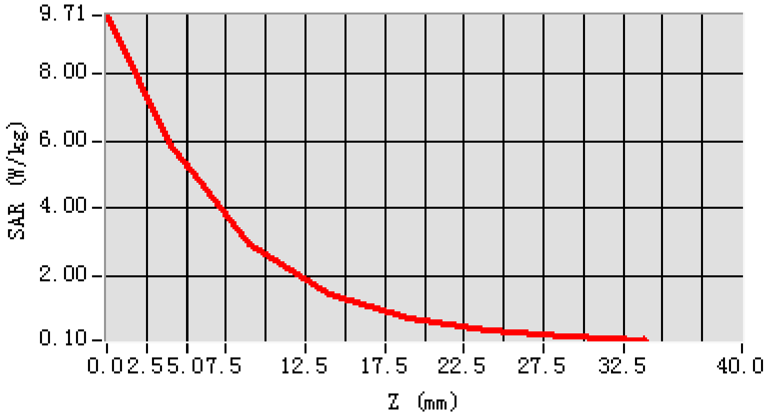
SURFACE SAR	VOLUME SAR
	

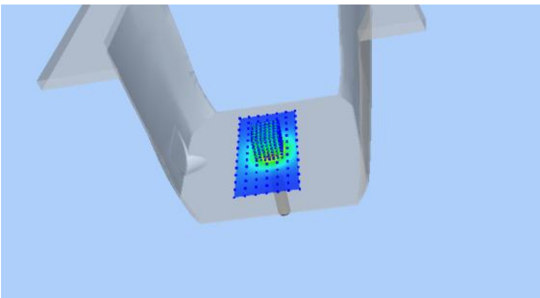
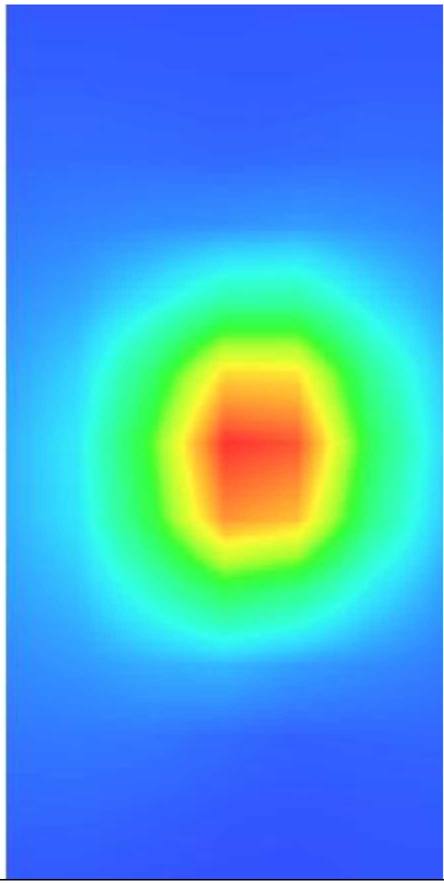
Maximum location: X=-1.00, Y=-1.00

SAR Peak: 9.83 W/kg

SAR 10g (W/Kg)	2.585046
SAR 1g (W/Kg)	4.884065

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	9.7156	5.8307	2.9220	1.4629	0.7436	0.3733	0.1932



3D screen shot	Hot spot position
	

MEASUREMENT 6

Date of measurement: 29/10/2023

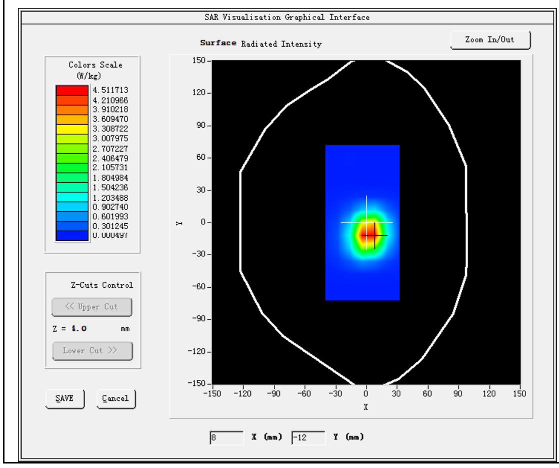
A. Experimental conditions.

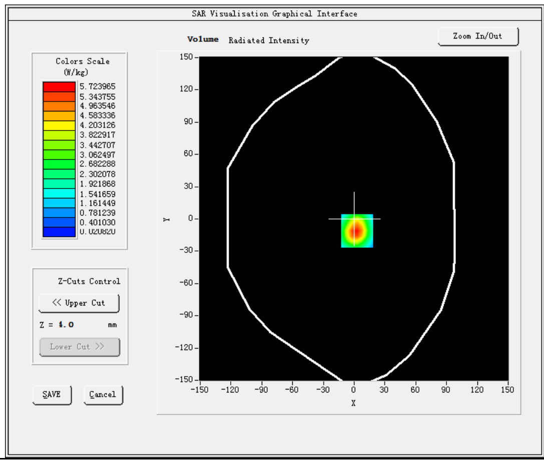
Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2600
Channels	Middle
Signal	CW (Crest factor: 1.0)
ConvF	2.65

B. SAR Measurement Results

Frequency (MHz)	2600.000000
Relative permittivity (real part)	38.574072
Relative permittivity (imaginary part)	13.237614
Conductivity (S/m)	1.912100
Variation (%)	0.820000

SURFACE SAR	VOLUME SAR



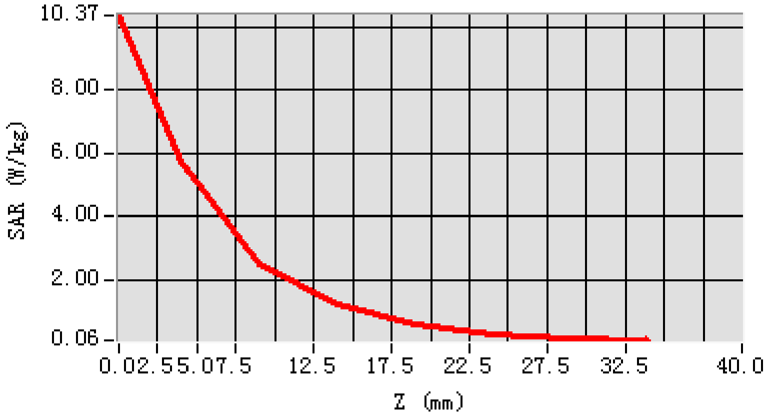


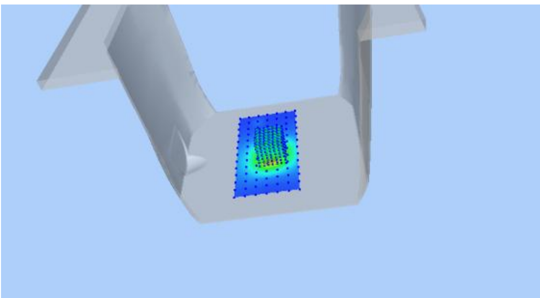
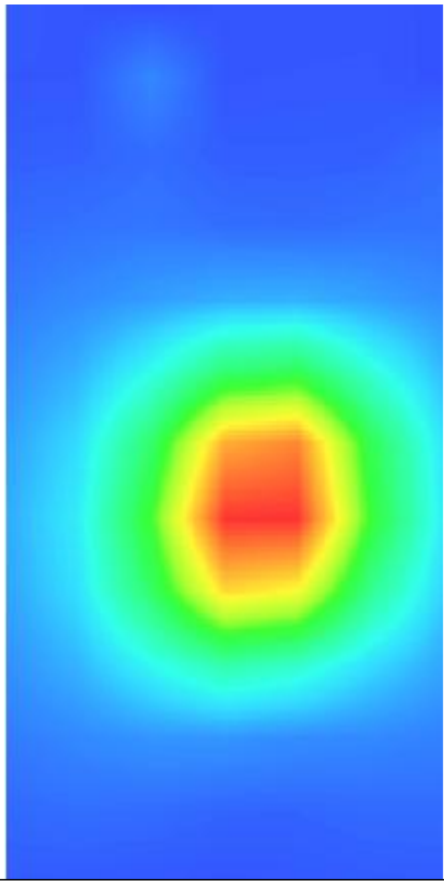
Maximum location: X=3.00, Y=-11.00

SAR Peak: 10.29 W/kg

SAR 10g (W/Kg)	2.322293
SAR 1g (W/Kg)	5.374081

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	10.300	5.7212	2.5035	1.1728	0.5785	0.2630	0.1221



3D screen shot	Hot spot position
	

12. Appendix C. Plots of High SAR Measurement

Table of contents
MEASUREMENT 1 WCDMA Band 2 Body
MEASUREMENT 2 WCDMA Band 4 Body
MEASUREMENT 3 WCDMA Band 5 Body
MEASUREMENT 4 WLAN 2.4G Body
MEASUREMENT 5 WLAN 2.4G Body
MEASUREMENT 6 LTE Band 2 Body
MEASUREMENT 7 LTE Band 4 Body
MEASUREMENT 8 LTE Band 5 Body
MEASUREMENT 9 LTE Band 7 Body
MEASUREMENT 10 LTE Band 41 Body

MEASUREMENT 1

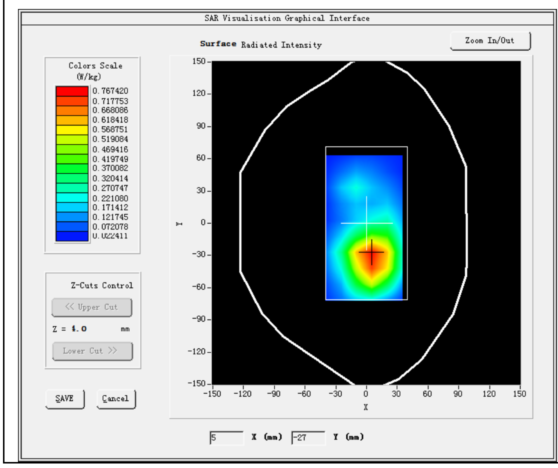
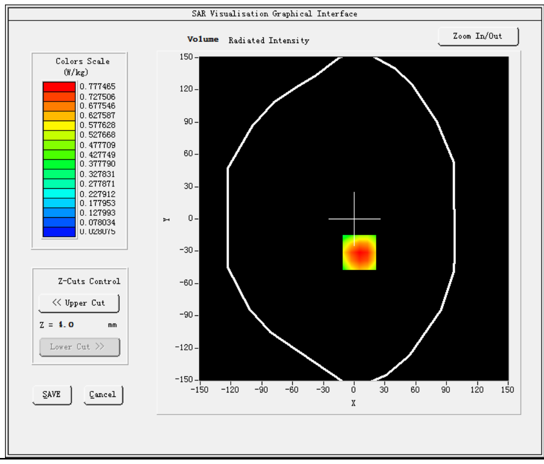
Date of measurement: 24/10/2023

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	39.098179
Relative permittivity (imaginary part)	13.676342
Conductivity (S/m)	1.428418
Variation (%)	-3.910000

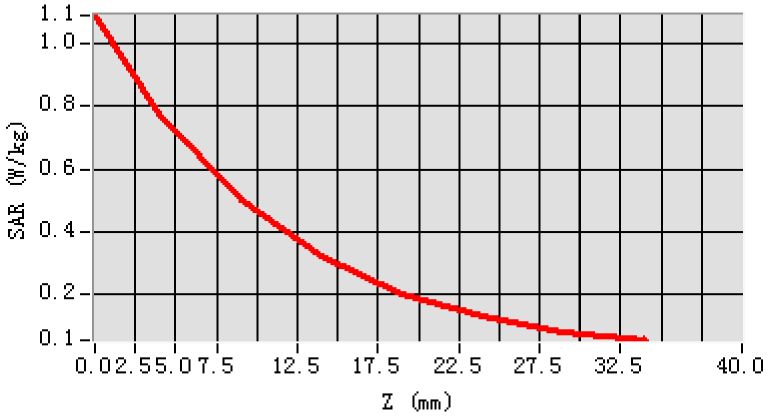
SURFACE SAR	VOLUME SAR
	

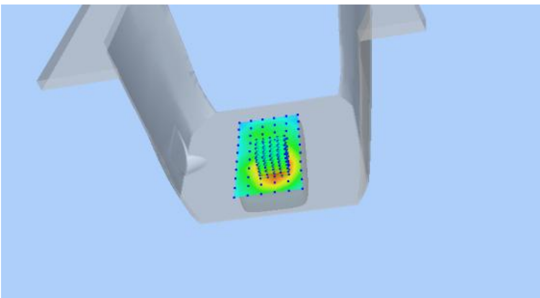
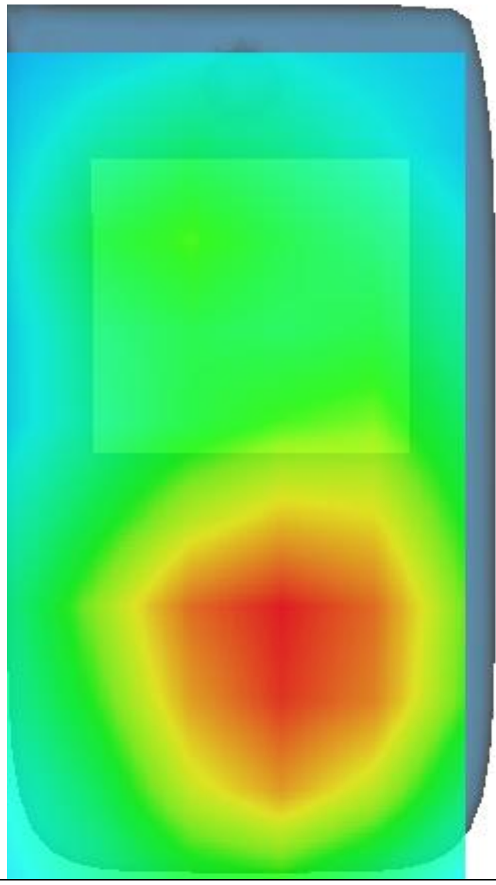
Maximum location: X=5.00, Y=-31.00

SAR Peak: 1.12 W/kg

SAR 10g (W/Kg)	0.457538
SAR 1g (W/Kg)	0.758708

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.0906	0.7775	0.5016	0.3227	0.2050	0.1304	0.0838



3D screen shot	Hot spot position
	

MEASUREMENT 2

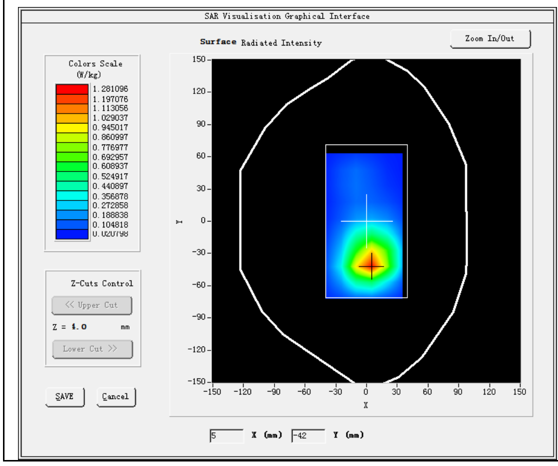
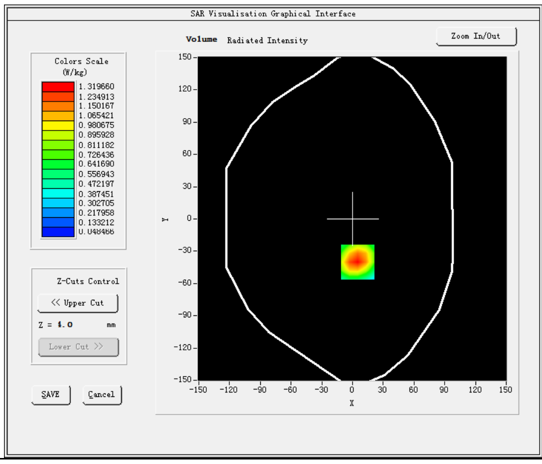
Date of measurement: 31/10/2023

A. Experimental conditions.

Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band4_WCDMA1700
Channels	Low
Signal	WCDMA (Crest factor: 1.0)
ConvF	2.45

B. SAR Measurement Results

Frequency (MHz)	1712.400000
Relative permittivity (real part)	40.681423
Relative permittivity (imaginary part)	14.217545
Conductivity (S/m)	1.352247
Variation (%)	0.170000

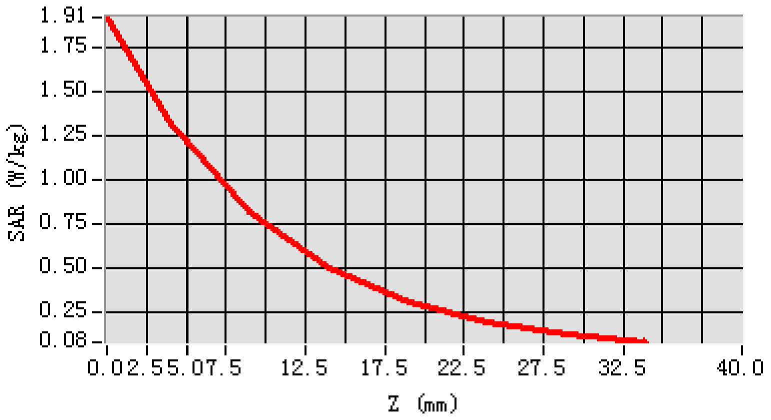
SURFACE SAR	VOLUME SAR
	

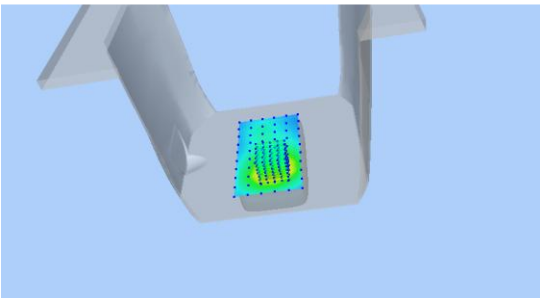
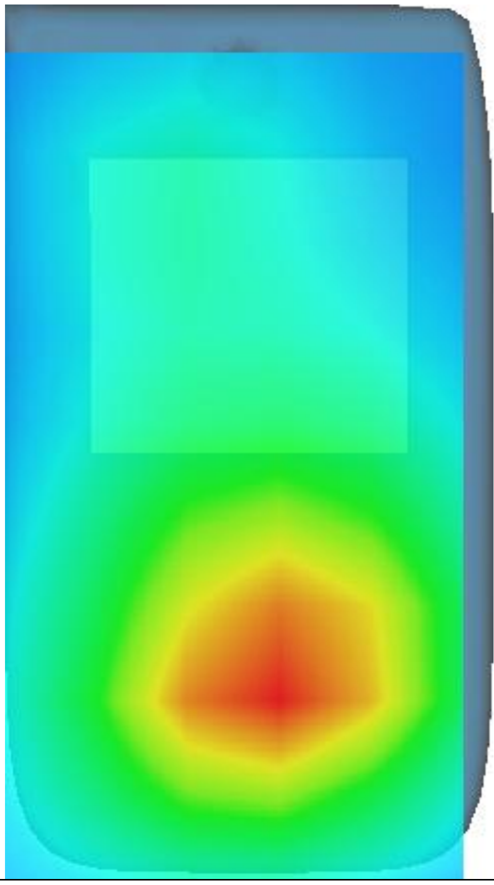
Maximum location: X=5.00, Y=-40.00

SAR Peak: 1.92 W/kg

SAR 10g (W/Kg)	0.709831
SAR 1g (W/Kg)	1.124056

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.9141	1.3195	0.8132	0.5001	0.3081	0.1947	0.1259



3D screen shot	Hot spot position
	

MEASUREMENT 3

Date of measurement: 2/11/2023

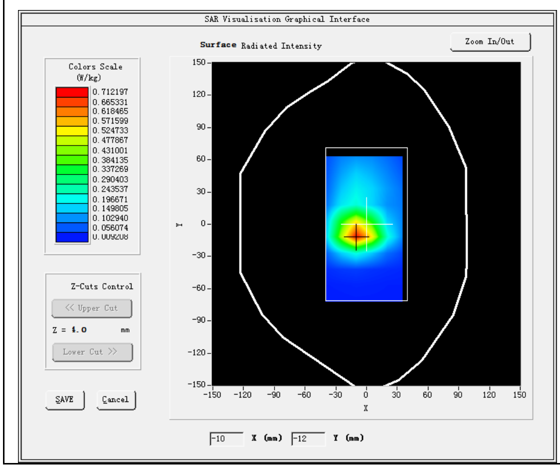
A. Experimental conditions.

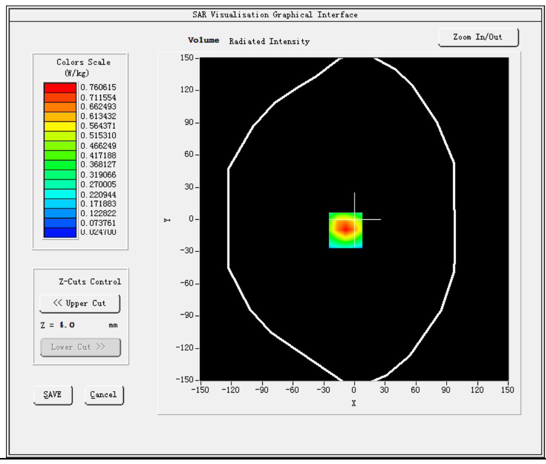
Area Scan	dx=15mm dy=15mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band5_WCDMA850
Channels	Middle
Signal	WCDMA (Crest factor: 1.0)
ConvF	2.32

B. SAR Measurement Results

Frequency (MHz)	836.400000
Relative permittivity (real part)	41.430595
Relative permittivity (imaginary part)	19.311037
Conductivity (S/m)	0.897320
Variation (%)	-2.080000

SURFACE SAR	VOLUME SAR

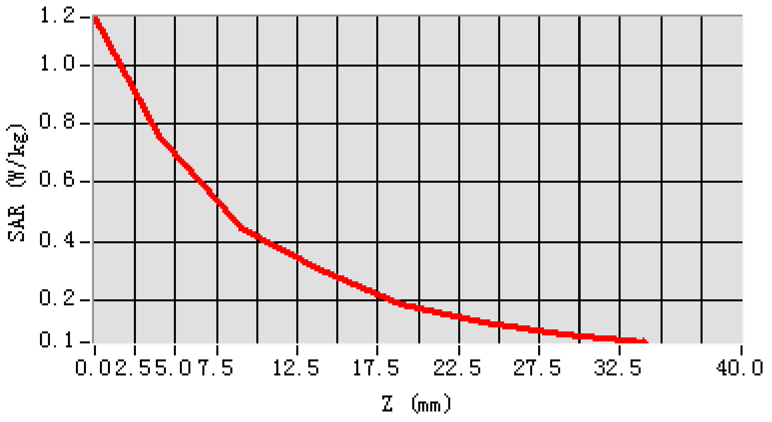


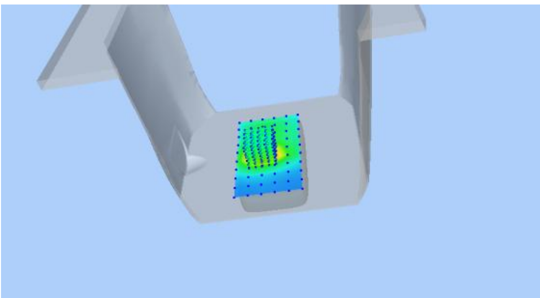
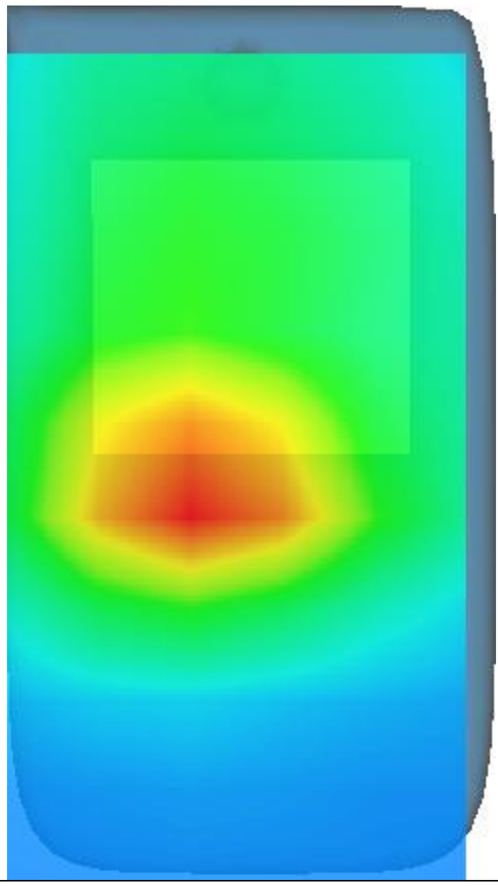


Maximum location: X=-9.00, Y=-10.00
SAR Peak: 1.16 W/kg

SAR 10g (W/Kg)	0.399291
SAR 1g (W/Kg)	0.721627

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.1670	0.7606	0.4440	0.3008	0.1849	0.1191	0.0789



3D screen shot	Hot spot position
	

MEASUREMENT 4

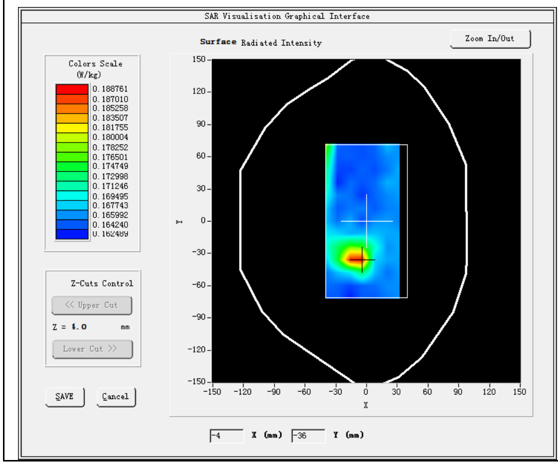
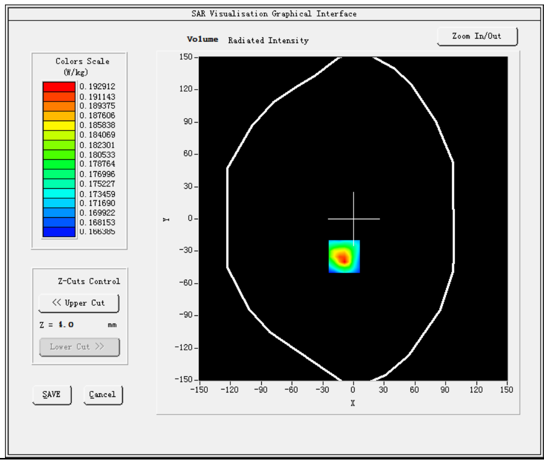
Date of measurement: 28/10/2023

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	2437.000000
Relative permittivity (real part)	38.780731
Relative permittivity (imaginary part)	13.134110
Conductivity (S/m)	1.778213
Variation (%)	-1.580000

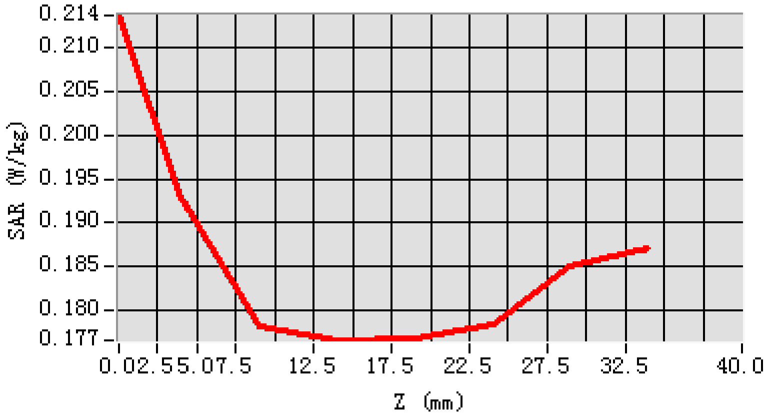
SURFACE SAR	VOLUME SAR
	

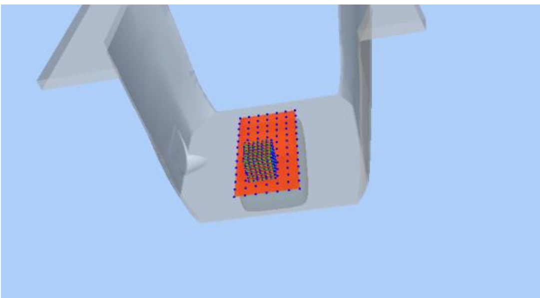
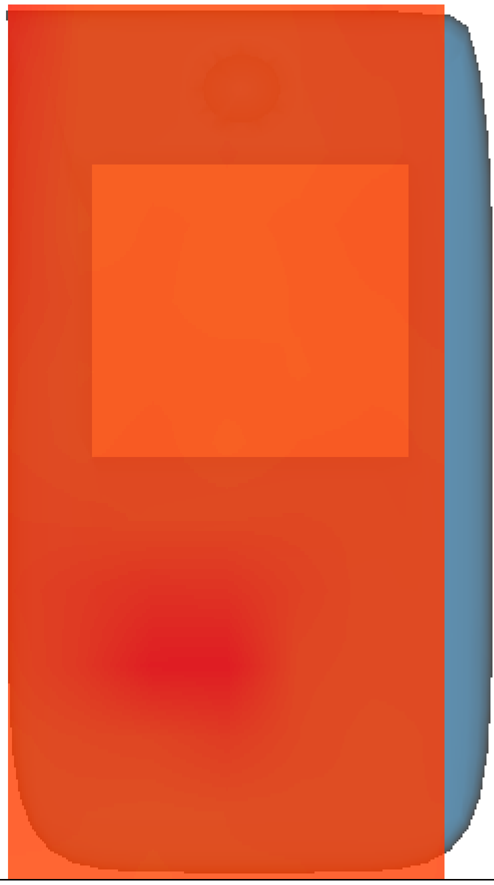
Maximum location: X=-9.00, Y=-35.00

SAR Peak: 0.22 W/kg

SAR 10g (W/Kg)	0.179211
SAR 1g (W/Kg)	0.190753

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.2137	0.1929	0.1782	0.1766	0.1767	0.1785	0.1851



3D screen shot	Hot spot position
	

MEASUREMENT 5

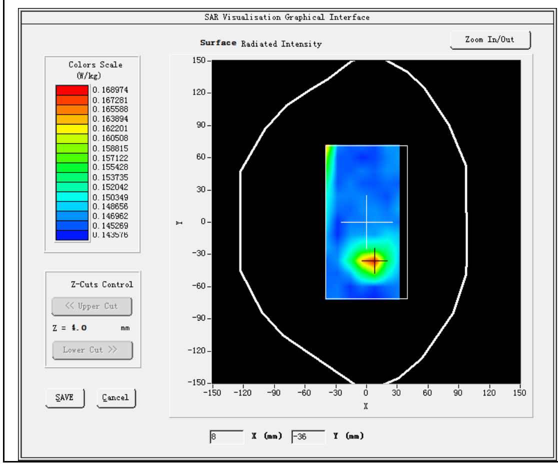
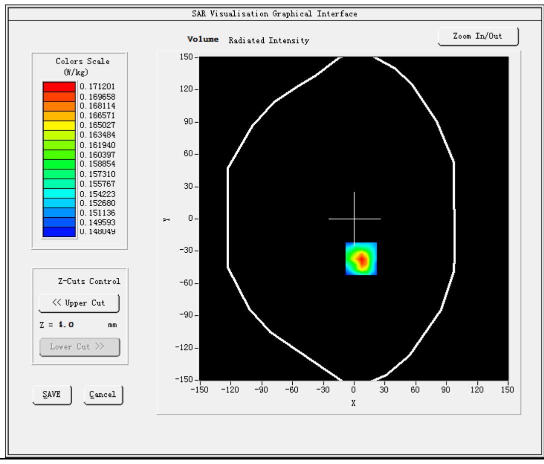
Date of measurement: 28/10/2023

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	2437.000000
Relative permittivity (real part)	38.780731
Relative permittivity (imaginary part)	13.134110
Conductivity (S/m)	1.778213
Variation (%)	-0.050000

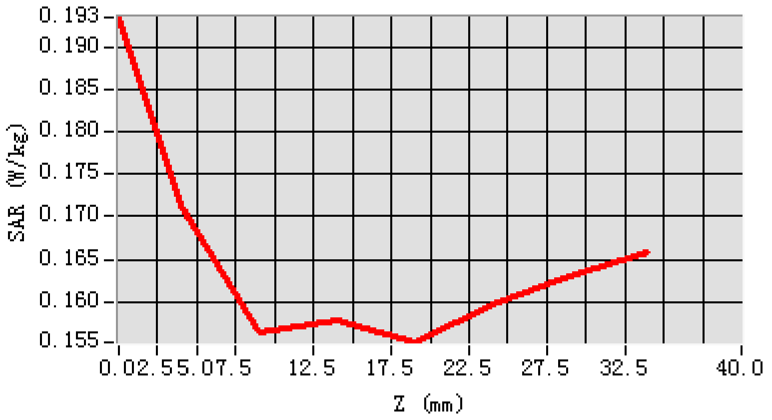
SURFACE SAR	VOLUME SAR
	

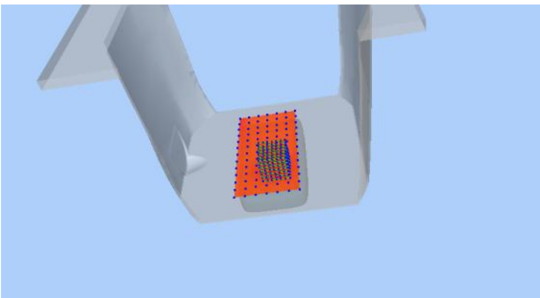
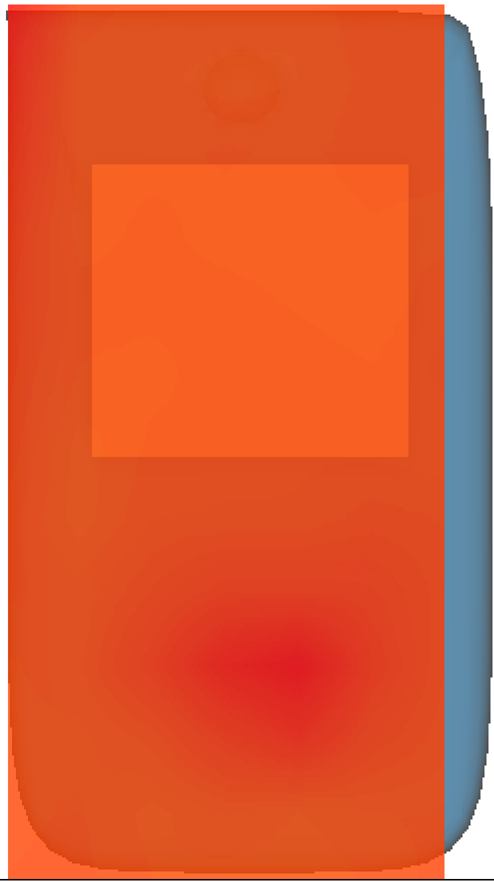
Maximum location: X=7.00, Y=-37.00

SAR Peak: 0.19 W/kg

SAR 10g (W/Kg)	0.158773
SAR 1g (W/Kg)	0.168690

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1935	0.1712	0.1565	0.1578	0.1552	0.1596	0.1629



3D screen shot	Hot spot position
	

MEASUREMENT 6

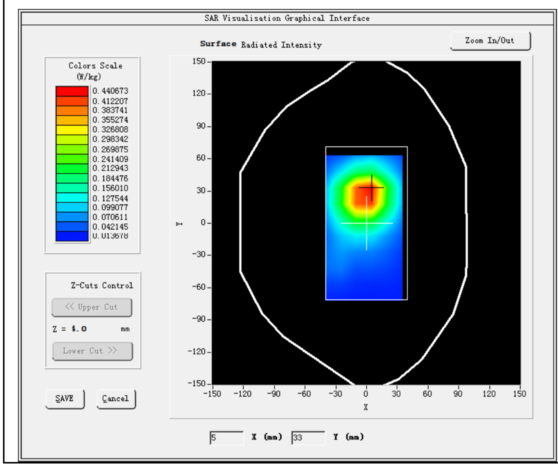
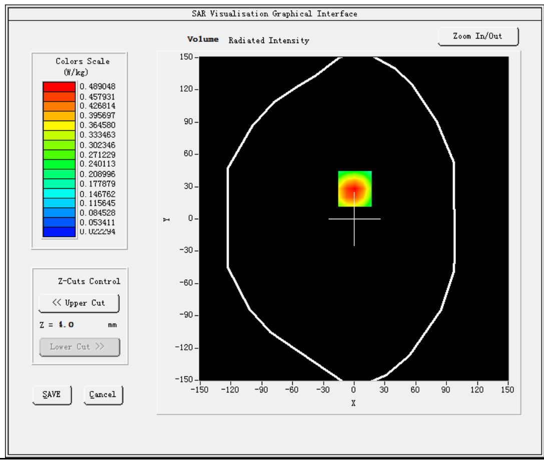
Date of measurement: 24/10/2023

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	39.098179
Relative permittivity (imaginary part)	13.676342
Conductivity (S/m)	1.428418
Variation (%)	-2.570000

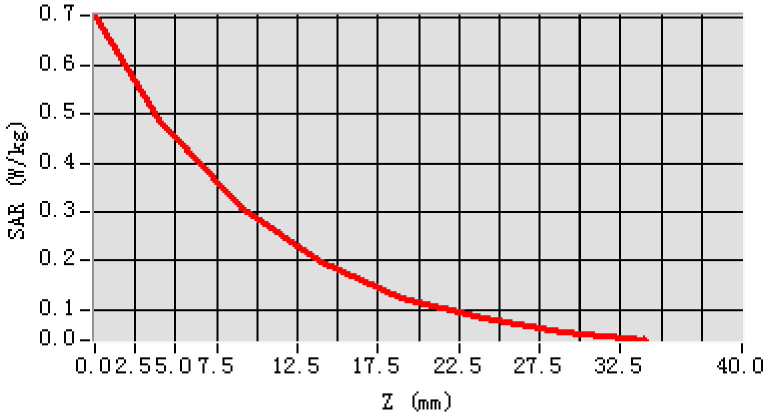
SURFACE SAR	VOLUME SAR
	

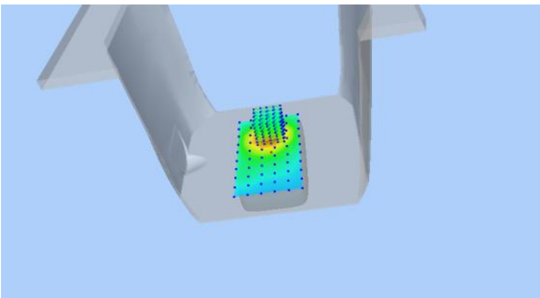
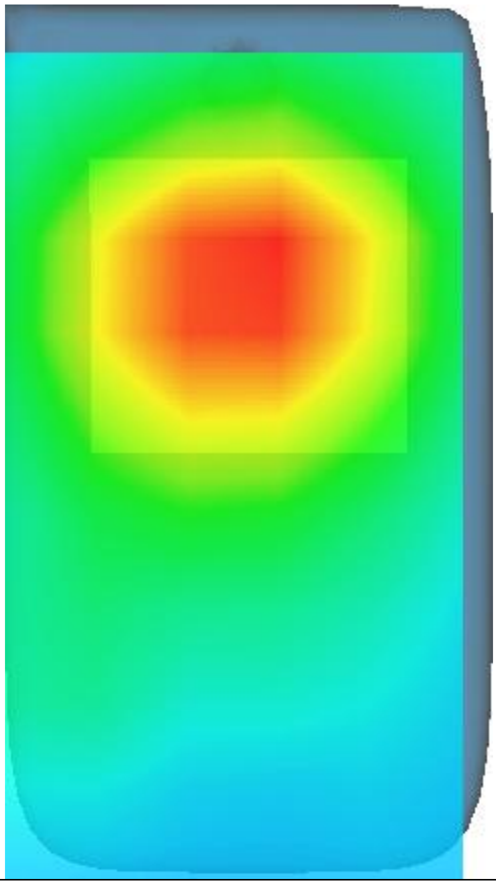
Maximum location: X=1.00, Y=28.00

SAR Peak: 0.70 W/kg

SAR 10g (W/Kg)	0.283620
SAR 1g (W/Kg)	0.476424

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.7027	0.4890	0.3080	0.1961	0.1257	0.0835	0.0553



3D screen shot	Hot spot position
	

MEASUREMENT 7

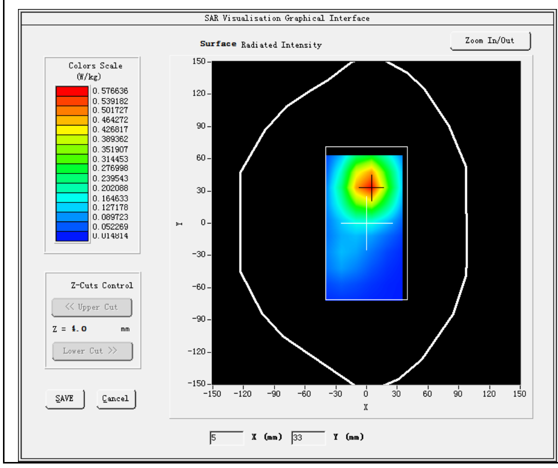
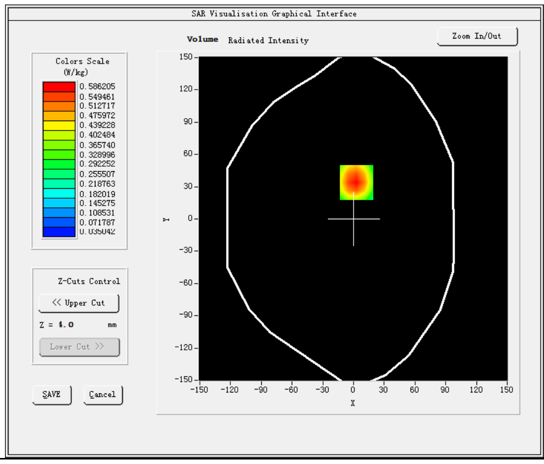
Date of measurement: 31/10/2023

A. Experimental conditions.

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

B. SAR Measurement Results

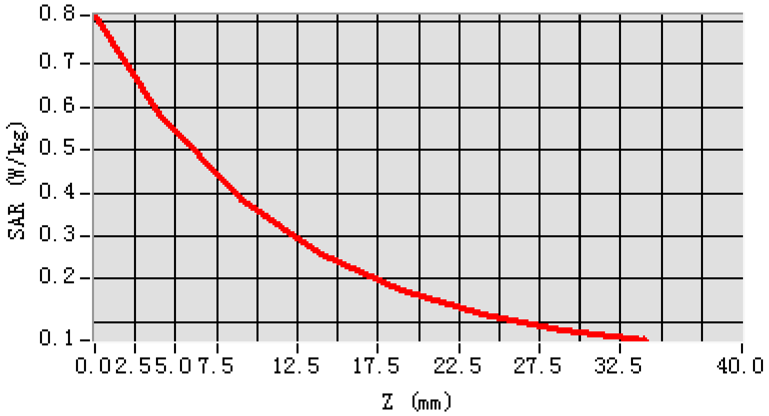
Frequency (MHz)	1732.500000
Relative permittivity (real part)	40.523621
Relative permittivity (imaginary part)	14.255795
Conductivity (S/m)	1.372120
Variation (%)	-0.950000

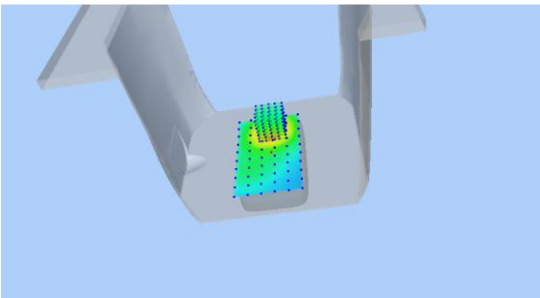
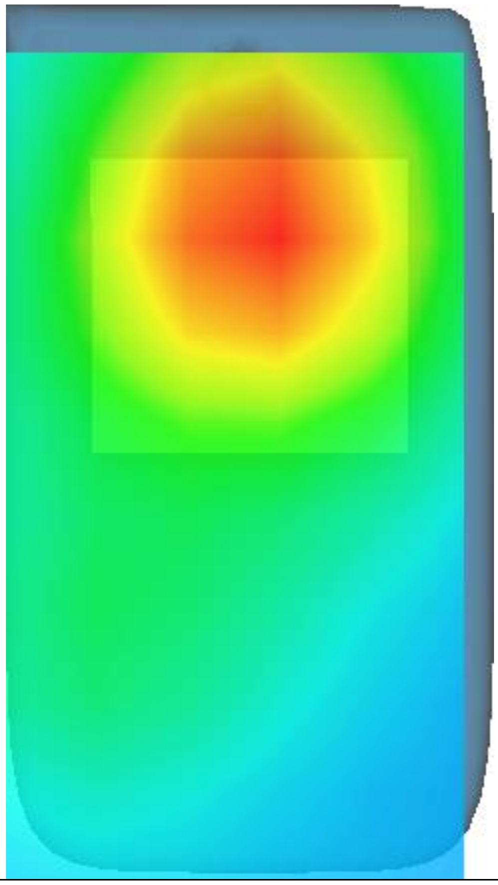
SURFACE SAR	VOLUME SAR
	

Maximum location: X=3.00, Y=34.00
SAR Peak: 0.81 W/kg

SAR 10g (W/Kg)	0.348584
SAR 1g (W/Kg)	0.560889

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.8141	0.5862	0.3858	0.2585	0.1725	0.1175	0.0822



3D screen shot	Hot spot position
	

MEASUREMENT 8

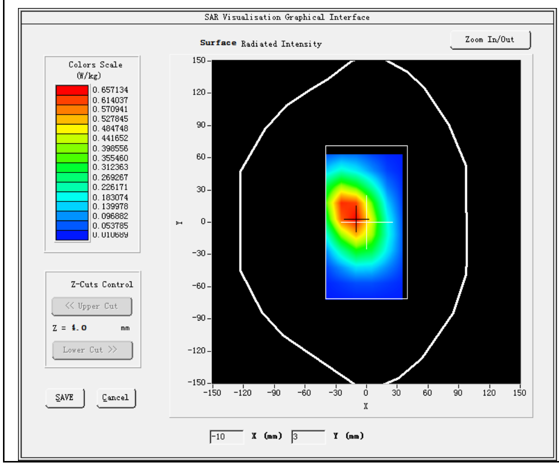
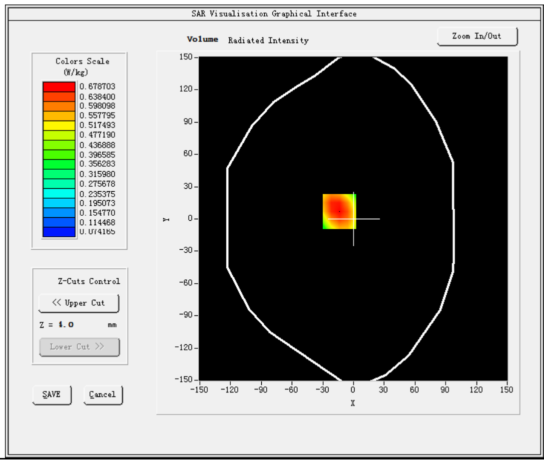
Date of measurement: 2/11/2023

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	836.500000
Relative permittivity (real part)	41.432865
Relative permittivity (imaginary part)	19.312838
Conductivity (S/m)	0.897510
Variation (%)	-1.130000

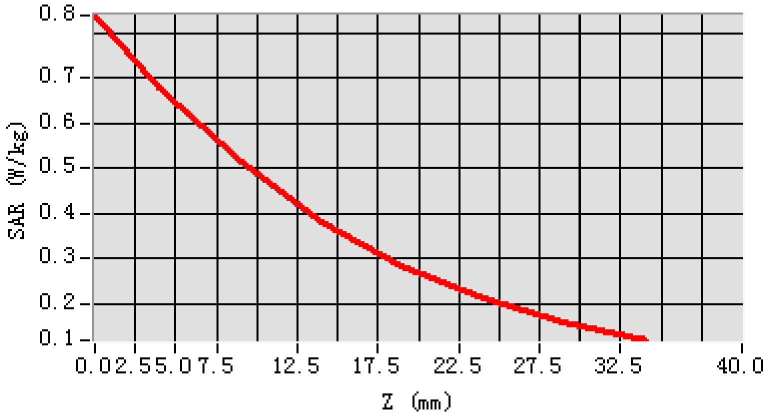
SURFACE SAR	VOLUME SAR
	

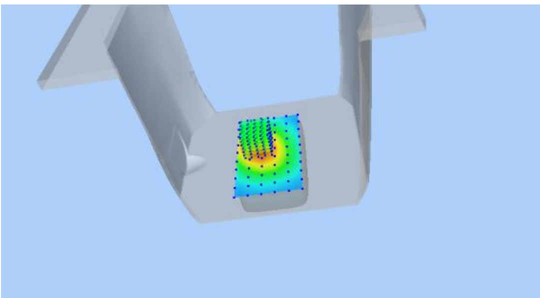
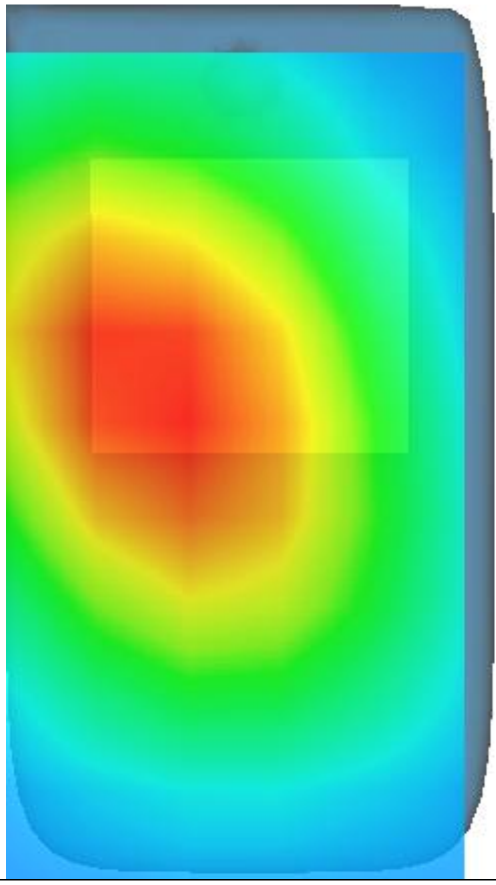
Maximum location: X=-14.00, Y=7.00

SAR Peak: 0.87 W/kg

SAR 10g (W/Kg)	0.460233
SAR 1g (W/Kg)	0.656929

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.8390	0.6787	0.5143	0.3834	0.2855	0.2121	0.1582



3D screen shot	Hot spot position
	

MEASUREMENT 9

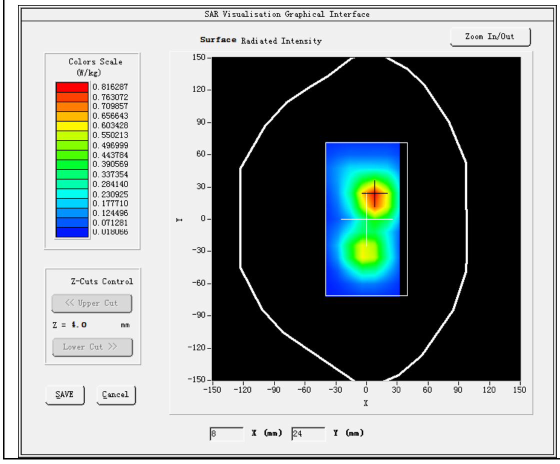
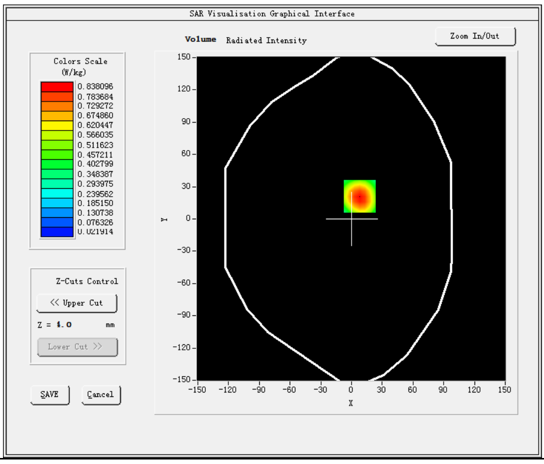
Date of measurement: 29/10/2023

A. Experimental conditions.

Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 7
Channels	Middle
Signal	LTE (Crest factor: 1.0)
ConvF	2.65

B. SAR Measurement Results

Frequency (MHz)	2535.000000
Relative permittivity (real part)	38.909370
Relative permittivity (imaginary part)	13.105514
Conductivity (S/m)	1.845693
Variation (%)	1.250000

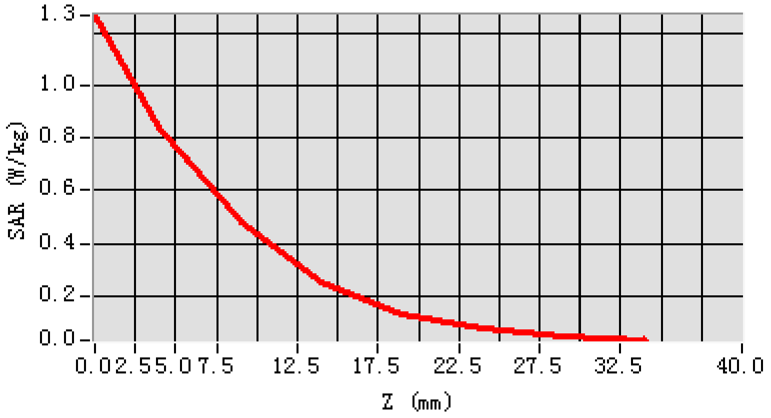
SURFACE SAR	VOLUME SAR
	

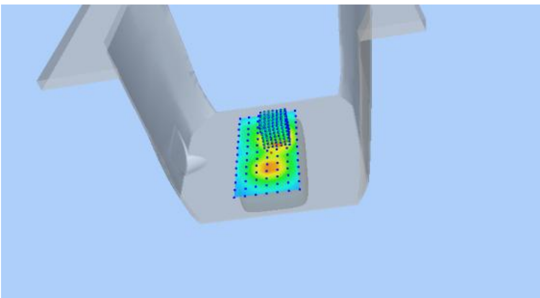
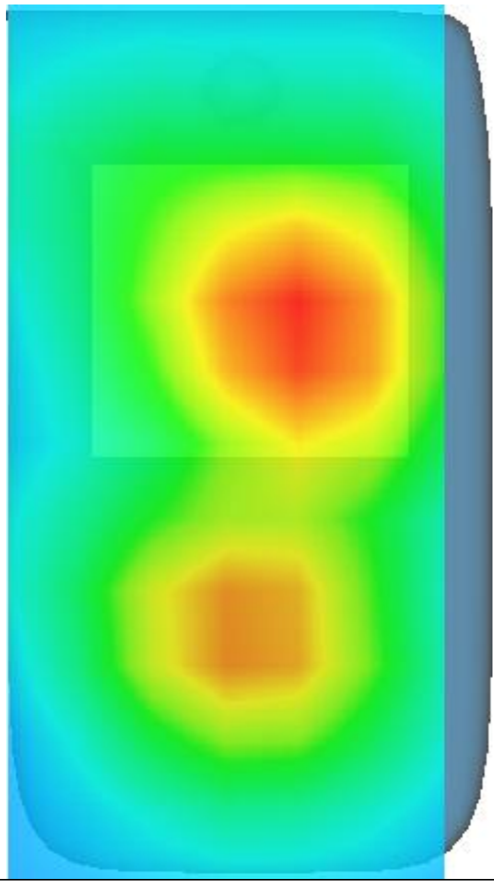
Maximum location: X=8.00, Y=21.00

SAR Peak: 1.26 W/kg

SAR 10g (W/Kg)	0.425582
SAR 1g (W/Kg)	0.778245

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.2649	0.8381	0.4777	0.2520	0.1346	0.0771	0.0474



3D screen shot	Hot spot position
	

MEASUREMENT 10

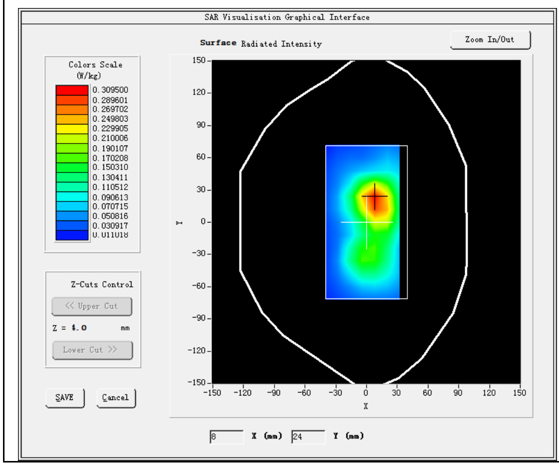
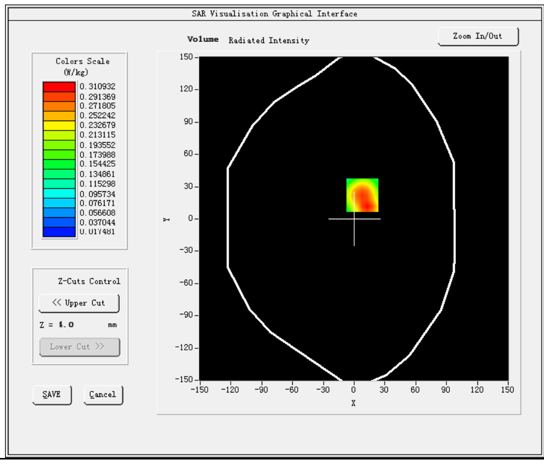
Date of measurement: 29/10/2023

A. Experimental conditions.

Area Scan	dx=12mm dy=12mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 41
Channels	Middle
Signal	LTE (Crest factor: 1.0)
ConvF	2.65

B. SAR Measurement Results

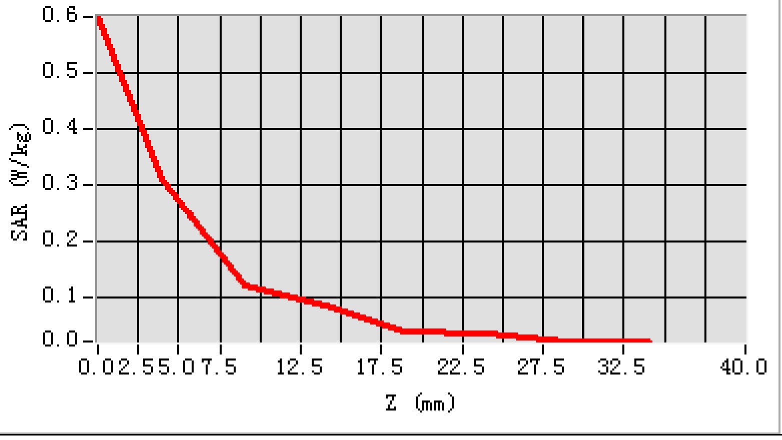
Frequency (MHz)	2593.000000
Relative permittivity (real part)	38.627872
Relative permittivity (imaginary part)	13.269114
Conductivity (S/m)	1.911490
Variation (%)	0.160000

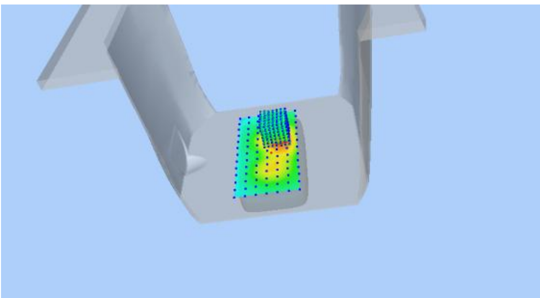
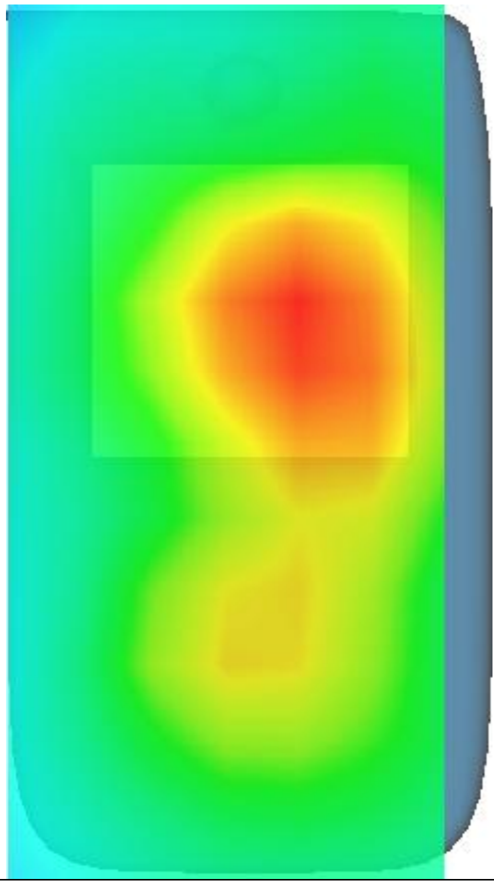
SURFACE SAR	VOLUME SAR
	

Maximum location: X=8.00, Y=22.00
SAR Peak: 0.53 W/kg

SAR 10g (W/Kg)	0.159849
SAR 1g (W/Kg)	0.293295

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.6006	0.3109	0.1236	0.0865	0.0419	0.0370	0.0223



3D screen shot	Hot spot position
	

13. Appendix D. Calibration Certificate

Table of contents

COMOSAR E-Field Probe Calibration Report

Ref : ACR.261.11.23.BES.A

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

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

Calibration date: 09/18/2023

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

Summary:

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

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

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

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

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

TABLE OF CONTENTS

1 DEVICE UNDER TEST

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

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

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

Figure 1 – *MVG COMOSAR Dosimetric E field Probe*

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

3 MEASUREMENT METHOD

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

3.1 SENSITIVITY

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

3.2 LINEARITY

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

3.3 ISOTROPY

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

3.4 BOUNDARY EFFECT

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

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

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

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.

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

4 MEASUREMENT UNCERTAINTY

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

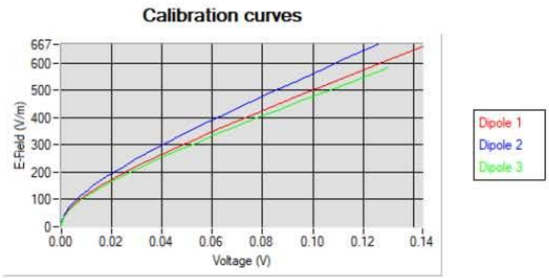
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-11% for the frequency range 150-450MHz.
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

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

5.1 CALIBRATION IN AIR

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



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

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

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

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
0.78	0.62	0.85

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

5.2 CALIBRATION IN LIQUID

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

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

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

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

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

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

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

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

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

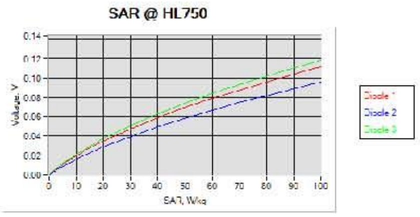
$$SAR = \frac{4Pw}{ab\delta}e^{\frac{-2z}{\delta}}$$

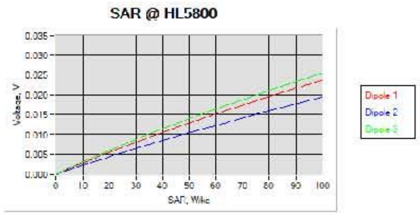
where
a=the larger cross-sectional of the waveguide
b=the smaller cross-sectional of the waveguide
δ=the skin depth for the liquid in the waveguide
Pw=the power delivered to the liquid

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

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

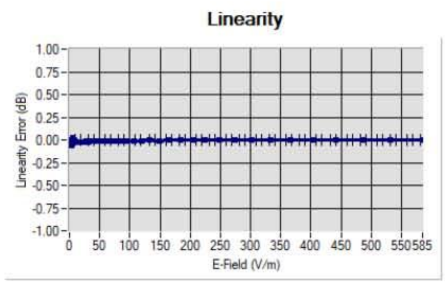
(*) Frequency validity is +/-50MHz below 600MHz, +/-100MHz from 600MHz to 6GHz and +/-700MHz above 6GHz



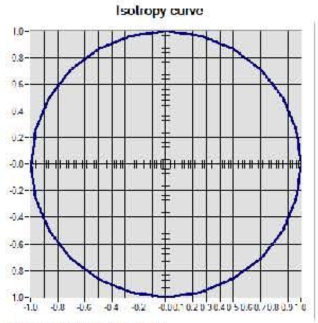


6 VERIFICATION RESULTS

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



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



Isotropy +/ 0.21% (+/ 0.01dB)

7 LIST OF EQUIPMENT

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

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

SAR Reference Dipole Calibration Report

Ref : ACR.60.2.21.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: 750 MHZ
SERIAL NO.: SN 03/15 DIP0G750-355

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.60.2.21.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Luc	Technical Manager	3/1/2021	
Checked by :	Jérôme Luc	Technical Manager	3/1/2021	
Approved by :	Yann Toutain	Laboratory Director	3/1/2021	Yann Toutain 2021.03.01 13:08:18 +01'00'

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

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

TABLE OF CONTENTS

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 750 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID750
Serial Number	SN 03/15 DIP0G750-355
Product Condition (new / used)	Used

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*

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. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

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 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

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