WCDMA 1900 Right Cheek Low

Date/Time: 2017-2-12

Electronics: DAE4 Sn786

Medium: Head 1900 MHz

Medium parameters used (interpolated): f = 1852.4 MHz; σ = 1.379 S/m; ε_r = 40.778; ρ = 1000 kg/m^3

Ambient Temperature:21.8^{o}C   Liquid Temperature:21.3^{o}C

Communication System: UID 0, 3G_WCDMA (0) Frequency: 1852.4 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3151 ConvF(4.88, 4.88, 4.88);;

Right Cheek Low/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.458 W/kg

Right Cheek Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.064 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.616 W/kg

SAR(1 g) = 0.417 W/kg; SAR(10 g) = 0.241 W/kg

Maximum value of SAR (measured) = 0.451 W/kg

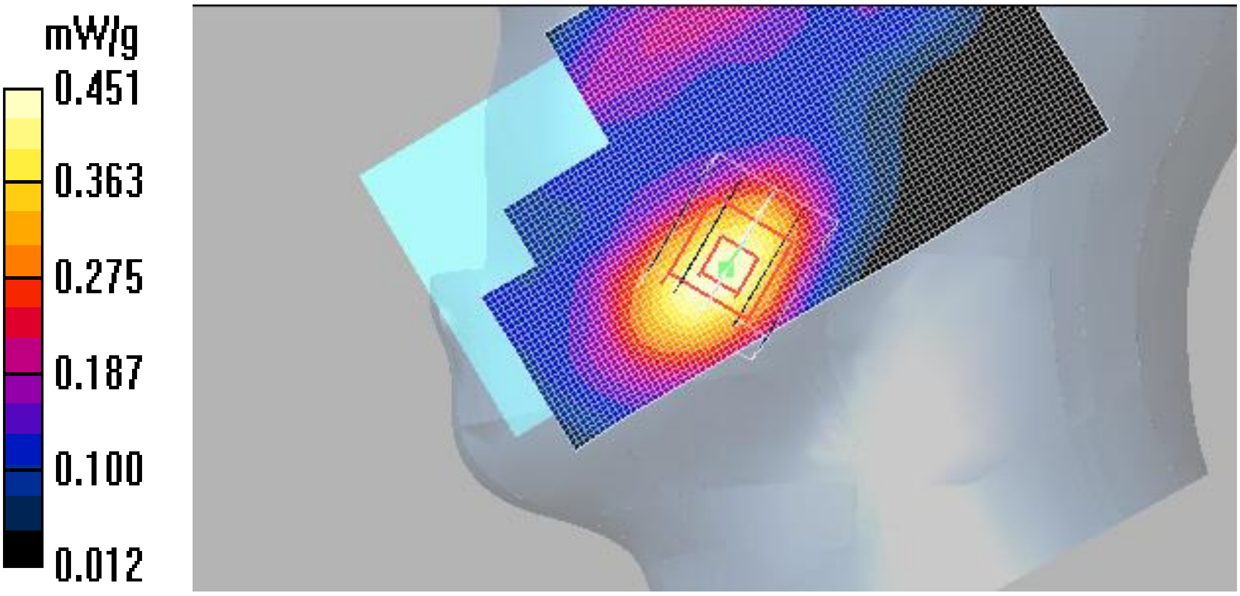


Fig.7 WCDMA1900 CH9262

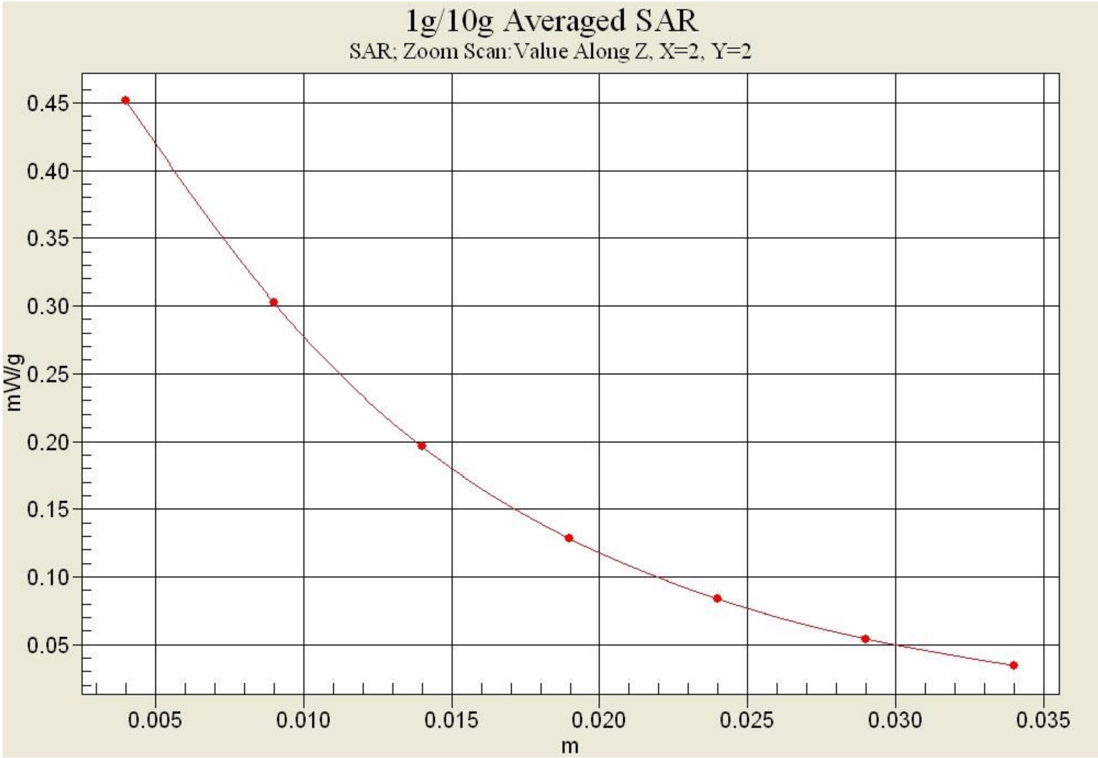


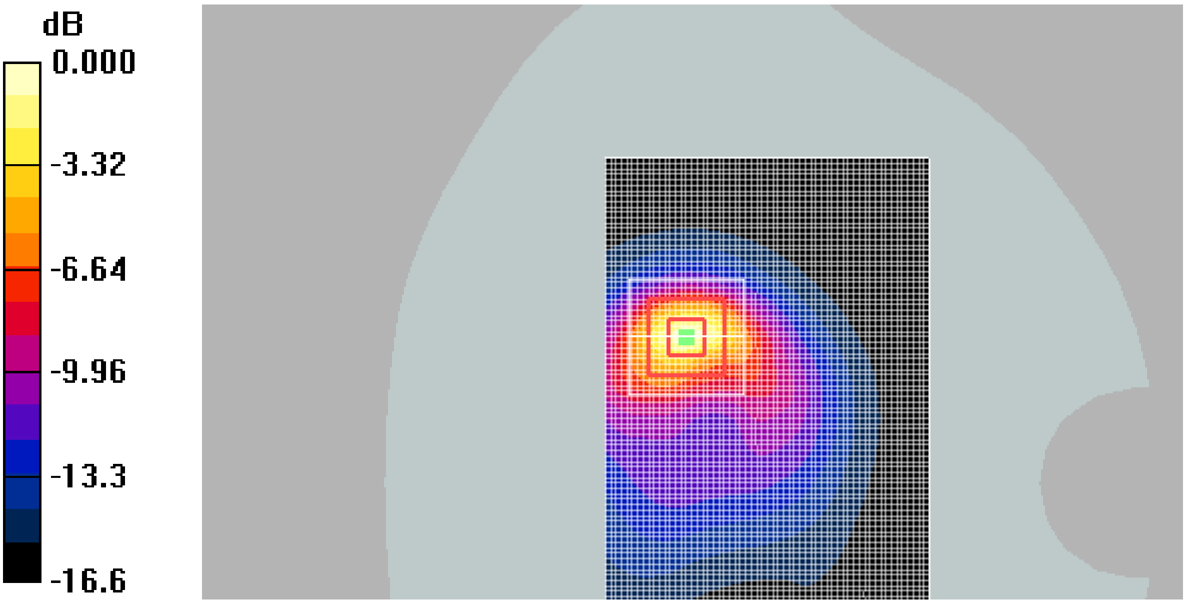
Fig.7-1 Z-Scan at power reference point (WCDMA1900 CH9262)

WCDMA 1900 Body BottomMiddle

Date/Time: 2017-2-12
Electronics: DAE4 Sn786
Medium: Body 1900 MHz
Medium parameters used: f = 1880 MHz; σ = 1.531 S/m; ε_r = 52.973; ρ = 1000 kg/m^3
Ambient Temperature:22.3°C Liquid Temperature:21.8°C
Communication System: UID 0, 3G_WCDMA (0) Frequency: 1880 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF(4.49, 4.49, 4.49);

Bottom side Mid/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.36 W/kg

Bottom side Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.586 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 2.25 W/kg
SAR(1 g) = 1.11 W/kg; SAR(10 g) = 0.571 W/kg
Maximum value of SAR (measured) = 1.26 W/kg



0 dB = 1.26W/kg

Fig.8 WCDMA1900 CH9400

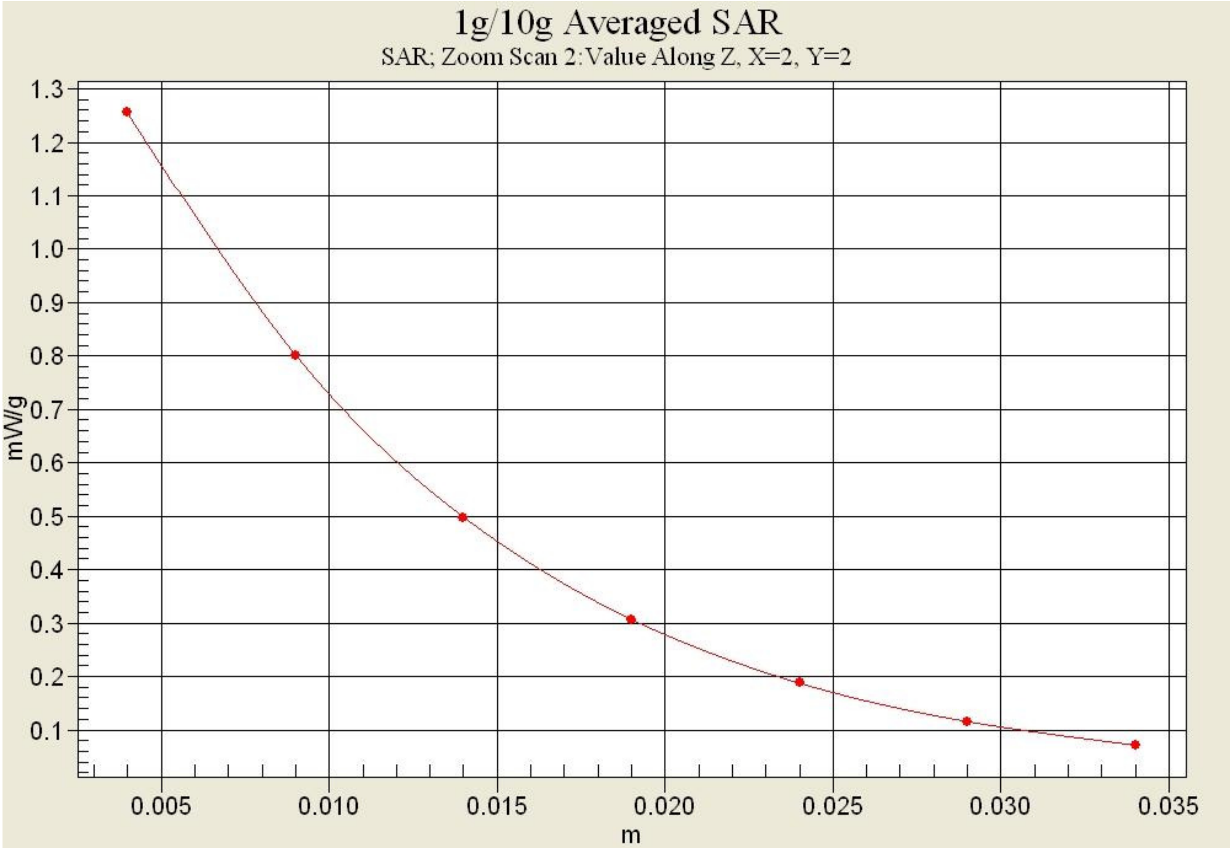


Fig.8-1 Z-Scan at power reference point (WCDMA1900 CH9400)

WCDMA 1700 Right Cheek High

Date/Time: 2017-2-13
Electronics: DAE4 Sn786
Medium: Head 1800 MHz
Medium parameters used (interpolated): f = 1752.6 MHz; σ = 1.338 S/m; ε_r = 41.21; ρ = 1000 kg/m^3
Ambient Temperature:22.7°C Liquid Temperature:22.2°C
Communication System: UID 0, 3G_WCDMA (0) Frequency: 1752.6 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF(5.10, 5.10, 5.10);

Right Cheek High/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.600 W/kg

Right Cheek High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.594 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.689 W/kg
SAR(1 g) = 0.545 W/kg; SAR(10 g) = 0.342 W/kg
Maximum value of SAR (measured) = 0.597 W/kg

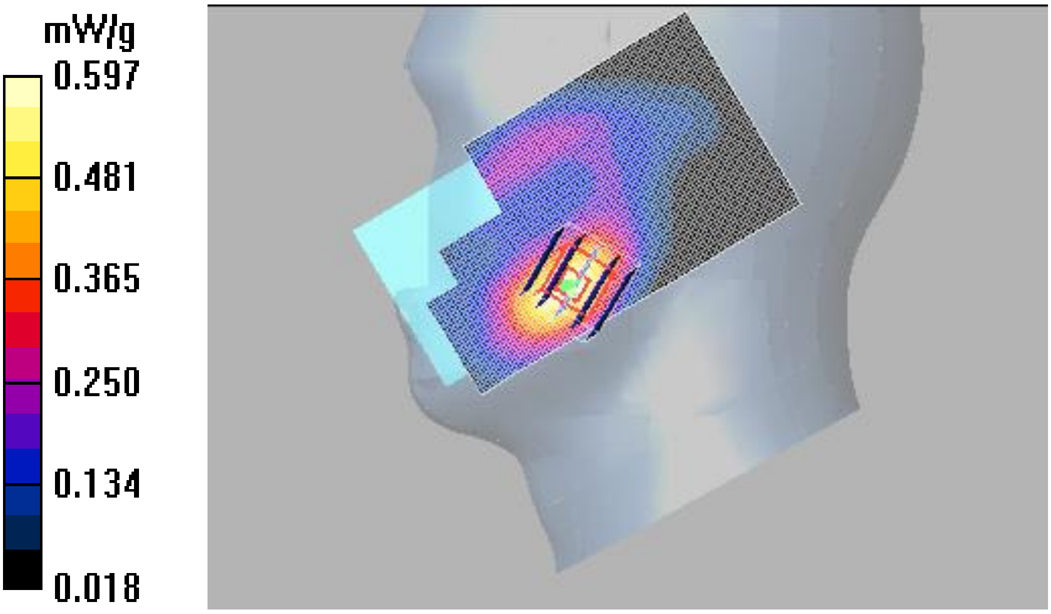


Fig.9 WCDMA1700 CH1513

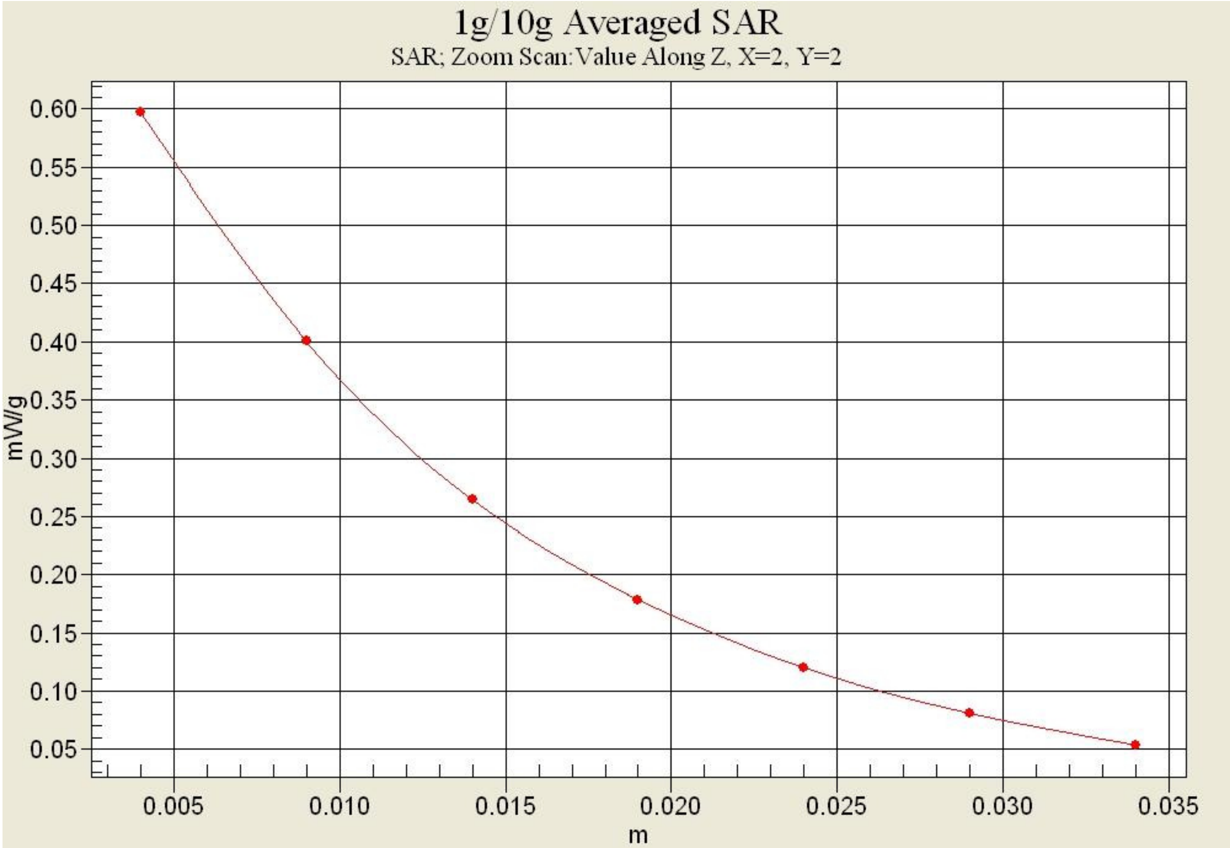


Fig.9-1 Z-Scan at power reference point (WCDMA1700 CH1513)

WCDMA 1700 Body FrontMiddle

Date/Time: 2017-2-13

Electronics: DAE4 Sn786

Medium: Body 1800 MHz

Medium parameters used (interpolated): f = 1732.6 MHz; σ = 1.437 S/m; ε_r = 53.438; ρ = 1000 kg/m^3

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

Communication System: UID 0, 3G_WCDMA (0) Frequency: 1732.6 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3151 ConvF(4.95, 4.95, 4.95);

Front side Mid/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.48 W/kg

Front side Mid /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 11.474 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.64 W/kg

SAR(1 g) = 1.09 W/kg; SAR(10 g) = 0.592 W/kg

Maximum value of SAR (measured) = 1.12 W/kg

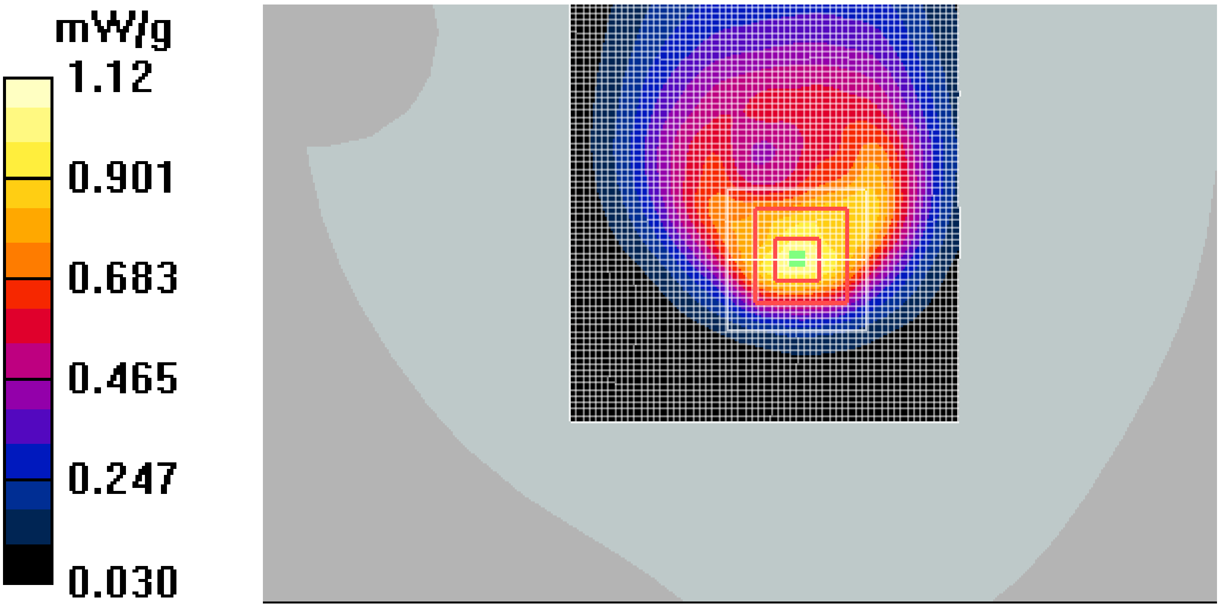


Fig.10 WCDMA1700 CH1413

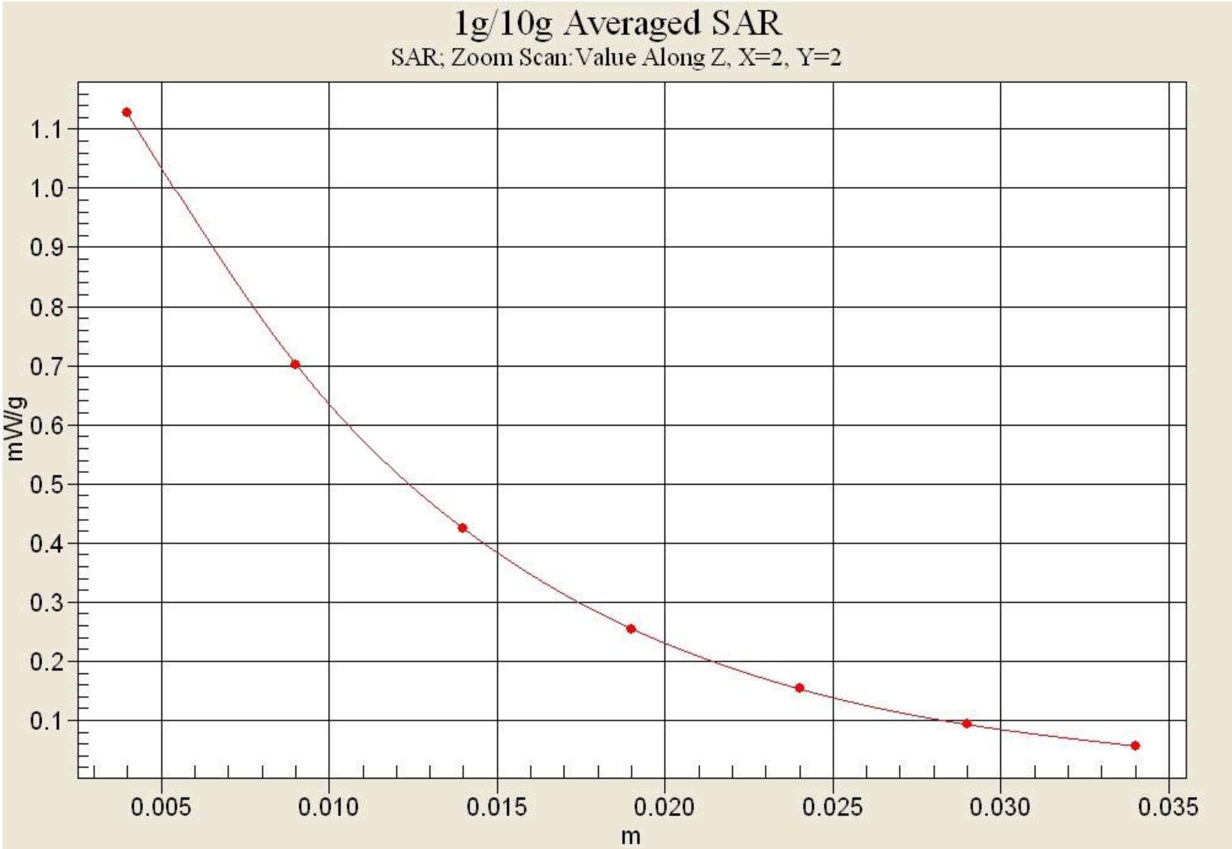


Fig.10-1 Z-Scan at power reference point (WCDMA1700 CH1413)

LTE Band 2Left Cheek Low with QPSK_20MHz_1RB_Mid

Date/Time: 2017-2-12
Electronics: DAE4 Sn786
Medium: Head 1900 MHz
Medium parameters used: f = 1860 MHz; σ = 1.385 S/m; ε_r = 40.761; ρ = 1000 kg/m^3
Ambient Temperature:21.5°C Liquid Temperature:21.0°C
Communication System: UID 0, 4G_LTE_FDD (0) Frequency: 1860 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF(4.88, 4.88, 4.88);

Left Cheek Low 1RB_Mid/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.296 W/kg

LeftCheek Low 1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value =8.580 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.482 W/kg
SAR(1 g) = 0.269 W/kg; SAR(10 g) = 0.157 W/kg
Maximum value of SAR (measured) = 0.289 W/kg

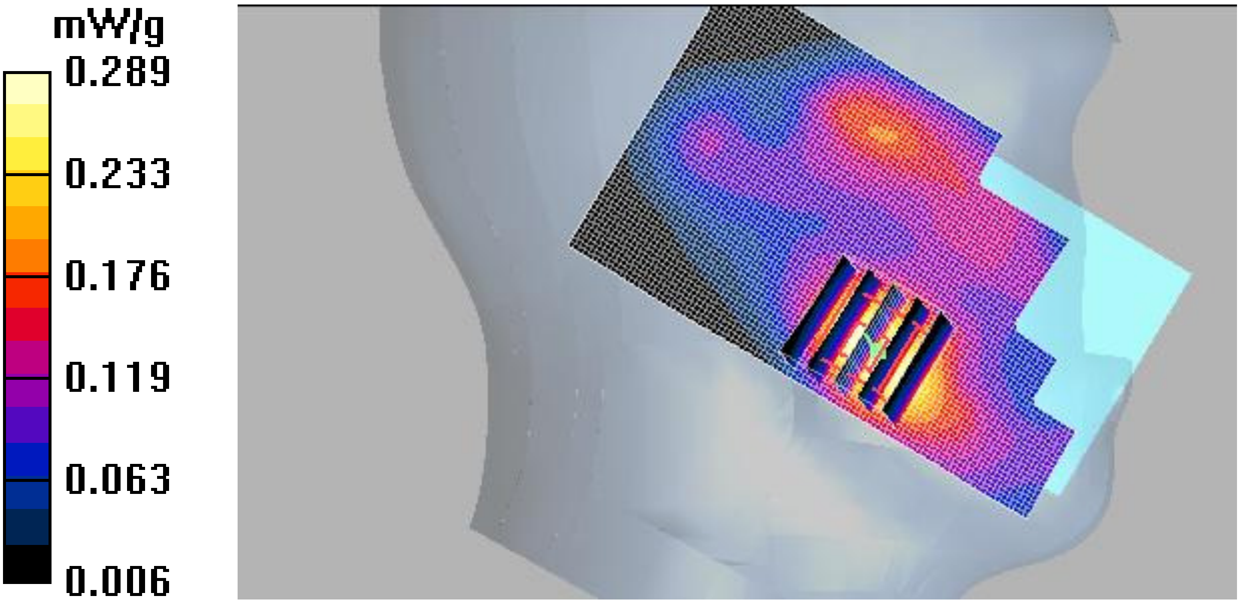


Fig.11 LTE Band 2 CH18700

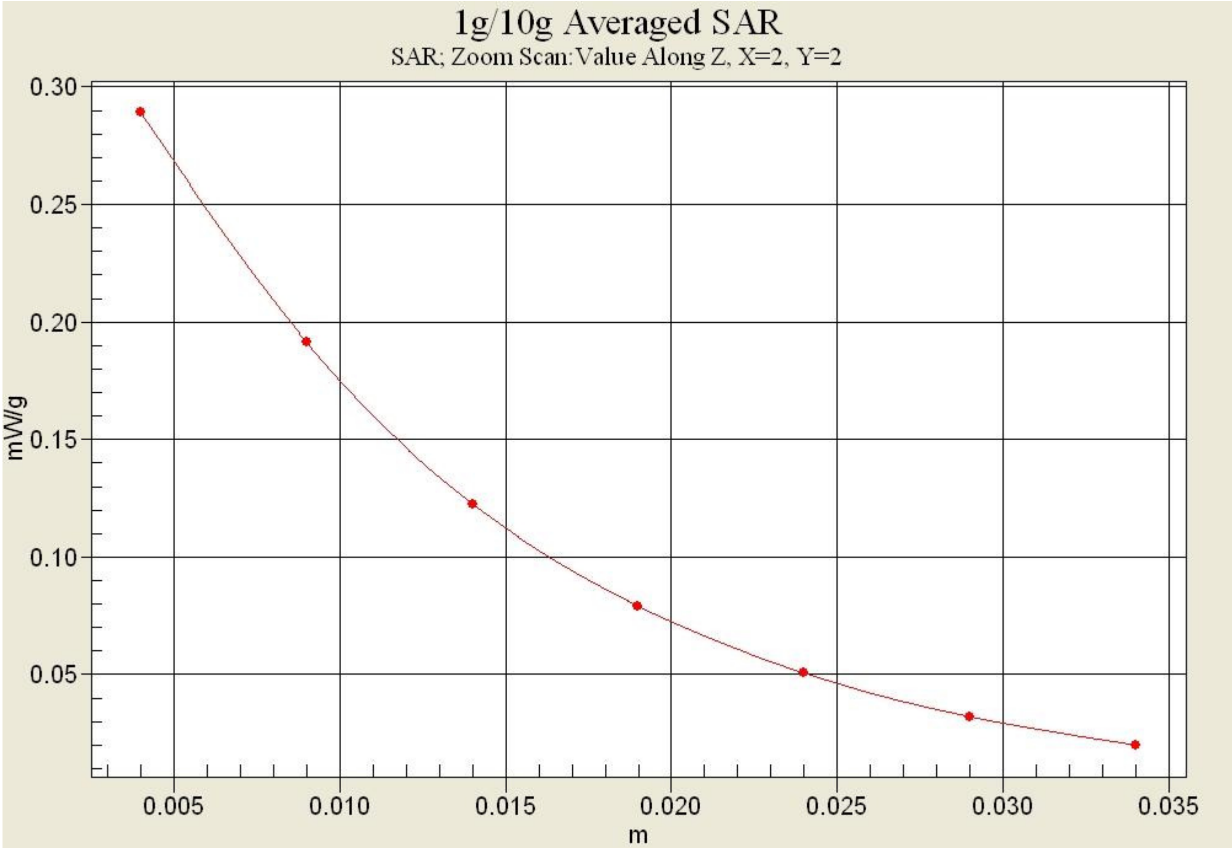


Fig.11-1 Z-Scan at power reference point (LTE Band 2CH18700)

LTE Band 2 Body BottomMid with QPSK_20MHz_1RB_Mid

Date/Time: 2017-2-12
Electronics: DAE4 Sn786
Medium: Body 1900 MHz
Medium parameters used: f = 1880 MHz; σ = 1.531 S/m; ε_r = 52.973; ρ = 1000 kg/m^3
Ambient Temperature:21.8^{o}C Liquid Temperature:21.3^{o}C
Communication System: UID 0, 4G_LTE_FDD (0) Frequency: 1880 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF(4.49, 4.49, 4.49);

Bottom side Mid1RB_Mid/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.08 W/kg

Bottom side Mid 1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.065 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.78 W/kg
SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.530 W/kg
Maximum value of SAR (measured) = 1.13 W/kg

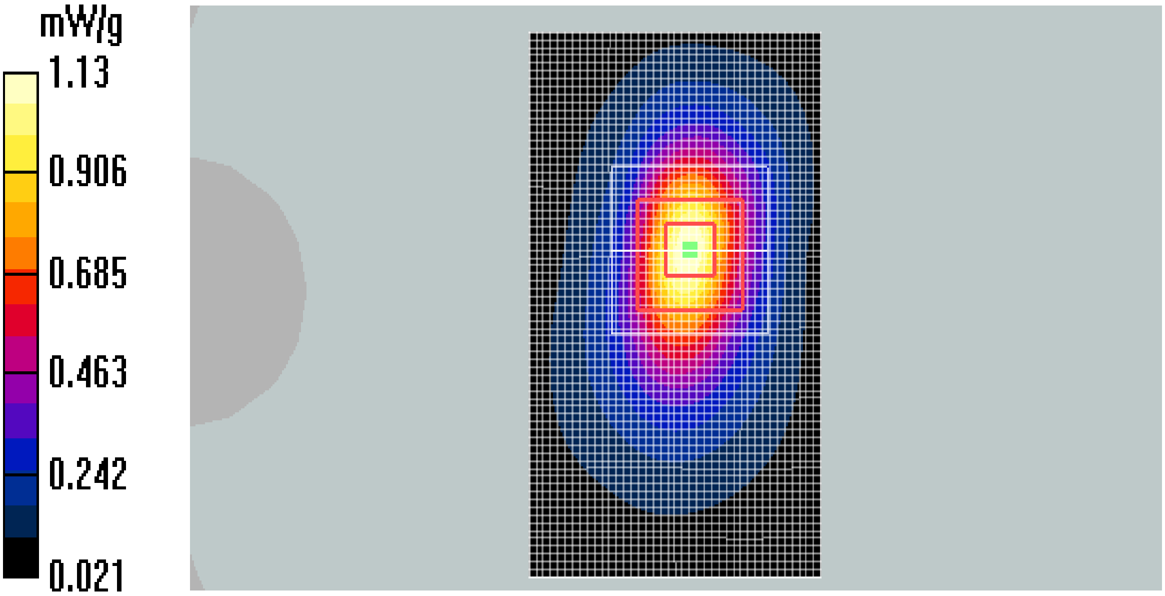


Fig.12 LTE Band 2 CH18900

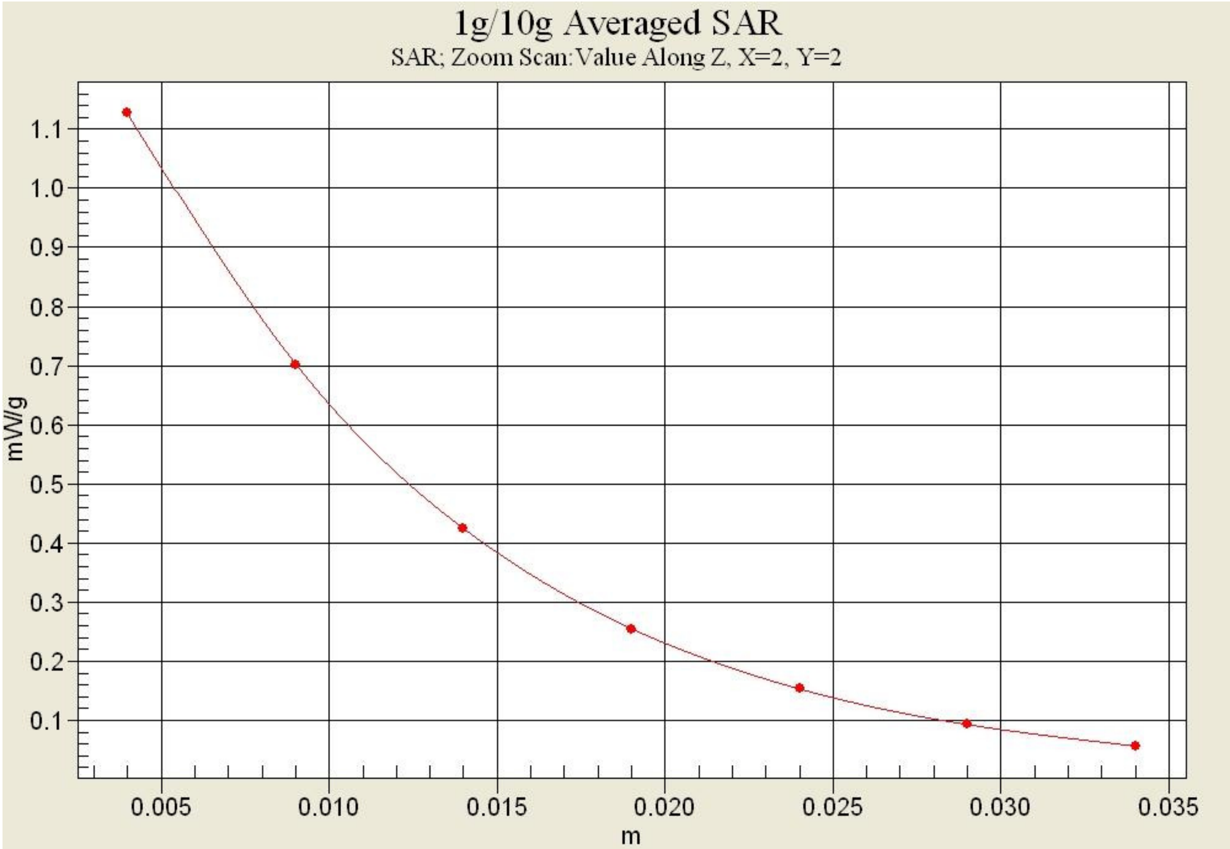


Fig.12-1 Z-Scan at power reference point (LTE Band 2CH18900)

LTE Band 4Right Cheek Low with QPSK_20MHz_1RB_Low

Date/Time: 2017-2-13
Electronics: DAE4 Sn786
Medium: Head 1800 MHz
Medium parameters used: f = 1720 MHz; σ = 1.307 S/m; ε_r = 41.344; ρ = 1000 kg/m^3
Ambient Temperature:22.2^{o}C   Liquid Temperature:21.7^{o}C
Communication System: UID 0, 4G_LTE_FDD (0) Frequency: 1720 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF(5.10, 5.10, 5.10);

Right Cheek Low 1RB_Low /Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.378 W/kg

Right Cheek Low 1RB_Low /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.87 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 0.501 W/kg
SAR(1 g) = 0.350 W/kg; SAR(10 g) = 0.223 W/kg
Maximum value of SAR (measured) = 0.382 W/kg

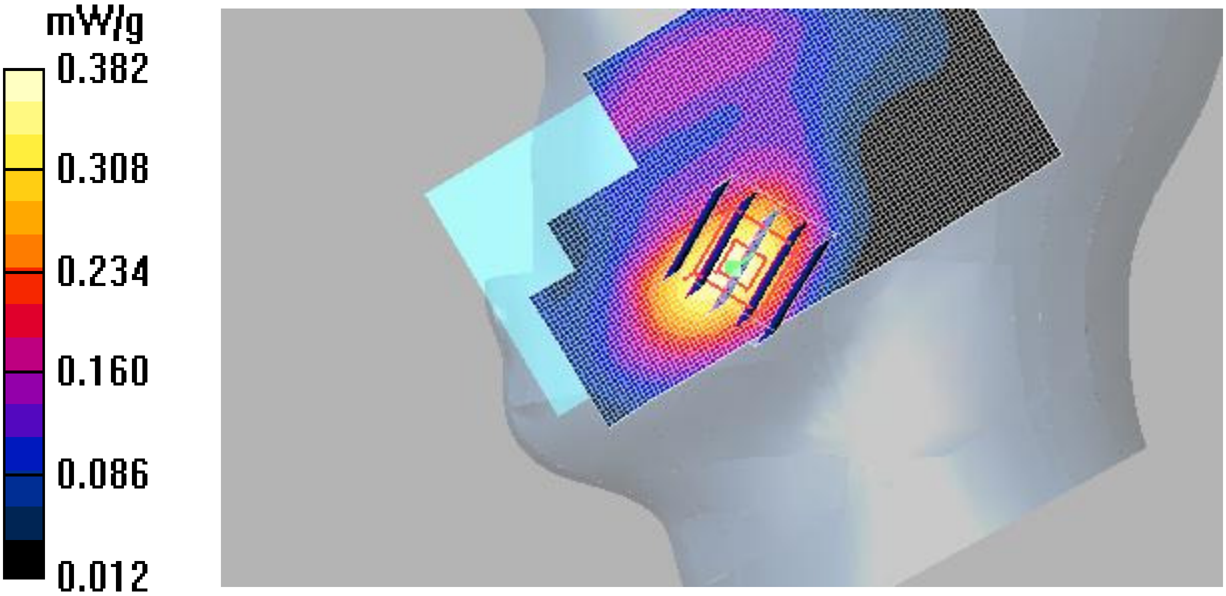


Fig.13 LTE Band4 CH20050

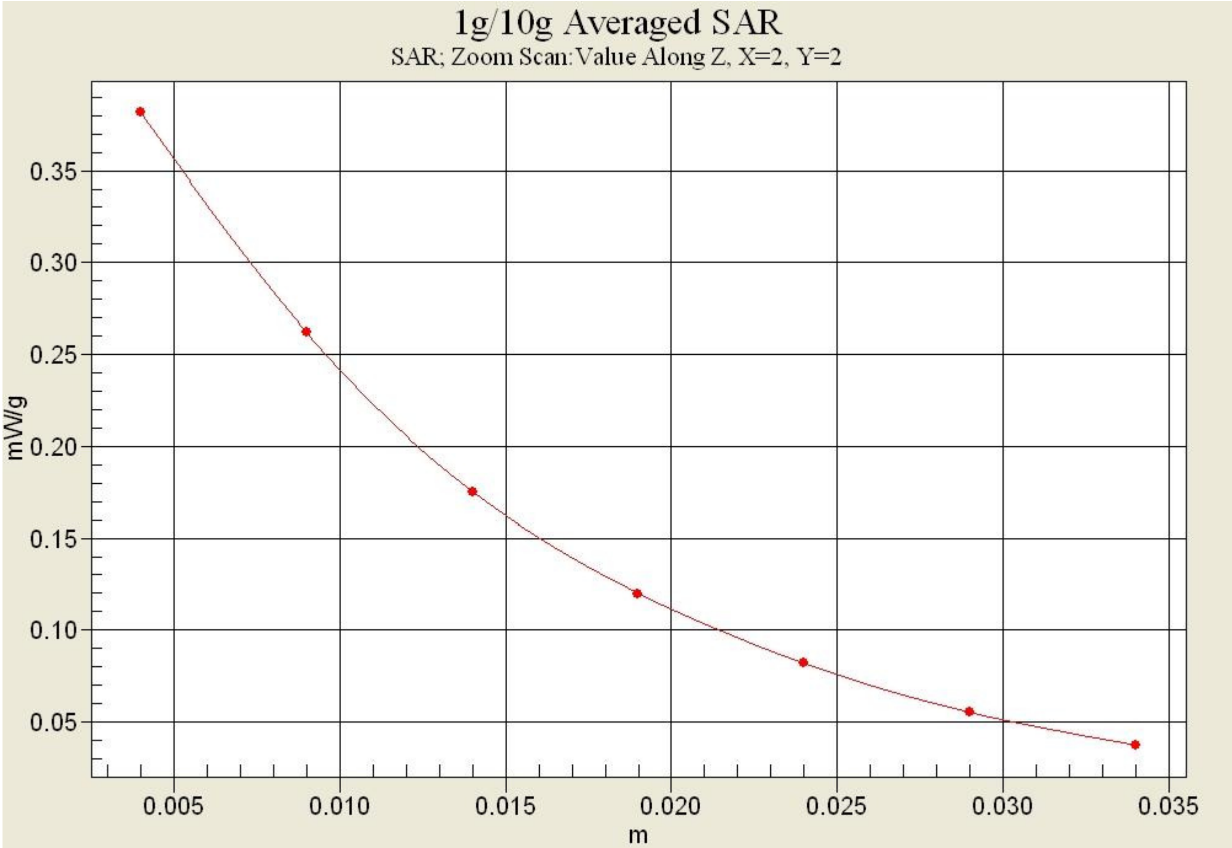


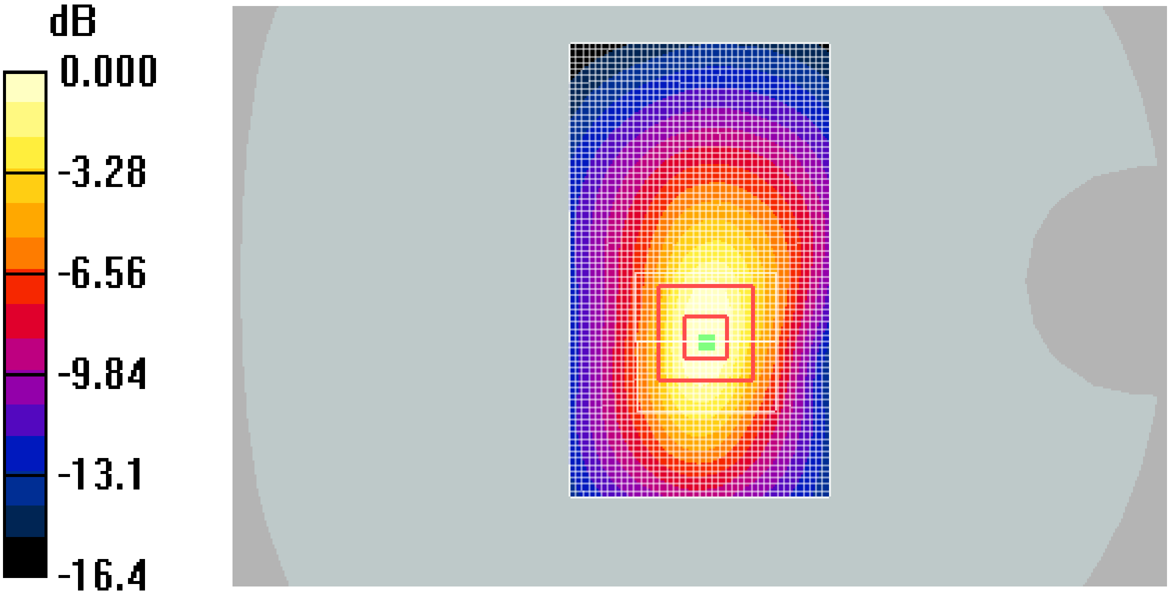
Fig.13-1 Z-Scan at power reference point (LTE Band 4CH20050)

LTE Band 4 Body BottomHigh with QPSK_20MHz_1RB_Middle

Date/Time: 2017-2-13
Electronics: DAE4 Sn786
Medium: Body 1800 MHz
Medium parameters used: f = 1745 MHz; σ = 1.449 S/m; ε_r = 53.396; ρ = 1000 kg/m^3
Ambient Temperature:21.8^{o}C Liquid Temperature:21.3^{o}C
Communication System: UID 0, 4G_LTE_FDD (0) Frequency: 1745 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF(7.63, 7.63, 7.63);

Bottom sideHigh 1RB_Mid/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.03 W/kg

Bottom side High 1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.477 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 1.48 W/kg
SAR(1 g) = 0.892 W/kg; SAR(10 g) = 0.486 W/kg
Maximum value of SAR (measured) = 0.994 W/kg



0 dB = 0.994 W/kg

Fig.14 LTE Band 4 CH20300

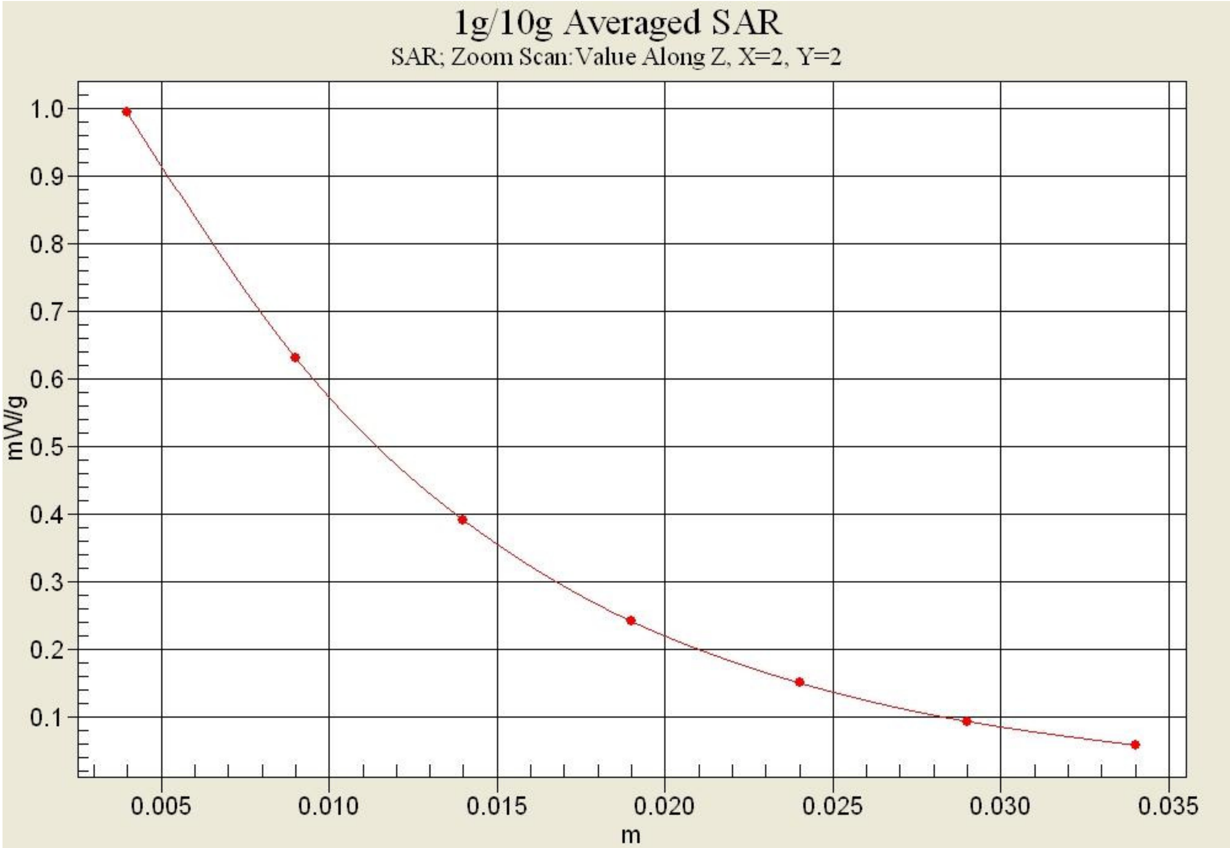


Fig.14-1 Z-Scan at power reference point (LTE Band 4CH20300)

LTE Band 5Right Cheek Highwith QPSK_10MHz_1RB_Mid

Date/Time: 2017-2-8

Electronics: DAE4 Sn786

Medium: Head 835 MHz

Medium parameters used: f = 844 MHz; σ = 0.905 S/m; ε_r = 41.071; ρ = 1000 kg/m^3

Ambient Temperature:22.0^{o}C Liquid Temperature:21.5^{o}C

Communication System: UID 0, 4G_LTE_FDD (0) Frequency: 844 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3151 ConvF(6.08,6.08, 6.08);

Right Cheek High 1RB_Mid/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.378 W/kg

Right Cheek High1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.902 V/m; Power Drift = -0.12dB

Peak SAR (extrapolated) = 0.474 W/kg

SAR(1 g) = 0.356 W/kg; SAR(10 g) = 0.268 W/kg

Maximum value of SAR (measured) = 0.370 W/kg

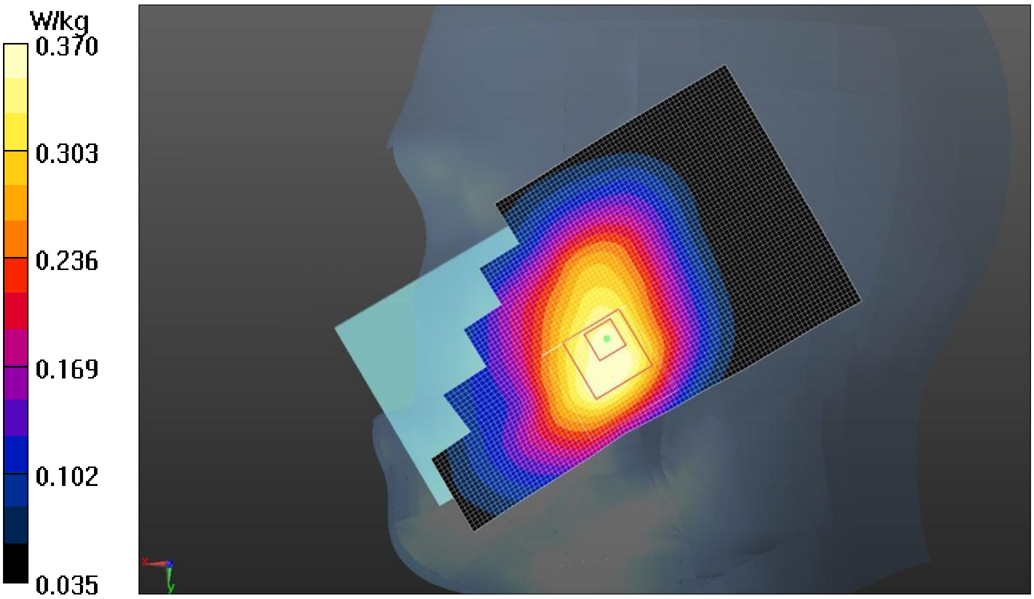


Fig.15 LTE Band 5 CH20600

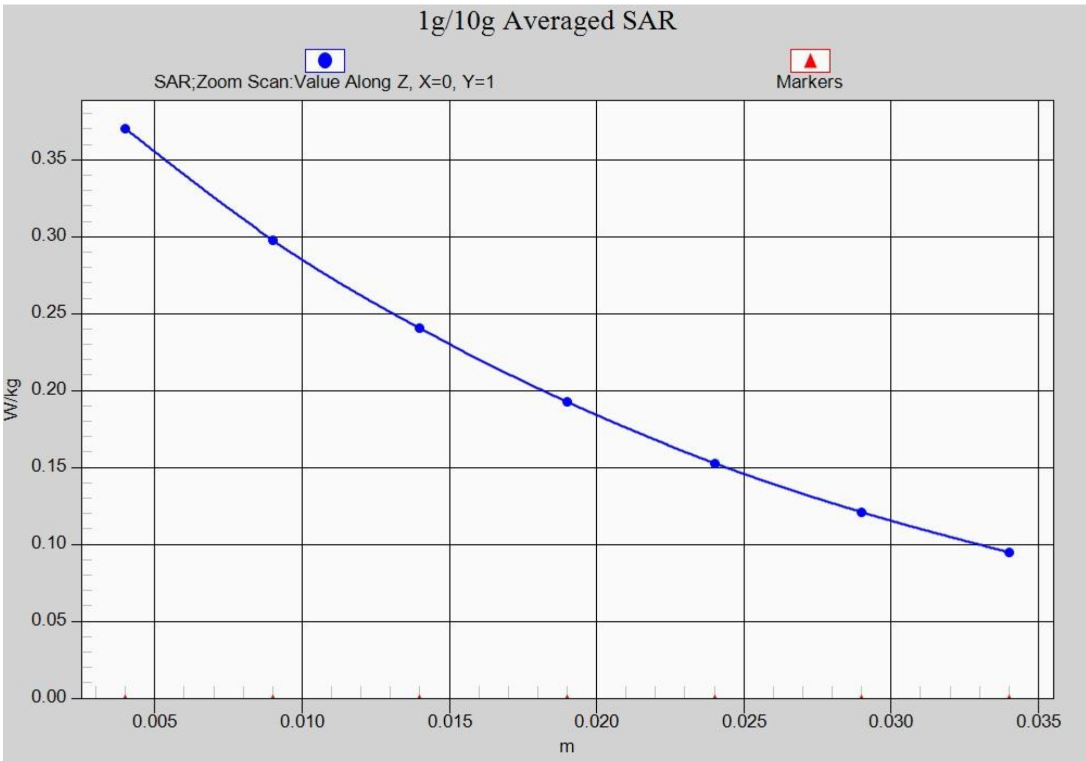


Fig.15-1 Z-Scan at power reference point (LTE Band 5CH20600)

LTE Band 5 Body RearHigh with QPSK_10MHz_1RB_Mid

Date/Time: 2017-2-8
Electronics: DAE4 Sn786
Medium: Body 835 MHz
Medium parameters used: f = 844 MHz; σ = 0.992 S/m; ε_r = 55.511; ρ = 1000 kg/m^3
Ambient Temperature:22.4^{o}C   Liquid Temperature:21.9^{o}C
Communication System: UID 0, 4G_LTE_FDD (0) Frequency: 844 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF(6.13, 6.13, 6.13);

Rear side High 1RB_Mid/Area Scan (41x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.605 W/kg

Rear side High 1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.496 V/m; Power Drift = -0.06
Peak SAR (extrapolated) = 0.706 W/kg
SAR(1 g) = 0.570 W/kg; SAR(10 g) = 0.433 W/kg
Maximum value of SAR (measured) = 0.597 W/kg

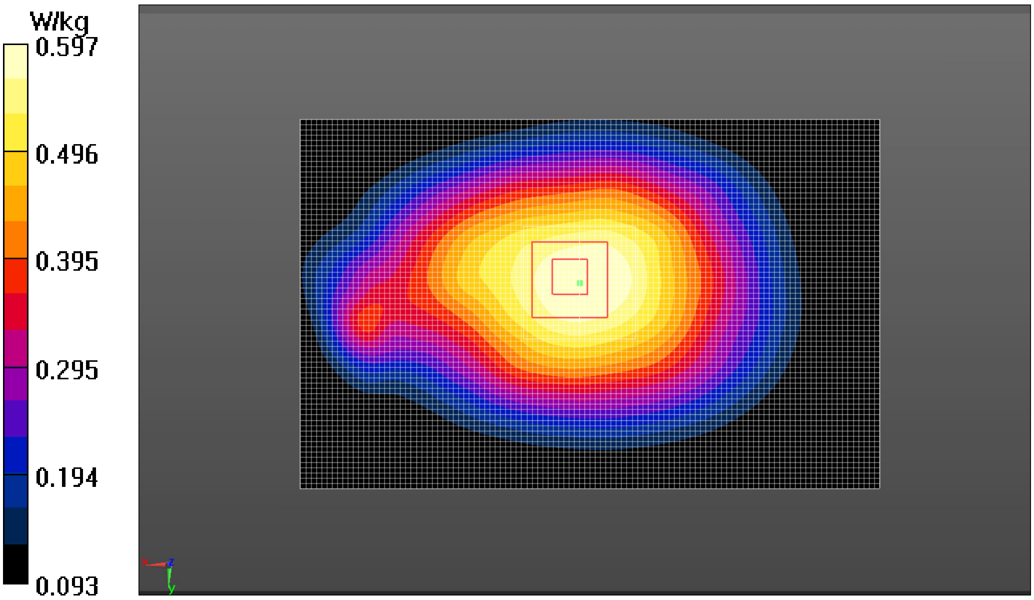


Fig.16 LTE Band 5CH20600

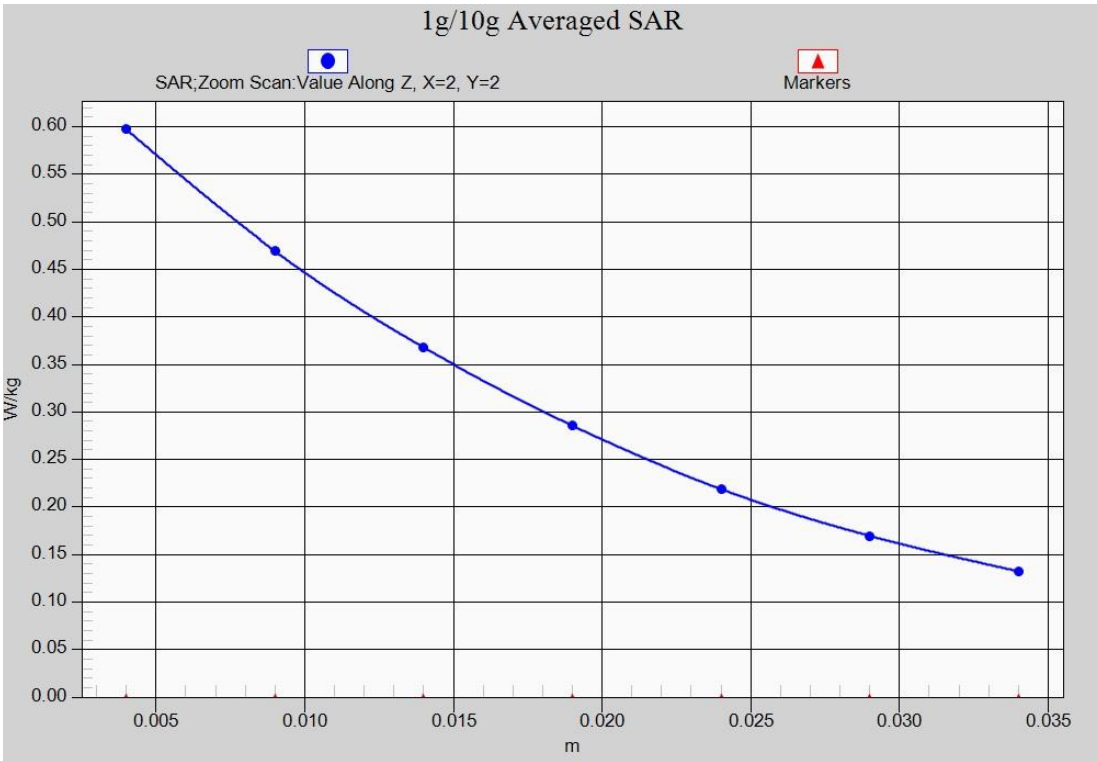


Fig.16-1 Z-Scan at power reference point (LTE Band 5CH20600)

LTE Band 12Left Cheek Middle with QPSK_10MHz_1RB_Middle

Date/Time: 2017-2-14
Electronics: DAE4 Sn786
Medium: Head 750 MHz
Medium parameters used (interpolated): f = 707.5 MHz; σ = 0.878 S/m; ε_r = 41.248; ρ = 1000 kg/m^3
Ambient Temperature:22.3^{o}C Liquid Temperature:21.8^{o}C
Communication System: UID 0, 4G_LTE_FDD (0) Frequency: 707.5 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF(6.34, 6.34, 6.34);

Left Cheek Mid1RB_Mid/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.262 W/kg

Left Cheek Mid1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.915 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.296 W/kg
SAR(1 g) = 0.245 W/kg; SAR(10 g) = 0.192 W/kg
Maximum value of SAR (measured) = 0.256 W/kg

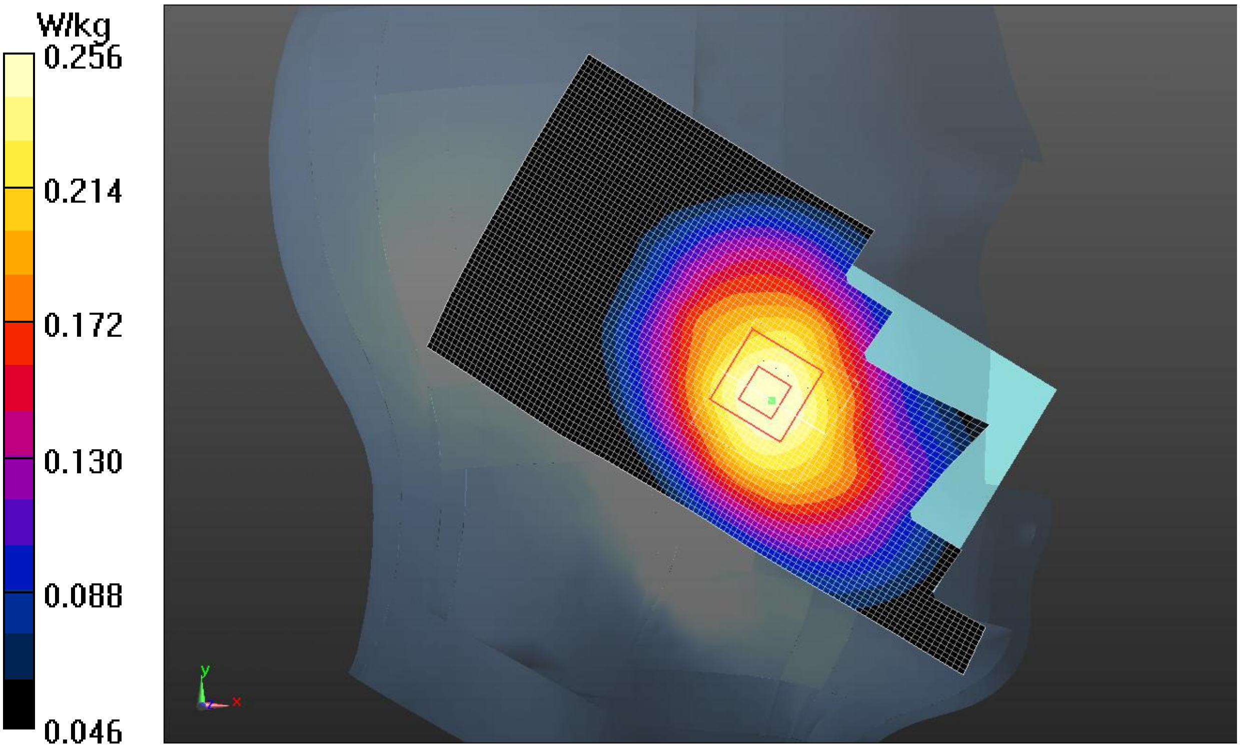


Fig.17 LTE Band 12CH23095

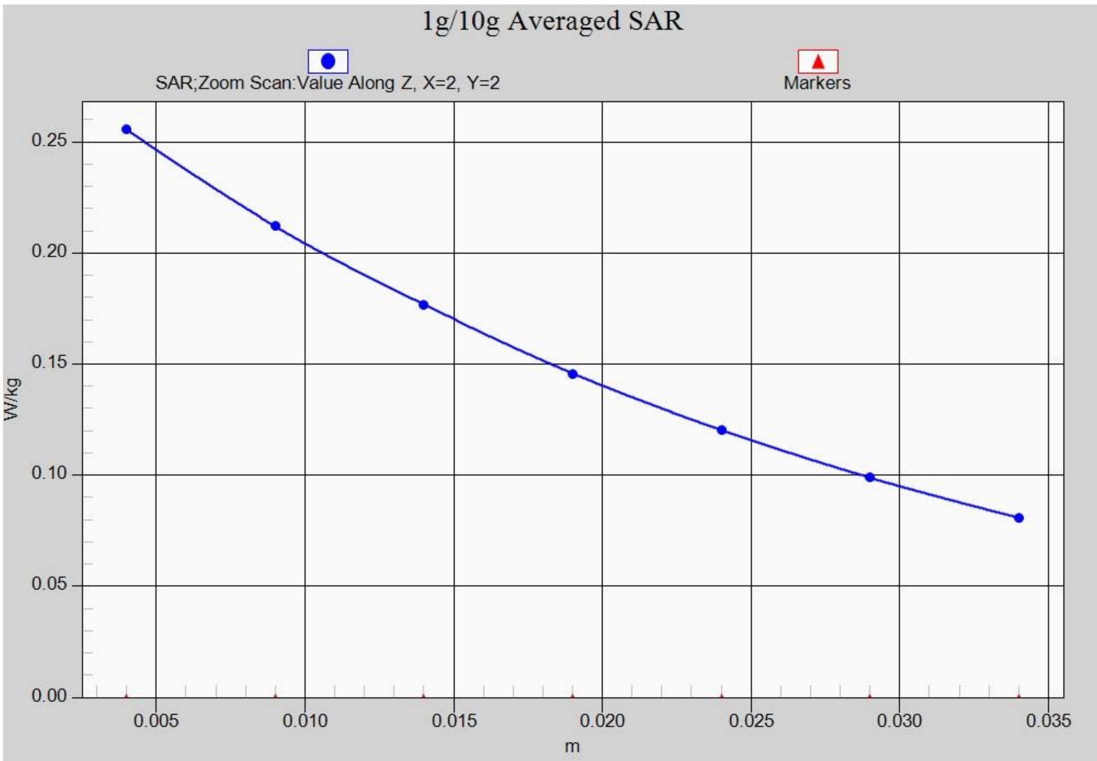


Fig.17-1 Z-Scan at power reference point (LTE Band 12CH23095)

LTE Band 12 Body RearMiddle with QPSK_10MHz_1RB_Middle

Date/Time: 2017-2-14

Electronics: DAE4 Sn786

Medium: Body 750 MHz

Medium parameters used (interpolated): f = 707.5 MHz; σ = 0.933 S/m; ε_r = 53.905; ρ = 1000 kg/m^3

Ambient Temperature:22.7^{o}C Liquid Temperature:22.2^{o}C

Communication System: UID 0, 4G_LTE_FDD (0) Frequency: 707.5 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3151 ConvF(6.12, 6.12, 6.12);

Rear side Mid 1RB_Mid /Area Scan (111x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.480 W/kg

Rear side Mid 1RB_Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.973 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.580 W/kg

SAR(1 g) = 0.459 W/kg; SAR(10 g) = 0.385 W/kg

Maximum value of SAR (measured) = 0.482 W/kg

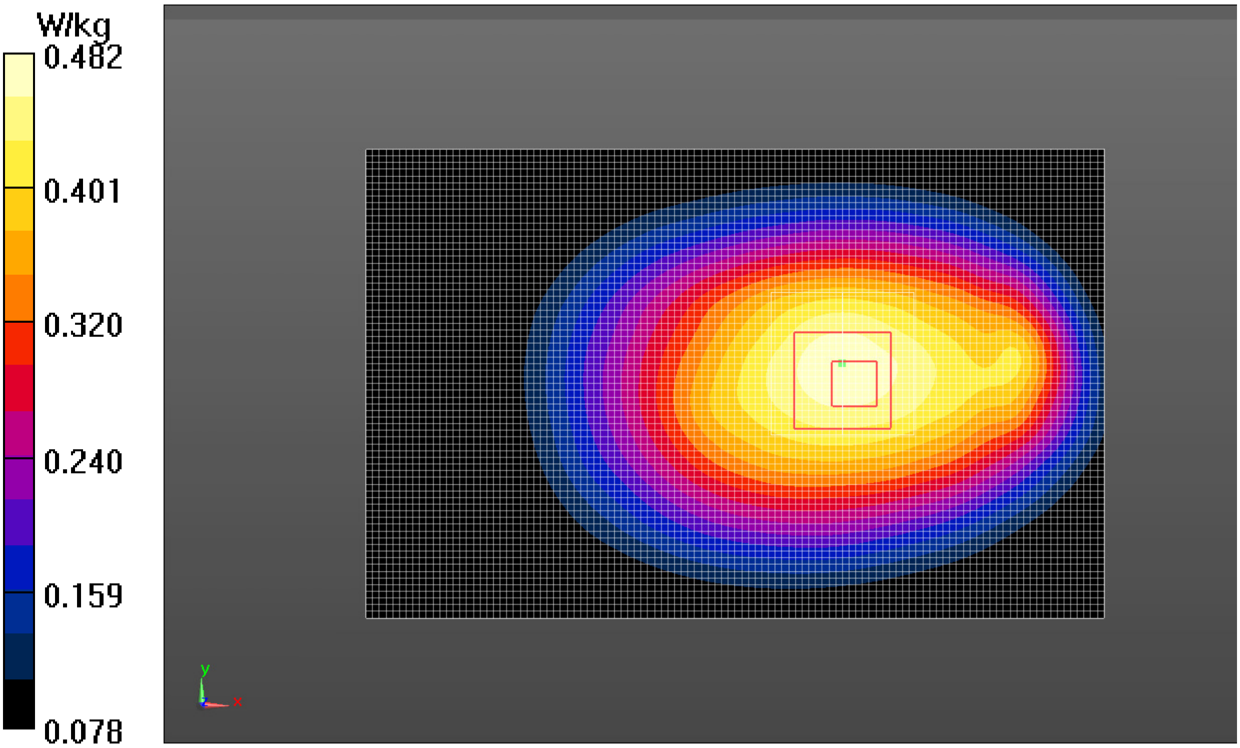


Fig.18 LTE Band 12CH23095

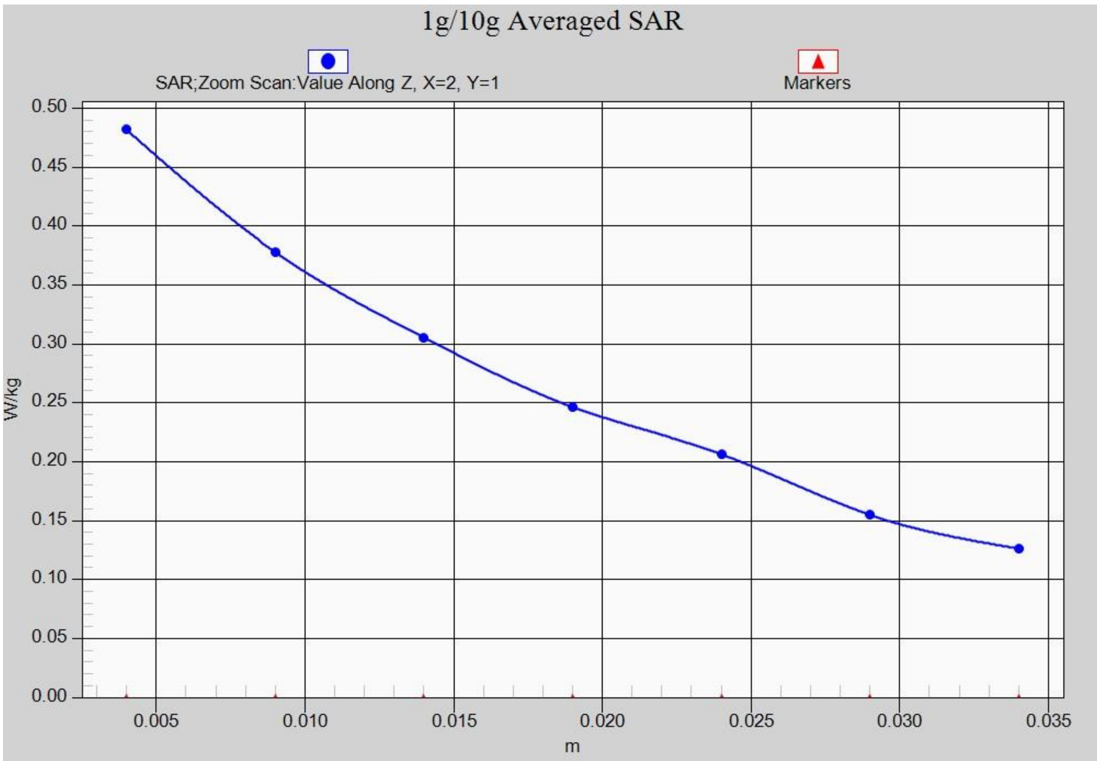


Fig.18-1 Z-Scan at power reference point (LTE Band 12CH23095)

Wi-Fi 802.11b Left Cheek Channel 11

Date/Time: 2017-2-15

Electronics: DAE4 Sn786

Medium: Head 2450MHz

Medium parameters used: f = 2462 MHz; σ = 1.867 S/m; ε_r = 37.822; ρ = 1000 kg/m^3

Ambient Temperature:22.2^{o}C Liquid Temperature:21.7^{o}C

Communication System: UID 0, WiFi (0) Frequency: 2462 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3151 ConvF(4.44, 4.44, 4.44);

Left Cheek High/Area Scan (61x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.10 W/kg

Left Cheek High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.980 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 2.06 W/kg

SAR(1 g) = 0.835 W/kg; SAR(10 g) = 0.438 W/kg

Maximum value of SAR (measured) = 1.01 W/kg

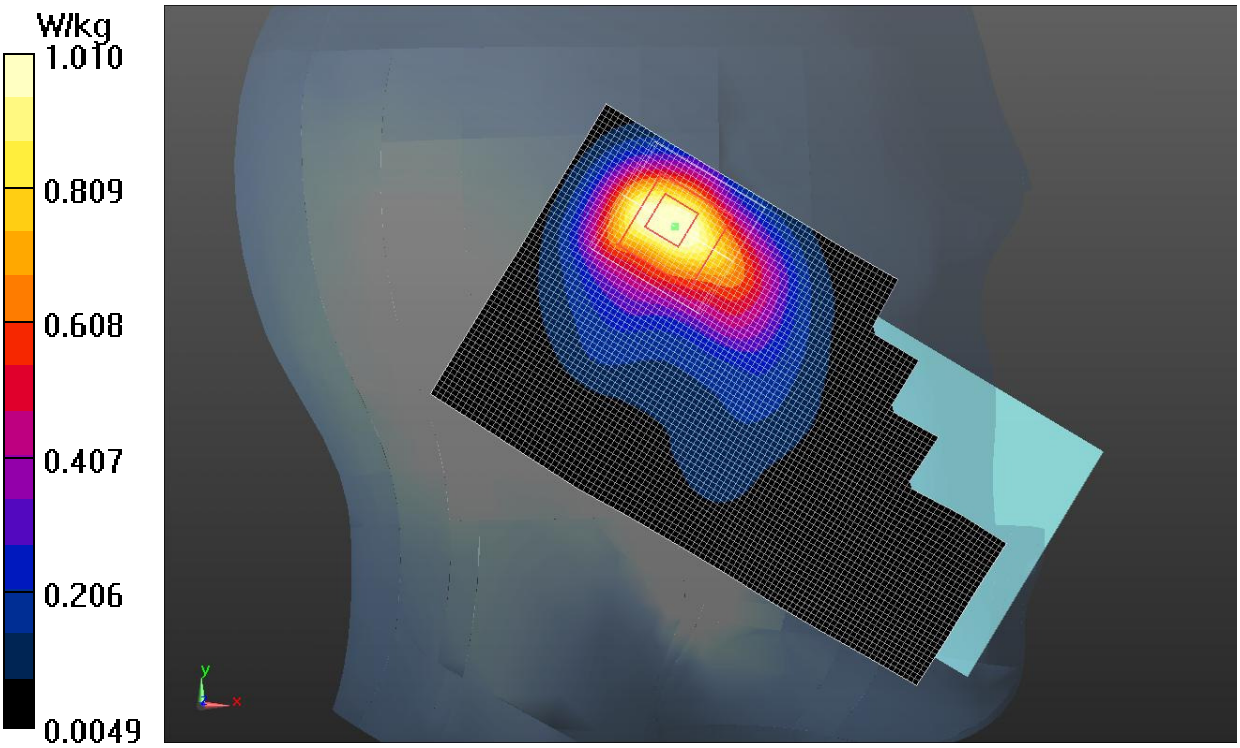


Fig.19 Wi-Fi 2450 MHz CH11

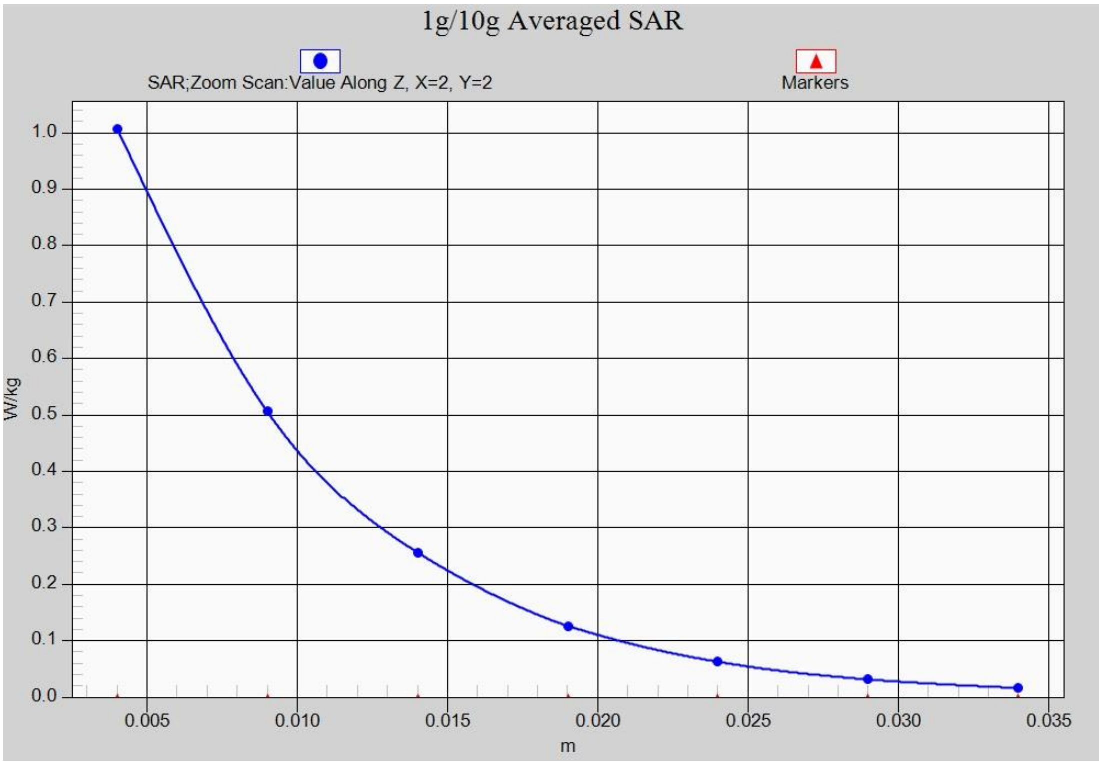


Fig.19-1 Z-Scan at power reference point (Wi-Fi 2450 MHz CH11)

Wi-Fi 802.11b Body Rear Channel 11

Date/Time: 2017-2-15
Electronics: DAE4 Sn786
Medium: Body 2450 MHz
Medium parameters used: f = 2462 MHz; σ = 1.928 S/m; ε_r = 51.622; ρ = 1000 kg/m^3
Ambient Temperature:22.3°C   Liquid Temperature:21.8°C
Communication System: UID 0, WiFi (0) Frequency: 2462 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF(4.23, 4.23, 4.23);

Rear side High/Area Scan (111x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.292 W/kg

Rear side High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.616 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.454 W/kg
SAR(1 g) = 0.224 W/kg; SAR(10 g) = 0.115 W/kg
Maximum value of SAR (measured) = 0.249 W/kg

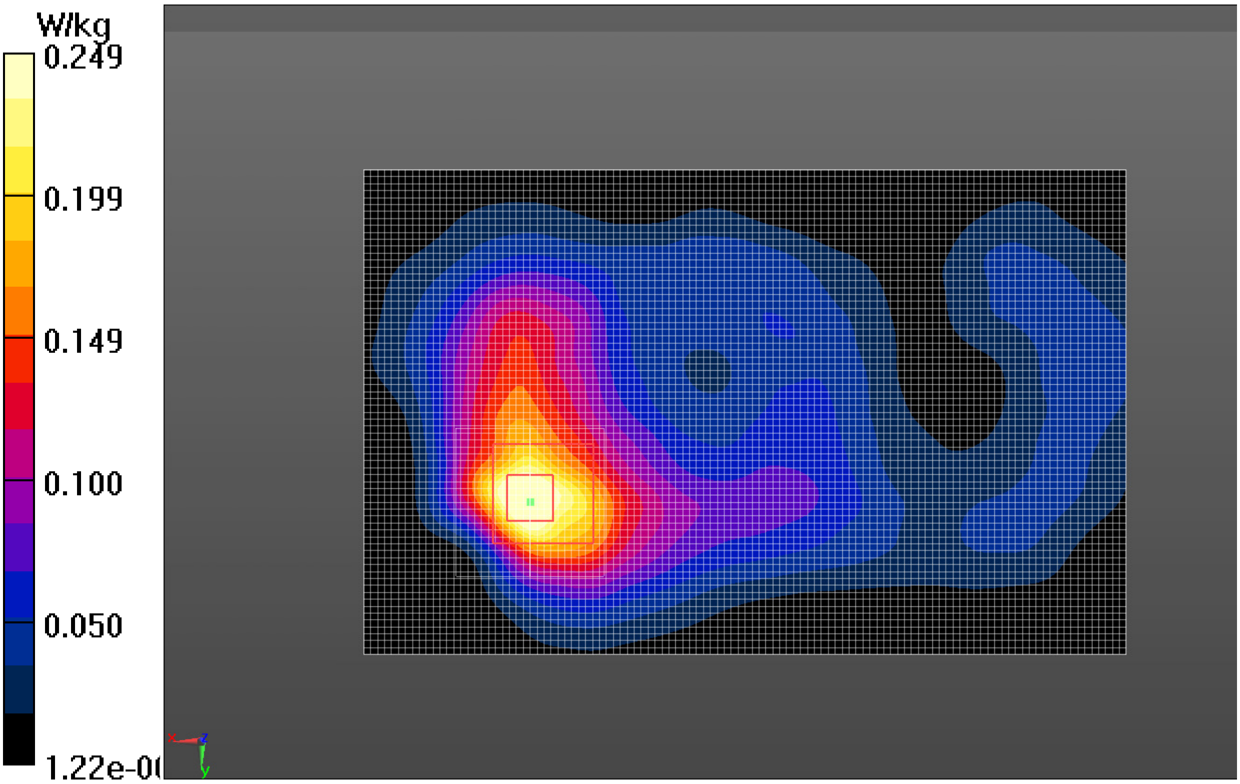


Fig.20 Wi-Fi 2450 MHz CH11

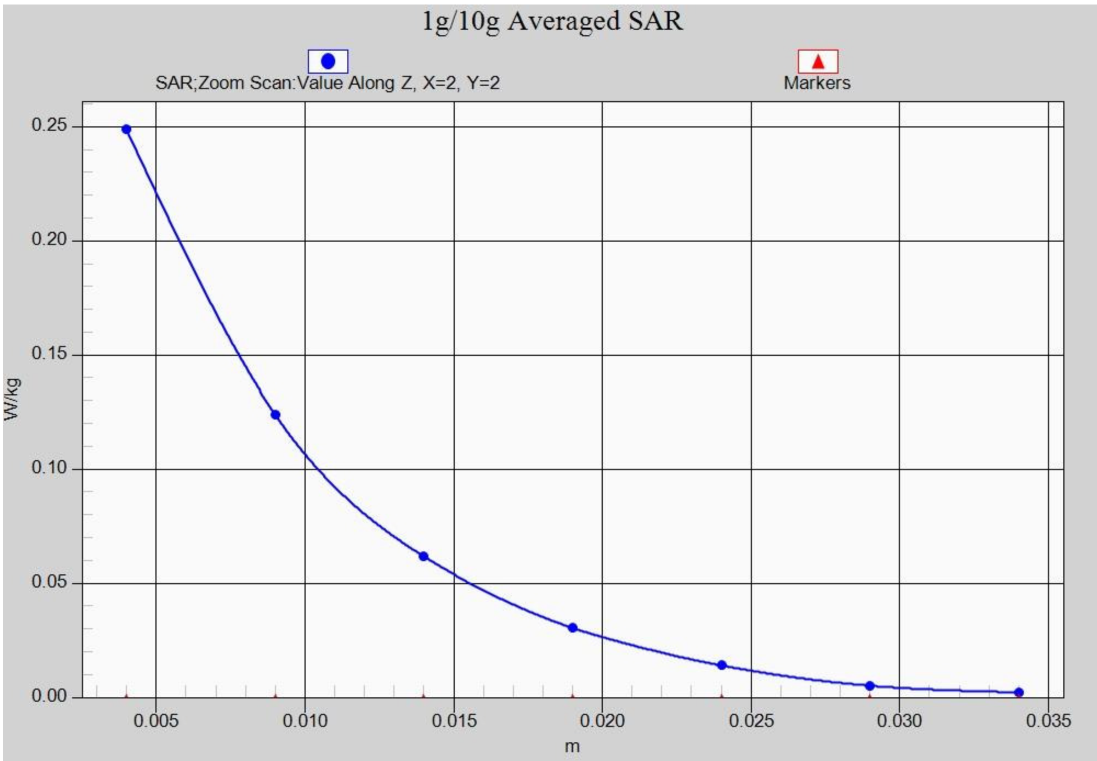


Fig.20-1 Z-Scan at power reference point (Wi-Fi 2450 MHz CH11)

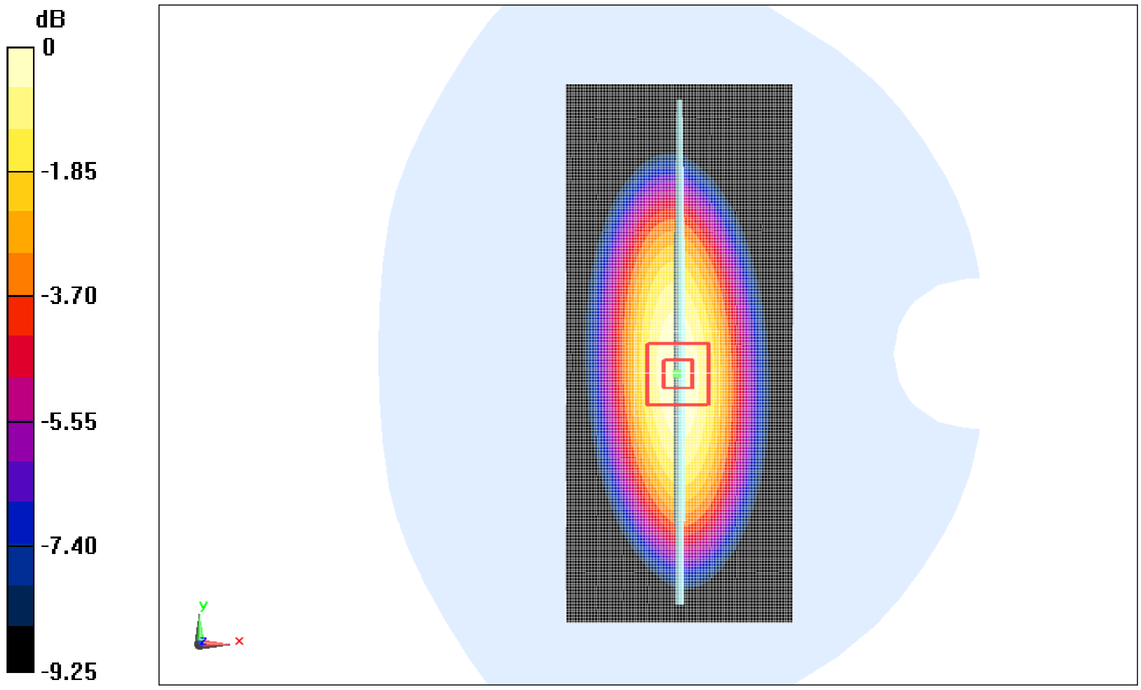
ANNEX B SystemVerification Results

750MHz

Date: 2017-2-14
Electronics: DAE4 Sn786
Medium: Head 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.906 S/m; ε_r = 41.152; ρ = 1000 kg/m^3
Ambient Temperature: 22.5^{o}C   Liquid Temperature: 22.0^{o}C
Communication System: CW Frequency: 750 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF (6.34, 6.34, 6.34)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 55.185 V/m; Power Drift = -0.02 dB
Fast SAR: SAR(1 g) = 2.19 W/kg; SAR(10 g) = 1.45 W/kg
Maximum value of SAR (interpolated) = 2.36 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.185 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.99 W/kg
SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.41W/kg
Maximum value of SAR (measured) = 2.31 W/kg



0 dB = 2.31 W/kg = 3.64 dB W/kg

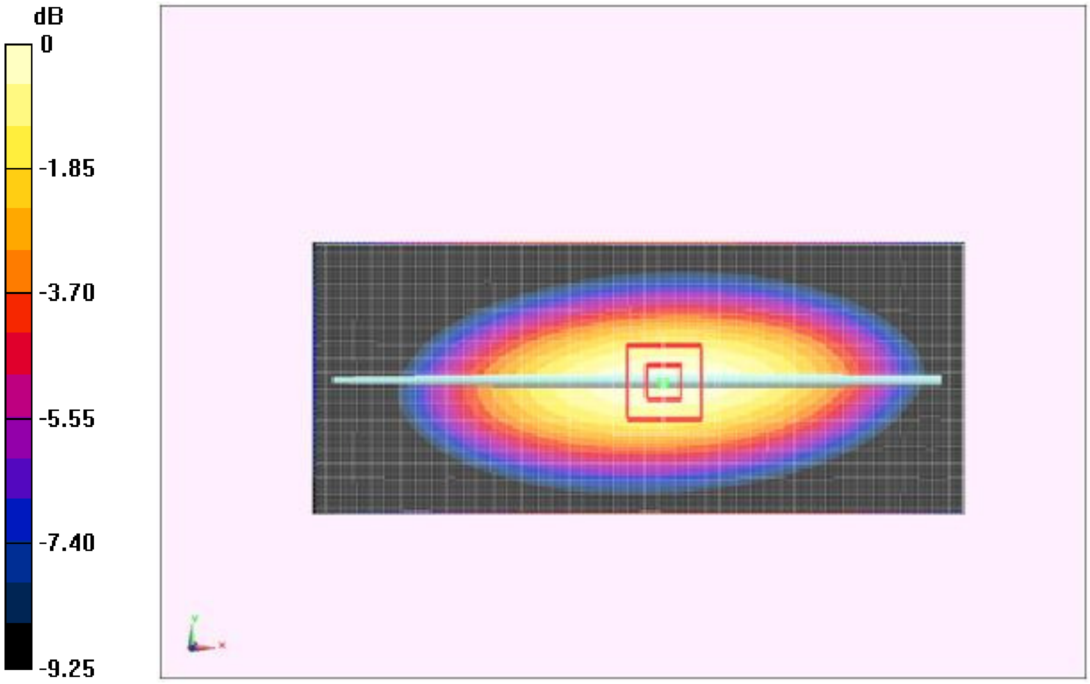
Fig.B.1 validation 750MHz 250mW

750MHz

Date: 2017-2-14
Electronics: DAE4 Sn786
Medium: Body 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.954 S/m; ε_r = 53.456; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.0°C
Communication System: CW Frequency: 750 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF (6.12, 6.12, 6.12)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 54.623 V/m; Power Drift = -0.05 dB
Fast SAR: SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.43 W/kg
Maximum value of SAR (interpolated) = 2.32 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.623 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 2.46 W/kg
SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.40 W/kg
Maximum value of SAR (measured) = 2.25 W/kg



0 dB = 2.25 W/kg = 3.52 dB W/kg

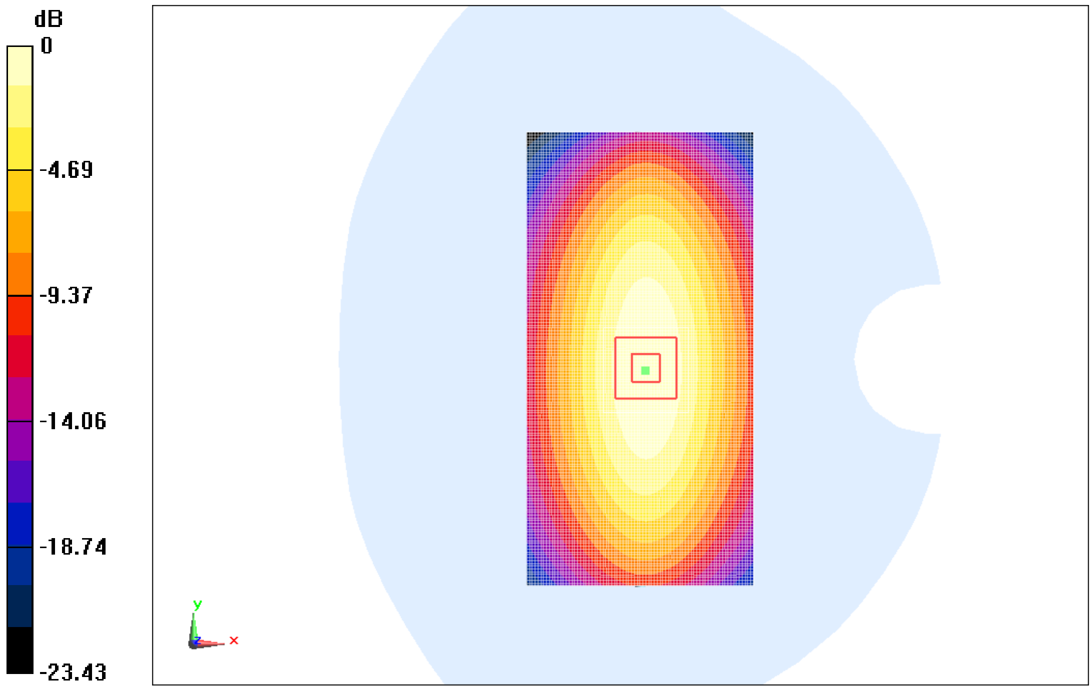
Fig.B.2 validation 750MHz 250mW

835MHz

Date: 2017-2-8
Electronics: DAE4 Sn786
Medium: Head 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.896 S/m; ε_r = 41.178; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C   Liquid Temperature: 22.5°C
Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF (6.08, 6.08, 6.08)

System Validation /Area Scan (81x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 55.028 V/m; Power Drift = 0.06 dB
Fast SAR: SAR(1 g) = 2.29 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (interpolated) = 2.53 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.028 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 2.26 W/kg; SAR(10 g) = 1.47 W/kg
Maximum value of SAR (measured) = 2.41 W/kg



0 dB = 2.41 W/kg = 3.82 dBW/kg

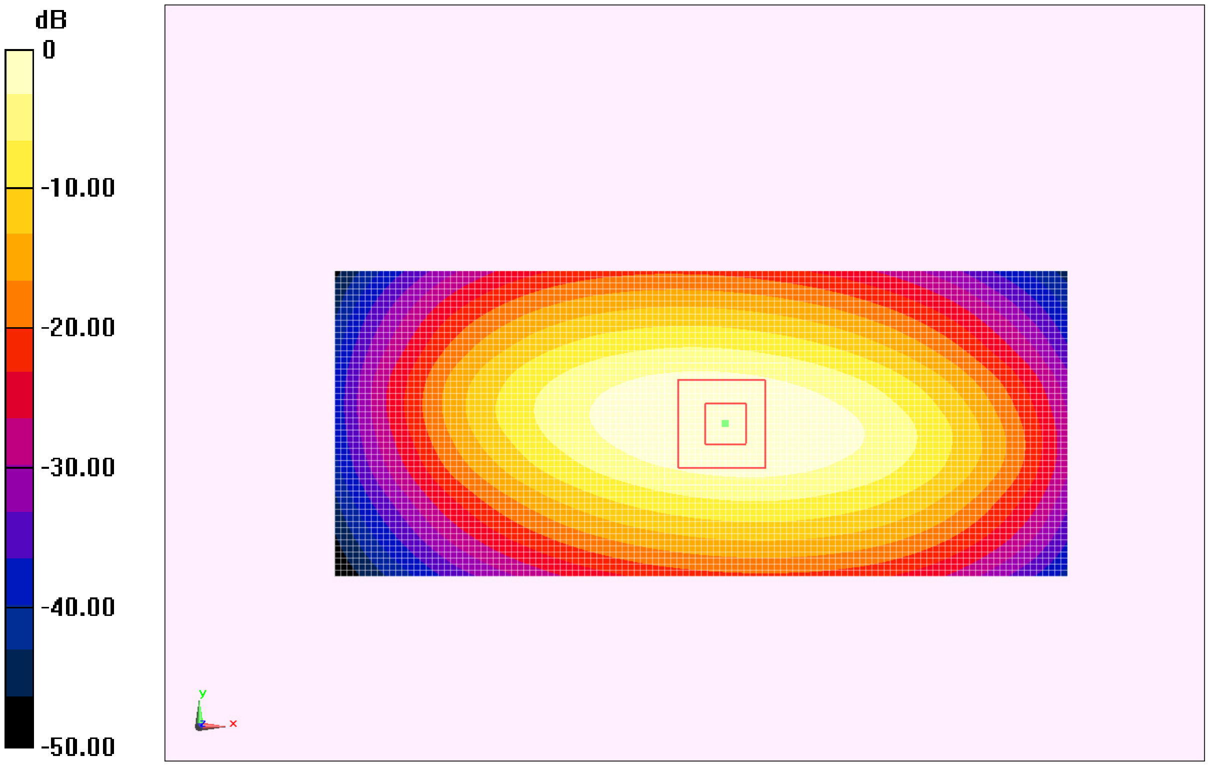
Fig.B.3 validation 835MHz 250mW

835MHz

Date: 2017-2-8
Electronics: DAE4 Sn786
Medium: Body 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.984 S/m; ε_r = 55.584; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C
Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF (6.13, 6.13, 6.13)

System Validation /Area Scan (81x171x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 51.542 V/m; Power Drift = -0.04 dB
Fast SAR: SAR(1 g) = 2.30 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (interpolated) = 2.55 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 51.542 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.45 W/kg
SAR(1 g) = 2.27 W/kg; SAR(10 g) = 1.50 W/kg
Maximum value of SAR (measured) = 2.49 W/kg



0 dB = 2.49 W/kg = 3.96 dBW/kg

Fig.B.4 validation 835MHz 250mW

1800MHz

Date/Time: 2017-2-13

Electronics: DAE4 Sn786

Medium: Head 1800 MHz

Medium parameters used: f = 1800 MHz; σ = 1.384 S/m; ε_r = 40.994; ρ = 1000 kg/m^3

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: CW_TMC Frequency: 1800 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3151 ConvF (5.10, 5.10, 5.10);

System Validation/Area Scan (61x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value = 78.214 V/m; Power Drift = 0.08 dB

Fast SAR: SAR(1 g) = 9.61 W/kg; SAR(10 g) = 5.20 W/kg

Maximum value of SAR (interpolated) = 11.9 W/kg

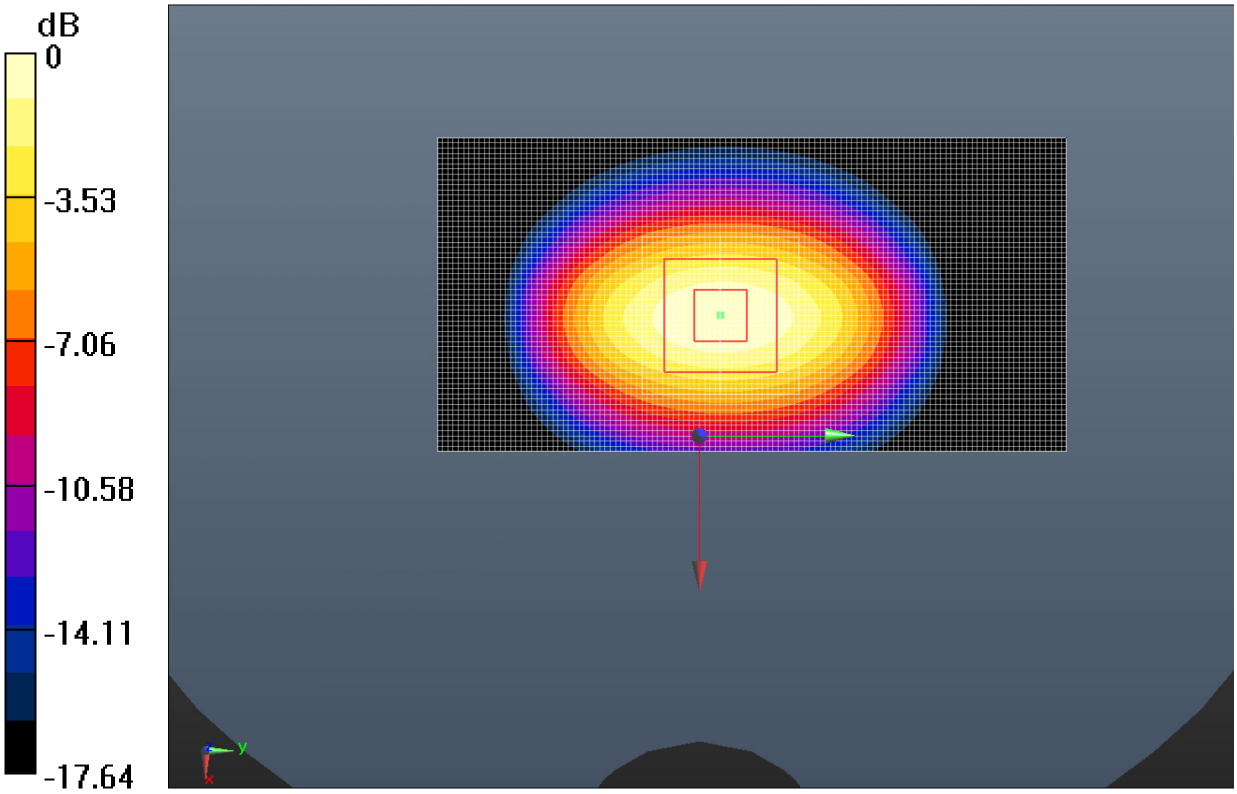
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 78.214 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 18.2 W/kg

SAR(1 g) = 9.48 W/kg; SAR(10 g) = 5.09 W/kg

Maximum value of SAR (measured) = 11.4 W/kg



0 dB = 11.4 W/kg = 10.57 dBW/kg

Fig.B.5 validation 1800MHz 250mW

1800MHz

Date/Time: 2017-2-13

Electronics: DAE4 Sn786

Medium: Body 1800 MHz

Medium parameters used: f = 1800 MHz; σ = 1.502 S/m; ε_r = 53.22; ρ = 1000 kg/m^3

Ambient Temperature: 22.0°C Liquid Temperature: 21.5°C

Communication System: CW_TMC Frequency: 1800 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3151 ConvF (4.95, 4.95, 4.95);

System Validation/Area Scan (61x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value = 77.854 V/m; Power Drift = -0.11 dB

Fast SAR: SAR(1 g) = 9.88 W/kg; SAR(10 g) = 5.22 W/kg

Maximum value of SAR (interpolated) = 12.5 W/kg

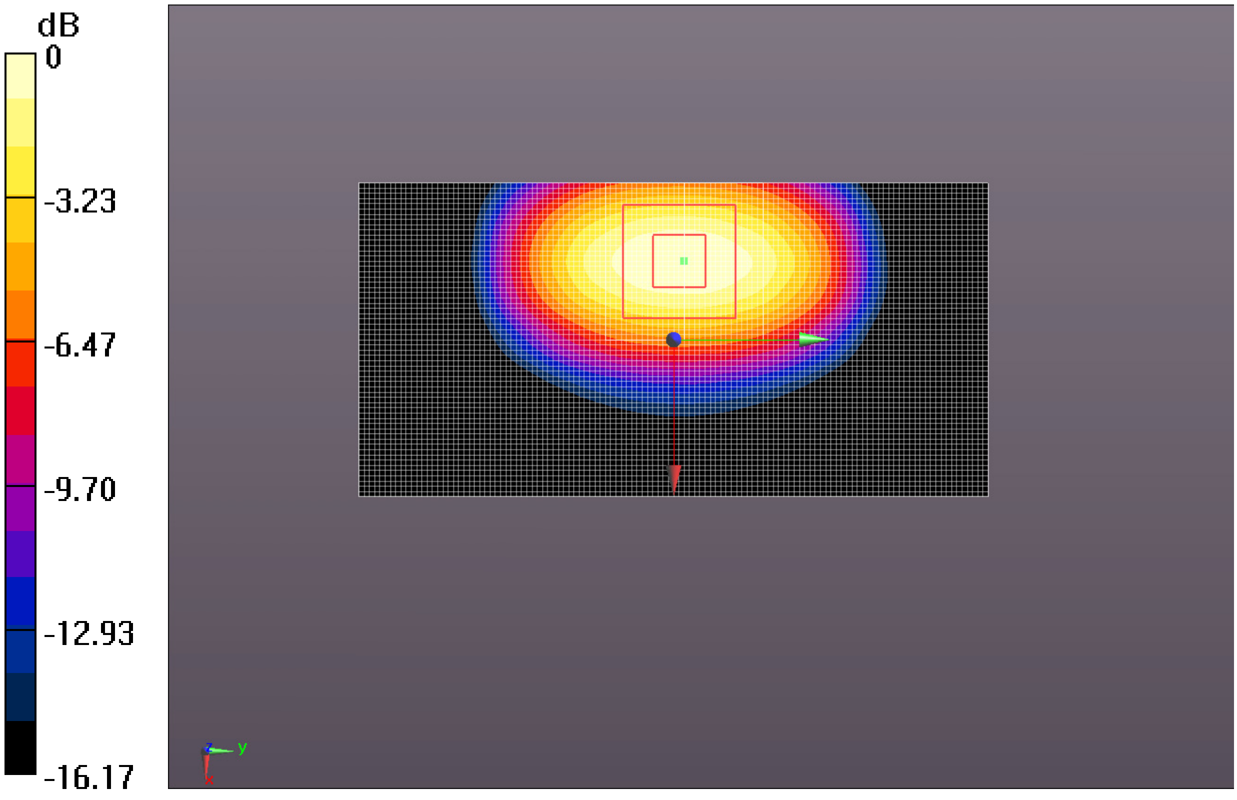
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 77.854 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 17.4 W/kg

SAR(1 g) = 9.65 W/kg; SAR(10 g) = 5.13 W/kg

Maximum value of SAR (measured) = 11.8 W/kg



0 dB = 11.8 W/kg = 10.72 dBW/kg

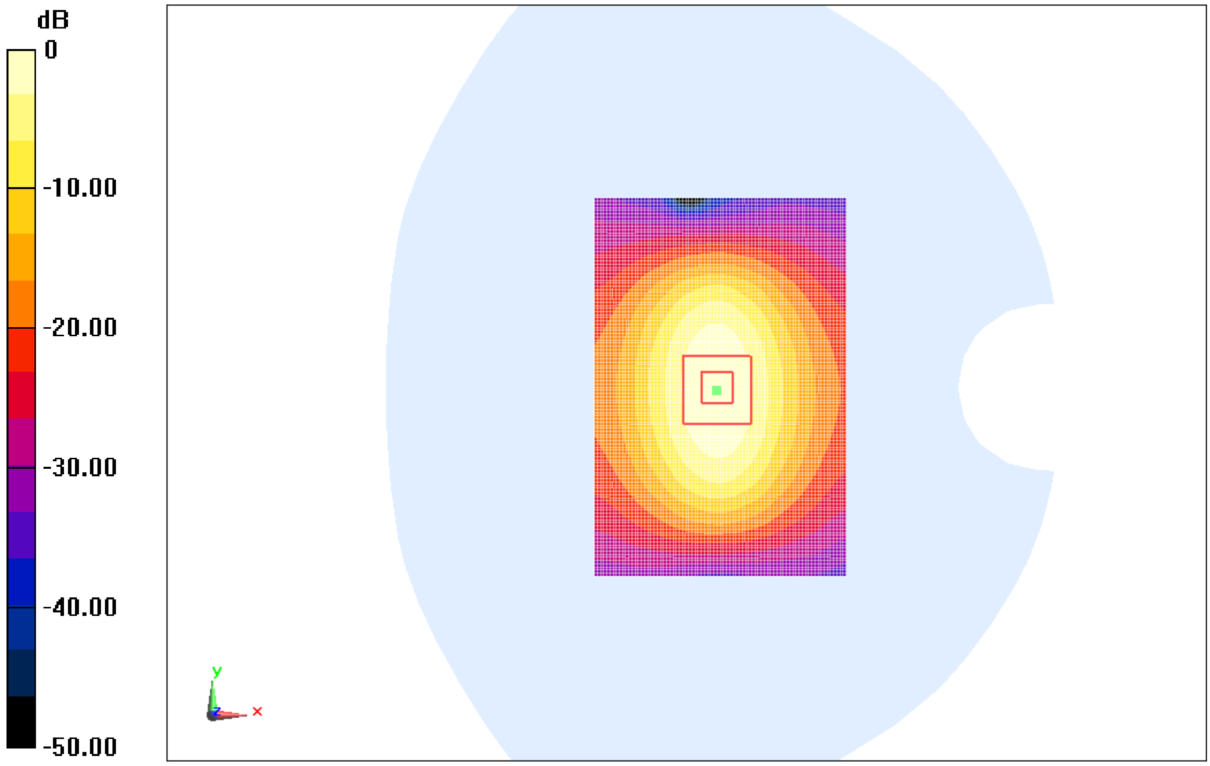
Fig.B.6 validation 1800MHz 250mW

1900MHz

Date: 2017-2-12
Electronics: DAE4 Sn786
Medium: Head 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.419 S/m; ε_r = 40.662; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF (4.88, 4.88, 4.88)

System Validation /Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 91.684 V/m; Power Drift = -0.07 dB
Fast SAR: SAR(1 g) = 10.7 W/kg; SAR(10 g) = 5.42 W/kg
Maximum value of SAR (interpolated) = 12.7 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.684 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 18.8 W/kg
SAR(1 g) = 10.5 W/kg; SAR(10 g) = 5.36 W/kg
Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.9 W/kg = 10.76 dBW/kg

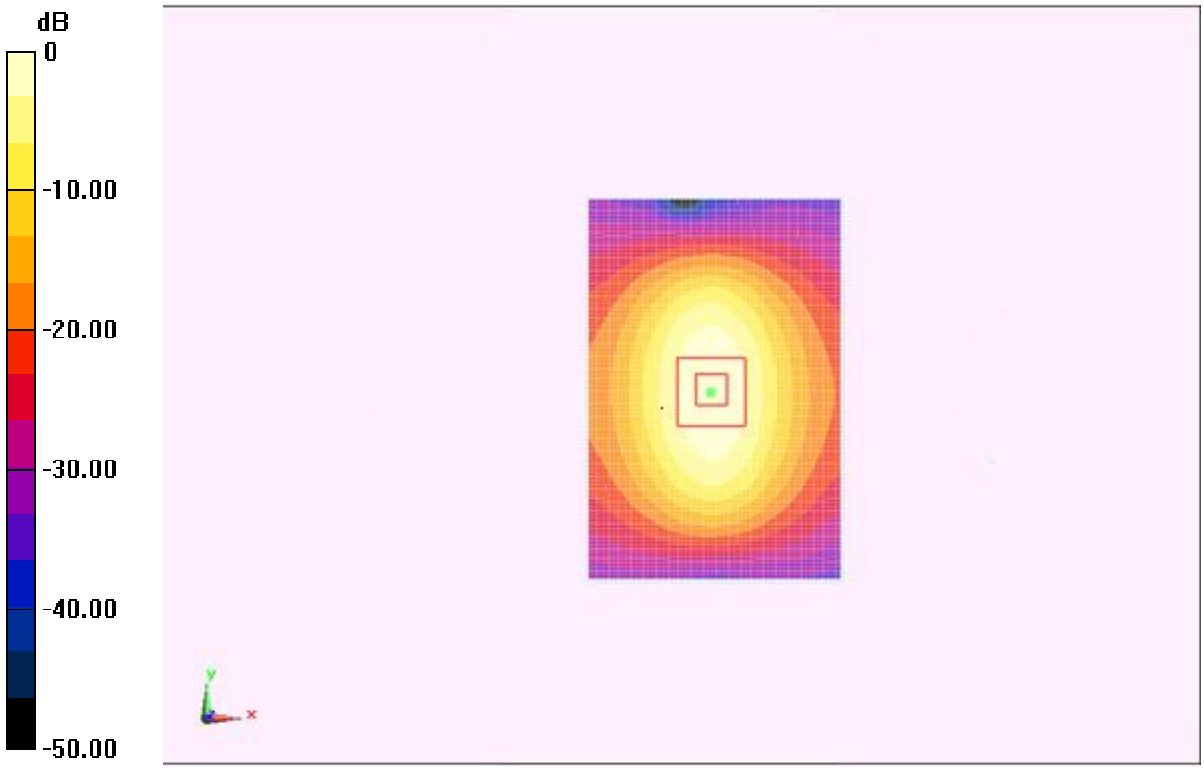
Fig.B.7validation 1900MHz 250mW

1900MHz

Date: 2017-2-12
Electronics: DAE4 Sn786
Medium: Body 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.548 S/m; ε_r = 52.95; ρ = 1000 kg/m^3
Ambient Temperature: 22.9^{o}C   Liquid Temperature: 22.5^{o}C
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF (4.49, 4.49, 4.49)

System validation /Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 62.745 V/m; Power Drift = -0.02 dB
Fast SAR: SAR(1 g) = 10.9 W/kg; SAR(10 g) = 5.62 W/kg
Maximum value of SAR (interpolated) = 12.8 W/kg

System validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 62.745 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 19.6 W/kg
SAR(1 g) = 10.6 W/kg; SAR(10 g) = 5.51 W/kg
Maximum value of SAR (measured) = 12.3 W/kg



0 dB = 12.3 W/kg = 10.90 dBW/kg

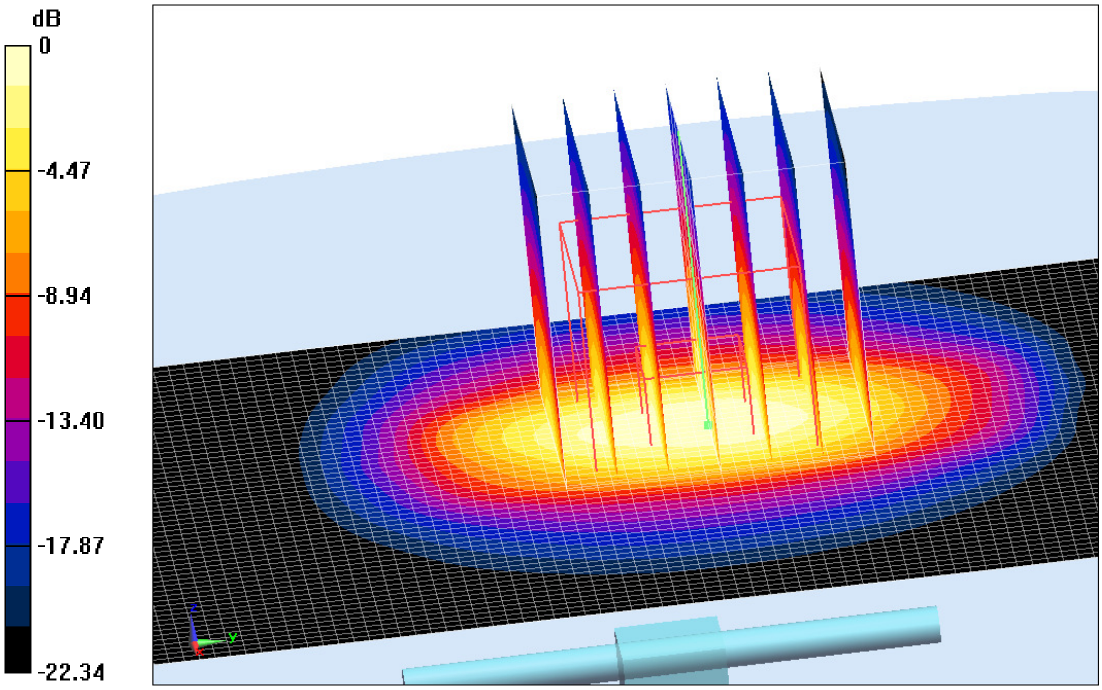
Fig.B.8validation 1900MHz 250Mw

2450MHz

Date: 2017-2-15
Electronics: DAE4 Sn786
Medium: Head 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.853 S/m; ε_r = 37.874; ρ = 1000 kg/m^3
Ambient Temperature: 22.0°C Liquid Temperature: 21.6°C
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF (4.44, 4.44, 4.44)

System Validation /Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 85.664 V/m; Power Drift = -0.09 dB
SAR(1 g) = 13.0 W/kg; SAR(10 g) = 5.97 W/kg
Maximum value of SAR (interpolated) = 16.7 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 85.664 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 26.23 W/kg
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.88 W/kg
Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

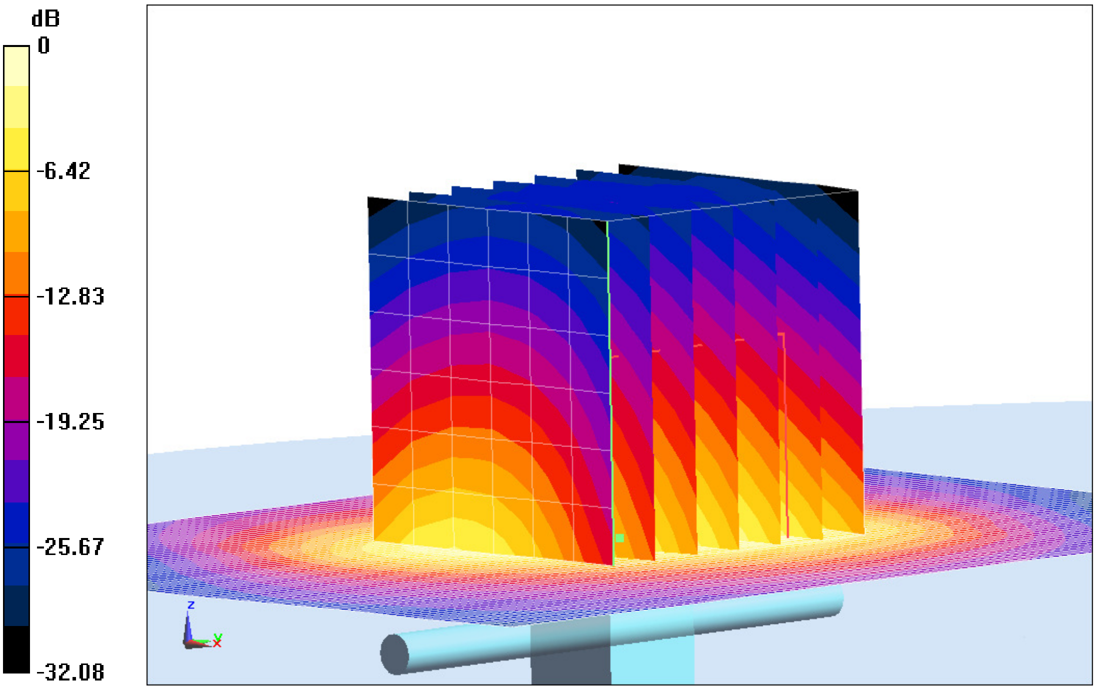
Fig.B.9validation 2450MHz 250mW

2450MHz

Date: 2017-2-15
Electronics: DAE4 Sn786
Medium: Body 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.914 S/m; ε_r = 54.654; ρ = 1000 kg/m^3
Ambient Temperature: 22.0°C Liquid Temperature: 21.6°C
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: ES3DV3 - SN3151 ConvF (4.23, 4.23, 4.23)

System Validation/Area Scan (81x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 88.556 V/m; Power Drift = 0.01 dB
SAR(1 g) = 12.4 W/kg; SAR(10 g) = 5.82 W/kg
Maximum value of SAR (interpolated) = 14.0 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.556 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.27 W/kg
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.88 W/kg
Maximum value of SAR (measured) = 14.6 W/kg



0 dB = 14.6 W/kg = 11.64 dB W/kg

Fig.B.10validation 2450MHz 250mW

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.

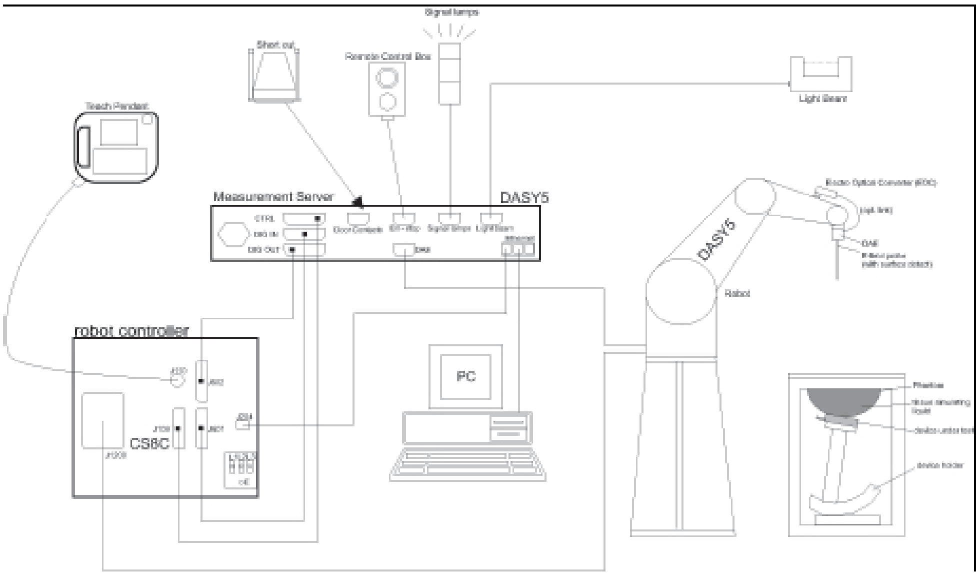
Table B.1 Comparison between area scan and zoom scan for system verification

Band	Position	Area scan (1g)	Zoom scan (1g)	Drift (%)
750	Head	2.19	2.16	-1.37
750	Body	2.17	2.14	-1.38
835	Head	2.29	2.26	-1.31
835	Body	2.30	2.27	-1.30
1800	Head	9.61	9.48	-1.35
1800	Body	9.88	9.65	-2.33
1900	Head	10.7	10.5	-1.87
1900	Body	10.9	10.6	-2.75
2450	Head	13.0	12.7	-2.31
2450	Body	12.4	12.6	1.61

ANNEX C SAR Measurement Setup

C.1 Measurement Set-up

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 (StäubliTX=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 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 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 DASY5 software reads the reflection durning a software approach and looks for the maximum using 2ndord curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model: ES3DV3, EX3DV4
Frequency Range: 10MHz — 6.0GHz(EX3DV4)
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
DynamicRange: 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 inn 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/ cm^2.

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/m^3).

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 (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 5

C.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5:128MB), RAM (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 broad, which is directly connected to the PC/104 bus of the CPU broad.

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.6 Server for DASY 5

C.4.4 Device Holder for Phantom

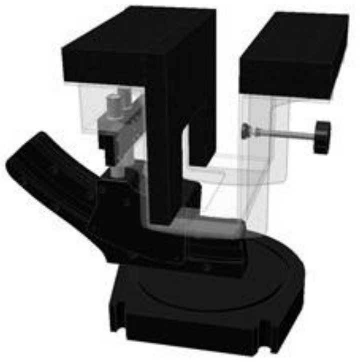
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. Accurate device positioning is therefore crucial for accurate 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 ε =3 and loss tangent δ =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.7-1: Device Holder Picture C.7-2: 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

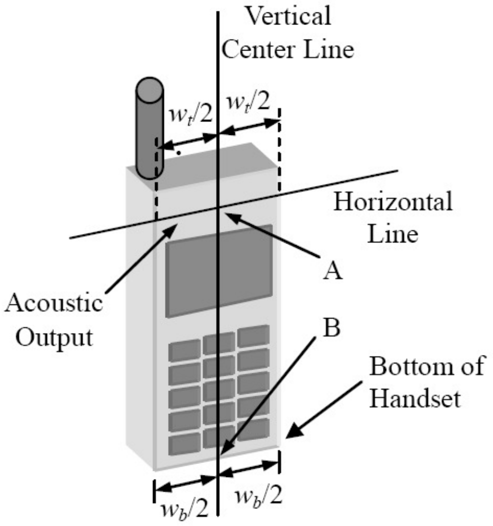
Filling Volume: Approx. 25 liters
Dimensions: 810 x l000 x 500 mm (H x L x W)
Available: Special

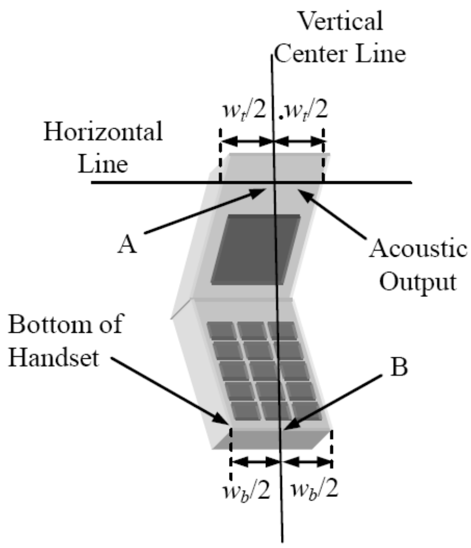
Picture C.8: SAM Twin Phantom

ANNEX D Position of the wireless device in relation to the phantom

D.1 General considerations

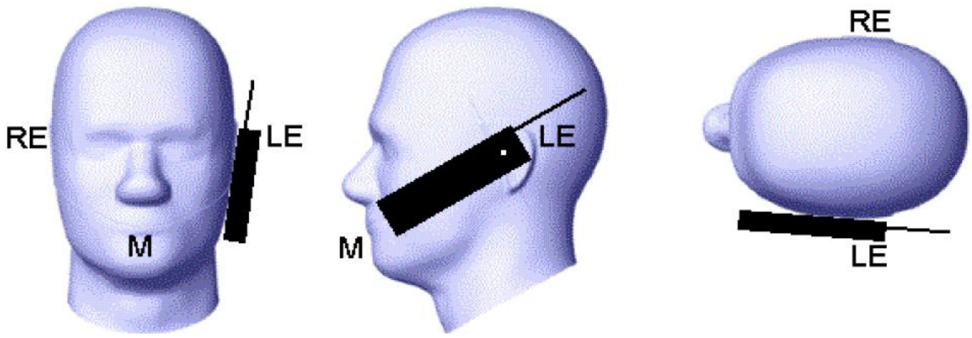
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



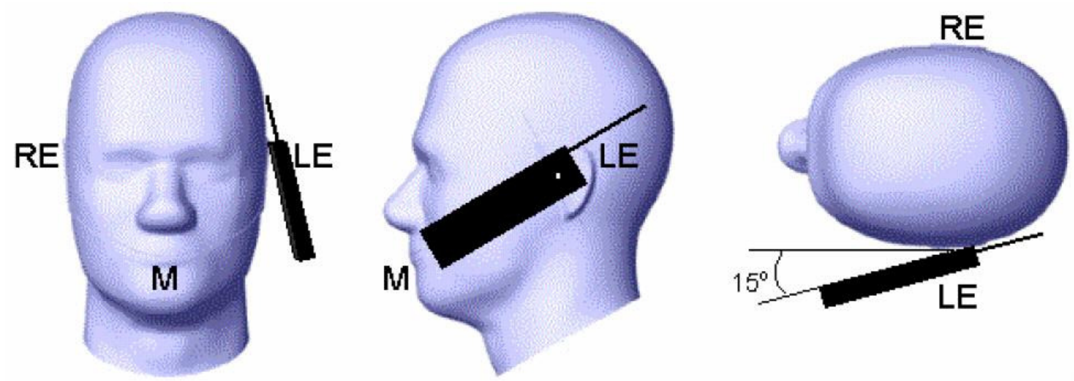


w_t	Width of the handset at the level of the acoustic
w_b	Width of the bottom of the handset
A	Midpoint of the width w_t of the handset at the level of the acoustic output
B	Midpoint of the width w_b of the bottom of the handset

Picture D.1-a Typical “fixed” case handset **Picture D.1-b Typical “clam-shell” case handset**



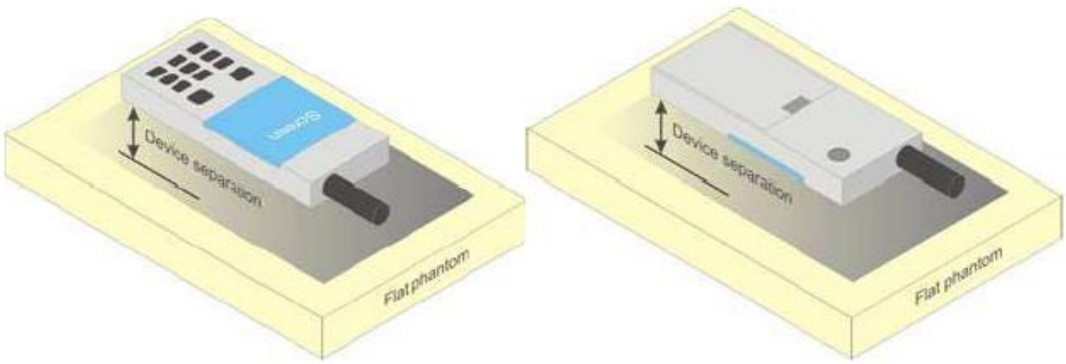
Picture D.2 Cheek position of the wireless device on the left side of SAM



Picture D.3 Tilt position of the wireless device on the left side of SAM

D.2 Body-worn device

A typical example of a body-worn device is a mobile phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.

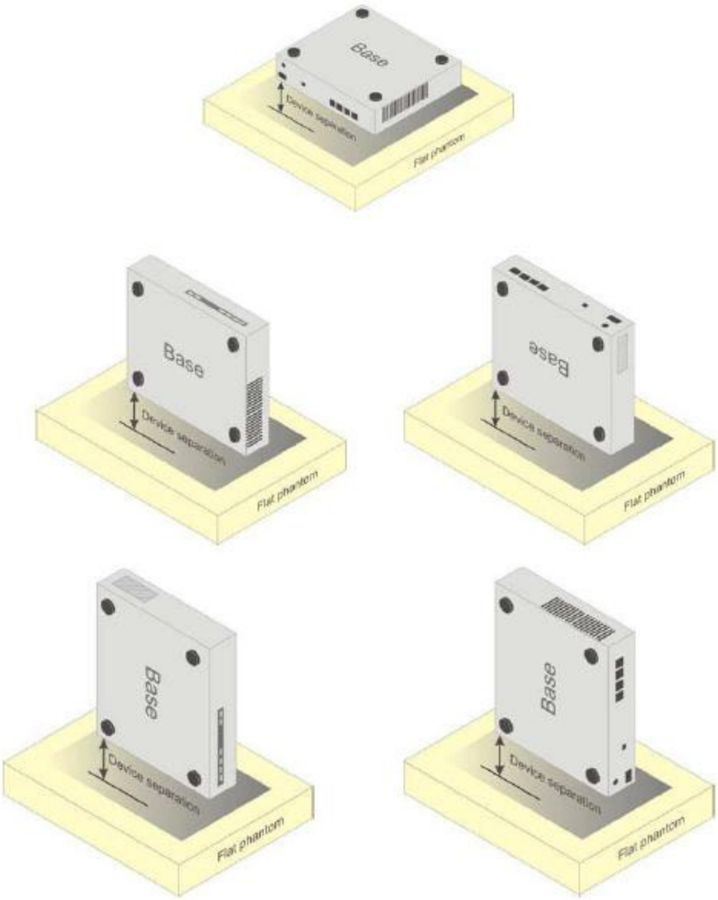


Picture D.4 Test positions for body-worn devices

D.3 Desktop device

A typical example of a desktop device is a wireless enabled desktop computer placed on a table or desk when used.

The DUT shall be positioned at the distance and in the orientation to the phantom that corresponds to the intended use as specified by the manufacturer in the user instructions. For devices that employ an external antenna with variable positions, tests shall be performed for all antenna positions specified. Picture 8.5 show positions for desktop device SAR tests. If the intended use is not specified, the device shall be tested directly against the flat phantom.



Picture D.5 Test positions for desktop devices

D.4 DUT Setup Photos

Picture D.6

ANNEX E Equivalent Media Recipes

The liquid used for the frequency range of 700-6000 MHz consisted of water, sugar, salt, preventol, glycol monobutyl and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table E.1 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.

Table E.1: Composition of the Tissue Equivalent Matter

Frequency (MHz)	835 Head	835 Body	1900 Head	1900 Body	2450 Head	2450 Body	5800 Head	5800 Body
Ingredients (% by weight)								
Water	41.45	52.5	55.242	69.91	58.79	72.60	65.53	65.53
Sugar	56.0	45.0	\	\	\	\	\	\
Salt	1.45	1.4	0.306	0.13	0.06	0.18	\	\
Preventol	0.1	0.1	\	\	\	\	\	\
Cellulose	1.0	1.0	\	\	\	\	\	\
Glycol Monobutyl	\	\	44.452	29.96	41.15	27.22	\	\
Diethylenglycol monohexylether	\	\	\	\	\	\	17.24	17.24
Triton X-100	\	\	\	\	\	\	17.24	17.24
Dielectric Parameters Target Value	ε=41.5 σ=0.90	ε=55.2 σ=0.97	ε=40.0 σ=1.40	ε=53.3 σ=1.52	ε=39.2 σ=1.80	ε=52.7 σ=1.95	ε=35.3 σ=5.27	ε=48.2 σ=6.00

Note:Thereisa littleadjustmentrespectivelyfor750,1800and 2600,basedon the recipeofclosestfrequencyintableE.1

ANNEX F System Validation

The SAR system must be validated against its performance specifications before it is deployed. When SAR probes, system components or software are changed, upgraded or recalibrated, these must be validated with the SAR system(s) that operates with such components.

Table F.1: System Validation

Probe SN.	Liquid name	Validation date	Frequency point	Status (OK or Not)
3151	Head 750MHz	2016-11-20	750 MHz	OK
3151	Head 835MHz	2016-11-20	835 MHz	OK
3151	Head 1800MHz	2016-11-22	1800 MHz	OK
3151	Head 1900MHz	2016-11-22	1900 MHz	OK
3151	Head 2450MHz	2016-11-23	2450 MHz	OK
3151	Body 750MHz	2016-11-20	750 MHz	OK
3151	Body 835MHz	2016-11-20	835 MHz	OK
3151	Body 1800MHz	2016-11-22	1800 MHz	OK
3151	Body 1900MHz	2016-11-22	1900 MHz	OK
3151	Body 2450MHz	2016-11-23	2450 MHz	OK

ANNEX G DAE Calibration Certificate

DAE4 SN:786 Calibration Certificate

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **CTTL (Auden)**

Certificate No: DAE4-786_Dec16

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 786
Calibration procedure(s)	QA CAL-06.v29 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	December 08, 2016

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	09-Sep-16 (No:19065)	Sep-17
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	05-Jan-16 (in house check)	In house check: Jan-17
Calibrator Box V2.1	SE UMS 006 AA 1002	05-Jan-16 (in house check)	In house check: Jan-17

	Name	Function	Signature
Calibrated by:	Eric Hainfeld	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V.

Issued: December 8, 2016

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S **Schweizerischer Kalibrierdienst**
C **Service suisse d'étalonnage**
S **Servizio svizzero di taratura**
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100…+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.298 ± 0.02% (k=2)	403.491 ± 0.02% (k=2)	403.881 ± 0.02% (k=2)
Low Range	3.96445 ± 1.50% (k=2)	3.96537 ± 1.50% (k=2)	3.95169 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	226.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200026.19	-5.79	-0.00
Channel X	+ Input	20005.74	1.53	0.01
Channel X	- Input	-19998.94	6.48	-0.03
Channel Y	+ Input	200029.93	-2.27	-0.00
Channel Y	+ Input	20002.71	-1.40	-0.01
Channel Y	- Input	-20003.56	1.97	-0.01
Channel Z	+ Input	200031.82	-0.21	-0.00
Channel Z	+ Input	20003.07	-0.95	-0.00
Channel Z	- Input	-20004.84	0.72	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2002.07	1.48	0.07
Channel X	+ Input	200.89	0.14	0.07
Channel X	- Input	-199.34	-0.07	0.04
Channel Y	+ Input	1999.99	-0.49	-0.02
Channel Y	+ Input	200.10	-0.60	-0.30
Channel Y	- Input	-200.06	-0.69	0.34
Channel Z	+ Input	2000.67	0.22	0.01
Channel Z	+ Input	199.73	-0.77	-0.38
Channel Z	- Input	-201.22	-1.74	0.87

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	12.75	10.67
	- 200	-10.14	-11.33
Channel Y	200	20.16	19.71
	- 200	-21.14	-21.51
Channel Z	200	6.53	6.44
	- 200	-9.02	-9.17

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-1.43	-3.68
Channel Y	200	10.01	-	-0.12
Channel Z	200	7.49	7.39	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16159	15833
Channel Y	15971	15598
Channel Z	16202	15888

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.28	-1.90	1.06	0.50
Channel Y	-0.27	-1.57	1.37	0.50
Channel Z	-1.30	-2.38	-0.44	0.44

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	–0.01	-8	-9

ANNEX HProbe Calibration Certificate

Probe ES3DV3-SN:3151 Calibration Certificate

In Collaboration with
speag
CALIBRATION LABORATORY

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Client CTTL(South Branch) Certificate No: Z16-97202

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3151
Calibration Procedure(s)	FD-Z11-004-01 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	November 17, 2016

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101548	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference10dBAttenuator	18N50W-10dB	13-Mar-16(CTTL,No.J16X01547)	Mar-18
Reference20dBAttenuator	18N50W-20dB	13-Mar-16(CTTL, No.J16X01548)	Mar-18
Reference Probe EX3DV4	SN 7307	19-Feb-16(SPEAG,No.EX3-7307_Feb16)	Feb-17
DAE4	SN 1331	21-Jan-16(SPEAG, No.DAE4-1331_Jan16)	Jan -17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-16 (CTTL, No.J16X04776)	Jun-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan -17

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: November 18, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.