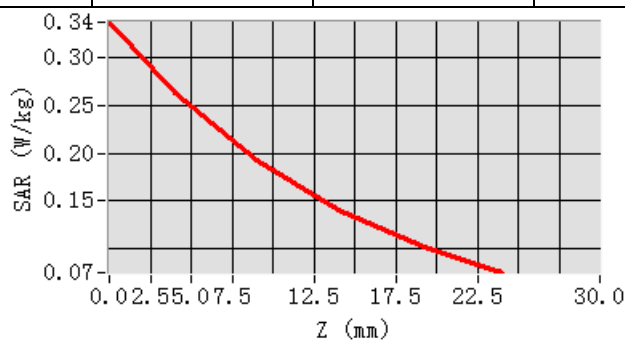
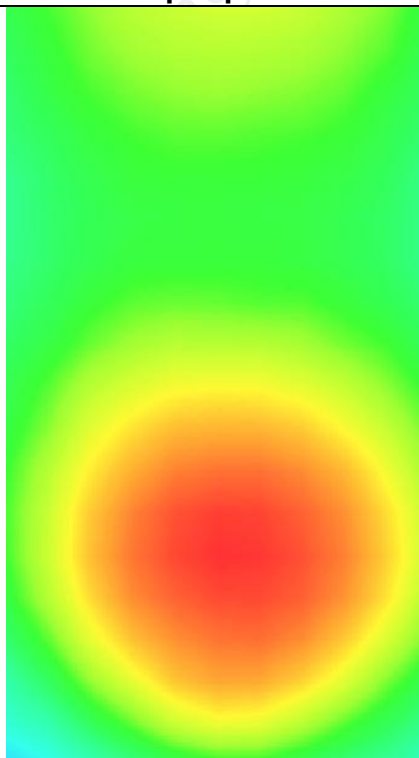


| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.3372 | 0.2634 | 0.1926 | 0.1412 | 0.1038 |

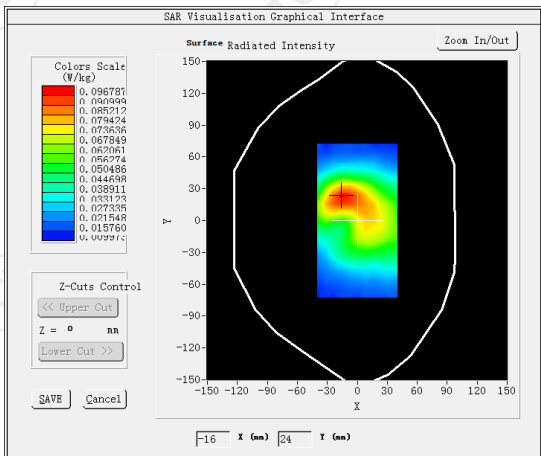
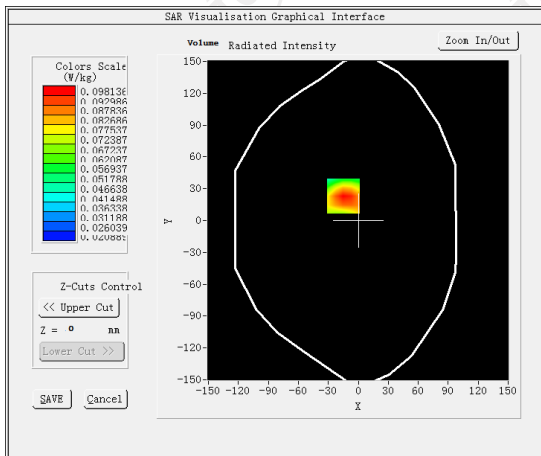


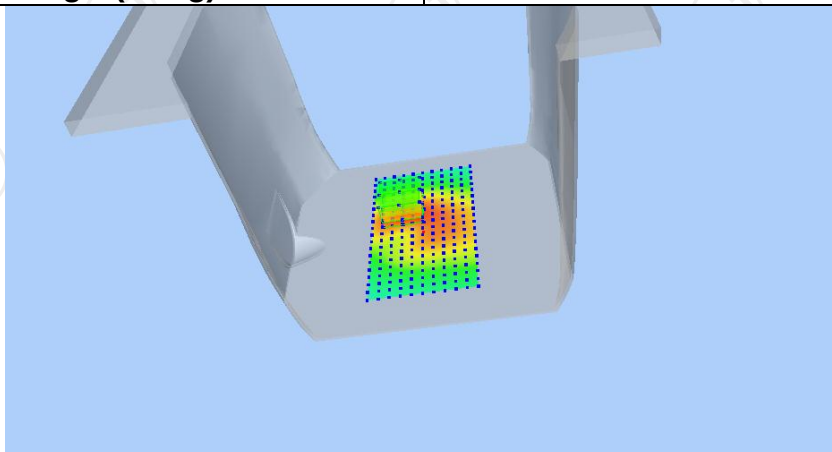
Hot spot position



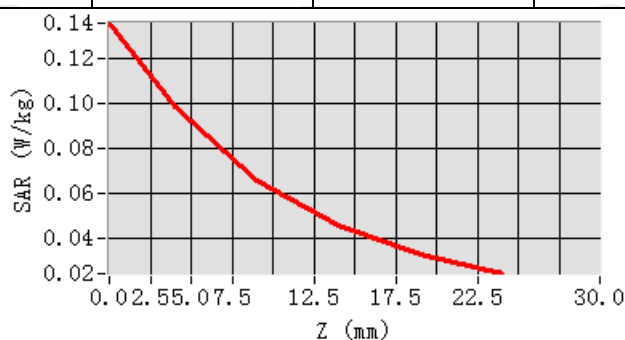
## LTE Band 17

### MEASUREMENT 1

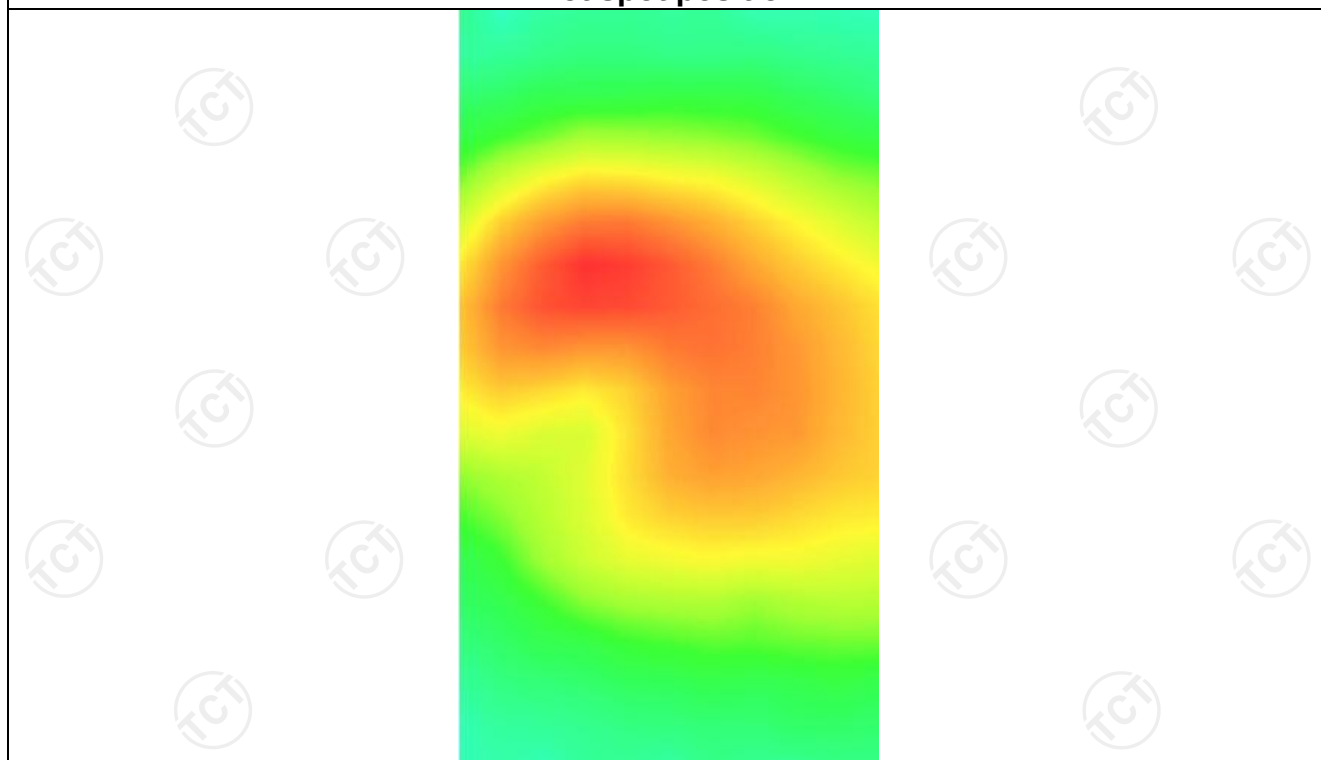
|                                                                                                          |                                                                   |                                                                                                          |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| High Band SAR (Channel 23800):                                                                           |                                                                   | Date: 11/09/2023                                                                                         |
| Frequency (MHz)                                                                                          | 711.000000                                                        |                                                                                                          |
| Relative permittivity (real part)                                                                        | 42.113335                                                         |                                                                                                          |
| Relative permittivity (imaginary part)                                                                   | 23.152000                                                         |                                                                                                          |
| Conductivity (S/m)                                                                                       | 0.913218                                                          |                                                                                                          |
| Variation (%)                                                                                            | 2.450000                                                          |                                                                                                          |
| Crest Factor                                                                                             | 1.0                                                               |                                                                                                          |
| Probe Conversion factor                                                                                  | 1.71                                                              |                                                                                                          |
| E-Field Probe:                                                                                           | SSE2 (SN 25/22 EPG0375)                                           |                                                                                                          |
| Area Scan                                                                                                | dx=8mm dy=8mm, h= 5.00 mm                                         |                                                                                                          |
| ZoomScan                                                                                                 | 5x5x7,dx=8mm dy=8mm<br>dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm |                                                                                                          |
| Phantom                                                                                                  | Validation plane                                                  |                                                                                                          |
| Device Position                                                                                          | Body front(10mm)                                                  |                                                                                                          |
| Band                                                                                                     | LTE band 17(1 RB#24)                                              |                                                                                                          |
| <b>SURFACE SAR</b><br> |                                                                   | <b>VOLUME SAR</b><br> |
| Maximum location: X=-15.00, Y=23.00 SAR Peak: 0.14 W/kg                                                  |                                                                   |                                                                                                          |
| SAR 10g (W/Kg)                                                                                           | 0.063050                                                          |                                                                                                          |
| SAR 1g (W/Kg)                                                                                            | 0.096487                                                          |                                                                                                          |



| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.1355 | 0.0981 | 0.0658 | 0.0455 | 0.0330 |



Hot spot position



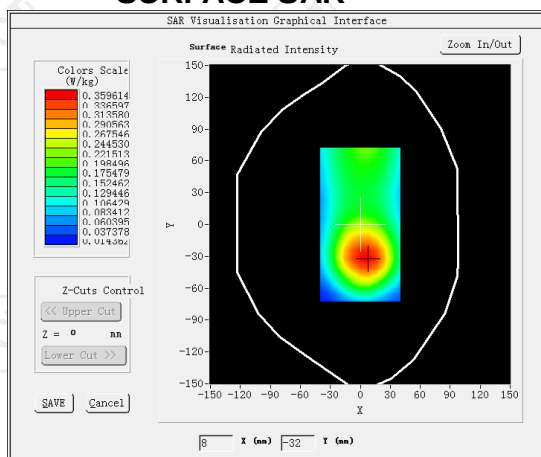
## MEASUREMENT 2

High3 Band SAR (Channel 23800):

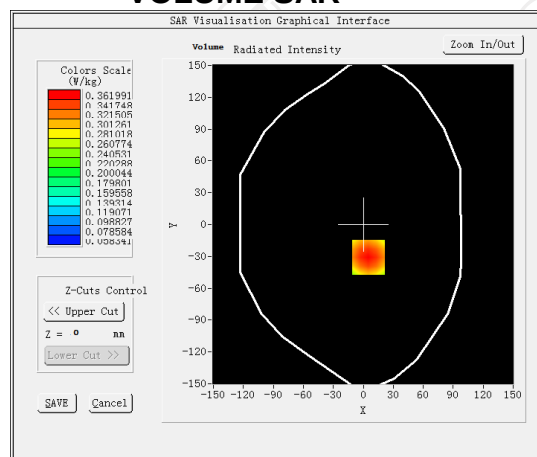
Date: 11/09/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 711.000000                                                                                |
| Relative permittivity (real part)      | 42.113335                                                                                 |
| Relative permittivity (imaginary part) | 23.152000                                                                                 |
| Conductivity (S/m)                     | 0.913218                                                                                  |
| Variation (%)                          | -2.710000                                                                                 |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 1.71                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=8mm dy=8mm, h= 5.00 mm</u>                                                          |
| ZoomScan                               | <u>5x5x7,dx=8mm dy=8mm</u><br><u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | <u>Validation plane</u>                                                                   |
| Device Position                        | <u>Body back(10mm)</u>                                                                    |
| Band                                   | <u>LTE band 17(1 RB#24)</u>                                                               |

### SURFACE SAR

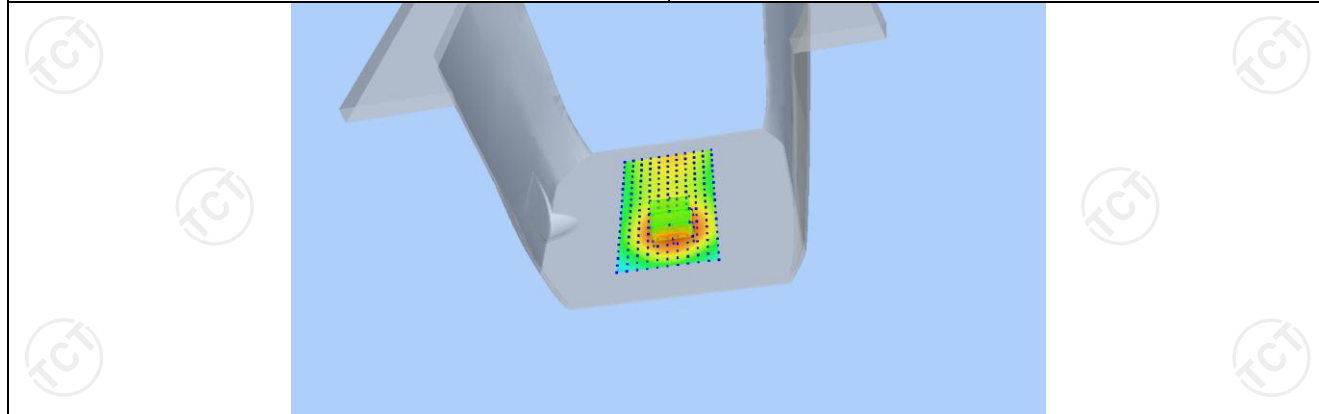


### VOLUME SAR

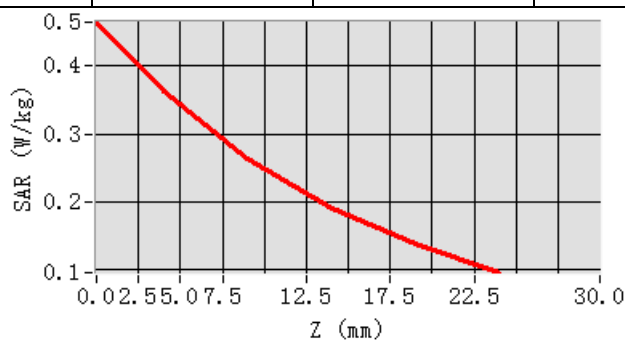


Maximum location: X=5.00, Y=-31.00 SAR Peak: 0.46 W/kg

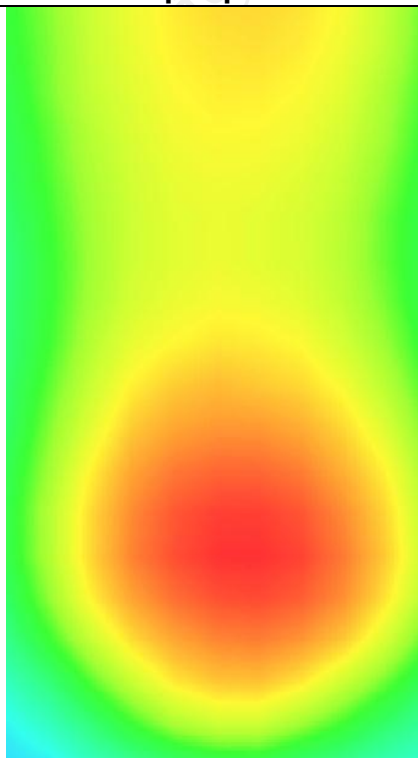
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.247611 |
| SAR 1g (W/Kg)  | 0.354177 |



| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.4643 | 0.3620 | 0.2631 | 0.1905 | 0.1372 |



Hot spot position



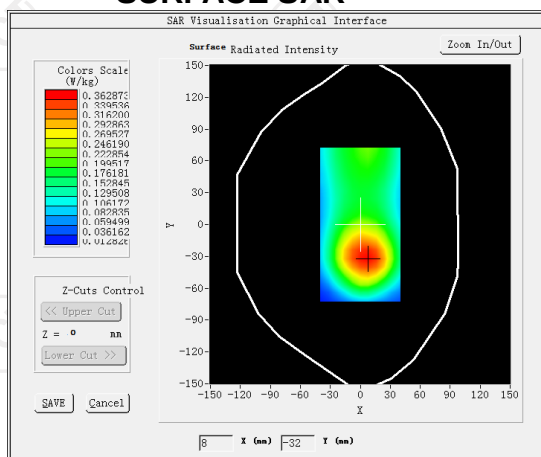
## MEASUREMENT 3

High Band SAR (Channel 23800):

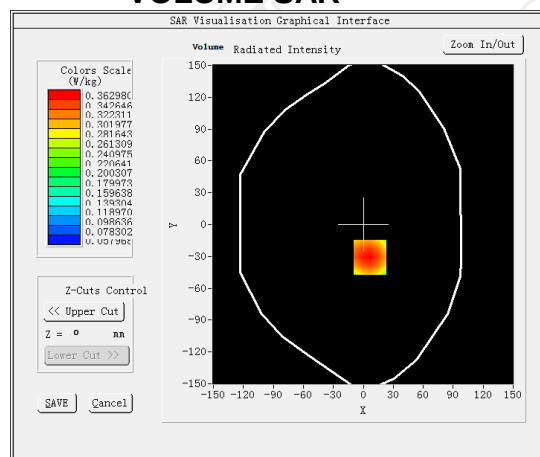
Date: 11/09/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 711.000000                                                                                |
| Relative permittivity (real part)      | 42.113335                                                                                 |
| Relative permittivity (imaginary part) | 23.152000                                                                                 |
| Conductivity (S/m)                     | 0.913218                                                                                  |
| Variation (%)                          | -2.340000                                                                                 |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 1.71                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=8mm dy=8mm, h= 5.00 mm</u>                                                          |
| ZoomScan                               | <u>5x5x7,dx=8mm dy=8mm</u><br><u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | <u>Body back(hotspot 10mm)</u>                                                            |
| Band                                   | <u>LTE band 17(1 RB#24)</u>                                                               |

### SURFACE SAR

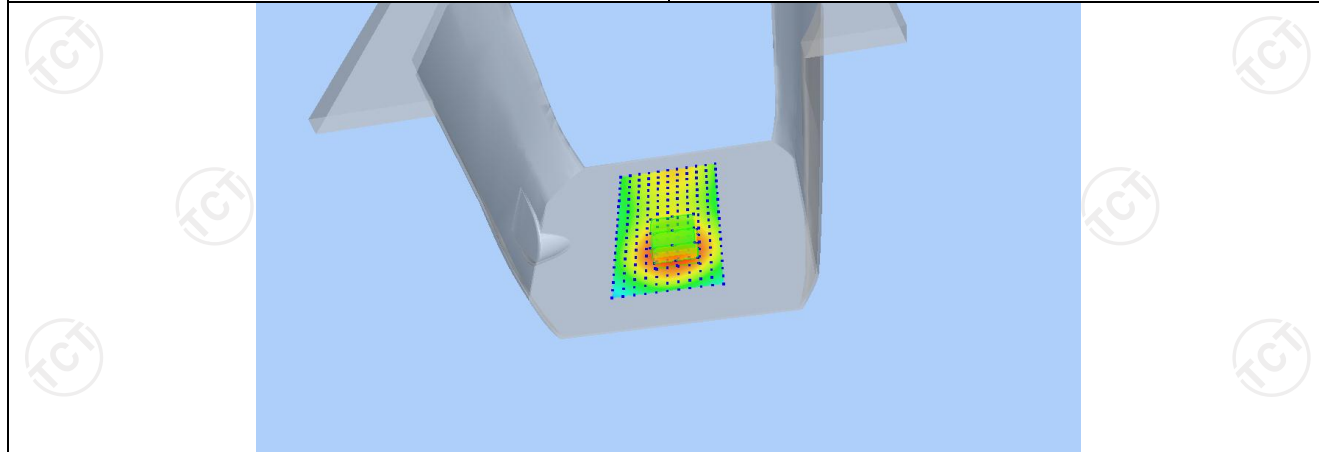


### VOLUME SAR

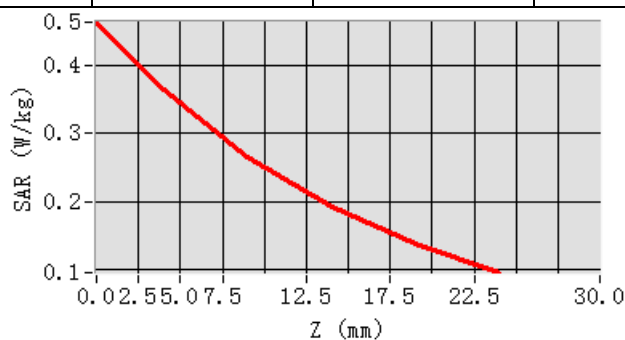


Maximum location: X=7.00, Y=-31.00 SAR Peak: 0.46 W/kg

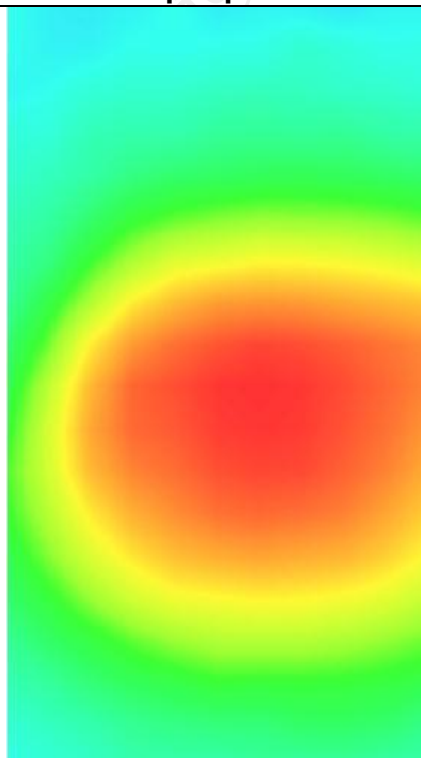
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.249273 |
| SAR 1g (W/Kg)  | 0.355913 |



| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.4625 | 0.3630 | 0.2654 | 0.1924 | 0.1379 |

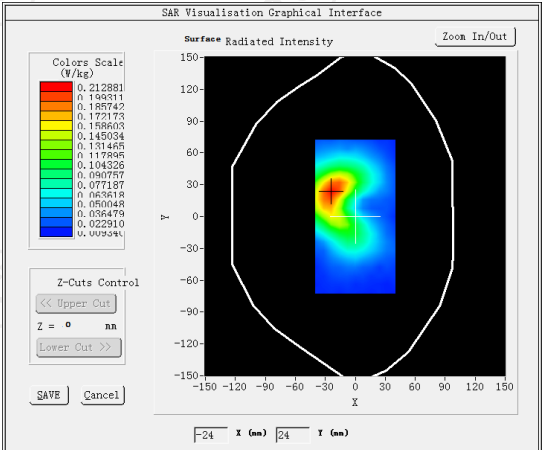
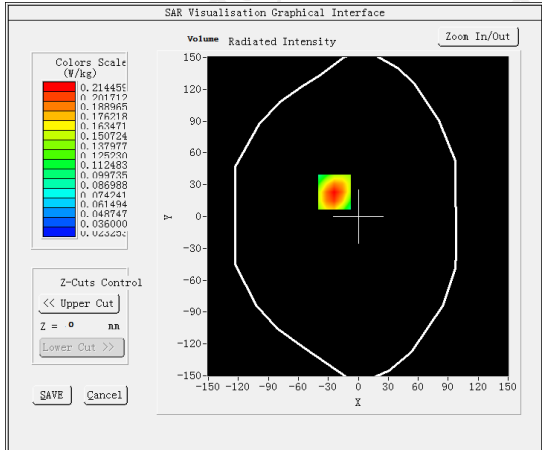
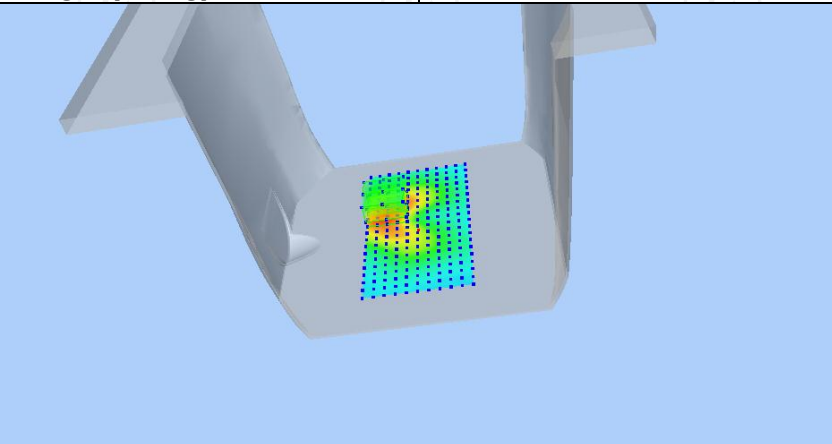


Hot spot position

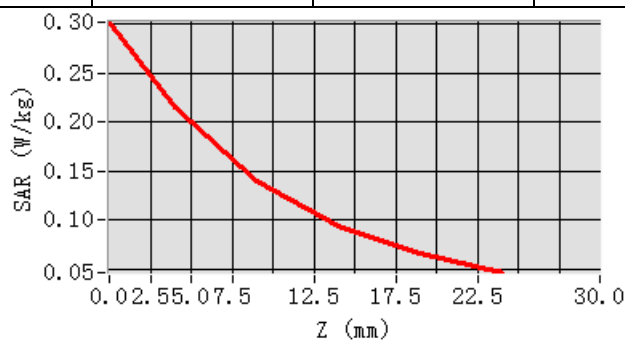


## LTE Band 41

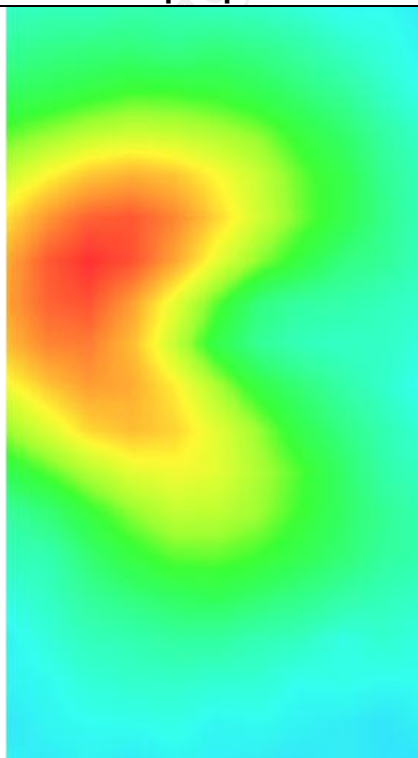
### MEASUREMENT 1

|                                                                                      |                                                                   |                                                                                     |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Low Band SAR (Channel 39750):                                                        |                                                                   | Date: 11/30/2023                                                                    |
| Frequency (MHz)                                                                      | 2506.000000                                                       |                                                                                     |
| Relative permittivity (real part)                                                    | 39.009335                                                         |                                                                                     |
| Relative permittivity (imaginary part)                                               | 13.553667                                                         |                                                                                     |
| Conductivity (S/m)                                                                   | 1.952481                                                          |                                                                                     |
| Variation (%)                                                                        | 0.490000                                                          |                                                                                     |
| Crest Factor                                                                         | 1.0                                                               |                                                                                     |
| Probe Conversion factor                                                              | 4.36                                                              |                                                                                     |
| E-Field Probe:                                                                       | SSE2 (SN 25/22 EPG0375)                                           |                                                                                     |
| Area Scan                                                                            | dx=8mm dy=8mm, h= 5.00 mm                                         |                                                                                     |
| ZoomScan                                                                             | 5x5x7,dx=8mm dy=8mm<br>dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm |                                                                                     |
| Phantom                                                                              | Validation plane                                                  |                                                                                     |
| Device Position                                                                      | Body Front(10mm)                                                  |                                                                                     |
| Band                                                                                 | LTE band 41(1 RB#49)                                              |                                                                                     |
| SURFACE SAR                                                                          |                                                                   | VOLUME SAR                                                                          |
|    |                                                                   |  |
| Maximum location: X=-24.00, Y=23.00 SAR Peak: 0.30 W/kg                              |                                                                   |                                                                                     |
| SAR 10g (W/Kg)                                                                       |                                                                   | 0.128515                                                                            |
| SAR 1g (W/Kg)                                                                        |                                                                   | 0.203815                                                                            |
|  |                                                                   |                                                                                     |

| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.3017 | 0.2145 | 0.1399 | 0.0936 | 0.0655 |



Hot spot position



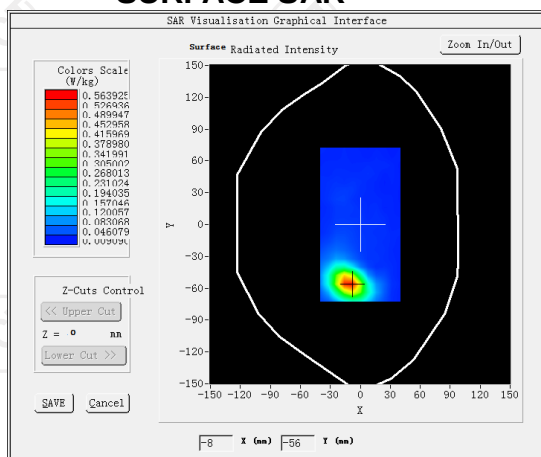
## MEASUREMENT 2

Low Band SAR (Channel 39750):

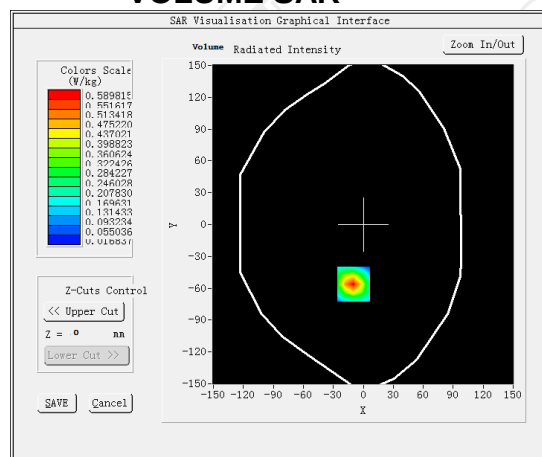
Date: 11/30/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 2506.000000                                                                               |
| Relative permittivity (real part)      | 39.009335                                                                                 |
| Relative permittivity (imaginary part) | 13.553667                                                                                 |
| Conductivity (S/m)                     | 1.952481                                                                                  |
| Variation (%)                          | -4.550000                                                                                 |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 4.36                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=8mm dy=8mm, h= 5.00 mm</u>                                                          |
| ZoomScan                               | <u>5x5x7,dx=8mm dy=8mm</u><br><u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body back(10mm)                                                                           |
| Band                                   | <u>LTE band 41(1 RB#49)</u>                                                               |

### SURFACE SAR



### VOLUME SAR



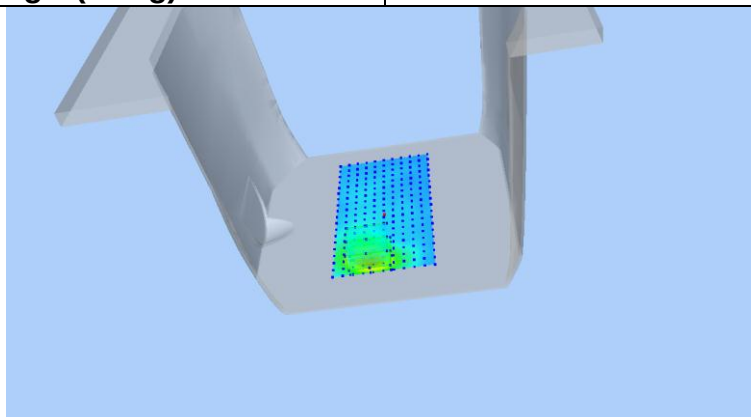
Maximum location: X=-10.00, Y=-56.00 SAR Peak: 0.95 W/kg

SAR 10g (W/Kg)

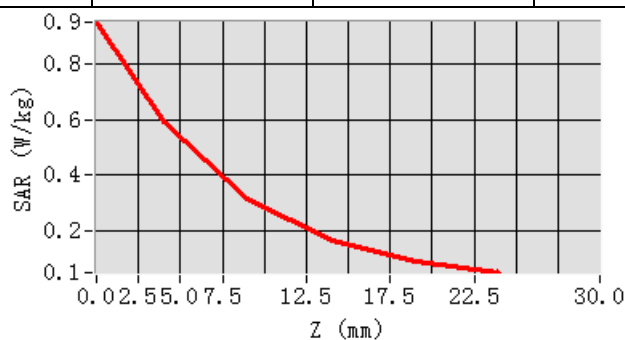
0.261172

SAR 1g (W/Kg)

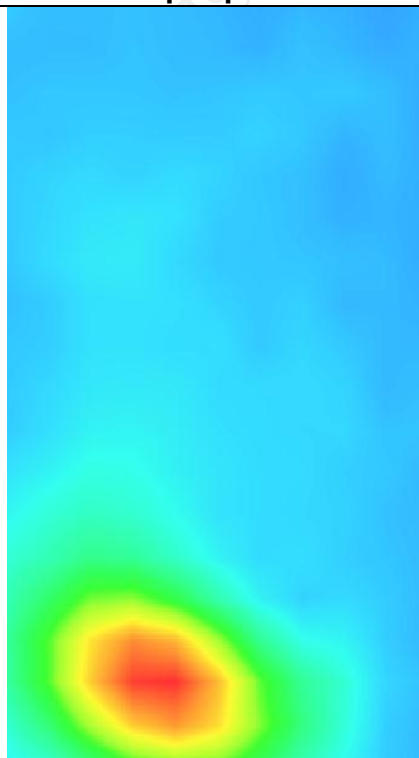
0.536813



| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.9465 | 0.5898 | 0.3162 | 0.1700 | 0.0961 |



**Hot spot position**



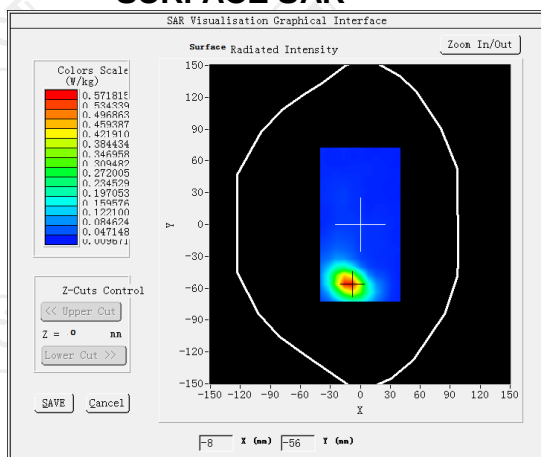
## MEASUREMENT 3

Low Band SAR (Channel 39750):

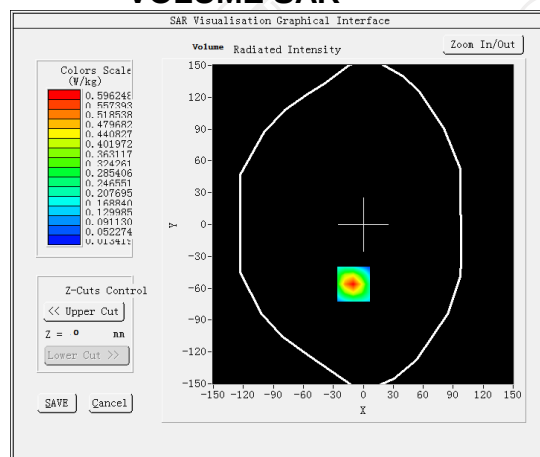
Date: 11/30/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 2506.000000                                                                               |
| Relative permittivity (real part)      | 39.009335                                                                                 |
| Relative permittivity (imaginary part) | 13.553667                                                                                 |
| Conductivity (S/m)                     | 1.952481                                                                                  |
| Variation (%)                          | -3.390000                                                                                 |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 4.36                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=8mm dy=8mm, h= 5.00 mm</u>                                                          |
| ZoomScan                               | <u>5x5x7,dx=8mm dy=8mm</u><br><u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body back(hotspot 10mm)                                                                   |
| Band                                   | <u>LTE band 41(1 RB#49)</u>                                                               |

### SURFACE SAR

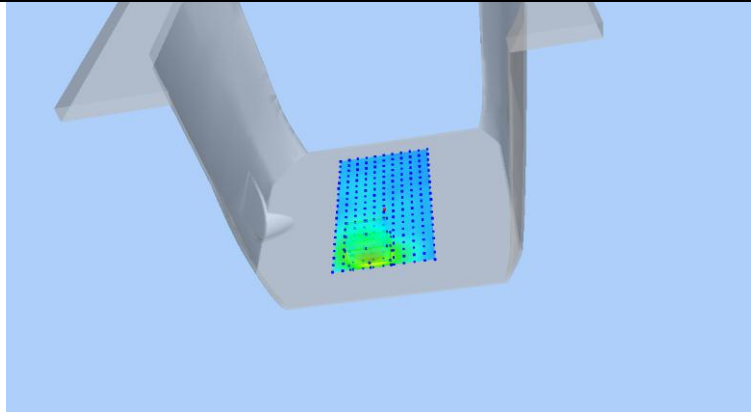


### VOLUME SAR

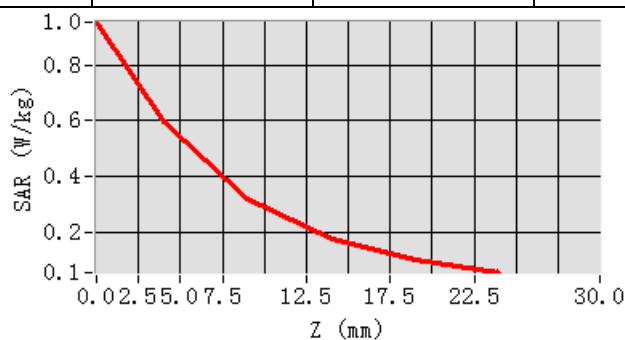


Maximum location: X=-10.00, Y=-56.00 SAR Peak: 0.96 W/kg

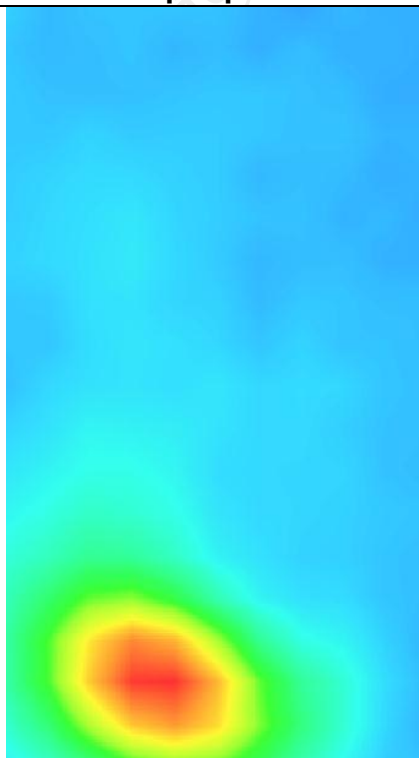
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.265279 |
| SAR 1g (W/Kg)  | 0.543186 |



| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.9537 | 0.5962 | 0.3212 | 0.1735 | 0.0984 |

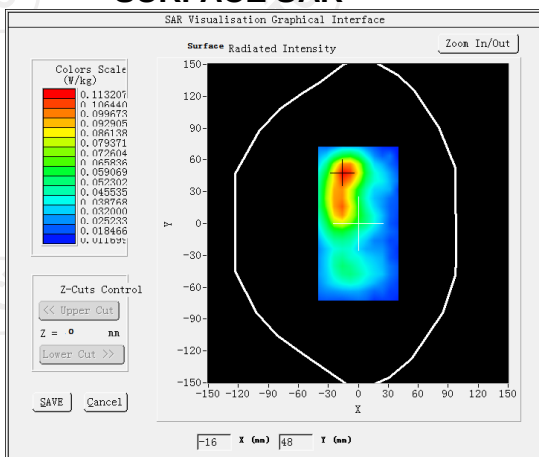
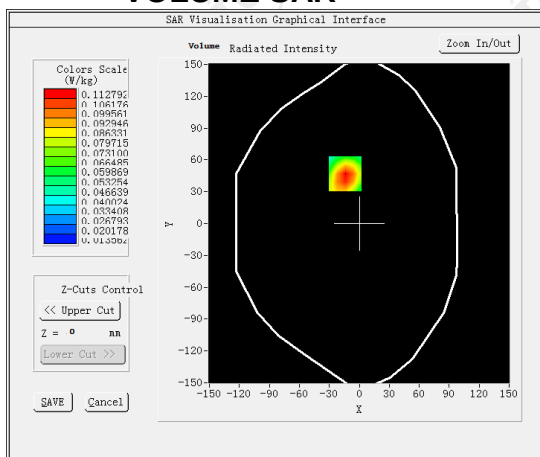
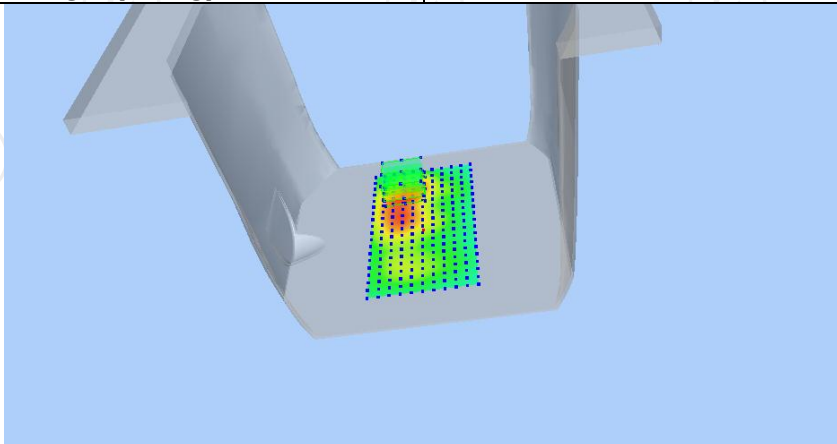


Hot spot position

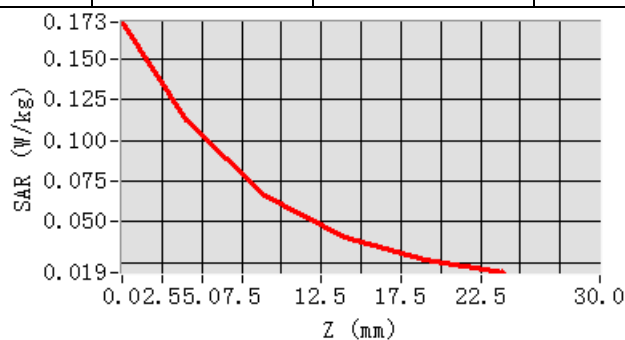


## WLAN 2.4G

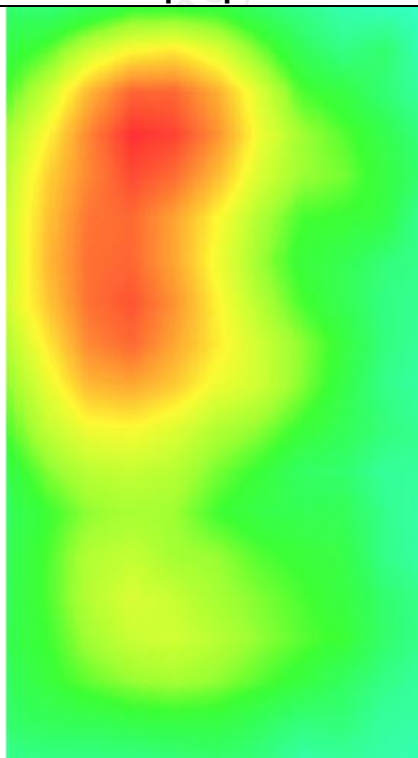
### MEASUREMENT 1

|                                                                                      |                                                                   |                                                                                     |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| High Band SAR (Channel 11):                                                          |                                                                   | Date: 11/27/2023                                                                    |
| Frequency (MHz)                                                                      | 2462.000000                                                       |                                                                                     |
| Relative permittivity (real part)                                                    | 37.821613                                                         |                                                                                     |
| Relative permittivity (imaginary part)                                               | 13.546980                                                         |                                                                                     |
| Conductivity (S/m)                                                                   | 1.834111                                                          |                                                                                     |
| Variation (%)                                                                        | 1.820000                                                          |                                                                                     |
| Crest Factor                                                                         | 1.0                                                               |                                                                                     |
| Probe Conversion factor                                                              | 2.31                                                              |                                                                                     |
| E-Field Probe:                                                                       | SSE2 (SN 25/22 EPG0375)                                           |                                                                                     |
| Area Scan                                                                            | dx=8mm dy=8mm, h= 5.00 mm                                         |                                                                                     |
| ZoomScan                                                                             | 5x5x7,dx=8mm dy=8mm<br>dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm |                                                                                     |
| Phantom                                                                              | Validation plane                                                  |                                                                                     |
| Device Position                                                                      | Body front(10mm)                                                  |                                                                                     |
| Band                                                                                 | IEEE 802.11b ISM                                                  |                                                                                     |
| SURFACE SAR                                                                          |                                                                   | VOLUME SAR                                                                          |
|    |                                                                   |  |
| Maximum location: X=-14.00, Y=47.00 SAR Peak: 0.17 W/kg                              |                                                                   |                                                                                     |
| SAR 10g (W/Kg)                                                                       |                                                                   | 0.072991                                                                            |
| SAR 1g (W/Kg)                                                                        |                                                                   | 0.127566                                                                            |
|  |                                                                   |                                                                                     |

| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.1726 | 0.1128 | 0.0659 | 0.0401 | 0.0268 |



Hot spot position



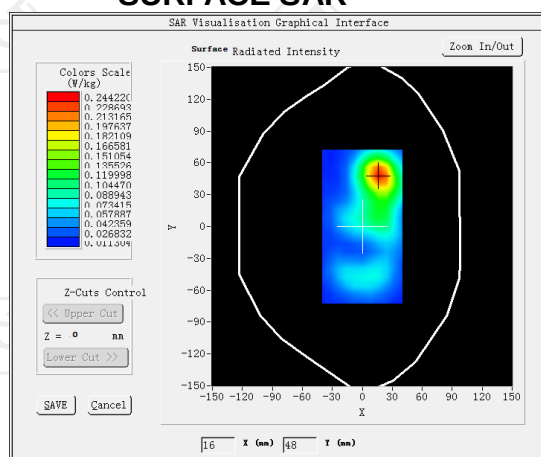
## MEASUREMENT 2

High Band SAR (Channel 11):

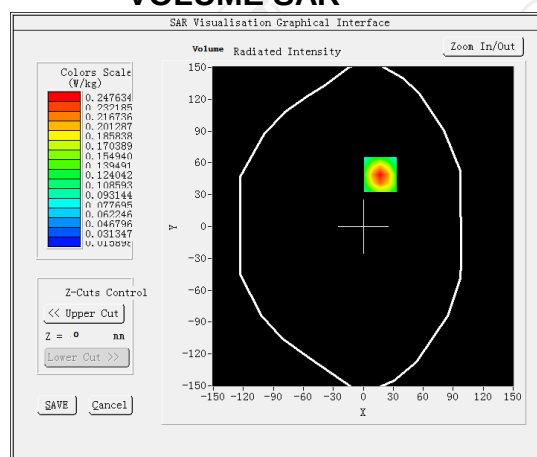
Date: 11/27/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 2462.000000                                                                               |
| Relative permittivity (real part)      | 37.821613                                                                                 |
| Relative permittivity (imaginary part) | 13.546980                                                                                 |
| Conductivity (S/m)                     | 1.834111                                                                                  |
| Variation (%)                          | 1.580000                                                                                  |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 2.31                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=12mm dy=12mm, h= 5.00 mm</u>                                                        |
| ZoomScan                               | <u>5x5x7,dx=5mm dy=5mm</u><br><u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body back(10mm)                                                                           |
| Band                                   | IEEE 802.11b ISM                                                                          |

### SURFACE SAR

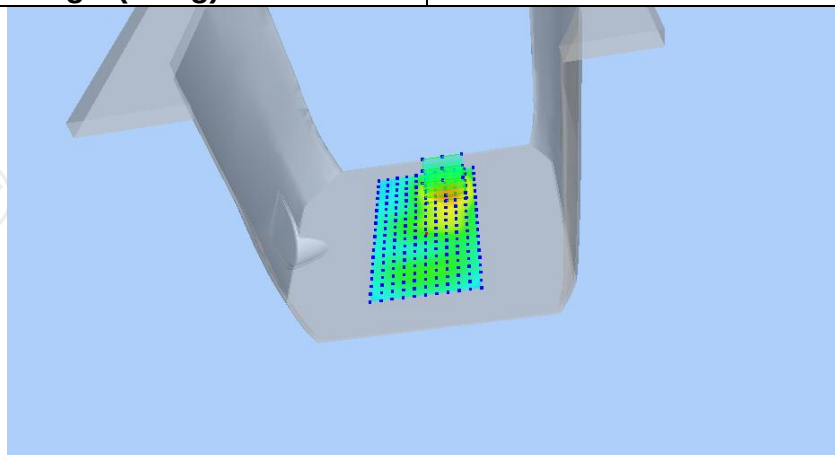


### VOLUME SAR

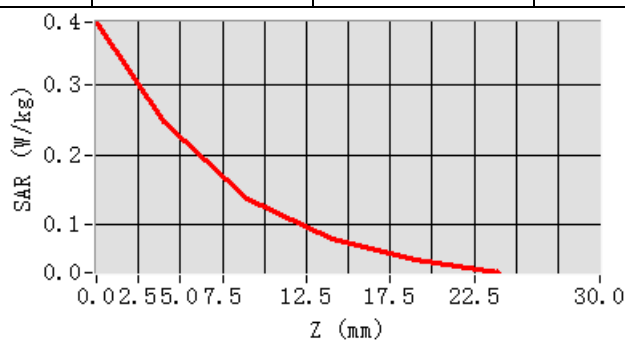


Maximum location: X=17.00, Y=49.00 SAR Peak: 0.39 W/kg

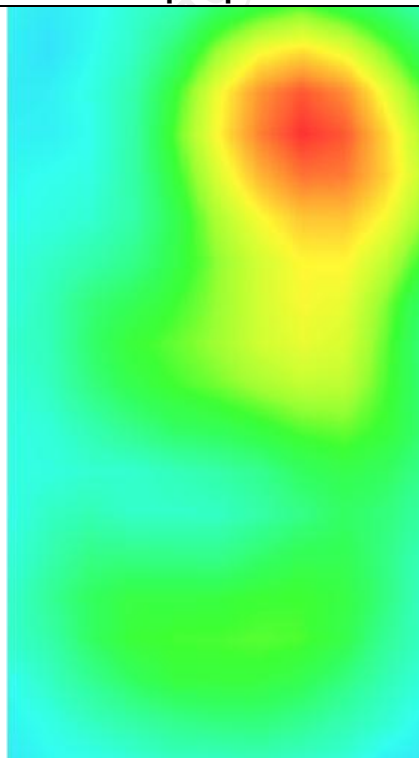
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.141003 |
| SAR 1g (W/Kg)  | 0.310036 |



| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.3901 | 0.2476 | 0.1376 | 0.0785 | 0.0484 |



Hot spot position



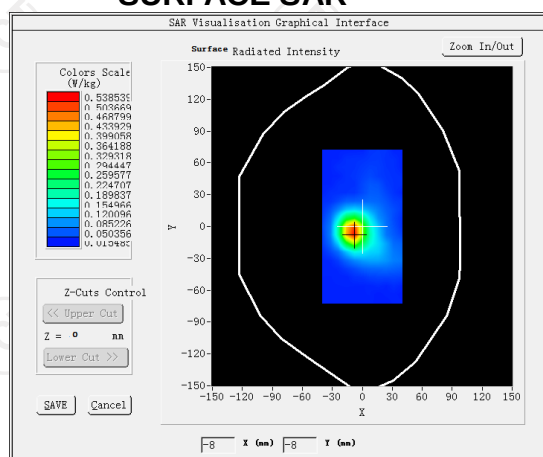
## MEASUREMENT 3

High Band SAR (Channel 11):

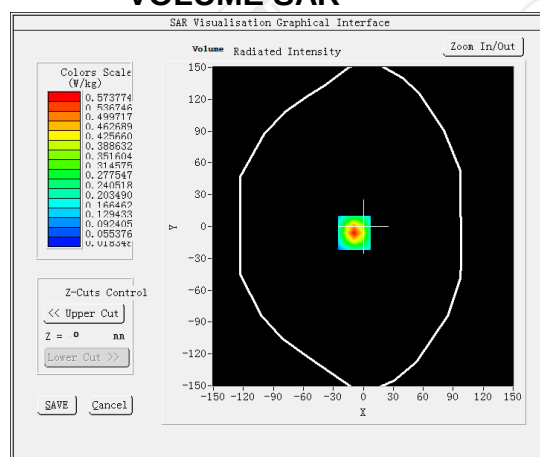
Date: 11/27/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 2462.000000                                                                               |
| Relative permittivity (real part)      | 37.821613                                                                                 |
| Relative permittivity (imaginary part) | 13.546980                                                                                 |
| Conductivity (S/m)                     | 1.834111                                                                                  |
| Variation (%)                          | 2.310000                                                                                  |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 2.31                                                                                      |
| E-Field Probe:                         | SSE2 (SN 36/20 EPG0346)                                                                   |
| Area Scan                              | <u>dx=8mm dy=8mm, h= 5.00 mm</u>                                                          |
| ZoomScan                               | <u>5x5x7,dx=8mm dy=8mm</u><br><u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body back(10mm)                                                                           |
| Band                                   | <u>IEEE 802.11b ISM(hotspot)</u>                                                          |

### SURFACE SAR

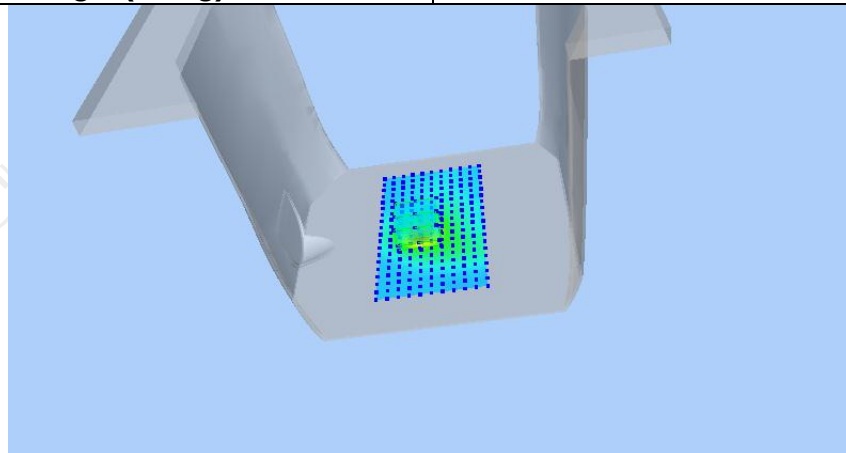


### VOLUME SAR

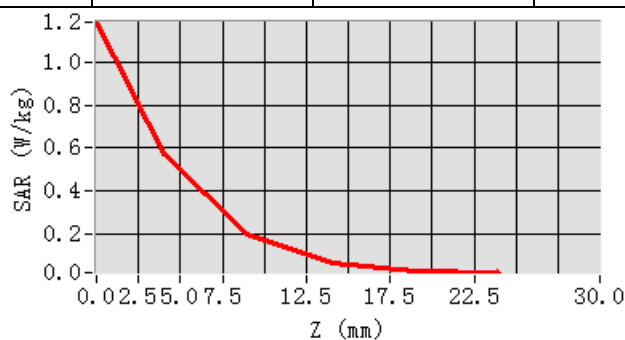


Maximum location: X=-14.00, Y=55.00 SAR Peak: 0.37 W/kg

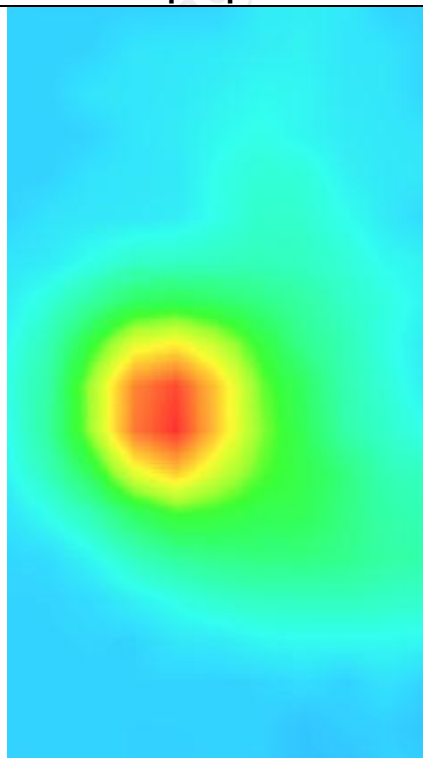
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.135130 |
| SAR 1g (W/Kg)  | 0.306190 |



| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 1.1857 | 0.5738 | 0.2014 | 0.0679 | 0.0308 |



Hot spot position



## WLAN 5.2G

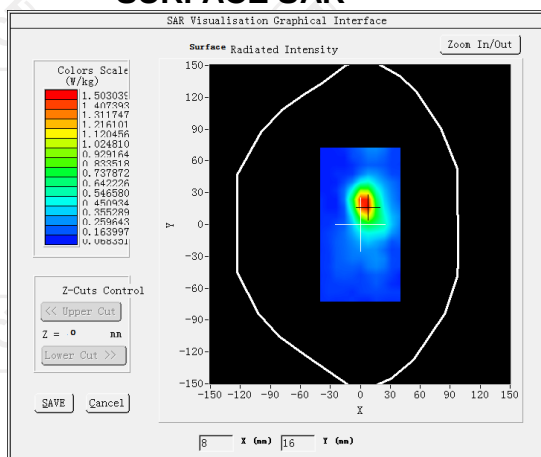
### MEASUREMENT 1

SAR (Channel 46):

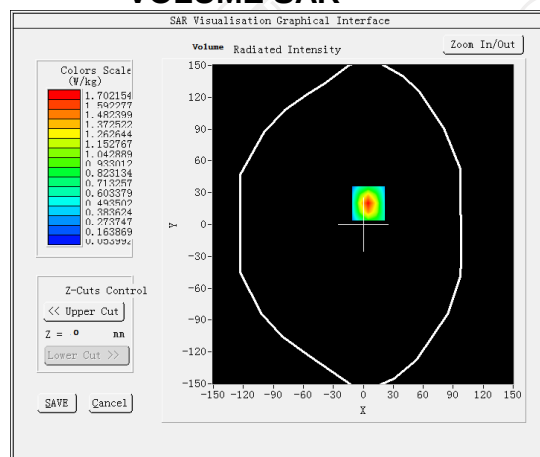
Date: 12/01/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 5230.000000                                                                               |
| Relative permittivity (real part)      | 35.068832                                                                                 |
| Relative permittivity (imaginary part) | 13.679428                                                                                 |
| Conductivity (S/m)                     | 5.220788                                                                                  |
| Variation (%)                          | -2.100000                                                                                 |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 2.01                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=10mm dy=10mm, h= 5.00 mm</u>                                                        |
| ZoomScan                               | <u>5x5x7,dx=4mm dy=4mm</u><br><u>dz=2mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body front(10mm)                                                                          |
| Band                                   | <u>IEEE 802.11n HT40 ISM</u>                                                              |

#### SURFACE SAR

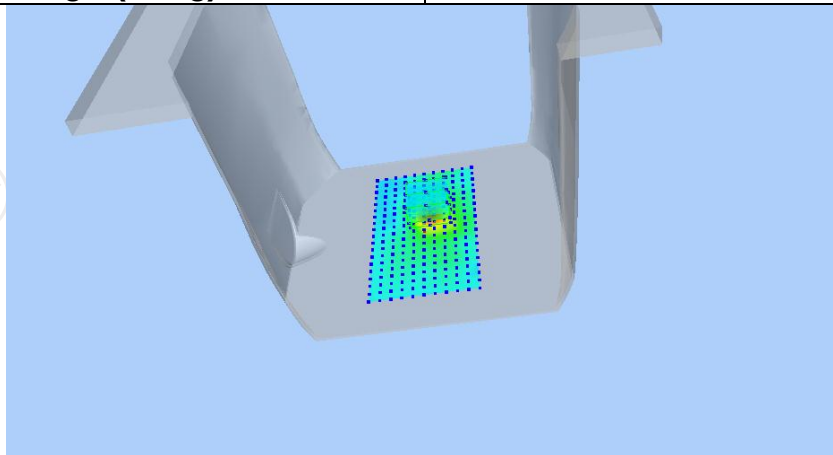


#### VOLUME SAR

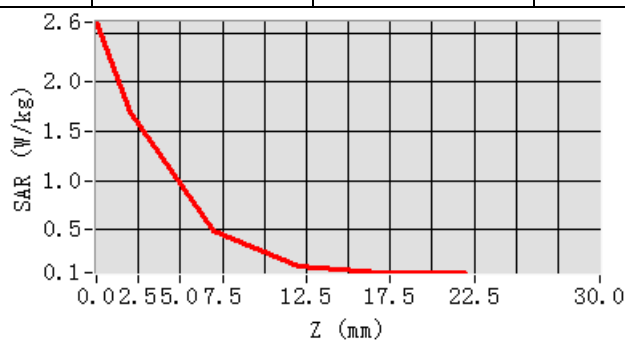


Maximum location: X=15.00, Y=21.00 SAR Peak: 0.93 W/kg

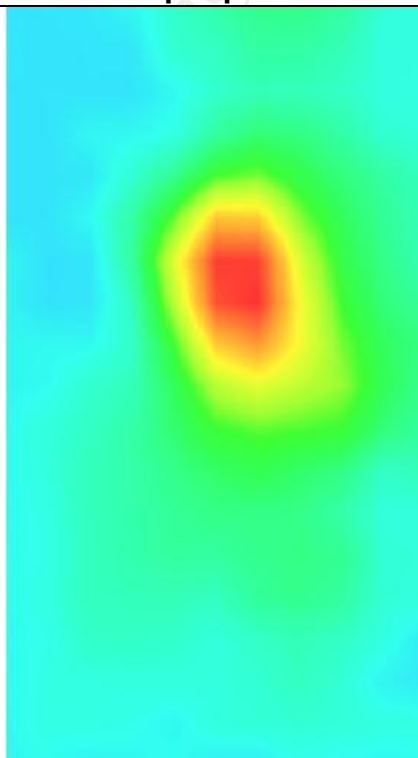
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.140821 |
| SAR 1g (W/Kg)  | 0.161250 |



| Z (mm)     | 0.00   | 2.00   | 7.00   | 12.00  | 17.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.9068 | 0.5742 | 0.1505 | 0.0398 | 0.0276 |



Hot spot position



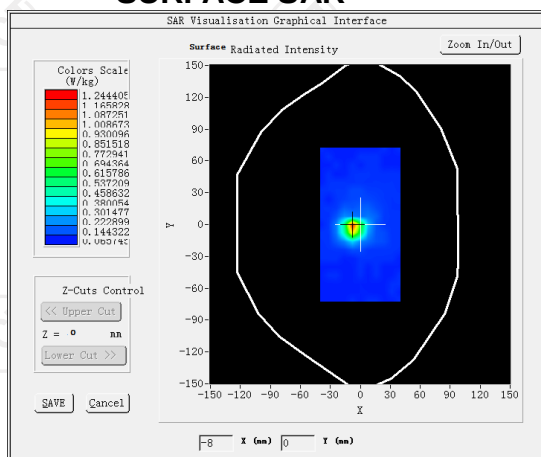
## MEASUREMENT 2

SAR (Channel 46):

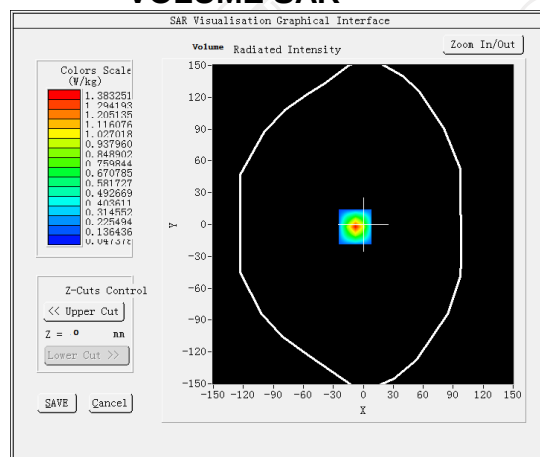
Date: 12/01/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 5230.000000                                                                               |
| Relative permittivity (real part)      | 35.068832                                                                                 |
| Relative permittivity (imaginary part) | 13.679428                                                                                 |
| Conductivity (S/m)                     | 5.220788                                                                                  |
| Variation (%)                          | 3.640000                                                                                  |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 2.01                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=10mm dy=10mm, h= 5.00 mm</u>                                                        |
| ZoomScan                               | <u>5x5x7,dx=4mm dy=4mm</u><br><u>dz=2mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body back(10mm)                                                                           |
| Band                                   | IEEE 802.11n HT40 ISM                                                                     |

### SURFACE SAR

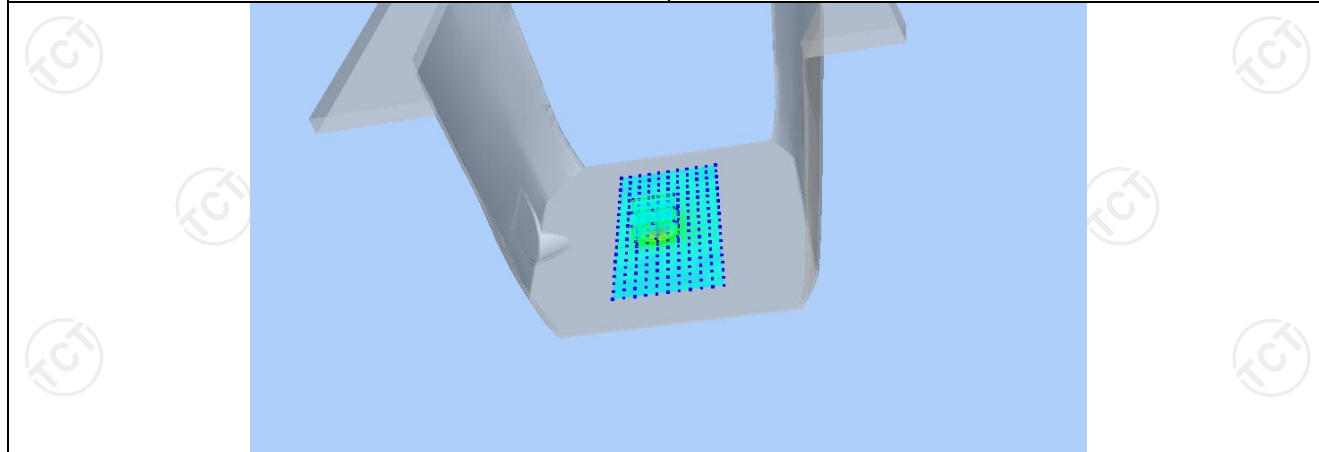


### VOLUME SAR

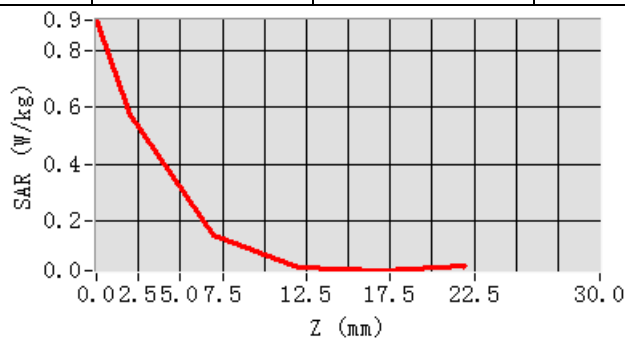


Maximum location: X=-8.00, Y=-2.00 SAR Peak: 2.20 W/kg

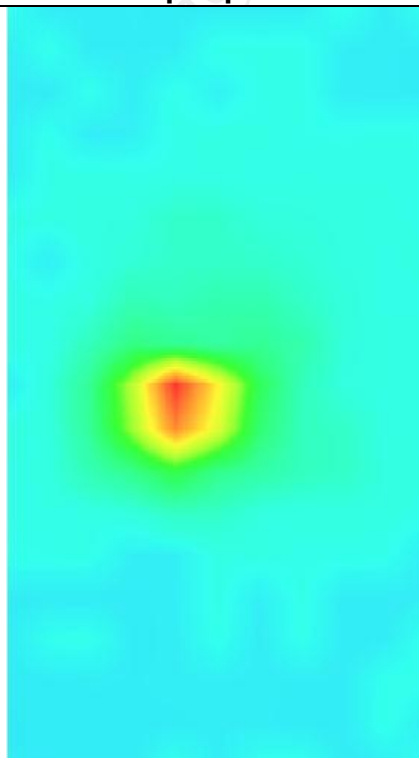
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.297653 |
| SAR 1g (W/Kg)  | 0.441245 |



| Z (mm)     | 0.00   | 2.00   | 7.00   | 12.00  | 17.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 2.2442 | 1.3830 | 0.3180 | 0.0671 | 0.0475 |



Hot spot position



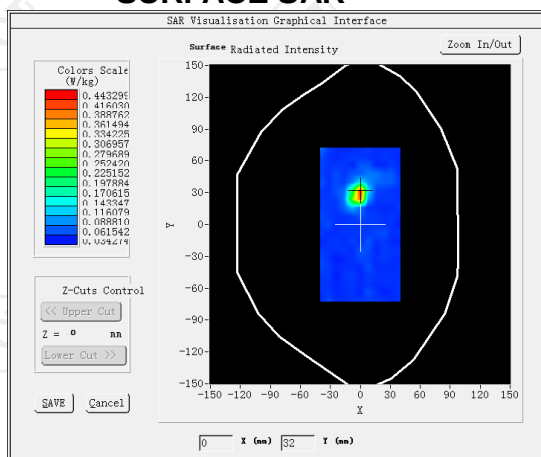
## MEASUREMENT 3

SAR (Channel 46):

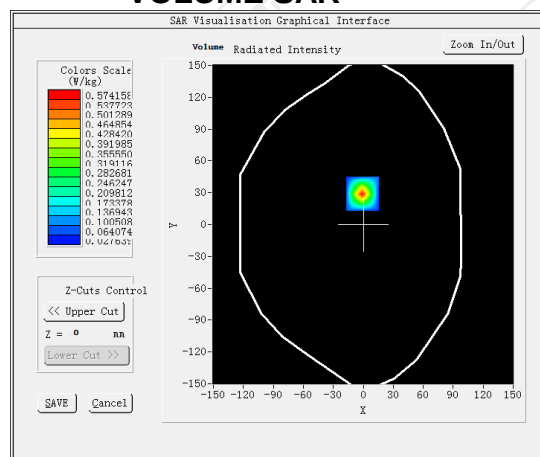
Date: 12/01/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 5230.000000                                                                               |
| Relative permittivity (real part)      | 35.068832                                                                                 |
| Relative permittivity (imaginary part) | 13.679428                                                                                 |
| Conductivity (S/m)                     | 5.220788                                                                                  |
| Variation (%)                          | 2.610000                                                                                  |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 2.01                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=10mm dy=10mm, h= 5.00 mm</u>                                                        |
| ZoomScan                               | <u>5x5x7,dx=4mm dy=4mm</u><br><u>dz=2mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body back(10mm)                                                                           |
| Band                                   | <u>IEEE 802.11n HT40 ISM(hotspot)</u>                                                     |

### SURFACE SAR

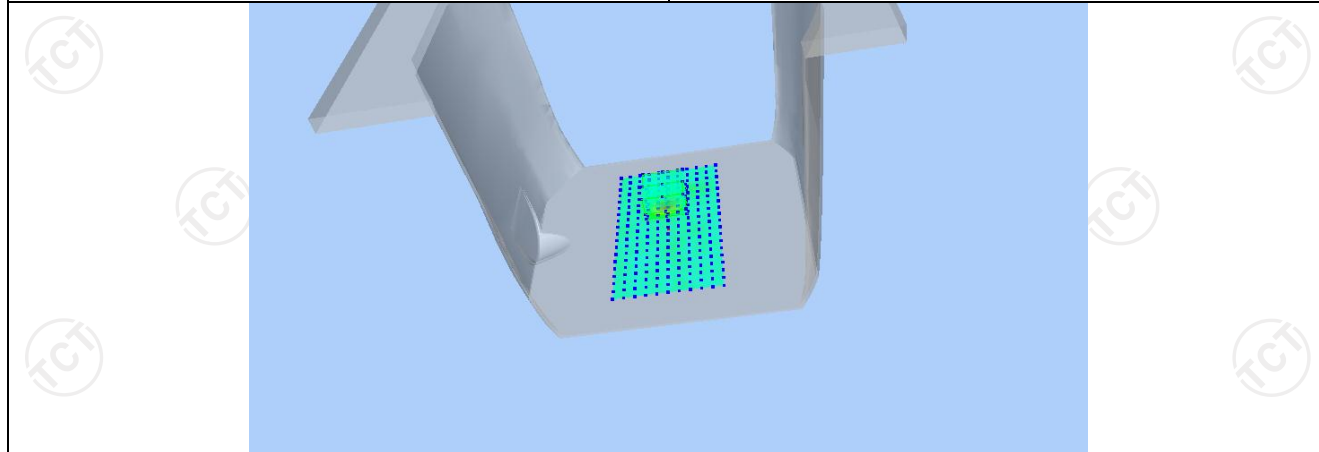


### VOLUME SAR

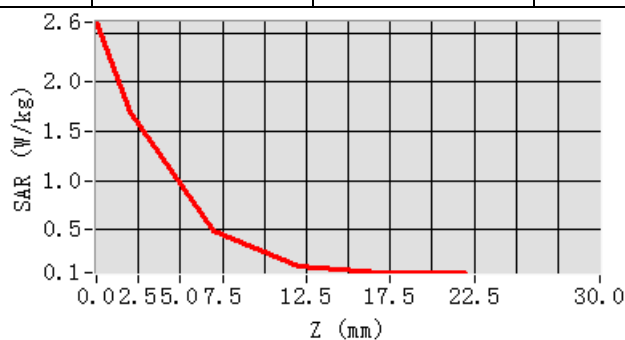


Maximum location: X=-1.00, Y=29.00 SAR Peak: 2.60 W/kg

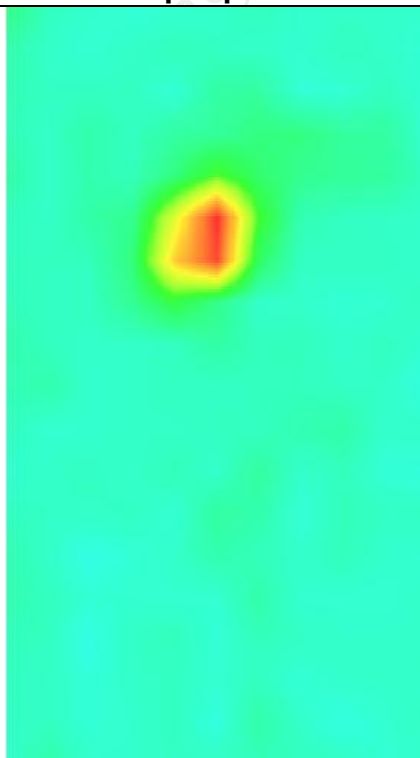
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.229168 |
| SAR 1g (W/Kg)  | 0.457520 |



| Z (mm)     | 0.00   | 2.00   | 7.00   | 12.00  | 17.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 2.6015 | 1.7021 | 0.4950 | 0.1380 | 0.0691 |



Hot spot position



## WLAN 5.3G

### MEASUREMENT 1

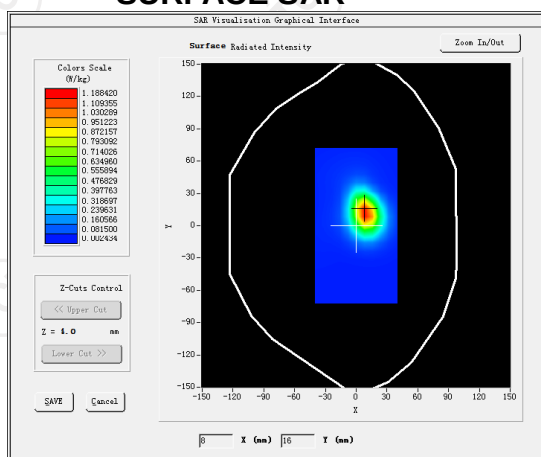
SAR (Channel 52):

Date: 12/05/2023

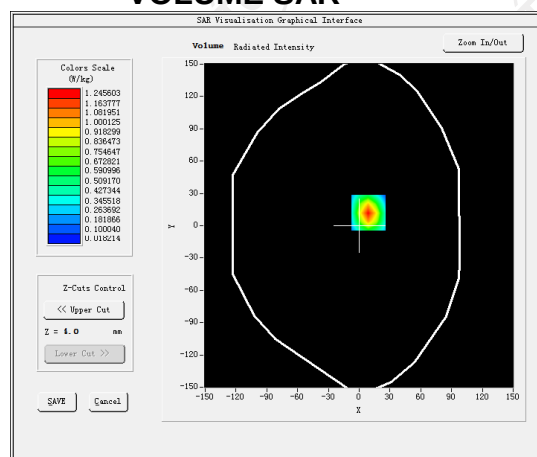
|                                        |                                                                                             |
|----------------------------------------|---------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 5290.000000                                                                                 |
| Relative permittivity (real part)      | 36.068832                                                                                   |
| Relative permittivity (imaginary part) | 13.680430                                                                                   |
| Conductivity (S/m)                     | 4.690788                                                                                    |
| Variation (%)                          | 2.490000                                                                                    |
| Crest Factor                           | 1.0                                                                                         |
| Probe Conversion factor                | 1.94                                                                                        |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                     |
| Area Scan                              | <u>dx=10mm dy=10mm, h= 5.00 mm</u>                                                          |
| ZoomScan                               | <u>5x5x7, dx=4mm dy=4mm</u><br><u>dz=2mm, Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |

|                 |                              |
|-----------------|------------------------------|
| Phantom         | Validation plane             |
| Device Position | Body front(10mm)             |
| Band            | <u>IEEE 802.11n HT20 ISM</u> |

#### SURFACE SAR

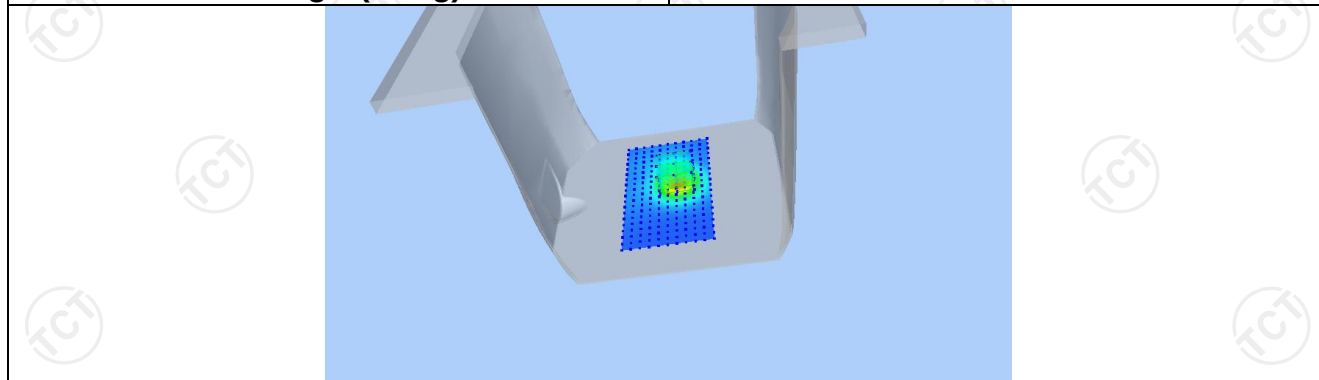


#### VOLUME SAR

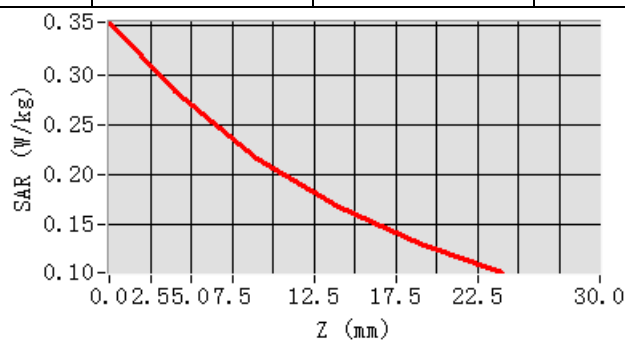


Maximum location: X=18.00, Y=35.00 SAR Peak: 0.36 W/kg

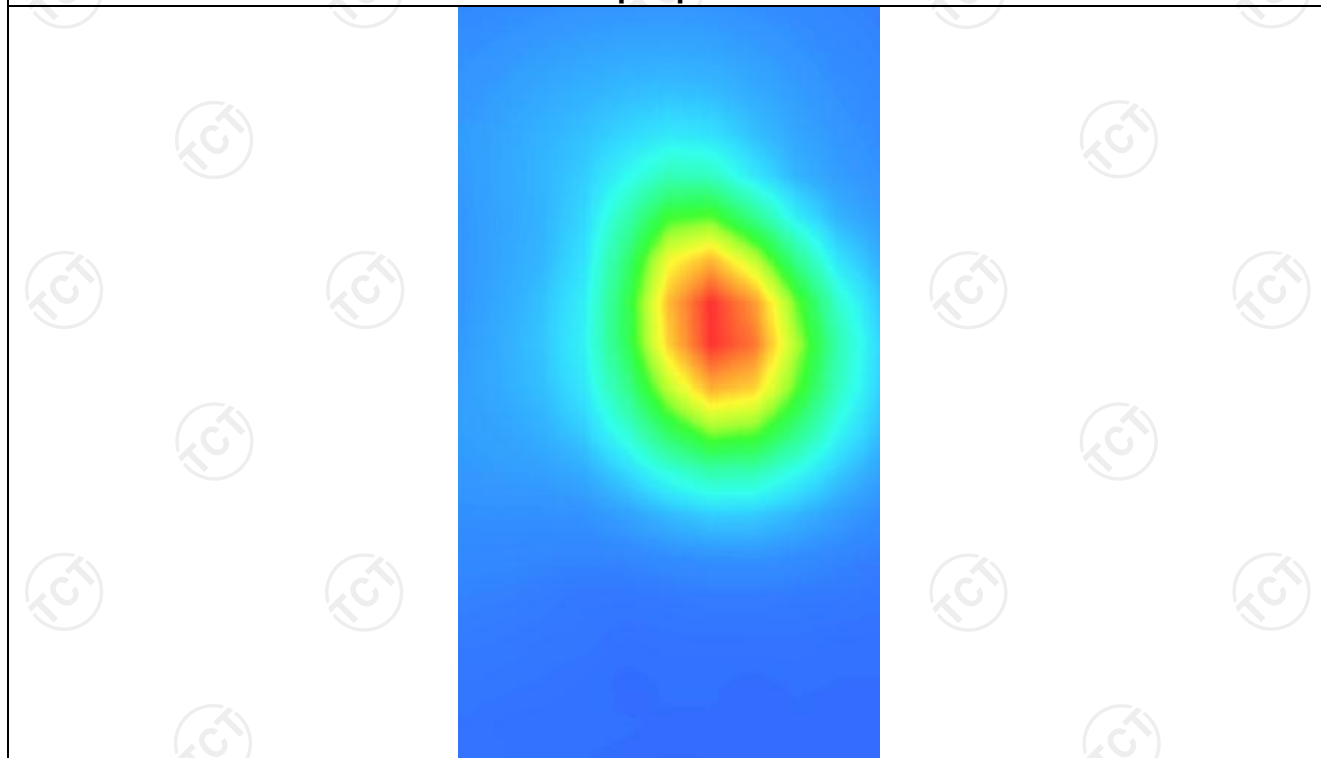
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.067955 |
| SAR 1g (W/Kg)  | 0.116047 |



| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.3521 | 0.2840 | 0.2161 | 0.1657 | 0.1324 |



Hot spot position



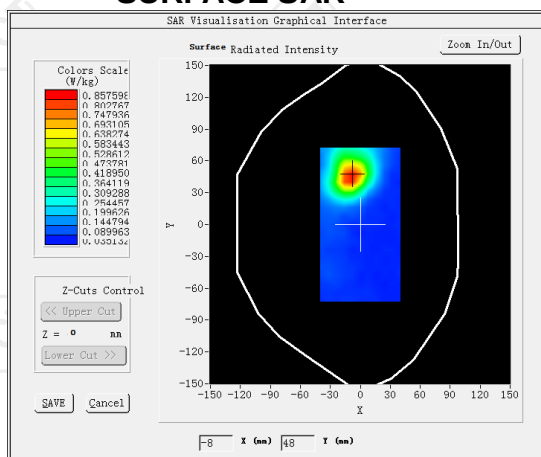
## MEASUREMENT 2

SAR (Channel 52):

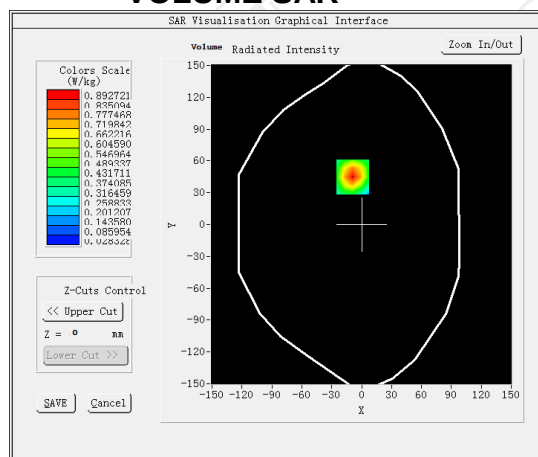
Date: 12/05/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 5290.000000                                                                               |
| Relative permittivity (real part)      | 36.068832                                                                                 |
| Relative permittivity (imaginary part) | 13.680430                                                                                 |
| Conductivity (S/m)                     | 4.690788                                                                                  |
| Variation (%)                          | 1.380000                                                                                  |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 1.94                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=10mm dy=10mm, h= 5.00 mm</u>                                                        |
| ZoomScan                               | <u>5x5x7,dx=4mm dy=4mm</u><br><u>dz=2mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | <u>Validation plane</u>                                                                   |
| Device Position                        | <u>Body back(10mm)</u>                                                                    |
| Band                                   | <u>IEEE 802.11n HT20 ISM</u>                                                              |

### SURFACE SAR

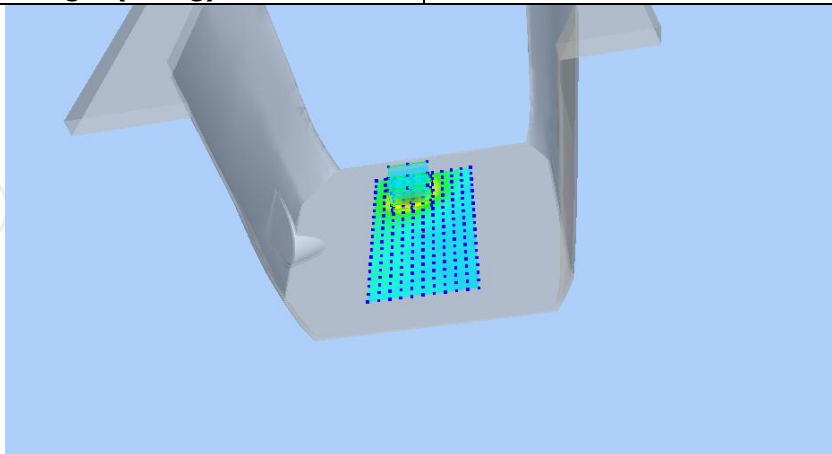


### VOLUME SAR

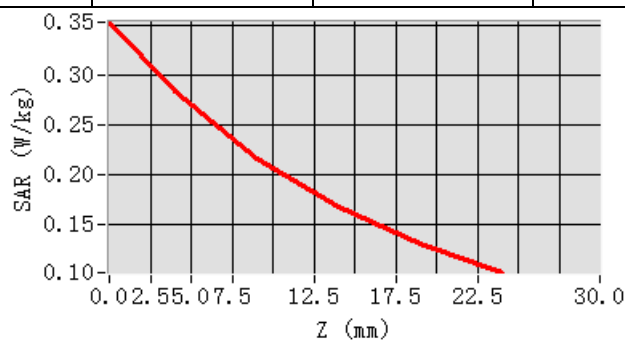


Maximum location: X=-9.00, Y=45.00 SAR Peak: 0.35 W/kg

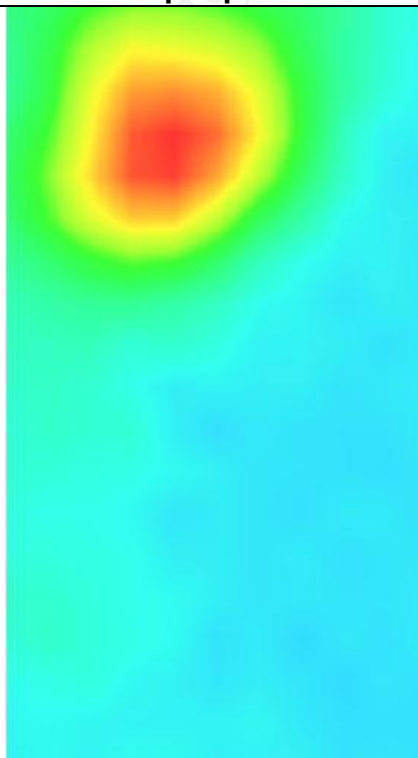
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.146515 |
| SAR 1g (W/Kg)  | 0.231682 |



| Z (mm)     | 0.00   | 2.00   | 7.00   | 12.00  | 17.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.3521 | 0.2840 | 0.2161 | 0.1657 | 0.1324 |



Hot spot position



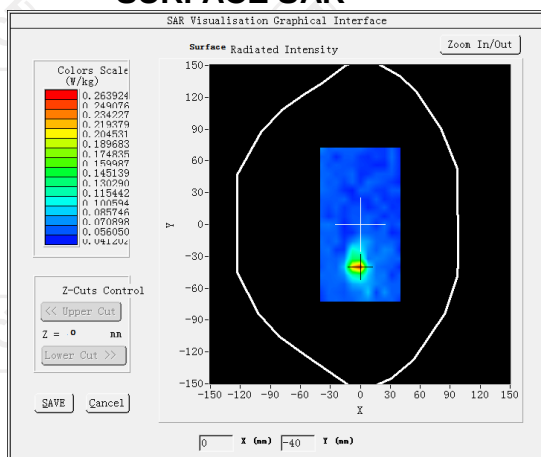
## MEASUREMENT 3

SAR (Channel 52):

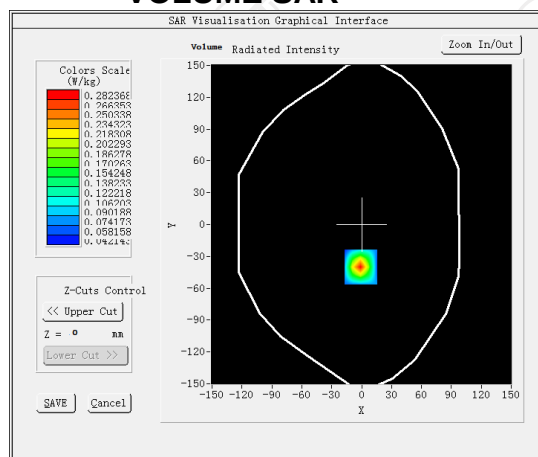
Date: 12/05/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 5290.000000                                                                               |
| Relative permittivity (real part)      | 36.068832                                                                                 |
| Relative permittivity (imaginary part) | 13.680430                                                                                 |
| Conductivity (S/m)                     | 4.690788                                                                                  |
| Variation (%)                          | 1.520000                                                                                  |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 1.94                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=10mm dy=10mm, h= 5.00 mm</u>                                                        |
| ZoomScan                               | <u>5x5x7,dx=4mm dy=4mm</u><br><u>dz=2mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | <u>Validation plane</u>                                                                   |
| Device Position                        | <u>Body back(10mm)</u>                                                                    |
| Band                                   | <u>IEEE 802.11n HT20 ISM(hotspot)</u>                                                     |

### SURFACE SAR

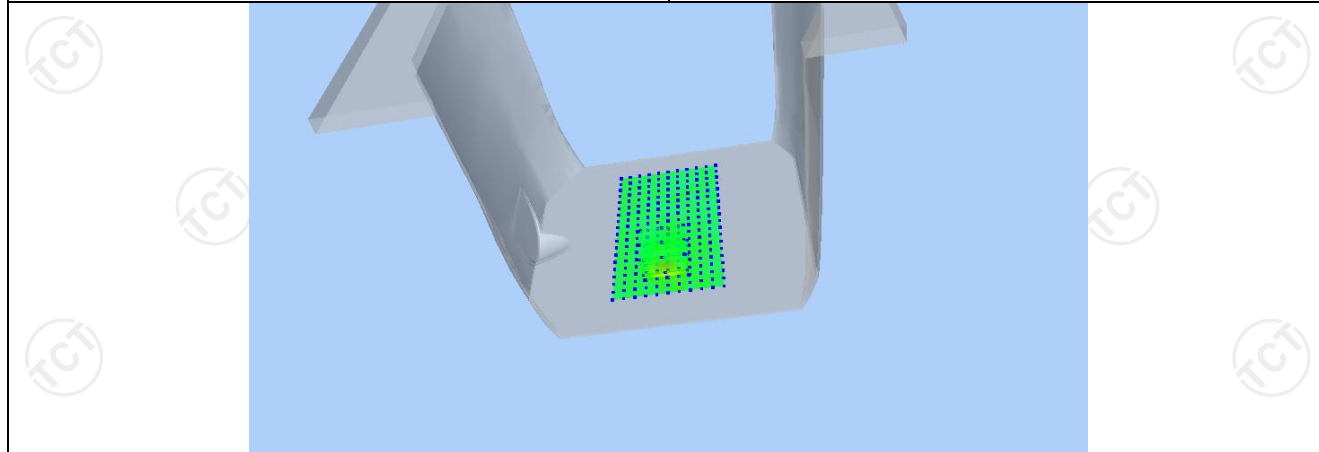


### VOLUME SAR

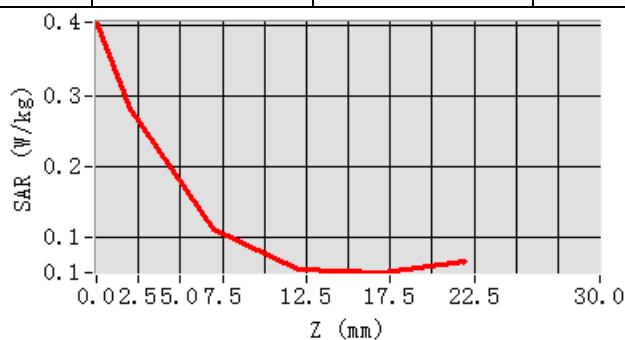


Maximum location: X=-1.00, Y=-40.00 SAR Peak: 0.41 W/kg

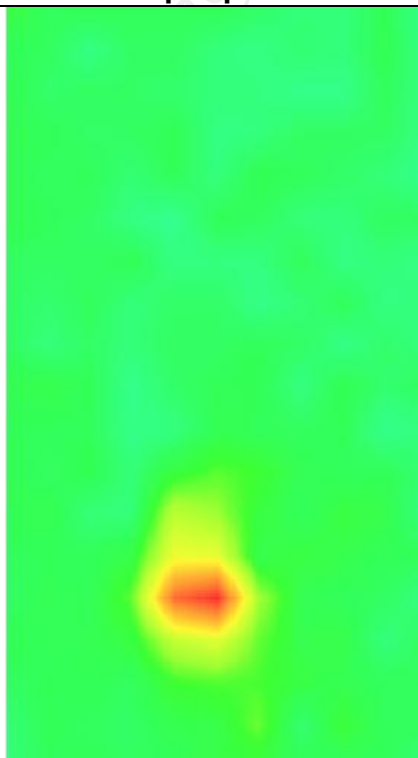
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.138038 |
| SAR 1g (W/Kg)  | 0.252432 |



| Z (mm)     | 0.00   | 2.00   | 7.00   | 12.00  | 17.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.4047 | 0.2824 | 0.1112 | 0.0558 | 0.0508 |



Hot spot position



## WLAN 5.8G

### MEASUREMENT 1

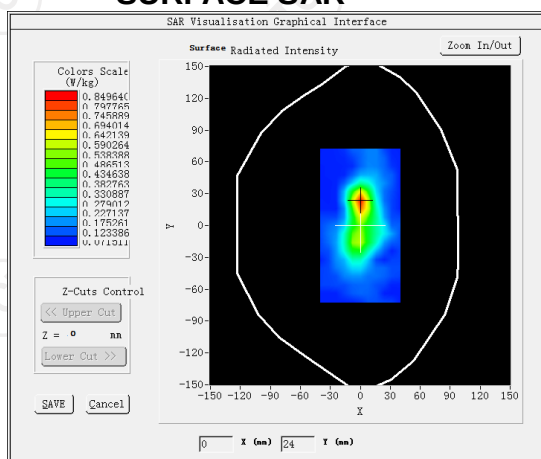
SAR (Channel 155):

Date: 12/08/2023

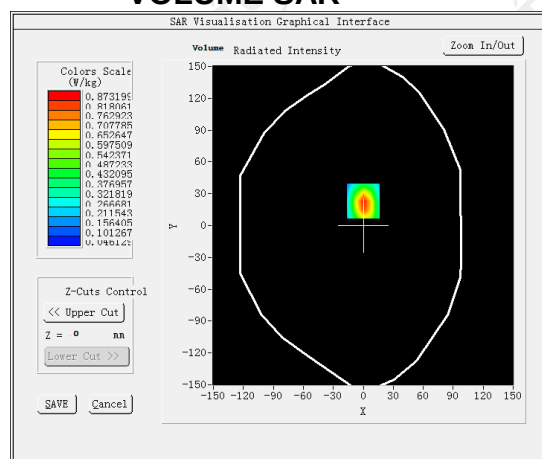
|                                        |                                                                                             |
|----------------------------------------|---------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 5775.000000                                                                                 |
| Relative permittivity (real part)      | 38.352823                                                                                   |
| Relative permittivity (imaginary part) | 13.671675                                                                                   |
| Conductivity (S/m)                     | 5.430828                                                                                    |
| Variation (%)                          | 2.420000                                                                                    |
| Crest Factor                           | 1.0                                                                                         |
| Probe Conversion factor                | 2.06                                                                                        |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                     |
| Area Scan                              | <u>dx=10mm dy=10mm, h= 5.00 mm</u>                                                          |
| ZoomScan                               | <u>5x5x7, dx=4mm dy=4mm</u><br><u>dz=2mm, Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |

|                 |                               |
|-----------------|-------------------------------|
| Phantom         | Validation plane              |
| Device Position | Body front(10mm)              |
| Band            | <u>IEEE 802.11ac HT80 ISM</u> |

#### SURFACE SAR

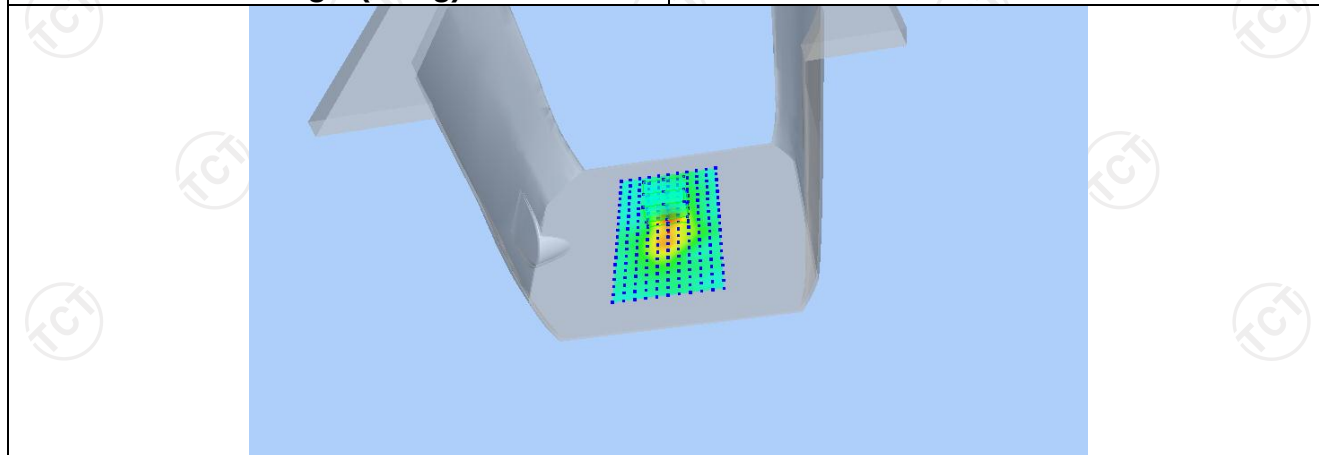


#### VOLUME SAR

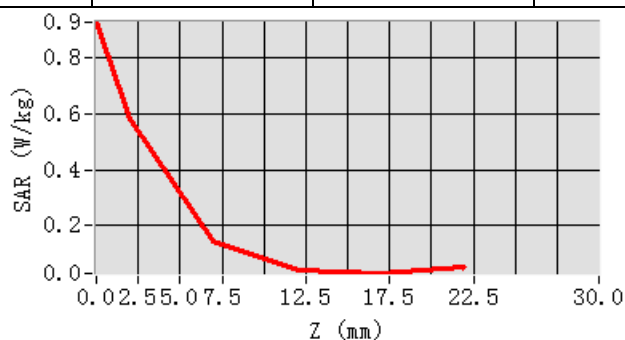


Maximum location: X=0.00, Y=23.00 SAR Peak: 0.97 W/kg

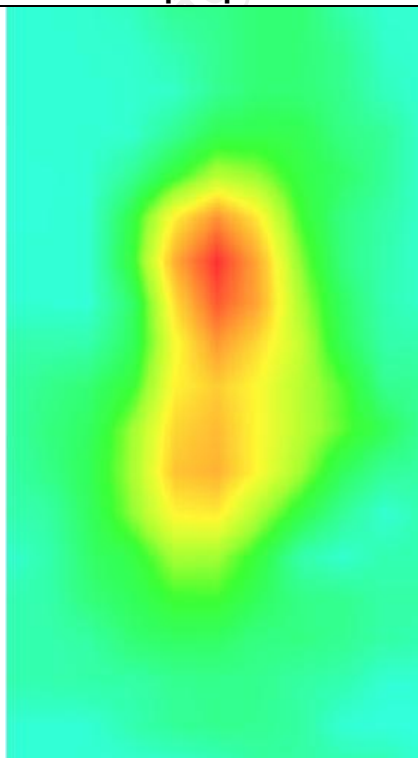
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.096070 |
| SAR 1g (W/Kg)  | 0.144200 |



| Z (mm)     | 0.00   | 2.00   | 7.00   | 12.00  | 17.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.9300 | 0.5823 | 0.1459 | 0.0373 | 0.0285 |



Hot spot position



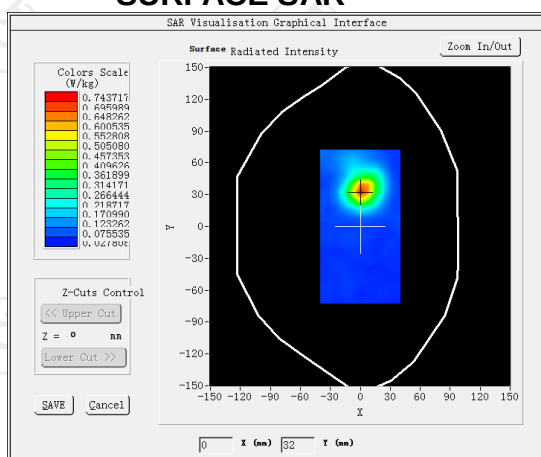
## MEASUREMENT 2

SAR (Channel 155):

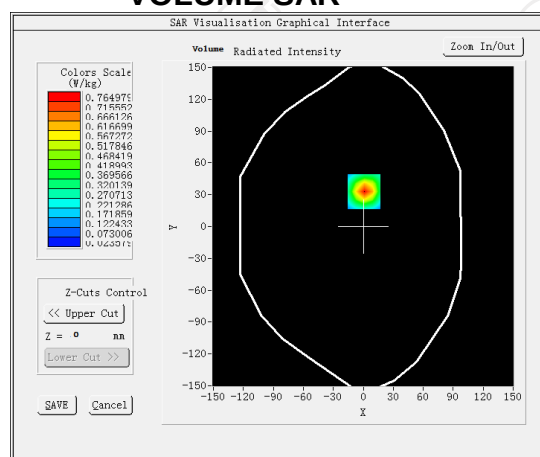
Date: 12/08/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 5775.000000                                                                               |
| Relative permittivity (real part)      | 38.352823                                                                                 |
| Relative permittivity (imaginary part) | 13.671675                                                                                 |
| Conductivity (S/m)                     | 5.430828                                                                                  |
| Variation (%)                          | 0.790000                                                                                  |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 2.06                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPGO3475)                                                                  |
| Area Scan                              | <u>dx=10mm dy=10mm, h= 5.00 mm</u>                                                        |
| ZoomScan                               | <u>5x5x7,dx=4mm dy=4mm</u><br><u>dz=2mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body back(10mm)                                                                           |
| Band                                   | IEEE 802.11ac HT80 ISM                                                                    |

### SURFACE SAR

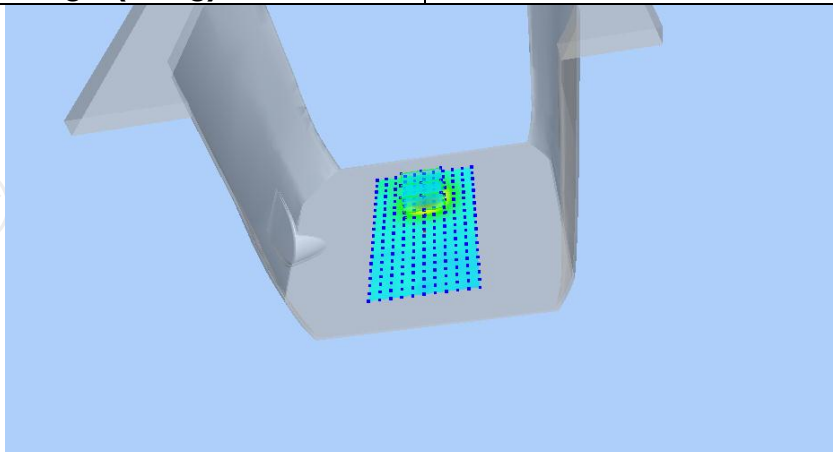


### VOLUME SAR

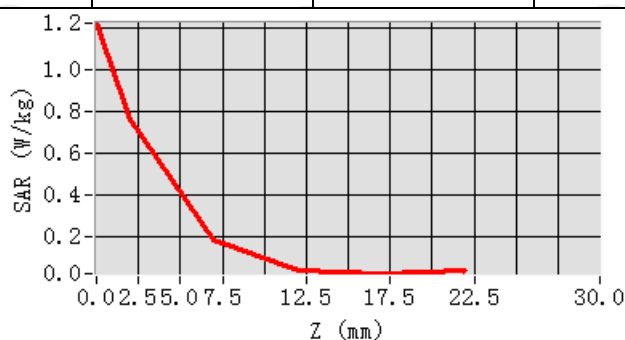


Maximum location: X=1.00, Y=33.00 SAR Peak: 1.26 W/kg

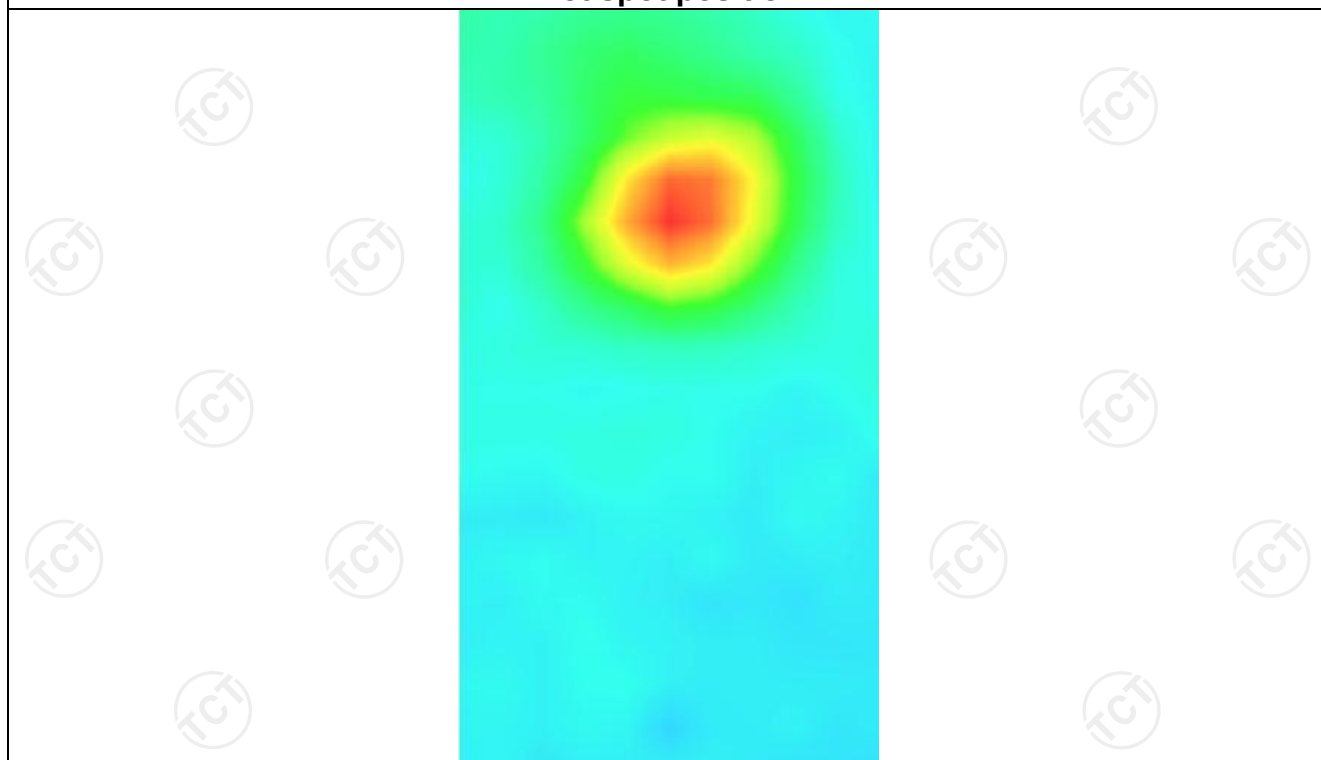
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.250904 |
| SAR 1g (W/Kg)  | 0.402019 |



| Z (mm)     | 0.00   | 2.00   | 7.00   | 12.00  | 17.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 1.2251 | 0.7650 | 0.1866 | 0.0408 | 0.0239 |



**Hot spot position**



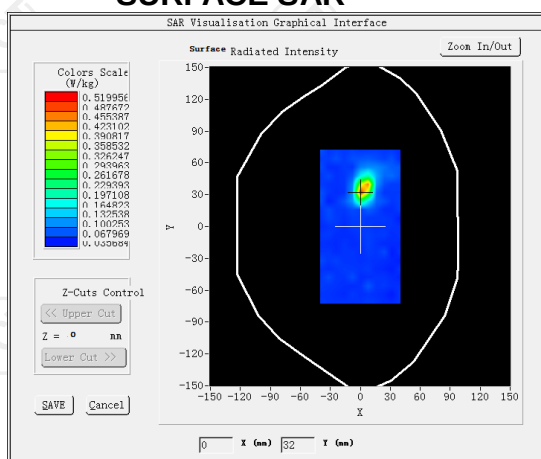
## MEASUREMENT 3

SAR (Channel 155):

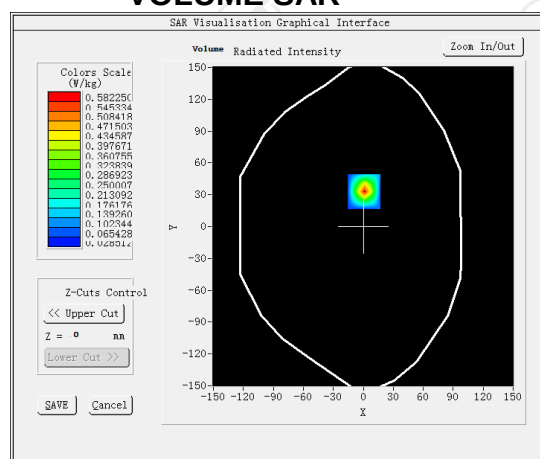
Date: 12/08/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 5775.000000                                                                               |
| Relative permittivity (real part)      | 38.352823                                                                                 |
| Relative permittivity (imaginary part) | 13.671675                                                                                 |
| Conductivity (S/m)                     | 5.430828                                                                                  |
| Variation (%)                          | 2.840000                                                                                  |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 2.06                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=10mm dy=10mm, h= 5.00 mm</u>                                                        |
| ZoomScan                               | <u>5x5x7,dx=4mm dy=4mm</u><br><u>dz=2mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body back(10mm)                                                                           |
| Band                                   | <u>IEEE 802.11ac HT80 ISM(hotspot)</u>                                                    |

### SURFACE SAR

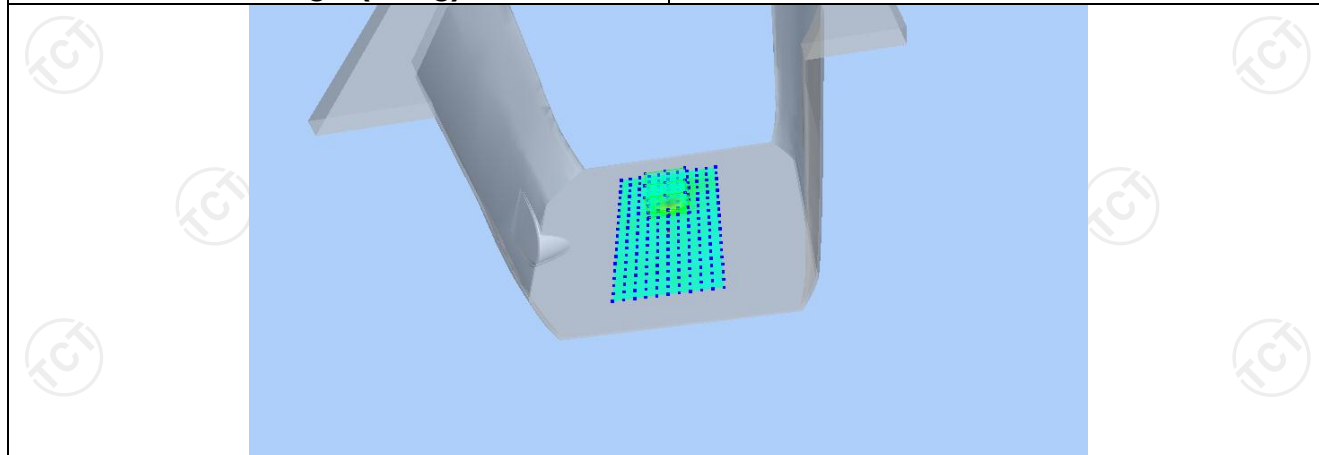


### VOLUME SAR

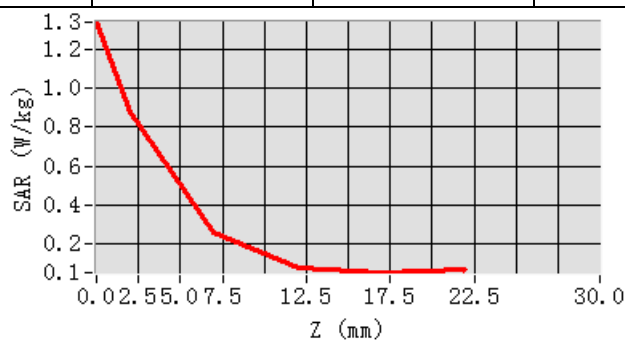


Maximum location: X=1.00, Y=33.00 SAR Peak: 1.30 W/kg

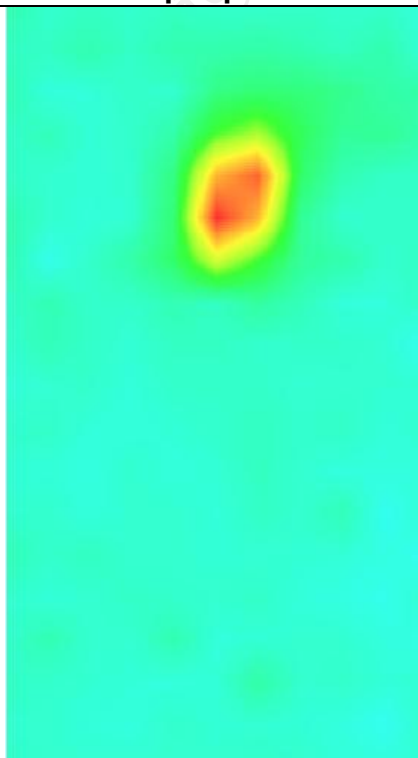
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.236442 |
| SAR 1g (W/Kg)  | 0.415897 |



| Z (mm)     | 0.00   | 2.00   | 7.00   | 12.00  | 17.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 1.3015 | 0.8730 | 0.2610 | 0.0821 | 0.0550 |



Hot spot position



BT

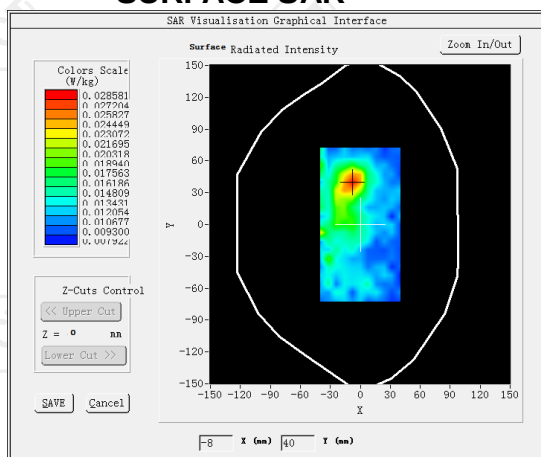
## MEASUREMENT 1

Low Band SAR (Channel 0):

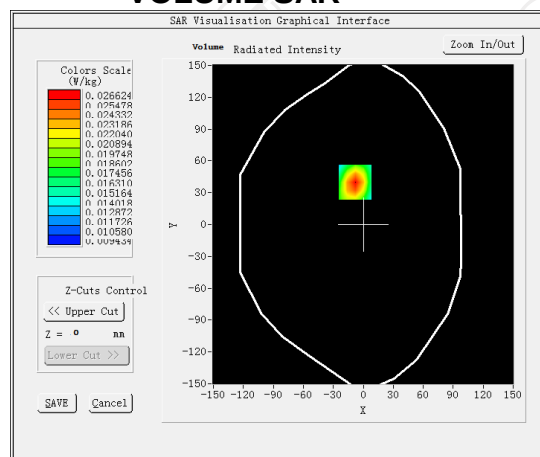
Date: 11/27/2023

|                                        |                                                                                           |
|----------------------------------------|-------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 2402.000000                                                                               |
| Relative permittivity (real part)      | 37.821613                                                                                 |
| Relative permittivity (imaginary part) | 13.546980                                                                                 |
| Conductivity (S/m)                     | 1.834111                                                                                  |
| Variation (%)                          | -0.240000                                                                                 |
| Crest Factor                           | 1.0                                                                                       |
| Probe Conversion factor                | 2.31                                                                                      |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                   |
| Area Scan                              | <u>dx=8mm dy=8mm, h= 5.00 mm</u>                                                          |
| ZoomScan                               | <u>5x5x7,dx=8mm dy=8mm</u><br><u>dz=5mm,Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                          |
| Device Position                        | Body front(10mm)                                                                          |
| Band                                   | <u>GFSK</u>                                                                               |

### SURFACE SAR

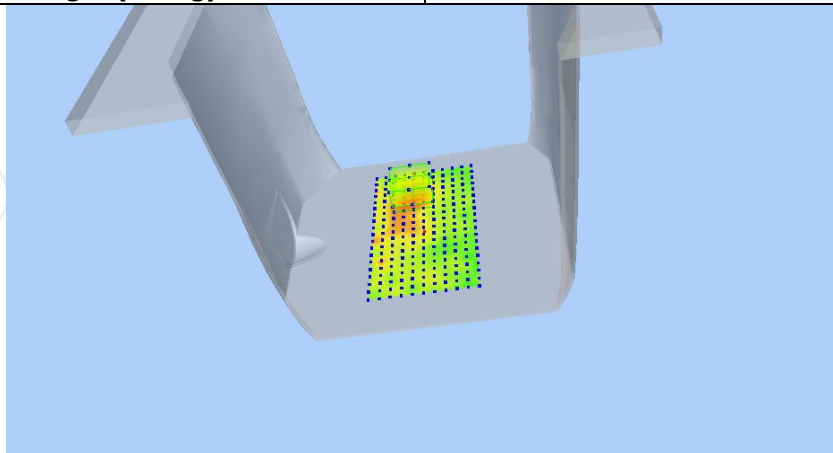


### VOLUME SAR

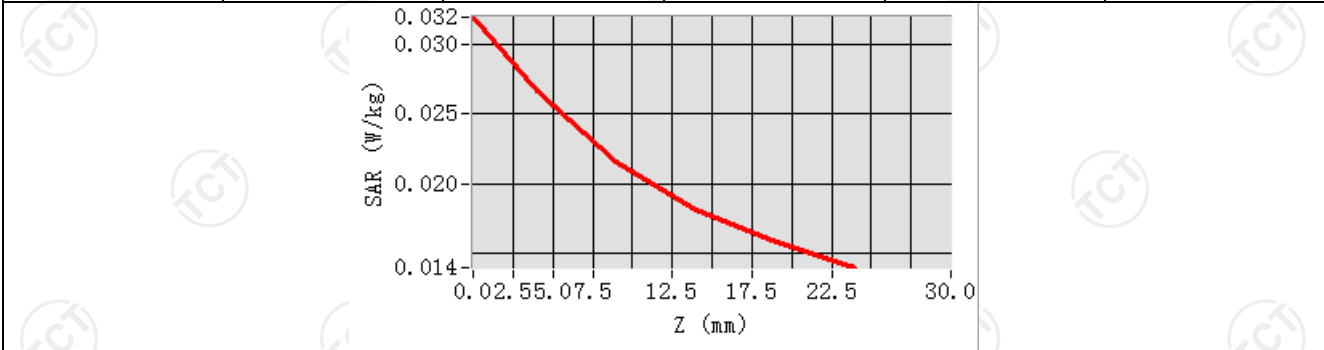


Maximum location: X=-8.00, Y=40.00 SAR Peak: 0.03 W/kg

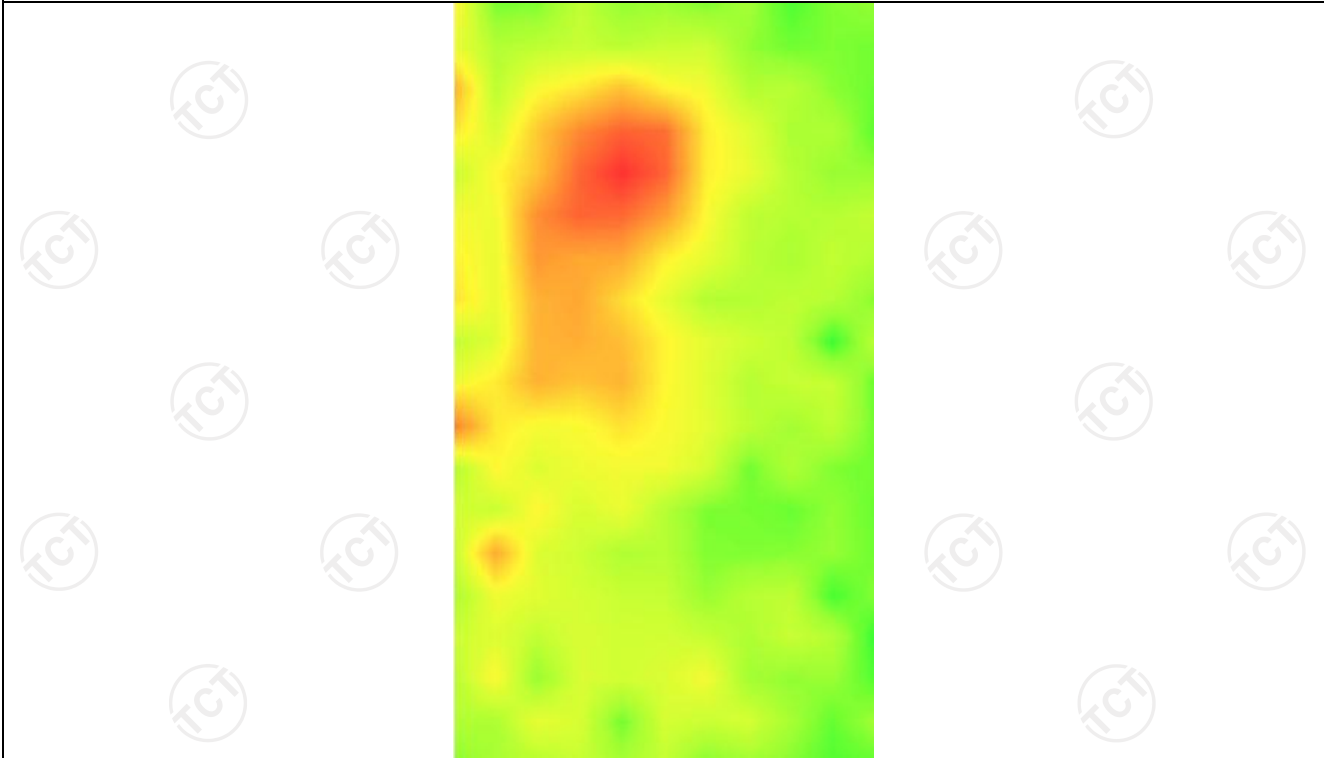
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.019369 |
| SAR 1g (W/Kg)  | 0.025577 |



|            |        |        |        |        |        |
|------------|--------|--------|--------|--------|--------|
| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
| SAR (W/Kg) | 0.0319 | 0.0266 | 0.0216 | 0.0182 | 0.0158 |



Hot spot position



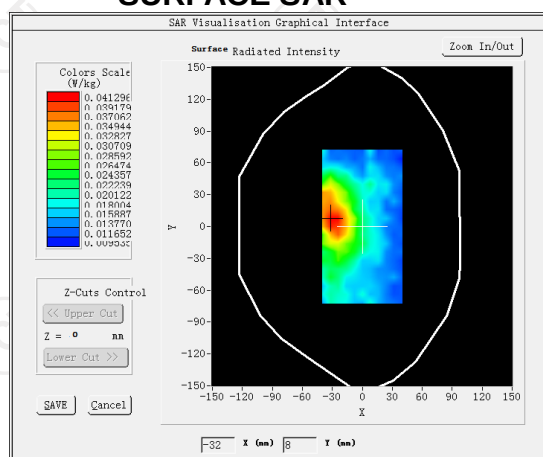
## MEASUREMENT 2

Low Band SAR (Channel 0):

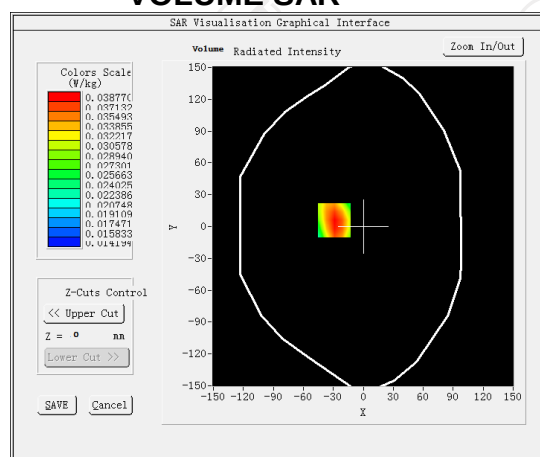
Date: 11/27/2023

|                                        |                                                                                             |
|----------------------------------------|---------------------------------------------------------------------------------------------|
| Frequency (MHz)                        | 2402.000000                                                                                 |
| Relative permittivity (real part)      | 37.821613                                                                                   |
| Relative permittivity (imaginary part) | 13.546980                                                                                   |
| Conductivity (S/m)                     | 1.834111                                                                                    |
| Variation (%)                          | 1.930000                                                                                    |
| Crest Factor                           | 1.0                                                                                         |
| Probe Conversion factor                | 2.31                                                                                        |
| E-Field Probe:                         | SSE2 (SN 25/22 EPG0375)                                                                     |
| Area Scan                              | <u>dx=8mm dy=8mm, h= 5.00 mm</u>                                                            |
| ZoomScan                               | <u>5x5x7, dx=8mm dy=8mm</u><br><u>dz=5mm, Complete/ndx=8mm dy=8mm, h=</u><br><u>5.00 mm</u> |
| Phantom                                | Validation plane                                                                            |
| Device Position                        | Body back(10mm)                                                                             |
| Band                                   | <u>GFSK</u>                                                                                 |

### SURFACE SAR

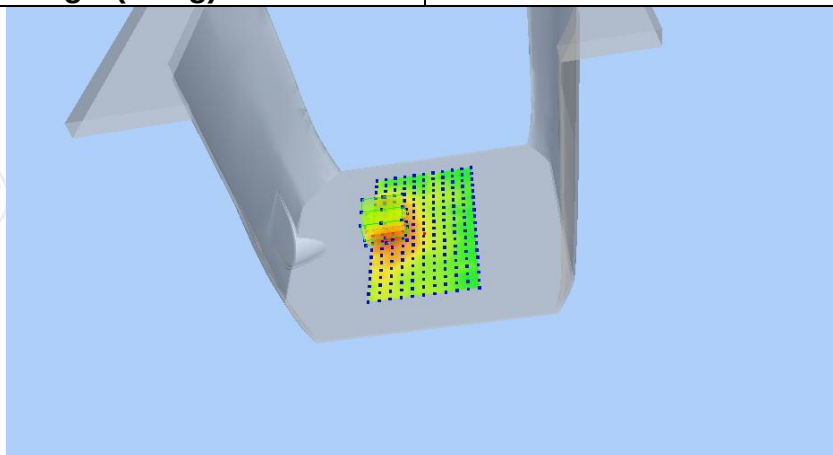


### VOLUME SAR

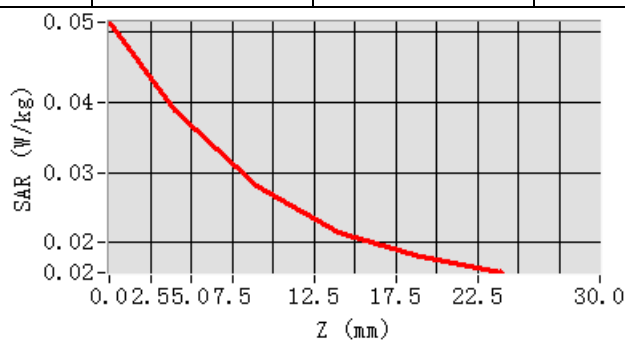


Maximum location: X=-29.00, Y=6.00 SAR Peak: 0.05 W/kg

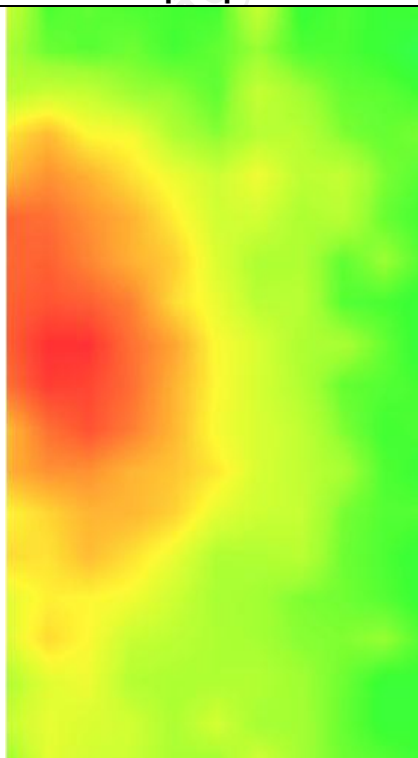
|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.028107 |
| SAR 1g (W/Kg)  | 0.037717 |



| Z (mm)     | 0.00   | 4.00   | 9.00   | 14.00  | 19.00  |
|------------|--------|--------|--------|--------|--------|
| SAR (W/Kg) | 0.0515 | 0.0388 | 0.0280 | 0.0215 | 0.0180 |



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)

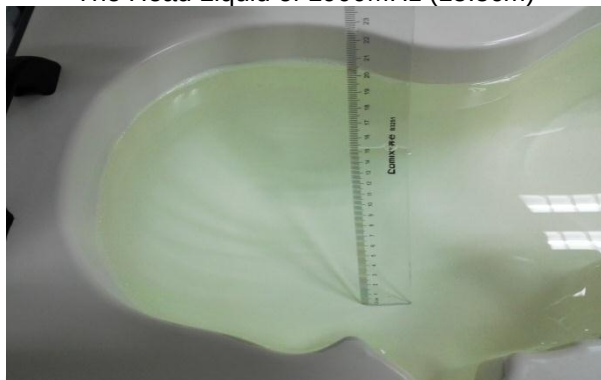
The Body Liquid of 5000-6000MHz (16.5cm)



The Head Liquid of 1900MHz (15.5cm)



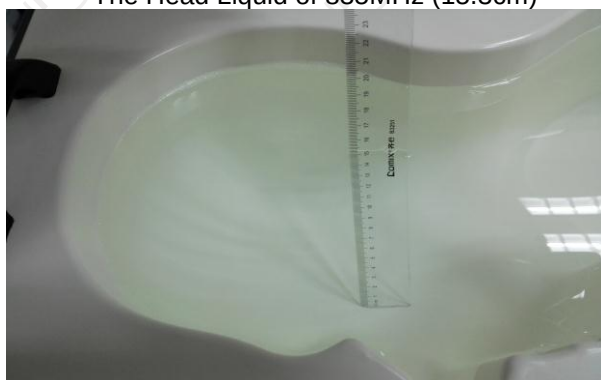
The Head Liquid of 2450MHz (15.6cm)



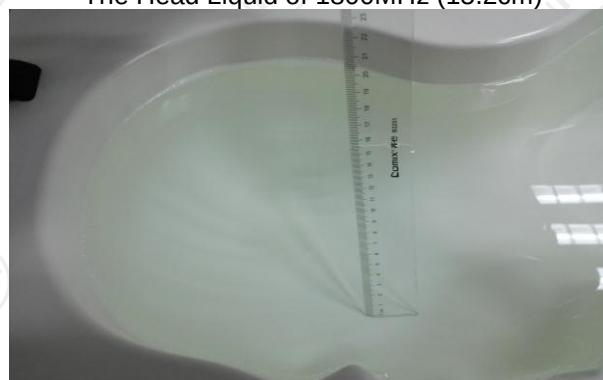
The Head Liquid of 835MHz (15.3cm)



The Head Liquid of 1800MHz (15.2cm)

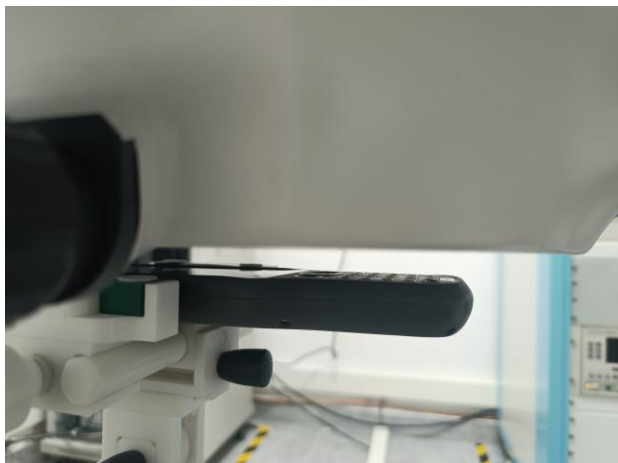


The Head Liquid of 2600MHz (15.1cm)



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

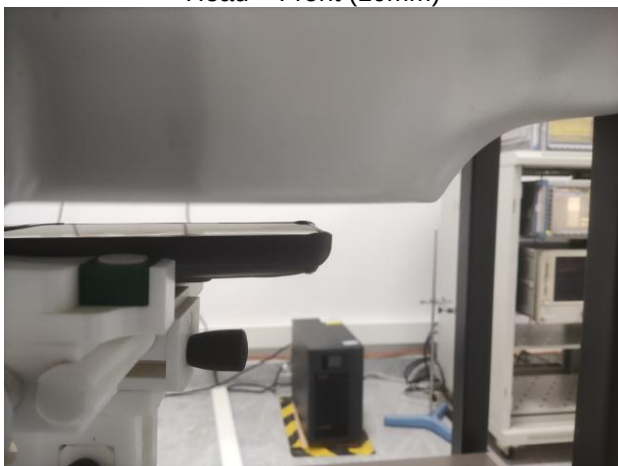
## Appendix B: Test Setup Photos



Head – Front (10mm)



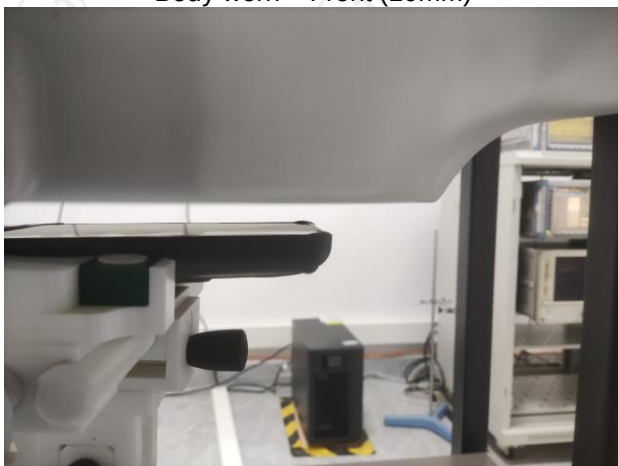
Head –Bottom (10mm)



Body worn – Front (10mm)



Body worn – Back (10mm)



Hotspo Front (10mm)



Hotspo 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.180.7.22.BES.B

#### SHENZHEN TONGCE TESTING LAB

2101 & 2201, ZHENCHANG FACTORY RENSHAN INDUSTRIAL  
ZONE, FUHAI SUBDISTRICT, BAO'AN DISTRICT SHENZHEN,  
GUANGDONG, 518103, PEOPLE'S REPUBLIC OF CHINA

#### MVG COMOSAR DOSIMETRIC E-FIELD PROBE

SERIAL NO.: SN 25/22 EPG0375

#### Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon  
29280 PLOUZANE - FRANCE

Calibration date: 06/29/2023



Accreditations #2-6789  
Scope available on [www.cofrac.fr](http://www.cofrac.fr)

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#### Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).



## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.7.22.BES.B

|                        | Name           | Function                | Date      | Signature |
|------------------------|----------------|-------------------------|-----------|-----------|
| Prepared by :          | Jérôme Le Gall | Measurement Responsible | 6/30/2023 |           |
| Checked & approved by: | Jérôme Luc     | Technical Manager       | 6/30/2023 |           |
| Authorized by:         | Yann Toutain   | Laboratory Director     | 7/05/2023 |           |

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

| Issue | Name           | Date      | Modifications   |
|-------|----------------|-----------|-----------------|
| A     | Jérôme Le Gall | 6/30/2023 | Initial release |
|       |                |           |                 |
|       |                |           |                 |



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.7.22.BES.B

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.7.22.BES.B

## 1 DEVICE UNDER TEST

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

## 2 PRODUCT DESCRIPTION

### 2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Probe

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

## 3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

### 3.1 LINEARITY

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

### 3.2 SENSITIVITY

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

Page: 4/11

Template\_ACR.DDD.N.YY.MVGB.ISSUE\_COMOSAR Probe vK

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### 3.3 LOWER DETECTION LIMIT

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

### 3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

### 3.1 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and  $d_{be} + d_{step}$  along lines that are approximately normal to the surface:

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

where

$SAR_{uncertainty}$  is the uncertainty in percent of the probe boundary effect

$d_{be}$  is the distance between the surface and the closest *zoom-scan* measurement point, in millimetre

$\Delta_{step}$  is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible

$\delta$  is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e.,  $\delta \approx 14$  mm at 3 GHz;

$\Delta SAR_{be}$  in percent of SAR is the deviation between the measured SAR value, at the distance  $d_{be}$  from the boundary, and the analytical SAR value.

The measured worst case boundary effect SAR uncertainty[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).



#### 4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

| Uncertainty analysis of the probe calibration in waveguide |                       |                          |         |    |                          |
|------------------------------------------------------------|-----------------------|--------------------------|---------|----|--------------------------|
| ERROR SOURCES                                              | Uncertainty value (%) | Probability Distribution | Divisor | ci | Standard Uncertainty (%) |
| Expanded uncertainty<br>95 % confidence level k = 2        |                       |                          |         |    | 14 %                     |

#### 5 CALIBRATION MEASUREMENT RESULTS

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

##### 5.1 SENSITIVITY IN AIR

|                                                           |                                                           |                                                           |
|-----------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|
| Normx dipole<br>1 ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) | Normy dipole<br>2 ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) | Normz dipole<br>3 ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) |
| 0.64                                                      | 0.53                                                      | 0.44                                                      |

|                      |                      |                      |
|----------------------|----------------------|----------------------|
| DCP dipole 1<br>(mV) | DCP dipole 2<br>(mV) | DCP dipole 3<br>(mV) |
| 106                  | 108                  | 109                  |

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

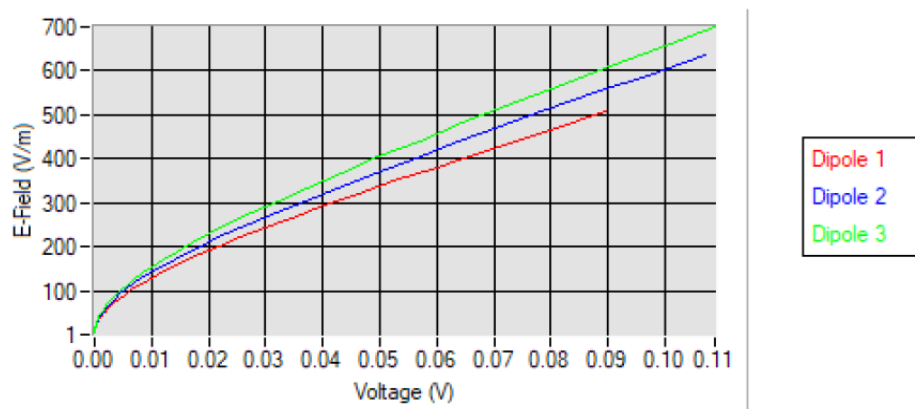
$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



## COMOSAR E-FIELD PROBE CALIBRATION REPORT

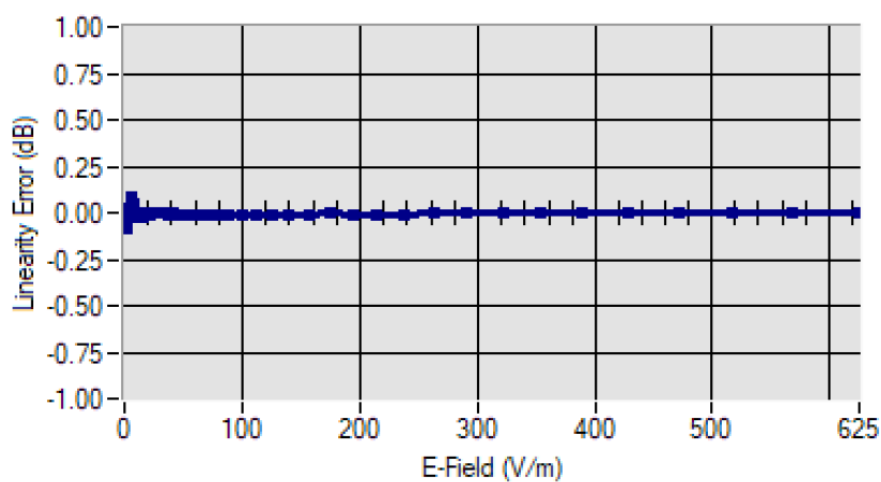
Ref: ACR.180.7.22.BES.B

### Calibration curves



### 5.2 LINEARITY

#### Linearity



Linearity:  $\pm 1.94\%$  ( $\pm 0.09\text{dB}$ )



### 5.3 SENSITIVITY IN LIQUID

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

LOWER DETECTION LIMIT: 7mW/kg

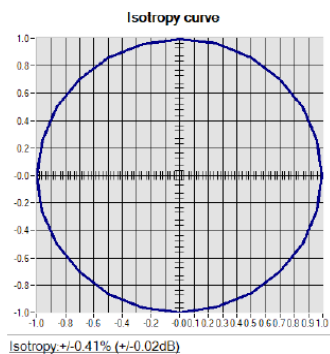


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.7.22.BES.B

5.4 ISOTROPY

HL1800 MHz





## 6 LIST OF EQUIPMENT

| Equipment Summary Sheet            |                      |                         |                                               |                                               |
|------------------------------------|----------------------|-------------------------|-----------------------------------------------|-----------------------------------------------|
| Equipment Description              | Manufacturer / Model | Identification No.      | Current Calibration Date                      | Next Calibration Date                         |
| CALIPROBE Test Bench               | Version 2            | NA                      | Validated. No cal required.                   | Validated. No cal required.                   |
| Network Analyzer                   | Rohde & Schwarz ZVM  | 100203                  | 08/2021                                       | 08/2024                                       |
| Network Analyzer                   | Agilent 8753ES       | MY40003210              | 10/2023                                       | 10/2026                                       |
| Network Analyzer – Calibration kit | HP 85033D            | 3423A08186              | 06/2021                                       | 06/2027                                       |
| Multimeter                         | Keithley 2000        | 1160271                 | 02/2023                                       | 02/2026                                       |
| Signal Generator                   | Rohde & Schwarz SMB  | 106589                  | 03/2022                                       | 03/2025                                       |
| Amplifier                          | MVG                  | MODU-023-C-0002         | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Power Meter                        | NI-USB 5680          | 170100013               | 06/2021                                       | 06/2024                                       |
| Power Meter                        | Rohde & Schwarz NRVD | 832839-056              | 11/2023                                       | 11/2026                                       |
| Directional Coupler                | Krytar 158020        | 131467                  | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Waveguide                          | MVG                  | SN 32/16 WG4_1          | Validated. No cal required.                   | Validated. No cal required.                   |
| Liquid transition                  | MVG                  | SN 32/16 WGLIQ_0G900_1  | Validated. No cal required.                   | Validated. No cal required.                   |
| Waveguide                          | MVG                  | SN 32/16 WG6_1          | Validated. No cal required.                   | Validated. No cal required.                   |
| Liquid transition                  | MVG                  | SN 32/16 WGLIQ_1G500_1  | Validated. No cal required.                   | Validated. No cal required.                   |
| Waveguide                          | MVG                  | SN 32/16 WG8_1          | Validated. No cal required.                   | Validated. No cal required.                   |
| Liquid transition                  | MVG                  | SN 32/16 WGLIQ_1G800B_1 | Validated. No cal required.                   | Validated. No cal required.                   |
| Liquid transition                  | MVG                  | SN 32/16 WGLIQ_1G800H_1 | Validated. No cal required.                   | Validated. No cal required.                   |
| Waveguide                          | MVG                  | SN 32/16 WG10_1         | Validated. No cal required.                   | Validated. No cal required.                   |
| Liquid transition                  | MVG                  | SN 32/16 WGLIQ_3G500_1  | Validated. No cal required.                   | Validated. No cal required.                   |
| Waveguide                          | MVG                  | SN 32/16 WG12_1         | Validated. No cal required.                   | Validated. No cal required.                   |

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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.7.22.BES.B

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



## Dielectric Probe Calibration Report

Ref : ACR.138.4.33.SATU.A

**SHENZHEN TONGCE TESTING LAB**  
**2101&2201, ZHENCHANG FACTORY, RENSHAN**  
**INDUSTRIAL ZONE, FUHAI SUBDISTRICT, BAOAN**  
**DISTRICT, SHENZHEN, GUANGDONG, 518103,**  
**PEOPLES REPUBLIC OF CHINA**  
**MVG COMOSAR DOSIMETRIC E-FIELD PROBE**

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

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



**Calibration Date: 06/05/2021**

### *Summary:*

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



## SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref: ACR.138.4.33..SATUA

|               | Name          | Function        | Date       | Signature            |
|---------------|---------------|-----------------|------------|----------------------|
| Prepared by : | Jérôme LUC    | Product Manager | 06/05/2021 | <i>JS</i>            |
| Checked by :  | Jérôme LUC    | Product Manager | 06/05/2021 | <i>JS</i>            |
| Approved by : | Kim RUTKOWSKI | Quality Manager | 06/05/2021 | <i>Kim Rutkowski</i> |

|                | Customer Name                  |
|----------------|--------------------------------|
| Distribution : | SHENZHEN TONGCE<br>TESTING LAB |

| Issue | Date       | Modifications   |
|-------|------------|-----------------|
| A     | 06/05/2021 | Initial release |
|       |            |                 |
|       |            |                 |
|       |            |                 |



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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**

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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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## SAR DIELECTRIC PROBE CALIBRATION REPORT

Ref: ACR.138.4.33..SATU.A

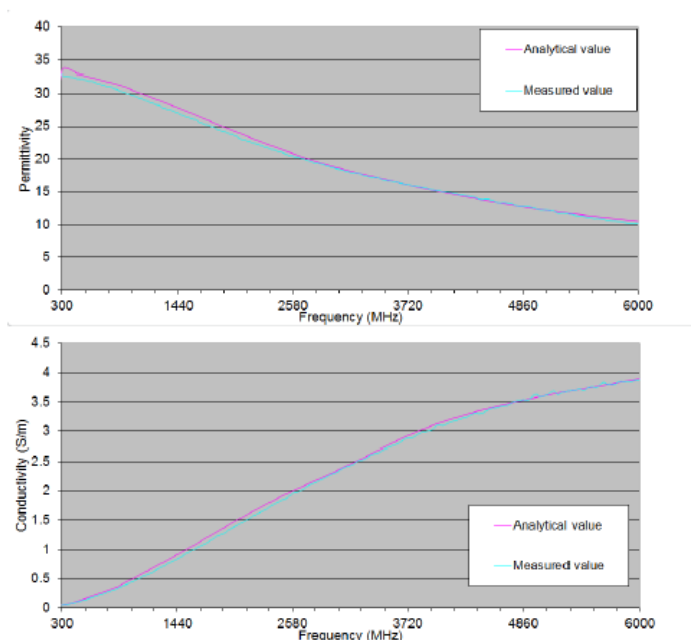
### 6 CALIBRATION MEASUREMENT RESULTS

#### 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.



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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           | 02/2021                     | 02/2024                     |
| Methanol CAS 67-56-1            | Alpha Aesar          | Lot D13W011        | Validated. No cal required. | Validated. No cal required. |
| Temperature and Humidity Sensor | Control Company      | 11-661-9           | 09/2023                     | 09/2024                     |

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## Appendix D: Dipole Calibration Report

SID 750



### SAR Reference Dipole Calibration Report

Ref : ACR.156.3.15.SATU.A

**SHENZHEN TONGCE TESTING LAB**  
2101&2201, ZHENCHANG FACTORY, RENSHAN  
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DISTRICT, SHENZHEN, GUANGDONG, 518103,  
PEOPLES REPUBLIC OF CHINA

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

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



**Calibration Date: 06/05/2021**

#### *Summary:*

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



## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.3.15.SATU.A

|                      | <i>Name</i>   | <i>Function</i> | <i>Date</i> | <i>Signature</i>     |
|----------------------|---------------|-----------------|-------------|----------------------|
| <i>Prepared by :</i> | Jérôme LUC    | Product Manager | 06/05/2021  | <i>JS</i>            |
| <i>Checked by :</i>  | Jérôme LUC    | Product Manager | 06/05/2021  | <i>JS</i>            |
| <i>Approved by :</i> | Kim RUTKOWSKI | Quality Manager | 06/05/2021  | <i>Kim Rutkowski</i> |

|                       | <i>Customer Name</i>          |
|-----------------------|-------------------------------|
| <i>Distribution :</i> | SHENZHEN TONGC<br>TESTING LAB |

| <i>Issue</i> | <i>Date</i> | <i>Modifications</i> |
|--------------|-------------|----------------------|
| A            | 06/05/2021  | Initial release      |
|              |             |                      |
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.156.3.15.SATU.A

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