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 ≤ 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 (~ 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 Band (MHz)	RF Exposure Configuration	Test Position	Repeated SAR (yes/no)	Highest Measured SAR1-g (W/Kg)	First Repeated	
						Measued SAR1-g (W/Kg)	Largest to Smallest SAR Ratio
GSM 850	824.2	Hotspot	Top Side	Yes	1.155	1.091	1.059
WCDMA Band V	846.6	Hotspot	Top Side	Yes	1.037	0.993	1.044

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 transmiting antenna.

Application Simultaneous Transmission information:

No.	Configurations	Body SAR	Hotspot SAR
1	GSM/ WCDMA + WIFI	Yes	Yes
2	GSM/ WCDMA + Bluetooth	Yes	Yes

Remark:

1. GSM and WCDMA cannot be transmitted simultaneously.
2. WIFI and Bluetooth share the same antenna, and cannot transmit simultaneously.
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:

● (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 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 mm

Estimated stand alone SAR						
Communication system	Frequency (MHz)	Maximum Power (dBm)	Maximum Power (mW)	Separation Distance (mm)	X	Estimated SAR1-g (W/kg)
Bluetooth*	2480	5.5	3.55	5	7.5	0.149
Bluetooth*	2480	5.5	3.55	10	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 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 ≤1.6 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	GSM/ WCDMA	WIFI2.4G	Summed SAR (W/kg)	SAR1-g Limit (W/kg)
		Scaled SAR (W/kg)	Scaled SAR (W/kg)		
Body-worn & Hotspot	Front	0.453	0.177	0.630	1.6
	Back	0.088	0.038	0.126	1.6
Hotspot	Top side	1.037	0.272	1.309	1.6

15. Test Plots

15.1 System Performance Check

System check at 835 MHz

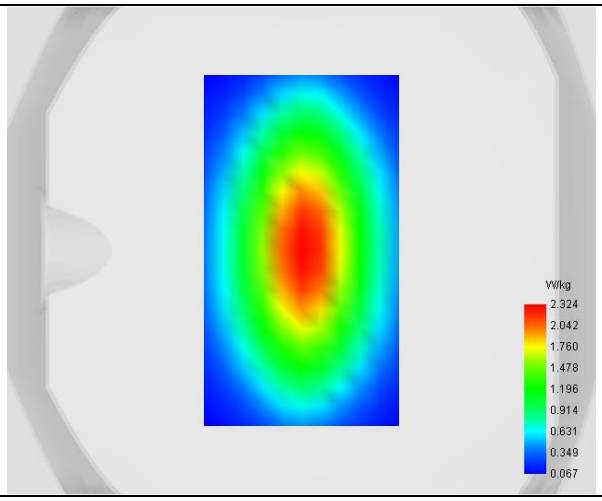
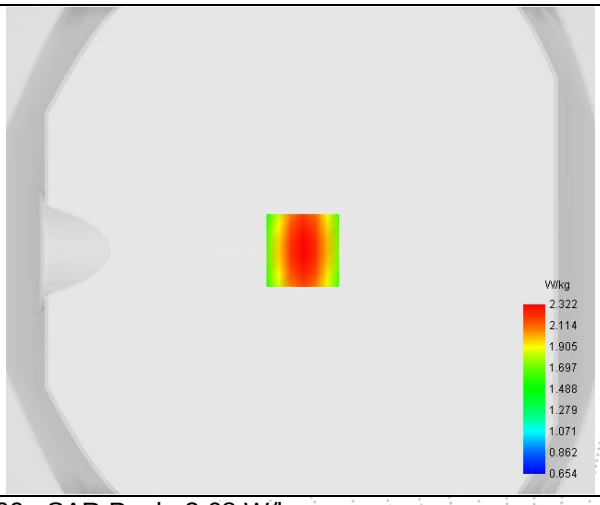
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.81
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=4mm
Phantom	Validation plane
Device Position	Dipole
Band	CW835
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	835.000
Relative permitivity (real part)	40.685
Relative permitivity (imaginary part)	20.910
Conductivity (S/m)	0.999

C. SAR Surface and Volume

SURFACE SAR	**VOLUME SAR**
	

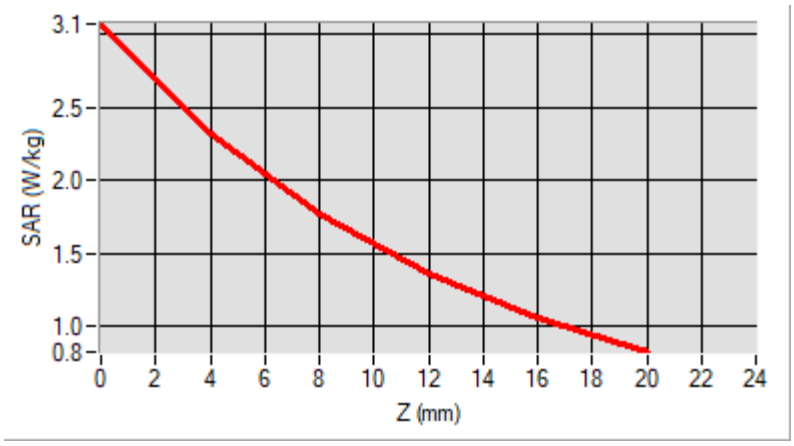
Maximum location: X=1.00, Y=0.00 ; SAR Peak: 3.68 W/kg

D. SAR 1g & 10g

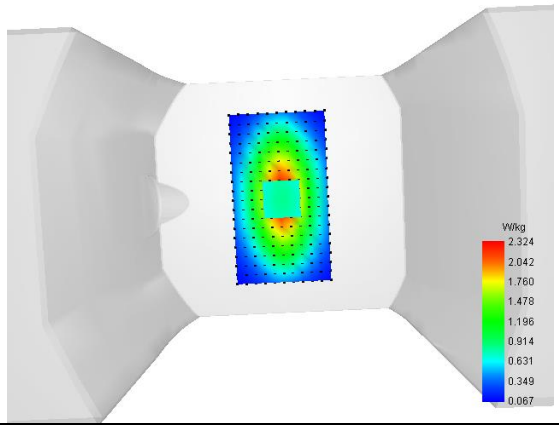
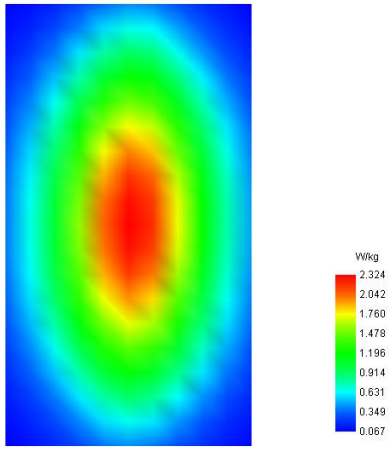
SAR 10g (W/Kg)	1.076
SAR 1g (W/Kg)	2.478
Variation (%)	-2.132
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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

3D screen shot	Hot spot position
	

System check at 1900 MHz

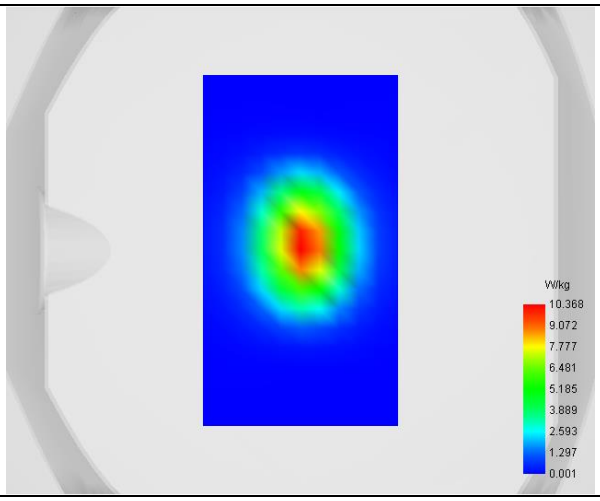
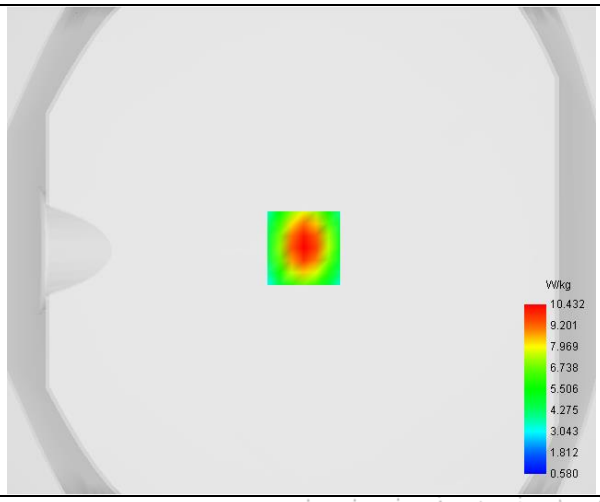
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=4mm
Phantom	Validation plane
Device Position	Dipole
Band	CW1900
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1900.000
Relative permitivity (real part)	40.395
Relative permitivity (imaginary part)	12.866
Conductivity (S/m)	1.443

C. SAR Surface and Volume

SURFACE SAR	**VOLUME SAR**
	

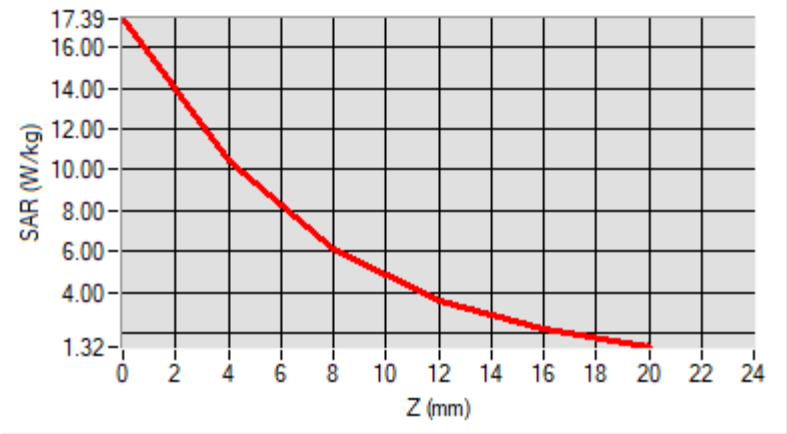
Maximum location: X=1.00, Y=1.00 ; SAR Peak: 11.54 W/kg

D. SAR 1g & 10g

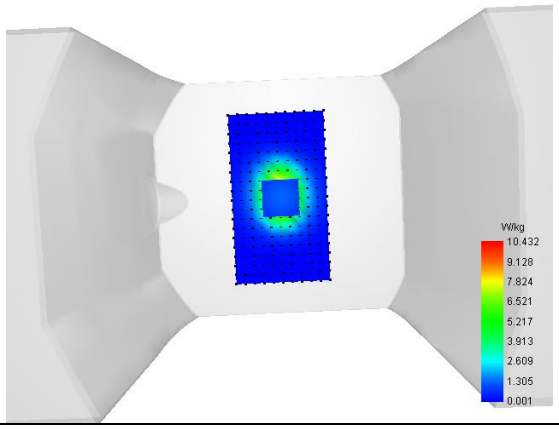
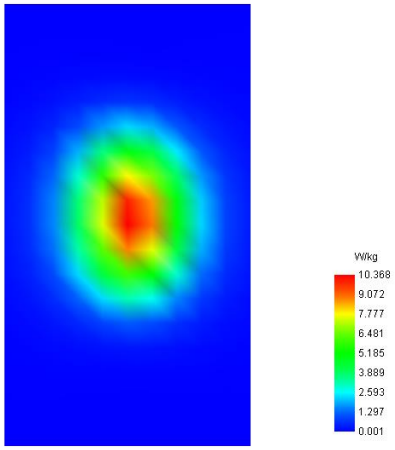
SAR 10g (W/Kg)	4.190
SAR 1g (W/Kg)	10.015
Variation (%)	-0.650
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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

3D screen shot	Hot spot position
	

System check at 2450 MHz

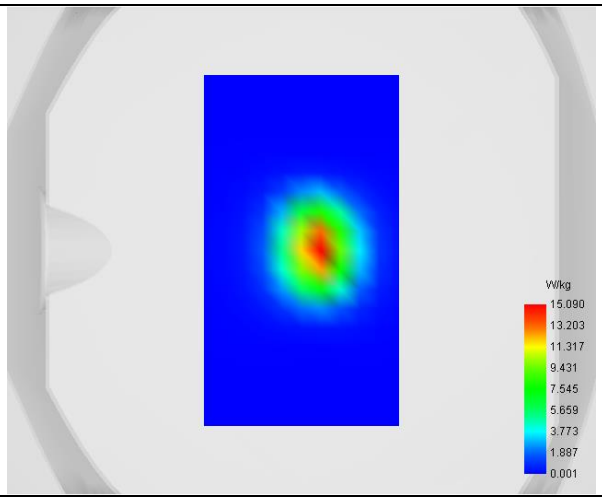
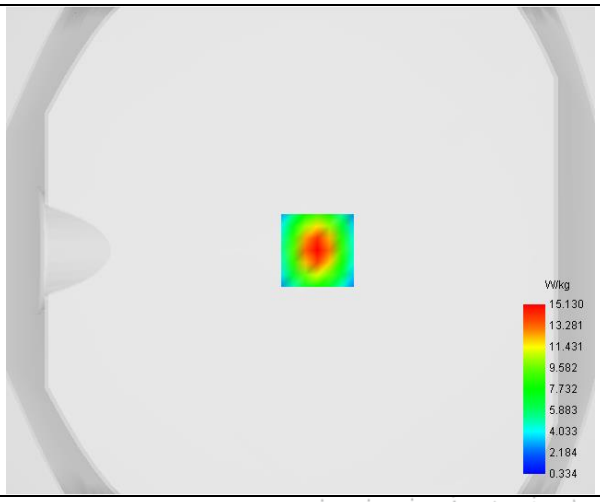
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=4mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	2450.000
Relative permitivity (real part)	38.216
Relative permitivity (imaginary part)	13.242
Conductivity (S/m)	1.834

C. SAR Surface and Volume

SURFACE SAR	**VOLUME SAR**
	

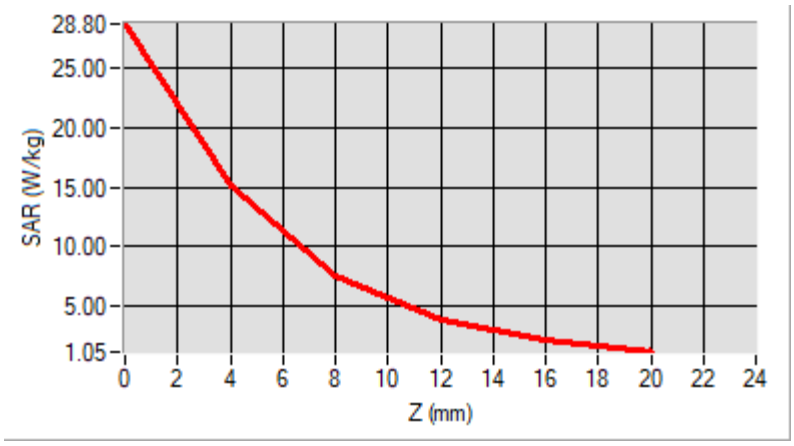
Maximum location: X=7.00, Y=0.00 ; SAR Peak: 14.42 W/kg

D. SAR 1g & 10g

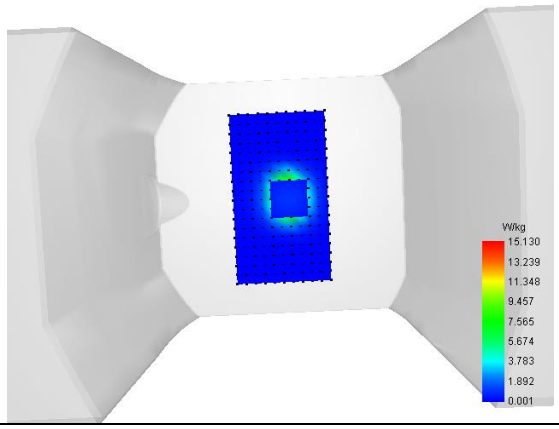
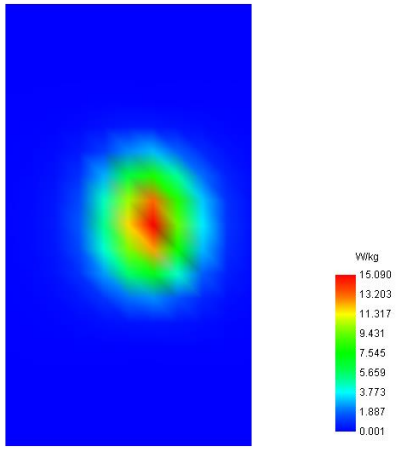
SAR 10g (W/Kg)	6.080
SAR 1g (W/Kg)	13.819
Variation (%)	-3.160
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	28.802	15.018	7.416	3.658	1.912



F. 3D Image

3D screen shot	Hot spot position
	

15.2 SAR Test Graph Results

SAR plots for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination according to FCC KDB 865664 D02

Plot 1

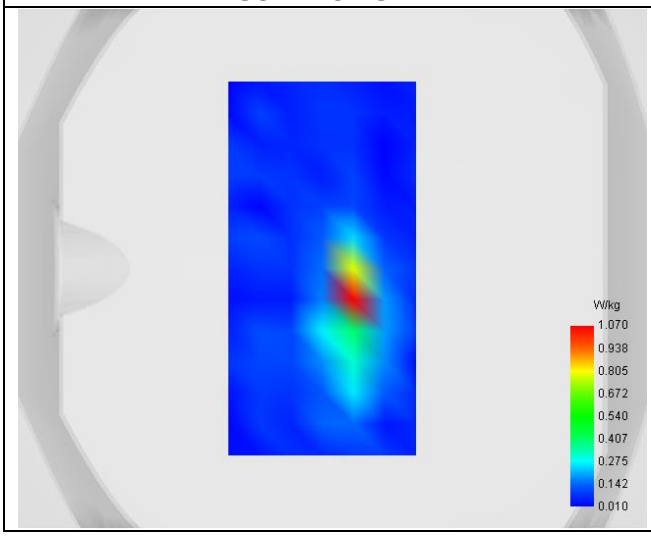
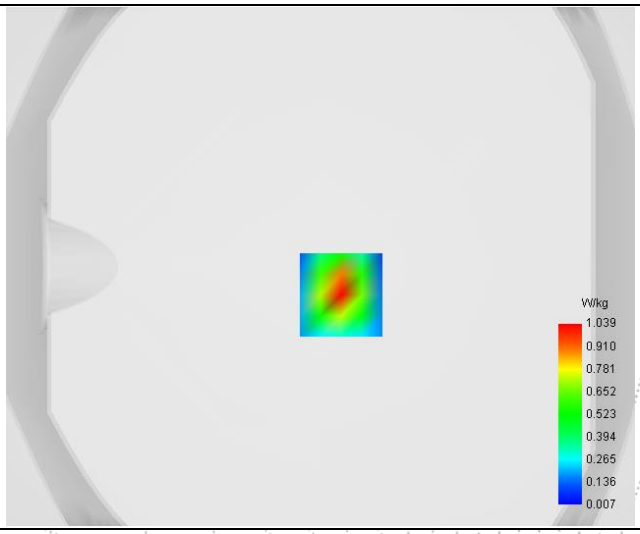
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.81
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	GSM850
Channels	Lower (0)
Signal	Custom (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	824.200
Relative permitivity (real part)	40.685
Relative permitivity (imaginary part)	19.649
Conductivity (S/m)	0.999

C. SAR Surface and Volume

SURFACE SAR	VOLUME SAR
	

Maximum location: X=8.00, Y=-11.00 ; SAR Peak: 2.07 W/kg

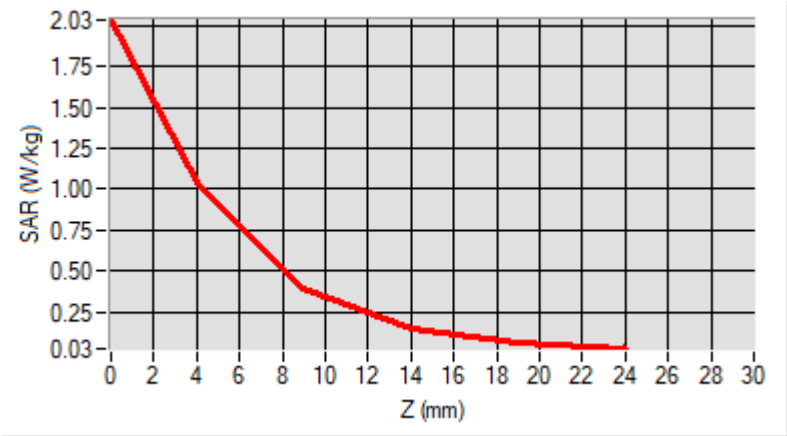
D. SAR 1g & 10g

SAR 10g (W/Kg)	0.393
SAR 1g (W/Kg)	0.954
Variation (%)	-1.450
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

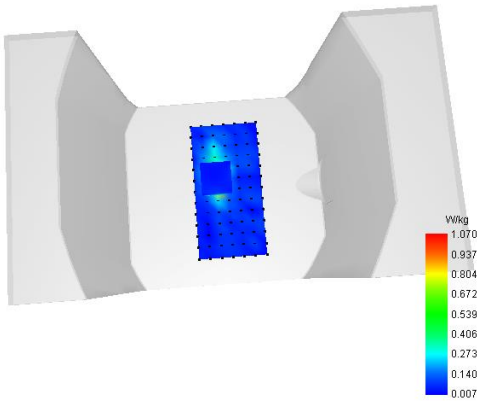
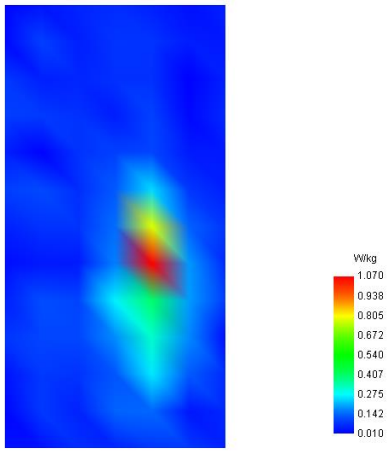
E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00

SAR (W/Kg)	2.034	1.039	0.399	0.144	0.059



F. 3D Image

3D screen shot	Hot spot position
	

Plot 2

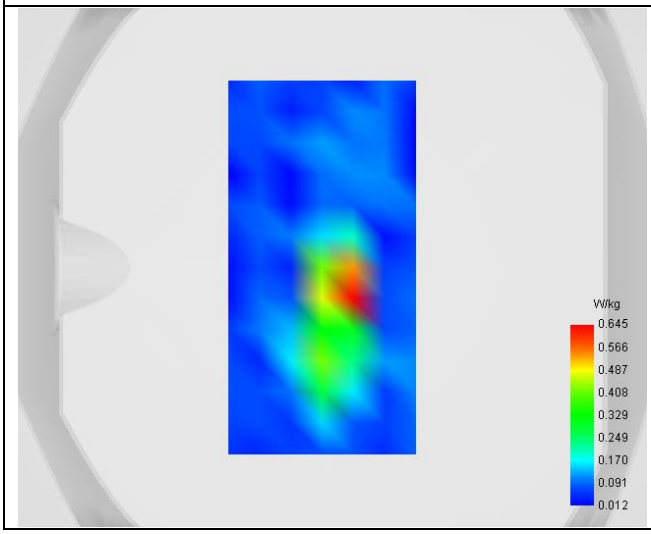
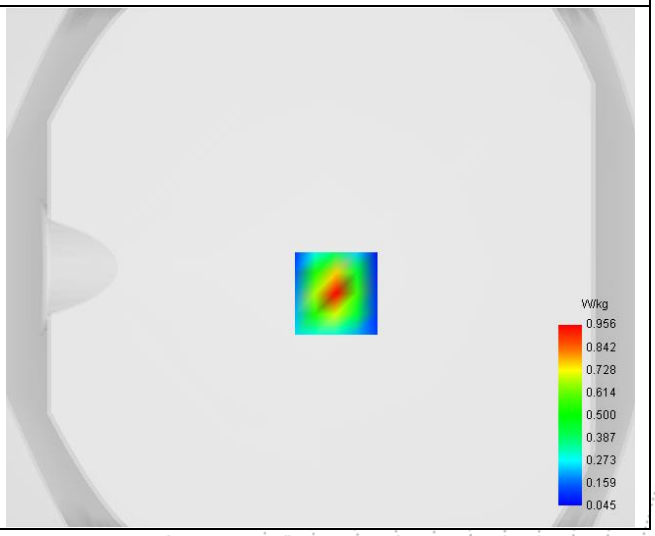
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	GSM1900
Channels	810
Signal	Custom (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1909.800
Relative permitivity (real part)	40.395
Relative permitivity (imaginary part)	13.408
Conductivity (S/m)	1.443

C. SAR Surface and Volume

SURFACE SAR	**VOLUME SAR**
	

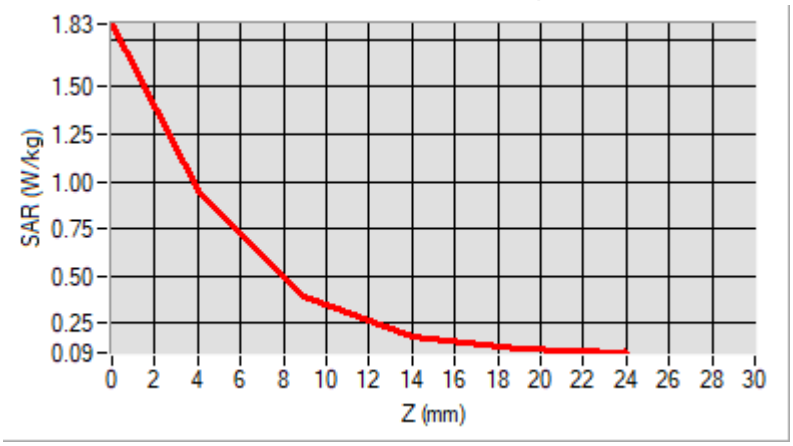
Maximum location: X=7.00, Y=-2.00 ; SAR Peak: 0.76 W/kg

D. SAR 1g & 10g

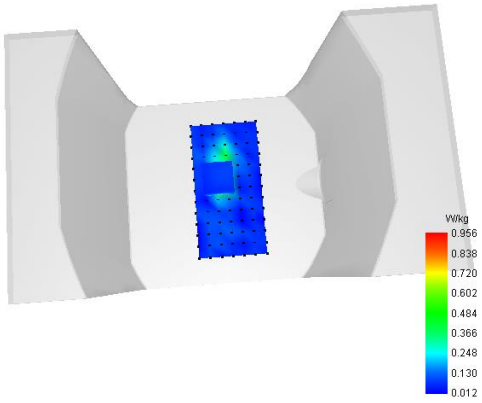
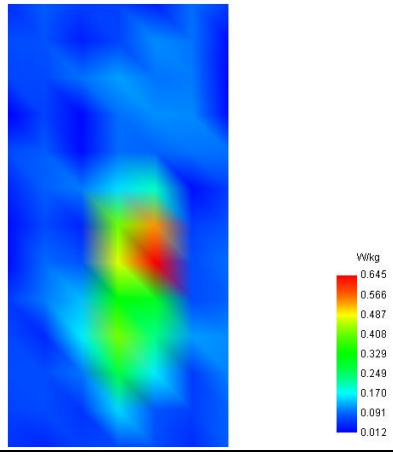
SAR 10g (W/Kg)	0.316
SAR 1g (W/Kg)	0.711
Variation (%)	-2.430
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	4.455	2.403	1.043	0.476	0.277



F. 3D Image

3D screen shot	Hot spot position
	

Plot 3

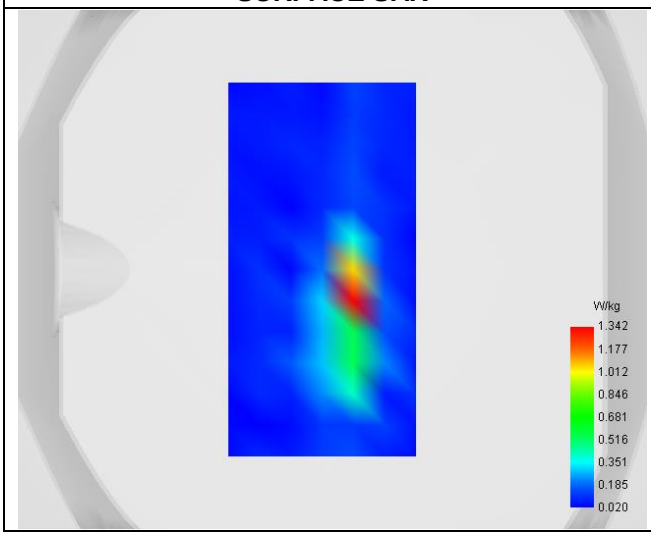
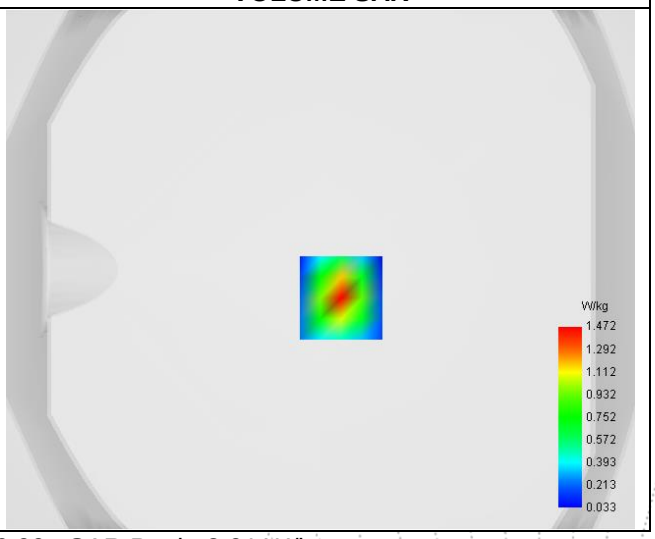
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.04
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band2_WCDMA1900
Channels	9262
Signal	WCDMA (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1852.400
Relative permitivity (real part)	40.395
Relative permitivity (imaginary part)	13.408
Conductivity (S/m)	1.443

C. SAR Surface and Volume

SURFACE SAR	**VOLUME SAR**
	

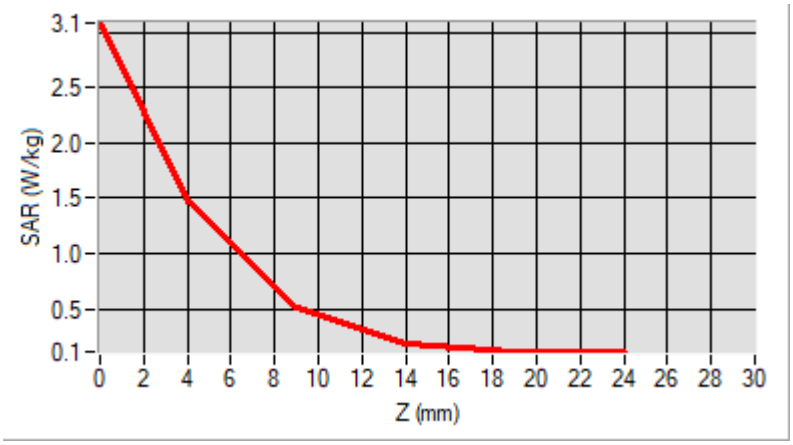
Maximum location: X=-5.00, Y=-36.00 ; SAR Peak: 8.01 W/kg

D. SAR 1g & 10g

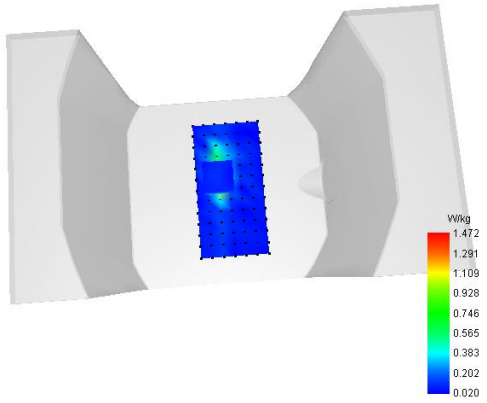
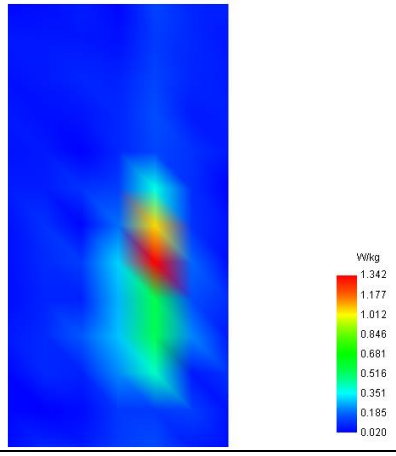
SAR 10g (W/Kg)	0.407
SAR 1g (W/Kg)	0.704
Variation (%)	-2.870
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	6.061	3.683	1.893	0.962	0.509



F. 3D Image

3D screen shot	Hot spot position
	

Plot 4

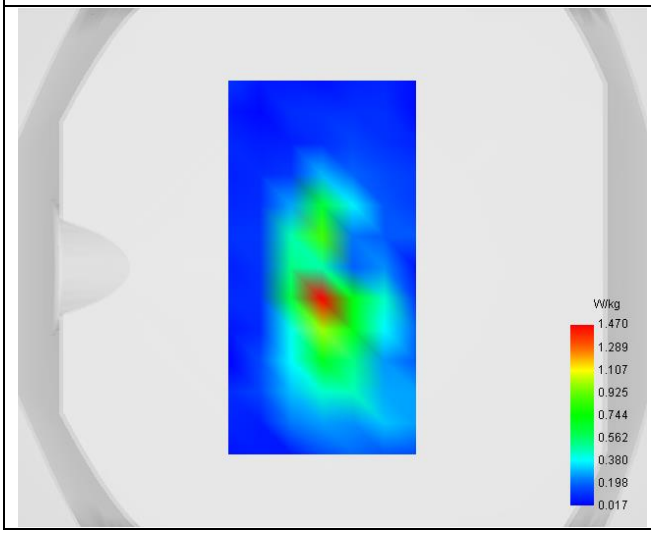
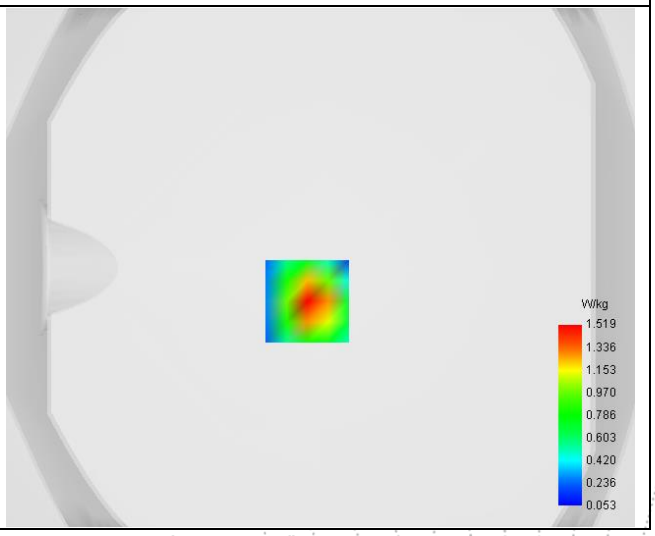
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	0.81
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band5_WCDMA850
Channels	4233
Signal	WCDMA (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	846.600
Relative permitivity (real part)	40.685
Relative permitivity (imaginary part)	20.226
Conductivity (S/m)	0.999

C. SAR Surface and Volume

SURFACE SAR	**VOLUME SAR**
	

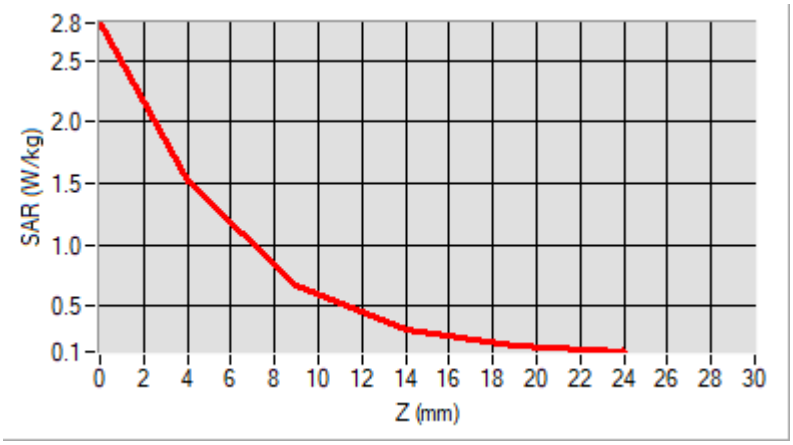
Maximum location: X=-2.00, Y=-5.00 ; SAR Peak: 1.30 W/kg

D. SAR 1g & 10g

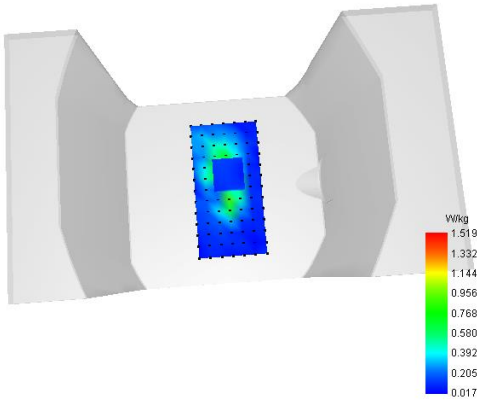
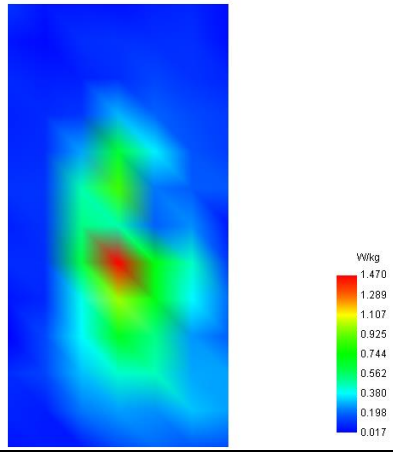
SAR 10g (W/Kg)	0.372
SAR 1g (W/Kg)	0.948
Variation (%)	0.690
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.327	2.644	0.974	0.349	0.162



F. 3D Image

3D screen shot	Hot spot position
	

Plot 5

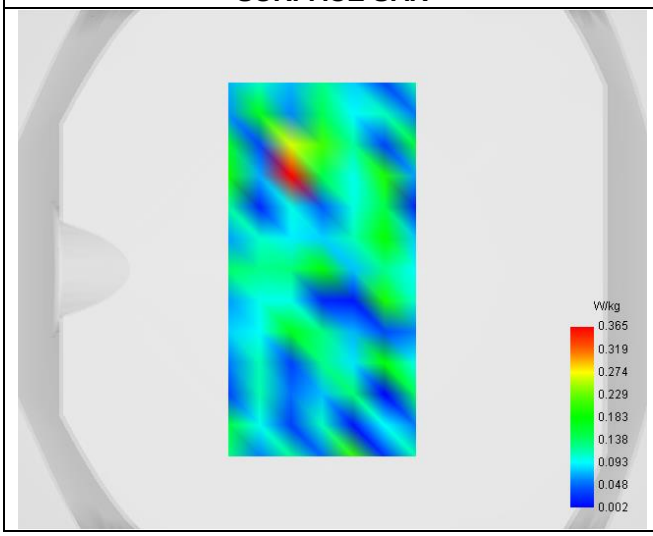
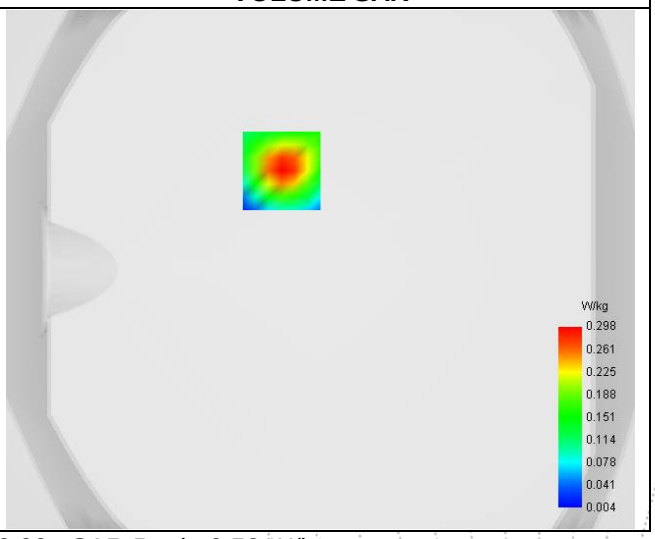
A. Experimental conditions.

Probe	SN 26/23 EPGO420
ConvF	1.11
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	6
Signal	IEEE802.b (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	2437.000
Relative permitivity (real part)	38.216
Relative permitivity (imaginary part)	13.182
Conductivity (S/m)	1.834

C. SAR Surface and Volume

SURFACE SAR	**VOLUME SAR**
	

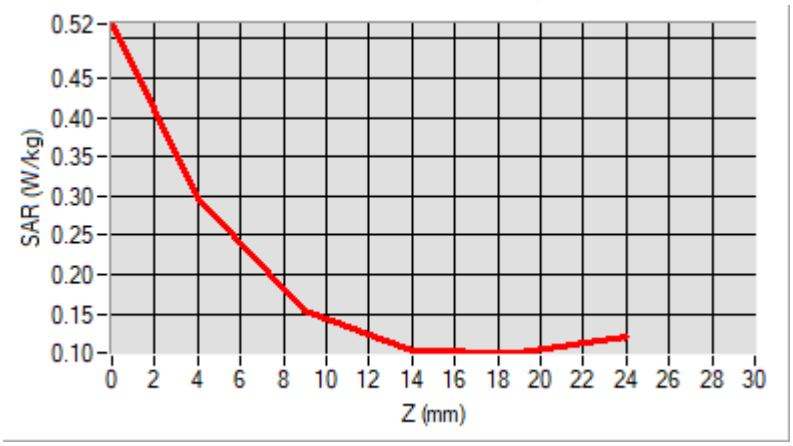
Maximum location: X=-15.00, Y=38.00 ; SAR Peak: 0.52 W/kg

D. SAR 1g & 10g

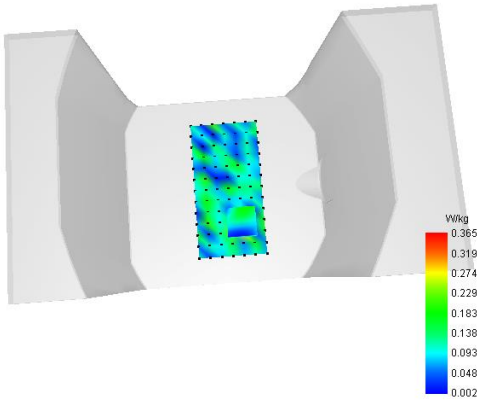
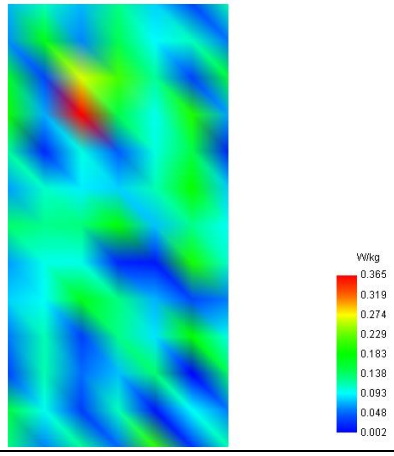
SAR 10g (W/Kg)	0.161
SAR 1g (W/Kg)	0.235
Variation (%)	-0.810
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.519	0.298	0.154	0.102	0.101



F. 3D Image

3D screen shot	Hot spot position
	

16. CALIBRATION CERTIFICATES

Probe-EPGO420 Calibration Certificate
SID835Dipole Calibration Ceriticate
SID1900Dipole Calibration Ceriticate
SID2450Dipole Calibration Ceriticate

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).

Page: 1/11