

15. Test Plots

15.1 System Performance Check

System check at 2450 MHz	Test date: 20/12/2023
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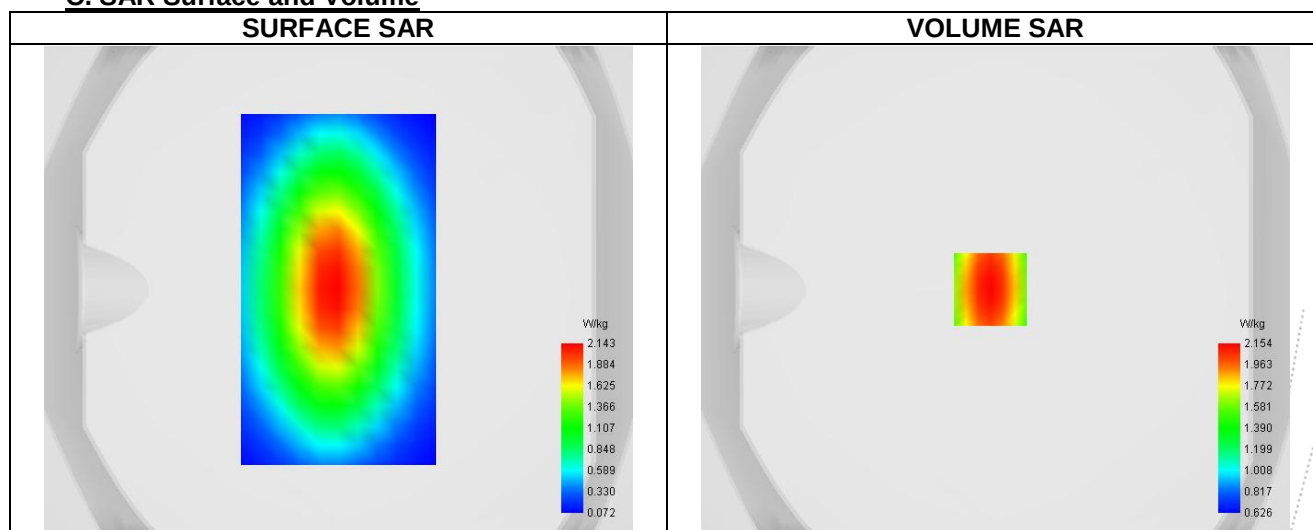
A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2450.000
Relative permittivity (real part)	39.547
Relative permittivity (imaginary part)	13.984
Conductivity (S/m)	1.765

C. SAR Surface and Volume



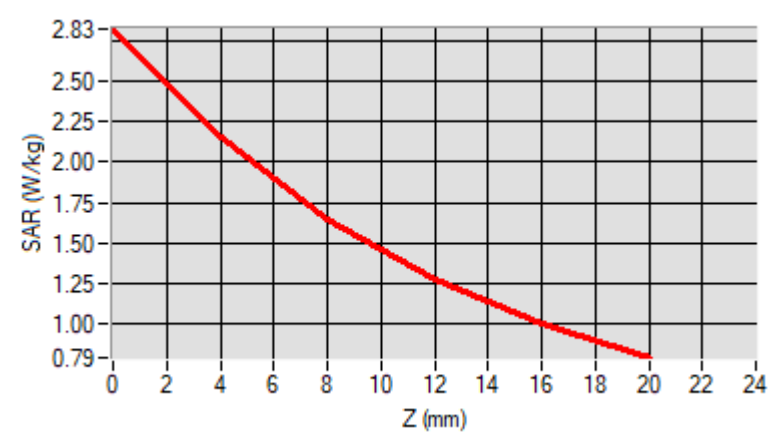
Maximum location: X=-2.00, Y=0.00 ; SAR Peak: 4.96 W/kg

D. SAR 1g & 10g

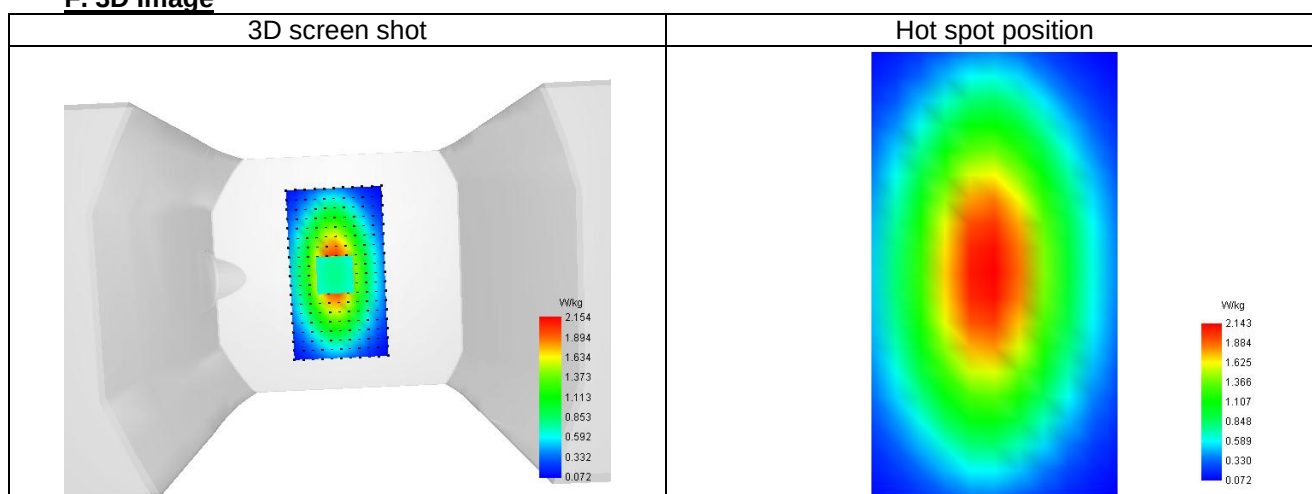
SAR 10g (W/Kg)	6.084
SAR 1g (W/Kg)	14.154
Variation (%)	-1.634
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	2.832	2.176	1.674	1.285	1.064



F. 3D Image

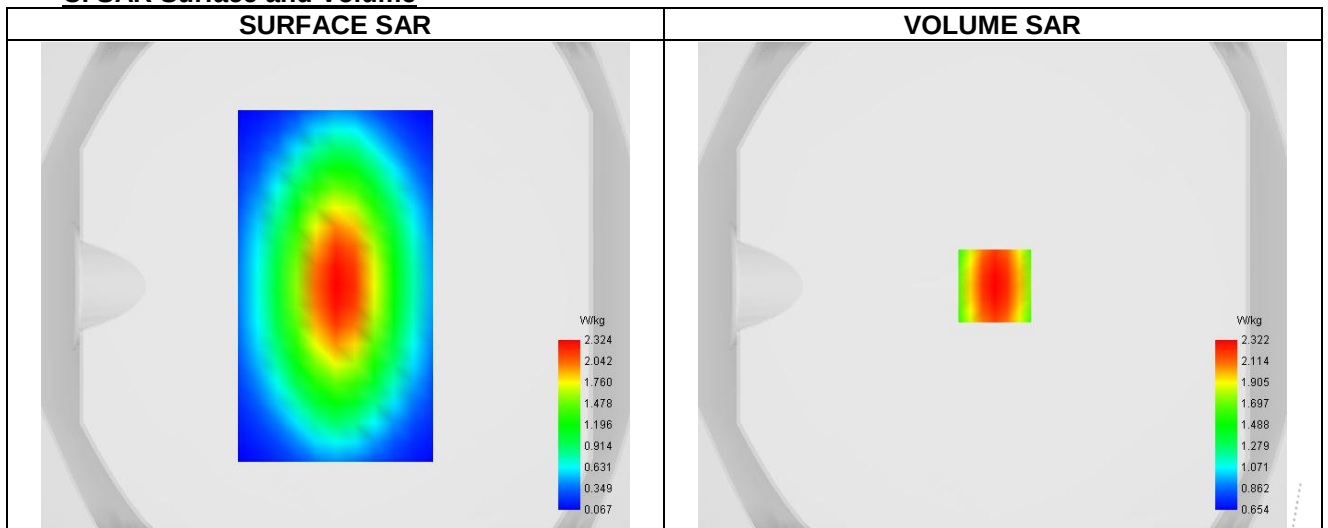


System check at 5200 MHz
Test date: 21/12/2023
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.18
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=2mm
Phantom	Validation plane
Device Position	Dipole
Band	CW5200
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5200.000
Relative permittivity (real part)	34.580
Relative permittivity (imaginary part)	16.154
Conductivity (S/m)	4.820

C. SAR Surface and Volume


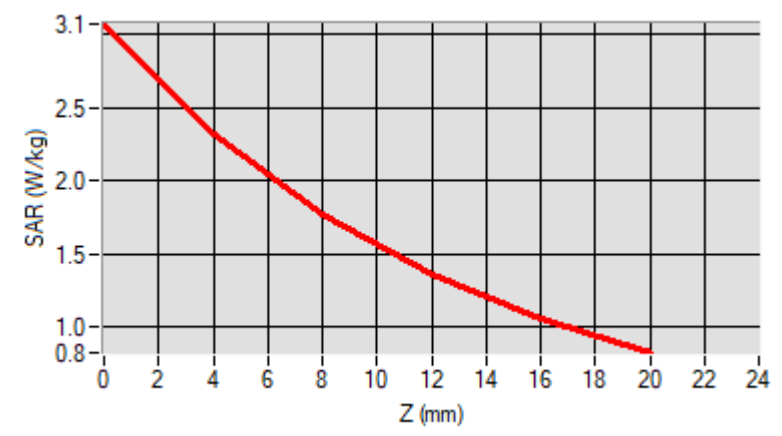
Maximum location: X=1.00, Y=0.00 ; SAR Peak: 5.68 W/kg

D. SAR 1g & 10g

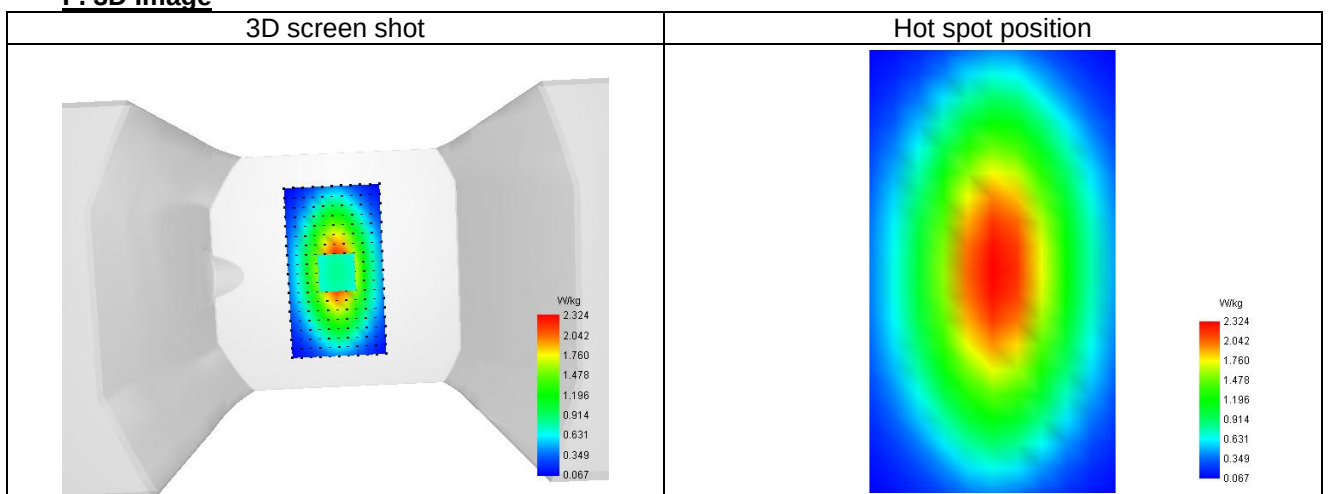
SAR 10g (W/Kg)	8.061
SAR 1g (W/Kg)	19.736
Variation (%)	3.479
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	3.108	2.344	1.786	1.395	1.109



F. 3D Image

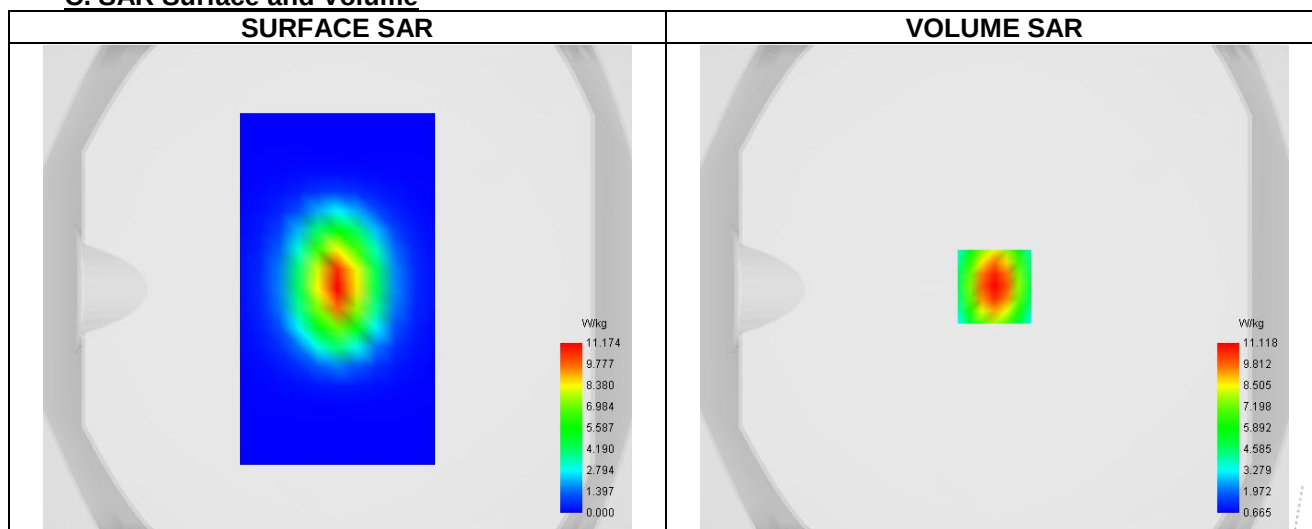


System check at 5400 MHz
Test date: 21/12/2023
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.18
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=2mm
Phantom	Validation plane
Device Position	Dipole
Band	CW5400
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5400.000
Relative permittivity (real part)	36.170
Relative permittivity (imaginary part)	17.082
Conductivity (S/m)	4.651

C. SAR Surface and Volume


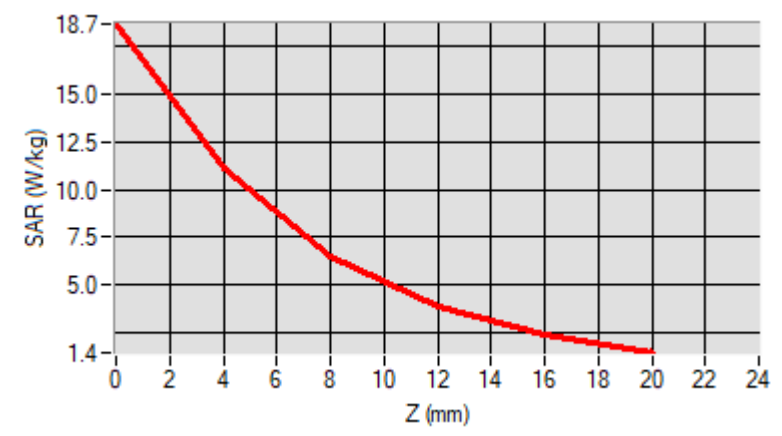
Maximum location: X=0.00, Y=1.00 ; SAR Peak: 22.78 W/kg

D. SAR 1g & 10g

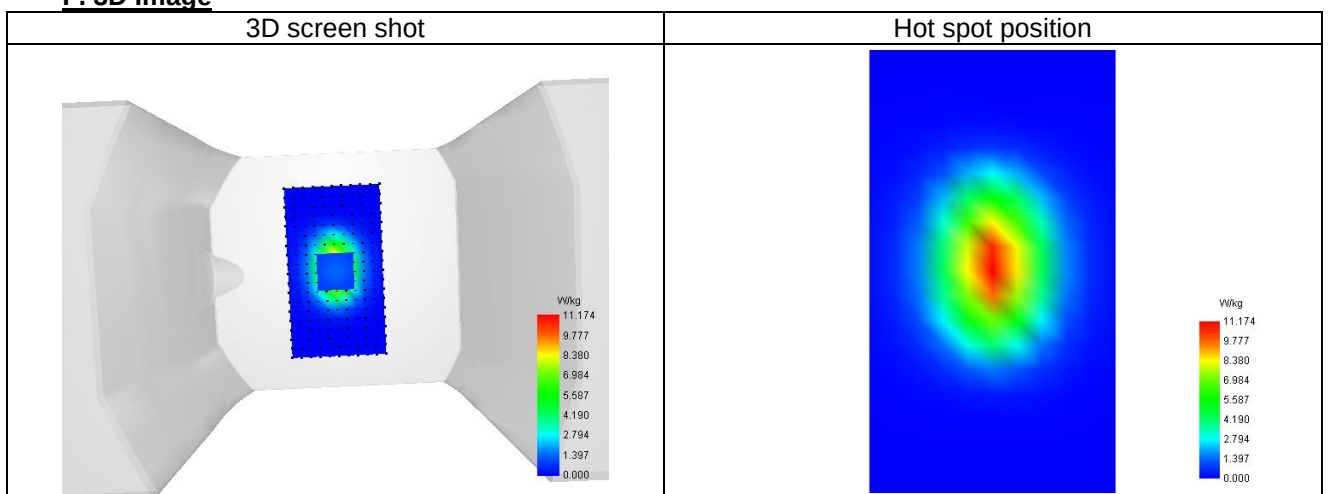
SAR 10g (W/Kg)	8.907
SAR 1g (W/Kg)	20.090
Variation (%)	-0.520
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	18.711	11.234	6.561	3.924	2.453



F. 3D Image



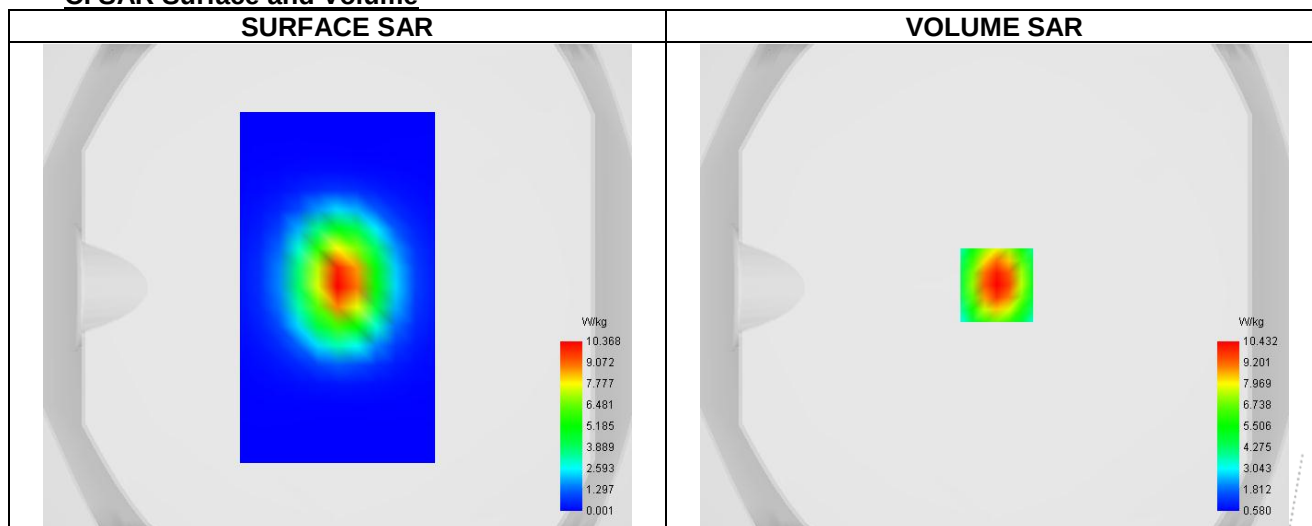
System check at 5600 MHz	Test date: 21/12/2023
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A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.20
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=2mm
Phantom	Validation plane
Device Position	Dipole
Band	CW5600
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5600.000
Relative permittivity (real part)	36.360
Relative permittivity (imaginary part)	16.911
Conductivity (S/m)	4.892

C. SAR Surface and Volume


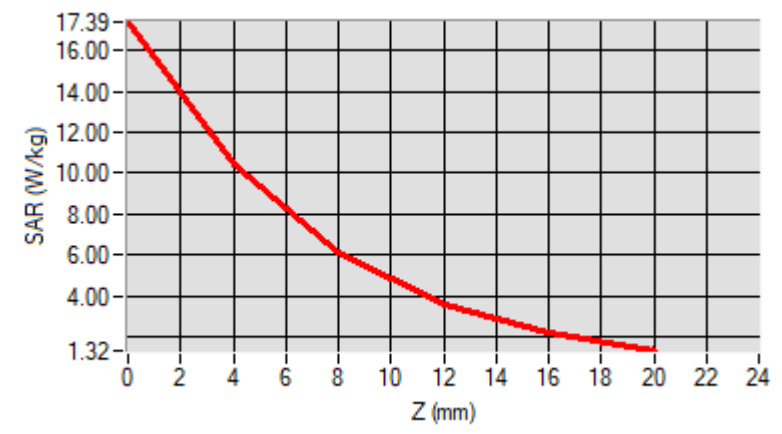
Maximum location: X=1.00, Y=1.00 ; SAR Peak: 22.54 W/kg

D. SAR 1g & 10g

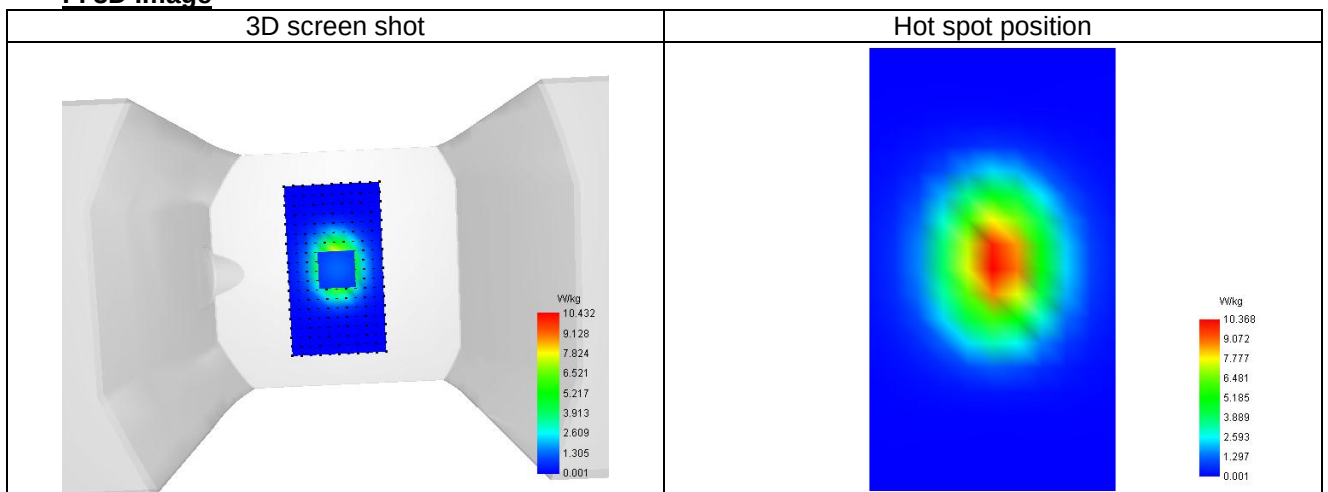
SAR 10g (W/Kg)	8.709
SAR 1g (W/Kg)	19.738
Variation (%)	-0.467
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	17.387	10.484	6.206	3.672	2.184



F. 3D Image

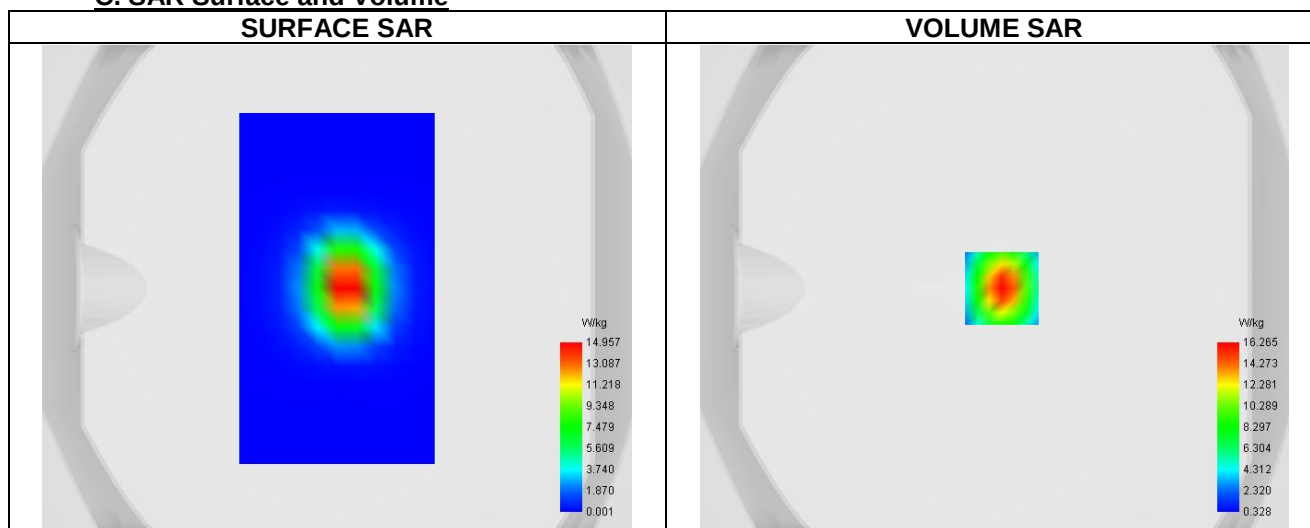


System check at 5800 MHz
Test date: 21/12/2023
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.15
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=2mm
Phantom	Validation plane
Device Position	Dipole
Band	CW5800
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

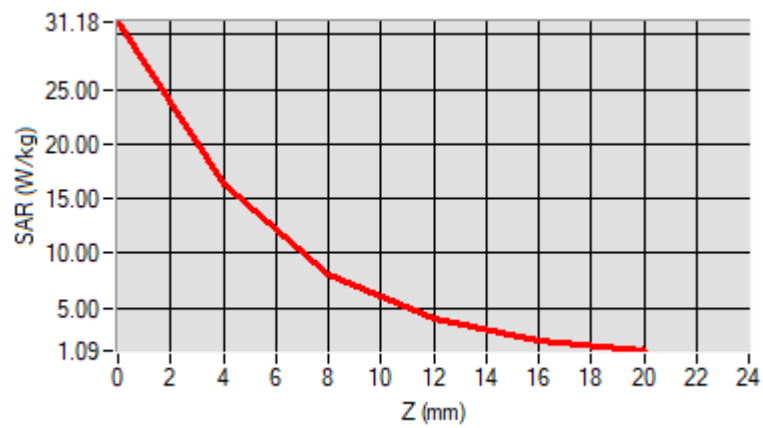
Frequency (MHz)	5800.000
Relative permittivity (real part)	36.622
Relative permittivity (imaginary part)	15.906
Conductivity (S/m)	5.478

C. SAR Surface and Volume

D. SAR 1g & 10g

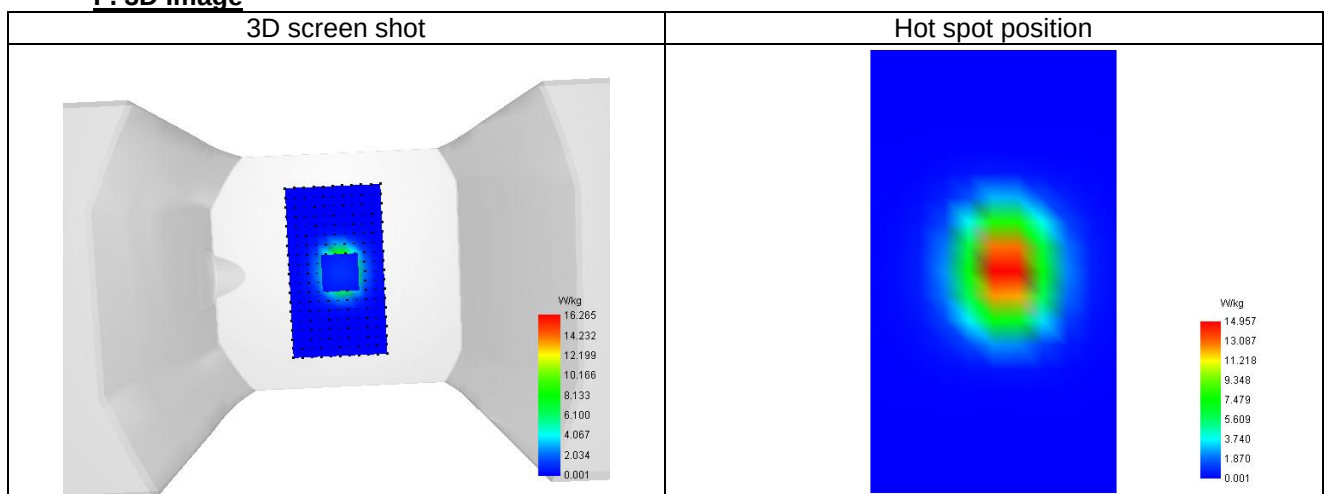
SAR 10g (W/Kg)	8.564
SAR 1g (W/Kg)	18.538
Variation (%)	3.896
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	31.172	16.108	7.982	3.835	1.964



F. 3D Image



15.2 SAR Test Graph Results

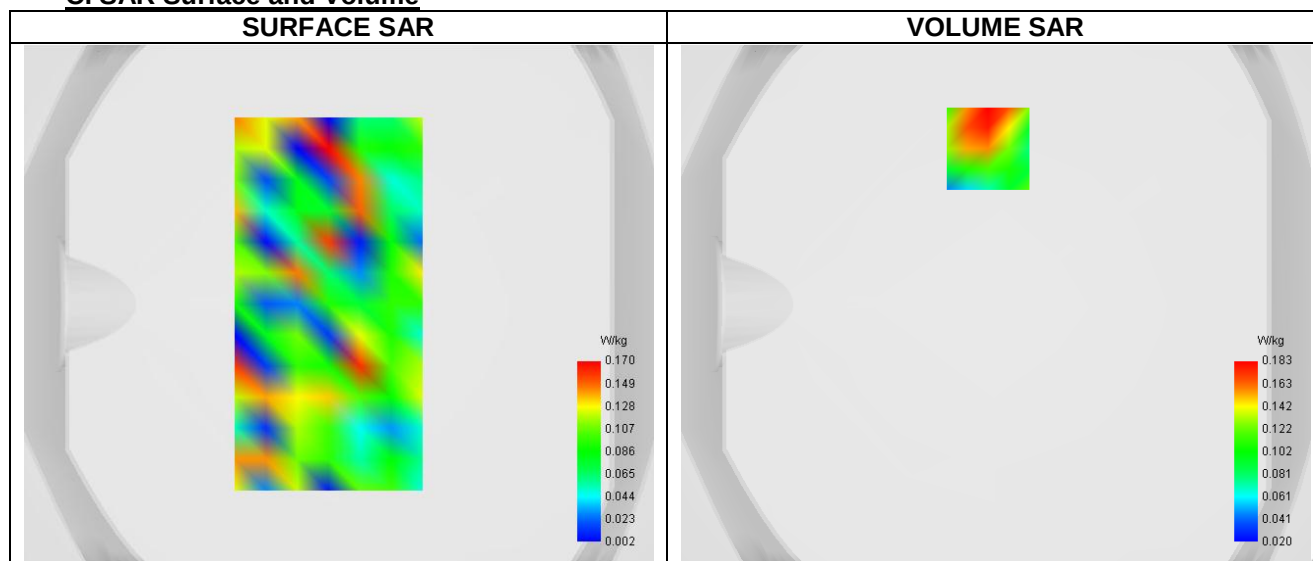
Plot 1	Test date: 20/12/2023
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A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Bluetooth
Channels	Lower (0)
Signal	Bluetooth (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2402.000
Relative permittivity (real part)	39.715
Relative permittivity (imaginary part)	13.211
Conductivity (S/m)	1.816

C. SAR Surface and Volume


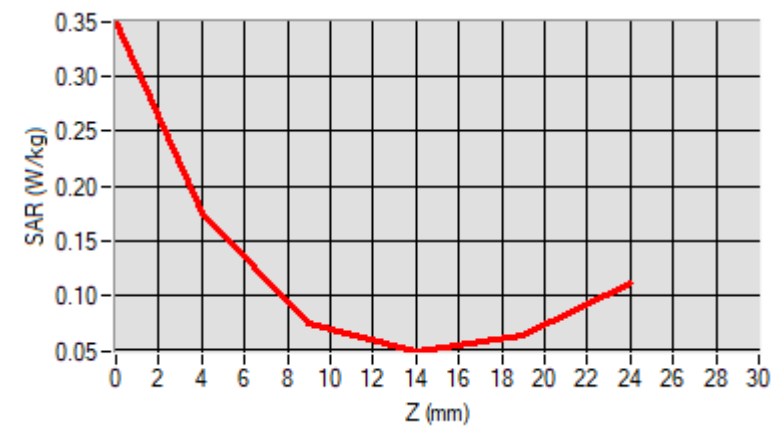
Maximum location: X=-3.00, Y=60.00 ; SAR Peak: 0.48 W/kg

D. SAR 1g & 10g

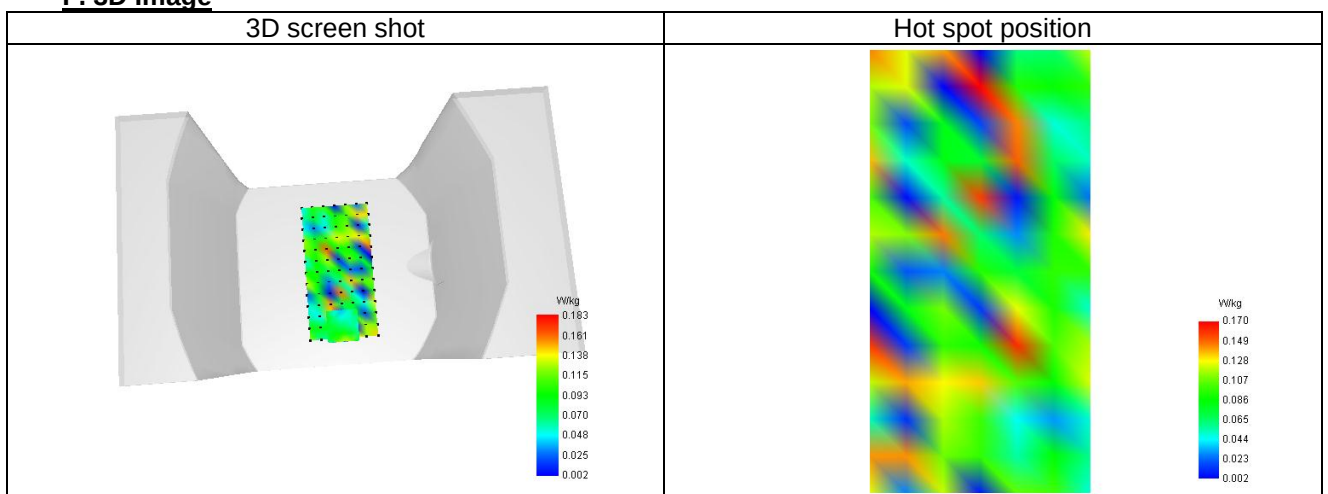
SAR 10g (W/Kg)	0.110
SAR 1g (W/Kg)	0.198
Variation (%)	-0.750
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	-0.155	0.183	0.118	0.020	0.083



F. 3D Image



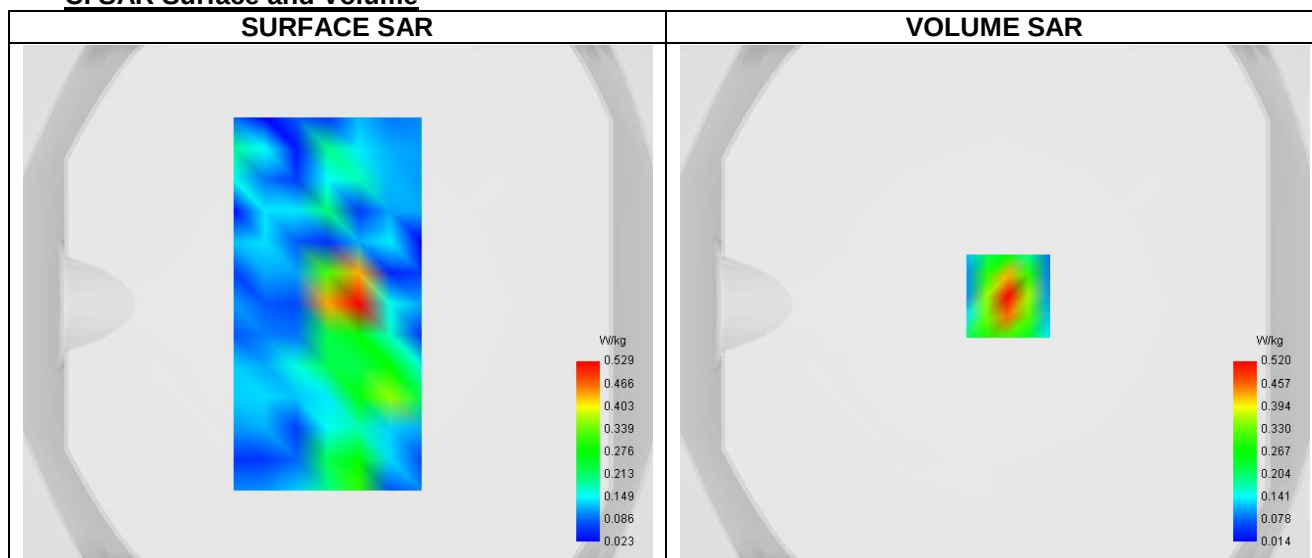
Plot 2	Test date: 20/12/2023
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A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	Higher (11)
Signal	IEEE802.b (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2462.000
Relative permittivity (real part)	39.184
Relative permittivity (imaginary part)	13.248
Conductivity (S/m)	1.812

C. SAR Surface and Volume


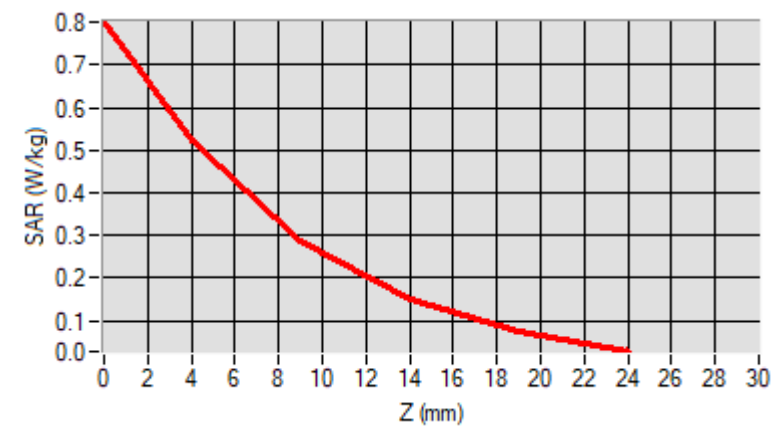
Maximum location: X=5.00, Y=3.00 ; SAR Peak: 0.82 W/kg

D. SAR 1g & 10g

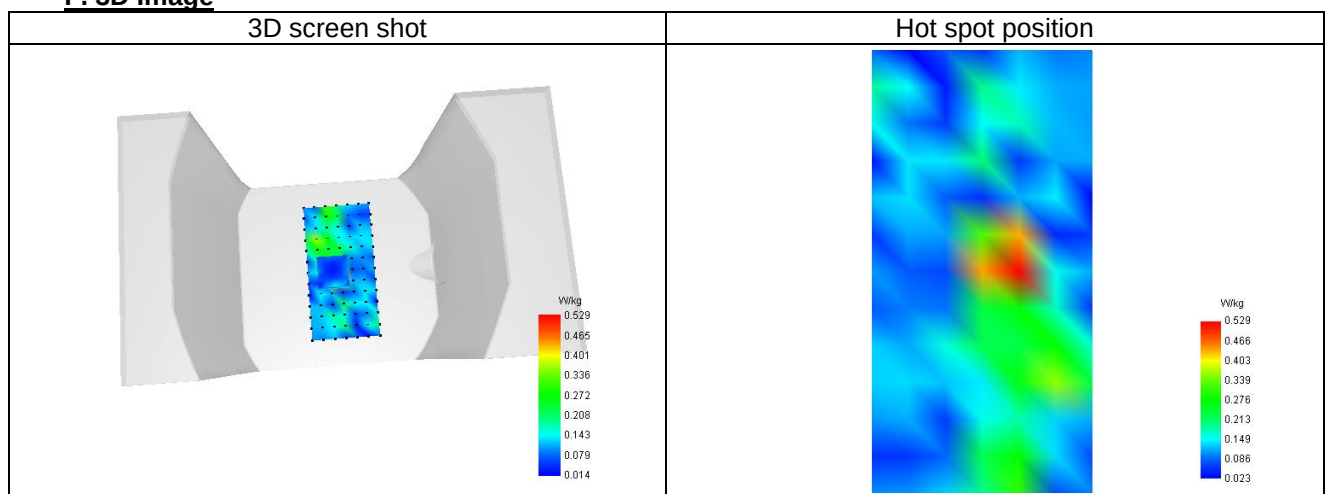
SAR 10g (W/Kg)	0.239
SAR 1g (W/Kg)	0.473
Variation (%)	-3.860
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.800	0.520	0.289	0.151	0.072



F. 3D Image



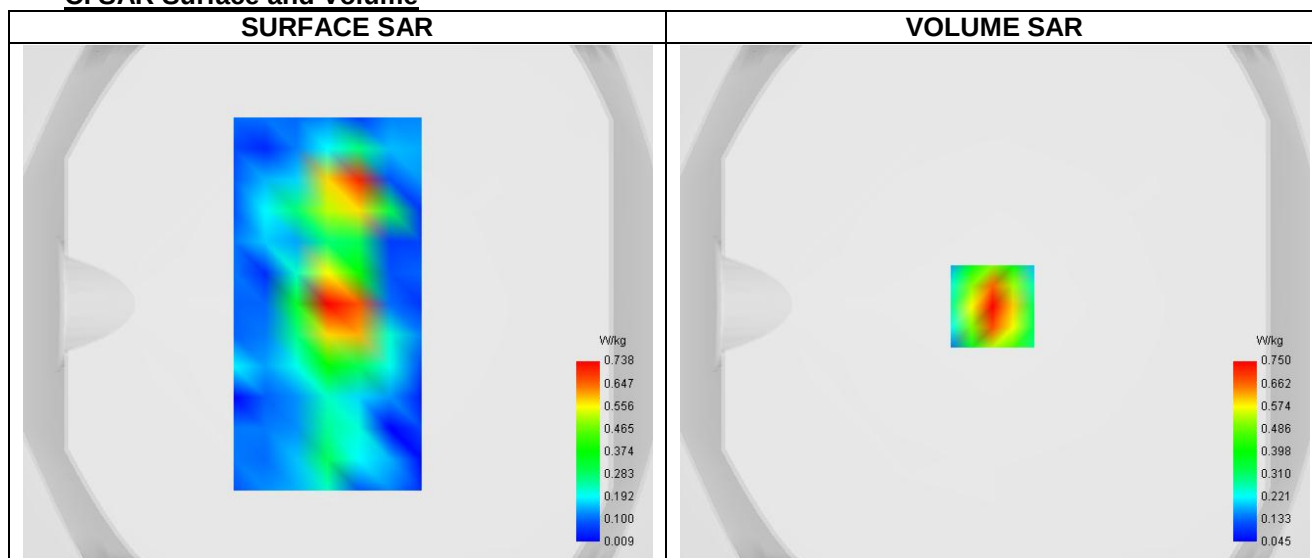
Plot 3	Test date: 20/12/2023
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A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	Higher (11)
Signal	IEEE802.b (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2462.000
Relative permittivity (real part)	38.643
Relative permittivity (imaginary part)	13.248
Conductivity (S/m)	1.794

C. SAR Surface and Volume


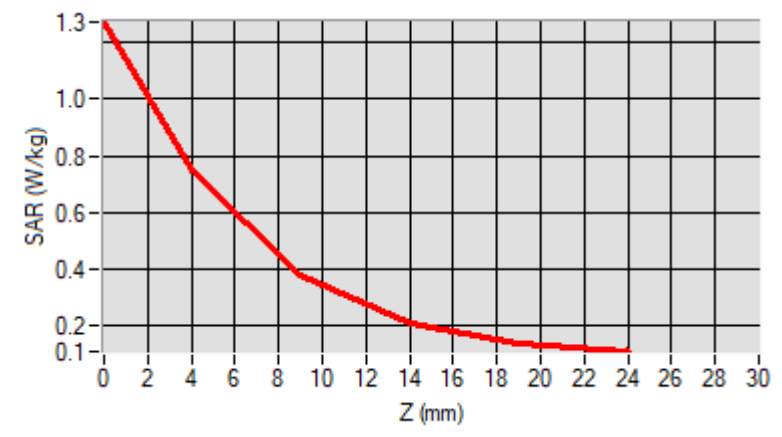
Maximum location: X=-1.00, Y=-1.00 ; SAR Peak: 1.29 W/kg

D. SAR 1g & 10g

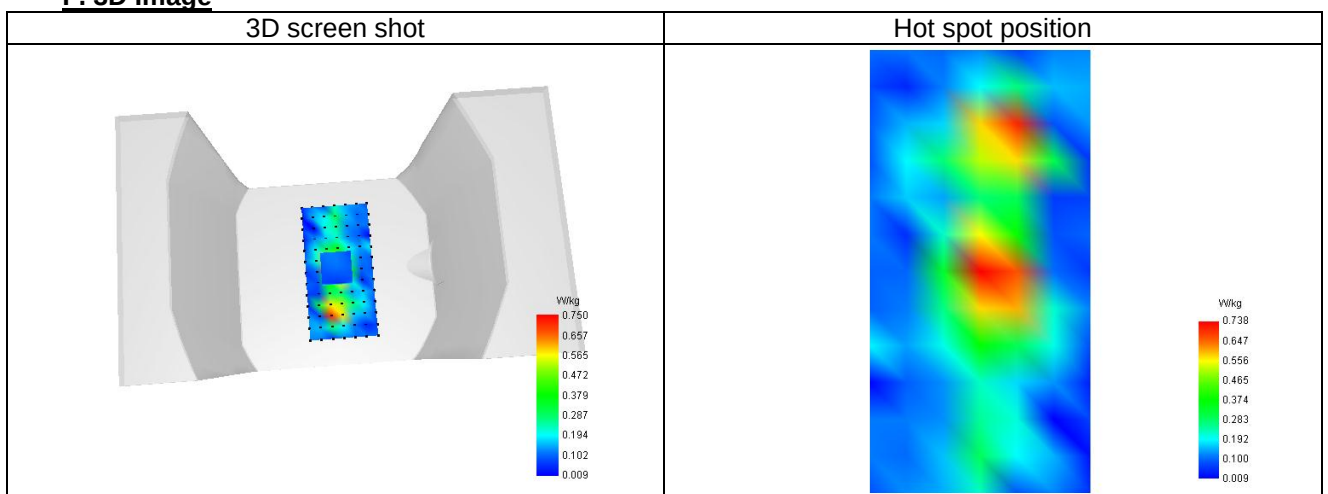
SAR 10g (W/Kg)	0.213
SAR 1g (W/Kg)	0.305
Variation (%)	0.310
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.273	0.750	0.380	0.209	0.141



F. 3D Image



Plot 4

Test date: 21/12/2023

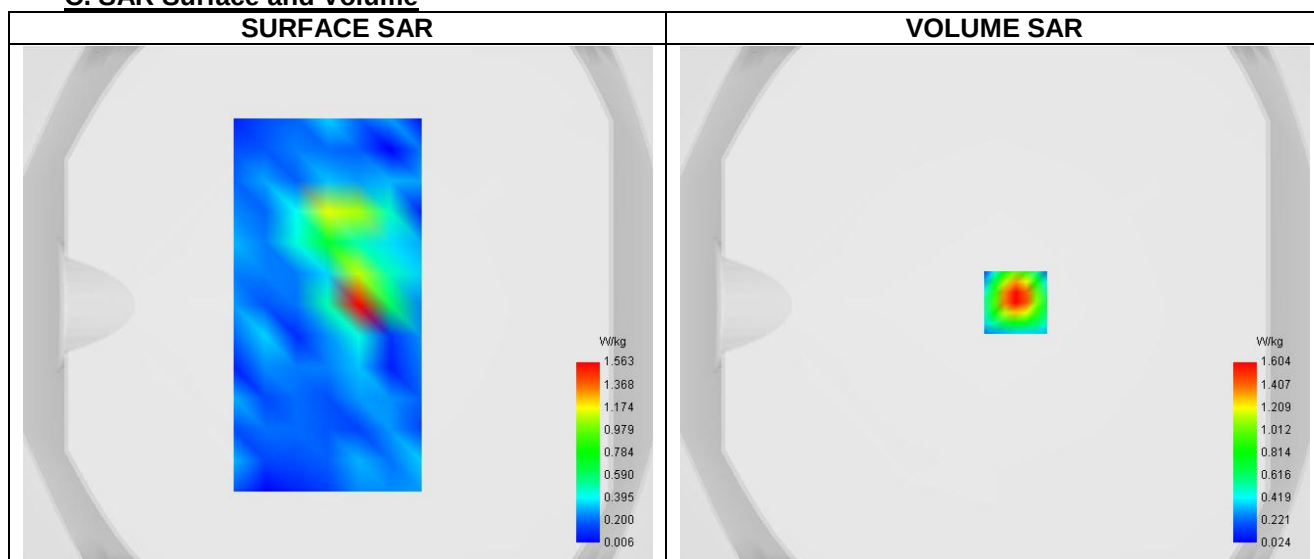
A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.18
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	5200
Channels	Lower (0)
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5180.000
Relative permittivity (real part)	36.941
Relative permittivity (imaginary part)	16.119
Conductivity (S/m)	4.856

C. SAR Surface and Volume



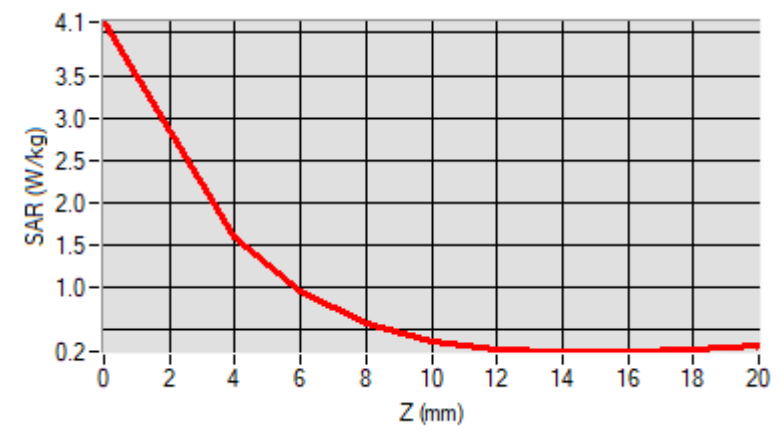
Maximum location: X=8.00, Y=1.00 ; SAR Peak: 2.72 W/kg

D. SAR 1g & 10g

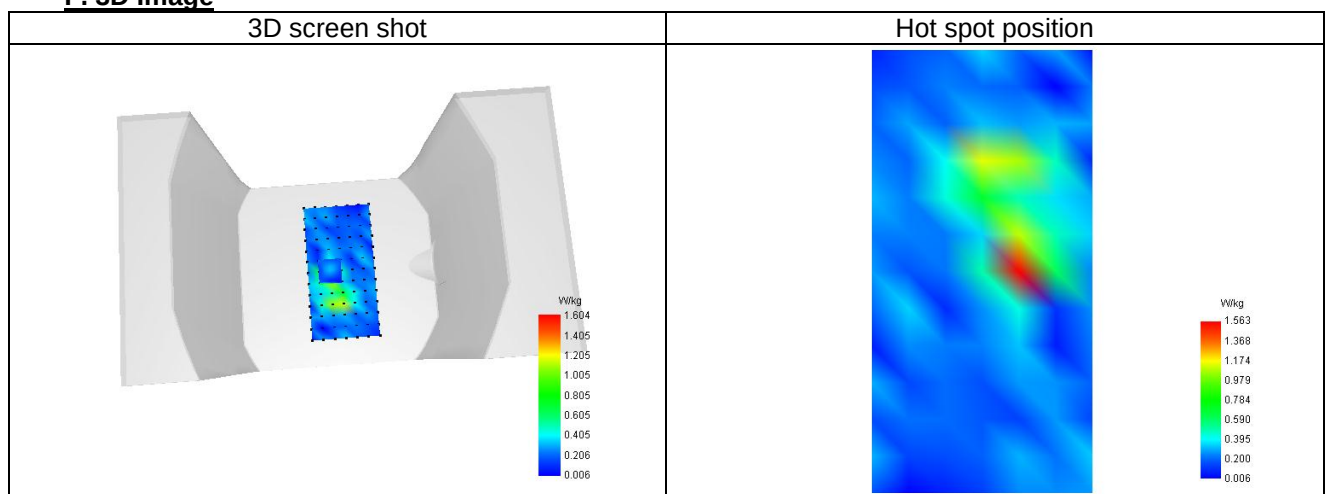
SAR 10g (W/Kg)	0.337
SAR 1g (W/Kg)	0.636
Variation (%)	3.480
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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)	4.129	1.604	0.955	0.574	0.376	0.281	0.247	0.250	0.280



F. 3D Image



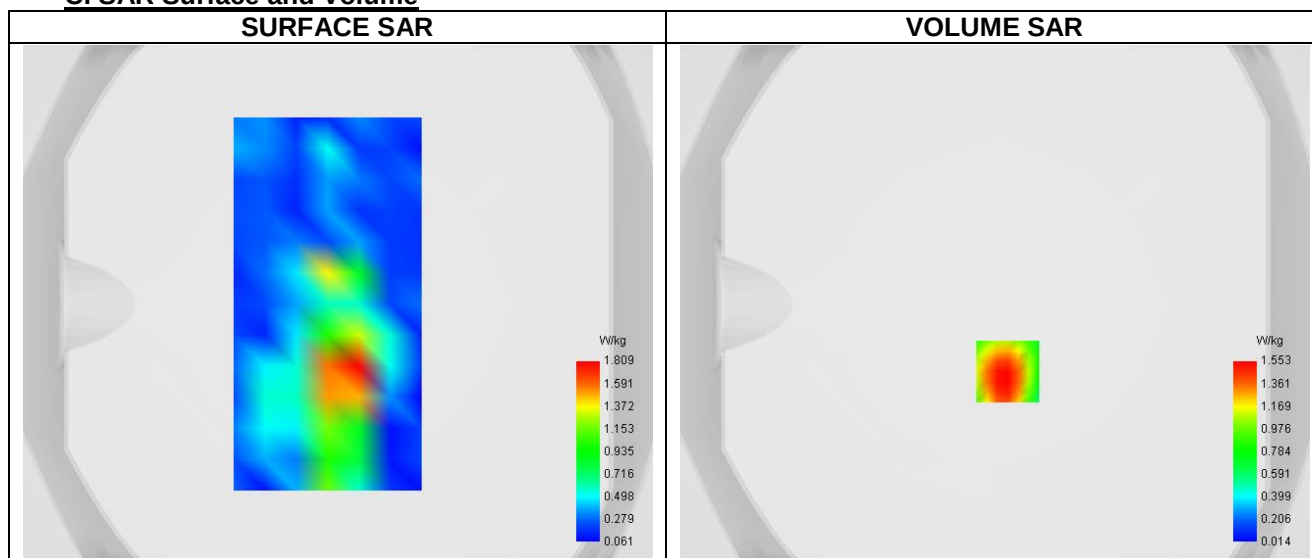
Plot 5	Test date: 21/12/2023
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A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.18
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	5200
Channels	Higher (2)
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5200.000
Relative permittivity (real part)	34.580
Relative permittivity (imaginary part)	16.119
Conductivity (S/m)	4.820

C. SAR Surface and Volume


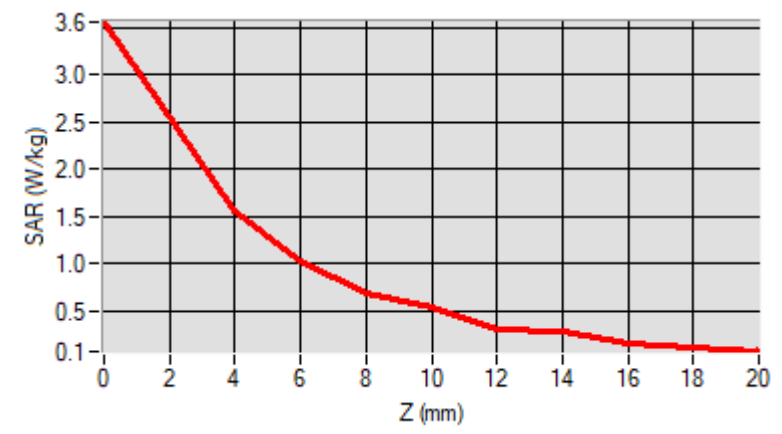
Maximum location: X=5.00, Y=-26.00 ; SAR Peak: 2.58 W/kg

D. SAR 1g & 10g

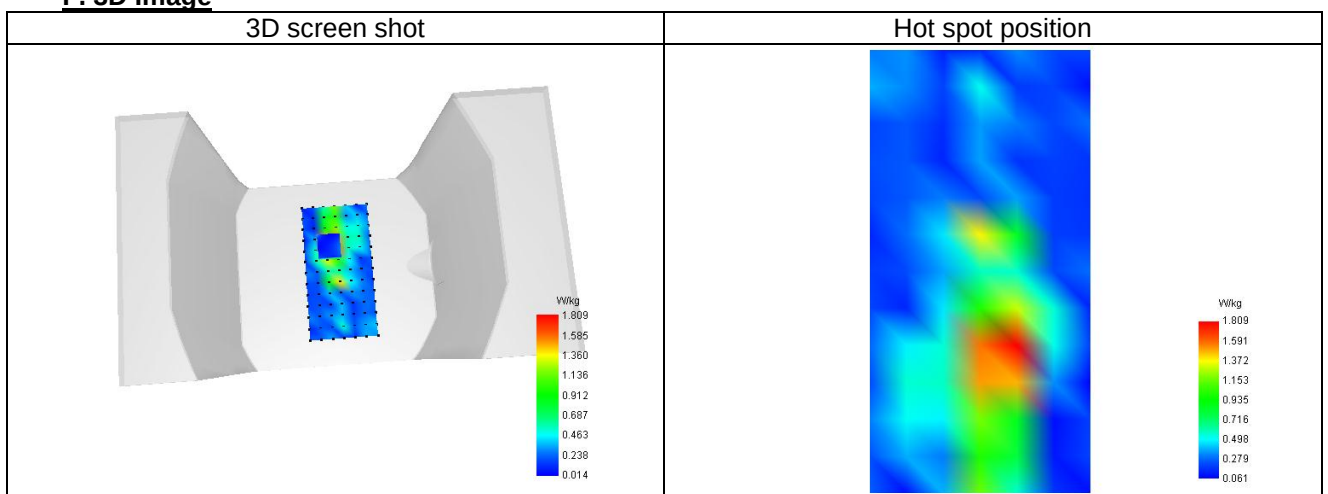
SAR 10g (W/Kg)	0.355
SAR 1g (W/Kg)	0.612
Variation (%)	0.710
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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)	3.555	1.553	1.033	0.685	0.534	0.306	0.284	0.144	0.099



F. 3D Image



Plot 6

Test date: 21/12/2023

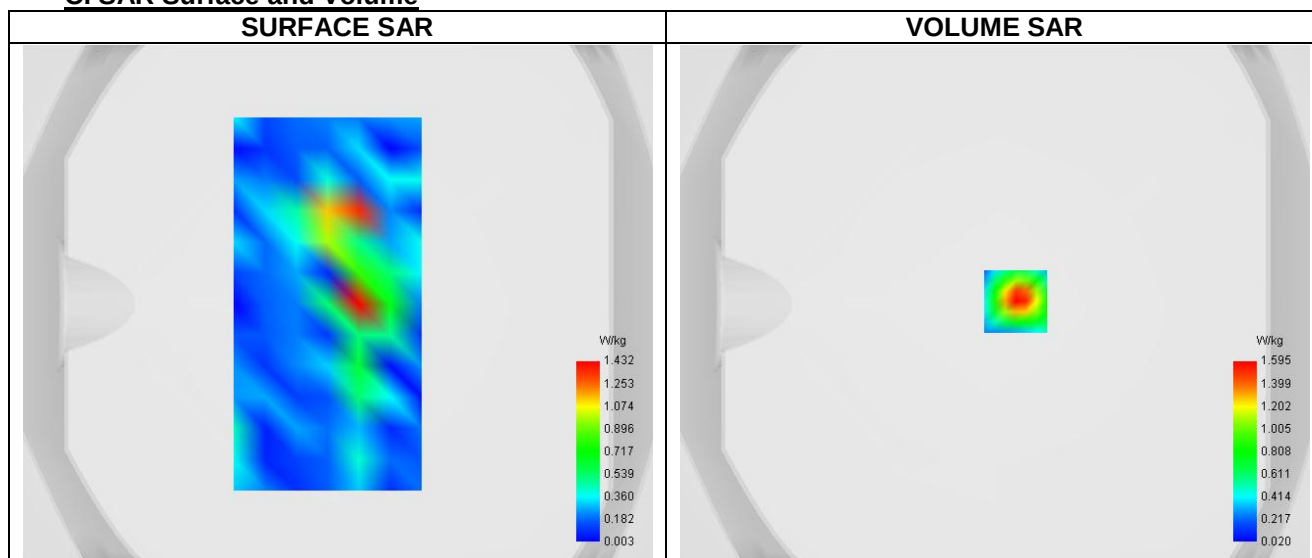
A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.17
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	5400
Channels	Higher (2)
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5310.000
Relative permittivity (real part)	37.196
Relative permittivity (imaginary part)	16.169
Conductivity (S/m)	4.549

C. SAR Surface and Volume

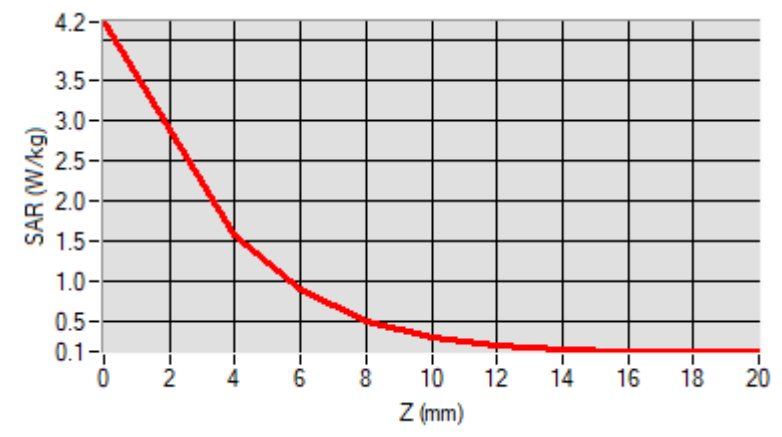


D. SAR 1g & 10g

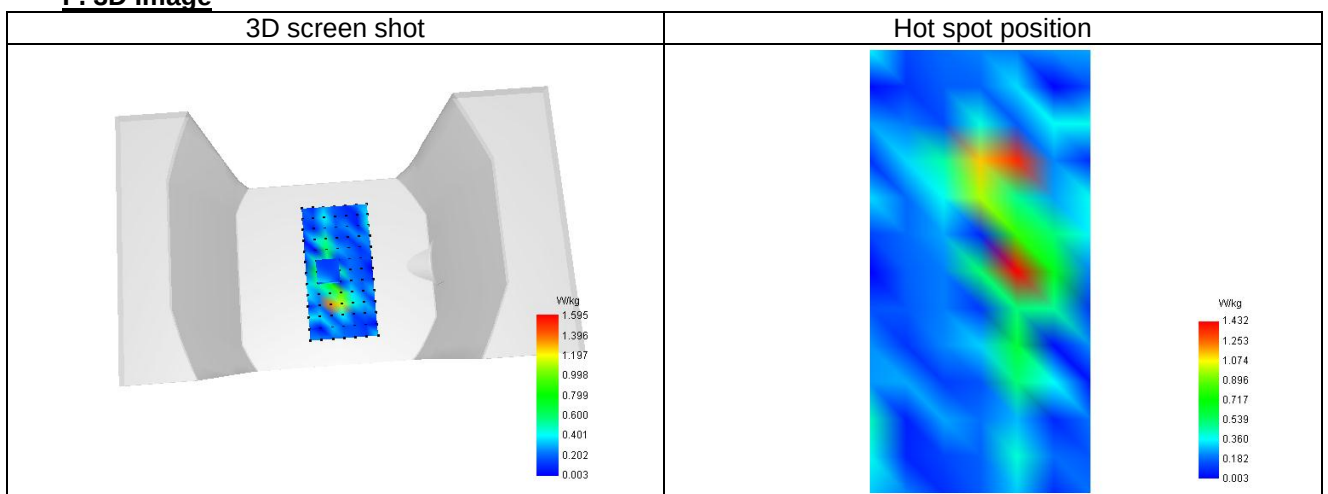
SAR 10g (W/Kg)	0.294
SAR 1g (W/Kg)	0.480
Variation (%)	-2.970
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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)	4.235	1.595	0.918	0.520	0.309	0.202	0.154	0.137	0.138



F. 3D Image



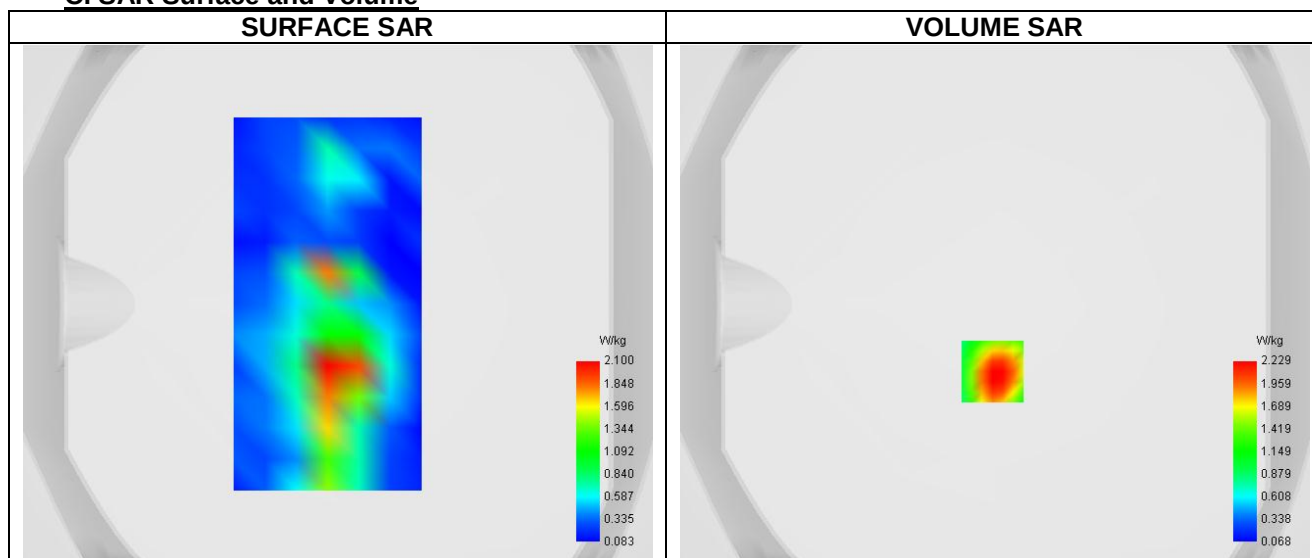
Plot 7	Test date: 21/12/2023
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A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.18
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	5400
Channels	Lower (0)
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5300.000
Relative permittivity (real part)	34.881
Relative permittivity (imaginary part)	16.151
Conductivity (S/m)	4.737

C. SAR Surface and Volume


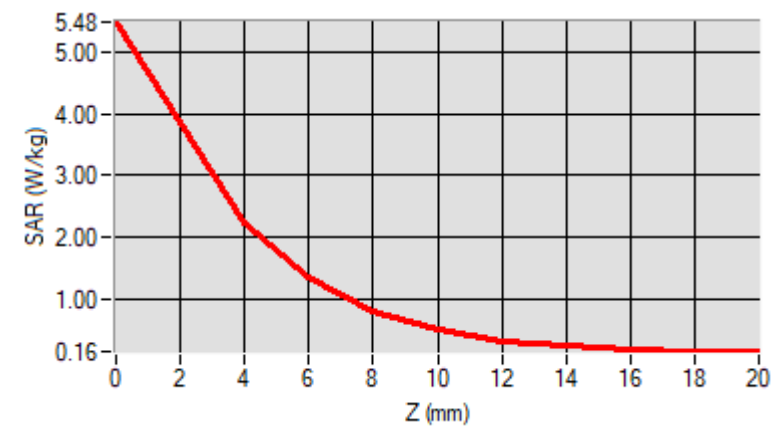
Maximum location: X=-1.00, Y=-26.00 ; SAR Peak: 3.79 W/kg

D. SAR 1g & 10g

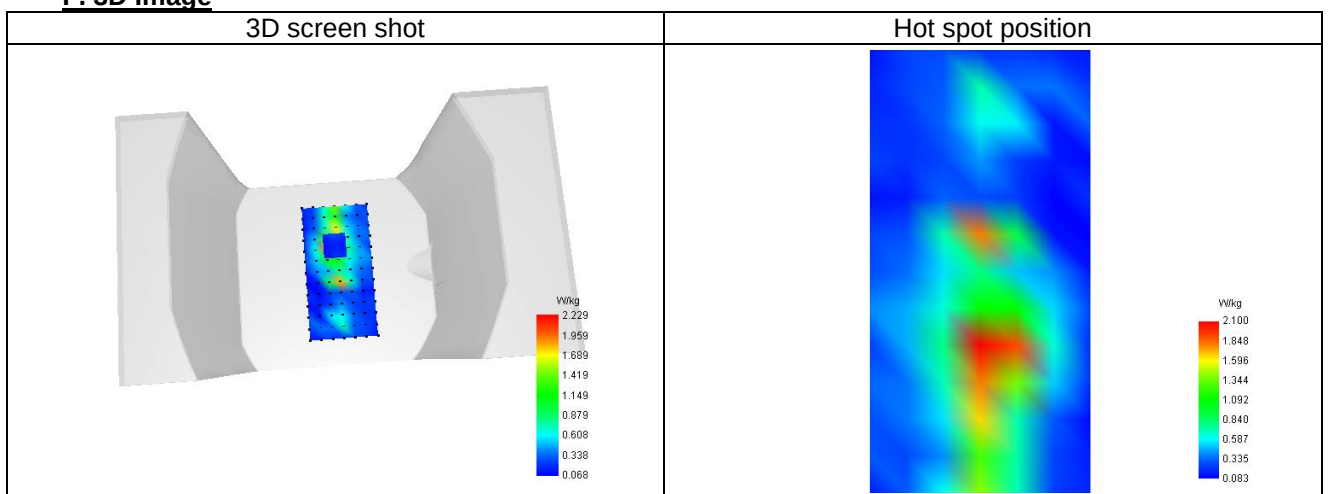
SAR 10g (W/Kg)	0.275
SAR 1g (W/Kg)	0.584
Variation (%)	-3.290
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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)	5.481	2.229	1.357	0.816	0.507	0.335	0.243	0.195	0.172



F. 3D Image



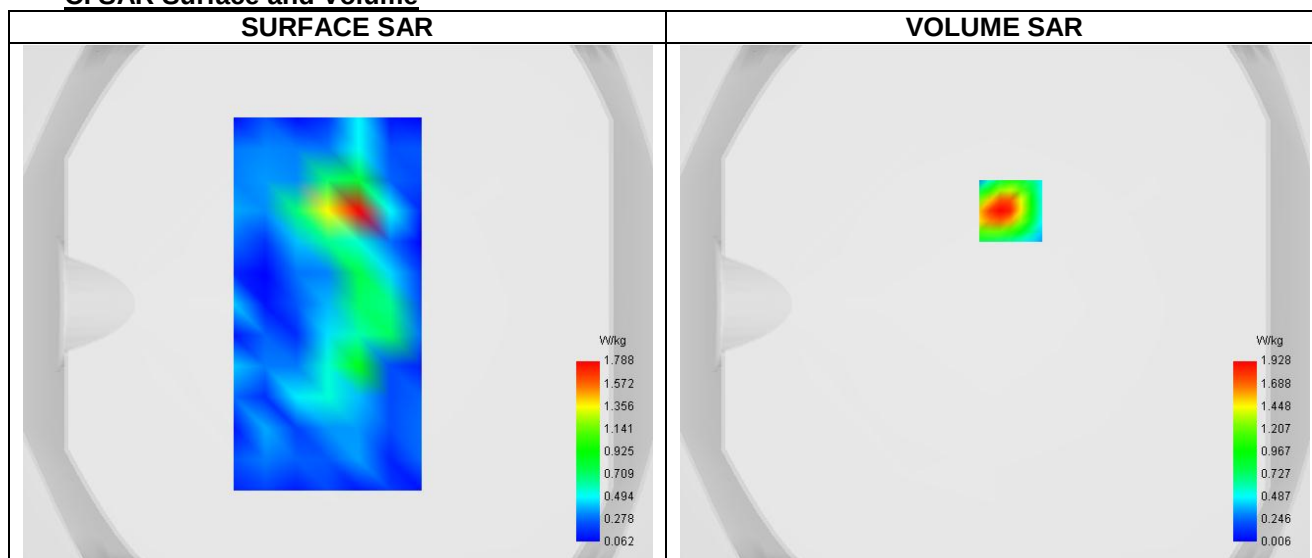
Plot 8	Test date: 21/12/2023
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A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.20
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm,
Phantom	Validation plane
Device Position	Body
Band	5600
Channels	Middle (1)
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5580.000
Relative permittivity (real part)	37.386
Relative permittivity (imaginary part)	16.295
Conductivity (S/m)	4.699

C. SAR Surface and Volume


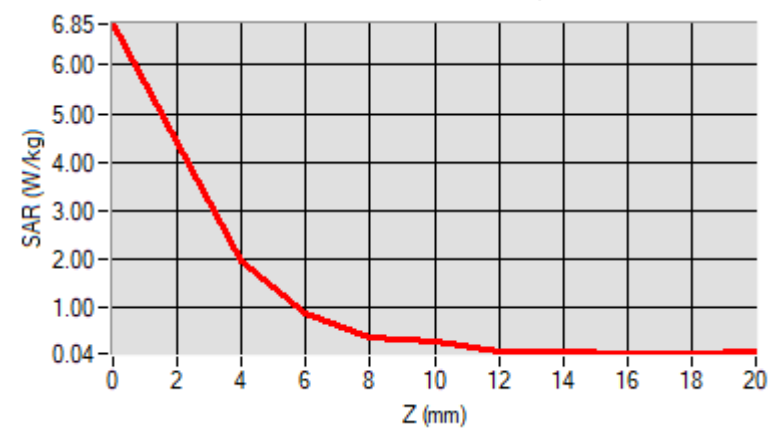
Maximum location: X=6.00, Y=36.00 ; SAR Peak: 3.92 W/kg

D. SAR 1g & 10g

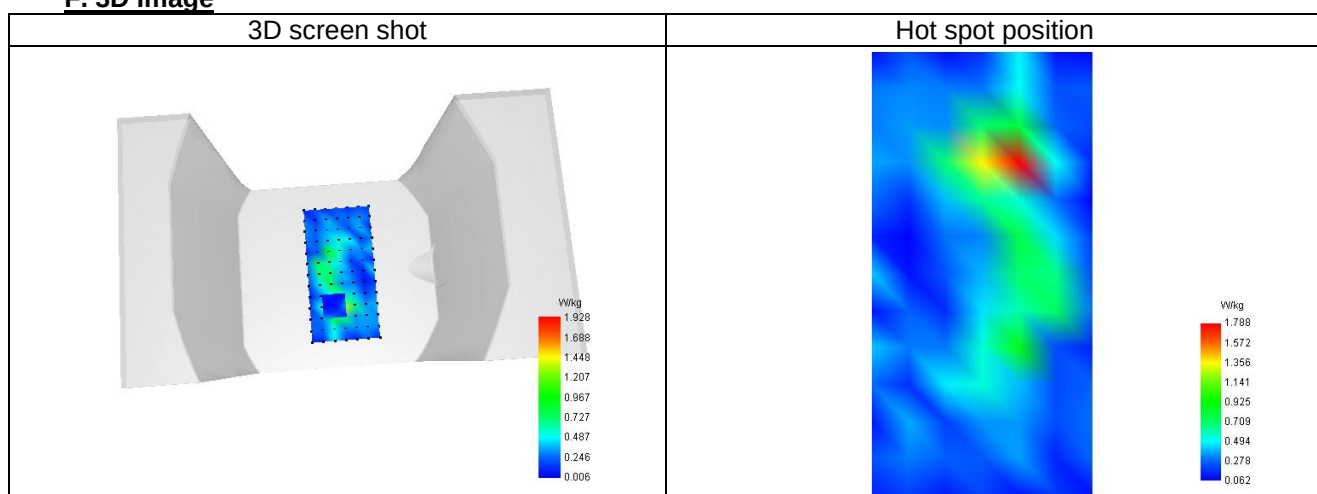
SAR 10g (W/Kg)	0.309
SAR 1g (W/Kg)	0.658
Variation (%)	0.540
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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)	6.850	1.928	0.860	0.360	0.267	0.059	0.090	0.037	0.040



F. 3D Image



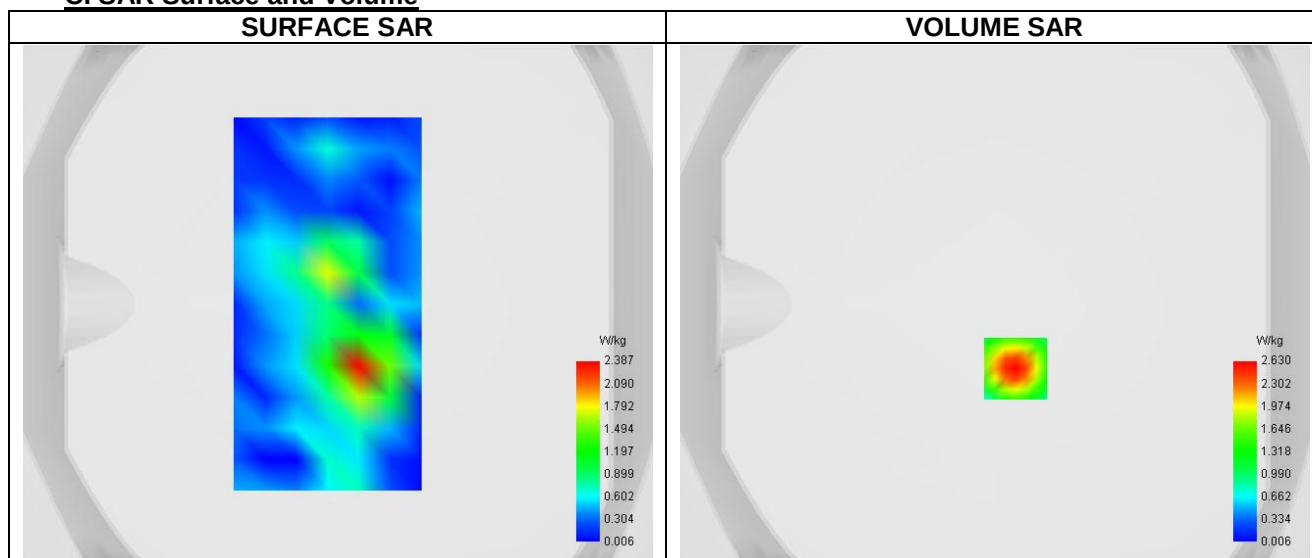
Plot 9	Test date: 21/12/2023
---------------	------------------------------

A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.20
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	5600
Channels	Higher (2)
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5700.000
Relative permittivity (real part)	36.839
Relative permittivity (imaginary part)	16.330
Conductivity (S/m)	5.281

C. SAR Surface and Volume


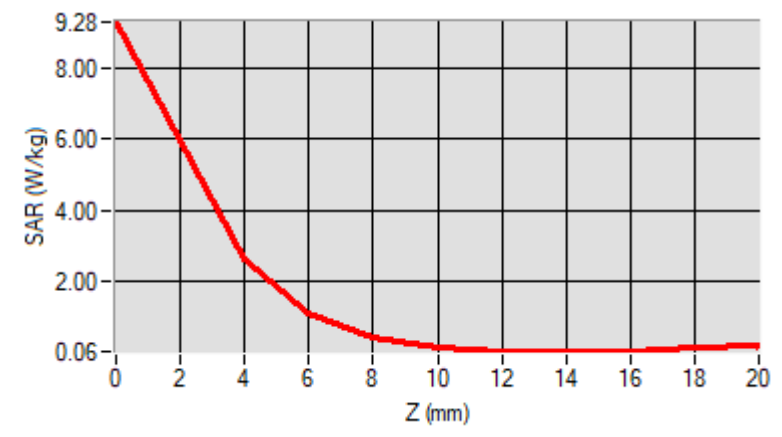
Maximum location: X=8.00, Y=-25.00 ; SAR Peak: 5.53 W/kg

D. SAR 1g & 10g

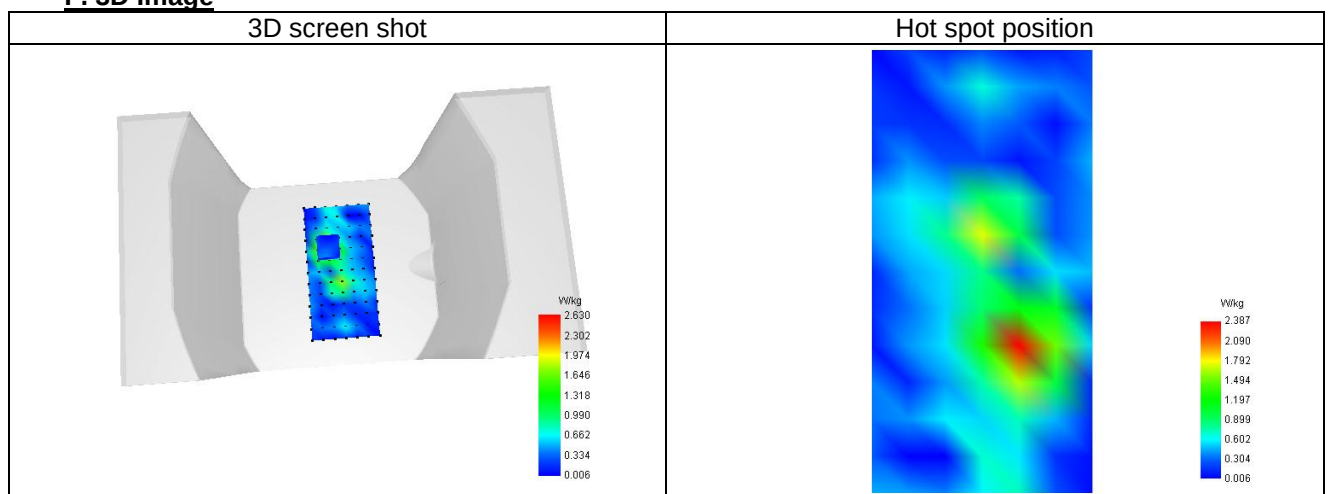
SAR 10g (W/Kg)	0.231
SAR 1g (W/Kg)	0.518
Variation (%)	1.260
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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)	9.280	2.630	1.147	0.439	0.164	0.075	0.058	0.081	0.144



F. 3D Image



Plot 10

Test date: 21/12/2023

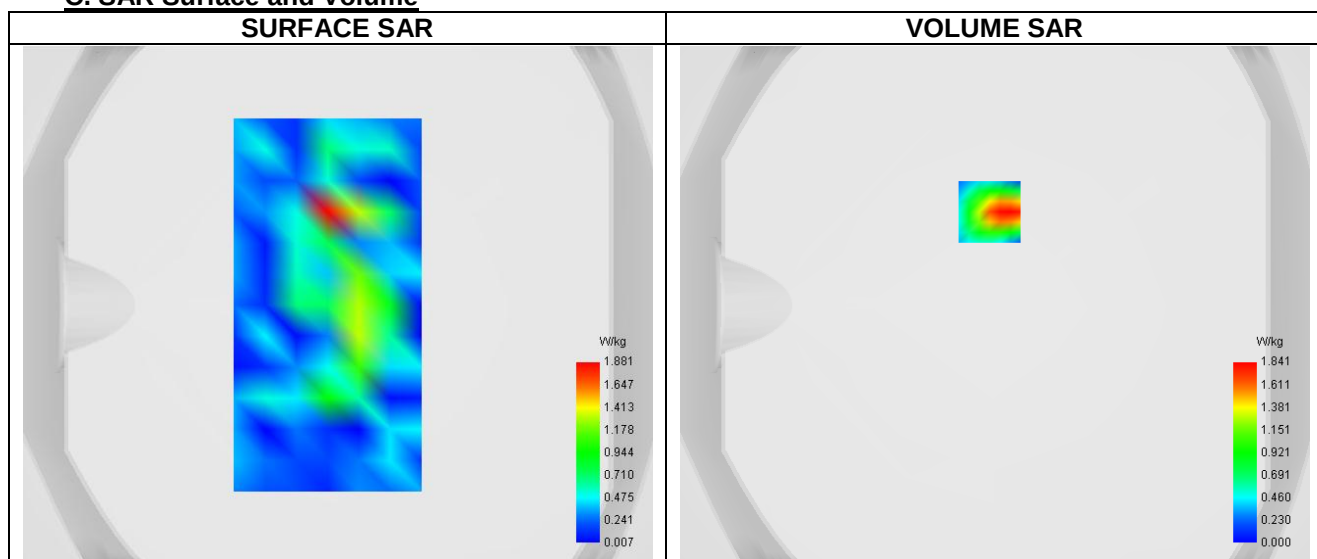
A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.15
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	5800
Channels	Lower (0)
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5755.000
Relative permittivity (real part)	35.644
Relative permittivity (imaginary part)	16.347
Conductivity (S/m)	4.853

C. SAR Surface and Volume



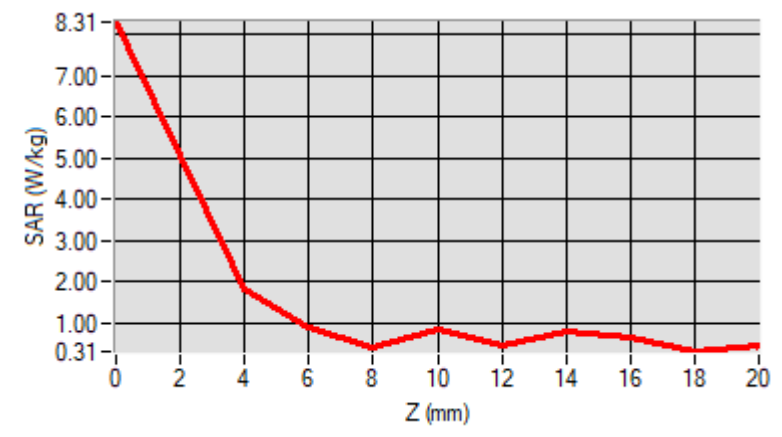
Maximum location: X=-2.00, Y=36.00 ; SAR Peak: 4.55 W/kg

D. SAR 1g & 10g

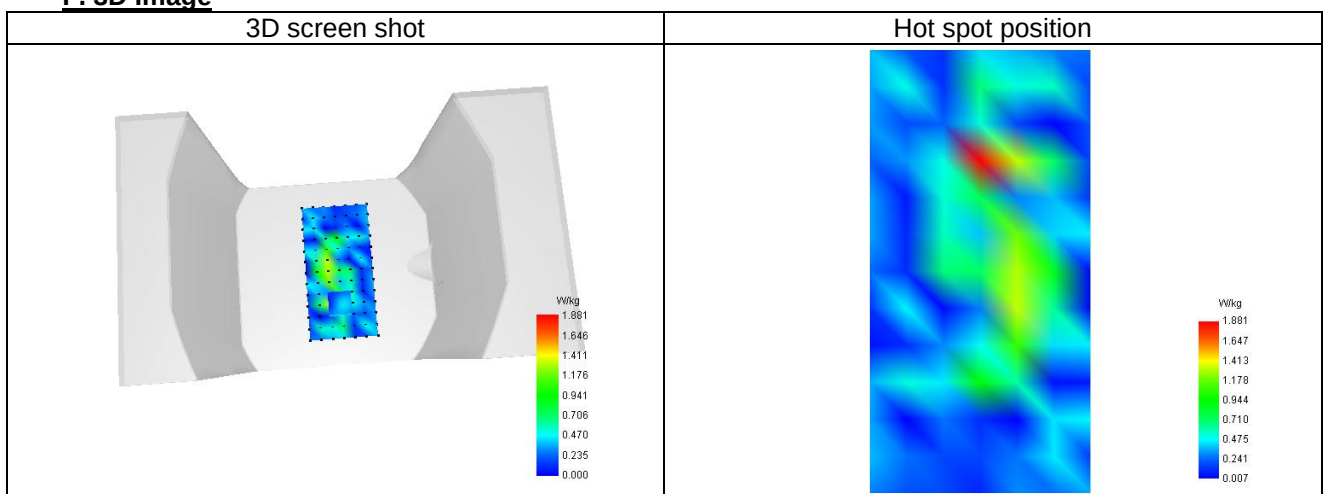
SAR 10g (W/Kg)	0.221
SAR 1g (W/Kg)	0.586
Variation (%)	0.530
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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)	8.309	1.841	0.893	0.385	0.850	0.430	0.770	0.650	0.306



F. 3D Image



Plot 11

Test date: 21/12/2023

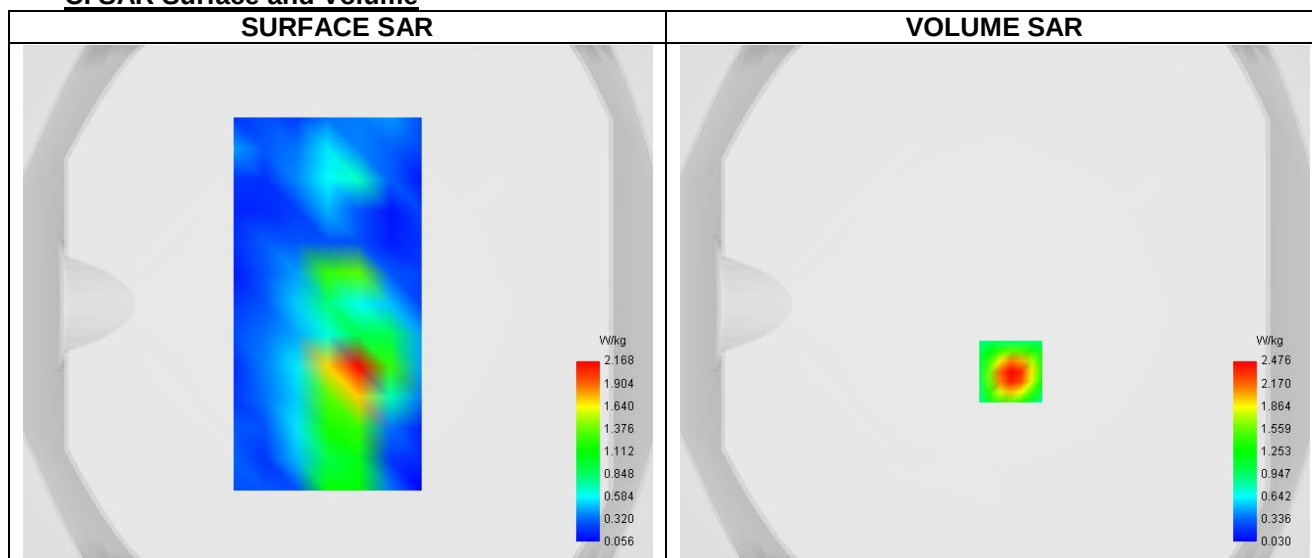
A. Experimental conditions.

Probe	SN 26/23 EPG0420
ConvF	1.15
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm
Phantom	Validation plane
Device Position	Body
Band	5800
Channels	Middle (1)
Signal	Custom (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5785.000
Relative permittivity (real part)	37.186
Relative permittivity (imaginary part)	16.358
Conductivity (S/m)	5.076

C. SAR Surface and Volume



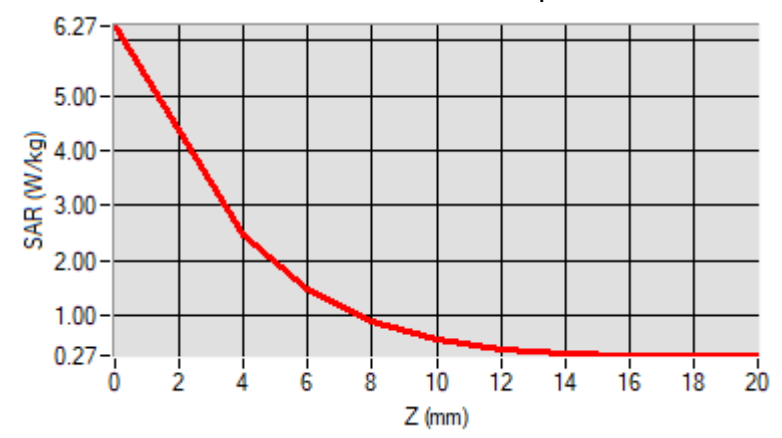
Maximum location: X=6.00, Y=-26.00 ; SAR Peak: 4.16 W/kg

D. SAR 1g & 10g

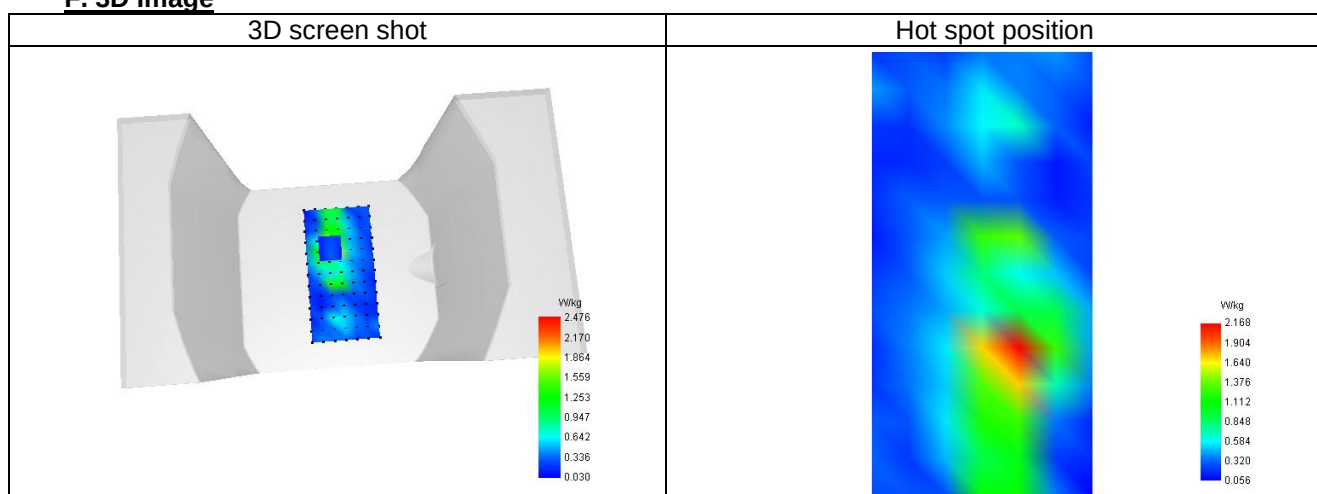
SAR 10g (W/Kg)	0.246
SAR 1g (W/Kg)	0.530
Variation (%)	2.980
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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)	6.273	2.476	1.481	0.882	0.554	0.383	0.302	0.272	0.271

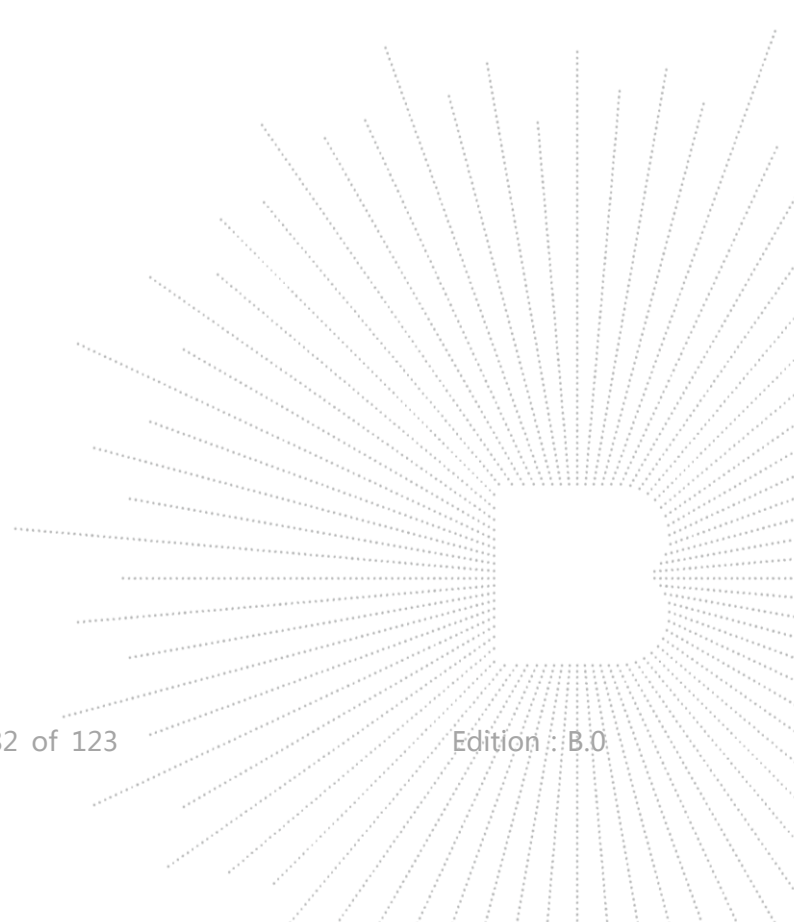


F. 3D Image



16 CALIBRATION CERTIFICATES

Probe-EPGO420 Calibration Certificate
SID2450Dipole Calibration Certificate
SID5000Dipole Calibration Certificate



**COMOSAR E-Field Probe Calibration Report**

Ref : ACR.199.1.23.BES.A

SHENZHEN BCTC TECHNOLOGY CO., LTD.

**1 ~2/ F, NO. B FACTORY BUILDING, PENGZHOU
INDUSTRIAL PARK, FUYUAN 1ST ROAD,
TANGWEI COMMUNITY, FUHAI STREET, BAO'AN
DISTRICT, SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: 2623-EPGO-420**

Calibrated at MVG**Z.I. de la pointe du diable**

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

Calibration date: 7/18/2023

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

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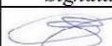
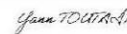
Summary:

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

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.199.1.23.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Cyrille ONNEE	Measurement Responsible	7/18/2023	
<i>Checked & approved by:</i>	Jérôme Luc	Technical Manager	7/18/2023	
<i>Authorized by:</i>	Yann Toutain	Laboratory Director	7/18/2023	

Yann
Toutain ID

Signature numérique
de Yann Toutain ID
Date : 2023.07.18
10:38:49 +02'00'

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen BCTC Technology Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Cyrille ONNEE	7/18/2023	Initial release

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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	2623-EPGO-420
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-7.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.228 MΩ Dipole 2: R2=0.238 MΩ Dipole 3: R3=0.230 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Dosimetric E field Probe

Probe Length	330 mm
Length of Individual Dipoles	24.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.55 mm
Distance between dipoles / probe extremity	12.7 mm

3 MEASUREMENT METHOD

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

3.1 SENSITIVITY

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



3.2 LINEARITY

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

3.3 ISOTROPY

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

3.4 BOUNDARY EFFECT

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

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

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

where

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

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



4 MEASUREMENT UNCERTAINTY

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

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

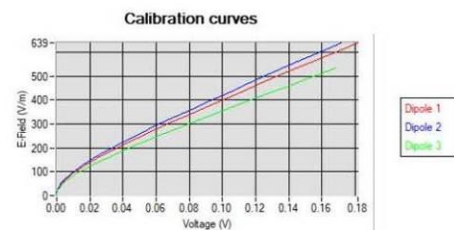
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

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

5.1 CALIBRATION IN AIR

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



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

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

where

V_i =voltage readings on the 3 channels of the probe

DCP_i =diode compression point given below for the 3 channels of the probe

$Norm_i$ =dipole sensitivity given below for the 3 channels of the probe

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Normx dipole 1 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normy dipole 2 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normz dipole 3 ($\mu\text{V}/(\text{V}/\text{m})^2$)
1.21	1.09	1.56

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
106	109	103

5.2 CALIBRATION IN LIQUID

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

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

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

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

where

σ =the conductivity of the liquid

ρ =the volumetric density of the liquid

SAR=the SAR measured from the formula that depends on the setup used. The SAR formulas are given below

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

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

where

c =the specific heat for the liquid

dT/dt =the temperature rises over the time

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

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

where

a =the larger cross-sectional of the waveguide

b =the smaller cross-sectional of the waveguide

δ =the skin depth for the liquid in the waveguide

P_W =the power delivered to the liquid

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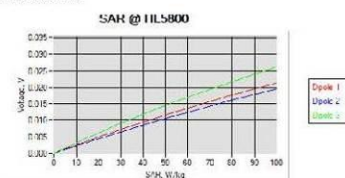
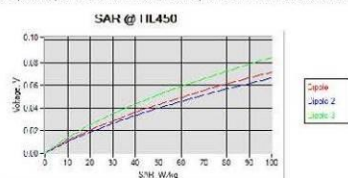

COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.199.1.23.BES.A

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

Liquid	Frequency (MHz*)	ConvF
HL450	450	0.86
BL450	450	0.78
HL750	750	0.80
BL750	750	0.87
HL850	835	0.81
BL850	835	0.80
HL900	900	0.76
BL900	900	0.87
HL1800	1800	0.96
BL1800	1800	1.01
HL1900	1900	1.04
BL1900	1900	1.11
HL2100	2100	1.00
BL2100	2100	1.16
HL2300	2300	1.11
BL2300	2300	1.23
HL2450	2450	1.11
BL2450	2450	1.32
HL2600	2600	1.03
BL2600	2600	1.19
HL5200	5200	1.18
BL5200	5200	0.97
HL5400	5400	1.17
BL5400	5400	1.00
HL5600	5600	1.20
BL5600	5600	0.95
HL5800	5800	1.15
BL5800	5800	1.05

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



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