Kyocera Wireless Corp.
KWC 7135

Reconfirmation of compliance

SPECIFIC ABSORPTION RATE (SAR)

CONTENT

1 PURPOSE

This test report re-confirms compliance of the Kyocera Wireless Corp. (KWC) model 7135 Specific Absorbtion Rate. The phone utilizes a new antenna helix to improve receiver paging coverage. All normal antenna operating conditions were tested and the SAR test setup remained the same as the previous setup.

The testing was performed in March 2003 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:	*KWC-7135*
Tx Frequency :	*824.04 – 848.97 and 1851.25 – 1908.75 MHz*
Modulation:	*CDMA and Analog*
Antenna:	*Retracting whip w/ helix*
FCC Classification:	*Non-Broadcast Transmitter Held to Ear*
Application Type:	*Certification*
Serial Number :	*3G-X-00Z659*
FCC ID:	*OVFKWC-7135*
Place of Test:	*KWC, 10300 Campus Point Drive, Lab AA-136, San Diego, CA, USA*
Date of Test:	*March 2003*
FCC Rule Part:	*47 CFR 2.1093; OET Bulletin 65, Sup. C; 47 CFR 22; 47 CFR 24*

Testing has been carried out in accordance with:

IEEE P1528-200X Draft 6.4

2 SAR TEST RESULT SUMMARY

This device has been tested for localized 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 IEEE P1528-200X Draft 6.4. 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 localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE std. C95.1-1992

2.1 Maximum Results Found during SAR Evaluation

The equipment is deemed to fulfil the requirements if the measured values are less than or equal to the limit.

2.1.1 Head Configuration

Mode/Ch/f(MHz)	Conducted Power	Antenna Position	Device Position	Limit (mW/g)	Measured (mW/g)	Result
FM/799/848.97	26.04 dBm	Retracted	Right Cheek	1.6	0.98	PASSED

Mode/Ch/f(MHz)	Conducted Power	Antenna Position	Device Position	Limit (mW/g)	Measured (mW/g)	Result
PCS/600/1880	23.55 dBm	Retracted	Right Cheek	1.6	1.01	PASSED

2.1.2 Body Worn Configuration (with KWC body worn accessories)

Mode/Ch/f(MHz)	Conducted Power	Antenna Position	Device Position	Limit (mW/g)	Measured (mW/g)	Result
FM/799/848.97	26.02 dBm	Retracted	Waist level	1.6	0.49	PASSED

2.1.3 Measurement Uncertainty

Combined Uncertainty (Assessment & Source)	**$\pm$ 10.32 %**
Extended Uncertainty (k=2)	**$\pm$ 20.6 %**

3 DESCRIPTION OF TESTED DEVICE

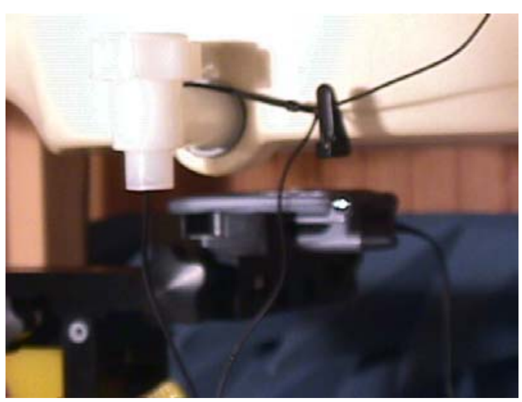
The test sample consisted of a KWC 7135. This model will operate in CDMA PCS, CDMA and analog cellular mode. The CDMA PCS mode is designed to transmit in the 1851.25 – 1908.75 MHz band. The cellular FM AMPS mode is designed to transmit in the 824.04 – 848.97 MHz. The cellular CDMA mode is designed to transmit in the 824.04 – 848.97 MHz band.

The KWC-7135 is a tri-mode and dual band cellular/PCS phone. The antenna is a telescoping retracting whip antenna tuned for dual frequency, with a helix antenna that is at the top of the whip which gets activated when the whip is retracted. See pictures below. Since either position is possible during use, both retracted and extended were tested, at the low, mid, and high frequencies of each band.

There is only one battery option available to operate KWC-7155. All measurements were done with production batteries.

The KWC-7135 has provision for headset to allow hands-free operation. The following body worn accessories are available for KWC-7135. SAR measurements for hands-free operating condition were done at the low, mid, and high frequencies of each band.

The SAR levels were also tested with 22.5mm air space in all modes for the hands-free application with other body-worn holster that contains no metal and provides at least 22.5mm separation from the closest point of the handset (antenna side of phone away from body) to the body.



22.5mm

4 TEST CONDITIONS

4.1 Ambient Conditions

All tests were performed under the following environmental conditions:

Ambient Temperature:	22 ± 1 Degrees C
Tissue simulating liquid temperature:	22 ± 1 Degrees C
Humidity:	33 to 40 %
Pressure:	1015 mB

4.2 RF characteristics of the test site

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 2 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.

4.3 Test Signal, Frequencies and Output Power

The device was controlled by using Kyocera Wireless Phone Support Toolkit, Test Code Controller.

In all operating bands, the measurements were performed on low, mid and high channels.

The phone was set to nominal maximum power level during all tests and at the beginning of the each test the battery was fully charged. Radiated power output was measured in KWC antenna range, fully an-echoic chamber from the same unit that was used in SAR testing.

DASY3 system measures power drift during SAR testing by comparing E-field in the same location at the beginning and at the end of measurement. These records were used to monitor stability of power output.

5 DESCRIPTION OF THE TEST EQUIPMENT

The measurements were performed with an automated near-field scanning system, DASY3, manufactured by Schmid & Partner Engineering AG (SPEAG) of Zurich, Switzerland.

Test Equipment	Serial Number	Due date
DASY3 DAE3 Version 1	322	08-27-03
E-field Probe ET3DV6	1712	09-06-03
Dipole Validation kit, D835V2	454	02-11-04
Dipole Validation kit, D1900V2	5D003	02-20-04

The calibration records of E-field probe are attached in Appendix C.

Additional equipment needed in validation

Test Equipment	Due date
Signal Generator, HP E4421B	04-12-03
Power meter, Giga-tronics 8541C	08-10-03
Power Sensor, Giga-tronics	01-16-04
Network Analyzer, HP 8753C	09-30-03
HP 85070B Dielectric Probe	--
Thermometer	--

5.1 System Validation

The probes are calibrated annually by the manufacturer. Dielectric parameters of the stimulating liquids are measured with an automated Hewlett Packard 85070B dielectric probe in conjunction with an HP 8753C network analyzer.

The SAR measurements of the device were done within 24 hours of system accuracy verification, which was done using the dipole validation kit. Power level of 20dBm was supplied to a dipole antenna placed under the flat section of SAM phantom. The validation results are in the table below and printouts of the validation test are attached in Appendix A. All the measured parameters were within the specification.
Note since the validation reference in muscle liquid is not available, the system validation with head tissues was done for the device testing in muscle. Based on OET 65 Supplement C EAB Part 22/24 SAR review Reminder Sheet 01/2002, this is a valid test.

Tissue	F (MHz)	Description	Validation SAR (mW/g), 1g	Dielectric Parameters		Temp (^{o}C)	Test date	Comments Validation testing -
				εr	σ (S/m)			
Head	**835**	Measured	1.03	41.9	0.86	22	02-24-03	for device testing in head liquid
		Measured	1.04	41.5	0.86	22	02-25-03	for continuing testing in head liquid
		SPEAG Reference	*1.04*	*41.9*	*0.89*	--	*02-11-02*	
		FCC Reference	--	***41.5***	***0.90***	*20-26*	--	
Head	**1900**	Measured	4.53	39.9	1.39	22	02-26-03	for device testing in head liquid
		SPEAG Reference	*4.56*	*39.1*	*1.47*	--	*02-20-02*	
		FCC Reference	--	***40.0***	***1.40***	*20-26*	--	
Muscle	**835**	Measured	--	54.9	0.90	22	02-27-03	for device testing in muscle
		FCC Reference	--	***55.2***	***0.97***	*20-26*	--	
Muscle	**1900**	Measured	--	53.5	1.50	22	02-26-03	for device testing in muscle
		FCC Reference	--	***53.3***	***1.52***	*20-26*	--	

FCC reference values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).

5.2 Tissue Stimulants

All dielectric parameters of tissue stimulants were measured within 24 hours of SAR measurements. The depth of the tissue stimulant in the ear reference point and flat reference point of the phantom were at least 15cm during all the tests.

5.2.1 Head Tissue Stimulant

The composition of the head tissue simulating liquid for 835MHz is

51.07%	Water
0.23%	Cellulose
47.31%	Sugar
0.24%	Preventol
1.15%	Salt

and for 1900MHz is

54%	Water
44.91%	Glycol monobutyl
0.21%	Salt

The ingredients above are adopted from Application Note: Recipes for Head Tissue Simulating Liquid by SPEAG.

5.2.2 Muscle Tissue Stimulant

The composition of the muscle tissue simulating liquid for 835MHz is

65.45%	Water
34.31%	Sugar
0.1%	Preventol
0.62%	Salt

and for 1900MHz is

69.91%	Water
29.96%	Glycol monobutyl
0.13%	Salt

The ingredients above are adopted from Application Note: Recipes for Muscle Tissue Simulating Liquid by SPEAG.

5.3 Phantoms

SAM v4.0 phantom, manufactured by SPEAG, was used during the measurement. It has fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by IEEE SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. Reference markings on the phantom allow the complete set-up of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

The thickness of phantom shell is 2mm except for the ear, where an integrated ear spacer provides a 6mm spacing from the tissue boundary. Manufacturer reports tolerance in shell thickness to be ± **0.1mm.**

5.4 Isotropic E-Field Probe ET3DV6

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycol)
Calibration	Calibration certificate in Appendix C
Frequency	10MHz to 3GHz (dosimetry); Linearity: ± 0.2dB (30MHz to 3GHz)
Optical Surface	± 0.2mm repeatability in air and clear liquid over diffuse reflecting
Detection	surface
Directivity	± 0.2dB in HSL (rotation around probe axis) ± 0.4dB in HSL (rotation normal to probe axis)
Dynamic Range	5 uW/g to > 100 mW/g; Linearity: ± 0.2dB
Dimensions	Overall length: 330mm Tip length: 16mm Body diameter: 12mm Tip diameter: 6.8mm Distance from probe tip to dipole centers: 2.7mm

Application	General dosimetry up to 3GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms.

6 DESCRIPTION OF THE TEST PROCEDURE

6.1 Test Positions

The device was placed in the holder so that the ear reference point of the phone, aligns with the ear reference of the SAM phantom. See picture.

Device holder was provided by SPEAG together with DASY3.

6.1.1 Against Phantom Head

Measurements were made on both left hand side and right hand side of the phantom.

The device was position against phantom according to OET Bulletin 65 (97-01) Supplement C (01-01). Definitions of terms used in aligning the device to a head phantom are available in IEEE Draft Standard P1528-2001 “Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”

6.1.1.1 Initial Ear Position

The device was initially positioned with the earpiece region pressed against the ear spacer of a head phantom parallel to the “Neck-Front” line defined along the base of the ear spacer that contains the “ear reference point”. The “test device reference point” is aligned to the “ear reference point” on the head phantom and the “vertical centerline” is aligned to the “phantom reference plane”. With the phone in this initial position, the measurement system was not able to capture the peak SAR location in several test modes. The system software from SPEAG that will enable the measurement probe to tilt is currently not available. In order to measure the peak SAR, the phone was positioned 0.5 inches pass the initial ear position described above. This was a worst case position and the different tests modes in which it was used are described in the test results. Additional tests were performed to show the SAR results in the normal position (initial ear position described above) and the 0.5 inch modified position. The normal initial ear position and the 0.5 inch modified ear position are shown below.

Normal Initial Ear Position

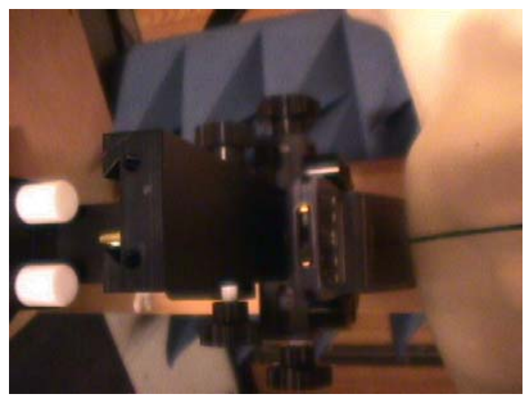
Modified 0.5 Inch Initial Ear Position

6.1.1.2 Cheek Position

"Initial ear position" alignments are maintained and the device is brought toward the mouth of the head phantom by pivoting along the "Neck-Front" line until any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom or when any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

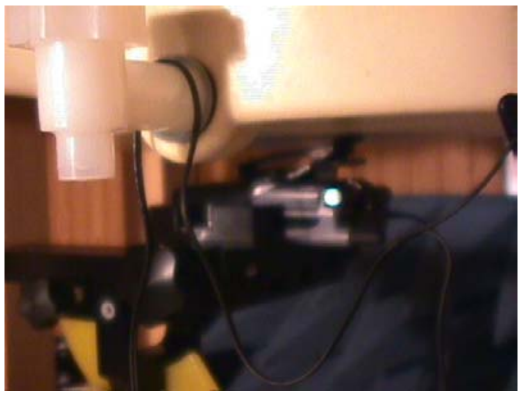
6.1.1.3 Tilt Position

In the "cheek position", if the earpiece of the device is not in full contact with the phantom's ear spacer and the peak SAR location for the "cheek position" is located at the ear spacer region or corresponds to the earpiece region of the handset, the device is returned to the "initial ear position" by rotating it away from the mouth until the earpiece is in full contact with the ear spacer. Otherwise, the device is moved away from the cheek perpendicular to the line passes through both "ear reference points" for approximate 2-3cm. While it is in this position, the device is tilted away from the mouth with respect to the "test device reference point" by 15^o. After the tilt, it is then moved back toward the head perpendicular to the line passes through both "ear reference point" until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process is repeated with a tilt angle less than 15^o so that the device and its antenna would touch the phantom simultaneously.



6.1.2 Body Worn Configuration

KWC body worn accessories were tested for the FCC RF exposure compliance. The phone was positioned into the holester and placed below the flat phantom. Headset was connected during measurements.



The SAR levels were also measured with 22.5mm air space for the hands-free application, which allow user can use other body-worn holster that contains no metal and provides at least 22.5mm separation from the closest point of the handset to the body. The handset needs to be in the clamshell shut and antenna oriented away from the body position.

6.2 Scan Procedures

First coarse scans are used for quick determination of the field distribution. Next a cube scan, 7x7x7 points; spacing between each point 5x5x5mm, is performed around the highest E-field value to determine the averaged SAR-distribution over 1g.

6.3 SAR Averaging Methods

The maximum SAR value is average over its volume using interpolation and extrapolation.

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the “Not a knot” –condition [W. Gander, Computermathematik, p. 141-150] (x, y and z – directions) [numerical Recipes in C, Second Edition, p 123].

The extrapolation is based on least square algorithm [W. Gander, Computermathematik, p. 168-180]. Through the points in the first 30mm in all z-axis, polynomials of order four are calculated. This polynomial is then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1mm from one another.

7 MEASUREMENT UNCERTAINTY

Description of individual measurement uncertainty

Uncert. description	**Uncert. Value %**	**Probability distribution**	**Divisor**	**C_i^1 1g**	**Stand. Uncert (1g) %**	**V_i^2 or V_{eff}**
Measurement system						
Probe calibration	± 4.4	normal	1	1	± 4.4	∞
Axial isotropy of the probe	± 4.7	rectangular	√3	$(1-C_p)^{1/2}$	± 1.9	∞
Sph. Isotropy of the probe	± 9.6	rectangular	√3	$(C_p)^{1/2}$	± 3.9	∞
Spatial resolution	± 0.0	rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	normal	1	1	± 1.0	∞
Response time	± 0.8	rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	rectangular	√3	1	± 1.7	∞
Mech. Constrains of robot	± 0.4	rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	rectangular	√3	1	± 1.7	∞
Extrap. and integration	± 3.9	rectangular	√3	1	± 2.3	∞
Test Sample Related						
Device positioning	± 3.0	normal	√3	1	± 1.7	∞
Power drift	± 5.0	normal	√3	1	± 2.9	∞
Phantom and setup						
Phantom uncertainty	± 4.0	rectangular	1	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (meas.)	± 10.0	rectangular	√3	0.6	± 3.5	∞
Liquid permittivity (target)	± 5.0	rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (meas.)	± 5.0	rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					± 10.32	
Extended Standard Uncertainty (k=2)					± 20.6	

8 TEST DATA

For each mode, corresponding SAR distribution printouts of maximum results in every device position (Cheek or Tilt), every antenna position (Extended or Retracted) are shown in Appendix B. Included in the test results for the following modes: Left Cheek FM, Right Cheek FM, Left Cheek CDMA 800, Right Cheek CDMA 800, Left Cheek CDMA PCS are the SAR plots for both the normal initial ear position and the 0.5 inch modified initial ear position. For these modes the data in the tables below are for the 0.5 inch modified initial ear position because that is the position in which the peak SAR was able to be measured. For the Right Cheek CDMA PCS mode, the peak SAR was captured with the phone in the normal initial ear position.

8.1 Head SAR Test Results

The Appendix B includes the SAR distribution plots for all data shown in the following tables.

Left Head SAR

Mode	Channel # / Frequency (MHz)	Conducted Power (dBm)	SAR, Average over 1g (mW/g)			
			Cheek Position		Tilted Position	
			Antenna Retracted	Antenna Extended	Antenna Retracted	Antenna Extended
FM 835	991/824.04	26.20	.798	.533	.355	.250
	383/836.49	26.05	.538	.521	.260	.242
	799/848.97	26.10	.776	.642	.392	.336
Cellular CDMA 835	1013/824.70	25.09	.610	.401	.275	.183
	383/836.49	25.18	.453	.381	.212	.183
	777/848.31	25.30	.672	.653	.317	.297
PCS CDMA 1900	25/1851.25	23.73	.487	.370	.079	.089
	600/1880	23.54	.544	.420	.083	.099
	1175/1908.75	23.72	.538	.391	.077	.101

Right Head SAR

Mode	Channel # / Frequency (MHz)	Conducted Power (dBm)	SAR, Average over 1g (mW/g)			
			Cheek Position		Tilted Position	
			Antenna Retracted	Antenna Extended	Antenna Retracted	Antenna Extended
FM 835	991/824.04	26.08	.924	.680	.402	.273
	383/836.49	26.02	.724	.608	.307	.246
	799/848.97	26.04	.983	.707	.386	.300
Cellular CDMA 835	1013/824.70	25.11	.904	.513	.306	.203
	383/836.49	25.25	.624	.459	.242	.199
	777/848.31	25.12	.851	.675	.313	.253
PCS CDMA 1900	25/1851.25	23.64	.886	.702	.051	.080
	600/1880	23.55	1.01	.772	.055	.088
	1175/1908.75	23.68	.983	.782	.049	.094

The highest measured SAR (at head) in the cellular band is 0.983mW/g. The highest measured SAR (at head) in PCS band is 1.01 mW/g.

8.2 Body Worn SAR Test Result

The Appendix B includes the SAR distribution plots for all data shown in the following tables.

Waist Level SAR with KWC Body Worn Accessories

Mode	Channel # / Frequency (MHz)	Conducted Power Before Test (dBm)	SAR, Average over 1g (mW/g)	
			Antenna Retracted	Antenna Extended
FM 835	991/824.04	26.09	.424	.322
	383/836.49	25.97	.356	.331
	799/848.97	26.02	.490	.431
Cellular CDMA 835	1013/824.70	25.05	.349	.251
	383/836.49	25.09	.277	.262
	777/848.31	25.31	.430	.376
PCS CDMA 1900	25/1851.25	23.52	.184	.183
	600/1880	23.75	.174	.144
	1175/1908.75	23.68	.142	.129

Waist Level SAR with 22.5mm Air Separation

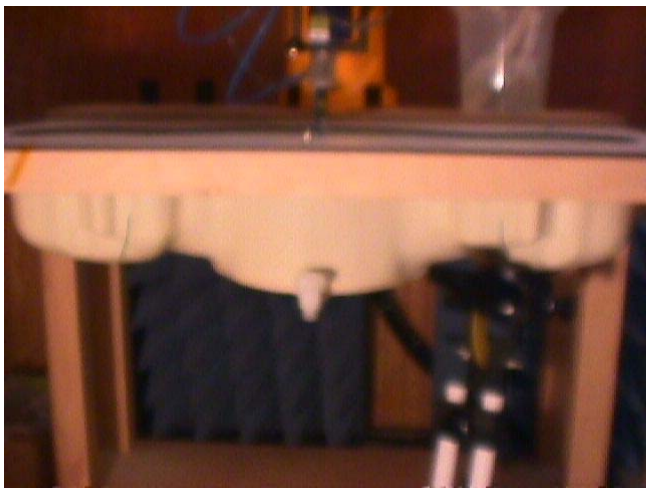
Mode	Channel # / Frequency (MHz)	Conducted Power Before Test (dBm)	SAR, Average over 1g (mW/g)	
			Antenna Retracted	Antenna Extended
FM 835	991/824.04	26.1	.379	.282
	383/836.49	25.9	.291	.270
	799/848.97	26.0	.434	.356
Cellular CDMA 835	1013/824.70	25.0	.295	.210
	383/836.49	25.0	.230	.212
	777/848.31	25.3	.356	.313
PCS CDMA 1900	25/1851.25	23.9	.105	.138
	600/1880	23.8	.110	.142
	1175/1908.75	23.6	.095	.137

With KWC body worn accessories, the highest measured SAR in the cellular band is 0.490mW/g, in PCS band is 0.184 mW/g.

9 TEST SYSTEM PHOTOS

DASY 3 System

SAM Phantom

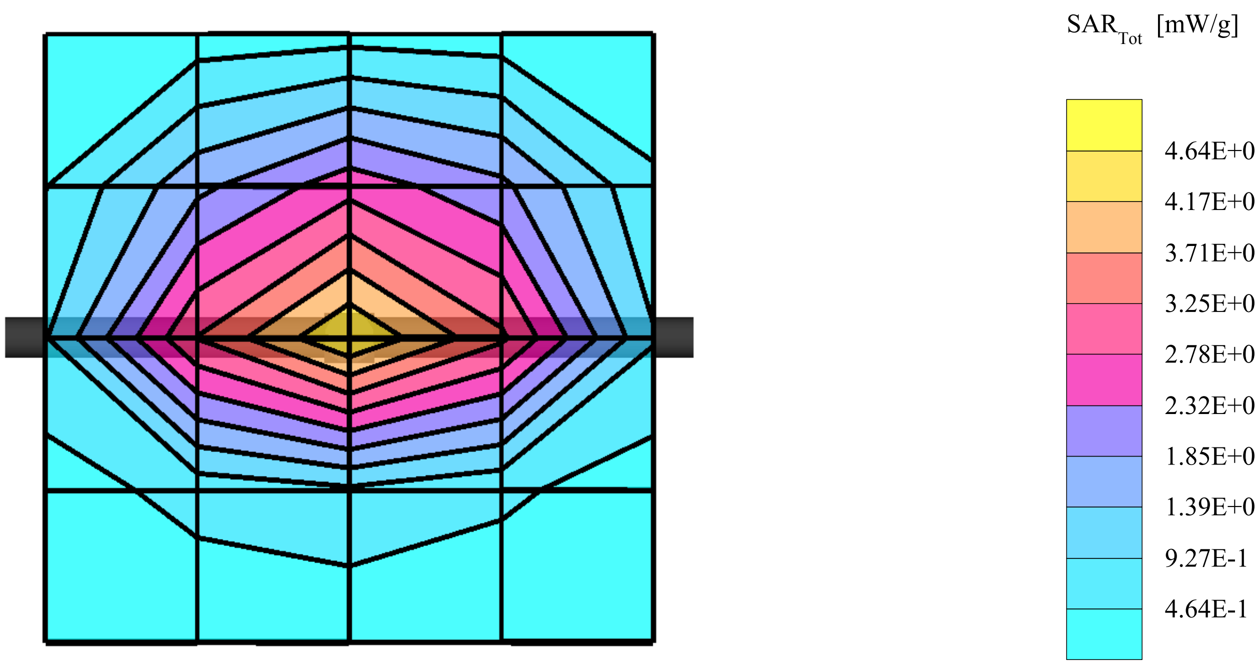


APPENDIX A: VALIDATION TEST PRINTOUT

Dipole 1900MHz

Dipole validation:

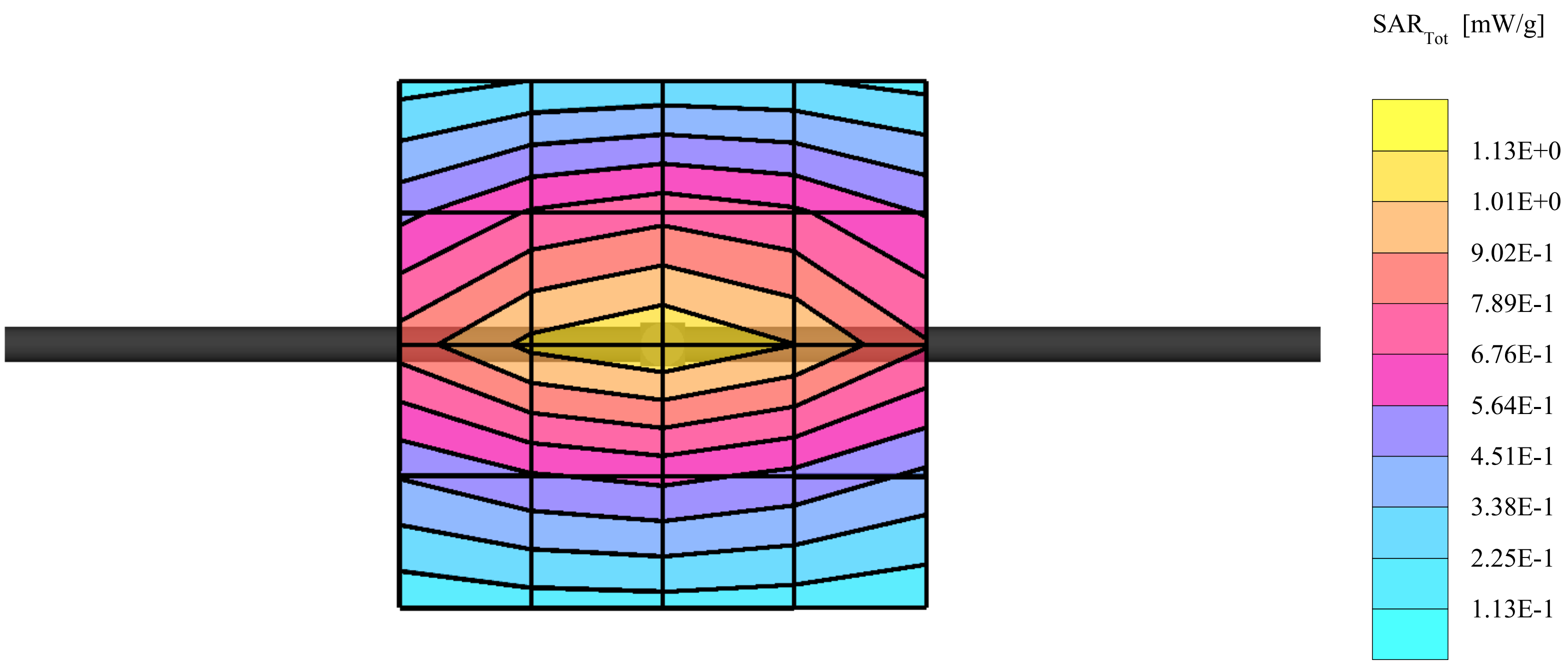
for f < 1 GHz, distance to the liquid d = 10 mm
for f > 1 GHz, distance to the liquid d=15 mm
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz
Probe: ET3DV6 - SN1712; ConvF(5.40,5.40,5.40); Crest factor: 1.0; 1900 MHz Brain: σ = 1.39 mho/m ε_r = 39.9 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 4.53 mW/g ± 0.02 dB, SAR (10g): 2.31 mW/g ± 0.00 dB, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.00 dB



Dipole 835MHz

Dipole validation:

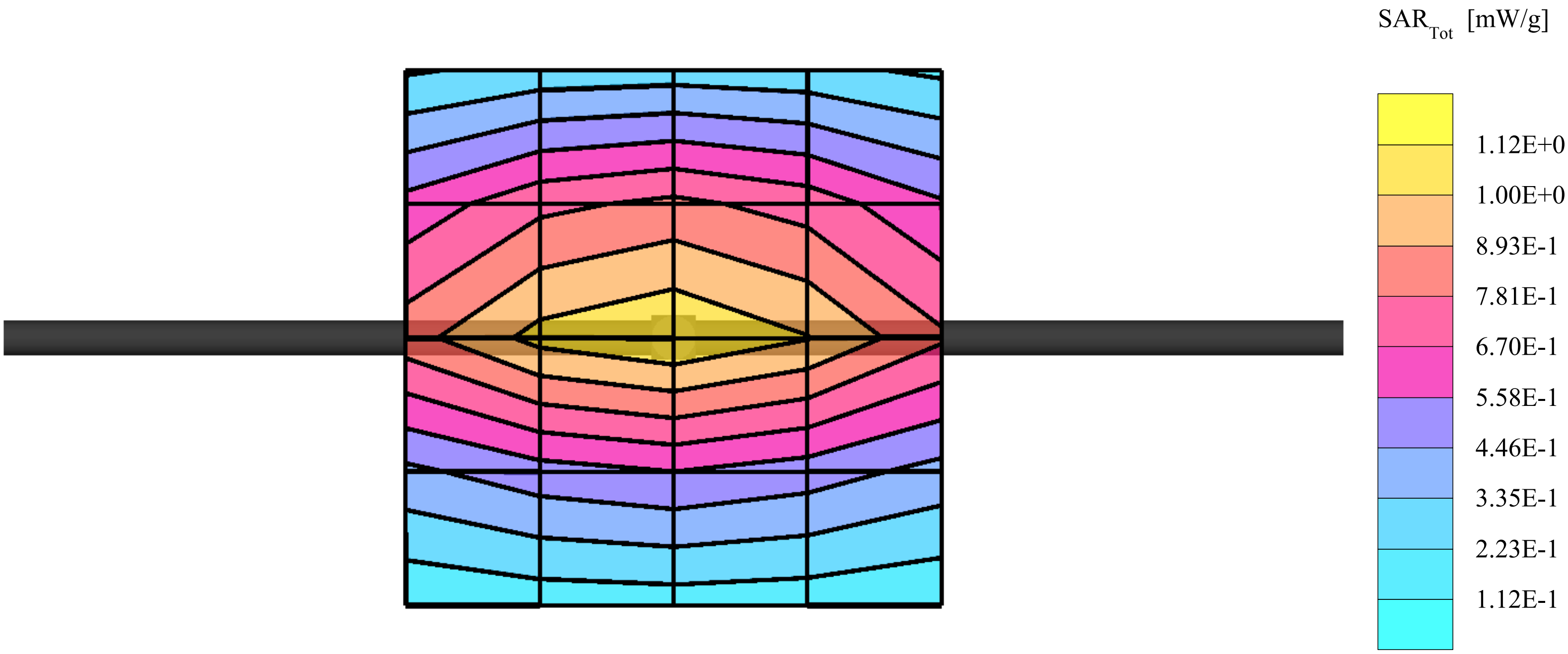
for f < 1 GHz, distance to the liquid d = 10 mm
for f > 1 GHz, distance to the liquid d=15 mm
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 835 MHz
Probe: ET3DV6 - SN1712; ConvF(6.50,6.50,6.50); Crest factor: 1.0; 835 MHz Brain: σ = 0.86 mho/m ε_r = 41.9 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 1.03 mW/g ± 0.02 dB, SAR (10g): 0.659 mW/g ± 0.02 dB, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.00 dB



Dipole 835MHz

Dipole validation:

for f < 1 GHz, distance to the liquid d = 10 mm
for f > 1 GHz, distance to the liquid d=15 mm
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 835 MHz
Probe: ET3DV6 - SN1712; ConvF(6.50,6.50,6.50); Crest factor: 1.0; 835 MHz Brain: σ = 0.86 mho/m ε_r = 41.5 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 1.04 mW/g ± 0.00 dB, SAR (10g): 0.660 mW/g ± 0.01 dB, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.23 dB



Schmid & Partner
Engineering AG

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

Calibration Certificate

1900 MHz System Validation Dipole

Type:	**D1900V2**
Serial Number:	**5d003**
Place of Calibration:	**Zurich**
Date of Calibration:	**February 20, 2002**
Calibration Interval:	**24 months**

asset #
039924

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:	Veltenli Nico
Approved by:	[signature]

Schmid & Partner
Engineering AG

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

DASY3

Dipole Validation Kit

Type: D1900V2

Serial: 5d003

Manufactured: February 14, 2002
Calibrated: February 20, 2002

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with brain simulating sugar solution of the following electrical parameters at 1900 MHz:

Relative permitivity	**39.1**	± 5%
Conductivity	**1.47 mho/m**	± 10%

The DASY3 System (Software version 3.1d) with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 5.3) was used for the measurements.

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

The coarse grid with a grid spacing of 20mm 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 normalized 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 normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**45.6 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**23.0 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 analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.185 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 1900 MHz:	Re{Z} = **51.2 Ω**
	Im {Z} = **0.9 Ω**
Return Loss at 1900 MHz	**- 36.7 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

Small end caps have been added to the dipole arms in order to improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

5. Design

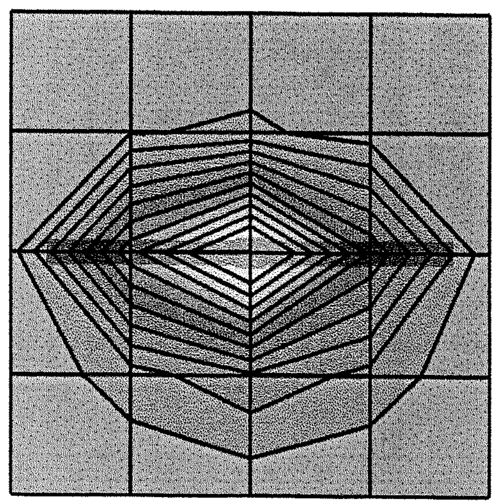
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

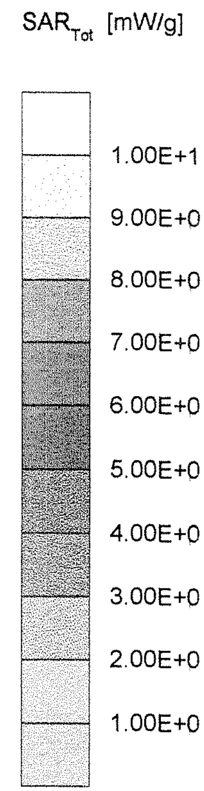
6. Power Test

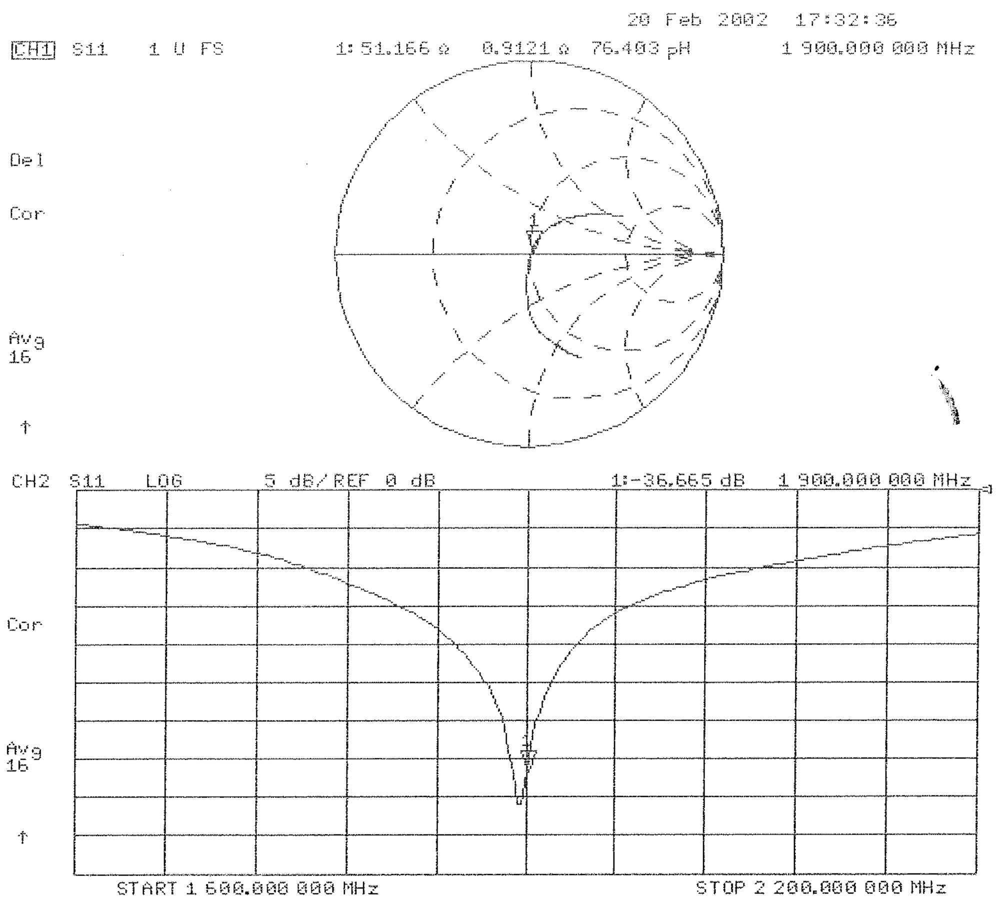
After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Validation Dipole D1900V2 SN:5d003, d = 10 mm

Frequency: 1900 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.30,5.30,5.30) at 1800 MHz; IEEE1528 1900 MHz ; σ = 1.47 mho/m ε_r = 39.1 ρ = 1.00 g/cm^3
Cubes (2): Peak: 22.0 mW/g ± 0.06 dB, SAR (1g): 11.4 mW/g ± 0.01 dB, SAR (10g): 5.76 mW/g ± 0.03 dB, (Worst-case extrapolation)
Penetration depth: 7.9 (7.5, 8.8) [mm]
Powerdrift: -0.04 dB



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Cor
Avg
16
START 1 600.000 000 MHz
STOP 2 200.000 000 MHz

Schmid & Partner Engineering AG

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Calibration Certificate

835 MHz System Validation Dipole

Type:	**D835V2**
Serial Number:	**454**
Place of Calibration:	**Zurich**
Date of Calibration:	**February 11, 2002**
Calibration Interval:	**24 months**

asset # 039925

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:

Schmid & Partner
Engineering AG

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DASY

Dipole Validation Kit

Type: D835V2

Serial: 454

Manufactured: January 31, 2002
Calibrated: February 11, 2002

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating solution of the following electrical parameters at 835 MHz:

Relative Dielectricity	**41.9**	± 5%
Conductivity	**0.89 mho/m**	± 5%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.5 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center 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 center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 20mm 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 normalized 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 normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**10.4 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**6.64 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.

3. Dipole Impedance and Return Loss

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

Electrical delay:	**1.379 ns**	(one direction)
Transmission factor:	**0.989**	(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 835 MHz:	Re{Z} = **50.0 Ω**
	Im {Z} = **-3.4 Ω**
Return Loss at 835 MHz	**-29.5 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

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

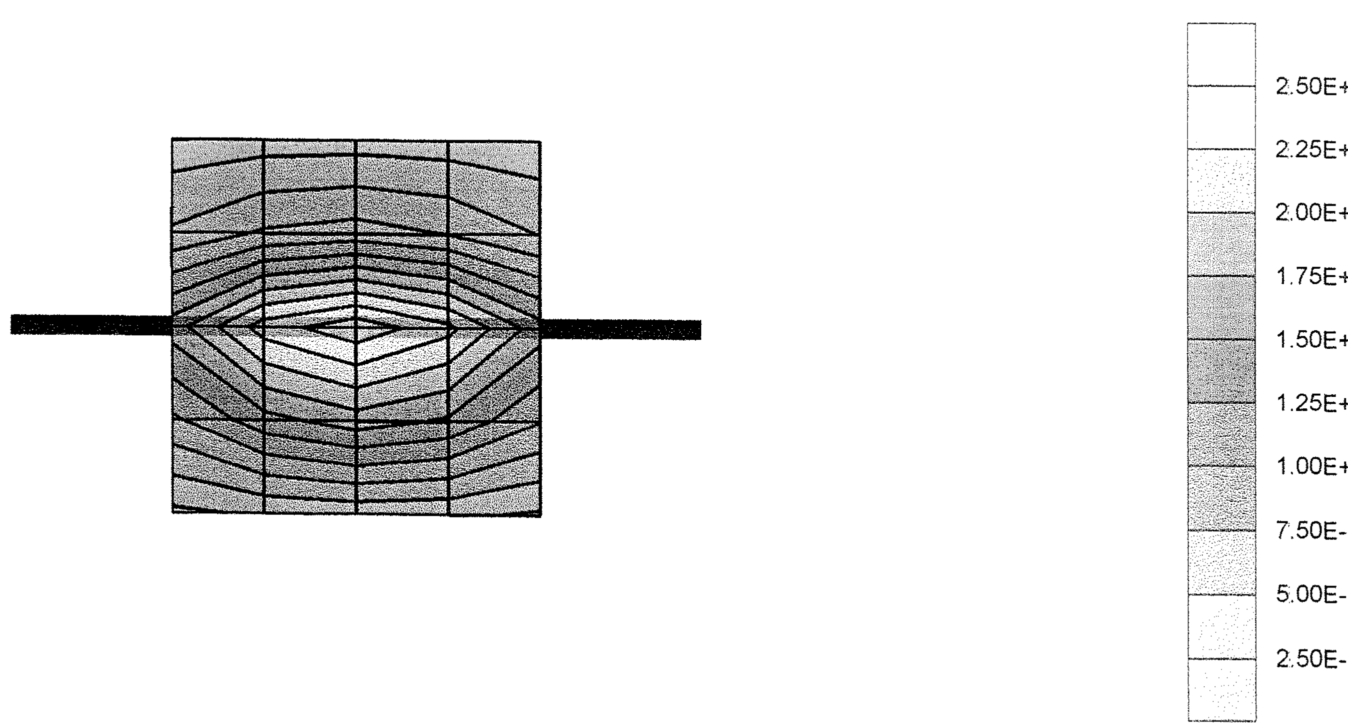
6. Power Test

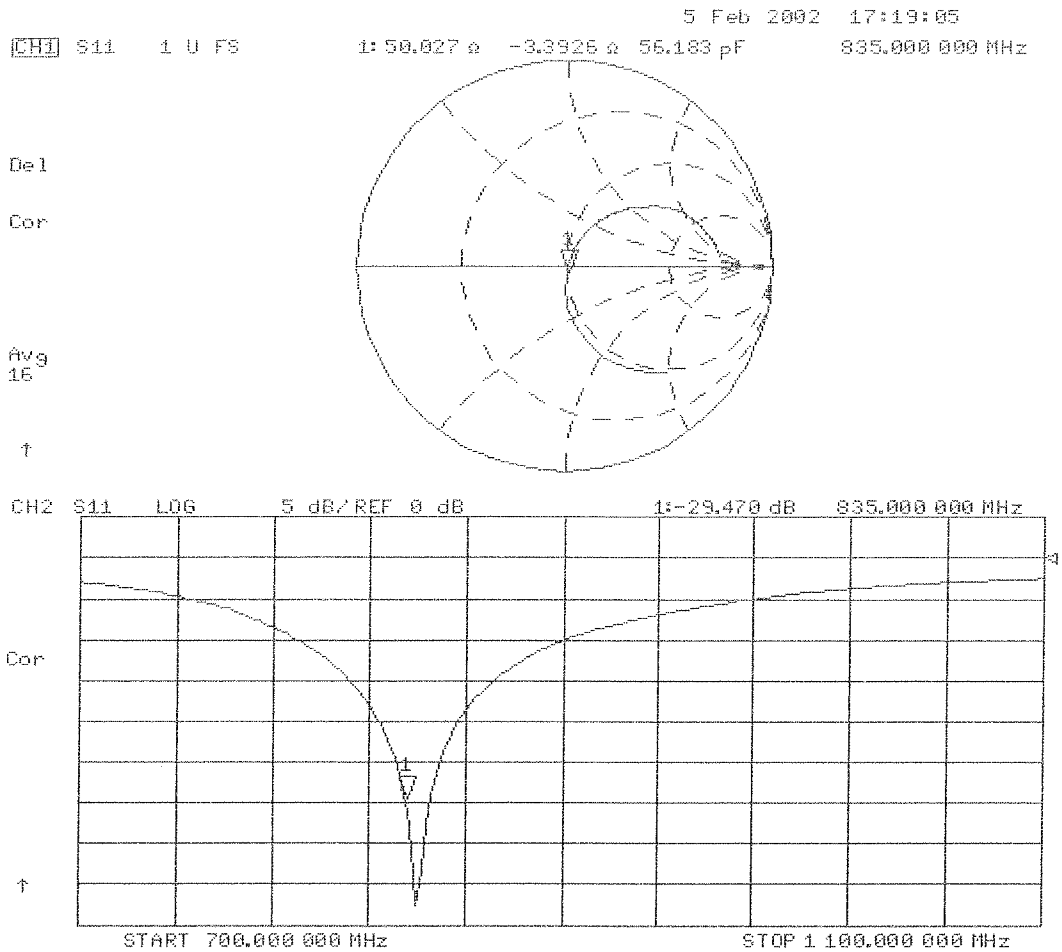
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

02/11/02

Validation Dipole D835V2 SN:454, d = 15 mm

Frequency: 835 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(6.50,6.50,6.50) at 900 MHz; IEEE1528 835 MHz; σ = 0.89 mho/m ε_r = 41.9 ρ = 1.00 g/cm^3
Cubes (2): Peak: 4.14 mW/g ± 0.03 dB, SAR (1g): 2.59 mW/g ± 0.00 dB, SAR (10g): 1.66 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 12.2 (10.8, 13.9) [mm]
Powerdrift: -0.03 dB

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