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 July 2001 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-3035*
Tx Frequency :	*824.04 – 848.97 and 1851.25 – 1908.75 MHz*
Max. Output Power:	*27.22 dBm ERP Analog (in cellular band)*
	27.10 dBm ERP Digital (in cellular band)
	27.18 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 :	*98AV0108551120*
Place of Test:	*KWC, San Diego, CA, USA*
Date of Test:	*July, 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-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, FCC ID: OVFQCP-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 27.18 dBm. The cellular FM AMPS mode is designed to transmit in the 824.04 – 848.97 MHz band at a maximum ERP of 27.22 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-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, FCC ID: OVFQCP-3035, 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
Humidity Range:	25 - 75 %
Pressure:	860 - 1060 mbar

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):

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

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

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

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

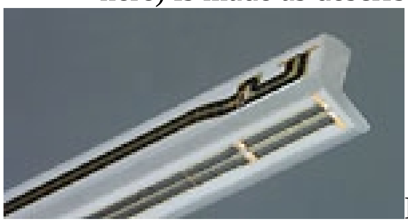
In this equation, σ is a function of frequency, and so it must be measured at the frequency of the test. It is measured in terms of the real and imaginary components of the complex permitivity;

$$\varepsilon = \varepsilon_0 \left(\varepsilon' - j\varepsilon''\right)$$

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

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

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	0.357 W / 25.53 dBm	
824.7	1013		0.373 W / 25.72 dBm
836.49	383	0.360 W / 25.56 dBm	0.370 W / 25.69 dBm
848.31	777		0.369 W / 25.68 dBm
848.97	799	0.356 W / 25.52 dBm	
Maximum Power over Band		**25.56 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	0.262 W / 24.19 dBm
1880	600	0.265 W / 24.24 dBm
1908.75	1175	0.265 W / 24.23 dBm
Maximum Power over Band		**24.24 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	27.22 dBm	
824.7	1013		27.10 dBm
836.49	383	26.21 dBm	26.53 dBm
848.31	777		26.62 dBm
848.97	799	26.84 dBm	
Max power over band		**27.22 dBm**	**27.10 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	27.18 dBm
1880	600	26.94 dBm
1908.75	1175	26.08 dBm
Max power over band		**27.18 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

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV5**
Serial Number:	**1353**
Place of Calibration:	**Zurich**
Date of Calibration:	**July 26, 2000**
Calibration Interval:	**12 months**

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:	Nikolos K. Neviana
Approved by:	Thomas Schmid

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Telephone +41 1 245 97 00, Fax +41 1 245 97 79

Probe ET3DV5

SN:1353

Manufactured:	August 14, 1998
Last calibration:	August 28, 1998
Recalibrated:	July 26, 2000

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV5 SN:1353

Sensitivity in Free Space

NormX	**1.59** $\mu V/(V/m)^2$
NormY	**1.47** $\mu V/(V/m)^2$
NormZ	**1.75** $\mu V/(V/m)^2$

Diode Compression

DCP X	**102** mV
DCP Y	**102** mV
DCP Z	**102** mV

Sensitivity in Tissue Simulating Liquid

Brain **450 MHz** **ε_r = 48 ± 5%** **σ = 0.50 ± 10% mho/m**

ConvF X	**6.08**	extrapolated	Boundary effect:	
ConvF Y	**6.08**	extrapolated	Alpha	**0.07**
ConvF Z	**6.08**	extrapolated	Depth	**3.39**

Brain **900 MHz** **ε_r = 42.5 ± 5%** **σ = 0.86 ± 10% mho/m**

ConvF X	**5.70**	± 7% (k=2)	Boundary effect:	
ConvF Y	**5.70**	± 7% (k=2)	Alpha	**0.33**
ConvF Z	**5.70**	± 7% (k=2)	Depth	**2.82**

Brain **1500 MHz** **ε_r = 41 ± 5%** **σ = 1.32 ± 10% mho/m**

ConvF X	**5.20**	interpolated	Boundary effect:	
ConvF Y	**5.20**	interpolated	Alpha	**0.68**
ConvF Z	**5.20**	interpolated	Depth	**2.06**

Brain **1800 MHz** **ε_r = 41 ± 5%** **σ = 1.69 ± 10% mho/m**

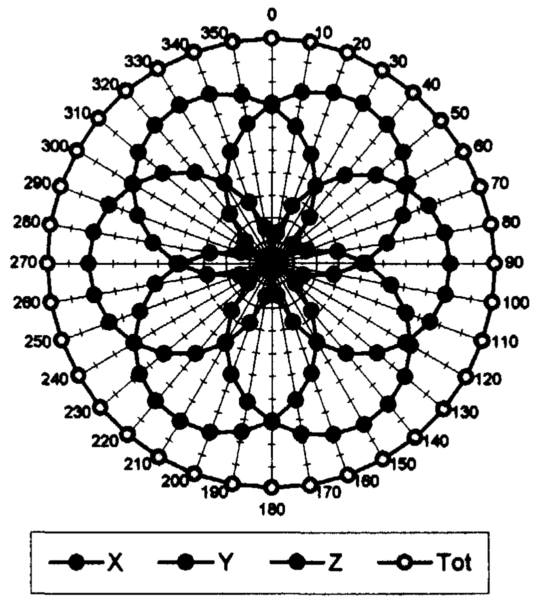
ConvF X	**4.94**	± 7% (k=2)	Boundary effect:	
ConvF Y	**4.94**	± 7% (k=2)	Alpha	**0.86**
ConvF Z	**4.94**	± 7% (k=2)	Depth	**1.68**

Sensor Offset

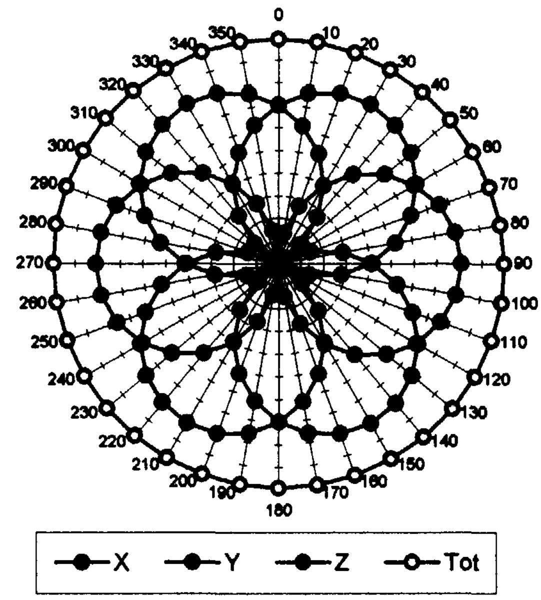
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.8 ± 0.2**	mm

Receiving Pattern (ϕ), $\theta = 0°$

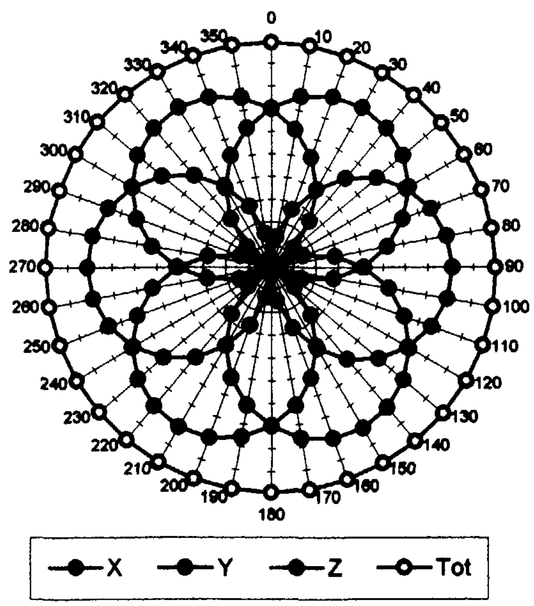
f = 30 MHz, TEM cell ifi110



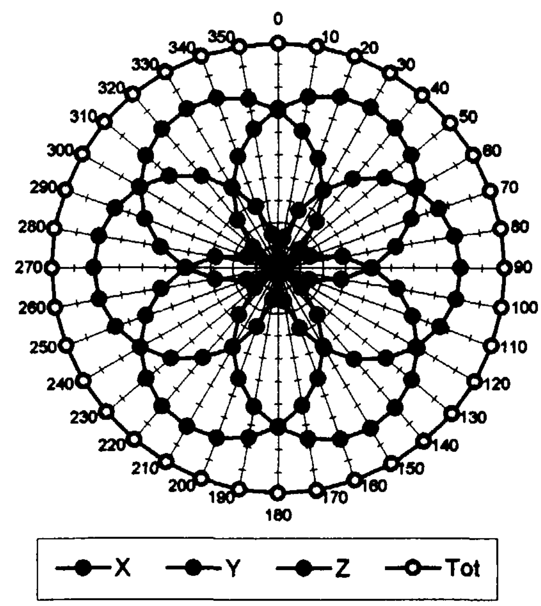
f = 100 MHz, TEM cell ifi110

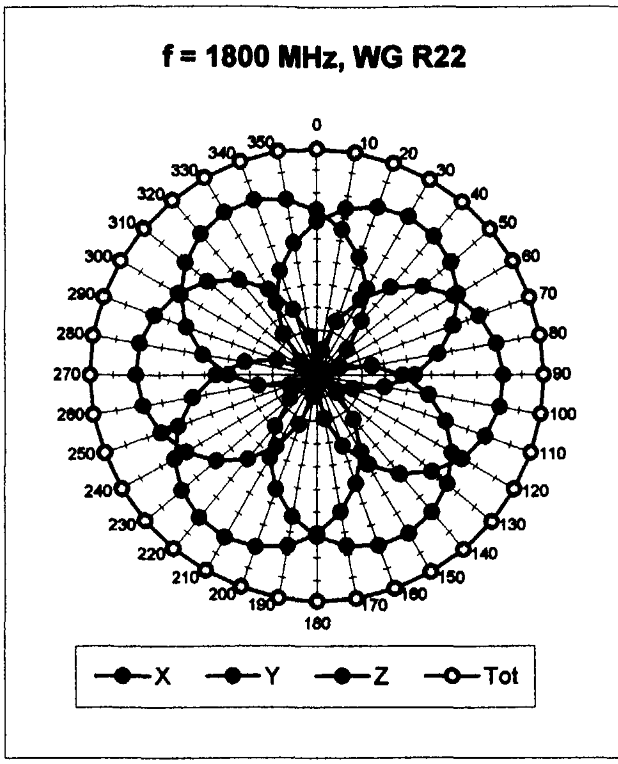


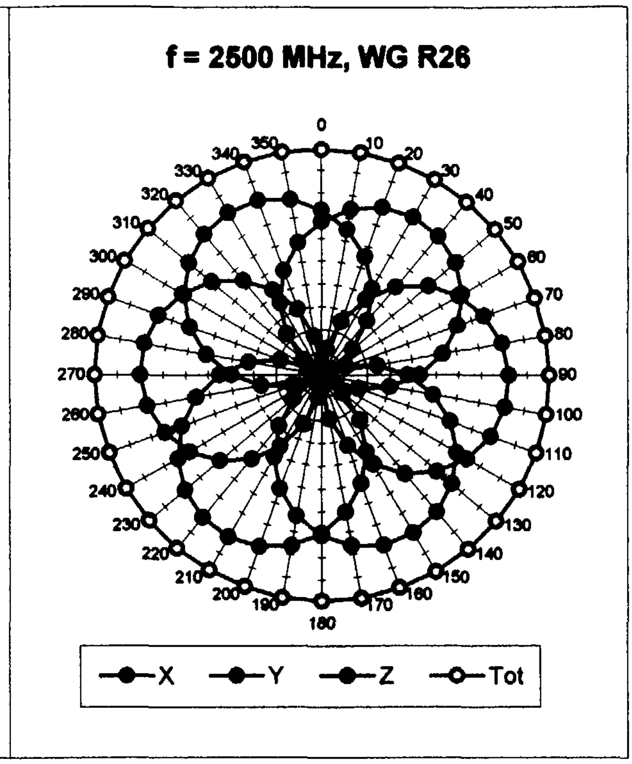
f = 300 MHz, TEM cell ifi110



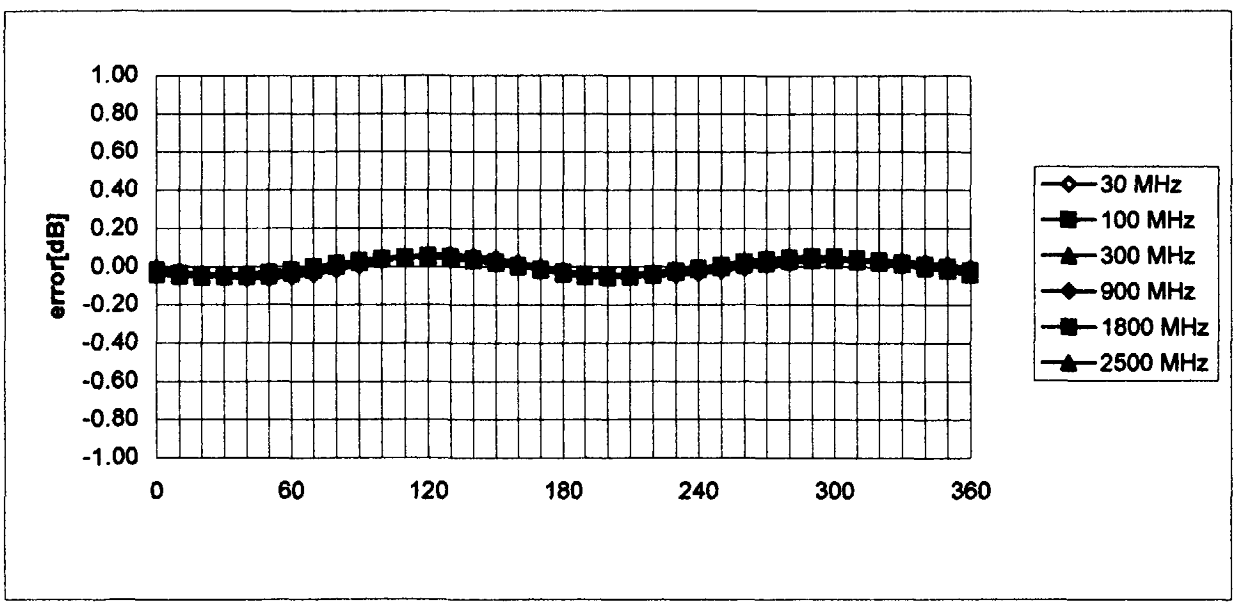
f = 900 MHz, TEM cell ifi110





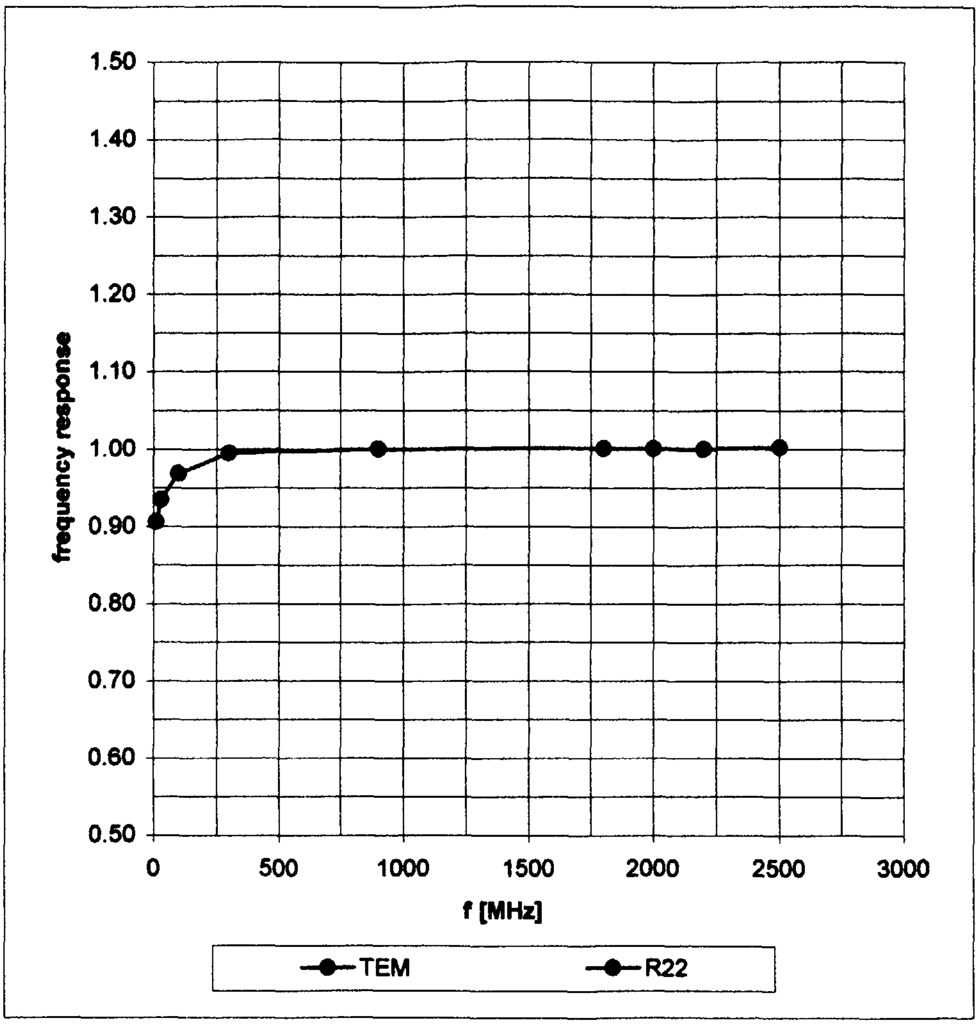


Isotropy Error (ϕ), θ = 0°



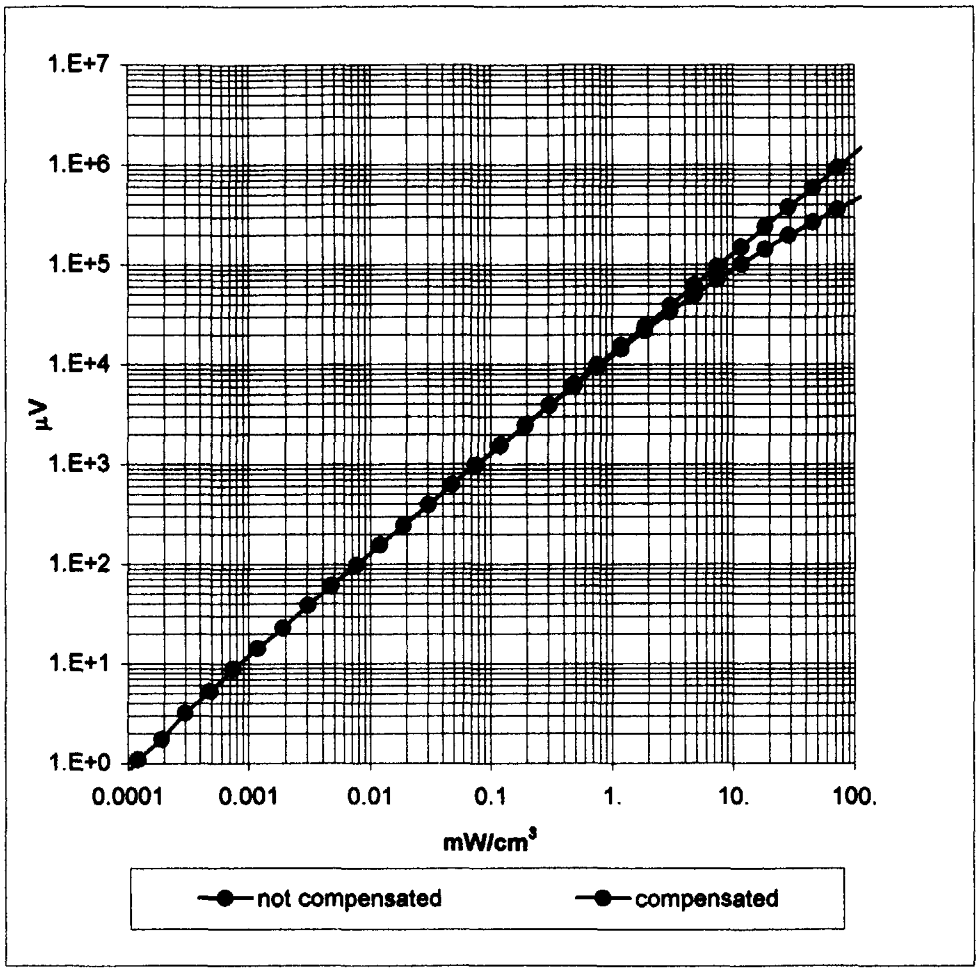
Frequency Response of E-Field

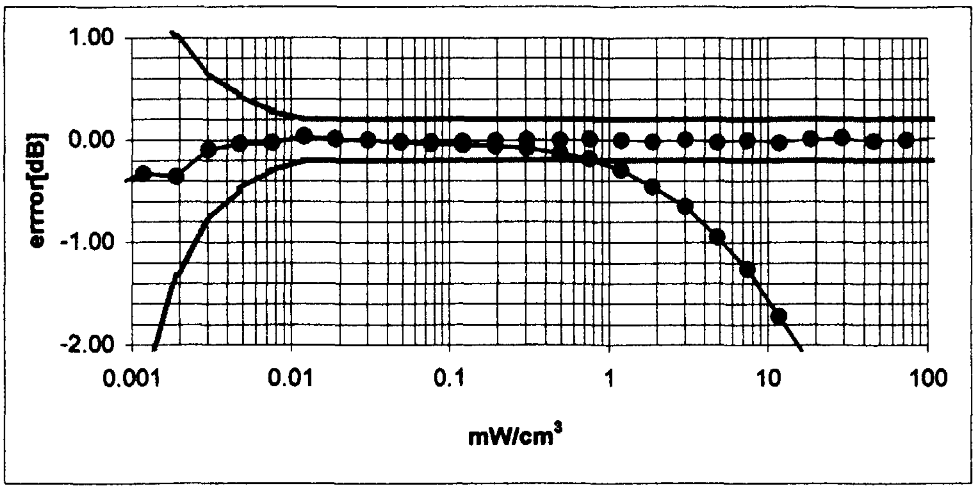
(TEM-Cell:ifi110, Waveguide R22, R26)



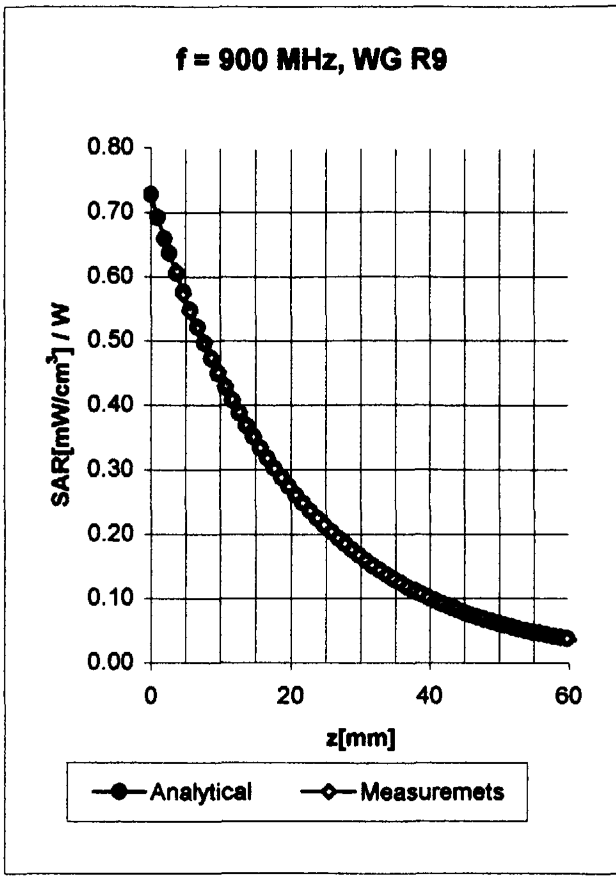
Dynamic Range f(SAR$_{brain}$)

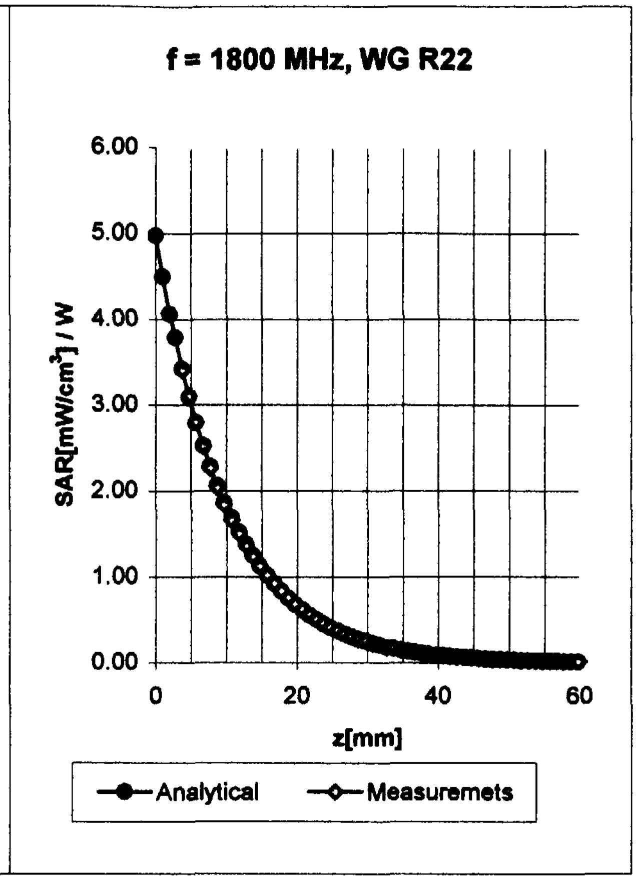
(TEM-Cell:ifi110)





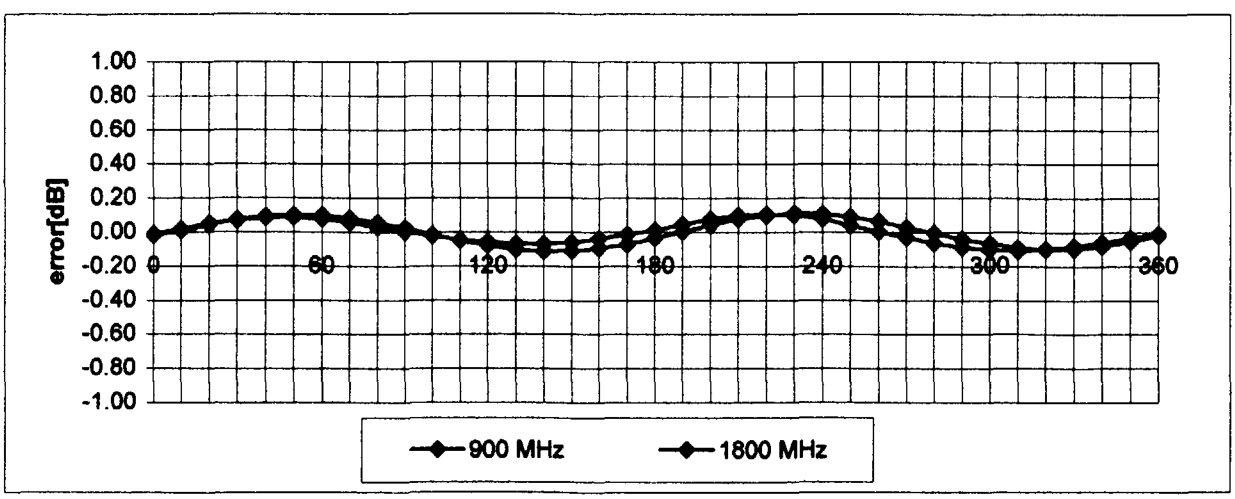
Conversion Factor Assessment





Receiving Pattern (ϕ)

(in brain tissue, z = 5 mm)



DASY - DOSIMETRIC ASSESSMENT SYSTEM

CALIBRATION REPORT

DATA ACQUISITION ELECTRONICS

MODEL:	**DAE3 V1**
SERIAL NUMBER:	**409**

This Data Acquisition Unit was calibrated and tested using a FLUKE 702 Process Calibrator. Calibration and verification were performed at an ambient temperature of 23 ± 5 °C and a relative humidity of < 70%.

Measurements were performed using the standard DASY software for converting binary values, offset compensation and noise filtering. Software settings are indicated in the reports.

Results from this calibration relate only to the unit calibrated.

Calibrated by:	**E. Meyer**
Calibration Date:	**Dec. 18, 2000**
DASY Software Version:	**DASY3 V3.1c**

1. DC Voltage Measurement

DA - Converter Values from DAE

High Range:	1LSB =	6.1µV ,	full range =	400 mV
Low Range:	1LSB =	61nV ,	full range =	4 mV

Software Set-up: Calibration time: 3 sec   Measuring time: 3 sec

Setup	X	Y	Z
High Range	404.688	404.222	403.891
Low Range	3.991	3.980	3.986
Connector Position	150 °		

High Range	Input	Reading in µV	% Error
Channel X + Input	200mV	199999.0	0.00
	20mV	20004.8	0.02
Channel X - Input	20mV	-19998.1	-0.01
Channel Y + Input	200mV	200001.0	0.00
	20mV	20002.2	0.01
Channel Y - Input	20mV	-19998.1	-0.01
Channel Z + Input	200mV	199999.0	0.00
	20mV	20000.6	0.00
Channel Z - Input	20mV	-19997.7	-0.01

Low Range	Input	Reading in µV	% Error
Channel X + Input	2mV	2000.15	0.01
	0.2mV	199.728	-0.14
Channel X - Input	0.2mV	-200.188	0.09
Channel Y + Input	2mV	1999.85	-0.01
	0.2mV	199.150	-0.42
Channel Y - Input	0.2mV	-201.257	0.63
Channel Z + Input	2mV	2000.17	0.01
	0.2mV	199.254	-0.37
Channel Z - Input	0.2mV	-201.436	0.72

2. Common mode sensitivity

Software Set-up
Calibration time: 3 sec, Measuring time: 3 sec
High/Low Range

in µV	Common mode Input Voltage	High Range Reading	Low Range Reading
Channel X	200mV	13.45	13.17
	- 200mV	-13.95	-12.42
Channel Y	200mV	-0.17	0.57
	- 200mV	-2.46	-1.25
Channel Z	200mV	1.74	3.24
	- 200mV	-3.88	-4.55

3. Channel separation

Software Set-up
Calibration time: 3 sec, Measuring time: 3 sec
High Range

in µV	Input Voltage	Channel X	Channel Y	Channel Z
Channel X	200mV	-	2.098	0.630
Channel Y	200mV	1.117	-	3.237
Channel Z	200mV	-1.468	0.411	-

4. AD-Converter Values with inputs shorted

in LSB	Low Range	High Range
Channel X	15551	15612
Channel Y	17285	16039
Channel Z	13368	15670

5. Input Offset Measurement

Measured after 15 min warm-up time of the Data Acquisition Electronic.
Every Measurement is preceded by a calibration cycle.

Software set-up:
Calibration time: 3 sec
Measuring time: 3 sec
Number of measurements: 100, Low Range

Input 10MΩ

in µV	Average	min. Offset	max. Offset	Std. Deviation
Channel X	1.23	0.16	1.97	0.48
Channel Y	-0.35	-1.70	0.63	0.53
Channel Z	-2.33	-3.31	-0.26	0.61

Input shorted

in µV	Average	min. Offset	max. Offset	Std. Deviation
Channel X	0.06	-0.90	1.08	0.36
Channel Y	-0.60	-3.14	1.46	0.50
Channel Z	-0.76	-3.28	0.90	0.56

6. Input Offset Current

in fA	Input Offset Current
Channel X	< 25
Channel Y	< 25
Channel Z	< 25

7. Input Resistance

	Calibrating	Measuring
Channel X	200.1 kΩ	199.9 MΩ
Channel Y	200.0 kΩ	199.5 MΩ
Channel Z	200.1 kΩ	200.0 MΩ

8. Low Battery Alarm Voltage

in V	Alarm Level
Supply (+ Vcc)	7.81 V
Supply (- Vcc)	-7.58 V

9. Power Consumption

in mA	Switched off	Stand by	Transmitting
Supply (+ Vcc)	0.000	7.5	15.5
Supply (- Vcc)	-0.012	-7.59	-8.75

10. Functional test

Touch async pulse 1	ok
Touch async pulse 2	ok
Touch status bit 1	ok
Touch status bit 2	ok
Remote power off	ok
Remote analog Power control	ok
Modification Status	B - C

Date: 18.12.2000 **Signature:** E. [illegible]

Schmid & Partner
Engineering AG

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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

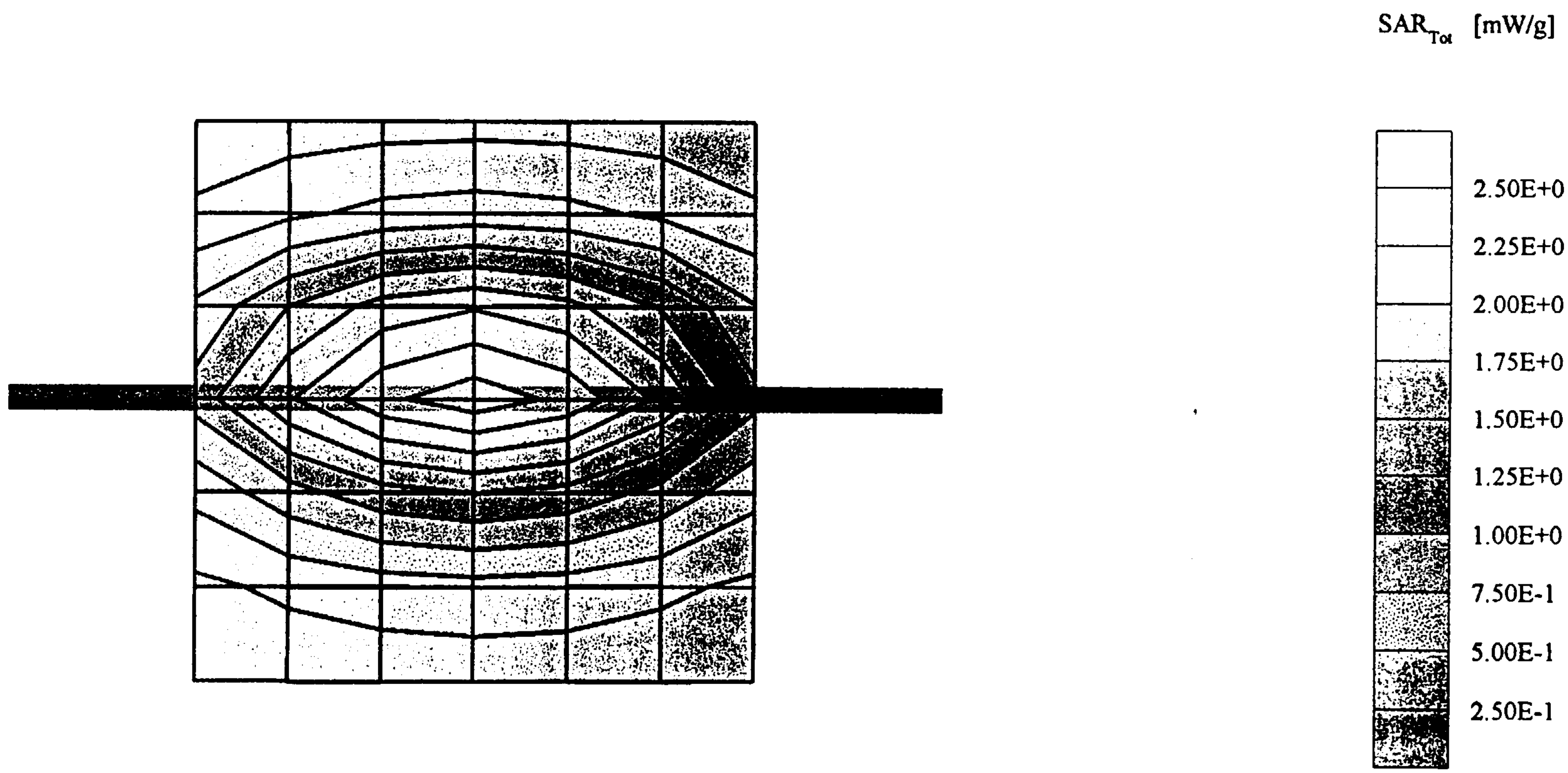
The dipole is made of standard semirigid coaxial cable. The centre conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

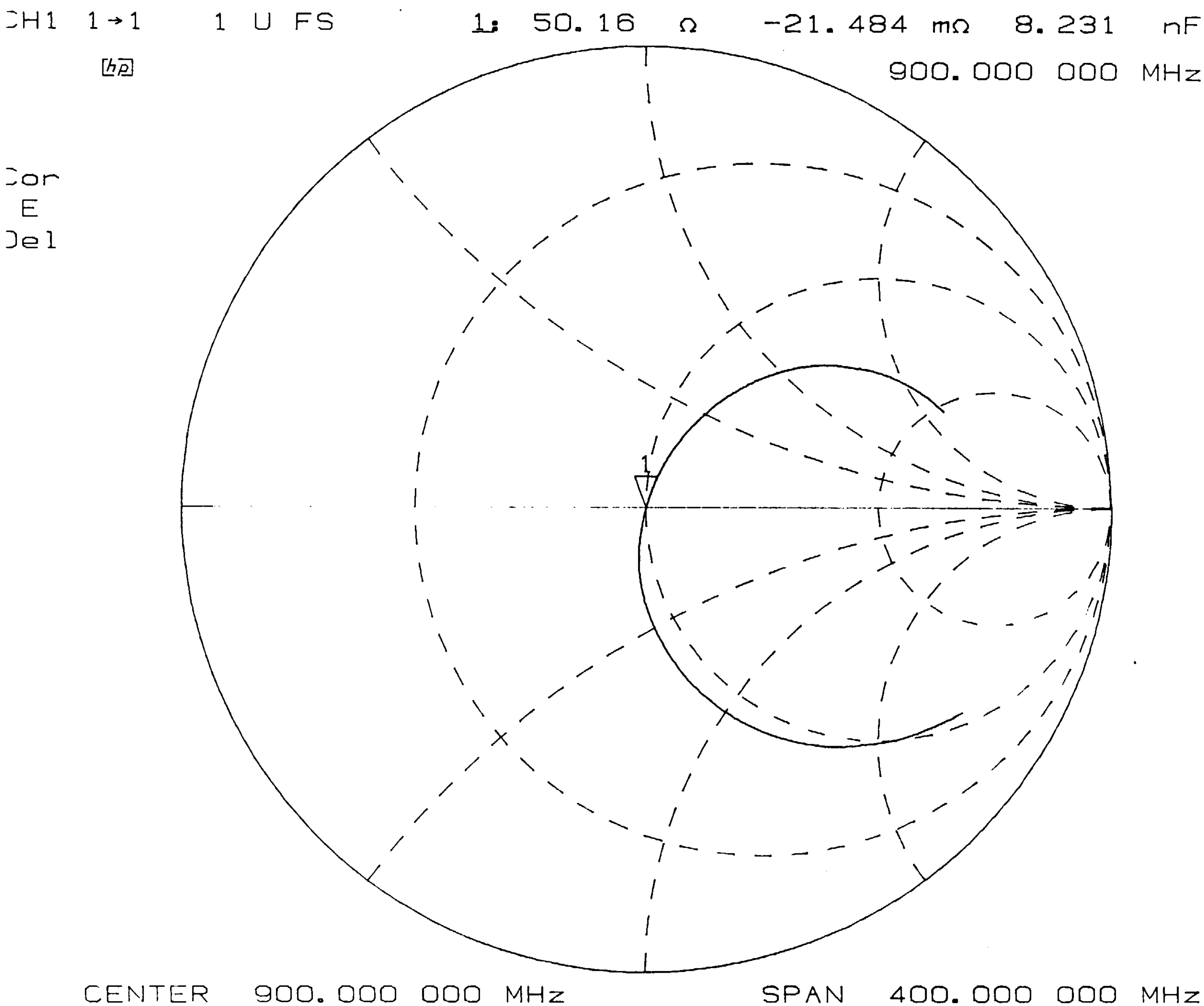
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

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; }: $\sigma = 0.85$ [mho/m] $\varepsilon_r = 42.3$ $\rho = 1.00$ [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





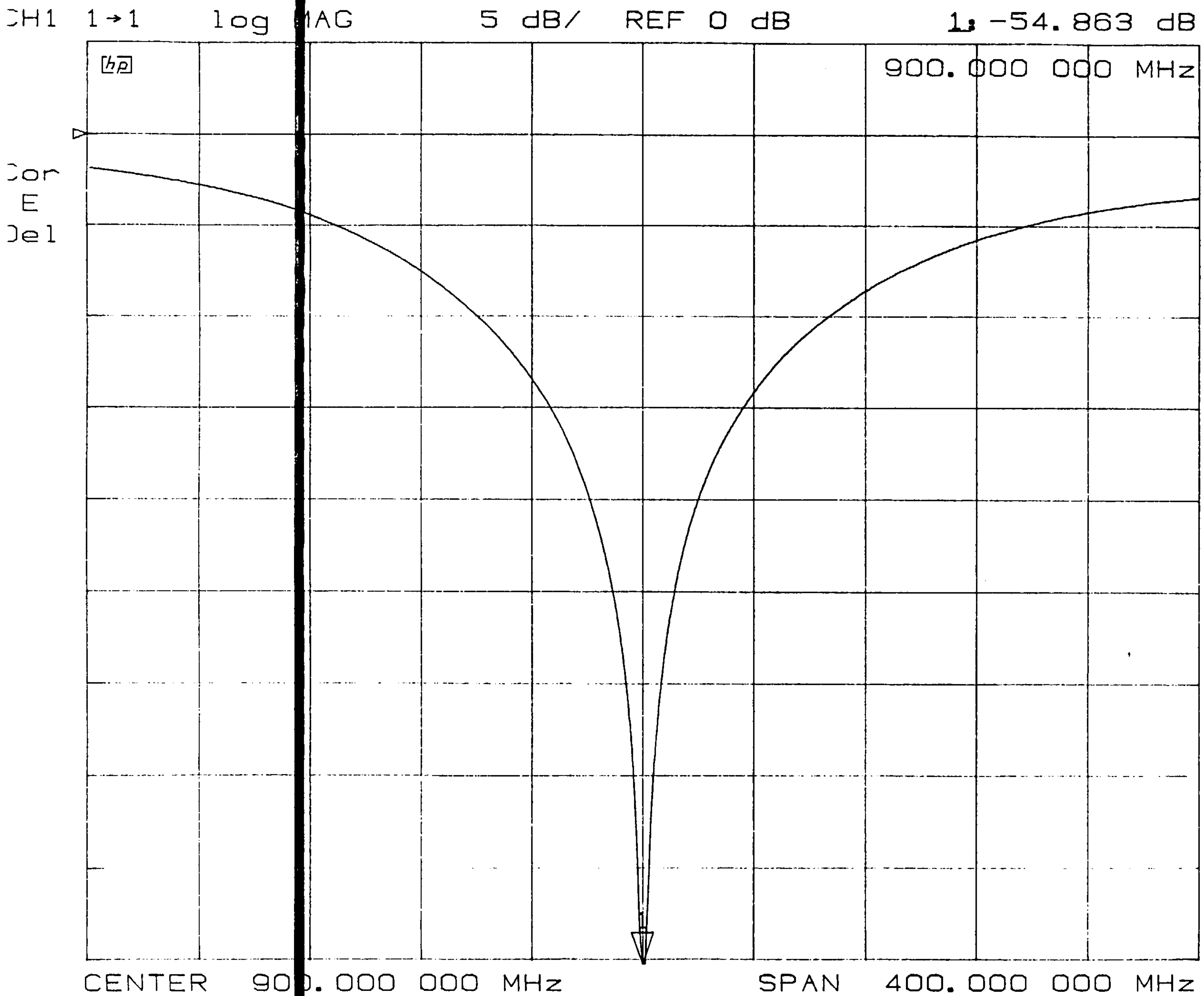
D900V2 SN: 024

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)

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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

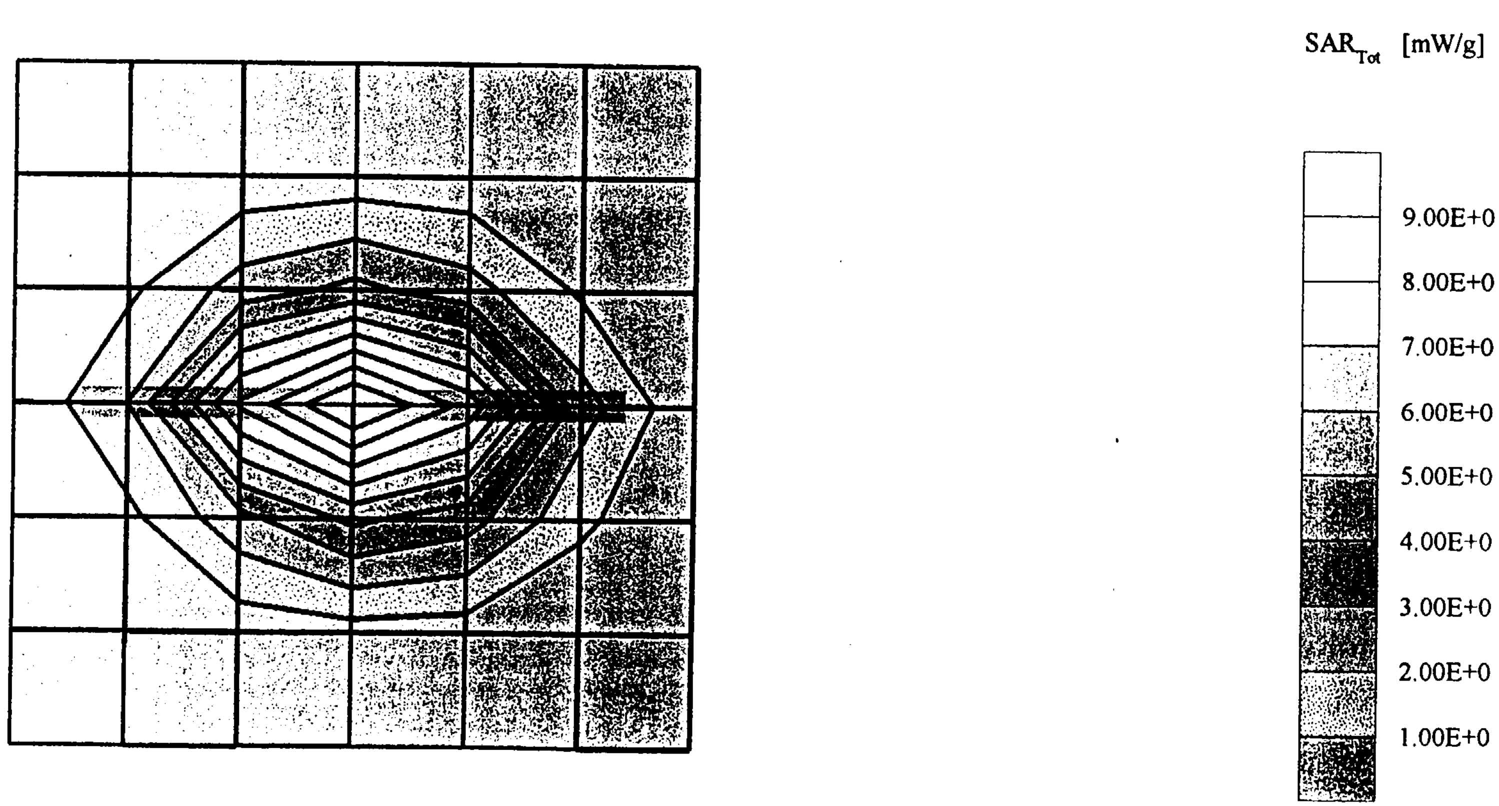
The dipole is made of standard semirigid coaxial cable. The centre conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

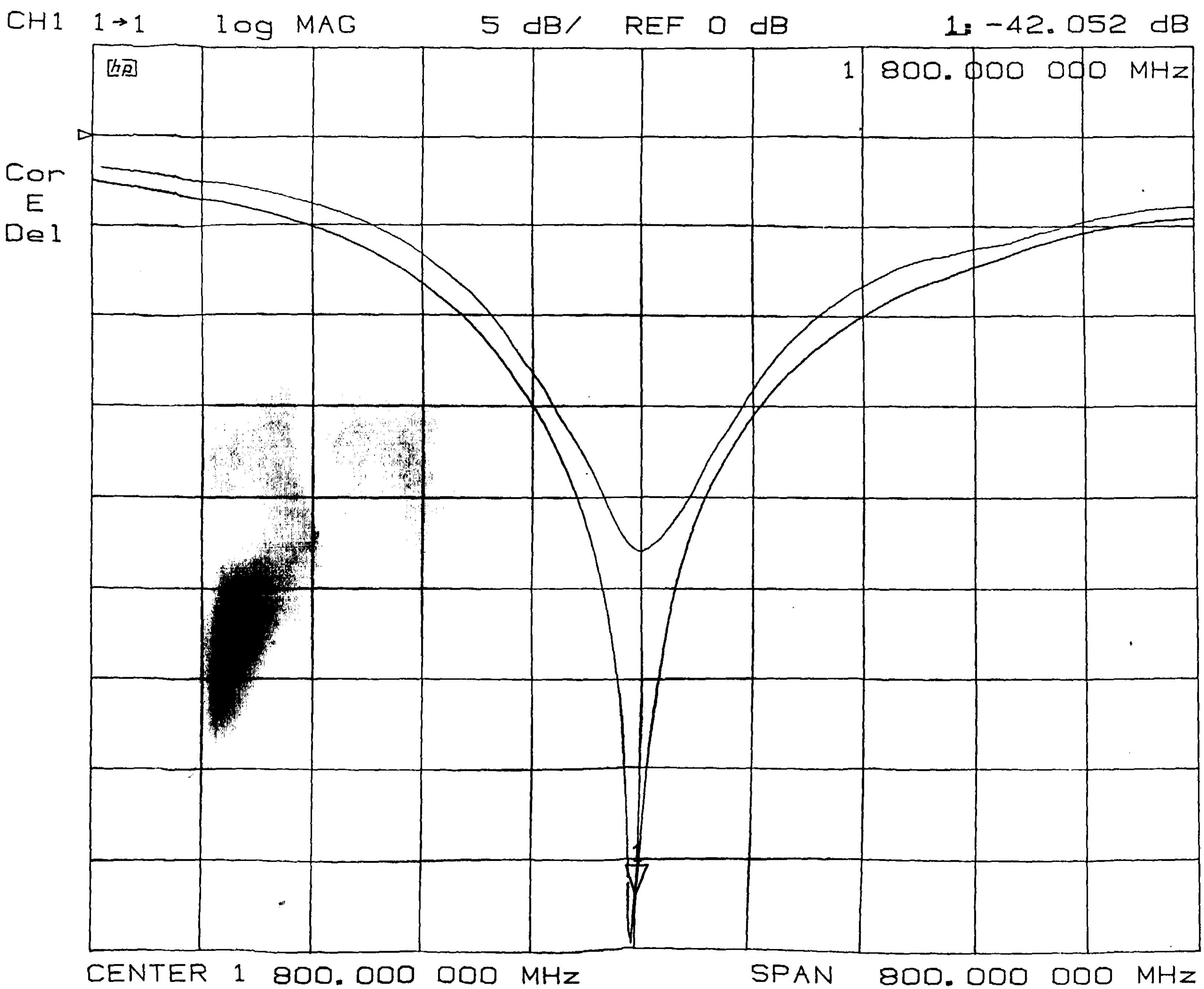
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

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; }: σ = 1.70 [mho/m] ε_r = 39.5 ρ = 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





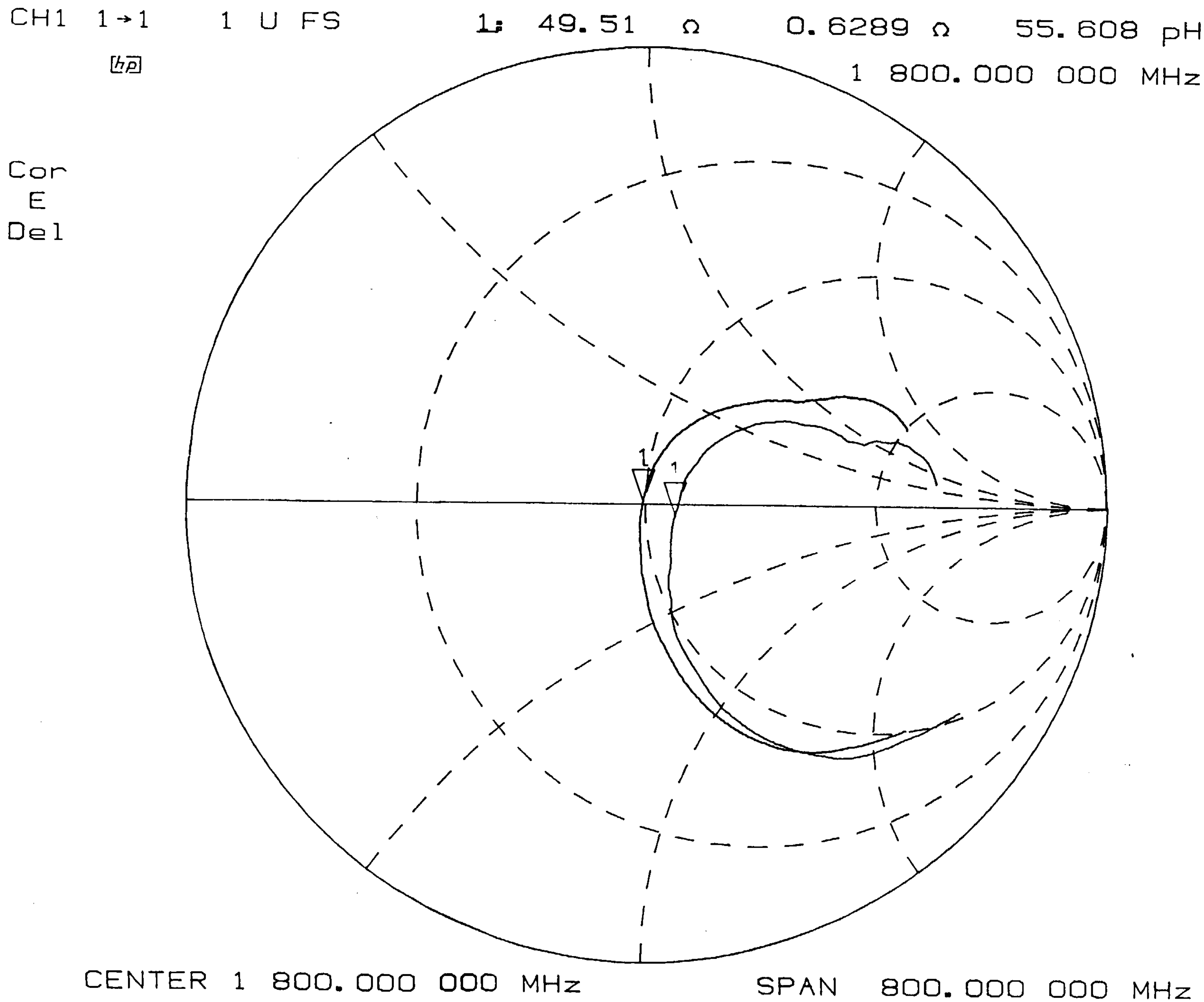
D1800V2 SN

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

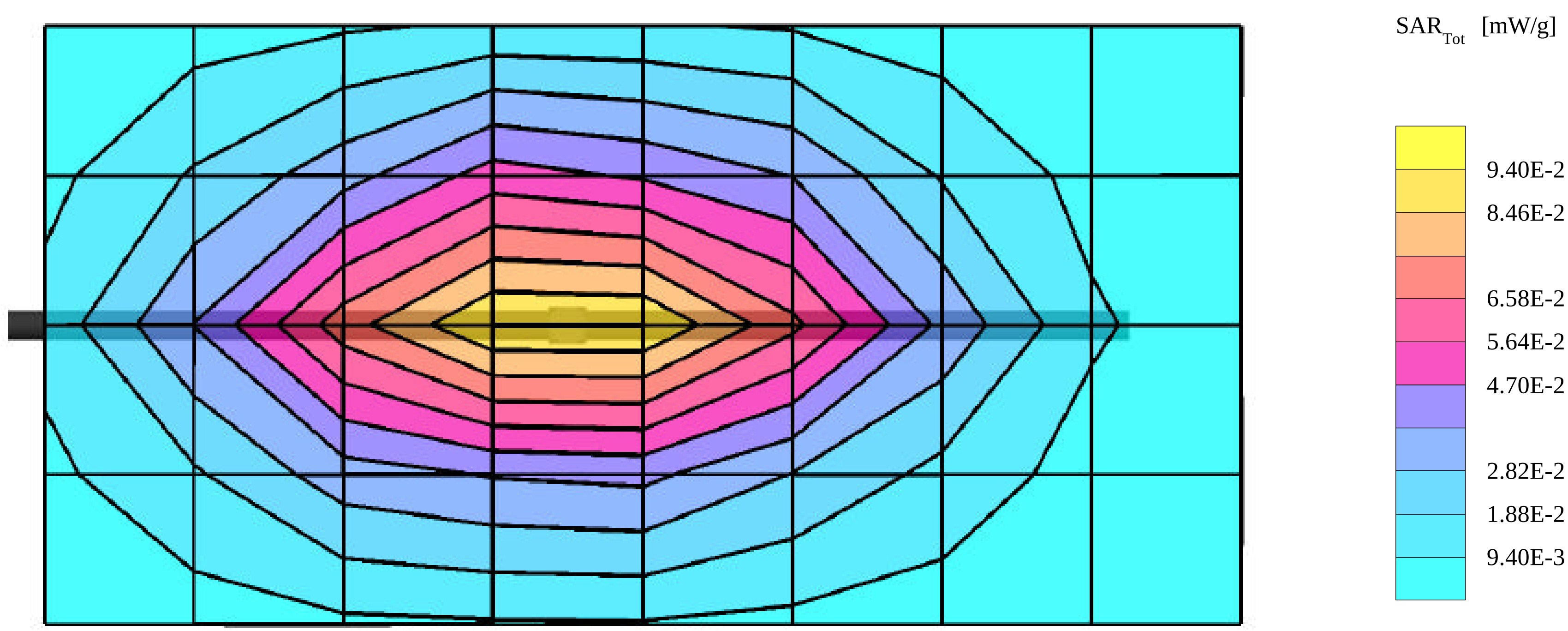
blk: d = 10mm
red: d = 20mm

(distance from dipo
center to solution)

Brain Tissue Validation Test Results

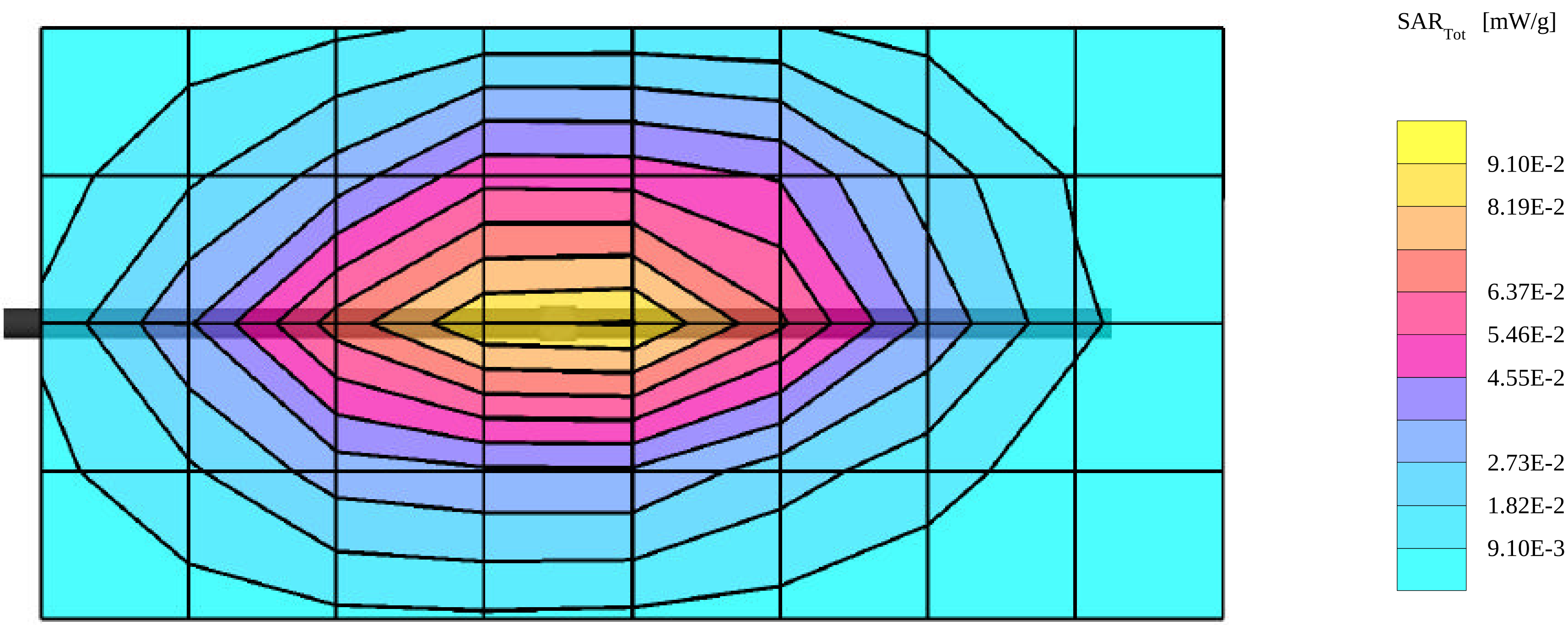
06-27-2001, 900MHz Validation, Target=0.0944mW/g

SAR (1g): 0.0959 [mW/g] ± 0.05 dB, SAR (10g): 0.0637 [mW/g] ± 0.05 dB
Cubes (2) (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.70,5.70,5.70)
Brain 900 MHz: $\sigma = 0.87$ [mho/m] $\varepsilon_r = 42.6$ $\rho = 1.00$ [g/cm^3]
File Name: FCC, ValidationFlat 900MHz 06-27-2001.DA3
Operator: DL



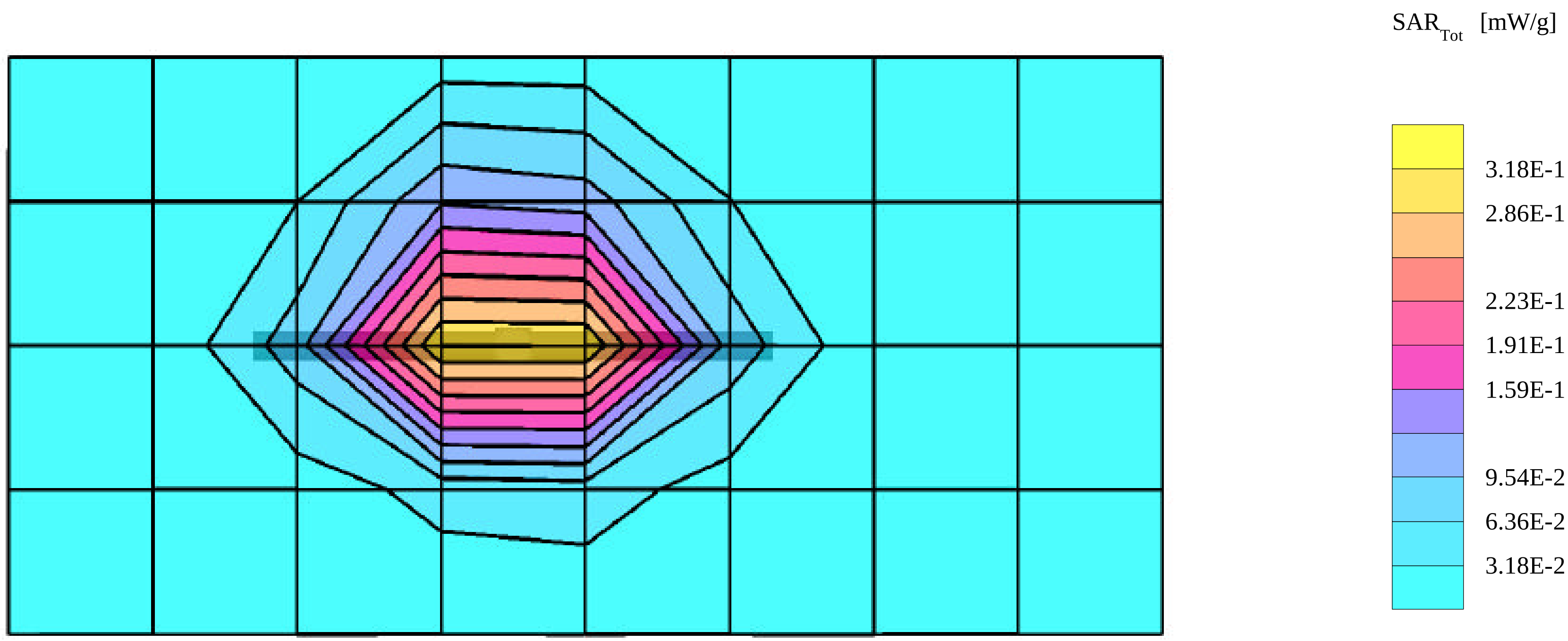
06-28-2001, 900MHz CDMA Validation, Target=0.0944mW/g

SAR (1g): 0.0936 [mW/g] ± 0.04 dB, SAR (10g): 0.0621 [mW/g] ± 0.04 dB
Cubes (2) (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.70,5.70,5.70)
Brain 900 MHz: σ = 0.87 [mho/m] ε_r = 43.4 ρ = 1.00 [g/cm³]
File Name: FCC, ValidationFlat 900MHz CDMA 06-28-2001.DA3
Operator: DL



06-26-2001, 1800MHz Validation, Target=0.399mW/g

SAR (1g): 0.383 [mW/g] ± 0.03 dB, SAR (10g): 0.198 [mW/g] ± 0.06 dB
Cubes (2) (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Generic Twin Phantom; Flat Section
Probe: ET3DV5 - SN1353; ConvF(5.00,5.00,5.00)
Brain 1800 MHz: σ = 1.64 [mho/m] ε_r = 40.3 ρ = 1.00 [g/cm^3]
File Name: FCC, ValidationFlat 1800MHz 06-26-2001.DA3
Operator: DL



Muscle Tissue Calibration Data Sheet

Reference math : OFF   Title: 07-10-01

7GP_FM(MUSCLE)

Pt#	Frequency (GHz)	Data real	Data imag
1	0.000030000	9999.00	9999.00
2	0.015029850	108.31	454.83
3	0.030029700	69.37	204.49
4	0.045029550	68.95	136.10
5	0.060029400	67.70	103.80
6	0.075029250	66.70	84.08
7	0.090029100	66.66	70.99
8	0.105028950	66.03	61.71
9	0.120028800	65.52	55.01
10	0.135028650	65.30	49.69
11	0.150028500	65.15	45.40
12	0.165028350	64.63	42.07
13	0.180028200	64.33	39.28
14	0.195028050	64.15	36.99
15	0.210027900	63.91	34.90
16	0.225027750	63.62	33.27
17	0.240027600	63.39	31.69
18	0.255027450	63.21	30.46
19	0.270027300	63.03	29.37
20	0.285027150	62.77	28.36
21	0.300027000	62.57	27.45
22	0.315026850	62.40	26.65
23	0.330026700	62.21	25.95
24	0.345026550	62.03	25.29
25	0.360026400	61.84	24.75
26	0.375026250	61.64	24.26
27	0.390026100	61.44	23.79
28	0.405025950	61.28	23.37
29	0.420025800	61.13	22.99
30	0.435025650	60.97	22.62
31	0.450025500	60.78	22.30
32	0.465025350	60.65	21.98
33	0.480025200	60.48	21.77
34	0.495025050	60.36	21.53
35	0.510024900	60.18	21.27
36	0.525024750	60.02	21.10
37	0.540024600	59.85	20.91
38	0.555024450	59.71	20.74
39	0.570024300	59.59	20.54
40	0.585024150	59.40	20.36
41	0.600024000	59.25	20.24
42	0.615023850	59.11	20.14
43	0.630023700	58.96	20.00
44	0.645023550	58.81	19.92
45	0.660023400	58.71	19.79
46	0.675023250	58.55	19.71
47	0.690023100	58.41	19.64
48	0.705022950	58.26	19.56
49	0.720022800	58.10	19.48
50	0.735022650	57.99	19.43
51	0.750022500	57.86	19.37
52	0.765022350	57.74	19.31
53	0.780022200	57.58	19.23
54	0.795022050	57.43	19.16
55	0.810021900	57.34	19.14
56	0.825021750	57.22	19.12

57	0.840021600	57.07	19.08
58	0.855021450	56.93	19.06
59	0.870021300	56.83	19.01
60	0.885021150	56.66	18.97
61	0.900021000	56.59	18.96
62	0.915020850	56.44	18.94
63	0.930020700	56.28	18.91
64	0.945020550	56.19	18.92
65	0.960020400	56.07	18.89
66	0.975020250	55.92	18.84
67	0.990020100	55.80	18.87
68	1.005019950	55.69	18.80
69	1.020019800	55.55	18.78
70	1.035019650	55.45	18.79
71	1.050019500	55.37	18.78
72	1.065019350	55.23	18.80
73	1.080019200	55.10	18.79
74	1.095019050	54.99	18.76
75	1.110018900	54.88	18.75
76	1.125018750	54.78	18.74
77	1.140018600	54.69	18.73
78	1.155018450	54.59	18.77
79	1.170018300	54.49	18.81
80	1.185018150	54.41	18.80
81	1.200018000	54.24	18.84
82	1.215017850	54.12	18.85
83	1.230017700	54.03	18.86
84	1.245017550	53.88	18.88
85	1.260017400	53.76	18.86
86	1.275017250	53.65	18.86
87	1.290017100	53.53	18.88
88	1.305016950	53.44	18.87
89	1.320016800	53.31	18.87
90	1.335016650	53.23	18.89
91	1.350016500	53.13	18.89
92	1.365016350	53.00	18.89
93	1.380016200	52.92	18.92
94	1.395016050	52.83	18.92
95	1.410015900	52.71	18.93
96	1.425015750	52.60	18.97
97	1.440015600	52.51	18.97
98	1.455015450	52.40	19.00
99	1.470015300	52.30	19.03
100	1.485015150	52.20	19.01
101	1.500015000	52.08	19.04
102	1.515014850	51.98	19.05
103	1.530014700	51.87	19.05
104	1.545014550	51.75	19.09
105	1.560014400	51.66	19.10
106	1.575014250	51.56	19.10
107	1.590014100	51.45	19.09
108	1.605013950	51.36	19.11
109	1.620013800	51.25	19.11
110	1.635013650	51.15	19.11
111	1.650013500	51.08	19.12
112	1.665013350	51.00	19.11
113	1.680013200	50.91	19.12
114	1.695013050	50.81	19.14
115	1.710012900	50.73	19.16
116	1.725012750	50.63	19.17

$\sigma = 0.95$ mho/m

117	1.740012600	50.55	19.19
118	1.755012450	50.45	19.20
119	1.770012300	50.36	19.22
120	1.785012150	50.27	19.22
121	1.800012000	50.17	19.23
122	1.815011850	50.09	19.26
123	1.830011700	50.00	19.26
124	1.845011550	49.90	19.27
125	1.860011400	49.81	19.31
126	1.875011250	49.72	19.29
127	1.890011100	49.64	19.31
128	1.905010950	49.56	19.31
129	1.920010800	49.46	19.31
130	1.935010650	49.36	19.32
131	1.950010500	49.29	19.32
132	1.965010350	49.23	19.33
133	1.980010200	49.15	19.34
134	1.995010050	49.08	19.33
135	2.010009900	49.00	19.34
136	2.025009750	48.94	19.36
137	2.040009600	48.87	19.39
138	2.055009450	48.80	19.39
139	2.070009300	48.73	19.43
140	2.085009150	48.68	19.45
141	2.100009000	48.58	19.47
142	2.115008850	48.52	19.51
143	2.130008700	48.44	19.53
144	2.145008550	48.37	19.55
145	2.160008400	48.28	19.57
146	2.175008250	48.20	19.58
147	2.190008100	48.11	19.60
148	2.205007950	48.03	19.64
149	2.220007800	47.97	19.66
150	2.235007650	47.88	19.69
151	2.250007500	47.80	19.72
152	2.265007350	47.70	19.72
153	2.280007200	47.62	19.76
154	2.295007050	47.53	19.77
155	2.310006900	47.44	19.80
156	2.325006750	47.37	19.80
157	2.340006600	47.29	19.82
158	2.355006450	47.21	19.84
159	2.370006300	47.13	19.84
160	2.385006150	47.04	19.86
161	2.400006000	46.94	19.88
162	2.415005850	46.88	19.89
163	2.430005700	46.80	19.88
164	2.445005550	46.73	19.89
165	2.460005400	46.66	19.90
166	2.475005250	46.59	19.90
167	2.490005100	46.51	19.92
168	2.505004950	46.43	19.94
169	2.520004800	46.37	19.96
170	2.535004650	46.31	19.98
171	2.550004500	46.22	19.98
172	2.565004350	46.16	19.99
173	2.580004200	46.09	19.99
174	2.595004050	46.02	20.00
175	2.610003900	45.94	20.02
176	2.625003750	45.89	20.04

177	2.640003600	45.83	20.06
178	2.655003450	45.76	20.07
179	2.670003300	45.69	20.09
180	2.685003150	45.62	20.10
181	2.700003000	45.54	20.12
182	2.715002850	45.47	20.15
183	2.730002700	45.39	20.15
184	2.745002550	45.31	20.18
185	2.760002400	45.24	20.17
186	2.775002250	45.19	20.19
187	2.790002100	45.11	20.21
188	2.805001950	45.05	20.23
189	2.820001800	45.00	20.24
190	2.835001650	44.93	20.24
191	2.850001500	44.86	20.26
192	2.865001350	44.79	20.29
193	2.880001200	44.71	20.30
194	2.895001050	44.65	20.33
195	2.910000900	44.58	20.36
196	2.925000750	44.50	20.37
197	2.940000600	44.45	20.38
198	2.955000450	44.38	20.38
199	2.970000300	44.31	20.39
200	2.985000150	44.25	20.41
201	3.000000000	44.19	20.41

Reference math : OFF Title: 07-11-01

PCS MUSCLE

Pt#	Frequency (GHz)	Data real	Data imag
1	0.000030000	2684.25	-1709.43
2	0.015029850	211.09	-143.36
3	0.030029700	66.55	6.62
4	0.045029550	66.48	4.38
5	0.060029400	66.41	4.27
6	0.075029250	66.37	3.95
7	0.090029100	65.97	4.08
8	0.105028950	65.97	4.11
9	0.120028800	65.93	4.20
10	0.135028650	65.70	4.27
11	0.150028500	65.61	4.42
12	0.165028350	65.41	4.56
13	0.180028200	65.23	4.59
14	0.195028050	65.10	4.73
15	0.210027900	65.05	4.92
16	0.225027750	64.88	5.08
17	0.240027600	64.81	5.21
18	0.255027450	64.75	5.31
19	0.270027300	64.53	5.48
20	0.285027150	64.46	5.68
21	0.300027000	64.35	5.82
22	0.315026850	64.16	5.95
23	0.330026700	64.07	6.18
24	0.345026550	64.07	6.18
25	0.360026400	63.86	6.35
26	0.375026250	63.78	6.51
27	0.390026100	63.69	6.65
28	0.405025950	63.56	6.83
29	0.420025800	63.53	6.99
30	0.435025650	63.41	7.05
31	0.450025500	63.30	7.22
32	0.465025350	63.21	7.40
33	0.480025200	63.11	7.55
34	0.495025050	63.01	7.59
35	0.510024900	62.88	7.79
36	0.525024750	62.78	7.92
37	0.540024600	62.65	8.07
38	0.555024450	62.59	8.18
39	0.570024300	62.46	8.29
40	0.585024150	62.38	8.42
41	0.600024000	62.23	8.56
42	0.615023850	62.16	8.69
43	0.630023700	62.01	8.81
44	0.645023550	61.96	8.92
45	0.660023400	61.87	9.06
46	0.675023250	61.78	9.16
47	0.690023100	61.66	9.28
48	0.705022950	61.53	9.38
49	0.720022800	61.41	9.55
50	0.735022650	61.32	9.67
51	0.750022500	61.22	9.76
52	0.765022350	61.10	9.88
53	0.780022200	61.01	9.97
54	0.795022050	60.91	10.11
55	0.810021900	60.83	10.23
56	0.825021750	60.71	10.31
57	0.840021600	60.61	10.44
58	0.855021450	60.51	10.54
59	0.870021300	60.41	10.65
60	0.885021150	60.31	10.74
61	0.900021000	60.20	10.86
62	0.915020850	60.12	10.96
63	0.930020700	59.98	11.06
64	0.945020550	59.88	11.18
65	0.960020400	59.79	11.25
66	0.975020250	59.68	11.34
67	0.990020100	59.57	11.43
68	1.005019950	59.46	11.54
69	1.020019800	59.35	11.62
70	1.035019650	59.24	11.73

7[illegible]	1.050019500	59.16	11.80
72	1.065019350	59.09	11.89
73	1.080019200	58.97	11.99
74	1.095019050	58.86	12.02
75	1.110018900	58.76	12.10
76	1.125018750	58.70	12.16
77	1.140018600	58.62	12.25
78	1.155018450	58.57	12.37
79	1.170018300	58.49	12.49
80	1.185018150	58.36	12.58
81	1.200018000	58.26	12.68
82	1.215017850	58.15	12.78
83	1.230017700	58.02	12.87
84	1.245017550	57.94	12.93
85	1.260017400	57.85	13.02
86	1.275017250	57.72	13.10
87	1.290017100	57.63	13.18
88	1.305016950	57.54	13.24
89	1.320016800	57.42	13.34
90	1.335016650	57.35	13.41
91	1.350016500	57.27	13.44
92	1.365016350	57.16	13.50
93	1.380016200	57.07	13.57
94	1.395016050	56.98	13.66
95	1.410015900	56.88	13.76
96	1.425015750	56.81	13.82
97	1.440015600	56.72	13.89
98	1.455015450	56.61	13.99
99	1.470015300	56.53	14.03
100	1.485015150	56.41	14.09
101	1.500015000	56.32	14.16
102	1.515014850	56.24	14.23
103	1.530014700	56.14	14.30
104	1.545014550	56.05	14.37
105	1.560014400	55.92	14.39
106	1.575014250	55.83	14.45
107	1.590014100	55.73	14.52
108	1.605013950	55.65	14.58
109	1.620013800	55.57	14.63
110	1.635013650	55.49	14.68
111	1.650013500	55.39	14.73
112	1.665013350	55.29	14.77
113	1.680013200	55.20	14.81
114	1.695013050	55.12	14.88
115	1.710012900	55.04	14.93
116	1.725012750	54.98	14.98
117	1.740012600	54.92	15.03
118	1.755012450	54.82	15.07
119	1.770012300	54.74	15.12
120	1.785012150	54.64	15.18
121	1.800012000	54.58	15.26
122	1.815011850	54.50	15.34
123	1.830011700	54.41	15.37
124	1.845011550	54.34	15.42
125	1.860011400	54.22	15.47
126	1.875011250	54.11	15.51
127	1.890011100	54.04	15.55
128	1.905010950	53.97	15.62
129	1.920010800	53.89	15.66
130	1.935010650	53.82	15.68
131	1.950010500	53.75	15.71
132	1.965010350	53.67	15.73
133	1.980010200	53.60	15.78
134	1.995010050	53.53	15.84
135	2.010009900	53.46	15.92
136	2.025009750	53.40	15.97
137	2.040009600	53.35	16.03
138	2.055009450	53.28	16.07
139	2.070009300	53.21	16.12
140	2.085009150	53.13	16.17
141	2.100009000	53.02	16.21
142	2.115008850	52.96	16.30
143	2.130008700	52.89	16.36
144	2.145008550	52.84	16.42

$\sigma = 1.52$ mho/m

145	2.160008400	52.77	16.46
146	2.175008250	52.66	16.48
147	2.190008100	52.57	16.54
148	2.205007950	52.47	16.60
149	2.220007800	52.40	16.66
150	2.235007650	52.33	16.74
151	2.250007500	52.28	16.77
152	2.265007350	52.20	16.81
153	2.280007200	52.11	16.83
154	2.295007050	51.98	16.87
155	2.310006900	51.89	16.95
156	2.325006750	51.82	17.00
157	2.340006600	51.77	17.04
158	2.355006450	51.71	17.08
159	2.370006300	51.62	17.10
160	2.385006150	51.50	17.11
161	2.400006000	51.41	17.16
162	2.415005850	51.33	17.25
163	2.430005700	51.27	17.28
164	2.445005550	51.22	17.33
165	2.460005400	51.14	17.33
166	2.475005250	51.05	17.35
167	2.490005100	50.98	17.37
168	2.505004950	50.87	17.42
169	2.520004800	50.81	17.49
170	2.535004650	50.75	17.54
171	2.550004500	50.69	17.59
172	2.565004350	50.63	17.60
173	2.580004200	50.56	17.60
174	2.595004050	50.46	17.63
175	2.610003900	50.37	17.66
176	2.625003750	50.31	17.73
177	2.640003600	50.27	17.80
178	2.655003450	50.21	17.83
179	2.670003300	50.17	17.84
180	2.685003150	50.08	17.85
181	2.700003000	49.98	17.89
182	2.715002850	49.90	17.94
183	2.730002700	49.84	18.02
184	2.745002550	49.79	18.06
185	2.760002400	49.74	18.06
186	2.775002250	49.66	18.09
187	2.790002100	49.58	18.11
188	2.805001950	49.48	18.14
189	2.820001800	49.40	18.20
190	2.835001650	49.34	18.25
191	2.850001500	49.30	18.29
192	2.865001350	49.25	18.31
193	2.880001200	49.19	18.32
194	2.895001050	49.10	18.34
195	2.910000900	49.01	18.37
196	2.925000750	48.93	18.41
197	2.940000600	48.87	18.47
198	2.955000450	48.84	18.52
199	2.970000300	48.79	18.53
200	2.985000150	48.73	18.56
201	3.000000000	48.62	18.58

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	98AV0108551120	ANALOG	Ext	1.24
824	991	98AV0108551120	ANALOG	Ret	0.861
836.5	383	98AV0108551120	ANALOG	Ext	1.15
836.5	383	98AV0108551120	ANALOG	Ret	0.844
849	799	98AV0108551120	ANALOG	Ext	1.22
849	799	98AV0108551120	ANALOG	Ret	0.895
824	1013	98AV0108551120	Cellular CDMA	Ext	1.35
824	1013	98AV0108551120	Cellular CDMA	Ret	0.851
836.5	383	98AV0108551120	Cellular CDMA	Ext	1.39
836.5	383	98AV0108551120	Cellular CDMA	Ret	0.795
849	777	98AV0108551120	Cellular CDMA	Ext	1.32
849	777	98AV0108551120	Cellular CDMA	Ret	0.983
1851.25	25	98AV0108551120	PCS CDMA	Ext	0.720
1851.25	25	98AV0108551120	PCS CDMA	Ret	1.28
1880	600	98AV0108551120	PCS CDMA	Ext	0.622
1880	600	98AV0108551120	PCS CDMA	Ret	1.17
1908.75	1175	98AV0108551120	PCS CDMA	Ext	0.511
1908.75	1175	98AV0108551120	PCS CDMA	Ret	0.959

For the FCC ID: OVFQCP-3035 the highest SAR (at head) in the cellular band is 1.39 mW/g. The highest SAR (at head) in PCS band is 1.28 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	98AV0108551120	ANALOG	Ext	0.442
824	991	98AV0108551120	ANALOG	Ret	0.533
836.5	383	98AV0108551120	ANALOG	Ext	0.327
836.5	383	98AV0108551120	ANALOG	Ret	0.569
849	799	98AV0108551120	ANALOG	Ext	0.385
849	799	98AV0108551120	ANALOG	Ret	0.517
824	1013	98AV0108551120	Cellular CDMA	Ext	0.418
824	1013	98AV0108551120	Cellular CDMA	Ret	0.452
836.5	383	98AV0108551120	Cellular CDMA	Ext	0.312
836.5	383	98AV0108551120	Cellular CDMA	Ret	0.563
849	777	98AV0108551120	Cellular CDMA	Ext	0.389
849	777	98AV0108551120	Cellular CDMA	Ret	0.528
1851.25	25	98AV0108551120	PCS CDMA	Ext	0.642
1851.25	25	98AV0108551120	PCS CDMA	Ret	0.525
1880	600	98AV0108551120	PCS CDMA	Ext	0.345
1880	600	98AV0108551120	PCS CDMA	Ret	0.472
1908.75	1175	98AV0108551120	PCS CDMA	Ext	0.284
1908.75	1175	98AV0108551120	PCS CDMA	Ret	0.458

For the FCC ID: OVFQCP-3035 with tested belt-clip (provides 23.50 mm closest separation), the highest body-worn SAR is 0.642 mW/g.

The QCP-3035 has provision for headset and body-worn holster to allow hands-free operation. The SAR for the operating condition with a space of 23.5 mm closet separation to the body (no belt clip) was measured. The following is the summary of the results.

Body-worn SAR Test Results (23.5 mm Space Only)

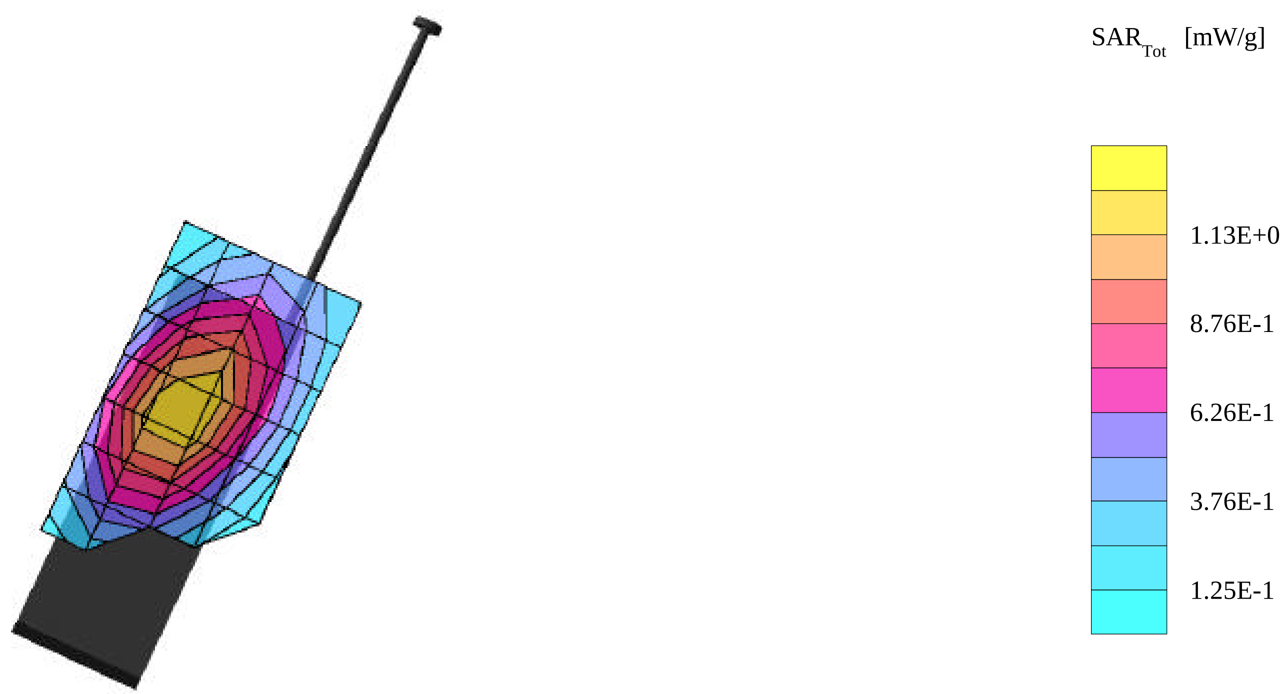
FREQ. MHZ	CH.#	SERIAL NUMBER	MODULATION	ANTENNA POSITION	1 GRAM AVG. SAR (MW/G)
824	991	98AV0108551120	ANALOG	Ext	0.362
824	991	98AV0108551120	ANALOG	Ret	0.436
836.5	383	98AV0108551120	ANALOG	Ext	0.262
836.5	383	98AV0108551120	ANALOG	Ret	0.396
849	799	98AV0108551120	ANALOG	Ext	0.310
849	799	98AV0108551120	ANALOG	Ret	0.422
824	1013	98AV0108551120	Cellular CDMA	Ext	0.319
824	1013	98AV0108551120	Cellular CDMA	Ret	0.336
836.5	383	98AV0108551120	Cellular CDMA	Ext	0.284
836.5	383	98AV0108551120	Cellular CDMA	Ret	0.464
849	777	98AV0108551120	Cellular CDMA	Ext	0.303
849	777	98AV0108551120	Cellular CDMA	Ret	0.416
1851.25	25	98AV0108551120	PCS CDMA	Ext	0.401
1851.25	25	98AV0108551120	PCS CDMA	Ret	0.556
1880	600	98AV0108551120	PCS CDMA	Ext	0.321
1880	600	98AV0108551120	PCS CDMA	Ret	0.575
1908.75	1175	98AV0108551120	PCS CDMA	Ext	0.276
1908.75	1175	98AV0108551120	PCS CDMA	Ret	0.482

For the FCC ID: OVFQCP-3035 tested with a 23.50 mm closest separation (without a belt clip in place), the highest body-worn SAR is 0.575 mW/g.

11 SAR PLOTS

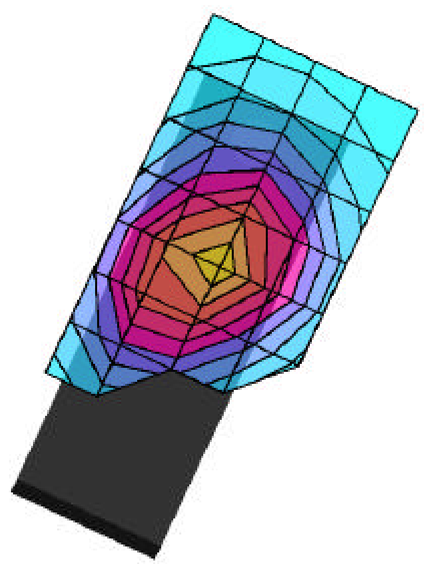
7GP P5K8C #1120, FM Ch991, FCC compliance, conducted power=25.5dBm (Hdet=634), Head level.

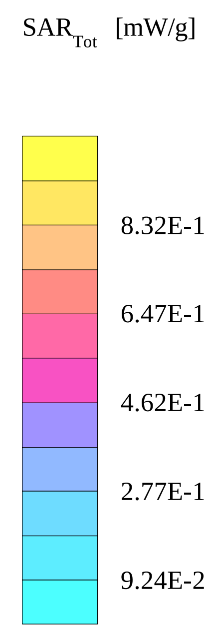
SAR (1g): 1.24 [mW/g] ± 0.12 dB, SAR (10g): 0.894 [mW/g] ± 0.11 dB
Cubes (2) (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.70,5.70,5.70)
Brain 900 MHz: σ = 0.87 [mho/m] ε_r = 42.6 ρ = 1.00 [g/cm^3]
File Name: 7GP #1120, FM Ch991, 06-27-01.DA3
Operator: DL



7GP P5K8C #1120, FM Ch991, FCC compliance, conducted power=25.5dBm (Hdet=634), Head level.

SAR (1g): 0.861 [mW/g] ± 0.05 dB, SAR (10g): 0.612 [mW/g] ± 0.04 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: σ = 0.87 [mho/m] ε_r = 42.6 ρ = 1.00 [g/cm^3]
File Name: 7GP #1120, FM Ch991, 06-27-01.DA3
Operator: DL

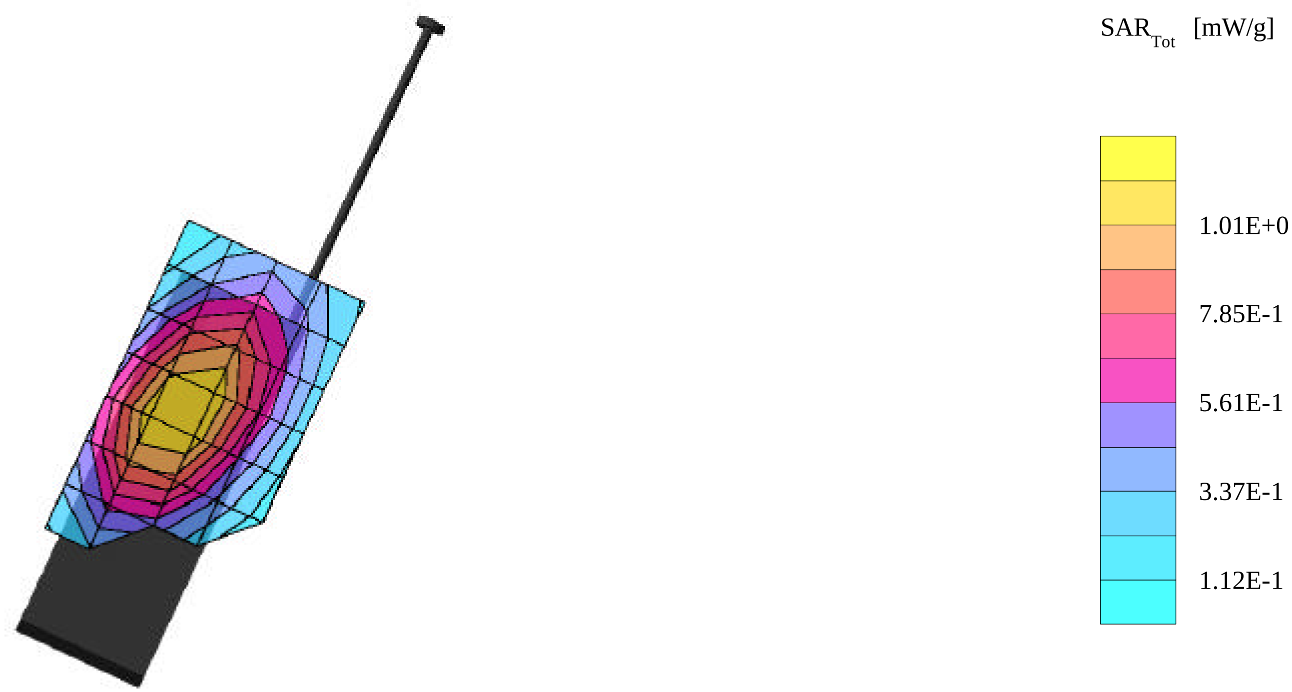




06/27/01

7GP P5K8C #1120, FM Ch383, FCC compliance, conducted power=25.5dBm (Hdet=601), Head level.

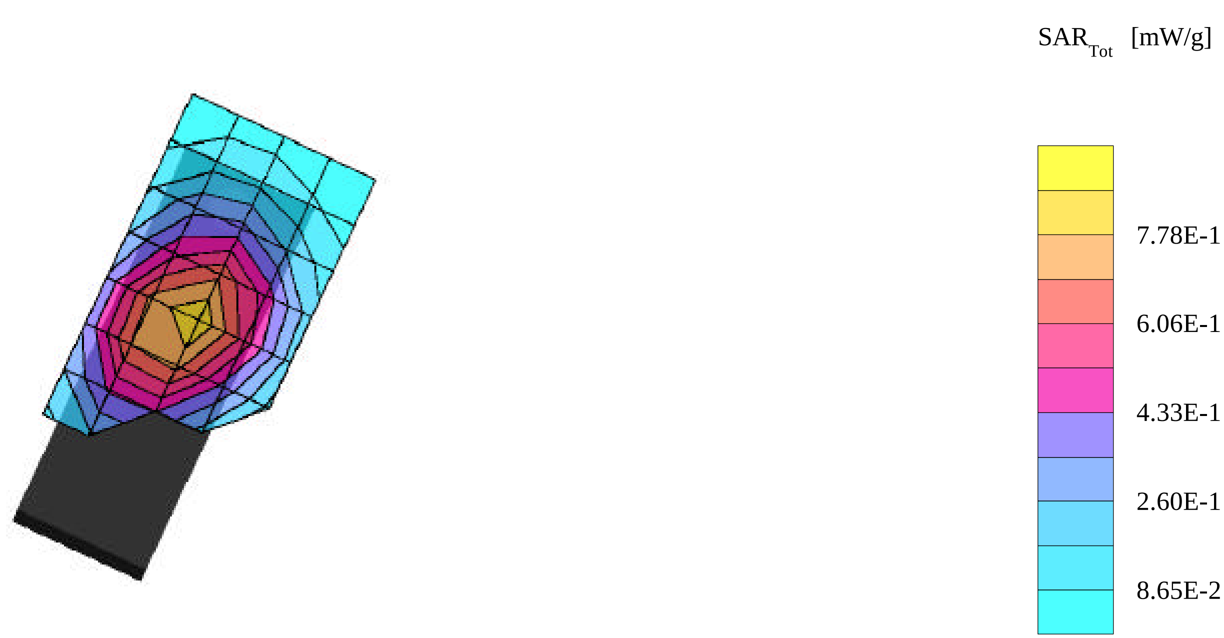
SAR (1g): 1.15 [mW/g] ± 0.10 dB, SAR (10g): 0.831 [mW/g] ± 0.11 dB
Cubes (2) (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Generic Twin Phantom; Left Hand Section
Probe: ET3DV5 - SN1353; ConvF(5.70,5.70,5.70)
Brain 900 MHz: σ = 0.87 [mho/m] ε_r = 42.6 ρ = 1.00 [g/cm^3]
File Name: 7GP #1120, FM Ch383, 06-27-01.DA3
Operator: DL



<ENTER HERE YOUR COMPANY NAME>

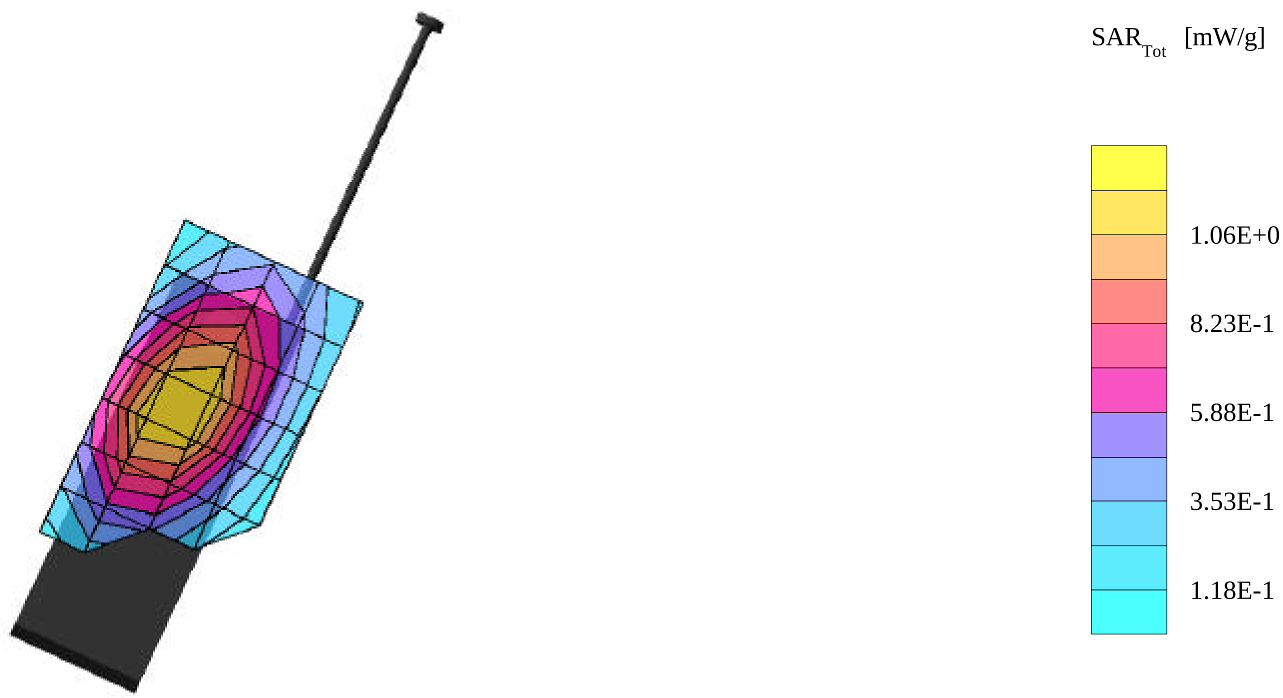
7GP P5K8C #1120, FM Ch383, FCC compliance, conducted power=25.5dBm (Hdet=601), Head level.

SAR (1g): 0.844 [mW/g] ± 0.01 dB, SAR (10g): 0.596 [mW/g] ± 0.03 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: σ = 0.87 [mho/m] ε_r = 42.6 ρ = 1.00 [g/cm^3]
File Name: 7GP #1120, FM Ch383, 06-27-01.DA3
Operator: DL



7GP P5K8C #1120, FM Ch799, FCC compliance, conducted power=25.5dBm (Hdet=596), Head level.

SAR (1g): 1.22 [mW/g] ± 0.09 dB, SAR (10g): 0.874 [mW/g] ± 0.08 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: σ = 0.87 [mho/m] ε_r = 42.6 ρ = 1.00 [g/cm^3]
File Name: 7GP #1120, FM Ch799, 06-27-01.DA3
Operator: DL



7GP P5K8C #1120, FM Ch799, FCC compliance, conducted power=25.5dBm (Hdet=596), Head level.

SAR (1g): 0.895 [mW/g] ± 0.07 dB, SAR (10g): 0.631 [mW/g] ± 0.06 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] $\varepsilon_r = 42.6$ $\rho = 1.00$ [g/cm³]
File Name: 7GP #1120, FM Ch799, 06-27-01.DA3
Operator: DL