FCC SAR Compliance Test Report

For

TECNO MOBILE LIMITED

FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET

FOTAN NT HONGKONG

Model: T1001W

Test Engineer:	Zeng Longhao
Report Number:	WSCT-ANAB-R&E241000052A-SAR
Report Date:	08 November 2024
FCC ID:	2ADYY-T1001W
Check By:	Jiang Xuling
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Modified History

REV.	Modification Description	Issued Date	Remark
REV.1.0	Initial Test Report Relesse	05 November 2024	Li Huaibi

1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in this test report. Shenzhen Timeway Testing Laboratories does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report is not to be reproduced or published in full without the prior written permission.

1.2 Application details

Date of receipt of test item: 2024-10-23
Start of test: 2024-10-24
End of test: 2024-11-02

1.3 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for LincPlus T3 is as below:

Band	Position Test Points	MAX Reported SAR_{1g} (W/kg)
Wi-Fi 2.4G	Body & Hotspot 0mm	0.814
WIFI5G Band1	Body & Hotspot 0mm	0.740
WIFI5G Band2	Body & Hotspot 0mm	0.724
WIFI5G Band3	Body & Hotspot 0mm	0.755
WIFI5G Band4	Body & Hotspot 0mm	0.766
BT	Body & Hotspot 0mm	0.069
Maximum Max. SAR Level(s) Measured: (Limit: 1.6W/Kg):	Wi-Fi 2.4G	0.814W/kg1gBodyTissue

The device is in compliance with Specific Absorption Rate（SAR）for general population/uncontraolled exposure limits of 1.6 W/Kg as averaged over any 1g tissue according to the FCC rule the ANSI/IEEE C95.1:2005, the NCRP Report Number 86 for uncontrolled environment, according to the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013.

1.4 EUT Information

Device Information：			
Product Type:	Tablet		
Model:	T1001W		
Trade Name:	TECNO		
Device Type:	Portable device		
Exposure Category:	uncontrolled environment / general population		
Production Unit or Identical Prototype：	Production Unit		
Antenna Type :	PIFA Antenna		
Device Operating Configurations:			
Supporting Mode(s) :	Wi-Fi , BT		
Modulation:	GFSK/π/4-DQPSK/8-DPSK DSSS (DBPSK, DQPSK, CCK) for IEEE 802.11b OFDM (BPSK,QPSK,16QAM,64QAM,256QAM,) for IEEE 802.11g/n IEEE 802.11a/n/ac: OFDM (BPSK/QPSK/16QAM/64QAM/256QAM)		
Device Class :	Class B, No DTM Mode		
Operating Frequency Range(s)	Band	TX(MHz)	RX(MHz)
	Wi-Fi	2412-2462	
	Wi-Fi (5G)	Band 1: 5180-5240 MHz Band 2: 5260-5320 MHz Band 3: 5500-5700 MHz Band 4: 5745-5825 MHz	
	BT	2402~2480	
GPRS class level:	GPRS class 12		
Antenna gain:	BT: -0.08dBi 2.4WIFI: -0.08dBi 5GWIFI:1.05dbi		
Power Source:	Rechargeable Li-ion Battery: T1001 Nominal Voltage: 3.85V⎓ Limited Charge Voltage: 4.4V⎓ Rated Capacity: 7000mAh Rated Energy: 26.95Wh		

Note:1:The test results of this test report relate exclusively to the test item specified in this test report. World Standardization Certification & Testing Group (Shenzhen) Co.,Ltd does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report is not to be reproduced or published in full without the prior written permission.

Note: 2. N/A stands for no applicable.

3. Antenna gain provided by the customer.

Configuration differences

Configuration	Model	Camera	Adapter	LCD
1	T1001W	SA1036G5M / SE1035G13M	T1001 (Ganfeng)	HJR101059D
2	T1001W	AC55925 / AM5A926	T1001 (Gaoyuan)	SAT101AT45IM0712-Q0054
Note: The prototypes of both configurations have been tested, and the “Configuration1” has the worst test result, which is the main test model reported				

2 Testing laboratory

Test Site	World Standardization Certification & Testing Group (Shenzhen) Co., Ltd.
Test Location	Building A-B, Baoli'an Industrial Park, No. 58 Tangtou Avenue, Shiyan Street, Bao'an District, Shenzhen, Guangdong, China
Telephone	+86-755-26996192
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3 ACCREDITATIONS

ANAB - Certificate Number: AT-3951

The EMC Laboratory has been accredited by the American Association for Laboratory Accreditation (ANAB).Certification Number: AT-3951

4 Test Environment

	Required	Actual
Ambient temperature:	18 – 25 °C	22 ± 2 °C
Tissue Simulating liquid:	22 ± 2 °C	22 ± 2 °C
Relative humidity content:	30 – 70 %	30 – 70 %

5 Applicant and Manufacturer

Applicant/Client Name:	TECNO MOBILE LIMITED
Applicant Address:	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG
Manufacturer Name:	TECNO MOBILE LIMITED
Manufacturer Address:	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG

6 Test standard/s:

No.	Identity	Document Title
1	47 CFR Part 2.1093	Radiofrequency radiation exposure evaluation: portable devices
2	IEC/IEEE 62209-1528	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate in the Human Head from Wireless Communications Devices: Measurement Techniques
3	KDB447498 D01	General RF Exposure Guidance v06
4	KDB447498 D04	Interim General RF Exposure Guidance v01
5	KDB865664 D01	SAR measurement 100MHz to 6GHz v01r04
6	KDB865664 D02	RF Exposure Reporting v01r02
7	KDB941225 D01	3G SAR Procedures v03r01
8	KDB941225 D05	SAR for LTE Devices v02r05
9	KDB248227 D01	802.11 Wi-Fi SAR v02r02
10	KDB941225 D06	Hotspot Mode v02r01
11	KDB648474 D04	Handset SAR v01r03
12	KDB690783 D01	SAR Listings on Grant v01r03

6.1 RF exposure limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain/Body/Arms/Legs)	1.60 mW/g	8.00 mW/g
Spatial Average SAR** (Whole Body)	0.08 mW/g	0.40 mW/g
Spatial Peak SAR*** (Heads/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

The limit applied in this test report is shown in bold letters

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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

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

6.2 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dW) absorbed by(dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ).

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dV}\right)$$

SAR is expressed in units of watts per kilogram (W/kg). SAR can be related to the electric field at a point by

$$SAR = \frac{\sigma |E|^2}{\rho}$$

where:

σ = conductivity of the tissue (S/m)

ρ = mass density of the tissue (kg/m^3)

E = rms electric field strength (V/m)

7 SAR Measurement System

7.1 The Measurement System

Comosar is a system that is able to determine the SAR distribution inside a phantom of human being according to different standards. The Comosar system consists of the following items:

- Main computer to control all the system
- 6 axis robot
- Data acquisition system
- Miniature E-field probe
- Device holder
- Head simulating tissue

The following figure shows the system.

The EUT under test operating at the maximum power level is placed in the phone holder, under the phantom, which is filled with head simulating liquid. The E-Field probe measures the electric field inside the phantom. The OpenSAR software computes the results to give a SAR value in a 1g or 10g mass.

7.2 Robot

The COMOSAR system uses the high precision robots KR 6 R900 sixx type out of the newer series from Satimo SA (France).For the 6-axis controller COMOSAR system, the KUKA robot controller version from Satimo is used. The KR 6 R900 sixx robot series have many features that are important for
our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

7.3 Probe

For the measurements the Specific Dosimetric E-Field Probe SSE 5 with following specifications is used

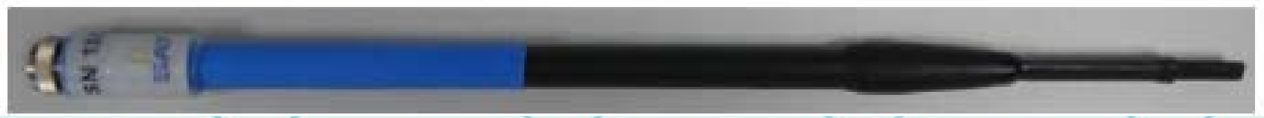


Figure 1 – MVG COMOSAR Dosimetric E field Dipole

- Dynamic range: 0.01-100 W/kg

Probe Length	330 mm
Length of Individual Dipoles	4.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	5 mm
Distance between dipoles / probe extremity	2.7 mm

- Calibration range: 300MHz to 3GHz for head & body simulating liquid.

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

Figure 2 – MVG COMOSAR Dosimetric E field Dipole

Dynamic range: 0.01-100 W/kg

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

- Calibration range: 3GHz to 6GHz for head & body simulating liquid.

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

7.4 Measurement procedure

The following steps are used for each test position

- Establish a call with the maximum output power with a base station simulator.The connection between the mobile and the base station simulator is established via air interface.
- Measurement of the local E-field value at a fixed location.This value serves as a reference value for calculating a possible power drift.
- Measurement of the SAR distribution with a grid of 8 to 16 mm * 8 to 16 mm and a constant distance to the inner surface of the phantom.Since the sensors can not directly measure at the inner phantom surface,the values between the sensors and the inner phantom surface are extrapolated.With these values the area of the maximum SAR is calculated by an interpolation scheme.
- Around this point,a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8 * 4 or 5 mm.With these data,the peak spatial-average SAR value can be calculated.

Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The SATIMO software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine. The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

SAR Averaged Methods

In SATIMO, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

7.5 Description of interpolation/extrapolation scheme

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

- An extrapolation is using to determinate this highest local SAR values.
  The extrapolation is based on afourth-order least-square polynomial fit of measured data.The local SAR value is then extrapolated from the liquid surface with a 1 mm step.

- The measurements have to be performed over a limited time(due to the duration of the battery) so the step of measurement is high.It could vary between 5 and 8 mm.To obtain an accurate assessment of the maximum SAR average over 10 grams and 1gram requires a very fine resolution in the three dimensional scanned data array.

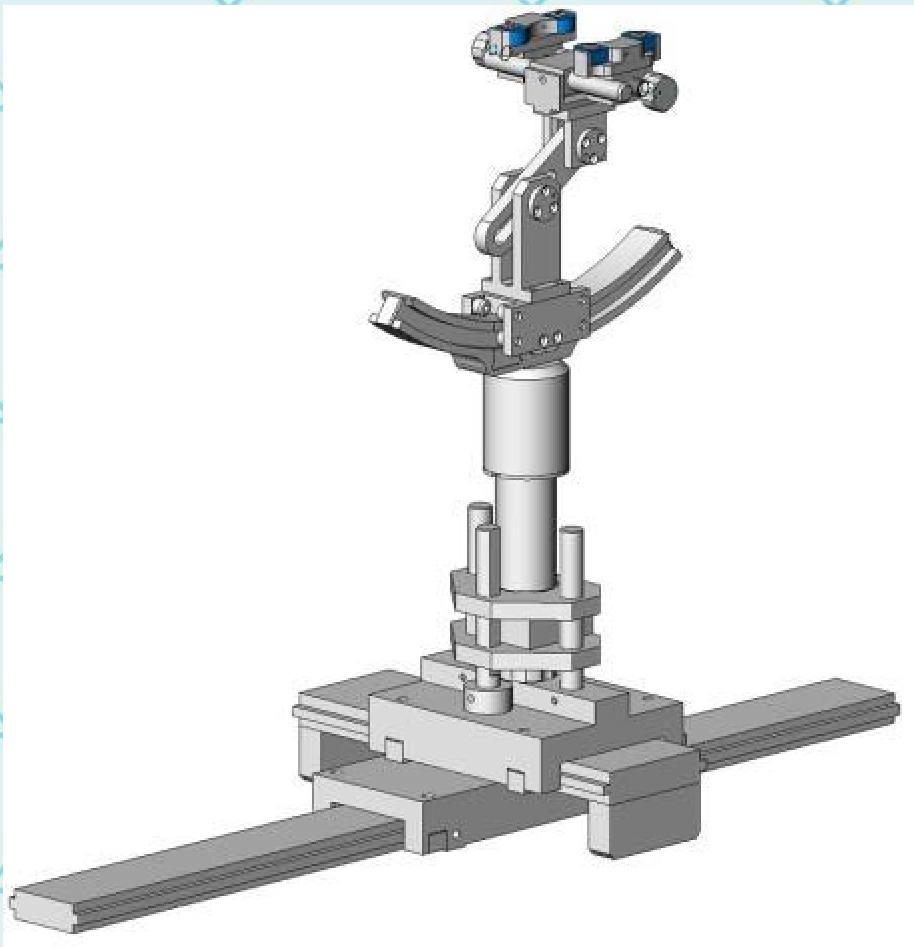
7.6 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.

System Material	Permittivity	Loss Tangent
Delrin	3.7	0.005

7.7 Device Holder

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



Device holder

System Material	Permittivity	Loss Tangent
Delrin	3.7	0.005

7.8 Video Positioning System

- The video positioning system is used in OpenSAR to check the probe. Which is composed of a camera, LED, mirror and mechanical parts. The camera is piloted by the main computer with firewire link.

- During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.

- The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

7.9 Tissue simulating liquids: dielectric properties

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectic parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ± 5% of the target values.

The following materials are used for producing the tissue-equivalent materials.
(Liquids used for tests are marked with☒):

Ingredients(% of weight)	**Frequency (MHz)**					
frequency band	☐ 750	☐ 835	☐ 1800	☐ 1900	☐ 2450	☐ 2600
Tissue Type	Head	Head	Head	Head	Head	Head
Water	39.2	41.45	52.64	55.242	62.7	55.242
Salt (NaCl)	2.7	1.45	0.36	0.306	0.5	0.306
Sugar	57.0	56.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	47.0	44.542	0.0	44.452
Ingredients(% of weight)	**Frequency (MHz)**					
frequency band	☐ 750	☐ 835	☐ 1800	☐ 1900	☒ 2450	☐ 2600
Tissue Type	Body	Body	Body	Body	Body	Body
Water	50.30	52.4	69.91	69.91	73.2	64.493
Salt (NaCl)	1.60	1.40	0.13	0.13	0.04	0.024
Sugar	47.0	45.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	29.96	29.96	26.7	32.252

Salt: 99+% Pure Sodium Chloride
Sugar: 98+% Pure Sucrose
Water: De-ionized, 16MΩ+ resistivity
HEC: Hydroxyethyl Cellulose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100(ultra pure): Polyethylene glycol mono [4-(1,1,3,3-tetramethylbutyl)phenyl]ether

7.10 Tissue simulating liquids: parameters

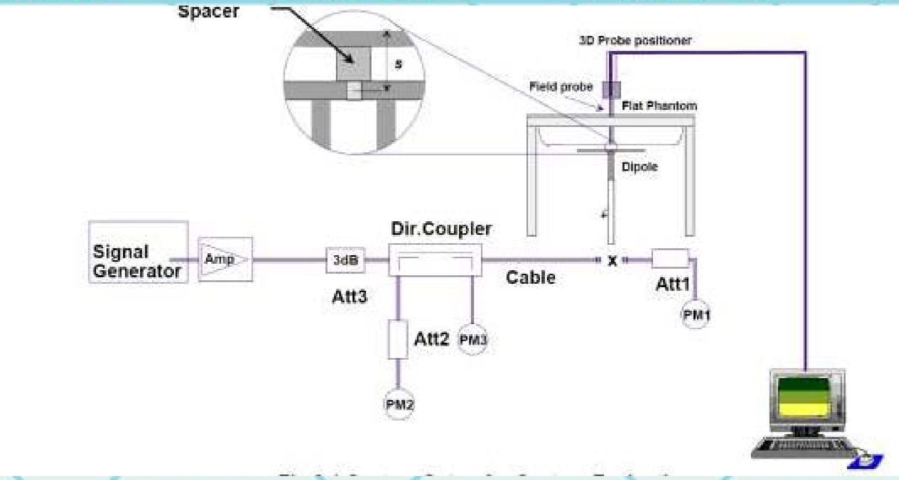
Tissue Type	Measured Frequency (MHz)	Target Tissue				Measured Tissue		Liquid Temp.	Test Date
		TargetPermittivity ε_r	Range of ±5%	TargetConductivity σ (S/m)	Range of ±5%	ε_r	σ (S/m)		
2450MHz Body	2410	52.80	50.16~55.44	1.91	1.81~2.00	52.50	1.94	21.6°C	2024-10-24
	2435	52.70	50.07~55.34	1.94	1.84~2.04	52.52	1.95		
	2450	52.70	50.07~55.34	1.95	1.85~2.05	52.73	1.96		
	2460	52.70	50.07~55.34	1.96	1.86~2.06	52.76	1.99		
5G Body	5200	49.00	46.55~51.45	5.30	5.03~5.56	49.86	5.19	21.6°C	2024-10-28
	5300	48.90	46.05~51.35	5.42	5.15~5.69	48.32	5.27		
	5800	48.20	45.79~50.61	6.00	5.70~6.30	47.74	6.09		
ε_r= Relative permittivity, σ= Conductivity									

8 System Check

8.1 System check procedure

The System check is performed by using a System check dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 100 mW. To adjust this power a power meter is used. The power sensor is connected to the cable before the System check to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the validation to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).

System check results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system.



8.2 System check results

The system Check is performed for verifying the accuracy of the complete measurement system and performance of the software.The following table shows System check results for all frequency bands and tissue liquids used during the tests (plot(s) see annex A).

System Check	Target SAR (1W) (+/-10%)				Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (W/g)	Range of ±10% 1-g (W/g)	10-g (W/g)	Range of ±10% 10-g (W/g)	1-g (W/g)	10-g (W/g)		
D2450V2 Body	51.39	46.25~56.53	23.63	21.27~25.99	54.330	23.330	21.6°C	2024-10-24
D5200V2 Body	163.36	147.03~179.69	57.09	51.39~62.79	167.180	59.640	21.6°C	2024-10-28
D5300V2 Body	166.22	149.60~182.84	57.22	51.50~62.94	165.370	58.820	21.6°C	2024-10-30
D5800V2 Body	177.10	159.39~194.81	59.95	53.96~65.94	179.660	60.800	21.6°C	2024-11-01
Note: All SAR values are normalized to 1W forward power.								

Note: 5G band system check USES standard waveguide, so the test results are standard en62209-2 table B2

9 SAR Test Test Configuration

9.1 Wi-Fi Test Configuration

For the 802.11b/g SAR tests, a communication link is set up with the test mode software for Wi-Fi mode test. The Absolute Radio Frequency Channel Number(ARFCN) is allocated to 1 ,6 and 11 respectively in the case of 2450 MHz.During the test,at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate. 802.11b/g operating modes are tested independently according to the service requirements in each frquency band. 802.11b/g modes are tested on channel 1, 6, 11; however,if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2412	1#	√	△
		2437	6	√	△
		2462	11#	√	△

Notes:

√ = "default test channels"

△= possible 802.11g channels with maximum average output ¼ dB the "default test channels"

= when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

802.11 Test Channels per FCC Requirements

9.2 WiFi 2.4G SAR Test Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions.

A)802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the reported SAR of the highest measured maximum output power channel (section 3.1 of of KDB 248227D01v02) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

2) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

B) 2.4GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3 of of KDB 248227D01v02r01). SAR is not required for the following 2.4 GHz OFDM conditions.

1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.

2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

C) SAR Test Requirements for OFDM configurations

When SAR measurement is required for 802.11 g/n OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

9.3 WiFi 5G SAR Test Procedures

A) U-NII-1 and U-NII-2A Bands

For devices that operate in only one of the U-NII-1 and U-NII-2A bands, the normally required SAR procedures for OFDM configurations are applied. For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following：

1) When the same maximum output power is specified for both bands, begin SAR measurement in U- NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, both bands are tested independently for SAR.

2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, both bands are tested independently for SAR.

3) The two U-NII bands may be aggregated to support a 160 MHz channel on channel number 50.

Without additional testing, the maximum output power for this is limited to the lower of the maximum output power certified for the two bands. When SAR measurement is required for at least one of the bands and the highest reported SAR adjusted by the ratio of specified maximum output power of aggregated to standalone band is > 1.2 W/kg, SAR is required for the 160 MHz channel. This procedure does not apply to an aggregated band with maximum output higher than the standalone band(s); the aggregated band must be tested independently for SAR. SAR is not required when the 160 MHz channel is operating at a reduced maximum power and also qualifies for SAR test exclusion.

B) U-NII-2C and U-NII-3 Bands

The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. when Terminal Doppler Weather Radar (TDWR) restriction applies, all channels that operate at 5.60 – 5.65 GHz must be included to apply the SAR test reduction and measurement procedures.

When the same transmitter and antenna(s) are used for U-NII-2C band and U-NII-3 band or 5.8 GHz band of §15.247, the bands may be aggregated to enable additional channels with 20, 40 or 80 MHz bandwidth to span across the band gap, as illustrated in Appendix B. The maximum output power for the additional band gap channels is limited to the lower of those certified for the bands. Unless band gap channels are permanently disabled, they must be considered for SAR testing. The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. To maintain SAR measurement accuracy and to facilitate test reduction, the channels in U-NII-2C band above 5.65 GHz may be grouped with the 5.8 GHz channels in U-NII-3 or §15.247 band to enable two SAR probe calibration frequency points to cover the bands, including the band gap channels. When band gap channels are supported and the bands are not aggregated for SAR testing, band gap channels must be considered independently in each band according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

C) OFDM Transmission Mode SAR Test Configuration and Channel Selection Requirements

The initial test configuration for 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures. When multiple configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined according to the following steps applied sequentially.

1) The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.

2) If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.

3) If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.

4) When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n. After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following. These channel selection procedures apply to both the initial test configuration and subsequent test configuration(s), with respect to the default power measurement procedures or additional power measurements required for further SAR test reduction. The same procedures also apply to subsequent highest output power channel(s) selection.

1) The channel closest to mid-band frequency is selected for SAR measurement.

2) For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

D) SAR Test Requirements for OFDM configurations

When SAR measurement is required for 802.11 a/n/ac OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. When the same transmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction applies. When band gap channels between U-NII-2C band and 5.8 GHz U-NII-3 or §15.247 band are supported, the highest maximum output power transmission mode configuration and maximum output power channel across the bands must be used to determine SAR test reduction, according to the initial test configuration and subsequent test configuration requirements. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

10 Detailed Test Results

10.1 Conducted Power measurements

The maximum conducted average power (Unit: dBm) including tune-up tolerance is shown as below.

10.1.1 Conducted Power of Wi-Fi 2.4G

Mode	802.11b		
Channel/Frequency(MHz)	1(2412)	6(2437)	11(2462)
Average Power(dBm)	21.51	21.79	21.28
Mode	802.11g		
Channel/Frequency(MHz)	1(2412)	6(2437)	11(2462)
Average Power(dBm)	23.65	23.85	23.20
Mode	802.11n(HT20)		
Channel/Frequency(MHz)	1(2412)	6(2437)	11(2462)
Average Power(dBm)	23.50	23.67	23.26
Mode	802.11n(HT40)		
Channel/Frequency(MHz)	7(2422)	6(2437)	9(2452)
Average Power(dBm)	23.15	23.11	**24.57**

<KDB 248227 D01, SAR Guidance for Wi-Fi Transmitters>

(1) For handsets operating next to ear, hotspot mode or mini-tablet configurations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When the reported SAR of initial test position is <= 0.4 W/kg, SAR testing for remaining test positions is not required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is <= 0.8 W/kg or all test positions are measured.

(2) For Wi-Fi 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

10.1.2 Conducted Power of Wi-Fi 5G

Band	Mode	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
U-NII-1 (5150-5250)	802.11a	5180	14.50±1.0dbm	**14.21**	Yes
		5240	14.00±1.0dbm	13.70	No
	802.11n-HT20	5180	14.00±1.0dbm	13.64	No
		5240	14.00±1.0dbm	13.63	No
	802.11n-HT40	5190	13.50±1.0dbm	13.01	No
		5230	13.00±1.0dbm	12.95	No
	802.11ac-VHT20	5180	13.00±1.0dbm	12.70	No
		5240	13.00±1.0dbm	12.63	No
	802.11ac-VHT40	5190	12.50±1.0dbm	12.15	No
		5230	12.00±1.0dbm	11.73	No
	802.11ac-VHT80	5210	10.50±1.0dbm	10.47	No
Band	Mode	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
U-NII-2a (5250-5350)	802.11a	5260	13.50±1.0dbm	13.49	No
		5320	14.50±1.0dbm	**14.32**	Yes
	802.11n-HT20	5260	13.50 ±1.0dbm	13.48	No
		5320	14.50±1.0dbm	14.23	No
	802.11n-HT40	5270	13.00±1.0dbm	12.64	No
		5310	13.50±1.0dbm	13.28	No
	802.11ac-VHT20	5260	12.50±1.0dbm	12.35	No
		5320	13.50±1.0dbm	13.18	No
	802.11ac-VHT40	5270	12.00±1.0dbm	11.71	No
		5310	12.50±1.0dbm	12.28	No
	802.11ac-VHT80	5290	11.00±1.0dbm	10.51	No
Band	Mode	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
U-NII-2c (5470-5725)	802.11a	5500	15.00±1.0dbm	14.87	No
		5700	17.00±1.0dbm	**16.60**	Yes
	802.11n-HT20	5500	15.00±1.0dbm	14.88	No
		5700	17.00±1.0dbm	16.56	No
	802.11n-HT40	5510	14.50±1.0dbm	14.37	No
		5670	16.00±1.0dbm	15.63	No
	802.11ac-VHT20	5500	14.00±1.0dbm	13.79	No
		5700	15.50±1.0dbm	15.48	No
	802.11ac-VHT40	5510	13.50±1.0dbm	13.31	No
		5670	14.50±1.0dbm	14.49	No
	802.11ac-VHT80	5530	13.00±1.0dbm	12.51	No
		5610	13.50±1.0dbm	13.10	No
Band	Mode	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
U-NII-3 (5725-5825)	802.11a	5745	17.50±1.0dbm	17.13	No
		5825	18.00±1.0dbm	**17.52**	Yes
	802.11n-HT20	5745	17.50±1.0dbm	17.13	No
		5825	17.50±1.0dbm	17.21	No
	802.11n-HT40	5755	17.00±1.0dbm	16.53	No
		5795	17.00±1.0dbm	16.61	No
	802.11ac-VHT20	5745	16.00±1.0dbm	15.94	No
		5825	16.00±1.0dbm	15.97	No
	802.11ac-VHT40	5755	15.50±1.0dbm	15.38	No
		5795	16.00 ±1.0dbm	15.62	No
	802.11ac-VHT80	5775	14.50±1.0dbm	14.01	No

10.1.3 Conducted Power of BT

EDR	Mode	Maximum Tune-up(dBm)	Average Conducted Output Power (dBm)		
			0	39	78
			2402MHz	2441MHz	2480MHz
	GFSK	12.00	7.97	11.97	9.37
	π/4DQPSK	12.00	11.95	11.95	9.03
	8DPSK	12.50	9.95	**12.03**	9.08

BLE	Mode	Maximum Tune-up(dBm)	Average Conducted Output Power (dBm)		
			0	20	39
			2402MHz	2440MHz	2480MHz
	1Mbps	0	-2.12	**-0.39**	-2.24
	2Mbps	0	-2.01	-0.47	-1.97

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Exclusion thresholds for 1-g SAR(mW)	SAR evaluation required
39	2.441	12.50	12.03	0	3	Yes
20	2.440	0	-0.39	0	3	NO

Note

1. Per KDB 447498 D04 Interim General RF Exposure Guidance v01, the 1-g SAR test exclusion thresholds for 300 MHz to 6 GHz at *test separation distances* ≤ 40 cm are determined by:

$$P_{th}\,(\text{mW}) = ERP_{20\,cm}\,(\text{mW}) = \begin{cases} 2040f & 0.3\text{ GHz} \le f < 1.5\text{ GHz} \\ 3060 & 1.5\text{ GHz} \le f \le 6\text{ GHz} \end{cases} \qquad (B.1)$$

$$P_{th}\,(\text{mW}) = \begin{cases} ERP_{20\,cm}(d/20\text{ cm})^{x} & d \le 20\text{ cm} \\ ERP_{20\,cm} & 20\text{ cm} < d \le 40\text{ cm} \end{cases} \qquad (B.2)$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,cm}\sqrt{f}}\right)$$

and f is in GHz, d is the separation distance (cm), and ERP_{20cm} is per Formula (B.1).

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

2. Per KDB 248227 D01 v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.

3 . The output power of all data rate were prescan, just the worst case (the lowest data rate) of all mode were shown in report.

10.1.4 Tune-up power tolerance

WIFI	2.4GWIFI	802.11b	Max output power =22.00±1.0dBm
		802.11g	Max output power =24.00±1.0dBm
		802.11n (HT20)	Max output power =24.00±1.0dBm
		802.11n (HT40)	Max output power =25.00±1.0dBm
	U-NII-1(5150-5250)	802.11a	Max output power =14.50±1.0dBm
	U-NII-2a(5250-5350)	802.11a	Max output power =14.50±1.0dBm
	U-NII-2c(5470-5725)	802.11a	Max output power =17.00±1.0dBm
	U-NII-3(5725-5825)	802.11a	Max output power =18.00±1.0dBm
BT	GFSK		Max output power =12.00±1.0dBm
	π/4DQPSK		Max output power =12.00±1.0dBm
	8DPSK		Max output power =12.50±1.0dBm
BLE	1Mbps		Max output power =0±1.0dBm
	2Mbps		Max output power =0±1.0dBm

10.2 SAR test results

Notes:

1) Per KDB447498 D01v05 r02,the SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the scaled SAR measured at mid-band channel for each test configuration is at least 3.0 dB lower than the SAR limit (< 0.8 W/kg), testing at the high and low channels is optional.

2) Per KDB447498 D01v05r02, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is: ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz. When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.

3) Per KDB447498 D01v05r02, All measurement SAR result is scaled-up to account for tune-up tolerance is compliant.

4) Per KDB648474 D04v01r02, body-worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn with headset SAR.

5)Per KDB248227 D01v01r02, the procedures required to establish specific device operating configurations for testing the SAR of 802.11 a/b/g transmitters.

(1) For Headsets operating next to ear, hotspot mode or mini-tablet configurations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When the reported SAR of initial test position is <= 0.4 W/kg, SAR testing for remaining test positions is not required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is <= 0.8 W/kg or all test positions are measured.

(2) For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

(3) For WLAN 5 GHz, the initial test configuration was selected according to the transmission mode with the highest maximum output power. When the reported SAR of initial test configuration is > 0.8 W/kg, SAR is required for the subsequent highest measured output power channel until the reported SAR result is <= 1.2 W/kg or all required channels are measured. For other transmission modes, SAR is not required when the highest reported SAR for initial test configuration is adjusted by the ratio of subsequent test configuration to initial test configuration specified maximum output power and it is <= 1.2 W/kg.

6) Per KDB865664 D01v01r04,for each frequency band,repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/Kg,only one repeated measurement is required.

7) Per KDB865664 D02v01r01, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing(Refer to appendix B for details).

8) Per KDB941225 D06v01r01, the DUT Dimension is bigger than 9 cm x 5 cm, so 10mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5cm,such position does not need to be tested.

9) Per KDB 941225 D01, 3G SAR Measurement Procedures ,The mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is≤ 1/4 dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤1.2 W/kg, SAR measurement is not required for the secondary mode.

10)Per KDB 941225 D05, SAR Evaluation Considerations for LTE Devices

(1)QPSK with 1 RB and 50% RB allocation

Start with the largest channel bandwidth and measure SAR, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

(2)QPSK with 100% RB allocation

SAR is not required when the highest maximum output power for 100% RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

(3)Higher order modulations

SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > 1/2 dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is >1.45 W/kg.

(4)Other channel bandwidth

SAR is required when the highest maximum output power of the smaller channel bandwidth is > 1/2 dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

10.2.1 Results overview of Wi-Fi 2.4G

Mode	Position	Ch.	Freq. (MHz)	Power Drift (%)	1g Meas. SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)
2.4g (2.4~2.4835) 802.11n (HT40)	Front	9	2452	-1.680	0.737	100	1.00	24.57	25.00	1.104	0.814
	Back	9	2452	-2.880	0.635	100	1.00	24.57	25.00	1.104	0.701
	Left	9	2452	1.040	0.105	100	1.00	24.57	25.00	1.104	0.116
	Right	9	2452	-2.570	0.010	100	1.00	24.57	25.00	1.104	0.011
	Top	9	2452	-0.680	0.109	100	1.00	24.57	25.00	1.104	0.120
	Bottom	9	2452	-3.170	0.009	100	1.00	24.57	25.00	1.104	0.010

10.2.2 Results overview of Wi-Fi 5G&BT

Mode	Position	Ch.	Freq. (MHz)	Power Drift (%)	1g Meas. SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)
5g Band1 5180-5240	Front	36	5180	4.760	0.692	100	1.00	14.21	14.50	1.069	0.740
	Back	36	5180	-3.160	0.518	100	1.00	14.21	14.50	1.069	0.554
	Left	36	5180	0.560	0.076	100	1.00	14.21	14.50	1.069	0.081
	Right	36	5180	-2.880	0.009	100	1.00	14.21	14.50	1.069	0.010
	Top	36	5180	-4.430	0.079	100	1.00	14.21	14.50	1.069	0.084
	Bottom	36	5180	-4.100	0.008	100	1.00	14.21	14.50	1.069	0.009

Mode	Position	Ch.	Freq. (MHz)	Power Drift (%)	1g Meas. SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)
5g Band2 5260-5320	Front	64	5320	2.330	0.695	100	1.00	14.32	14.50	1.042	0.724
	Back	64	5320	0.880	0.519	100	1.00	14.32	14.50	1.042	0.541
	Left	64	5320	3.830	0.078	100	1.00	14.32	14.50	1.042	0.081
	Right	64	5320	0.390	0.009	100	1.00	14.32	14.50	1.042	0.009
	Top	64	5320	-1.080	0.080	100	1.00	14.32	14.50	1.042	0.083
	Bottom	64	5320	3.560	0.008	100	1.00	14.32	14.50	1.042	0.008

Mode	Position	Ch.	Freq. (MHz)	Power Drift (%)	1g Meas. SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)
5g Band3 5500-5700	Front	140	5700	1.940	0.689	100	1.00	16.60	17.00	1.096	0.755
	Back	140	5700	-0.950	0.515	100	1.00	16.60	17.00	1.096	0.565
	Left	140	5700	2.250	0.074	100	1.00	16.60	17.00	1.096	0.081
	Right	140	5700	1.280	0.008	100	1.00	16.60	17.00	1.096	0.009
	Top	140	5700	-0.080	0.075	100	1.00	16.60	17.00	1.096	0.082
	Bottom	140	5700	4.060	0.007	100	1.00	16.60	17.00	1.096	0.008

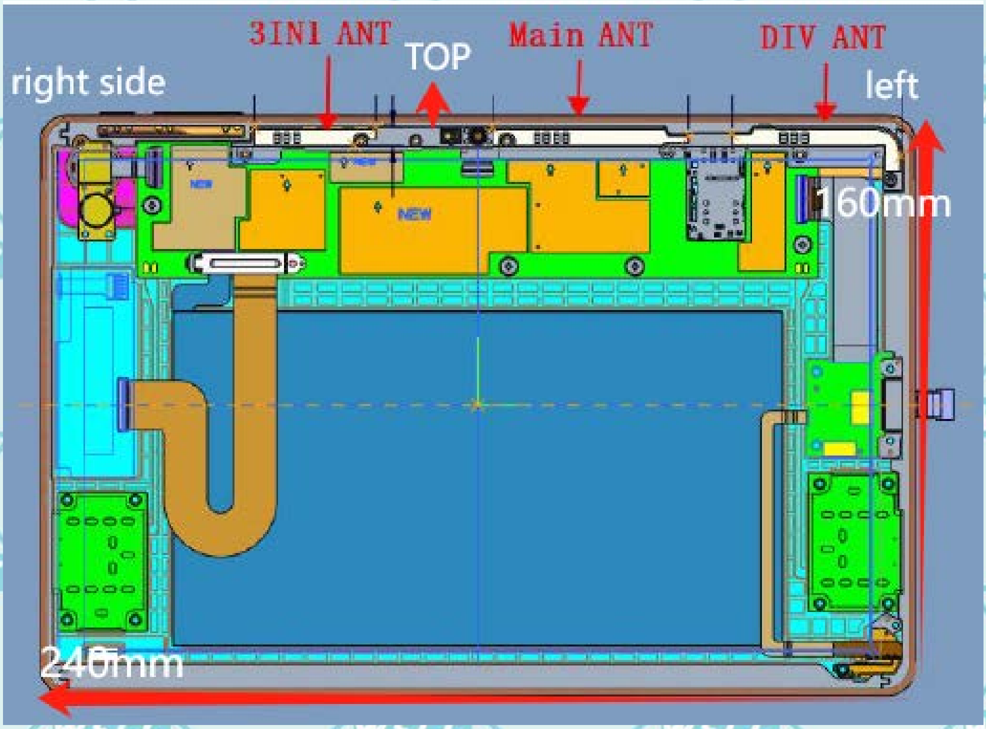
Mode	Position	Ch.	Freq. (MHz)	Power Drift (%)	1g Meas. SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)
5g Band4 5745-5825	Front	165	5825	-2.160	0.686	100	1.00	17.52	18.00	1.117	0.766
	Back	165	5825	-4.360	0.512	100	1.00	17.52	18.00	1.117	0.572
	Left	165	5825	-1.530	0.072	100	1.00	17.52	18.00	1.117	0.080
	Right	165	5825	4.560	0.007	100	1.00	17.52	18.00	1.117	0.008
	Top	165	5825	-4.450	0.073	100	1.00	17.52	18.00	1.117	0.082
	Bottom	165	5825	2.960	0.006	100	1.00	17.52	18.00	1.117	0.007

Mode	Position	Ch.	Freq. (MHz)	Power Drift (%)	1g Meas. SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)
Bluetooth	Front	39	2441	4.340	0.062	100	1.00	12.03	12.50	1.114	0.069
	Back	39	2441	-4.890	0.054	100	1.00	12.03	12.50	1.114	0.060
	Left	39	2441	0.280	0.012	100	1.00	12.03	12.50	1.114	0.013
	Right	39	2441	-1.600	0.002	100	1.00	12.03	12.50	1.114	0.002
	Top	39	2441	-0.570	0.013	100	1.00	12.03	12.50	1.114	0.014
	Bottom	39	2441	-3.420	0.003	100	1.00	12.03	12.50	1.114	0.003

Note:

11 Multiple Transmitter Information

The SAR measurement positions of each side are as below:



< Rear Side >

Mode	Front side	Rear side	Left side	Right side	Top side	Bottom side
Wi-Fi/BT Antenna	Yes	Yes	Yes	Yes	Yes	Yes

1) Per KDB941225 D06v01r01, the DUT Dimension is bigger than 9 cm x 5 cm, so 0mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5cm,such position does not need to be tested.

11.1 Simultaneous Transmission Possibilities

The Simultaneous Transmission Possibilities are as below:

Simultaneous Transmission Possibilities		
Simultaneous Tx Combination	Configuration	Body
1	Wi-Fi+ BT	NO

Note: The device does not support simultaneous BT and Wi-Fi ,because the BT and Wi-Fi share the same antenna and can't transmit simultaneously.

12 Measurement uncertainty evaluation

12.1 Measurement uncertainty evaluation for SAR test

The following table includes the uncertainty table of the IEEE 1528. The values are determined by Satimo.The breakdown of the individual uncertainties is as follows:

Measurement Uncertainty evaluation for SAR test								
Uncertainty Component	Tol. (±%)	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g U_i (±%)	10g U_i (±%)	V_i
measurement system								
Probe Calibration	5.8	N	1	1	1	5.8	5.8	∞
Axial Isotropy	3.5	R	$\sqrt{3}$	$(1-C_p)^{1/2}$	$(1-C_p)^{1/2}$	1.43	1.43	∞
Hemispherical Isotropy	5.9	R	$\sqrt{3}$	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
Boundary Effect	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
system Detection Limits	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	3	N	1	1	1	3.00	3.00	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Response Time	0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF Ambient Conditions-Noise	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Conditions-Reflections	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe Positioner Mechanical Tolerance	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation and Integration Algorithms for Max.SAR Evaluation	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Test sample Related								
Test Sample Positioning	2.6	N	1	1	1	2.60	2.60	11
Device Holder Uncertainty	3	N	1	1	1	3.00	3.00	7
Output Power Variation-SAR drift measurement	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
SAR scaling	2	R	$\sqrt{3}$	1	1	1.15	1.15	∞

Phantom and Tissue Parameters								
Phantom Uncertainty (shape and thickness tolerances)	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviation (in permittivity and conductivity)	2	N	1	1	0.84	2.00	1.68	∞
Liquid conductivity（meas.）	2.5	N	1	0.64	0.43	1.60	1.08	5
Liquid conductivity (target.)	5	R	$\sqrt{3}$	0.64	0.43	1.85	1.24	5
Liquid Permittivity（meas.）	2.5	N	1	0.60	0.49	1.50	1.23	∞
Liquid Permittivity (target.)	5	R	$\sqrt{3}$	0.60	0.49	1.73	1.42	∞
Combined Standard Uncertainly		Rss				10.63	10.54	
Expanded Uncertainty{95% CONFIDENCE INTERRVAL}		k				21.26	21.08	

12.2 Measurement uncertainty evaluation for system check

The following table includes the uncertainty table of the IEEE 1528. The values are determined by Satimo.The breakdown of the individual uncertainties is as follows:

Uncertainty For System Performance Check								
Uncertainty Component	Tol. (±%)	Prob. Dist.	Div.	C_i 1g	C_i 10g	1g U_i(±%)	10g U_i (±%)	V_i
measurement system								
Probe Calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	$\sqrt{3}$	$(1-C_p)^{1/2}$	$(1-C_p)^{1/2}$	1.43	1.43	∞
Hemispherical Isotropy	5.9	R	$\sqrt{3}$	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
Boundary Effect	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
system detection Limits	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	0	N	1	1	1	0.00	0.00	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Response Time	0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient Conditions – Reflections	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioned Mechanical Tolerance	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Dipole								
Deviation of experimental source from numerical source	4	N	1	1	1	4.00	4.00	∞
Input power and SAR drift measurement	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole axis to liquid Distance	2	R	$\sqrt{3}$	1	1	1.16	1.16	∞
Phantom and Tissue Parameters								
Phantom Uncertainty (shape and thickness tolerances)	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviation (in permittivity and conductivity)	2	N	1	1	0.84	2.00	1.68	∞
Liquid conductivity（meas.）	2.5	N	1	0.64	0.43	1.60	1.08	5
Liquid conductivity (target.)	5	R	$\sqrt{3}$	0.64	0.43	1.85	1.24	5
Liquid Permittivity（meas.）	2.5	N	1	0.60	0.49	1.50	1.23	∞
Liquid Permittivity (target.)	5	R	$\sqrt{3}$	0.60	0.49	1.73	1.41	∞
Combined Standard Uncertainty		Rss				10.28	9.98	
Expanded Uncertainty (95% Confidence interval)		k				20.57	19.95	

13 Test equipment and ancillaries used for tests

To simplify the identification of the test equipment and/or ancillaries which were used, the reporting of the relevant test cases only refer to the test item number as specified in the table below.

	Manufacturer	Device Type	Type(Model)	Serial number	calibration	
					Last Cal.	Due Date
☒	SATIMO	COMOSAR DOSIMETRIC E FIELD PROBE	SSE2	3523-EPGO-428	2024-06-18	2025-06-17
☒	SATIMO	COMOSAR 750 MHz REFERENCE DIPOLE	SID750	SN 48/16 DIP0G750-444	2023-06-25	2026-06-24
☒	SATIMO	COMOSAR 835 MHz REFERENCE DIPOLE	SID835	SN 14/13 DIP0G835-235	2023-06-25	2026-06-24
☒	SATIMO	COMOSAR 900 MHz REFERENCE DIPOLE	SID900	SN 14/13 DIP0G900-231	2023-06-25	2026-06-24
☒	SATIMO	COMOSAR 1800 MHz REFERENCE DIPOLE	SID1800	SN 14/13 DIP1G800-232	2023-06-25	2026-06-24
☐	SATIMO	COMOSAR 1900 MHz REFERENCE DIPOLE	SID1900	SN 14/13 DIP1G900-236	2023-06-25	2026-06-24
☒	SATIMO	COMOSAR 2000 MHz REFERENCE DIPOLE	SID2000	SN 14/13 DIP2G000-237	2023-06-25	2026-06-24
☒	SATIMO	COMOSAR 2450 MHz REFERENCE DIPOLE	SID2450	SN 14/13 DIP2G450-238	2023-06-25	2026-06-24
☒	SATIMO	COMOSAR 2600 MHz REFERENCE DIPOLE	SID2600	SN 28/14 DIP2G600-327	2023-06-25	2026-06-24
☒	SATIMO	Software	OPENSAR	N/A	N/A	N/A
☒	SATIMO	Phantom	COMOSAR IEEE SAM PHANTOM	SN 14/13 SAM99	N/A	N/A
☒	R & S	Universal Radio Communication Tester	CMU 200	119733	2024-10-21	2025-10-20
☒	R & S	Universal Radio Communication Tester	CMW500	144459	2024-10-21	2025-10-20
☒	R & S	UXM5G Wireless Test Platform	E7515B	MY60192341	2024-10-21	2025-10-20
☒	HP	Network Analyser	8753D	3410A08889	2024-10-21	2025-10-20
☒	HP	Signal Generator	E4421B	GB39340770	2024-10-28	2025-10-27
☒	Keithley	Multimeter	Keithley 2000	4014539	2024-10-28	2025-10-27
☒	SATIMO	Amplifier	Power Amplifier	MODU-023-A-0004	2024-10-21	2025-10-20
☒	Agilent	Power Meter	E4418B	GB43312909	2024-10-21	2025-10-20
☒	Agilent	Power Meter Sensor	E4412A	MY41500046	2024-10-21	2025-10-20

Annex A: System performance verification

(**Please See the SAR Measurement Plots of annex A.**)

Annex B: Measurement results

(**Please See the SAR Measurement Plots of annex B.**)

Annex C: Calibration reports

(Please See the Calibration reports of annex C.)

	Annex A: System Check
	Tested Model :T1001W
	Report Number: WSCT-ANAB-R&E241000052A-SAR

MEASUREMENT 1

BODY

Type: Validation measurement (Complete)

Date of measurement:24/10/2024

Measurement duration: 10 minutes 43 seconds

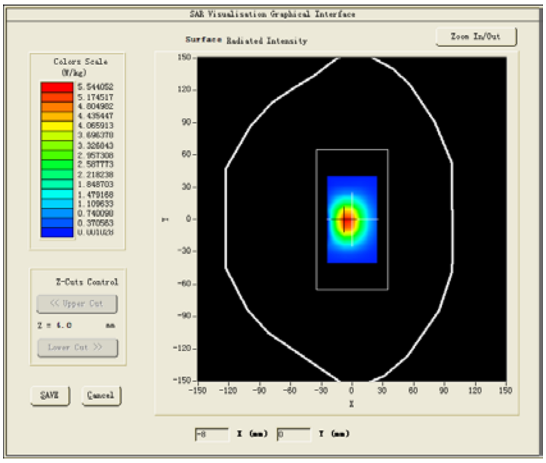
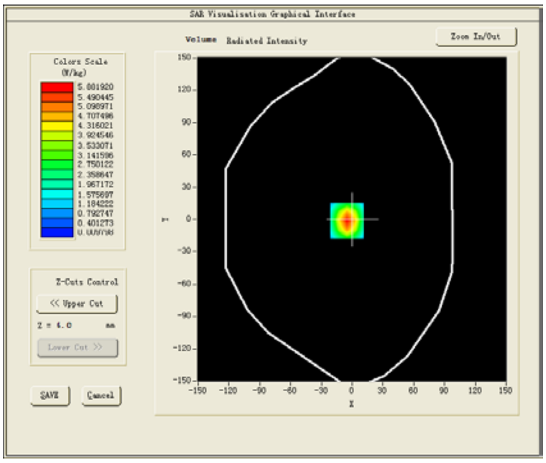
A. Experimental conditions.

Area Scan	dx=8mm dy=8mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. SAR Measurement Results

Middle Band SAR (Channel -1):

Frequency (MHz)	2450.000000
Relative permittivity (real part)	52.735699
Relative permittivity (imaginary part)	14.017300
Conductivity (S/m)	1.907910
Variation (%)	0.390000

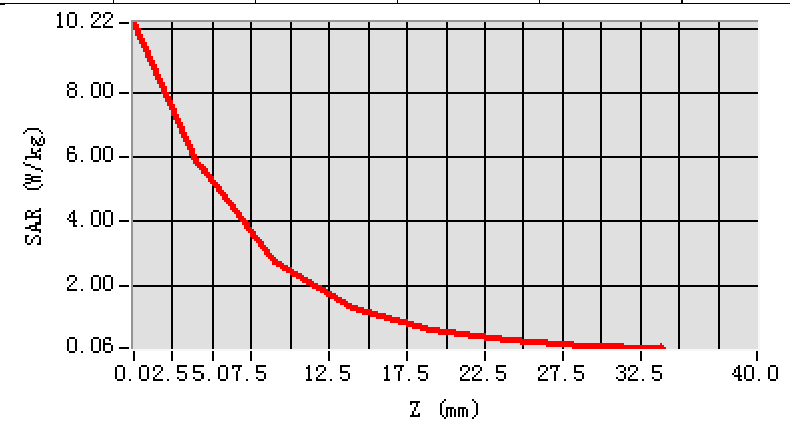
SURFACE SAR	VOLUME SAR
	

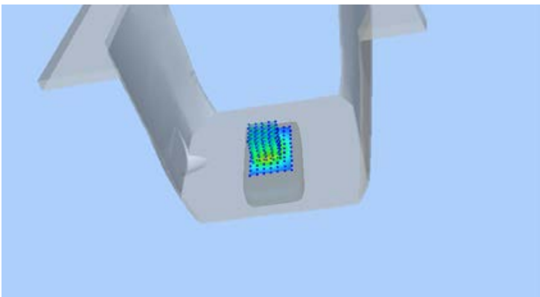
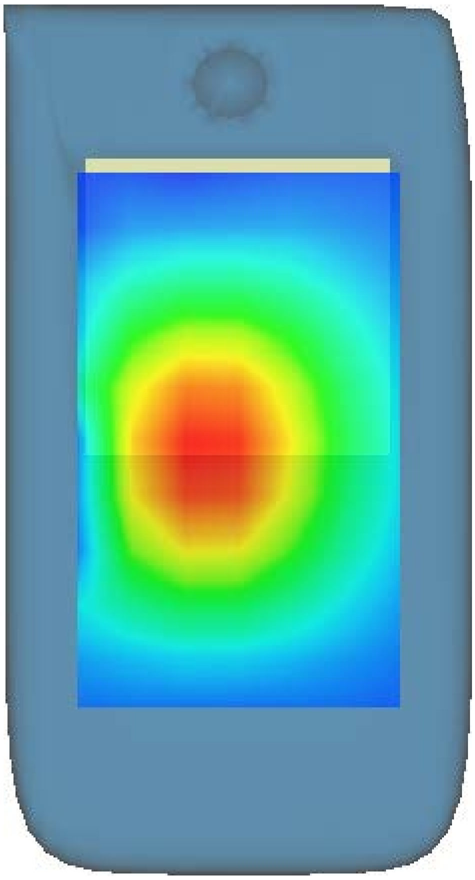
Maximum location: X=-5.00, Y=-1.00

SAR Peak: 10.96 W/kg

SAR 10g (W/Kg)	2.265453
SAR 1g (W/Kg)	5.363343

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	10.2188	5.8819	2.7478	1.3151	0.6266	0.2969	0.1341



3D screen shot	Hot spot position
	

MEASUREMENT 2

BODY

Type: Validation measurement (Complete)

Date of measurement: 28/10/2023

Measurement duration: 27 minutes 45 seconds

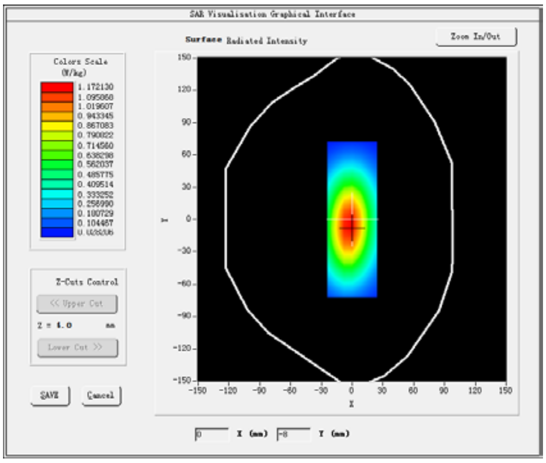
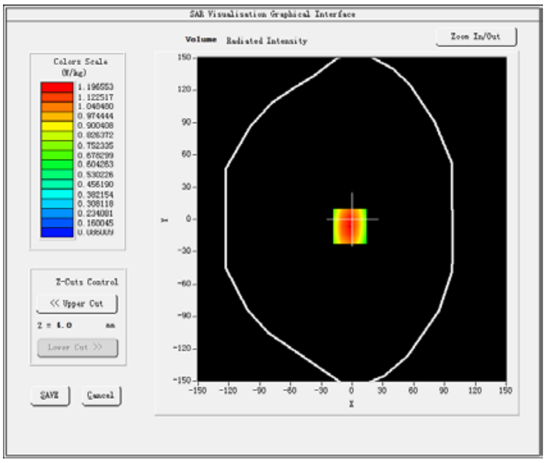
A. Experimental conditions.

Area Scan	dx=10mm dy=10mm
ZoomScan	8x8x7,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW5200
Channels	Middle
Signal	CW (Duty cycle:1:1)

B. SAR Measurement Results

Middle Band SAR (Channel -1):

Frequency (MHz)	5200.000000
Relative permittivity (real part)	50.422599
Relative permittivity (imaginary part)	18.202492
Conductivity (S/m)	5.26371
Variation (%)	0.270000

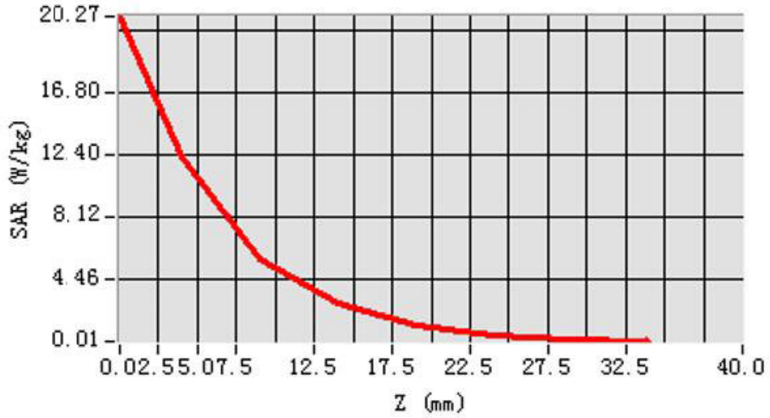
SURFACE SAR	VOLUME SAR
	

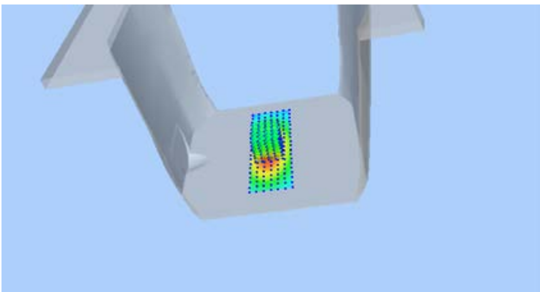
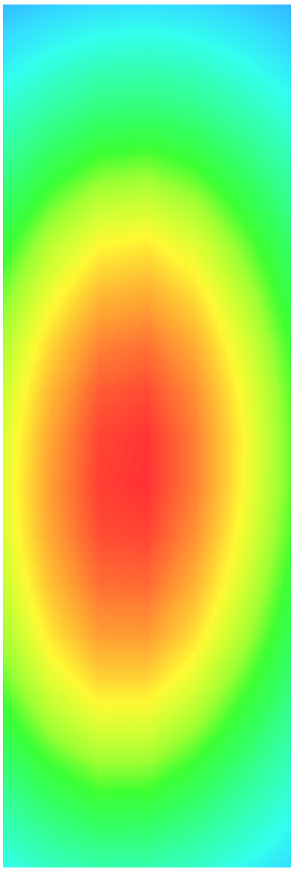
Maximum location: X=-2.00, Y=-6.00

SAR Peak: 20.27 W/kg

SAR 10g (W/Kg)	5.964061
SAR 1g (W/Kg)	16.7183141

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	20.2711	16.1966	12.7784	10.5196	8.1218	4.2403	1.1660



3D screen shot	Hot spot position
	

MEASUREMENT 3

BODY

Type: Validation measurement (Complete)

Date of measurement: 30/10/2024

Measurement duration: 29 minutes 31 seconds

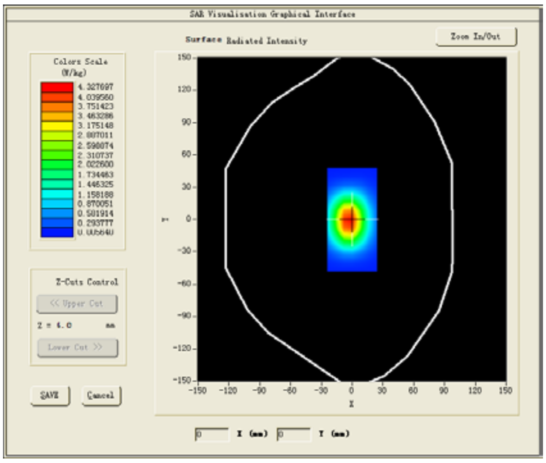
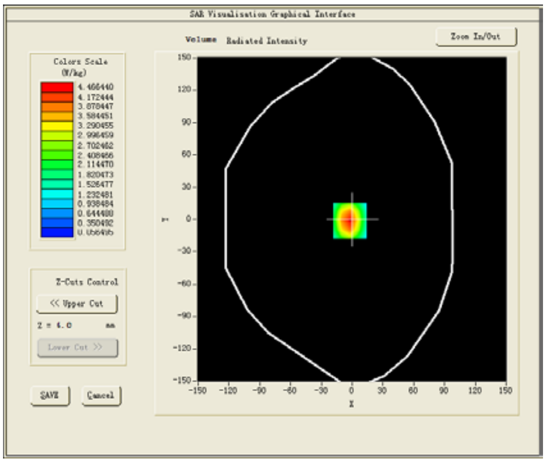
A. Experimental conditions.

Area Scan	dx=10mm dy=10mm
ZoomScan	8x8x7,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Waveguide
Band	CW5300
Channels	Middle
Signal	CW (Duty cycle:1:1)

B. SAR Measurement Results

Middle Band SAR (Channel -1):

Frequency (MHz)	5300.000000
Relative permittivity (real part)	47.944300
Relative permittivity (imaginary part)	18.167566
Conductivity (S/m)	5.353919
Variation (%)	-0.350000

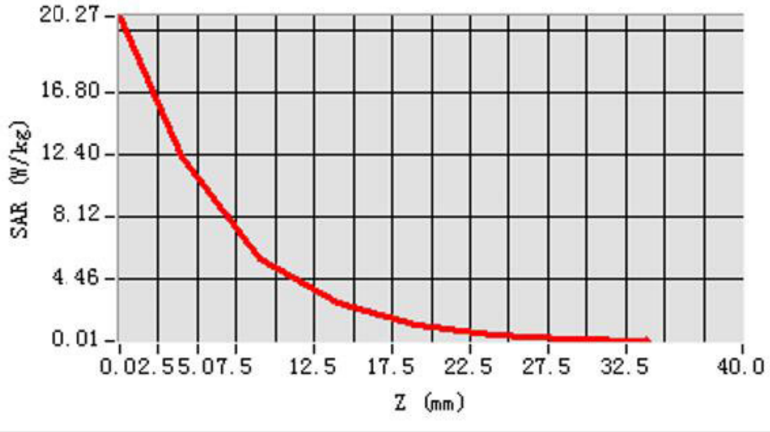
SURFACE SAR	VOLUME SAR
	

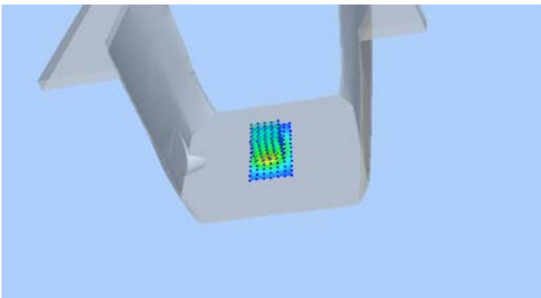
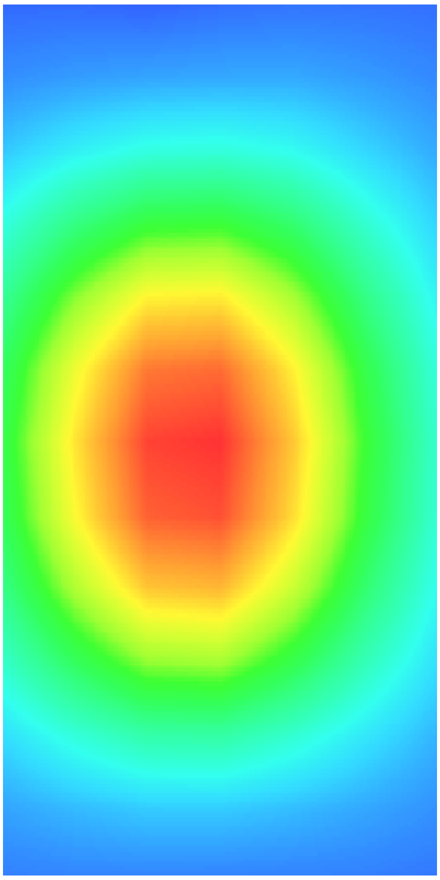
Maximum location: X=-2.00, Y=-1.00

SAR Peak: 20.27 W/kg

SAR 10g (W/Kg)	5.882155
SAR 1g (W/Kg)	16.537029

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	20.2697	16.4664	12.4603	10.3992	6.7963	4.4560	1.2601



3D screen shot	Hot spot position
	

MEASUREMENT 4

BODY

Type: Validation measurement (Complete)

Date of measurement: 01/11/2023

Measurement duration: 31 minutes 30 seconds

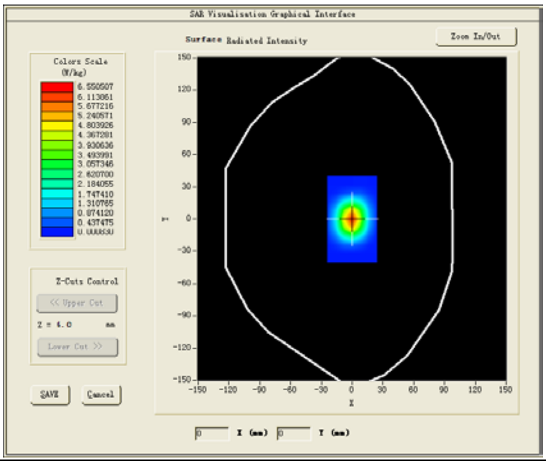
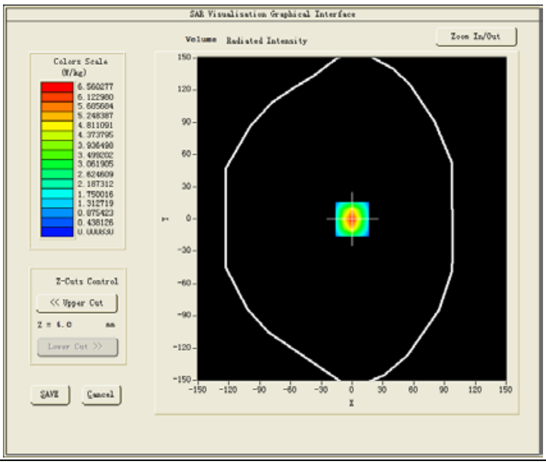
A. Experimental conditions.

Area Scan	dx=10mm dy=10mm
ZoomScan	8x8x7,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW5800
Channels	Middle
Signal	CW (Duty cycle:1:1)

B. SAR Measurement Results

Middle Band SAR (Channel -1):

Frequency (MHz)	5800.000000
Relative permittivity (real part)	48.090699
Relative permittivity (imaginary part)	19.043921
Conductivity (S/m)	6.14163
Variation (%)	0.010000

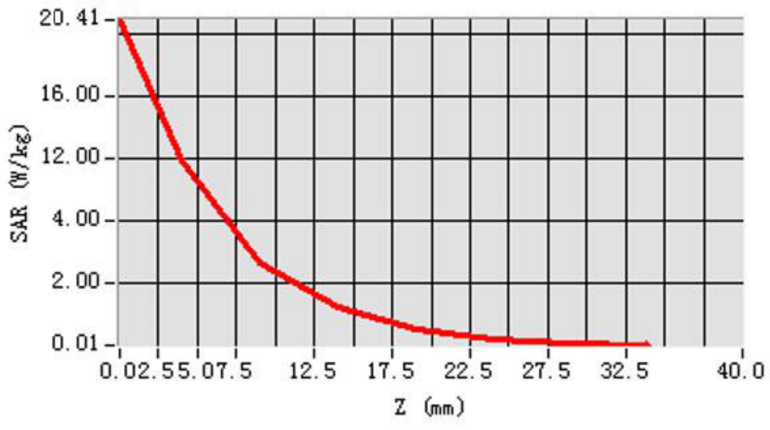
SURFACE SAR	VOLUME SAR
	

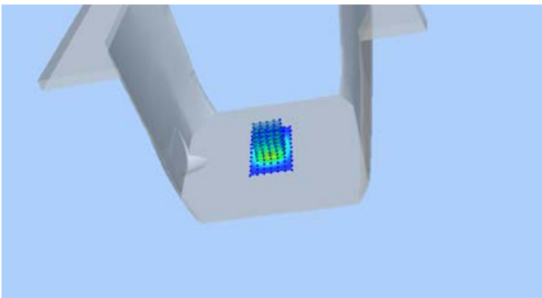
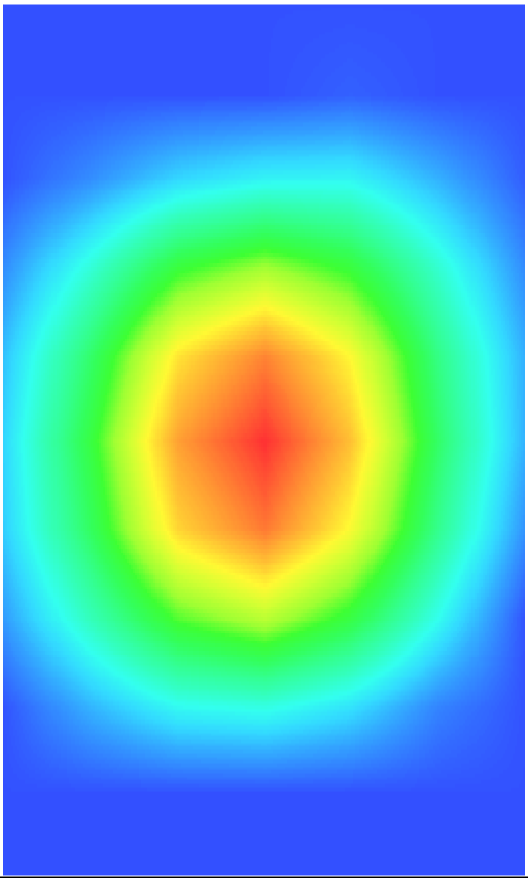
Maximum location: X=0.00, Y=0.00

SAR Peak: 20.41 W/kg

SAR 10g (W/Kg)	6.080196
SAR 1g (W/Kg)	17.965831

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	20.4140	16.5603	12.8797	8.2004	4.4226	2.1066	1.0008



3D screen shot	Hot spot position
	

Annex B: Measurement Results

Tested Model :T1001W

Report Number:

WSCT-ANAB-R&E241000052A-SAR

MEASUREMENT 1

Front-side

Type: Phone measurement (Complete)

Date of measurement:24/10/2024

Measurement duration: 9 minutes 11 seconds

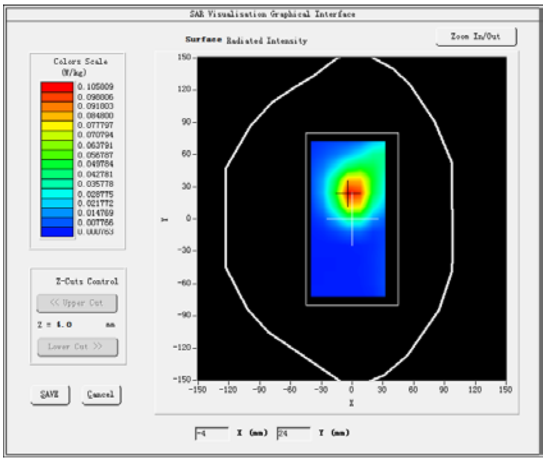
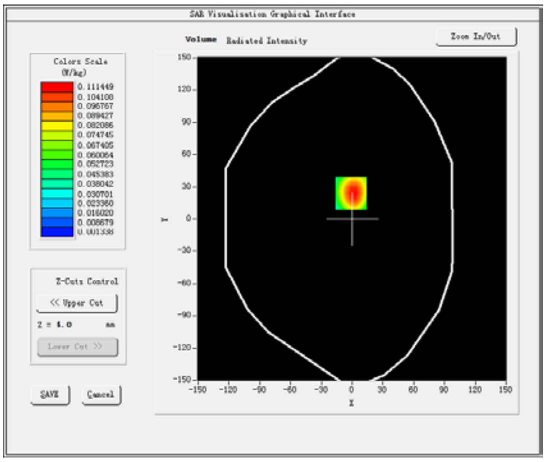
A. Experimental conditions.

Area Scan	dx=15mm dy=15mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11n ISM
Channels	Middle
Signal	IEEE802.b (Crest factor: 1.0)

B. SAR Measurement Results

Middle Band SAR (Channel 9):

Frequency (MHz)	2452.000000
Relative permittivity (real part)	52.756401
Relative permittivity (imaginary part)	14.076200
Conductivity (S/m)	1.909671
Variation (%)	-1.680000

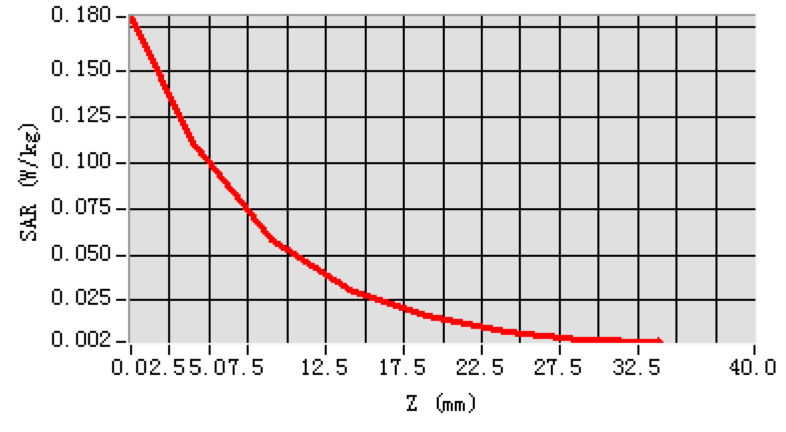
SURFACE SAR	VOLUME SAR
	

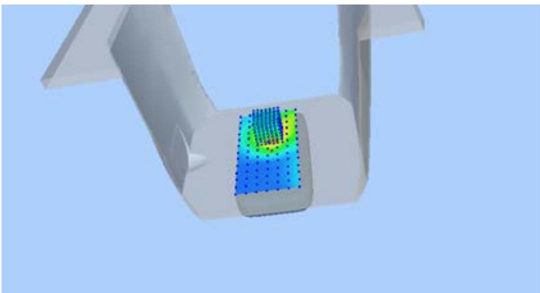
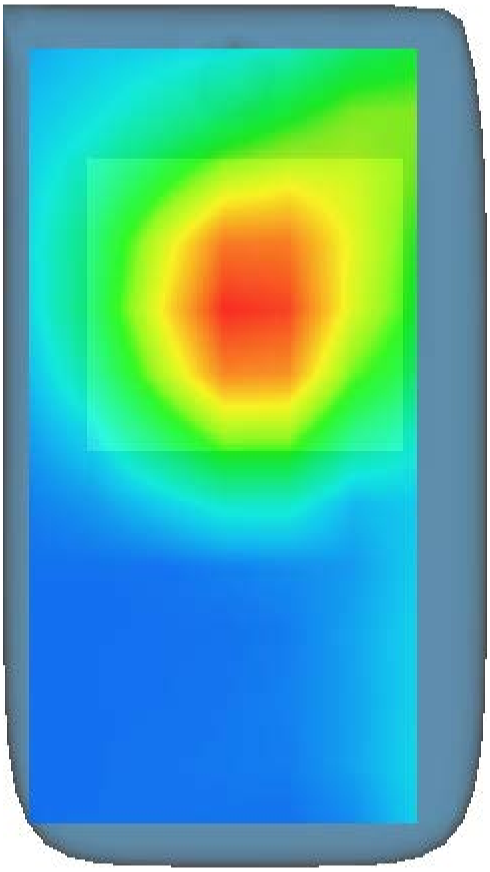
Maximum location: X=-1.00, Y=24.00

SAR Peak: 0.76 W/kg

SAR 10g (W/Kg)	0.315451
SAR 1g (W/Kg)	0.736605

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1801	0.1114	0.0587	0.0309	0.0161	0.0083	0.0040



3D screen shot	Hot spot position
	

MEASUREMENT 2

Front-side

Type: Phone measurement (Complete)

Date of measurement: 28/10/2024

Measurement duration: 10 minutes 44 seconds

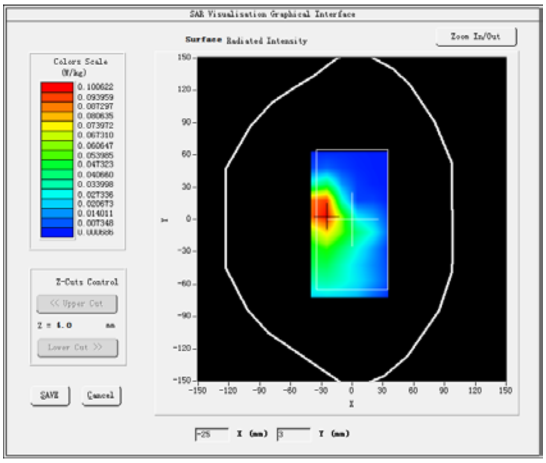
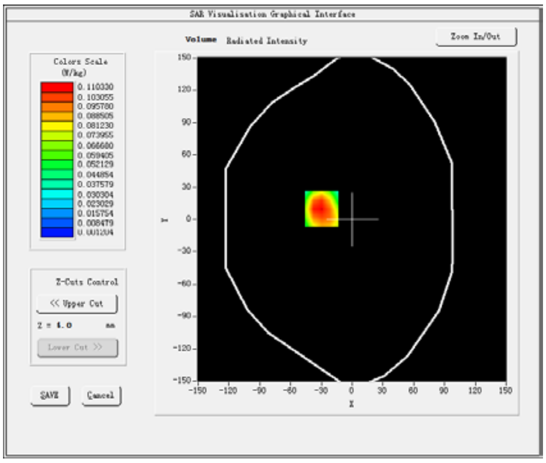
A. Experimental conditions.

Area Scan	dx=10mm dy=10mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a U-NII-1
Channels	Middle
Signal	Duty cycle:1:1

B. SAR Measurement Results

Lower Band SAR (Channel 36):

Frequency (MHz)	5180.000000
Relative permittivity (real part)	49.858526
Relative permittivity (imaginary part)	17.828438
Conductivity (S/m)	5.194532
Variation (%)	4.760000

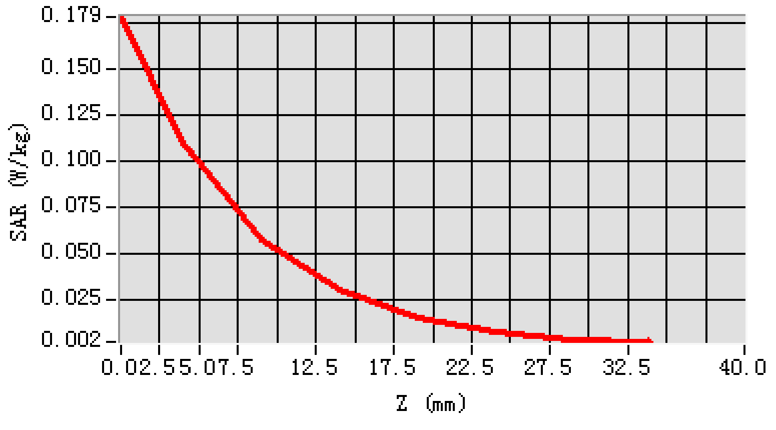
SURFACE SAR	VOLUME SAR
	

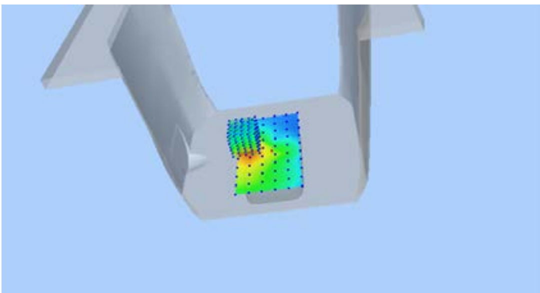
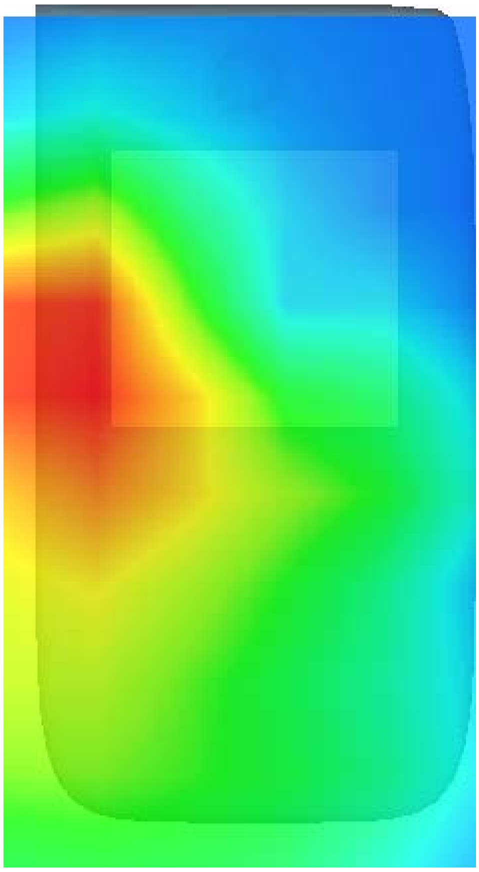
Maximum location: X=-30.00, Y=10.00

SAR Peak: 0.75 W/kg

SAR 10g (W/Kg)	0.277158
SAR 1g (W/Kg)	0.692010

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1788	0.1103	0.0576	0.0303	0.0156	0.0075	0.0040



3D screen shot	Hot spot position
	

MEASUREMENT 3

Front-side

Type: Phone measurement (Complete)

Date of measurement: 29/10/2024

Measurement duration: 16 minutes 21 seconds

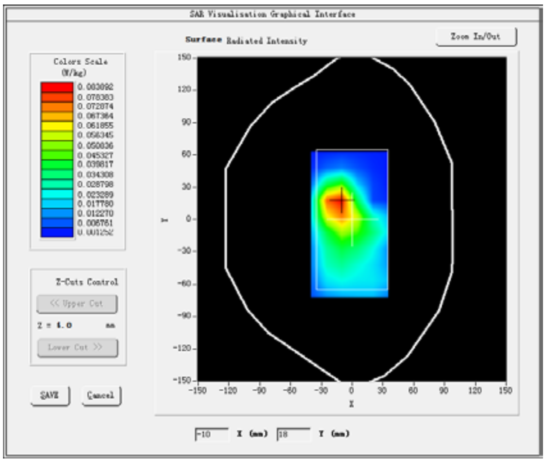
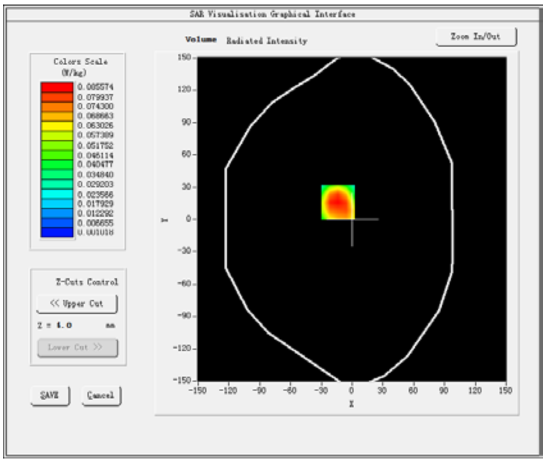
A. Experimental conditions.

Area Scan	dx=10mm dy=10mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a U-NII-2a
Channels	Middle
Signal	Duty cycle:1:1

B. SAR Measurement Results

Middleer Band SAR (Channel 64):

Frequency (MHz)	5320.000000
Relative permittivity (real part)	48.139400
Relative permittivity (imaginary part)	19.154900
Conductivity (S/m)	6.205808
Variation (%)	2.330000

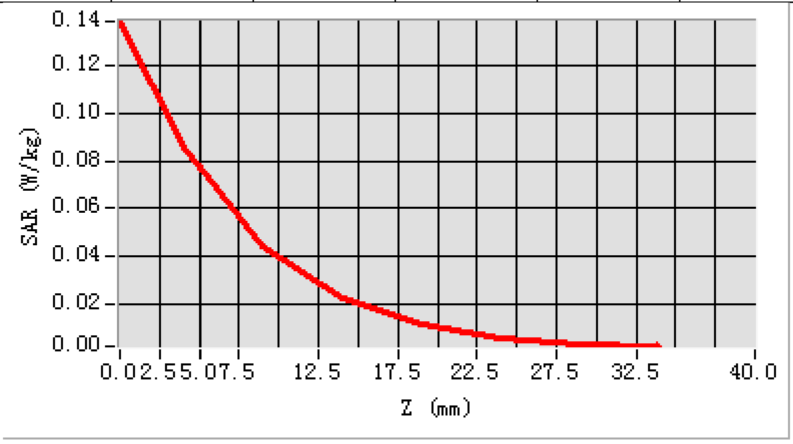
SURFACE SAR	VOLUME SAR
	

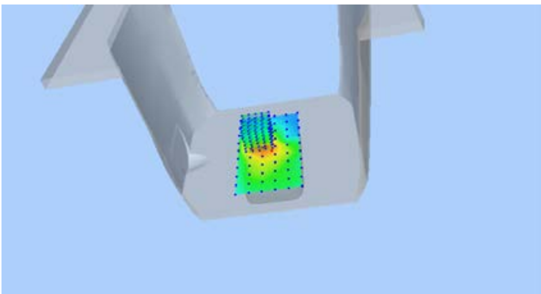
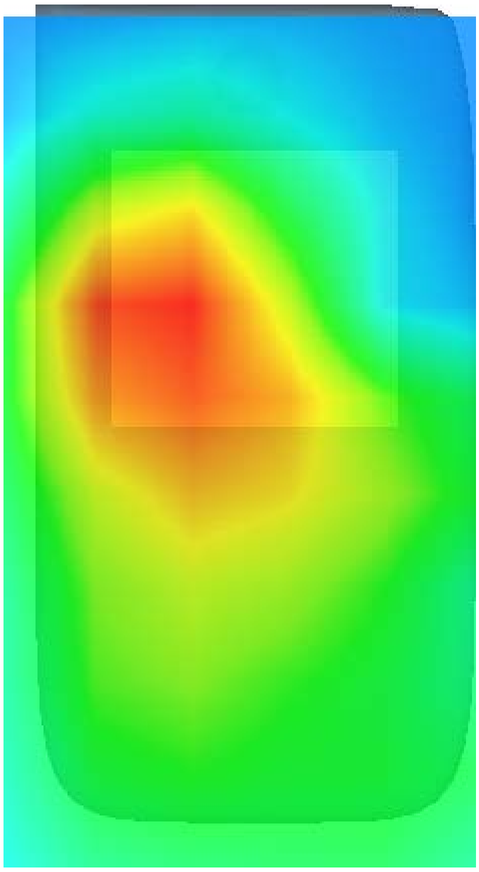
Maximum location: X=-14.00, Y=16.00

SAR Peak: 0.72 W/kg

SAR 10g (W/Kg)	0.277715
SAR 1g (W/Kg)	0.694590

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1388	0.0856	0.0441	0.0224	0.0109	0.0049	0.0027



3D screen shot	Hot spot position
	

MEASUREMENT 4

Front-side

Type: Phone measurement (Complete)

Date of measurement: 30/10/2024

Measurement duration: 16 minutes 21 seconds

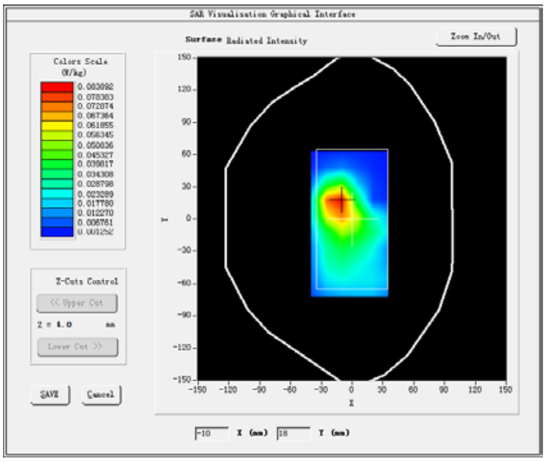
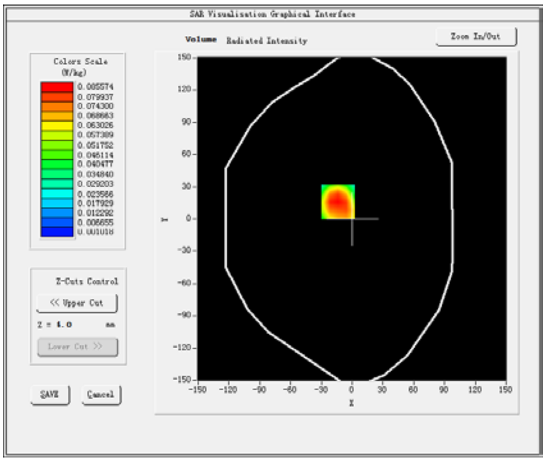
A. Experimental conditions.

Area Scan	dx=10mm dy=10mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a U-NII-2c
Channels	Middle
Signal	Duty cycle:1:1

B. SAR Measurement Results

Middleer Band SAR (Channel 140):

Frequency (MHz)	5700.000000
Relative permittivity (real part)	48.139400
Relative permittivity (imaginary part)	19.154900
Conductivity (S/m)	6.205808
Variation (%)	1.940000

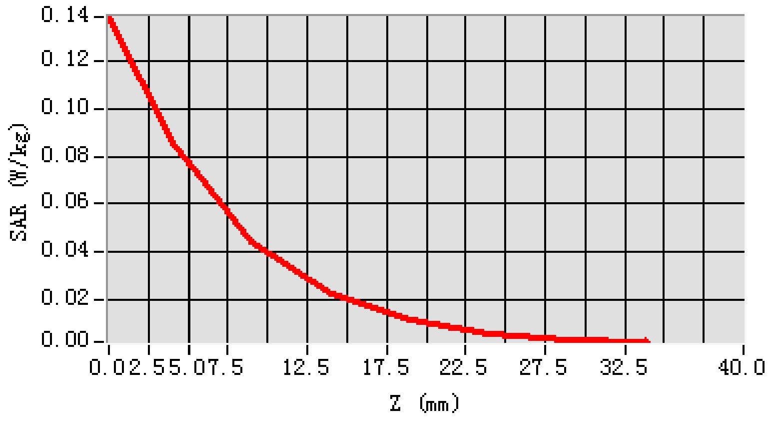
SURFACE SAR	VOLUME SAR
	

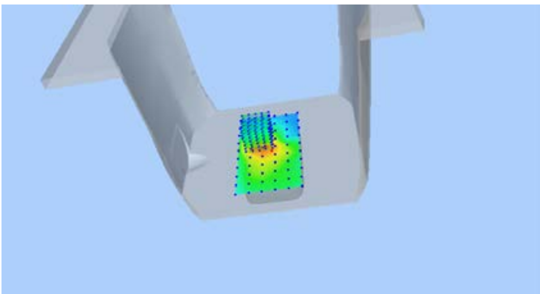
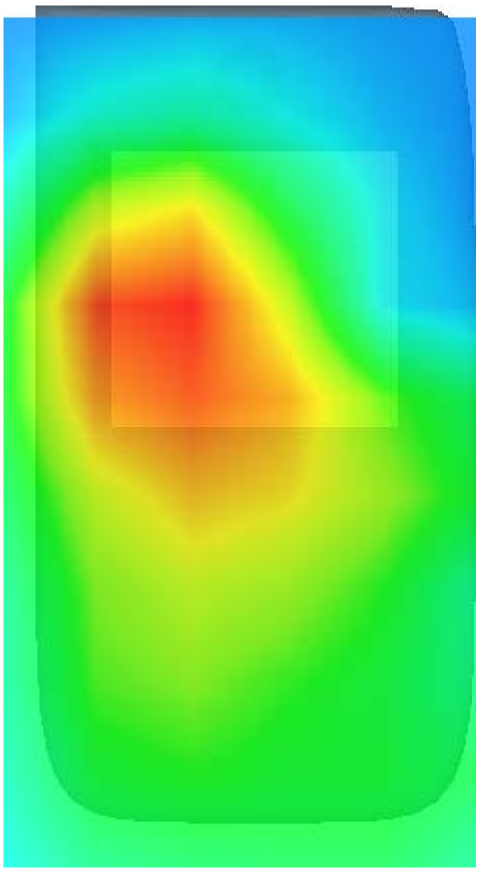
Maximum location: X=-14.00, Y=16.00

SAR Peak: 0.72 W/kg

SAR 10g (W/Kg)	0.274021
SAR 1g (W/Kg)	0.688620

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1388	0.0856	0.0441	0.0224	0.0109	0.0049	0.0027



3D screen shot	Hot spot position
	

MEASUREMENT 5

Front-side

Type: Phone measurement (Complete)

Date of measurement: 01/11/2024

Measurement duration: 8 minutes 31 seconds

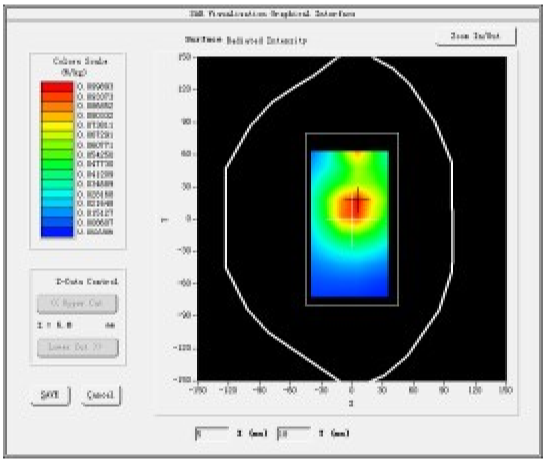
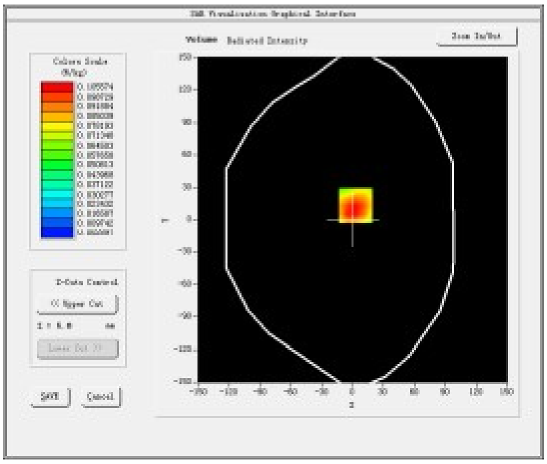
A. Experimental conditions.

Area Scan	dx=10mm dy=10mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a U-NII-3
Channels	Middle
Signal	Duty cycle:1:1

B. SAR Measurement Results

Middleer Band SAR (Channel 165):

Frequency (MHz)	5825.000000
Relative permittivity (real part)	48.235748
Relative permittivity (imaginary part)	19.060800
Conductivity (S/m)	6.173560
Variation (%)	-2.160000

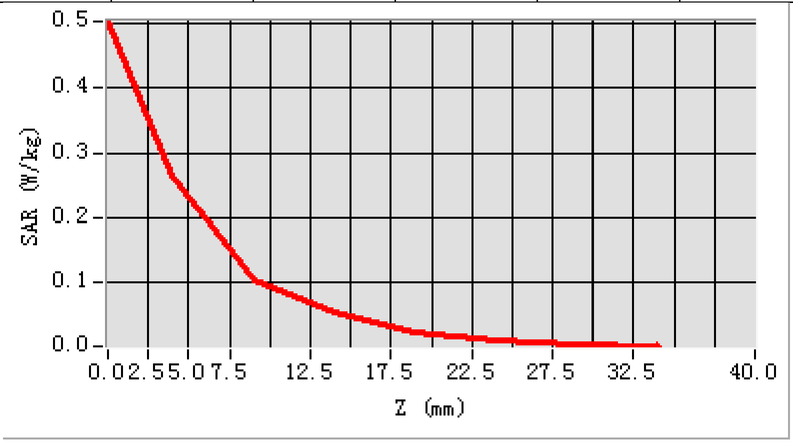
SURFACE SAR	VOLUME SAR
	

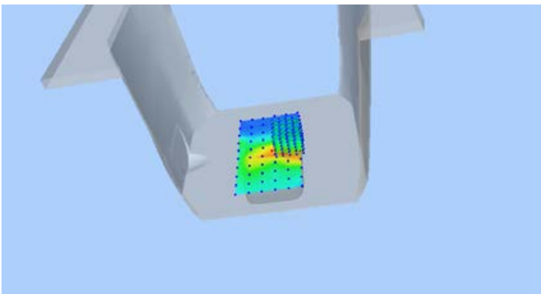
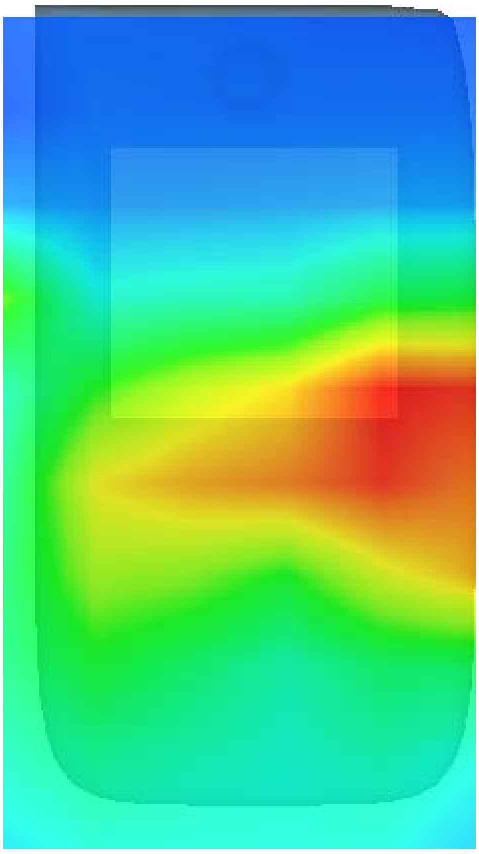
Maximum location: X=3.00, Y=13.00

SAR Peak: 0.71 W/kg

SAR 10g (W/Kg)	0.265351
SAR 1g (W/Kg)	0.686410

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.5035	0.2644	0.1036	0.0539	0.0226	0.0107	0.0050



3D screen shot	Hot spot position
	

MEASUREMENT 6

Front-side

Type: Phone measurement (Complete)

Date of measurement: 25/10/2024

Measurement duration: 13 minutes 55 seconds

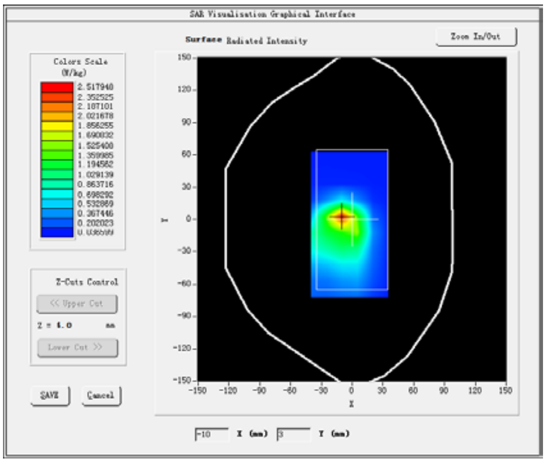
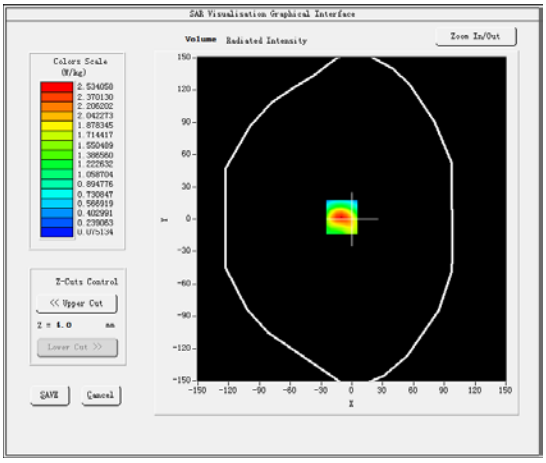
A. Experimental conditions.

Area Scan	dx=15mm dy=15mm
ZoomScan	7x7x8,dx=5mm dy=5mm dz=4mm,Complete
Phantom	Validation plane
Device Position	Body
Band	Bluetooth
Channels	Middle
Signal	WCDMA (Crest factor: 1.0)

B. SAR Measurement Results

Middle Band SAR (Channel 39):

Frequency (MHz)	2441.000000
Relative permittivity (real part)	39.211102
Relative permittivity (imaginary part)	15.961500
Conductivity (S/m)	1.729163
Variation (%)	4.340000

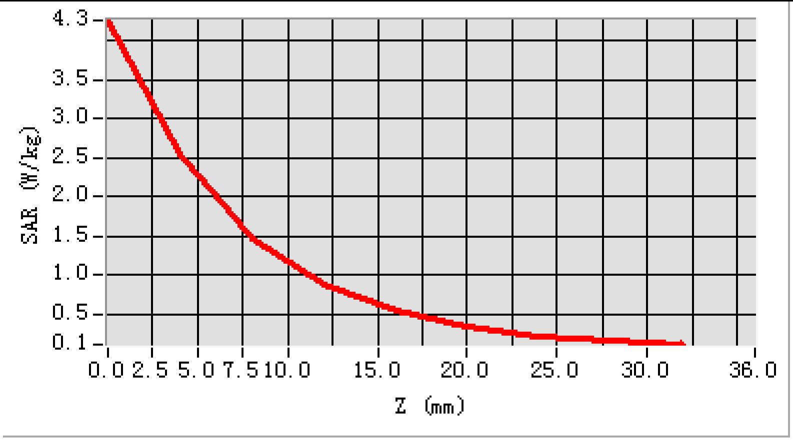
SURFACE SAR	VOLUME SAR
	

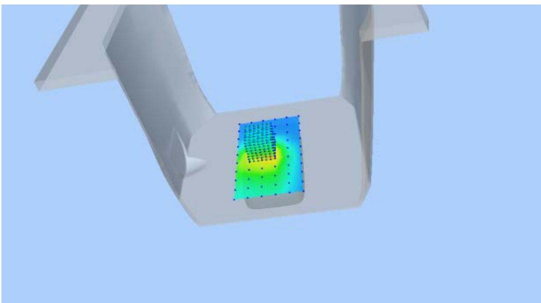
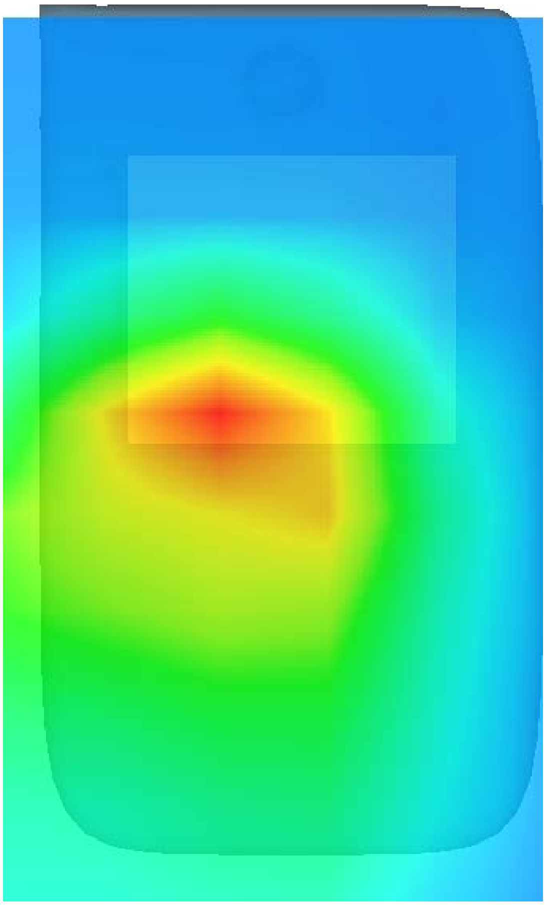
Maximum location: X=-10.00, Y=2.00

SAR Peak: 0.092 W/kg

SAR 10g (W/Kg)	0.026355
SAR 1g (W/Kg)	0.062044

Z (mm)	0.00	4.00	8.00	12.00	16.00	20.00	24.00	28.00
SAR (W/Kg)	4.2605	2.5341	1.4640	0.8736	0.5382	0.3384	0.2192	0.1509



3D screen shot	Hot spot position
	

SATIMO	Annex C: Calibration Reports
	Tested Model : T1001W
	Report Number: WSCT-ANAB-R&E241000052A-SAR

SAR Reference Dipole Calibration Report

Ref : ACR.313.16.23.BES.A

WORLD STANDARDIZATION CERTIFICATION & TESTING GROUP CO .,LTD
BLOCK A, BAO SHI SCIENCE PARK,BAO SHI ROAD, BAO'AN DISTRICT
SHENZHEN 518108,P.R. CHINA
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 2450 MHZ
SERIAL NO.: 3723-DIP2G450-738

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

Calibration date: 09/11/2023

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

Summary:

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

	Name	*Function*	*Date*	*Signature*
Prepared by :	Cyrille ONNEE	Measurement Responsible	11/9/2023	
Checked & approved by:	Jérôme Luc	Technical Manager	11/9/2023	
Authorized by:	Yann Toutain	Laboratory Director	11/9/2023	Yann TOUTAIN

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2023.11.09 16:44:40 +01'00'

	Customer Name
Distribution :	World Standardization Certification & Testing Group Co .,Ltd

Issue	*Name*	*Date*	*Modifications*
A	Cyrille ONNEE	11/9/2023	Initial release

TABLE OF CONTENTS

1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2450 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2450
Serial Number	3723-DIP2G450-738
Product Condition (new / used)	New

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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

Figure 1 – *MVG COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

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

4.2 S11 PARAMETER REQUIREMENTS

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

4.3 SAR REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

5.1 MECHANICAL DIMENSIONS

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

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

5.2 S11 PARAMETER

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

5.3 SAR

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

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

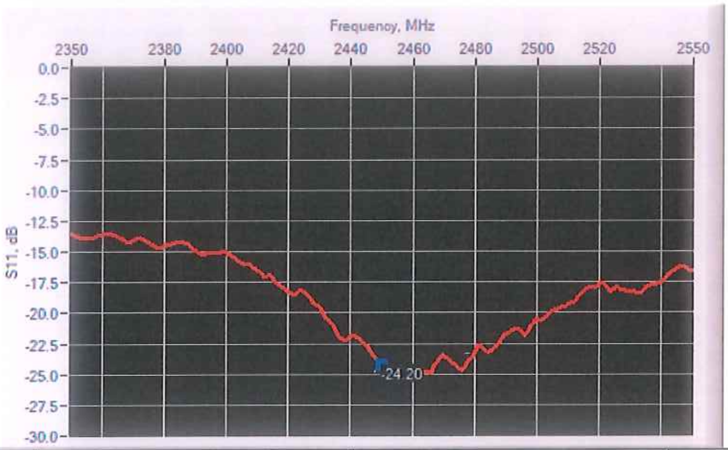
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
51.74	51.50 +/- 2%	30.50	30.40 +/- 2%	3.60	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2450	-24.20	-20	46.4Ω + 4.7jΩ

6.3 SAR

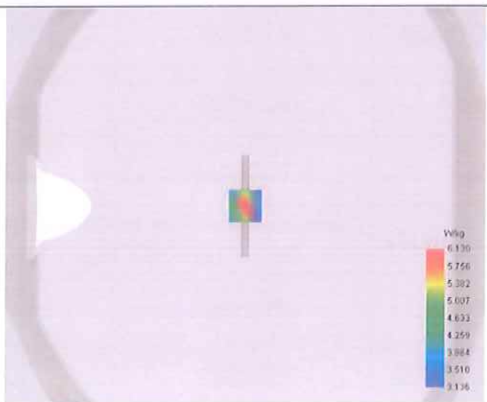
The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom,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

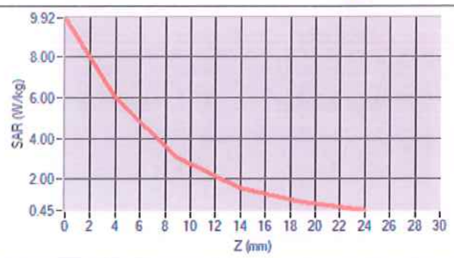
6.3.1 SAR with Head Liquid

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

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPGO333
Liquid	Head Liquid Values: eps' : 42.8 sigma : 1.87
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
2450 MHz	5.33	53.30	52.40	2.51	25.11	24.00





7 LIST OF EQUIPMENT

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

SAR Reference Dipole Calibration Report

Ref : ACR.353.22.23.BES.A

WORLD STANDARDIZATION CERTIFICATION & TESTING GROUP CO .,LTD
BLOCK A, BAO SHI SCIENCE PARK,BAO SHI ROAD, BAO'AN DISTRICT
SHENZHEN 518108,P.R. CHINA
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 5200-5800 MHZ
SERIAL NO.: 3723-DIP5G000-745

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

Calibration date: 12/19/2023

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

Summary:

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