Certificate Number: 1449-02

MOTOROLA

CGISS EME Test Laboratory

8000 West Sunrise Blvd
Fort Lauderdale, FL. 33322

S.A.R. EME Compliance Test Report

Date of Report: September 22, 2003
Report Revision: Rev. A
Manufacturer: Motorola
Product Description: iDEN 1:6, 2:6, 81:120 TDM; 64 QAM, 16 QAM & QSPK Modulation; 0.600W Pulse Average
FCC ID: **AZ489FT5815**
Device Model: H40XAH6RR1BN/H58XAH6RR7AN

Test Period: 7/23/03 & 9/12/03
EME Technician: Clint Miller
EME Engineer: Kim Uong (Lead EME Engineer)
Author: Michael Sailsman (Global EME Regulatory Affairs Liaison)

Note: Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 2.0 of this report.

Signature on File — 9/22/03

Ken Enger
Senior Resource Manager, Laboratory Director, CGISS EME Lab

Date Approved

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REVISION HISTORY

Date	Revision	Comments
7/3/02	O	Current Release on file with FCC
9/22/03	A	Disclosure of Mini Keyboard accessory compliance results

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (S.A.R.) measurements performed at the CGISS EME Test Lab for FCC ID: AZ489FT5815. A mini keyboard option model NNTN4877A is being offered for the applicable derivative models that are covered by this FCC ID. This report discloses updated compliance results.

The applicable exposure environment is General Population/Uncontrolled.

The test results included herein represent the highest S.A.R. levels applicable to this product and clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 1.6 mW/g per the requirements of 47 CFR 2.1093(d).

2.0 Reference Standards and Guidelines

This product is designed to comply with the following national and international standards and guidelines.

- United States Federal Communications Commission, Code of Federal Regulations; 47CFR part 2 sub-part J
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Terminal frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Terminal communications (Electromagnetic Radiation - Human Exposure) Standard 2003
- ANATEL, Brazil Regulatory Authority, Resolution 256 (April 11, 2001) "additional requirements for SMR, cellular and PCS product certification."

3.0 Description of Test Sample

FCC ID: AZ489FT5815, iDEN digital multi-service data capable phone models H58XAH6RR7AN (i88s/i58sr) and H40XAH6RR1BN (i85s). The i88s, i58sr, and i85s operates using 1:6, 2:6, 81:120 TDM; 64 QAM, 16 QAM & QPSK modulation. Transmission employs time division multiplexing with a duty cycle ranging from 16.67% to 33.33% using 16-QAM for voice or circuit data transmissions. Packet data transmission is also supported up to a maximum duty cycle of 67.5% depending on the modulation used. The i88s and i58sr has GPS functionality. The intended functional use is by the general population handheld at the head or by two-way PTT operation 1 to 2 inches in front of the face. The phone may also be mounted to a person or vehicle with the offered options and accessories. In addition, the phone may also be connected to a personal computer or digital assistant using a data cable interface.

FCC ID: AZ489FT5815 is capable of operating in the 806-825 MHz and 896-901 MHz bands. The rated power is 0.60 watts with a maximum output capability of 0.70 watts as defined by the upper limit of the production line final test station.

The following accessories were assessed with FCC ID: AZ489FT5815. All other options and accessories offered for this ID were disclosed during the respective product compliance certification.

Battery:

SNN5717C	450 mAh Lithium Ion
NNTN4655A	1350 mAH Lithium Ion (Maximum Capacity)
NTN9343A	Maximum capacity battery cover
NTN9345A	Slim battery cover

Attached accessory:

NNTN4877A	Mini-Keyboard for text usage

3.1 Test Signal

Test Signal mode:

Test Mode	X	Base Station		Simulator	

Transmission Mode:

CW	
Native Transmission	**X**
TDM: 81:120	**X**
Other	

3.2 Test Output Power

Output power was measured before each test. The DASY 3 system's S.A.R. drift function was used to determine the power slump characteristic of the device. A characteristic power slump table based on 50 ohms measurements is provided in APPENDIX A for the battery producing the highest S.A.R. results.

4.0 Description of Test Equipment

4.1 Descriptions of S.A.R. Measurement System

The laboratory utilizes a Dosimetric Assessment System (DASY3™) S.A.R. measurement system manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot with an ET3DV6 E-Field probe. Please reference the

SPEAG user manual and application notes for detailed probe, robot, and S.A.R. computational procedures.
The S.A.R. measurements were conducted with probe model/serial number ET3DV6/SN1547 & 1383. The system performance check was conducted daily and within 24 hours prior to testing. DASY output files of the system performance test results and the probe/dipole calibration certificates are included
in appendices C and D respectively. The table below summarizes the system performance check results normalized to 1W.

Probe Serial #	Tissue Type	Probe Cal Date	Dipole Kit / Serial #	System Perf. Result when normalized to 1W (mW/g)	Reference S.A.R @ 1W (mW/g)	Test Date(s)
1383	FCC Body	2/26/03	SPEAG D900V2 MHz /084	11.43 +/- 0.00	11.99 +/- 10%	7/23/03
1547	FCC Body	9/28/02	SPEAG D900V2 MHz /084	11.31 +/- 0.00	11.99 +/- 10%	9/12/03

Note: see APPENDIX C for an explanation of the reference S.A.R. targets stated above.

The DASY3™ system is operated per the instructions in the DASY3™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess EME S.A.R. compliance was calibrated according to 17025 A2LA guidelines.

4.2 Description of Phantom

4.2.1 Flat Phantom

A rectangular shaped box made of loss acrylic material. The phantom is mounted on a wooden supporting structure that has a loss tangent of < 0.05. The structure has a 60.96 cm x 15.24 cm opening at its center to allow positioning the DUT to the phantom's surface. The flat phantom dimensions used for S.A.R. performance assessment at the abdomen is L=40cm, W=23cm, H=20cm with a surface thickness of 0.2cm .

4.2.2 SAM Phantom

SAM Phantom assessment was not applicable for this filing.

4.3 Simulated Tissue Properties

4.3.1 Type of Simulated Tissue

The simulated tissue used is compliant to that specified in FCC Supplement C (Edition 01 - 01) to OET Bulletin 65 (Edition 97 - 01).

Simulated Tissue	Body Position
FCC Body	Torso

4.3.2 Simulated Tissue Composition

Tissue Ingredient (%) @ 900 MHz		
	Head	**Body**
Sugar	56.5	44.9
DGBE (Glycol)	-	-
De ionized -Water	40.95	53.06
Salt	1.45	0.94
HEC	1.0	1.0
Bact.	0.1	0.1

Characterization of Simulated tissue materials and ambient conditions:

Simulated tissue prepared for S.A.R. measurements is measured daily and within 24 hours prior to actual S.A.R. testing to verify that the tissue is within 5% of target parameters at the center of the transmit band. This measurement is done using the Agilent (HP) probe kit model 85070C and a HP8753D Network Analyzer.

Target tissue parameters

FCC Body				
Frequency (MHz)	**Di-electric Constant Target**	**Di-electric Constant Meas. (Range)**	**Conductivity Target S/m**	**Conductivity Meas. (Range) S/m**
900	55.0	52.4-52.5	1.05	1.02-1.05
813	55.3	53.1-53.2	0.97	0.93-0.95

4.4 Test conditions

The EME Laboratory ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within +/ - 2^{o}C of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was 15cm +/- 0.5cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not actively in process in order to minimize evaporation. The lab environment is continuously monitored. The table below presents the range and average environmental conditions during the S.A.R. tests reported herein:

	Target	Measured
Ambient Temperature	20 - 25 ˚C	Range: 21.5-23.5˚C Avg. 22.7˚C
Relative Humidity	30 - 70 %	Range: 40.7-45.9% Avg. 42.3%
Tissue Temperature	NA	Range: 20.5-21.5˚C Avg: 21.10˚C

The EME Lab RF environment uses a Spectrum Analyzer to monitor for extraneous large signal RF contaminants that could possibly affect the test results. If such unwanted signals are discovered the S.A.R scans are repeated. However, the lab environment is sufficiently protected such that no S.A.R. impacting interference has been experienced to date.

5.0 Description of Test Procedure

The mini keyboard accessory option was assessed while attached to the DUT that was separated 2.5cm from the flat phantom with the antenna retracted and extended. All assessments were done using the flat phantom with the DUT in 81:120 mode using FCC body tissue parameters.

5.1 Device Test Positions

Reference figure 1 for the device orientation and position which exhibited the highest S.A.R. performance.

5.1.1 Abdomen

The DUT was positioned with 2.5cm separation distance from the flat phantom.

5.1.2 Head

Assessments at the head was not applicable for this filing

5.1.3 Face

Assessments at the head was not applicable for this filing

5.2 Test Position Photographs

Figure 1: Highest S.A.R. Test Position
(DUT with attached mini-keyboard)

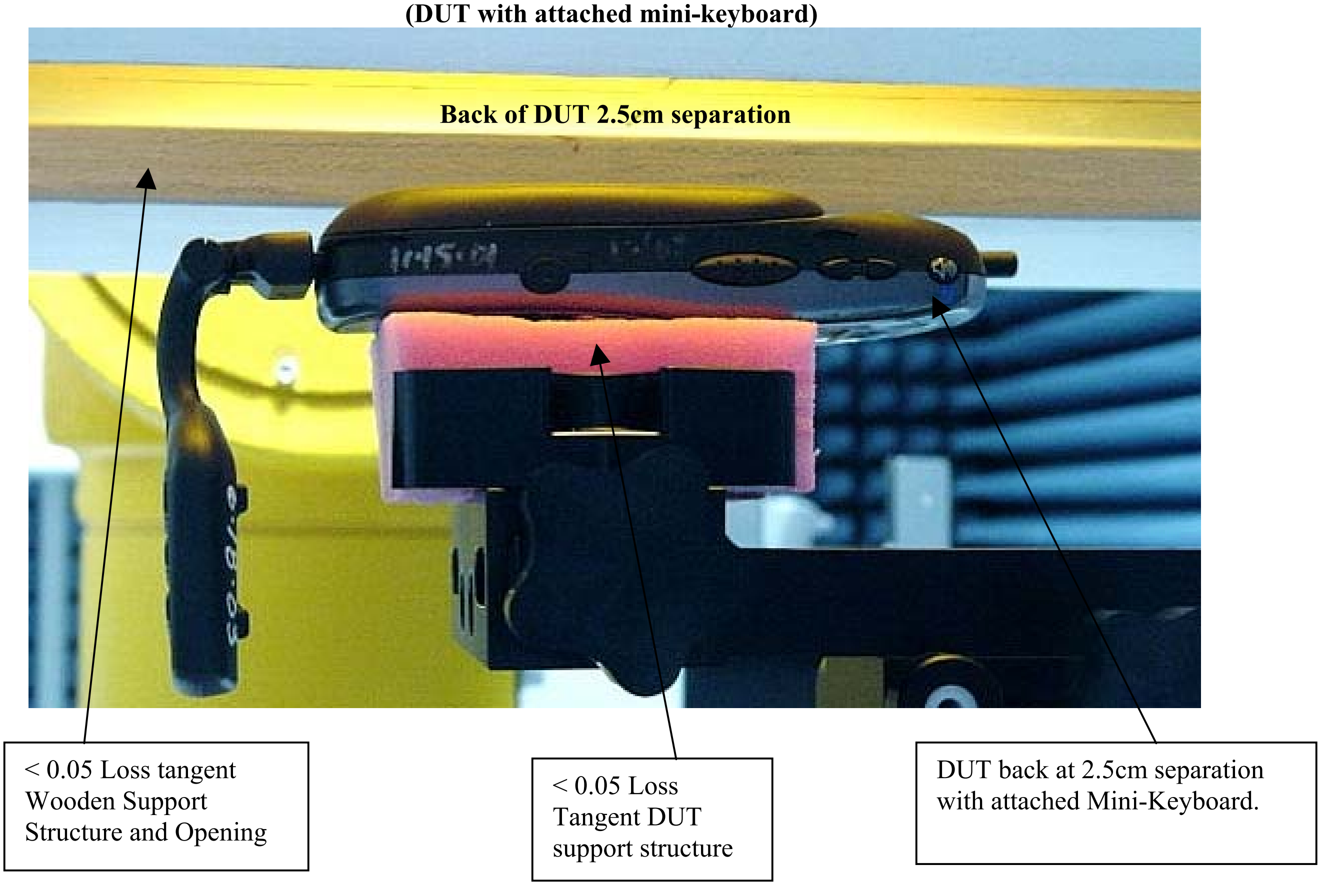
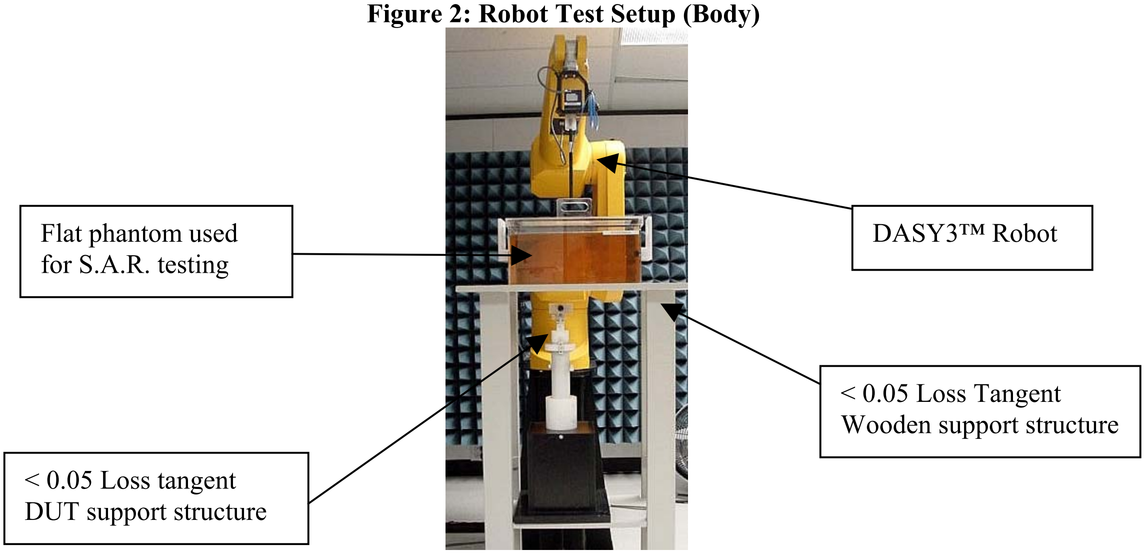


Figure 2: Robot Test Setup (Body)



5.3 Probe Scan Procedures

The E-field probe first scans a coarse grid over a large area inside the phantom in order to locate the interpolated maximum S.A.R. distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

6.0 Measurement Uncertainty

Uncertainty Budget for Device Under Test

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**Section of IEEE P1528**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	c_i (1 g)	c_i (10 g)	**1 g** u_i (±%)	**10 g** u_i (±%)	v_i
Measurement System									
Probe Calibration	E.2.1	4.8	N	1.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	5.7	R	1.73	1	1	3.3	3.3	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	1.3	R	1.73	1	1	0.8	0.8	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.6	N	1.00	1	1	3.6	3.6	29
Device Holder Uncertainty	E.4.1	2.8	N	1.00	1	1	2.8	2.8	8
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Combined Standard Uncertainty			RSS				12	11	1361
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				23	22	

Uncertainty Budget for System Performance Check (dipole & flat phantom)

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	Sec.	**Tol. (± %)**	**Prob. Dist.**	**Div.**	c_i **(1 g)**	c_i **(10 g)**	**1 g** u_i **(±%)**	**10 g** u_i **(±%)**	v_i
Measurement System									
Probe Calibration	E.2.1	4.8	N	1.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	5.7	R	1.73	1	1	3.3	3.3	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	1.0	R	1.73	1	1	0.6	0.6	∞
Input Power and SAR Drift Measurement	8, 6.6.2	4.7	R	1.73	1	1	2.7	2.7	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Combined Standard Uncertainty			RSS				10	9.4	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				20	18	

Notes for Tables 1 and 2
a) Column headings *a-k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty.

7.0 S.A.R. Test Results

All S.A.R. results obtained by the tests described in Section 5.0 are listed in section 7.1 below. The bolded result indicates the highest observed S.A.R. performance. DASY3™ S.A.R. measurement scans are provided in APPENDIX B for the highest observed S.A.R.

7.1 S.A.R. results

Run Number/ SN	Freq. (MHz)	Antenna/Pos.	Battery	Test position	Body- worn Acc.	Additional attachments	Initial Power (W)	S.A.R. Drift (dB)	Measured 1g-S.A.R. (mW/g)	Max Calc. 1g-S.A.R. (mW/g)	Meas. 10g-S.A.R. (mW/g)	Max Calc. 10g-S.A.R. (mW/g)
Assessment of mini keyboard w/ 2.5cm separation (model H40XAH6RR1BN); Mode 81:120												
CM-R2-030723-03/919ABW03W9	814	8585197D02/ Out	SNN5717C	Back 2.5cm	None	NNTN4877A	0.709	-1.470	0.460	0.65	0.335	0.47
CM-R2-030723-04/919ABW03W9	814	8585197D02/ In	SNN5717C	Back 2.5cm	None	NNTN4877A	0.682	-0.990	0.657	**0.85**	0.476	0.61
Assessment of mini keyboard w/ 2.5cm separation (model H58XAH6RR7AN i88s); Mode 81:120												
KU-R2-030912-04/919ACQ0Y3N	825	8585197D02/ Out	NNTN4655A	Back 2.5cm	None	NNTN4877A	0.692	0.04	0.282	0.29	0.206	0.21
KU-R2-030912-05/919ACQ0Y3N	825	8585197D02/ In	NNTN4655A	Back 2.5cm	None	NNTN4877A	0.680	0.10	0.217	0.22	0.159	0.16
Assessment of mini keyboard w/ 2.5cm separation (model H58XAH6RR7AN i58sr); Mode 81:120												
KU-R2-030912-06/919ACQ0Y3N	825	8585197D02/ Out	NNTN4655A	Back 2.5cm	None	NNTN4877A	0.696	0.13	0.291	**0.29**	0.212	0.21

7.2 Peak S.A.R. location

Refer to APPENDIX B for detailed S.A.R. scan distributions.

7.3 Highest S.A.R. results calculation methodology

The calculated maximum 1-gram and 10-gram averaged S.A.R. values are determined by scaling the measured S.A.R. to account for power leveling variations and power output slump below the reported maximum power during the S.A.R. measurements. For this device the Maximum Calculated 1-gram and 10-gram averaged peak S.A.R. is calculated using the following formula:

Max. Calc. 1-g and 10-g Avg. SAR = ((S.A.R. meas. / (10^(Pdrift/10))*(Pmax/Pint))* DC%)
P_{max} = Maximum Power (W)
P_{int} = Initial Power (W)
Pdrift = DASY drift results (dB)
$SAR_{meas.}$ = Measured 1 gram averaged peak S.A.R. (mW/g)
DC % = Transmission mode duty cycle in % where applicable

8.0 Conclusion

The highest applicable Operational Maximum Calculated 1-gram and 10-gram average S.A.R. values found for FCC ID: AZ489FT5815 using the mini keyboard option model NNTN4877A are:

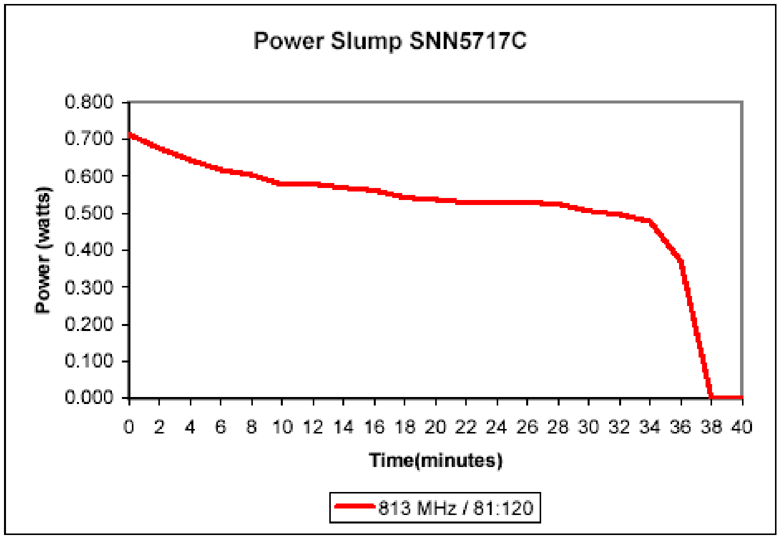
At the body: 1-g Avg. = 0.85 mW/g; 10-g Avg. = 0.61 mW/g

The previously reported highest maximum calculated 1-gram compliance results for FCC ID: AZ489FT5815 were 0.59 mW/g at the body.
The current reported compliance results for FCC ID: AZ489FT5815 supercedes the previously reported results.

These test results clearly demonstrate compliance with FCC General Population/Uncontrolled RF Exposure limits of **1.6 mW/g** per the requirements of 47 CFR 2.1093(d).

APPENDIX A
Power Slump Data

	813 MHz / 81:120
Time	power(mw)
0	0.713
2	0.676
4	0.644
6	0.618
8	0.604
10	0.578
12	0.579
14	0.569
16	0.562
18	0.543
20	0.537
22	0.530
24	0.531
26	0.530
28	0.525
30	0.506
32	0.497
34	0.478
36	0.371
38	0.000
40	0.000

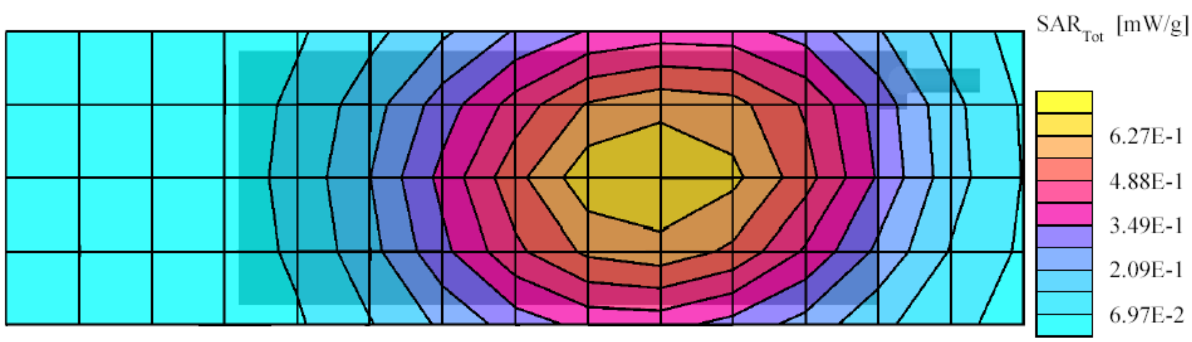


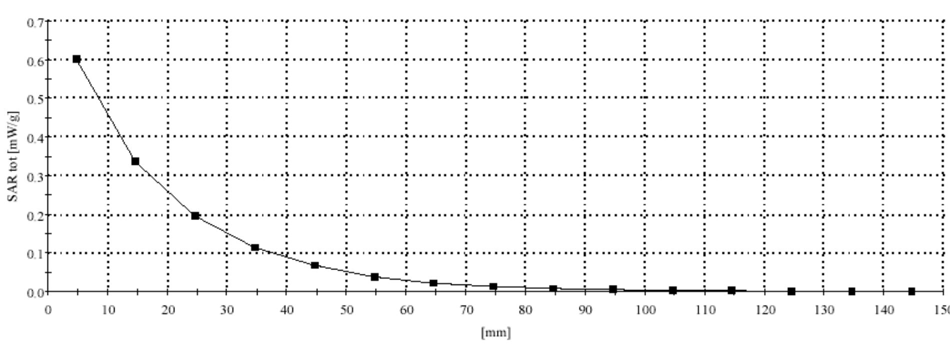
APPENDIX B
Data Results

FCC ID: AZ489FT5815; Test Date: 07/23/03
Motorola CGISS EME Laboratory
RUN #: Ab-R2-030723-04
MODEL #: H40XAH6RR1BN S/N: 919ABW03W9
TX FREQ: 813.5125
Simulated tissue temp: 20.5C
Start power : 0.682 W

ANTENNA KIT #: 8585197D02/Retracted
BATTERY KIT #: SNN5717C
Body worn ACCESSORIES: None
AUDIO ACCESSORIES: None
Attached accessory Kit #: NNTN4877A

DUT back separated 2.5cm w/ attached Mini keyboard
Flat Phantom; Flat Abdomen Back Section; Position: (90°,90°);
Probe: ET3DV6 - SN1547 (Cal Date 09-28-2002); ConvF(6.20,6.20,6.20); Probe cal date: 28/09/02; Crest factor: 1.5; FCC Body 813: σ = 0.95 mho/m ε = 53.1 ρ = 1.00 g/cm3; DAE3V1-SN401 Cal. Date 8/26/02
Cube 7x7x7: SAR (1g): 0.657 mW/g, SAR (10g): 0.476 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0; Max at 30.0, 130.5, 4.7
Power drift: -0.990 dB



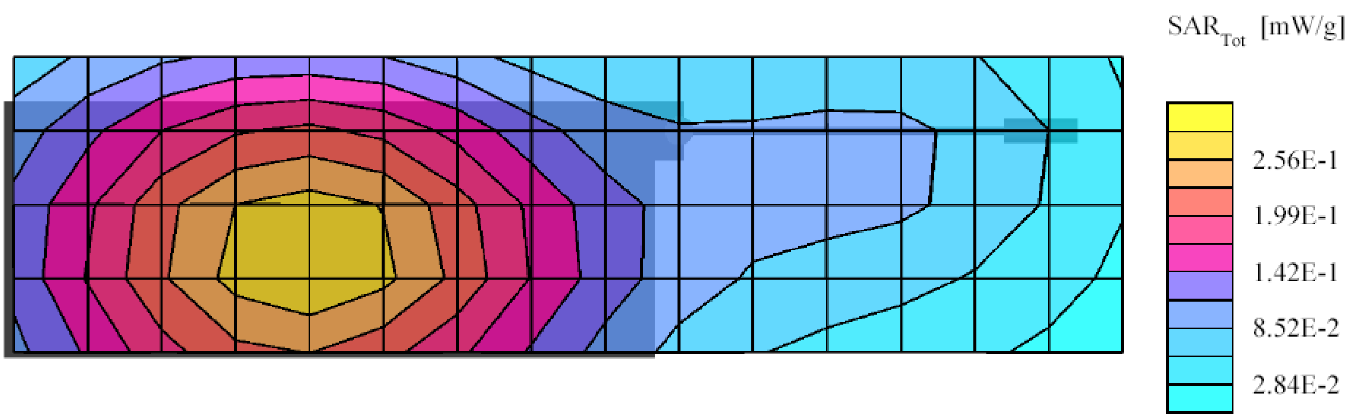


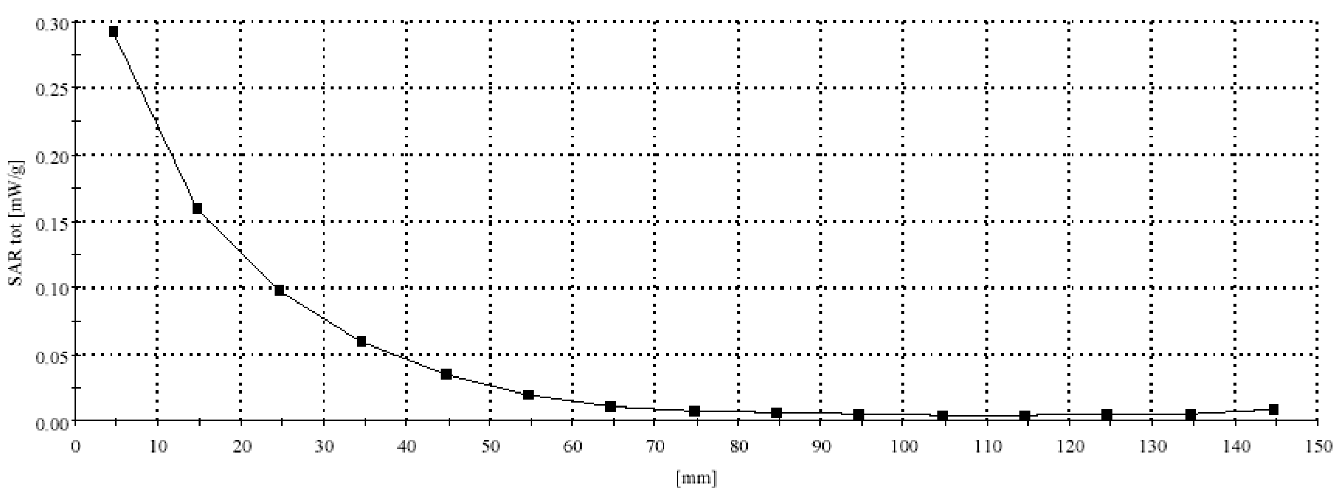
FCC ID: AZ489FT5815; Test Date: 09/12/03
Motorola CGISS EME Laboratory

RUN #: KU-R2-030912-06
MODEL #: i58sr-H58XAH6RR7AN S/N: 919ACQ0Y48
Tx freq: 824.9875
Simulated tissue temp: 21.5
Start power : 0.696 W

Antenna position: Out
Battery kit: NNTN4655A(NTN9343A)
Carry Accessories: None, back - radio at 2.5cm
Audio/data accessories: NNTN4877A Mini keyboard

DUT back separated 2.5cm w/ attached Mini keyboard
Flat Phantom; Flat Abdomen (1) Section; Position: (90°,90°);
Probe: ET3DV6 - SN1383 (Cal Date 26 February 2003); ConvF(6.30,6.30,6.30); Probe cal date: 26/02/03; Crest factor: 1.5;
FCC Body 813: σ = 0.93 mho/m ε = 53.2 ρ = 1.00 g/cm3; DAE3V1SN406(11/11/02)
Cube 7x7x7: SAR (1g): 0.291 mW/g, SAR (10g): 0.212 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0; Max at 42.0, 60.0, 4.7
Power drift: 0.13dB





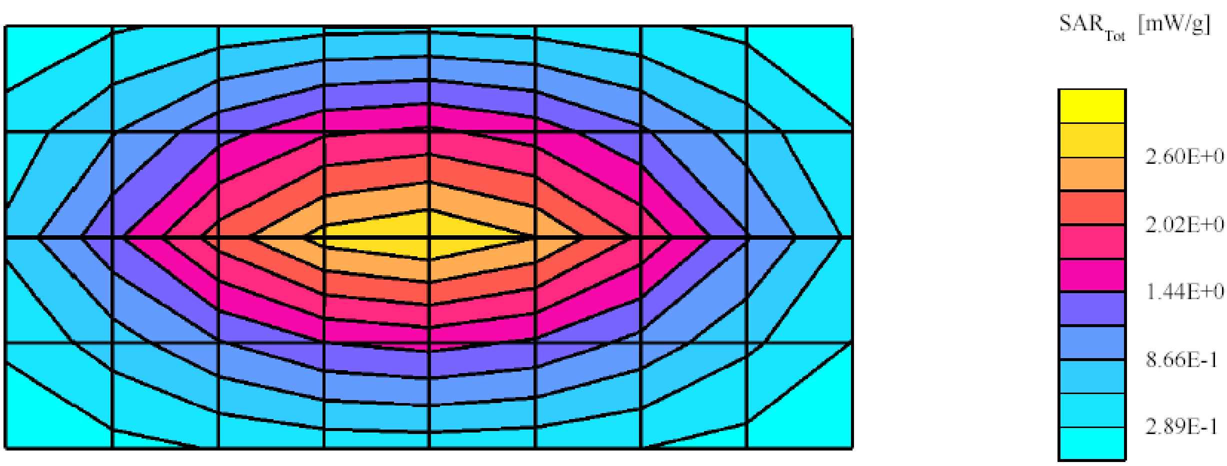
APPENDIX C
Dipole System Performance Check Results

Dipole validations at the head and body from SPEAG are provided in APPENDIX D herein. The CGISS EME lab validated the SPEAG dipole to the applicable SPEAG system performance targets. System validation was performed using FCC body tissue parameters to generate the system performance target values for body at the applicable frequency. The results of the CGISS' respective EME daily system performance checks as well as the new target assessment at the body are provided in this appendix.

CGISS Dipole 900MHz; SN 084; Test Date: 07/23/03
Motorola CGISS EME Lab
Run #: System perf R2-030723-01
TX Freq: 900 MHz
Sim Tissue Temp: 20.8 (Celsius)
Start Power; 250mW

Target:
11.99W/g for 1g SAR, 7.58mW/g for 10g SAR, +/- 10% from system performance target.
SAR calculated 1g is 11.43 mW/g percent from target (including drift) is -4.7%
SAR Calculated 10g is 7.30 mW/g Percent from target (including drift) is -3.7%

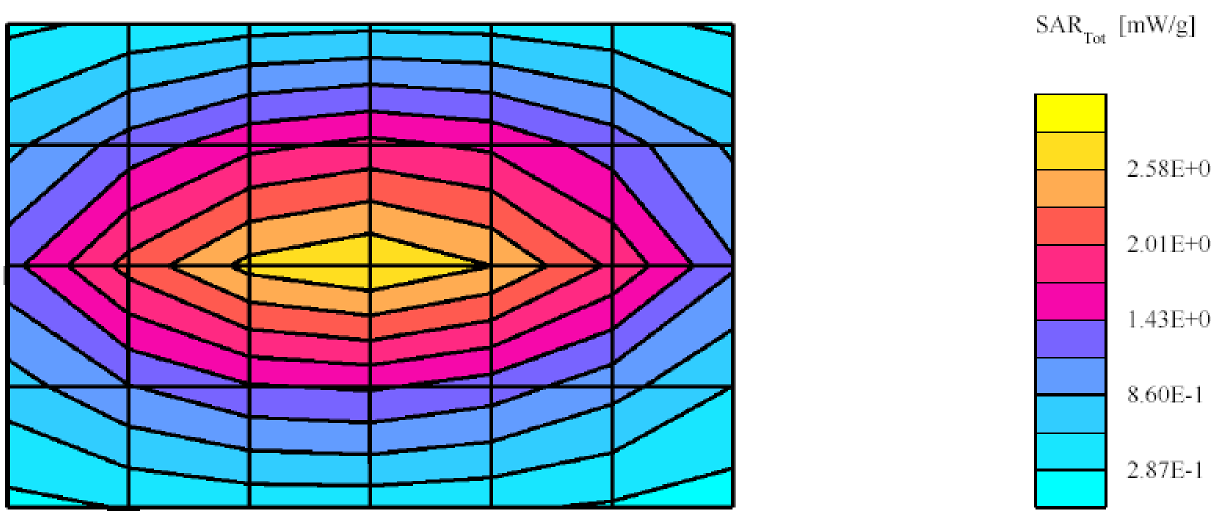
Flat Phantom; Probe: ET3DV6 - SN1547 (Cal Date 09-28-2002);Probe Cal Date: 28/09/02ConvF(6.20,6.20,6.20); Crest factor: 1.0; FCC Body 900: σ = 1.05 mho/m ε = 52.5 ρ = 1.00 g/cm3; DAE3V1-SN401 Cal. Date 8/26/02
Cubes (2): Peak: 4.43 mW/g ± 0.03 dB, SAR (1g): 2.85 mW/g ± 0.01 dB, SAR (10g): 1.82 mW/g ± 0.01 dB, (Worst-case extrapolation) Penetration depth: 12.2 (11.2, 13.4) [mm]
Power drift: -0.01 dB



CGISS Dipole 900MHz; SN 084; Test Date: 09/12/03
Motorola CGISS EME Lab
Run #: Sys Perf R2-030912-01
TX Freq: 900 MHz
Tx Freq: 900MHz
Simulated tissue temp: 21.7 C
Start power: 250mW

Target:
11.99 mW/g for 1g SAR, 7.58 mW/g for 10g SAR, +/- 10% from system performance target 1/16/03.
SAR calculated 1g is 11.31 mW/g percent from target (including drift) is -5.7%
SAR Calculated 10g is 7.18 mW/g Percent from target (including drift) is -5.32 %

Flat; Probe: ET3DV6 - SN1383 (Cal Date 26 February 2003);Probe Cal Date: 26/02/03ConvF(6.30,6.30,6.30); Crest factor: 1.0;
FCC Body 900: σ = 1.02 mho/m ε = 52.4 ρ = 1.00 g/cm3; DAE3V1SN406 (11/11/02)
Cubes (2): Peak: 4.41 mW/g ± 0.01 dB, SAR (1g): 2.82 mW/g ± 0.01 dB, SAR (10g): 1.79 mW/g ± 0.01 dB, (Worst-case extrapolation) Penetration depth: 12.1 (11.2, 13.4) [mm]
Power drift: -0.01 dB



SYSTEM PERFORMANCE CHECK TARGET SAR

Date:	05/22/03	Frequency (MHz):	900
Lab Location:	CGISS	Mixture Type:	900-FCC Body
Robot System:	CGISS-2	Ambient Temp.(°C):	20.9
Probe Serial #:	1547	Tissue Temp.(°C):	21.0
DAE Serial #:	DAE3V1 SN401		

Tissue Characteristics		Phantom Type/SN:	80302002A/S8
Permitivity:	53.9	Distance (mm):	15
Conductivity:	1.07		

Reference Source: Dipole (Dipole/Handset)
Reference SN: 084

Power to Dipole: 250 mW

Measured SAR Value: 2.99 mW/g, 1.89 mW/g (10g avg.)
Power Drift: -0.01 dB

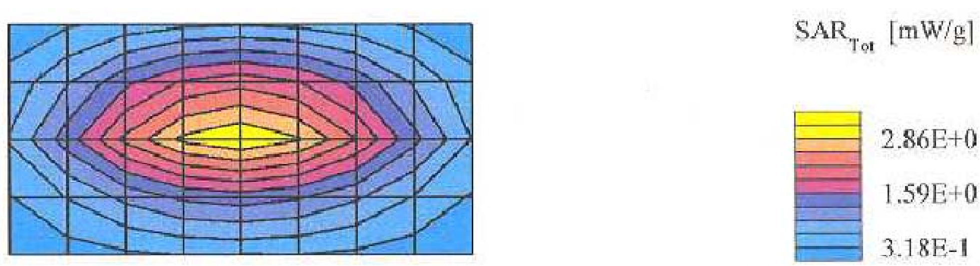
New Target/Measured SAR Value: (normalized to 1.0 W, with drift compensation) 11.99 mW/g, 7.58 mW/g (10g avg.)

Test performed by: Kim Uong Initial: KU

Dipole D900V2 SN084; Test Date: 05/22/03

Run #: 0305022-06 Phantom #:80302002A/S8
Model#: SPEAG dipole D900V2 SN084
Robot#: CGISS-2 DAE: DAE3V1 SN374 (2/11/02) Tester: Kim Uong
Tx Freq:900MHz Simulated tissue temp: 21.0C, Ambient :20.9C
Start power: 250mW
Target:
11.8mW/g for 1g-SAR, 7.52mW/g for 10g-SAR, +/-12% from SPEAG Dipole certificate 2/11/02

Flat Phantom; Section;
Probe: ET3DV6 - SN1547 (Cal Date 09-28-2002); ConvF(6.20,6.20,6.20); Probe cal date: 28/09/02; Crest factor: 1.0; FCC Body 900: σ = 1.07 mho/m ε_r = 53.9 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 2.99 mW/g ± 0.03 dB, SAR (10g): 1.89 mW/g ± 0.03 dB, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0; Max at 28.5, 60.0, 4.0
Powerdrift: -0.01 dB



Motorola CGISS EME Lab

APPENDIX D
Calibration Certificates

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client Motorola CGISS

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1383
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	February 26, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	8-Mar-02	Mar-03
Power sensor HP 8481A	MY41092180	18-Sep-02	Sep-03
Power meter EPM E4419B	GB41293874	13-Sep-02	Sep-03
Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01	Sep-03

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: February 26, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

DASY - Parameters of Probe: ET3DV6 SN:1383

Sensitivity in Free Space

NormX	1.80	$\mu V/(V/m)^2$
NormY	1.55	$\mu V/(V/m)^2$
NormZ	1.62	$\mu V/(V/m)^2$

Diode Compression

DCP X	93	mV
DCP Y	93	mV
DCP Z	93	mV

Sensitivity in Tissue Simulating Liquid

Head 900 MHz ε_r = 41.5 ± 5% σ = 0.97 ± 5% mho/m
Head 835 MHz ε_r = 41.5 ± 5% σ = 0.90 ± 5% mho/m

ConvF X	6.5	± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.5	± 9.5% (k=2)	Alpha	0.59
ConvF Z	6.5	± 9.5% (k=2)	Depth	1.97

Head 1800 MHz ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m
Head 1900 MHz ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

ConvF X	5.2	± 9.5% (k=2)	Boundary effect:	
ConvF Y	5.2	± 9.5% (k=2)	Alpha	0.57
ConvF Z	5.2	± 9.5% (k=2)	Depth	2.54

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR_{be} [%]	Without Correction Algorithm	10.0	5.2
SAR_{be} [%]	With Correction Algorithm	0.1	0.5

Head 1800 MHz Typical SAR gradient: 10 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR_{be} [%]	Without Correction Algorithm	15.1	9.9
SAR_{be} [%]	With Correction Algorithm	0.2	0.0

Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	0.5 ± 0.2	mm

Schmid & Partner
Engineering AG

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

Additional Conversion Factors

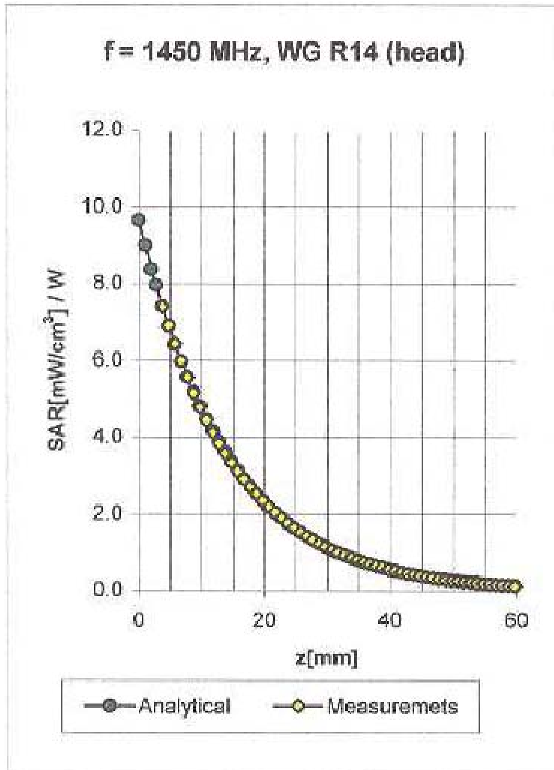
for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1383**
Place of Assessment:	**Zurich**
Date of Assessment:	**February 28, 2003**
Probe Calibration Date:	**February 26, 2003**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:

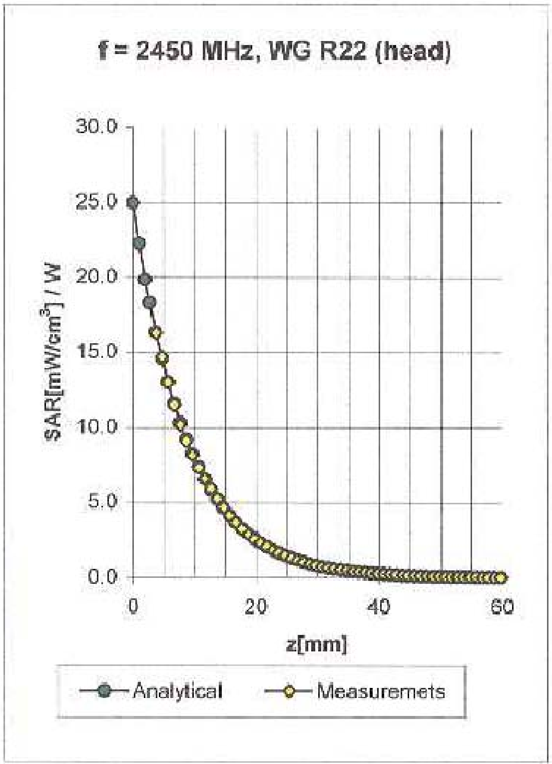
Conversion Factor Assessment

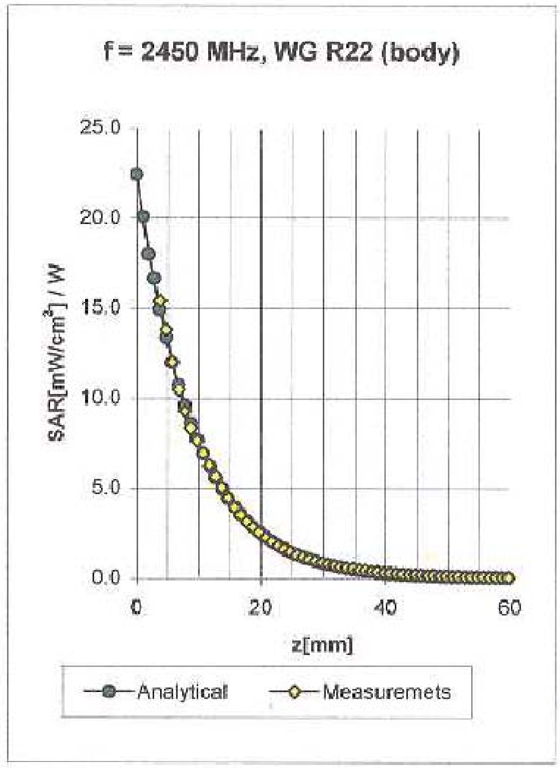


Head	1450 MHz	ε_r = 40.4 ± 5%	σ = 1.23 ± 5% mho/m

ConvF X	**5.8** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.8** ± 8.9% (k=2)	Alpha	**0.75**
ConvF Z	**5.8** ± 8.9% (k=2)	Depth	**1.91**

Conversion Factor Assessment

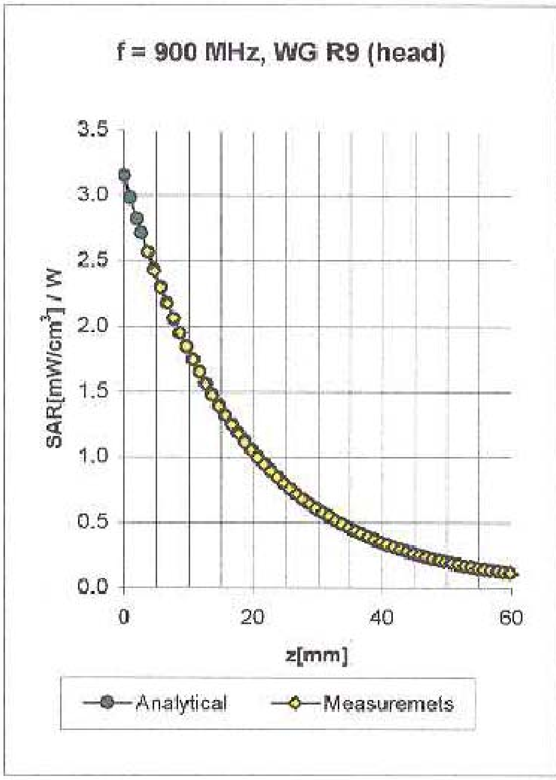


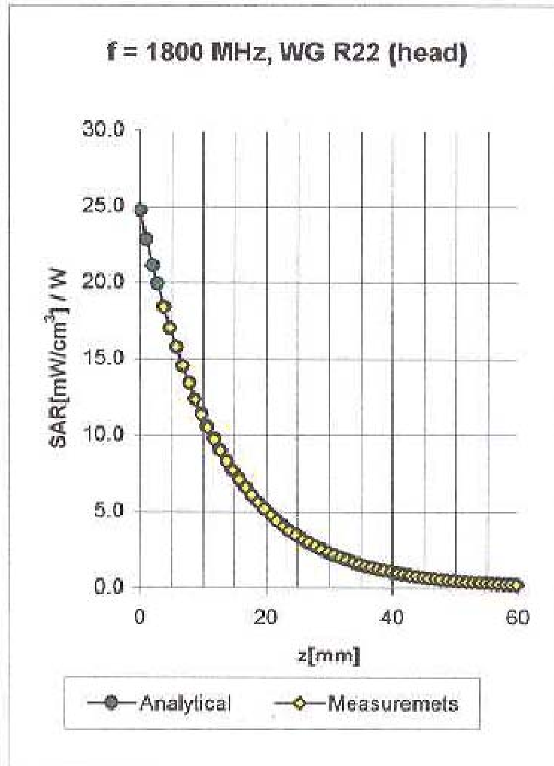


Head	**2450**	**MHz**	ε_r = **39.2 ± 5%**	σ = **1.80 ± 5% mho/m**	
	ConvF X	**5.0** ± 8.9% (k=2)		Boundary effect:	
	ConvF Y	**5.0** ± 8.9% (k=2)		Alpha	**1.15**
	ConvF Z	**5.0** ± 8.9% (k=2)		Depth	**1.76**

Body	**2450**	**MHz**	ε_r = **52.7 ± 5%**	σ = **1.95 ± 5% mho/m**	
	ConvF X	**4.7** ± 8.9% (k=2)		Boundary effect:	
	ConvF Y	**4.7** ± 8.9% (k=2)		Alpha	**2.00**
	ConvF Z	**4.7** ± 8.9% (k=2)		Depth	**1.24**

Conversion Factor Assessment



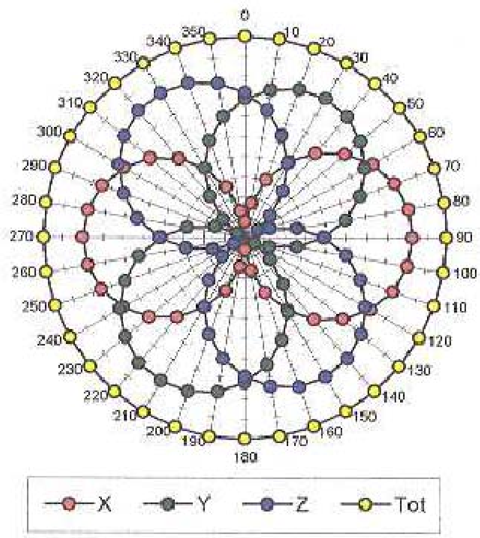


Head	900 MHz		ε_r = 41.5 ± 5%	σ = 0.97 ± 5% mho/m	
Head	835 MHz		ε_r = 41.5 ± 5%	σ = 0.90 ± 5% mho/m	
	ConvF X	6.5	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	6.5	± 9.5% (k=2)	Alpha	0.59
	ConvF Z	6.5	± 9.5% (k=2)	Depth	1.97

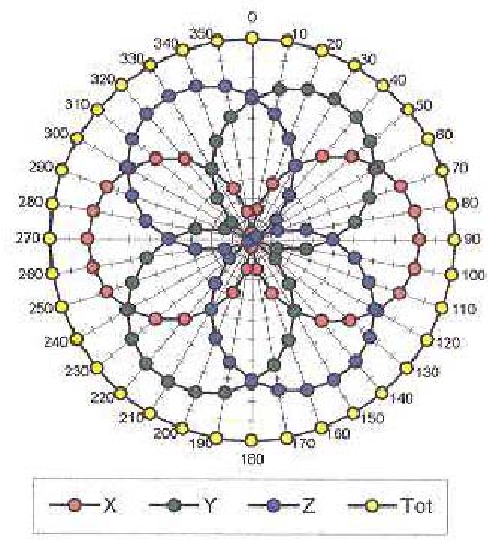
Head	1800 MHz		ε_r = 40.0 ± 5%	σ = 1.40 ± 5% mho/m	
Head	1900 MHz		ε_r = 40.0 ± 5%	σ = 1.40 ± 5% mho/m	
	ConvF X	5.2	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	5.2	± 9.5% (k=2)	Alpha	0.57
	ConvF Z	5.2	± 9.5% (k=2)	Depth	2.54

Receiving Pattern (ϕ), θ = 0°

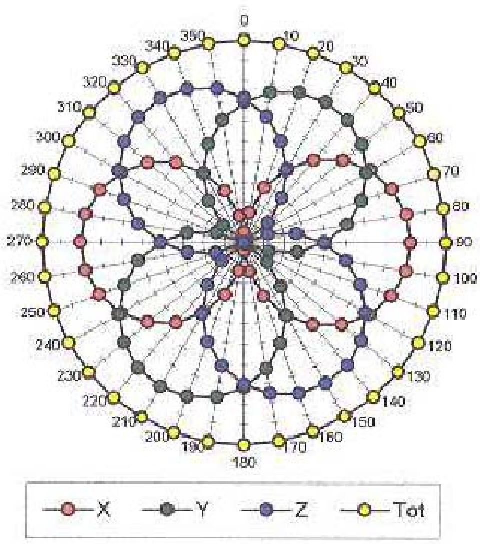
f = 30 MHz, TEM cell ifi110



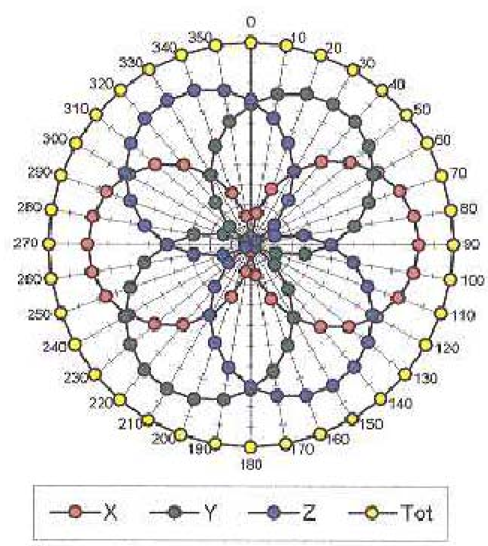
f = 100 MHz, TEM cell ifi110

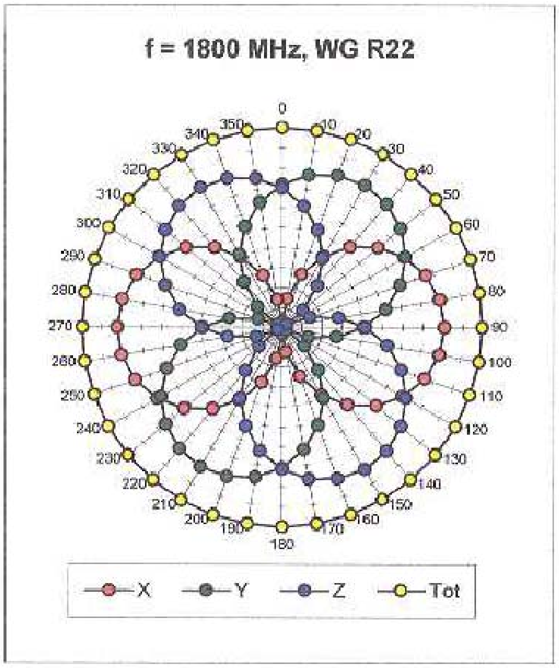


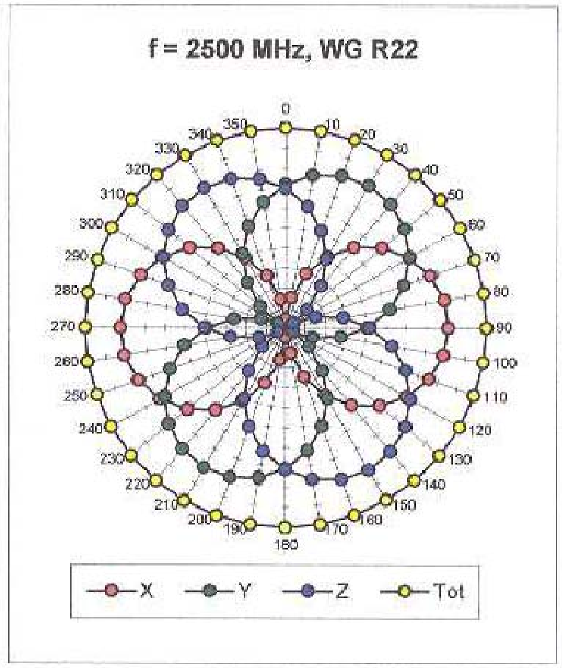
f = 300 MHz, TEM cell ifi110



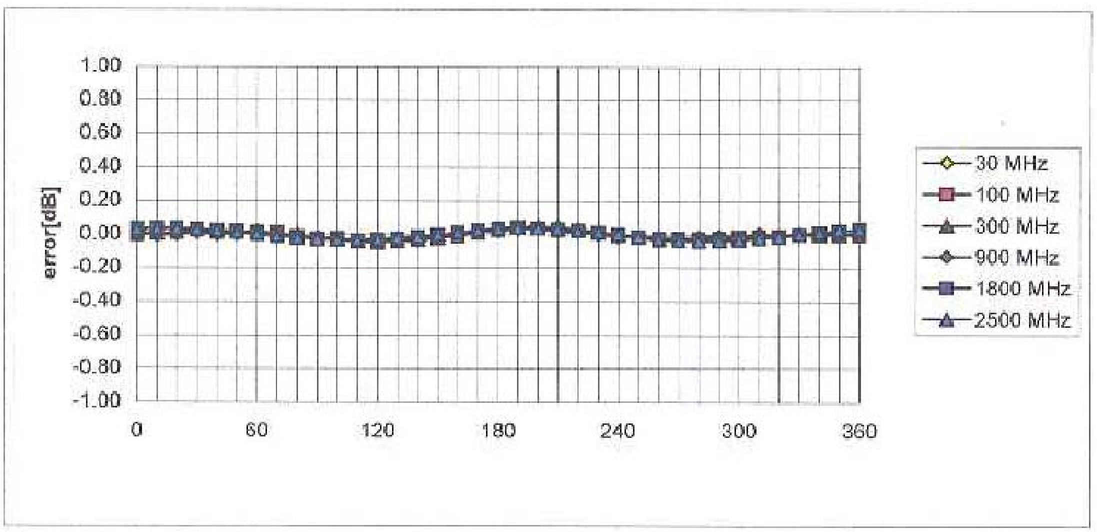
f = 900 MHz, TEM cell ifi110





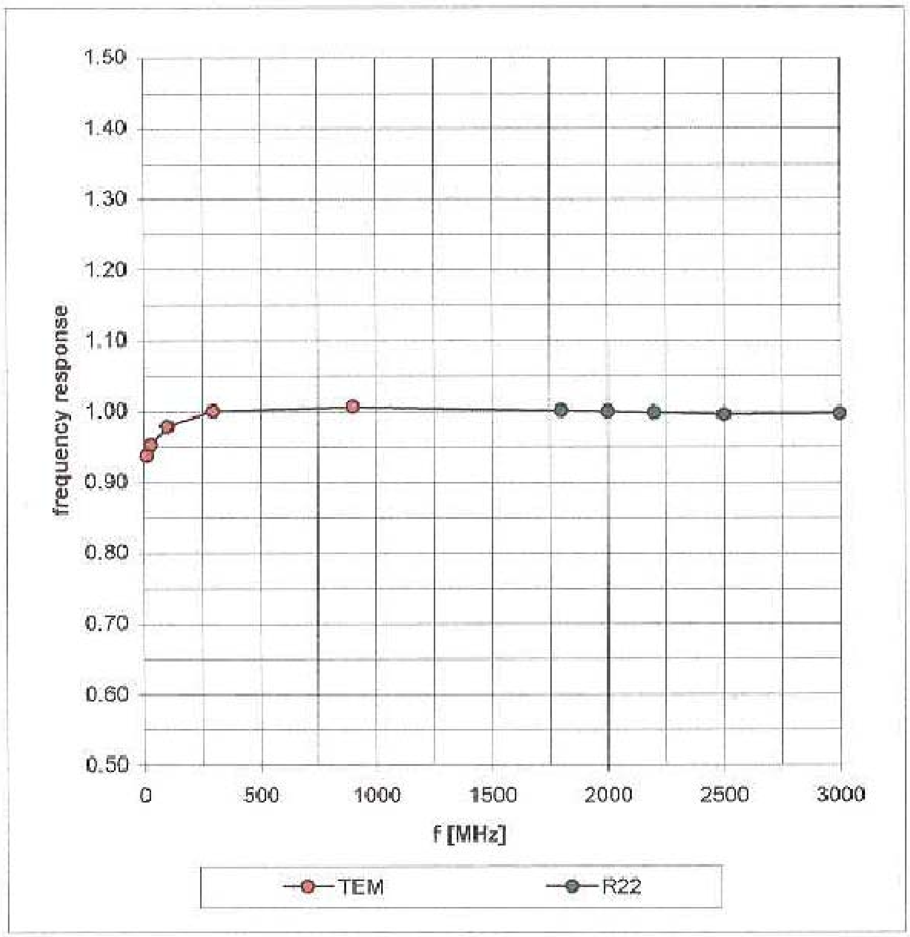


Isotropy Error (ϕ), θ = 0°



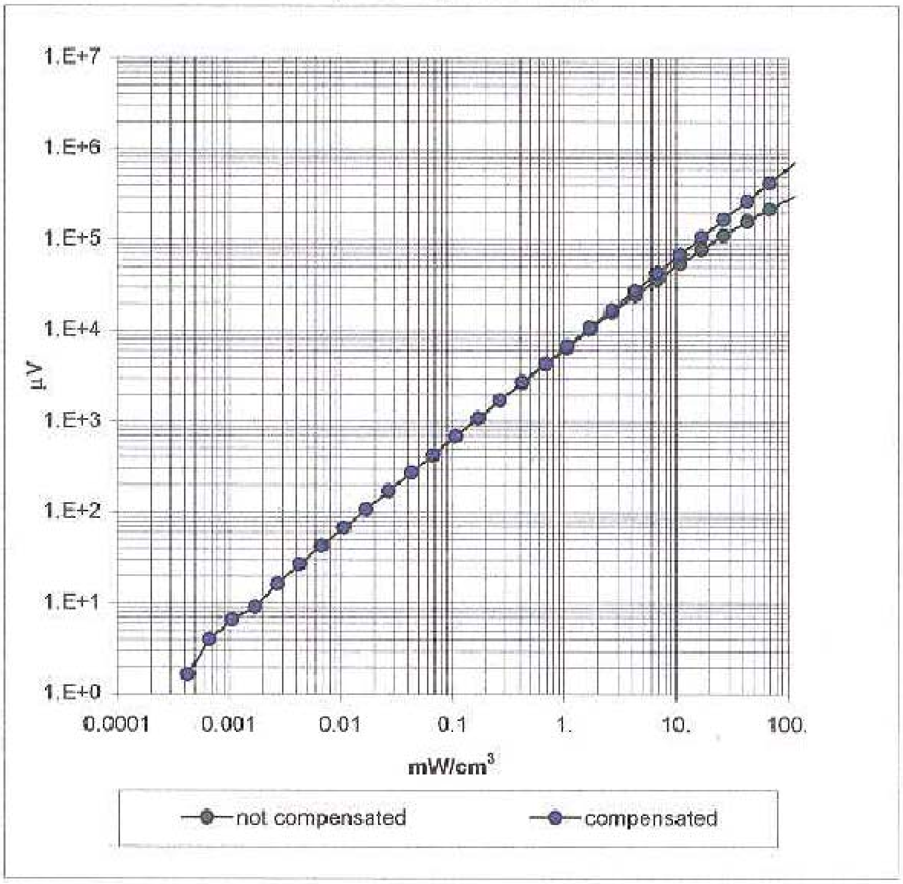
Frequency Response of E-Field

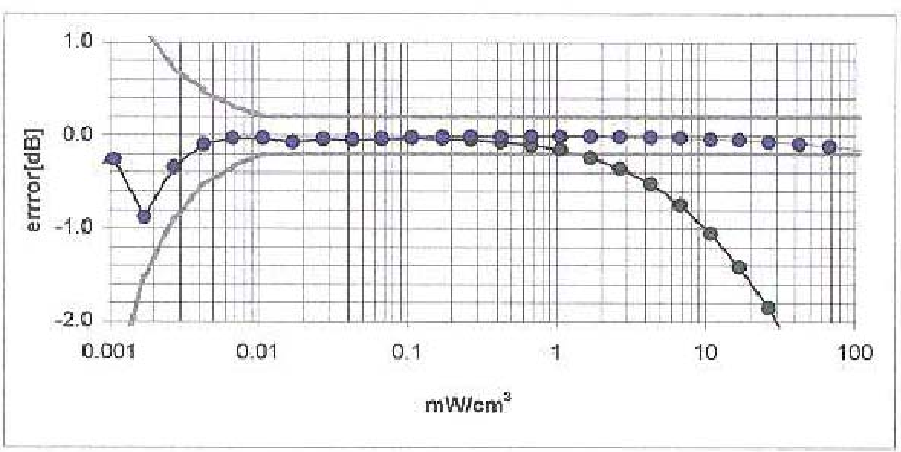
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range f(SAR_{brain})

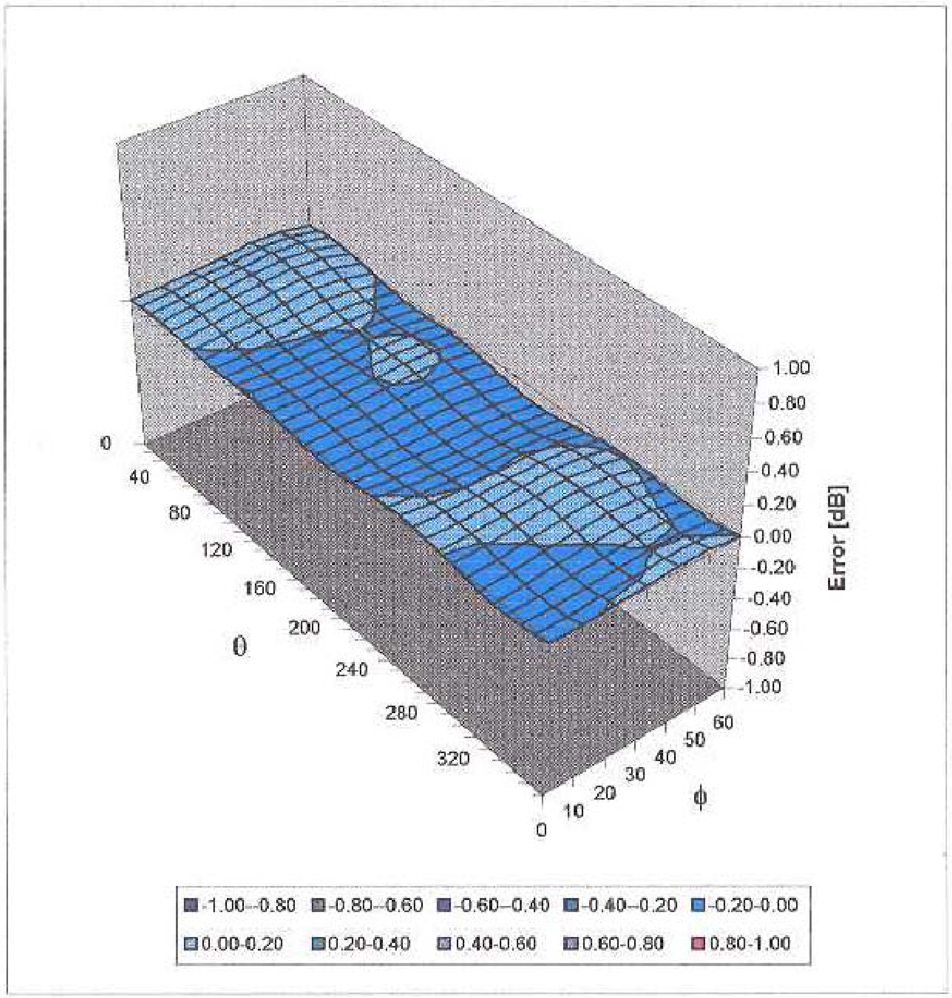
(Waveguide R22)





Deviation from Isotropy in HSL

Error (θ,ϕ), f = 900 MHz



Schmid & Partner
Engineering AG

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

Calibration Certificate

900 MHz System Validation Dipole

Type:	**D900V2**
Serial Number:	**084**
Place of Calibration:	**Zurich**
Date of Calibration:	**February 11, 2002**
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:

Approved by:

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 900 MHz:

Relative Dielectricity	**41.1**	± 5%
Conductivity	**0.95 mho/m**	± 5%

The DASY3 System (Software version 3.1d) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.5) 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:	**11.2 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**7.12 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:	**1.389 ns**	(one direction)
Transmission factor:	**0.997**	(voltage transmission, one direction)

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

Feedpoint impedance at 900 MHz:	Re{Z} = **52.1 Ω**
	Im {Z} = **-4.3 Ω**
Return Loss at 900 MHz	**-26.5 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with body simulating solution of the following electrical parameters at 900 MHz:

Relative Dielectricity	**54.8**	± 5%
Conductivity	**1.03 mho/m**	± 5%

The DASY3 System (Software version 3.1d) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.2) 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.

5. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 4. 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:	**11.8 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**7.52 mW/g**

6. Dipole Impedance and Return Loss

The dipole was positioned at the flat phantom sections according to section 4 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 900 MHz:	Re{Z} = **47.6 Ω**
	Im {Z} = **-6.0 Ω**
Return Loss at 900 MHz	**-23.6 dB**

7. 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.

8. 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.

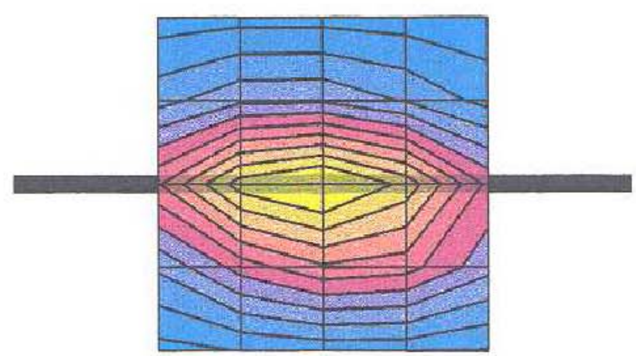
9. Power Test

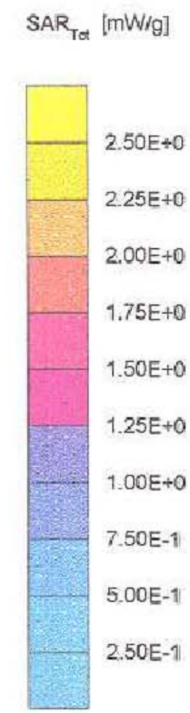
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

02/11/02

Validation Dipole D900V2 SN:084, d = 15 mm

Frequency: 900 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 900 MHz; σ = 0.95 mho/m ε_r = 41.1 ρ = 1.00 g/cm^3
Cubes (2): Peak: 4.54 mW/g ± 0.03 dB, SAR (1g): 2.81 mW/g ± 0.02 dB, SAR (10g): 1.78 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 11.5 (10.3, 13.2) [mm]
Powerdrift: -0.01 dB



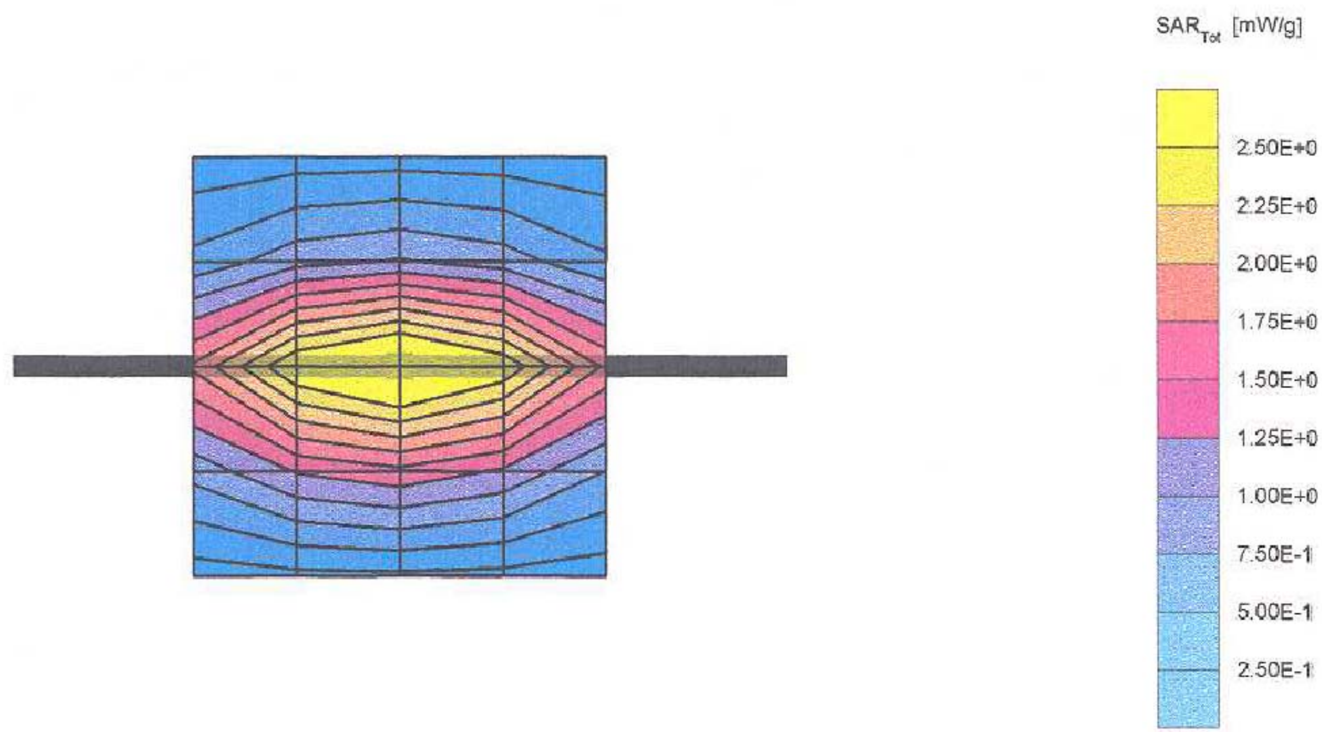


Schmid & Partner Engineering AG, Zurich, Switzerland

02/11/02

Validation Dipole D900V2 SN:084, d = 15 mm

Frequency: 900 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(6.20,6.20,6.20) at 900 MHz; Muscle 900 MHz: σ = 1.03 mho/m ε_r = 54.8 ρ = 1.00 g/cm^3
Cubes (2): Peak: 4.72 mW/g ± 0.02 dB, SAR (1g): 2.95 mW/g ± 0.01 dB, SAR (10g): 1.88 mW/g ± 0.00 dB, (Worst-case extrapolation)
Penetration depth: 12.0 (10.7, 13.7) [mm]
Powerdrift: -0.01 dB



Schmid & Partner Engineering AG, Zurich, Switzerland