



Accredited testing laboratory

DAR registration number: TTI-P-G 166/98

**Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97**

**Appendix to test report 4-1567-05-02/05
Calibration data, Phantom certificate
and detail information of the DASY4 System**

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1 Calibration report "Probe ET3DV6"

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

Client **Cetecom**

CALIBRATION CERTIFICATE

Object(s) **ET3DV6 - SN:1558**

Calibration procedure(s) **QA CAL-01.v2**
Calibration procedure for dosimetric E-field probes

Calibration date: **September 6, 2004**

Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

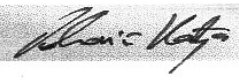
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	5-May-04 (METAS, No 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No 251-00388)	May-05
Reference 20 dB Attenuator	SN: 5086 (20b)	3-May-04 (METAS, No 251-00389)	May-05
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct03)	In house check: Oct 05
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug02)	In house check: Aug05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct03)	In house check: Oct 05

Calibrated by: **Name** **Function** **Signature**
Nico Vetterli Technician 

Approved by: **Katja Pokovic** **Laboratory Director** 

Date issued: September 6, 2004

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.

Probe ET3DV6

SN:1558

Manufactured: September 16, 2003
Last calibrated: September 6, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1558

September 6, 2004

DASY - Parameters of Probe: ET3DV6 SN:1558**Sensitivity in Free Space****Diode Compression^A**

NormX	2.03 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.92 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.63 $\mu\text{V}/(\text{V}/\text{m})^2$

DCP X	94	mV
DCP Y	94	mV
DCP Z	94	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 7.

Boundary Effect**Head 900 MHz Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	9.6	5.2
SAR _{be} [%]	With Correction Algorithm	0.1	0.2

Head 1750 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	13.8	9.0
SAR _{be} [%]	With Correction Algorithm	0.2	0.1

Sensor Offset

Probe Tip to Sensor Center	2.7 mm
Optical Surface Detection	in tolerance

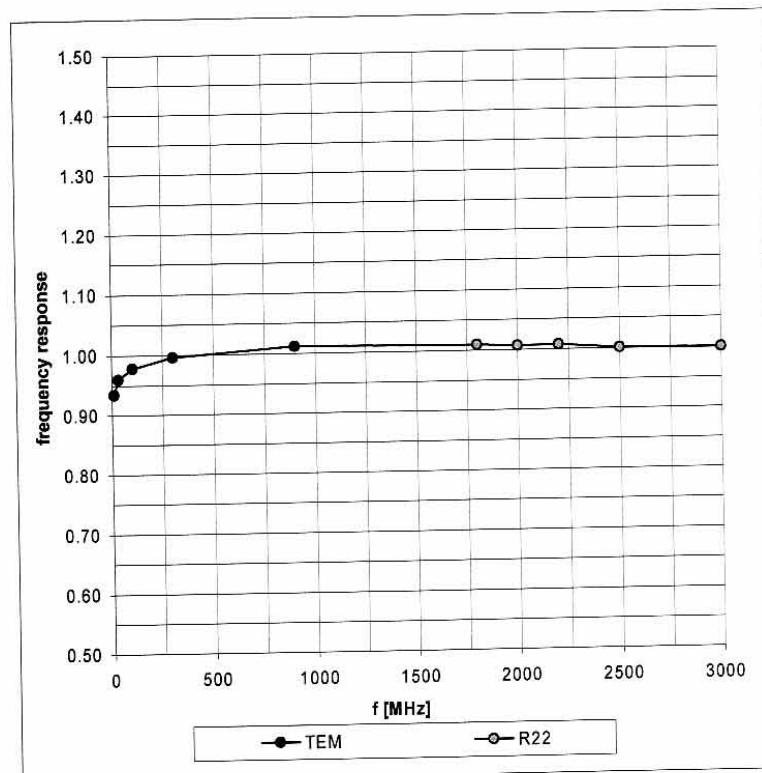
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A numerical linearization parameter: uncertainty not required

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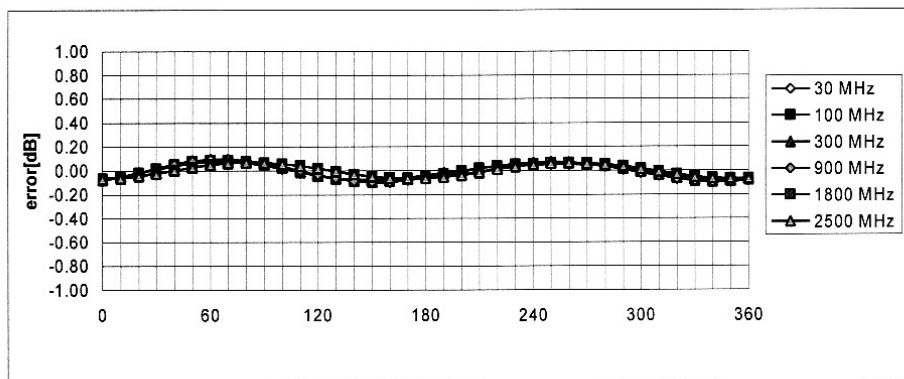
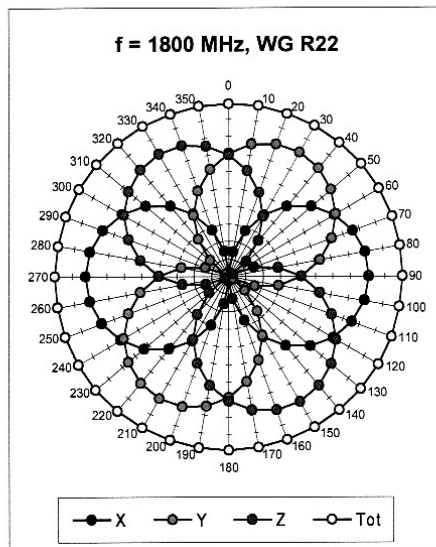
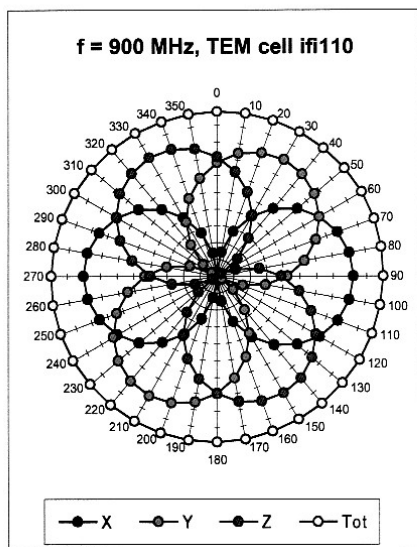
Frequency Response of E-Field (TEM-Cell:ifi110, Waveguide R22)



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

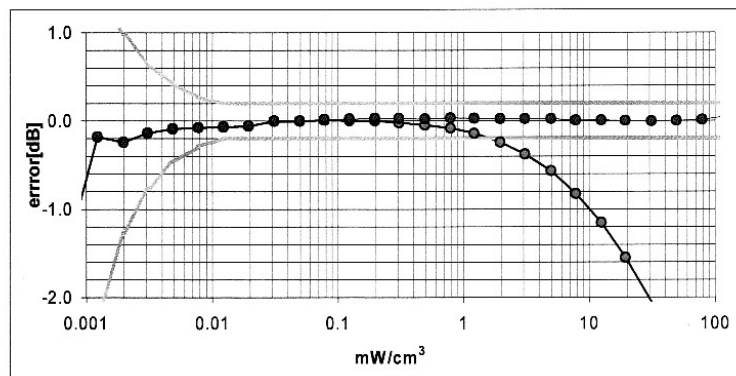
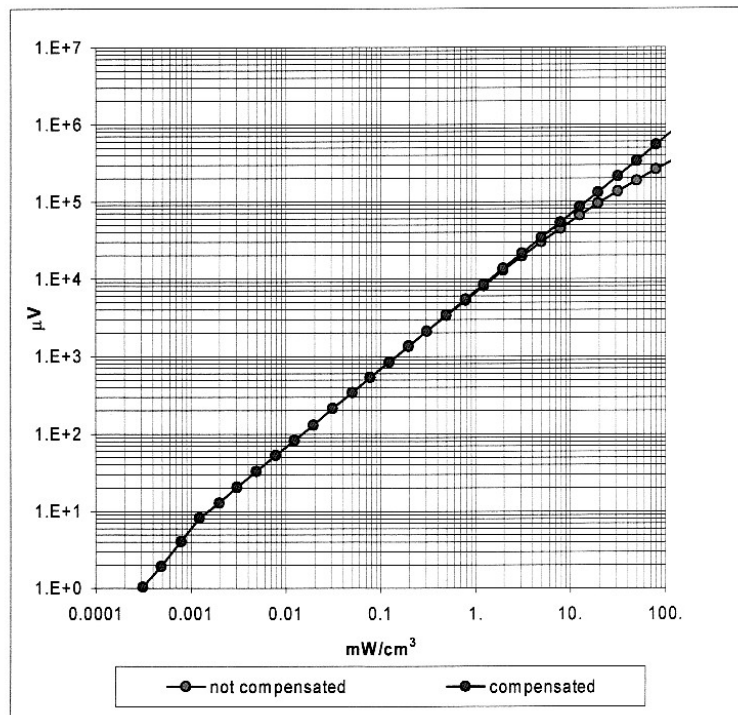


Axial Isotropy Error < ± 0.2 dB

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

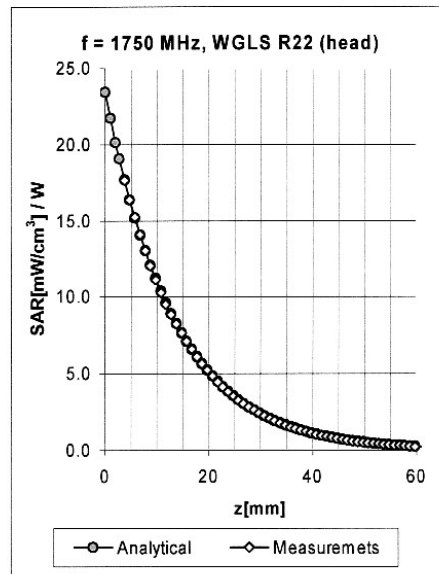
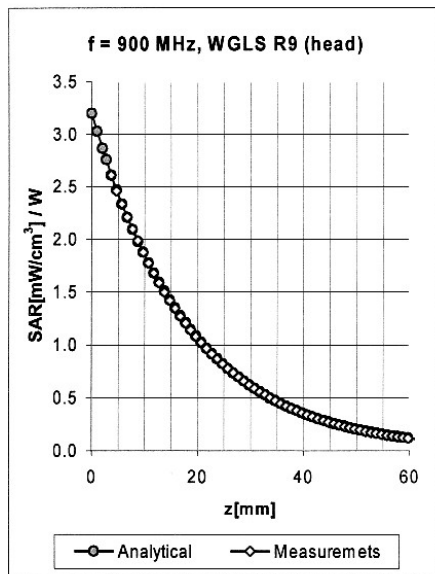


Probe Linearity Error < ± 0.2 dB

ET3DV6 SN:1558

September 6, 2004

Conversion Factor Assessment



f [MHz]	Validity [MHz] ^B	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	785-885	Head	41.5 ± 5%	0.90 ± 5%	0.60	1.89	6.31	± 9.7% (k=2)
900	850-950	Head	41.5 ± 5%	0.97 ± 5%	0.62	1.89	6.03	± 9.7% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.52	2.56	4.96	± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.52	2.64	4.82	± 9.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.95	1.92	4.27	± 9.7% (k=2)
835	785-885	Body	55.2 ± 5%	0.97 ± 5%	0.51	2.15	6.01	± 9.7% (k=2)
900	850-950	Body	55.0 ± 5%	1.05 ± 5%	0.47	2.24	5.78	± 9.7% (k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.52	2.85	4.45	± 9.7% (k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.57	2.83	4.32	± 9.7% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	1.01	1.69	4.06	± 9.7% (k=2)

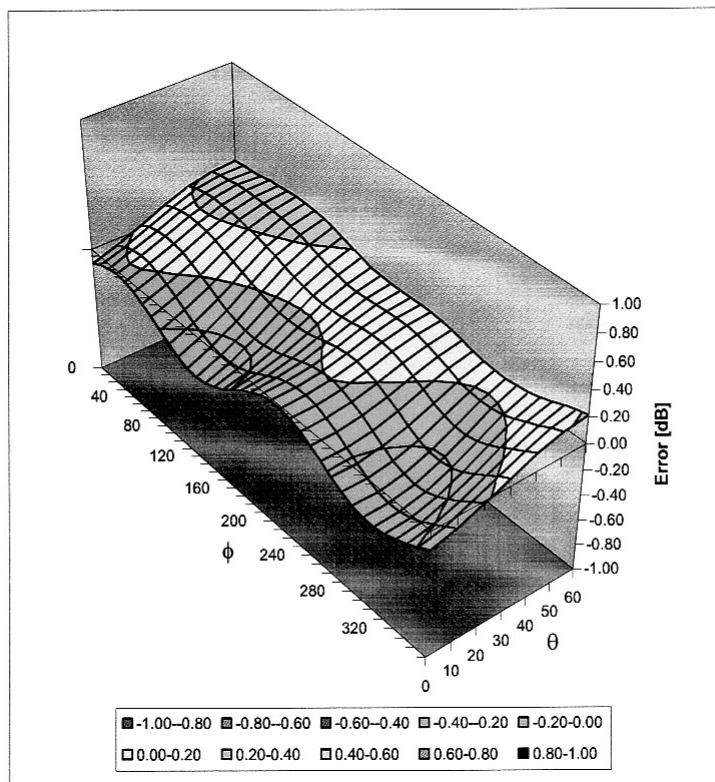
^B The total standard uncertainty is calculated as root-sum-square of standard uncertainty of the Conversion Factor at calibration frequency and the standard uncertainty for the indicated frequency band.

ET3DV6 SN:1558

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Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz

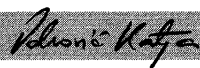


Spherical Isotropy Error $< \pm 0.4$ dB

2 Calibration report "900 MHz System validation dipole"

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

Client **Cetecomm**

CALIBRATION CERTIFICATE			
Object(s)	D900V2 - SN:102		
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits		
Calibration date:	February 4, 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 7, 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.			

**Schmid & Partner
Engineering AG**

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

DASY

Dipole Validation Kit

Type: D900V2

Serial: 102

Manufactured: January 24, 2001

Calibrated: February 4, 2003

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	40.8	$\pm 5\%$
Conductivity	0.95 mho/m	$\pm 5\%$

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.6 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.

The dipole input power (forward power) was $250\text{mW} \pm 3\%$. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	10.6 mW/g
averaged over 10 cm^3 (10 g) of tissue:	6.68 mW/g

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:	1.405 ns	(one direction)
Transmission factor:	0.999	(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:	$\text{Re}\{Z\} = 49.6 \Omega$
	$\text{Im}\{Z\} = -4.9 \Omega$
Return Loss at 900 MHz	-26.3 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	53.5	$\pm 5\%$
Conductivity	1.03 mho/m	$\pm 5\%$

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.3 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.

The dipole input power (forward power) was $250\text{mW} \pm 3\%$. The results are normalized to 1W input power.

5. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 4. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm³ (1 g) of tissue: **11.1 mW/g**

averaged over 10 cm³ (10 g) of tissue: **7.08 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: $\text{Re}\{Z\} = 45.5 \Omega$

$\text{Im}\{Z\} = -6.1 \Omega$

Return Loss at 900 MHz **-22.0 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.

Date/Time: 02/07/03 17:05:43

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN102_SN1507_HSL900_030203.da4

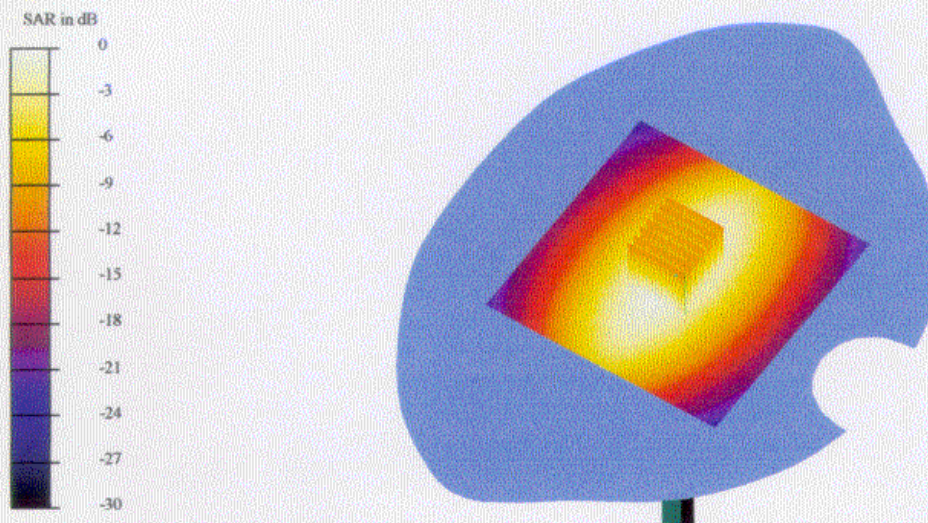
DUT: Dipole 900 MHz Type & Serial Number: D900V2 - SN102
Program: Dipole Calibration; Pin = 250 mW; d = 15 mm

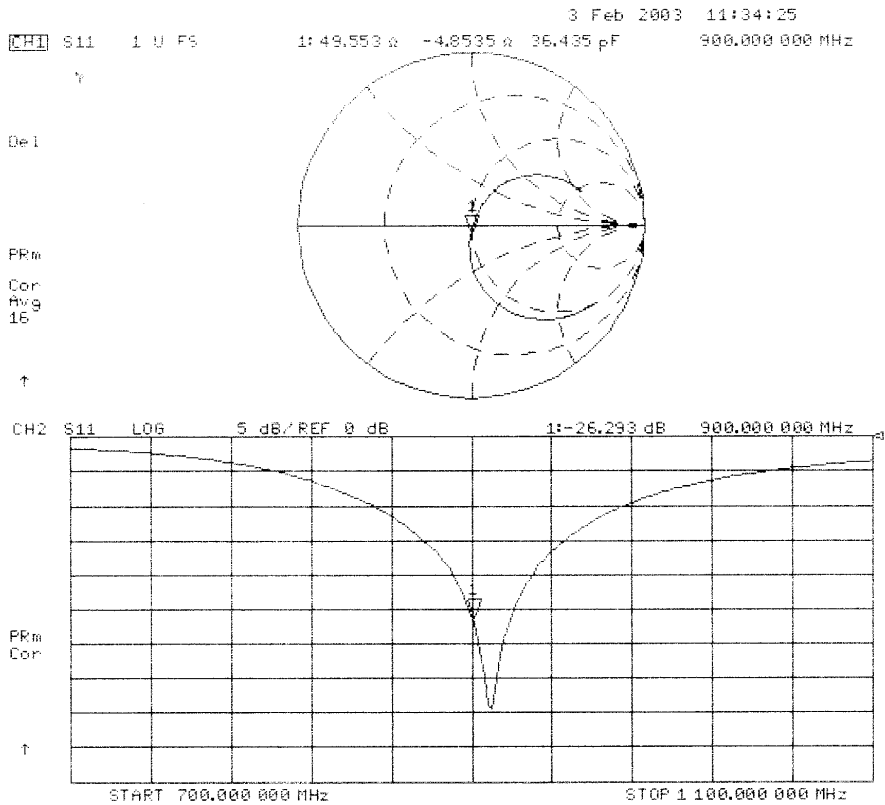
Communication System: CW-900; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL 900 MHz ($\sigma = 0.95$ mho/m, $\epsilon = 40.75$, $\rho = 1000$ kg/m³)
Phantom section: FlatSection

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.6, 6.6, 6.6); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN410; Calibrated: 1/14/2003
- Phantom: SAM 4.0 - TP:1006
- Software: DASY4, V4.0 Build 51

Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm
Reference Value = 57.2 V/m
Peak SAR = 3.94 mW/g
SAR(1 g) = 2.64 mW/g; SAR(10 g) = 1.67 mW/g
Power Drift = 0.005 dB





Date/Time: 02/07/03 17:14:19

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN102_SN1507_M900_040203.da4

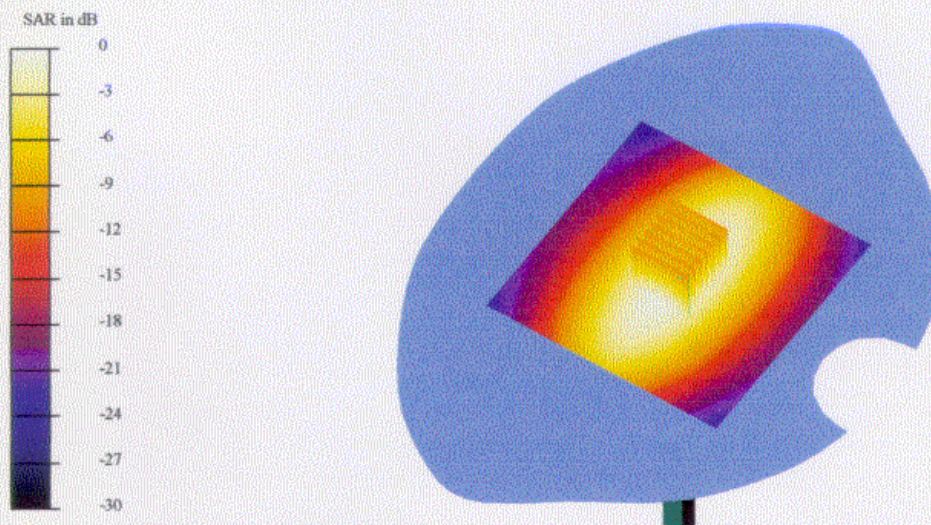
DUT: Dipole 900 MHz Type & Serial Number: D900V2 - SN102
Program: Dipole Calibration; Pin = 250 mW; d = 15 mm

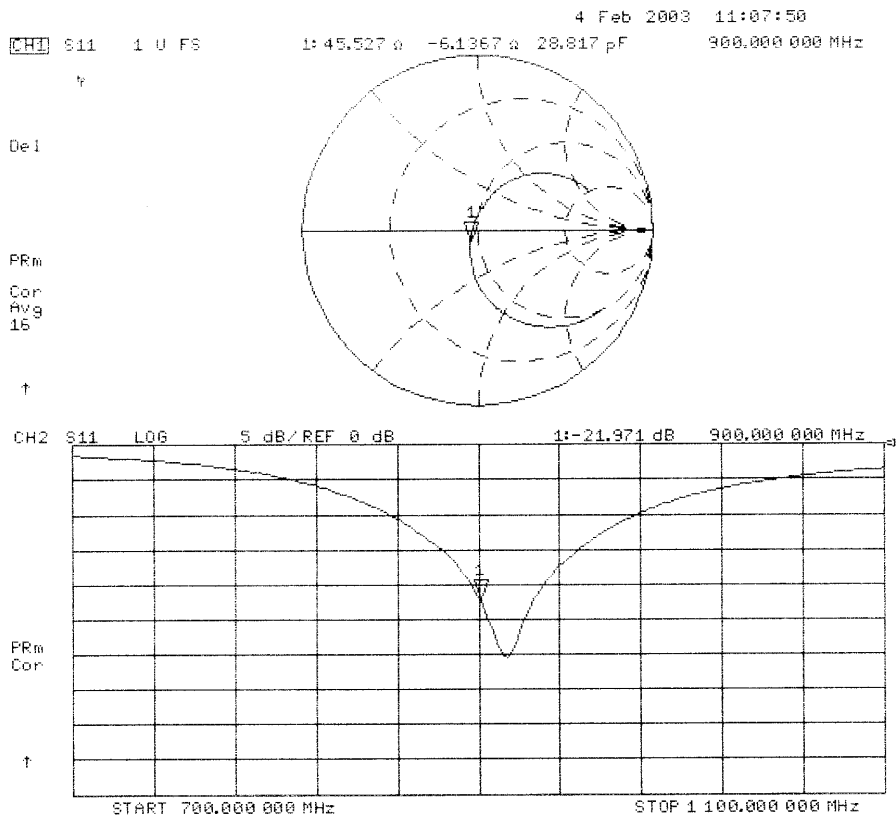
Communication System: CW-900; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: Muscle 900 MHz ($\sigma = 1.03$ mho/m, $\epsilon = 53.48$, $\rho = 1000$ kg/m³)
Phantom section: FlatSection

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.3, 6.3, 6.3); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN410; Calibrated: 1/14/2003
- Phantom: SAM 4.0 - TP:1006
- Software: DASY4, V4.0 Build 51

Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm
Reference Value = 56.3 V/m
Peak SAR = 4.07 mW/g
SAR(1 g) = 2.77 mW/g; SAR(10 g) = 1.77 mW/g
Power Drift = -0.0008 dB





See Muscle

