

19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
21	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
22	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						10.4	10.3	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						20.8	20.6	

16.4 Measurement Uncertainty for Fast SAR Tests (3~6GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.55	N	1	1	1	6.55	6.55	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	2.0	R	$\sqrt{3}$	1	1	1.2	1.2	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RF ambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. Restrictions	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
12	Probe positioning with respect to phantom shell	B	6.7	R	$\sqrt{3}$	1	1	3.9	3.9	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
14	Fast SAR z-Approximation	B	14.0	R	$\sqrt{3}$	1	1	8.1	8.1	∞
Test sample related										
15	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71

16	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
17	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
18	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
21	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
22	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						13.5	13.4	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						27.0	26.8	



17 MAIN TEST INSTRUMENTS

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 24, 2018	One year
02	Power meter	NRVD	102083	November 01,2017	One year
03	Power sensor	NRV-Z5	100542		
04	Signal Generator	E4438C	MY49070393	January 02,2018	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	CMW500	159889	December 20, 2017	One year
07	E-field Probe	SPEAG EX3DV4	7464	September 12,2017	One year
08	DAE	SPEAG DAE4	1525	October 02, 2017	One year
09	Dipole Validation Kit	SPEAG D835V2	4d069	July 19,2017	One year
10	Dipole Validation Kit	SPEAG D1900V2	5d101	July 26,2017	One year
11	Dipole Validation Kit	SPEAG D2450V2	853	July 21,2017	One year

END OF REPORT BODY

ANNEX A Graph Results

GSM850_CH251 Right Cheek

Date: 6/1/2018

Electronics: DAE4 Sn1525

Medium: head 835 MHz

Medium parameters used: $f = 848.8$ MHz; $\sigma = 0.931$ mho/m; $\epsilon_r = 41.47$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: GSM850 848.8 MHz Duty Cycle: 1:8.3

Probe: EX3DV4 – SN7464 ConvF(10.28,10.28,10.28)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.273 W/kg

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

Reference Value = 6.896 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.315 W/kg

SAR(1 g) = 0.248 W/kg; SAR(10 g) = 0.189 W/kg

Maximum value of SAR (measured) = 0.273 W/kg

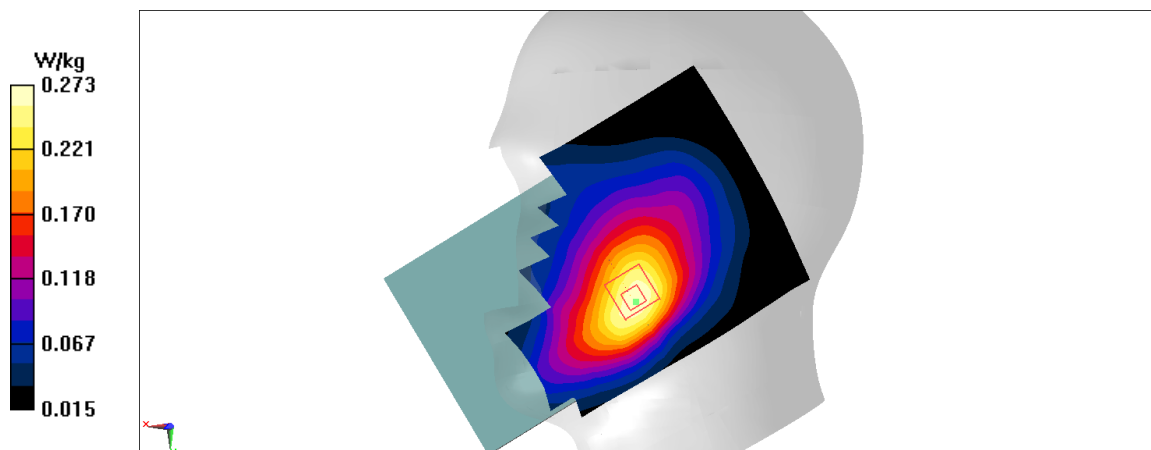


Fig A.1

GSM850_CH128 Rear 12mm

Date: 6/1/2018

Electronics: DAE4 Sn1525

Medium: body 835 MHz

Medium parameters used: $f = 824.2$ MHz; $\sigma = 0.954$ mho/m; $\epsilon_r = 55.02$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: GSM850 824.2 MHz Duty Cycle: 1:2

Probe: EX3DV4 – SN7464 ConvF(10.21,10.21,10.21)

Area Scan (71x121x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 0.918 W/kg

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

Reference Value = 19.21 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.18 W/kg

SAR(1 g) = 0.8 W/kg; SAR(10 g) = 0.545 W/kg

Maximum value of SAR (measured) = 0.918 W/kg

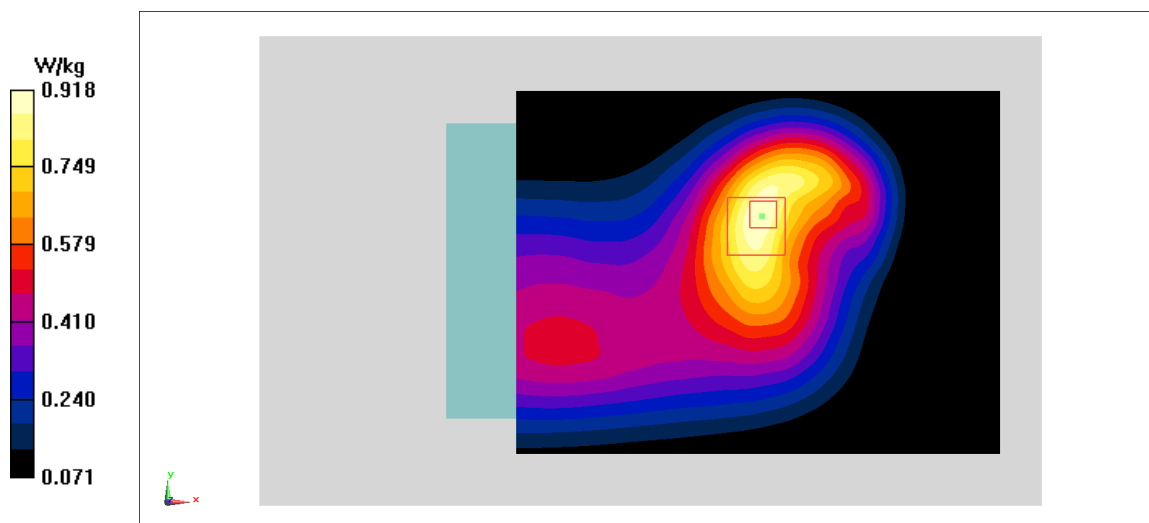


Fig A.2

PCS1900_CH661 Left Cheek

Date: 6/2/2018

Electronics: DAE4 Sn1525

Medium: head 1900 MHz

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.366$ mho/m; $\epsilon_r = 39.8$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: PCS1900 1880 MHz Duty Cycle: 1:8.3

Probe: EX3DV4 – SN7464 ConvF(8.39,8.39,8.39)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0763 W/kg

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

Reference Value = 4.348 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.111 W/kg

SAR(1 g) = 0.071 W/kg; SAR(10 g) = 0.043 W/kg

Maximum value of SAR (measured) = 0.0821 W/kg

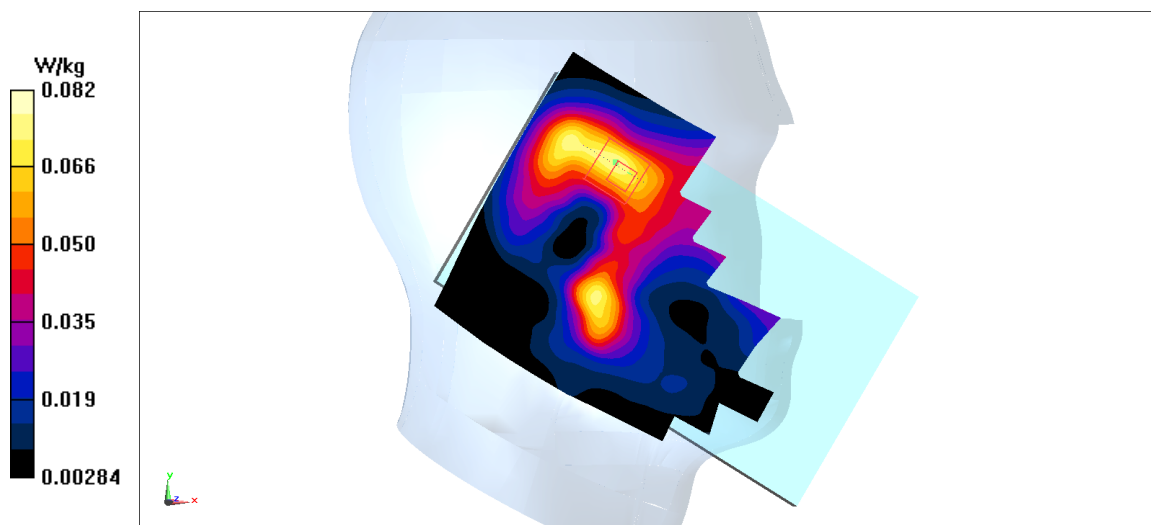


Fig A.3

PCS1900_CH810 Rear 12mm

Date: 6/2/2018

Electronics: DAE4 Sn1525

Medium: body 1900 MHz

Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.534$ mho/m; $\epsilon_r = 54.09$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: PCS1900 1909.8 MHz Duty Cycle: 1:2.67

Probe: EX3DV4 – SN7464 ConvF(8.32,8.32,8.32)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.841 W/kg

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

Reference Value = 9.289 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 1.14 W/kg

SAR(1 g) = 0.667 W/kg; SAR(10 g) = 0.372 W/kg

Maximum value of SAR (measured) = 0.822 W/kg

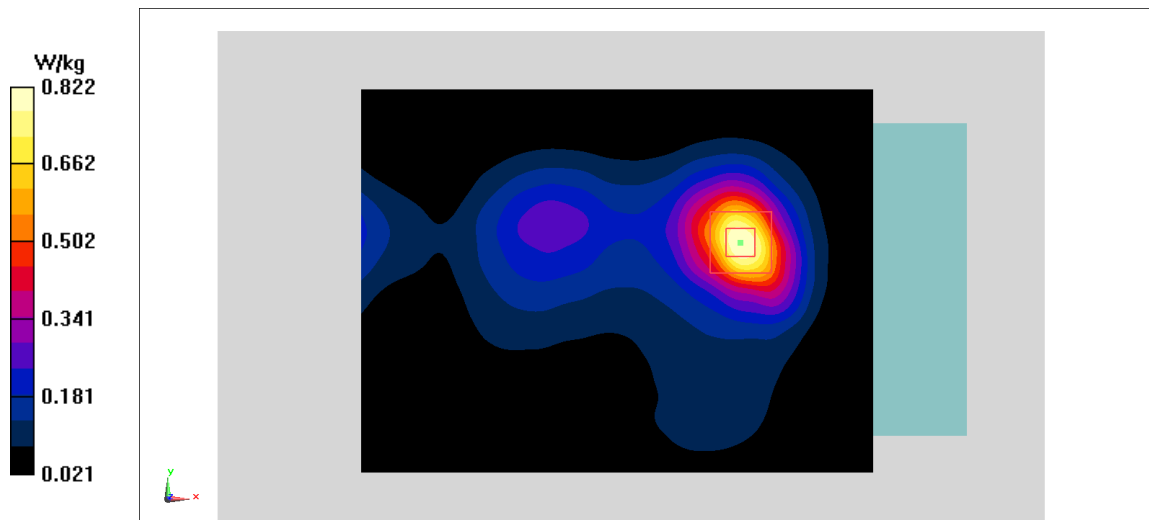


Fig A.4

WCDMA1900-BII_CH9400 Left Cheek

Date: 6/2/2018

Electronics: DAE4 Sn1525

Medium: head 1900 MHz

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.366$ mho/m; $\epsilon_r = 39.8$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WCDMA1900-BII 1880 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7464 ConvF(8.39,8.39,8.39)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.347 W/kg

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

Reference Value = 5.589 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.409 W/kg

SAR(1 g) = 0.292 W/kg; SAR(10 g) = 0.186 W/kg

Maximum value of SAR (measured) = 0.331 W/kg

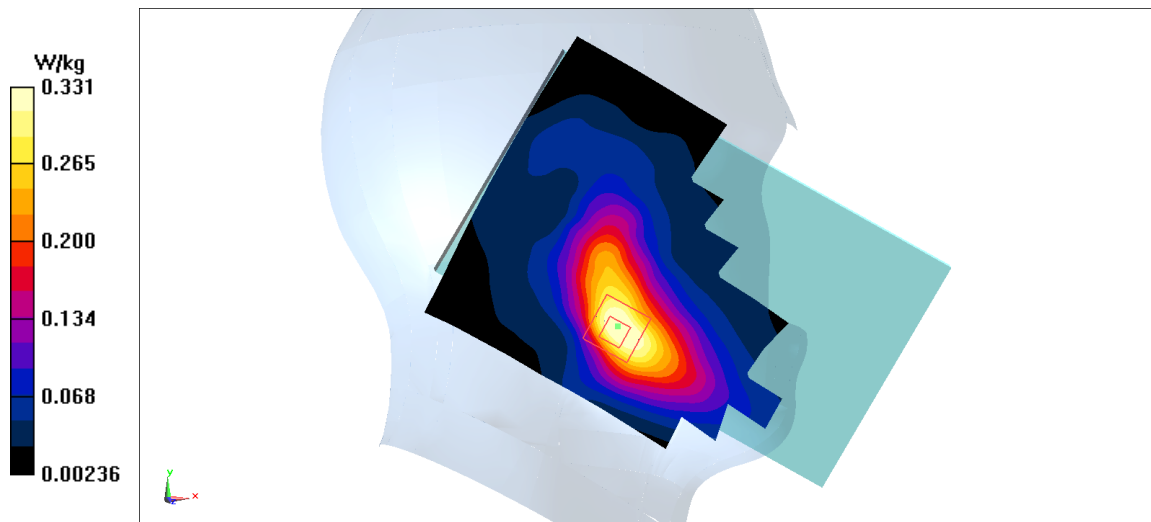


Fig A.5

WCDMA1900-BII_CH9400 Rear 0mm

Date: 6/2/2018

Electronics: DAE4 Sn1525

Medium: body 1900 MHz

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.506$ mho/m; $\epsilon_r = 54.12$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WCDMA1900-BII 1880 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7464 ConvF(8.32,8.32,8.32)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.07 W/kg

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

Reference Value = 6.05 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.52 W/kg

SAR(1 g) = 0.809 W/kg; SAR(10 g) = 0.405 W/kg

Maximum value of SAR (measured) = 1.05 W/kg

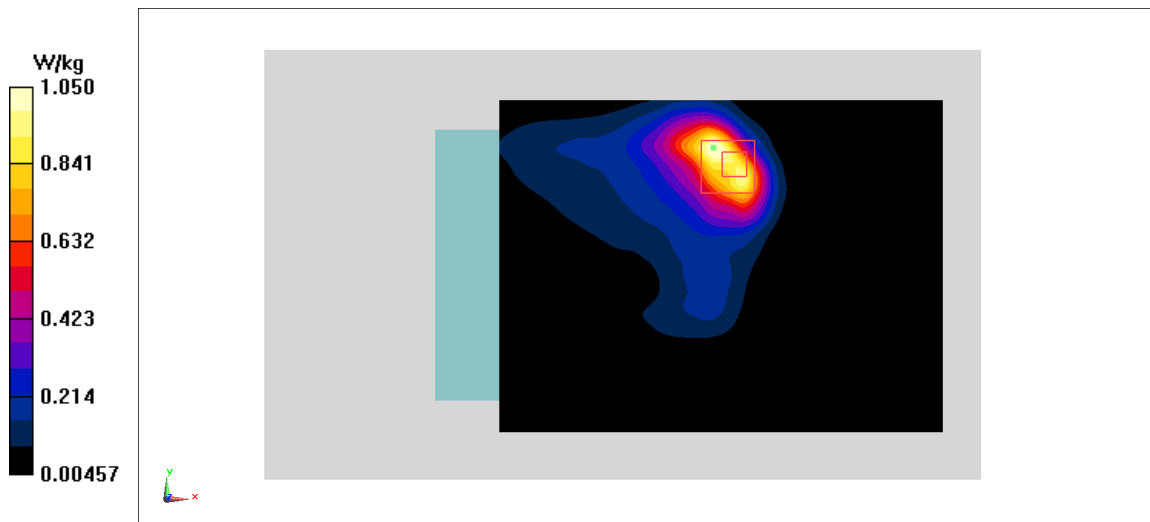


Fig A.6

WCDMA850-BV_CH4233 Right Cheek

Date: 6/1/2018

Electronics: DAE4 Sn1525

Medium: head 835 MHz

Medium parameters used: $f = 846.6$ MHz; $\sigma = 0.929$ mho/m; $\epsilon_r = 41.48$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WCDMA850-BV 846.6 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7464 ConvF(10.28,10.28,10.28)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.24 W/kg

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

Reference Value = 8.08 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.273 W/kg

SAR(1 g) = 0.214 W/kg; SAR(10 g) = 0.164 W/kg

Maximum value of SAR (measured) = 0.235 W/kg

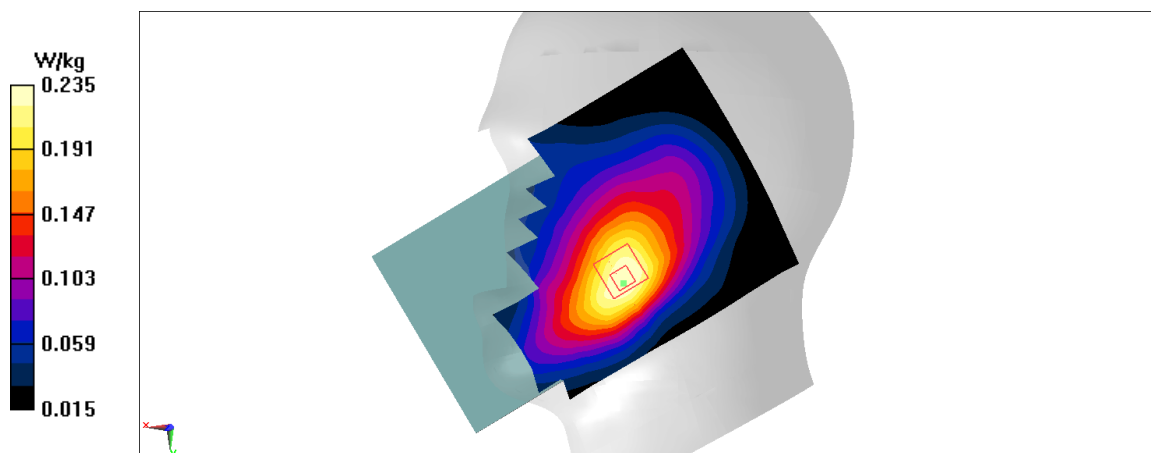


Fig A.7

WCDMA850-BV_CH4233 Rear 12mm

Date: 6/1/2018

Electronics: DAE4 Sn1525

Medium: body 835 MHz

Medium parameters used: $f = 846.6$ MHz; $\sigma = 0.975$ mho/m; $\epsilon_r = 55$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WCDMA850-BV 846.6 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7464 ConvF(10.21,10.21,10.21)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.775 W/kg

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

Reference Value = 23.26 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.994 W/kg

SAR(1 g) = 0.672 W/kg; SAR(10 g) = 0.454 W/kg

Maximum value of SAR (measured) = 0.763 W/kg

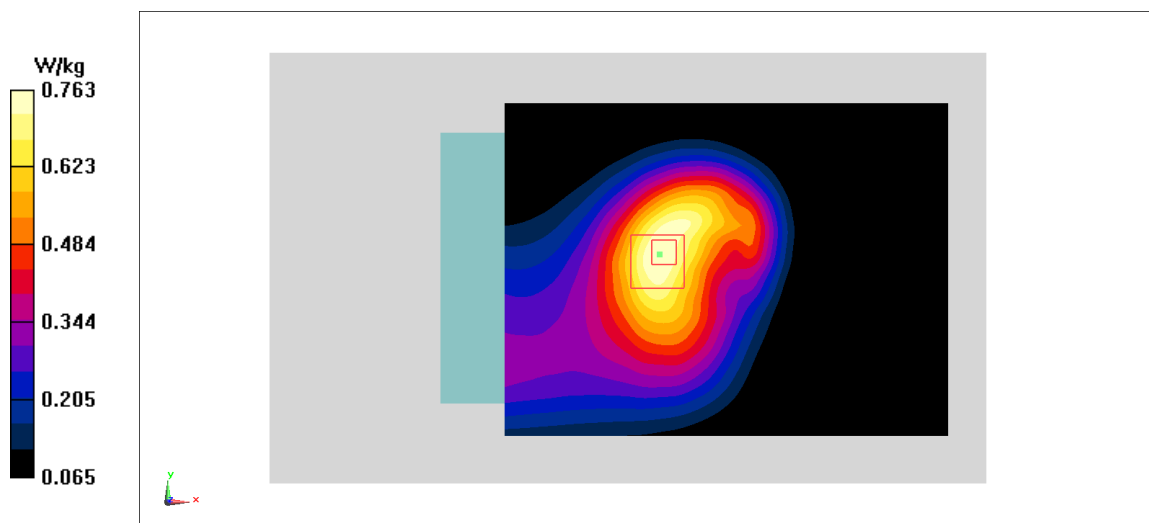


Fig A.8

WLAN2450_CH1 Right Cheek

Date: 6/3/2018

Electronics: DAE4 Sn1525

Medium: head 2450 MHz

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.731$ mho/m; $\epsilon_r = 39.3$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WLAN2450 2412 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7464 ConvF(7.89,7.89,7.89)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

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

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

Reference Value = 10.88 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 2.1 W/kg

SAR(1 g) = 0.182 W/kg; SAR(10 g) = 0.086 W/kg

Maximum value of SAR (measured) = 1.33 W/kg

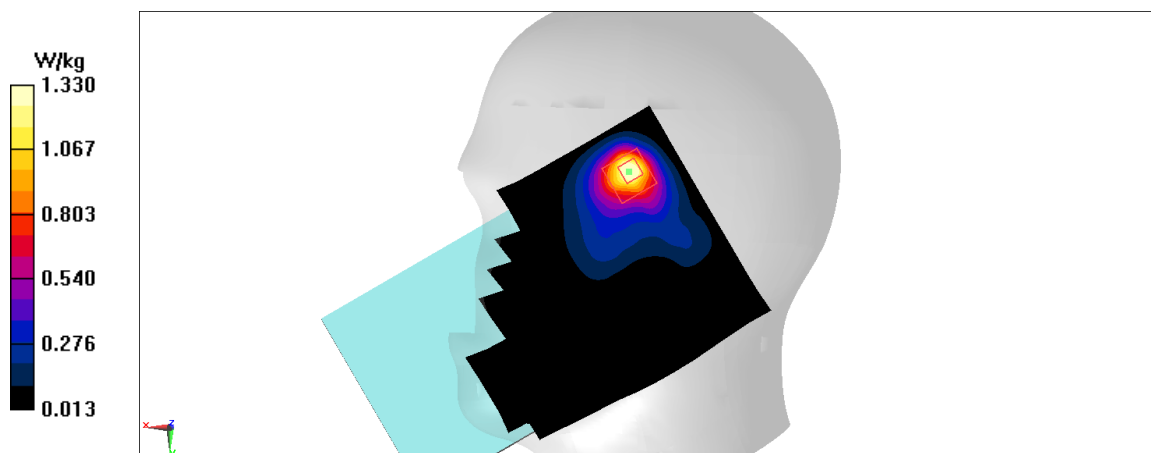


Fig A.9

WLAN2450_CH1 Left edge 0mm

Date: 6/3/2018

Electronics: DAE4 Sn1525

Medium: body 2450 MHz

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.931$ mho/m; $\epsilon_r = 52.88$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WLAN2450 2412 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7464 ConvF(8.09,8.09,8.09)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.757 W/kg

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

Reference Value = 15.41 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.436 W/kg; SAR(10 g) = 0.198 W/kg

Maximum value of SAR (measured) = 0.716 W/kg

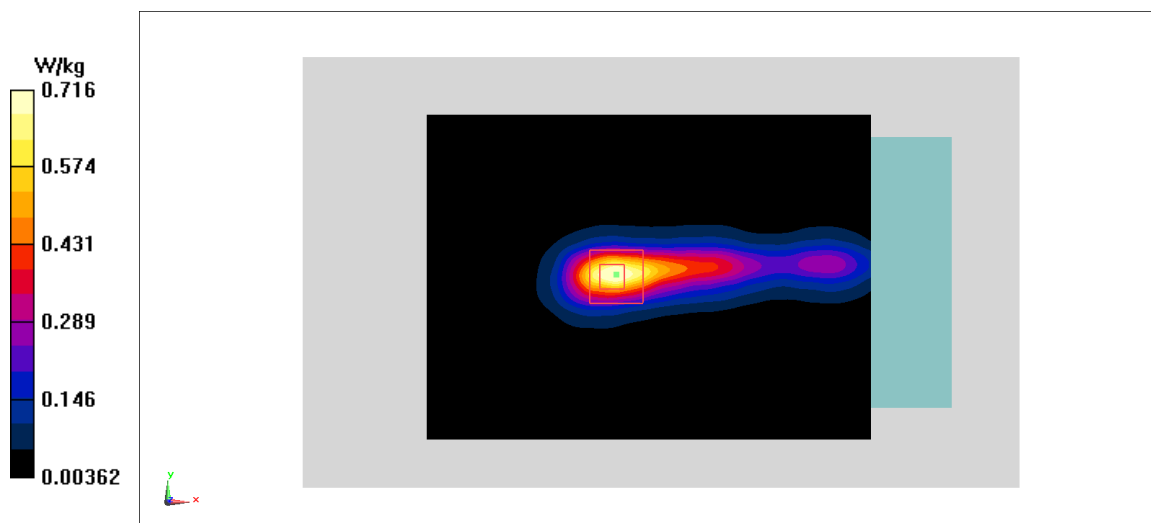


Fig A.10

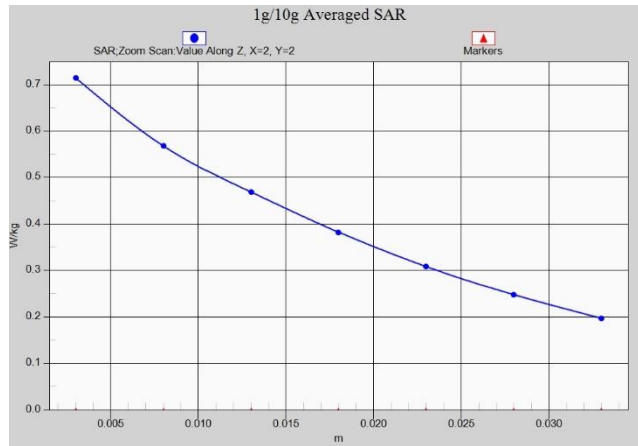


Fig.A.1- 1 Z-Scan at power reference point (GSM850)

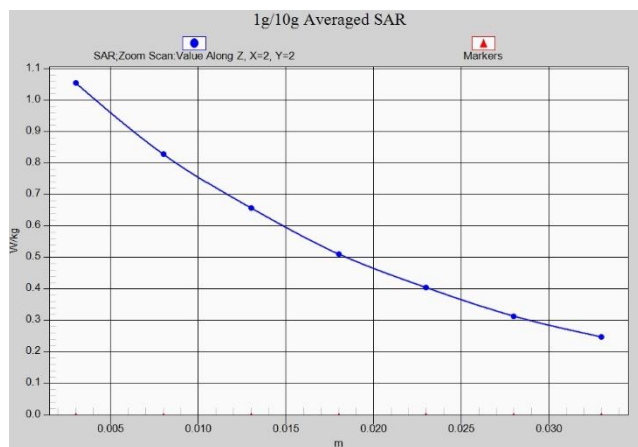


Fig.A.1- 2 Z-Scan at power reference point (GSM850)

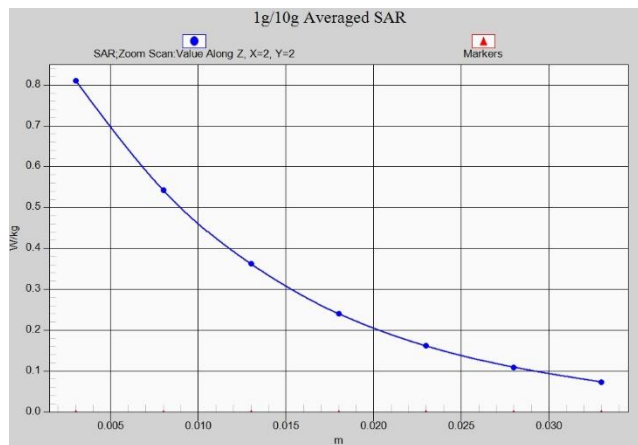


Fig.A.1- 3 Z-Scan at power reference point (PCS1900)

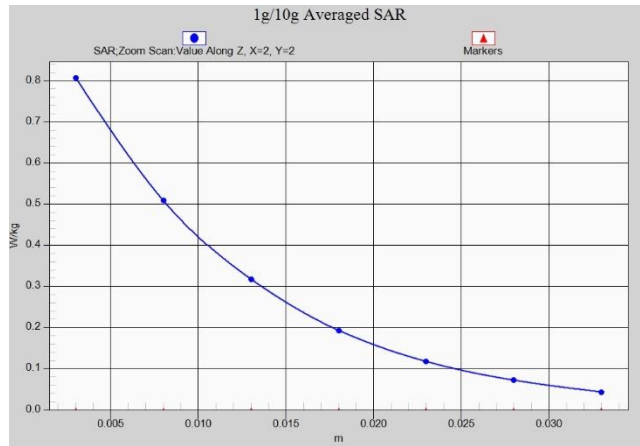


Fig.A.1- 4 Z-Scan at power reference point (PCS1900)

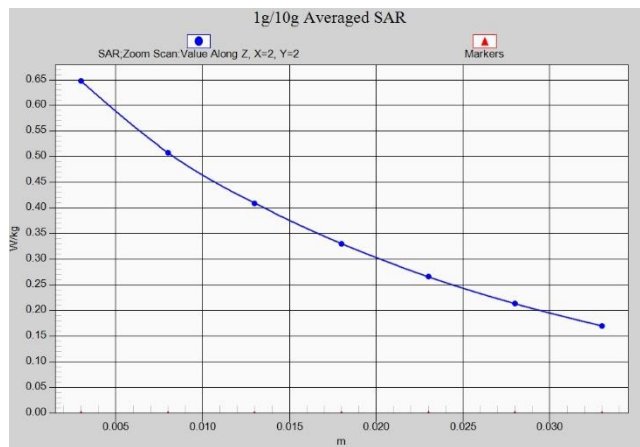


Fig.A.1- 5 Z-Scan at power reference point (W850)

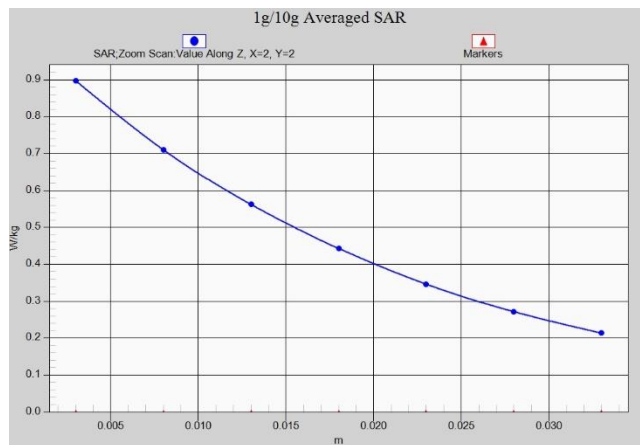


Fig.A.1- 6 Z-Scan at power reference point (W850)