

12.4 Standalone SAR Test Exclusion Considerations

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied. The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR, where

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

Table 12.1: Standalone SAR test exclusion considerations

Band/Mode	F(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.441	Head	9.60	7.84	6.08	Yes
		Body	19.20	7.84	6.08	Yes
2.4GHz WLAN 802.11 b	2.45	Head	9.58	13.40	21.88	No
		Body	19.17	13.40	21.88	No

13 Evaluation of Simultaneous

Table 13.1: The sum of reported SAR values for main antenna and WiFi

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Head	Left head, Touch cheek	0.82	0.19	1.01
Highest reported SAR value for Body	Rear	0.93	0.08	1.01

Table 13.2: The sum of reported SAR values for main antenna and Bluetooth

	Position	Main antenna	BT*	Sum
Highest reported SAR value for Head	Left head, Touch cheek	0.82	0.26	1.08
Highest reported SAR value for Body	Rear	0.93	0.13	1.06

BT* - Estimated SAR for Bluetooth (see the table 13.3)

Table 13.3: Estimated SAR for Bluetooth

Position	F (GHz)	Distance (mm)	Upper limit of power *		Estimated _{1g} (W/kg)
			dBm	mW	
Head	2.441	5	8	6.31	0.26
Body	2.441	10	8	6.31	0.13

* - Maximum possible output power declared by manufacturer

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

$(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / x] \text{ W/kg}$ for test separation distances $\leq 50 \text{ mm}$;

where $x = 7.5$ for 1-g SAR.

When the minimum test separation distance is $< 5 \text{ mm}$, a distance of 5 mm is applied to determine SAR test exclusion

Conclusion:

According to the above tables, the sum of reported SAR values is $< 1.6 \text{ W/kg}$. So the simultaneous transmission SAR with volume scans is not required.

14 SAR Test Result

It is determined by user manual for the distance between the EUT and the phantom bottom.

The distance is 10mm and just applied to the condition of body worn accessory.

It is performed for all SAR measurements with area scan based 1-g SAR estimation (Fast SAR). A zoom scan measurement is added when the estimated 1-g SAR is the highest measured SAR in each exposure configuration, wireless mode and frequency band combination or > 1.2W/kg.

The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{\text{Target}} - P_{\text{Measured}})/10}$$

Where P_{Target} is the power of manufacturing upper limit;

P_{Measured} is the measured power in chapter 11.

Table 14.1: Duty Cycle

Mode	Duty Cycle
Speech for GSM850/1900	1:8.3
GPRS&EGPRS for GSM850	1:4
GPRS&EGPRS for GSM1900	1:2.67
WiFi	1:1

14.1 SAR results for Fast SAR

Table 14.2: SAR Values (GSM 850 MHz Band - Head)

Frequency		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)
MHz	Ch.										
Ambient Temperature: 22.4 °C		Liquid Temperature: 21.9 °C									
848.8	251	Left	Touch	Fig.1	32.18	33	0.481	0.58	0.680	0.82	-0.02
836.6	190	Left	Touch	/	32.12	33	0.351	0.43	0.517	0.63	0.12
824.2	128	Left	Touch	/	32.20	33	0.222	0.27	0.325	0.39	0.08
848.8	251	Left	Tilt	/	32.18	33	0.234	0.28	0.335	0.40	-0.03
836.6	190	Left	Tilt	/	32.12	33	0.188	0.23	0.271	0.33	-0.17
824.2	128	Left	Tilt	/	32.20	33	0.118	0.14	0.169	0.20	0.14
848.8	251	Right	Touch	/	32.18	33	0.457	0.55	0.614	0.74	-0.13
836.6	190	Right	Touch	/	32.12	33	0.296	0.36	0.427	0.52	-0.11
824.2	128	Right	Touch	/	32.20	33	0.208	0.25	0.300	0.36	-0.14
848.8	251	Right	Tilt	/	32.18	33	0.214	0.26	0.312	0.38	-0.18
836.6	190	Right	Tilt	/	32.12	33	0.142	0.17	0.205	0.25	-0.19
824.2	128	Right	Tilt	/	32.20	33	0.113	0.14	0.163	0.20	0.00

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

Frequency		Mode (number of timeslots)	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)	
MHz	Ch.											
		Ambient Temperature: 22.4 °C						Liquid Temperature: 21.9 °C				
836.6	190	GPRS (2)	Front	/	29.87	30	0.447	0.46	0.629	0.65	-0.08	
848.8	251	GPRS (2)	Rear	/	29.90	30	0.543	0.56	0.819	0.84	0.00	
836.6	190	GPRS (2)	Rear	Fig.2	29.87	30	0.682	0.70	0.904	0.93	0.10	
824.2	128	GPRS (2)	Rear	/	29.99	30	0.578	0.58	0.852	0.85	-0.03	
836.6	190	GPRS (2)	Left	/	29.87	30	0.488	0.50	0.707	0.73	-0.16	
836.6	190	GPRS (2)	Right	/	29.87	30	0.425	0.44	0.617	0.64	-0.17	
836.6	190	GPRS (2)	Bottom	/	29.87	30	0.035	0.04	0.053	0.05	-0.14	
848.8	251	EGPRS (2)	Rear	/	29.70	30	0.558	0.60	0.840	0.90	0.03	
836.6	190	EGPRS (2)	Rear	/	29.86	30	0.664	0.69	0.834	0.86	0.03	
824.2	128	EGPRS (2)	Rear	/	29.87	30	0.579	0.60	0.858	0.88	-0.05	
836.6	190	Speech	Rear Headset1	/	32.12	33	0.458	0.56	0.652	0.80	-0.18	
836.6	190	Speech	Rear Headset2	/	32.12	33	0.291	0.36	0.410	0.50	0.02	

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

Note2: The Headset1 is CCB3160A11C4, the Headset2 is CCB3160A11C6.

Table 14.4: SAR Values (GSM 1900 MHz Band - Head)

Frequency		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)	
MHz	Ch.											
		Ambient Temperature: 22.4 °C						Liquid Temperature: 21.9 °C				
1909.8	810	Left	Touch	/	29.62	30	0.204	0.22	0.325	0.35	0.04	
1880	661	Left	Touch	/	29.54	30	0.132	0.15	0.240	0.27	-0.16	
1850.2	512	Left	Touch	/	29.27	30	0.114	0.13	0.207	0.24	-0.17	
1909.8	810	Left	Tilt	/	29.62	30	0.081	0.09	0.144	0.16	0.19	
1880	661	Left	Tilt	/	29.54	30	0.097	0.11	0.172	0.19	0.08	
1850.2	512	Left	Tilt	/	29.27	30	0.081	0.10	0.141	0.17	-0.05	
1909.8	810	Right	Touch	/	29.62	30	0.218	0.24	0.409	0.45	0.08	
1880	661	Right	Touch	Fig.3	29.54	30	0.287	0.32	0.489	0.54	-0.09	
1850.2	512	Right	Touch	/	29.27	30	0.244	0.29	0.457	0.54	-0.10	
1909.8	810	Right	Tilt	/	29.62	30	0.083	0.09	0.141	0.15	0.00	
1880	661	Right	Tilt	/	29.54	30	0.096	0.11	0.164	0.18	0.18	
1850.2	512	Right	Tilt	/	29.27	30	0.094	0.11	0.161	0.19	0.11	

Table 14.5: SAR Values (GSM 1900 MHz Band - Body)

Frequency		Mode (number of timeslots)	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)
MHz	Ch.										
Ambient Temperature: 22.4 °C Liquid Temperature: 21.9 °C											
1880	661	GPRS (3)	Front	/	25.19	26.5	0.209	0.28	0.360	0.49	0.00
1909.8	810	GPRS (3)	Rear	/	25.30	26.5	0.160	0.21	0.288	0.38	0.06
1880	661	GPRS (3)	Rear	/	25.19	26.5	0.211	0.29	0.379	0.51	0.00
1850.2	512	GPRS (3)	Rear	Fig.4	25.32	26.5	0.325	0.43	0.544	0.71	-0.07
1880	661	GPRS (3)	Left	/	25.19	26.5	0.056	0.08	0.097	0.13	0.19
1880	661	GPRS (3)	Right	/	25.19	26.5	0.090	0.12	0.154	0.21	0.12
1880	661	GPRS (3)	Bottom	/	25.19	26.5	0.063	0.09	0.110	0.15	0.01
1850.2	512	EGPRS (3)	Rear	/	25.32	26.5	0.301	0.39	0.539	0.71	0.19
1850.2	512	Speech	Rear Headset1	/	29.27	30	0.214	0.25	0.376	0.44	-0.18
1850.2	512	Speech	Rear Headset2	/	29.27	30	0.209	0.25	0.368	0.44	0.09

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

Note2: The Headset1 is CCB3160A11C4, the Headset2 is CCB3160A11C6.

Table 14.6: SAR Values (Wi-Fi 802.11b - Head)

Frequency		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)
MHz	Ch.										
Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C											
2412	1	Left	Touch	Fig.5	13.40	14	0.087	0.10	0.164	0.19	0.15
2412	1	Left	Tilt	/	13.40	14	0.047	0.05	0.083	0.10	0.13
2412	1	Right	Touch	/	13.40	14	0.068	0.08	0.114	0.13	-0.15
2412	1	Right	Tilt	/	13.40	14	0.048	0.06	0.088	0.10	-0.10

Table 14.7: SAR Values (Wi-Fi 802.11b - Body)

Frequency		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)
MHz	Ch.									
Ambient Temperature: 22.5 °C Liquid Temperature: 22.0 °C										
2412	1	Front	/	13.40	14	0.029	0.03	0.055	0.06	-0.08
2412	1	Rear	Fig.6	13.40	14	0.040	0.05	0.070	0.08	-0.11
2412	1	Right	/	13.40	14	0.025	0.03	0.052	0.06	0.12
2412	1	Top	/	13.40	14	0.016	0.02	0.030	0.03	0.18

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

14.2 SAR results for Standard procedure

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

Table 14.8: SAR Values (GSM 850 MHz Band - Head)

Frequency		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)
MHz	Ch.										
848.8	251	Left	Touch	Fig.1	32.18	33	0.481	0.58	0.680	0.82	-0.02

Table 14.9: SAR Values (GSM 850 MHz Band - Body)

Frequency		Mode (number of timeslots)	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)
MHz	Ch.										
836.6	190	GPRS (2)	Rear	Fig.2	29.87	30	0.682	0.70	0.904	0.93	0.10

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

Table 14.10: SAR Values (GSM 1900 MHz Band - Head)

Frequency		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)
MHz	Ch.										
1880	661	Right	Touch	Fig.3	29.54	30	0.287	0.32	0.489	0.54	-0.09

Table 14.11: SAR Values (GSM 1900 MHz Band - Body)

Frequency		Mode (number of timeslots)	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)
MHz	Ch.										
1850.2	512	GPRS (3)	Rear	Fig.4	25.32	26.5	0.325	0.43	0.544	0.71	-0.07

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

Table 14.12: SAR Values (Wi-Fi 802.11b - Head)

Frequency		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)
MHz	Ch.										
2412	1	Left	Touch	Fig.5	13.40	14	0.087	0.10	0.164	0.19	0.15

Table 14.13: SAR Values (Wi-Fi 802.11b - Body)

Frequency		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)
MHz	Ch.									
2412	1	Rear	Fig.6	13.40	14	0.040	0.05	0.070	0.08	-0.11

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

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; steps 2) 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 ≥ 1.45 W/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 GSM 850 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
836.6	190	Rear	10	0.904	0.894	1.01	/

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	5.5	N	1	1	1	5.5	5.5	∞
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	RF ambient 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	$u_c = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$							9.25	9.12	257
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$							18.5	18.2	

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	6.5	N	1	1	1	6.5	6.5	∞
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	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 (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		$u_c = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						10.8	10.7	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						21.6	21.4	

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	5.5	N	1	1	1	5.5	5.5	∞
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	RF ambient 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		$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						10.1	9.95	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						20.2	19.9	

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	6.5	N	1	1	1	6.5	6.5	∞
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	A	3.3	N	1	1	1	3.3	3.3	71

	positioning									
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		$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						13.3	13.2	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						26.6	26.4	

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	February 15, 2014	One year
02	Power meter	NRVD	102083	September 11, 2013	One year
03	Power sensor	NRV-Z5	100542		
04	Signal Generator	E4438C	MY49070393	November 08, 2013	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	E5515C	MY50263375	January 30, 2014	One year
07	E-field Probe	SPEAG EX3DV4	3846	September 03, 2013	One year
08	DAE	SPEAG DAE4	771	November 12, 2013	One year
09	Dipole Validation Kit	SPEAG D835V2	443	August 29, 2013	One year
10	Dipole Validation Kit	SPEAG D1900V2	5d018	June 18, 2014	One year
11	Dipole Validation Kit	SPEAG D2450V2	869	June 13, 2014	One year

END OF REPORT BODY

ANNEX A Graph Results

850 Left Cheek High

Date: 2014-7-31

Electronics: DAE4 Sn771

Medium: Head 850 MHz

Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.905$ S/m; $\epsilon_r = 40.552$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.4°C Liquid Temperature: 21.9°C

Communication System: GSM 850 Frequency: 848.8 MHz Duty Cycle: 1:8.3

Probe: EX3DV4 - SN3846 ConvF(8.92, 8.92, 8.92)

Cheek High/Area Scan (61x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.764 W/kg

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

Reference Value = 7.667 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.852 W/kg

SAR(1 g) = 0.680 W/kg; SAR(10 g) = 0.481 W/kg

Maximum value of SAR (measured) = 0.715 W/kg

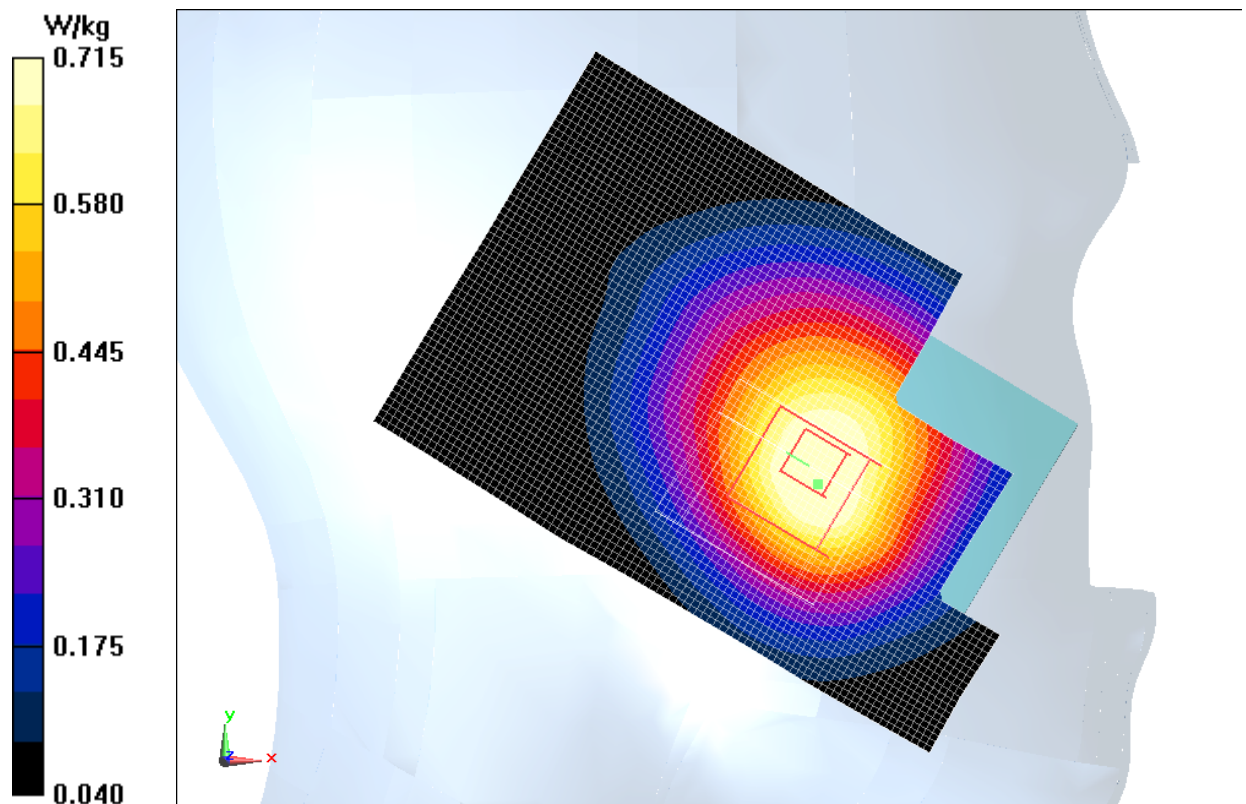


Fig.1 850MHz CH251

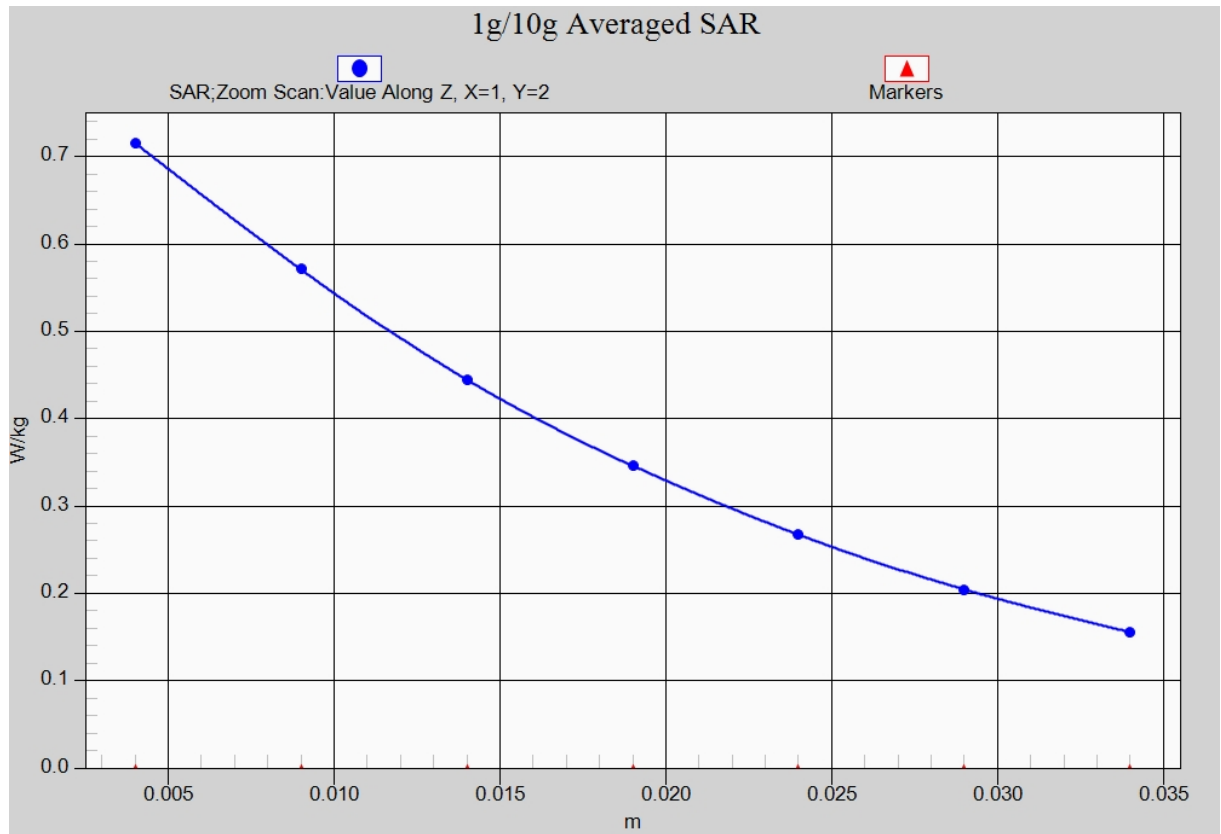


Fig. 1-1 Z-Scan at power reference point (850 MHz CH251)

850 Body Rear Middle

Date: 2014-7-31

Electronics: DAE4 Sn771

Medium: Body 850 MHz

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.995$ S/m; $\epsilon_r = 54.492$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.4°C Liquid Temperature: 21.9°C

Communication System: GSM 850 GPRS Frequency: 836.6 MHz Duty Cycle: 1:4

Probe: EX3DV4 - SN3846 ConvF(8.73, 8.73, 8.73)

Rear Side Middle/Area Scan (61x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.974 W/kg

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

Reference Value = 24.585 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 1.08 W/kg

SAR(1 g) = 0.904 W/kg; SAR(10 g) = 0.682 W/kg

Maximum value of SAR (measured) = 1.03 W/kg

Rear Side Middle/Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 24.585 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 1.26 W/kg

SAR(1 g) = 0.824 W/kg; SAR(10 g) = 0.565 W/kg

Maximum value of SAR (measured) = 0.913 W/kg

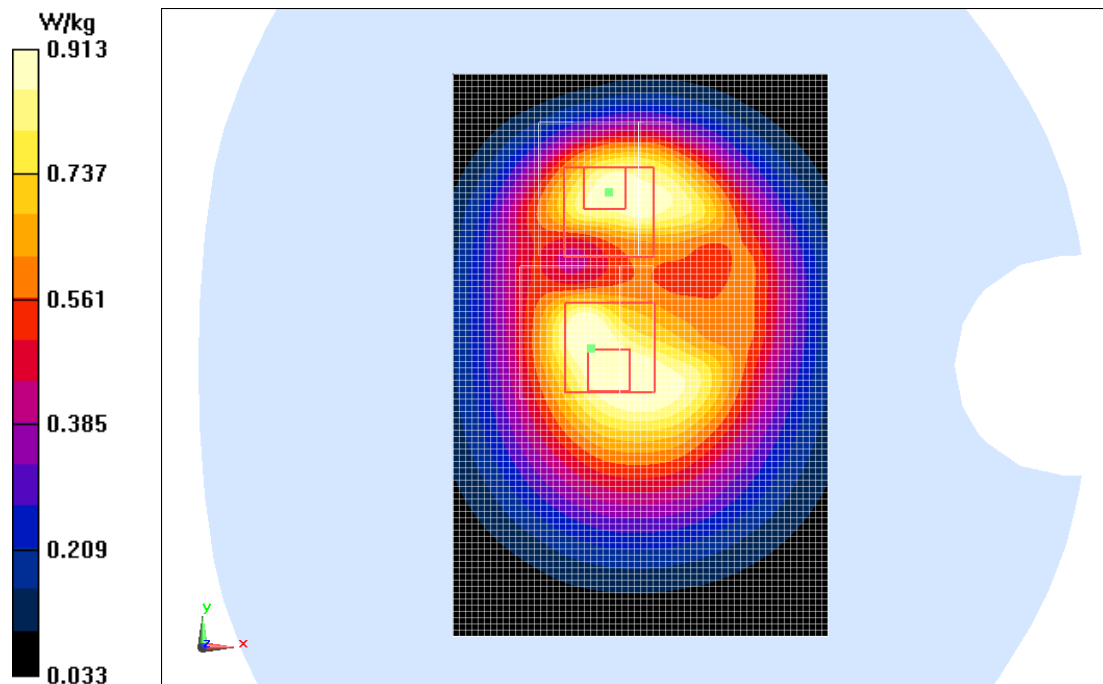


Fig.2 850 MHz CH190

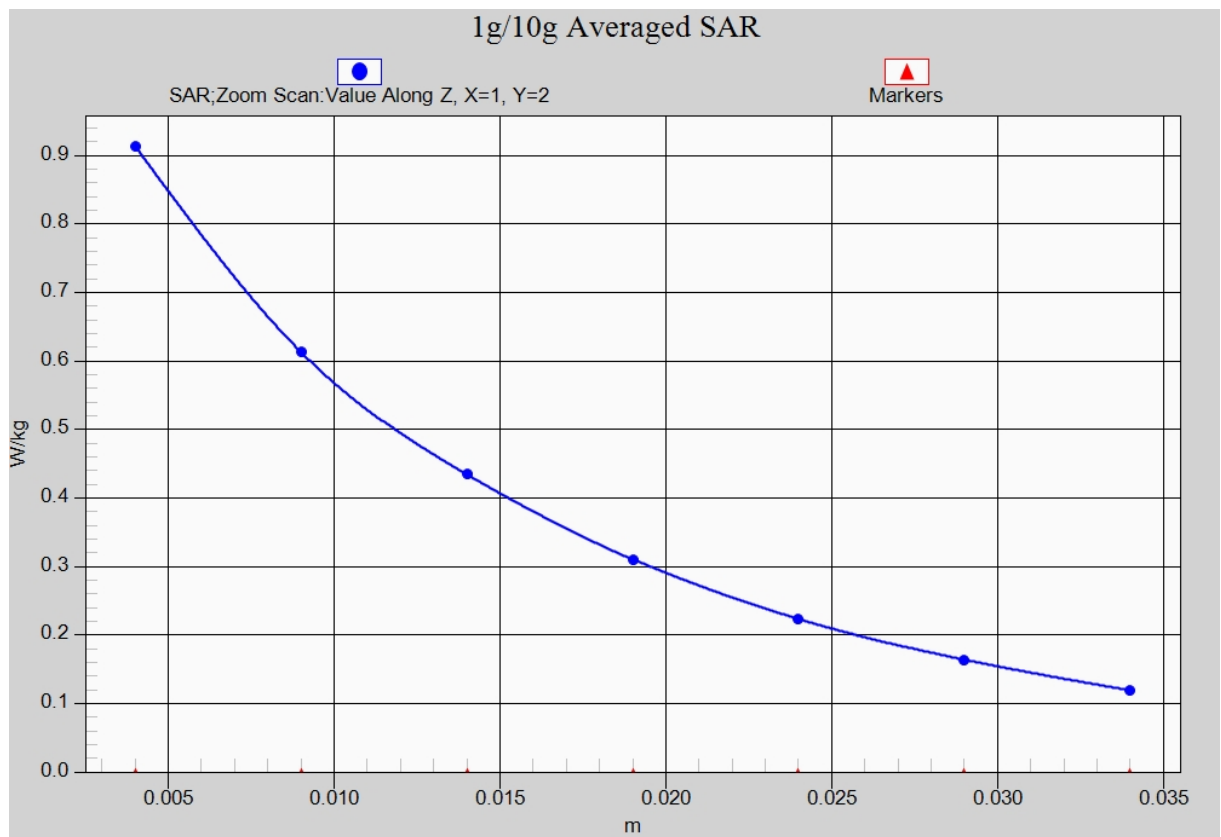


Fig. 2-1 Z-Scan at power reference point (850 MHz CH190)

GSM1900 Right Cheek Middle

Date: 2014-8-1

Electronics: DAE4 Sn771

Medium: Head 1900 MHz

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.367$ S/m; $\epsilon_r = 40.726$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.4°C Liquid Temperature: 21.9°C

Communication System: GSM 1900MHz Frequency: 1880 MHz Duty Cycle: 1:8.3

Probe: EX3DV4 - SN3846 ConvF(7.57, 7.57, 7.57)

Cheek Middle/Area Scan (61x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.619 W/kg

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

Reference Value = 7.424 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.746 W/kg

SAR(1 g) = 0.489 W/kg; SAR(10 g) = 0.287 W/kg

Maximum value of SAR (measured) = 0.503 W/kg

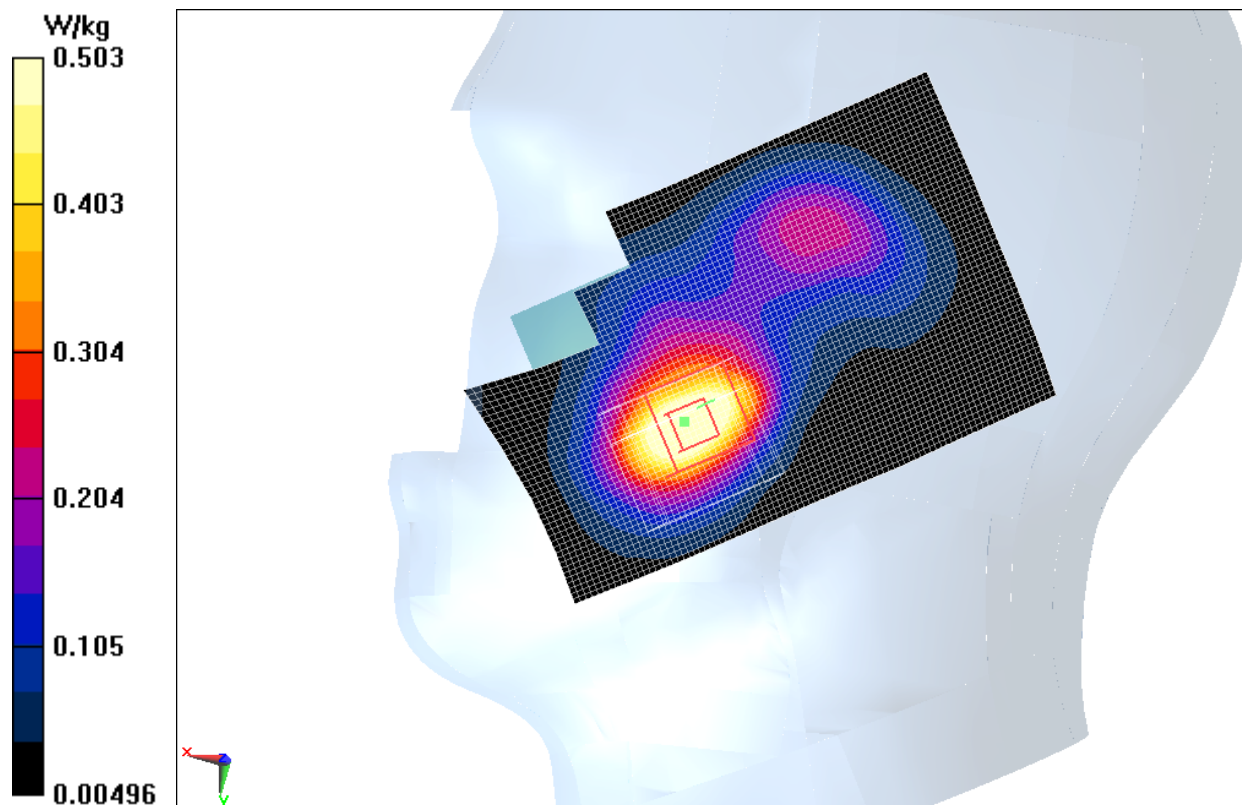


Fig.3 1900 MHz CH661

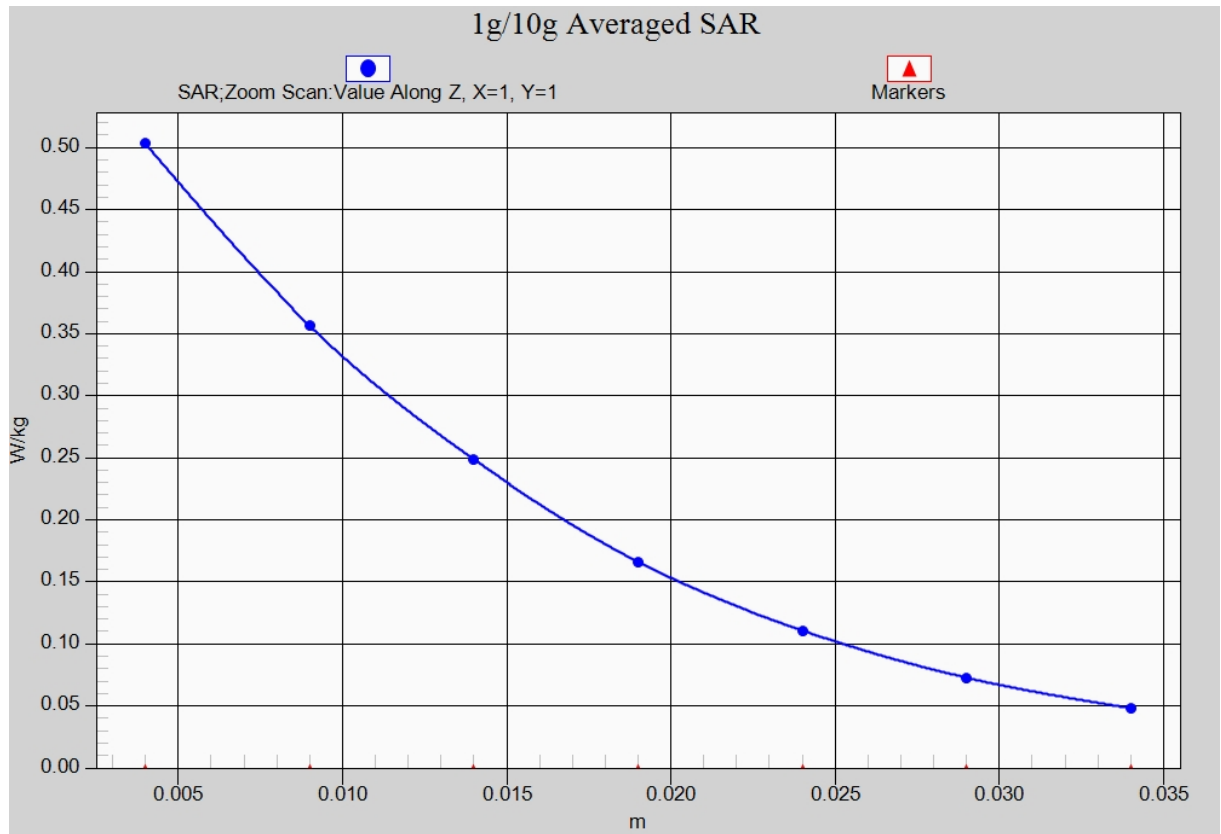


Fig. 3-1 Z-Scan at power reference point (1900 MHz CH661)

GSM1900 Body Rear Low

Date: 2014-8-1

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.498$ S/m; $\epsilon_r = 54.618$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.4°C Liquid Temperature: 21.9°C

Communication System: GSM 1900MHz GPRS Frequency: 1850.2 MHz Duty Cycle: 1:2.67

Probe: EX3DV4 - SN3846 ConvF(7.03, 7.03, 7.03)

Rear Low/Area Scan (61x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.618 W/kg

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

Reference Value = 11.273 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.831 W/kg

SAR(1 g) = 0.544 W/kg; SAR(10 g) = 0.325 W/kg

Maximum value of SAR (measured) = 0.586 W/kg

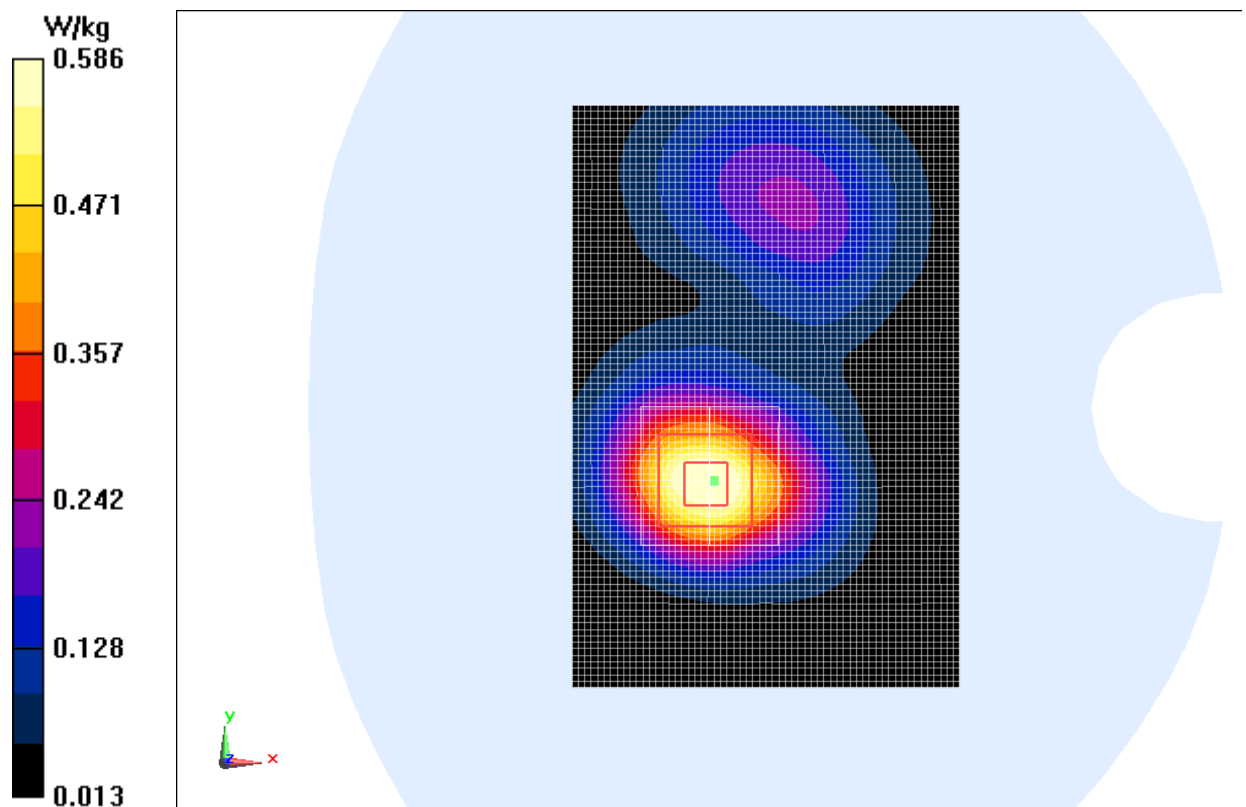


Fig.4 1900 MHz CH512

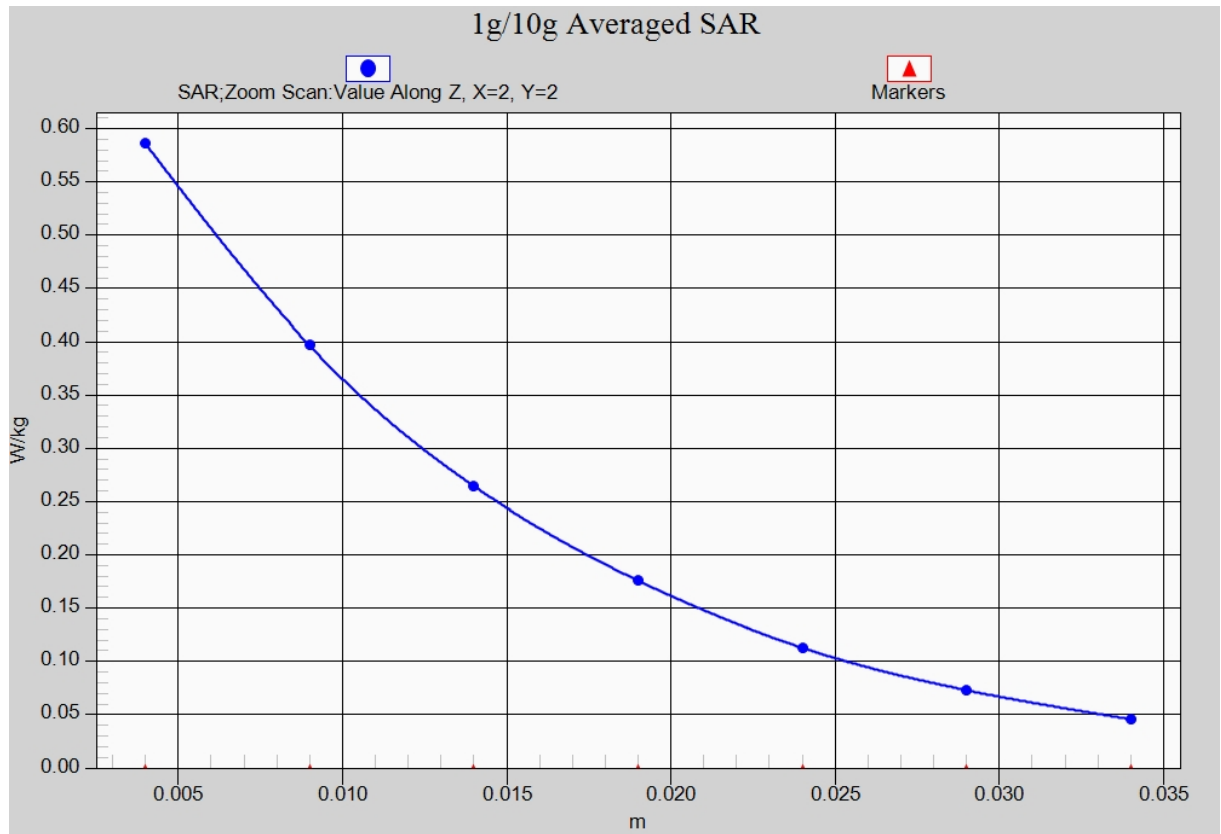


Fig.4-1 Z-Scan at power reference point (1900 MHz CH512)

Wifi 802.11b Left Cheek Channel 1

Date: 2014-8-2

Electronics: DAE4 Sn771

Medium: Head 2450 MHz

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.786$ S/m; $\epsilon_r = 40.462$; $\rho = 1000$ kg/m³

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

Communication System: WLAN 2450 Frequency: 2412 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(6.78, 6.78, 6.78)

Cheek Low/Area Scan (71x111x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.200 W/kg

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

Reference Value = 5.832 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.284 W/kg

SAR(1 g) = 0.164 W/kg; SAR(10 g) = 0.087 W/kg

Maximum value of SAR (measured) = 0.189 W/kg

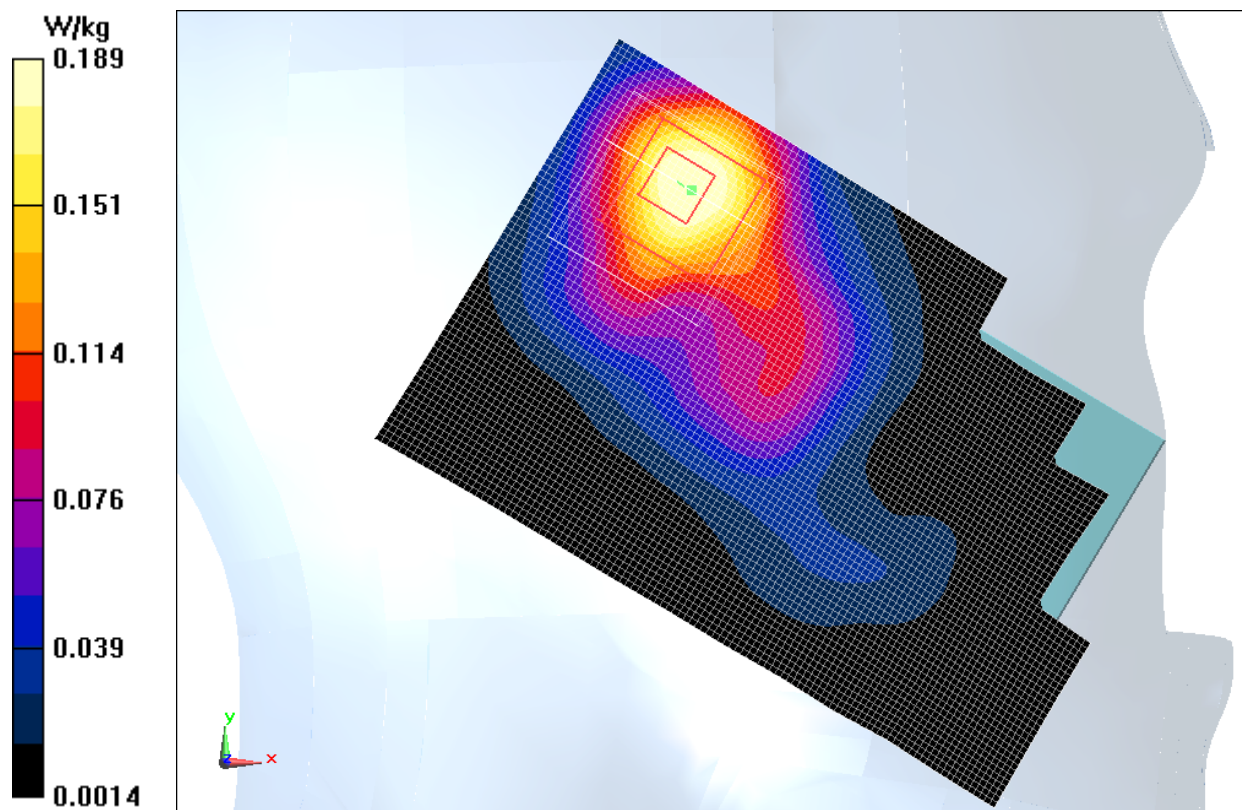


Fig.5 2450 MHz CH1

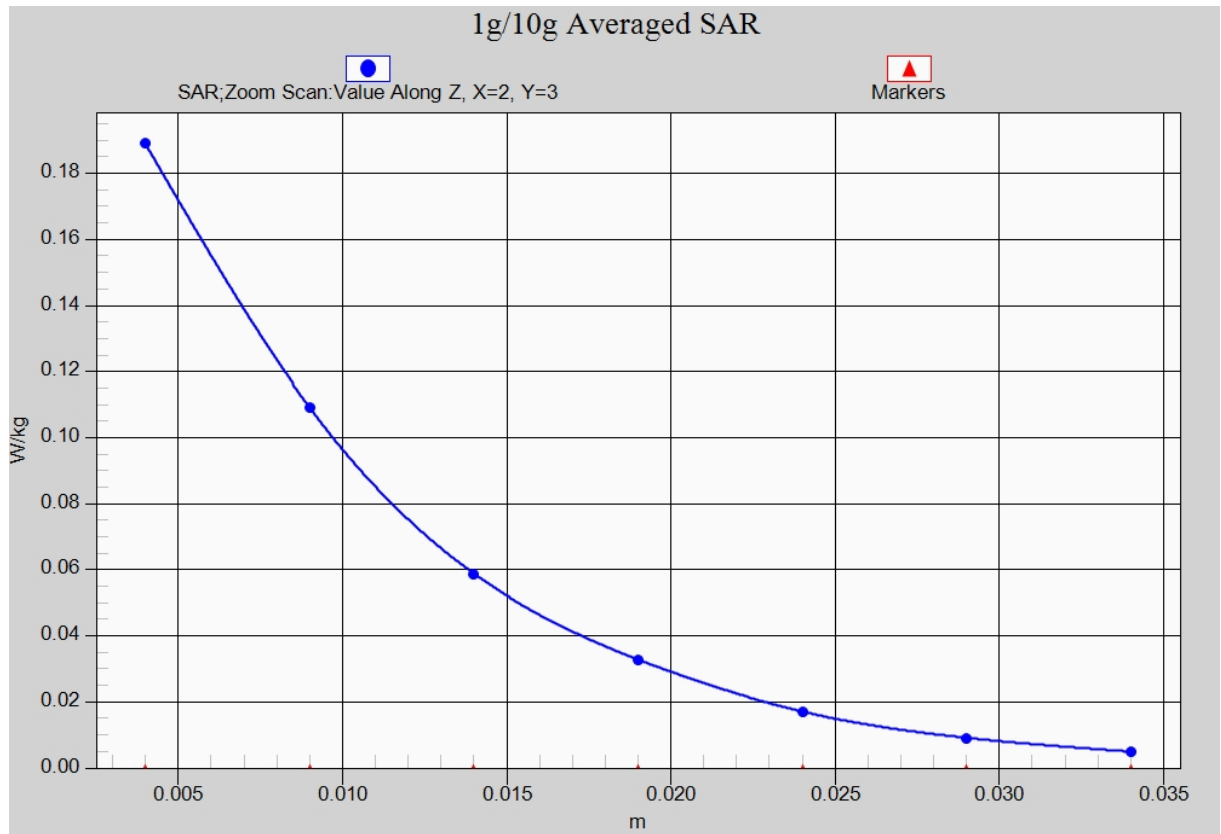


Fig. 5-1 Z-Scan at power reference point (2450 MHz CH1)

Wifi 802.11b Body Rear Channel 1

Date: 2014-8-2

Electronics: DAE4 Sn771

Medium: Body 2450 MHz

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.929$ S/m; $\epsilon_r = 53.733$; $\rho = 1000$ kg/m³

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

Communication System: WLAN 2450 Frequency: 2412 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(6.73, 6.73, 6.73)

Rear Low/Area Scan (71x111x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.0790 W/kg

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

Reference Value = 5.211 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.119 W/kg

SAR(1 g) = 0.070 W/kg; SAR(10 g) = 0.040 W/kg

Maximum value of SAR (measured) = 0.0772 W/kg

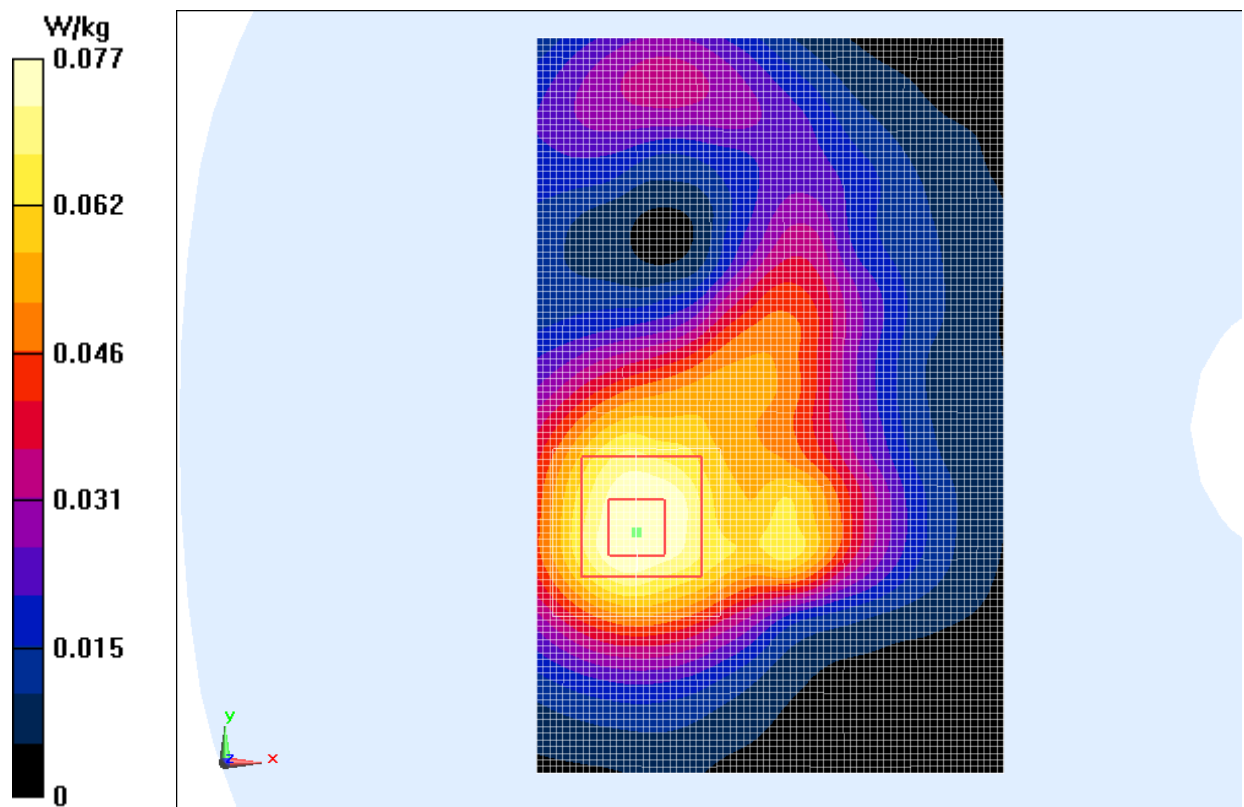


Fig.6 2450 MHz CH1

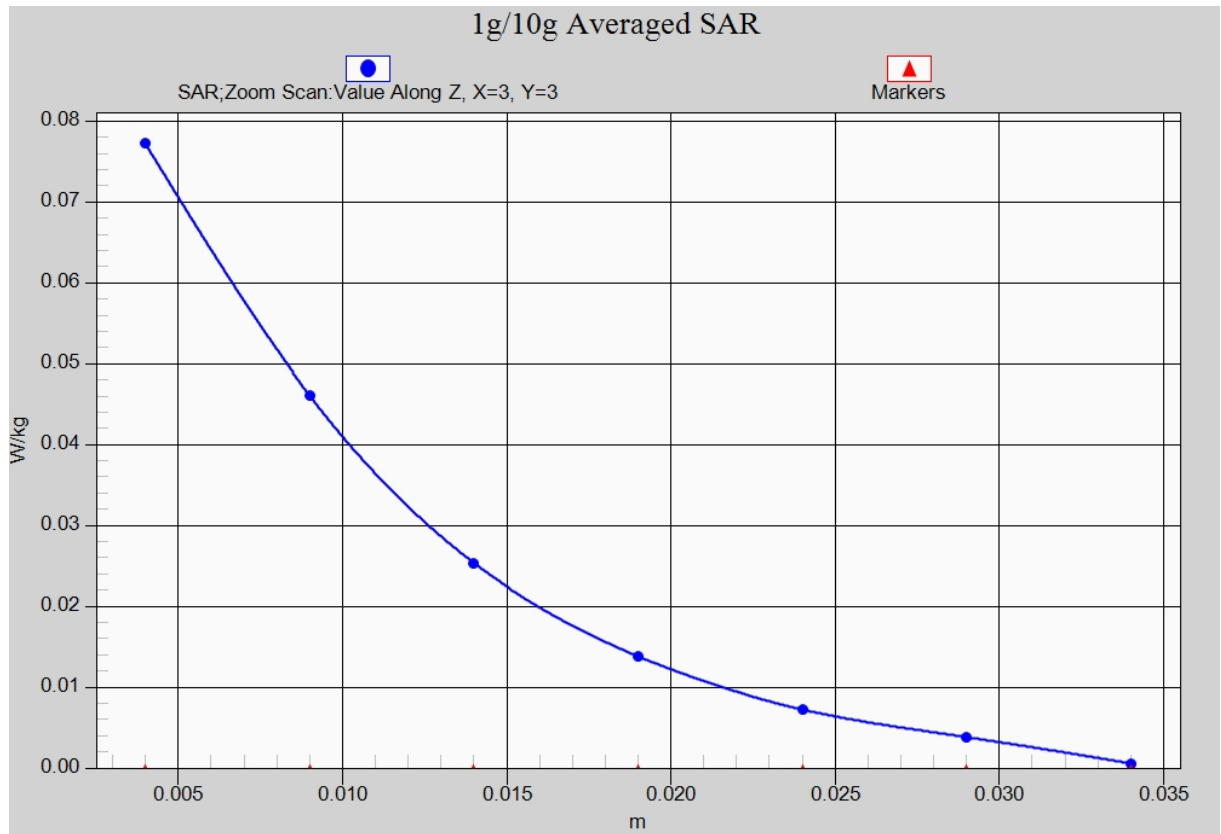


Fig. 6-1 Z-Scan at power reference point (2450 MHz CH1)

ANNEX B System Verification Results

835MHz

Date: 2014-7-31

Electronics: DAE4 Sn771

Medium: Head 850 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 40.74$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.4°C Liquid Temperature: 21.9°C

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

Probe: EX3DV4 - SN3846 ConvF(8.92, 8.92, 8.92)

System Validation /Area Scan (61x121x1): Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$

Reference Value = 48.615 V/m ; Power Drift = 0.05 dB

SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.55 W/kg

Maximum value of SAR (interpolated) = 2.82 W/kg

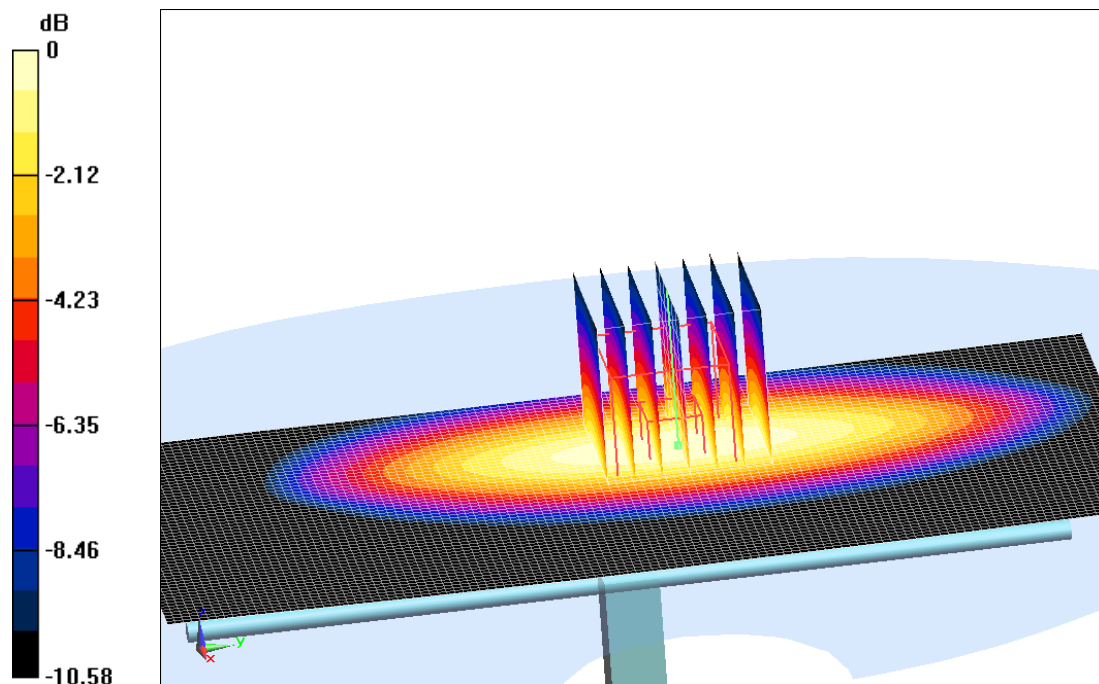
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 48.615 V/m ; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 3.60 W/kg

SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 2.83 W/kg



$0 \text{ dB} = 2.83 \text{ W/kg} = 4.52 \text{ dBW/kg}$

Fig.B.1 validation 835MHz 250mW