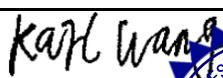


SAR Test Report

Test Report No.:	TCT220810E070	
Date of issue	Sep. 28, 2022	
Testing laboratory	Shenzhen TCT Testing Technology Co., Ltd.	
Testing location/ address:	2101 & 2201, Zhenchang Factory, Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China	
Applicant's name	Shenzhen Huafurui Technology Co., Ltd	
Address	Unit 1401 & 1402, 14/F, Jinqi Zhigu Mansion (No. 4 Building of Chongwen Garden), Crossing of the Liuxian Street and Tangling Road, Taoyuan Street, Nanshan District, Shenzhen, P.R. China	
Manufacturer's name	Shenzhen Huafurui Technology Co., Ltd	
Address	Unit 1401 & 1402, 14/F, Jinqi Zhigu Mansion (No. 4 Building of Chongwen Garden), Crossing of the Liuxian Street and Tangling Road, Taoyuan Street, Nanshan District, Shenzhen, P.R. China	
Test item description	Smartphone	
Trade Mark.....	CUBOT	
Model/Type reference	KINGKONG MINI 3	
SAR Max. Values.....	0.57 W/Kg (10g) for Head; 0.88 W/Kg (10g) for Body 0.28W/Kg (10g) for Front-to-face; 1.44W/Kg (10g) for Limbs	
Simultaneous Reported SAR.....	0.95 W/Kg (10g) for Head; 1.23W/Kg (10g) for Body 0.38W/Kg (10g) for Front-to-face; 1.78 W/Kg (10g) for Limbs	
Date of receipt of test item	Aug. 10, 2022	
Date (s) of performance of test	Aug. 10, 2022 ~ Sep. 28, 2022	
Tested by (+signature).....	Karl WANG	
Check by (+signature)	Beryl Zhao	
Approved by (+signature):	Tomsin	



General disclaimer:

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1. General Product Information

1.1. EUT description

Test item description.....:	Smartphone
Model/Type reference.....:	KINGKONG MINI 3
Hardware Version.....:	TE155_XXA1
Software Version.....:	CUBOT_KINGKONG MINI 3_C031C_V01_20220728
Rating(s).....:	Rechargeable Li-polymer Battery DC 3.87V
2G	
Operation Band.....:	GSM900,GSM1800
Supported type.....:	GSM/GPRS/EGPRS
Power Class.....:	GSM900:Power Class 5; GSM1800:Power Class 0
Modulation Type.....:	GMSK for GSM/GPRS; 8QPSK for EGPRS
GSM Release Version.....:	R99
GPRS Multislot Class.....:	12
EGPRS Multislot Class.....:	12
3G	
Operation Band.....:	WCDMA Band I & Band VIII
Power Class.....:	Power Class 3
Modulation Type.....:	QPSK for WCDMA/HSDPA/HSUPA
WCDMA Release Version.....:	R99
HSDPA Release Version.....:	Release 5
HSUPA Release Version.....:	Release 6
DC-HSUPA Release Version.....:	Not Supported
LTE	
Operation Band.....:	LTE Band 1 & LTE Band 3 & LTE Band 7 & LTE Band 8 & LTE Band 20 & LTE Band 40
Power Class.....:	Power Class 3
Modulation Type.....:	QPSK &16-QAM for LTE
WiFi 2.4G	
Supported type.....:	802.11b/802.11g/802.11n
Modulation Type.....:	802.11b: DSSS; 802.11g/802.11n:OFDM
Operation Frequency.....:	802.11b/802.11g/802.11n(HT20):2412MHz~2472MHz; 802.11n(HT40):2422MHz~2462MHz
Channel number.....:	802.11b/802.11g/802.11n(HT20):13; 802.11n(HT40):9
Channel separation.....:	5MHz

Bluetooth	
Bluetooth Version.....:	Supported BT5.0
Modulation.....:	GFSK(1Mbps) , $\pi/4$ -DQPSK(2Mbps) , 8-DPSK(3Mbps)
Operation Frequency.....:	2402MHz~2480MHz
Channel number.....:	79/40
Channel separation.....:	1MHz/2MHz
Wi-Fi 5G	
Operation Frequency.....:	Band 1: 5180 MHz -5240 MHz Band 3: 5745 MHz -5825 MHz
Channel Bandwidth.....:	802.11a: 20MHz 802.11n: 20MHz, 40MHz 802.11ac: 20MHz, 40MHz, 80MHz
Modulation Technology.....:	Orthogonal Frequency Division Multiplexing(OFDM)
Modulation Type.....:	256QAM, 64QAM, 16QAM, BPSK, QPSK
NFC	
Operation Frequency.....:	13.56MHz
Antenna Type.....:	Internal antenna

1.2. Model(s) list

None.

2. Test standard

The tests were performed according to following standards:

- BS EN 50566:2017
- BS EN 50663:2017
- BS IEC/IEEE 62209-1528:2020
- BS EN 50360:2017
- BS EN 62479:2010

3. Facilities and Accreditations

3.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 645098
SHENZHEN TONGCE TESTING LAB
Designation Number: CN1205

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1
SHENZHEN TONGCE TESTING LAB
CAB identifier: CN0031

The testing lab has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

3.2. Location

Shenzhen TCT Testing Technology Co., Ltd.

Address: 2101 & 2201, Zhenchang Factory, Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

3.3. Environment Condition

Temperature:	18°C ~25°C
Humidity:	35%~75% RH
Atmospheric Pressure:	1011 mbar

4. Test Result Summary

The maximum results of Specific Absorption Rate (SAR) found during test as bellows:
<Highest Reported standalone SAR Summary>

Exposure Position	Frequency Band	Reported 10g SAR (W/kg)	Equipment Class	Highest Reported 10-g SAR (W/kg)
Head	GSM 900	0.11	PCE	0.57
	GSM 1800	0.22		
	WCDMA Band I	0.15		
	WCDMA Band VIII	0.18		
	LTE Band 1	0.26		
	LTE Band 3	0.48		
	LTE Band 7	0.57		
	LTE Band 8	0.16		
	LTE Band 20	0.18		
	LTE Band 40	0.12		
	5.2GWLAN	0.18	NII	
	5.8GWLAN	0.15	DTS	
	2.4GWLAN	0.38		
Body (5 mm Gap)	GSM900	0.22	PCE	0.88
	GSM1800	0.88		
	WCDMA Band I	0.39		
	WCDMA Band VIII	0.67		
	LTE Band 1	0.55		
	LTE Band 3	0.48		
	LTE Band 7	0.49		
	LTE Band 8	0.52		
	LTE Band 20	0.53		
	LTE Band 40	0.82		
	5.2GWLAN	0.23	NII	
	5.8GWLAN	0.19		
	2.4GWLAN	0.35	DTS	

Exposure Position	Frequency Band	Reported 10g SAR (W/kg)	Equipment Class	Highest Reported 10-g SAR (W/kg)
Front-to-face (10 mm Gap)	GSM900	0.06	PCE	0.28
	GSM1800	0.23		
	WCDMA Band I	0.11		
	WCDMA Band VIII	0.20		
	LTE Band 1	0.15		
	LTE Band 3	0.12		
	LTE Band 7	0.19		
	LTE Band 8	0.19		
	LTE Band 20	0.17		
	LTE Band 40	0.28		
	5.2GWLAN	0.07	NII	
	5.8GWLAN	0.05		
	2.4GWLAN	0.10	DTS	

Wrist Worn (0 mm Gap)	GSM900	0.63	PCE	1.44
	GSM1800	1.17		
	WCDMA Band I	0.70		
	WCDMA Band VIII	1.22		
	LTE Band 1	0.83		
	LTE Band 3	0.82		
	LTE Band 7	0.99		
	LTE Band 8	1.00		
	LTE Band 20	0.99		
	LTE Band 40	1.44		
	5.2GWLAN	0.34	NII	
	5.8GWLAN	0.31		
	2.4GWLAN	0.69	DTS	

<Highest Reported simultaneous SAR Summary>

Exposure Position	Highest Reported Simultaneous Transmission SAR (W/kg)	Limit (W/Kg)
Head 10-g SAR	0.95	2
Body-worn 10-g SAR (5 mm Gap)	1.23	2
Front-to-face (10 mm Gap)	0.38	4
Wrist Worn (0 mm Gap)	1.78	4

The EUT battery must be fully charged and checked periodically during the test to ascertain inform power output

This EUT has two batteries, and we have pre-tested the two batteries; we record the results of the worst-case battery in this report.

5. RF Exposure Limit

Type Exposure	AR (W kg)
	Uncontrolled Exposure Limit
Spatial Peak SAR (10g cube tissue for head and trunk)	2.00
Spatial Peak SAR (10g cube tissue for limbs)	4.00
Spatial Peak SAR (10g cube tissue for whole body)	0.08

Note:

1. This limit is according to recommendation 1999/519/EC, Annex II (Basic Restrictions)
2. Occupational/Uncontrolled 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)

6. SAR Measurement System Configuration

6.1. SAR Measurement Set-up

The OPENSAR system for performing compliance tests consist of the following items:

A standard high precision 6-axis robot (KUKA) with controller and software.

KUKA Control Panel (KCP)

A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with a Video Positioning System (VPS).

The stress sensor is composed with mechanical and electronic when the electronic part detects a change on the electro-mechanical switch; it sends an “Emergency signal” to the robot controller that to stop robot’s moves A computer operating Windows XP.

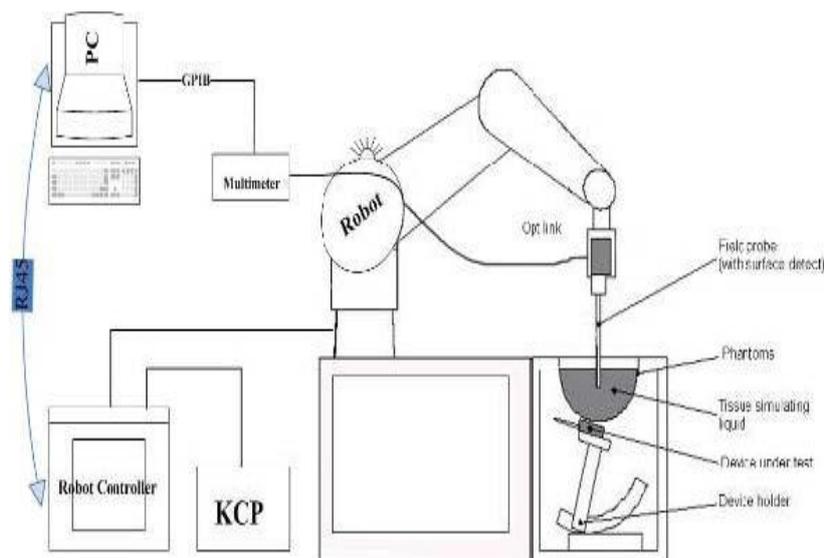
OPENSAR software Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

The SAM phantom enabling testing left-hand right-hand and body usage.

The Position device for handheld EUT

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles to validate the proper functioning of the system.



KUKA SAR Test System Configuration

6.2. E-field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by MVG).
The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

Probe Specification

Construction Symmetrical design with triangular core
Interleaved sensors
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration ISO/IEC 17025 calibration service available.

Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 36/20 EPGO346
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.217 M Dipole 2: R2=0.245 M Dipole 3: R3=0.219 M



Photo of E-Field Probe

6.3. Phantom

The SAM Phantom SAM120 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is in compliance with the specification set in IEEE P1528 and CENELEC EN62209-1, EN62209-2:2010.

The phantom enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region.

A cover prevents the evaporation of the liquid.

Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot

System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections.

Body SAR testing also used the flat section between the head profiles.

Name: COMOSAR IEEE SAM PHANTOM
S/N: SN 19/15 SAM 120
Manufacture: MVG



SAM Twin Phantom

6.4. Device Holder

In combination with the Generic Twin Phantom SAM120, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).



**COMOSAR Mobile
phone positioning
system**

6.5. Data Storage and Evaluation

Data Storage

The OPENSAR software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation

The OPENSAR software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	<i>Normi, ai0, ai1, ai2</i>
	- Conversion factor	<i>ConvFi</i>
	- Diode compression point	<i>Dcpi</i>
Device parameters:	- Frequency	<i>f</i>
	- Crest factor	<i>cf</i>
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the OPENSAR components. In the direct measuring mode of the millimetre option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot c f / d c p_i$$

With	<i>V_i</i>	= compensated signal of channel <i>i</i>	(<i>i</i> = x, y, z)
	<i>U_i</i>	= input signal of channel <i>i</i>	(<i>i</i> = x, y, z)
	<i>cf</i>	= crest factor of exciting field	(MVG parameter)
	<i>dcpi</i>	= diode compression point	(MVG parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$E\text{-field probes: } E_i = (V_i / \text{Norm}_i \cdot \text{Conv}F)^{1/2}$$

$$H\text{-field probes: } H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$$

With	V_i	= compensated signal of channel i	($i = x, y, z$)
	Norm_i	= sensor sensitivity of channel i	($i = x, y, z$)
		[mV/(V/m) ²] for E-field Probes	
	$\text{Conv}F$	= sensitivity enhancement in solution	
	a_{ij}	= sensor sensitivity factors for H-field probes	
	f	= carrier frequency [GHz]	
	E_i	= electric field strength of channel i in V/m	
	H_i	= magnetic field strength of channel i in A/m	

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{\text{tot}} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$\text{SAR} = (E_{\text{tot}})^2 \cdot \sigma / (\rho \cdot 1000)$$

with	SAR	= local specific absorption rate in mW/g
	E_{tot}	= total field strength in V/m
	σ	= conductivity in [mho/m] or [Siemens/m]
	ρ	= equivalent tissue density in g/cm ³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

6.6. Position of the wireless device in relation to the phantom

Handset Reference Points

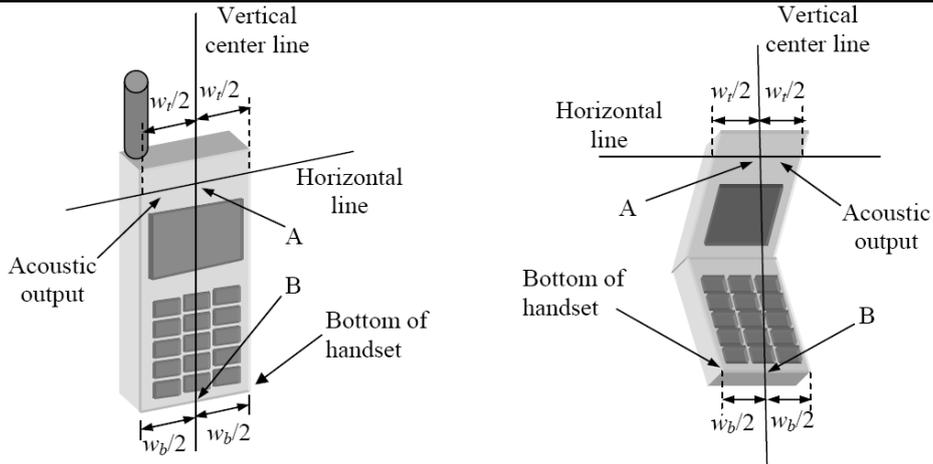
$$P_{\text{pwe}} = E_{\text{tot}}^2 / 3770 \text{ or } P_{\text{pwe}} = H_{\text{tot}}^2 \cdot 37.7$$

With **P_{pwe}** = equivalent power density of a plane wave in mW/cm²

E_{tot} = total electric field strength in V/m

H_{tot} = total magnetic field strength in A/m





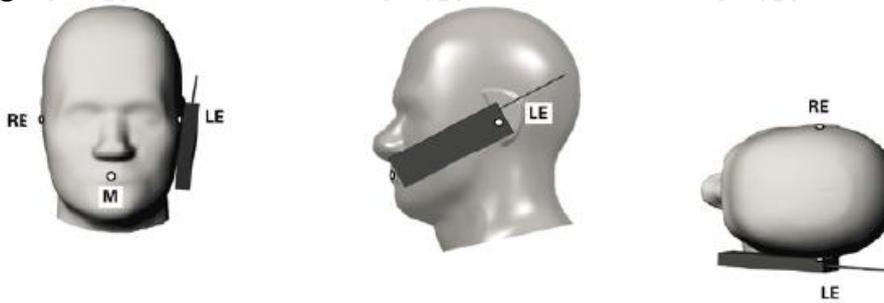
W_t Width of the handset at the level of the acoustic

W_b Width of the bottom of the handset

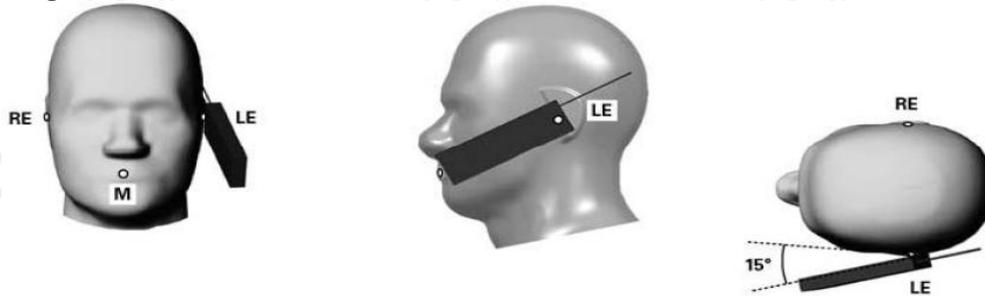
A Midpoint of the width w_t of the handset at the level of the acoustic output

B Midpoint of the width w_b of the bottom of the handset

Positioning for Cheek / Touch



Positioning for Ear / 15° Tilt



Body Worn Accessory Configurations

To position the device parallel to the phantom surface with either keypad up or down.

To adjust the device parallel to the flat phantom.

To adjust the distance between the device surface and the flat phantom to 5mm or holster surface and the flat phantom to 0 mm.

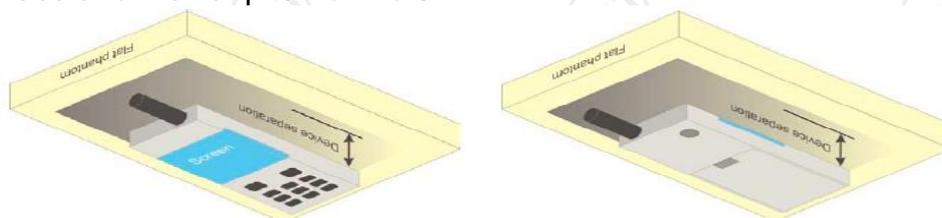


Illustration for Body Worn Position

6.7. Tissue Dielectric Parameters

According to EN 62209-2:2010, the liquid parameters for head are the same as body requirements. For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid a depth of at least 15cm, For head SAR testing, the liquid height from the ear reference point(ERP) of the phantom to the liquid top surface is larger than 15cm, For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm.

Frequency (MHz)	Liquid Type	Liquid Type (σ)	\pm 5% Range	Permittivity (ϵ)	\pm 5% Range
300	Head	0.87	0.83~0.91	45.3	43.04~47.57
50	Head	0.87	0.83~0.91	43.5	41.33~45.68
835	Head	0.90	0.86~0.95	41.5	39.43~43.58
900	Head	0.97	0.92~1.02	41.5	39.43~43.58
1800-2000	Head	1.40	1.33~1.47	40.0	38.00~42.00
2450	Head	1.80	1.71~1.89	39.2	37.24~41.16
2600	Head	1.96	1.86~2.06	39.0	37.05~40.95
3000	Head	2.40	2.28~2.52	38.5	36.58~40.43
5800	Head	5.27	5.01~5.53	35.3	33.54~37.07

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000$ kg/m³)

6.8. Tissue-equivalent Liquid Properties

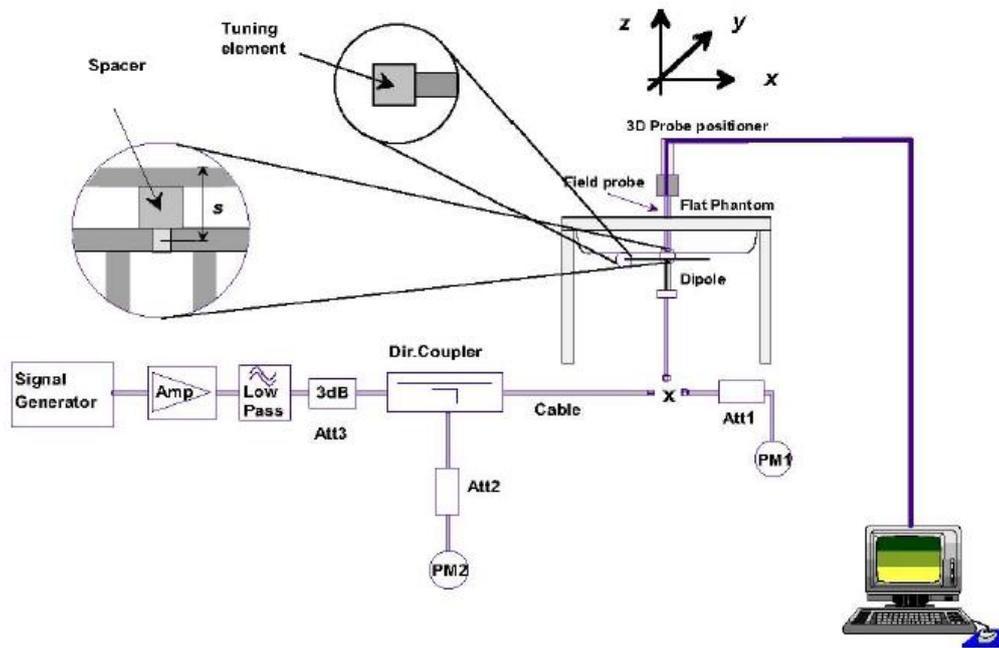
Frequency (MHz)	Test Date	Temp °C	ϵ_r	σ (s/m)
900	08/15/2022	22	41.92	0.96
1800	08/17/2022	22	38.85	1.41
2000	08/18/2022	22	39.72	1.43
2450	08/22/2022	22	38.35	1.92
2600	08/23/2022	22	38.34	1.92
5200	08/30/2022	22	35.07	5.22

6.9. System Check

The SAR system must be validated against its performance specifications before it is deployed. When SAR probe and system component or software are changed, upgraded or recalibrated, these must be validated with the SAR system(s) that operates with such component. Reference dipoles are used with the required tissue-equivalent media for system validation.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ($\pm 10\%$).

System check is performed regularly on all frequency bands where tests are performed with the OPENSAR system.



System Check Set-up

Verification Results:

Data	Frequency (MHz)	Measured Value in 31.6mW (W/kg)		Normalized to 1W (W/kg)		Target Value (W/kg)		Deviation (%)	
		1 g Average	10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average	10 g Average
08/15/2022	900	0.33	0.21	10.44	6.65	10.90	6.99	-4.19	-4.93
08/17/2022	1800	1.16	0.63	36.71	19.94	38.40	20.10	-4.40	-0.81
08/18/2022	2000	1.30	0.67	41.14	21.20	41.10	21.10	0.10	0.49
08/22/2022	2450	1.59	0.74	49.69	23.13	52.40	24.00	-5.17	-3.63
08/23/2022	2600	1.69	0.78	53.48	24.68	54.11	24.03	-1.16	2.72
08/30/2022	5200	5.01	1.81	158.7	57.2	163.88	56.90	-3.16	0.53

Comparing to the original SAR value provided by MVG, 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 as below indicates the system performance check can meet the variation criterion and the plots can be referred to Section 10 of this report.

7. Measurement Procedure

7.1. Measurement Process Diagram

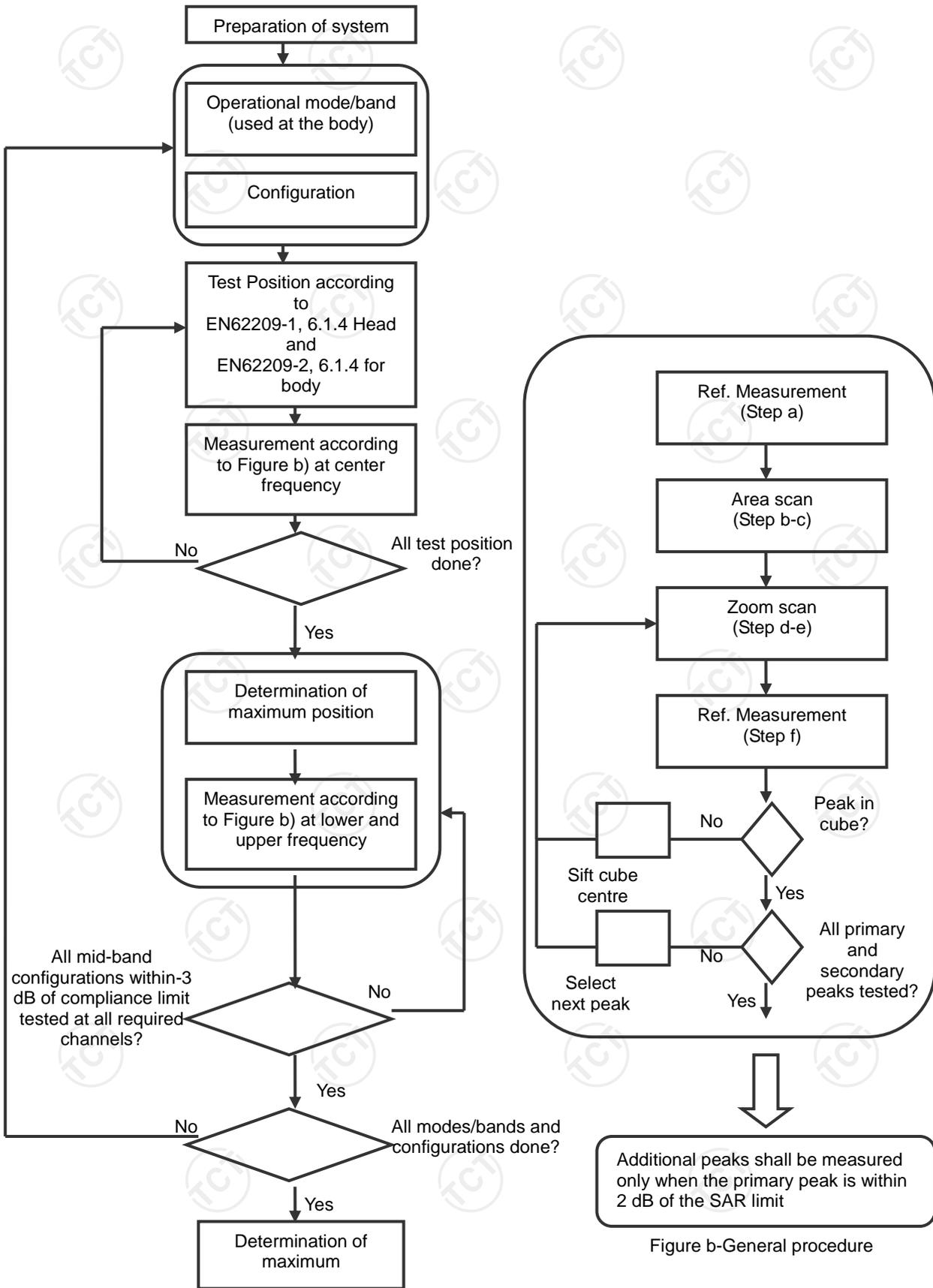


Figure a-Tests to be performed

Figure b-General procedure

7.2. Measurement Procedure

Setup a Call Connection

Establish a call in handset at the maximum power level with a base station simulator via air interface, or make the EUT estimate by itself in testing band.

Power Reference Measurement

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

Area Scan

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm² step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2003, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard.

Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 4 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more than one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

Power Drift measurement

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have OPENSAR software stop the measurements if this limit is exceeded. If the power drifts more than 5%, the SAR will be retested.

8. Conducted Output Power

Band: GSM 900		Measured Power (dBm)			Calculation (dB)	Averaged Power (dBm)		
Channel	975	60	124	975		60	124	
Frequency	880.2	902	914.8	880.2		902	914.8	
GSM (GMSK, Voice)	33.11	33.43	33.39	-9.03	24.08	24.40	24.36	
GPRS (GMSK, 1-slot)	33.48	33.60	33.65	-9.03	24.45	24.57	24.62	
GPRS (GMSK, 2-slot)	32.75	32.88	32.93	-6.02	26.73	26.86	26.91	
GPRS (GMSK, 3-slot)	30.83	30.81	31.08	-4.26	26.57	26.55	26.82	
GPRS (GMSK, 4-slot)	29.55	29.69	29.68	-3.01	26.54	26.68	26.67	
EGPRS (GMSK, 1-slot)	26.22	26.26	26.29	-9.03	17.19	17.23	17.26	
EGPRS (GMSK, 2-slot)	25.15	25.12	25.14	-6.02	19.13	19.10	19.12	
EGPRS (GMSK, 3-slot)	22.93	22.74	22.87	-4.26	18.67	18.48	18.61	
EGPRS (GMSK, 4-slot)	21.70	21.66	21.76	-3.01	18.69	18.65	18.75	
Band: GSM 1800		Measured Power (dBm)			Calculation (dB)	Averaged Power (dBm)		
Channel	512	700	885	512		700	885	
Frequency	1710.2	1747.8	1784.8	1710.2		1747.8	1784.8	
GSM (GMSK, Voice)	29.87	29.93	29.21	-9.03	20.84	20.90	20.18	
GPRS (GMSK, 1-slot)	29.98	29.99	29.26	-9.03	20.95	20.96	20.23	
GPRS (GMSK, 2-slot)	28.96	28.64	28.37	-6.02	22.94	22.62	22.35	
GPRS (GMSK, 3-slot)	27.42	27.04	26.56	-4.26	23.16	22.78	22.30	
GPRS (GMSK, 4-slot)	25.96	25.96	25.41	-3.01	22.95	22.95	22.40	
EGPRS (GMSK, 1-slot)	26.30	26.26	25.40	-9.03	17.27	17.23	16.37	
EGPRS (GMSK, 2-slot)	25.21	25.20	24.09	-6.02	19.19	19.18	18.07	
EGPRS (GMSK, 3-slot)	23.08	23.44	22.23	-4.26	18.82	19.18	17.97	
EGPRS (GMSK, 4-slot)	21.68	21.81	21.07	-3.01	18.67	18.80	18.06	

Note:

- Division Factors
To average the power, the division factor is as follows:
 1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB
 2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB
 3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB
 4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB
- According to the conducted power as above, the body measurements are performed with 4Txslots for 900MHz and 1800 MHz for GPRS.

Band	WCDMA Band I			WCDMA Band VIII		
Channel	9612	9750	9888	2712	2788	2863
Frequency	1922.4	1950	1977.6	882.4	897.6	912.6
RMC 12.2Kbps	22.48	22.56	22.34	22.67	22.78	22.55
HSDPA Subtest-1	22.02	22.15	22.07	22.07	22.20	22.12
HSDPA Subtest-2	21.72	21.84	21.79	21.77	21.89	21.84
HSDPA Subtest-3	21.66	21.79	21.73	21.71	21.84	21.78
HSDPA Subtest-4	21.60	21.77	21.72	21.65	21.82	21.77
HSUPA Subtest-1	21.36	21.49	21.39	21.41	21.54	21.44
HSUPA Subtest-2	21.26	21.39	21.31	21.31	21.44	21.36
HSUPA Subtest-3	21.21	21.02	20.99	21.26	21.07	21.04
HSUPA Subtest-4	20.82	20.96	20.87	20.87	21.01	20.92
HSUPA Subtest-5	20.73	20.80	20.78	20.78	20.85	20.83

Note:

1. According to the power listed above, the HSDPA and HSUPA were not determined for SAR testing.
2. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode

WLAN 2.4G						
Mode	802.11b			802.11g		
Channel	1	7	13	1	7	13
Frequency	2412	2442	2472	2412	2442	2472
Average Power (dBm)	14.97	14.72	13.11	11.21	12.72	10.88
Mode	802.11n(HT20)			802.11n(HT40)		
Channel	1	7	13	3	7	11
Frequency	2412	2442	2472	2422	2442	2462
Average Power (dBm)	11.04	12.65	10.87	10.53	11.18	11.52
BDR+EDR						
Mode	GFSK		Pi/4DQPSK		8DPSK	
Average Power (dBm)	4.42		3.28		3.44	
Mode	BLE(1M)					
Frequency	2402		2440		2480	
Average Power (dBm)	-10.95		-7.53		-9.28	
Mode	BLE(2M)					
Frequency	2402		2440		2480	
Average Power (dBm)	-10.23		-7.50		-9.27	

Note:

1. Because the output power(eirp) of Bluetooth of the EUT is less than 20mW(13dBm), so standalone SAR are exempt according to EN62479.

WLAN 5G						
Mode	802.11a					
Channel	36	48	149	157	165	
Frequency	5180	5240	5745	5785	5825	
Average Power (dBm)	9.05	7.58	8.47	9.24	8.50	
Mode	802.11n					
Channel	36	38	46	48	149	149
Frequency	5180	5190	5230	5240	5745	5745
Average Power (dBm)	8.47	7.42	8.99	7.01	8.70	8.70
Channel	151	157	159	165		
Frequency	5755	5785	5795	5825		
Average Power (dBm)	8.51	9.06	9.03	8.25		
Mode	802.11ac					
Channel	36	38	46	48	149	151
Frequency	5180	5190	5230	5240	5745	5755
Average Power (dBm)	8.63	7.38	8.15	7.18	8.50	8.45
Channel	155	157	159	165		
Frequency	5775	5785	5795	5825		
Average Power (dBm)	8.47	9.28	8.99	8.52		

NFC

About NFC reference to Reference levels for electric, magnetic and electromagnetic fields (0Hz to 300GHz,unperturbed ms values)

Frequency range	E-field strength (V/m)	H-field strength (A/m)	B-field (uT)	Equivalent plane wave power density Seq(W/m2)
0-1Hz	--	3.2×10^4	4×10^4	--
1-8Hz	10000	$3.2 \times 10^4/f^2$	$4 \times 10^4/f^2$	--
8-25Hz	10000	$4000/f$	$5000/f$	--
0.025-0.8KHz	$250/f$	$4/f$	$5/f$	--
0.8-3KHz	$250/f$	5	6.25	--
3-150KHz	87	5	6.25	--
0.15-1MHz	87	$0.73/f$	$0.92/f$	--
1-10MHz	$87/f^{1/2}$	$0.73/f$	$0.92/f$	--
10-400MHz	28	0.073	0.092	2
400-2000MHz	$1.375f^{1/2}$	$0.0037f^{1/2}$	$0.0046f^{1/2}$	$f/200$
2-300GHz	61	0.16	0.20	10

Reference to B19N02883-NFC

Maximum Emissions Level					
Mode	Frequency (MHz)	H-field Level (dB μ A/m)	H-field Level (A/m)	Limit (A/m)	Result
NFC	13.56	-12.8	2.291×10^{-7}	0.073	PASS

$H^{10M} = -12.80 \text{ dB}\mu\text{A/m} = 2.291 \times 10^{-6} \text{ A/m} < 0.073 \text{ A/m}$

So the SAR measurement for the of NFC is not necessary

The conducted power measurement results for LTE

LTE-BAND 1

Condition	Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
			RB Size	RB Offset		
Normal	5MHz	Low range	1	0	22.72	22.54
				max	22.61	22.43
			Partial	0	22.82	22.64
				max	22.72	22.54
		Mid range	1	0	22.45	22.27
				max	22.35	22.17
			Partial	0	22.45	22.27
				max	22.44	22.26
		High range	1	0	22.27	22.09
				max	22.22	22.04
			Partial	0	22.19	22.01
				max	22.27	22.08
	20MHz	Low range	1	0	22.58	22.39
				max	22.50	22.32
			Partial	0	22.42	22.24
				max	22.49	22.31
		Mid range	1	0	22.98	22.80
				max	22.25	22.07
			Partial	0	22.20	22.02
				max	22.05	21.87
		High range	1	0	22.05	21.87
				max	21.55	21.37
			Partial	0	21.73	21.55
				max	21.74	21.56

LTE-BAND 3

Condition	Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
			RB Size	RB Offset		
Normal	1.4MHz	Low range	1	0	22.11	21.93
				max	22.10	21.92
			Partial	0	22.15	21.97
				max	21.49	21.31
		Mid range	1	0	21.87	21.69
				max	21.85	21.67
			Partial	0	21.86	21.68
				max	21.81	21.63
		High range	1	0	21.87	21.69
				max	21.38	21.20
			Partial	0	21.47	21.29
				max	21.54	21.35
	5 MHz	Low range	1	0	22.11	21.92
				max	22.07	21.89
			Partial	0	22.12	21.94
				max	21.82	21.64
		Mid range	1	0	21.88	21.70
				max	21.39	21.21
			Partial	0	21.44	21.26
				max	21.37	21.19
		High range	1	0	21.43	21.25
				max	21.40	21.22
			Partial	0	21.38	21.20
				max	21.40	21.22
	20 MHz	Low range	1	0	22.02	21.84
				max	21.89	21.71
			Partial	0	21.91	21.73
				max	21.44	21.26
		Mid range	1	0	22.16	21.98
				max	21.32	21.15
			Partial	0	21.36	21.17
				max	21.33	21.16
		High range	1	0	21.20	21.02
				max	21.25	21.07
			Partial	0	21.32	21.20
				max	21.30	21.18

LTE-BAND 7

Condition	Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
			RB Size	RB Offset		
Normal	5MHz	Low range	1	0	22.34	22.16
				max	21.71	21.53
			Partial	0	21.88	21.70
				max	21.86	21.68
		Mid range	1	0	21.83	21.65
				max	21.79	21.61
			Partial	0	21.79	21.61
				max	21.78	21.60
		High range	1	0	21.86	21.68
				max	21.98	21.80
			Partial	0	21.98	21.80
				max	22.28	22.09
	20MHz	Low range	1	0	21.85	21.66
				max	21.77	21.59
			Partial	0	21.83	21.65
				max	21.80	21.62
		Mid range	1	0	22.37	22.19
				max	21.73	21.55
			Partial	0	21.59	21.41
				max	21.60	21.42
		High range	1	0	21.76	21.58
				max	21.72	21.54
			Partial	0	21.79	21.61
				max	22.34	22.16

LTE-BAND 8

Condition	Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
			RB Size	RB Offset		
Normal	1.4MHz	Low range	1	0	22.95	22.77
				max	23.55	23.37
			Partial	0	23.55	23.37
				max	23.57	23.39
		Mid range	1	0	23.06	22.88
				max	23.04	22.86
			Partial	0	23.05	22.87
				max	23.06	22.88
		High range	1	0	22.89	22.71
				max	22.87	22.69
			Partial	0	22.92	22.74
				max	22.92	22.73
	5 MHz	Low range	1	0	23.59	23.40
				max	23.55	23.37
			Partial	0	23.55	23.37
				max	23.47	23.29
		Mid range	1	0	23.08	22.90
				max	23.05	22.87
			Partial	0	23.07	22.89
				max	23.01	22.83
		High range	1	0	23.05	22.87
				max	22.95	22.77
			Partial	0	23.08	22.90
				max	22.92	22.74
	10 MHz	Low range	1	0	23.58	23.40
				max	23.23	23.05
			Partial	0	23.52	23.34
				max	23.37	23.19
		Mid range	1	0	23.59	23.41
				max	23.08	22.91
Partial			0	23.14	22.95	
			max	23.00	22.83	
High range		1	0	22.98	22.80	
			max	22.95	22.77	
		Partial	0	23.06	22.94	
			max	23.00	22.88	

LTE-BAND 20

Condition	Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
			RB Size	RB Offset		
Normal	5MHz	Low range	1	0	23.35	23.17
				max	23.20	23.02
			Partial	0	23.20	23.02
				max	23.19	23.01
		Mid range	1	0	23.19	23.01
				max	23.31	23.13
			Partial	0	23.18	23.00
				max	23.25	23.07
		High range	1	0	23.33	23.15
				max	23.28	23.10
			Partial	0	23.25	23.07
				max	23.25	23.06
	20MHz	Low range	1	0	23.31	23.12
				max	23.21	23.03
			Partial	0	23.07	22.89
				max	23.24	23.06
		Mid range	1	0	23.41	23.23
				max	23.26	23.08
			Partial	0	23.28	23.10
				max	23.18	23.00
		High range	1	0	23.13	22.95
				max	23.16	22.98
			Partial	0	23.23	23.05
				max	23.32	23.14

LTE-BAND 40

Condition	Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
			RB Size	RB Offset		
Normal	5MHz	Low range	1	0	22.93	22.75
				max	22.80	22.62
			Partial	0	23.06	22.88
				max	23.02	22.84
		Mid range	1	0	23.12	22.94
				max	23.12	22.94
			Partial	0	23.10	22.92
				max	23.17	22.99
		High range	1	0	23.01	22.83
				max	23.04	22.86
			Partial	0	23.13	22.95
				max	23.11	22.92
	20MHz	Low range	1	0	22.96	22.77
				max	22.80	22.62
			Partial	0	22.92	22.74
				max	22.83	22.65
		Mid range	1	0	23.19	23.01
				max	23.07	22.89
			Partial	0	23.10	22.92
				max	23.10	22.92
		High range	1	0	23.03	22.85
				max	22.98	22.80
			Partial	0	23.01	22.83
				max	22.89	22.71

9. SAR Test Results Summary

9.1. Head SAR 10g Value

Band	Mode	Position	CH.	Freq. (MHz)	Meas. Power (dBm)	Max. Tune-Up Power (dBm)	Power Drift (%)	Meas. SAR10g (W/kg)	Scaling Factor	Reported SAR10g (W/kg)	Limit (W/Kg)
GSM900	voice	Right Cheek	60	902	33.43	33.50	3.24	0.09	1.016	0.09	2.00
		Right Tilt	60	902	33.43	33.50	-1.22	0.04	1.016	0.04	
		Left Cheek	60	902	33.43	33.50	-2.68	0.11	1.016	0.11	
		Left Tilt	60	902	33.43	33.50	0.02	0.05	1.016	0.05	
GSM1800	voice	Right Cheek	700	1747.8	29.93	30.00	0.42	0.20	1.016	0.20	
		Right Tilt	700	1747.8	29.93	30.00	-0.31	0.10	1.016	0.10	
		Left Cheek	700	1747.8	29.93	30.00	0.31	0.22	1.016	0.22	
		Left Tilt	700	1747.8	29.93	30.00	-2.64	0.11	1.016	0.11	
WCDMA Band I	RMC	Right Cheek	9750	1950	22.56	23.00	2.46	0.12	1.107	0.13	
		Right Tilt	9750	1950	22.56	23.00	-0.39	0.06	1.107	0.07	
		Left Cheek	9750	1950	22.56	23.00	2.82	0.14	1.107	0.15	
		Left Tilt	9750	1950	22.56	23.00	-2.67	0.07	1.107	0.08	
WCDMA Band VIII	RMC	Right Cheek	2788	897.6	22.78	23.00	0.87	0.15	1.052	0.16	
		Right Tilt	2788	897.6	22.78	23.00	1.37	0.07	1.052	0.07	
		Left Cheek	2788	897.6	22.78	23.00	-1.42	0.17	1.052	0.18	
		Left Tilt	2788	897.6	22.78	23.00	0.06	0.08	1.052	0.08	
802.11b	DATA	Right Cheek	07	2442	14.97	15.00	-1.36	0.36	1.007	0.36	
		Right Tilt	07	2442	14.97	15.00	-0.34	0.21	1.007	0.21	
		Left Cheek	07	2442	14.97	15.00	1.18	0.38	1.007	0.38	
		Left Tilt	07	2442	14.97	15.00	2.21	0.23	1.007	0.23	
802.11a	DATA	Right Cheek	36	5180	9.05	9.50	-1.50	0.16	1.109	0.18	
		Right Tilt	36	5180	9.05	9.50	2.24	0.08	1.109	0.09	
		Left Cheek	36	5180	9.05	9.50	-0.47	0.14	1.109	0.16	
		Left Tilt	36	5180	9.05	9.50	0.33	0.07	1.109	0.08	

802.11ac	DATA	Right Cheek	157	5785	9.28	9.50	1.09	0.12	1.052	0.13
		Right Tilt	157	5785	9.28	9.50	-2.01	0.06	1.052	0.06
		Left Cheek	157	5785	9.28	9.50	-2.15	0.14	1.052	0.15
		Left Tilt	157	5785	9.28	9.50	3.04	0.07	1.052	0.07

Band	Mode	Test Position	CH.	Freq. (MHz)	RB allocation	RB offset	Ave. Power (dBm)	Tune-Up Limit (dBm)	Power Drift (%)	Meas. SAR10g (W/kg)	Scaling Factor	Reported SAR10g (W/kg)
LTE Band 1	QPSK (20MHz)	Right Cheek	18300	1950	1	0	22.98	23.00	-2.57	0.24	1.005	0.24
		Right Tilt	18300	1950	1	0	22.98	23.00	2.63	0.12	1.005	0.12
		Left Cheek	18300	1950	1	0	22.98	23.00	0.66	0.26	1.005	0.26
		Left Tilt	18300	1950	1	0	22.98	23.00	1.08	0.14	1.005	0.14
LTE Band 3	QPSK (20MHz)	Right Cheek	19575	1747.5	1	0	22.16	22.50	-1.11	0.42	1.081	0.45
		Right Tilt	19575	1747.5	1	0	22.16	22.50	2.99	0.27	1.081	0.29
		Left Cheek	19575	1747.5	1	0	22.16	22.50	0.54	0.44	1.081	0.48
		Left Tilt	19575	1747.5	1	0	22.16	22.50	-2.36	0.29	1.081	0.31
LTE Band 7	QPSK (20MHz)	Right Cheek	21100	2535	1	0	22.37	22.50	0.34	0.50	1.030	0.52
		Right Tilt	21100	2535	1	0	22.37	22.50	-0.21	0.30	1.030	0.31
		Left Cheek	21100	2535	1	0	22.37	22.50	3.72	0.55	1.030	0.57
		Left Tilt	21100	2535	1	0	22.37	22.50	1.27	0.32	1.030	0.33
LTE Band 8	QPSK (10MHz)	Right Cheek	21625	897.5	1	0	23.59	24.00	0.21	0.12	1.099	0.13
		Right Tilt	21625	897.5	1	0	23.59	24.00	2.04	0.06	1.099	0.07
		Left Cheek	21625	897.5	1	0	23.59	24.00	-0.60	0.15	1.099	0.16
		Left Tilt	21625	897.5	1	0	23.59	24.00	-2.69	0.07	1.099	0.08
LTE Band 20	QPSK (20MHz)	Right Cheek	24300	847	1	0	23.41	23.50	-0.34	0.16	1.021	0.16
		Right Tilt	24300	847	1	0	23.41	23.50	0.05	0.09	1.021	0.09
		Left Cheek	24300	847	1	0	23.41	23.50	-3.53	0.18	1.021	0.18
		Left Tilt	24300	847	1	0	23.41	23.50	-3.02	0.10	1.021	0.10
LTE Band 40	QPSK (20MHz)	Right Cheek	39150	2350	1	0	23.19	23.50	-1.02	0.10	1.074	0.11
		Right Tilt	39150	2350	1	0	23.19	23.50	-2.05	0.05	1.074	0.05
		Left Cheek	39150	2350	1	0	23.19	23.50	1.93	0.11	1.074	0.12
		Left Tilt	39150	2350	1	0	23.19	23.50	1.67	0.06	1.074	0.06

9.2. Body-Worn 10g SAR Value

Band	Mode	Test Position with 5mm	CH.	Freq. (MHz)	Meas. Power (dBm)	Max. Tune-Up Power (dBm)	Power Drift (%)	Meas. SAR10g (W/kg)	Scaling Factor	Reported SAR10g (W/kg)	Limit (W/Kg)
GSM900	voice	Back	60	902	33.43	33.50	-2.54	0.22	1.016	0.22	2.00
		Front	60	902	33.43	33.50	-1.07	0.11	1.016	0.11	
	GPRS 2 slots	Back	60	902	32.88	33.00	2.28	0.20	1.028	0.21	
		Front	60	902	32.88	33.00	0.65	0.10	1.028	0.10	
		Left	60	902	32.88	33.00	-1.44	0.02	1.028	0.02	
		Right	60	902	32.88	33.00	-1.12	0.02	1.028	0.02	
		Top	60	902	32.88	33.00	2.81	0.01	1.028	0.01	
Bottom	60	902	32.88	33.00	1.07	0.01	1.028	0.01			
GSM1800	voice	Back	700	1747.8	29.93	30.00	-2.79	0.73	1.016	0.74	
		Front	700	1747.8	29.93	30.00	-1.34	0.43	1.016	0.44	
	GPRS 4 slots	Back	700	1747.8	25.96	26.00	0.61	0.87	1.009	0.88	
		Front	700	1747.8	25.96	26.00	-1.37	0.52	1.009	0.52	
		Left	700	1747.8	25.96	26.00	-2.61	0.01	1.009	0.01	
		Right	700	1747.8	25.96	26.00	0.69	0.01	1.009	0.01	
		Top	700	1747.8	25.96	26.00	0.44	0.01	1.009	0.01	
Bottom	700	1747.8	25.96	26.00	-1.54	0.02	1.009	0.02			
WCDMA Band I	RMC	Back	9750	1950	22.56	23.00	0.55	0.35	1.107	0.39	
		Front	9750	1950	22.56	23.00	-3.54	0.20	1.107	0.22	
		Left	9750	1950	22.56	23.00	-1.40	0.03	1.107	0.03	
		Right	9750	1950	22.56	23.00	3.05	0.02	1.107	0.02	
		Top	9750	1950	22.56	23.00	-1.35	0.01	1.107	0.01	
		Bottom	9750	1950	22.56	23.00	1.03	0.01	1.107	0.01	

WCDMA Band VIII	RMC	Back	2788	897.6	22.78	23.00	-0.12	0.64	1.052	0.67
		Front	2788	897.6	22.78	23.00	2.34	0.34	1.052	0.36
		Left	2788	897.6	22.78	23.00	0.51	0.01	1.052	0.01
		Right	2788	897.6	22.78	23.00	-1.62	0.01	1.052	0.01
		Top	2788	897.6	22.78	23.00	-1.04	0.02	1.052	0.02
		Bottom	2788	897.6	22.78	23.00	3.16	0.01	1.052	0.01
802.11b	DATA	Back	07	2442	14.97	15.00	1.13	0.35	1.007	0.35
		Front	07	2442	14.97	15.00	-2.69	0.20	1.007	0.20
		Left	07	2442	14.97	15.00	0.61	0.02	1.007	0.02
		Right	07	2442	14.97	15.00	-1.69	0.01	1.007	0.01
		Top	07	2442	14.97	15.00	1.21	0.01	1.007	0.01
		Bottom	07	2442	14.97	15.00	2.63	0.01	1.007	0.01
802.11a	DATA	Back	36	5180	9.05	9.50	-1.66	0.21	1.109	0.23
		Front	36	5180	9.05	9.50	0.79	0.11	1.109	0.12
		Left	36	5180	9.05	9.50	1.98	0.01	1.109	0.01
		Right	36	5180	9.05	9.50	-1.02	0.01	1.109	0.01
		Top	36	5180	9.05	9.50	2.34	0.01	1.109	0.01
		Bottom	36	5180	9.05	9.50	3.32	0.01	1.109	0.01
802.11ac	DATA	Back	157	5785	9.28	9.50	-0.30	0.18	1.052	0.19
		Front	157	5785	9.28	9.50	-1.36	0.10	1.052	0.11
		Left	157	5785	9.28	9.50	-2.60	0.01	1.052	0.01
		Right	157	5785	9.28	9.50	-3.66	0.01	1.052	0.01
		Top	157	5785	9.28	9.50	2.51	0.01	1.052	0.01
		Bottom	157	5785	9.28	9.50	1.65	0.01	1.052	0.01

2.00

Band	Mode	Test Position with 5mm	CH.	Freq. (MHz)	RB allocation	RB offset	Ave. Power (dBm)	Tune-Up Limit (dBm)	Power Drift (%)	Meas. SAR10g (W/kg)	Scaling Factor	Reported SAR10g (W/kg)
LTE Band 1	QPSK (20MHz)	Back	18300	1950	1	0	22.98	23.00	-0.34	0.55	1.005	0.55
		Front	18300	1950	1	0	22.98	23.00	-1.60	0.30	1.005	0.30
		Left	18300	1950	1	0	22.98	23.00	-1.61	0.02	1.005	0.02
		Right	18300	1950	1	0	22.98	23.00	-2.62	0.02	1.005	0.02
		Top	18300	1950	1	0	22.98	23.00	-1.33	0.01	1.005	0.01
		Bottom	18300	1950	1	0	22.98	23.00	2.07	0.01	1.005	0.01
LTE Band 3	QPSK (20MHz)	Back	19575	1747.5	1	0	22.16	22.50	0.25	0.44	1.081	0.48
		Front	19575	1747.5	1	0	22.16	22.50	0.20	0.22	1.081	0.24
		Left	19575	1747.5	1	0	22.16	22.50	-1.46	0.02	1.081	0.02
		Right	19575	1747.5	1	0	22.16	22.50	1.06	0.01	1.081	0.01
		Top	19575	1747.5	1	0	22.16	22.50	2.07	0.01	1.081	0.01
		Bottom	19575	1747.5	1	0	22.16	22.50	3.21	0.01	1.081	0.01
LTE Band 7	QPSK (20MHz)	Back	21100	2535	1	0	22.37	22.50	0.32	0.48	1.030	0.49
		Front	21100	2535	1	0	22.37	22.50	-1.68	0.28	1.030	0.29
		Left	21100	2535	1	0	22.37	22.50	1.63	0.02	1.030	0.02
		Right	21100	2535	1	0	22.37	22.50	2.55	0.02	1.030	0.02
		Top	21100	2535	1	0	22.37	22.50	-3.72	0.01	1.030	0.01
		Bottom	21100	2535	1	0	22.37	22.50	1.30	0.01	1.030	0.01
LTE Band 8	QPSK (10MHz)	Back	21625	897.5	1	0	23.59	24.00	-0.33	0.47	1.099	0.52
		Front	21625	897.5	1	0	23.59	24.00	-0.93	0.27	1.099	0.30
		Left	21625	897.5	1	0	23.59	24.00	-1.25	0.01	1.099	0.01
		Right	21625	897.5	1	0	23.59	24.00	2.41	0.01	1.099	0.01
		Top	21625	897.5	1	0	23.59	24.00	-3.33	0.02	1.099	0.02
		Bottom	21625	897.5	1	0	23.59	24.00	2.62	0.01	1.099	0.01

LTE Band 20	QPSK (20MHz)	Back	24300	847	1	0	23.41	23.50	-1.85	0.52	1.021	0.53
		Front	24300	847	1	0	23.41	23.50	-1.73	0.27	1.021	0.28
		Left	24300	847	1	0	23.41	23.50	1.30	0.02	1.021	0.02
		Right	24300	847	1	0	23.41	23.50	-2.14	0.01	1.021	0.01
		Top	24300	847	1	0	23.41	23.50	-3.01	0.01	1.021	0.01
		Bottom	24300	847	1	0	23.41	23.50	2.16	0.01	1.021	0.01
LTE Band 40	QPSK (20MHz)	Back	39150	2350	1	0	23.19	23.50	-0.87	0.76	1.074	0.82
		Front	39150	2350	1	0	23.19	23.50	-3.60	0.46	1.074	0.49
		Left	39150	2350	1	0	23.19	23.50	1.75	0.02	1.074	0.02
		Right	39150	2350	1	0	23.19	23.50	2.06	0.01	1.074	0.01
		Top	39150	2350	1	0	23.19	23.50	-1.09	0.01	1.074	0.01
		Bottom	39150	2350	1	0	23.19	23.50	2.61	0.01	1.074	0.01

Note:

1. Body-worn SAR testing was performed at 0mm separation, and this distance is determined by the handset manufacturer that there will be body-worn accessories that users may acquire at the time of equipment certification, to enable users to purchase aftermarket body-worn accessories with the required minimum separation.
2. Determination of the worst-case configuration and all configurations with less than 3 dB of applicable limits.
3. When $10g \text{ SAR} \leq 1.0 \text{ W/kg}$, testing for low and high channel is optional.

9.3. Front-to-face 10g SAR

Band	Mode	Test Position with 10mm	CH.	Freq. (MHz)	Meas. Power (dBm)	Max. Tune-Up Power (dBm)	Power Drift (%)	Meas. SAR10g (W/kg)	Scaling Factor	Reported SAR10g (W/kg)	Limit (W/Kg)
GSM900	voice	Front	60	902	33.43	33.50	2.33	0.06	1.016	0.06	4.00
GSM1800	voice	Front	700	1747.8	29.93	30.00	-1.71	0.23	1.016	0.23	
WCDMA Band I	RMC	Front	9750	1950	22.56	23.00	2.02	0.10	1.107	0.11	
WCDMA Band VIII	RMC	Front	2788	897.6	22.78	23.00	-0.89	0.19	1.052	0.20	
802.11b	DATA	Front	07	2442	14.97	15.00	1.22	0.10	1.007	0.10	
802.11a	DATA	Front	36	5180	9.05	9.50	-0.92	0.06	1.109	0.07	
802.11ac	DATA	Front	157	5785	9.28	9.50	-1.33	0.05	1.052	0.05	

Band	Mode	Test Position with 10mm	CH.	Freq. (MHz)	RB allocation	RB offset	Ave. Power (dBm)	Tune-Up Limit (dBm)	Power Drift (%)	Meas. SAR10g (W/kg)	Scaling Factor	Reported SAR10g (W/kg)
LTE Band 1	QPSK (20MHz)	Front	18300	1950	1	0	22.98	23.00	1.04	0.15	1.005	0.15
LTE Band 3	QPSK (20MHz)	Front	19575	1747.5	1	0	22.16	22.50	0.17	0.11	1.081	0.12
LTE Band 7	QPSK (20MHz)	Front	21100	2535	1	0	22.37	22.50	-0.16	0.18	1.030	0.19
LTE Band 8	QPSK (10MHz)	Front	21625	897.5	1	0	23.59	24.00	1.54	0.17	1.099	0.19
LTE Band 20	QPSK (20MHz)	Front	24300	847	1	0	23.41	23.50	-0.24	0.17	1.021	0.17
LTE Band 40	QPSK (20MHz)	Front	39150	2350	1	0	23.19	23.50	0.21	0.26	1.074	0.28

Note:

1. Front-to-face SAR testing was performed at 10mm separation.
2. Determination of the worst-case configuration and all configurations with less than 3 dB of applicable limits.
3. When 10g SAR \leq 2.0 W/kg for front-to-face, testing for low and high channel is optional.

9.4. Wrist Worn 10g SAR

Band	Mode	Test Position with 0mm	CH.	Freq. (MHz)	Meas. Power (dBm)	Max. Tune-Up Power (dBm)	Power Drift (%)	Meas. SAR10g (W/kg)	Scaling Factor	Reported SAR10g (W/kg)	Limit (W/Kg)
GSM900	voice	Back	60	902	33.43	33.50	-0.27	0.62	1.016	0.63	4.00
	GPRS 2 slots	Back	60	902	32.88	33.00	1.33	0.54	1.028	0.56	
GSM1800	voice	Back	700	1747.8	29.93	30.00	2.12	1.11	1.016	1.13	
	GPRS 4 slots	Back	700	1747.8	25.96	26.00	1.05	1.16	1.009	1.17	
WCDMA Band I	RMC	Back	9750	1950	22.56	23.00	-0.57	0.63	1.107	0.70	
WCDMA Band VIII	RMC	Back	2788	897.6	22.78	23.00	-2.02	1.16	1.052	1.22	
802.11b	DATA	Back	07	2442	14.97	15.00	-0.56	0.69	1.007	0.69	
802.11a	DATA	Back	36	5180	9.05	9.50	1.14	0.31	1.109	0.34	
802.11ac	DATA	Back	157	5785	9.28	9.50	-2.02	0.29	1.052	0.31	

Band	Mode	Test Position with 0mm	CH.	Freq. (MHz)	RB allocation	RB offset	Ave. Power (dBm)	Tune-Up Limit (dBm)	Power Drift (%)	Meas. SAR10g (W/kg)	Scaling Factor	Reported SAR10g (W/kg)
LTE Band 1	QPSK (20MHz)	Back	18300	1950	1	0	22.98	23.00	-0.03	0.83	1.005	0.83
LTE Band 3	QPSK (20MHz)	Back	19575	1747.5	1	0	22.16	22.50	1.07	0.76	1.081	0.82
LTE Band 7	QPSK (20MHz)	Back	21100	2535	1	0	22.37	22.50	-2.43	0.96	1.030	0.99
LTE Band 8	QPSK (20MHz)	Back	21625	897.5	1	0	23.59	24.00	-0.75	0.91	1.099	1.00
LTE Band 20	QPSK (20MHz)	Back	24300	847	1	0	23.41	23.50	-0.95	0.97	1.021	0.99
LTE Band 40	QPSK (20MHz)	Back	39150	2350	1	0	23.19	23.50	-0.19	1.34	1.074	1.44

Note:

1. Wrist Worn SAR testing was performed at 0mm separation, and this distance is determined by the handset manufacturer that there will be body-worn accessories that users may acquire at the time of equipment certification, to enable users to purchase aftermarket body-worn accessories with the required minimum separation.
2. Determination of the worst-case configuration and all configurations with less than 3 dB of applicable limits.
3. When 10g SAR \leq 2.0 W/kg for wrist worn, testing for low and high channel is optional.

9.5. Simultaneous Transmission Considerations

The device contain transmitters (GSM & WIFI, GPRS & WIFI, RMC & WIFI, HSDPA & WIFI, HSUPA & WIFI, LTE & WIFI, GSM & Bluetooth, LTE & Bluetooth, GPRS & Bluetooth, RMC & Bluetooth, HSDPA & Bluetooth, HSUPA & Bluetooth) can transmit multiple transmission modes at the same time, determining the threshold power level available to the secondary transmitter ($P_{available}$) is to calculate it from the measured peak spatial-average SAR of the primary transmitter (SAR_1) according to the equation:

$$P_{available} = P_{th,m} \cdot (SAR_{lim} - SAR_1) / SAR_{lim}$$

where $P_{th,m}$ is the threshold exclusion power level taken from Annex B of IEC 62479 for the frequency of the secondary transmitter at the separation distance used in the testing.

The maximum SAR_1 of head is **0.57 W/Kg**, so

$$P_{available} = 20mW \times (2.0 - 0.57/2.0) = 14.30mW$$

The maximum power of 2.4GWIFI is 14.97 dBm = 32.81mw > $P_{available_1}$

So the SAR measurement for the secondary transmitter of 2.4Gwifi is necessary

The maximum power of 5GWIFI is 9.28 dBm = 8.47mw < $P_{available_1}$

So the SAR measurement for the secondary transmitter of 5Gwifi is necessary

The maximum power of BT is 4.42 dBm = 2.77mw < $P_{available_1}$

So the SAR measurement for the secondary transmitter of BT is not necessary

NFC power is less than $p_{available_1}$ and can be exempted from evaluation

The maximum SAR_2 of body-worn is **0.88W/Kg**, so

$$P_{available} = 20mW \times (2.0 - 0.88)/2.0 = 11.20mW$$

The maximum power of 2.4GWIFI is 14.97 dBm = 31.41mw > $P_{available_2}$

So the SAR measurement for the secondary transmitter of 2.4Gwifi is necessary

The maximum power of 5GWIFI is 9.28 dBm = 8.47mw < $P_{available_2}$

So the SAR measurement for the secondary transmitter of 5Gwifi is necessary

The maximum power of BT is 4.42 dBm = 2.77mw < $P_{available_2}$

So the SAR measurement for the secondary transmitter of BT is not necessary

NFC power is less than $p_{available_1}$ and can be exempted from evaluation

The maximum SAR_3 of Front-to-face is **0.28W/Kg**, so

$$P_{available} = 20mW \times (4.0 - 0.28)/4.0 = 18.60mW$$

The maximum power of 2.4GWIFI is 14.97 dBm = 31.41mw > $P_{available_3}$

So the SAR measurement for the secondary transmitter of 2.4Gwifi is necessary

The maximum power of 5GWIFI is 9.28 dBm = 8.47mw < $P_{available_3}$

So the SAR measurement for the secondary transmitter of 5Gwifi is necessary

The maximum power of BT is 4.42 dBm = 2.77mw < $P_{available_3}$

So the SAR measurement for the secondary transmitter of BT is not necessary

NFC power is less than $p_{available_1}$ and can be exempted from evaluation

The maximum SAR_4 of Wrist Worn is **1.44W/Kg**, so

$$P_{available} = 20mW \times (4.0 - 1.44)/4.0 = 12.80mW$$

The maximum power of 2.4GWIFI is 14.97 dBm = 31.41mw > $P_{available_4}$

So the SAR measurement for the secondary transmitter of 2.4Gwifi is necessary

The maximum power of 5GWIFI is 9.28 dBm = 8.47 < $P_{available_4}$

So the SAR measurement for the secondary transmitter of 5Gwifi is necessary

The maximum power of BT is 4.42 dBm = 2.77mw < $P_{available_4}$

So the SAR measurement for the secondary transmitter of BT is not necessary

NFC power is less than $p_{available_1}$ and can be exempted from evaluation

So highest simultaneous Transmission Procedures as below:

Head Mode	Position WWAN SAR10g (W/kg)		Position WLAN-2.4G SAR10g (W/kg)		Position WLAN -5G SAR10g (W/kg)		Σ SAR ₁ (W/kg)	Limit (W/Kg)
	Right Cheek	Left Cheek	Right Cheek	Left Cheek	Right Cheek	Left Cheek		
GSM 900	0.09	0.11	0.36	0.38	0.18	0.16	0.49	2.00
GSM1800	0.20	0.22	0.36	0.38	0.18	0.16	0.60	
WCDMA Band I	0.13	0.15	0.36	0.38	0.18	0.16	0.53	
WCDMA Band VIII	0.16	0.18	0.36	0.38	0.18	0.16	0.56	
LTE Band 1	0.24	0.26	0.36	0.38	0.18	0.16	0.64	
LTE Band 3	0.45	0.48	0.36	0.38	0.18	0.16	0.86	
LTE Band 7	0.52	0.57	0.36	0.38	0.18	0.16	0.95	
LTE Band 8	0.13	0.16	0.36	0.38	0.18	0.16	0.54	
LTE Band 20	0.16	0.18	0.36	0.38	0.18	0.16	0.56	
LTE Band 40	0.11	0.12	0.36	0.38	0.18	0.16	0.50	

Note: Σ SAR₁ is equal to the maximum value of the sum of Right Cheek or Left Cheek

Body Mode	Position	WWAN SAR10g (W/kg)	WLAN -2.4G SAR10g (W/kg)	WLAN -5G SAR10g (W/kg)	Σ SAR ₂ (W/kg)	Limit (W/Kg)
GSM 900 (GPRS)	Back	0.22	0.35	0.23	0.57	2.00
GSM1800(GPRS)	Back	0.88	0.35	0.23	1.23	
WCDMA Band I	Back	0.39	0.35	0.23	0.74	
WCDMA Band VIII	Back	0.67	0.35	0.23	1.02	
LTE Band 1	Back	0.55	0.35	0.23	0.90	
LTE Band 3	Back	0.48	0.35	0.23	0.83	
LTE Band 7	Back	0.49	0.35	0.23	0.84	
LTE Band 8	Back	0.52	0.35	0.23	0.87	
LTE Band 20	Back	0.53	0.35	0.23	0.88	
LTE Band 40	Back	0.82	0.35	0.23	1.17	

Front-to-face	Position	WWAN SAR10g	WLAN -2.4G	WLAN -5G	Σ SAR ₂ (W/kg)	Limit (W/Kg)
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		(W/kg)	SAR10g (W/kg)	SAR10g (W/kg)		
GSM 900 (voice)	Front	0.06	0.10	0.07	0.16	4.00
GSM1800(voice)	Front	0.23	0.10	0.07	0.33	
WCDMA Band I	Front	0.11	0.10	0.07	0.21	
WCDMA Band VIII	Front	0.20	0.10	0.07	0.30	
LTE Band 1	Front	0.15	0.10	0.07	0.25	
LTE Band 3	Front	0.12	0.10	0.07	0.22	
LTE Band 7	Front	0.19	0.10	0.07	0.29	
LTE Band 8	Front	0.19	0.10	0.07	0.29	
LTE Band 20	Front	0.17	0.10	0.07	0.27	
LTE Band 40	Front	0.28	0.10	0.07	0.38	

Wrist Worn	Position	WWAN SAR10g (W/kg)	WLAN -2.4G SAR10g (W/kg)	WLAN -5G SAR10g (W/kg)	Σ SAR ₂ (W/kg)	Limit (W/Kg)
GSM 900 (GPRS 2slots)	Back	0.63	0.69	0.34	0.97	4.00
GSM1800(GPRS 4slots)	Back	1.17	0.69	0.34	1.51	
WCDMA Band I	Back	0.70	0.69	0.34	1.04	
WCDMA Band VIII	Back	1.22	0.69	0.34	1.56	
LTE Band 1	Back	0.83	0.69	0.34	1.17	
LTE Band 3	Back	0.82	0.69	0.34	1.16	
LTE Band 7	Back	0.99	0.69	0.34	1.33	
LTE Band 8	Back	1.00	0.69	0.34	1.34	
LTE Band 20	Back	0.99	0.69	0.34	1.33	
LTE Band 40	Back	1.44	0.69	0.34	1.78	

9.6. Measurement Uncertainty (450MHz-3GHz)

UNCERTAINTY EVALUATION FOR HEADSET SAR									
Uncertainty Component	Description	Uncertainty Value(%)	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. 1g(%)	Std. Unc. 10g(%)	v
Measurement system									
Probe calibration	7.2.1	5.8	N	1	1	1	5.8	5.8	∞
Axial isotropy	7.2.1.1	3.5	R	$\sqrt{3}$	$(1-C_p)^{1/2}$	$(1-C_p)^{1/2}$	1.43	1.43	∞
Hemispherical isotropy	7.2.1.1	5.9	R	$\sqrt{3}$	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
Boundary Effects	7.2.1.4	1.00	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	7.2.1.2	4.70	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	7.2.1.2	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation Response	7.2.1.3	3	N	1	1	1	3.00	3.00	∞
Readout Electronics	7.2.1.5	0.5	N	1	1	1	0.50	0.50	∞
Response Time	7.2.1.6	0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	7.2.1.7	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF Ambient Conditions-Noise	7.2.3.7	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Conditions-Reflection	7.2.3.7	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioned mechanical Tolerance	7.2.2.1	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	7.2.2.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation interpolation and integration algorithms for Max. SAR evaluation	7.2.4	2.3	R	1	1	1	1.33	1.33	∞
Test sample related									
Test sample positioning	7.2.2.4.4	2.6	N	1	1	1	2.60	2.60	∞
Device holder uncertainty	7.2.2.4.2 7.2.2.4.3	3	N	1	1	1	3.00	3.00	∞
output power variation-SAR drift measurement	7.2.3.6	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
SAR scaling	7.2.5	2	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and tissue parameters									
Phantom uncertainty (shape and thickness tolerances)	7.2.2.2	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
uncertainty in SAR correction for deviation (in permittivity and conductivity)	7.2.6	2	N	1	1	0.84	2.00	1.68	∞
Liquid conductivity (temperature uncertainty)	7.2.3.5	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid conductivity -measurement uncertainty	7.2.3.3	4	N	1	0.23	0.26	0.92	1.04	∞
Liquid permittivity (temperature uncertainty)	7.2.3.5	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid permittivity measurement uncertainty	7.2.3.4	5	N	1	0.23	0.26	1.15	1.30	∞
Combined standard uncertainty			RSS				10.83	10.54	
Expanded uncertainty (95%CONFIDENCEINTERVAL)			k				21.26	21.08	

UNCERTAINTY FOR PERFORMANCE CHECK

Uncertainty Component	Description	Uncertainty Value(%)	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. 1g(%)	Std. Unc. 10g(%)	v
Measurement system									
Probe calibration	7.2.1	5.8	N	1	1	1	5.8	5.8	∞
Axial isotropy	7.2.1.1	3.5	R	$\sqrt{3}$	$(1-C_p)^{1/2}$	$(1-C_p)^{1/2}$	1.43	1.43	∞
Hemispherical isotropy	7.2.1.1	5.9	R	$\sqrt{3}$	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
Boundary Effects	7.2.1.4	1.00	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	7.2.1.2	4.70	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	7.2.1.2	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation Response	7.2.1.3	3	N	1	1	1	0.00	0.00	∞
Readout Electronics	7.2.1.5	0.5	N	1	1	1	0.50	0.50	∞
Response Time	7.2.1.6	0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	7.2.1.7	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF Ambient Conditions-Noise	7.2.3.7	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Conditions-Reflection	7.2.3.7	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioned mechanical Tolerance	7.2.2.1	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	7.2.2.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation interpolation and integration algorithms for Max.SAR evaluation	7.2.4	2.3	R	1	1	1	1.33	1.33	∞
Dipole									
Deviation of experimental source from numerical source		4	N	1	1	1	4.00	4.00	∞
Input power and SAR drift measurement	7.2.3.6	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole axis to liquid distance		2	R	$\sqrt{3}$	1	1			∞
Phantom and tissue parameters									
Phantom uncertainty (shape and thickness tolerances)	7.2.2.2	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
uncertainty in SAR correction for deviation (in permittivity and conductivity)	7.2.6	2	N	1	1	0.84	2.00	1.68	∞
Liquid conductivity (temperature uncertainty)	7.2.3.5	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid conductivity -measurement uncertainty	7.2.3.3	4	N	1	0.23	0.26	0.92	1.04	∞
Liquid permittivity (temperature uncertainty)	7.2.3.5	2.5	N	1	0.78	0.71	1.95	1.78	∞
Liquid permittivity measurement uncertainty	7.2.3.4	5	N	1	0.23	0.26	1.15	1.30	∞
Combined standard uncertainty			RSS				10.15	10.05	
Expanded uncertainty (95%CONFIDENCEINTE RVAL			k				20.29	20.10	

9.7. Test Equipment List

Test Equipment	Manufacturer	Model	Serial Number	Calibration	
				Calibration Date	Calibration Due
PC	Lenovo	H3050	N/A	N/A	N/A
Signal Generator	Agilent	N5182A	MY47070282	Jul. 04, 2022	Jul. 03, 2023
Multimeter	Keithley	Multimeter 2000	4078275	Jul. 04, 2022	Jul. 03, 2023
Network Analyzer	Agilent	8753E	US38432457	Jul. 04, 2022	Jul. 03, 2023
Wideband Radio Communication Tester	R & S	CMW500	114220	Jul. 04, 2022	Jul. 03, 2023
Power Meter	Agilent	E4418B	GB43312526	Jul. 04, 2022	Jul. 03, 2023
Power Meter	Agilent	E4416A	MY45101555	Jul. 04, 2022	Jul. 03, 2023
Power Meter	Agilent	N1912A	MY50001018	Jul. 04, 2022	Jul. 03, 2023
Power Sensor	Agilent	E9301A	MY41497725	Jul. 04, 2022	Jul. 03, 2023
Power Sensor	Agilent	E9327A	MY44421198	Jul. 04, 2022	Jul. 03, 2023
Power Sensor	Agilent	E9323A	MY53070005	Jul. 04, 2022	Jul. 03, 2023
Power Amplifier	PE	PE15A4019	112342	N/A	N/A
Directional Coupler	Agilent	722D	MY52180104	N/A	N/A
Attenuator	Chensheng	FF779	134251	N/A	N/A
E-Field PROBE	MVG	SSE2	SN 36/20 EPGO346	Oct. 08, 2021	Oct. 07, 2022
DIPOLE 750	MVG	SID 750	SN 16/15 DIP 0G750-368	Jun. 05, 2021	Jun. 04, 2024
DIPOLE 900	MVG	SID 900	SN 16/15 DIP 0G900-370	Jun. 05, 2021	Jun. 04, 2024
DIPOLE 1800	MVG	SID 1800	SN 16/15 DIP 1G800-371	Jun. 05, 2021	Jun. 04, 2024
DIPOLE 2000	MVG	SID 2000	SN 16/15 DIP 2G000-373	Jun. 05, 2021	Jun. 04, 2024
DIPOLE 2450	MVG	SID2450	SN 16/15 DIP 2G450-374	Jun. 05, 2021	Jun. 04, 2024
DIPOLE 2600	MVG	SID2600	SN 16/15 DIP 2G600-375	Jun. 05, 2021	Jun. 04, 2024
DIPOLE 5G	MVG	SID 5G	SN 13/14 WGA32	May 15, 2021	May 14, 2024
Communication Antenna	MVG	ANTA59	SN 39/14 ANTA59	N/A	N/A
Mobile Phone Position Device	MVG	MSH101	SN 19/15 MSH101	N/A	N/A
SAM PHANTOM	MVG	SAM120	SN 19/15 SAM120	N/A	N/A
PHANTOM TABLE	MVG	TABP101	SN 19/15 TABP101	N/A	N/A
Robot TABLE	MVG	TABP61	SN 19/15 TABP61	N/A	N/A
6 AXIS ROBOT	KUKA	KR6-R900	501822	N/A	N/A

Note:

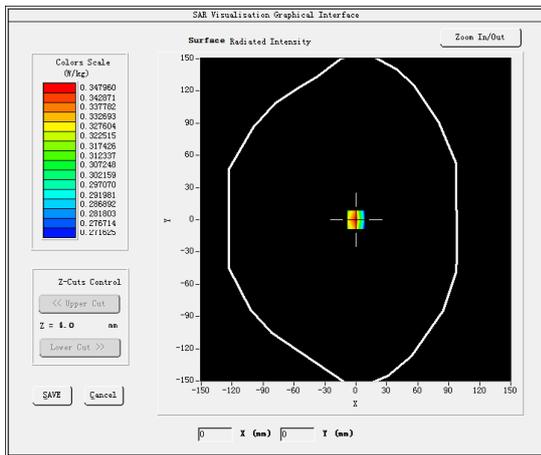
1. N/A means this equipment no need to calibrate
2. Each Time means this device need to calibrate every use time

10. System Check Results

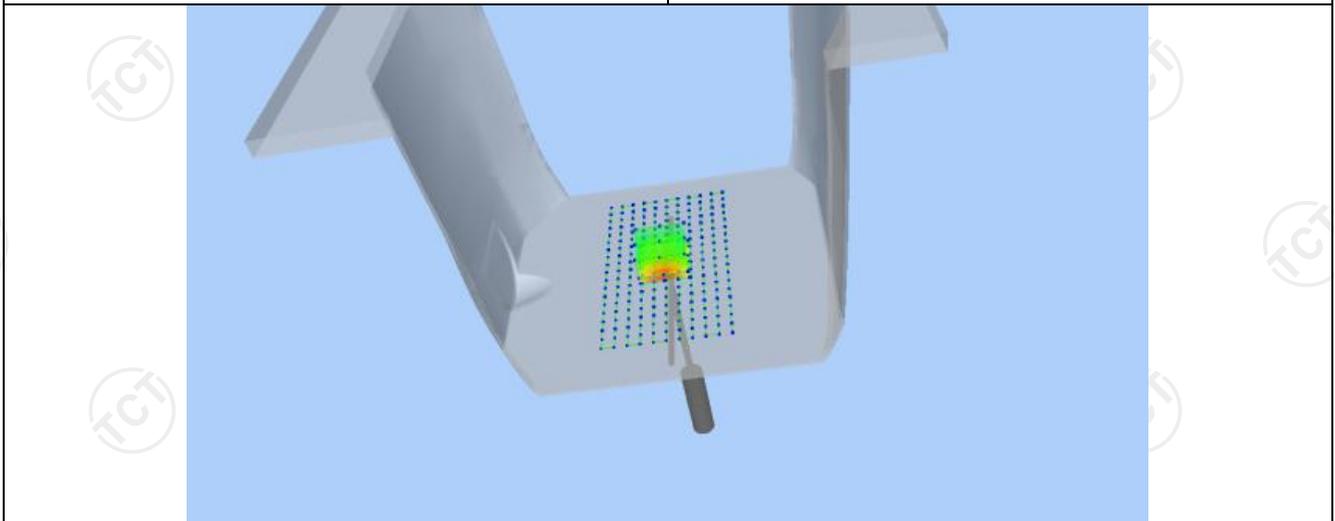
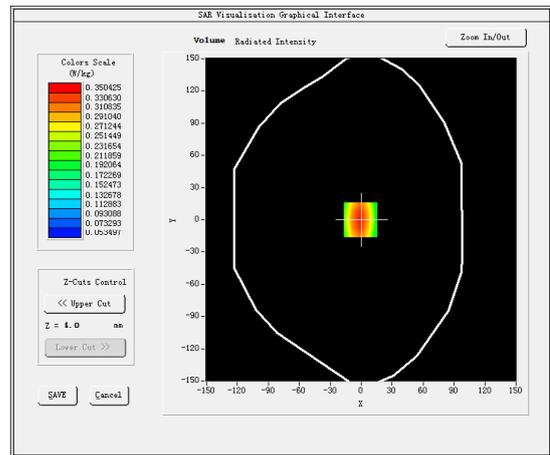
Date of measurement: 08/15/2022 Test mode: 900MHz (Head)
 Product Description: Validation
 Dipole Model: SID900
 E-Field Probe: SSE2 (SN 36/20 EPGO346)

Phantom	Validation plane
Input Power	31.6mW
Frequency (MHz)	900.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	-0.040000
SAR 10g (W/Kg)	0.212972
SAR 1g (W/Kg)	0.332613

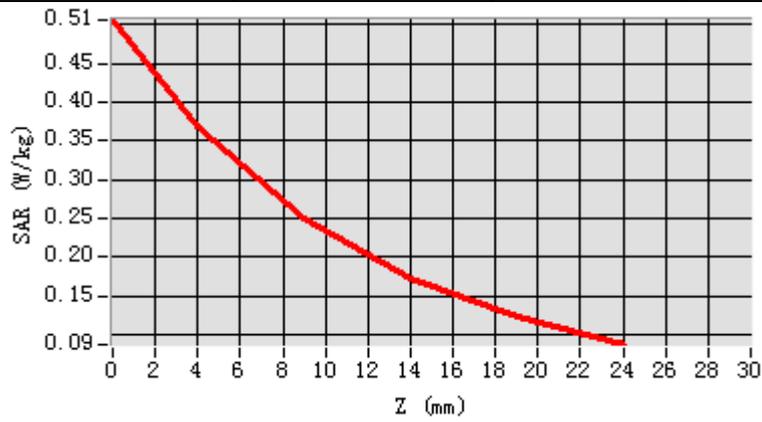
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.5056	0.3693	0.2494	0.1719	0.1225



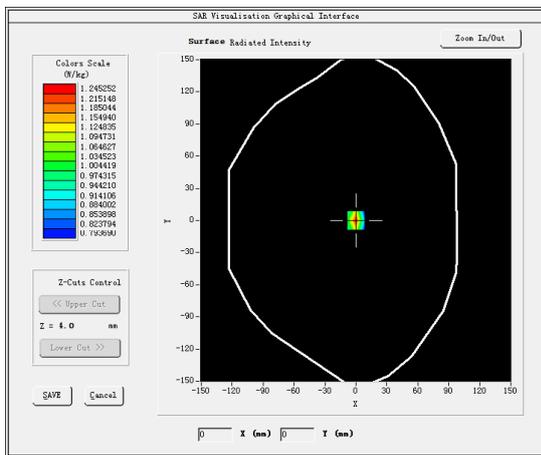
Hot spot position



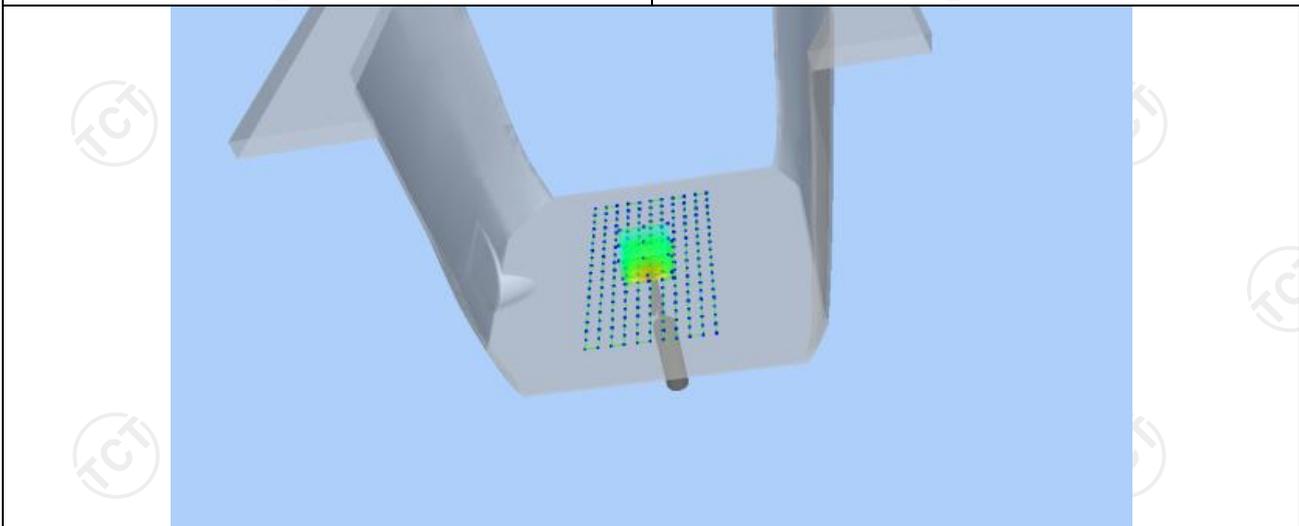
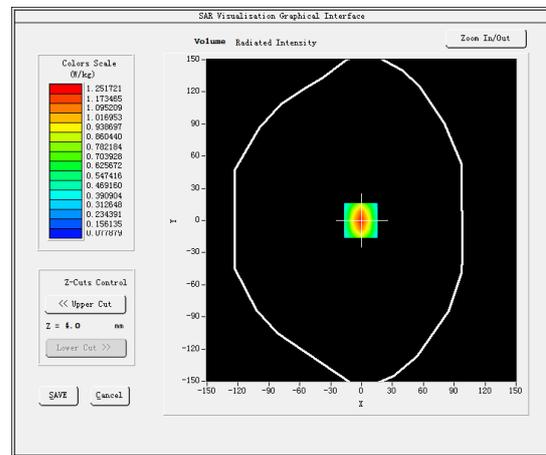
Date of measurement: 08/17/2022 Test mode: 1800MHz (Head)
Product Description: Validation
Dipole Model: SID1800
E-Field Probe: SSE2 (SN 36/20 EPGO346)

Phantom	Validation plane
Input Power	31.6mW
Frequency (MHz)	1800.000000
Relative permittivity (real part)	38.854207
Relative permittivity (imaginary part)	13.770436
Conductivity (S/m)	1.412109
Variation (%)	-0.010000
SAR 10g (W/Kg)	0.633056
SAR 1g (W/Kg)	1.156185

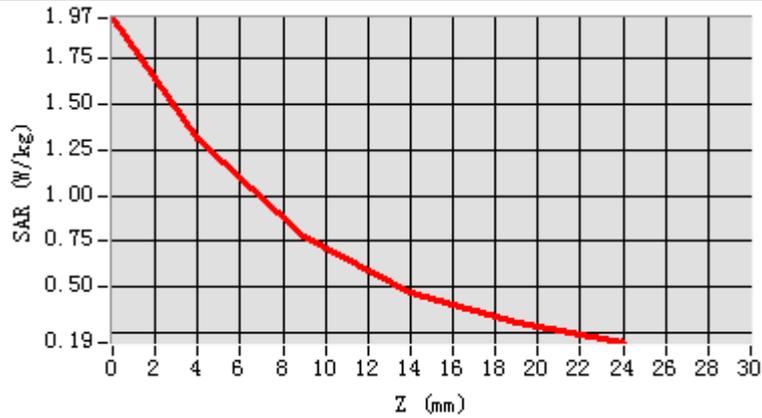
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.9743	1.3143	0.7807	0.4734	0.3027



Hot spot position

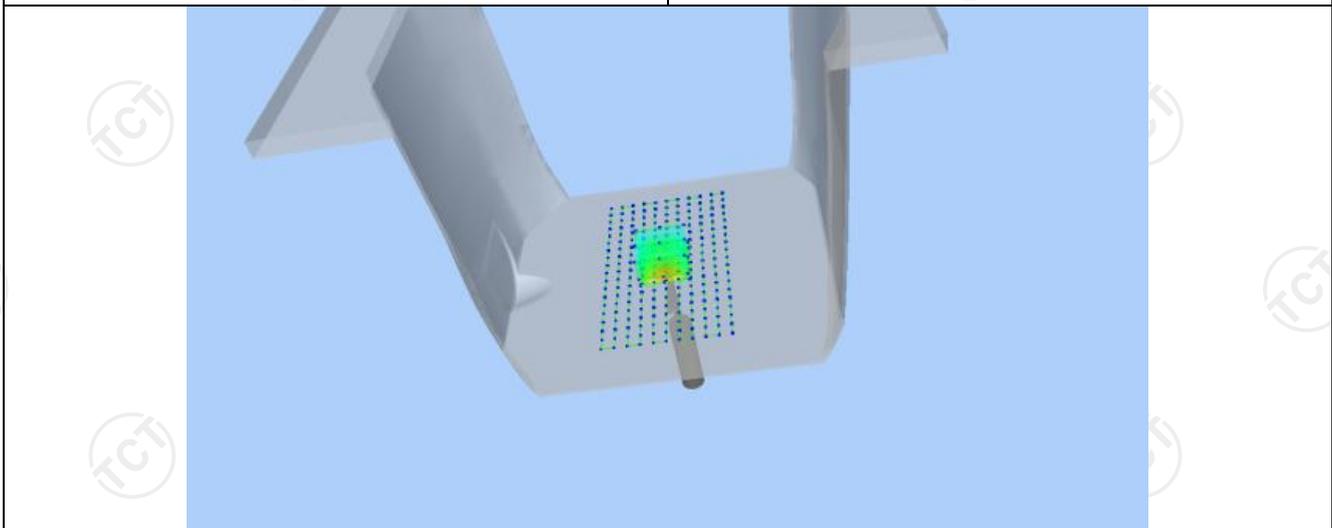
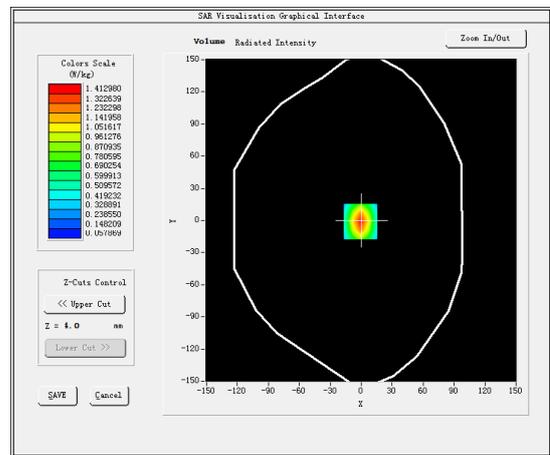
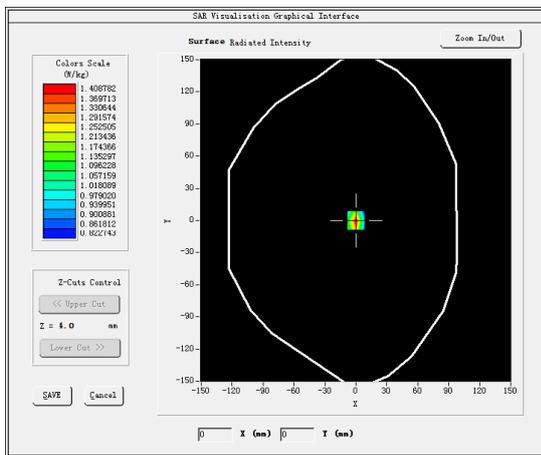


Date of measurement: 08/18/2022 Test mode: 2000MHz (Head)
 Product Description: Validation
 Dipole Model: SID2000
 E-Field Probe: SSE2 (SN 36/20 EPGO346)

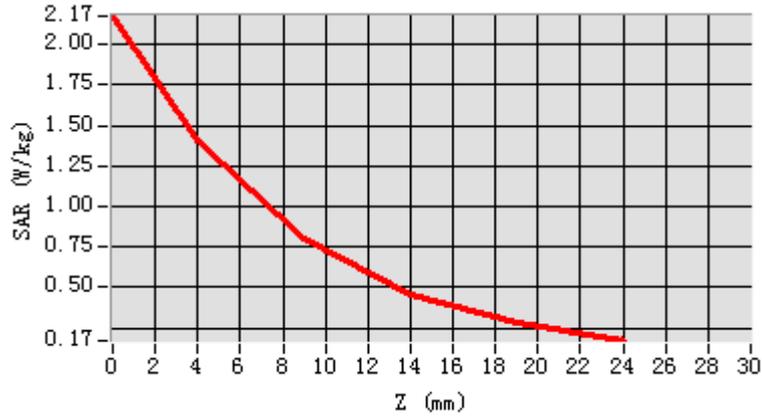
Phantom	Validation plane
Input Power	31.6mW
Frequency (MHz)	2000.000000
Relative permittivity (real part)	39.721249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.430792
Variation (%)	-0.450000
SAR 10g (W/Kg)	0.673813
SAR 1g (W/Kg)	1.298495

SURFACE SAR

VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.1749	1.4043	0.7969	0.4595	0.2803



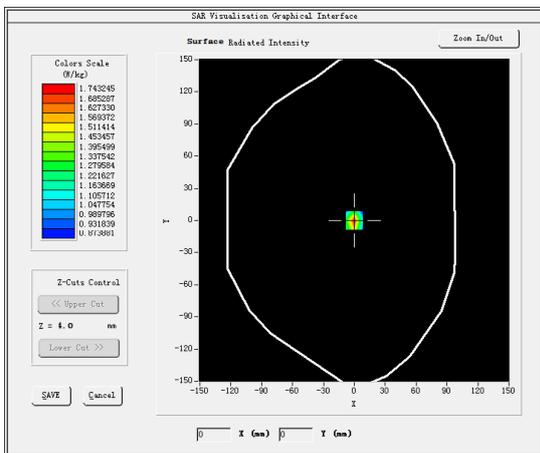
Hot spot position



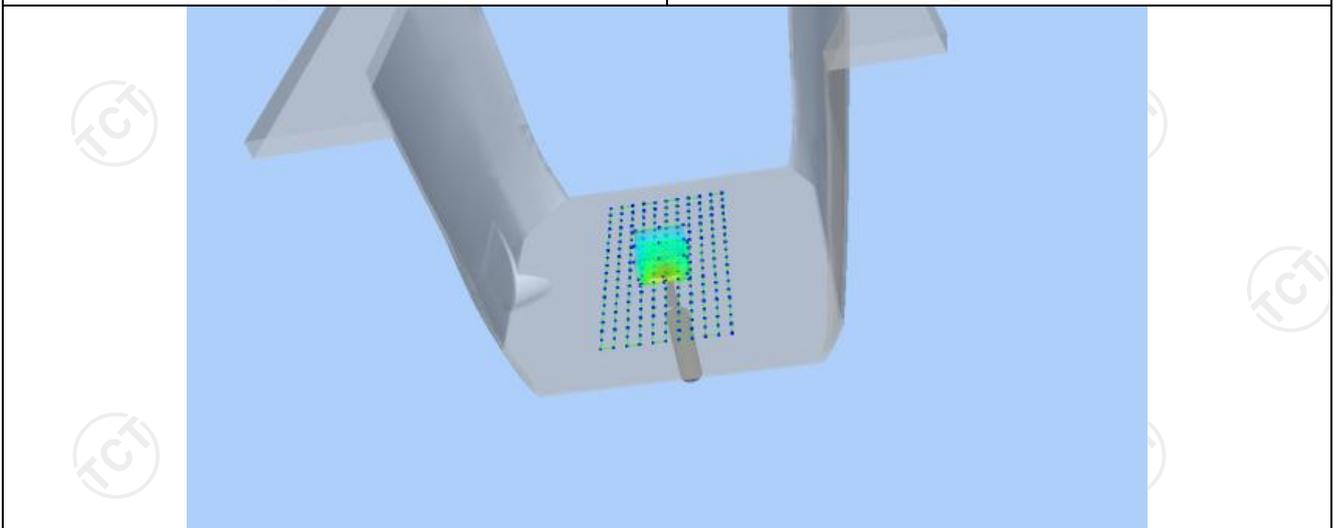
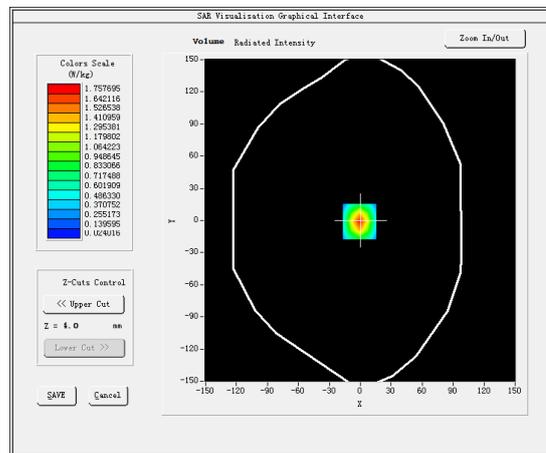
Date of measurement: 08/22/2022 Test mode: 2450MHz (Head)
 Product Description: Validation
 Dipole Model: SID2450
 E-Field Probe: SSE2 (SN 36/20 EPGO346)

Phantom	Validation plane
Input Power	31.6mW
Frequency (MHz)	2450.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	-0.510000
SAR 10g (W/Kg)	0.740967
SAR 1g (W/Kg)	1.590162

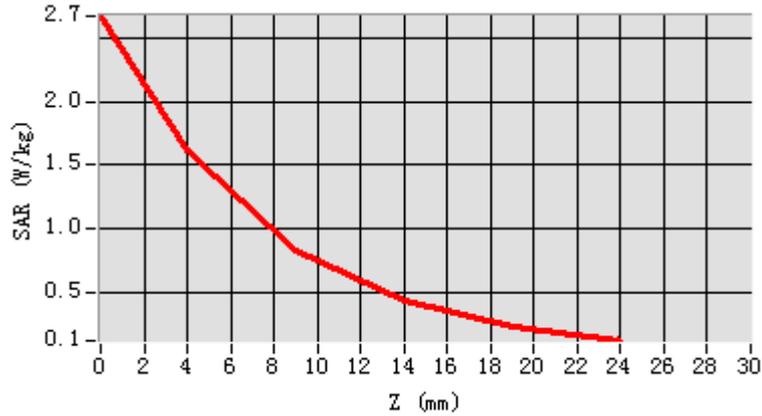
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.6697	1.6242	0.8388	0.4321	0.2349



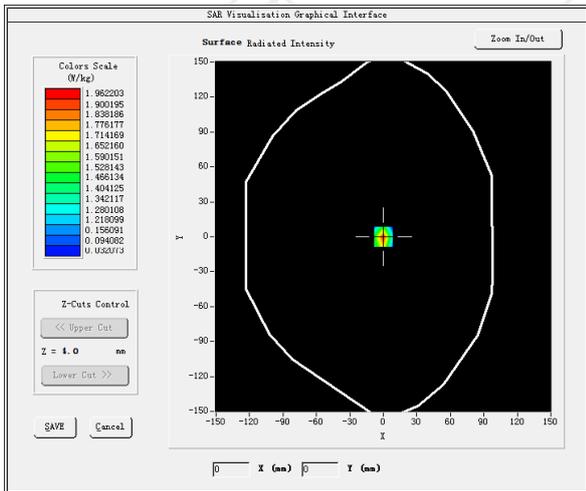
Hot spot position



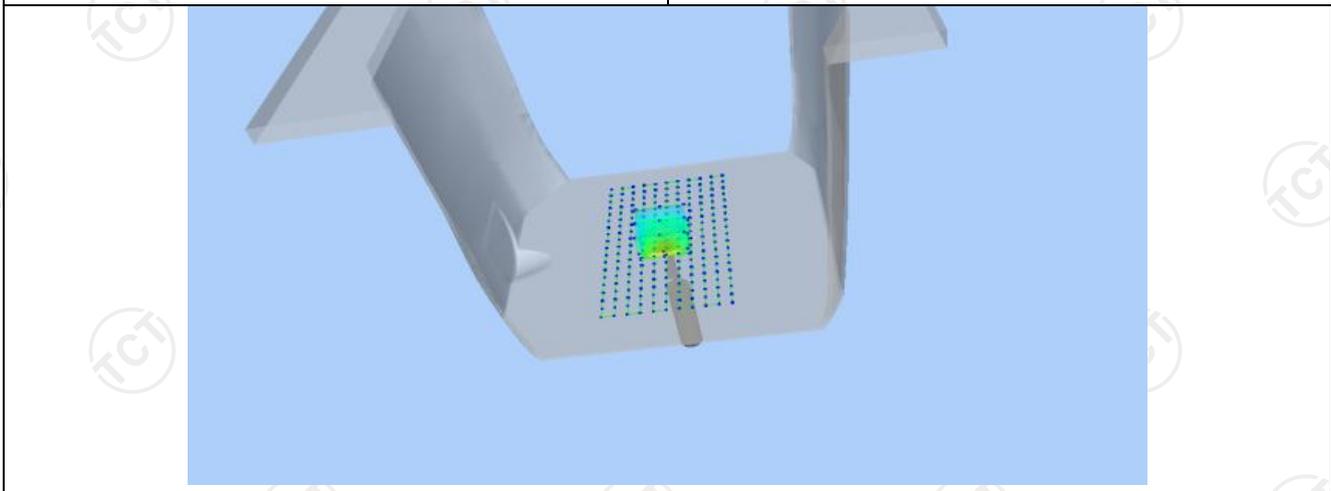
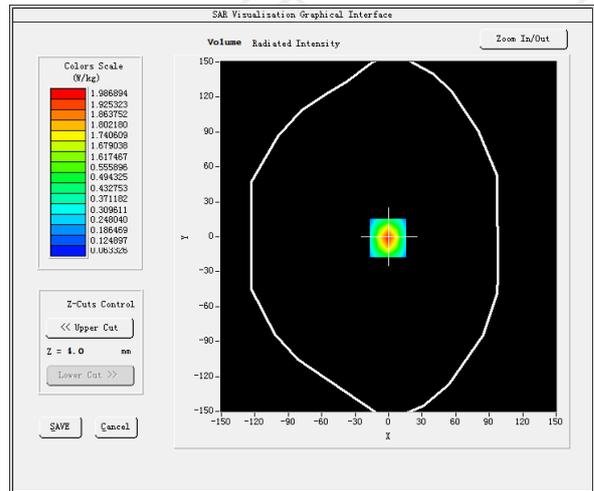
Date of measurement: 08/23/2022 Test mode: 2600MHz (Head)
 Product Description: Validation
 Dipole Model: SID2600
 E-Field Probe: SSE2 (SN 36/20 EPGO346)

Phantom	Validation plane
Input Power	31.6mW
Frequency (MHz)	2600.000000
Relative permittivity (real part)	38.342158
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.921254
Variation (%)	-0.470000
SAR 10g (W/Kg)	0.782541
SAR 1g (W/Kg)	1.690254

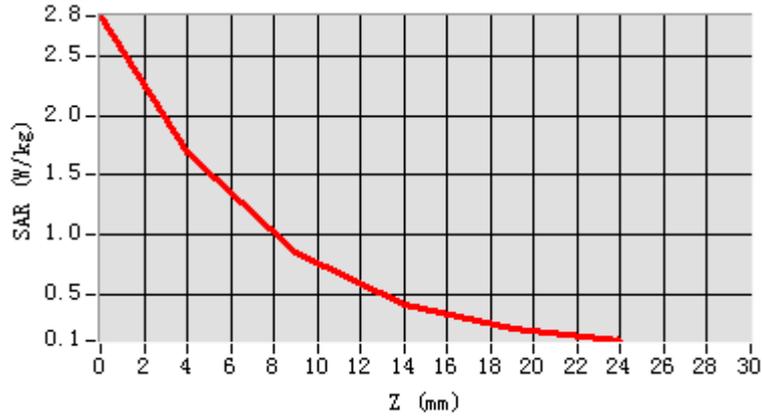
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.8357	1.6928	0.8472	0.4195	0.2184



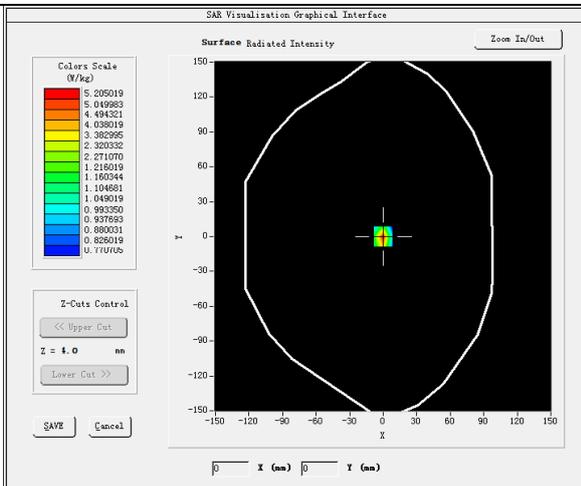
Hot spot position



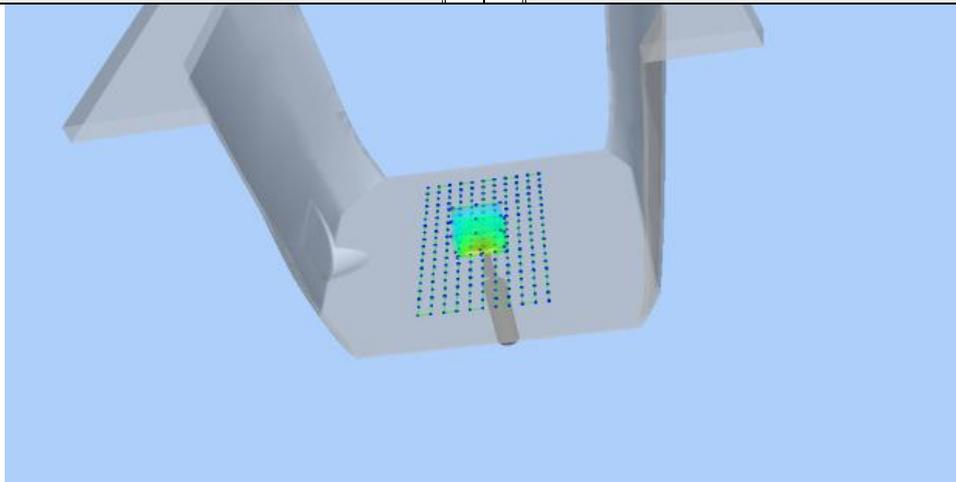
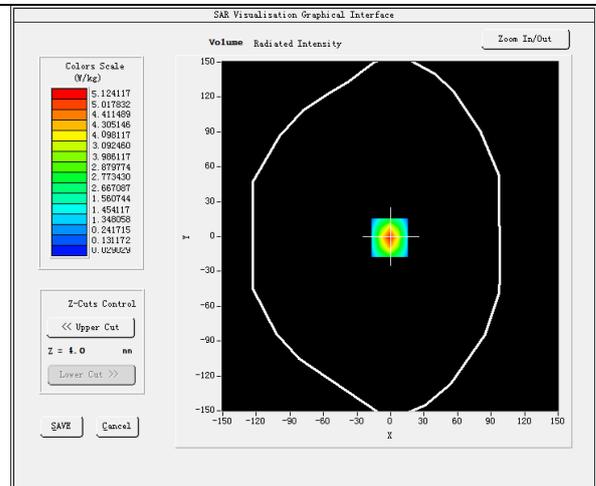
Date of measurement: 08/30/2022 Test mode: 5200MHz (Head)
 Product Description: Validation
 Dipole Model: SID5200
 E-Field Probe: SSE2 (SN 36/20 EPGO346)

Phantom	Validation plane
Input Power	31.6mW
Frequency (MHz)	5200.000000
Relative permittivity (real part)	35.068832
Relative permittivity (imaginary part)	13.679428
Conductivity (S/m)	5.220788
Variation (%)	-0.820000
SAR 10g (W/Kg)	1.807521
SAR 1g (W/Kg)	5.012481

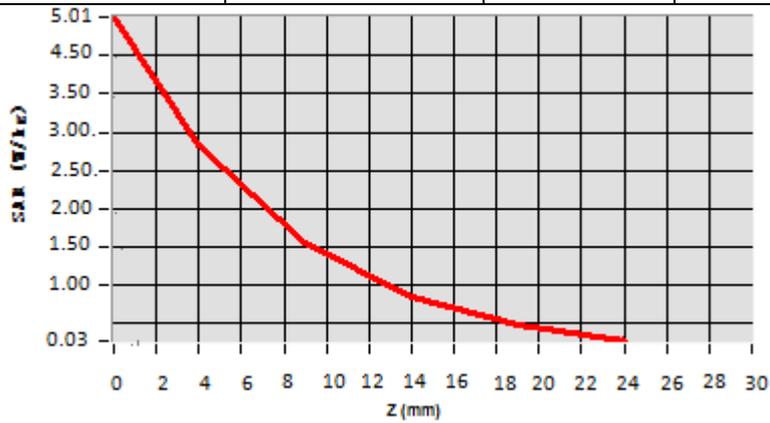
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.0132	2.7584	1.5026	0.8252	0.4125



Hot spot position



11. SAR Test Data

GSM900

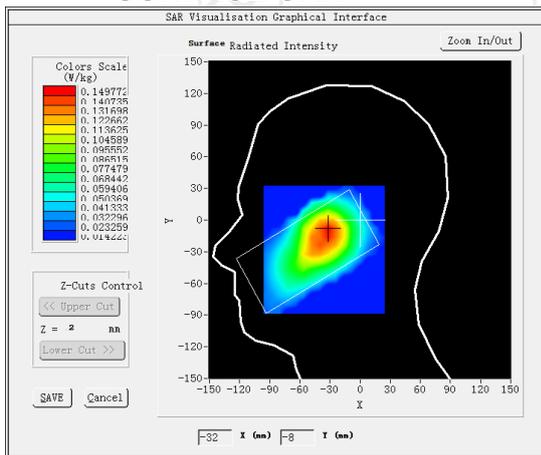
MEASUREMENT 1

Middle Band SAR (Channel 60):

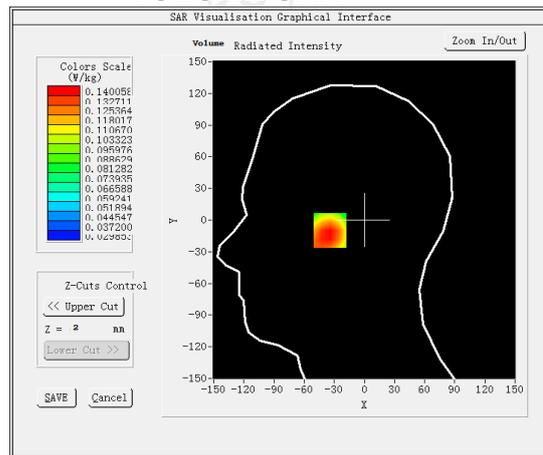
Date: 08/15/2022

Frequency (MHz)	902.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	-2.680000
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7, dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Left head
Device Position	Cheek
Band	GSM900

SURFACE SAR



VOLUME SAR



Maximum location: X=-32.00, Y=-10.00

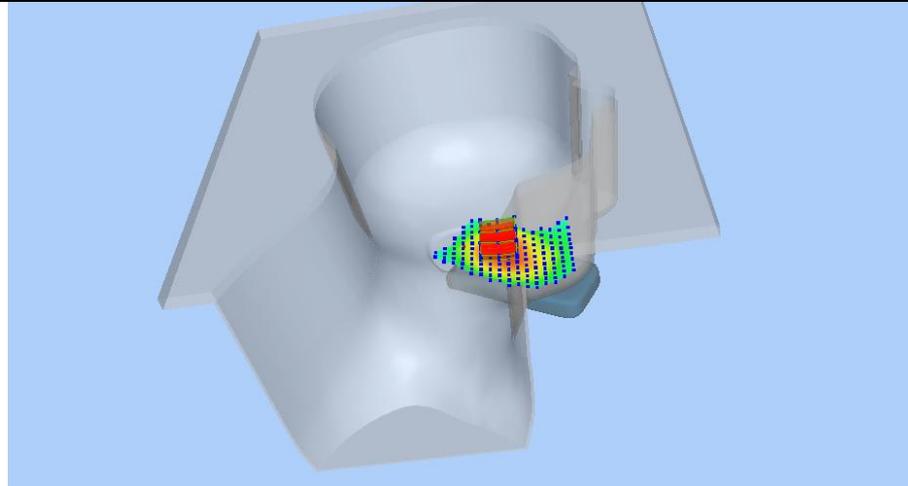
SAR Peak: 0.16 W/kg

SAR 10g (W/Kg)

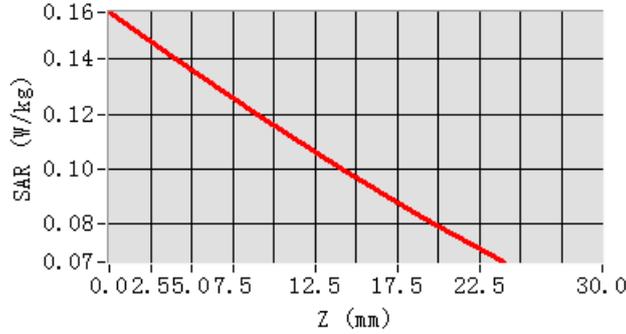
0.107933

SAR 1g (W/Kg)

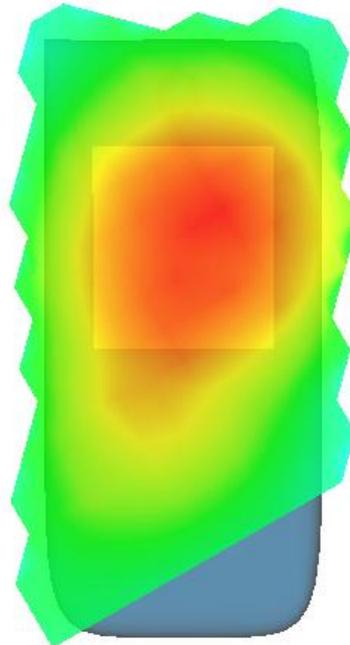
0.137377



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.1572	0.1401	0.1196	0.1003	0.0824



Hot spot position



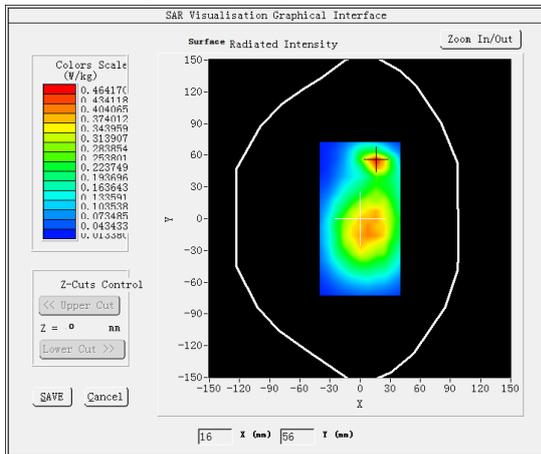
MEASUREMENT 2

Middle Band SAR (Channel 60):

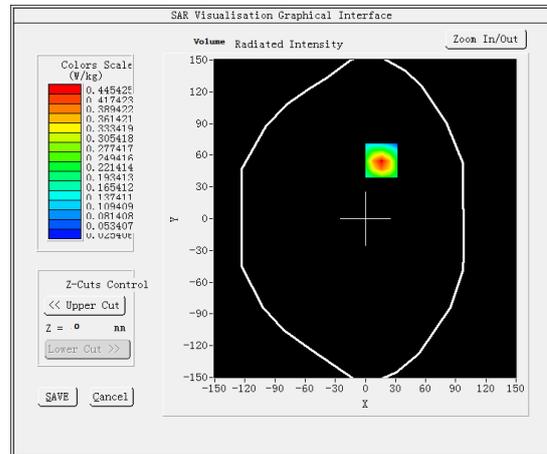
Date: 08/15/2022

Frequency (MHz)	902.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	-2.540000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>GSM900(voice)</u>

SURFACE SAR



VOLUME SAR



Maximum location: X=16.00, Y=55.00

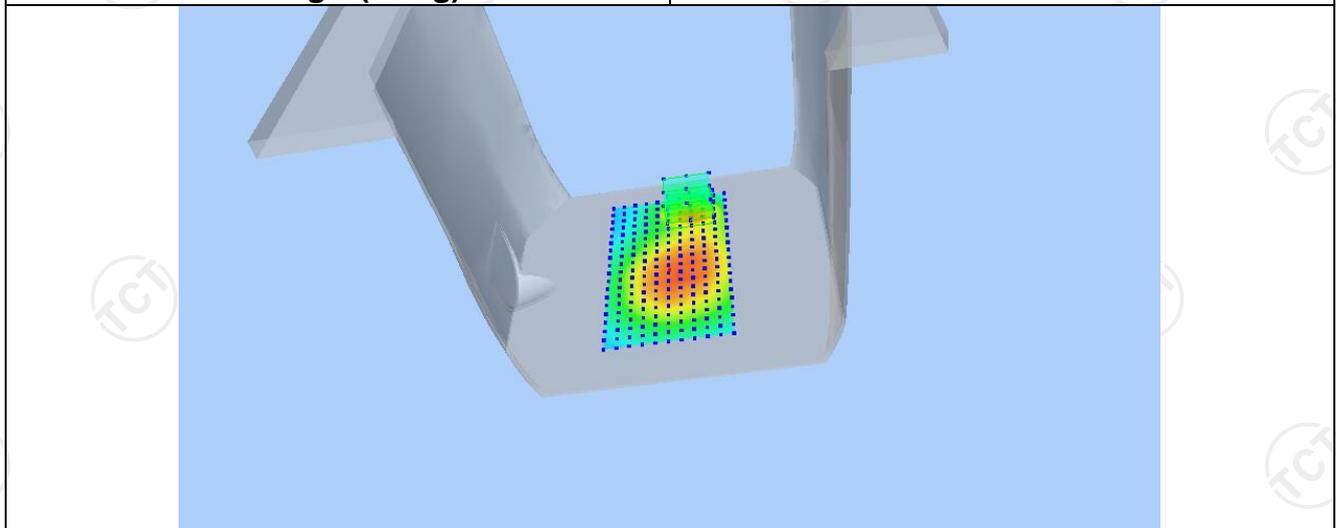
SAR Peak: 0.72 W/kg

SAR 10g (W/Kg)

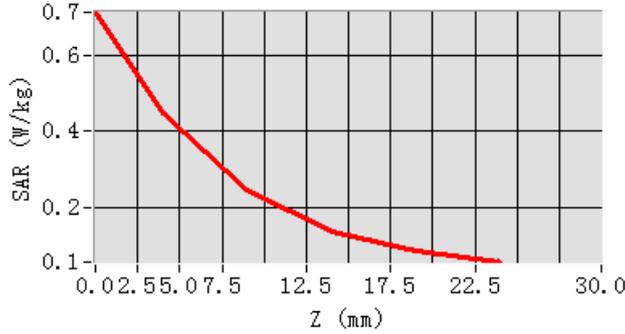
0.222136

SAR 1g (W/Kg)

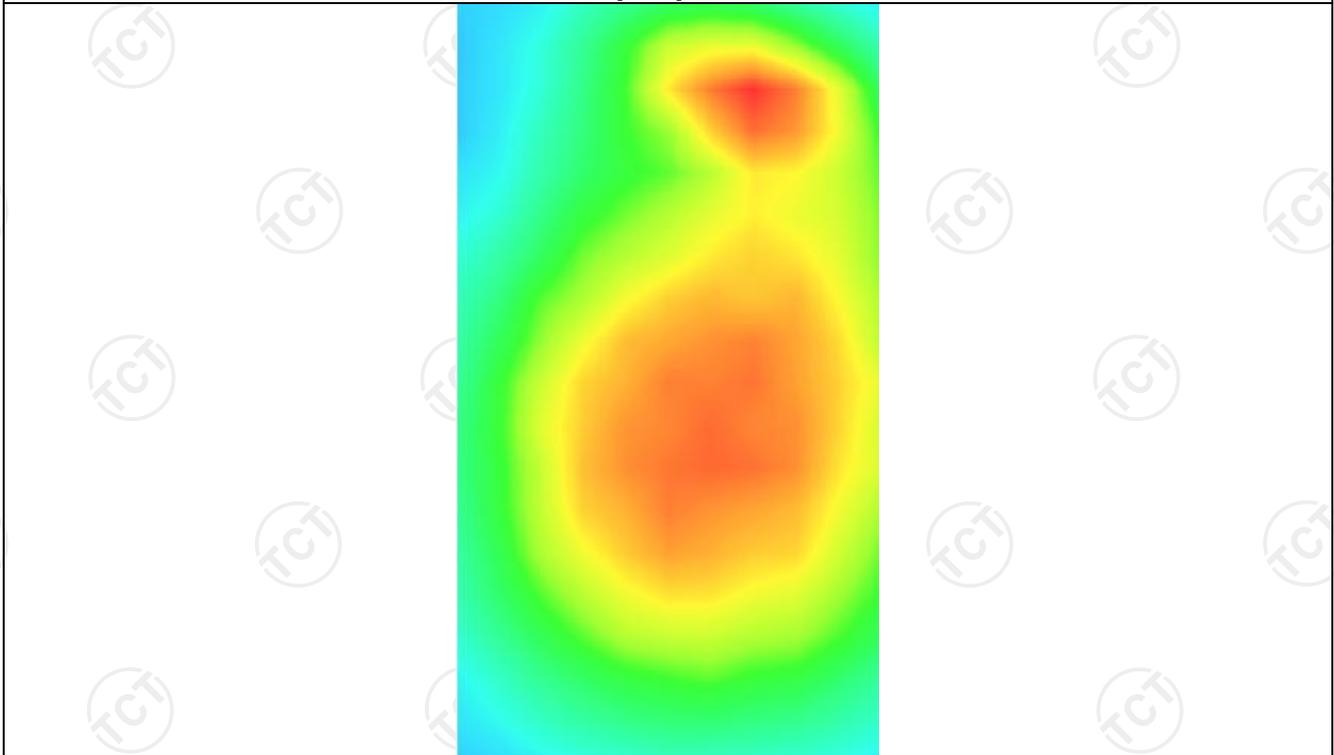
0.418072



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.7121	0.4454	0.2430	0.1370	0.0850



Hot spot position



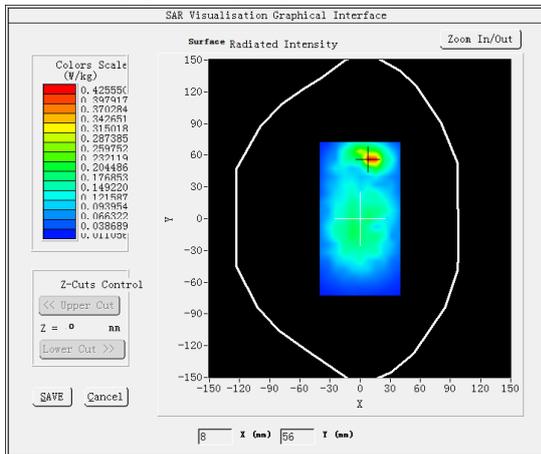
MEASUREMENT 3

Middle Band SAR (Channel 60):

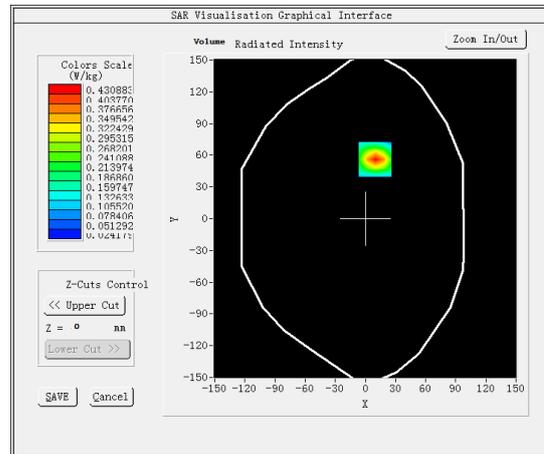
Date: 08/15/2022

Frequency (MHz)	902.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	2.280000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>GSM900(GPRS 2slot)</u>

SURFACE SAR



VOLUME SAR



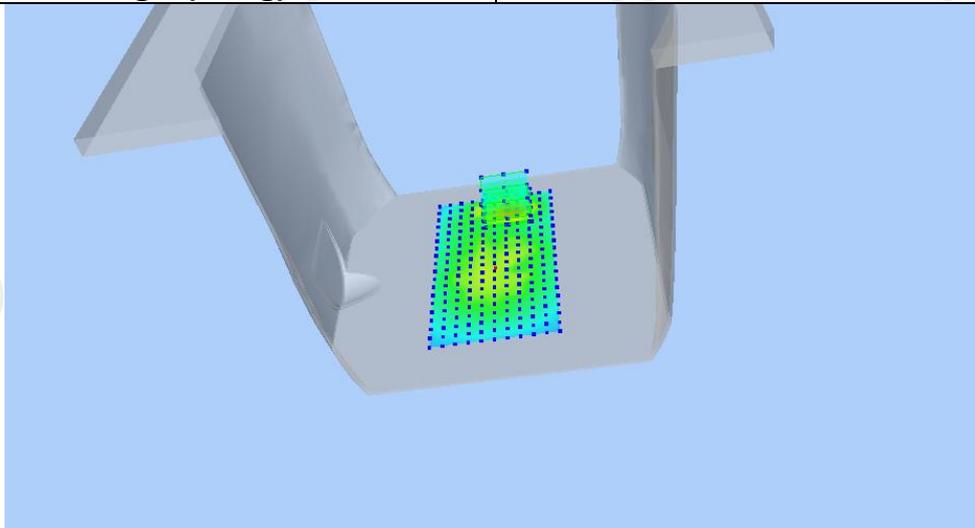
Maximum location: X=10.00, Y=56.00
SAR Peak: 0.70 W/kg

SAR 10g (W/Kg)

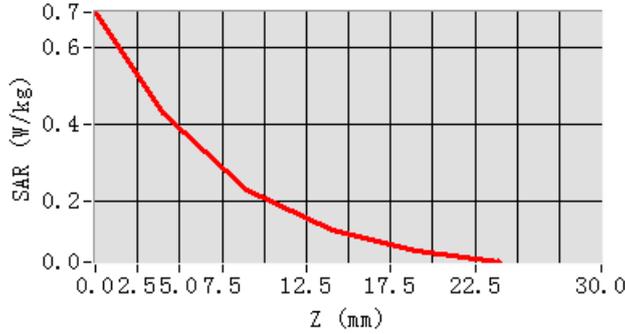
0.198427

SAR 1g (W/Kg)

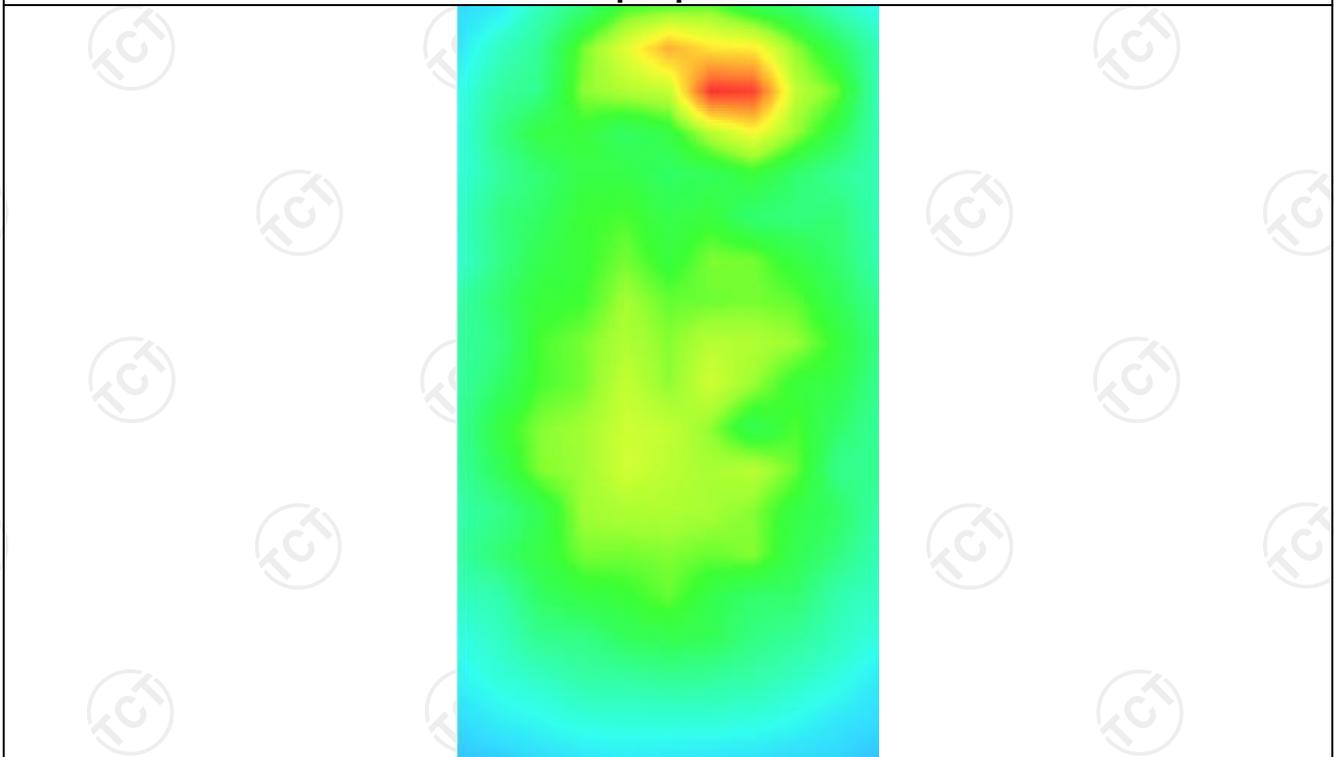
0.395478



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.6927	0.4309	0.2311	0.1253	0.0724



Hot spot position



GSM1800

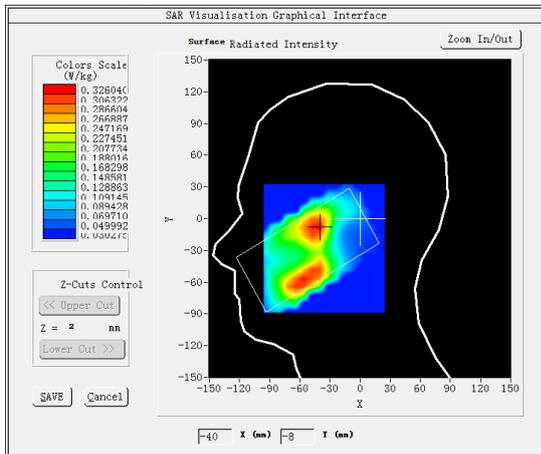
MEASUREMENT 1

Middle Band SAR (Channel 700):

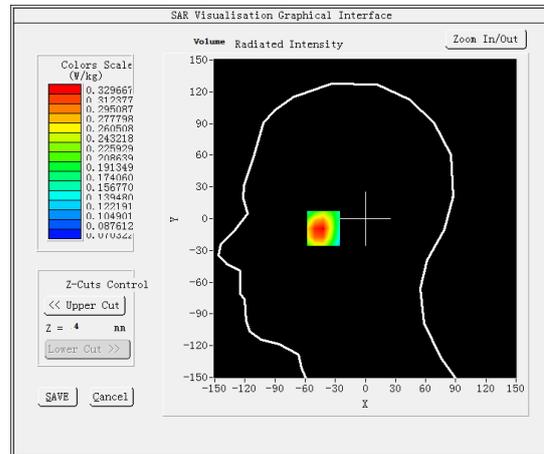
Date: 08/17/2022

Frequency (MHz)	1747.800049
Relative permittivity (real part)	38.854207
Relative permittivity (imaginary part)	13.770436
Conductivity (S/m)	1.412109
Variation (%)	0.310000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>GSM1800</u>

SURFACE SAR



VOLUME SAR



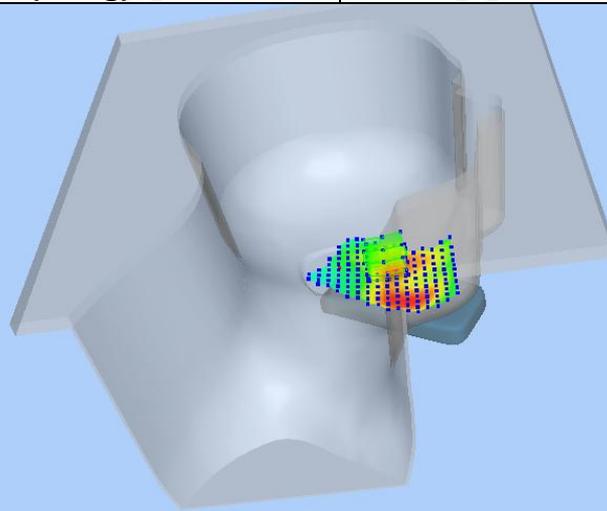
Maximum location: X=-42.00, Y=-8.00
SAR Peak: 0.44 W/kg

SAR 10g (W/Kg)

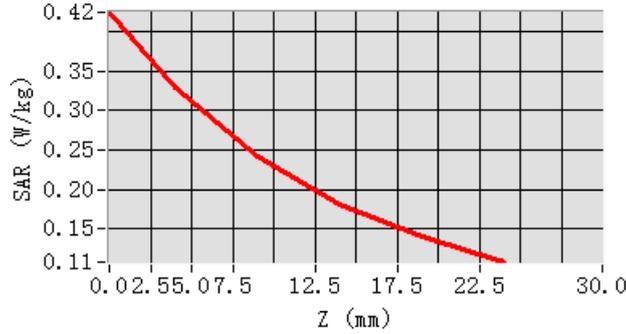
0.215667

SAR 1g (W/Kg)

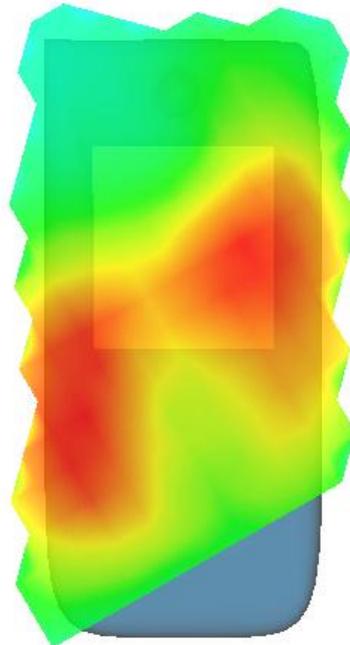
0.319096



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.4243	0.3297	0.2420	0.1815	0.1400



Hot spot position



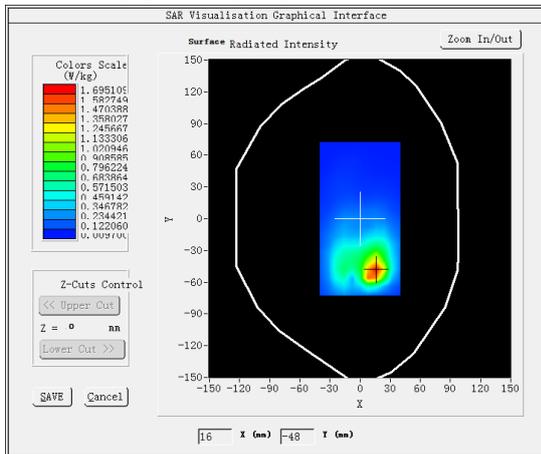
MEASUREMENT 2

Middle Band SAR (Channel 700):

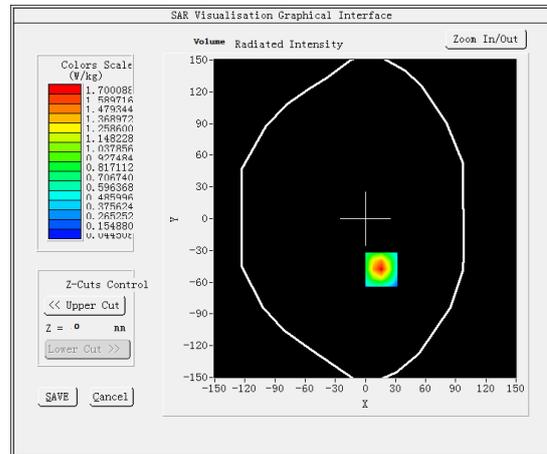
Date: 08/17/2022

Frequency (MHz)	1747.800049
Relative permittivity (real part)	38.854207
Relative permittivity (imaginary part)	13.770436
Conductivity (S/m)	1.412109
Variation (%)	-2.790000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>GSM1800(voice)</u>

SURFACE SAR



VOLUME SAR



Maximum location: X=16.00, Y=-48.00

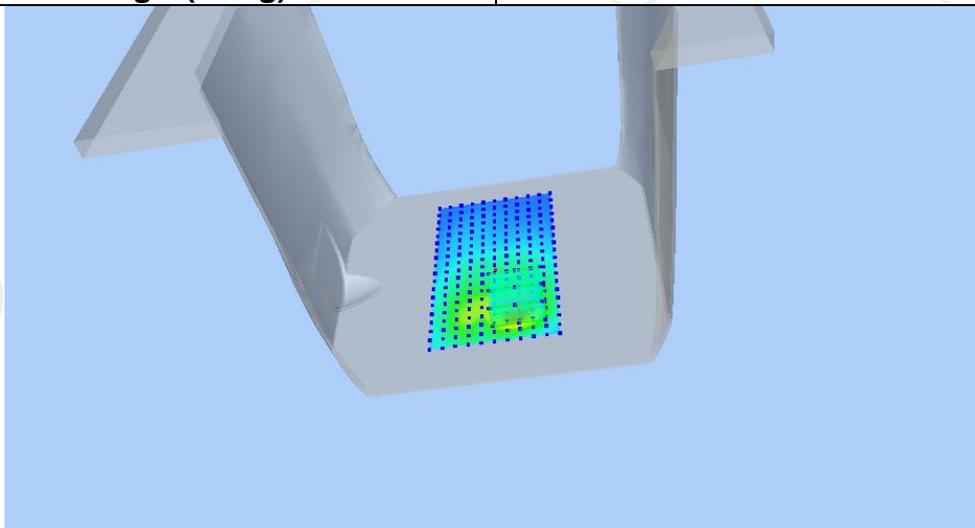
SAR Peak: 3.26 W/kg

SAR 10g (W/Kg)

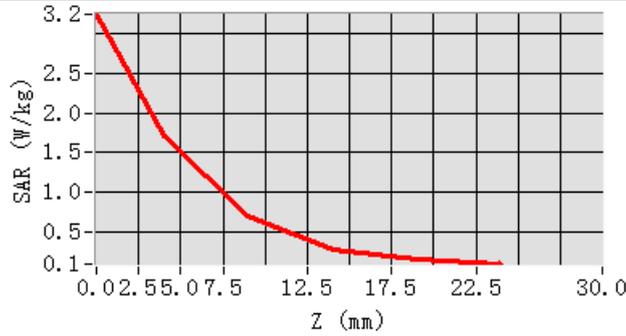
0.734288

SAR 1g (W/Kg)

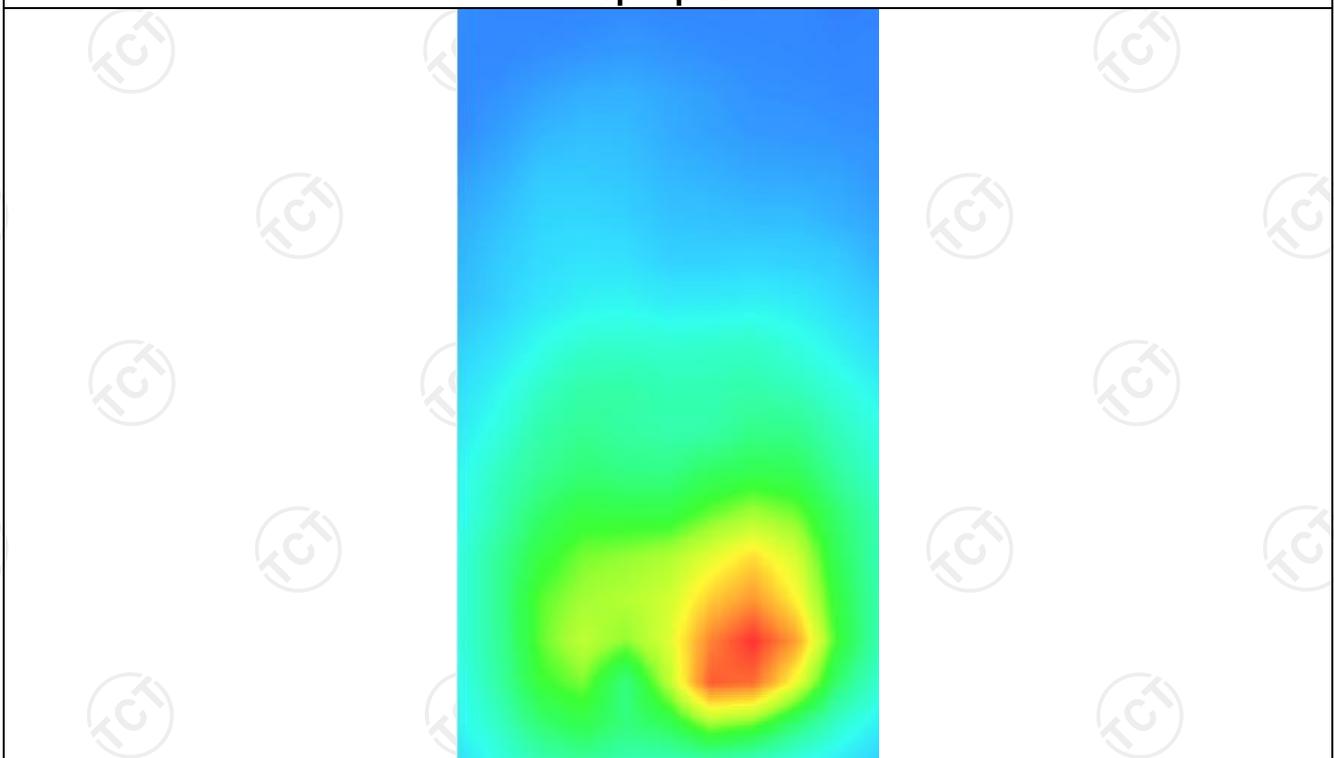
1.593624



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	3.2348	1.7001	0.7008	0.2945	0.1567



Hot spot position



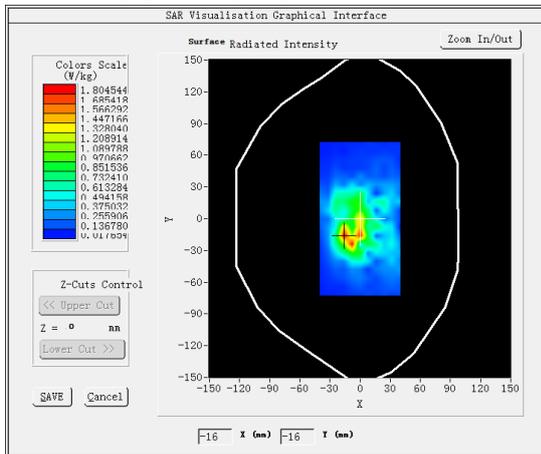
MEASUREMENT 3

Middle Band SAR (Channel 700):

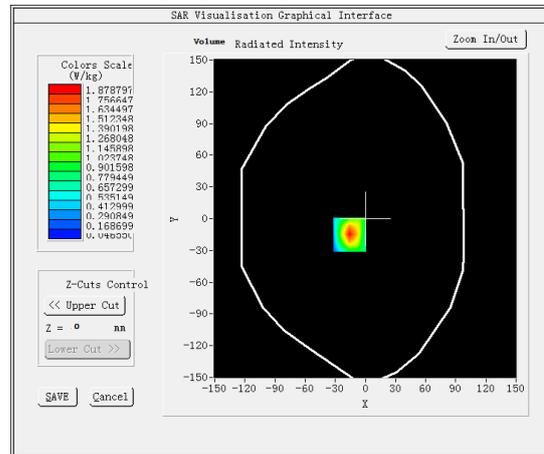
Date: 08/17/2022

Frequency (MHz)	1747.800049
Relative permittivity (real part)	38.854207
Relative permittivity (imaginary part)	13.770436
Conductivity (S/m)	1.412109
Variation (%)	0.610000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>GSM1800(GPRS 4slot)</u>

SURFACE SAR

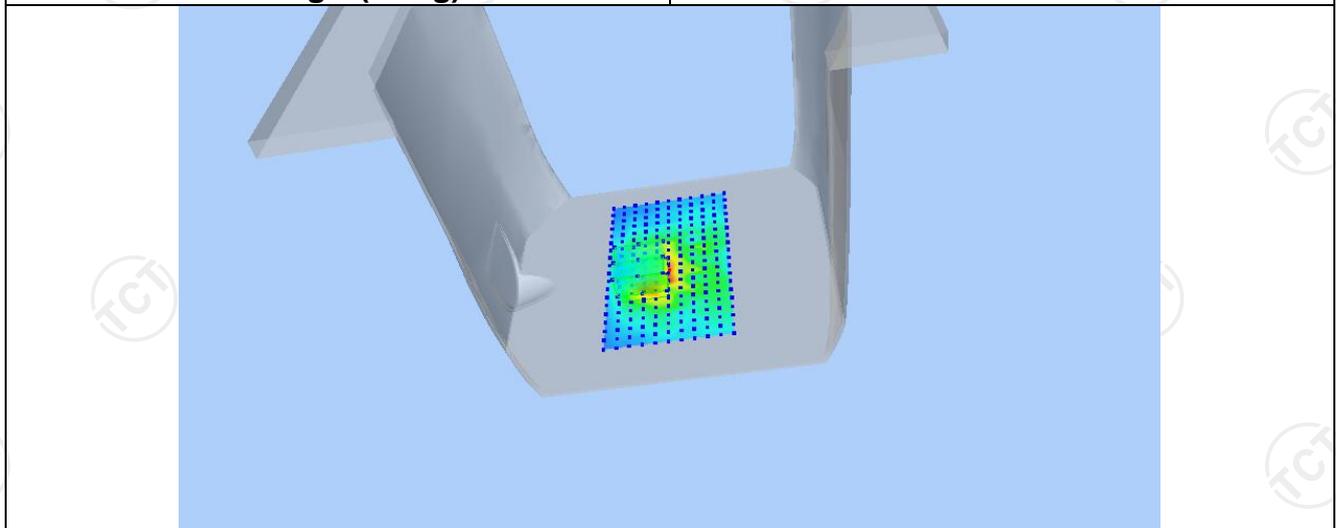


VOLUME SAR

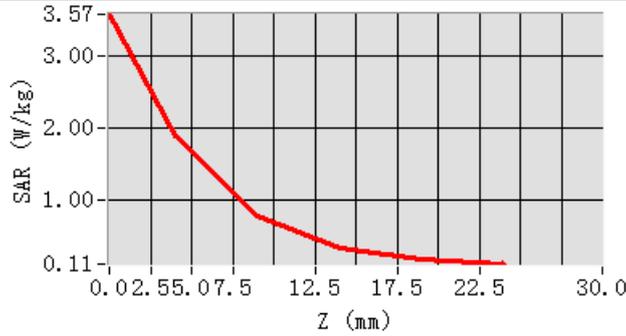


Maximum location: X=-16.00, Y=-15.00
SAR Peak: 3.56 W/kg

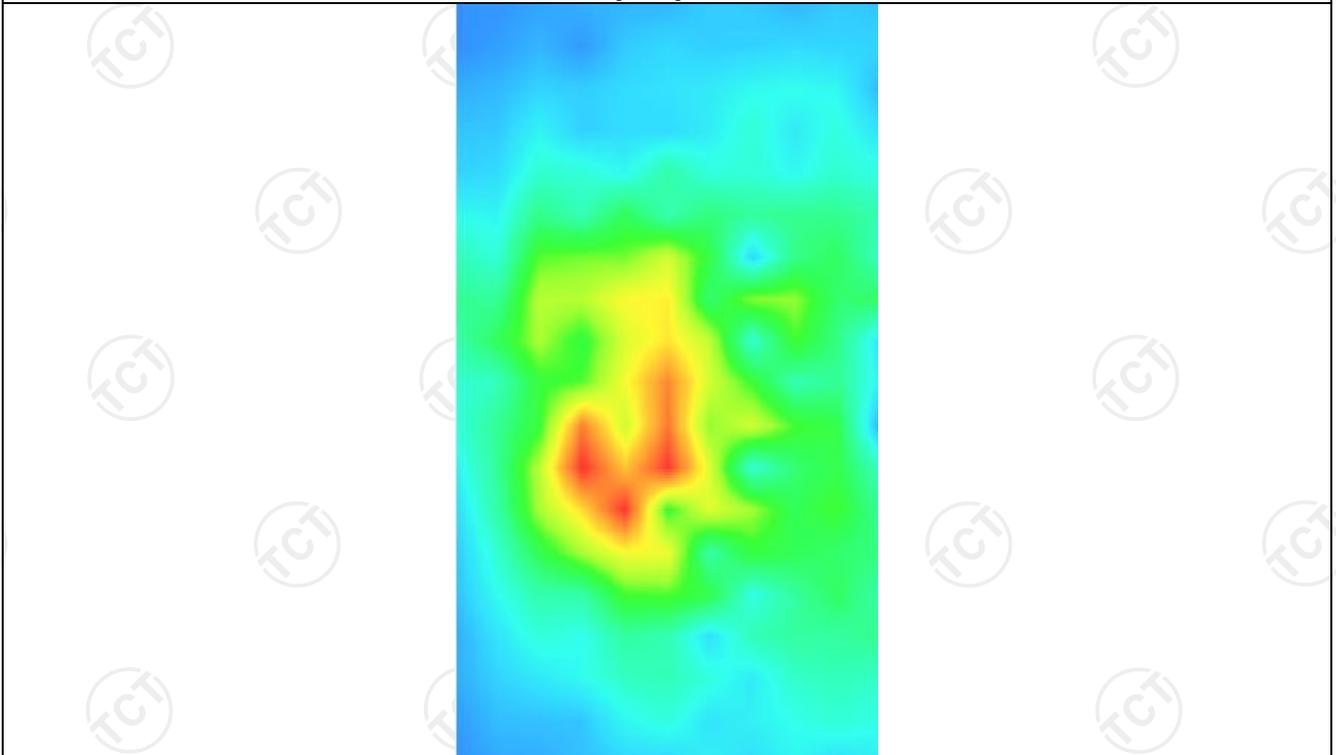
SAR 10g (W/Kg)	0.871162
SAR 1g (W/Kg)	1.767062



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	3.5709	1.8788	0.7750	0.3246	0.1708



Hot spot position



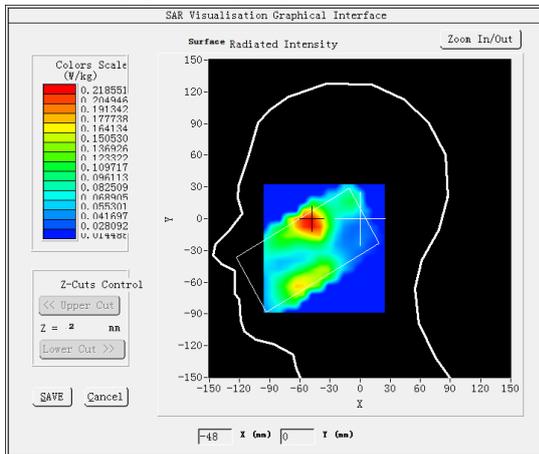
WCDMA Band I
MEASUREMENT 1

Middle Band SAR (Channel 9750):

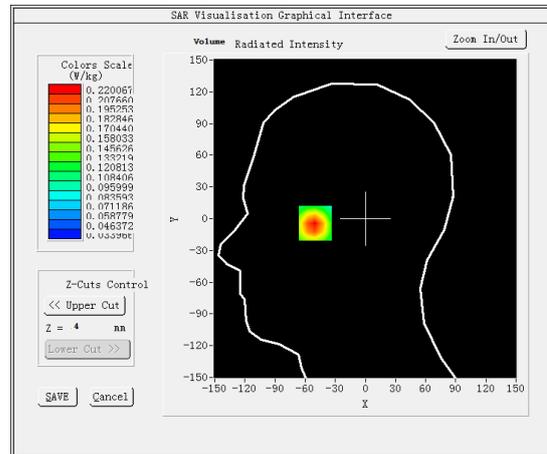
Date: 08/18/2022

Frequency (MHz)	1950.000000
Relative permittivity (real part)	39.721249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.430792
Variation (%)	2.820000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>Band1_UMTS</u>

SURFACE SAR

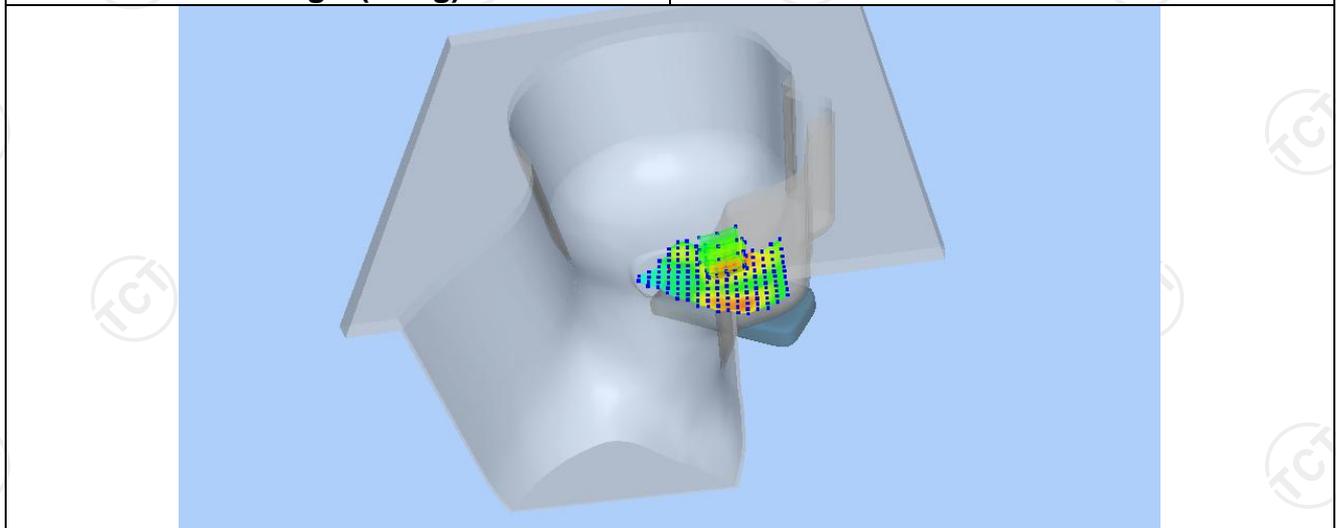


VOLUME SAR

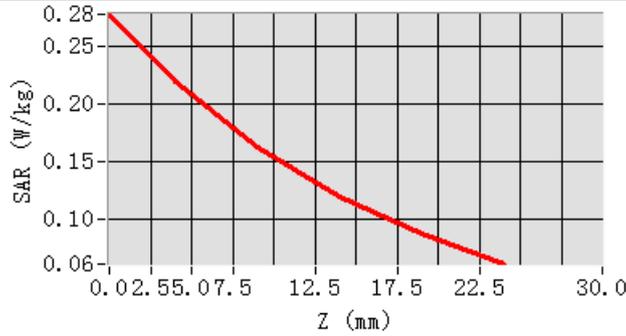


Maximum location: X=-50.00, Y=-2.00
SAR Peak: 0.28 W/kg

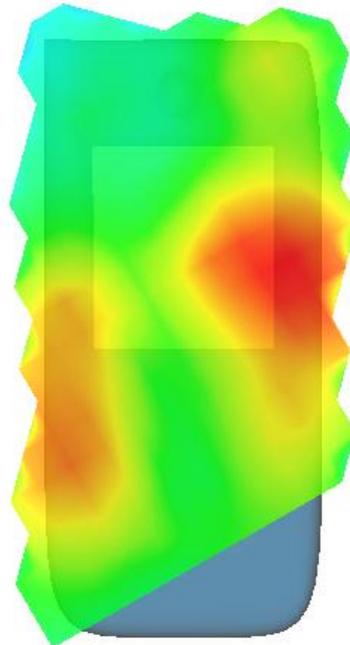
SAR 10g (W/Kg)	0.138826
SAR 1g (W/Kg)	0.209334



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.2780	0.2201	0.1628	0.1196	0.0871



Hot spot position



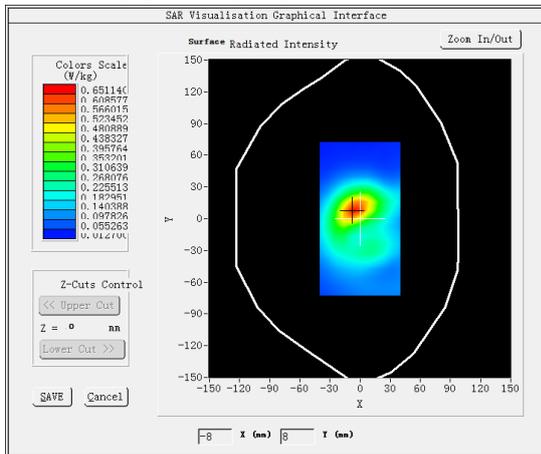
MEASUREMENT 2

Middle Band SAR (Channel 9750):

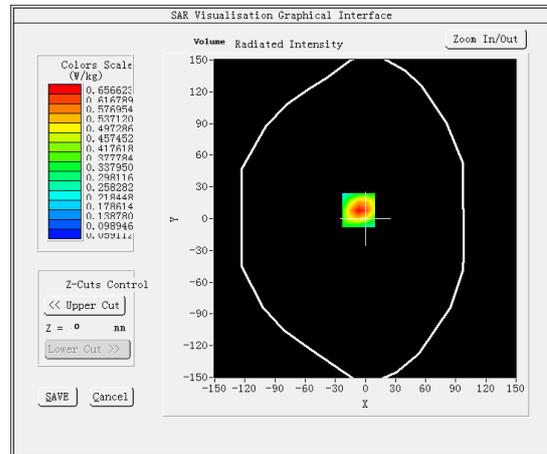
Date: 08/18/2022

Frequency (MHz)	1950.000000
Relative permittivity (real part)	39.721249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.430792
Variation (%)	0.550000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body Back</u>
Band	<u>BAND1_WCDMA2100</u>

SURFACE SAR



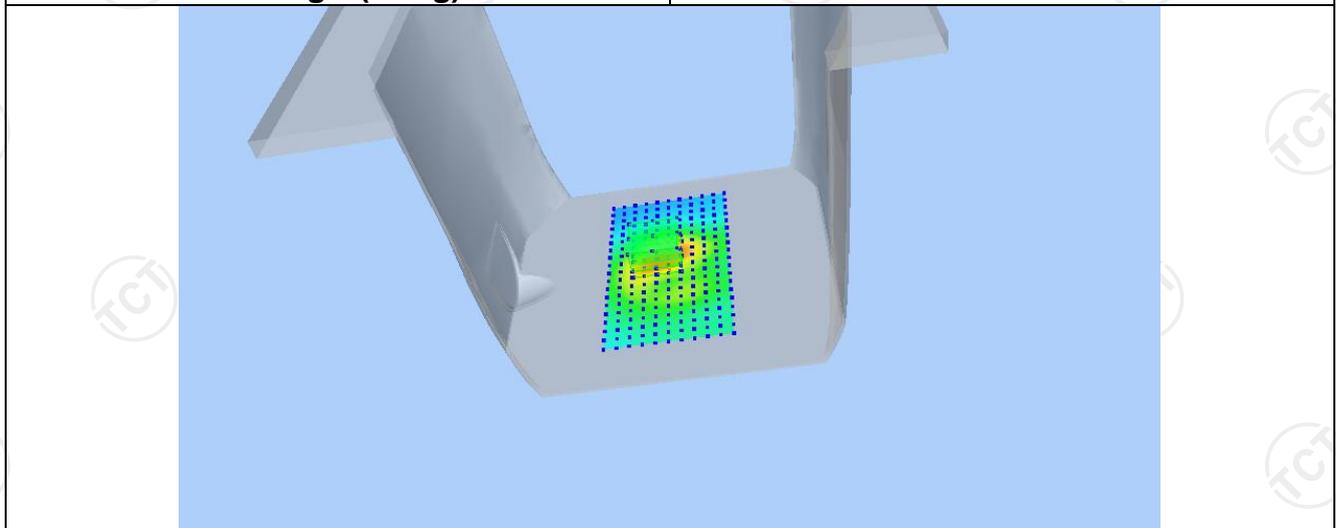
VOLUME SAR



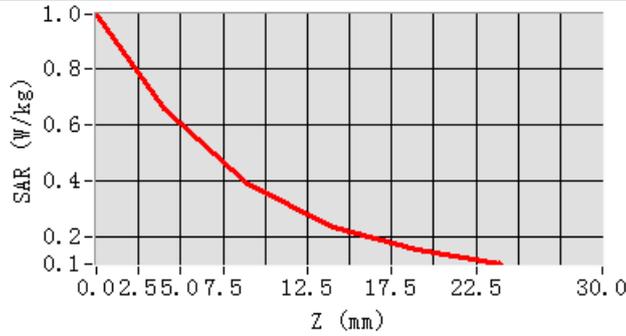
Maximum location: X=-7.00, Y=8.00

SAR Peak: 0.99 W/kg

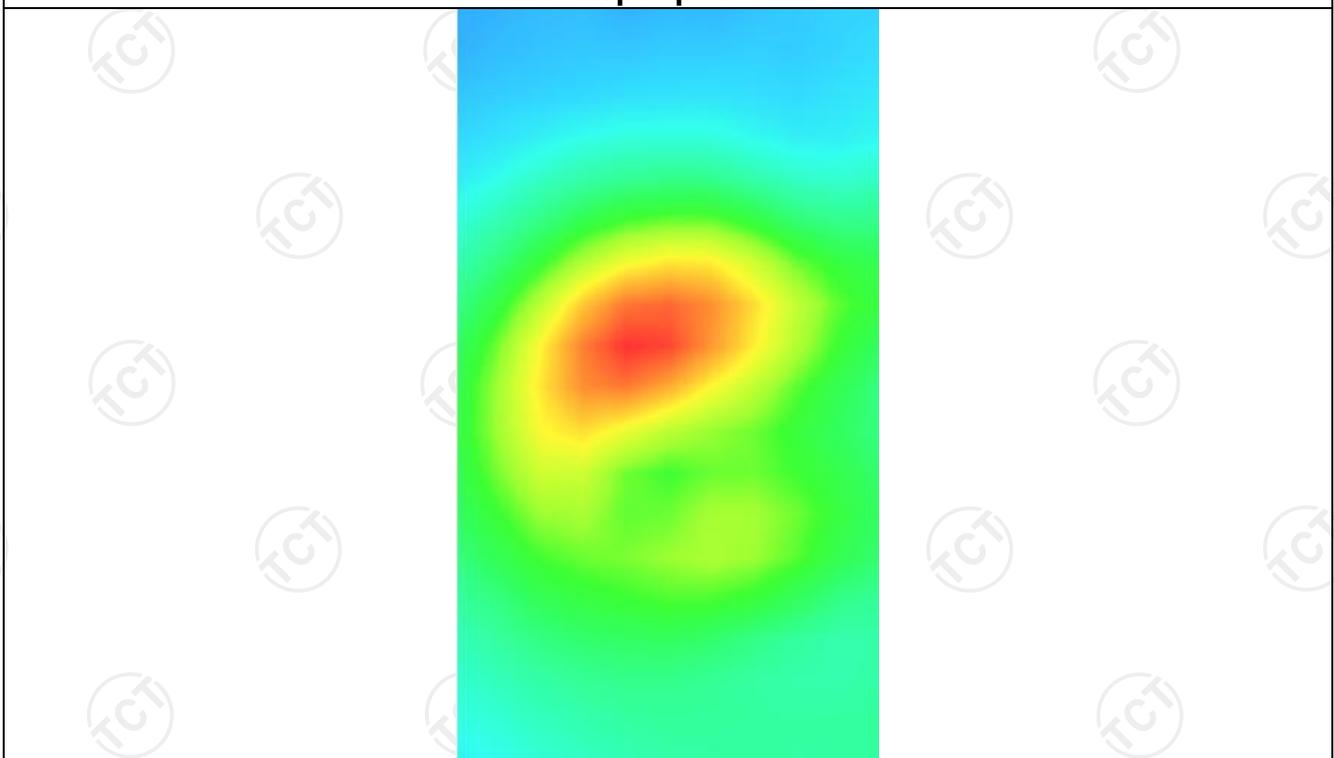
SAR 10g (W/Kg)	0.352172
SAR 1g (W/Kg)	0.614973



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.9925	0.6566	0.3881	0.2363	0.1540



Hot spot position



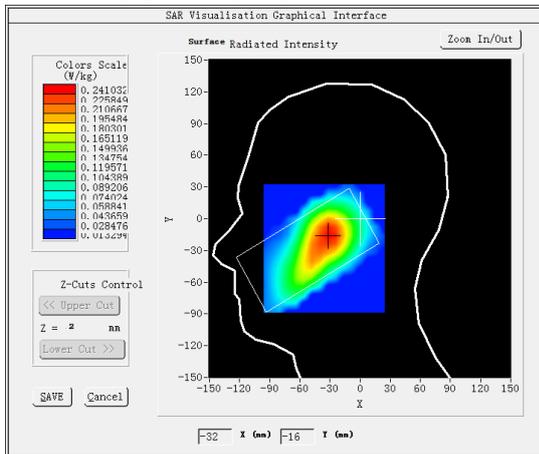
WCDMA Band VIII
MEASUREMENT 1

Middle Band SAR (Channel 2788):

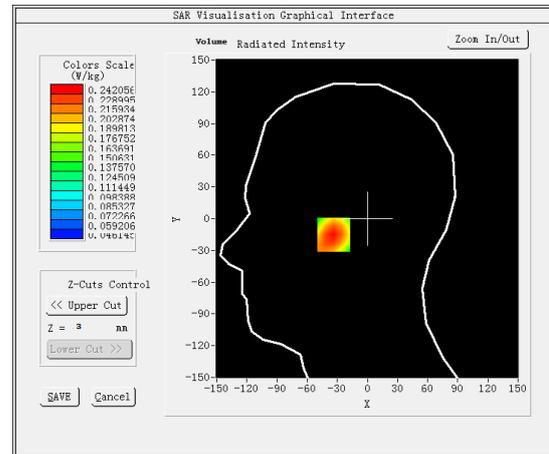
Date: 08/15/2022

Frequency (MHz)	897.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	-1.420000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>BAND8_WCDMA900</u>

SURFACE SAR



VOLUME SAR



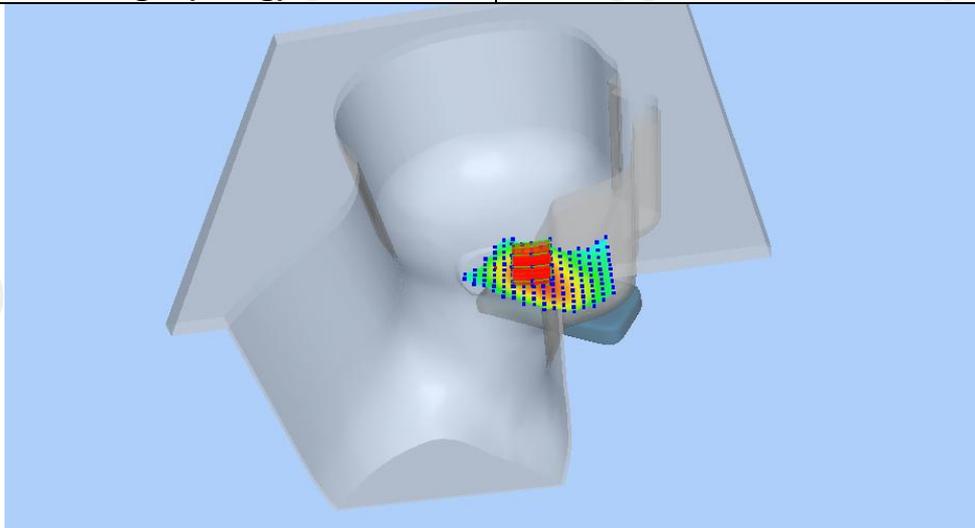
Maximum location: X=-31.00, Y=-15.00
SAR Peak: 0.29 W/kg

SAR 10g (W/Kg)

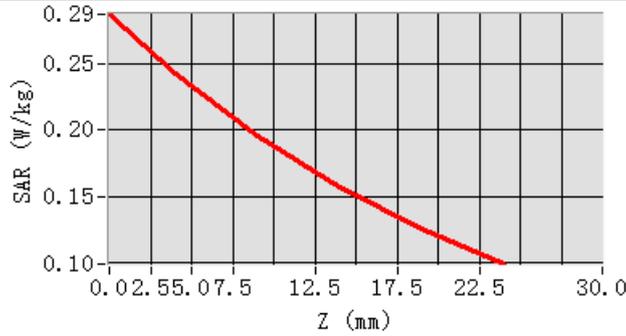
0.173787

SAR 1g (W/Kg)

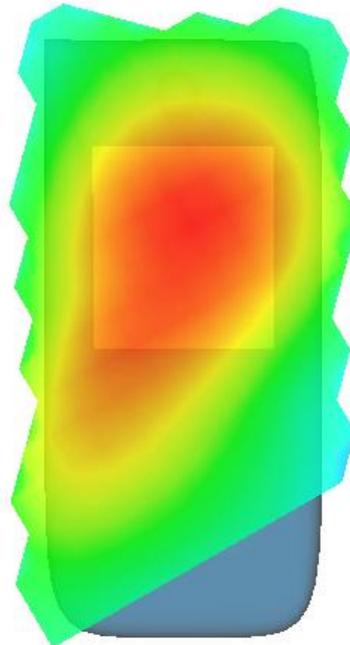
0.232990



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.2870	0.2421	0.1950	0.1568	0.1256



Hot spot position



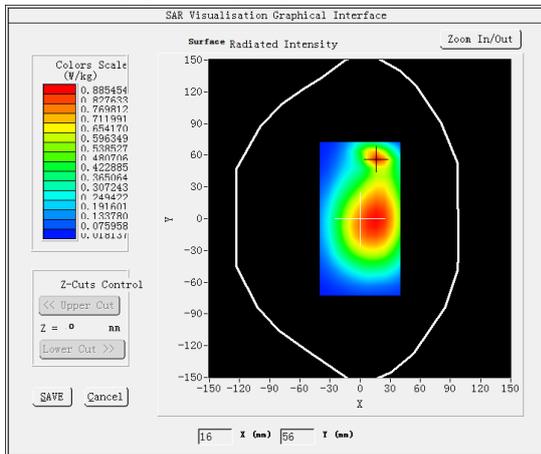
MEASUREMENT 2

Middle Band SAR (Channel 2788):

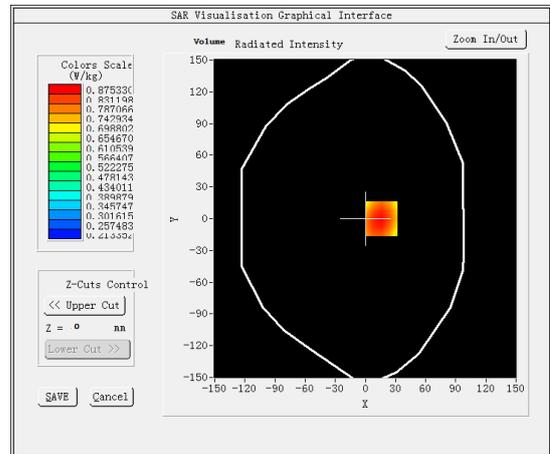
Date: 08/15/2022

Frequency (MHz)	897.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	-0.120000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>BAND8_WCDMA900</u>

SURFACE SAR



VOLUME SAR



Maximum location: X=16.00, Y=0.00

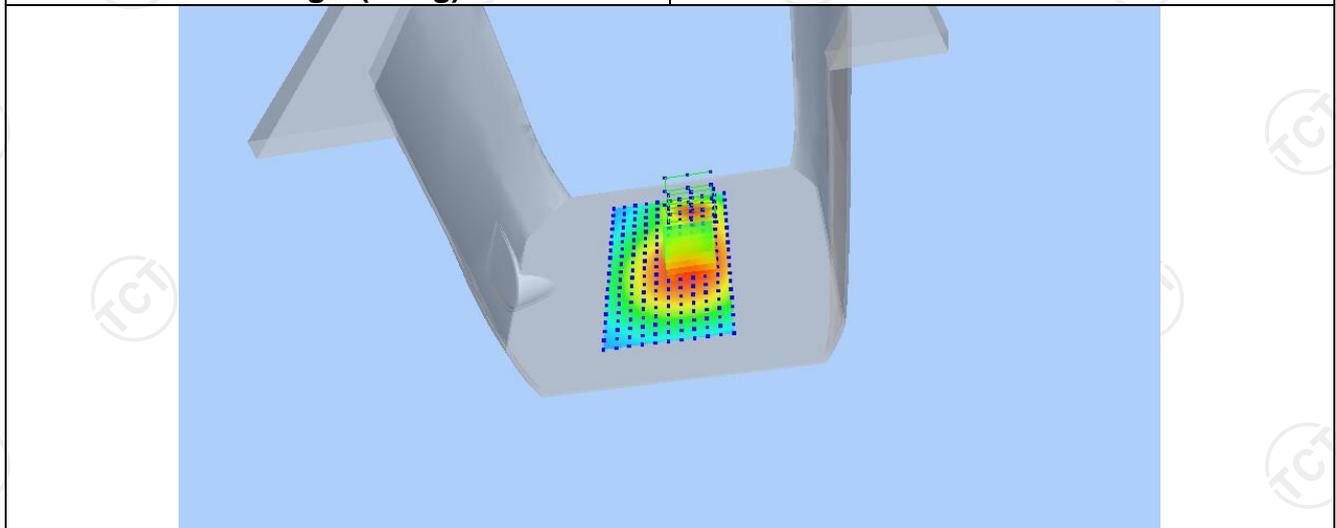
SAR Peak: 1.05 W/kg

SAR 10g (W/Kg)

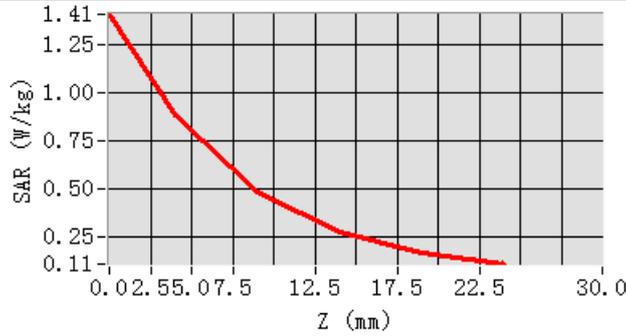
0.638830

SAR 1g (W/Kg)

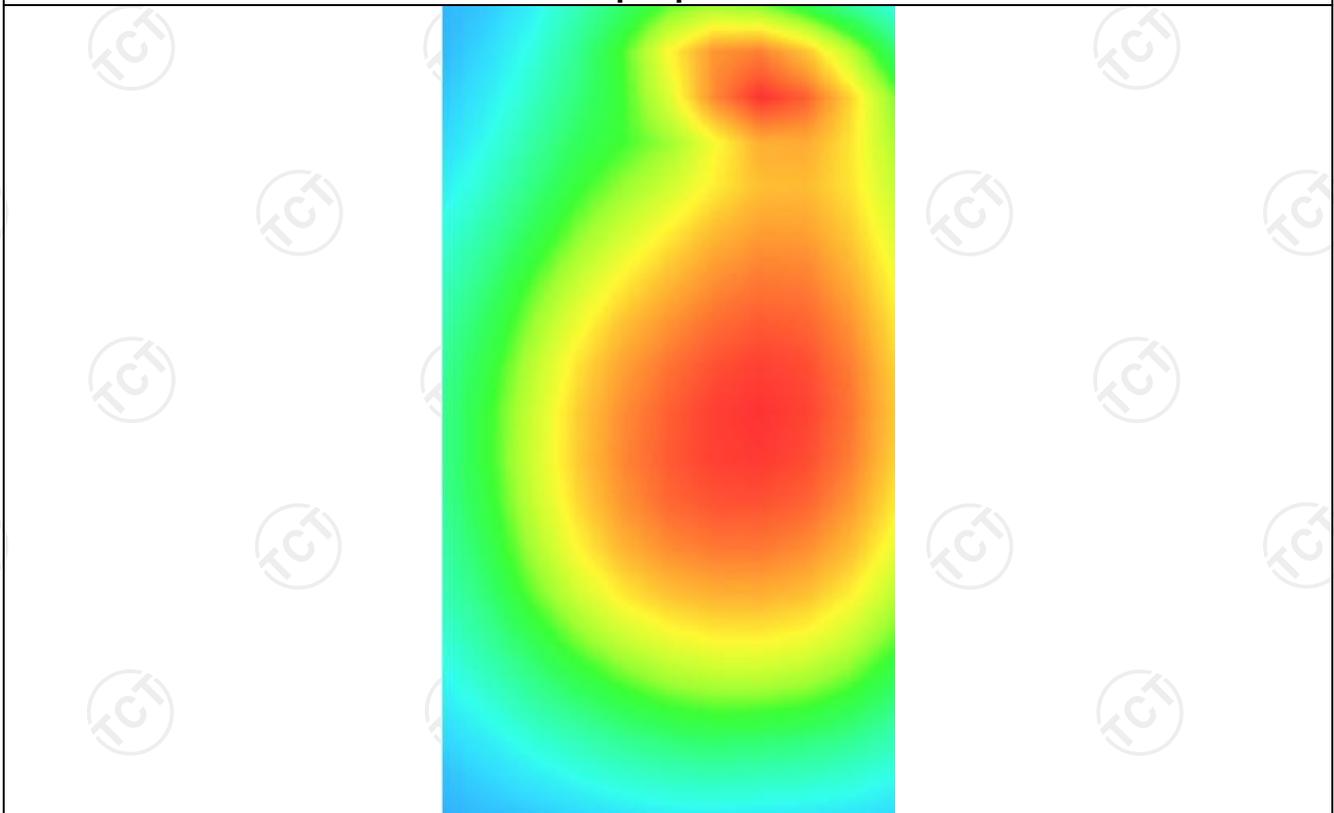
0.847151



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.4125	0.8857	0.4841	0.2723	0.1673



Hot spot position



LTE Band 1

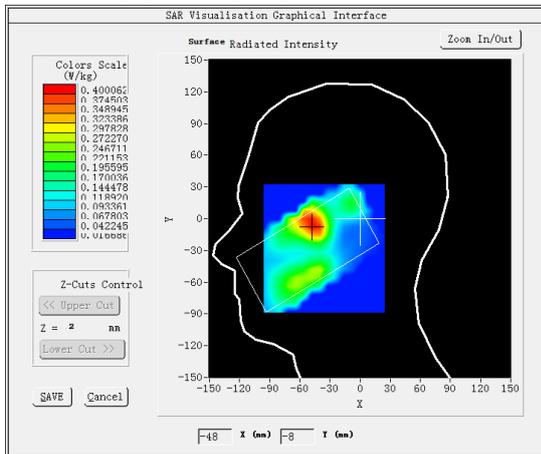
MEASUREMENT 1

Middle Band SAR (Channel 18300):

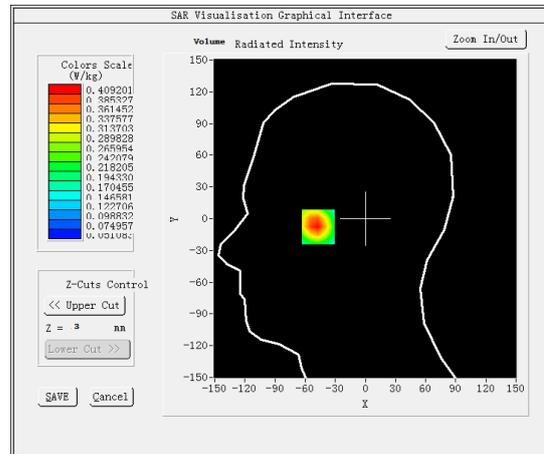
Date: 08/18/2022

Frequency (MHz)	1950.000000
Relative permittivity (real part)	39.721249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.430792
Variation (%)	0.660000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>LTE band 1</u>

SURFACE SAR

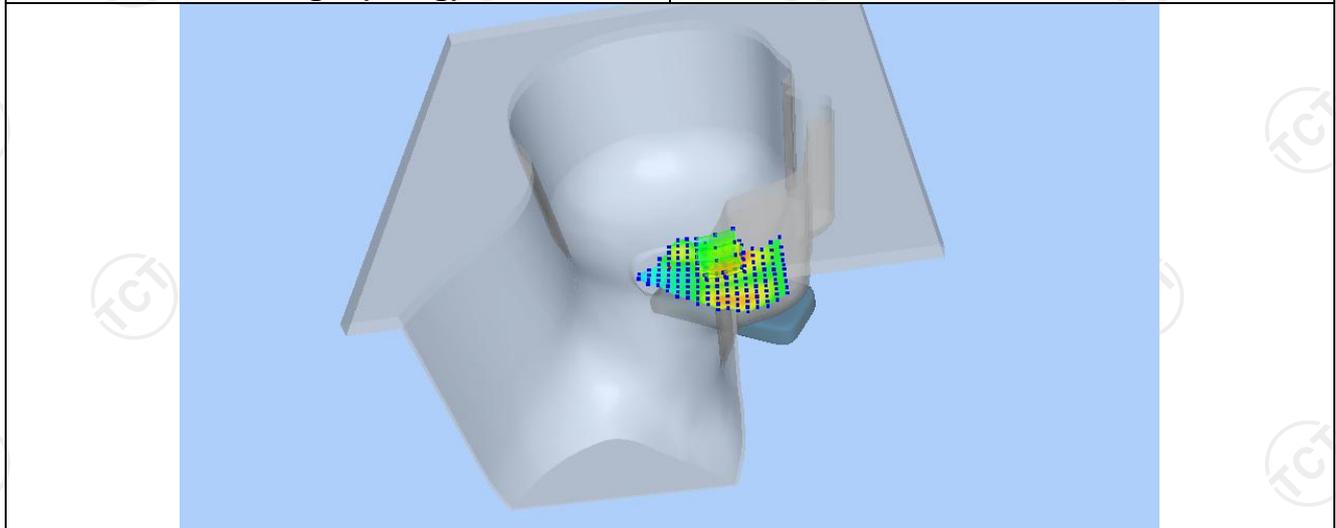


VOLUME SAR

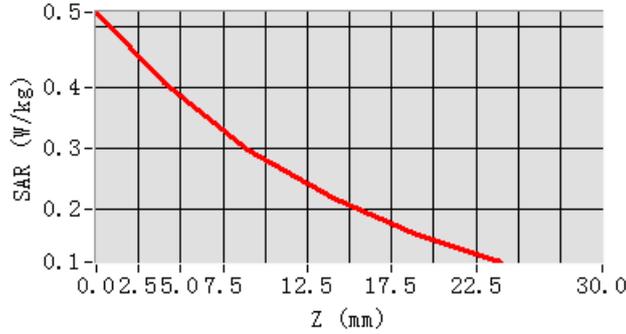


Maximum location: X=-47.00, Y=-6.00
SAR Peak: 0.53 W/kg

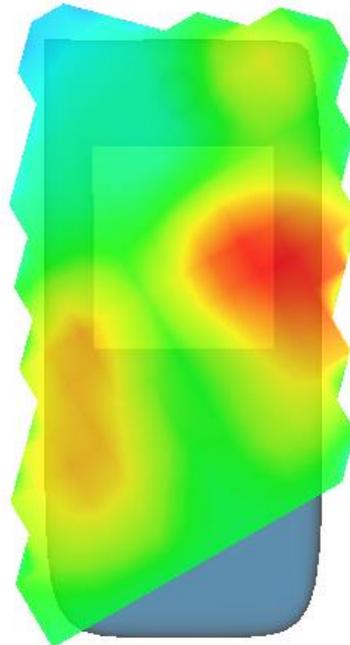
SAR 10g (W/Kg)	0.256503
SAR 1g (W/Kg)	0.389191



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.5242	0.4092	0.2985	0.2176	0.1584



Hot spot position



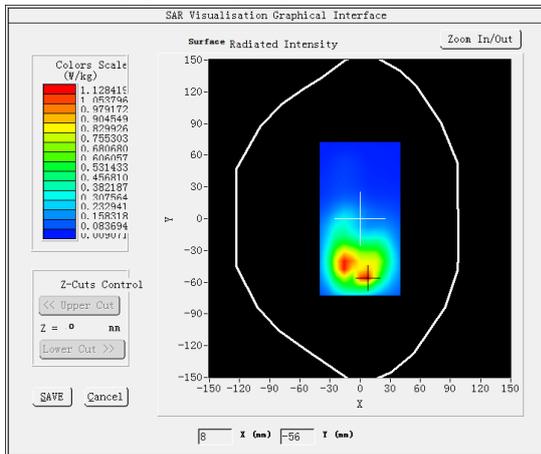
MEASUREMENT 2

Middle Band SAR (Channel 18300):

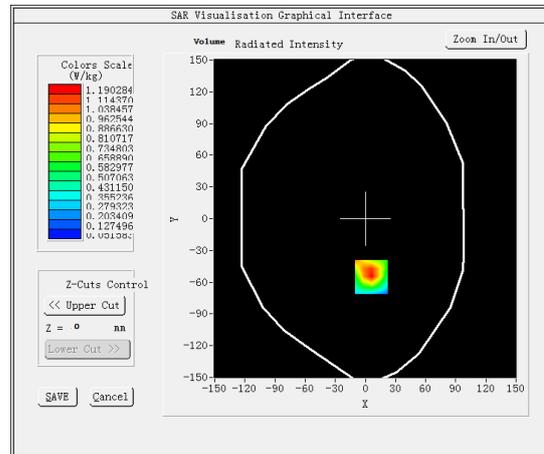
Date: 08/18/2022

Frequency (MHz)	1950.000000
Relative permittivity (real part)	39.721249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.430792
Variation (%)	-0.340000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 1</u>

SURFACE SAR



VOLUME SAR



Maximum location: X=6.00, Y=-55.00

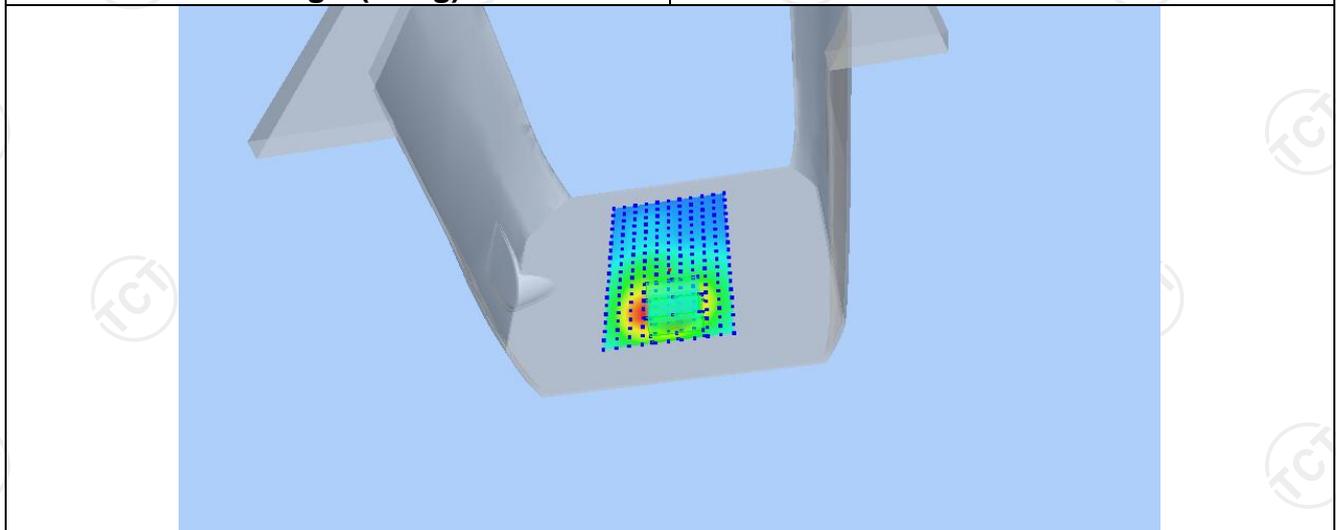
SAR Peak: 2.46 W/kg

SAR 10g (W/Kg)

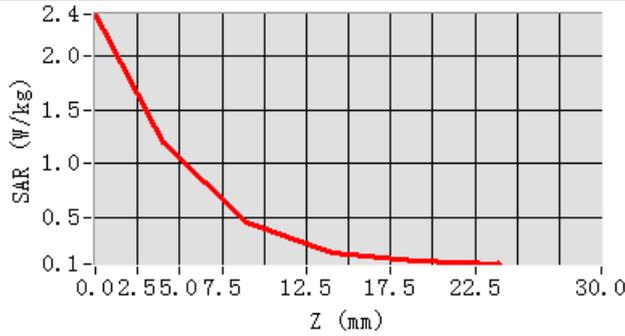
0.548773

SAR 1g (W/Kg)

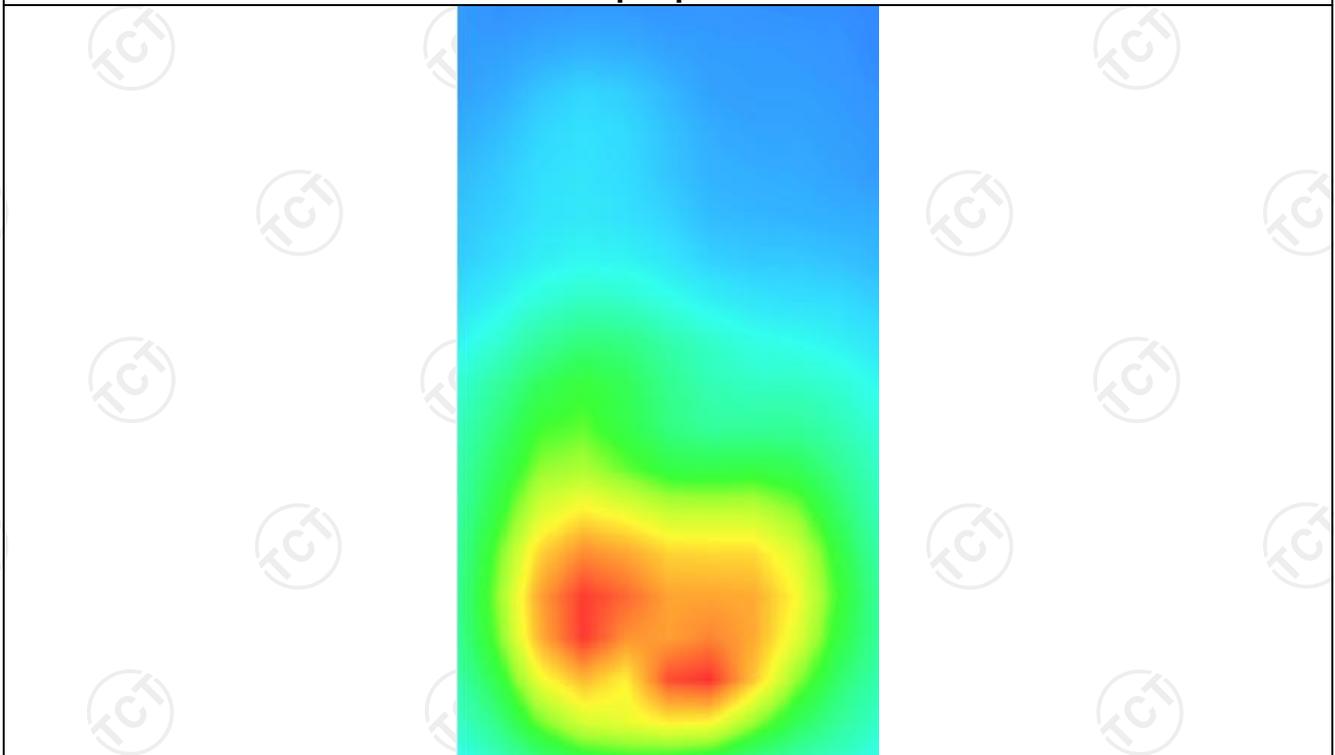
1.159272



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.3922	1.1903	0.4443	0.1670	0.0861



Hot spot position



LTE Band 3

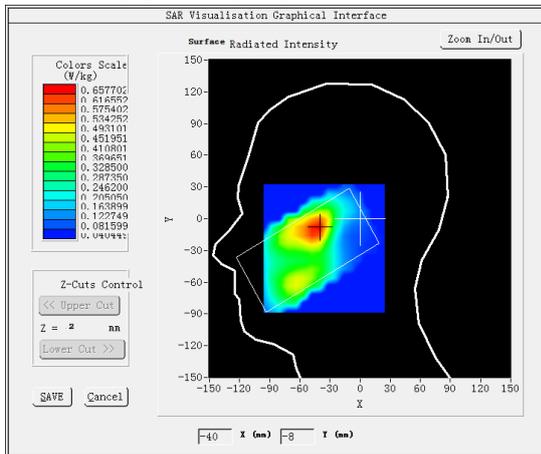
MEASUREMENT 1

Middle Band SAR (Channel 19575):

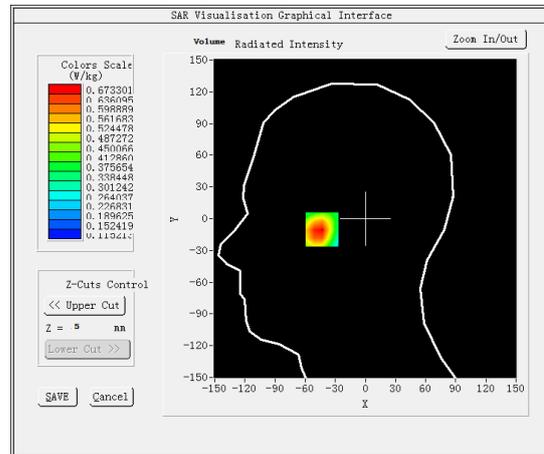
Date: 08/17/2022

Frequency (MHz)	1747.500000
Relative permittivity (real part)	38.854207
Relative permittivity (imaginary part)	13.770436
Conductivity (S/m)	1.412109
Variation (%)	0.540000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>LTE band 3</u>

SURFACE SAR

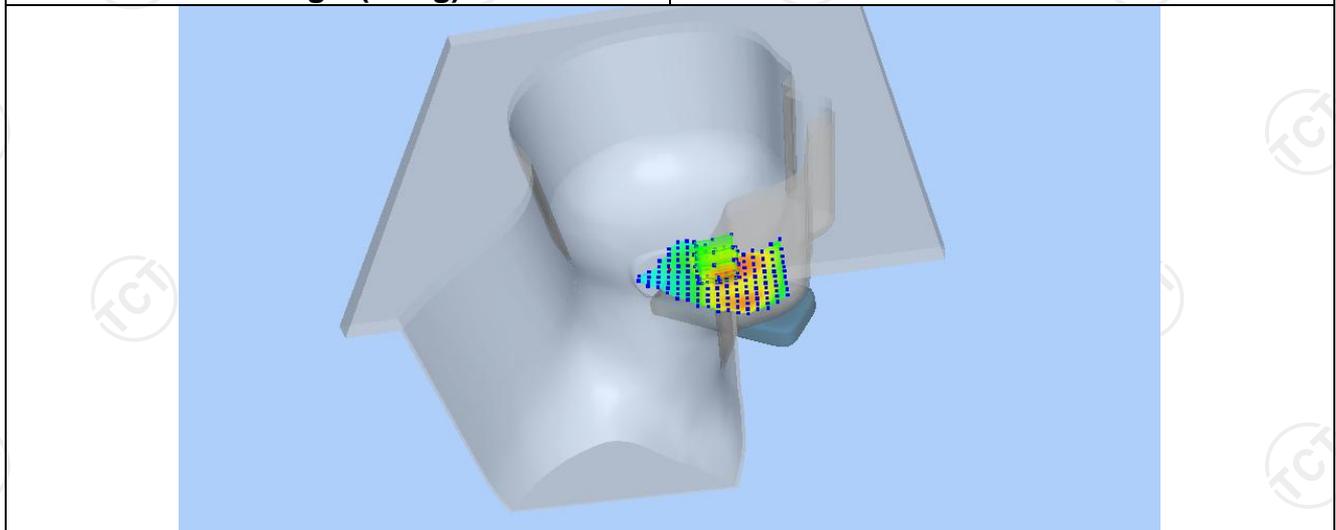


VOLUME SAR

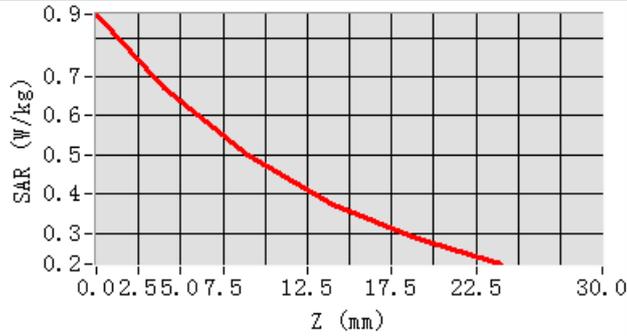


Maximum location: X=-43.00, Y=-9.00
SAR Peak: 0.88 W/kg

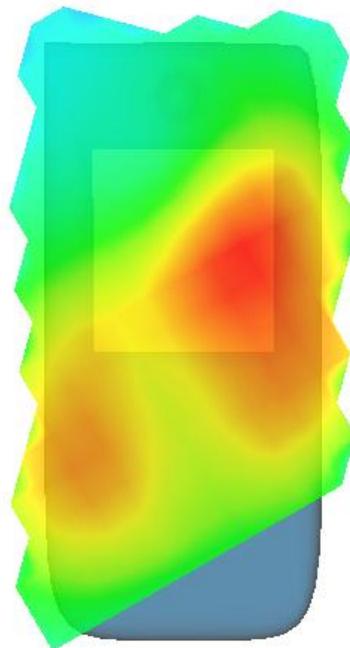
SAR 10g (W/Kg)	0.443069
SAR 1g (W/Kg)	0.650569



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.8602	0.6733	0.4978	0.3743	0.2875



Hot spot position



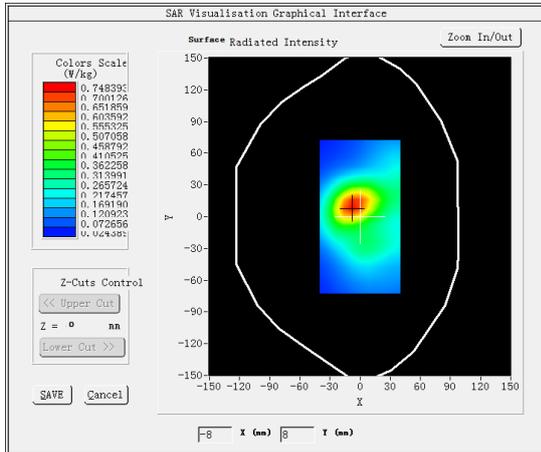
MEASUREMENT 2

Middle Band SAR (Channel 19575):

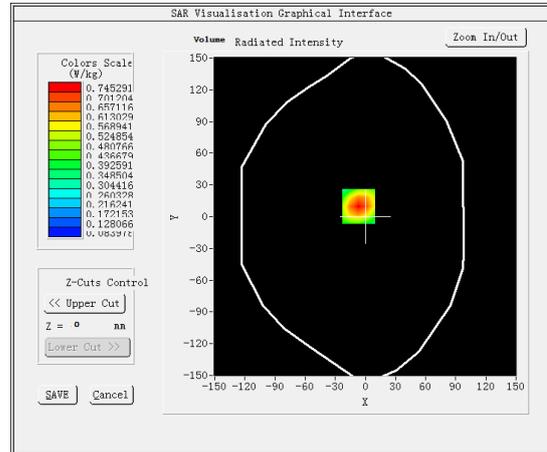
Date: 08/17/2022

Frequency (MHz)	1747.000000
Relative permittivity (real part)	38.854207
Relative permittivity (imaginary part)	13.770436
Conductivity (S/m)	1.412109
Variation (%)	0.250000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 3</u>

SURFACE SAR



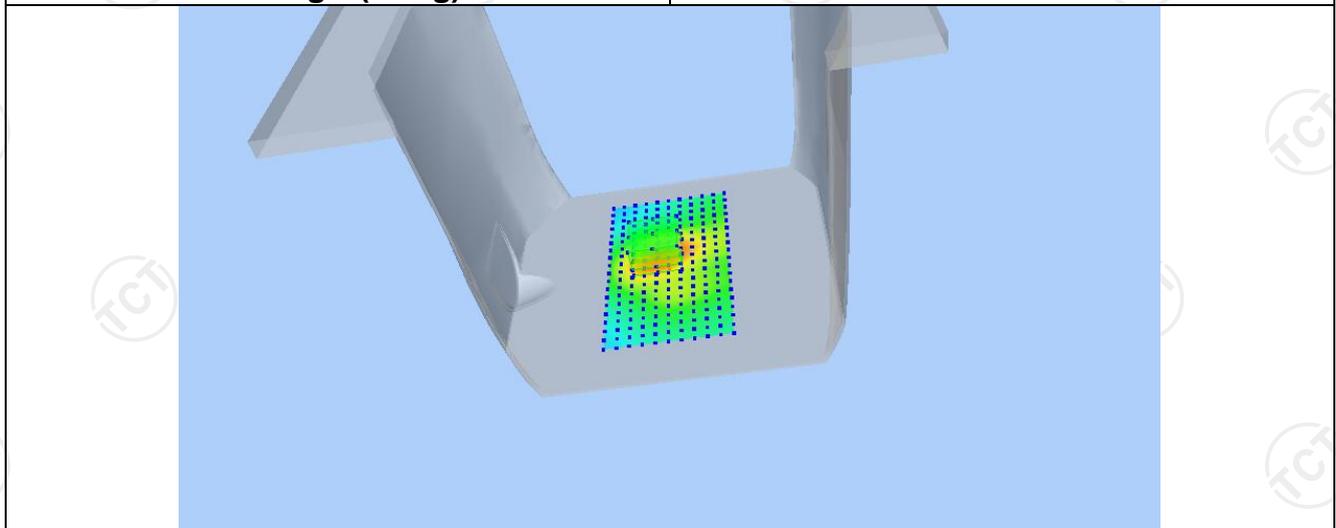
VOLUME SAR



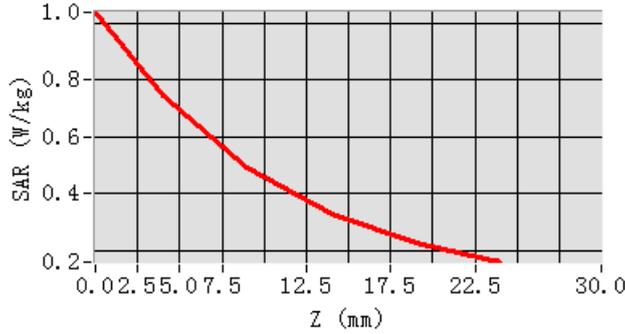
Maximum location: X=-7.00, Y=10.00

SAR Peak: 1.04 W/kg

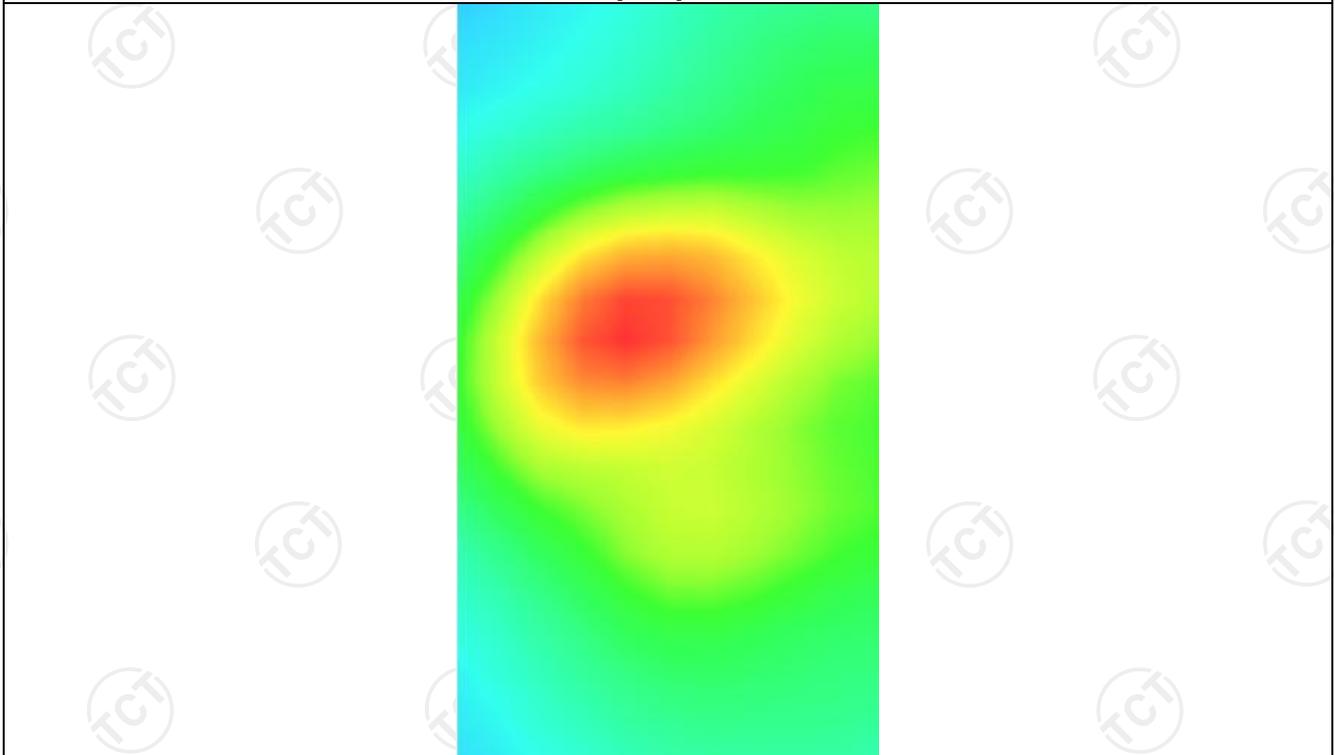
SAR 10g (W/Kg)	0.438018
SAR 1g (W/Kg)	0.701965



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.0387	0.7453	0.4908	0.3292	0.2282



Hot spot position



LTE Band 7

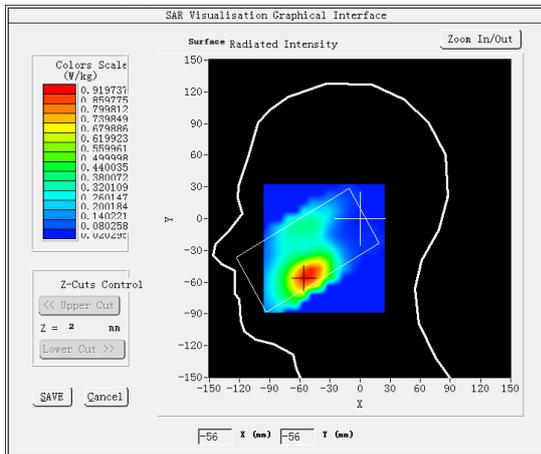
MEASUREMENT 1

Middle Band SAR (Channel 21100):

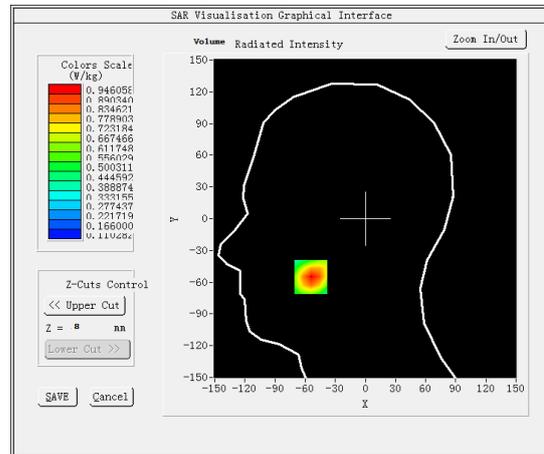
Date: 08/23/2022

Frequency (MHz)	2535.000000
Relative permittivity (real part)	38.350154
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.922154
Variation (%)	3.720000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>LTE band 7</u>

SURFACE SAR



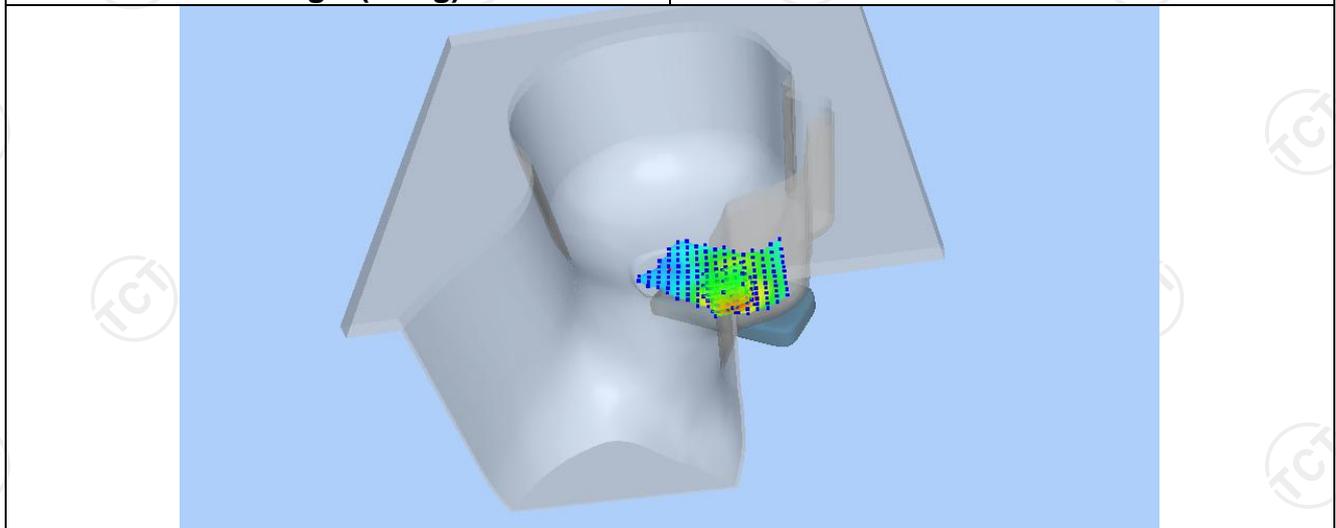
VOLUME SAR



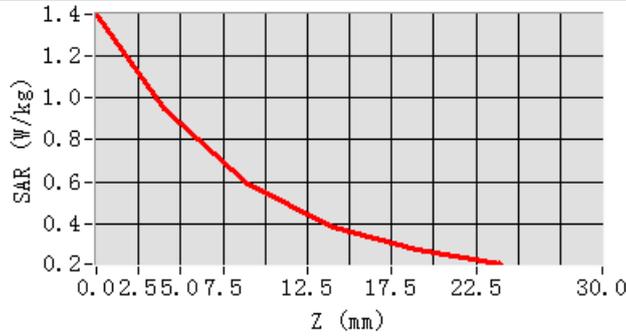
Maximum location: X=-54.00, Y=-55.00

SAR Peak: 1.40 W/kg

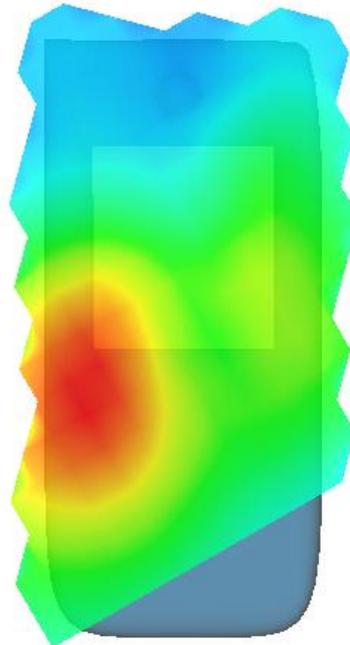
SAR 10g (W/Kg)	0.552774
SAR 1g (W/Kg)	0.910511



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.3951	0.9461	0.5859	0.3833	0.2755



Hot spot position



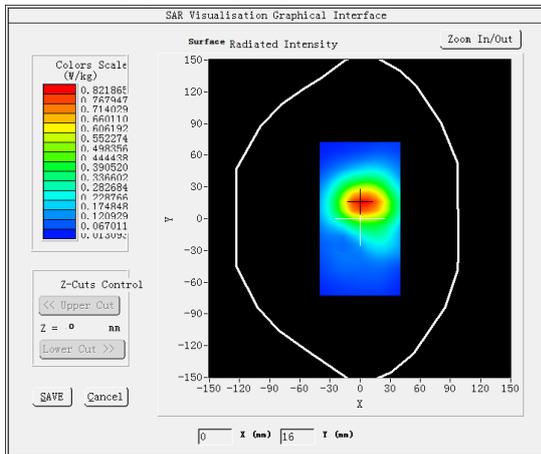
MEASUREMENT 2

Middle Band SAR (Channel 21100):

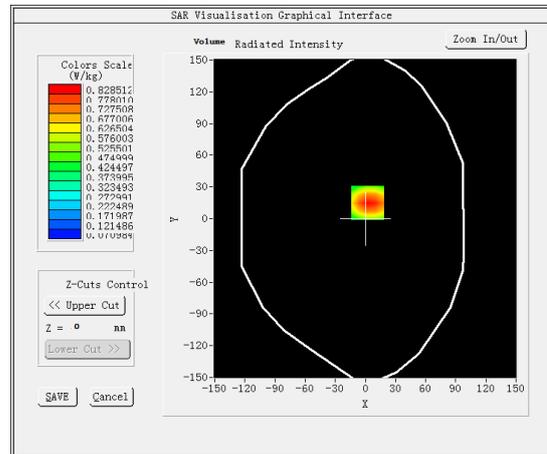
Date: 08/23/2022

Frequency (MHz)	2535.000000
Relative permittivity (real part)	38.350154
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.922154
Variation (%)	0.320000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 7</u>

SURFACE SAR



VOLUME SAR



Maximum location: X=2.00, Y=15.00

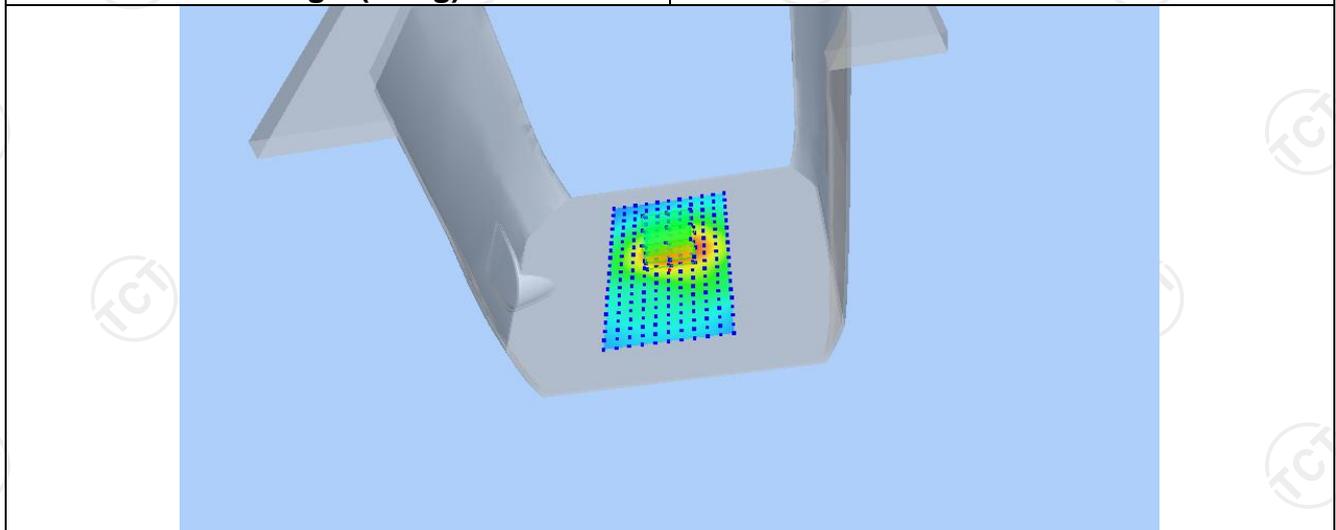
SAR Peak: 1.24 W/kg

SAR 10g (W/Kg)

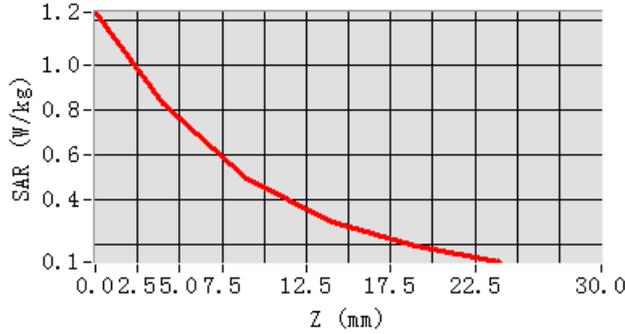
0.481116

SAR 1g (W/Kg)

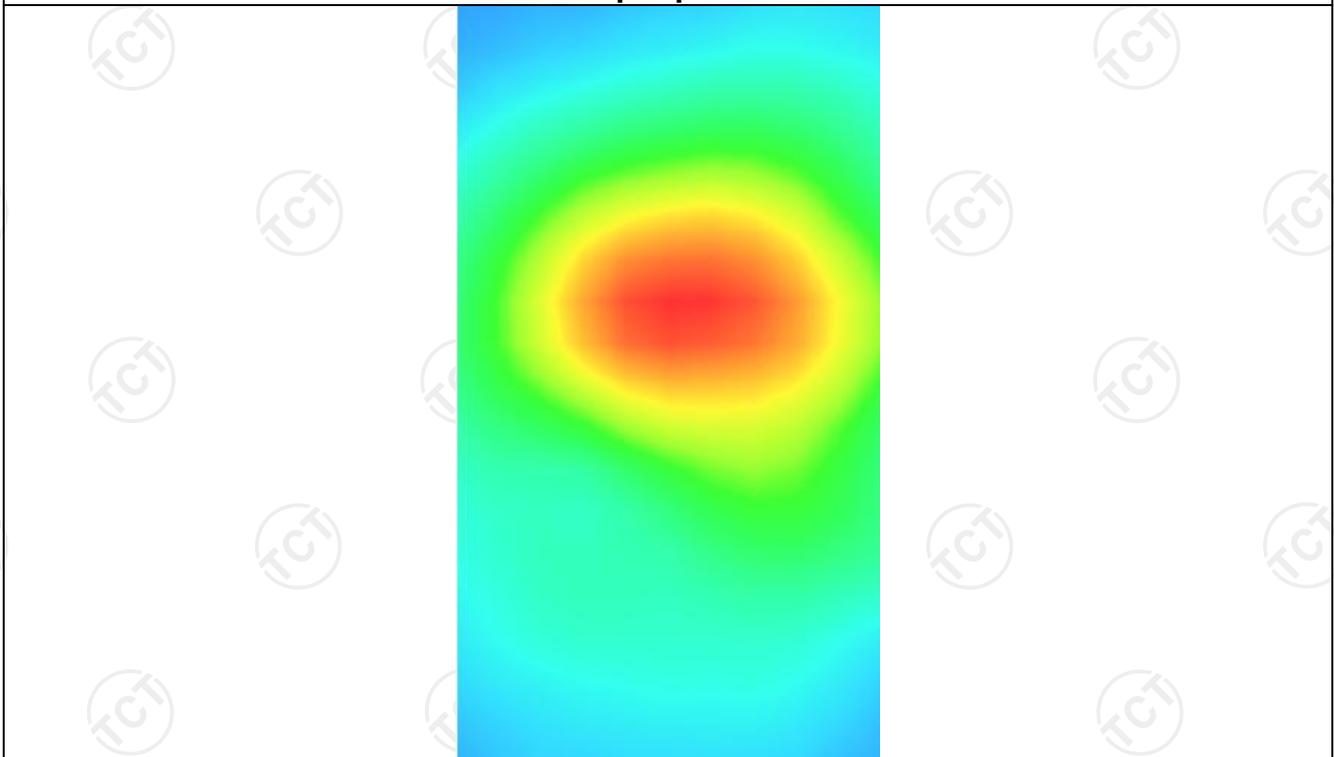
0.800573



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.2369	0.8285	0.4953	0.3006	0.1905



Hot spot position



LTE Band 8

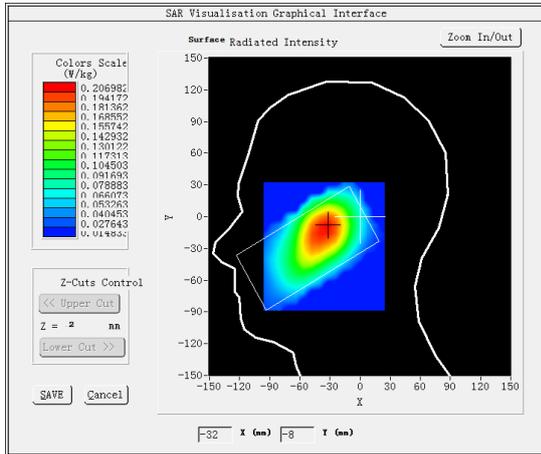
MEASUREMENT 1

Middle Band SAR (Channel 21625):

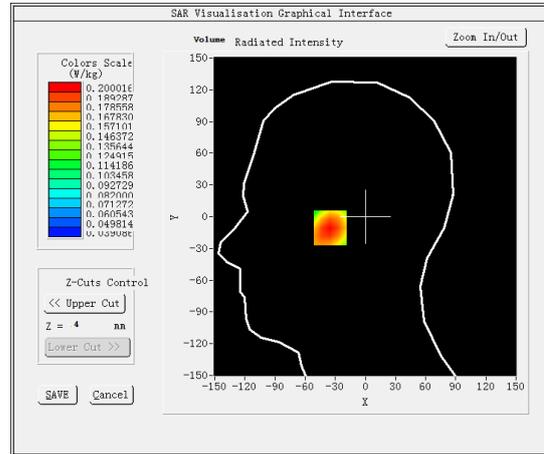
Date: 08/15/2022

Frequency (MHz)	897.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.324451
Conductivity (S/m)	0.960017
Variation (%)	-0.600000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>LTE band 8</u>

SURFACE SAR



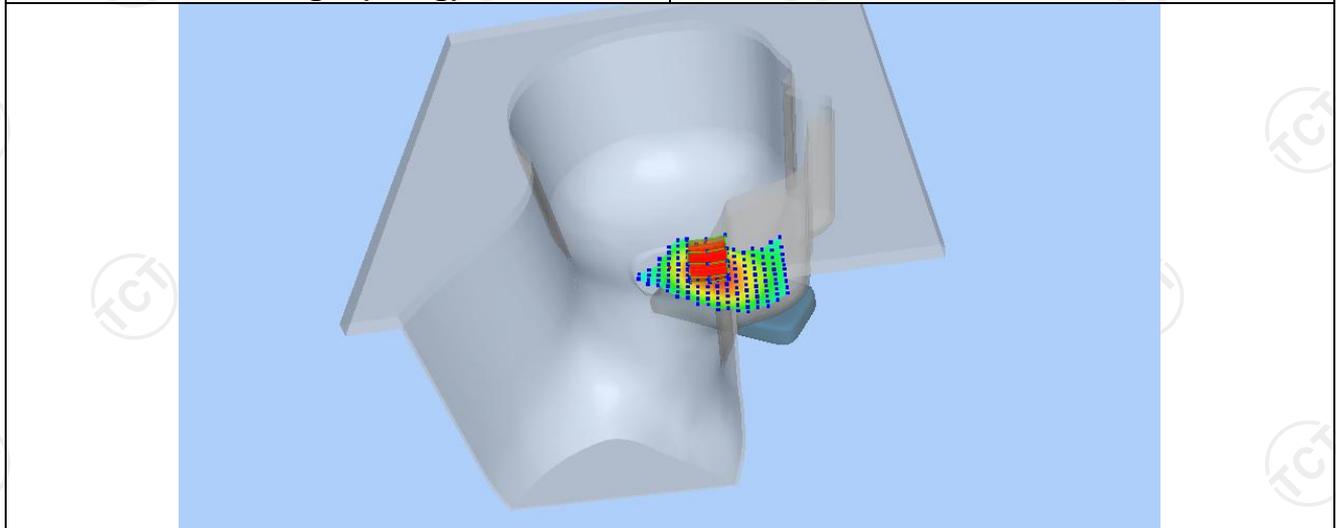
VOLUME SAR



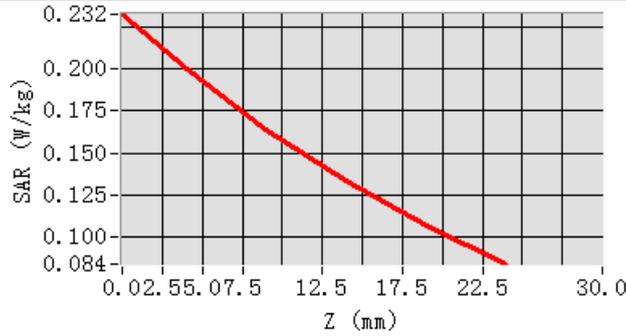
Maximum location: X=-34.00, Y=-10.00

SAR Peak: 0.23 W/kg

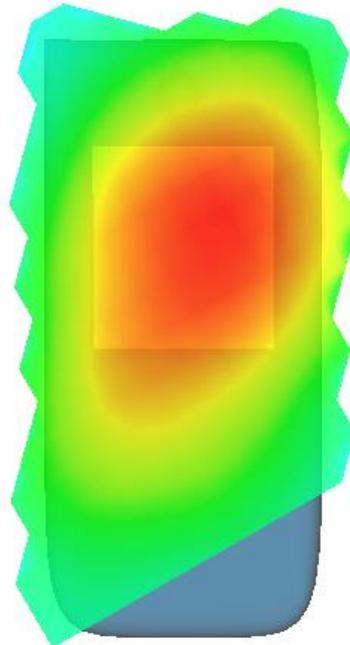
SAR 10g (W/Kg)	0.146256
SAR 1g (W/Kg)	0.192986



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.2324	0.2000	0.1643	0.1336	0.1071



Hot spot position



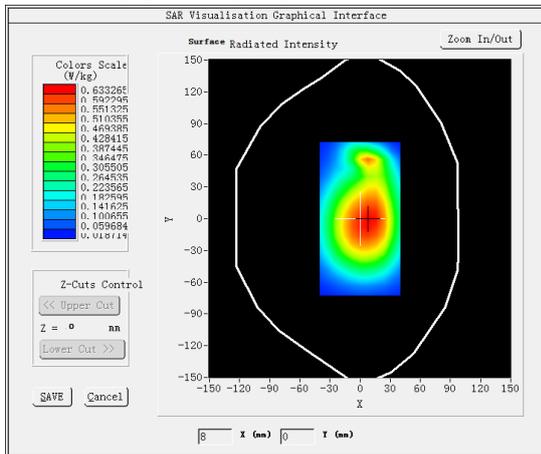
MEASUREMENT 2

Middle Band SAR (Channel 21625):

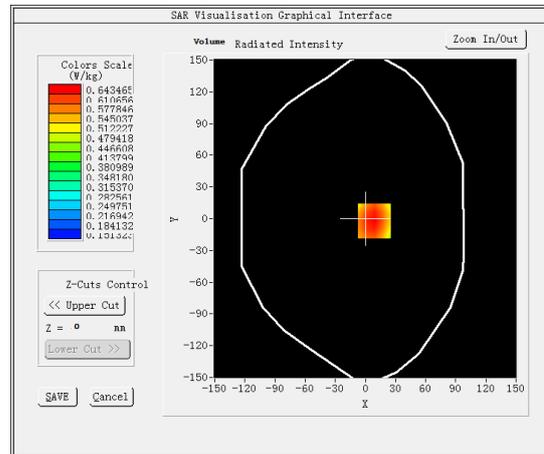
Date: 08/15/2022

Frequency (MHz)	897.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.324451
Conductivity (S/m)	0.960017
Variation (%)	-0.330000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 8</u>

SURFACE SAR



VOLUME SAR



Maximum location: X=9.00, Y=-2.00

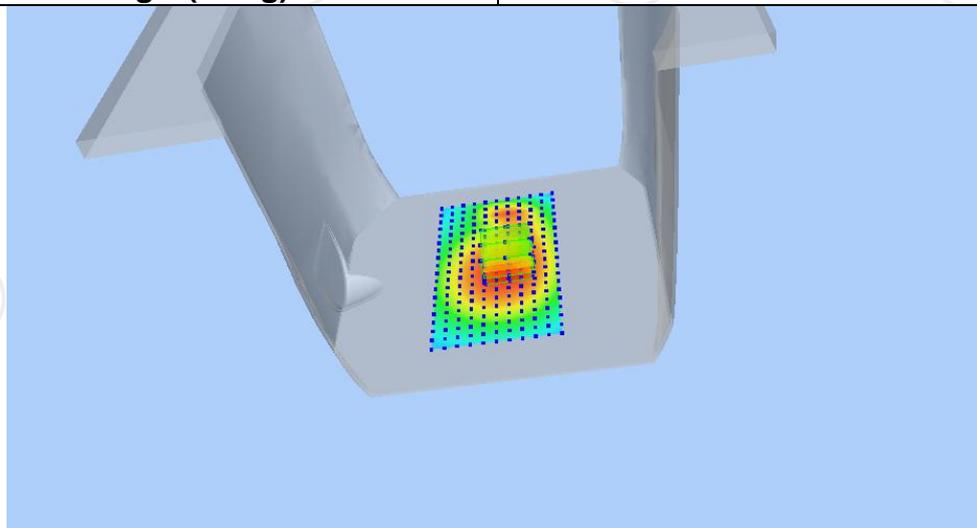
SAR Peak: 0.76 W/kg

SAR 10g (W/Kg)

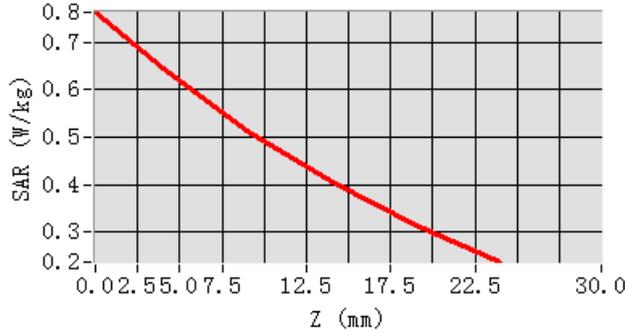
0.471285

SAR 1g (W/Kg)

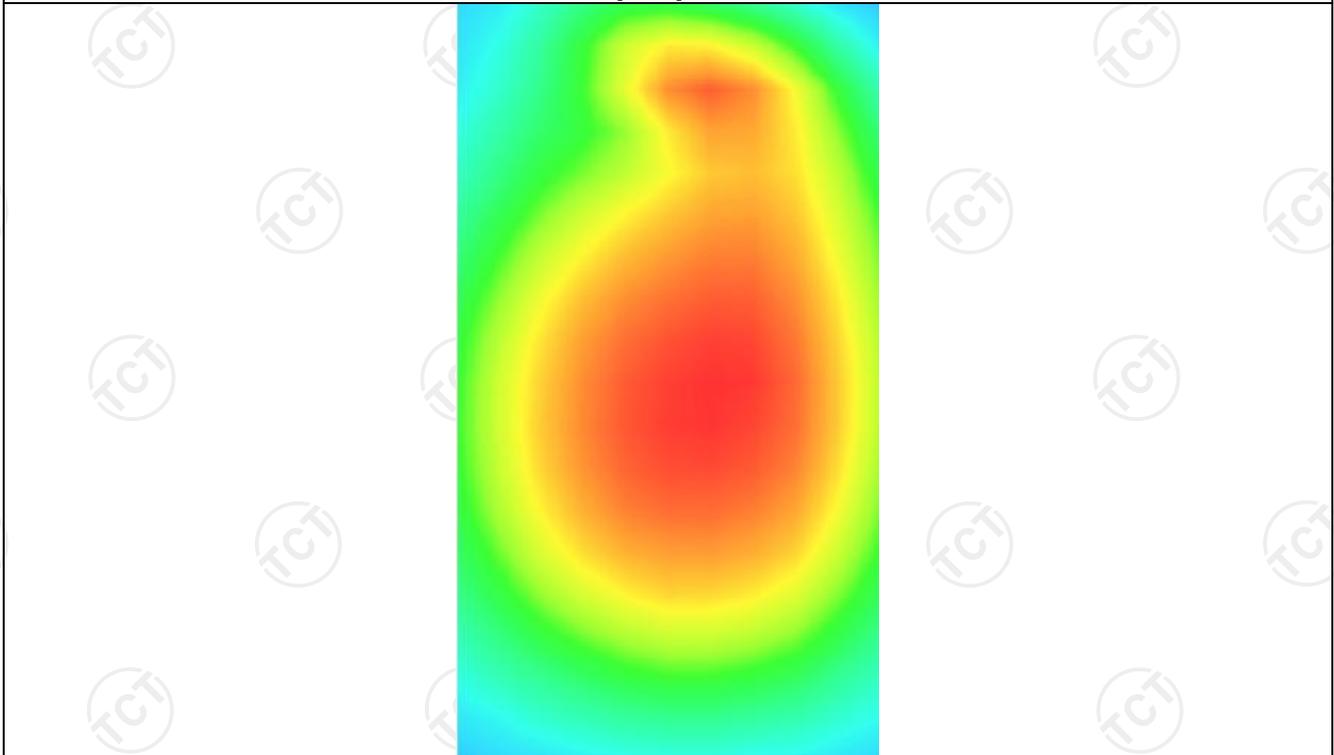
0.623094



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.7631	0.6435	0.5143	0.4056	0.3143



Hot spot position



LTE Band 20

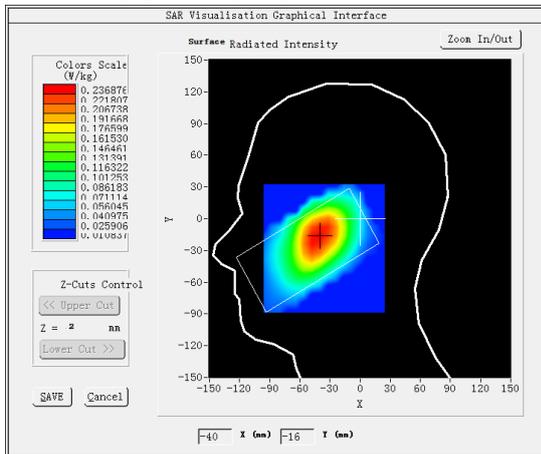
MEASUREMENT 1

Middle Band SAR (Channel 24300):

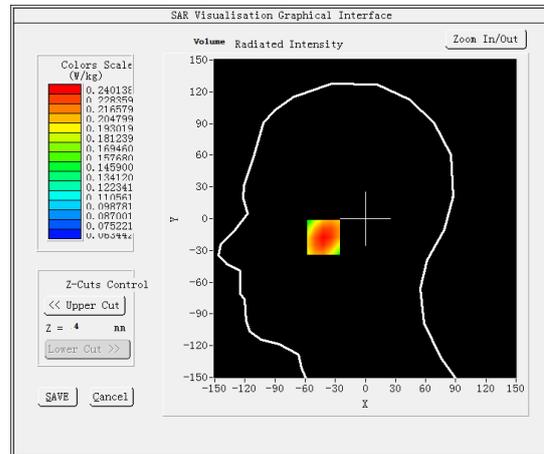
Date: 08/15/2022

Frequency (MHz)	847.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.296230
Conductivity (S/m)	0.960017
Variation (%)	-3.530000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>LTE band 20</u>

SURFACE SAR



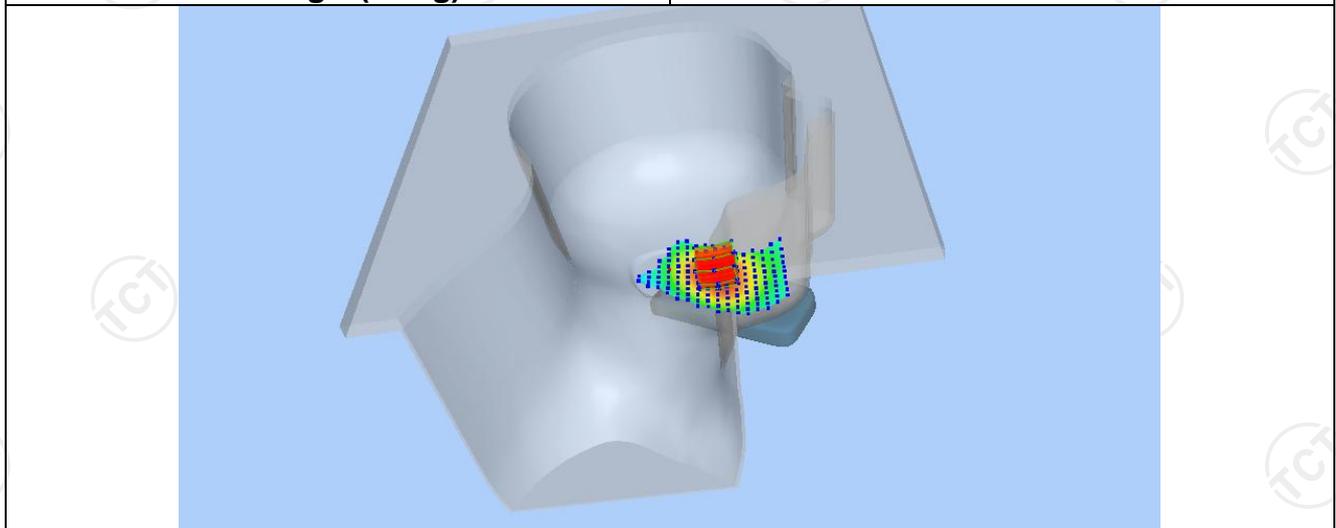
VOLUME SAR



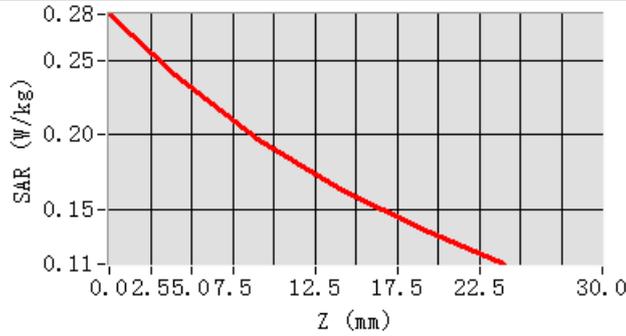
Maximum location: X=-42.00, Y=-17.00

SAR Peak: 0.28 W/kg

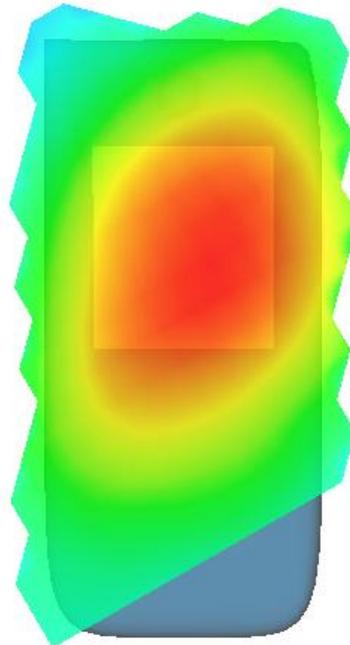
SAR 10g (W/Kg)	0.178586
SAR 1g (W/Kg)	0.232624



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.2812	0.2401	0.1975	0.1635	0.1361



Hot spot position



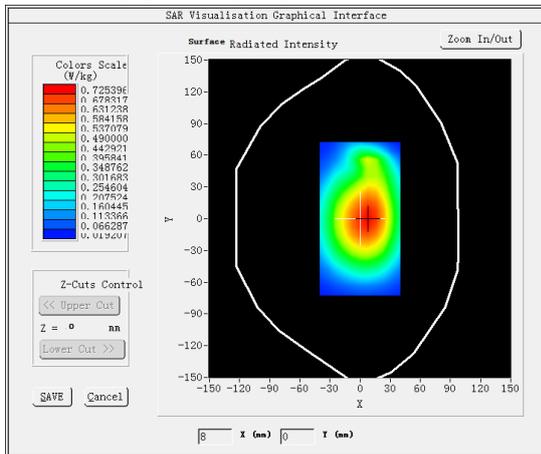
MEASUREMENT 2

Middle Band SAR (Channel 24300):

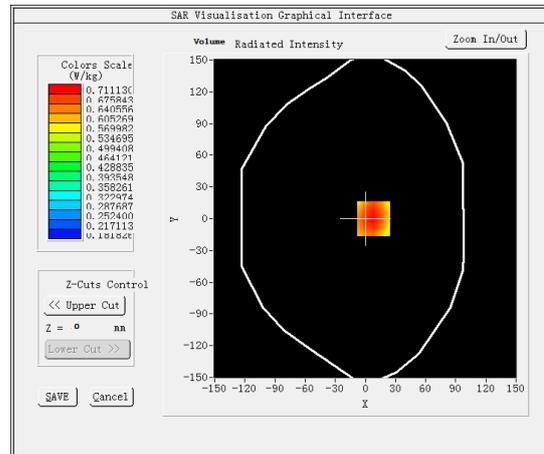
Date: 08/15/2022

Frequency (MHz)	847.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.296230
Conductivity (S/m)	0.960017
Variation (%)	-1.850000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 20</u>

SURFACE SAR



VOLUME SAR



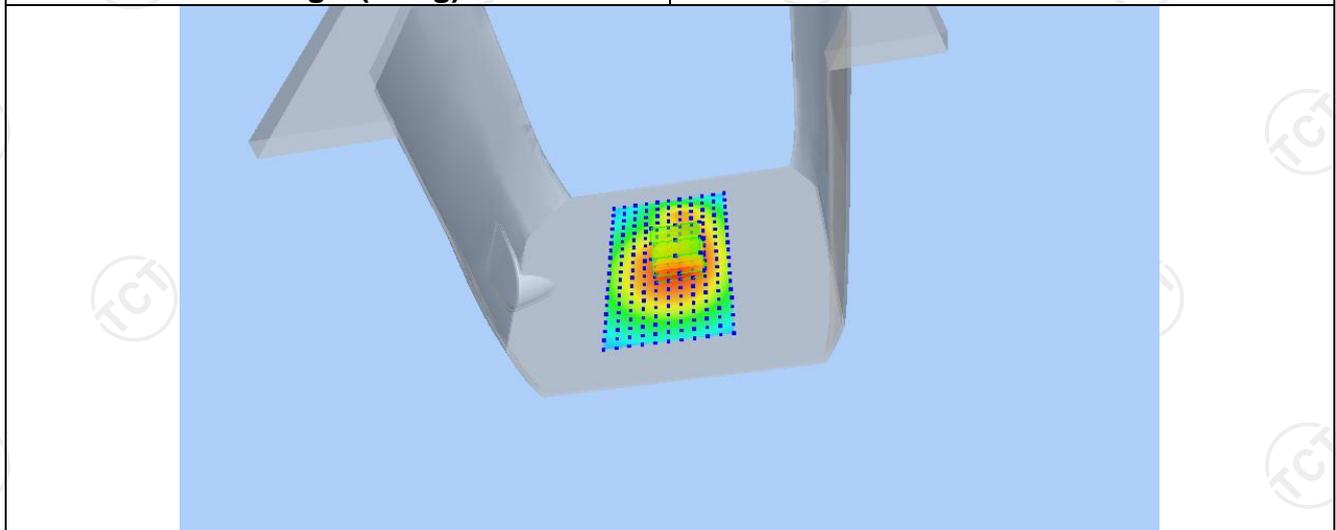
Maximum location: X=8.00, Y=0.00
SAR Peak: 0.85 W/kg

SAR 10g (W/Kg)

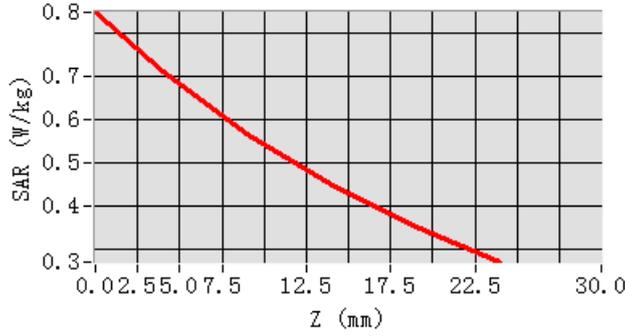
0.520886

SAR 1g (W/Kg)

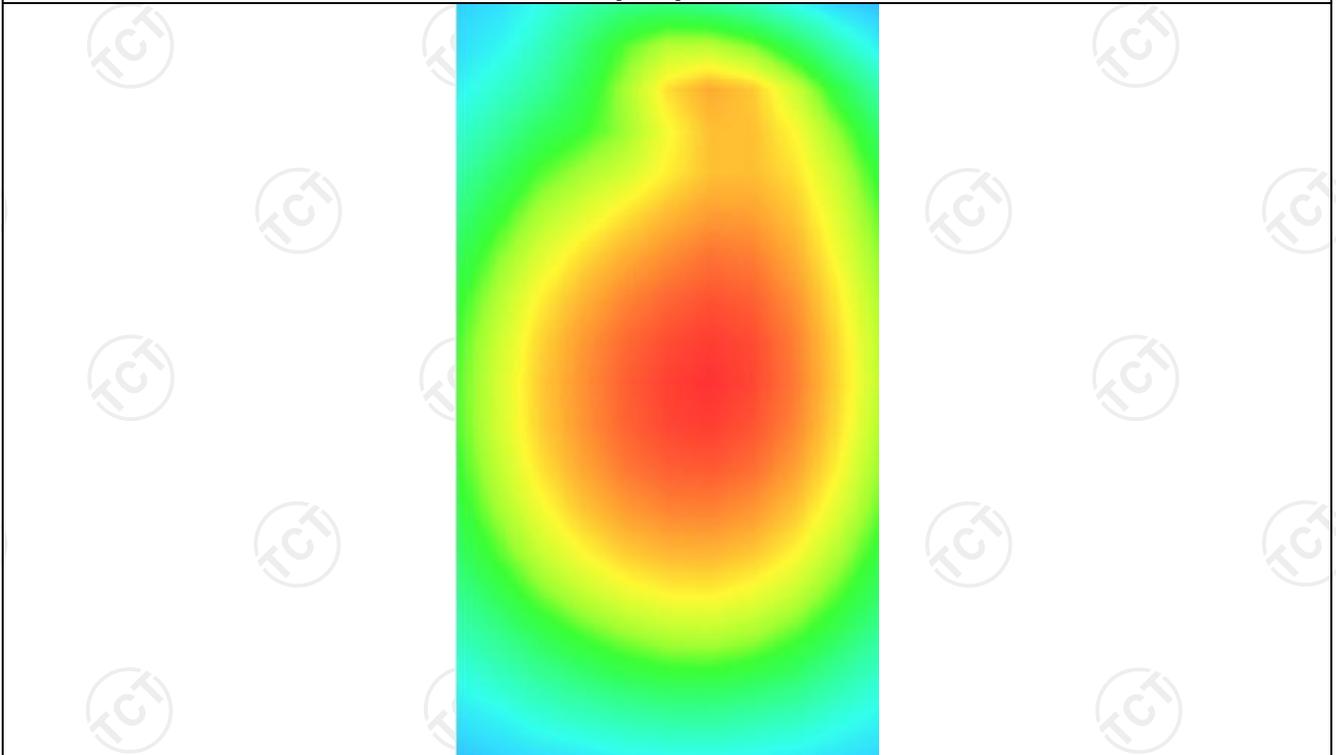
0.688460



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.8491	0.7111	0.5663	0.4484	0.3523



Hot spot position



LTE Band 40

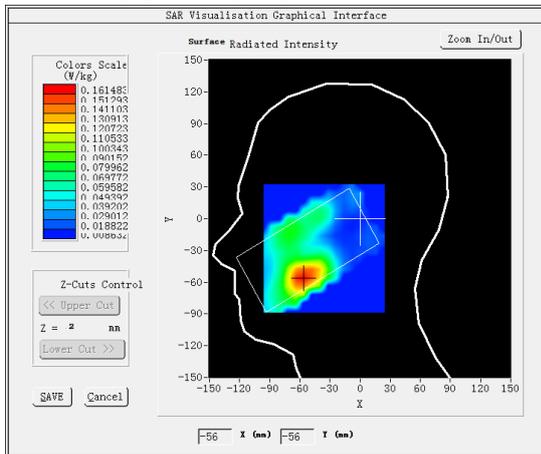
MEASUREMENT 1

Middle Band SAR (Channel 39150)

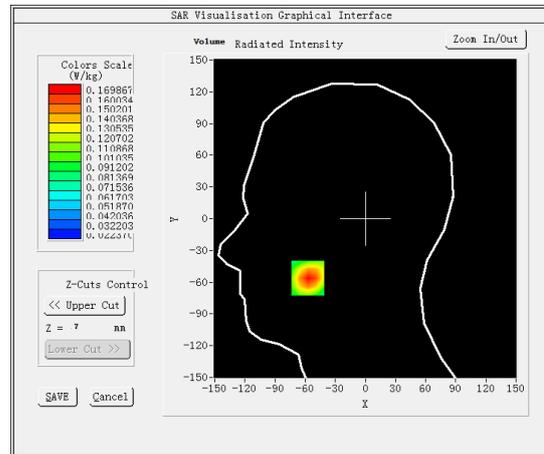
Date: 08/22/2022

Frequency (MHz)	2350.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	1.930000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>LTE band 40</u>

SURFACE SAR



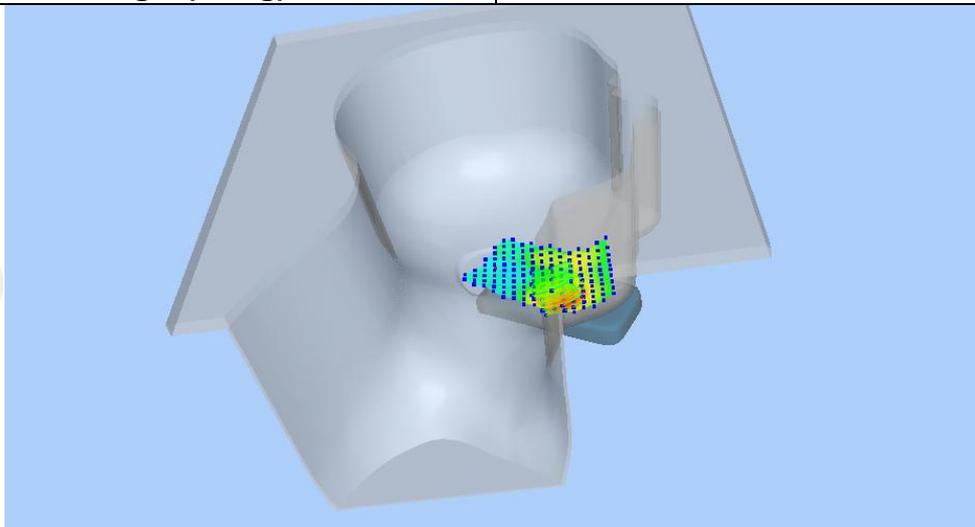
VOLUME SAR



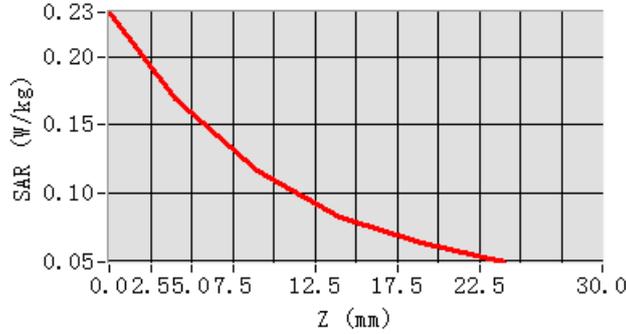
Maximum location: X=-57.00, Y=-56.00

SAR Peak: 0.23 W/kg

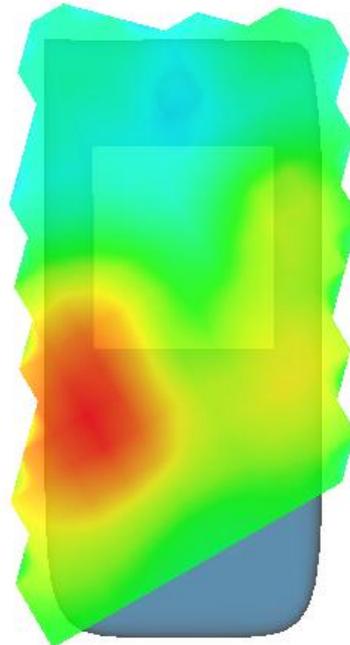
SAR 10g (W/Kg)	0.105030
SAR 1g (W/Kg)	0.160648



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.2331	0.1699	0.1158	0.0826	0.0628



Hot spot position



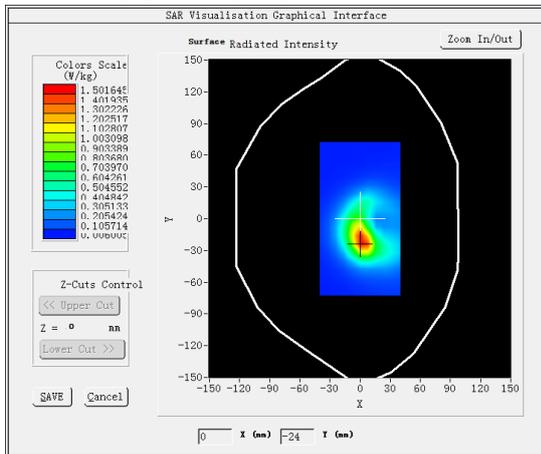
MEASUREMENT 2

Middle Band SAR (Channel 39150):

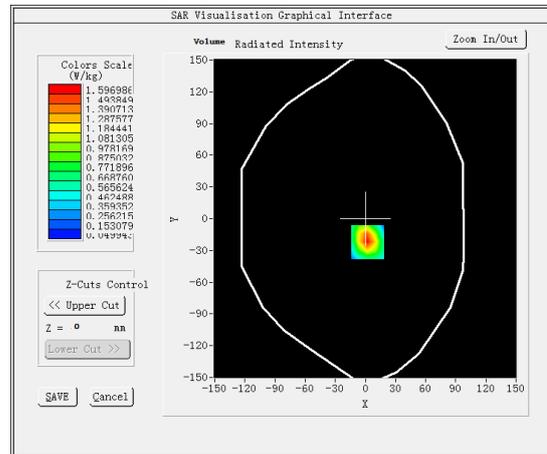
Date: 08/22/2022

Frequency (MHz)	2350.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	-0.870000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 40</u>

SURFACE SAR



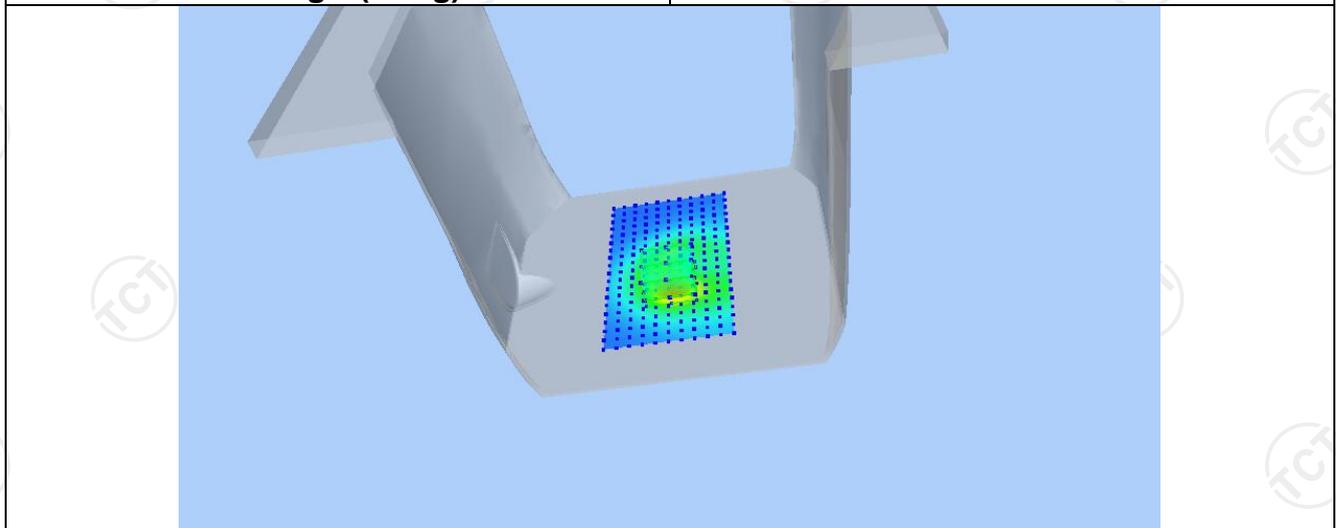
VOLUME SAR



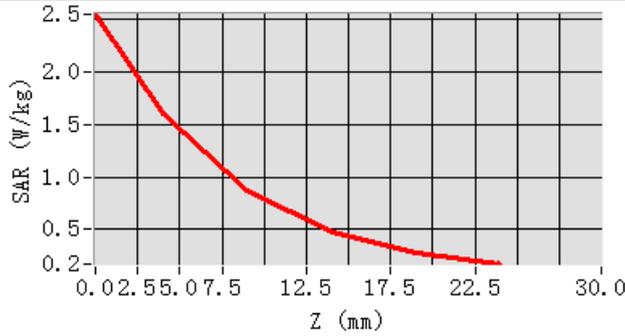
Maximum location: X=2.00, Y=-22.00

SAR Peak: 2.57 W/kg

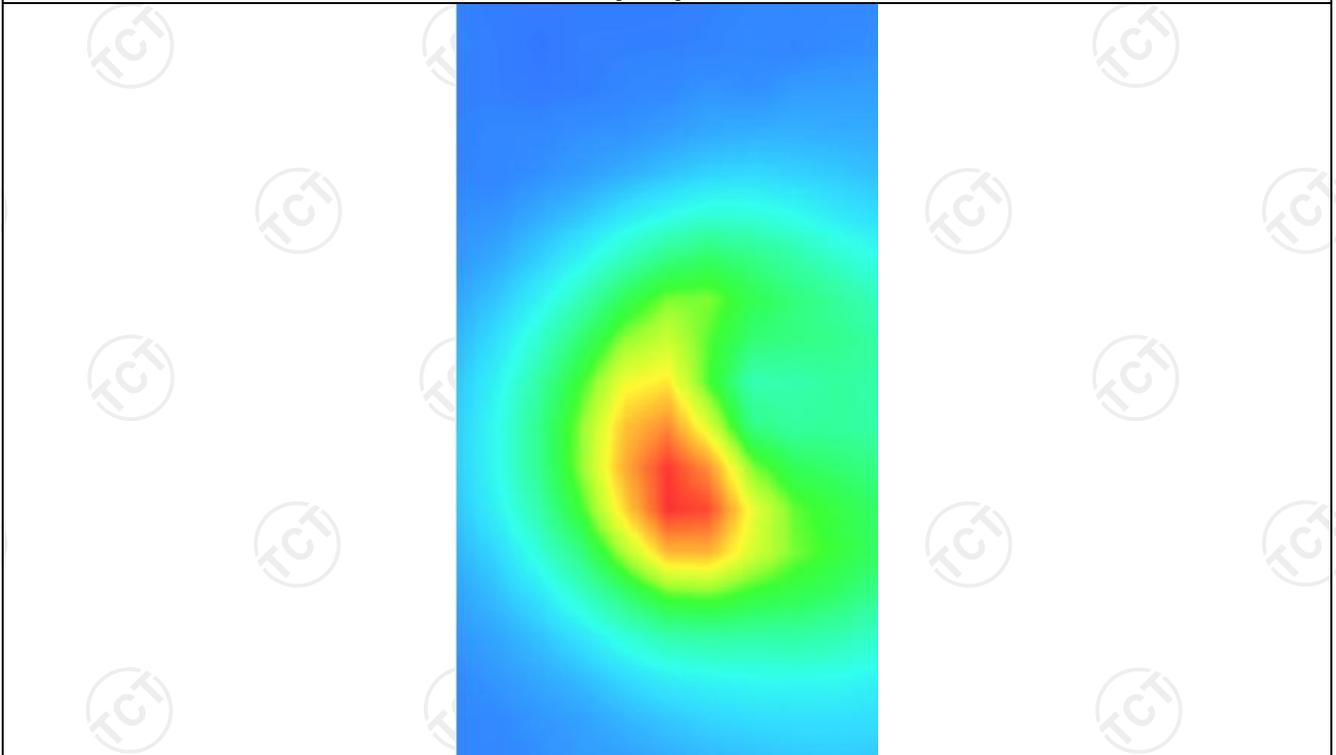
SAR 10g (W/Kg)	0.755341
SAR 1g (W/Kg)	1.478045



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.5457	1.5970	0.8690	0.4803	0.2841



Hot spot position



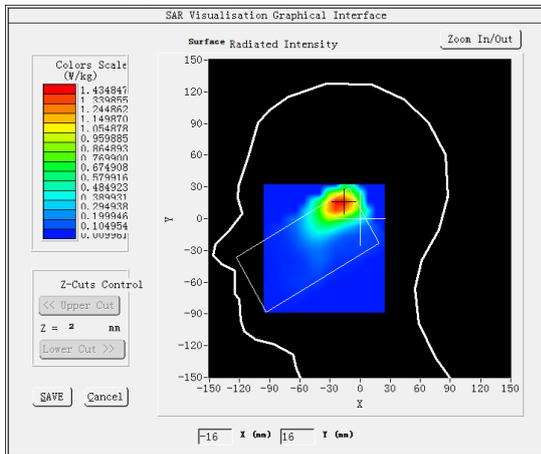
2.4G WLAN
MEASUREMENT 1

Middle Band SAR (Channel 7):

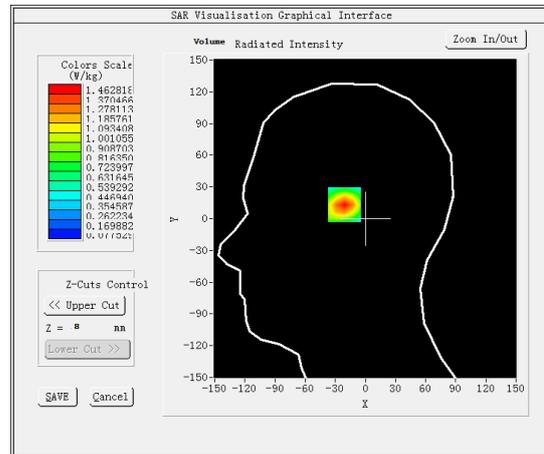
Date: 08/22/2022

Frequency (MHz)	2442.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	1.180000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>IEEE 802.11b ISM</u>

SURFACE SAR

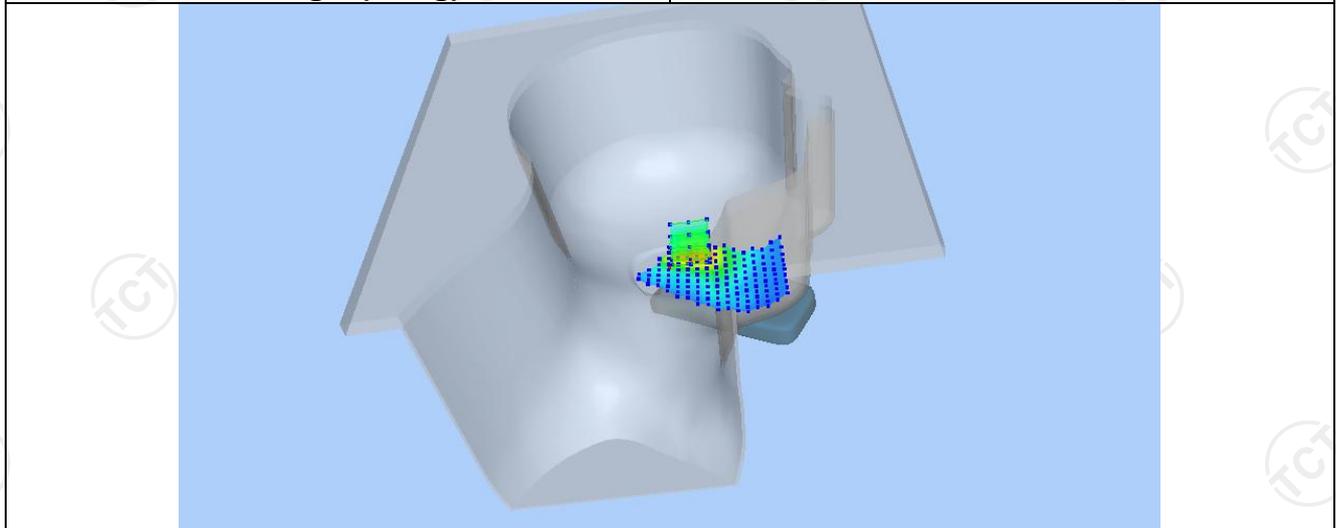


VOLUME SAR

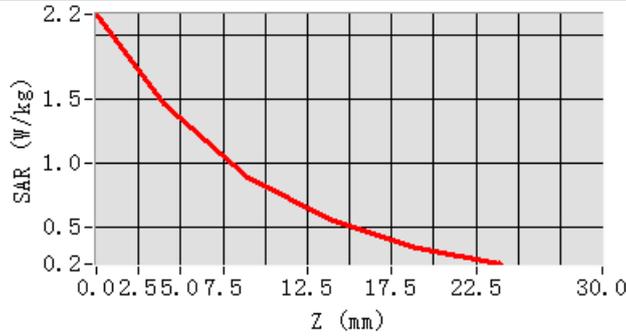


Maximum location: X=-19.00, Y=15.00
SAR Peak: 2.16 W/kg

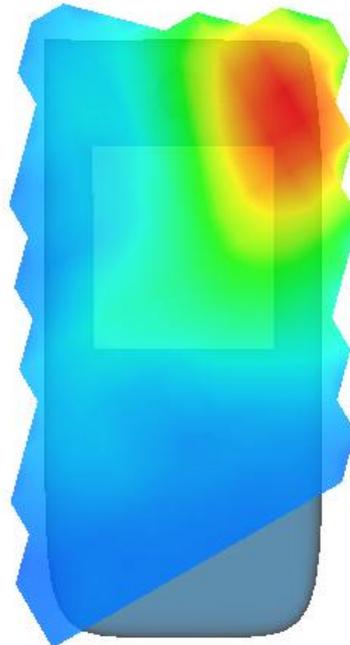
SAR 10g (W/Kg)	0.378031
SAR 1g (W/Kg)	0.965146



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.1587	1.4628	0.8853	0.5393	0.3376



Hot spot position



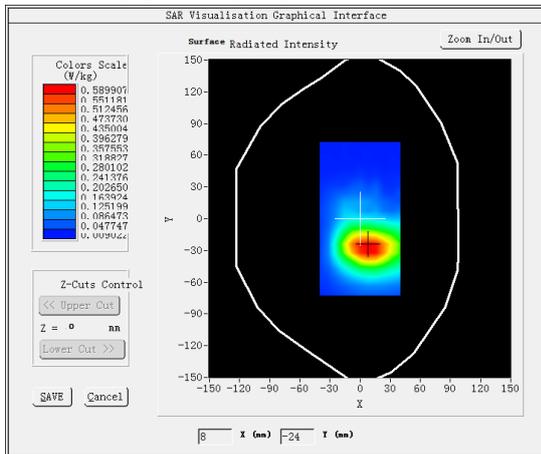
MEASUREMENT 2

Middle Band SAR (Channel 7):

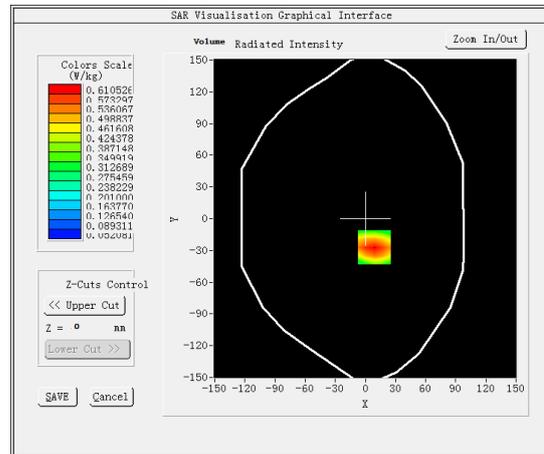
Date: 08/22/2022

Frequency (MHz)	2442.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	1.130000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body Back</u>
Band	<u>IEEE 802.11b ISM</u>

SURFACE SAR



VOLUME SAR



Maximum location: X=9.00, Y=-27.00

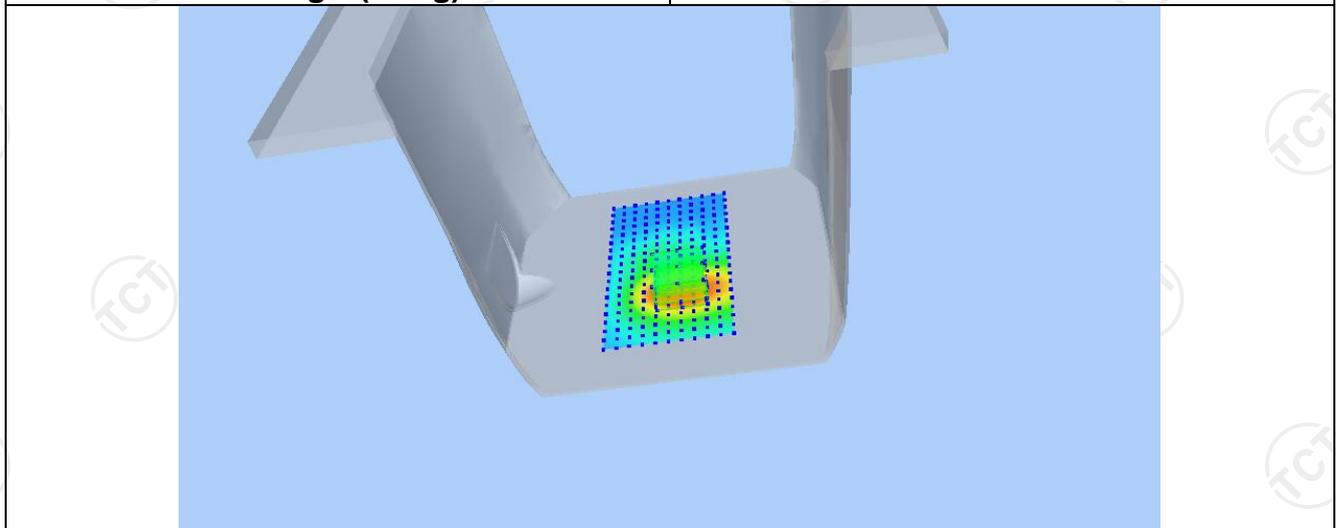
SAR Peak: 0.90 W/kg

SAR 10g (W/Kg)

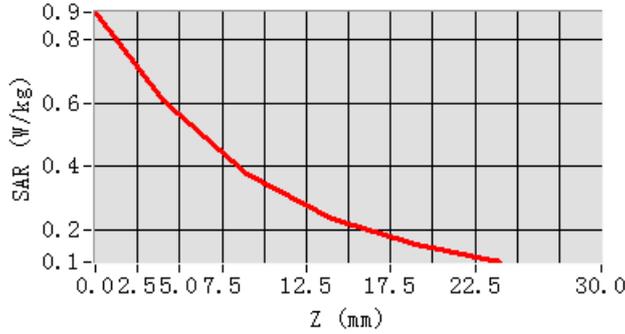
0.351043

SAR 1g (W/Kg)

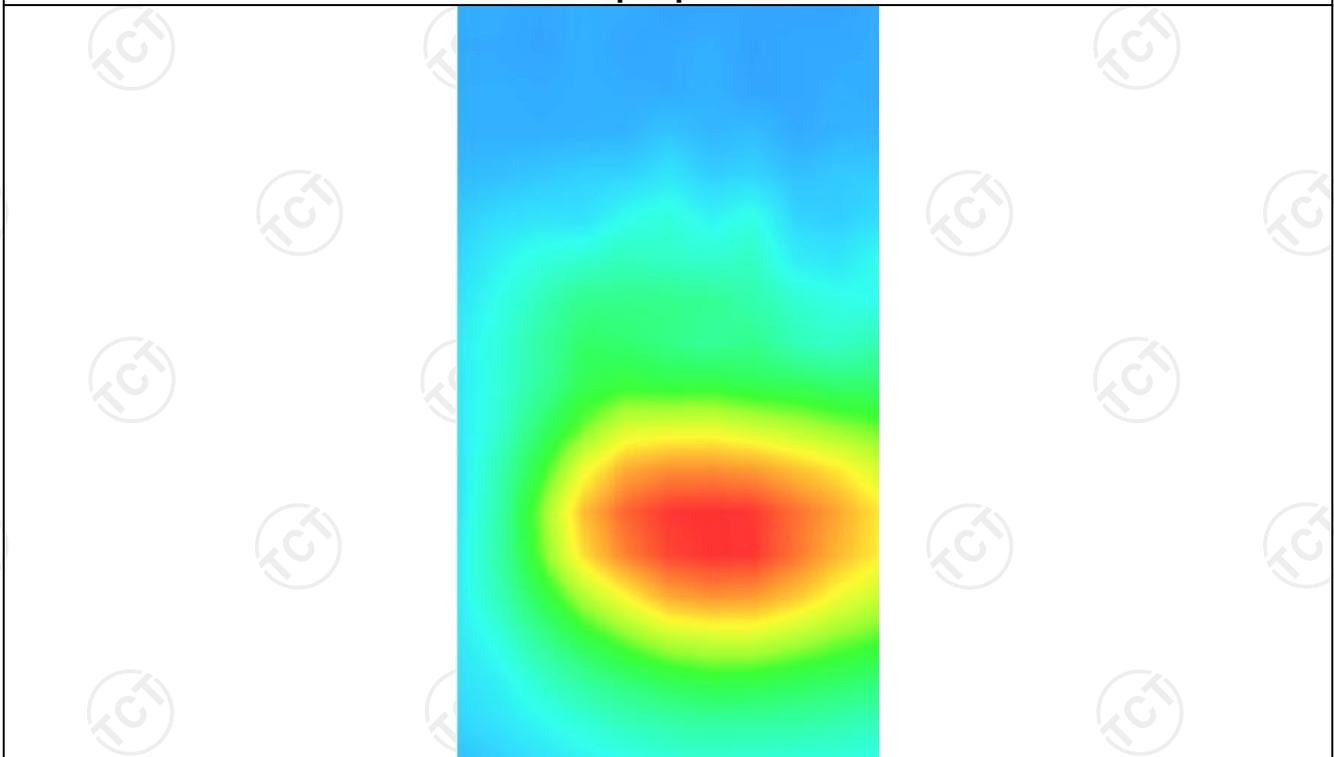
0.579068



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.8885	0.6105	0.3776	0.2363	0.1526



Hot spot position



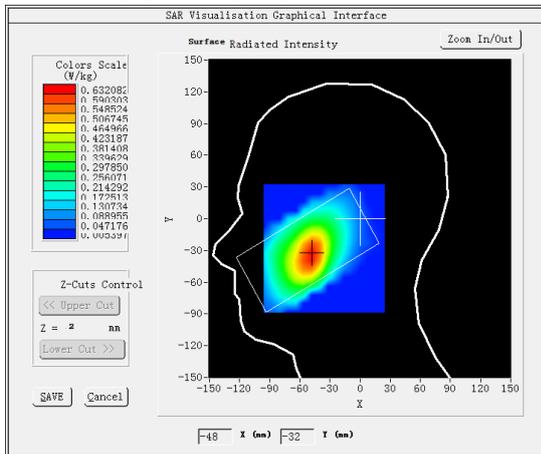
5.2G WLAN
MEASUREMENT 1

SAR(Channel 36):

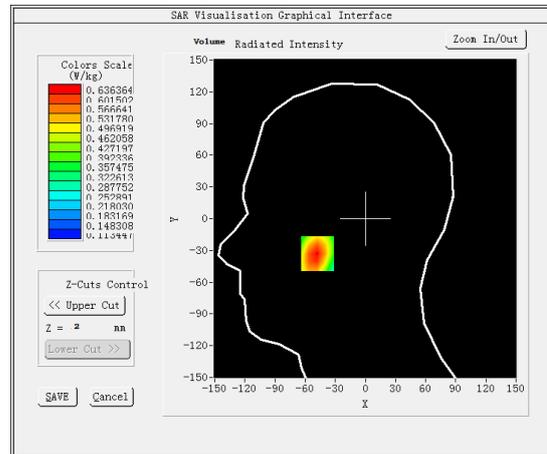
Date: 08/30/2022

Frequency (MHz)	5180.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	-1.500000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Right head</u>
Device Position	<u>Cheek</u>
Band	<u>IEEE 802.11a ISM</u>

SURFACE SAR

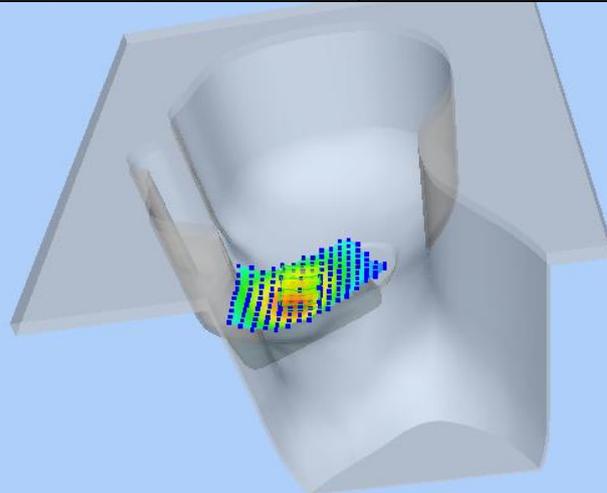


VOLUME SAR

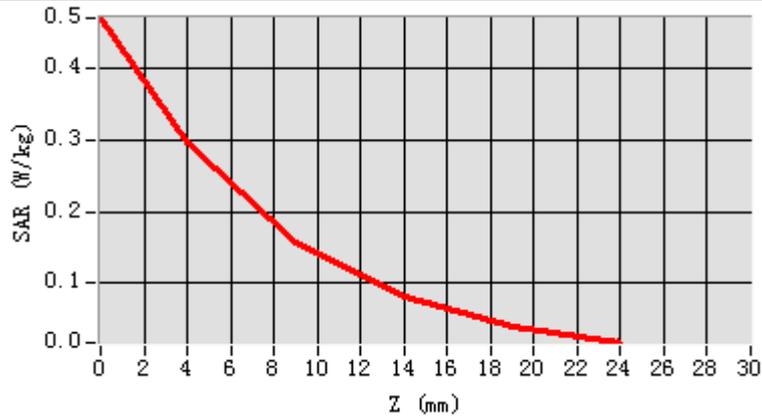


Maximum location: X=-40.00, Y=-30.00
SAR Peak: 0.50 W/kg

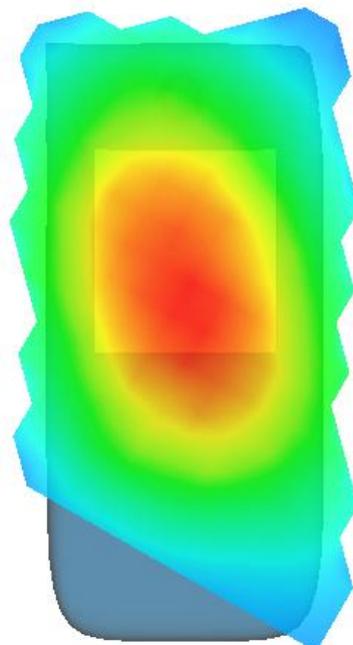
SAR 10g (W/Kg)	0.161411
SAR 1g (W/Kg)	0.625124



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.4690	0.2950	0.1577	0.0810	0.0405



Hot spot position



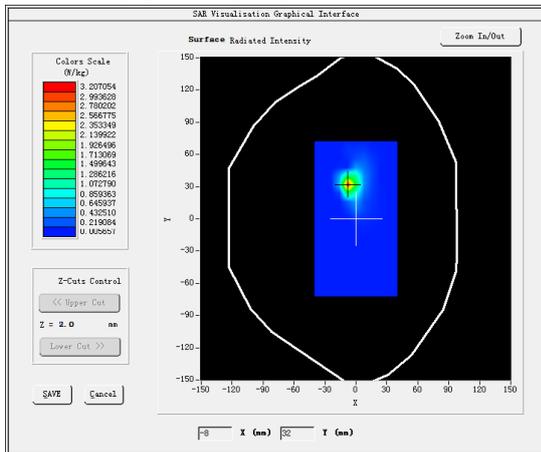
MEASUREMENT 2

SAR(Channel 36):

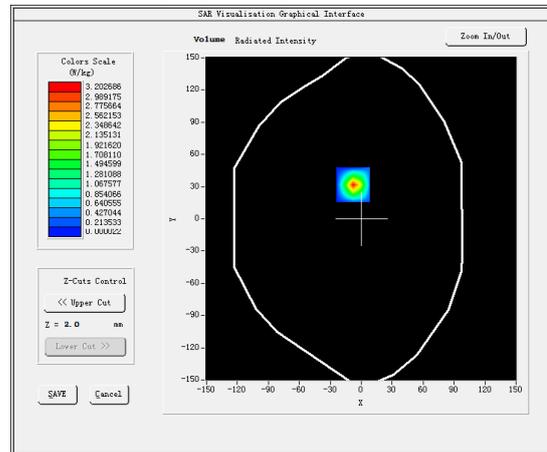
Date: 08/30/2022

Frequency (MHz)	5180.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	-1.660000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>IEEE 802.11a ISM</u>

SURFACE SAR

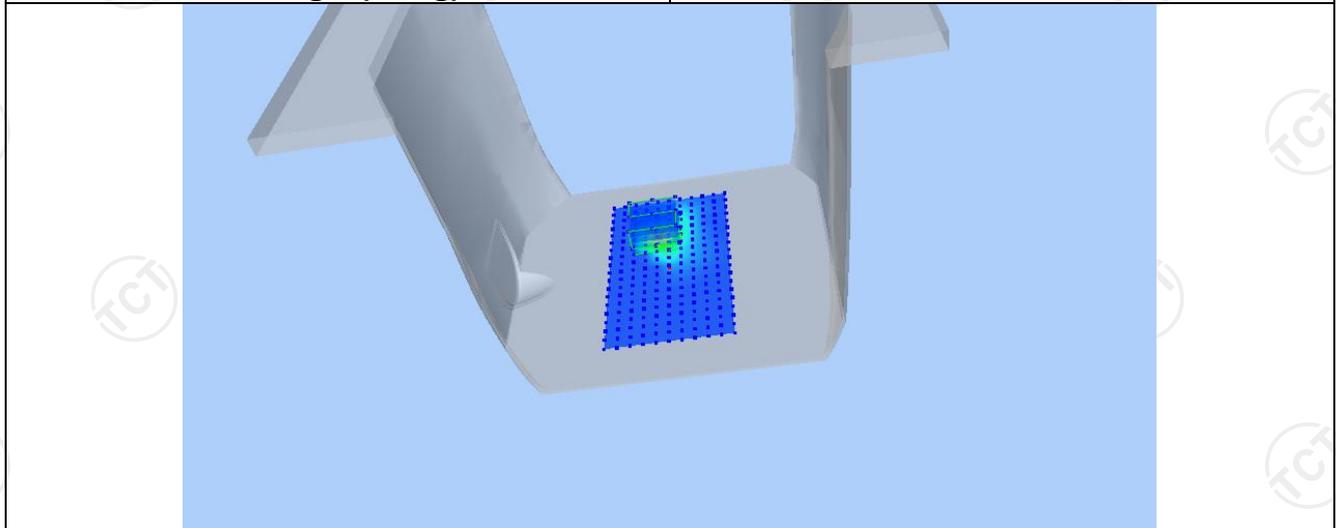


VOLUME SAR

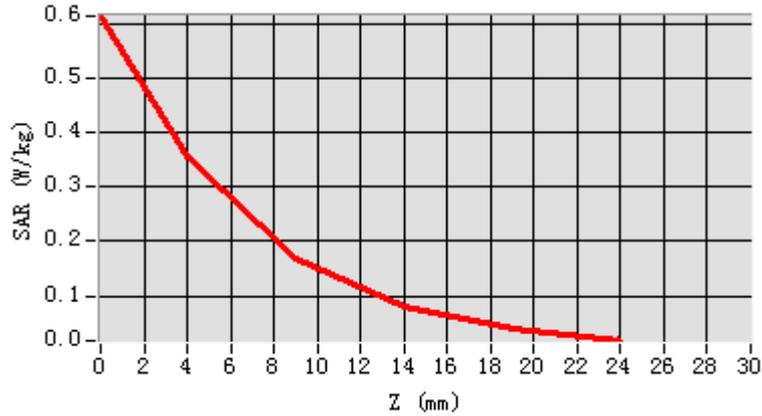


Maximum location: X=-18.00, Y=22.00
SAR Peak: 0.60 W/kg

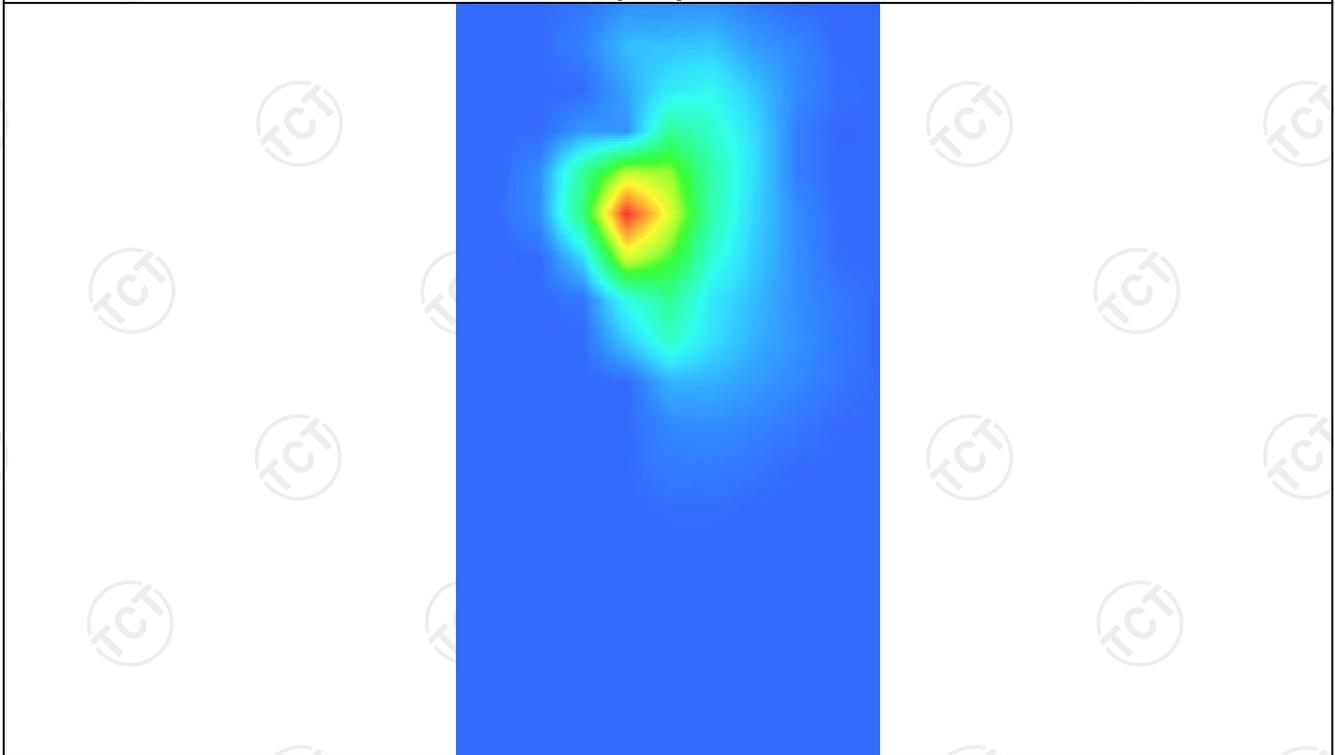
SAR 10g (W/Kg)	0.207002
SAR 1g (W/Kg)	0.691023



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.6133	0.3552	0.1689	0.0782	0.0378



Hot spot position



5.8G WLAN

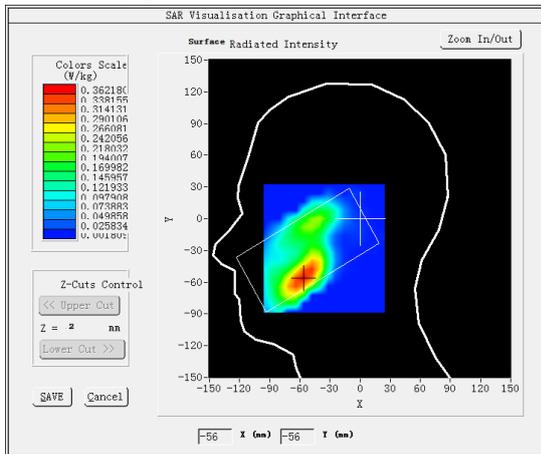
MEASUREMENT 1

SAR (Channel 157):

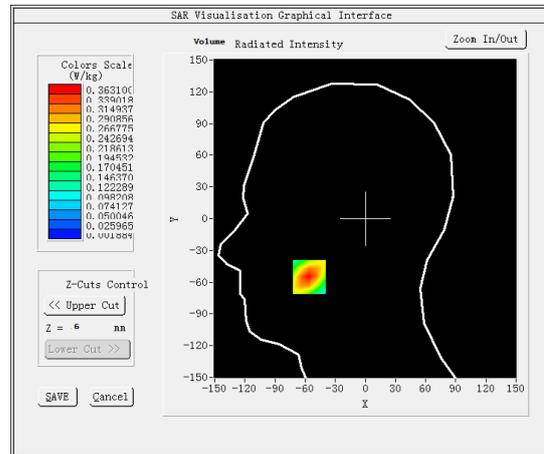
Date: 08/30/2022

Frequency (MHz)	5785.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	-2.150000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>IEEE 802.11ac ISM</u>

SURFACE SAR



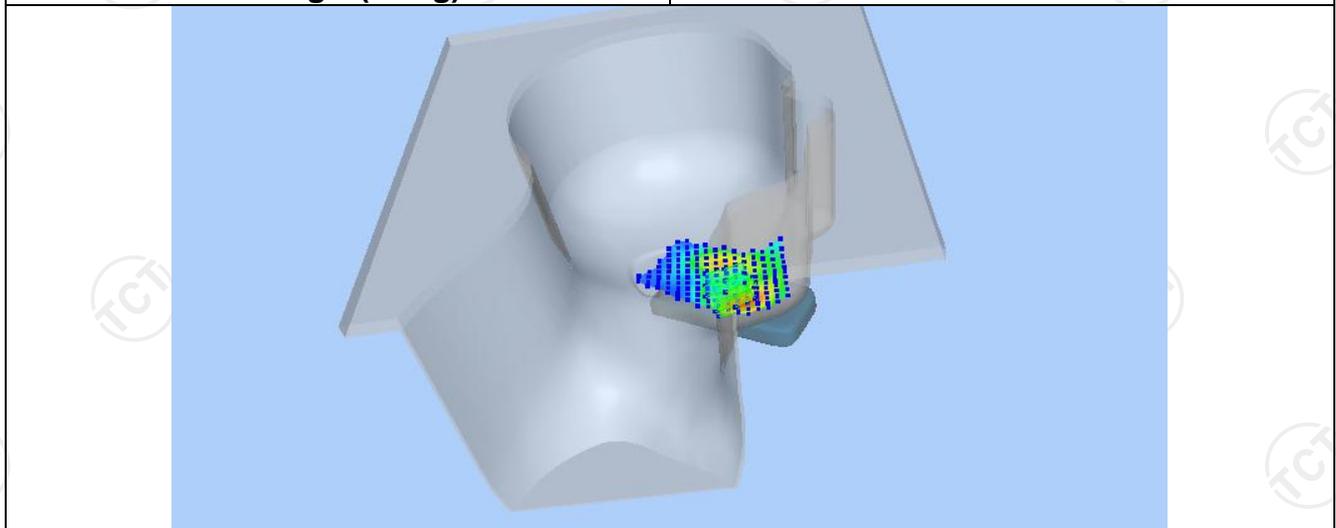
VOLUME SAR



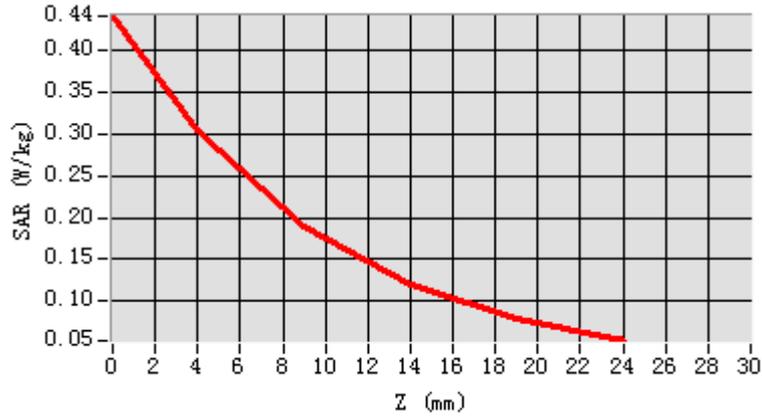
Maximum location: X=-46.00, Y=-42.00

SAR Peak: 0.44 W/kg

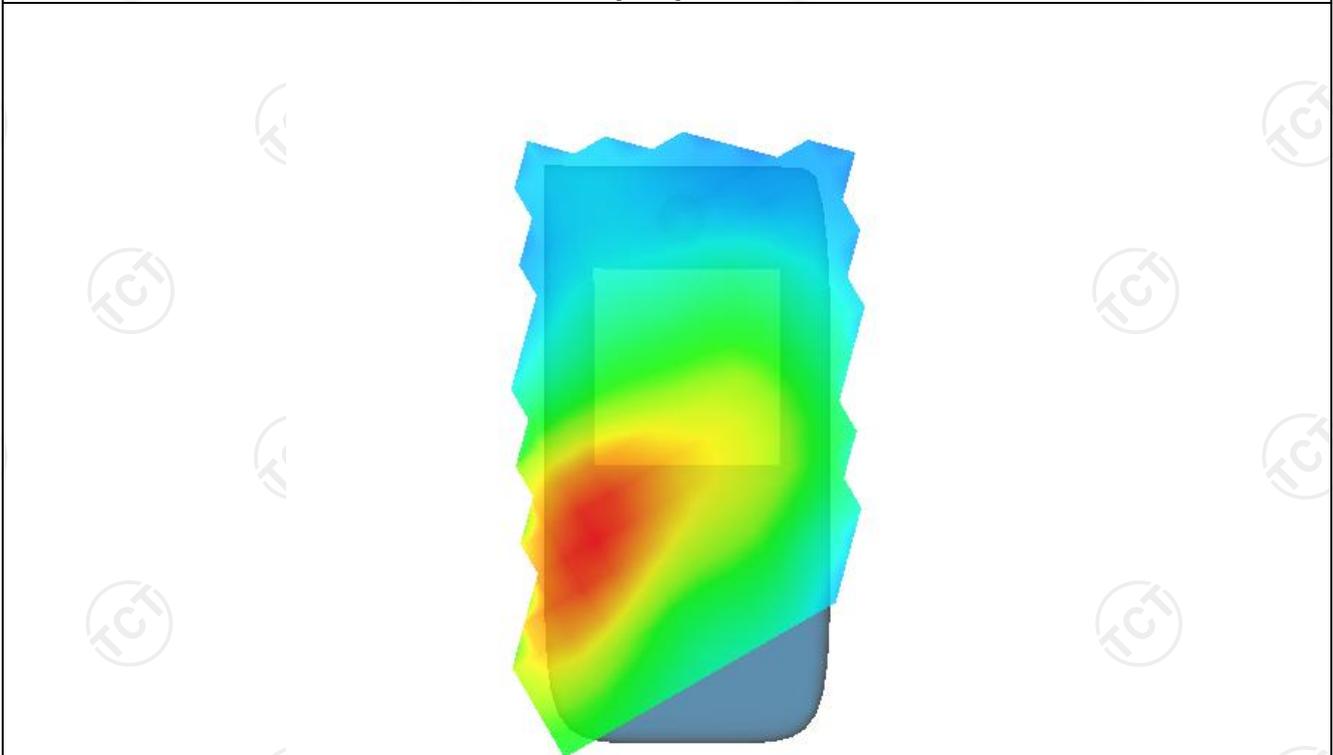
SAR 10g (W/Kg)	0.139410
SAR 1g (W/Kg)	0.422385



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.4420	0.3045	0.1897	0.1204	0.0797



Hot spot position



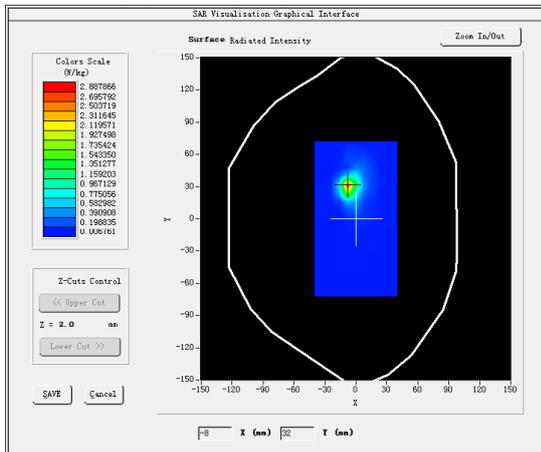
MEASUREMENT 2

SAR (Channel 157):

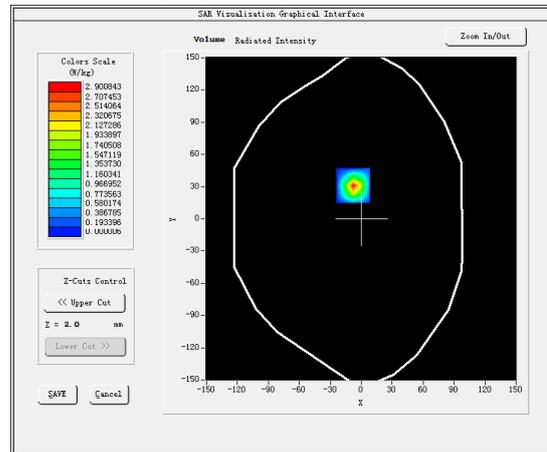
Date: 08/30/2022

Frequency (MHz)	5785.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	-0.300000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>IEEE 802.11ac ISM</u>

SURFACE SAR

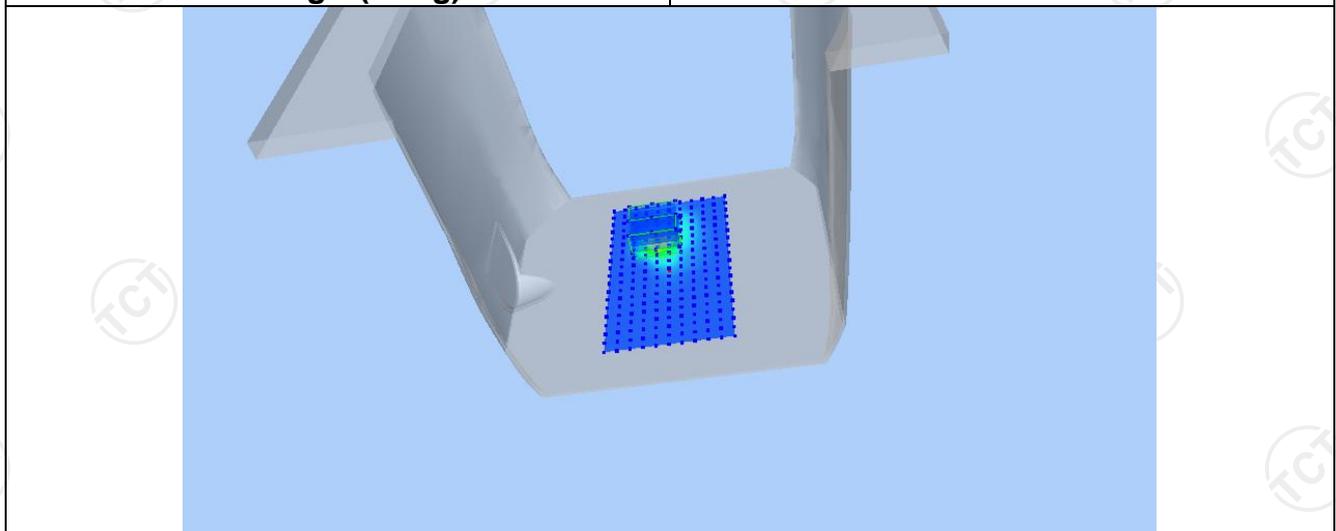


VOLUME SAR

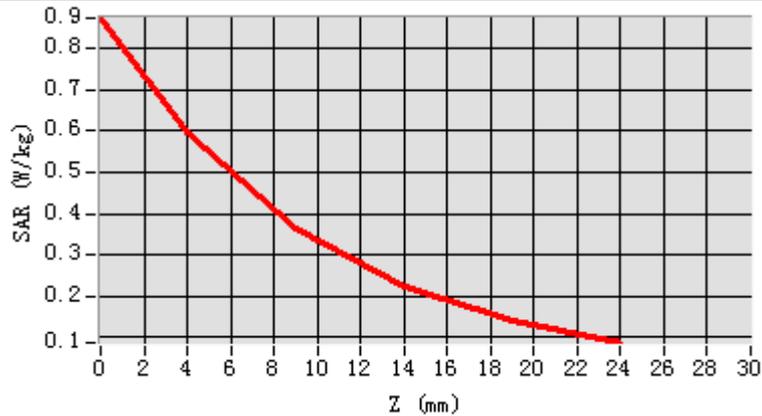


Maximum location: X=-31.00, Y=33.00
SAR Peak: 0.90 W/kg

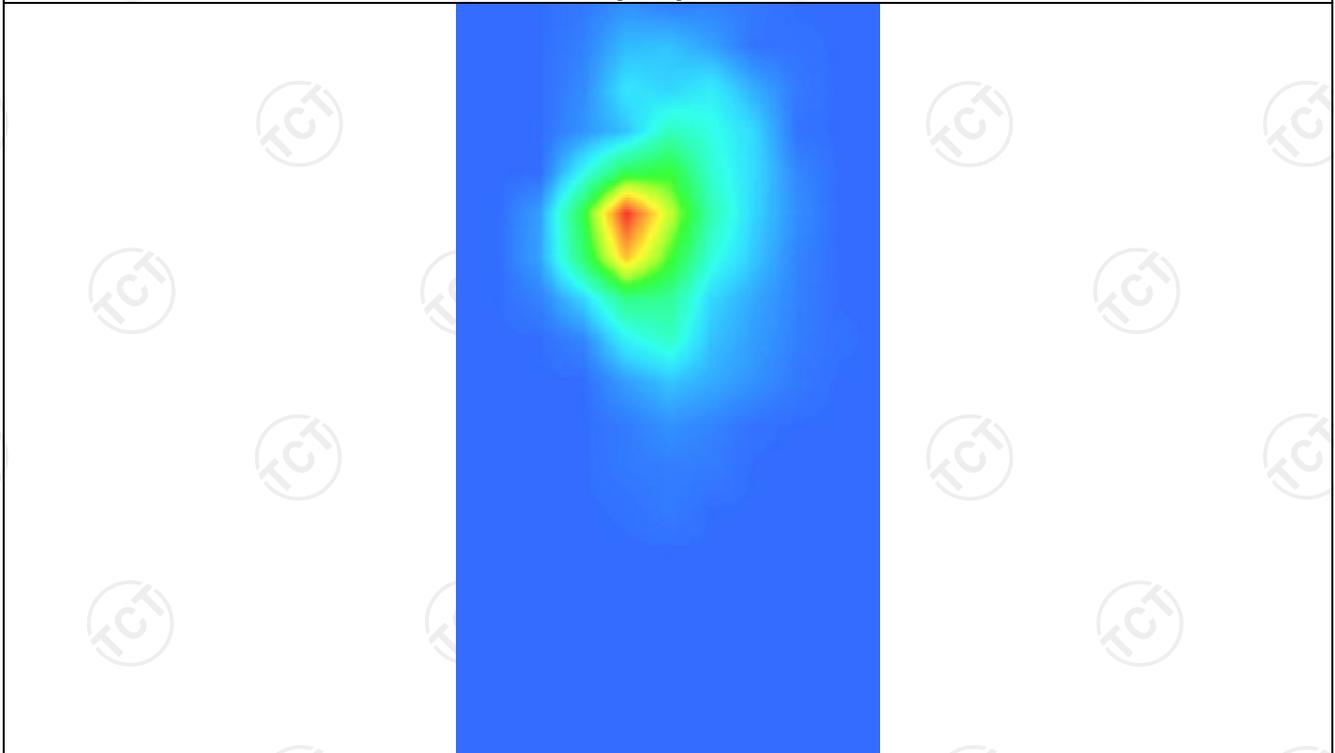
SAR 10g (W/Kg)	0.184232
SAR 1g (W/Kg)	0.640514



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.8740	0.5955	0.3633	0.2234	0.1411



Hot spot position



Body wearing equipment
GSM900

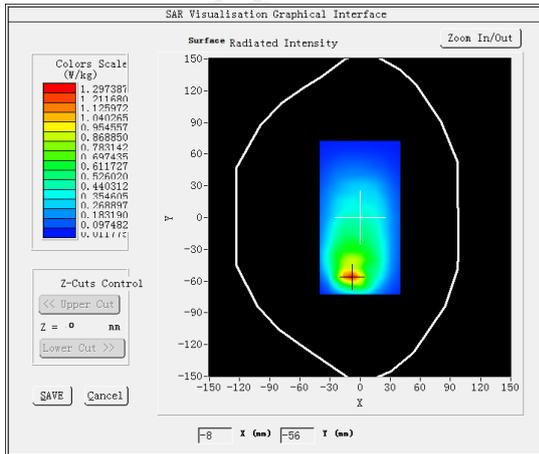
MEASUREMENT 1

Middle Band SAR (Channel 60):

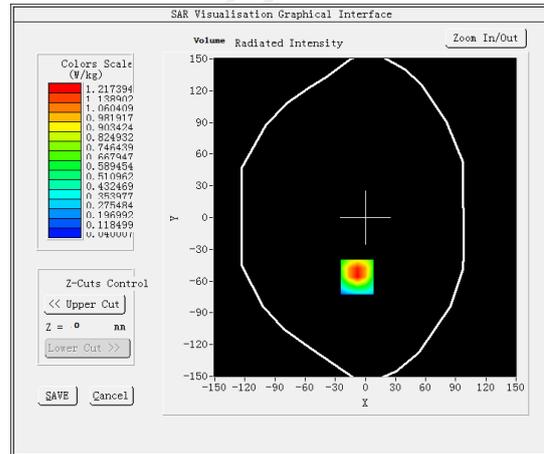
Date: 08/15/2022

Frequency (MHz)	902.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	-0.270000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>GSM900(voice)</u>

SURFACE SAR



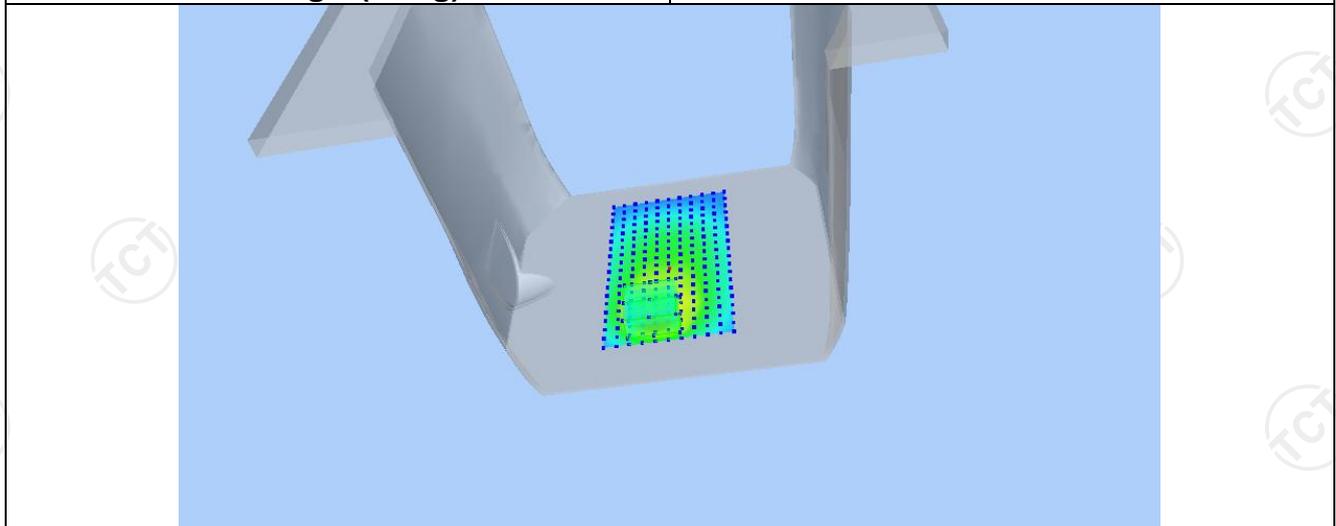
VOLUME SAR



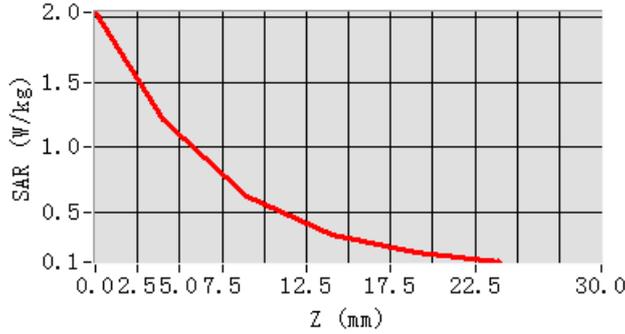
Maximum location: X=-8.00, Y=-56.00

SAR Peak: 2.12 W/kg

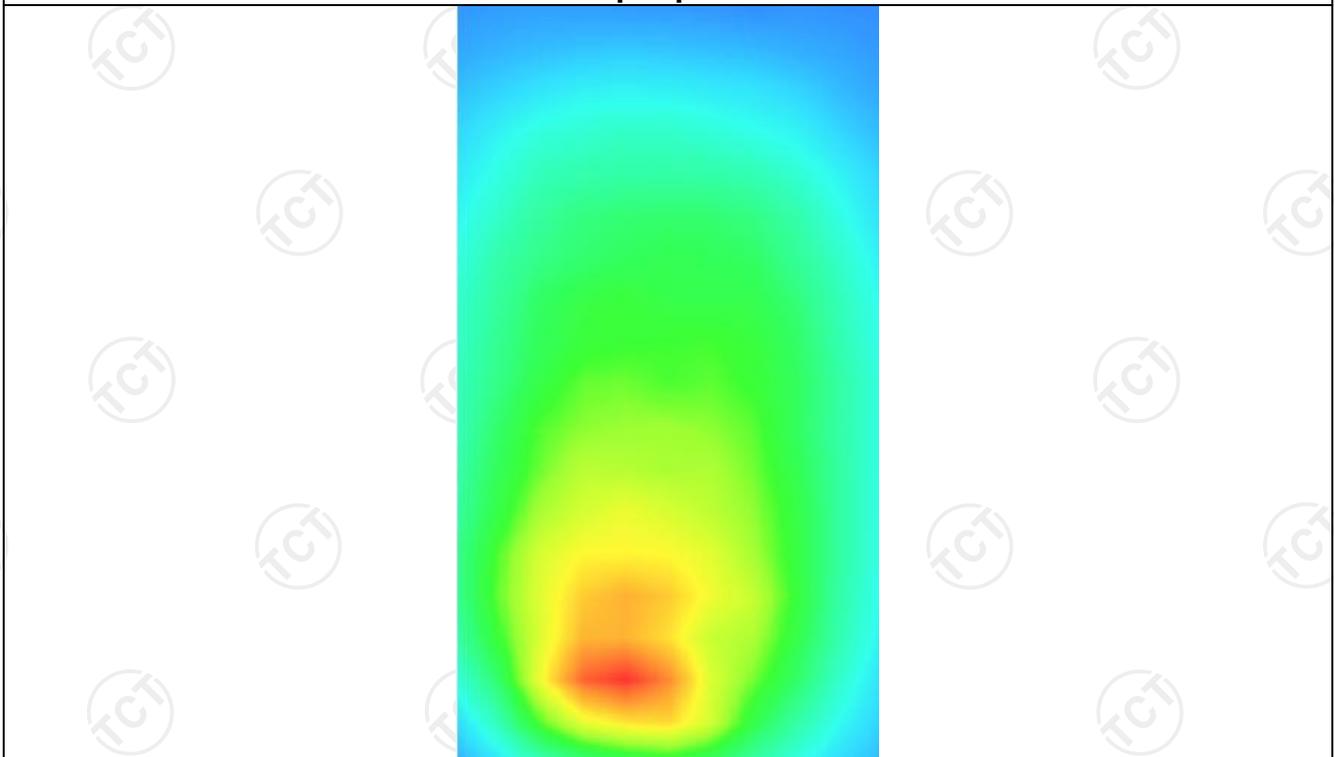
SAR 10g (W/Kg)	0.616445
SAR 1g (W/Kg)	1.178209



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.0371	1.2174	0.6194	0.3247	0.1916



Hot spot position



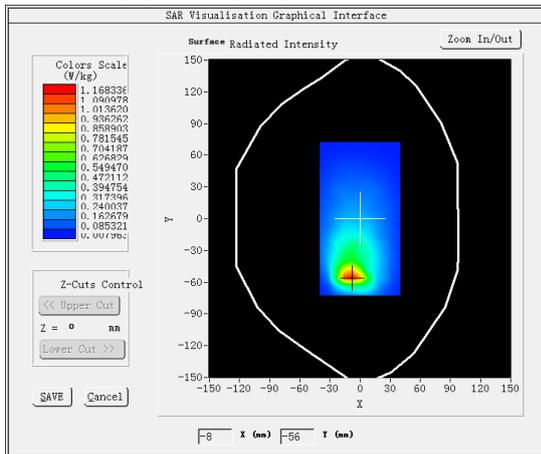
MEASUREMENT 2

Middle Band SAR (Channel 60):

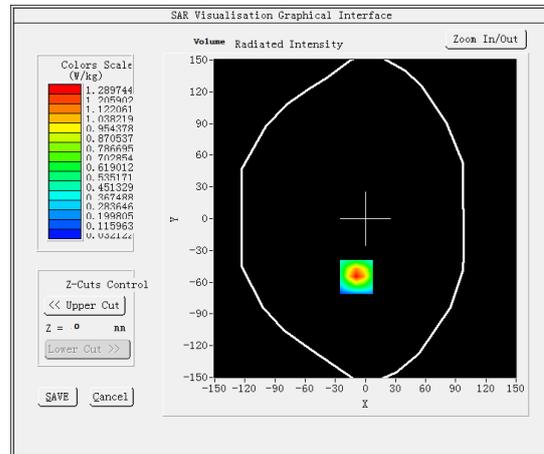
Date: 08/15/2022

Frequency (MHz)	902.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	1.330000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>GSM900(GPRS 2slot)</u>

SURFACE SAR



VOLUME SAR



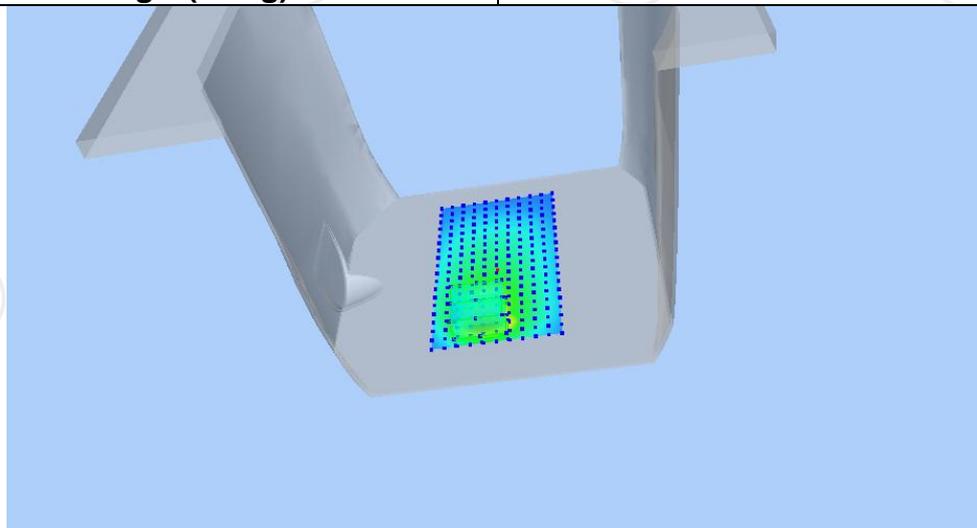
Maximum location: X=-9.00, Y=-55.00
SAR Peak: 2.59 W/kg

SAR 10g (W/Kg)

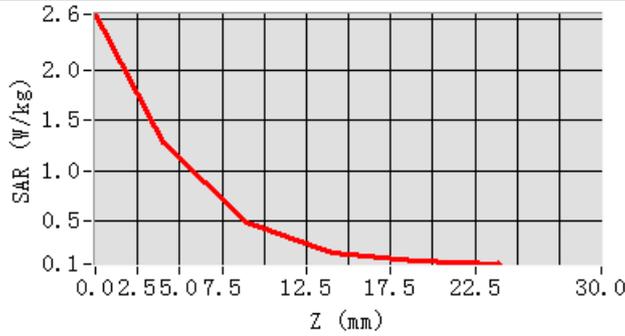
0.539260

SAR 1g (W/Kg)

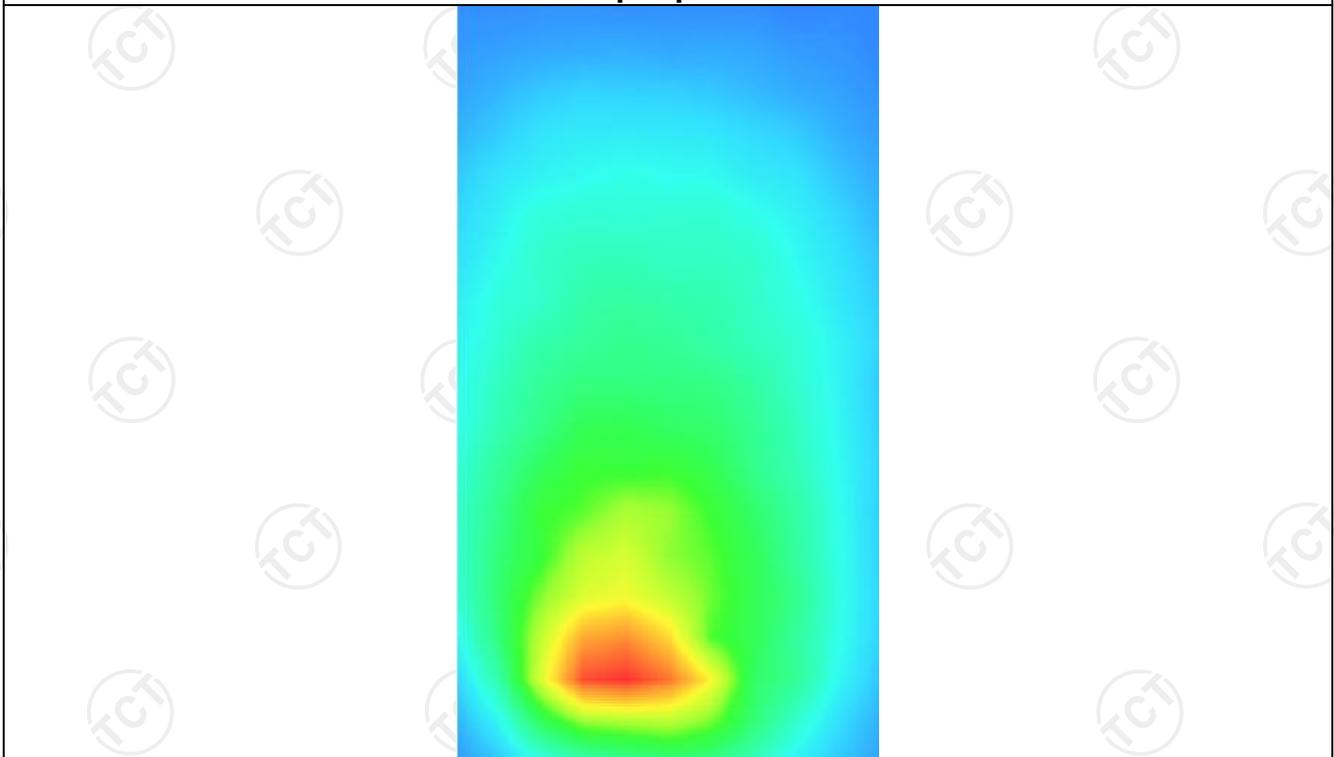
1.215916



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.5511	1.2897	0.4976	0.1968	0.1064



Hot spot position



GSM1800

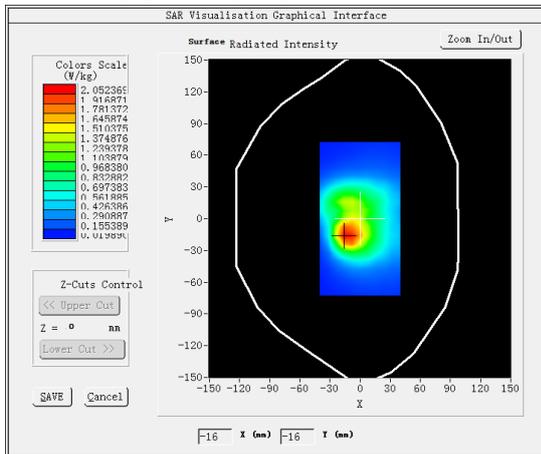
MEASUREMENT 1

Middle Band SAR (Channel 700):

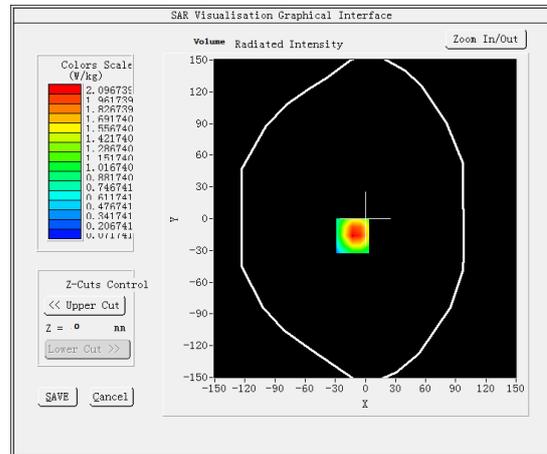
Date: 08/17/2022

Frequency (MHz)	1747.800049
Relative permittivity (real part)	38.854207
Relative permittivity (imaginary part)	13.770436
Conductivity (S/m)	1.412109
Variation (%)	2.120000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>GSM1800(voice)</u>

SURFACE SAR



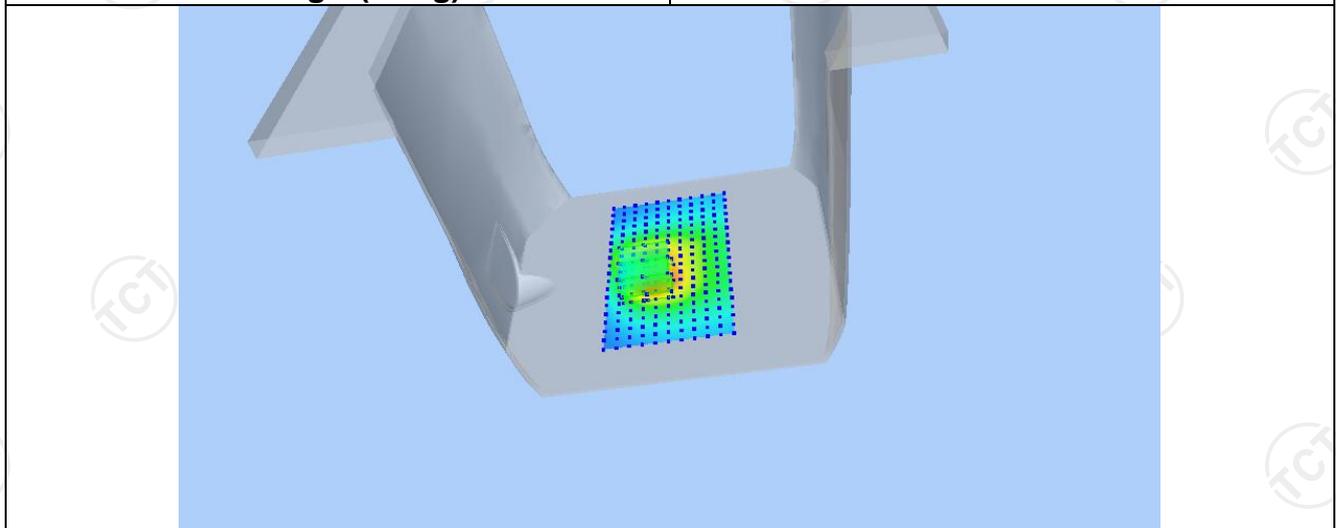
VOLUME SAR



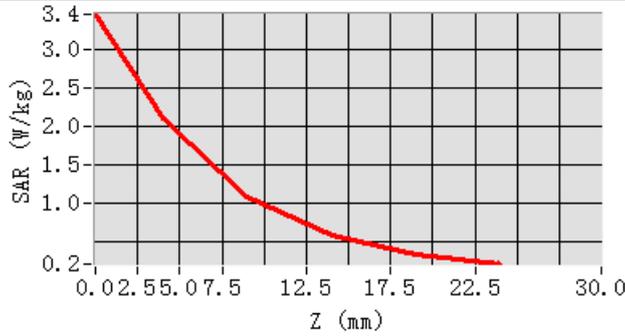
Maximum location: X=-13.00, Y=-16.00

SAR Peak: 3.52 W/kg

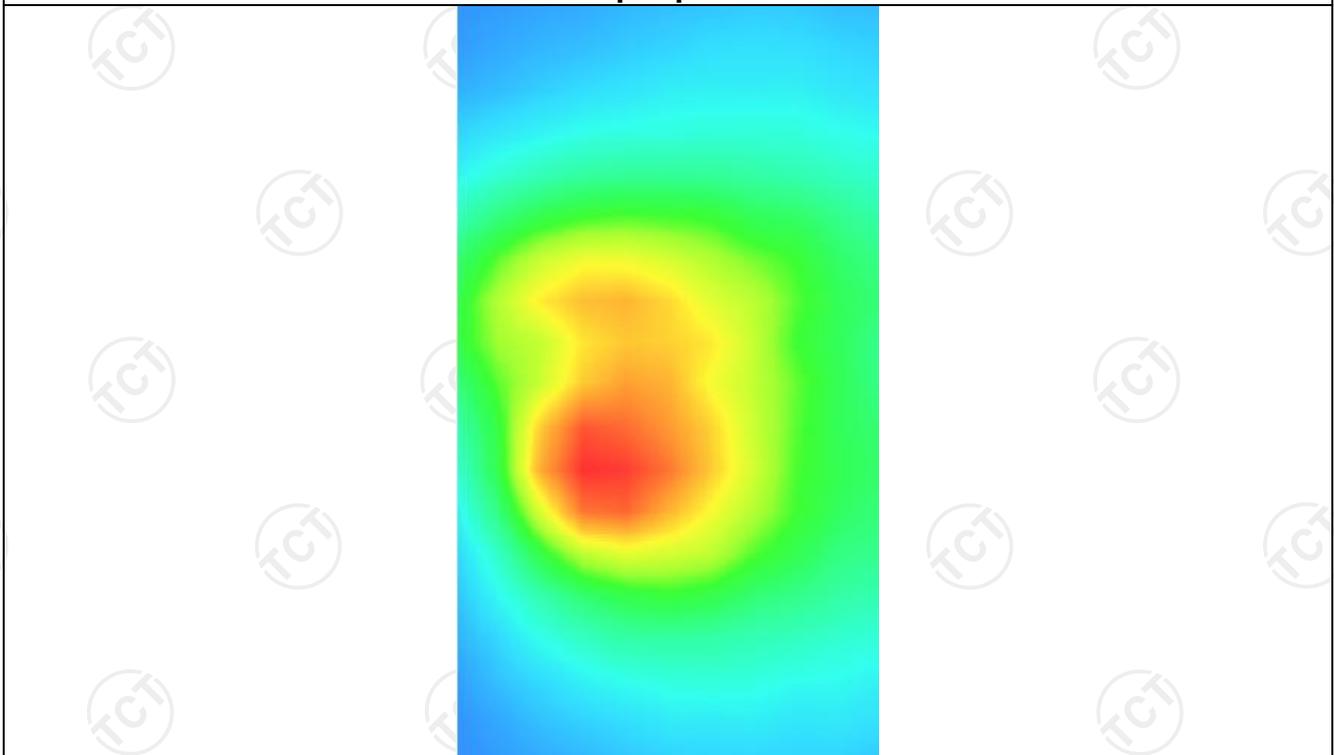
SAR 10g (W/Kg)	1.108033
SAR 1g (W/Kg)	2.017595



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	3.4472	2.0967	1.0948	0.5878	0.3500



Hot spot position



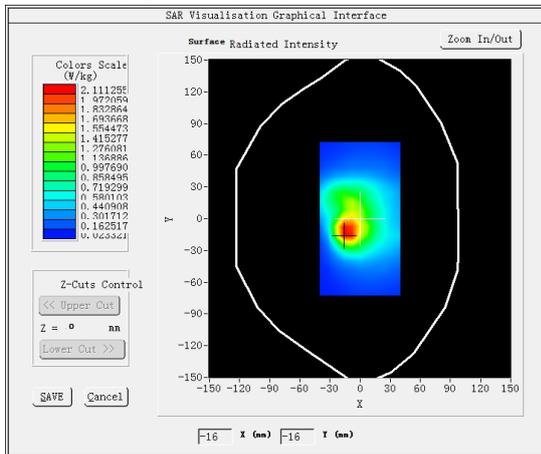
MEASUREMENT 2

Middle Band SAR (Channel 700):

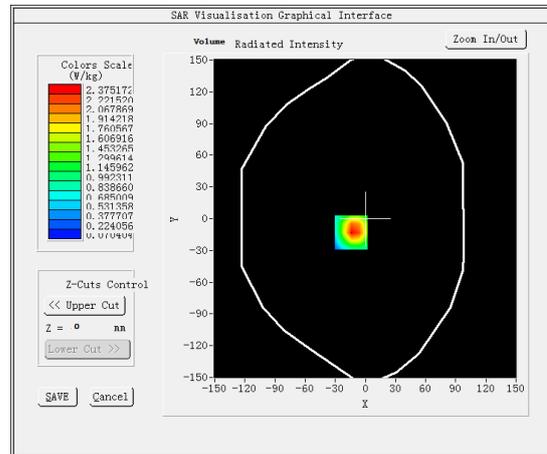
Date: 08/17/2022

Frequency (MHz)	1747.800049
Relative permittivity (real part)	38.854207
Relative permittivity (imaginary part)	13.770436
Conductivity (S/m)	1.412109
Variation (%)	1.050000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>GSM1800(GPRS 4slot)</u>

SURFACE SAR



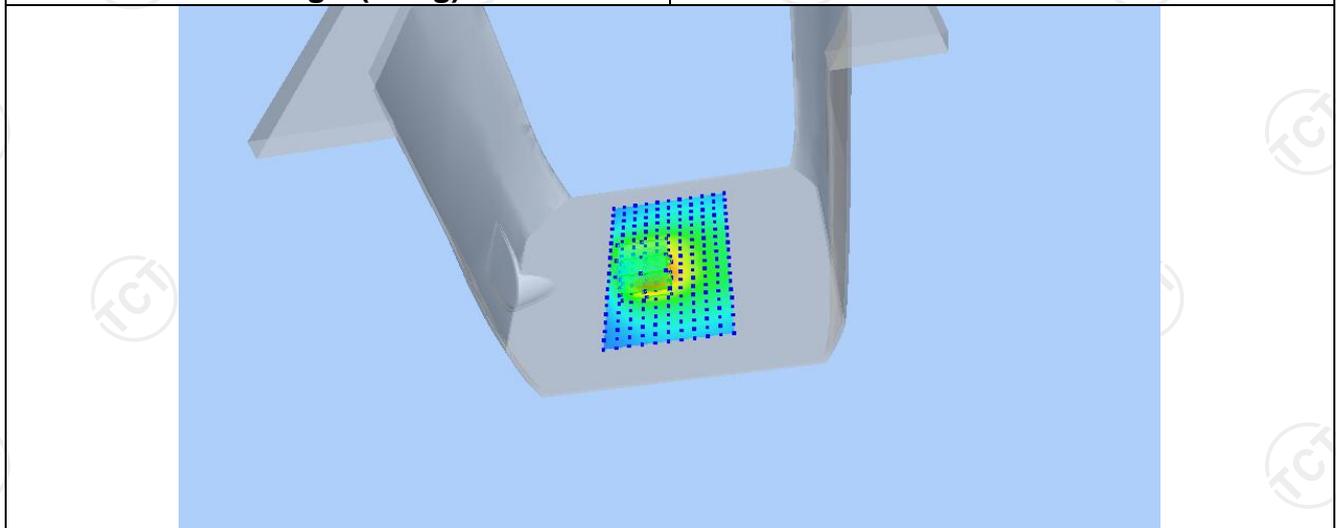
VOLUME SAR



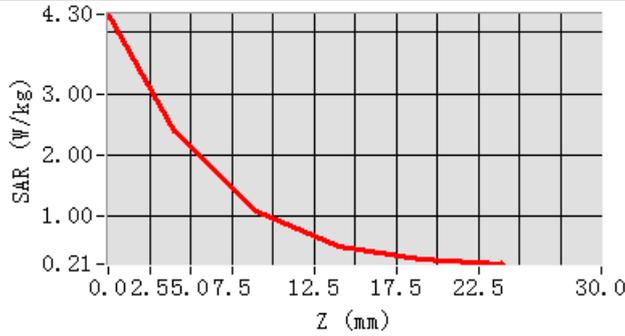
M Maximum location: X=-14.00, Y=-13.00

SAR Peak: 4.38 W/kg

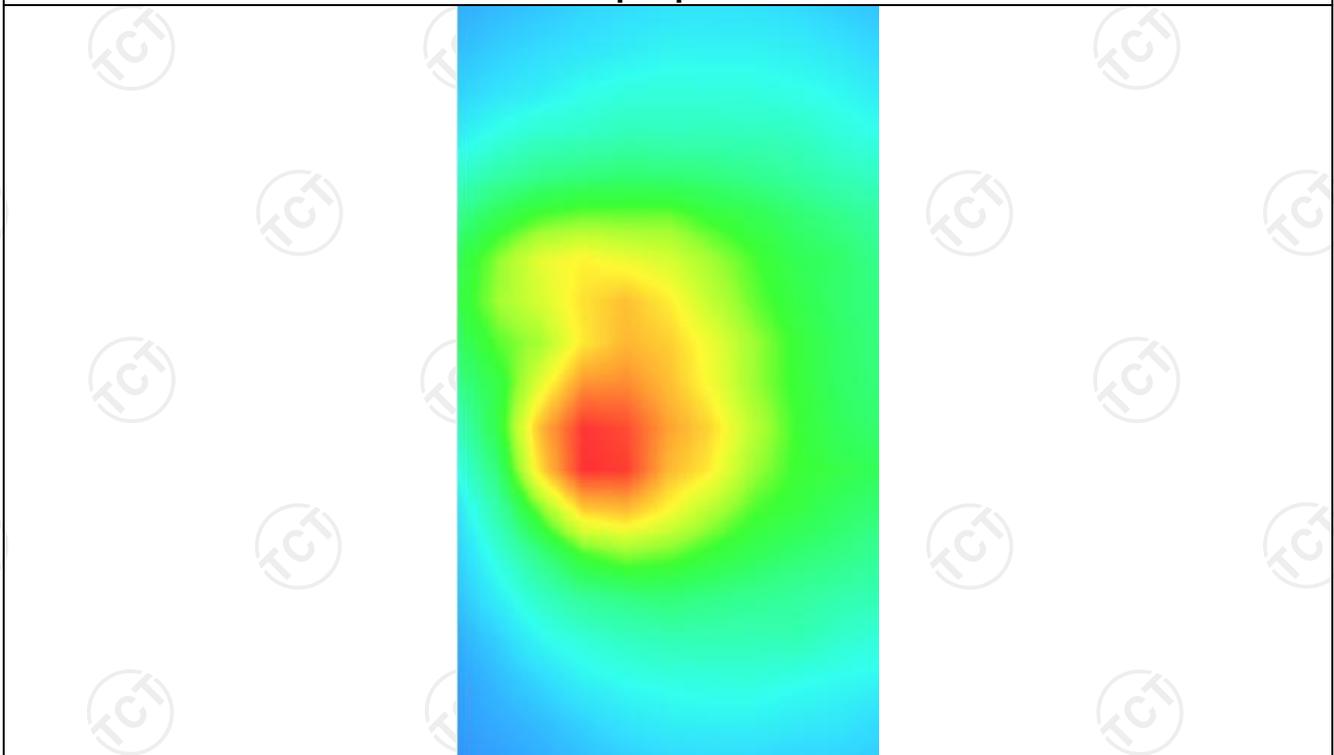
SAR 10g (W/Kg)	1.159496
SAR 1g (W/Kg)	2.280912



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	4.3017	2.3752	1.0715	0.5058	0.2953



Hot spot position



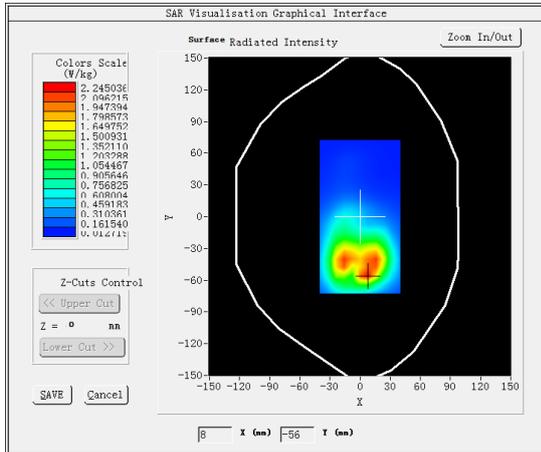
WCDMA Band I
MEASUREMENT 1

Middle Band SAR (Channel 9750):

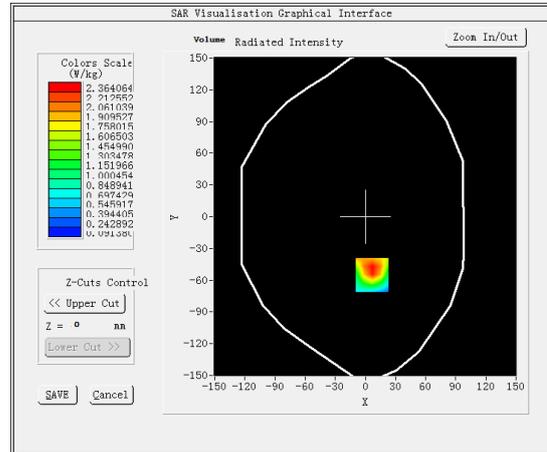
Date: 08/18/2022

Frequency (MHz)	1950.000000
Relative permittivity (real part)	39.721249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.430792
Variation (%)	-0.570000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>BAND1_WCDMA2100</u>

SURFACE SAR

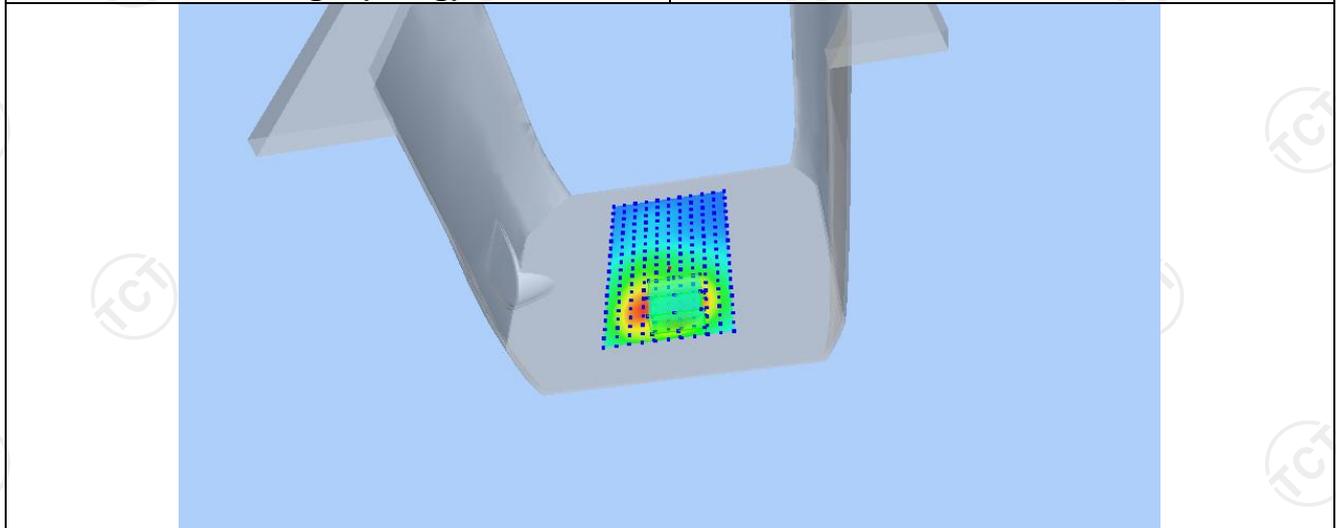


VOLUME SAR

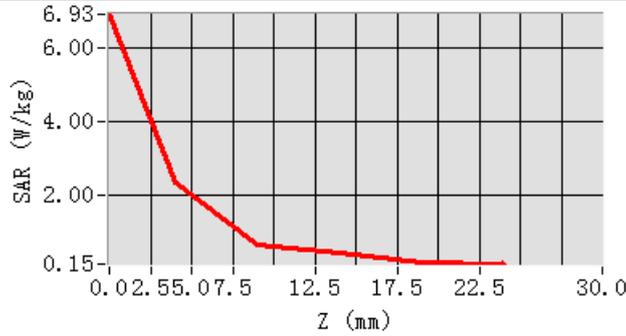


Maximum location: X=7.00, Y=-55.00
SAR Peak: 4.70 W/kg

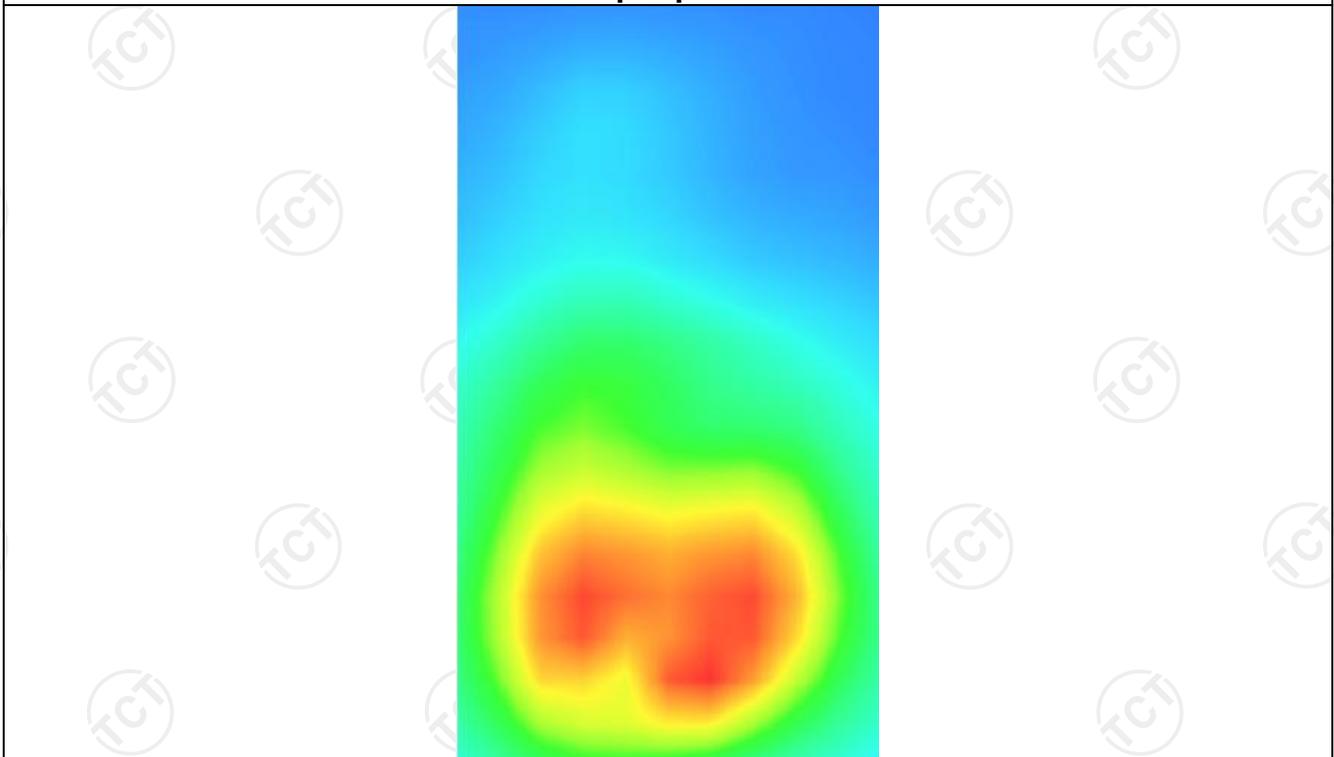
SAR 10g (W/Kg)	0.633695
SAR 1g (W/Kg)	1.301910



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	6.9277	2.3641	0.6725	0.4480	0.1825



Hot spot position



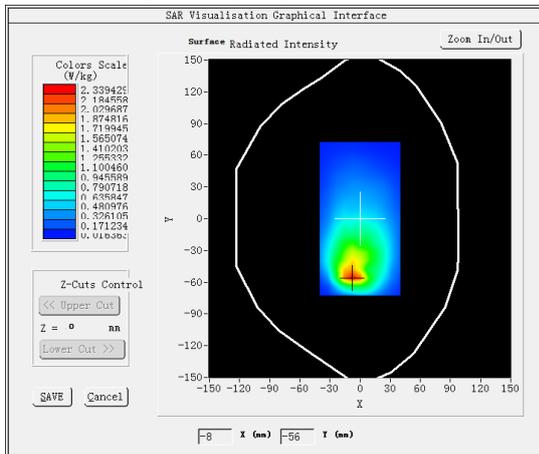
WCDMA Band VIII
MEASUREMENT 1

Middle Band SAR (Channel 2788):

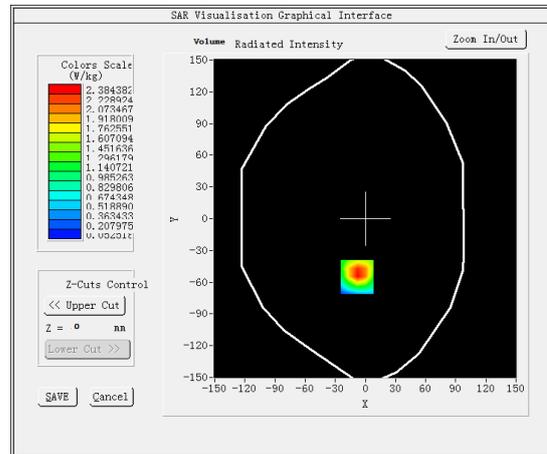
Date: 08/15/2022

Frequency (MHz)	897.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	-2.020000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>BAND8 WCDMA900</u>

SURFACE SAR



VOLUME SAR



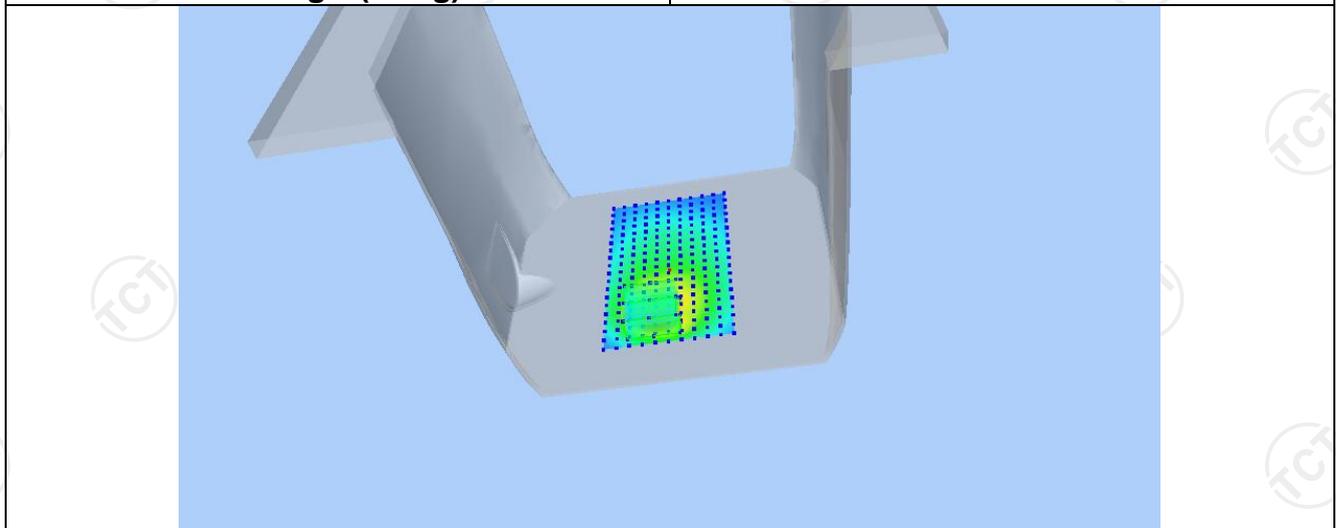
Maximum location: X=-8.00, Y=-55.00
SAR Peak: 4.37 W/kg

SAR 10g (W/Kg)

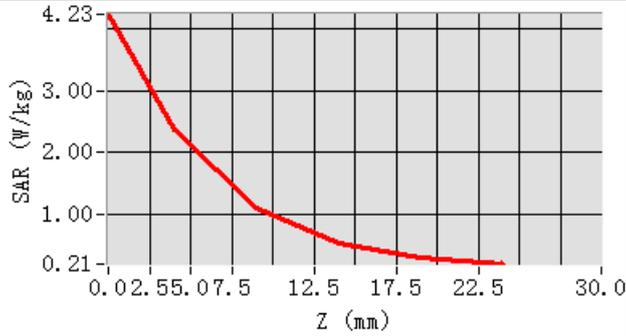
1.164640

SAR 1g (W/Kg)

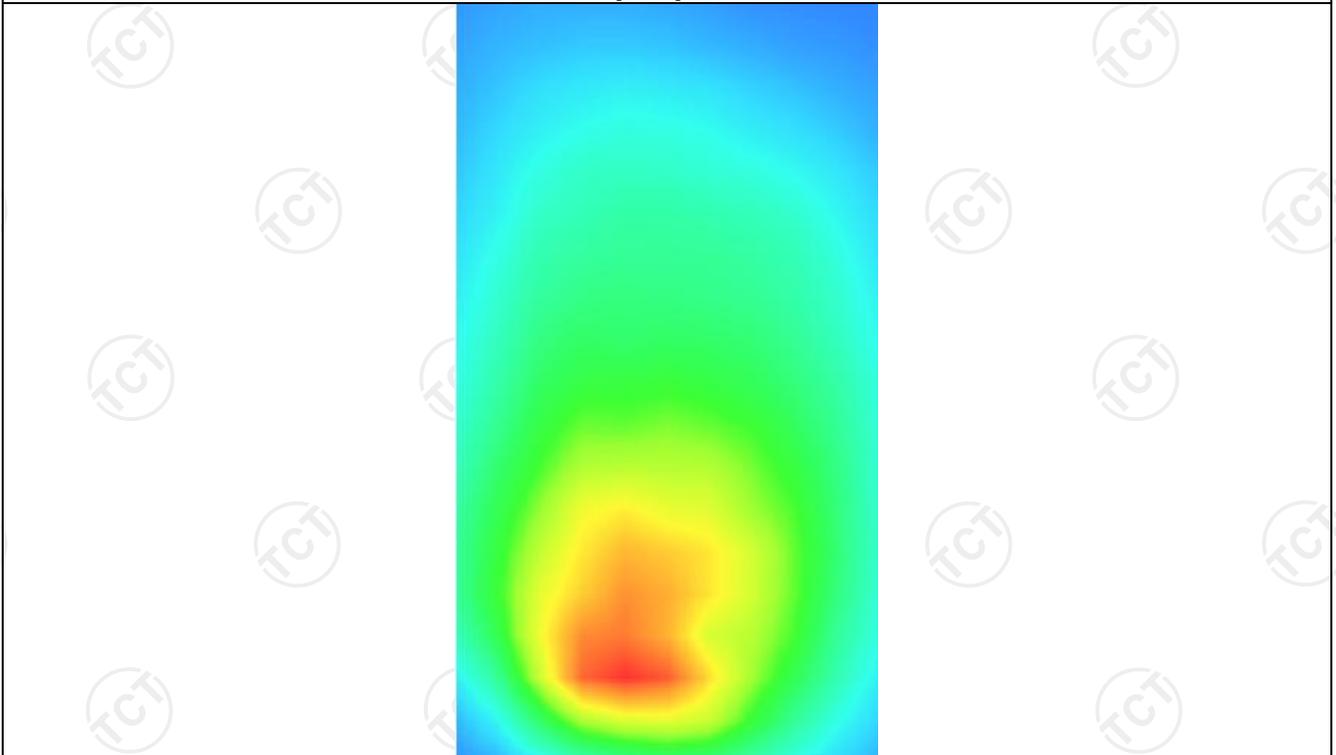
2.309764



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	4.2275	2.3844	1.1111	0.5380	0.3115



Hot spot position



LTE Band 1

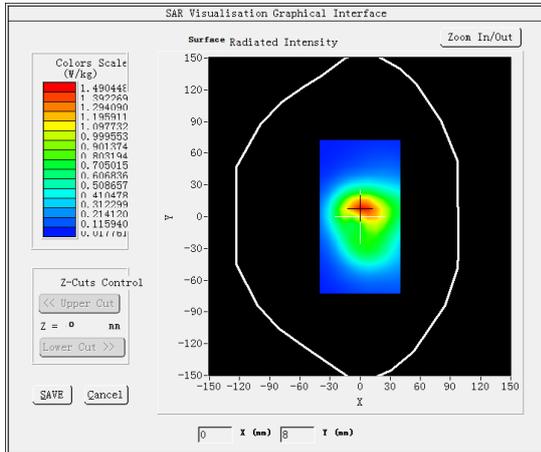
MEASUREMENT 1

Middle Band SAR (Channel 18300):

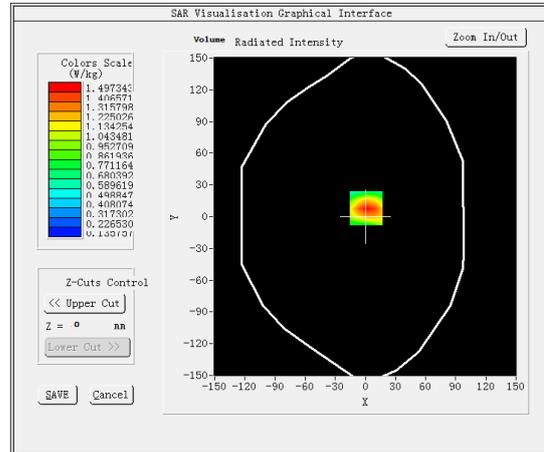
Date: 08/18/2022

Frequency (MHz)	1950.000000
Relative permittivity (real part)	39.721249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.430792
Variation (%)	-0.030000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 1</u>

SURFACE SAR



VOLUME SAR



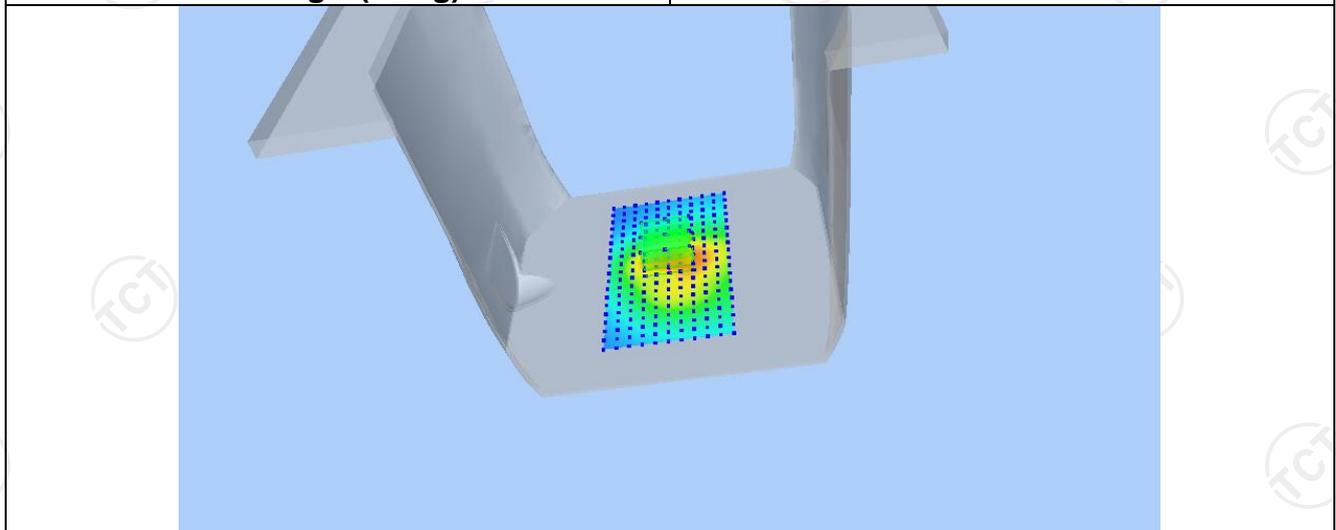
Maximum location: X=1.00, Y=8.00
SAR Peak: 2.26 W/kg

SAR 10g (W/Kg)

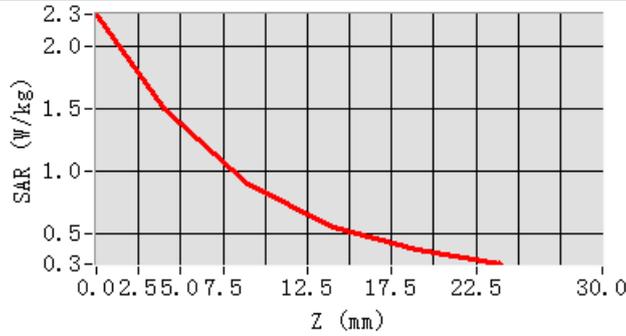
0.834635

SAR 1g (W/Kg)

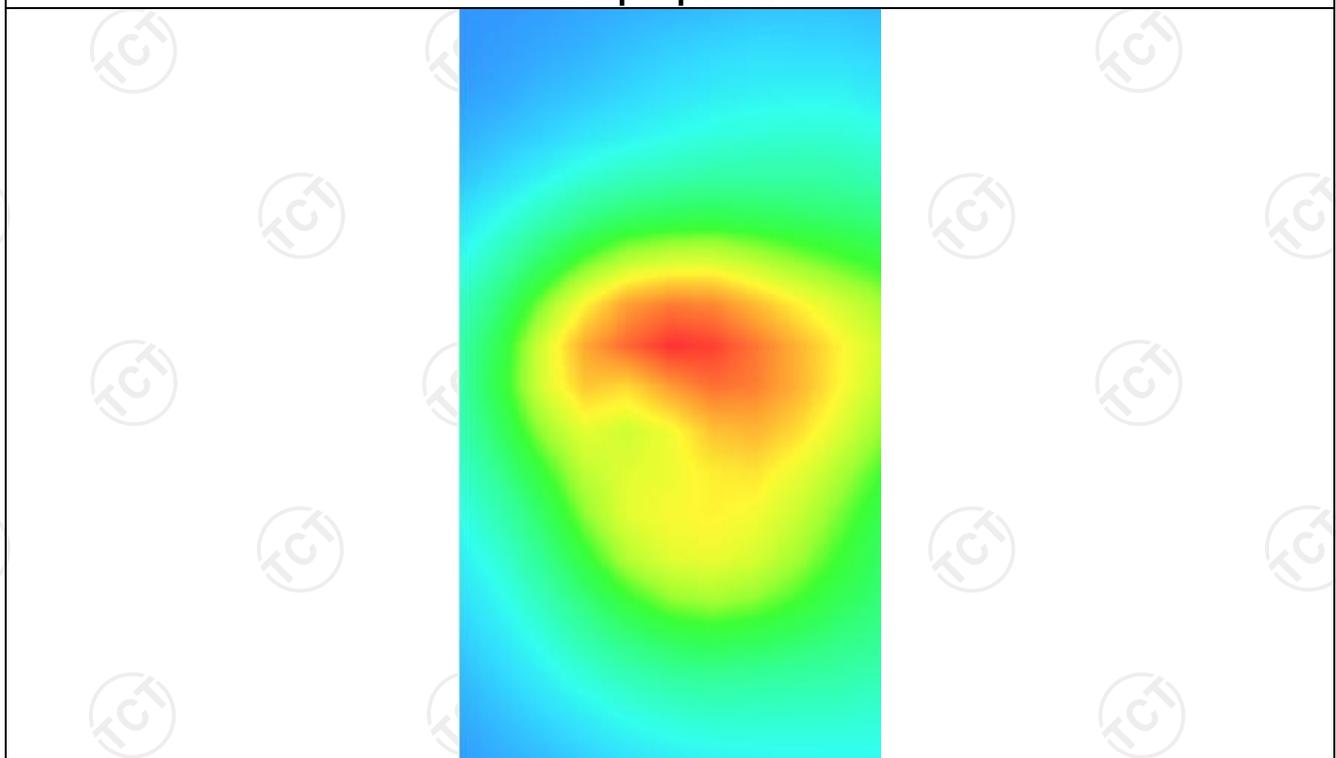
1.409248



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.2514	1.4973	0.8941	0.5530	0.3686



Hot spot position



LTE Band 3

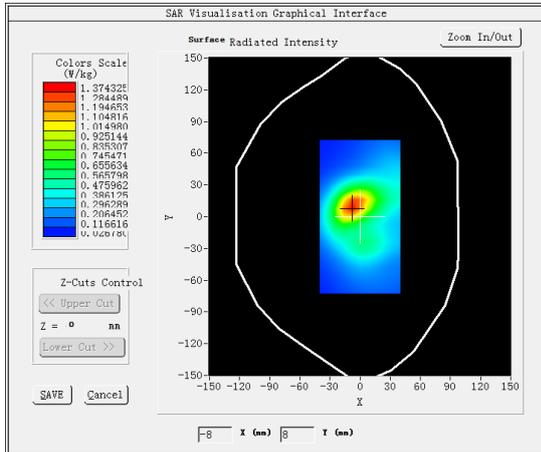
MEASUREMENT 1

Middle Band SAR (Channel 19575):

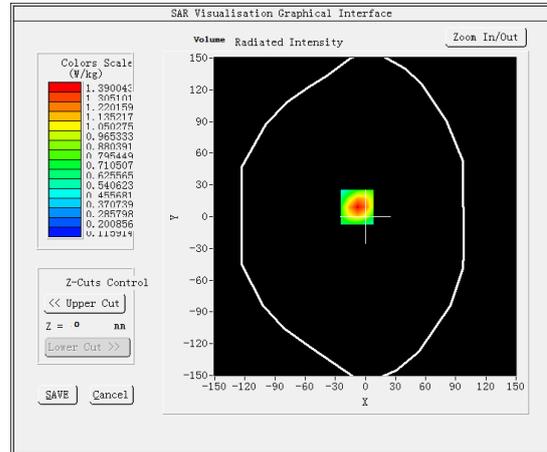
Date: 08/17/2022

Frequency (MHz)	1747.000000
Relative permittivity (real part)	38.854207
Relative permittivity (imaginary part)	13.770436
Conductivity (S/m)	1.412109
Variation (%)	1.070000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 3</u>

SURFACE SAR



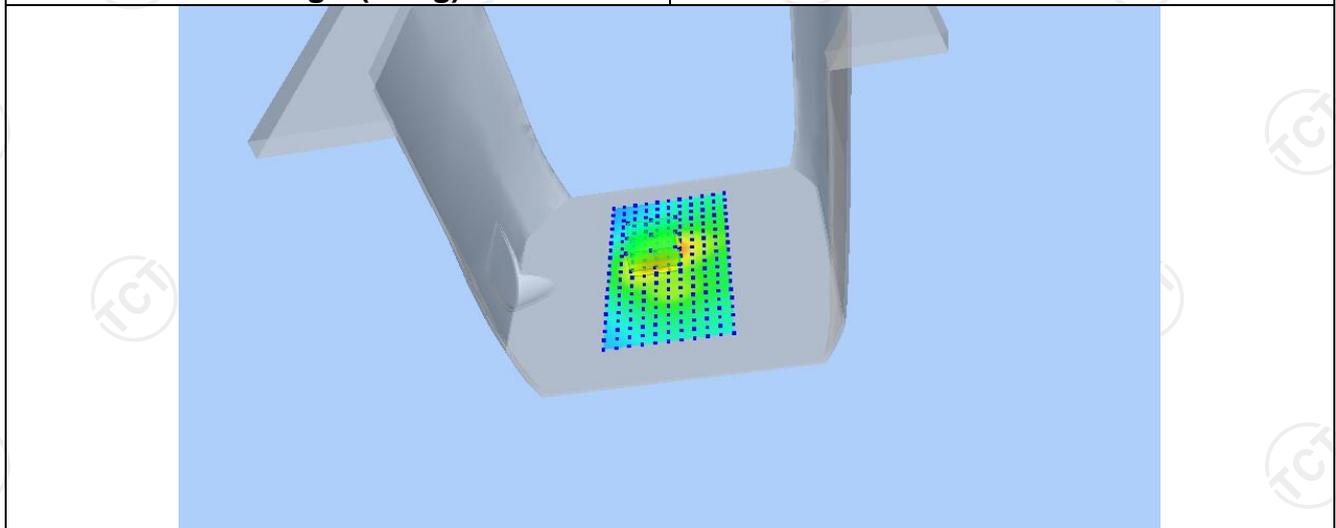
VOLUME SAR



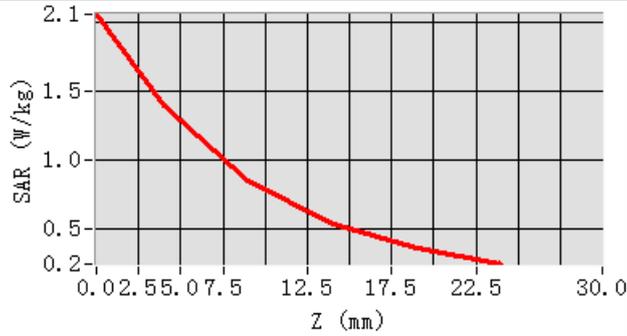
Maximum location: X=-8.00, Y=9.00

SAR Peak: 2.06 W/kg

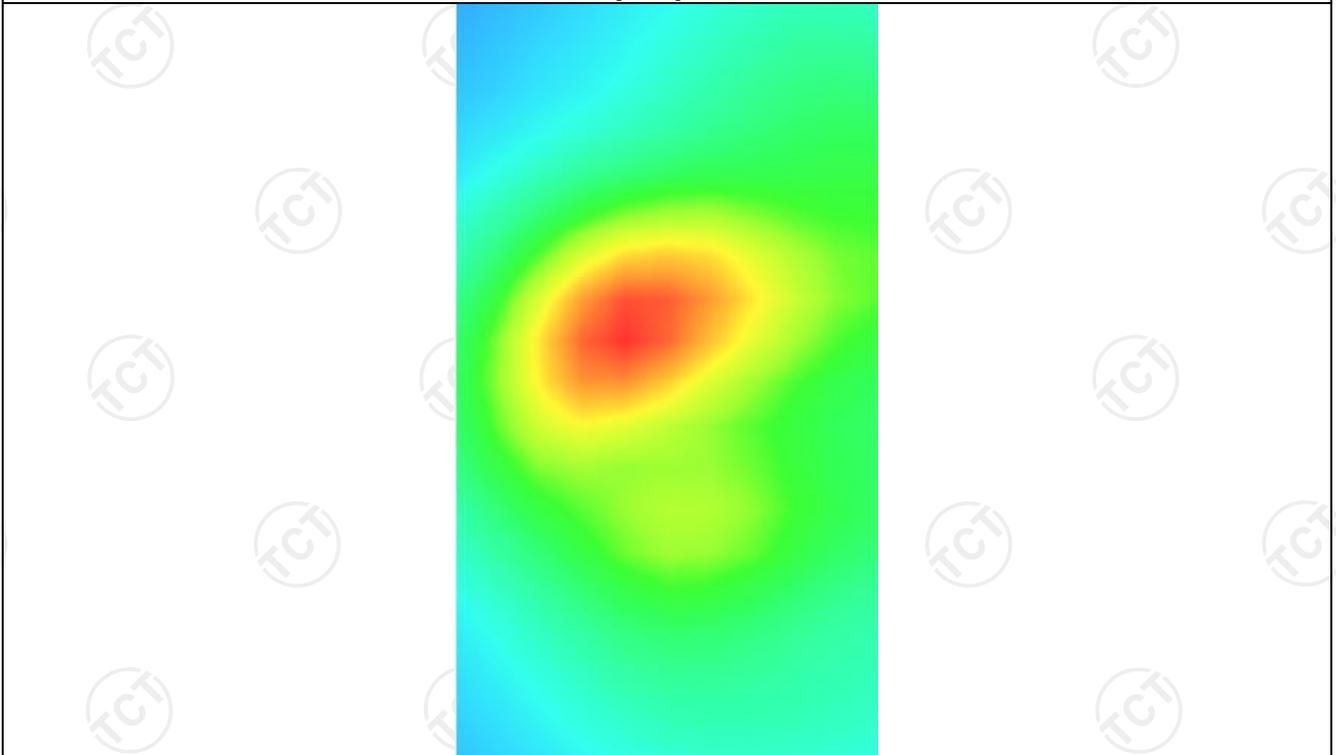
SAR 10g (W/Kg)	0.758385
SAR 1g (W/Kg)	1.298630



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.0570	1.3900	0.8471	0.5322	0.3561



Hot spot position



LTE Band 7

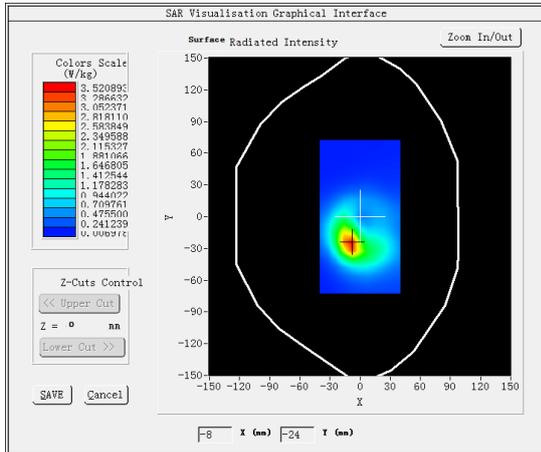
MEASUREMENT 1

Middle Band SAR (Channel 21100):

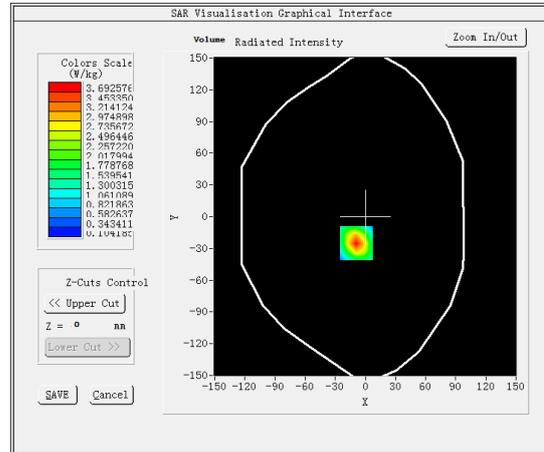
Date: 08/23/2022

Frequency (MHz)	2535.000000
Relative permittivity (real part)	38.350154
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.922154
Variation (%)	-2.430000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 7</u>

SURFACE SAR



VOLUME SAR



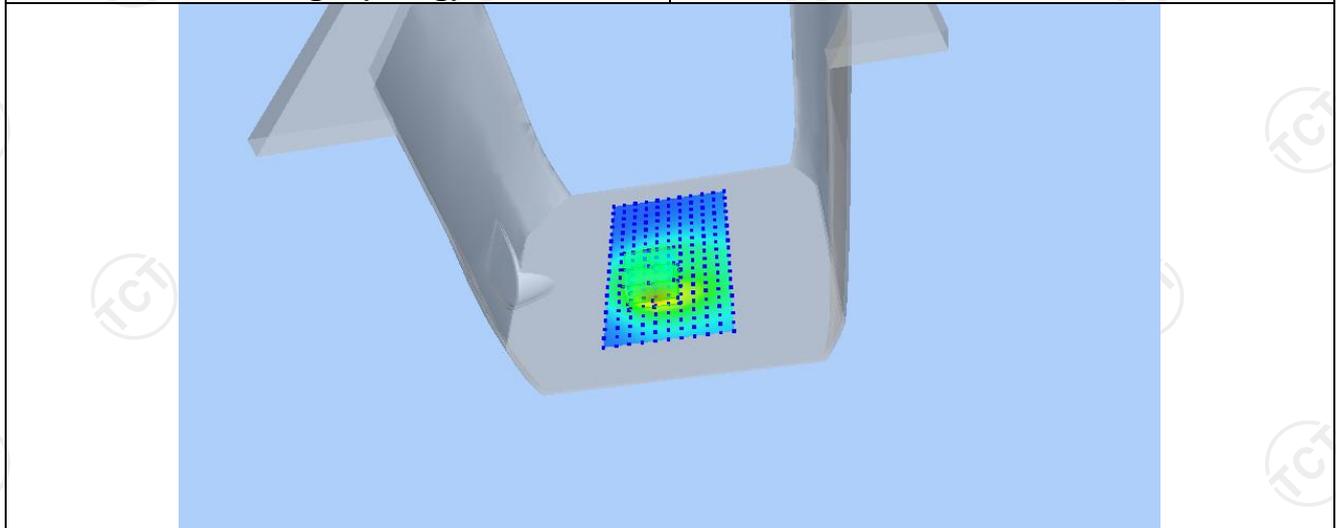
Maximum location: X=-9.00, Y=-25.00
SAR Peak: 6.24 W/kg

SAR 10g (W/Kg)

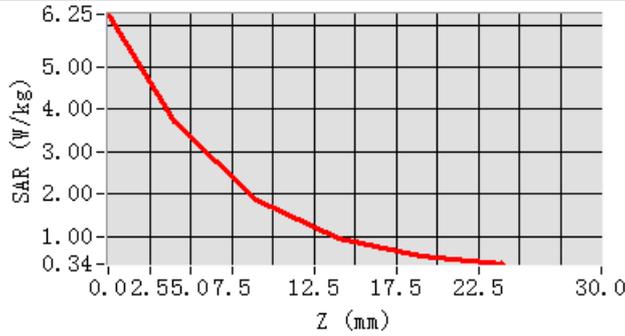
0.960492

SAR 1g (W/Kg)

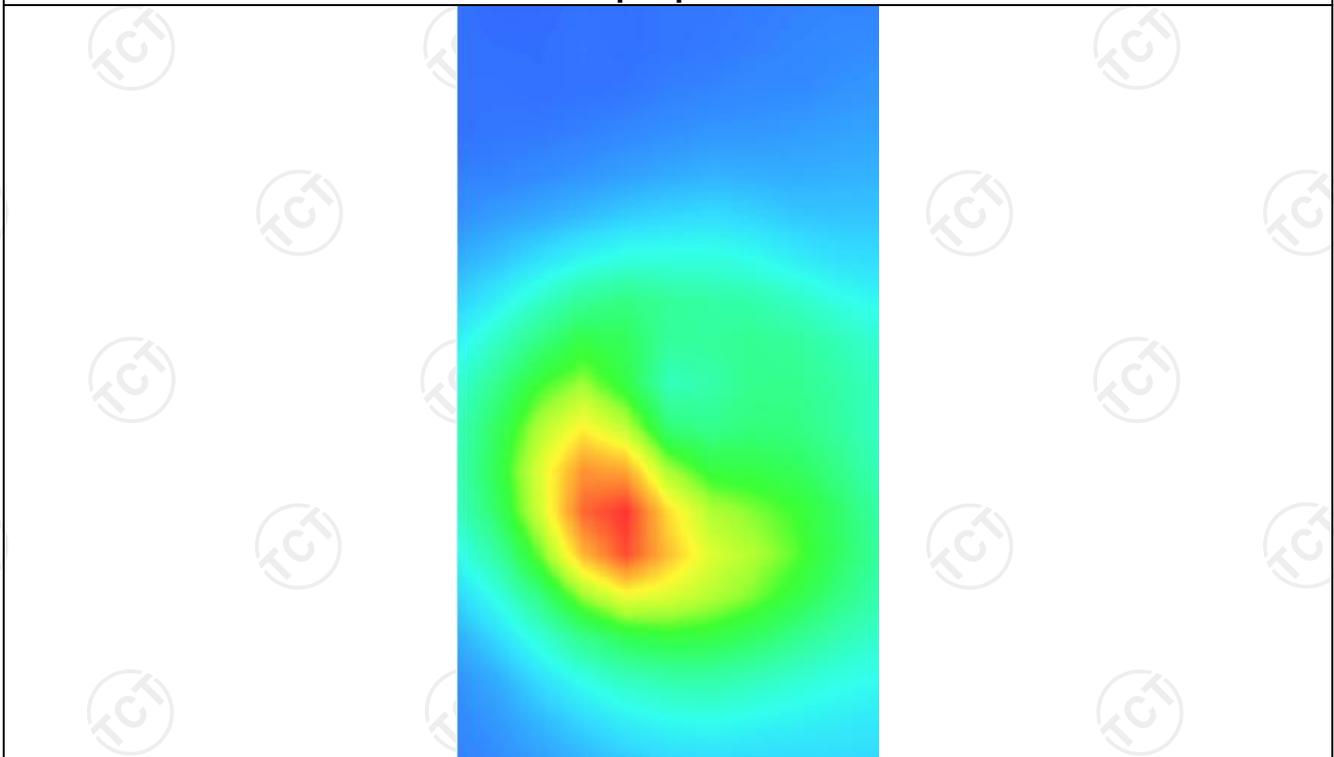
1.447266



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	6.2498	3.6926	1.8431	0.9440	0.5448



Hot spot position



LTE Band 8

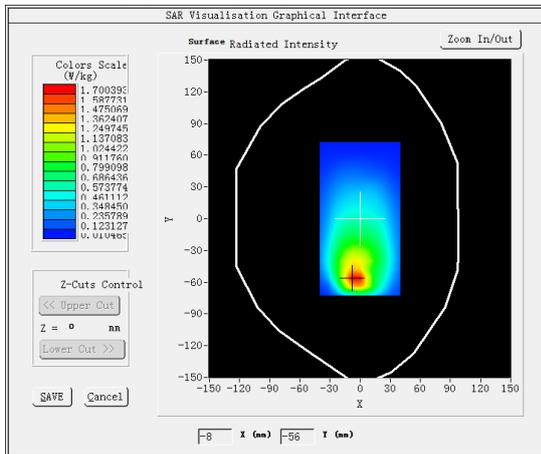
MEASUREMENT 1

Middle Band SAR (Channel 21625):

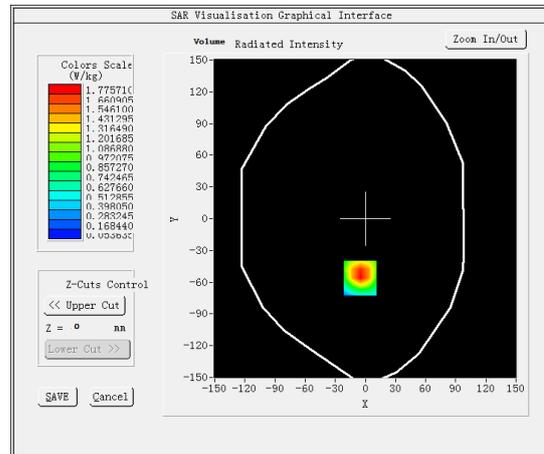
Date: 08/15/2022

Frequency (MHz)	897.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.359541
Conductivity (S/m)	0.960017
Variation (%)	-0.750000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 8</u>

SURFACE SAR



VOLUME SAR



Maximum location: X=-5.00, Y=-56.00

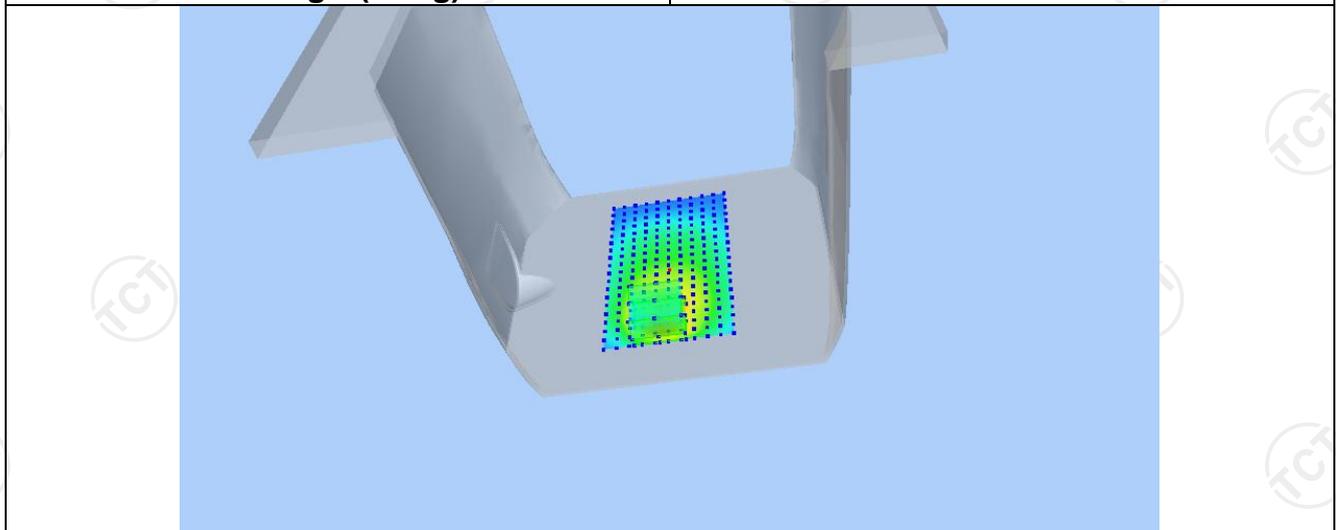
SAR Peak: 3.11 W/kg

SAR 10g (W/Kg)

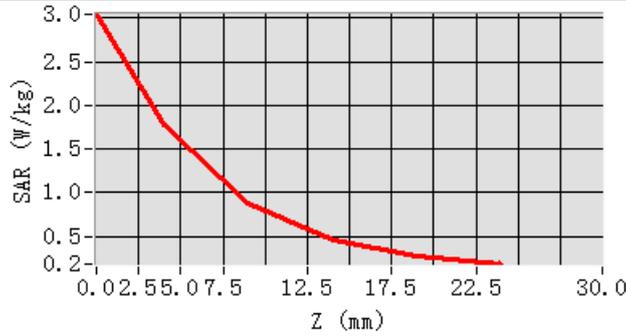
0.909365

SAR 1g (W/Kg)

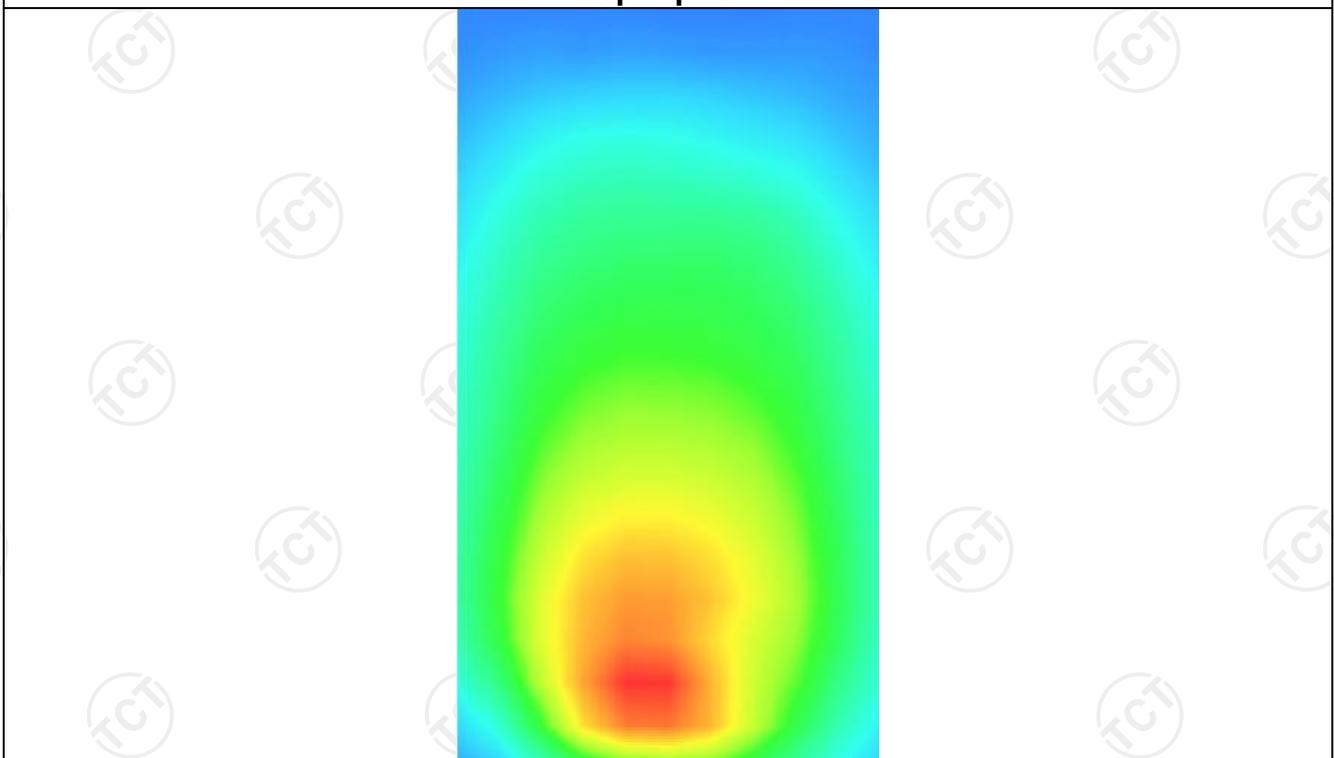
1.709601



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	3.0442	1.7757	0.8741	0.4490	0.2695



Hot spot position



LTE Band 20

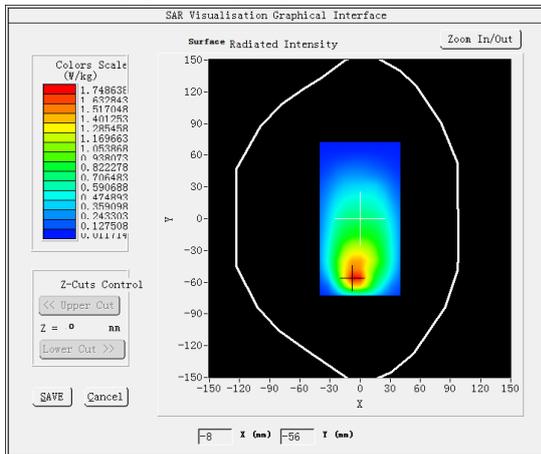
MEASUREMENT 1

Middle Band SAR (Channel 24300):

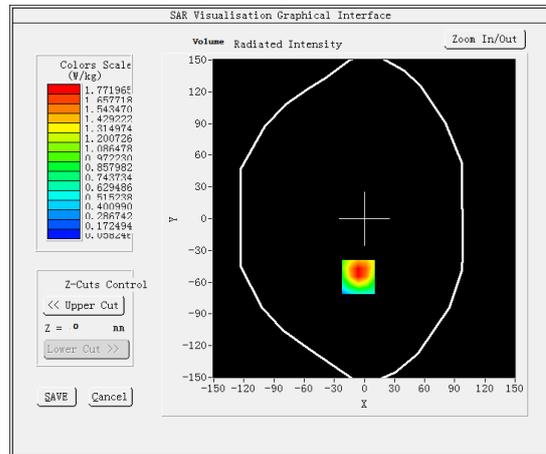
Date: 08/15/2022

Frequency (MHz)	847.000000
Relative permittivity (real part)	41.923440
Relative permittivity (imaginary part)	18.296230
Conductivity (S/m)	0.960017
Variation (%)	-0.950000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 20</u>

SURFACE SAR



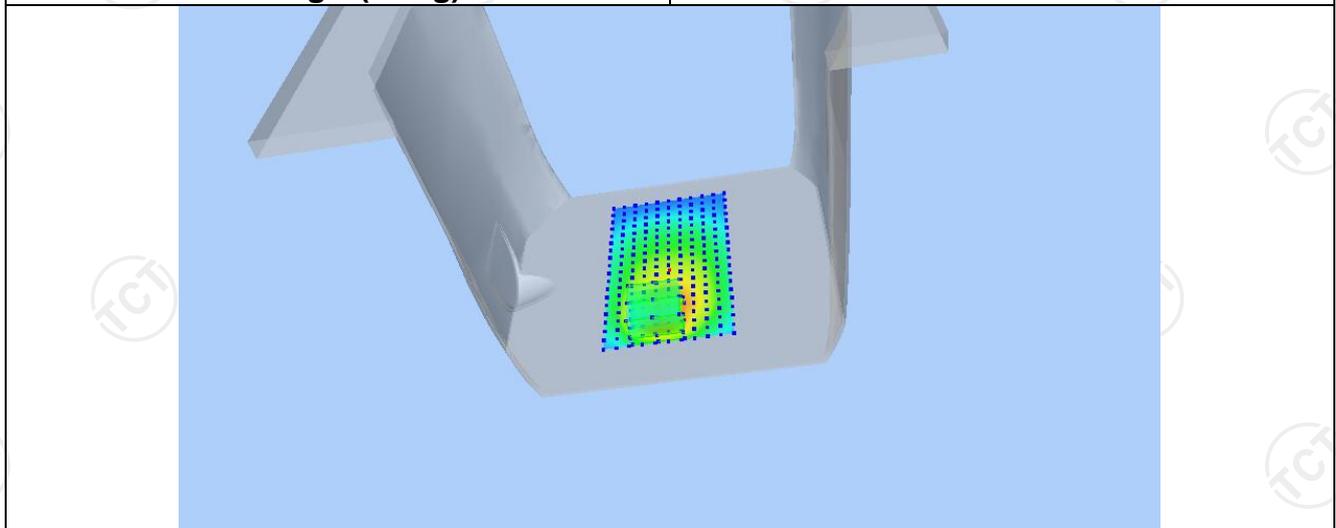
VOLUME SAR



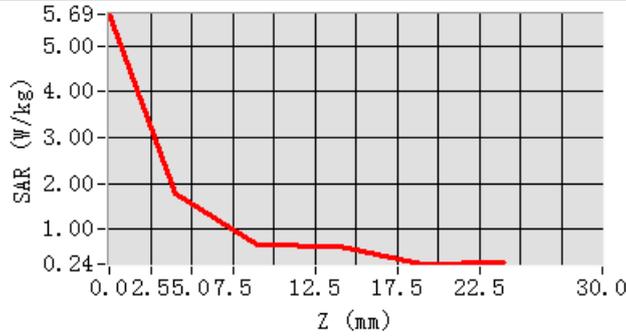
Maximum location: X=-6.00, Y=-55.00

SAR Peak: 3.01 W/kg

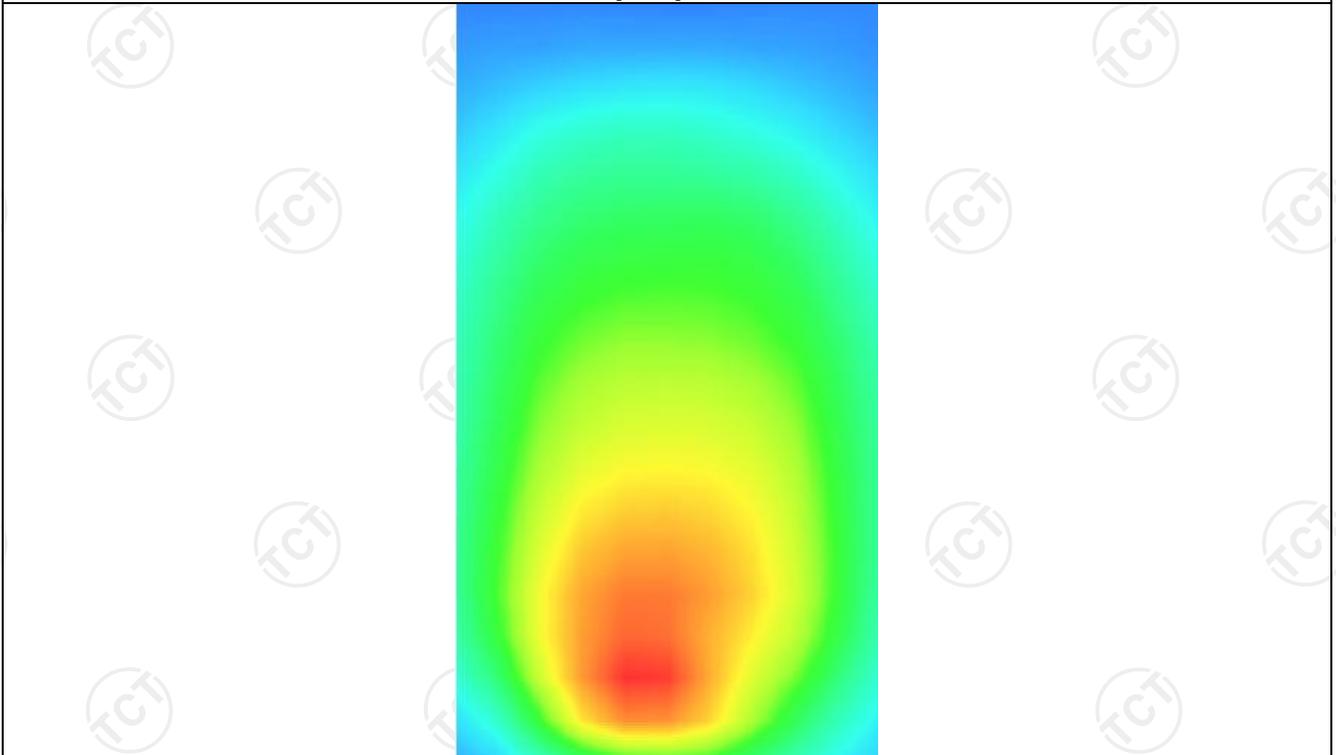
SAR 10g (W/Kg)	0.968771
SAR 1g (W/Kg)	1.736347



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.6945	1.7720	0.6626	0.6115	0.2375



Hot spot position



LTE Band 40

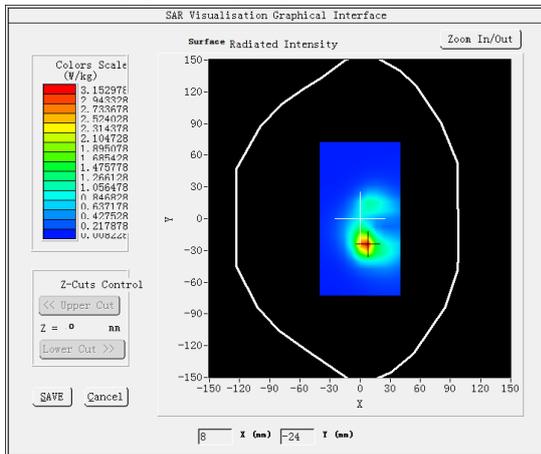
MEASUREMENT 1

Middle Band SAR (Channel 39150):

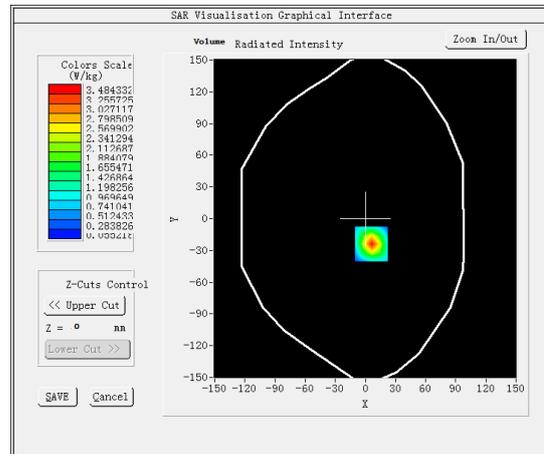
Date: 08/22/2022

Frequency (MHz)	2350.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	-0.190000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>LTE band 40</u>

SURFACE SAR



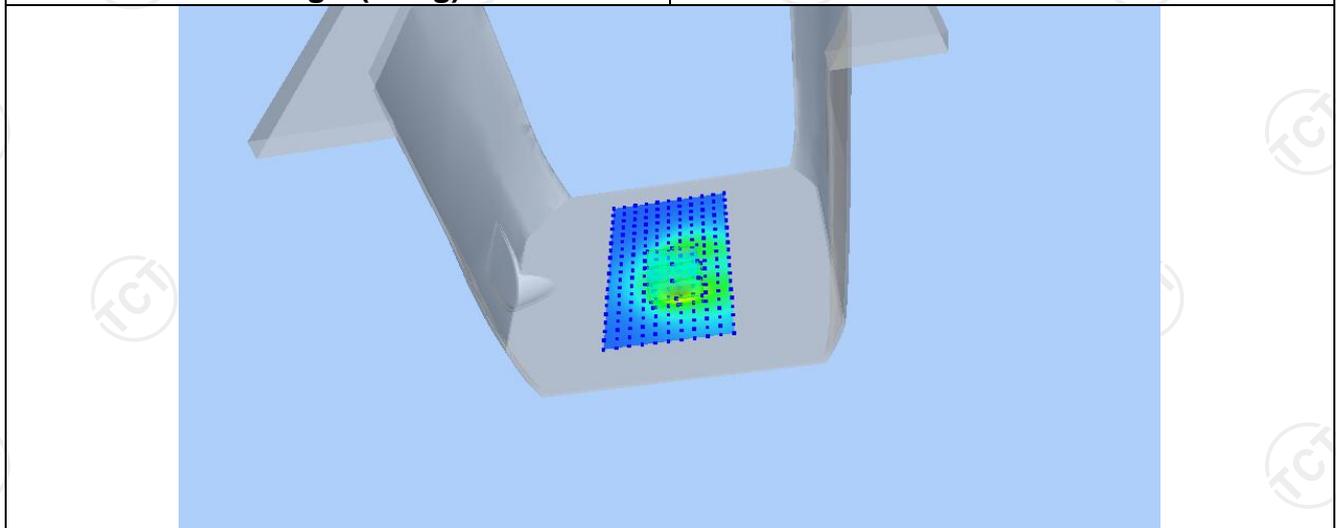
VOLUME SAR



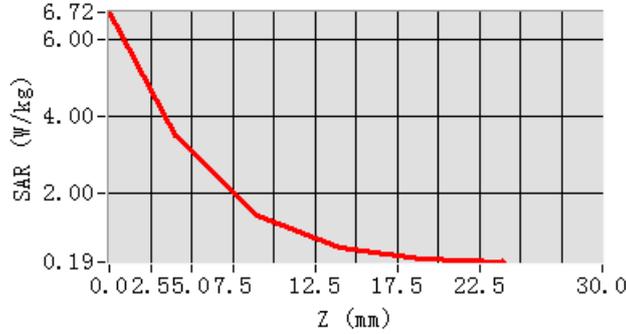
Maximum location: X=6.00, Y=-24.00

SAR Peak: 6.70 W/kg

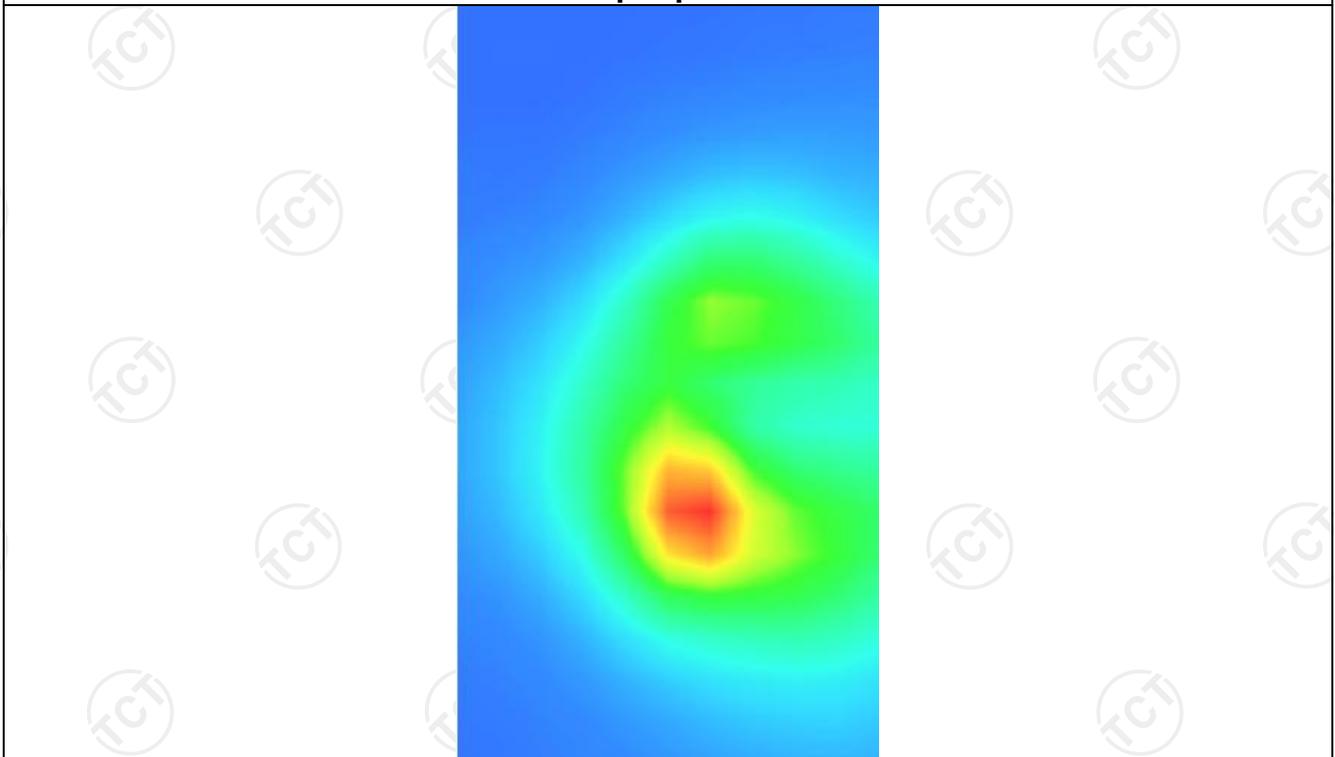
SAR 10g (W/Kg)	1.344683
SAR 1g (W/Kg)	3.169964



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	6.7235	3.4843	1.3983	0.5665	0.2925



Hot spot position



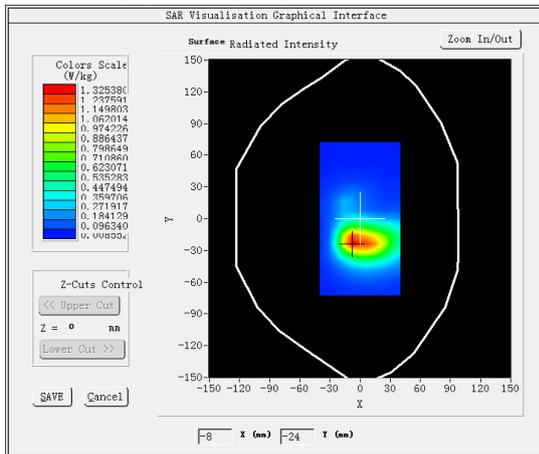
2.4G WLAN
MEASUREMENT 1

Middle Band SAR (Channel 7):

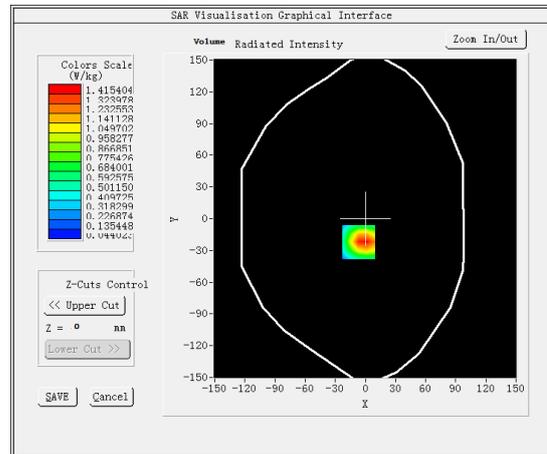
Date: 08/18/2022

Frequency (MHz)	2442.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	-0.560000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>IEEE 802.11b ISM</u>

SURFACE SAR



VOLUME SAR



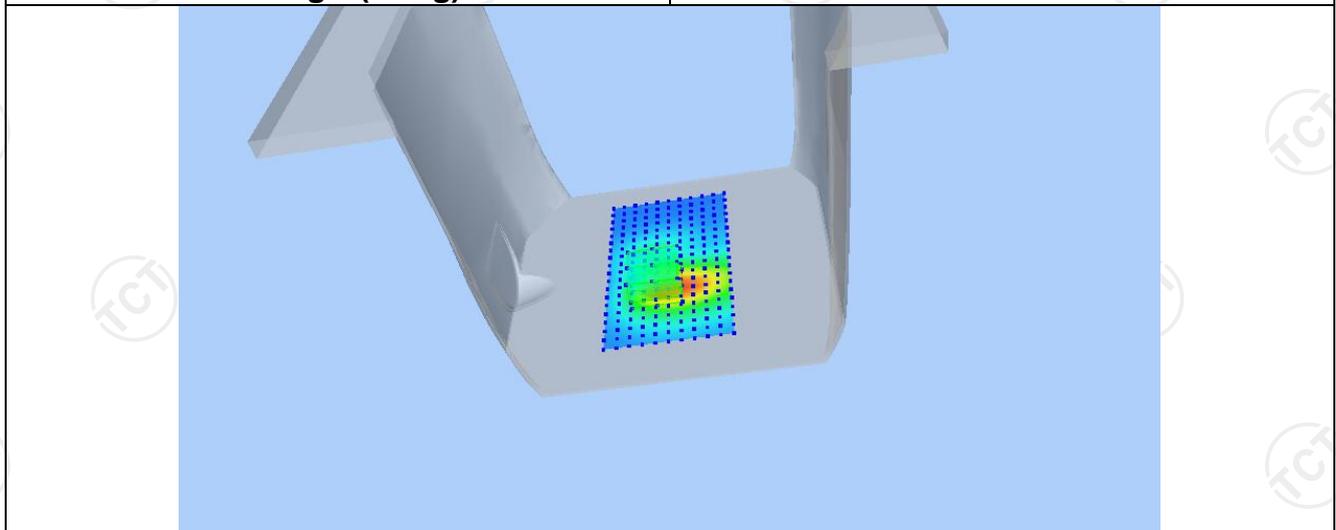
Maximum location: X=-7.00, Y=-22.00
SAR Peak: 2.44 W/kg

SAR 10g (W/Kg)

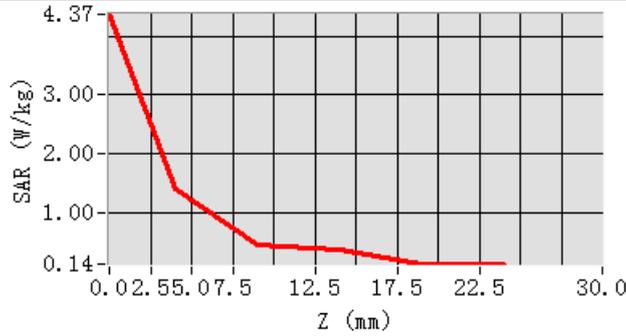
0.692971

SAR 1g (W/Kg)

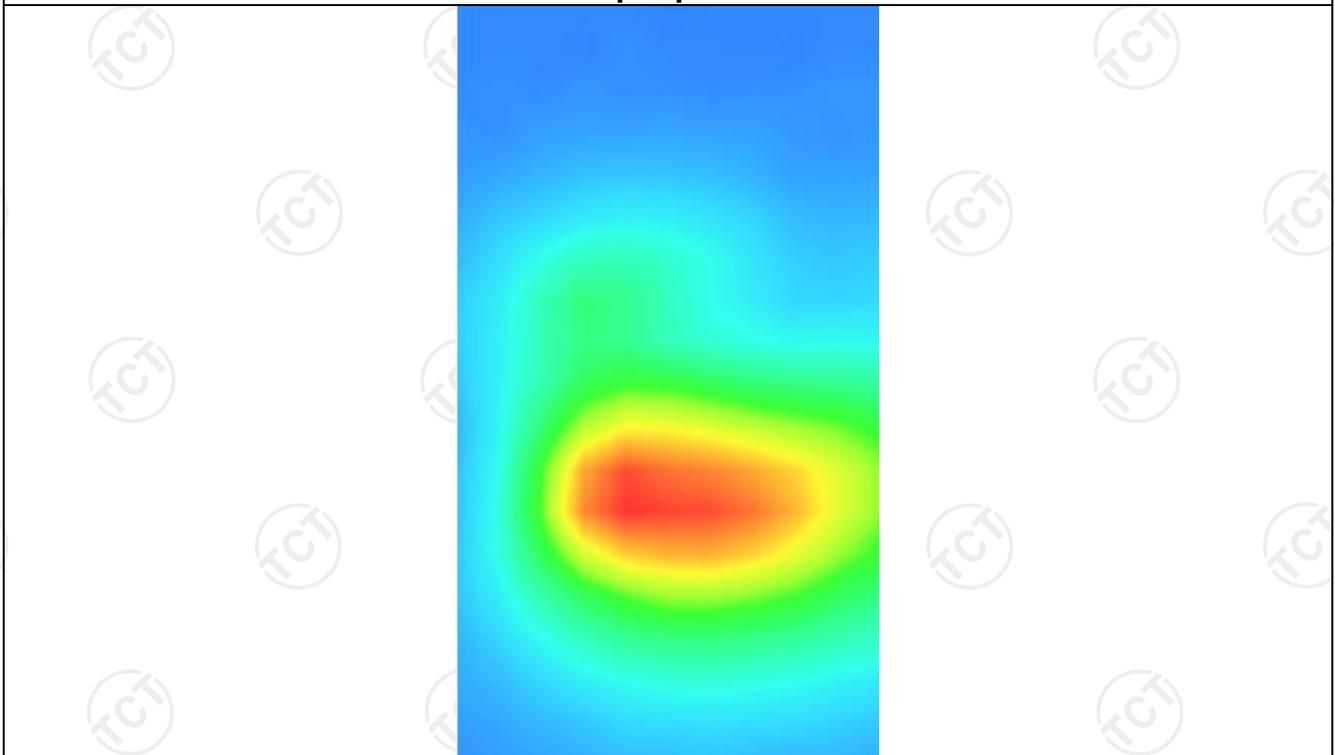
1.340543



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	4.3661	1.4154	0.4791	0.3936	0.1454



Hot spot position



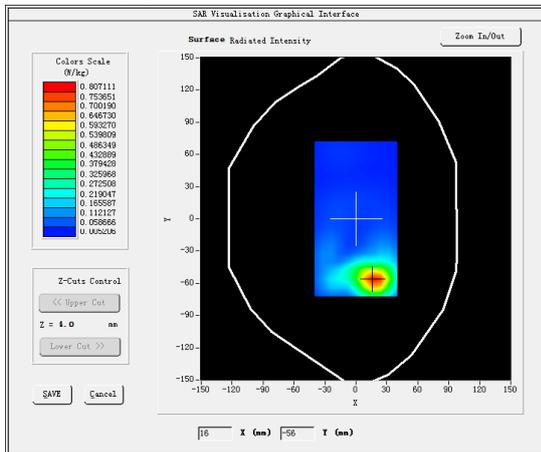
5.2G WLAN
MEASUREMENT 1

SAR (Channel 36):

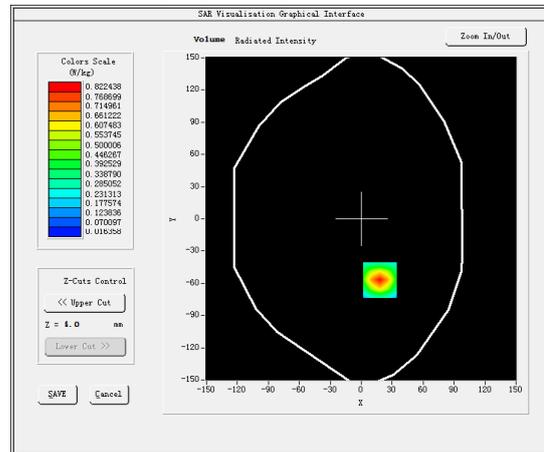
Date: 08/30/2022

Frequency (MHz)	5180.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	1.140000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>IEEE 802.11a ISM</u>

SURFACE SAR



VOLUME SAR



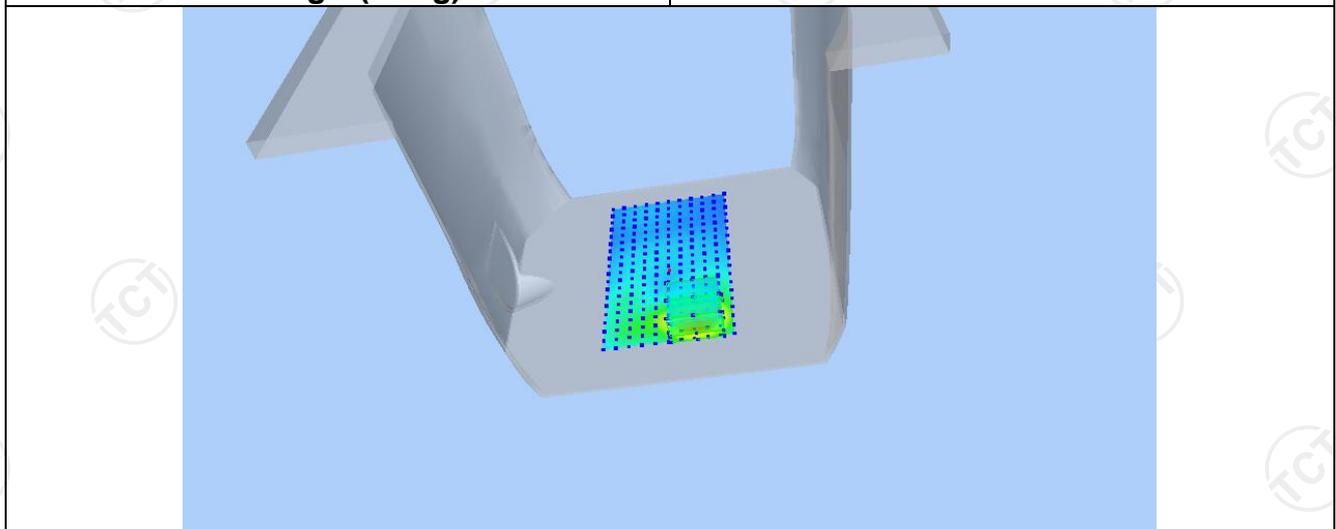
Maximum location: X=14.00, Y=-16.00
SAR Peak: 0.90 W/kg

SAR 10g (W/Kg)

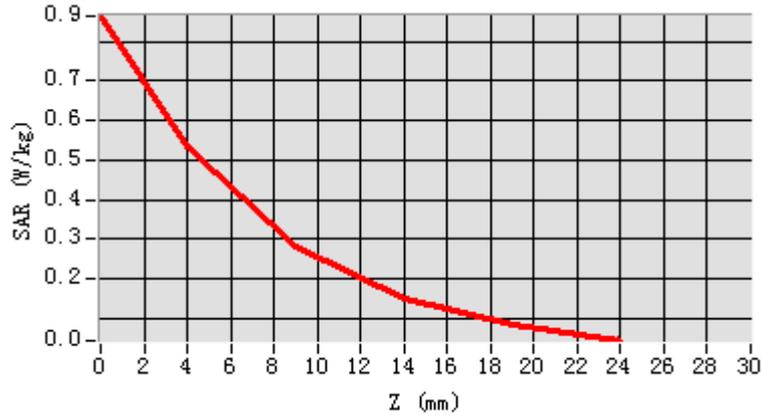
0.312212

SAR 1g (W/Kg)

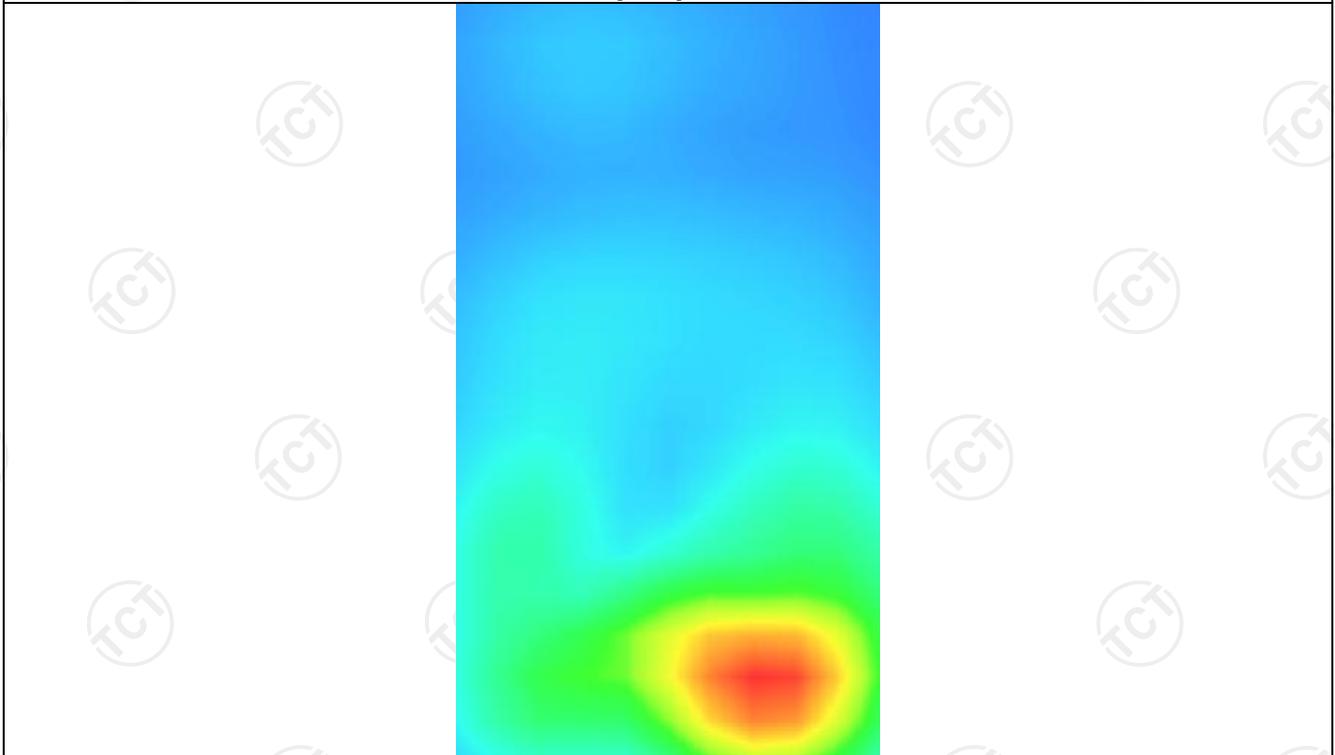
0.701012



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.8634	0.5339	0.2824	0.1489	0.0820



Hot spot position



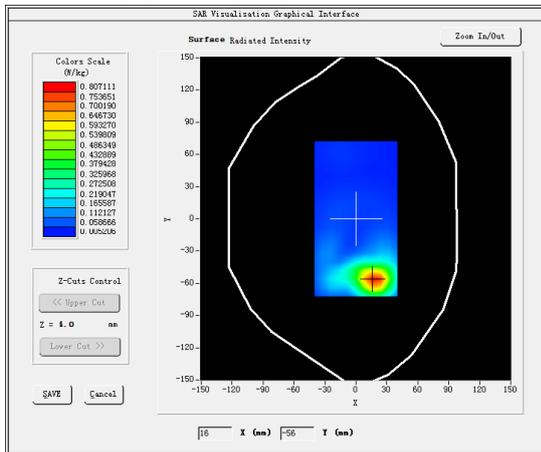
5.8G WLAN
MEASUREMENT 1

SAR (Channel 157):

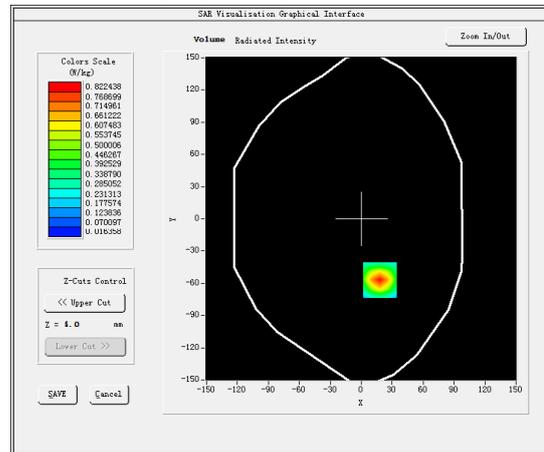
Date: 08/30/2022

Frequency (MHz)	5785.000000
Relative permittivity (real part)	38.352823
Relative permittivity (imaginary part)	13.671675
Conductivity (S/m)	1.925428
Variation (%)	-2.020000
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm</u> <u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back</u>
Band	<u>IEEE 802.11ac ISM</u>

SURFACE SAR

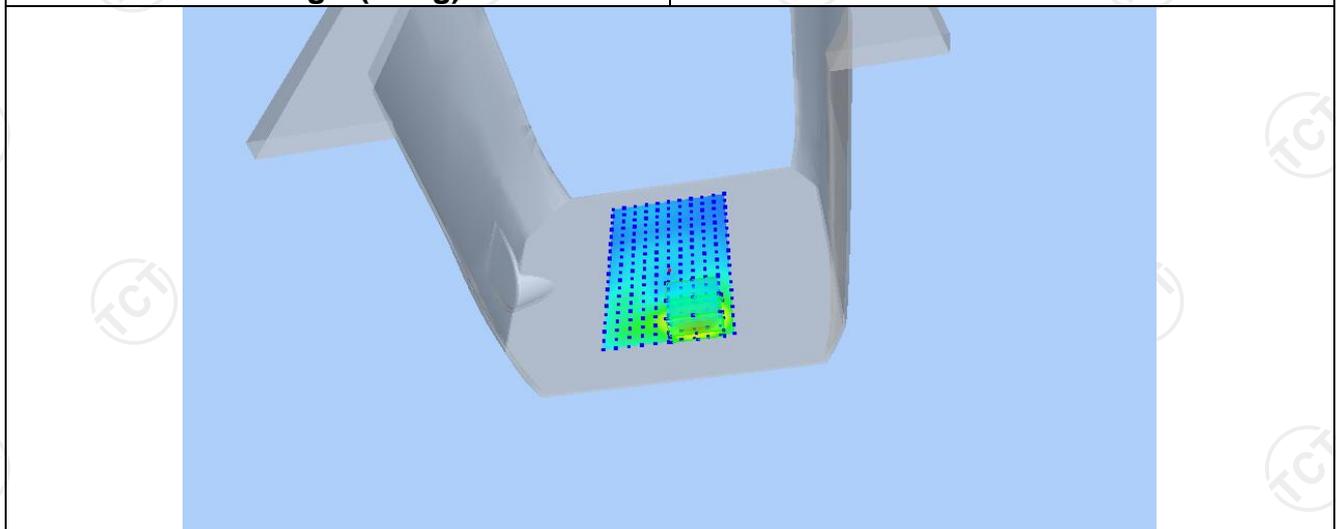


VOLUME SAR

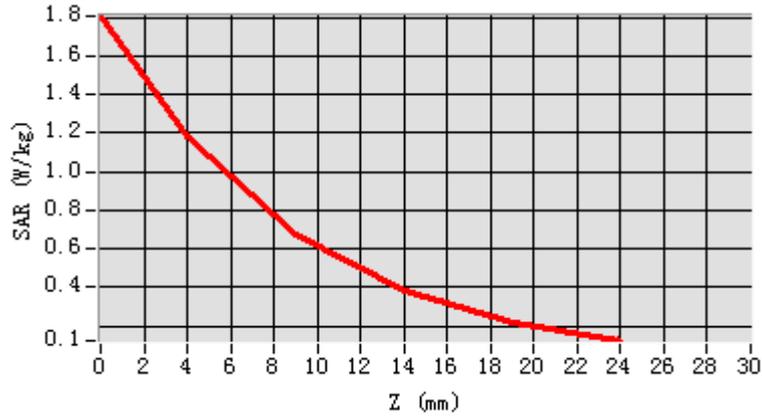


Maximum location: X=11.00, Y=-49.00
SAR Peak: 1.80 W/kg

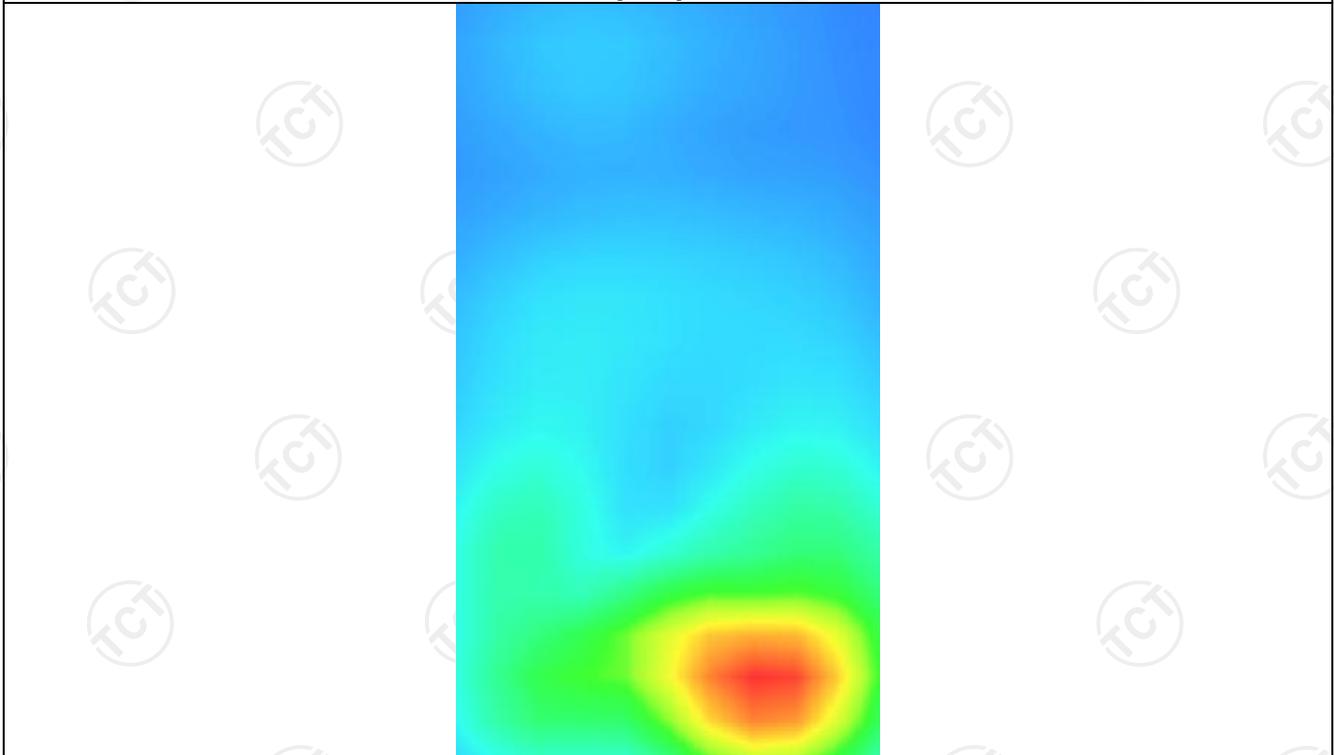
SAR 10g (W/Kg)	0.294134
SAR 1g (W/Kg)	0.710143



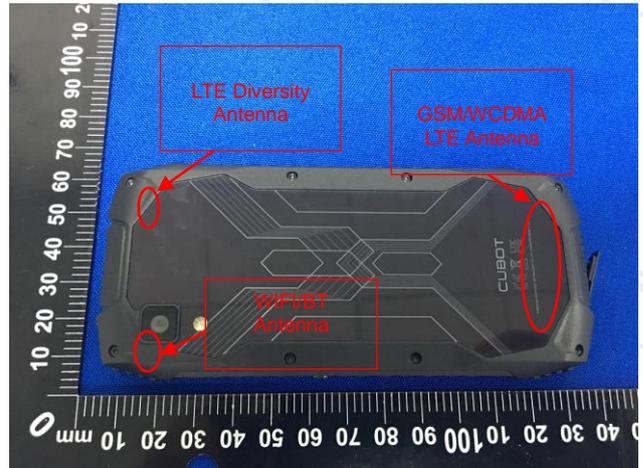
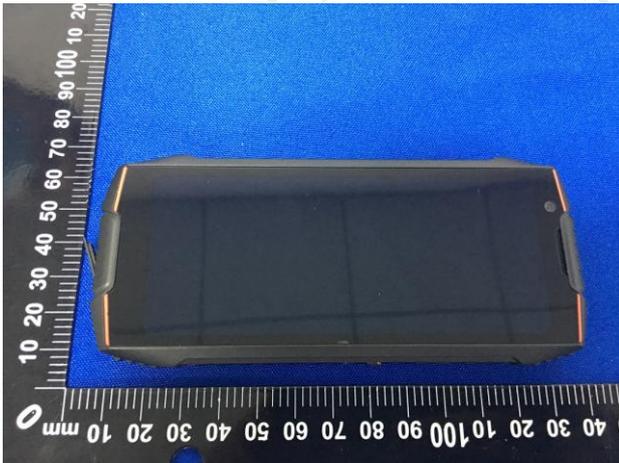
Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.8014	1.1783	0.6720	0.3814	0.2207



Hot spot position



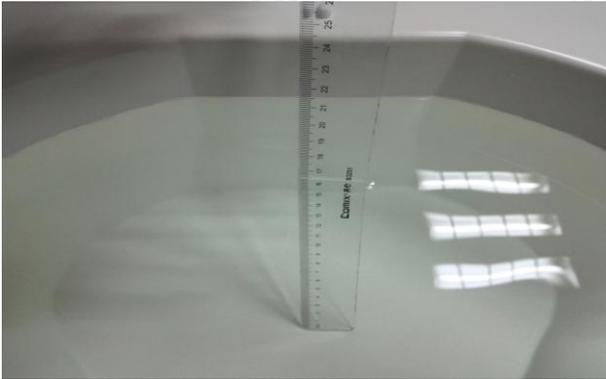
Appendix A: EUT Photos



Note:

1. Diversity antenna is used to improve the acceptance of the main antenna. It does not have a transmitter function.

Liquid Setup Photos



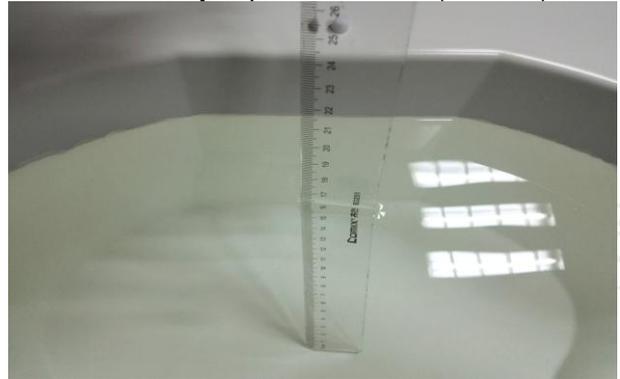
The Body Liquid 2450MHz (16.4cm)



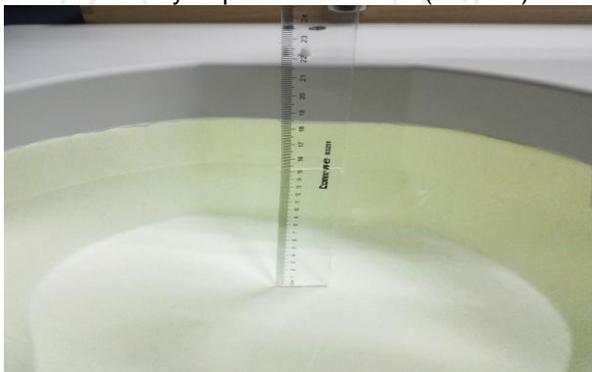
The Body Liquid of 900MHz (15.9 cm)



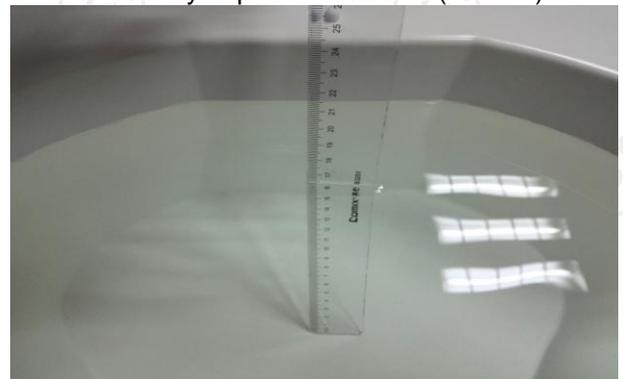
The Body Liquid of 1800MHz (16.3cm)



The Body Liquid of 2000MHz (16.5cm)



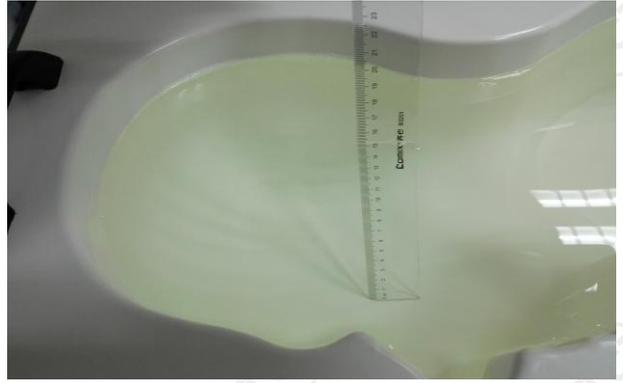
The Body Liquid of 5000-6000MHz (15.2 cm)



The Body Liquid of 2600MHz (16.6cm)



The Head Liquid of 2450MHz (15.7cm)



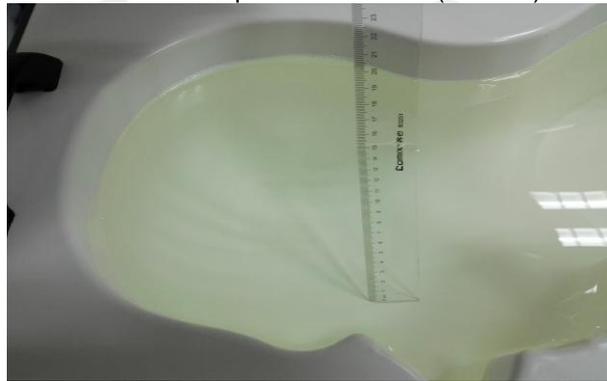
The Head Liquid of 900MHz (15.2cm)



The Head Liquid of 1800MHz (15.6cm)



The Head Liquid of 2000MHz (15.5cm)

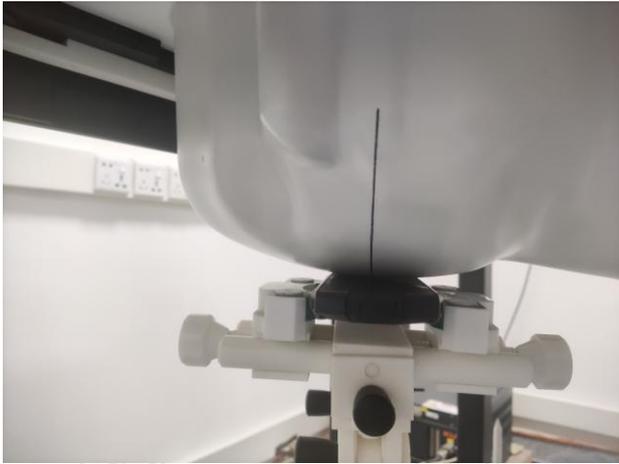


The Head Liquid of 5000-6000MHz (15.3cm)

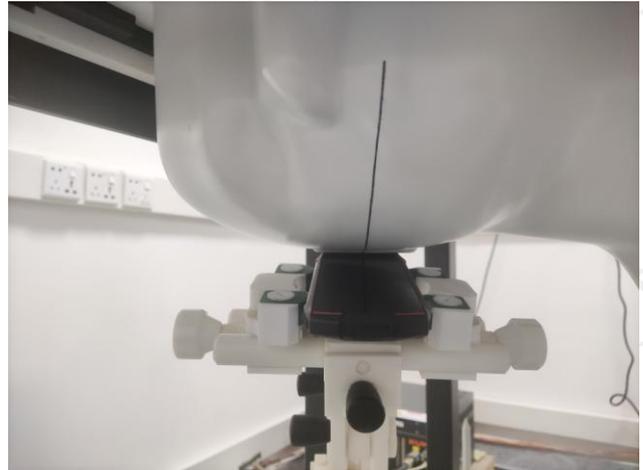


The Head Liquid of 2600MHz (15.1cm)

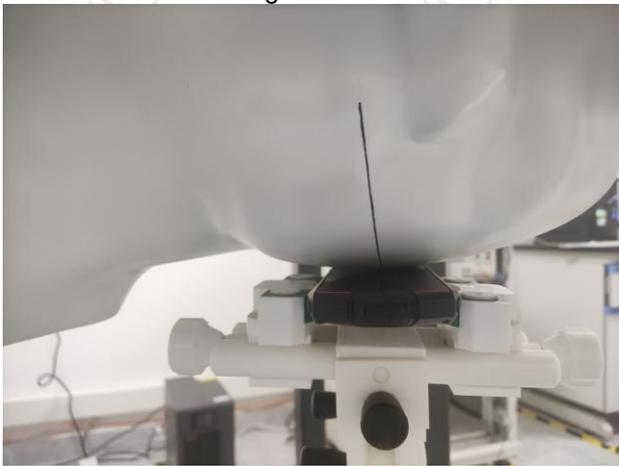
Appendix B: Test Setup Photos



Right Cheek



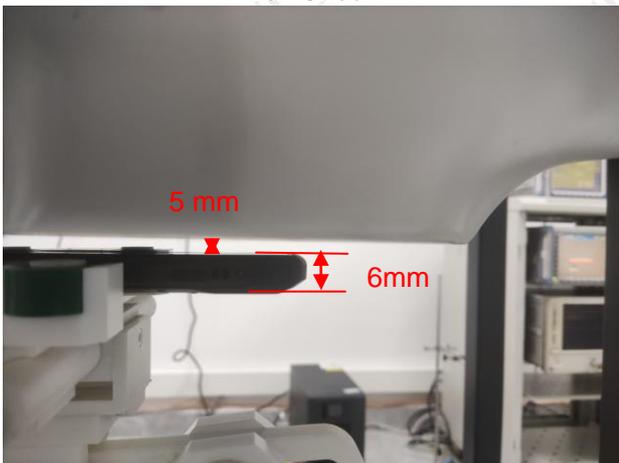
Right Tilted



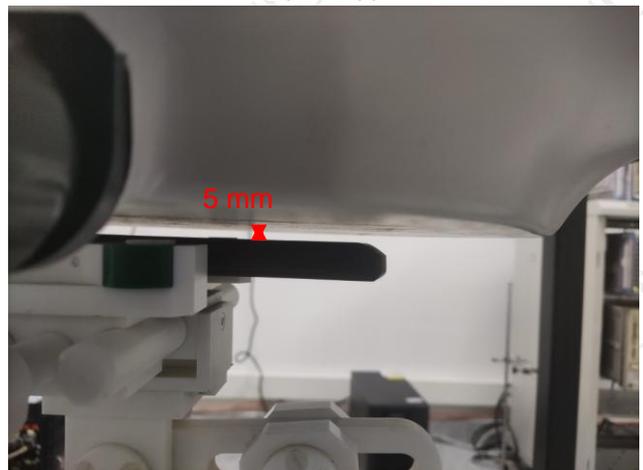
Left Cheek



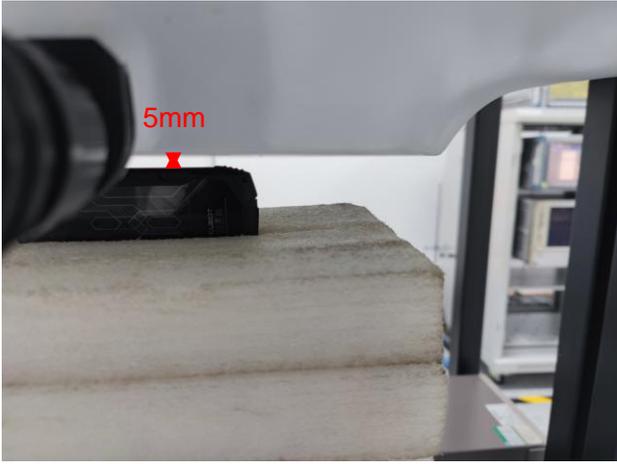
Left Tilted



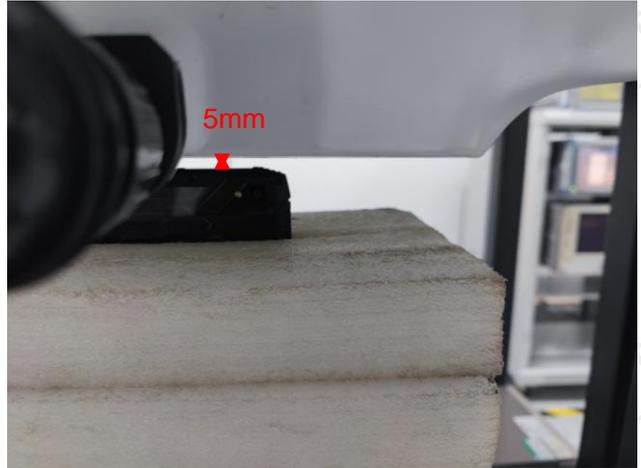
Body worn – Front(5 mm)



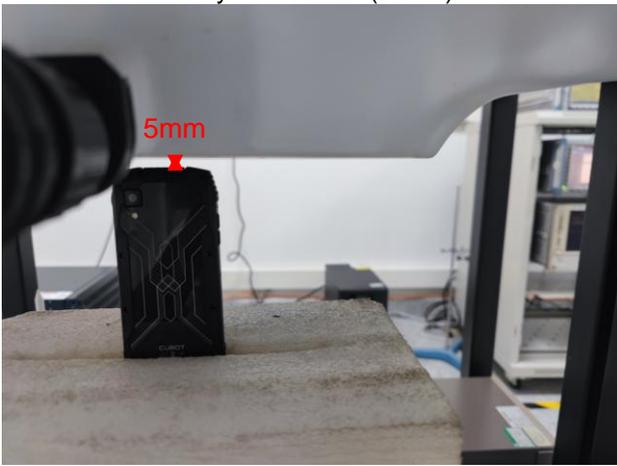
Body worn – Back(5 mm)



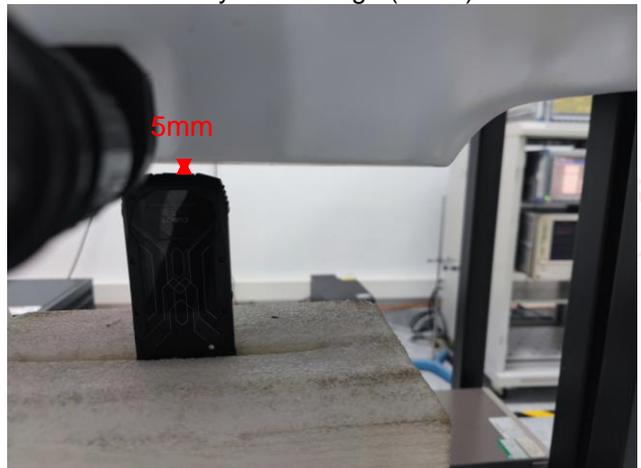
Body worn – Left(5 mm)



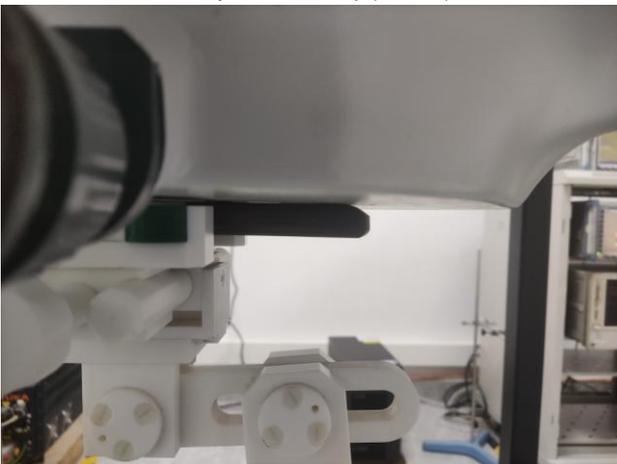
Body worn – Right(5 mm)



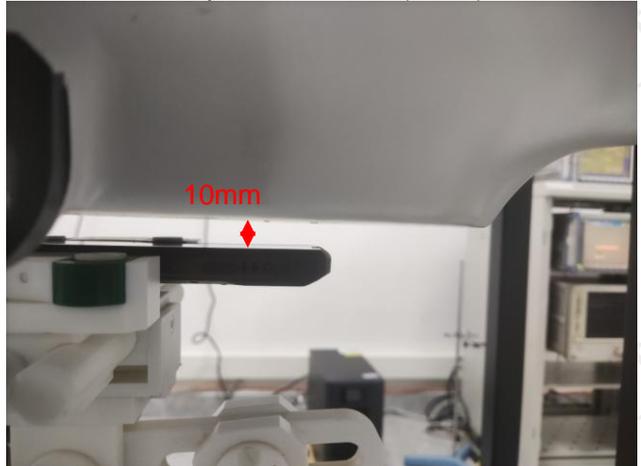
Body worn – Top(5 mm)



Body worn – Bottom(5 mm)



Wrist Worn –Back (0 mm)



Front to face–Front (10mm)

Appendix C: Probe Calibration Certificate



COMOSAR E-Field Probe Calibration Report

Ref : ACR.297.1.20.MVGB.A

**SHENZHEN TCT TESTING
TECHNOLOGY CO., LTD**
2101 2201, ZHENCHANG FACTORY, RENSHAN
INDUSTRIAL ZONE, FUHAI SUBDISTRICT,
BAOAN DISTRICT, SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 36/20 EPGO346

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

Calibration date: 10/08/2021



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

Summary:

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



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.297.1.20.MVGB.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Technical Manager	10/08/2021	<i>JL</i>
<i>Checked by :</i>	Jérôme LUC	Technical Manager	10/08/2021	<i>JL</i>
<i>Approved by :</i>	Yann Toutain	Laboratory Director	10/11/2021	<i>Yann Toutain</i>

	<i>Customer Name</i>
<i>Distribution :</i>	SHENHEN TCT TESTING TECHNOLOGY CO., LTD

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Jérôme LUC	10/11/2021	Initial release



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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 36/20 EPG0346
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.217 MΩ Dipole 2: R2=0.245 MΩ Dipole 3: R3=0.219 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Dosimetric E field Dipole

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

3 MEASUREMENT METHOD

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

3.1 LINEARITY

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



3.2 SENSITIVITY

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

3.3 LOWER DETECTION LIMIT

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

3.4 ISOTROPY

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

3.1 BOUNDARY EFFECT

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

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

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

where

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



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

4 MEASUREMENT UNCERTAINTY

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

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

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-80 %

5.1 SENSITIVITY IN AIR

Normx dipole 1 (µV/(V/m) ²)	Normy dipole 2 (µV/(V/m) ²)	Normz dipole 3 (µV/(V/m) ²)
0.81	0.71	0.80

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
115	112	112

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

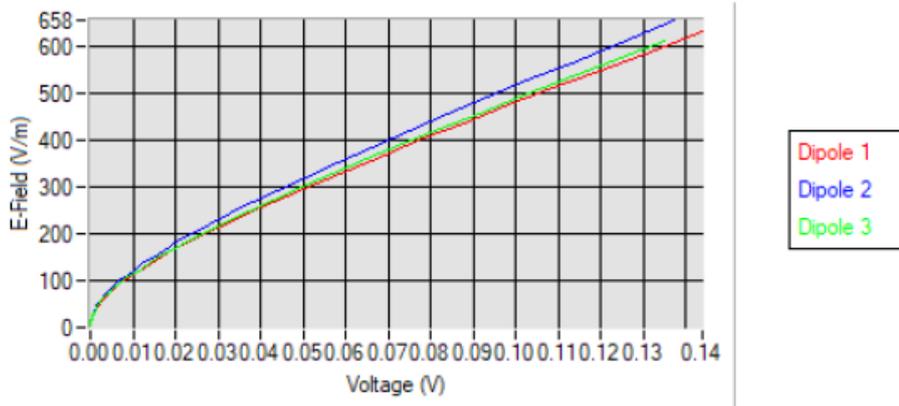
$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



COMOSAR E-FIELD PROBE CALIBRATION REPORT

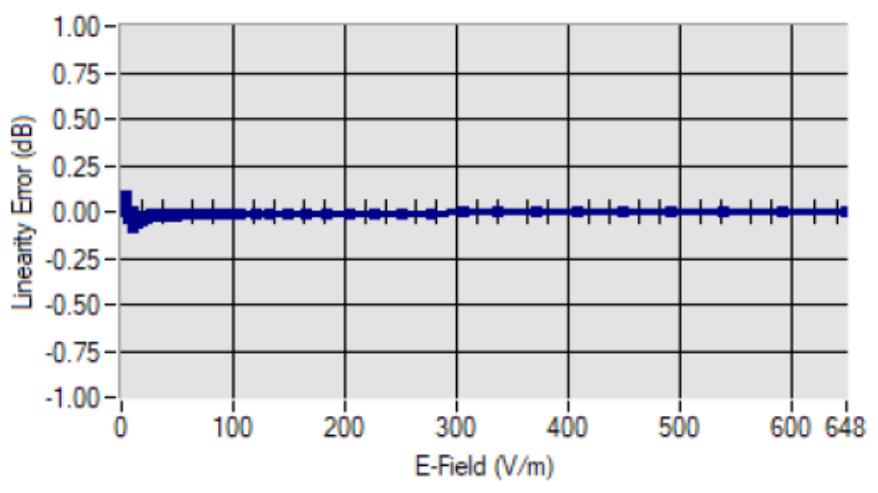
Ref: ACR.297.1.20.MVGB.A

Calibration curves



5.2 LINEARITY

Linearity



Linearity: $\pm 1.97\%$ ($\pm 0.09\text{dB}$)



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.297.1.20.MVGB.A

5.3 SENSITIVITY IN LIQUID

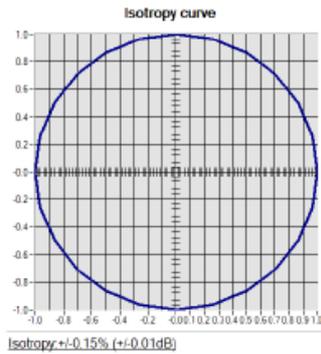
Liquid	Frequency (MHz +/- 100MHz)	ConvF	Epsilon (S/m)	Permittivity
HL750	750	1.71	0.93	40.76
BL750	750	1.78	0.98	56.70
HL900	900	1.91	0.93	41.94
BL900	900	1.96	0.98	54.62
HL1800	1800	2.08	1.29	40.86
BL1800	1800	2.16	1.47	52.27
HL2000	2000	2.03	1.42	38.37
BL2000	2000	2.10	1.52	52.03
HL2450	2450	2.31	1.80	38.72
BL2450	2450	2.37	1.97	54.91
HL2600	2600	2.16	1.89	39.98
BL2600	2600	2.23	2.18	54.42
HL5200	5200	2.01	4.45	36.68
BL5200	5200	2.08	5.46	49.02
HL5800	5800	2.06	5.08	34.81
BL5800	5800	2.13	6.12	47.81

LOWER DETECTION LIMIT: 8mW/kg



5.4 ISOTROPY

HL1800 MHz





6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	05/2019	05/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	05/2019	05/2022
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44220687	05/2020	05/2023

Appendix D: Dipole Calibration Report
SID900



SAR Reference Dipole Calibration Report

Ref : ACR.156.5.15.SATU.A

SHENZHEN TCT TESTING TECHNOLOGY CO., LTD
2101&2201, ZHENCHANG FACTORY, RENSHAN INDUSTRIAL ZONE,
FUHAI SUBDISTRICT, BAOAN DISTRICT, SHENZHEN, GUANGDONG, CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 900 MHZ
SERIAL NO.: SN 16/15 DIP 0G900-370

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



Calibration Date: 06/05/2021

Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.5.15.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	06/05/2021	<i>JL</i>
Checked by :	Jérôme LUC	Product Manager	06/05/2021	<i>JL</i>
Approved by :	Kim RUTKOWSKI	Quality Manager	06/05/2021	<i>Kim Rutkowski</i>

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

Issue	Date	Modifications
A	06/05/2021	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.172.5.15.SATU.A

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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 900 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID900
Serial Number	SN 16/15 DIP 0G900-370
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

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

Scan Volume	Expanded Uncertainty
1 g	20.3 %



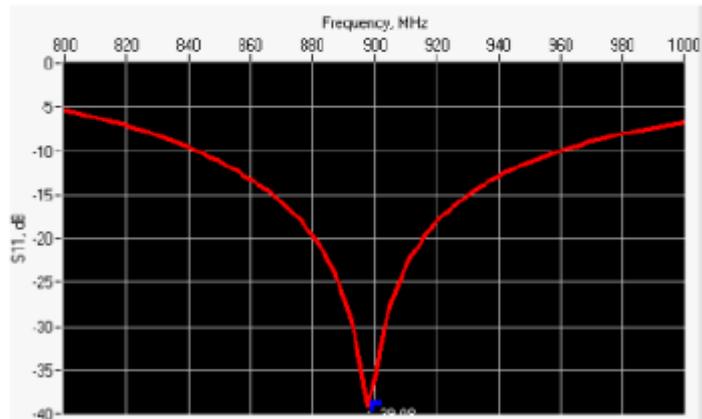
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.172.5.15.SATU.A

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

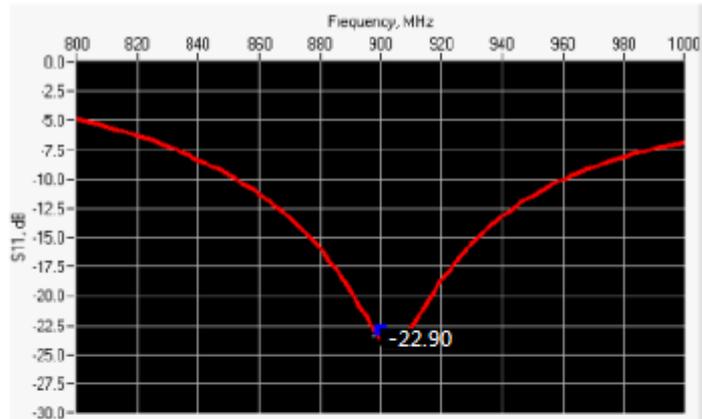
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
900	-38.86	-20	51.3 Ω + 0.7 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
900	-22.90	-20	53.5 Ω + 6.1 jΩ

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
900	420.0 ±1 %		250.0 ±1 %		6.35 ±1 %	

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Ref: ACR.172.5.15.SATU.A

450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.	PASS	83.3 ±1 %.	PASS	3.6 ±1 %.	PASS
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

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

7.1 HEAD LIQUID MEASUREMENT

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

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Ref: ACR.172.5.15.SATU.A

1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 42.1 sigma : 0.98
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9	10.61 (0.97)	6.99	6.91 (1.20)
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	

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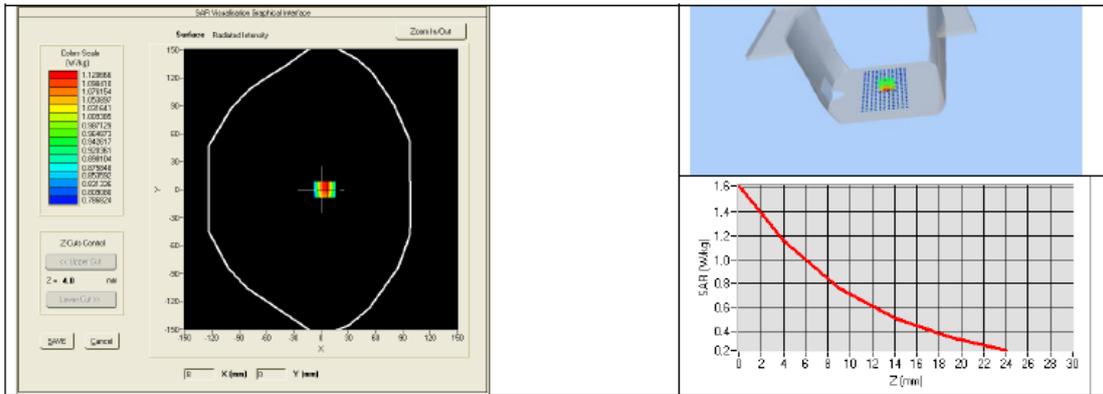
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Ref: ACR.172.5.15.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

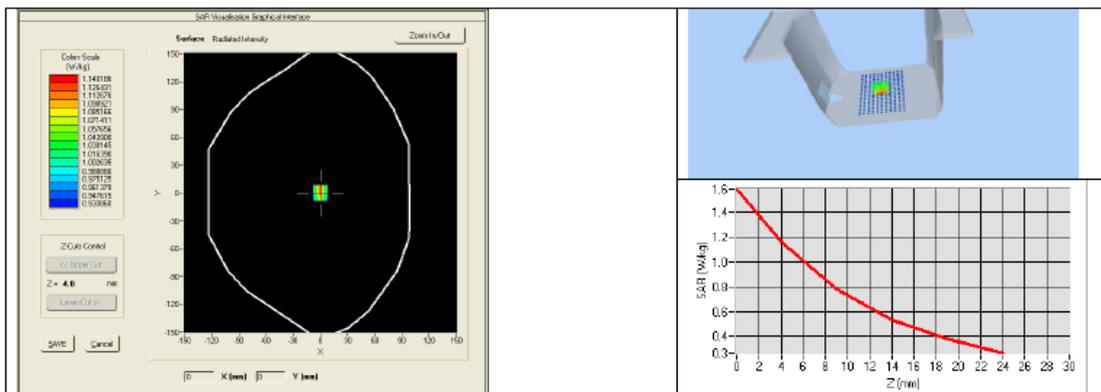
Ref: ACR.172.5.15.SATU.A

2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 56.4 sigma : 1.08
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
900	10.79 (0.53)	6.98 (0.66)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2021	02/2024
Calipers	Carrera	CALIPER-01	02/2021	02/2024
Reference Probe	MVG	EPG122 SN 18/11	02/2020	02/2021
Multimeter	Keithley 2000	1188656	02/2021	02/2024
Signal Generator	Agilent E4438C	MY49070581	02/2021	02/2024
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	02/2021	02/2024
Power Sensor	HP ECP-E26A	US37181460	02/2021	02/2024
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	02/2021	02/2024



SAR Reference Dipole Calibration Report

Ref : ACR.156.6.15.SATU.A

SHENZHEN TCT TESTING TECHNOLOGY CO., LTD

2101&2201, ZHENCHANG FACTORY, RENSHAN INDUSTRIAL
ZONE, FUHAI SUBDISTRICT, BAOAN DISTRICT, SHENZHEN,
GUANGDONG, CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 1800 MHZ

SERIAL NO.: SN 16/15 DIP 1G800-371

Calibrated at MVG US

2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 06/05/2021

Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.6.15.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	06/05/2021	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	06/05/2021	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	06/05/2021	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	SSHENZHEN TCT TESTING TECHNOLOGY CO., LTD

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	06/05/2021	Initial release



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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 1800 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID1800
Serial Number	SN 16/15 DIP 1G800-371
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

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

Scan Volume	Expanded Uncertainty
1 g	20.3 %



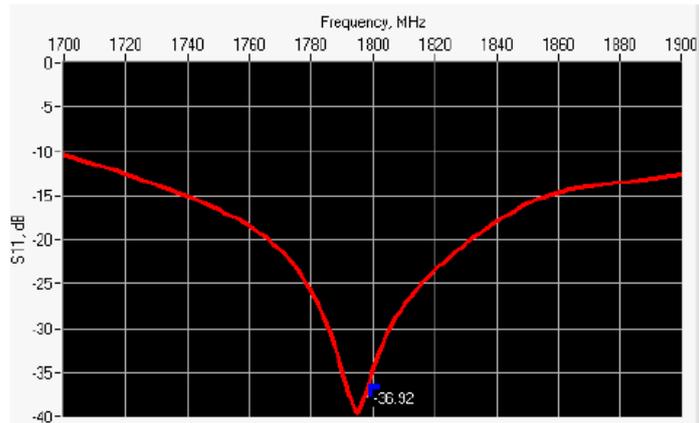
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.6.15.SATU.A

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

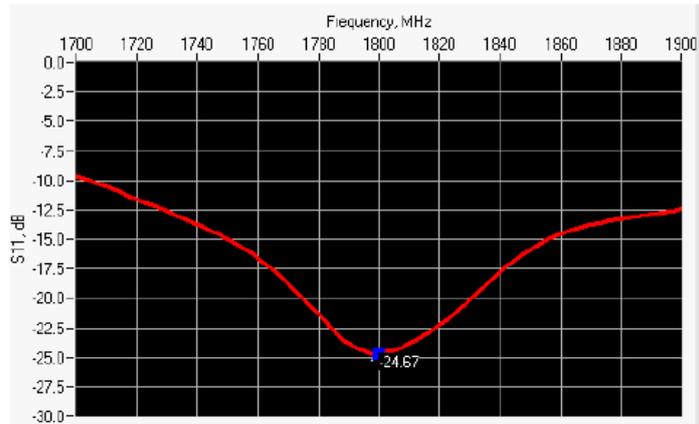
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-36.92	-20	48.1 Ω - 0.5 j Ω

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-24.67	-20	47.4 Ω - 5.1 j Ω

6.3 MECHANICAL DIMENSIONS

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.6.15.SATU.A

450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.	PASS	41.7 ±1 %.	PASS	3.6 ±1 %.	PASS
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

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

7.1 HEAD LIQUID MEASUREMENT

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.6.15.SATU.A

1800	40.0 ±5 %	PASS	1.40 ±5 %	PASS
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 41.8 sigma : 1.38
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4	37.64 (3.16)	20.1	20.26 (2.18)

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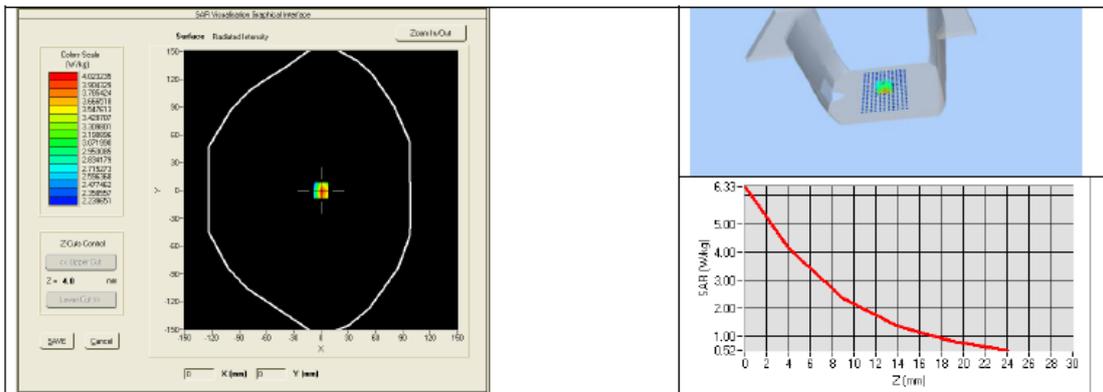
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.1566.15.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

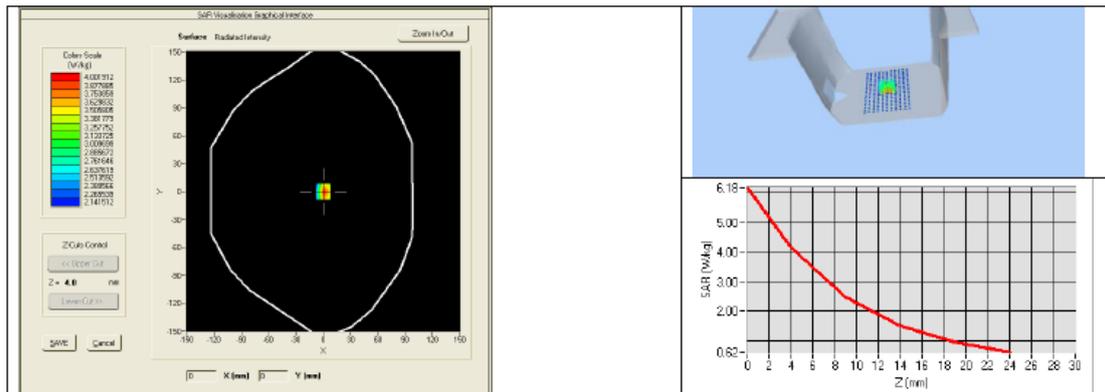
Ref: ACR.156.6.15.SATU.A

2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 53.0 sigma : 1.52
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1800	37.60 (3.24)	20.59 (2.20)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2021	02/2024
Calipers	Carrera	CALIPER-01	02/2021	02/2024
Reference Probe	MVG	EPG122 SN 18/11	02/2020	02/2021
Multimeter	Keithley 2000	1188656	02/2021	02/2024
Signal Generator	Agilent E4438C	MY49070581	02/2021	02/2024
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	02/2021	02/2024
Power Sensor	HP ECP-E26A	US37181460	02/2021	02/2024
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	02/2021	02/2024



SAR Reference Dipole Calibration Report

Ref : ACR.156.8.15.SATU.A

SHENZHEN TCT TESTING TECHNOLOGY CO., LTD

2101&2201, ZHENCHANG FACTORY, RENSHAN INDUSTRIAL
FUHAI SUBDISTRICT, BAOAN DISTRICT, SHENZHEN,
GUANGDONG, CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 2000 MHZ

SERIAL NO.: SN 16/15 DIP 2G000-373

Calibrated at MVG US

2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 06/05/2021

Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.8.15.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	06/05/2021	<i>JL</i>
Checked by :	Jérôme LUC	Product Manager	06/05/2021	<i>JL</i>
Approved by :	Kim RUTKOWSKI	Quality Manager	06/05/2021	<i>Kim Rutkowski</i>

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

Issue	Date	Modifications
A	06/05/2021	Initial release



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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 2000 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2000
Serial Number	SN 16/15 DIP 2G000-373
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

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

Scan Volume	Expanded Uncertainty
1 g	20.3 %



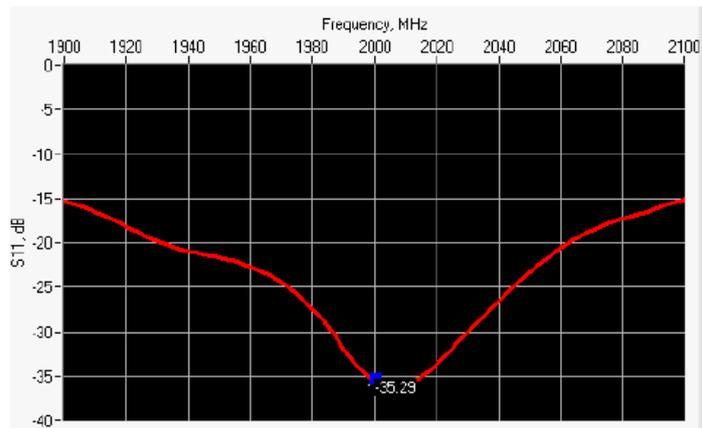
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156&.15.SATU.A

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

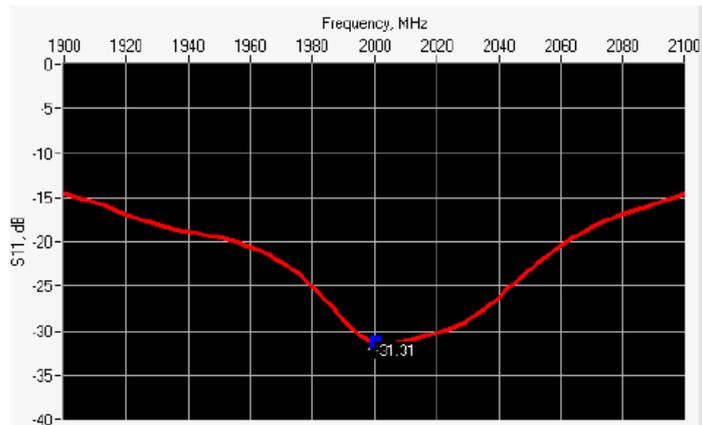
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2000	-35.20	-20	48.1 Ω - 0.6 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2000	-31.11	-20	51.5 Ω + 2.0 jΩ

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %		250.0 ±1 %		6.35 ±1 %	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.156.8.15.SATU.A

450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.	PASS	37.5 ±1 %.	PASS	3.6 ±1 %.	PASS
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

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

7.1 HEAD LIQUID MEASUREMENT

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

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Ref: ACR.1568.15.SATU.A

1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %	PASS	1.40 ±5 %	PASS
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 40.1 sigma: 1.43
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2000 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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

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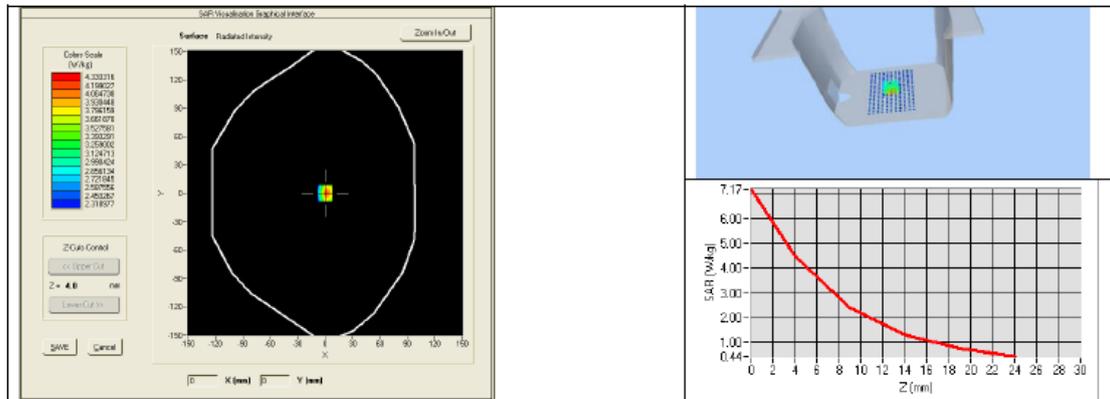
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Ref: ACR.156.8.15.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1	42.15 (2.35)	21.1	21.17 (0.34)
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3600	67.1		25	



7.3 BODY LIQUID MEASUREMENT

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

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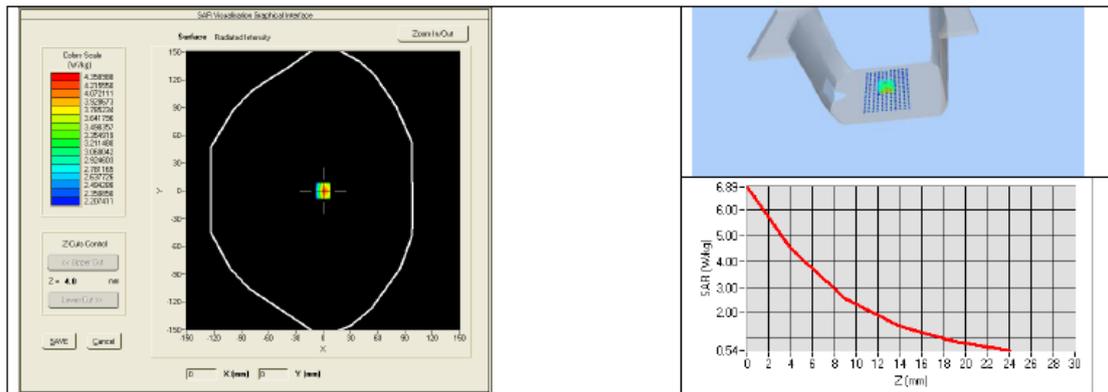
Ref: ACR.156.8.15.SATU.A

2600	52.5 ±5 %		2.16 ±5 %
3000	52.0 ±5 %		2.73 ±5 %
3500	51.3 ±5 %		3.31 ±5 %
5200	49.0 ±10 %		5.30 ±10 %
5300	48.9 ±10 %		5.42 ±10 %
5400	48.7 ±10 %		5.53 ±10 %
5500	48.6 ±10 %		5.65 ±10 %
5600	48.5 ±10 %		5.77 ±10 %
5800	48.2 ±10 %		6.00 ±10 %

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 53.6 sigma : 1.54
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2000 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2000	41.60 (1.36)	21.26 (1.92)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2021	02/2024
Calipers	Carrera	CALIPER-01	02/2021	02/2024
Reference Probe	MVG	EPG122 SN 18/11	02/2020	02/2021
Multimeter	Keithley 2000	1188656	02/2021	02/2024
Signal Generator	Agilent E4438C	MY49070581	02/2021	02/2024
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	02/2021	02/2024
Power Sensor	HP ECP-E26A	US37181460	02/2021	02/2024
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	02/2021	02/2024



SAR Reference Dipole Calibration Report

Ref : ACR.156.9.15.SATU.A

SHENZHEN TCT TESTING TECHNOLOGY CO., LTD

2101&2201, ZHENCHANG FACTORY, RENSHAN INDUSTRIAL
FUHAI SUBDISTRICT, BAOAN DISTRICT,
SHENZHEN, GUANGDONG, CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 2450 MHZ

SERIAL NO.: SN 16/15 DIP 2G450-374

Calibrated at MVG US

2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 06/05/2021

Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.9.15.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	06/05/2021	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	06/05/2021	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	06/05/2021	<i>Kim Rutkowski</i>

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

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	06/05/2021	Initial release



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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 2450 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2450
Serial Number	SN 16/15 DIP 2G450-374
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

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

Scan Volume	Expanded Uncertainty
1 g	20.3 %

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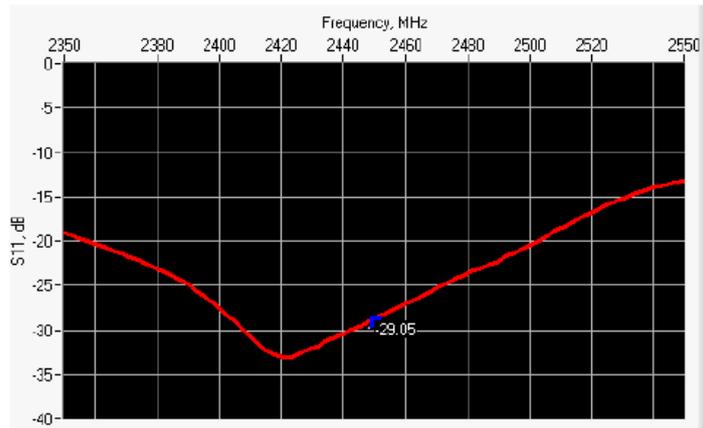
SAR REFERENCE DIPOLE CALIBRATION REPORT

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

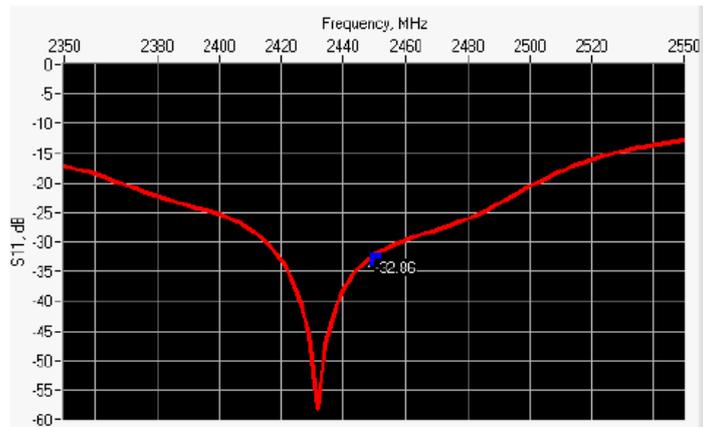
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-28.97	-20	46.3 Ω - 0.2 j Ω

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-32.77	-20	48.5 Ω - 1.8 j Ω

6.3 MECHANICAL DIMENSIONS

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

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450	290.0 ±1 %		166.7 ±1 %		6.35 ±1 %	
750	176.0 ±1 %		100.0 ±1 %		6.35 ±1 %	
835	161.0 ±1 %		89.8 ±1 %		3.6 ±1 %	
900	149.0 ±1 %		83.3 ±1 %		3.6 ±1 %	
1450	89.1 ±1 %		51.7 ±1 %		3.6 ±1 %	
1500	80.5 ±1 %		50.0 ±1 %		3.6 ±1 %	
1640	79.0 ±1 %		45.7 ±1 %		3.6 ±1 %	
1750	75.2 ±1 %		42.9 ±1 %		3.6 ±1 %	
1800	72.0 ±1 %		41.7 ±1 %		3.6 ±1 %	
1900	68.0 ±1 %		39.5 ±1 %		3.6 ±1 %	
1950	66.3 ±1 %		38.5 ±1 %		3.6 ±1 %	
2000	64.5 ±1 %		37.5 ±1 %		3.6 ±1 %	
2100	61.0 ±1 %		36.7 ±1 %		3.6 ±1 %	
2300	55.5 ±1 %		32.6 ±1 %		3.6 ±1 %	
2450	51.5 ±1 %	PASS	30.4 ±1 %	PASS	3.6 ±1 %	PASS
2600	48.5 ±1 %		28.8 ±1 %		3.6 ±1 %	
3000	41.5 ±1 %		25.0 ±1 %		3.6 ±1 %	
3500	37.0 ±1 %		26.4 ±1 %		3.6 ±1 %	
3700	34.7 ±1 %		26.4 ±1 %		3.6 ±1 %	

7 VALIDATION MEASUREMENT

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

7.1 HEAD LIQUID MEASUREMENT

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

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1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %	PASS	1.80 ±5 %	PASS
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 38.3 sigma : 1.80
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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

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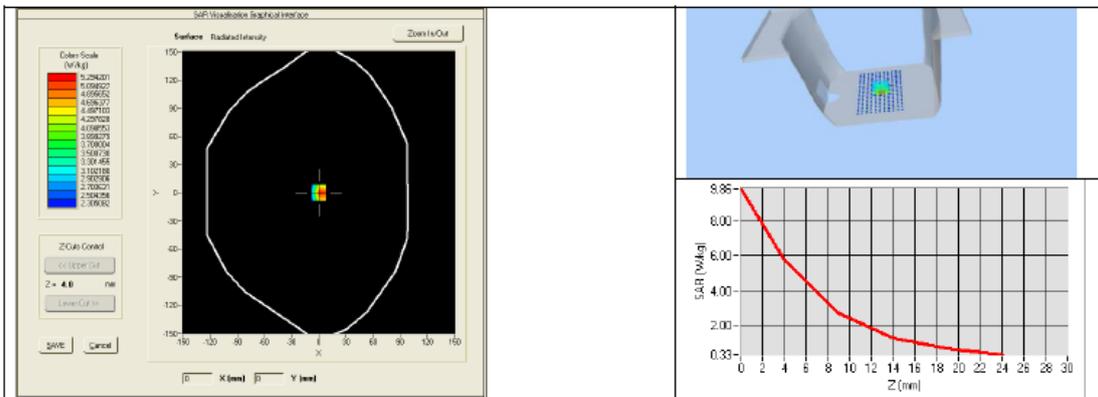
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Ref: ACR.156.9.15.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4	52.89 (3.14)	24	24.21 (2.02)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

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

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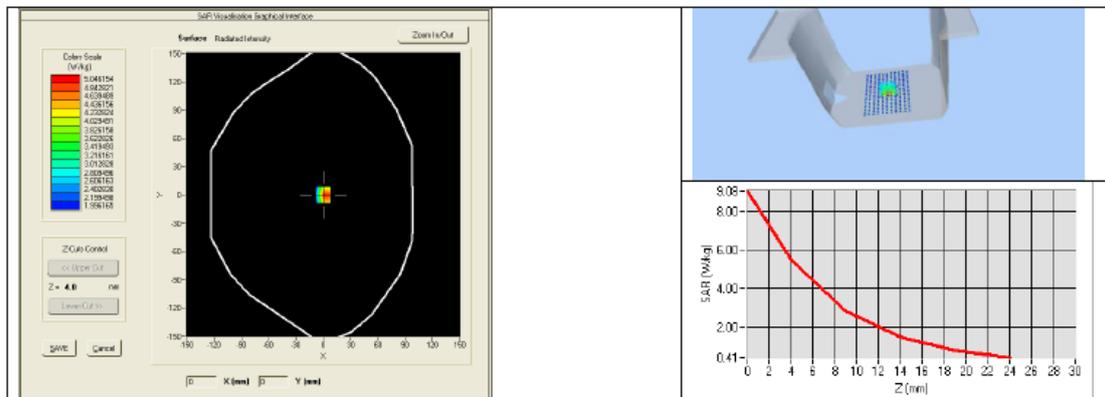
Ref: ACR.156.9.15.SATU.A

2600	52.5 ±5 %		2.16 ±5 %
3000	52.0 ±5 %		2.73 ±5 %
3500	51.3 ±5 %		3.31 ±5 %
5200	49.0 ±10 %		5.30 ±10 %
5300	48.9 ±10 %		5.42 ±10 %
5400	48.7 ±10 %		5.53 ±10 %
5500	48.6 ±10 %		5.65 ±10 %
5600	48.5 ±10 %		5.77 ±10 %
5800	48.2 ±10 %		6.00 ±10 %

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 52.7 sigma : 1.94
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2450	50.65 (4.50)	23.40 (2.11)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2021	02/2024
Calipers	Carrera	CALIPER-01	02/2021	02/2024
Reference Probe	MVG	EPG122 SN 18/11	02/2020	02/2021
Multimeter	Keithley 2000	1188656	02/2021	02/2024
Signal Generator	Agilent E4438C	MY49070581	02/2021	02/2024
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	02/2021	02/2024
Power Sensor	HP ECP-E26A	US37181460	02/2021	02/2024
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	02/2021	02/2024



SAR Reference Dipole Calibration Report

Ref : ACR.156.10.15.SATU.A

SHENZHEN TCT TESTING TECHNOLOGY CO., LTD

**2101&2201, ZHENCHANG FACTORY, RENSHAN INDUSTRIAL
ZONE, FUHAI SUBDISTRICT, BAOAN DISTRICT,**

SHENZHEN, GUANGDONG, CHINA

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 2600 MHZ

SERIAL NO.: SN 16/15 DIP 2G600-375

Calibrated at MVG US

2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 06/05/2021

Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.10.15.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	06/05/2021	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	06/05/2021	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	06/05/2021	<i>Kim Rutkowski</i>

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

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	06/05/2021	Initial release



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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 2600 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2600
Serial Number	SN 16/15 DIP 2G600-375
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

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

Scan Volume	Expanded Uncertainty
1 g	20.3 %



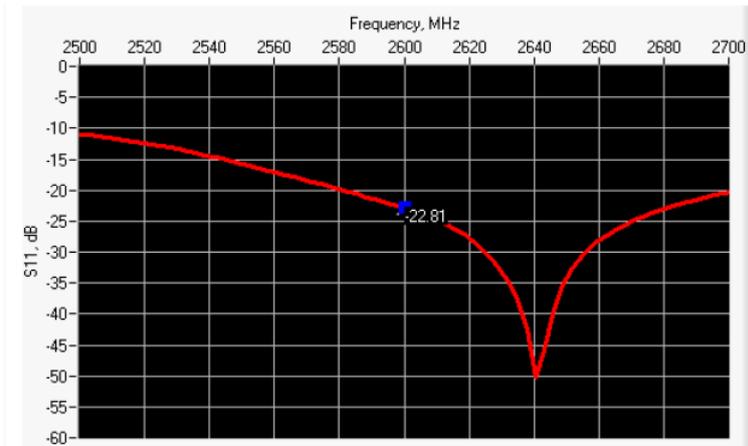
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.156.10.15.SATU.A

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

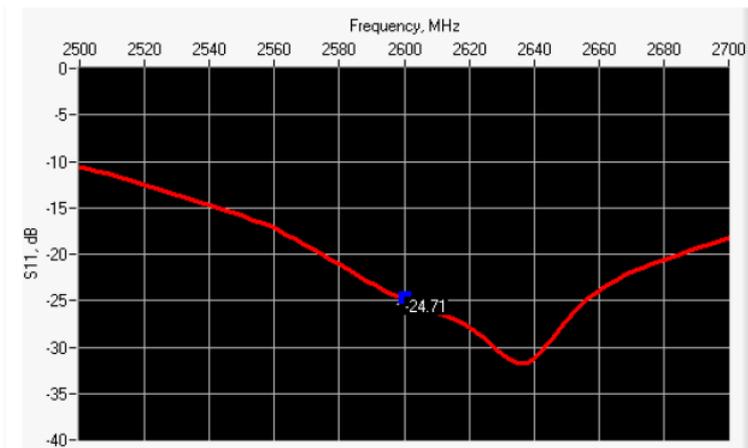
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2600	-22.81	-20	55.3 Ω - 5.1 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2600	-24.71	-20	51.5 Ω - 5.5 jΩ

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %		250.0 ±1 %		6.35 ±1 %	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.10.15.SATU.A

450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.	PASS	28.8 ±1 %.	PASS	3.6 ±1 %.	PASS
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

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

7.1 HEAD LIQUID MEASUREMENT

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

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Ref: ACR.156.10.15.SATU.A

1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %	PASS	1.96 ±5 %	PASS
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 38.2 sigma : 1.93
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2600 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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

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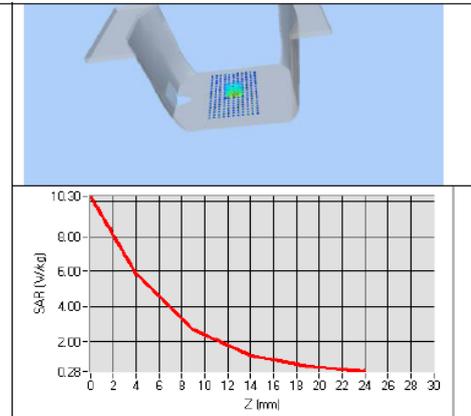
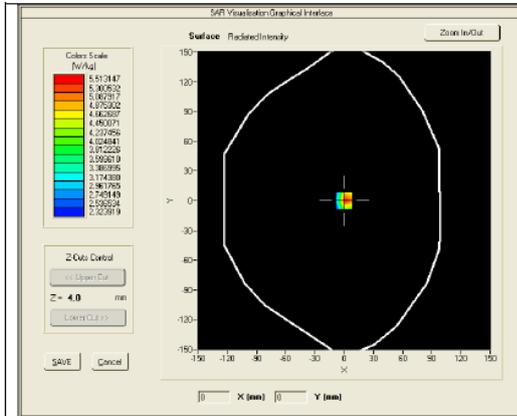
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.10.15.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3	54.31 (5.36)	24.6	24.14 (2.42)
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

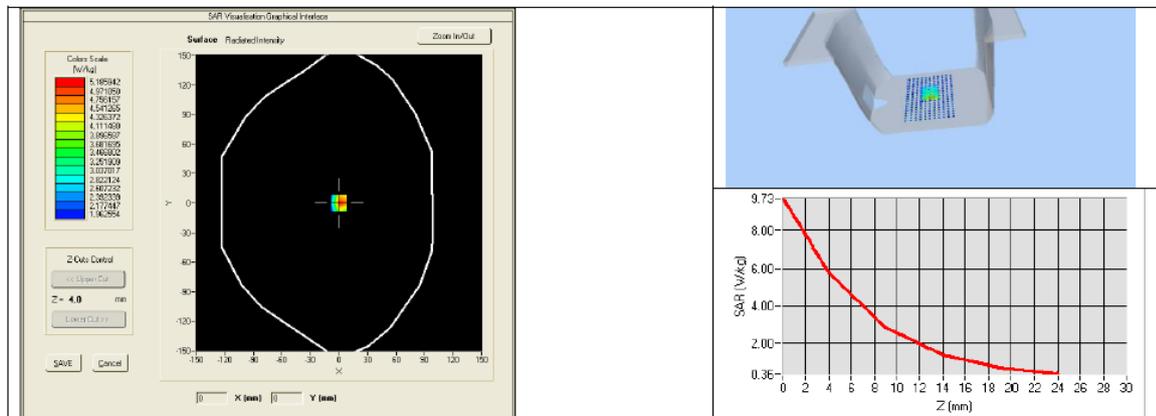
Ref: ACR.156.10.15.SATU.A

2600	52.5 ±5 %	PASS	2.16 ±5 %	PASS
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 51.6 sigma : 2.21
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2600 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2600	53.26 (5.12)	23.89 (2.30)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2021	02/2024
Calipers	Carrera	CALIPER-01	02/2021	02/2024
Reference Probe	MVG	EPG122 SN 18/11	02/2021	02/2022
Multimeter	Keithley 2000	1188656	02/2021	02/2024
Signal Generator	Agilent E4438C	MY49070581	02/2021	02/2024
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	02/2021	02/2024
Power Sensor	HP ECP-E26A	US37181460	02/2021	02/2024
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	09/2021	09/2022



SAR Reference Waveguide Calibration Report

Ref : ACR.256.12.15.SATU.A

SHENZHEN TCT TESTING TECHNOLOGY CO., LTD
2101&2201, ZHENCHANG FACTORY, RENSHAN INDUSTRIAL
ZONE, FUHAI SUBDISTRICT, BAOAN DISTRICT,
SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR REFERENCE WAVEGUIDE
FREQUENCY: 5000-6000 MHZ
SERIAL NO.: SN 13/14 WGA32

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



Calibration Date: 05/15/2021

Summary:

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



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.256.12.15.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	8/29/2021	<i>JL</i>
Checked by :	Jérôme LUC	Product Manager	8/29/2021	<i>JL</i>
Approved by :	Kim RUTKOWSKI	Quality Manager	8/29/2021	<i>Kim Rutkowski</i>

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

Issue	Date	Modifications
A	8/29/2021	Initial release



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1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 5000-6000 MHz REFERENCE WAVEGUIDE
Manufacturer	MVG
Model	SWG5500
Serial Number	SN 13/14 WGA32
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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

4 MEASUREMENT METHOD

The IEEE 1528 and CEI/IEC 62209 standards provide requirements for reference waveguides 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 waveguide used for SAR system validation measurements and checks must have a return loss of -8 dB or better. The return loss measurement shall be performed with matching layer placed in the open end of the waveguide, with the waveguide and matching layer in direct contact with the phantom shell as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE 1528 and CEI/IEC 62209 standards specify the mechanical dimensions of the validation waveguide, the specified dimensions are as shown in Section 6.2. Figure 1 shows how the dimensions relate to the physical construction of the waveguide.

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5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

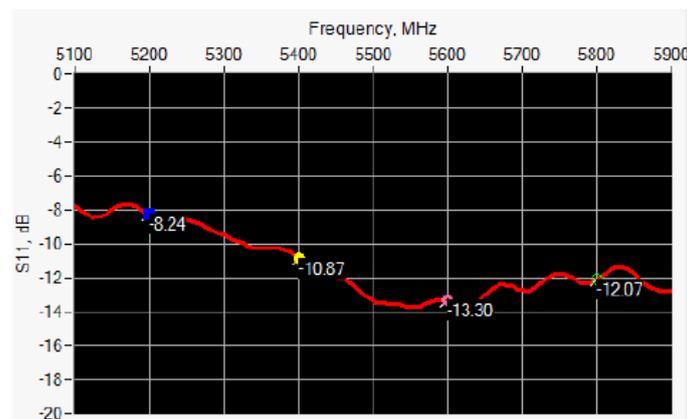
5.3 VALIDATION MEASUREMENT

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

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

6 CALIBRATION MEASUREMENT RESULTS

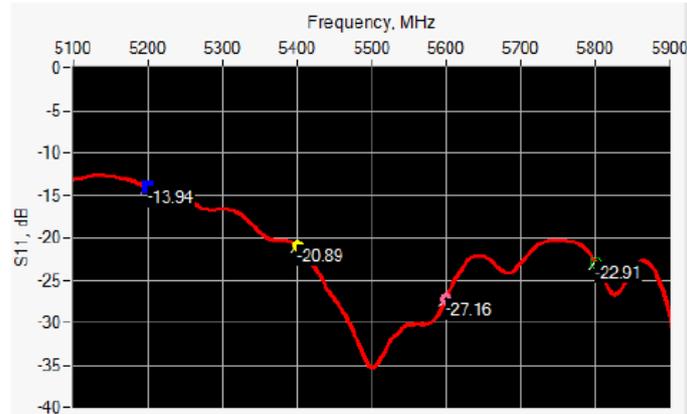
6.1 RETURN LOSS IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)
5000-6000	< -8.24	-8



6.2 RETURN LOSS IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)
5000-6000	< -13.94	-8

6.3 MECHANICAL DIMENSIONS

Frequency (MHz)	L (mm)		W (mm)		L _f (mm)		W _f (mm)		T (mm)	
	Required	Measured	Required	Measured	Required	Measured	Required	Measured	Required	Measured
5200	40.39 ± 0.13	PASS	20.19 ± 0.13	PASS	81.03 ± 0.13	PASS	61.98 ± 0.13	PASS	5.3*	PASS
5800	40.39 ± 0.13	PASS	20.19 ± 0.13	PASS	81.03 ± 0.13	PASS	61.98 ± 0.13	PASS	4.3*	PASS

* The tolerance for the matching layer is included in the return loss measurement.

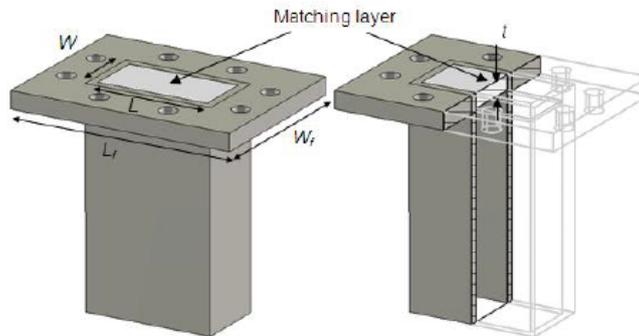


Figure 1: Validation Waveguide Dimensions

7 VALIDATION MEASUREMENT

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



7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
5000	36.2 ±10 %		4.45 ±10 %	
5100	36.1 ±10 %		4.56 ±10 %	
5200	36.0 ±10 %	PASS	4.66 ±10 %	PASS
5300	35.9 ±10 %		4.76 ±10 %	
5400	35.8 ±10 %	PASS	4.86 ±10 %	PASS
5500	35.6 ±10 %		4.97 ±10 %	
5600	35.5 ±10 %	PASS	5.07 ±10 %	PASS
5700	35.4 ±10 %		5.17 ±10 %	
5800	35.3 ±10 %	PASS	5.27 ±10 %	PASS
5900	35.2 ±10 %		5.38 ±10 %	
6000	35.1 ±10 %		5.48 ±10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values 5200 MHz: ϵ_r' :36.62 σ : 4.93 Head Liquid Values 5400 MHz: ϵ_r' :35.95 σ : 5.18 Head Liquid Values 5600 MHz: ϵ_r' :36.08 σ : 5.60 Head Liquid Values 5800 MHz: ϵ_r' :34.73 σ : 5.74
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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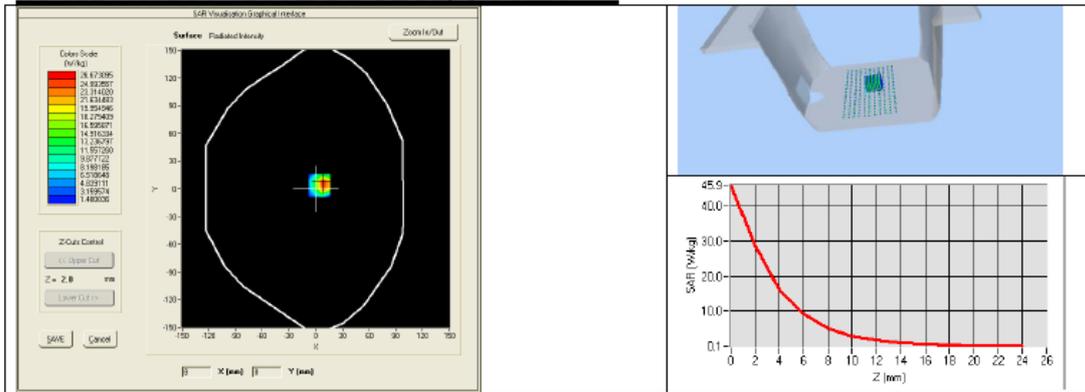


SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

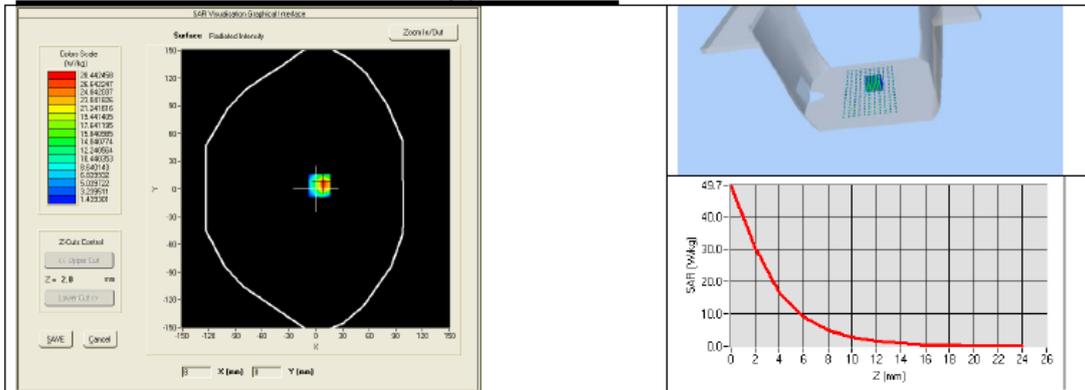
Ref: ACR.262.12.17.SATU.A

Frequency (MHz)	1 g SAR (W/kg)		10 g SAR (W/kg)	
	required	measured	required	measured
5200	159.00	163.88 (16.39)	56.90	57.29 (5.73)
5400	166.40	172.23 (17.22)	58.43	59.16 (5.92)
5600	173.80	181.28 (18.13)	59.97	61.57 (6.16)
5800	181.20	188.95 (18.90)	61.50	63.45 (6.35)

SAR MEASUREMENT PLOTS @ 5200 MHz

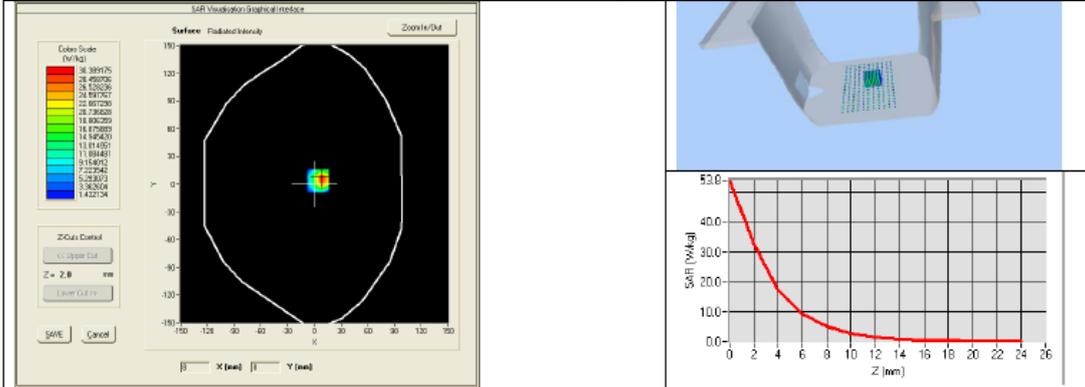


SAR MEASUREMENT PLOTS @ 5400 MHz

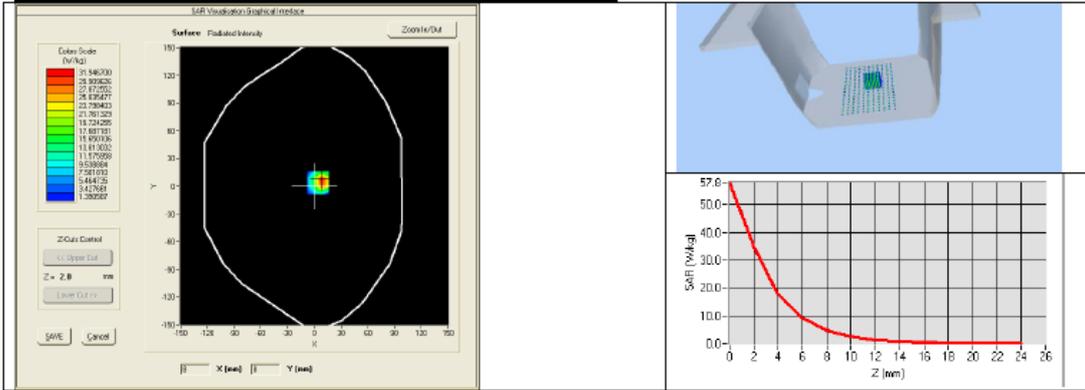




SAR MEASUREMENT PLOTS @ 5600 MHz



SAR MEASUREMENT PLOTS @ 5800 MHz





7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
5200	49.0 ±10 %	PASS	5.30 ±10 %	PASS
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %	PASS	5.53 ±10 %	PASS
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %	PASS	5.77 ±10 %	PASS
5800	48.2 ±10 %	PASS	6.00 ±10 %	PASS

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values 5200 MHz: ϵ_r' :50.69 sigma : 4.98 Body Liquid Values 5400 MHz: ϵ_r' :48.45 sigma : 5.82 Body Liquid Values 5600 MHz: ϵ_r' :50.57 sigma : 6.37 Body Liquid Values 5800 MHz: ϵ_r' :48.19 sigma : 6.45
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

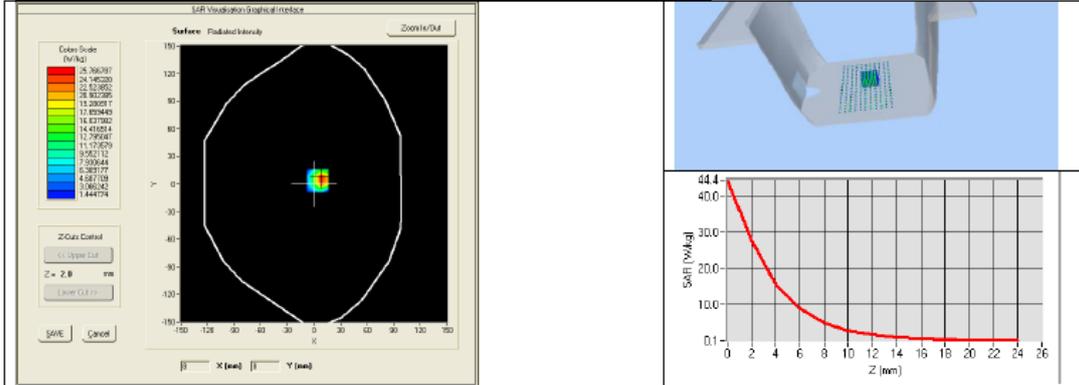
Frequency (MHz)	1 g SAR (W/kg)	10 g SAR (W/kg)
	measured	measured
5200	158.49 (15.85)	55.40 (5.54)
5400	167.20 (16.72)	57.39 (5.74)
5600	175.65 (17.57)	59.48 (5.95)
5800	183.06 (18.31)	61.62 (6.16)



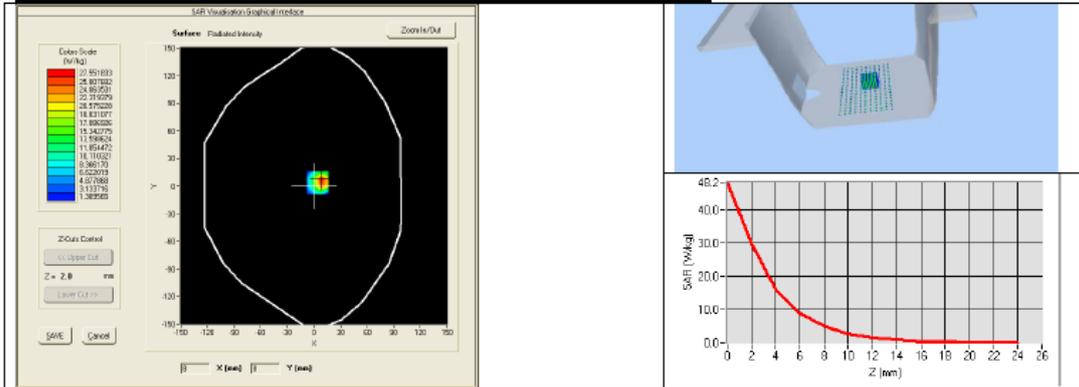
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.262.12.17.SATU.A

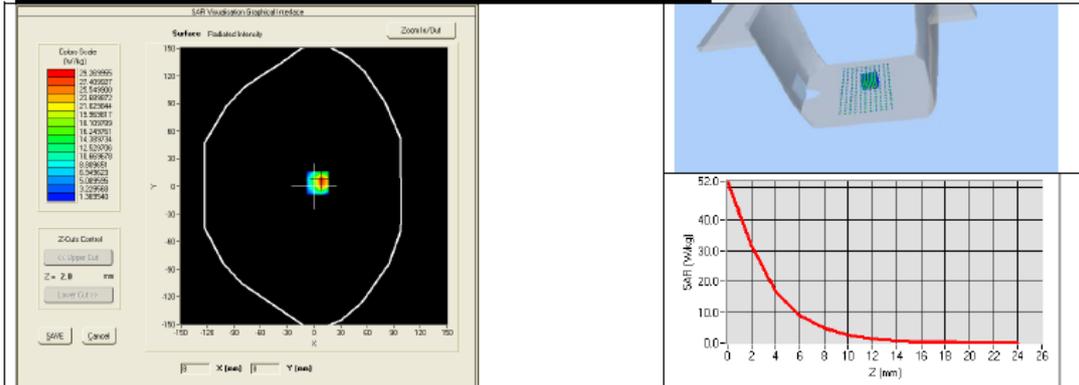
BODY SAR MEASUREMENT PLOTS @ 5200 MHz



BODY SAR MEASUREMENT PLOTS @ 5400 MHz



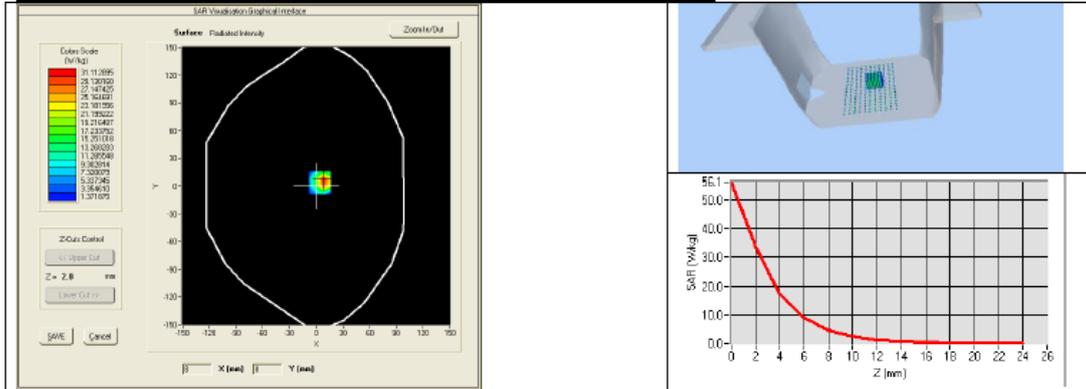
BODY SAR MEASUREMENT PLOTS @ 5600 MHz



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BODY SAR MEASUREMENT PLOTS @ 5800 MHz





8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2016	02/2019
Calipers	Carrera	CALIPER-01	01/2017	01/2020
Reference Probe	MVG	EPG122 SN 18/11	10/2016	10/2017
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	150798832	10/2015	10/2017

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