

TEST REPORT

Report No.: BCTC2506590493E

Applicant: Shenzhen Tianruixiang Communication
Equipment Co.,LTD

Product Name: Smart Phone

Test Model: Panther 2

Tested Date: 2025-06-05 to 2025-07-08

Issued Date: 2025-07-09

Shenzhen BCTC Testing Co., Ltd.



FCC ID: 2BOJC-PANTHER2

Product Name: Smart Phone

Trademark: LAGENIO 

Model/Type Reference: Panther 2
Panther 2 PRO

Prepared For: Shenzhen Tianruixiang Communication Equipment Co.,LTD

Address: 12/F, Building B, Longhua Digital Innovation Center, Longhua District Shenzhen.
China

Manufacturer: Shenzhen Tianruixiang Communication Equipment Co.,LTD

Address: 12/F, Building B, Longhua Digital Innovation Center, Longhua District Shenzhen.
China

Prepared By: Shenzhen BCTC Testing Co., Ltd.

Address: 1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng,
Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

Sample Received Date: 2025-06-05

Sample tested Date: 2025-06-05 to 2025-07-08

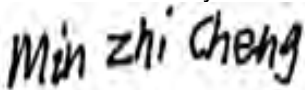
Issue Date: 2025-07-09

Test Standards: IEEE Std C95.1-2019
IEEE Std 1528-2013
FCC Part 2.1093

Test Results: PASS

Remark: This is SAR test report

Tested by:



Min Zhi Cheng / Project Handler

Approved by:



Zero Zhou / Reviewer

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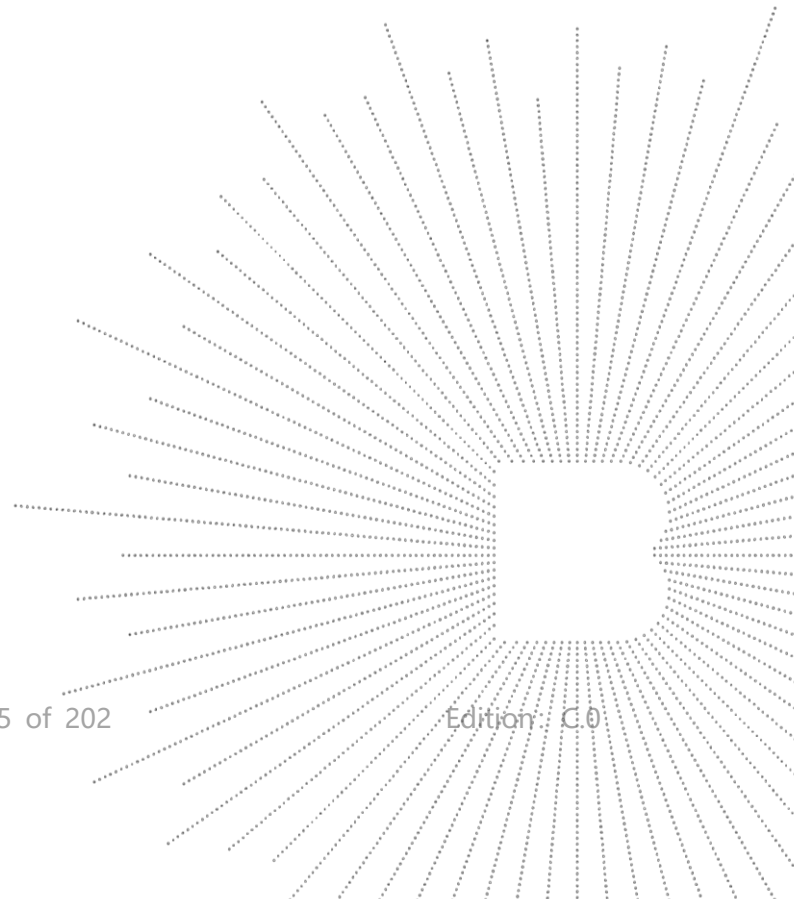
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(Note: N/A Means Not Applicable)

1. Version

Report No.	Issue Date	Description	Approved
BCTC2506590493E	2025-07-09	Original	Valid



2. Test Standards

IEEE Std C95.1-2019: IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0Hz to 300GHz. It specifies the maximum exposure limit of 1.6W/kg as averaged over any 1gram of tissue for portable devices being used within 20cm of the user in the uncontrolled environment.

IEEE Std 1528-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

FCC Part 2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices

KDB 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

KDB 865664 D01 SAR Measurement 100MHz to 6GHz v01r04: SAR Measurement Requirements for 100MHz to 6GHz

KDB 865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

KDB 248227 D01 802.11 Wi-Fi SAR v02r02: SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS

KDB 941225 D01 3G SAR Procedures: 3G SAR MEAUREMENT PROCEDURES

KDB 941225 D05 SAR for LTE Devices: SAR EVALUATION CONSIDERATIONS FOR LTE DEVICES

KDB 941225 D06 Hotspot Mode v02r01: SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES

KDB 648474 D04 Handset SAR v01r03: SAR EVALUATION CONSIDERATIONS FOR WIRELESS HANDSETS

3. Test Summary

The maximum results of Specific Absorption Rate (SAR) have found during testing are as follows:

Frequency Band	Maximum SAR _{1g} (W/kg)			Limit SAR _{1g} (W/kg)
	Head	Body (10mm Gap)	Hotspot (10mm Gap)	
Bluetooth	0.075	0.075	/	1.6
WIFI 2.4G	0.199	0.236	0.155	
WIFI 5G	0.711	0.439	0.395	
GSM	0.200	0.363	0.263	
WCDMA	0.348	0.511	0.458	
LTE	0.291	0.481	0.494	
Simultaneous Transmission	0.958	0.906	0.783	

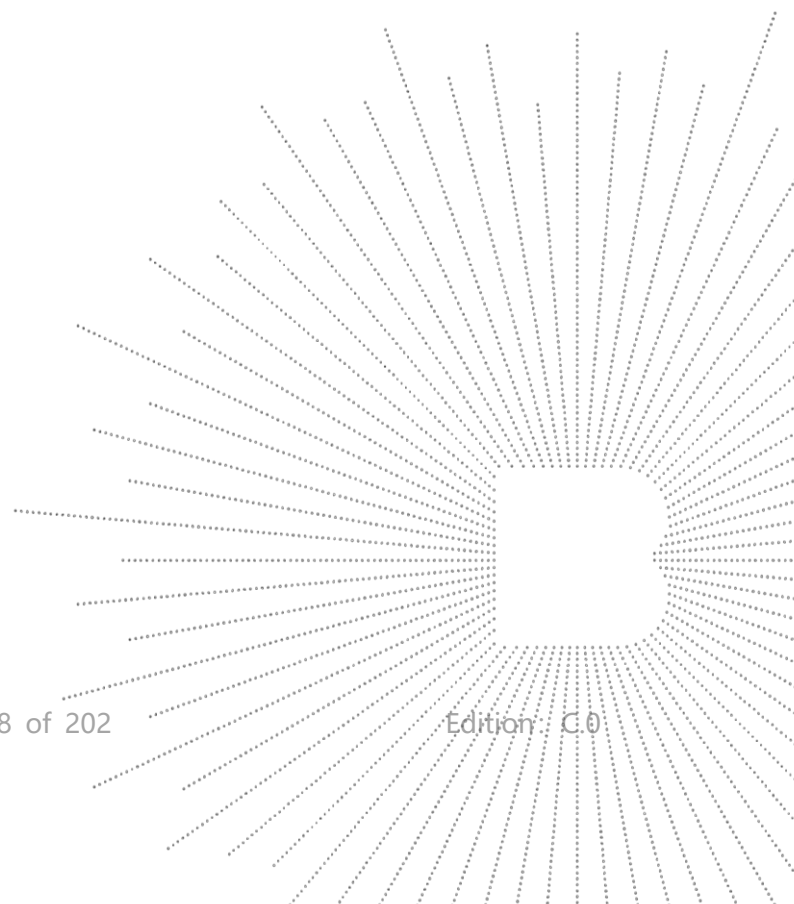
The device in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2019, and had been tested in accordance with the measurement methods and procedure specified in IEEE 1528-2013.

4. SAR Limits

Exposure Limits	SAR (W/kg)	
	General Population	Occupational
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (Averaged over any 1g of tissue)	1.6	8.0
Spatial Peak (Hand/wrist/foot/ankle average over 10g)	4.0	20.0

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

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



5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be $\leq 30\%$, for a confidence interval of $k=2$. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

Therefore, the measurement uncertainty is not required.

6. Product Information and Test Setup

6.1 Product Information

Model/Type reference: Panther 2
Panther 2 PRO

Model differences: All the circuit and RF modules are the same, only the model names and colors are different.

Bluetooth Version: 5.2

Hardware Version: SC6035LU

Software Version: LAGENIO_Panther2_V07_20250629

Ratings: DC 9V from adapter/DC 3.87V from battery
Model: QZ-0180AA2H
Input: 100-240V~50/60Hz 0.5A
Output: DC 5.0V 3.0A 15.0W or DC 9.0V 2.22A 20.0W Max.
or DC 12.0V 1.67A 20.0W Max.

Adapter Information:

BDR, EDR

Operation Frequency: 2402-2480MHz

Type of Modulation: GFSK, $\pi/4$ DQPSK, 8DPSK

Number Of Channel: 79CH

Antenna installation: Internal antenna
0.23 dBi

Antenna Gain: Remark:
☐ The antenna gain of the product comes from the antenna report provided by the customer, and the test data is affected by the customer information.
☒ The antenna gain of the product is provided by the customer, and the test data is affected by the customer information.

BLE

Operation Frequency: 2402-2480MHz

Type of Modulation: GFSK

Number Of Channel: 40CH

Antenna installation: Internal antenna
0.23 dBi

Antenna Gain: Remark:
☐ The antenna gain of the product comes from the antenna report provided by the customer, and the test data is affected by the customer information.
☒ The antenna gain of the product is provided by the customer, and the test data is affected by the customer information.

NFC

Operation Frequency: 13.56 MHz

Modulation Type: ASK

Number Of Channel: 1 CH

Antenna installation: Internal Antenna

Antenna Gain: 0 dBi

WIFI 2.4G

Operation Frequency:	802.11b/g/n20MHz:2412~2462 MHz 802.11n40MHz:2422~2452 MHz
Bit Rate of Transmitter	802.11b:11/5.5/2/1 Mbps 802.11g:54/48/36/24/18/12/9/6Mbps 802.11n Up to 150Mbps
Type of Modulation:	OFDM/DSSS
Number Of Channel	802.11b/g/n20MHz:11 CH 802.11n40MHz: 7 CH
Antenna installation:	Internal antenna 0.23 dBi
Antenna Gain:	Remark: <input type="checkbox"/> The antenna gain of the product comes from the antenna report provided by the customer, and the test data is affected by the customer information. <input checked="" type="checkbox"/> The antenna gain of the product is provided by the customer, and the test data is affected by the customer information.

WIFI 5G

IEEE 802.11 WLAN Mode Supported	802.11a/n/ac(20MHz channel bandwidth) 802.11n/ac(40MHz channel bandwidth) 802.11ac(80MHz channel bandwidth)
Operation Frequency:	5180-5240MHz for 802.11a/n(HT20)/ac(HT20); 5190-5230MHz for 802.11n(HT40)/ac(HT40); 5210MHz for 802.11 ac(HT80); 5745-5825 MHz for 802.11a/n(HT20)/ac(HT20); 5755-5795 MHz for 802.11n(HT40)/ac(HT40); 5775MHz for 802.11 ac(HT80);
Data Rate	802.11a: 6,9,12,18,24,36,48,54Mbps; 802.11n(HT20/HT40):MCS0-MCS15; 802.11ac(VHT20): NSS1, MCS0-MCS8 802.11ac(VHT40/VHT80):NSS1, MCS0-MCS
Type of Modulation:	OFDM with BPSK/QPSK/16QAM/64QAM/256QAM for 802.11a/n/ac; 4 channels for 802.11a/n20/ac20 in the 5180-5240MHz band ; 2 channels for 802.11 n40/ac40 in the 5190-5230MHz band ;
Number Of Channel	1 channels for 802.11 ac80 in the 5210MHz band ; 5 channels for 802.11a/n20/ac20 in the 5745-5825MHz band ; 2 channels for 802.11 n40/ac40 in the 5755-5795MHz band ; 1 channels for 802.11 ac80 in the 5775MHz band.
Antenna installation:	Internal antenna 0.30 dBi
Antenna Gain:	Remark: <input type="checkbox"/> The antenna gain of the product comes from the antenna report provided by the customer, and the test data is affected by the customer information. <input checked="" type="checkbox"/> The antenna gain of the product is provided by the customer, and the test data is affected by the customer information.

2G, 3G

Operation Frequency:

GSM/GPRS/EGPRS 850: TX: 824~849MHz; RX: 869~894MHz;
GSM/GPRS/EGPRS 1900: TX:1850~1910MHz; RX:1930~1990MHz;
WCDMA Band II: TX: 1852.40~1907.60MHz; Rx: 1932.60~1987.40MHz;
WCDMA Band IV: TX: 1712.40~1752.60MHz; RX: 2112.60 – 2452.40MHz
WCDMA Band V: TX: 826.40~846.60MHz; RX: 871.40~ 891.60MHz;

GPRS Class:

Class 12

Max RF Output Power:

GSM/GPRS/EGPRS 850: 34.51 dBm,
GSM/GPRS/EGPRS 1900: 27.98 dBm
WCDMA Band II: 21.81 dBm
WCDMA Band IV: 21.86 dBm
WCDMA Band V: 23.95 dBm

Type of Modulation:

GSM with GMSK Modulation
WCDMA Mode with BPSK Modulation
HSDPA Mode with QPSK, 16QAM Modulation
HSUPA Mode with QPSK, 16QAM Modulation

Type of Emission:

GSM/GPRS 850: 242KGXW
EGPRS 850:247KG7W
GSM/GPRS 1900: 246KGXW
EGPRS 1900:251KG7W
WCDMA Band II: 4M16F9W
WCDMA Band IV: 4M16F9W
WCDMA Band V: 4M16F9W

Antenna installation:

Internal antenna

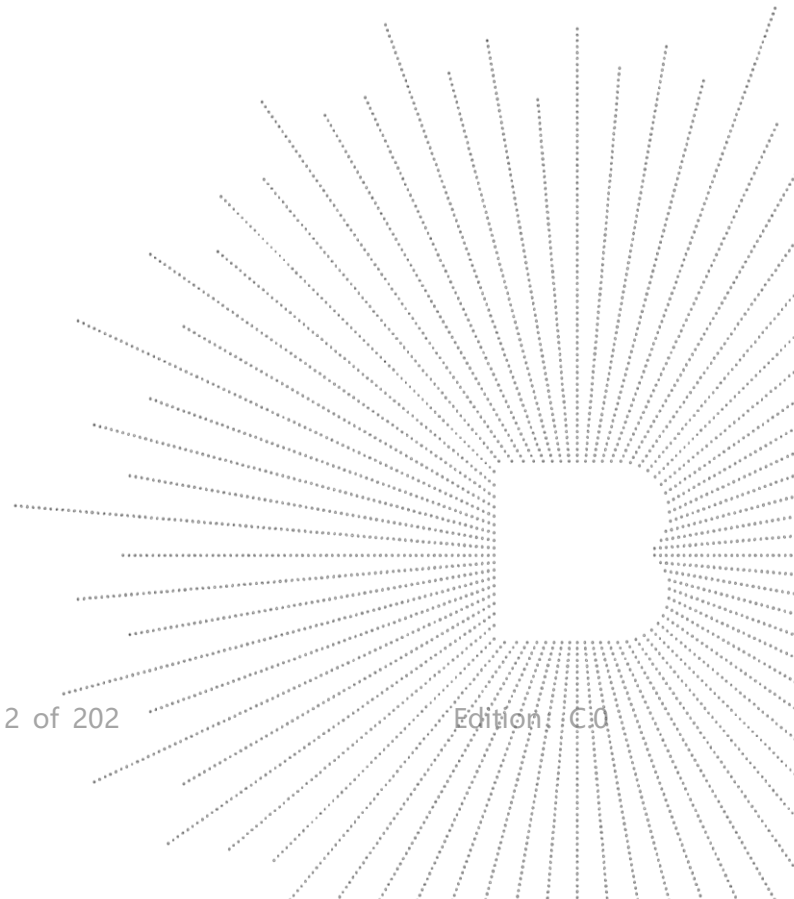
Antenna Gain:

GSM850: -2.20 dBi
GSM1900: 0.13 dBi
WCDMA Band II: 0.13 dBi
WCDMA Band IV: 0.21 dBi
WCDMA Band V: -2.20 dBi

Remark:

- ☐ The antenna gain of the product comes from the antenna report provided by the customer, and the test data is affected by the customer information.
☒ The antenna gain of the product is provided by the customer, and the test data is affected by the customer information.

C0.LTD



4G

Tx Frequency:

LTE Band 2: 1850 MHz ~ 1910 MHz
 LTE Band 4: 1710 MHz ~ 1755 MHz
 LTE Band 5: 824 MHz ~ 849 MHz
 LTE Band 7: 2500MHz-2570MHz
 LTE Band 12: 699 MHz ~ 716 MHz
 LTE Band 17: 704MHz ~ 716MHz

Rx Frequency:

LTE Band 2: 1930 MHz ~ 1990 MHz
 LTE Band 4: 2110 MHz ~ 2155 MHz
 LTE Band 5: 869 MHz ~ 894 MHz
 LTE Band 7: 2620MHz ~ 2690MHz
 LTE Band 12: 729 MHz ~ 746 MHz
 LTE Band 17: 734MHz ~ 746MHz

Bandwidth:

LTE Band 2: 1.4MHz /3MHz /5MHz /10MHz /15MHz /20MHz
 LTE Band 4: 1.4MHz /3MHz /5MHz /10MHz /15MHz /20MHz
 LTE Band 5: 1.4MHz /3MHz /5MHz /10MHz
 LTE Band 7: 5MHz /10MHz /15MHz /20MHz
 LTE Band 12: 1.4MHz /3MHz /5MHz /10MHz
 LTE Band 17: 5MHz /10MHz

The Max RF Output
Power (EIRP/ERP)

LTE Band 2: 23.16 dBm
 LTE Band 4: 22.99 dBm
 LTE Band 5: 20.85 dBm
 LTE Band 7: 23.33 dBm
 LTE Band 12: 20.18 dBm
 LTE Band 17: 19.87 dBm

99% Occupied Bandwidth:

LTE Band 2: 18M0W7D
 LTE Band 4: 18M0G7D
 LTE Band 5: 9M04G7D
 LTE Band 7: 18M0G7D
 LTE Band 12: 9M01G7D
 LTE Band 17: 9M03W7D

Type of Modulation:

QPSK/16QAM

Antenna Type:

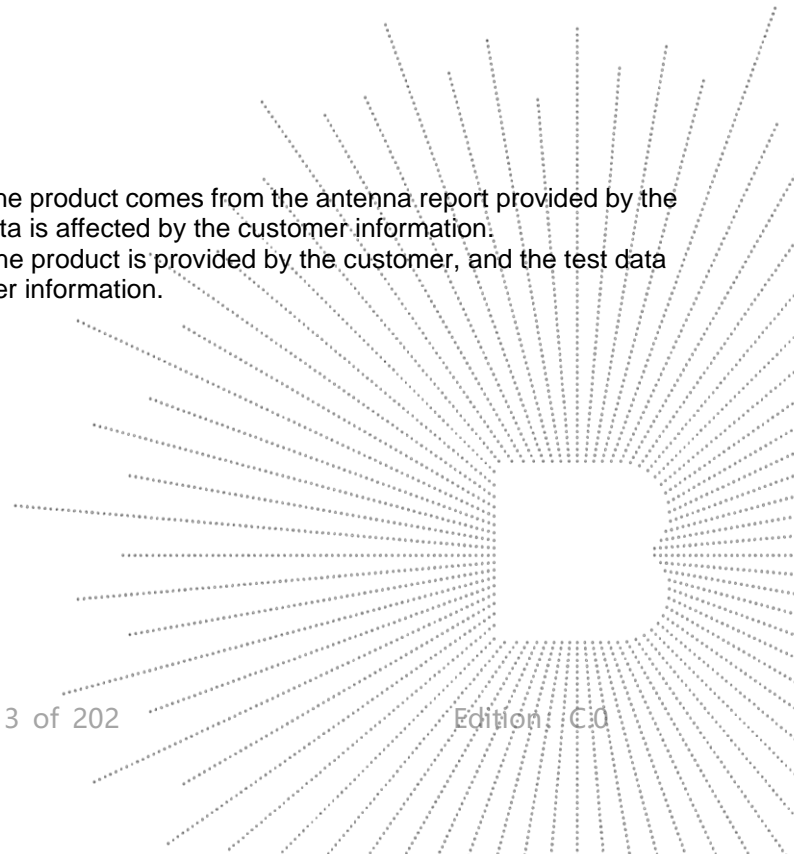
Internal Antenna

Antenna Gain:

LTE Band 2: 0.13 dBi
 LTE Band 4: 0.21 dBi
 LTE Band 5: -2.20 dBi
 LTE Band 7: 0.33 dBi
 LTE Band 12: -2.50 dBi
 LTE Band 17: -2.50 dBi

Remark:

☐ The antenna gain of the product comes from the antenna report provided by the customer, and the test data is affected by the customer information.
☒ The antenna gain of the product is provided by the customer, and the test data is affected by the customer information.



6.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

6.3 Support Equipment

Cable of Product

No.	Cable Type	Quantity	Provider	Length (m)	Shielded	Note
1	--	--	Applicant	---	Yes/No	--
2	--	--	BCTC	--	Yes/No	--

No.	Device Type	Brand	Model	Series No.	Note
1.	---	---	---	---	---
2.	--	--	--	--	--

Notes:

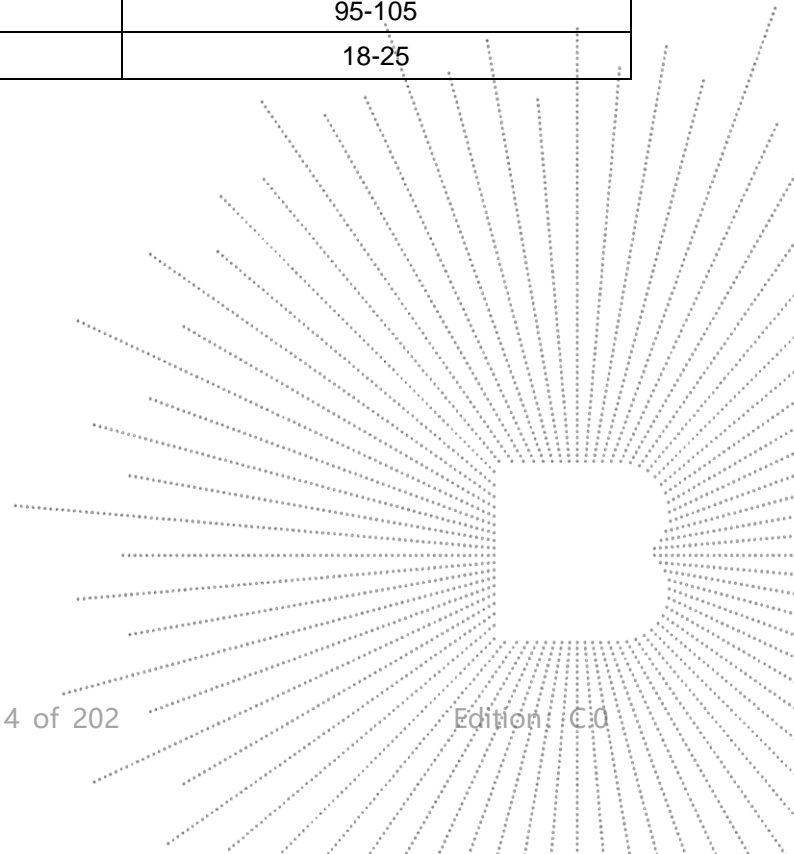
1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

6.4 Test Environment

1. Normal Test Conditions:

Humidity(%):	35-75
Atmospheric Pressure(kPa):	95-105
Temperature(°C):	18-25

2. Extreme Test Conditions: N/A



7. Test Facility and Test Instrument Used

7.1 Test Facility

All measurement facilities used to collect the measurement data are located at Shenzhen BCTC Testing Co., Ltd. Address: 1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

FCC Test Firm Registration Number: 712850
A2LA certificate registration number is: CN1212
ISED Registered No.: 23583
ISED CAB identifier: CN0017

7.2 Test Instrument Used

Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.
PC	DELL	\	\	N/A	N/A
SAR Measurement system	SATIMO	\	\	N/A	N/A
Signal Generator	Keysight	83711B	US37100131	May 14, 2025	May 13, 2026
Multimeter	Keithley	1160271	\	Nov. 10, 2024	Nov 09, 2025
S-parameter Network Analyzer	R&S	ZVB 8	101353	Dec. 07, 2024	Dec. 06, 2025
Wideband Radio Communication Tester	R&S	CMW500	\	Nov. 10, 2024	Nov 09, 2025
E SAR PROBE 6GHz	MVG	SSE2	2623-EPGO-420	July 18, 2024	July 17, 2025
DIPOLE 750	SATIMO	SID 750	SN 47/21 DIP 0G750-620	Nov. 25, 2024	Nov. 24, 2027
DIPOLE 835	SATIMO	SID 835	SN 47/21 DIP 0G835-621	Nov. 25, 2024	Nov. 24, 2027
DIPOLE 1800	SATIMO	SID 1800	SN 47/21 DIP 1G800-623	Nov. 25, 2024	Nov. 24, 2027
DIPOLE 1900	SATIMO	SID 1900	SN 47/21 DIP 1G900-624	Nov. 25, 2024	Nov. 24, 2027
DIPOLE 2450	SATIMO	SID 2450	SN 47/21 DIP 2G450-627	Nov. 25, 2024	Nov. 24, 2027
DIPOLE 2600	SATIMO	SID 2600	SN 47/21 DIP 2G600-628	Nov. 25, 2024	Nov. 24, 2027
DIPOLE 5000	SATIMO	SID 5000	SN 47/21 DIP 5G000-629	Nov. 25, 2024	Nov. 24, 2027
COMOSAR OPEN Coaxial Probe	SATIMO	\	\	Nov. 18, 2024	Nov. 17, 2025
SAR Locator	SATIMO	\	\	Nov. 18, 2024	Nov. 17, 2025
Communication Antenna	SATIMO	\	\	Nov. 18, 2024	Nov. 17, 2025
FEATURE PHONEPOSITIONING DEVICE	SATIMO	\	\	N/A	N/A
DUMMY PROBE	SATIMO	\	\	N/A	N/A
SAM Phantom	MVG	\	SN 13/09 SAM68	N/A	N/A
Liquid measurement Kit	HP	85033D	3423A08186	N/A	N/A
Power meter	Keysight	E4419	A00065	May 14, 2025	May 13, 2026
Power sensor	Keysight	E9300A	US39211659	May 14, 2025	May 13, 2026
Power sensor	Keysight	E9300A	US39211305	May 14, 2025	May 13, 2026
Directional Coupler	Krytar 158020	131467	\	Nov. 10, 2024	Nov 09, 2025
Thermometer	BTE	\	\	Dec. 02, 2024	Dec. 01, 2025
Broad Band Tissue Simulation Liquid	Schmid	\	\	N/A	N/A

Note:

Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three year extended calibration interval. Each measured dipole is expected to evaluate with following criteria at least on annual interval.

1. There is no physical damage on the dipole;
2. System check with specific dipole is within 10% of calibrated values;
3. The most recent return-loss results, measured at least annually, deviates by no more than 20% from the previous measurement;
4. The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.

8. Specific Absorption Rate (SAR)

8.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

8.2 SAR Definition

The SAR definition is 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). The equation description is as below:

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

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = C \left(\frac{\delta T}{\delta t} \right)$$

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the

electrical field in the tissue by

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

9. SAR Measurement System

9.1 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
- Phone 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.

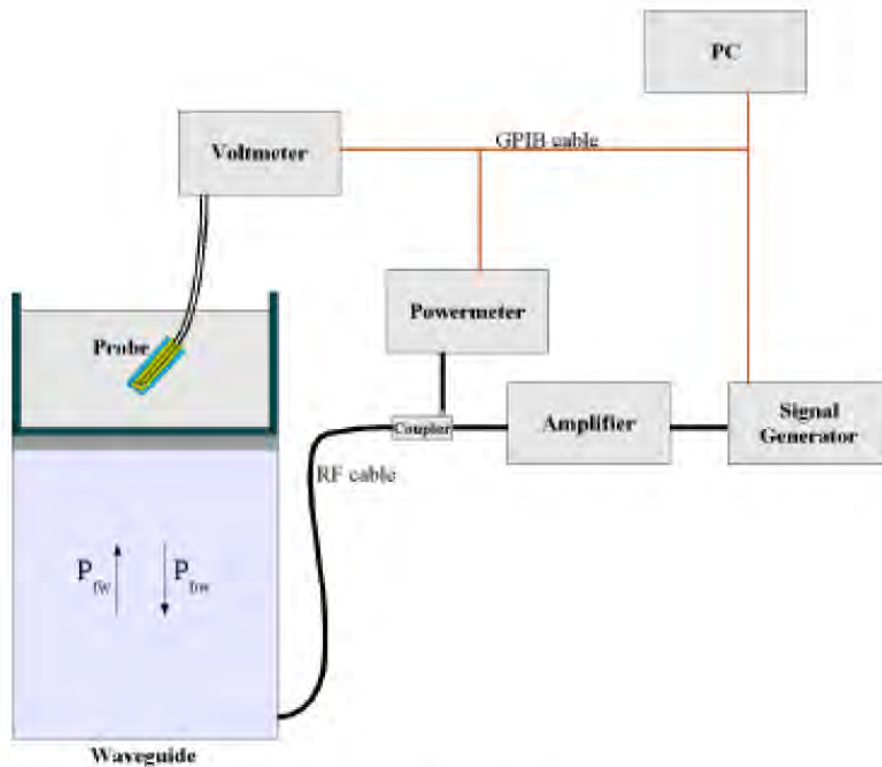
9.2 Probe

For the measurements the Specific Dosimetric E-Field Probe SN 46/21 EPGO362 with following specifications is used

- Dynamic range: 0.01-100 W/kg
- Tip Diameter : 5 mm
- Distance between probe tip and sensor center: 2.10mm
- Distance between sensor center and the inner phantom surface: 4 mm (repeatability better than +/- 1mm)
- Probe linearity: <0.25 dB
- Axial Isotropy: <0.25 dB
- Spherical Isotropy: <0.50 dB
- Calibration range: 835 to 2500MHz for head & body simulating liquid.

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

Probe calibration is realized, in compliance with EN 62209-1 and IEEE 1528 STD, with CALISAR, Antennessa proprietary calibration system. The calibration is performed with the EN 62209-1 annex technique using reference guide at the five frequencies.



$$SAR = \frac{4(p_{fw} - p_{pbw})}{ab\delta} \cos^2\left(\pi \frac{y}{a}\right) c^{(2\pi/\delta)}$$

Where :

P_{fw} = Forward Power

P_{bw} = Backward Power

a and b = Waveguide dimensions

l = Skin depth

Keithley configuration:

Rate = Medium; Filter = ON; RDGS = 10; Filter type = Moving Average; Range auto after each calibration, a SAR measurement is performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

The calibration factors, CF(N), for the 3 sensors corresponding to dipole 1, dipole 2 and dipole 3 are:

$$CF(N) = SAR(N)/V_{lin}(N) \quad (N=1,2,3)$$

The linearised output voltage V_{lin}(N) is obtained from the displayed output voltage V(N) using

$$V_{lin}(N) = V(N) * (1 + V(N)/DCP(N)) \quad (N=1,2,3)$$

where DCP is the diode compression point in mV.

9.3 Probe Calibration Process

Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. SATIMO Probe calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm²) using an with CALISAR, Antenna proprietary calibration system.

Free Space Assessment Procedure

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1mW/cm².

Temperature Assessment Procedure

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated head tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

Where:

$$SAR = C \frac{\Delta T}{\Delta t}$$

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

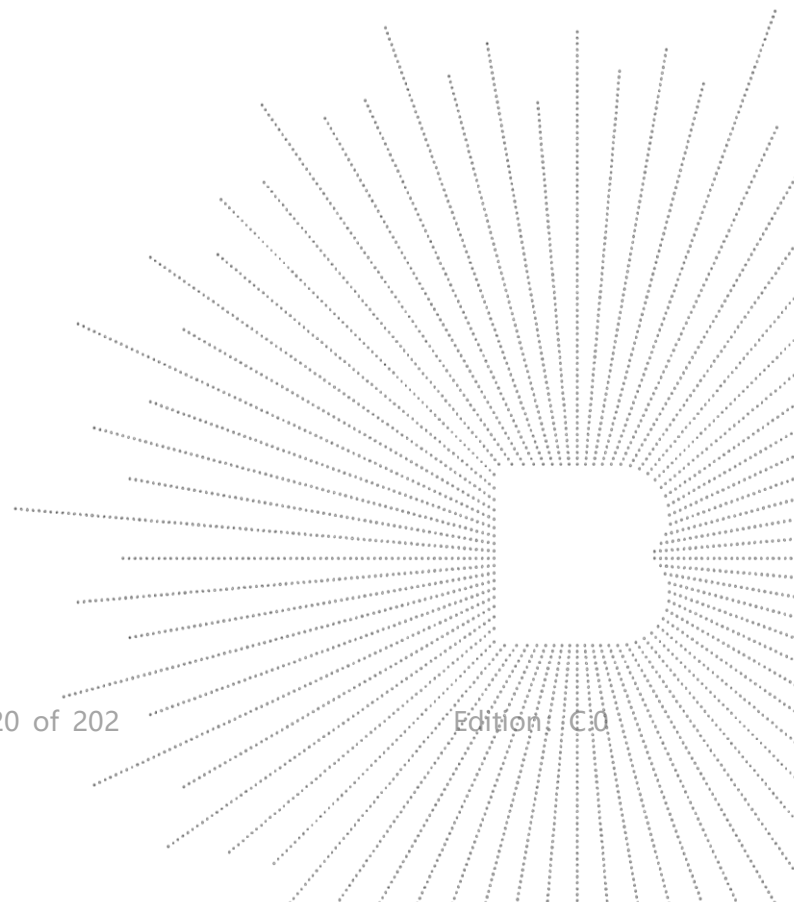
SAR is proportional to $\Delta T/\Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. The electric field in the simulated tissue can be used to estimate SAR by equating the thermally derived SAR to that with the E- field component.

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

Where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm³ for brain tissue)

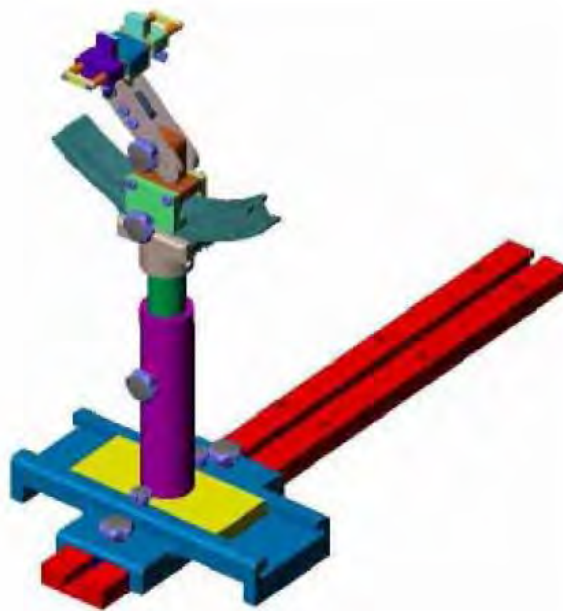


9.4 Phantom

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.

9.5 Device Holder

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



System Material	Permittivity	Loss Tangent
Delrin	3.7	0.005

10. Tissue Simulating Liquids

10.1 Composition of Tissue Simulating Liquid

For the measurement of the field distribution inside the SAM phantom with SMTIMO, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. 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. Please see the following photos for the liquid height.



Liquid Height for Body SAR

The Composition of Tissue Simulating Liquid

Frequency (MHz)	Water (%)	Salt (%)	1,2-Propane diol (%)	HEC (%)	Preventol (%)	DGBE (%)
Head/Body						
835	40.3	1.4	57.9	0.2	0.2	0
900	40.3	1.4	57.9	0.2	0.2	0
1800-2000	55.2	0.3	0	0	0	44.5
2450	55.0	0.1	0	0	0	44.9
2600	54.9	0.1	0	0	0	45.0

Frequency (MHz)	Water (%)	Hexyl Carbitol (%)	Triton X-100 (%)
Head/Body			
5000-6000	65.52	17.24	17.24

10.2 Limit

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters

computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Target Frequency (MHz)	Head	
	Conductivity (σ)	Permittivity (ϵ_r)
150	0.76	52.3
300	0.87	45.3
450	0.87	43.5
750	0.89	41.9
835	0.90	41.5
900	0.97	41.5
915	0.98	41.5
1450	1.20	40.5
1610	1.29	40.3
1800-2000	1.40	40.0
2450	1.80	39.2
2600	1.96	39.0
3000	2.40	38.5
5200	4.66	36.0
5400	4.86	35.8
5600	5.07	35.5
5800	5.27	35.3

10.3 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an R&S ZVB 8. Dielectric Probe Kit and an Agilent Network Analyzer.

Calibration Result for Dielectric Parameters of Tissue Simulating Liquid

Frequency (MHz)	Liquid	Target		Measured		Deviation		Limit	Air (°C)	Date
		(σ)	(ϵ_r)	(σ)	(ϵ_r)	(σ)	(ϵ_r)			
750	Head	0.89	41.90	0.860	40.917	-3.37	-2.35	±5	24.3	23/6/2025
835	Head	0.90	41.50	0.925	40.260	2.78	-2.99	±5	24.3	23/6/2025
1800	Head	1.40	40.00	1.352	38.778	-3.43	-3.06	±5	24.3	27/6/2025
1900	Head	1.40	40.00	1.425	41.063	1.79	2.66	±5	24.3	27/6/2025
2450	Head	1.80	39.20	1.803	40.929	0.17	4.41	±5	24.0	25/6/2025
2600	Head	1.96	39.00	1.945	39.203	-0.77	0.52	±5	24.0	25/6/2025
5200	Head	4.66	36.00	4.550	36.066	-2.36	0.18	±5	24.0	25/6/2025
5800	Head	5.27	35.30	5.363	35.999	1.76	1.98	±5	24.0	25/6/2025

Remark:

1. The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within $\pm 2^\circ\text{C}$ of the temperature when the tissue parameters are characterized.
2. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

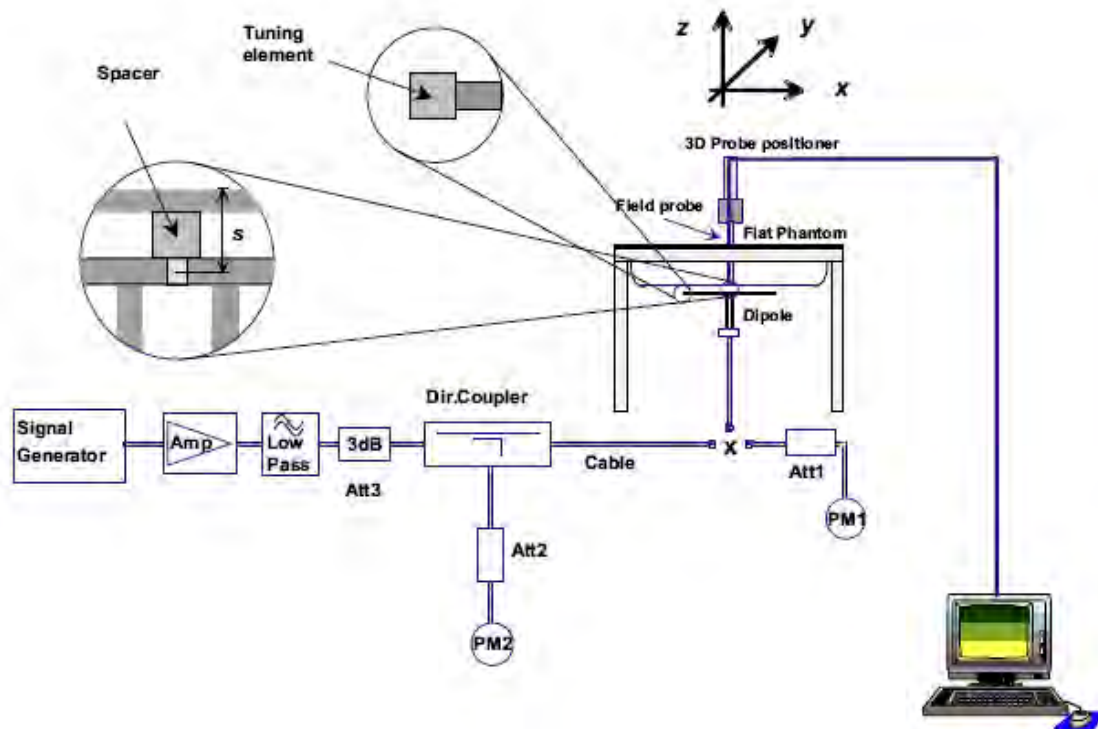
11. System Check

11.1 Purpose of System Performance Check

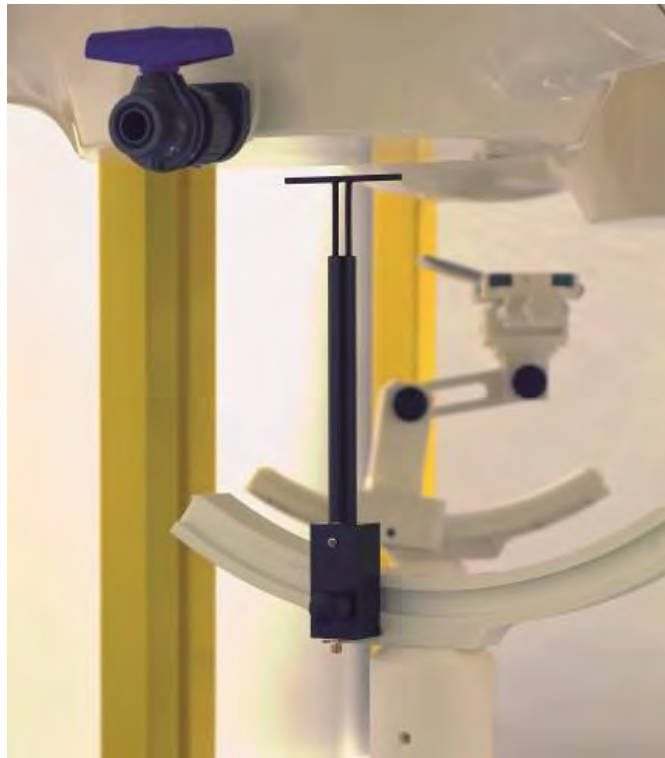
At the device test frequencies. System check verifies the measurement repeatability of a SAR system before compliance testing and is not a validation of all system specifications. The latter is not required for testing a device but is mandatory before the system is deployed. The system check detects possible short-term drift and unacceptable measurement errors or uncertainties in the system.

11.2 System Setup

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator at frequency 600MHz-6000MHz. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The output power on dipole port must be calibrated to 20 dBm (100 mW) before dipole is connected.



System Verification Setup Block Diagram



Setup Photo of Dipole Antenna

11.3 Validation Results

Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10 %. The following table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion.

Frequency (MHz)	Power	Measured SAR _{1g} (W/Kg)	Measured Normalized	Target Normalized	Drift	Limit	Liquid (°C)	Date
750	250mW	2.256	9.023	8.58	5.16	±10	24.0	23/6/2025
835	250mW	2.560	10.241	10.01	2.31	±10	24.0	23/6/2025
1800	250mW	9.829	39.317	39.74	-1.06	±10	23.8	27/6/2025
1900	250mW	9.932	39.729	41.26	-3.71	±10	23.8	27/6/2025
2450	250mW	14.526	58.103	55.16	5.34	±10	23.8	25/6/2025
2600	250mW	14.364	57.454	56.50	1.69	±10	23.8	25/6/2025
5200	250mW	19.595	78.378	76.41	2.58	±10	23.8	25/6/2025
5800	250mW	18.246	72.983	76.49	-4.58	±10	23.8	25/6/2025

12. EUT Testing Position

12.1 Define Two Imaginary Lines on the Handset

(a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width w_t of the handset at the level of the acoustic output, and the midpoint of the width w_b of the bottom of the handset.

(b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.

(c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.

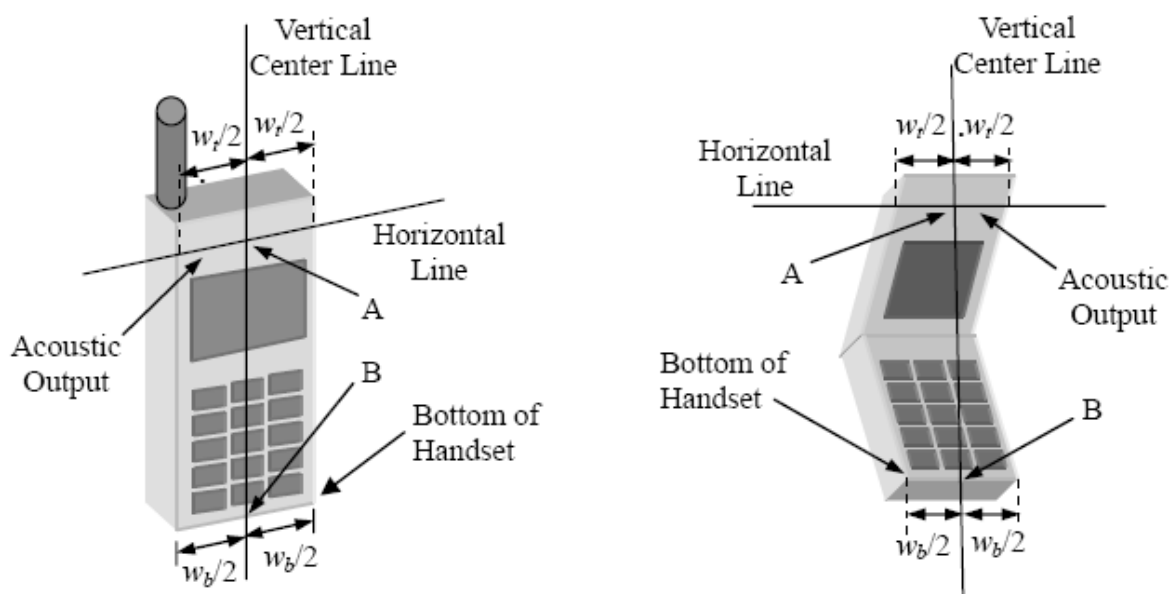


Illustration for Handset Vertical and Horizontal Reference Lines

12.2 Cheek Position

(a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

(b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see below).

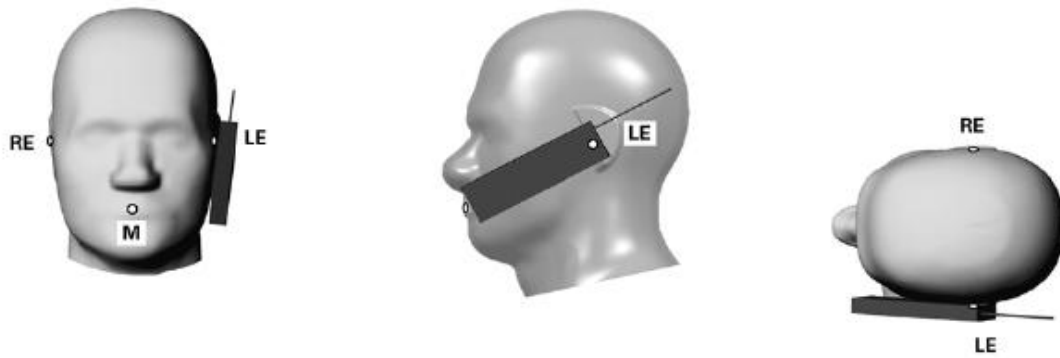


Illustration for Cheek Position

12.3 Tilted Position

- (a) To position the device in the “cheek” position described above.
- (b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see below).

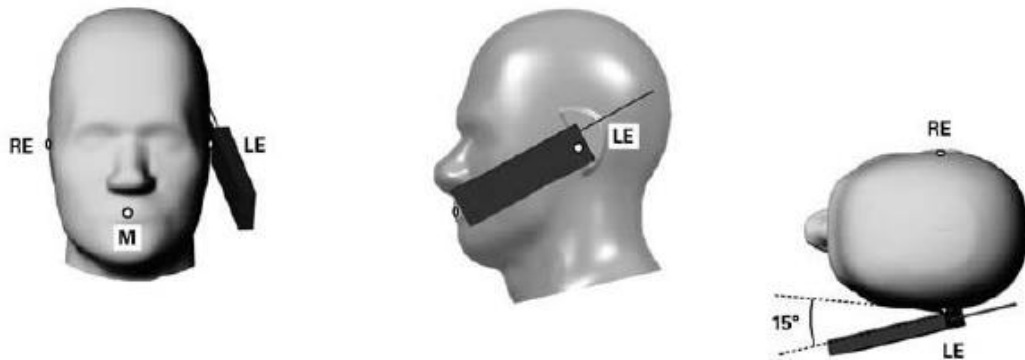
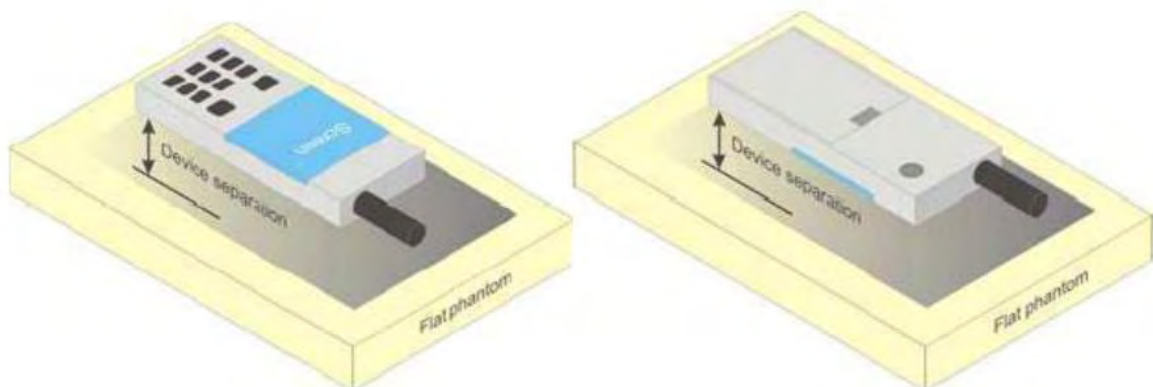


Illustration for Tilted Position

12.4 Body Position

A typical example of a body-worn device is a Mobile Phone , wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.



Test positions for body-worn devices

13. SAR Measurement Procedures

13.1 Measurement Procedures

The measurement procedures are as follows:

- (a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the highest power channel.
- (b) Keep EUT to radiate maximum output power or 100% factor (if applicable)
- (c) Measure output power through RF cable and power meter.
- (d) Place the EUT in the positions as Annex D demonstrates.
- (e) Set scan area, grid size and other setting on the SATIMO software.
- (f) Measure SAR results for the highest power channel on each testing position.
- (g) Find out the largest SAR result on these testing positions of each band
- (h) Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

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

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

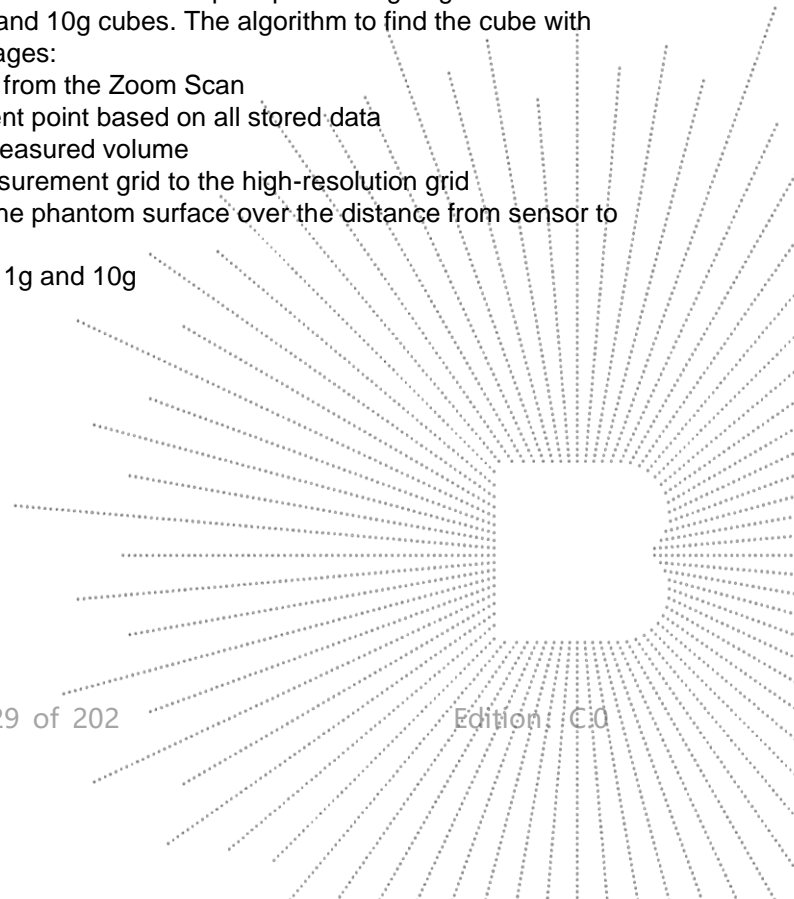
13.2 Spatial Peak SAR Evaluation

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
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3D 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



13.3 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 5x5x7 points with step size 8, 8 and 5mm for 300MHz to 3GHz, and 8x8x8 points with step size 4, 4 and 2.5 mm for 3GHz to 6GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10g.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 mm \pm 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm \pm 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° \pm 1°	20° \pm 1°
Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.				
* When zoom scan is required and the <u>reported</u> SAR from the <u>area scan based 1-g SAR estimation</u> procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

13.4 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing (step-size is 4, 4 and 2.5 mm). When all volume scan were completed, the software can combine and subsequently superpose these measurement data to calculating the multiband SAR.

13.5 SAR Averaged Methods

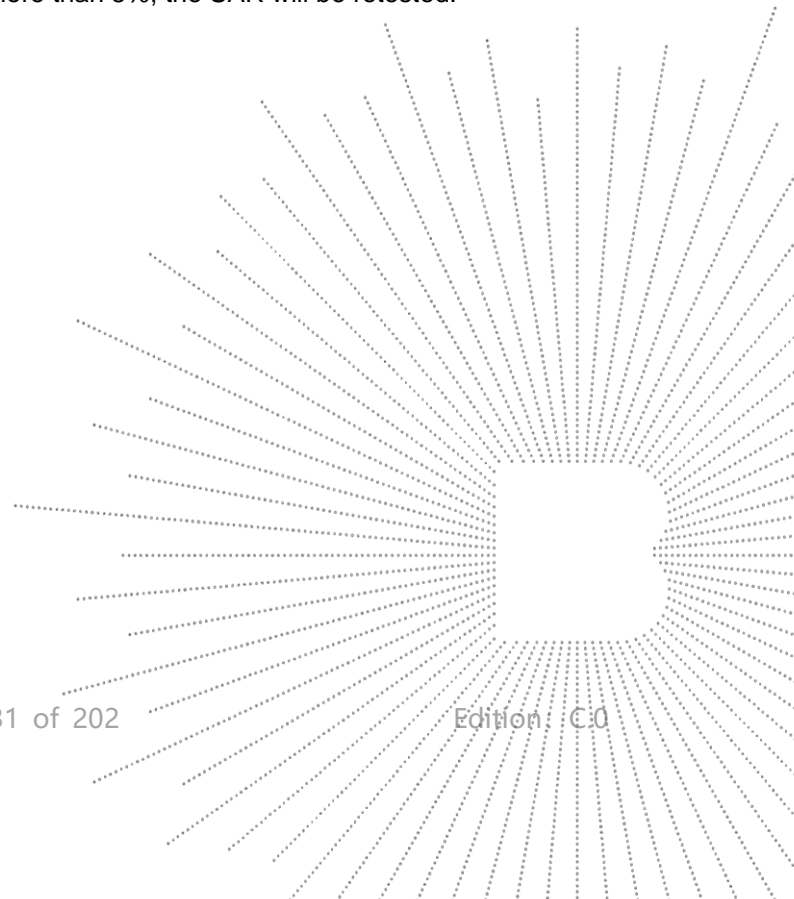
The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimize measurements errors, but the highest local SAR will occur at the surface of the phantom.

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

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

13.6 Power Drift Monitoring

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



14. SAR Test Result

14.1 Conducted RF Output Power

Bluetooth			
Modulation	Frequency (MHz)	Conducted Power (dBm)	Tune-up power (dBm)
1-DH1	2402	1.73	2.5
1-DH1	2441	2.22	
1-DH1	2480	1.97	
2-DH1	2402	-0.42	0.0
2-DH1	2441	-0.55	
2-DH1	2480	-2.34	
3-DH1	2402	-0.16	0.0
3-DH1	2441	-0.26	
3-DH1	2480	-2.02	

BLE			
Mode	Frequency (MHz)	Conducted Power (dBm)	Tune-up power (dBm)
BLE 1M	2402	2.04	2.5
BLE 1M	2440	1.70	
BLE 1M	2480	0.57	
BLE 2M	2402	1.86	2.0
BLE 2M	2440	1.60	
BLE 2M	2480	0.44	

Note:

Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances $\leq 50\text{mm}$ are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \times \sqrt{f(\text{GHz})}$

≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

$f(\text{GHz})$ is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

Turn-up Power (dBm)	Turn-up Power (mW)	Separation Distance (mm)	Frequency (GHz)	Result	Exclusion Thresholds
2.5	1.78	5	2.480	0.56	3

Per KDB 447498 D01v06, when the minimum test separation distance is $< 5\text{ mm}$, a distance of 5 mm is applied to determine SAR test exclusion.

According to the calculation results in the table above, Bluetooth SAR does not need to be tested.

NFC								
Modulation	Frequency (MHz)	Output Power (dBuV/m)	Output Power (dBm)	Tune-up (dBm)	Tune-up (mW)	Separation Distance (mm)	Result	exclusion thresholds for 1-g SAR
ASK	13.5609	57.45	-42.45	-42.5	0.00006	≤5.0	0.00002	3.0

Note:

Per KDB 447498 D01v06, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

According to the calculation results in the table above, NFC SAR does not need to be tested.

WIFI 2.4G			
Mode	Frequency (MHz)	Conducted Power (dBm)	Tune-up power (dBm)
b	2412	12.66	14.0
b	2437	13.49	
b	2462	13.15	
g	2412	11.49	12.5
g	2437	12.44	
g	2462	11.69	
n20	2412	10.52	11.5
n20	2437	11.38	
n20	2462	10.63	
n40	2422	8.94	10.0
n40	2437	9.62	
n40	2452	9.66	

WIFI 5.1G			
Mode	Frequency (MHz)	Conducted Power (dBm)	Tune-up power (dBm)
a	5180	10.07	10.5
a	5200	9.07	
a	5240	7.79	
n20	5180	8.69	9.0
n20	5200	8.25	
n20	5240	7.29	
n40	5190	7.58	8.0
n40	5230	6.78	
ac20	5180	8.60	9.0
ac20	5200	8.41	
ac20	5240	7.58	
ac40	5190	7.60	8.0
ac40	5230	6.79	
ac80	5210	6.20	6.5

WIFI 5.8G			
Mode	Frequency (MHz)	Conducted Power (dBm)	Tune-up power (dBm)
a	5745	9.21	9.5
a	5785	8.78	
a	5825	7.82	
n20	5745	8.20	8.5
n20	5785	7.87	
n20	5825	7.11	
n40	5755	7.04	7.5
n40	5795	6.84	
ac20	5745	8.01	8.5
ac20	5785	7.74	
ac20	5825	7.03	
ac40	5755	7.34	7.5
ac40	5795	6.91	
ac80	5775	5.72	6.0

GSM - Burst Average Power (dBm)								
Band	GSM850				GSM1900			
Channel	128	190	251	Tune-up	512	661	810	Tune-up
Frequency (MHz)	824.2	836.6	848.8		1850.2	1880	1909.8	
GSM	34.51	34.23	34.28	35.0	27.98	27.49	27.07	28.5
GPRS slots-1	34.03	33.82	33.85	34.5	27.67	27.16	26.79	28.0
GPRS slots-2	30.97	30.65	30.51	31.0	27.51	26.92	26.52	28.0
GPRS slots-3	29.01	28.63	28.58	29.5	25.71	25.12	24.76	26.0
GPRS slots-4	26.83	26.42	26.17	27.0	23.51	22.90	22.49	24.0
EGPRS slots-1	34.05	34.01	34.09	34.5	27.53	27.67	27.41	28.0
EGPRS slots-2	31.39	31.10	30.97	31.5	27.95	27.42	27.22	28.0
EGPRS slots-3	29.52	29.12	28.98	30.0	26.15	25.67	25.41	26.5
EGPRS slots-4	27.31	27.05	26.83	27.5	24.10	23.44	23.18	24.5

GSM - Source-Based Time-Average Power (dBm)						
Band	GSM850			GSM1900		
Channel	128	190	251	512	661	810
Frequency (MHz)	824.2	836.6	848.8	1850.2	1880	1909.8
GSM	25.51	25.23	25.28	18.98	18.49	18.07
GPRS slots-1	25.03	24.82	24.85	18.67	18.16	17.79
GPRS slots-2	24.97	24.65	24.51	21.51	20.92	20.52
GPRS slots-3	24.76	24.38	24.33	21.46	20.87	20.51
GPRS slots-4	23.83	23.42	23.17	20.51	19.90	19.49
EGPRS slots-1	25.05	25.01	25.09	18.53	18.67	18.41
EGPRS slots-2	25.39	25.10	24.97	21.95	21.42	21.22
EGPRS slots-3	25.27	24.87	24.73	21.90	21.42	21.16
EGPRS slots-4	24.31	24.05	23.83	21.10	20.44	20.18

Notes:

Division Factors

To average the power, the division factor is as follows:

1TX-slots = 1 transmit time slots out of 8 time slots=> conducted power divided by (8/1) => -9.00dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.00dB

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) => -3.00dB

Band	WCDMA Band II				WCDMA Band IV			
Channel	9262	9400	9538	Tune-up	1312	1450	1513	Tune-up
Frequency (MHz)	1852.4	1880.0	1907.6		1712.4	1740	1752.6	
RMC 12.2K	21.81	21.57	21.64	22.0	21.73	21.86	21.79	22.0
HSDPA Subtest-1	21.28	20.92	20.79	21.5	21.38	21.26	21.26	21.5
HSDPA Subtest-2	21.02	20.71	20.42		21.11	20.90	20.76	
HSDPA Subtest-3	20.69	20.49	20.30		20.51	20.85	20.81	
HSDPA Subtest-4	20.58	20.24	20.14		20.34	20.64	20.34	
HSUPA Subtest-1	21.09	20.80	20.61	21.5	21.19	21.09	21.10	21.5
HSUPA Subtest-2	21.05	20.91	20.66		21.37	21.23	21.17	
HSUPA Subtest-3	20.81	20.83	20.24		21.19	20.79	20.82	
HSUPA Subtest-4	21.12	20.86	20.74		21.31	21.24	21.23	
HSUPA Subtest-5	20.90	20.82	20.51		21.19	21.19	21.22	

Band	WCDMA Band V				/			
Channel	4132	4182	4233	Tune-up	/	/	/	/
Frequency (MHz)	826.4	836.4	846.6		/	/	/	
RMC 12.2K	23.44	23.66	23.95	24.5	/	/	/	/
HSDPA Subtest-1	23.05	23.45	23.61	23.5	/	/	/	/
HSDPA Subtest-2	22.85	23.34	23.39		/	/	/	
HSDPA Subtest-3	22.55	22.96	23.29		/	/	/	
HSDPA Subtest-4	22.38	22.33	22.99		/	/	/	
HSUPA Subtest-1	23.03	23.24	23.42	24.0	/	/	/	/
HSUPA Subtest-2	22.98	23.43	23.70		/	/	/	
HSUPA Subtest-3	22.47	23.39	23.64		/	/	/	
HSUPA Subtest-4	22.96	23.44	23.67		/	/	/	
HSUPA Subtest-5	22.27	23.16	23.43		/	/	/	

Note:

1. Per KDB 941225 D01 v03, the 12.2kbps RMC mode was selected for SAR testing (the primary mode).
2. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq 1/4$ dB higher than the primary mode (RMC12.2kbps) 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.

See Appendix 1 for RF conduction data for LTE.

14.2 Transmit Antennas and SAR Measurement Position

EUT frontal view antenna position:



Antennas	Support Band
MAIN-WWAN	GSM 850/1900 + WCDMA Band 2/4/5 + LTE Band 2/4/7/12/17 TX
DIV-WWAN	GSM 850/1900 + WCDMA Band 2/4/5 + LTE Band 2/4/7/12/17 RX
BT/WIFI	Bluetooth + WIFI

Distance of The Antenna to the EUT surface and edge (mm)						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
MAIN-WWAN	<25	<25	162	<25	<25	<25
BT/WIFI	<25	<25	<25	160	52	<25

Positions for SAR tests; Hotspot mode						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
MAIN-WWAN	Yes	Yes	No	Yes	Yes	Yes
BT/WIFI	Yes	Yes	Yes	No	No	Yes

14.3 Measured and Reported (Scaled) SAR Results

The calculated SAR is obtained by the following formula:

1. Reported SAR for WWAN=Measured SAR * Tune-up Scaling factor
2. Reported SAR for WLAN and Bluetooth=Measured SAR * Tune-up Scaling factor * Duty Cycle Scaling factor
3. Duty Cycle Scaling factor=1/ Duty Cycle (%)

KDB 447498 D01 General RF Exposure Guidance:

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
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 648474 D04 Handset SAR v01r03:

1. When the *reported* SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest *reported* SAR configuration for that wireless mode and frequency band should be repeated for the body-worn accessory with a headset attached to the handset.
2. when the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, using the same wireless mode test configuration for voice and data, such as UMTS, LTE and Wi-Fi, and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface)
3. For Smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

KDB 941225 D01 3G SAR Procedures:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq 1/4$ dB higher than the primary mode (RMC12.2kbps) 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.

KDB 941225 D05 SAR for LTE Devices:

1. Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, 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.
2. When the reported SAR is > 0.8 W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
3. Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
4. SAR measurement is not required for the 16QAM and 64QAM. When the highest maximum output power for 16QAM and 64QAM is $\leq 1/2$ dB higher than the QPSK or when the reported SAR for the QPSK configuration is ≤ 1.45 W/kg.
5. Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

WIFI 2.4G									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	802.11b	Left Cheek	2437	13.49	14.0	1.125	0.127	0.143	
		Left Tilt	2437	13.49	14.0	1.125	0.173	0.195	
		Right Cheek	2437	13.49	14.0	1.125	0.160	0.180	
		Right Tilt	2437	13.49	14.0	1.125	0.177	0.199	
Body & Hotspot	802.11b	Front Face	2437	13.49	14.0	1.125	0.164	0.184	
		Back Face	2437	13.49	14.0	1.125	0.210	0.236	1
Hotspot	802.11b	Right Side	2437	13.49	14.0	1.125	0.138	0.155	
		Top Side	2437	13.49	14.0	1.125	0.125	0.141	

WIFI 5.1G									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	802.11a	Left Cheek	5180	10.07	10.5	1.104	0.360	0.397	
		Left Tilt	5180	10.07	10.5	1.104	0.368	0.406	
		Right Cheek	5180	10.07	10.5	1.104	0.460	0.508	2
		Right Tilt	5180	10.07	10.5	1.104	0.300	0.331	
Body & Hotspot	802.11a	Front Face	5180	10.07	10.5	1.104	0.296	0.327	
		Back Face	5180	10.07	10.5	1.104	0.358	0.395	
Hotspot	802.11a	Right Side	5180	10.07	10.5	1.104	0.342	0.378	
		Top Side	5180	10.07	10.5	1.104	0.328	0.362	

WIFI 5.8G									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	802.11a	Left Cheek	5745	9.21	9.5	1.069	0.500	0.535	
		Left Tilt	5745	9.21	9.5	1.069	0.576	0.616	
		Right Cheek	5745	9.21	9.5	1.069	0.558	0.597	
		Right Tilt	5745	9.21	9.5	1.069	0.665	0.711	3
Body & Hotspot	802.11a	Front Face	5745	9.21	9.5	1.069	0.363	0.388	
		Back Face	5745	9.21	9.5	1.069	0.321	0.343	
Hotspot	802.11a	Right Side	5745	9.21	9.5	1.069	0.317	0.339	
		Top Side	5745	9.21	9.5	1.069	0.411	0.439	

GSM 850									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	GSM	Left Cheek	824.2	34.51	35.0	1.119	0.077	0.086	
		Left Tilt	824.2	34.51	35.0	1.119	0.103	0.115	
		Right Cheek	824.2	34.51	35.0	1.119	0.069	0.077	
		Right Tilt	824.2	34.51	35.0	1.119	0.132	0.148	
Body & Hotspot	GSM	Front Face	824.2	34.51	35.0	1.119	0.109	0.122	
		Back Face	824.2	34.51	35.0	1.119	0.135	0.151	
	GPRS slots-1	Front Face	824.2	34.03	34.5	1.114	0.111	0.124	
		Back Face	824.2	34.03	34.5	1.114	0.141	0.157	
Hotspot	GPRS slots-1	Left Side	824.2	34.03	34.5	1.114	0.082	0.091	
		Right Side	824.2	34.03	34.5	1.114	0.144	0.160	4
		Bottom Side	824.2	34.03	34.5	1.114	0.123	0.137	

GSM 1900									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	GSM	Left Cheek	1850.2	27.98	28.5	1.127	0.132	0.149	
		Left Tilt	1850.2	27.98	28.5	1.127	0.097	0.109	
		Right Cheek	1850.2	27.98	28.5	1.127	0.177	0.200	
		Right Tilt	1850.2	27.98	28.5	1.127	0.132	0.149	
Body & Hotspot	GSM	Front Face	1850.2	27.98	28.5	1.127	0.164	0.185	
		Back Face	1850.2	27.98	28.5	1.127	0.205	0.231	
	GPRS slots-3	Front Face	1850.2	27.51	28.0	1.119	0.257	0.288	
		Back Face	1850.2	27.51	28.0	1.119	0.324	0.363	5
Hotspot	GSM	Left Side	1850.2	27.51	28.0	1.119	0.235	0.263	
		Right Side	1850.2	27.51	28.0	1.119	0.131	0.147	
		Bottom Side	1850.2	27.51	28.0	1.119	0.191	0.214	

WCDMA Band 2									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	RMC	Left Cheek	1852.4	21.81	22.0	1.045	0.271	0.283	
		Left Tilt	1852.4	21.81	22.0	1.045	0.138	0.144	
		Right Cheek	1852.4	21.81	22.0	1.045	0.117	0.122	
		Right Tilt	1852.4	21.81	22.0	1.045	0.230	0.240	
Body & Hotspot	RMC	Front Face	1852.4	21.81	22.0	1.045	0.302	0.316	
		Back Face	1852.4	21.81	22.0	1.045	0.489	0.511	6
Hotspot	RMC	Left Side	1852.4	21.81	22.0	1.045	0.292	0.305	
		Right Side	1852.4	21.81	22.0	1.045	0.154	0.161	
		Bottom Side	1852.4	21.81	22.0	1.045	0.265	0.277	

WCDMA Band 4									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	RMC	Left Cheek	1740	21.86	22.0	1.033	0.337	0.348	
		Left Tilt	1740	21.86	22.0	1.033	0.239	0.247	
		Right Cheek	1740	21.86	22.0	1.033	0.179	0.185	
		Right Tilt	1740	21.86	22.0	1.033	0.202	0.209	
Body & Hotspot	RMC	Front Face	1740	21.86	22.0	1.033	0.243	0.251	
		Back Face	1740	21.86	22.0	1.033	0.442	0.456	
Hotspot	RMC	Left Side	1740	21.86	22.0	1.033	0.443	0.458	7
		Right Side	1740	21.86	22.0	1.033	0.259	0.267	
		Bottom Side	1740	21.86	22.0	1.033	0.364	0.376	

WCDMA Band 5									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	RMC	Left Cheek	846.6	23.95	24.5	1.135	0.130	0.148	
		Left Tilt	846.6	23.95	24.5	1.135	0.090	0.102	
		Right Cheek	846.6	23.95	24.5	1.135	0.095	0.108	
		Right Tilt	846.6	23.95	24.5	1.135	0.116	0.132	
Body & Hotspot	RMC	Front Face	846.6	23.95	24.5	1.135	0.096	0.109	
		Back Face	846.6	23.95	24.5	1.135	0.202	0.229	
Hotspot	RMC	Left Side	846.6	23.95	24.5	1.135	0.066	0.075	
		Right Side	846.6	23.95	24.5	1.135	0.125	0.142	
		Bottom Side	846.6	23.95	24.5	1.135	0.238	0.270	8

LTE Band 2 (20MHz Bandwidth)									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	QPSK, 1RB	Left Cheek	1880	22.71	23.0	1.069	0.272	0.291	
		Left Tilt	1880	22.71	23.0	1.069	0.230	0.246	
		Right Cheek	1880	22.71	23.0	1.069	0.167	0.179	
		Right Tilt	1880	22.71	23.0	1.069	0.231	0.247	
	QPSK, 50%RB	Left Cheek	1900	21.77	22.0	1.054	0.145	0.153	
		Left Tilt	1900	21.77	22.0	1.054	0.123	0.130	
		Right Cheek	1900	21.77	22.0	1.054	0.153	0.161	
		Right Tilt	1900	21.77	22.0	1.054	0.190	0.200	
Body & Hotspot	QPSK, 1RB	Front Face	1880	22.71	23.0	1.069	0.272	0.291	
		Back Face	1880	22.71	23.0	1.069	0.450	0.481	9
	QPSK, 50%RB	Front Face	1900	21.77	22.0	1.054	0.260	0.274	
		Back Face	1900	21.77	22.0	1.054	0.330	0.348	
Hotspot	QPSK, 1RB	Left Side	1880	22.71	23.0	1.069	0.237	0.253	
		Right Side	1880	22.71	23.0	1.069	0.188	0.201	
		Bottom Side	1880	22.71	23.0	1.069	0.265	0.283	
	QPSK, 50%RB	Left Side	1900	21.77	22.0	1.054	0.181	0.191	
		Right Side	1900	21.77	22.0	1.054	0.170	0.179	
		Bottom Side	1900	21.77	22.0	1.054	0.115	0.121	

LTE Band 4 (20MHz Bandwidth)									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	QPSK, 1RB	Left Cheek	1732.5	22.78	23.0	1.052	0.267	0.281	
		Left Tilt	1732.5	22.78	23.0	1.052	0.192	0.202	
		Right Cheek	1732.5	22.78	23.0	1.052	0.189	0.199	
		Right Tilt	1732.5	22.78	23.0	1.052	0.180	0.189	
	QPSK, 50%RB	Left Cheek	1745	21.73	22.0	1.064	0.162	0.172	
		Left Tilt	1745	21.73	22.0	1.064	0.145	0.154	
		Right Cheek	1745	21.73	22.0	1.064	0.184	0.196	
		Right Tilt	1745	21.73	22.0	1.064	0.164	0.175	
Body & Hotspot	QPSK, 1RB	Front Face	1732.5	22.78	23.0	1.052	0.209	0.220	
		Back Face	1732.5	22.78	23.0	1.052	0.440	0.463	
	QPSK, 50%RB	Front Face	1745	21.73	22.0	1.064	0.170	0.181	
		Back Face	1745	21.73	22.0	1.064	0.366	0.389	
Hotspot	QPSK, 1RB	Left Side	1732.5	22.78	23.0	1.052	0.240	0.252	
		Right Side	1732.5	22.78	23.0	1.052	0.234	0.246	
		Bottom Side	1732.5	22.78	23.0	1.052	0.455	0.479	10
	QPSK, 50%RB	Left Side	1745	21.73	22.0	1.064	0.226	0.240	
		Right Side	1745	21.73	22.0	1.064	0.153	0.163	
		Bottom Side	1745	21.73	22.0	1.064	0.326	0.347	

LTE Band 5 (10MHz Bandwidth)									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	QPSK, 1RB	Left Cheek	836.5	25.03	25.5	1.114	0.089	0.099	
		Left Tilt	836.5	25.03	25.5	1.114	0.056	0.062	
		Right Cheek	836.5	25.03	25.5	1.114	0.096	0.107	
		Right Tilt	836.5	25.03	25.5	1.114	0.127	0.142	
	QPSK, 50%RB	Left Cheek	844	24.18	24.5	1.076	0.062	0.067	
		Left Tilt	844	24.18	24.5	1.076	0.051	0.055	
		Right Cheek	844	24.18	24.5	1.076	0.068	0.073	
		Right Tilt	844	24.18	24.5	1.076	0.071	0.076	
Body & Hotspot	QPSK, 1RB	Front Face	836.5	25.03	25.5	1.114	0.138	0.154	
		Back Face	836.5	25.03	25.5	1.114	0.284	0.316	
	QPSK, 50%RB	Front Face	844	24.18	24.5	1.076	0.114	0.123	
		Back Face	844	24.18	24.5	1.076	0.211	0.227	
Hotspot	QPSK, 1RB	Left Side	836.5	25.03	25.5	1.114	0.098	0.109	
		Right Side	836.5	25.03	25.5	1.114	0.170	0.189	
		Bottom Side	836.5	25.03	25.5	1.114	0.285	0.318	11
	QPSK, 50%RB	Left Side	844	24.18	24.5	1.076	0.058	0.062	
		Right Side	844	24.18	24.5	1.076	0.141	0.152	
		Bottom Side	844	24.18	24.5	1.076	0.231	0.249	

LTE Band 7 (20MHz Bandwidth)									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	QPSK, 1RB	Left Cheek	2535	23.00	23.5	1.122	0.164	0.184	
		Left Tilt	2535	23.00	23.5	1.122	0.143	0.160	
		Right Cheek	2535	23.00	23.5	1.122	0.210	0.236	
		Right Tilt	2535	23.00	23.5	1.122	0.161	0.181	
	QPSK, 50%RB	Left Cheek	2560	21.89	22.0	1.026	0.137	0.141	
		Left Tilt	2560	21.89	22.0	1.026	0.122	0.125	
		Right Cheek	2560	21.89	22.0	1.026	0.133	0.136	
		Right Tilt	2560	21.89	22.0	1.026	0.128	0.131	
Body & Hotspot	QPSK, 1RB	Front Face	2535	23.00	23.5	1.122	0.322	0.361	
		Back Face	2535	23.00	23.5	1.122	0.327	0.367	
	QPSK, 50%RB	Front Face	2560	21.89	22.0	1.026	0.195	0.200	
		Back Face	2560	21.89	22.0	1.026	0.282	0.289	
Hotspot	QPSK, 1RB	Left Side	2535	23.00	23.5	1.122	0.171	0.192	
		Right Side	2535	23.00	23.5	1.122	0.181	0.203	
		Bottom Side	2535	23.00	23.5	1.122	0.440	0.494	12
	QPSK, 50%RB	Left Side	2560	21.89	22.0	1.026	0.113	0.116	
		Right Side	2560	21.89	22.0	1.026	0.160	0.164	
		Bottom Side	2560	21.89	22.0	1.026	0.406	0.416	

LTE Band 12 (10MHz Bandwidth)									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	QPSK, 1RB	Left Cheek	707.5	24.54	25.0	1.112	0.142	0.158	
		Left Tilt	707.5	24.54	25.0	1.112	0.071	0.079	
		Right Cheek	707.5	24.54	25.0	1.112	0.110	0.122	
		Right Tilt	707.5	24.54	25.0	1.112	0.124	0.138	
	QPSK, 50%RB	Left Cheek	711	23.64	24.0	1.086	0.121	0.131	
		Left Tilt	711	23.64	24.0	1.086	0.070	0.076	
		Right Cheek	711	23.64	24.0	1.086	0.068	0.074	
		Right Tilt	711	23.64	24.0	1.086	0.078	0.085	
Body & Hotspot	QPSK, 1RB	Front Face	707.5	24.54	25.0	1.112	0.182	0.202	
		Back Face	707.5	24.54	25.0	1.112	0.206	0.229	
	QPSK, 50%RB	Front Face	711	23.64	24.0	1.086	0.172	0.187	
		Back Face	711	23.64	24.0	1.086	0.173	0.188	
Hotspot	QPSK, 1RB	Left Side	707.5	24.54	25.0	1.112	0.149	0.166	
		Right Side	707.5	24.54	25.0	1.112	0.318	0.354	
		Bottom Side	707.5	24.54	25.0	1.112	0.324	0.360	13
	QPSK, 50%RB	Left Side	711	23.64	24.0	1.086	0.124	0.135	
		Right Side	711	23.64	24.0	1.086	0.262	0.285	
		Bottom Side	711	23.64	24.0	1.086	0.265	0.288	

LTE Band 17 (10MHz Bandwidth)									
RF Exposure Conditions	Mode	Test Position	Freq. (MHz)	Power (dBm)		Scaling Factor	SAR _{1g} (W/kg)		Plot No.
				Meas.	Tuen-up		Meas.	Scaled	
Head	QPSK, 1RB	Left Cheek	711	24.52	25.0	1.117	0.097	0.108	
		Left Tilt	711	24.52	25.0	1.117	0.085	0.095	
		Right Cheek	711	24.52	25.0	1.117	0.093	0.104	
		Right Tilt	711	24.52	25.0	1.117	0.084	0.094	
	QPSK, 50%RB	Left Cheek	711	23.61	24.0	1.094	0.066	0.072	
		Left Tilt	711	23.61	24.0	1.094	0.079	0.086	
		Right Cheek	711	23.61	24.0	1.094	0.059	0.065	
		Right Tilt	711	23.61	24.0	1.094	0.062	0.068	
Body & Hotspot	QPSK, 1RB	Front Face	711	24.52	25.0	1.117	0.190	0.212	
		Back Face	711	24.52	25.0	1.117	0.267	0.298	
	QPSK, 50%RB	Front Face	711	23.61	24.0	1.094	0.149	0.163	
		Back Face	711	23.61	24.0	1.094	0.173	0.189	
Hotspot	QPSK, 1RB	Left Side	711	24.52	25.0	1.117	0.160	0.179	
		Right Side	711	24.52	25.0	1.117	0.363	0.405	14
		Bottom Side	711	24.52	25.0	1.117	0.354	0.395	
	QPSK, 50%RB	Left Side	711	23.61	24.0	1.094	0.143	0.156	
		Right Side	711	23.61	24.0	1.094	0.285	0.312	
		Bottom Side	711	23.61	24.0	1.094	0.263	0.288	

14.4 SAR Measurement Variability

According to KDB865664, Repeated measurements are required only when the measured SAR is ≥ 0.80 W/kg. If the measured SAR value of the initial repeated measurement is < 1.45 W/kg with $\leq 20\%$ variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties. The following procedures are applied to determine if repeated measurements are required. The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.¹⁹ The repeated measurement results must be clearly identified in the SAR report. All measured SAR, including the repeated results, must be considered to determine compliance and for reporting according to KDB 690783. Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

- 1) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- 2) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg ($\sim 10\%$ from the 1-g SAR limit).
- 3) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

Test Mode	Frequency (MHz)	RF Exposure Configuration	Test Position	Repeated SAR (yes/no)	Highest Measured SAR1-g (W/Kg)	First Repeated	
						Measured SAR1-g (W/Kg)	Largest to Smallest SAR Ratio
/	/	/	/	/	/	/	/

14.5 Simultaneous Transmission Evaluation

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna.

Application Simultaneous Transmission information:

No.	Configurations	Head SAR	Body SAR	Hotspot SAR
1	WWAN+WIFI	Yes	Yes	Yes
2	WWAN+Bluetooth	Yes	Yes	Yes
3	WIFI+Bluetooth	No	No	No

Remark:

1. The MAIN antenna and the DIV antenna both have WWAN functionality and cannot transmit data simultaneously.
2. Bluetooth and WIFI share the same antenna and cannot transmit data at the same time.
3. According to the KDB 447498 D01 v06, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
 - $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})/x}] \text{ W/kg}$ for test separation distances $\leq 50 \text{ mm}$; where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.
 - 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is $> 50 \text{ mm}$

Estimated stand alone SAR						
Mode	Frequency (MHz)	Maximum Power (dBm)	Maximum Power (mW)	Separation Distance (mm)	X	Estimated SAR1-g (W/kg)
Bluetooth	2480	2.5	1.78	5	7.5	0.075

Note:

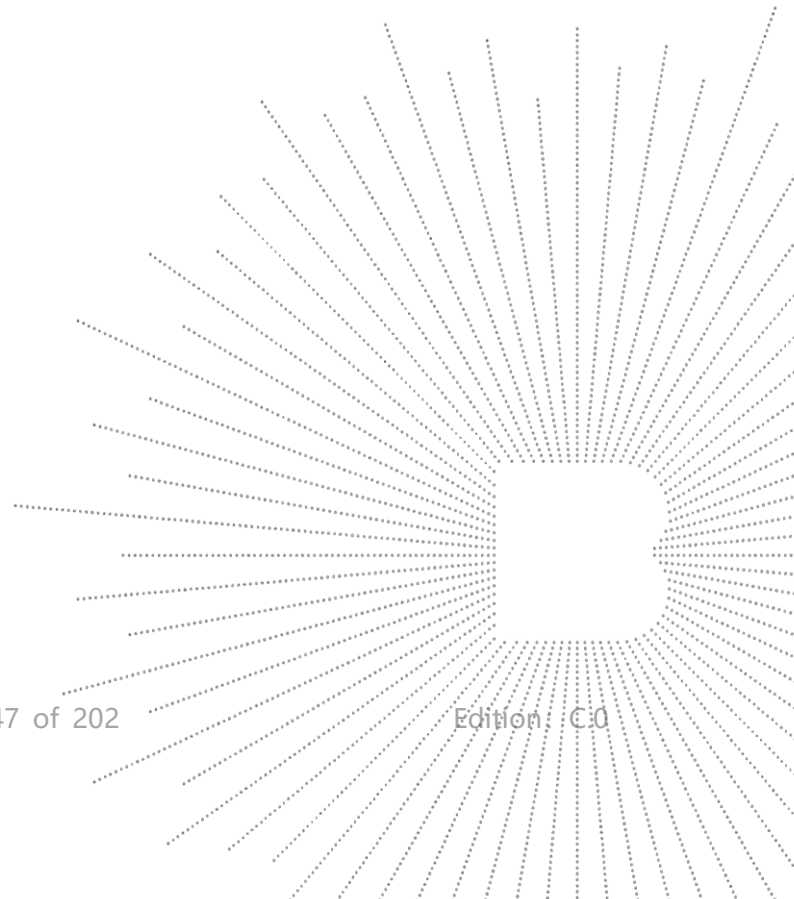
1. Bluetooth*- Including Lower power Bluetooth
2. Maximum average power including tune-up tolerance;
3. When the minimum test separation distance is $< 5 \text{ mm}$, a distance of 5 mm is applied to determine SAR test exclusion

4. Per FCC KD B447498 D01, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the transmitting antenna in a specific a physical test configuration is $\leq 1.6 \text{ W/Kg}$. When the sum is greater than the SAR limit, SAR test exclusion is determined by the SAR to peak location separation ratio.

$$\text{Ratio} = \frac{(\text{SAR}_1 + \text{SAR}_2)^{1.5}}{(\text{peak location separation, mm})} < 0.04$$

5. Simultaneous transmission of maximum SAR sum calculation.

RF Exposure Conditions	Test Position	Scaled SAR _{1g} (W/kg)		Summed SAR _{1g} (W/kg)	Limit SAR _{1g} (W/kg)
		BT/WIFI	WWAN		
Head	Left Cheek	0.535	0.348	0.883	1.6
	Left Tilt	0.616	0.247	0.863	
	Right Cheek	0.597	0.236	0.833	
	Right Tilt	0.711	0.247	0.958	
Body& Hotspot	Front Face	0.388	0.361	0.749	
	Back Face	0.395	0.511	0.906	
Hotspot	Left Side	/	0.458	0.458	
	Right Side	0.378	0.405	0.783	
	Top Side	0.439	/	0.439	
	Bottom Side	/	0.494	0.494	



15. Test Plots

15.1 System Performance Check

System check at 750 MHz

Date of measurement: 23/6/2025

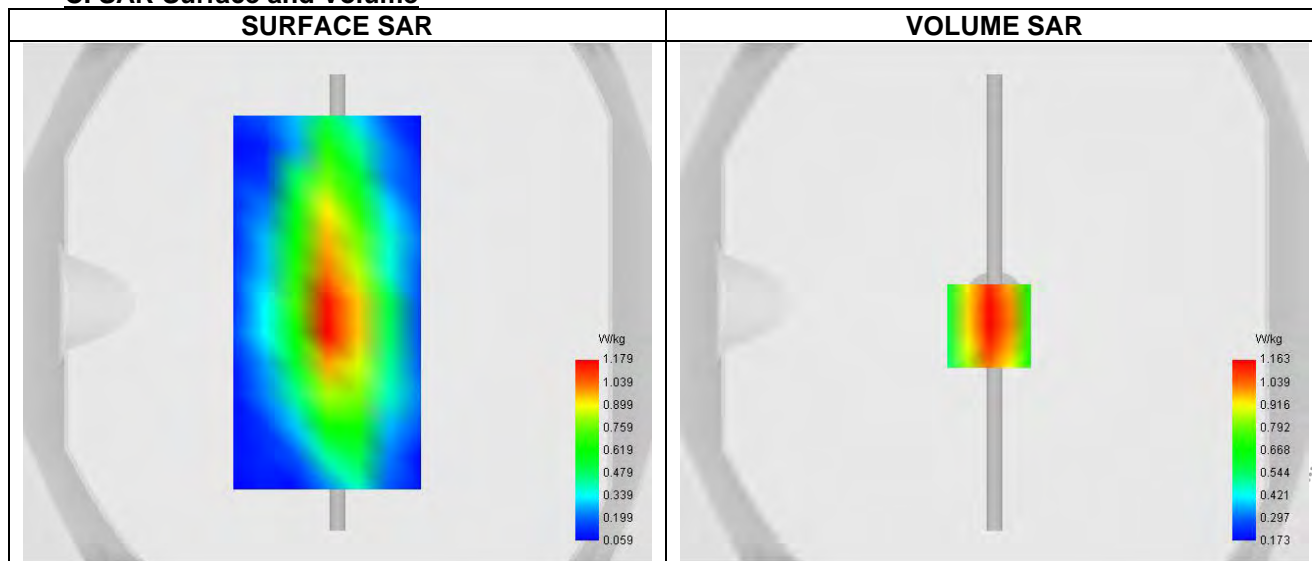
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.80
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Dipole
Band	CW750
Signal	CW

B. Permittivity

Frequency (MHz)	750.000
Relative permittivity (real part)	40.917
Relative permittivity (imaginary part)	24.595
Conductivity (S/m)	0.860

C. SAR Surface and Volume

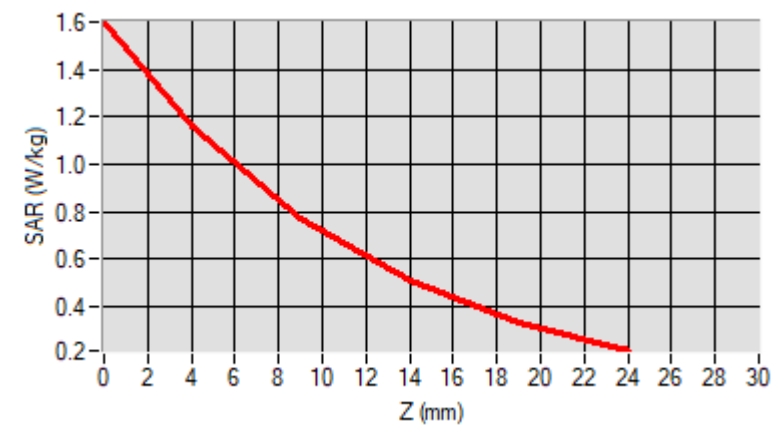


D. SAR 1g & 10g

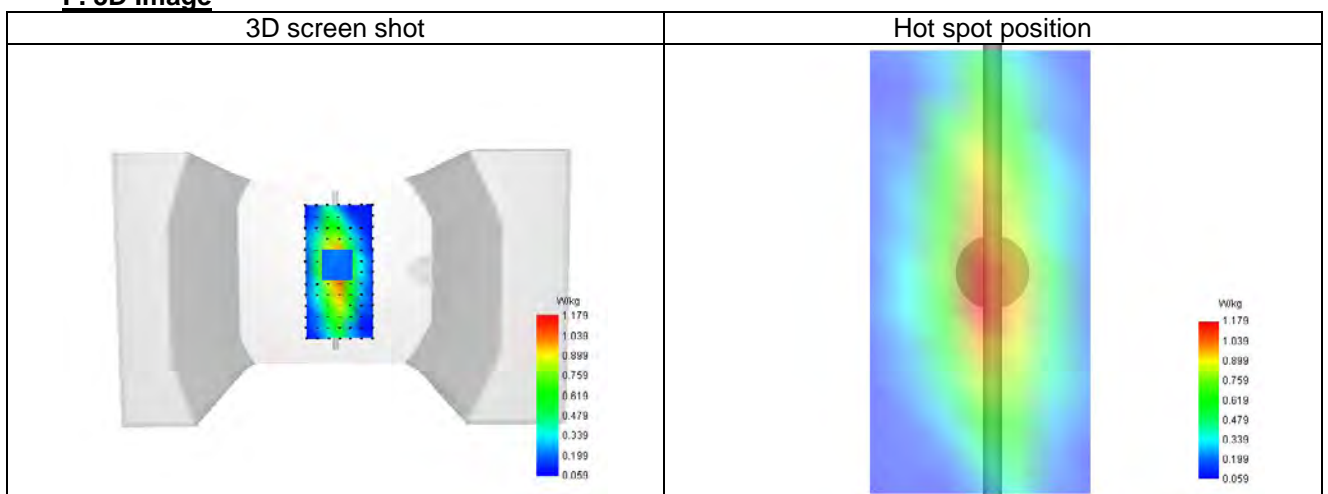
SAR 10g (W/Kg)	1.318
SAR 1g (W/Kg)	2.256
Variation (%)	-3.655

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.603	1.163	0.769	0.506	0.333



F. 3D Image



System check at 835 MHz

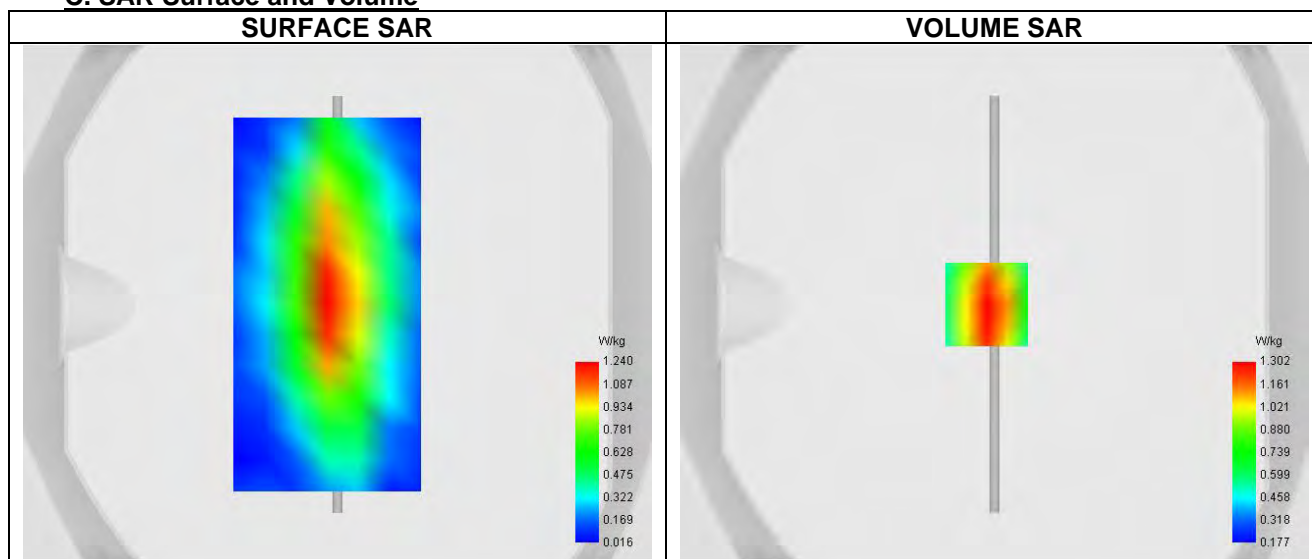
Date of measurement: 23/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.81
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Dipole
Band	CW835
Signal	CW

B. Permittivity

Frequency (MHz)	835.000
Relative permittivity (real part)	40.260
Relative permittivity (imaginary part)	20.910
Conductivity (S/m)	0.925

C. SAR Surface and Volume


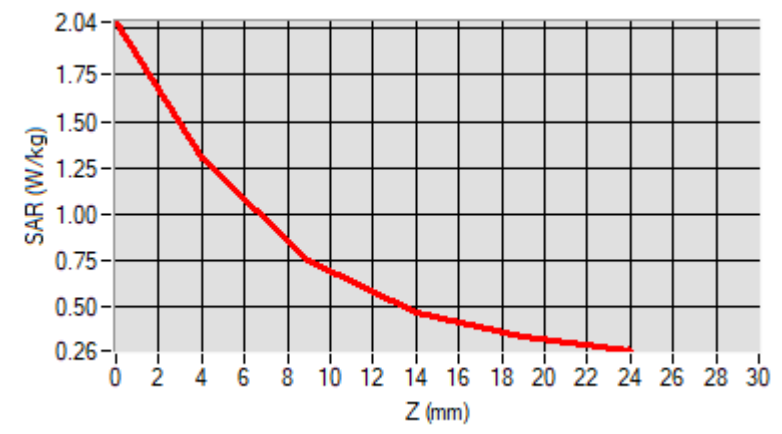
Maximum location: X=-3.00, Y=0.00 ; SAR Peak: 2.06 W/kg

D. SAR 1g & 10g

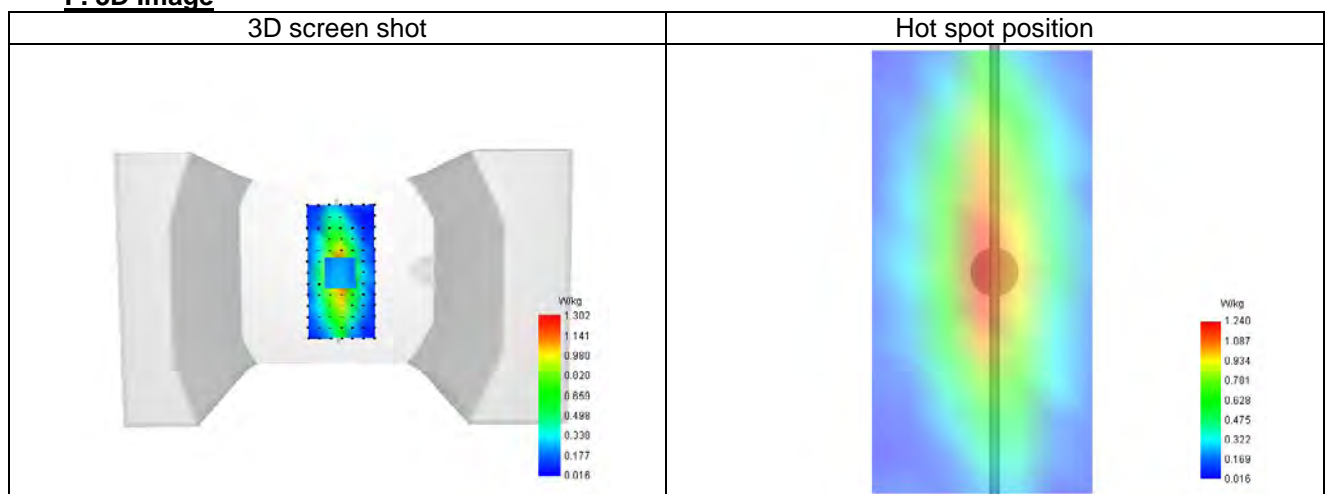
SAR 10g (W/Kg)	1.497
SAR 1g (W/Kg)	2.560
Variation (%)	3.567

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.036	1.302	0.747	0.462	0.331



F. 3D Image



System check at 1800 MHz

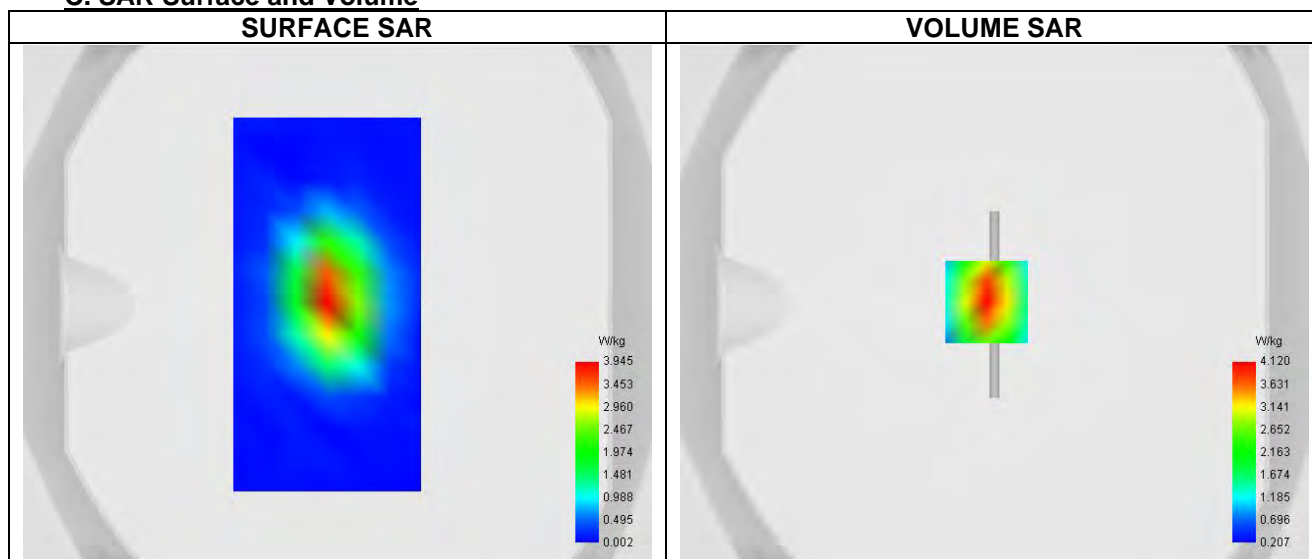
Date of measurement: 27/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.96
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Dipole
Band	CW1800
Signal	CW

B. Permittivity

Frequency (MHz)	1800.000
Relative permittivity (real part)	38.778
Relative permittivity (imaginary part)	15.200
Conductivity (S/m)	1.352

C. SAR Surface and Volume


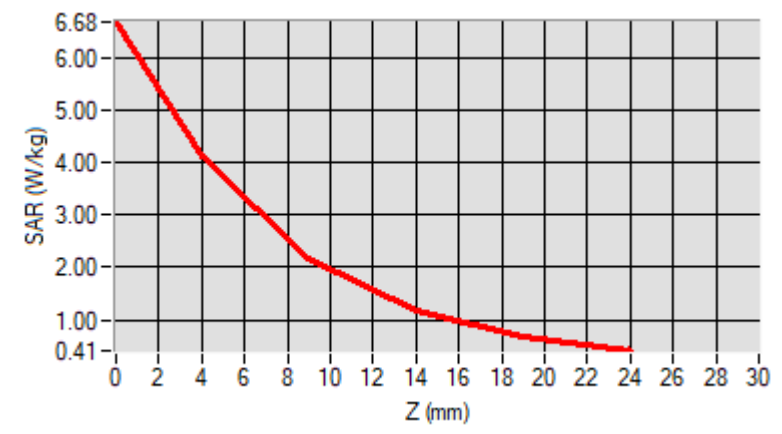
Maximum location: X=-3.00, Y=1.00 ; SAR Peak: 6.69 W/kg

D. SAR 1g & 10g

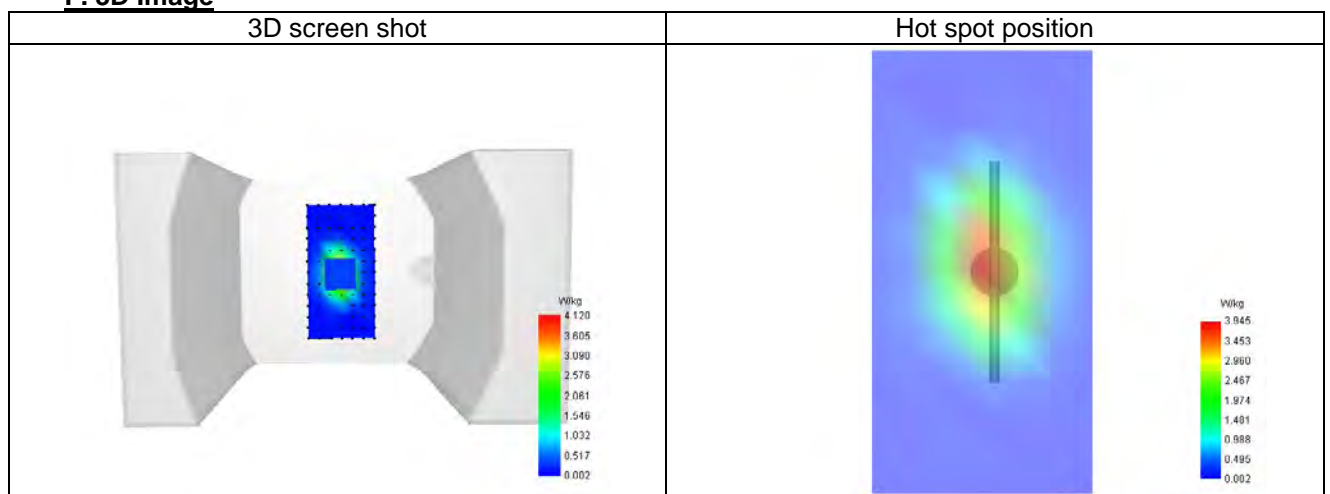
SAR 10g (W/Kg)	5.224
SAR 1g (W/Kg)	9.829
Variation (%)	-4.192

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	6.684	4.120	2.184	1.177	0.685



F. 3D Image



System check at 1900 MHz

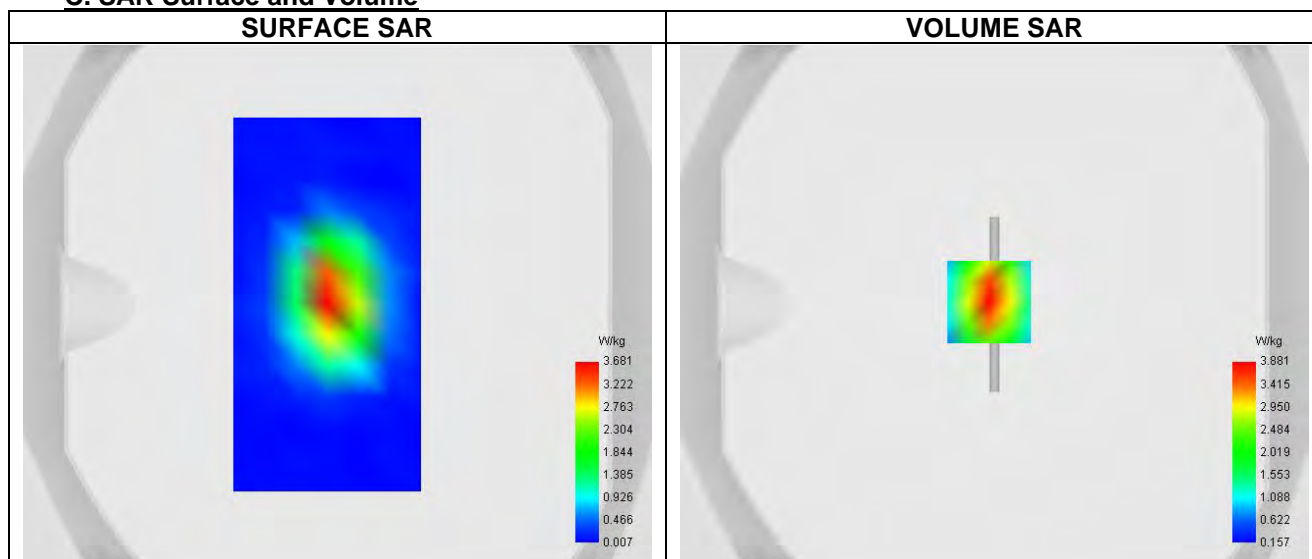
Date of measurement: 27/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Dipole
Band	CW1900
Signal	CW

B. Permittivity

Frequency (MHz)	1900.000
Relative permittivity (real part)	41.063
Relative permittivity (imaginary part)	14.400
Conductivity (S/m)	1.425

C. SAR Surface and Volume


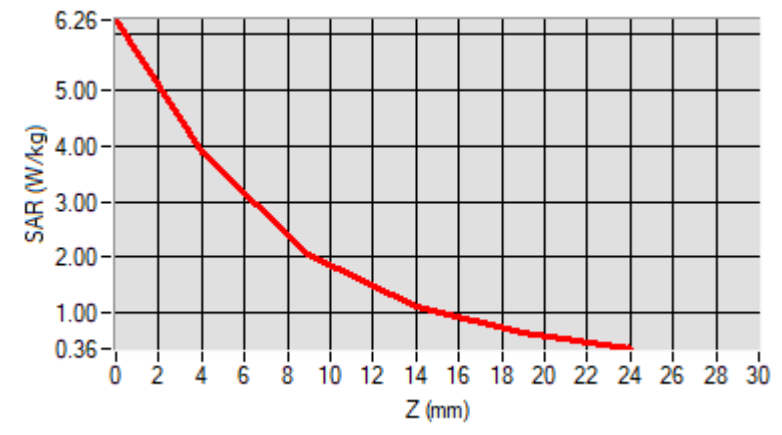
Maximum location: X=-2.00, Y=1.00 ; SAR Peak: 6.27 W/kg

D. SAR 1g & 10g

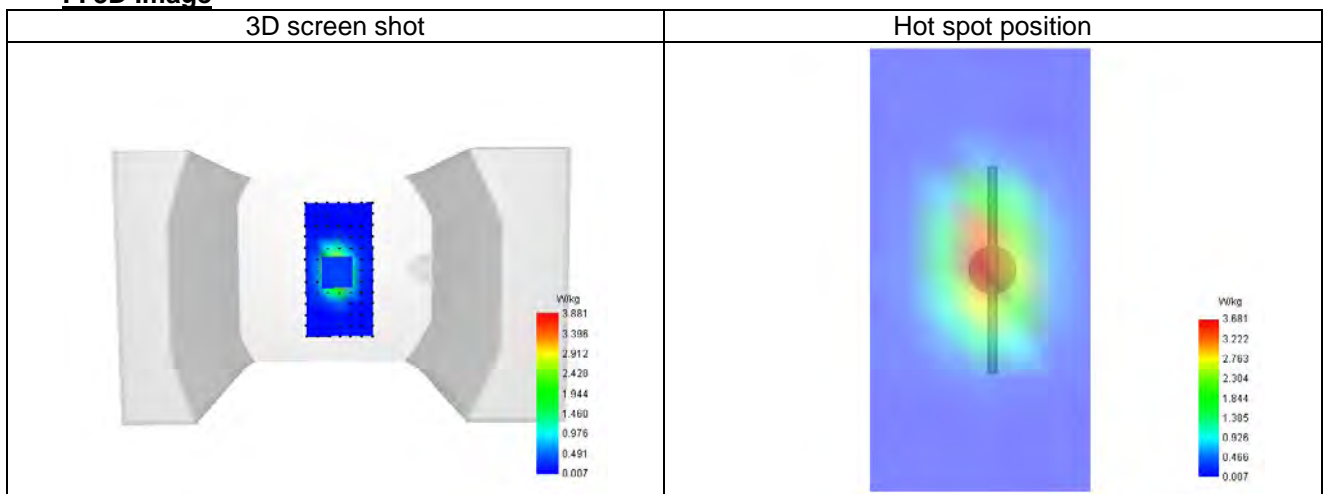
SAR 10g (W/Kg)	5.217
SAR 1g (W/Kg)	9.932
Variation (%)	4.503

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	6.259	3.881	2.069	1.111	0.634



F. 3D Image



System check at 2450 MHz

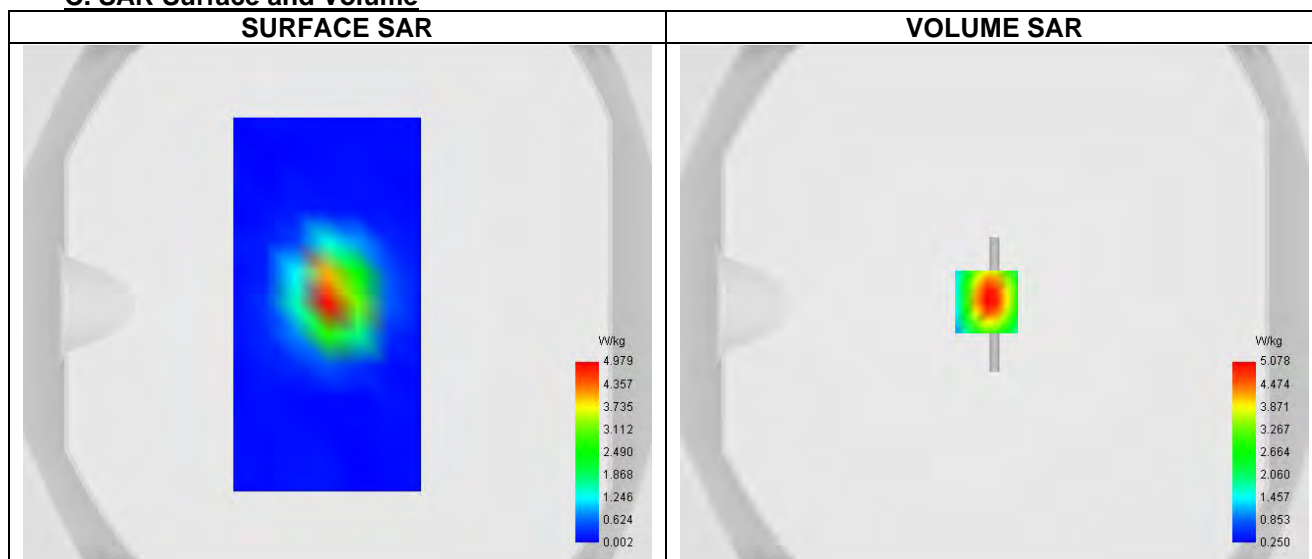
Date of measurement: 25/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=5.0mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Signal	CW

B. Permittivity

Frequency (MHz)	2450.000
Relative permittivity (real part)	40.929
Relative permittivity (imaginary part)	14.330
Conductivity (S/m)	1.803

C. SAR Surface and Volume


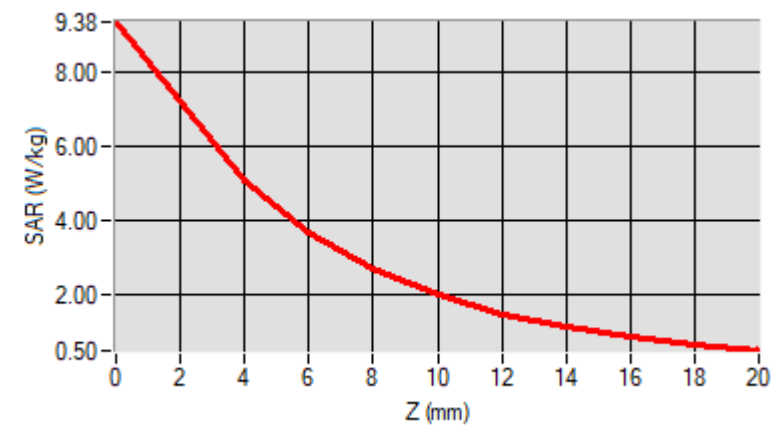
Maximum location: X=-3.00, Y=1.00 ; SAR Peak: 9.50 W/kg

D. SAR 1g & 10g

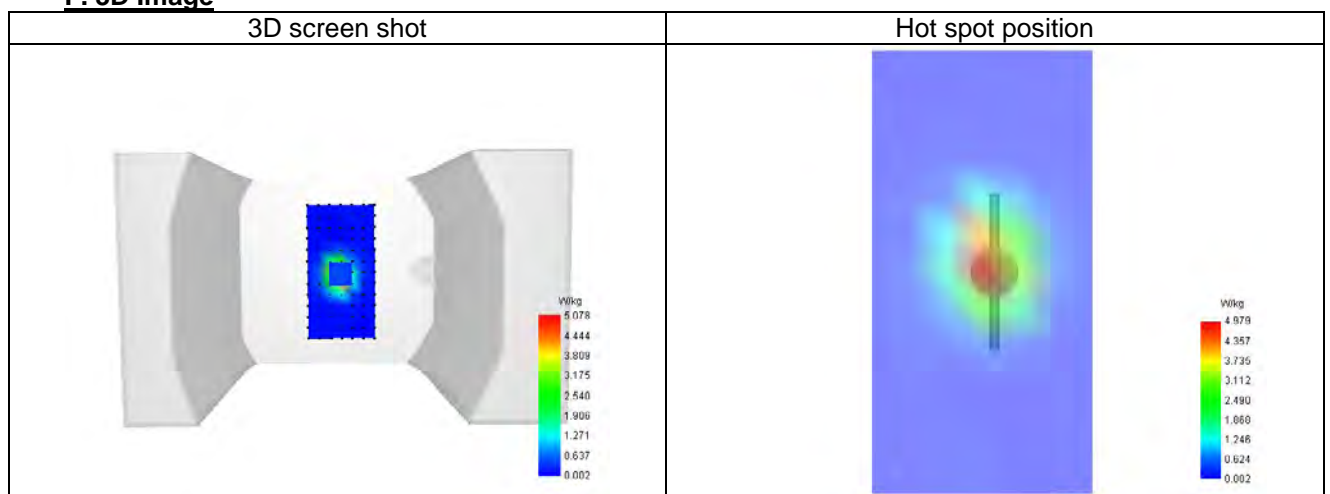
SAR 10g (W/Kg)	5.726
SAR 1g (W/Kg)	14.526
Variation (%)	-0.933

E. Z Axis Scan

Z (mm)	0.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00
SAR (W/Kg)	9.380	5.078	3.712	2.709	2.001	1.499	1.138	0.871	0.667



F. 3D Image



System check at 2600 MHz

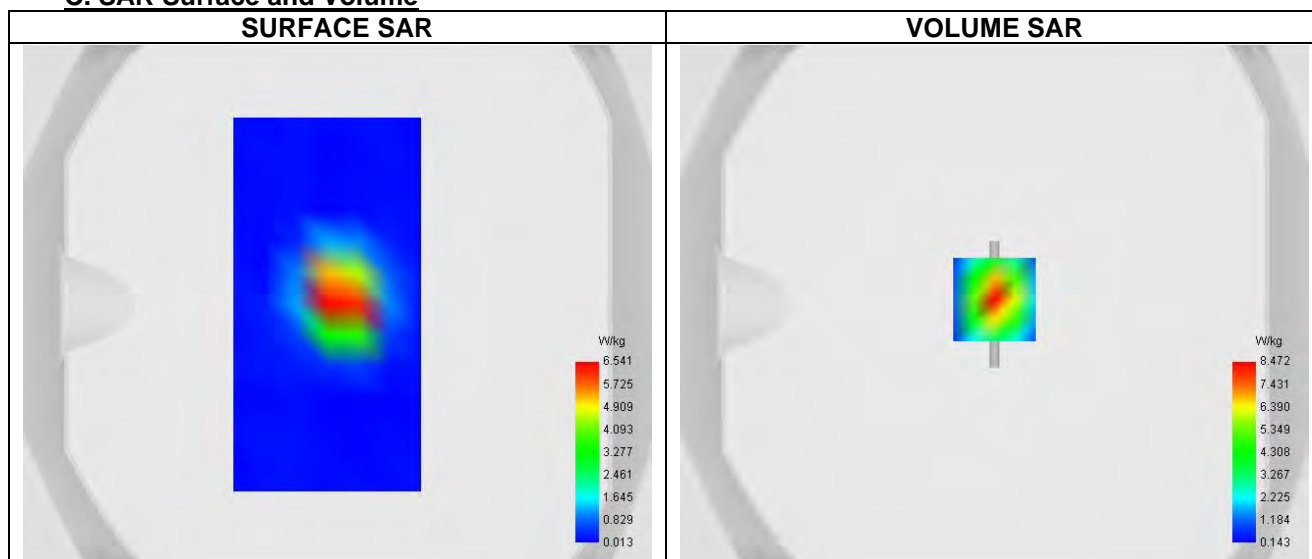
Date of measurement: 25/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.03
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2600
Signal	CW

B. Permittivity

Frequency (MHz)	2600.000
Relative permittivity (real part)	39.203
Relative permittivity (imaginary part)	14.889
Conductivity (S/m)	1.945

C. SAR Surface and Volume


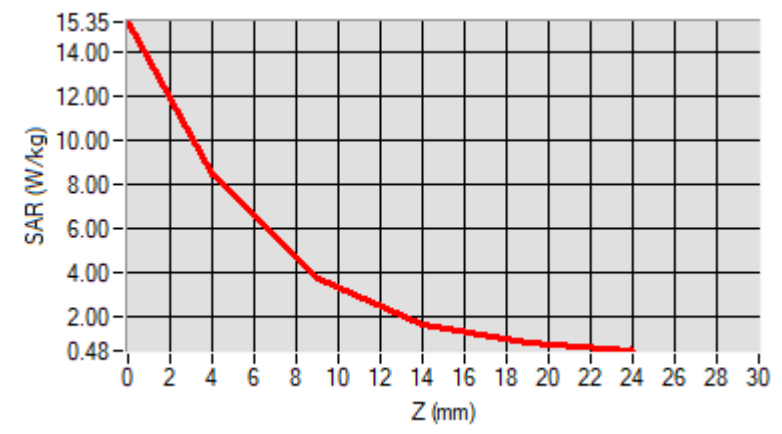
Maximum location: X=0.00, Y=2.00 ; SAR Peak: 15.35 W/kg

D. SAR 1g & 10g

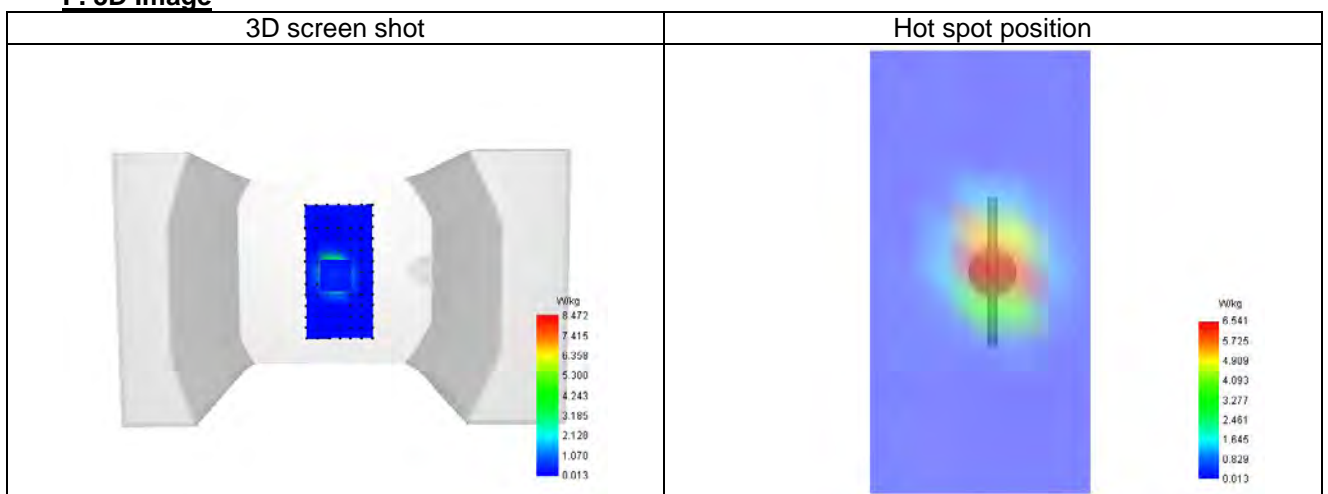
SAR 10g (W/Kg)	6.266
SAR 1g (W/Kg)	14.364
Variation (%)	-2.521

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	15.347	8.472	3.768	1.677	0.856



F. 3D Image



System check at 5200 MHz

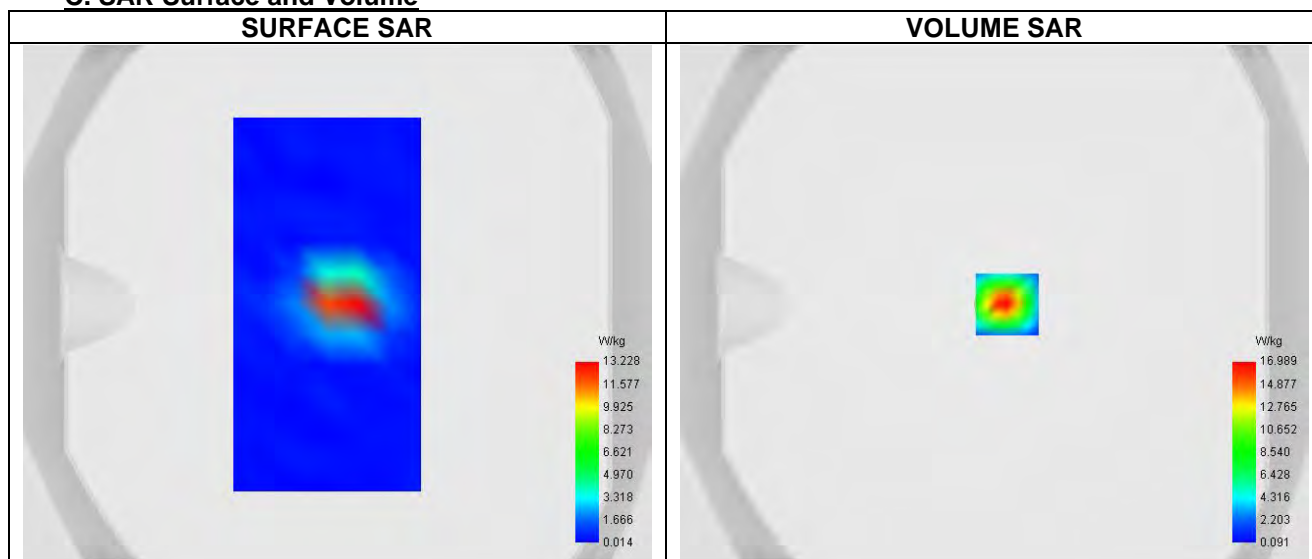
Date of measurement: 25/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.18
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm
Phantom	Validation plane
Device Position	Dipole
Band	CW5200
Signal	CW

B. Permittivity

Frequency (MHz)	5200.000
Relative permittivity (real part)	36.066
Relative permittivity (imaginary part)	18.140
Conductivity (S/m)	4.550

C. SAR Surface and Volume


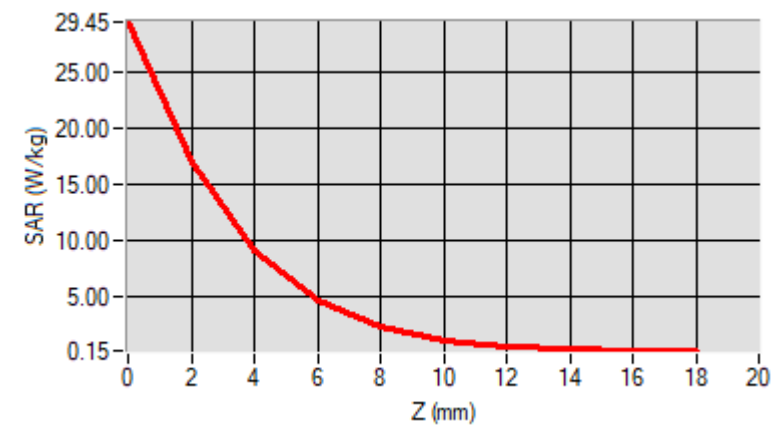
Maximum location: X=5.00, Y=0.00 ; SAR Peak: 30.79 W/kg

D. SAR 1g & 10g

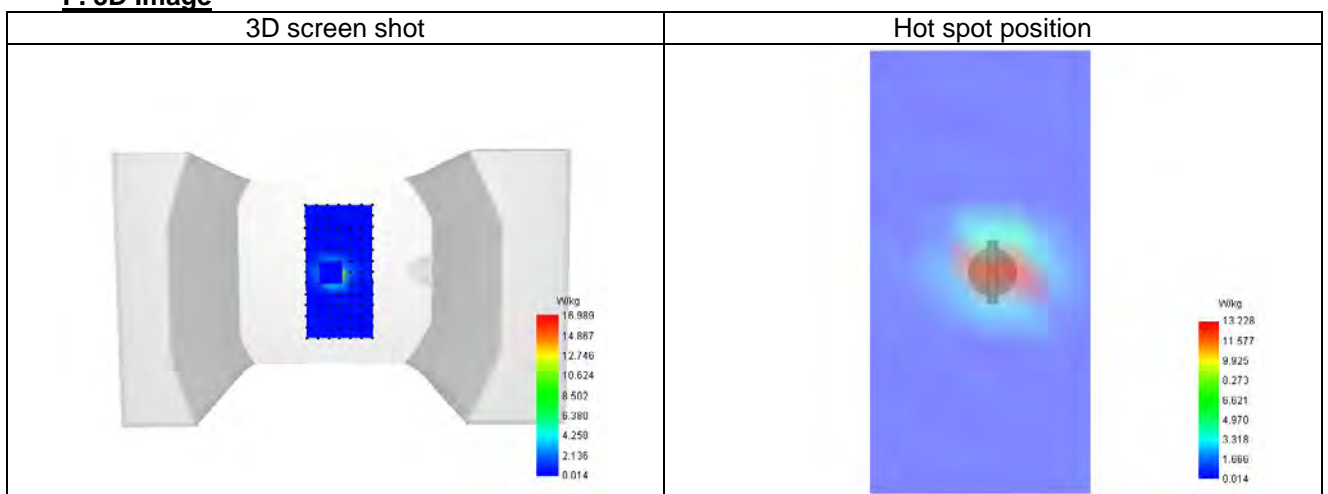
SAR 10g (W/Kg)	5.441
SAR 1g (W/Kg)	19.595
Variation (%)	2.724

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	29.452	16.989	9.130	4.585	2.232	1.083	0.552	0.315	0.209



F. 3D Image



System check at 5800 MHz

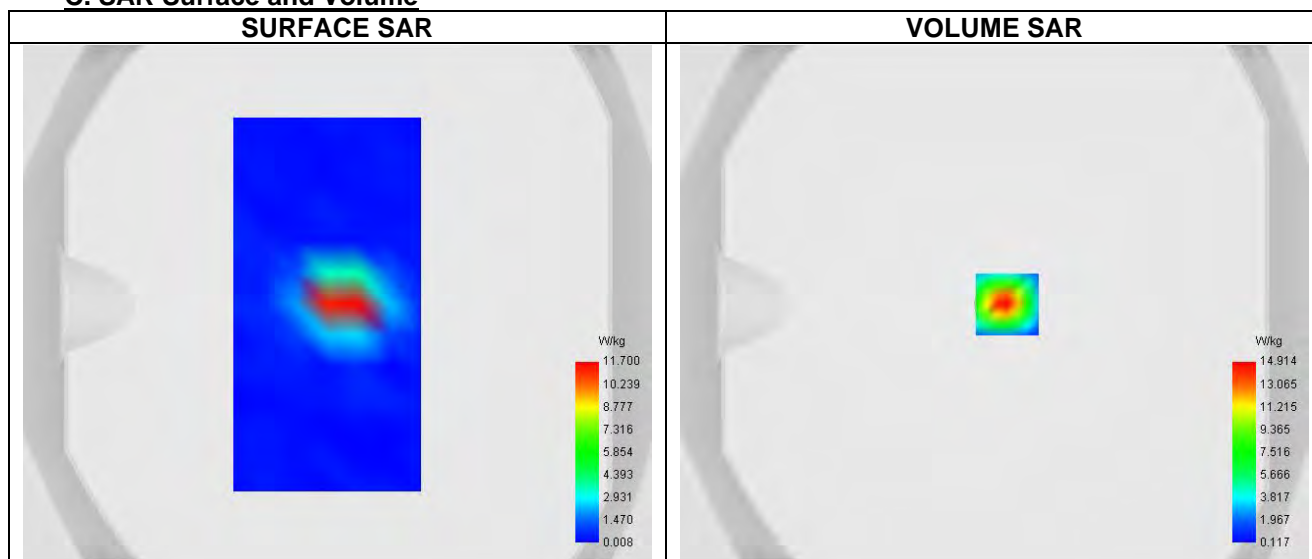
Date of measurement: 25/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.15
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm
Phantom	Validation plane
Device Position	Dipole
Band	CW5800
Signal	CW

B. Permittivity

Frequency (MHz)	5800.000
Relative permittivity (real part)	35.999
Relative permittivity (imaginary part)	18.620
Conductivity (S/m)	5.363

C. SAR Surface and Volume


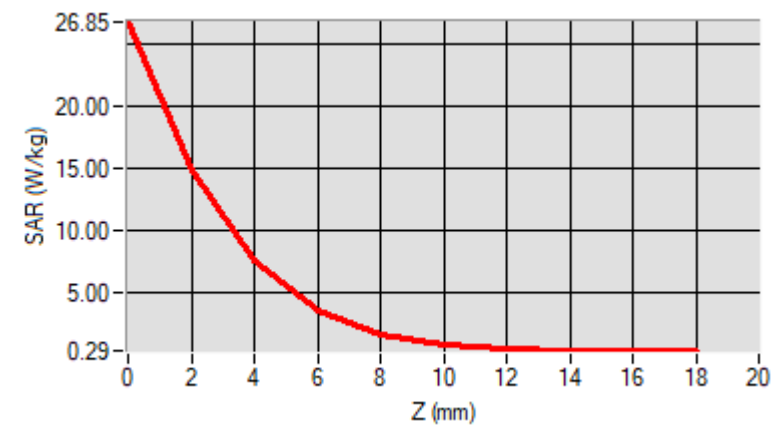
Maximum location: X=5.00, Y=0.00 ; SAR Peak: 28.22 W/kg

D. SAR 1g & 10g

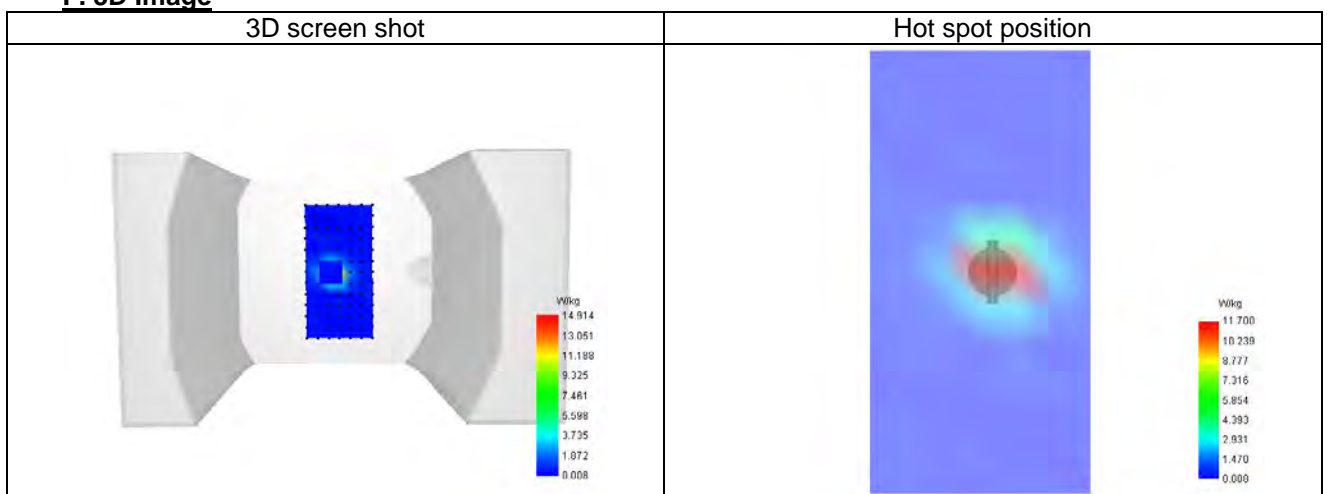
SAR 10g (W/Kg)	5.682
SAR 1g (W/Kg)	18.246
Variation (%)	2.186

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	26.852	14.914	7.581	3.559	1.627	0.770	0.423	0.303	0.288



F. 3D Image



15.2 SAR Test Graph Results

Plot 1

Date of measurement: 25/6/2025

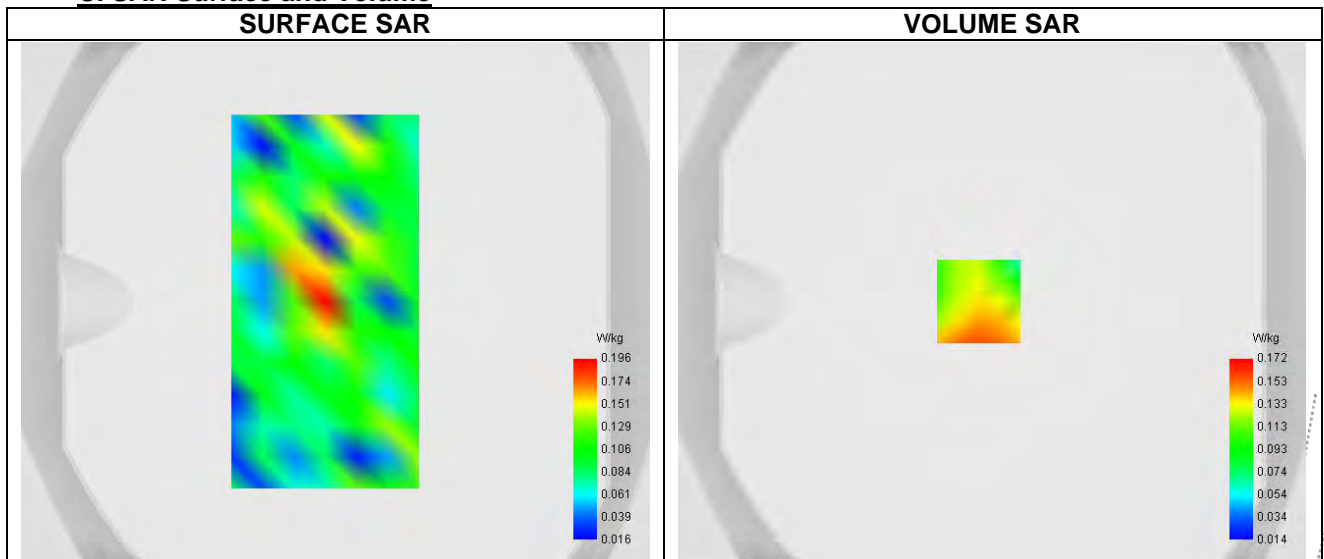
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Body
Band	ISM
Signal	IEEE 802.11 b

B. Permittivity

Frequency (MHz)	2437.000
Relative permittivity (real part)	40.929
Relative permittivity (imaginary part)	13.207
Conductivity (S/m)	1.803

C. SAR Surface and Volume

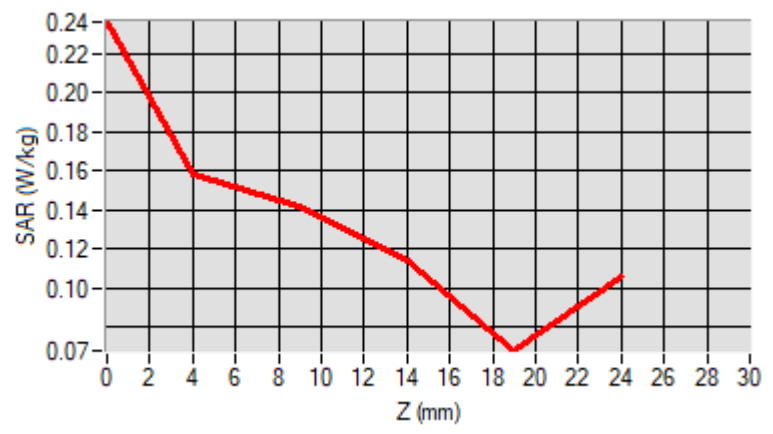


D. SAR 1g & 10g

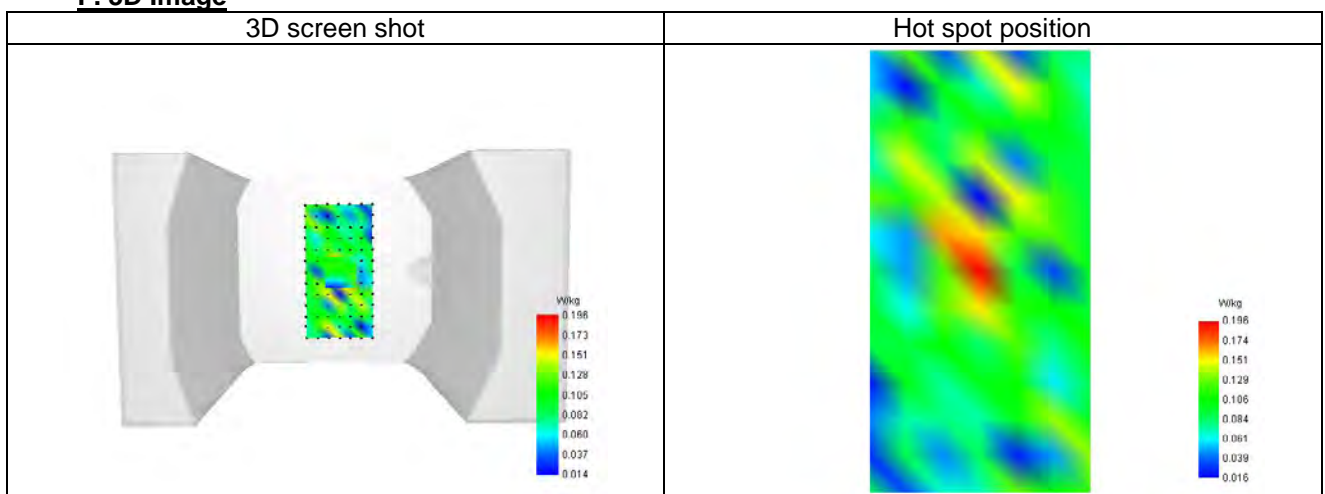
SAR 10g (W/Kg)	0.109
SAR 1g (W/Kg)	0.210
Variation (%)	-3.860

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	-0.001	0.182	0.157	0.136	0.184



F. 3D Image



Plot 2

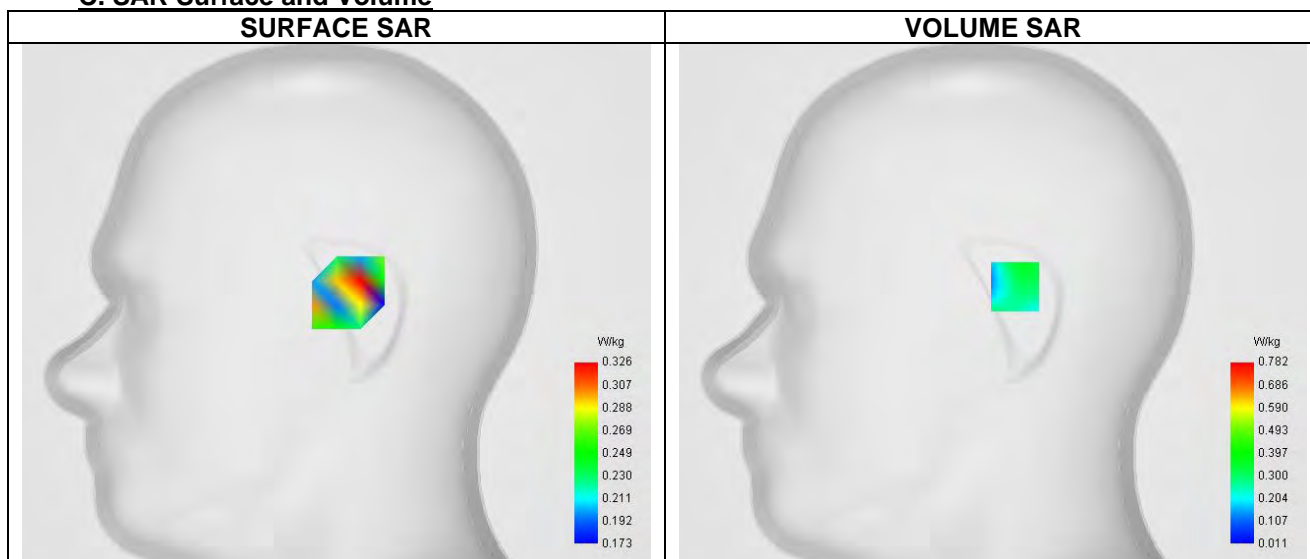
Date of measurement: 25/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.18
Area Scan	dx=12mm dy=12mm, Adaptive 1 max
Zoom Scan	7x7x12, dx=4mm dy=4mm dz=2.0mm
Phantom	Right head
Device Position	Cheek
Band	5200
Signal	--

B. Permittivity

Frequency (MHz)	5180.000
Relative permittivity (real part)	36.066
Relative permittivity (imaginary part)	16.130
Conductivity (S/m)	4.550

C. SAR Surface and Volume


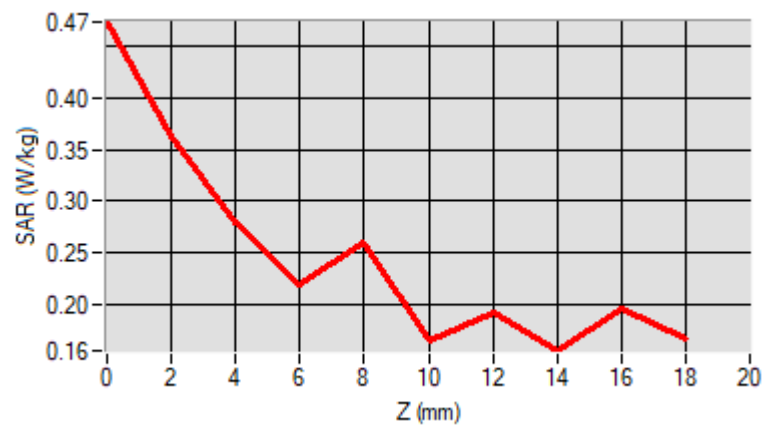
Maximum location: X=11.00, Y=9.00 ; SAR Peak: 1.52 W/kg

D. SAR 1g & 10g

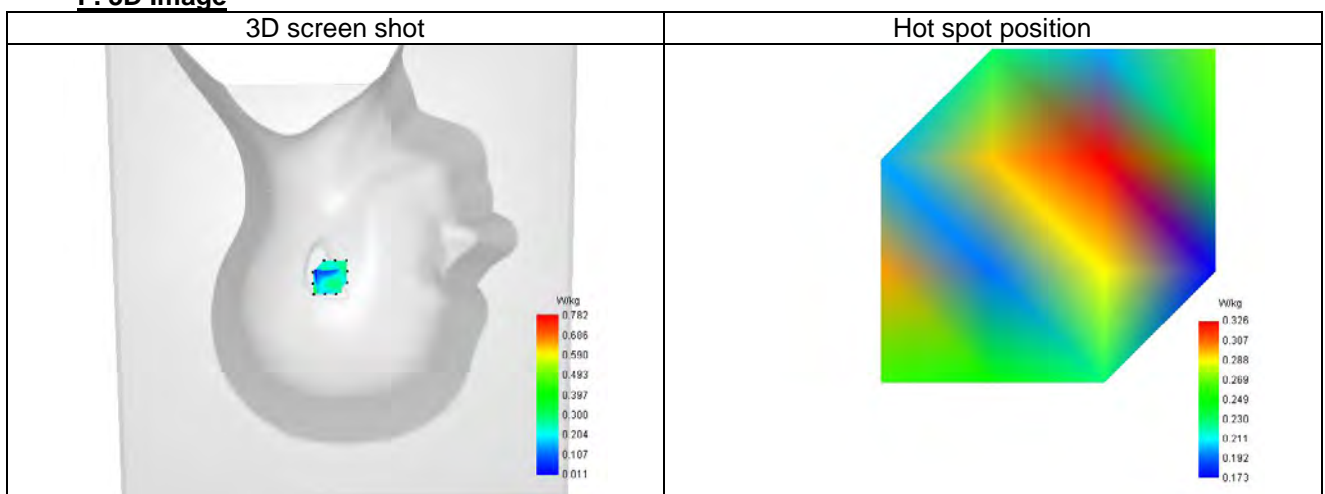
SAR 10g (W/Kg)	0.199
SAR 1g (W/Kg)	0.460
Variation (%)	-3.760

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	0.473	0.364	0.280	0.219	0.260	0.165	0.192	0.156	0.196



F. 3D Image



Plot 3

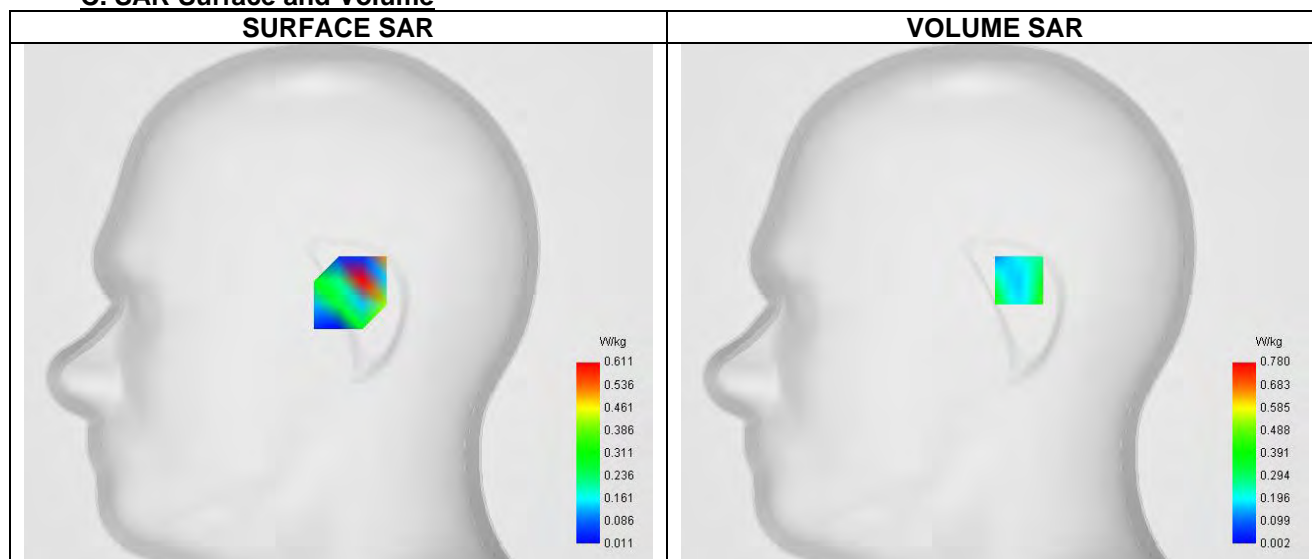
Date of measurement: 25/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.15
Area Scan	dx=12mm dy=12mm, Adaptive 1 max
Zoom Scan	7x7x12, dx=4mm dy=4mm dz=2.0mm
Phantom	Right head
Device Position	Tilt
Band	5800
Signal	--

B. Permittivity

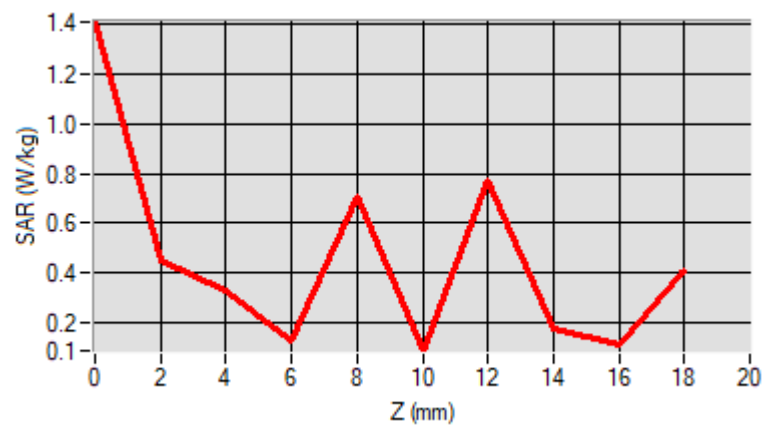
Frequency (MHz)	5745.000
Relative permittivity (real part)	35.999
Relative permittivity (imaginary part)	16.355
Conductivity (S/m)	5.363

C. SAR Surface and Volume

D. SAR 1g & 10g

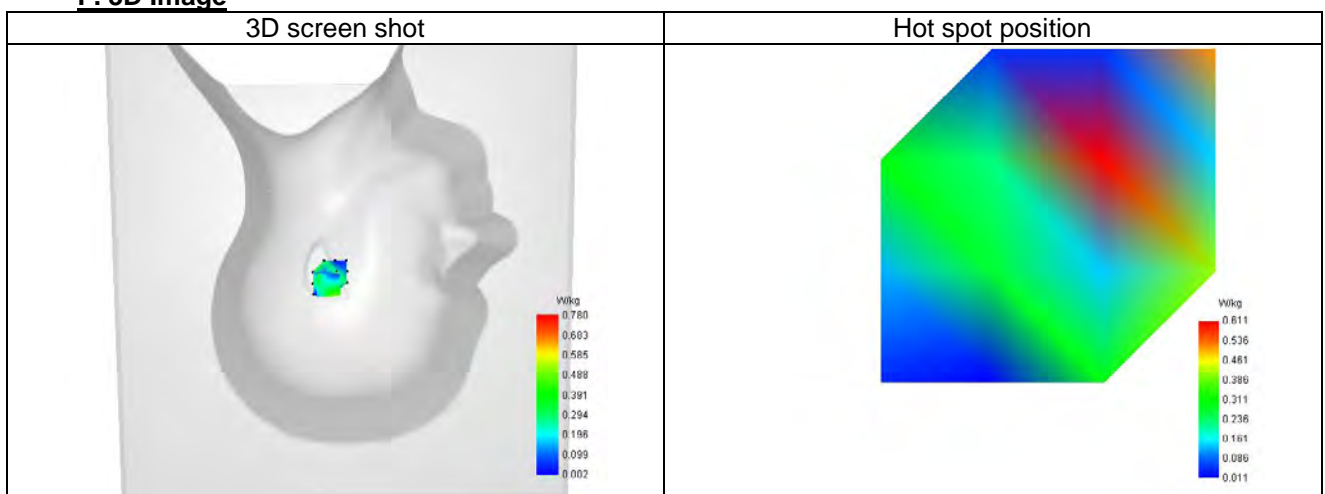
SAR 10g (W/Kg)	0.265
SAR 1g (W/Kg)	0.665
Variation (%)	-3.590

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	1.407	0.453	0.330	0.127	0.709	0.089	0.770	0.181	0.115



F. 3D Image



Plot 4

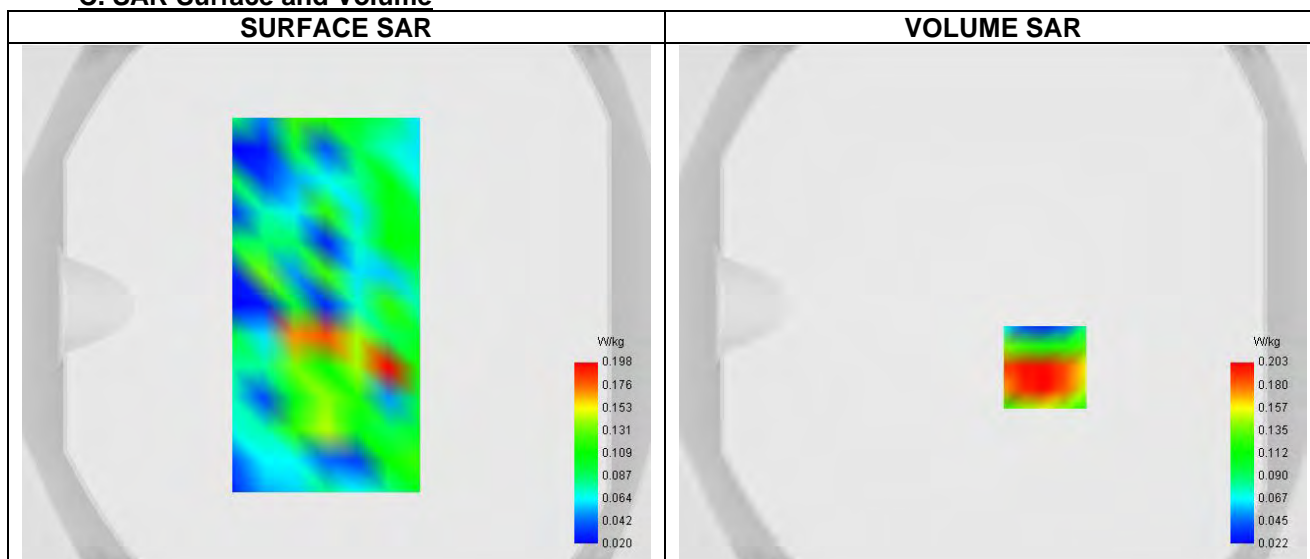
Date of measurement: 23/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.81
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Body
Band	GPRS850
Signal	TDMA (GPRS)

B. Permittivity

Frequency (MHz)	824.200
Relative permittivity (real part)	40.260
Relative permittivity (imaginary part)	19.400
Conductivity (S/m)	0.925

C. SAR Surface and Volume


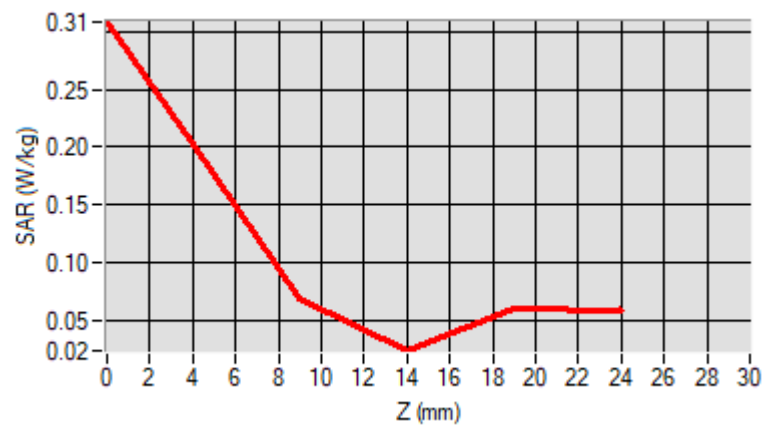
Maximum location: X=7.00, Y=60.00 ; SAR Peak: 0.20 W/kg

D. SAR 1g & 10g

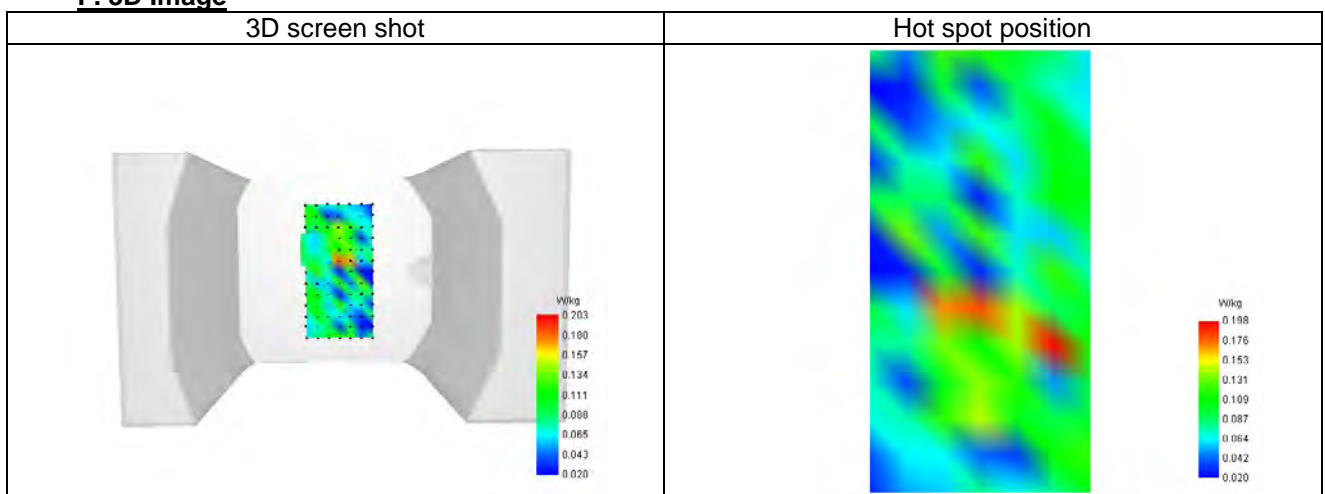
SAR 10g (W/Kg)	0.065
SAR 1g (W/Kg)	0.144
Variation (%)	3.850

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.023	0.149	0.113	0.070	0.079



F. 3D Image



Plot 5

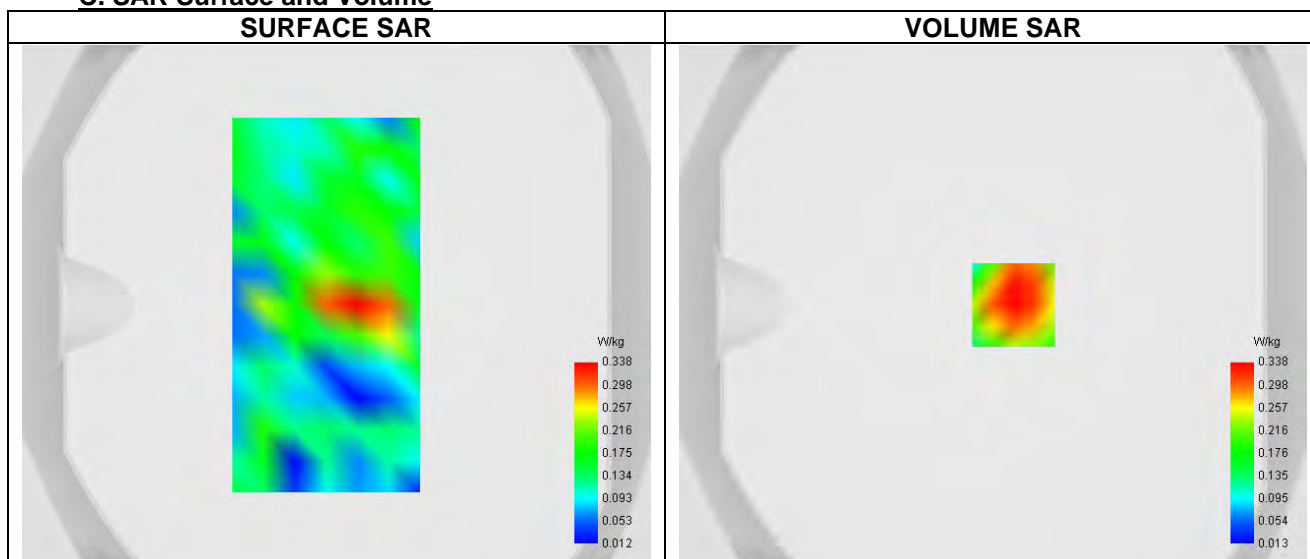
Date of measurement: 27/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Body
Band	GPRS1900
Signal	TDMA (GPRS)

B. Permittivity

Frequency (MHz)	1850.200
Relative permittivity (real part)	41.063
Relative permittivity (imaginary part)	13.408
Conductivity (S/m)	1.425

C. SAR Surface and Volume


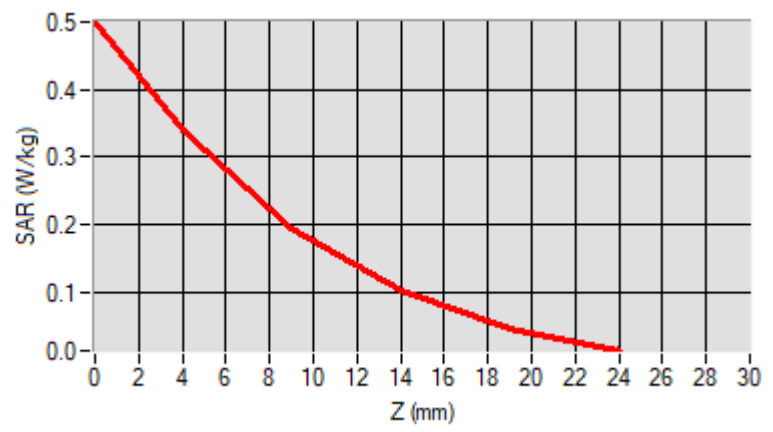
Maximum location: X=8.00, Y=0.00 ; SAR Peak: 0.51 W/kg

D. SAR 1g & 10g

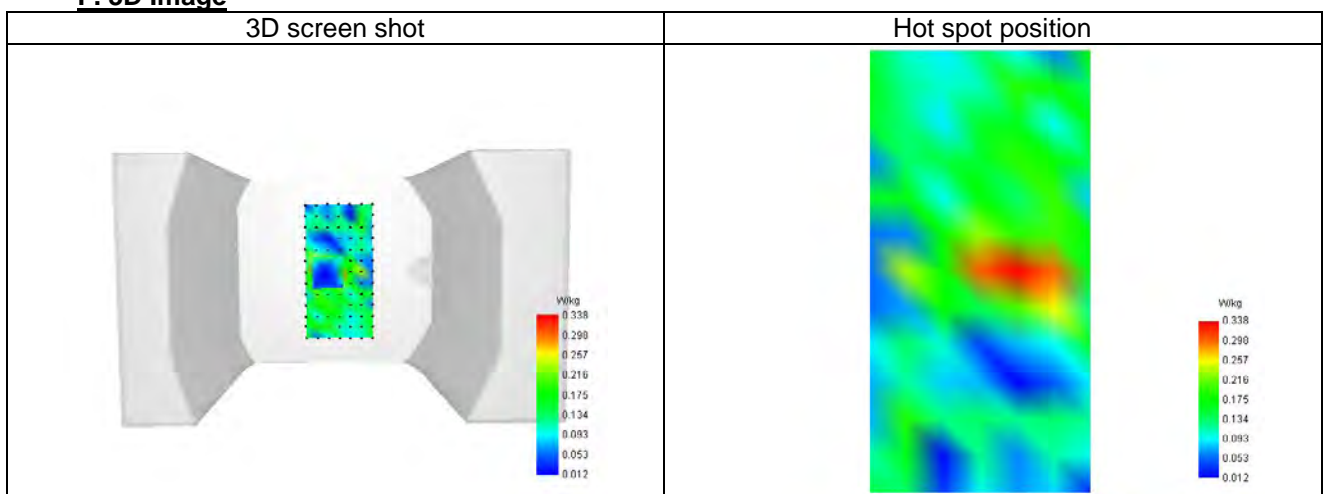
SAR 10g (W/Kg)	0.187
SAR 1g (W/Kg)	0.324
Variation (%)	-3.170

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.500	0.338	0.195	0.103	0.046



F. 3D Image



Plot 6

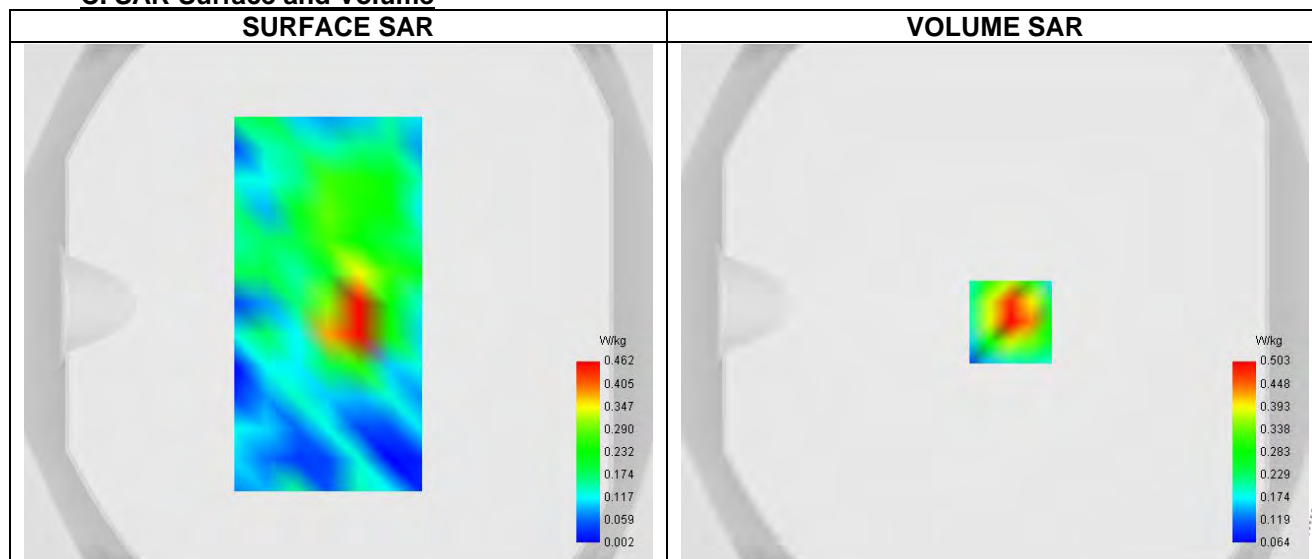
Date of measurement: 27/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Body
Band	Band 2 (1900)
Signal	WCDMA
Mode	Release 99
Connection Type	RMC, 12.2 kbps

B. Permittivity

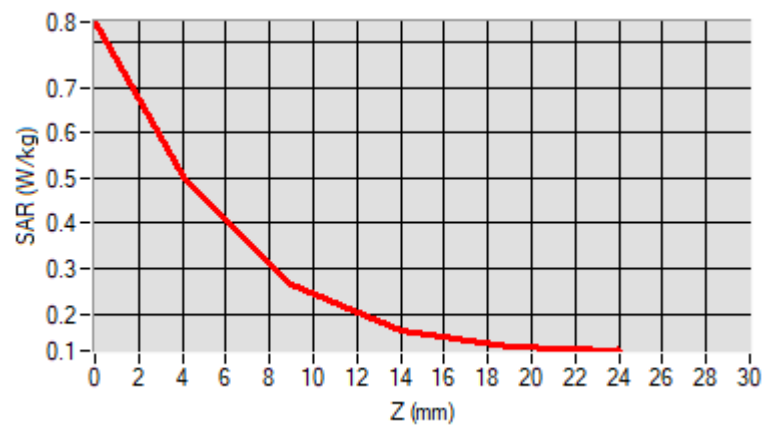
Frequency (MHz)	1852.400
Relative permittivity (real part)	41.063
Relative permittivity (imaginary part)	13.408
Conductivity (S/m)	1.425

C. SAR Surface and Volume

D. SAR 1g & 10g

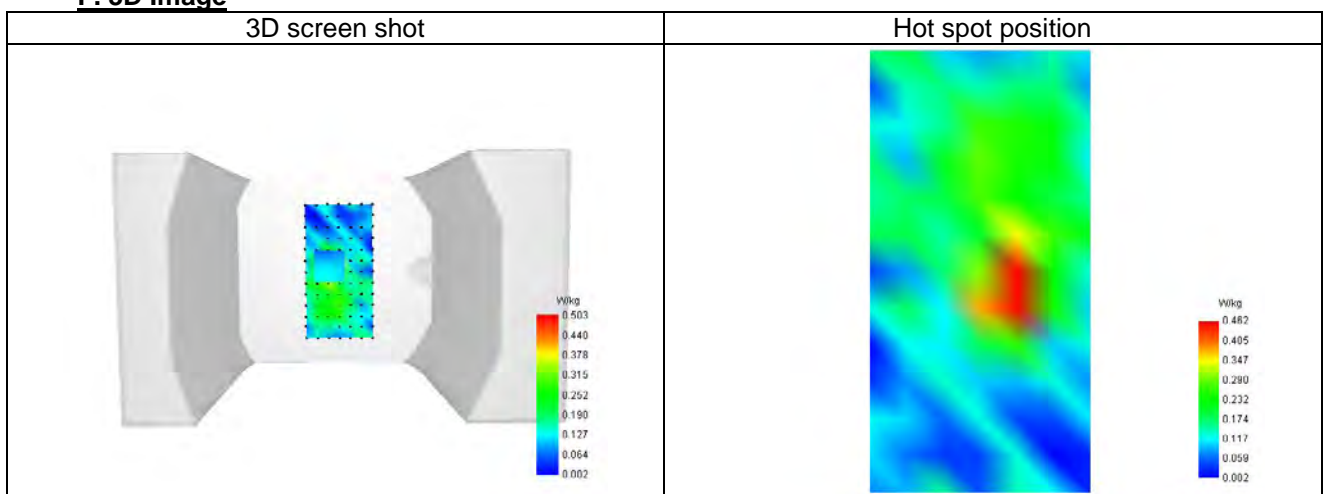
SAR 10g (W/Kg)	0.258
SAR 1g (W/Kg)	0.489
Variation (%)	3.520

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.845	0.503	0.265	0.160	0.126



F. 3D Image



Plot 7

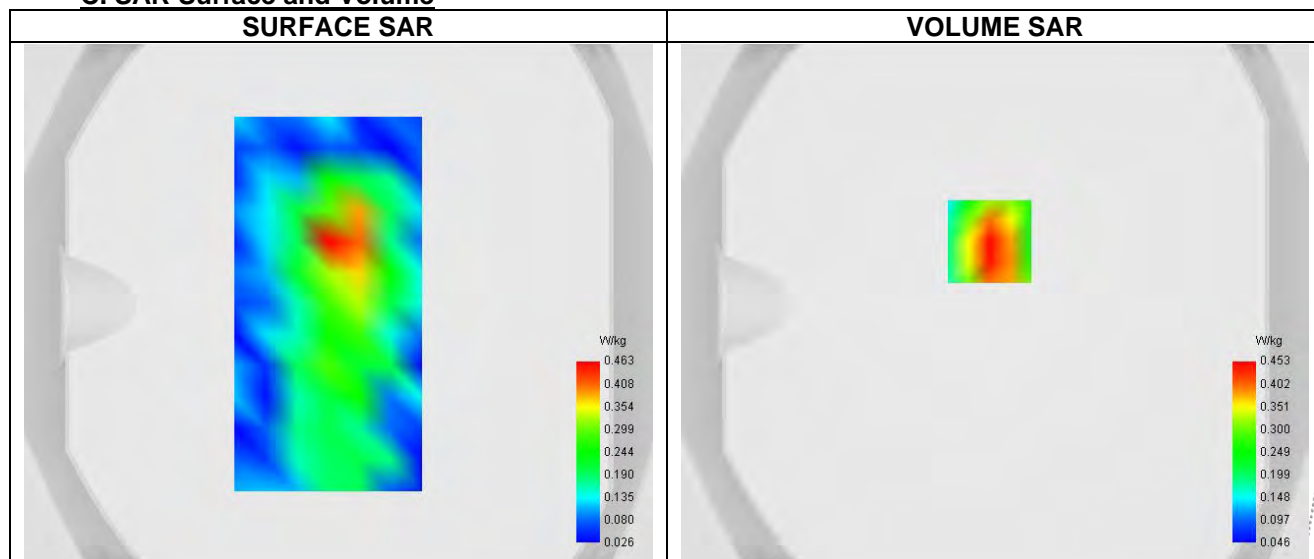
Date of measurement: 27/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.96
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Body
Band	Band 4 (1700)
Signal	WCDMA
Mode	Release 99
Connection Type	RMC, 12.2 kbps

B. Permittivity

Frequency (MHz)	1740.000
Relative permittivity (real part)	38.778
Relative permittivity (imaginary part)	14.136
Conductivity (S/m)	1.352

C. SAR Surface and Volume


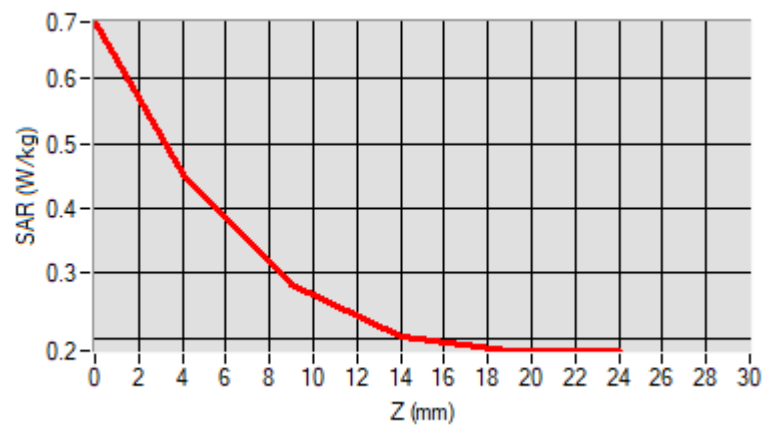
Maximum location: X=-2.00, Y=24.00 ; SAR Peak: 0.74 W/kg

D. SAR 1g & 10g

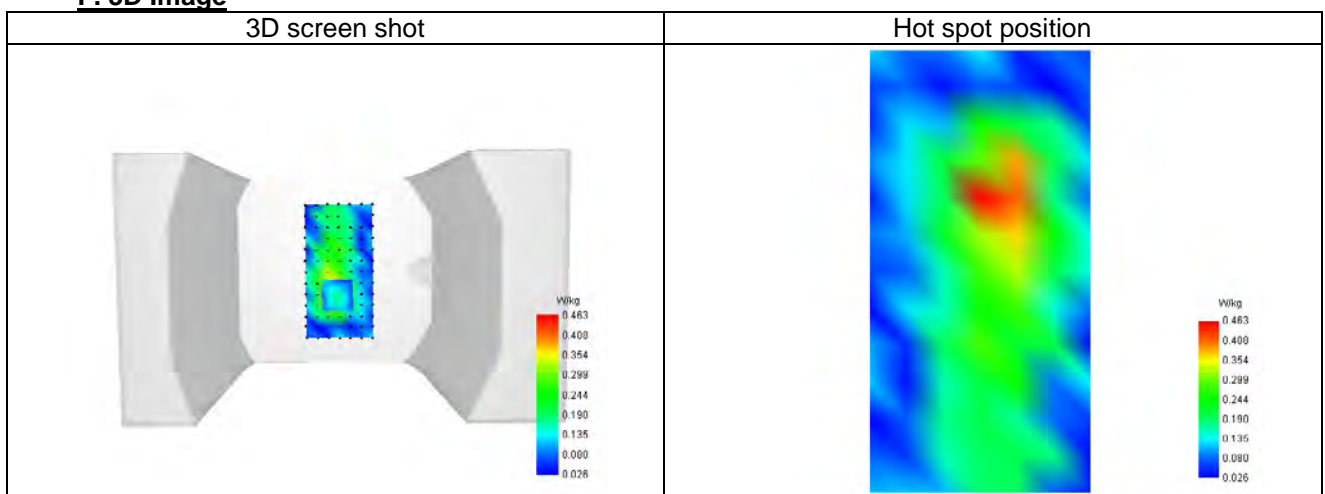
SAR 10g (W/Kg)	0.244
SAR 1g (W/Kg)	0.443
Variation (%)	2.740

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.687	0.453	0.281	0.203	0.180



F. 3D Image



Plot 8

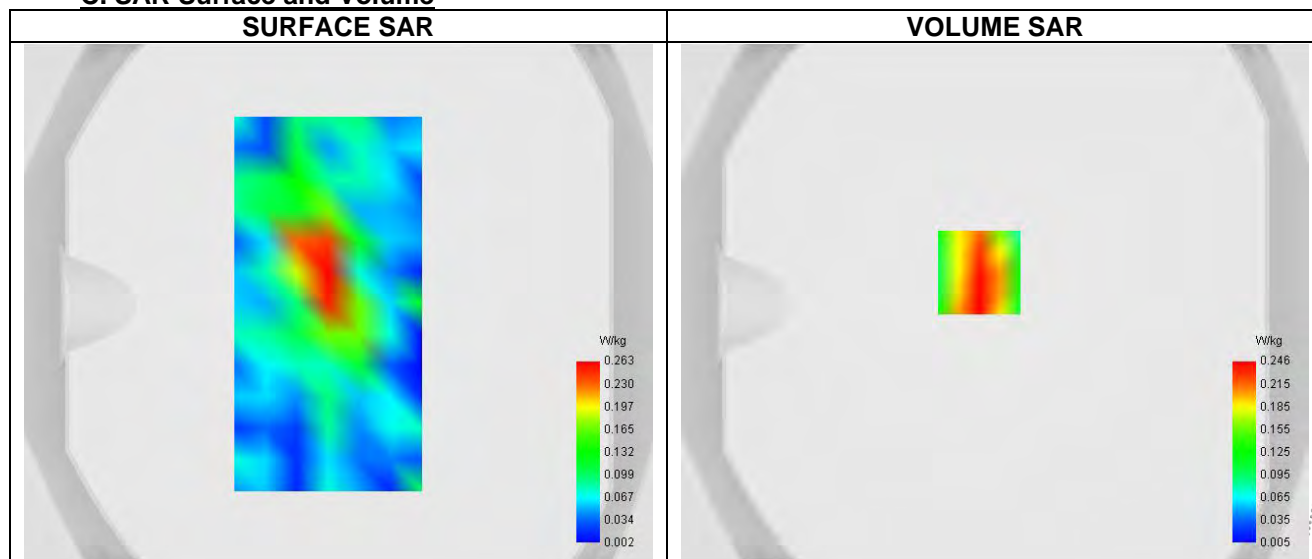
Date of measurement: 23/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.81
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Body
Band	Band 5 (850)
Signal	WCDMA
Mode	Release 99
Connection Type	RMC, 12.2 kbps

B. Permittivity

Frequency (MHz)	846.600
Relative permittivity (real part)	40.260
Relative permittivity (imaginary part)	19.400
Conductivity (S/m)	0.925

C. SAR Surface and Volume


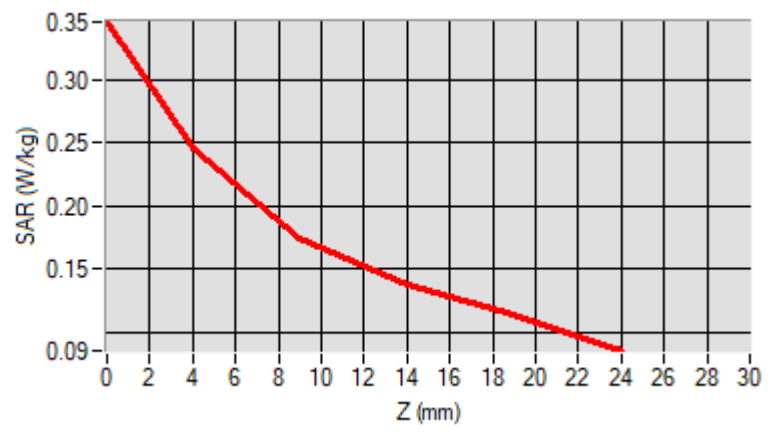
Maximum location: X=-6.00, Y=12.00 ; SAR Peak: 0.36 W/kg

D. SAR 1g & 10g

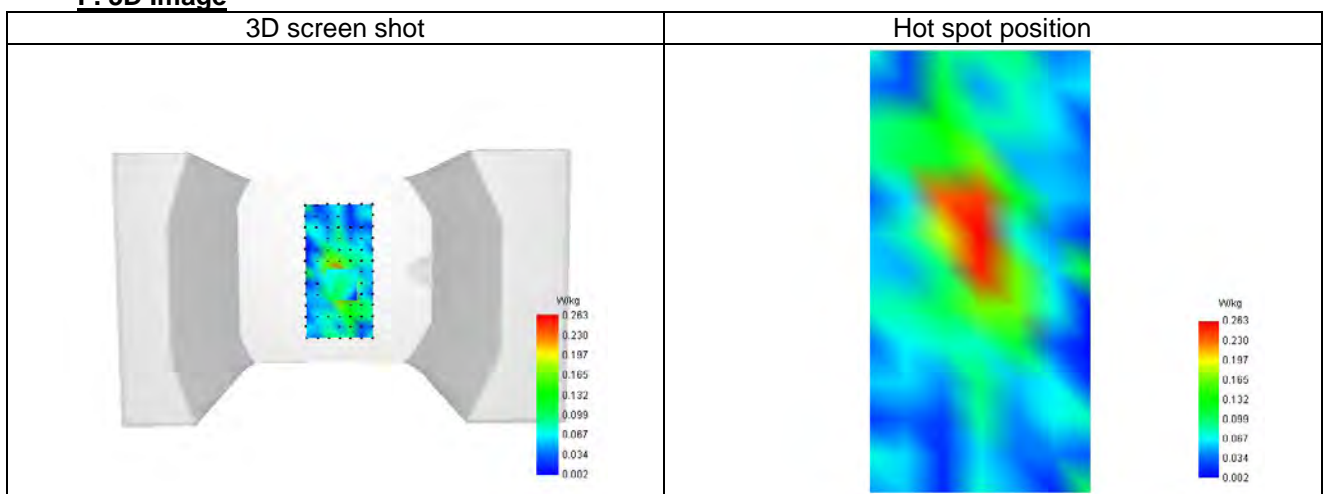
SAR 10g (W/Kg)	0.152
SAR 1g (W/Kg)	0.238
Variation (%)	1.670

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.346	0.246	0.174	0.137	0.113



F. 3D Image



Plot 9

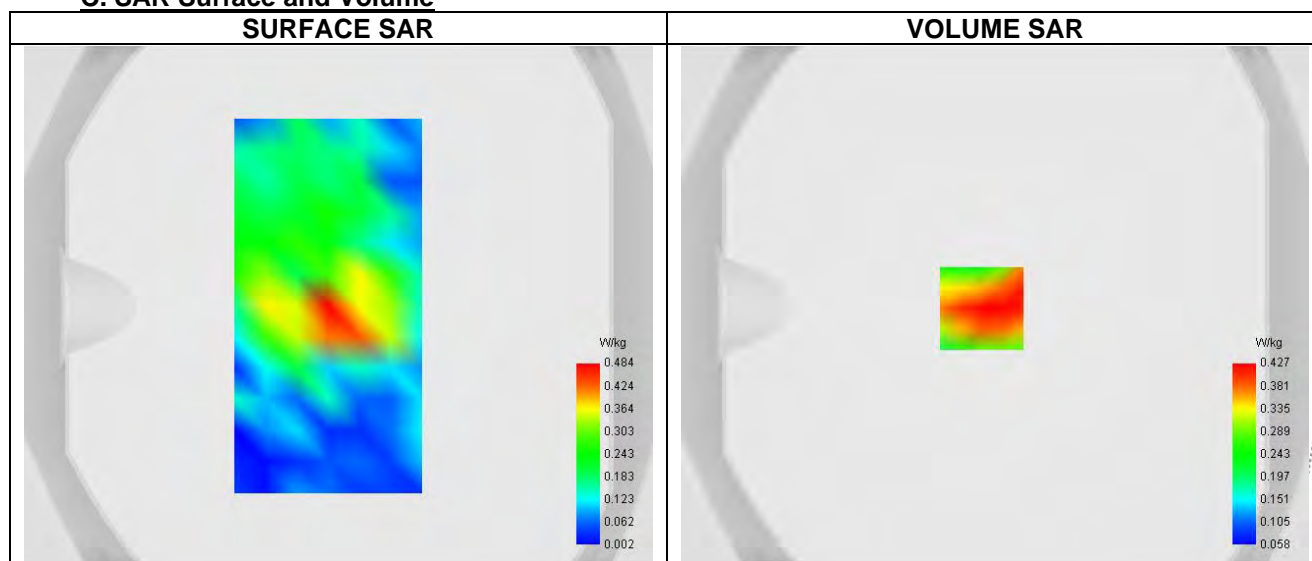
Date of measurement: 27/6/2025

A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5.0mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 2
Signal	LTE FDD
Cell Bandwidth	20 Mhz
Modulation	SC-OFDM - QPSK
RB offset	5
RB size	20

B. Permittivity

Frequency (MHz)	1880.000
Relative permittivity (real part)	41.063
Relative permittivity (imaginary part)	13.455
Conductivity (S/m)	1.425

C. SAR Surface and Volume

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.237
SAR 1g (W/Kg)	0.450
Variation (%)	4.320

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.829	0.427	0.180	0.093	0.079