

MEASUREMENT 8

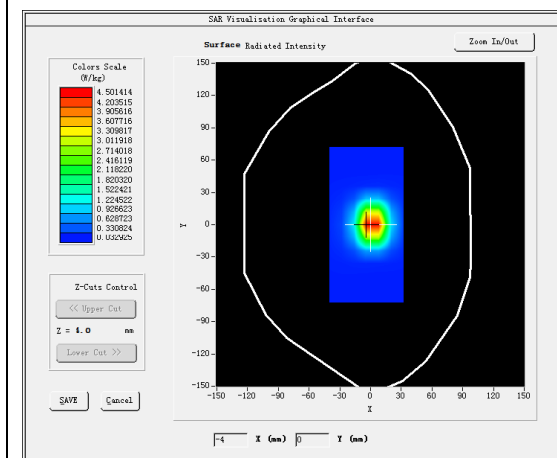
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm</u> <u>dz=5mm,Complete/ndx=12mm dy=12mm,</u> <u>h= 5.00 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW2450</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>

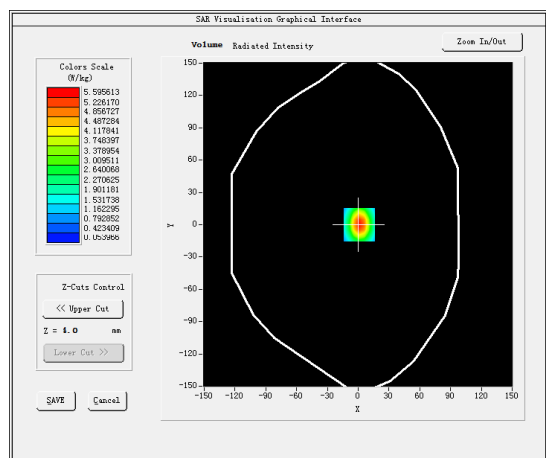
B. SAR Measurement Results

Frequency (MHz)	2450.000000
Relative permittivity (real part)	52.544097
Relative permittivity (imaginary part)	14.451220
Conductivity (S/m)	1.966738
Variation (%)	-0.060000

SURFACE SAR



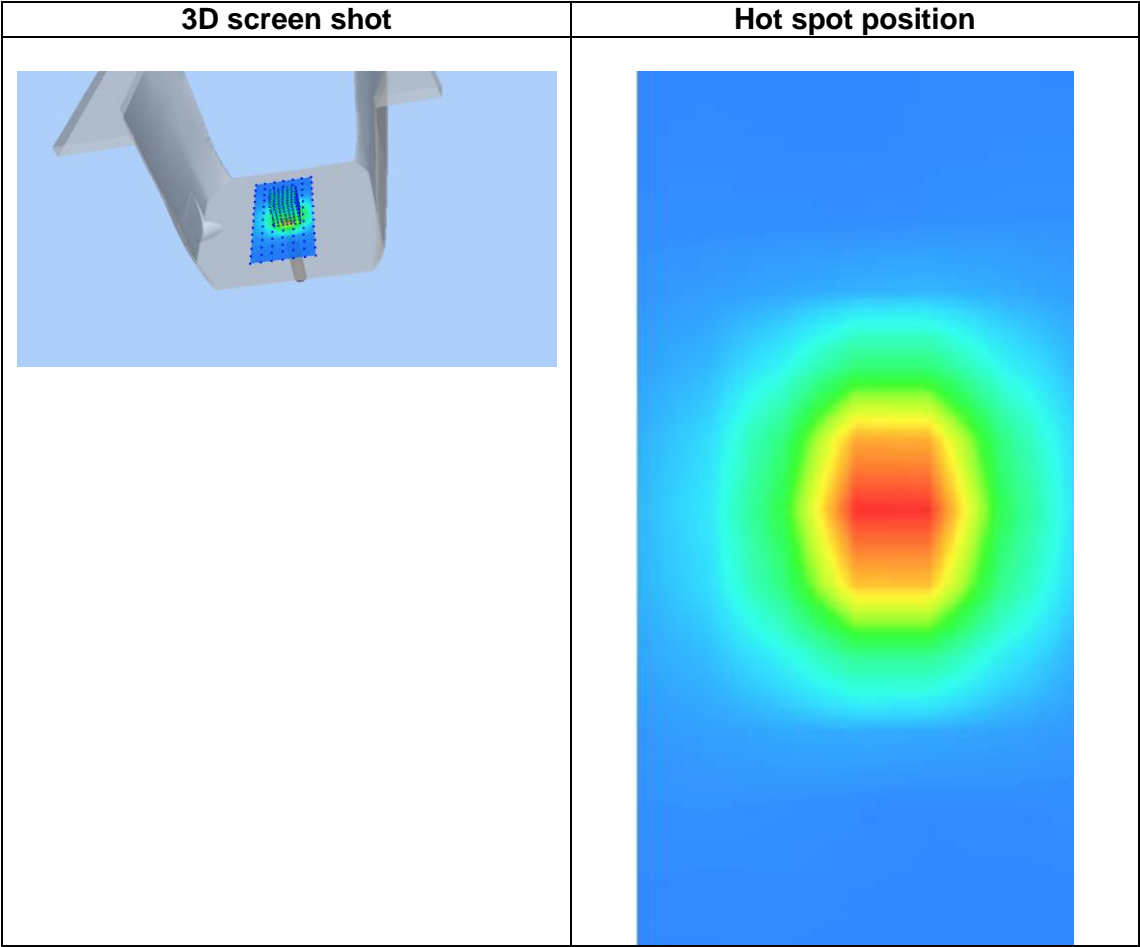
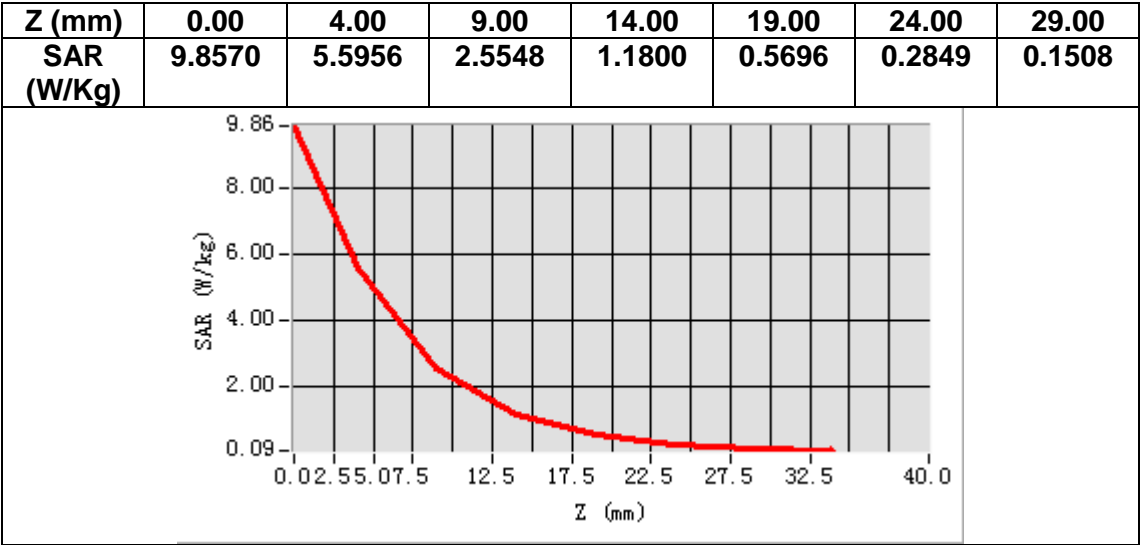
VOLUME SAR



Maximum location: X=1.00, Y=0.00

SAR Peak: 9.78 W/kg

SAR 10g (W/Kg)	2.293258
SAR 1g (W/Kg)	5.179459



MEASUREMENT 9

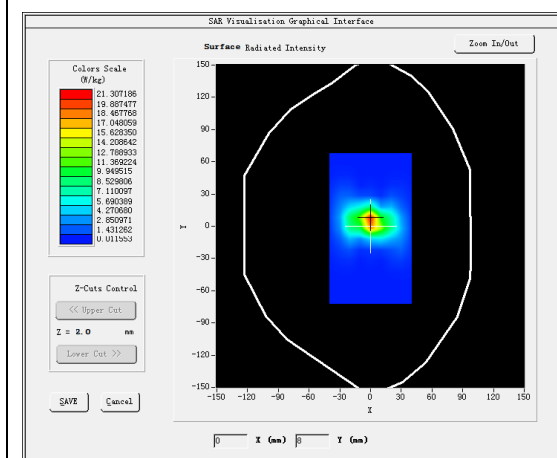
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.31 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm</u> <u>dz=2mm,Complete/ndx=4mm dy=4mm, h=</u> <u>2.31 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW5200</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>

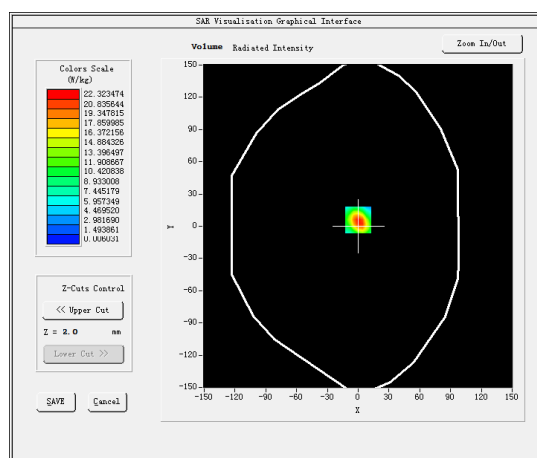
B. SAR Measurement Results

Frequency (MHz)	5200.000000
Relative permittivity (real part)	36.205237
Relative permittivity (imaginary part)	16.249619
Conductivity (S/m)	4.694271
Variation (%)	-0.880000

SURFACE SAR



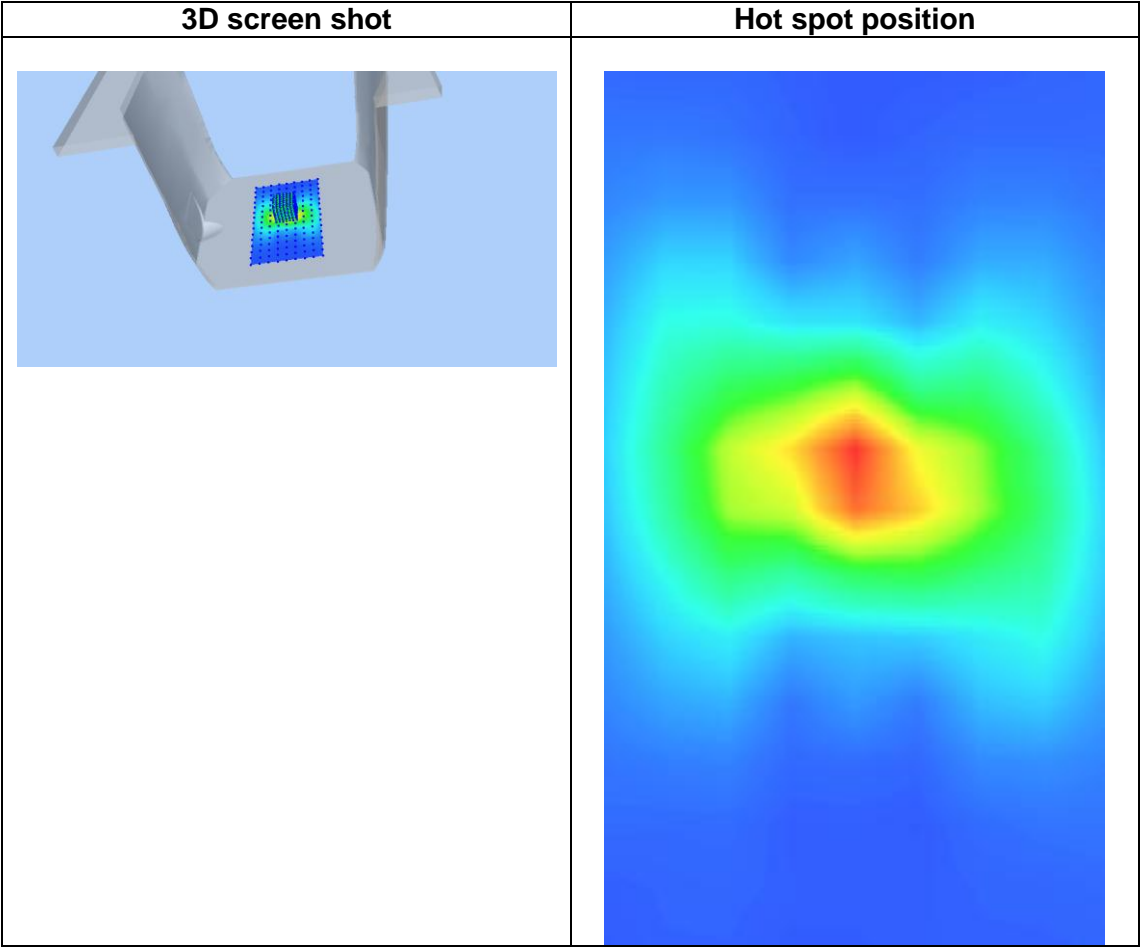
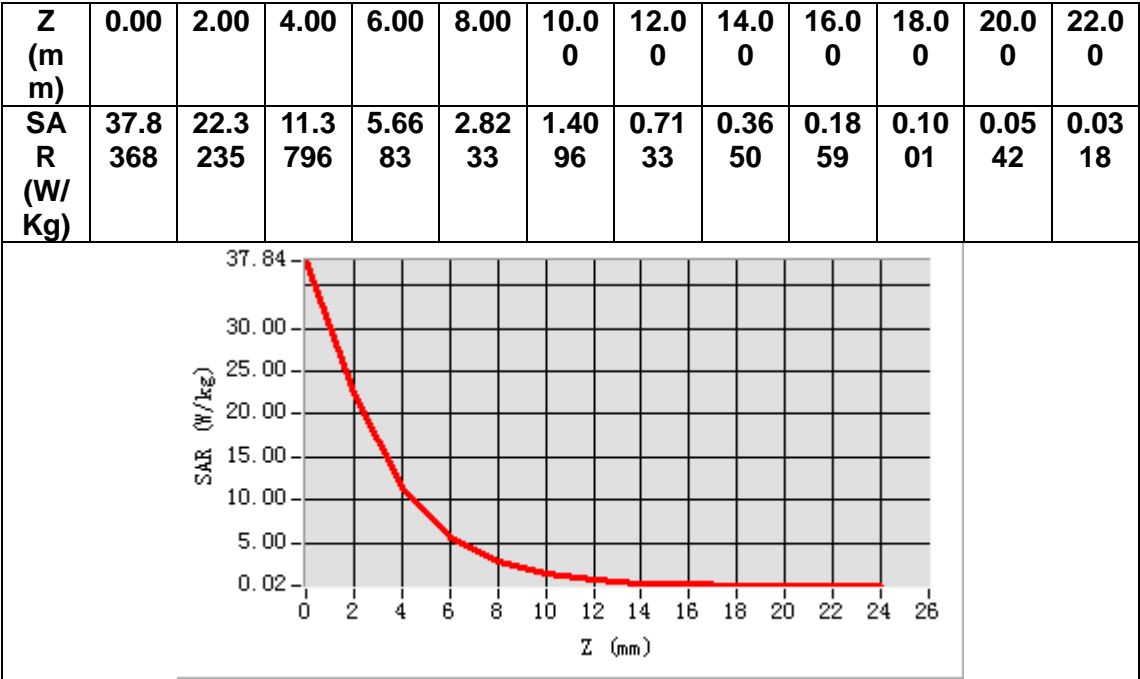
VOLUME SAR



Maximum location: X=0.00, Y=6.00

SAR Peak: 40.06 W/kg

SAR 10g (W/Kg)	5.445711
SAR 1g (W/Kg)	15.244327



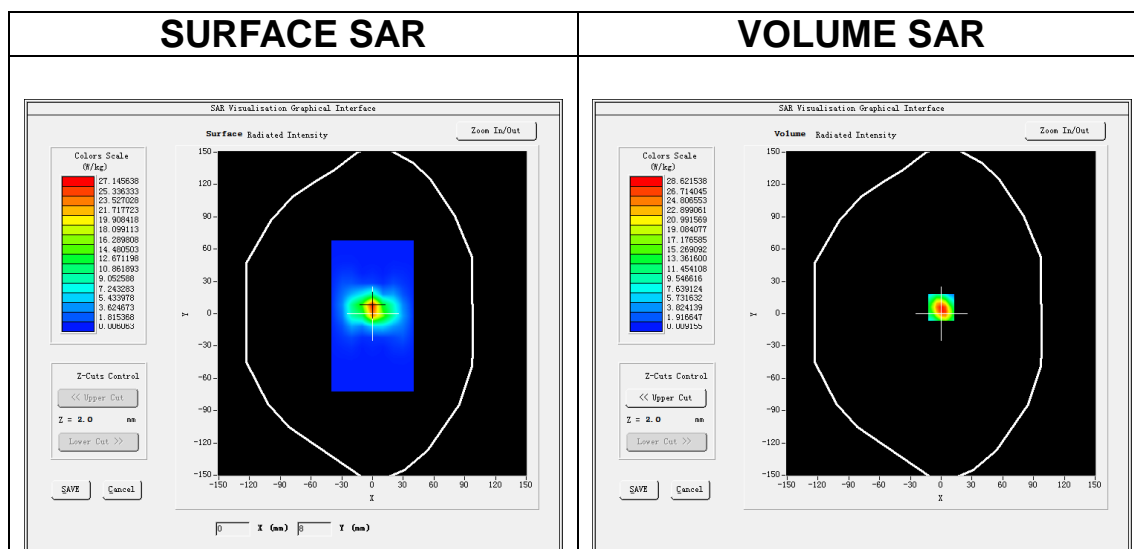
MEASUREMENT 10

A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.31 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm</u> <u>dz=2mm,Complete/ndx=4mm dy=4mm, h=</u> <u>2.31 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW5200</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>

B. SAR Measurement Results

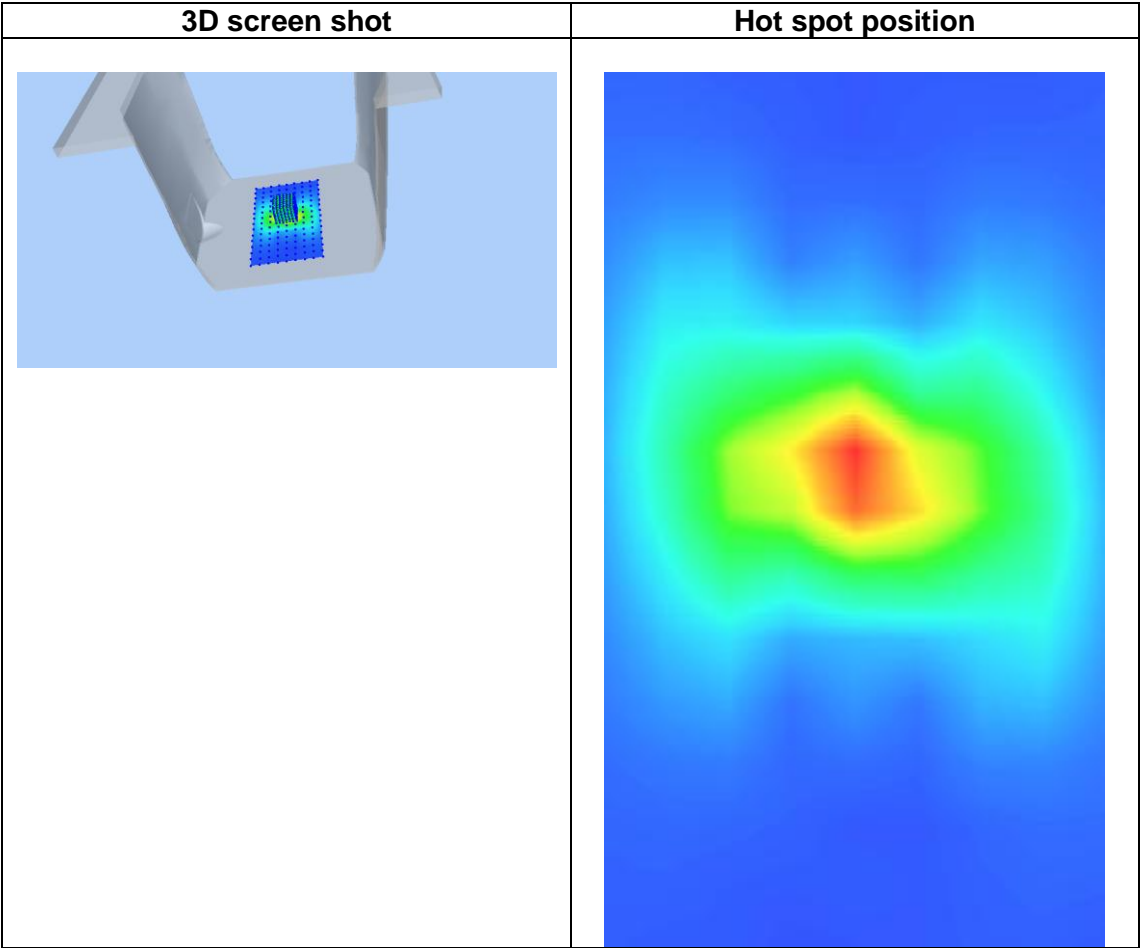
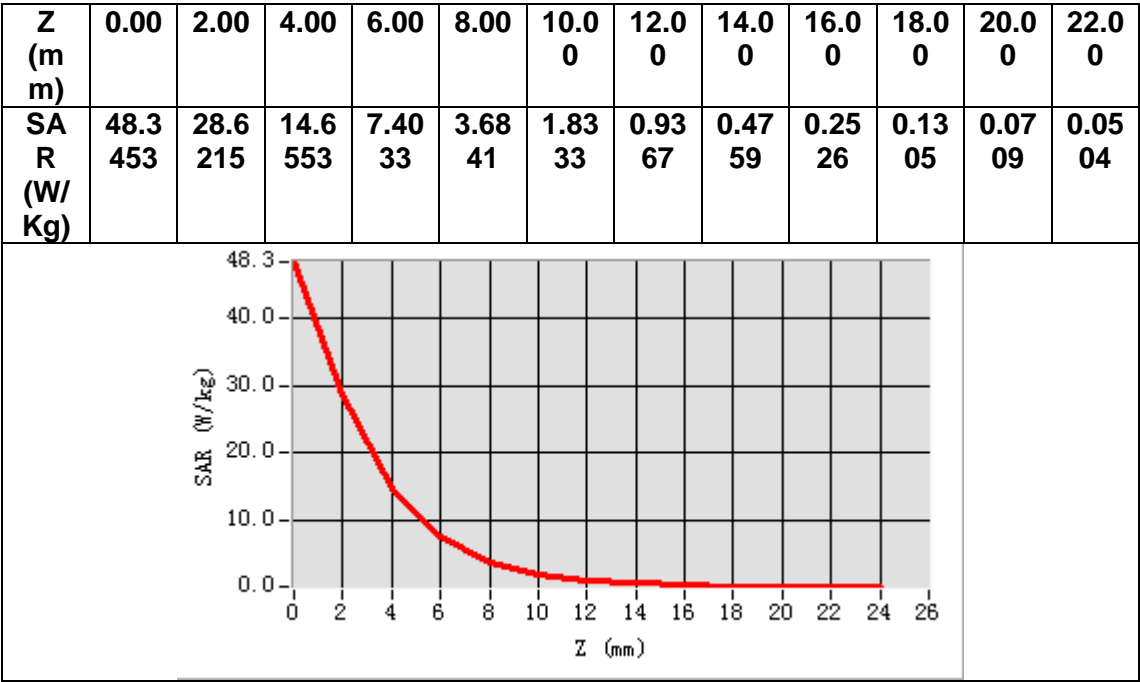
Frequency (MHz)	5200.000000
Relative permittivity (real part)	49.975237
Relative permittivity (imaginary part)	18.172619
Conductivity (S/m)	5.254271
Variation (%)	-0.450000



Maximum location: X=0.00, Y=6.00

SAR Peak: 51.30 W/kg

SAR 10g (W/Kg)	5.637744
SAR 1g (W/Kg)	15.199757



MEASUREMENT 11

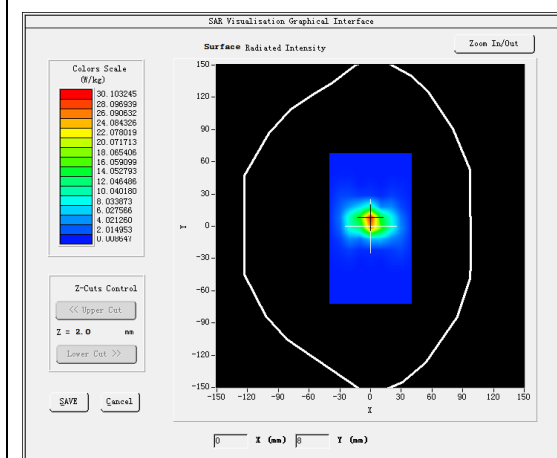
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.31 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm</u> <u>dz=2mm,Complete/ndx=4mm dy=4mm, h=</u> <u>2.31 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW5800</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>

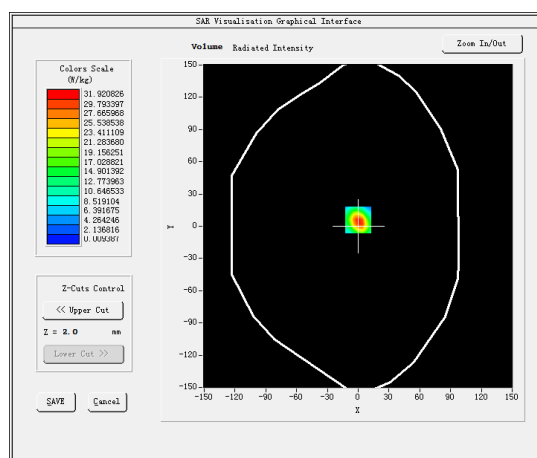
B. SAR Measurement Results

Frequency (MHz)	5800.000000
Relative permittivity (real part)	34.626837
Relative permittivity (imaginary part)	15.836709
Conductivity (S/m)	5.114271
Variation (%)	-0.400000

SURFACE SAR



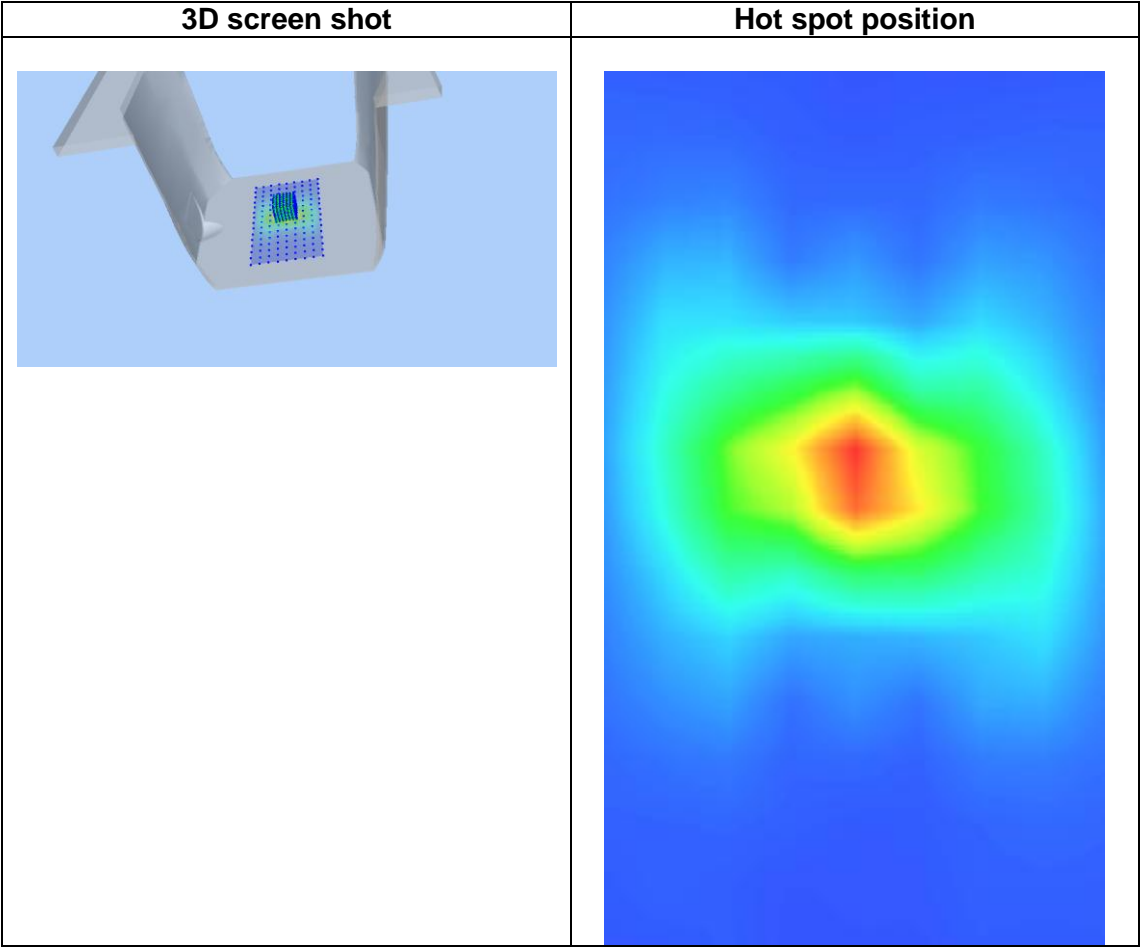
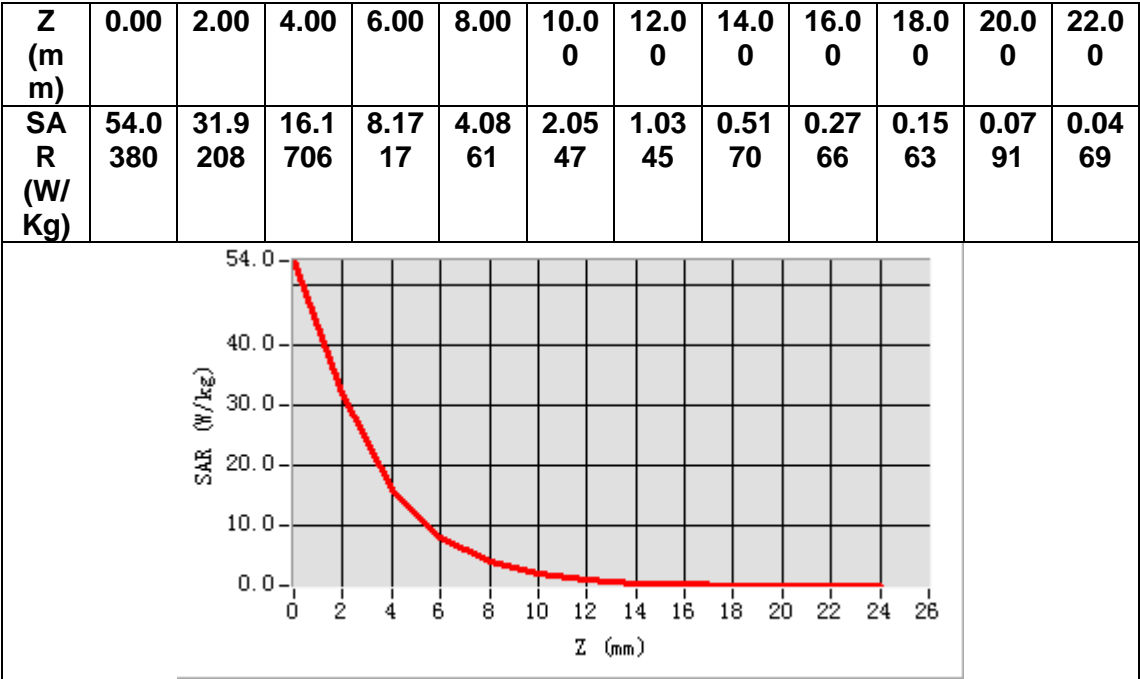
VOLUME SAR



Maximum location: X=0.00, Y=6.00

SAR Peak: 57.37 W/kg

SAR 10g (W/Kg)	6.143874
SAR 1g (W/Kg)	17.958472



MEASUREMENT 12

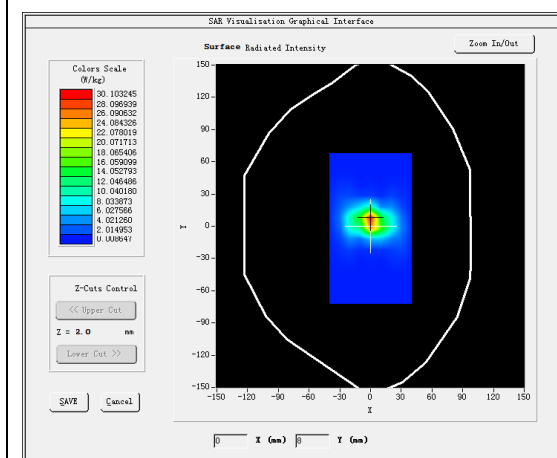
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.31 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm</u> <u>dz=2mm,Complete/ndx=4mm dy=4mm, h=</u> <u>2.31 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW5800</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>

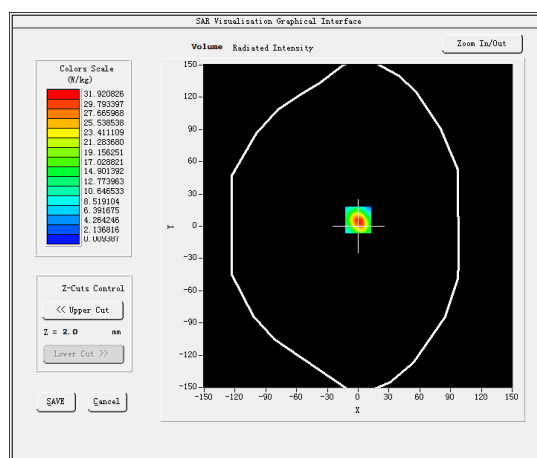
B. SAR Measurement Results

Frequency (MHz)	5800.000000
Relative permittivity (real part)	48.655424
Relative permittivity (imaginary part)	18.728709
Conductivity (S/m)	6.044247
Variation (%)	-0.400000

SURFACE SAR



VOLUME SAR

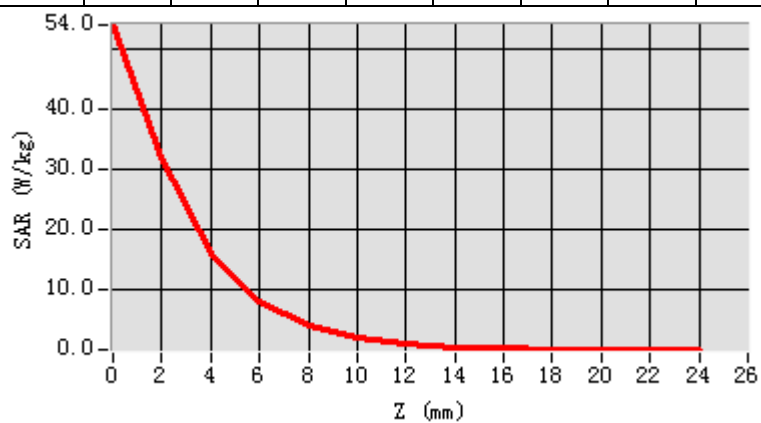


Maximum location: X=0.00, Y=6.00

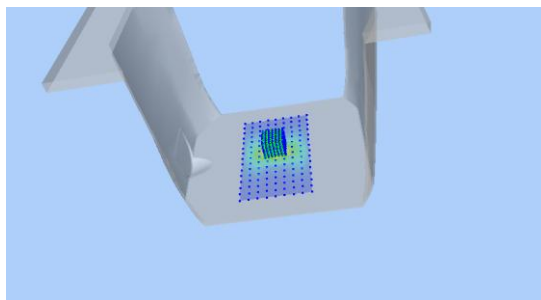
SAR Peak: 57.37 W/kg

SAR 10g (W/Kg)	6.238753
SAR 1g (W/Kg)	17.648044

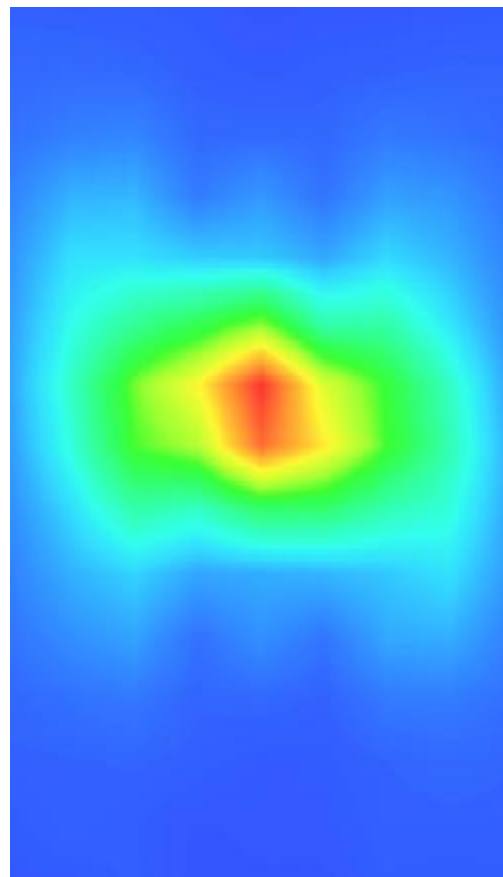
Z (m m)	0.00	2.00	4.00	6.00	8.00	10.0 0	12.0 0	14.0 0	16.0 0	18.0 0	20.0 0	22.0 0
SA R (W/ Kg)	54.0 380	31.9 208	16.1 706	8.17 17	4.08 61	2.05 47	1.03 45	0.51 70	0.27 66	0.15 63	0.07 91	0.04 69



3D screen shot



Hot spot position



13. Appendix C. Plots of High SAR Measurement

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MEASUREMENT 1

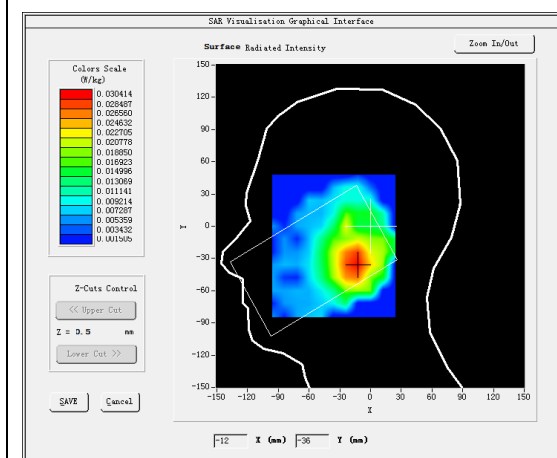
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm</u> <u>dz=5mm,Complete/ndx=12mm dy=12mm,</u> <u>h= 5.00 mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>IEEE 802.11b ISM</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>IEEE802.11b (Crest factor: 1.0)</u>

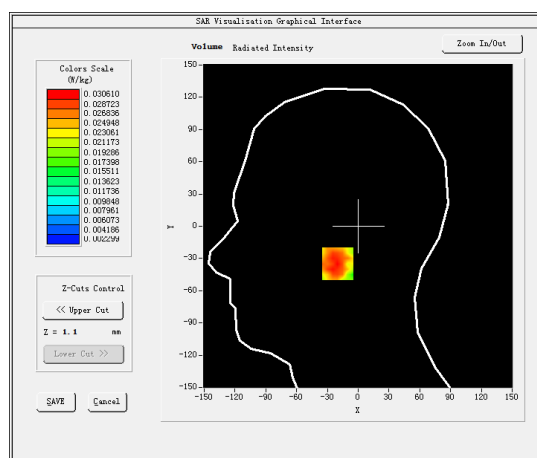
B. SAR Measurement Results

Frequency (MHz)	2437.000000
Relative permittivity (real part)	39.091999
Relative permittivity (imaginary part)	13.461900
Conductivity (S/m)	1.822592
Variation (%)	4.230000

SURFACE SAR



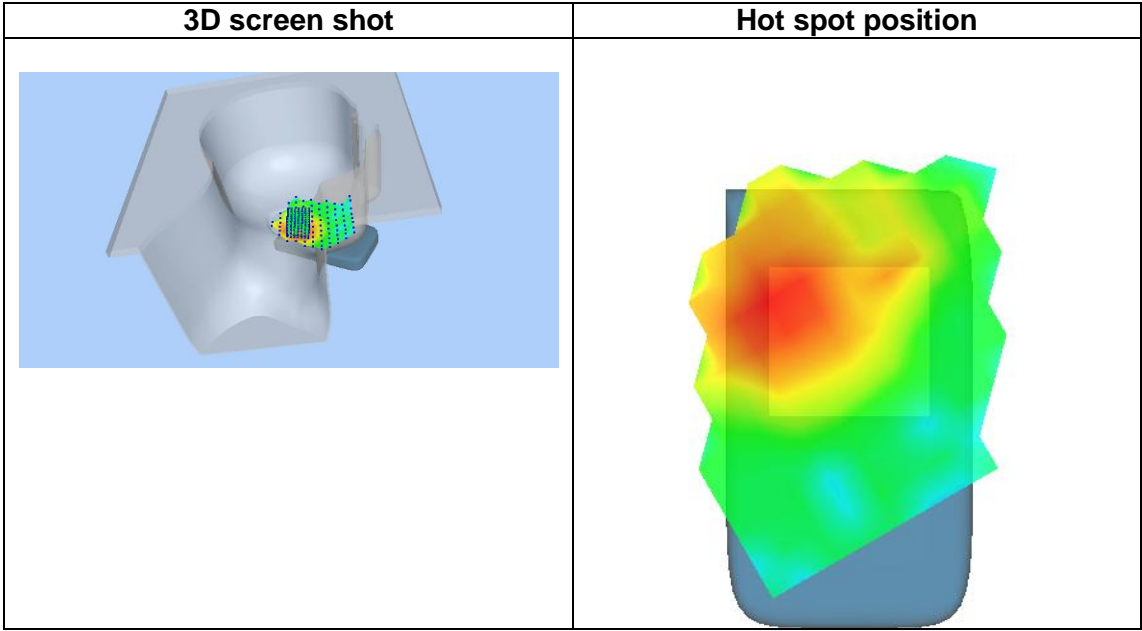
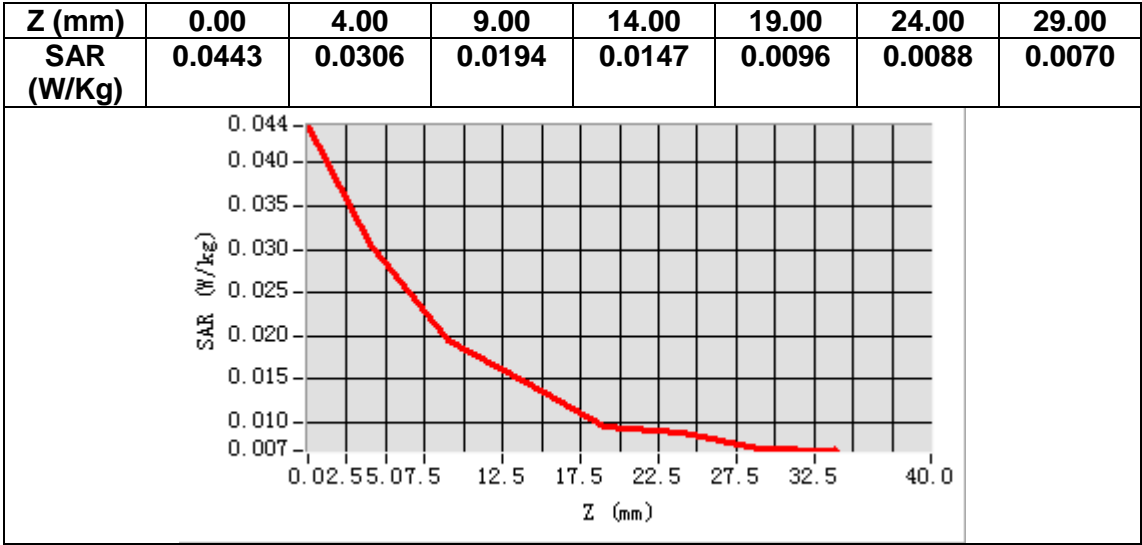
VOLUME SAR



Maximum location: X=-14.00, Y=-35.00

SAR Peak: 0.05 W/kg

SAR 10g (W/Kg)	0.019425
SAR 1g (W/Kg)	0.029135



MEASUREMENT 2

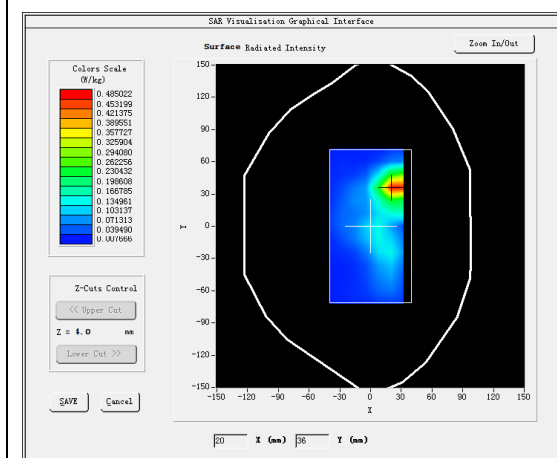
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm</u> <u>dz=5mm,Complete/ndx=12mm dy=12mm,</u> <u>h= 5.00 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11b ISM</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>IEEE802.11b (Crest factor: 1.0)</u>

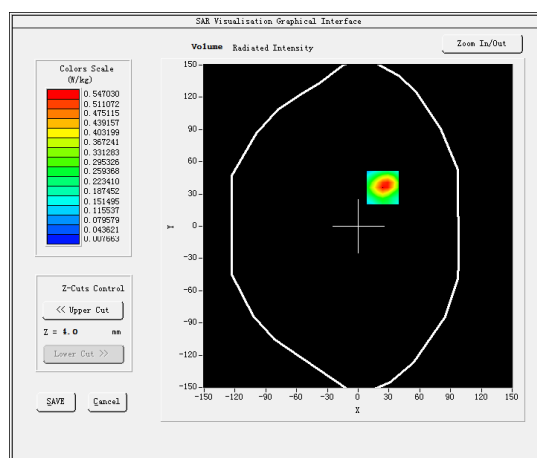
B. SAR Measurement Results

Frequency (MHz)	2437.000000
Relative permittivity (real part)	52.599300
Relative permittivity (imaginary part)	14.403320
Conductivity (S/m)	1.950049
Variation (%)	-2.050000

SURFACE SAR



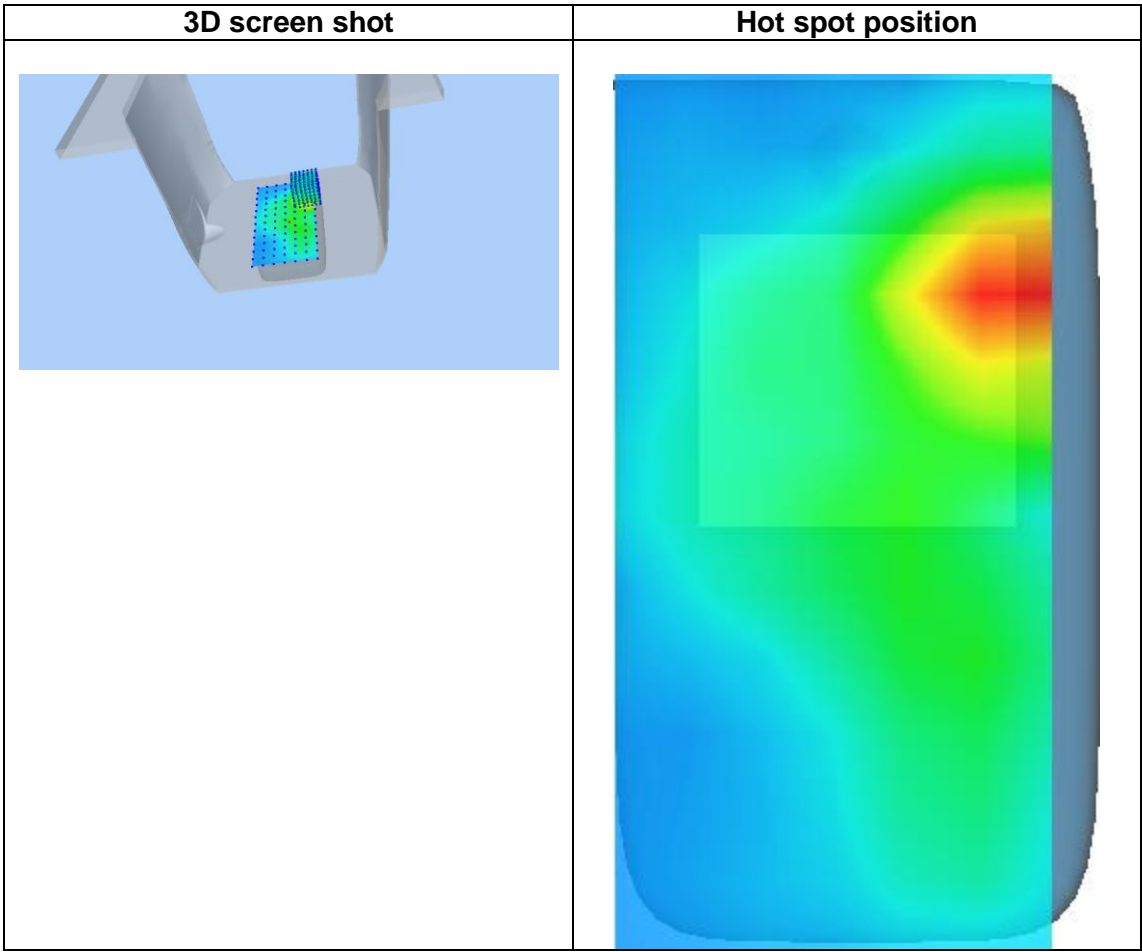
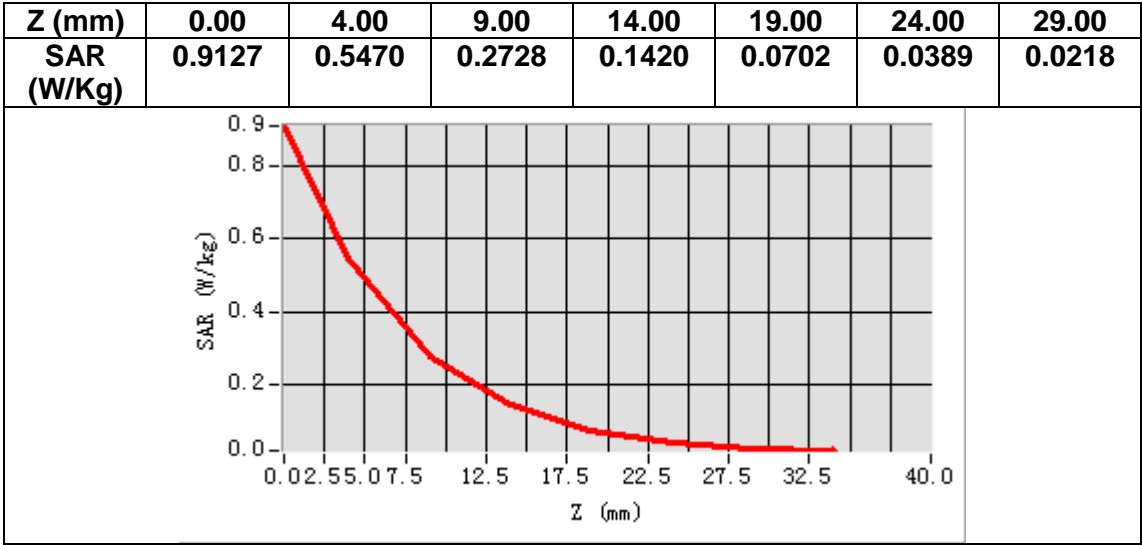
VOLUME SAR



Maximum location: X=24.00, Y=36.00

SAR Peak: 0.94 W/kg

SAR 10g (W/Kg)	0.204396
SAR 1g (W/Kg)	0.377095



MEASUREMENT 3

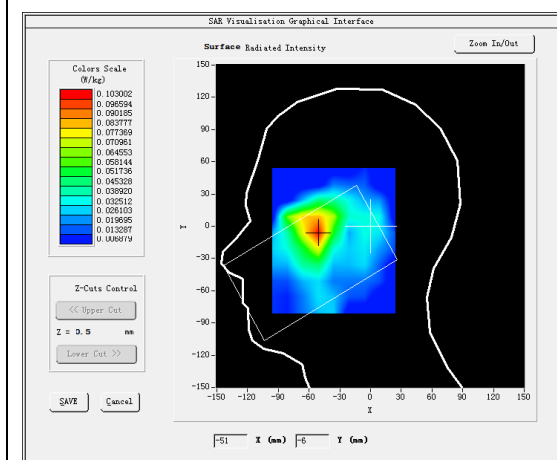
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=15mm dy=15mm,</u> <u>h= 5.00 mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 2</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>

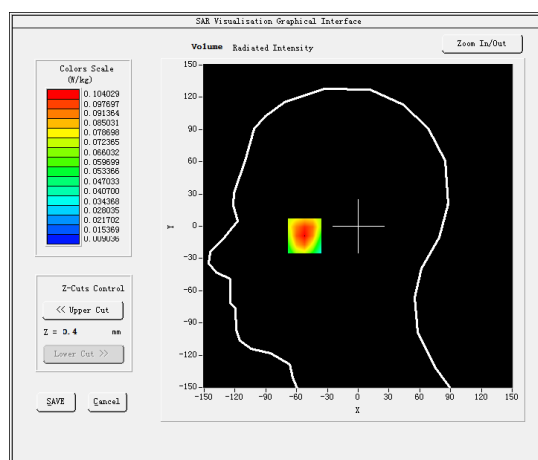
B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	39.567951
Relative permittivity (imaginary part)	13.623750
Conductivity (S/m)	1.422547
Variation (%)	0.960000

SURFACE SAR



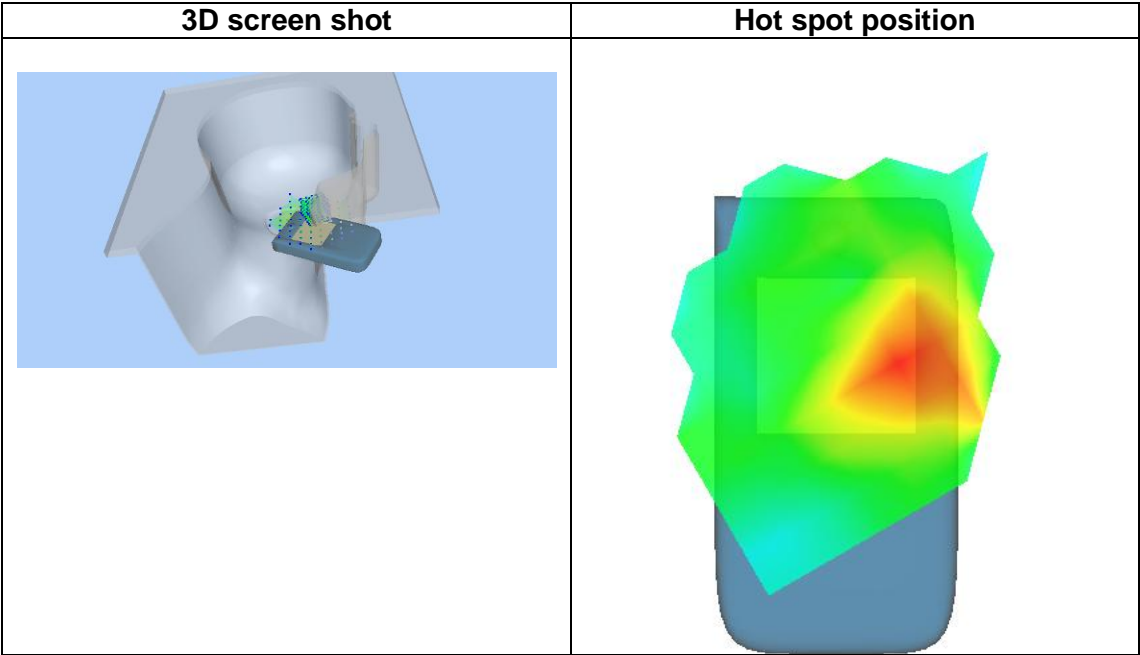
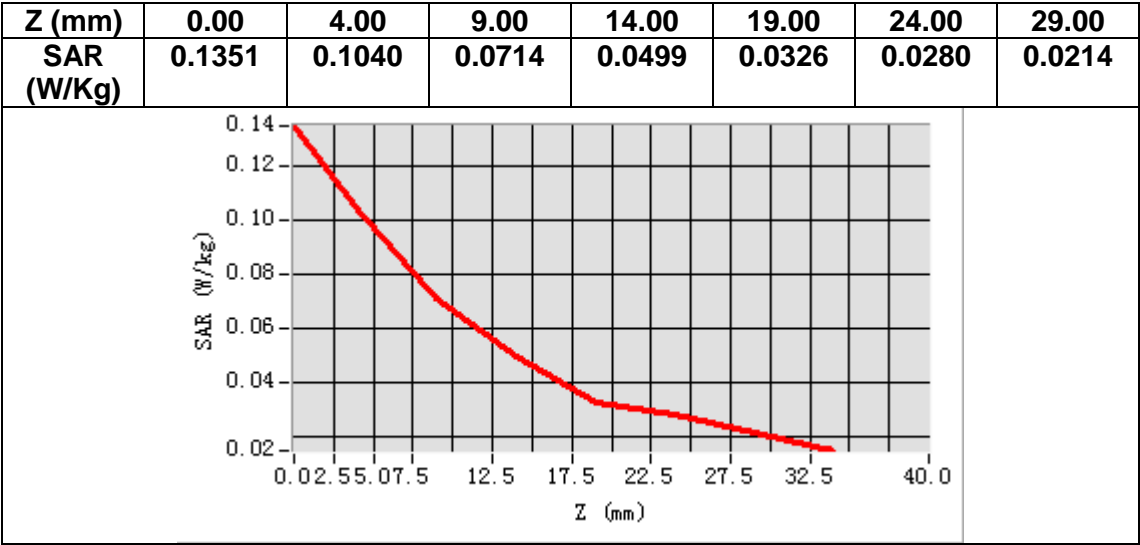
VOLUME SAR



Maximum location: X=-52.00, Y=-6.00

SAR Peak: 0.14 W/kg

SAR 10g (W/Kg)	0.063762
SAR 1g (W/Kg)	0.099643



MEASUREMENT 4

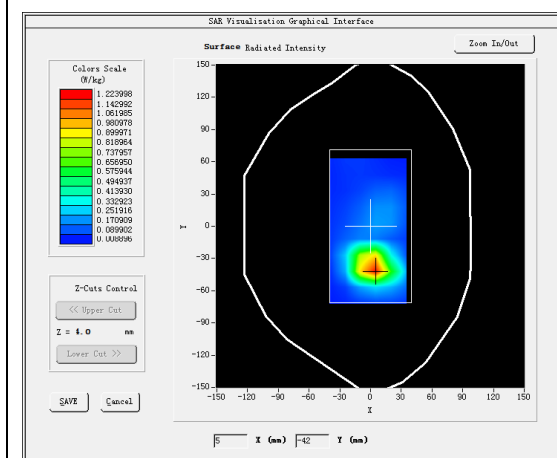
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=15mm dy=15mm,</u> <u>h= 5.00 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 2</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>

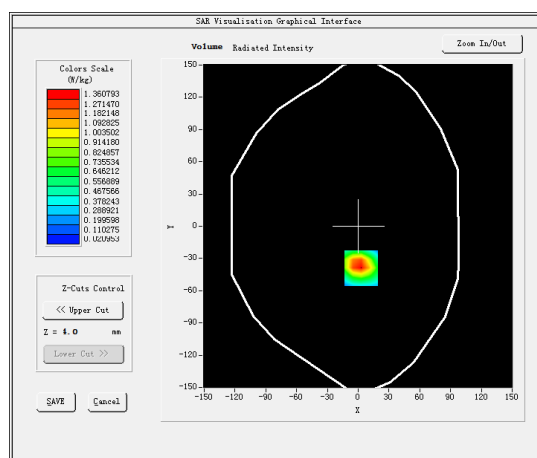
B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	53.581738
Relative permittivity (imaginary part)	14.660210
Conductivity (S/m)	1.530770
Variation (%)	1.010000

SURFACE SAR



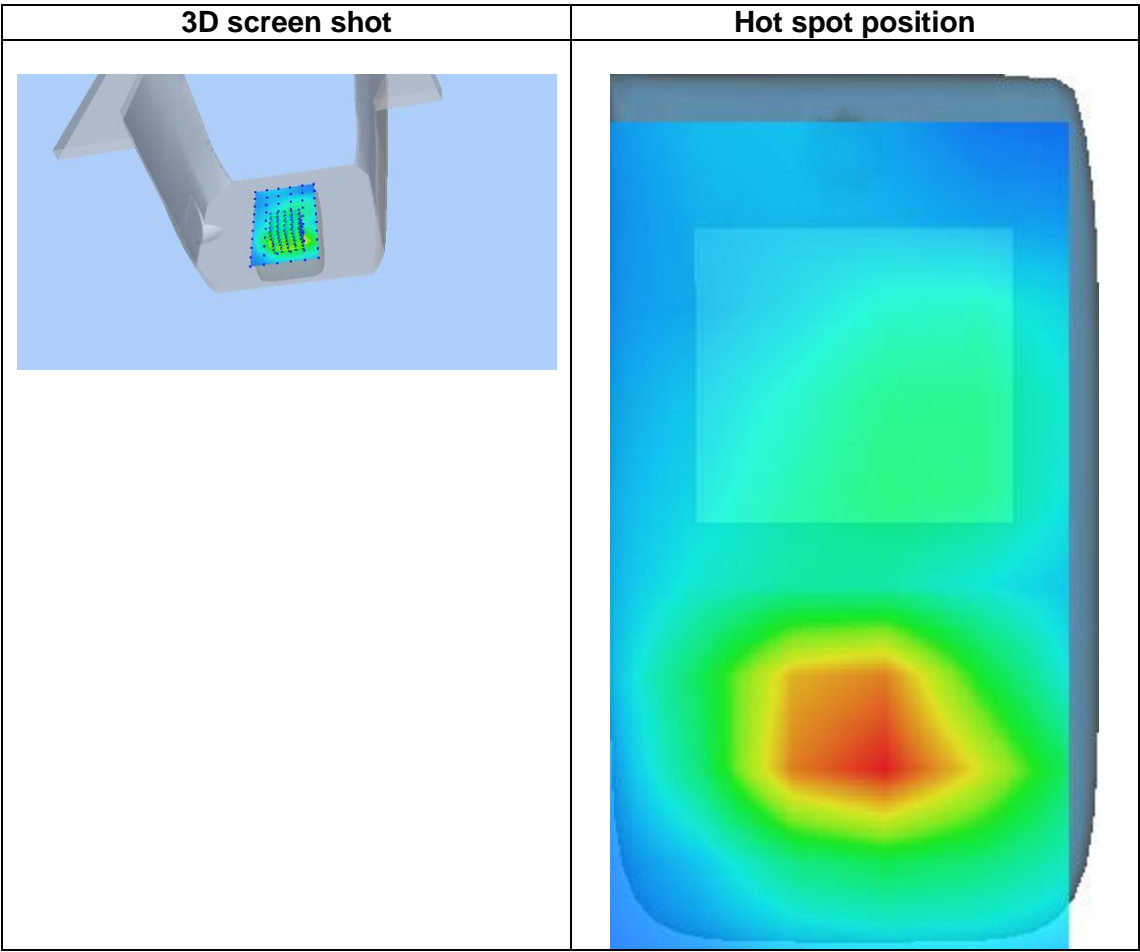
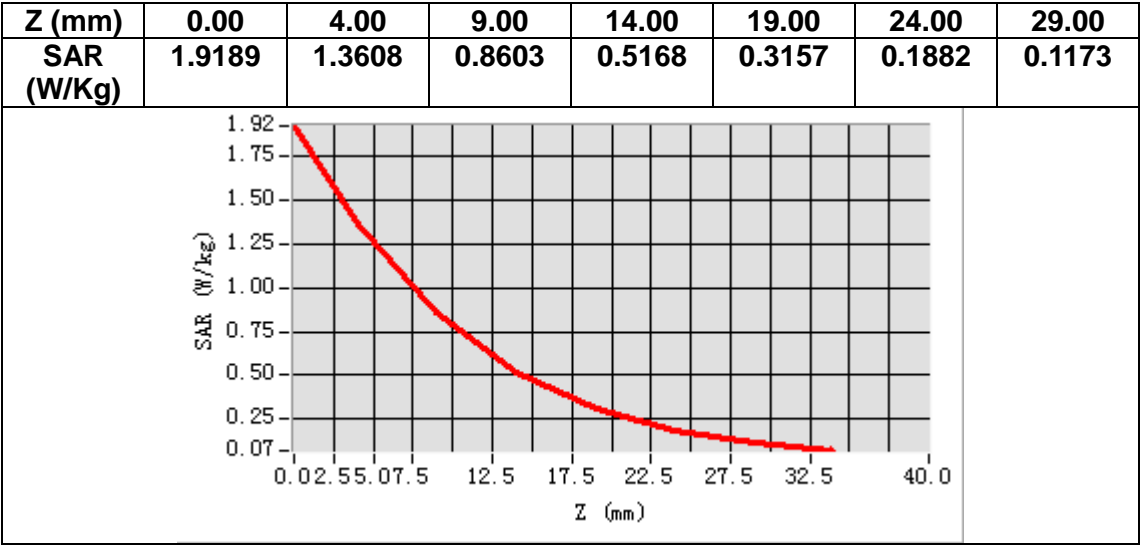
VOLUME SAR



Maximum location: X=3.00, Y=-39.00

SAR Peak: 2.13 W/kg

SAR 10g (W/Kg)	0.636028
SAR 1g (W/Kg)	1.121555



MEASUREMENT 5

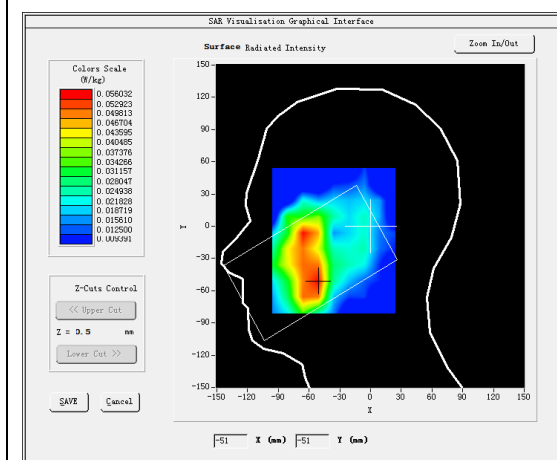
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=15mm dy=15mm,</u> <u>h= 5.00 mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 4</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>

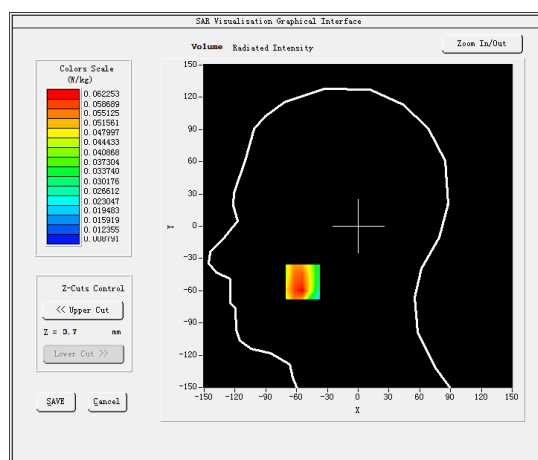
B. SAR Measurement Results

Frequency (MHz)	1732.500000
Relative permittivity (real part)	40.377289
Relative permittivity (imaginary part)	13.939192
Conductivity (S/m)	1.341647
Variation (%)	2.830000

SURFACE SAR



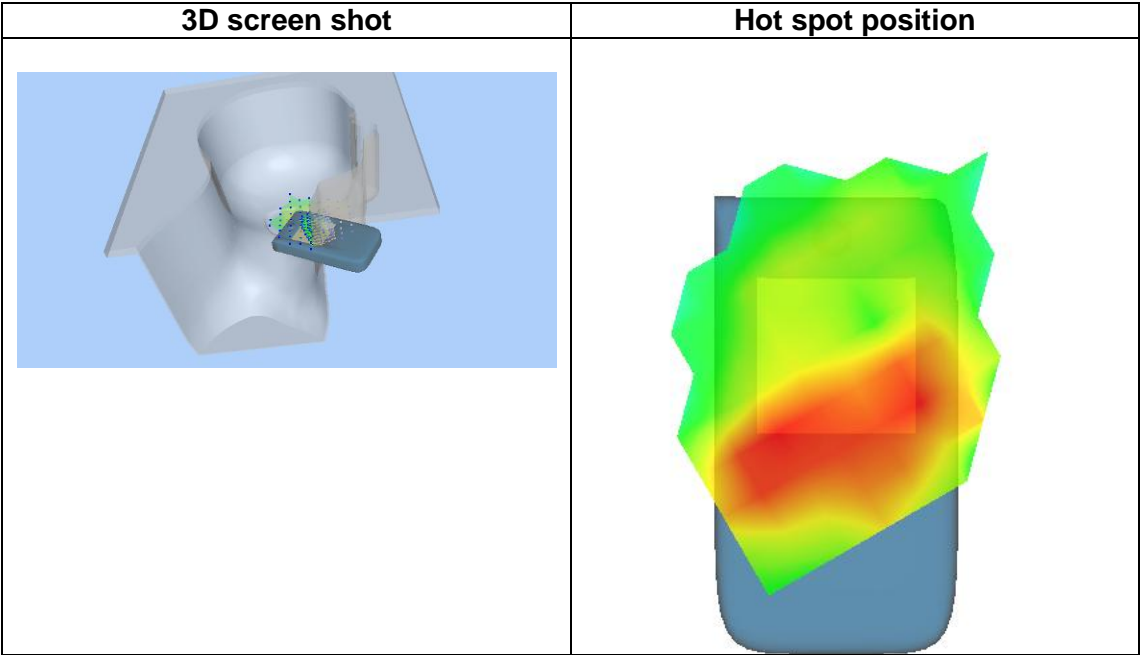
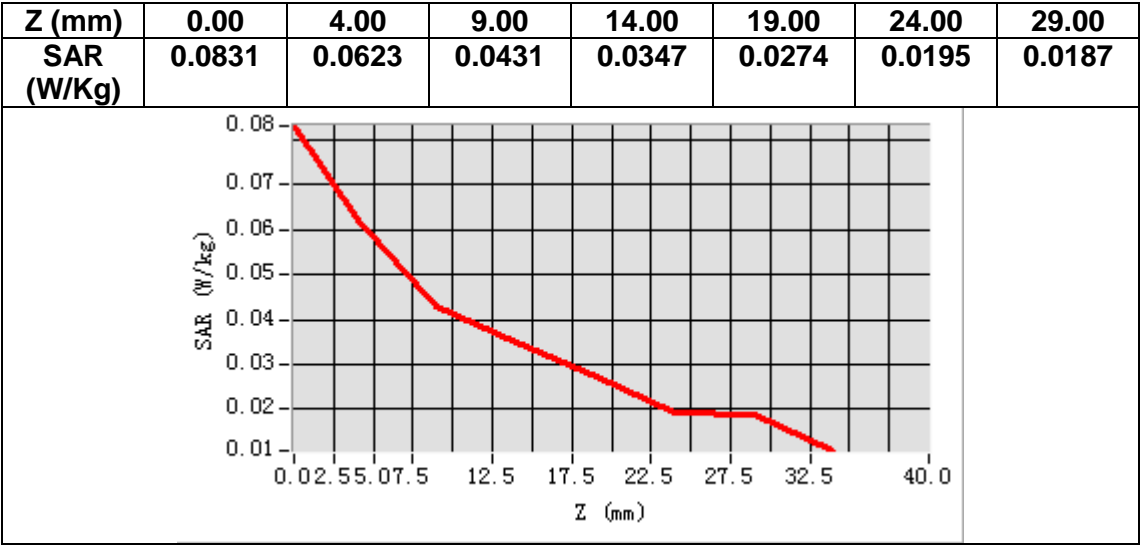
VOLUME SAR



Maximum location: X=-54.00, Y=-52.00

SAR Peak: 0.08 W/kg

SAR 10g (W/Kg)	0.041172
SAR 1g (W/Kg)	0.058524



MEASUREMENT 6

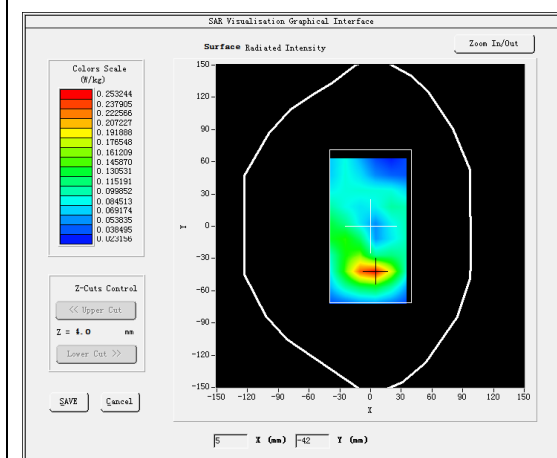
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=15mm dy=15mm,</u> <u>h= 5.00 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 4</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>

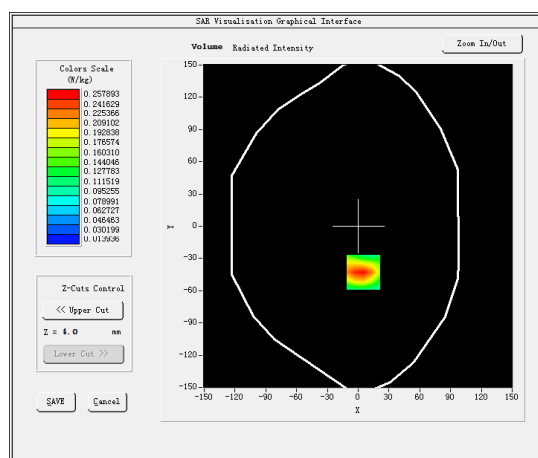
B. SAR Measurement Results

Frequency (MHz)	1732.500000
Relative permittivity (real part)	54.369366
Relative permittivity (imaginary part)	15.174220
Conductivity (S/m)	1.460519
Variation (%)	-1.870000

SURFACE SAR



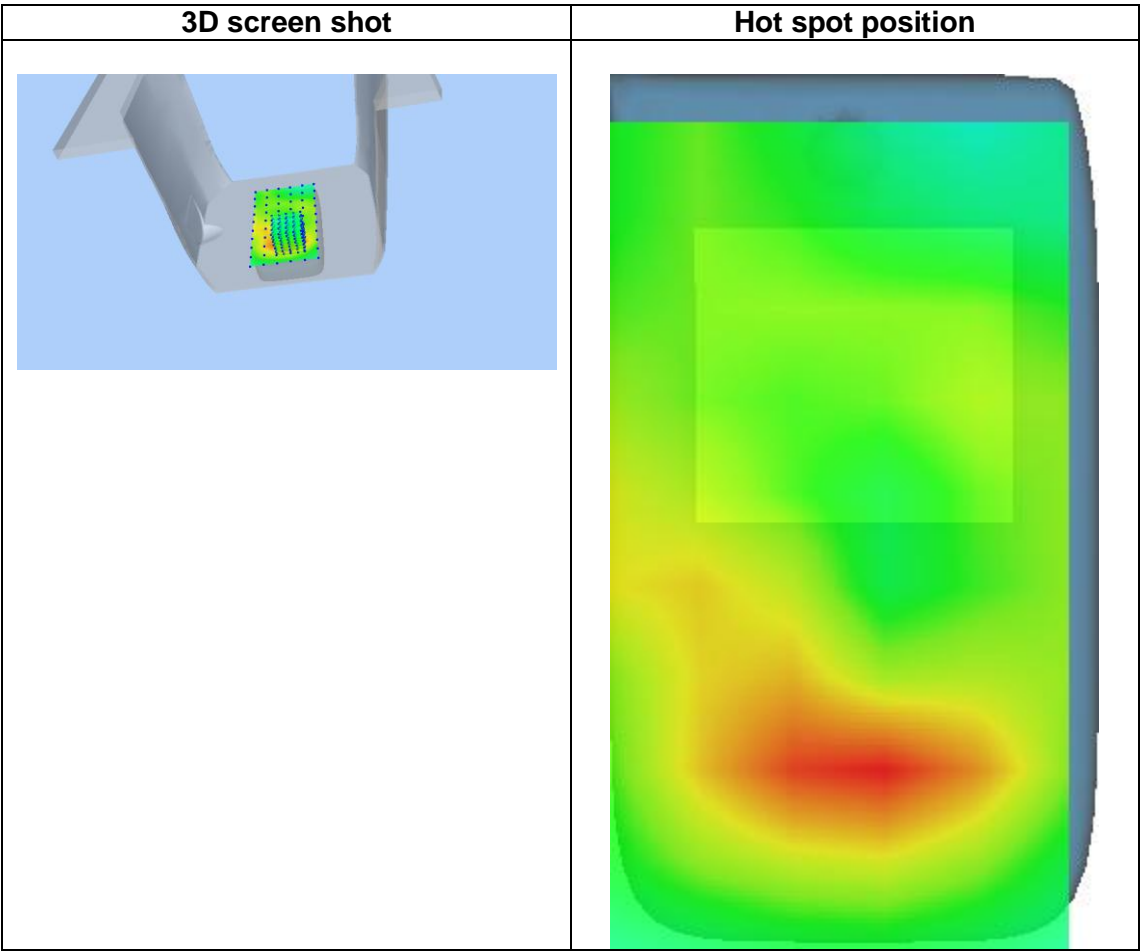
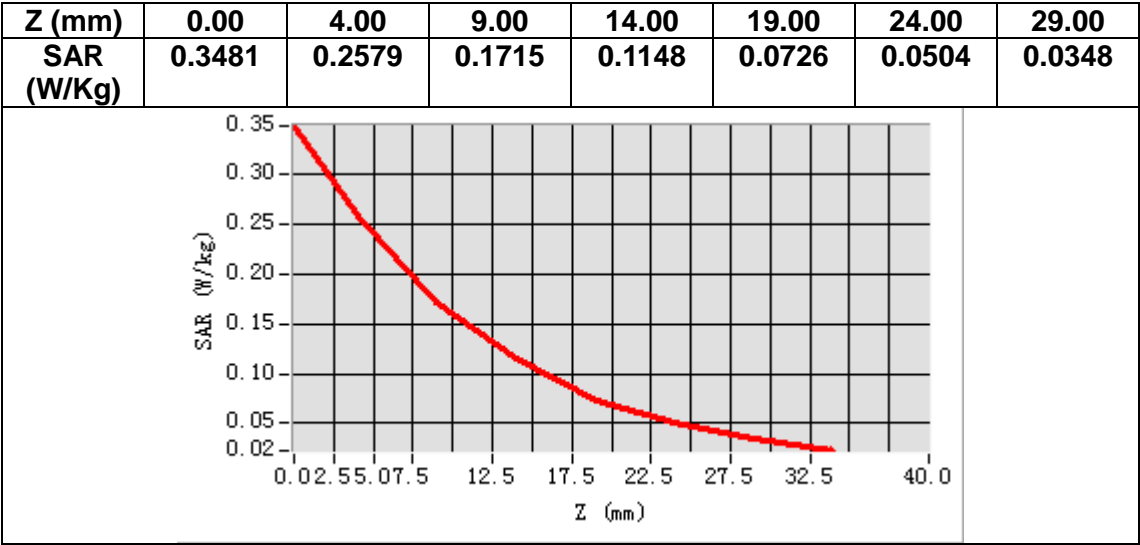
VOLUME SAR



Maximum location: X=5.00, Y=-43.00

SAR Peak: 0.36 W/kg

SAR 10g (W/Kg)	0.144785
SAR 1g (W/Kg)	0.240915



MEASUREMENT 7

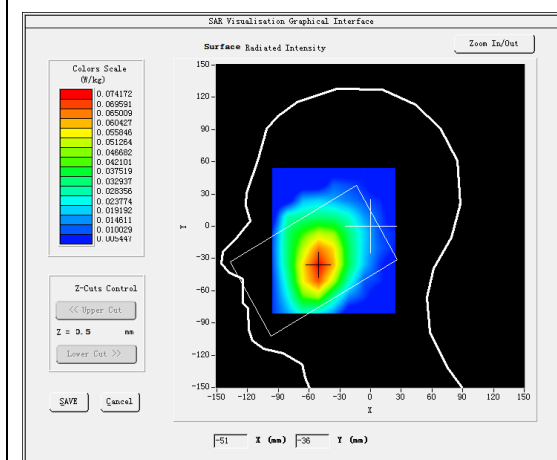
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=15mm dy=15mm,</u> <u>h= 5.00 mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 13</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>

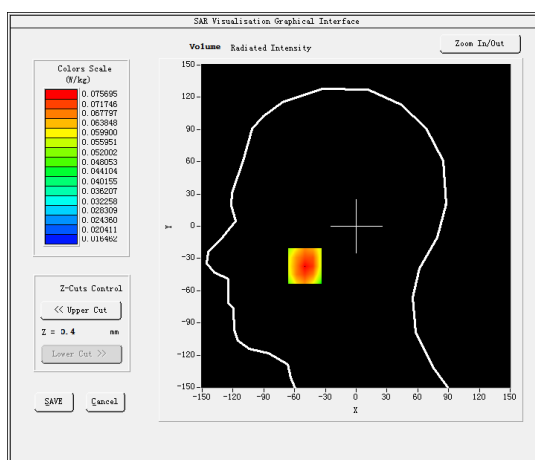
B. SAR Measurement Results

Frequency (MHz)	782.000000
Relative permittivity (real part)	41.147911
Relative permittivity (imaginary part)	22.100979
Conductivity (S/m)	0.959551
Variation (%)	3.090000

SURFACE SAR



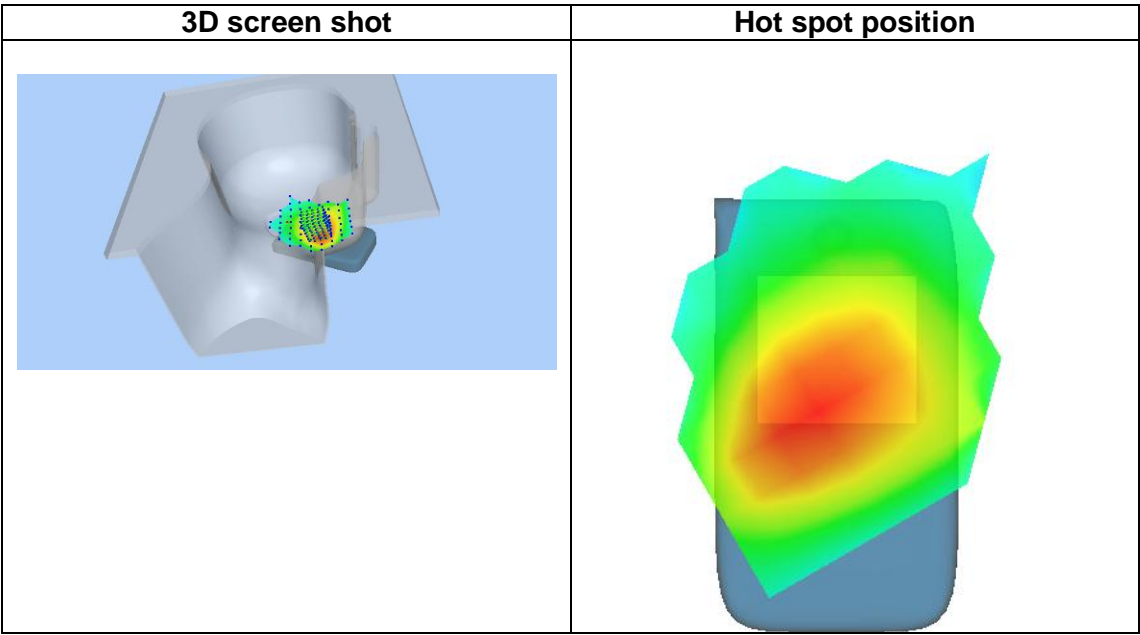
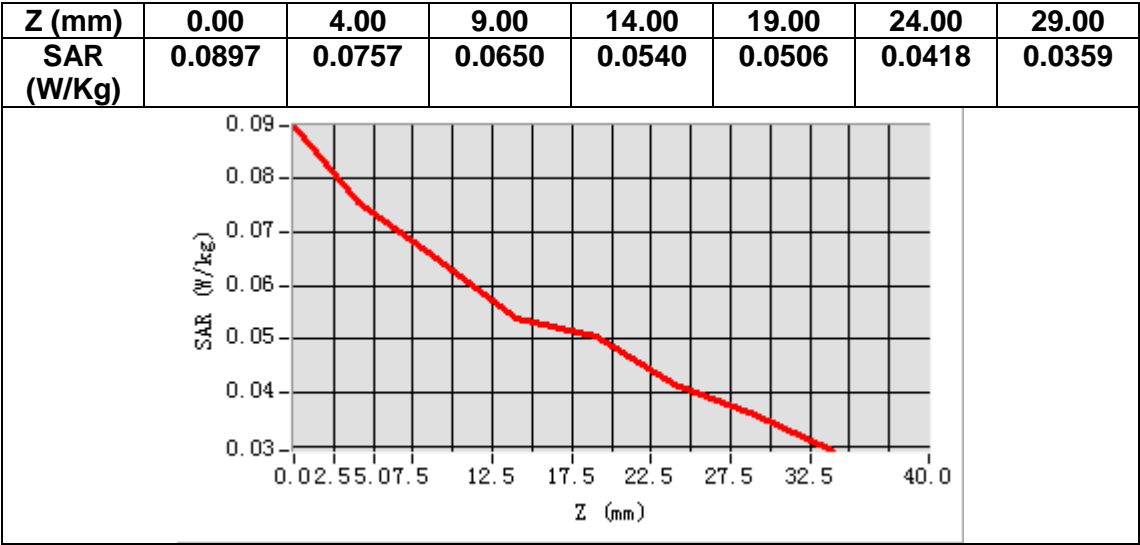
VOLUME SAR



Maximum location: X=-50.00, Y=-37.00

SAR Peak: 0.09 W/kg

SAR 10g (W/Kg)	0.061572
SAR 1g (W/Kg)	0.078012



MEASUREMENT 8

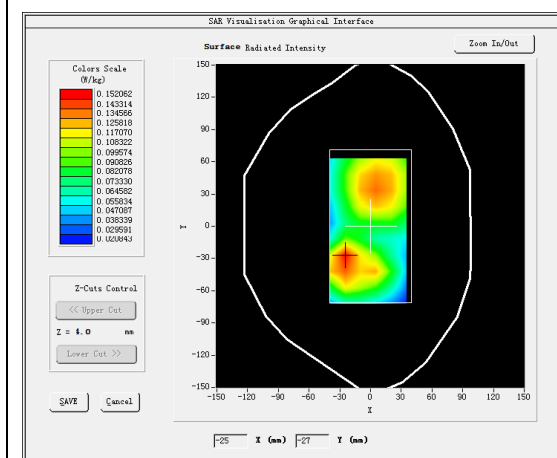
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=15mm dy=15mm,</u> <u>h= 5.00 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 13</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>

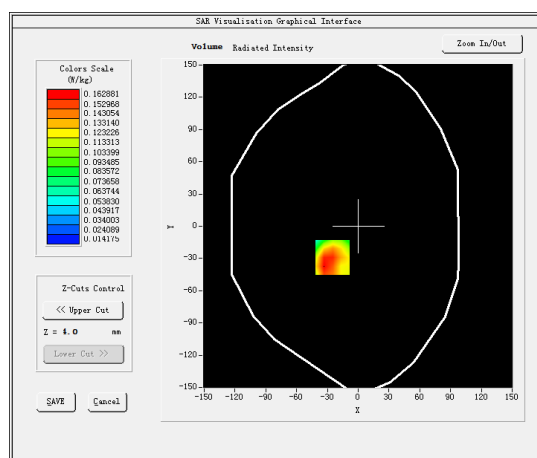
B. SAR Measurement Results

Frequency (MHz)	782.000000
Relative permittivity (real part)	55.205761
Relative permittivity (imaginary part)	23.279301
Conductivity (S/m)	1.010710
Variation (%)	3.450000

SURFACE SAR



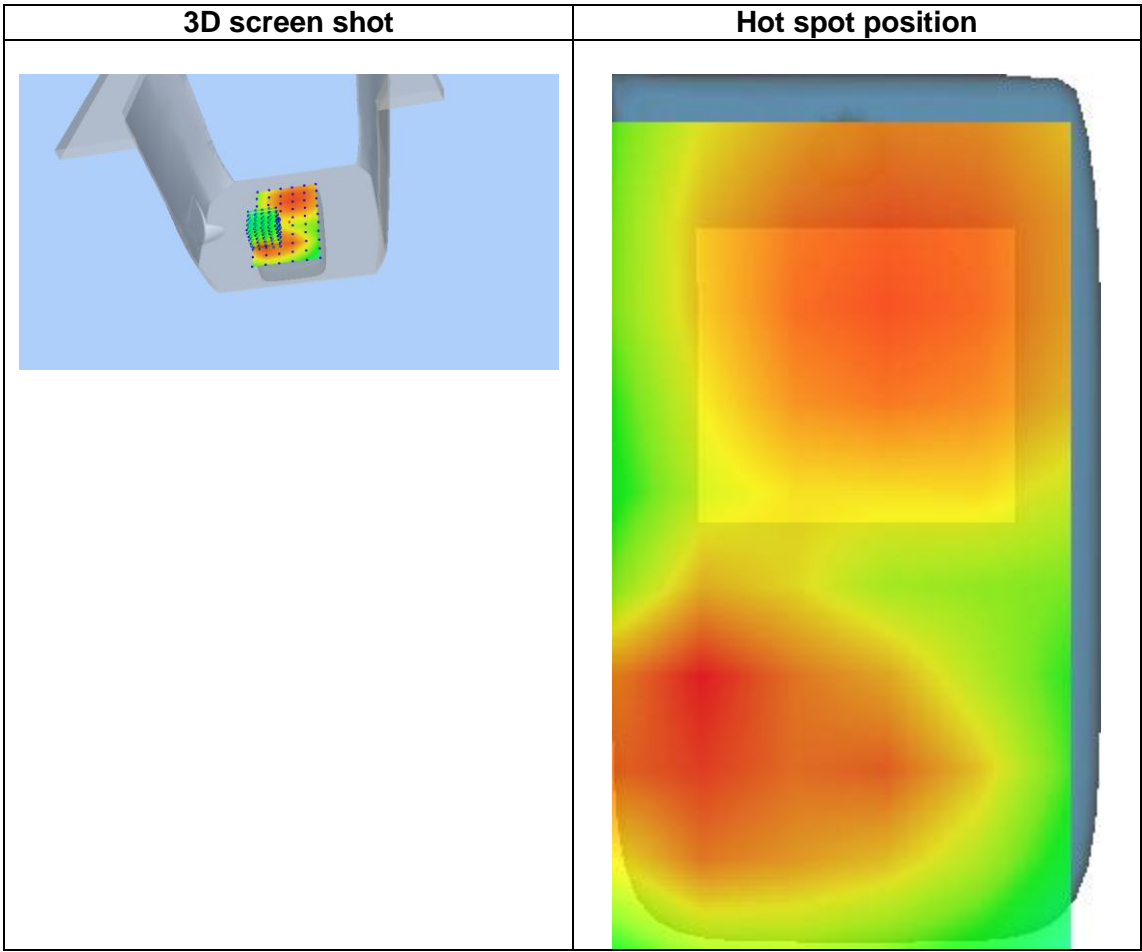
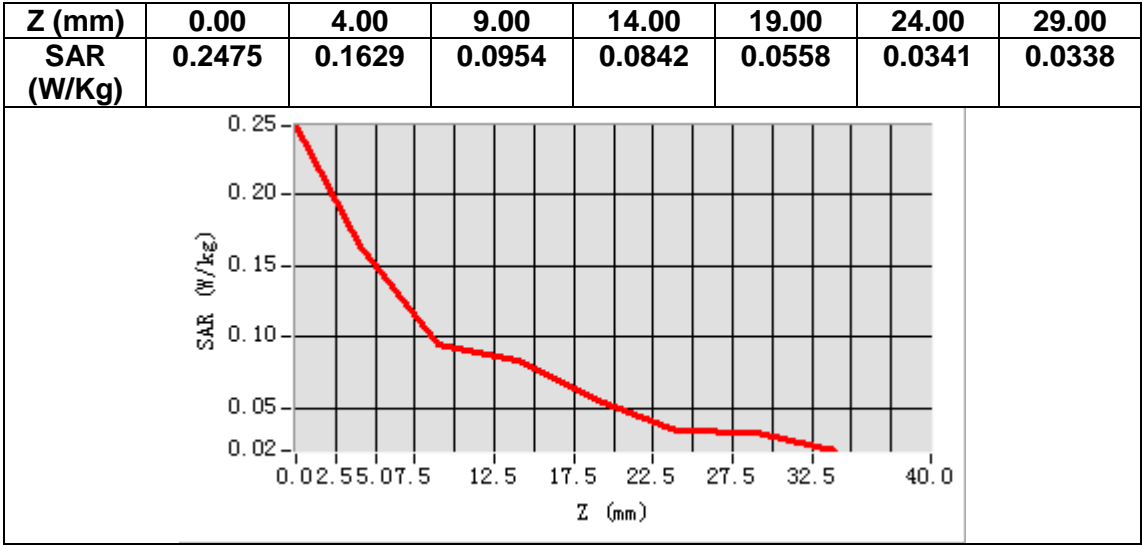
VOLUME SAR



Maximum location: X=-25.00, Y=-29.00

SAR Peak: 0.24 W/kg

SAR 10g (W/Kg)	0.103009
SAR 1g (W/Kg)	0.164644



MEASUREMENT 9

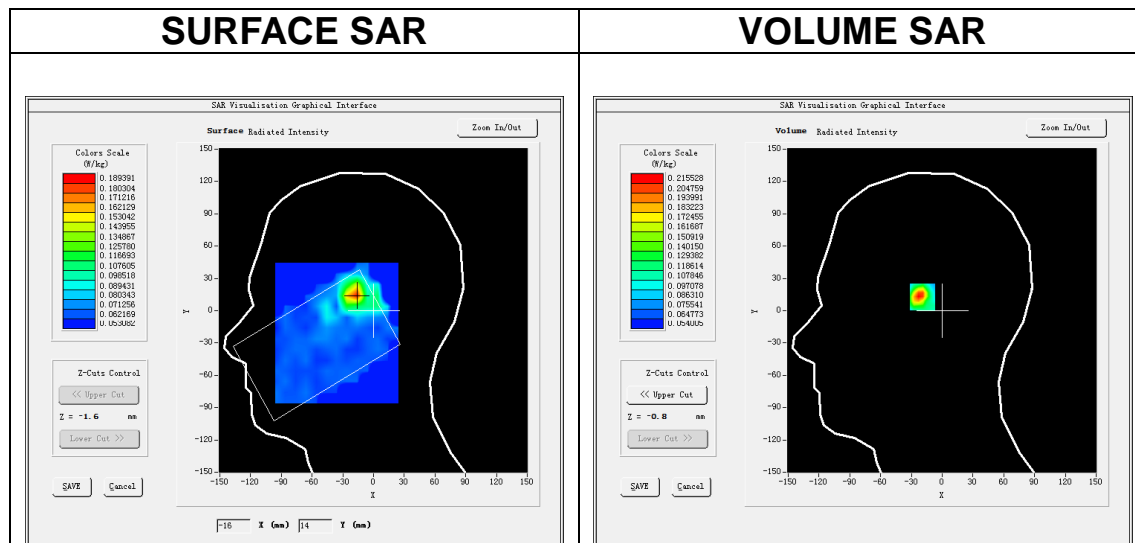
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.31 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm</u> <u>dz=2mm,Complete/ndx=4mm dy=4mm, h=</u> <u>2.31 mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>IEEE 802.11a U-NII</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>IEEE802.11a (Crest factor: 1.0)</u>

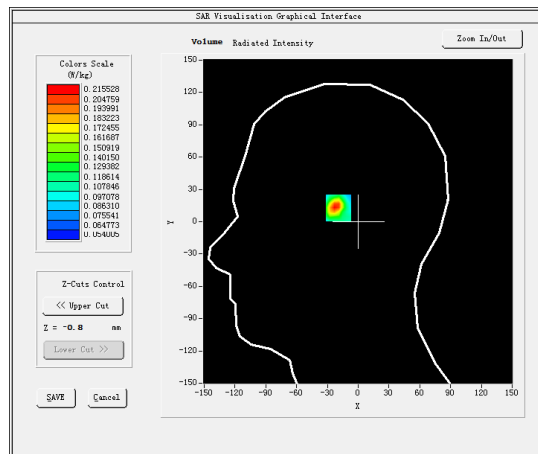
B. SAR Measurement Results

Frequency (MHz)	5200.000000
Relative permittivity (real part)	36.210979
Relative permittivity (imaginary part)	16.245619
Conductivity (S/m)	4.693179
Variation (%)	-3.380000

SURFACE SAR



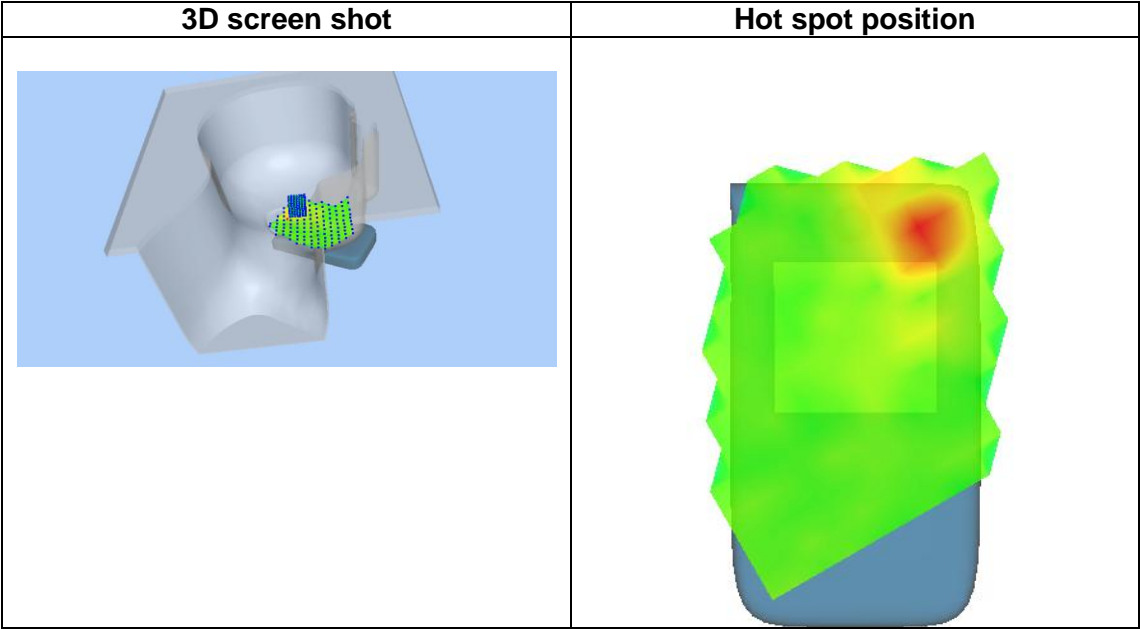
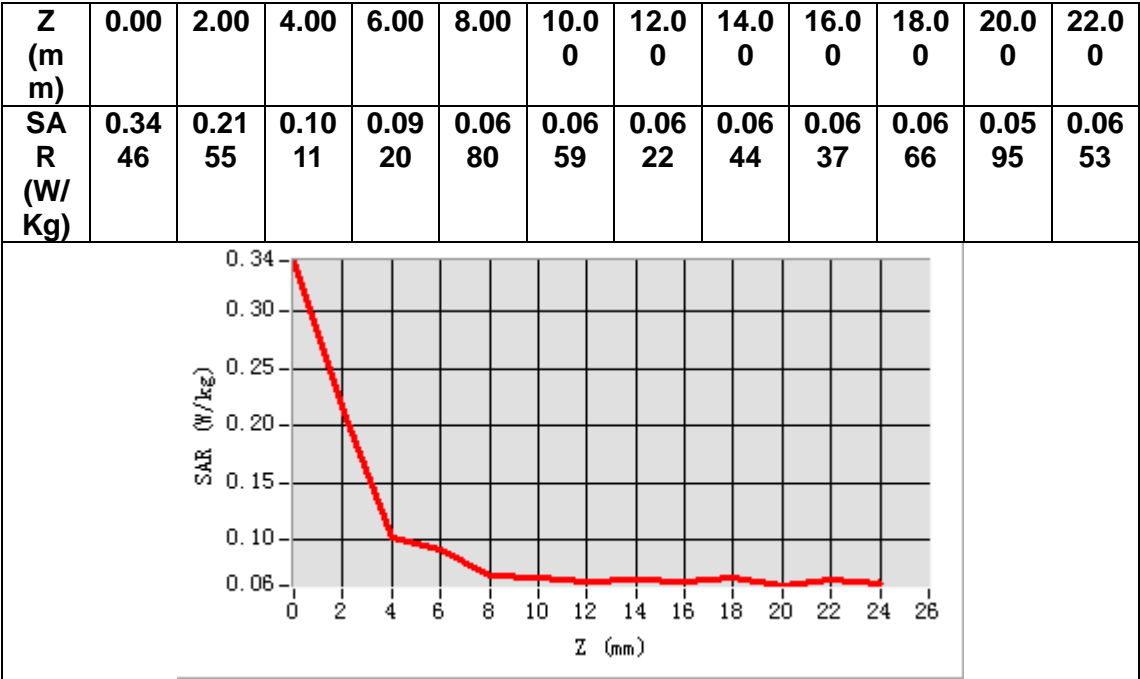
VOLUME SAR



Maximum location: X=-17.00, Y=15.00

SAR Peak: 0.51 W/kg

SAR 10g (W/Kg)	0.104865
SAR 1g (W/Kg)	0.208065



MEASUREMENT 10

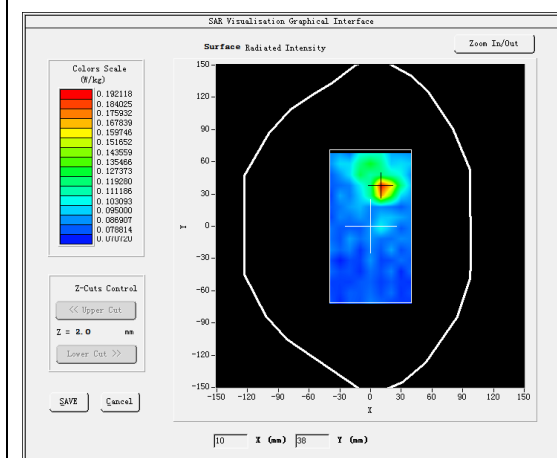
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.31 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm</u> <u>dz=2mm,Complete/ndx=4mm dy=4mm, h=</u> <u>2.31 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11a U-NII</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>IEEE802.11a (Crest factor: 1.0)</u>

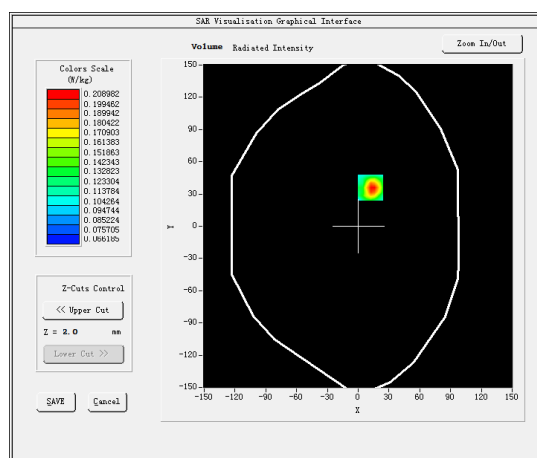
B. SAR Measurement Results

Frequency (MHz)	5200.000000
Relative permittivity (real part)	49.979538
Relative permittivity (imaginary part)	18.165508
Conductivity (S/m)	5.247814
Variation (%)	-1.070000

SURFACE SAR



VOLUME SAR

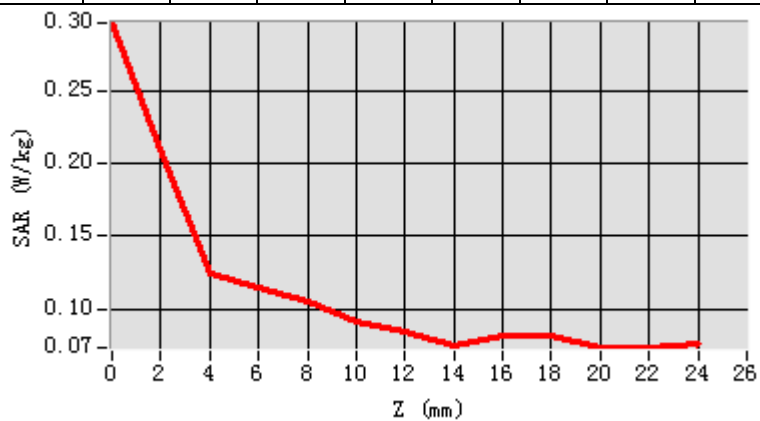


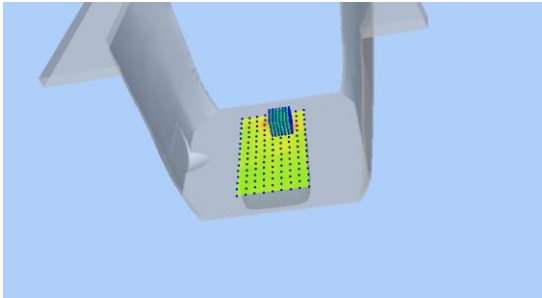
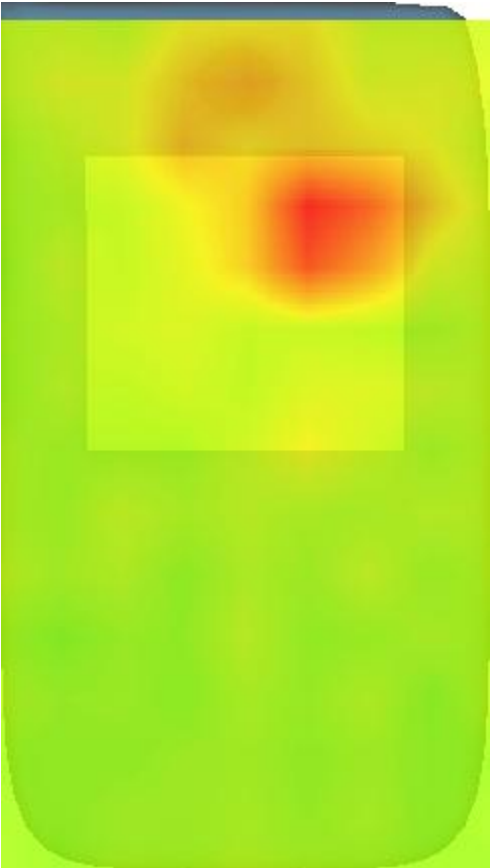
Maximum location: X=12.00, Y=36.00

SAR Peak: 0.33 W/kg

SAR 10g (W/Kg)	0.102346
SAR 1g (W/Kg)	0.151330

Z (m m)	0.00	2.00	4.00	6.00	8.00	10.0 0	12.0 0	14.0 0	16.0 0	18.0 0	20.0 0	22.0 0
SA R (W/ Kg)	0.29 60	0.20 90	0.12 46	0.11 49	0.10 54	0.09 12	0.08 47	0.07 55	0.08 23	0.08 16	0.07 36	0.07 36



3D screen shot	Hot spot position
	

MEASUREMENT 11

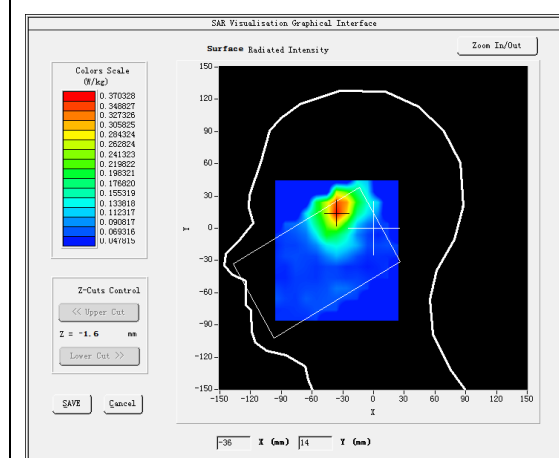
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.31 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm</u> <u>dz=2mm,Complete/ndx=4mm dy=4mm, h=</u> <u>2.31 mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>IEEE 802.11a U-NII</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>IEEE802.11a (Crest factor: 1.0)</u>

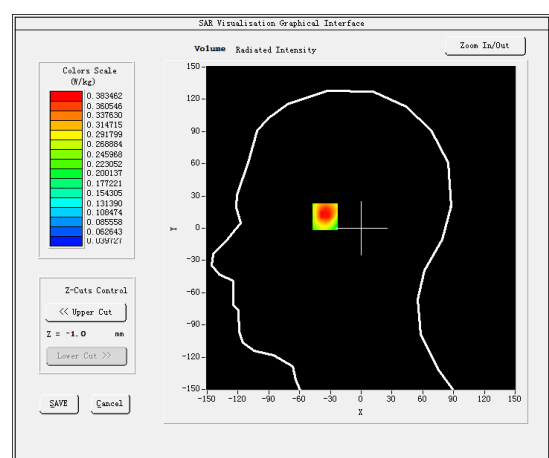
B. SAR Measurement Results

Frequency (MHz)	5785.000000
Relative permittivity (real part)	34.702789
Relative permittivity (imaginary part)	15.720266
Conductivity (S/m)	5.052319
Variation (%)	-4.010000

SURFACE SAR



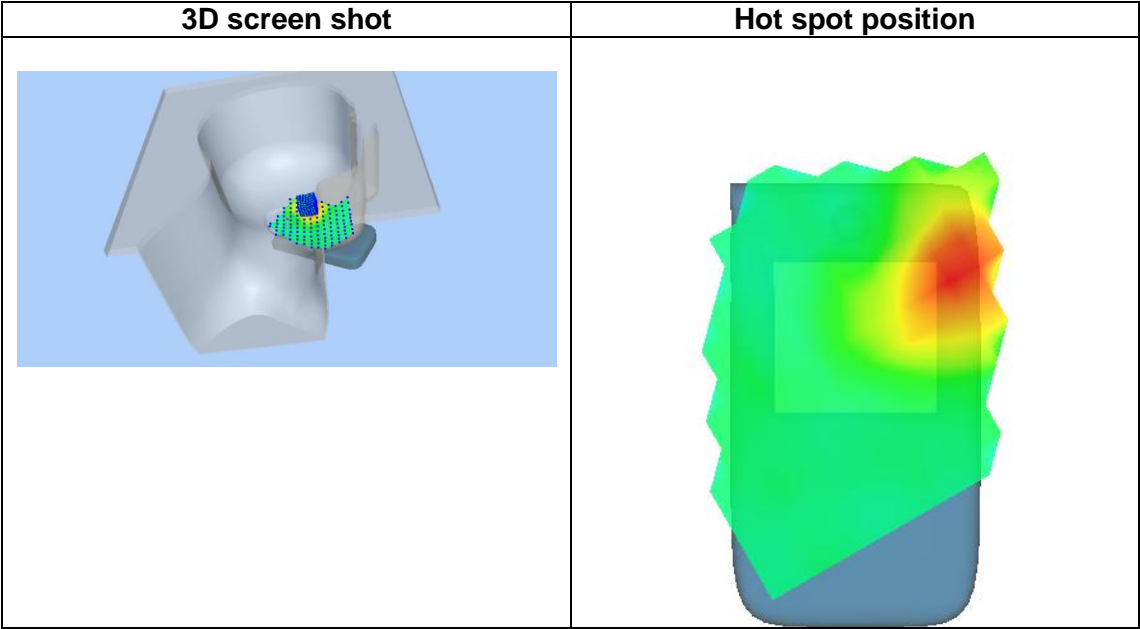
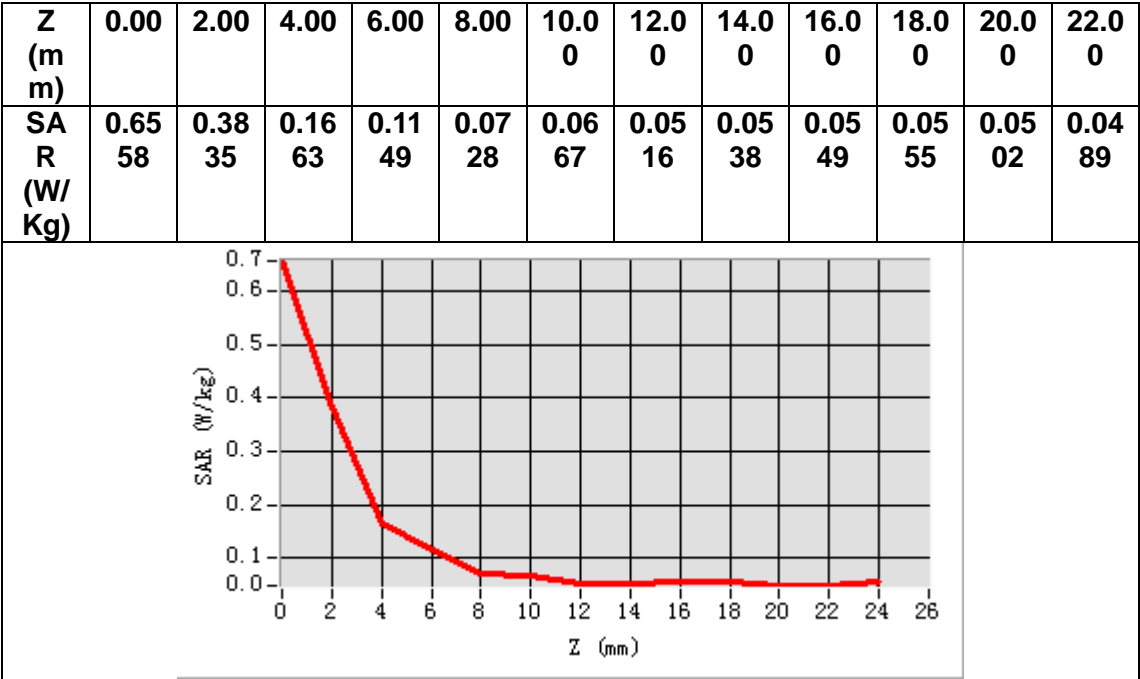
VOLUME SAR



Maximum location: X=-35.00, Y=15.00

SAR Peak: 1.03 W/kg

SAR 10g (W/Kg)	0.189467
SAR 1g (W/Kg)	0.403679



MEASUREMENT 12

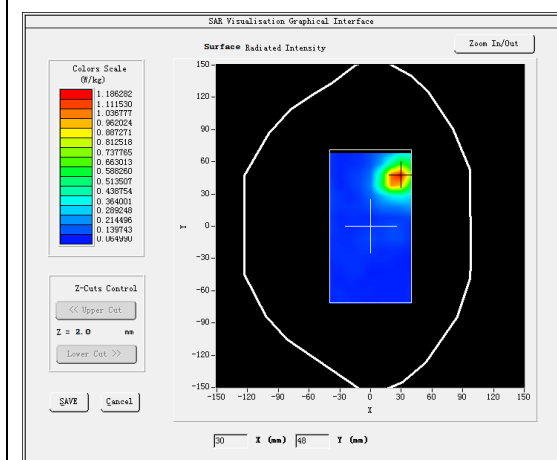
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.31 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm</u> <u>dz=2mm,Complete/ndx=4mm dy=4mm, h=</u> <u>2.31 mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11a U-NII</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>IEEE802.11a (Crest factor: 1.0)</u>

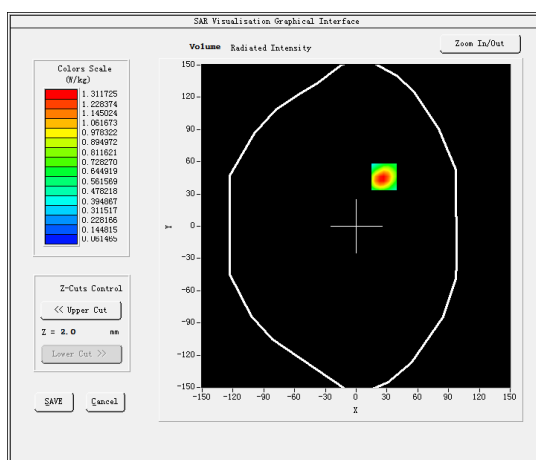
B. SAR Measurement Results

Frequency (MHz)	5785.000000
Relative permittivity (real part)	48.738701
Relative permittivity (imaginary part)	18.606766
Conductivity (S/m)	5.980008
Variation (%)	0.830000

SURFACE SAR



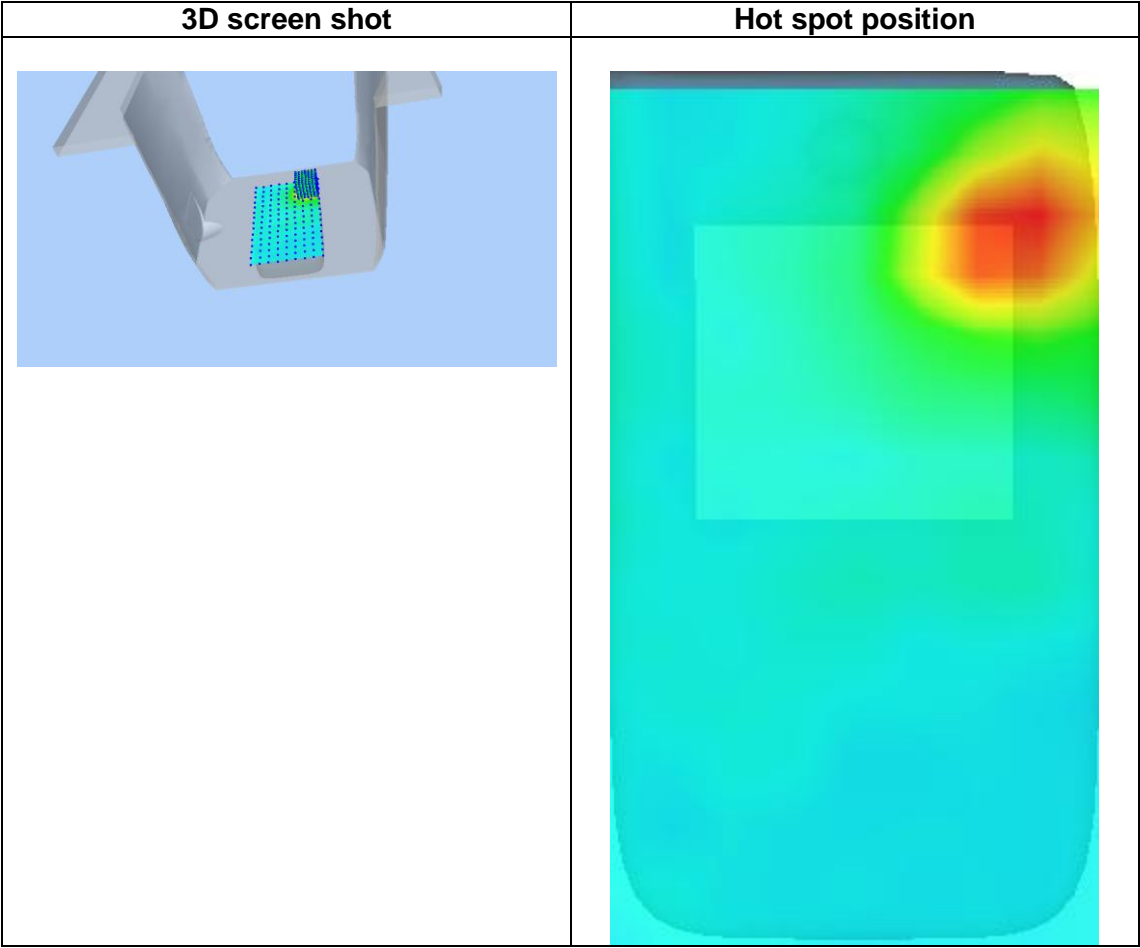
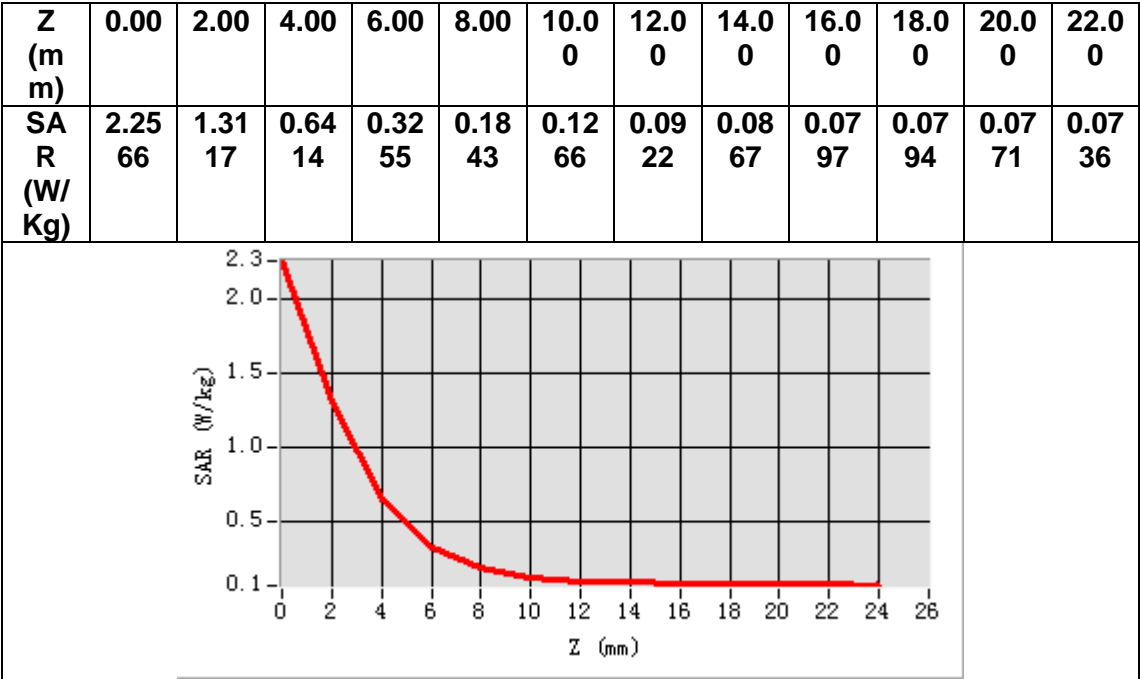
VOLUME SAR



Maximum location: X=27.00, Y=46.00

SAR Peak: 2.42 W/kg

SAR 10g (W/Kg)	0.281942
SAR 1g (W/Kg)	0.381020



14. Appendix D. Calibration Certificate

Table of contents
E Field Probe - SN 08/16 EPGO287
750 MHz Dipole - SN 03/15 DIP 0G750-355
1800 MHz Dipole - SN 03/15 DIP 1G800-349
1900 MHz Dipole - SN 03/15 DIP 1G900-350
2450 MHz Dipole - SN 03/15 DIP 2G450-352
5000-6000 MHz Dipole - SN 13/14 WGA 33



COMOSAR E-Field Probe Calibration Report

Ref : ACR.261.2.17.SATU.A

Shenzhen NTEK Testing Technology Co., Ltd.
BUILDING E, FENDA SCIENCE PARK,
SANWEI COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 08/16 EPGO287

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



Calibration Date: 09/18/2017

Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in MVG USA using the CALISAR / CALIBAIR test bench, for use with a COMOSAR system only. All calibration results are traceable to national metrology institutions.



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	9/18/2017	
<i>Checked by :</i>	Jérôme LUC	Product Manager	9/18/2017	
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	9/18/2017	

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

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	9/18/2017	Initial release



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 08/16 EPGO287
Product Condition (new / used)	Used
Frequency Range of Probe	0.4 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: $R_1=0.208 \text{ M}\Omega$ Dipole 2: $R_2=0.196 \text{ M}\Omega$ Dipole 3: $R_3=0.196 \text{ M}\Omega$

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Dipole

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

3 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

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

3.2 SENSITIVITY

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

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

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3.3 LOWER DETECTION LIMIT

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

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 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°).

3.5 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.

4 MEASUREMENT UNCERTAINTY

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

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	Uncertainty value (%)	Probability Distribution	Divisor	ci	Standard Uncertainty (%)
Incident or forward power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Reflected power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Liquid conductivity	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Liquid permittivity	4.00%	Rectangular	$\sqrt{3}$	1	2.309%
Field homogeneity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Field probe positioning	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

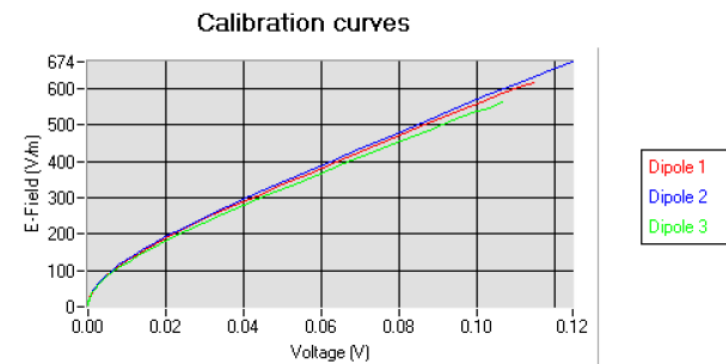
5.1 SENSITIVITY IN AIR

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 ($\mu\text{V}/(\text{V}/\text{m})^2$)
0.69	0.78	0.61

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
92	90	96

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

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

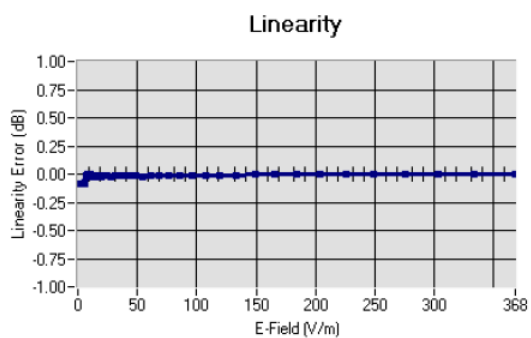




COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

5.2 LINEARITY

Linearity: $\pm 1.86\%$ ($\pm 0.08\text{dB}$)

5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz $\pm 100\text{MHz}$)	Permittivity	Epsilon (S/m)	ConvF
HL750	750	42.09	0.91	1.44
BL750	750	55.69	0.95	1.49
HL850	835	42.71	0.89	1.48
BL850	835	57.52	1.03	1.53
HL900	900	41.94	0.93	1.50
BL900	900	52.87	1.09	1.54
HL1800	1800	40.62	1.39	1.75
BL1800	1800	53.22	1.47	1.79
HL1900	1900	41.22	1.37	2.00
BL1900	1900	50.99	1.52	2.07
HL2000	2000	40.39	1.36	1.93
BL2000	2000	54.39	1.54	1.99
HL2450	2450	40.46	1.87	2.18
BL2450	2450	54.62	1.95	2.27
HL2600	2600	38.46	2.01	2.15
BL2600	2600	51.98	2.16	2.19
HL5200	5200	35.14	4.74	2.37
BL5200	5200	49.01	5.27	2.46
HL5400	5400	34.52	4.77	2.33
BL5400	5400	49.67	5.45	2.41
HL5600	5600	37.08	5.03	2.47
BL5600	5600	47.57	5.69	2.54
HL5800	5800	34.64	5.19	2.51
BL5800	5800	49.82	5.94	2.57

LOWER DETECTION LIMIT: 7mW/kg

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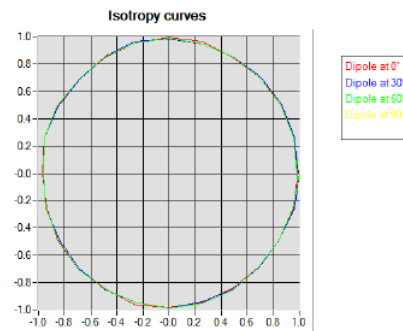
COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

5.4 ISOTROPY

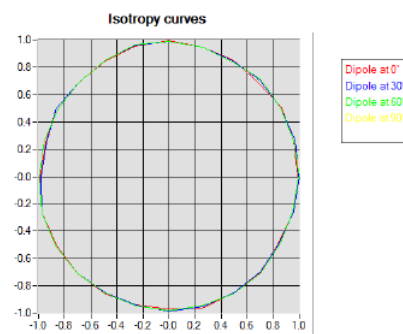
HL900 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.06 dB



HL1800 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.08 dB



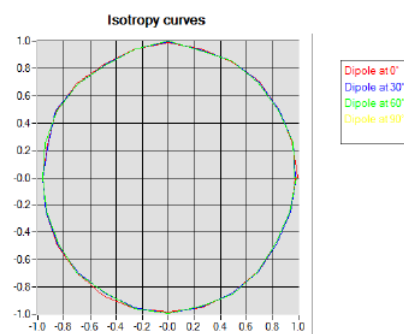


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

HL5600 MHz

- Axial isotropy: 0.06 dB
- Hemispherical isotropy: 0.08 dB





COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2016	02/2019
Reference Probe	MVG	EP 94 SN 37/08	10/2016	10/2017
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	150798832	10/2015	10/2017



COMOSAR E-Field Probe Calibration Report

Ref : ACR.260.1.18.SATU.A

**SHENZHEN NTEK TESTING TECHNOLOGY
CO., LTD.**

**BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 08/16 EPGO287**

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



Calibration Date: 09/17/2018




Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in MVG USA using the CALISAR / CALIBAIR test bench, for use with a COMOSAR system only. All calibration results are traceable to national metrology institutions.



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.260.1.18.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
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<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	9/17/2018	Initial release



COMOSAR E-FIELD PROBE CALIBRATION REPORT

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.260.1.18.SATU.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 08/16 EPGO287
Product Condition (new / used)	Used
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.209 MΩ Dipole 2: R2=0.196 MΩ Dipole 3: R3=0.197 MΩ

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Dipole

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

3 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

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



COMOSAR E-FIELD PROBE CALIBRATION REPORT

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3.2 SENSITIVITY

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

3.3 LOWER DETECTION LIMIT

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

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 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°).

3.5 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.

4 MEASUREMENT UNCERTAINTY

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

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	Uncertainty value (%)	Probability Distribution	Divisor	ci	Standard Uncertainty (%)
Incident or forward power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Reflected power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Liquid conductivity	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Liquid permittivity	4.00%	Rectangular	$\sqrt{3}$	1	2.309%
Field homogeneity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Field probe positioning	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%

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5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

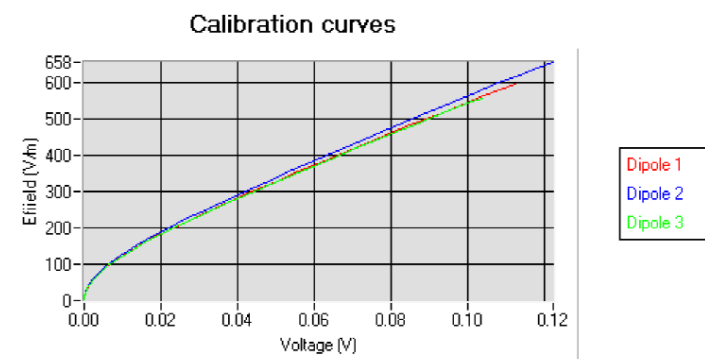
5.1 SENSITIVITY IN AIR

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 ($\mu\text{V}/(\text{V}/\text{m})^2$)
0.66	0.75	0.58

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
93	93	98

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

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

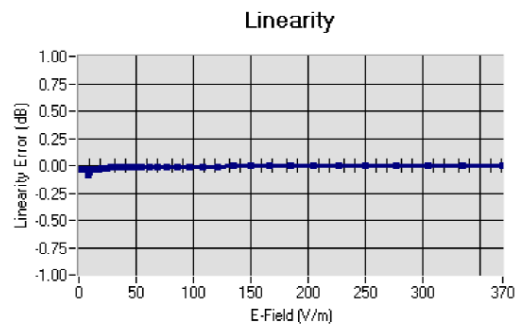




COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.260.1.18.SATU.A

5.2 LINEARITY

Linearity: $\pm 1.89\%$ ($\pm 0.08\text{dB}$)

5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz \pm 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL750	750	40.03	0.93	1.45
BL750	750	56.83	1.00	1.49
HL850	835	42.19	0.90	1.50
BL850	835	54.67	1.01	1.56
HL900	900	42.08	1.01	1.51
HL1800	1800	41.68	1.46	1.71
BL1800	1800	53.86	1.46	1.77
HL1900	1900	38.45	1.45	2.03
BL1900	1900	53.32	1.56	2.07
HL2000	2000	38.26	1.38	1.76
HL2450	2450	37.50	1.80	2.00
BL2450	2450	53.22	1.89	2.08
HL2600	2600	39.80	1.99	2.12
BL2600	2600	52.52	2.23	2.19
HL5200	5200	35.64	4.67	2.55
BL5200	5200	48.64	5.51	2.62
HL5400	5400	36.44	4.87	2.53
BL5400	5400	46.52	5.77	2.59
HL5600	5600	36.66	5.17	2.64
BL5600	5600	46.79	5.77	2.73
HL5800	5800	35.31	5.31	2.72
BL5800	5800	47.04	6.10	2.81

LOWER DETECTION LIMIT: 7mW/kg

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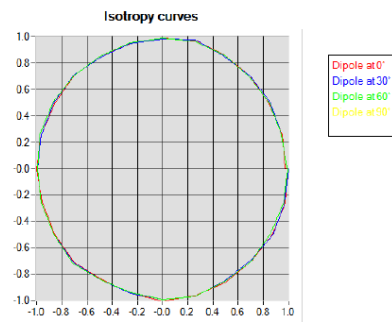
COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.260.1.18.SATU.A

5.4 ISOTROPY

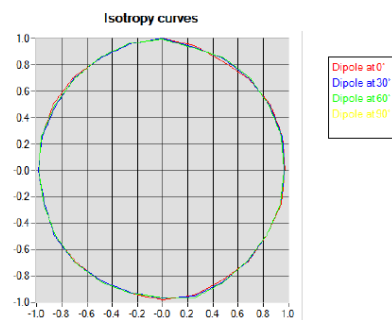
HL900 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.07 dB



HL1800 MHz

- Axial isotropy: 0.06 dB
- Hemispherical isotropy: 0.08 dB



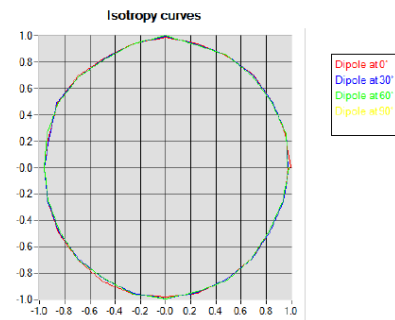


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HL5600 MHz

- Axial isotropy: 0.06 dB
- Hemispherical isotropy: 0.08 dB





COMOSAR E-FIELD PROBE CALIBRATION REPORT

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6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2016	02/2019
Reference Probe	MVG	EP 94 SN 37/08	10/2017	10/2018
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	150798832	11/2017	11/2020



SAR Reference Dipole Calibration Report

Ref : ACR.109.1.18.SATU.A

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CO., LTD.**

**BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE**

FREQUENCY: 750 MHZ

SERIAL NO.: SN 03/15 DIP 0G750-355

Calibrated at MVG US

2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 04/19/2018




Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.109.1.18.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	4/19/2018	
Checked by :	Jérôme LUC	Product Manager	4/19/2018	
Approved by :	Kim RUTKOWSKI	Quality Manager	4/19/2018	

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

Issue	Date	Modifications
A	4/19/2018	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

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1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 750 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID750
Serial Number	SN 03/15 DIP 0G750-355
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

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4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

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

Scan Volume	Expanded Uncertainty
1 g	20.3 %



SAR REFERENCE DIPOLE CALIBRATION REPORT

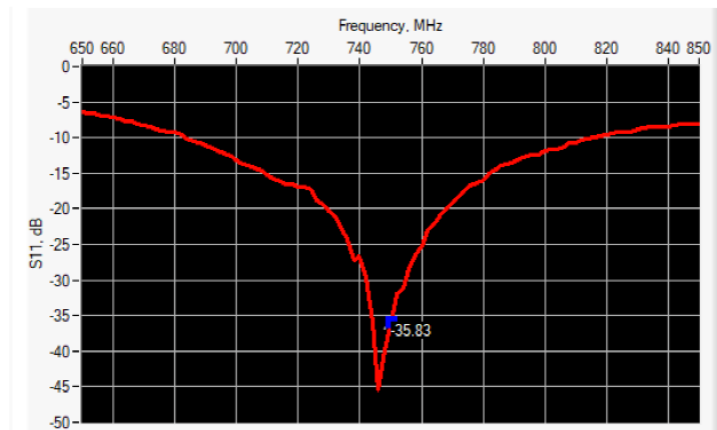
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10 g

20.1 %

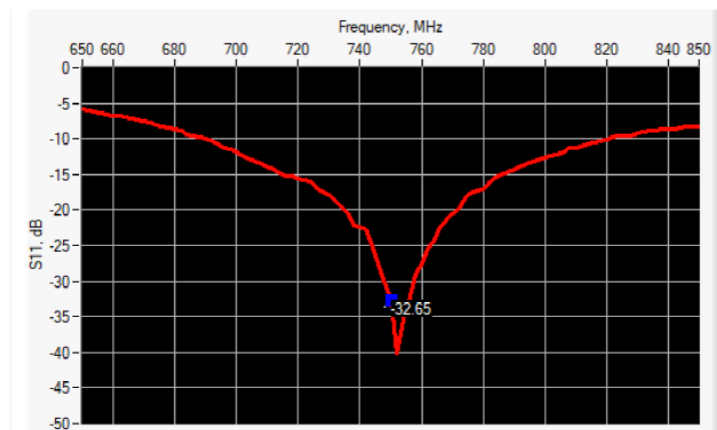
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-35.83	-20	51.3 Ω - 1.2 j Ω

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-32.65	-20	50.8 Ω + 2.3 j Ω

6.3 MECHANICAL DIMENSIONS

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

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

7 VALIDATION MEASUREMENT

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

7.1 HEAD LIQUID MEASUREMENT

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

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

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_{ps}' : 40.0 σ : 0.93
Distance between dipole center and liquid	15.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	750 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49	8.56 (0.86)	5.55	5.61 (0.56)
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	

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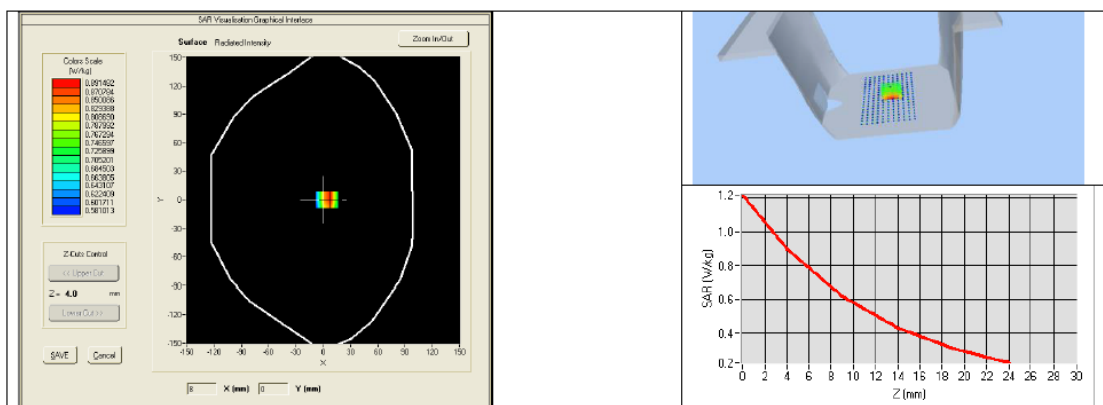
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1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	
3700	67.4		24.2	



7.3 BODY LIQUID MEASUREMENT

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

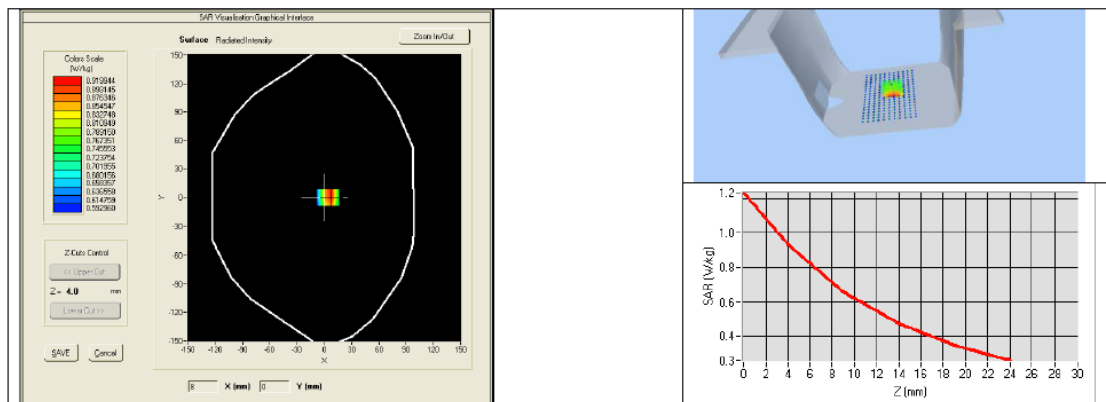
Ref. ACR.109.1.18.SATU.A

2300	52.9 ±5 %		1.81 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
3700	51.0 ±5 %		3.55 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 56.8 sigma : 1.00
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	750 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
750	8.85 (0.89)	5.91 (0.59)



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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.109.1.18.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2016	02/2019
Calipers	Carrera	CALIPER-01	01/2017	01/2020
Reference Probe	MVG	EPG122 SN 18/11	10/2017	10/2018
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	150798832	11/2017	11/2020



SAR Reference Dipole Calibration Report

Ref : ACR.109.4.18.SATU.A

SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 1800 MHZ

SERIAL NO.: SN 03/15 DIP 1G800-349

Calibrated at MVG US

2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 04/19/2018




Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.109.4.18.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	4/19/2018	
Checked by :	Jérôme LUC	Product Manager	4/19/2018	
Approved by :	Kim RUTKOWSKI	Quality Manager	4/19/2018	

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

Issue	Date	Modifications
A	4/19/2018	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.109.4.18.SATU.A

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