To: rscodell@kyocera-wireless.com
Subject: Fwd:
Cc: jmoulton@kyocera-wireless.com

Date: Thu, 29 Mar 2001 13:08:59 -0500 (EST)
From: OET <oetech@fccsun07w.fcc.gov>
To: jmoulton@qcpi.com
Subject:

To: Jay Moulton, Kyocera Wireless Corp.
From: Joe Dichoso
jdichoso@fcc.gov
FCC Application Processing Branch

Re: FCC ID OVFQCP-3035A
Applicant: Kyocera Wireless Corp
Correspondence Reference Number: 18606
731 Confirmation Number: EA100274

1. A belt-clip photo was requested. Please submit the belt-clip photo. Also, several photo's were skipped that were included in the original. The missing photos are needed to resolve the belt-clip/device separation distance issues you had raised.

2. SAR was done with and without the belt-clip for the original filing, therefore, the body-worn statement in the original accounts for both. You did not do body-worn SAR without the belt-clip for this new filing. The same body-worn statement for the original needs to be revised to indicate body-worn is applicable to the tested belt-clip only.

3. New photos of the shielding and metallization were requested. The reply indicates it is in the SAR report and there is none in the SAR report.

4. The reply indicates no new spurious emissions is required. This is not true, spurious emissions were requested via e-mail sent to Jay Moulton on 2/28/01.

5. The field strength of the fundamental (for 800 MHz band) are indicating higher output than those ERP data, please check if there could be output issues. Measured ERP is 646 mW and 479 mW for AMPS and CDMA (as reported in the original filing, not re-measured) but the field strength of spurious emission is indicating 855 mW and 579 mW ERP ? Make sure the new spurious emissions data agrees with the submitted ERP data.

6. The SAR report is describing the device with the original FCC ID (the recalled one), not this new FCC ID. Please correct it.

7. The SAR report describes a body-worn holster. It was tested with a belt-clip ? (see Section 5). We need those photos to verify which is which.

8. The AMPS mode SAR plots for the low and middle channels are identical. Re-submit the correct plots.

.FYI Use SCC-34 tissue parameters for future filings and also report tissue parameters within the operating frequencies of the device instead of using generic frequencies (900 MHz and 1800 MHz, these are out of band). Mid band frequencies for this device are 836 MHz and 1880 MHz.

The items indicated above must be submitted before processing can continue on the above referenced application. Failure to provide the requested information within 60 days of the original e-mail date may result in application dismissal pursuant to Section 2.917 (c) and forfeiture of the filing fee pursuant to section 1.1108.

DO NOT reply to this e-mail by using the Reply button. In order for your response to be processed expeditiously, you must upload your response via the Internet at www.fcc.gov, Electronic Filing, OET Equipment Authorization Electronic Filing. If the response is submitted through Add Attachments, in order to expedite processing, a message which informs the processing staff that a new exhibit has been submitted must also be submitted via Submit Correspondence. Also, please note that partial responses increase processing time and should not be submitted.

Any questions about the content of this correspondence should be directed to the e-mail address listed below the name of the sender.

Respounce

Q1. A belt-clip photo was requested. Please submit the belt-clip photo. Also, several photo's were skipped that were included in the original. The missing photos are needed to resolve the belt-clip/device separation distance issues you had raised.

A1. The following photos show the belt clip and the separation between the belt clip and the body.

Q2. SAR was done with and without the belt-clip for the original filing, therefore, the body-worn statement in the original accounts for both. You did not do body-worn SAR without the belt-clip for this new filing. The same body-worn statement for the original needs to be revised to indicate body-worn is applicable to the tested belt-clip only.

A2. We should have provided the body-worn SAR without the belt-clip. The following data is for body-worn SAR without the belt-clip at a distance of 23.50 mm closest separation to the rear of the phone.

Muscle Tissue Calibration Data Sheet

Reference math : OFF   Title: 04-06-01

MUSCLE DATA

900 MHz

Pt#	Frequency (GHz)	Data real	Data imag
1	0.000300000	756.79	-0.72
2	0.007799250	405.76	359.67
3	0.015298500	207.56	288.62
4	0.022797750	139.95	218.74
5	0.030297000	109.57	173.19
6	0.037796250	95.82	142.04
7	0.045295500	86.93	119.66
8	0.052794750	81.60	104.17
9	0.060294000	78.38	92.61
10	0.067793250	75.97	83.25
11	0.075292500	73.94	75.53
12	0.082791750	72.57	69.37
13	0.090291000	71.43	64.21
14	0.097790250	70.39	59.83
15	0.105289500	69.51	56.21
16	0.112788750	69.16	52.96
17	0.120288000	68.47	50.12
18	0.127787250	68.06	47.72
19	0.135286500	67.51	45.35
20	0.142785750	67.19	43.43
21	0.150285000	66.73	41.65
22	0.157784250	66.51	40.06
23	0.165283500	66.16	38.71
24	0.172782750	65.85	37.43
25	0.180282000	65.58	36.07
26	0.187781250	65.57	35.01
27	0.195280500	65.28	33.98
28	0.202779750	65.10	33.10
29	0.210279000	64.75	32.30
30	0.217778250	64.71	31.55
31	0.225277500	64.51	30.75
32	0.232776750	64.34	30.07
33	0.240276000	64.06	29.41
34	0.247775250	63.98	28.91
35	0.255274500	63.76	28.25
36	0.262773750	63.64	27.83
37	0.270273000	63.51	27.28
38	0.277772250	63.48	26.84
39	0.285271500	63.28	26.34
40	0.292770750	63.20	26.00
41	0.300270000	63.02	25.56
42	0.307769250	62.93	25.25
43	0.315268500	62.76	24.89
44	0.322767750	62.65	24.59
45	0.330267000	62.56	24.24
46	0.337766250	62.43	24.01
47	0.345265500	62.30	23.74
48	0.352764750	62.26	23.46
49	0.360264000	62.13	23.27
50	0.367763250	62.04	22.99
51	0.375262500	61.93	22.72
52	0.382761750	61.82	22.56
53	0.390261000	61.70	22.32
54	0.397760250	61.63	22.19
55	0.405259500	61.51	21.96
56	0.412758750	61.39	21.76

57	0.420258000	61.32	21.63
58	0.427757250	61.22	21.48
59	0.435256500	61.15	21.34
60	0.442755750	61.09	21.21
61	0.450255000	61.02	21.07
62	0.457754250	60.90	20.93
63	0.465253500	60.81	20.79
64	0.472752750	60.69	20.65
65	0.480252000	60.62	20.57
66	0.487751250	60.56	20.44
67	0.495250500	60.48	20.35
68	0.502749750	60.37	20.19
69	0.510249000	60.27	20.16
70	0.517748250	60.23	20.06
71	0.525247500	60.15	19.97
72	0.532746750	60.06	19.90
73	0.540246000	60.00	19.78
74	0.547745250	59.95	19.72
75	0.555244500	59.82	19.65
76	0.562743750	59.78	19.55
77	0.570243000	59.67	19.51
78	0.577742250	59.58	19.44
79	0.585241500	59.54	19.38
80	0.592740750	59.43	19.36
81	0.600240000	59.38	19.23
82	0.607739250	59.30	19.20
83	0.615238500	59.25	19.16
84	0.622737750	59.14	19.11
85	0.630237000	59.11	19.07
86	0.637736250	58.96	19.01
87	0.645235500	58.93	18.99
88	0.652734750	58.89	18.92
89	0.660234000	58.79	18.90
90	0.667733250	58.71	18.84
91	0.675232500	58.63	18.82
92	0.682731750	58.56	18.79
93	0.690231000	58.50	18.77
94	0.697730250	58.43	18.71
95	0.705229500	58.34	18.67
96	0.712728750	58.27	18.64
97	0.720228000	58.22	18.60
98	0.727727250	58.16	18.62
99	0.735226500	58.07	18.59
100	0.742725750	57.99	18.55
101	0.750225000	57.95	18.54
102	0.757724250	57.88	18.50
103	0.765223500	57.79	18.50
104	0.772722750	57.75	18.48
105	0.780222000	57.68	18.43
106	0.787721250	57.61	18.44
107	0.795220500	57.49	18.41
108	0.802719750	57.48	18.35
109	0.810219000	57.41	18.41
110	0.817718250	57.31	18.36
111	0.825217500	57.29	18.37
112	0.832716750	57.21	18.34
113	0.840216000	57.17	18.33
114	0.847715250	57.07	18.35
115	0.855214500	57.03	18.29
116	0.862713750	57.00	18.29

117	0.870213000	56.88	18.32
118	0.877712250	56.78	18.26
119	0.885211500	56.76	18.26
120	0.892710750	56.67	18.27
121	0.900210000	56.64	18.23 $\sigma = 0.913$ S/m
122	0.907709250	56.56	18.26
123	0.915208500	56.51	18.21
124	0.922707750	56.49	18.20
125	0.930207000	56.37	18.23
126	0.937706250	56.33	18.19
127	0.945205500	56.27	18.21
128	0.952704750	56.17	18.19
129	0.960204000	56.14	18.15
130	0.967703250	56.09	18.19
131	0.975202500	56.00	18.18
132	0.982701750	55.93	18.17
133	0.990201000	55.85	18.18
134	0.997700250	55.83	18.17
135	1.005199500	55.77	18.19
136	1.012698750	55.68	18.14
137	1.020198000	55.63	18.11
138	1.027697250	55.59	18.16
139	1.035196500	55.50	18.13
140	1.042695750	55.47	18.09
141	1.050195000	55.44	18.09
142	1.057694250	55.38	18.09
143	1.065193500	55.38	18.07
144	1.072692750	55.31	18.13
145	1.080192000	55.25	18.11
146	1.087691250	55.23	18.13
147	1.095190500	55.18	18.17
148	1.102689750	55.09	18.15
149	1.110189000	55.08	18.17
150	1.117688250	54.98	18.20
151	1.125187500	54.93	18.21
152	1.132686750	54.87	18.24
153	1.140186000	54.82	18.22
154	1.147685250	54.76	18.24
155	1.155184500	54.68	18.26
156	1.162683750	54.62	18.24
157	1.170183000	54.58	18.24
158	1.177682250	54.51	18.28
159	1.185181500	54.43	18.27
160	1.192680750	54.38	18.26
161	1.200180000	54.31	18.29
162	1.207679250	54.26	18.29
163	1.215178500	54.20	18.31
164	1.222677750	54.13	18.29
165	1.230177000	54.09	18.29
166	1.237676250	54.05	18.30
167	1.245175500	53.98	18.28
168	1.252674750	53.93	18.29
169	1.260174000	53.87	18.29
170	1.267673250	53.81	18.28
171	1.275172500	53.76	18.30
172	1.282671750	53.71	18.28
173	1.290171000	53.67	18.29
174	1.297670250	53.61	18.29
175	1.305169500	53.59	18.29
176	1.312668750	53.54	18.33

177	1.320168000	53.49	18.35
178	1.327667250	53.44	18.36
179	1.335166500	53.42	18.36
180	1.342665750	53.36	18.39
181	1.350165000	53.27	18.38
182	1.357664250	53.25	18.40
183	1.365163500	53.16	18.42
184	1.372662750	53.09	18.43
185	1.380162000	53.05	18.44
186	1.387661250	52.99	18.45
187	1.395160500	52.95	18.45
188	1.402659750	52.88	18.47
189	1.410159000	52.83	18.45
190	1.417658250	52.80	18.47
191	1.425157500	52.73	18.48
192	1.432656750	52.70	18.47
193	1.440156000	52.65	18.51
194	1.447655250	52.59	18.52
195	1.455154500	52.57	18.52
196	1.462653750	52.50	18.54
197	1.470153000	52.43	18.52
198	1.477652250	52.42	18.56
199	1.485151500	52.34	18.58
200	1.492650750	52.28	18.57
201	1.500150000	52.24	18.59
202	1.507649250	52.19	18.59
203	1.515148500	52.13	18.61
204	1.522647750	52.07	18.63
205	1.530147000	52.01	18.61
206	1.537646250	51.97	18.64
207	1.545145500	51.92	18.67
208	1.552644750	51.85	18.65
209	1.560144000	51.82	18.65
210	1.567643250	51.77	18.67
211	1.575142500	51.70	18.66
212	1.582641750	51.68	18.66
213	1.590141000	51.61	18.66
214	1.597640250	51.56	18.67
215	1.605139500	51.52	18.70
216	1.612638750	51.48	18.69
217	1.620138000	51.44	18.71
218	1.627637250	51.39	18.72
219	1.635136500	51.34	18.71
220	1.642635750	51.31	18.73
221	1.650135000	51.25	18.75
222	1.657634250	51.20	18.75
223	1.665133500	51.15	18.76
224	1.672632750	51.09	18.76
225	1.680132000	51.05	18.76
226	1.687631250	50.99	18.80
227	1.695130500	50.92	18.79
228	1.702629750	50.88	18.80
229	1.710129000	50.85	18.81
230	1.717628250	50.79	18.79
231	1.725127500	50.76	18.81
232	1.732626750	50.69	18.82
233	1.740126000	50.66	18.81
234	1.747625250	50.62	18.82
235	1.755124500	50.56	18.81
236	1.762623750	50.54	18.81

237	1.770123000	50.47	18.83
238	1.777622250	50.44	18.83
239	1.785121500	50.39	18.85
240	1.792620750	50.35	18.85
241	1.800120000	50.33	18.87
242	1.807619250	50.29	18.88
243	1.815118500	50.24	18.88
244	1.822617750	50.19	18.88
245	1.830117000	50.16	18.89
246	1.837616250	50.11	18.90
247	1.845115500	50.07	18.91
248	1.852614750	50.01	18.92
249	1.860114000	49.98	18.93
250	1.867613250	49.94	18.96
251	1.875112500	49.89	18.97
252	1.882611750	49.84	18.97
253	1.890111000	49.80	18.98
254	1.897610250	49.75	19.00
255	1.905109500	49.71	19.00
256	1.912608750	49.67	19.00
257	1.920108000	49.63	19.01
258	1.927607250	49.56	19.03
259	1.935106500	49.52	19.02
260	1.942605750	49.47	19.03
261	1.950105000	49.43	19.01
262	1.957604250	49.40	19.04
263	1.965103500	49.34	19.03
264	1.972602750	49.31	19.04
265	1.980102000	49.26	19.04
266	1.987601250	49.24	19.05
267	1.995100500	49.19	19.07
268	2.002599750	49.14	19.05
269	2.010099000	49.11	19.06
270	2.017598250	49.06	19.07
271	2.025097500	49.03	19.05
272	2.032596750	49.01	19.08
273	2.040096000	48.95	19.07
274	2.047595250	48.93	19.08
275	2.055094500	48.90	19.08
276	2.062593750	48.85	19.08
277	2.070093000	48.83	19.10
278	2.077592250	48.77	19.10
279	2.085091500	48.75	19.10
280	2.092590750	48.72	19.14
281	2.100090000	48.68	19.14
282	2.107589250	48.65	19.14
283	2.115088500	48.62	19.17
284	2.122587750	48.59	19.17
285	2.130087000	48.57	19.19
286	2.137586250	48.52	19.21
287	2.145085500	48.49	19.20
288	2.152584750	48.47	19.23
289	2.160084000	48.41	19.24
290	2.167583250	48.36	19.24
291	2.175082500	48.33	19.26
292	2.182581750	48.29	19.26
293	2.190081000	48.25	19.29
294	2.197580250	48.20	19.30
295	2.205079500	48.16	19.31
296	2.212578750	48.12	19.34

297	2.220078000	48.09	19.35
298	2.227577250	48.06	19.34
299	2.235076500	48.02	19.38
300	2.242575750	47.96	19.38
301	2.250075000	47.93	19.37
302	2.257574250	47.88	19.39
303	2.265073500	47.85	19.38
304	2.272572750	47.80	19.38
305	2.280072000	47.77	19.41
306	2.287571250	47.71	19.41
307	2.295070500	47.69	19.42
308	2.302569750	47.64	19.42
309	2.310069000	47.61	19.43
310	2.317568250	47.58	19.45
311	2.325067500	47.54	19.45
312	2.332566750	47.52	19.45
313	2.340066000	47.48	19.47
314	2.347565250	47.45	19.46
315	2.355064500	47.43	19.48
316	2.362563750	47.40	19.50
317	2.370063000	47.35	19.50
318	2.377562250	47.32	19.50
319	2.385061500	47.28	19.51
320	2.392560750	47.24	19.54
321	2.400060000	47.20	19.54
322	2.407559250	47.17	19.57
323	2.415058500	47.14	19.59
324	2.422557750	47.11	19.60
325	2.430057000	47.07	19.62
326	2.437556250	47.03	19.63
327	2.445055500	47.01	19.65
328	2.452554750	46.98	19.66
329	2.460054000	46.94	19.68
330	2.467553250	46.88	19.67
331	2.475052500	46.86	19.70
332	2.482551750	46.81	19.69
333	2.490051000	46.79	19.72
334	2.497550250	46.73	19.73
335	2.505049500	46.69	19.75
336	2.512548750	46.65	19.77
337	2.520048000	46.61	19.78
338	2.527547250	46.57	19.80
339	2.535046500	46.54	19.81
340	2.542545750	46.48	19.84
341	2.550045000	46.46	19.84
342	2.557544250	46.40	19.84
343	2.565043500	46.37	19.86
344	2.572542750	46.33	19.86
345	2.580042000	46.29	19.87
346	2.587541250	46.24	19.86
347	2.595040500	46.20	19.87
348	2.602539750	46.16	19.90
349	2.610039000	46.13	19.90
350	2.617538250	46.08	19.91
351	2.625037500	46.04	19.91
352	2.632536750	46.00	19.92
353	2.640036000	45.97	19.92
354	2.647535250	45.92	19.95
355	2.655034500	45.90	19.95
356	2.662533750	45.84	19.96

357	2.670033000	45.82	19.98
358	2.677532250	45.78	19.98
359	2.685031500	45.74	19.98
360	2.692530750	45.69	19.99
361	2.700030000	45.66	19.99
362	2.707529250	45.62	20.01
363	2.715028500	45.59	20.02
364	2.722527750	45.55	20.03
365	2.730027000	45.50	20.03
366	2.737526250	45.47	20.04
367	2.745025500	45.44	20.03
368	2.752524750	45.41	20.05
369	2.760024000	45.36	20.04
370	2.767523250	45.33	20.05
371	2.775022500	45.29	20.06
372	2.782521750	45.25	20.07
373	2.790021000	45.20	20.08
374	2.797520250	45.18	20.09
375	2.805019500	45.13	20.10
376	2.812518750	45.10	20.10
377	2.820018000	45.06	20.12
378	2.827517250	45.03	20.12
379	2.835016500	45.00	20.12
380	2.842515750	44.95	20.12
381	2.850015000	44.93	20.13
382	2.857514250	44.88	20.12
383	2.865013500	44.84	20.13
384	2.872512750	44.80	20.13
385	2.880012000	44.77	20.13
386	2.887511250	44.73	20.15
387	2.895010500	44.70	20.14
388	2.902509750	44.66	20.16
389	2.910009000	44.63	20.16
390	2.917508250	44.60	20.16
391	2.925007500	44.57	20.16
392	2.932506750	44.54	20.17
393	2.940006000	44.49	20.17
394	2.947505250	44.47	20.17
395	2.955004500	44.43	20.17
396	2.962503750	44.41	20.16
397	2.970003000	44.36	20.17
398	2.977502250	44.33	20.16
399	2.985001500	44.31	20.19
400	2.992500750	44.26	20.19
401	3.000000000	44.25	20.19

Reference math : OFF   Title: 04-05-01

1800 MHz muscle

Pt#	Frequency (GHz)	Data real	Data imag
1	0.000300000	219.90	341.86
2	0.007799250	63.96	13.97
3	0.015298500	62.77	7.41
4	0.022797750	66.26	6.01
5	0.030297000	66.81	5.00
6	0.037796250	66.95	4.53
7	0.045295500	67.06	4.33
8	0.052794750	66.58	4.03
9	0.060294000	67.06	3.49
10	0.067793250	66.93	3.71
11	0.075292500	66.78	4.11
12	0.082791750	66.74	4.14
13	0.090291000	66.83	3.85
14	0.097790250	66.61	3.82
15	0.105289500	66.36	3.93
16	0.112788750	66.32	4.06
17	0.120288000	66.16	4.22
18	0.127787250	66.33	4.16
19	0.135286500	66.17	4.22
20	0.142785750	66.14	4.41
21	0.150285000	66.09	4.42
22	0.157784250	66.00	4.60
23	0.165283500	65.86	4.68
24	0.172782750	65.90	4.72
25	0.180282000	65.81	4.68
26	0.187781250	65.74	4.75
27	0.195280500	65.71	4.80
28	0.202779750	65.56	4.96
29	0.210279000	65.55	4.99
30	0.217778250	65.47	5.04
31	0.225277500	65.30	5.16
32	0.232776750	65.37	5.30
33	0.240276000	65.22	5.27
34	0.247775250	65.18	5.39
35	0.255274500	65.10	5.54
36	0.262773750	65.03	5.66
37	0.270273000	65.03	5.68
38	0.277772250	64.88	5.74
39	0.285271500	64.88	5.84
40	0.292770750	64.83	5.95
41	0.300270000	64.76	5.94
42	0.307769250	64.78	6.02
43	0.315268500	64.63	6.15
44	0.322767750	64.58	6.22
45	0.330267000	64.56	6.31
46	0.337766250	64.52	6.42
47	0.345265500	64.36	6.40
48	0.352764750	64.39	6.44
49	0.360264000	64.29	6.60
50	0.367763250	64.27	6.67
51	0.375262500	64.25	6.73
52	0.382761750	64.14	6.79
53	0.390261000	64.03	6.86
54	0.397760250	64.02	6.97
55	0.405259500	63.97	7.03
56	0.412758750	63.86	7.11

57	0.420258000	63.84	7.21
58	0.427757250	63.74	7.22
59	0.435256500	63.67	7.32
60	0.442755750	63.65	7.41
61	0.450255000	63.61	7.42
62	0.457754250	63.55	7.52
63	0.465253500	63.52	7.63
64	0.472752750	63.42	7.67
65	0.480252000	63.38	7.74
66	0.487751250	63.35	7.84
67	0.495250500	63.32	7.91
68	0.502749750	63.22	7.94
69	0.510249000	63.16	8.00
70	0.517748250	63.10	8.09
71	0.525247500	63.09	8.16
72	0.532746750	62.97	8.17
73	0.540246000	62.96	8.24
74	0.547745250	62.91	8.35
75	0.555244500	62.83	8.40
76	0.562743750	62.82	8.53
77	0.570243000	62.67	8.59
78	0.577742250	62.68	8.60
79	0.585241500	62.66	8.73
80	0.592740750	62.53	8.78
81	0.600240000	62.52	8.80
82	0.607739250	62.48	8.87
83	0.615238500	62.40	8.94
84	0.622737750	62.39	8.99
85	0.630237000	62.30	9.10
86	0.637736250	62.21	9.09
87	0.645235500	62.19	9.20
88	0.652734750	62.08	9.27
89	0.660234000	62.07	9.28
90	0.667733250	62.03	9.41
91	0.675232500	61.97	9.40
92	0.682731750	61.91	9.51
93	0.690231000	61.83	9.54
94	0.697730250	61.85	9.60
95	0.705229500	61.74	9.71
96	0.712728750	61.66	9.75
97	0.720228000	61.67	9.82
98	0.727727250	61.61	9.88
99	0.735226500	61.53	9.91
100	0.742725750	61.49	9.99
101	0.750225000	61.43	10.04
102	0.757724250	61.42	10.07
103	0.765223500	61.31	10.15
104	0.772722750	61.26	10.20
105	0.780222000	61.23	10.22
106	0.787721250	61.16	10.33
107	0.795220500	61.06	10.35
108	0.802719750	61.06	10.41
109	0.810219000	61.02	10.50
110	0.817718250	60.92	10.52
111	0.825217500	60.92	10.60
112	0.832716750	60.83	10.64
113	0.840216000	60.80	10.68
114	0.847715250	60.76	10.78
115	0.855214500	60.67	10.75
116	0.862713750	60.68	10.84

117	0.870213000	60.57	10.91
118	0.877712250	60.51	10.89
119	0.885211500	60.49	10.96
120	0.892710750	60.47	11.05
121	0.900210000	60.43	11.10
122	0.907709250	60.38	11.18
123	0.915208500	60.33	11.22
124	0.922707750	60.28	11.27
125	0.930207000	60.22	11.31
126	0.937706250	60.18	11.34
127	0.945205500	60.15	11.43
128	0.952704750	60.06	11.48
129	0.960204000	60.00	11.52
130	0.967703250	59.96	11.56
131	0.975202500	59.90	11.61
132	0.982701750	59.86	11.68
133	0.990201000	59.79	11.72
134	0.997700250	59.73	11.80
135	1.005199500	59.69	11.85
136	1.012698750	59.63	11.86
137	1.020198000	59.59	11.94
138	1.027697250	59.51	11.98
139	1.035196500	59.46	12.00
140	1.042695750	59.41	12.07
141	1.050195000	59.35	12.10
142	1.057694250	59.31	12.12
143	1.065193500	59.25	12.18
144	1.072692750	59.20	12.17
145	1.080192000	59.17	12.24
146	1.087691250	59.12	12.27
147	1.095190500	59.08	12.31
148	1.102689750	59.08	12.37
149	1.110189000	59.02	12.44
150	1.117688250	58.97	12.48
151	1.125187500	58.92	12.55
152	1.132686750	58.88	12.60
153	1.140186000	58.82	12.66
154	1.147685250	58.76	12.68
155	1.155184500	58.72	12.74
156	1.162683750	58.67	12.79
157	1.170183000	58.61	12.83
158	1.177682250	58.57	12.87
159	1.185181500	58.53	12.93
160	1.192680750	58.47	12.98
161	1.200180000	58.41	13.02
162	1.207679250	58.37	13.07
163	1.215178500	58.32	13.13
164	1.222677750	58.25	13.18
165	1.230177000	58.19	13.20
166	1.237676250	58.14	13.25
167	1.245175500	58.09	13.26
168	1.252674750	58.05	13.33
169	1.260174000	58.00	13.36
170	1.267673250	57.91	13.40
171	1.275172500	57.87	13.45
172	1.282671750	57.81	13.49
173	1.290171000	57.76	13.53
174	1.297670250	57.70	13.57
175	1.305169500	57.66	13.62
176	1.312668750	57.60	13.66

177	1.320168000	57.56	13.69
178	1.327667250	57.48	13.72
179	1.335166500	57.44	13.76
180	1.342665750	57.39	13.79
181	1.350165000	57.32	13.82
182	1.357664250	57.28	13.85
183	1.365163500	57.23	13.88
184	1.372662750	57.15	13.93
185	1.380162000	57.11	13.95
186	1.387661250	57.07	13.98
187	1.395160500	57.01	14.03
188	1.402659750	56.95	14.05
189	1.410159000	56.91	14.08
190	1.417658250	56.86	14.10
191	1.425157500	56.80	14.12
192	1.432656750	56.80	14.14
193	1.440156000	56.74	14.18
194	1.447655250	56.67	14.18
195	1.455154500	56.66	14.21
196	1.462653750	56.61	14.25
197	1.470153000	56.57	14.27
198	1.477652250	56.55	14.29
199	1.485151500	56.54	14.36
200	1.492650750	56.49	14.37
201	1.500150000	56.45	14.42
202	1.507649250	56.42	14.45
203	1.515148500	56.39	14.49
204	1.522647750	56.35	14.56
205	1.530147000	56.27	14.59
206	1.537646250	56.26	14.62
207	1.545145500	56.24	14.70
208	1.552644750	56.13	14.73
209	1.560144000	56.09	14.76
210	1.567643250	56.05	14.79
211	1.575142500	56.00	14.83
212	1.582641750	55.93	14.89
213	1.590141000	55.86	14.90
214	1.597640250	55.82	14.94
215	1.605139500	55.80	14.97
216	1.612638750	55.73	14.99
217	1.620138000	55.69	15.03
218	1.627637250	55.63	15.07
219	1.635136500	55.59	15.08
220	1.642635750	55.54	15.11
221	1.650135000	55.48	15.13
222	1.657634250	55.45	15.15
223	1.665133500	55.39	15.17
224	1.672632750	55.35	15.20
225	1.680132000	55.29	15.21
226	1.687631250	55.26	15.27
227	1.695130500	55.20	15.28
228	1.702629750	55.17	15.29
229	1.710129000	55.14	15.31
230	1.717628250	55.10	15.33
231	1.725127500	55.07	15.36
232	1.732626750	55.04	15.38
233	1.740126000	55.00	15.41
234	1.747625250	54.96	15.44
235	1.755124500	54.91	15.48
236	1.762623750	54.89	15.50

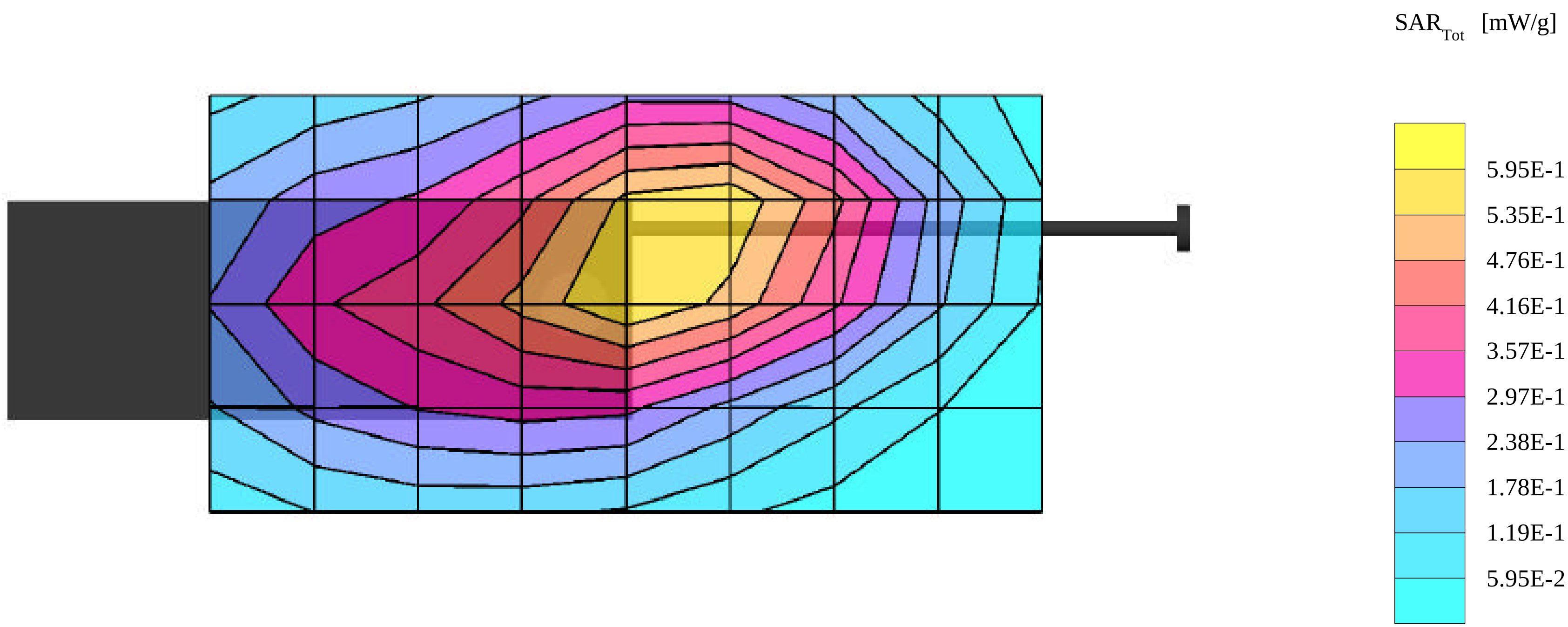
237	1.770123000	54.83	15.54	
238	1.777622250	54.79	15.57	
239	1.785121500	54.75	15.60	
240	1.792620750	54.72	15.64	
241	1.800120000	54.68	15.68	$\sigma = 1.57$ S/m
242	1.807619250	54.65	15.72	
243	1.815118500	54.61	15.75	
244	1.822617750	54.57	15.79	
245	1.830117000	54.52	15.81	
246	1.837616250	54.45	15.82	
247	1.845115500	54.43	15.83	
248	1.852614750	54.38	15.90	
249	1.860114000	54.30	15.92	
250	1.867613250	54.28	15.95	
251	1.875112500	54.21	15.99	
252	1.882611750	54.15	16.00	
253	1.890111000	54.12	16.04	
254	1.897610250	54.07	16.05	
255	1.905109500	54.03	16.07	
256	1.912608750	53.98	16.09	
257	1.920108000	53.92	16.09	
258	1.927607250	53.91	16.12	
259	1.935106500	53.83	16.16	
260	1.942605750	53.81	16.15	
261	1.950105000	53.78	16.18	
262	1.957604250	53.73	16.19	
263	1.965103500	53.72	16.20	
264	1.972602750	53.65	16.24	
265	1.980102000	53.61	16.23	
266	1.987601250	53.60	16.26	
267	1.995100500	53.55	16.30	
268	2.002599750	53.53	16.30	
269	2.010099000	53.51	16.34	
270	2.017598250	53.46	16.37	
271	2.025097500	53.45	16.38	
272	2.032596750	53.44	16.42	
273	2.040096000	53.38	16.45	
274	2.047595250	53.36	16.48	
275	2.055094500	53.31	16.52	
276	2.062593750	53.28	16.53	
277	2.070093000	53.25	16.57	
278	2.077592250	53.21	16.60	
279	2.085091500	53.14	16.64	
280	2.092590750	53.09	16.70	
281	2.100090000	53.06	16.72	
282	2.107589250	53.01	16.75	
283	2.115088500	52.97	16.79	
284	2.122587750	52.93	16.81	
285	2.130087000	52.88	16.85	
286	2.137586250	52.82	16.85	
287	2.145085500	52.80	16.87	
288	2.152584750	52.74	16.89	
289	2.160084000	52.68	16.90	
290	2.167583250	52.64	16.92	
291	2.175082500	52.60	16.94	
292	2.182581750	52.54	16.97	
293	2.190081000	52.50	16.98	
294	2.197580250	52.46	17.01	
295	2.205079500	52.42	17.03	
296	2.212578750	52.38	17.04	

297	2.220078000	52.37	17.07
298	2.227577250	52.33	17.09
299	2.235076500	52.28	17.09
300	2.242575750	52.27	17.11
301	2.250075000	52.23	17.13
302	2.257574250	52.18	17.13
303	2.265073500	52.18	17.13
304	2.272572750	52.13	17.16
305	2.280072000	52.09	17.17
306	2.287571250	52.05	17.20
307	2.295070500	52.01	17.24
308	2.302569750	51.99	17.24
309	2.310069000	51.97	17.29
310	2.317568250	51.92	17.33
311	2.325067500	51.89	17.32
312	2.332566750	51.87	17.36
313	2.340066000	51.83	17.37
314	2.347565250	51.80	17.39
315	2.355064500	51.76	17.41
316	2.362563750	51.74	17.44
317	2.370063000	51.69	17.47
318	2.377562250	51.65	17.46
319	2.385061500	51.62	17.50
320	2.392560750	51.56	17.54
321	2.400060000	51.52	17.56
322	2.407559250	51.52	17.59
323	2.415058500	51.46	17.63
324	2.422557750	51.42	17.65
325	2.430057000	51.39	17.69
326	2.437556250	51.34	17.69
327	2.445055500	51.34	17.70
328	2.452554750	51.32	17.75
329	2.460054000	51.24	17.74
330	2.467553250	51.23	17.76
331	2.475052500	51.17	17.79
332	2.482551750	51.13	17.81
333	2.490051000	51.10	17.82
334	2.497550250	51.06	17.86
335	2.505049500	51.00	17.88
336	2.512548750	50.96	17.92
337	2.520048000	50.91	17.95
338	2.527547250	50.92	17.97
339	2.535046500	50.87	18.02
340	2.542545750	50.81	18.02
341	2.550045000	50.78	18.05
342	2.557544250	50.73	18.07
343	2.565043500	50.73	18.06
344	2.572542750	50.70	18.09
345	2.580042000	50.64	18.10
346	2.587541250	50.59	18.12
347	2.595040500	50.52	18.15
348	2.602539750	50.47	18.17
349	2.610039000	50.47	18.19
350	2.617538250	50.42	18.24
351	2.625037500	50.38	18.24
352	2.632536750	50.34	18.27
353	2.640036000	50.30	18.28
354	2.647535250	50.26	18.31
355	2.655034500	50.24	18.34
356	2.662533750	50.21	18.34

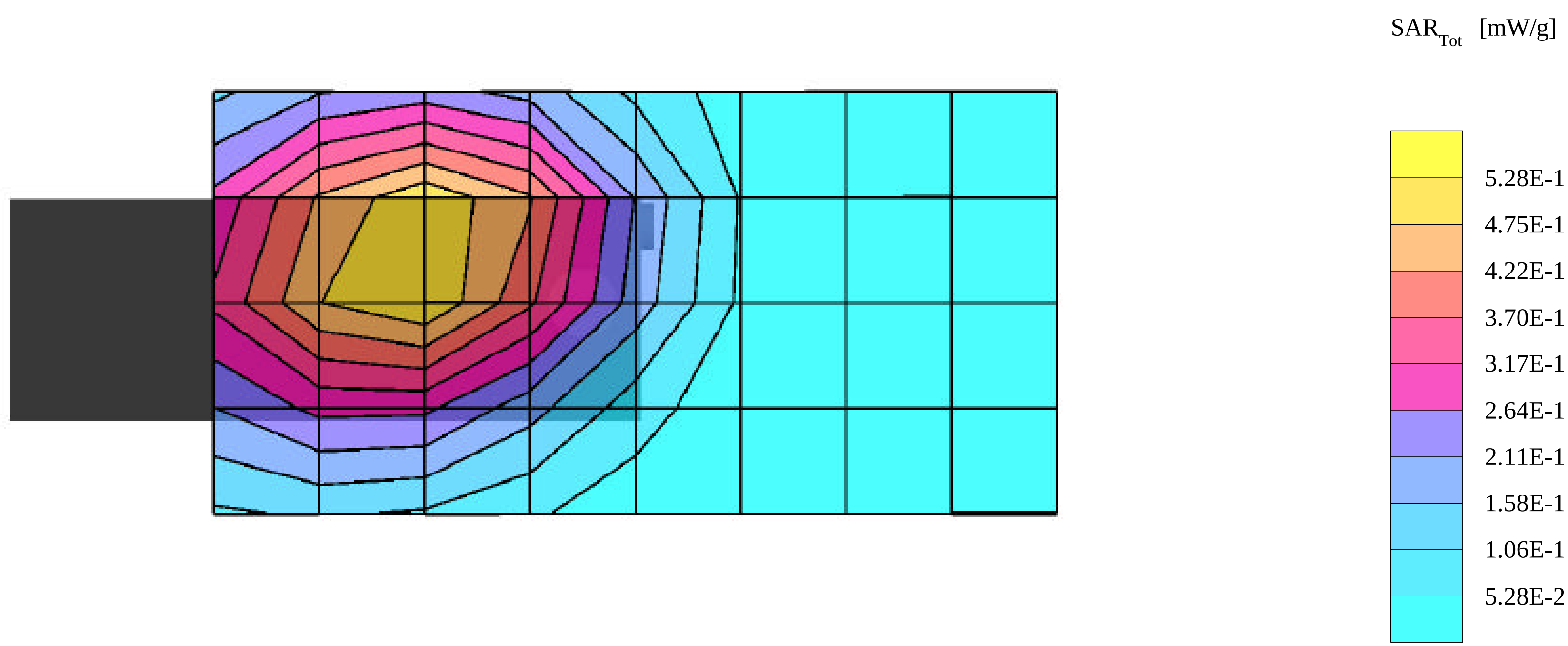
357	2.670033000	50.17	18.35
358	2.677532250	50.12	18.37
359	2.685031500	50.08	18.39
360	2.692530750	50.02	18.41
361	2.700030000	49.98	18.42
362	2.707529250	49.95	18.46
363	2.715028500	49.93	18.48
364	2.722527750	49.87	18.49
365	2.730027000	49.81	18.51
366	2.737526250	49.79	18.54
367	2.745025500	49.76	18.55
368	2.752524750	49.75	18.55
369	2.760024000	49.72	18.59
370	2.767523250	49.67	18.58
371	2.775022500	49.61	18.61
372	2.782521750	49.56	18.63
373	2.790021000	49.53	18.63
374	2.797520250	49.50	18.67
375	2.805019500	49.47	18.68
376	2.812518750	49.44	18.72
377	2.820018000	49.38	18.72
378	2.827517250	49.34	18.74
379	2.835016500	49.29	18.77
380	2.842515750	49.26	18.78
381	2.850015000	49.25	18.79
382	2.857514250	49.23	18.82
383	2.865013500	49.18	18.83
384	2.872512750	49.15	18.84
385	2.880012000	49.08	18.85
386	2.887511250	49.04	18.87
387	2.895010500	49.00	18.89
388	2.902509750	48.96	18.91
389	2.910009000	48.95	18.91
390	2.917508250	48.92	18.95
391	2.925007500	48.87	18.97
392	2.932506750	48.81	18.96
393	2.940006000	48.77	18.98
394	2.947505250	48.74	18.99
395	2.955004500	48.71	19.01
396	2.962503750	48.68	19.03
397	2.970003000	48.67	19.05
398	2.977502250	48.65	19.05
399	2.985001500	48.59	19.06
400	2.992500750	48.54	19.07
401	3.000000000	48.50	19.09

FM ch991, muscle, power=27dBm, hdet=785

SAR (1g): 0.662 [mW/g] ± 0.19 dB, SAR (10g): 0.473 [mW/g] ± 0.16 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.53,5.53,5.53)
Muscle 900 MHz: σ = 0.91 [mho/m] ε_r = 56.6 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #1093, FM ch991, muscle, 04-06-01.DA3
Powerdrift: 0.21 dB

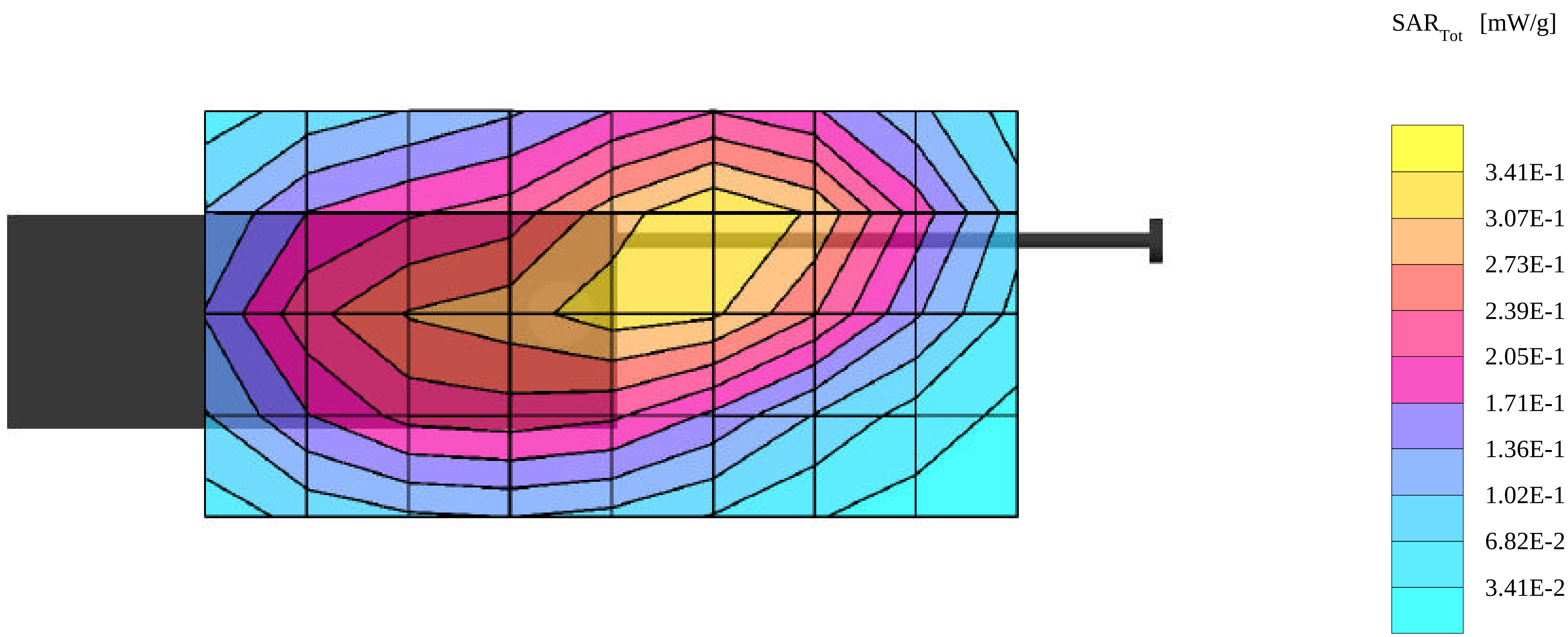


FM ch991, muscle, power=27dBm, hdet=785
SAR (1g): 0.585 [mW/g] ± 0.12 dB, SAR (10g): 0.420 [mW/g] ± 0.12 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.53,5.53,5.53)
Muscle 900 MHz: σ = 0.91 [mho/m] ε_r = 56.6 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #1093, FM ch991, muscle, 04-06-01.DA3
Powerdrift: 0.02 dB



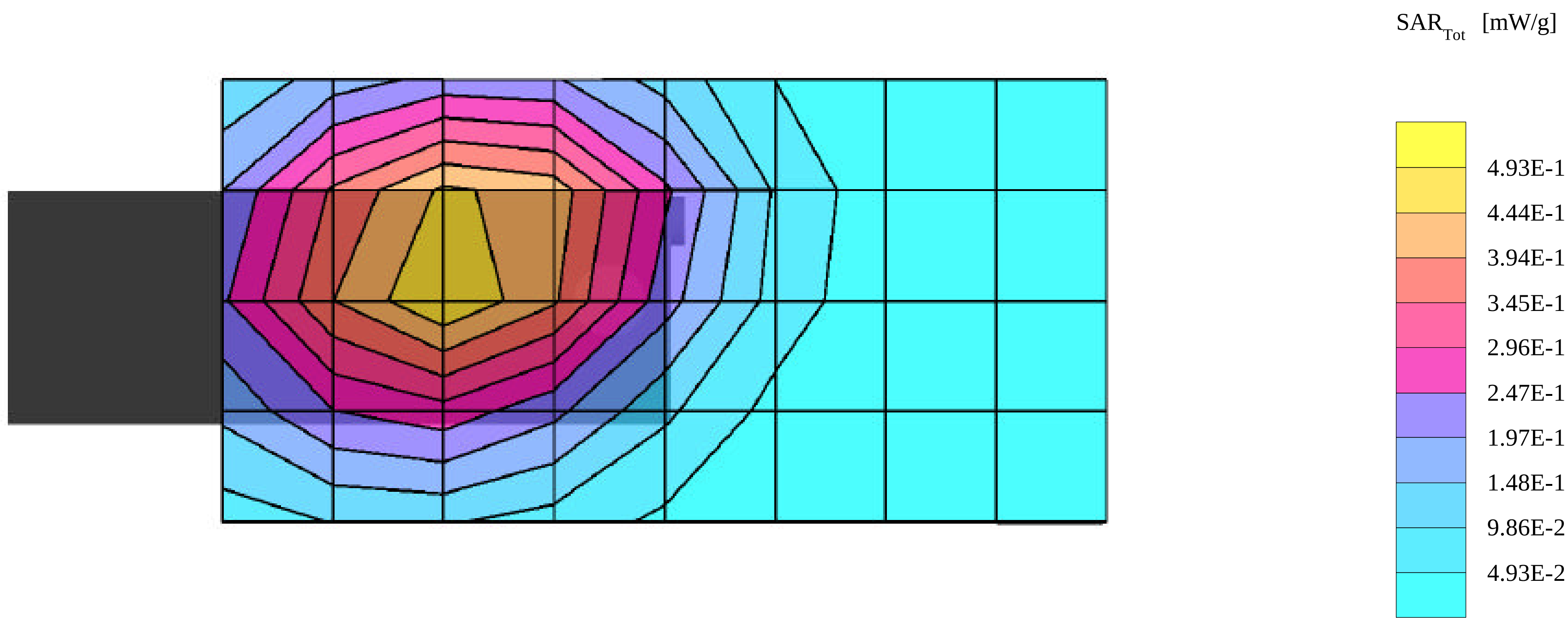
FM ch383, muscle, power=27dBm, hdet=715

SAR (1g): 0.361 [mW/g] ± 0.14 dB, SAR (10g): 0.262 [mW/g] ± 0.15 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.53,5.53,5.53)
Muscle 900 MHz: σ = 0.91 [mho/m] ε_r = 56.6 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #1093, FM ch383, muscle, 04-06-01.DA3
Powerdrift: -0.10 dB



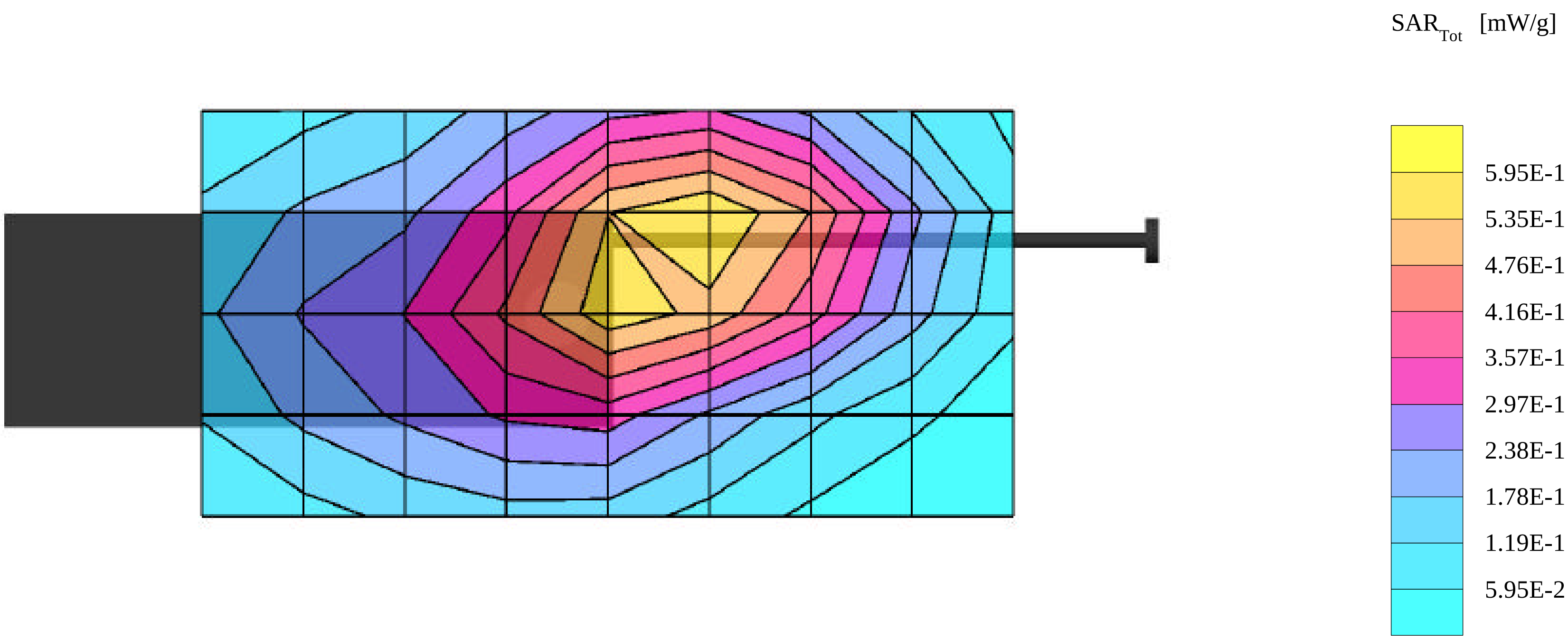
FM ch383, muscle, power=27dBm, hdet=715

SAR (1g): 0.516 [mW/g] ± 0.10 dB, SAR (10g): 0.376 [mW/g] ± 0.11 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.53,5.53,5.53)
Muscle 900 MHz: σ = 0.91 [mho/m] ε_r = 56.6 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #1093, FM ch383, muscle, 04-06-01.DA3
Powerdrift: 0.01 dB



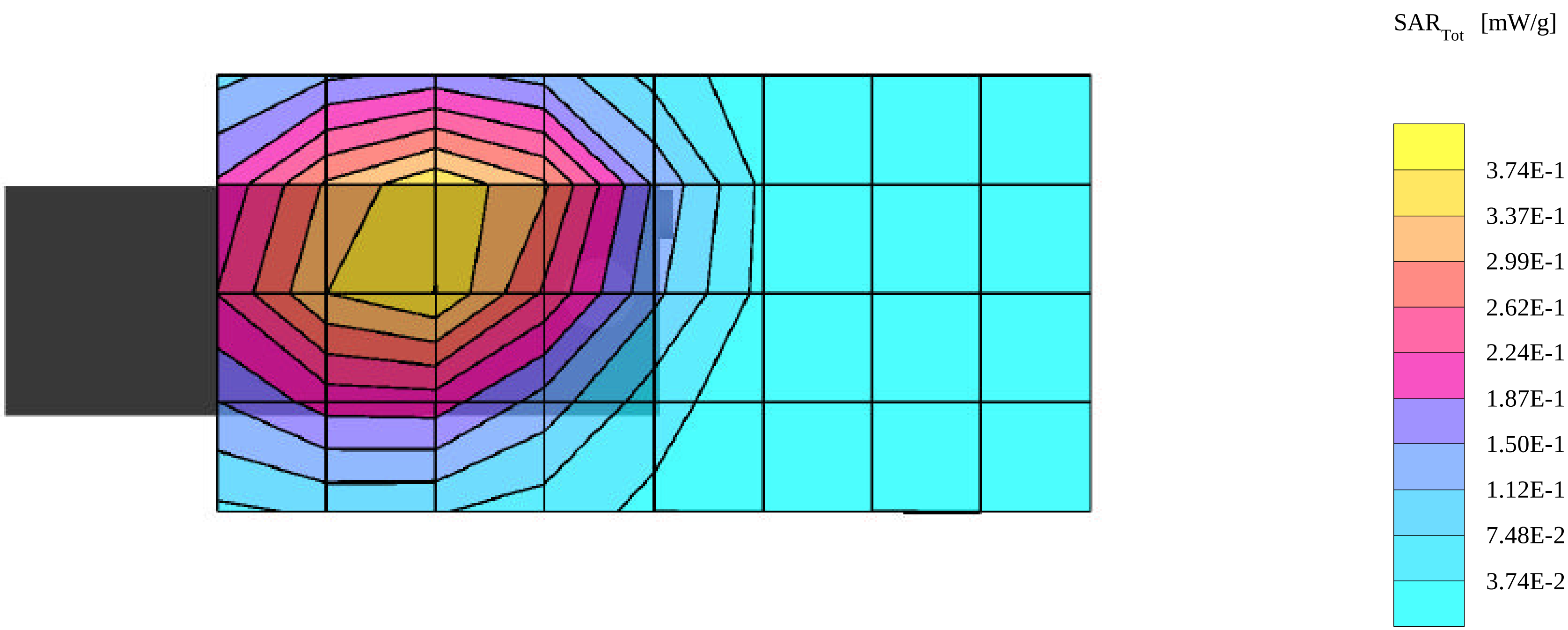
FM ch799, muscle, power=27dBm, hdet=720

SAR (1g): 0.628 [mW/g] ± 0.08 dB, SAR (10g): 0.449 [mW/g] ± 0.08 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.53,5.53,5.53)
Muscle 900 MHz: $\sigma = 0.91$ [mho/m] $\varepsilon_r = 56.6$ $\rho = 1.00$ [g/cm^3]
File Name: 7GP P5K8C #1093, FM ch799, muscle, 04-06-01.DA3
Powerdrift: -0.04 dB



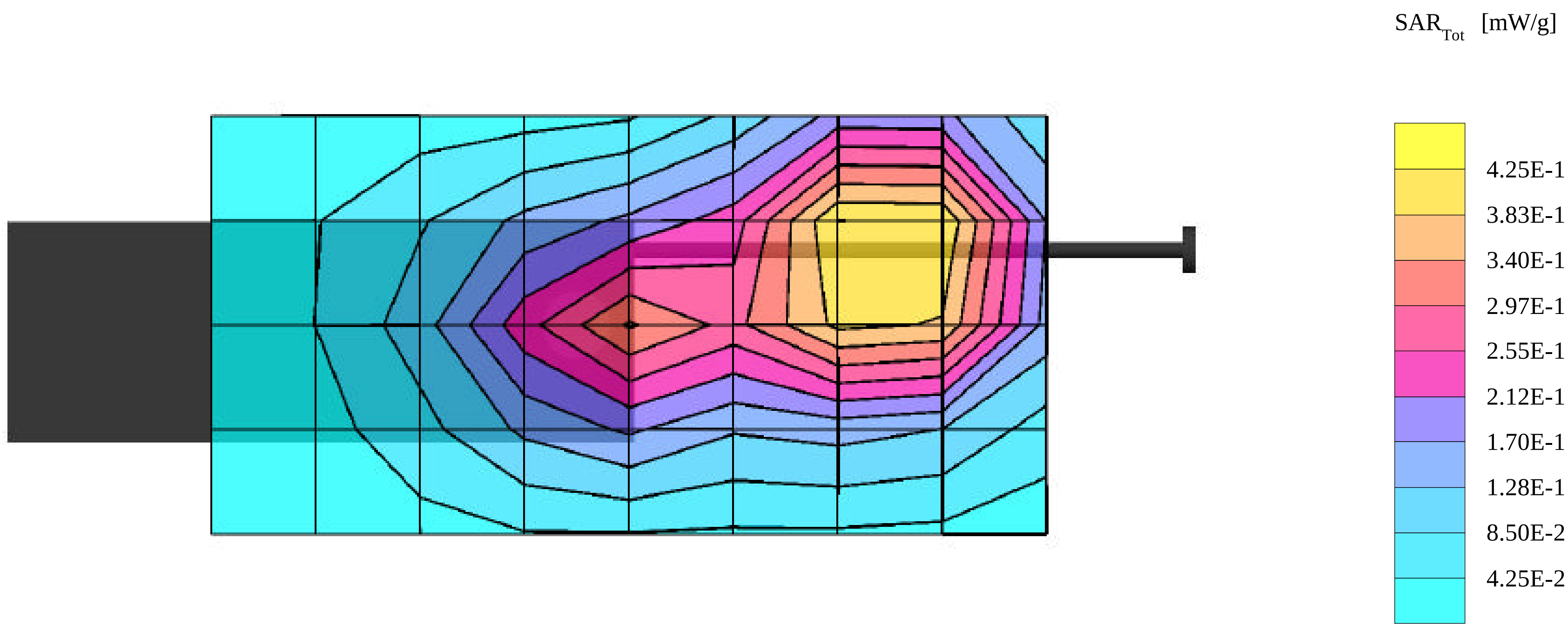
FM ch799, muscle, power=27dBm, hdet=720

SAR (1g): 0.411 [mW/g] ± 0.09 dB, SAR (10g): 0.293 [mW/g] ± 0.11 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.53,5.53,5.53)
Muscle 900 MHz: σ = 0.91 [mho/m] ε_r = 56.6 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #1093, FM ch799, muscle, 04-06-01.DA3
Powerdrift: 0.04 dB



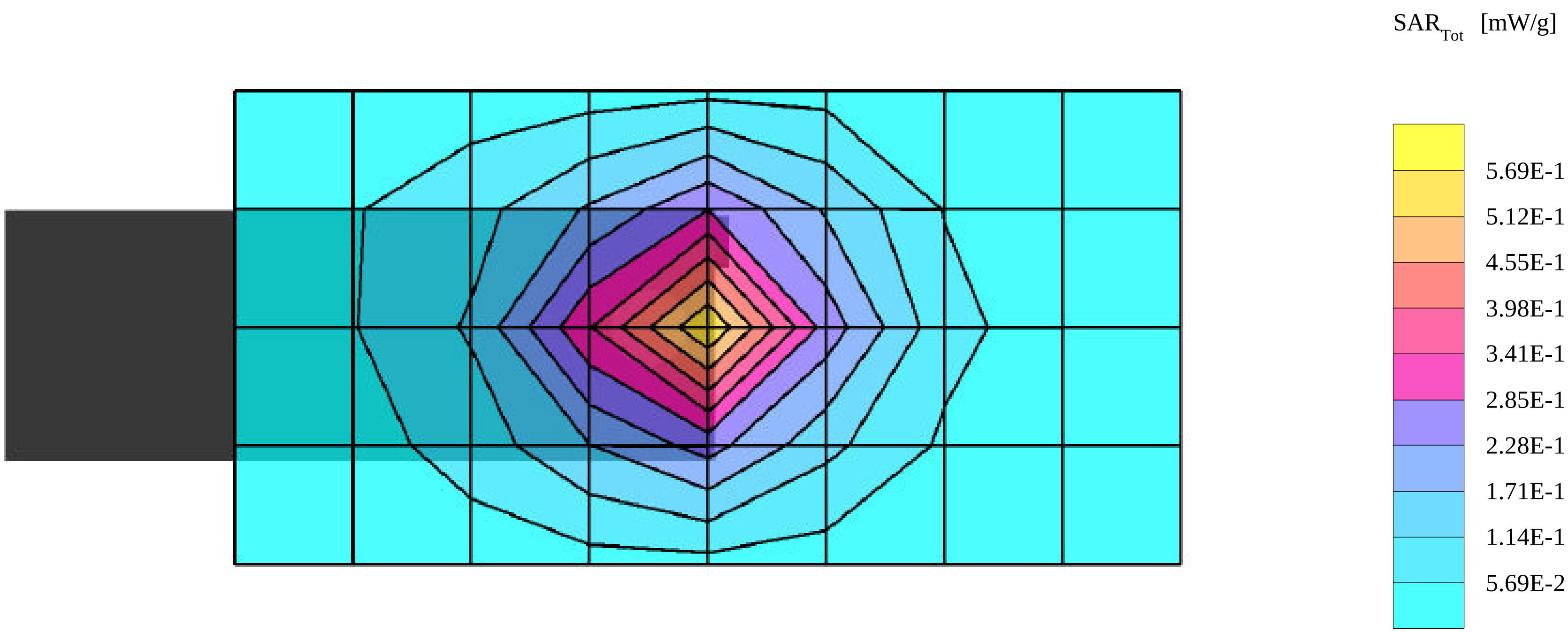
PCS ch25, FCC compliance, muscle, conducted power=24.2dBm (hdet=355)

SAR (1g): 0.500 [mW/g] ± 0.00 dB, SAR (10g): 0.301 [mW/g] ± 0.01 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(4.50,4.50,4.50)
Muscle 1800 MHz: σ = 1.57 [mho/m] ε_r = 54.7 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #XXXX, PCS ch25, muscle, sep, 04-05-01.DA3
Powerdrift: -0.13 dB



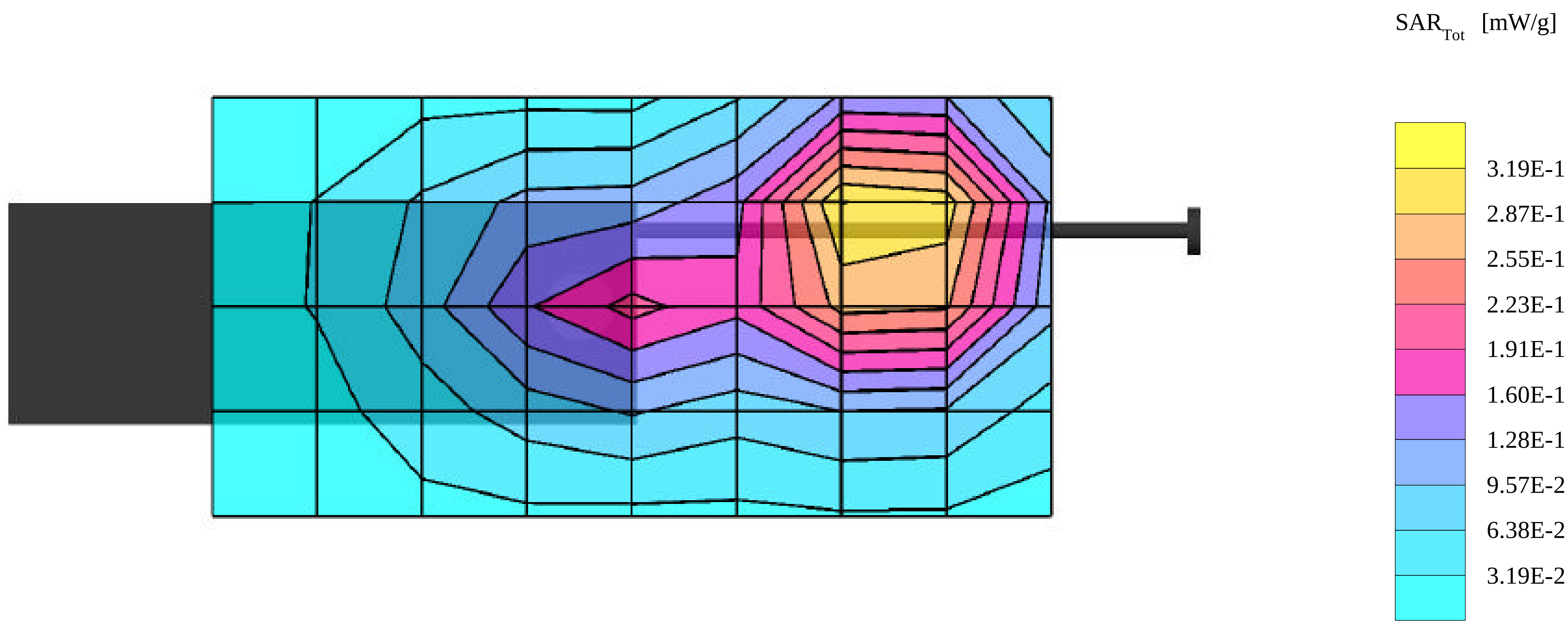
PCS ch25, FCC compliance, muscle, conducted power=24.2dBm (hdet=355)

SAR (1g): 0.539 [mW/g] ± 0.04 dB, SAR (10g): 0.312 [mW/g] ± 0.06 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(4.50,4.50,4.50)
Muscle 1800 MHz: $\sigma = 1.57$ [mho/m] $\varepsilon_r = 54.7$ $\rho = 1.00$ [g/cm^3]
File Name: 7GP P5K8C #XXXX, PCS ch25, muscle, sep, 04-05-01.DA3
Powerdrift: -0.04 dB



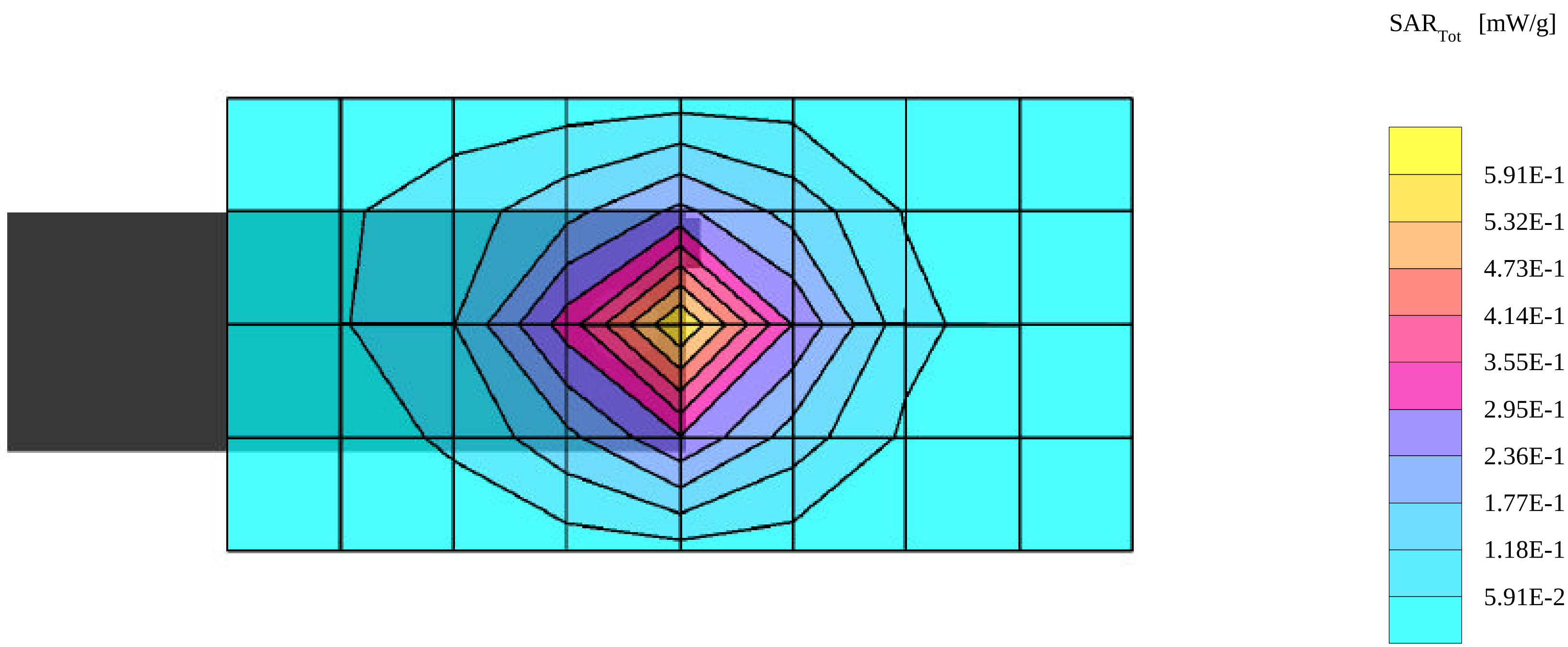
PCS ch600, FCC compliance, muscle, conducted power=24.2dBm (hdet=320)

SAR (1g): 0.362 [mW/g] ± 0.03 dB, SAR (10g): 0.216 [mW/g] ± 0.01 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(4.50,4.50,4.50)
Muscle 1800 MHz: σ = 1.57 [mho/m] ε_r = 54.7 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #XXXX, PCS ch600, muscle, sep, 04-05-01.DA3
Powerdrift: -0.30 dB



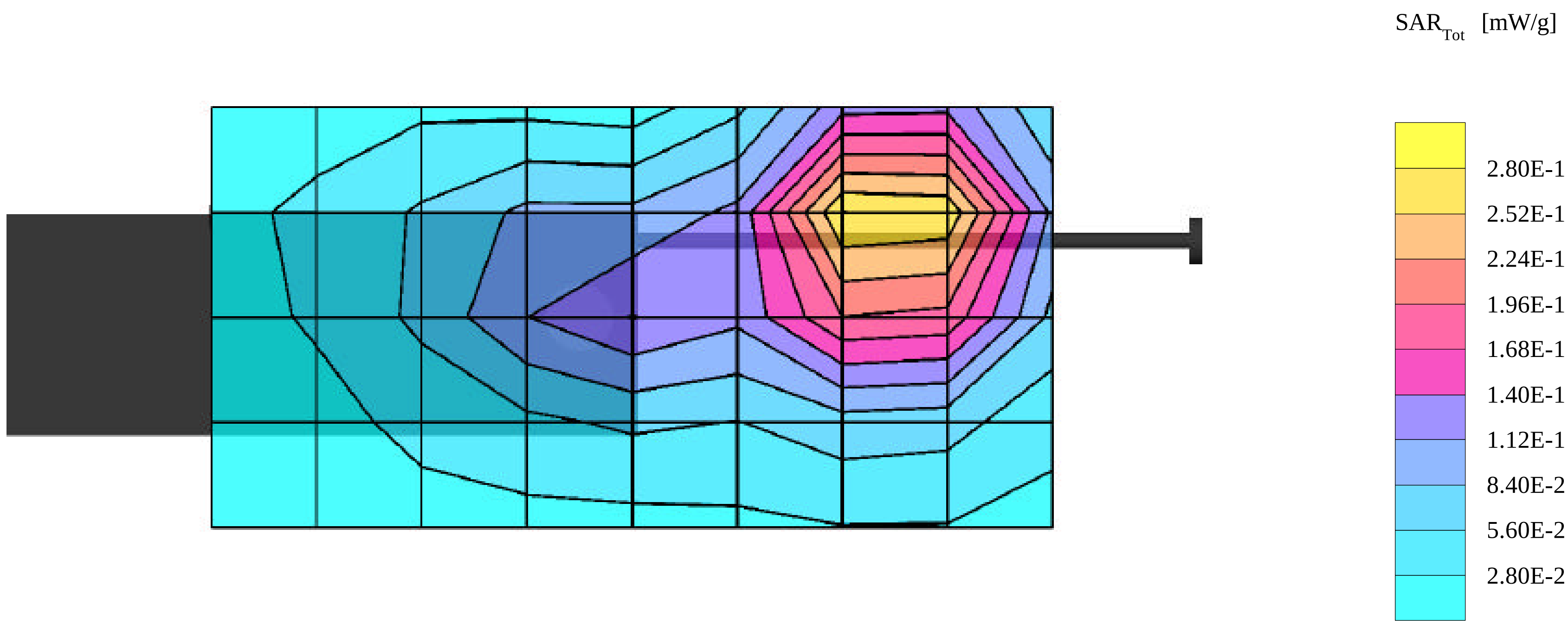
PCS ch600, FCC compliance, muscle, conducted power=24.2dBm (hdet=320)

SAR (1g): 0.564 [mW/g] ± 0.06 dB, SAR (10g): 0.325 [mW/g] ± 0.06 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(4.50,4.50,4.50)
Muscle 1800 MHz: σ = 1.57 [mho/m] ε_r = 54.7 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #XXXX, PCS ch600, muscle, sep, 04-05-01.DA3
Powerdrift: -0.03 dB



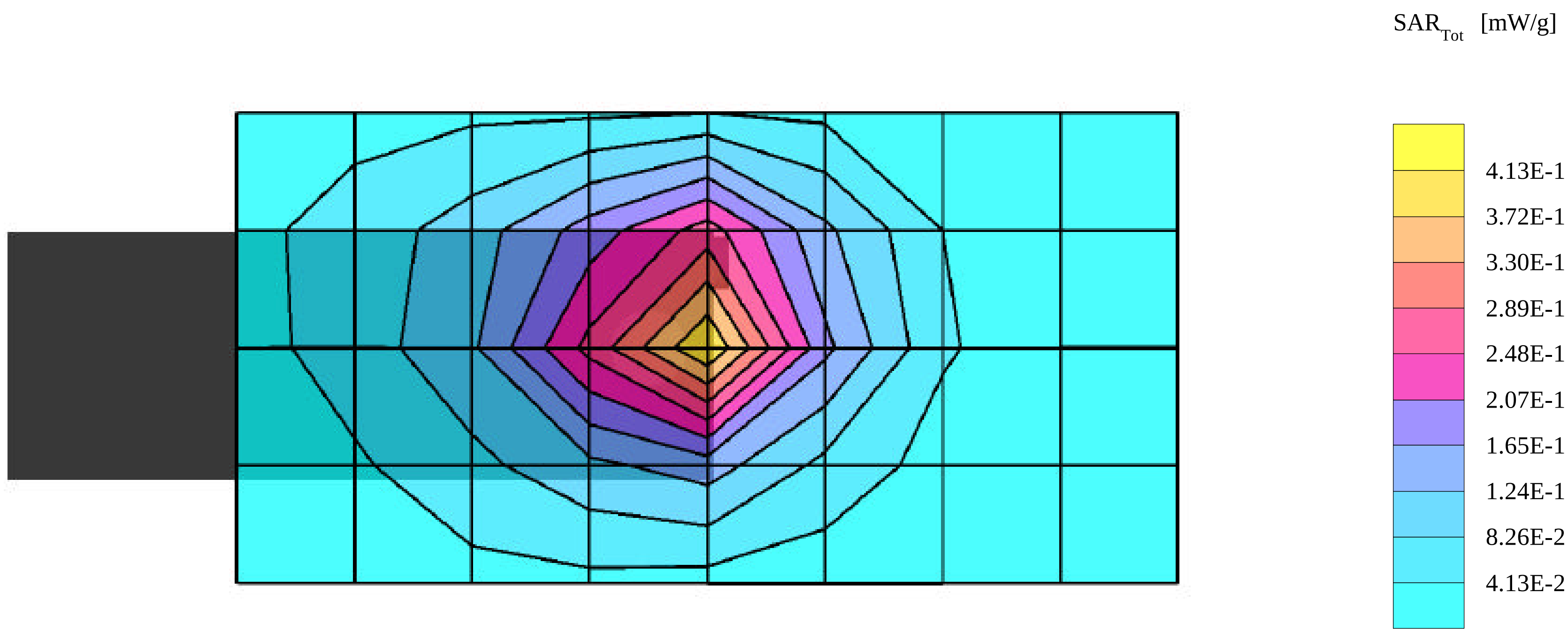
PCS ch1175, FCC compliance, muscle, conducted power=24.2dBm (hdet=390)

SAR (1g): 0.309 [mW/g] ± 0.02 dB, SAR (10g): 0.182 [mW/g] ± 0.04 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(4.50,4.50,4.50)
Muscle 1800 MHz: σ = 1.57 [mho/m] ε_r = 54.7 ρ = 1.00 [g/cm³]
File Name: 7GP P5K8C #XXXX, PCS ch1175, muscle, sep, 04-05-01.DA3
Powerdrift: -0.05 dB



PCS ch1175, FCC compliance, muscle, conducted power=24.2dBm (hdet=390)

SAR (1g): 0.412 [mW/g] ± 0.08 dB, SAR (10g): 0.237 [mW/g] ± 0.08 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(4.50,4.50,4.50)
Muscle 1800 MHz: σ = 1.57 [mho/m] ε_r = 54.7 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #XXXX, PCS ch1175, muscle, sep, 04-05-01.DA3
Powerdrift: -0.01 dB



Q3. New photos of the shielding and metalization were requested. The reply indicates it is in the SAR report and there is none in the SAR report.

A3. The initial reply was incorrect. The new photos of the shielding and metalization were included in main report with the internal photos.

Q4. The reply indicates no new spurious emissions is required. This is not true, spurious emissions were requested via e-mail sent to Jay Moulton on 2/28/01.

A4. The spurious emissions report for the FCC ID: OVFQCP-3035A cellular phone is sent as a separate attachment.

Q5. The field strength of the fundamental (for 800 MHz band) are indicating higher output than those ERP data, please check if there could be output issues. Measured ERP is 646 mW and 479 mW for AMPS and CDMA (as reported in the original filing, not re-measured) but the field strength of spurious emission is indicating 855 mW and 579 mW ERP ? Make sure the new spurious emissions data agrees with the submitted ERP data.

A5. The radiated spurious emissions data is taken with the field strength of the fundamental set to nominal output power, which is 0.7 dB below the ERP or EIRP field strength at which SAR is measured. The new radiated spurious data agrees with the ERP and EIRP data that was submitted in the new SAR report for FCC ID: OVFQCP-3035A.

Q6. The SAR report is describing the device with the original FCC ID (the recalled one), not this new FCC ID. Please correct it.

A6. At the end of this response is the text body of the SAR report with the new FCC ID and description.

Q7. The SAR report describes a body-worn holster. It was tested with a belt-clip ? (see Section 5). We need those photos to verify which is which.

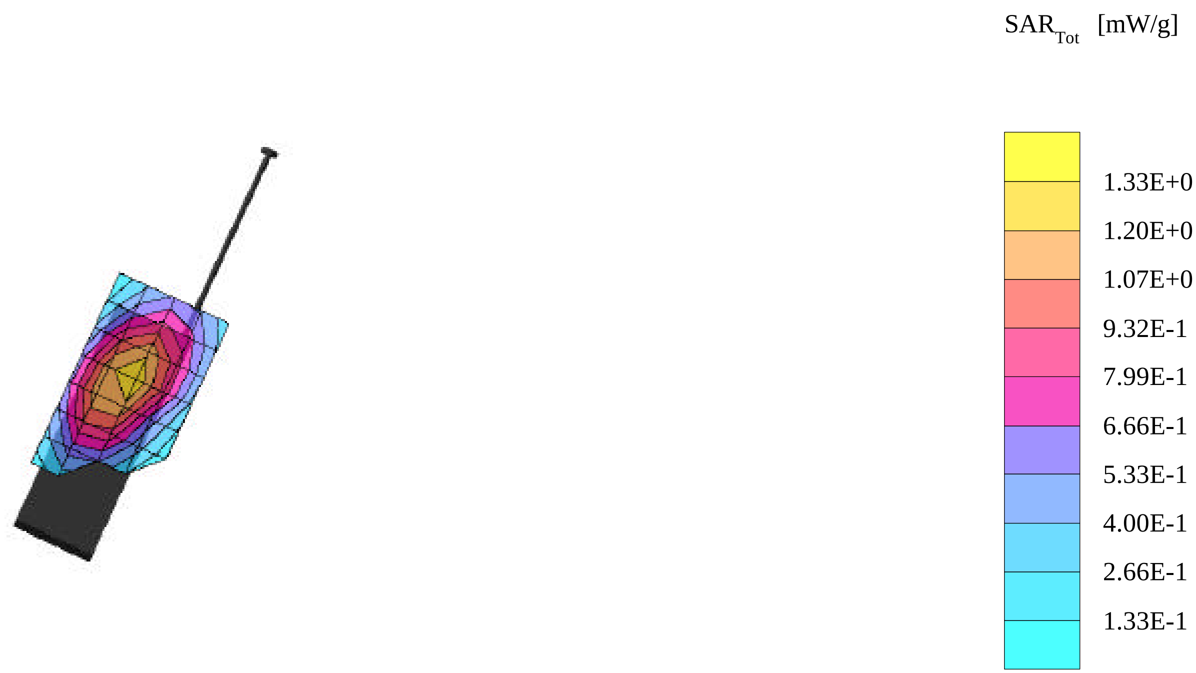
A7. The FCC ID: OVFQCP-3035A phone was only tested with a belt-clip. The reference to a body-worn holster has been deleted from the SAR report. The photos showing the belt clip are included in the response to question #1 above.

Q8. The AMPS mode SAR plots for the low and middle channels are identical. Re-submit the correct plots.

A8. The AMPS mode SAR plots for the low and middle channels follows:

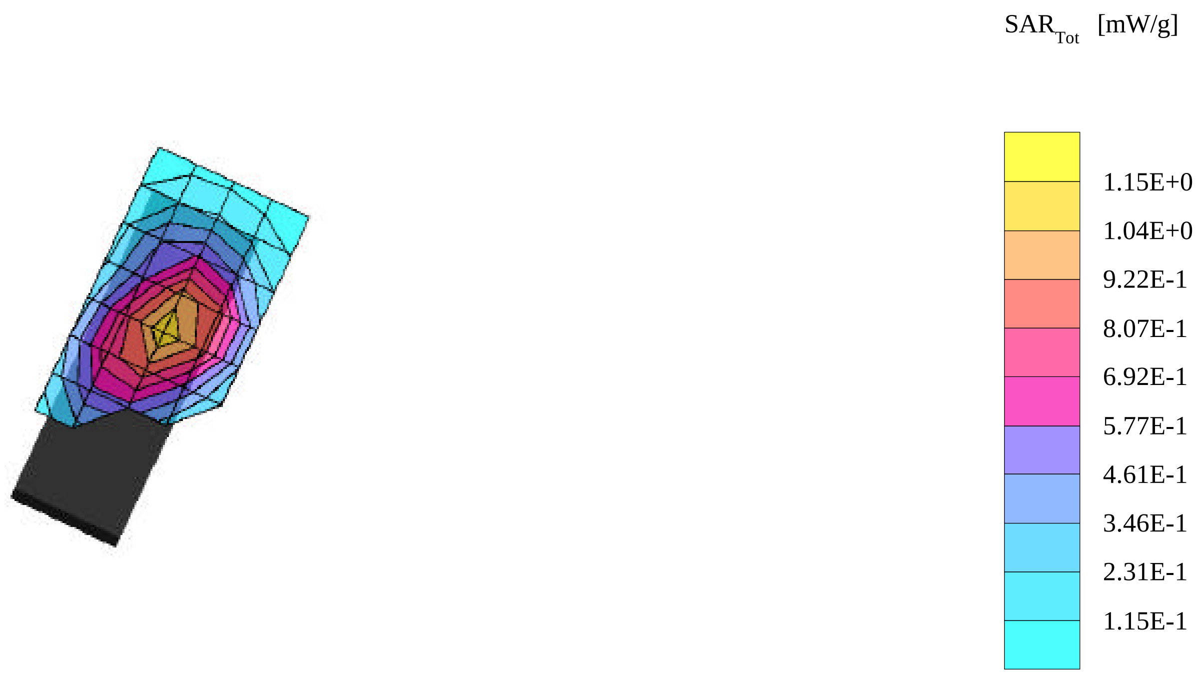
7GP P5K8C #3140, FM ch991, FCC compliance, conducted power=27.0dBm (hdet=778)

SAR (1g): 1.32 [mW/g] ± 0.01 dB, SAR (10g): 0.962 [mW/g] ± 0.01 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.70,5.70,5.70)
Brain 900 MHz: σ = 0.87 [mho/m] ε_r = 42.3 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, FM ch991, 03-05-01.DA3
Powerdrift: 0.02 dB



7GP P5K8C #3140, FM ch991, FCC compliance, conducted power=27.0dBm (hdet=778)

SAR (1g): 1.11 [mW/g] ± 0.07 dB, SAR (10g): 0.769 [mW/g] ± 0.07 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.70,5.70,5.70)
Brain 900 MHz: $\sigma = 0.87$ [mho/m] $\varepsilon_r = 42.3$ $\rho = 1.00$ [g/cm³]
File Name: 7GP P5K8C #3140, FM ch991, 03-05-01.DA3
Powerdrift: -0.08 dB

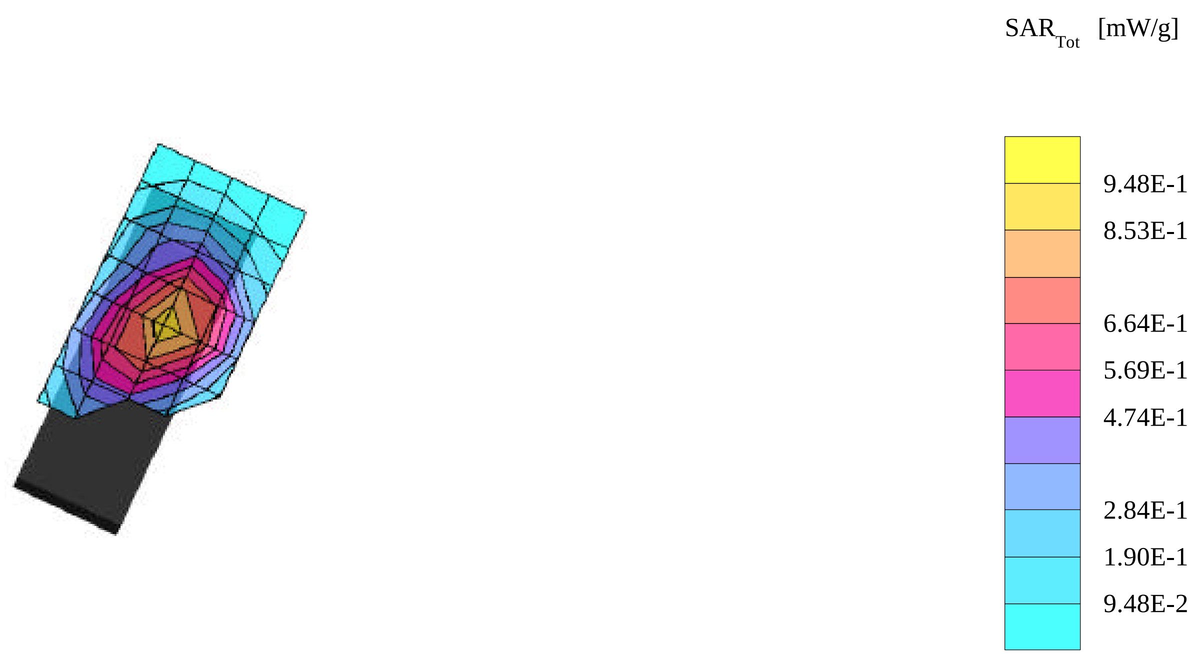


7GP P5K8C #3140, FM ch 383, FCC compliance, conducted power=27.0dBm (hdet=703)

SAR (1g): 1.51 [mW/g] ± 0.04 dB, SAR (10g): 1.08 [mW/g] ± 0.05 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.70,5.70,5.70)
Brain 900 MHz: σ = 0.87 [mho/m] ε_r = 42.3 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, FM ch383, 03-05-01.DA3
Powerdrift: -0.24 dB

7GP P5K8C #3140, FM ch 383, FCC compliance, conducted power=27.0dBm (hdet=703)

SAR (1g): 0.936 [mW/g] ± 0.01 dB, SAR (10g): 0.649 [mW/g] ± 0.01 dB
Cubes (2) (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.70,5.70,5.70)
Brain 900 MHz: $\sigma = 0.87$ [mho/m] $\varepsilon_r = 42.3$ $\rho = 1.00$ [g/cm^3]
File Name: 7GP P5K8C #3140, FM ch383, 03-05-01.DA3
Operator: DL



Kyocera Wireless Corp.
QCP 3035

SPECIFIC ABSORPTION RATE (SAR)

REPORT

CONTENTS

1 INTRODUCTION

This test report describes an environmental evaluation measurement of specific absorption rate (SAR) distribution in simulated human head tissues exposed to radio frequency (RF) radiation from a wireless portable device manufactured by Kyocera Wireless Corp. (KWC). These measurements were performed for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC). The testing was performed in August 2000 in the KWC SAR Test Facility. The wireless device is described as follows;

EUT Type:	*Trimode, CDMA(PCS), CDMA and Analog (Cellular) Phone*
Trade Name:	*Kyocera Wireless Corp.*
Model:	*QCP-3035*
FCC ID:	*OVFQCP-3035A*
Tx Frequency :	*824.04 – 848.97 and 1851.25 – 1908.75 MHz*
Max. Output Power:	*28.41 dBm ERP Analog (in cellular band)*
	27.08 dBm ERP Digital (in cellular band)
	27.90 dBm EIRP Digital (in PCS band)
Modulation:	*CDMA and Analog*
Antenna:	*Retracting whip w/internal antenna*
FCC Classification:	*Non-Broadcast Transmitter Held to Ear*
Application Type:	*Certification*
Serial Number :	*75B0100353140*
Place of Test:	*KWC, San Diego, CA, USA*
Date of Test:	*March 5 - 6, 2001*
FCC Rule Part:	*47 CFR 2.1093; OET Bulletin 65, Sup. C; 47 CFR 22; 47 CFR 24*

2 SAR TEST FACILITY

SAR tests were performed in the KWC SAR Test Facility located at the following address:

QCP Inc.
Building AA.
10290 Campus Point Drive
San Diego CA 92121-1522

3 APPLICABLE REGULATIONS

The QCP-3035, FCC ID: OVFQCP-3035A, is designed to comply with the specific absorption rate SAR limits for distances within 20 cm of the transmitting elements of the mobile phone, and with general public uncontrolled environment Maximum Permissible Exposure (MPE) limits at distances greater than 20 cm from the transmitting elements of the device, as required by Sections 1.1307 through 1.1310, 2.1091 and 2.1093 of the 47 C.F.R. (1997). These FCC RF safety limits, which are based on a hybrid combination of the SAR and MPE requirements from ANSI/IEEE C95.1-1992 and the National Council on Radiation Protection and Measurements (NCRP) report no. 86, are also consistent with the RF safety limits defined in the IRPA Guidelines on Protection Against Non-Ionizing Radiation which are reportedly in the process of being adopted in Europe, as codified in European Pre-Standard ENV 59166-2 approved by CENELEC (1994). This test report pertains specifically to the following limit from the Code of Federal Regulations 47, Part 2 "Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube)."

4 SAR TEST RESULTS SUMMARY

This device has been tested for localised specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1 ~ 1992 and has been tested in accordance with the measurement procedures specified in ANSI/IEEE Std. C95.3 ~ 1992 . Normal antenna operating positions were incorporated, with the device transmitting at frequencies consistent with normal usage of the device. The device has been shown to be capable of compliance for localised specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE std. C95.1-1992

5 TECHNICAL DESCRIPTION

The test sample consisted of a KWC QCP-3035, FCC ID: OVFQCP-3035A. This model will operate in CDMA PCS, CDMA and analog cellular mode. The CDMA PCS mode is designed to transmit in the 1851.25 – 1908.75 MHz band at a maximum EIRP of 27.90 dBm. The cellular FM AMPS mode is designed to transmit in the 824.04 – 848.97 MHz band at a maximum ERP of 28.41 dBm. The cellular CDMA mode is designed to transmit in the 824.04 – 848.97 MHz band at a maximum output power of 27.08 dBm.

The QCP-3035, FCC ID: OVFQCP-3035A, is a tri-mode and dual band cellular/PCS phone. The antenna is a standard retracting whip antenna tuned for dual frequency, with an internal antenna that is at the base of the whip which gets activated when the whip is retracted. Since either position is possible during use, both retracted and extended were tested, at the low, middle, and high frequencies of each band.

The QCP-3035, FCC ID: OVFQCP-3035A, has provision for headset and belt-clip to allow hands-free operation. The SAR for such operating condition was also measured at the low, middle, and high frequencies of each band.

5.1 DESCRIPTION OF KWC SAR TEST FACILITY

All tests were performed under the following environmental conditions:

Temperature Range:	15 - 35 Degrees C	(Actual 20 C)
Humidity Range:	25 - 75 %	(Actual 38 %)
Pressure:	860 - 1060 mbar	(Actual 1015 mB)

The SAR tests were performed using the following facilities:
All KWC dosimetry equipment is operated within a shielded screen room manufactured by Lindgren RF Enclosures to provide isolation from external EM fields.
The E-field probes of the DASY 3 system are capable of detecting signals as low as 5μW/g in the liquid dielectric, and so external fields are minimised by the screen room, leaving the phone as the dominate radiation source. The floor of the screen room is reflective, so four two-foot square ferrite panels are placed beneath the phantom area of the DASY system to minimise reflected energy that would otherwise re-enter the phantom and combine constructively or destructively with the desired fields. These ferrite panels provide roughly 12 to 13 dB of attenuation in the frequency range of 900 MHz, and 7 to 8 dB of attenuation in the frequency range of 1.9 GHz. Space beneath the DASY system limits the absorber type to ferrite tiles, although this attenuation combined with scattering of the energy is sufficient to bring the system validation within the acceptable tolerance.
DOSIMETRY SYSTEM The dosimetry equipment consists of a complete DASY3 V1.0 dosimetry system manufactured and calibrated by Schmid & Partner Engineering AG of Zurich, Switzerland, it is currently a state of the art system and from our research, it appears to be the best available at this time. The DASY3 system consists of a six axis robot, a robot controller, a teach pendant, automation software on a Pentium 200 MHz computer, data acquisition system, isotropic e-field probe, and validation kit.
E-FIELD PROBE This test was performed using an E-field probe with conversion factors determined by Schmid & Partner (S & P). The probe is the most important part of the system, so will be discussed in section 5.2.
PHANTOM The phantom was the so called “generic phantom” supplied by S & P, and consists of a left and right side head for simulating phone usage on both sides of the head. The phantom is constructed of fibreglass with 2 +/- 0.1 mm shell thickness. The shape of the shell is based on data from an anatomical study of a group of 33 men and 19 women to determine the maximum exposure in approximately 90% of all users. The DASY system uses a homogeneous tissue phantom based on studies concerning energy absorption of the human head, and the different absorption rates between adults and children. These studies indicated that a homogeneous

phantom should overestimate SAR by no more than 15% for 1 g averages and should not underestimate SAR. In similar studies, it was found that a typical ear thickness is approximately 4 mm, so a 4 mm rubber ring is attached to the phantom at the ear area.
LIQUID DIELECTRIC The tissue simulating liquid which fills the phantom is supplied by QCP Inc.. There are two separate formulas for the two frequencies 900 MHz and 1800 MHz. This is necessary because the water molecules raise the conductivity to approximately 1.65 +/- 10% at the 1800 MHz frequency, without the addition of salt, so no salt is needed. Before the test, the permitivity and conductivity were measured with an automated Hewlett Packard 85070B dielectric probe in conjunction with a HP 8752C network analyser to monitor permitivity change due to evaporation. The electromagnetic parameters of the liquid were maintained as shown in table 1. The target values were obtained from the FCC web page for Tissue Dielectric Properties with internet address www.fcc.gov/fcc-bin/dielec.sh . The 1800 MHz liquid prepared has no salt or any conductive additive (the chemical/physical properties of the water, preservative, and sugar molecules alone provide too much conductivity). It is impossible to lower the conductivity to 1.15 S/m without a new formula with different ingredients. In other words, we would have to locate an ingredient to replace the sugar/water/preservative ingredients with materials providing similar density, permitivity, and optical properties (for the optical surface detection) but having lower conductivity at 1800 MHz. It was determined that using the 1800 MHz fluid from Schmid & Partner would overestimate the SAR by a small margin, and maintain maximum confidence.

FREQUENCY	PERMITIVITY	CONDUCTIVITY	DENSITY
900 MHz	41.8 +/- 5%	.82 +/- 10% mho/m	1 g/cm^3
1800 MHz	42.3 +/- 5%	1.62 +/- 10% mho/m	1 g/cm^3

Table 1

Schmid & Partner has supplied us with data that can be used to show the error in SAR caused by using higher conductivity. In general, higher conductivity over estimates measured SAR values. So by using a higher conductivity in the 1800 MHz band we were measuring SAR values higher than would exist in the human brain. This data is provided here in Table 2.

Distance of radiator from liquid surface	***Frequency MHz***	*Avg. volume gram*	*Increase of SAR per Increase in conductivity*	*Relative. permitivity*	*Conductivity of liquid S/m*	*Density of liquid g/cm³*
10 mm	900	1	+ 0 .62	41.5	0.85	1
10 mm	900	10	+ 0.39	41.5	0.85	1
15 mm	900	1	+ 0.63	41.5	0.85	1
15 mm	900	10	+ 0.39	41.5	0.85	1
30 mm	900	1	+0.63	41.5	0.85	1
30 mm	900	10	+0.39	41.5	0.85	1
10 mm	1500	1	+ 0.55	40.5	1.2	1
10 mm	1500	10	+ 0.27	40.5	1.2	1
15 mm	1500	1	+ 0.55	40.5	1.2	1
15 mm	1500	10	+ 0.27	40.5	1.2	1
30 mm	1500	1	+ 0.54	40.5	1.2	1
30 mm	1500	10	+ 0.26	40.5	1.2	1
10 mm	1800	1	+ 0.43	40.0	1.65	1
10 mm	1800	10	+ 0.13	40.0	1.65	1
15 mm	1800	1	+0. 42	40.0	1.65	1
15 mm	1800	10	+ 0.13	40.0	1.65	1
30 mm	1800	1	+ 0.41	40.0	1.65	1
30 mm	1800	10	+ 0.12	40.0	1.65	1

Table 2

The E-field probe is calibrated by the manufacturer in brain simulating tissue at frequencies of 900 MHz, and 1.8 GHz, accurate to +/- 8%. Linearity is said by the manufacturer to be +/- .2 dB from 30 MHz to 3 GHz. Dynamic range is said by the manufacturer to be 5 µW/gm to > 100 mW/g. The probe contains 3 small dipoles positioned symmetrically on a triangular core to provide for isotropic detection of the field. Each dipole contains a diode at the feed point that converts the RF signal to DC, which is conducted down a high impedance line to the data acquisition system.

The data acquisition system amplifies the signals, and converts them to digital values so that they may be sent to the computer. The inputs to the signal amplifiers are auto zeroed after every measurement to prevent charge build up on the lines, which could lead to errors.

5.2 SAR SYSTEM THEORY

The human body absorbs energy from a radiating cell phone by ionic motion and oscillation of polar molecules. The human head is in the near field of the device where polarisation and field intensity are very complex. Also the human head can cause large reflections and scattering, so it is more practical to measure the field absorbed inside the head, than to measure incident power before it enters the head. Inside the lossy brain tissue, the power per unit volume is given by (next page):

$$P_v = \tfrac{1}{2}\ \mathbf{J} \bullet \mathbf{E}^* = \tfrac{1}{2}\,\sigma\,|E|^2 \quad W/m^3$$

where **J** is current density

σ is conductivity of human tissue due to conductive and lossy displacement currents.

E is the electric field

But since SAR is the absorption of RF power per unit mass

$$P_g = \tfrac{1}{2}\ \sigma/\boldsymbol{p}\ |E|^2\ W/kg$$

where ***p*** is density of the tissue in kilograms per cubic meter.

In this equation, σ is a function of frequency, and so it must be measured at the frequency of the test. It is measured in terms of the real and imaginary components of the complex permitivity;

$$\varepsilon = \varepsilon_0\,(\varepsilon' - j\varepsilon'')$$

$$\sigma = 2\pi f \times (8.854 \times 10^{-12}) \times \varepsilon''$$

$$\textbf{Loss Tangent} \equiv \tan\delta = \varepsilon''/\varepsilon'$$

In order to measure the E field strength without distorting the field, the E field probe(shown here) is made as described by Schmid, Egger, and Kuster in [3].


E-field Probe

A major concern is that secondary coupling of the EUT radiated fields to the feed lines of the probe are minimised. This is done by making the feed lines of high impedance "twin-line" transmission line, printed very close together. In the probe tip there are three orthogonal dipoles, electrically small to minimise field distortion from coupling. The electrically small dipoles have source impedance's of 5 to 8 MΩ due to their small size, the high resistive feed lines, and the distributed filters on the lines. This high impedance makes them less sensitive so a sophisticated Data Acquisition Electronics (DAE) box is needed to amplify, multiplex, and digitize the signals. The DAE is installed on top of the robot arm. It also detects the proximity of the phantom surface with a fiber-optic cable. It provides for multiplexing between the three dipoles, and between 1X gain and 100X amplification, and it provides some filtering that will remove unwanted signals picked up by the probe. The DAE also provides a fast digital link to the robot for stopping in the event of a touch detection. It samples the probe output for 2600 complete E field measurements per dipole, per second. These samples are used to determine the amplification needed, 1X or 100X, and the magnitude determines what diode compression correction factor should be used. These factors as well as sensitivity factors of the specific probe, which are stored in the program, are used to determine the actual field strength for the test point.

The substrate on which the dipoles are printed, has been shaped to align each dipole with the E-field *after* the field lines are distorted by the permitivity of the substrate. In other words, since the substrate and the liquid dielectric have different permitivities, the E-field will diffract as it passes through the interface, and so the dipoles have been positioned to align with the fields *after* this distortion is accounted for.

The dipole elements in the probe are offset from the tip of the probe approximately 2.7 mm so unfortunately the field strength cannot be measured at the surface of the phantom, where it is likely to be maximum. The magnitude of the field at the surface must therefore be calculated with interpolation by using the data points stepped away from the surface and curve fitting, this is done automatically by the software.

6 TEST SAMPLE OPERATION

The wireless device was made to transmit maximum power that is allowed by the software (KWC phone control software, named phone_t) in the device. The software was used to force the device to transmit maximum power for the duration of the SAR tests. The DASY 3 system checks E field strength at a fixed location before and after each scan, and checks for drift due to draining of the battery or some other effect. This shows up as “drift” on the report and if it is too high the test is repeated.

Power settings –

The nominal manufacture power levels were used for EMC tests required in 47 CFR Part 22 and Part 24. For SAR test discussed in this RF exposure test report, the conducted power level was set 0.7 dB higher than the nominal power level to include the manufacture tolerance. The radiated power (ERP/EIRP) corresponding to the conducted power level used for SAR tests was measured in the antenna range (fully anechonic chamber). The measurement procedures and technique are described in the Part 22 and Part 24 test report.

The conducted power levels and corresponding ERP/EIRP for SAR test are listed in following tables.

Table 3: Conducted power used for SAR test - Cellular

		RF output power (W or dBm) - Cellular	
		Measured	
carrier frequency (MHz)	channel	FM	CDMA
824.04	991	0.504 W / 27.02 dBm	
824.7	1013		0.373 W / 25.72 dBm
836.49	383	0.500 W / 26.99 dBm	0.372 W / 25.71 dBm
848.31	777		0.372 W / 25.70 dBm
848.97	799	0.501 W / 27.00 dBm	
Maximum Power over Band		**27.02 dBm**	**25.72 dBm**

Table 4: Conducted power used for SAR test - PCS

		RF output power (W) - PCS
carrier frequency (MHz)	channel	CDMA
		Measured
1851.25	25	0.264 W / 24.22 dBm
1880	600	0.265 W / 24.23 dBm
1908.75	1175	0.264 W / 24.21 dBm
Maximum Power over Band		**24.23 dBm**

Table 5: Radiated power (ERP) corresponding to Table 3 - Cellular

		RF output power ERP (W or dBm) – Cellular	
		Measured	
carrier frequency (MHz)	channel	FM	CDMA
824.04	991	28.41 dBm	
824.7	1013		27.08 dBm
836.49	383	27.92 dBm	26.46 dBm
848.31	777		26.76 dBm
848.97	799	28.01 dBm	
Max power over band		**28.41 dBm**	**27.08 dBm**

Table 6: Radiated power (EIRP) corresponding to Table 4 - PCS

		RF output power EIRP (W or dBm) - PCS
carrier frequency (MHz)	channel	CDMA
		measured
1851.25	25	27.90 dBm
1880	600	26.98 dBm
1908.75	1175	26.84 dBm
Max power over band		**27.90 dBm**

7 SAR TEST SYSTEM VALIDATION

We performed the validation test by using a dipole before the SAR tests. The following plots are the results of validation tests. The muscle tissues were calibrated by using HP85070B dielectric measurement system. The data sheets are attached below. The original validation results provided by the system manufacturer for cellular and PCS band are attached as well.

Manufacturer Validation Data

Brain Tissue Validation Test Results

Muscle Tissue Calibration Data Sheet

8 SAR MEASUREMENT PROCEDURE

DEVICE POSITIONING The phone was tested in the primary test position that is described by Supplement C of OET Bulletin 65 from the Office of Engineering & Technology, of the FCC. The procedure places the surface of the phone in contact with the phantom.

9 SAR MEASUREMENT UNCERTAINTY

The possible errors included in this measurement arise from device positioning uncertainty, device manufacturing uncertainty, liquid dielectric permitivity uncertainty, liquid dielectric conductivity uncertainty, uncertainty due to disturbance of the fields by the probe.

These will be discussed as they are of much importance to the final dosimetric assessment. Every attempt is made to reduce uncertainty, as well as to test for worst case SAR. These uncertainties are likely to be pessimistic, but they should be considered when comparing data taken from one lab to another. Thomas Schmid of Schmid and Partners has performed a study of SAR repeatability due to many different uncertainties, this is likely the most complete study of the topic so it is referred to here.

Device positioning; this uncertainty is due to different operators positioning the device on the phantom differently, it depends on the operators, the device design, the phantom, and the device holder. Repeatability for some devices in Schmid's study was as poor as +/- 30% for the "touch" position. For the "intended use" position the repeatability was approximately +/- 5%, depending on the device tested, overall a figure of +/- 6% was taken as typical device positioning uncertainty. One operator is used at the Kyocera lab, trained to place the phone as close as possible to phantom, and the test is performed after the position of maximum SAR is determined. This minimises device positioning error. Typically the phone is clamped in the holder in the horizontal position, and a short wooden dowel is placed in a small hole where the center of the ear speaker resides, this wooden dowel allows the operator to line up the speaker with the ear canal. Once aligned, the tooth pick is removed, and the phone is raised up until it touches the phantom on the ear. Then the cradle is rocked so the phone rocks toward the chin of the phantom, touching as closely as possible without depressing the keypad. This puts the phone as close as possible to the phantom, allowing maximum SAR to be measured, for most positions. In the event that this may not produce maximum SAR, the phone is placed in several other positions and a coarse scan is run for each position. The DASY system has a command called "move to max" which allows the probe to be sent to the point of max field intensity found with the coarse scan. This gives a visual indication of where the maximum surface currents may be, and allows the operator to position this point of the phone as close as possible to the phantom.

Liquid dielectric permittivity and conductivity; The average permittivity of a typical human head was determined by Dr. Gabriel and has been listed by the FCC (OET bulletin 65 supplement C) as 46.1 at 835 MHz and 43.4 at 1800 MHz. The lower permittivity generally gives a slightly higher SAR value, so slightly lower values were used for the test. Since SAR is defined as the time rate of absorption per unit of weight, only the macroscopic simulation of the tissue's permittivity, permeability, and conductivity are required. These electrical properties are obtained with a liquid which uses sugar to raise the permittivity, salt to raise the conductivity, and cellulose to hold the two in suspension. After installing the liquid it is measured with an HP 85070A dielectric probe kit. The achievable accuracy of this device is +/- 5% for the permittivity and +/- 10% for the conductivity. The liquid is also measured at the beginning of each SAR measurement day, to check for evaporation.

FIELD DISTURBANCES Errors due to disturbance of the fields by the probe; because the polarisation of the fields are unknown, the near field probe must measure all polarisation's without disturbing them by being present. Three orthogonal dipoles are located at the tip of a special dielectric support, with diodes at the feed points sensitive to fields as small as 5 microWatt/gm. To prevent secondary coupling of the fields to the feed lines, the lines are high resistance printed lines with distributed filters integrated in the lines, after the diode. Much research has been put into these probe designs, so their uncertainty is considered minimized. There are other uncertainties, such as laboratory setup uncertainty, the reader should refer to attachment 10 of the March 1998 minutes of the IEEE standards coordinating committee, by Thomas Schmid. Mr. Schmid's preliminary uncertainty figure is –12% to +52% for the SAR measurement. As stated before this is possible, but believed to be pessimistic because many of the sources of uncertainty have been reduced or eliminated, at considerable expense. All practical precautionary measures are taken to reduce these errors in the Kyocera Corp SAR lab.

Surface Detection The surface detection on the DASY system is mechanical and optical, it is checked and compared automatically to ensure correct operation. This can indicate that the optical surface detection is not in agreement with the mechanical, which might mean the liquid needs to be stirred. This process insures minimum distance from the surface of the phantom for measurements.

10 TEST DATA SUMMARY

The device, which was tested, is the final production model in both the analogue and digital modes. The SAR values measured indicate that the device produces SAR levels below the limit of 1.6 mW/g for the one gram average.

Parameters of brain and muscle tissue

	Frequency	**Permittivity**	**Conductivity (S/m)**	**Notes**
Brain	900 MHz	42.7	0.86	specified by DASY3-user manual
Muscle	900 MHz	55.9	0.94	specified by OET bulletin 65, supplemental C and DASY3-user manual
Brain	1800 MHz	40.4	1.68	specified by DASY3-user manual
Muscle	1800 MHz	40.1	1.67	specified by OET bulletin 65, supplemental C.

ANSI/IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak (Brain) Uncontrolled Exposure/General Population	1.6 W/kg (mW/g)

Brain SAR Test Results

FREQ. MHZ	CH.#	SERIAL NUMBER	MODULATION	ANTENNA POSITION	1 GRAM AVG. SAR (MW/G)
824	991	75BV0100353140	ANALOG	Ext	1.32
824	991	75BV0100353140	ANALOG	Ret	1.11
836.5	383	75BV0100353140	ANALOG	Ext	1.51
836.5	383	75BV0100353140	ANALOG	Ret	0.936
849	799	75BV0100353140	ANALOG	Ext	1.56
849	799	75BV0100353140	ANALOG	Ret	1.21
849	777	75BV0100353140	Cellular CDMA	Ext	1.13
849	777	75BV0100353140	Cellular CDMA	Ret	0.931
1851.25	25	75BV0100353140	PCS CDMA	Ext	0.806
1851.25	25	75BV0100353140	PCS CDMA	Ret	1.42
1880	600	75BV0100353140	PCS CDMA	Ext	0.761
1880	600	75BV0100353140	PCS CDMA	Ret	1.40
1908.75	1175	75BV0100353140	PCS CDMA	Ext	0.685
1908.75	1175	75BV0100353140	PCS CDMA	Ret	1.26

For the FCC ID: OVFQCP-3035A the highest SAR (at head) in the cellular band is 1.56 mW/g. The highest SAR (at head) in PCS band is 1.42 mW/g.

The QCP-3035 has provision for headset and body-worn holster to allow hands-free operation. The SAR for such operating condition was measured. The following is the summary of the results.

Body-worn SAR Test Results

FREQ. MHZ	CH.#	SERIAL NUMBER	MODULATION	ANTENNA POSITION	1 GRAM AVG. SAR (MW/G)
824	991	75BV0100353140	ANALOG	Ext	0.527
824	991	75BV0100353140	ANALOG	Ret	0.701
836.5	383	75BV0100353140	ANALOG	Ext	0.467
836.5	383	75BV0100353140	ANALOG	Ret	0.645
849	799	75BV0100353140	ANALOG	Ext	0.533
849	799	75BV0100353140	ANALOG	Ret	0.616
1851.25	25	75BV0100353140	PCS CDMA	Ext	0.598
1851.25	25	75BV0100353140	PCS CDMA	Ret	0.650
1880	600	75BV0100353140	PCS CDMA	Ext	0.383
1880	600	75BV0100353140	PCS CDMA	Ret	0.703
1908.75	1175	75BV0100353140	PCS CDMA	Ext	0.355
1908.75	1175	75BV0100353140	PCS CDMA	Ret	0.296

For the FCC ID: OVFQCP-3035A with tested belt-clip (provides 23.50 mm closest separation), the highest body-worn SAR is 0.703 mW/g.

11 SAR PLOTS

12 PHOTOS

References

[1] Klaus Meier, Voker Hombach, Ralf Kastle, Roger Yew-Siow Tay, and Neils Kuster "The dependence of Electromagnetic Energy Absorption upon Human-Head Modeling at 1800 MHz" IEEE Transactions on Microwave Theory and Techniques, Vol. 45 No 11, November 1997

[2] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard Kuhn, and Neils Kuster "The Dependence of EM Energy Absorption Upon Human Head Modeling at 900 MHz" " IEEE Transactions on Microwave Theory and Techniques, Vol. 44 No 10, October 1996

[3] Thomas Schmid, Oliver Egger, Niels Kuster "Automated E-Field Scanning System for Dosimetric Assessments" IEEE Transactions on Microwave Theory and Techniques, Vol 44, No 1, January 1996

[4] Niels Kuster, Q. Balzano, and J.C. Lin "Mobile Communications Safety" Chapman & Hall, First edition 1997