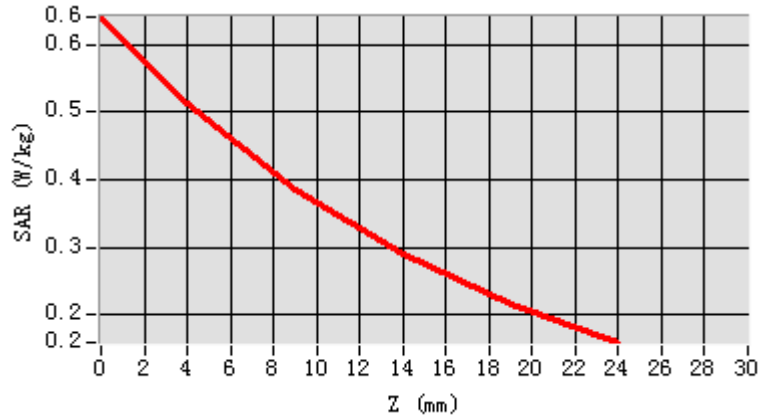
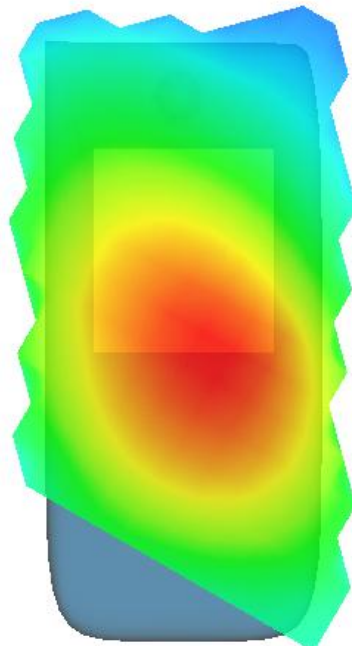


| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.6402 | 0.5116 | 0.3847 | 0.2891 | 0.2168 |



Hot spot position



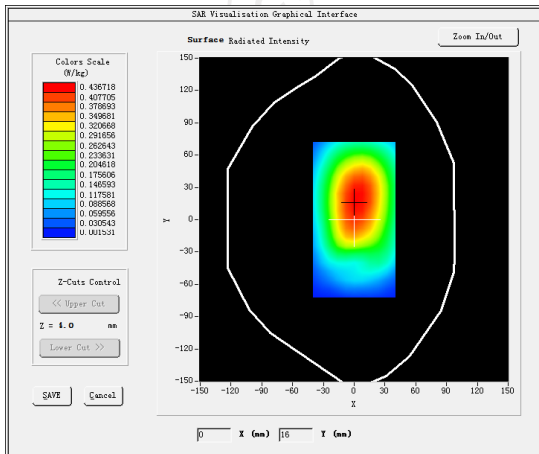
MEASUREMENT 2

Middle Band SAR (Channel 9182):

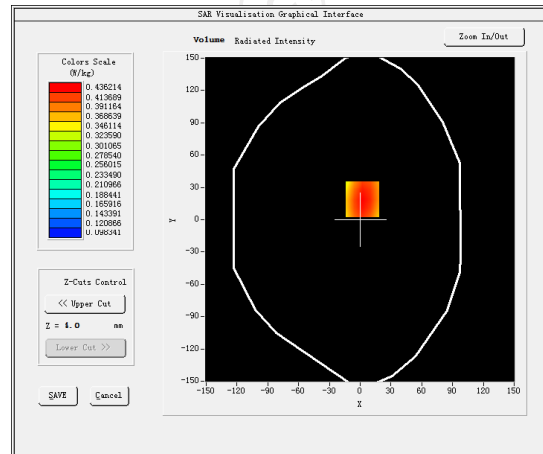
Date: 10/15/2019

| | |
|--|---|
| Frequency (MHz) | 836.400000 |
| Relative permittivity (real part) | 55.242927 |
| Relative permittivity (imaginary part) | 21.378266 |
| Conductivity (S/m) | 0.941230 |
| Variation (%) | -1.740000 |
| 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/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u> |
| Phantom | <u>Validation plane</u> |
| Device Position | <u>Body front(10mm)</u> |
| Band | <u>BAND5_WCDMA850</u> |

SURFACE SAR



VOLUME SAR



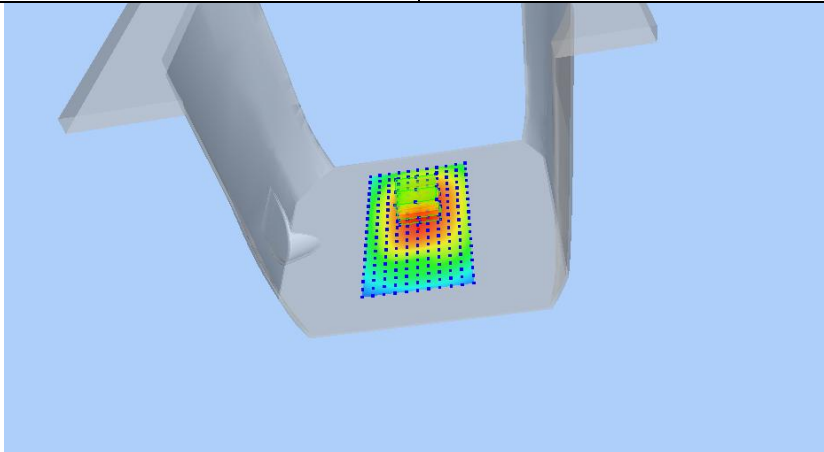
Maximum location: X=2.00, Y=19.00 SAR Peak: 0.53 W/kg

SAR 10g (W/Kg)

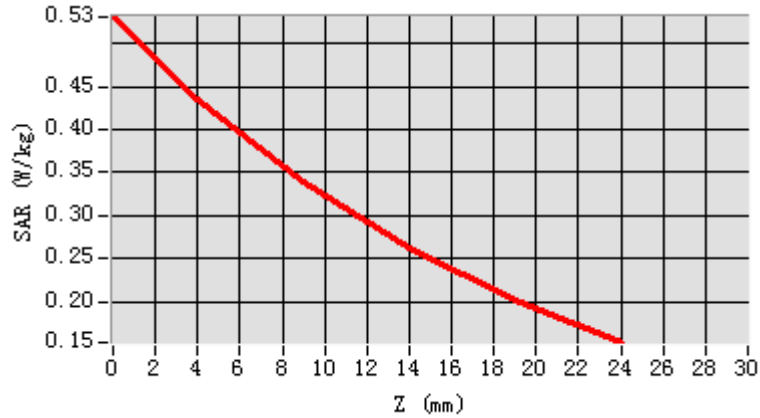
0.313148

SAR 1g (W/Kg)

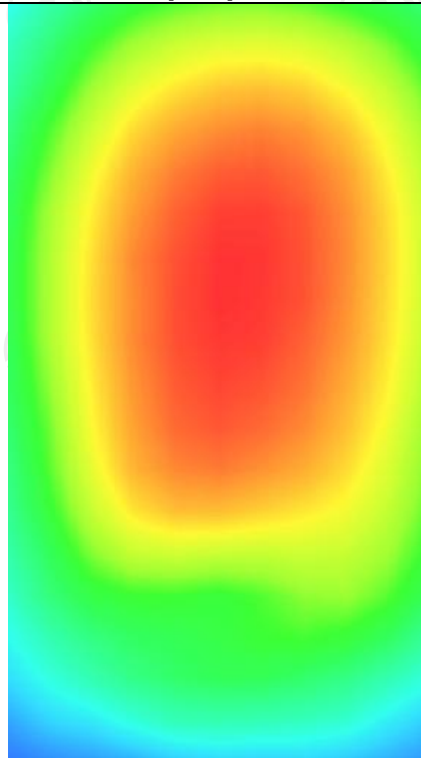
0.421654



| | | | | | |
|------------|--------|--------|--------|--------|--------|
| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
| SAR (W/Kg) | 0.5310 | 0.4362 | 0.3392 | 0.2626 | 0.2020 |



Hot spot position



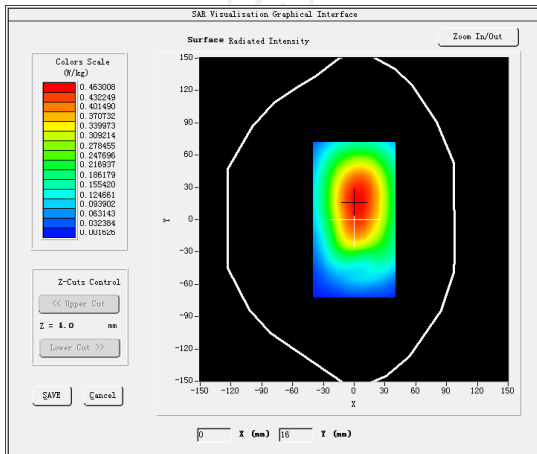
MEASUREMENT 3

Middle Band SAR (Channel 9182):

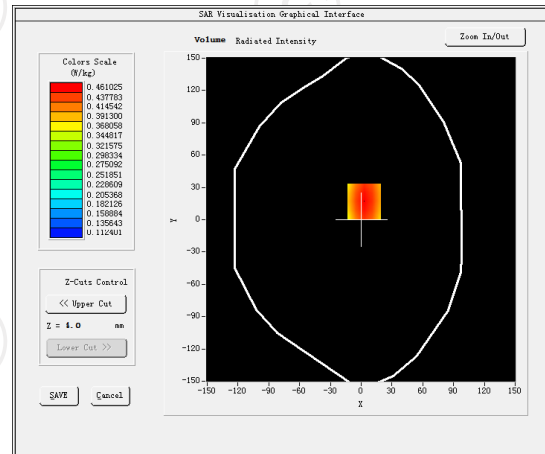
Date: 10/15/2019

| | |
|---|---|
| Frequency (MHz) | 836.400000 |
| Relative permittivity (real part) | 55.242927 |
| Relative permittivity (imaginary part) | 21.378266 |
| Conductivity (S/m) | 0.941230 |
| Variation (%) | -1.020000 |
| 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/ndx=8mm dy=8mm,</u> <u>h= 5.00 mm</u> |
| Phantom | <u>Validation plane</u> |
| Device Position | <u>Body front(10mm)</u> |
| Band | <u>BAND5_WCDMA850(hotspot)</u> |

SURFACE SAR



VOLUME SAR



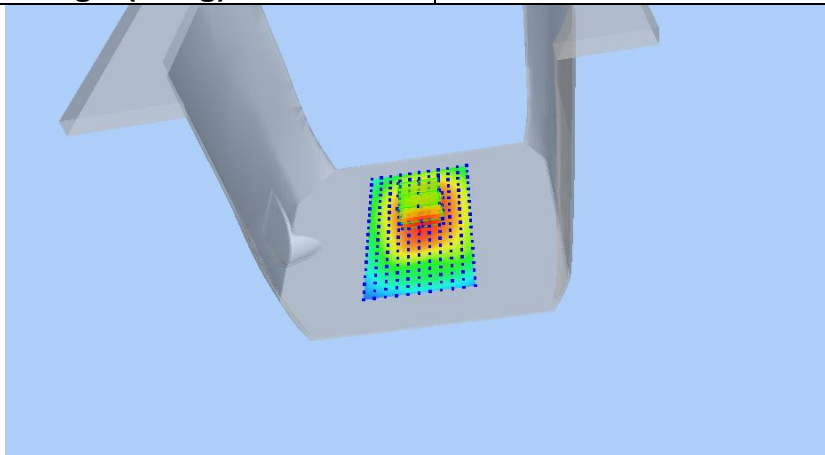
Maximum location: X=3.00, Y=17.00 SAR Peak: 0.56 W/kg

SAR 10g (W/Kg)

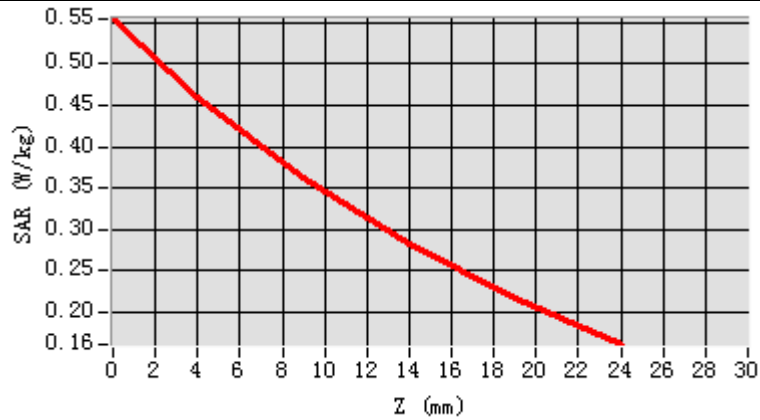
0.332736

SAR 1g (W/Kg)

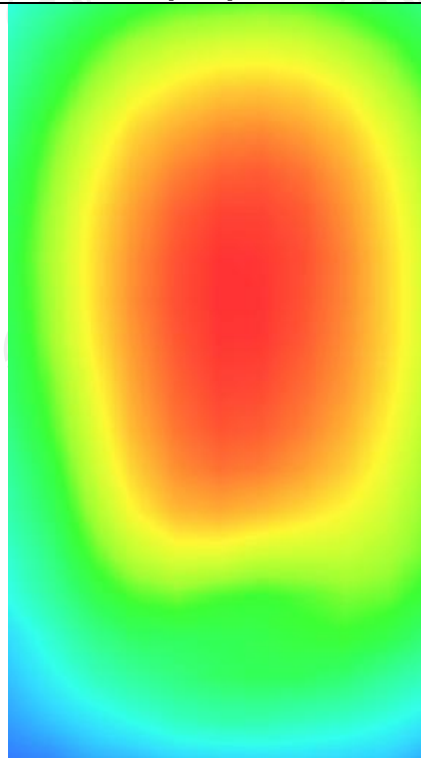
0.445507



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.5547 | 0.4610 | 0.3624 | 0.2819 | 0.2161 |



Hot spot position



LTE Band 2

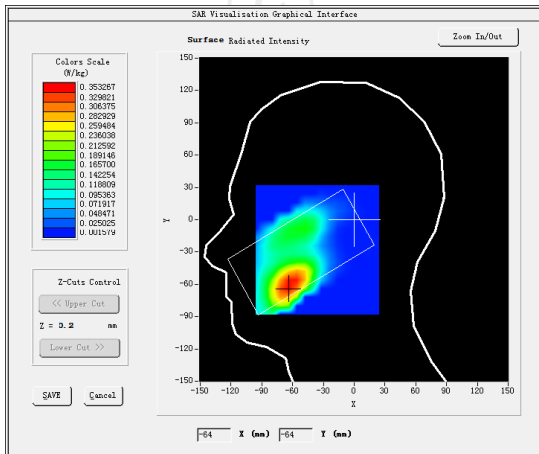
MEASUREMENT 1

Lower Band SAR (Channel 18607):

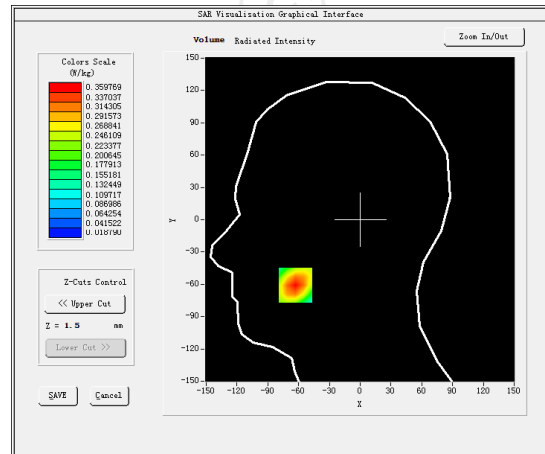
Date: 10/17/2019

| | |
|--|---|
| Frequency (MHz) | 1850.700000 |
| Relative permittivity (real part) | 39.113793 |
| Relative permittivity (imaginary part) | 12.607061 |
| Conductivity (S/m) | 1.337526 |
| Variation (%) | -2.190000 |
| 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>LTE band 2 (1 RB#2)</u> |

SURFACE SAR



VOLUME SAR



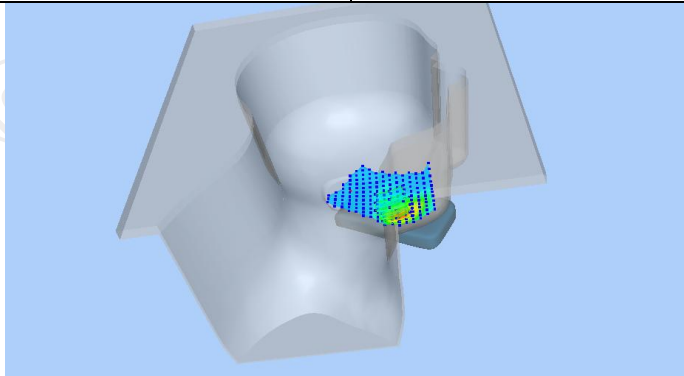
Maximum location: X=-63.00, Y=-61.00 SAR Peak: 0.53 W/kg

SAR 10g (W/Kg)

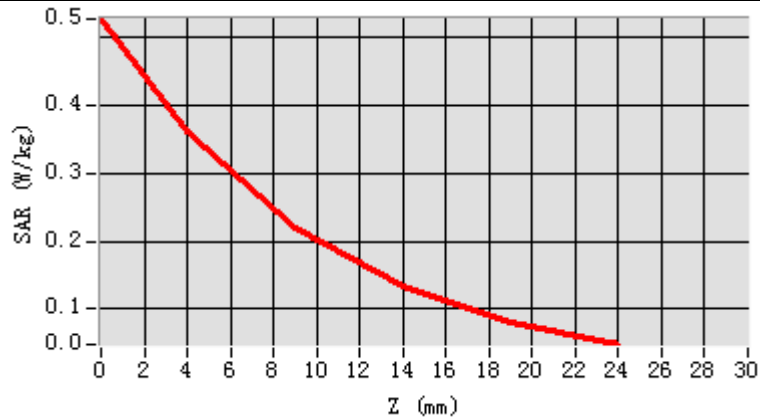
0.197362

SAR 1g (W/Kg)

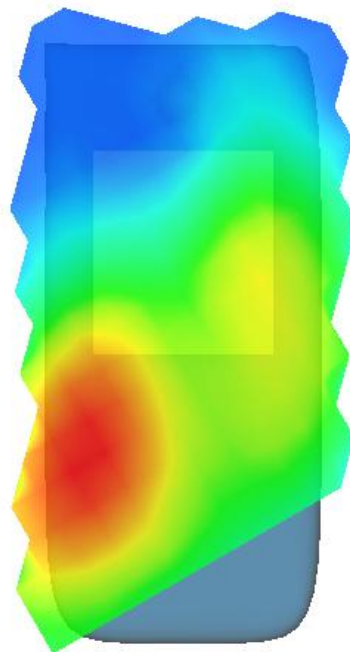
0.338399



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.5260 | 0.3598 | 0.2195 | 0.1335 | 0.0820 |



Hot spot position



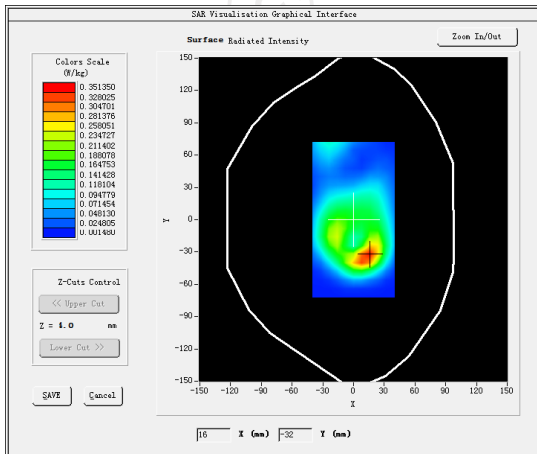
MEASUREMENT 2

Lower Band SAR (Channel 18607):

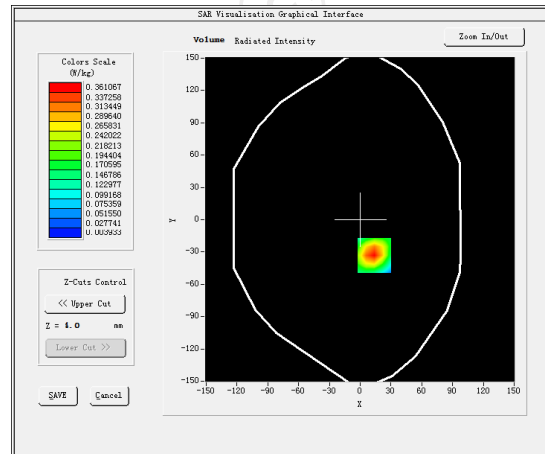
Date: 10/17/2019

| | |
|---|---|
| Frequency (MHz) | 1850.700000 |
| Relative permittivity (real part) | 53.342133 |
| Relative permittivity (imaginary part) | 14.329440 |
| Conductivity (S/m) | 1.491983 |
| Variation (%) | -0.100000 |
| 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 front(10mm)</u> |
| Band | <u>LTE band 2 (1 RB#2)</u> |

SURFACE SAR



VOLUME SAR



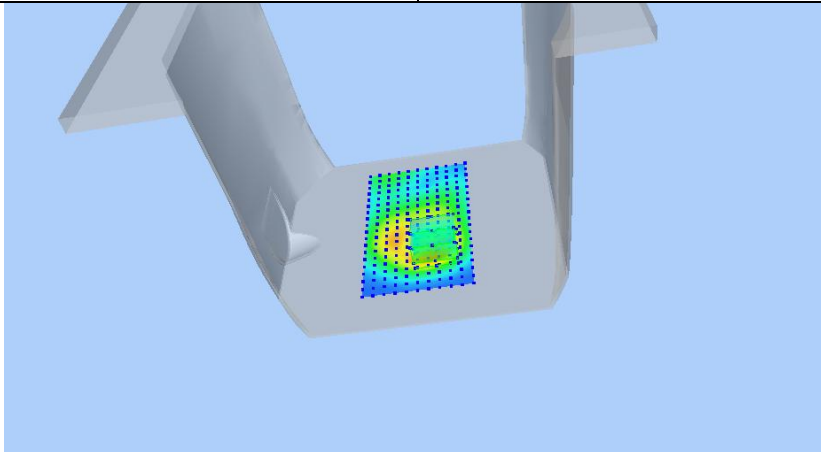
Maximum location: X=14.00, Y=-33.00 SAR Peak: 0.59 W/kg

SAR 10g (W/Kg)

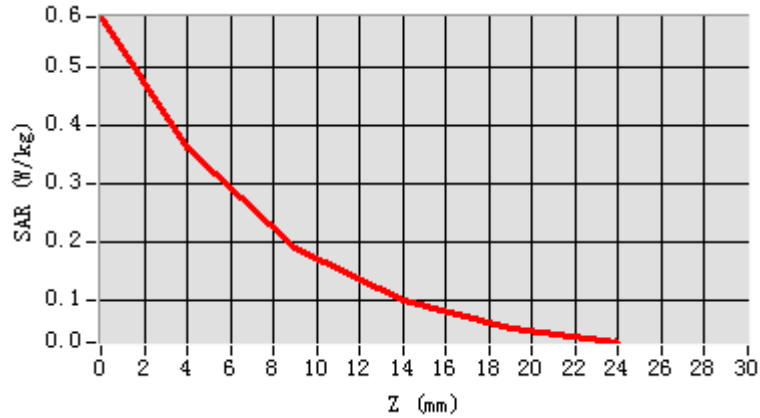
0.170390

SAR 1g (W/Kg)

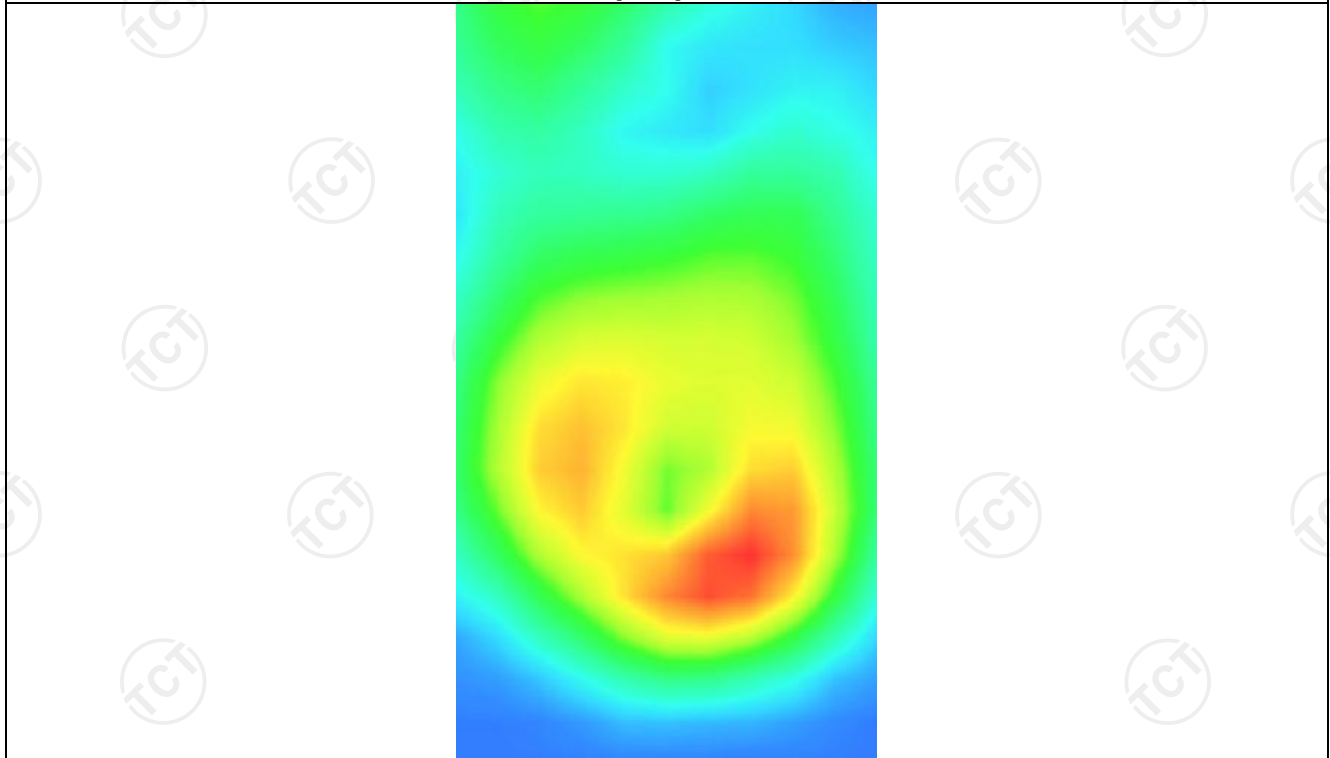
0.337189



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.5863 | 0.3611 | 0.1894 | 0.0984 | 0.0530 |



Hot spot position



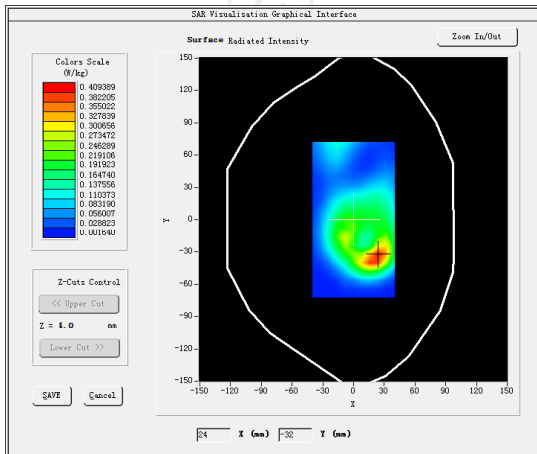
MEASUREMENT 3

Lower Band SAR (Channel 18607):

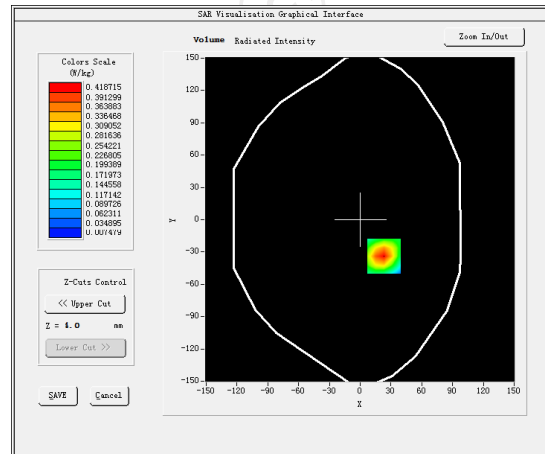
Date: 10/17/2019

| | |
|--|---|
| Frequency (MHz) | 1850.700000 |
| Relative permittivity (real part) | 53.342133 |
| Relative permittivity (imaginary part) | 14.329440 |
| Conductivity (S/m) | 1.491983 |
| Variation (%) | -1.800000 |
| 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 front(hotspot 10mm)</u> |
| Band | <u>LTE band 2 (1 RB#2)</u> |

SURFACE SAR



VOLUME SAR



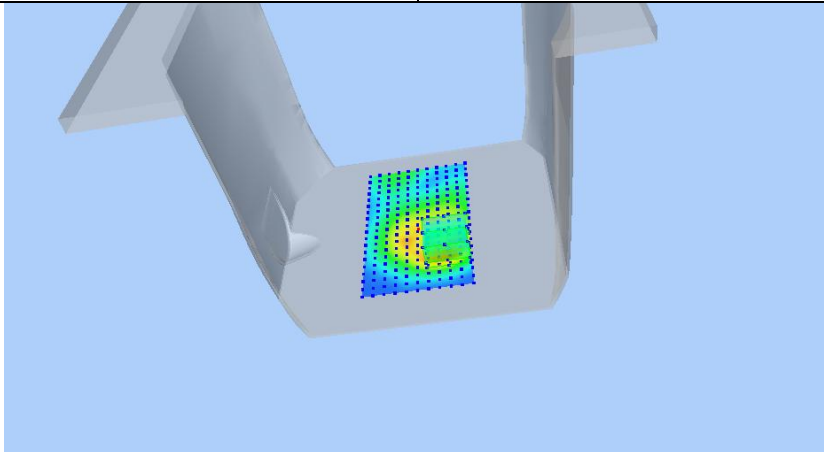
Maximum location: X=23.00, Y=-34.00 SAR Peak: 0.69 W/kg

SAR 10g (W/Kg)

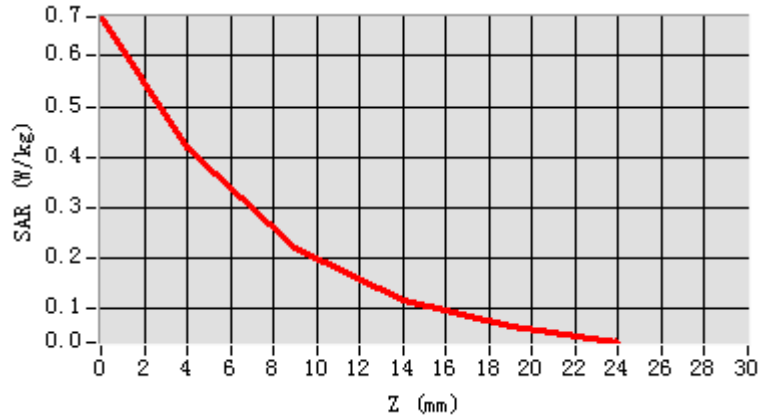
0.198068

SAR 1g (W/Kg)

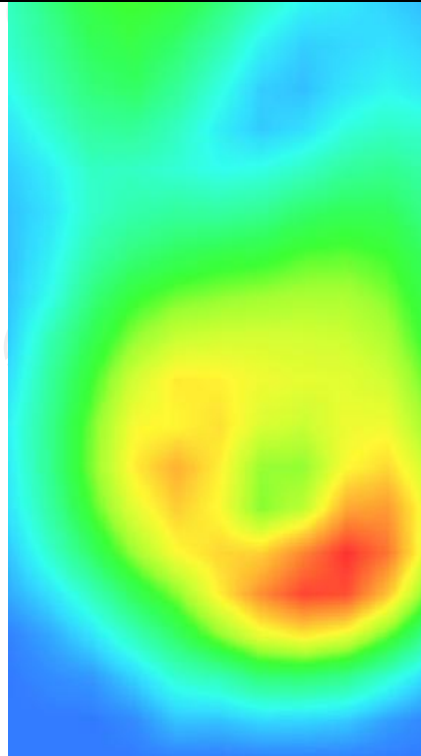
0.390858



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.6774 | 0.4187 | 0.2207 | 0.1151 | 0.0619 |



Hot spot position



LTE Band 4

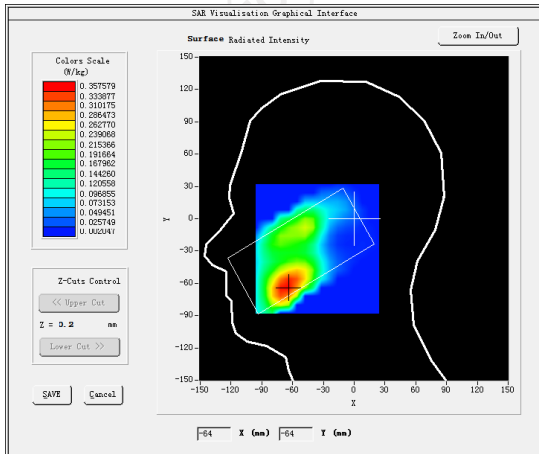
MEASUREMENT 1

Middle Band SAR (Channel 20175):

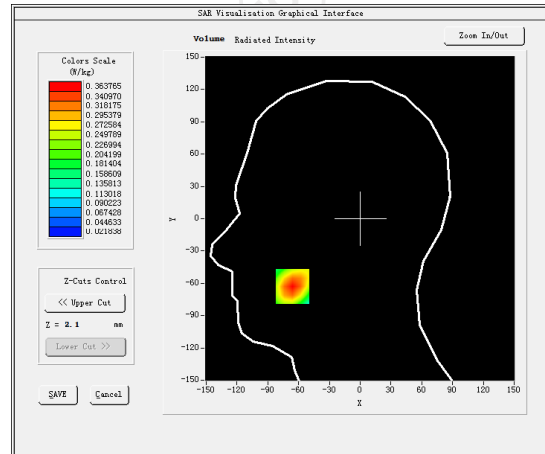
Date: 10/15/2019

| | |
|---|---|
| Frequency (MHz) | 1732.500000 |
| Relative permittivity (real part) | 39.101249 |
| Relative permittivity (imaginary part) | 12.468850 |
| Conductivity (S/m) | 1.350792 |
| Variation (%) | -1.100000 |
| 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#50)</u> |

SURFACE SAR



VOLUME SAR



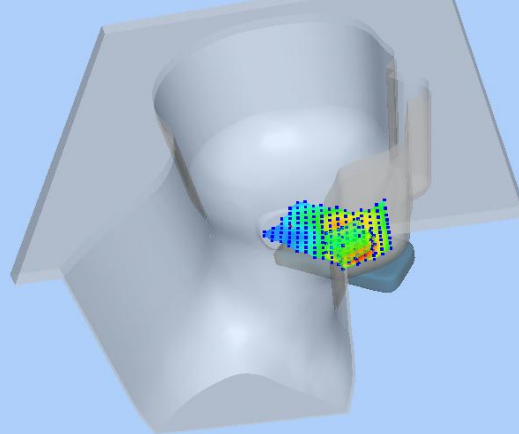
Maximum location: X=-66.00, Y=-63.00 SAR Peak: 0.56 W/kg

SAR 10g (W/Kg)

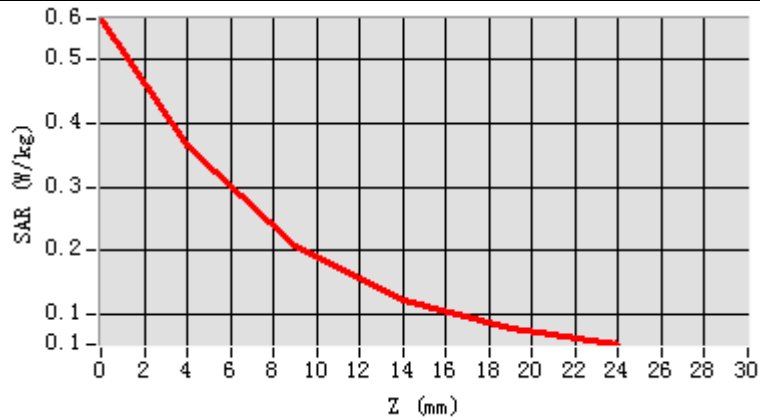
0.198777

SAR 1g (W/Kg)

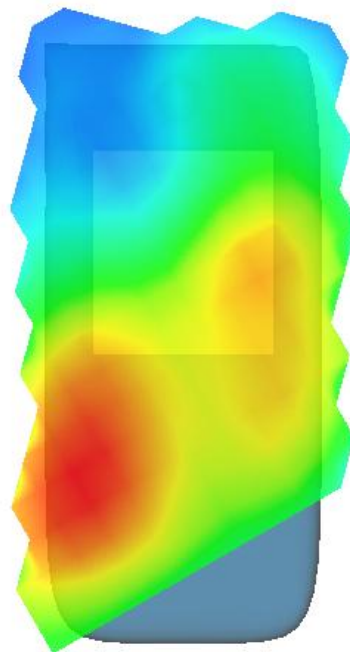
0.343708



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.5646 | 0.3638 | 0.2073 | 0.1222 | 0.0782 |



Hot spot position



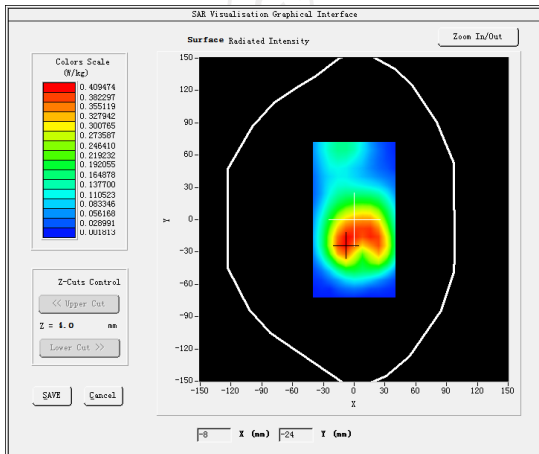
MEASUREMENT 2

Middle Band SAR (Channel 20175):

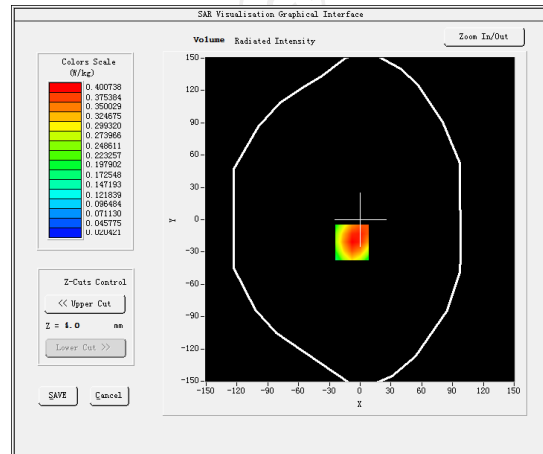
Date: 10/15/2019

| | |
|--|---|
| Frequency (MHz) | 1732.500000 |
| Relative permittivity (real part) | 53.321249 |
| Relative permittivity (imaginary part) | 12.468850 |
| Conductivity (S/m) | 1.502592 |
| Variation (%) | -3.240000 |
| 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/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>LTE band 4(1 RB#50)</u> |

SURFACE SAR



VOLUME SAR



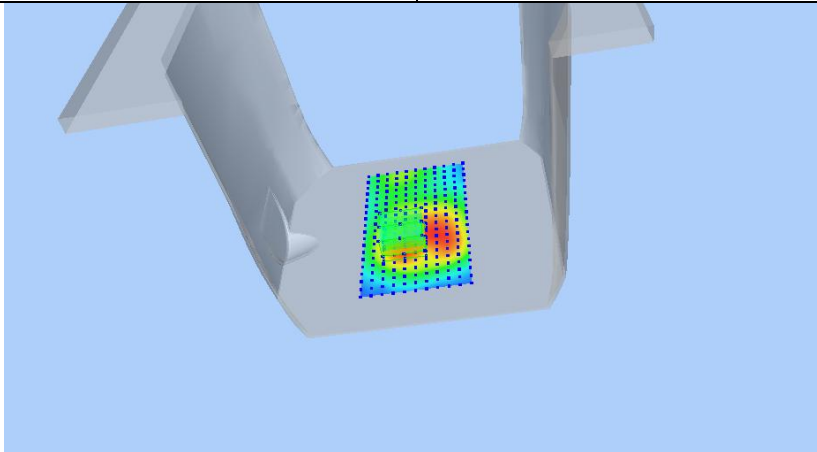
Maximum location: X=-8.00, Y=-21.00 SAR Peak: 0.58 W/kg

SAR 10g (W/Kg)

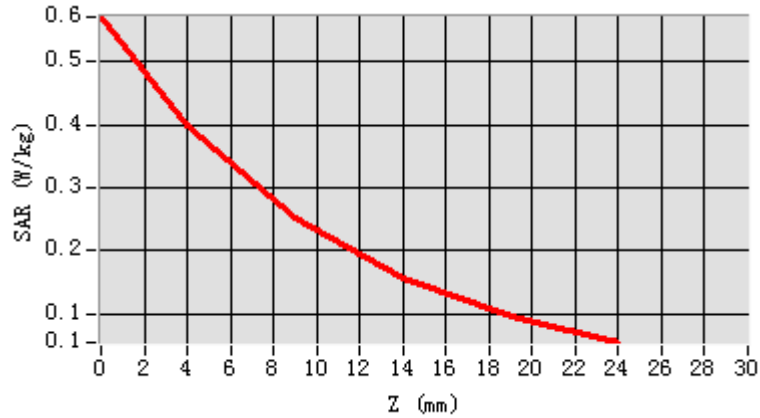
0.235807

SAR 1g (W/Kg)

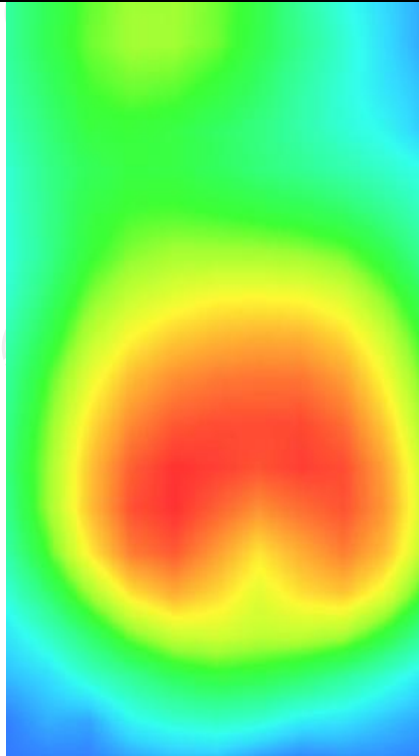
0.384789



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.5719 | 0.4007 | 0.2515 | 0.1556 | 0.0951 |



Hot spot position



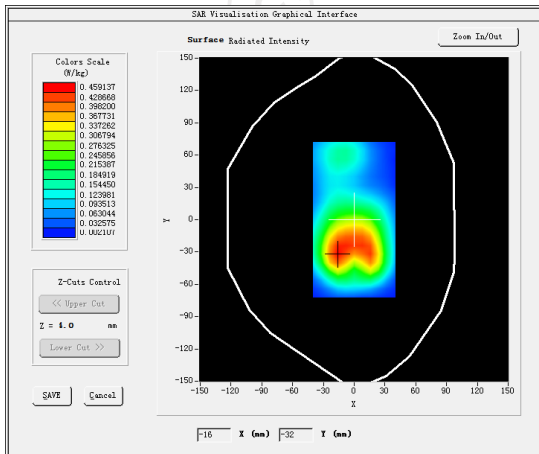
MEASUREMENT 3

Middle Band SAR (Channel 20175):

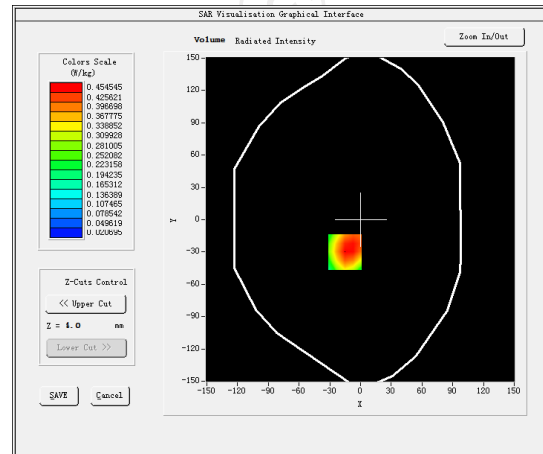
Date: 10/15/2019

| | |
|--|---|
| Frequency (MHz) | 1732.500000 |
| Relative permittivity (real part) | 53.321249 |
| Relative permittivity (imaginary part) | 12.468850 |
| Conductivity (S/m) | 1.502592 |
| Variation (%) | -0.080000 |
| 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/ndx=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#50)</u> |

SURFACE SAR



VOLUME SAR



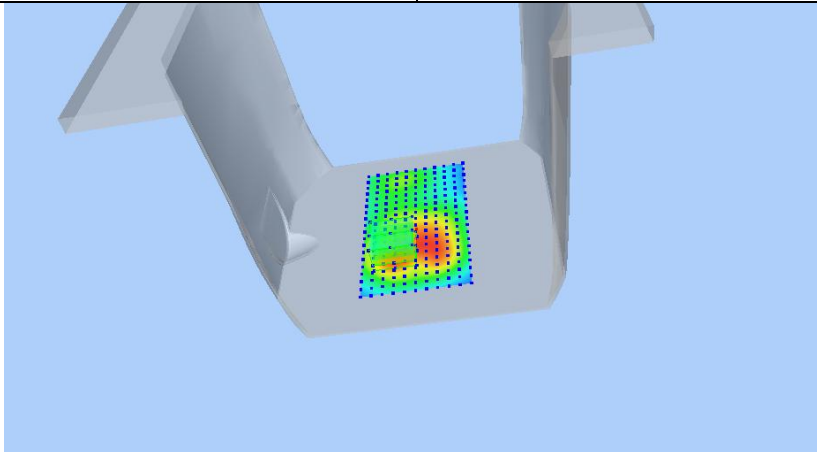
Maximum location: X=-15.00, Y=-30.00 SAR Peak: 0.67 W/kg

SAR 10g (W/Kg)

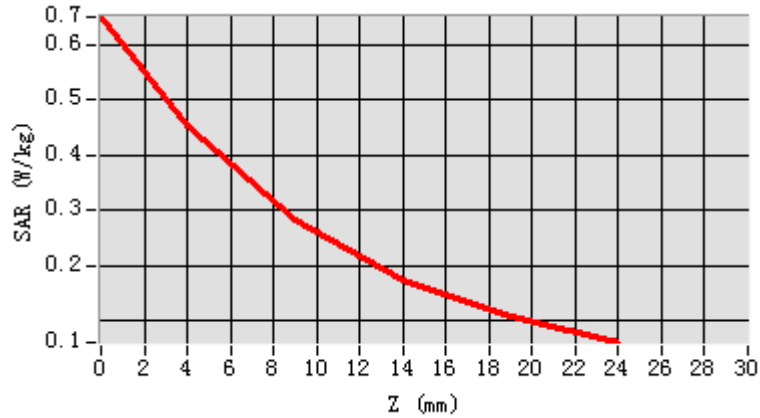
0.269294

SAR 1g (W/Kg)

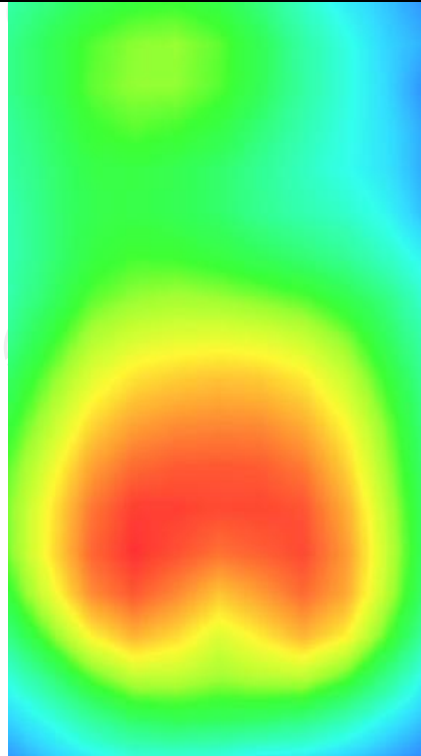
0.440446



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.6505 | 0.4545 | 0.2842 | 0.1753 | 0.1069 |



Hot spot position



LTE Band 5

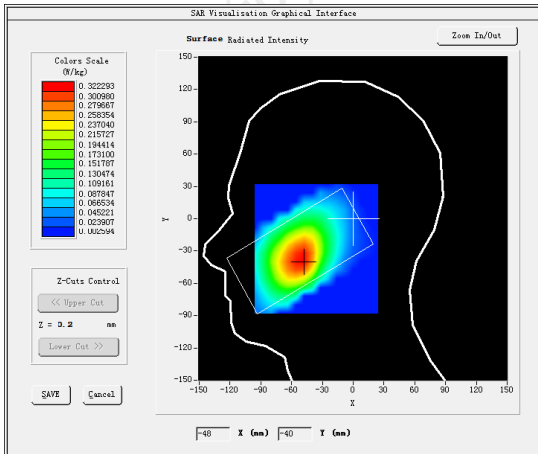
MEASUREMENT 1

Middle Band SAR (Channel 20525):

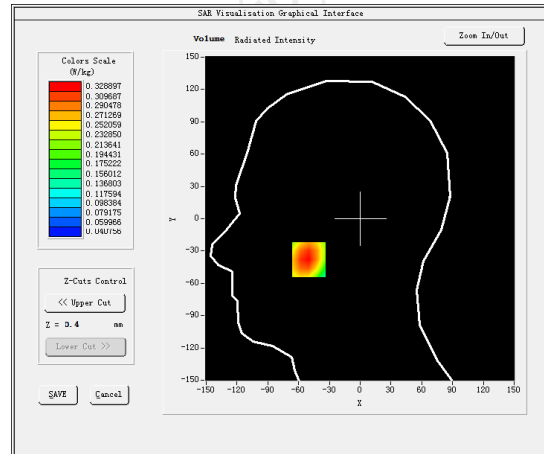
Date: 10/10/2019

| | |
|---|---|
| Frequency (MHz) | 836.600000 |
| Relative permittivity (real part) | 41.422883 |
| Relative permittivity (imaginary part) | 18.129634 |
| Conductivity (S/m) | 0.867241 |
| Variation (%) | 0.840000 |
| 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 5(1 RB#25)</u> |

SURFACE SAR



VOLUME SAR



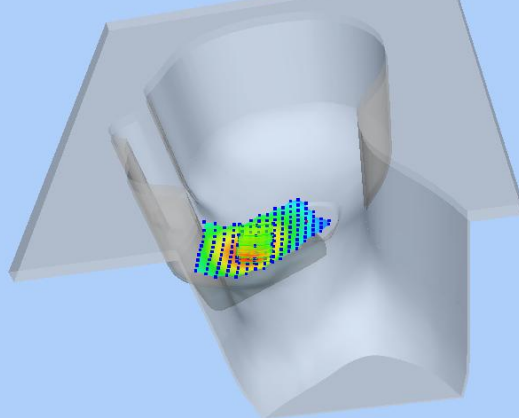
Maximum location: X=-50.00, Y=-38.00 SAR Peak: 0.41 W/kg

SAR 10g (W/Kg)

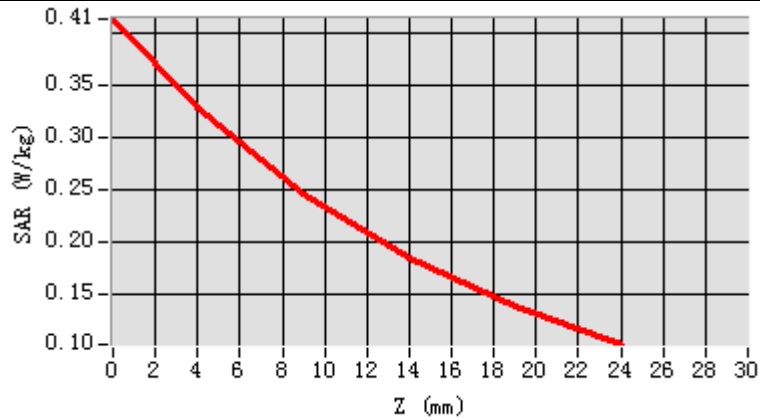
0.222185

SAR 1g (W/Kg)

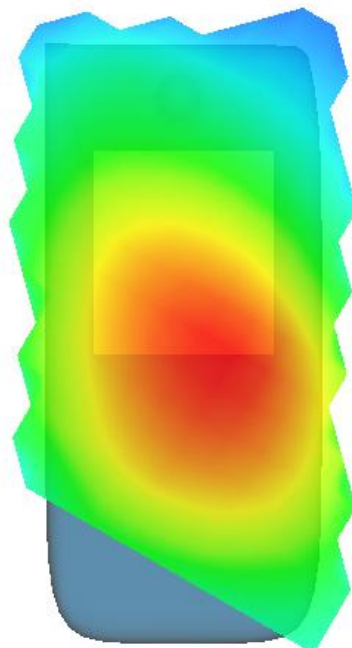
0.315982



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.4134 | 0.3289 | 0.2463 | 0.1848 | 0.1389 |



Hot spot position



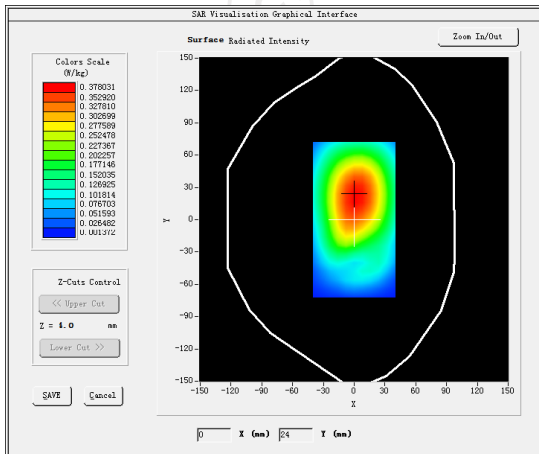
MEASUREMENT 2

Middle Band SAR (Channel 20525):

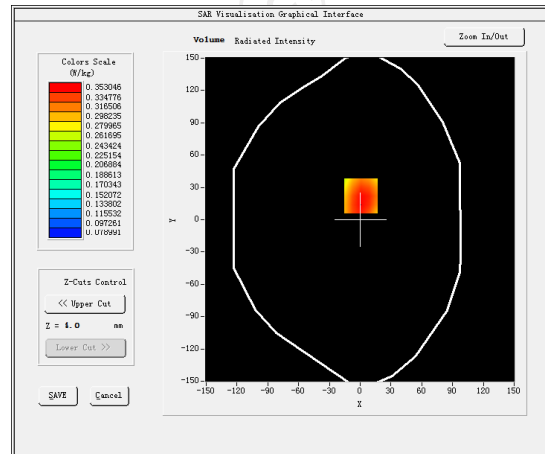
Date: 10/10/2019

| | |
|--|---|
| Frequency (MHz) | 836.600000 |
| Relative permittivity (real part) | 55.242927 |
| Relative permittivity (imaginary part) | 21.378266 |
| Conductivity (S/m) | 0.941230 |
| Variation (%) | -1.260000 |
| 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/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>LTE band 5(1 RB#25)</u> |

SURFACE SAR



VOLUME SAR



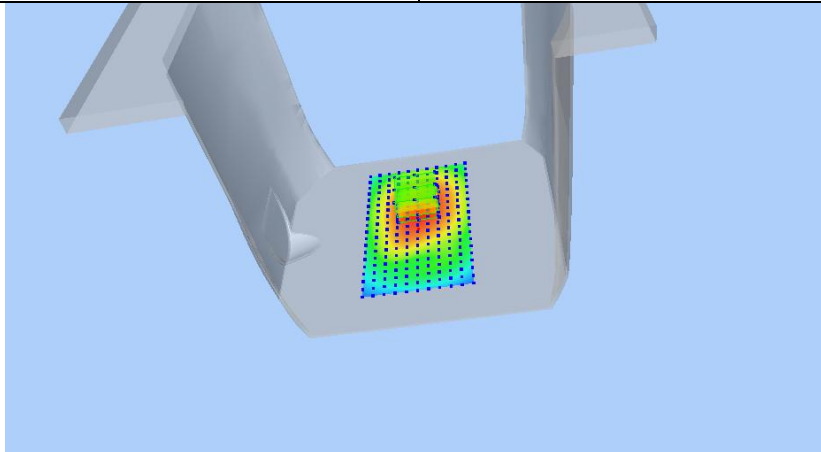
Maximum location: X=1.00, Y=22.00 SAR Peak: 0.46 W/kg

SAR 10g (W/Kg)

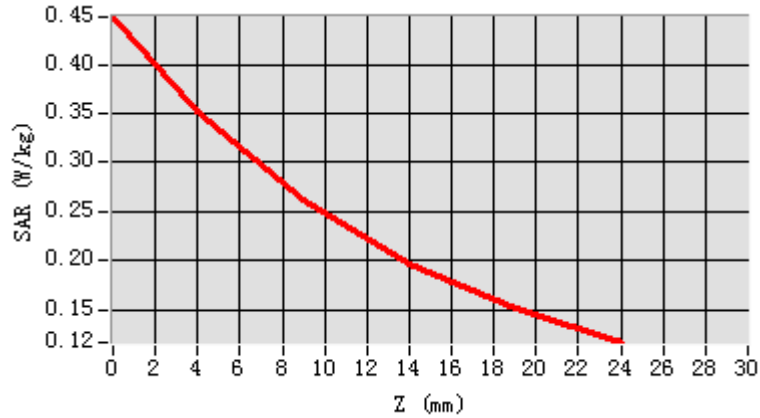
0.246175

SAR 1g (W/Kg)

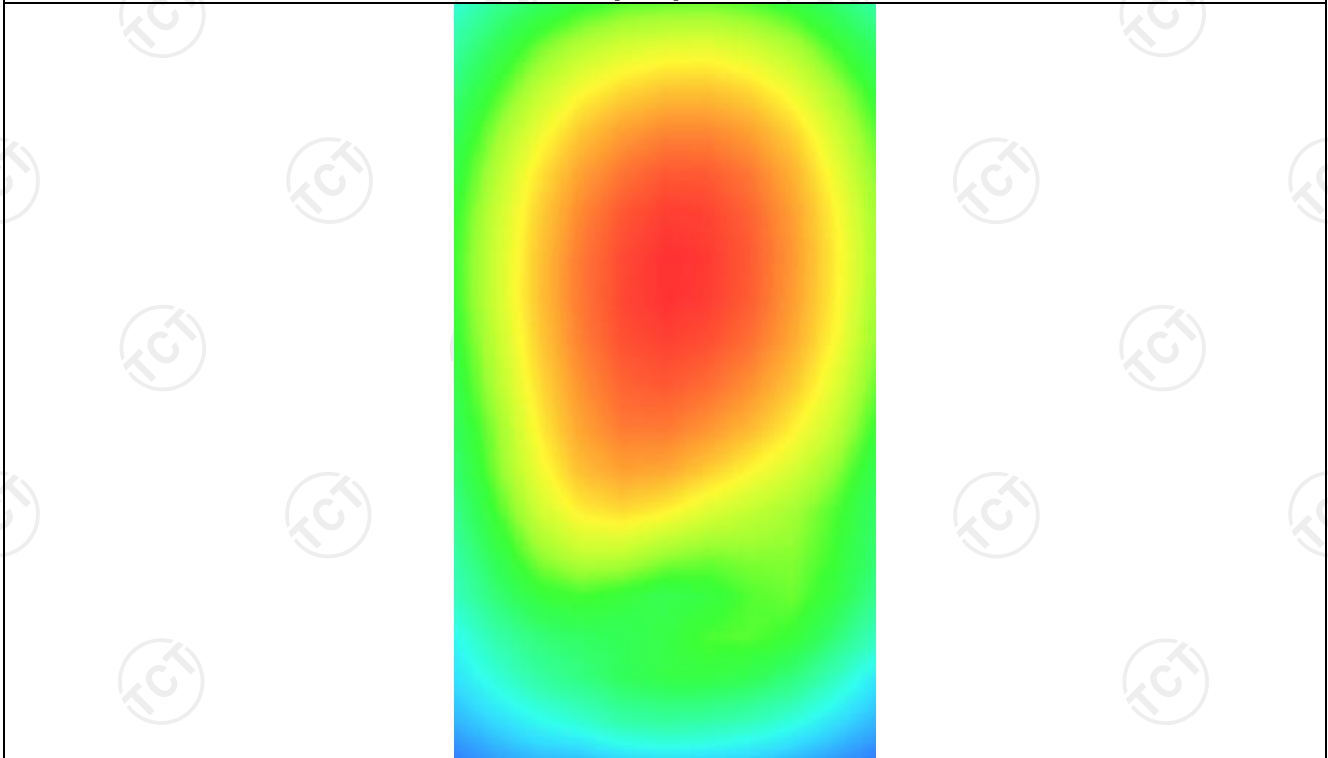
0.341899



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.4486 | 0.3520 | 0.2610 | 0.1968 | 0.1514 |



Hot spot position



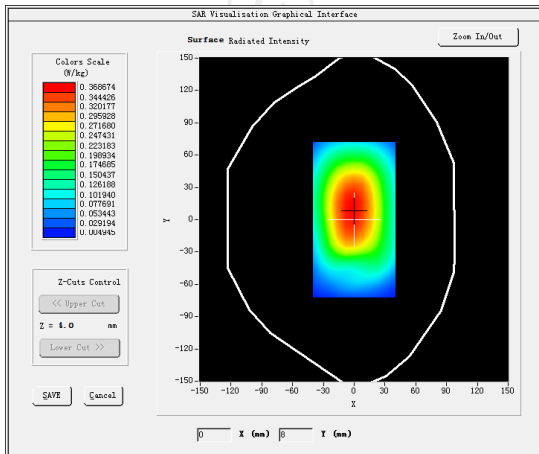
MEASUREMENT 3

Middle Band SAR (Channel 20525):

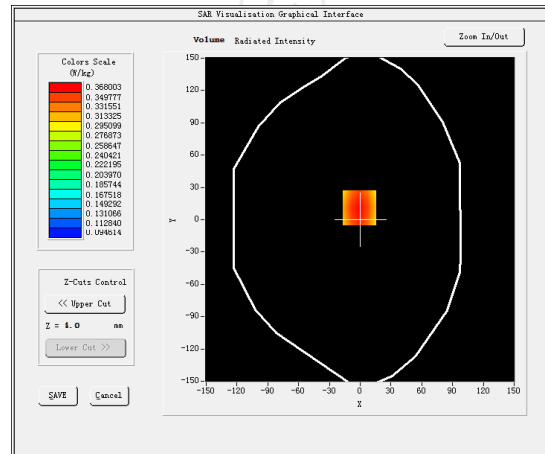
Date: 10/10/2019

| | |
|--|---|
| Frequency (MHz) | 836.600000 |
| Relative permittivity (real part) | 55.242927 |
| Relative permittivity (imaginary part) | 21.378266 |
| Conductivity (S/m) | 0.941230 |
| Variation (%) | -0.910000 |
| 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/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>LTE band 5(1 RB#25)</u> |

SURFACE SAR



VOLUME SAR



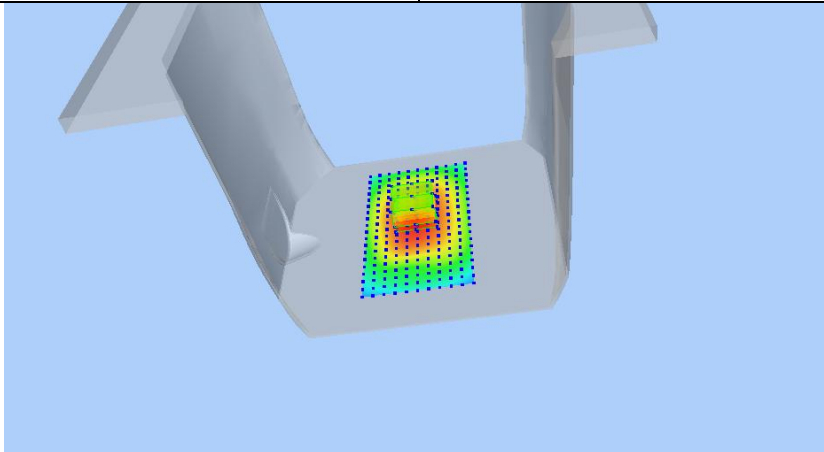
Maximum location: X=-1.00, Y=11.00 SAR Peak: 0.44 W/kg

SAR 10g (W/Kg)

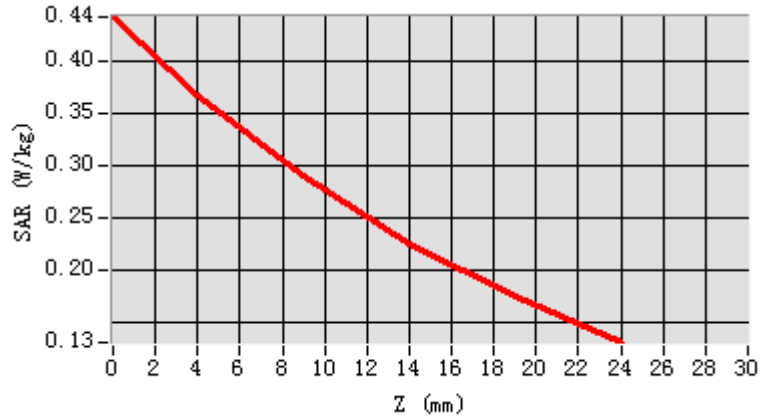
0.265781

SAR 1g (W/Kg)

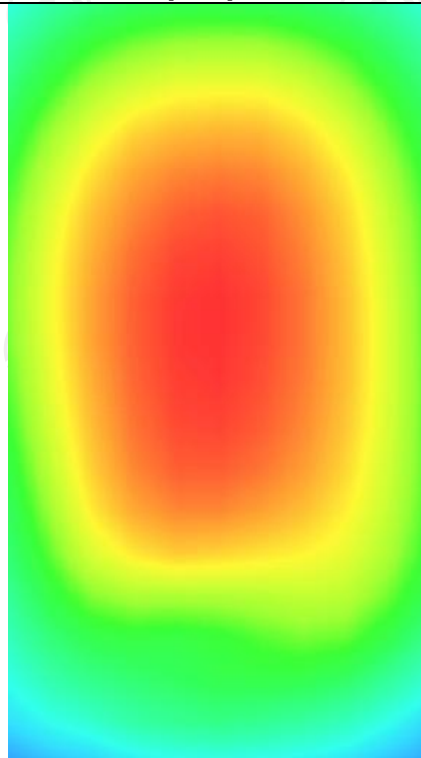
0.355653



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.4428 | 0.3680 | 0.2895 | 0.2256 | 0.1737 |



Hot spot position



LTE Band 12

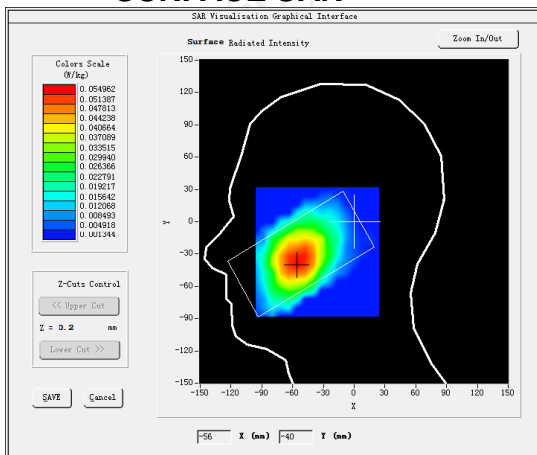
MEASUREMENT 1

Higher Band SAR (Channel 23130):

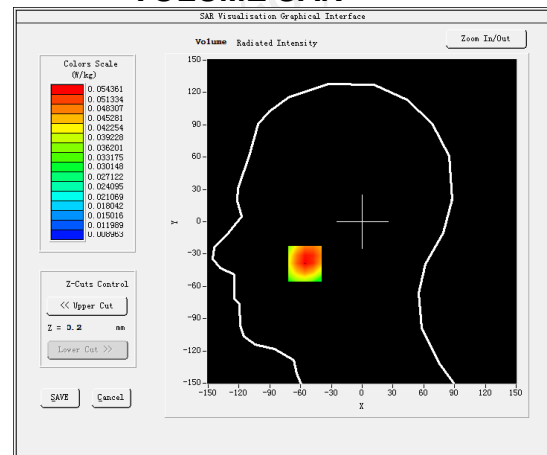
Date: 10/10/2019

| | |
|---|---|
| Frequency (MHz) | 711.000000 |
| Relative permittivity (real part) | 40.392517 |
| Relative permittivity (imaginary part) | 12.468850 |
| Conductivity (S/m) | 0.881392 |
| Variation (%) | 1.330000 |
| 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 12(1 RB#25)</u> |

SURFACE SAR



VOLUME SAR



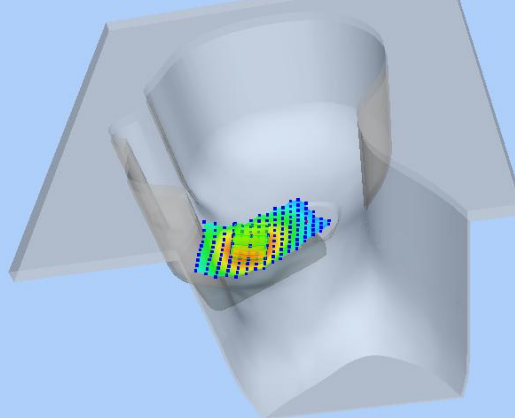
Maximum location: X=-56.00, Y=-39.00 SAR Peak: 0.06 W/kg

SAR 10g (W/Kg)

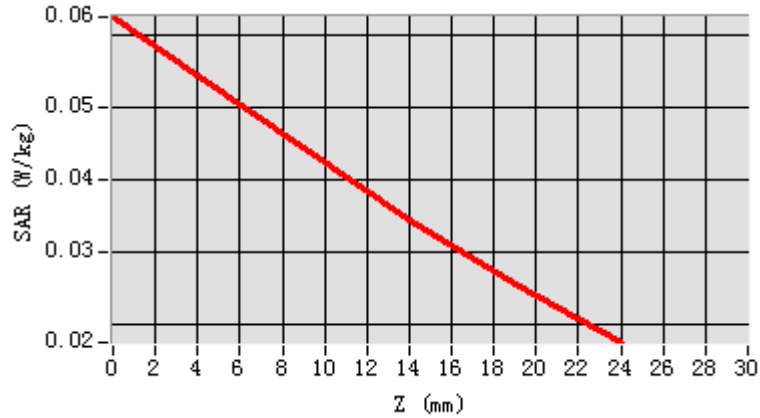
0.039343

SAR 1g (W/Kg)

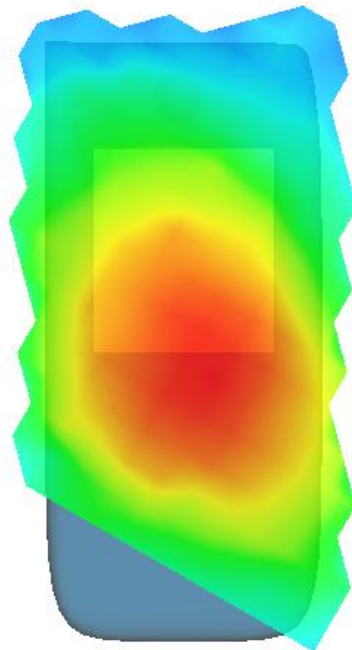
0.053933



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.0624 | 0.0544 | 0.0443 | 0.0346 | 0.0255 |



Hot spot position



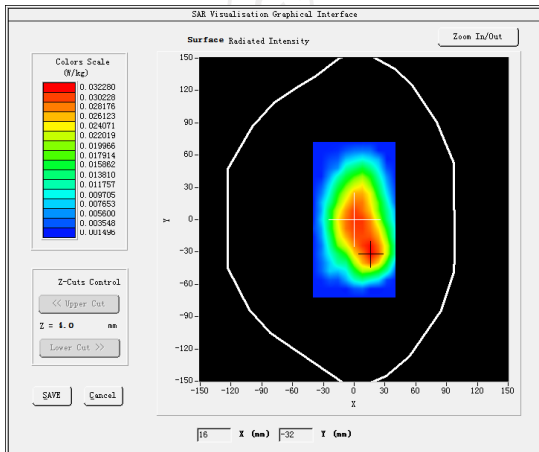
MEASUREMENT 2

Higher Band SAR (Channel 23130):

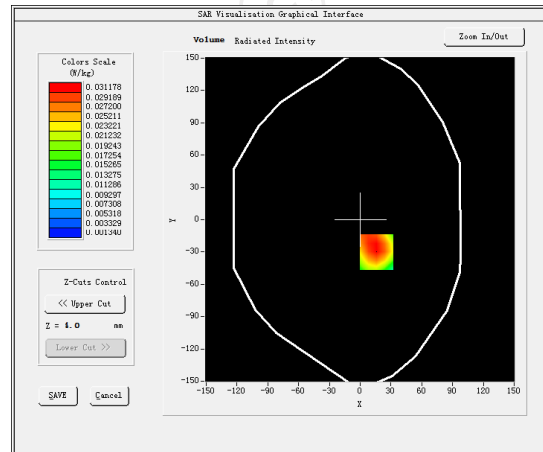
Date: 10/10/2019

| | |
|--|---|
| Frequency (MHz) | 711.000000 |
| Relative permittivity (real part) | 53.214937 |
| Relative permittivity (imaginary part) | 12.468850 |
| Conductivity (S/m) | 0.973512 |
| Variation (%) | -1.090000 |
| 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/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>LTE band 12(1 RB#25)</u> |

SURFACE SAR



VOLUME SAR



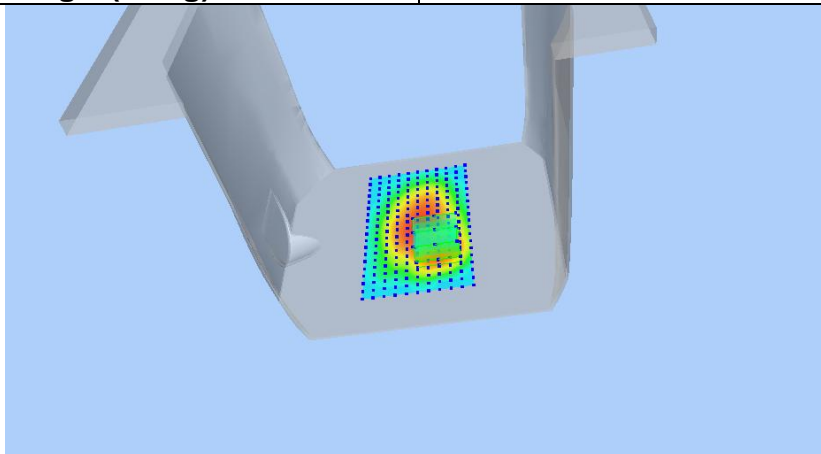
Maximum location: X=16.00, Y=-30.00 SAR Peak: 0.04 W/kg

SAR 10g (W/Kg)

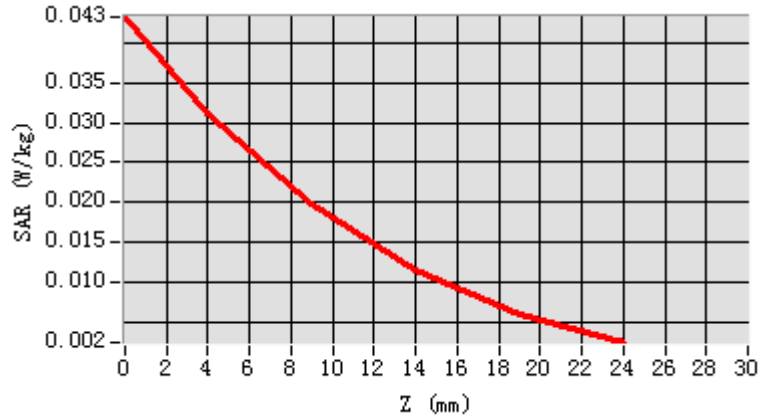
0.019051

SAR 1g (W/Kg)

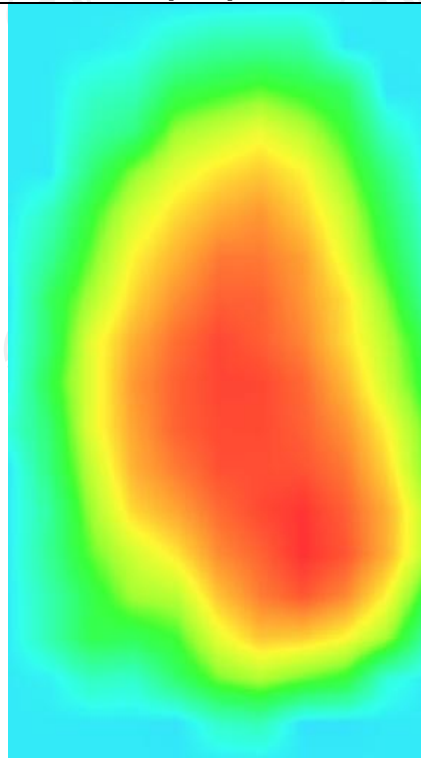
0.031672



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.0432 | 0.0312 | 0.0197 | 0.0116 | 0.0060 |



Hot spot position



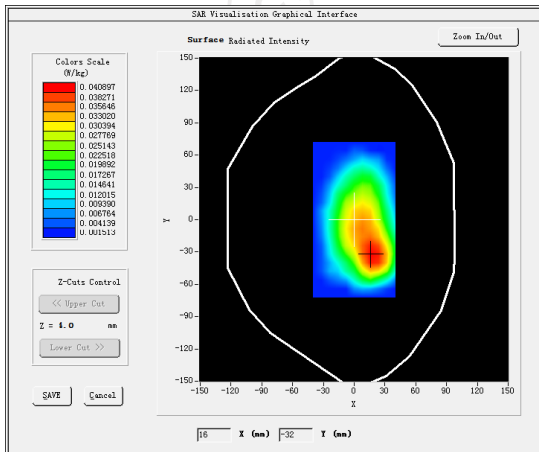
MEASUREMENT 3

Higher Band SAR (Channel 23130):

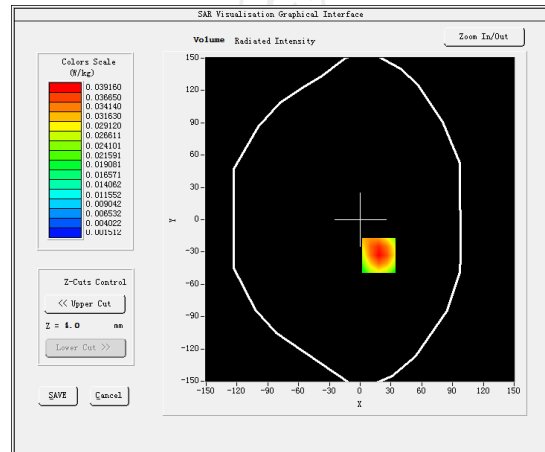
Date: 10/10/2019

| | |
|--|---|
| Frequency (MHz) | 711.000000 |
| Relative permittivity (real part) | 53.214937 |
| Relative permittivity (imaginary part) | 12.468850 |
| Conductivity (S/m) | 0.973512 |
| Variation (%) | -1.590000 |
| 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/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>LTE band 12(1 RB#25)</u> |

SURFACE SAR



VOLUME SAR



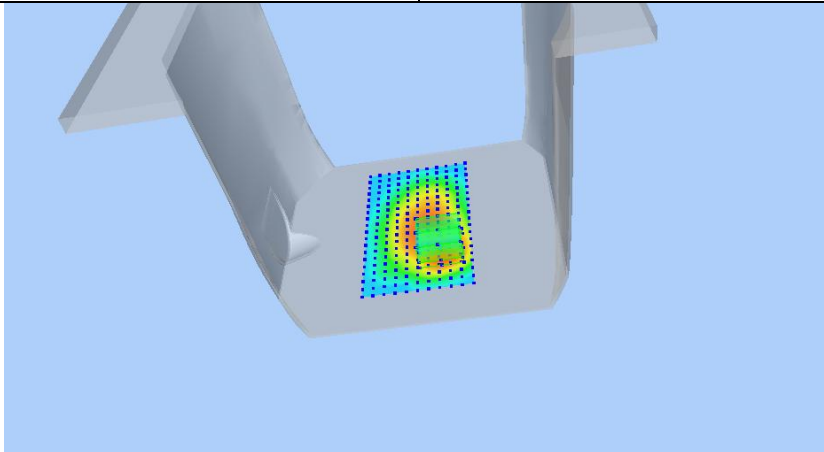
Maximum location: X=18.00, Y=-33.00 SAR Peak: 0.06 W/kg

SAR 10g (W/Kg)

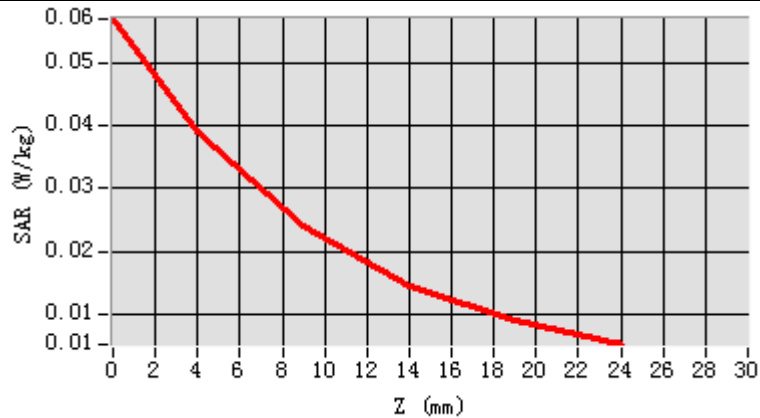
0.024139

SAR 1g (W/Kg)

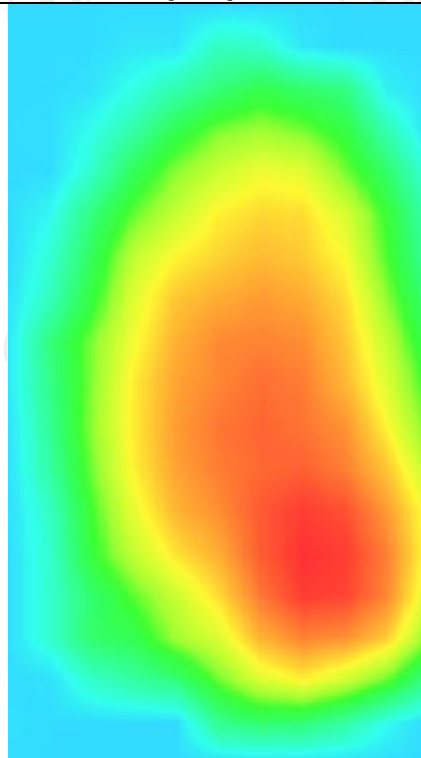
0.039528



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.0571 | 0.0392 | 0.0239 | 0.0145 | 0.0088 |



Hot spot position



LTE Band 17

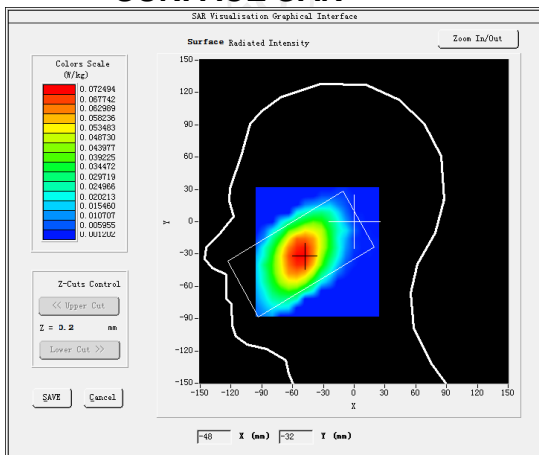
MEASUREMENT 1

Middle Band SAR (Channel 23790):

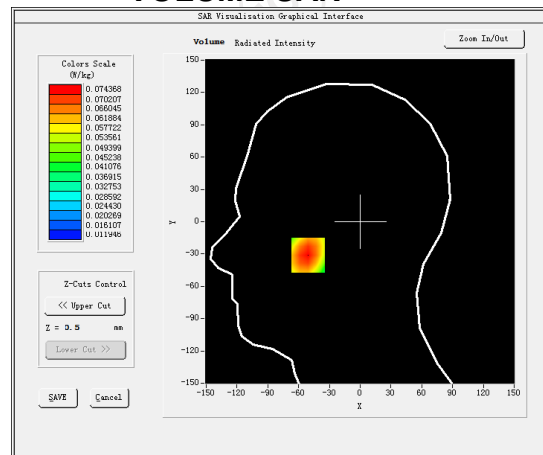
Date: 10/10/2019

| | |
|---|---|
| Frequency (MHz) | 710.000000 |
| Relative permittivity (real part) | 41.422883 |
| Relative permittivity (imaginary part) | 18.129634 |
| Conductivity (S/m) | 0.867241 |
| Variation (%) | 0.150000 |
| 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 17(1 RB#13)</u> |

SURFACE SAR



VOLUME SAR



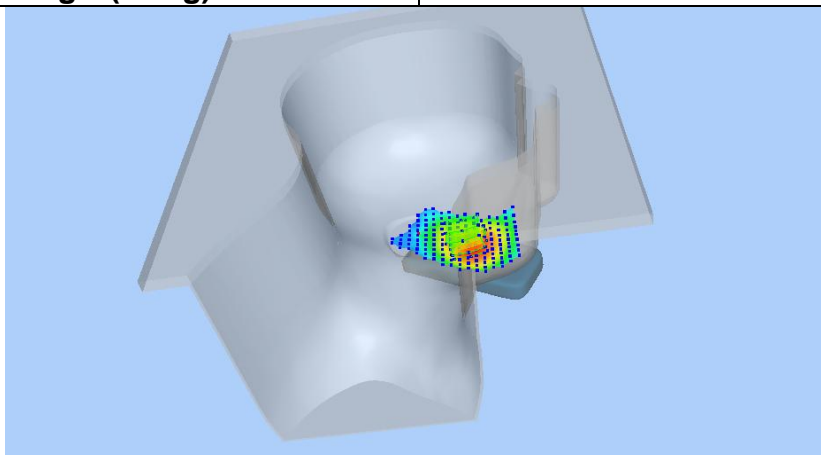
Maximum location: X=-51.00, Y=-31.00 SAR Peak: 0.09 W/kg

SAR 10g (W/Kg)

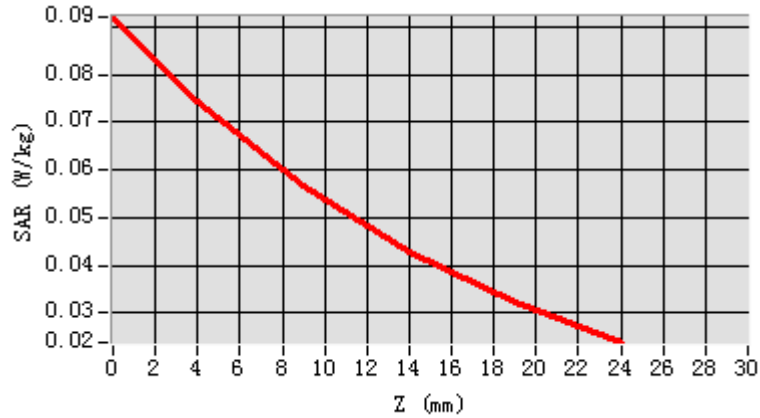
0.051714

SAR 1g (W/Kg)

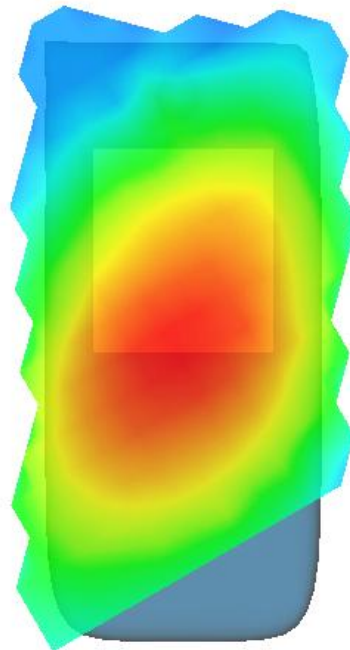
0.072773



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.0920 | 0.0744 | 0.0566 | 0.0430 | 0.0324 |



Hot spot position



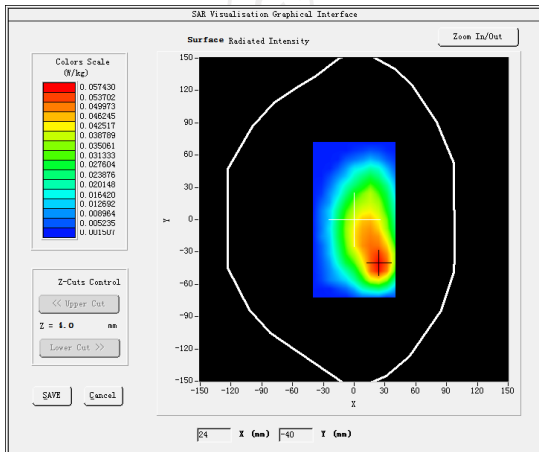
MEASUREMENT 2

Middle Band SAR (Channel 23790):

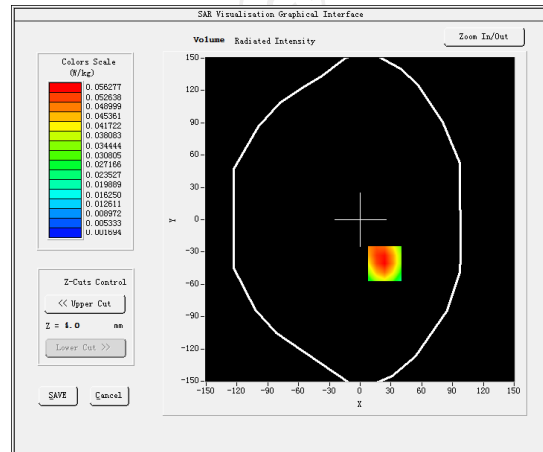
Date: 10/10/2019

| | |
|---|---|
| Frequency (MHz) | 710.000000 |
| Relative permittivity (real part) | 55.242927 |
| Relative permittivity (imaginary part) | 21.378266 |
| Conductivity (S/m) | 0.941230 |
| Variation (%) | -0.610000 |
| 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/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>LTE band 17(1 RB#13)</u> |

SURFACE SAR



VOLUME SAR



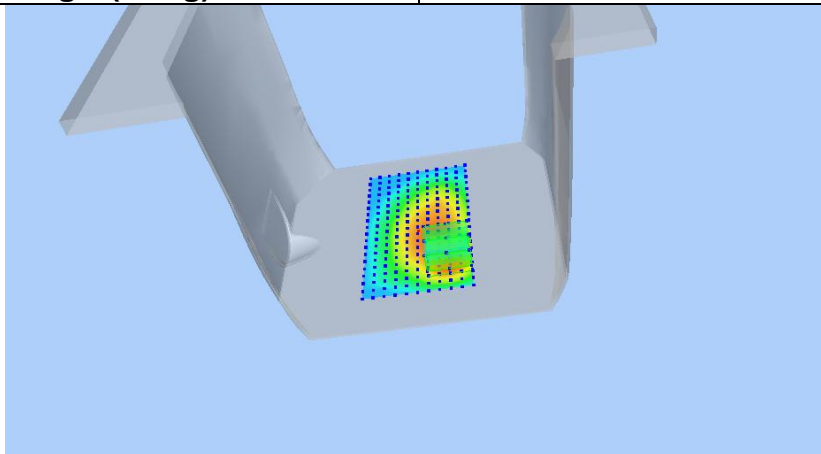
Maximum location: X=24.00, Y=-41.00 SAR Peak: 0.09 W/kg

SAR 10g (W/Kg)

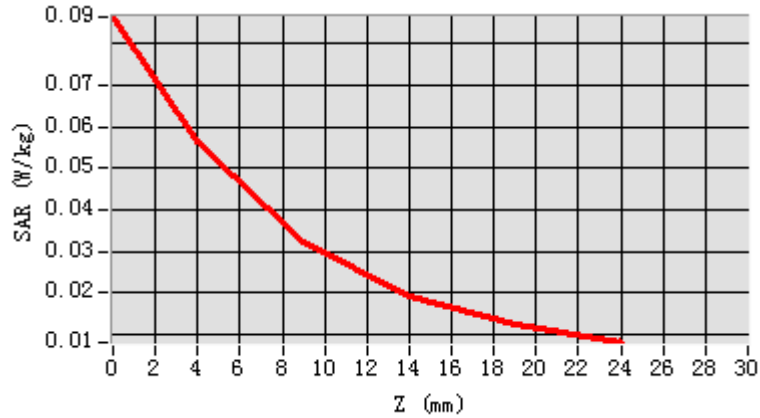
0.034699

SAR 1g (W/Kg)

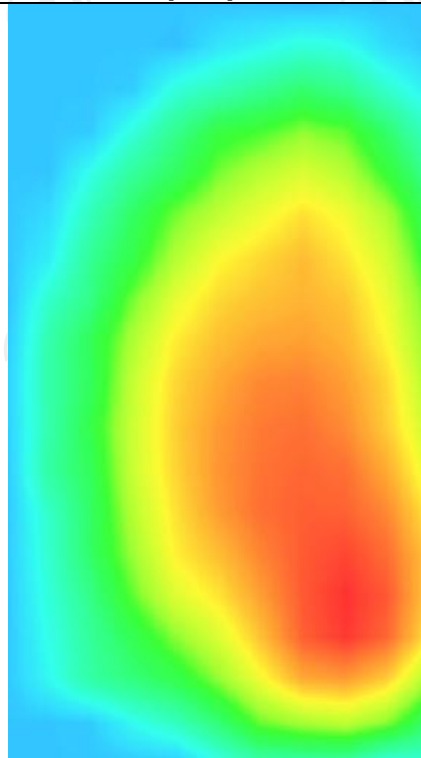
0.057620



| | | | | | |
|------------|--------|--------|--------|--------|--------|
| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
| SAR (W/Kg) | 0.0865 | 0.0563 | 0.0325 | 0.0193 | 0.0123 |



Hot spot position



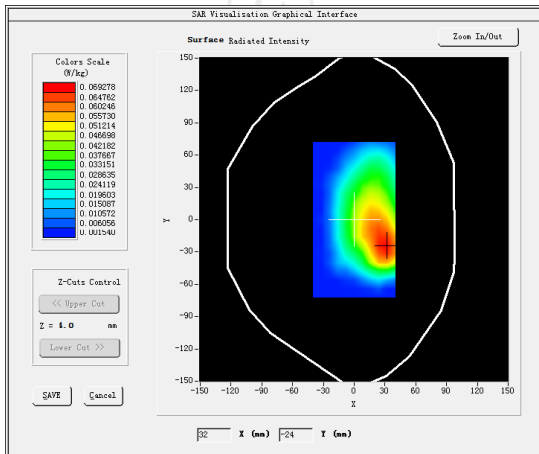
MEASUREMENT 3

Middle Band SAR (Channel 23790):

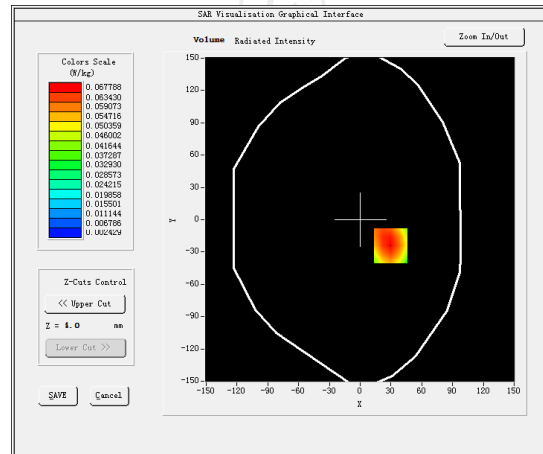
Date: 10/10/2019

| | |
|---|---|
| Frequency (MHz) | 710.000000 |
| Relative permittivity (real part) | 55.242927 |
| Relative permittivity (imaginary part) | 21.378266 |
| Conductivity (S/m) | 0.941230 |
| Variation (%) | 2.640000 |
| 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/ndx=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 17(1 RB#13)</u> |

SURFACE SAR



VOLUME SAR



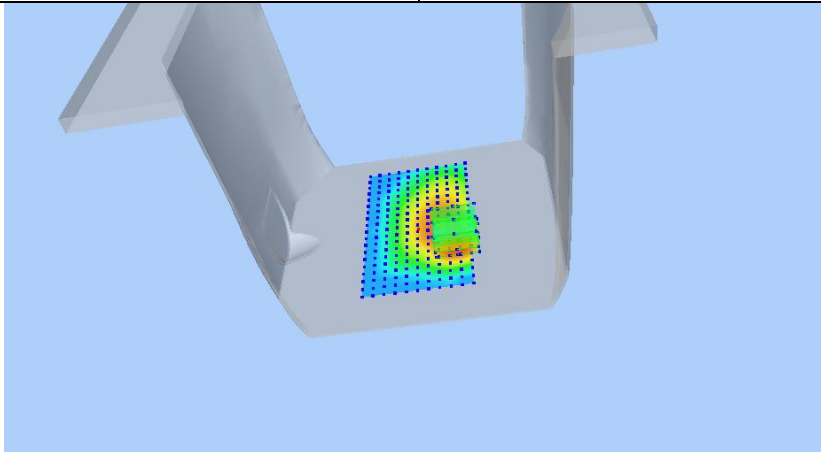
Maximum location: X=30.00, Y=-24.00 SAR Peak: 0.09 W/kg

SAR 10g (W/Kg)

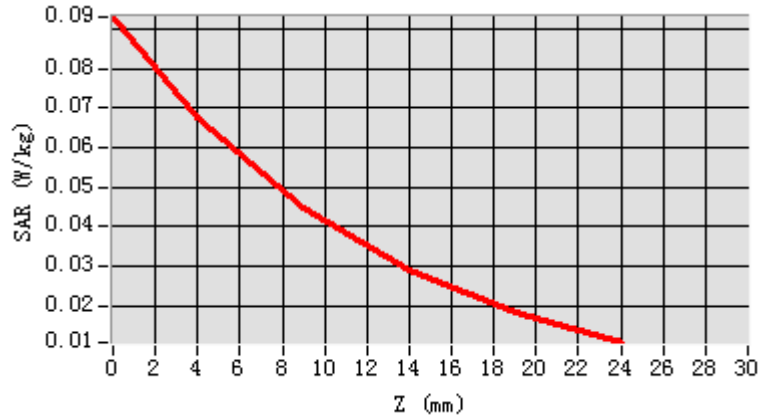
0.043887

SAR 1g (W/Kg)

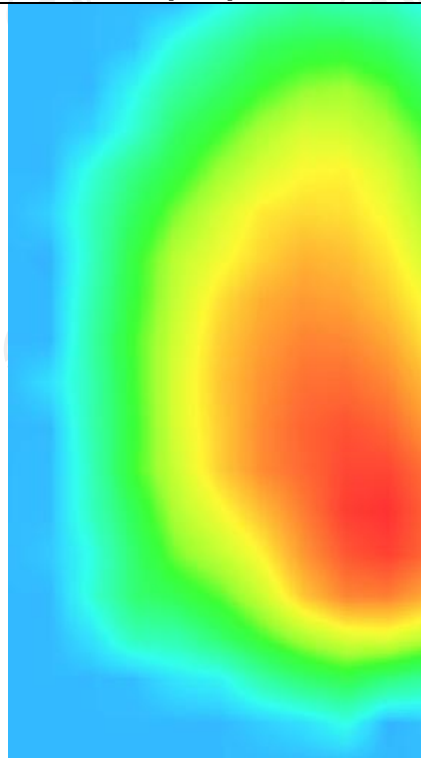
0.068513



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.0931 | 0.0678 | 0.0447 | 0.0288 | 0.0182 |



Hot spot position



LTE Band 66

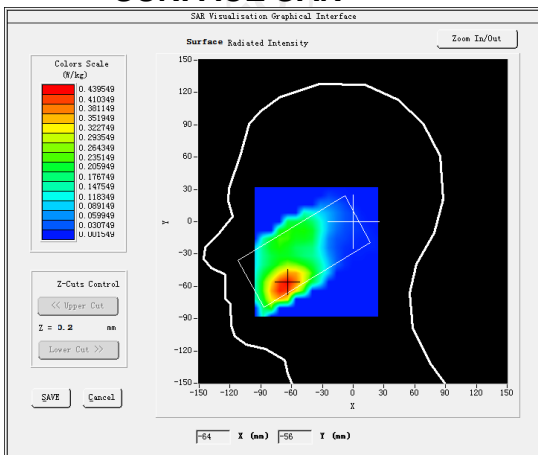
MEASUREMENT 1

Lower Band SAR (Channel 132022):

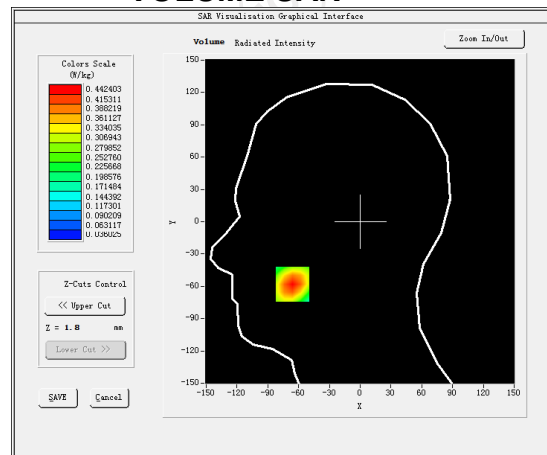
Date: 10/15/2019

| | |
|---|---|
| Frequency (MHz) | 1715.000000 |
| Relative permittivity (real part) | 39.107208 |
| Relative permittivity (imaginary part) | 12.468862 |
| Conductivity (S/m) | 1.342186 |
| Variation (%) | 0.550000 |
| 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#25)</u> |

SURFACE SAR



VOLUME SAR



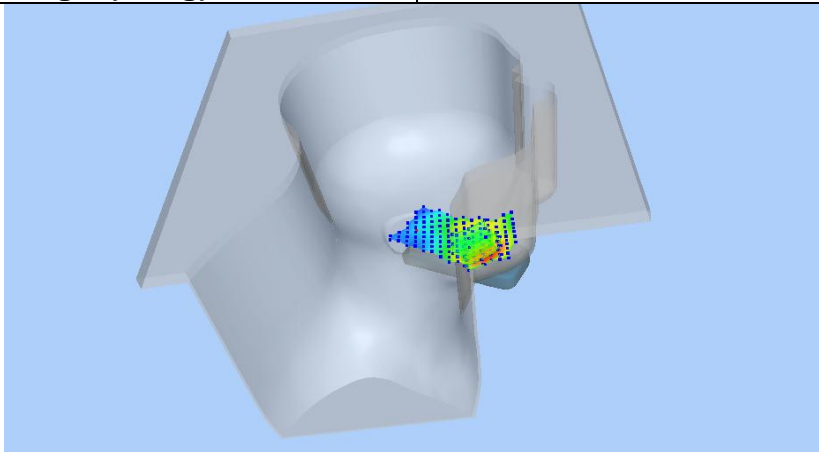
Maximum location: X=-66.00, Y=-58.00 SAR Peak: 0.66 W/kg

SAR 10g (W/Kg)

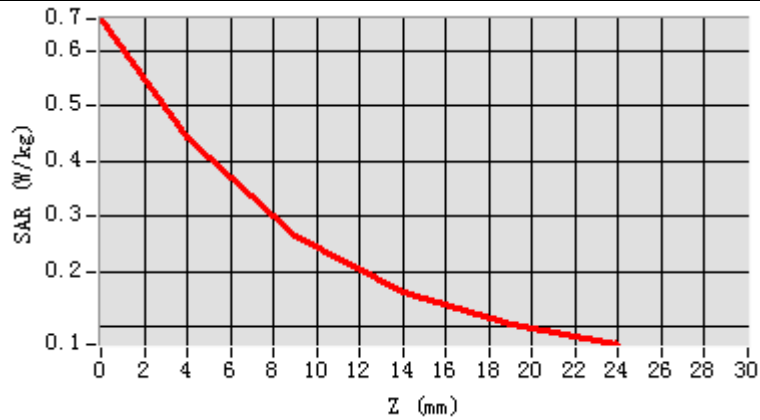
0.247634

SAR 1g (W/Kg)

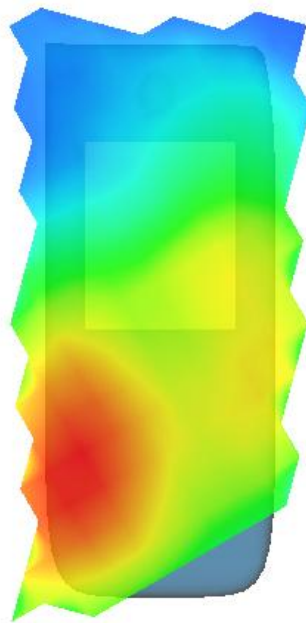
0.418306



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.6588 | 0.4424 | 0.2658 | 0.1628 | 0.1046 |



Hot spot position



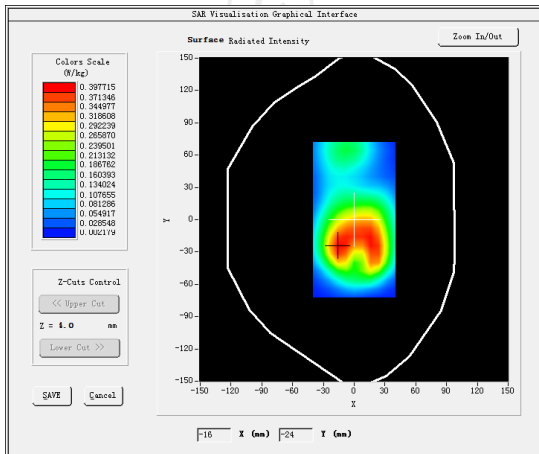
MEASUREMENT 2

Lower Band SAR (Channel 132022):

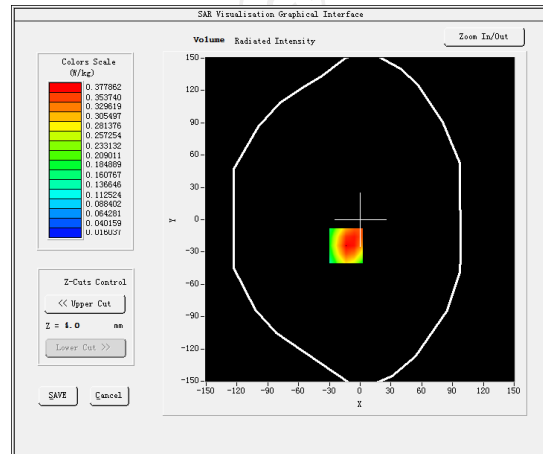
Date: 10/15/2019

| | |
|--|---|
| Frequency (MHz) | 1715.000000 |
| Relative permittivity (real part) | 53.342972 |
| Relative permittivity (imaginary part) | 12.468808 |
| Conductivity (S/m) | 1.492548 |
| Variation (%) | -1.950000 |
| 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/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>LTE band 66(1 RB#25)</u> |

SURFACE SAR



VOLUME SAR



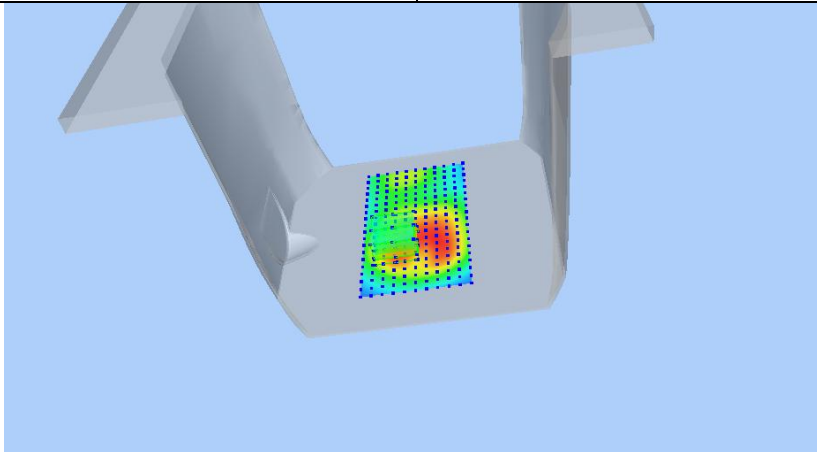
Maximum location: X=-14.00, Y=-24.00 SAR Peak: 0.56 W/kg

SAR 10g (W/Kg)

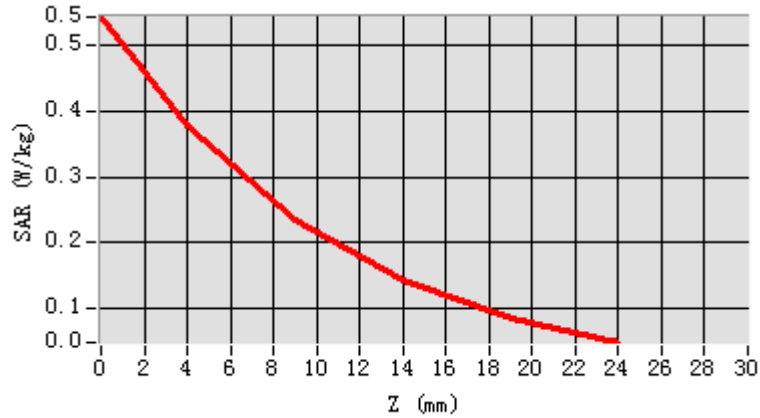
0.220778

SAR 1g (W/Kg)

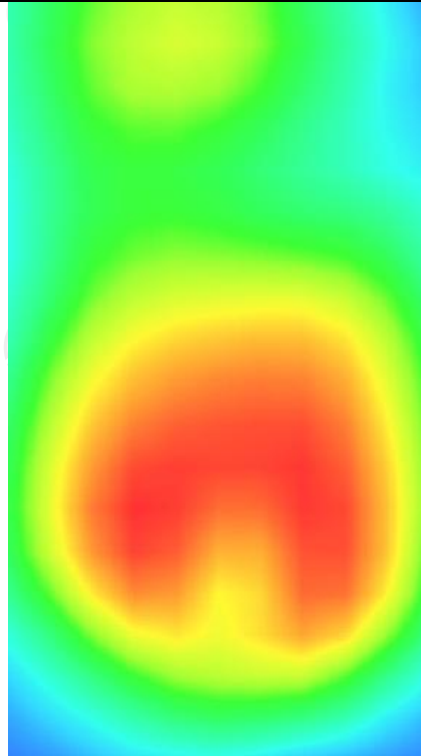
0.364568



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.5433 | 0.3779 | 0.2345 | 0.1431 | 0.0861 |



Hot spot position



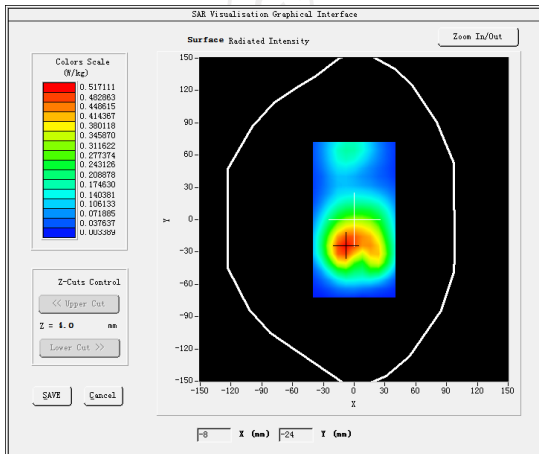
MEASUREMENT 3

Lower Band SAR (Channel 132022):

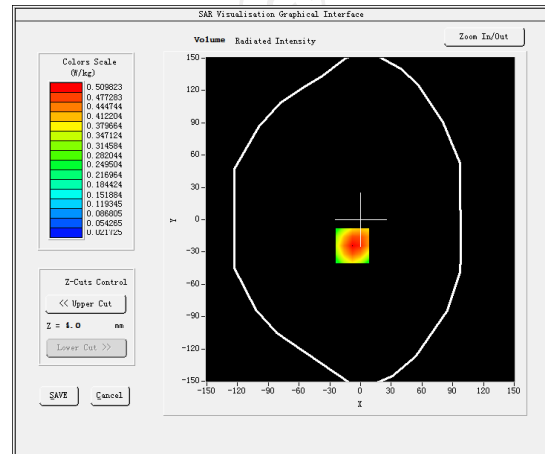
Date: 10/15/2019

| | |
|--|---|
| Frequency (MHz) | 1715.000000 |
| Relative permittivity (real part) | 53.342972 |
| Relative permittivity (imaginary part) | 12.468808 |
| Conductivity (S/m) | 1.492548 |
| Variation (%) | -4.440000 |
| 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/ndx=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#25)</u> |

SURFACE SAR



VOLUME SAR



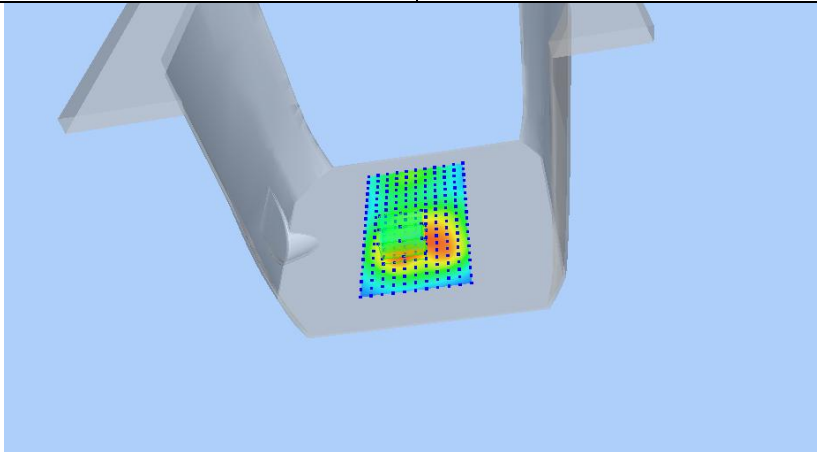
Maximum location: X=-8.00, Y=-24.00 SAR Peak: 0.74 W/kg

SAR 10g (W/Kg)

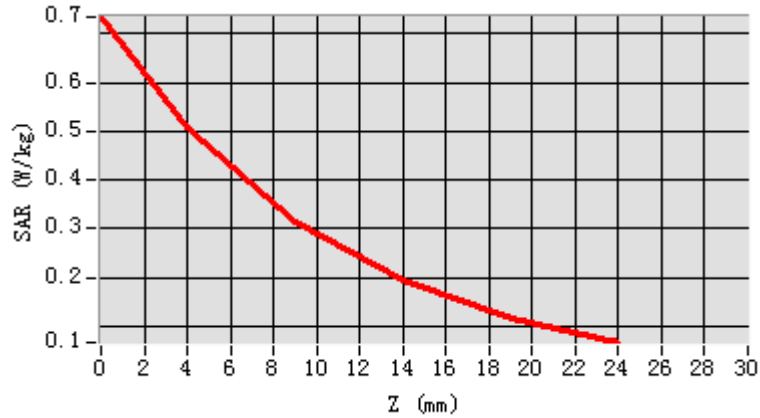
0.292349

SAR 1g (W/Kg)

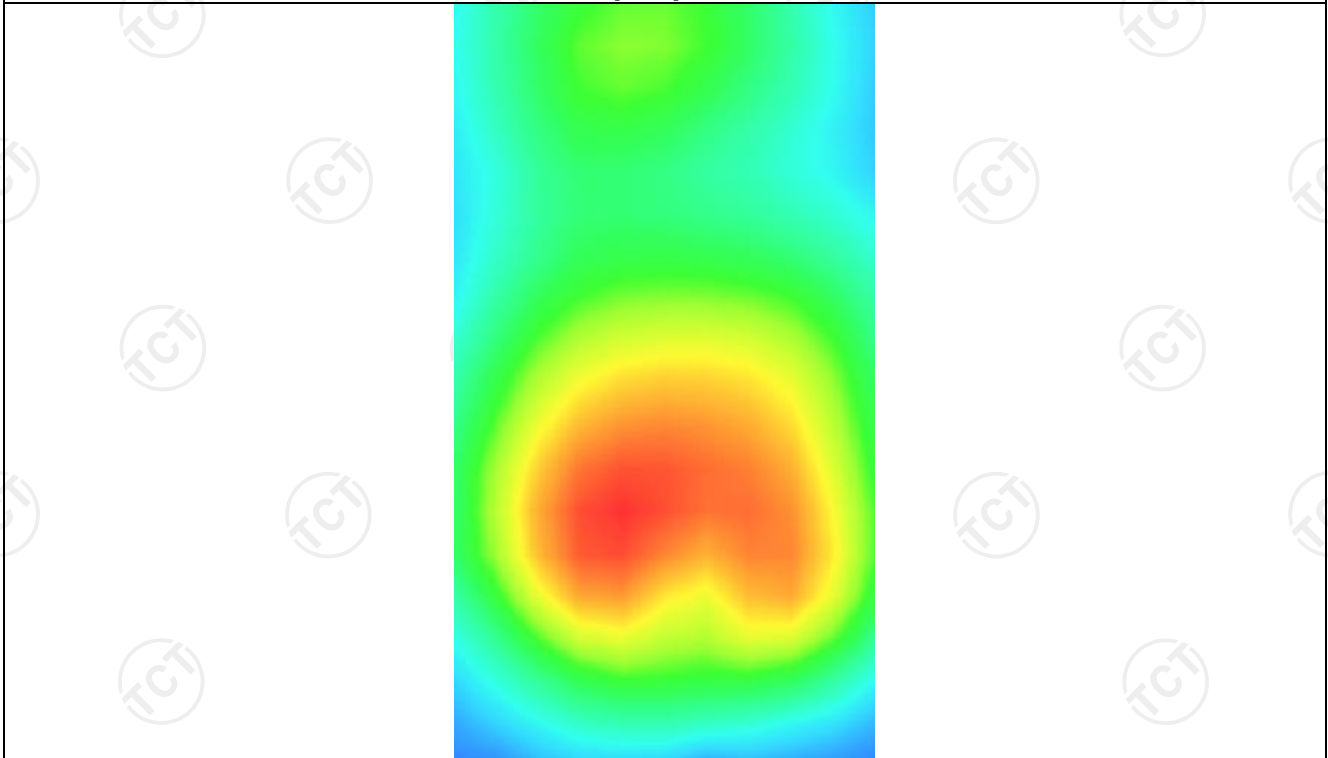
0.485880



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.7349 | 0.5098 | 0.3158 | 0.1932 | 0.1172 |



Hot spot position



IEEE 802.11b

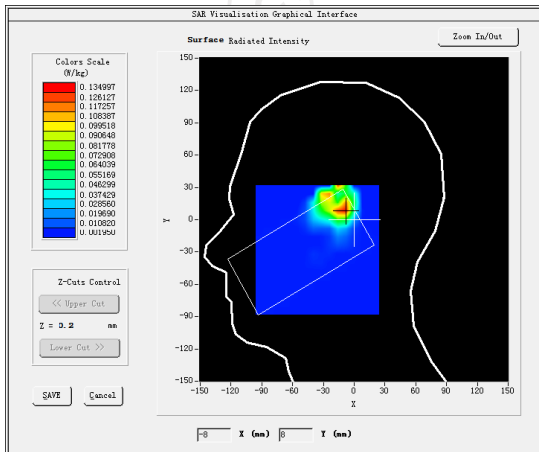
MEASUREMENT 1

Middle Band SAR (Channel 6):

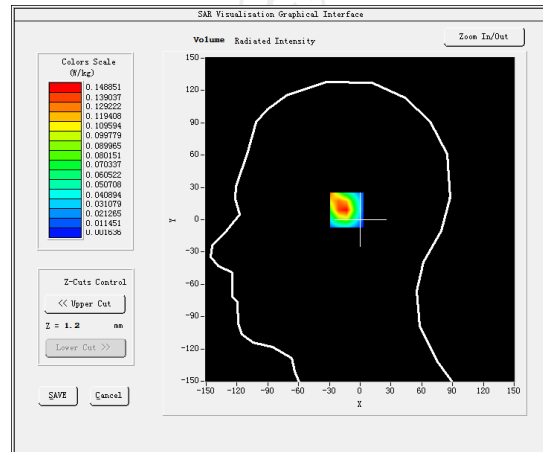
Date: 10/21/2019

| | |
|---|---|
| Frequency (MHz) | 2437.000000 |
| Relative permittivity (real part) | 37.851613 |
| Relative permittivity (imaginary part) | 13.546980 |
| Conductivity (S/m) | 1.814111 |
| Variation (%) | -1.450000 |
| 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/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u> |
| Phantom | <u>Right head</u> |
| Device Position | <u>Cheek</u> |
| Band | <u>IEEE 802.11b ISM</u> |

SURFACE SAR



VOLUME SAR



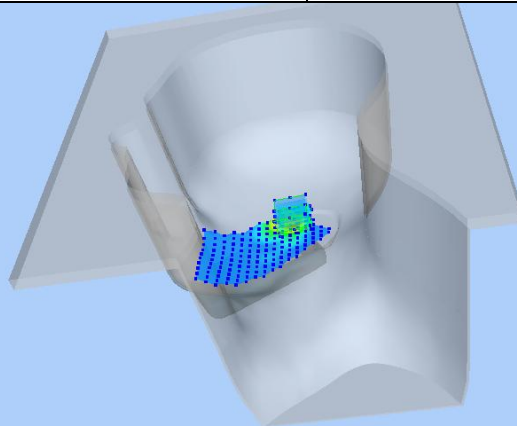
Maximum location: X=-10.00, Y=9.00 SAR Peak: 0.28 W/kg

SAR 10g (W/Kg)

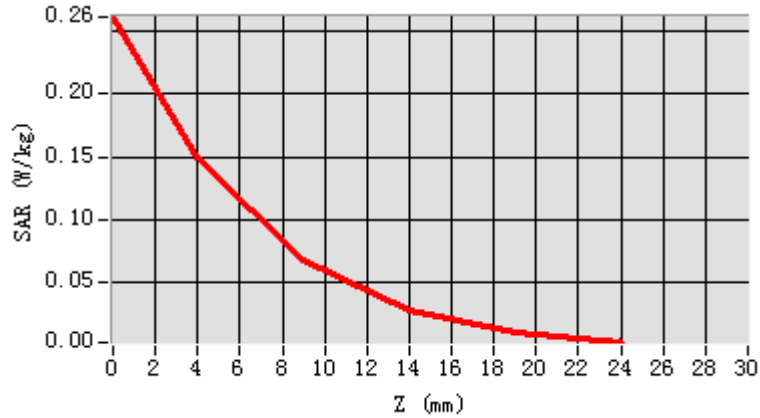
0.060967

SAR 1g (W/Kg)

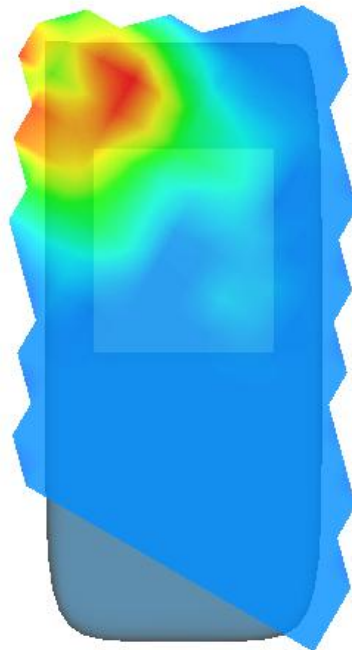
0.142578



| | | | | | |
|------------|--------|--------|--------|--------|--------|
| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
| SAR (W/Kg) | 0.2615 | 0.1489 | 0.0672 | 0.0273 | 0.0098 |



Hot spot position



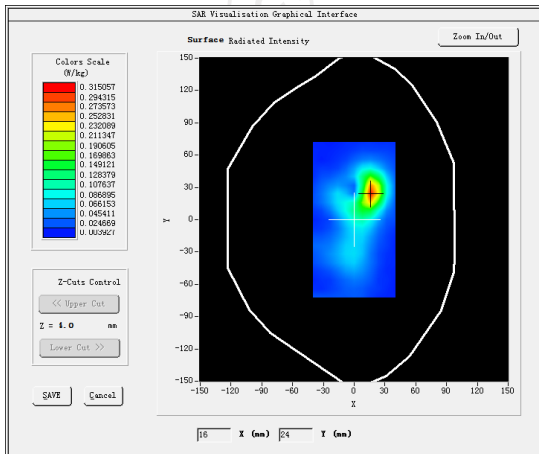
MEASUREMENT 2

Middle Band SAR (Channel 6):

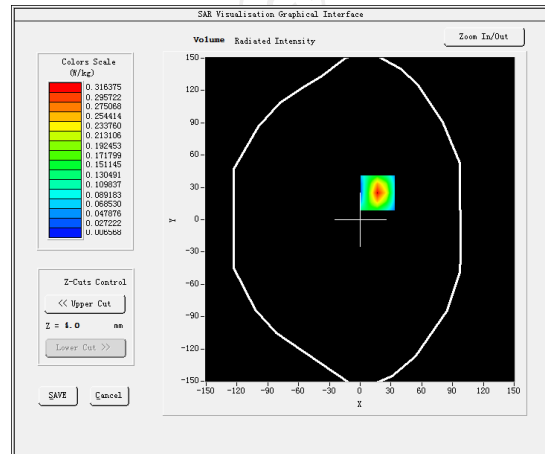
Date: 10/21/2019

| | |
|---|---|
| Frequency (MHz) | 2437.000000 |
| Relative permittivity (real part) | 54.630667 |
| Relative permittivity (imaginary part) | 14.318444 |
| Conductivity (S/m) | 1.982536 |
| Variation (%) | -0.300000 |
| 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/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u> |
| Phantom | Validation plane |
| Device Position | Body back(10mm) |
| Band | <u>IEEE 802.11b ISM</u> |

SURFACE SAR



VOLUME SAR



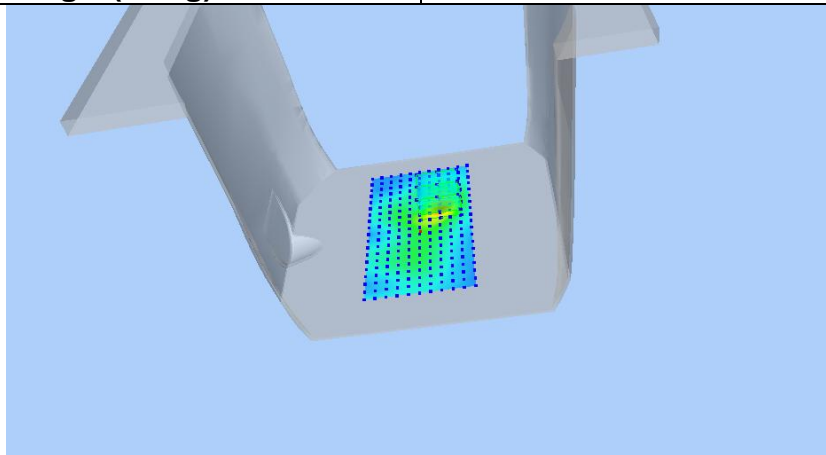
Maximum location: X=17.00, Y=25.00 SAR Peak: 0.56 W/kg

SAR 10g (W/Kg)

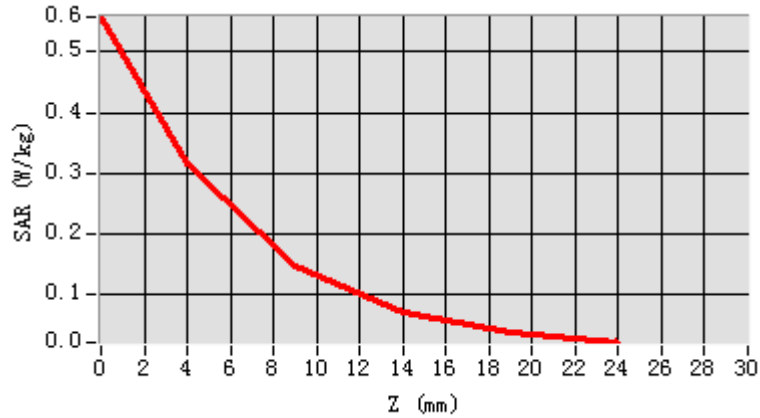
0.129995

SAR 1g (W/Kg)

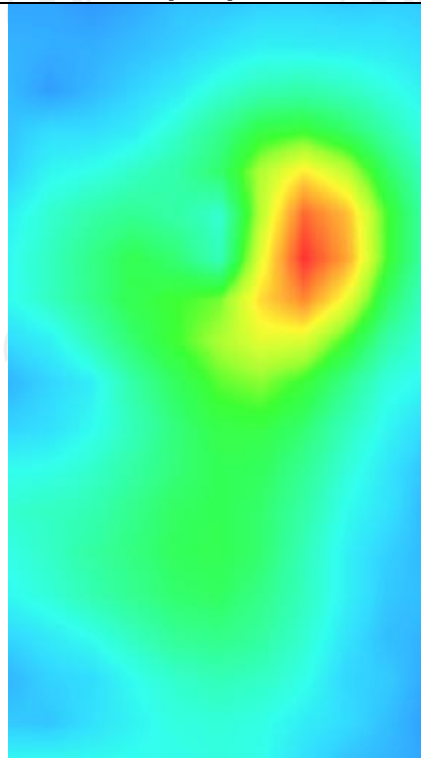
0.288303



| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.5580 | 0.3164 | 0.1468 | 0.0682 | 0.0354 |



Hot spot position



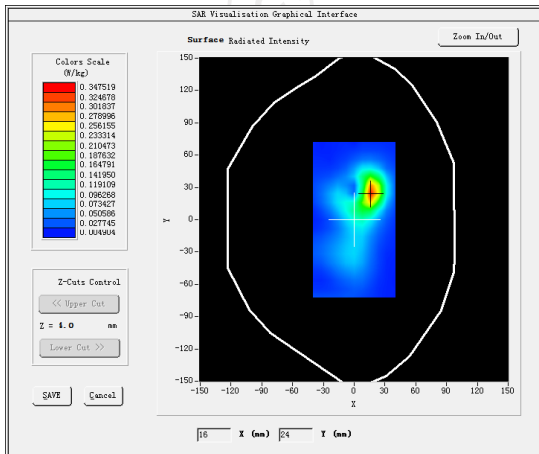
MEASUREMENT 3

Middle Band SAR (Channel 6):

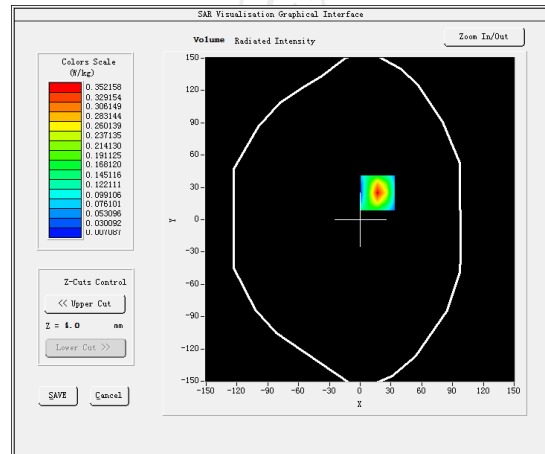
Date: 10/21/2019

| | |
|---|---|
| Frequency (MHz) | 2437.000000 |
| Relative permittivity (real part) | 54.630667 |
| Relative permittivity (imaginary part) | 14.318444 |
| Conductivity (S/m) | 1.982536 |
| Variation (%) | -4.330000 |
| 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/ndx=8mm dy=8mm, h=</u> <u>5.00 mm</u> |
| Phantom | Validation plane |
| Device Position | Body back(10mm) |
| Band | <u>IEEE 802.11b ISM(hotspot)</u> |

SURFACE SAR



VOLUME SAR



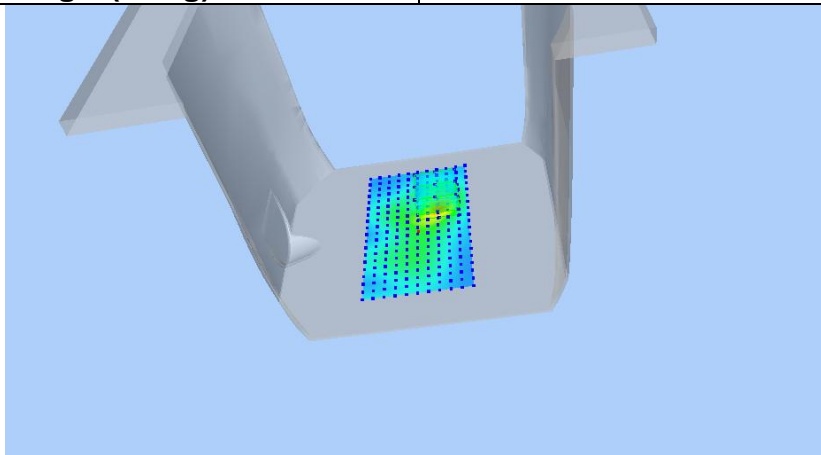
Maximum location: X=17.00, Y=25.00 SAR Peak: 0.62 W/kg

SAR 10g (W/Kg)

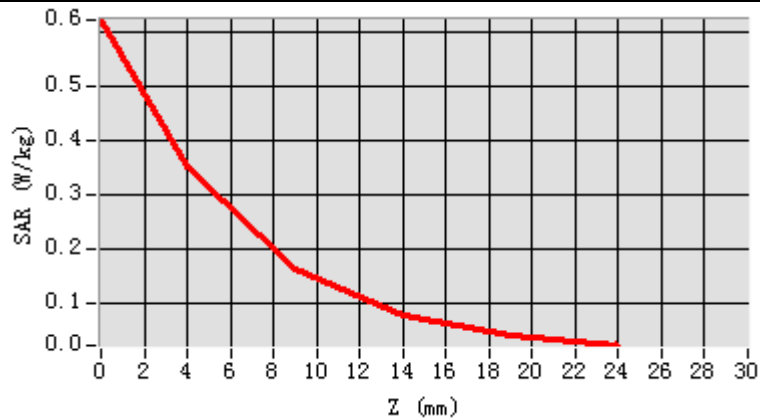
0.142360

SAR 1g (W/Kg)

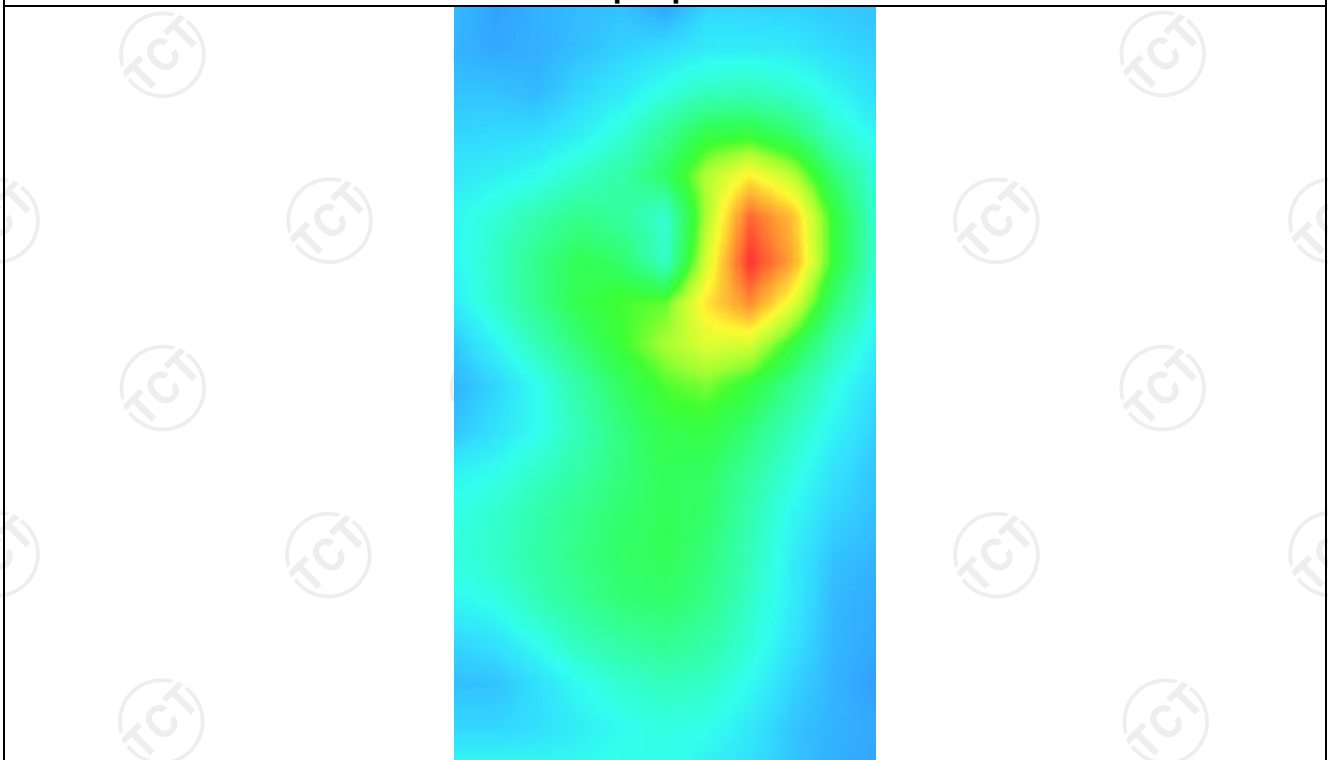
0.319895



| | | | | | |
|------------|--------|--------|--------|--------|--------|
| Z (mm) | 0.00 | 4.00 | 9.00 | 14.00 | 19.00 |
| SAR (W/Kg) | 0.6234 | 0.3522 | 0.1622 | 0.0742 | 0.0376 |



Hot spot position



Appendix A: EUT Photos



Liquid depth



The Body Liquid of 835MHz (15.4cm)



The Body Liquid of 1800MHz (15.2 cm)



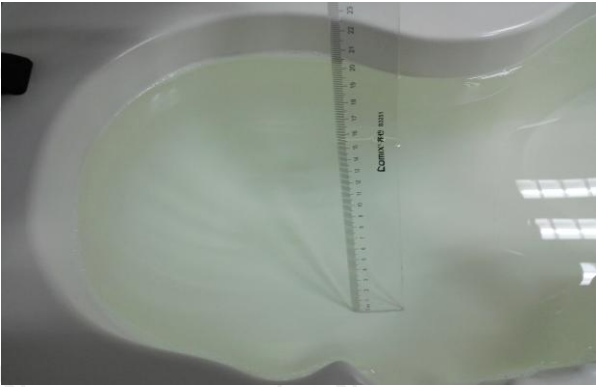
The Body Liquid of 1900MHz (16.4 cm)



The Body Liquid of 2450MHz (15.3cm)



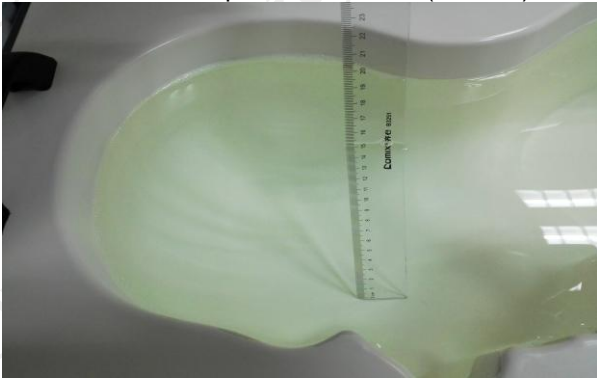
The Body Liquid of 2600MHz (16.5cm)



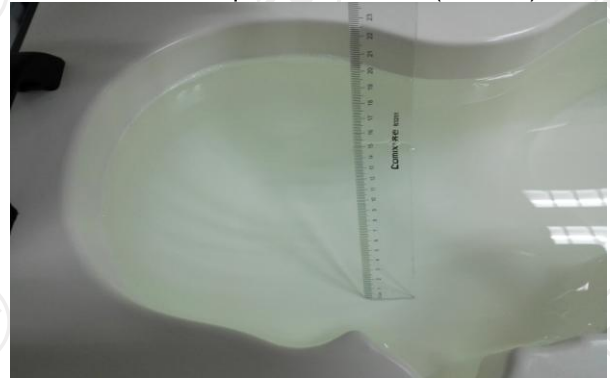
The Head Liquid of 1900MHz (15.5cm)



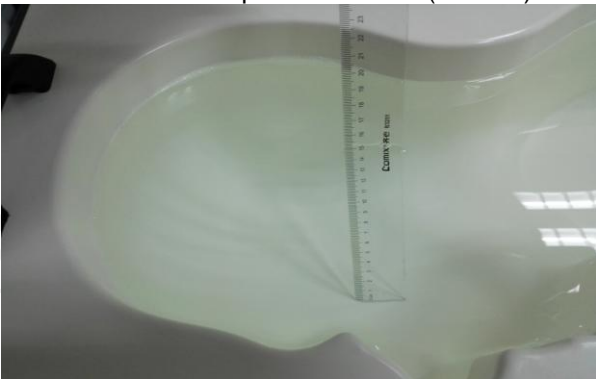
The Head Liquid of 2450MHz (15.6cm)



The Head Liquid of 835MHz (15.3cm)

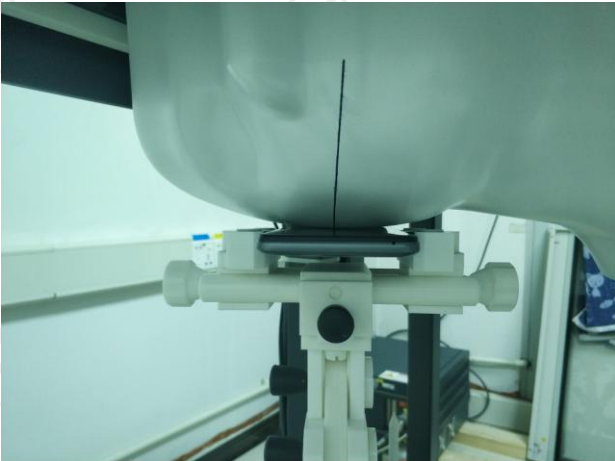


The Head Liquid of 2600MHz (15.1cm)

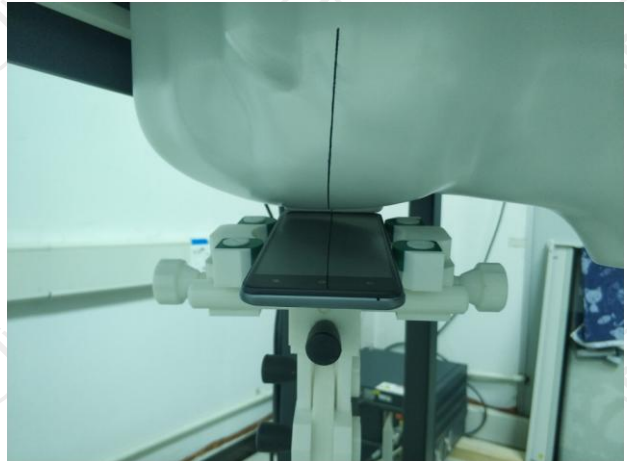


The Head Liquid of 1800MHz (15.2cm)

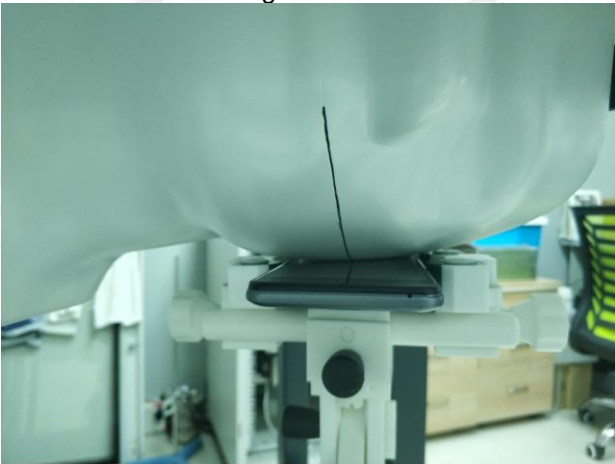
Appendix B: Test Setup Photos



Right Cheek



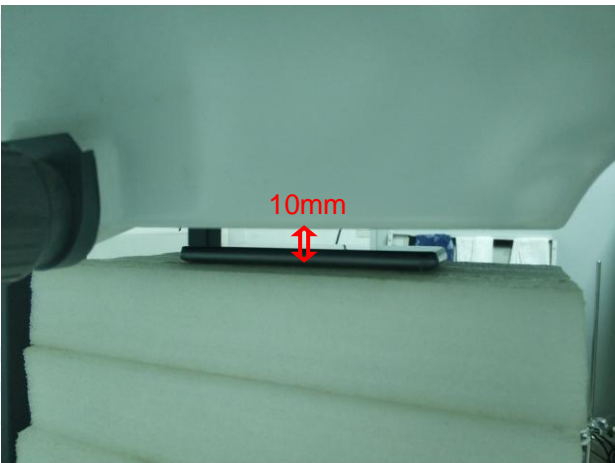
Right Tilted



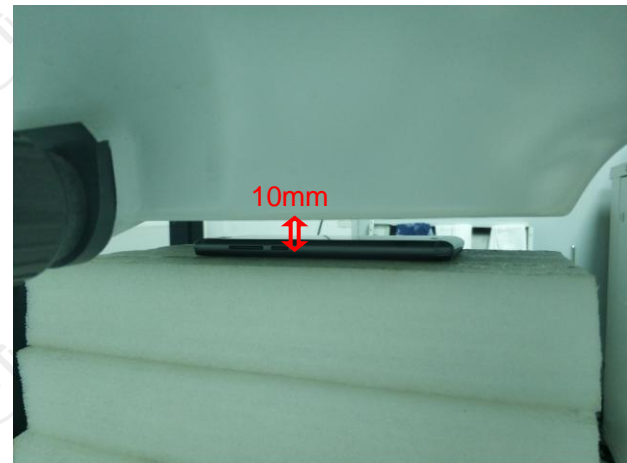
Left Cheek



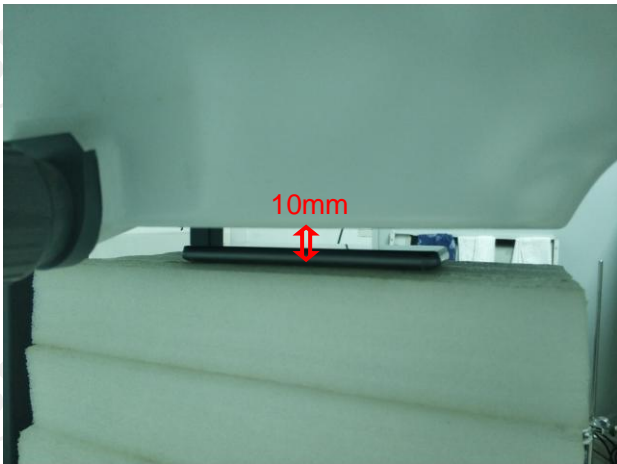
Left Tilted



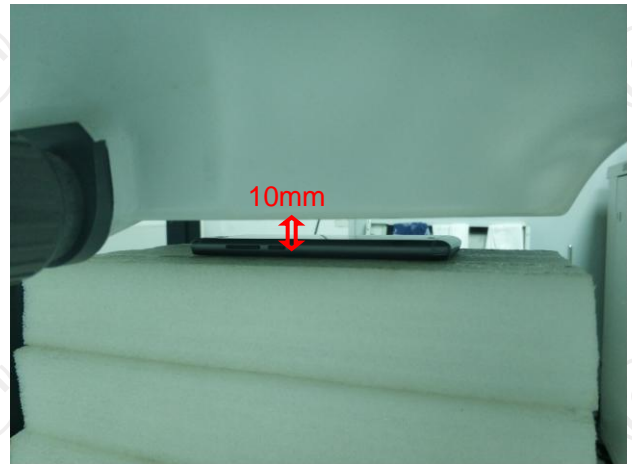
Body worn – Front (10mm)



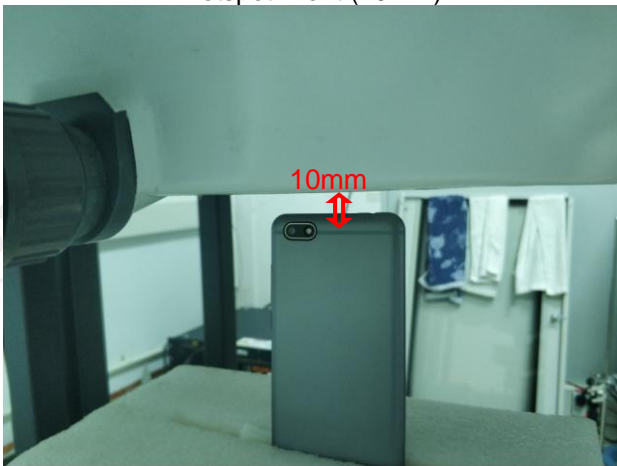
Body worn – Back (10mm)



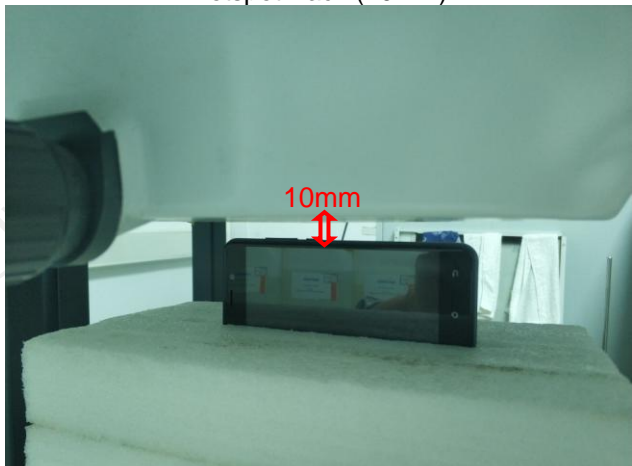
Hotspot Front (10mm)



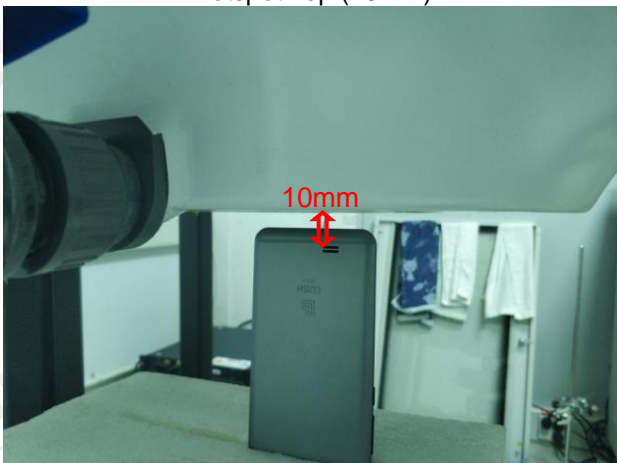
Hotspot Back (10mm)



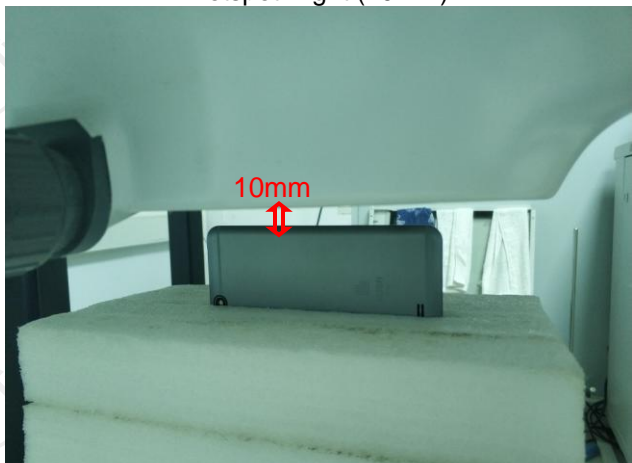
Hotspot Top (10mm)



Hotspot Right (10mm)



Hotspot Bottom (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 | <i>JS</i> |
| Checked by : | Jérôme LUC | Product Manager | 1/09/2019 | <i>JS</i> |
| Approved by : | Kim RUTKOWSKI | Quality Manager | 1/09/2019 | <i>Kim Rutkowski</i> |

| | Customer Name |
|----------------|-----------------------------|
| Distribution : | Shenzhen Tongce Testing Lab |

| Issue | Date | Modifications |
|-------|-----------|-----------------|
| A | 1/09/2019 | Initial release |
| | | |
| | | |
| | | |



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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.



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% |



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 % |

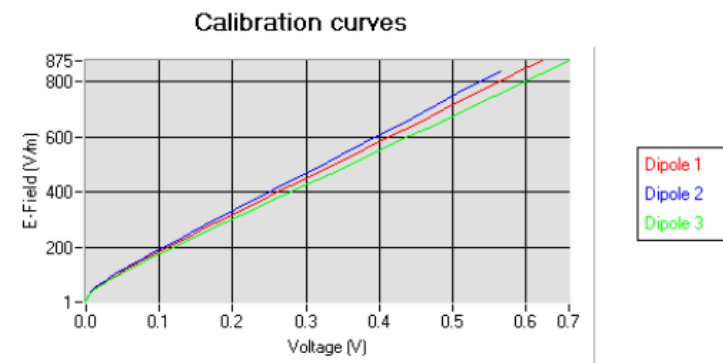
5.1 SENSITIVITY IN AIR

| 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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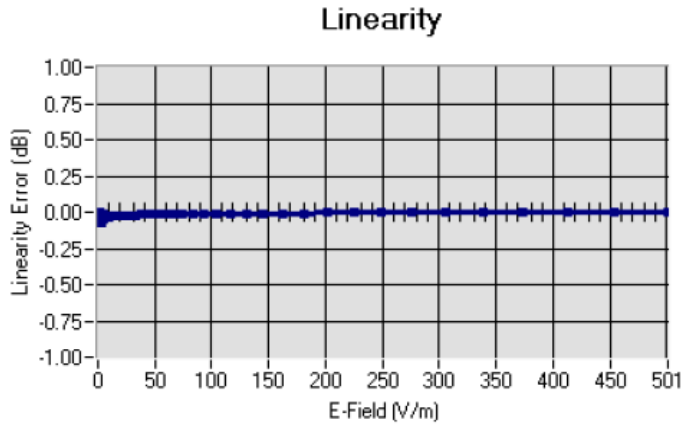
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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.121.4.19.SATUA

5.2 LINEARITY



Linearity: $\pm 1.58\%$ ($\pm 0.07\text{dB}$)

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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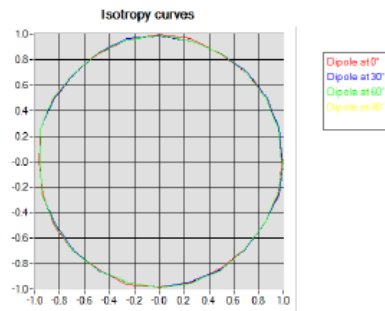
COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.121.4.19.SATU.A

5.4 ISOTROPY

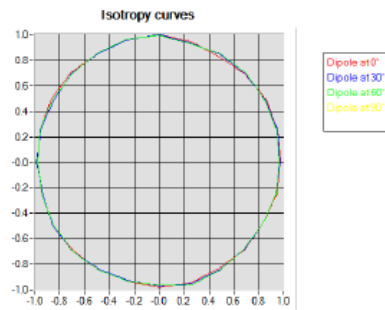
HL900 MHz

- 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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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 |



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 | <i>JS</i> |
| Checked by : | Jérôme LUC | Product Manager | 06/05/2018 | <i>JS</i> |
| Approved by : | Kim RUTKOWSKI | Quality Manager | 06/05/2018 | <i>Kim Rutkowski</i> |

| | Customer Name |
|----------------|-----------------------------|
| Distribution : | Shenzhen Tongce Testing Lab |

| Issue | Date | Modifications |
|-------|------------|-----------------|
| A | 06/05/2018 | Initial release |
| | | |
| | | |
| | | |



SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref: ACR.138.4.33.SATUA

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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% |



SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref: ACR.138.4.33..SATU.A

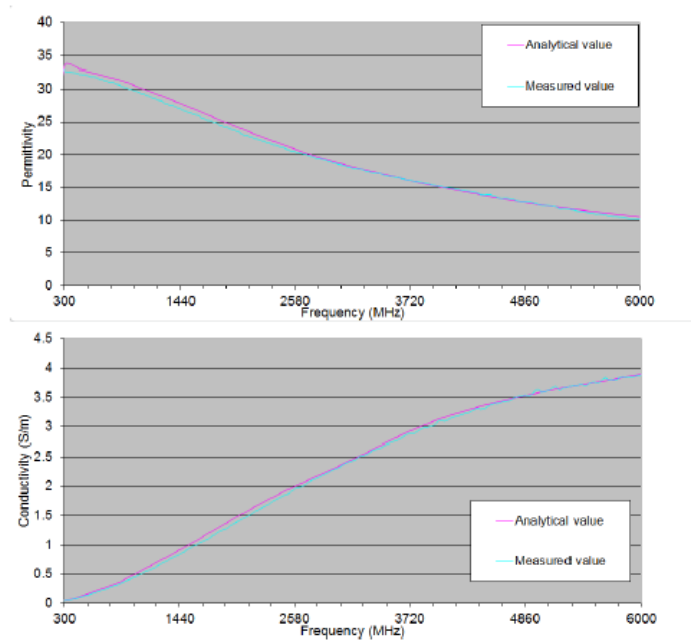
6 CALIBRATION MEASUREMENT RESULTS

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

Ref: ACR.138.4.33..SATU.A

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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Appendix D: Dipole Calibration Report

SID 835



SAR Reference Dipole Calibration Report

Ref : ACR.156.4.15.SATU.A

SHENZHEN TONGCE TESTING Lab.

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

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 835 MHZ

SERIAL NO.: SN 16/15 DIP 0G835-369

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 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.156.4.15.SATU.A

| | Name | Function | Date | Signature |
|---------------|---------------|-----------------|------------|----------------------|
| Prepared by : | Jérôme LUC | Product Manager | 06/05/2018 | <i>JS</i> |
| Checked by : | Jérôme LUC | Product Manager | 06/05/2018 | <i>JS</i> |
| Approved by : | Kim RUTKOWSKI | Quality Manager | 06/05/2018 | <i>Kim Rutkowski</i> |

| | Customer Name |
|----------------|-----------------------------|
| Distribution : | Shenzhen Tongce Testing Lab |

| Issue | Date | Modifications |
|-------|------------|-----------------|
| A | 06/05/2018 | Initial release |
| | | |
| | | |
| | | |