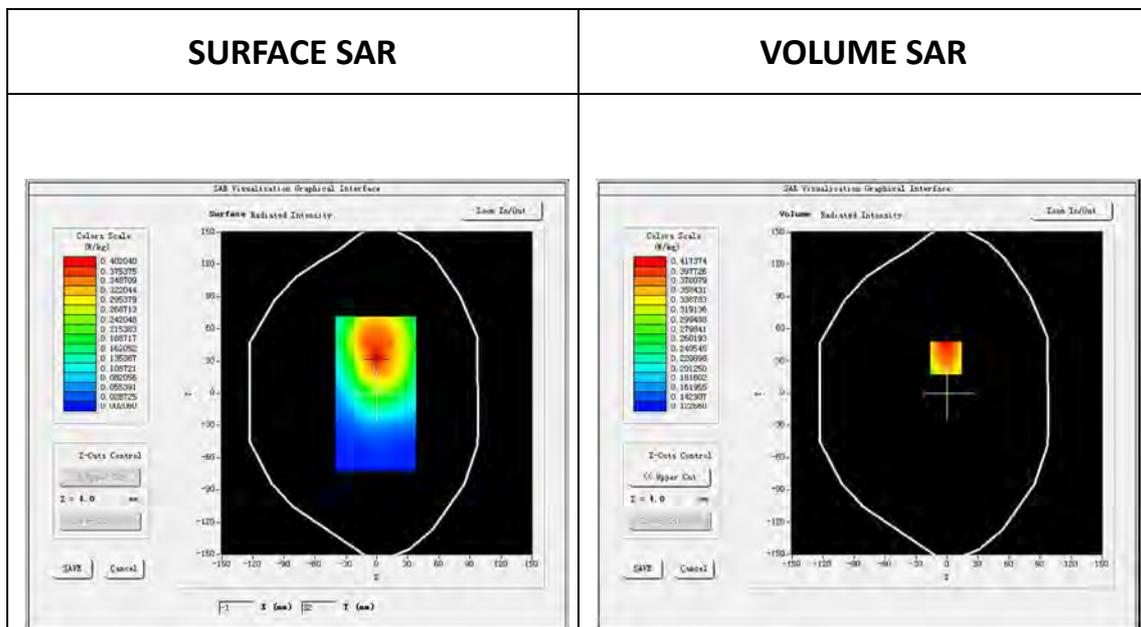


B.SAR Measurement Results

Middle Band SAR (Channel 190):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	836.6
Relative permittivity (real part)	55.184227
Relative permittivity (imaginary)	21.109612
Conductivity (S/m)	0.980893
Variation (%)	4.060000
ConvF:	7.07

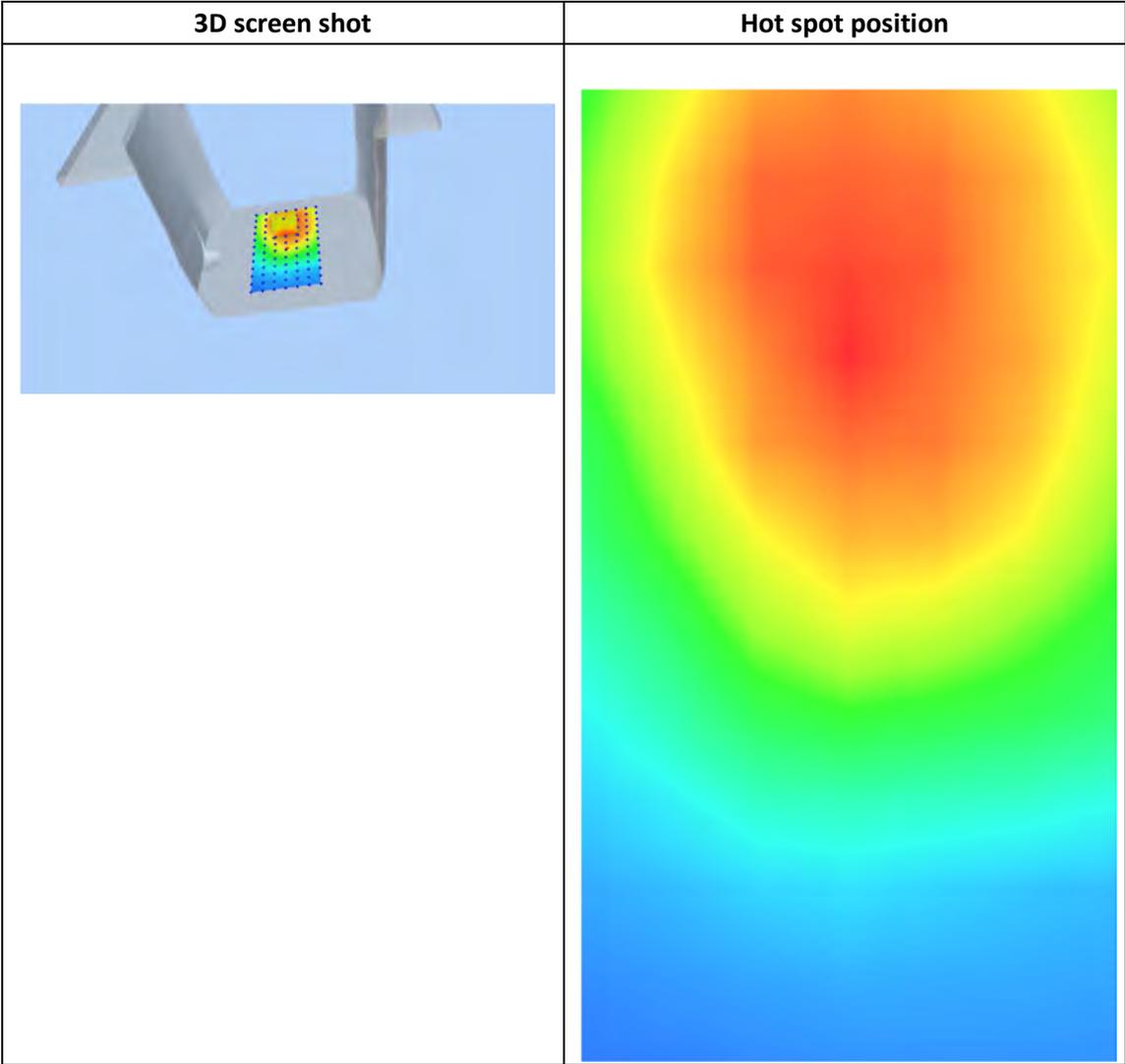
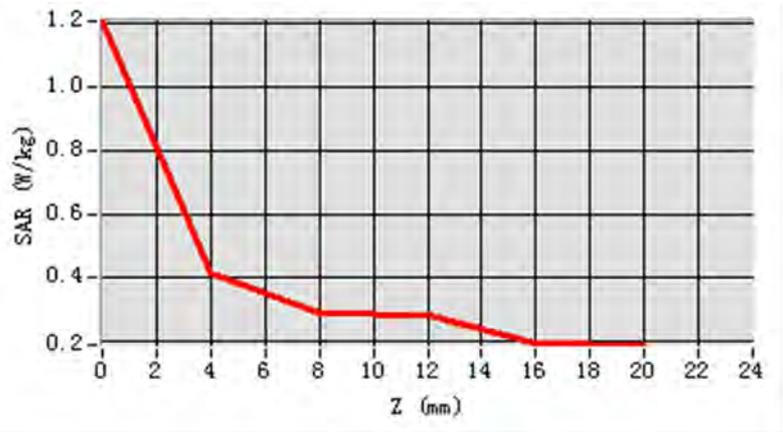


Maximum location: X=-1.00, Y=33.00

SAR Peak: 0.51 W/kg

SAR 10g (W/Kg)	0.287103
SAR 1g (W/Kg)	0.394612

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	1.2085	0.4174	0.2894	0.2803	0.1950



Plot No	Band	Mode	Test Position	Channel	Battery
3	G850	GPRS10	Back upward	190	1

Type: Phone measurement

Date of measurement: 19/9/2016

Measurement duration: 20 minutes 9 seconds

Mobile Phone IMEI number: --

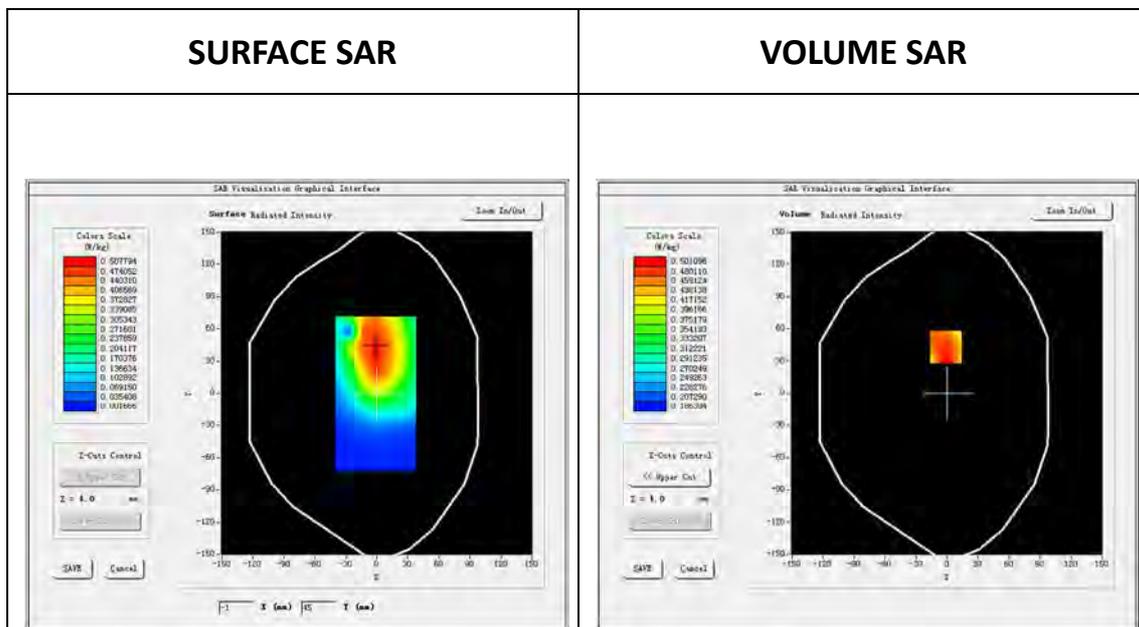
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=8mm dy=8mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>CUSTOM (GPRS850-2Tx)</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>Duty Cycle: 4 (Crest factor: 4)</u>

B.SAR Measurement Results

Middle Band SAR (Channel 190):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	836.6
Relative permittivity (real part)	55.184227
Relative permittivity (imaginary)	21.109612
Conductivity (S/m)	0.980893
Variation (%)	-2.230000
ConvF:	7.07

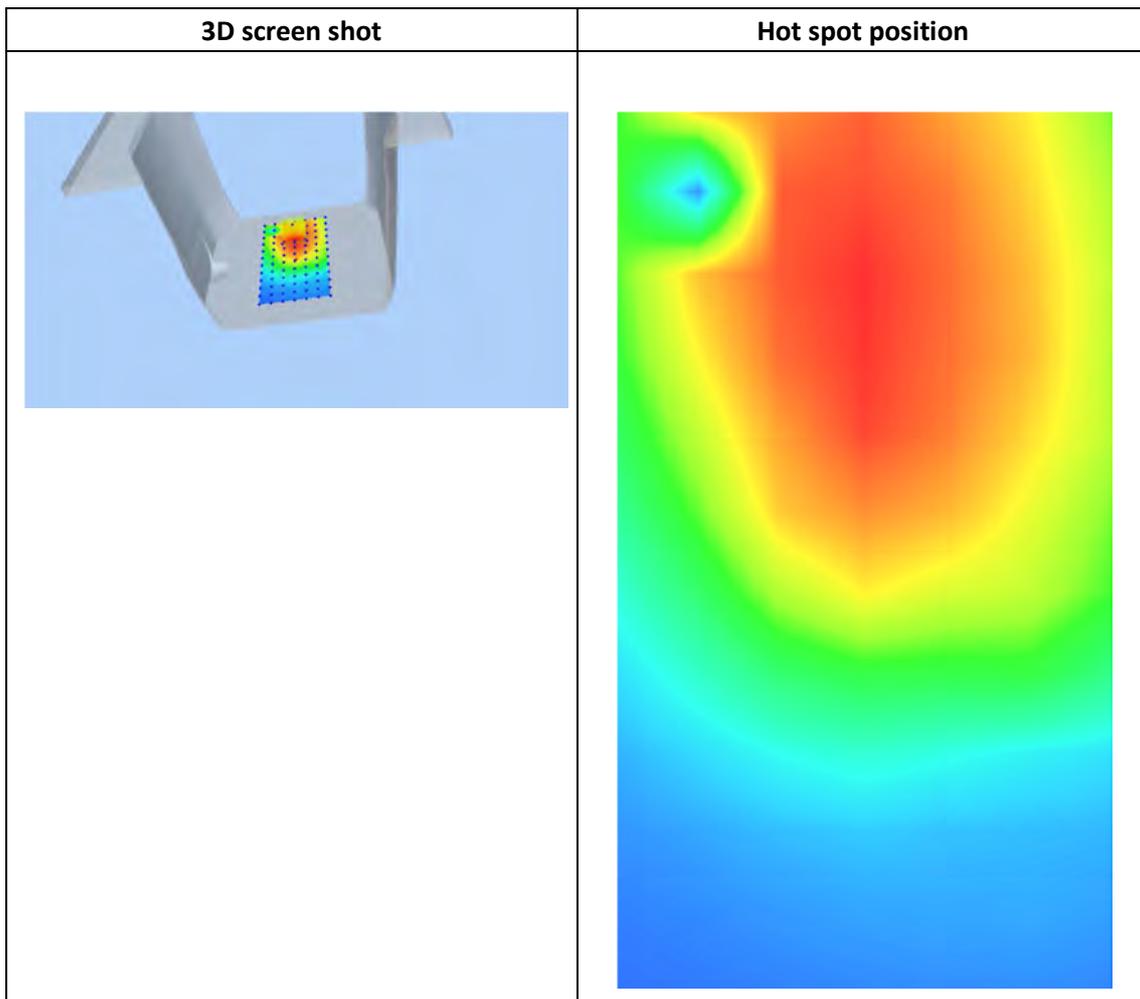
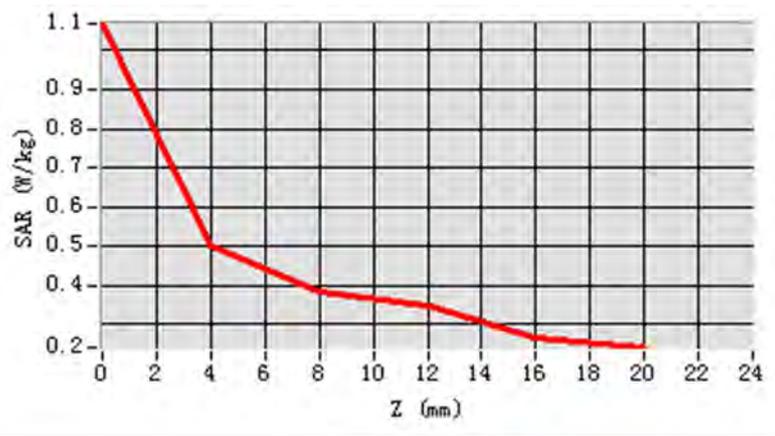


Maximum location: X=-1.00, Y=43.00

SAR Peak: 0.60 W/kg

SAR 10g (W/Kg)	0.371240
SAR 1g (W/Kg)	0.480445

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	1.0686	0.5011	0.3826	0.3482	0.2666



Plot No	Band	Mode	Test Position	Channel	Battery
4	G1900	GSM	Left Cheek	661	1

Type: Phone measurement

Date of measurement: 28/9/2016

Measurement duration: 20 minutes 34 seconds

Mobile Phone IMEI number: --

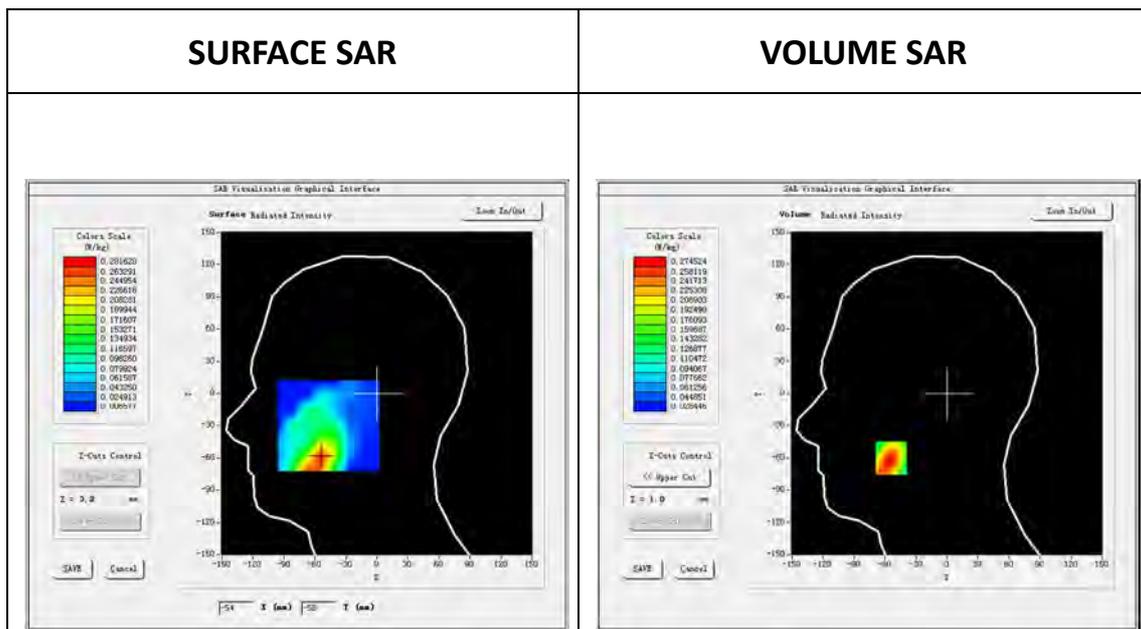
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=8mm dy=8mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>GSM1900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 8.3)</u>

B. SAR Measurement Results

Middle Band SAR (Channel 661):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	1880.0
Relative permittivity (real part)	40.701401
Relative permittivity (imaginary)	13.253600
Conductivity (S/m)	1.384265
Variation (%)	-2.120000
ConvF:	6.05

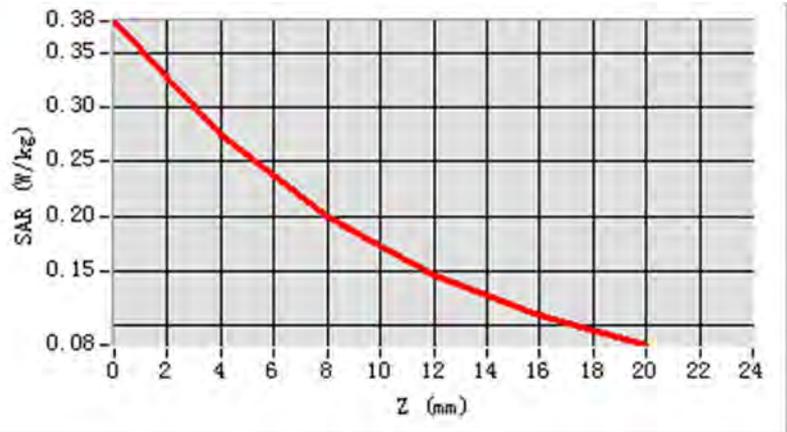


Maximum location: X=-54.00, Y=-60.00

SAR Peak: 0.38 W/kg

SAR 10g (W/Kg)	0.163098
SAR 1g (W/Kg)	0.258388

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.3788	0.2745	0.1992	0.1465	0.1098



3D screen shot	Hot spot position
<p>A 3D model of a human head and neck, rendered in a light blue color. A small, localized area on the side of the head is highlighted with a multi-colored grid of dots, representing the hot spot position.</p>	<p>A 2D heatmap visualization of the hot spot position. The color scale ranges from red (highest SAR) to blue (lowest SAR). The red area is concentrated in the lower-left region of the heatmap, corresponding to the hot spot location in the 3D model.</p>

Plot No	Band	Mode	Test Position	Channel	Battery
5	G1900	GSM	Back upward	661	1

Type: Phone measurement

Date of measurement: 20/9/2016

Measurement duration: 20 minutes 6 seconds

Mobile Phone IMEI number: --

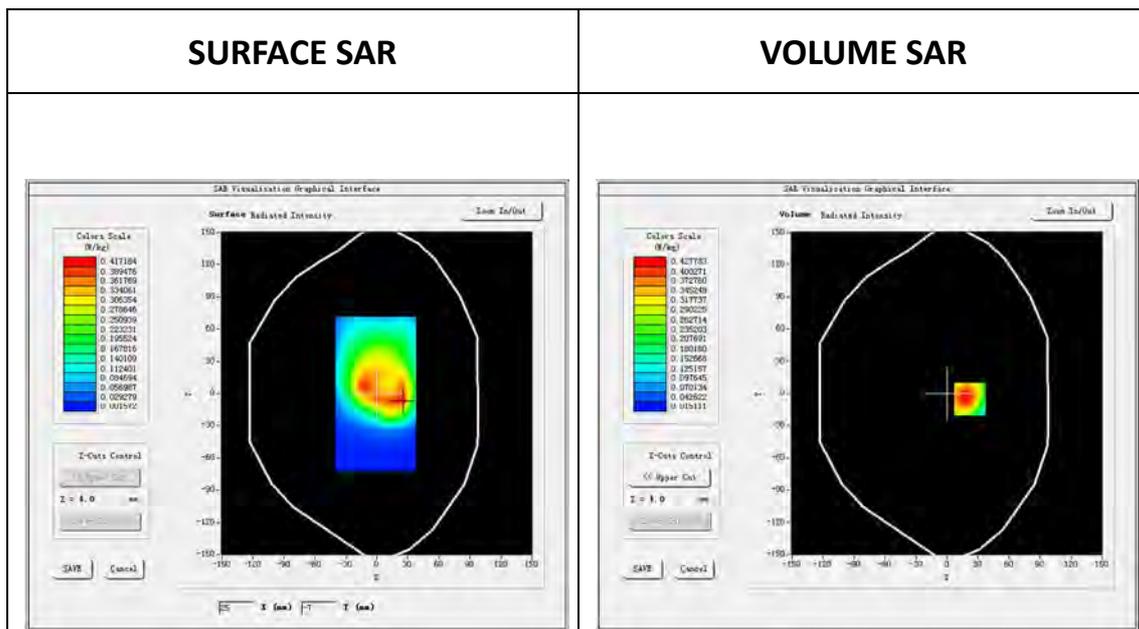
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=8mm dy=8mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>GSM1900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 8.3)</u>

B. SAR Measurement Results

Middle Band SAR (Channel 661):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	1880.0
Relative permittivity (real part)	53.232201
Relative permittivity (imaginary)	14.663500
Conductivity (S/m)	1.531521
Variation (%)	2.490000
ConvF:	6.18

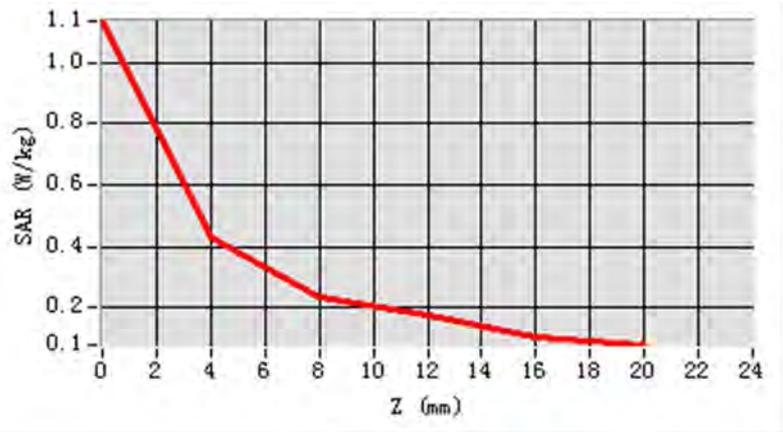


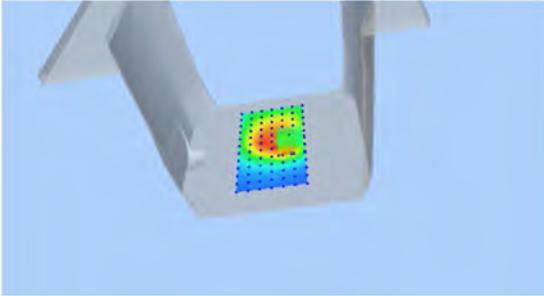
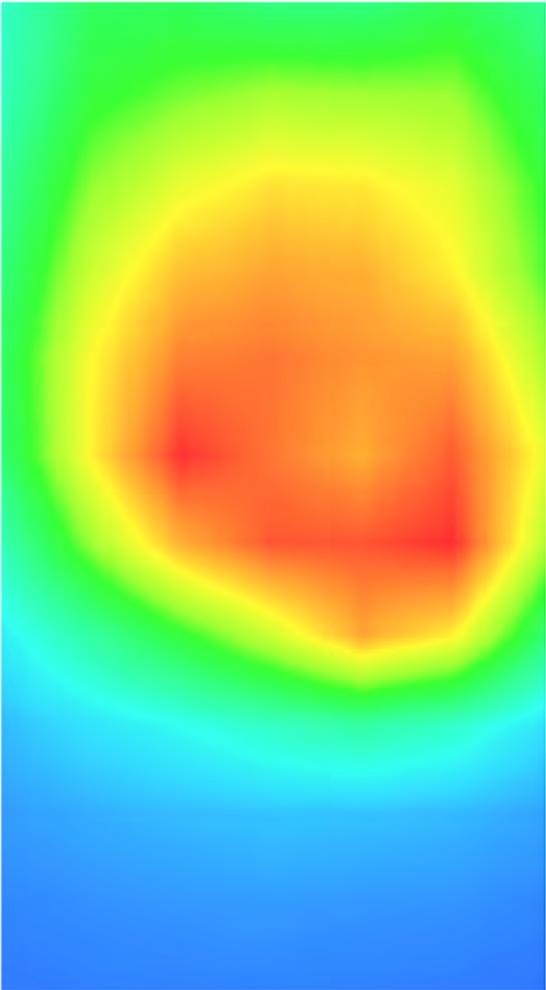
Maximum location: X=22.00, Y=-5.00

SAR Peak: 0.67 W/kg

SAR 10g (W/Kg)	0.228845
SAR 1g (W/Kg)	0.405853

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	1.1348	0.4278	0.2343	0.1765	0.1007



3D screen shot	Hot spot position
 <p>A 3D perspective view of a grey, L-shaped device. A small, square area on the inner surface of the L-shape is highlighted with a color-coded grid, representing a hot spot. The colors range from blue (low SAR) to red (high SAR).</p>	 <p>A 2D heatmap visualization of the hot spot position. The central area is red, indicating the highest SAR values, surrounded by concentric rings of yellow, green, and blue, representing decreasing SAR values as distance from the center increases.</p>

Plot No	Band	Mode	Test Position	Channel	Battery
6	G1900	GPRS12	Back upward	661	1

Type: Phone measurement

Date of measurement: 20/9/2016

Measurement duration: 21 minutes 57 seconds

Mobile Phone IMEI number: --

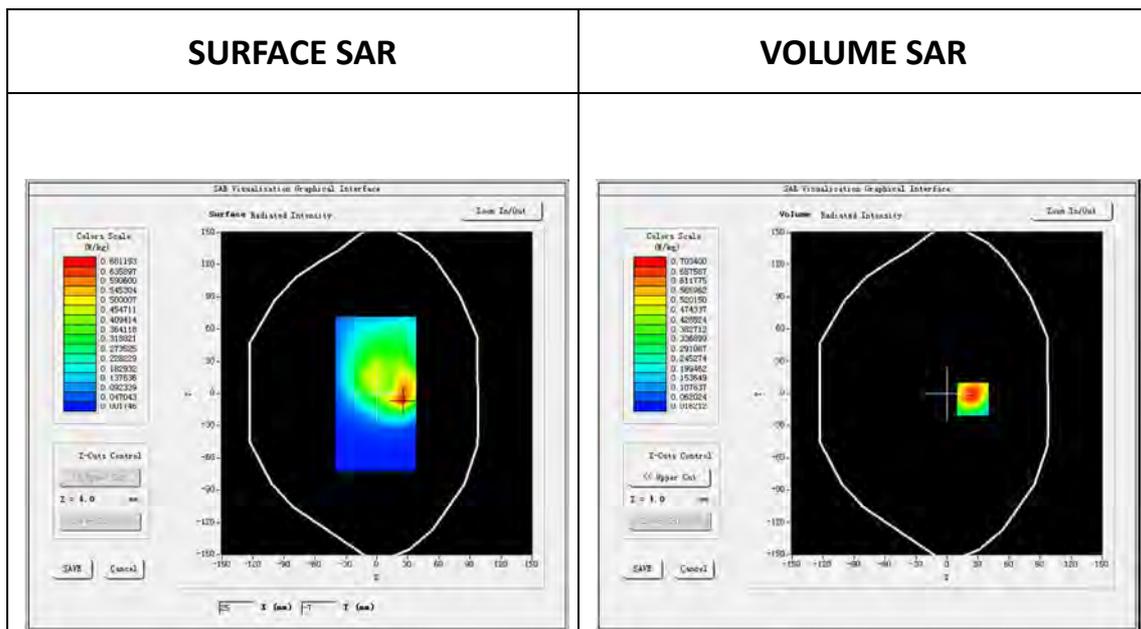
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=8mm dy=8mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>CUSTOM (GPRS1900-4Tx)</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>Duty Cycle: 2 (Crest factor: 2)</u>

B.SAR Measurement Results

Middle Band SAR (Channel 661):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	1880.0
Relative permittivity (real part)	53.299999
Relative permittivity (imaginary)	14.560000
Conductivity (S/m)	1.520711
Variation (%)	-0.620000
ConvF:	6.81

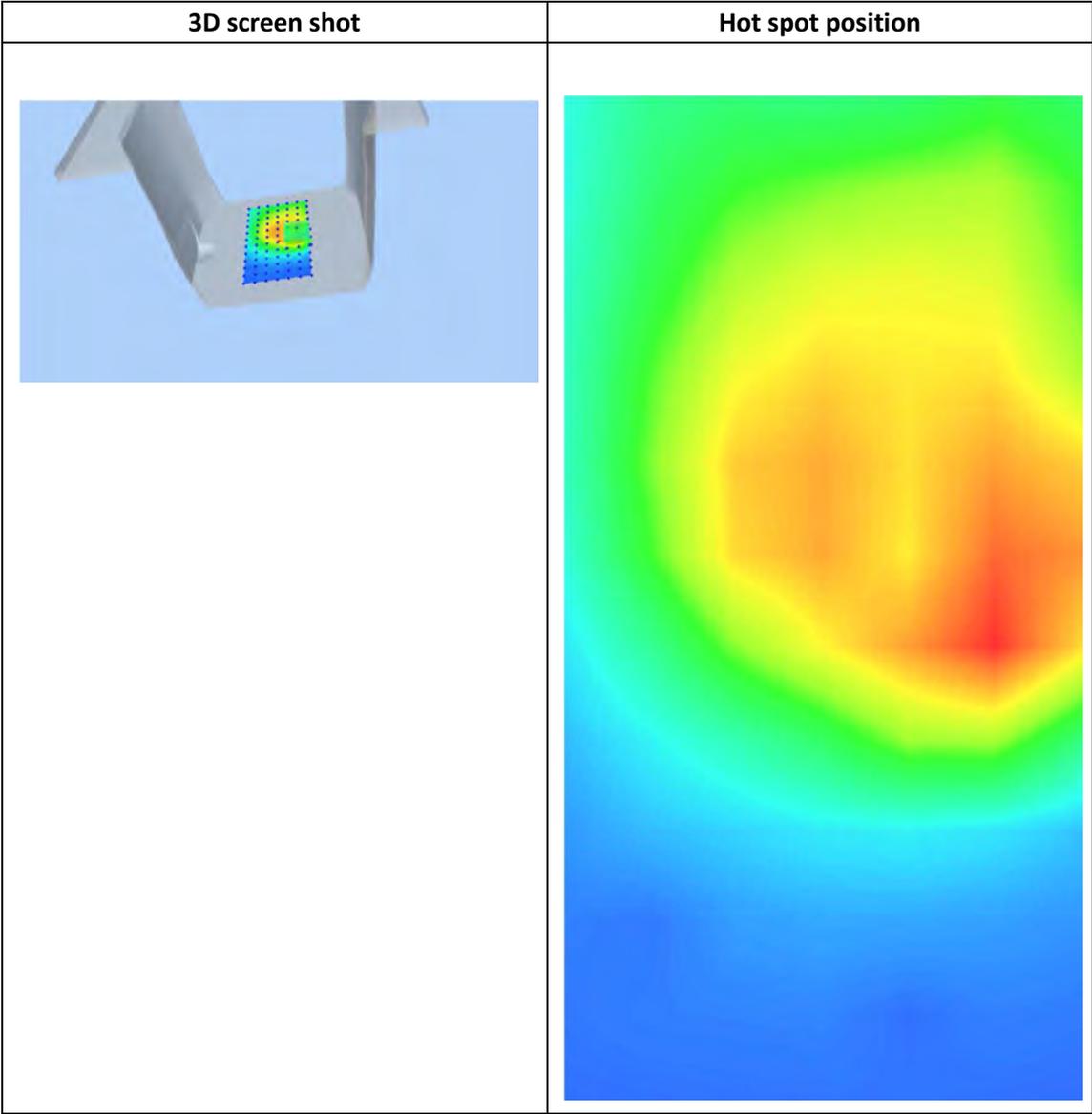
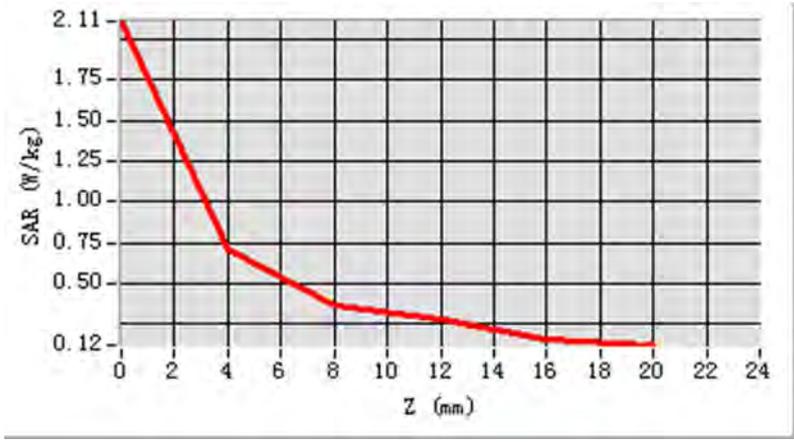


Maximum location: X=25.00, Y=-5.00

SAR Peak: 1.12 W/kg

SAR 10g (W/Kg)	0.356064
SAR 1g (W/Kg)	0.657457

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	2.1129	0.7034	0.3574	0.2790	0.1473



Plot No	Band	Mode	Test Position	Channel	Battery
7	WCDMA II	12.2RMC	Left Cheek	9400	1

Type: Phone measurement

Date of measurement: 28/9/2016

Measurement duration: 20 minutes 26 seconds

Mobile Phone IMEI number: --

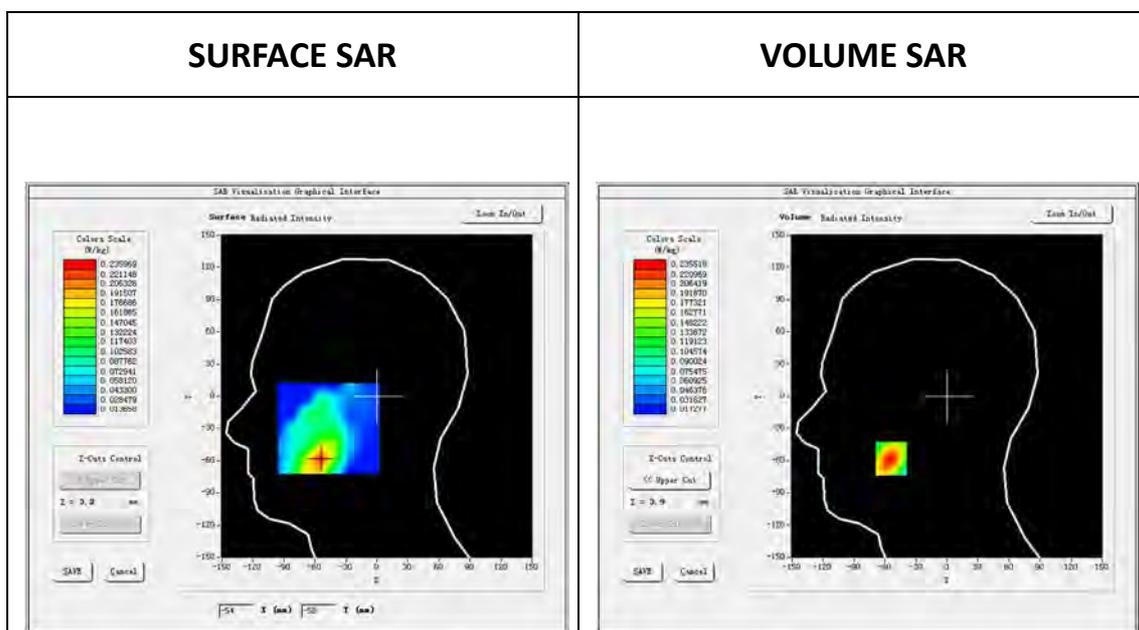
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=8mm dy=8mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>Band2 WCDMA1900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>

B. SAR Measurement Results

Middle Band SAR (Channel 9400):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	1880.0
Relative permittivity (real part)	40.701401
Relative permittivity (imaginary)	13.253600
Conductivity (S/m)	1.384265
Variation (%)	-0.950000
ConvF:	6.05

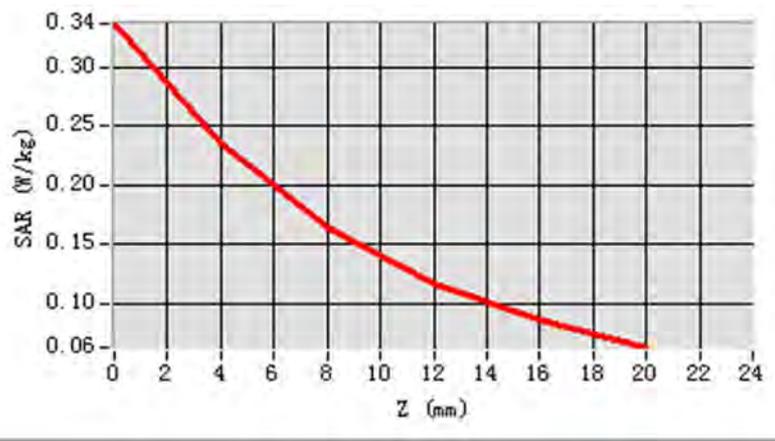


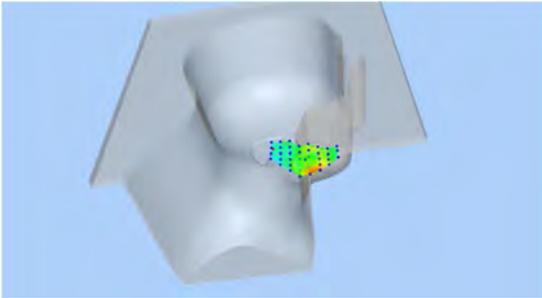
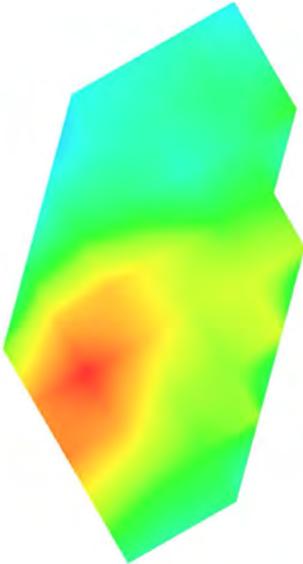
Maximum location: X=-54.00, Y=-58.00

SAR Peak: 0.34 W/kg

SAR 10g (W/Kg)	0.131711
SAR 1g (W/Kg)	0.218775

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.3369	0.2355	0.1647	0.1171	0.0854



3D screen shot	Hot spot position
	

Plot No	Band	Mode	Test Position	Channel	Battery
8	WCDMA II	12.2RMC	Back upward	9400	1

Type: Phone measurement

Date of measurement: 20/9/2016

Measurement duration: 21 minutes 33 seconds

Mobile Phone IMEI number: --

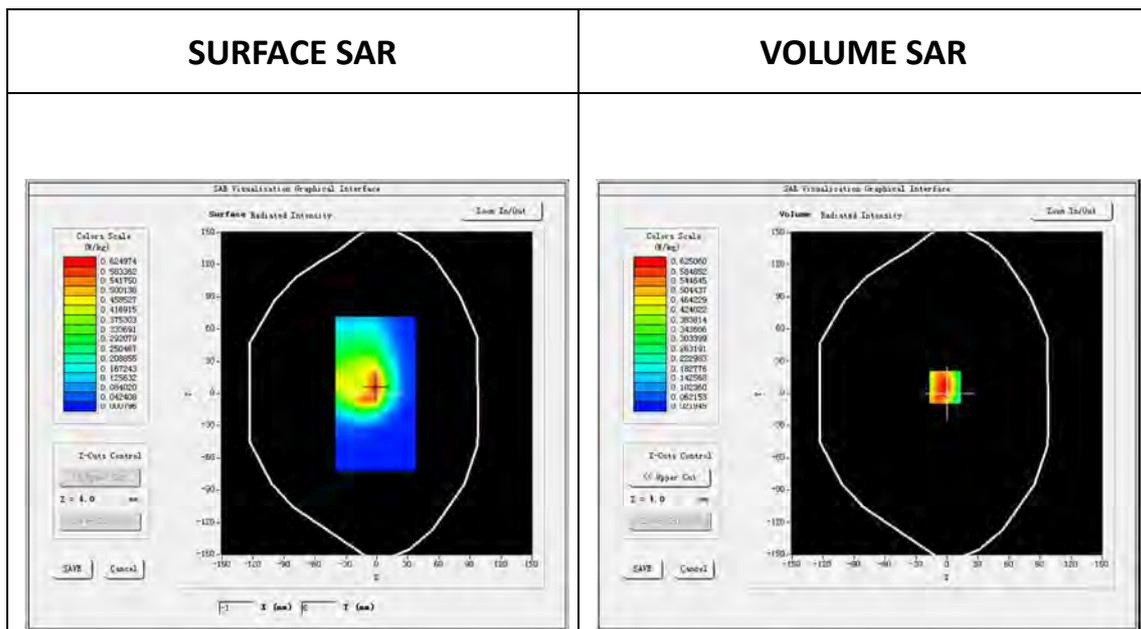
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=8mm dy=8mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>Band2 WCDMA1900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>

B. SAR Measurement Results

Middle Band SAR (Channel 9400):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	1880.000000
Relative permittivity (real part)	53.232201
Relative permittivity (imaginary)	14.663500
Conductivity (S/m)	1.531521
Variation (%)	-0.100000
ConvF:	6.18

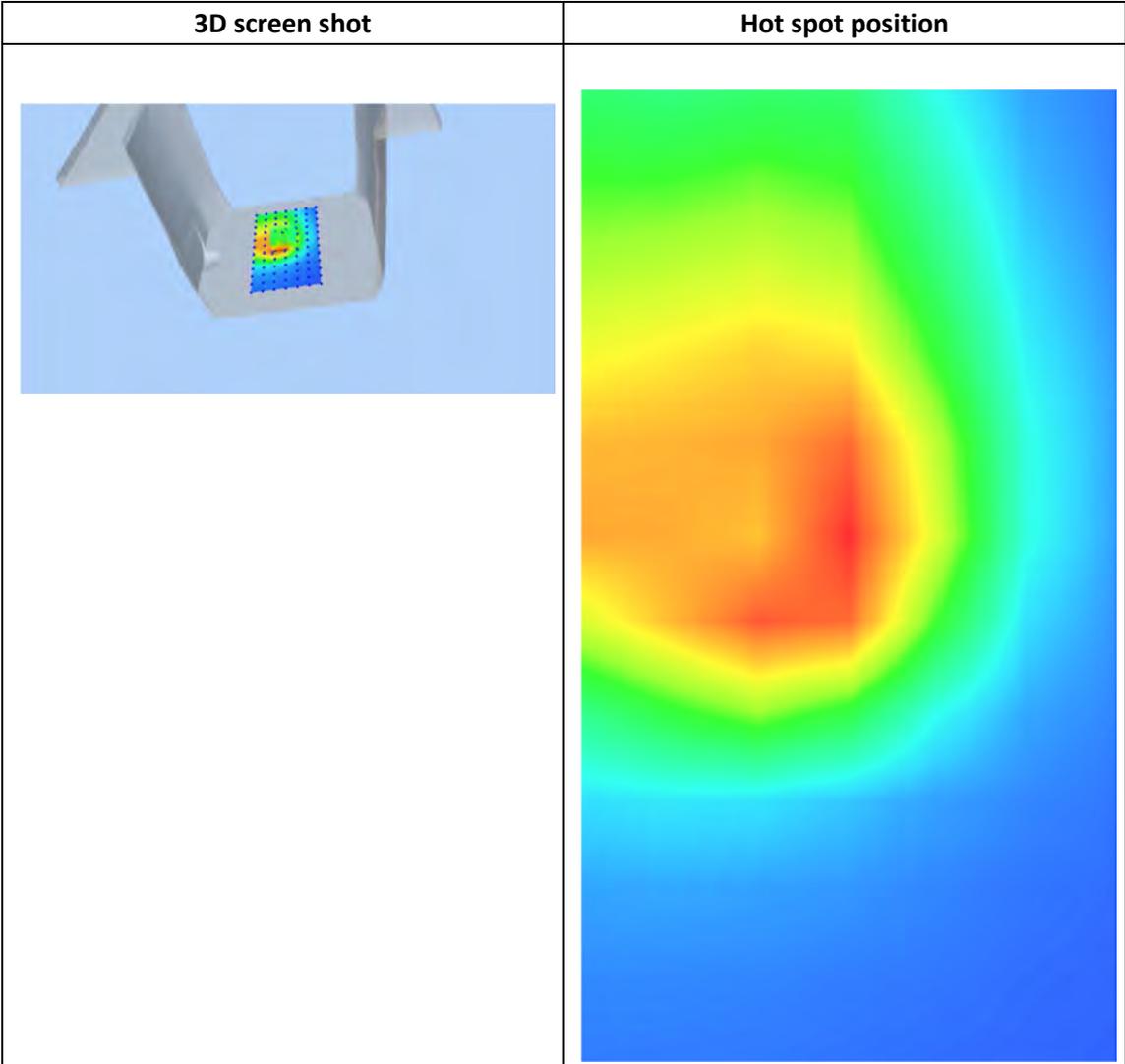
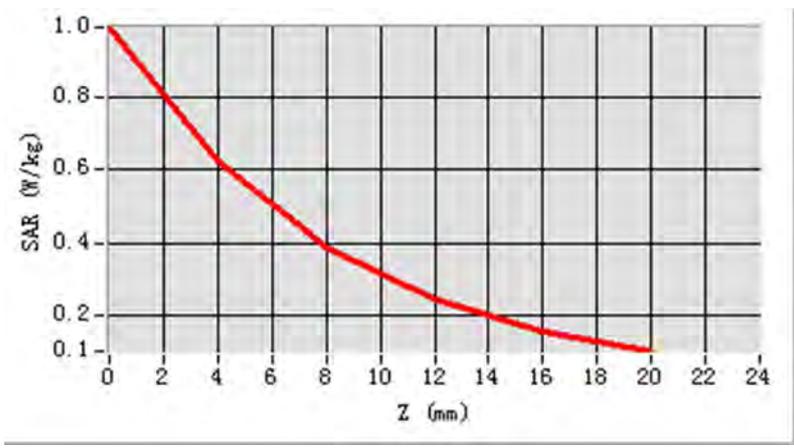


Maximum location: X=-2.00, Y=6.00

SAR Peak: 0.99 W/kg

SAR 10g (W/Kg)	0.323813
SAR 1g (W/Kg)	0.585533

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.9894	0.6251	0.3898	0.2461	0.1602



Plot No	Band	Mode	Test Position	Channel	Battery
9	WCDMA V	RMC12.2K	Right Cheek	4183	1

Type: Phone measurement

Date of measurement: 26/9/2016

Measurement duration: 20 minutes 31 seconds

Mobile Phone IMEI number: --

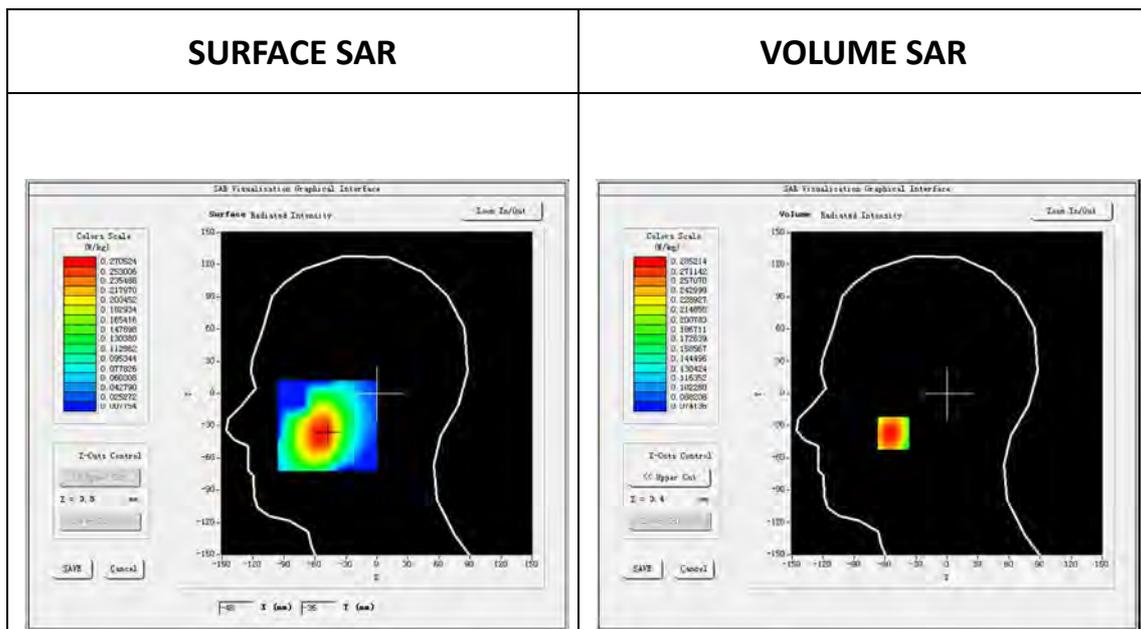
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=8mm dy=8mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Right head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>Band5 WCDMA850</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>

B. SAR Measurement Results

Middle Band SAR (Channel 4183):

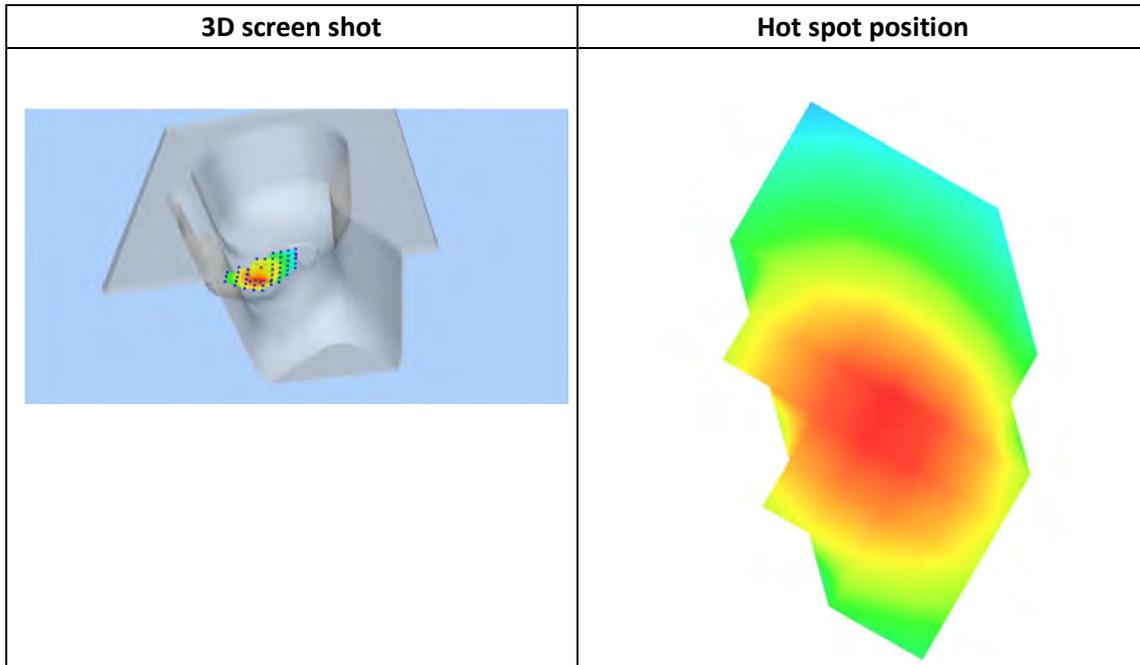
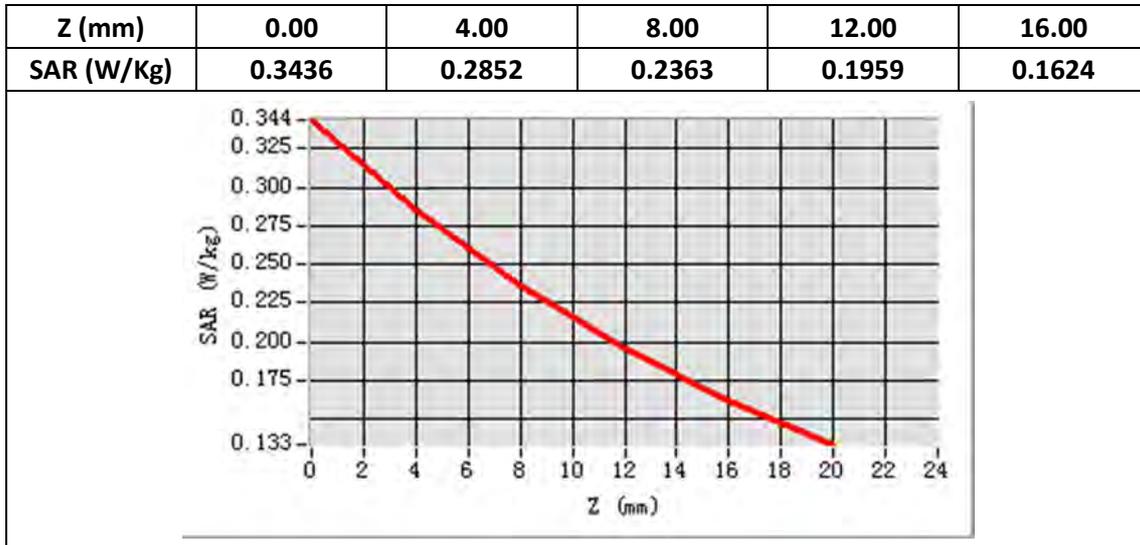
E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	836.6
Relative permittivity (real part)	41.884895
Relative permittivity (imaginary)	19.273376
Conductivity (S/m)	0.895570
Variation (%)	-0.060000
ConvF:	6.81



Maximum location: X=-52.00, Y=-37.00

SAR Peak: 0.35 W/kg

SAR 10g (W/Kg)	0.201963
SAR 1g (W/Kg)	0.273276



Plot No	Band	Mode	Test Position	Channel	Battery
10	WCDMA V	12.2RMC	Back upward	4183	1

Type: Phone measurement

Date of measurement: 19/9/2016

Measurement duration: 20 minutes 29 seconds

Mobile Phone IMEI number: --

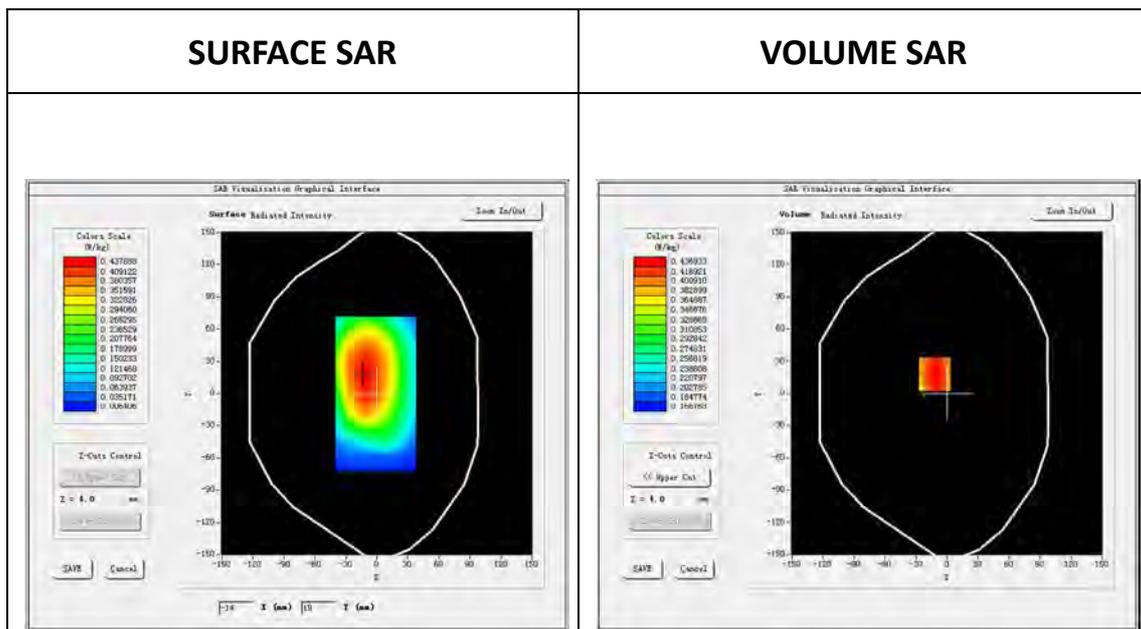
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=8mm dy=8mm</u>
<u>ZoomScan</u>	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>Band5 WCDMA850</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>

B. SAR Measurement Results

Middle Band SAR (Channel 4183):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	836.6
Relative permittivity (real part)	55.184227
Relative permittivity (imaginary)	21.109612
Conductivity (S/m)	0.980893
Variation (%)	-0.350000
ConvF:	7.07

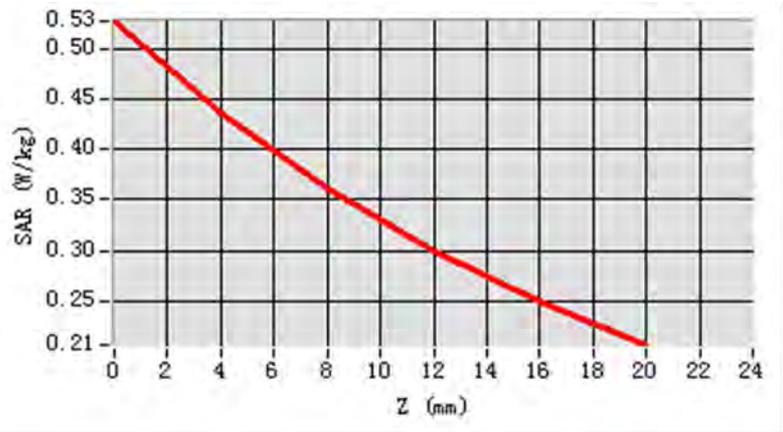


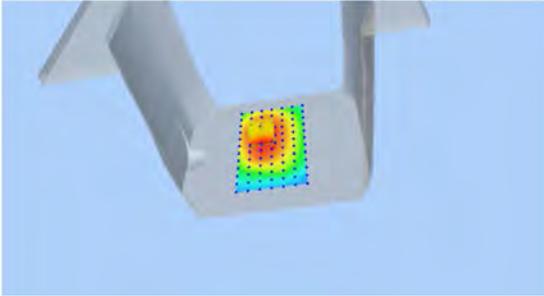
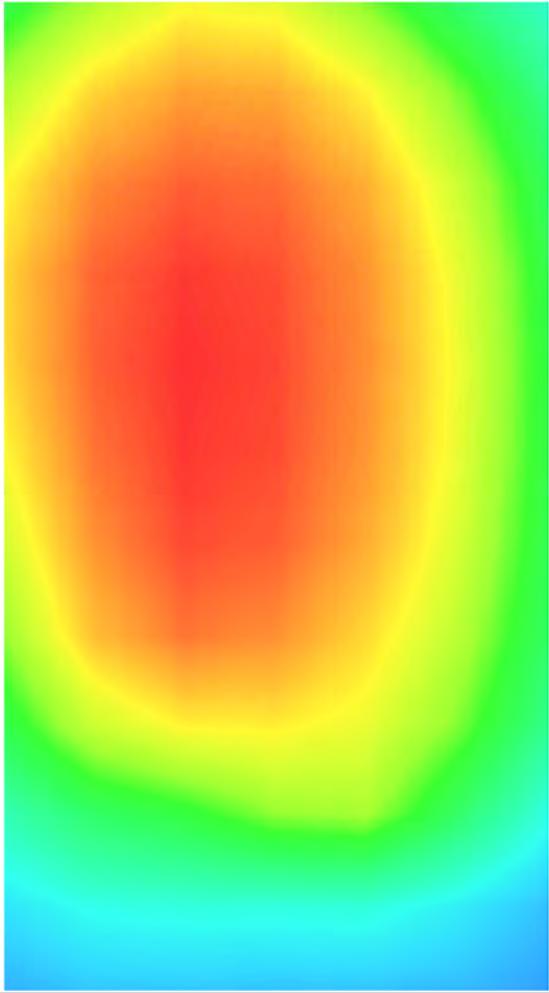
Maximum location: X=-12.00, Y=18.00

SAR Peak: 0.53 W/kg

SAR 10g (W/Kg)	0.325386
SAR 1g (W/Kg)	0.425734

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.5280	0.4369	0.3614	0.2998	0.2491



3D screen shot	Hot spot position
 <p>A 3D perspective view of a chair seat. A color-coded heatmap is overlaid on the seat surface, showing a central 'hot spot' in red and yellow, with values decreasing towards the edges, represented by green and blue colors.</p>	 <p>A 2D color-coded heatmap showing the spatial distribution of SAR. The center is a bright red oval, transitioning through yellow and green to a light blue background, indicating the highest SAR values are concentrated in the center of the seat.</p>

Plot No	Band	Mode	Test Position	Channel	Battery	RB	offset
11	LTE4	QPSK20M	Left Cheek	20175	1	1	50

Type: Phone measurement

Date of measurement: 27/9/2016

Measurement duration: 21 minutes 25 seconds

Mobile Phone IMEI number: --

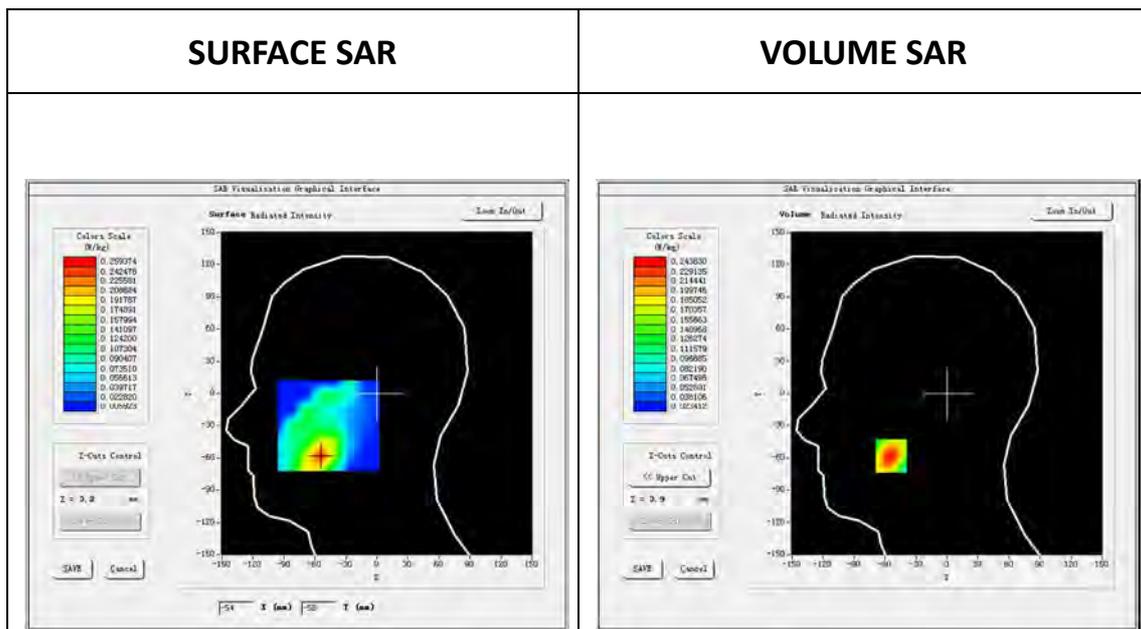
A. Experimental conditions.

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

B.SAR Measurement Results

Middle Band SAR (Channel 20175):

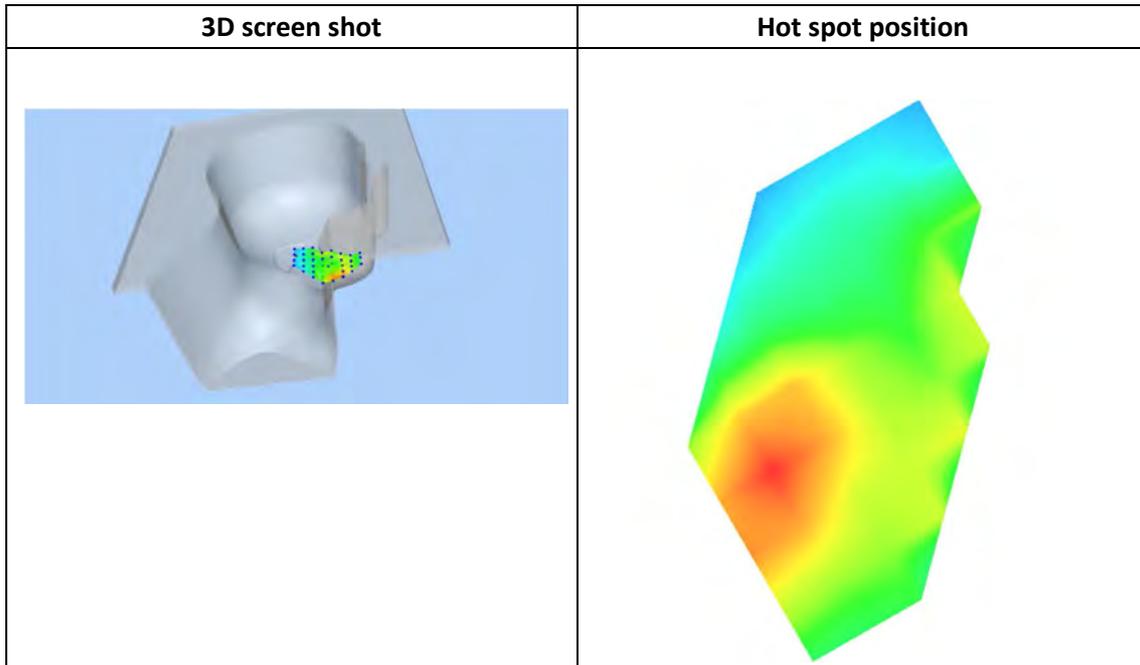
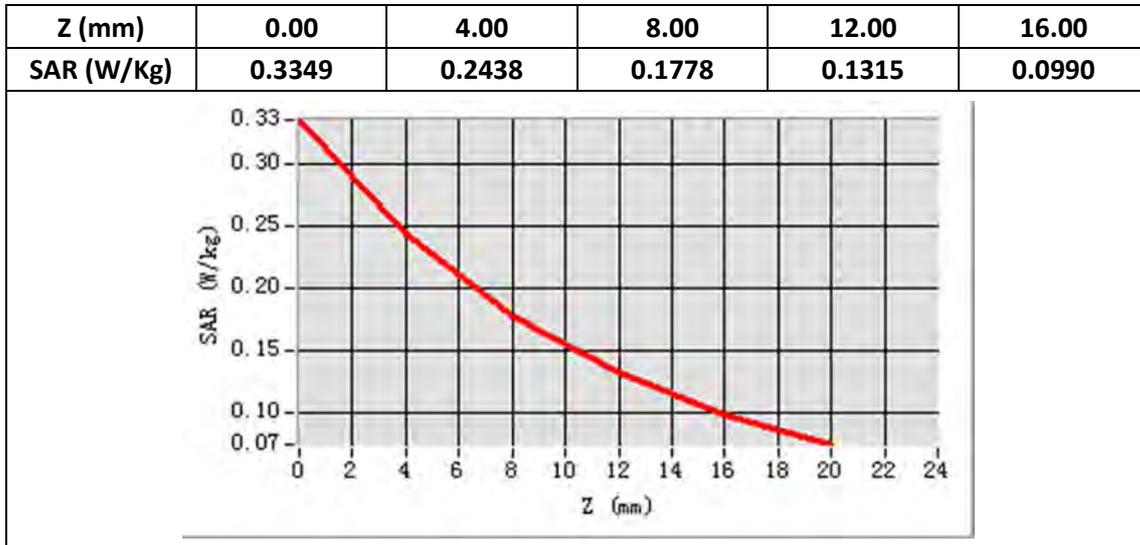
E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	1732.5
Relative permittivity (real part)	41.352400
Relative permittivity (imaginary)	14.023520
Conductivity (S/m)	1.402352
Variation (%)	2.520000
ConvF:	5.44



Maximum location: X=-54.00, Y=-58.00

SAR Peak: 0.33 W/kg

SAR 10g (W/Kg)	0.144202
SAR 1g (W/Kg)	0.229245



Plot No	Band	Mode	Test Position	Channel	Battery	RB	offset
12	LTE4	QPSK20M	Back upward	20175	1	1	50

Type: Phone measurement

Date of measurement: 20/9/2016

Measurement duration: 20 minutes 6 seconds

Mobile Phone IMEI number: --

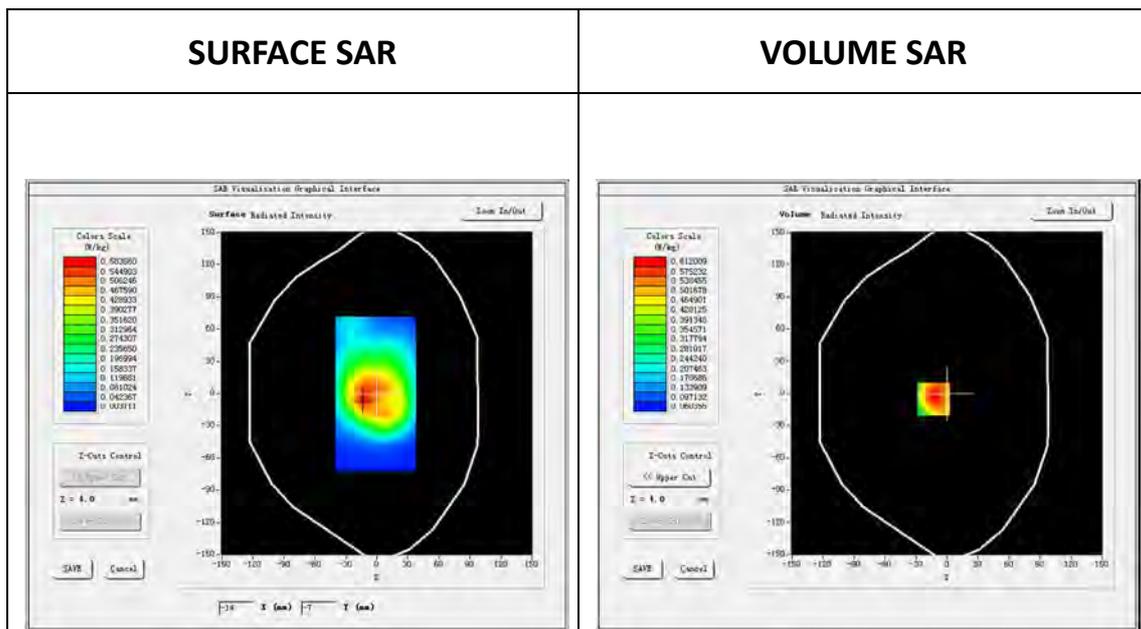
A. Experimental conditions.

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

B.SAR Measurement Results

Middle Band SAR (Channel 20175):

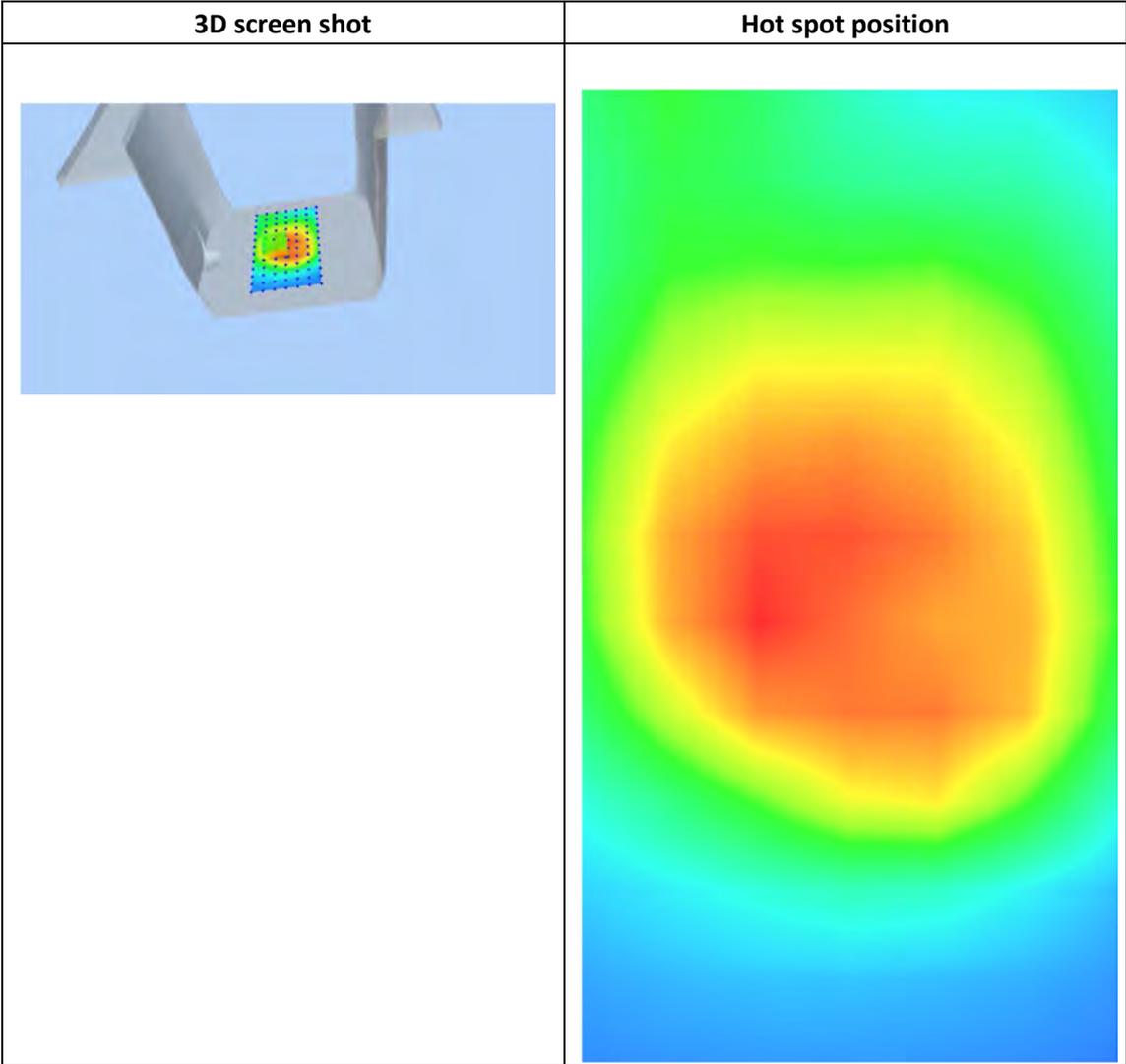
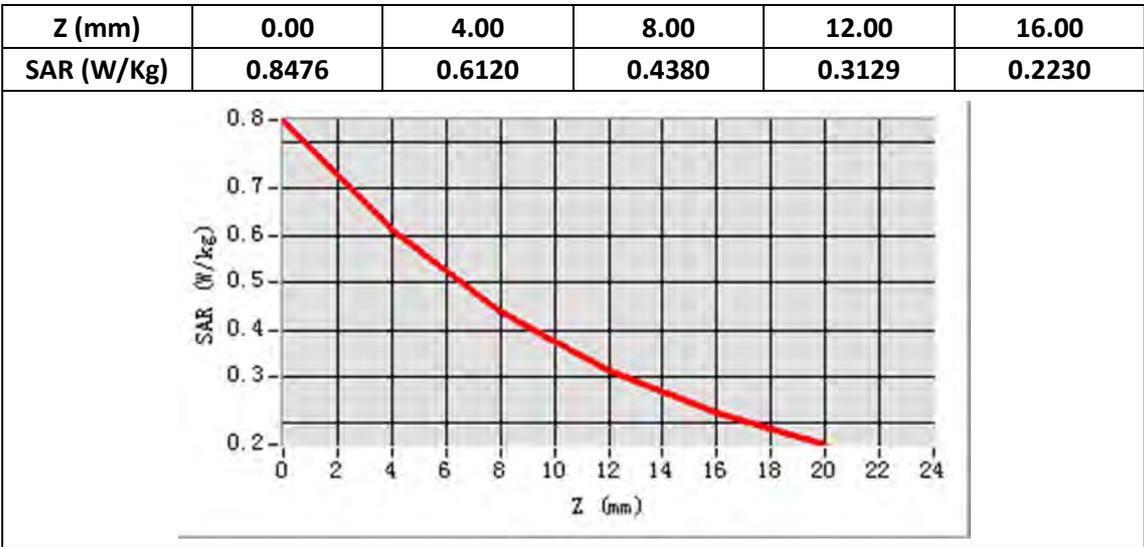
E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	1732.5
Relative permittivity (real part)	53.477631
Relative permittivity (imaginary)	15.359868
Conductivity (S/m)	1.478387
Variation (%)	2.880000
ConvF:	5.62



Maximum location: X=-13.00, Y=-5.00

SAR Peak: 0.86 W/kg

SAR 10g (W/Kg)	0.361155
SAR 1g (W/Kg)	0.580943



Plot No	Band	Mode	Test Position	Channel	Battery	RB	offset
13	LTE Band5	QPSK10M	Right Cheek	20525	1	1	0

Type: Phone measurement

Date of measurement: 26/9/2016

Measurement duration: 20 minutes 10 seconds

Mobile Phone IMEI number: --

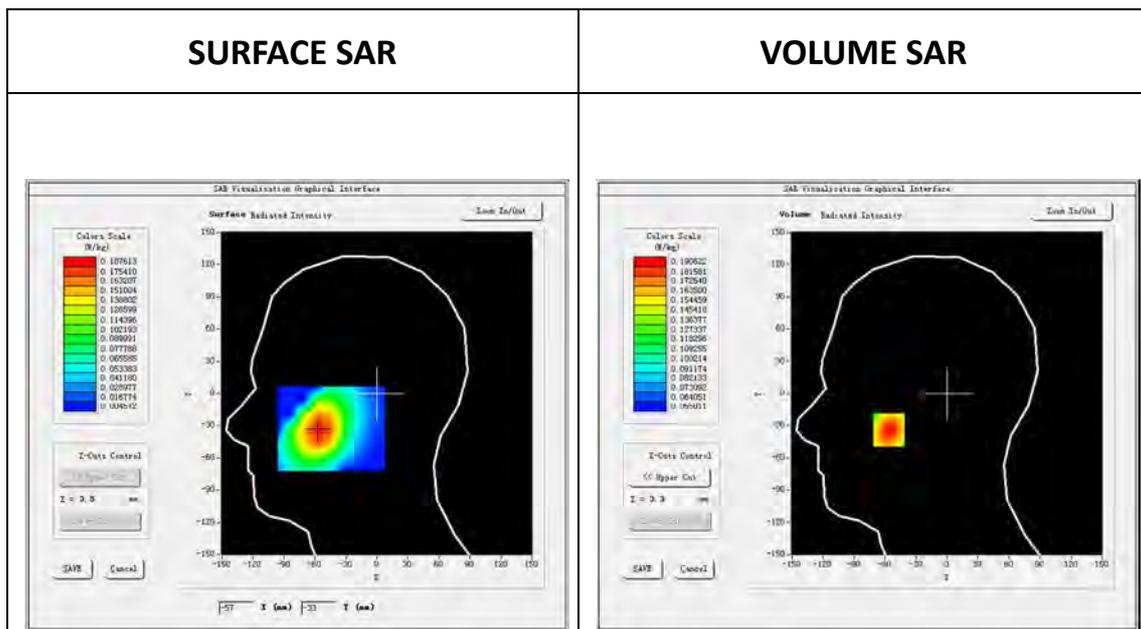
A. Experimental conditions.

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

B. SAR Measurement Results

Middle Band SAR (Channel 20525):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	836.5
Relative permittivity (real part)	41.884186
Relative permittivity (imaginary)	19.275536
Conductivity (S/m)	0.895777
Variation (%)	-0.520000
ConvF:	6.81

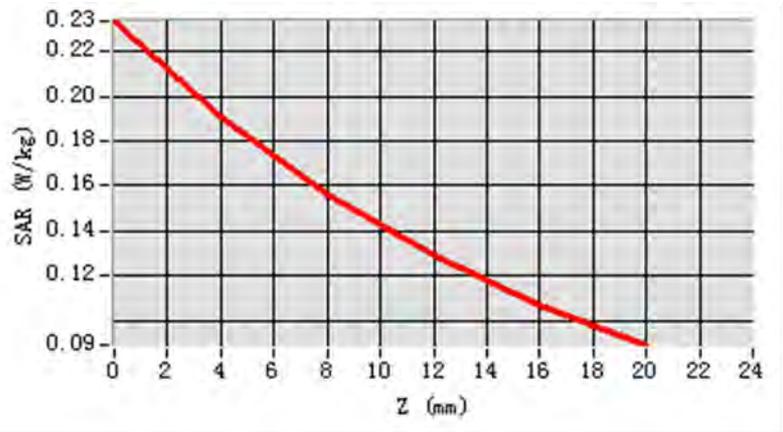


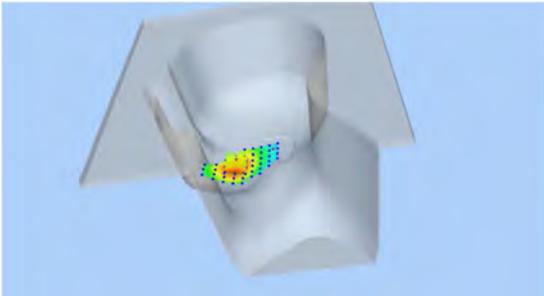
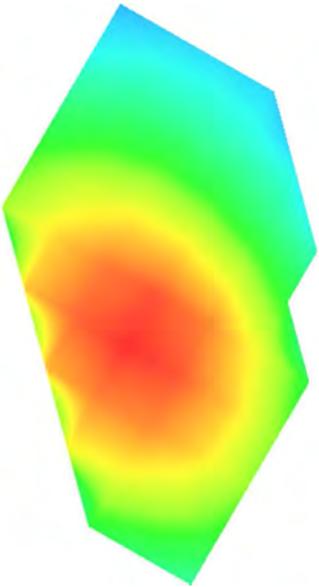
Maximum location: X=-56.00, Y=-34.00

SAR Peak: 0.23 W/kg

SAR 10g (W/Kg)	0.134324
SAR 1g (W/Kg)	0.182090

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.2335	0.1906	0.1561	0.1289	0.1073



3D screen shot	Hot spot position
	

Plot No	Band	Mode	Test Position	Channel	Battery	RB	offset
14	LTE Band 5	QPSK10M	Back upward	20525	1	1	0

Type: Phone measurement

Date of measurement: 19/9/2016

Measurement duration: 21 minutes 18 seconds

Mobile Phone IMEI number: --

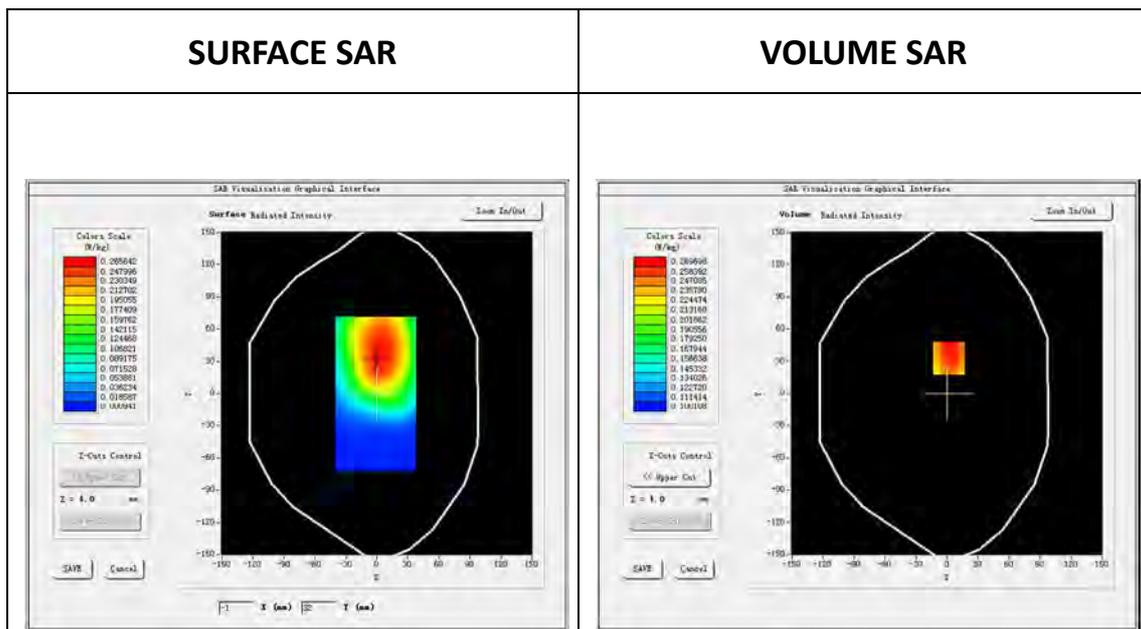
A. Experimental conditions.

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

B. SAR Measurement Results

Middle Band SAR (Channel 20525):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	836.5
Relative permittivity (real part)	55.184227
Relative permittivity (imaginary)	21.109612
Conductivity (S/m)	0.980893
Variation (%)	2.010000
ConvF:	7.07

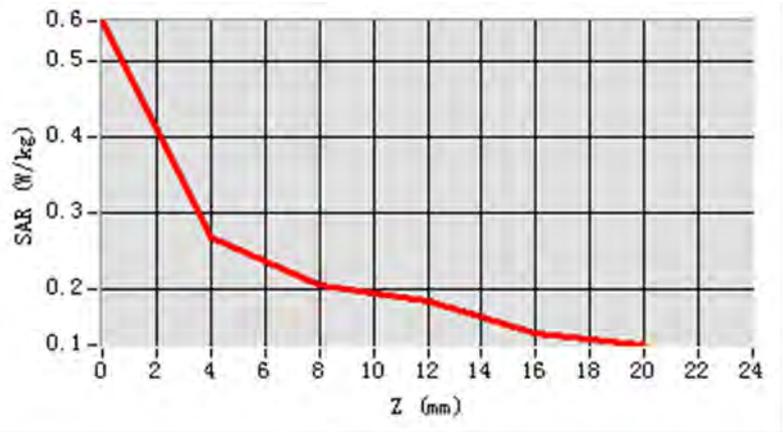


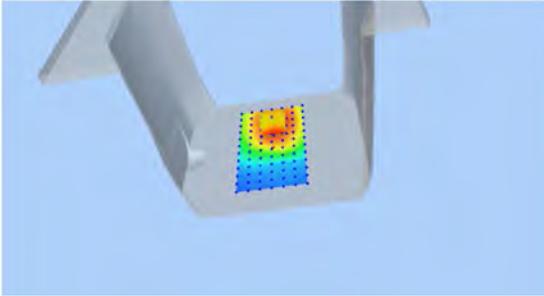
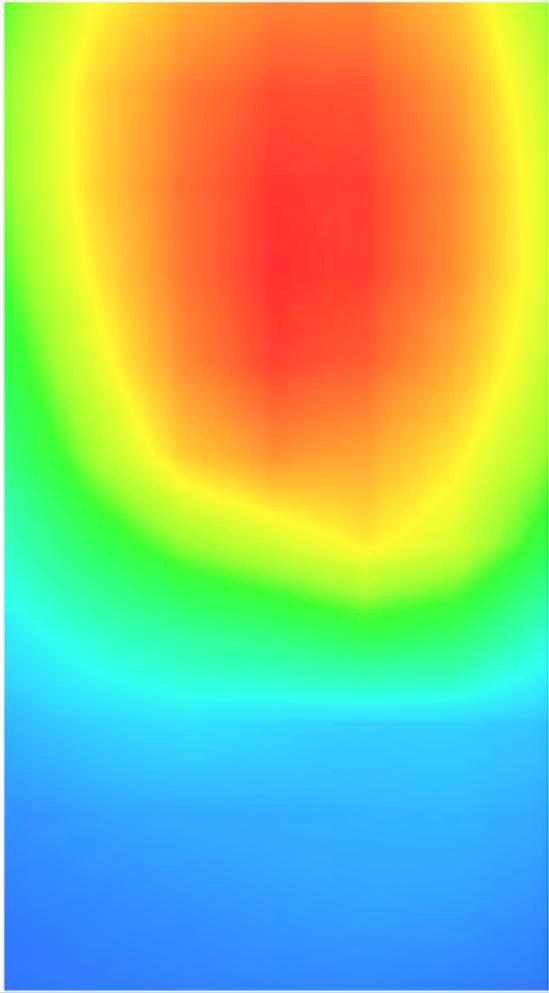
Maximum location: X=2.00, Y=33.00

SAR Peak: 0.33 W/kg

SAR 10g (W/Kg)	0.198210
SAR 1g (W/Kg)	0.259959

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.5526	0.2697	0.2065	0.1855	0.1425



3D screen shot	Hot spot position
 <p>A 3D perspective view of a grey, L-shaped device. A small, square area on the inner surface of the 'L' is highlighted with a color-coded grid, representing a hot spot. The colors range from blue (low SAR) to red (high SAR).</p>	 <p>A 2D heatmap visualization of the hot spot. The color scale ranges from blue (low SAR) at the bottom to red (high SAR) at the top. The highest SAR values are concentrated in a central, vertical region, with values decreasing as they move away from the center.</p>

Plot No	Band	Mode	Test Position	Channel	Battery	RB	offset
15	LTE Band 7	QPSK20M	Left Cheek	21100	1	1	0

Type: Phone measurement

Date of measurement: 23/9/2016

Measurement duration: 21 minutes 38 seconds

Mobile Phone IMEI number: --

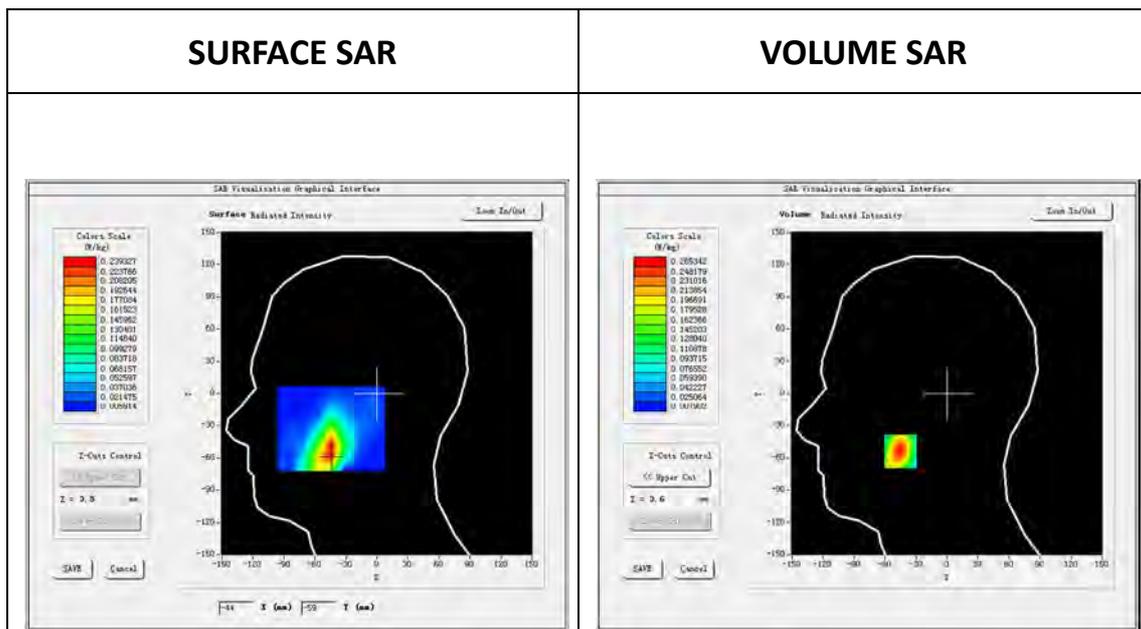
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=5mm dy=5mm</u>
<u>ZoomScan</u>	<u>7x7x8,dx=5mm dy=5mm dz=4mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 7</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>

B.. SAR Measurement Results

Middle Band SAR (Channel 21100):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	2535.0
Relative permittivity (real part)	39.086666
Relative permittivity (imaginary)	13.418333
Conductivity (S/m)	1.889749
Variation (%)	-0.970000
ConvF:	5.57

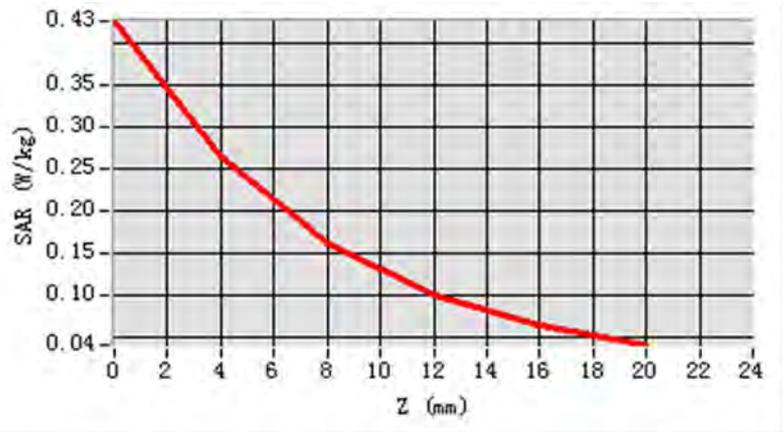


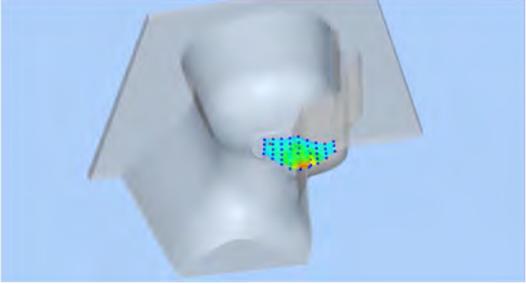
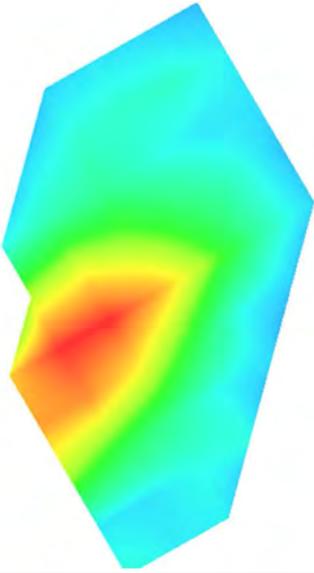
Maximum location: X=-45.00, Y=-54.00

SAR Peak: 0.43 W/kg

SAR 10g (W/Kg)	0.126888
SAR 1g (W/Kg)	0.242871

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.4271	0.2653	0.1623	0.1002	0.0638



3D screen shot	Hot spot position
	

Plot No	Band	Mode	Test Position	Channel	Battery	RB	offset
16	LTE Band 7	QPSK20M	Back upward	21100	1	1	0

Type: Phone measurement

Date of measurement: 21/9/2016

Measurement duration: 21 minutes 59 seconds

Mobile Phone IMEI number: --

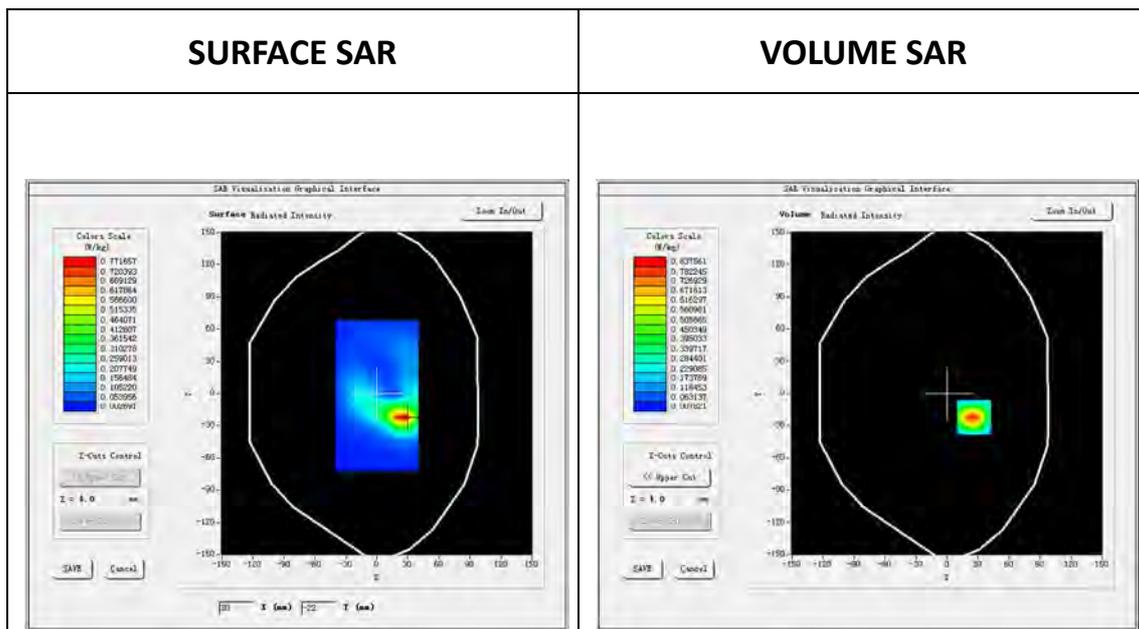
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=5mm dy=5mm</u>
<u>ZoomScan</u>	<u>7x7x8,dx=5mm dy=5mm dz=4mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 7</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>

B.SAR Measurement Results

Middle Band SAR (Channel 21100):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	2535.0
Relative permittivity (real part)	54.468500
Relative permittivity (imaginary)	14.286489
Conductivity (S/m)	2.063604
Variation (%)	2.010000
ConvF:	5.73

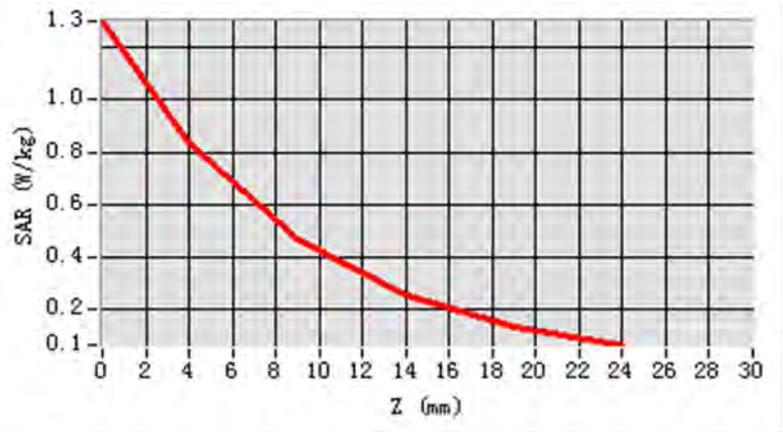


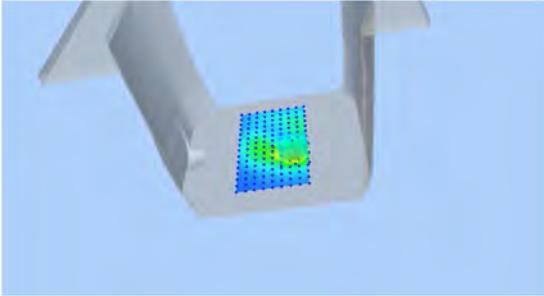
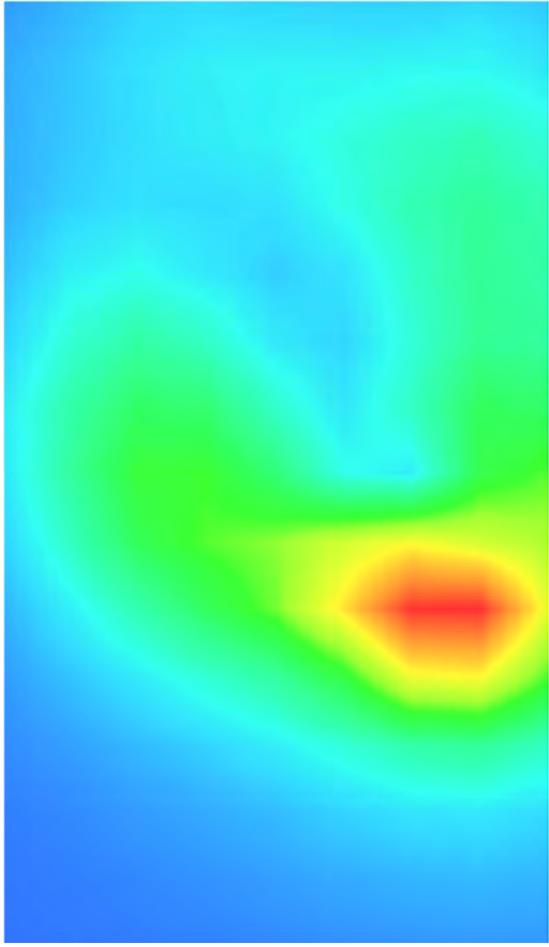
Maximum location: X=26.00, Y=-22.00

SAR Peak: 1.31 W/kg

SAR 10g (W/Kg)	0.358167
SAR 1g (W/Kg)	0.759986

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.3013	0.8376	0.4647	0.2509	0.1333



3D screen shot	Hot spot position
 <p>A 3D perspective view of a white, L-shaped device. A small rectangular area on the inner surface of the 'L' is highlighted with a color-coded heatmap, showing a concentration of high SAR values (red and yellow) in the center, transitioning to lower values (green and blue) towards the edges.</p>	 <p>A 2D heatmap visualization of the SAR distribution. The color scale ranges from blue (low SAR) to red (high SAR). A prominent red and yellow hot spot is visible in the lower-right quadrant, corresponding to the high SAR region shown in the 3D view.</p>

Plot No	Band	Mode	Test Position	Channel	Battery	RB	offset
17	LTE Band 41	QPSK20M	Left Cheek	40740	1	1	50

Type: Phone measurement

Date of measurement: 23/9/2016

Measurement duration: 21 minutes 45 seconds

Mobile Phone IMEI number: --

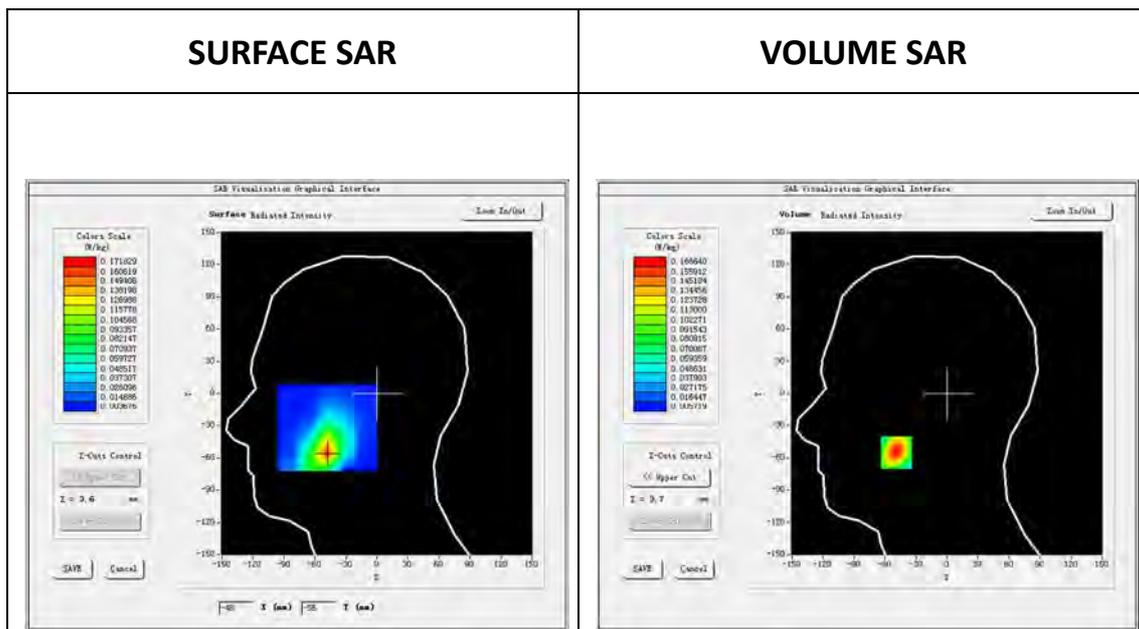
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=5mm dy=5mm</u>
<u>ZoomScan</u>	<u>7x7x8,dx=5mm dy=5mm dz=4mm</u>
<u>Phantom</u>	<u>Left head</u>
<u>Device Position</u>	<u>Cheek</u>
<u>Band</u>	<u>LTE band 41</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.58)</u>

B.SAR Measurement Results

Middle Band SAR (Channel 40740):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	2605.0
Relative permittivity (real part)	39.009335
Relative permittivity (imaginary)	13.553667
Conductivity (S/m)	1.952481
Variation (%)	-0.390000
ConvF:	5.57

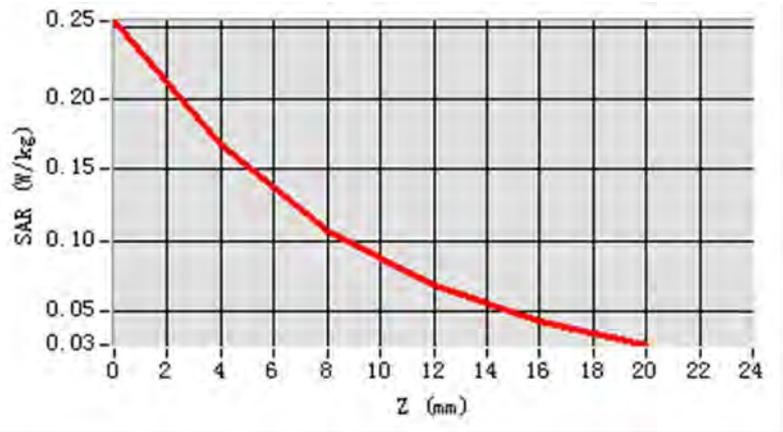


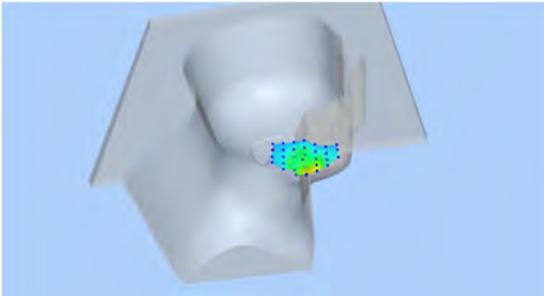
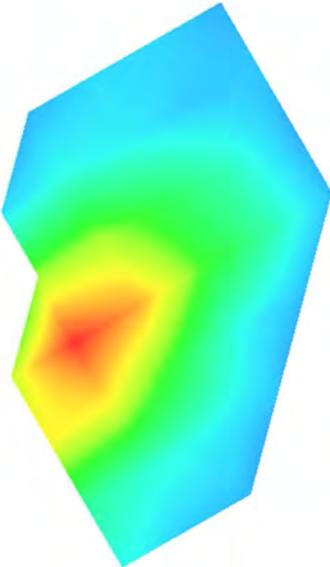
Maximum location: X=-49.00, Y=-55.00

SAR Peak: 0.26 W/kg

SAR 10g (W/Kg)	0.080870
SAR 1g (W/Kg)	0.152759

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.2547	0.1666	0.1070	0.0681	0.0432



3D screen shot	Hot spot position
	

Plot No	Band	Mode	Test Position	Channel	Battery	RB	offset
18	LTE Band 41	QPSK20M	Back upward	40740	1	1	50

Type: Phone measurement

Date of measurement: 21/9/2016

Measurement duration: 21 minutes 40 seconds

Mobile Phone IMEI number: --

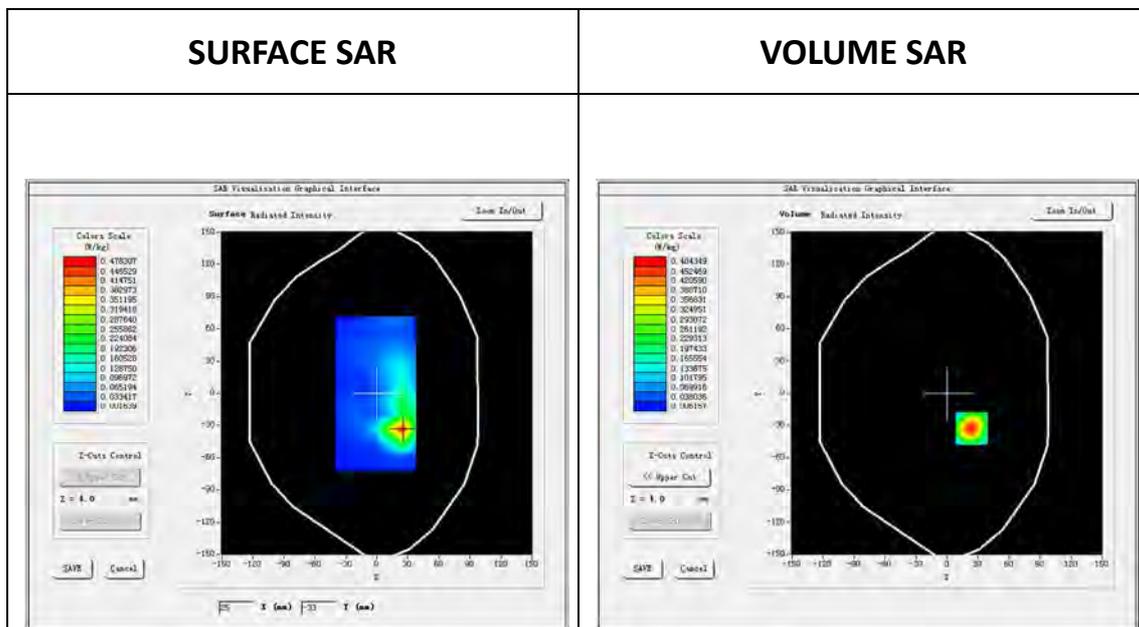
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=5mm dy=5mm</u>
<u>ZoomScan</u>	<u>7x7x8,dx=5mm dy=5mm dz=4mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 41</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.58)</u>

B.SAR Measurement Results

Middle Band SAR (Channel 40740):

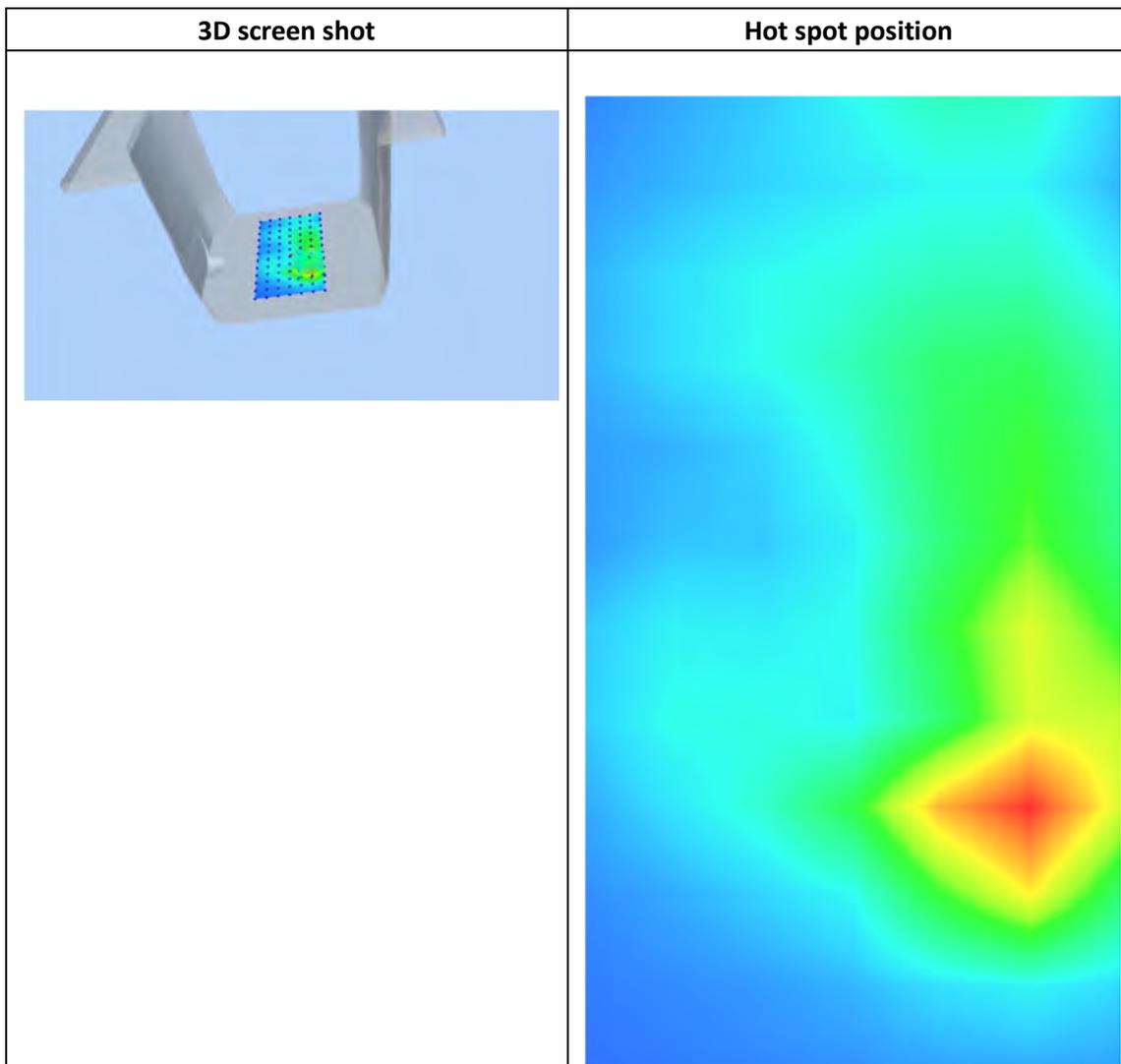
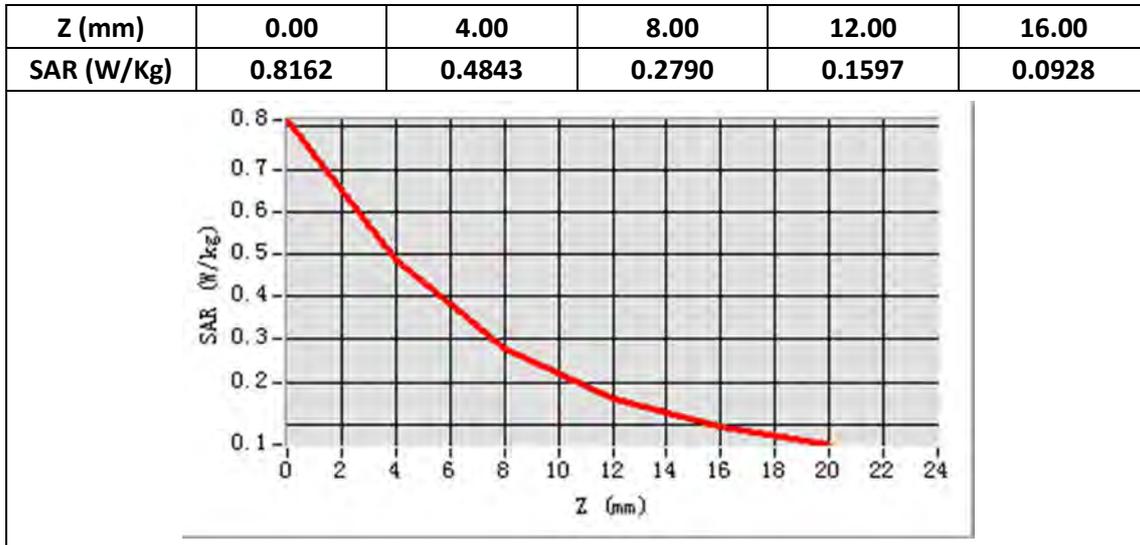
E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	2605.0
Relative permittivity (real part)	52.518002
Relative permittivity (imaginary)	14.863000
Conductivity (S/m)	2.141098
Variation (%)	-0.680000
ConvF:	5.73



Maximum location: X=24.00, Y=-33.00

SAR Peak: 0.82 W/kg

SAR 10g (W/Kg)	0.207546
SAR 1g (W/Kg)	0.438247



Plot No	Band	Mode	Test Position	Channel	Battery
19	802.11b		Right Tilt	1	1

Type: Phone measurement

Date of measurement: 23/9/2016

Measurement duration: 20 minutes 35 seconds

Mobile Phone IMEI number: --

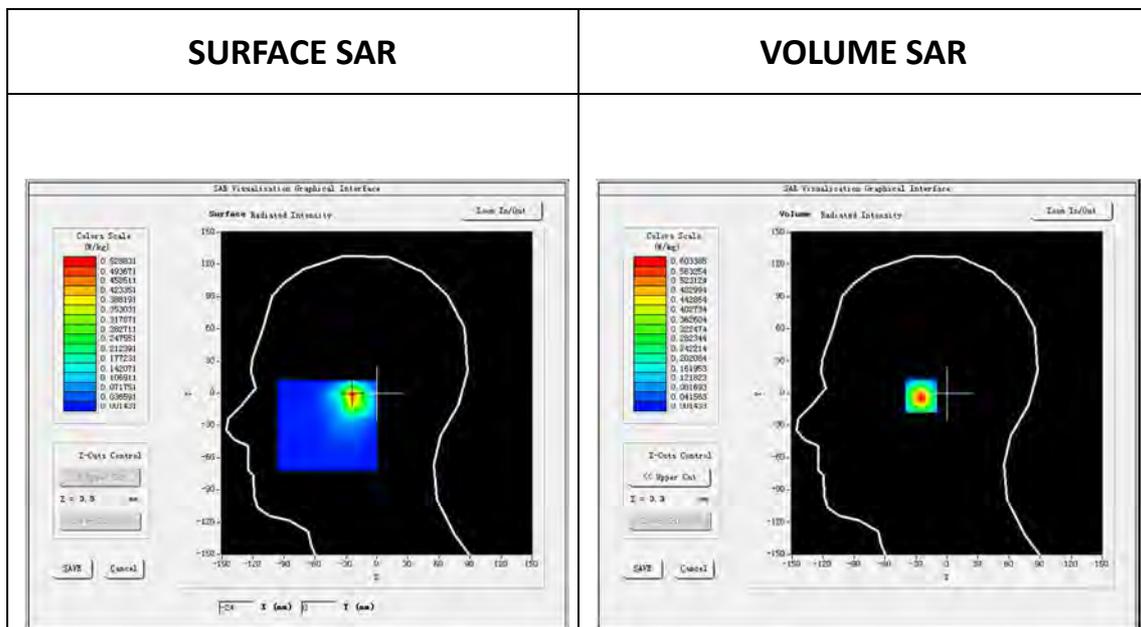
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=5mm dy=5mm</u>
<u>ZoomScan</u>	<u>7x7x8,dx=5mm dy=5mm dz=4mm</u>
<u>Phantom</u>	<u>Right head</u>
<u>Device Position</u>	<u>Tilt</u>
<u>Band</u>	<u>IEEE 802.11b ISM</u>
<u>Channels</u>	<u>Low</u>
<u>Signal</u>	<u>IEEE802.b (Crest factor: 1.0)</u>

B. SAR Measurement Results

Low Band SAR (Channel 1):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	2412.0
Relative permittivity (real part)	54.716228
Relative permittivity (imaginary)	13.970050
Conductivity (S/m)	1.891390
Variation (%)	-0.430000
ConvF:	5.52

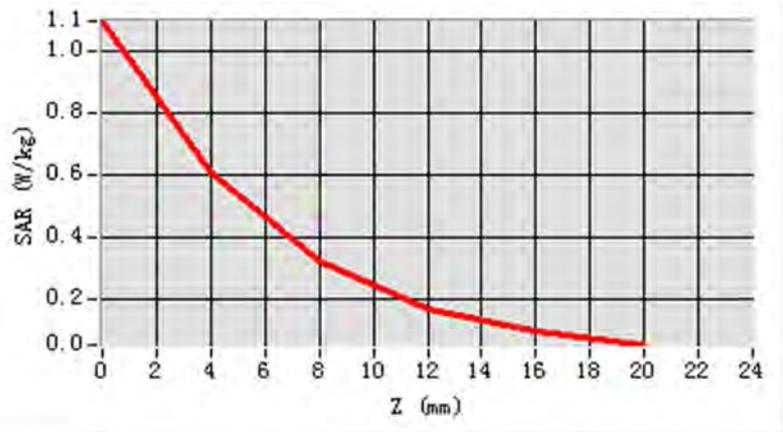


Maximum location: X=-23.00, Y=-2.00

SAR Peak: 1.11 W/kg

SAR 10g (W/Kg)	0.222775
SAR 1g (W/Kg)	0.533413

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	1.0972	0.6034	0.3184	0.1676	0.0925



3D screen shot	Hot spot position
<p>A 3D rendering of a human head model. A small, localized area on the side of the head is highlighted with a color gradient from blue to red, indicating a hot spot of high SAR exposure.</p>	<p>A 2D heatmap showing the spatial distribution of SAR exposure. The highest intensity (red) is concentrated in a small central region, which then transitions through yellow and green to blue as the intensity decreases towards the edges of the model.</p>

Plot No	Band	Mode	Test Position	Channel	Battery
20	802.11b	-	Back	1	1

Type: Phone measurement

Date of measurement: 21/9/2016

Measurement duration: 22 minutes 15 seconds

Mobile Phone IMEI number: --

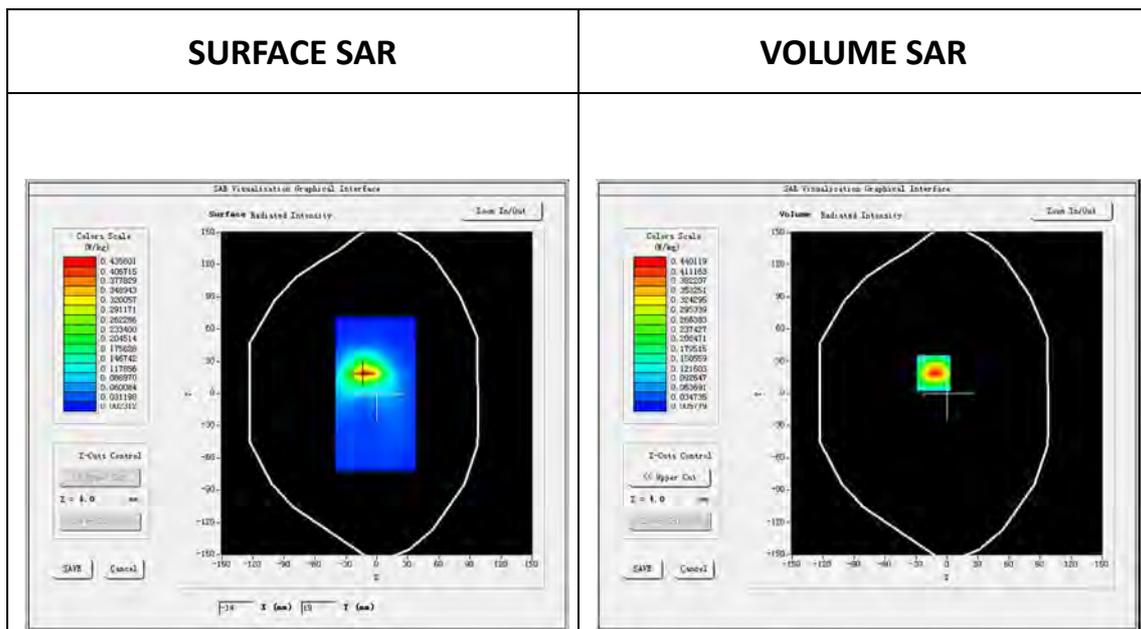
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=5mm dy=5mm</u>
<u>ZoomScan</u>	<u>7x7x8,dx=5mm dy=5mm dz=4mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11b ISM</u>
<u>Channels</u>	<u>Low</u>
<u>Signal</u>	<u>IEEE802.b (Crest factor: 1.0)</u>

B. SAR Measurement Results

Low Band SAR (Channel 1):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	2412.000000
Relative permittivity (real part)	54.716228
Relative permittivity (imaginary)	13.970050
Conductivity (S/m)	1.891390
Variation (%)	-0.320000
ConvF:	5.70

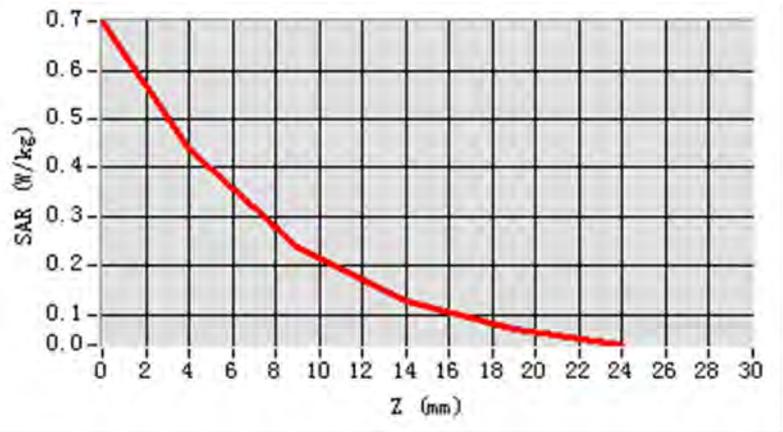


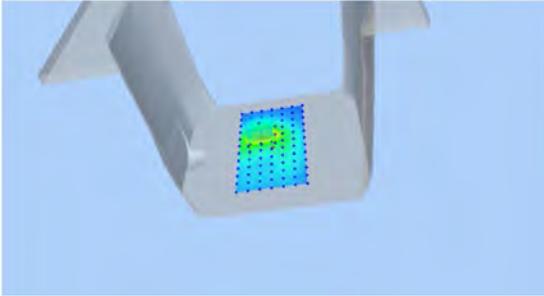
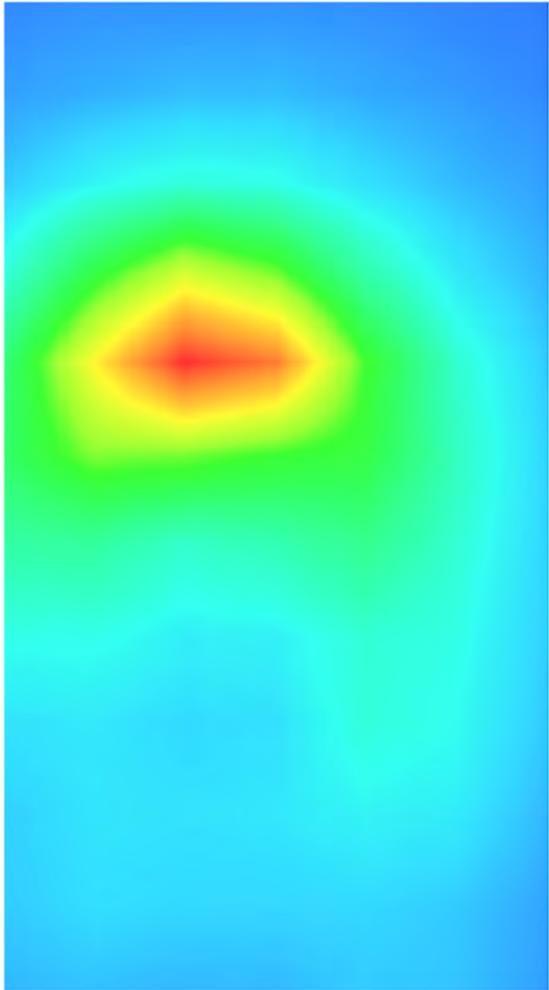
Maximum location: X=-13.00, Y=19.00

SAR Peak: 0.71 W/kg

SAR 10g (W/Kg)	0.195422
SAR 1g (W/Kg)	0.401524

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.7005	0.4401	0.2379	0.1277	0.0706



3D screen shot	Hot spot position
 <p>A 3D perspective view of a white, L-shaped device. A small rectangular area on the inner surface of the L is highlighted with a color-coded heatmap, showing a concentration of high SAR values (red and yellow) in the center, transitioning to lower values (green and blue) towards the edges.</p>	 <p>A 2D heatmap visualization of the SAR distribution. The color scale ranges from blue (low SAR) to red (high SAR). A prominent, roughly circular hot spot is visible in the upper-middle section, with a red core surrounded by yellow and green, indicating the highest SAR values in the region.</p>

Plot No	Band	Mode	Test Position	Channel	Battery
21	802.11b		Edge A	1	1

Type: Phone measurement

Date of measurement: 21/9/2016

Measurement duration: 20 minutes 21 seconds

Mobile Phone IMEI number: --

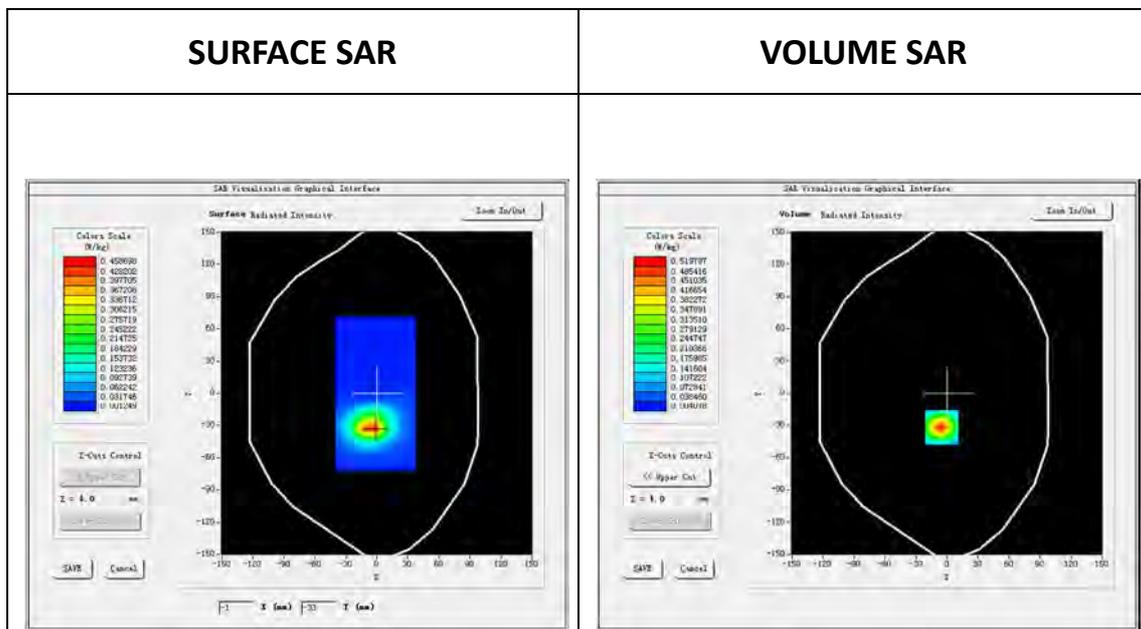
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=5mm dy=5mm</u>
<u>ZoomScan</u>	<u>7x7x8,dx=5mm dy=5mm dz=4mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11b ISM</u>
<u>Channels</u>	<u>Low</u>
<u>Signal</u>	<u>IEEE802.b (Crest factor: 1.0)</u>

B. SAR Measurement Results

Low Band SAR (Channel 1):

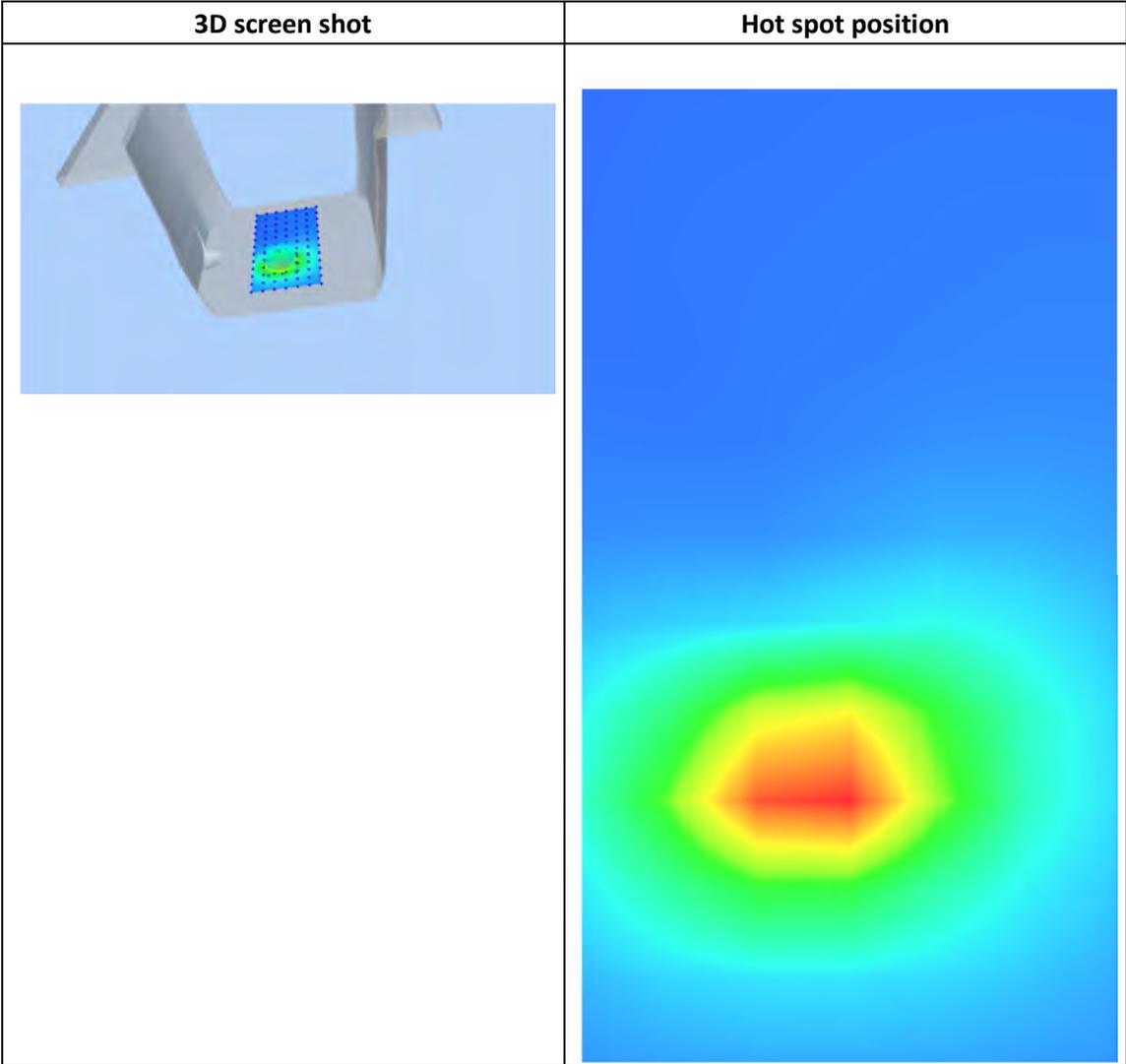
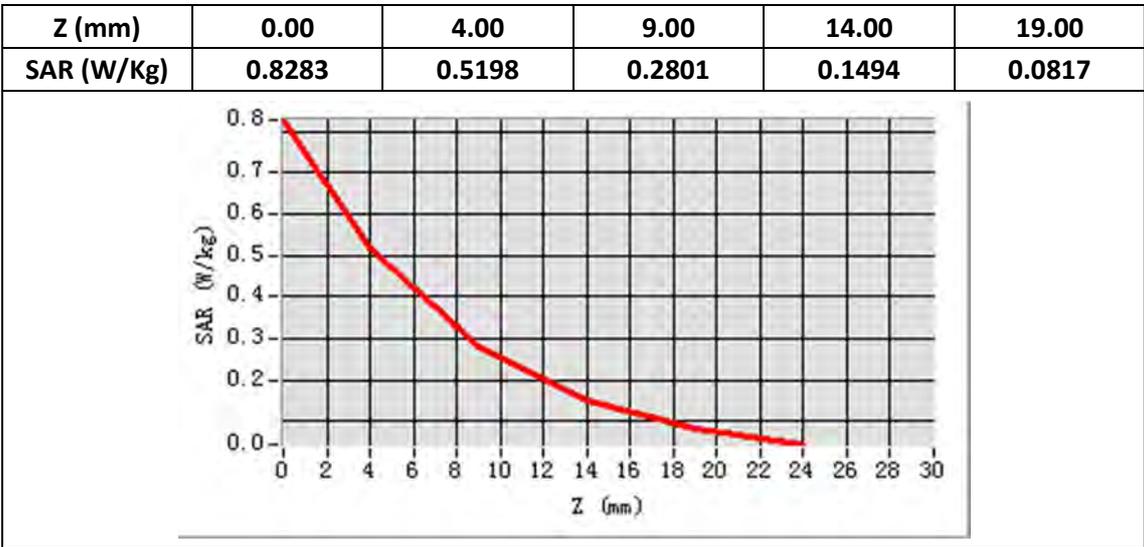
E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	2412.0
Relative permittivity (real part)	54.716228
Relative permittivity (imaginary)	13.970050
Conductivity (S/m)	1.891390
Variation (%)	0.830000
ConvF:	5.70



Maximum location: X=-5.00, Y=-32.00

SAR Peak: 0.83 W/kg

SAR 10g (W/Kg)	0.220708
SAR 1g (W/Kg)	0.469016



Plot No	Band	Mode	Test Position	Channel	Battery
21	BT	GFSK	Right Tilt	39	1

Type: Phone measurement

Date of measurement: 23/9/2016

Measurement duration: 20 minutes 11 seconds

Mobile Phone IMEI number: --

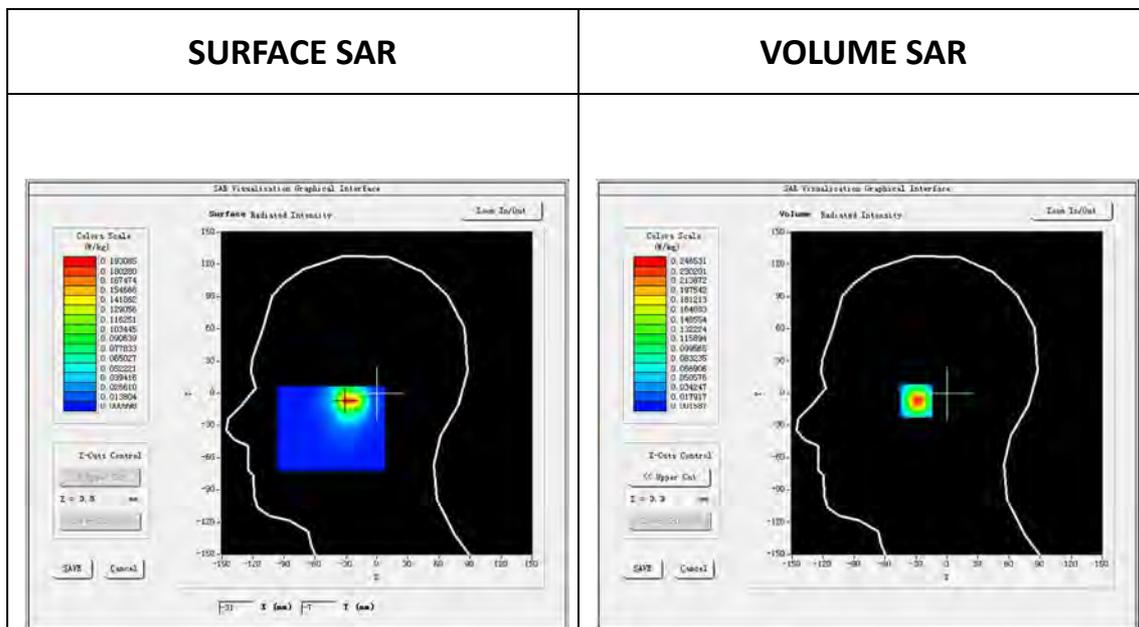
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=5mm dy=5mm</u>
<u>ZoomScan</u>	<u>7x7x8,dx=5mm dy=5mm dz=4mm</u>
<u>Phantom</u>	<u>Right head</u>
<u>Device Position</u>	<u>Tilt</u>
<u>Band</u>	<u>Bluetooth</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>Bluetooth (Crest factor: 30.67%)</u>

B.SAR Measurement Results

Middle Band SAR (Channel 39):

E-Field Probe	SATIMO SN_43/15_EP276
Frequency (MHz)	2441.0
Relative permittivity (real part)	38.581211
Relative permittivity (imaginary)	13.225210
Conductivity (S/m)	1.799363
Variation (%)	1.510000
ConvF:	5.52

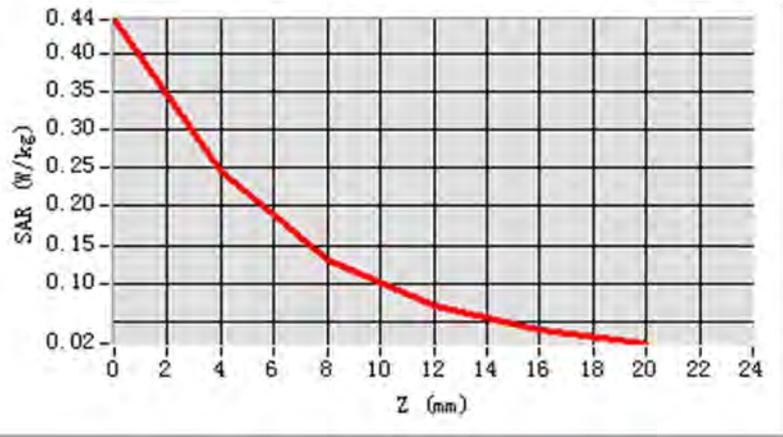


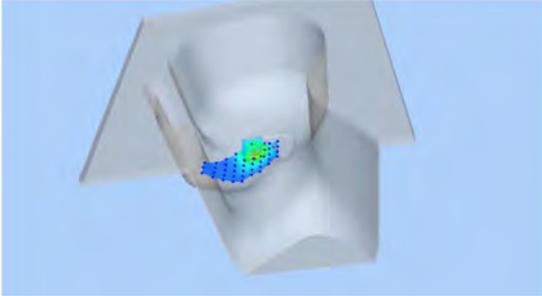
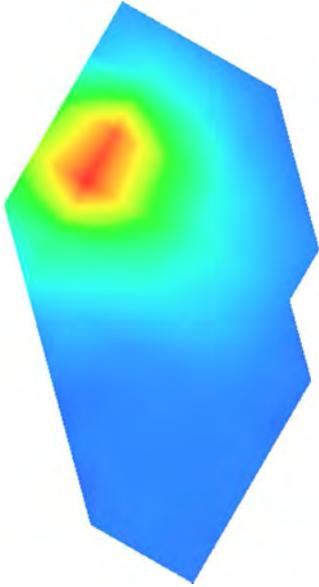
Maximum location: X=-28.00, Y=-7.00

SAR Peak: 0.45 W/kg

SAR 10g (W/Kg)	0.090840
SAR 1g (W/Kg)	0.218238

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.4432	0.2465	0.1320	0.0706	0.0395



3D screen shot	Hot spot position
	

Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.





SAR Reference Dipole Calibration Report

Ref : ACR.240.1.14.SATU.A

**CCIC SOUTHERN ELECTRONIC PRODUCT
TESTING (SHENZHEN) CO., LTD**
ELECTRONIC TESTING BUILDING, SHAHE ROAD, XILI
TOWN
SHENZHEN, P.R. CHINA (POST CODE:518055)
SATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 835 MHZ
SERIAL NO.: SN 09/13 DIP0G835-217

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



08/28/14

Summary:

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

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	8/29/2014	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	8/29/2014	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	8/29/2014	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	CCIC SOUTHERN ELECTRONIC PRODUCT TESTING (SHENZHEN) Co., Ltd

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	8/29/2014	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 835 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID835
Serial Number	SN 09/13 DIP0G835-217
Product Condition (new / used)	used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo’s COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

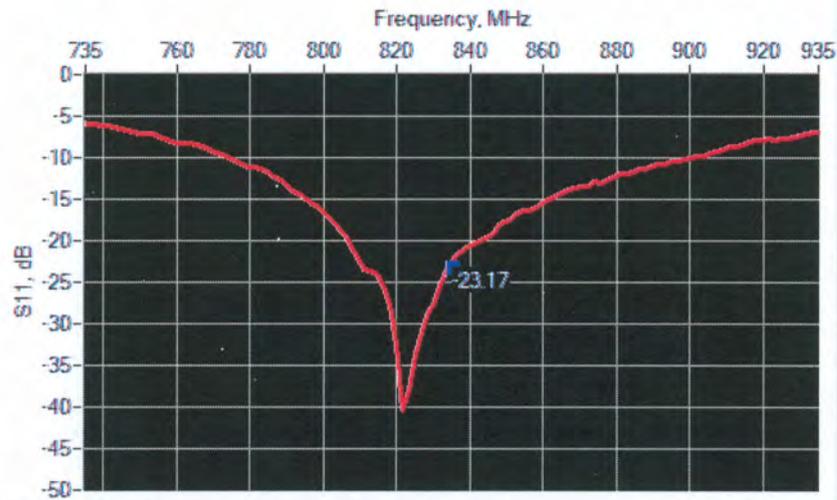
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

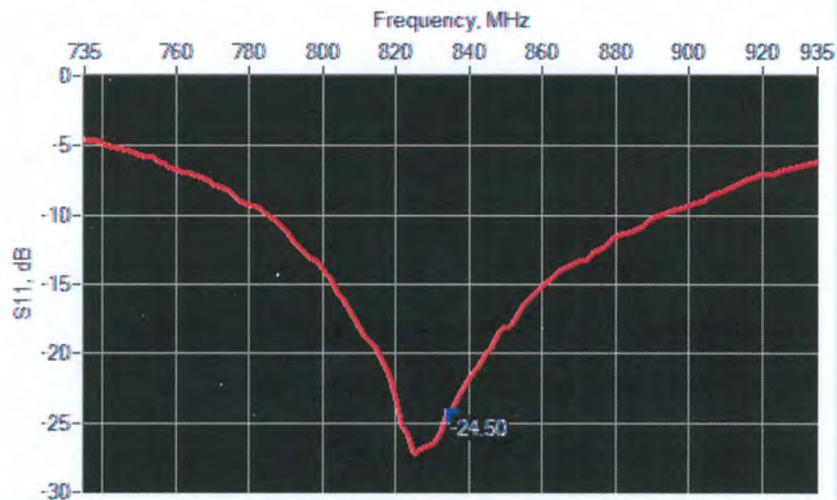
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-23.17	-20	57.4 Ω - 0.2 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-24.50	-20	55.0 Ω + 3.9 jΩ

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.	PASS	89.8 ±1 %.	PASS	3.6 ±1 %.	PASS

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

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %	PASS	0.90 ±5 %	PASS
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	

2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

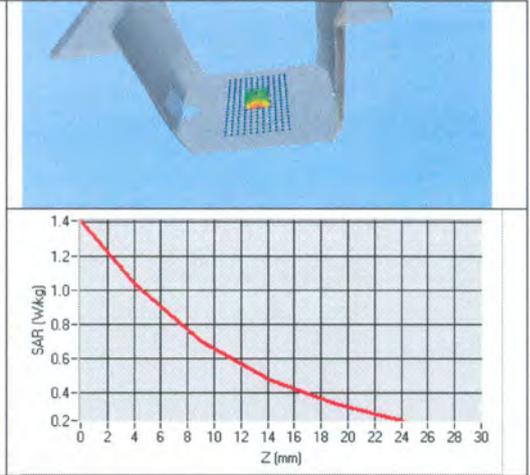
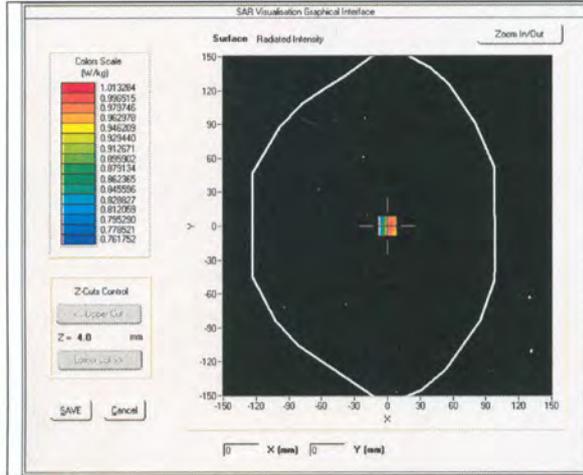
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_p' : 42.3 σ : 0.92
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56	9.77 (0.98)	6.22	6.30 (0.63)
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	

2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

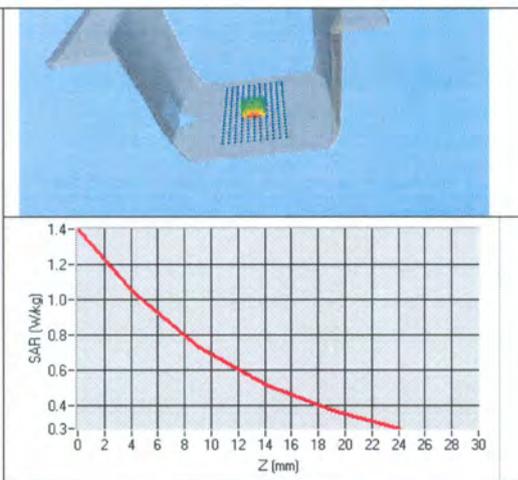
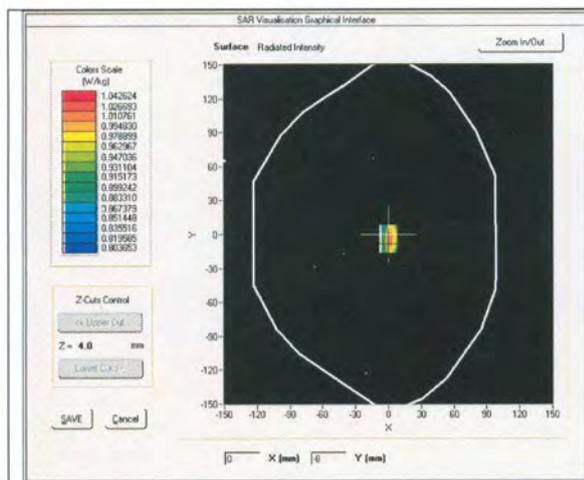
Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %	PASS	0.97 ±5 %	PASS
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	

5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 54.1 sigma : 0.97
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
835	10.31 (1.03)	6.74 (0.67)



8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Calipers	Carrera	CALIPER-01	12/2013	12/2016
Reference Probe	Satimo	EPG122 SN 18/11	10/2013	10/2014
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015



SAR Reference Dipole Calibration Report

Ref : ACR.240.3.14.SATU.A

**CCIC SOUTHERN ELECTRONIC PRODUCT
TESTING (SHENZHEN) CO., LTD
ELECTRONIC TESTING BUILDING, SHAHE ROAD, XILI
TOWN**

**SHENZHEN, P.R. CHINA (POST CODE:518055)
SATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 1800 MHZ
SERIAL NO.: SN 09/13 DIP1G800-216**

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



08/28/14

Summary:

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

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	8/29/2014	<i>JL</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	8/29/2014	<i>JL</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	8/29/2014	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	CCIC SOUTHERN ELECTRONIC PRODUCT TESTING (SHENZHEN) Co., Ltd

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	8/29/2014	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1800
Serial Number	SN 09/13 DIP1G800-216
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo’s COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – Satimo COMOSAR Validation Dipole

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

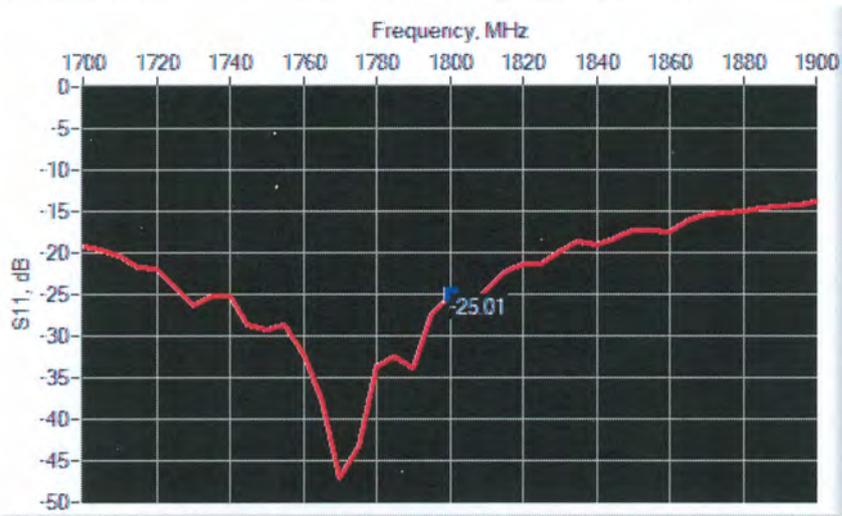
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

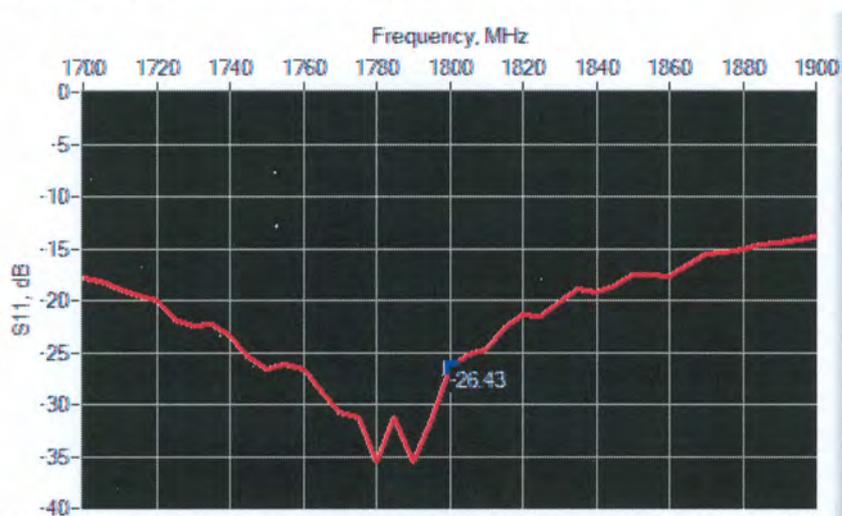
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-25.01	-20	46.7 Ω + 4.5 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-26.43	-20	45.8 Ω + 1.3 jΩ

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	

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

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %	PASS	1.40 ±5 %	PASS
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	

2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

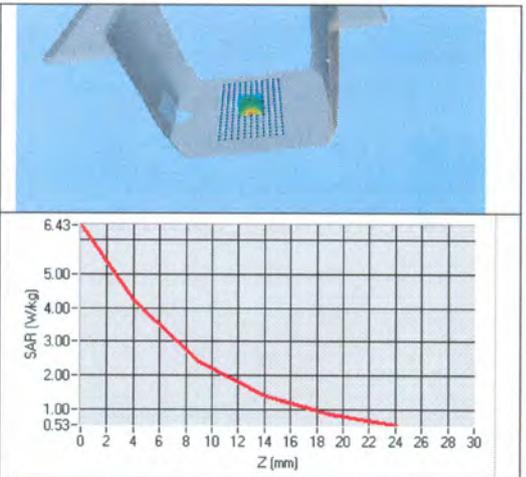
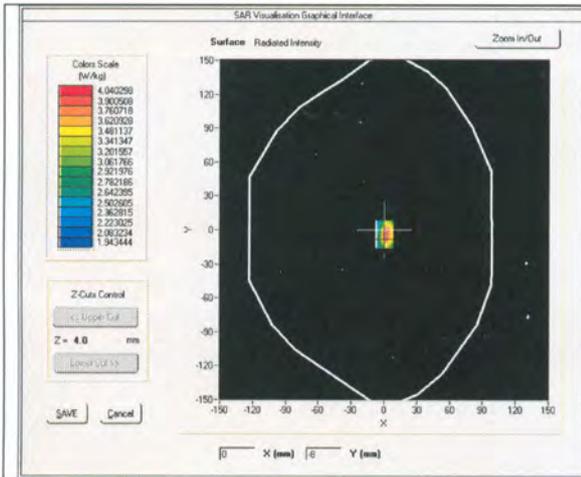
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 41.3 sigma : 1.38
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4	38.67 (3.87)	20.1	20.30 (2.03)
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	

2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

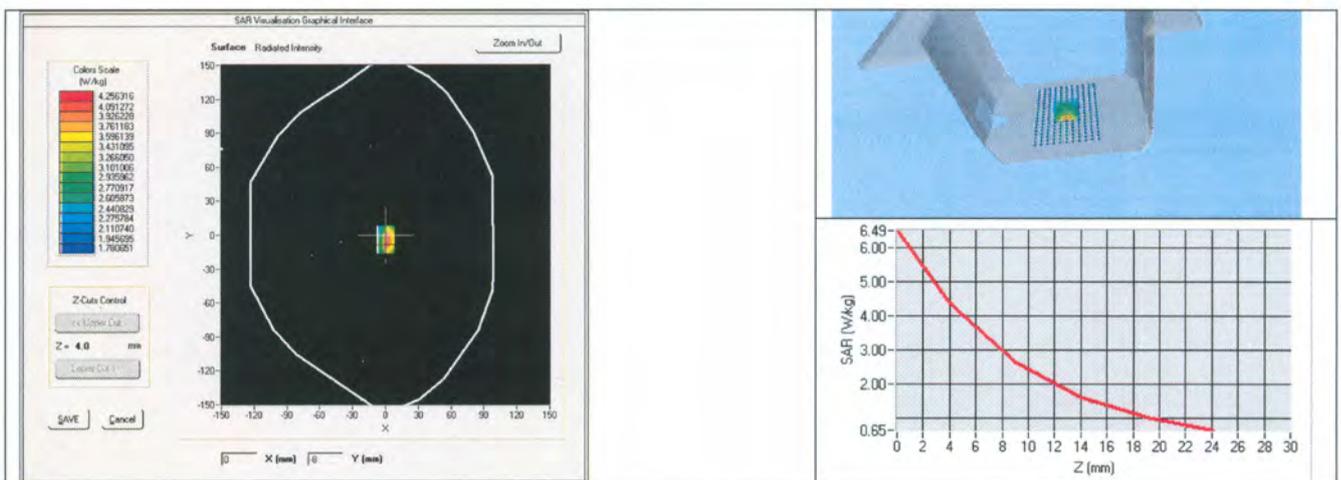
Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %	PASS	1.52 ±5 %	PASS
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	

5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 53.3 sigma : 1.51
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1800	40.07 (4.01)	21.27 (2.13)



8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Calipers	Carrera	CALIPER-01	12/2013	12/2016
Reference Probe	Satimo	EPG122 SN 18/11	10/2013	10/2014
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015



SAR Reference Dipole Calibration Report

Ref : ACR.240.4.14.SATU.A

**CCIC SOUTHERN ELECTRONIC PRODUCT
TESTING (SHENZHEN) CO., LTD**
ELECTRONIC TESTING BUILDING, SHAHE ROAD, XILI
TOWN
SHENZHEN, P.R. CHINA (POST CODE:518055)
SATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 1900 MHZ
SERIAL NO.: SN 09/13 DIP1G900-218

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



08/28/14

Summary:

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

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	8/29/2014	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	8/29/2014	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	8/29/2014	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	CCIC SOUTHERN ELECTRONIC PRODUCT TESTING (SHENZHEN) Co., Ltd

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	8/29/2014	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1900 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1900
Serial Number	SN 09/13 DIP1G900-218
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %