



MOTOROLA



CGISS EME Test Laboratory

8000 West Sunrise Blvd
Fort Lauderdale, FL. 33322

S.A.R. EME Compliance Test Report

Part 3 of 3

Date of Report: November 20, 2003
Report Revision: Rev. O
Manufacturer: Motorola
Product Description: Portable 136-174 MHz, 5W, 32 CH
w/ display/Limited Keypad
FCC ID: **ABZ99FT3050**
Device Model: PMUD1928A

Test Period: 11/6/03 – 11/13/03

EME Technician: Ed Church
Responsible Engineer: Kim Uong (Sr. 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 all applicable national and international reference standards and guidelines.

Deanna Zakharia Signature on File

11/20/03

Ken Enger
Senior Resource Manager, Product Safety and EME Director, Phone: 954-723-6299

Date Approved

Note: Consistent with the ISO/IEC 17025 recommendation this report shall not be reproduced in part without written approval from an officially designated representative of the Motorola EME Laboratory.

APPENDIX D

Calibration Certificates

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

Calibrated by: Name Nico Vetterli Function Technician Signature 

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 $\mu\text{V}/(\text{V/m})^2$
NormY	1.55 $\mu\text{V}/(\text{V/m})^2$
NormZ	1.62 $\mu\text{V}/(\text{V/m})^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\% \text{ mho/m}$
ConvF X	6.5 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.5 $\pm 9.5\%$ (k=2)	Alpha	0.59
ConvF Z	6.5 $\pm 9.5\%$ (k=2)	Depth	1.97
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
ConvF X	5.2 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.2 $\pm 9.5\%$ (k=2)	Alpha	0.57
ConvF Z	5.2 $\pm 9.5\%$ (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 $\pm$ 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:



Dosimetric E-Field Probe ET3DV6 SN:1383

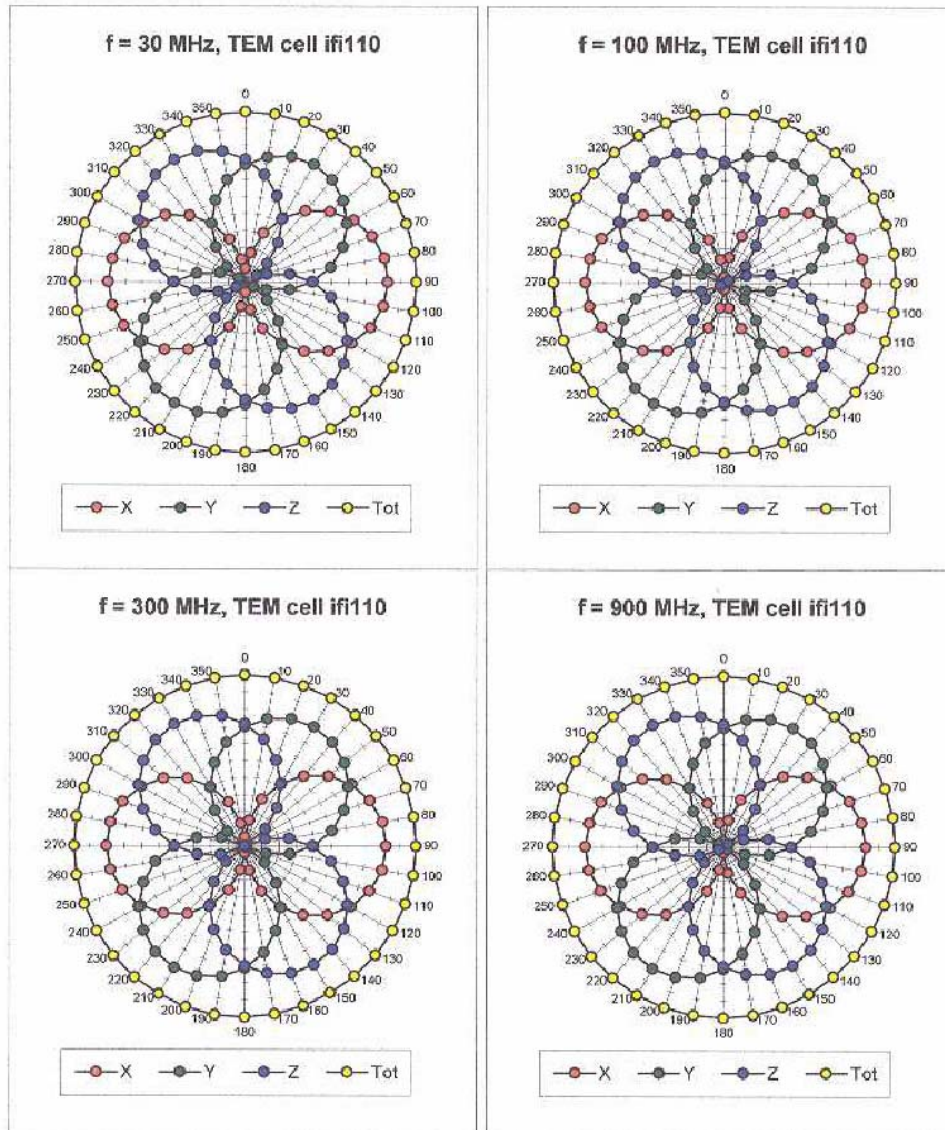
Conversion factor ($\pm$ standard deviation)

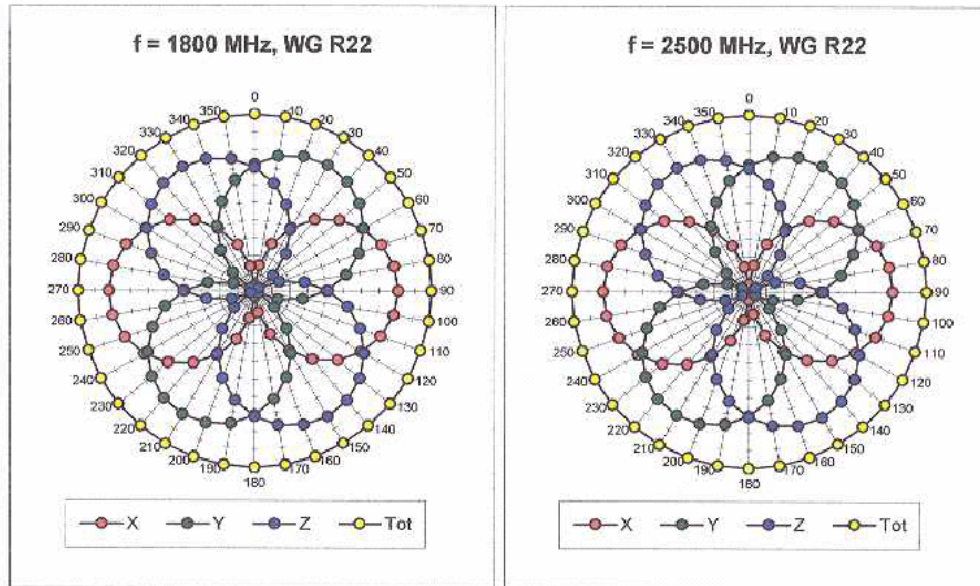
150 MHz ✓	ConvF	8.1 $\pm$ 8%	$\epsilon_r = 61.9$ $\sigma = 0.80$ mho/m (body tissue)
236 MHz ✓	ConvF	7.9 $\pm$ 8%	$\epsilon_r = 59.8$ $\sigma = 0.87$ mho/m (body tissue)
300 MHz ✓	ConvF	7.8 $\pm$ 8%	$\epsilon_r = 58.2$ $\sigma = 0.92$ mho/m (body tissue)
350 MHz ✓	ConvF	7.8 $\pm$ 8%	$\epsilon_r = 57.7$ $\sigma = 0.93$ mho/m (body tissue)
450 MHz ✓	ConvF	7.5 $\pm$ 8%	$\epsilon_r = 56.7$ $\sigma = 0.94$ mho/m (body tissue)
784 MHz ✓	ConvF	6.5 $\pm$ 8%	$\epsilon_r = 55.4$ $\sigma = 0.97$ mho/m (body tissue)
1450 MHz ✓	ConvF	5.3 $\pm$ 8%	$\epsilon_r = 54.0$ $\sigma = 1.30$ mho/m (body tissue)

Dosimetric E-Field Probe ET3DV6 SN:1383

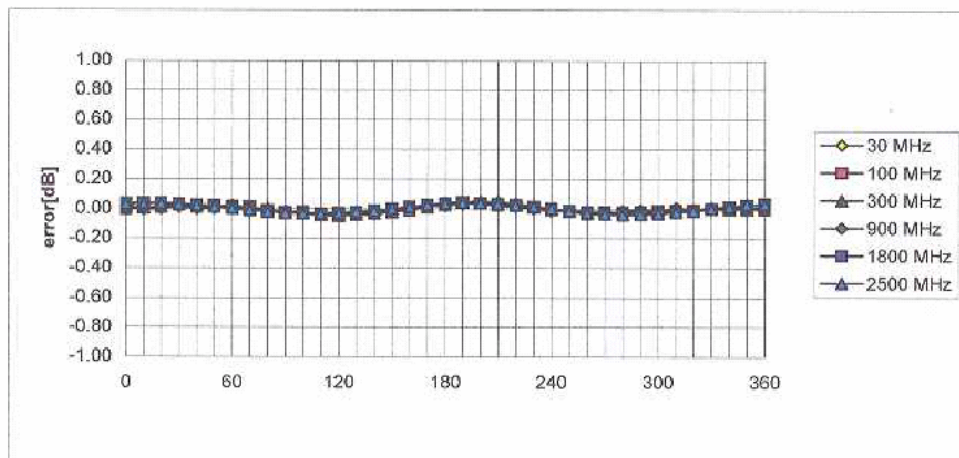
Conversion factor ($\pm$ standard deviation)

150 MHz ✓	ConvF	9.0 $\pm$ 8 %	$\epsilon_r = 52.3$ $\sigma = 0.76$ mho/m (head tissue)
236 MHz ✓	ConvF	8.2 $\pm$ 8 %	$\epsilon_r = 48.3$ $\sigma = 0.82$ mho/m (head tissue)
300 MHz ✓	ConvF	7.7 $\pm$ 8 %	$\epsilon_r = 45.3$ $\sigma = 0.87$ mho/m (head tissue)
350 MHz ✓	ConvF	7.7 $\pm$ 8 %	$\epsilon_r = 44.7$ $\sigma = 0.87$ mho/m (head tissue)
400 MHz ✓	ConvF	7.5 $\pm$ 8 %	$\epsilon_r = 44.4$ $\sigma = 0.87$ mho/m (head tissue - CENELEC)
450 MHz ✓	ConvF	7.5 $\pm$ 8 %	$\epsilon_r = 43.5$ $\sigma = 0.87$ mho/m (head tissue)
784 MHz ✓	ConvF	6.7 $\pm$ 8 %	$\epsilon_r = 41.8$ $\sigma = 0.90$ mho/m (head tissue)

Receiving Pattern (ϕ), $\theta = 0^\circ$ 

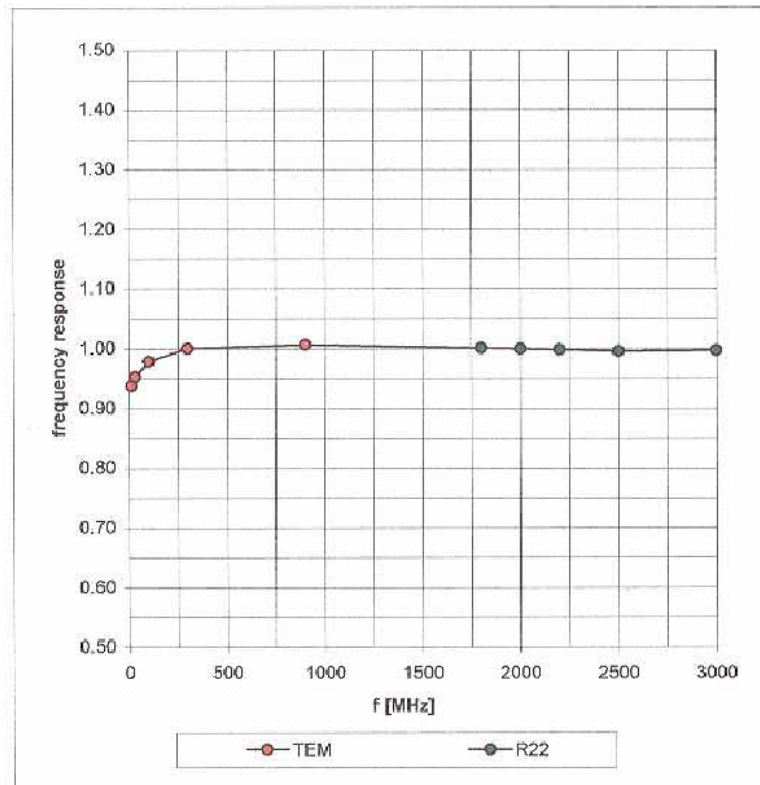


Isotropy Error (ϕ), $\theta = 0^\circ$

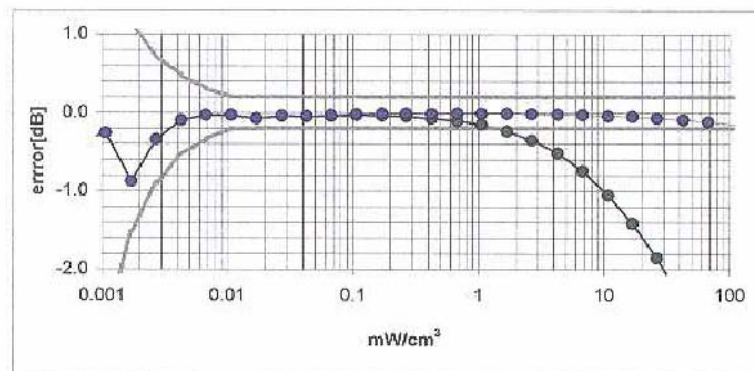
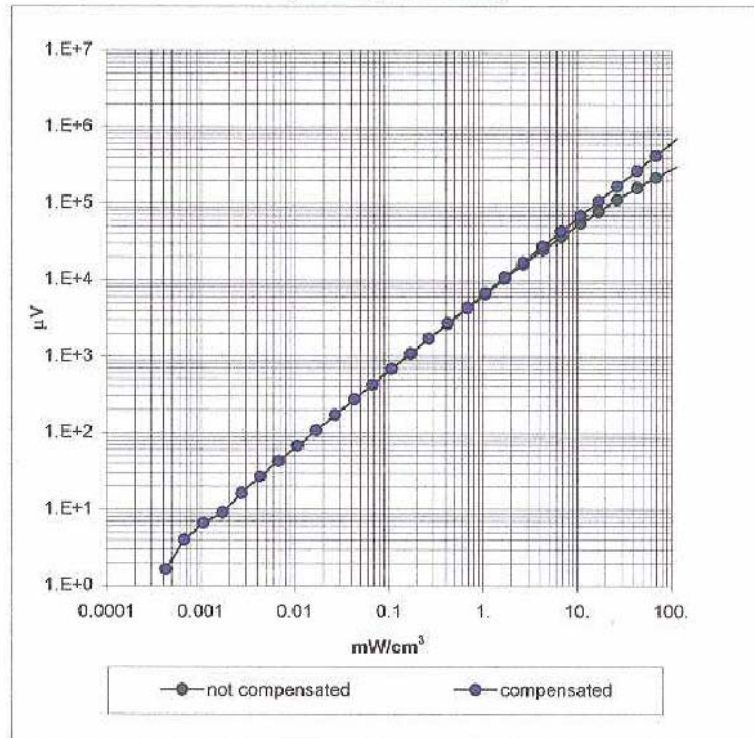


Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)

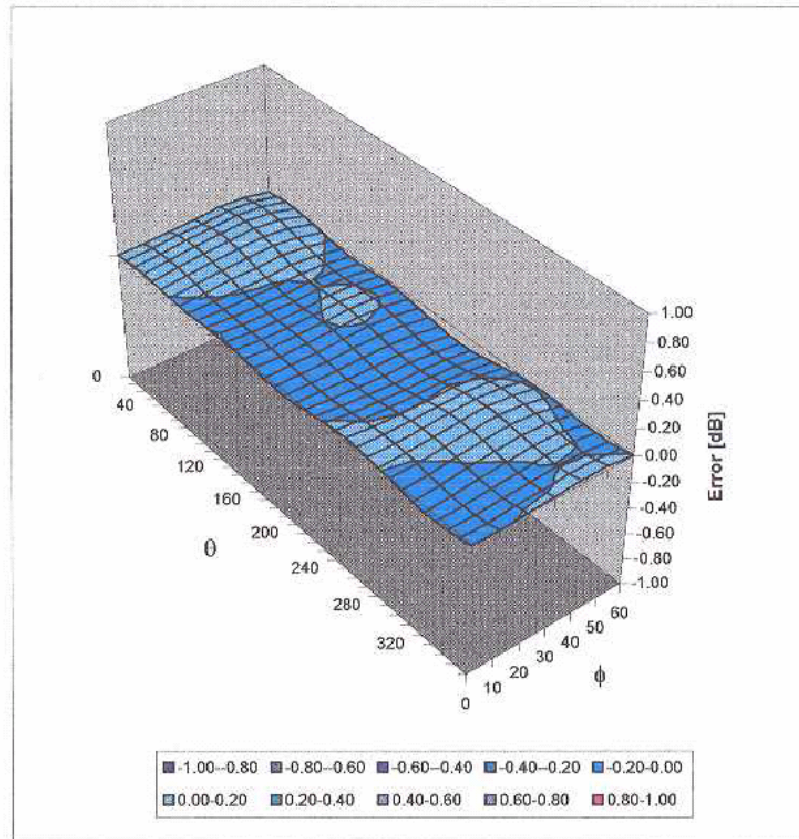


Dynamic Range f(SAR_{brain})
(Waveguide R22)

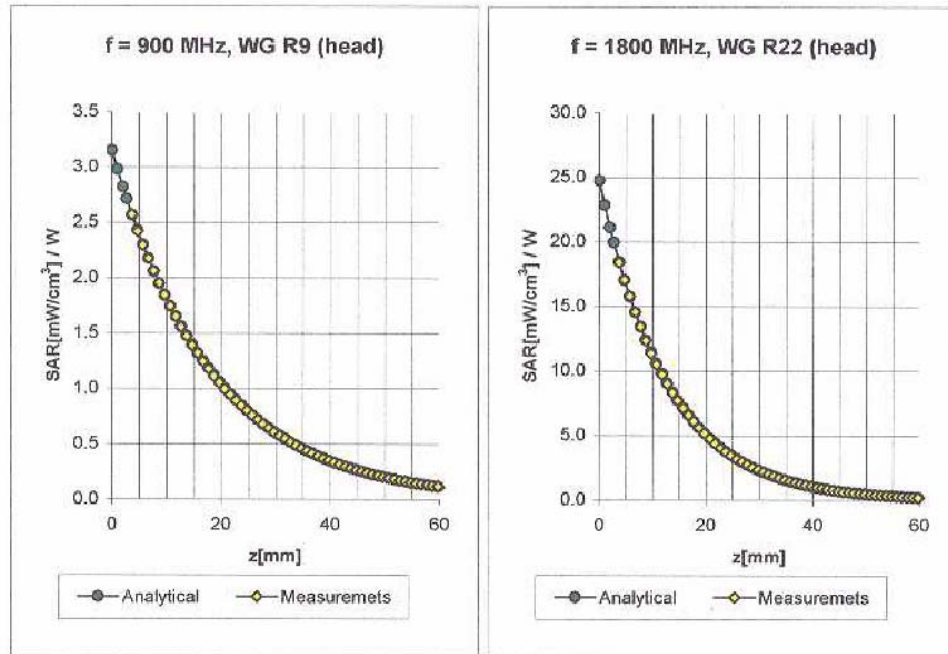


Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz

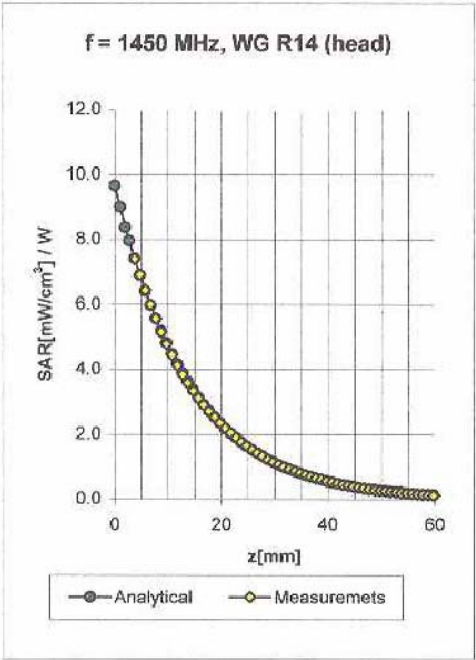


Conversion Factor Assessment



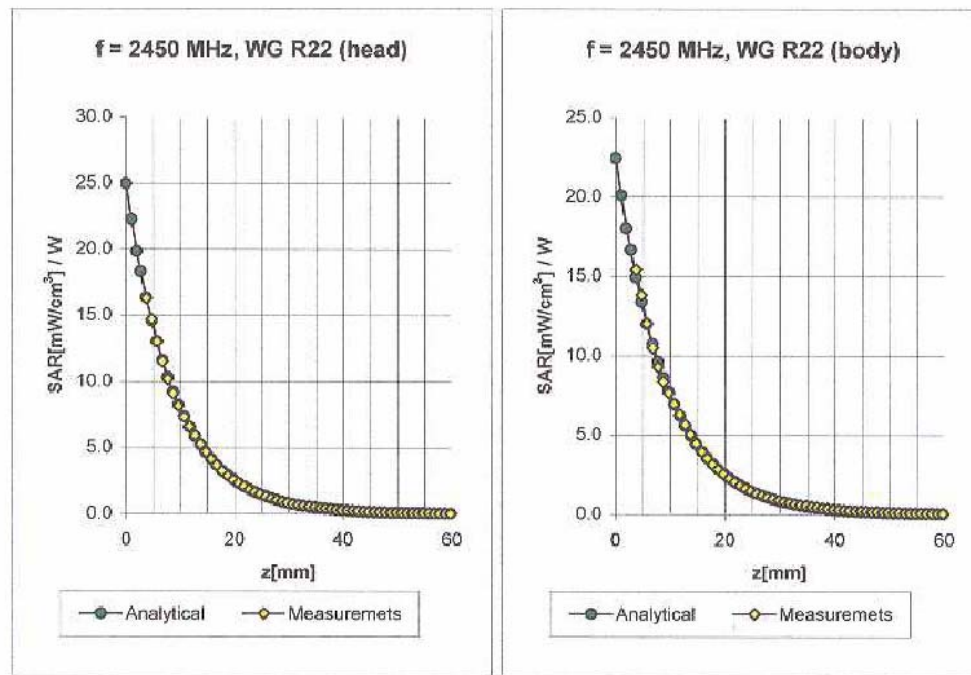
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
	ConvF X	$6.5 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$6.5 \pm 9.5\%$ (k=2)	Alpha 0.59
	ConvF Z	$6.5 \pm 9.5\%$ (k=2)	Depth 1.97
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
	ConvF X	$5.2 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$5.2 \pm 9.5\%$ (k=2)	Alpha 0.57
	ConvF Z	$5.2 \pm 9.5\%$ (k=2)	Depth 2.54

Conversion Factor Assessment



Head	1450 MHz	$\epsilon_r = 40.4 \pm 5\%$	$\sigma = 1.23 \pm 5\% \text{ mho/m}$
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** $\epsilon_r = 39.2 \pm 5\%$ $\sigma = 1.80 \pm 5\% \text{ mho/m}$

ConvF X **5.0** $\pm 8.9\%$ (k=2)

Boundary effect:

ConvF Y **5.0** $\pm 8.9\%$ (k=2)

Alpha **1.15**

ConvF Z **5.0** $\pm 8.9\%$ (k=2)

Depth **1.76**

Body **2450** **MHz** $\epsilon_r = 52.7 \pm 5\%$ $\sigma = 1.95 \pm 5\% \text{ mho/m}$

ConvF X **4.7** $\pm 8.9\%$ (k=2)

Boundary effect:

ConvF Y **4.7** $\pm 8.9\%$ (k=2)

Alpha **2.00**

ConvF Z **4.7** $\pm 8.9\%$ (k=2)

Depth **1.24**

Calibration Certificate

300 MHz System Validation Dipole

Type:

D300V2

Serial Number:

1002

Place of Calibration:

Zurich

Date of Calibration:

September 11, 2002

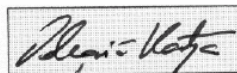
Calibration Interval:

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 phantom filled with head simulating liquid of the following electrical parameters at 300 MHz:

Relative Dielectricity	45.8	$\pm 5\%$
Conductivity	0.93 mho/m	$\pm 5\%$

The DASY System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 8.5 at 300 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 and the dipole was oriented parallel to the longer side of the phantom. The standard measuring distance was 15mm from dipole center to the liquid surface including the 6mm thick phantom shell. 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 400 mW $\pm 3\%$. 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:	2.83 mW/g (Advanced Extrapolation)
averaged over 10 cm ³ (10 g) of tissue	1.89 mW/g (Advanced Extrapolation)

Advanced extrapolation has been applied to the measured SAR values to compensate for the probe boundary effect (see DASY User Manual for details).

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:	1.738 ns	(one direction)
Transmission factor:	0.995	(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 300 MHz:	$\text{Re}\{Z\} = 56.3 \, \Omega$
	$\text{Im}\{Z\} = -3.6 \, \Omega$
Return Loss at 300 MHz	-23.5 dB

4. Handling

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

5. Design

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

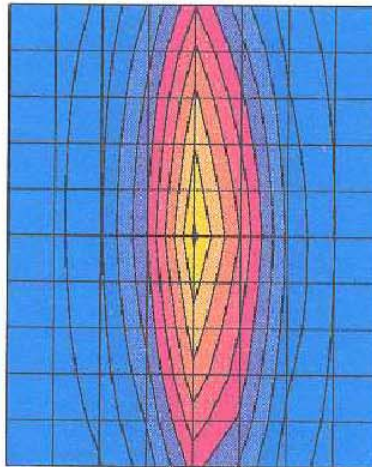
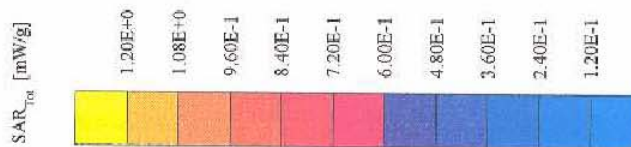
6. Power Test

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

09/11/02

Validation Dipole D300V2 SN:1002, $d = 15$ mm

Frequency: 300 MHz; Antenna Input Power: 400 [mW], Flat Phantom (shell thickness = 6mm)
Grid Spacing: $D_x = 20.0$, $D_y = 20.0$, $D_z = 10.0$
Probe: ET3DV6 - SN1507; ConvF(8.50,8.50,8.50); Crest factor: 1.0; Head 300 MHz: $\sigma = 0.93$ mho/m $\epsilon_r = 45.8$ $\rho = 1.00$ g/cm³
Cubes (2): Peak: 1.74 mW/g ± 0.01 dB, SAR (1g): 1.13 mW/g ± 0.02 dB, SAR (10g): 0.754 mW/g ± 0.02 dB, (Advanced extrapolation)
Penetration depth: 12.8 (11.5, 14.6) [mm]

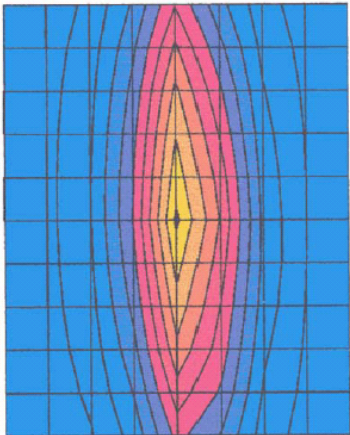
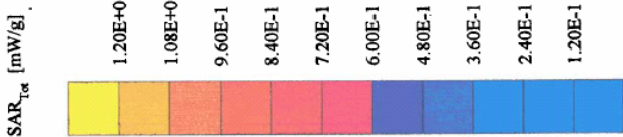


Schmid & Partner Engineering AG, Zurich, Switzerland

09/11/02

Validation Dipole D300V2 SN:1002, d = 15 mm

Frequency: 300 MHz; Antenna Input Power: 400 [mW], Flat Phantom (shell thickness = 6mm)
Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(8.50,8.50,8.50); Crest factor: 1.0; Head 300 MHz: $\sigma = 0.93$ mho/m $\epsilon_r = 45.8$ $\rho = 1.00$ g/cm³
Cubes (2): Peak: 1.88 mW/g ± 0.01 dB, SAR (1g): 1.19 mW/g ± 0.02 dB, SAR (10g): 0.779 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 12.2 (10.6, 14.4) [mm]



Schmid & Partner Engineering AG, Zurich, Switzerland

APPENDIX E
Illustration of Body-Worn Accessories

The purpose of this appendix is to illustrate the body-worn carry accessories for FCC ID: ABZ99FT3050. The sample that was used in the following photos represents the product used to obtain the results presented herein and was used in this section to demonstrate the different body-worn accessories.



Photo 1.
Model
PMLN4467A
Back View



Photo 2.
Model
PMLN4467A
Side View



Photo 3.
Model
PMLN4467A
Front View



Photo 4.
Model
HLN9844A
Back View



Photo 5.
Model
HLN9844A
Side View



Photo 5.
Model
PMLN4468A
Back View



Photo 6.
Model
PMLN4468A
Side View



Photo 7.
Model
PMLN4468A
Front View



Photo 8.
Model
PMLN4469A
Back View



Photo 9.
Model
PMLN4468A
Side View



Photo 10.
Model
PMLN4468A
Front View



Photo 11.
Model RLN4815A

Appendix F

Applicable Accessories and options test status and separation distances

The following tables present a summary of the test status of the applicable offered options and accessories as well as separation distances provided by each of the body-worn accessories:

Carry Case Models	Tested ?	Closest Separation distances between DUT antenna and phantom surface. (mm)	Comments
HLN9844A	Yes	36-53	
PMLN4467A	Yes	42-61	
PMLN4468A	Yes	37-49	
RLN4815A	Yes	48-54	
PMLN4469A	No	37-49	Same as PMLN4468A except for color.
HLN9985B	No	NA	Water proof bag. DUT does not transmit while using the bag.

Audio Attachments	Tested ?	Closest Separation distances between DUT antenna and phantom surface. (mm)	Comments
PMLN4294C	Yes	NA	NA
PMLN4425A	Yes	NA	NA
HMN9030A	Yes	NA	NA
HMN9013A	Yes	NA	NA

Other Attachments	Tested ?	Closest Separation distances between DUT antenna and phantom surface. (mm)	Comments
4285820Z01	Yes	NA	Tested w/ PMLN4468A