



KYOCERA WIRELESS CORP.
10300 CAMPUS POINT DRIVE
SAN DIEGO, CA 92121

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10300 Campus Point Drive
San Diego, CA 92121

858 882 2100

Oct. 21, 2002

Federal Communications Commission,
Authorization & Evaluation Division,
7435 Oakland Mills Road
Columbia, MD. 21046

We hereby certify that the that handset FCC ID: OVFKWC-3225 complies with
ANSI/IEEE C95.1-1992 Standard for Safety Level with Respect to Human
Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

Compliance was determined by testing appropriate parameters according to
standard.

Kyocera Wireless Corp.

A handwritten signature in black ink, appearing to read "Allen Tran".

Allen Tran

Director, Engineering

FCC/IC Notice

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

To maintain compliance with FCC RF exposure guidelines, if you wear a handset on your body, use the Kyocera Wireless Corp. (KWC) supplied and approved carrying case CA90-61068-01 and holster CE90-B1700-01).

Other accessories used with this device for body-worn operations must not contain any metallic components and must provide at least (TBD) _____ mm separation distance including the antenna and the user's body.

THIS MODEL PHONE MEETS THE GOVERNMENT'S REQUIREMENTS FOR EXPOSURE TO RADIO WAVES.

Your wireless phone is a radio transmitter and receiver. It is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the U.S. Government. These limits are part of comprehensive guidelines and establish permitted levels of RF energy for the general population. The guidelines are based on standards that were developed by independent scientific organizations through periodic and thorough evaluation of scientific studies. The standards include a substantial safety margin designed to assure the safety of all persons, regardless of age and health.

The exposure standard for wireless mobile phones employs a unit of measurement known as the Specific Absorption Rate, or SAR. The SAR limit set by the FCC is 1.6 W/kg.* Tests for SAR are conducted using standard operating positions specified by the FCC with the phone

transmitting at its highest certified power level in all tested frequency bands.

Although the SAR is determined at the highest certified power level, the actual SAR level of the phone while operating can be well below the maximum value. This is because the phone is designed to operate at multiple power levels so as to use only the power required to reach the network. In general, the closer you are to a wireless base station antenna, the lower the power output.

Before a phone model is available for sale to the public, it must be tested and certified to the FCC that it does not exceed the limit established by the government-adopted requirement for safe exposure. The tests are performed in positions and locations (e.g., at the ear and worn on the body) as required by the FCC for each model. The highest SAR values for this model phone are:

AMPS mode-head: 1.30 mW/g; Body-worn: 0.649 mW/g with KWC leather case CA90-61068-01.

PCS mode-head: 1.1 mW/g; Body-worn: 0.279 mW/g with KWC universal belt clip CE90-B1700-01.

(Body-worn measurements differ among phone models, depending upon availability of accessories and FCC requirements. The body-worn SAR values provided above were obtained by using Kyocera Wireless Corp. (KWC) supplied and approved carrying case CA90-61068-01 and holster CE90-B1700-01).

While there may be differences between the SAR levels of various phones and at various positions, they all meet the government requirement for safe exposure.

The FCC has granted an Equipment Authorization for this model phone with all reported SAR levels evaluated as in compliance with the FCC RF emission guidelines. SAR information on this model phone is on file with the FCC and can be found under the Display Grant section <http://www.fcc.gov/oet/fccid> after searching on FCC ID OVFKWC-3225. Additional information on SAR can be

found on the Cellular Telecommunications and Internet Association (CTIA) web-site at <http://www.wow-com.com>.

* In the United States and Canada, the SAR limit for mobile phones used by the public is 1.6 watts/kg (W/kg) averaged over one gram of tissue. The standard incorporates a substantial margin of safety to give additional protection for the public and to account for any variations in measurements.

Caution

The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the warranty and user's authority to operate the equipment.

Warning

Use only Kyocera approved accessories with Kyocera phones. Use of any unauthorized accessories (includes faceplates/front housings) may be dangerous and will invalidate the phone warranty if said accessories cause damage or a defect to the phone.

Optimize your phone's performance

Use the guidelines on page 2 to learn how to optimize the performance and life of your phone, antenna, and battery.

Air bags

If you have an air bag, DO NOT place installed or portable phone equipment or other objects over the air bag or in the air bag deployment area. If equipment is not properly installed, you and your passengers risk serious injury.

Potentially unsafe areas

Posted facilities—Turn your phone off in any facility when posted notices require you to do so.

Aircraft—FCC regulations prohibit using your phone on a plane that is in the air. Turn your phone off before boarding aircraft.

Vehicles—RF signals may affect improperly installed or inadequately shielded electronic systems in motor vehicles. Check with the manufacturer of the device to determine if it is adequately shielded from external RF energy. Your physician may be able to help you obtain this information.

Blasting areas—Turn off your phone where blasting is in progress. Observe restrictions, and follow any regulations or rules.

Potentially explosive atmospheres—Turn off your phone when you are in any area with a potentially explosive atmosphere. Obey all signs and instructions. Sparks in such areas could cause an explosion or fire, resulting in bodily injury or death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include:

- fueling areas such as gas stations
- below deck on boats
- transfer or storage facilities for fuel or chemicals
- vehicles using liquefied petroleum gas, such as propane or butane
- areas where the air contains chemicals or particles such as grain, dust, or metal powders
- any other area where you would normally be advised to turn off your vehicle engine

Use with care

Use only in normal position (to ear). Avoid dropping, hitting, bending, or sitting on the phone.

Keep phone dry

If the phone gets wet, turn the power off immediately and return it to the dealer for service.

**Kyocera Wireless Corp.
KWC 3225**

**SPECIFIC ABSORPTION RATE (SAR)
REPORT**

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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 Oct. 2002 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-3225*
 Tx Frequency : *824.04 – 848.97 and 1851.25 – 1908.75 MHz*
 Modulation: *CDMA and Analog*
 Antenna: *Stubby Antenna*
 FCC Classification: *Non-Broadcast Transmitter Held to Ear*
 Application Type: *Certification*
 Serial Number : *4E-X---05GT1H*
 FCC ID: *OVFKWC-3225*
 Place of Test: *KWC, 10300 Campus Point Drive, Lab AA-136, San Diego, CA, USA*
 Date of Test: *Oct. 14-21, 2002*
 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 6.5

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2 SAR TEST RESULT 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 IEEE P1528-200X Draft 6.5. 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

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	Device Position	Limit (mW/g)	Measured (mW/g)	Result
FM/383/836.49	26.00 dBm	Left Tilt	1.6	1.30	PASSED
PCS/600/1880	23.06 dBm	Left Cheek	1.6	1.12	PASSED

2.1.2 Body Worn Configuration (with KWC body worn accessories)

Mode/Ch/f(MHz)	Conducted Power	Device Position	Limit (mW/g)	Measured (mW/g)	Result
FM/991/824.04	26.02 dBm	Waist level	1.6	0.649	PASSED
PCS/600/1880	23.06 dBm	Waist level	1.6	0.279	PASSED

2.1.3 Measurement Uncertainty

Combined Uncertainty (Assessment & Source)	± 10.32 %
Extended Uncertainty (k=2)	± 20.6 %

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3 DESCRIPTION OF TESTED DEVICE

The test sample consisted of a KWC 3225. 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-3225 is a tri-mode and dual band cellular/PCS phone. The antenna is a standard stubby antenna tuned for dual frequency. See pictures below. The KWC-3225 was tested, at the low, mid, and high frequencies of each band.



There is only one battery option available to operate KWC-3225. All measurements were done with production batteries.

The KWC-3225 has provision for headset to allow hands-free operation. The following body worn accessories are available for KWC-3225. SAR measurements for hands-free operating condition were done at the low, mid, and high frequencies of each band.

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KWC Leather Case CA90-61068-01



KWC Universal Belt Clip CE90-B1700-01

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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 (included the antenna) to the body.



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:	38 %
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

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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	494	01-21-03
E-field Probe ET3DV6	1663	02-21-03
Dipole Validation kit, D835V2	453	02-11-04
Dipole Validation kit, D1900V2	5D005	02-20-04

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

Additional equipment needed in validation

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Test Equipment	Due date
Signal Generator, HP E4421B	02-26-03
Power meter, Giga-tronics 8541C	03-19-03
Power Sensor, Giga-tronics	01-31-03
Vector Network Analyzer, Agilent 8753ES	02-11-03
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 Agilent 8753ES network analyser.

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 (°C)	Test date	Comments
				ϵ_r	σ (S/m)			
Head	835	Measured	1.03	41.9	0.88	22±1	10-16-02	for device testing in head liquid
		Measured	1.03	41.5	0.87	22±1	10-17-02	For device testing in muscle
		SPEAG Reference	1.04	41.9	0.89	--	02-11-02	
		FCC Reference	--	41.5	0.90	20-26	--	
Head	1900	Measured	4.59	39.8	1.40	22±1	10-17-02	for device testing in head liquid
		Measured	4.52	39.8	1.42	22±1	10-18-02	for device testing in muscle
		SPEAG Reference	4.56	39.1	1.47	--	02-20-02	
Muscle	835	FCC Reference	--	40.0	1.40	20-26	--	
		Measured	--	56.5	0.94	22±1	10-17-02	for device testing in muscle
Muscle	1900	FCC Reference	--	55.2	0.97	--	--	
		Measured	--	53.6	1.53	22±1	07-02-02	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).

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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

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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 $\pm 0.1\text{mm}$.

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: $\pm 0.2\text{dB}$ (30MHz to 3GHz)
Optical Surface	$\pm 0.2\text{mm}$ repeatability in air and clear liquid over diffuse reflecting
Detection	surface
Directivity	$\pm 0.2\text{dB}$ in HSL (rotation around probe axis) $\pm 0.4\text{dB}$ in HSL (rotation normal to probe axis)
Dynamic Range	5 uW/g to > 100 mW/g; Linearity: $\pm 0.2\text{dB}$

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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. The bottom of the device aligns with the bottom of the holder clamp to provide a standard positioning and ensure enough free space for antenna. See picture.

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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

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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”.

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

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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°. 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° 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 carrying case and placed below the flat phantom. Headset was connected during measurements.

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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.

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.

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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	$\sqrt{3}$	$(1-C_p)^{1/2}$	± 1.9	∞
Sph. Isotropy of the probe	± 9.6	rectangular	$\sqrt{3}$	$(C_p)^{1/2}$	± 3.9	∞
Spatial resolution	± 0.0	rectangular	$\sqrt{3}$	1	± 0.0	∞
Boundary effects	± 5.5	rectangular	$\sqrt{3}$	1	± 3.2	∞
Probe linearity	± 4.7	rectangular	$\sqrt{3}$	1	± 2.7	∞
Detection limit	± 1.0	rectangular	$\sqrt{3}$	1	± 0.6	∞
Readout electronics	± 1.0	normal	1	1	± 1.0	∞
Response time	± 0.8	rectangular	$\sqrt{3}$	1	± 0.5	∞
Integration time	± 1.4	rectangular	$\sqrt{3}$	1	± 0.8	∞
RF ambient conditions	± 3.0	rectangular	$\sqrt{3}$	1	± 1.7	∞
Mech. Constrains of robot	± 0.4	rectangular	$\sqrt{3}$	1	± 0.2	∞
Probe positioning	± 2.9	rectangular	$\sqrt{3}$	1	± 1.7	∞
Extrap. and integration	± 3.9	rectangular	$\sqrt{3}$	1	± 2.3	∞
Test Sample Related						
Device positioning	± 3.0	normal	$\sqrt{3}$	1	± 1.7	∞
Power drift	± 5.0	normal	$\sqrt{3}$	1	± 2.9	∞
Phantom and setup						
Phantom uncertainty	± 4.0	rectangular	1	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	rectangular	$\sqrt{3}$	0.6	± 1.7	∞
Liquid conductivity (meas.)	± 10.0	rectangular	$\sqrt{3}$	0.6	± 3.5	∞
Liquid permittivity (target)	± 5.0	rectangular	$\sqrt{3}$	0.6	± 1.7	∞
Liquid permittivity (meas.)	± 5.0	rectangular	$\sqrt{3}$	0.6	± 1.7	∞
Combined Standard Uncertainty					± 10.32	
Extended Standard Uncertainty (k=2)					± 20.6	

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8 TEST DATA

8.1 Head SAR Test Results

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

Left Head SAR

Mode	Channel # / Frequency (MHz)	Conducted Power (dBm)	SAR, Average over 1g (mW/g)	
			Cheek Position	Tilted Position
FM 835	991/824.04	26.02	1.10	1.21
	383/836.49	26.00	1.18	1.30
	799/848.97	26.00	1.20	1.16
Cellular CDMA 835	1013/824.70	24.50	0.830	0.925
	383/836.49	24.57	0.908	0.966
	777/848.31	24.55	0.904	0.909
PCS CDMA 1900	25/1851.25	23.12	0.925	0.923
	600/1880	23.06	1.10	1.05
	1175/1908.75	23.05	1.03	1.02

Right Head SAR

Mode	Channel # / Frequency (MHz)	Conducted Power (dBm)	SAR, Average over 1g (mW/g)	
			Cheek Position	Tilted Position
FM 835	991/824.04	26.02	1.07	1.19
	383/836.49	26.00	1.21	1.22
	799/848.97	26.00	1.09	1.10
Cellular CDMA 835	1013/824.70	24.50	0.757	0.859
	383/836.49	24.57	0.909	0.951
	777/848.31	24.55	0.829	0.830
PCS CDMA 1900	25/1851.25	23.12	0.998	1.01
	600/1880	23.06	1.12	1.09
	1175/1908.75	23.05	1.10	1.07

The highest measured SAR (at head) in the cellular band is 1.30mW/g. The highest measured SAR (at head) in PCS band is 1.12mW/g.

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8.2 Body Worn SAR Test Result

For each mode, corresponding SAR distribution printouts of maximum results per set-up (in blue below), i.e., the device was tested with a 22.5mm air gap or with KWC leather case or with KWC universal belt clip, are shown in Appendix B. The rest of SAR distributions is substantially similar or equivalent to the plots submitted regardless of used channel.

Waist Level SAR with KWC Body Worn Accessories

Mode	Channel # / Frequency (MHz)	Conducted Power Before Test (dBm)	SAR, Average over 1g (mW/g)	
			With Leather Case CA90-61068-01	With Universal Belt Clip CE90-B1700-01
FM 835	991/824.04	26.02	0.649	0.636
	383/836.49	26.00	0.552	0.540
	799/848.97	26.00	0.501	0.490
Cellular CDMA 835	1013/824.70	24.50	0.436	0.456
	383/836.49	24.57	0.389	0.394
	777/848.31	24.55	0.369	0.359
PCS CDMA 1900	25/1851.25	23.12	0.212	0.223
	600/1880	23.06	0.268	0.279
	1175/1908.75	23.05	0.223	0.239

Waist Level SAR with 22.5mm Air Separation

Mode	Channel # / Frequency (MHz)	Conducted Power Before Test (dBm)	SAR, Average over 1g (mW/g)
FM 835	991/824.04	25.45	0.690
	383/836.49	25.56	0.500
	799/848.97	25.56	0.442
Cellular CDMA 835	1013/824.70	24.53	0.519
	383/836.49	24.53	0.369
	777/848.31	24.53	0.347
PCS CDMA 1900	25/1851.25	22.15	0.223
	600/1880	21.97	0.279
	1175/1908.75	22.14	0.239

With KWC body worn accessories, the highest measured SAR in the cellular band is 0.649mW/g, in PCS band is 0.279 mW/g.

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9 TEST SYSTEM PHOTOS

DASY 3 System



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The following photos show both 835MHz and 1900MHz liquid depth of at least 15cm

835MHz liquid depth = 156mm



1900MHz liquid depth = 154mm



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APPENDIX A: VALIDATION TEST PRINTOUT

835MHz Validation, Target Value = 1.04 mW/g, 10-16-02

Liquid Temp. = 22 C +/- 1C

Dipole 835 MHz

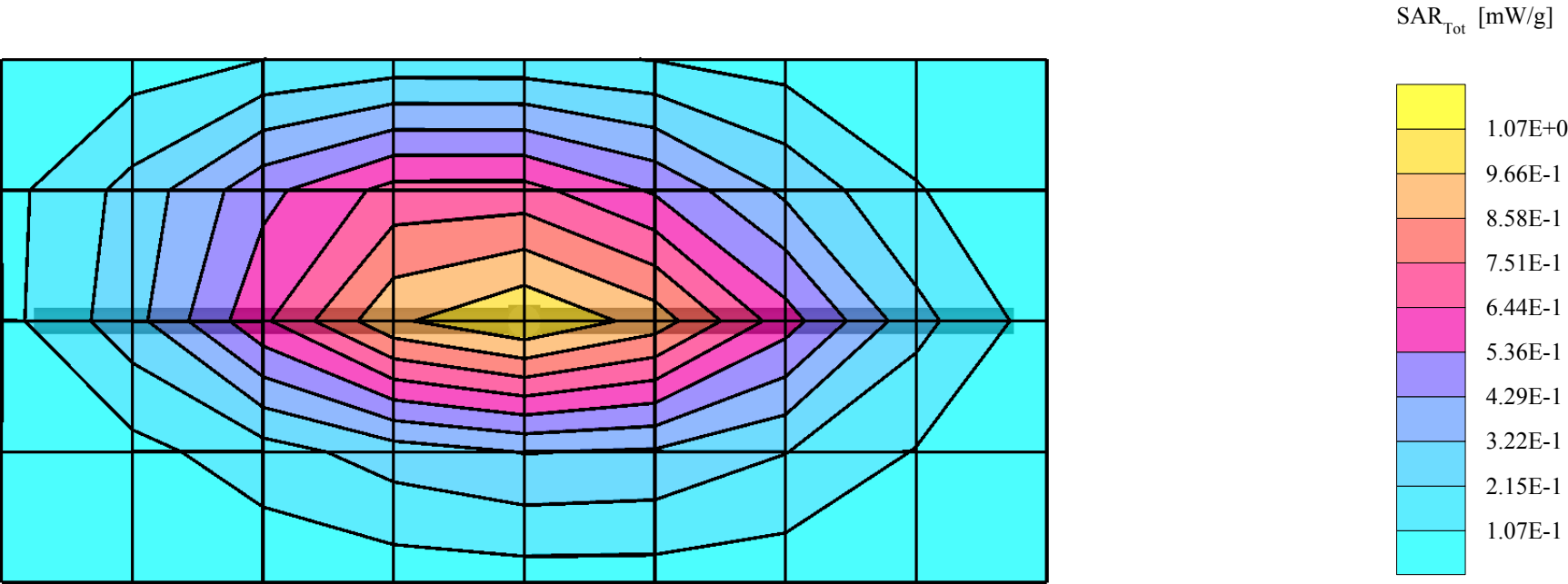
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 835 MHz

Probe: ET3DV6 - SN1663; ConvF(6.70,6.70,6.70); Crest factor: 1.0; Head 835 MHz: $\sigma = 0.88 \text{ mho/m}$ $\epsilon_r = 41.9$ $\rho = 1.00 \text{ g/cm}^3$

Cubes (2): SAR (1g): 1.03 mW/g $\pm 0.01 \text{ dB}$, SAR (10g): 0.657 mW/g $\pm 0.01 \text{ dB}$, (Worst-case extrapolation)

Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0

Powerdrift: -0.05 dB



835MHz Validation, Target Value = 1.04 mW/g, 10-17-02

Liquid Temp. = 22 C +/- 1C

Dipole 835 MHz

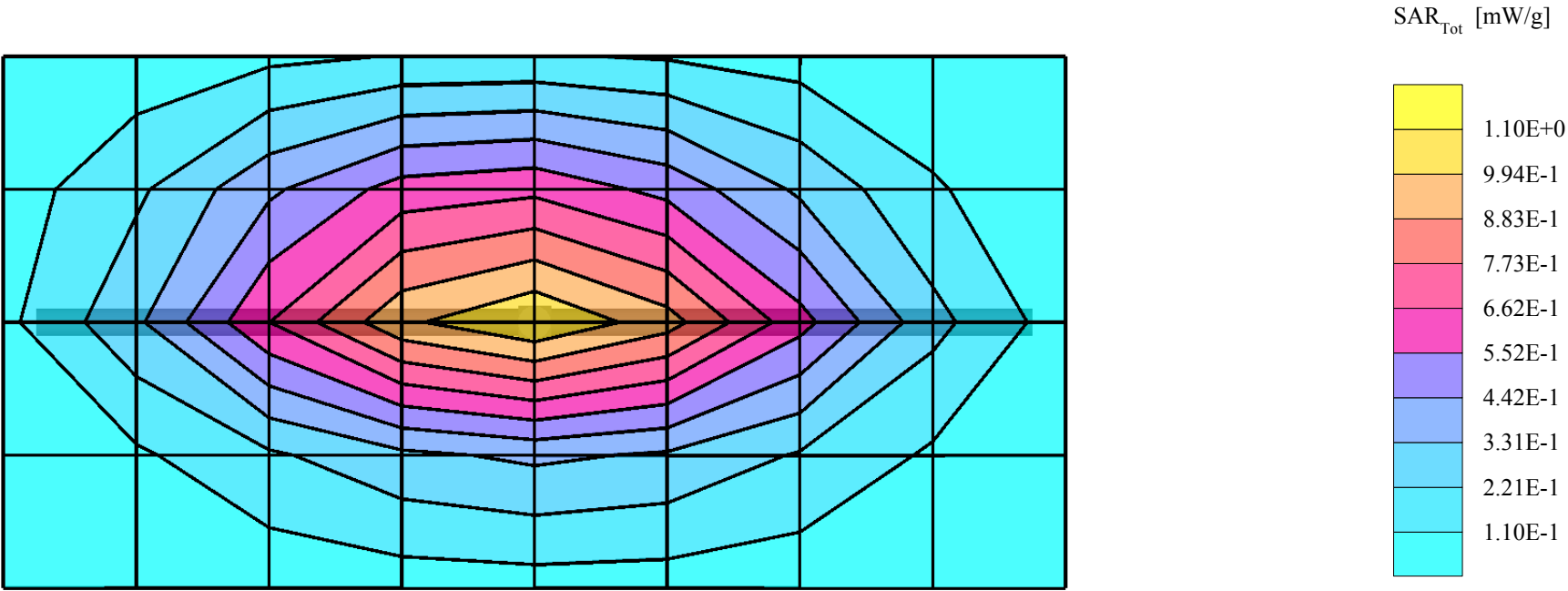
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 835 MHz

Probe: ET3DV6 - SN1663; ConvF(6.70,6.70,6.70); Crest factor: 1.0; Head 835 MHz: $\sigma = 0.87 \text{ mho/m}$ $\epsilon_r = 41.5$ $\rho = 1.00 \text{ g/cm}^3$

Cubes (2): SAR (1g): 1.03 mW/g $\pm 0.02 \text{ dB}$, SAR (10g): 0.656 mW/g $\pm 0.01 \text{ dB}$, (Worst-case extrapolation)

Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0

Powerdrift: -0.02 dB



1900MHz Validation, Target Value = 4.56 mW/g, 10-17-02

Liquid Temp. = 22 C +/- 1C

Dipole 1900 MHz

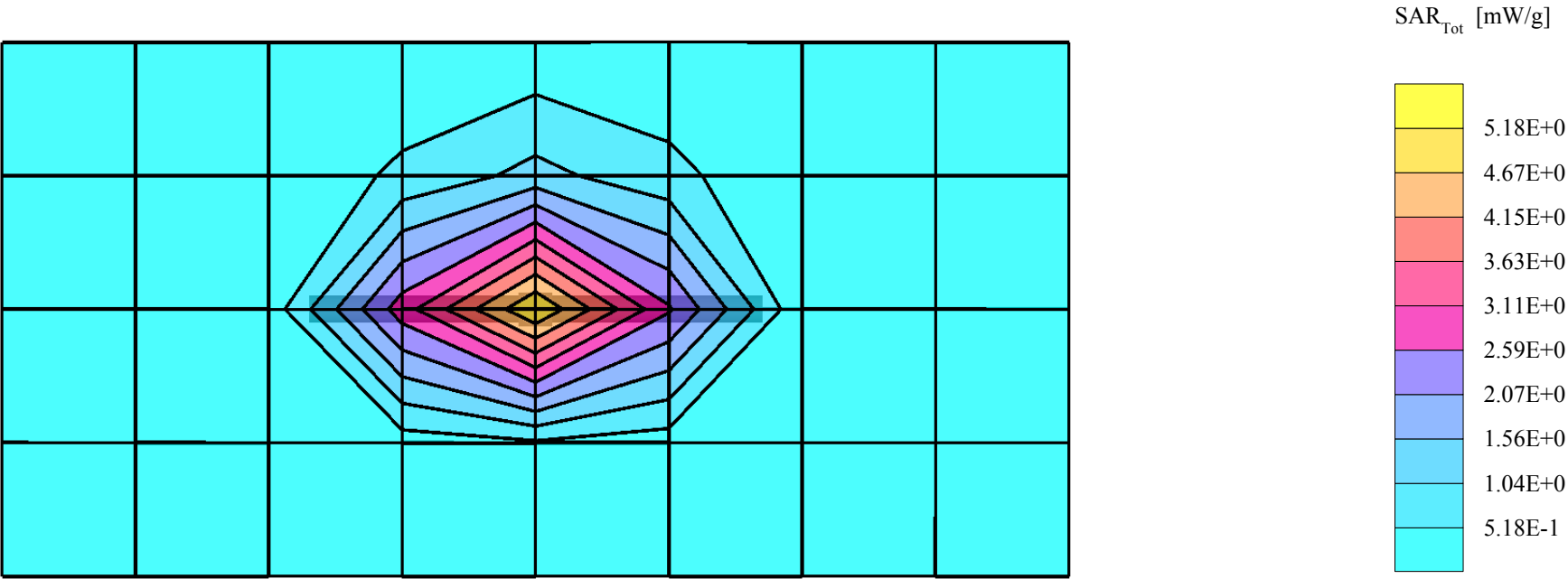
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz

Probe: ET3DV6 - SN1663; ConvF(5.30,5.30,5.30); Crest factor: 1.0; Head 1900 MHz: $\sigma = 1.40 \text{ mho/m}$ $\epsilon_r = 39.8$ $\rho = 1.00 \text{ g/cm}^3$

Cubes (2): SAR (1g): 4.59 mW/g $\pm 0.04 \text{ dB}$, SAR (10g): 2.35 mW/g $\pm 0.00 \text{ dB}$, (Worst-case extrapolation)

Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0

Powerdrift: -0.04 dB



1900MHz Validation, Target Value = 4.56 mW/g, 10-18-02

Liquid Temp. = 22 C +/- 1C

Dipole 1900 MHz

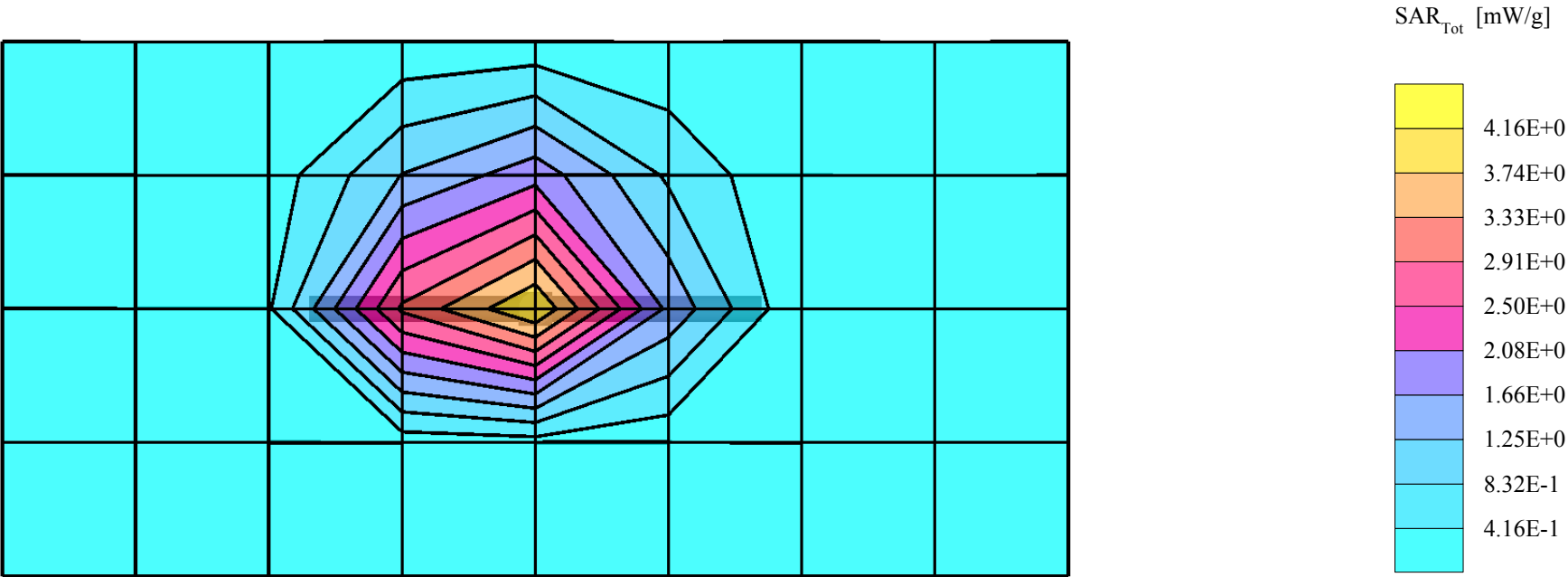
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz

Probe: ET3DV6 - SN1663; ConvF(5.30,5.30,5.30); Crest factor: 1.0; Head 1900 MHz: $\sigma = 1.42 \text{ mho/m}$ $\epsilon_r = 39.8$ $\rho = 1.00 \text{ g/cm}^3$

Cubes (2): SAR (1g): 4.52 mW/g $\pm 0.03 \text{ dB}$, SAR (10g): 2.34 mW/g $\pm 0.01 \text{ dB}$, (Worst-case extrapolation)

Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0

Powerdrift: -0.00 dB



Schmid & Partner Engineering AG

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

Calibration Certificate

835 MHz System Validation Dipole

Type:

D835V2

Serial Number:

453

Place of Calibration:

Zurich

Date of Calibration:

February 11, 2002

Calibration Interval:

24 months

asset #
039931

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:

Mary Kaya

Approved by:

[Signature]

DASY

Dipole Validation Kit

Type: D835V2

Serial: 453

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	$\pm 5\%$
Conductivity	0.89 mho/m	$\pm 5\%$

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 $\pm 3\%$. 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:	1.375 ns	(one direction)
Transmission factor:	0.987	(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:	$\text{Re}\{Z\} = $ 49.4 Ω
---------------------------------	---

	$\text{Im}\{Z\} = $ -3.8 Ω
--	---

Return Loss at 835 MHz	-28.4 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.

Validation Dipole D835V2 SN:453, d = 15 mm

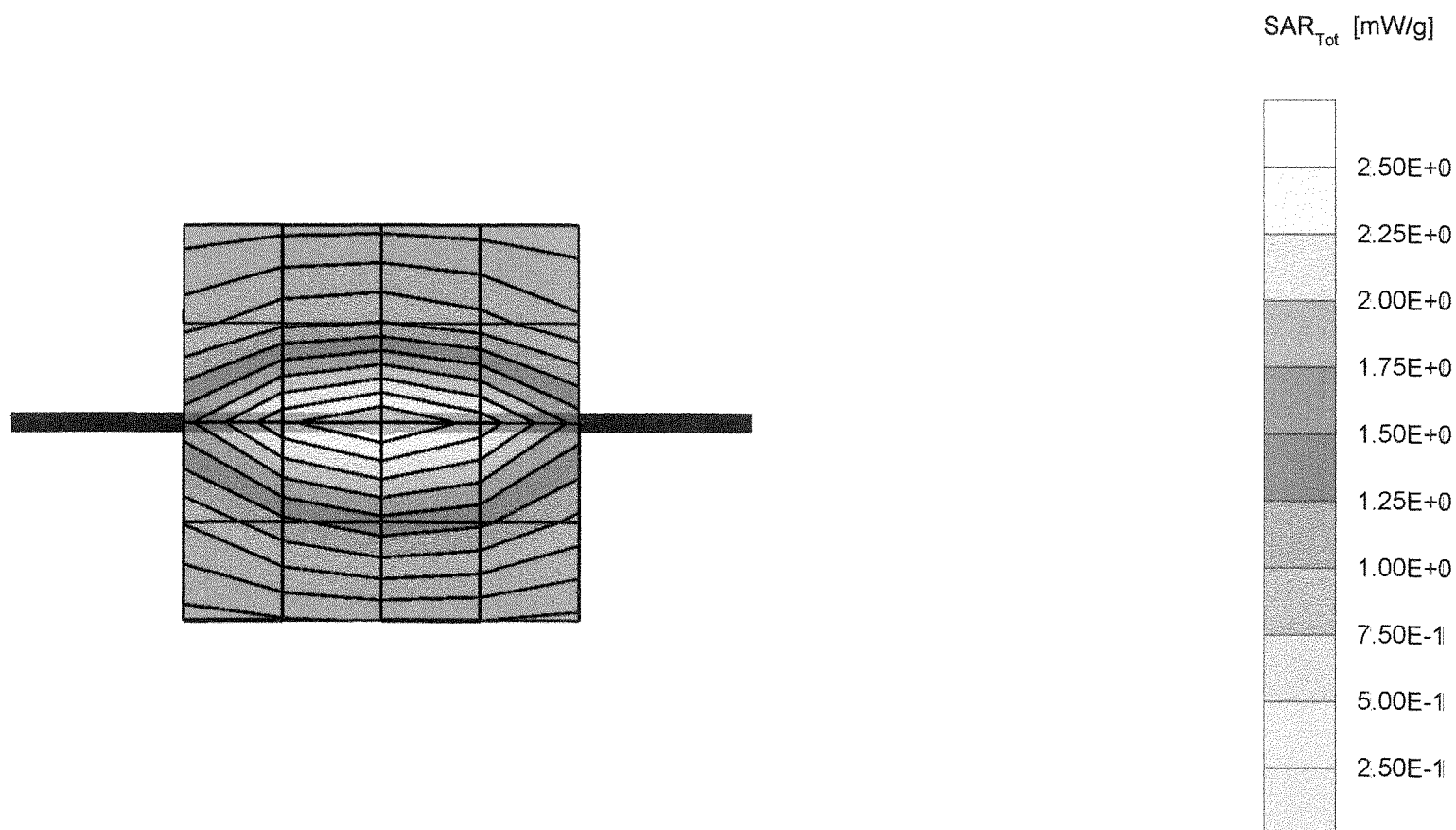
Frequency: 835 MHz; Antenna Input Power: 250 [mW]

Phantom: M 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; $\sigma = 0.89$ mho/m $\epsilon_r = 41.9$ $\rho = 1.00$ g/cm³Results (2): Peak: 4.16 mW/g ± 0.00 dB, SAR (1g): 2.60 mW/g ± 0.01 dB, SAR (10g): 1.66 mW/g ± 0.02 dB, (Worst-case extrapolation)

Penetration depth: 12.0 (10.6, 13.8) [mm]

Frequency drift: -0.00 dB



5 Feb 2002 17:15:07

CH1 S11 1 U FS

1: 49.424 \angle -3.8203 \angle 49.892 pF

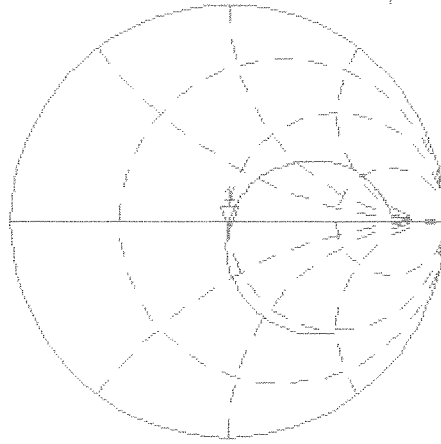
835.000 000 MHz

Del

Cor

Avg
15

↑



CH2 S11 LOG 5 dB/REF 0 dB

1: -28.414 dB 835.000 000 MHz

Cor

↑



START 700.000 000 MHz

STOP 1 100.000 000 MHz

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:

5d005

Place of Calibration:

Zurich

Date of Calibration:

February 20, 2002

959e177
039930

Calibration Interval:

24 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:

Vitali Nico

Approved by:

Walter Kitz

DASY3

Dipole Validation Kit

Type: D1900V2

Serial: 5d005

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 permittivity	39.1	$\pm 5\%$
Conductivity	1.47 mho/m	$\pm 10\%$

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 $\pm 3\%$. 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 cm³ (1 g) of tissue: **45.6 mW/g**

averaged over 10 cm³ (10 g) of tissue: **23.1 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 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:	1.182 ns	(one direction)
Transmission factor:	0.996	(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:	$\text{Re}\{Z\} = $ 50.9 Ω
----------------------------------	---

	$\text{Im}\{Z\} = $ 2.4 Ω
--	--

Return Loss at 1900 MHz	- 32.0 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:5d005, d = 10 mm

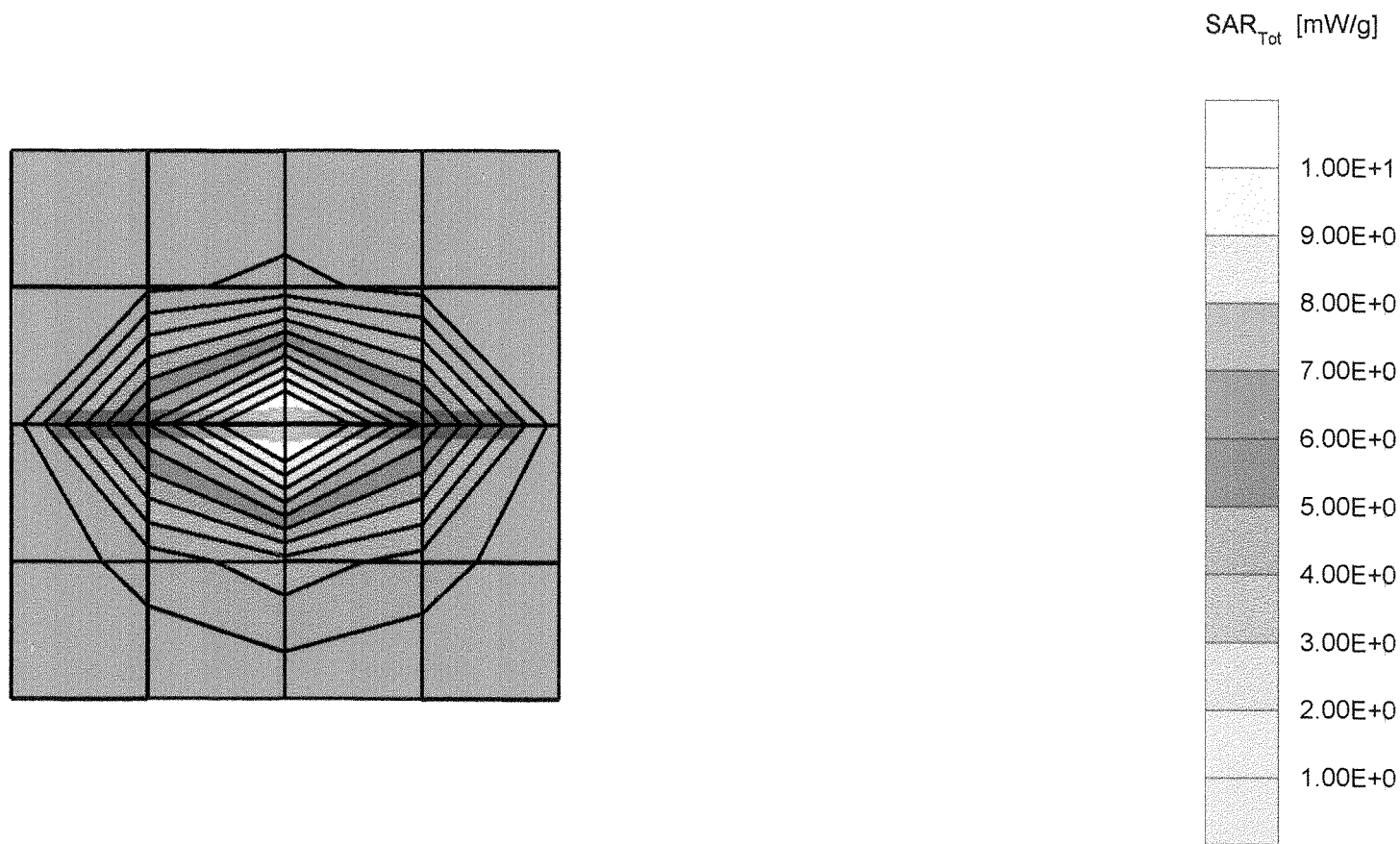
Frequency: 1900 MHz; Antenna Input Power: 250 [mW]

Model: M Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0

Subject: ET3DV6 - SN1507; ConvF(5.30,5.30,5.30) at 1800 MHz; IEEE1528 1900 MHz; $\sigma = 1.47$ mho/m $\epsilon_r = 39.1$ $\rho = 1.00$ g/cm³Results (2): Peak: 21.9 mW/g ± 0.03 dB, SAR (1g): 11.4 mW/g ± 0.03 dB, SAR (10g): 5.78 mW/g ± 0.02 dB, (Worst-case extrapolation)

Penetration depth: 7.8 (7.4, 8.7) [mm]

Frequency drift: -0.02 dB



20 Feb 2002 17:43:08

CHI S11 1 U FS

1: 50.867 Ω 2.3691 Ω 198.45 μH

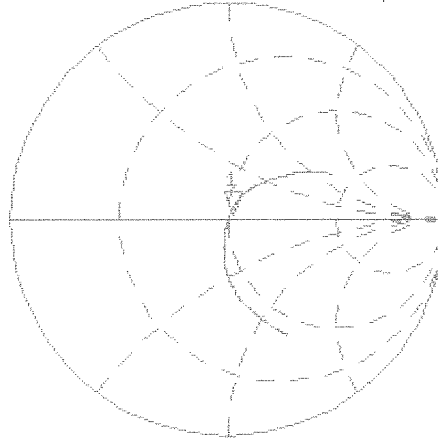
1 900.000 000 MHz

Del

Cor

Avg
16

↑

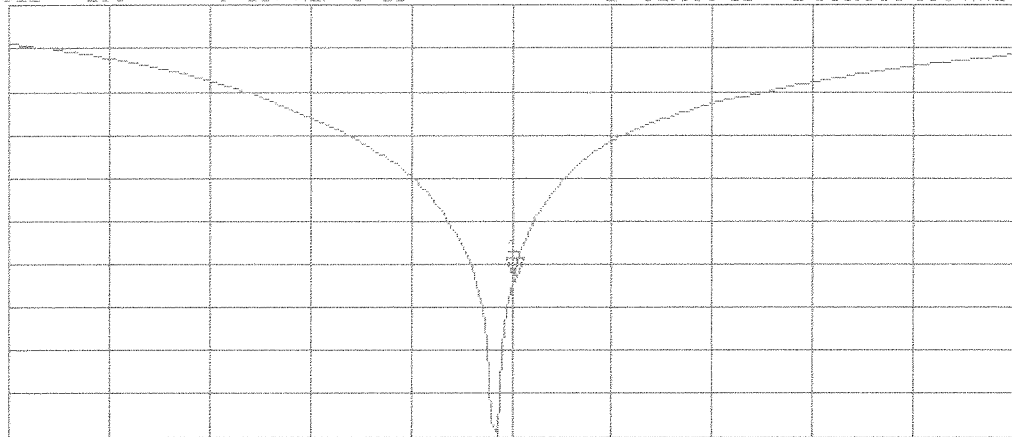


CH2 S11 LOG 5 dB/REF 0 dB 1:-32.035 dB 1 900.000 000 MHz

Cor

Avg
16

↑



START 1 600.000 000 MHz

STOP 2 200.000 000 MHz