April 17, 2003

RESPONSE TO FCC QUESTIONS ON THE SAR REPORT FOR AMBIT MICROSYSTEMS MODEL T60H677 802.11 a/b/g MINI PCI WITH THREE HOST COMPUTERS

Host Computers:

1. Quantatw Model ZG1S with Ambit Model ZG1S 802.11a antenna (PC Serial #QCHCP025000023)
2. Quantatw Model ZI1S with Ambit Model ZI1S 802.11a antenna (PC Serial #QCHCOU24800018)
3. Compal Model L1S with Ambit Model BY27 802.11a antenna (PC Serial #BBY27001004)

SAR Report originally submitted: February 25, 2003

1. Clarification if there are two transmitting antennas for each of the configurations (of the PCs). Please provide SAR data for both as appropriate.

Response:

Indeed, there are two transmitting antennas for each of the PCs. Similar to the right-side antennas illustrated in Figs. 1-3 parts c of the previous SAR report, the left-side antennas are built into the keyboards close to the left edges and back ends of the individual PCs. The measured SAR distributions and the peak 1-g SARs for the right-side antennas are given in our previous report submitted on February 25, 2003. The SAR distributions have now been measured for the left-side antennas for all three configurations of the PCs and are given in Tables a-f here. The peak 1-g SARs for these left-side antennas are summarized together with the previously submitted 1-g SARs for the right-side antennas in Tables g-i, respectively. As given in Tables g-i, the SARs were too low to measure within the noise limits of the SAR measurement system for the left-side antennas for all three Configurations 1, 2, and 3 for Quantatw Model ZI1S PC, for Configurations 1 and 2 for Quantatw Model ZG1S PC, and for Configurations 1 and 3 for Compal Model L1S PC.

Steps taken to comply with Supplement C recommendation to perform system verification within 100 MHz of device frequency

We have developed a system verification system by using an open-ended, air-filled waveguide as an irradiation system placed at a distance of 8 mm from the base of the planar phantom (10 mm from the lossy fluid in the phantom). For this application, we have set up a WR 187 rectangular waveguide of internal dimensions 1.872" × 0.872" that is fed with microwave power from a Hewlett Packard Model 83620A Synthesized Sweeper (10 MHz-20 GHz). The operating (TE_{10} mode) band of this waveguide is from 3.95 to 5.85 GHz. When placed at a distance of 8 mm from the base of the planar phantom, the reflection coefficient is

about 10-20%. Even this relatively small amount of reflection has been reduced to less than 0.5% by using a movable slide screw waveguide tuner (Narda Model 22CI). The measured SAR distributions for peak 1-g SAR region using this system at 5.25 and 5.80 GHz for the day of SAR measurements April 15, 2003 are given in Appendix I. Also given in Appendix I are the waveguide SAR plots for this date of left antenna SAR measurements. The peak 1-g SARs measured for 100 mW of radiated power for 5.25 and 5.80 GHz are 3.592 and 3.939 W/kg, respectively. The measured 1-g SARs are in excellent agreement with the FDTD-calculated 1-g SARs for this waveguide of 3.58 and 3.95 W/kg at 5.25 and 5.80 GHz, respectively. Also as expected, the measured SAR plots in Appendix I are quite symmetric at both of the irradiation frequencies.

2. SAR plots should show the antenna outline overlaid on the contours

Response:

This has been done for the coarse scan SAR measurements given in Figs. a-f. Also, the outline of the WR187 rectangular waveguide used for system verification is overlaid on the SAR measurement plots given in Appendix I.

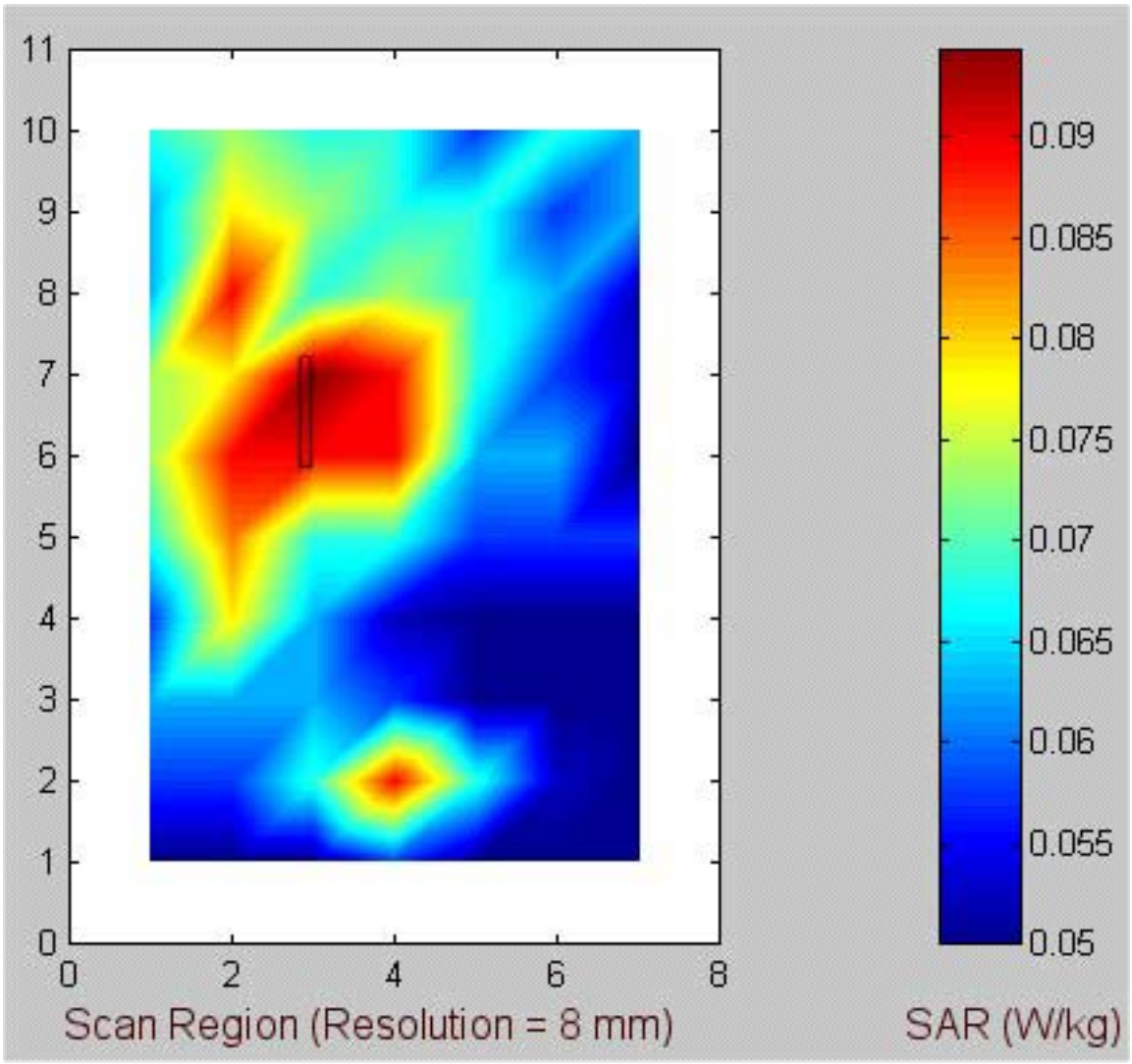

Fig. a. Coarse scans for the SAR measurements for the **End-on** Configuration 3 of the Quantatw Model ZG1S PC left-side antenna for the normal mode at 5.20 GHz (see Table a for peak 1-g SAR). Also shown is the antenna outline overlaid on the SAR contours.

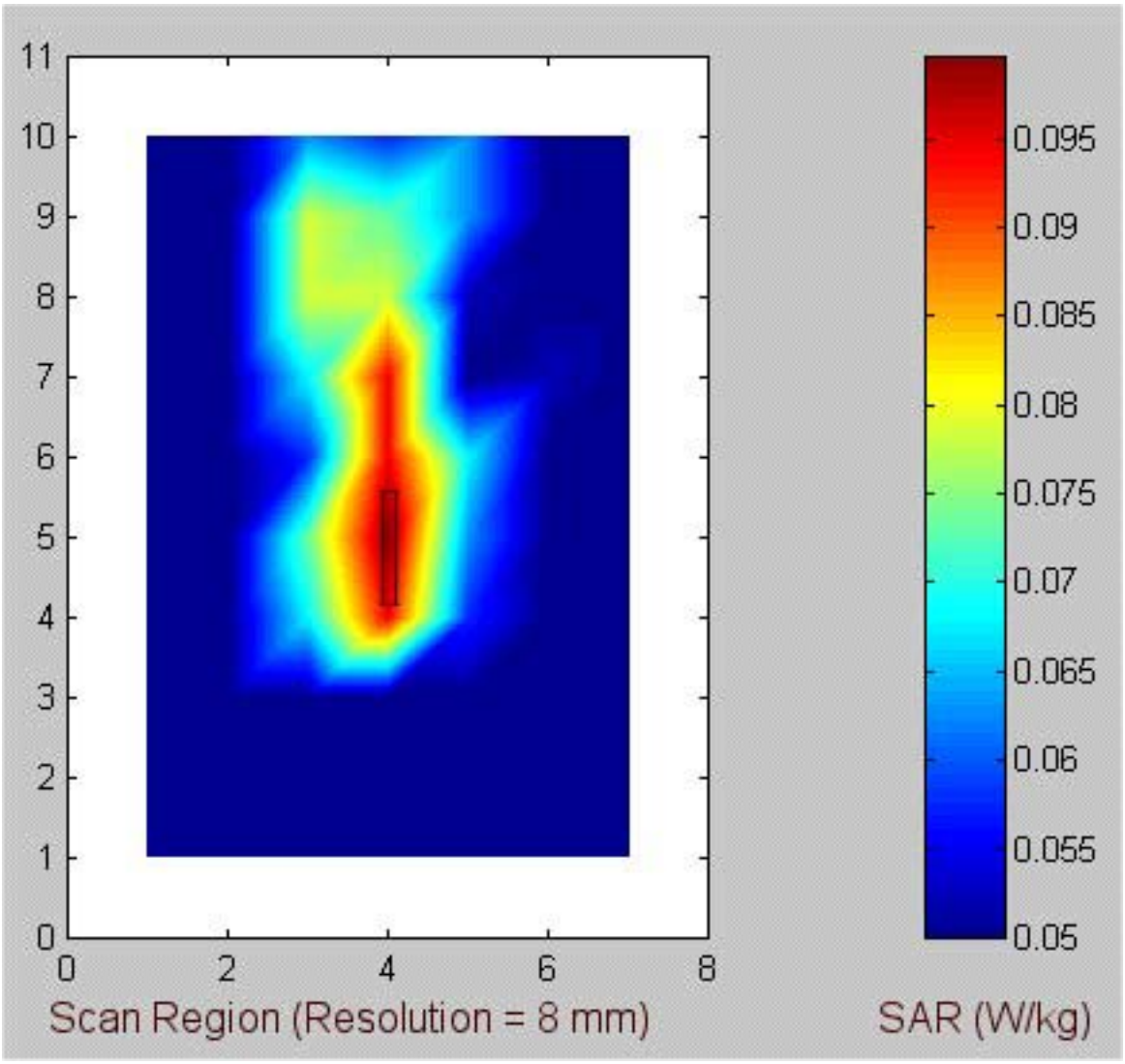

Fig. b. Coarse scans for the SAR measurements for the **End-on** Configuration 3 of the Quantatw Model ZG1S PC left-side antenna for the normal mode at 5.30 GHz (see Table b for peak 1-g SAR). Also shown is the antenna outline overlaid on the SAR contours.

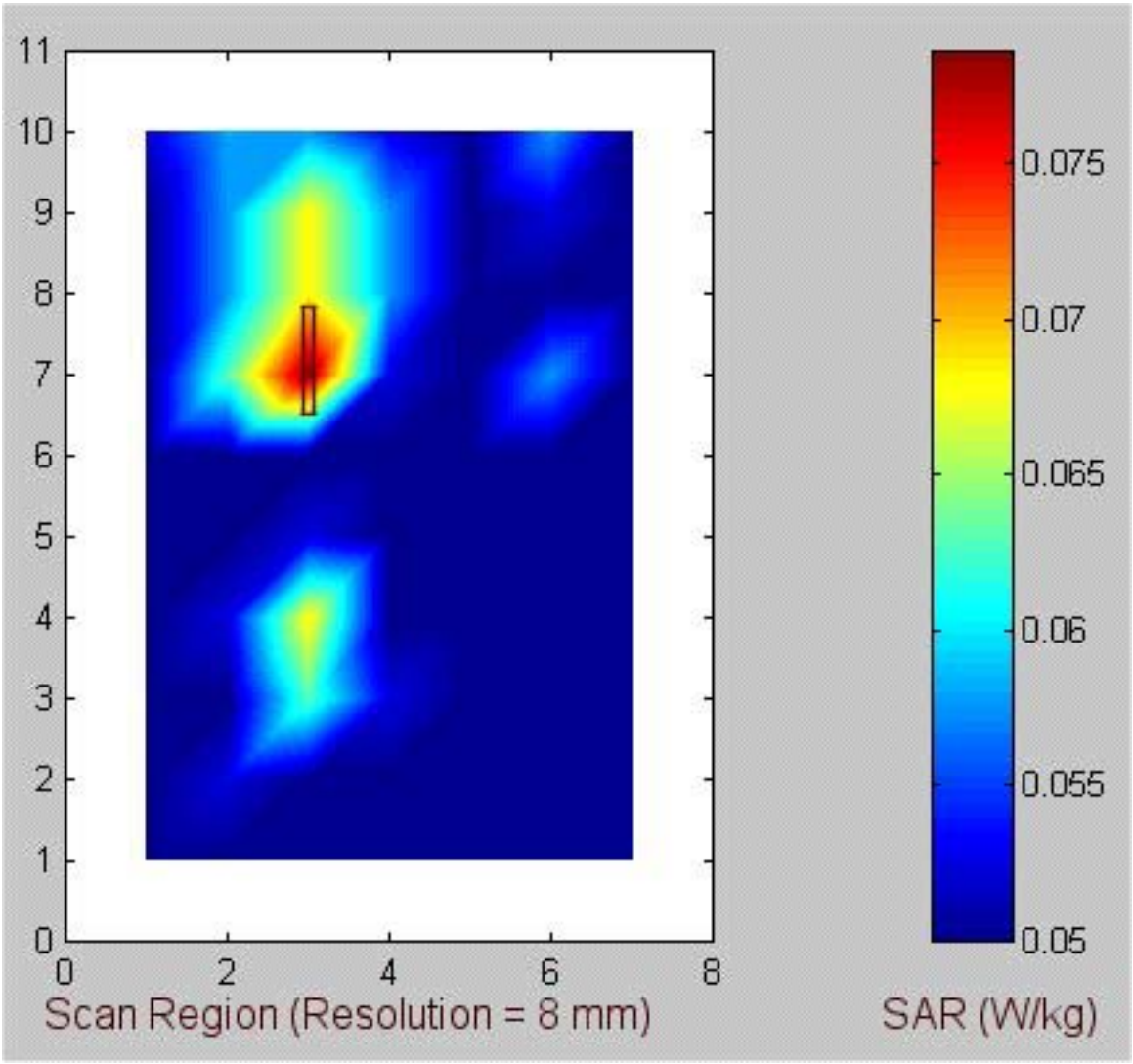

Fig. c. Coarse scans for the SAR measurements for the **End-on** Configuration 3 of the Quantatw Model ZG1S PC left-side antenna for the normal mode at 5.745 GHz (see Table c for peak 1-g SAR). Also shown is the antenna outline overlaid on the SAR contours.

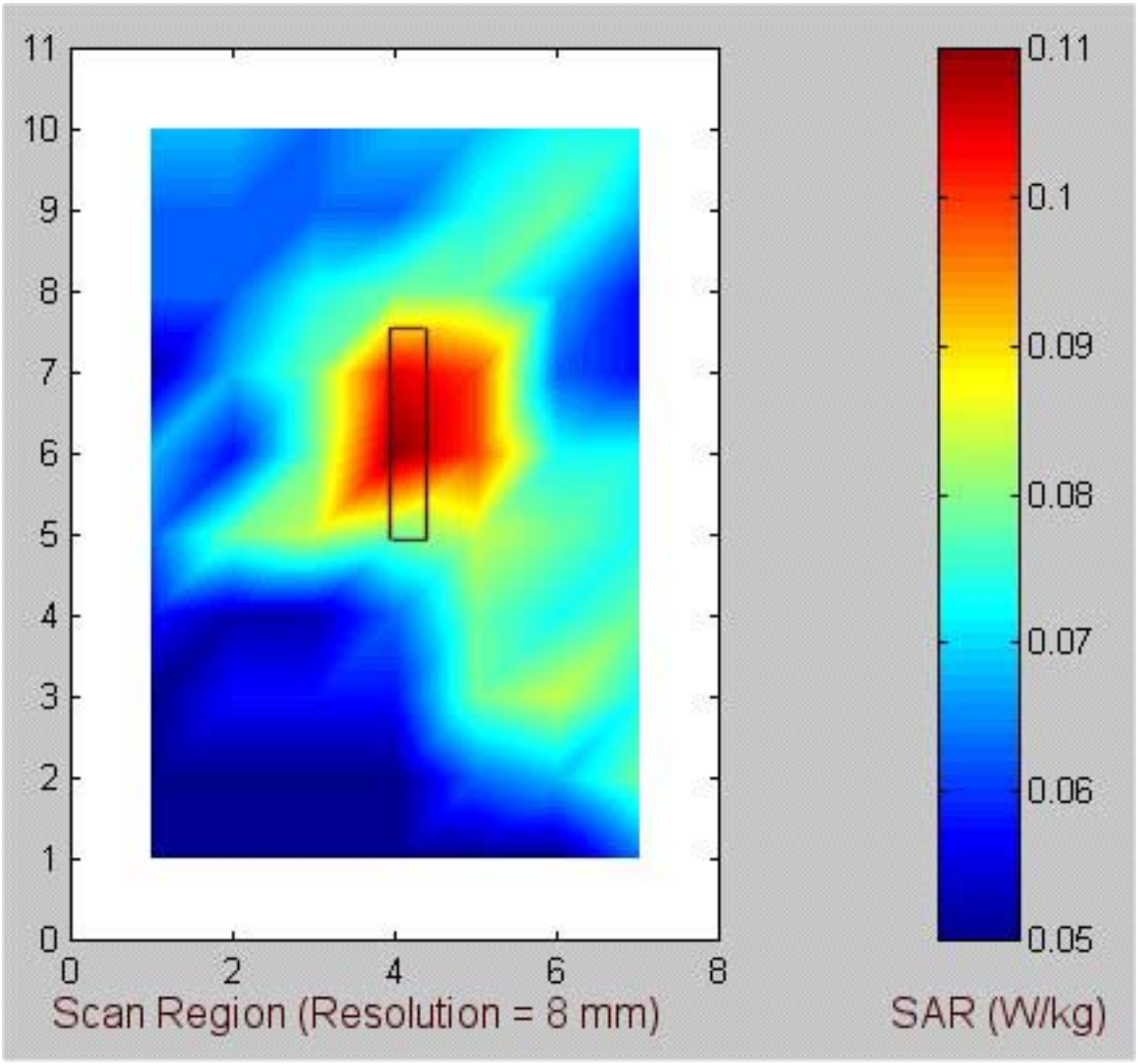

Fig. d. Coarse scans for the SAR measurements for the **Edge-on** Configuration 2 of the Compal Model L1S PC left-side antenna for the normal mode at 5.20 GHz (see Table d for peak 1-g SAR). Also shown is the antenna outline overlaid on the SAR contours.

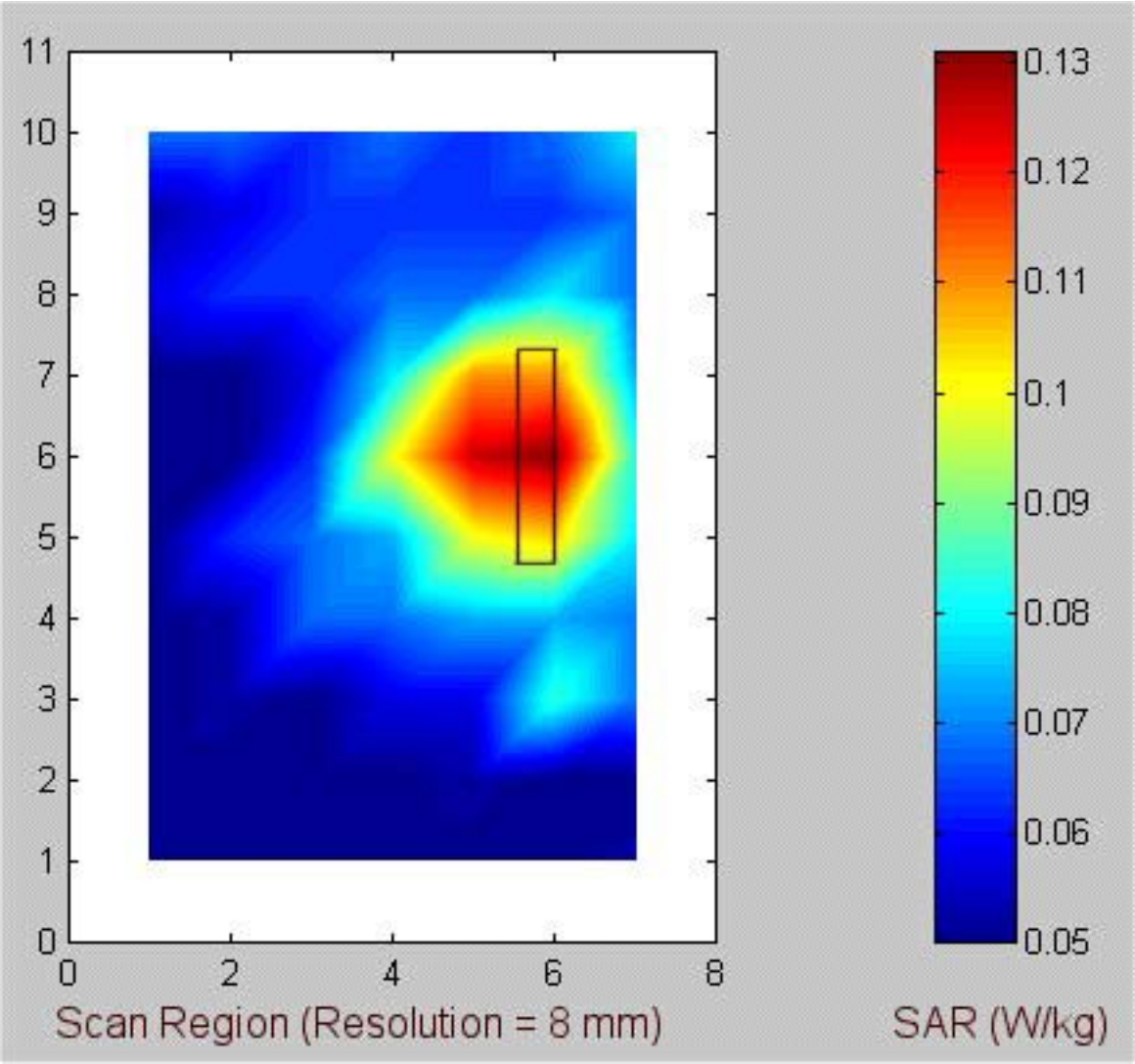

Fig. e. Coarse scans for the SAR measurements for the **Edge-on** Configuration 2 of the Compal Model L1S PC left-side antenna for the normal mode at 5.30 GHz (see Table e for peak 1-g SAR). Also shown is the antenna outline overlaid on the SAR contours.

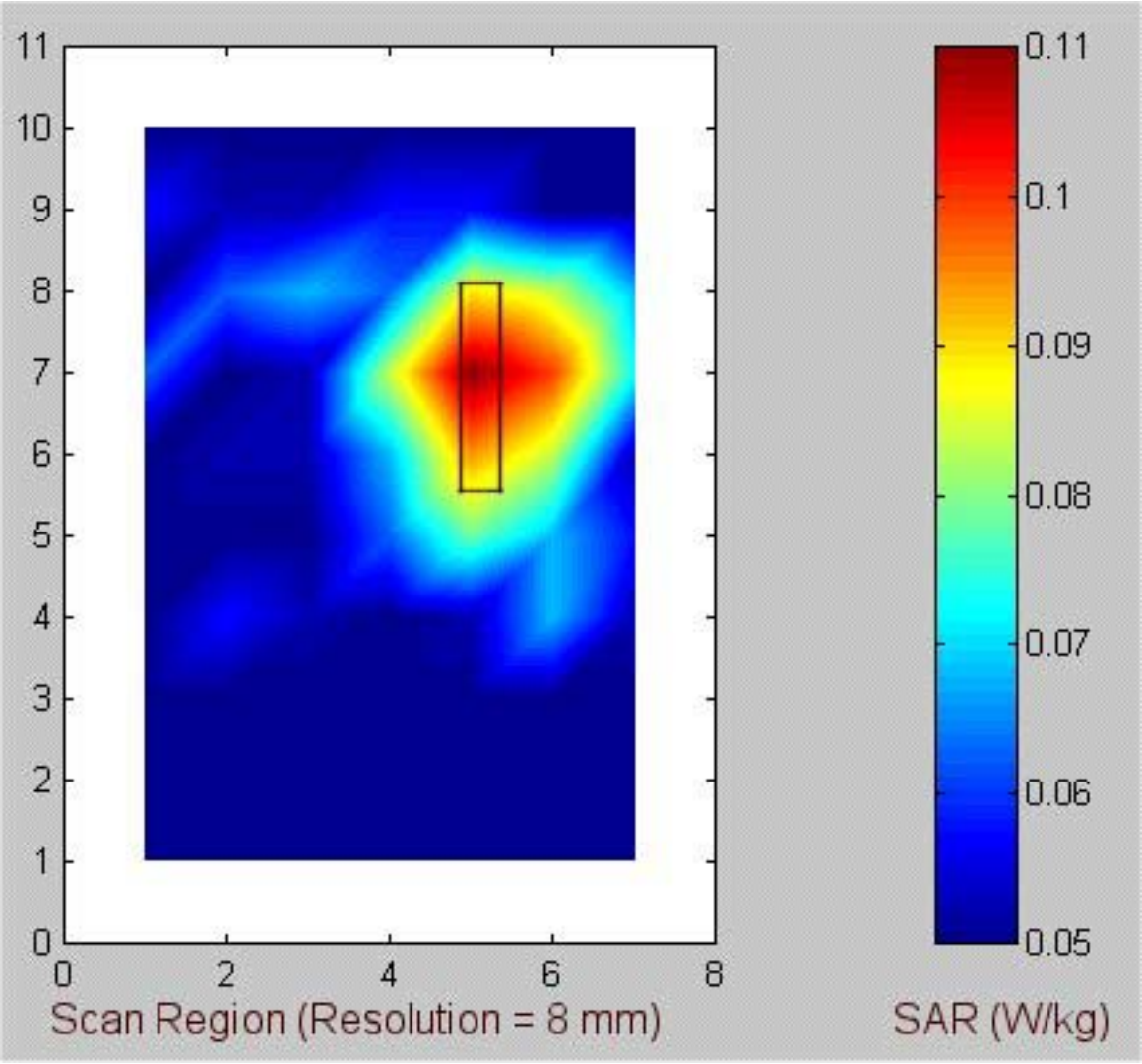

Fig. f. Coarse scans for the SAR measurements for the **Edge-on** Configuration 2 of the Compal Model L1S PC left-side antenna for the normal mode at 5.745 GHz (see Table f for peak 1-g SAR). Also shown is the antenna outline overlaid on the SAR contours.

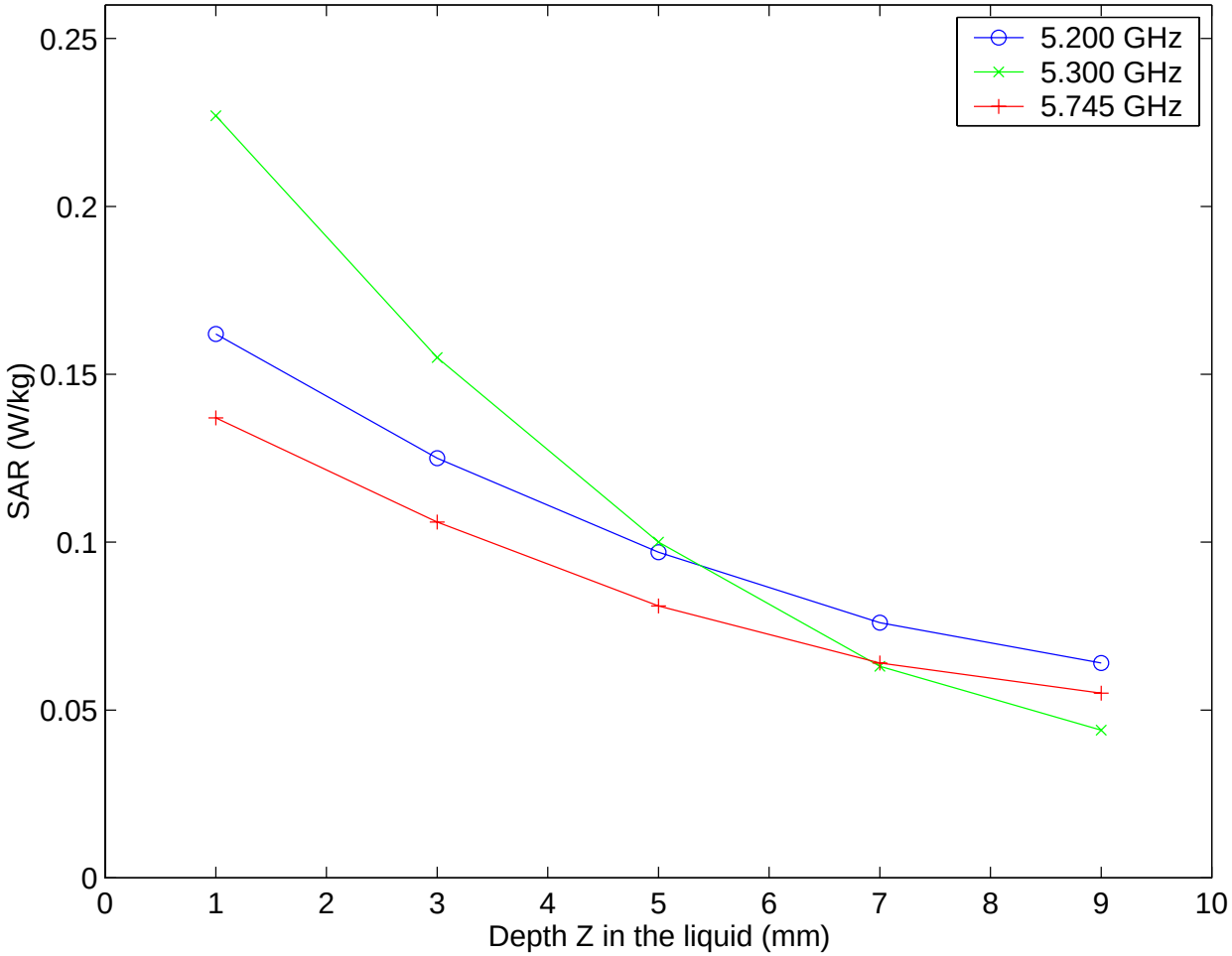

Fig. g. Plot of the SAR variations as a function of depth Z in the liquid for locations of the highest SAR (from Tables a-c) for End-on position (Configuration 3) for Quantatw Model ZG1S PC for the 802.11a left-side antenna.

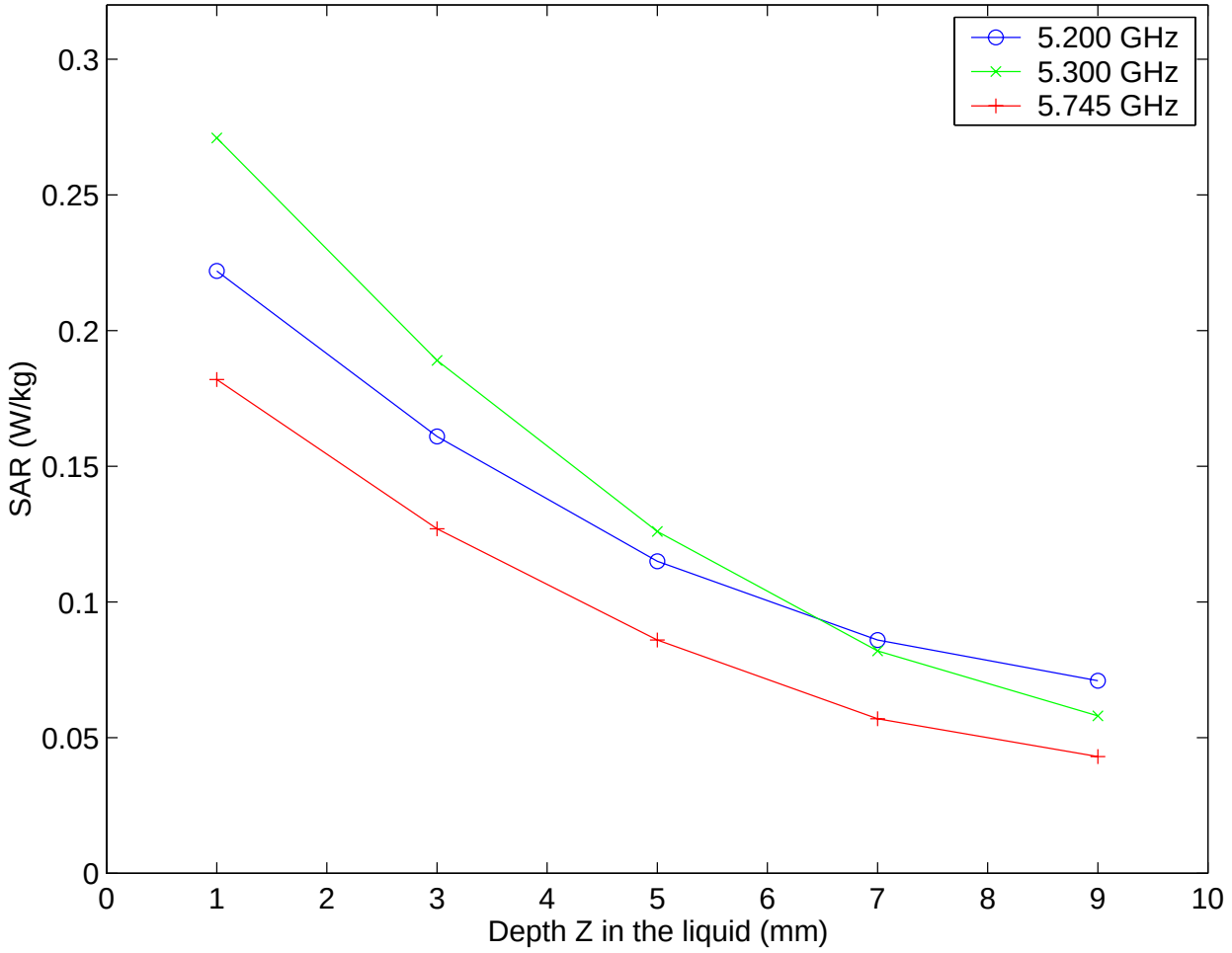

Fig. h. Plot of the SAR variations as a function of depth Z in the liquid for locations of the highest SAR (from Tables d-f) for Edge-on position (Configuration 2) for Compal Model L1S PC for the 802.11a left-side antenna.

Table a. **End-on position (Configuration 3).** The SARs measured for the left-side antenna for Quantatw Model ZG1S PC for the normal mode at 5.20 GHz (see Fig. a for the coarse scan).

1-g SAR = 0.087 W/kg

a. At depth of 1 mm

0.120	0.129	0.130	0.117	0.122
0.098	0.121	0.112	0.124	0.121
0.128	0.162	0.158	0.125	0.111
0.121	0.127	0.148	0.118	0.123
0.129	0.130	0.136	0.100	0.101

b. At depth of 3 mm

0.103	0.103	0.104	0.096	0.107
0.085	0.097	0.088	0.098	0.095
0.104	0.125	0.121	0.099	0.088
0.098	0.110	0.116	0.097	0.096
0.100	0.104	0.105	0.092	0.075

c. At depth of 5 mm

0.088	0.084	0.084	0.081	0.094
0.073	0.077	0.070	0.079	0.075
0.086	0.097	0.091	0.078	0.070
0.081	0.096	0.092	0.081	0.075
0.079	0.085	0.082	0.083	0.054

d. At depth of 7 mm

0.077	0.071	0.069	0.071	0.082
0.064	0.062	0.058	0.066	0.064
0.073	0.076	0.070	0.064	0.059
0.070	0.084	0.075	0.070	0.059
0.065	0.072	0.066	0.072	0.040

e. At depth of 9 mm

0.069	0.063	0.061	0.066	0.071
0.058	0.052	0.051	0.060	0.060
0.065	0.064	0.057	0.056	0.054
0.065	0.074	0.065	0.064	0.050
0.058	0.065	0.057	0.059	0.031

Table b. **End-on position (Configuration 3).** The SARs measured for the left-side antenna for Quantatw Model ZG1S PC for the normal mode at 5.30 GHz (see Fig. b for the coarse scan).

1-g SAR = 0.098 W/kg

a. At depth of 1 mm

0.181	0.191	0.178	0.206	0.214
0.147	0.168	0.196	0.190	0.189
0.116	0.140	0.167	0.198	0.209
0.096	0.138	0.164	0.227	0.203
0.069	0.116	0.175	0.212	0.207

b. At depth of 3 mm

0.128	0.139	0.135	0.149	0.150
0.113	0.120	0.145	0.139	0.133
0.091	0.101	0.117	0.141	0.147
0.083	0.099	0.114	0.155	0.140
0.052	0.091	0.127	0.141	0.137

c. At depth of 5 mm

0.089	0.100	0.103	0.106	0.101
0.086	0.085	0.106	0.100	0.092
0.072	0.072	0.080	0.097	0.100
0.072	0.070	0.078	0.100	0.093
0.040	0.072	0.089	0.088	0.083

d. At depth of 7 mm

0.063	0.072	0.080	0.075	0.068
0.067	0.062	0.080	0.071	0.064
0.058	0.052	0.054	0.067	0.069
0.062	0.049	0.054	0.063	0.060
0.032	0.058	0.062	0.053	0.045

e. At depth of 9 mm

0.050	0.056	0.067	0.056	0.049
0.056	0.052	0.065	0.054	0.049
0.049	0.042	0.040	0.050	0.052
0.053	0.038	0.043	0.044	0.042
0.029	0.049	0.045	0.037	0.022

Table c. **End-on position (Configuration 3).** The SARs measured for the left-side antenna for Quantatw Model ZG1S PC for the normal mode at 5.745 GHz (see Fig. c for the coarse scan).

1-g SAR = 0.077 W/kg

a. At depth of 1 mm

0.106	0.136	0.110	0.137	0.101
0.112	0.106	0.112	0.117	0.114
0.085	0.095	0.107	0.112	0.117
0.094	0.107	0.130	0.131	0.126
0.099	0.094	0.114	0.096	0.092

b. At depth of 3 mm

0.086	0.101	0.094	0.106	0.084
0.093	0.082	0.094	0.094	0.087
0.073	0.076	0.082	0.091	0.097
0.083	0.089	0.104	0.103	0.098
0.081	0.078	0.088	0.075	0.076

c. At depth of 5 mm

0.071	0.076	0.082	0.081	0.071
0.077	0.065	0.080	0.075	0.067
0.063	0.062	0.065	0.076	0.081
0.074	0.076	0.084	0.082	0.077
0.068	0.066	0.068	0.059	0.064

d. At depth of 7 mm

0.061	0.060	0.074	0.064	0.061
0.066	0.054	0.069	0.062	0.053
0.054	0.053	0.055	0.066	0.068
0.066	0.067	0.069	0.067	0.062
0.059	0.058	0.053	0.047	0.056

e. At depth of 9 mm

0.056	0.052	0.069	0.055	0.056
0.058	0.049	0.063	0.054	0.046
0.046	0.049	0.053	0.061	0.059
0.060	0.063	0.061	0.057	0.054
0.055	0.053	0.043	0.040	0.051

Table d. **Edge-on position (Configuration 2).** The SARs measured for the left-side antenna for Compal Model L1S PC for the normal mode at 5.20 GHz (see Fig. d for the coarse scan).

1-g SAR = 0.117 W/kg

a. At depth of 1 mm

0.150	0.174	0.159	0.199	0.183
0.163	0.184	0.206	0.222	0.192
0.193	0.199	0.193	0.198	0.197
0.188	0.187	0.194	0.163	0.169
0.150	0.187	0.184	0.165	0.152

b. At depth of 3 mm

0.129	0.136	0.126	0.156	0.148
0.130	0.134	0.148	0.161	0.152
0.145	0.147	0.149	0.150	0.148
0.140	0.139	0.148	0.132	0.136
0.122	0.139	0.138	0.125	0.118

c. At depth of 5 mm

0.111	0.107	0.100	0.122	0.119
0.103	0.096	0.104	0.115	0.120
0.109	0.108	0.113	0.114	0.110
0.103	0.104	0.112	0.108	0.111
0.099	0.104	0.102	0.094	0.089

d. At depth of 7 mm

0.094	0.085	0.083	0.098	0.097
0.083	0.071	0.075	0.086	0.097
0.083	0.083	0.086	0.088	0.084
0.078	0.081	0.087	0.089	0.093
0.083	0.080	0.077	0.074	0.065

e. At depth of 9 mm

0.080	0.072	0.074	0.084	0.082
0.070	0.057	0.060	0.071	0.082
0.067	0.072	0.068	0.074	0.069
0.064	0.071	0.073	0.077	0.083
0.072	0.069	0.062	0.063	0.047

Table e. **Edge-on position (Configuration 2).** The SARs measured for the left-side antenna for Compal Model L1S PC for the normal mode at 5.30 GHz (see Fig. e for the coarse scan).

1-g SAR = 0.132W/kg

a. At depth of 1 mm

0.221	0.222	0.246	0.201	0.191
0.228	0.271	0.230	0.240	0.228
0.241	0.242	0.237	0.233	0.212
0.220	0.238	0.219	0.224	0.200
0.220	0.229	0.233	0.201	0.176

b. At depth of 3 mm

0.164	0.169	0.183	0.154	0.149
0.174	0.189	0.170	0.176	0.173
0.177	0.180	0.167	0.165	0.158
0.163	0.168	0.162	0.167	0.150
0.159	0.163	0.166	0.150	0.130

c. At depth of 5 mm

0.120	0.127	0.133	0.117	0.115
0.131	0.126	0.123	0.128	0.130
0.127	0.131	0.115	0.113	0.115
0.118	0.114	0.118	0.123	0.110
0.112	0.113	0.115	0.110	0.093

d. At depth of 7 mm

0.089	0.097	0.096	0.090	0.090
0.099	0.082	0.089	0.094	0.100
0.092	0.095	0.079	0.078	0.083
0.085	0.076	0.087	0.092	0.081
0.080	0.079	0.080	0.082	0.066

e. At depth of 9 mm

0.071	0.079	0.073	0.073	0.074
0.079	0.058	0.069	0.075	0.081
0.070	0.071	0.061	0.059	0.063
0.064	0.054	0.069	0.074	0.062
0.061	0.061	0.063	0.064	0.047

Table f. **Edge-on position (Configuration 2).** The SARs measured for the left-side antenna for Compal Model L1S PC for the normal mode at 5.745 GHz (see Fig. f for the coarse scan).

1-g SAR = 0.093 W/kg

a. At depth of 1 mm

0.138	0.125	0.132	0.167	0.136
0.144	0.160	0.154	0.143	0.135
0.145	0.154	0.167	0.156	0.150
0.171	0.174	0.148	0.182	0.161
0.146	0.169	0.155	0.149	0.160

b. At depth of 3 mm

0.105	0.099	0.106	0.125	0.102
0.104	0.116	0.121	0.110	0.109
0.107	0.115	0.124	0.121	0.105
0.131	0.127	0.110	0.127	0.116
0.117	0.128	0.115	0.113	0.104

c. At depth of 5 mm

0.080	0.080	0.086	0.092	0.076
0.073	0.083	0.095	0.085	0.089
0.079	0.084	0.092	0.093	0.071
0.099	0.090	0.080	0.086	0.082
0.094	0.096	0.084	0.084	0.062

d. At depth of 7 mm

0.062	0.067	0.071	0.069	0.057
0.053	0.063	0.077	0.067	0.074
0.060	0.062	0.070	0.073	0.050
0.076	0.064	0.059	0.057	0.057
0.075	0.071	0.060	0.063	0.035

e. At depth of 9 mm

0.051	0.059	0.061	0.056	0.045
0.044	0.055	0.067	0.056	0.064
0.051	0.050	0.058	0.061	0.040
0.061	0.048	0.046	0.043	0.044
0.062	0.055	0.045	0.047	0.022

Table g. The peak 1-g SARs measured for the Quantatw Model ZG1S PC with built-in Ambit Model ZG1S 802.11a Antenna.

			1-g SAR in W/kg		
PC position relative to the flat phantom	Spacing to the bottom of the phantom	802.11a Antenna	5.20 GHz normal mode	5.30 GHz normal mode	5.745 GHz normal mode
Configuration 1 – "**Above-lap"** position; bottom of PC pressed against bottom of the flat phantom	0 cm	Right-side antenna	0.114	0.084	0.057
		Left-side antenna	<0.02*	<0.02*	<0.02*
Configuration 2 – **"Edge-on"** position; appropriate antenna edge of PC pressed against bottom of the flat phantom	0 cm	Right-side antenna	<0.02*	<0.02*	<0.02*
		Left-side antenna	<0.02*	<0.02*	<0.02*
Configuration 3 – "End-on" position; broader back edge of PC pressed against bottom of the flat phantom	0 cm	Right-side antenna	0.384	0.424	0.290
		Left-side antenna	0.087	0.098	0.077

* Too low to measure, within the noise limit of the SAR measurement system.

Table h. The peak 1-g SARs measured for the Quantatw Model ZI1S PC with built-in Ambit Model Z11S 802.11a Antenna.

			1-g SAR in W/kg		
PC position relative to the flat phantom	Spacing to the bottom of the phantom	802.11a Antenna	5.20 GHz normal mode	5.30 GHz normal mode	5.745 GHz normal mode
Configuration 1 – "**Above-lap"** position; bottom of PC pressed against bottom of the flat phantom	0 cm	Right-side antenna	<0.02*	<0.02*	<0.02*
		Left-side antenna	<0.02*	<0.02*	<0.02*
Configuration 2 – **"Edge-on"** position; appropriate antenna edge of PC pressed against bottom of the flat phantom	0 cm	Right-side antenna	<0.02*	<0.02*	<0.02*
		Left-side antenna	<0.02*	<0.02*	<0.02*
Configuration 3 – "End-on" position; broader back edge of PC pressed against bottom of the flat phantom	0 cm	Right-side antenna	<0.02*	<0.02*	<0.02*
		Left-side antenna	<0.02*	<0.02*	<0.02*

* Too low to measure, within the noise limit of the SAR measurement system.

Table i. The peak 1-g SARs measured for the Compal Model L1S PC with built-in Ambit Model BY27 802.11a Antenna.

			1-g SAR in W/kg		
PC position relative to the flat phantom	Spacing to the bottom of the phantom	802.11a Antenna	5.20 GHz normal mode	5.30 GHz normal mode	5.745 GHz normal mode
Configuration 1 – "**Above-lap"** position; bottom of PC pressed against bottom of the flat phantom	0 cm	Right-side antenna	<0.02*	<0.02*	<0.02*
		Left-side antenna	<0.02*	<0.02*	<0.02*
Configuration 2 – **"Edge-on"** position; appropriate antenna edge of PC pressed against bottom of the flat phantom	0 cm	Right-side antenna	0.233	0.306	0.352
		Left-side antenna	0.117	0.132	0.093
Configuration 3 – "End-on" position; broader back edge of PC pressed against bottom of the flat phantom	0 cm	Right-side antenna	<0.02*	<0.02*	<0.02*
		Left-side antenna	<0.02*	<0.02*	<0.02*

* Too low to measure, within the noise limit of the SAR measurement system.

APPENDIX I

SAR System Verification for April 15, 2003

The measured SAR distribution for the peak 1-g SAR region using WR187 rectangular waveguide irradiation system

For April 15, 2003 – The SAR plot at 5.25 GHz

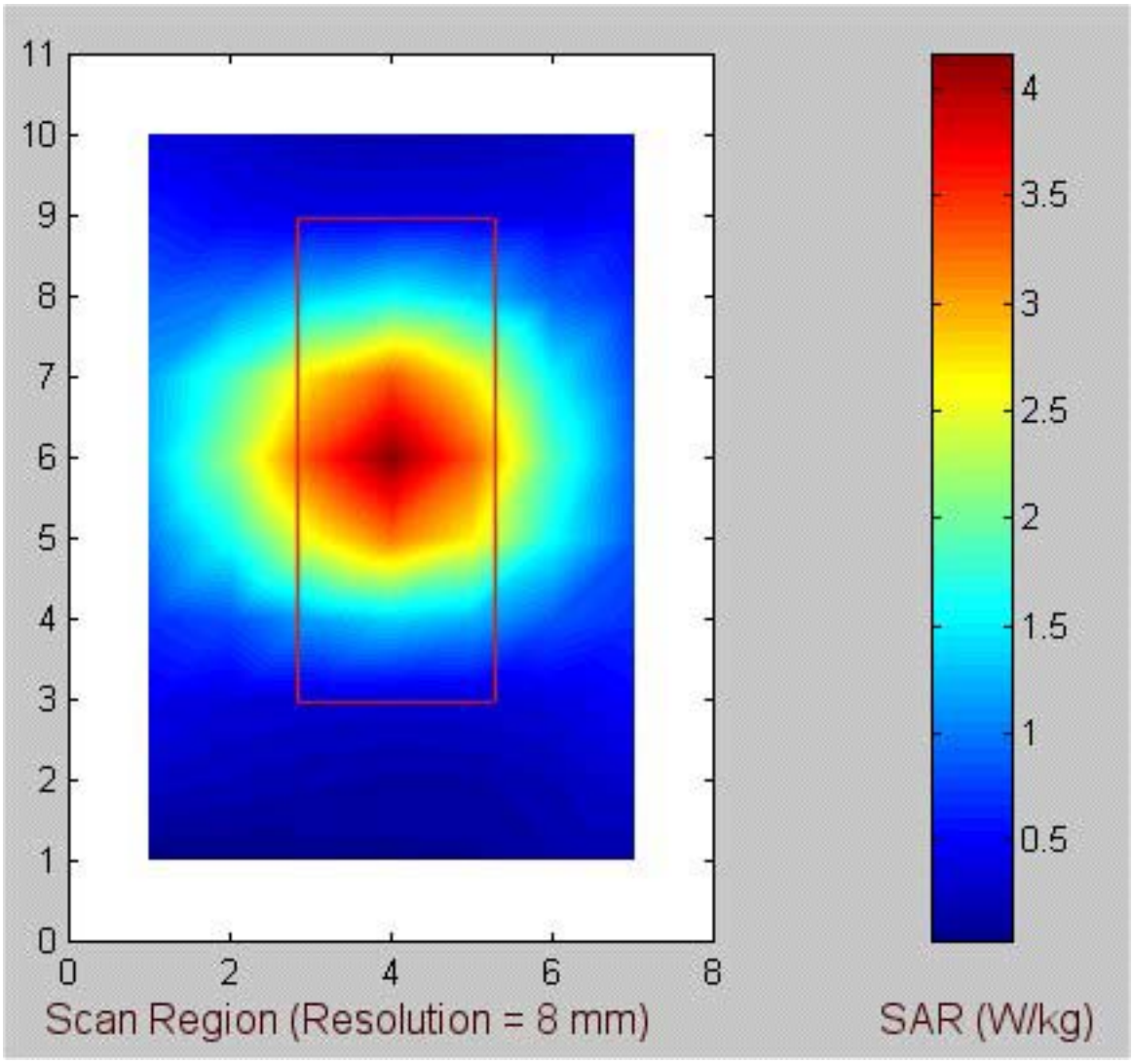

Fig. I.1. Coarse scans of the measured SAR distribution for the WR187 rectangular waveguide irradiation system used for system verification at 5.25 GHz. Also shown is the outline of the rectangular waveguide overlaid on the SAR contours. Radiated power = 100 mW.

1-g SAR at 5.25 GHz = 3.592 W/kg

a. At depth of 1 mm

7.524	7.750	7.815	7.580	7.278
8.011	8.214	8.225	8.000	7.693
8.245	8.469	8.506	8.228	7.873
8.239	8.436	8.471	8.200	7.881
8.018	8.181	8.247	7.961	7.591

b. At depth of 3 mm

4.816	4.963	5.010	4.859	4.677
5.133	5.269	5.273	5.132	4.937
5.285	5.416	5.451	5.260	5.034
5.262	5.405	5.421	5.248	5.049
5.131	5.240	5.279	5.090	4.864

c. At depth of 5 mm

2.737	2.823	2.855	2.770	2.677
2.922	3.005	3.004	2.926	2.819
3.011	3.071	3.102	2.980	2.853
2.979	3.074	3.078	2.979	2.874
2.915	2.981	2.999	2.885	2.769

d. At depth of 7 mm

1.289	1.331	1.350	1.312	1.277
1.379	1.425	1.419	1.384	1.340
1.421	1.433	1.458	1.388	1.330
1.389	1.444	1.440	1.394	1.355
1.369	1.402	1.407	1.346	1.305

e. At depth of 9 mm

0.472	0.487	0.493	0.485	0.476
0.502	0.526	0.518	0.504	0.499
0.517	0.501	0.520	0.484	0.464
0.492	0.514	0.508	0.493	0.492
0.492	0.505	0.503	0.472	0.473

For April 15, 2003 – The SAR plot at 5.8 GHz

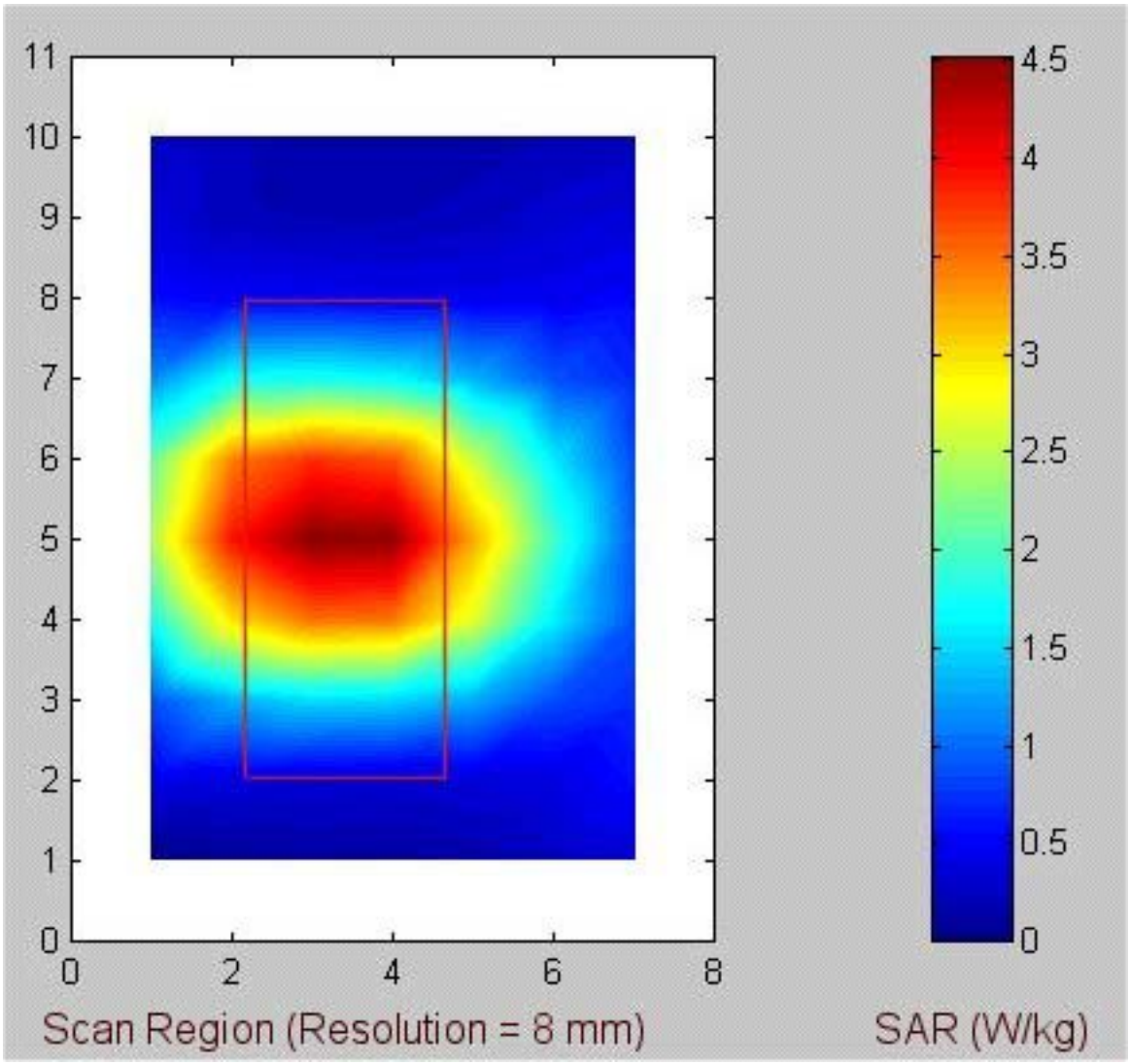

Fig. I.2. Coarse scans of the measured SAR distribution for the WR187 rectangular waveguide irradiation system used for system verification at 5.8 GHz. Also shown is the outline of the rectangular waveguide overlaid on the SAR contours. Radiated power = 100 mW.

1-g SAR at 5.8 GHz = 3.939 W/kg

a. At depth of 1 mm

8.586	8.730	8.650	8.490	8.296
9.138	9.310	9.132	9.060	8.751
9.461	9.616	9.544	9.258	9.002
9.442	9.663	9.498	9.280	8.976
9.288	9.396	9.178	8.979	8.615

b. At depth of 3 mm

5.410	5.497	5.455	5.357	5.223
5.732	5.845	5.742	5.690	5.508
5.936	6.028	5.994	5.815	5.664
5.951	6.068	5.954	5.820	5.625
5.823	5.911	5.777	5.633	5.415

c. At depth of 5 mm

2.985	3.030	3.018	2.963	2.880
3.134	3.203	3.155	3.121	3.034
3.250	3.295	3.287	3.192	3.116
3.285	3.326	3.252	3.181	3.070
3.181	3.250	3.179	3.080	2.972

d. At depth of 7 mm

1.312	1.331	1.338	1.310	1.268
1.347	1.384	1.372	1.355	1.329
1.402	1.416	1.422	1.388	1.358
1.444	1.439	1.392	1.362	1.311
1.363	1.415	1.385	1.321	1.286

e. At depth of 9 mm

0.391	0.399	0.415	0.397	0.386
0.369	0.389	0.392	0.391	0.393
0.393	0.390	0.399	0.403	0.391
0.428	0.405	0.375	0.366	0.348
0.367	0.404	0.395	0.357	0.358