SAR COMPLIANCE TESTING OF SIEMENS MODELS 4000 AND 4200 PORTABLE TELEPHONES

FINAL TECHNICAL REPORT

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I. Introduction

The U.S. Federal Communications Commission (FCC) has adopted limits of human exposure to RF emissions from mobile and portable devices that are regulated by the FCC [1]. The FCC has also issued Supplement C (Edition 97-01) to OET Bulletin 65 defining both the measurement and the computational procedures that should be followed for evaluating compliance of mobile and portable devices with FCC limits for human exposure to radiofrequency emissions [2].

The Siemens Models 4000 and 4200 Portable Telephones radiate a peak power of up to 19.5 dBm measured by the Communication Certification Laboratory (CCL), Salt Lake City, Utah. However, both of the telephones operate in the TDMA mode with a pulse duration of 0.88 ms for each of the 10 ms intervals. With a duty cycle of 0.088, the source-based time-averaged radiated power can be as high as 7.84 mW. The frequency band of transmission channels for both Models 4000 and 4200 Portable Telephones can vary from 2401 MHz (channel 00) to 2482 MHz (channel 94, Hex display band channel 5E). Since each of the telephones may be held either against the head or against the torso, the SAR compliance testing was done for both of the handsets held against the phantom model of the head or a planar lossy tissue-simulant model as a surrogate of the torso.

Both Models 4000 and 4200 Portable Telephones use internal antennas printed or mounted close to the top edge of the respective handsets on the right hand side. Thus as recommended in [2], both of the telephones were placed against the left ear for SAR measurements against the head phantom. This allows the antenna to be in close proximity to the model of the head resulting in higher SARs allowing, thereby, the worst case determination of absorbed energy in the user's head [3]. Also as recommended in [2], the SAR distributions were measured without the model of a hand to determine the worse case SARs.

II. The Tissue-Simulant Models

For measurements of the SAR distributions for telephones held against the head, we have used the Utah Experimental Model that is described in detail in [4]. This model uses a lossy outer shell of the following approximate dimensions:

Axial length from chin to top of the head = 26 cm
Distance from location of the ear canal to top of the head = 14.7 cm
Width from side to side = 16.5 cm

These dimensions are typical for adult human beings. The shell thickness of the head and neck model is approximately 4-7 mm, which is typical of the human skull thickness. The thickness for the ear region is, however, considerably less and is only about 3 mm.

A photograph of both of the Siemens Models 4000 and 4200 Portable Telephones is given in Fig. 1. The head phantom model with the Siemens Model 4000 (black front) held against it is shown in Fig. 2. The head-simulant model shown in Fig. 2 has, in the past, been used for comparison of the measured peak 1-g SARs with those obtained with the Utah FDTD Code for ten wireless telephones, five at 835 MHz and five for PCS (1900 MHz) frequencies [see Table 1]. The numerical SARs were obtained using the anatomically-based, 15-tissue Utah model of the head and neck with a resolution of 1.974 × 1.974 × 3.0 mm that has been described in the scientific literature through numerous publications (see e.g. references 3, 5). The measured and calculated 1-g SARs for these ten telephones, including some research test samples from diverse manufacturers using a variety of radiating antennas for different source-based time-averaged powers are compared in Table 1 [4]. Even though widely different peak 1-g SARs from 0.13 to 5.41 W/kg are obtained because of the variety of antennas and handsets, agreement between the calculated and the measured data is excellent and generally within ± 25 percent.

These tests validate the Utah Experimental Phantom Model as being capable of giving peak 1-g SARs that are in good agreement with the SARs obtained with the realistic, anatomically-based model of the human head and neck both at 835 and 1900 MHz.

The head and neck and the upper part of the torso of the model are filled with a liquid with measured electrical properties (dielectric constant and conductivity) close to the average properties of the brain for white and gray matters in the frequency band 2401-2482 MHz. Taken from the FCC Website (http://www.fcc.gov/fcc-bin/dielec.sh), the average dielectric properties for the brain are: $\varepsilon_r = 42.5$ and $\sigma = 1.51$ S/m. For a composition of 43.0% water, 54.7% sugar, 1.3% salt (NaCℓ) and 1.0% HEC, we have measured the values of $\varepsilon_r = 42.7 \pm 1.3$ and $\sigma = 1.50 \pm 0.04$ S/m at the midband frequency of 2444 MHz using the HP Model 85070 B Dielectric Probe in conjunction with HP Model 8720 C Network Analyzer (50 MHz - 20 GHz). Since these values are very close to the desired values for ε_r and σ, this composition was, therefore, used as the biological phantom material to fill the head-simulant model shown in Fig. 2.

For the SAR distributions of the telephones placed against the torso, we have used a planar rectangular box phantom model shown in Fig. 3. This box phantom of external dimensions 30 × 50 cm is filled with a tissue-simulant fluid up to a depth of 15.5 cm. To maintain flatness of the phantom, the rectangular box is made of acrylic ($\varepsilon_r = 2.56$) of thickness 6.35 mm. The tissue-simulant fluid uses a composition developed at the University of Utah which consists of 62.0% water, 37.0% sugar and 1% HEC. For this composition, we have measured the dielectric properties using the aforementioned Hewlett Packard (HP) Model 85070B Dielectric Probe in conjunction with HP Model 8720C Network Analyzer (50 MHz-20 GHz). The measured dielectric properties at the midband frequency of 2444 MHz are as follows: $\varepsilon_r = 51.3 \pm 1.7$ and $\sigma = 1.78 \pm 0.07$ S/m. From the FCC Website, we obtain the desired dielectric properties to simulate the muscle tissue to be $\varepsilon_r = 53.6$ and $\sigma = 1.81$ S/m. Thus, the measured properties for the muscle-simulant fluid are close to the desired values.

The SAR distributions were measured using the automated 3-D stepper-motor driven SAR measurement system described in [4].

III. The Measured SAR Distributions for Siemens Models 4000 and 4200 Portable Telephones

The SAR distributions were measured for Models 4000 and 4200 Portable Telephones held against the head-simulant model (Fig. 2) and the planar muscle-simulant model representative of torso (Fig. 3), respectively. For each of the telephones, the SAR distributions were measured for the handsets radiating maximum peaks power output for the low end channel (channel 00 at 2401 MHz), the midband channel (actual channel 50, hex channel 32 at 2444 MHz) and high-end channel (actual channel 94, hex channel 5E at 2482 MHz), respectively. The measured SAR distributions are given in Tables 2-13. The measured peak 1-g SARs are summarized in Table 14. All of the measured peak 1-g SARs are considerably smaller than the SAR limit of 1.6 W/kg given in the FCC 96-326 Guidelines [1].

REFERENCES

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5. O. P. Gandhi, "FDTD in Bioelectromagnetics: Safety Assessment and Medical Applications," Chapter 11, pp. 613-651 in *Advances in Computational Electrodynamics: The FDTD Method*, edited by A. Taflove, Artech House Inc., Dedham, MA, 1998.

Table 1. Comparison of the experimentally measured and FDTD-calculated peak 1-g SARs for ten wireless telephones, five each at 835 and 1900 MHz, respectively [4].

	Time-Averaged Radiated Power mW	Using Experimental Model W/kg	Numerical Method W/kg
Cellular Telephones at 835 MHz			
Telephone A	600	4.02	3.90
Telephone B	600	5.41	4.55
Telephone C	600	4.48	3.52
Telephone D	600	3.21	2.80
Telephone E	600	0.54	0.53
PCS Telephones at 1900 MHz			
Telephone A	125	1.48	1.47
Telephone B	125	0.13	0.15
Telephone C	125	0.65	0.81
Telephone D	125	1.32	1.56
Telephone E	99.3	1.41	1.25

Table 2. **The SARs measured for the head model for Siemens Model 4000 at the low band frequency of 2401 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.049 W/kg

a. At depth of 1 mm

0.088	0.087	0.083	0.077	0.076
0.092	0.095	0.094	0.089	0.088
0.089	0.087	0.088	0.089	0.089
0.083	0.082	0.082	0.080	0.083
0.076	0.076	0.078	0.081	0.083

b. At depth of 3 mm

0.067	0.066	0.063	0.058	0.055
0.070	0.071	0.070	0.066	0.063
0.067	0.065	0.066	0.066	0.064
0.063	0.062	0.063	0.060	0.060
0.058	0.059	0.059	0.061	0.060

c. At depth of 5 mm

0.050	0.049	0.046	0.042	0.037
0.051	0.052	0.050	0.047	0.043
0.050	0.047	0.048	0.047	0.044
0.046	0.045	0.046	0.044	0.042
0.043	0.044	0.043	0.044	0.042

d. At depth of 7 mm

0.036	0.035	0.032	0.029	0.024
0.037	0.036	0.034	0.032	0.028
0.036	0.033	0.033	0.032	0.029
0.032	0.031	0.032	0.031	0.028
0.031	0.032	0.031	0.031	0.029

e. At depth of 9 mm

0.025	0.024	0.022	0.019	0.016
0.026	0.024	0.023	0.021	0.019
0.025	0.023	0.022	0.022	0.020
0.023	0.021	0.022	0.020	0.019
0.022	0.023	0.022	0.022	0.020

Table 3. **The SARs measured for the head model for Siemens Model 4000 at the midband frequency of 2444 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR =0.045 W/kg

a. At depth of 1 mm

0.069	0.068	0.067	0.068	0.071
0.071	0.069	0.069	0.070	0.070
0.069	0.073	0.073	0.075	0.077
0.067	0.073	0.080	0.072	0.082
0.072	0.075	0.077	0.082	0.089

b. At depth of 3 mm

0.052	0.051	0.051	0.052	0.053
0.054	0.054	0.053	0.054	0.054
0.053	0.057	0.057	0.058	0.060
0.053	0.057	0.061	0.058	0.063
0.057	0.058	0.061	0.064	0.067

c. At depth of 5 mm

0.038	0.037	0.037	0.039	0.038
0.041	0.041	0.040	0.041	0.041
0.039	0.043	0.043	0.044	0.045
0.041	0.044	0.046	0.046	0.048
0.044	0.045	0.048	0.049	0.049

d. At depth of 7 mm

0.027	0.026	0.027	0.028	0.028
0.030	0.030	0.029	0.030	0.031
0.029	0.032	0.032	0.033	0.034
0.031	0.033	0.034	0.036	0.036
0.033	0.033	0.037	0.037	0.036

e. At depth of 9 mm

0.019	0.018	0.019	0.020	0.020
0.021	0.022	0.022	0.022	0.023
0.021	0.024	0.024	0.024	0.026
0.023	0.025	0.025	0.027	0.027
0.026	0.025	0.028	0.028	0.027

Table 4. **The SARs measured for the head model for Siemens Model 4000 at the high band frequency of 2482 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.049 W/kg

a. At depth of 1 mm

0.074	0.069	0.070	0.072	0.072
0.070	0.078	0.077	0.075	0.081
0.072	0.078	0.084	0.081	0.086
0.074	0.081	0.083	0.083	0.091
0.083	0.084	0.090	0.083	0.088

b. At depth of 3 mm

0.057	0.054	0.054	0.055	0.055
0.055	0.060	0.060	0.060	0.062
0.056	0.061	0.064	0.064	0.066
0.059	0.063	0.066	0.065	0.069
0.063	0.065	0.069	0.066	0.066

c. At depth of 5 mm

0.042	0.041	0.042	0.042	0.042
0.042	0.045	0.045	0.046	0.046
0.043	0.047	0.048	0.049	0.049
0.046	0.048	0.051	0.051	0.052
0.048	0.050	0.052	0.051	0.048

d. At depth of 7 mm

0.030	0.030	0.031	0.031	0.031
0.031	0.033	0.033	0.035	0.034
0.032	0.035	0.035	0.037	0.036
0.035	0.036	0.039	0.038	0.039
0.036	0.037	0.039	0.039	0.035

e. At depth of 9 mm

0.021	0.022	0.023	0.023	0.023
0.023	0.024	0.024	0.027	0.025
0.024	0.026	0.026	0.028	0.027
0.027	0.027	0.029	0.029	0.029
0.027	0.029	0.029	0.029	0.026

Table 5. **The SARs measured for the head model for Siemens Model 4200 at the low band frequency of 2401 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.093 W/kg

a. At depth of 1 mm

0.145	0.158	0.165	0.161	0.161
0.152	0.162	0.162	0.155	0.156
0.147	0.157	0.152	0.150	0.154
0.143	0.149	0.147	0.148	0.152
0.137	0.142	0.135	0.141	0.146

b. At depth of 3 mm

0.113	0.123	0.127	0.124	0.121
0.117	0.125	0.124	0.118	0.118
0.115	0.122	0.118	0.115	0.115
0.111	0.116	0.114	0.113	0.114
0.108	0.110	0.106	0.108	0.110

c. At depth of 5 mm

0.086	0.094	0.095	0.093	0.088
0.088	0.094	0.093	0.087	0.086
0.087	0.091	0.088	0.086	0.083
0.085	0.089	0.087	0.084	0.083
0.083	0.084	0.081	0.081	0.080

d. At depth of 7 mm

0.064	0.069	0.069	0.067	0.062
0.064	0.068	0.067	0.062	0.061
0.065	0.067	0.065	0.062	0.058
0.064	0.065	0.064	0.061	0.059
0.063	0.063	0.061	0.059	0.057

e. At depth of 9 mm

0.046	0.049	0.049	0.047	0.043
0.046	0.049	0.048	0.043	0.042
0.047	0.047	0.046	0.044	0.041
0.047	0.047	0.046	0.043	0.041
0.046	0.046	0.044	0.042	0.041

Table 6. **The SARs measured for the head model for Siemens Model 4200 at the midband frequency of 2444 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.091 W/kg

a. At depth of 1 mm

0.121	0.128	0.129	0.126	0.131
0.145	0.151	0.151	0.151	0.140
0.165	0.170	0.170	0.168	0.162
0.163	0.166	0.162	0.160	0.160
0.156	0.158	0.153	0.158	0.160

b. At depth of 3 mm

0.093	0.097	0.098	0.095	0.096
0.112	0.116	0.116	0.114	0.104
0.127	0.129	0.129	0.127	0.121
0.125	0.127	0.123	0.122	0.119
0.121	0.121	0.118	0.119	0.118

c. At depth of 5 mm

0.069	0.072	0.071	0.068	0.067
0.084	0.087	0.087	0.083	0.074
0.094	0.096	0.095	0.092	0.087
0.094	0.094	0.090	0.090	0.086
0.090	0.090	0.087	0.087	0.084

d. At depth of 7 mm

0.049	0.051	0.050	0.048	0.045
0.061	0.063	0.063	0.058	0.051
0.068	0.069	0.068	0.065	0.061
0.068	0.067	0.064	0.064	0.060
0.066	0.065	0.063	0.062	0.058

e. At depth of 9 mm

0.035	0.035	0.035	0.032	0.030
0.044	0.044	0.044	0.040	0.035
0.048	0.048	0.047	0.044	0.041
0.048	0.047	0.045	0.044	0.041
0.047	0.046	0.044	0.043	0.041

Table 7. **The SARs measured for the head model for Siemens Model 4200 at the high band frequency of 2482 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.098 W/kg

a. At depth of 1 mm

0.130	0.142	0.145	0.141	0.143
0.154	0.165	0.173	0.169	0.161
0.176	0.183	0.185	0.187	0.185
0.171	0.174	0.171	0.179	0.178
0.159	0.165	0.167	0.165	0.170

b. At depth of 3 mm

0.100	0.109	0.109	0.106	0.106
0.120	0.127	0.131	0.128	0.118
0.135	0.140	0.141	0.141	0.136
0.132	0.133	0.130	0.134	0.131
0.122	0.126	0.126	0.125	0.125

c. At depth of 5 mm

0.075	0.080	0.080	0.077	0.075
0.091	0.094	0.096	0.093	0.084
0.101	0.104	0.104	0.102	0.096
0.099	0.099	0.096	0.097	0.093
0.091	0.093	0.093	0.091	0.088

d. At depth of 7 mm

0.054	0.057	0.056	0.054	0.051
0.067	0.068	0.068	0.066	0.057
0.073	0.075	0.074	0.072	0.066
0.072	0.071	0.068	0.068	0.063
0.066	0.067	0.066	0.064	0.060

e. At depth of 9 mm

0.038	0.040	0.037	0.036	0.034
0.048	0.048	0.047	0.044	0.038
0.052	0.052	0.051	0.049	0.044
0.051	0.050	0.047	0.046	0.042
0.047	0.047	0.045	0.044	0.041

Table 8. **The SARs measured for the muscle-simulant planar phantom for Siemens Model 4000 at the low band frequency of 2401 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.128 W/kg

a. At depth of 1 mm

0.200	0.202	0.207	0.205	0.201
0.199	0.209	0.213	0.216	0.207
0.204	0.215	0.222	0.215	0.210
0.204	0.215	0.211	0.213	0.207
0.197	0.207	0.209	0.204	0.196

b. At depth of 3 mm

0.155	0.157	0.159	0.159	0.156
0.154	0.161	0.164	0.165	0.160
0.158	0.165	0.169	0.165	0.162
0.157	0.164	0.161	0.162	0.158
0.151	0.158	0.159	0.155	0.149

c. At depth of 5 mm

0.118	0.120	0.120	0.120	0.119
0.118	0.122	0.123	0.124	0.121
0.120	0.124	0.126	0.123	0.121
0.118	0.122	0.120	0.119	0.118
0.113	0.117	0.118	0.115	0.110

d. At depth of 7 mm

0.088	0.090	0.089	0.090	0.089
0.088	0.090	0.091	0.092	0.090
0.090	0.092	0.092	0.091	0.090
0.087	0.089	0.088	0.087	0.087
0.084	0.086	0.086	0.083	0.078

e. At depth of 9 mm

0.067	0.067	0.066	0.068	0.067
0.066	0.068	0.068	0.069	0.068
0.068	0.068	0.068	0.067	0.067
0.065	0.066	0.065	0.064	0.064
0.062	0.063	0.063	0.060	0.055

Table 9. **The SARs measured for the muscle-simulant planar phantom for Siemens Model 4000 at the midband frequency of 2444 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.132 W/kg

a. At depth of 1 mm

0.211	0.221	0.220	0.223	0.222
0.211	0.221	0.223	0.220	0.221
0.206	0.216	0.225	0.222	0.216
0.209	0.213	0.213	0.214	0.209
0.195	0.202	0.205	0.204	0.199

b. At depth of 3 mm

0.164	0.171	0.170	0.173	0.171
0.165	0.171	0.173	0.170	0.169
0.161	0.166	0.172	0.170	0.165
0.159	0.162	0.164	0.163	0.160
0.151	0.155	0.157	0.156	0.153

c. At depth of 5 mm

0.125	0.128	0.129	0.131	0.129
0.126	0.130	0.131	0.129	0.127
0.123	0.125	0.129	0.127	0.123
0.118	0.121	0.123	0.122	0.119
0.114	0.116	0.116	0.116	0.114

d. At depth of 7 mm

0.094	0.096	0.096	0.097	0.095
0.095	0.097	0.097	0.096	0.093
0.092	0.093	0.095	0.094	0.091
0.087	0.089	0.090	0.089	0.088
0.085	0.085	0.085	0.085	0.083

e. At depth of 9 mm

0.072	0.071	0.072	0.073	0.071
0.072	0.072	0.073	0.072	0.069
0.069	0.069	0.070	0.070	0.067
0.064	0.066	0.067	0.066	0.065
0.063	0.062	0.062	0.063	0.060

Table 10. **The SARs measured for the muscle-simulant planar phantom for Siemens Model 4000 at the high band frequency of 2482 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.125 W/kg

a. At depth of 1 mm

0.203	0.218	0.217	0.215	0.210
0.207	0.216	0.220	0.208	0.206
0.202	0.203	0.201	0.209	0.206
0.192	0.197	0.199	0.203	0.195
0.189	0.195	0.195	0.194	0.188

b. At depth of 3 mm

0.157	0.167	0.167	0.165	0.160
0.160	0.165	0.166	0.161	0.160
0.155	0.156	0.156	0.159	0.156
0.148	0.150	0.154	0.154	0.149
0.144	0.148	0.148	0.146	0.141

c. At depth of 5 mm

0.119	0.126	0.125	0.124	0.120
0.121	0.123	0.123	0.122	0.121
0.117	0.118	0.118	0.117	0.115
0.112	0.112	0.116	0.114	0.112
0.108	0.110	0.110	0.107	0.103

d. At depth of 7 mm

0.089	0.093	0.093	0.091	0.089
0.090	0.090	0.089	0.091	0.089
0.087	0.087	0.088	0.085	0.083
0.083	0.083	0.086	0.083	0.082
0.080	0.080	0.080	0.076	0.073

e. At depth of 9 mm

0.067	0.069	0.069	0.067	0.066
0.068	0.067	0.065	0.069	0.066
0.065	0.065	0.066	0.062	0.061
0.062	0.061	0.064	0.061	0.060
0.059	0.059	0.058	0.055	0.052

Table 11. **The SARs measured for the muscle-simulant planar phantom for Siemens Model 4200 at the low band frequency of 2401 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.277 W/kg

a. At depth of 1 mm

0.446	0.456	0.461	0.464	0.451
0.464	0.475	0.480	0.472	0.464
0.473	0.478	0.481	0.479	0.469
0.457	0.474	0.479	0.471	0.461
0.447	0.457	0.469	0.466	0.454

b. At depth of 3 mm

0.338	0.346	0.350	0.350	0.340
0.351	0.359	0.361	0.355	0.348
0.356	0.360	0.364	0.360	0.352
0.345	0.357	0.360	0.355	0.347
0.336	0.344	0.352	0.347	0.337

c. At depth of 5 mm

0.249	0.255	0.259	0.256	0.248
0.258	0.264	0.264	0.260	0.253
0.260	0.263	0.267	0.263	0.257
0.254	0.262	0.262	0.259	0.252
0.245	0.252	0.255	0.249	0.242

d. At depth of 7 mm

0.178	0.183	0.186	0.182	0.177
0.185	0.189	0.187	0.184	0.179
0.185	0.187	0.191	0.186	0.182
0.182	0.186	0.185	0.184	0.178
0.174	0.179	0.180	0.174	0.168

e. At depth of 9 mm

0.127	0.131	0.133	0.129	0.125
0.132	0.135	0.132	0.130	0.126
0.131	0.133	0.135	0.132	0.128
0.130	0.132	0.130	0.129	0.125
0.122	0.126	0.125	0.121	0.115

Table 12. **The SARs measured for the muscle-simulant planar phantom for Siemens Model 4200 at the midband frequency of 2444 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.241 W/kg

a. At depth of 1 mm

0.401	0.402	0.407	0.401	0.392
0.403	0.413	0.413	0.417	0.405
0.402	0.417	0.422	0.416	0.402
0.400	0.413	0.412	0.410	0.399
0.385	0.398	0.400	0.398	0.390

b. At depth of 3 mm

0.303	0.306	0.308	0.304	0.297
0.307	0.312	0.314	0.314	0.305
0.306	0.316	0.317	0.313	0.304
0.303	0.310	0.310	0.308	0.300
0.291	0.298	0.299	0.299	0.291

c. At depth of 5 mm

0.222	0.226	0.226	0.224	0.218
0.227	0.229	0.231	0.229	0.224
0.227	0.232	0.231	0.228	0.223
0.223	0.225	0.226	0.225	0.218
0.214	0.217	0.216	0.217	0.210

d. At depth of 7 mm

0.159	0.163	0.161	0.161	0.157
0.163	0.164	0.166	0.163	0.160
0.164	0.166	0.164	0.161	0.159
0.160	0.160	0.161	0.159	0.154
0.153	0.153	0.152	0.153	0.146

e. At depth of 9 mm

0.114	0.116	0.115	0.115	0.111
0.117	0.116	0.118	0.115	0.113
0.117	0.118	0.116	0.114	0.112
0.114	0.113	0.113	0.112	0.108
0.108	0.107	0.106	0.107	0.101

Table 13. **The SARs measured for the muscle-simulant planar phantom for Siemens Model 4200 at the high band frequency of 2482 MHz.** The SARs in W/kg are measured with a step size of 2 mm for the highest SAR region of the model.

1-g SAR = 0.211 W/kg

a. At depth of 1 mm

0.348	0.350	0.359	0.353	0.345
0.356	0.369	0.368	0.363	0.351
0.353	0.365	0.362	0.361	0.353
0.346	0.354	0.359	0.358	0.352
0.337	0.343	0.347	0.347	0.343

b. At depth of 3 mm

0.264	0.268	0.271	0.268	0.261
0.270	0.279	0.278	0.273	0.266
0.267	0.275	0.274	0.273	0.268
0.262	0.269	0.271	0.269	0.264
0.255	0.259	0.259	0.259	0.255

c. At depth of 5 mm

0.195	0.199	0.199	0.197	0.192
0.199	0.205	0.204	0.199	0.195
0.196	0.202	0.202	0.200	0.197
0.193	0.198	0.198	0.197	0.193
0.187	0.190	0.187	0.187	0.182

d. At depth of 7 mm

0.141	0.145	0.143	0.142	0.138
0.143	0.147	0.146	0.142	0.140
0.141	0.144	0.145	0.143	0.142
0.139	0.143	0.141	0.141	0.137
0.134	0.135	0.132	0.132	0.126

e. At depth of 9 mm

0.101	0.104	0.102	0.101	0.099
0.103	0.105	0.104	0.101	0.099
0.101	0.103	0.104	0.101	0.101
0.100	0.103	0.100	0.100	0.097
0.096	0.095	0.092	0.093	0.086

Table 14. Summary of the measured peak 1-g SARs for Siemens Models 4000 and 4200 Portable Telephones.

Telephone Model	Band	1-g SAR Held against model of the head W/kg	1-g SAR Held against model of the torso W/kg
4000	Low band (2401 MHz)	0.049	0.128
	Midband (2444 MHz)	0.045	0.132
	High band (2482 MHz)	0.049	0.125
4200	Low band (2401 MHz)	0.093	0.277
	Midband (2444 MHz)	0.091	0.241
	High band (2482 MHz)	0.098	0.211

Fig. 1. Photograph of Siemens Models 4000 (black front) and 4200 (silver front) Portable Telephones.

Fig. 2. The Siemens portable telephone (Model 4000 in this case) held against the phantom model of the head for measurement of SAR distribution.

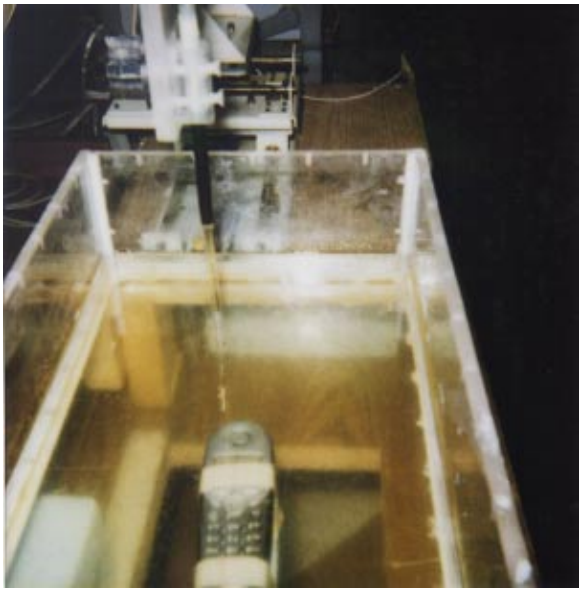

Fig. 3. The Siemens portable telephone (Model 4200 in this case) held against the planar box phantom for measurement of SAR distribution.