

11. System Check Results

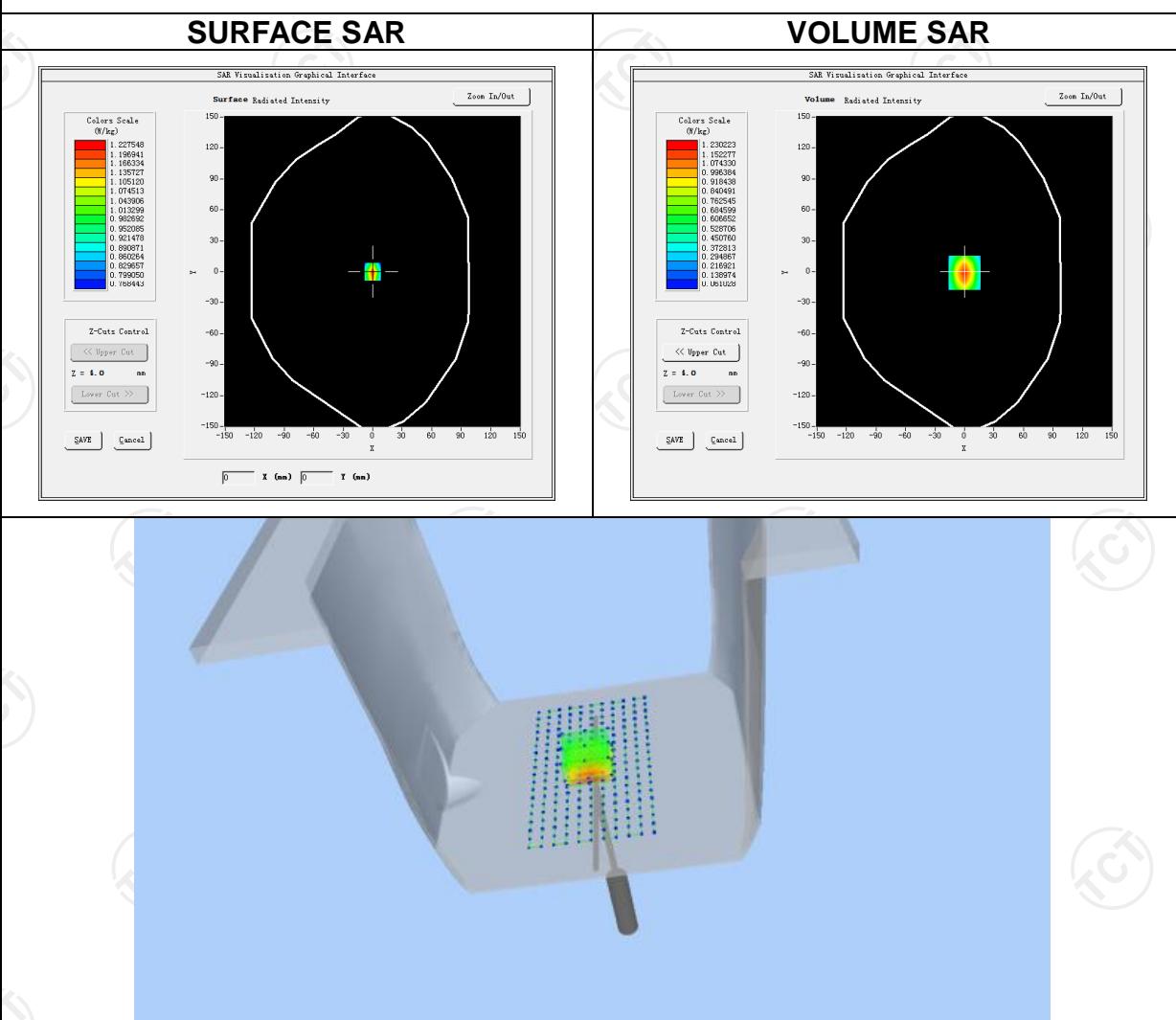
Date of measurement: 05/15/2019 Test mode: 835 (Head)

Product Description: Validation

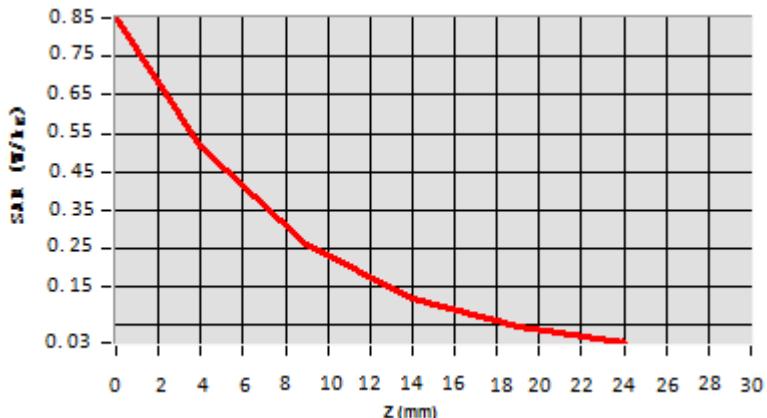
Dipole Model: SID835

E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	5.05
Frequency (MHz)	835.000000
Relative permittivity (real part)	41.417760
Relative permittivity (imaginary part)	18.129852
Conductivity (S/m)	0.874923
Variation (%)	-0.090000
SAR 10g (W/Kg)	0.570250
SAR 1g (W/Kg)	0.886135



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.8625	0.5302	0.2594	0.1302	0.1025

**Hot spot position**

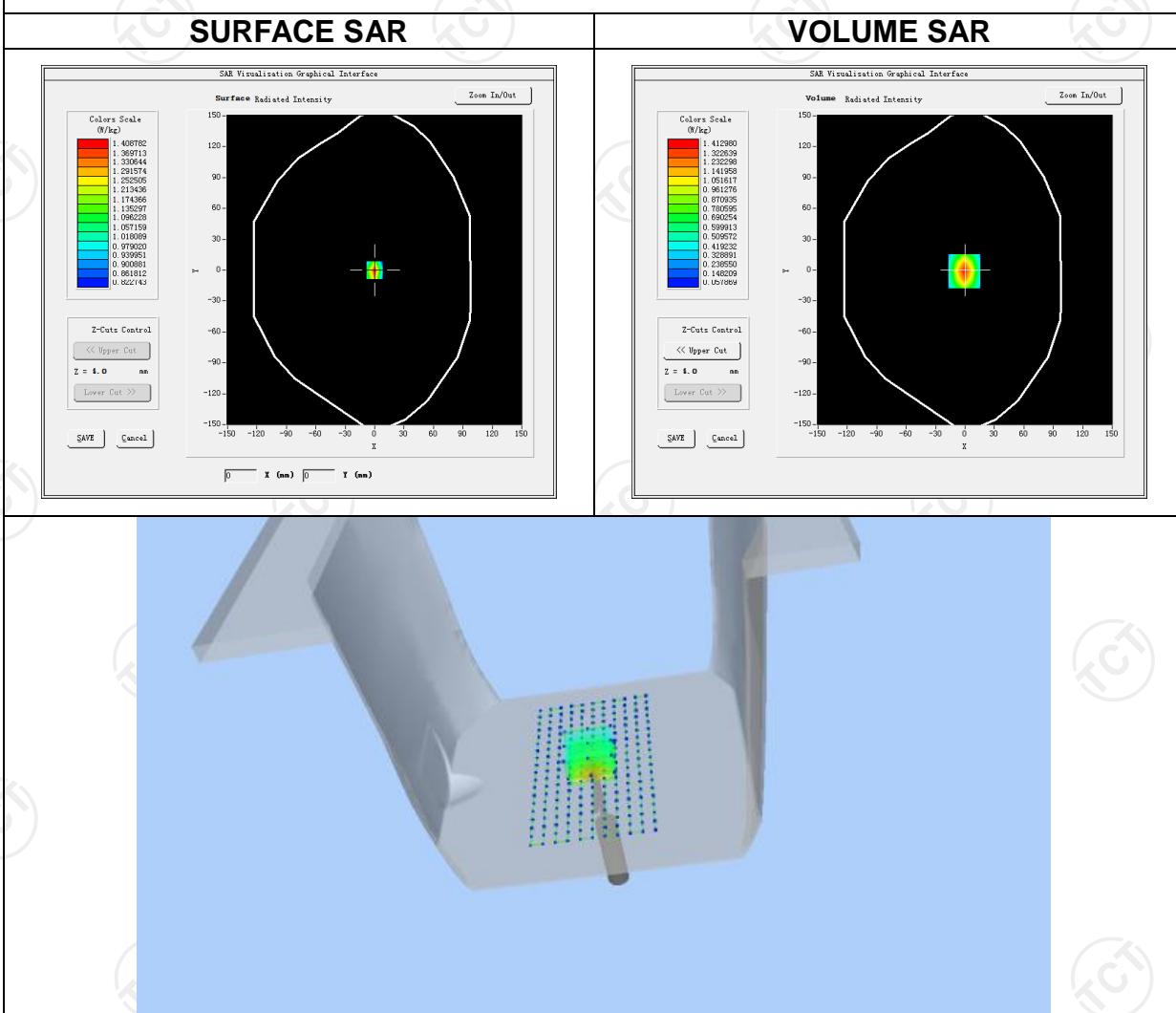
Date of measurement: 05/15/2019 Test mode: 835 (Body)

Product Description: Validation

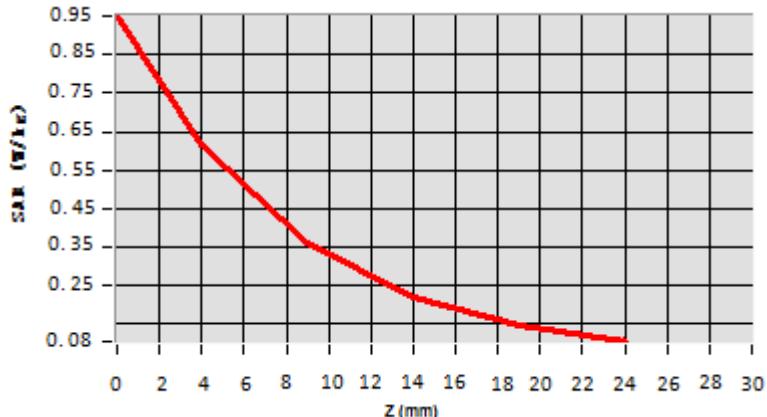
Dipole Model: SID835

E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	5.22
Frequency (MHz)	835.000000
Relative permittivity (real part)	55.242077
Relative permittivity (imaginary part)	21.378187
Conductivity (S/m)	0.938883
Variation (%)	-0.150000
SAR 10g (W/Kg)	0.633123
SAR 1g (W/Kg)	0.949446



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.9625	0.6022	0.3594	0.2202	0.0725

**Hot spot position**

Date of measurement: 05/22/2019 Test mode: 1800MHz (Head)

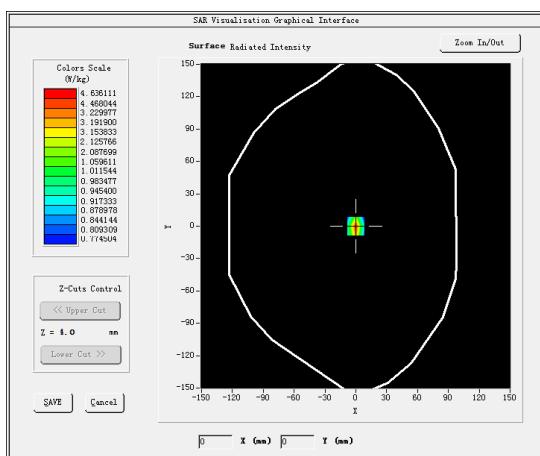
Product Description: Validation

Dipole Model: SID1800

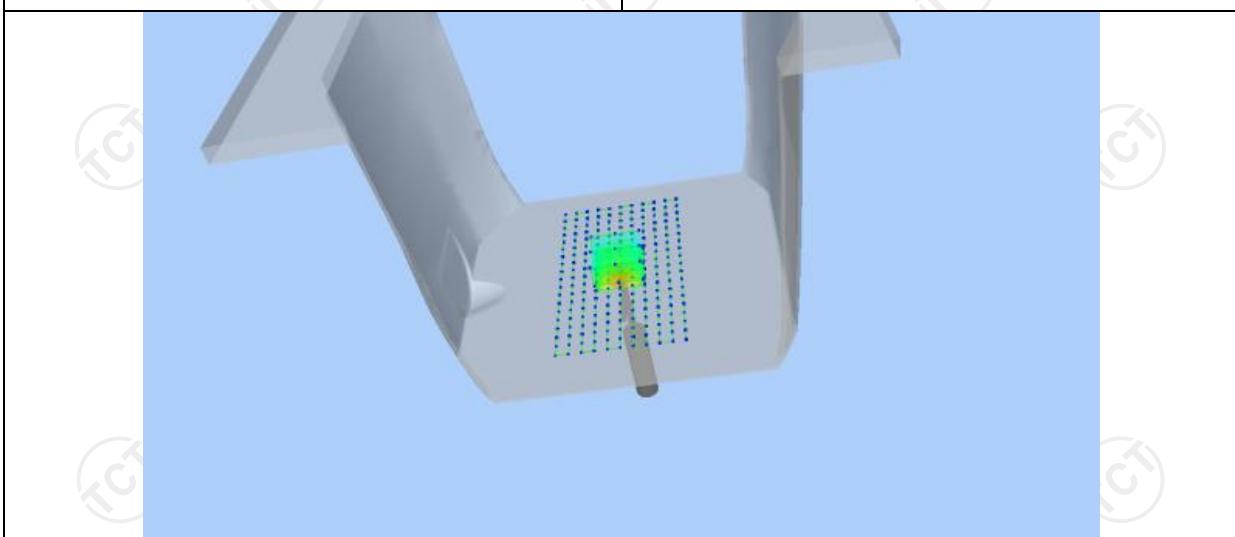
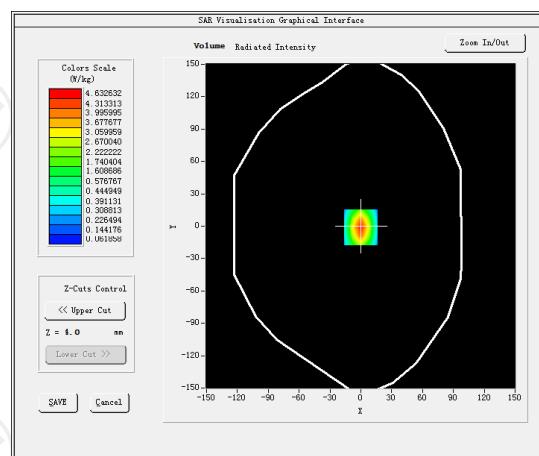
E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	5.05
Frequency (MHz)	1800.000000
Relative permittivity (real part)	39.070000
Relative permittivity (imaginary part)	14.000000
Conductivity (S/m)	1.38000
Variation (%)	1.250000
SAR 10g (W/Kg)	2.201458
SAR 1g (W/Kg)	3.752497

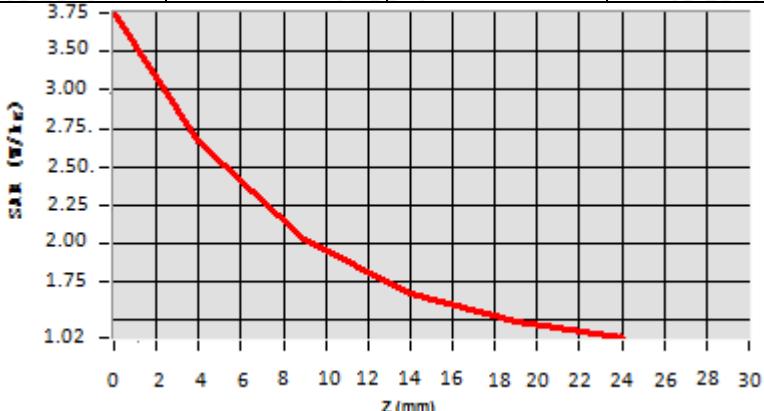
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	3.7625	2.6254	2.0245	1.6254	1.0214

**Hot spot position**

Date of measurement: 05/22/2019 Test mode: 1800MHz (Body)

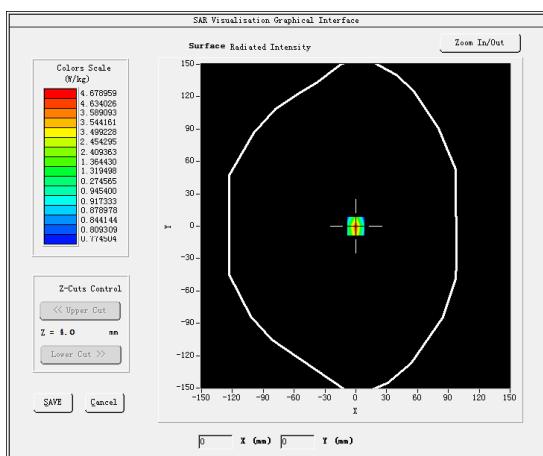
Product Description: Validation

Dipole Model: SID1800

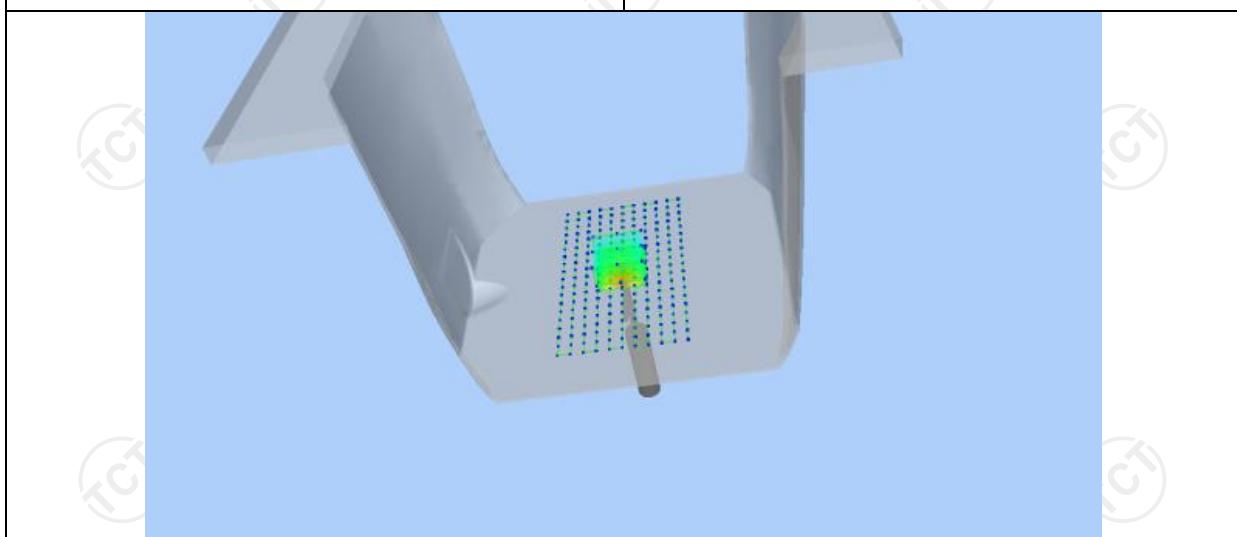
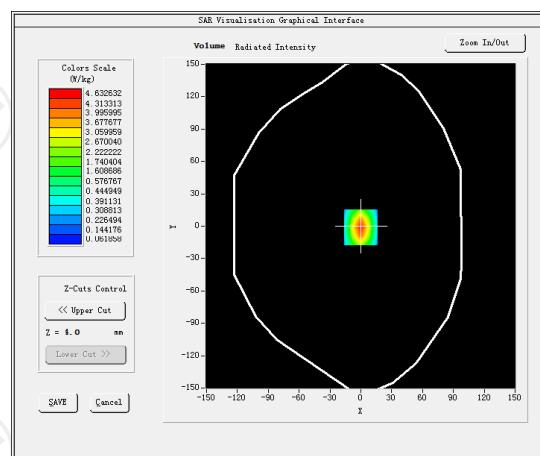
E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	5.05
Frequency (MHz)	1800.000000
Relative permittivity (real part)	53.292699
Relative permittivity (imaginary part)	15.200000
Conductivity (S/m)	1.530000
Variation (%)	3.050000
SAR 10g (W/Kg)	2.053687
SAR 1g (W/Kg)	3.782547

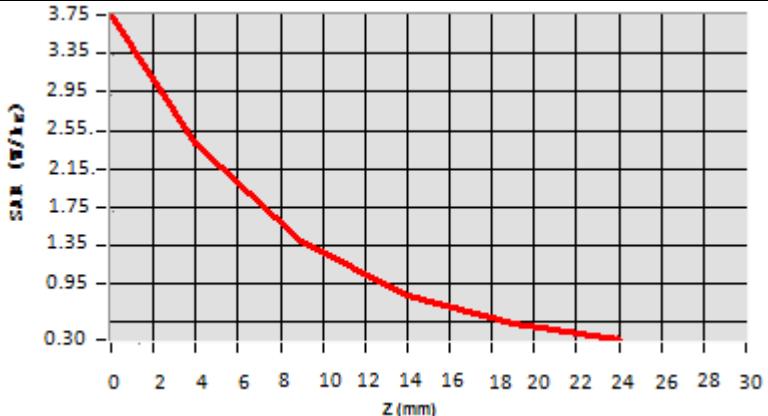
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	3.7545	2.4524	1.3520	0.8214	0.5525

**Hot spot position**

Date of measurement: 05/27/2019 Test mode: 1900MHz (Head)

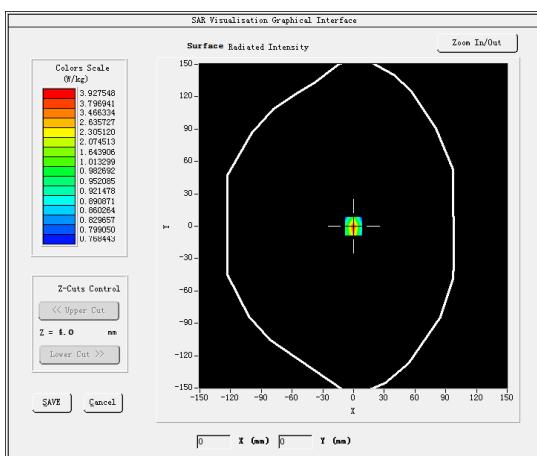
Product Description: Validation

Dipole Model: SID1900

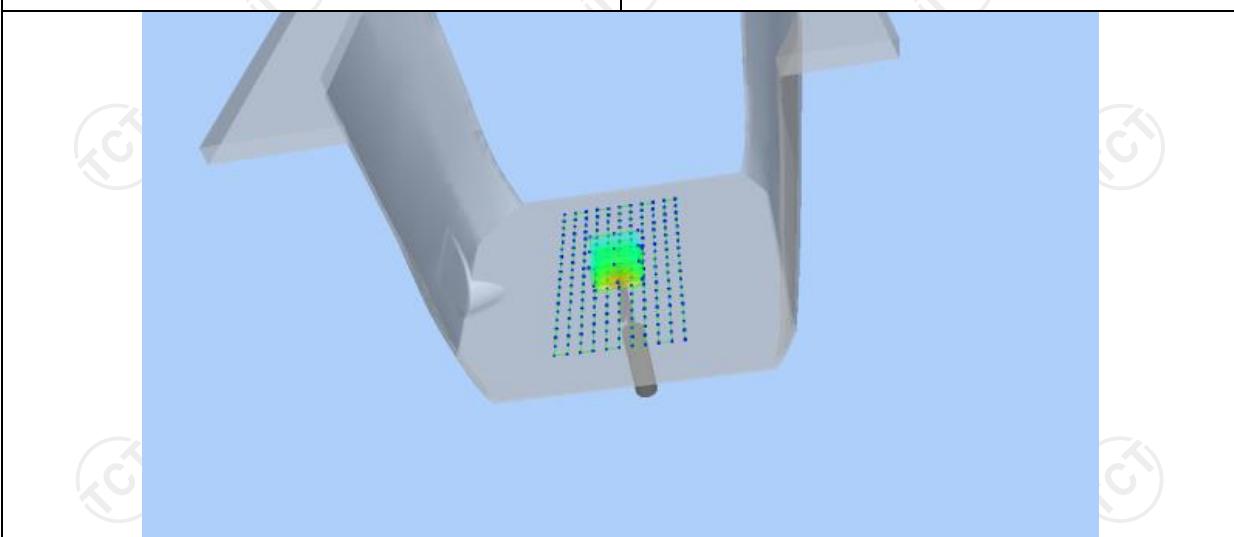
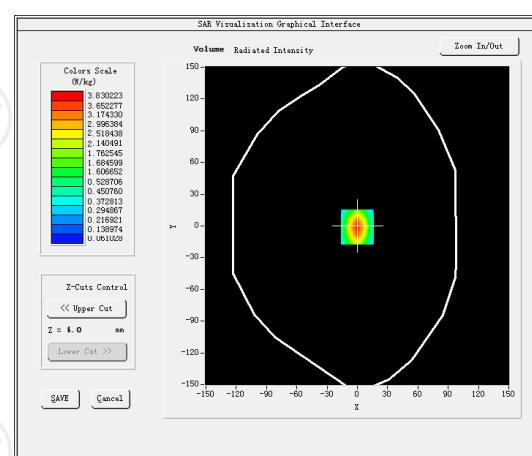
E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	4.86
Frequency (MHz)	1900.000000
Relative permittivity (real part)	39.076721
Relative permittivity (imaginary part)	12.607061
Conductivity (S/m)	1.367609
Variation (%)	-0.910000
SAR 10g (W/Kg)	1.899324
SAR 1g (W/Kg)	3.576354

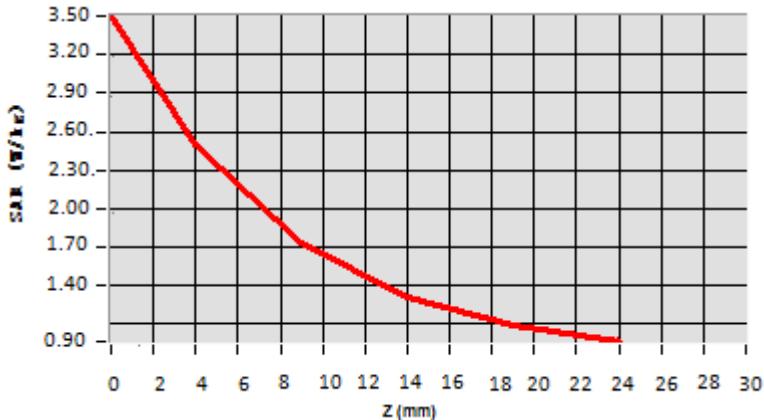
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	3.5325	2.5687	1.7025	1.3025	0.1125

**Hot spot position**

Date of measurement: 05/27/2019 Test mode: 1900MHz (Body)

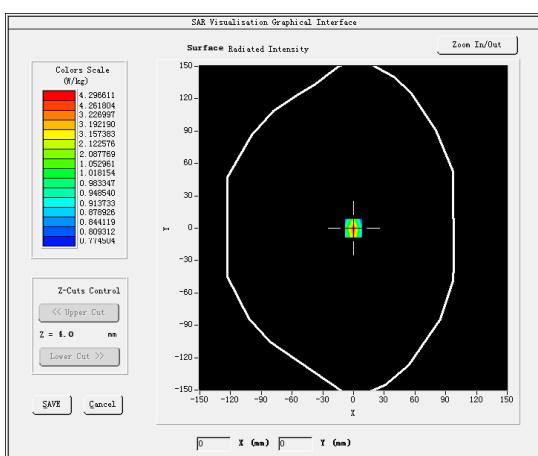
Product Description: Validation

Dipole Model: SID1900

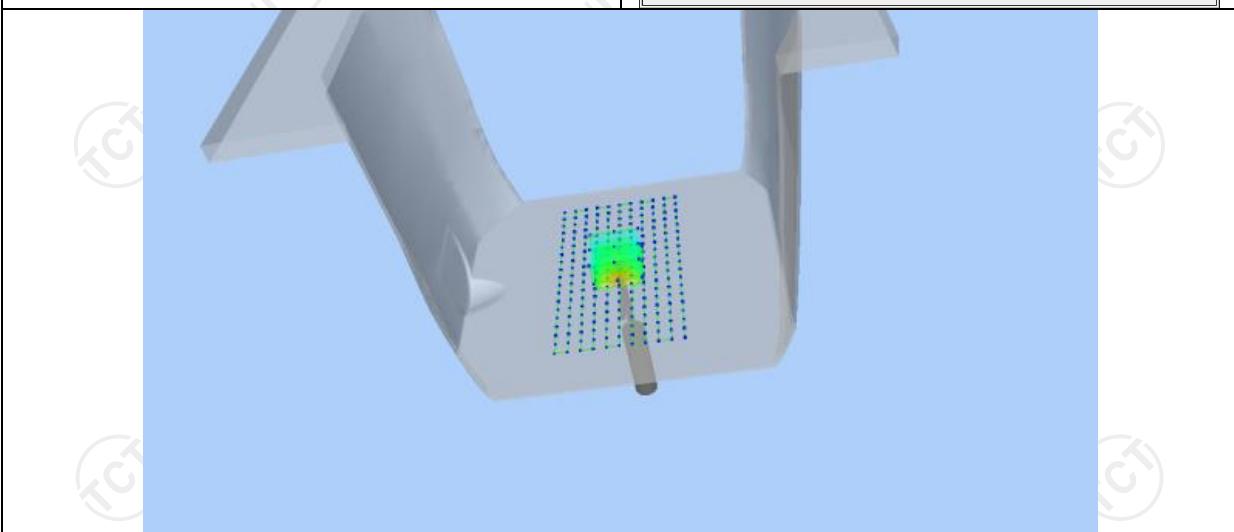
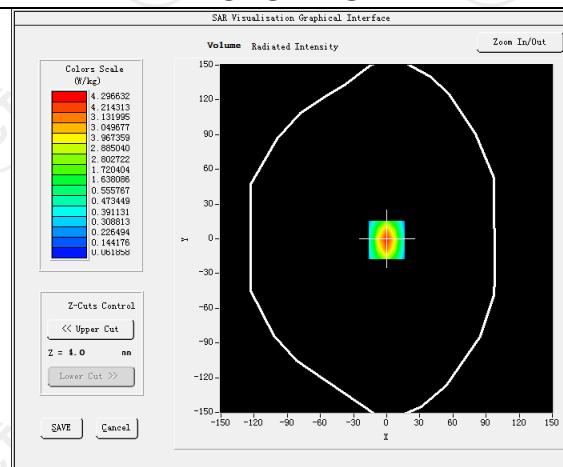
E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	5.05
Frequency (MHz)	1900.000000
Relative permittivity (real part)	53.309999
Relative permittivity (imaginary part)	14.329440
Conductivity (S/m)	1.510354
Variation (%)	1.250000
SAR 10g (W/Kg)	1.994255
SAR 1g (W/Kg)	3.766112

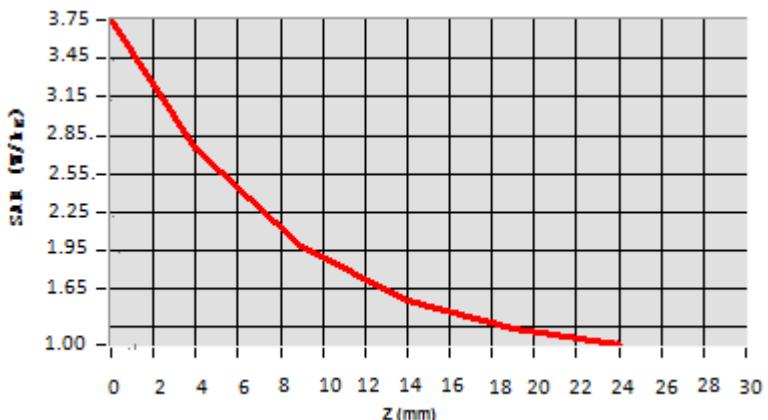
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	3.7752	2.7154	1.9525	1.5694	0.9014

**Hot spot position**

Date of measurement: 05/29/2019 Test mode: 2450MHz (Head)

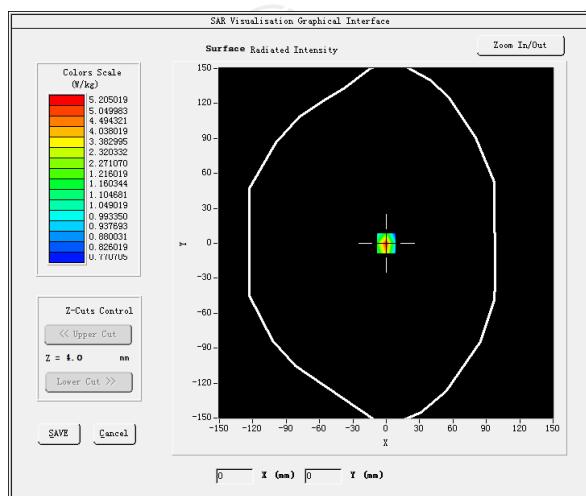
Product Description: Validation

Dipole Model: SID2450

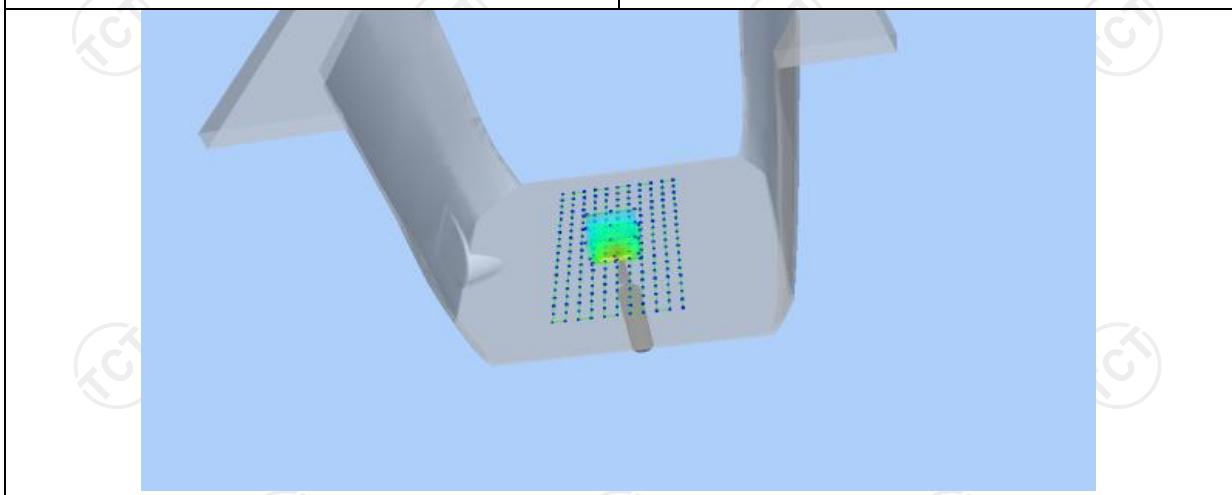
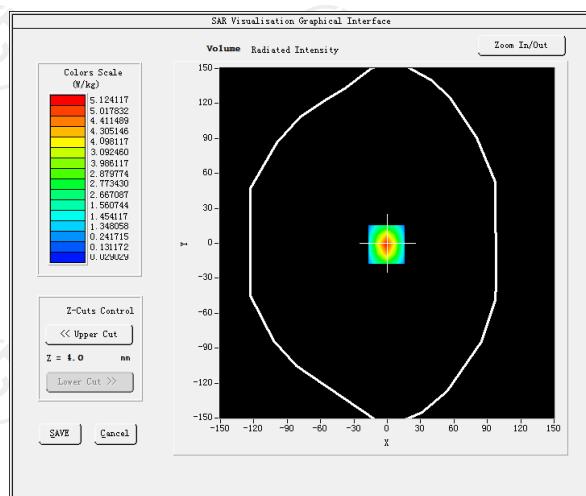
E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	4.21
Frequency (MHz)	2450.000000
Relative permittivity (real part)	37.821613
Relative permittivity (imaginary part)	13.546980
Conductivity (S/m)	1.834111
Variation (%)	-0.470000
SAR 10g (W/Kg)	2.364445
SAR 1g (W/Kg)	4.994244

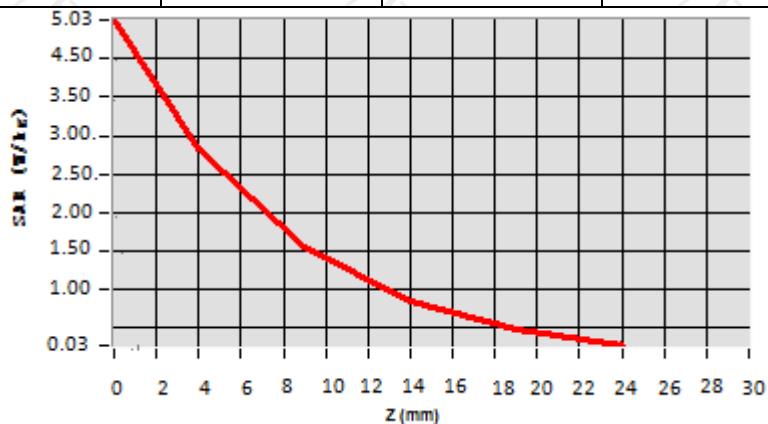
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.0262	2.7584	1.5026	0.8252	0.4125

**Hot spot position**

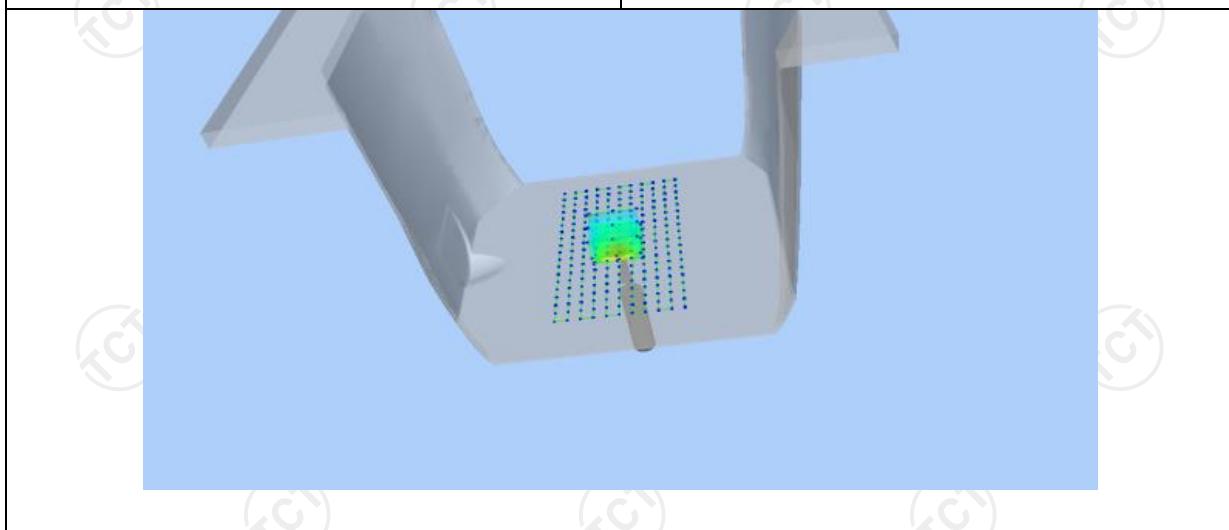
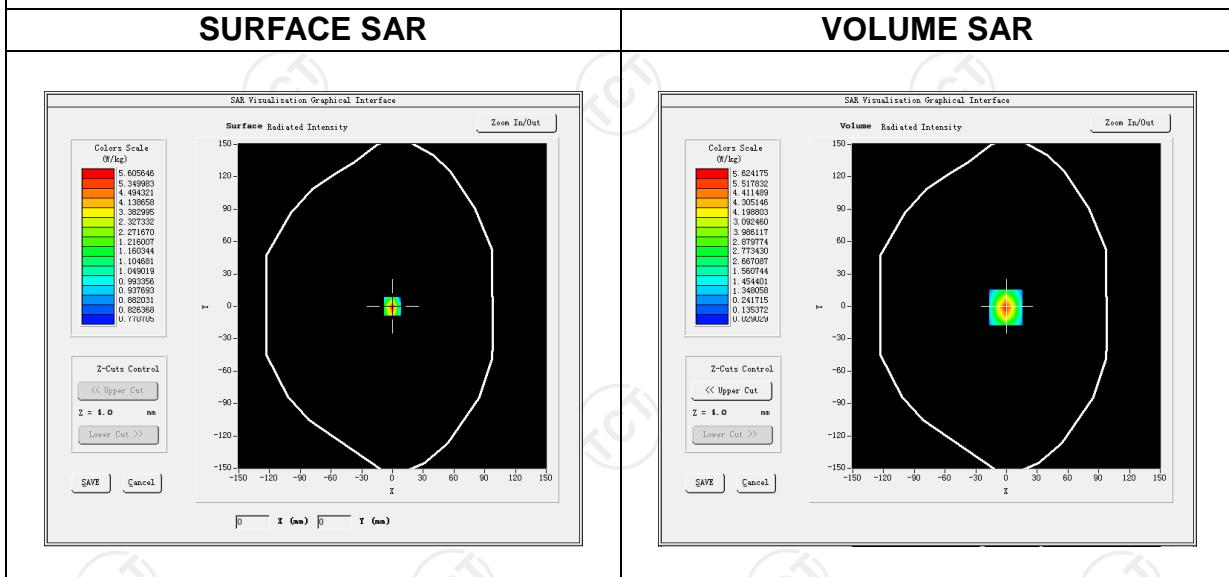
Date of measurement: 05/29/2019 Test mode: 2450MHz (Body)

Product Description: Validation

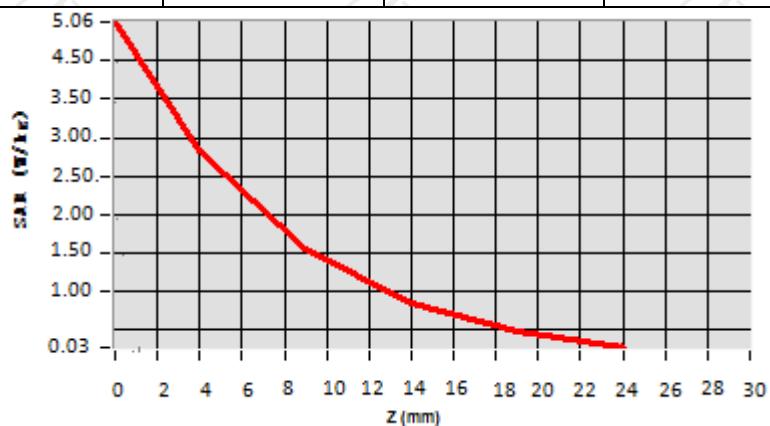
Dipole Model: SID2450

E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	4.36
Frequency (MHz)	2450.000000
Relative permittivity (real part)	54.616199
Relative permittivity (imaginary part)	14.930150
Conductivity (S/m)	2.012159
Variation (%)	-0.230000
SAR 10g (W/Kg)	2.416669
SAR 1g (W/Kg)	5.066368



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.0622	2.7984	1.5251	0.8352	0.4200

**Hot spot position**

Date of measurement: 05/31/2019 Test mode: 2600MHz (Head)

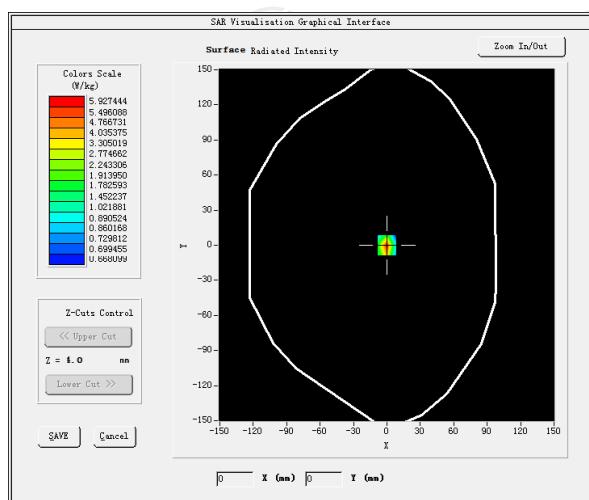
Product Description: Validation

Dipole Model: SID2600

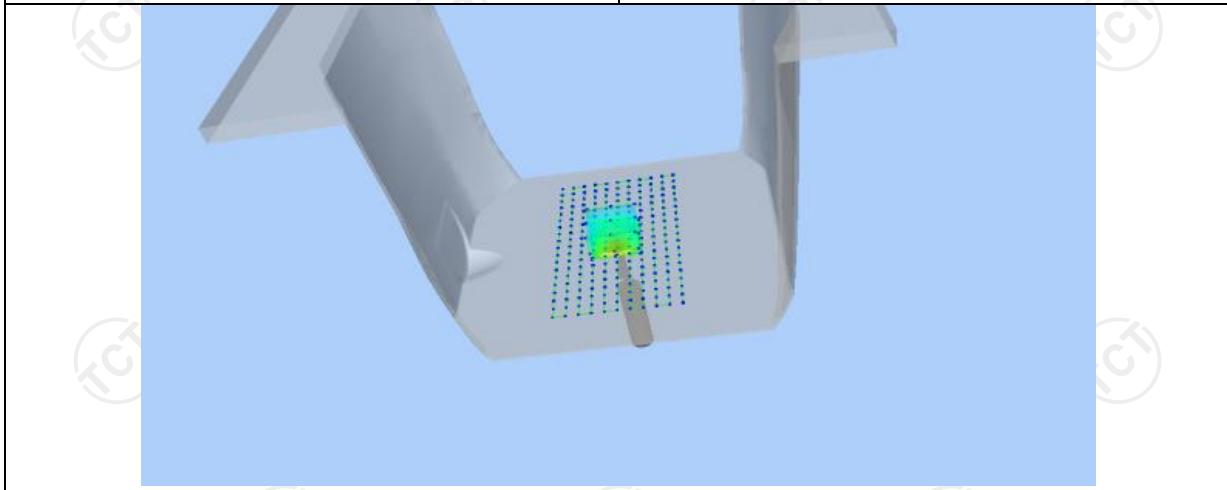
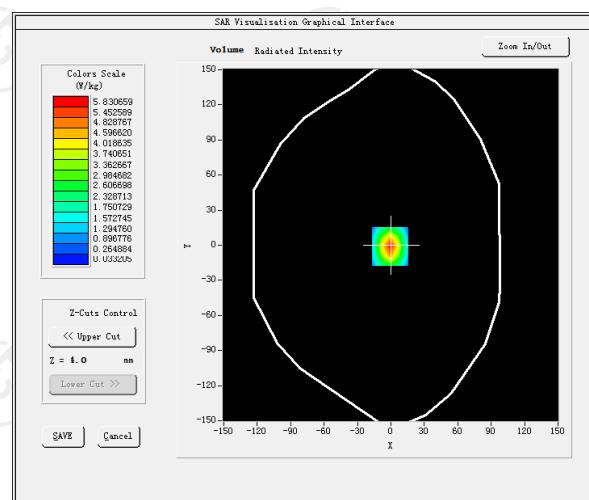
E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	4.36
Frequency (MHz)	2535.000000
Relative permittivity (real part)	38.853477
Relative permittivity (imaginary part)	13.545489
Conductivity (S/m)	1.922567
Variation (%)	-1.360000
SAR 10g (W/Kg)	2.430127
SAR 1g (W/Kg)	5.413744

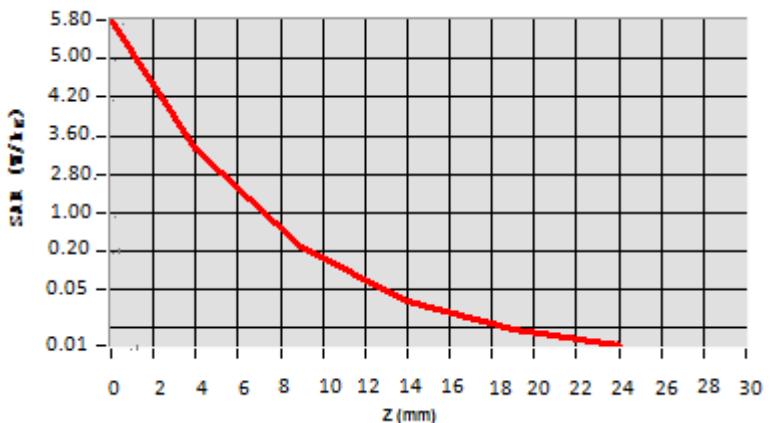
SURFACE SAR



VOLUME SAR



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.7893	3.2375	0.2098	0.0387	0.0249

**Hot spot position**

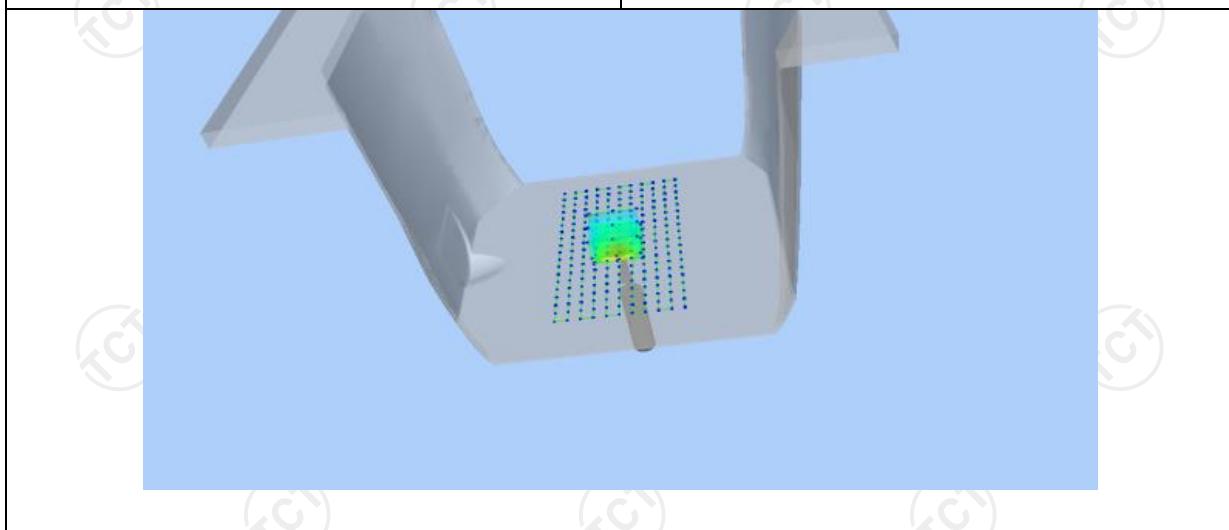
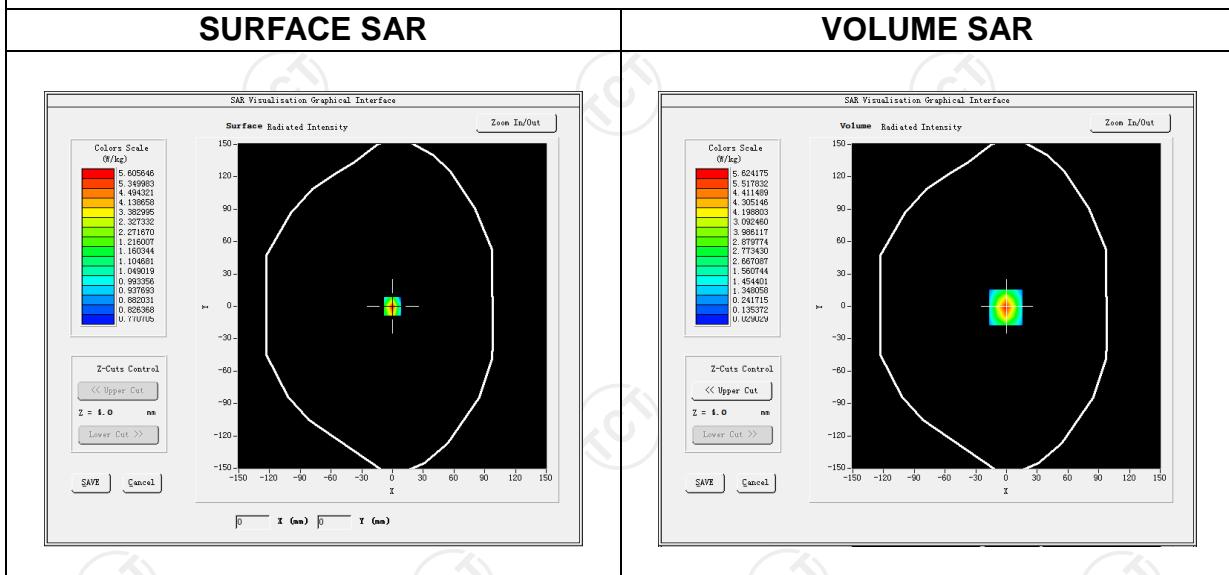
Date of measurement: 05/31/2019 Test mode: 2600MHz (Body)

Product Description: Validation

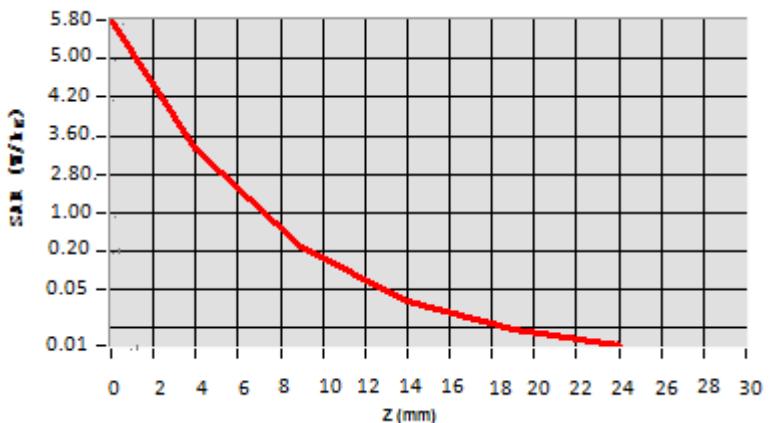
Dipole Model: SID2600

E-Field Probe: SSE5 (SN 07/15 EP248)

Phantom	Validation plane
Input Power	100mW
Crest Factor	1.0
Probe Conversion factor	4.50
Frequency (MHz)	2535.000000
Relative permittivity (real part)	52.013887
Relative permittivity (imaginary part)	14.935214
Conductivity (S/m)	2.114821
Variation (%)	-1.800000
SAR 10g (W/Kg)	2.382177
SAR 1g (W/Kg)	5.365098



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	5.7721	3.2210	0.1937	0.0321	0.0203

**Hot spot position**

12. SAR Test Data

GSM850

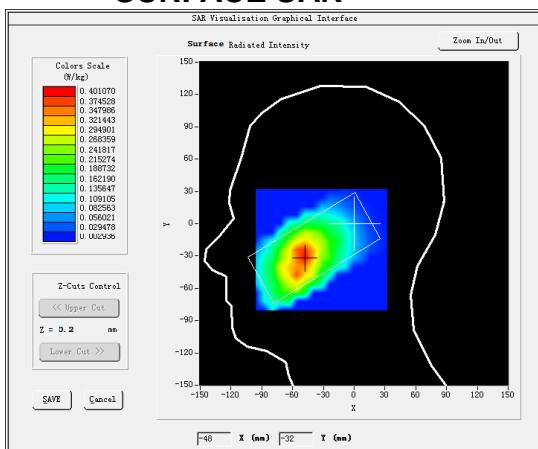
MEASUREMENT 1

Lower Band SAR (Channel 128):

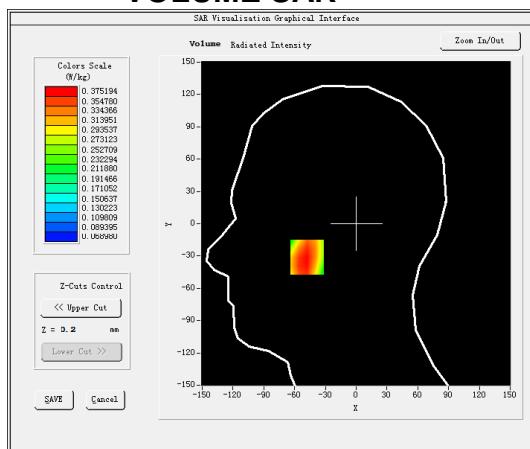
Date: 05/15/2019

Frequency (MHz)	824.200000
Relative permittivity (real part)	41.432883
Relative permittivity (imaginary part)	18.129634
Conductivity (S/m)	0.857241
Variation (%)	-1.250000
Crest Factor:	8.3
Probe Conversion factor	5.50
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>GSM850(voice)</u>

SURFACE SAR



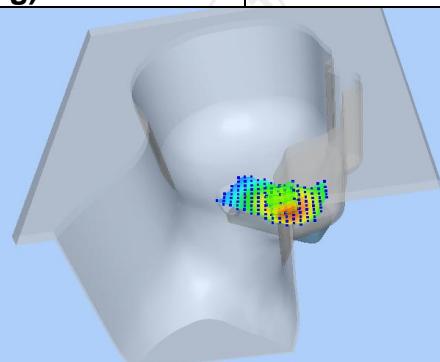
VOLUME SAR

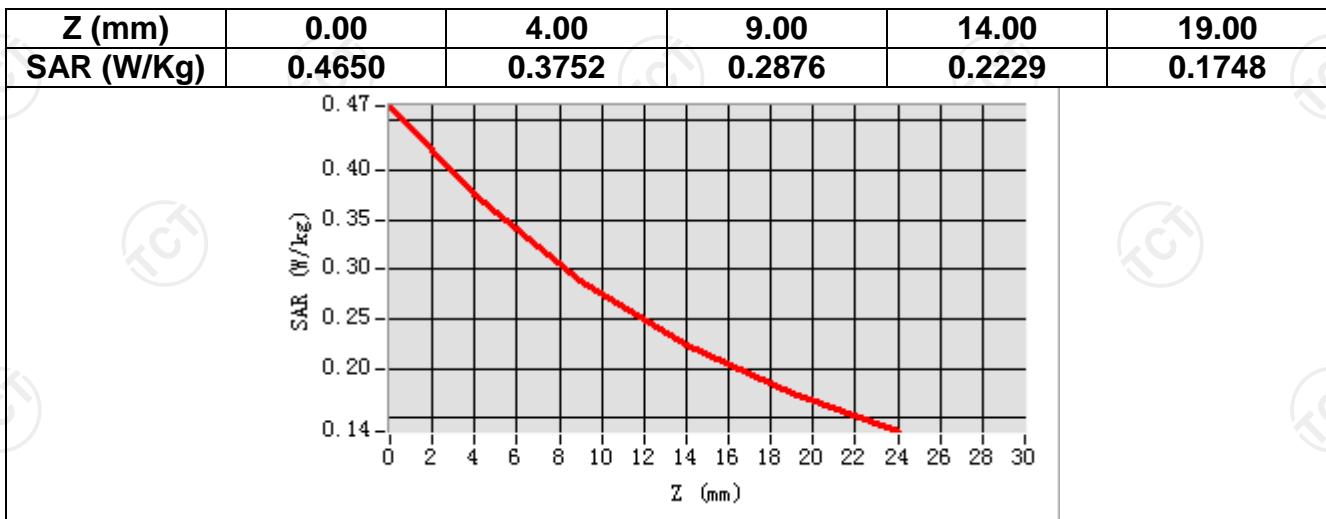
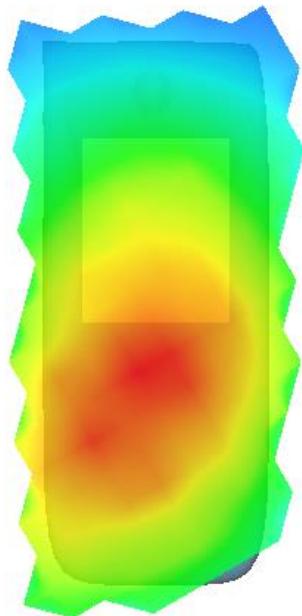


Maximum location: X=-48.00, Y=-31.00 SAR Peak: 0.47 W/kg

SAR 10g (W/Kg)

SAR 1g (W/Kg)



**Hot spot position**

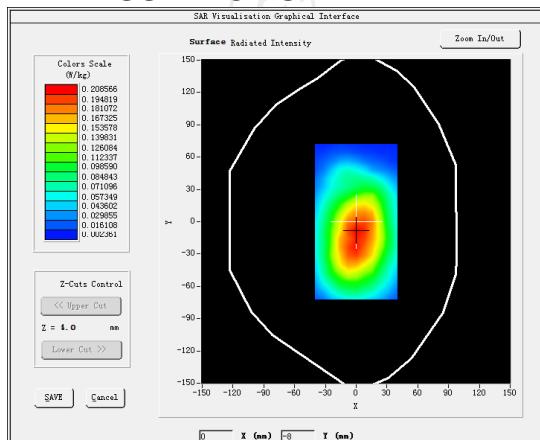
MEASUREMENT 2

Lower Band SAR (Channel 128):

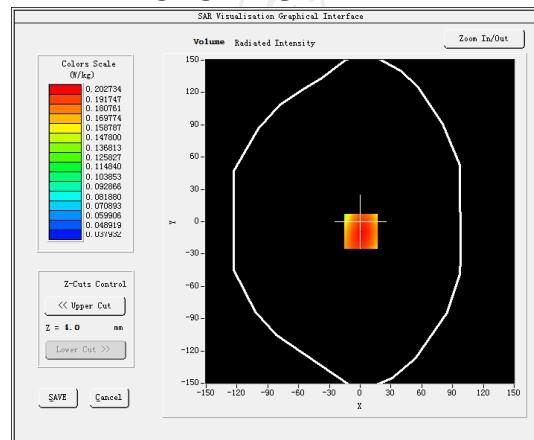
Date: 05/15/2019

Frequency (MHz)	824.200000
Relative permittivity (real part)	55.262457
Relative permittivity (imaginary part)	18.128360
Conductivity (S/m)	0.932668
Variation (%)	-2.270000
Crest Factor:	8.3
Probe Conversion factor	5.65
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h= 5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>GSM850(Voice)</u>

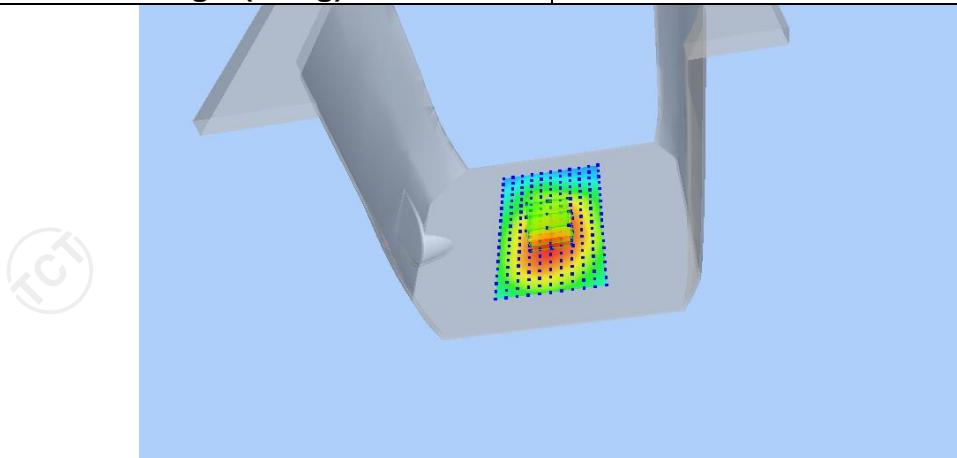
SURFACE SAR

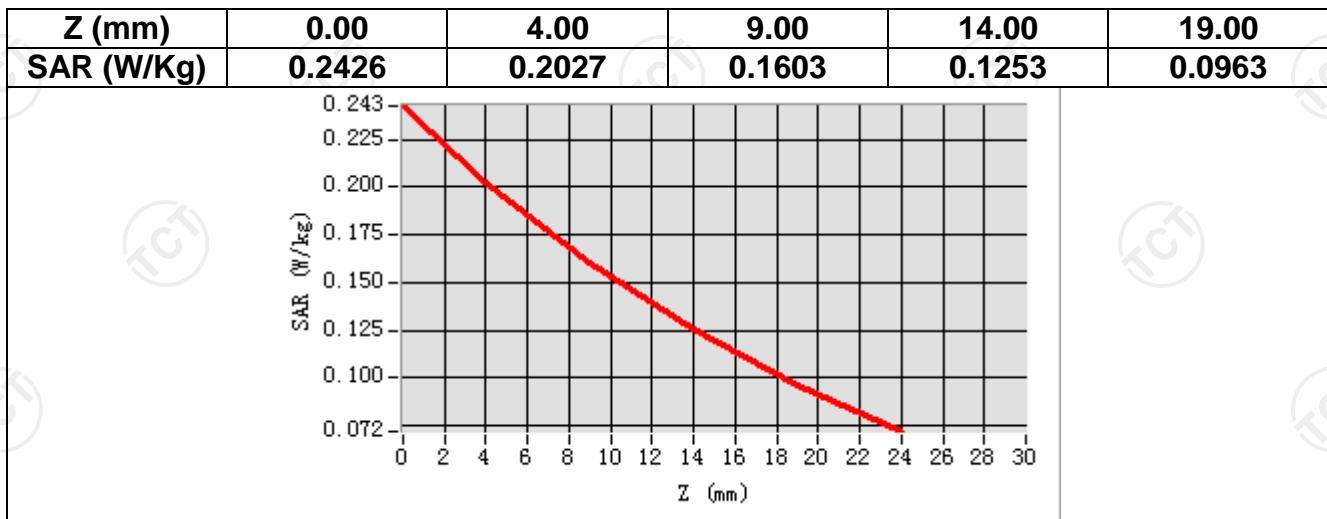
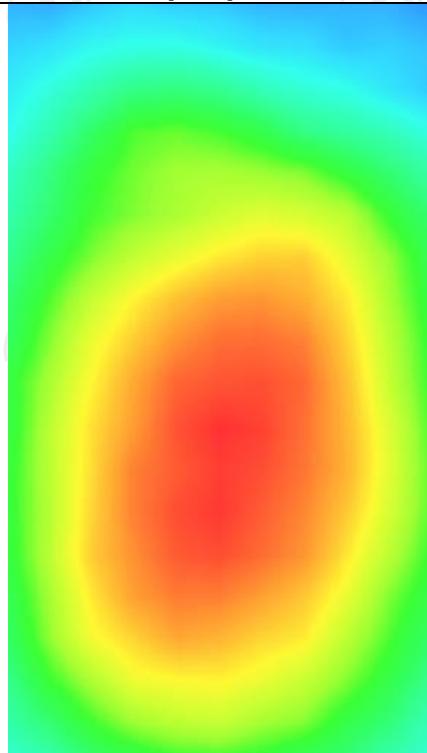


VOLUME SAR


Maximum location: X=1.00, Y=-9.00 SAR Peak: 0.24 W/kg

SAR 10g (W/Kg)	0.150553
SAR 1g (W/Kg)	0.203506

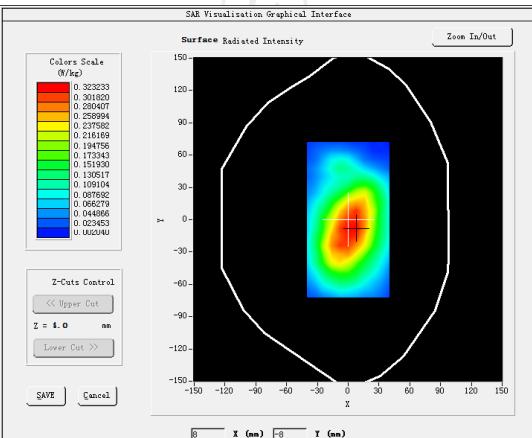
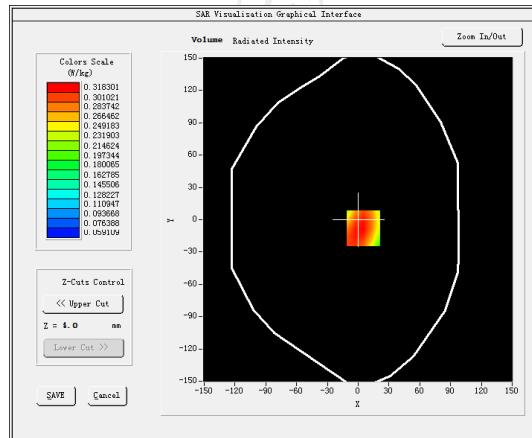


**Hot spot position**

MEASUREMENT 3

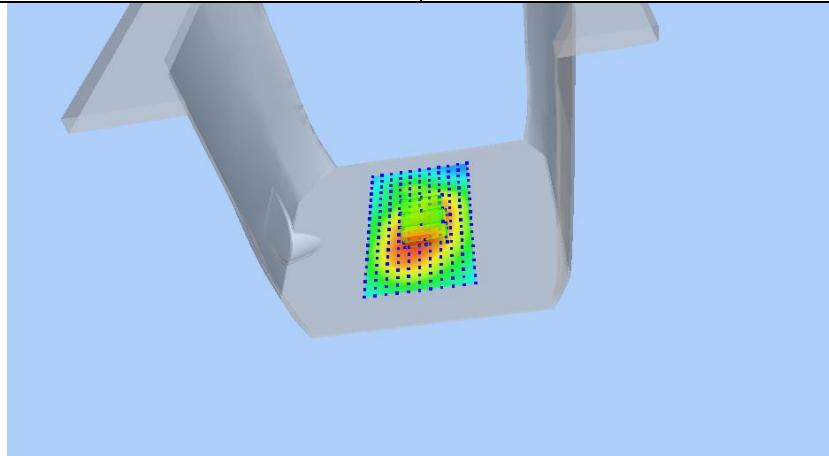
Higher Band SAR (Channel 251):

Date: 05/15/2019

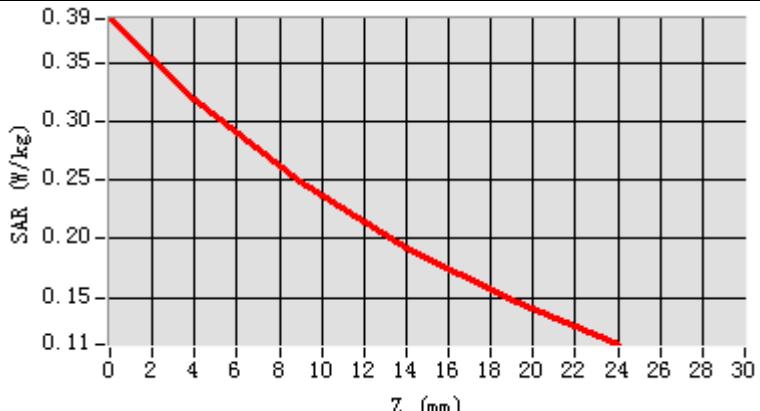
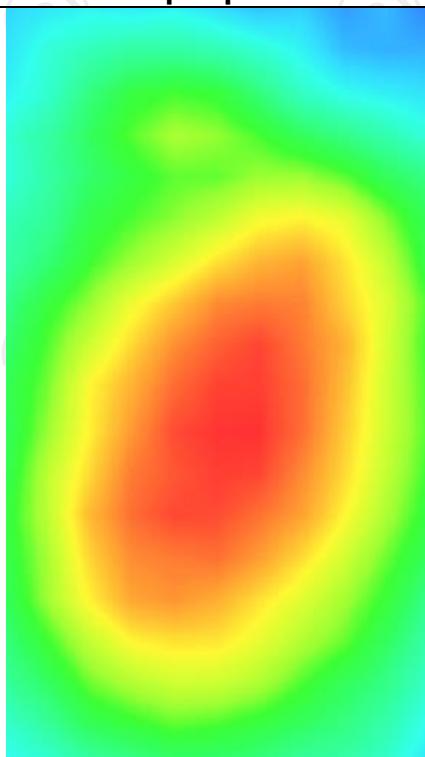
Frequency (MHz)	848.800000
Relative permittivity (real part)	55.212927
Relative permittivity (imaginary part)	21.378266
Conductivity (S/m)	0.971230
Variation (%)	-0.750000
Crest Factor:	2.0
Probe Conversion factor	5.65
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>GSM850(GPRS 4slot)</u>
SURFACE SAR	VOLUME SAR
	

Maximum location: X=5.00, Y=-8.00 SAR Peak: 0.41 W/kg

SAR 10g (W/Kg)	0.231636
SAR 1g (W/Kg)	0.321785



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.3867	0.3183	0.2478	0.1917	0.1470

**Hot spot position**

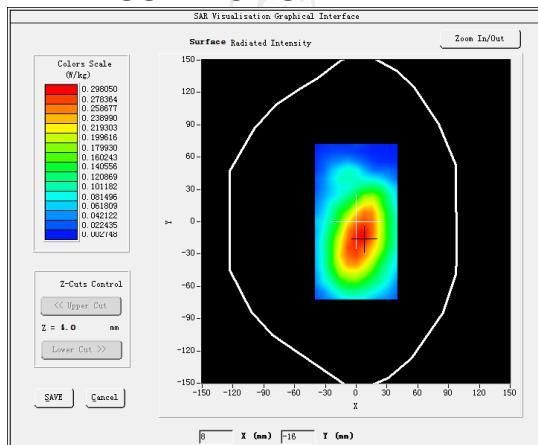
MEASUREMENT 4

Higher Band SAR (Channel 251):

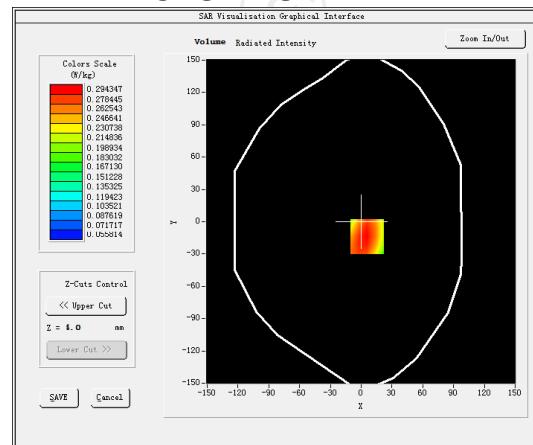
Date: 05/15/2019

Frequency (MHz)	848.800000
Relative permittivity (real part)	55.212927
Relative permittivity (imaginary part)	21.378266
Conductivity (S/m)	0.971230
Variation (%)	1.570000
Crest Factor:	2.0
Probe Conversion factor	5.65
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h= 5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>GSM850(GPRS 4slot hotspot)</u>

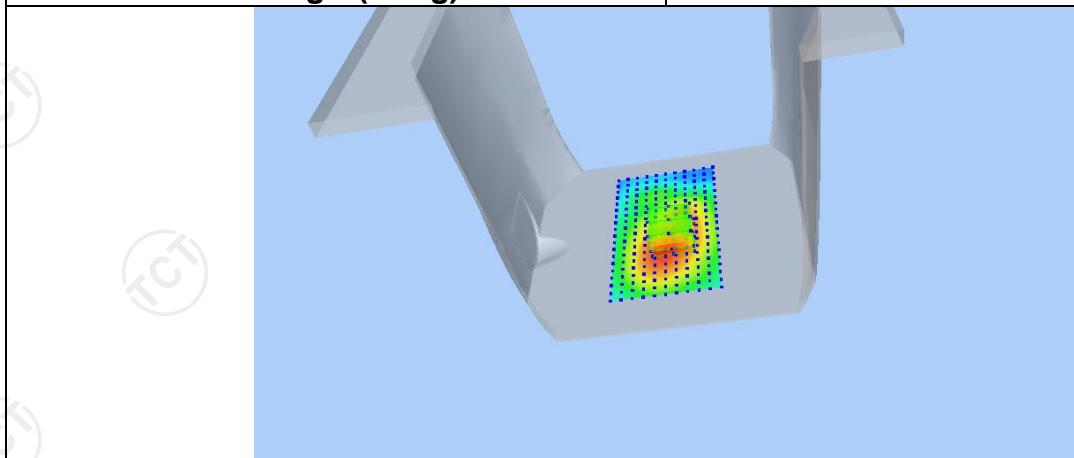
SURFACE SAR

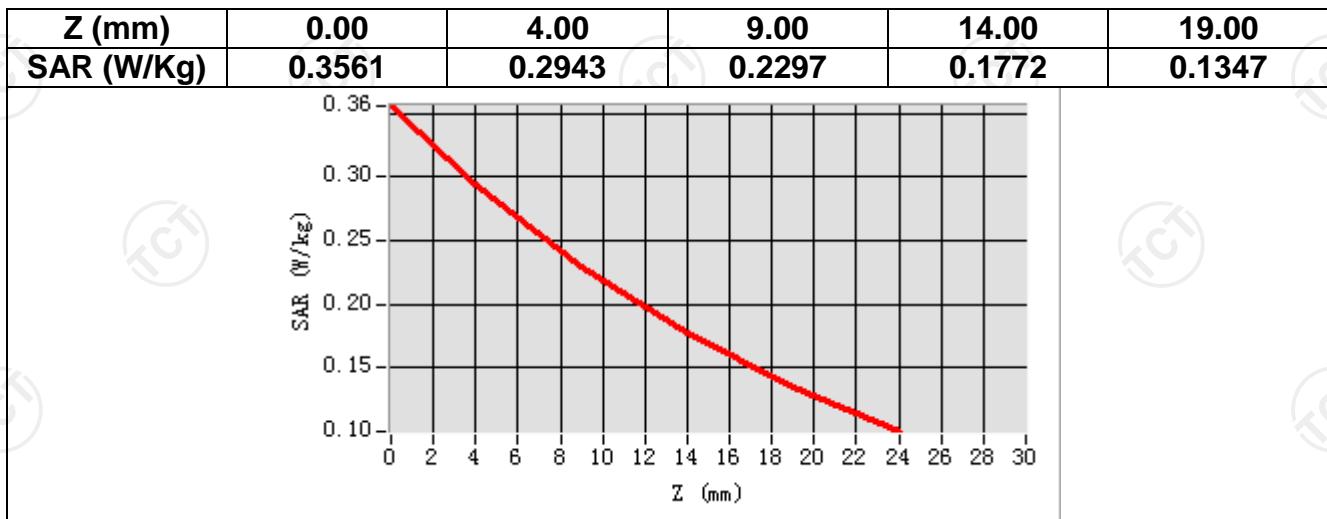
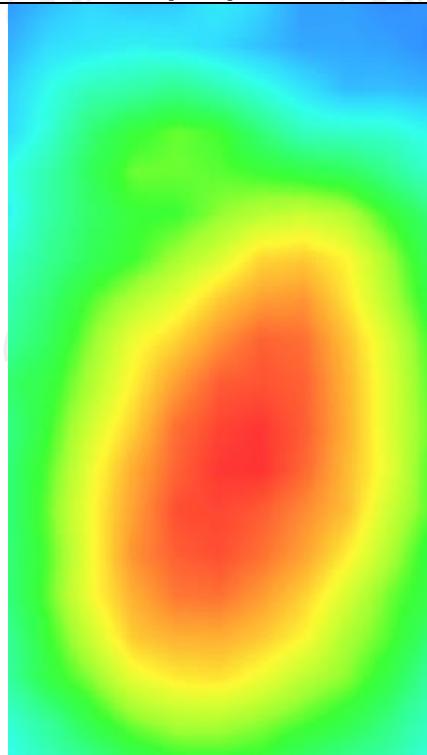


VOLUME SAR


Maximum location: X=6.00, Y=-14.00 SAR Peak: 0.36 W/kg

SAR 10g (W/Kg)	0.213126
SAR 1g (W/Kg)	0.295437



**Hot spot position**

GSM1900

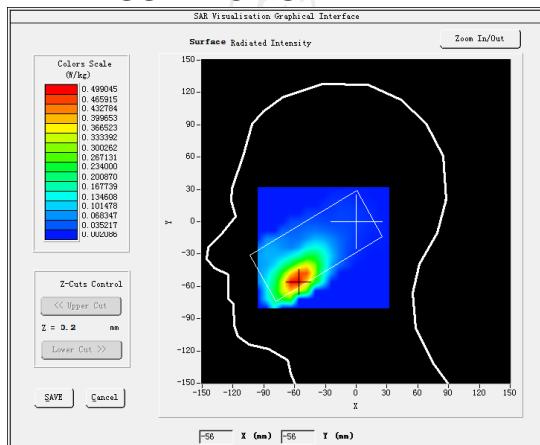
MEASUREMENT 1

Lower Band SAR (Channel 512):

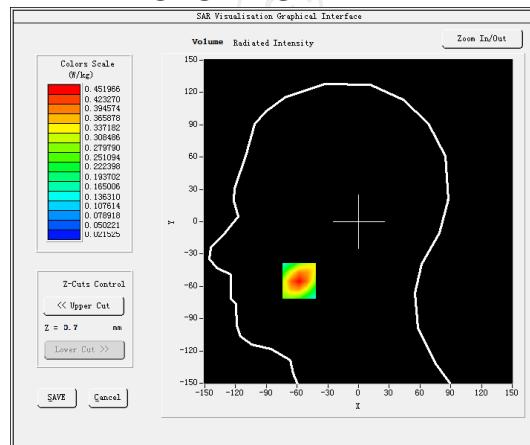
Date: 05/27/2019

Frequency (MHz)	1850.20000
Relative permittivity (real part)	39.112437
Relative permittivity (imaginary part)	12.607241
Conductivity (S/m)	1.342279
Variation (%)	-3.380000
Crest Factor	8.3
Probe Conversion factor	4.85
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	GSM1900(voice)

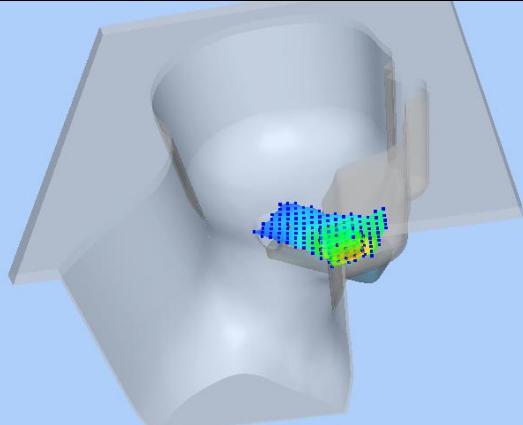
SURFACE SAR

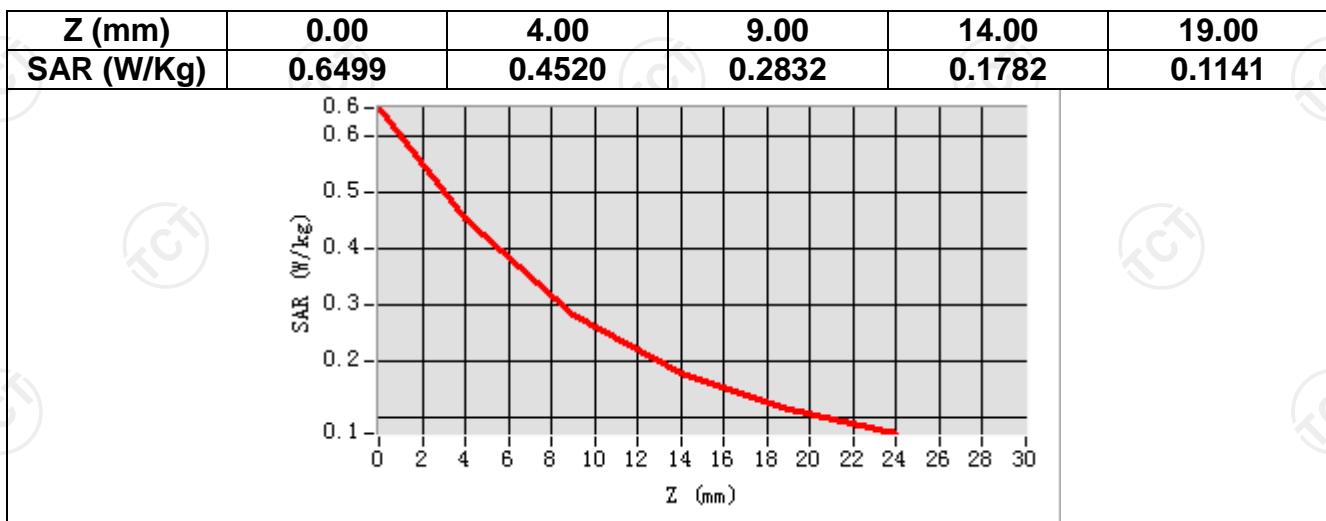
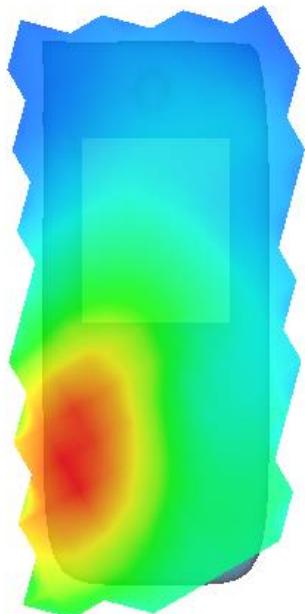


VOLUME SAR


Maximum location: X=-58.00, Y=-55.00 SAR Peak: 0.65 W/kg

SAR 10g (W/Kg)	0.247371
SAR 1g (W/Kg)	0.423585



**Hot spot position**

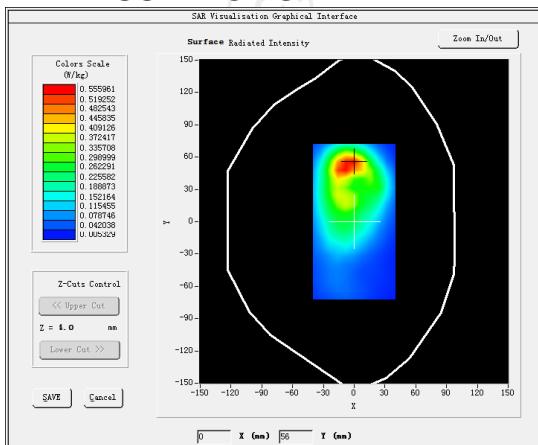
MEASUREMENT 2

Lower Band SAR (Channel 512):

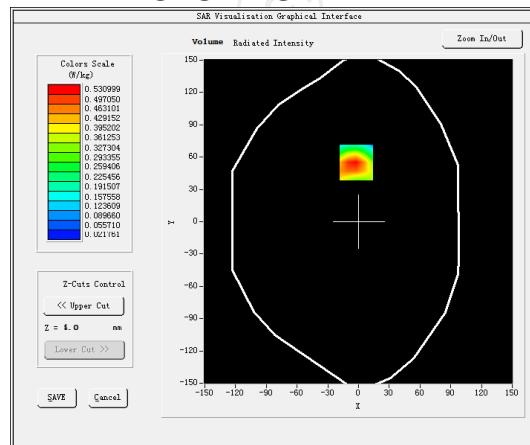
Date: 05/27/2019

Frequency (MHz)	1850.199951
Relative permittivity (real part)	53.341337
Relative permittivity (imaginary part)	14.232400
Conductivity (S/m)	1.491736
Variation (%)	1.190000
Crest Factor	8.3
Probe Conversion factor	5.01
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	GSM1900(voice)

SURFACE SAR

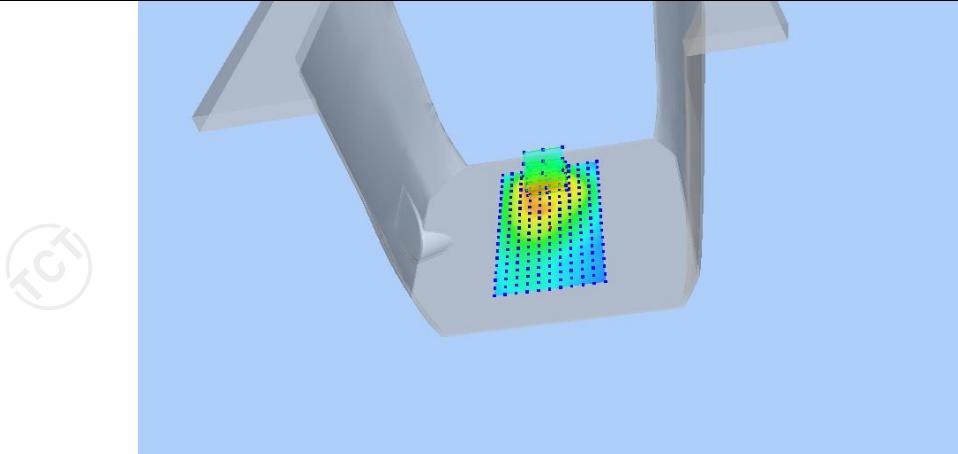


VOLUME SAR

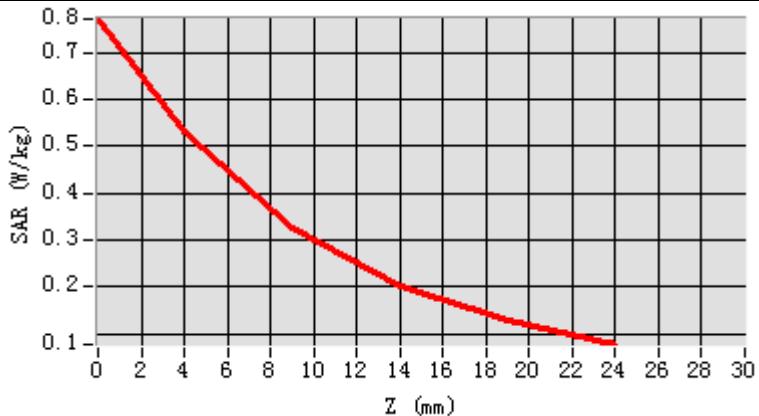
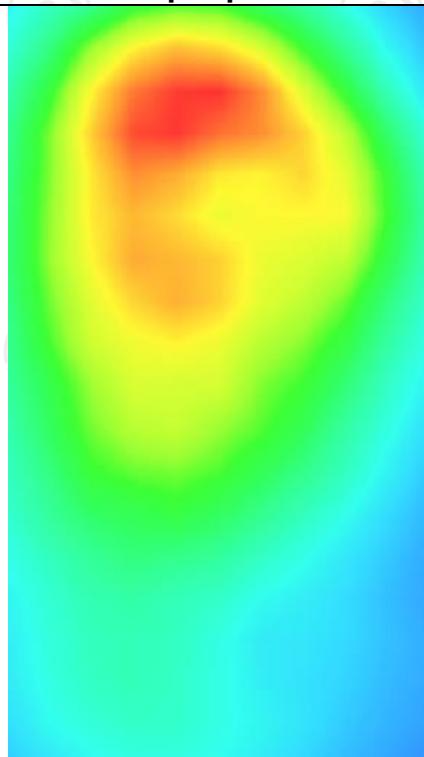


Maximum location: X=-2.00, Y=55.00 SAR Peak: 0.79 W/kg

SAR 10g (W/Kg)	0.290385
SAR 1g (W/Kg)	0.503956



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.7713	0.5310	0.3279	0.2030	0.1279

**Hot spot position**

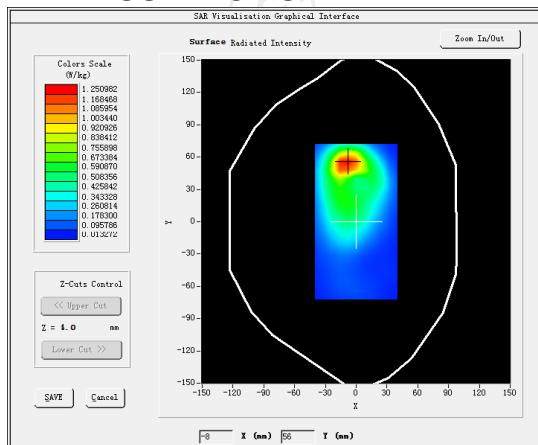
MEASUREMENT 3

Higher Band SAR (Channel 810):

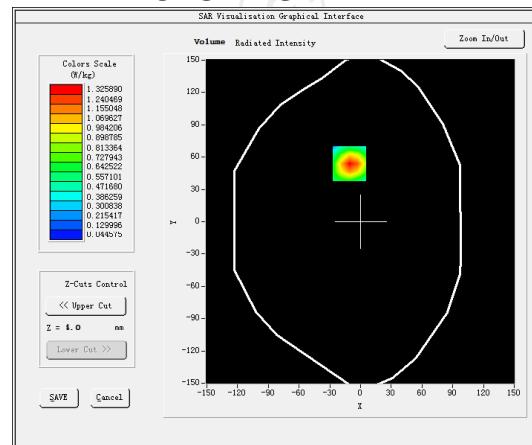
Date: 05/27/2019

Frequency (MHz)	1909.800049
Relative permittivity (real part)	53.290482
Relative permittivity (imaginary part)	14.232400
Conductivity (S/m)	1.530771
Variation (%)	-2.380000
Crest Factor	2.0
Probe Conversion factor	5.01
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>GSM1900(GPRS 4slot)</u>

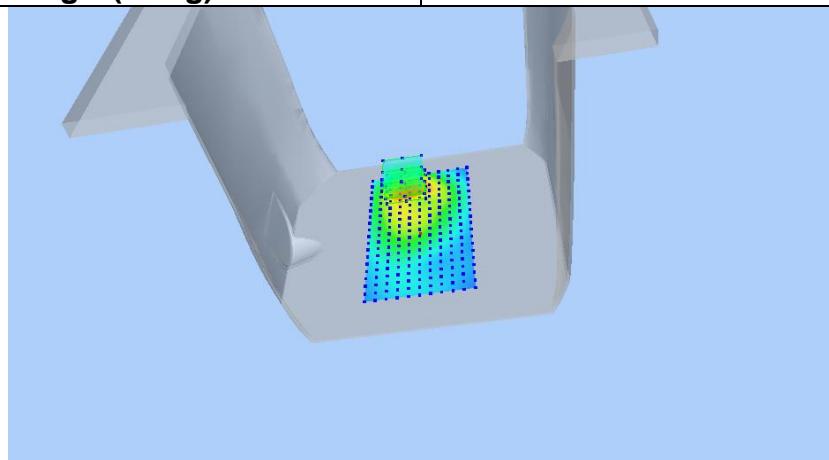
SURFACE SAR

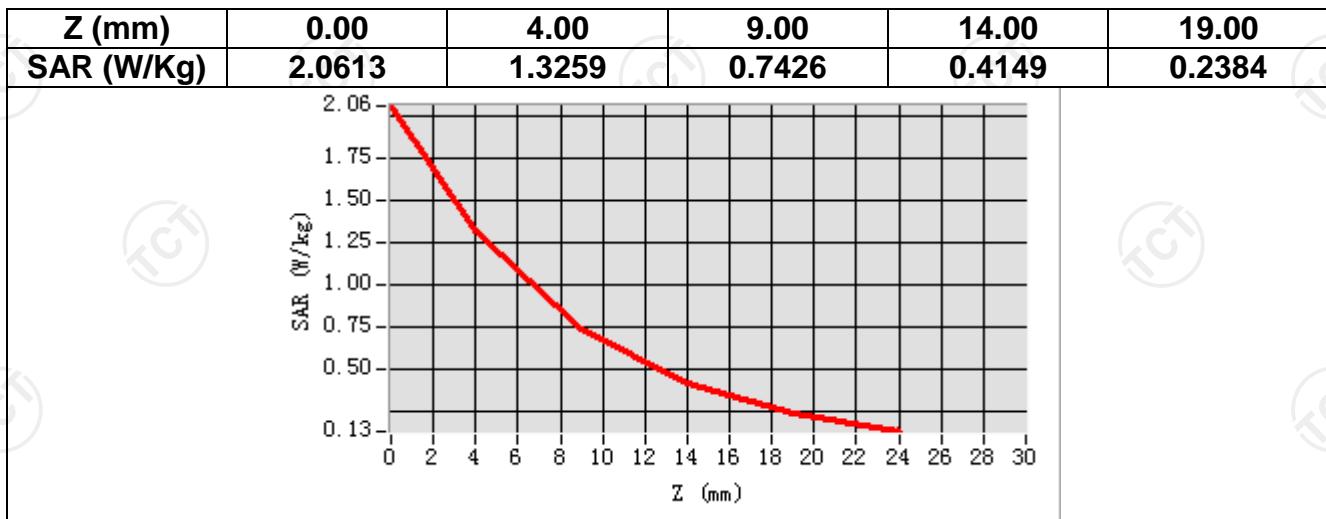
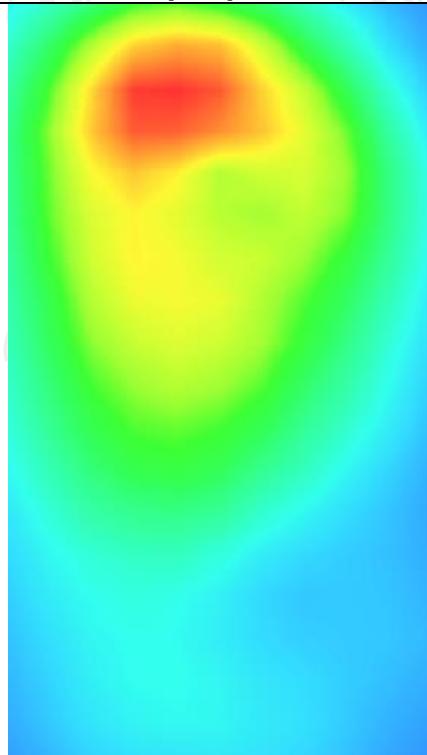


VOLUME SAR


Maximum location: X=-11.00, Y=54.00 SAR Peak: 2.07 W/kg

SAR 10g (W/Kg)	0.615317
SAR 1g (W/Kg)	1.203533



**Hot spot position**

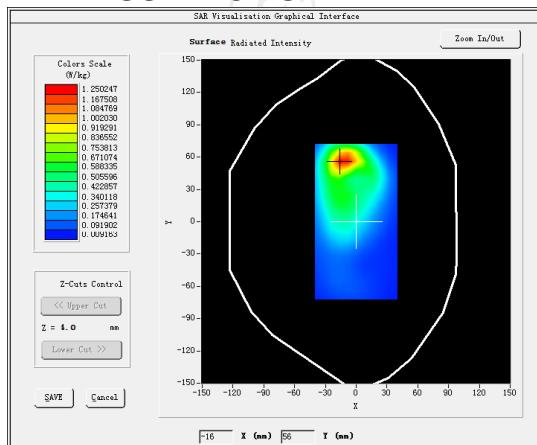
MEASUREMENT 4

Higher Band SAR (Channel 810):

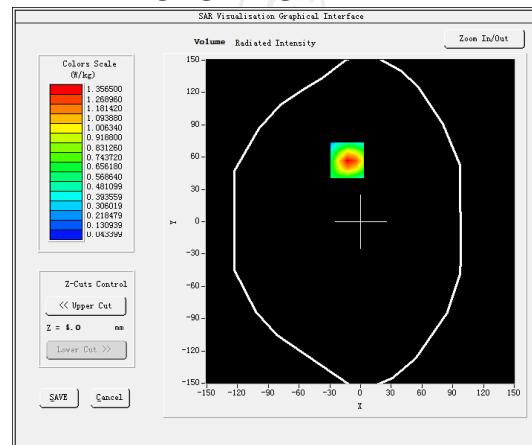
Date: 05/27/2019

Frequency (MHz)	1909.800049
Relative permittivity (real part)	53.290482
Relative permittivity (imaginary part)	14.232400
Conductivity (S/m)	1.530771
Variation (%)	3.380000
Crest Factor	2.0
Probe Conversion factor	5.01
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h= 5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>GSM1900(GPRS 4slot hotspot)</u>

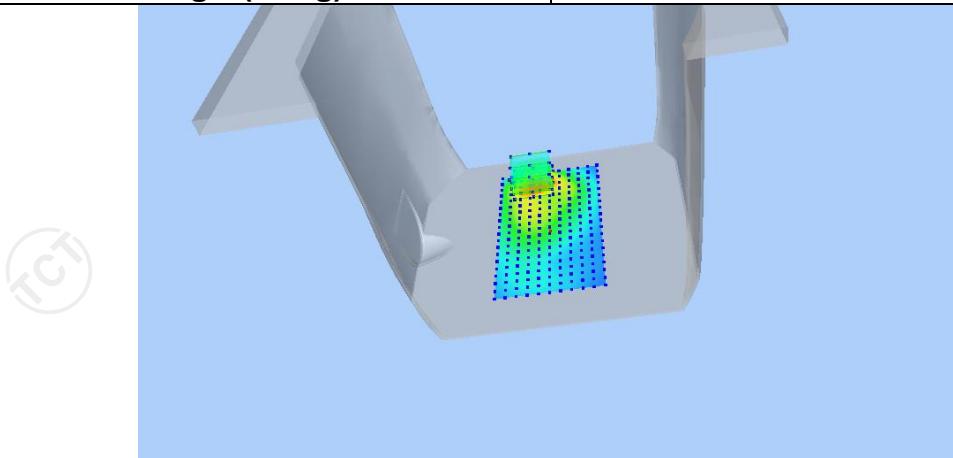
SURFACE SAR



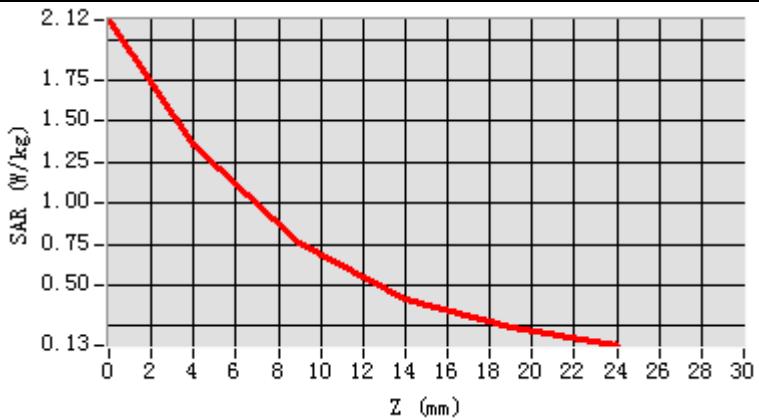
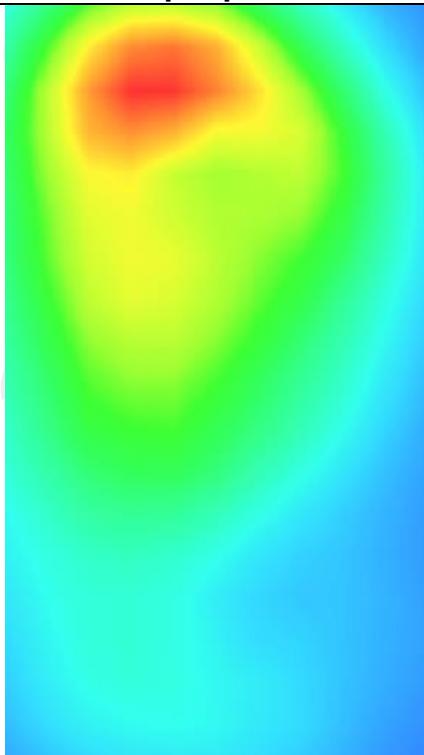
VOLUME SAR


Maximum location: X=-13.00, Y=57.00 SAR Peak: 2.15 W/kg

SAR 10g (W/Kg)	0.602219
SAR 1g (W/Kg)	1.215975



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.1182	1.3565	0.7546	0.4182	0.2383

**Hot spot position**

WCDMA Band II

MEASUREMENT 1

Middle Band SAR (Channel 9400):

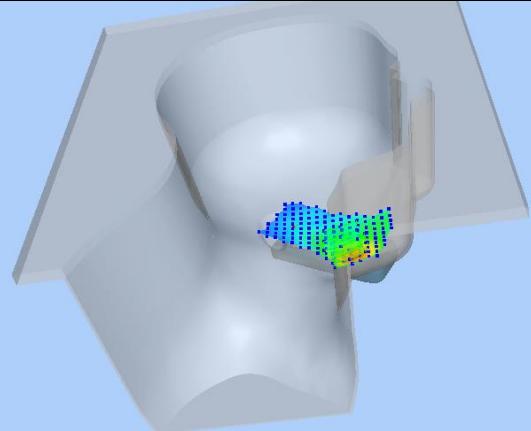
Date: 05/27/2019

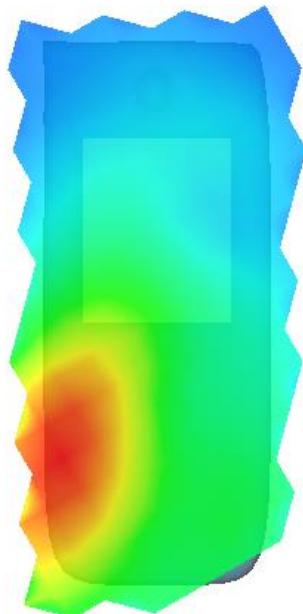
Frequency (MHz)	1880.000000
Relative permittivity (real part)	39.102741
Relative permittivity (imaginary part)	12.607061
Conductivity (S/m)	1.347304
Variation (%)	-0.180000
Crest Factor	1.0
Probe Conversion factor	4.85
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>BAND2_WCDMA1900</u>
SURFACE SAR	VOLUME SAR

Maximum location: X=-56.00, Y=-56.00 SAR Peak: 0.60 W/kg

SAR 10g (W/Kg) 0.226164

SAR 1g (W/Kg) 0.389848



**Hot spot position**

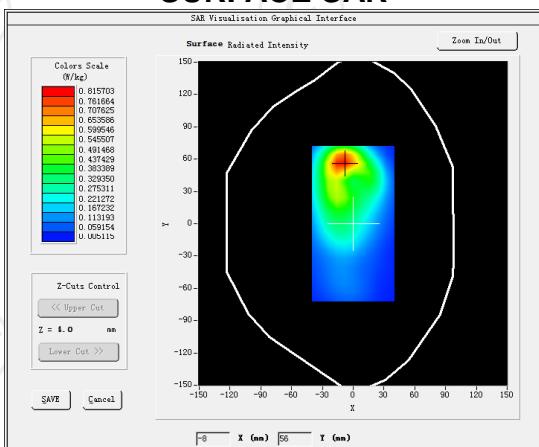
MEASUREMENT 2

Middle Band SAR (Channel 9400):

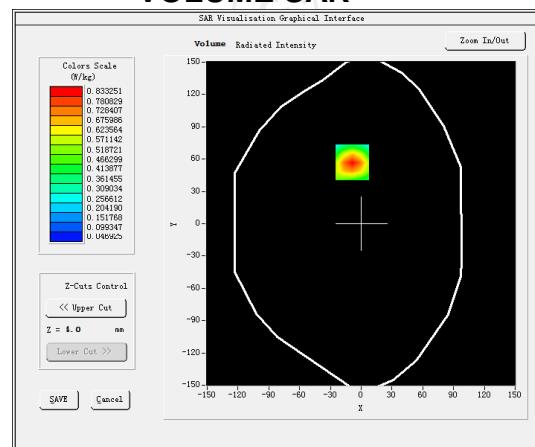
Date: 05/27/2019

Frequency (MHz)	1880.000000
Relative permittivity (real part)	53.323554
Relative permittivity (imaginary part)	14.225424
Conductivity (S/m)	1.502961
Variation (%)	-2.730000
Crest Factor	1.0
Probe Conversion factor	5.01
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>BAND2_WCDMA1900</u>

SURFACE SAR

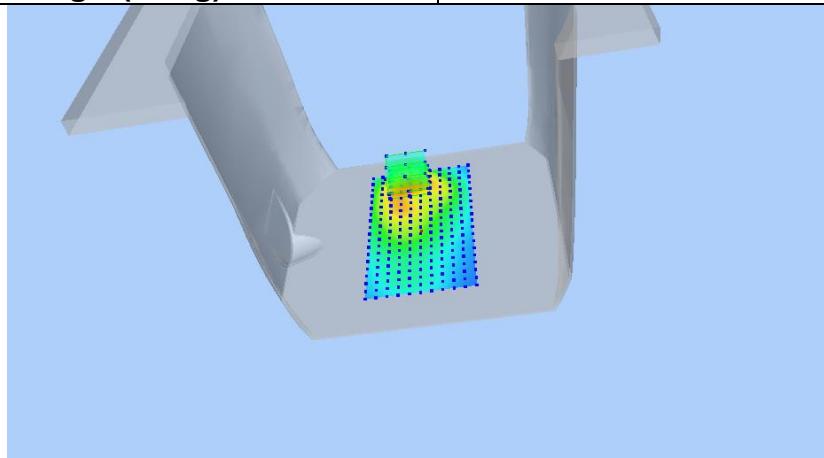


VOLUME SAR

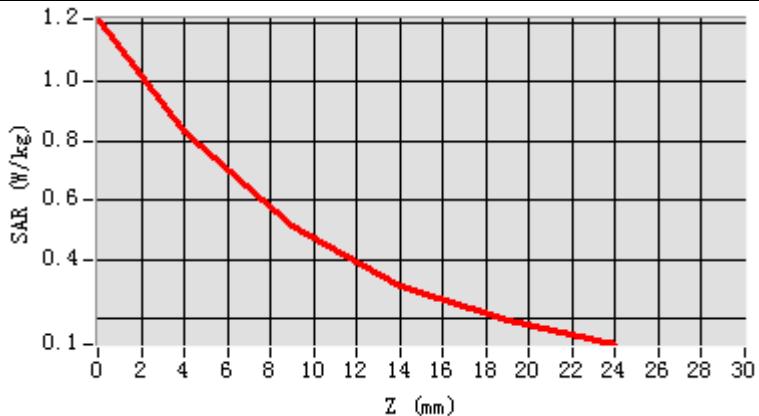
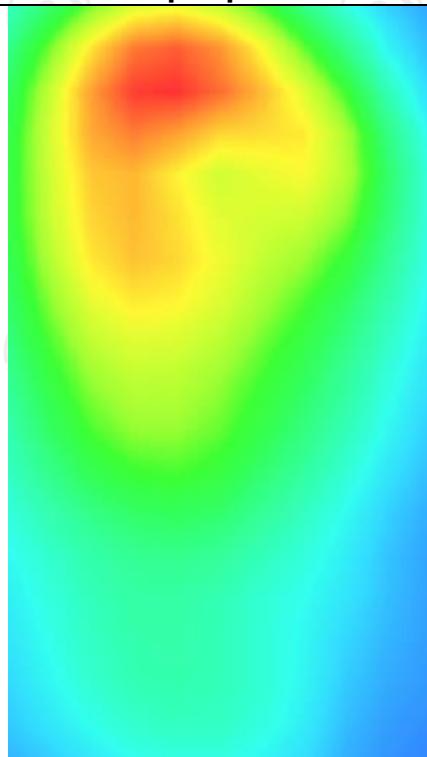


Maximum location: X=-9.00, Y=57.00 SAR Peak: 1.22 W/kg

SAR 10g (W/Kg)	0.391833
SAR 1g (W/Kg)	0.721104



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.2131	0.8333	0.5115	0.3130	0.1933

**Hot spot position**

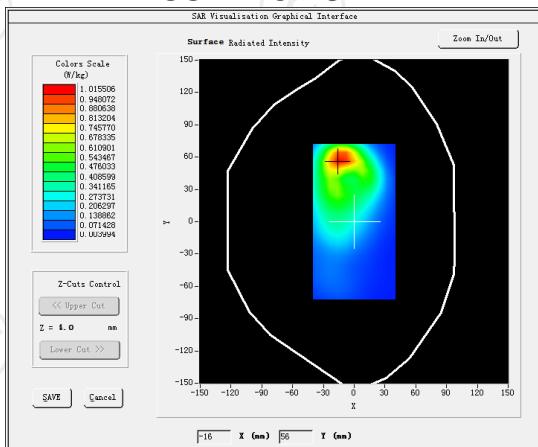
MEASUREMENT 3-repeated

Middle Band SAR (Channel 9400):

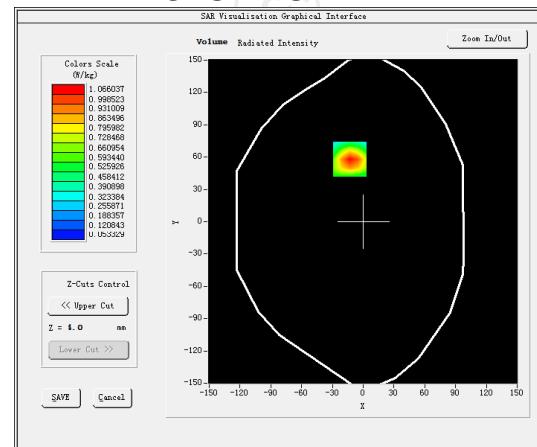
Date: 05/27/2019

Frequency (MHz)	1880.000000
Relative permittivity (real part)	53.293554
Relative permittivity (imaginary part)	14.225424
Conductivity (S/m)	1.532961
Variation (%)	-0.490000
Crest Factor	1.0
Probe Conversion factor	5.01
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>BAND2_WCDMA1900(hotspot)</u>

SURFACE SAR



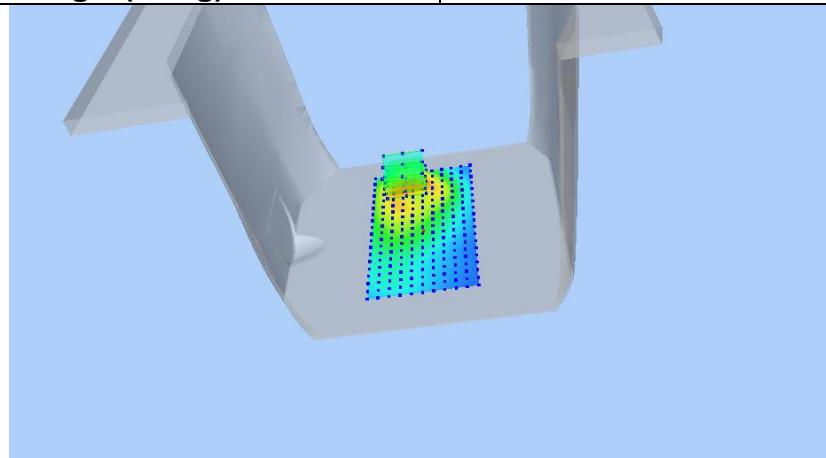
VOLUME SAR


Maximum location: X=-13.00, Y=58.00 SAR Peak: 1.57 W/kg
SAR 10g (W/Kg)

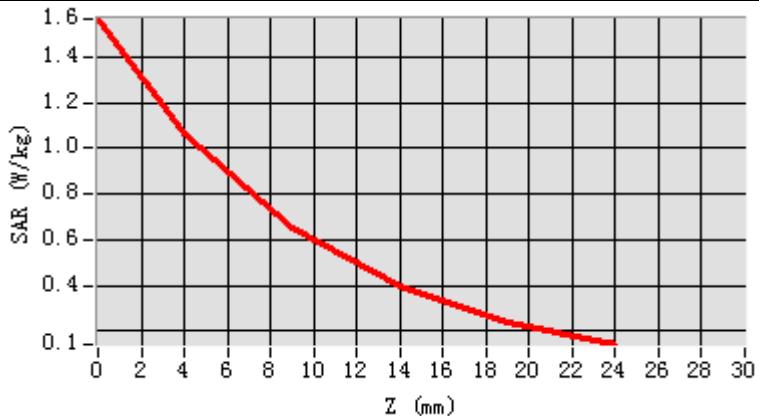
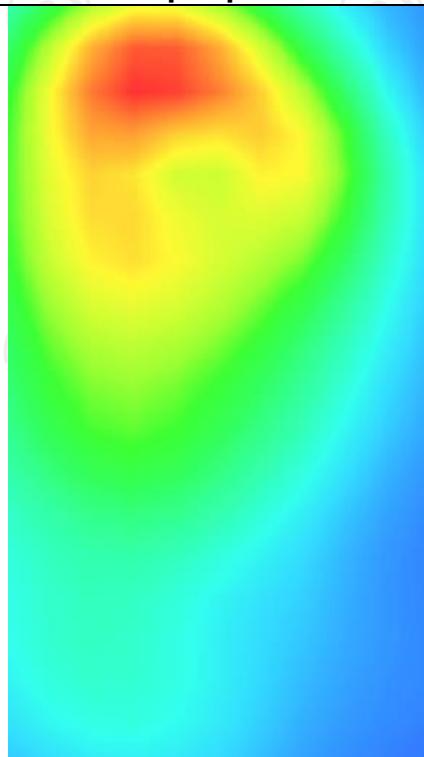
0.555213

SAR 1g (W/Kg)

0.994707



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.5651	1.0660	0.6473	0.3922	0.2406

**Hot spot position**

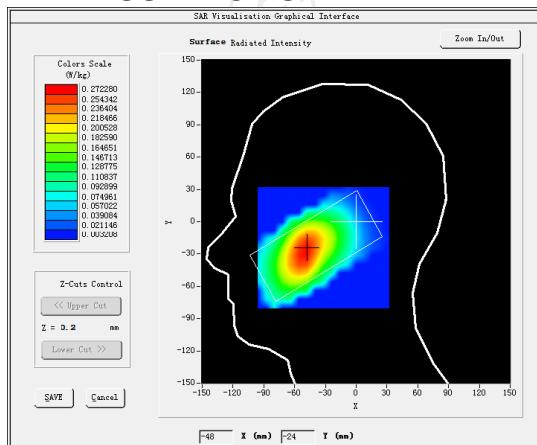
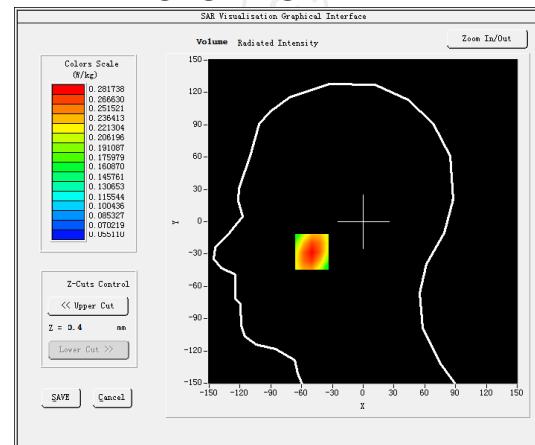
WCDMA Band V

MEASUREMENT 1

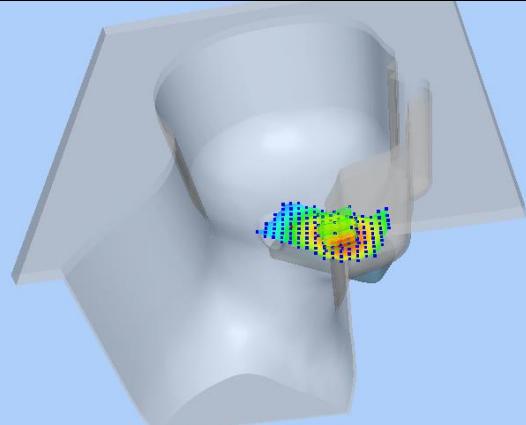
Higher Band SAR (Channel 4233):

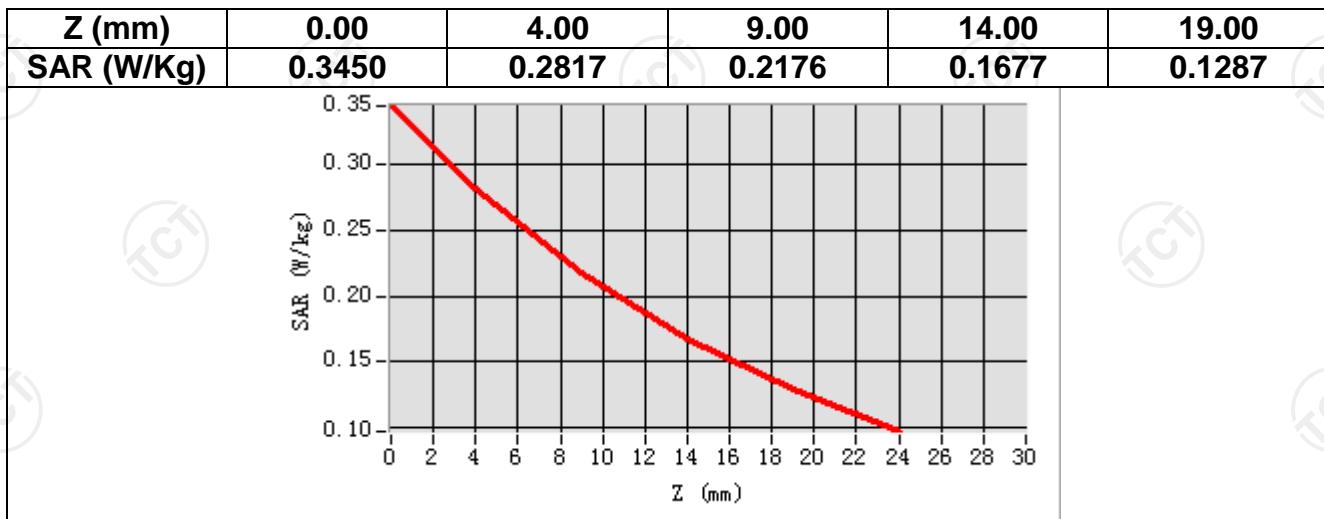
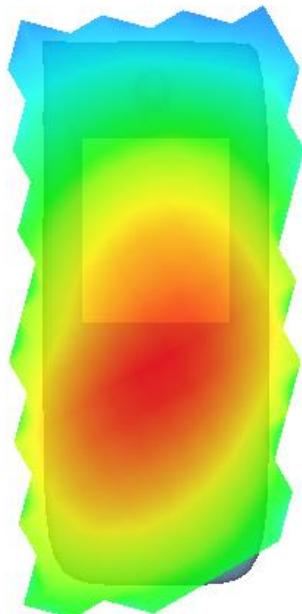
Date: 05/15/2019

Frequency (MHz)	846.600000
Relative permittivity (real part)	40.392883
Relative permittivity (imaginary part)	18.129634
Conductivity (S/m)	0.877241
Variation (%)	2.250000
Crest Factor:	1.0
Probe Conversion factor	5.50
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>BAND5_WCDMA850</u>

SURFACE SAR

VOLUME SAR

Maximum location: X=-50.00, Y=-28.00 SAR Peak: 0.35 W/kg

SAR 10g (W/Kg)	0.194399
SAR 1g (W/Kg)	0.269972



**Hot spot position**

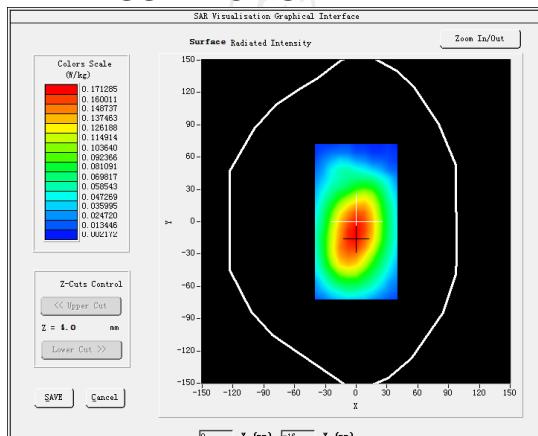
MEASUREMENT 2

Higher Band SAR (Channel 4233):

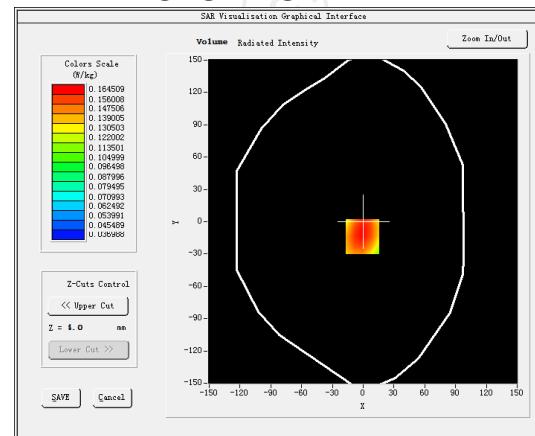
Date: 05/15/2019

Frequency (MHz)	846.600000
Relative permittivity (real part)	55.212927
Relative permittivity (imaginary part)	21.378266
Conductivity (S/m)	0.971230
Variation (%)	-2.980000
Crest Factor:	1.0
Probe Conversion factor	5.65
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h= 5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>BAND5_WCDMA850</u>

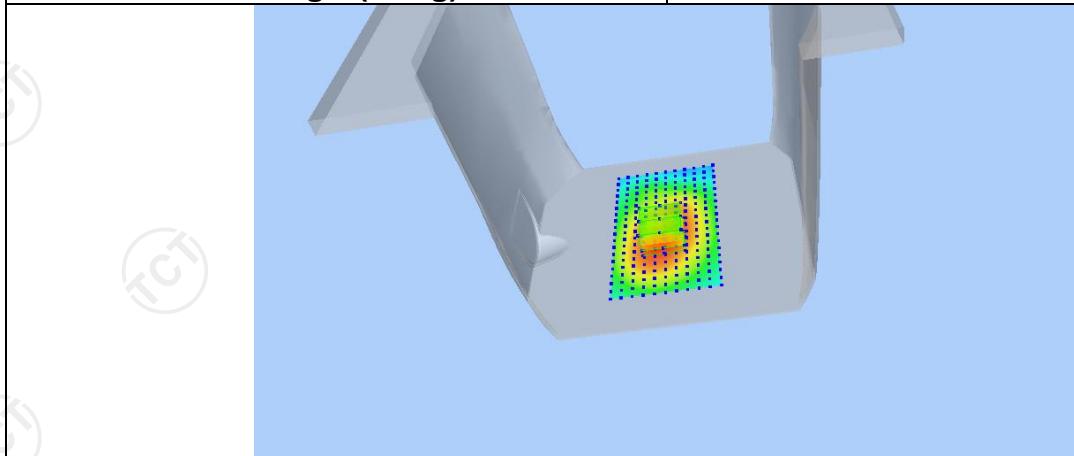
SURFACE SAR

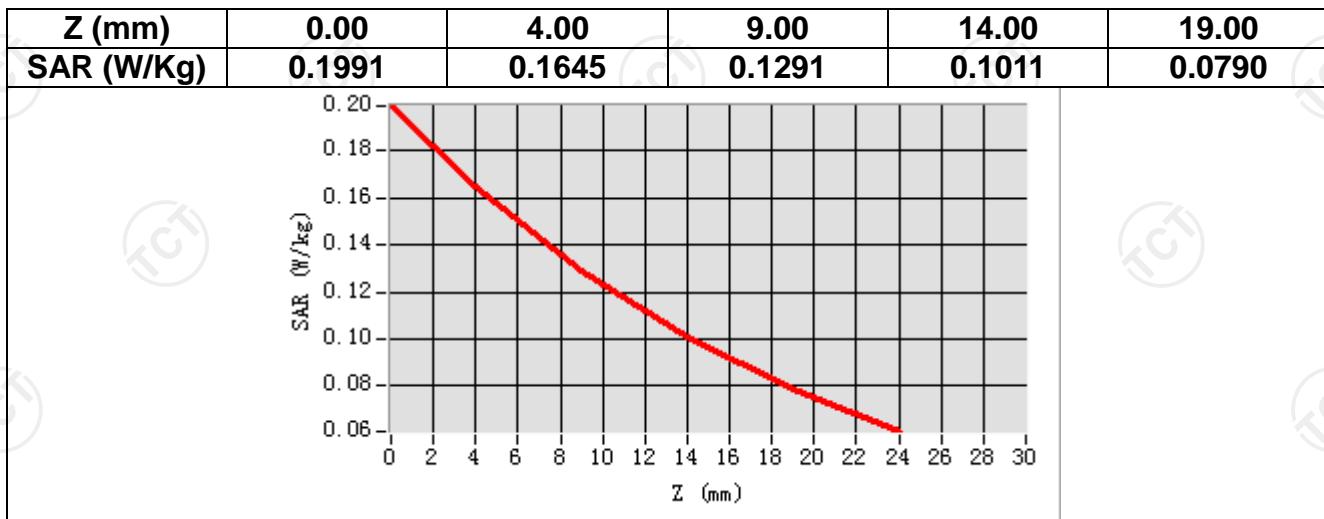
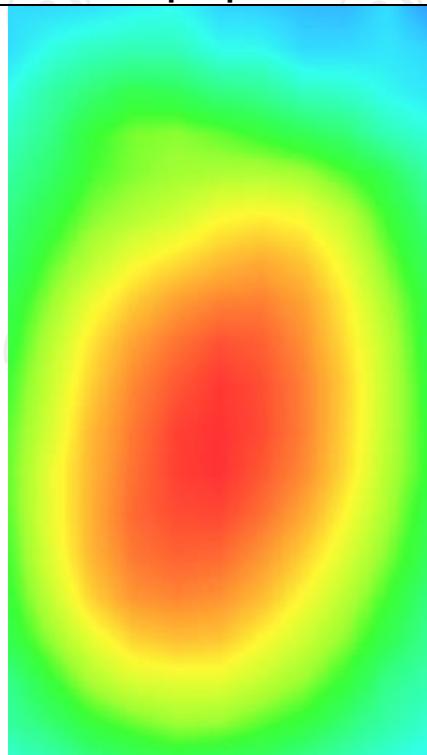


VOLUME SAR


Maximum location: X=-1.00, Y=-14.00 SAR Peak: 0.20 W/kg

SAR 10g (W/Kg)	0.119882
SAR 1g (W/Kg)	0.162462



**Hot spot position**

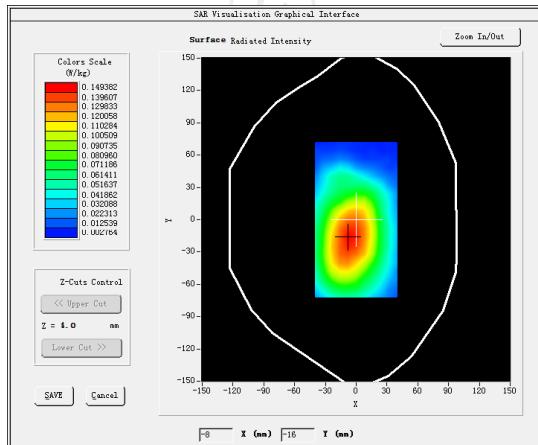
MEASUREMENT 3

Higher Band SAR (Channel 4233):

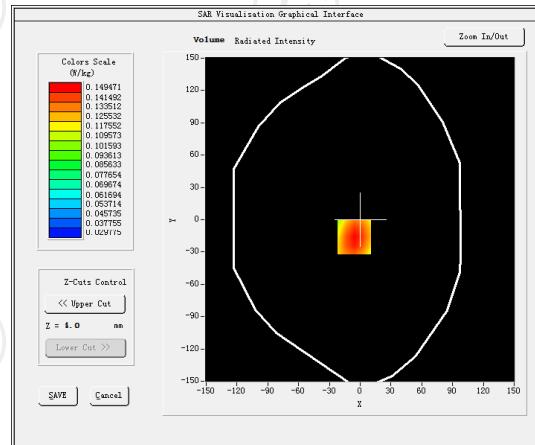
Date: 05/15/2019

Frequency (MHz)	846.600000
Relative permittivity (real part)	55.212927
Relative permittivity (imaginary part)	21.378266
Conductivity (S/m)	0.971230
Variation (%)	-0.950000
Crest Factor:	1.0
Probe Conversion factor	5.65
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm,</u> <u>h= 5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>BAND5_WCDMA850(hotspot)</u>

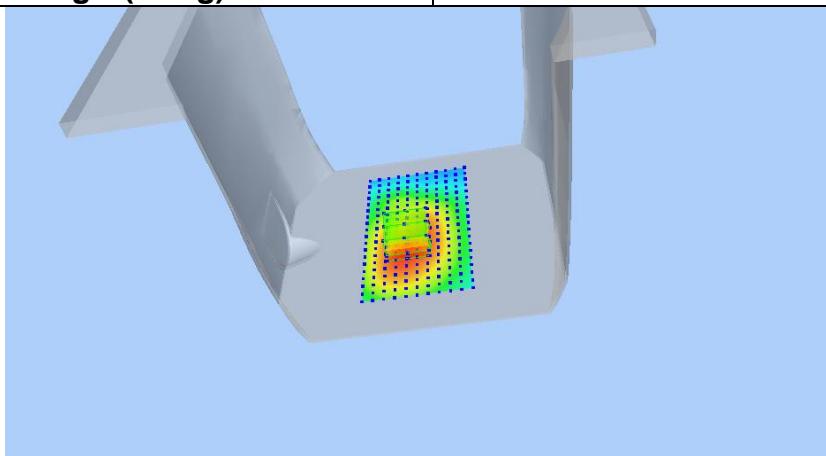
SURFACE SAR

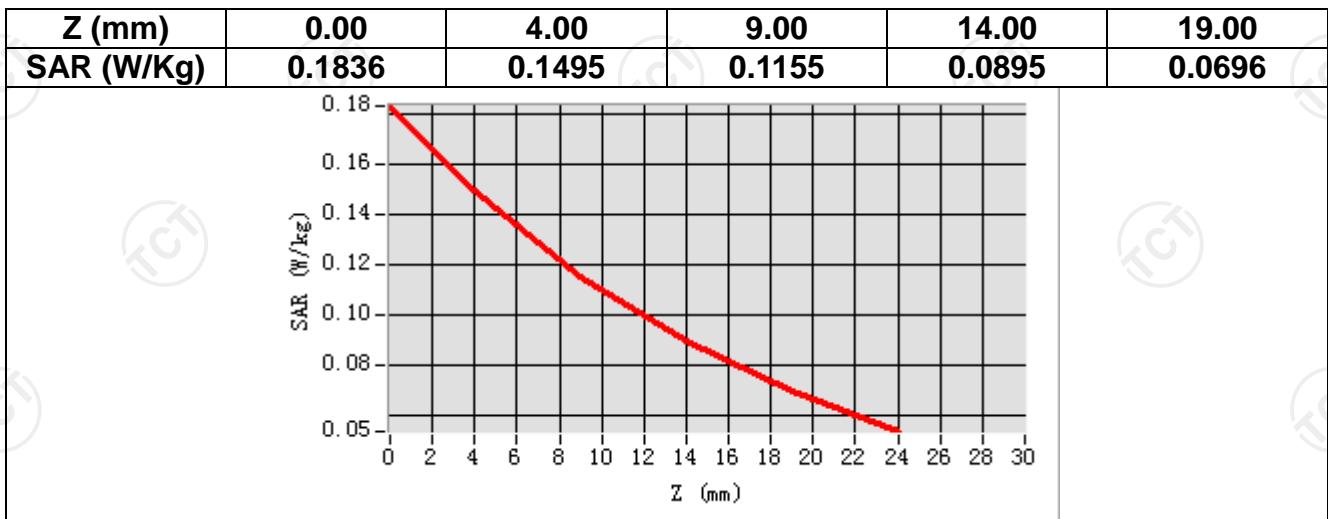
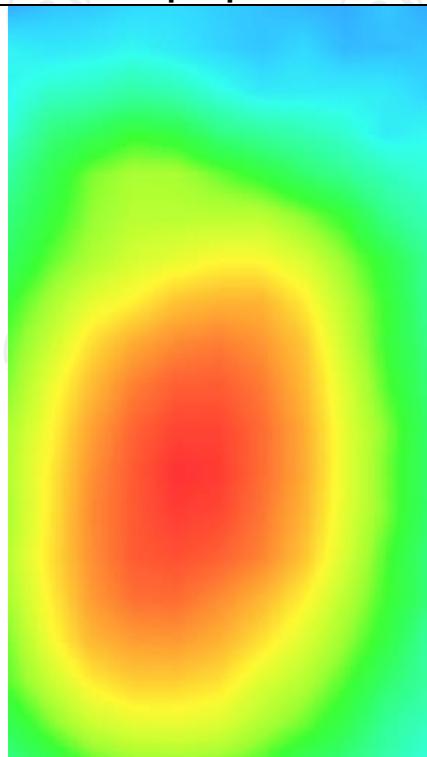


VOLUME SAR


Maximum location: X=-6.00, Y=-16.00 SAR Peak: 0.18 W/kg

SAR 10g (W/Kg)	0.107303
SAR 1g (W/Kg)	0.146847



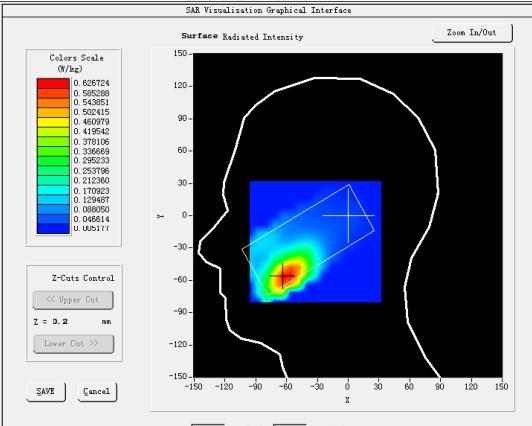
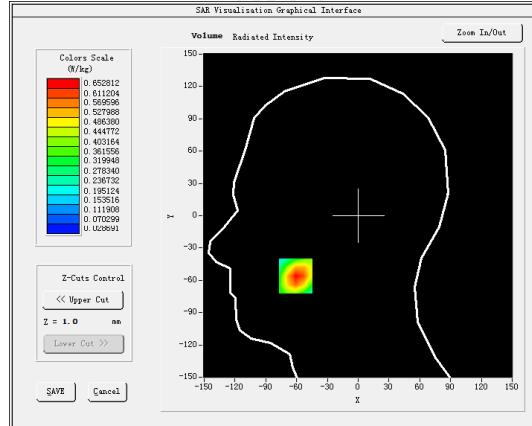
**Hot spot position**

LTE Band 4

MEASUREMENT 1

Middle Band SAR (Channel 20175):

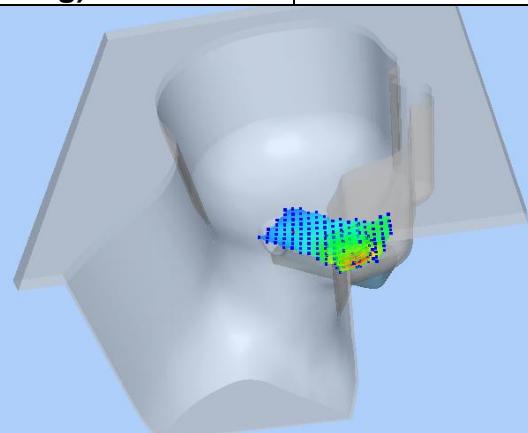
Date: 05/22/2019

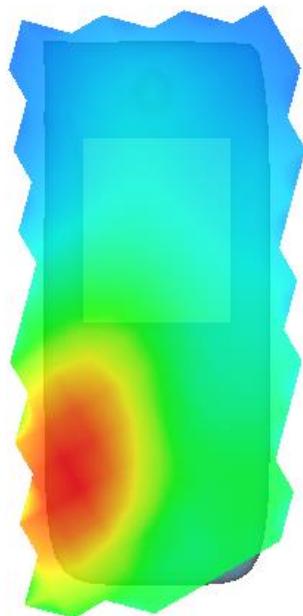
Frequency (MHz)	1732.500000
Relative permittivity (real part)	39.101249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.350792
Variation (%)	-1.150000
Crest Factor	1.0
Probe Conversion factor	4.38
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>LTE band 4(1 RB#0)</u>
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-61.00, Y=-56.00 SAR Peak: 0.94 W/kg

SAR 10g (W/Kg) 0.358921

SAR 1g (W/Kg) 0.613924

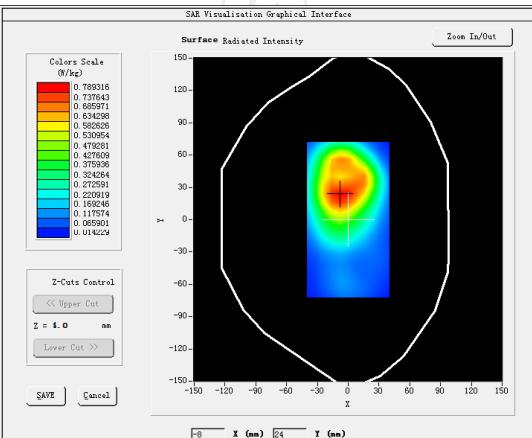
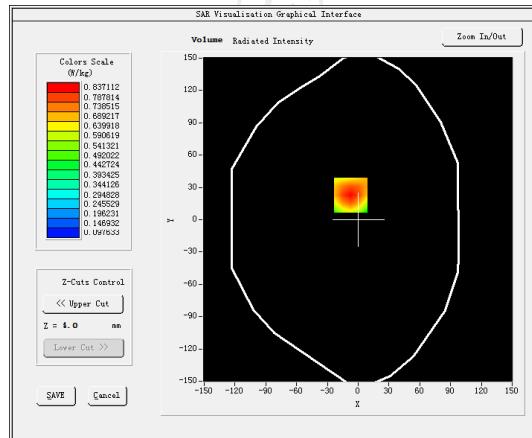


**Hot spot position**

MEASUREMENT 2

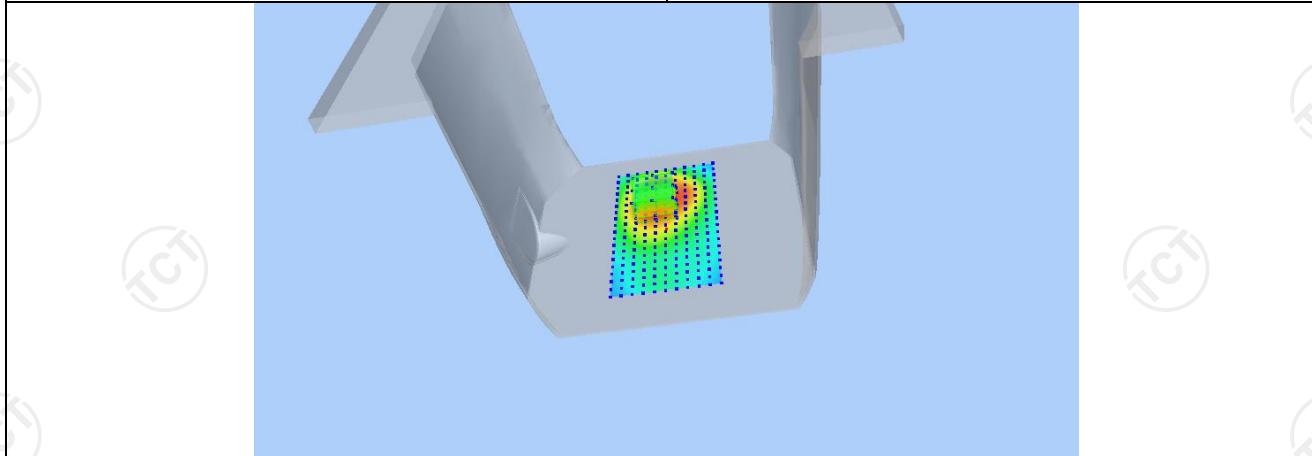
Middle Band SAR (Channel 20175):

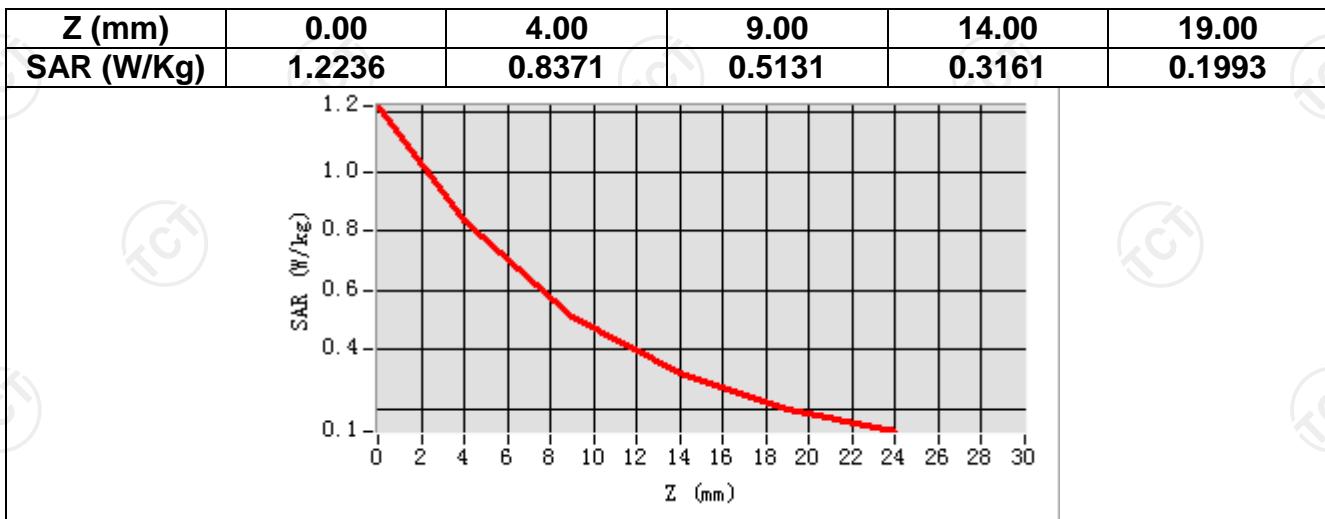
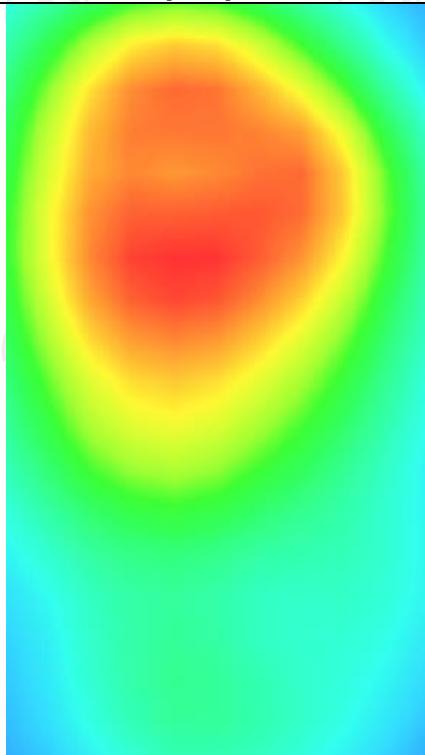
Date: 05/22/2019

Frequency (MHz)	1732.500000
Relative permittivity (real part)	53.321249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.502592
Variation (%)	1.050000
Crest Factor	1.0
Probe Conversion factor	4.52
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>LTE band 4(1 RB#0)</u>
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-7.00, Y=23.00 SAR Peak: 1.22 W/kg

SAR 10g (W/Kg)	0.386215
SAR 1g (W/Kg)	0.695227

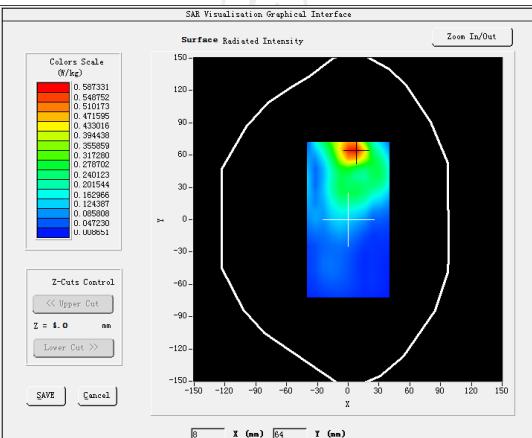
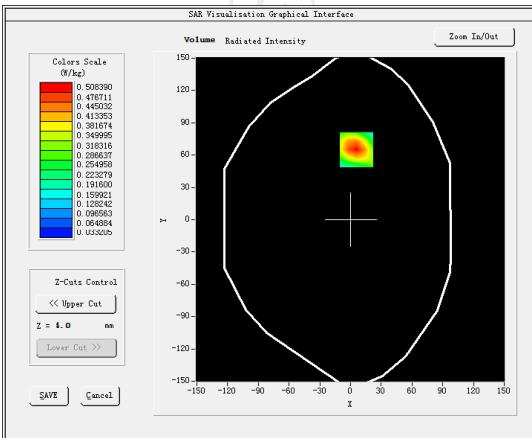


**Hot spot position**

MEASUREMENT 3

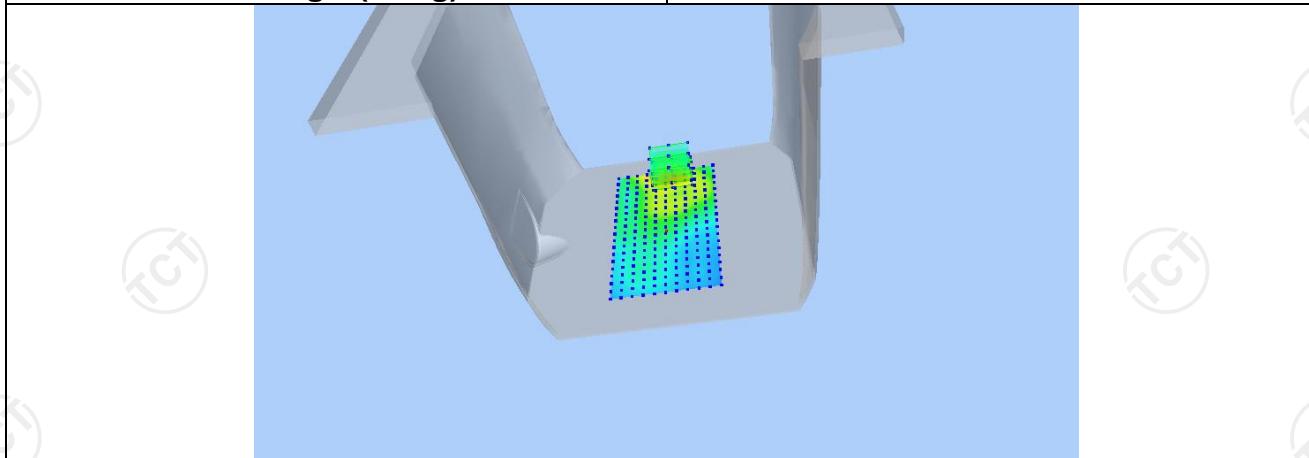
Middle Band SAR (Channel 20175):

Date: 05/22/2019

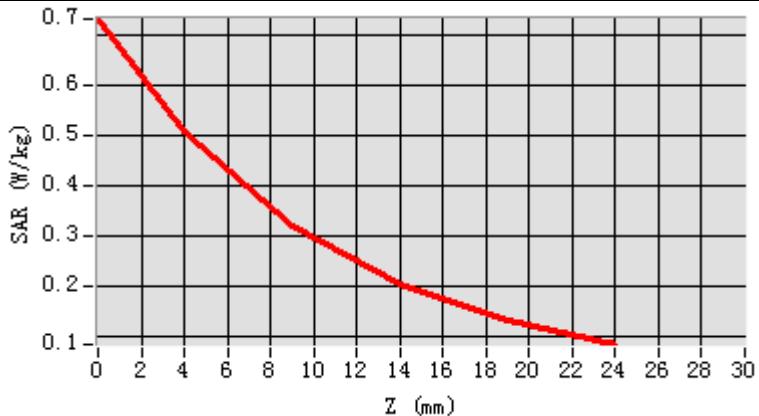
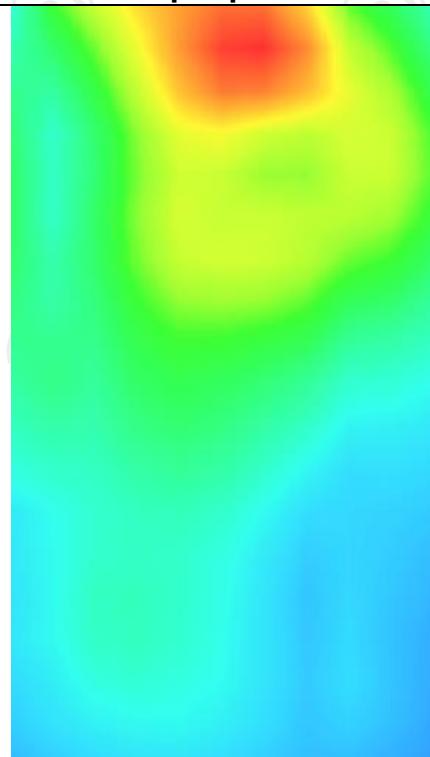
Frequency (MHz)	1732.500000
Relative permittivity (real part)	53.321249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.502592
Variation (%)	-3.540000
Crest Factor	1.0
Probe Conversion factor	4.52
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(hotspot 10mm)</u>
Band	<u>LTE band 4(1 RB#0)</u>
SURFACE SAR	VOLUME SAR
	

Maximum location: X=6.00, Y=65.00 SAR Peak: 0.74 W/kg

SAR 10g (W/Kg)	0.276556
SAR 1g (W/Kg)	0.476892



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.7321	0.5084	0.3185	0.2012	0.1302

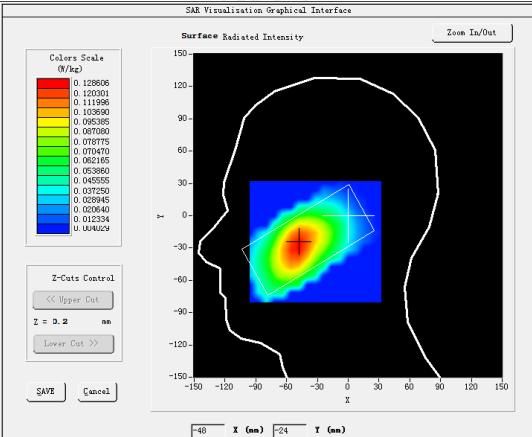
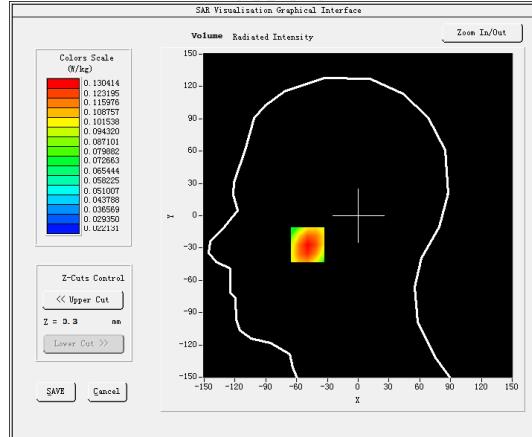
**Hot spot position**

LTE Band 5

MEASUREMENT 1

Middle Band SAR (Channel 20525):

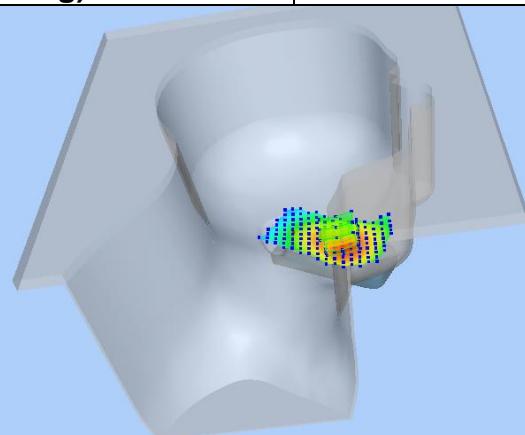
Date: 05/15/2019

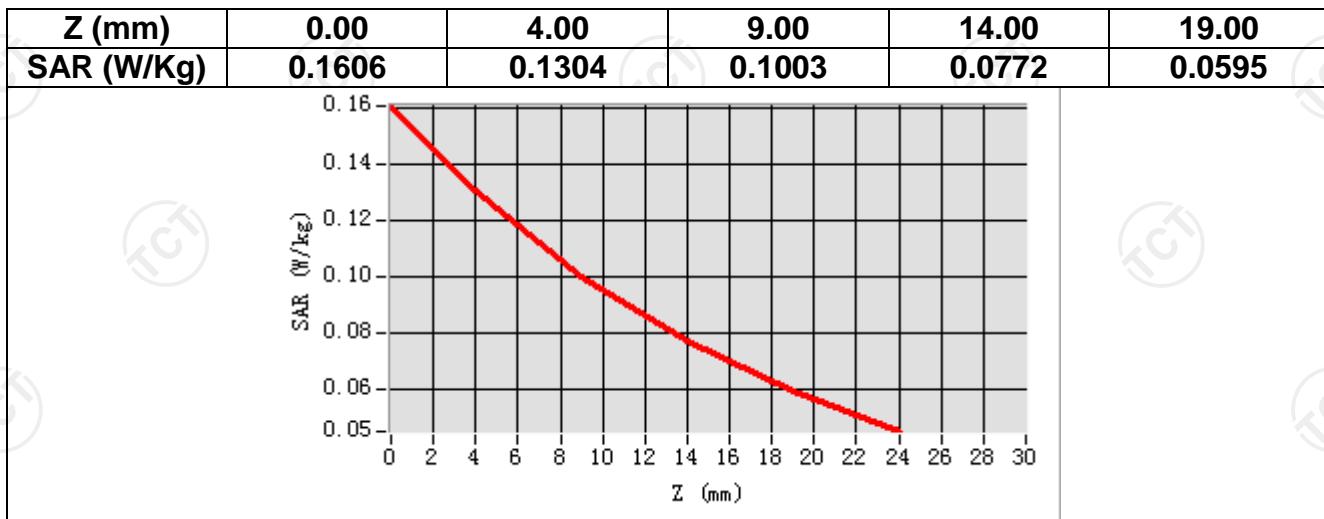
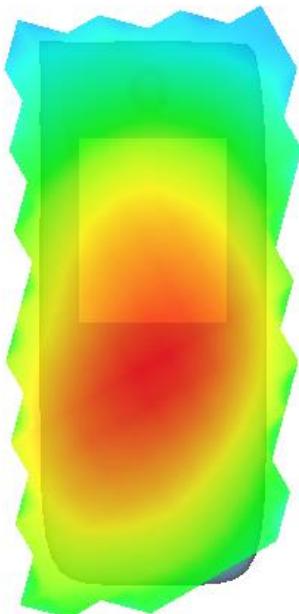
Frequency (MHz)	836.500000
Relative permittivity (real part)	41.422517
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	0.871392
Variation (%)	3.740000
Crest Factor	1.0
Probe Conversion factor	4.38
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	LTE band 5(1 RB#25)
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-49.00, Y=-27.00 SAR Peak: 0.16 W/kg

SAR 10g (W/Kg) 0.090584

SAR 1g (W/Kg) 0.125380

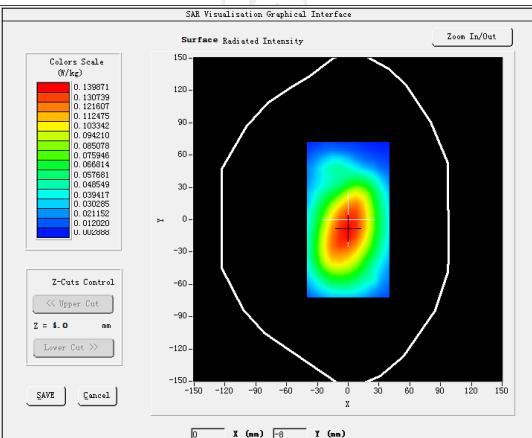
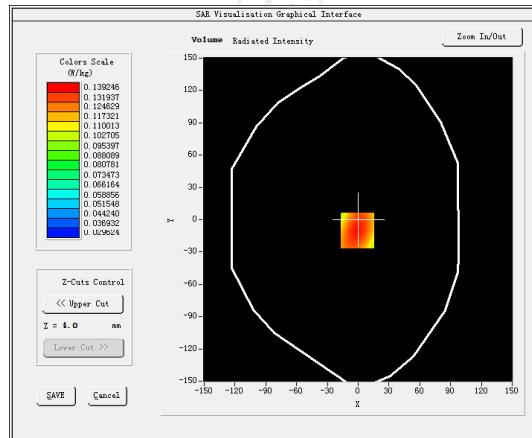


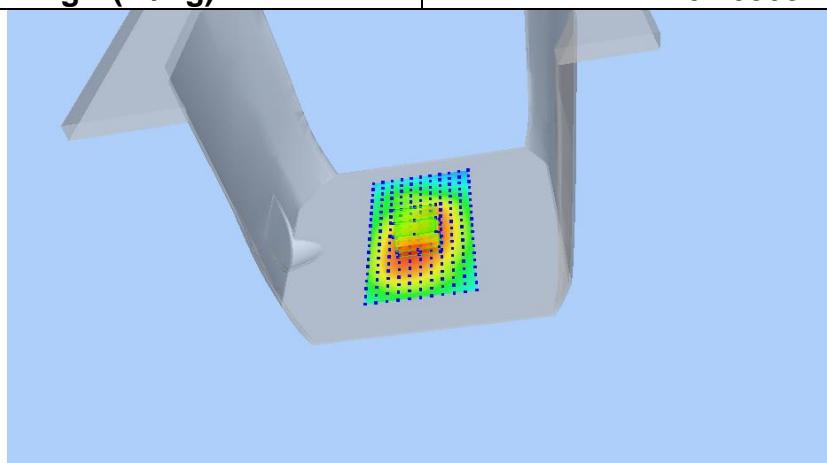
**Hot spot position**

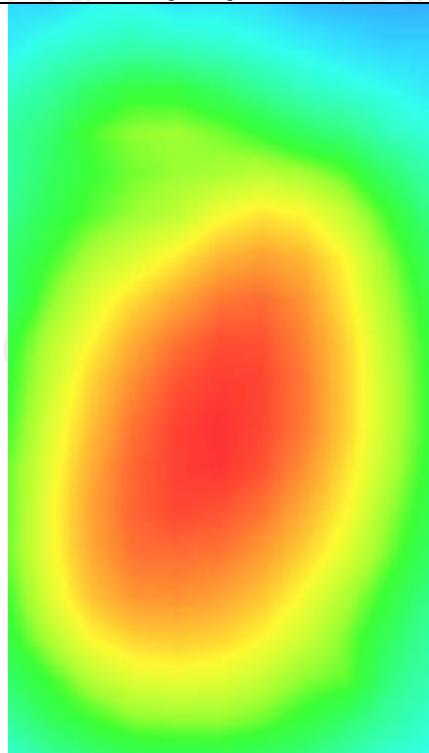
MEASUREMENT 2

Middle Band SAR (Channel 20525):

Date: 05/15/2019

Frequency (MHz)	836.500000
Relative permittivity (real part)	53.244937
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	0.943512
Variation (%)	-2.510000
Crest Factor	1.0
Probe Conversion factor	4.52
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>LTE band 5(1 RB#25)</u>
SURFACE SAR	VOLUME SAR
	
Maximum location: X=-1.00, Y=-10.00 SAR Peak: 0.17 W/kg	
SAR 10g (W/Kg)	0.100074
SAR 1g (W/Kg)	0.135032



**Hot spot position**

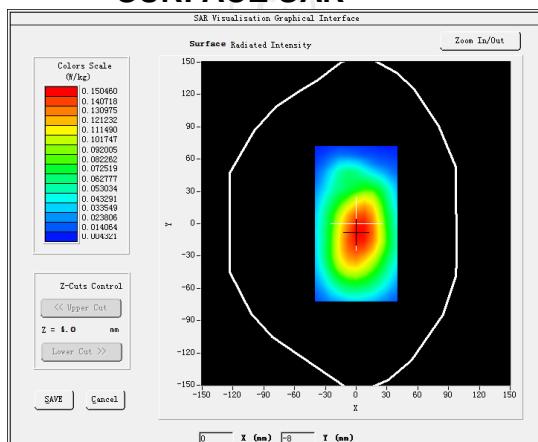
MEASUREMENT 3

Middle Band SAR (Channel 20525):

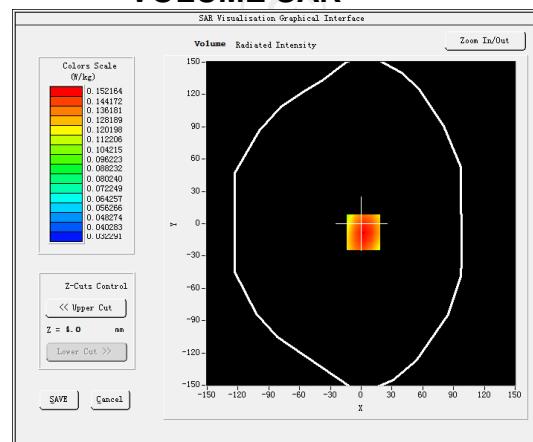
Date: 05/15/2019

Frequency (MHz)	836.500000
Relative permittivity (real part)	53.244937
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	0.943512
Variation (%)	-0.670000
Crest Factor	1.0
Probe Conversion factor	4.52
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h= 5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(hotspot 10mm)</u>
Band	<u>LTE band 5(1 RB#25)</u>

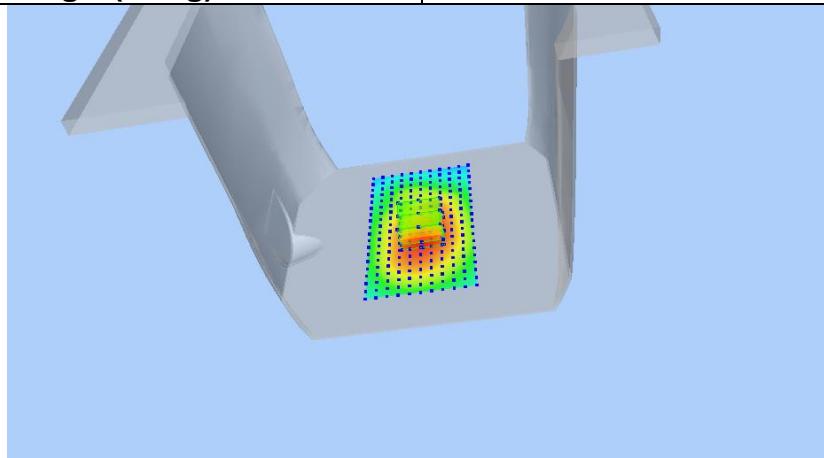
SURFACE SAR



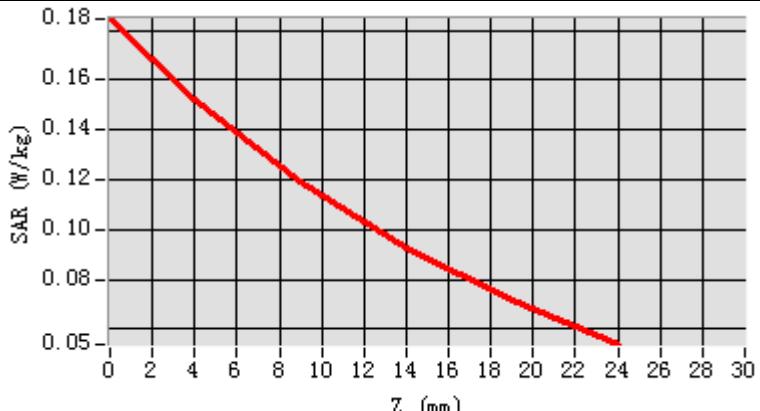
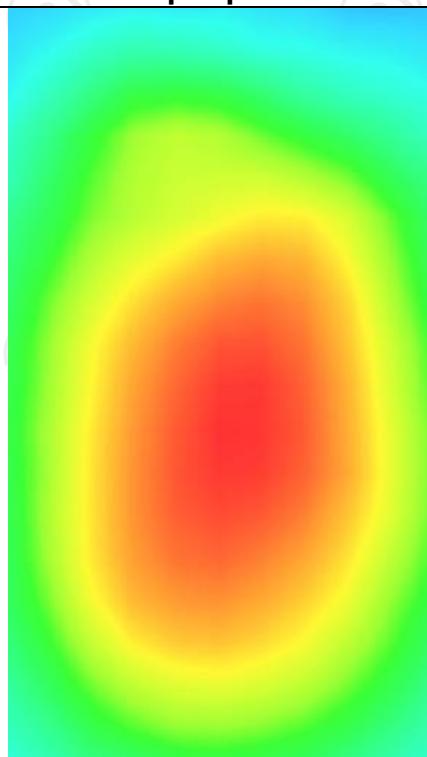
VOLUME SAR


Maximum location: X=2.00, Y=-8.00 SAR Peak: 0.18 W/kg

SAR 10g (W/Kg)	0.108848
SAR 1g (W/Kg)	0.147582



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.1845	0.1522	0.1189	0.0924	0.0713

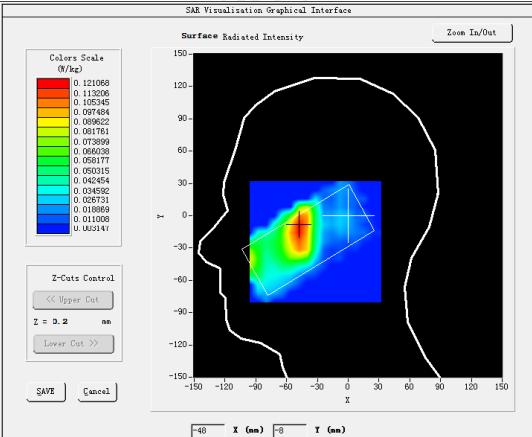
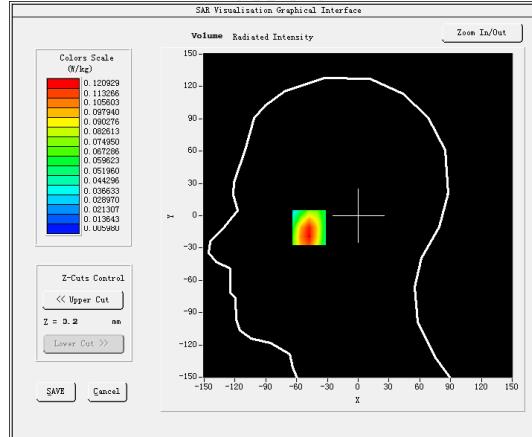
**Hot spot position**

LTE Band 7

MEASUREMENT 1

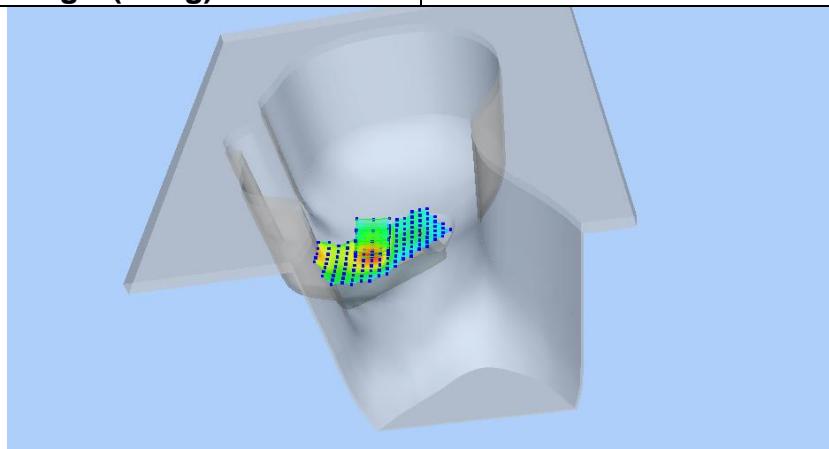
Lower Band SAR (Channel 20850):

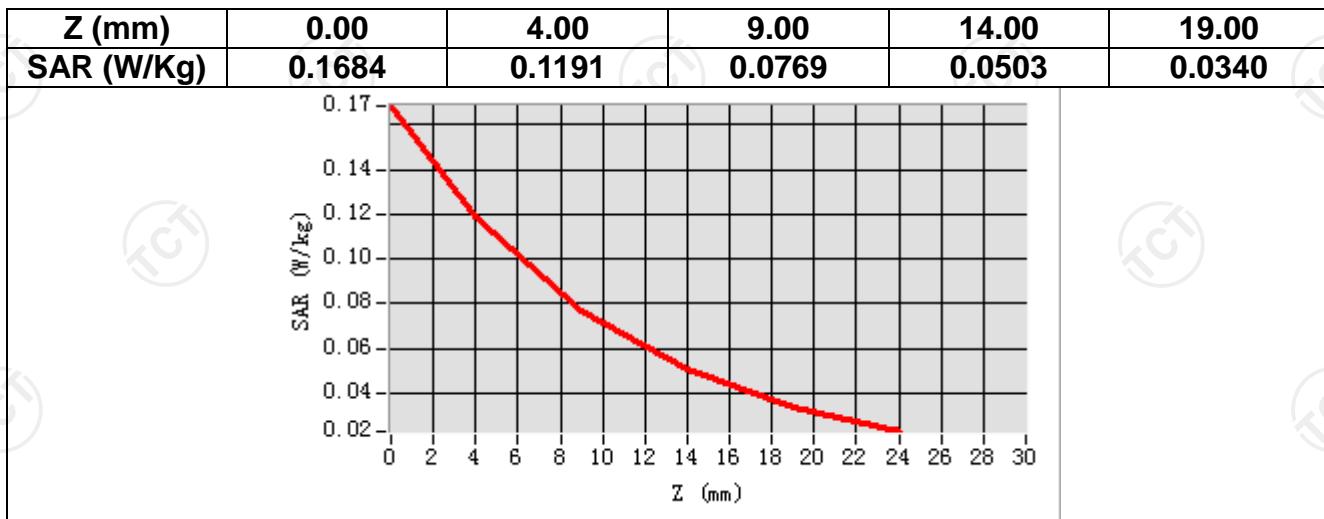
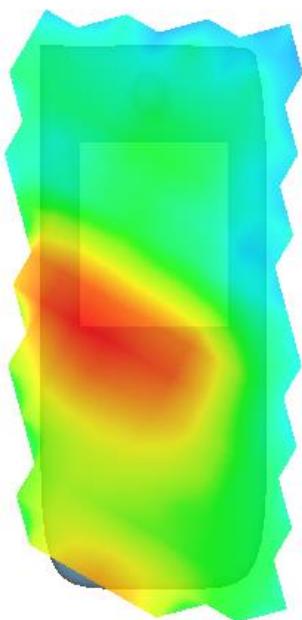
Date: 05/31/2019

Frequency (MHz)	2510.000000
Relative permittivity (real part)	38.862754
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.932731
Variation (%)	-1.240000
Crest Factor	1.0
Probe Conversion factor	4.38
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Right head</u>
Device Position	<u>Cheek</u>
Band	<u>LTE band 7(1 RB#0)</u>
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-48.00, Y=-10.00 SAR Peak: 0.17 W/kg

SAR 10g (W/Kg)	0.069503
SAR 1g (W/Kg)	0.114732



**Hot spot position**

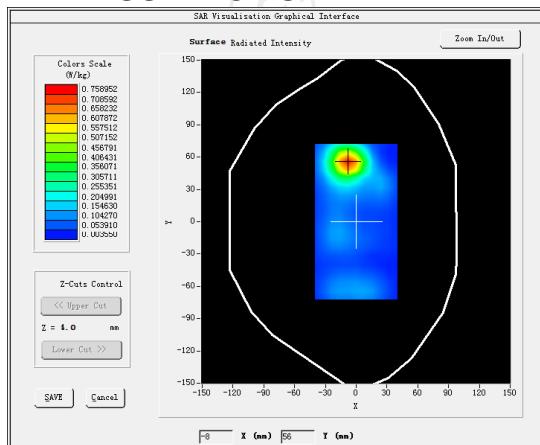
MEASUREMENT 2

Lower Band SAR (Channel 20850):

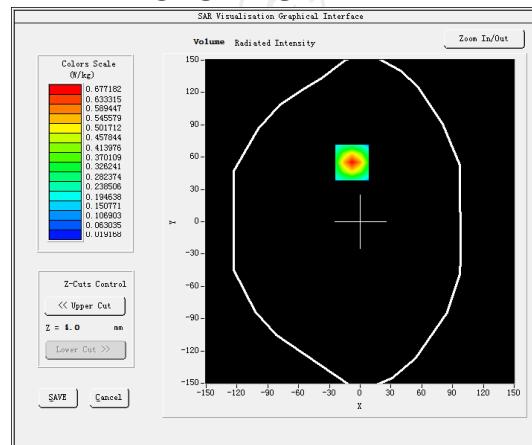
Date: 05/31/2019

Frequency (MHz)	2510.000000
Relative permittivity (real part)	51.961509
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	2.103245
Variation (%)	-1.560000
Crest Factor	1.0
Probe Conversion factor	4.52
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h= 5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>LTE band 7(1 RB#0)</u>

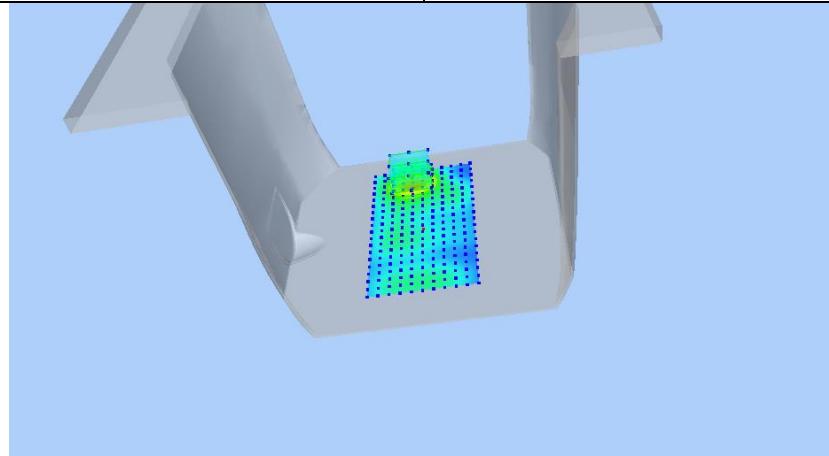
SURFACE SAR



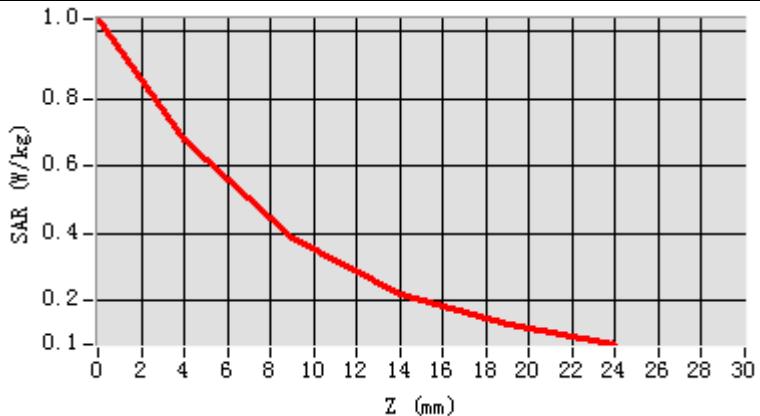
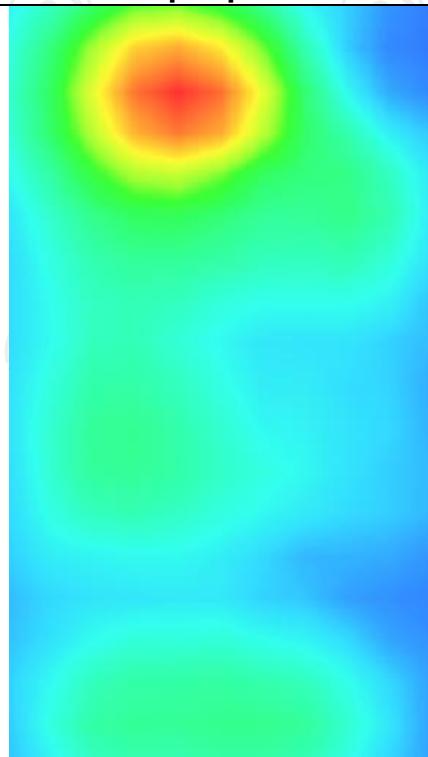
VOLUME SAR


Maximum location: X=-8.00, Y=55.00 SAR Peak: 1.04 W/kg

SAR 10g (W/Kg)	0.318688
SAR 1g (W/Kg)	0.620412



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.0389	0.6772	0.3858	0.2181	0.1253

**Hot spot position**

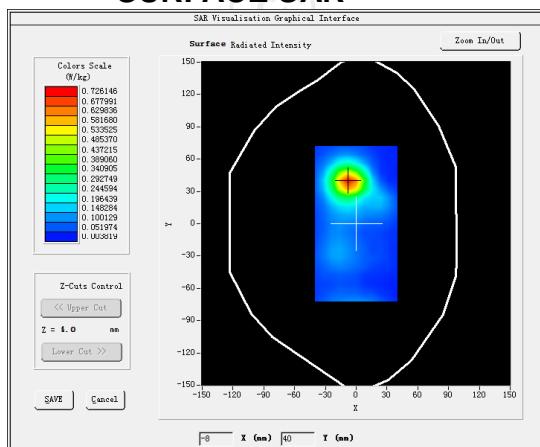
MEASUREMENT 3

Lower Band SAR (Channel 20850):

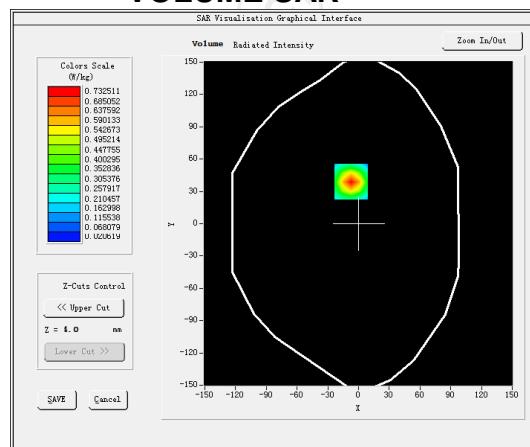
Date: 05/31/2019

Frequency (MHz)	2510.000000
Relative permittivity (real part)	51.961509
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	2.103245
Variation (%)	-1.690000
Crest Factor	1.0
Probe Conversion factor	4.52
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(hotspot 10mm)</u>
Band	<u>LTE band 7(1 RB#0)</u>

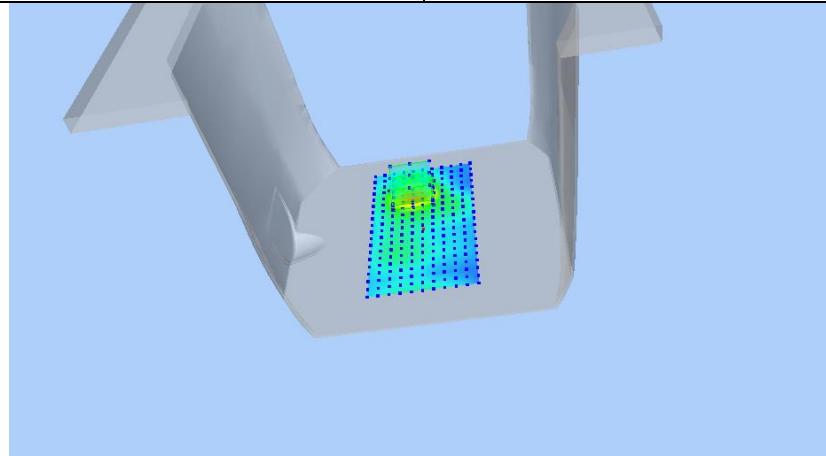
SURFACE SAR



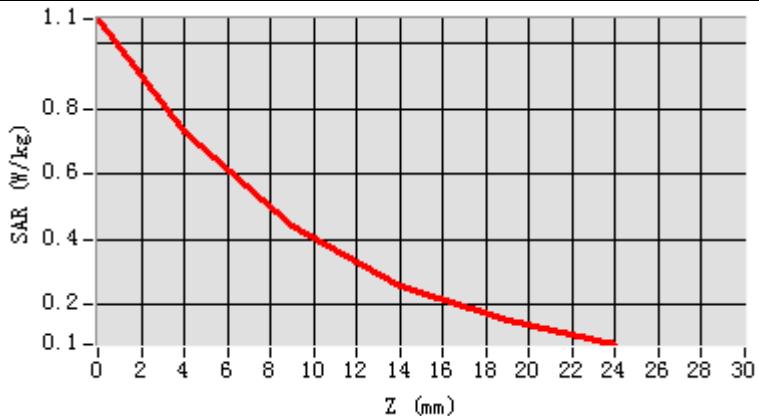
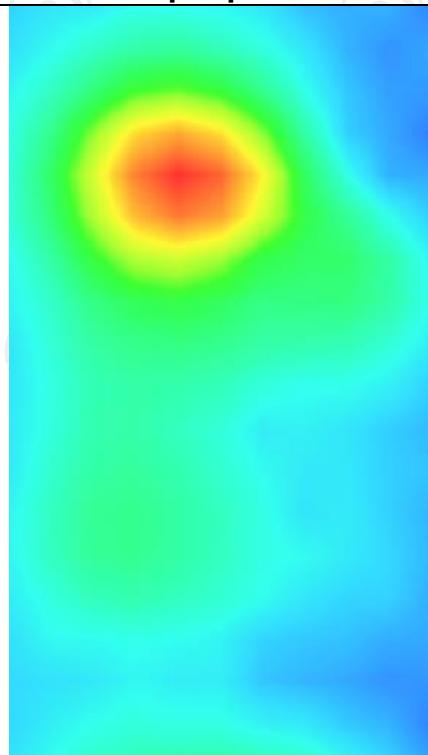
VOLUME SAR


Maximum location: X=-7.00, Y=39.00 SAR Peak: 1.07 W/kg

SAR 10g (W/Kg)	0.350653
SAR 1g (W/Kg)	0.668900



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.0753	0.7325	0.4411	0.2602	0.1508

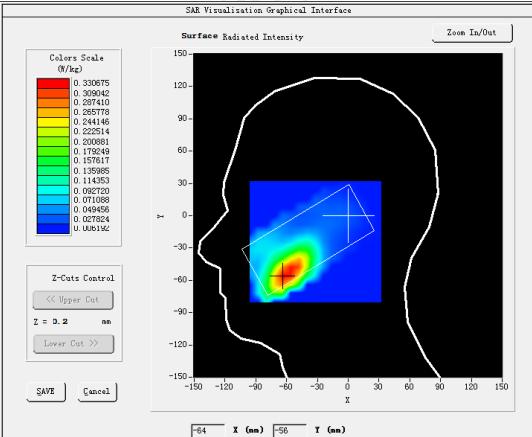
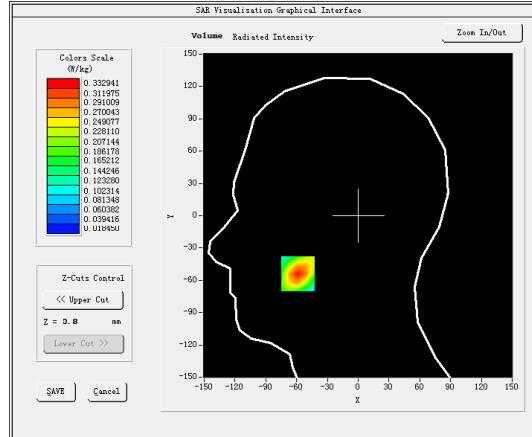
**Hot spot position**

LTE Band 66

MEASUREMENT 1

Lower Band SAR (Channel 132072):

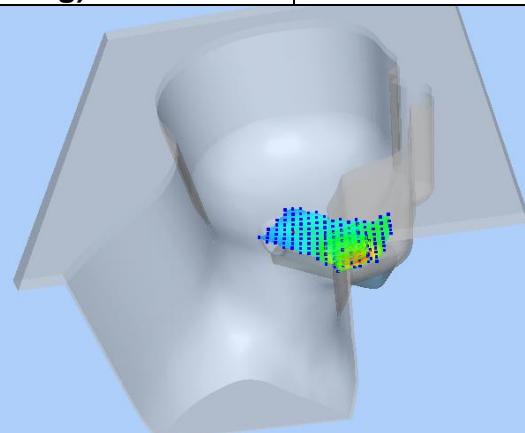
Date: 05/22/2019

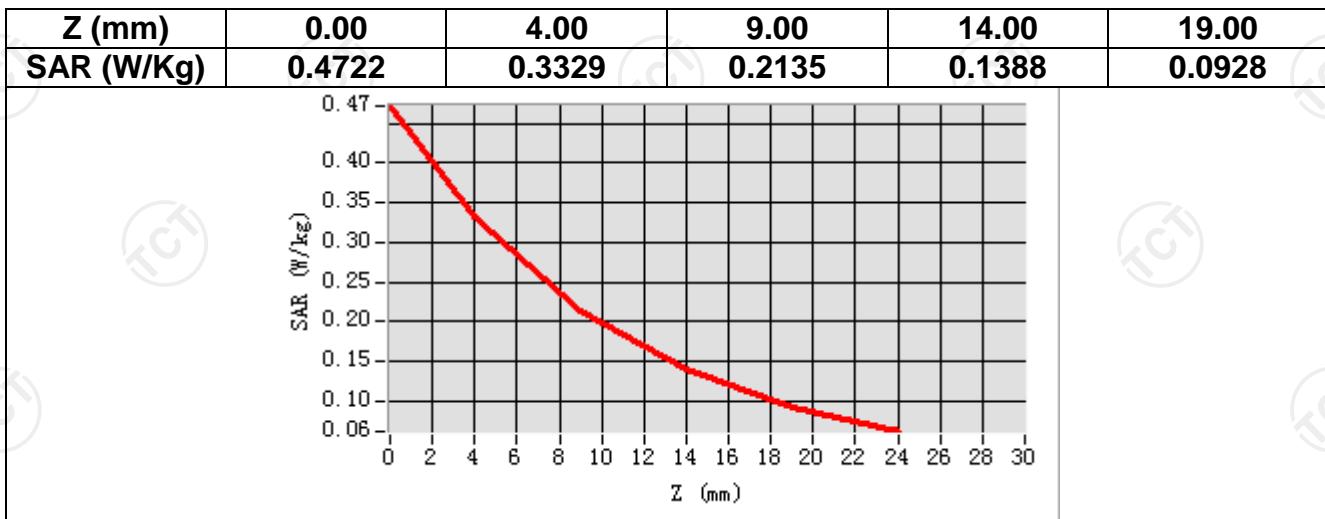
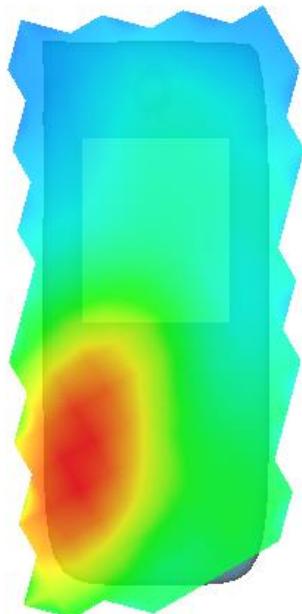
Frequency (MHz)	1720.000000
Relative permittivity (real part)	39.101249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.350792
Variation (%)	0.950000
Crest Factor	1.0
Probe Conversion factor	4.38
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>LTE band 66(1 RB#50)</u>
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-59.00, Y=-54.00 SAR Peak: 0.47 W/kg

SAR 10g (W/Kg) 0.183427

SAR 1g (W/Kg) 0.310843

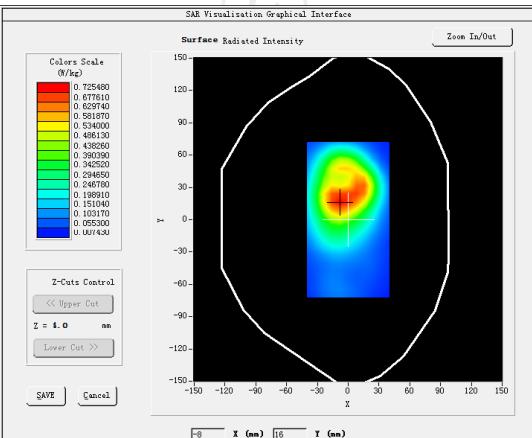
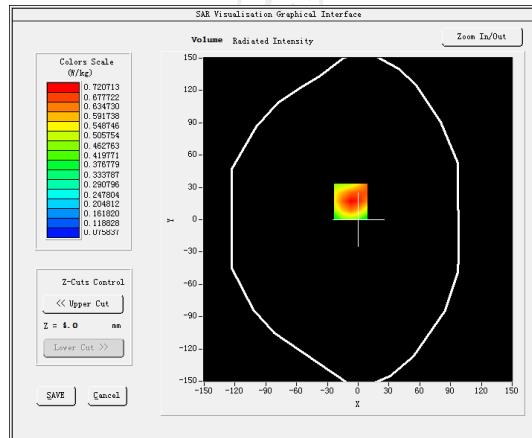


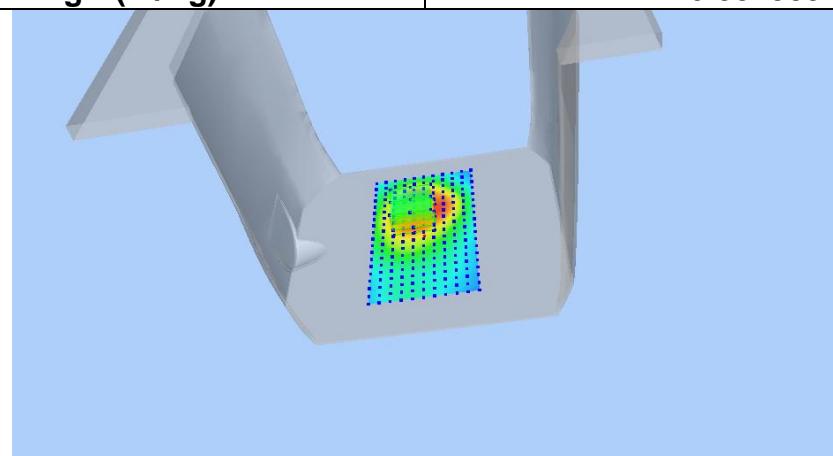
**Hot spot position**

MEASUREMENT 2

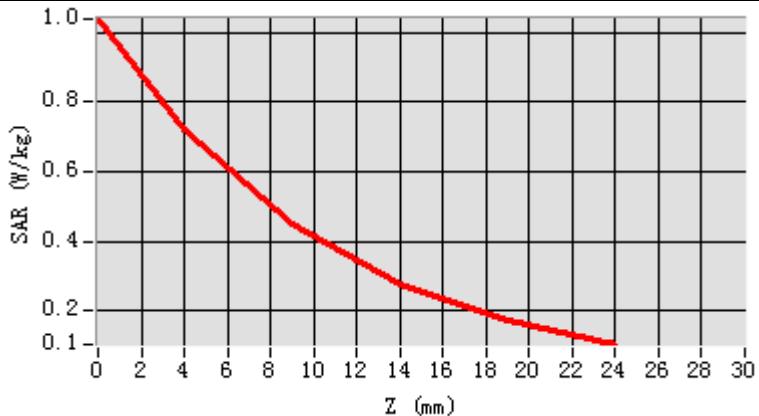
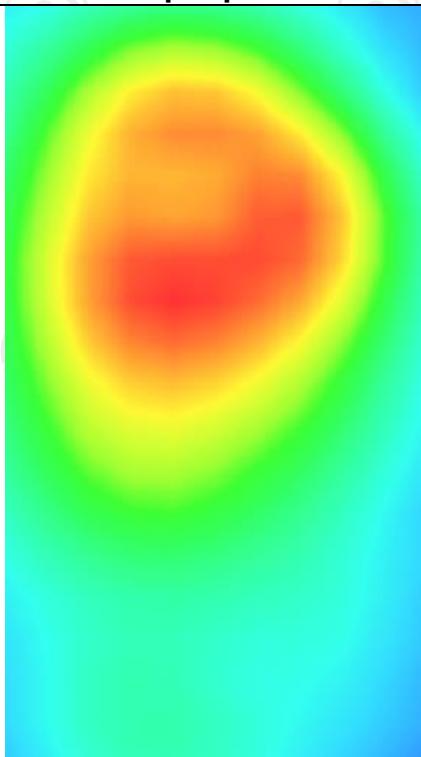
Lower Band SAR (Channel 132072):

Date: 05/22/2019

Frequency (MHz)	1720.000000
Relative permittivity (real part)	53.321249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.502592
Variation (%)	-1.100000
Crest Factor	1.0
Probe Conversion factor	4.52
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(10mm)</u>
Band	<u>LTE band 66(1 RB#50)</u>
SURFACE SAR	VOLUME SAR
	
Maximum location: X=-7.00, Y=17.00 SAR Peak: 1.04 W/kg	
SAR 10g (W/Kg)	0.419148
SAR 1g (W/Kg)	0.684869



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.0387	0.7207	0.4487	0.2785	0.1741

**Hot spot position**

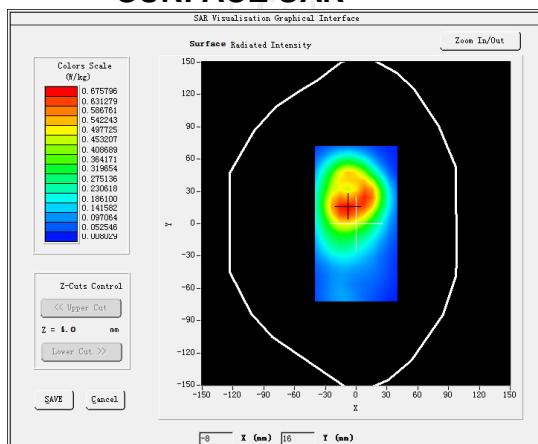
MEASUREMENT 3

Lower Band SAR (Channel 132072):

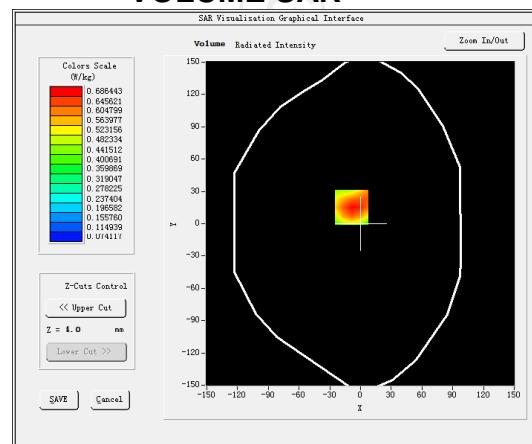
Date: 05/22/2019

Frequency (MHz)	1720.000000
Relative permittivity (real part)	53.321249
Relative permittivity (imaginary part)	12.468850
Conductivity (S/m)	1.502592
Variation (%)	1.440000
Crest Factor	1.0
Probe Conversion factor	4.52
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body back(hotspot 10mm)</u>
Band	<u>LTE band 66(1 RB#50)</u>

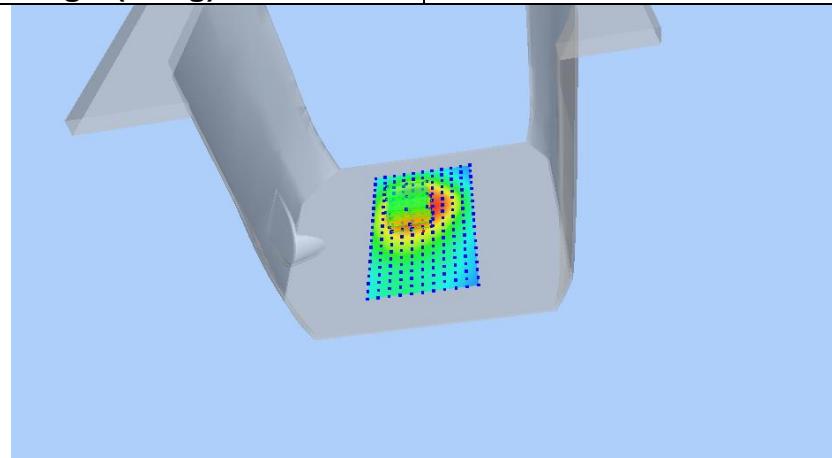
SURFACE SAR



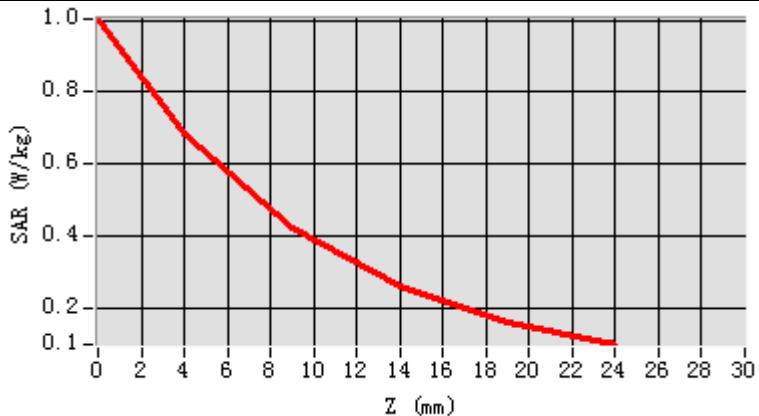
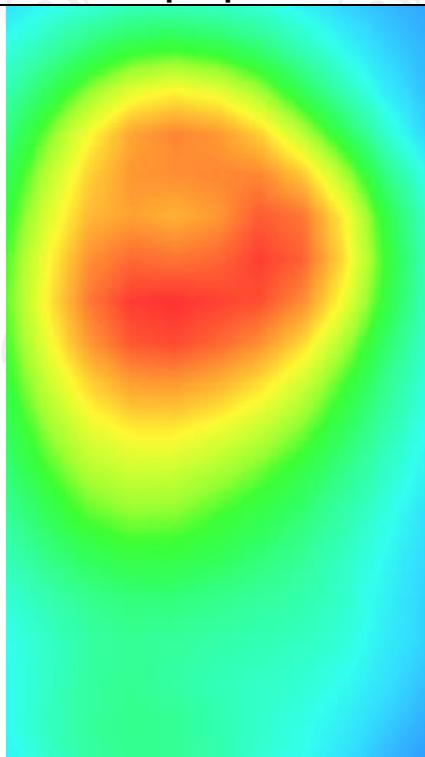
VOLUME SAR


Maximum location: X=-9.00, Y=15.00 SAR Peak: 1.01 W/kg

SAR 10g (W/Kg)	0.400456
SAR 1g (W/Kg)	0.653799



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.0035	0.6864	0.4201	0.2578	0.1612

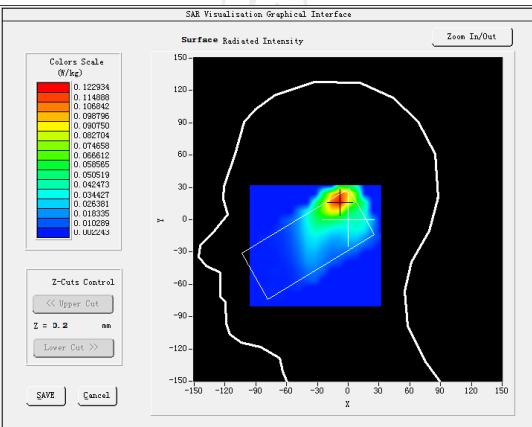
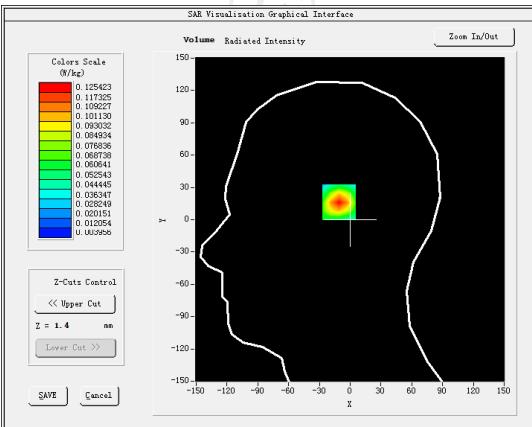
**Hot spot position**

WLAN 2.4

MEASUREMENT 1

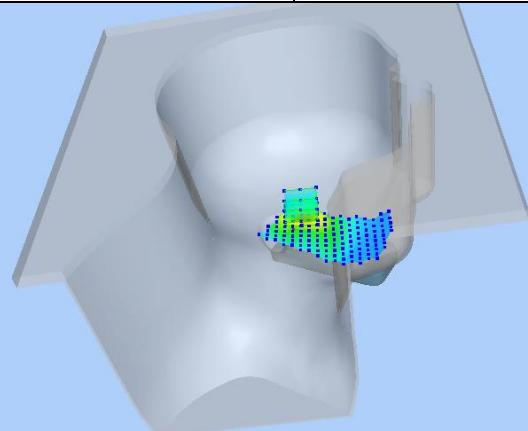
Middle Band SAR (Channel 6):

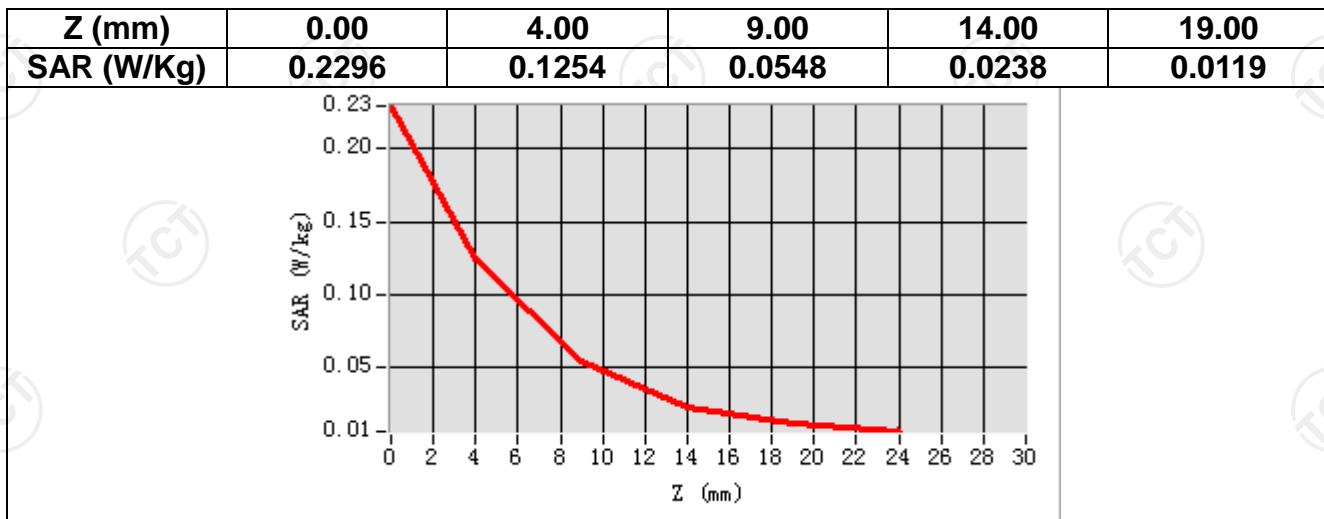
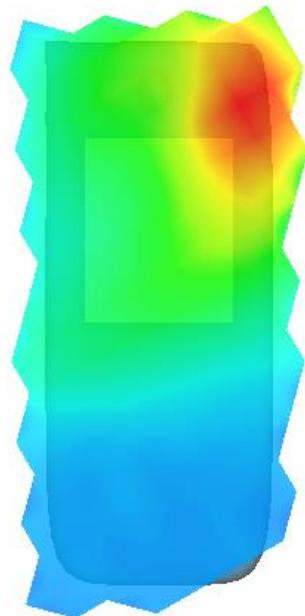
Date: 05/29/2019

Frequency (MHz)	2437.000000
Relative permittivity (real part)	37.851613
Relative permittivity (imaginary part)	13.546980
Conductivity (S/m)	1.814111
Variation (%)	0.760000
Crest Factor	1.0
Probe Conversion factor	4.58
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	<u>Left head</u>
Device Position	<u>Cheek</u>
Band	<u>IEEE 802.11b ISM</u>
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-9.00, Y=17.00 SAR Peak: 0.23 W/kg

SAR 10g (W/Kg)	0.056985
SAR 1g (W/Kg)	0.119585



**Hot spot position**

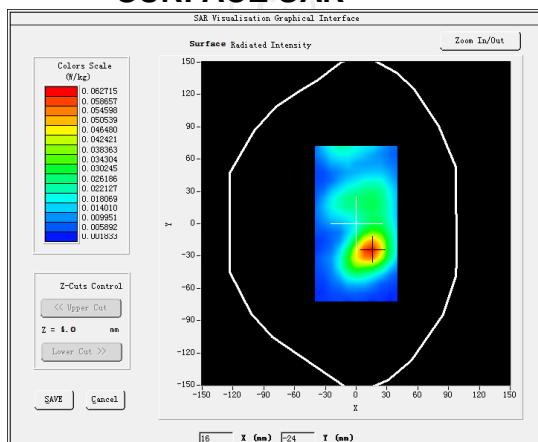
MEASUREMENT 2

Middle Band SAR (Channel 6):

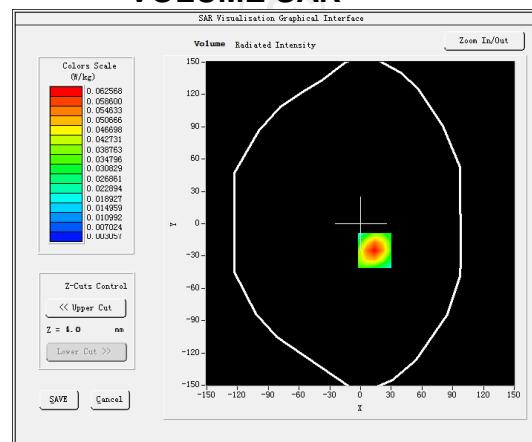
Date: 05/29/2019

Frequency (MHz)	243700000
Relative permittivity (real part)	54.630667
Relative permittivity (imaginary part)	14.318444
Conductivity (S/m)	1.982536
Variation (%)	3.040000
Crest Factor	1.0
Probe Conversion factor	4.70
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h=</u> <u>5.00 mm</u>
Phantom	Validation plane
Device Position	Body back(10mm)
Band	IEEE 802.11b ISM

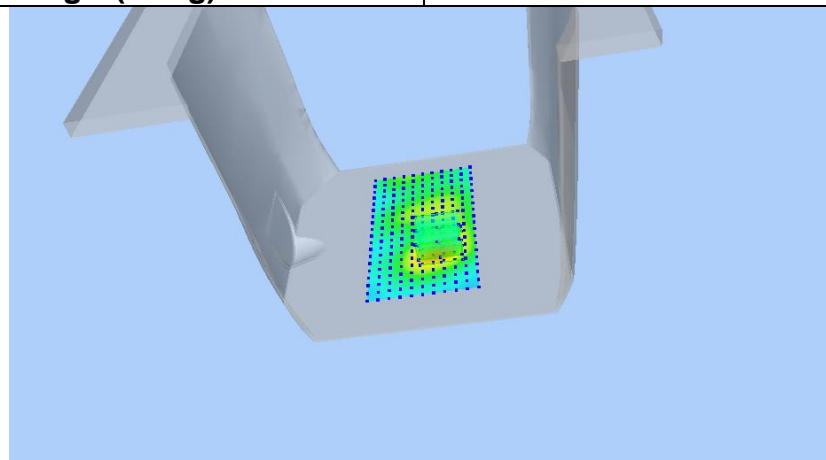
SURFACE SAR



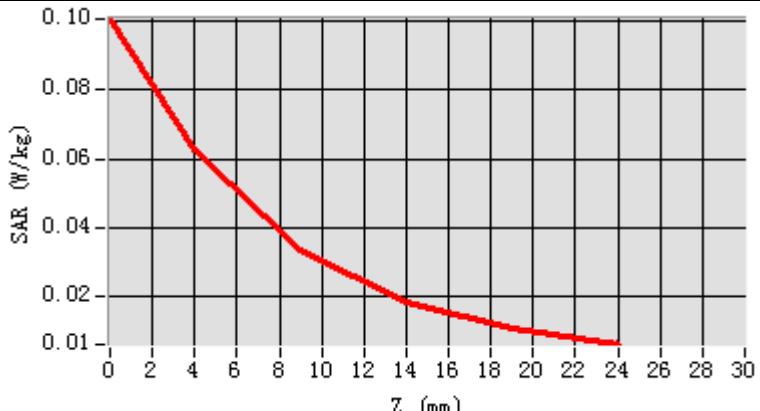
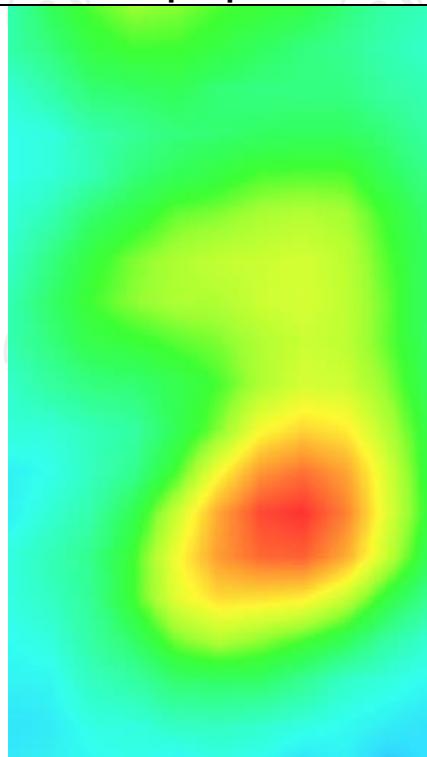
VOLUME SAR


Maximum location: X=14.00, Y=-25.00 SAR Peak: 0.10 W/kg

SAR 10g (W/Kg)	0.031998
SAR 1g (W/Kg)	0.060591



Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.1004	0.0626	0.0337	0.0184	0.0107

**Hot spot position**

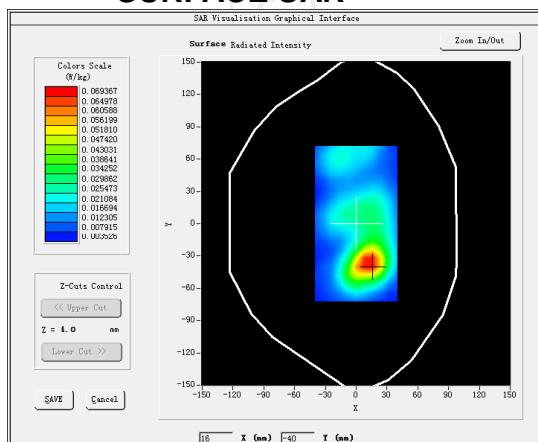
MEASUREMENT 3

Middle Band SAR (Channel 6):

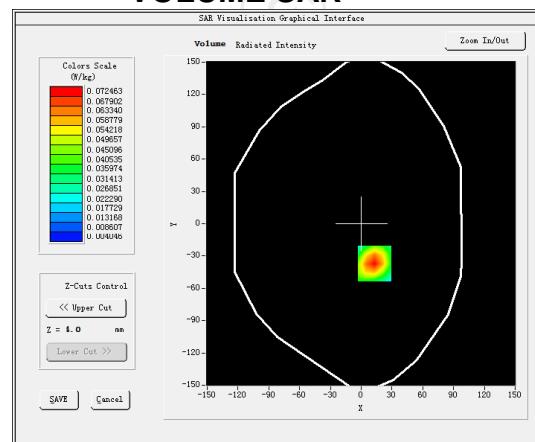
Date: 05/29/2019

Frequency (MHz)	2437.000000
Relative permittivity (real part)	54.630667
Relative permittivity (imaginary part)	14.318444
Conductivity (S/m)	1.982536
Variation (%)	0.060000
Crest Factor	1.0
Probe Conversion factor	4.70
E-Field Probe:	SSE5 (SN 07/15 EP248)
Area Scan	<u>dx=8mm dy=8mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm</u> <u>dz=5mm,Complete/hdx=8mm dy=8mm, h= 5.00 mm</u>
Phantom	Validation plane
Device Position	Body back(10mm)
Band	<u>IEEE 802.11b ISM(hotspot)</u>

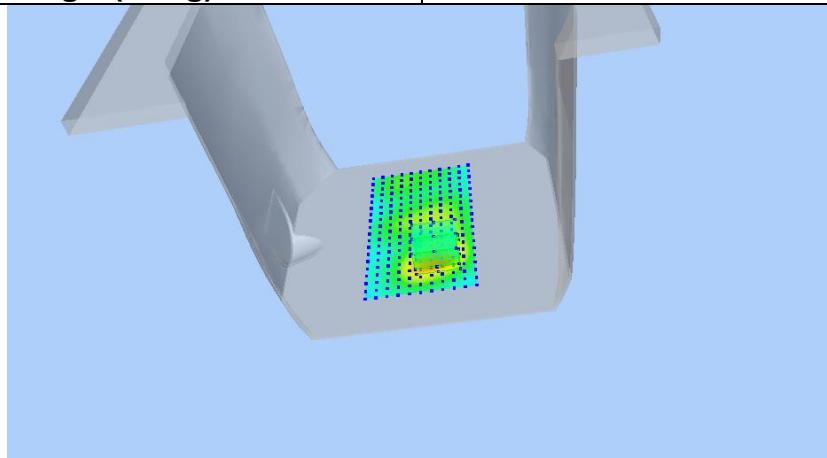
SURFACE SAR

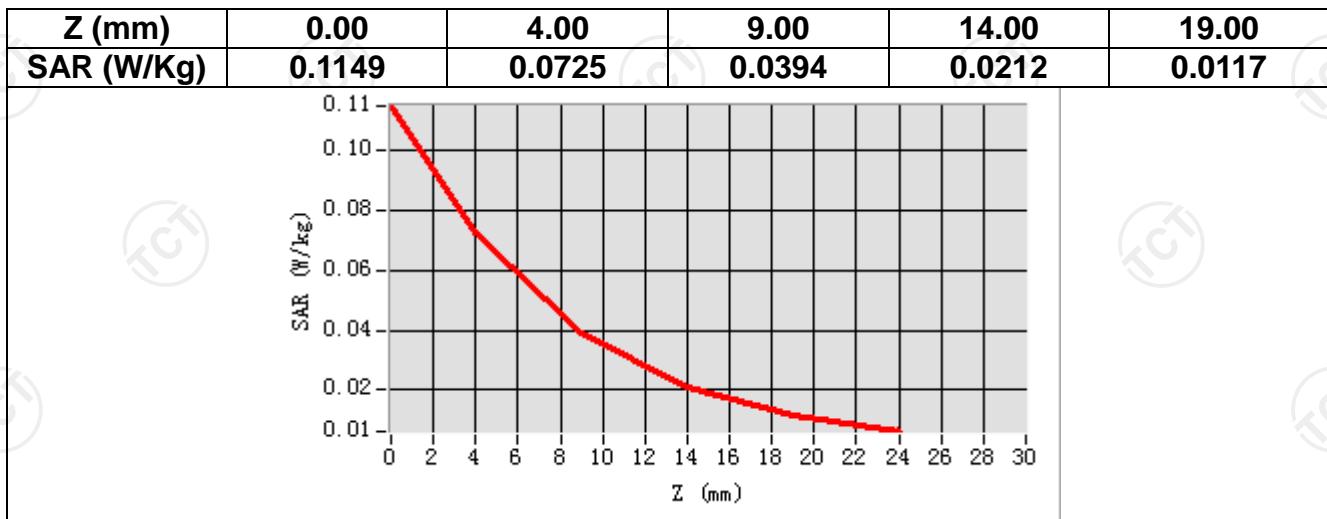
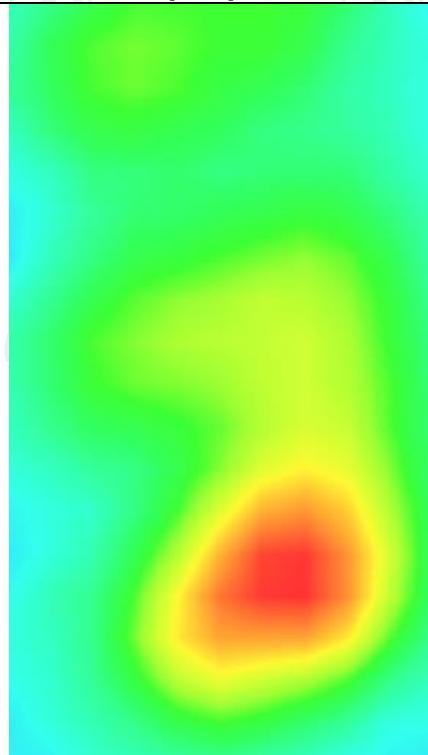


VOLUME SAR


Maximum location: X=13.00, Y=-37.00 SAR Peak: 0.12 W/kg

SAR 10g (W/Kg)	0.036752
SAR 1g (W/Kg)	0.070151



**Hot spot position**

Appendix A: EUT Photos



Liquid depth



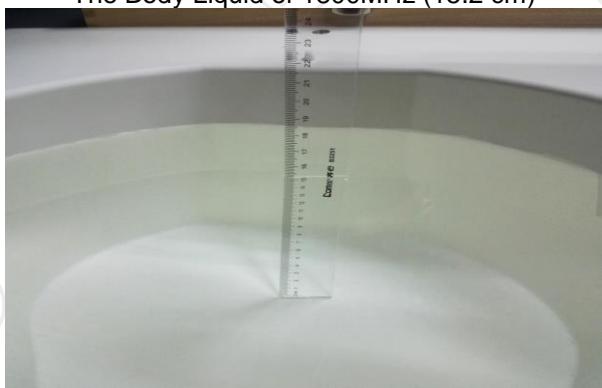
The Body Liquid of 835MHz (15.4cm)



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 Head Liquid of 1900MHz (15.5cm)



The Head Liquid of 2450MHz (15.6cm)



The Head Liquid of 835MHz (15.3cm)

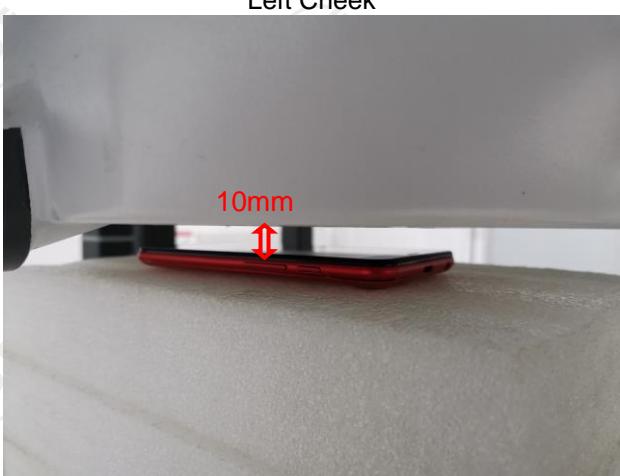
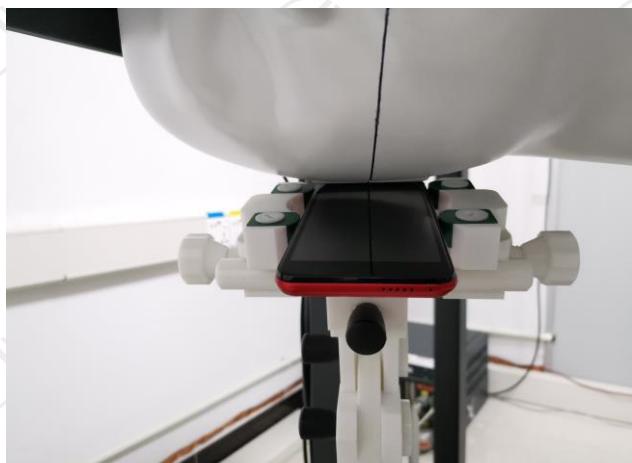
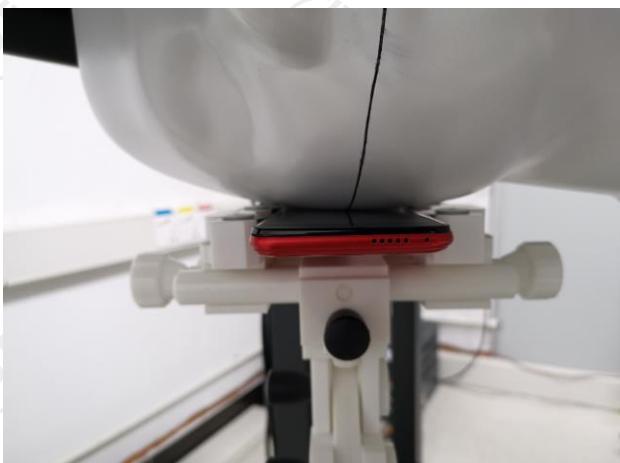


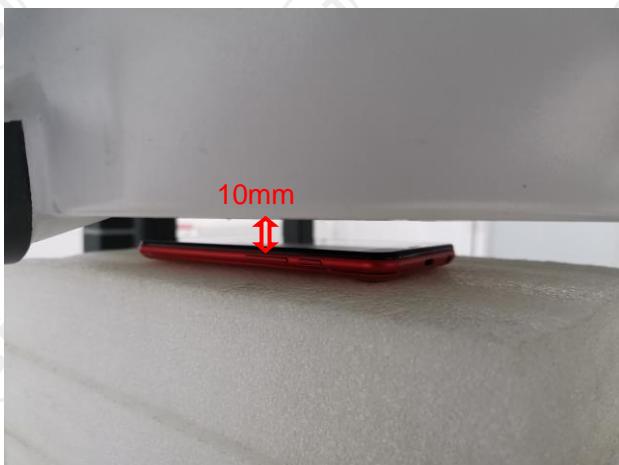
The Head Liquid of 2600MHz (15.1cm)



The Head Liquid of 1800MHz (15.2cm)

Appendix B: Test Setup Photos

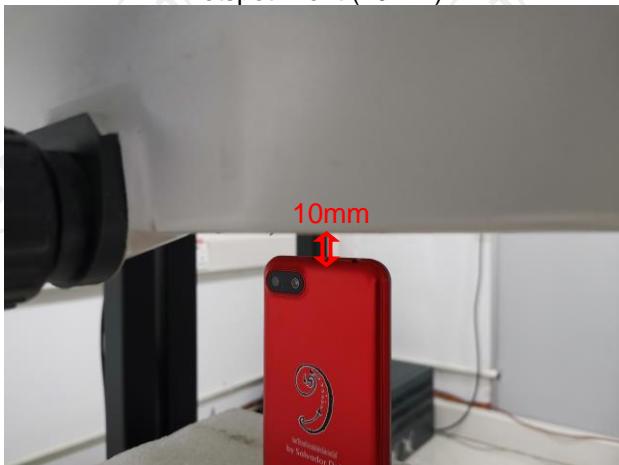




Hotspot Front (10mm)



Hotspot Back (10mm)



Hotspot Top (10mm)



Hotspot Bottom (10mm)



Hotspot Right (10mm)



Hotspot Left (10mm)

Appendix C: Probe Calibration Certificate

COMOSAR E-FIELD Probe



COMOSAR E-Field Probe Calibration Report

Ref : ACR.121.4.19.SATU.A

Shenzhen Tongce Testing Lab.
1B/F., Building 1, Yibaolai Industrial Park,
Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 07/15 EP248

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



Calibration Date: 01/09/2019

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.121.4.19.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	1/09/2019	
Checked by :	Jérôme LUC	Product Manager	1/09/2019	
Approved by :	Kim RUTKOWSKI	Quality Manager	1/09/2019	Kim Rutkowska

	Customer Name
Distribution :	Shenzhen Tongce Testing Lab

Issue	Date	Modifications
A	1/09/2019	Initial release

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.121.4.19.SATU.A

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.121.4.19.SATU.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE5
Serial Number	SN 07/15 EP248
Product Condition (new / used)	Used
Frequency Range of Probe	0.7 GHz-3GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.218 MΩ Dipole 2: R2=0.217 MΩ Dipole 3: R3=0.215 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	4.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	5 mm
Distance between dipoles / probe extremity	2.7 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.

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref. ACR.121.4.19.SATU.A

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%

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref. ACR.121.4.19.SATU.A

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%

5 CALIBRATION MEASUREMENT RESULTS

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

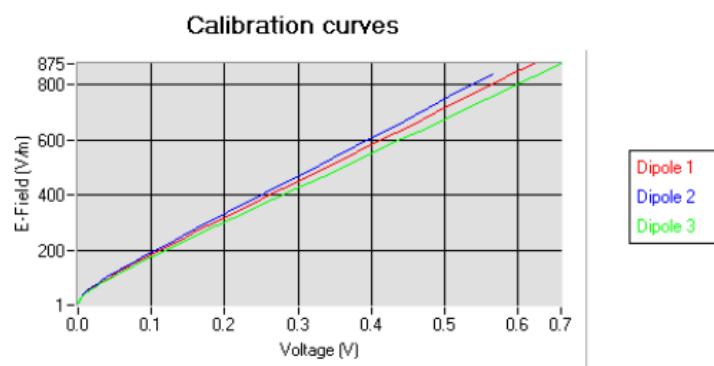
5.1 SENSITIVITY IN AIR

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 ($\mu\text{V}/(\text{V}/\text{m})^2$)
6.90	7.45	6.47

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
98	94	95

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

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



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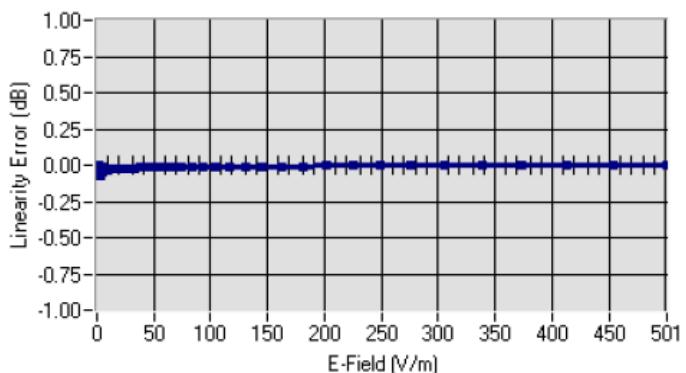


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.121.4.19.SATU.A

5.2 LINEARITY

Linearity

Linearity: +/-1.58% (+/-0.07dB)5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL450	450	42.17	0.87	5.33
BL450	450	57.65	0.94	5.51
HL750	750	40.03	0.93	4.74
BL750	750	56.83	1.00	4.93
HL850	835	42.19	0.90	5.50
BL850	835	54.67	1.01	5.65
HL900	900	42.08	1.01	4.93
BL900	900	55.25	1.08	5.04
HL1800	1800	41.68	1.46	4.38
BL1800	1800	53.86	1.46	4.52
HL1900	1900	38.45	1.45	4.85
BL1900	1900	53.32	1.56	5.01
HL2000	2000	38.26	1.38	4.68
BL2000	2000	52.70	1.51	4.80
HL2450	2450	37.50	1.80	4.58
BL2450	2450	53.22	1.89	4.70
HL2600	2600	39.80	1.99	4.36
BL2600	2600	52.52	2.23	4.50

LOWER DETECTION LIMIT: 8mW/kg

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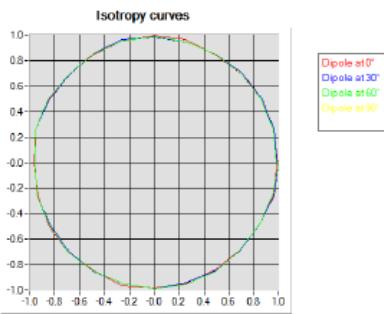


COMOSAR E-FIELD PROBE CALIBRATION REPORT

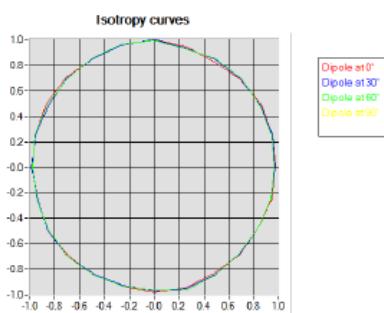
Ref: ACR.121.4.19.SATU.A

5.4 ISOTROPYHL900 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.07 dB

HL1800 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.05 dB



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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.121.4.19.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	02/2018	02/2021
Reference Probe	MVG	EP 94 SN 37/08	09/2018	02/2019
Multimeter	Keithley 2000	1188656	11/2016	11/2019
Signal Generator	Agilent E4438C	MY49070581	02/2018	02/2021
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2016	11/2019
Power Sensor	HP ECP-E26A	US37181460	11/2016	11/2019
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	11-661-9	10/2018	10/2019

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**Dielectric Probe Calibration Report**

Ref : ACR.138.4.33.SATU.A

Shenzhen Tongce Testing Lab.
1B/F., Building 1, Yibaolai Industrial Park,
Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, 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



Calibration Date: 06/05/2018

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	06/05/2018	
Checked by :	Jérôme LUC	Product Manager	06/05/2018	
Approved by :	Kim RUTKOWSKI	Quality Manager	06/05/2018	Kim RUTKOWSKI

	Customer Name
Distribution :	Shenzhen Tongce Testing Lab

Issue	Date	Modifications
A	06/05/2018	Initial release

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SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref. ACR.138.4.33..SATU.A

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SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref: ACR.138.4.33..SATU.A

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



SAR DIELECTRIC PROBE CALIBRATION REPORT

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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	$\sqrt{3}$	1	2.887%
Network analyser-drift, linearity	2.00%	R	$\sqrt{3}$	1	1.155%
Test-port cable variations	0.00%	U	$\sqrt{2}$	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	$\sqrt{3}$	1	1.732%
Network analyser-drift, linearity	2.00%	R	$\sqrt{3}$	1	1.155%
Test-port cable variations	0.00%	U	$\sqrt{2}$	1	0.000%
Combined standard uncertainty					4.072%
Expanded uncertainty (confidence level of 95%, k = 2)					8.1%

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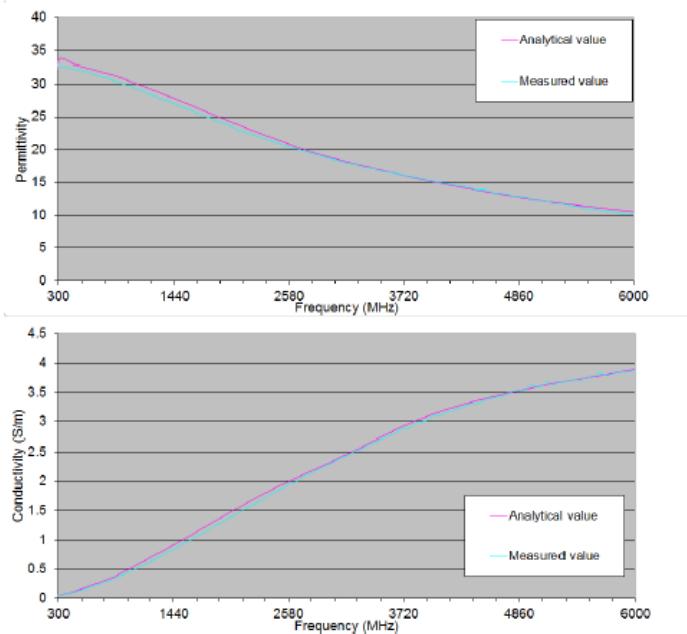
6 CALIBRATION MEASUREMENT RESULTS

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 $\epsilon' + j\epsilon''$) are compared with the well-known theoretical values for this liquid.





SAR DIELECTRIC PROBE CALIBRATION REPORT

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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	02/2018	02/2021
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	09/2018	09/2019

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