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*
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 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. 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 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 has provision for headset and body-worn holster 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/cm^3*
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):

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

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

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

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

Staffelstrasse 8, 8045 Zurich, Switzerland, Telefon +41 1 280 08 60, Fax +41 1 280 08 64

DASY3

Dipole Validation Kit

Type: D1800V2

Serial: 220

Manufactured: December 1997
Calibrated: January 1998

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom (shell thickness 2mm) filled with brain simulating sugar solution of the following electrical parameters at 1800 MHz:

Relative Dielectricity	**39.5**	± 5%
Conductivity	**1.70 mho/m**	± 10%

The DASY3 System (Software version 3.0b) with a dosimetric E-field probe ET3DV4 (SN:1302, conversion factor 4.6) was used for the measurements.

The dipole feedpoint was positioned below the centre marking and oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole centre to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging. The dipole input power (forward power) was 250mW ± 3 %. The results are normalised to 1W input power.

2. SAR Measurement

Standard SAR-measurements were performed with the head phantom according to the measurement conditions described in section 1. The results (see figure) have been normalised to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**39.9 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**20.1 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well. The estimated sensitivities of SAR-values and penetration depths to the liquid parameters are listed in the DASY Application Note 4: 'SAR Sensitivities'.

3. Dipole Impedanc and return loss

The impedance was measured at the SMA-connector with a network analyser and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.178 ns**	(one direction)
Transmission factor:	**0.993**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1800 MHz:	Re{Z} = **49.5 Ω**
	Im {Z} = **0.6 Ω**
Return Loss at 1800 MHz	**- 42.1 dB**

4. Handling

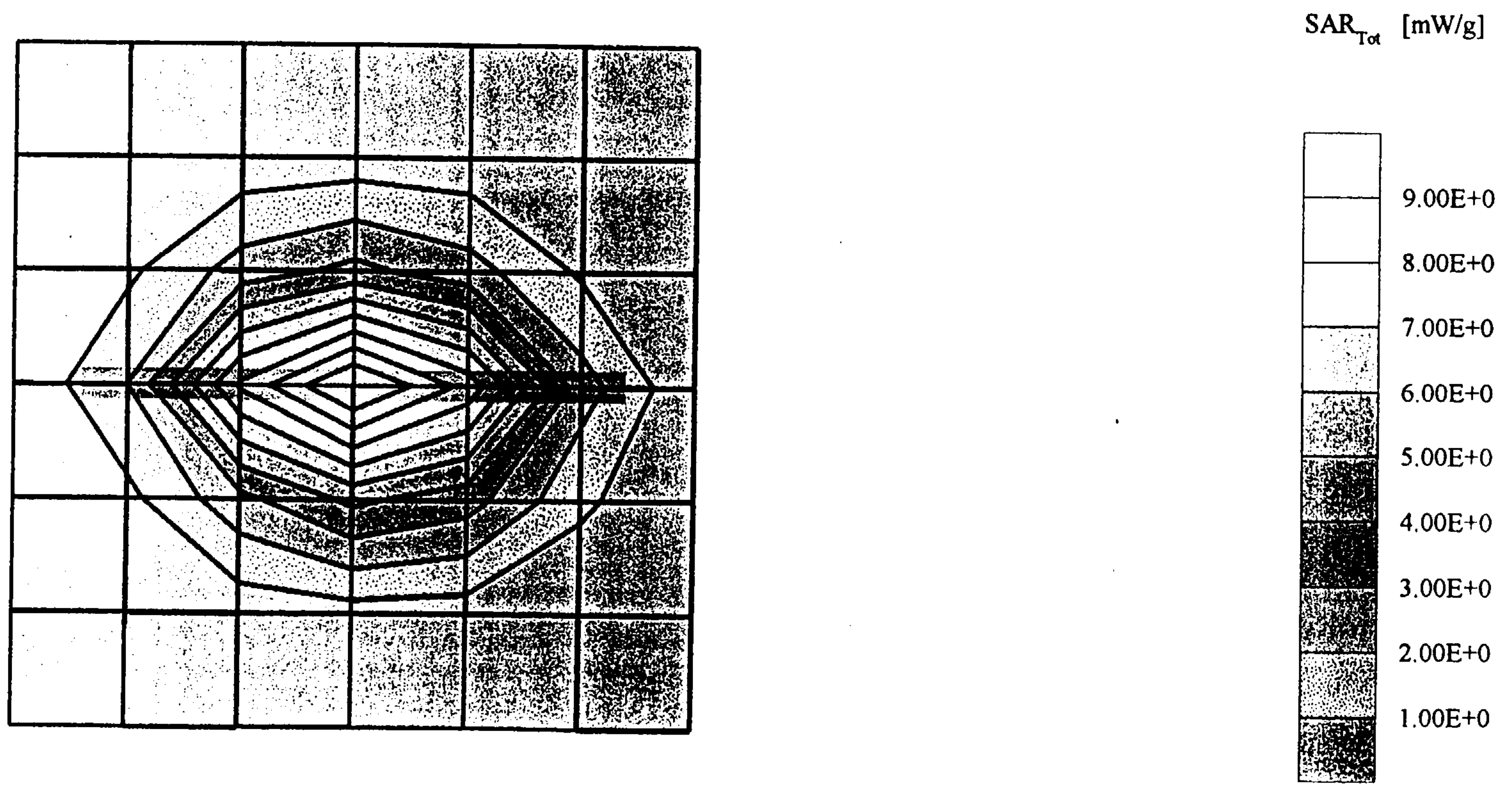
The dipole is made of standard semirigid coaxial cable. The centre conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

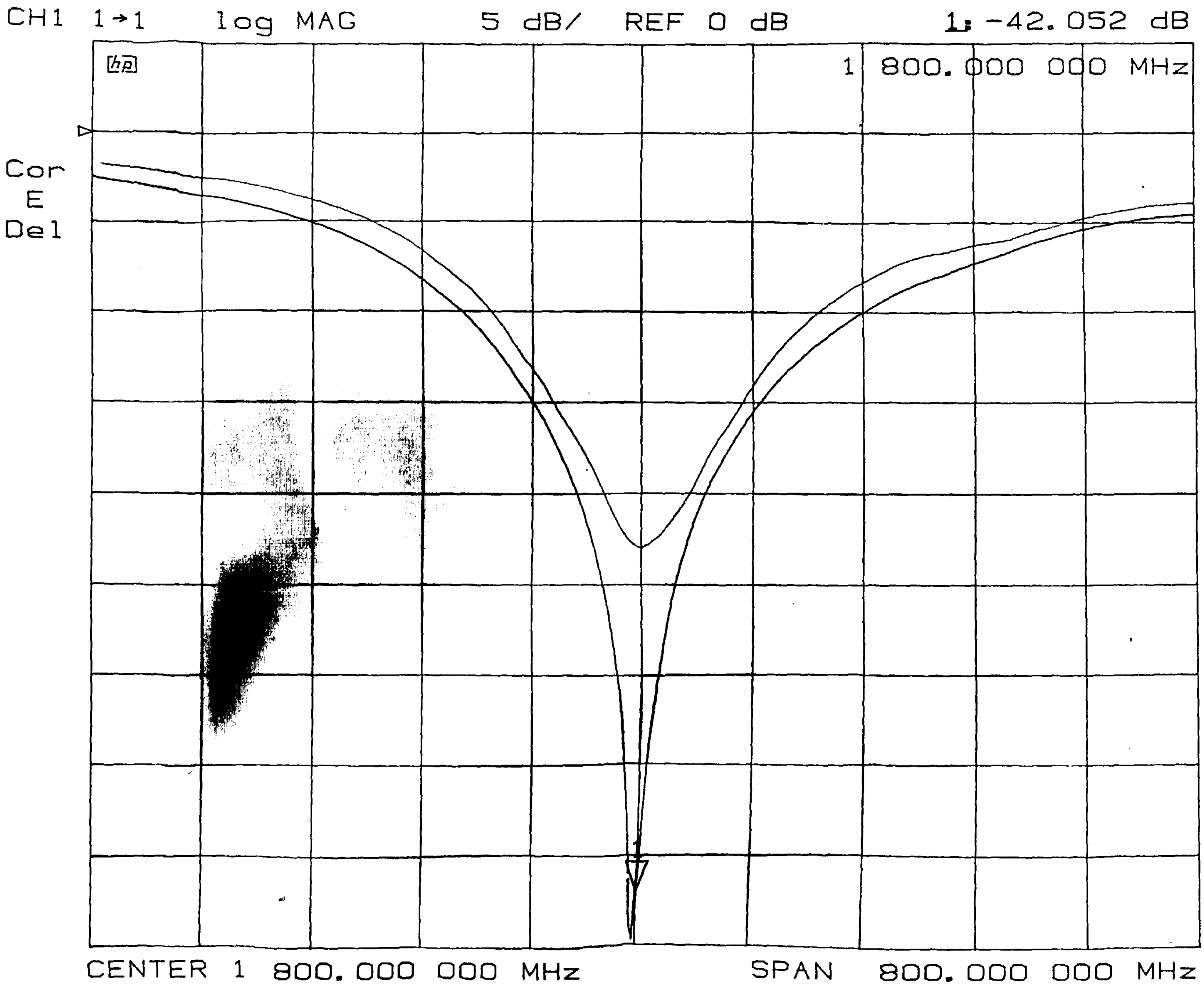
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

After prolonged use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Validation Dipole D1800V2 SN:220, d = 10mm

Frequency: 1800 [MHz]; Antanna Input Power: 250 [mW]
Generic Twin Phantom; Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0 [mm]
Probe: ET3DV5 - SN1302 DAE3; ConvF(4.60,4.60,4.60); Crest factor: 1.0; }: $\sigma = 1.70$ [mho/m] $\varepsilon_r = 39.5$ $\rho = 1.00$ [g/cm³]
Cubes (2): Peak: 19.2 [mW/g] ± 0.06 dB, SAR (1g): 9.97 [mW/g] ± 0.05 dB, SAR (10g): 5.02 [mW/g] ± 0.04 dB, (Worst-case extrapolation)
Penetration depth: 7.4 (7.2, 8.0) [mm]
Powerdrift: 0.03 dB





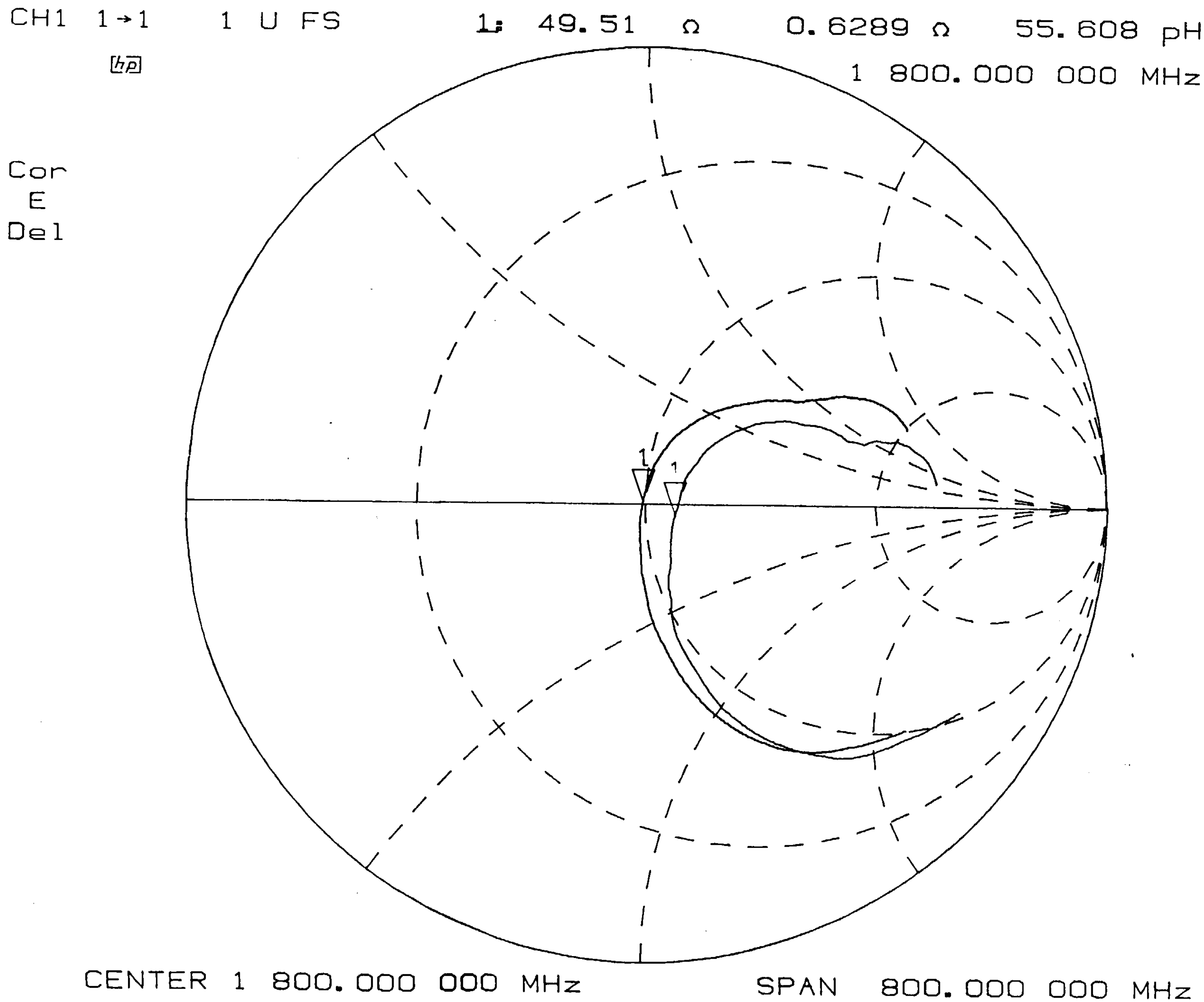
D1800V2 SN

S11

Flat phantom wi
brain simulating
solution

blk: d = 10mm
red: d = 20mm

(distance from dipo
center to solution)



D1800V2 SN

S11

Flat phantom wi
brain simulating
solution

blk: d = 10mm
red: d = 20mm

(distance from dipo
center to solution)

Schmid & Partner
Engineering AG

Staffelstrasse 8, 8045 Zurich, Switzerland, Telefon +41 1 280 08 60, Fax +41 1 280 08 64

DASY

Dipole Validation Kit

Type: D900V2

Serial: 024

Manufactured: December 1997
Calibrated: January 1998

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom (shell thickness 2mm) filled with brain simulating sugar solution of the following electrical parameters at 900 MHz:

Relative Dielectricity	**42.3**	± 5%
Conductivity	**0.85 mho/m**	± 5%

The DASY3 System (Software version 1.0a) with a dosimetric E-field probe ET3DV4 (SN:1302, Conversion factor 5.5) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the centre marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole centre to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging. The dipole input power (forward power) was 250mW ± 3 %. The results are normalised to 1W input power.

2. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 1. The results have been normalised to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**9.44 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**6.16 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well. The estimated sensitivities of SAR-values and penetration depths to the liquid parameters are listed in the DASY Application Note 4: 'SAR Sensitivities'.

3. Dipole Impedance and return loss

The impedance was measured at the SMA-connector with a network analyser and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.397 ns**	(one direction)
Transmission factor:	**0.988**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 900 MHz:	Re{Z} = **50.2 Ω**
	Im {Z} = **-0.0 Ω**
Return Loss at 900 MHz	**- 54.9 dB**

4. Handling

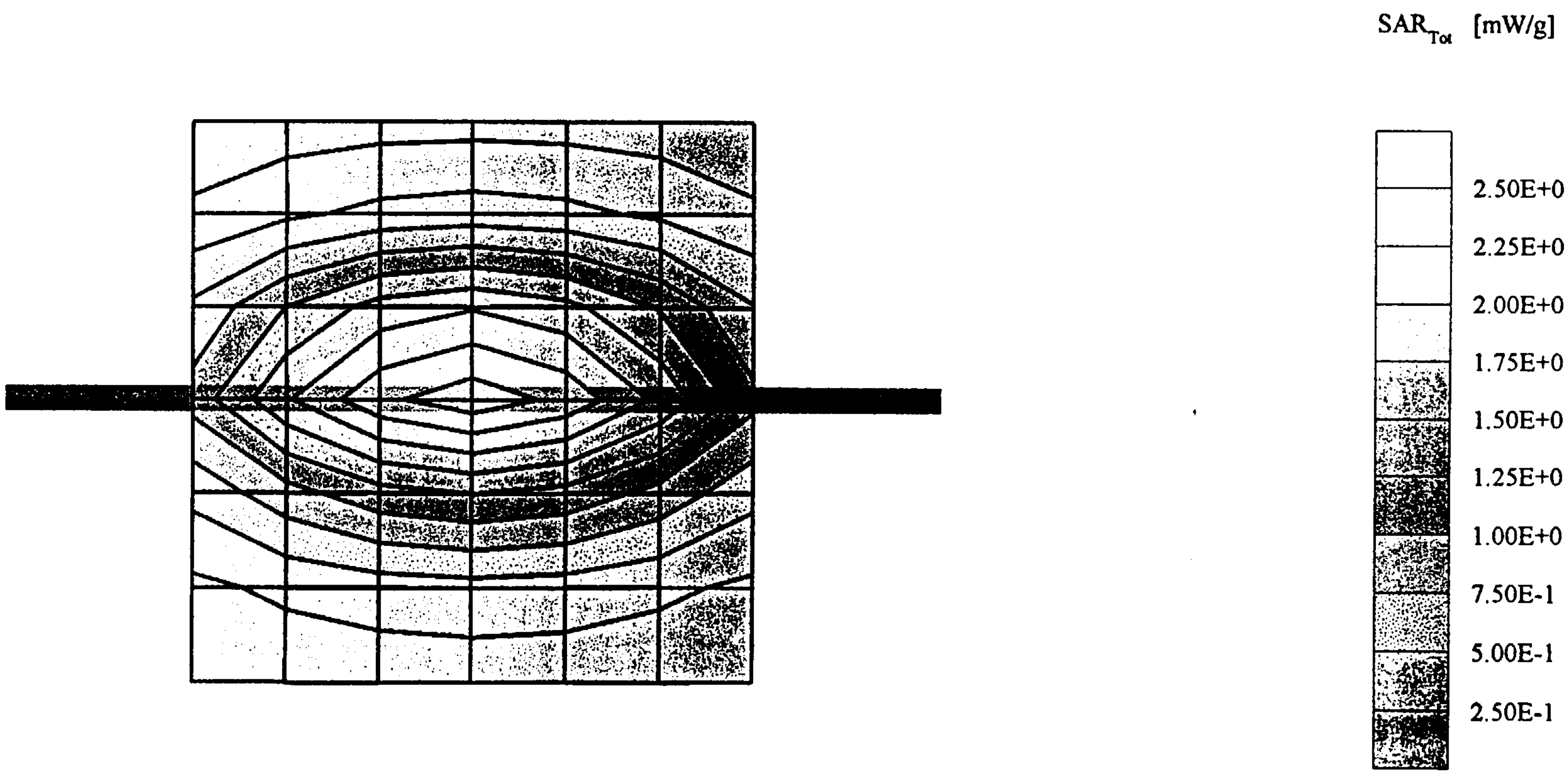
The dipole is made of standard semirigid coaxial cable. The centre conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

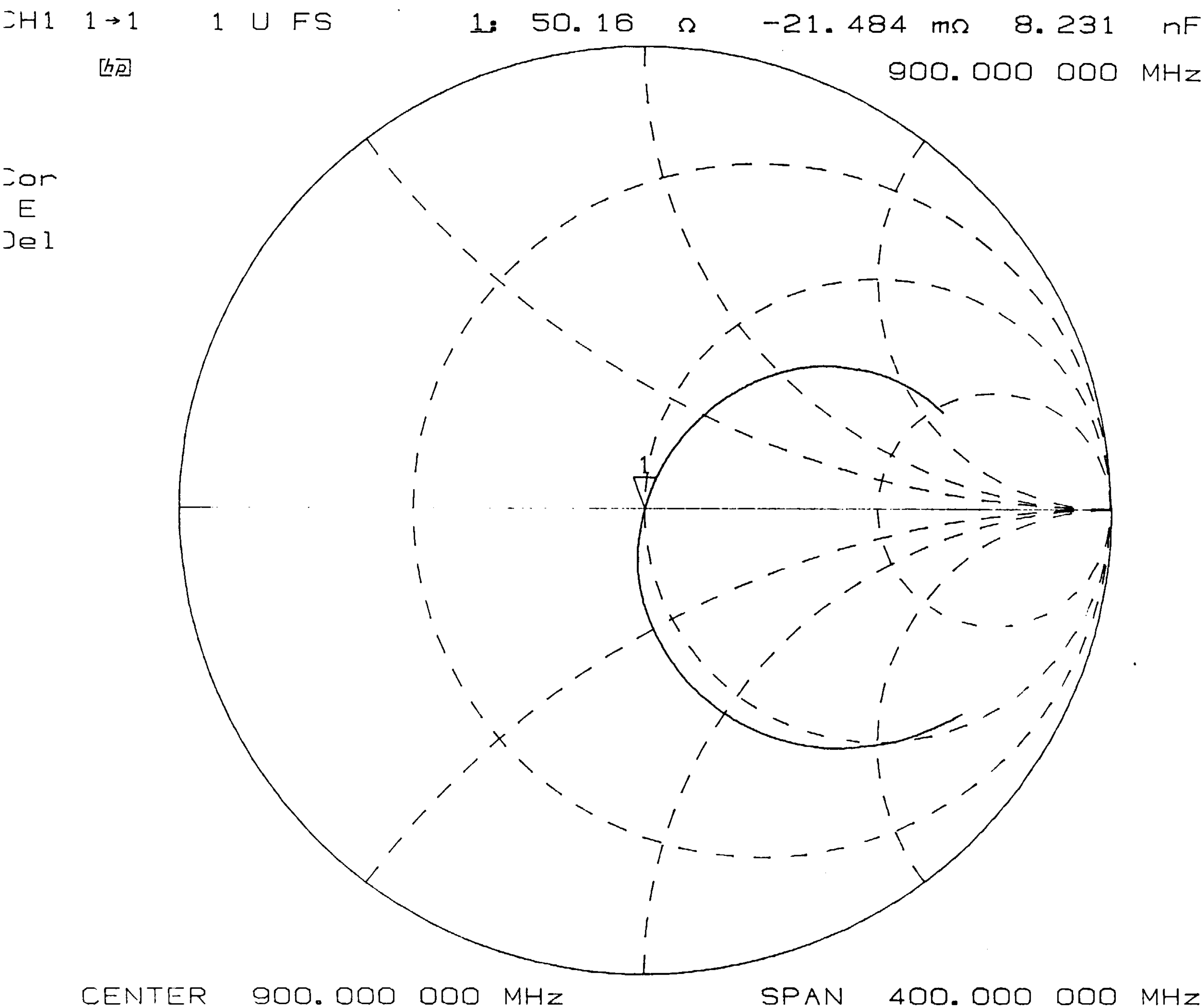
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

After prolonged use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

alidation Dipole D900V2 SN:024, d = 15mm

:quency: 900 [MHz]; Antanna Input Power: 250 [mW]
neric Twin Phantom; Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0 [mm]
›be: ET3DV5 - SN1302 DAE3; ConvF(5.40,5.40,5.40); Crest factor: 1.0; }: σ = 0.85 [mho/m] ε_r = 42.3 ρ = 1.00 [g/cm³]
bes (2): Peak: 3.58 [mW/g] ± 0.06 dB, SAR (1g): 2.36 [mW/g] ± 0.05 dB, SAR (10g): 1.54 [mW/g] ± 0.04 dB, (Worst-case extrapolation)
ıetration depth: 13.1 (12.1, 14.4) [mm]
werdrift: 0.03 dB





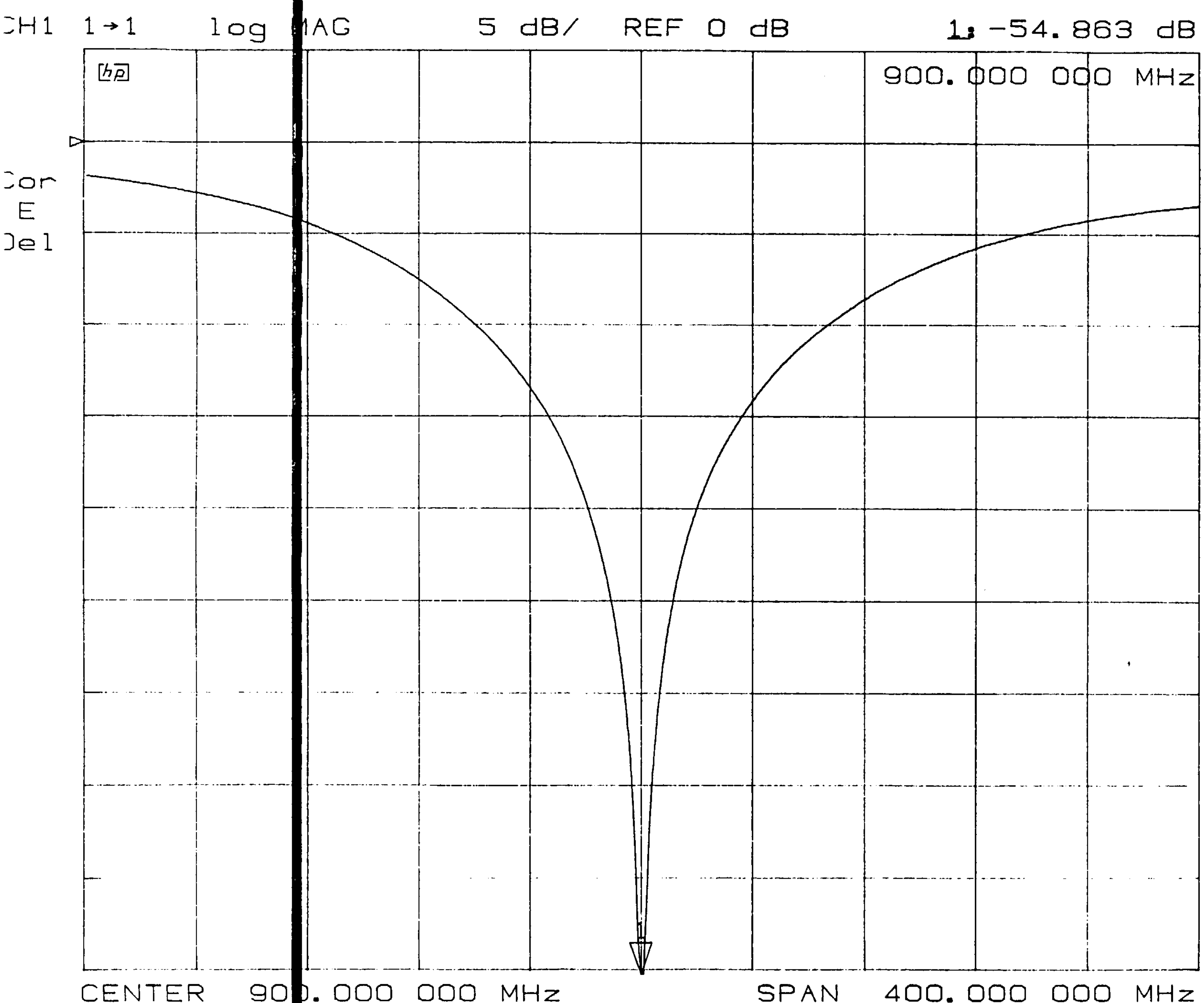
D900V2 SN: 024

S11

Flat phantom with brain simulating solution

d = 15mm

(distance from dipole center to solution)



D900V2 SN: 024

S11

Flat phantom with brain simulating solution

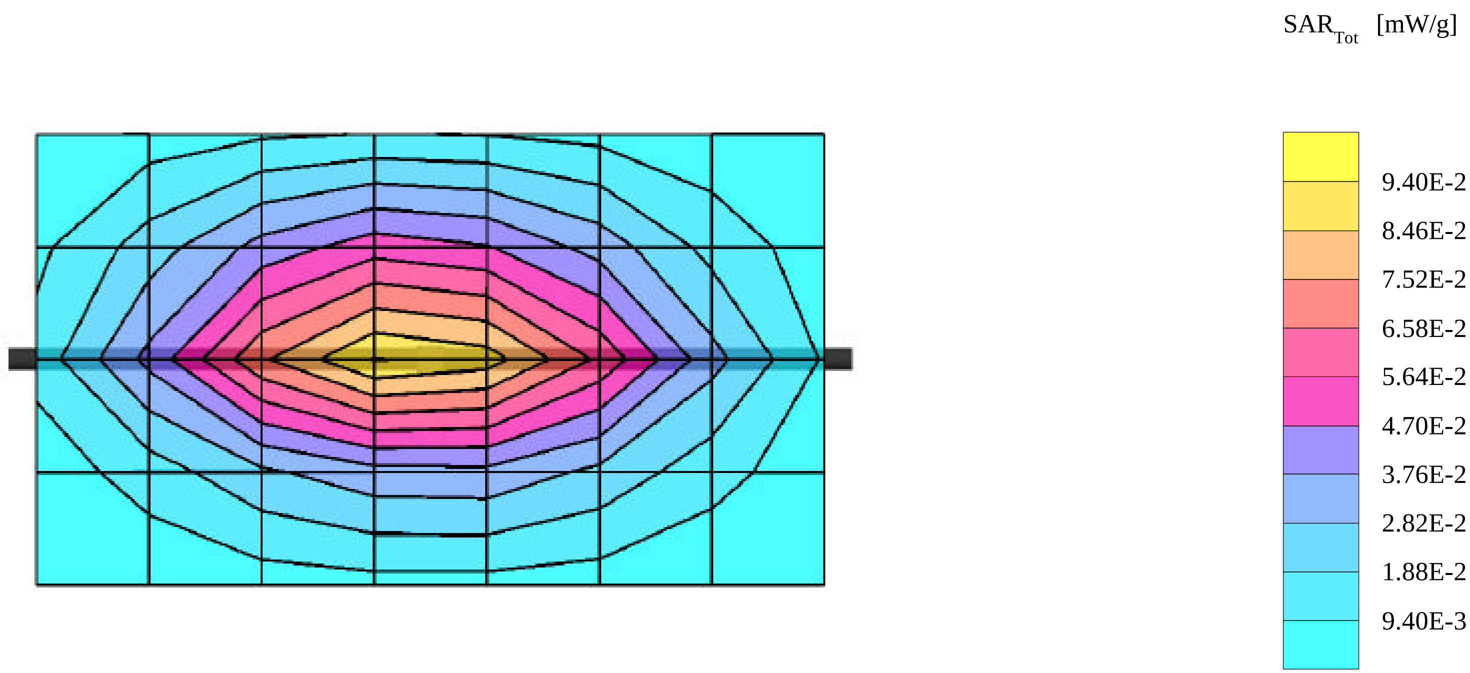
d = 15mm

(distance from dipole center to solution)

Brain Tissue Validation Test Results

03-05-01 900MHz Validation   Target=0.0944mW/g

SAR (1g): 0.0968 [mW/g] ± 0.10 dB, SAR (10g): 0.0635 [mW/g] ± 0.09 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat 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: ValidationFlat 900MHz 03-05-01b.DA3
Powerdrift: 0.02 dB



Reference math : OFF   Title: 03-05-01

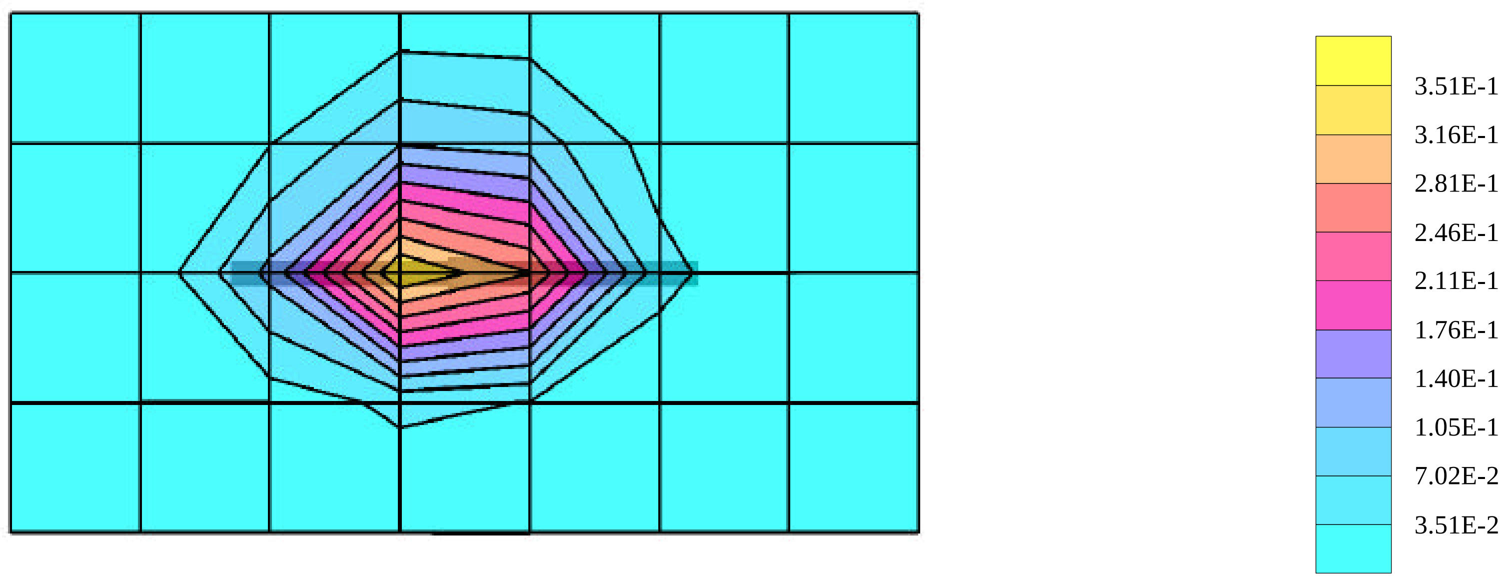
900 MHz

Pt#	Frequency (GHz)	Data real	Data imag
1	0.000300000	9999.00	9999.00
2	0.007799250	46.61	281.70
3	0.015298500	45.86	149.21
4	0.022797750	63.29	108.35
5	0.030297000	62.47	84.29
6	0.037796250	61.87	68.15
7	0.045295500	60.83	58.33
8	0.052794750	60.45	51.26
9	0.060294000	60.30	46.29
10	0.067793250	59.52	41.98
11	0.075292500	59.45	38.54
12	0.082791750	58.86	35.73
13	0.090291000	58.43	33.82
14	0.097790250	58.13	31.88
15	0.105289500	57.76	30.58
16	0.112788750	57.40	28.83
17	0.120288000	57.07	27.86
18	0.127787250	56.77	26.93
19	0.135286500	56.52	26.10
20	0.142785750	56.33	25.13
21	0.150285000	56.24	24.65
22	0.157784250	55.82	24.04
23	0.165283500	55.53	23.52
24	0.172782750	55.14	23.00
25	0.180282000	55.03	22.46
26	0.187781250	54.91	22.00
27	0.195280500	54.70	21.69
28	0.202779750	54.38	21.41
29	0.210279000	54.23	21.06
30	0.217778250	54.05	20.81
31	0.225277500	53.79	20.54
32	0.232776750	53.52	20.29
33	0.240276000	53.43	20.13
34	0.247775250	53.19	19.97
35	0.255274500	52.97	19.78
36	0.262773750	52.82	19.59
37	0.270273000	52.57	19.47
38	0.277772250	52.50	19.26
39	0.285271500	52.30	19.15
40	0.292770750	52.20	19.04
41	0.300270000	52.01	18.90
42	0.307769250	51.84	18.79
43	0.315268500	51.71	18.69
44	0.322767750	51.52	18.57
45	0.330267000	51.32	18.56
46	0.337766250	51.19	18.40
47	0.345265500	51.04	18.38
48	0.352764750	50.93	18.27
49	0.360264000	50.72	18.22
50	0.367763250	50.64	18.20
51	0.375262500	50.42	18.12
52	0.382761750	50.34	18.00
53	0.390261000	50.16	18.04
54	0.397760250	50.01	17.99
55	0.405259500	49.89	17.91
56	0.412758750	49.76	17.90

117	0.870213000	42.71	17.37
118	0.877712250	42.59	17.40
119	0.885211500	42.46	17.38
120	0.892710750	42.43	17.38
121	0.900210000	42.33	17.39
122	0.907709250	42.26	17.39 σ = 0.87
123	0.915208500	42.16	17.40
124	0.922707750	42.08	17.39
125	0.930207000	42.03	17.40
126	0.937706250	41.91	17.40
127	0.945205500	41.83	17.38
128	0.952704750	41.74	17.40
129	0.960204000	41.64	17.41
130	0.967703250	41.57	17.37
131	0.975202500	41.49	17.40
132	0.982701750	41.38	17.40
133	0.990201000	41.31	17.41
134	0.997700250	41.21	17.42
135	1.005199500	41.14	17.40
136	1.012698750	41.09	17.40
137	1.020198000	41.00	17.42
138	1.027697250	40.88	17.40
139	1.035196500	40.82	17.39
140	1.042695750	40.74	17.41
141	1.050195000	40.66	17.40
142	1.057694250	40.59	17.39
143	1.065193500	40.50	17.40
144	1.072692750	40.42	17.39
145	1.080192000	40.37	17.38
146	1.087691250	40.28	17.41
147	1.095190500	40.19	17.39
148	1.102689750	40.13	17.37
149	1.110189000	40.06	17.41
150	1.117688250	39.98	17.38
151	1.125187500	39.93	17.36
152	1.132686750	39.88	17.39
153	1.140186000	39.80	17.39
154	1.147685250	39.75	17.39
155	1.155184500	39.68	17.40
156	1.162683750	39.61	17.41
157	1.170183000	39.55	17.40
158	1.177682250	39.46	17.41
159	1.185181500	39.39	17.41
160	1.192680750	39.32	17.39
161	1.200180000	39.24	17.40
162	1.207679250	39.16	17.40
163	1.215178500	39.11	17.41
164	1.222677750	39.02	17.42
165	1.230177000	38.96	17.40
166	1.237676250	38.90	17.43
167	1.245175500	38.81	17.44
168	1.252674750	38.75	17.41
169	1.260174000	38.70	17.44
170	1.267673250	38.62	17.40
171	1.275172500	38.56	17.42
172	1.282671750	38.48	17.42
173	1.290171000	38.41	17.42
174	1.297670250	38.34	17.45
175	1.305169500	38.27	17.44
176	1.312668750	38.23	17.44

03-05-01 1800MHz Validation   Target=0.399 mW/g

SAR (1g): 0.385 [mW/g] ± 0.06 dB, SAR (10g): 0.196 [mW/g] ± 0.06 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.00,5.00,5.00)
Brain 1800 MHz: σ = 1.66 [mho/m] ε_r = 42.1 ρ = 1.00 [g/cm^3]
File Name: ValidationFlat 1800MHz 03-05-01.DA3
Powerdrift: -0.09 dB



Reference math : OFF   Title: 03-06-01

1800 MHz

Pt#	Frequency (GHz)	Data real	Data imag
1	0.000300000	24.41	-24.41
2	0.007799250	33.80	-4.73
3	0.015298500	35.41	-2.47
4	0.022797750	60.99	-3.89
5	0.030297000	60.64	-2.40
6	0.037796250	61.22	-0.78
7	0.045295500	60.95	-0.54
8	0.052794750	60.93	0.71
9	0.060294000	61.02	1.13
10	0.067793250	60.79	1.66
11	0.075292500	60.50	2.07
12	0.082791750	60.37	2.46
13	0.090291000	60.34	2.77
14	0.097790250	60.17	3.10
15	0.105289500	59.97	3.51
16	0.112788750	59.84	3.43
17	0.120288000	59.76	3.71
18	0.127787250	59.45	3.98
19	0.135286500	59.57	4.20
20	0.142785750	59.27	4.56
21	0.150285000	59.24	4.71
22	0.157784250	58.99	4.90
23	0.165283500	58.90	5.05
24	0.172782750	58.74	5.32
25	0.180282000	58.67	5.39
26	0.187781250	58.55	5.51
27	0.195280500	58.34	5.74
28	0.202779750	58.31	5.91
29	0.210279000	58.17	5.96
30	0.217778250	58.02	6.15
31	0.225277500	57.96	6.24
32	0.232776750	57.83	6.46
33	0.240276000	57.68	6.63
34	0.247775250	57.64	6.74
35	0.255274500	57.42	6.84
36	0.262773750	57.34	7.01
37	0.270273000	57.29	7.08
38	0.277772250	57.20	7.26
39	0.285271500	57.02	7.32
40	0.292770750	56.95	7.48
41	0.300270000	56.85	7.65
42	0.307769250	56.74	7.71
43	0.315268500	56.66	7.82
44	0.322767750	56.55	7.98
45	0.330267000	56.42	8.10
46	0.337766250	56.37	8.14
47	0.345265500	56.20	8.33
48	0.352764750	56.09	8.34
49	0.360264000	56.02	8.49
50	0.367763250	55.91	8.62
51	0.375262500	55.84	8.64
52	0.382761750	55.71	8.82
53	0.390261000	55.61	8.87
54	0.397760250	55.52	9.04
55	0.405259500	55.41	9.10
56	0.412758750	55.31	9.21

237	1.770123000	42.37	16.12	
238	1.777622250	42.31	16.14	
239	1.785121500	42.26	16.16	
240	1.792620750	42.19	16.19	
241	1.800120000	42.15	16.17	σ= 1.619 mho/m
242	1.807619250	42.11	16.21	
243	1.815118500	42.07	16.20	
244	1.822617750	42.02	16.21	
245	1.830117000	41.95	16.22	
246	1.837616250	41.91	16.19	
247	1.845115500	41.88	16.22	
248	1.852614750	41.80	16.22	
249	1.860114000	41.76	16.20	
250	1.867613250	41.72	16.24	
251	1.875112500	41.66	16.24	
252	1.882611750	41.63	16.25	
253	1.890111000	41.59	16.26	
254	1.897610250	41.55	16.26	
255	1.905109500	41.52	16.29	
256	1.912608750	41.47	16.28	
257	1.920108000	41.45	16.29	
258	1.927607250	41.41	16.32	
259	1.935106500	41.35	16.31	
260	1.942605750	41.33	16.32	
261	1.950105000	41.28	16.36	
262	1.957604250	41.25	16.35	
263	1.965103500	41.21	16.38	
264	1.972602750	41.14	16.40	
265	1.980102000	41.10	16.40	
266	1.987601250	41.07	16.43	
267	1.995100500	41.01	16.45	
268	2.002599750	40.98	16.46	
269	2.010099000	40.95	16.48	
270	2.017598250	40.88	16.49	
271	2.025097500	40.88	16.50	
272	2.032596750	40.82	16.54	
273	2.040096000	40.77	16.53	
274	2.047595250	40.71	16.55	
275	2.055094500	40.67	16.54	
276	2.062593750	40.64	16.56	
277	2.070093000	40.56	16.59	
278	2.077592250	40.53	16.57	
279	2.085091500	40.48	16.60	
280	2.092590750	40.42	16.61	
281	2.100090000	40.38	16.61	
282	2.107589250	40.35	16.63	
283	2.115088500	40.32	16.65	
284	2.122587750	40.28	16.66	
285	2.130087000	40.23	16.66	
286	2.137586250	40.20	16.65	
287	2.145085500	40.16	16.67	
288	2.152584750	40.12	16.68	
289	2.160084000	40.07	16.67	
290	2.167583250	40.04	16.68	
291	2.175082500	39.98	16.69	
292	2.182581750	39.95	16.70	
293	2.190081000	39.91	16.72	
294	2.197580250	39.88	16.73	
295	2.205079500	39.84	16.77	
296	2.212578750	39.80	16.77	

Muscle Tissue Calibration Data Sheet

Reference math : OFF   Title: 03-06-01

MUSCLE DATA
900 MHz

Pt#	Frequency (GHz)	Data real	Data imag
1	0.000300000	1854.22	-248.35
2	0.007799250	264.23	600.44
3	0.015298500	107.15	327.72
4	0.022797750	98.81	239.96
5	0.030297000	84.73	180.86
6	0.037796250	79.14	147.56
7	0.045295500	74.00	123.09
8	0.052794750	71.82	107.40
9	0.060294000	70.42	94.56
10	0.067793250	69.22	84.54
11	0.075292500	68.59	76.99
12	0.082791750	67.79	70.52
13	0.090291000	67.55	65.00
14	0.097790250	66.91	60.96
15	0.105289500	66.49	57.11
16	0.112788750	66.15	53.55
17	0.120288000	65.81	50.62
18	0.127787250	65.43	48.20
19	0.135286500	65.43	45.91
20	0.142785750	64.96	43.98
21	0.150285000	64.80	42.40
22	0.157784250	64.59	40.52
23	0.165283500	64.27	39.02
24	0.172782750	64.13	37.85
25	0.180282000	64.00	36.61
26	0.187781250	63.83	35.41
27	0.195280500	63.69	34.46
28	0.202779750	63.48	33.46
29	0.210279000	63.37	32.60
30	0.217778250	63.11	31.73
31	0.225277500	63.15	30.97
32	0.232776750	62.96	30.34
33	0.240276000	62.70	29.74
34	0.247775250	62.65	29.18
35	0.255274500	62.47	28.57
36	0.262773750	62.41	28.05
37	0.270273000	62.34	27.50
38	0.277772250	62.24	27.13
39	0.285271500	62.11	26.65
40	0.292770750	62.01	26.23
41	0.300270000	61.94	25.84
42	0.307769250	61.90	25.44
43	0.315268500	61.76	25.13
44	0.322767750	61.65	24.80
45	0.330267000	61.52	24.49
46	0.337766250	61.44	24.18
47	0.345265500	61.38	23.94
48	0.352764750	61.25	23.64
49	0.360264000	61.15	23.40
50	0.367763250	61.07	23.17
51	0.375262500	61.08	22.90
52	0.382761750	60.90	22.71
53	0.390261000	60.81	22.50
54	0.397760250	60.71	22.34
55	0.405259500	60.60	22.14
56	0.412758750	60.58	22.01

117	0.870213000	56.16	18.19
118	0.877712250	56.11	18.19
119	0.885211500	56.03	18.19
120	0.892710750	55.97	18.18
121	0.900210000	55.94	18.17
122	0.907709250	55.86	18.16
123	0.915208500	55.82	18.14
124	0.922707750	55.75	18.12
125	0.930207000	55.71	18.08
126	0.937706250	55.63	18.09
127	0.945205500	55.60	18.05
128	0.952704750	55.58	18.06
129	0.960204000	55.49	18.09
130	0.967703250	55.46	18.07
131	0.975202500	55.40	18.11
132	0.982701750	55.32	18.10
133	0.990201000	55.27	18.13
134	0.997700250	55.21	18.15
135	1.005199500	55.17	18.10
136	1.012698750	55.13	18.12
137	1.020198000	55.01	18.13
138	1.027697250	55.00	18.09
139	1.035196500	54.94	18.12
140	1.042695750	54.86	18.11
141	1.050195000	54.81	18.09
142	1.057694250	54.75	18.11
143	1.065193500	54.67	18.11
144	1.072692750	54.64	18.12
145	1.080192000	54.55	18.12
146	1.087691250	54.51	18.10
147	1.095190500	54.46	18.12
148	1.102689750	54.40	18.14
149	1.110189000	54.32	18.13
150	1.117688250	54.30	18.13
151	1.125187500	54.23	18.13
152	1.132686750	54.18	18.13
153	1.140186000	54.12	18.14
154	1.147685250	54.07	18.10
155	1.155184500	54.02	18.11
156	1.162683750	53.94	18.14
157	1.170183000	53.88	18.09
158	1.177682250	53.86	18.09
159	1.185181500	53.77	18.11
160	1.192680750	53.72	18.09
161	1.200180000	53.70	18.07
162	1.207679250	53.65	18.09
163	1.215178500	53.62	18.09
164	1.222677750	53.57	18.12
165	1.230177000	53.52	18.10
166	1.237676250	53.52	18.12
167	1.245175500	53.44	18.12
168	1.252674750	53.39	18.11
169	1.260174000	53.35	18.13
170	1.267673250	53.29	18.16
171	1.275172500	53.23	18.15
172	1.282671750	53.16	18.19
173	1.290171000	53.10	18.19
174	1.297670250	53.07	18.21
175	1.305169500	53.00	18.22
176	1.312668750	52.97	18.23

$\sigma \approx 0.910$

Reference math : OFF   Title: 03-06-01

MUSCLE

1800 MHz

Pt#	Frequency (GHz)	Data real	Data imag
1	0.000300000	24.41	-48.82
2	0.007799250	41.33	2.76
3	0.015298500	41.66	2.04
4	0.022797750	65.84	-1.70
5	0.030297000	65.50	-1.03
6	0.037796250	66.28	0.28
7	0.045295500	65.82	0.31
8	0.052794750	66.07	0.71
9	0.060294000	66.26	1.21
10	0.067793250	66.18	1.03
11	0.075292500	65.85	1.66
12	0.082791750	65.75	1.87
13	0.090291000	65.75	1.95
14	0.097790250	65.76	2.06
15	0.105289500	65.71	2.36
16	0.112788750	65.65	2.27
17	0.120288000	65.51	2.61
18	0.127787250	65.37	2.78
19	0.135286500	65.43	3.02
20	0.142785750	65.22	3.13
21	0.150285000	65.19	3.11
22	0.157784250	65.15	3.41
23	0.165283500	64.99	3.46
24	0.172782750	64.81	3.58
25	0.180282000	64.89	3.70
26	0.187781250	64.85	3.85
27	0.195280500	64.70	3.92
28	0.202779750	64.62	4.08
29	0.210279000	64.56	4.11
30	0.217778250	64.42	4.24
31	0.225277500	64.53	4.24
32	0.232776750	64.45	4.36
33	0.240276000	64.31	4.51
34	0.247775250	64.24	4.64
35	0.255274500	64.14	4.70
36	0.262773750	64.21	4.79
37	0.270273000	64.11	4.86
38	0.277772250	64.02	5.03
39	0.285271500	63.99	5.02
40	0.292770750	64.00	5.13
41	0.300270000	63.96	5.28
42	0.307769250	63.94	5.27
43	0.315268500	63.86	5.41
44	0.322767750	63.78	5.54
45	0.330267000	63.74	5.58
46	0.337766250	63.71	5.68
47	0.345265500	63.66	5.74
48	0.352764750	63.57	5.79
49	0.360264000	63.52	5.90
50	0.367763250	63.49	5.97
51	0.375262500	63.47	6.02
52	0.382761750	63.39	6.19
53	0.390261000	63.37	6.21
54	0.397760250	63.35	6.35
55	0.405259500	63.28	6.42
56	0.412758750	63.19	6.52

237	1.770123000	54.44	14.87
238	1.777622250	54.37	14.88
239	1.785121500	54.32	14.90
240	1.792620750	54.26	14.95
241	1.800120000	54.22	14.96 $\sigma = 1.49$ mho/m
242	1.807619250	54.18	14.98
243	1.815118500	54.13	15.00
244	1.822617750	54.09	15.03
245	1.830117000	54.02	15.05
246	1.837616250	53.96	15.04
247	1.845115500	53.96	15.07
248	1.852614750	53.88	15.08
249	1.860114000	53.83	15.08
250	1.867613250	53.82	15.12
251	1.875112500	53.74	15.13
252	1.882611750	53.72	15.16
253	1.890111000	53.68	15.18
254	1.897610250	53.64	15.18
255	1.905109500	53.62	15.21
256	1.912608750	53.57	15.24
257	1.920108000	53.54	15.24
258	1.927607250	53.52	15.27
259	1.935106500	53.47	15.31
260	1.942605750	53.44	15.33
261	1.950105000	53.39	15.35
262	1.957604250	53.37	15.39
263	1.965103500	53.33	15.41
264	1.972602750	53.28	15.45
265	1.980102000	53.22	15.46
266	1.987601250	53.20	15.49
267	1.995100500	53.16	15.56
268	2.002599750	53.12	15.56
269	2.010099000	53.10	15.61
270	2.017598250	53.03	15.63
271	2.025097500	53.01	15.64
272	2.032596750	52.97	15.68
273	2.040096000	52.90	15.72
274	2.047595250	52.87	15.73
275	2.055094500	52.81	15.76
276	2.062593750	52.77	15.78
277	2.070093000	52.72	15.79
278	2.077592250	52.67	15.83
279	2.085091500	52.61	15.85
280	2.092590750	52.58	15.87
281	2.100090000	52.54	15.91
282	2.107589250	52.50	15.92
283	2.115088500	52.47	15.92
284	2.122587750	52.43	15.97
285	2.130087000	52.38	15.97
286	2.137586250	52.35	15.99
287	2.145085500	52.31	16.02
288	2.152584750	52.27	16.01
289	2.160084000	52.24	16.03
290	2.167583250	52.18	16.08
291	2.175082500	52.15	16.07
292	2.182581750	52.11	16.12
293	2.190081000	52.08	16.14
294	2.197580250	52.06	16.17
295	2.205079500	52.01	16.21
296	2.212578750	51.98	16.22

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

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

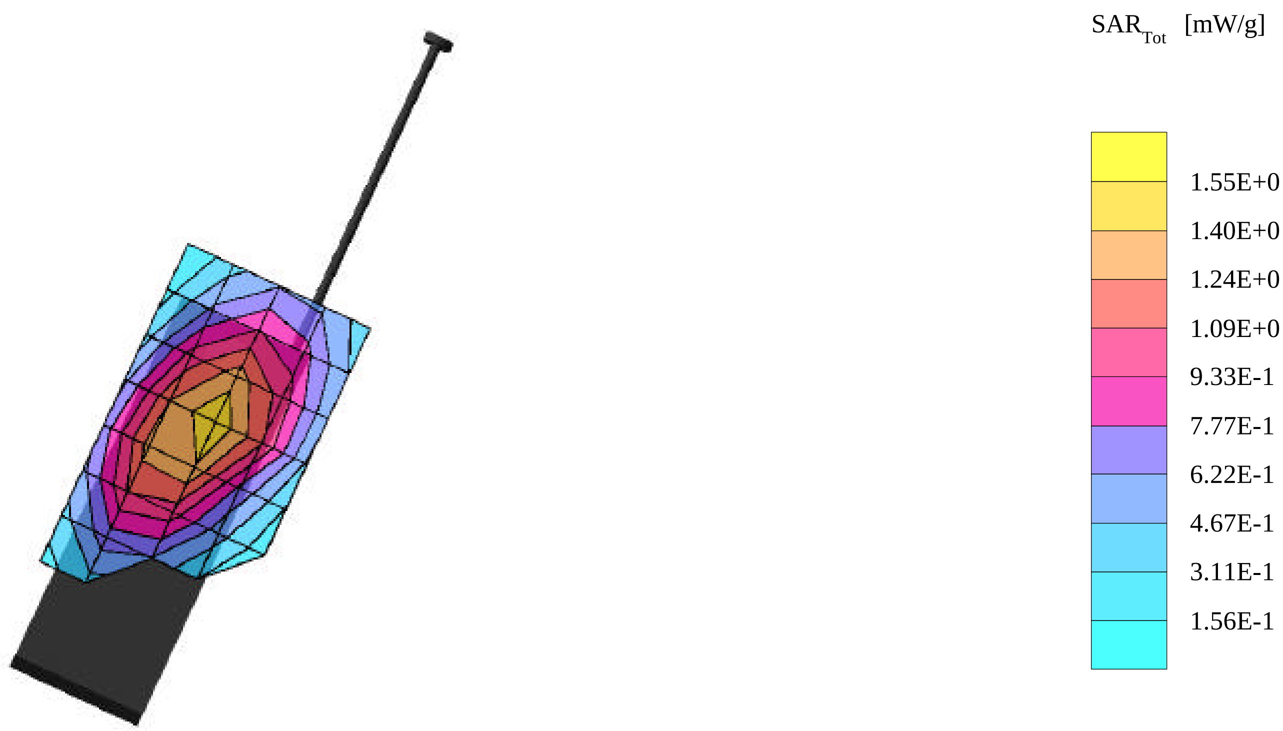
FREQ. MHZ	CH.#	SERIAL NUMBER	MODULATION	ANTENNA POSITION	1 GRAM AVG. SAR (MW/G)
824	991	75BV0100353140	ANALOG	Ext	0.527
824	991	75BV0100353140	ANALOG	Ret	0.701
836.5	383	75BV0100353140	ANALOG	Ext	0.467
836.5	383	75BV0100353140	ANALOG	Ret	0.645
849	799	75BV0100353140	ANALOG	Ext	0.533
849	799	75BV0100353140	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

With tested belt-clip (provides 23.50 mm closest separation), the highest body-worn SAR is 0.703 mW/g.

11 SAR PLOTS

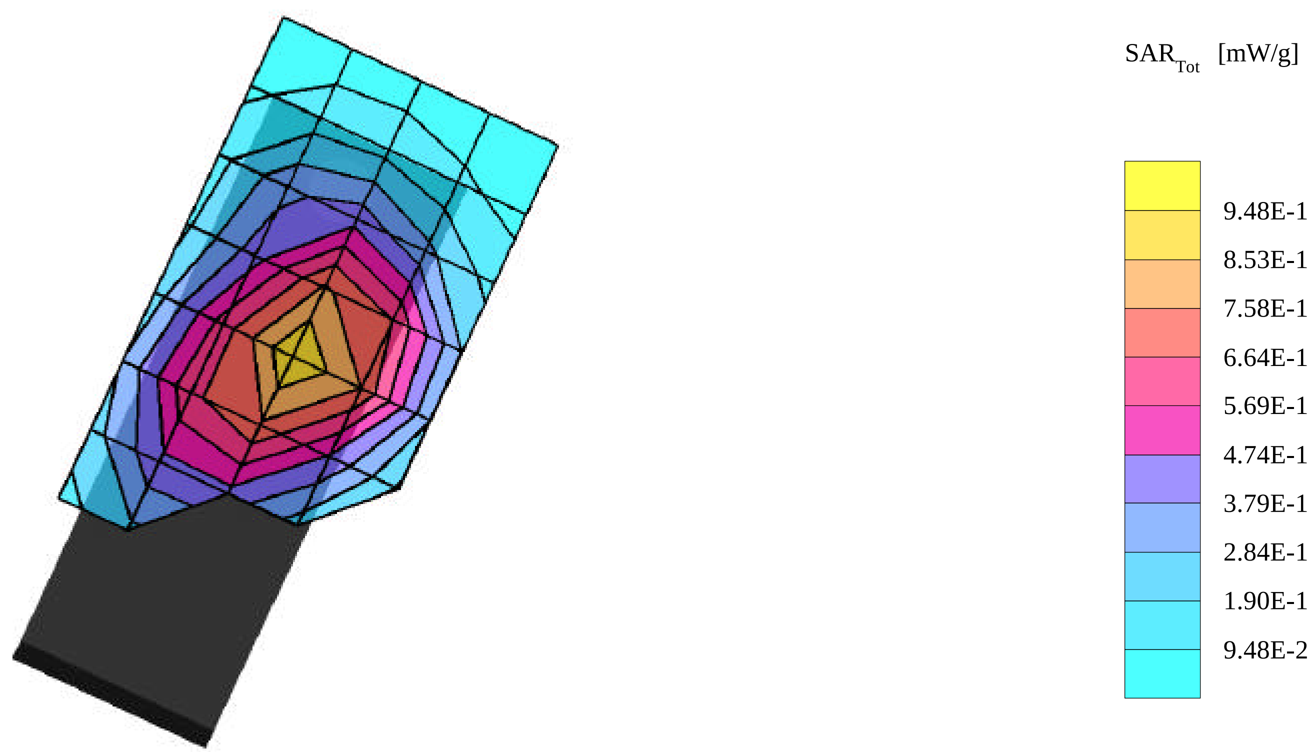
7GP P5K8C #3140, FM ch 991, FCC compliance, conducted power=27.0dBm (hdet=703)

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/cm³]
File Name: 7GP P5K8C #3140, FM ch383, 03-05-01.DA3
Powerdrift: -0.24 dB



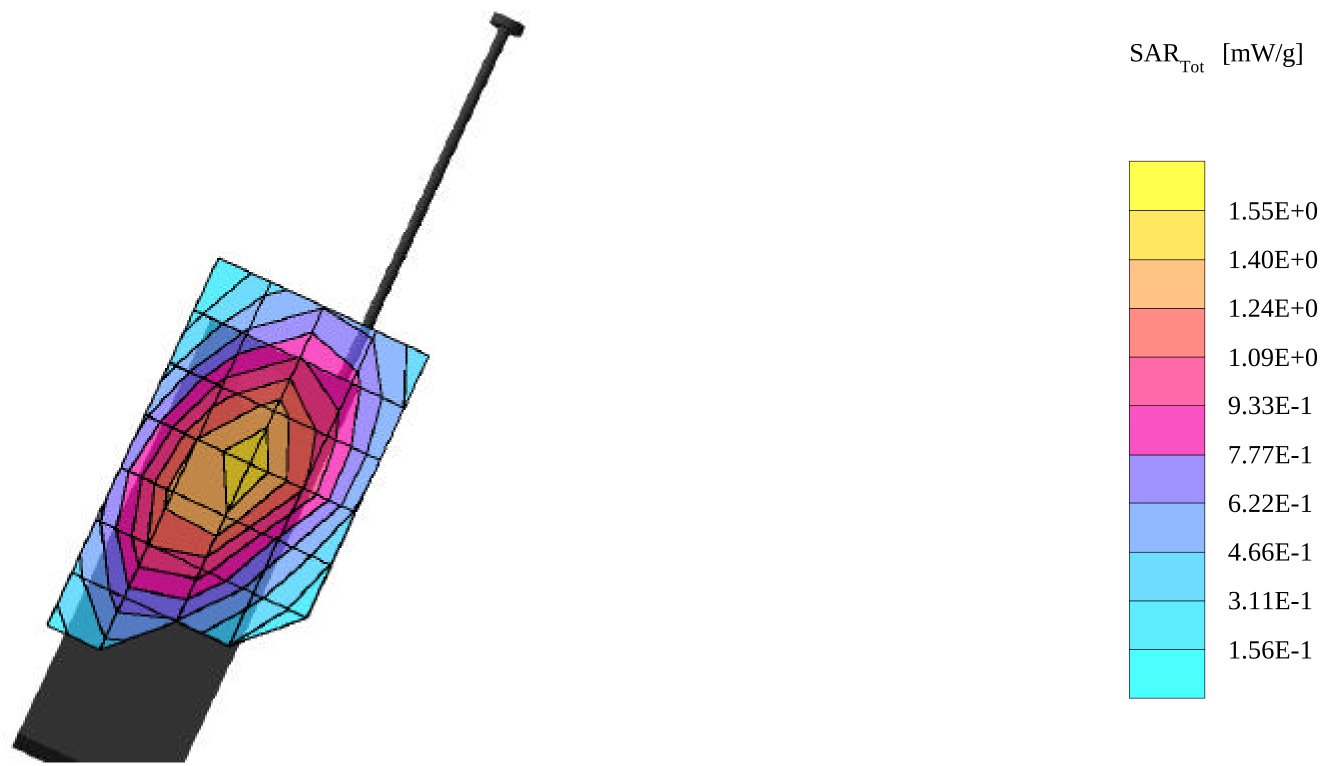
7GP P5K8C #3140, FM ch 991, FCC compliance, conducted power=27.0dBm (hdet=703)

SAR (1g): 0.936 [mW/g] ± 0.01 dB, SAR (10g): 0.649 [mW/g] ± 0.01 dB
Cubes (2) (Worst-case extrapolation)
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: -0.02 dB

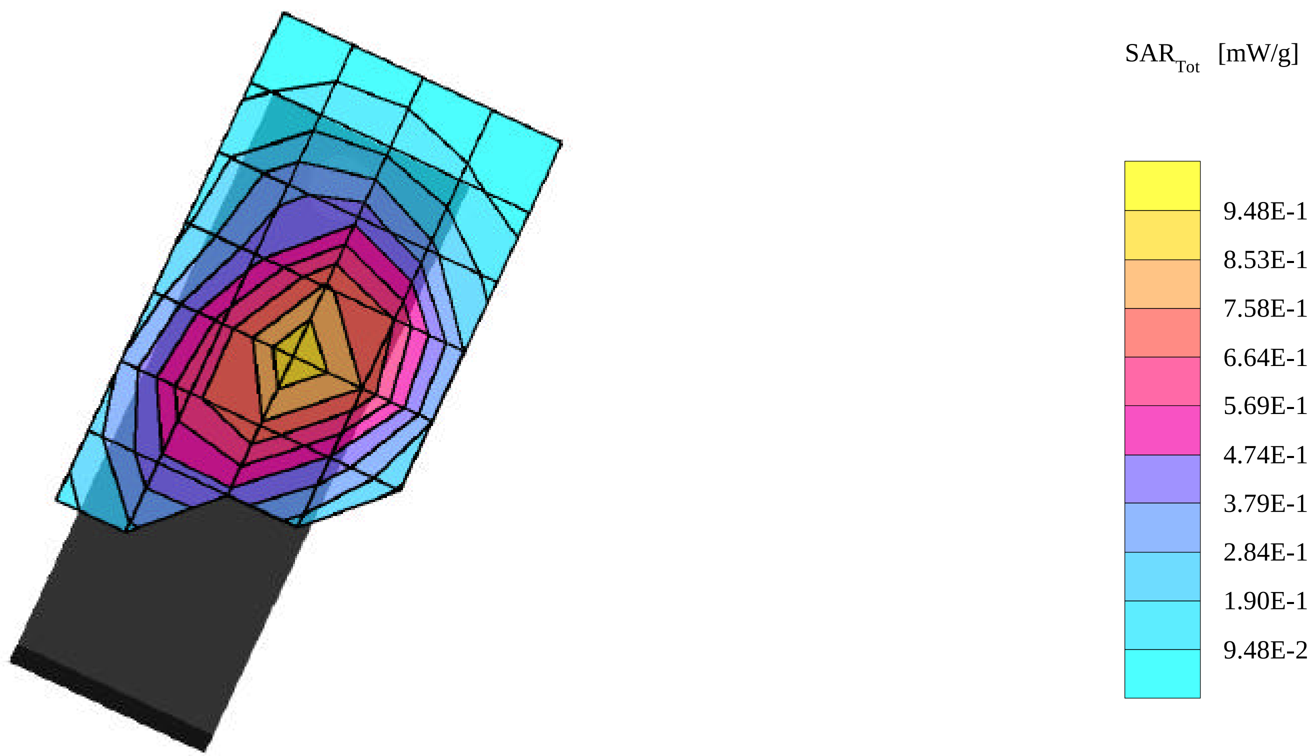


7GP P5K8C #3140, FM ch 383, FCC compliance, conducted power=27.0dBm (hdet=707)

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

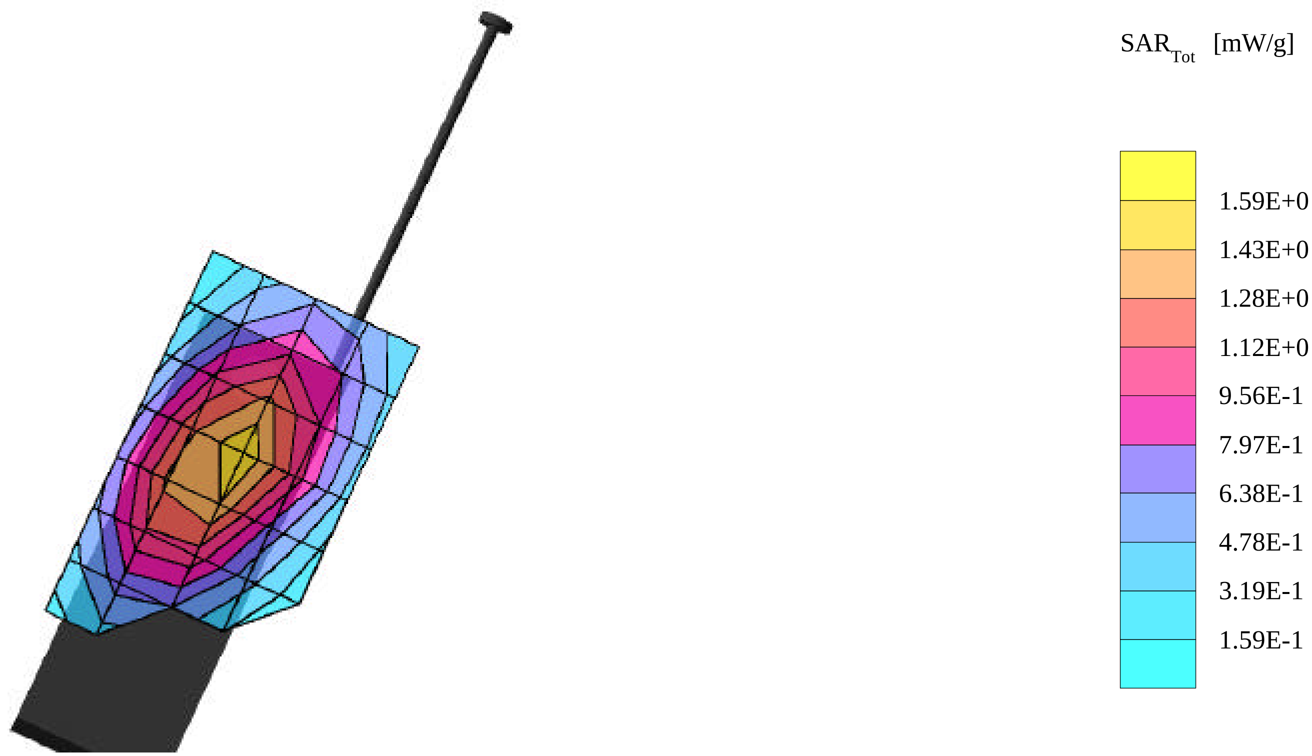


7GP P5K8C #3140, FM ch 383, FCC compliance, conducted power=27.0dBm (hdet=707)
SAR (1g): 0.936 [mW/g] ± 0.01 dB, SAR (10g): 0.649 [mW/g] ± 0.01 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.70,5.70,5.70)
Brain 900 MHz: $\sigma = 0.87$ [mho/m] $\varepsilon_r = 42.3$ $\rho = 1.00$ [g/cm³]
File Name: 7GP P5K8C #3140, FM ch383, 03-05-01.DA3
Powerdrift: -0.02 dB



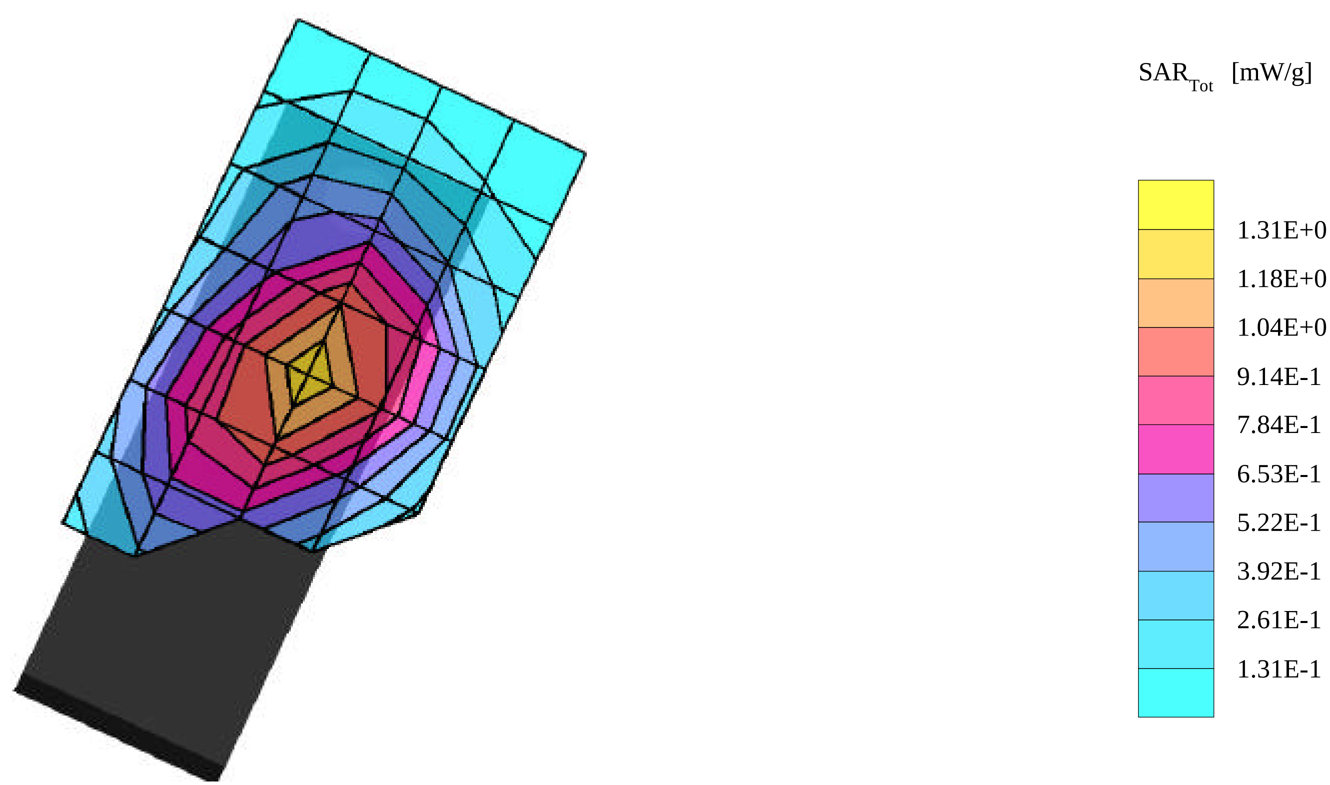
7GP P5K8C #3140, FM ch799, FCC compliance, conducted power=27.0dBm (hdet=728)

SAR (1g): 1.56 [mW/g] ± 0.03 dB, SAR (10g): 1.10 [mW/g] ± 0.03 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 ch799, 03-05-01.DA3
Powerdrift: 0.02 dB



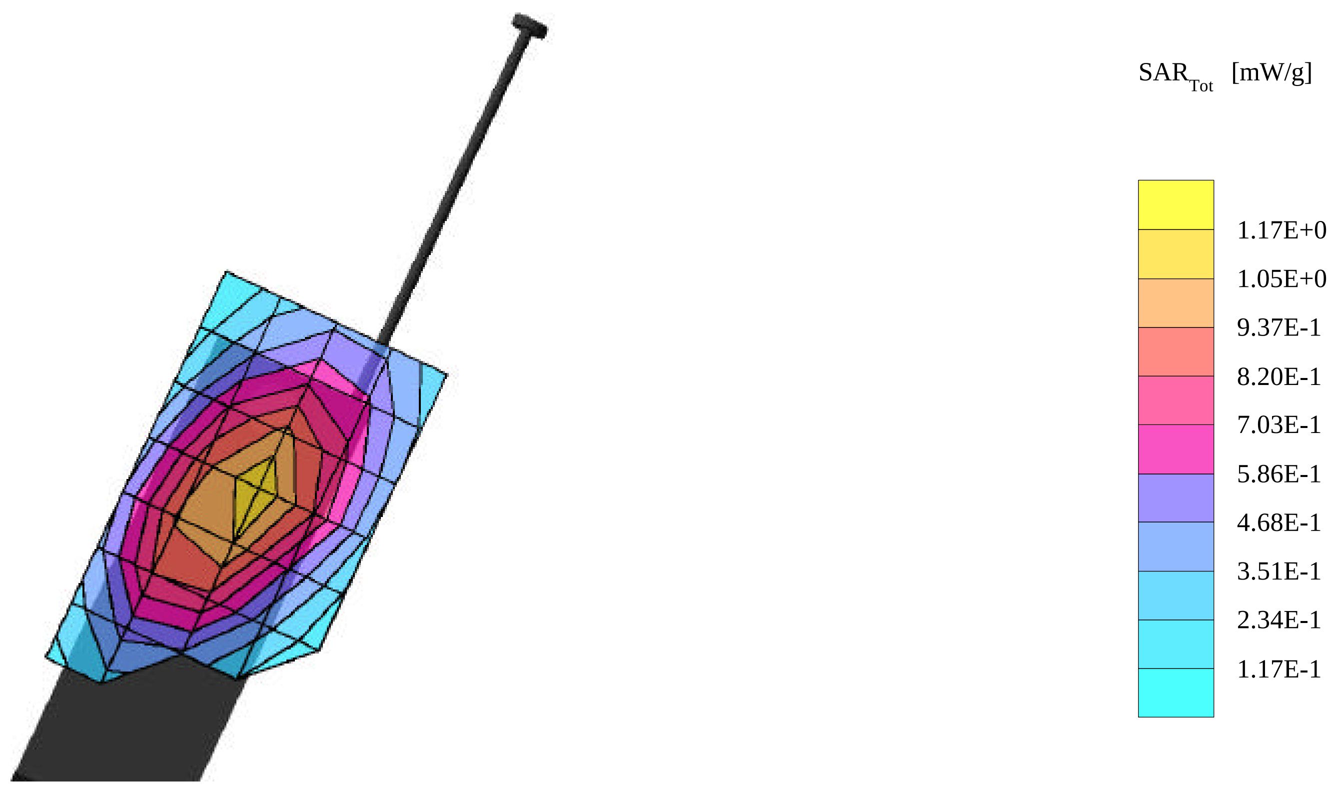
7GP P5K8C #3140, FM ch799, FCC compliance, conducted power=27.0dBm (hdet=728)

SAR (1g): 1.21 [mW/g] ± 0.05 dB, SAR (10g): 0.842 [mW/g] ± 0.06 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 ch799, 03-05-01.DA3
Powerdrift: -0.15 dB



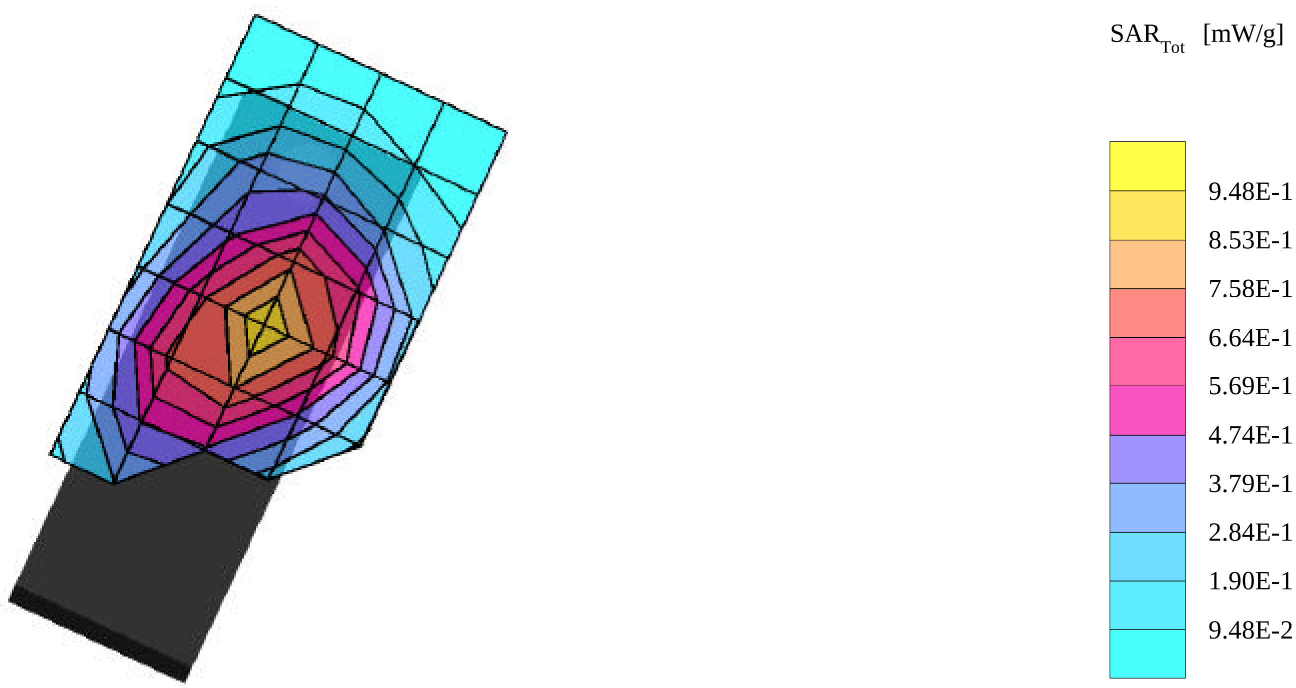
7GP P5K8C #3140, CDMA ch 777, FCC compliance, conducted power=25.7dBm (hdet=615)

SAR (1g): 1.13 [mW/g] ± 0.03 dB, SAR (10g): 0.801 [mW/g] ± 0.02 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/cm³]
File Name: 7GP P5K8C #3140, CDMA ch777, 03-05-01.DA3
Powerdrift: -0.05 dB



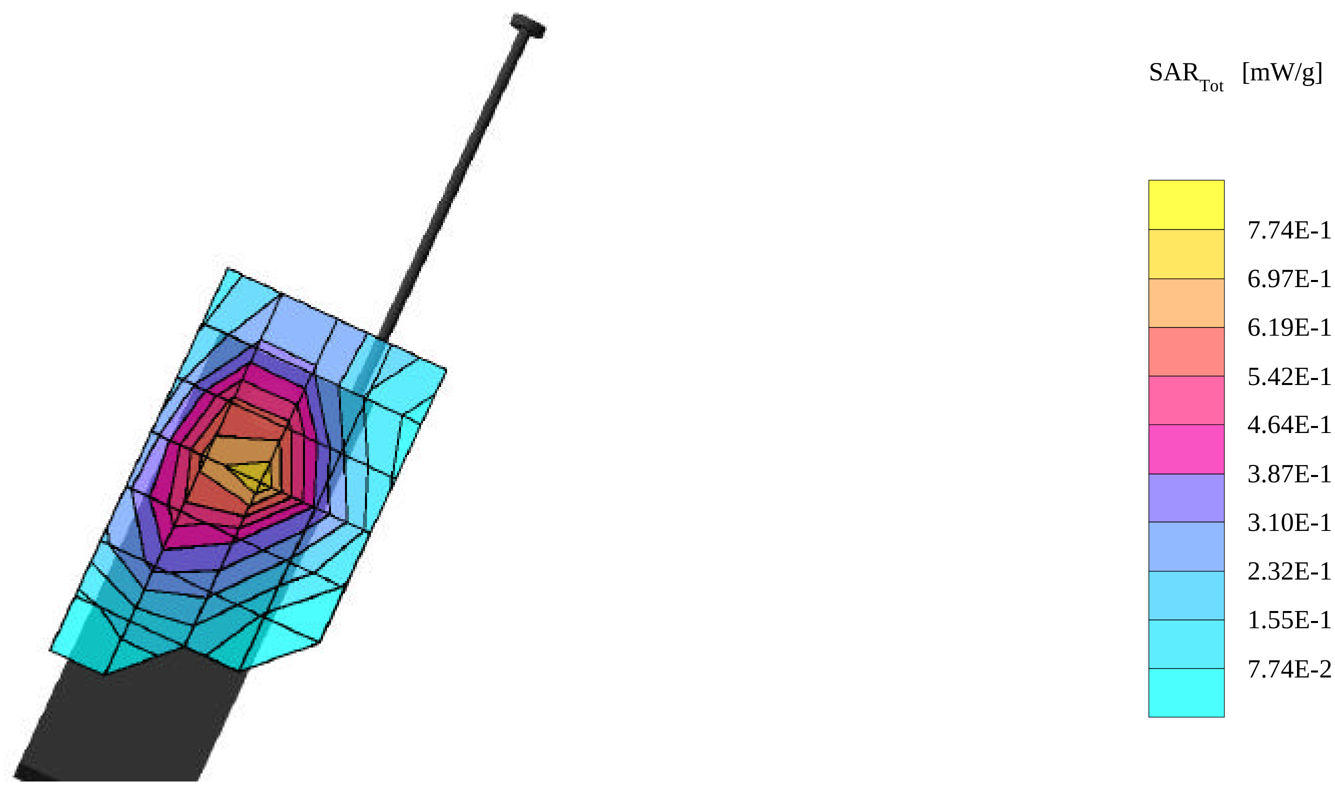
7GP P5K8C #3140, CDMA ch 777, FCC compliance, conducted power=25.7dBm (hdet=615)

SAR (1g): 0.931 [mW/g] ± 0.04 dB, SAR (10g): 0.647 [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: σ = 0.87 [mho/m] ε_r = 42.3 ρ = 1.00 [g/cm³]
File Name: 7GP P5K8C #3140, CDMA ch777, 03-05-01.DA3
Powerdrift: 0.02 dB

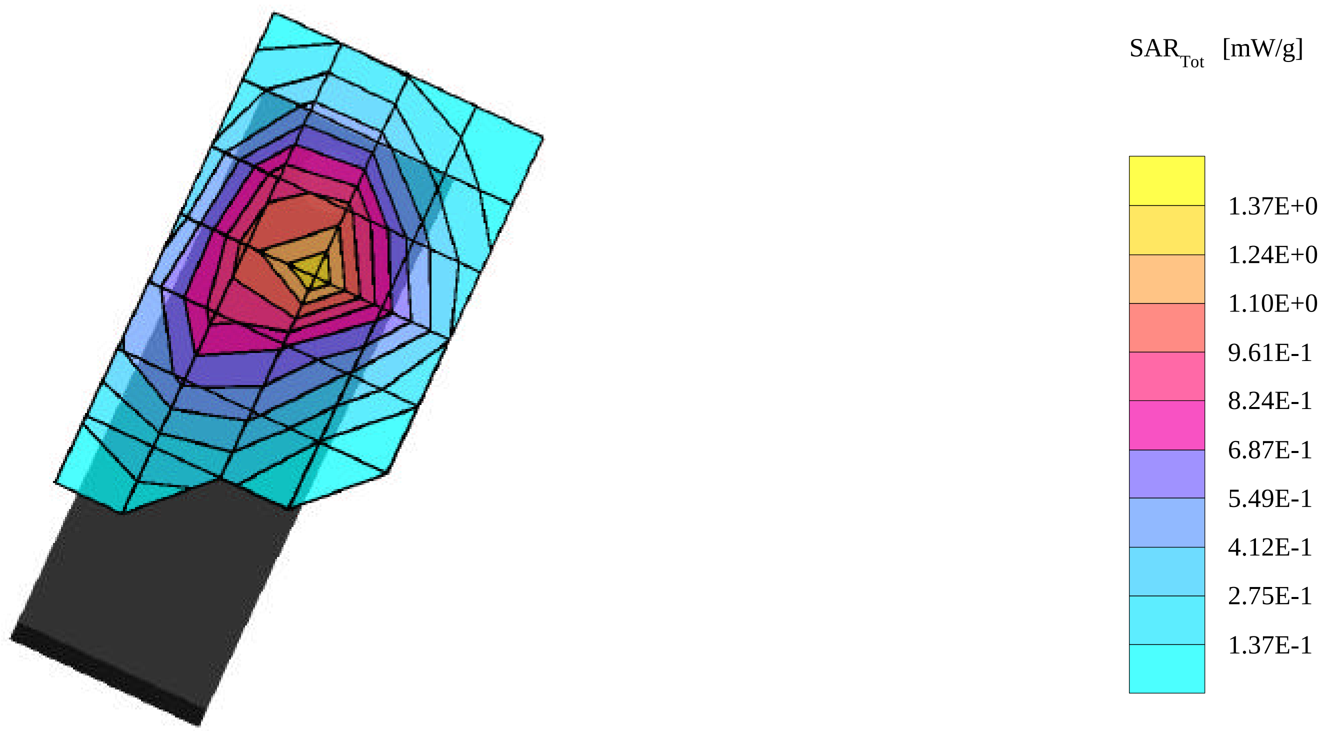


7GP P5K8C #3140, PCS ch25, FCC compliance, conducted power=24.2dBm (hdet=375)

SAR (1g): 0.806 [mW/g] ± 0.10 dB, SAR (10g): 0.469 [mW/g] ± 0.10 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.00,5.00,5.00)
Brain 1800 MHz: σ = 1.66 [mho/m] ε_r = 42.1 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, PCS ch25, 03-05-01.DA3
Powerdrift: -0.23 dB

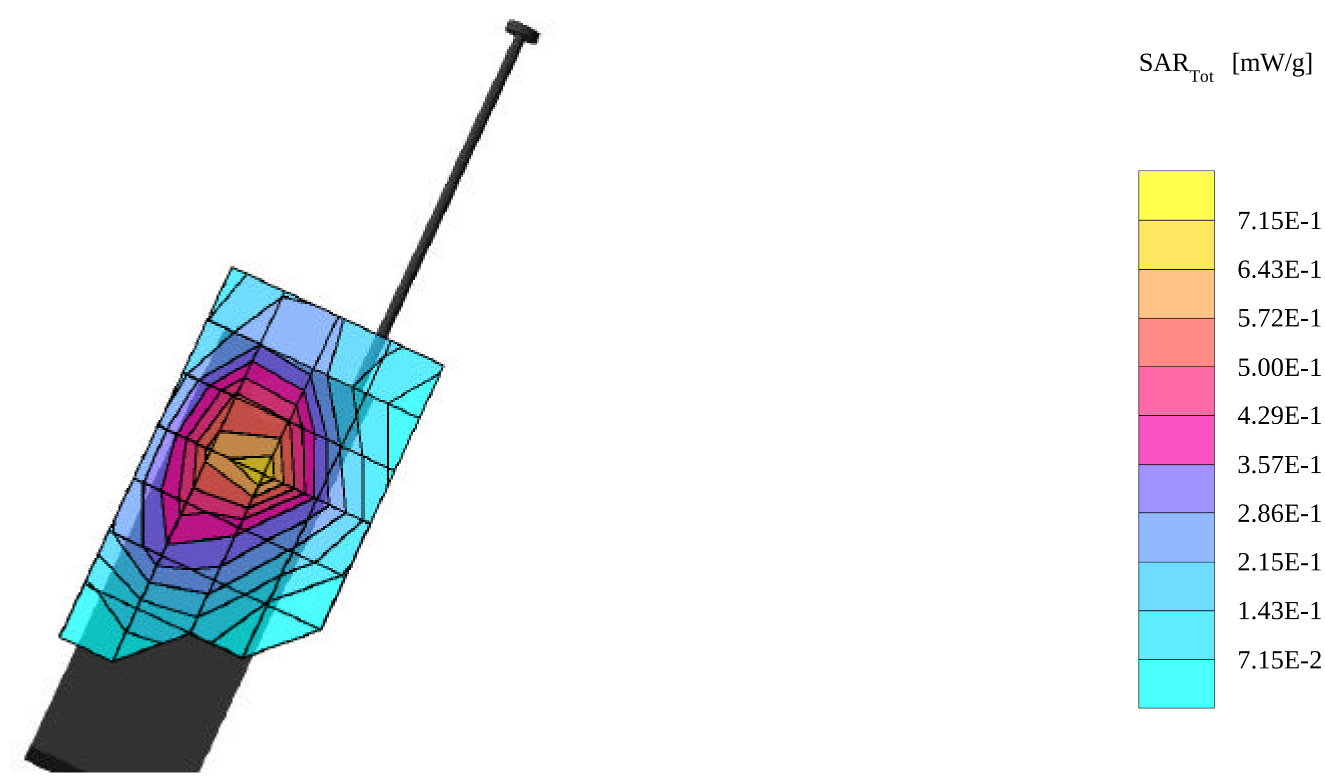


7GP P5K8C #3140, PCS ch25, FCC compliance, conducted power=24.2dBm (hdet=375)
SAR (1g): 1.42 [mW/g] ± 0.08 dB, SAR (10g): 0.826 [mW/g] ± 0.08 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.00,5.00,5.00)
Brain 1800 MHz: σ = 1.66 [mho/m] ε_r = 42.1 ρ = 1.00 [g/cm³]
File Name: 7GP P5K8C #3140, PCS ch25, 03-05-01.DA3
Powerdrift: -0.05 dB



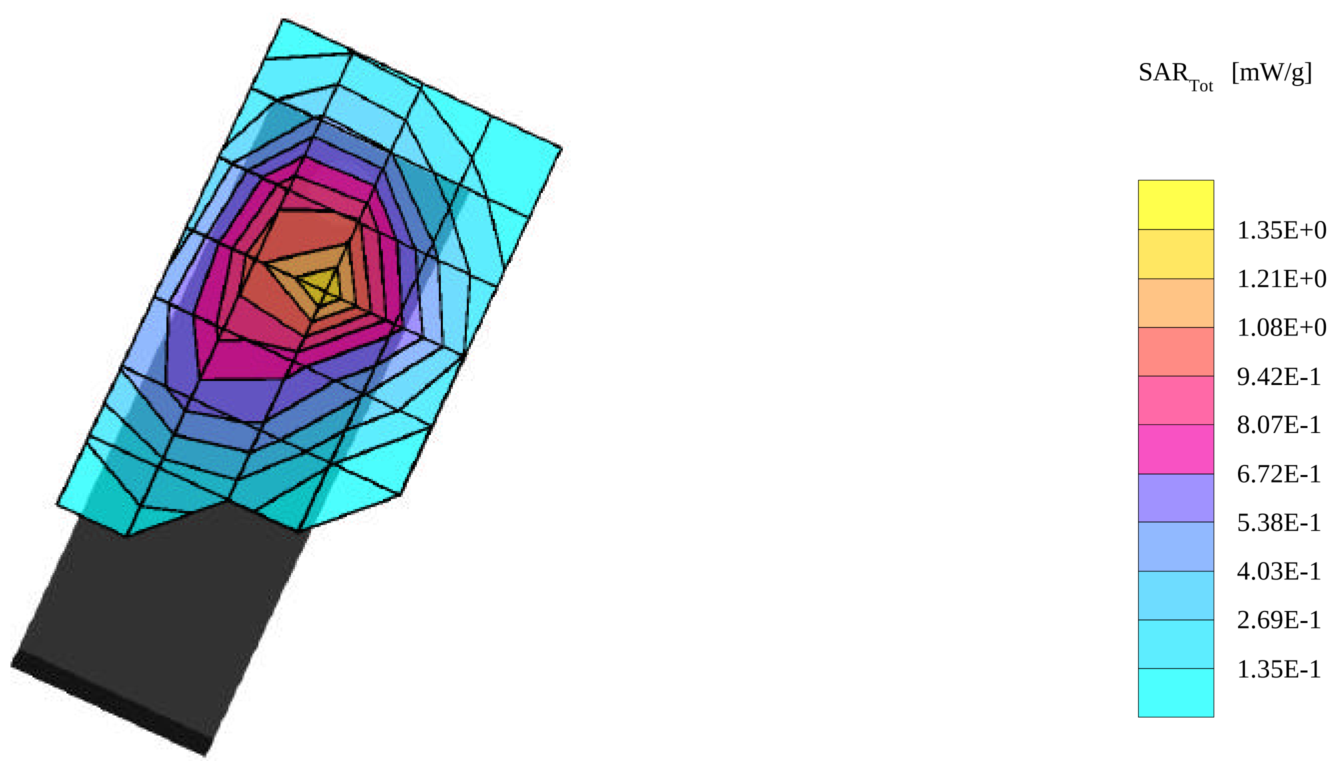
7GP P5K8C #3140, PCS ch600, FCC compliance, conducted power=24.2dBm (hdet=352)

SAR (1g): 0.761 [mW/g] ± 0.15 dB, SAR (10g): 0.436 [mW/g] ± 0.13 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.00,5.00,5.00)
Brain 1800 MHz: $\sigma = 1.66$ [mho/m] $\varepsilon_r = 42.1$ $\rho = 1.00$ [g/cm³]
File Name: 7GP P5K8C #3140, PCS ch600, 03-05-01.DA3
Powerdrift: 0.03 dB



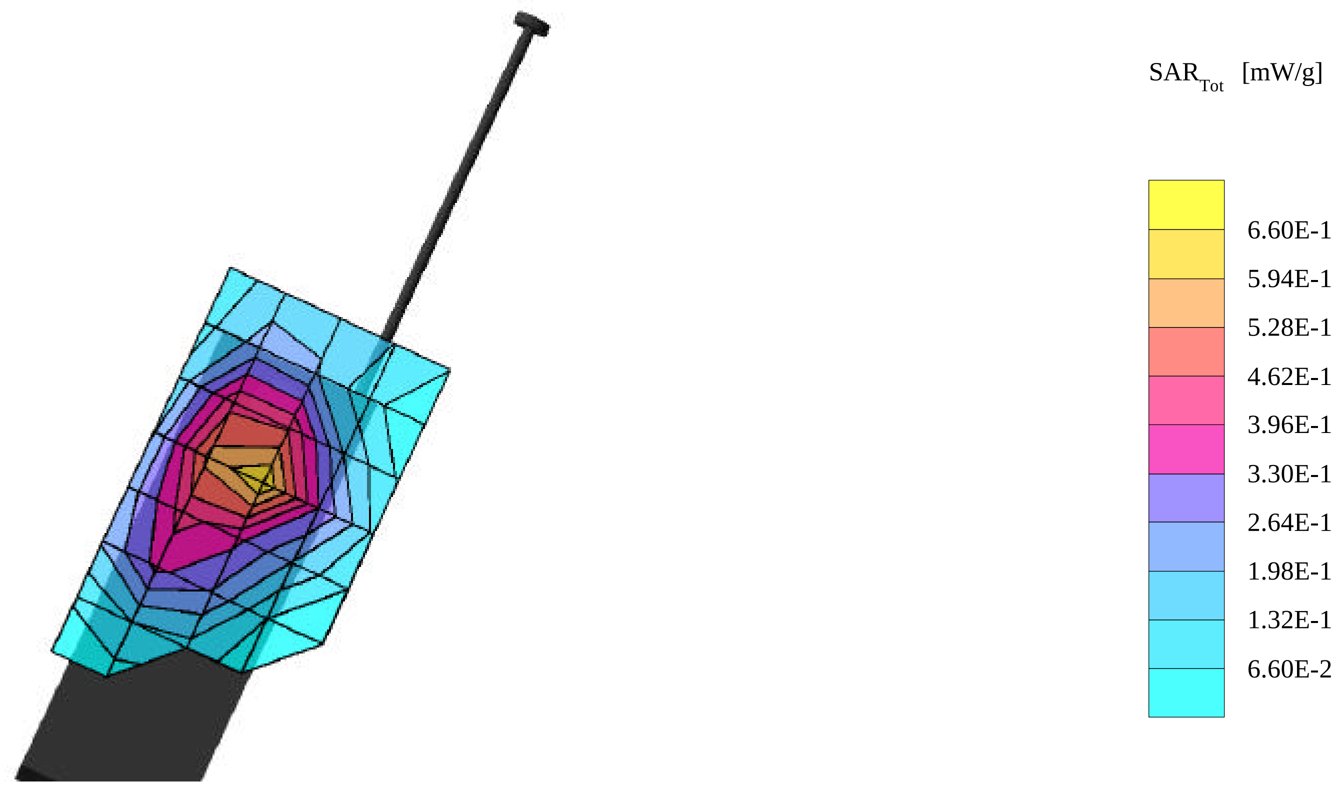
7GP P5K8C #3140, PCS ch600, FCC compliance, conducted power=24.2dBm (hdet=352)

SAR (1g): 1.40 [mW/g] ± 0.14 dB, SAR (10g): 0.809 [mW/g] ± 0.13 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.00,5.00,5.00)
Brain 1800 MHz: σ = 1.66 [mho/m] ε_r = 42.1 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, PCS ch600, 03-05-01.DA3
Powerdrift: 0.00 dB



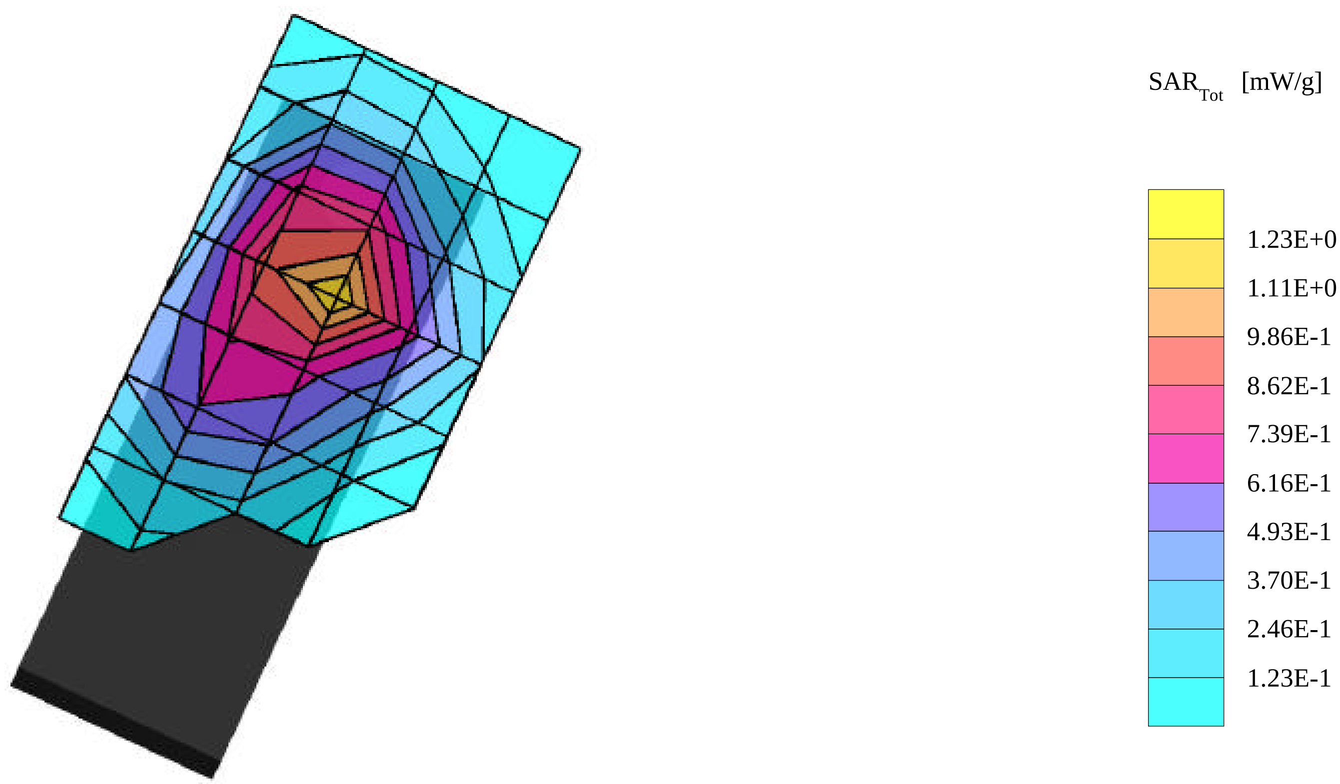
7GP P5K8C #3140, PCS ch1175, FCC compliance, conducted power=24.2dBm (hdet=410)

SAR (1g): 0.685 [mW/g] ± 0.12 dB, SAR (10g): 0.391 [mW/g] ± 0.12 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.00,5.00,5.00)
Brain 1800 MHz: σ = 1.66 [mho/m] ε_r = 42.1 ρ = 1.00 [g/cm³]
File Name: 7GP P5K8C #3140, PCS ch1175, 03-05-01.DA3
Powerdrift: -0.07 dB



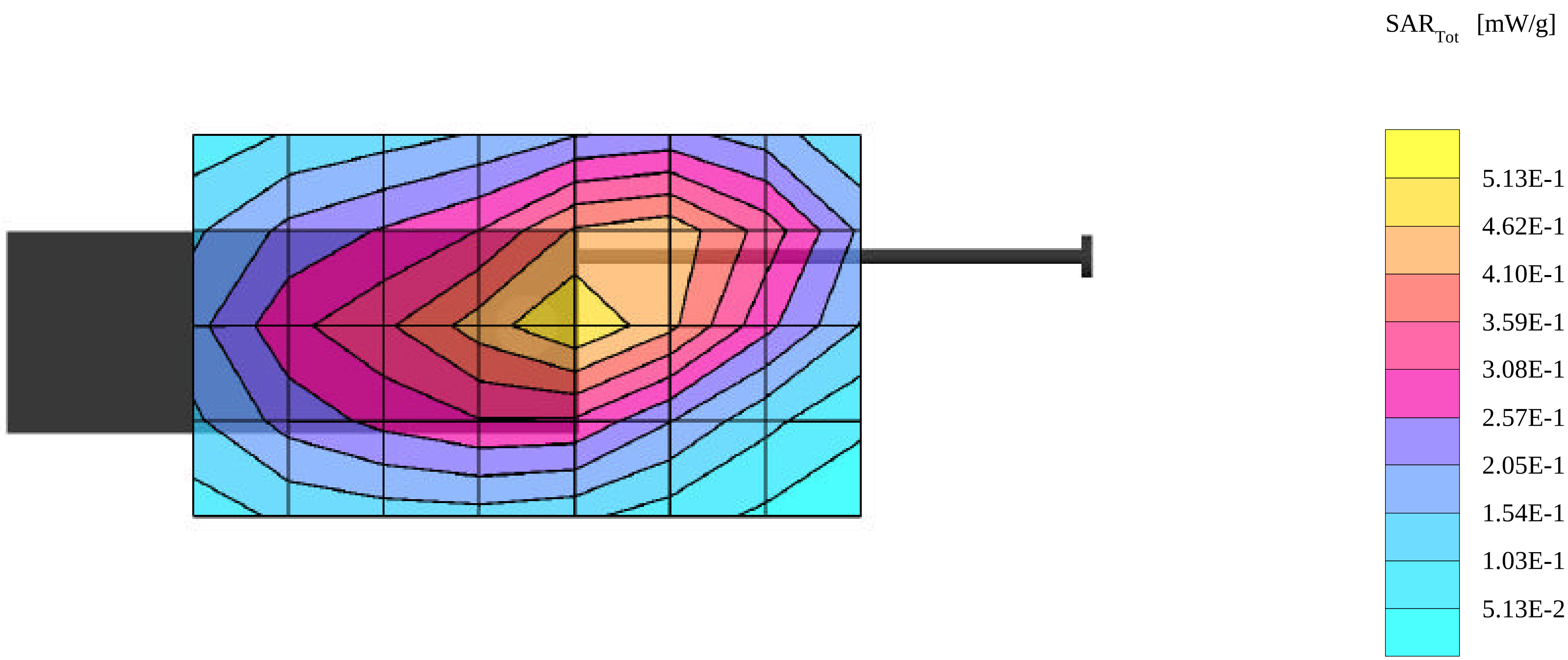
7GP P5K8C #3140, PCS ch1175, FCC compliance, conducted power=24.2dBm (hdet=410)

SAR (1g): 1.26 [mW/g] ± 0.10 dB, SAR (10g): 0.721 [mW/g] ± 0.11 dB
Cubes (2) (Worst-case extrapolation)
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.00,5.00,5.00)
Brain 1800 MHz: $\sigma = 1.66$ [mho/m] $\varepsilon_r = 42.1$ $\rho = 1.00$ [g/cm³]
File Name: 7GP P5K8C #3140, PCS ch1175, 03-05-01.DA3
Powerdrift: -0.02 dB



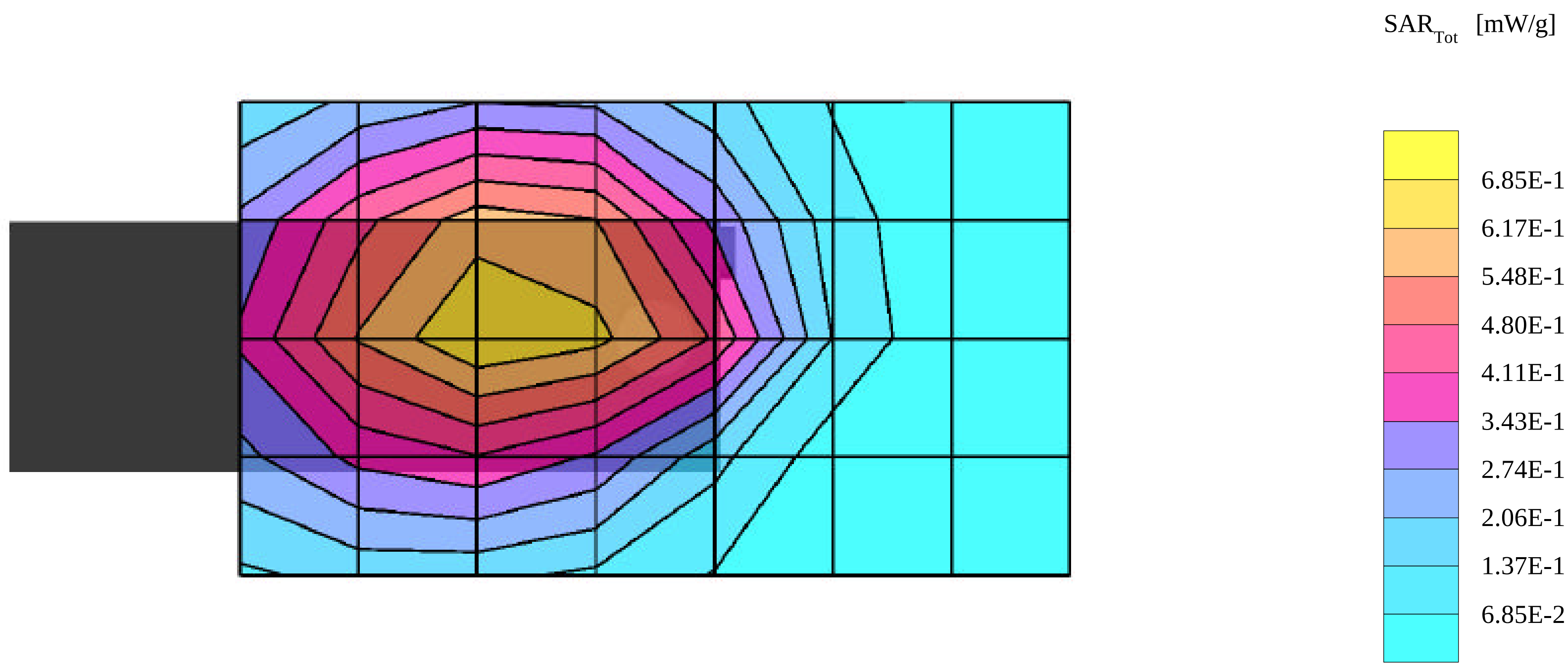
7GP P5K8C #3140, FM ch991, FCC compliance, conducted power=27.0dBm (hdet=808)

SAR (1g): 0.527 [mW/g] ± 0.08 dB, SAR (10g): 0.385 [mW/g] ± 0.07 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 = 55.9 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, FM ch991, muscle, 03-06-01.DA3
Powerdrift: -0.12 dB



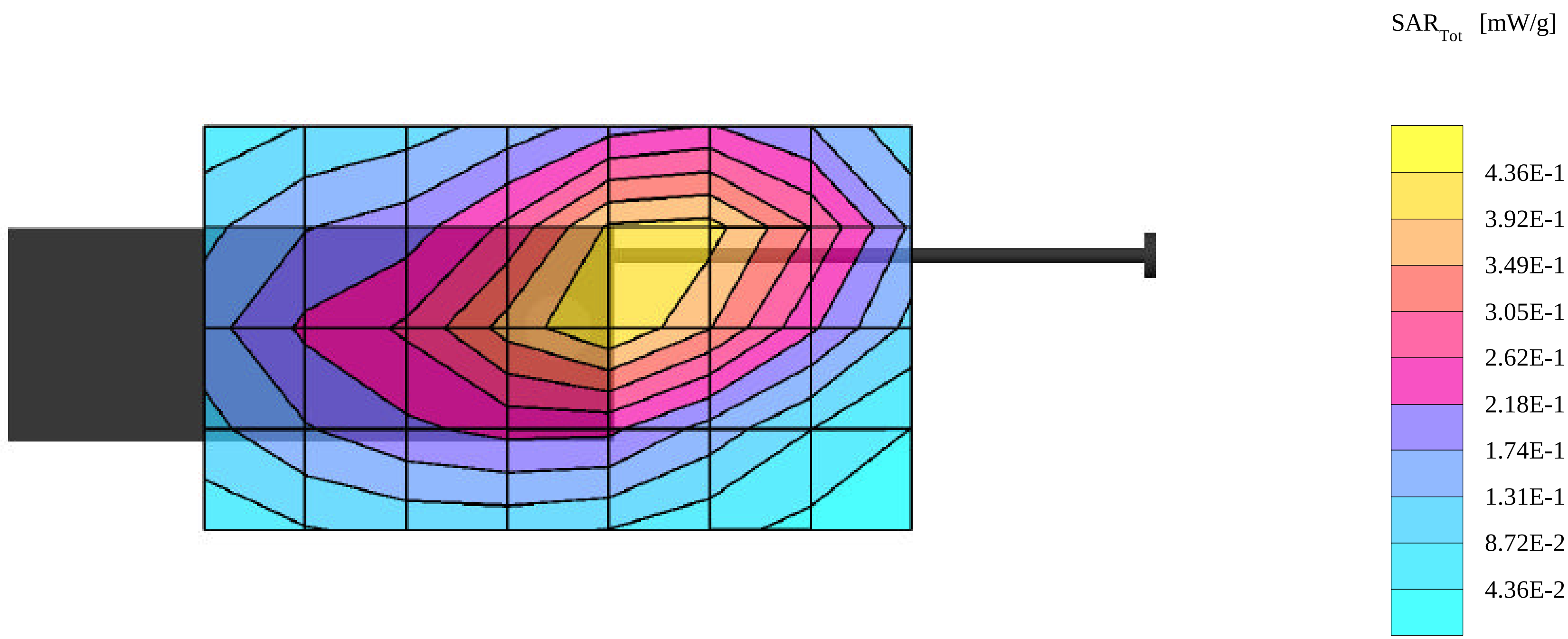
7GP P5K8C #3140, FM ch991, FCC compliance, conducted power=27.0dBm (hdet=808)

SAR (1g): 0.701 [mW/g] ± 0.09 dB, SAR (10g): 0.511 [mW/g] ± 0.09 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 = 55.9 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, FM ch991, muscle, 03-06-01.DA3
Powerdrift: -0.16 dB



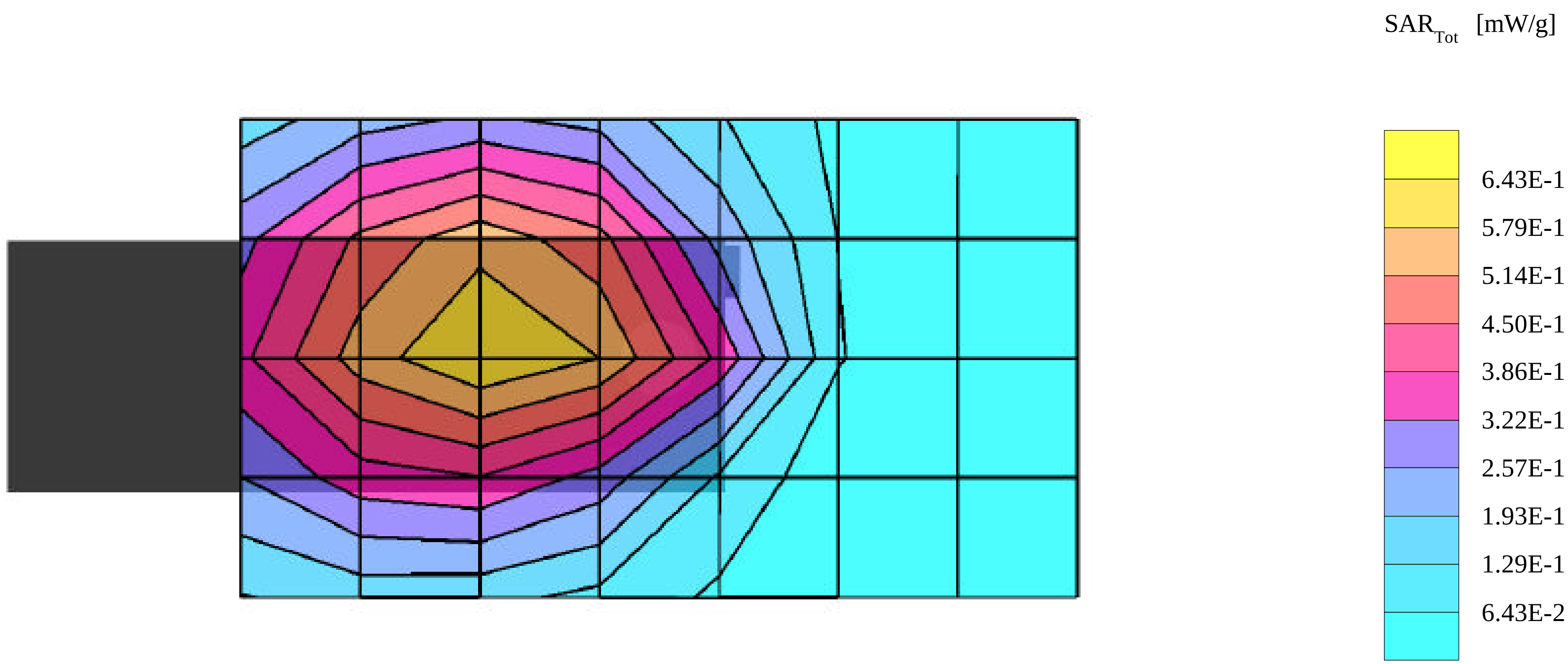
7GP P5K8C #3140, FM ch383, FCC compliance, conducted power=27.0dBm (hdet=747)

SAR (1g): 0.467 [mW/g] ± 0.11 dB, SAR (10g): 0.336 [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: σ = 0.91 [mho/m] ε_r = 55.9 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, FM ch383, muscle, 03-06-01.DA3
Powerdrift: 0.00 dB



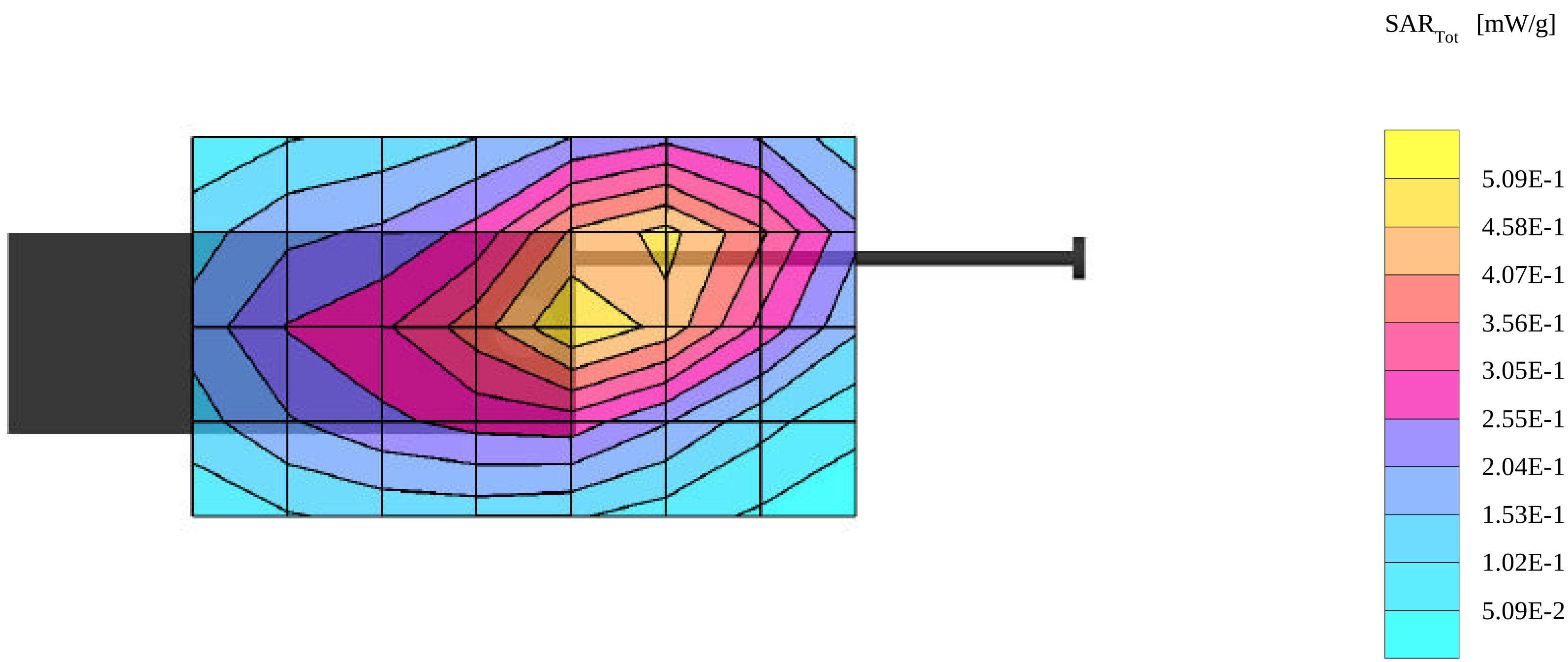
7GP P5K8C #3140, FM ch383, FCC compliance, conducted power=27.0dBm (hdet=747)

SAR (1g): 0.645 [mW/g] ± 0.06 dB, SAR (10g): 0.470 [mW/g] ± 0.07 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 = 55.9 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, FM ch383, muscle, 03-06-01.DA3
Powerdrift: -0.11 dB



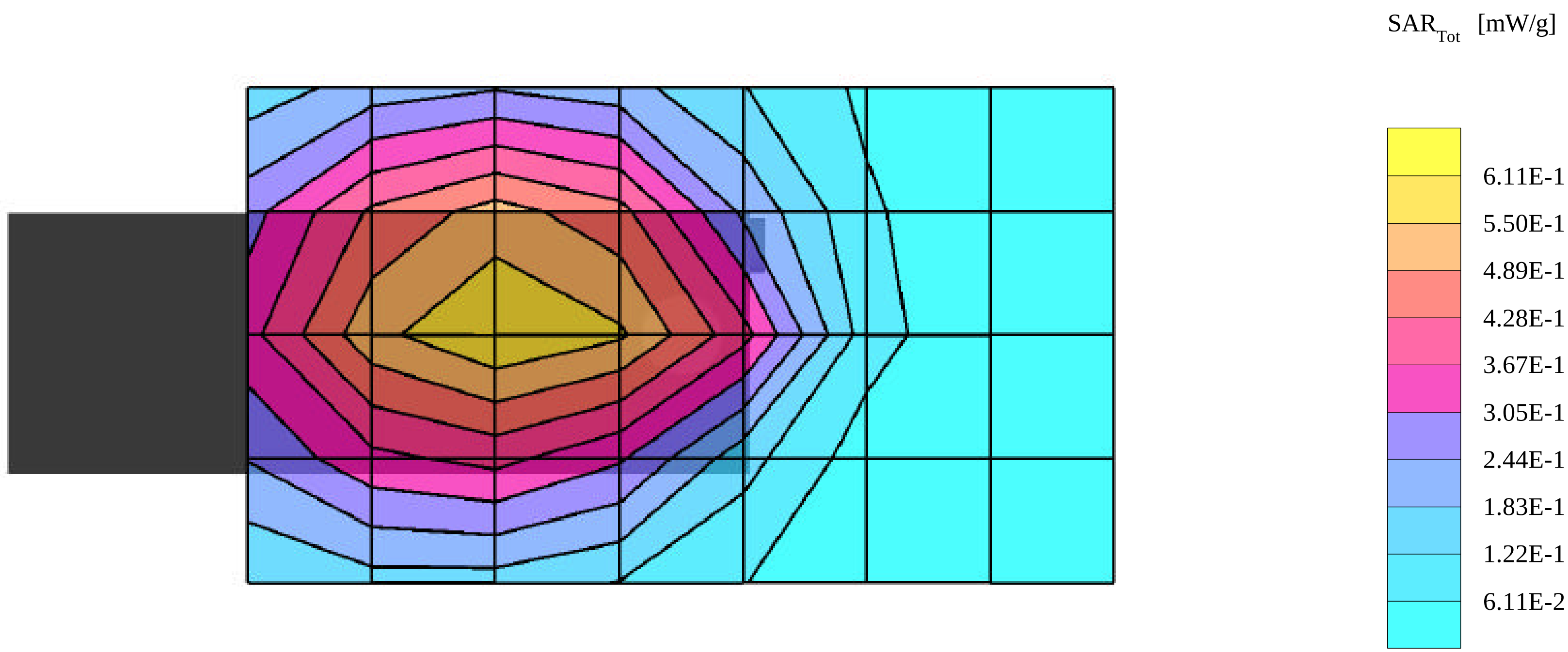
7GP P5K8C #3140, FM ch799, FCC compliance, conducted power=27.0dBm (hdet=744)

SAR (1g): 0.533 [mW/g] ± 0.09 dB, SAR (10g): 0.382 [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: σ = 0.91 [mho/m] ε_r = 55.9 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, FM ch799, muscle, 03-06-01.DA3
Powerdrift: 0.03 dB



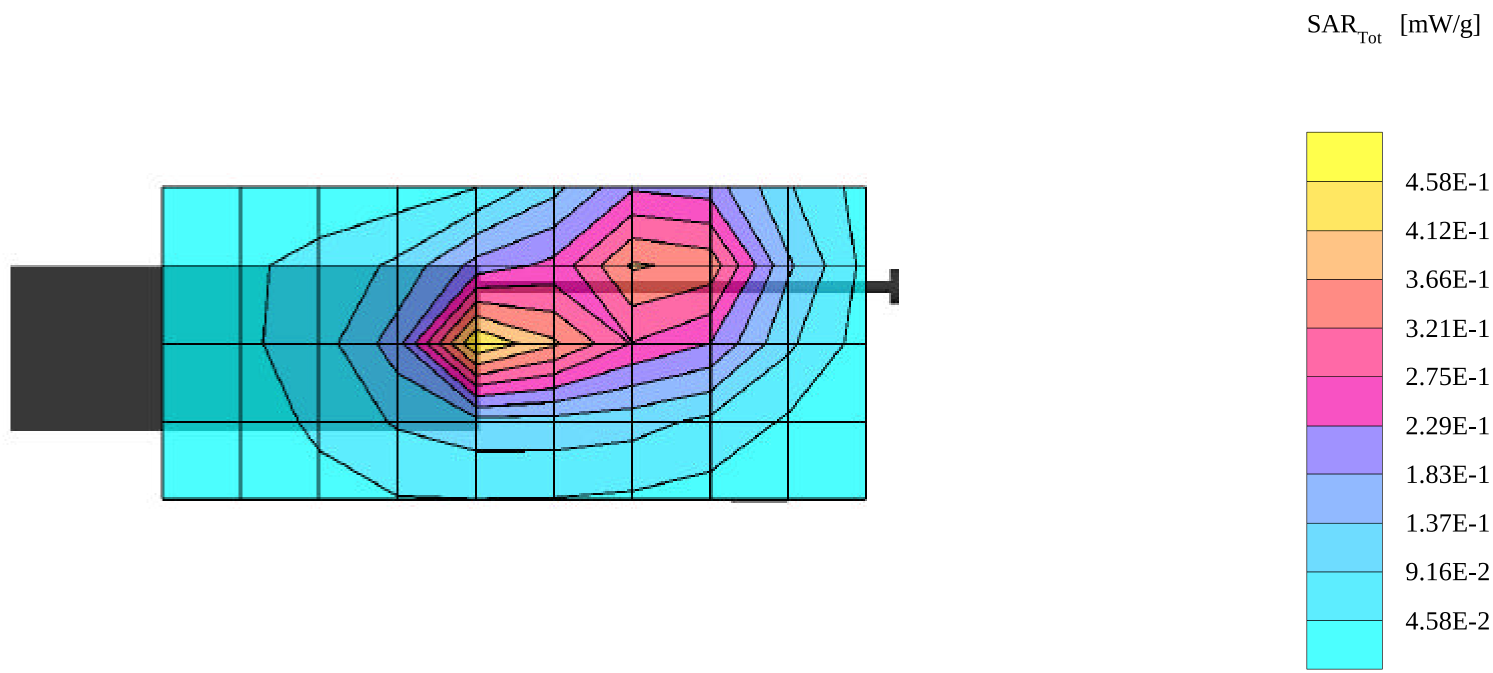
7GP P5K8C #3140, FM ch799, FCC compliance, conducted power=27.0dBm (hdet=744)

SAR (1g): 0.616 [mW/g] ± 0.06 dB, SAR (10g): 0.450 [mW/g] ± 0.07 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 = 55.9 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, FM ch799, muscle, 03-06-01.DA3
Powerdrift: -0.21 dB



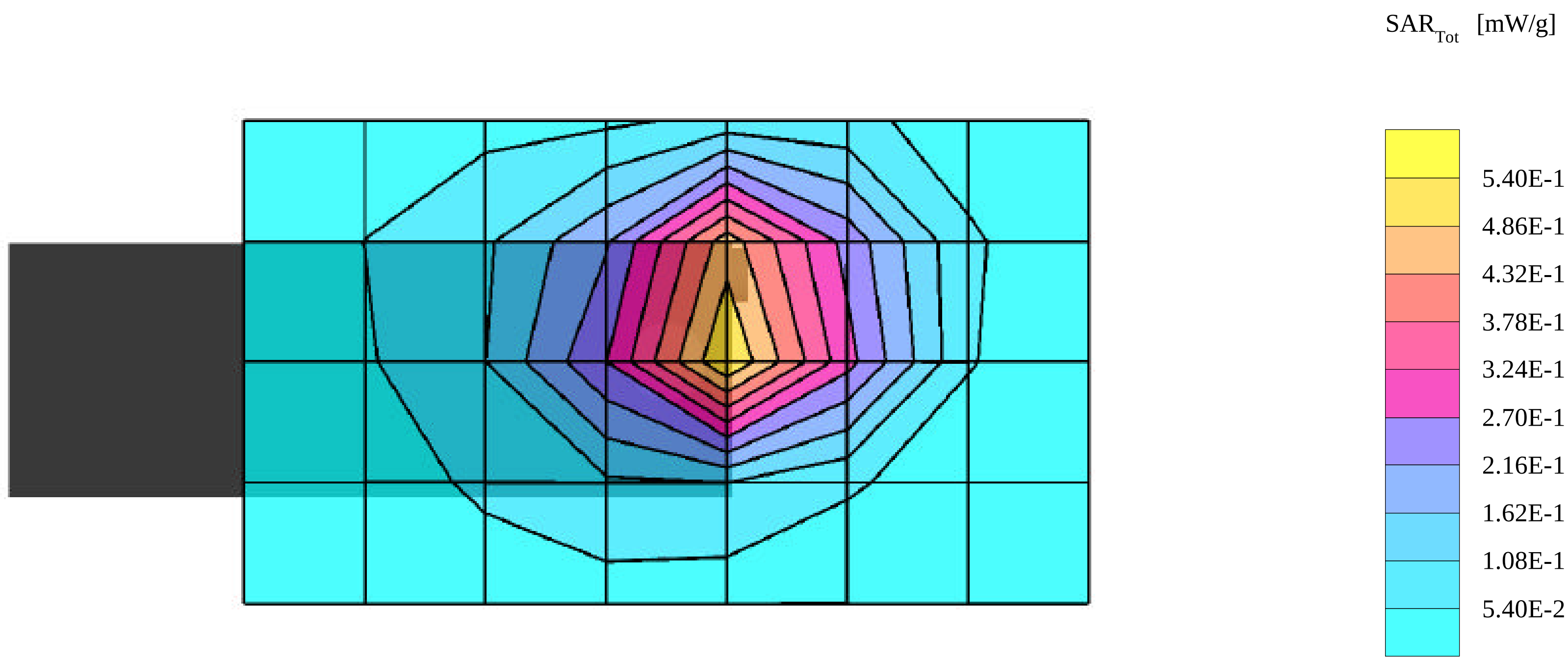
7GP P5K8C #3140, PCS ch25, FCC compliance, conducted power=24.2dBm (hdet=360)

SAR (1g): 0.511 [mW/g] ± 0.02 dB, SAR (10g): 0.285 [mW/g] ± 0.00 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 = 1.49 [mho/m] ε_r = 54.2 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140A, PCS ch25, muscle, 03-06-01.DA3
Powerdrift: -0.16 dB



7GP P5K8C #3140, PCS ch25, FCC compliance, conducted power=24.2dBm (hdet=360)

SAR (1g): 0.650 [mW/g] ± 0.08 dB, SAR (10g): 0.364 [mW/g] ± 0.11 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 = 1.49 [mho/m] ε_r = 54.2 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, PCS ch25, muscle, 03-06-01.DA3
Powerdrift: -0.31 dB



7GP P5K8C #3140, PCS ch600, FCC compliance, conducted power=24.2dBm (hdet=343)

SAR (1g): 0.450 [mW/g] ± 0.04 dB, SAR (10g): 0.248 [mW/g] ± 0.06 dB

Cubes (2) (Worst-case extrapolation)

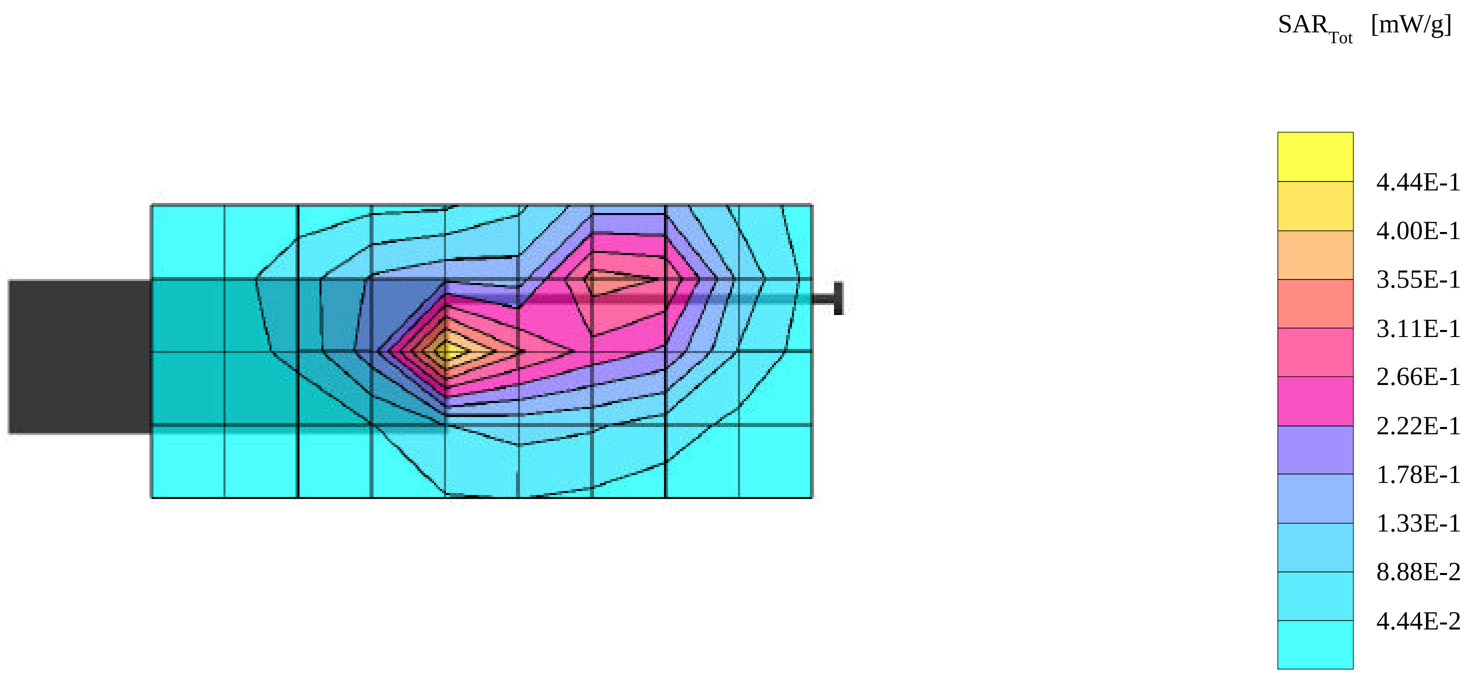
Generic Twin Phantom; Flat Section

Probe: ET3DV5 - SN1353; ConvF(4.50,4.50,4.50)

Muscle 1800 MHz: σ = 1.49 [mho/m] ε_r = 54.2 ρ = 1.00 [g/cm^3]

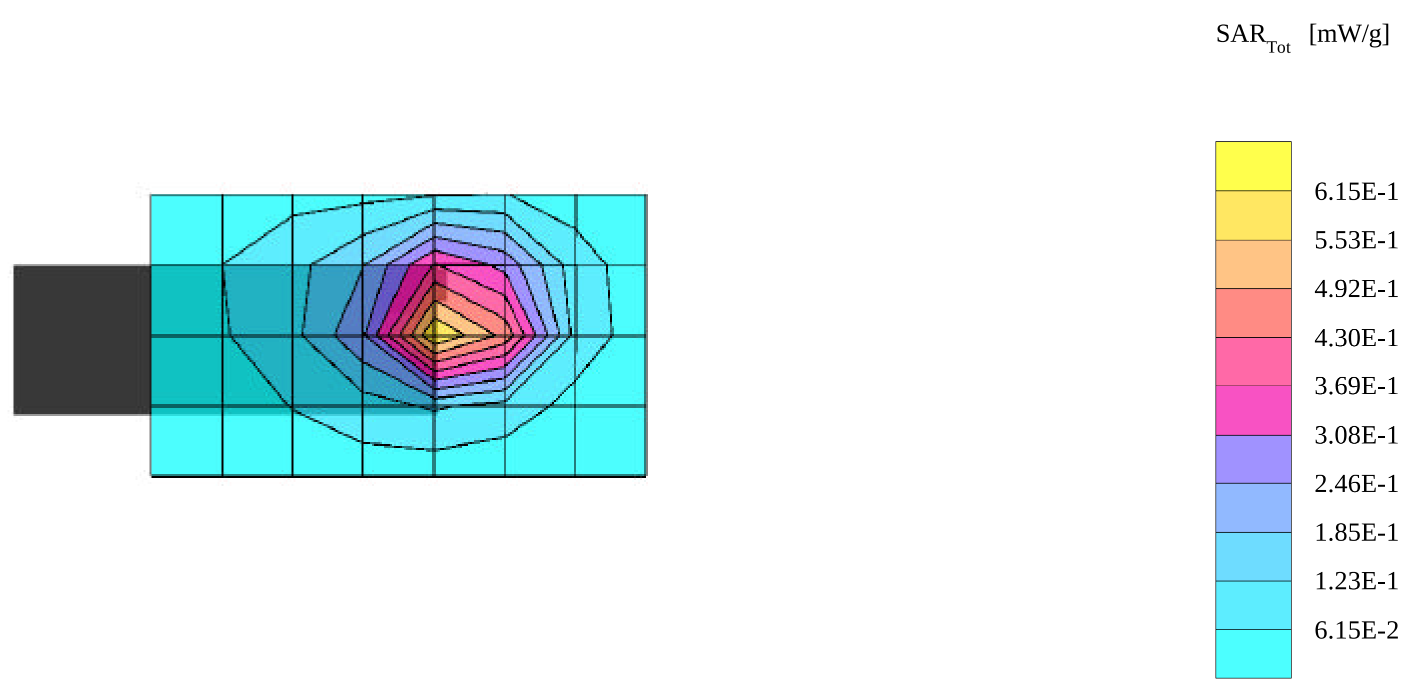
File Name: 7GP P5K8C #3140A, PCS ch600, muscle, 03-06-01.DA3

Powerdrift: -0.09 dB



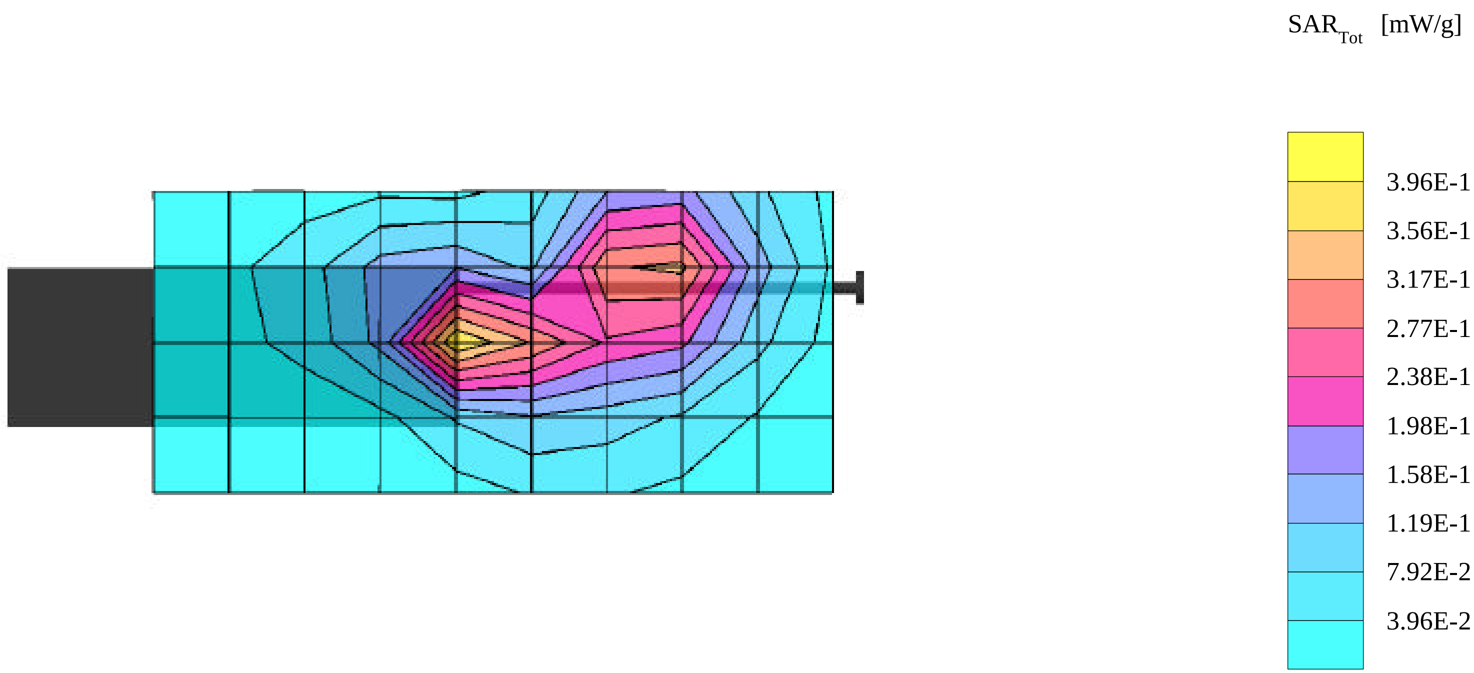
7GP P5K8C #3140, PCS ch600, FCC compliance, conducted power=24.2dBm (hdet=343)

SAR (1g): 0.703 [mW/g] ± 0.08 dB, SAR (10g): 0.399 [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: $\sigma = 1.49$ [mho/m] $\varepsilon_r = 54.2$ $\rho = 1.00$ [g/cm^3]
File Name: 7GP P5K8C #3140, PCS ch600, muscle, 03-06-01.DA3
Powerdrift: 0.05 dB



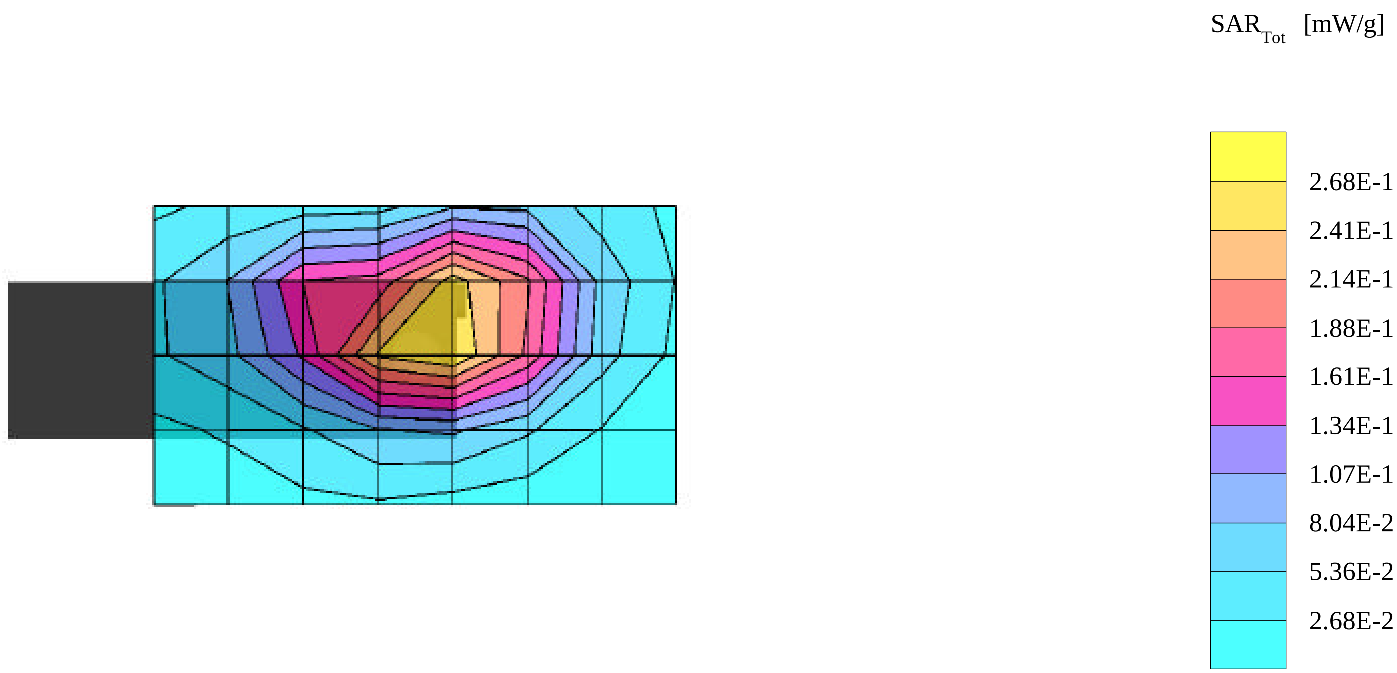
7GP P5K8C #3140, PCS ch1175, FCC compliance, conducted power=24.2dBm (hdet=410)

SAR (1g): 0.391 [mW/g] ± 0.02 dB, SAR (10g): 0.214 [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 = 1.49 [mho/m] ε_r = 54.2 ρ = 1.00 [g/cm³]
File Name: 7GP P5K8C #3140A, PCS ch1175, muscle, 03-06-01.DA3
Powerdrift: -0.67 dB



7GP P5K8C #3140, PCS ch1175, FCC compliance, conducted power=24.2dBm (hdet=410)

SAR (1g): 0.296 [mW/g] ± 0.08 dB, SAR (10g): 0.176 [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 = 1.49 [mho/m] ε_r = 54.2 ρ = 1.00 [g/cm^3]
File Name: 7GP P5K8C #3140, PCS ch1175, muscle, 03-06-01.DA3
Powerdrift: -0.05 dB

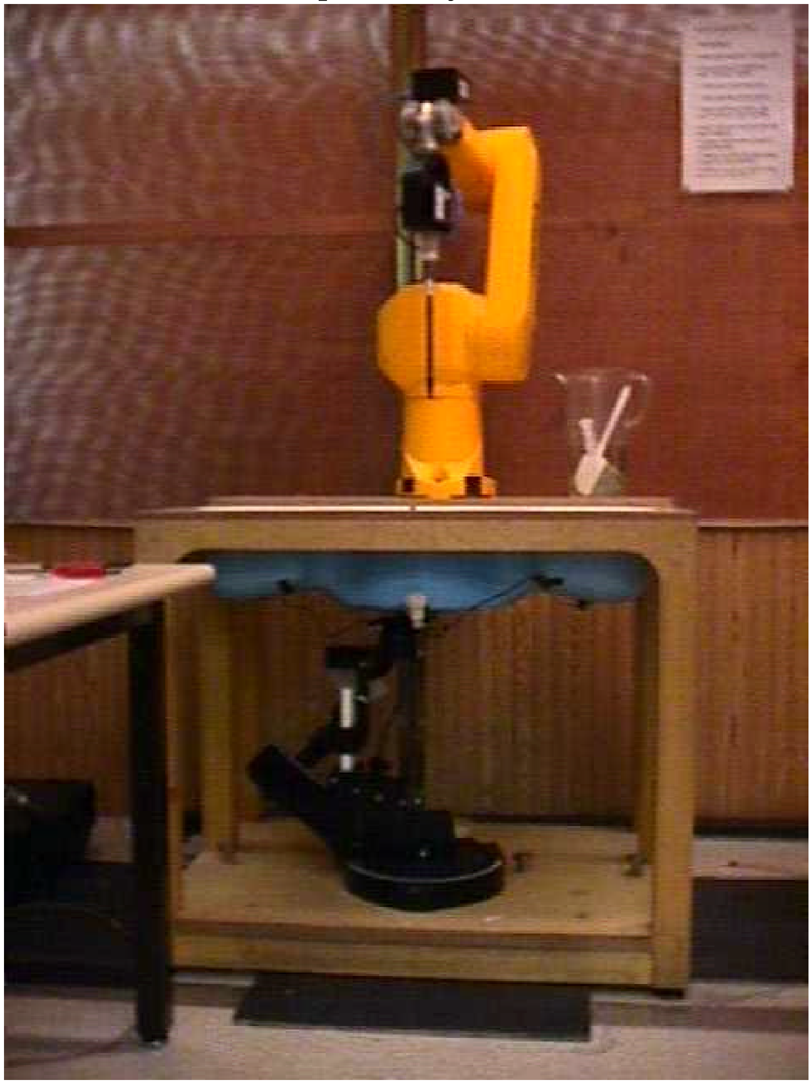


12 PHOTOS

QCP – 3035

Test Setup for SAR at Head

Test Setup for Body-worn SAR



Probe

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 Dos
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