14.3 SAR results for Standard procedure

There is zoom scan measurement to be added for the highest measured SAR in each exposure configuration/band.

Table 14.3-1: SAR Values (GSM 850 MHz Band - Head)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC											
Frequency		Side	Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
128	824.2	Right	Touch	Fig.1	32.05	32.5	0.464	**0.51**	0.621	**0.69**	0.02

Note: the head SAR of GSM850 is tested with GPRS (2Txslots) mode because of VoIP.

Table 14.3-2: SAR Values (GSM 850 MHz Band - Body)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC											
Frequency		Mode (number of timeslots)	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
128	824.2	GPRS (2)	Rear	Fig.2	32.05	32.5	0.525	**0.58**	0.668	**0.74**	-0.03

Note: The distance between the EUT and the phantom bottom is 10mm.

Table 14.3-3: SAR Values (GSM 1900 MHz Band - Head)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC											
Frequency		Side	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
661	1880	Left	Touch	Fig.3	28.75	29.5	0.105	**0.12**	0.169	**0.20**	0.07

Note: the head SAR of GSM1900 is tested with GPRS (2Txslots) mode because of VoIP.

Table 14.3-4: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC											
Frequency		Mode (number of timeslots)	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
512	1850.2	GPRS (2)	Bottom	Fig.4	28.79	29.5	0.564	**0.66**	1.06	**1.25**	0.11

Note: The distance between the EUT and the phantom bottom is 10mm.

Table 14.3-5: SAR Values (WCDMA 850 MHz Band - Head)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC											
Frequency		Side	Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
4233	846.6	Left	Touch	Fig.5	23.54	24.5	0.168	**0.21**	0.221	**0.28**	0.04

Table 14.3-6: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5°C				
Frequency		Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
4182	836.4	Rear	Fig.6	23.57	24.5	0.248	**0.31**	0.317	**0.39**	-0.06

Note: The distance between the EUT and the phantom bottom is 10mm.

Table 14.3-7: SAR Values (WCDMA 1700 MHz Band - Head)

Ambient Temperature: 22.9 °C							Liquid Temperature: 22.5°C				
Frequency		Side	Test Position	Figure No./Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
1637	1732.4	Left	Touch	Fig.7	23.14	24	0.082	**0.10**	0.122	**0.15**	0.09

Table 14.3-8: SAR Values (WCDMA 1700 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5°C				
Frequency		Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
1537	1712.4	Bottom	Fig.8	23.17	24	0.554	**0.67**	0.996	**1.21**	-0.04

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.3-9: SAR Values (WCDMA 1900 MHz Band - Head)

Ambient Temperature: 22.9 °C							Liquid Temperature: 22.5°C				
Frequency		Side	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
9800	1880	Left	Touch	Fig.9	22.67	23.5	0.208	**0.25**	0.338	**0.41**	0.07

Table 14.1-10: SAR Values (WCDMA 1900 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5°C				
Frequency		Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
9800	1880	Rear	Fig.10	22.67	23.5	0.431	**0.52**	0.817	**0.99**	0.07

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.3-11: SAR Values (LTE Band2 - Head)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C												
Frequency		Mode	Side	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz											
19100	1900	1RB_High	Left	Touch	Fig.11	23.13	24	0.325	**0.40**	0.545	**0.67**	0.13

Note1: The LTE mode is QPSK_20MHz.

Table 14.3-12: SAR Values (LTE Band2 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
18700	1860	1RB_High	Bottom	Fig.12	23.26	24	0.587	**0.70**	1.09	**1.29**	0.11

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: The LTE mode is QPSK_20MHz.

Table 14.3-13: SAR Values (LTE Band4 - Head)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C												
Frequency		Mode	Side	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz											
20300	1745	50RB_Low	Right	Touch	Fig.13	21.43	22.5	0.086	**0.11**	0.127	**0.16**	0.18

Note1: The LTE mode is QPSK_20MHz.

Table 14.3-14: SAR Values (LTE Band4 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
20175	1732.5	1RB_High	Bottom	Fig.14	22.45	23.5	0.481	**0.61**	0.865	**1.10**	-0.08

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: The LTE mode is QPSK_20MHz.

Table 14.3-15: SAR Values (LTE Band5 - Head)

Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C												
Frequency		Mode	Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz											
20450	829	1RB_High	Right	Touch	Fig.15	24.33	25	0.199	**0.23**	0.259	**0.30**	0.16

Note1: The LTE mode is QPSK_10MHz.

Table 14.3-16: SAR Values (LTE Band5 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
20450	829	1RB_High	Rear	Fig.16	24.33	25	0.324	**0.38**	0.412	**0.48**	0.04

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: The LTE mode is QPSK_10MHz.

Table 14.3-17: SAR Values (LTE Band7 - Head)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C												
Frequency		Mode	Side	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g)(W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz											
20850	2510	1RB_Low	Right	Touch	Fig.17	21.71	22.5	0.109	**0.13**	0.212	**0.25**	0.17

Note1: The LTE mode is QPSK_20MHz.

Table 14.3-18: SAR Values (LTE Band7 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
20850	2510	1RB_Low	Rear	Fig.18	21.71	22.5	0.294	**0.35**	0.616	**0.74**	-0.03

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: The LTE mode is QPSK_20MHz.

14.4 WLAN Evaluation for 2.4G

According to the KDB248227 D01, SAR is measured for 2.4GHz 802.11b DSSS using the initial test position procedure.

Head Evaluation

Table 14.4-1: SAR Values (WLAN - Head)– 802.11b (Fast SAR)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC											
Frequency		Side	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.										
2462	11	Left	Touch	/	16.75	17	0.254	**0.27**	0.551	**0.58**	0.07
2462	11	Left	Tilt	/	16.75	17	0.217	**0.23**	0.462	**0.49**	0.07
2462	11	Right	Touch	/	16.75	17	0.107	**0.11**	0.219	**0.23**	0.12
2462	11	Right	Tilt	/	16.75	17	0.096	**0.10**	0.207	**0.22**	0.05
2462	11	Left	Touch	/	16.75	17	0.244	**0.26**	0.524	**0.56**	0.09

As shown above table, the initial test position for head is "Left Touch". So the head SAR of WLAN is presented as below:

Table 14.4-2: SAR Values (WLAN - Head)– 802.11b (Full SAR)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC											
Frequency		Side	Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.										
2462	11	Left	Touch	Fig.19	16.75	17	0.263	**0.28**	0.602	**0.64**	0.07
2462	11	Left	Tilt	/	16.75	17	0.220	**0.23**	0.524	**0.56**	0.07
Note1: When the reported SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest estimated 1-g SAR conditions determined by area scans, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg. Note2: For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.											

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The scaled reported SAR is presented as below.

Table 14.4-3: SAR Values (WLAN - Head) – 802.11b (Scaled Reported SAR)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC							
Frequency		Side	Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.						
2462	11	Left	Touch	99.51%	100%	**0.64**	**0.64**
2462	11	Right	Touch	99.51%	100%	**0.23**	**0.23**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.

Body Evaluation

Table 14.4-4: SAR Values (WLAN - Body)– 802.11b (Fast SAR)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC										
Frequency		Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
2462	11	Front	/	16.75	17	0.057	**0.06**	0.111	**0.12**	0.09
2462	11	Rear	/	16.75	17	0.077	**0.08**	0.153	**0.16**	0.01
2462	11	Right	/	16.75	17	0.047	**0.05**	0.095	**0.10**	0.13
2462	11	Top	/	16.75	17	0.040	**0.04**	0.076	**0.08**	0.07
2462	11	Rear	/	16.75	17	0.070	**0.07**	0.143	**0.15**	-0.04

As shown above table, the initial test position for body is “Rear”. So the body SAR of WLAN is presented as below:

Table 14.4-5: SAR Values (WLAN - Body)– 802.11b (Full SAR)

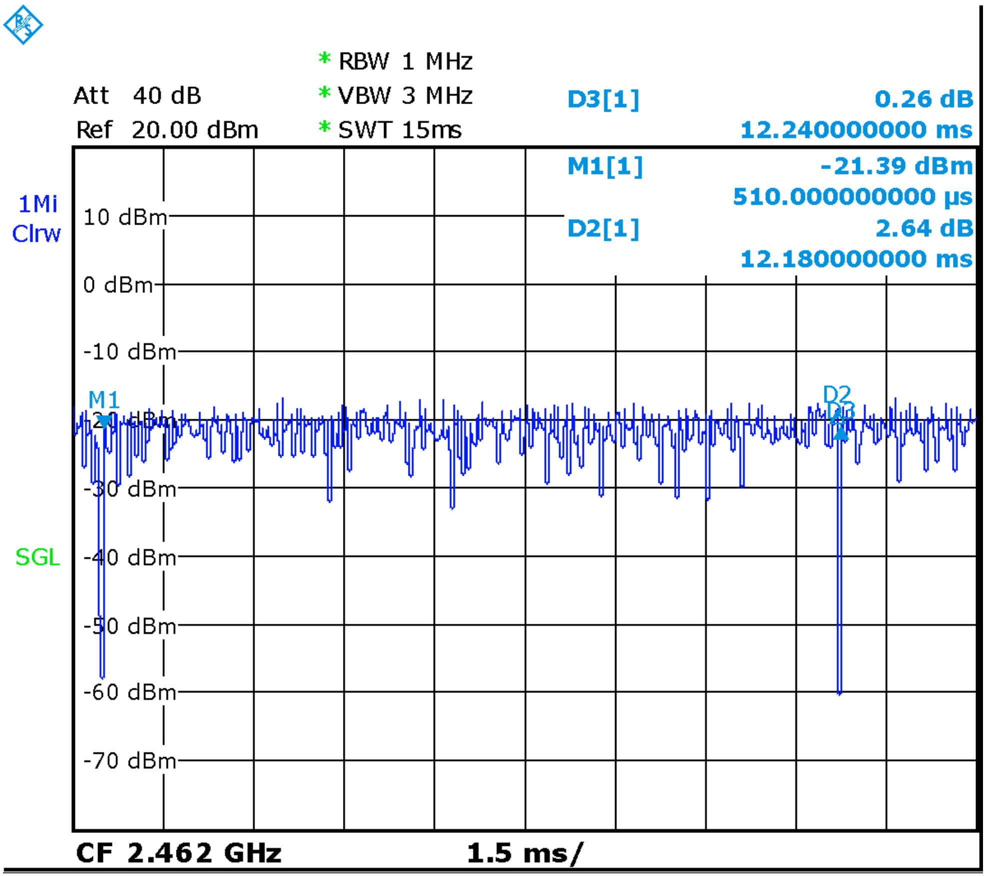
Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC										
Frequency		Test Position	Figure No./ Note	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
2462	11	Rear	Fig.20	16.75	17	0.076	**0.08**	0.154	**0.16**	0.01
Note1: When the reported SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest estimated 1-g SAR conditions determined by area scans, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg. Note2: For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.										

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The scaled reported SAR is presented as below.

Table 14.4-6: SAR Values (WLAN - Body) – 802.11b (Scaled Reported SAR)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC						
Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.					
2462	11	Rear	99.51%	100%	**0.16**	**0.16**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.



Picture 14.1 Duty factor plot for CH11

15 SAR Measurement Variability

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Table 15.1: SAR Measurement Variability for Body PCS1900 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
Ch.	MHz						
512	1850.2	Bottom	10	1.06	1.02	1.04	/

Table 15.2: SAR Measurement Variability for Body W1700 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
Ch.	MHz						
1537	1712.4	Bottom	10	0.996	0.978	1.02	/

Table 15.3: SAR Measurement Variability for Body W1900 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
Ch.	MHz						
9800	1880	Rear	10	0.817	0.803	1.02	/

Table 15.4: SAR Measurement Variability for Body LTE B2 (1g)

Frequency		Mode	Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
Ch.	MHz							
18700	1860	1RB_High	Bottom	10	1.09	1.05	1.04	/

Table 15.5: SAR Measurement Variability for Body LTE B4 (1g)

Frequency		Mode	Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
Ch.	MHz							
20175	1732.5	1RB_High	Bottom	10	0.865	0.852	1.02	/

16 Measurement Uncertainty

16.1 Measurement Uncertainty for Normal SAR Tests (300MHz~3GHz)

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	6.0	N	1	1	1	6.0	6.0	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	N	1	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	RFambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
20	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521

Combined standard uncertainty	$u_c^{'} = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					9.55	9.43	257
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$					19.1	18.9	

16.2 Measurement Uncertainty for Normal 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	RFambient 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	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
20	Liquid permittivity	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞

	(target)									
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						10.7	10.6	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						21.4	21.1	

16.3 Measurement Uncertainty for Fast SAR Tests (300MHz~3GHz)

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	6.0	N	1	1	1	6.0	6.0	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
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	RFambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. Restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
14	Fast SAR z-Approximation	B	7.0	R	$\sqrt{3}$	1	1	4.0	4.0	∞
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		$u_c^{'} = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						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	RFambient 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	A	3.4	N	1	1	1	3.4	3.4	5

	uncertainty									
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

Table 17.1: List of Main 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	MY49071430	January 2,2018	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	E5515C	MY50263375	January 23, 2018	One year
07	BTS	CMW500	149646	October 31, 2017	One year
08	E-field Probe	SPEAG EX3DV4	7464	September 12,2017	One year
09	DAE	SPEAG DAE4	1525	October 2, 2017	One year
10	Dipole Validation Kit	SPEAG D835V2	4d069	July 19, 2017	One year
11	Dipole Validation Kit	SPEAG D1750V2	1003	July 21, 2017	One year
12	Dipole Validation Kit	SPEAG D1900V2	5d101	July 26, 2017	One year
13	Dipole Validation Kit	SPEAG D2450V2	853	July 21, 2017	One year
14	Dipole Validation Kit	SPEAG D2600V2	1012	July 21, 2017	One year

END OF REPORT BODY

ANNEX A Graph Results

850 Right Cheek Low

Date: 2018-3-30
Electronics: DAE4 Sn1525
Medium: Head 850 MHz
Medium parameters used: f = 824.2 MHz; σ = 0.889 mho/m; εr = 42.02; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: GSM 850 GPRS Frequency: 824.2 MHz Duty Cycle: 1:4
Probe: EX3DV4 – SN7464 ConvF(10.28, 10.28, 10.28)

Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.684 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.928 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.816 W/kg
SAR(1 g) = 0.621 W/kg; SAR(10 g) = 0.464 W/kg
Maximum value of SAR (measured) = 0.685 W/kg

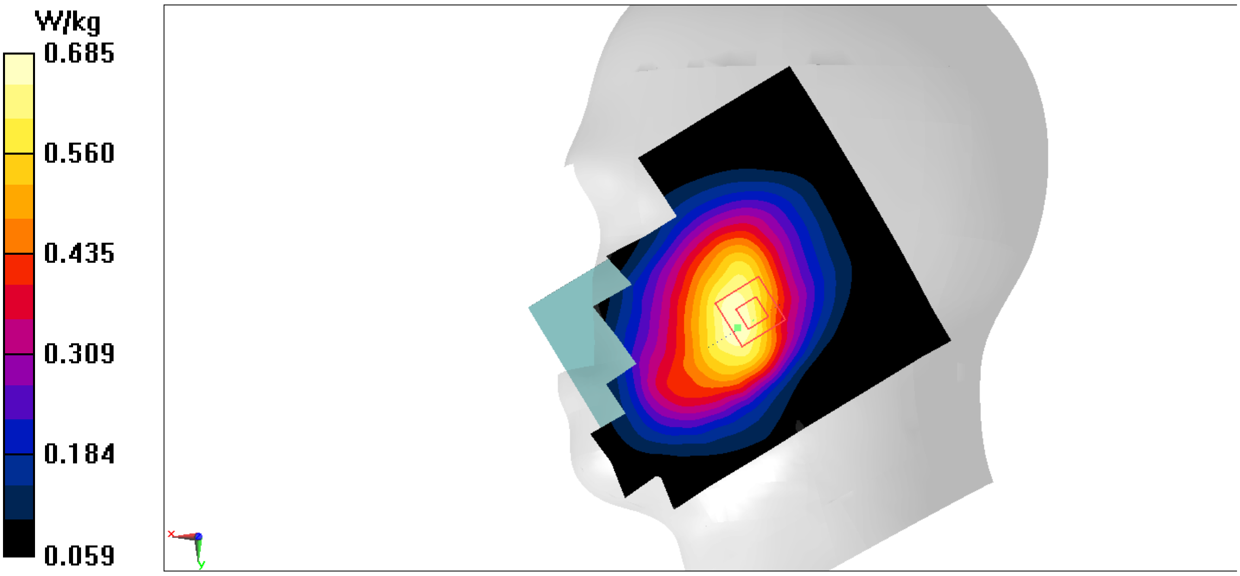


Fig.1 850MHz

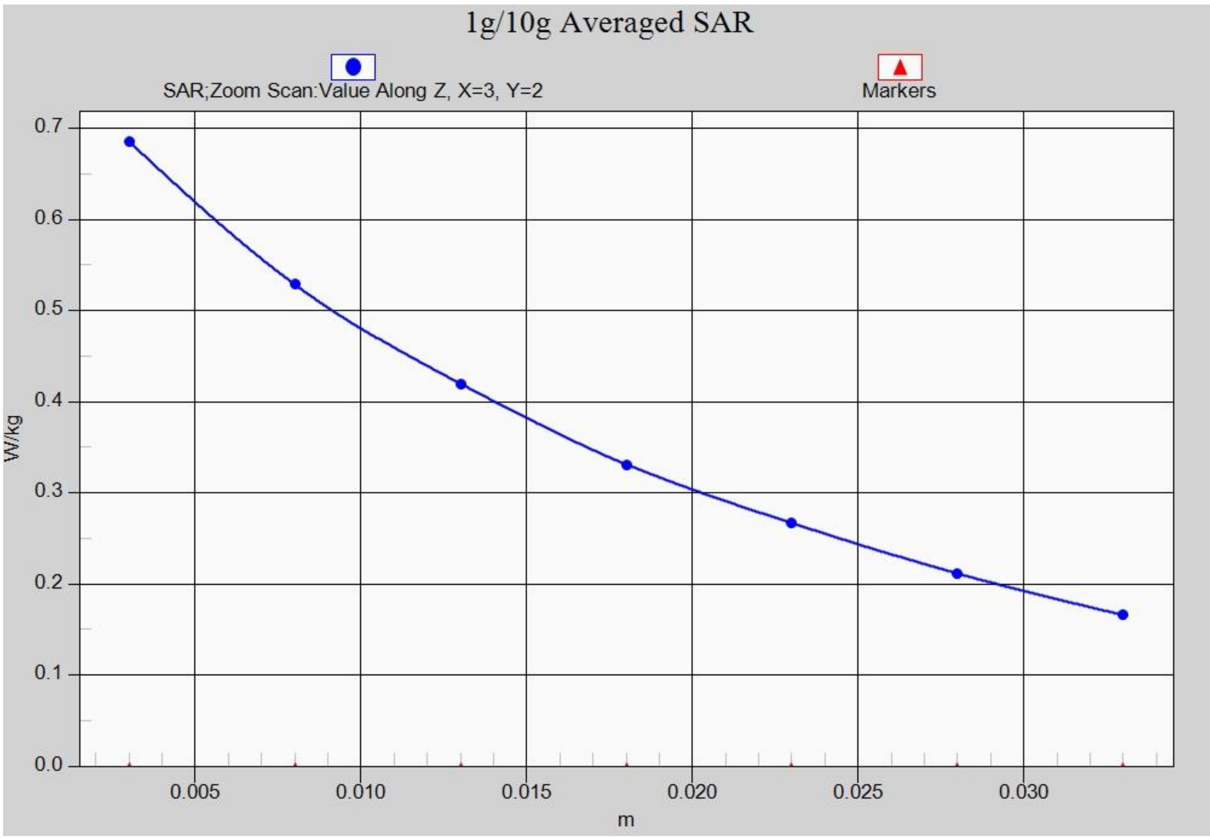


Fig. 1-1 Z-Scan at power reference point (850 MHz)

850 Body Rear Low

Date: 2018-3-30
Electronics: DAE4 Sn1525
Medium: Body 850 MHz
Medium parameters used: f = 824.2 MHz; σ = 0.96 mho/m; εr = 56.1; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: GSM 850 GPRS Frequency: 824.2 MHz Duty Cycle: 1:4
Probe: EX3DV4 – SN7464 ConvF(10.21, 10.21, 10.21)

Area Scan (131x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.764 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.61 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.976 W/kg
SAR(1 g) = 0.668 W/kg; SAR(10 g) = 0.525 W/kg
Maximum value of SAR (measured) = 0.732 W/kg

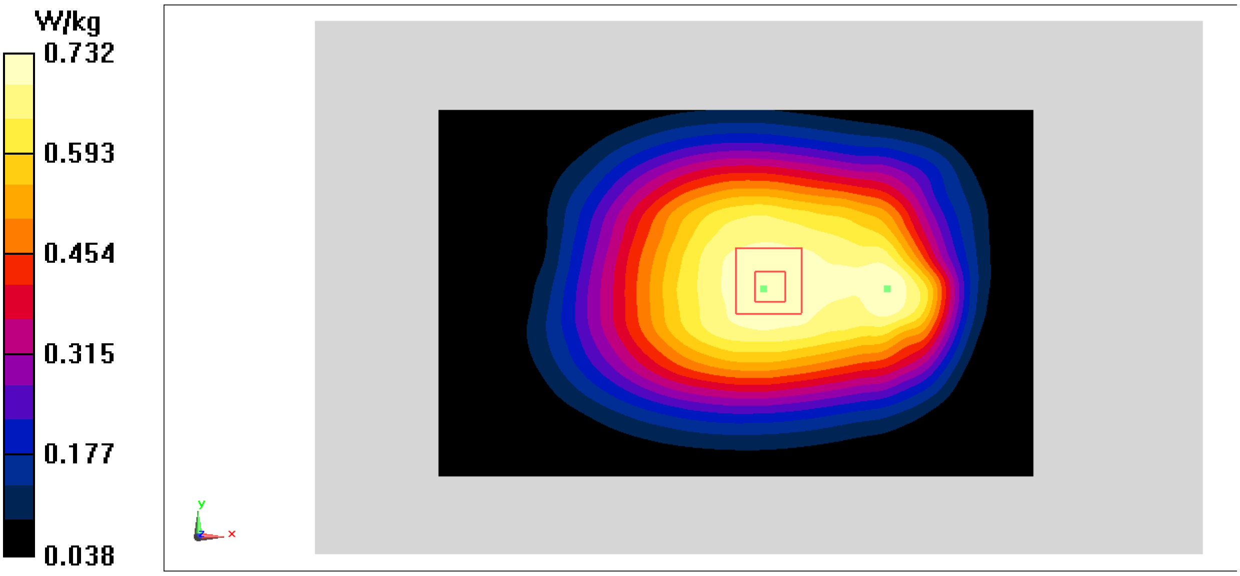


Fig.2 850 MHz

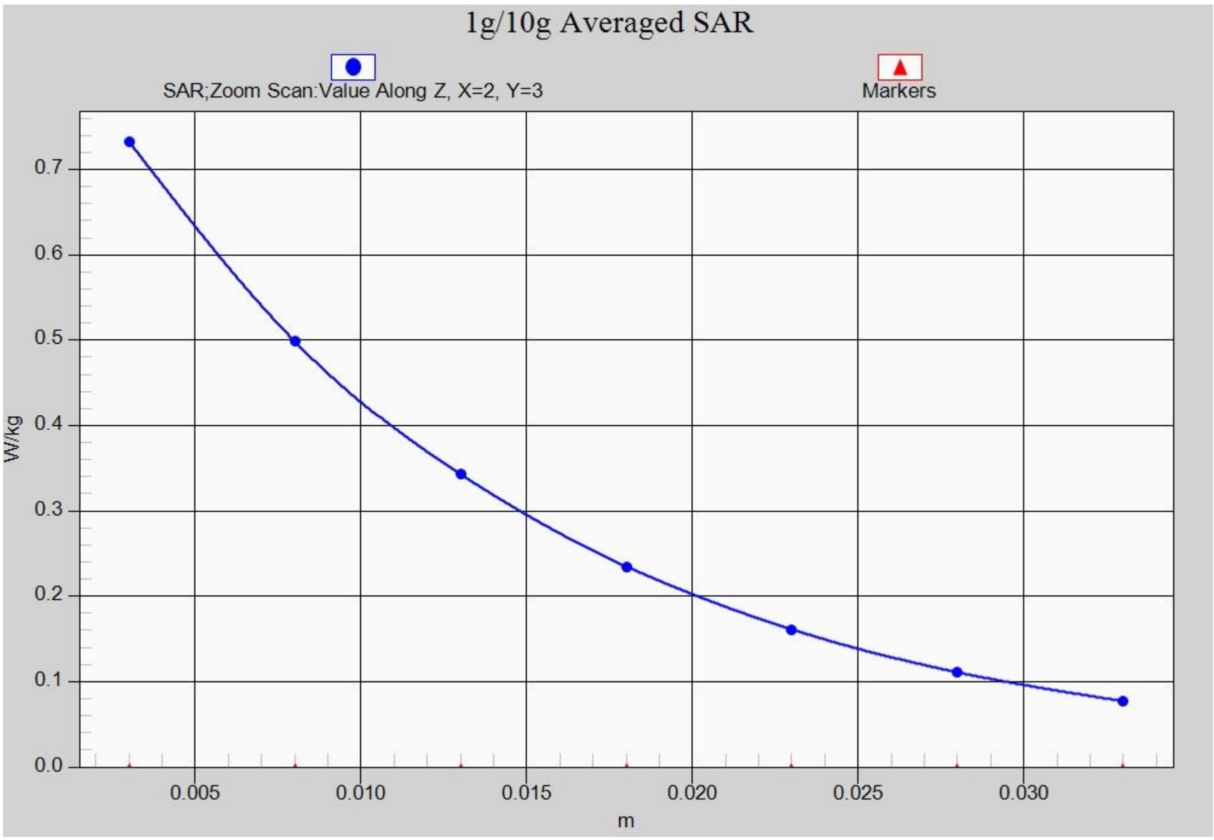


Fig. 2-1 Z-Scan at power reference point (850 MHz)

1900 Left Cheek Middle
Date: 2018-3-29
Electronics: DAE4 Sn1525
Medium: Head 1900 MHz
Medium parameters used: f = 1880 MHz; σ = 1.425 mho/m; εr = 40.51; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: GSM 1900MHz Frequency: 1880 MHz Duty Cycle: 1:4
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) = 0.208 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.858 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.265 W/kg
SAR(1 g) = 0.169 W/kg; SAR(10 g) = 0.105 W/kg
Maximum value of SAR (measured) = 0.201 W/kg

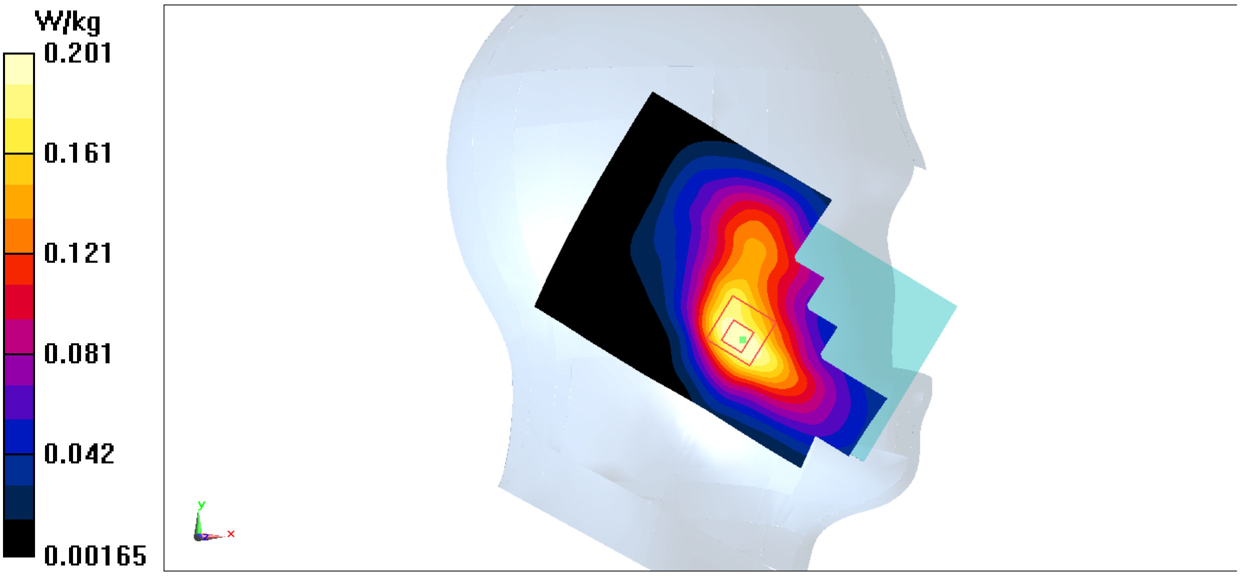


Fig.3 1900 MHz

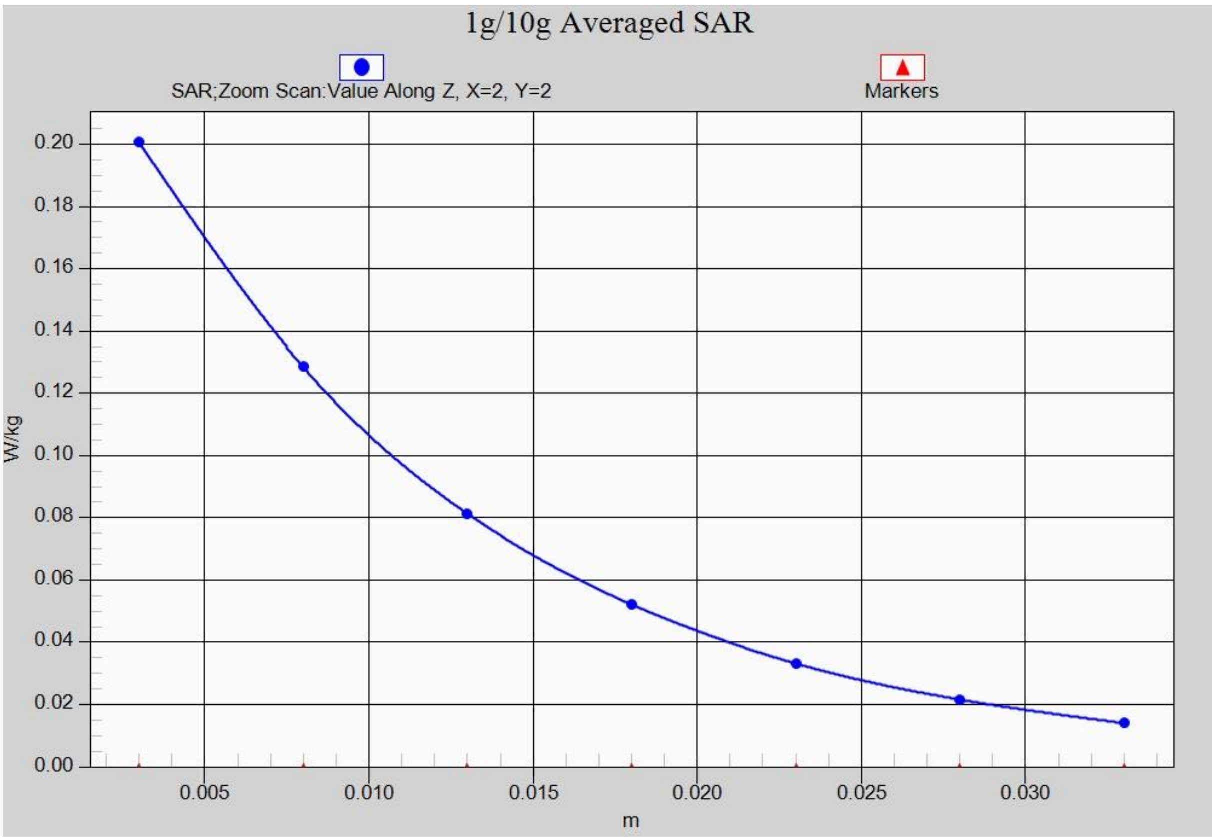


Fig. 3-1 Z-Scan at power reference point (1900 MHz)

1900 Body Bottom Low
Date: 2018-3-29
Electronics: DAE4 Sn1525
Medium: Body 1900 MHz
Medium parameters used: f = 1850.2 MHz; σ =1.515 mho/m; εr = 52.83; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: GSM 1900MHz GPRS Frequency: 1850.2 MHz Duty Cycle: 1:4
Probe: EX3DV4– SN7464 ConvF(8.32, 8.32, 8.32)

Area Scan (131x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.30 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.56 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 1.80 W/kg
SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.564 W/kg
Maximum value of SAR (measured) = 1.32 W/kg

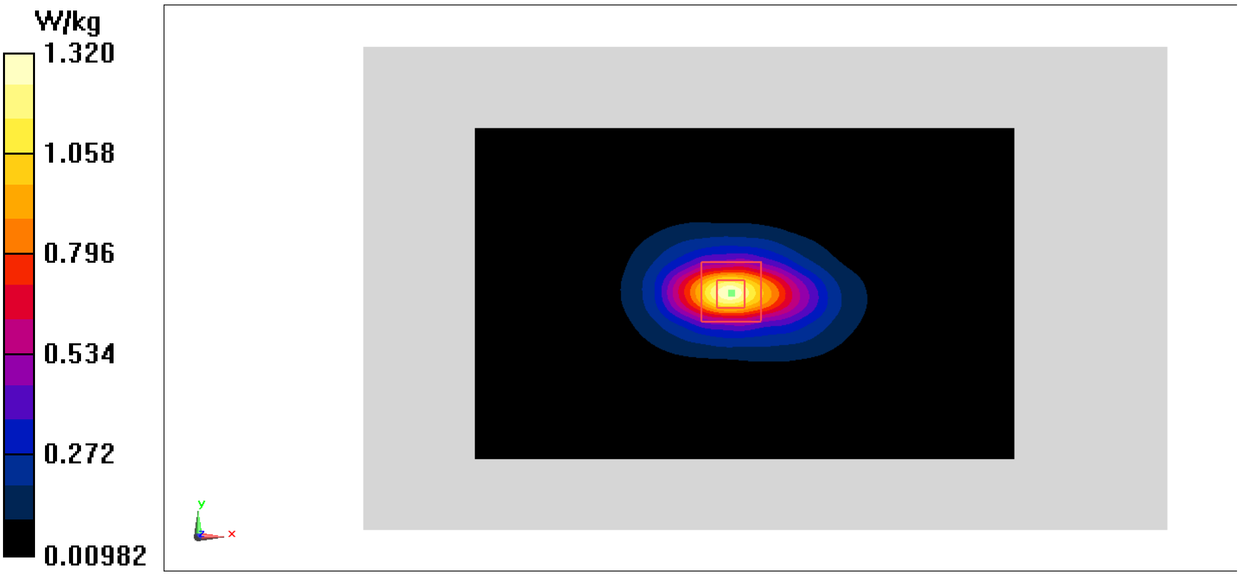


Fig.4 1900 MHz

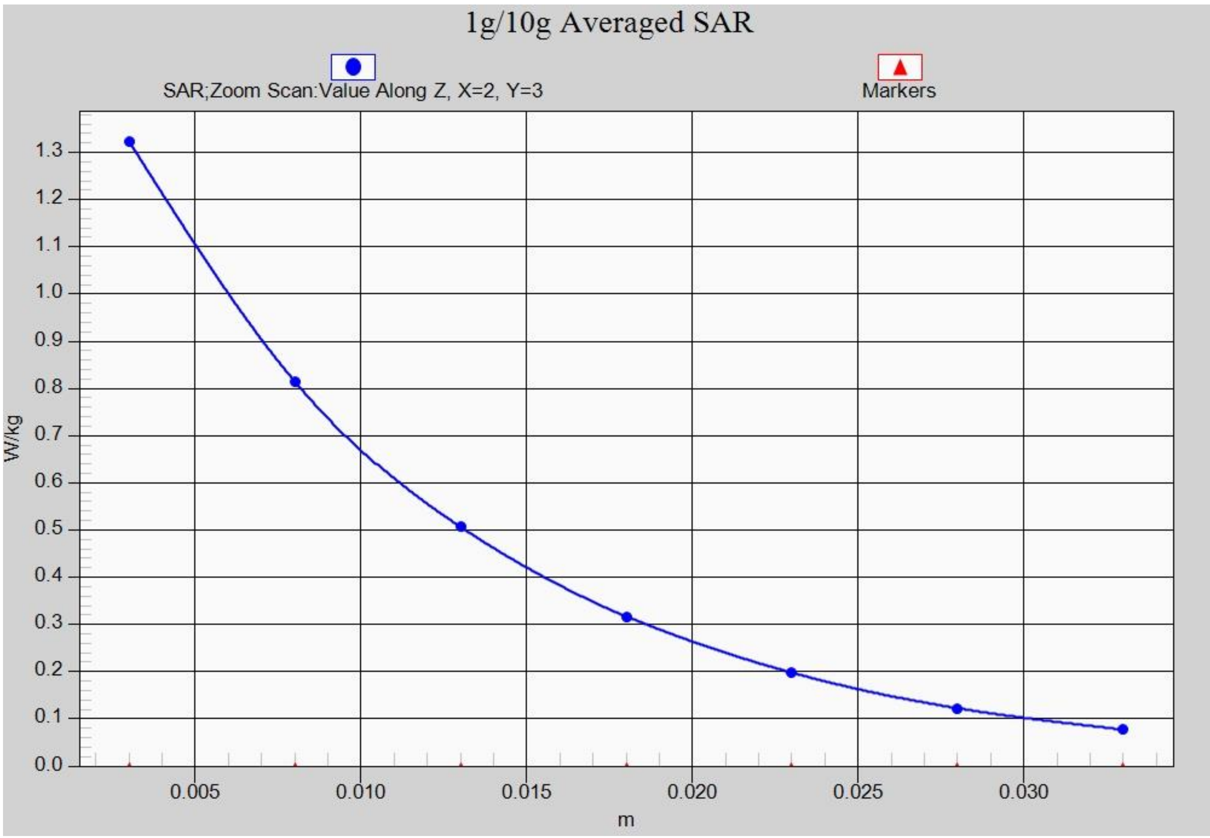


Fig. 4-1 Z-Scan at power reference point (1900 MHz)

WCDMA 850 Left Cheek High

Date: 2018-3-30
Electronics: DAE4 Sn1525
Medium: Head 850 MHz
Medium parameters used (interpolated): f = 846.6 MHz; σ = 0.909 mho/m; εr = 41.725; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(10.28, 10.28, 10.28)

Area Scan (81x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.246 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.362 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.285 W/kg
SAR(1 g) = 0.221 W/kg; SAR(10 g) = 0.168 W/kg
Maximum value of SAR (measured) = 0.244 W/kg

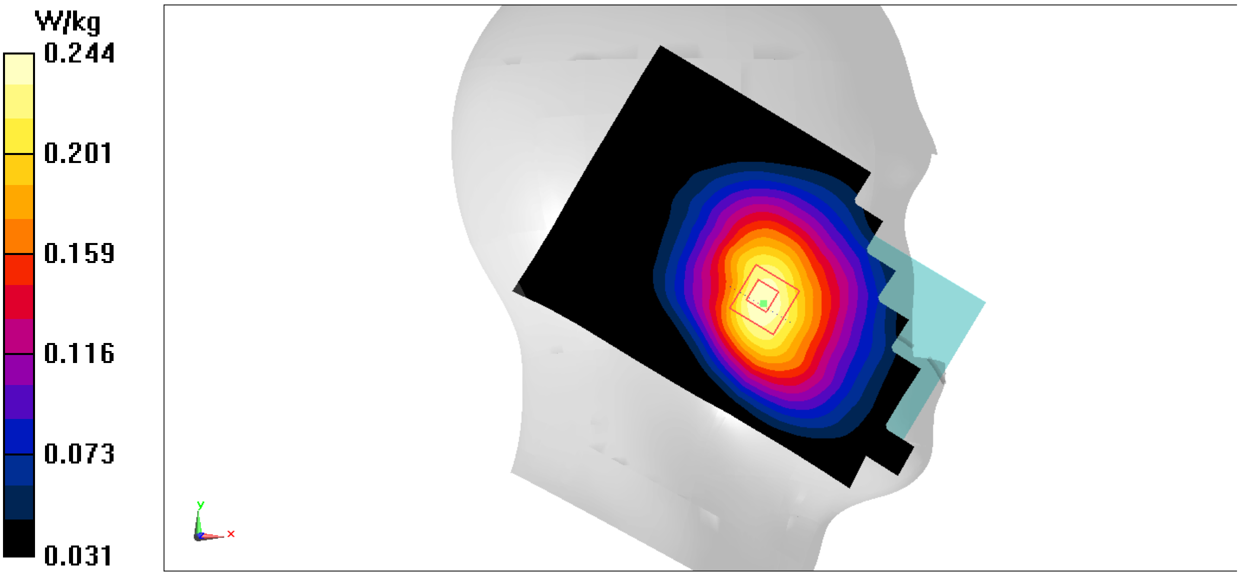


Fig.5 WCDMA 850

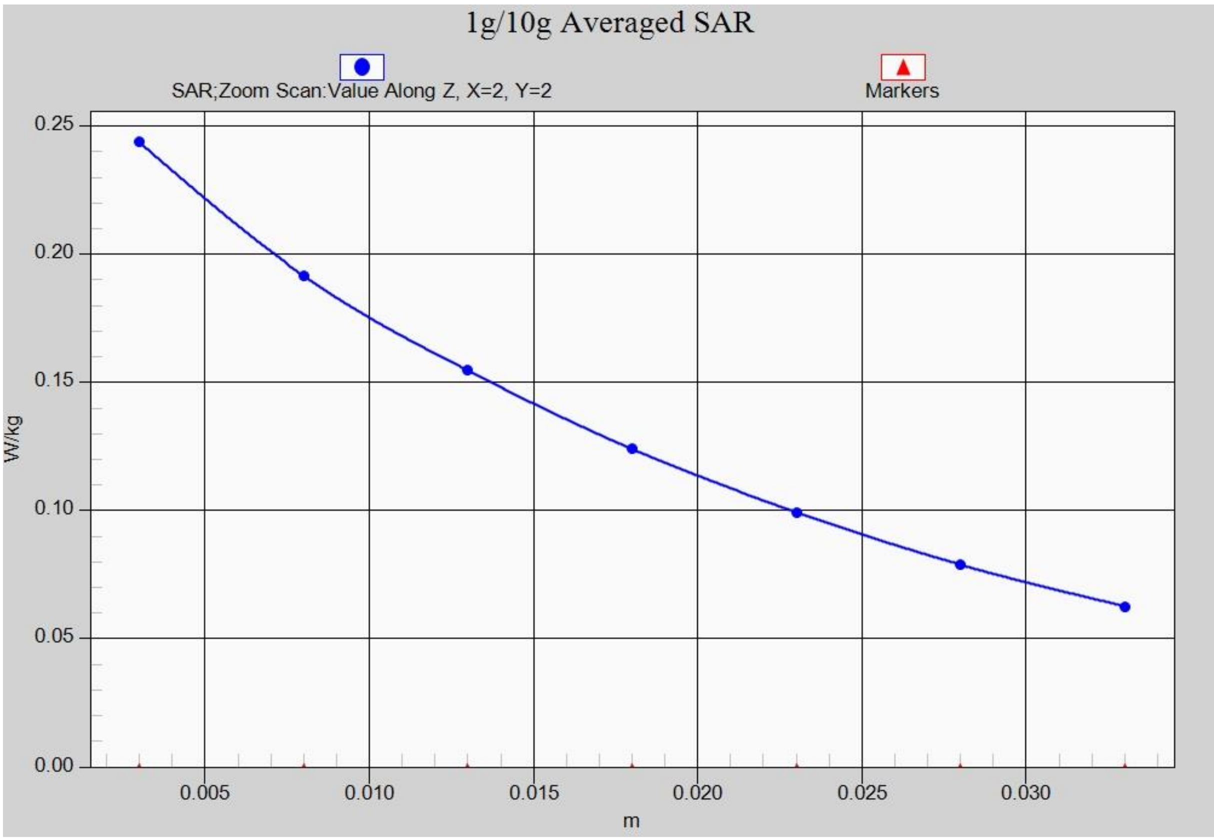


Fig. 5-1 Z-Scan at power reference point (850 MHz)

WCDMA 850 Body Rear Middle

Date: 2018-3-30
Electronics: DAE4 Sn1525
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 836.4 MHz; σ = 0.971 mho/m; εr = 55.976; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: WCDMA; Frequency: 836.4 MHz; Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(10.21, 10.21, 10.21)

Area Scan (131x81x1): 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 = 18.92 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.392 W/kg
SAR(1 g) = 0.317 W/kg; SAR(10 g) = 0.248 W/kg
Maximum value of SAR (measured) = 0.344 W/kg

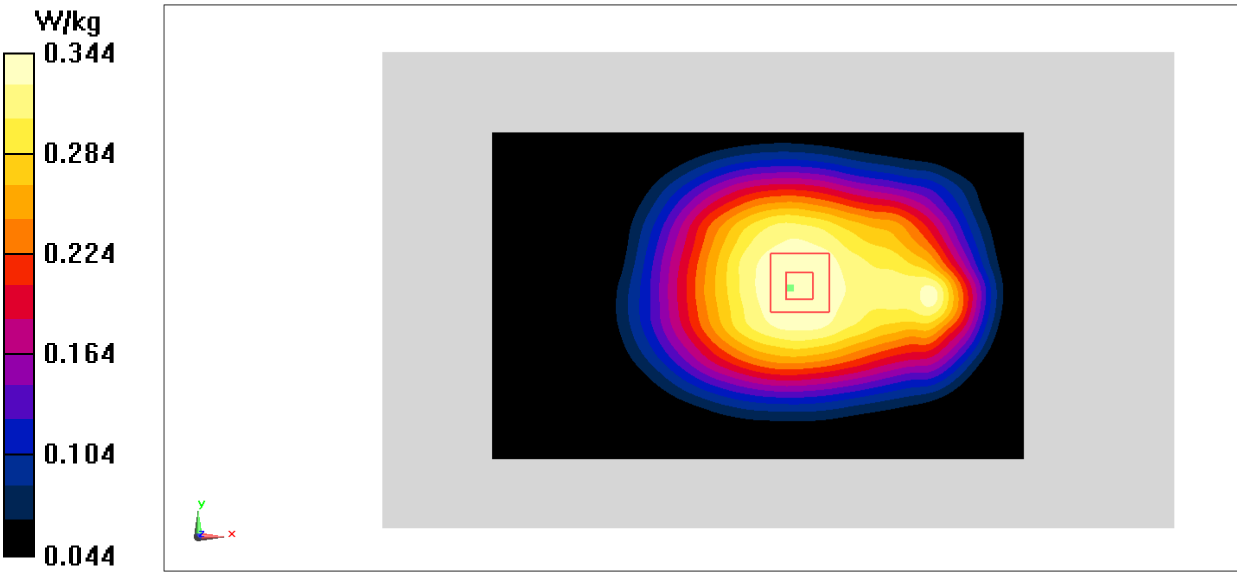


Fig.6 WCDMA 850

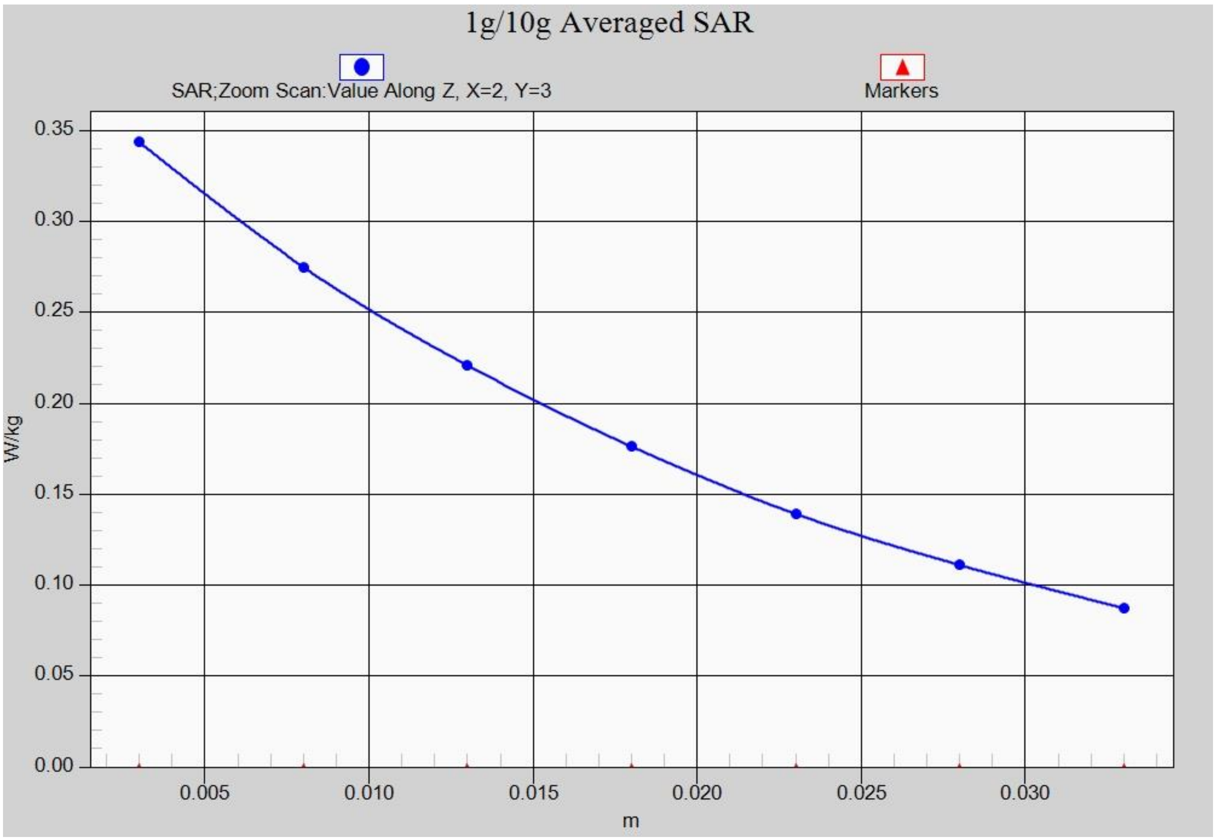


Fig. 6-1 Z-Scan at power reference point (WCDMA850)

WCDMA 1700 Left Cheek Middle

Date: 2018-3-31
Electronics: DAE4 Sn1525
Medium: Head 1750 MHz
Medium parameters used (interpolated): f = 1732.4 MHz; σ = 1.32 mho/m; εr = 40.637; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C
Communication System: WCDMA 1750 Frequency: 1732.4 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN7464 ConvF(8.70, 8.70, 8.70)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.145 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.497 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.175 W/kg
SAR(1 g) = 0.122 W/kg; SAR(10 g) = 0.082 W/kg
Maximum value of SAR (measured) = 0.139 W/kg

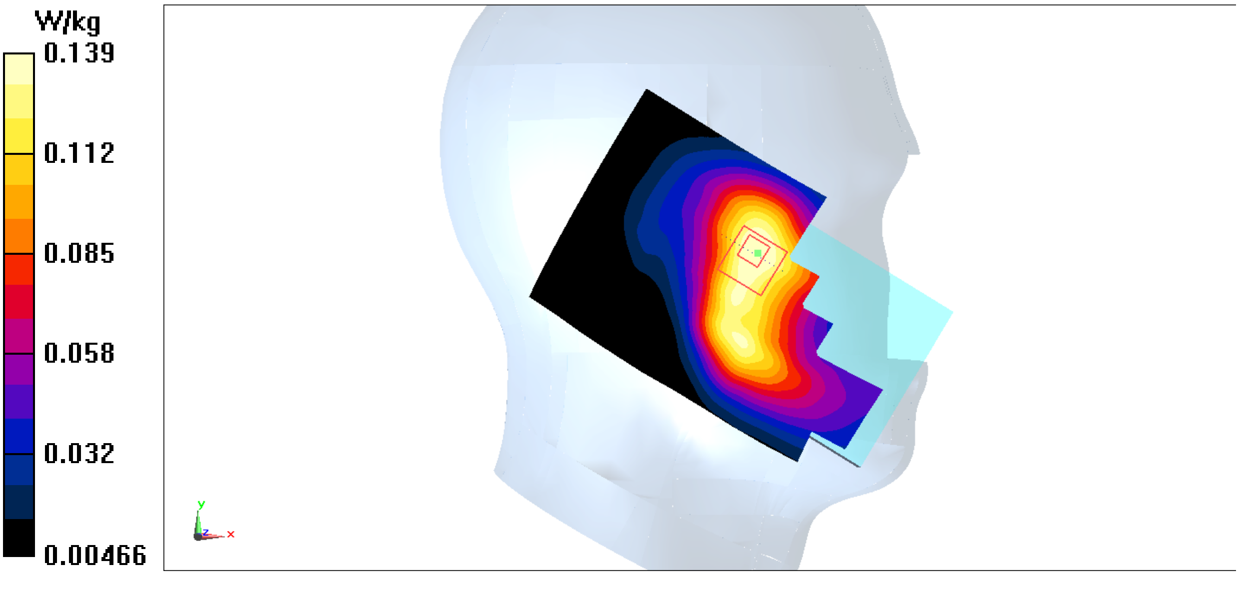


Fig.7 WCDMA1700

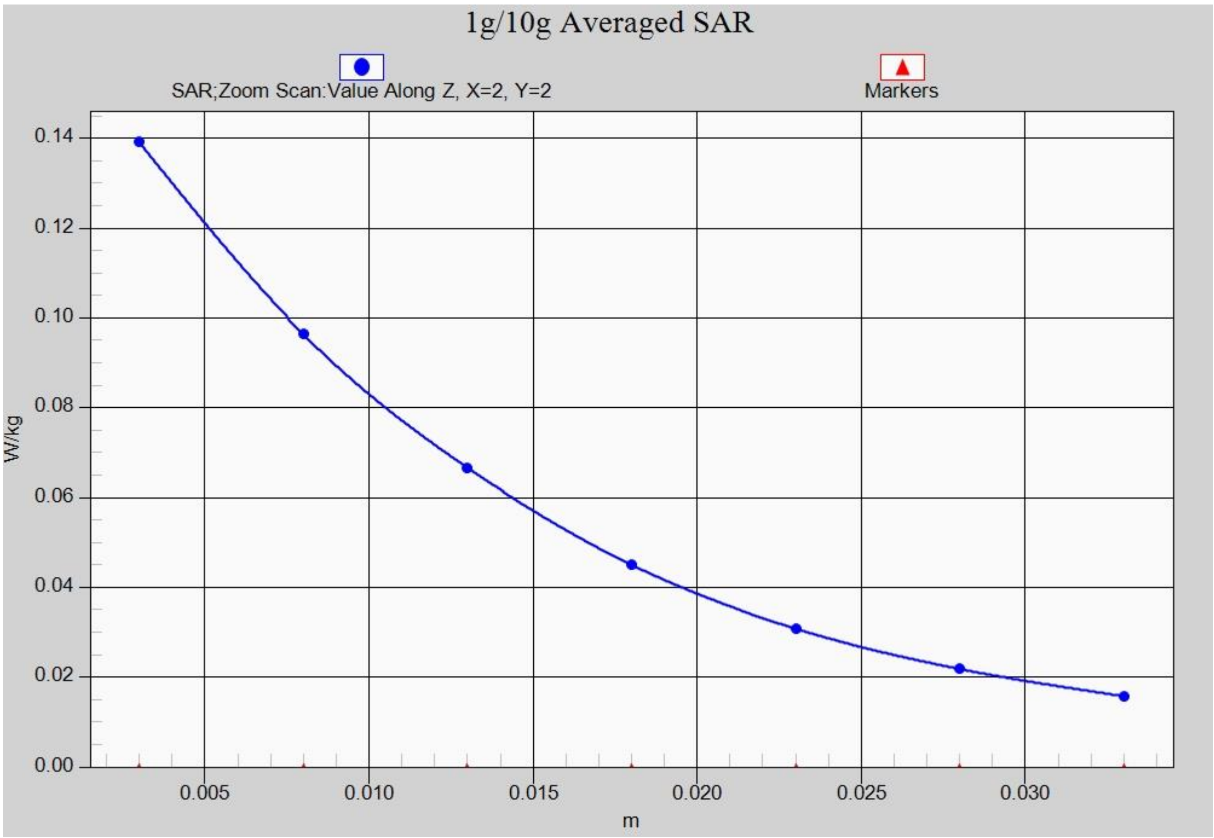


Fig. 7-1 Z-Scan at power reference point (WCDMA1700)

WCDMA 1700 Body Bottom Low

Date: 2018-3-31
Electronics: DAE4 Sn1525
Medium: Body 1750 MHz
Medium parameters used (interpolated): f = 1712.4 MHz; σ = 1.481 mho/m; εr = 53.828; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: WCDMA 1900 Frequency: 1712.4 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN7464 ConvF(8.60, 8.60, 8.60)

Area Scan (131x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.25 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.36 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.64 W/kg
SAR(1 g) = 0.996 W/kg; SAR(10 g) = 0.554 W/kg
Maximum value of SAR (measured) = 1.19 W/kg

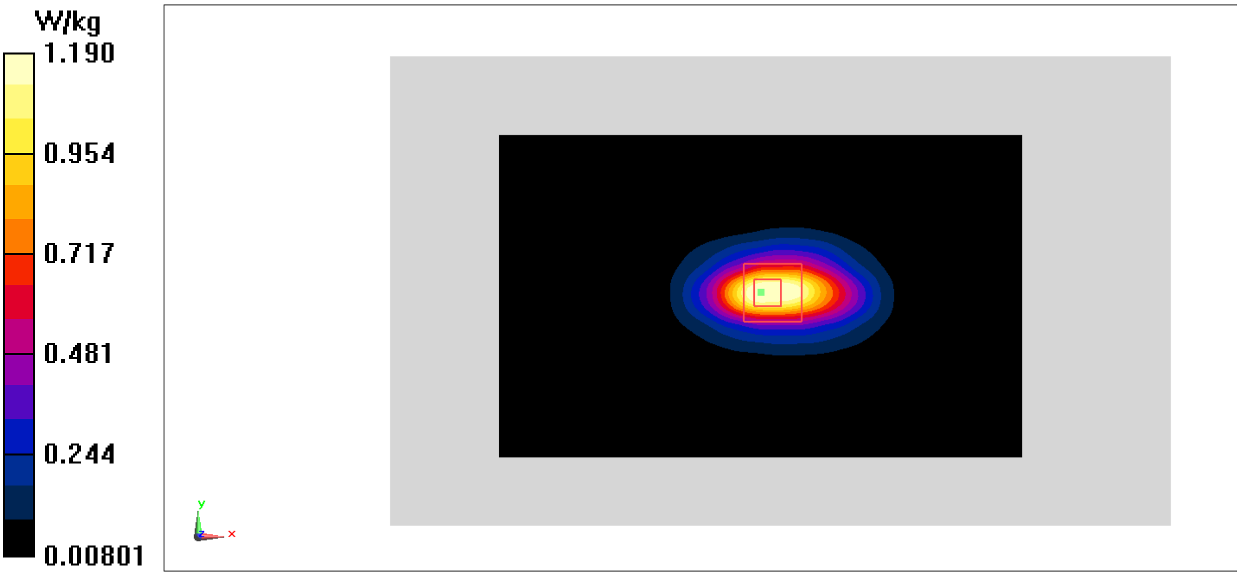


Fig.8 WCDMA1700

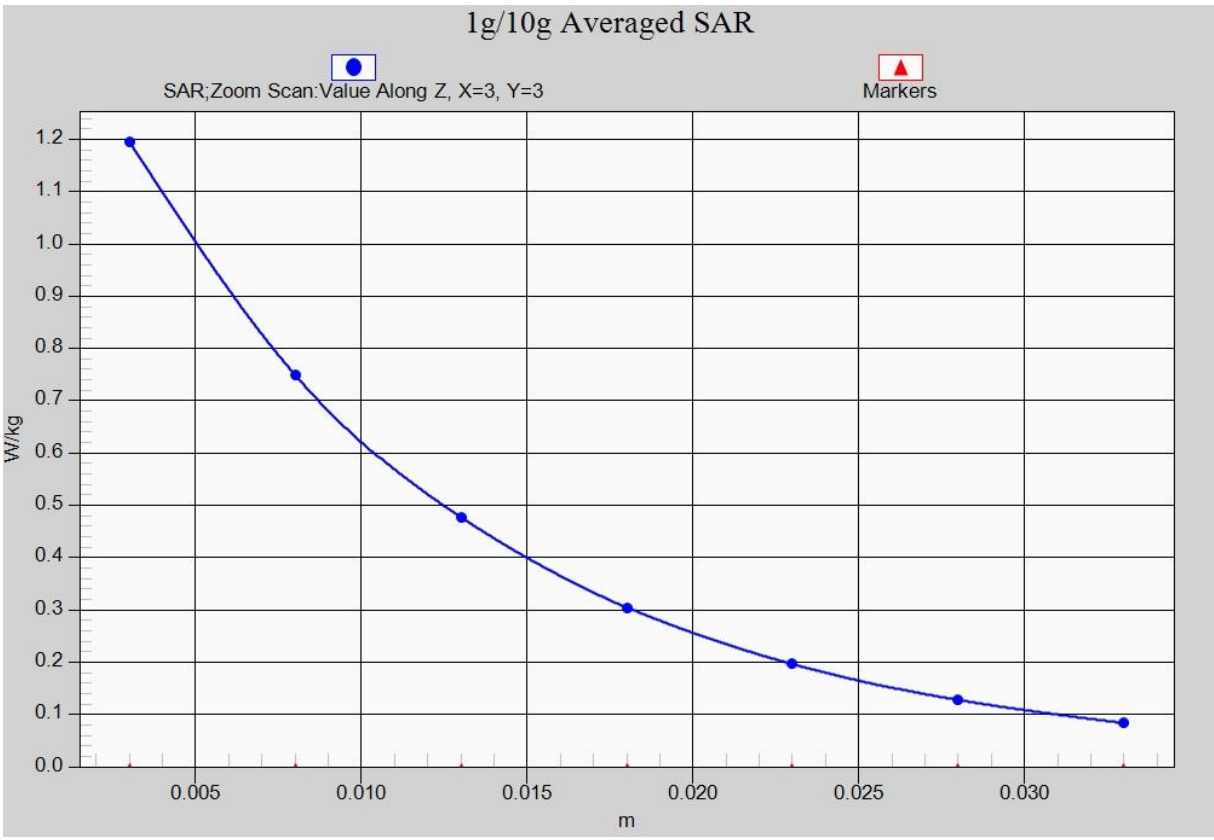


Fig. 8-1 Z-Scan at power reference point (WCDMA1700)

WCDMA 1900 Left Cheek Middle
Date: 2018-3-29
Electronics: DAE4 Sn1525
Medium: Head 1900 MHz
Medium parameters used: f = 1880 MHz; σ = 1.438 mho/m; εr = 40.926; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: WCDMA 1900 Frequency: 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) = 0.420 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.081 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.540 W/kg
SAR(1 g) = 0.338 W/kg; SAR(10 g) = 0.208 W/kg
Maximum value of SAR (measured) = 0.404 W/kg

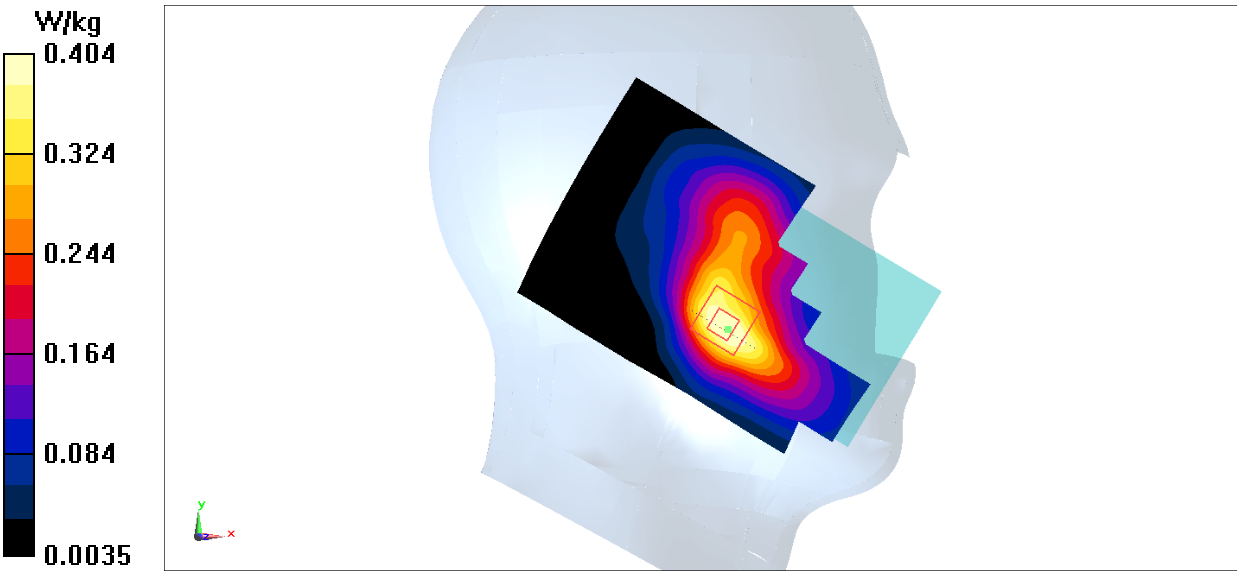


Fig.9 WCDMA1900

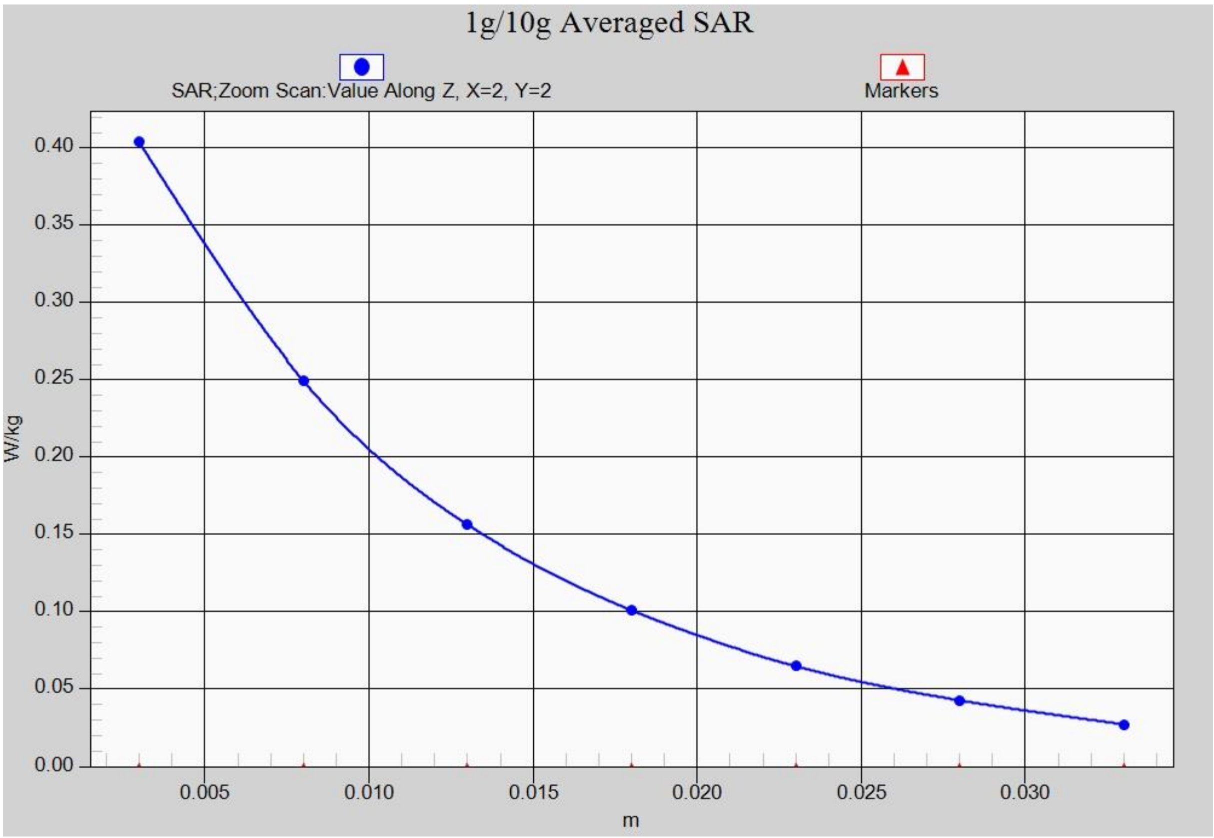


Fig. 9-1 Z-Scan at power reference point (WCDMA1900)

WCDMA 1900 Body Rear Middle

Date: 2018-3-29

Electronics: DAE4 Sn1525

Medium: Body 1900 MHz

Medium parameters used: f = 1880 MHz; σ = 1.531 mho/m; εr = 53.08; ρ = 1000 kg/m^3

Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC

Communication System: WCDMA 1900 Frequency: 1880 MHz Duty Cycle: 1:1

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

Area Scan (131x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.900 W/kg

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

Reference Value = 10.65 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.42 W/kg

SAR(1 g) = 0.817 W/kg; SAR(10 g) = 0.431 W/kg

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

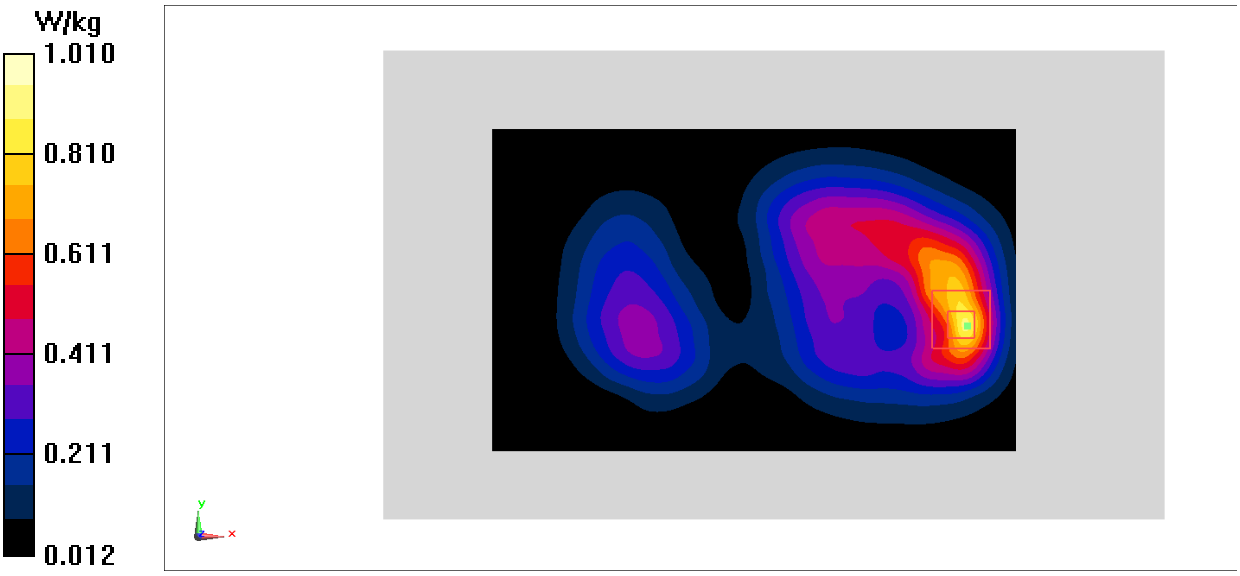


Fig.10 WCDMA1900

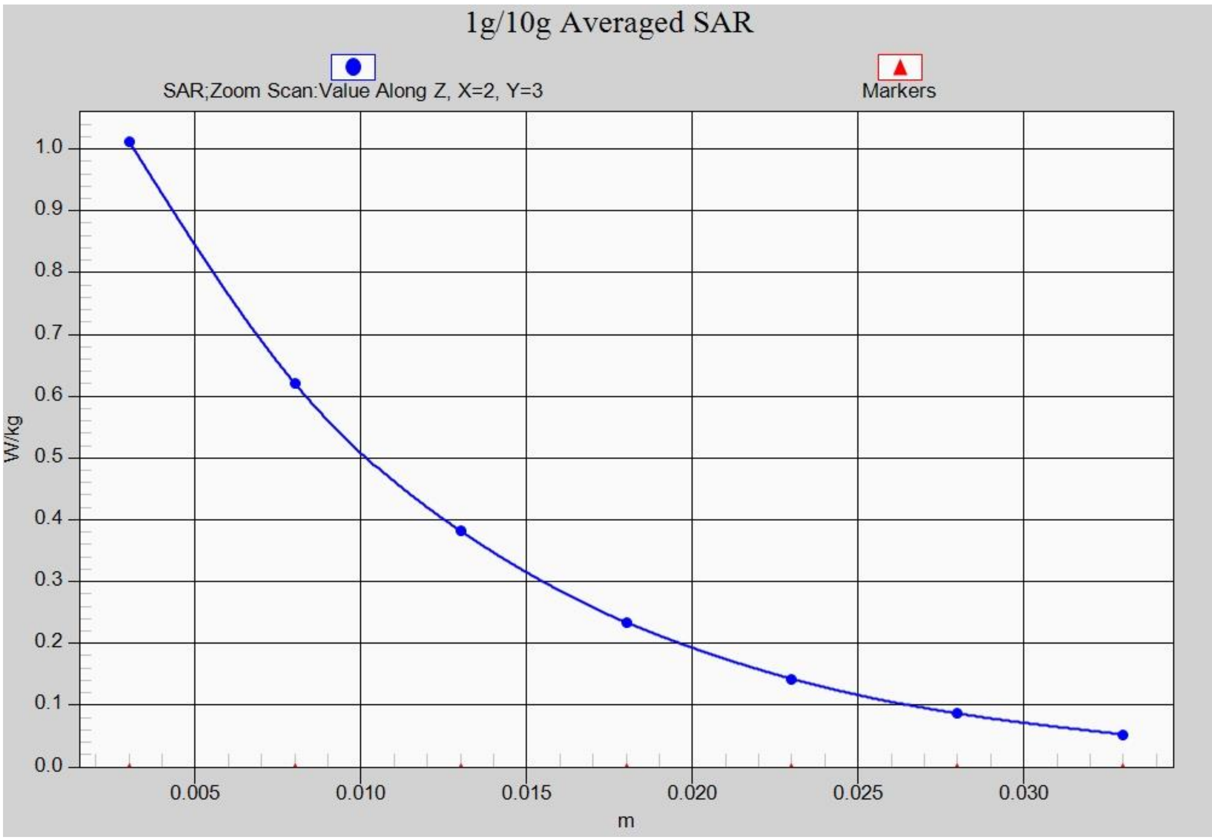


Fig. 10-1 Z-Scan at power reference point (WCDMA1900)

LTE Band2 Left Cheek High with QPSK_20M_1RB_High

Date: 2018-3-29
Electronics: DAE4 Sn1525
Medium: Head 1900 MHz
Medium parameters used: f = 1900 MHz; σ =1.401. mho/m; εr = 40.61; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC   Liquid Temperature: 22.5ºC
Communication System: LTE Band2 Frequency: 1900 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) = 0.653 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.244 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.887 W/kg
SAR(1 g) = 0.545 W/kg; SAR(10 g) = 0.325 W/kg
Maximum value of SAR (measured) = 0.593 W/kg

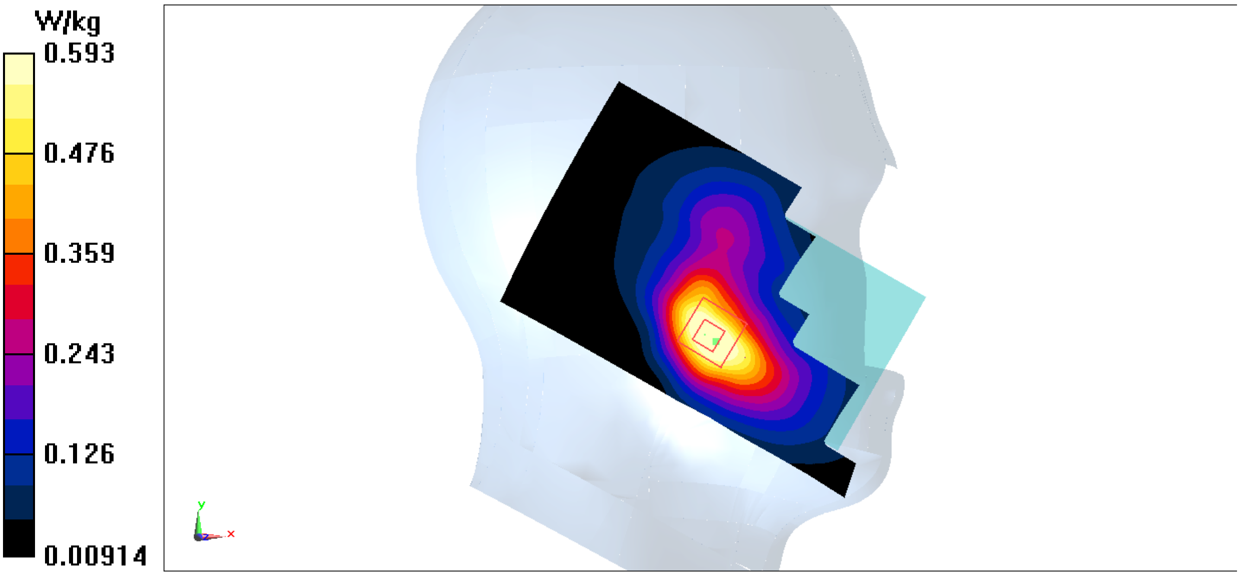


Fig.11 LTE Band2

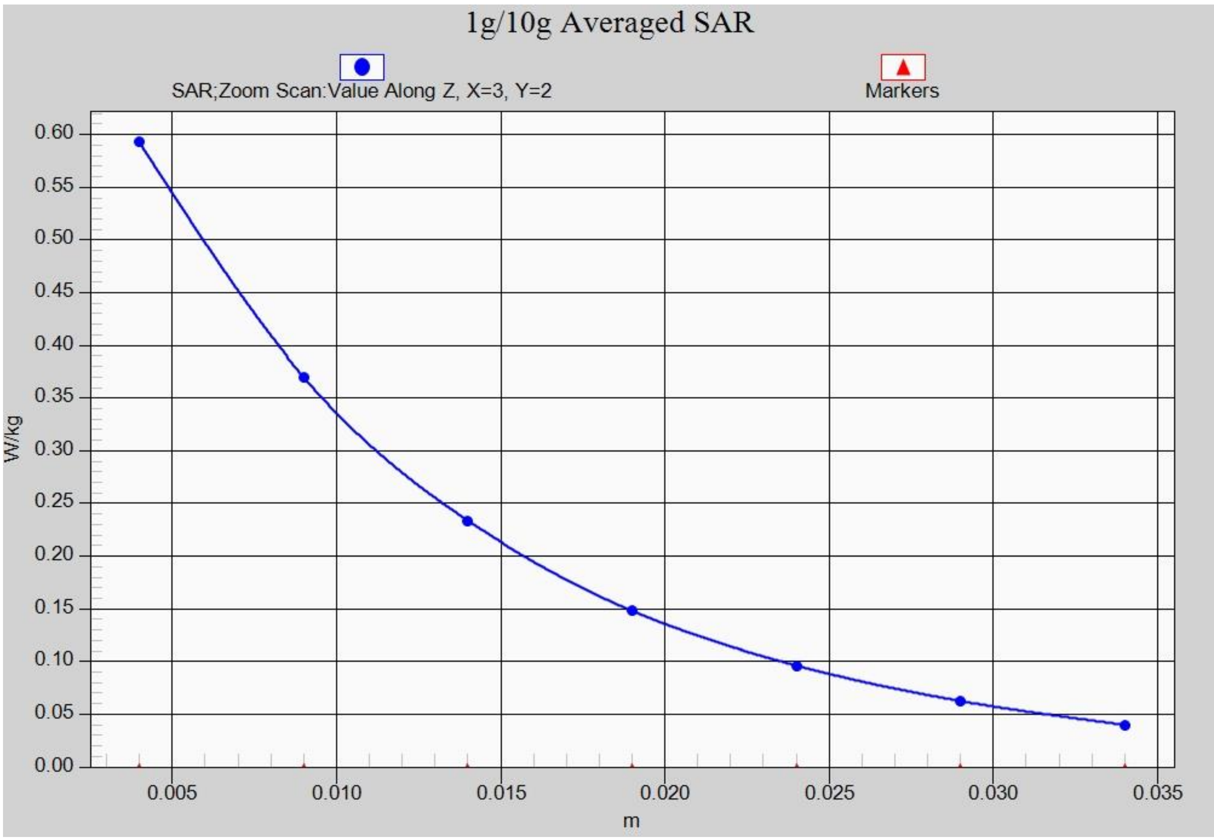


Fig. 11-1 Z-Scan at power reference point (LTE Band2)

LTE Band2 Body Bottom Low with QPSK_20M_1RB_High

Date: 2018-3-29
Electronics: DAE4 Sn1525
Medium: Body 1900 MHz
Medium parameters used: f = 1860 MHz; σ = 1.468 mho/m; εr = 52.83; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band2 Frequency: 1860 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN7464 ConvF(8.32, 8.32, 8.32)

Area Scan (131x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.37 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.60 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 1.85 W/kg
SAR(1 g) = 1.09 W/kg; SAR(10 g) = 0.587 W/kg
Maximum value of SAR (measured) = 1.35 W/kg

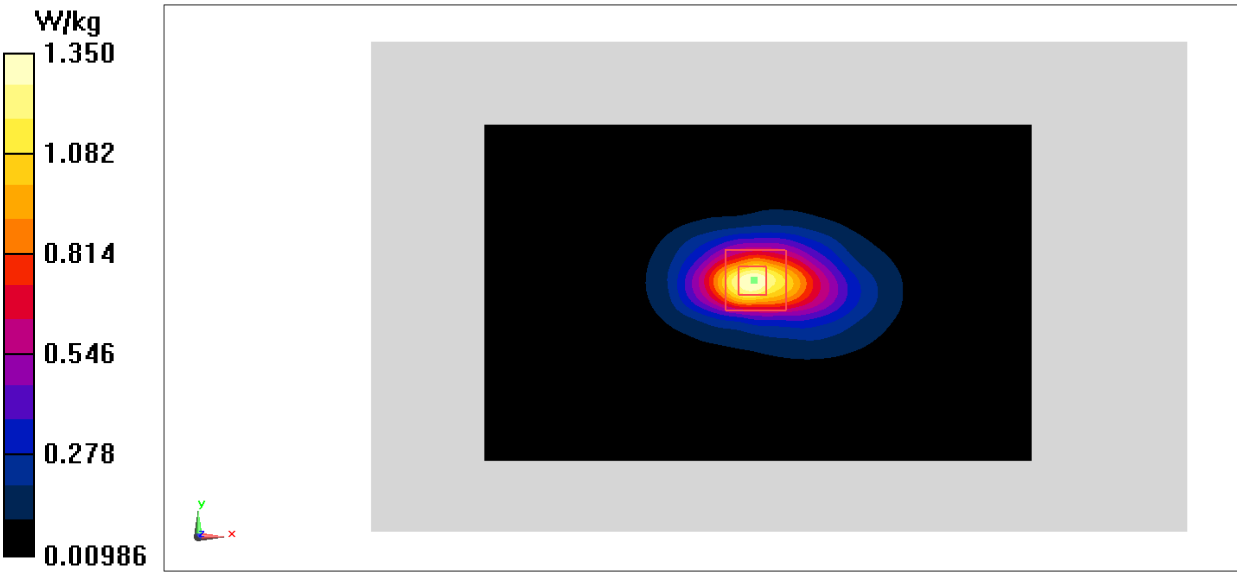


Fig.12 LTE Band2

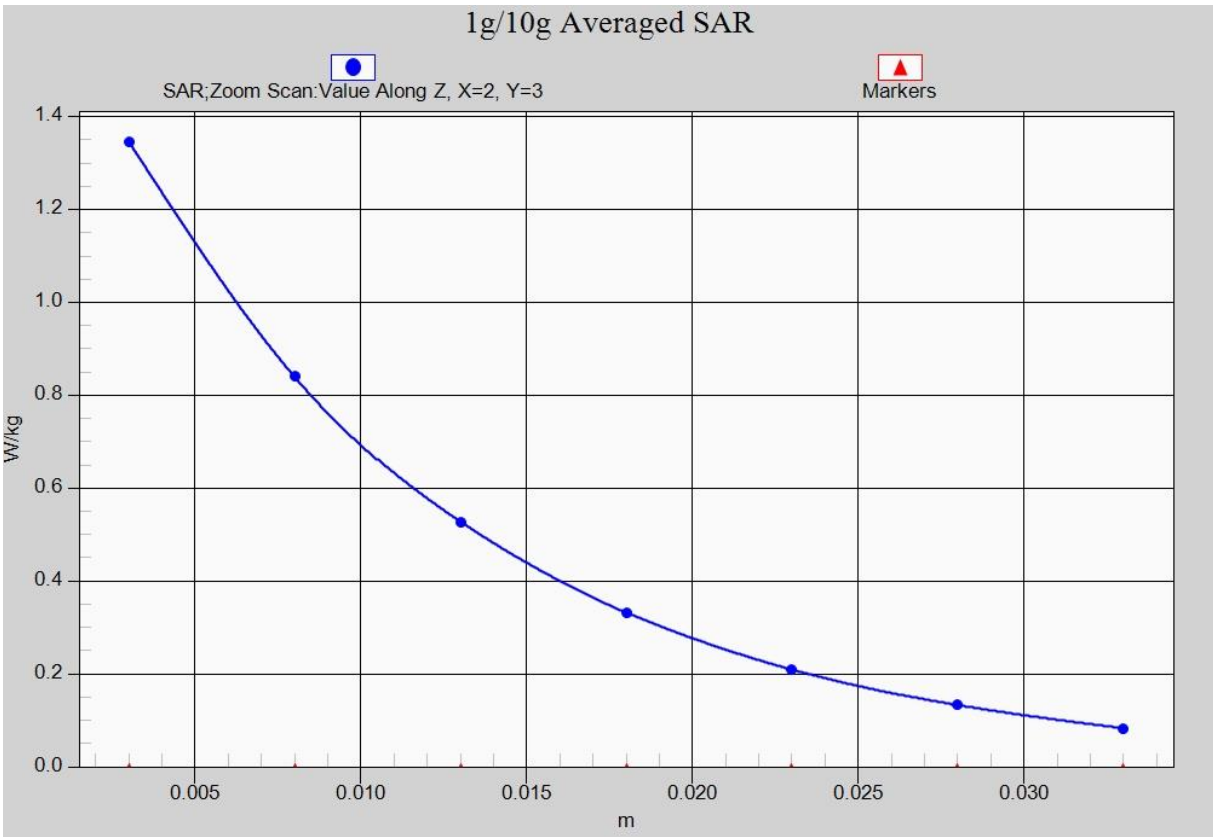


Fig. 12-1 Z-Scan at power reference point (LTE Band2)

LTE1700-FDD4_CH20300 Right Cheek
Date: 2018-3-31
Electronics: DAE4 Sn1525
Medium: Head 1750 MHz
Medium parameters used: f = 1745 MHz; σ = 1.414 mho/m; εr = 40.37; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: LTE1700-FDD4 1745 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(8.70,8.70,8.70)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.158 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.893 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.176 W/kg
SAR(1 g) = 0.127 W/kg; SAR(10 g) = 0.086 W/kg
Maximum value of SAR (measured) = 0.136 W/kg

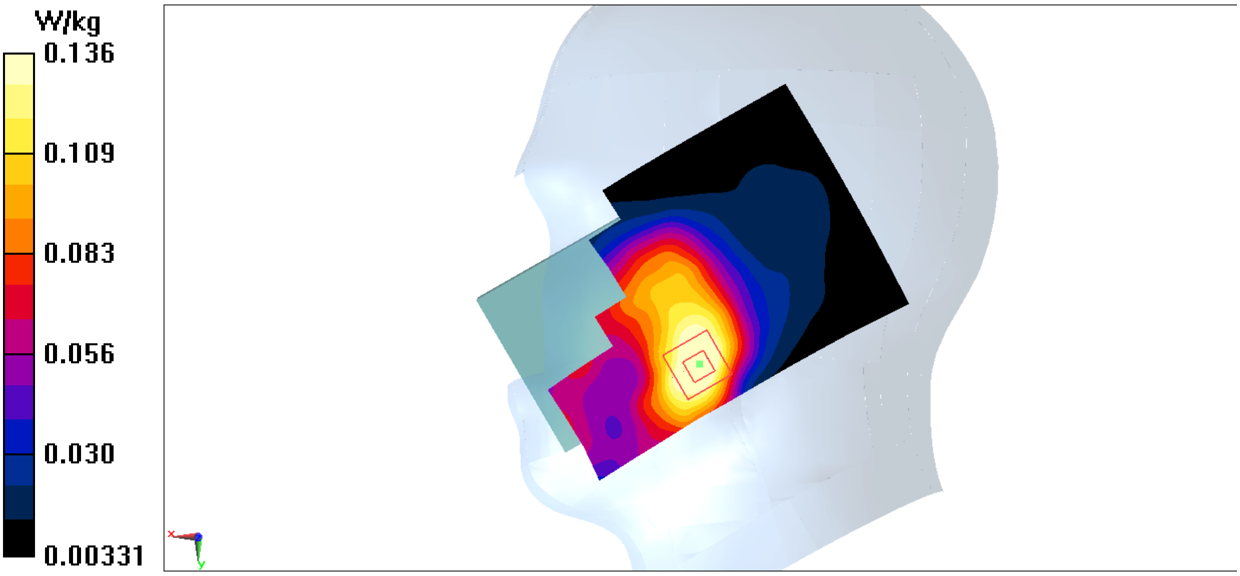


Fig.13 LTE Band4

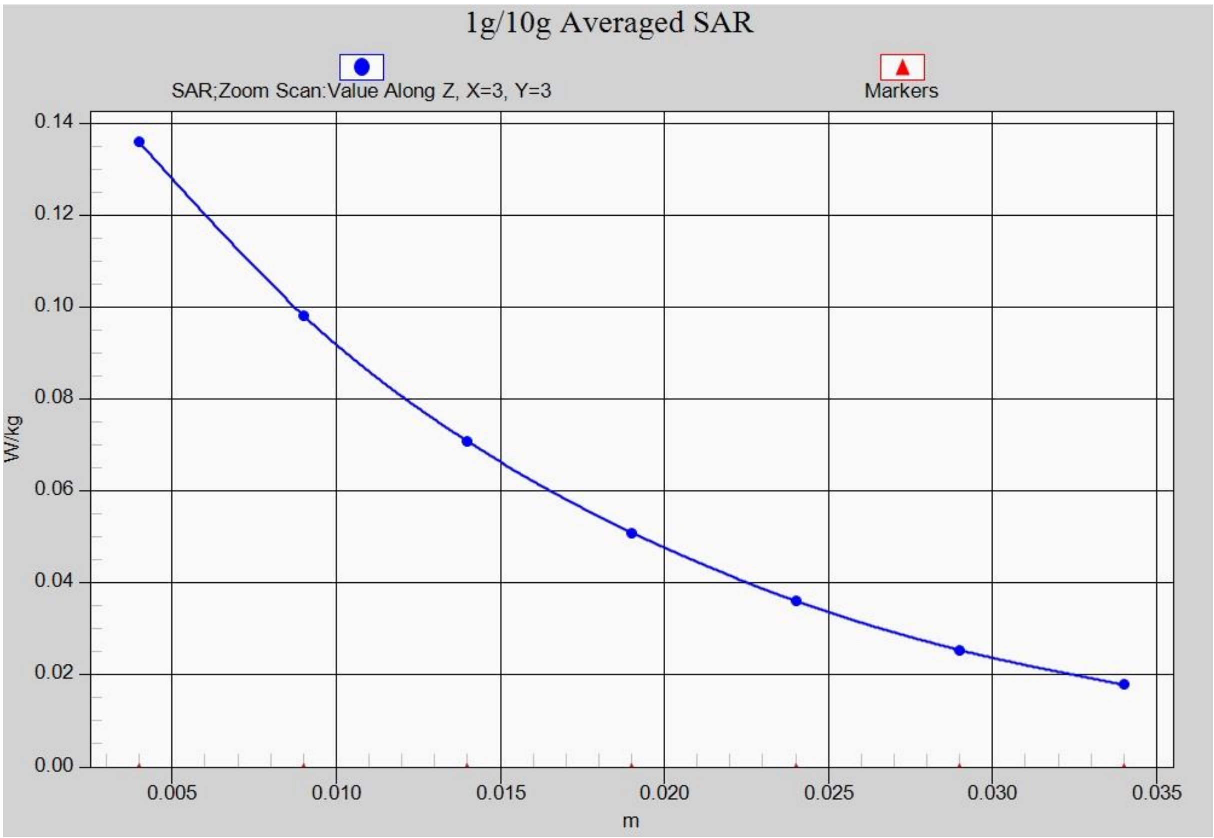


Fig. 13-1   Z-Scan at power reference point (LTE Band4)

LTE1700-FDD4_CH20175 Bottom
Date: 2018-3-31
Electronics: DAE4 Sn1525
Medium: Head 1750 MHz
Medium parameters used: f = 1732.5 MHz; σ = 1.502 mho/m; εr = 53.71; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C, Liquid Temperature: 22.5°C
Communication System: LTE1700-FDD4 1732.5 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(8.60, 8.60, 8.60)

Area Scan (131x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.09 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.66 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.865 W/kg; SAR(10 g) = 0.481 W/kg
Maximum value of SAR (measured) = 1.05 W/kg

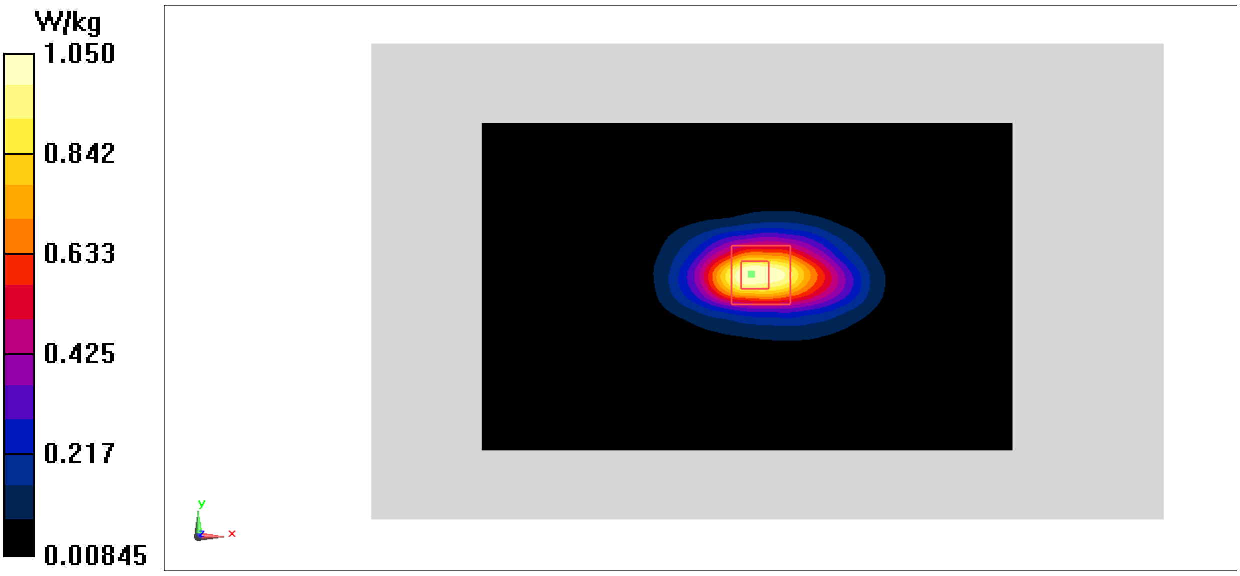


Fig.14 LTE Band4

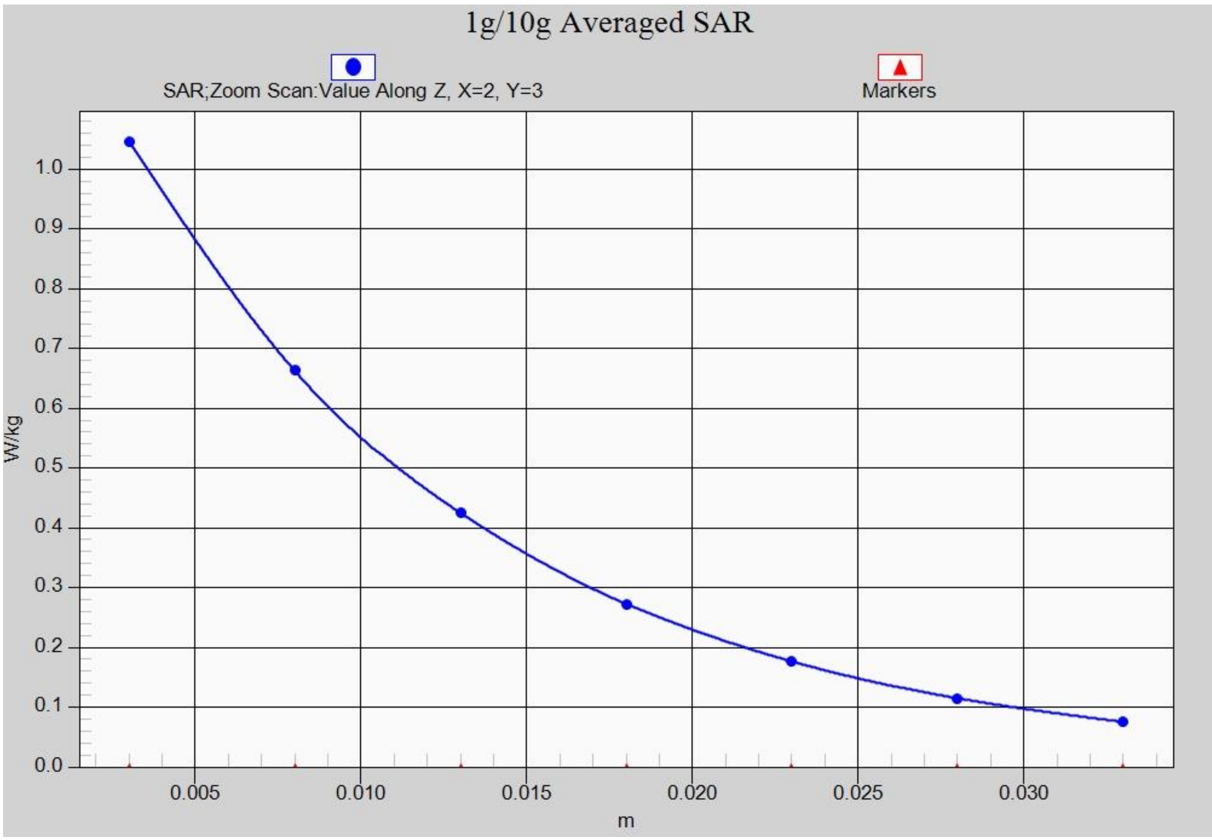


Fig. 14-1 Z-Scan at power reference point (LTE Band4)

LTE Band5 Right Cheek Low with QPSK_10M_1RB_High

Date: 2018-3-30
Electronics: DAE4 Sn1525
Medium: Head 850 MHz
Medium parameters used (interpolated): f = 829 MHz; σ = 0.904 mho/m; εr = 41.851; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C
Communication System: LTE Band5 Frequency: 829 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) = 0.283 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.036 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.322 W/kg
SAR(1 g) = 0.259 W/kg; SAR(10 g) = 0.199 W/kg
Maximum value of SAR (measured) = 0.273 W/kg

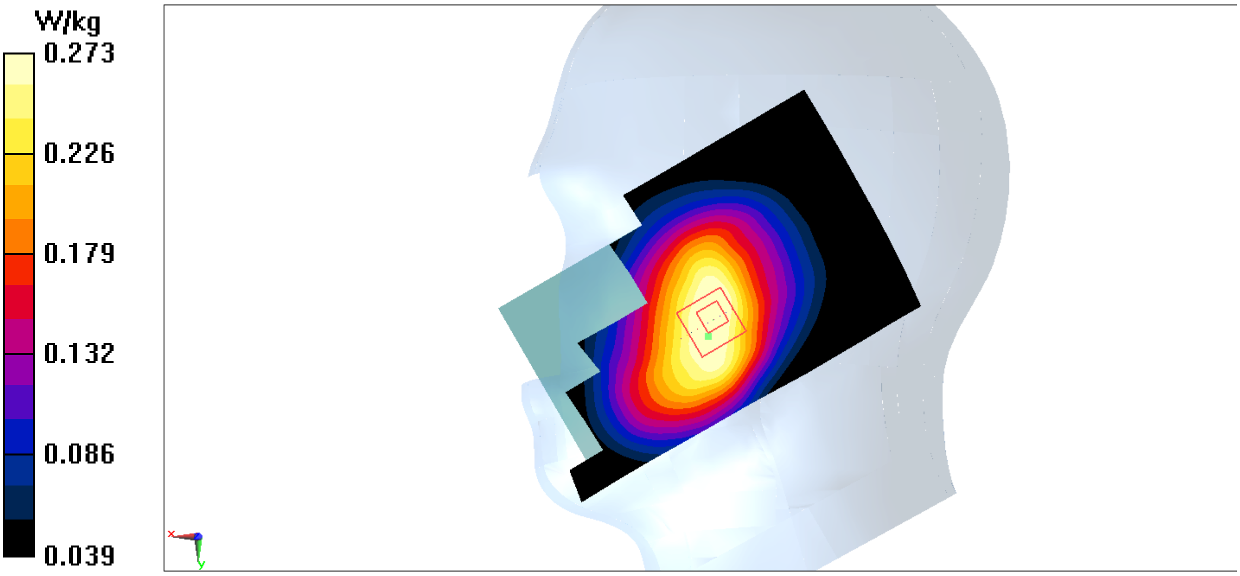


Fig.15 LTE Band5

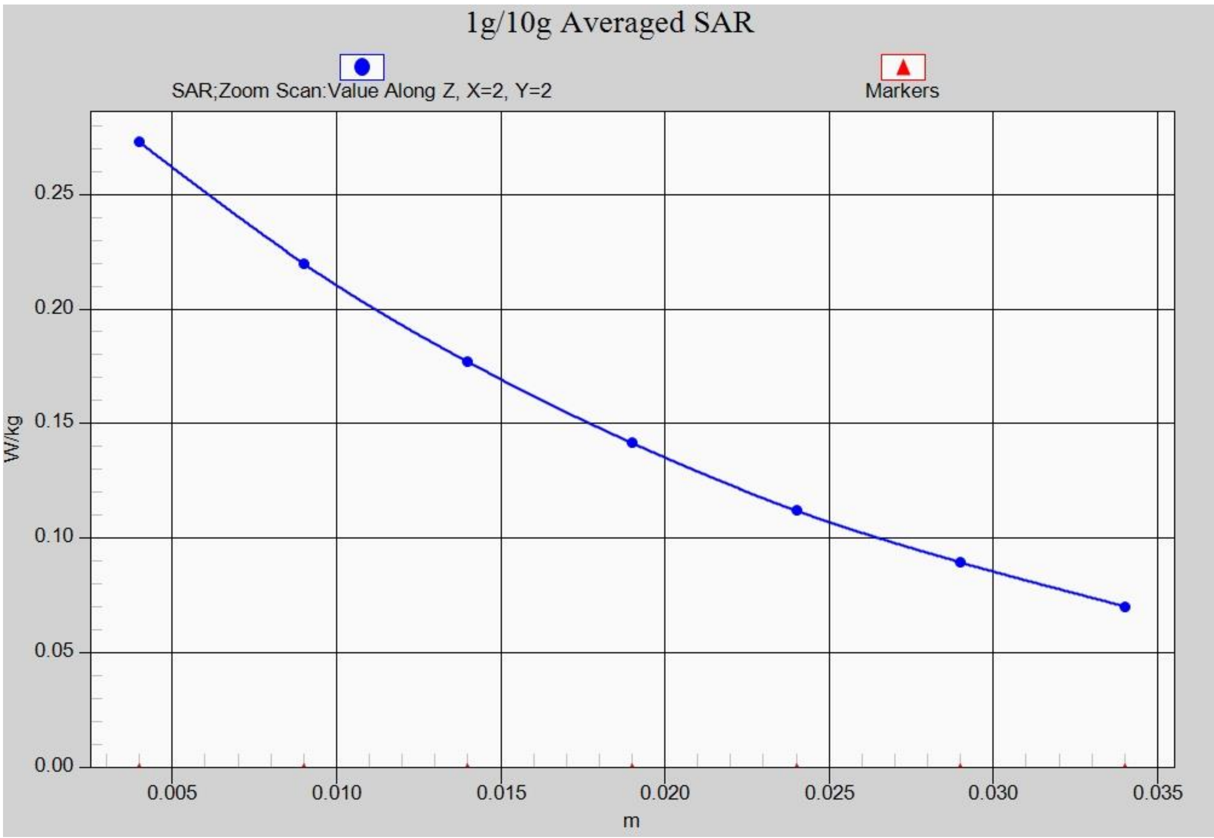


Fig. 15-1 Z-Scan at power reference point (LTE Band5)

LTE Band5 Body Rear Low with QPSK_10M_1RB_High
Date: 2018-3-30
Electronics: DAE4 Sn1525
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 829 MHz; σ = 1.003 mho/m; εr = 55.694; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band5 Frequency: 829 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) = 0.448 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.46 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.504 W/kg
SAR(1 g) = 0.412 W/kg; SAR(10 g) = 0.324 W/kg
Maximum value of SAR (measured) = 0.429 W/kg

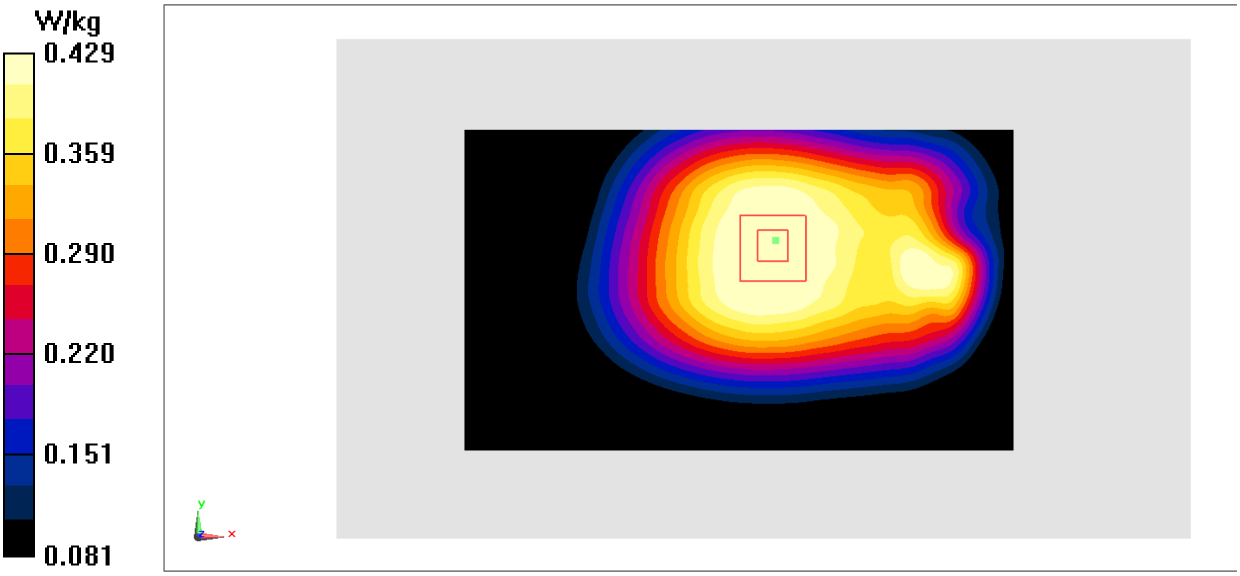


Fig.16 LTE Band5

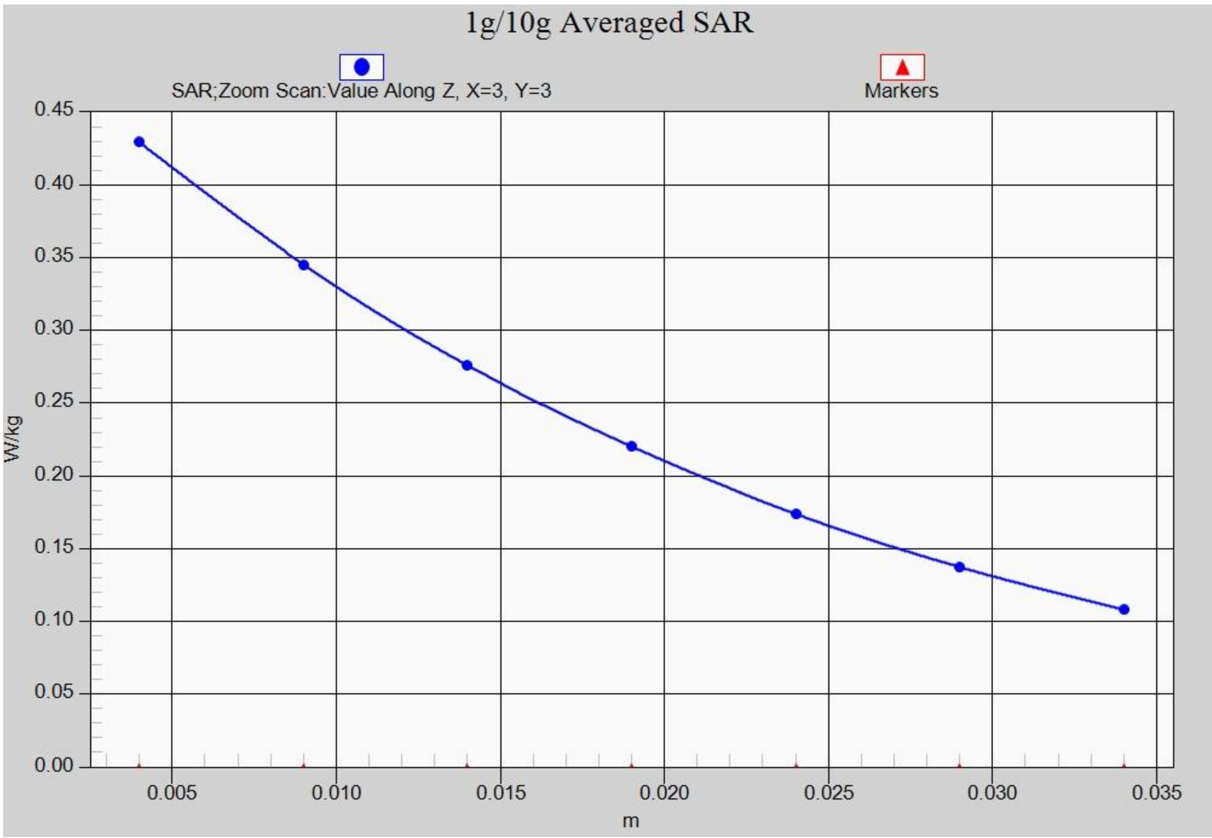


Fig. 16-1 Z-Scan at power reference point (LTE Band5)

LTE Band7 Right Cheek Low with QPSK_20M_1RB_Low

Date: 2018-4-1
Electronics: DAE4 Sn1525
Medium: Head 2600 MHz
Medium parameters used: f = 2510 MHz; σ = 1.925 mho/m; εr = 38.52; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band7Frequency: 2510 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN7464 ConvF(7.76, 7.76, 7.76)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.256 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.480 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.390 W/kg
SAR(1 g) = 0.212 W/kg; SAR(10 g) = 0.109 W/kg
Maximum value of SAR (measured) = 0.236 W/kg

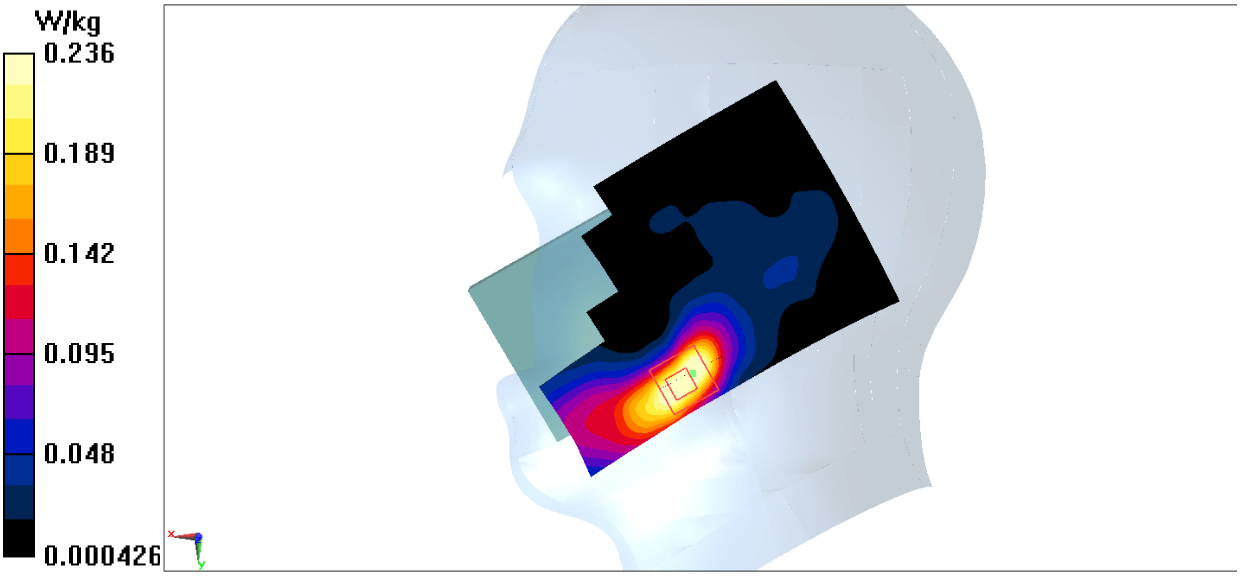


Fig.17 LTE Band7

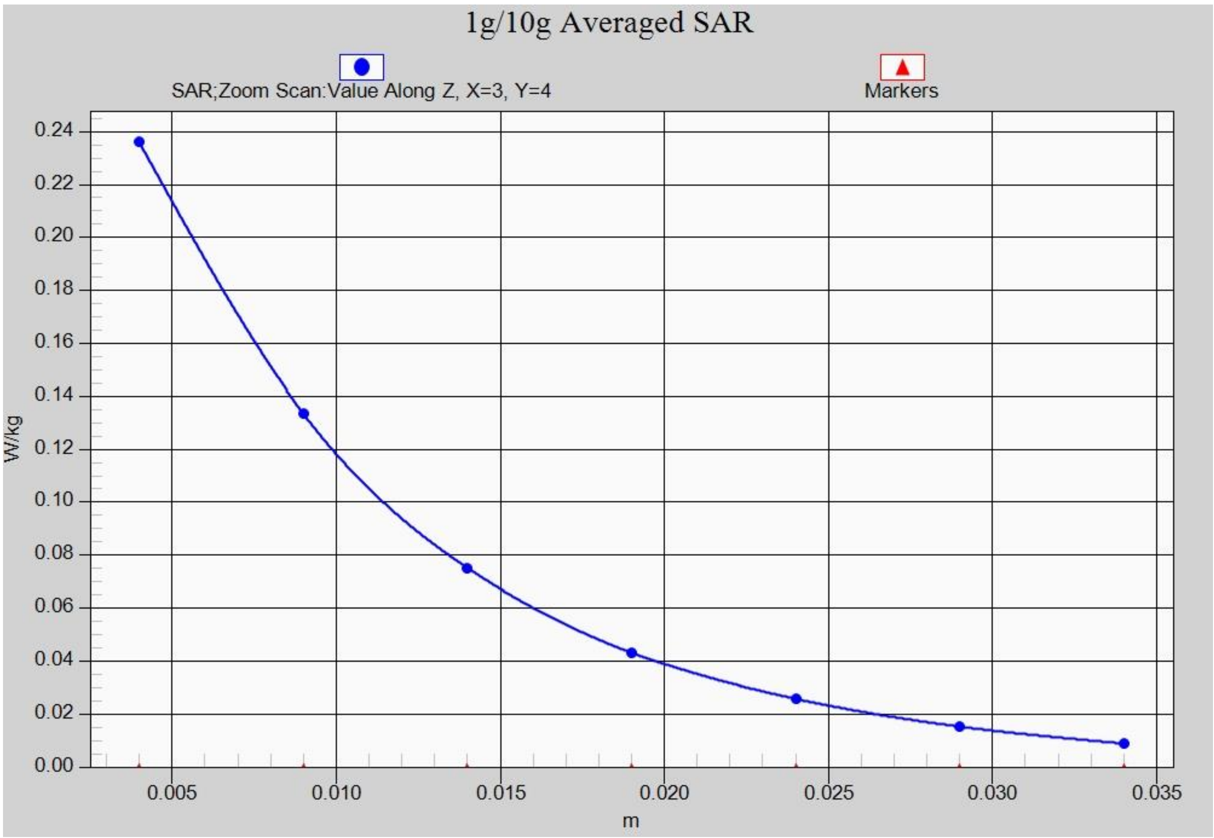


Fig. 17-1 Z-Scan at power reference point (LTE Band7)

LTE Band7 Body Rear Low with QPSK_20M_1RB Low

Date: 2018-4-1
Electronics: DAE4 Sn1525
Medium: Body 2600 MHz
Medium parameters used: f = 2510 MHz; σ = 2.095 mho/m; εr = 51.85; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C
Communication System: LTE Band7 Frequency: 2510 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN7464 ConvF(7.84, 7.84, 7.84)

Area Scan (81x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.820 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.501 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.616 W/kg; SAR(10 g) = 0.294 W/kg
Maximum value of SAR (measured) = 0.708 W/kg

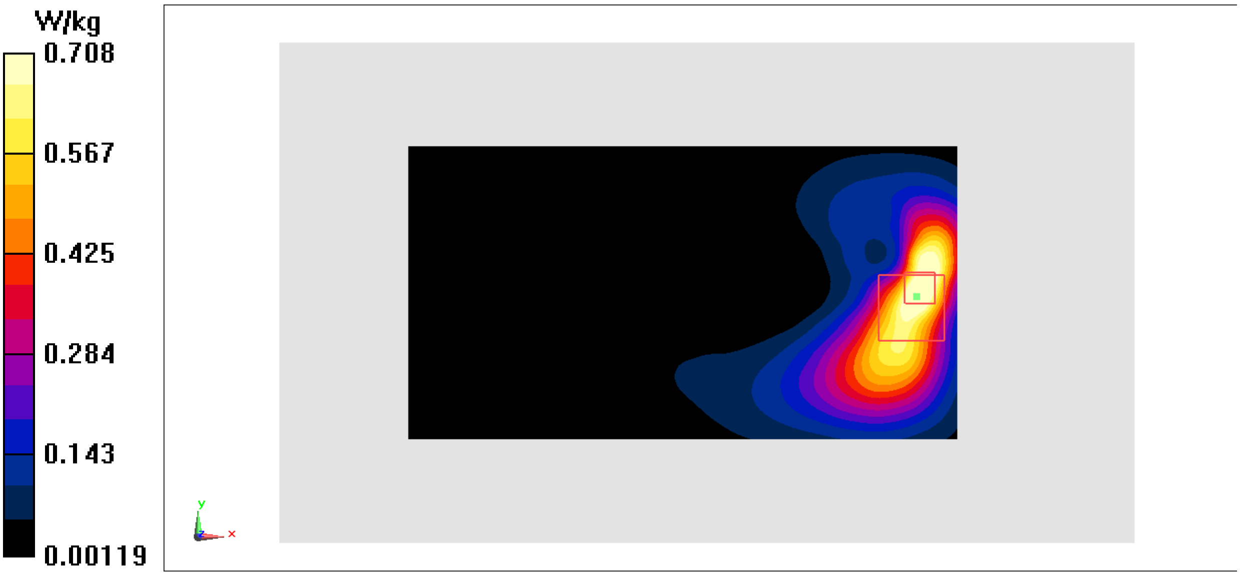


Fig.18 LTE Band7

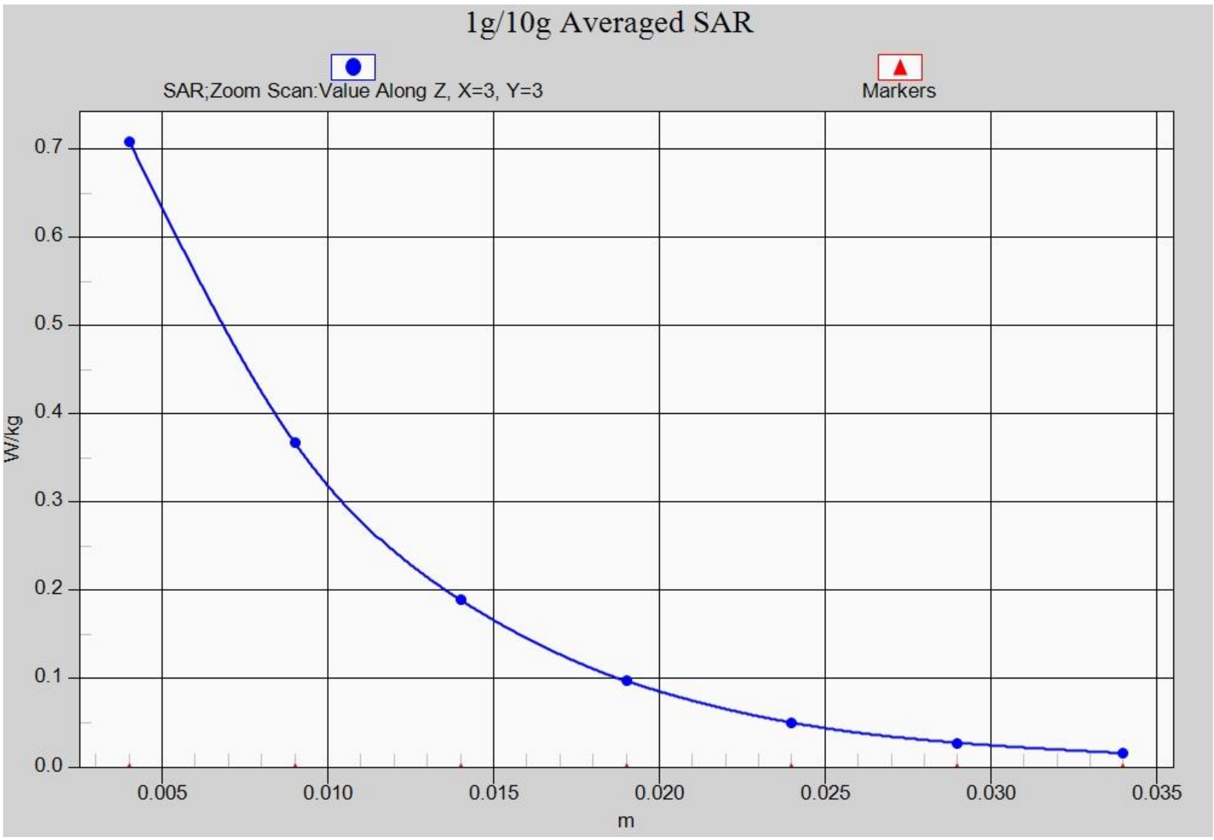


Fig. 18-1 Z-Scan at power reference point (LTE Band7)

Wifi 802.11b Left Cheek Channel 11
Date: 2018-4-1
Electronics: DAE4 Sn1525
Medium: Head 2450 MHz
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.82 mho/m; ε_r = 38.88; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C   Liquid Temperature: 22.5°C
Communication System: WLan 2450 Frequency: 2462 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN7464 ConvF(7.89, 7.89, 7.89)

Area Scan (91x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.747 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.306 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 1.51 W/kg
SAR(1 g) = 0.602 W/kg; SAR(10 g) = 0.263 W/kg
Maximum value of SAR (measured) = 0.672 W/kg

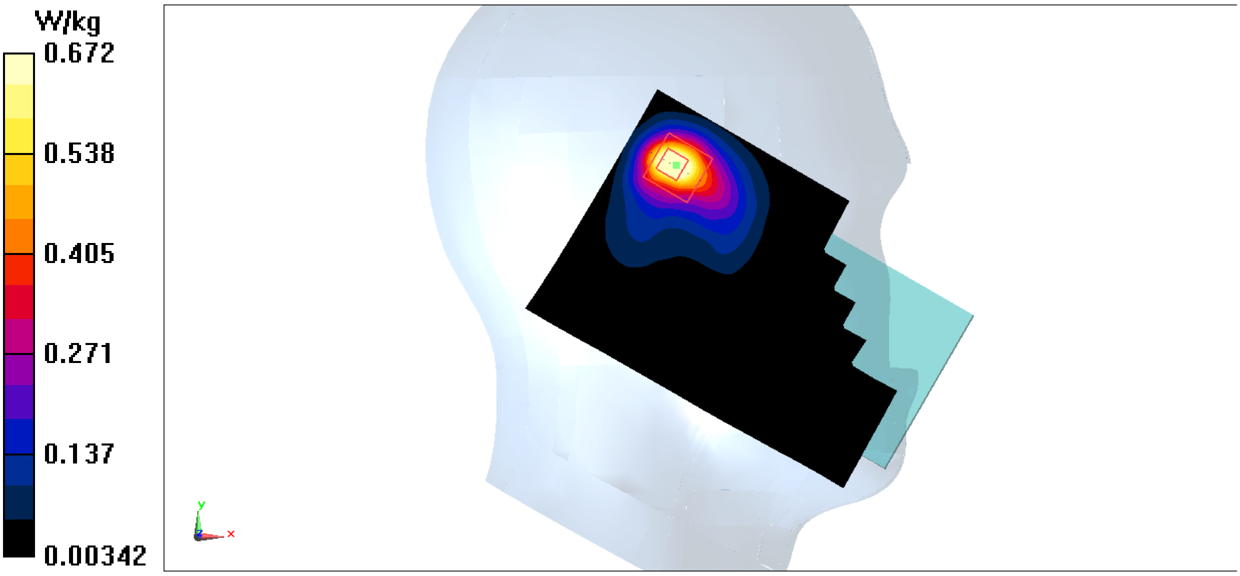


Fig.19 2450 MHz

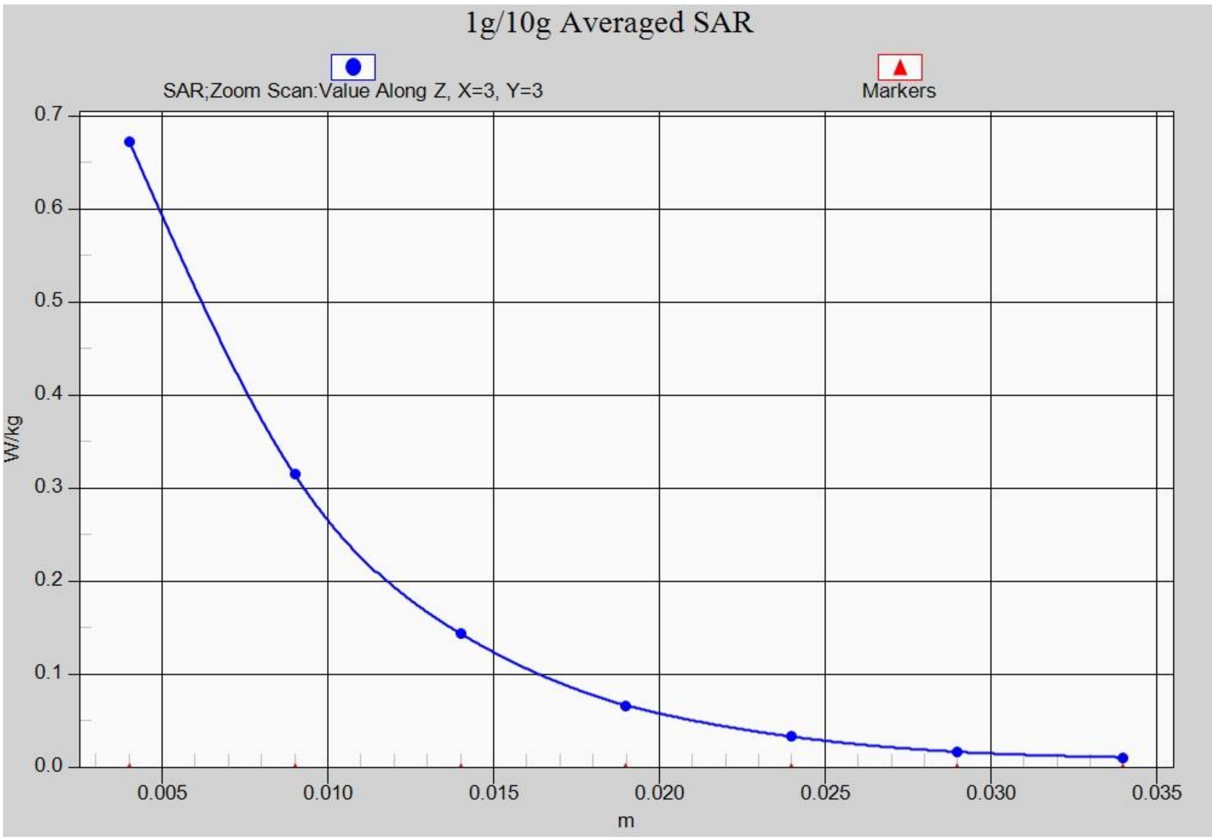


Fig. 19-1 Z-Scan at power reference point (2450 MHz)

Wifi 802.11b Body Rear Channel 11
Date: 2018-4-1
Electronics: DAE4 Sn1525
Medium: Body 2450 MHz
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.989 mho/m; ε_r = 52.12; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: WLan 2450 Frequency: 2462 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(8.09, 8.09, 8.09)

Area Scan (81x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.210 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.384 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.305 W/kg
SAR(1 g) = 0.154 W/kg; SAR(10 g) = 0.076 W/kg
Maximum value of SAR (measured) = 0.175 W/kg

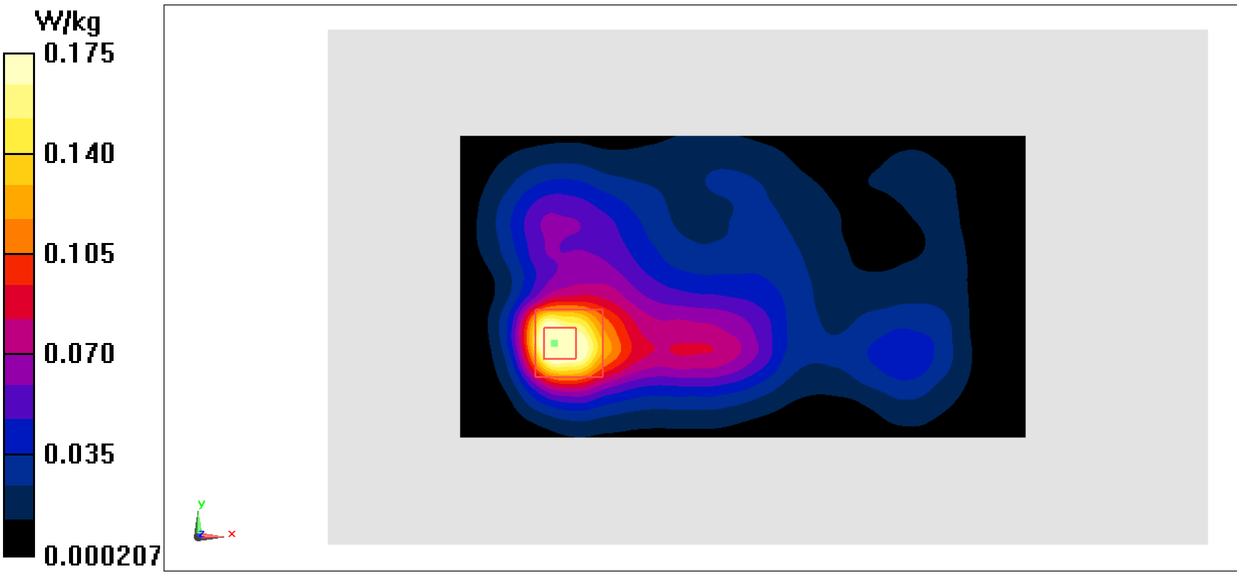


Fig.20 2450 MHz

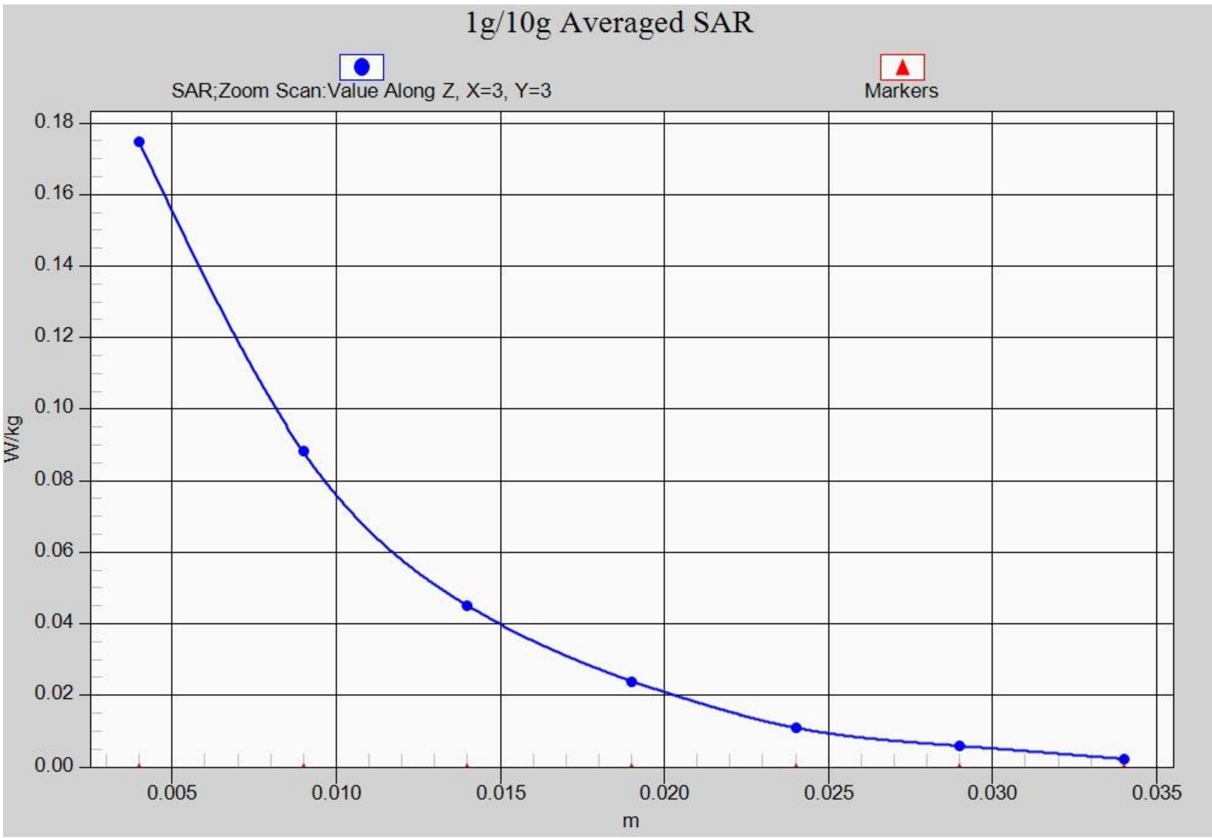


Fig. 20-1 Z-Scan at power reference point (2450 MHz)

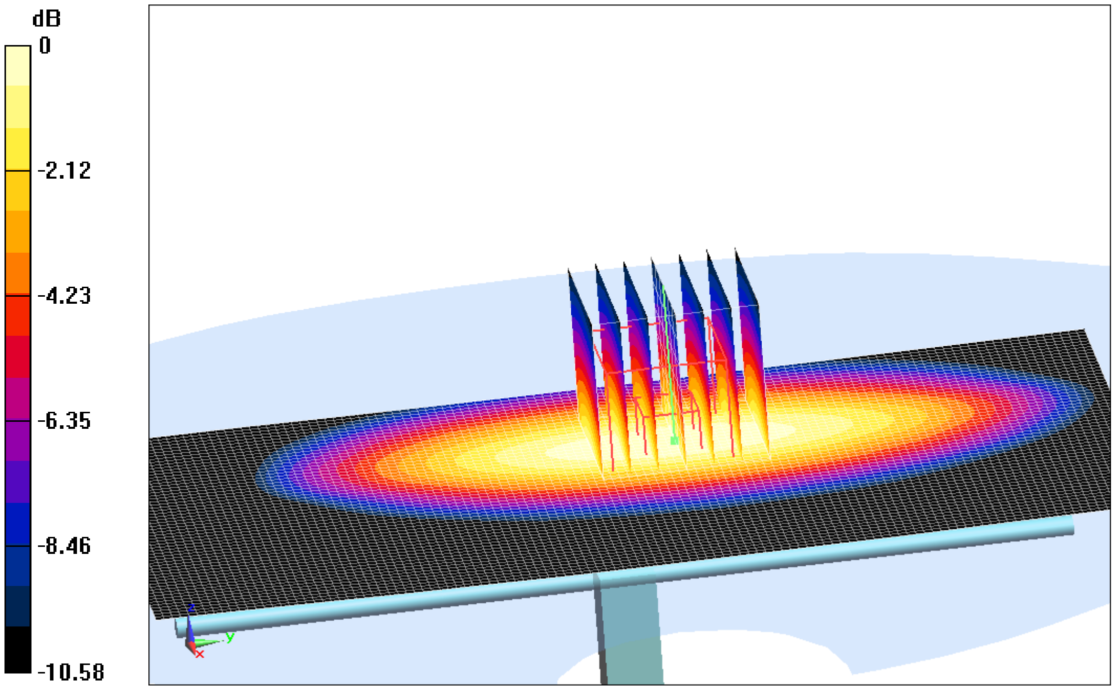
ANNEX B System Verification Results

835MHz

Date: 2018-3-30
Electronics: DAE4 Sn1525
Medium: Head 850 MHz
Medium parameters used: f = 835 MHz; σ = 0.908 S/m; ε_r = 41.76; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(10.28, 10.28, 10.28)

System Validation/Area Scan (61x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 54.82 V/m; Power Drift = 0.04 dB
Fast SAR: SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (interpolated) = 2.60 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.82 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 3.14 W/kg
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 2.57 W/kg



0 dB = 2.57 W/kg = 4.00 dBW/kg

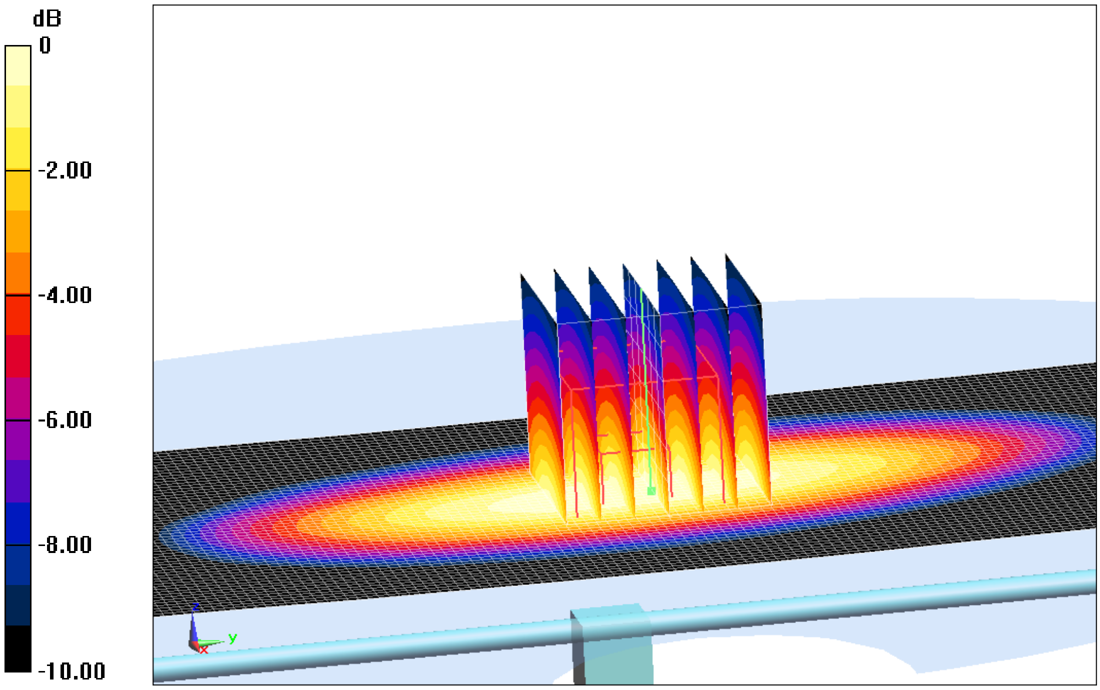
Fig.B.1 validation 835MHz 250mW

835MHz

Date: 2018-3-30
Electronics: DAE4 Sn1525
Medium: Body 850 MHz
Medium parameters used: f = 835 MHz; σ = 0.979 S/m; ε_r = 55.91; 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: EX3DV4 – SN7464 ConvF(10.21, 10.21, 10.21)

System Validation /Area Scan (61x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 52.95 V/m; Power Drift = -0.04 dB
Fast SAR: SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (interpolated) = 2.72 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.95 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.19 W/kg
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 2.76 W/kg



0 dB = 2.76 W/kg = 4.41 dBW/kg

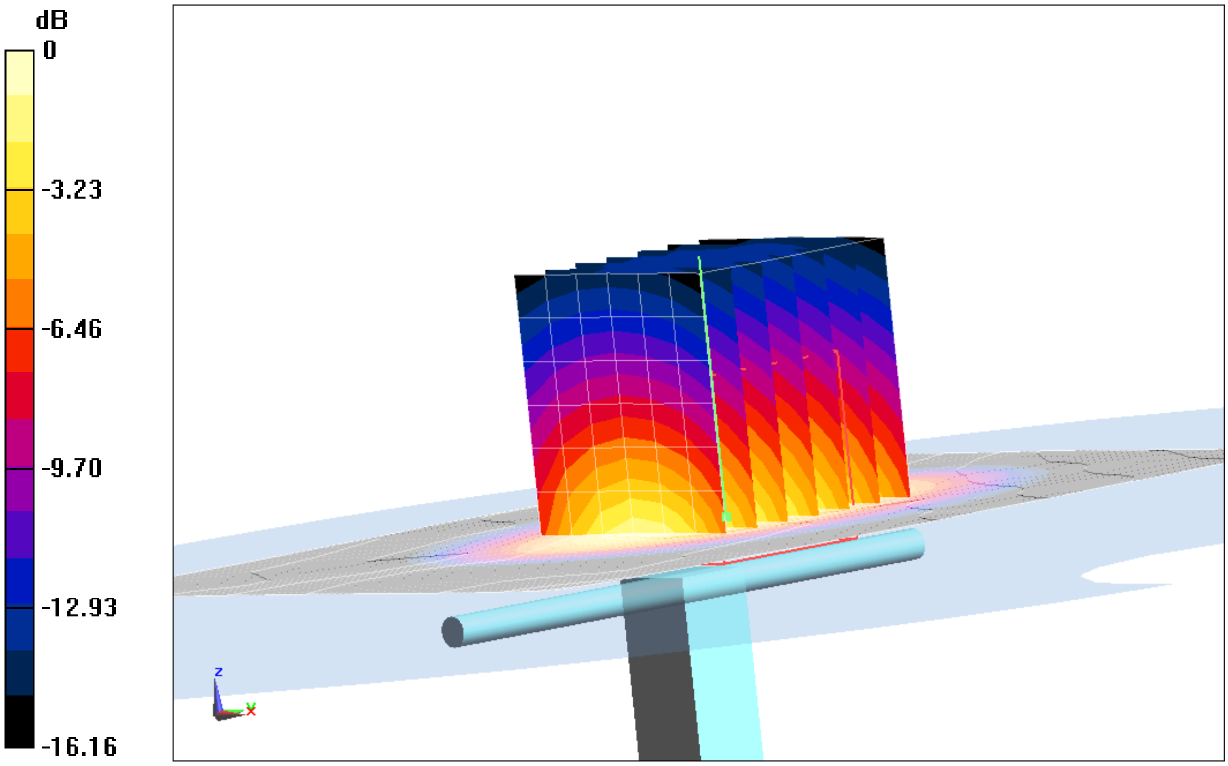
Fig.B.2 validation 835MHz 250mW

1750MHz

Date: 2018-3-31
Electronics: DAE4 Sn1525
Medium: Head 1750 MHz
Medium parameters used: f=1750 MHz; σ = 1.421 mho/m; εr = 40.41; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC   Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 1750 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(8.70, 8.70, 8.70)

System Validation/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 89.61 V/m; Power Drift = 0.06 dB
Fast SAR: SAR(1 g) = 9.08 W/kg; SAR(10 g) = 4.80 W/kg
Maximum value of SAR (interpolated) = 10.0 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.61 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 15.59 W/kg
SAR(1 g) = 9.18 W/kg; SAR(10 g) = 4.88 W/kg
Maximum value of SAR (measured) = 10.1 W/kg



0 dB = 10.1 W/kg = 10.04 dB W/kg

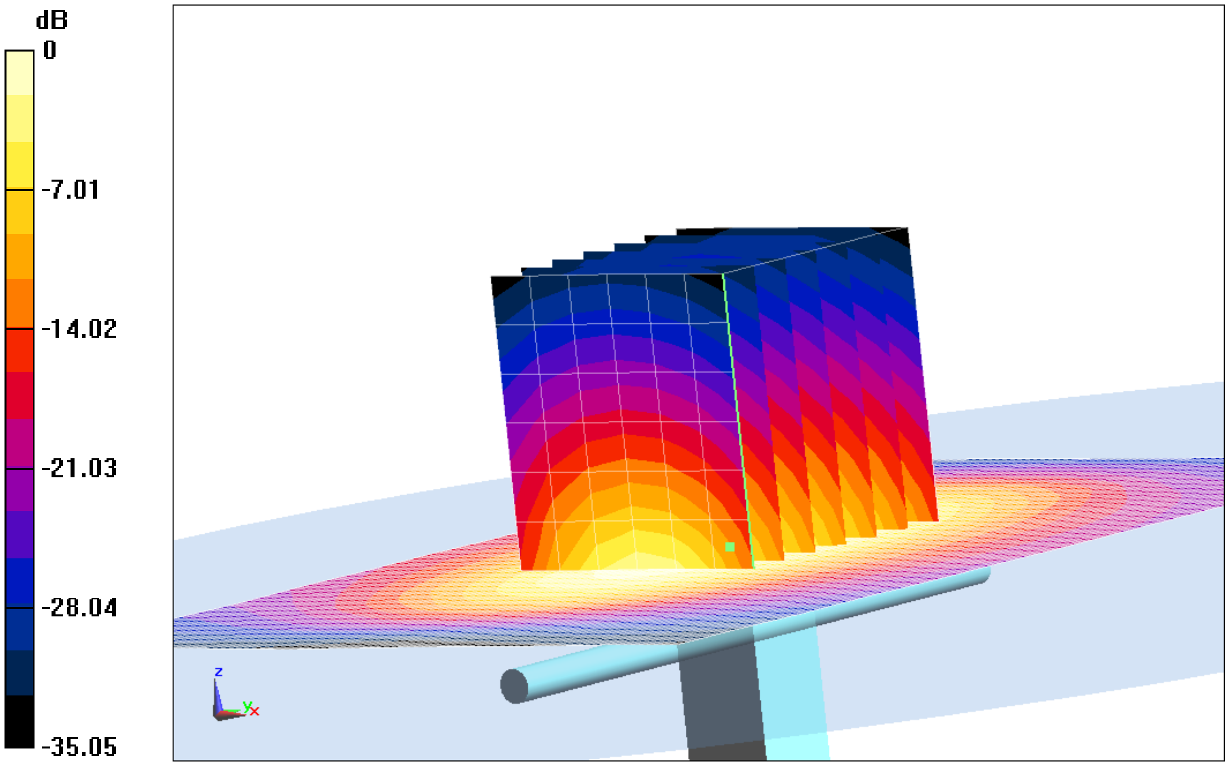
Fig.B.3 validation 1750MHz 250mW

1750MHz

Date: 2018-3-31
Electronics: DAE4 Sn1525
Medium: Body 1750 MHz
Medium parameters used: f=1750 MHz; σ = 1.506 mho/m; εr = 53.72; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 1750 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(8.60, 8.60, 8.60)

System Validation/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 95.17 V/m; Power Drift = -0.03 dB
Fast SAR: SAR(1 g) = 9.51 W/kg; SAR(10 g) = 5.07 W/kg
Maximum value of SAR (interpolated) = 10.4 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.17 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 15.54 W/kg
SAR(1 g) = 9.42 W/kg; SAR(10 g) = 4.99 W/kg
Maximum value of SAR (measured) = 10.3 W/kg



0 dB = 10.3 W/kg = 10.13 dB W/kg

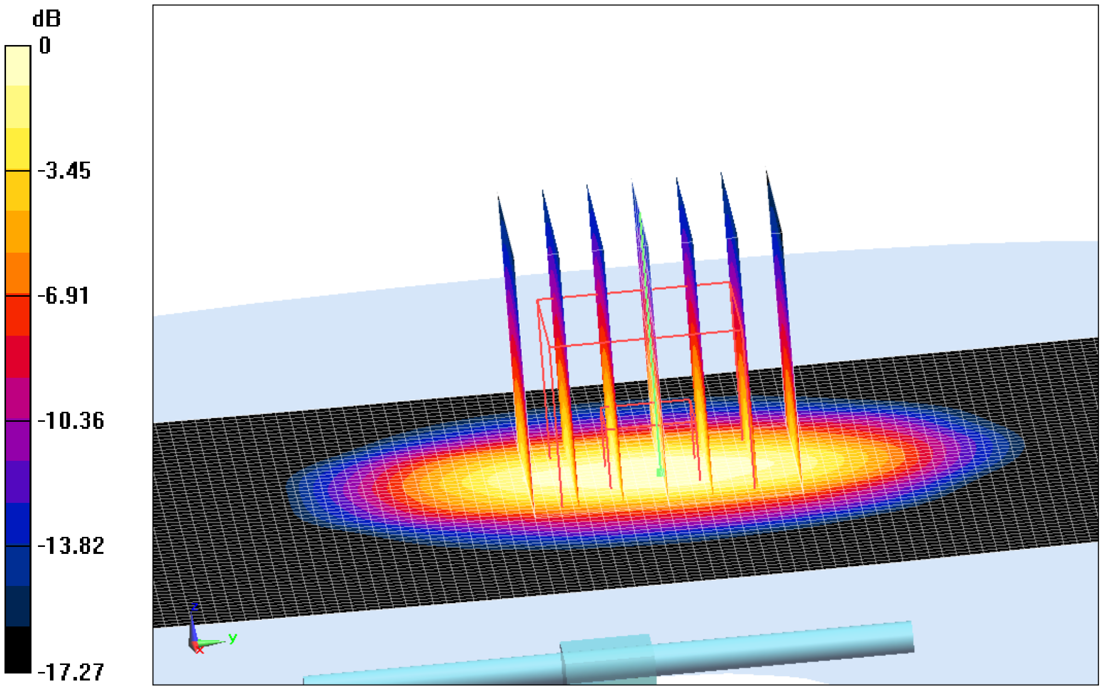
Fig.B.4 validation 1750MHz 250mW

1900MHz

Date: 2018-3-29
Electronics: DAE4 Sn1525
Medium: Head 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.411 mho/m; ε_r = 40.61; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC   Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF (8.39, 8.39, 8.39)

System Validation /Area Scan(61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 92.19 V/m; Power Drift = 0.05 dB
SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.52 W/kg
Maximum value of SAR (interpolated) = 12.6 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.19 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 18.05 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.38 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



0 dB = 12.4 W/kg = 10.93 dBW/kg

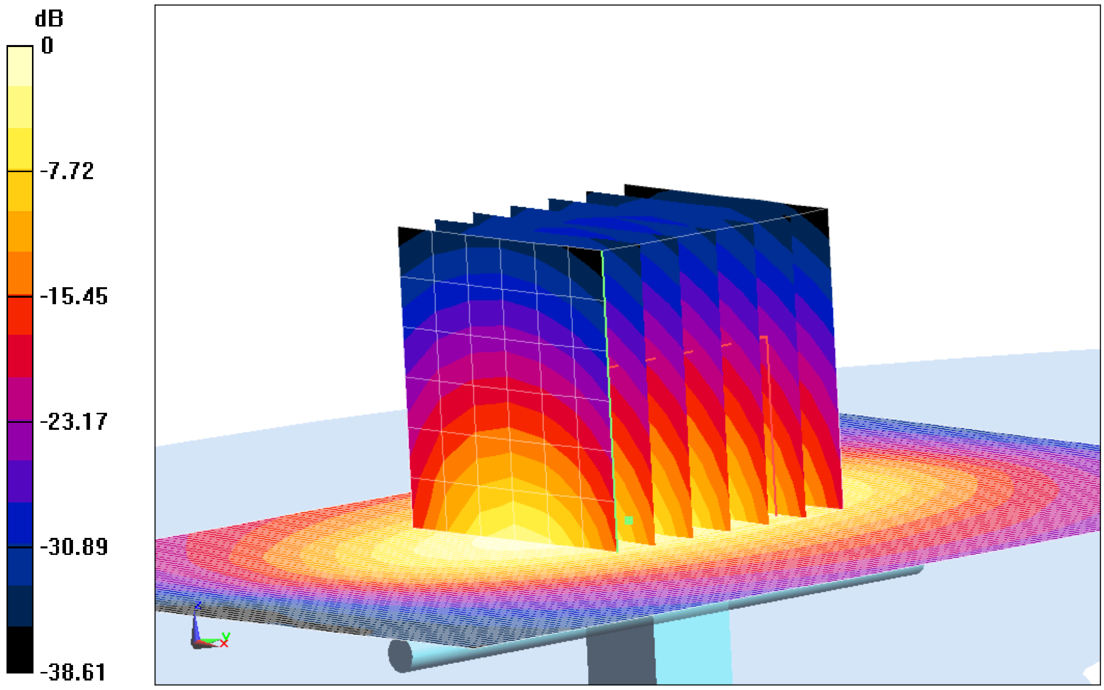
Fig.B.5 validation 1900MHz 250mW

1900MHz

Date: 2018-3-29
Electronics: DAE4 Sn1525
Medium: Body 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.527 S/m; ε_r = 52.71; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC   Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(8.32, 8.32, 8.32)

System Validation/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 94.27 V/m; Power Drift = -0.03 dB
Fast SAR: SAR(1 g) = 10.5 W/kg; SAR(10 g) = 5.58 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 = 94.27 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 19.18 W/kg
SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.49 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



0 dB = 12.4 W/kg = 10.93 dB W/kg

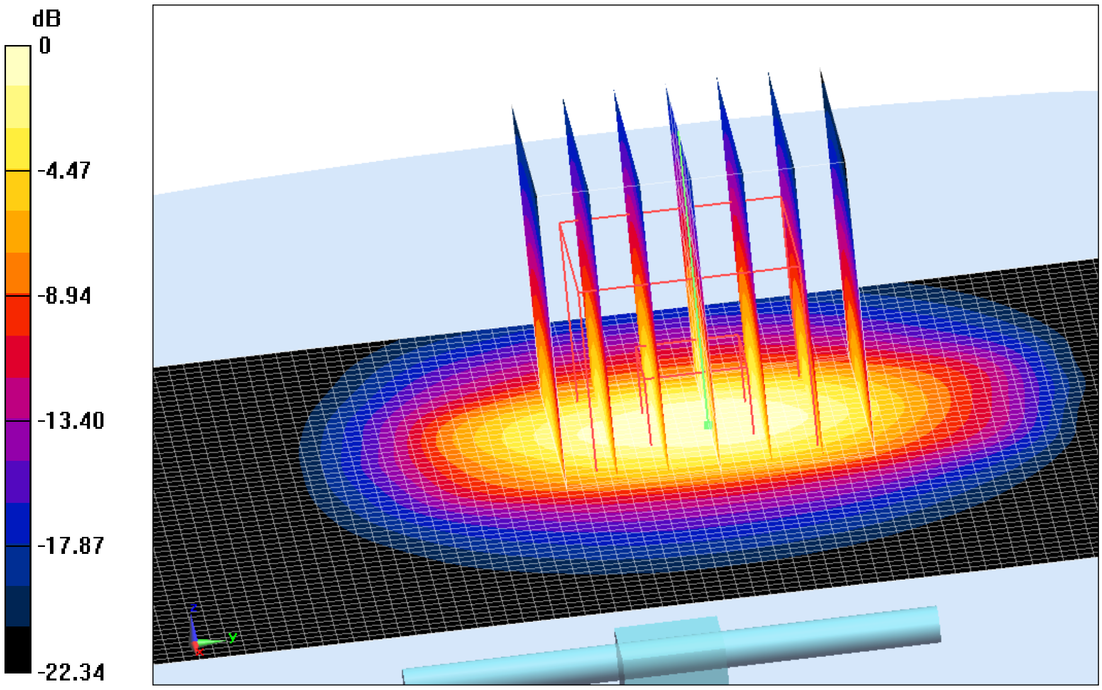
Fig.B.6 validation 1900MHz 250mW

2450MHz

Date: 2018-4-1
Electronics: DAE4 Sn1525
Medium: Head 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.811 mho/m; ε_r = 38.91; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(7.89, 7.89, 7.89)

System Validation /Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 90.36 V/m; Power Drift = 0.02 dB
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.46 W/kg
Maximum value of SAR (interpolated) = 16.8 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.36 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 27.41 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.27 W/kg
Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 12.17 dBW/kg

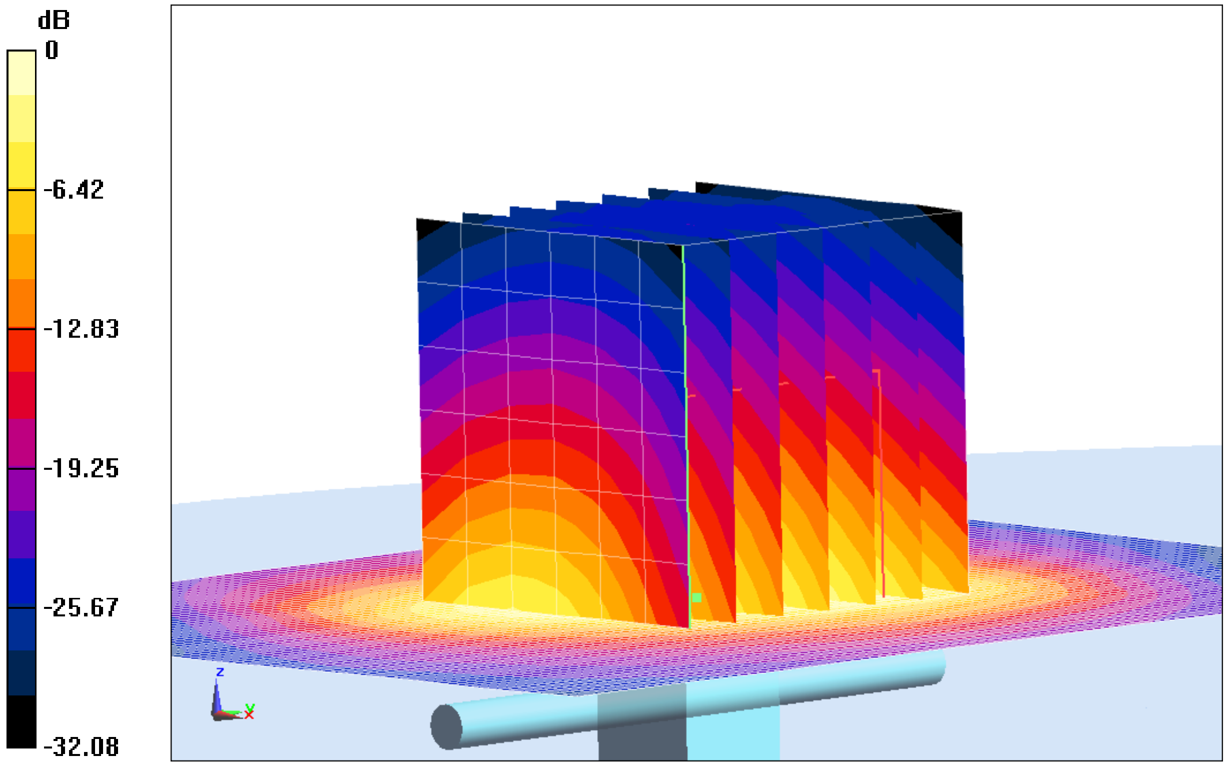
Fig.B.7 validation 2450MHz 250mW

2450MHz

Date: 2018-4-1
Electronics: DAE4 Sn1525
Medium: Body 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.982 S/m; ε_r = 52.09; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(8.09, 8.09, 8.09)

System Validation/Area Scan (81x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 90.06 V/m; Power Drift = -0.01 dB
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.92 W/kg
Maximum value of SAR (interpolated) = 14.4 W/kg

System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.06 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 24.63 W/kg
SAR(1 g) = 13.0 W/kg; SAR(10 g) = 6.08 W/kg
Maximum value of SAR (measured) = 14.6 W/kg



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

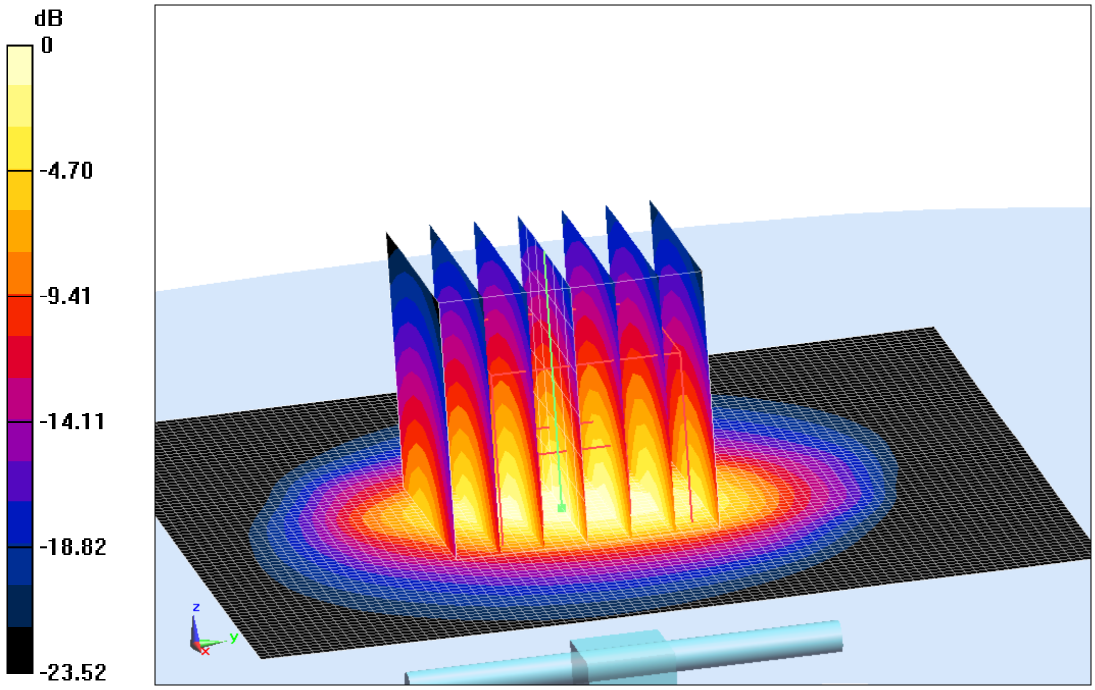
Fig.B.8 validation 2450MHz 250mW

2600MHz

Date: 2018-4-1
Electronics: DAE4 Sn1525
Medium: Head 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 1.949 mho/m; ε_r = 38.49; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C
Communication System: CW Frequency: 2600 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(7.76, 7.76, 7.76)

System Validation/Area Scan(81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 81.33 V/m; Power Drift = 0.05 dB
SAR(1 g) = 14.8 W/kg; SAR(10 g) = 6.73 W/kg
Maximum value of SAR (interpolated) = 22.5 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 81.33 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 31.14 W/kg
SAR(1 g) = 14.6 W/kg; SAR(10 g) = 6.55 W/kg
Maximum value of SAR (measured) = 22.2 W/kg



0 dB = 22.2 W/kg = 13.46 dBW/kg

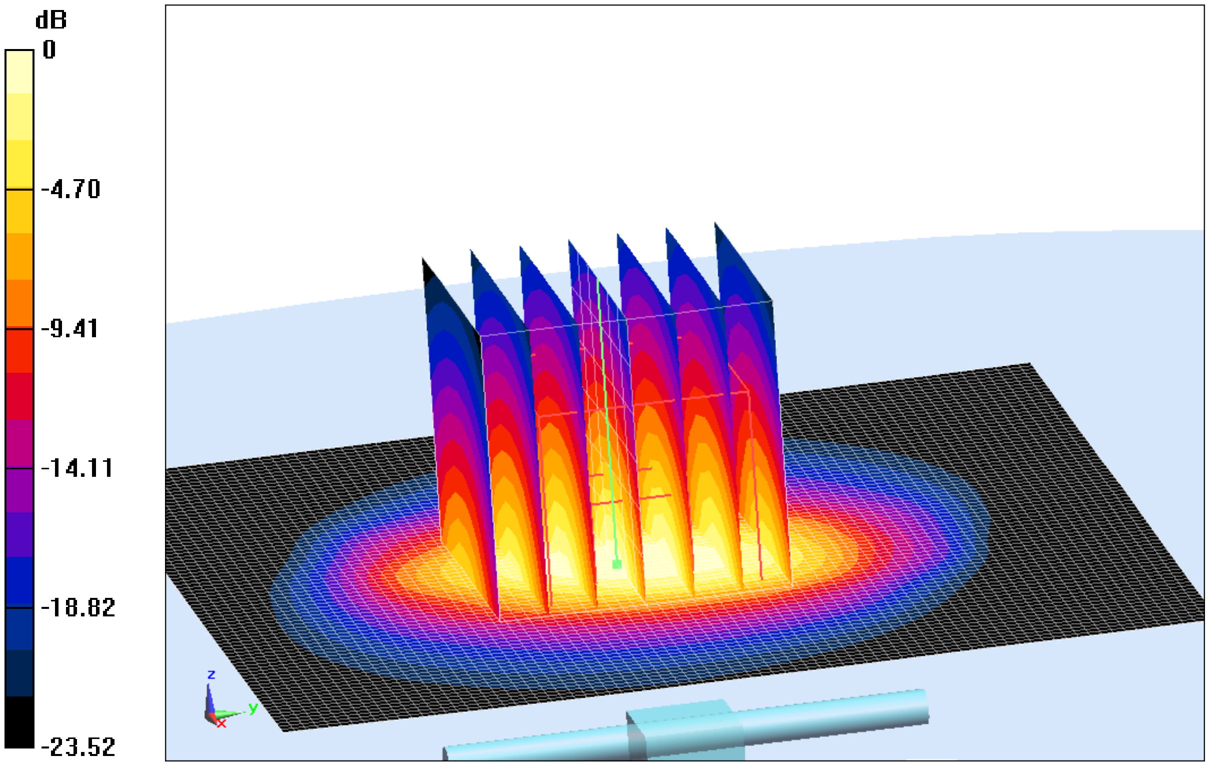
Fig.B.9 validation 2600MHz 250mW

2600MHz

Date: 2018-4-1
Electronics: DAE4 Sn1525
Medium: Body 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.14 mho/m; ε_r = 51.81; ρ = 1000 kg/m^3
Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C
Communication System: CW Frequency: 2600 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7464 ConvF(7.84, 7.84, 7.84)

System Validation /Area Scan(81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 82.47 V/m; Power Drift = -0.02 dB
Fast SAR: SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.44 W/kg
Maximum value of SAR (interpolated) = 22.5 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 82.47 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 31.15 W/kg
SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.35 W/kg
Maximum value of SAR (measured) = 22.4 W/kg



0 dB = 22.4 W/kg = 13.50 dB W/kg

Fig.B.10 validation 2600MHz 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.

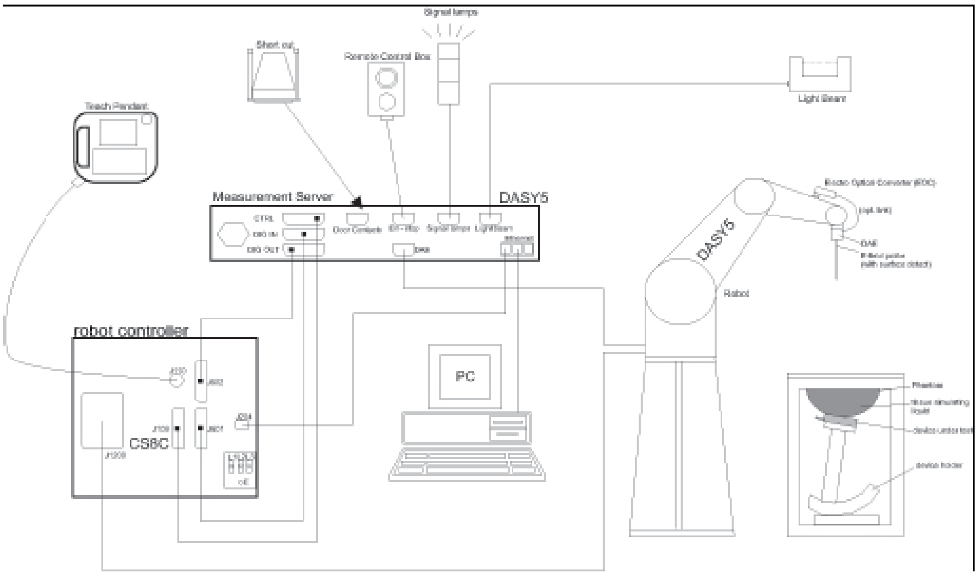
Table B.1 Comparison between area scan and zoom scan for system verification

Date	Band	Position	Area scan (1g)	Zoom scan (1g)	Drift (%)
2018-3-30	835	Head	2.41	2.37	1.69
	835	Body	2.38	2.43	-2.06
2018-3-31	1750	Head	9.08	9.18	-1.09
	1750	Body	9.51	9.42	0.96
2018-3-29	1900	Head	10.4	10.2	1.96
	1900	Body	10.5	10.4	0.96
2018-4-1	2450	Head	13.5	13.3	1.50
	2450	Body	12.8	13	-1.54
2018-4-1	2600	Head	14.8	14.6	1.37
	2600	Body	14.4	14.3	0.70

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.1SAR 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 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 durning a software approach and looks for the maximum using 2nd ord curve fitting. The approach is stopped at reaching the maximum.

Picture C.2Near-field Probe

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 ofmobile phones
Dosimetry in strong gradient fields

Picture C.3E-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 (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.5DASY 4

Picture C.6DASY 5

C.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad 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 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.7 Server for DASY 4 **Picture C.8 Server for DASY 5**

C.4.4 Device Holder for Phantom

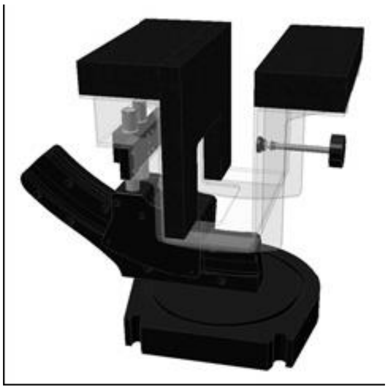
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. Accurate device positioning is therefore crucial for accurate 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 are 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.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 l000 x 500 mm (H x L x W)

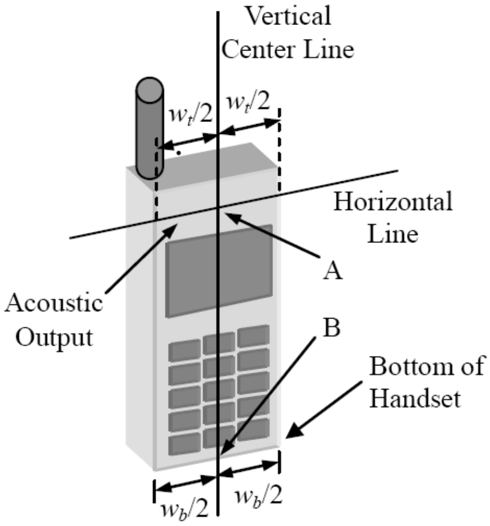
Available: Special

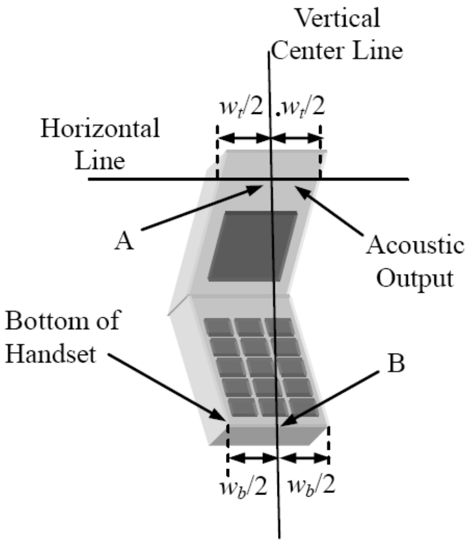
Picture C.10: SAM Twin Phantom

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

D.1 General considerations

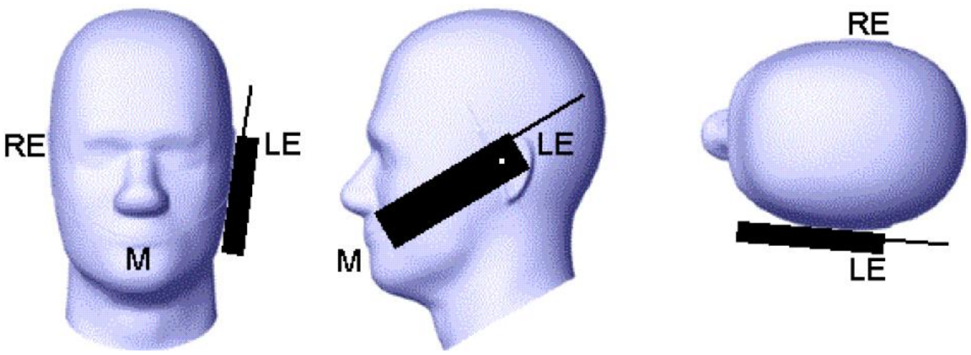
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



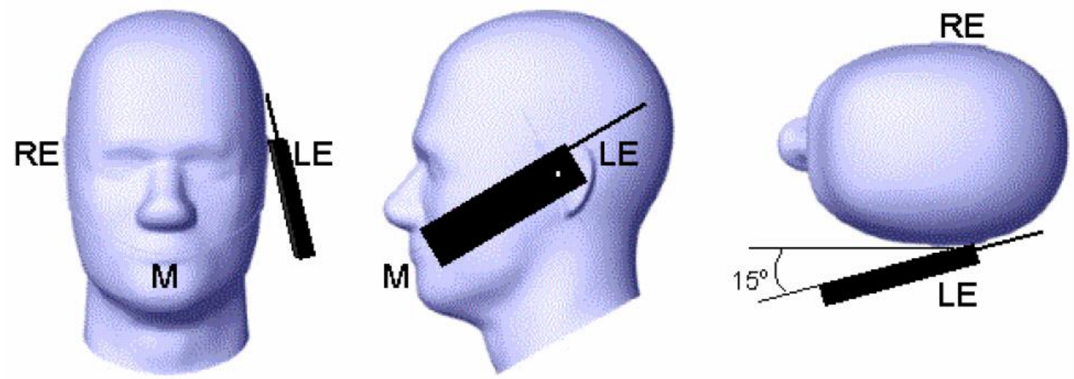


W_t	Width of the handset at the level of the acoustic
W_b	Width of the bottom of the handset
A	Midpoint of the width W_t of the handset at the level of the acoustic output
B	Midpoint of the width W_b of the bottom of the handset

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



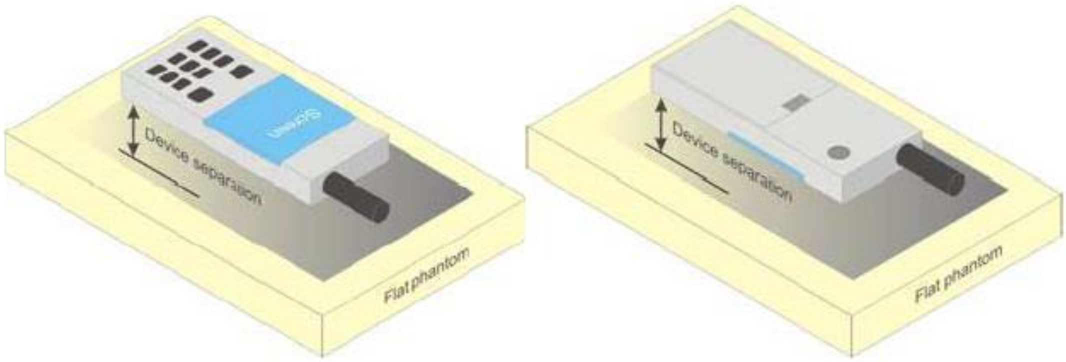
Picture D.2 Cheek position of the wireless device on the left side of SAM



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.

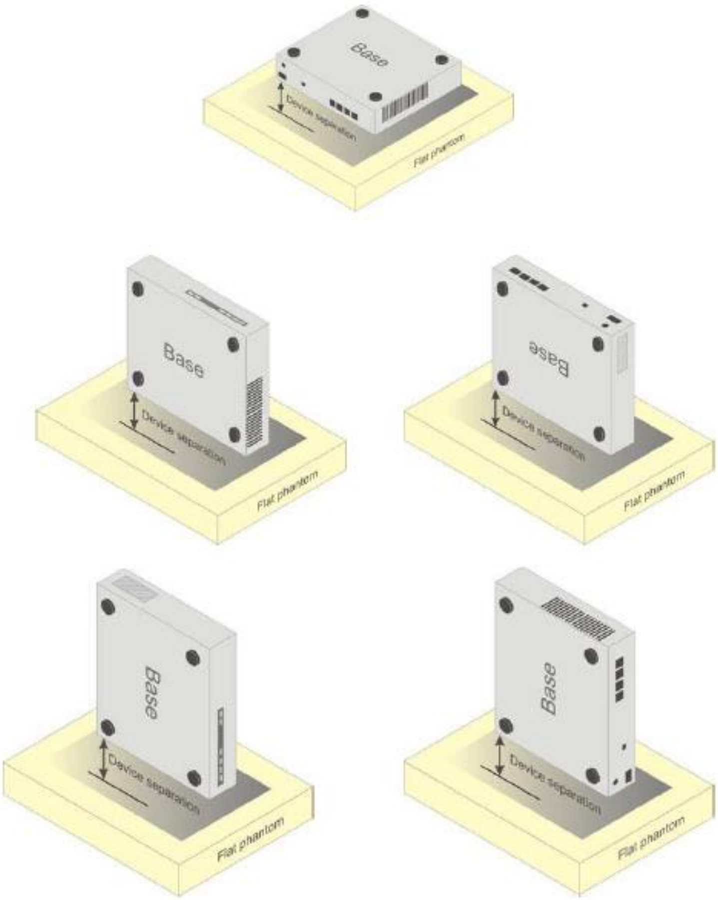


Picture D.4Test positions for body-worn devices

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. Picture8.5 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 800-3000 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.

TableE.1: Composition of the Tissue Equivalent Matter

Frequency (MHz)	835Head	835Body	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: There are a little adjustment respectively for 750, 1750, 2600, 5200, 5300 and 5600 based on the recipe of closest frequency in table E.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 for 7464

Probe SN.	Liquid name	Validation date	Frequency point	Status (OK or Not)
7464	Head 750MHz	Sep.26,2017	750 MHz	OK
7464	Head 850MHz	Sep.26,2017	850 MHz	OK
7464	Head 900MHz	Sep.26,2017	900 MHz	OK
7464	Head 1750MHz	Sep.26,2017	1750 MHz	OK
7464	Head 1810MHz	Sep.26,2017	1810 MHz	OK
7464	Head 1900MHz	Sep.27,2017	1900 MHz	OK
7464	Head 1950MHz	Sep.27,2017	1950 MHz	OK
7464	Head 2000MHz	Sep.27,2017	2000 MHz	OK
7464	Head 2100MHz	Sep.27,2017	2100 MHz	OK
7464	Head 2300MHz	Sep.27,2017	2300 MHz	OK
7464	Head 2450MHz	Sep.27,2017	2450 MHz	OK
7464	Head 2550MHz	Sep.28,2017	2550 MHz	OK
7464	Head 2600MHz	Sep.28,2017	2600 MHz	OK
7464	Head 3500MHz	Sep.28,2017	3500 MHz	OK
7464	Head 3700MHz	Sep.28,2017	3700 MHz	OK
7464	Head 5200MHz	Sep.28,2017	5200 MHz	OK
7464	Head 5500MHz	Sep.28,2017	5500 MHz	OK
7464	Head 5800MHz	Sep.28,2017	5800 MHz	OK
7464	Body 750MHz	Sep.28,2017	750 MHz	OK
7464	Body 850MHz	Sep.25,2017	850 MHz	OK
7464	Body 900MHz	Sep.25,2017	900 MHz	OK
7464	Body 1750MHz	Sep.25,2017	1750 MHz	OK
7464	Body 1810MHz	Sep.25,2017	1810 MHz	OK
7464	Body 1900MHz	Sep.25,2017	1900 MHz	OK
7464	Body 1950MHz	Sep.25,2017	1950 MHz	OK
7464	Body 2000MHz	Sep.29,2017	2000 MHz	OK
7464	Body 2100MHz	Sep.29,2017	2100 MHz	OK
7464	Body 2300MHz	Sep.29,2017	2300 MHz	OK
7464	Body 2450MHz	Sep.29,2017	2450 MHz	OK
7464	Body 2550MHz	Sep.29,2017	2550 MHz	OK
7464	Body 2600MHz	Sep.29,2017	2600 MHz	OK
7464	Body 3500MHz	Sep.24,2017	3500 MHz	OK
7464	Body 3700MHz	Sep.24,2017	3700 MHz	OK
7464	Body 5200MHz	Sep.24,2017	5200 MHz	OK
7464	Body 5500MHz	Sep.24,2017	5500 MHz	OK
7464	Body 5800MHz	Sep.24,2017	5800 MHz	OK