

Fig.4-1 Z-Scan at power reference point (1900 MHz CH810)

1900 Body Front High with Headset – AP OFF

Date: 2013-2-22

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used: $f = 1910$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 52.007$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.1°C

Communication System: GSM 1900MHz Frequency: 1909.8 MHz Duty Cycle: 1:8.3

Probe: ES3DV3 - SN3149 ConvF(4.64, 4.64, 4.64)

Front High/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.22 mW/g

Front High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.079 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.735 mW/g

SAR(1 g) = 1.1 mW/g; SAR(10 g) = 0.623 mW/g

Maximum value of SAR (measured) = 1.22 mW/g

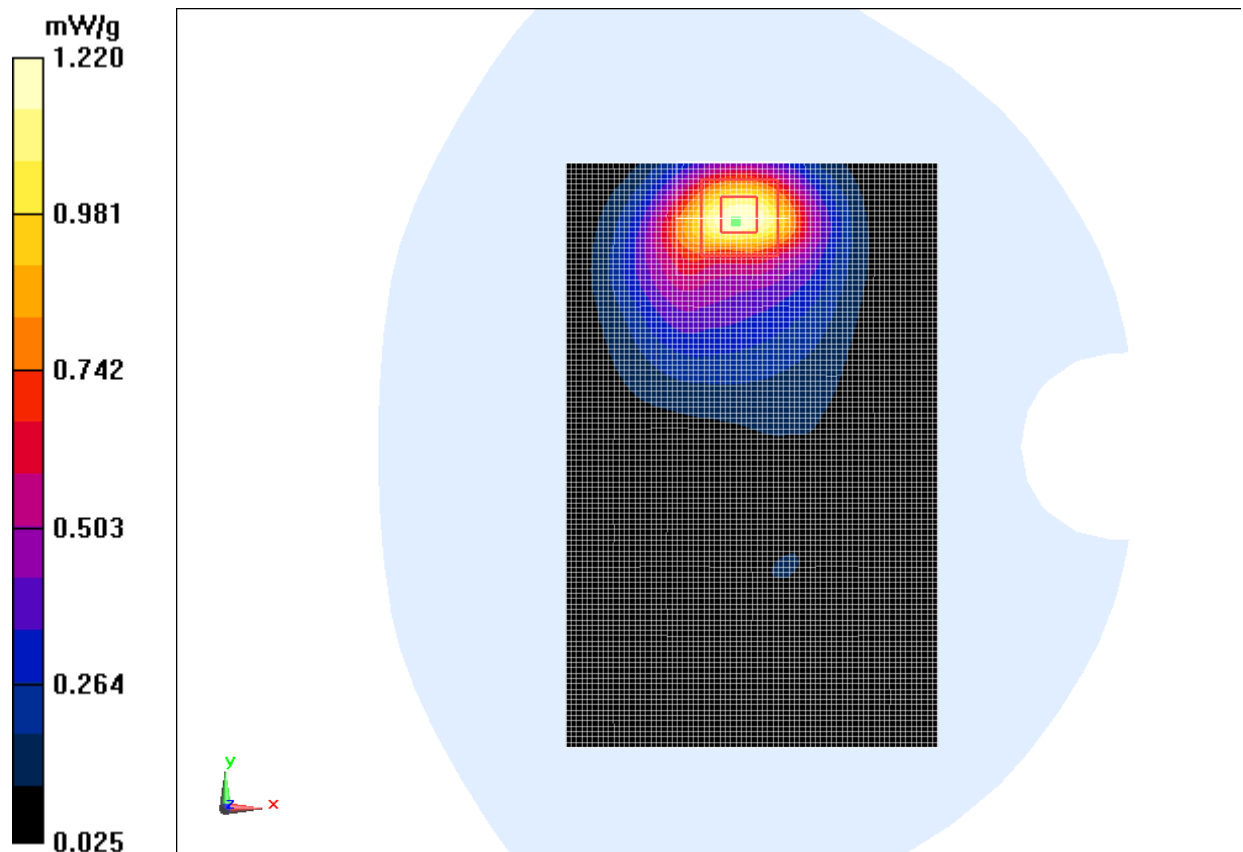


Fig.5 1900 MHz CH810

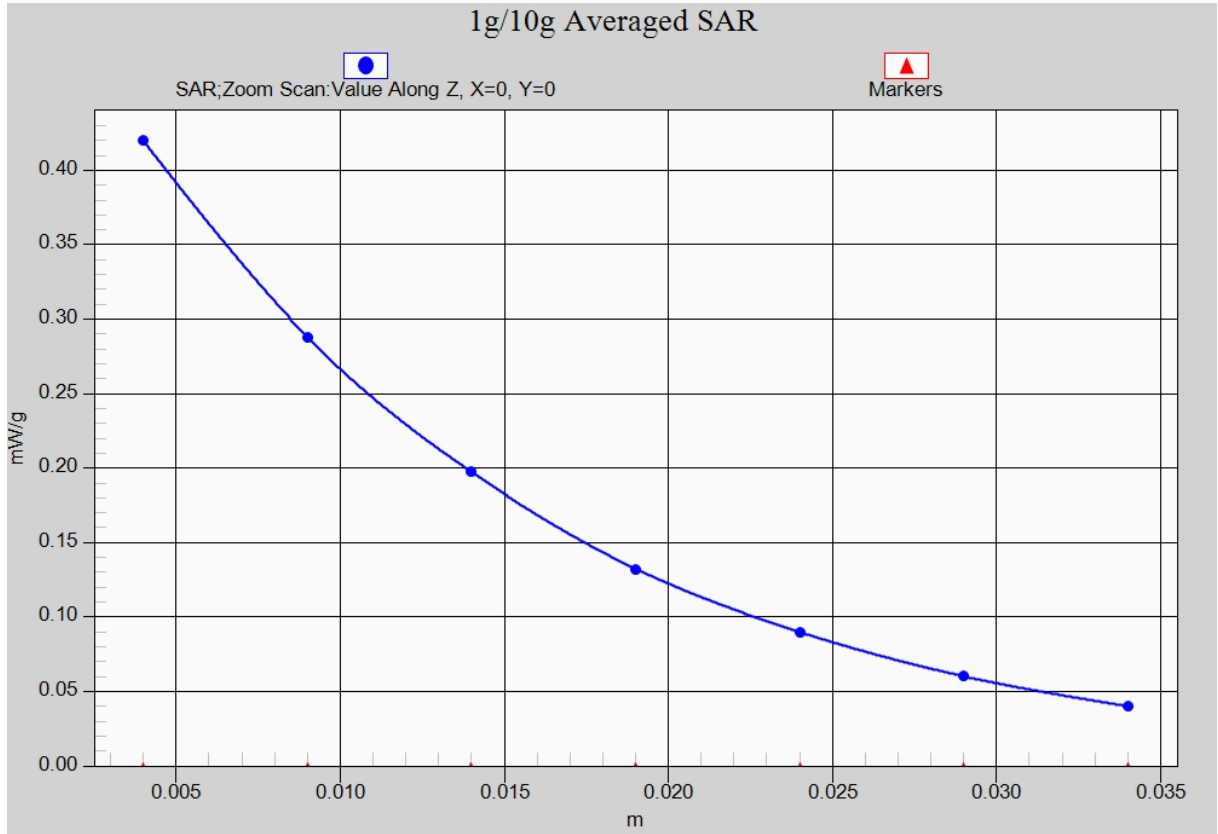


Fig.5-1 Z-Scan at power reference point (1900 MHz CH810)

WCDMA 850 Left Cheek High – AP OFF

Date: 2013-2-20

Electronics: DAE4 Sn771

Medium: Head 850 MHz

Medium parameters used (interpolated): $f = 846.6$ MHz; $\sigma = 0.893$ mho/m; $\epsilon_r = 40.183$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C

Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(6.26, 6.26, 6.26)

Cheek High/Area Scan (61x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.649 W/kg

Cheek High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.074 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.761 W/kg

SAR(1 g) = 0.607 W/kg; SAR(10 g) = 0.470 W/kg

Maximum value of SAR (measured) = 0.635 W/kg

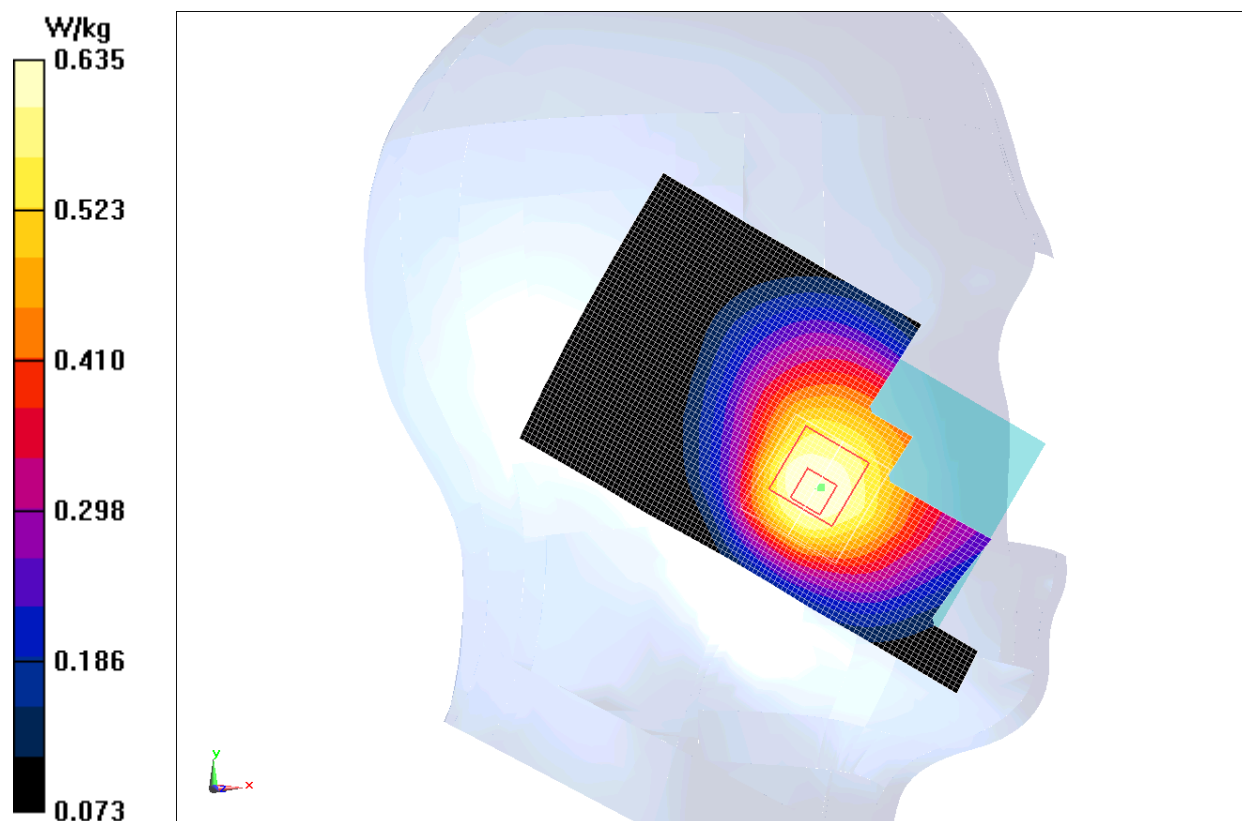


Fig.6 WCDMA 850 CH4233

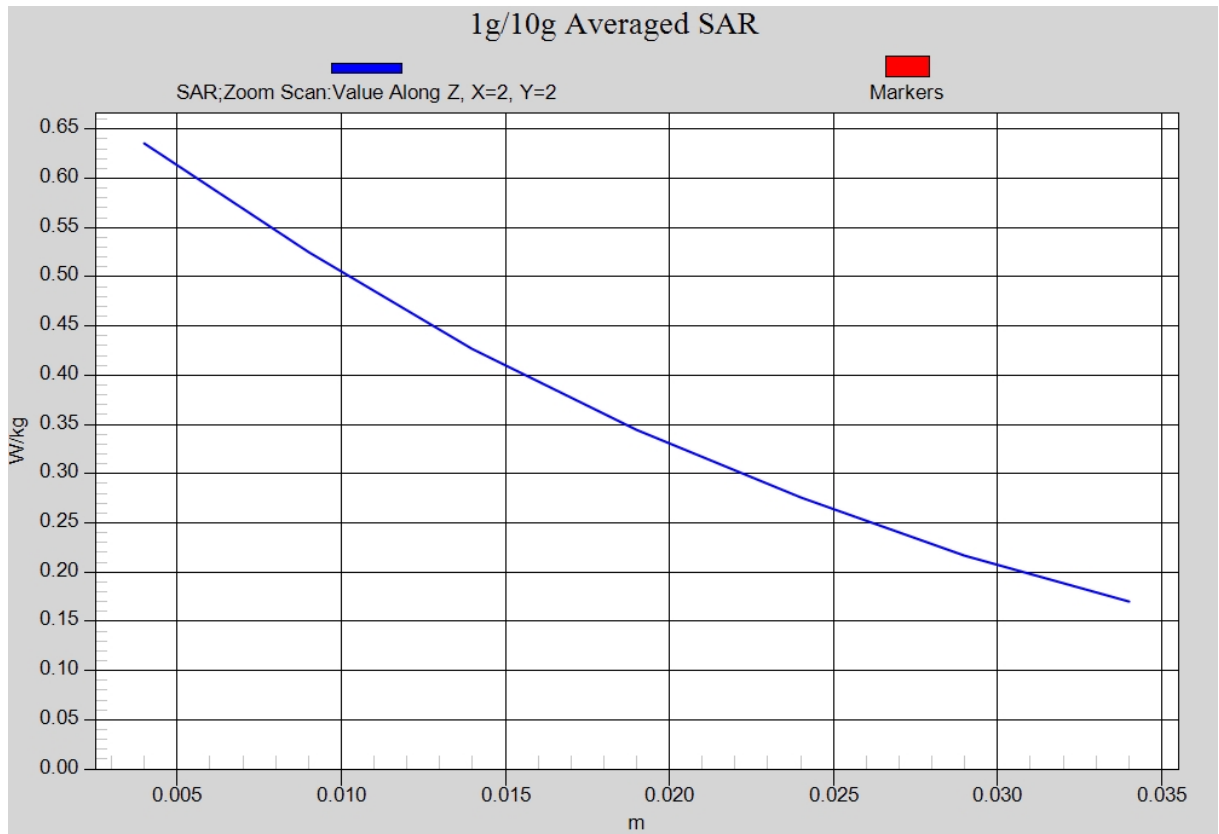


Fig. 6-1 Z-Scan at power reference point (WCDMA 850 CH4233)

WCDMA 850 Body Front High – AP OFF

Date: 2013-2-20

Electronics: DAE4 Sn771

Medium: Body 850 MHz

Medium parameters used (interpolated): $f = 846.6$ MHz; $\sigma = 0.997$ mho/m; $\epsilon_r = 56.667$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C

Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(6.14, 6.14, 6.14)

Front High/Area Scan (61x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.776 W/kg

Front High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 23.686 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.904 W/kg

SAR(1 g) = 0.722 W/kg; SAR(10 g) = 0.548 W/kg

Maximum value of SAR (measured) = 0.762 W/kg



Fig.7 WCDMA 850 CH4233

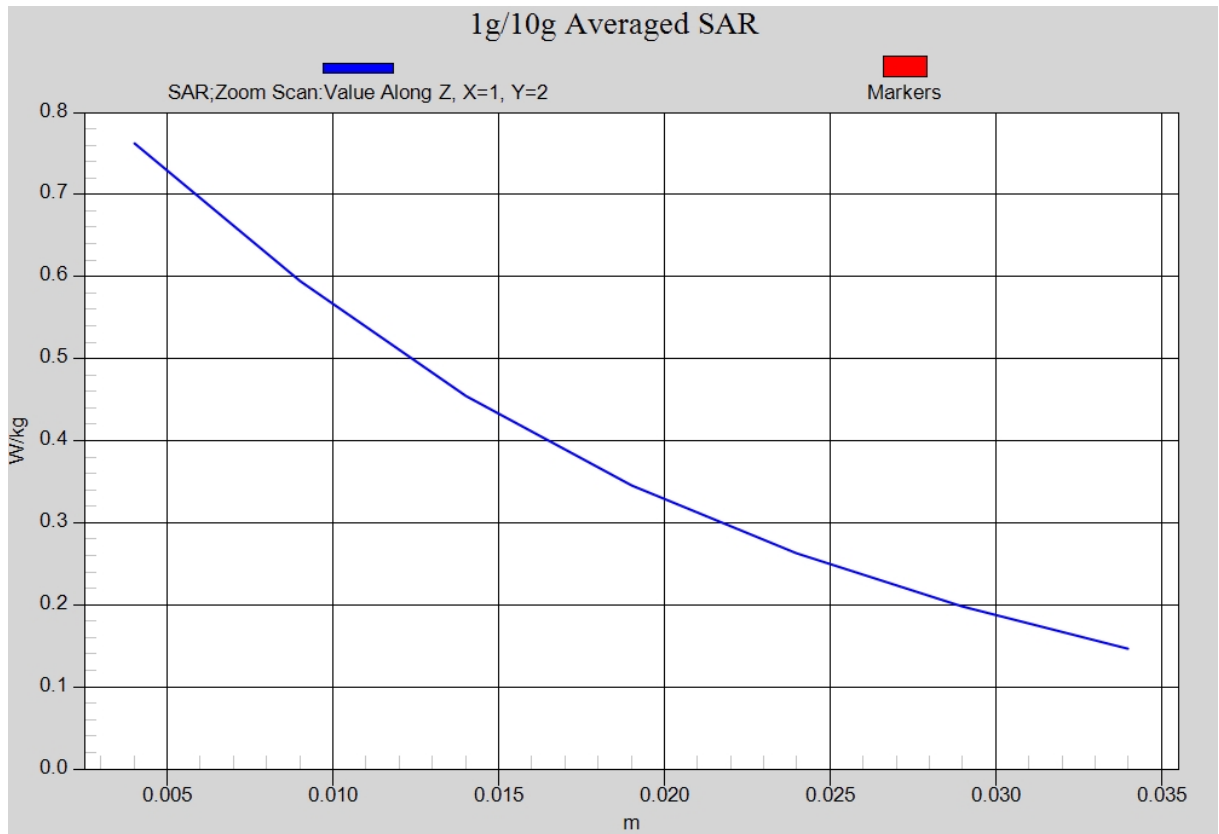


Fig. 7-1 Z-Scan at power reference point (WCDMA850 CH4233)

WCDMA 1700 Left Cheek Middle – AP OFF

Date: 2013-2-21

Electronics: DAE4 Sn771

Medium: Head 1750 MHz

Medium parameters used (interpolated): $f = 1732.4$ MHz; $\sigma = 1.361$ mho/m; $\epsilon_r = 39.835$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: WCDMA 1700 Frequency: 1732.4 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(5.23, 5.23, 5.23)

Cheek Middle/Area Scan (61x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.631 mW/g

Cheek Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.557 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.862 mW/g

SAR(1 g) = 0.601 mW/g; SAR(10 g) = 0.388 mW/g

Maximum value of SAR (measured) = 0.637 mW/g

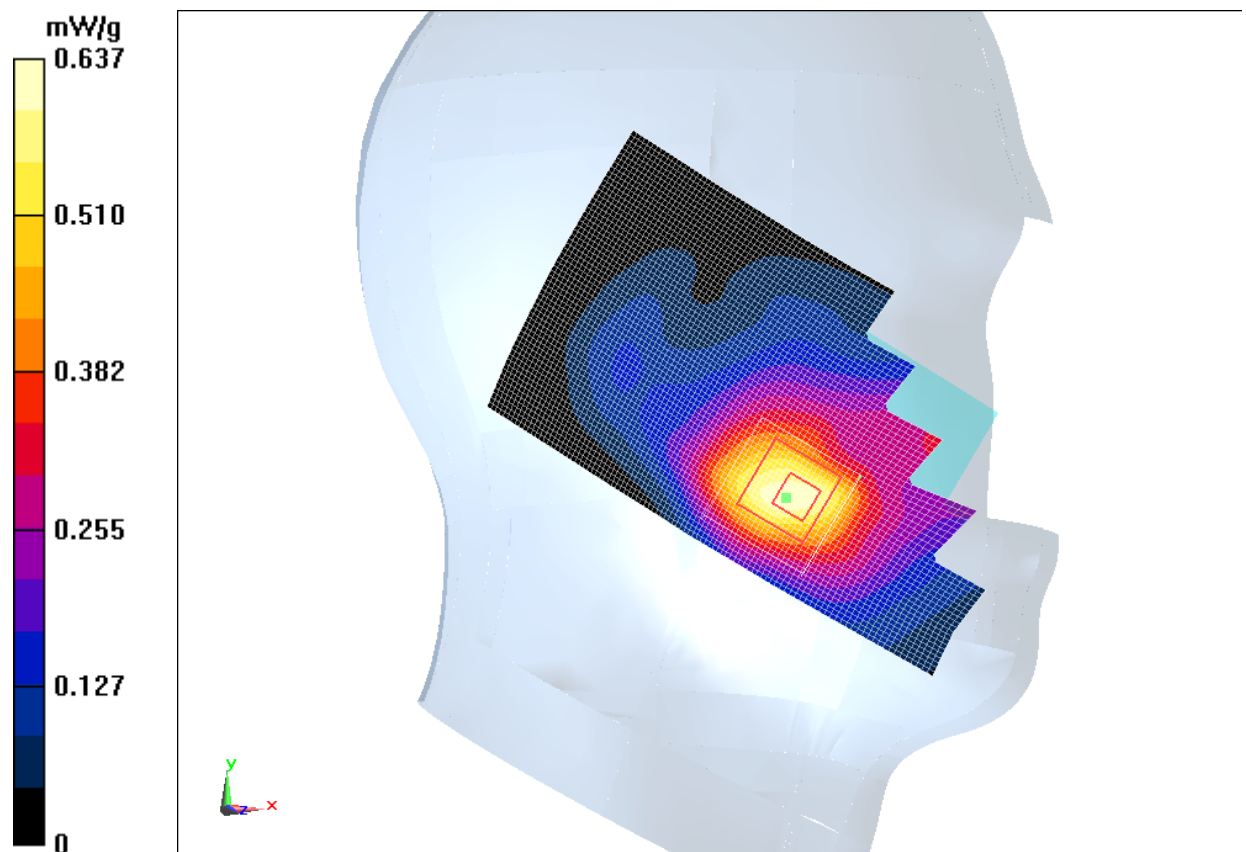


Fig.8 1700MHz CH1412

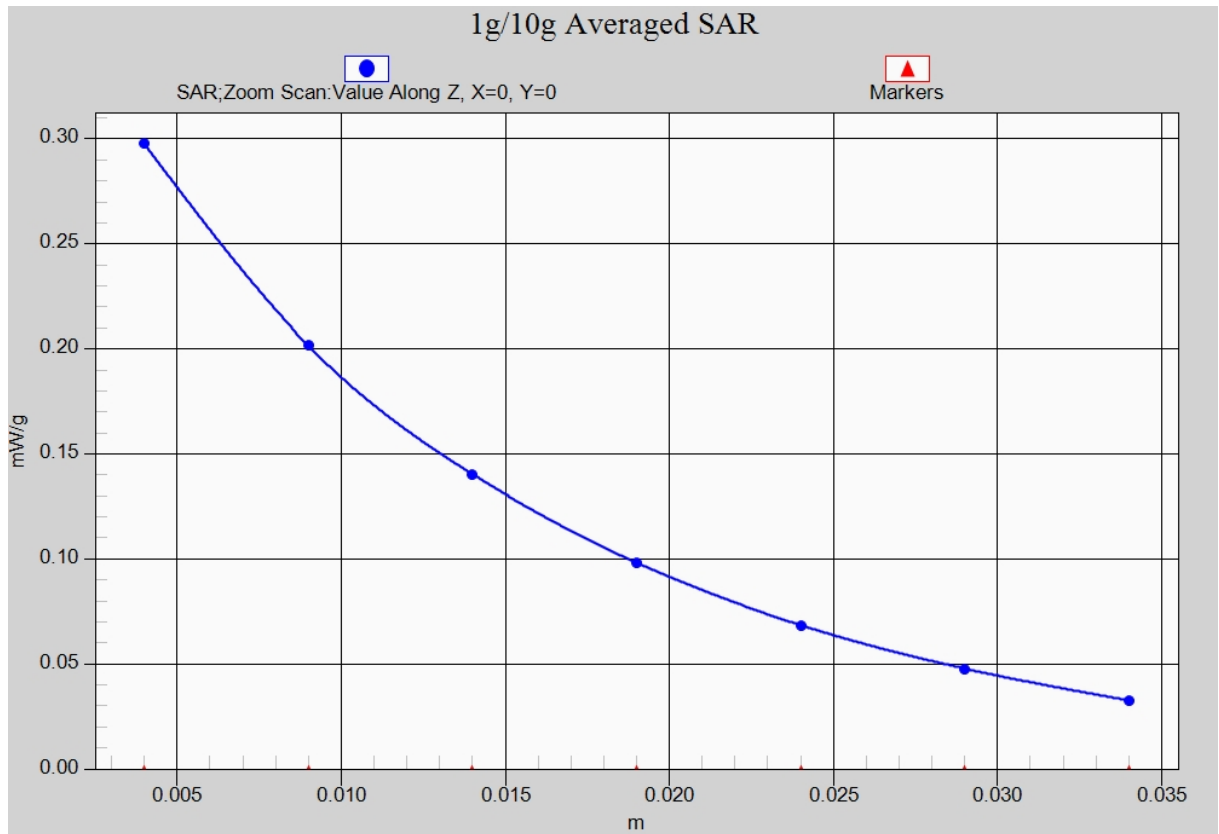


Fig. 8-1 Z-Scan at power reference point (1700 MHz CH1412)

WCDMA 1700 Body Front Middle – AP ON

Date: 2013-2-21

Electronics: DAE4 Sn771

Medium: Body 1750 MHz

Medium parameters used (interpolated): $f = 1732.4$ MHz; $\sigma = 1.504$ mho/m; $\epsilon_r = 54.284$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: WCDMA 1700 Frequency: 1732.4 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.84, 4.84, 4.84)

Front Middle/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.728 mW/g

Front Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.833 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 1.076 mW/g

SAR(1 g) = 0.709 mW/g; SAR(10 g) = 0.415 mW/g

Maximum value of SAR (measured) = 0.805 mW/g

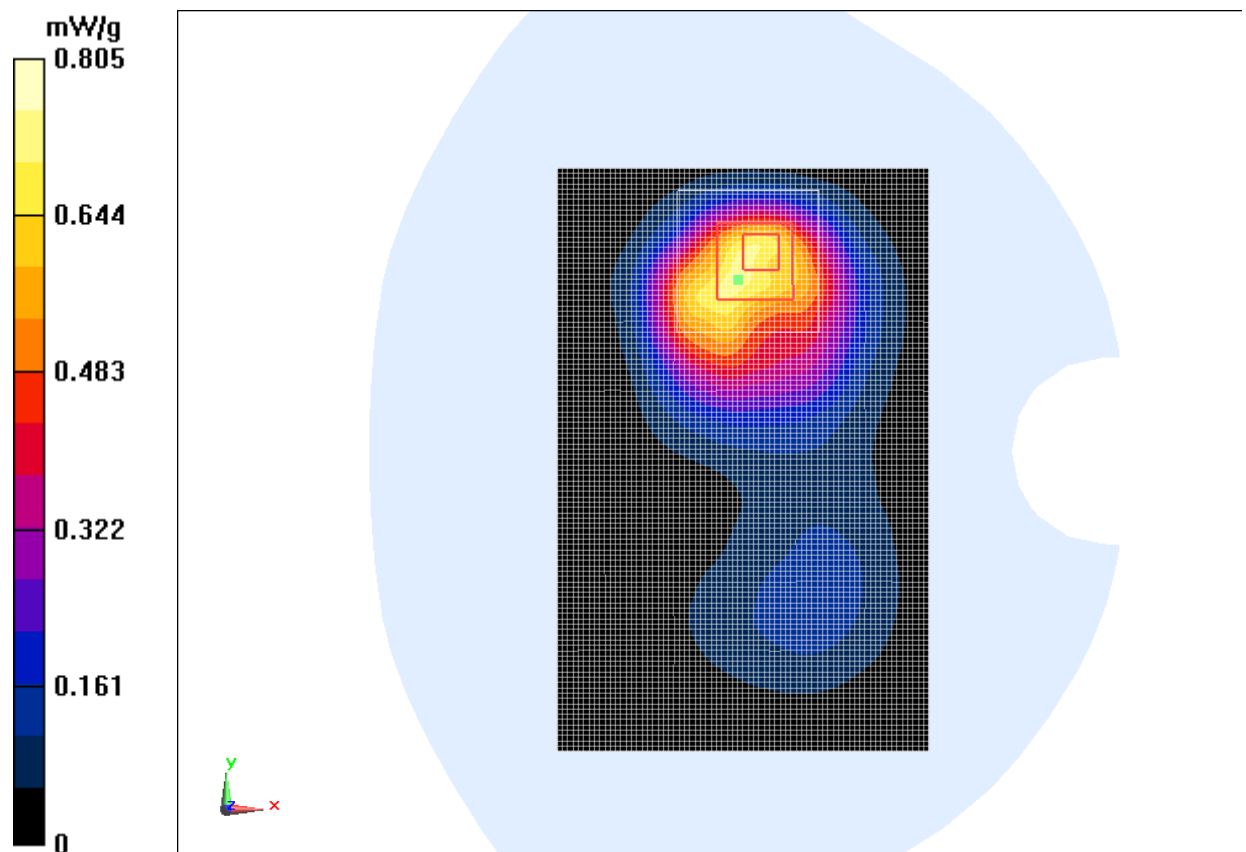


Fig.9 1700 MHz CH1412

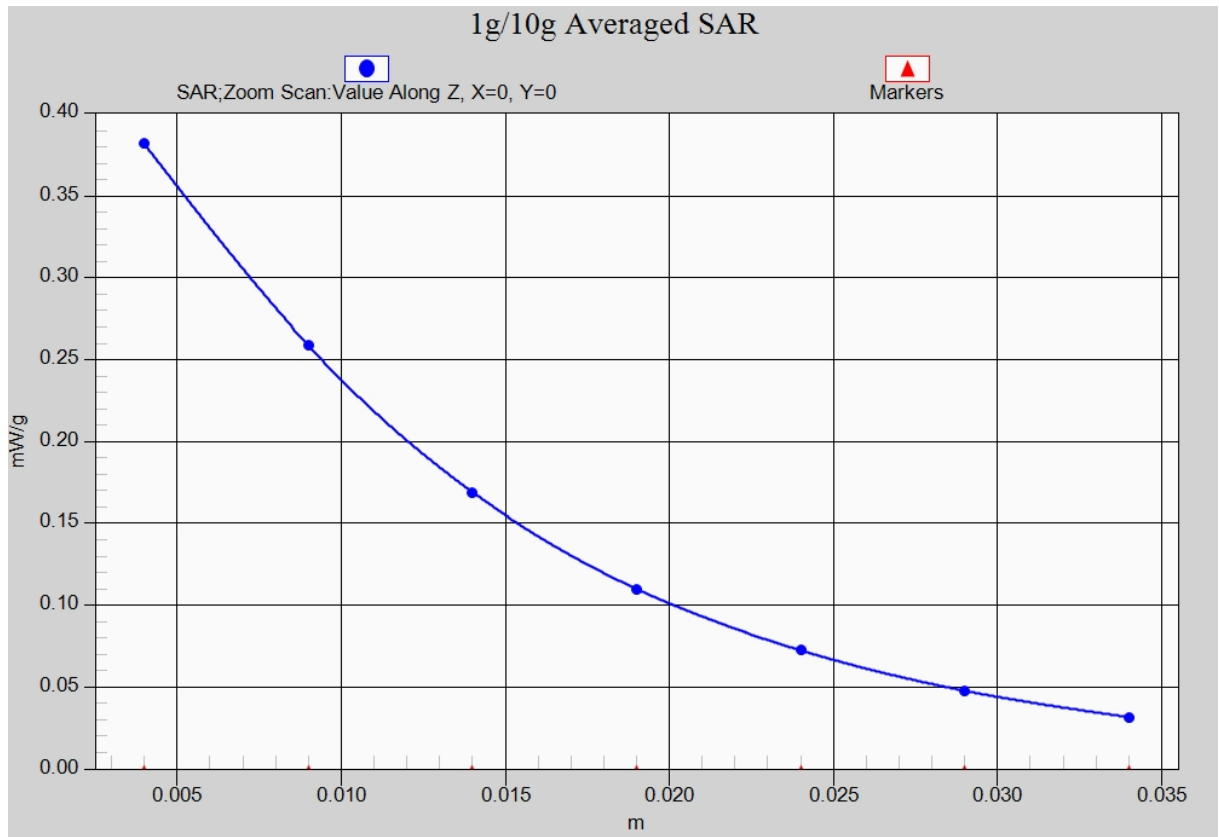


Fig. 9-1 Z-Scan at power reference point (1700 MHz CH1412)

WCDMA 1700 Body Front Middle – AP OFF

Date: 2013-2-21

Electronics: DAE4 Sn771

Medium: Body 1750 MHz

Medium parameters used (interpolated): $f = 1732.4$ MHz; $\sigma = 1.504$ mho/m; $\epsilon_r = 54.284$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: WCDMA 1700 Frequency: 1732.4 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.84, 4.84, 4.84)

Front Middle/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.14 mW/g

Front Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.691 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 1.529 mW/g

SAR(1 g) = 1.05 mW/g; SAR(10 g) = 0.640 mW/g

Maximum value of SAR (measured) = 1.15 mW/g

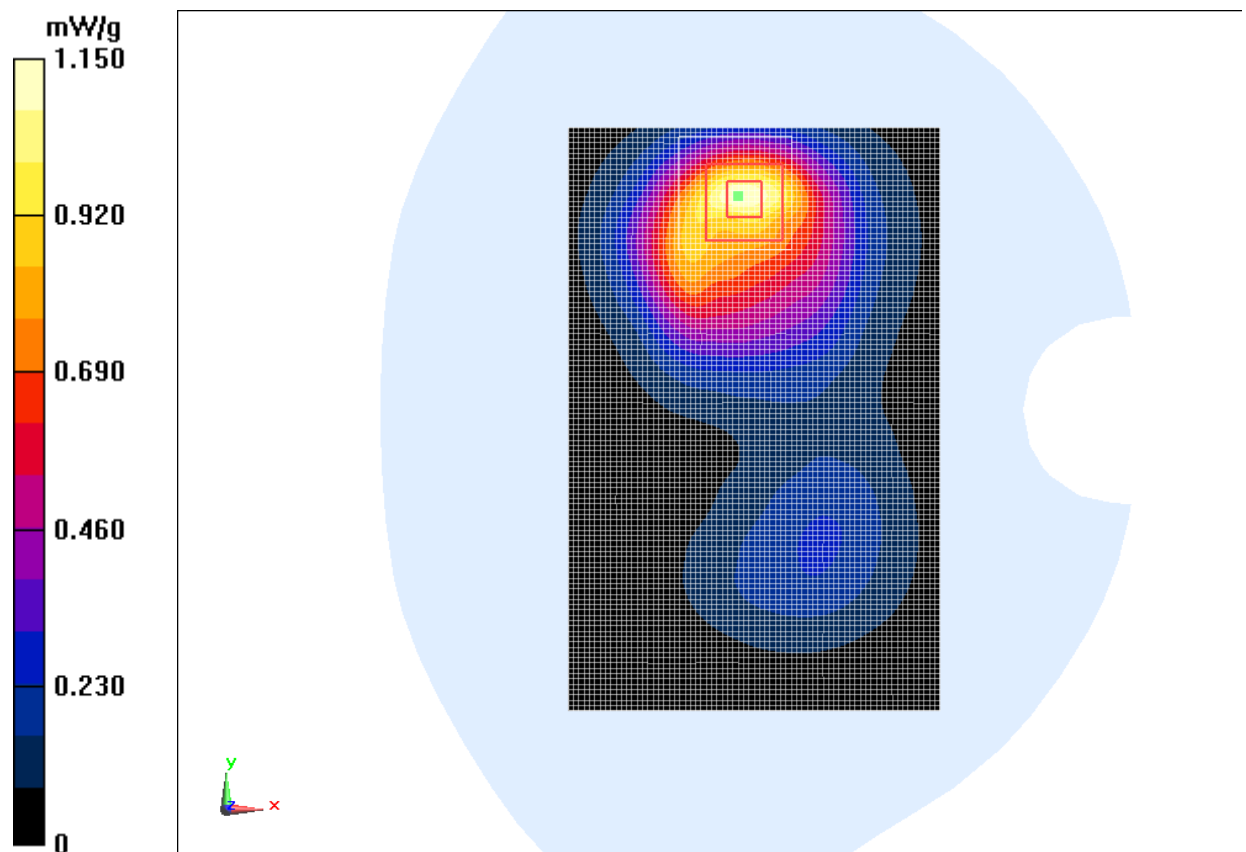


Fig.10 1700 MHz CH1412

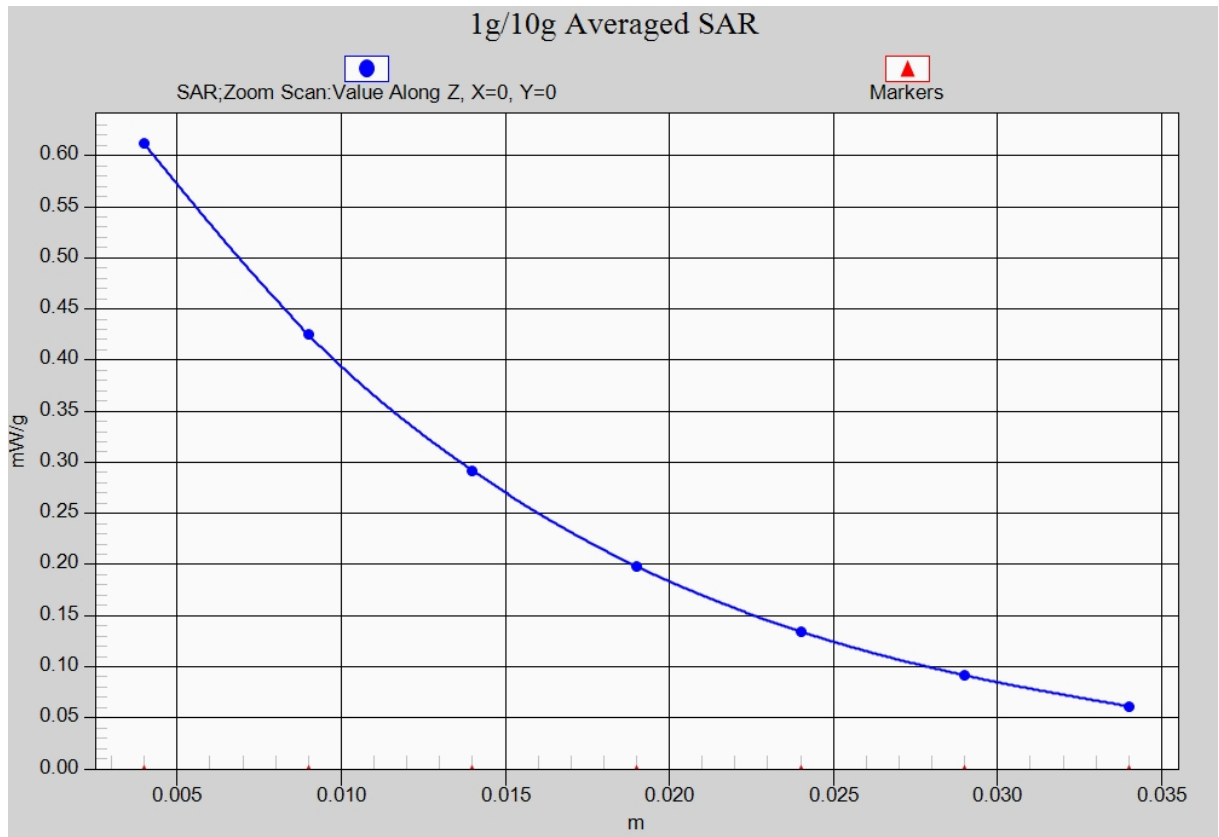


Fig. 10-1 Z-Scan at power reference point (1700 MHz CH1412)

WCDMA 1900 Left Cheek High – AP OFF

Date: 2013-2-22

Electronics: DAE4 Sn771

Medium: Head 1900 MHz

Medium parameters used: $f = 1907.6$ MHz; $\sigma = 1.419$ mho/m; $\epsilon_r = 39.172$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.1°C

Communication System: WCDMA 1900 Frequency: 1907.6 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(5.19, 5.19, 5.19)

Cheek High/Area Scan (61x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.583 mW/g

Cheek High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.848 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.772 mW/g

SAR(1 g) = 0.532 mW/g; SAR(10 g) = 0.340 mW/g

Maximum value of SAR (measured) = 0.561 mW/g

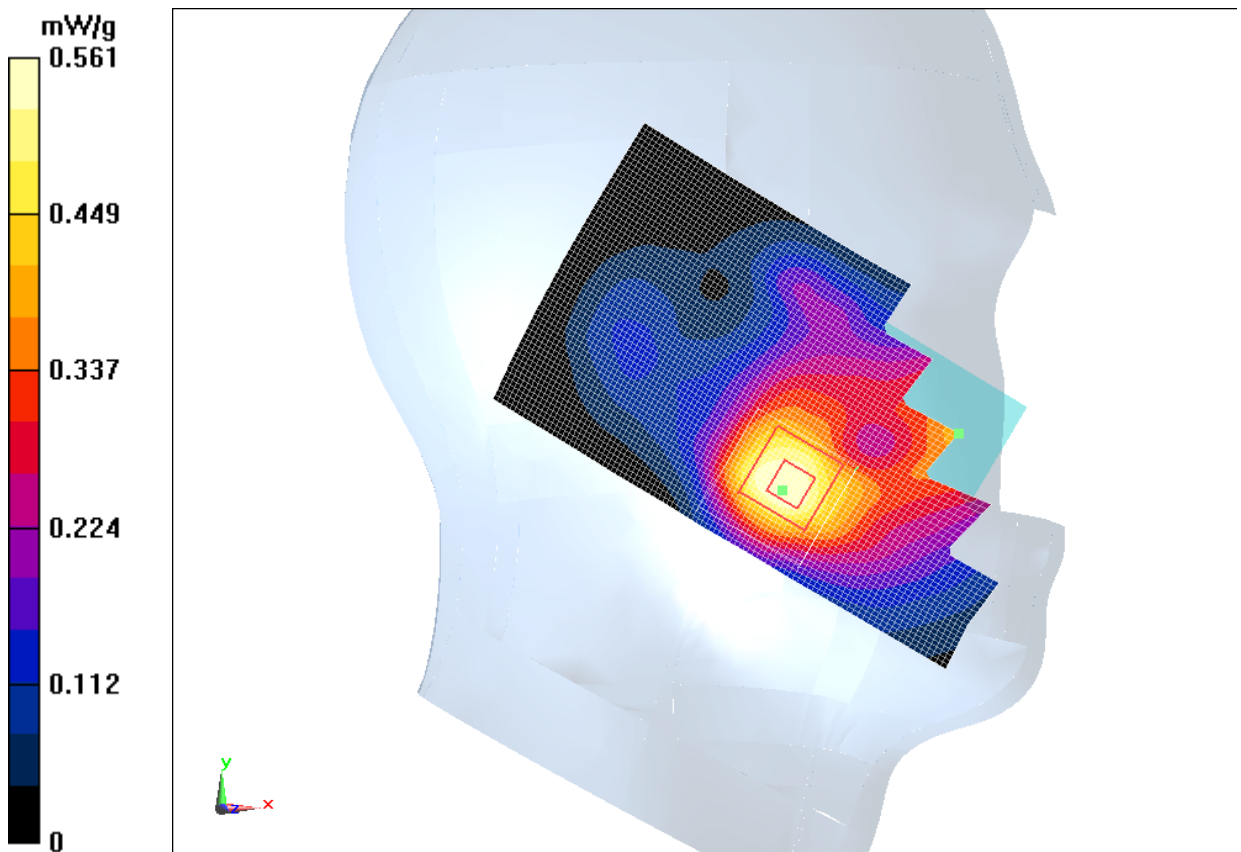


Fig.11 WCDMA1900 CH9538

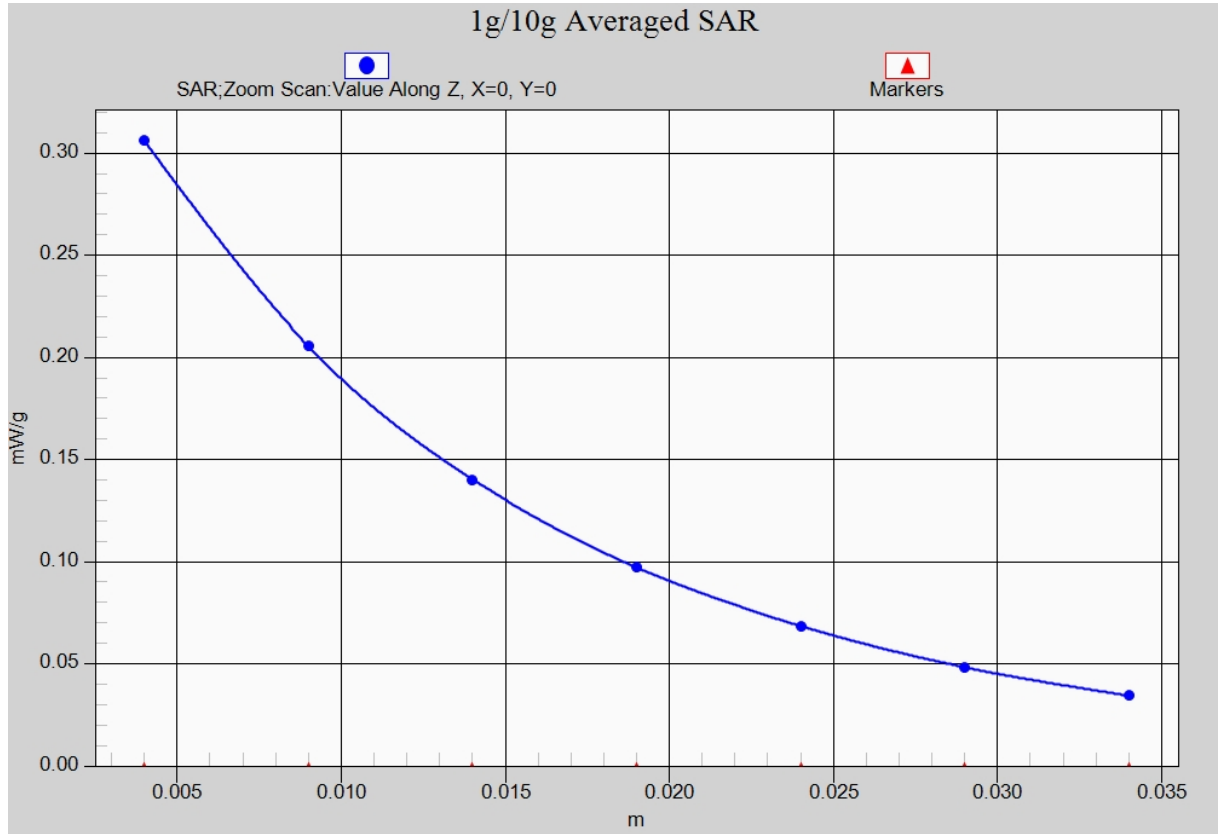


Fig. 11-1 Z-Scan at power reference point (WCDMA1900 CH9538)

WCDMA 1900 Body Bottom Edge High – AP ON

Date: 2013-2-22

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used (interpolated): $f = 1907.6$ MHz; $\sigma = 1.559$ mho/m; $\epsilon_r = 52.017$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.1°C

Communication System: WCDMA 1900 Frequency: 1907.6 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.64, 4.64, 4.64)

Bottom Edge High/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.29 mW/g

Bottom Edge High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 29.220 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 1.928 mW/g

SAR(1 g) = 1.16 mW/g; SAR(10 g) = 0.614 mW/g

Maximum value of SAR (measured) = 1.31 mW/g

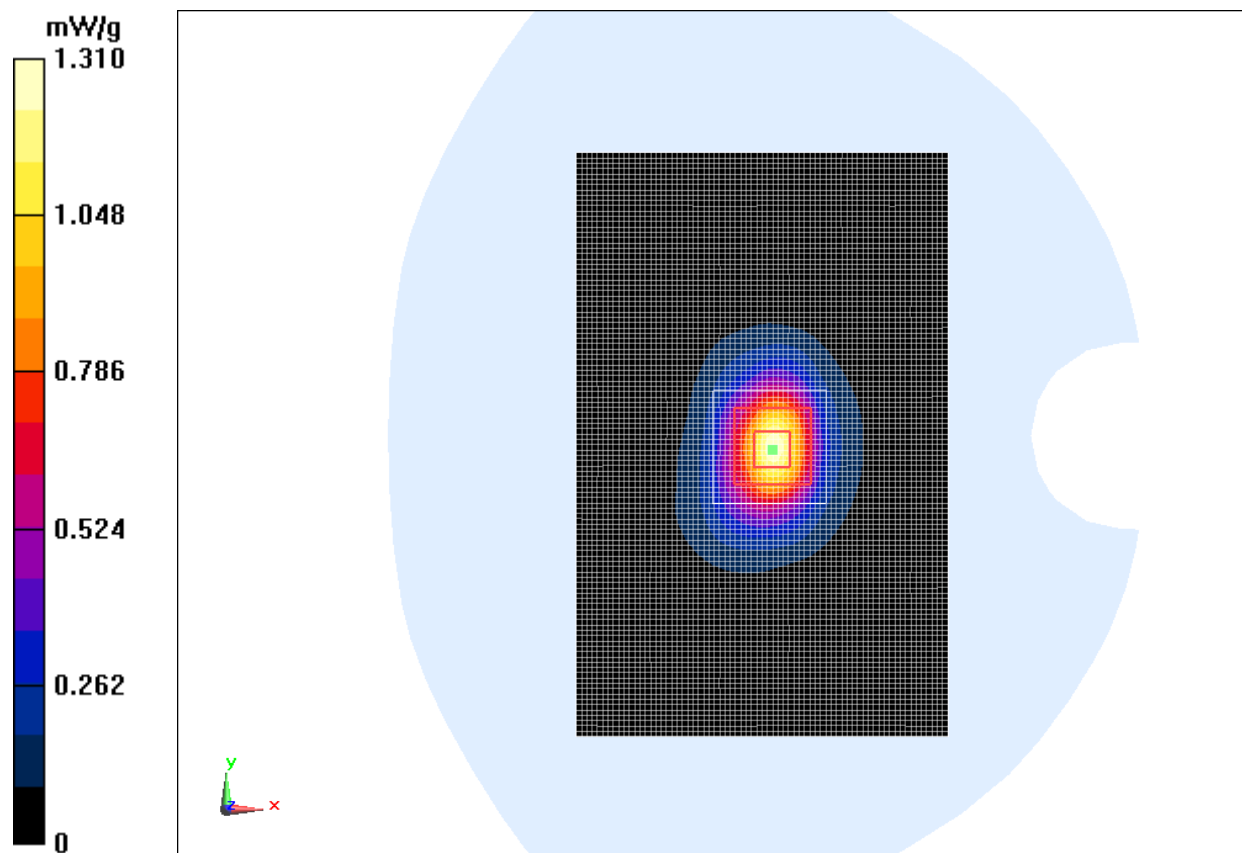


Fig.12 WCDMA1900 CH9538

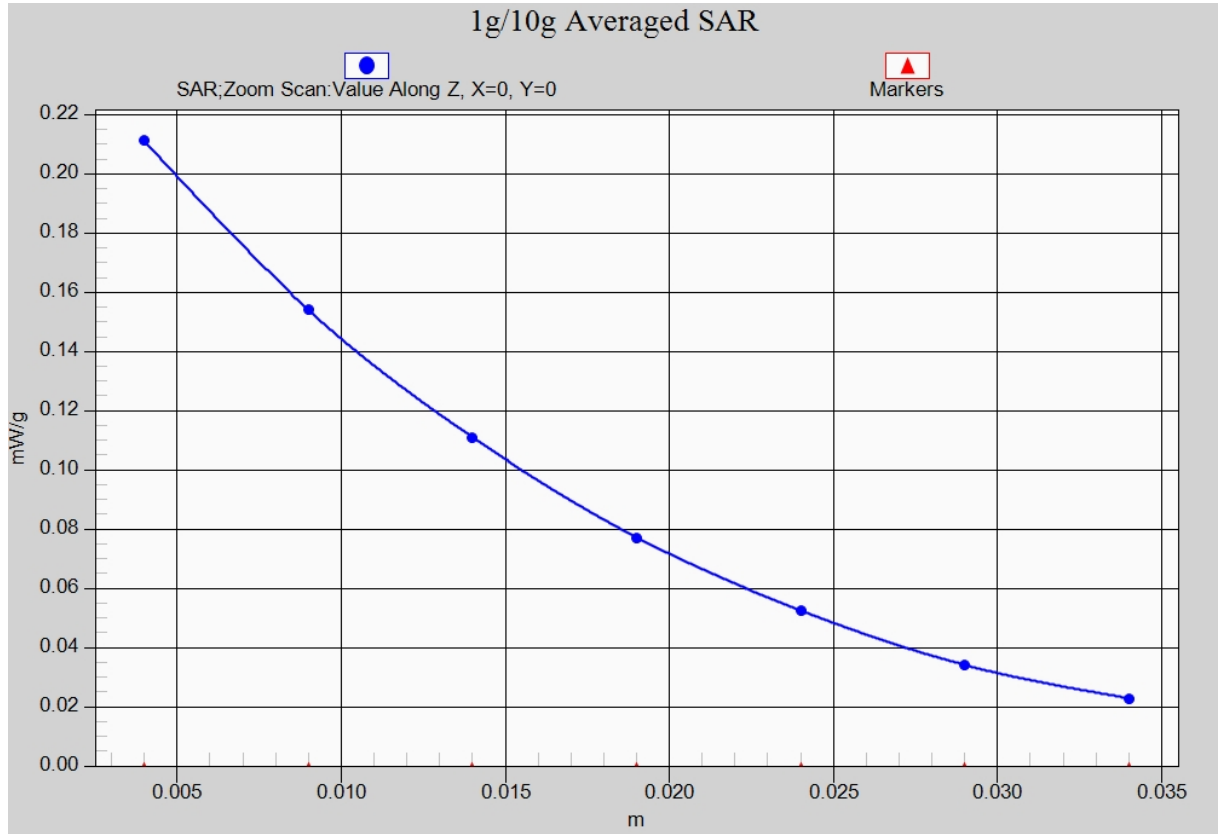


Fig. 12-1 Z-Scan at power reference point (WCDMA1900 CH9538)

WCDMA 1900 Body Front High – AP OFF

Date: 2013-2-22

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used (interpolated): $f = 1907.6$ MHz; $\sigma = 1.559$ mho/m; $\epsilon_r = 52.017$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.1°C

Communication System: WCDMA 1900 Frequency: 1907.6 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.64, 4.64, 4.64)

Front High/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.43 mW/g

Front High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.429 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 1.991 mW/g

SAR(1 g) = 1.28 mW/g; SAR(10 g) = 0.746 mW/g

Maximum value of SAR (measured) = 1.43 mW/g

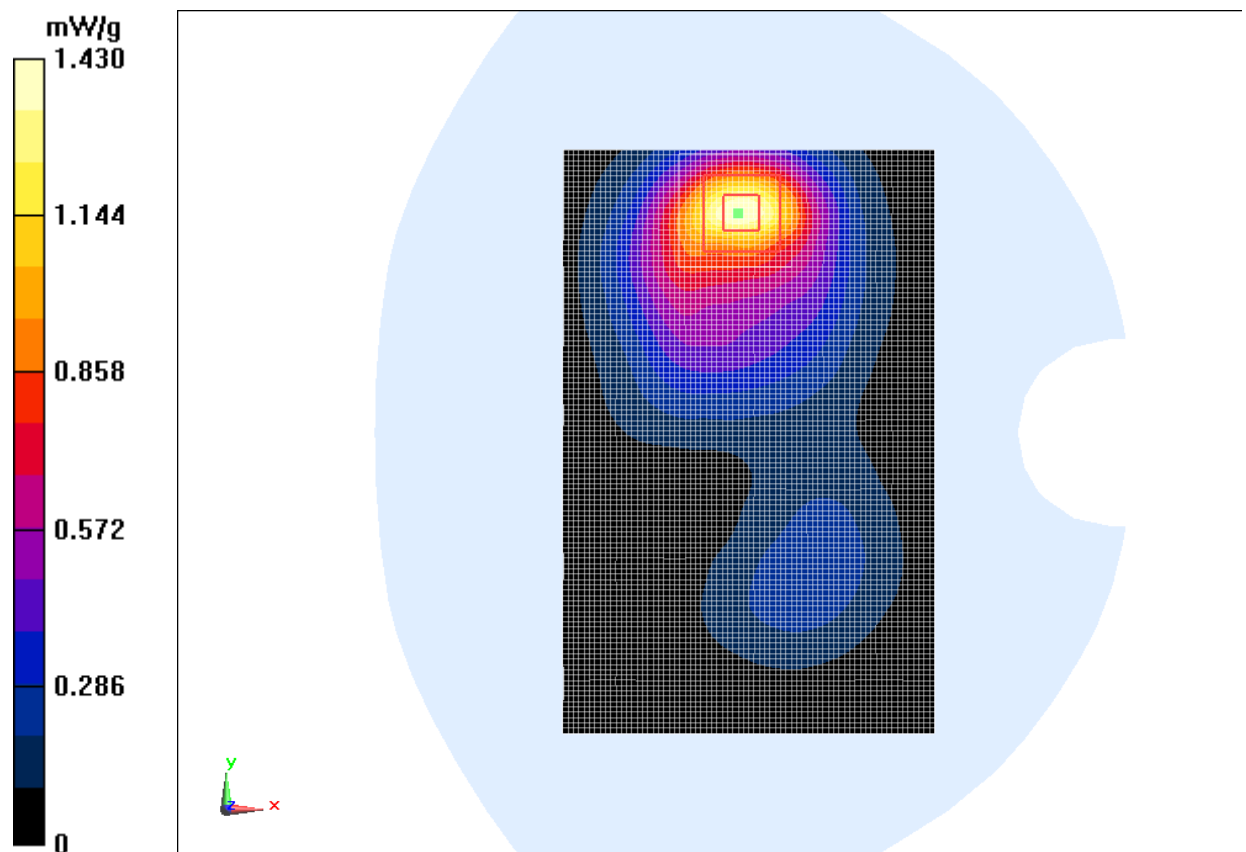


Fig.13 WCDMA1900 CH9538

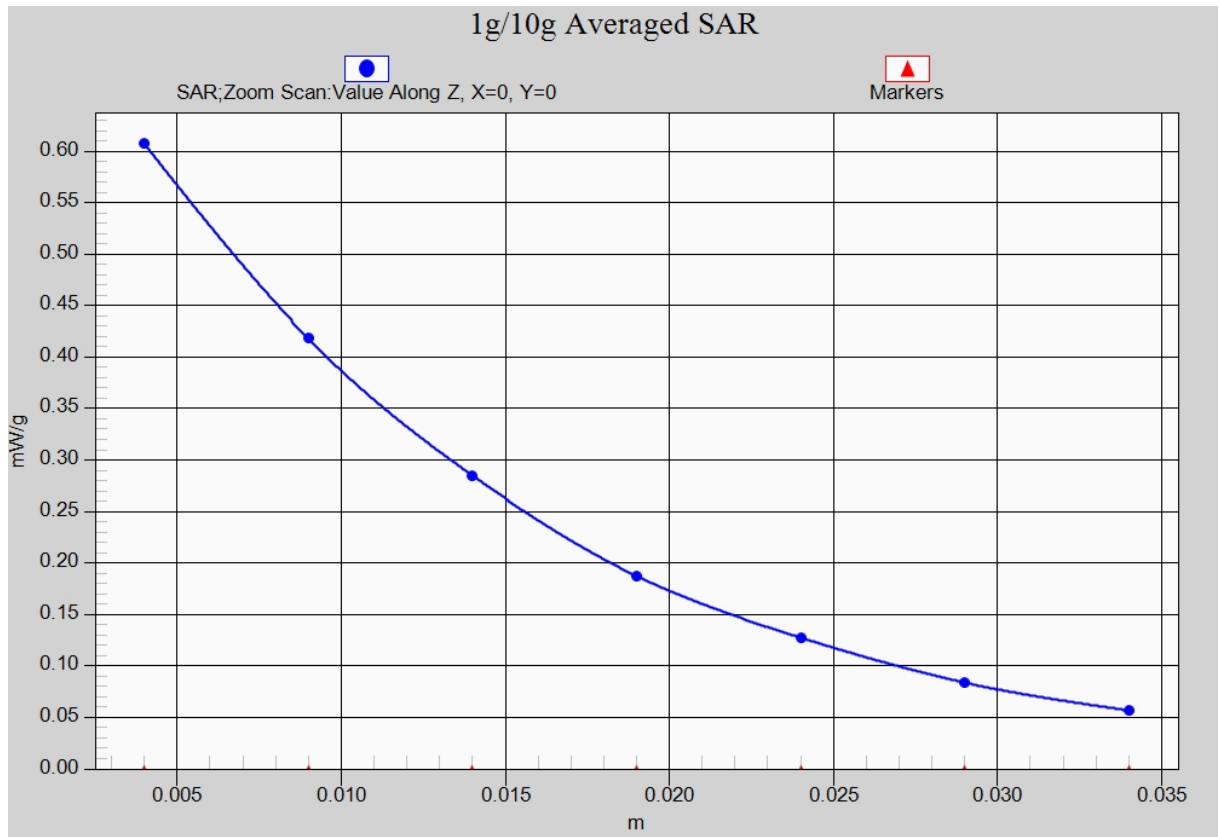


Fig. 13-1 Z-Scan at power reference point (WCDMA1900 CH9538)

WCDMA 1900 Body Bottom Edge High – AP OFF

Date: 2013-2-22

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used (interpolated): $f = 1907.6$ MHz; $\sigma = 1.559$ mho/m; $\epsilon_r = 52.017$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.1°C

Communication System: WCDMA 1900 Frequency: 1907.6 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.64, 4.64, 4.64)

Bottom Edge High/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.40 mW/g

Bottom Edge High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 22.818 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 1.951 mW/g

SAR(1 g) = 1.25 mW/g; SAR(10 g) = 0.725 mW/g

Maximum value of SAR (measured) = 1.38 mW/g

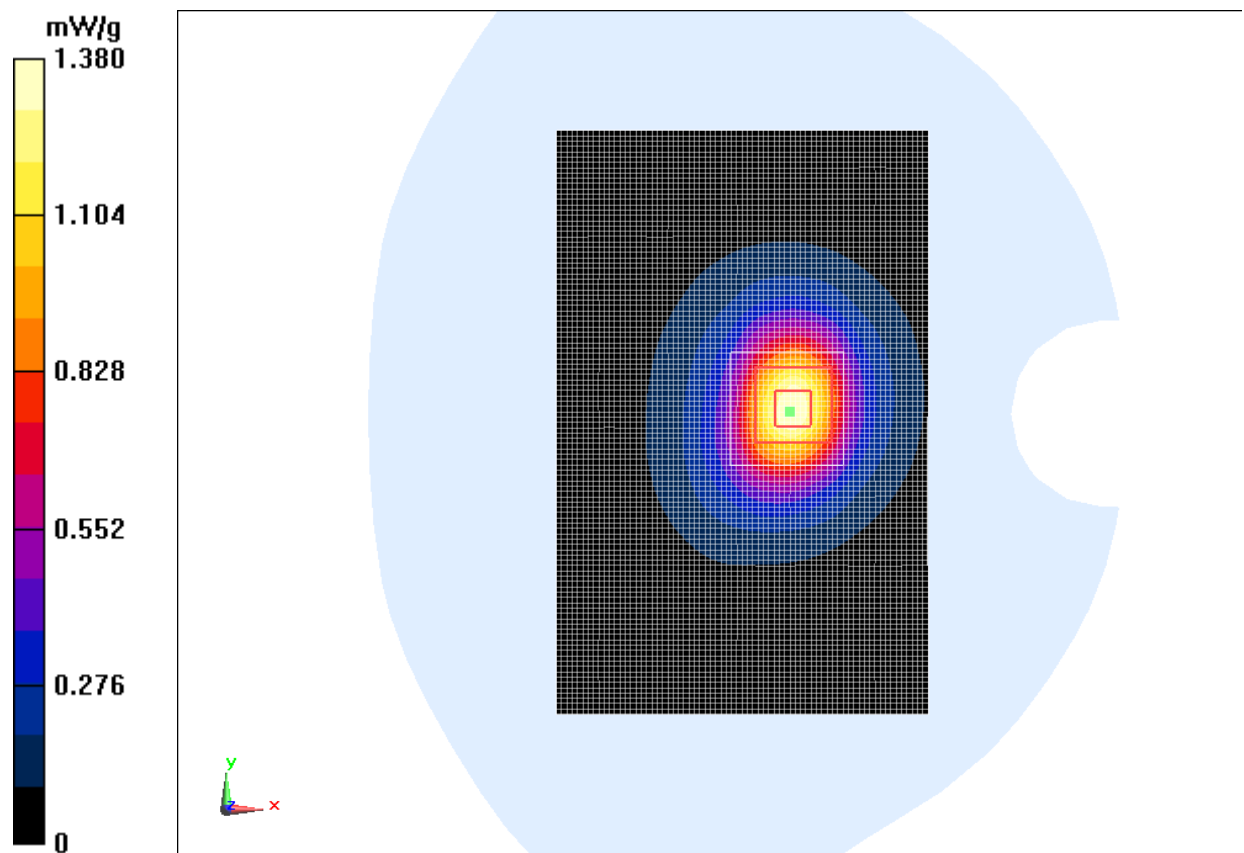


Fig.14 WCDMA1900 CH9538

WCDMA 1900 Body Front High with Headset – AP OFF

Date: 2013-2-22

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used (interpolated): $f = 1907.6$ MHz; $\sigma = 1.559$ mho/m; $\epsilon_r = 52.017$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.1°C

Communication System: WCDMA 1900 Frequency: 1907.6 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.64, 4.64, 4.64)

Front High/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.42 mW/g

Front High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.523 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.967 mW/g

SAR(1 g) = 1.27 mW/g; SAR(10 g) = 0.745 mW/g

Maximum value of SAR (measured) = 1.41 mW/g

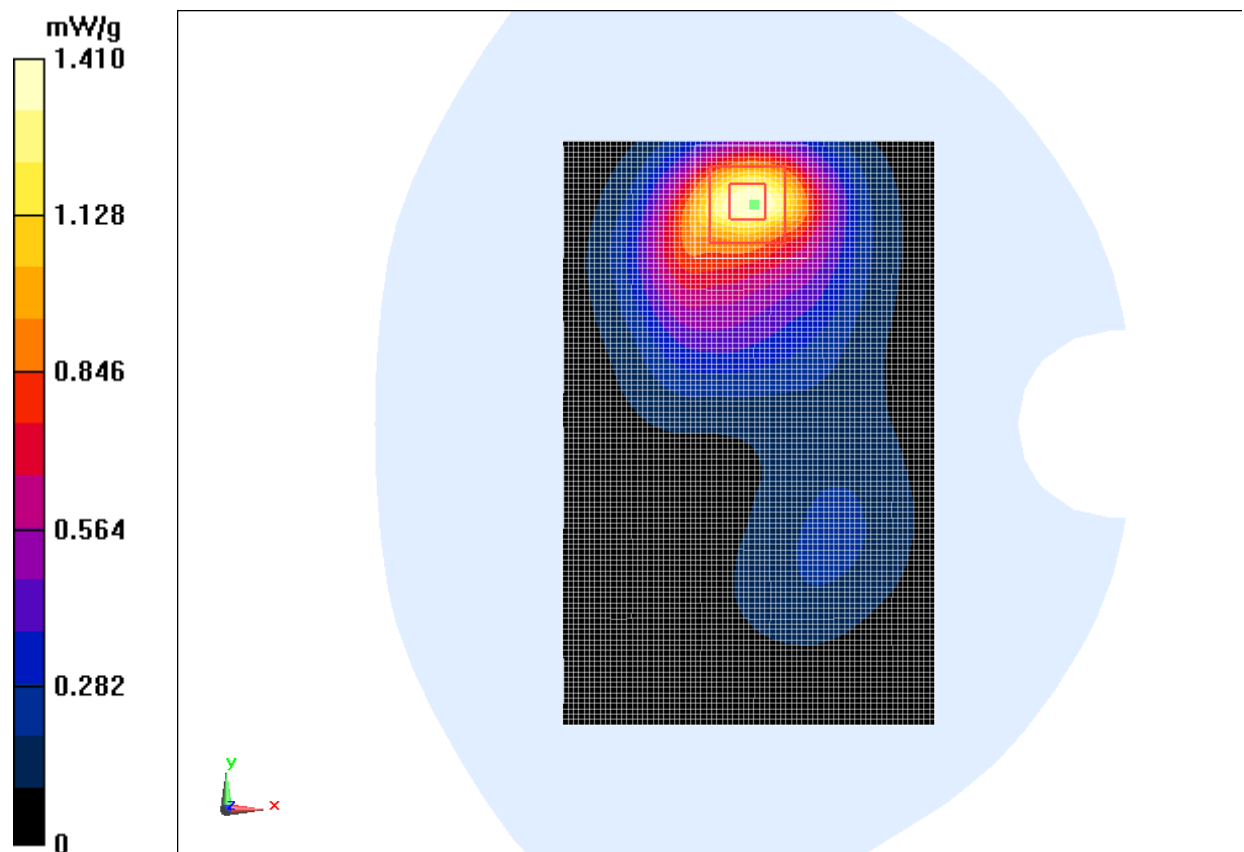


Fig.15 WCDMA1900 CH9538

Wifi 802.11b Right Cheek Channel 6 – AP OFF

Date: 2013-2-17

Electronics: DAE4 Sn771

Medium: Head 2450 MHz

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.83$ mho/m; $\epsilon_r = 38.93$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.0°C

Communication System: WLAN 2450 Frequency: 2437 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.49, 4.49, 4.49)

Right Cheek/Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.0601 mW/g

Right Cheek/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.060 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.125 mW/g

SAR(1 g) = 0.056 mW/g; SAR(10 g) = 0.026 mW/g

Maximum value of SAR (measured) = 0.0643 mW/g

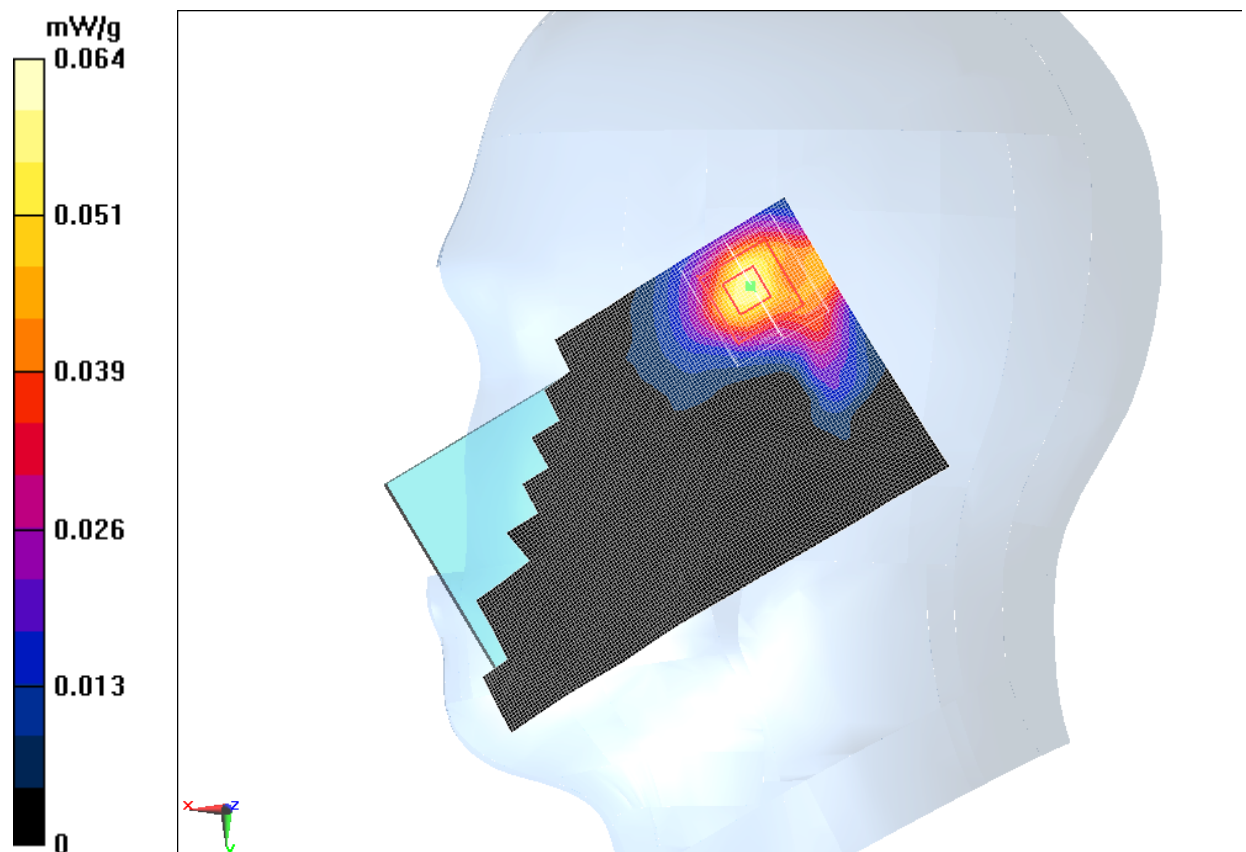


Fig.16 2450 MHz CH6

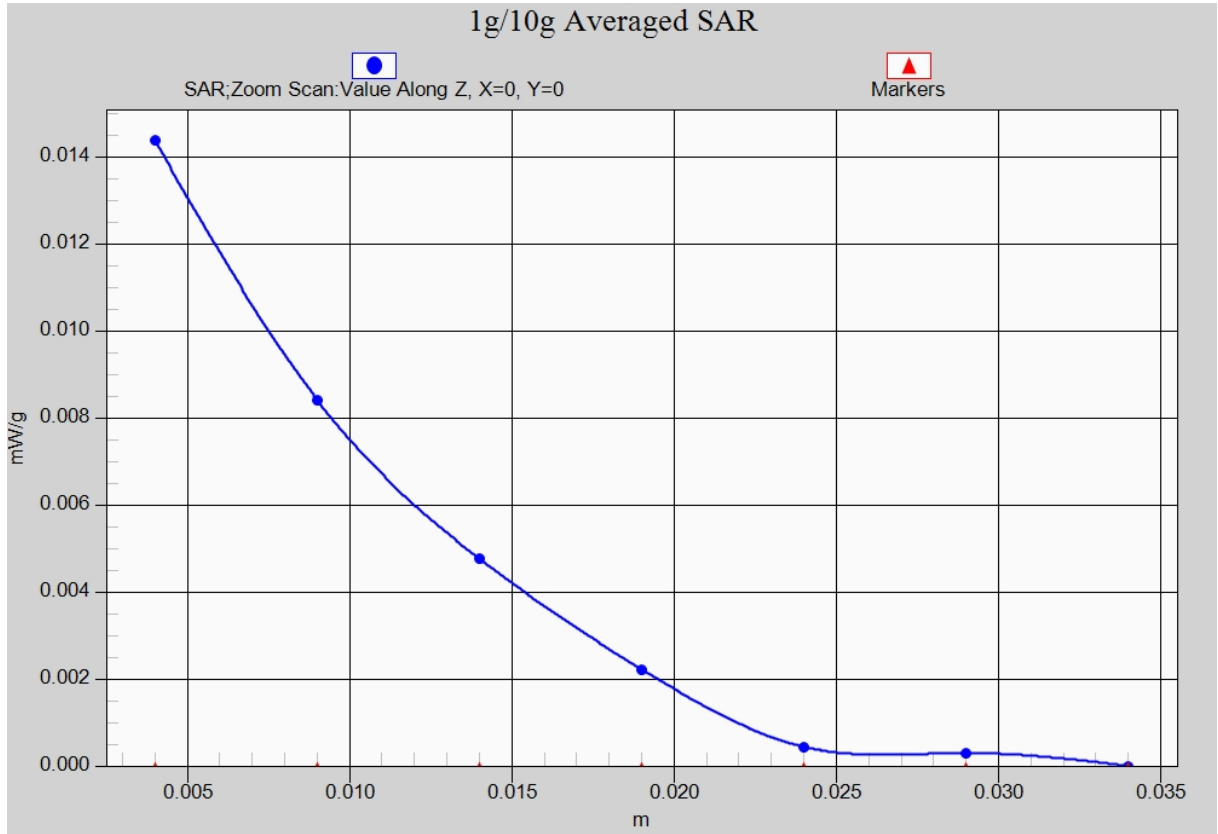


Fig. 16-1 Z-Scan at power reference point (2450 MHz CH6)

Wifi 802.11b Body Rear Channel 6 – AP OFF

Date: 2013-2-17

Electronics: DAE4 Sn771

Medium: Body 2450 MHz

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.954$ mho/m; $\epsilon_r = 52.288$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.0°C

Communication System: WLAN 2450 Frequency: 2437 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.15, 4.15, 4.15)

Rear/Area Scan (101x161x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.0611 mW/g

Rear/Zoom Scan (10x10x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.985 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.140 mW/g

SAR(1 g) = 0.053 mW/g; SAR(10 g) = 0.025 mW/g

Maximum value of SAR (measured) = 0.0606 mW/g

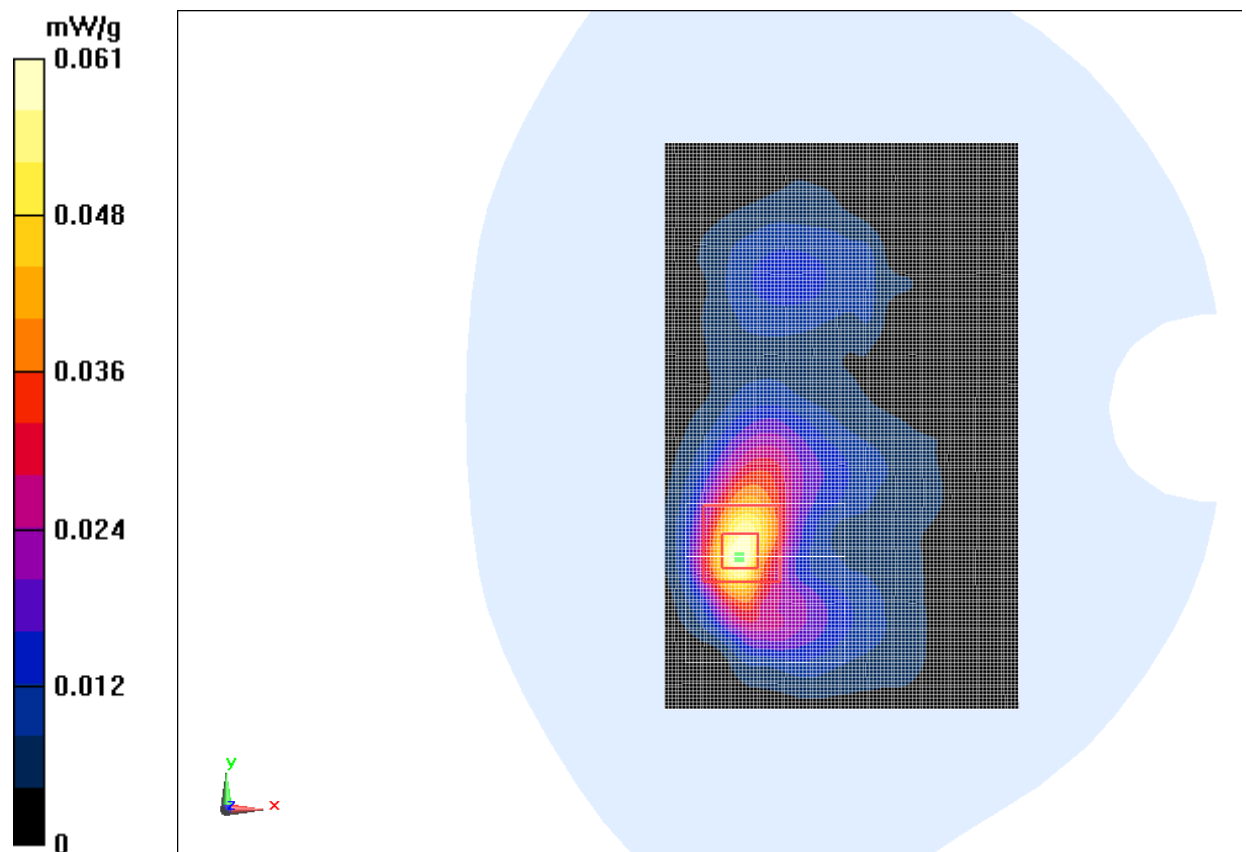


Fig.17 2450 MHz CH6

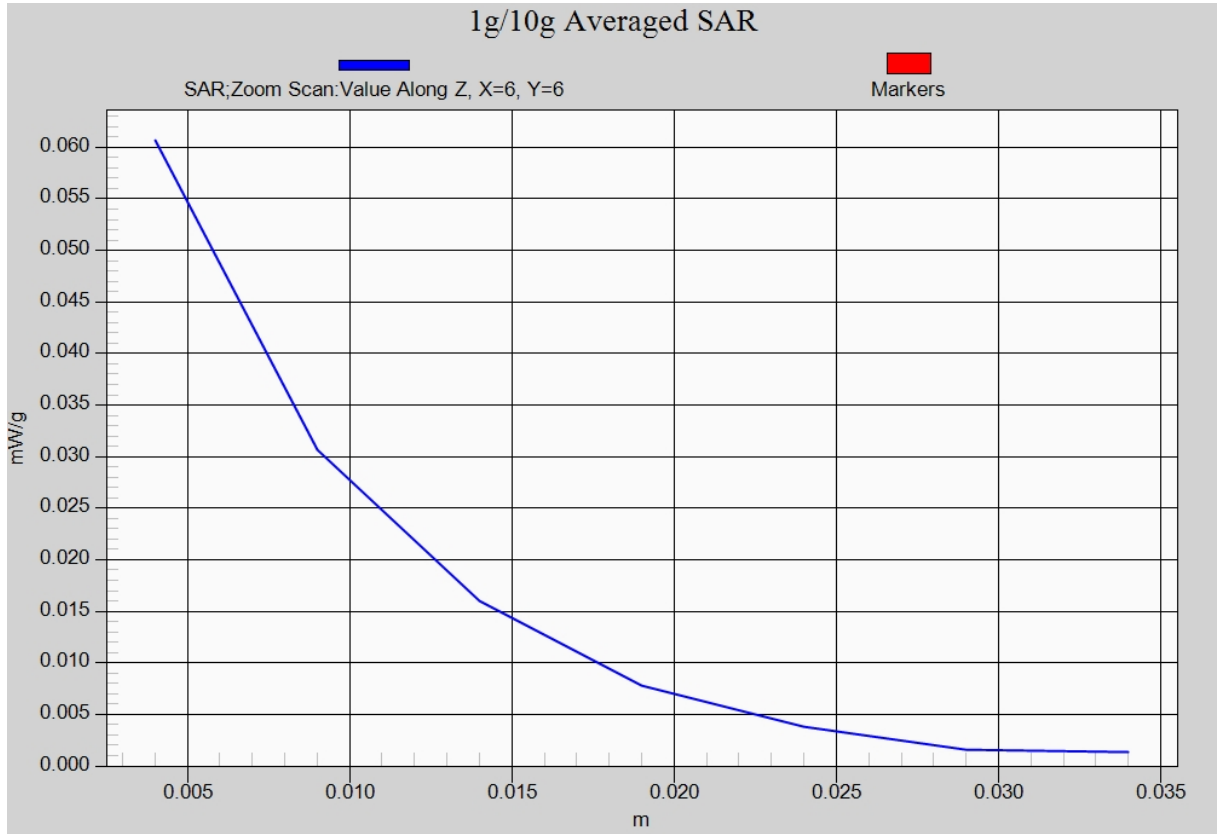


Fig. 17-1 Z-Scan at power reference point (2450 MHz CH6)

Wifi 802.11a Right Cheek Channel 149 – AP OFF

Date: 2013-3-10

Electronics: DAE4 Sn771

Medium: Head 5800 MHz

Medium parameters used: $f = 5745$ MHz; $\sigma = 5.316$ mho/m; $\epsilon_r = 35.1$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.2°C

Communication System: WLAN 5G Frequency: 5745 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(4.28, 4.28, 4.28)

Right Cheek/Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.0560 mW/g

Right Cheek/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 1.080 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.279 mW/g

SAR(1 g) = 0.043 mW/g; SAR(10 g) = 0.00656 mW/g

Maximum value of SAR (measured) = 0.0418 mW/g

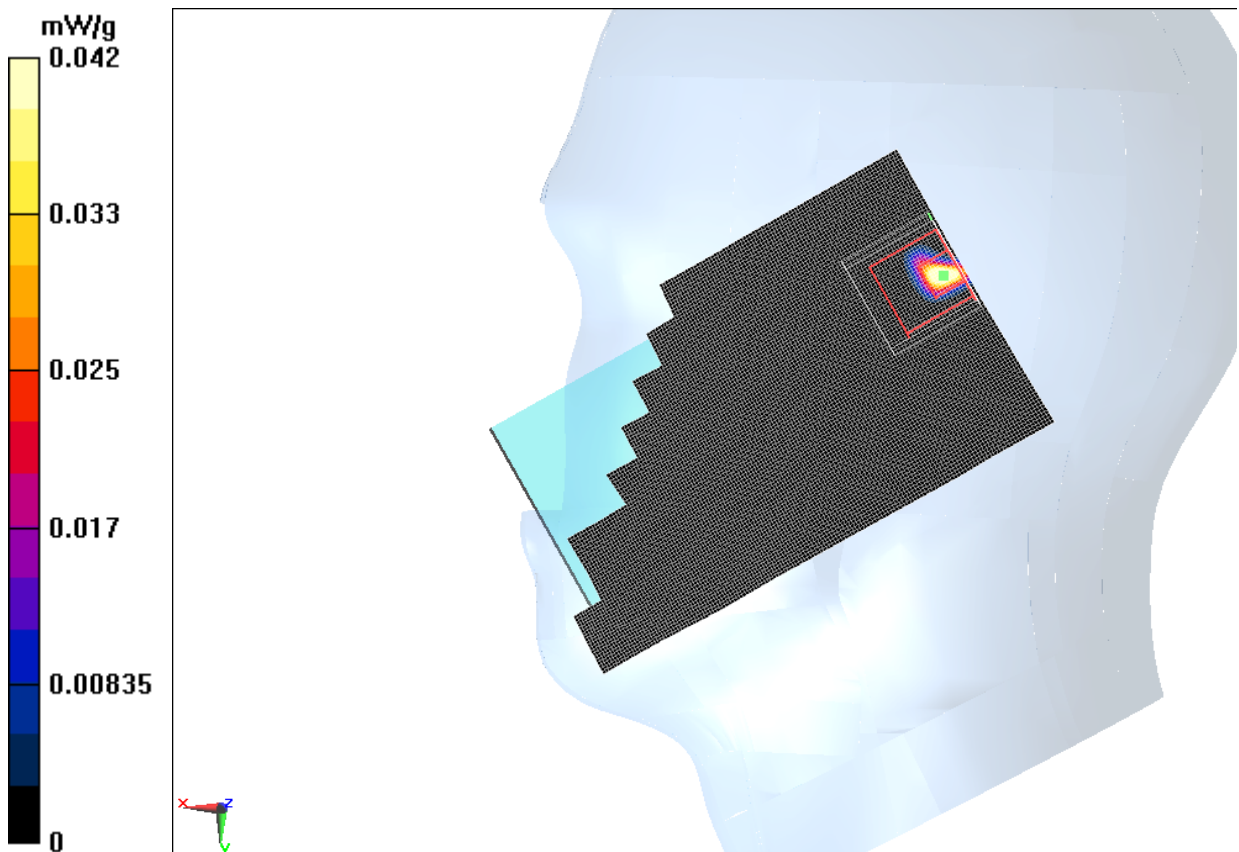


Fig.18 5GHz CH149

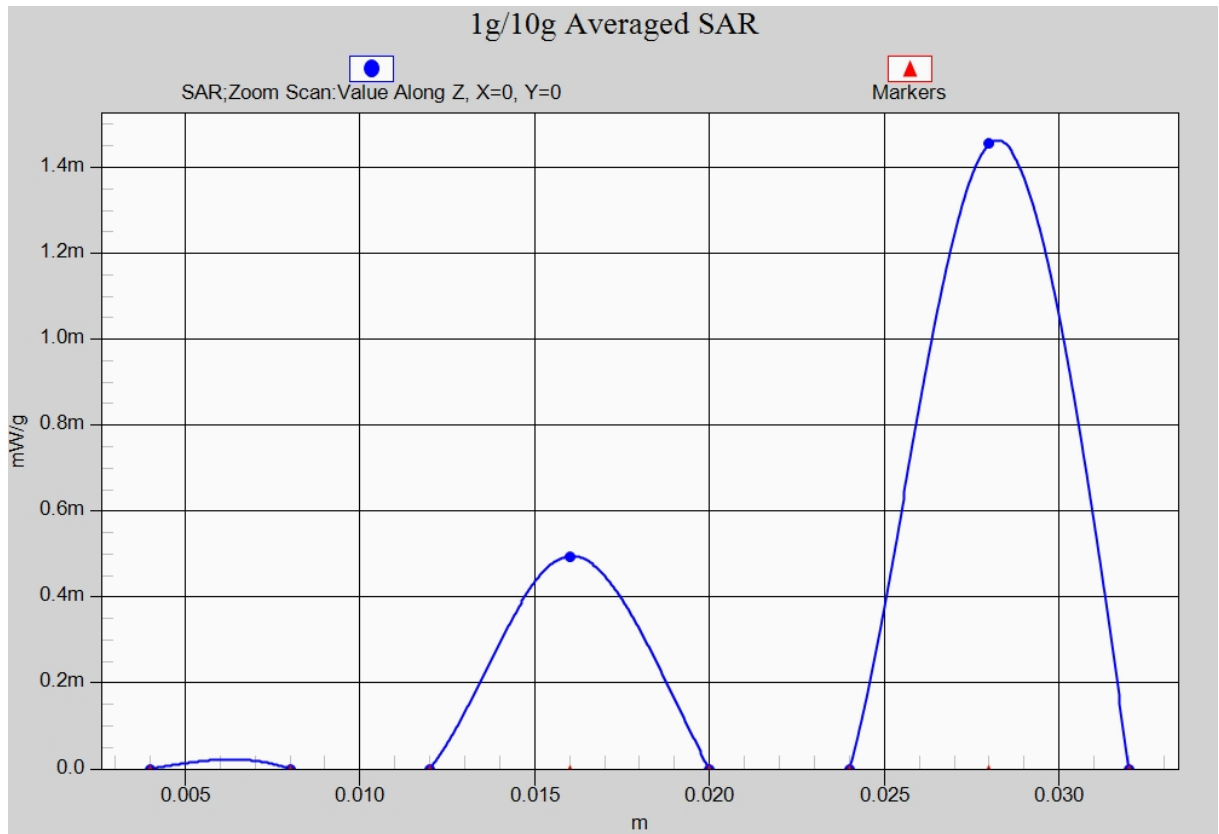


Fig. 18-1 Z-Scan at power reference point (5GHz CH149)

Wifi 802.11a Rear Channel 36 – AP OFF

Date: 2013-5-25

Electronics: DAE4 Sn771

Medium: Body 5200 MHz

Medium parameters used: $f = 5180$ MHz; $\sigma = 5.142$ mho/m; $\epsilon_r = 48.3$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.2°C

Communication System: WLan 5G Frequency: 5180 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(4.37, 4.37, 4.37)

Rear/Area Scan (101x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.108 W/kg

Rear /Zoom Scan (11x9x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 0.545 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.642 W/kg

SAR(1 g) = 0.103 W/kg; SAR(10 g) = 0.032 W/kg

Maximum value of SAR (measured) = 0.0806 W/kg

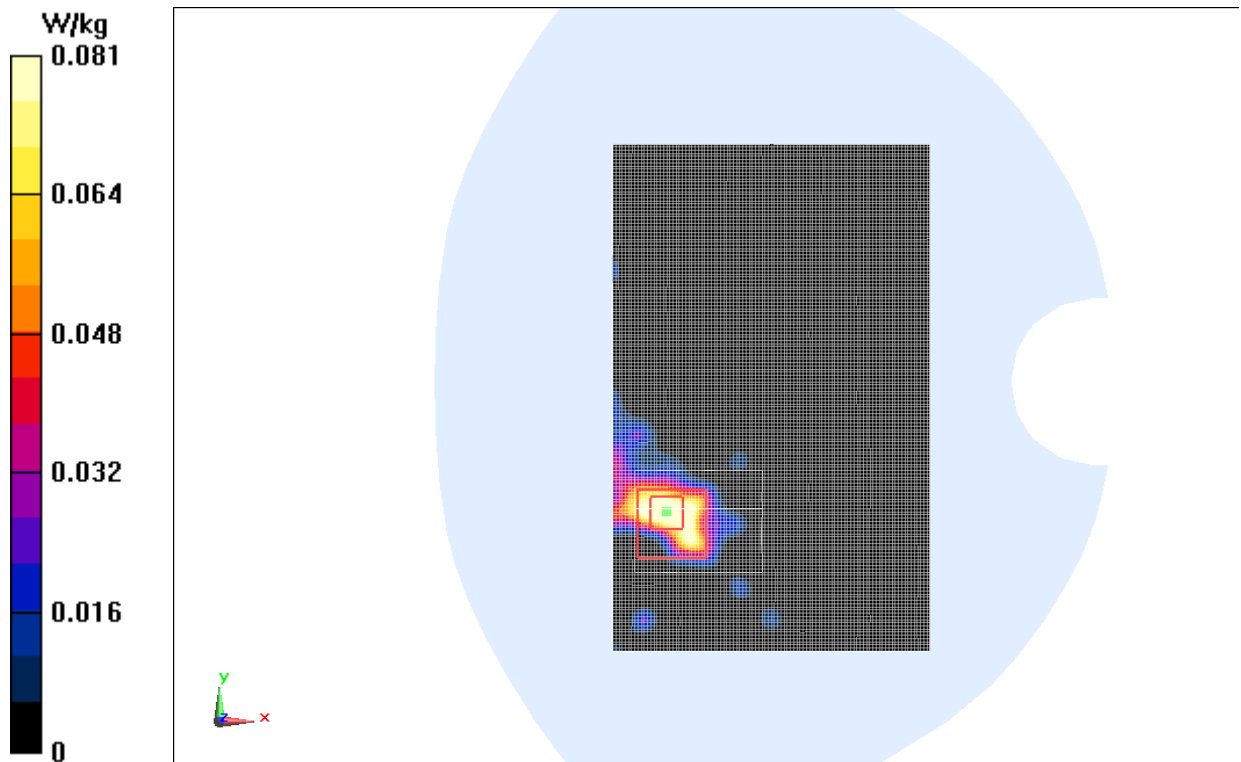


Fig.19 5GHz CH36

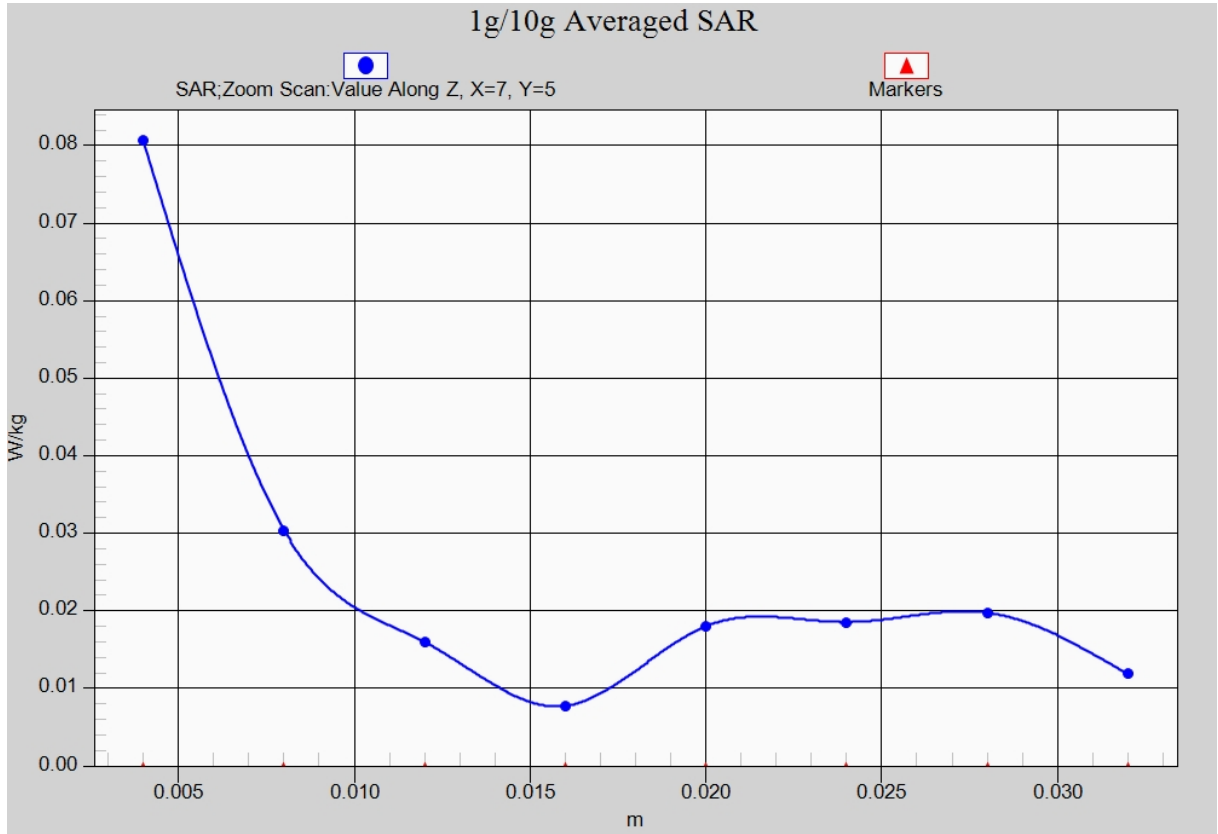


Fig. 19-1 Z-Scan at power reference point (5GHz CH36)

Wifi 802.11n Right Cheek Channel 149 – AP OFF

Date: 2013-3-10

Electronics: DAE4 Sn771

Medium: Head 5800 MHz

Medium parameters used: $f = 5745$ MHz; $\sigma = 5.316$ mho/m; $\epsilon_r = 35.1$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.2°C

Communication System: WLAN 5G Frequency: 5745 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(4.28, 4.28, 4.28)

Right Cheek/Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.0473 mW/g

Right Cheek/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 2.521 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 0.301 mW/g

SAR(1 g) = 0.048 mW/g; SAR(10 g) = 0.013 mW/g

Maximum value of SAR (measured) = 0.0425 mW/g

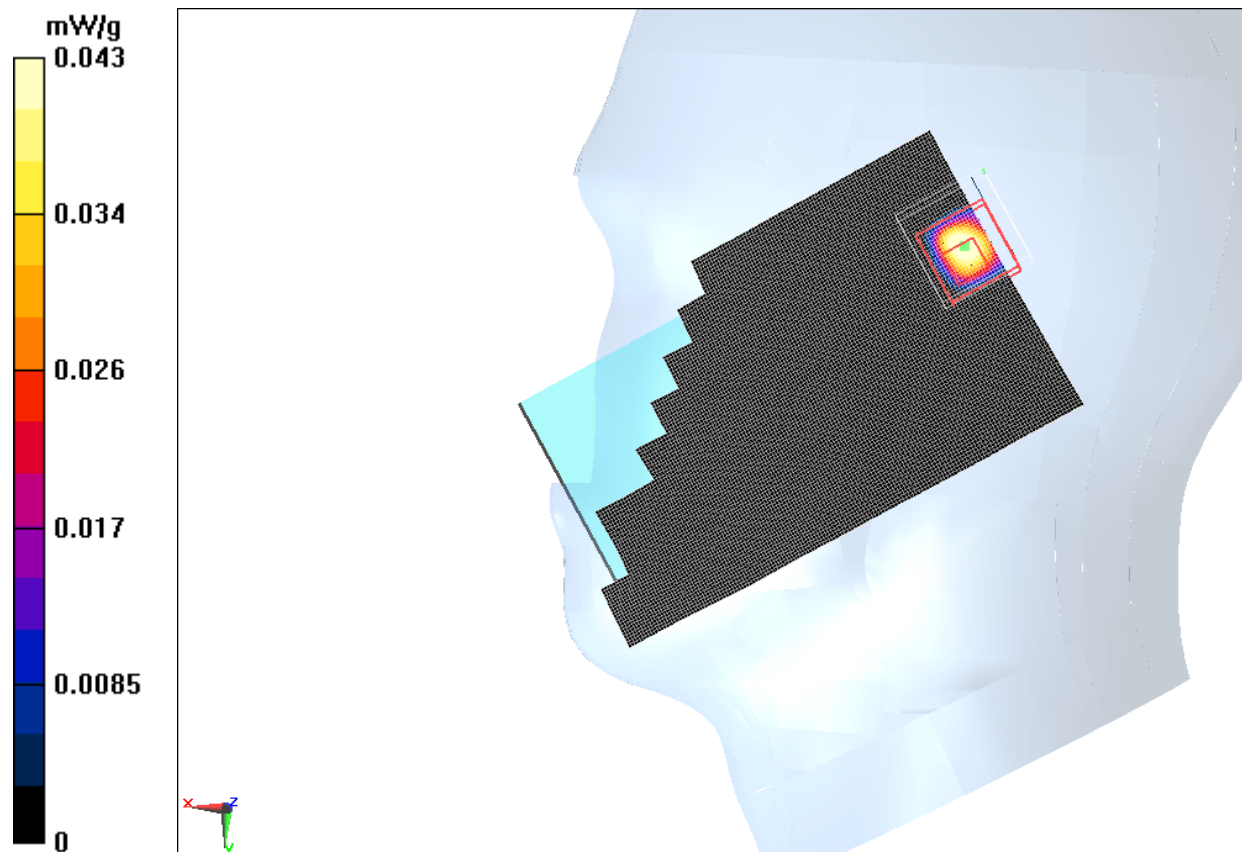


Fig.20 5GHz CH149

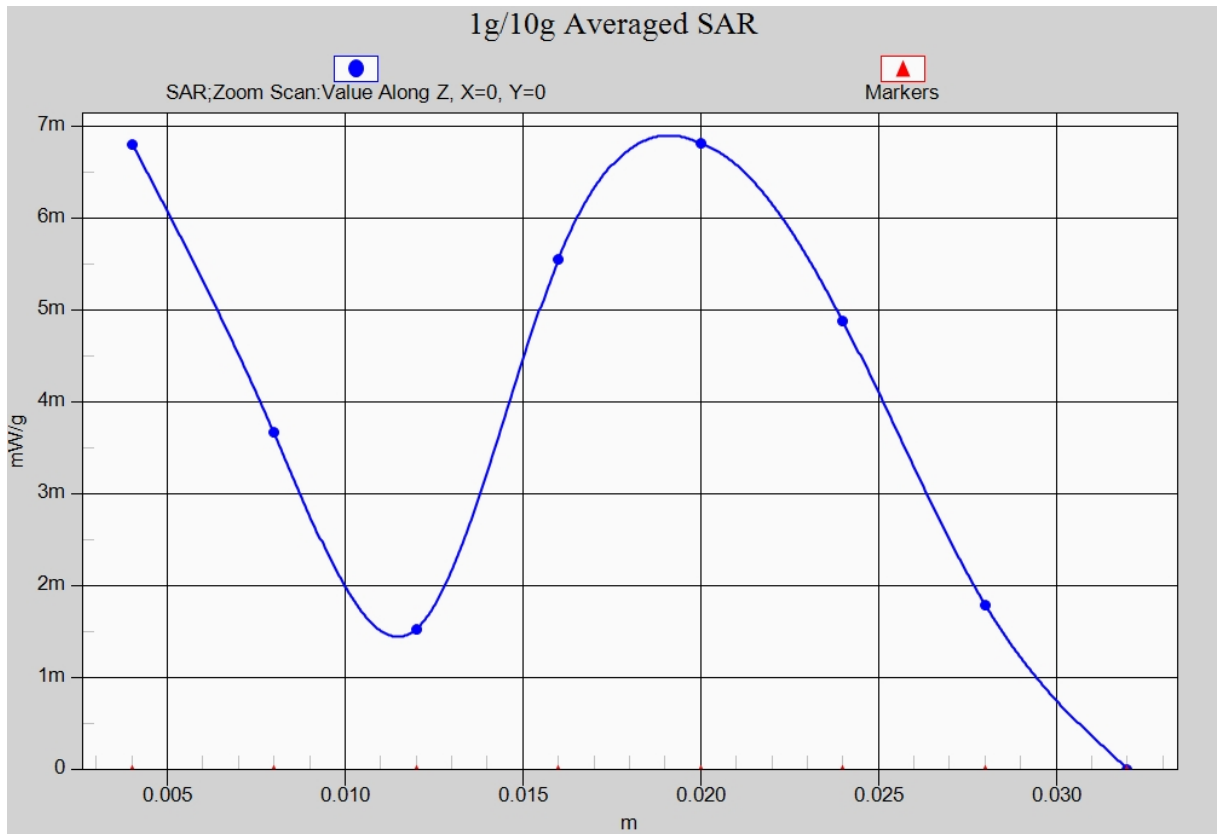


Fig. 20-1 Z-Scan at power reference point (5GHz CH149)

Wifi 802.11n Rear Channel 149 – AP OFF

Date: 2013-3-10

Electronics: DAE4 Sn771

Medium: Body 5800 MHz

Medium parameters used: $f = 5745$ MHz; $\sigma = 5.916$ mho/m; $\epsilon_r = 46.624$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.2°C

Communication System: WLAN 5G Frequency: 5745 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(3.92, 3.92, 3.92)

Toward Ground/Area Scan (101x161x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.0747 mW/g

Toward Ground/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 0.906 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 0.477 mW/g

SAR(1 g) = 0.072 mW/g; SAR(10 g) = 0.013 mW/g

Maximum value of SAR (measured) = 0.0565 mW/g

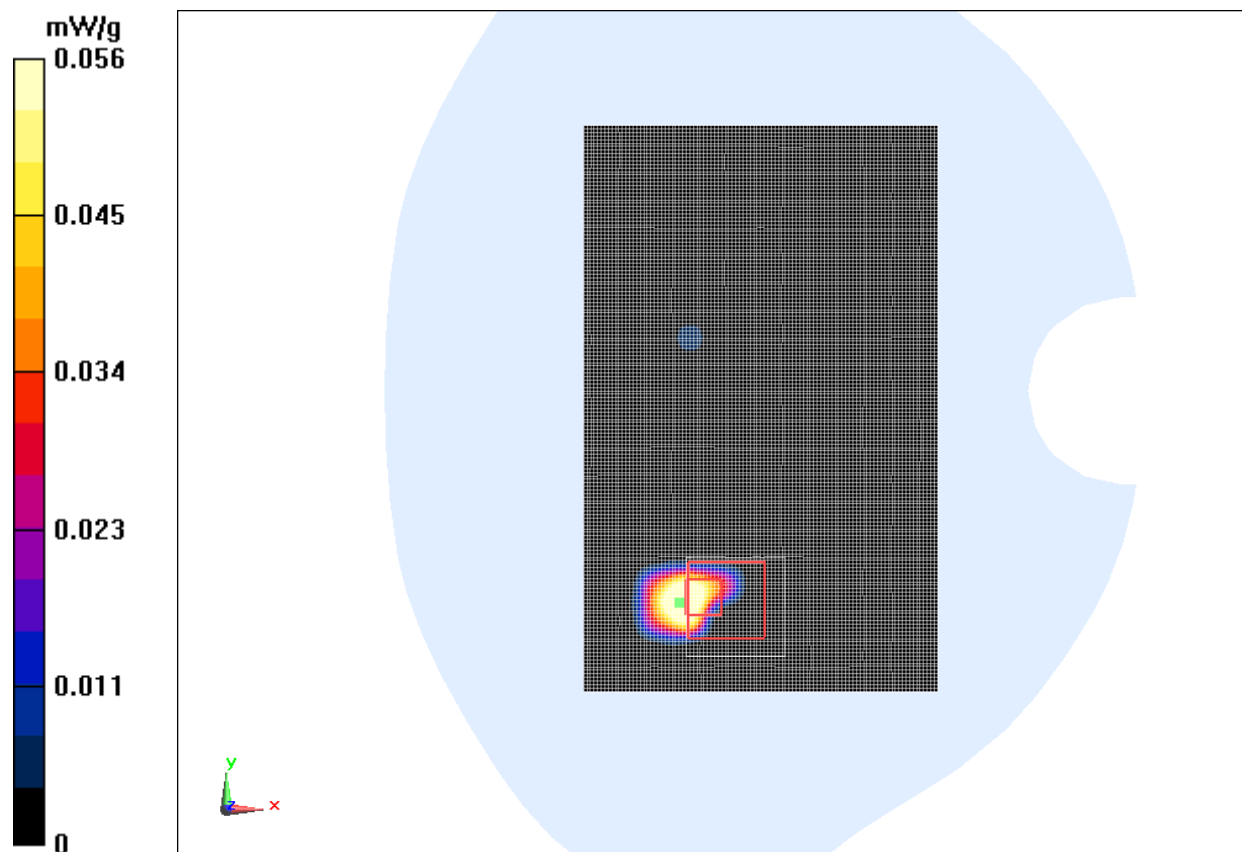


Fig.21 5GHz CH149

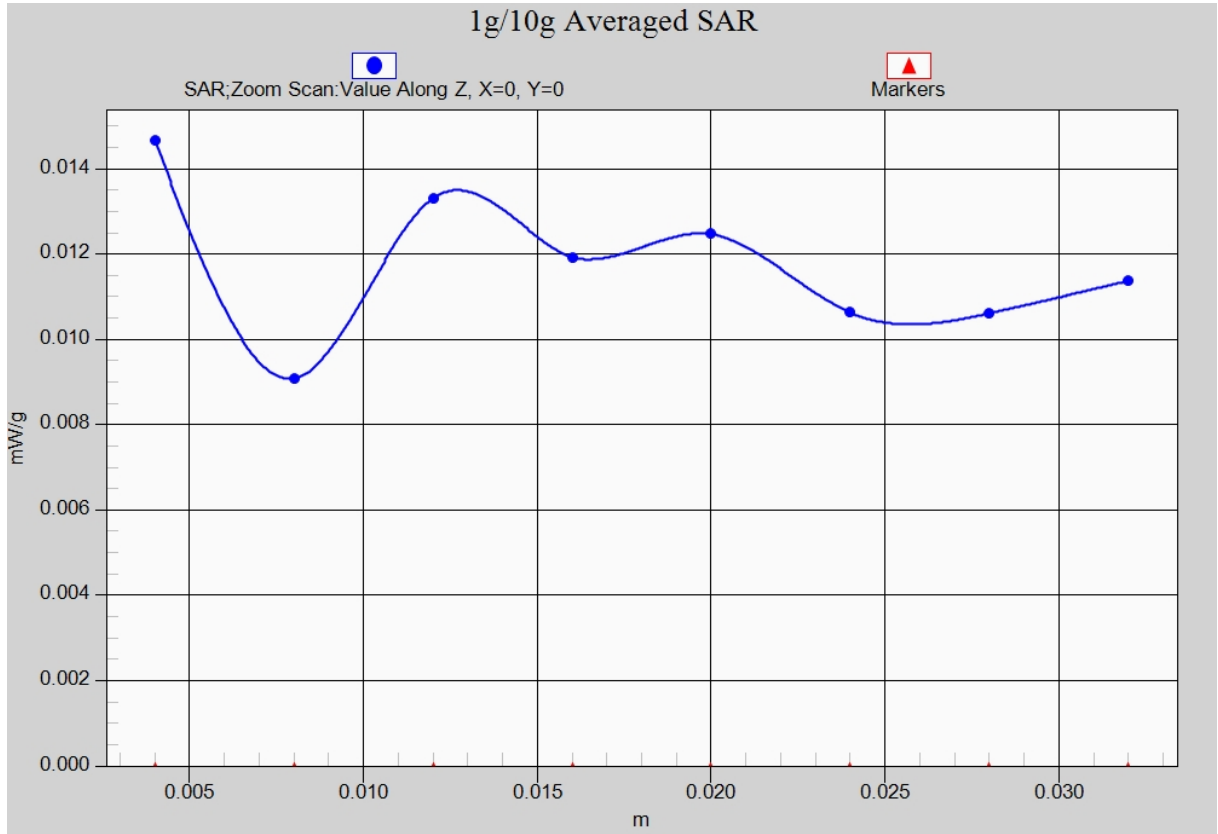


Fig. 21-1 Z-Scan at power reference point (5GHz CH149)

ANNEX B System Verification Results

835MHz

Date: 2013-2-20

Electronics: DAE4 Sn771

Medium: Head 850 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.883$ mho/m; $\epsilon_r = 40.32$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C

Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(6.26, 6.26, 6.26)

System Validation /Area Scan (81x161x1): Measurement grid: dx=10mm, dy=10mm

Reference Value = 53.254 V/m; Power Drift = -0.094 dB

Fast SAR: SAR(1 g) = 2.36 mW/g; SAR(10 g) = 1.53 mW/g

Maximum value of SAR (interpolated) = 2.59 mW/g

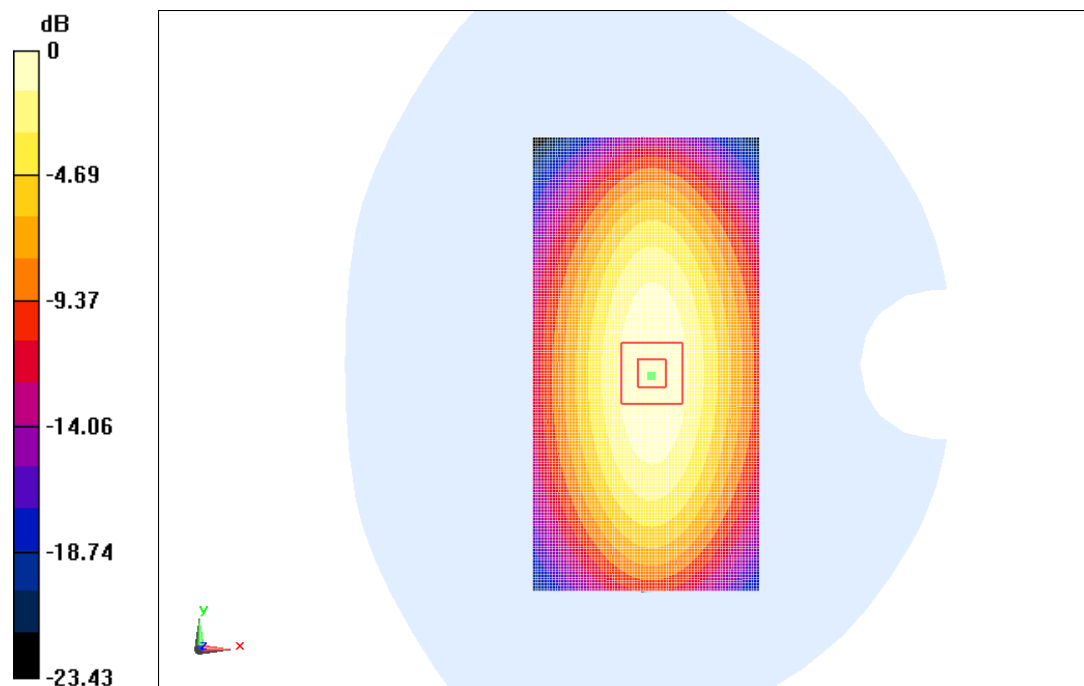
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.254 V/m; Power Drift = -0.094 dB

Peak SAR (extrapolated) = 3.548 W/kg

SAR(1 g) = 2.41 mW/g; SAR(10 g) = 1.57 mW/g

Maximum value of SAR (measured) = 2.60 mW/g



0 dB = 2.59 mW/g = 8.27 dB mW/g

Fig.B.1 validation 835MHz 250mW

835MHz

Date: 2013-2-20

Electronics: DAE4 Sn771

Medium: Body 850 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.985 \text{ mho/m}$; $\epsilon_r = 56.81$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C

Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(6.14, 6.14, 6.14)

System Validation /Area Scan (81x171x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Reference Value = 46.117 V/m ; Power Drift = -0.075 dB

Fast SAR: SAR(1 g) = 2.37 mW/g ; SAR(10 g) = 1.59 mW/g

Maximum value of SAR (interpolated) = 2.58 mW/g

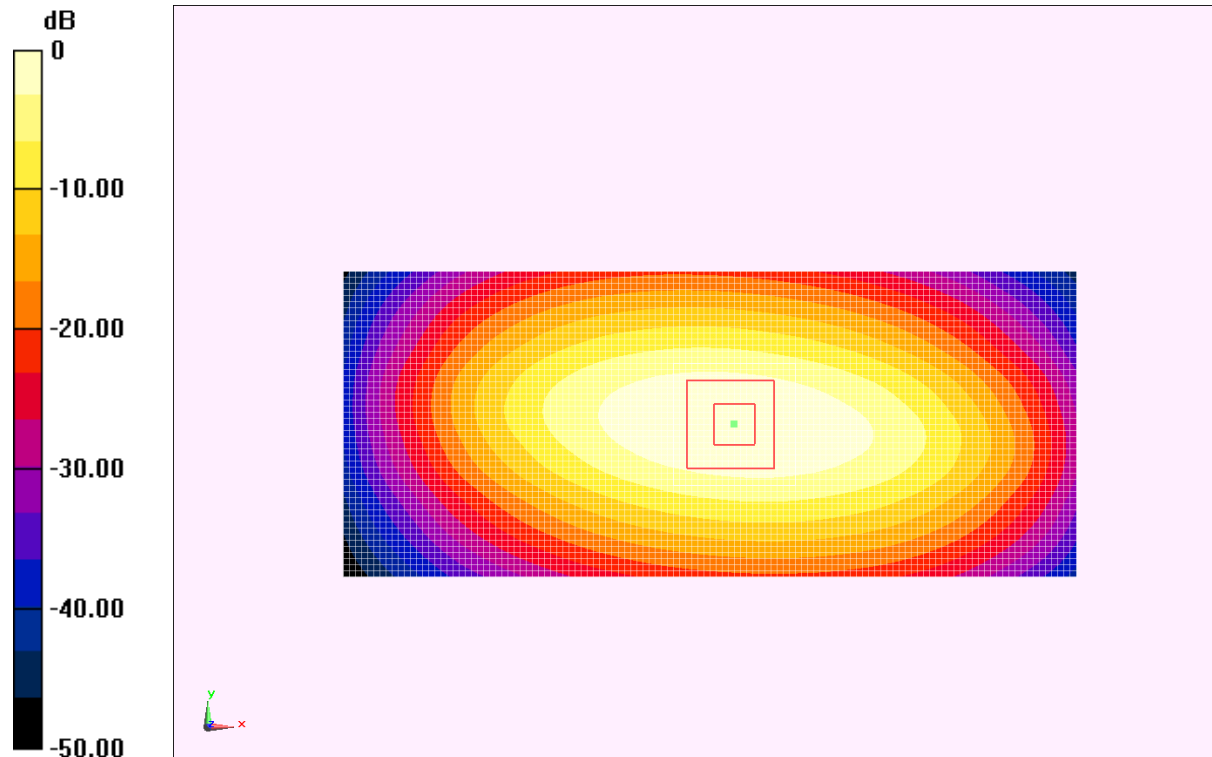
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 46.117 V/m ; Power Drift = -0.075 dB

Peak SAR (extrapolated) = 3.571 W/kg

SAR(1 g) = 2.38 mW/g ; SAR(10 g) = 1.59 mW/g

Maximum value of SAR (measured) = 2.58 mW/g



$$0 \text{ dB} = 2.58 \text{ mW/g} = 8.23 \text{ dB mW/g}$$

Fig.B.2 validation 835MHz 250mW

1750MHz

Date: 2013-2-21

Electronics: DAE4 Sn771

Medium: Head 1750 MHz

Medium parameters used: $f=1750$ MHz; $\sigma = 1.377$ mho/m; $\epsilon_r = 39.76$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 1750 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(5.23, 5.23, 5.23)

System Validation/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm

Reference Value = 90.887 V/m; Power Drift = 0.068 dB

Fast SAR: SAR(1 g) = 9.16 mW/g; SAR(10 g) = 4.86 mW/g

Maximum value of SAR (interpolated) = 10.4 mW/g

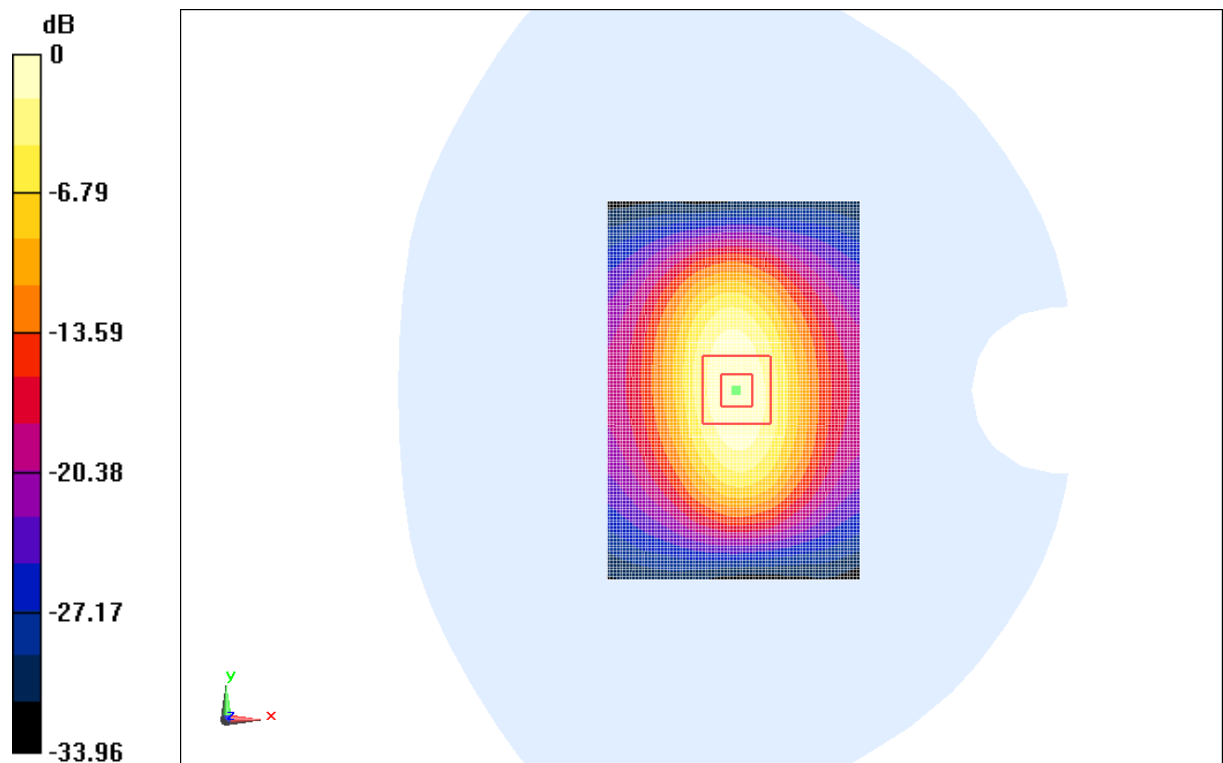
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 90.887 V/m; Power Drift = 0.068 dB

Peak SAR (extrapolated) = 16.293 W/kg

SAR(1 g) = 9.21 mW/g; SAR(10 g) = 4.90 mW/g

Maximum value of SAR (measured) = 10.4 mW/g



0 dB = 10.4 mW/g = 20.34 dB mW/g

Fig.B.3 validation 1750MHz 250mW

1750MHz

Date: 2013-2-21

Electronics: DAE4 Sn771

Medium: Body 1750 MHz

Medium parameters used: $f=1750$ MHz; $\sigma = 1.519$ mho/m; $\epsilon_r = 54.22$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 1750 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.84, 4.84, 4.84)

System Validation/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm

Reference Value = 89.037 V/m; Power Drift = 0.04 dB

Fast SAR: SAR(1 g) = 8.96 mW/g; SAR(10 g) = 4.89 mW/g

Maximum value of SAR (interpolated) = 10.4 mW/g

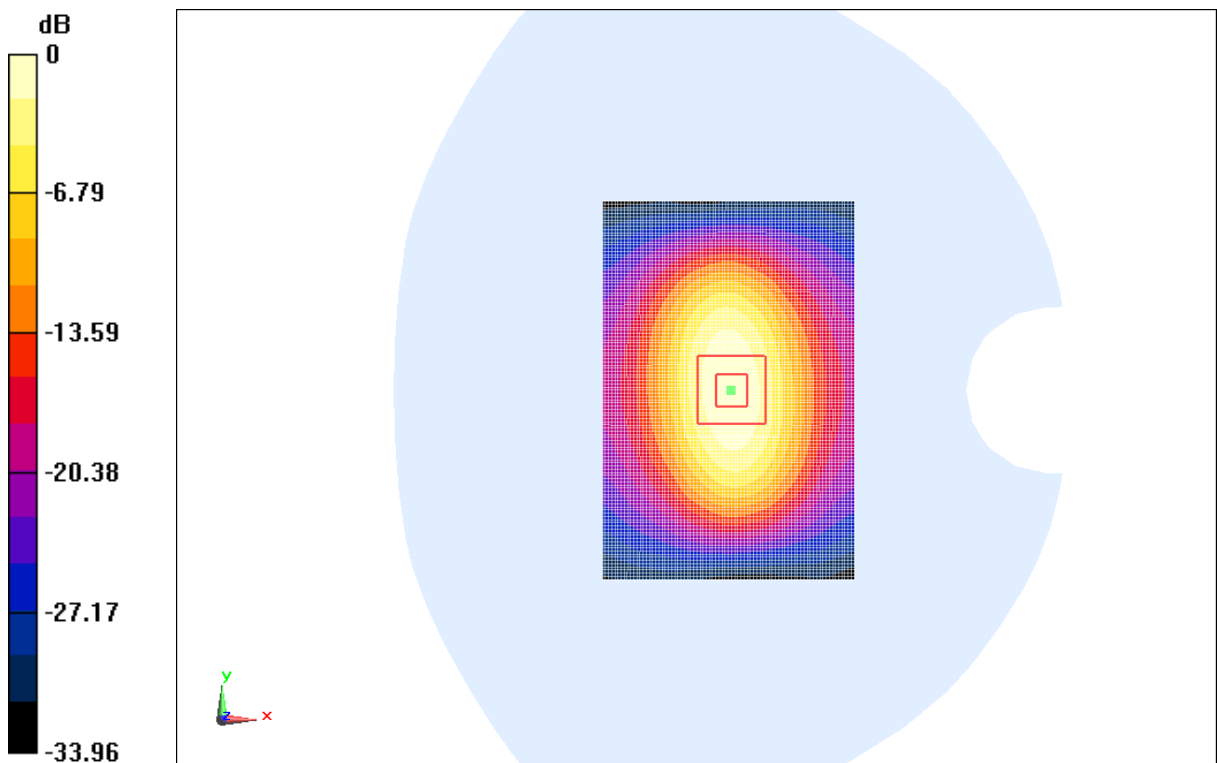
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.037 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 14.71 W/kg

SAR(1 g) = 9.03 mW/g; SAR(10 g) = 4.92 mW/g

Maximum value of SAR (measured) = 10.4 mW/g



0 dB = 10.4 mW/g = 20.34 dB mW/g

Fig.B.4 validation 1750MHz 250mW

1900MHz

Date: 2013-2-22

Electronics: DAE4 Sn771

Medium: Head 1900 MHz

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.411 \text{ mho/m}$; $\epsilon_r = 39.21$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.7°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(5.19, 5.19, 5.19)

System Validation/Area Scan (81x121x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Reference Value = 92.381 V/m ; Power Drift = 0.06 dB

Fast SAR: SAR(1 g) = 9.65 mW/g ; SAR(10 g) = 5.06 mW/g

Maximum value of SAR (interpolated) = 11.0 mW/g

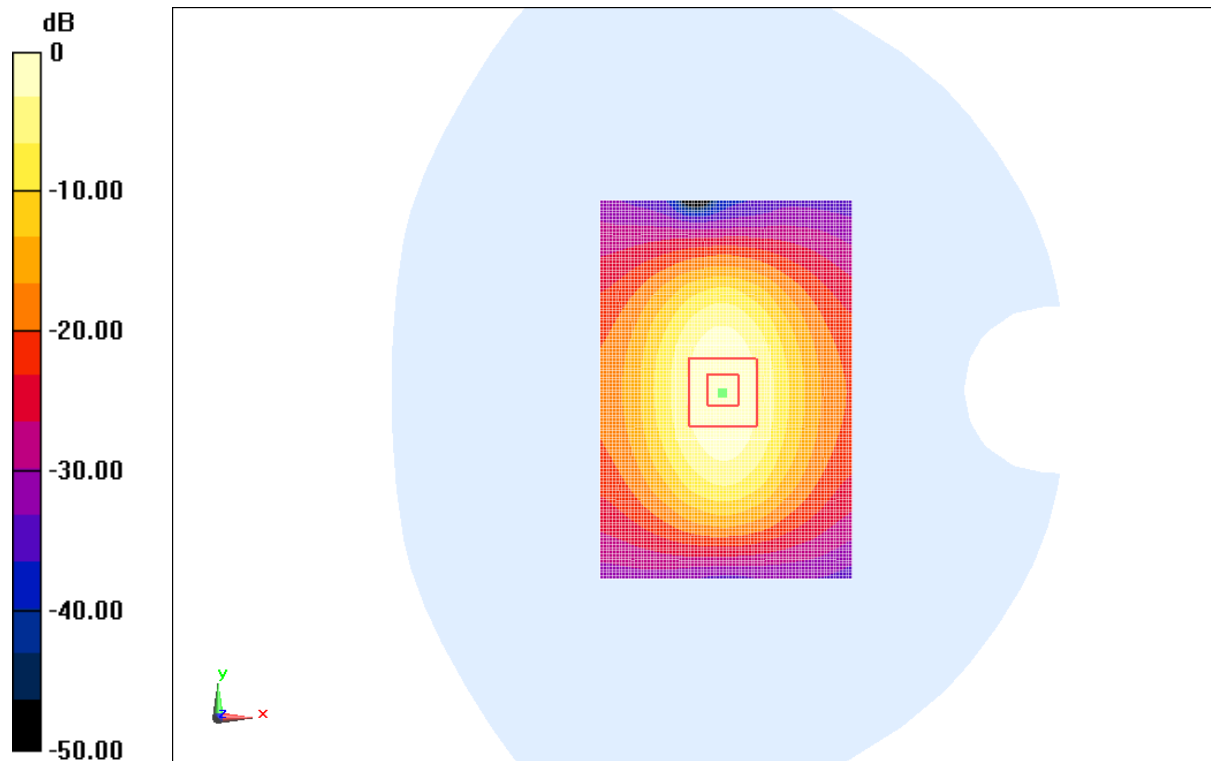
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 92.381 V/m ; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 17.898 W/kg

SAR(1 g) = 9.58 mW/g ; SAR(10 g) = 4.99 mW/g

Maximum value of SAR (measured) = 10.9 mW/g



0 dB = $11.0 \text{ mW/g} = 20.83 \text{ dB mW/g}$

Fig.B.5 validation 1900MHz 250mW

1900MHz

Date: 2013-2-22

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.547 \text{ mho/m}$; $\epsilon_r = 52.02$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.7°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.64, 4.64, 4.64)

System Validation/Area Scan (81x121x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Reference Value = 85.264 V/m ; Power Drift = -0.08 dB

Fast SAR: SAR(1 g) = 10.1 mW/g ; SAR(10 g) = 5.36 mW/g

Maximum value of SAR (interpolated) = 11.6 mW/g

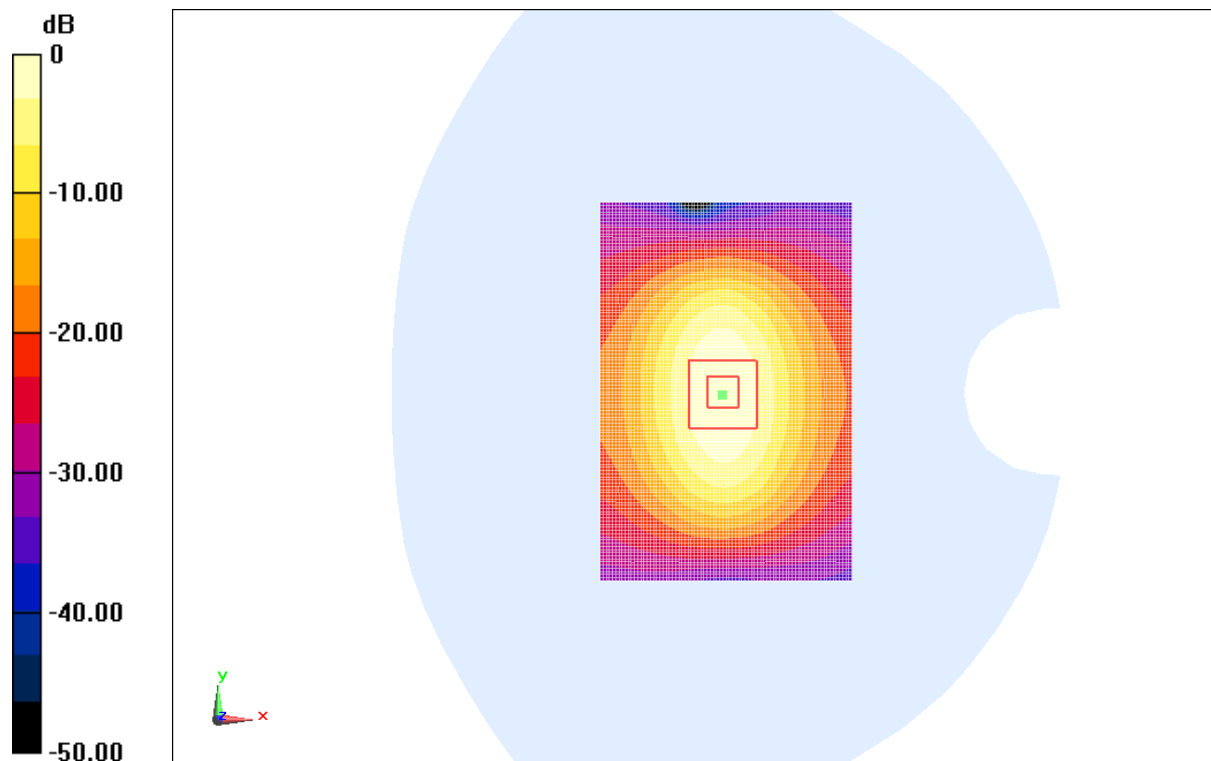
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 85.264 V/m ; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 16.709 W/kg

SAR(1 g) = 10.2 mW/g ; SAR(10 g) = 5.42 mW/g

Maximum value of SAR (measured) = 11.7 mW/g



0 dB = 11.6 mW/g = 21.29 dB mW/g

Fig.B.6 validation 1900MHz 250mW

2450MHz

Date: 2013-2-17

Electronics: DAE4 Sn771

Medium: Head 2450 MHz

Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 1.843 \text{ mho/m}$; $\epsilon_r = 38.87$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.6°C Liquid Temperature: 22.0°C

Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.49, 4.49, 4.49)

System Validation /Area Scan (81x101x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Reference Value = 95.478 V/m ; Power Drift = -0.077 dB

Fast SAR: SAR(1 g) = 13.2 mW/g ; SAR(10 g) = 6.13 mW/g

Maximum value of SAR (interpolated) = 15.0 mW/g

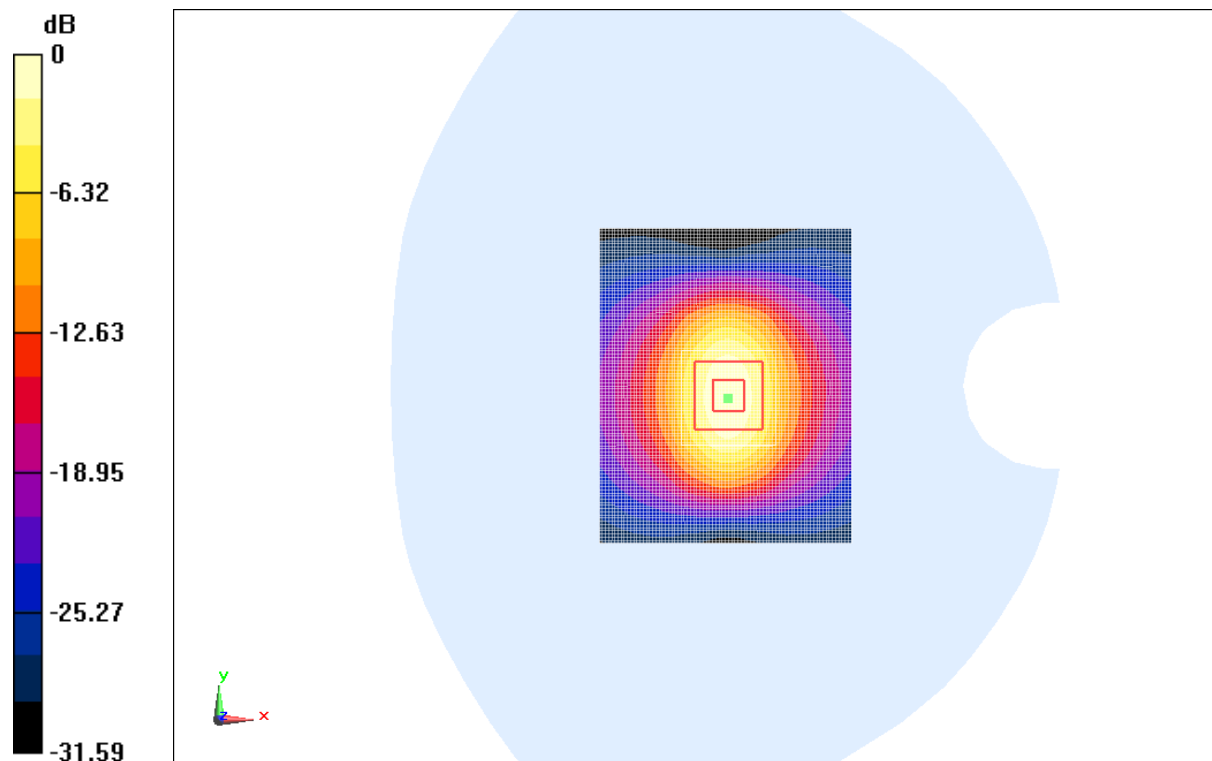
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 95.478 V/m ; Power Drift = -0.077 dB

Peak SAR (extrapolated) = 28.956 mW/g

SAR(1 g) = 13.1 mW/g ; SAR(10 g) = 5.98 mW/g

Maximum value of SAR (measured) = 14.9 mW/g



0 dB = 14.9 mW/g = 23.49 dB mW/g

Fig.B.7 validation 2450MHz 250mW

2450MHz

Date: 2013-2-17

Electronics: DAE4 Sn771

Medium: Body 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.968$ mho/m; $\epsilon_r = 52.26$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.0°C

Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.15, 4.15, 4.15)

System Validation/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm

Reference Value = 93.873 V/m; Power Drift = 0.068 dB

Fast SAR: SAR(1 g) = 12.9 mW/g; SAR(10 g) = 6.06 mW/g

Maximum value of SAR (interpolated) = 14.8 mW/g

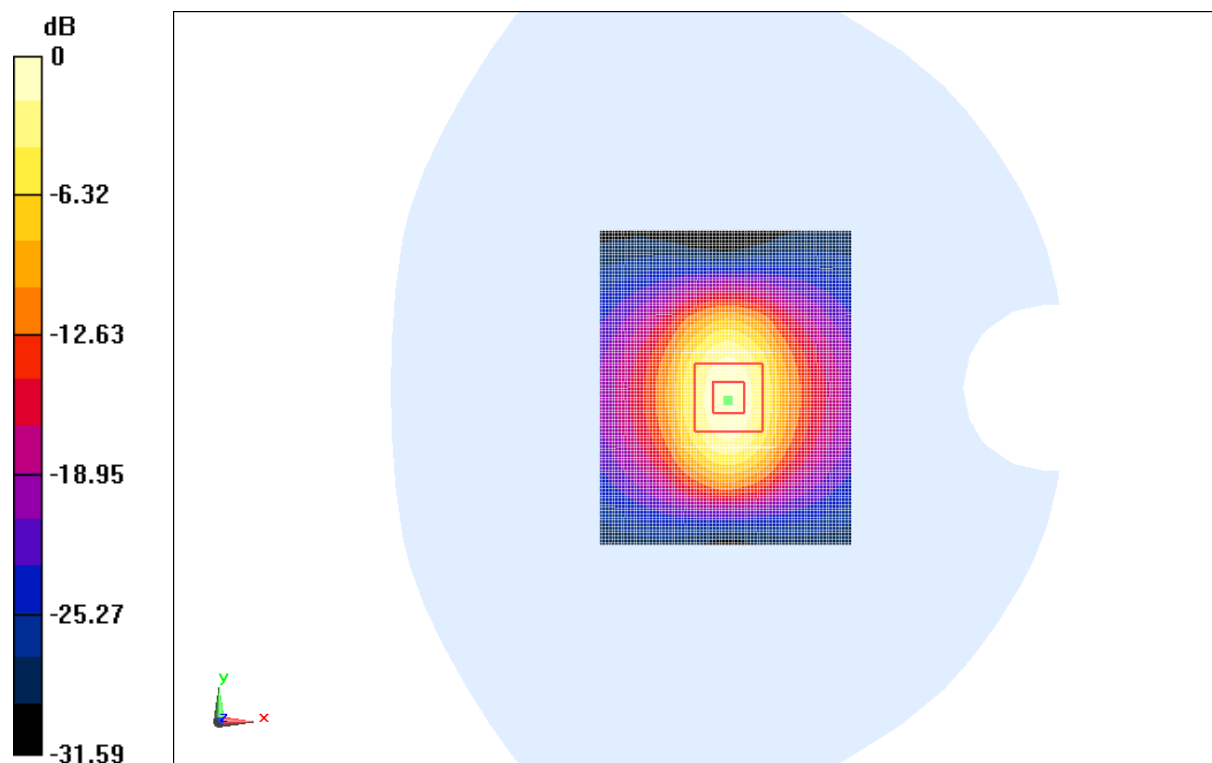
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.873 V/m; Power Drift = 0.068 dB

Peak SAR (extrapolated) = 25.971 mW/g

SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.95 mW/g

Maximum value of SAR (measured) = 14.7 mW/g



0 dB = 14.7 mW/g = 23.35 dB mW/g

Fig.B.8 validation 2450MHz 250mW

5800MHz

Date: 2013-3-10

Electronics: DAE4 Sn771

Medium: Head 5800 MHz

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.389$ mho/m; $\epsilon_r = 34.99$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.2°C

Communication System: CW Frequency: 5800 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(4.28, 4.28, 4.28)

System Validation /Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm

Reference Value = 59.683 V/m; Power Drift = 0.066 dB

Fast SAR: SAR(1 g) = 8.09 mW/g; SAR(10 g) = 2.26 mW/g

Maximum value of SAR (interpolated) = 9.81 mW/g

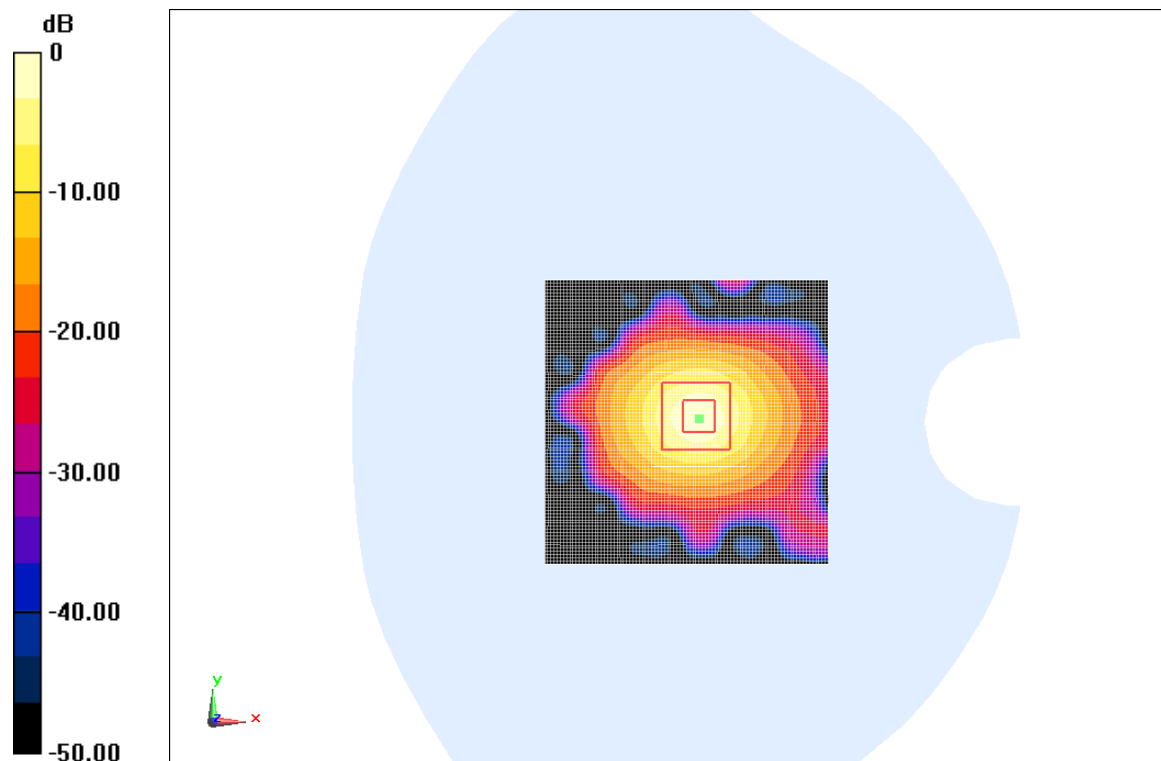
System Validation /Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 59.683 V/m; Power Drift = 0.066 dB

Peak SAR (extrapolated) = 33.914 mW/g

SAR(1 g) = 8.12 mW/g; SAR(10 g) = 2.28 mW/g

Maximum value of SAR (measured) = 9.87 mW/g



0 dB = 9.87 mW/g = 19.89 dB mW/g

Fig.B.9 validation 5800MHz 100mW

5800MHz

Date: 2013-3-10

Electronics: DAE4 Sn771

Medium: Body 5800 MHz

Medium parameters used: $f = 5800$ MHz; $\sigma = 6.014$ mho/m; $\epsilon_r = 46.52$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.7°C Liquid Temperature: 22.2°C

Communication System: CW Frequency: 5800 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(3.92, 3.92, 3.92)

System Validation /Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm

Reference Value = 58.235 V/m; Power Drift = -0.076 dB

Fast SAR: SAR(1 g) = 7.28 mW/g; SAR(10 g) = 1.95 mW/g

Maximum value of SAR (interpolated) = 8.87 mW/g

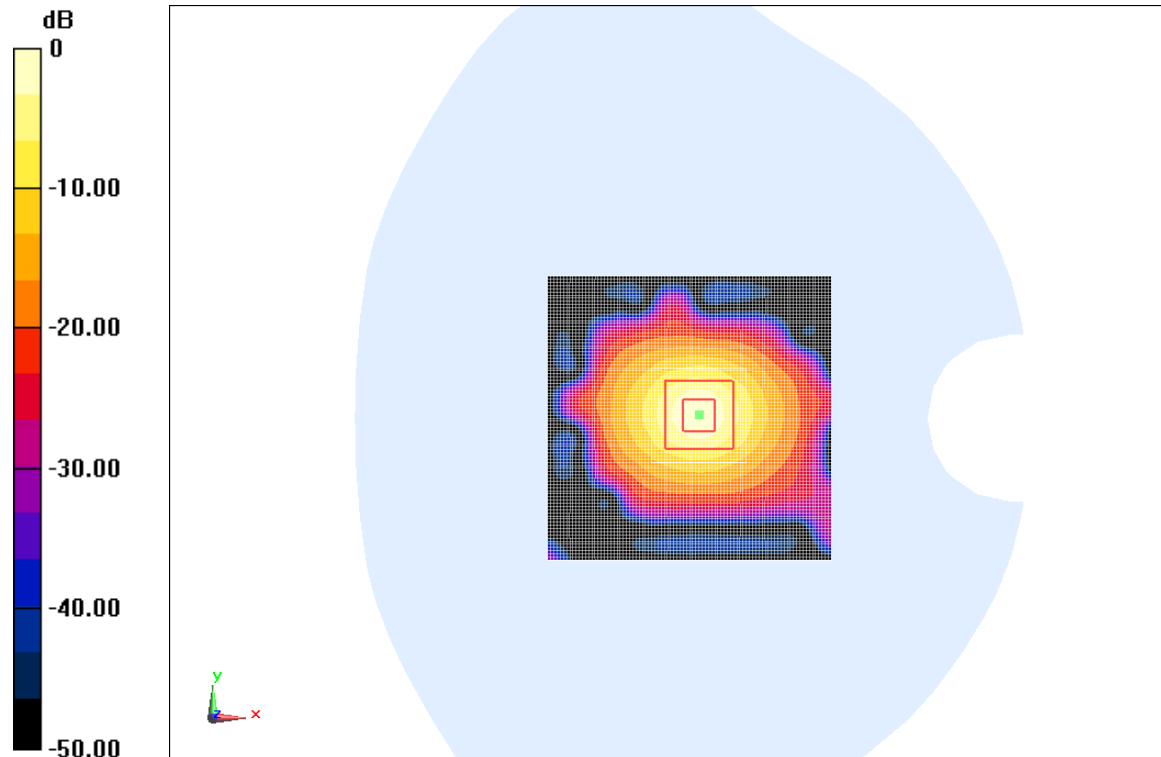
System Validation /Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 58.235 V/m; Power Drift = -0.076 dB

Peak SAR (extrapolated) = 33.592 mW/g

SAR(1 g) = 7.31 mW/g; SAR(10 g) = 1.97 mW/g

Maximum value of SAR (measured) = 8.94 mW/g



0 dB = 8.94 mW/g = 19.03 dB mW/g

Fig.B.10 validation 5800MHz 100mW

5200MHz

Date: 2013-5-25

Electronics: DAE4 Sn771

Medium: Head 5200 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.558$ mho/m; $\epsilon_r = 35.57$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 5200 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(4.68, 4.68, 4.68)

System Validation /Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 9.94 W/kg

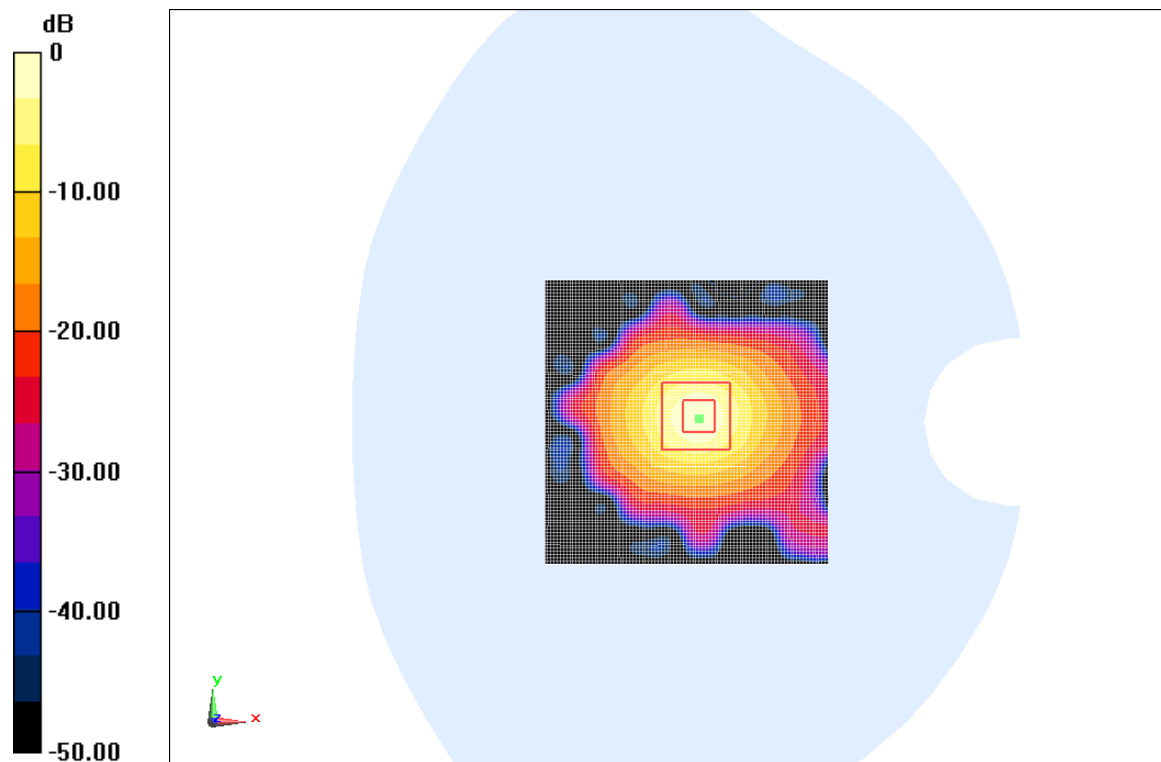
System Validation /Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 63.294 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 35.138 W/kg

SAR(1 g) = 8.27 W/kg; SAR(10 g) = 2.40 W/kg

Maximum value of SAR (measured) = 9.97 W/kg



0 dB = 9.94 W/kg = 19.95 dB W/kg

Fig.B.11 validation 5200MHz 100mW

5200MHz

Date: 2013-5-25

Electronics: DAE4 Sn771

Medium: Body 5200 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.167$ mho/m; $\epsilon_r = 48.24$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 5200 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(4.37, 4.37, 4.37)

System Validation /Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 8.92 W/kg

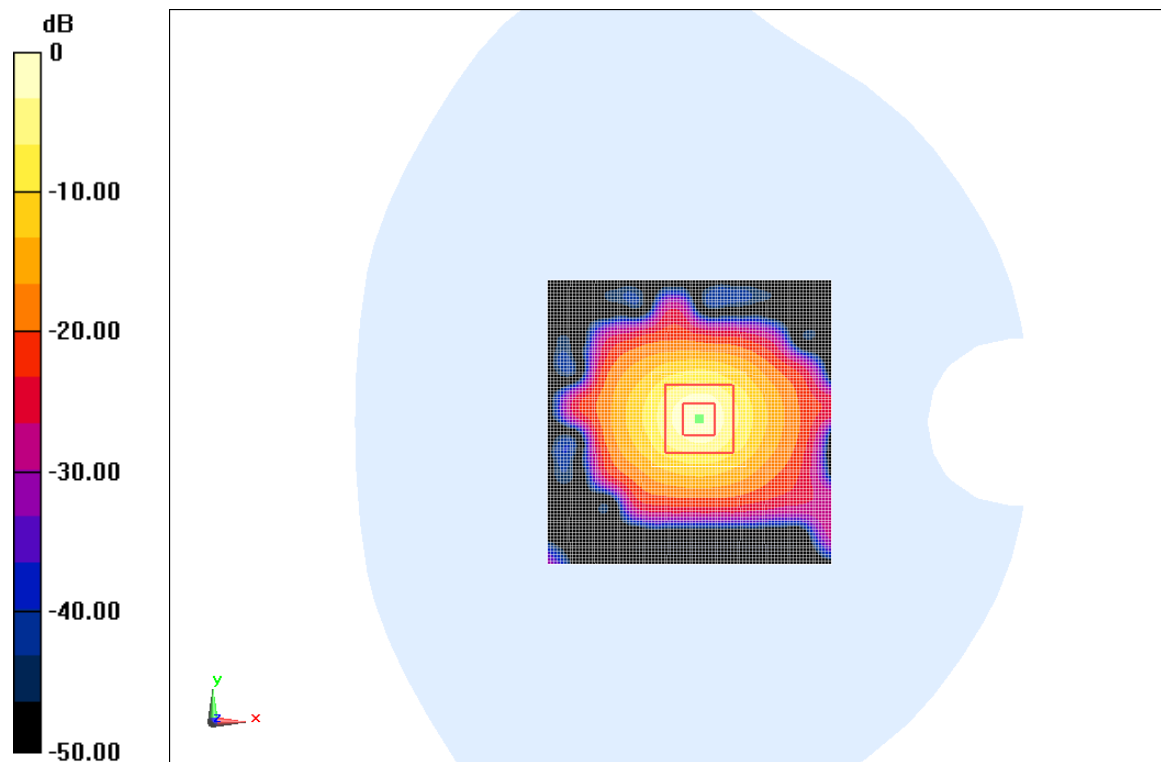
System Validation /Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 58.485 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 33.217 W/kg

SAR(1 g) = 7.32 W/kg; SAR(10 g) = 2.01 W/kg

Maximum value of SAR (measured) = 8.96 W/kg



0 dB = 8.92 W/kg = 19.01 dB W/kg

Fig.B.12 validation 5200MHz 100mW

5500MHz

Date: 2013-5-26

Electronics: DAE4 Sn771

Medium: Head 5500 MHz

Medium parameters used: $f = 5500$ MHz; $\sigma = 4.956$ mho/m; $\epsilon_r = 34.93$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 5500 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(4.43, 4.43, 4.43)

System Validation /Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 10.5 W/kg

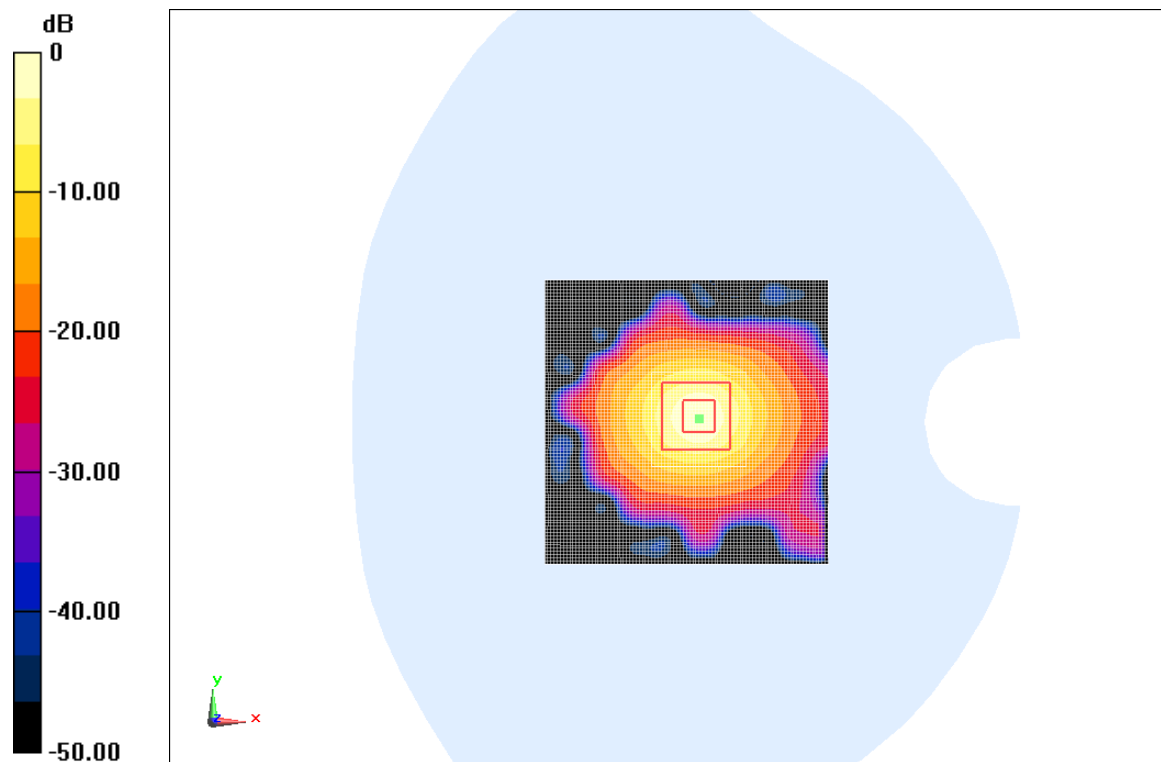
System Validation /Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 64.871 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 35.64 W/kg

SAR(1 g) = 8.75 W/kg; SAR(10 g) = 2.48 W/kg

Maximum value of SAR (measured) = 10.5 W/kg



0 dB = 10.5 W/kg = 20.42 dB W/kg

Fig.B.13 validation 5500MHz 100mW

5500MHz

Date: 2013-5-26

Electronics: DAE4 Sn771

Medium: Body 5500 MHz

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.639$ mho/m; $\epsilon_r = 47.59$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 5500 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(3.89, 3.89, 3.89)

System Validation /Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 9.48 W/kg

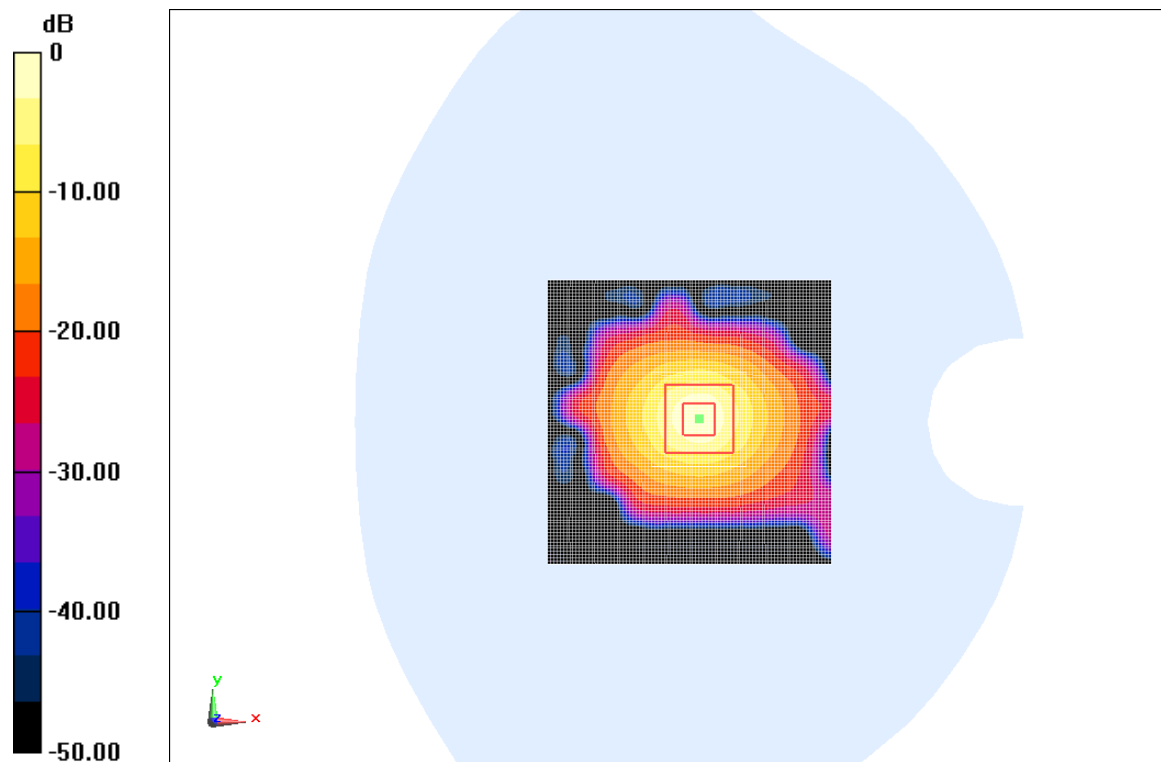
System Validation /Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 59.028 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 33.793 W/kg

SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.15 W/kg

Maximum value of SAR (measured) = 9.51 W/kg



0 dB = 9.48 W/kg = 19.54 dB W/kg

Fig.B.14 validation 5500MHz 100mW

5800MHz

Date: 2013-5-26

Electronics: DAE4 Sn771

Medium: Head 5800 MHz

Medium parameters used: $f = 5800 \text{ MHz}$; $\sigma = 5.354 \text{ mho/m}$; $\epsilon_r = 34.27$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 5800 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(4.28, 4.28, 4.28)

System Validation /Area Scan (91x91x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$
Maximum value of SAR (interpolated) = 9.92 W/kg

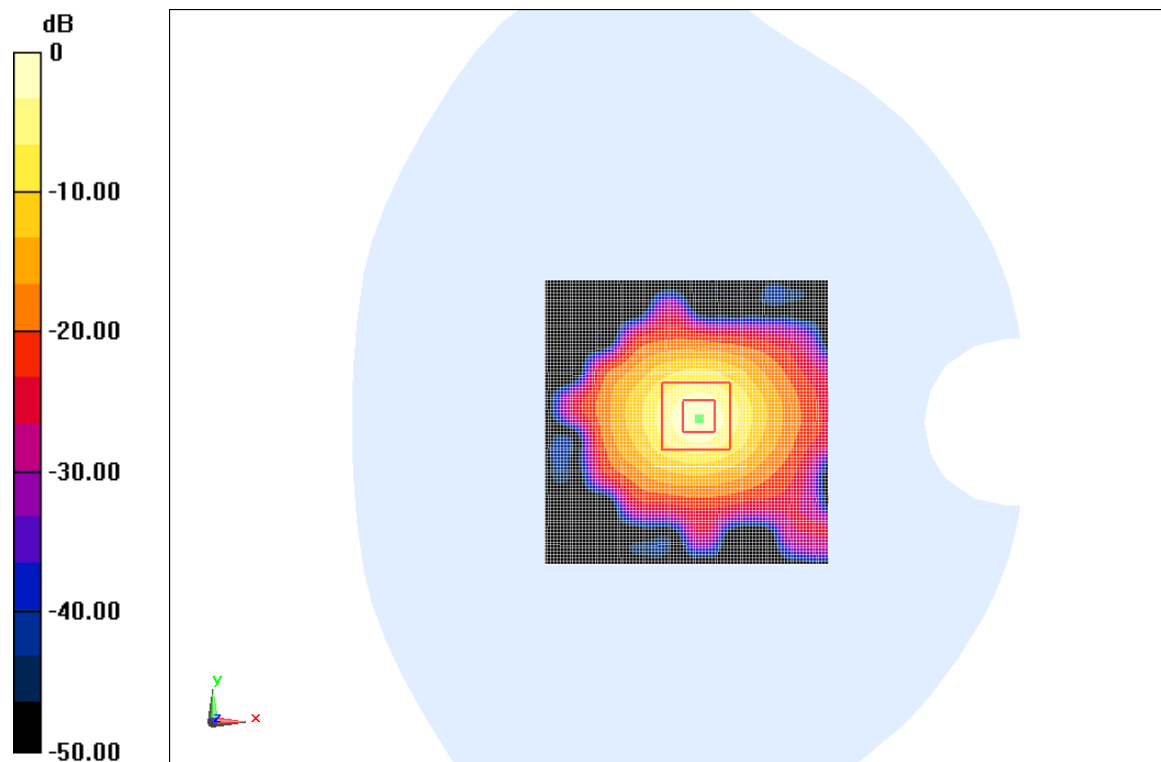
System Validation /Zoom Scan (8x8x8)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=4\text{mm}$

Reference Value = 60.579 V/m ; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 33.96 W/kg

SAR(1 g) = 8.17 W/kg ; SAR(10 g) = 2.31 W/kg

Maximum value of SAR (measured) = 9.91 W/kg



$0 \text{ dB} = 9.92 \text{ W/kg} = 19.93 \text{ dB W/kg}$

Fig.B.15 validation 5800MHz 100mW

5800MHz

Date: 2013-5-26

Electronics: DAE4 Sn771

Medium: Body 5800 MHz

Medium parameters used: $f = 5800$ MHz; $\sigma = 6.127$ mho/m; $\epsilon_r = 46.93$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.6°C Liquid Temperature: 22.1°C

Communication System: CW Frequency: 5800 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(3.92, 3.92, 3.92)

System Validation /Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 8.91 W/kg

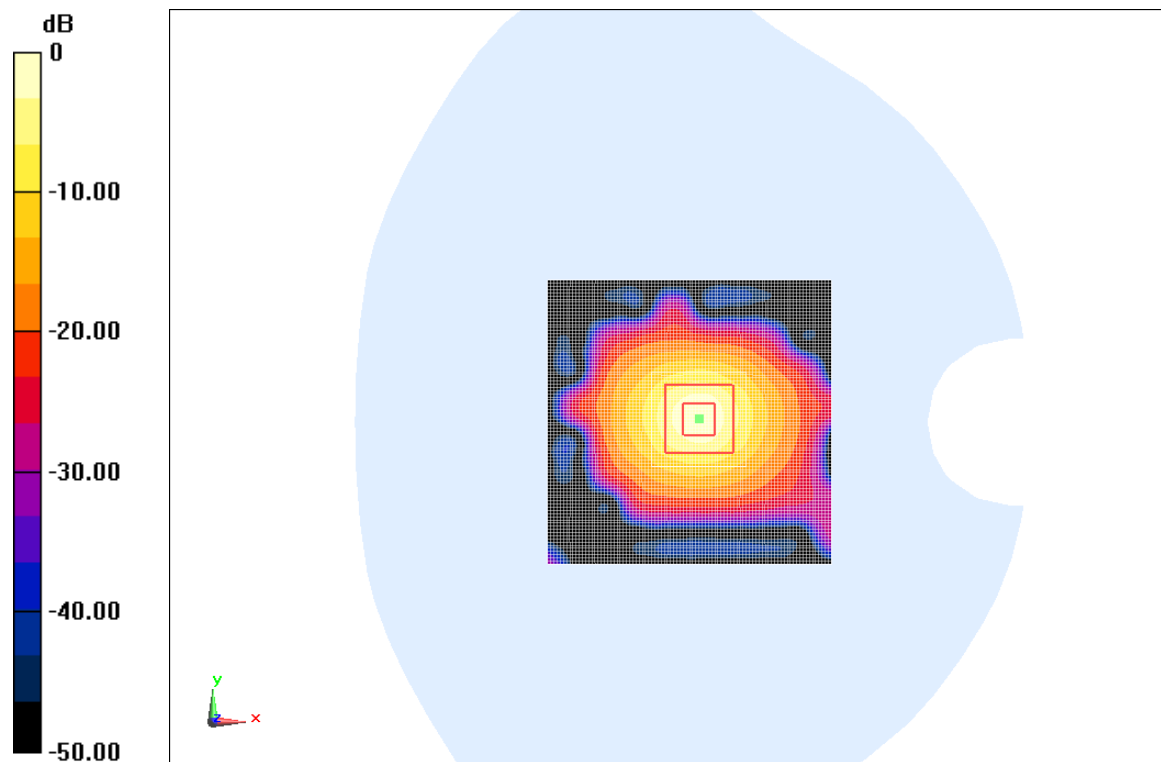
System Validation /Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm

Reference Value = 58.415 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 33.672 W/kg

SAR(1 g) = 7.34 W/kg; SAR(10 g) = 2.00 W/kg

Maximum value of SAR (measured) = 8.97 W/kg



0 dB = 8.91 W/kg = 19.00 dB W/kg

Fig.B.16 validation 5800MHz 100mW

The SAR system verification must be required that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR.

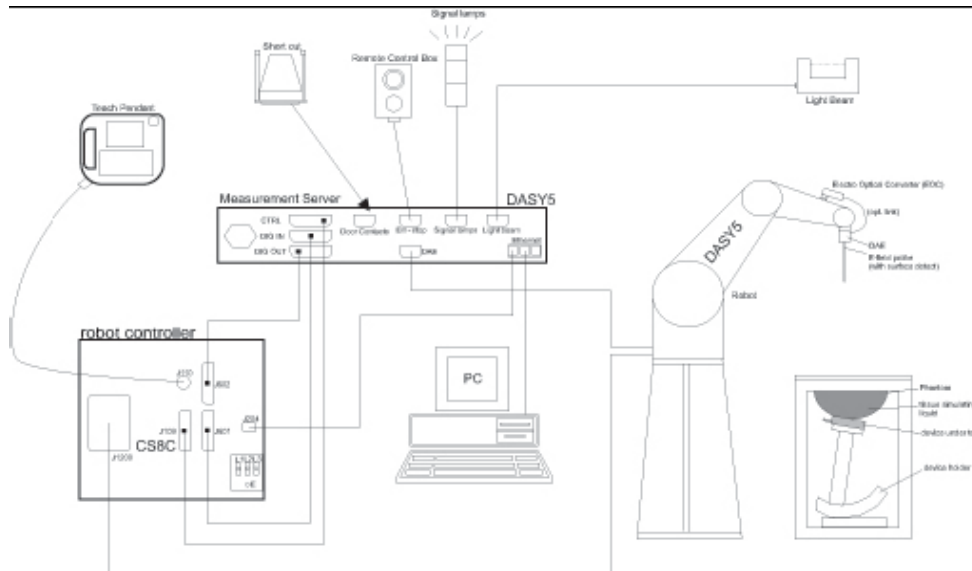
Table B.1 Comparison between area scan and zoom scan for system verification

Band	Position	Area scan (1g)	Zoom scan (1g)	Drift (%)
835	Head	2.36	2.41	-2.07
835	Body	2.37	2.38	-0.42
1750	Head	9.16	9.21	-0.54
1750	Body	8.96	9.03	-0.78
1900	Head	9.65	9.58	0.73
1900	Body	10.1	10.2	-0.98
2450	Head	13.2	13.1	0.76
2450	Body	12.9	12.8	0.78
5800	Head	8.09	8.12	-0.37
5800	Body	7.28	7.31	-0.41

ANNEX C SAR Measurement Setup

C.1 Measurement Set-up

The Dasy4 or DASY5 system for performing compliance tests is illustrated above graphically. This system consists of the following items:



Picture C.1 SAR Lab Test Measurement Set-up

- A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY4 or DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as
- warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

C.2 Dasy4 or DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 or DASY5 software reads the reflection during a software approach and looks for the maximum using 2nd order curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model:	ES3DV3, EX3DV4
Frequency	10MHz — 6.0GHz(EX3DV4)
Range:	10MHz — 4GHz(ES3DV3)
Calibration:	In head and body simulating tissue at Frequencies from 835 up to 5800MHz
Linearity:	± 0.2 dB(30 MHz to 6 GHz) for EX3DV4 ± 0.2 dB(30 MHz to 4 GHz) for ES3DV3
Dynamic Range:	10 mW/kg — 100W/kg
Probe Length:	330 mm
Probe Tip	
Length:	20 mm
Body Diameter:	12 mm
Tip Diameter:	2.5 mm (3.9 mm for ES3DV3)
Tip-Center:	1 mm (2.0mm for ES3DV3)
Application:	SAR Dosimetry Testing Compliance tests of mobile phones Dosimetry in strong gradient fields



Picture C.2 Near-field Probe



Picture C.3 E-field Probe

C.3 E-field Probe Calibration

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed

in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/ cm²:

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C \frac{\Delta T}{\Delta t}$$

Where:

Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

ΔT = Temperature increase due to RF exposure.

$$SAR = \frac{|E|^2 \cdot \sigma}{\rho}$$

Where:

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m³).

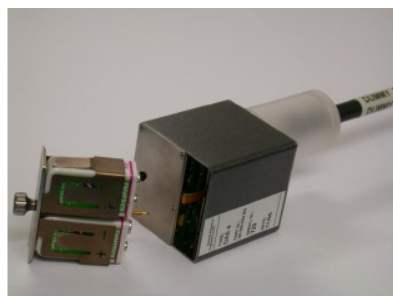
C.4 Other Test Equipment

C.4.1 Data Acquisition Electronics(DAE)

The data acquisition electronics consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



PictureC.4: DAE

C.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90XL; DASY5: RX160L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchron motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)



Picture C.5 DASY 4



Picture C.6 DASY 5

C.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU board with CPU (dasy4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128MB), RAM (DASY4: 64 MB, DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.



Picture C.7 Server for DASY 4



Picture C.8 Server for DASY 5

C.4.4 Device Holder for Phantom

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of $\pm 0.5\text{mm}$ would produce a SAR uncertainty of $\pm 20\%$. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric

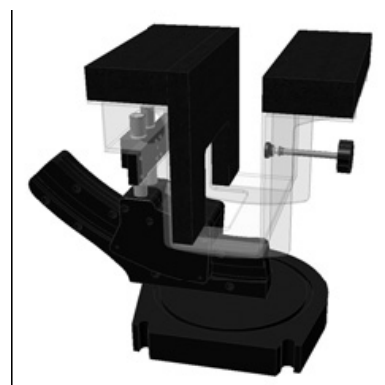
parameters: relative permittivity $\epsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.



Picture C.9-1: Device Holder



Picture C.9-2: Laptop Extension Kit

C.4.5 Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to represent the 90th percentile of the population. The phantom enables the dissymmetric evaluation

of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

Shell Thickness: 2 ± 0.2 mm

Filling Volume: Approx. 25 liters

Dimensions: 810 x 1000 x 500 mm (H x L x W)

Available: Special



Picture C.10: SAM Twin Phantom