CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Test Lab:

CELLTECH RESEARCH INC.
Testing and Engineering Lab
1955 Moss Court
Kelowna, B.C.
Canada V1Y 9L3
Phone: 250 - 860-3130
Fax: 250 - 860-3110
Toll Free: 1-877-545-6287
e-mail: info@celltechlabs.com
web site: www.celltechlabs.com

Applicant Information:

RADIOSHACK CORPORATION
100 Throckmorton St., Suite 1300
Fort Worth, TX 76102-2802

FCC ID:	**AAO1900903**
Trade / Model(s):	**RadioShack 19-903**
EUT Type:	**Portable GMRS PTT Radio Transceiver**
Modulation:	**FM**
Tx Frequency Range:	**462.5625 - 462.7250 MHz**
RF Output Power Tested:	**5.0 Watts (Conducted)**
No. of Channels:	**15**
FCC Rule Part(s):	**2.1093; ET Docket 96-326**
IC Rule Part(s):	**RSS-102 Issue 1**

This wireless portable device has been shown to be compliant for localized Specific Absorption Rate (SAR) for controlled environment / occupational 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. C95.3-1999.

I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Celltech Research Inc. certifies that no party to this application has been denied FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

Shawn McMillen
General Manager
Celltech Research Inc.

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1.0 INTRODUCTION

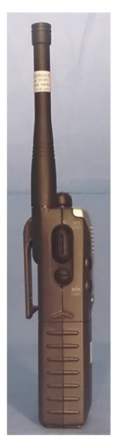
This measurement report shows compliance of the RADIOSHACK Model: 19-903 Portable GMRS PTT Radio Transceiver FCC ID: AAO1900903 with the regulations and procedures specified in FCC Part 2.1093, ET Docket 96-326 Rules (controlled exposure), and RSS-102, Issue 1 of Industry Canada for mobile and portable devices. The test procedures, as described in American National Standards Institute C95.1-1992 (1), FCC OET Bulletin 65, Supplement C (Edition 01-01) were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION of Equipment Under Test (EUT)

Rule Part(s)	FCC 2.1093; ET Docket 96.326 IC RSS-102 Issue 1	**Modulation**	FM
		No. of Channels	15
EUT Type	Portable GMRS PTT Radio Transceiver	**Tx Frequency Range (MHz)**	462.5625 - 462.7250
FCC ID	AAO1900903	**RF Output Power Tested**	5.0 Watts (Conducted)
Model No.(s)	19-903	**Antenna Type**	λ/4
Serial No.	Pre-production	**Power Supply**	8.4V, 1300mAh Ni-MH Battery Pack


Front of EUT


Back of EUT


Left Side of EUT


Right Side of EUT


EUT with ear/mic

3.0 SAR MEASUREMENT SYSTEM

Celltech Research SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, and the generic twin phantom containing brain or muscle equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card. The DAE3 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

DASY3 SAR Measurement System

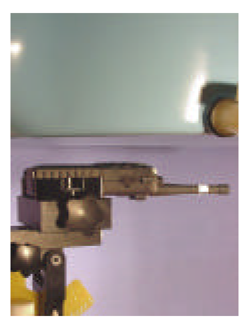
4.0 SAR MEASUREMENT SUMMARY

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the EUT are reported in Appendix A.

Face-Held SAR Measurements

Frequency (MHz)	Chan.	Mode	Cond. Power (W)	Antenna Position	Separ. Dist. (cm)	SAR (w/kg)			
						Measured SAR values with 3.2mm phantom		Extrapolated SAR values for 2.0mm phantom	
						100% Duty Cycle	50% Duty Cycle	100% Duty Cycle	50% Duty Cycle
462.5625	Low	CW	5.0	Fixed	2.5	1.44	0.72	1.51	0.76
462.7250	High	CW	5.0	Fixed	2.5	1.50	0.75	1.58	0.79
Mixture Type: Brain Dielectric Constant: 43.5 Conductivity: 0.87			**ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Controlled Exposure / Occupational BRAIN: 8.0 W/kg (averaged over 1 gram)**						

Notes: 1. The actual thickness of the flat phantom shell as reported by the system manufacturer is 3.2mm instead of the required 2.0mm thickness (see Appendix B). As a result of the increased thickness, the measured SAR values were approximately 5% lower than expected. The final SAR values were extrapolated from the measured SAR values and calculated for a 2.0mm flat phantom shell thickness.
2. The SAR values found were below the maximum limit of 8.0 w/kg (controlled exposure).
3. The highest SAR value found was 1.58 w/kg (based on 100% duty cycle & 2.0mm phantom).
4. The EUT was tested for face-held SAR with a 2.5cm separation distance between the front of the EUT and the outer surface of the planar phantom.
5. Ambient TEMPERATURE: 22.3 °C
Relative HUMIDITY: 56.1 %
Atmospheric PRESSURE: 94.9 kPa



Face-Held SAR Test Setup
2.5cm Separation Distance

SAR MEASUREMENT SUMMARY (CONT.)

Body-Worn SAR Measurements

Frequency (MHz)	Chan.	Mode	Cond. Power (W)	Antenna Position	Belt-Clip Separ. Dist. (cm)	SAR (w/kg)			
						Measured SAR values with 3.2mm phantom		Extrapolated SAR values for 2.0mm phantom	
						100% Duty Cycle	50% Duty Cycle	100% Duty Cycle	50% Duty Cycle
462.5625	Low	CW	5.0	Fixed	1.0	11.3	5.65	11.9	5.95
462.7250	High	CW	5.0	Fixed	1.0	11.5	5.75	12.1	6.05
Mixture Type: Body Dielectric Constant: 56.7 Conductivity: 0.94			ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Controlled Exposure / Occupational BODY: 8.0 W/kg (averaged over 1 gram)						

Notes: 1. The actual thickness of the flat phantom shell as reported by the system manufacturer is 3.2mm instead of the required 2.0mm thickness (see Appendix B). As a result of the increased thickness, the measured SAR values were approximately 5% lower than expected. The final SAR values were extrapolated from the measured SAR values and calculated for a 2.0mm flat phantom shell thickness.
2. The SAR values found were below the maximum limit of 8.0 w/kg (controlled exposure).
3. The highest SAR value found was 6.05 w/kg (based on 50% duty cycle & 2.0mm phantom).
4. The EUT was tested for body-worn SAR with the attached belt-clip providing a 1.0cm separation distance between the back of the EUT and the outer surface of the planar phantom.
5. Ambient TEMPERATURE: 22.3 °C
Relative HUMIDITY: 56.1 %
Atmospheric PRESSURE: 94.9 kPa

Body-Worn SAR Test Setup
with 1.0cm Belt-Clip

5.0 DETAILS OF SAR EVALUATION

The RADIOSHACK Model: 19-903 Portable GMRS PTT Radio Transceiver FCC ID: AAO1900903 was found to be compliant for localized Specific Absorption Rate (controlled exposure) based on the following test provisions and conditions:

1. The EUT was tested in a face-held configuration with the front of the device placed parallel to the outer surface of the planar phantom with a 2.5cm separation distance.
2. The EUT was tested in a body-worn configuration with the attached belt-clip touching the outer surface of the planar phantom and providing a 1.0cm separation distance between the back of the EUT and the outer surface of the planar phantom.
3. The EUT was evaluated for SAR at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimize drift. The conducted power level was checked before and after each test.
4. The conducted power was measured according to the procedures described in FCC Part 2.1046.
5. The device was operated continuously in the transmit mode for the duration of the test.
6. The location of the maximum spatial SAR distribution (Hot Spot) was determined relative to the device and its antenna.
7. The EUT was tested with a fully charged battery.

6.0 EVALUATION PROCEDURES

The Specific Absorption Rate (SAR) evaluation was performed in the following manner:

a. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01).

(ii) For body-worn and face-held devices the planar section of the phantom was used.

b. The SAR was determined by a pre-defined procedure within the DASY3 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm.

c. For frequencies below 500MHz a 4x4x7 matrix was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. For frequencies above 500MHz a 5x5x7 matrix was performed. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.

d. If the EUT had any appreciable drift over the course of the evaluation, then the EUT was re-evaluated. Any unusual anomalies over the course of the test also warranted a re-evaluation.

7.0 SIMULATED TISSUES

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellullose (HEC) gelling agent and saline solution. Preservation with a bactericide is added and visual inspection is made to ensure air bubbles are not trapped during the mixing process. The fluid was prepared in accordance with standardized procedures, and measured for dielectric parameters (permitivity and conductivity).

INGREDIENT	**MIXTURE**		
	900MHz Brain % (Validation)	**450MHz Brain %**	**450MHz Muscle %**
Water	51.07	38.56	52.00
Sugar	47.31	56.32	45.65
Salt	1.15	3.95	1.75
HEC	0.23	0.98	0.50
Bactericide	0.24	0.19	0.10

8.0 TISSUE PARAMETERS

The dielectric parameters of the fluids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer. The dielectric parameters of the fluid are as follows:

Equivalent Tissue	**Dielectric Constant** e_r	**Conductivity** s **(mho/m)**	r **(Kg/m^3)**
Brain (900MHz Validation)	42.4 ± 5%	0.97 ± 5%	1000
Brain (450MHz)	43.5 ± 5%	0.87 ± 5%	1000
Muscle (450MHz)	56.7 ± 5%	0.94 ± 5%	1000

9.0 SAR SAFETY LIMITS

EXPOSURE LIMITS	SAR (W/Kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10g)	4.0	20.0

Notes: 1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.

2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

10.0 SYSTEM VALIDATION

Prior to the assessment, the system was verified in the planar section of the phantom with a 900MHz dipole for devices operating below 1GHz, and an 1800MHz dipole for devices operating above 1GHz. A forward power of 250mW was applied to the dipole and system was verified to a tolerance of $\pm$10%. The applicable verifications are as follows (see Appendix B for validation test plot and explanation of phantom thickness):

Dipole Validation Kit	Target SAR 1g (w/kg)		Measured SAR 1g (w/kg)
	Target SAR value with 2.0mm phantom	Extrapolated SAR value with 3.2mm phantom	with 3.2mm phantom
D900V2	2.78	2.58	2.54

11.0 ROBOT SYSTEM SPECIFICATIONS

Specifications

POSITIONER:	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability:	0.02 mm
No. of axis:	6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor:	Pentium III
Clock Speed:	450 MHz
Operating System:	Windows NT
Data Card:	DASY3 PC-Board

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter, and control logic
Software:	DASY3 software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock

PC Interface Card

Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 16 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot

E-Field Probe

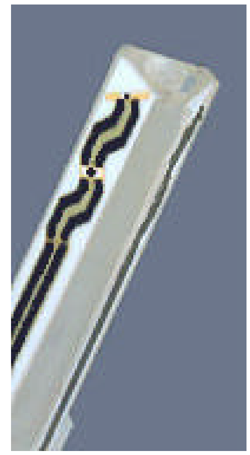
Model:	ET3DV6
Serial No.:	1590
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

Phantom

Phantom #1:	Generic Twin
Shell Material:	Fiberglass
Thickness:	Left/Right Head - 2.0 ± 0.1 mm Planar Phantom - 3.2 ± 0.1 mm

12.0 PROBE SPECIFICATION (ET3DV6)

Construction: Symmetrical design with triangular core
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g. glycol)
Calibration: In air from 10 MHz to 2.5 GHz
In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity: ± 0.2 dB in brain tissue (rotation around probe axis)
± 0.4 dB in brain tissue (rotation normal to probe axis)
Dynam. Rnge: 5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Srfce. Detect. ± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions: Overall length: 330 mm
Tip length: 16 mm
Body diameter: 12 mm
Tip diameter: 6.8 mm
Distance from probe tip to dipole centers: 2.7 mm
Application: General dosimetry up to 3 GHz
Compliance tests of mobile phone


ET3DV6 E-Field Probe

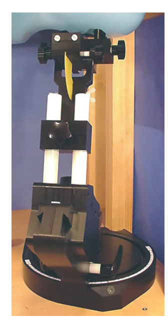
13.0 GENERIC TWIN PHANTOM

The generic twin phantom is a fiberglass shell phantom with a 2.0mm left and right head shell thickness and a 3.2mm flat planar area.


Generic Twin Phantom

14.0 DEVICE HOLDER

The DASY3 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.


Device Holder

15.0 TEST EQUIPMENT LIST

SAR MEASUREMENT SYSTEM		
EQUIPMENT	***SERIAL NO.***	***CALIBRATION DATE***
DASY3 System -Robot -ET3DV6 E-Field Probe -DAE -900MHz Validation Dipole -1800MHz Validation Dipole -Generic Twin Phantom V3.0	 599396-01 1590 383 054 247 N/A	 N/A Mar 2001 Sept 1999 June 2001 June 2001 N/A
85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8652A Power Meter -Power Sensor 80701A -Power Sensor 80701A	1835272 1833535 1833542	Oct 1999 Oct 1999 Oct 1999
E4408B Spectrum Analyzer	US39240170	Nov 1999
8594E Spectrum Analyzer	3543A02721	Mar 2000
8753E Network Analyzer	US38433013	Nov 1999
8648D Signal Generator	3847A00611	N/A
5S1G4 Amplifier Research Power Amplifier	26235	N/A

16.0 MEASUREMENT UNCERTAINTIES

Uncertainty Description	Error	Distribution	Weight	Standard Deviation	Offset
Probe Uncertainty					
Axial isotropy	±0.2 dB	U-Shaped	0.5	±2.4 %	
Spherical isotropy	±0.4 dB	U-Shaped	0.5	±4.8 %	
Isotropy from gradient	±0.5 dB	U-Shaped	0	±	
Spatial resolution	±0.5 %	Normal	1	±0.5 %	
Linearity error	±0.2 dB	Rectangle	1	±2.7 %	
Calibration error	±3.3 %	Normal	1	±3.3 %	
SAR Evaluation Uncertainty					
Data acquisition error	±1 %	Rectangle	1	±0.6 %	
ELF and RF disturbances	±0.25 %	Normal	1	±0.25 %	
Conductivity assessment	±5 %	Rectangle	1	±5.8 %	
Spatial Peak SAR Evaluation Uncertainty					
Extrapolated boundary effect	±3 %	Normal	1	±3 %	±5 %
Probe positioning error	±0.1 mm	Normal	1	±1 %	
Integrated and cube orientation	±3 %	Normal	1	±3 %	
Cube Shape inaccuracies	±2 %	Rectangle	1	±1.2 %	
Device positioning	±6 %	Normal	1	±6 %	
Combined Uncertainties				±11.7 %	±5 %

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental.

According to ANSI/IEEE C95.3, the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ± 1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ± 2dB can be expected.

According to CENELEC, typical worst-case uncertainty of field measurements is ± 5 dB.
For well-defined modulation characteristics the uncertainty can be reduced to ± 3 dB.

17.0 REFERENCES

(1) ANSI, *ANSI/IEEE C95.1: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 Ghz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.*

(2) Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, FCC, Washington, D.C. 20554, 1997.

(3) Thomas Schmid, Oliver Egger, and Neils Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE *Transaction on Microwave Theory and Techniques*, Vol. 44, pp. 105 – 113, January, 1996.

(4) Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with know precision", IEICE Transactions of Communications, vol. E80-B, no. 5, pp. 645 – 652, May 1997.

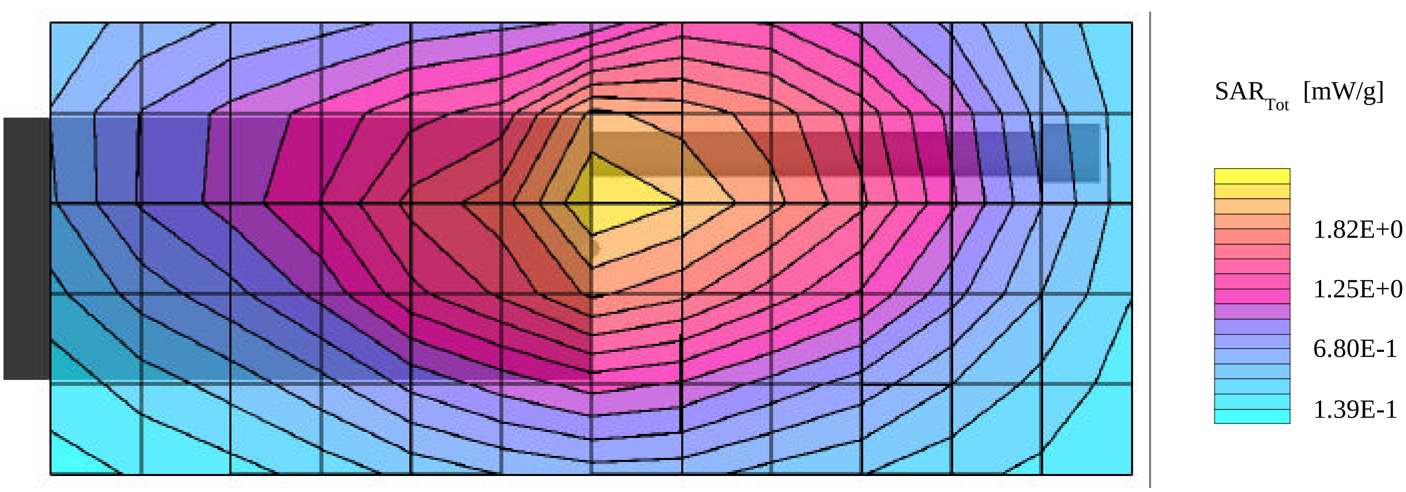
APPENDIX A - SAR MEASUREMENT DATA

The manufacturer of the DASY3 generic twin phantom has determined that the planar section used during system validations and SAR RF exposure evaluations is 3.2mm, instead of the required 2.0mm thickness (see Appendix B) per FCC OET Bulletin 65, Supplement C, Edition 01-01. Due to this issue the manufacturer has reported new system validation target values for our newly calibrated 1800MHz and 900MHz dipoles (see Appendix B). At 1800MHz with a separation distance of 10mm from the center of the dipole axis to the fluid, and at 900MHz with separation distances of 15mm, the new target values are lower then expected by 12% and 8% respectively. As the frequency is reduced further, the error due to the increased phantom thickness becomes less significant. Since the manufacturer has not given target values for other frequencies, it is estimated by extrapolation that at 450MHz the actual measured SAR values are approximately 5% lower than expected. This would cause both face-held and body-worn RF exposure evaluations to be approximately 5% lower than reported since they were both performed in the planar section of the phantom.

Radioshack Corporation FCC ID: AAO1900903

Generic Twin Phantom; Flat Section; Position: (90°,90°)
Probe: ET3DV6 - SN1590; ConvF(7.36,7.36,7.36); Crest factor: 1.0
450MHz Brain: σ = 0.87 mho/m ε_r = 43.5 ρ = 1.00 g/cm^3
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 4x4x7
SAR (1g): 1.44 mW/g , SAR (10g): 1.11 mW/g

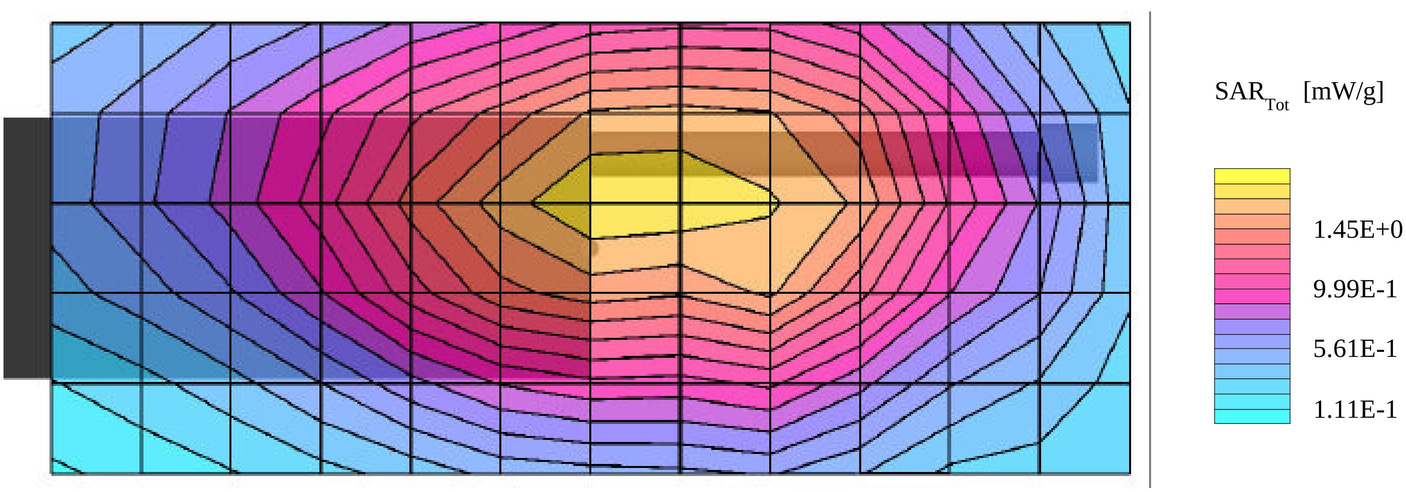
Face SAR at 2.5cm Separation Distance
Radioshack Model: 19-903
Continuous Wave Mode
Low Channel [462.5625 MHz]
Conducted Power: 5.0 Watts
Date Tested: September 17, 2001



Radioshack Corporation FCC ID: AAO1900903

Generic Twin Phantom; Flat Section; Position: (90°,90°)
Probe: ET3DV6 - SN1590; ConvF(7.36,7.36,7.36); Crest factor: 1.0
450MHz Brain: σ = 0.87 mho/m ε_r = 43.5 ρ = 1.00 g/cm^3
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 4x4x7
SAR (1g): 1.50 mW/g , SAR (10g): 1.05 mW/g

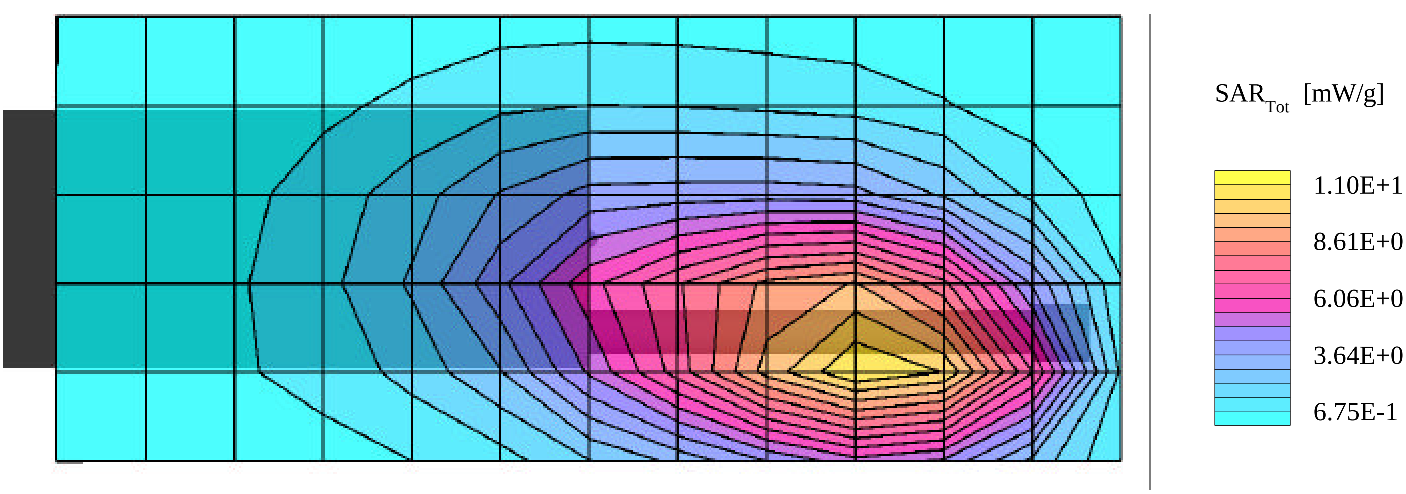
Face SAR at 2.5cm Separation Distance
Radioshack Model: 19-903
Continuous Wave Mode
High Channel [462.7250 MHz]
Conducted Power: 5.0 Watts
Date Tested: September 17, 2001



Radioshack Corporation FCC ID: AAO1900903

Generic Twin Phantom; Flat Section; Position: (270°,270°)
Probe: ET3DV6 - SN1590; ConvF(7.36,7.36,7.36); Crest factor: 1.0
450MHz Muscle: σ = 0.94 mho/m ε_r = 56.7 ρ = 1.00 g/cm^3
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 4x4x7
SAR (1g): 11.3 mW/g, SAR (10g): 7.92 mW/g

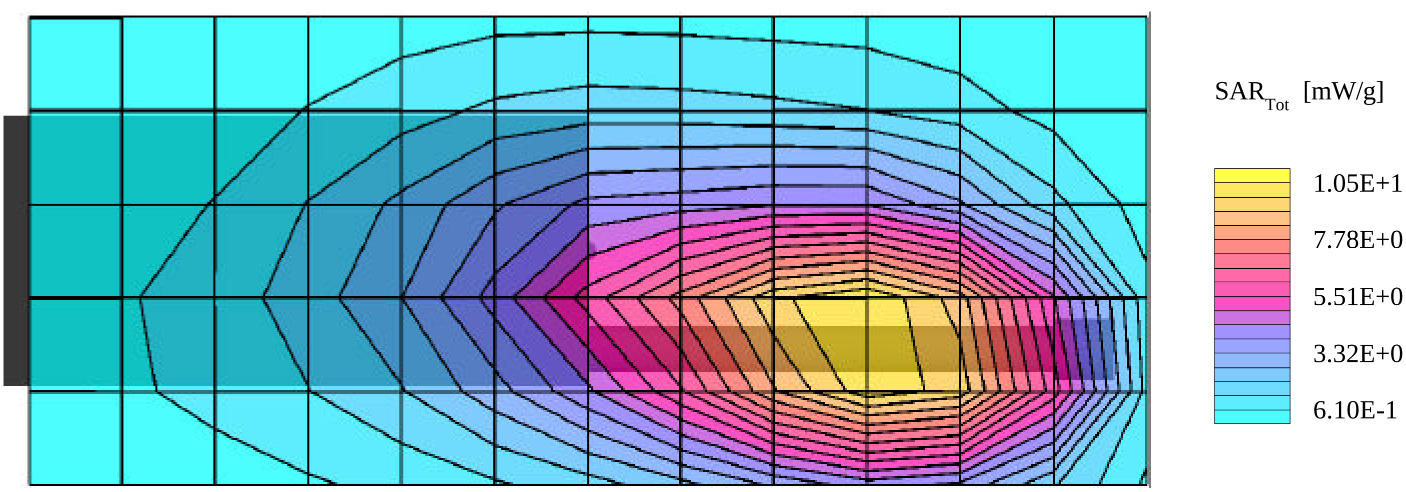
Body-Worn SAR with 1.0cm Belt-Clip
Radioshack Model: 19-903
Continuous Wave Mode
Low Channel [462.5625 MHz]
Conducted Power: 5.0 Watts
Date Tested: September 17, 2001



Radioshack Corporation FCC ID: AAO1900903

Generic Twin Phantom; Flat Section; Position: (270°,270°)
Probe: ET3DV6 - SN1590; ConvF(7.36,7.36,7.36); Crest factor: 1.0
450MHz Muscle: σ = 0.94 mho/m ε_r = 56.7 ρ = 1.00 g/cm^3
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 4x4x7
SAR (1g): 11.5 mW/g, SAR (10g): 8.55 mW/g

Body-Worn SAR with 1.0cm Belt-Clip
Radioshack Model: 19-903
Continuous Wave Mode
High Channel [462.7250 MHz]
Conducted Power: 5.0 Watts
Date Tested: September 17, 2001



APPENDIX B - DIPOLE VALIDATION

The manufacturer of the DASY3 generic twin phantom has determined that the planar section used during system validations and SAR RF exposure evaluations is 3.2mm instead of the required 2.0mm thickness (OET Bulletin 65, Supplement C, Edition 01-01). As a result of this increased thickness the system validation reported an 8% lower assessed value. Attached is the notice from the device manufacturer regarding the change in procedure of dipole calibration due to the increased shell thickness of the generic twin phantom. Also attached from the device manufacturer is the summary of validation dipole target numbers for the increased phantom shell thickness. Please note that the shell thickness of the left and right head of the generic twin phantom is the required 2.0mm.

MC0300: Change in Procedure of Dipole Calibration

Procedure Before February 2000

The distance between the dipole axis and head tissue simulating liquid was based on the specifications given by the vendor manufacturing the generic twin phantom. The specifications for the shell thickness were 2 ± 0.2 mm at the location where the phone touches the head as well as at the location of dipole validation in the flat phantom area. The thickness of the first phantom was carefully verified using the robot, which is a very tedious and time consuming procedure. Afterward, Schmid & Partner Engineering AG (SPEAG) relied on the manufacturer's specifications, since suitable equipment for routine validation of the shell thickness was not available before January 2000.

Rationale for Change of Procedure

During the course of closing the remaining gaps of quality control of our products and production, SPEAG purchased the hall effect wall thickness gauge MINITEST FH4100 of ElektroPhysik in January 2000. This instrumentation enables measurement of the shell thickness with a precision of better than ±0.1 mm. Verification of the phantoms revealed that the production variability in the regions of validation is considerably larger, i.e., about 2.8 ± 0.4 mm, which is due to an unnotified change in the production method of the vendor. The mean and deviation were estimated thereafter based on a limited number of samples.

The thickness of the phantom used for dipole calibration has a thickness of 3.2 ± 0.1 mm. In other words, the distances between the dipole axis and the liquid were 16.2 mm and not 15 mm below 1 GHz and 11.2 instead of 10 mm above 1 GHz. Therefore, an incorrect distance is stated in all calibration documents issued before February 2000. This does not effect laboratories using the generic twin phantom, only those groups which use other phantoms.

Changes in Procedure (effective February 2000)

1) Rigorous quality control of the new phantoms and conduct of the calibration at the correct distances of 15 mm and 10 mm respectively.

2) Provision of the corrected calibration distance as well as of extrapolated values for the distances 15, 15.5 and 16 mm for customers using phantoms other than the generic twin phantom. The latter are extrapolated values based on a series of measurements conducted with different dipoles which therefore have slightly enhanced uncertainties.

Suggested on: 15.04.2000 by: [signature]

Approved on: 16.04.2000 by: [signature]

Schmid & Partner
Engineering AG

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

D900V2 – SN:054 Summary of Dipole Data (June 20, 2001)

SAR Measurement

In the Table 1 averaged measured and extrapolated SAR values are normalized to a dipole input power of 1W (forward power). The dipole was position below the flat phantom filled with head-tissue simulating liquid (ε=42.4, σ=0.97).

Distance (mm)	SAR (1g) mW/g	SAR (10g) mW/g	Validation Repeatability (Standard deviation)	Method
15.0	**11.12**	**7.04**	**± 4%**	**Calibrated**
15.5	10.76	6.86	± 5%	Extrapolated
16.0	10.43	6.69	± 5%	Extrapolated
16.2 [1]	10.30	6.62	± 5%	Extrapolated

In the Table 2 averaged measured and extrapolated SAR values are normalized to a dipole input power of 1W (forward power). The dipole was position below the flat phantom filled with head-tissue simulating liquid (ε=41.0, σ=0.86).

Distance (mm)	SAR (1g) mW/g	SAR (10g) mW/g	Validation Repeatability (Standard deviation)	Method
15.0	**10.12**	**6.52**	**± 4%**	**Calibrated**
15.5	9.79	6.35	± 5%	Extrapolated
16.0	9.49	6.19	± 5%	Extrapolated
16.2 [1]	9.37	6.13	± 5%	Extrapolated

Dipole Impedance and Return Loss

The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.413 ns**	(one direction)
Transmission factor:	**0.989**	(voltage transmission, one direction)

[1] As explained in the document "MC0300: Change in Procedure of Dipole Calibration" of April 15th, 2000, the distance between the dipole axis and liquid was 1.2 mm more than stated in the original documents issued before February 2000. The extrapolated values and the given uncertainties have been carefully evaluated and have been validated by measurements and computations.

Schmid & Partner
Engineering AG

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

D1800V2 – SN:247 Summary of Dipole Data (June 20, 2001)

SAR Measurement

In the Table 1 averaged measured and extrapolated SAR values are normalized to a dipole input power of 1W (forward power). The dipole was position below the flat phantom filled with head-tissue simulating liquid (ε=40.0, σ=1.36).

Distance (mm)	SAR (1g) mW/g	SAR (10g) mW/g	Validation Repeatability (Standard deviation)	Method
10.0	**38.7**	**20.1**	**± 4%**	**Calibrated**
10.5	36.8	19.3	± 5%	Extrapolated
11.0	35.1	18.6	± 5%	Extrapolated
11.2 [1]	34.5	18.3	± 5%	Extrapolated

In the Table 2 averaged measured and extrapolated SAR values are normalized to a dipole input power of 1W (forward power). The dipole was position below the flat phantom filled with head-tissue simulating liquid (ε=40.1, σ=1.71).

Distance (mm)	SAR (1g) mW/g	SAR (10g) mW/g	Validation Repeatability (Standard deviation)	Method
10.0	**43.6**	**21.6**	**± 4%**	**Calibrated**
10.5	41.5	20.8	± 5%	Extrapolated
11.0	39.6	20.1	± 5%	Extrapolated
11.2 [1]	38.9	19.8	± 5%	Extrapolated

Dipole Impedance and Return Loss

The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.208 ns**	(one direction)
Transmission factor:	**0.995**	(voltage transmission, one direction)

[1] As explained in the document "MC0300: Change in Procedure of Dipole Calibration" of April 15th, 2000, the distance between the dipole axis and liquid was 1.2 mm more than stated in the original documents issued before February 2000. The extrapolated values and the given uncertainties have been carefully evaluated and have been validated by measurements and computations.

Dipole 900 MHz

Validation Date: September 17, 2001

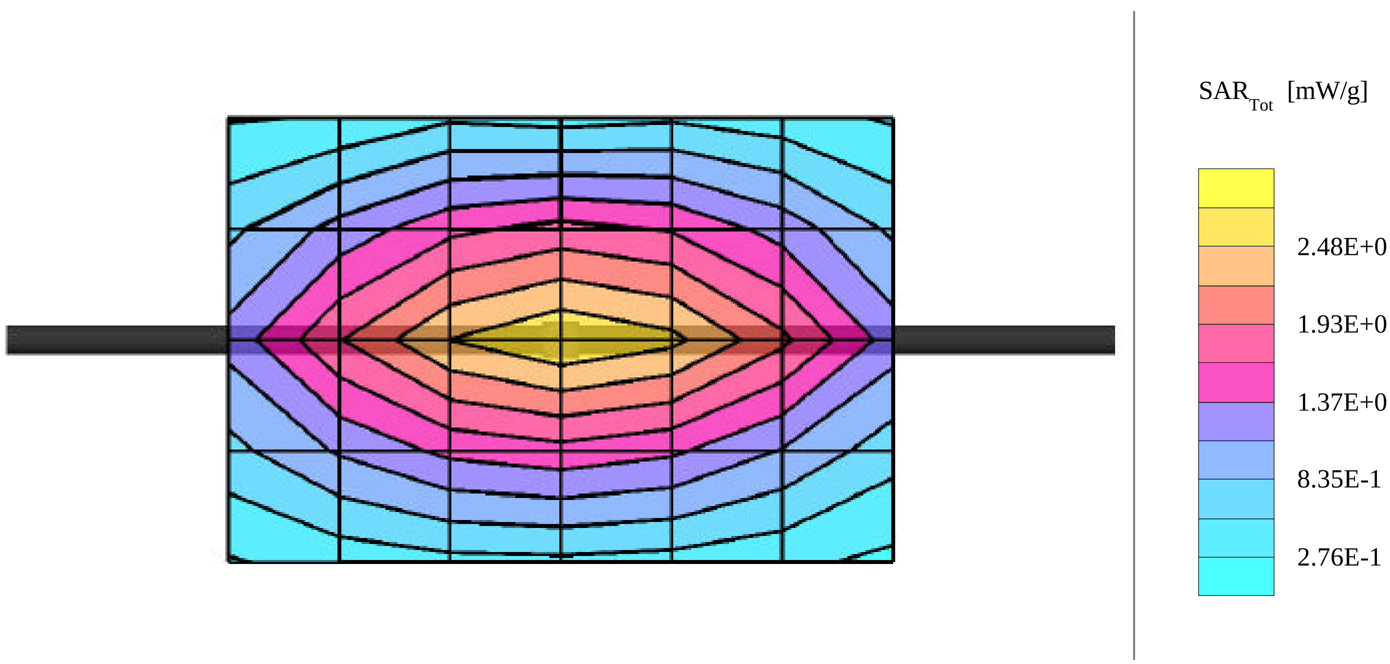
Generic Twin; Flat

Probe: ET3DV6 - SN1590; ConvF(6.83,6.83,6.83); Crest factor: 1.0; Brain 900 MHz: σ = 0.97 mho/m ε_r = 42.4 ρ = 1.00 g/cm^3

Cubes (2): Peak: 4.07 mW/g ± 0.02 dB, SAR (1g): 2.54 mW/g ± 0.01 dB, SAR (10g): 1.63 mW/g ± 0.01 dB, (Worst-case extrapolation)

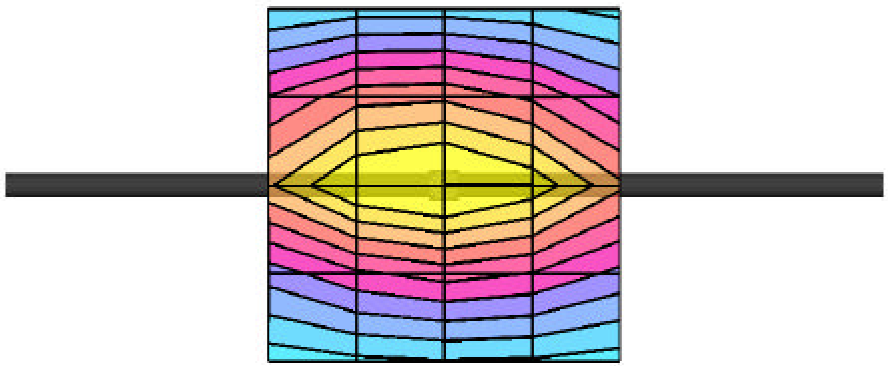
Penetration depth: 11.9 (10.8, 13.3) [mm]

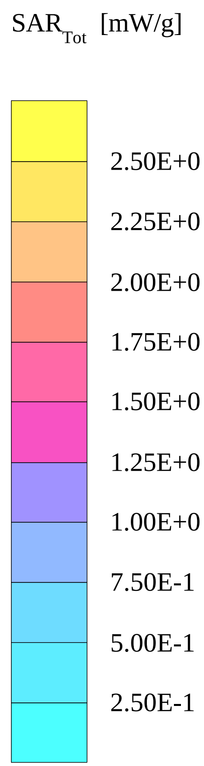
Powerdrift: -0.03 dB



Validation Dipole D900V2 SN:054, d = 15 mm

Frequency: 900 MHz; Antenna Input Power: 250 [mW]
Generic Twin Phantom; Flat Section; Grid Spacing:Dx = 15.0, Dy = 15.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(6.27,6.27,6.27); Crest factor: 1.0; IEEE1528 900 MHz: σ = 0.97 mho/m ε_r = 42.4 ρ = 1.00 g/cm^3
Cubes (2): Peak: 4.47 mW/g ± 0.05 dB, SAR (1g): 2.78 mW/g ± 0.04 dB, SAR (10g): 1.76 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 11.5 (10.3, 13.2) [mm]
Powerdrift: -0.00 dB





APPENDIX C - PROBE CALIBRATION

Probe ET3DV6

SN:1590

Manufactured: March 19, 2001
Calibrated: March 26, 2001

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1590

Sensitivity in Free Space

NormX	**1.77**	$\mu V/(V/m)^2$
NormY	**1.91**	$\mu V/(V/m)^2$
NormZ	**1.67**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**100**	mV
DCP Y	**100**	mV
DCP Z	**100**	mV

Sensitivity in Tissue Simulating Liquid

Head **450 MHz** e_r **= 43.5 ± 5%** s **= 0.87 ± 10% mho/m**

ConvF X	**7.36**	extrapolated	Boundary effect:	
ConvF Y	**7.36**	extrapolated	Alpha	**0.29**
ConvF Z	**7.36**	extrapolated	Depth	**2.72**

Head **900 MHz** e_r **= 42 ± 5%** s **= 0.97 ± 10% mho/m**

ConvF X	**6.83**	± 7% (k=2)	Boundary effect:	
ConvF Y	**6.83**	± 7% (k=2)	Alpha	**0.37**
ConvF Z	**6.83**	± 7% (k=2)	Depth	**2.48**

Head **1500 MHz** e_r **= 40.4 ± 5%** s **= 1.23 ± 10% mho/m**

ConvF X	**6.13**	interpolated	Boundary effect:	
ConvF Y	**6.13**	interpolated	Alpha	**0.47**
ConvF Z	**6.13**	interpolated	Depth	**2.17**

Head **1800 MHz** e_r **= 40 ± 5%** s **= 1.40 ± 10% mho/m**

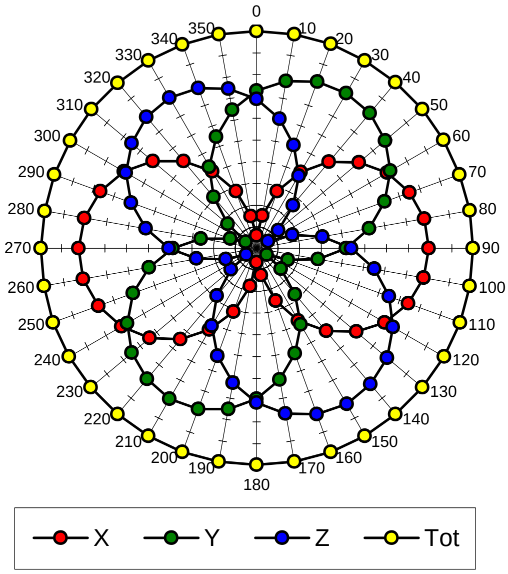
ConvF X	**5.78**	± 7% (k=2)	Boundary effect:	
ConvF Y	**5.78**	± 7% (k=2)	Alpha	**0.53**
ConvF Z	**5.78**	± 7% (k=2)	Depth	**2.01**

Sensor Offset

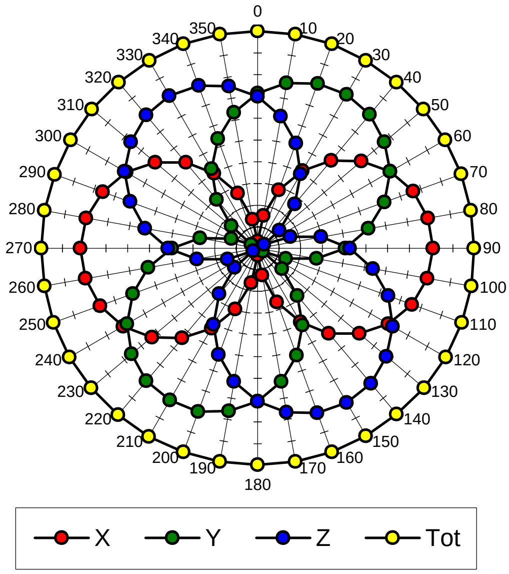
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.2 ± 0.2**	mm

Receiving Pattern (f), q = 0°

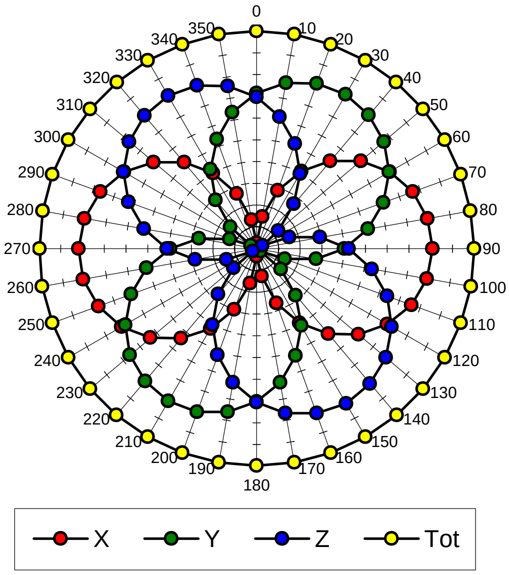
f = 30 MHz, TEM cell ifi110



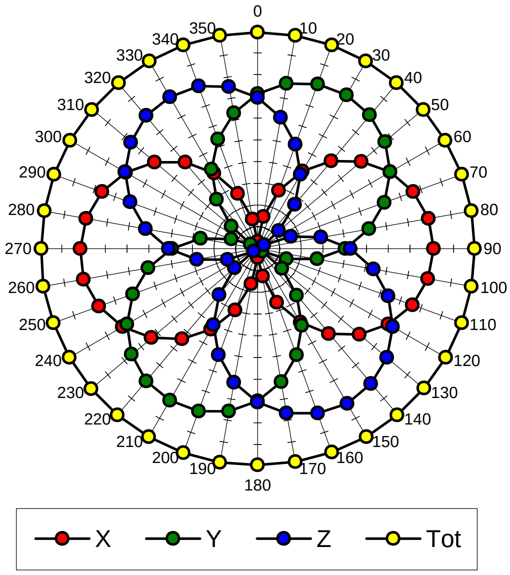
f = 100 MHz, TEM cell ifi110

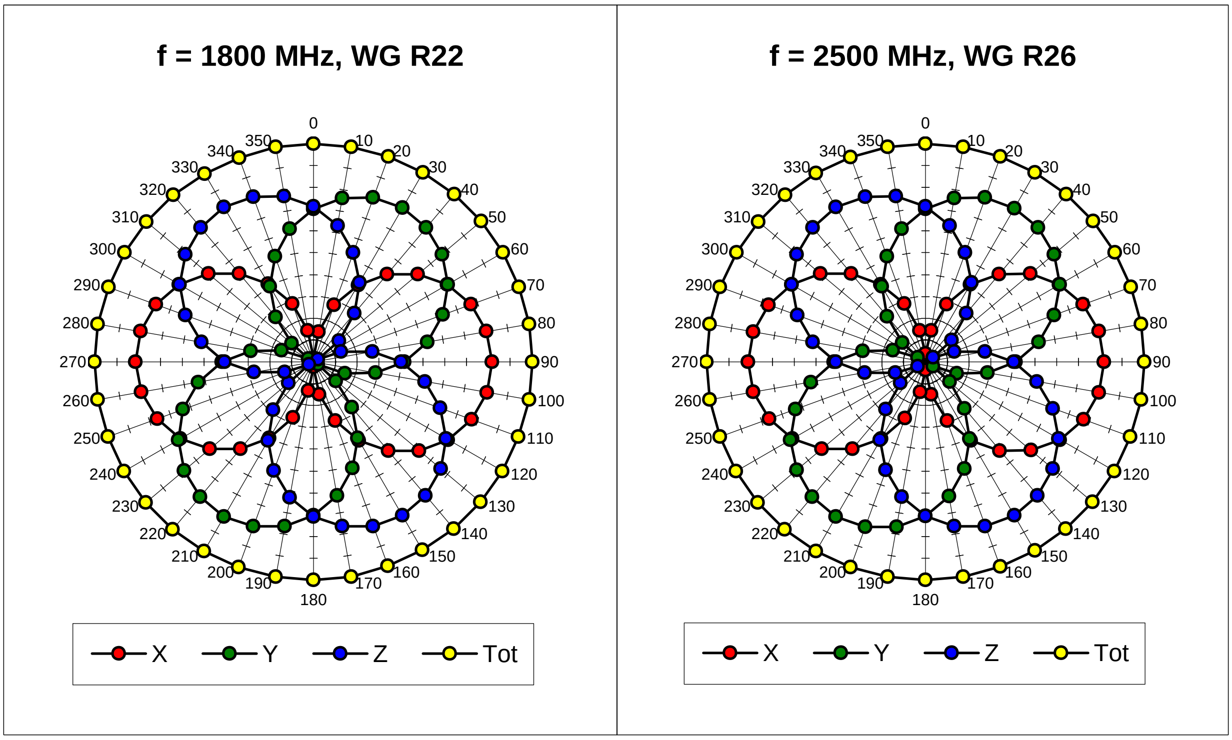


f = 300 MHz, TEM cell ifi110

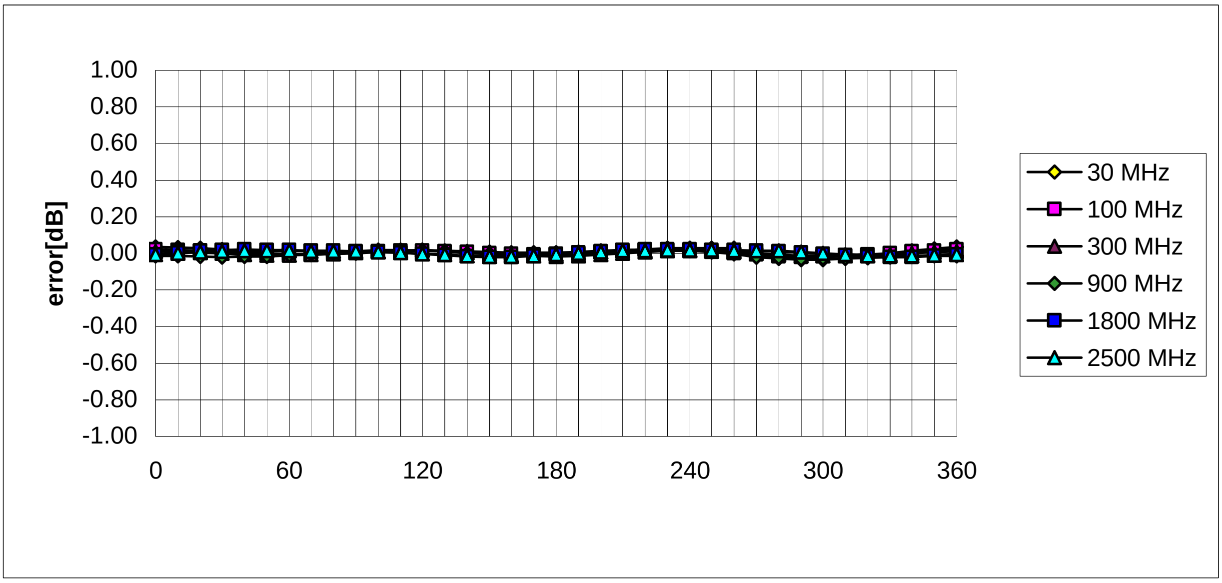


f = 900 MHz, TEM cell ifi110



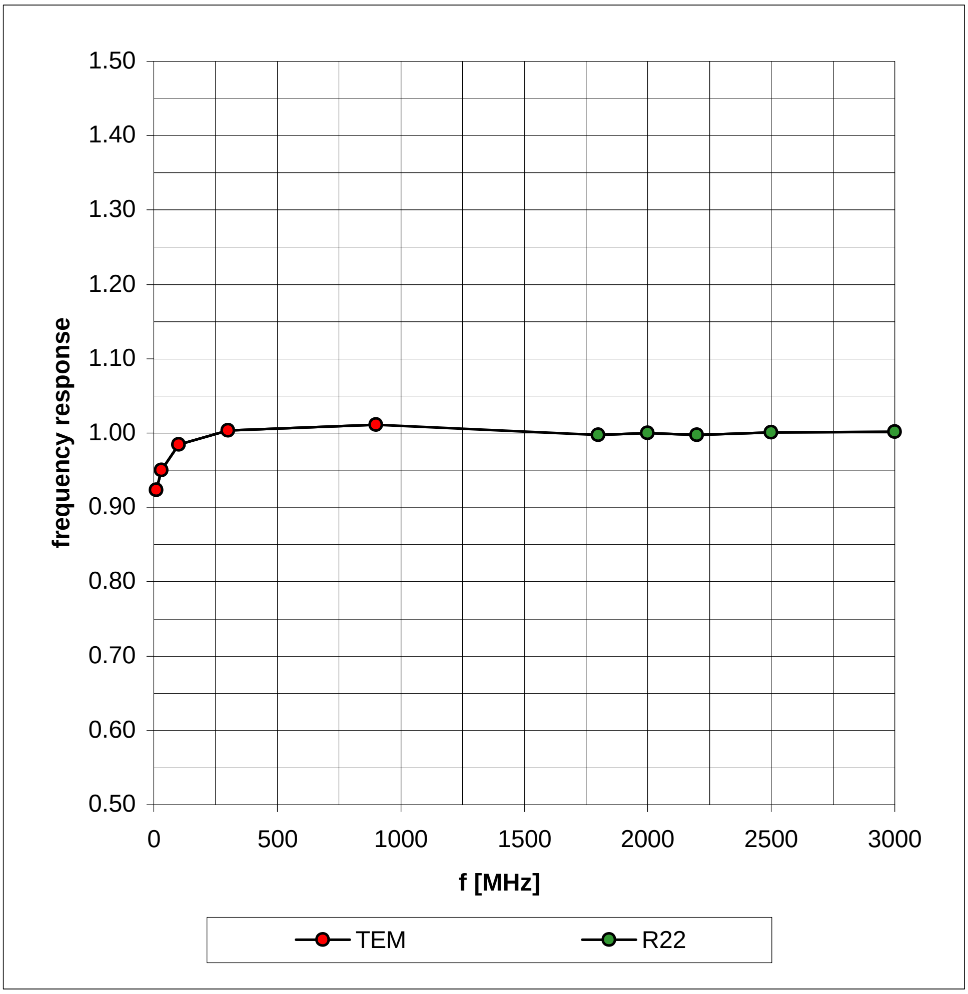


Isotropy Error (f), q = 0°



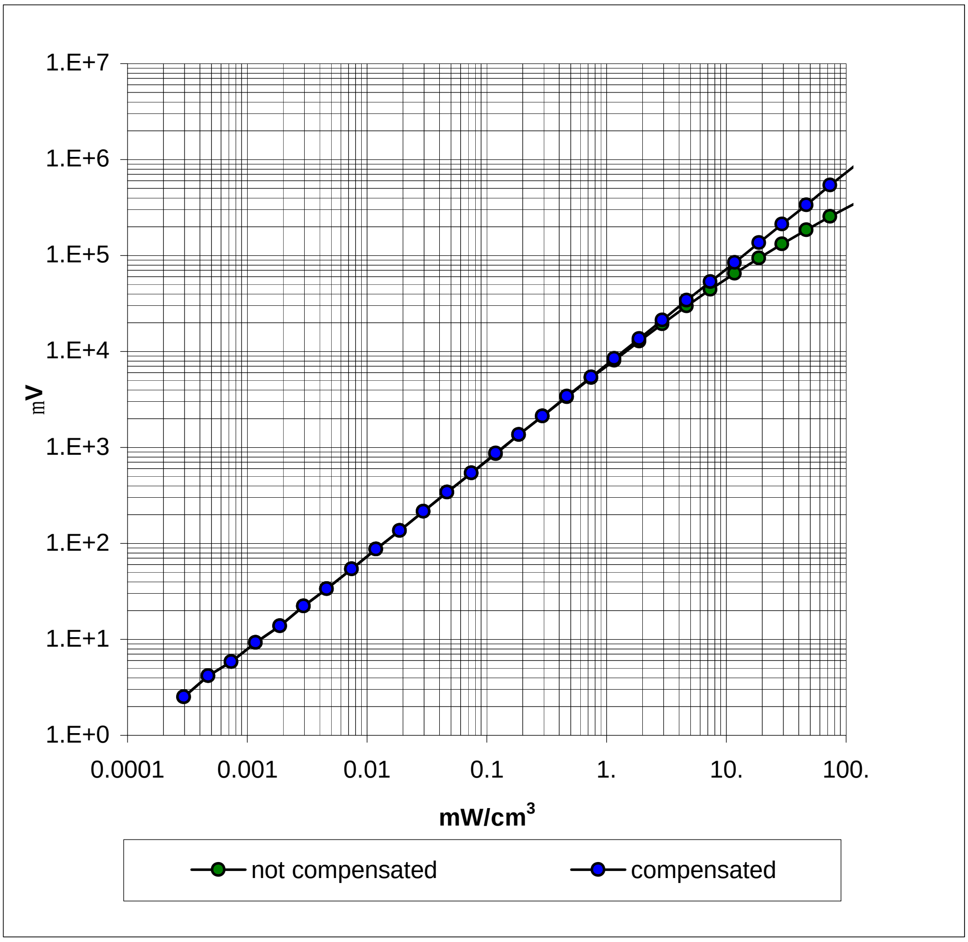
Frequency Response of E-Field

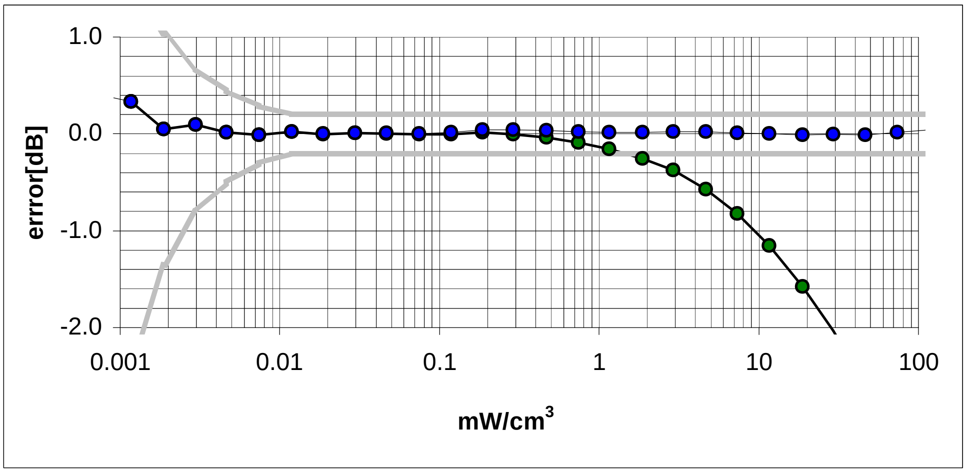
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range f(SAR_{brain})

(TEM-Cell:ifi110)

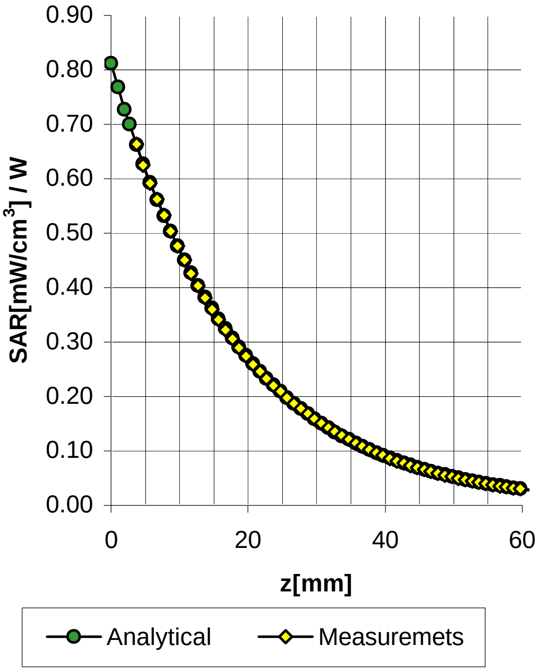




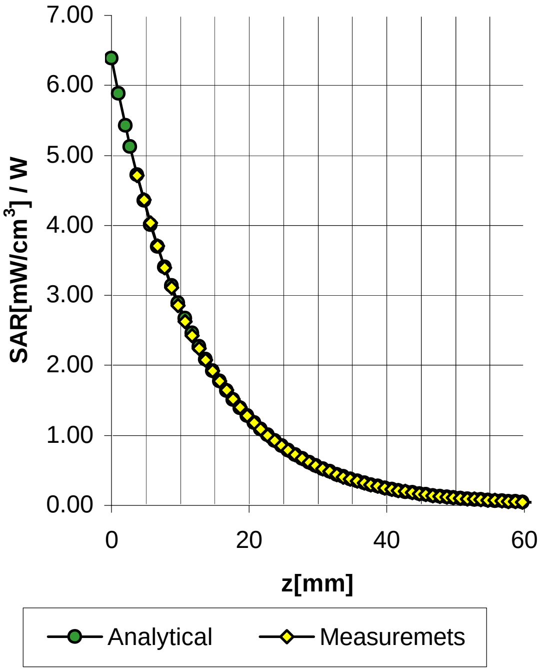
ET3DV6 SN:1590

Conversion Factor Assessment

f = 900 MHz, WG R9 (head)



f = 1800 MHz, WG R22 (head)



Head	**900 MHz**	e_r **= 42 ± 5%**	s **= 0.97 ± 10% mho/m**

ConvF X	**6.83**	± 7% (k=2)	Boundary effect:	
ConvF Y	**6.83**	± 7% (k=2)	Alpha	**0.37**
ConvF Z	**6.83**	± 7% (k=2)	Depth	**2.48**

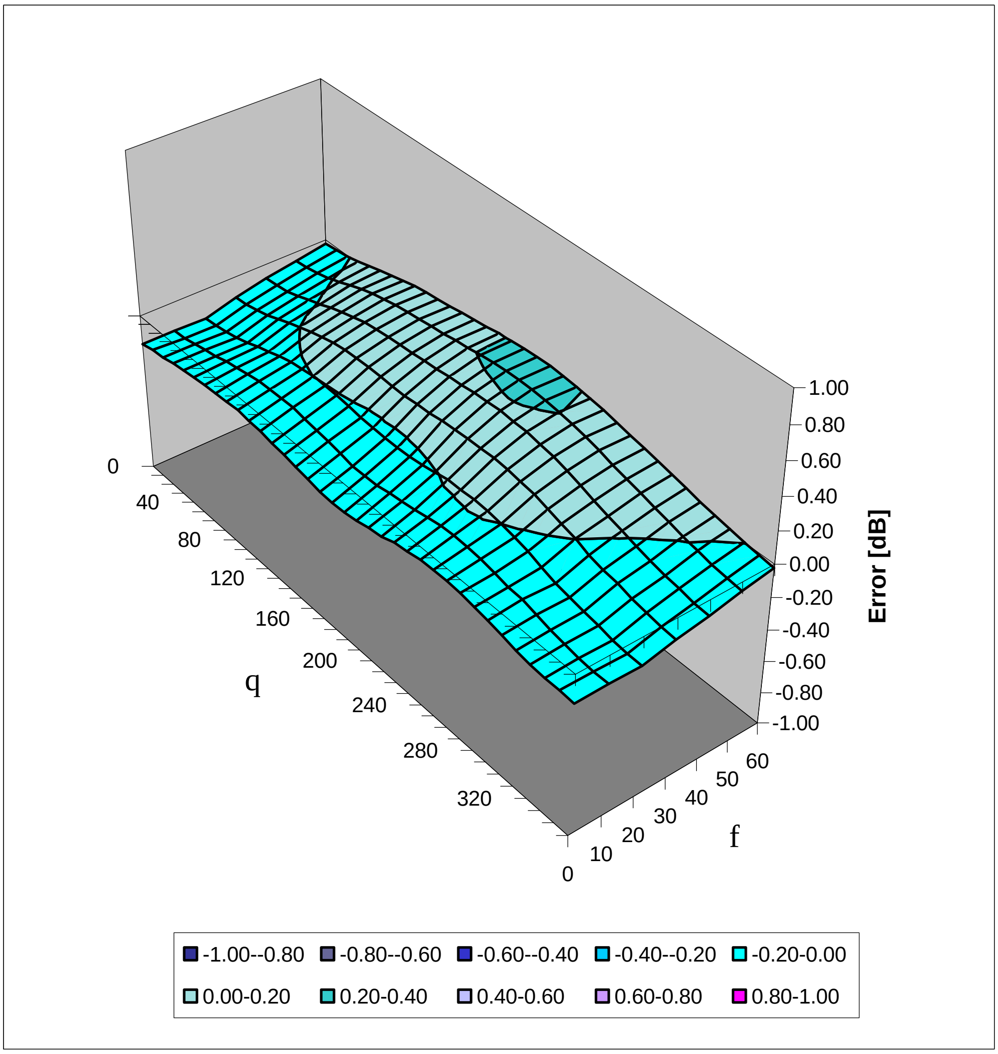
Head	**1800 MHz**	e_r **= 40 ± 5%**	s **= 1.40 ± 10% mho/m**

ConvF X	**5.78**	± 7% (k=2)	Boundary effect:	
ConvF Y	**5.78**	± 7% (k=2)	Alpha	**0.53**
ConvF Z	**5.78**	± 7% (k=2)	Depth	**2.01**

ET3DV6 SN:1590

Deviation from Isotropy in HSL

Error (q,f), f = 900 MHz



APPENDIX D - SAR TEST SETUP PHOTOGRAPHS

FACE-HELD SAR TEST SETUP PHOTOGRAPHS
with 2.5cm Separation Distance

BODY-WORN SAR TEST SETUP PHOTOGRAPHS
with 1.0cm Belt-Clip