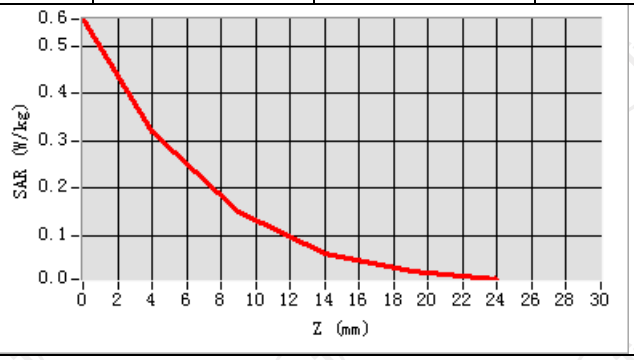
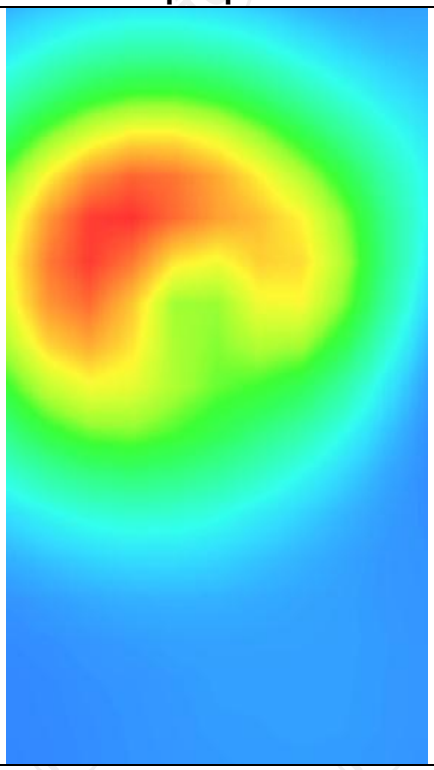
Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.5568	0.3206	0.1482	0.0630	0.0249



Hot spot position



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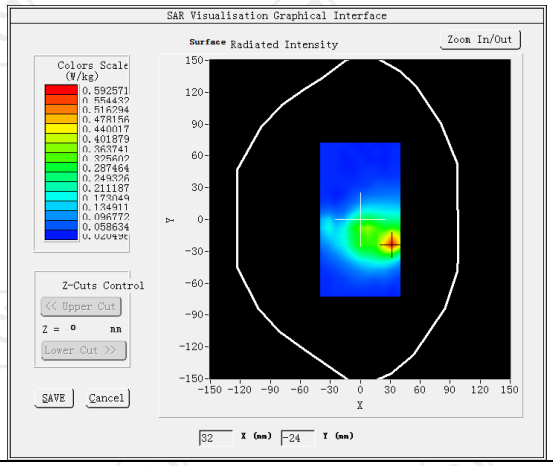
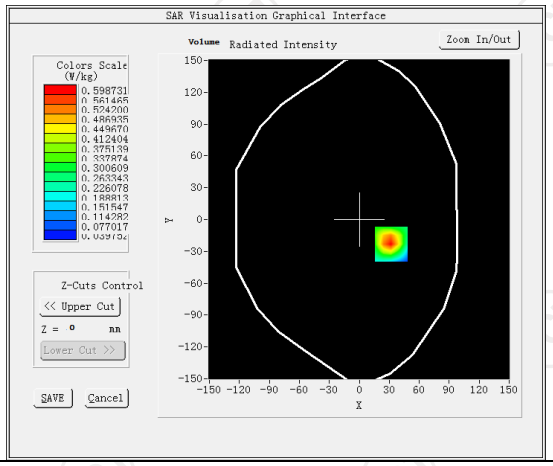
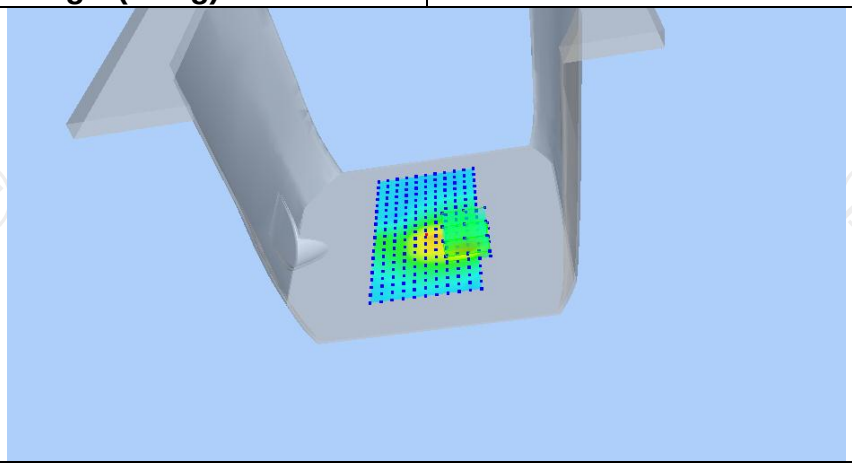
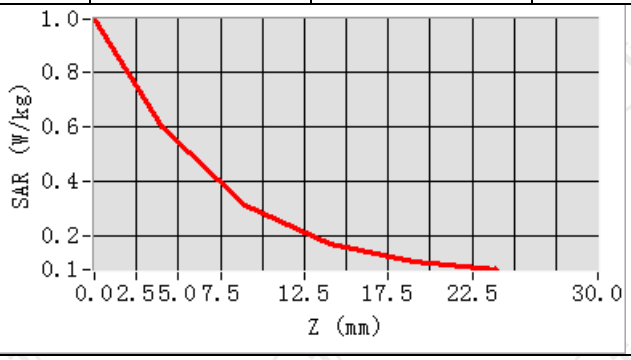
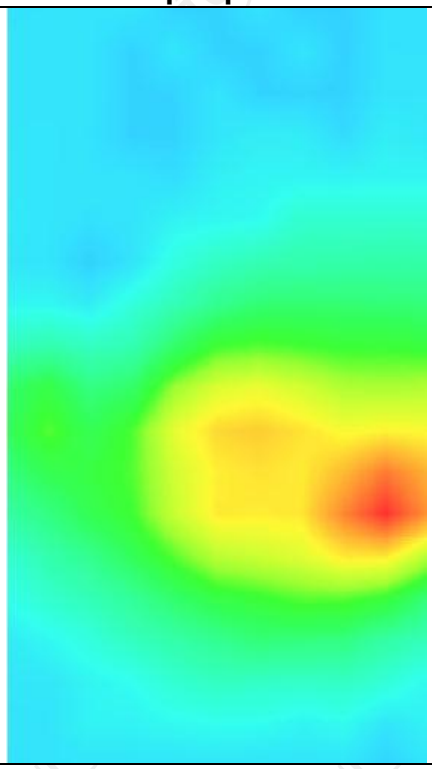
LTE Band 41-2

MEASUREMENT 1	
Lower Band SAR (Channel 39750):	Date: 11/25/2022
Frequency (MHz)	2506.000000
Relative permittivity (real part)	51.960667
Relative permittivity (imaginary part)	14.938428
Conductivity (S/m)	2.102536
Variation (%)	2.810000
Crest Factor	1.0
Probe Conversion factor	4.36
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body front(0mm)
Band	LTE band 41(1 RB#0)
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=32.00, Y=-23.00 SAR Peak: 1.01 W/kg	
SAR 10g (W/Kg)	0.787356
SAR 1g (W/Kg)	0.199148
	

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.9987	0.5987	0.3084	0.1670	0.1047



Hot spot position



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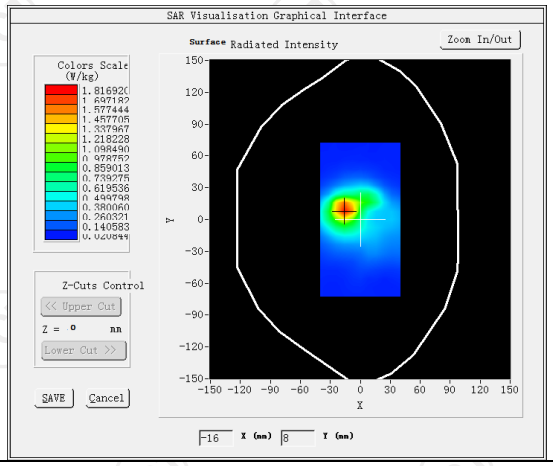
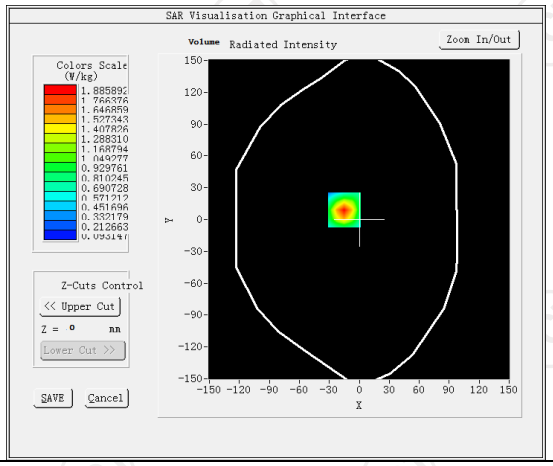
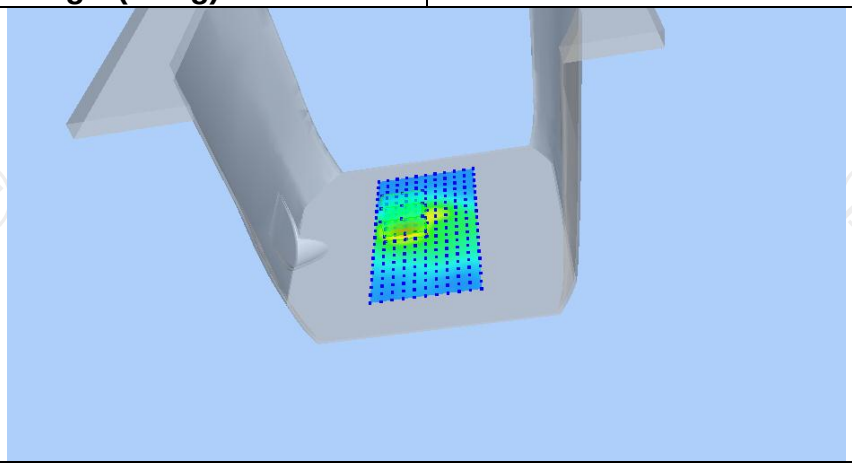
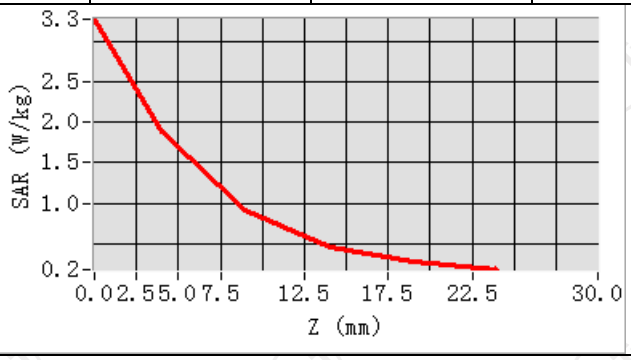
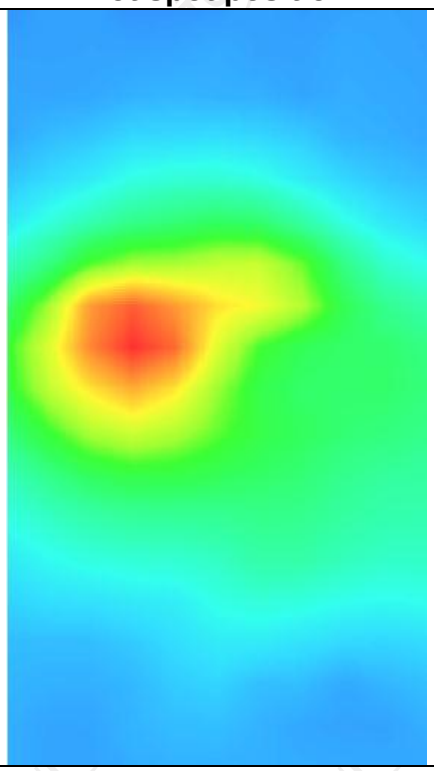
MEASUREMENT 2	
Lower Band SAR (Channel 39750):	Date: 11/25/2022
Frequency (MHz)	2506.000000
Relative permittivity (real part)	51.960667
Relative permittivity (imaginary part)	14.938428
Conductivity (S/m)	2.102536
Variation (%)	1.660000
Crest Factor	1.0
Probe Conversion factor	4.36
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(0mm)
Band	LTE band 41(1 RB#0)
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=-15.00, Y=9.00 SAR Peak: 3.29 W/kg	
SAR 10g (W/Kg)	0.856791
SAR 1g (W/Kg)	0.395644
	

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	3.2743	1.8859	0.9095	0.4570	0.2705



Hot spot position



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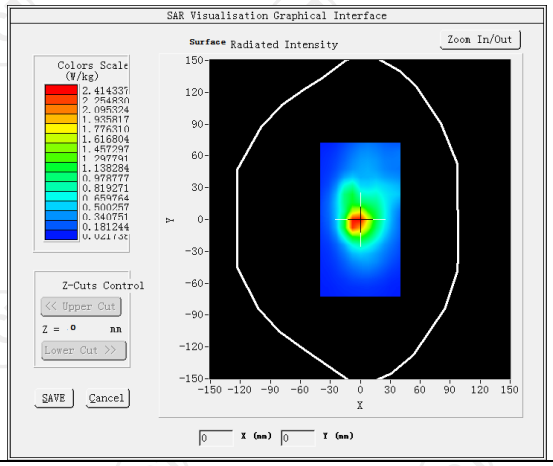
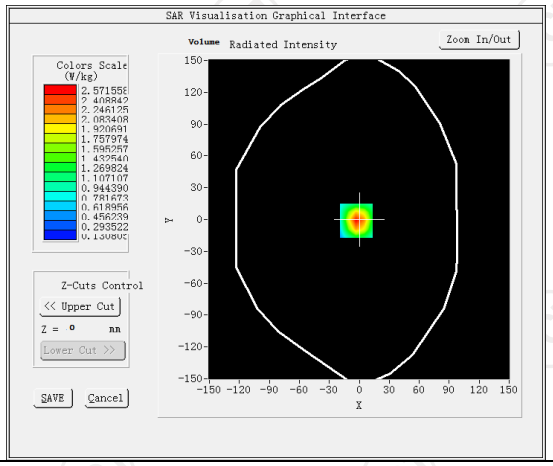
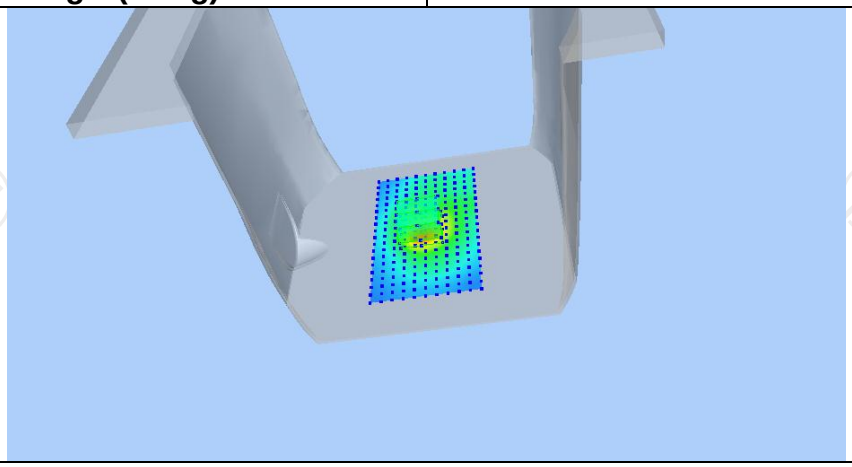
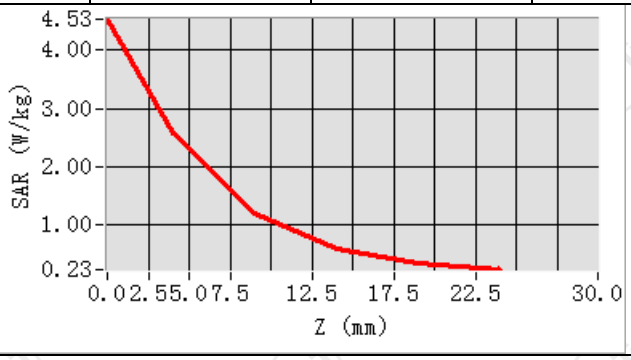
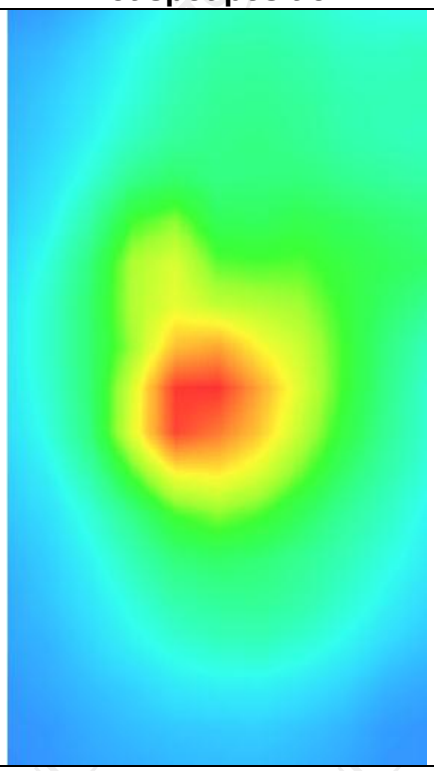
MEASUREMENT 3	
Lower Band SAR (Channel 39750):	Date: 11/25/2022
Frequency (MHz)	2506.000000
Relative permittivity (real part)	51.960667
Relative permittivity (imaginary part)	14.938428
Conductivity (S/m)	2.102536
Variation (%)	-2.120000
Crest Factor	1.0
Probe Conversion factor	4.36
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(hotspot 0mm)
Band	LTE band 41(1 RB#0)
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=-3.00, Y=-1.00 SAR Peak: 4.56 W/kg	
SAR 10g (W/Kg)	0.873477
SAR 1g (W/Kg)	0.453819
	

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	4.5335	2.5716	1.2103	0.5935	0.3476



Hot spot position



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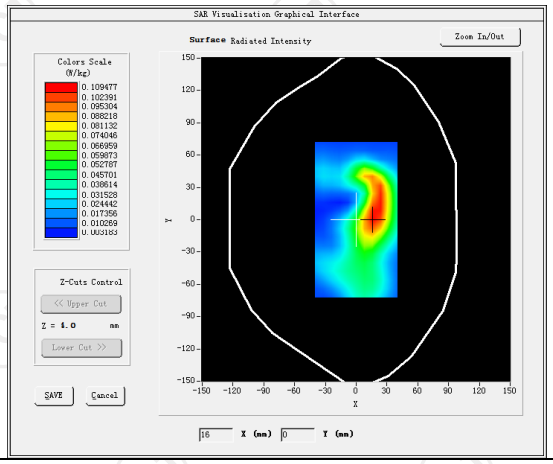
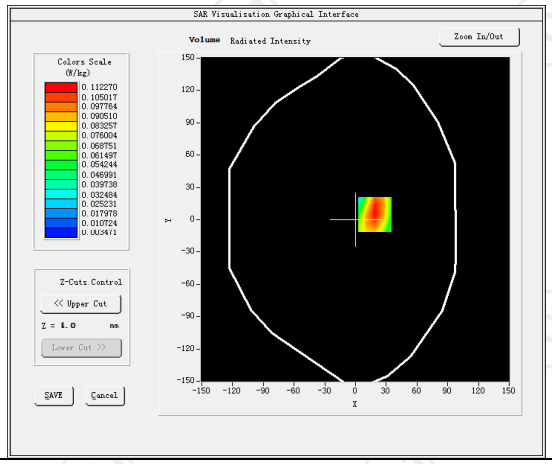
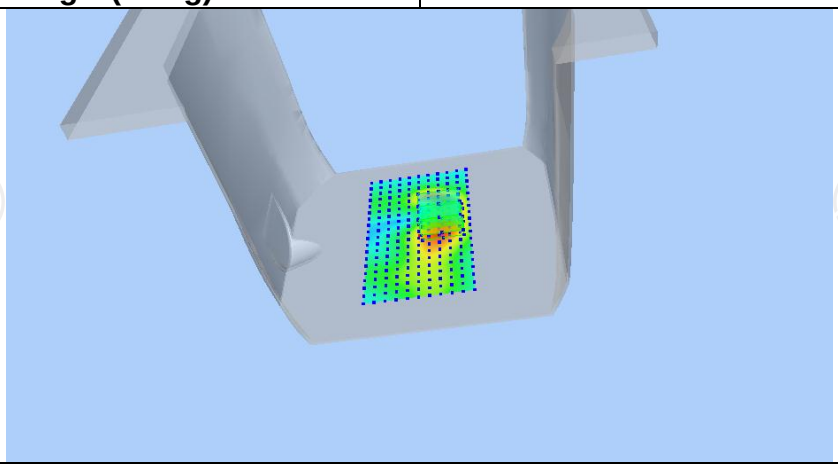
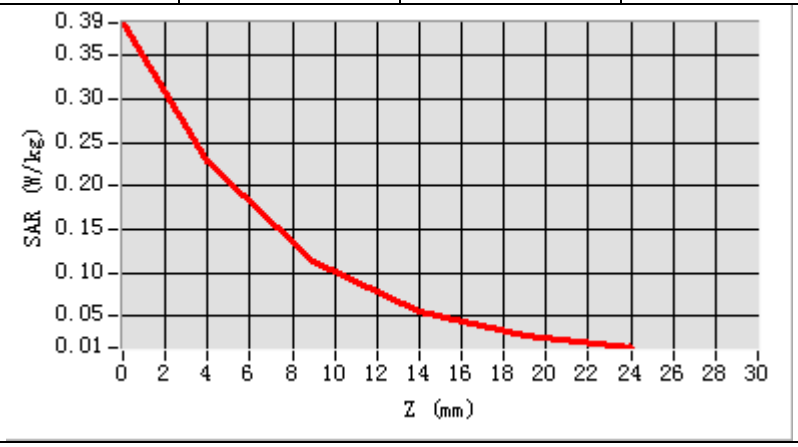
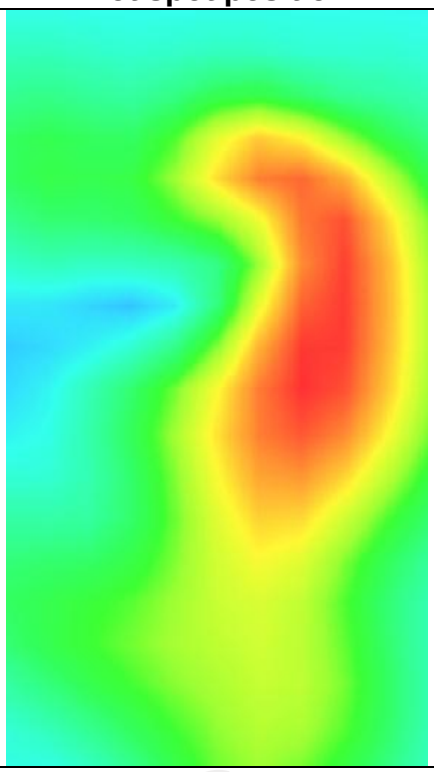
WLAN 2.4G -2

MEASUREMENT 1	
Middle Band SAR (Channel 06):	Date: 11/22/2022
Frequency (MHz)	2437.000000
Relative permittivity (real part)	54.630667
Relative permittivity (imaginary part)	14.318428
Conductivity (S/m)	1.982536
Variation (%)	-1.840000
Crest Factor	1.0
Probe Conversion factor	2.31
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body front(0mm)
Band	IEEE 802.11b ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=19.00, Y=5.00 SAR Peak: 0.39 W/kg	
SAR 10g (W/Kg)	0.068895
SAR 1g (W/Kg)	0.139565
	

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.3880	0.2293	0.1129	0.0549	0.0281



Hot spot position



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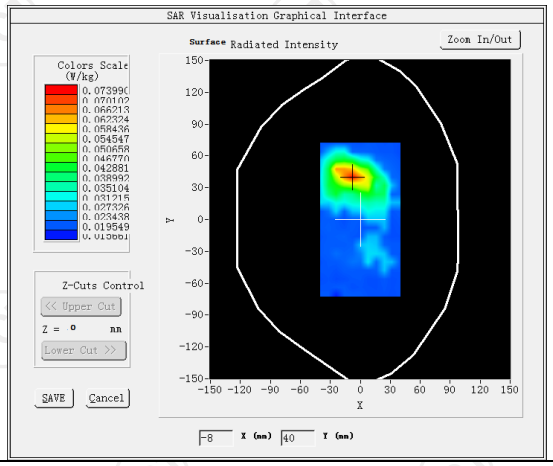
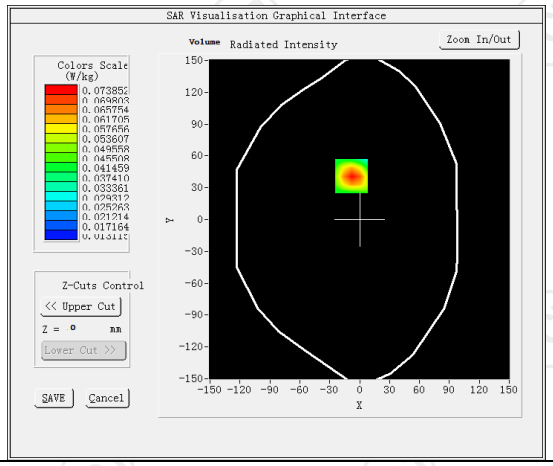
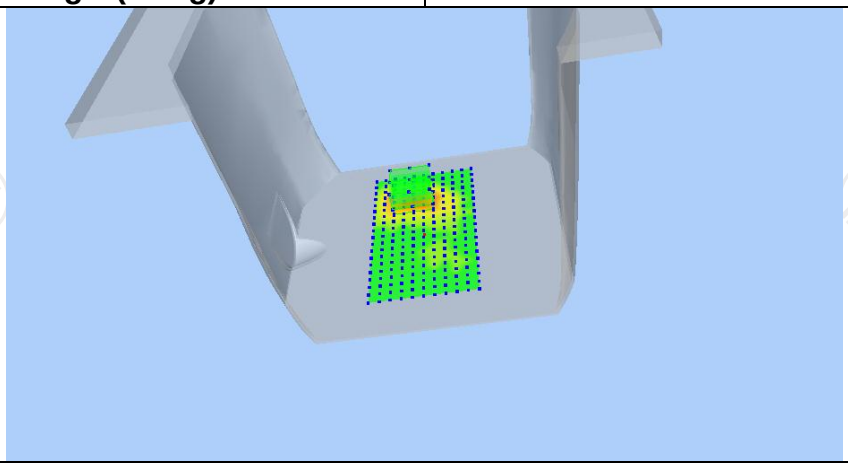
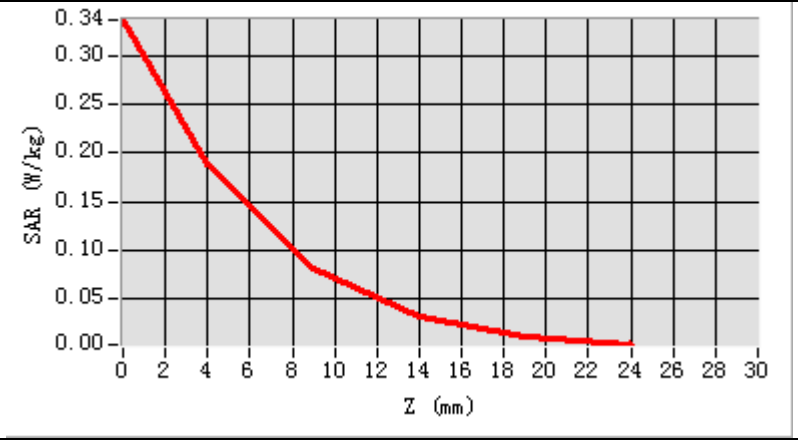
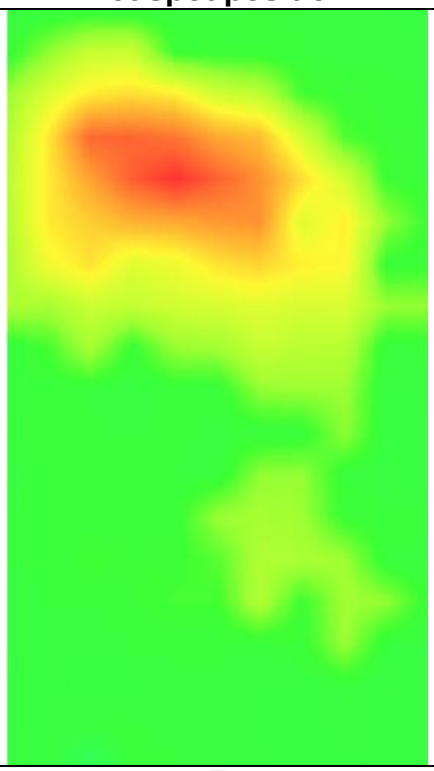
MEASUREMENT 2	
Middle Band SAR (Channel 06):	Date: 11/22/2022
Frequency (MHz)	2437.000000
Relative permittivity (real part)	54.630667
Relative permittivity (imaginary part)	14.318428
Conductivity (S/m)	1.982536
Variation (%)	2.140000
Crest Factor	1.0
Probe Conversion factor	2.31
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(0mm)
Band	IEEE 802.11b ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=16.00, Y=63.00 SAR Peak: 0.34 W/kg	
SAR 10g (W/Kg)	0.140642
SAR 1g (W/Kg)	0.238531
	

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.3402	0.1882	0.0821	0.0320	0.0110



Hot spot position



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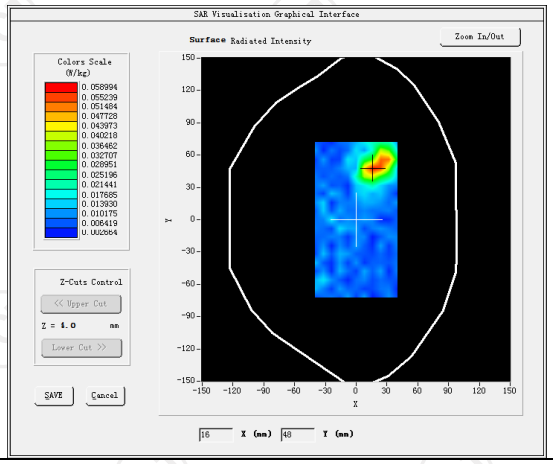
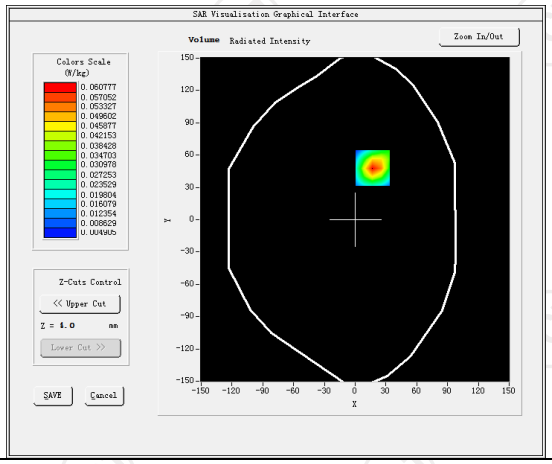
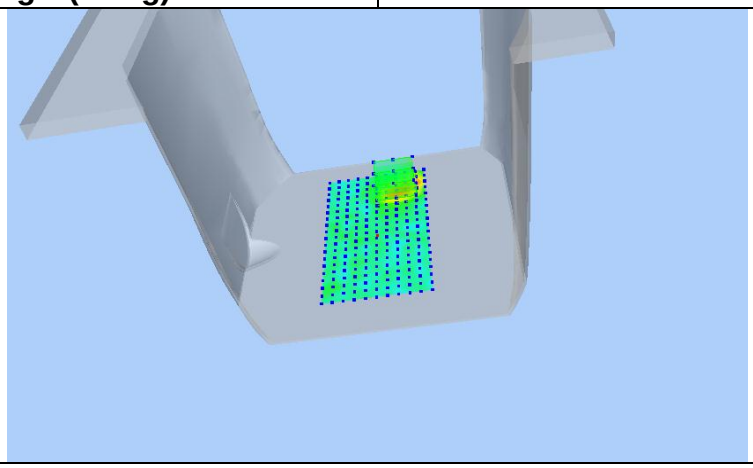
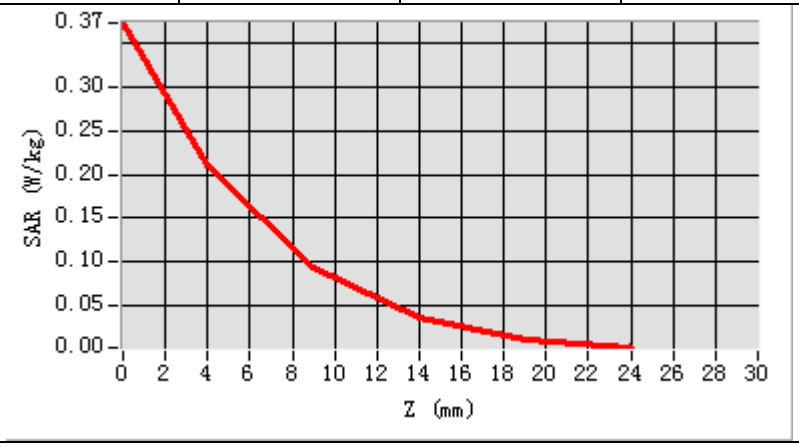
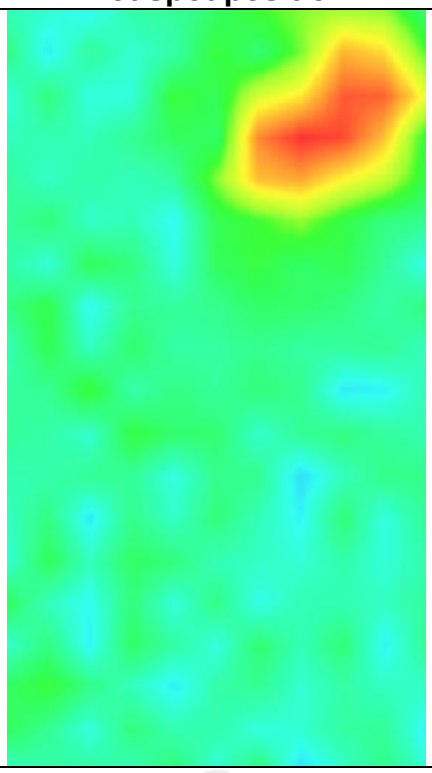
MEASUREMENT 3	
Middle Band SAR (Channel 06):	Date: 11/22/2022
Frequency (MHz)	2437.000000
Relative permittivity (real part)	54.630667
Relative permittivity (imaginary part)	14.318428
Conductivity (S/m)	1.982536
Variation (%)	-2.170000
Crest Factor	1.0
Probe Conversion factor	2.31
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(0mm)
Band	IEEE 802.11b ISM(hotspot)
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=17.00, Y=48.00 SAR Peak: 0.37 W/kg	
SAR 10g (W/Kg)	0.153770
SAR 1g (W/Kg)	0.257093
	

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.3704	0.2110	0.0942	0.0372	0.0121



Hot spot position



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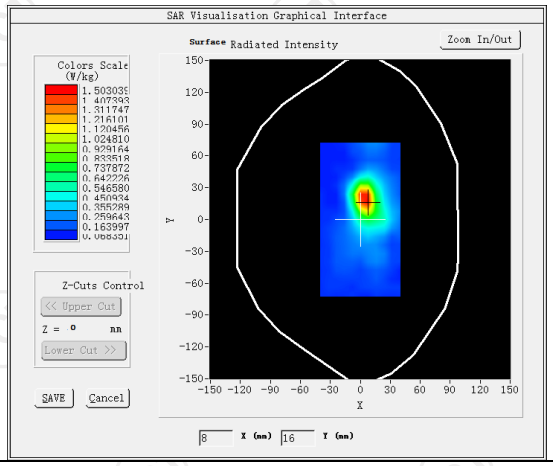
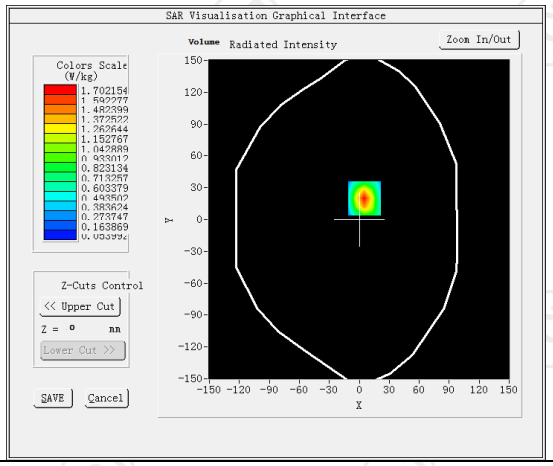
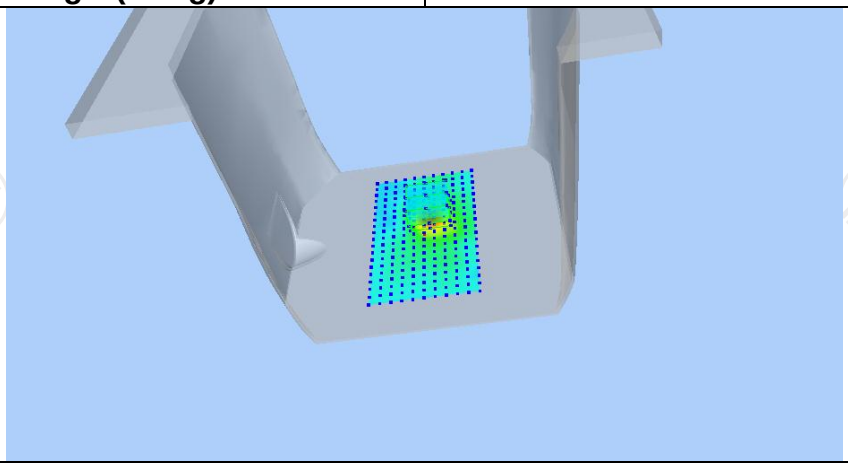
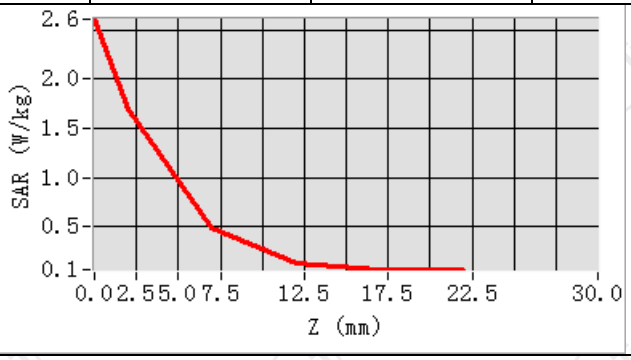
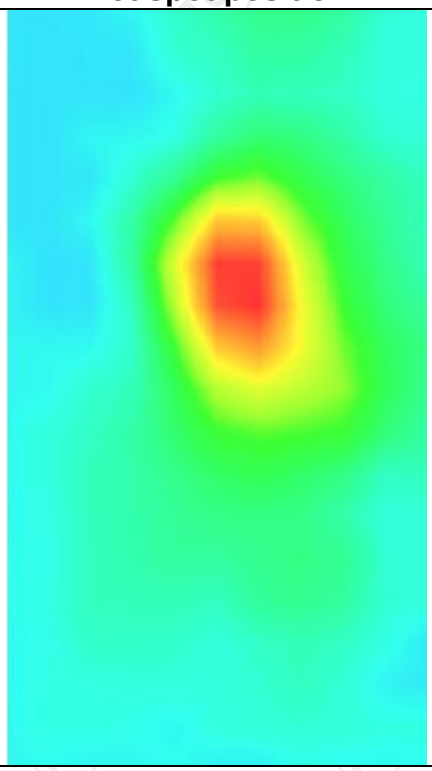
WLAN 5.2G -2

MEASUREMENT 1	
SAR (Channel 42):	Date: 11/28/2022
Frequency (MHz)	5210.000000
Relative permittivity (real part)	50.110667
Relative permittivity (imaginary part)	21.378187
Conductivity (S/m)	5.408883
Variation (%)	-1.010000
Crest Factor	1.0
Probe Conversion factor	2.01
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body front(0mm)
Band	IEEE 802.11acHT80 ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=5.00, Y=20.00 SAR Peak: 2.67 W/kg	
SAR 10g (W/Kg)	1.038750
SAR 1g (W/Kg)	0.118045
	

Z (mm)	0.00	2.00	7.00	12.00	17.00
SAR (W/Kg)	2.6069	1.7022	0.4979	0.1375	0.0688



Hot spot position



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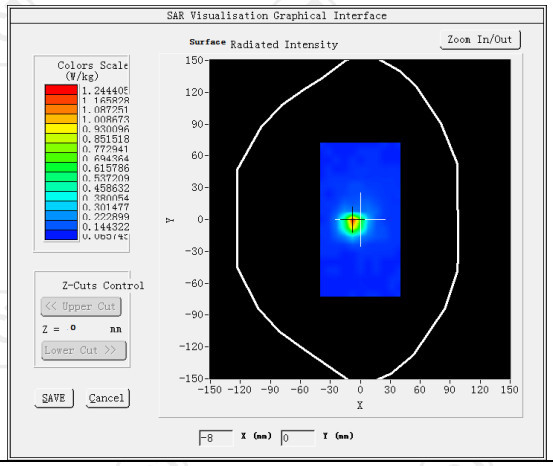
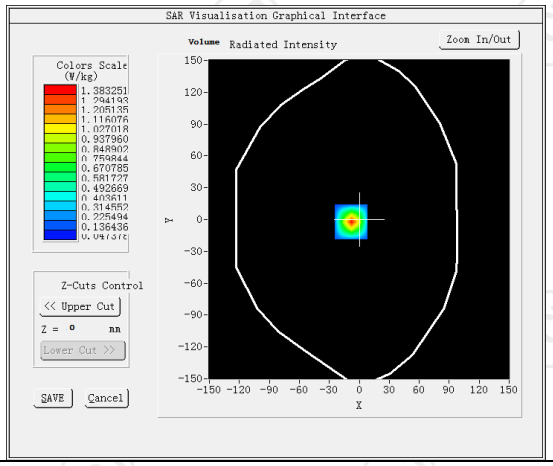
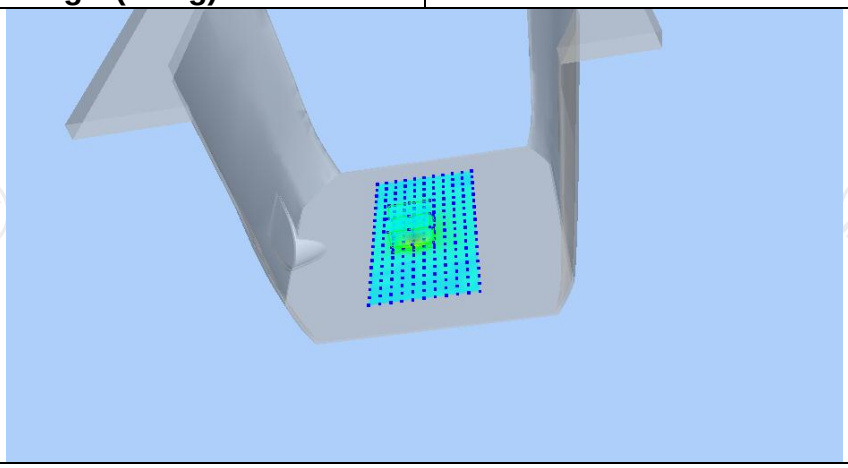
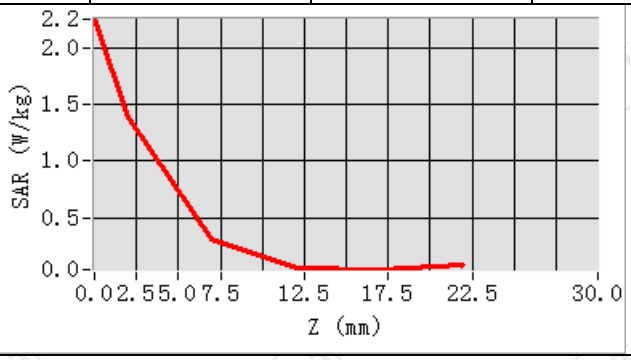
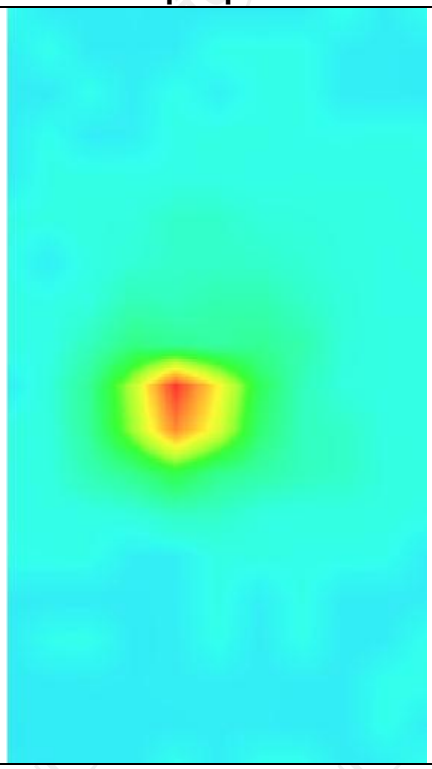
MEASUREMENT 2	
SAR (Channel 42):	Date: 11/28/2022
Frequency (MHz)	5210.000000
Relative permittivity (real part)	50.110667
Relative permittivity (imaginary part)	21.378187
Conductivity (S/m)	5.408883
Variation (%)	-0.460000
Crest Factor	1.0
Probe Conversion factor	2.01
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(0mm)
Band	IEEE 802.11acHT80 ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=-8.00, Y=-2.00 SAR Peak: 2.32 W/kg	
SAR 10g (W/Kg)	0.304653
SAR 1g (W/Kg)	0.221245
	

Z (mm)	0.00	2.00	7.00	12.00	17.00
SAR (W/Kg)	2.2471	1.3833	0.3184	0.0673	0.0474



Hot spot position



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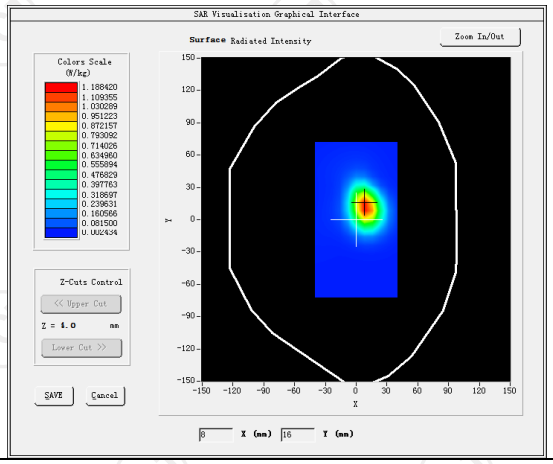
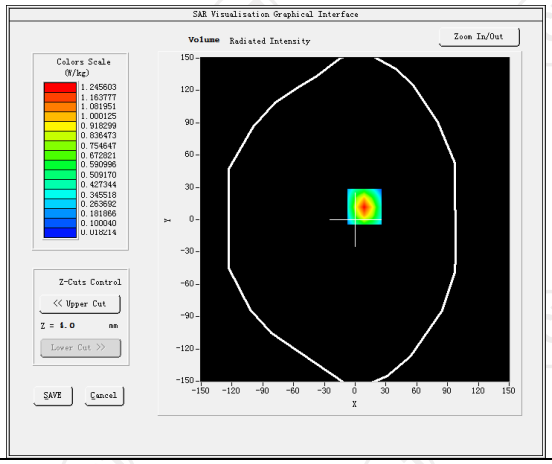
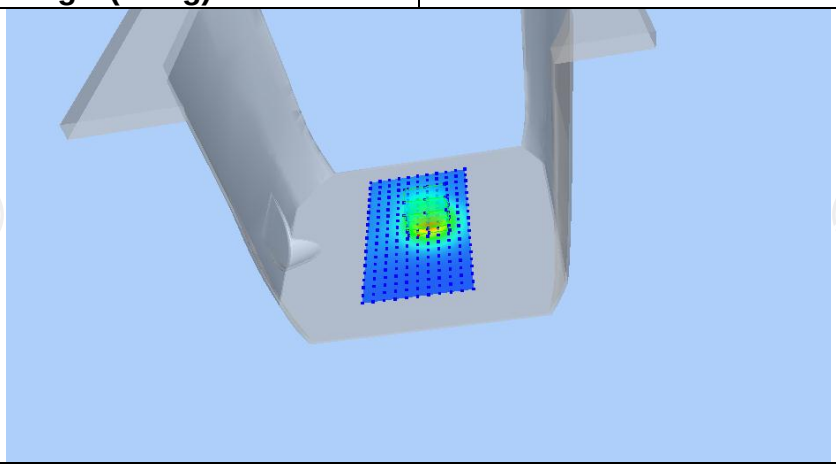
WLAN 5.3G -2

MEASUREMENT 1	
SAR (Channel 58):	Date: 12/02/2022
Frequency (MHz)	5290.000000
Relative permittivity (real part)	50.052699
Relative permittivity (imaginary part)	15.200000
Conductivity (S/m)	5.520000
Variation (%)	0.140000
Crest Factor	1.0
Probe Conversion factor	1.94
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body front(0mm)
Band	IEEE 802.11acHT80 ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=18.00, Y=35.00 SAR Peak: 0.36 W/kg	
SAR 10g (W/Kg)	0.537955
SAR 1g (W/Kg)	0.104047
	

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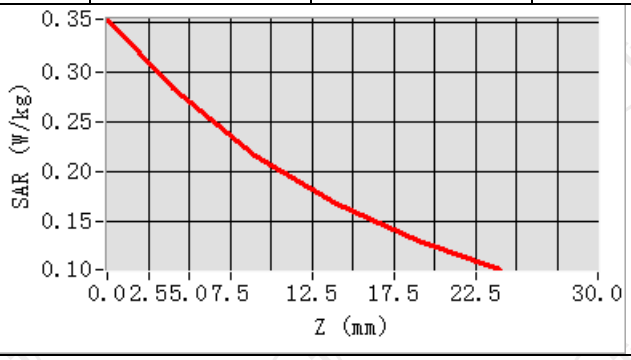
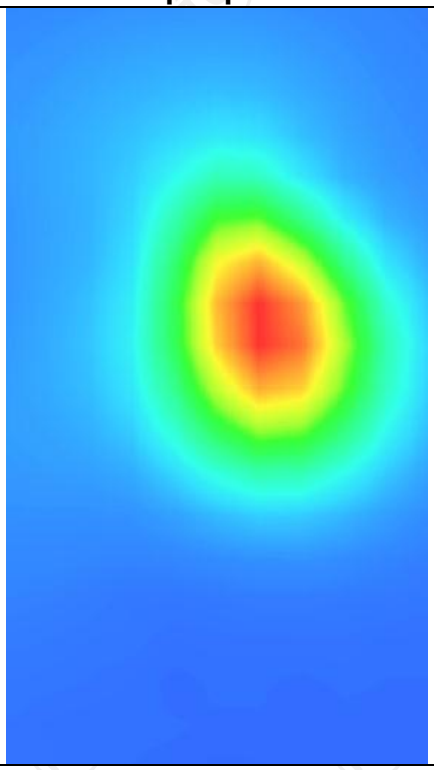
Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.3521	0.2840	0.2161	0.1657	0.1024



Hot spot position



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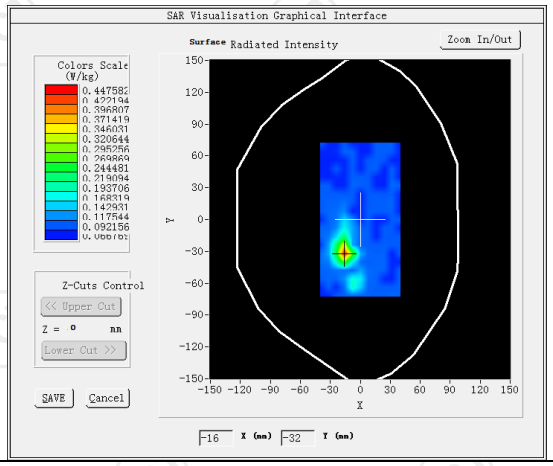
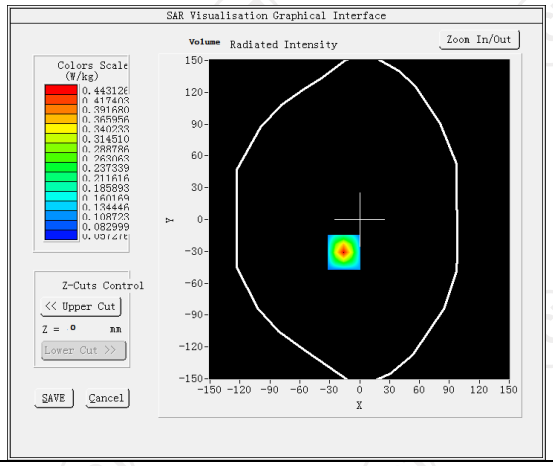
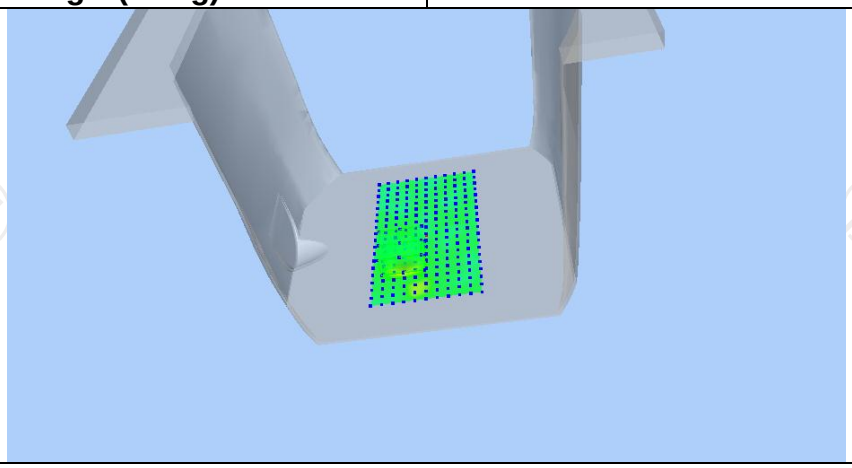
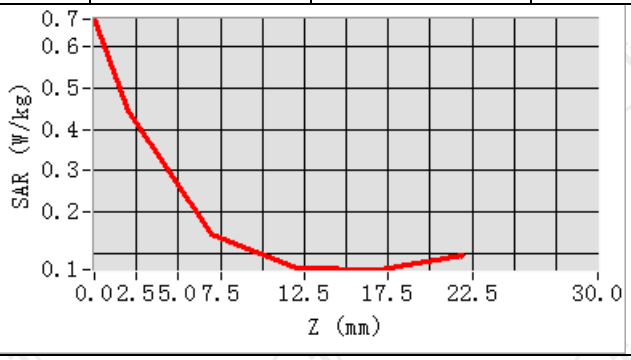
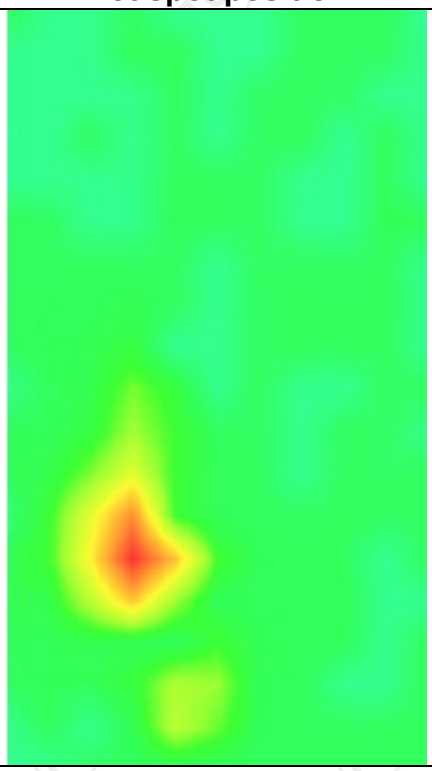
MEASUREMENT 2	
SAR (Channel 58):	Date: 12/02/2022
Frequency (MHz)	5290.000000
Relative permittivity (real part)	50.052699
Relative permittivity (imaginary part)	15.200000
Conductivity (S/m)	5.520000
Variation (%)	0.370000
Crest Factor	1.0
Probe Conversion factor	1.94
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(0mm)
Band	IEEE 802.11acHT80 ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=-16.00, Y=-31.00 SAR Peak: 0.69 W/kg	
SAR 10g (W/Kg)	0.145644
SAR 1g (W/Kg)	0.190391
	

Z (mm)	0.00	2.00	7.00	12.00	17.00
SAR (W/Kg)	0.6652	0.4431	0.1477	0.0636	0.0615



Hot spot position



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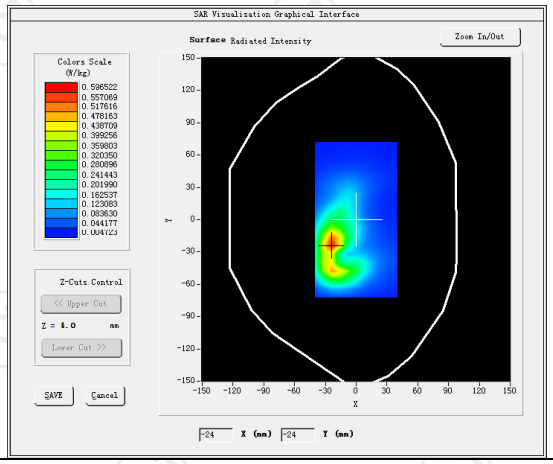
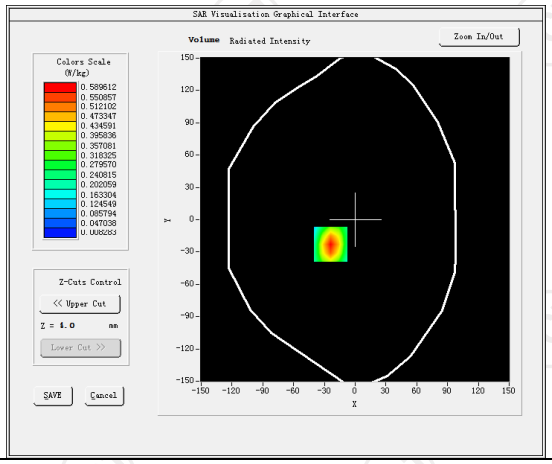
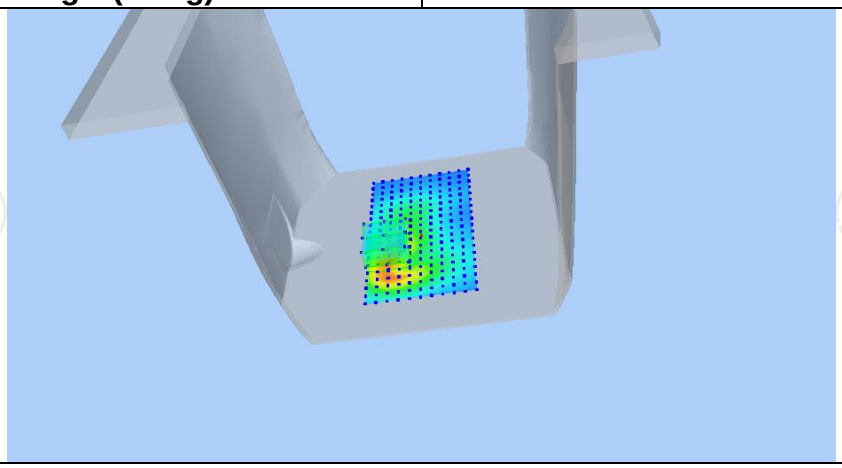
WLAN 5.6G -2

MEASUREMENT 1	
SAR (Channel 106):	Date: 12/07/2022
Frequency (MHz)	5530.000000
Relative permittivity (real part)	49.759999
Relative permittivity (imaginary part)	14.329440
Conductivity (S/m)	5.970354
Variation (%)	-1.470000
Crest Factor	1.0
Probe Conversion factor	2.12
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(0mm)
Band	IEEE 802.11acHT80 ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=-24.00, Y=-23.00 SAR Peak: 1.05 W/kg	
SAR 10g (W/Kg)	0.121226
SAR 1g (W/Kg)	0.008941
	

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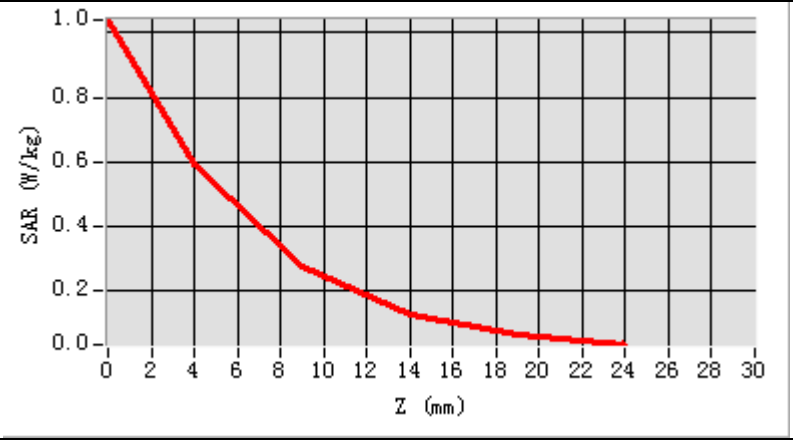
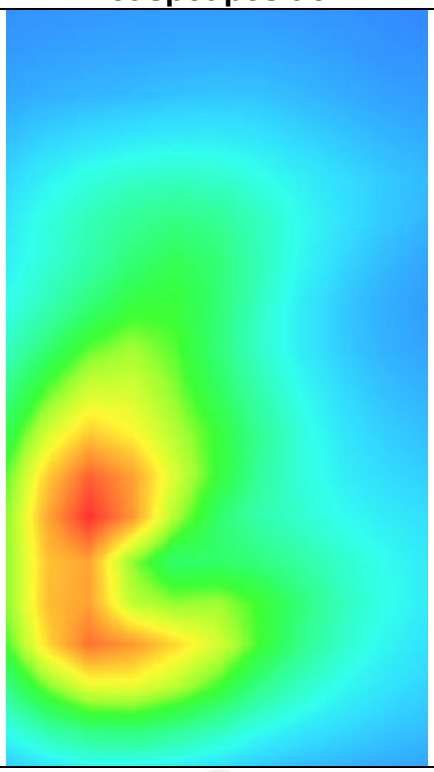
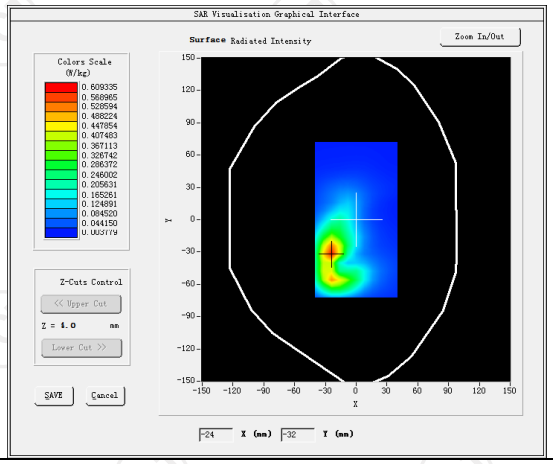
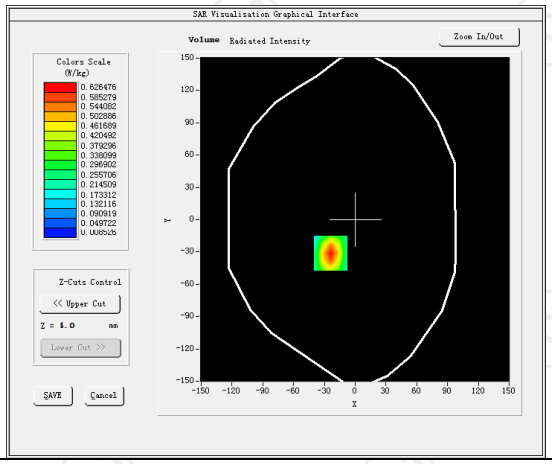
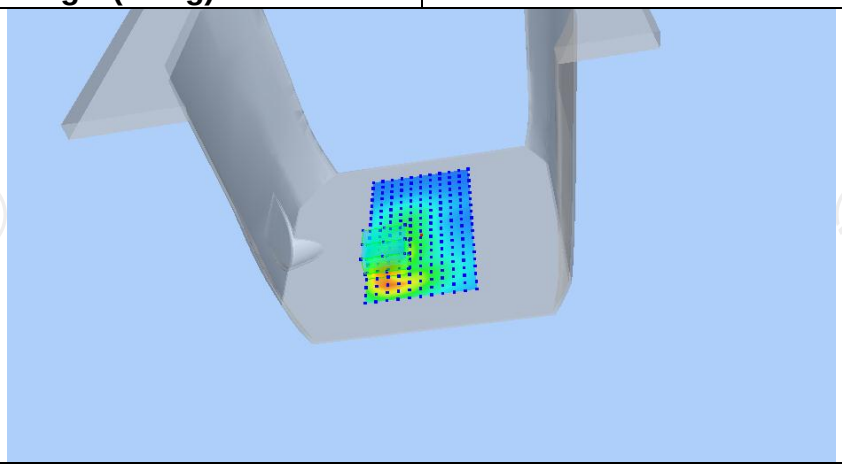
Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.0405	0.5896	0.2718	0.1231	0.0603

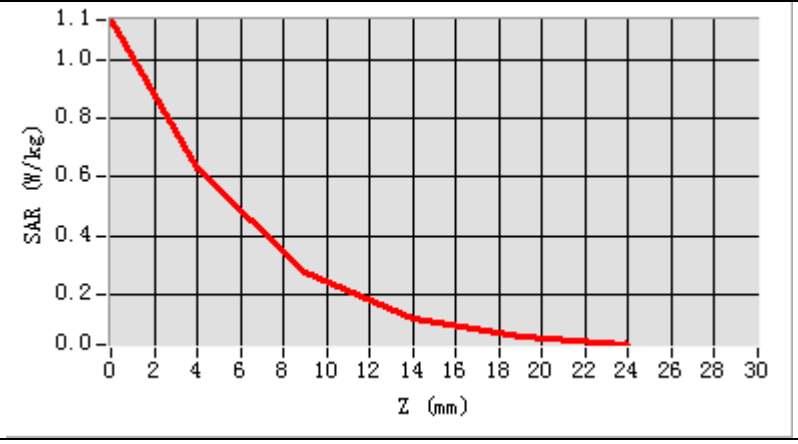


Hot spot position

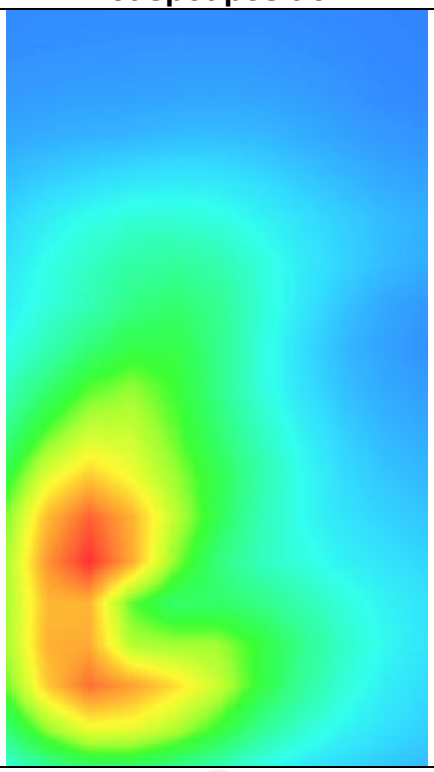


MEASUREMENT 2	
SAR (Channel 106):	Date: 12/07/2022
Frequency (MHz)	5530.000000
Relative permittivity (real part)	49.759999
Relative permittivity (imaginary part)	14.329440
Conductivity (S/m)	5.970354
Variation (%)	-0.580000
Crest Factor	1.0
Probe Conversion factor	2.12
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(0mm)
Band	IEEE 802.11acHT80 ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=-24.00, Y=-31.00 SAR Peak: 1.14 W/kg	
SAR 10g (W/Kg)	0.283380
SAR 1g (W/Kg)	0.165486
	

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.1333	0.6265	0.2777	0.1209	0.0583



Hot spot position



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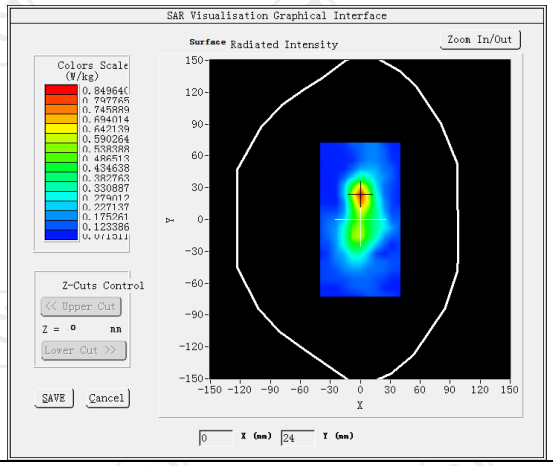
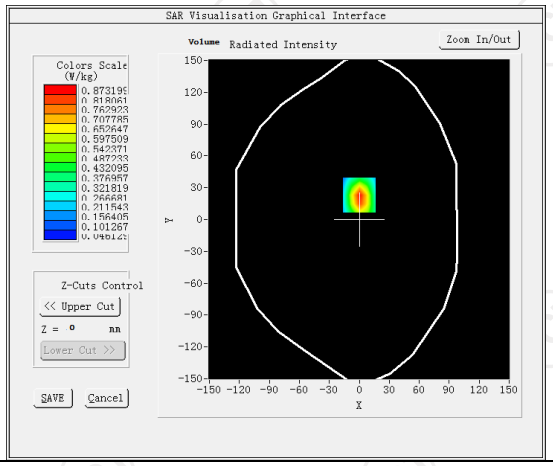
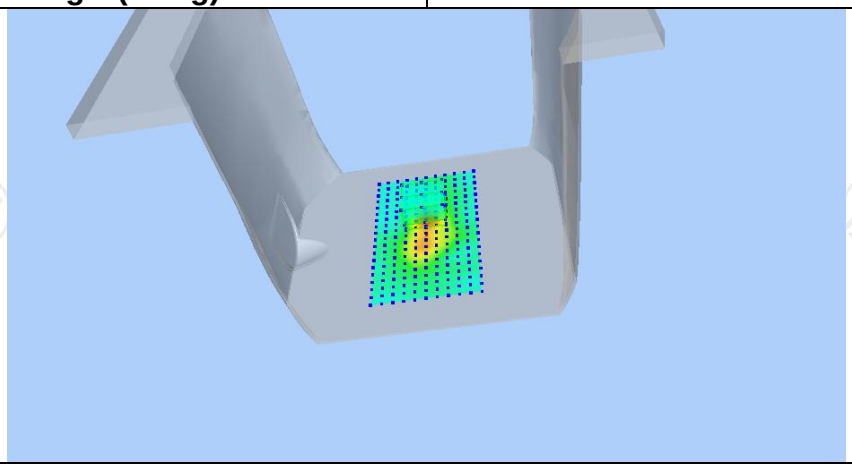
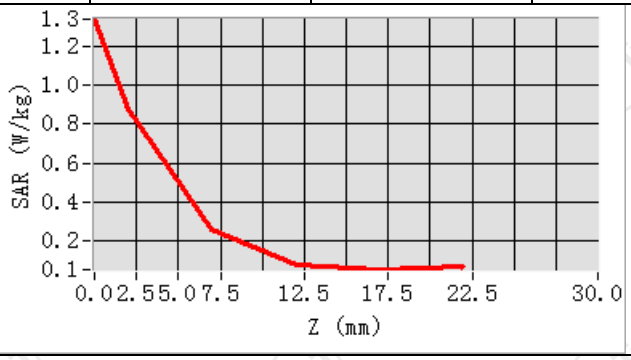
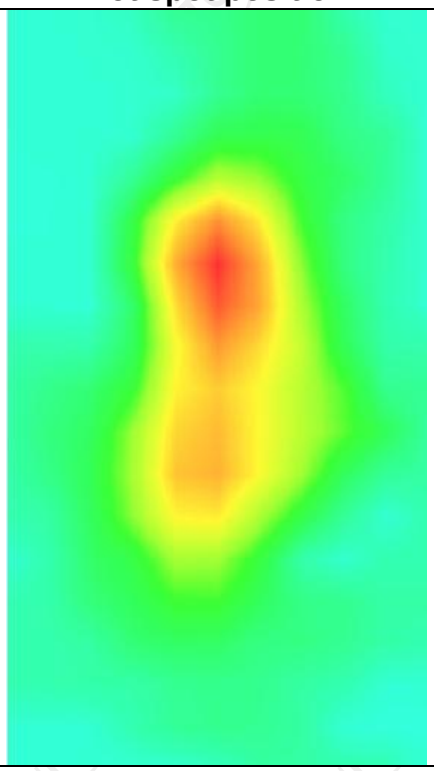
WLAN 5.8G-2

MEASUREMENT 1	
SAR (Channel 155):	Date: 12/13/2022
Frequency (MHz)	5775.000000
Relative permittivity (real part)	47.393887
Relative permittivity (imaginary part)	14.935214
Conductivity (S/m)	6.274821
Variation (%)	1.240000
Crest Factor	1.0
Probe Conversion factor	4.70
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body front(0mm)
Band	IEEE 802.11acHT80 ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=0.00, Y=23.00 SAR Peak: 1.39 W/kg	
SAR 10g (W/Kg)	0.245968
SAR 1g (W/Kg)	0.084770
	

Z (mm)	0.00	2.00	7.00	12.00	17.00
SAR (W/Kg)	1.3365	0.8732	0.2607	0.0823	0.0550



Hot spot position



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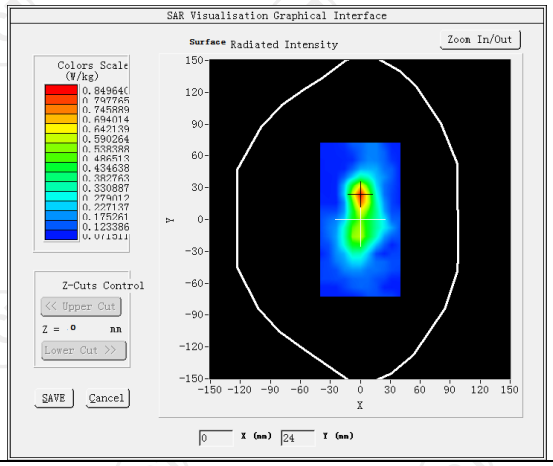
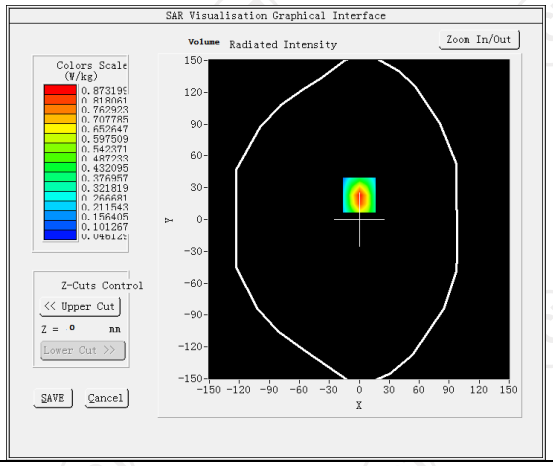
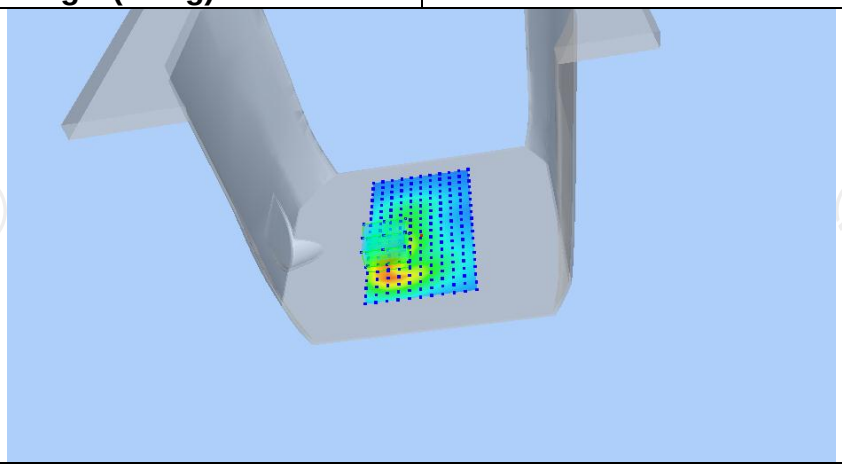
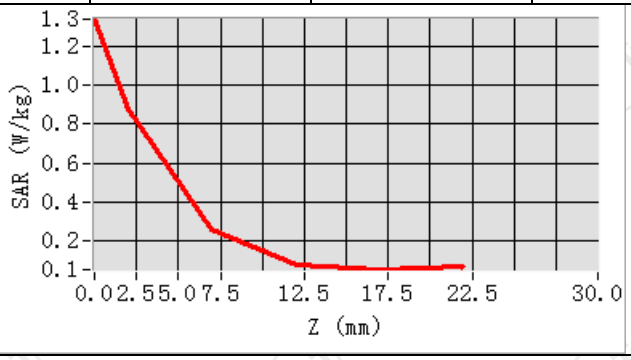
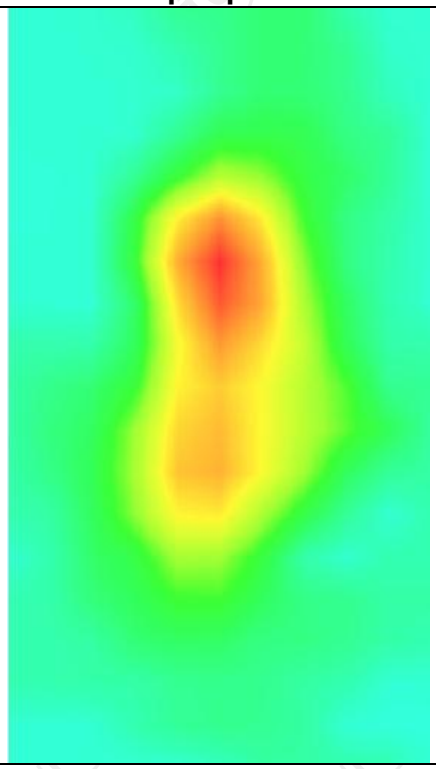
MEASUREMENT 2	
SAR (Channel 155):	Date: 12/13/2022
Frequency (MHz)	5775.000000
Relative permittivity (real part)	47.393887
Relative permittivity (imaginary part)	14.935214
Conductivity (S/m)	6.274821
Variation (%)	-0.990000
Crest Factor	1.0
Probe Conversion factor	2.12
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(0mm)
Band	IEEE 802.11acHT80 ISM
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=0.00, Y=23.00 SAR Peak: 1.39 W/kg	
SAR 10g (W/Kg)	0.245968
SAR 1g (W/Kg)	0.164770
	

Z (mm)	0.00	2.00	7.00	12.00	17.00
SAR (W/Kg)	1.3365	0.8732	0.2607	0.0823	0.0550



Hot spot position



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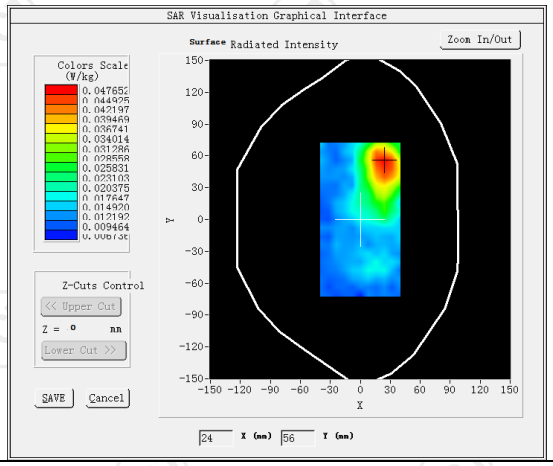
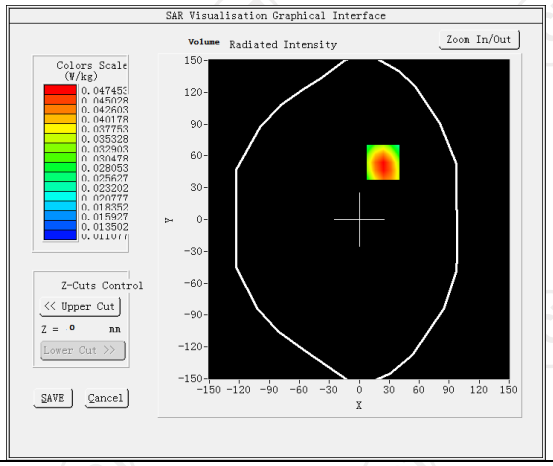
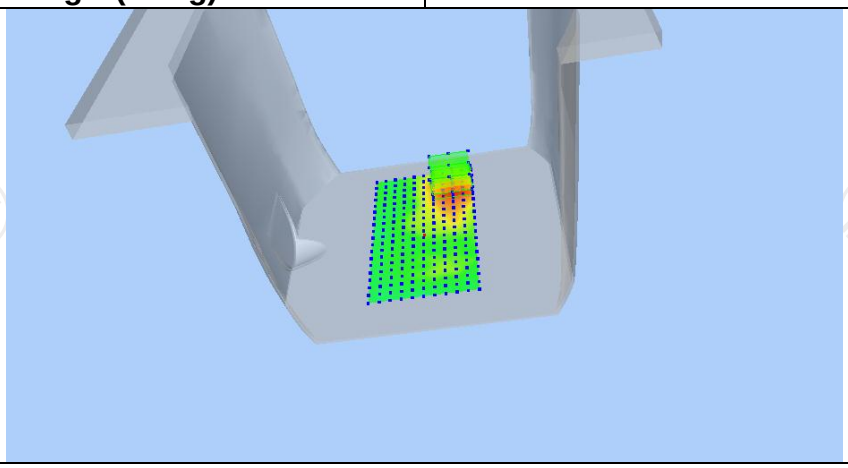
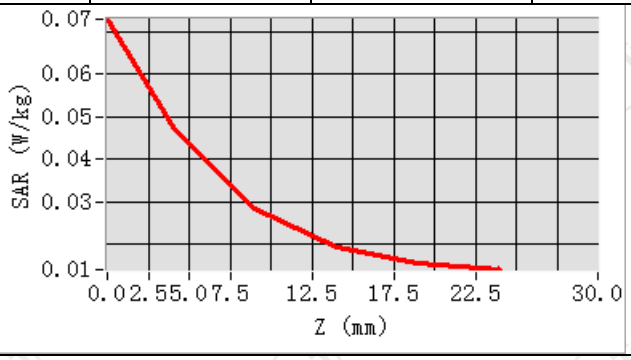
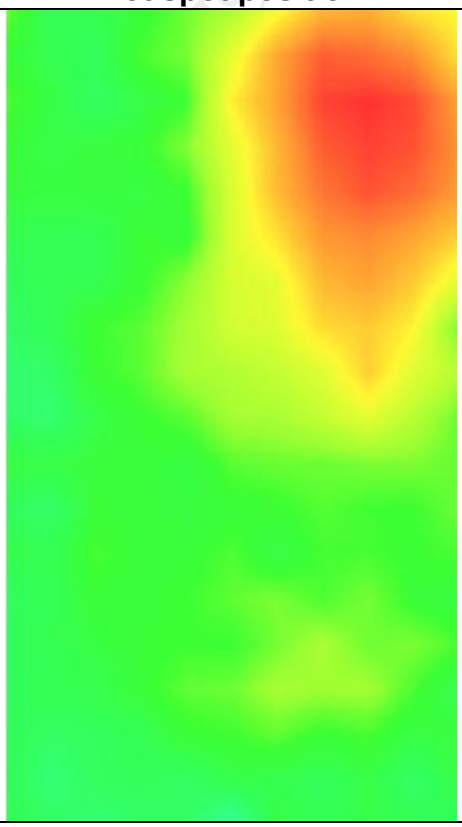
BT-2

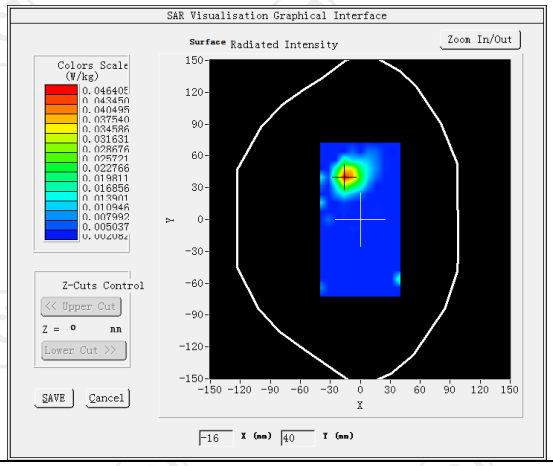
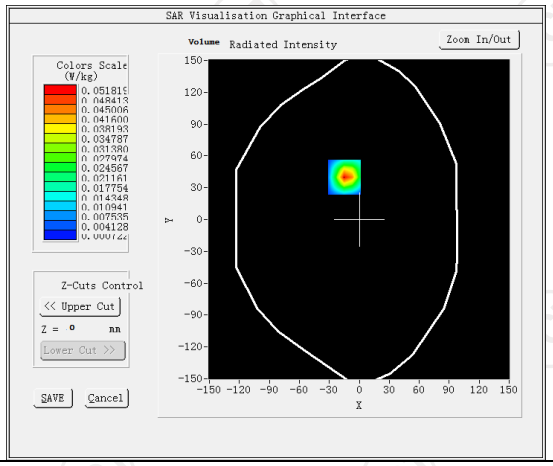
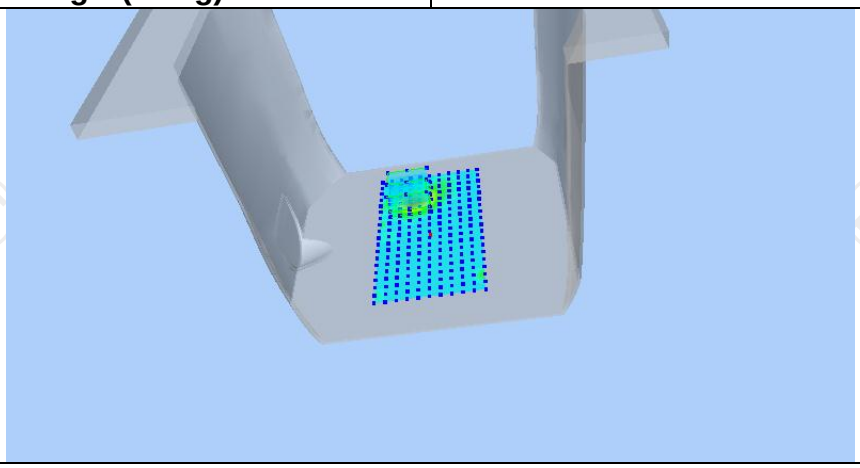
MEASUREMENT 1	
Hight Band SAR (Channel 78):	Date: 11/22/2022
Frequency (MHz)	2480.000000
Relative permittivity (real part)	37.821613
Relative permittivity (imaginary part)	13.546980
Conductivity (S/m)	1.834111
Variation (%)	2.310000
Crest Factor	1.0
Probe Conversion factor	2.31
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body front(0mm)
Band	GFSK
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=24.00, Y=54.00 SAR Peak: 0.07 W/kg	
SAR 10g (W/Kg)	0.049844
SAR 1g (W/Kg)	0.015910
	

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.0728	0.0475	0.0285	0.0192	0.0155

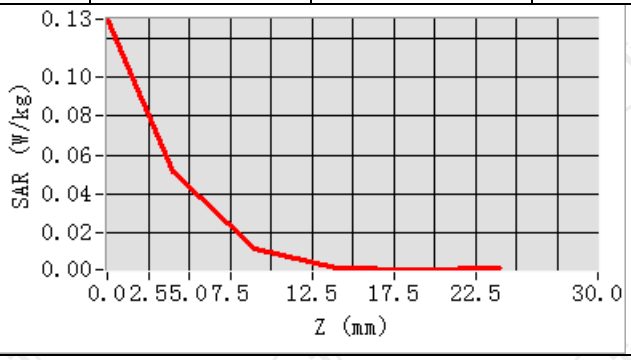


Hot spot position

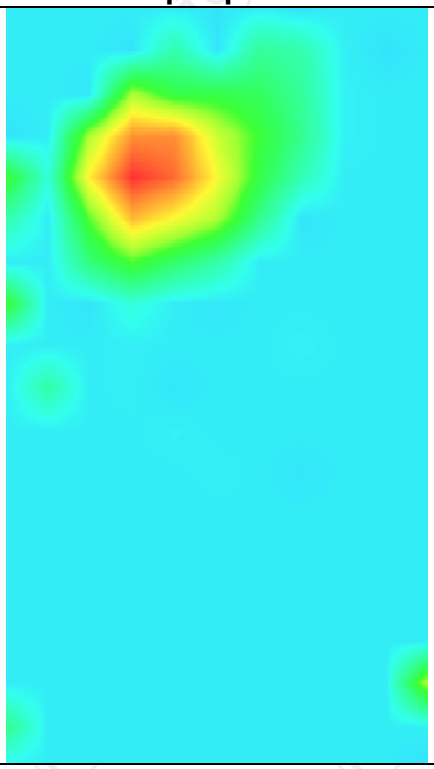


MEASUREMENT 2	
Hight Band SAR (Channel 78):	Date: 11/22/2022
Frequency (MHz)	2480.000000
Relative permittivity (real part)	37.821613
Relative permittivity (imaginary part)	13.546980
Conductivity (S/m)	1.834111
Variation (%)	-0.030000
Crest Factor	1.0
Probe Conversion factor	2.31
E-Field Probe:	SSE2 (SN 25/22 EPGO375)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body back(0mm)
Band	GFSK
SURFACE SAR	**VOLUME SAR**
	
Maximum location: X=-15.00, Y=40.00 SAR Peak: 0.13 W/kg	
SAR 10g (W/Kg)	0.008725
SAR 1g (W/Kg)	0.033370
	

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.1212	0.0515	0.0119	0.0020	0.0012

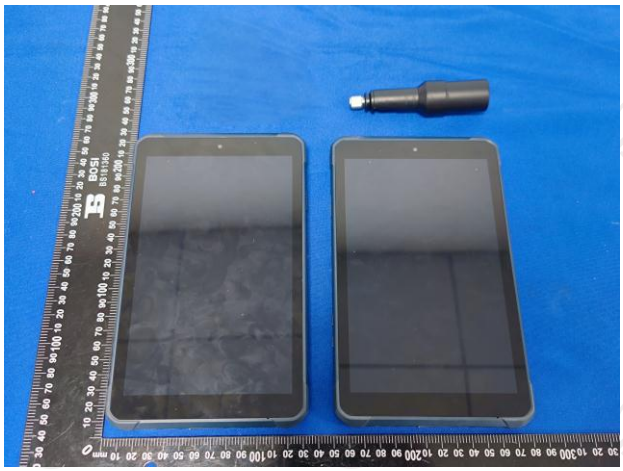


Hot spot position

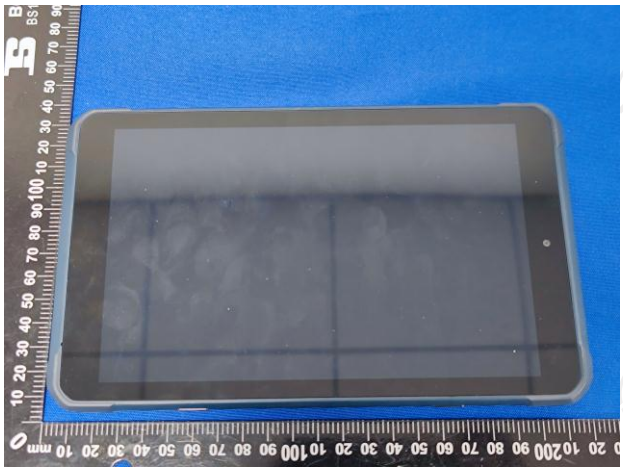


Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

Appendix A: EUT Photos

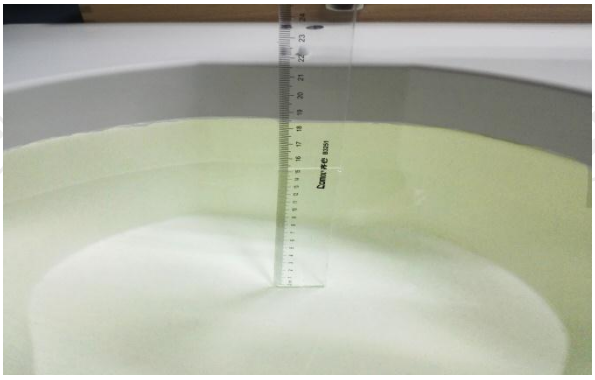




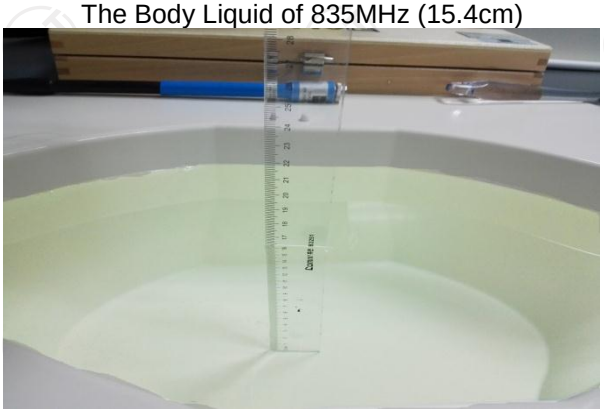



Liquid depth

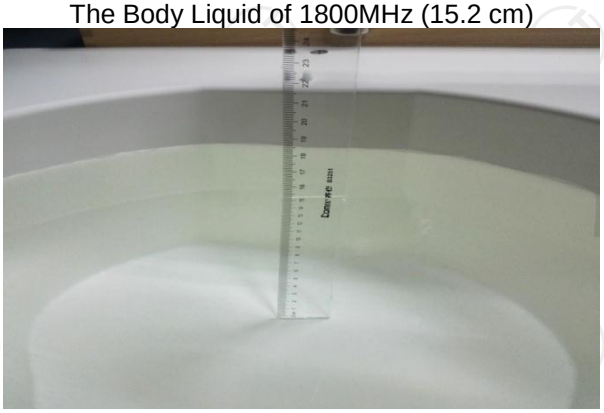
The Body Liquid of 835MHz (15.4cm)



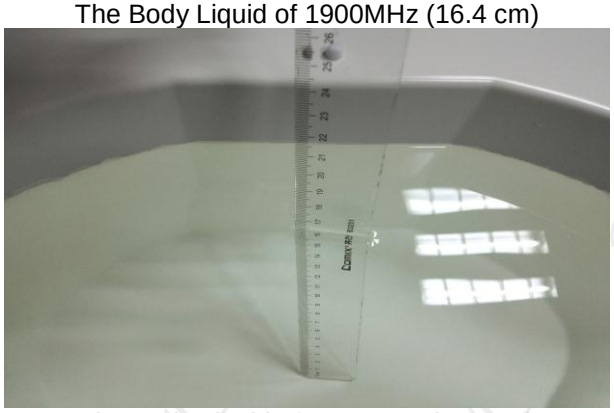
The Body Liquid of 1800MHz (15.2 cm)



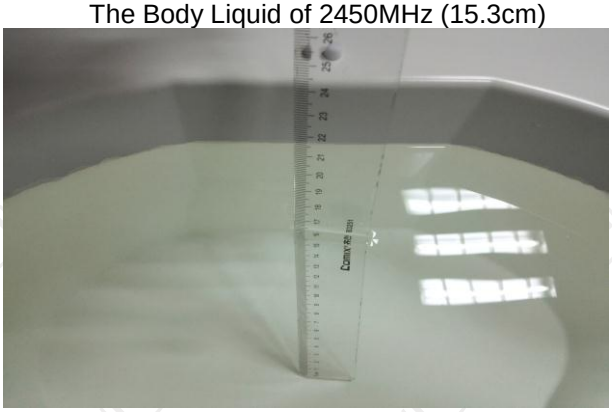
The Body Liquid of 1900MHz (16.4 cm)



The Body Liquid of 2450MHz (15.3cm)



The Body Liquid of 2600MHz (16.5cm)

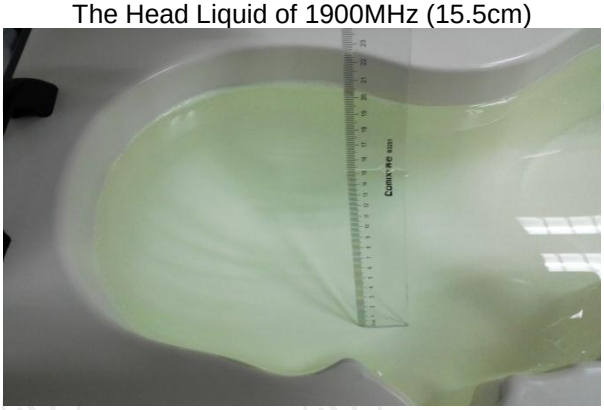


The Body Liquid of 5000-6000MHz (16.5cm)

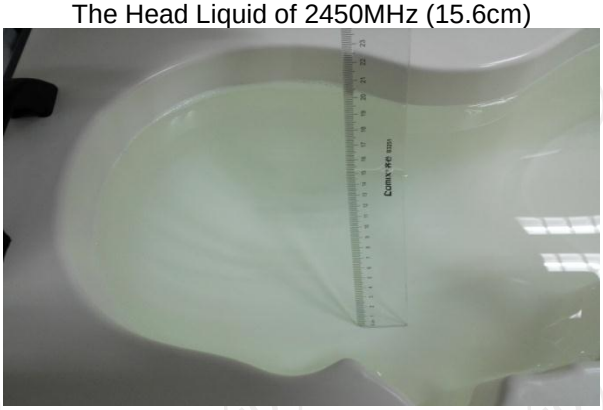
Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

The Head Liquid of 1900MHz (15.5cm)

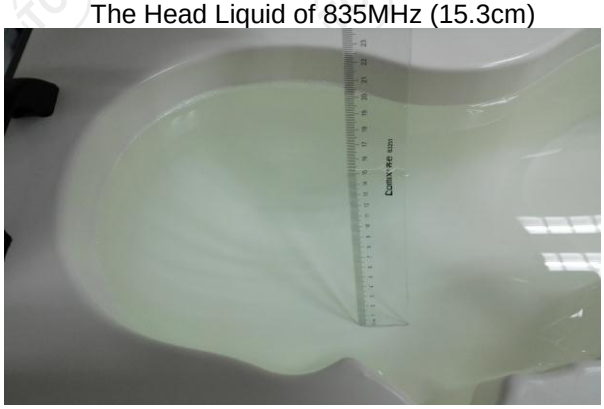
The Head Liquid of 2450MHz (15.6cm)



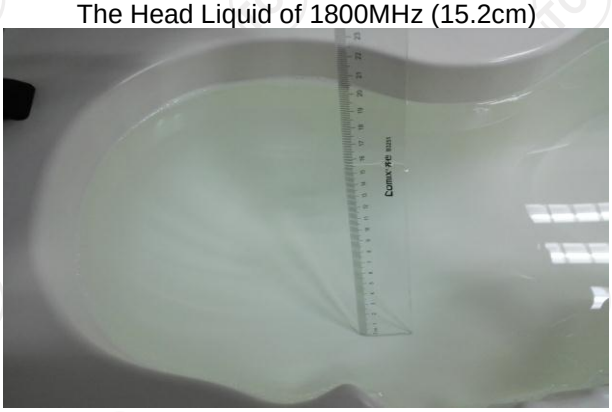
The Head Liquid of 835MHz (15.3cm)



The Head Liquid of 1800MHz (15.2cm)



The Head Liquid of 2600MHz (15.1cm)



The Body Liquid of 5000-6000MHz MHz (15.8cm)

Appendix B: Test Setup Photos

Head – Front(0 mm)

Head – Bottom(0 mm)

Body worn – Front(0 mm)

Body worn – Back(0 mm)

Hotspot Front (0mm)

Hotspot Back (0mm)

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Hotspot Left(0 mm)

Hotspot Right(0 mm)

Hotspot Bottom(0 mm)

Hotspot Top(0 mm)

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

Appendix C: Probe Calibration Certificate

COMOSAR E-FIELD Probe

COMOSAR E-Field Probe Calibration Report

Ref : ACR.180.7.22.BES.B

SHENZHEN TONGCE TESTIN LAB.

TCT TESTING INDUSTRIAL PAR, FUQIAO 5TH INDUSTRIAL ZONE, FUHAI STREET, BAO'AN DISTRICT, SHENZHEN, GUANGDONG, 518103, PEOPLE'S REPUBLIC OF CHINA

MVG COMOSAR DOSIMETRIC E-FIELD PROBE

SERIAL NO.: SN 25/22 EPGO375

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 06/29/2022

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

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).

COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.7.22.BES.B

	Name	Function	Date	Signature
Prepared by :	Jérôme Le Gall	Measurement Responsible	6/30/2022	
Checked & approved by:	Jérôme Luc	Technical Manager	6/30/2022	
Authorized by:	Yann Toutain	Laboratory Director	7/05/2022	Yann TOUTAIN 2022.07.05 09:30:00 +02'00'

	Customer Name
Distribution :	SHENHEN TONGCE TESTING LAB.

Issue	Name	Date	Modifications
A	Jérôme Le Gall	6/30/2022	Initial release

TABLE OF CONTENTS

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 25/22 EPGO375
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.197 MΩ Dipole 2: R2=0.230 MΩ Dipole 3: R3=0.208 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	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 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 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.

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 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°).

3.1 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:

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

where

$\mathrm{SAR}_{\mathrm{uncertainty}}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest *zoom-scan* 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;
$\Delta\mathrm{SAR}_{be}$	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 SAR uncertainty[%] 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 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 (%)**
Expanded uncertainty 95 % confidence level k = 2					14 %

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

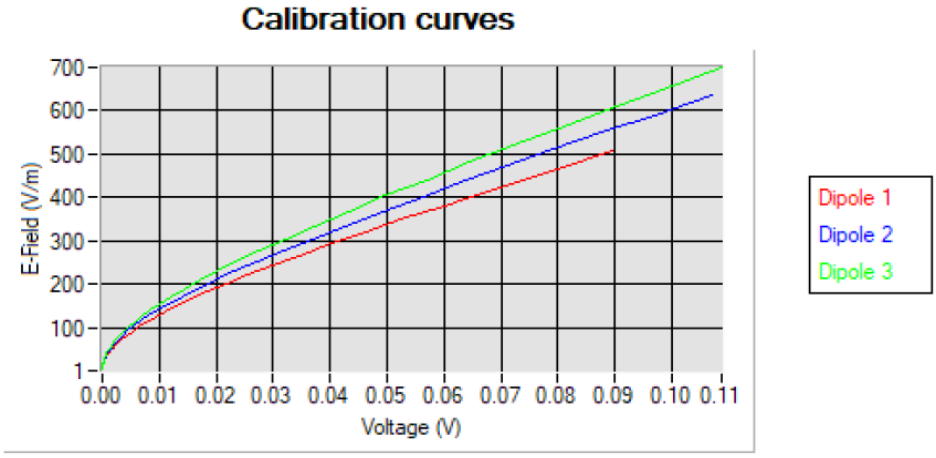
5.1 SENSITIVITY IN AIR

Normx dipole 1 (μV/(V/m)^2)	Normy dipole 2 (μV/(V/m)^2)	Normz dipole 3 (μV/(V/m)^2)
0.64	0.53	0.44

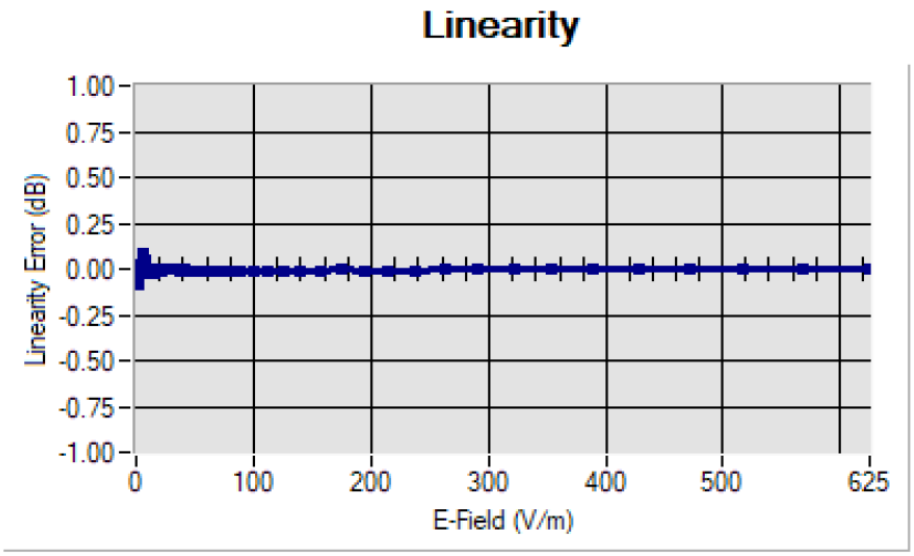
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
106	108	109

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

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



5.2 LINEARITY



Linearity:+/-1.94% (+/-0.09dB)

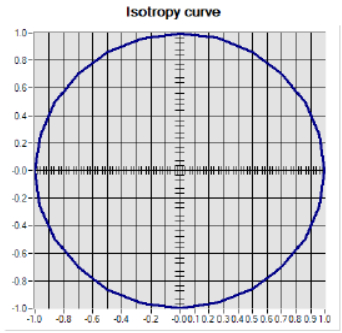
5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	ConvF
HL750	750	1.71
BL750	750	1.78
HL900	900	1.91
BL900	900	1.96
HL1800	1800	2.08
BL1800	1800	2.16
HL2000	2000	2.03
BL2000	2000	2.10
HL2450	2450	2.31
BL2450	2450	2.37
HL2600	2600	2.16
BL2600	2600	2.23
HL3500	3500	2.21
BL3500	3500	2.28
HL3700	3700	3.45
BL3700	3700	3.15
HL4600	4600	3.30
BL4600	4600	3.70
HL5200	5200	2.01
BL5200	5200	2.08
HL5600	5600	2.07
BL5600	5600	2.12
HL5800	5800	2.06
BL5800	5800	2.13

LOWER DETECTION LIMIT: 7mW/kg

5.4 ISOTROPY

HL1800 MHz



Isotropy:+/-0.41% (+/-0.02dB)

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2022
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2019	11/2022
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	MVG	SN 32/16 WG4_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G900_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG6_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG8_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800B_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800H_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG10_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_3G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.

Liquid transition	MVG	SN 32/16 WGLIQ_5G000_1	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

Dielectric Probe Calibration Report

Ref : ACR.138.4.33.SATU.A

SHENZHEN TCT TESTING TECHNOLOGY CO., LTD
2101&2201, ZHENCHANG FACTORY, RENSHAN INDUSTRIAL ZONE, FUHAI SUBDISTRICT, BAOAN DISTRICT, SHENZHEN, GUANGDONG, 518103, PEOPLES REPUBLIC OF CHINA

MVG COMOSAR DOSIMETRIC E-FIELD PROBE

FREQUENCY: 0.3-6 GHZ
SERIAL NO.: SN 19/15 OCPG 71

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

ACCREDITED Calibration CERT #2246-02

Calibration Date: 06/05/2021

Summary:

This document presents the method and results from an accredited Dielectric Probe calibration performed in MVG USA using the LIMESAR test bench. All calibration results are traceable to national metrology institutions.

SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref: ACR.138.4.33..SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	06/05/2021	
Checked by :	Jérôme LUC	Product Manager	06/05/2021	
Approved by :	Kim RUTKOWSKI	Quality Manager	06/05/2021	

	Customer Name
Distribution :	SHENZHEN TONGCE TESTING LAB

Issue	Date	Modifications
A	06/05/2021	Initial release

TABLE OF CONTENTS

1 INTRODUCTION

This document contains a summary of the suggested methods and requirements set forth by the IEEE 1528 and CEI/IEC 62209 standards for liquid permittivity measurements 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	LIMESAR DIELECTRIC PROBE
Manufacturer	MVG
Model	SCLMP
Serial Number	SN 19/15 OCPG 71
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's Dielectric Probes are built in accordance to the IEEE 1528 and CEI/IEC 62209 standards. The product is designed for use with the LIMESAR test bench only.

Figure 1 – *MVG LIMESAR Dielectric Probe*

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209-1 & 2 standards outline techniques for dielectric property measurements. The LIMESAR test bench employs one of the methods outlined in the standards, using a contact probe or open-ended coaxial transmission-line probe and vector network analyzer. The standards recommend the measurement of two reference materials that have well established and stable dielectric properties to validate the system, one for the calibration and one for checking the calibration. The LIMESAR test bench uses De-ionized water as the reference for the calibration and either DMS or Methanol as the reference for checking the calibration. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 LIQUID PERMITTIVITY MEASUREMENTS

The permittivity of a liquid with well established dielectric properties was measured and the measurement results compared to the values provided in the fore mentioned standards.

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 DIELECTRIC PERMITTIVITY MEASUREMENT

The following uncertainties apply to the Dielectric Permittivity measurement:

Uncertainty analysis of Permittivity Measurement					
ERROR SOURCES	**Uncertainty value (+/-%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (+/-%)**
Repeatability (n repeats, mid-band)	4.00%	N	1	1	4.000%
Deviation from reference liquid	5.00%	R	√3	1	2.887%
Network analyser-drift, linearity	2.00%	R	√3	1	1.155%
Test-port cable variations	0.00%	U	√2	1	0.000%
Combined standard uncertainty					5.066%
Expanded uncertainty (confidence level of 95%, k = 2)					10.0%

Uncertainty analysis of Conductivity Measurement					
ERROR SOURCES	**Uncertainty value (+/-%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (+/-%)**
Repeatability (n repeats, mid-band)	3.50%	N	1	1	3.500%
Deviation from reference liquid	3.00%	R	√3	1	1.732%
Network analyser-drift, linearity	2.00%	R	√3	1	1.155%
Test-port cable variations	0.00%	U	√2	1	0.000%
Combined standard uncertainty					4.072%
Expanded uncertainty (confidence level of 95%, k = 2)					8.1%

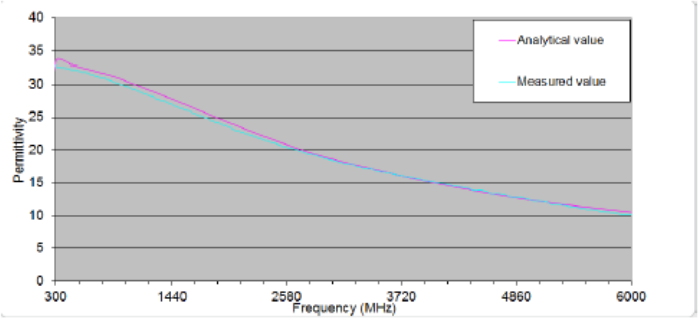
6 CALIBRATION MEASUREMENT RESULTS

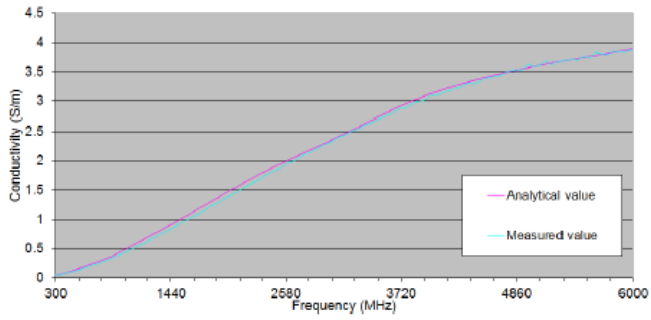
Measurement Condition

Software	LIMESAR
Liquid Temperature	21°C
Lab Temperature	21°C
Lab Humidity	44%

6.1 LIQUID PERMITTIVITY MEASUREMENT

A liquid of known characteristics (methanol at 20°C) is measured with the probe and the results (complex permittivity ε'+jε") are compared with the well-known theoretical values for this liquid.





7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
LIMESAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2021	02/2024
Methanol CAS 67-56-1	Alpha Aesar	Lot D13W011	Validated. No cal required.	Validated. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	09/2021	09/2022

Appendix D: Dipole Calibration Report

SID 750

SAR Reference Dipole Calibration Report

Ref : ACR.156.3.15.SATU.A

SHENZHEN TCT TESTING TECHNOLOGY CO., LTD
2101&2201, ZHENCHANG FACTORY, RENSHAN INDUSTRIAL ZONE, FUHAI SUBDISTRICT, BAOAN DISTRICT, SHENZHEN, GUANGDONG, 518103, PEOPLES REPUBLIC OF CHINA

COMOSAR REFERENCE DIPOLE
FREQUENCY: 750 MHZ
SERIAL NO.: SN 16/15 DIP 0G750-368

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

ACCREDITED Calibration CERT #2246-02

Calibration Date: 06/05/2021

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.156.3.15.SATU.A

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	06/05/2021	
Checked by :	Jérôme LUC	Product Manager	06/05/2021	
Approved by :	Kim RUTKOWSKI	Quality Manager	06/05/2021	

	Customer Name
Distribution :	SHENZHEN TONGC TESTING LAB

Issue	*Date*	*Modifications*
A	06/05/2021	Initial release

TABLE OF CONTENTS

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 16/15 DIP 0G750-368
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*