Schmid & Partner Engineering AG

s p e a g

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Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ET3DV6

SN:1785

Manufactured: May 28, 2003
Last calibration: July 28, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1785

Sensitivity in Free Space

NormX	**1.70**	$\mu V/(V/m)^2$
NormY	**1.70**	$\mu V/(V/m)^2$
NormZ	**1.63**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**97**	mV
DCP Y	**97**	mV
DCP Z	**97**	mV

Sensitivity in Tissue Simulating Liquid

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

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	6.6	± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.6	± 9.5% (k=2)	Alpha	**0.42**
ConvF Z	6.6	± 9.5% (k=2)	Depth	**2.27**

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

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.2	± 9.5% (k=2)	Boundary effect:	
ConvF Y	5.2	± 9.5% (k=2)	Alpha	**0.49**
ConvF Z	5.2	± 9.5% (k=2)	Depth	**2.55**

Boundary Effect

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

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	9.1	5.1
SAR_{be} [%]	With Correction Algorithm	0.2	0.4

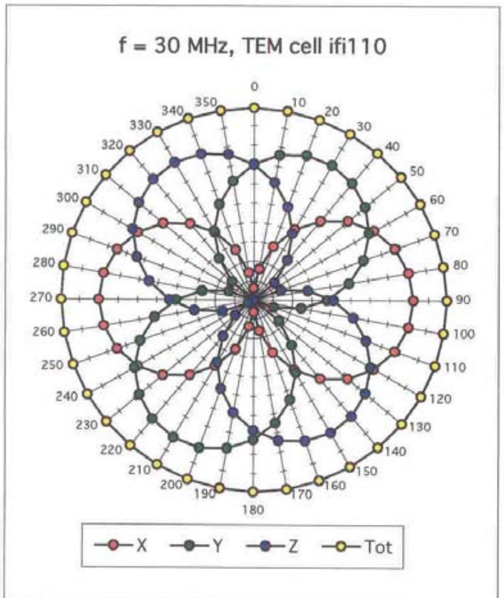
Head 1800 MHz **Typical SAR gradient: 10 % per mm**

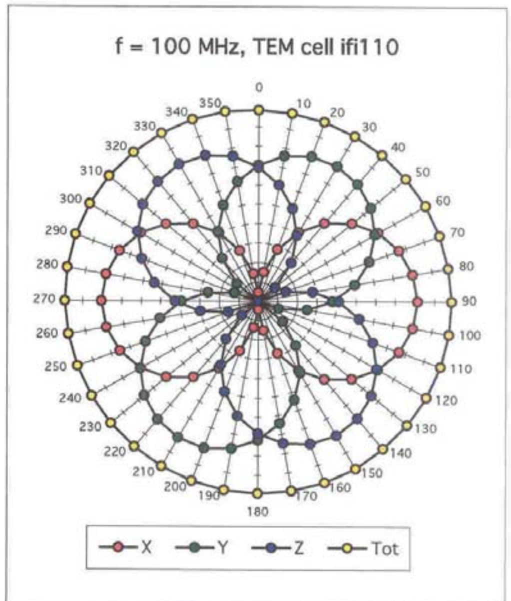
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	12.8	8.6
SAR_{be} [%]	With Correction Algorithm	0.2	0.1

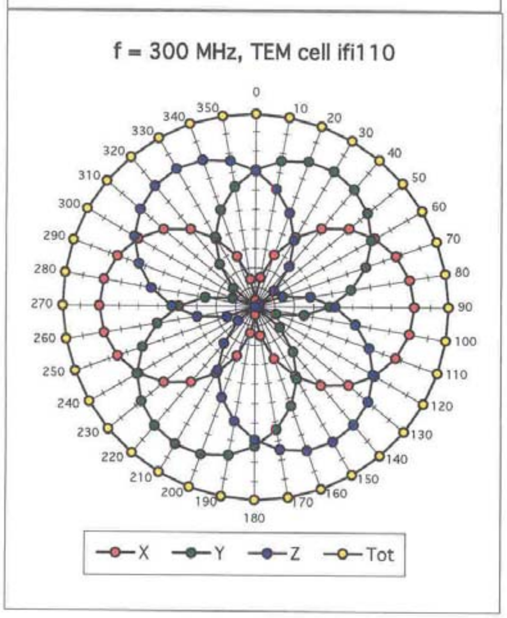
Sensor Offset

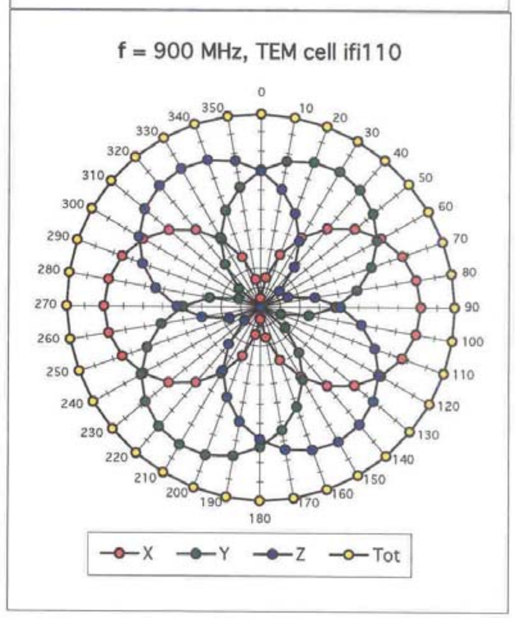
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.7 ± 0.2**	mm

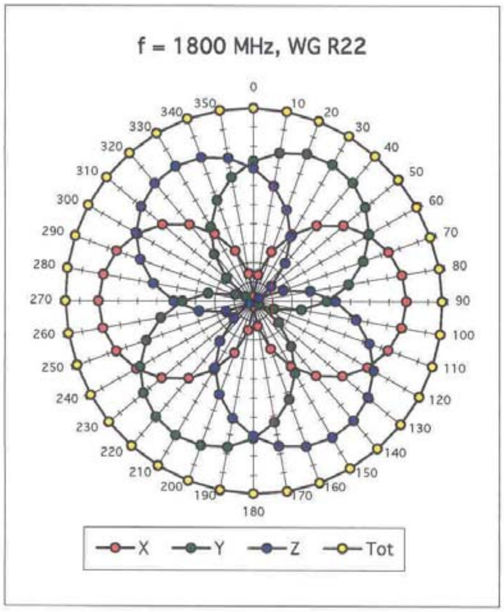
Receiving Pattern (ϕ), $\theta = 0°$

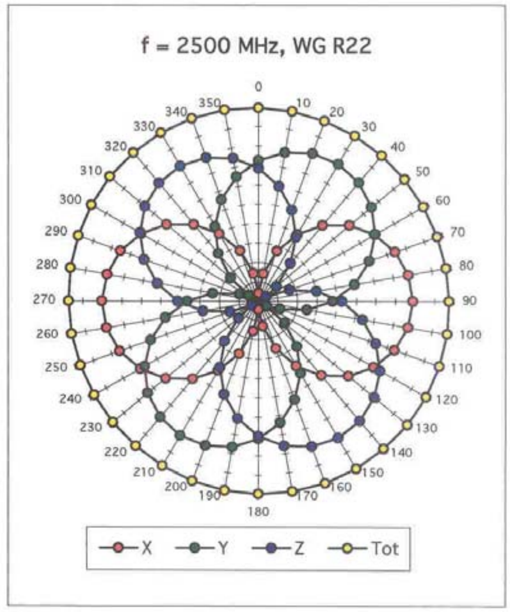




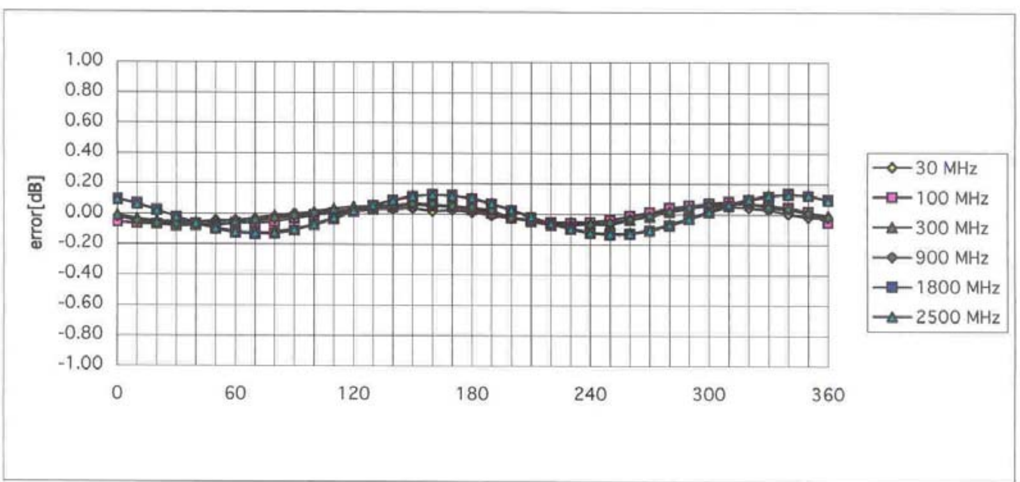






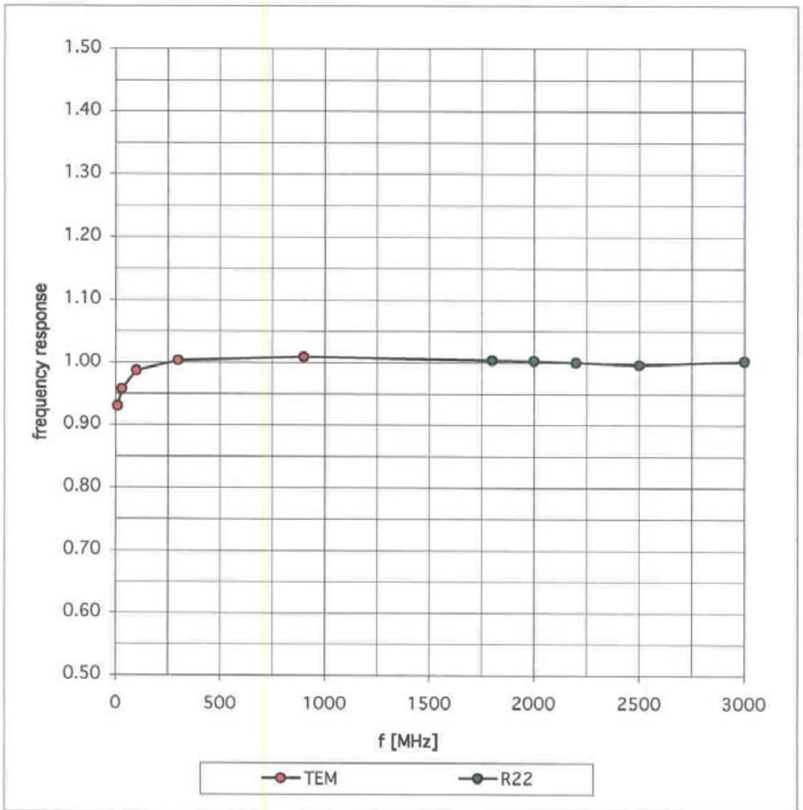


Isotropy Error (φ), θ = 0°



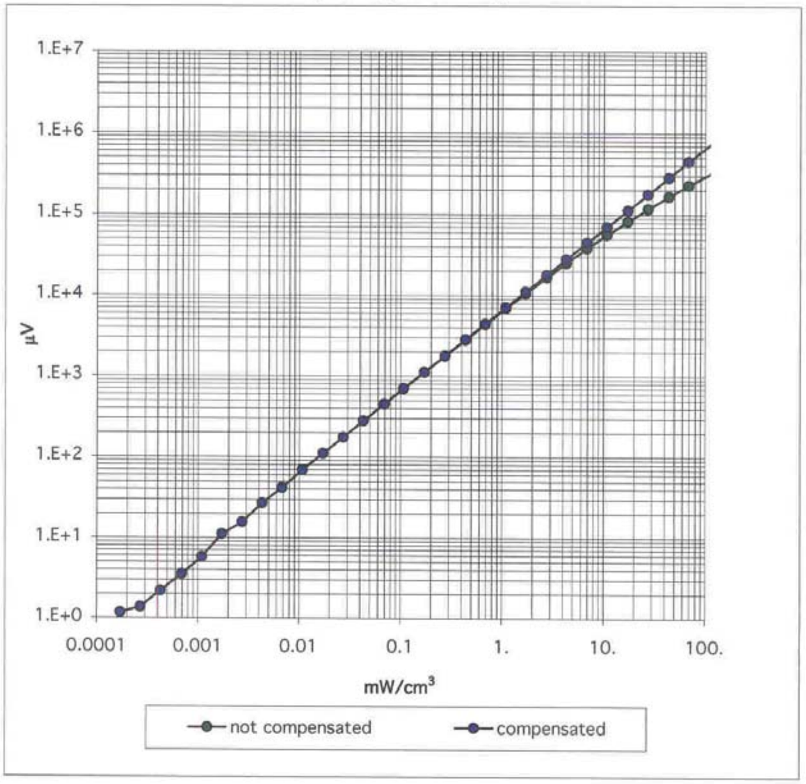
Frequency Response of E-Field

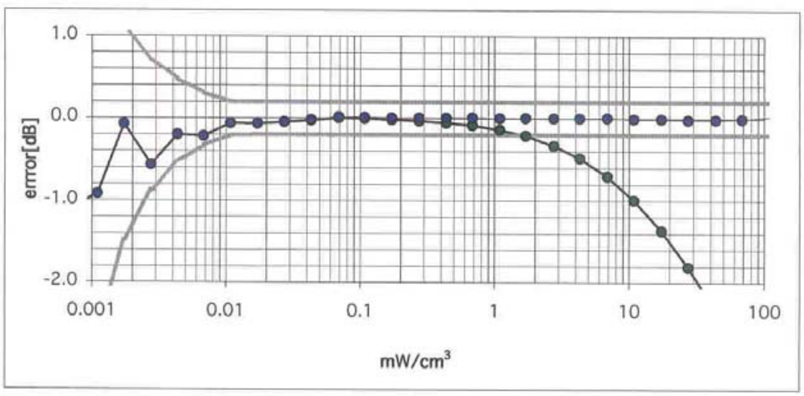
(TEM-Cell:ifi110, Waveguide R22)



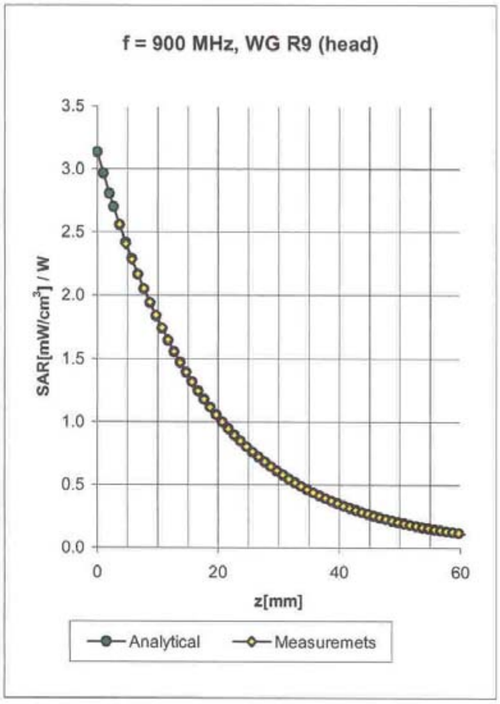
Dynamic Range f(SAR_{brain})

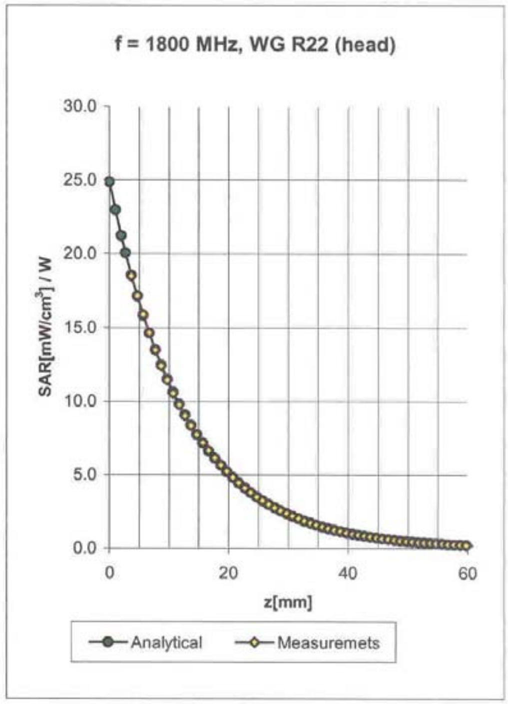
(Waveguide R22)





Conversion Factor Assessment





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

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

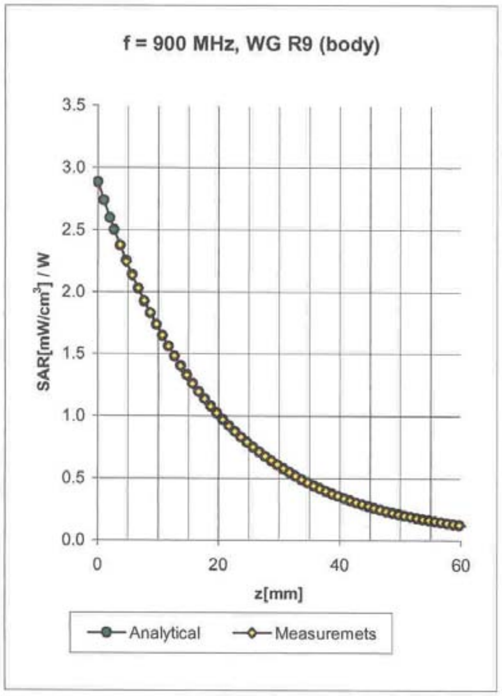
ConvF X	6.6 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.6 ± 9.5% (k=2)	Alpha	0.42
ConvF Z	6.6 ± 9.5% (k=2)	Depth	2.27

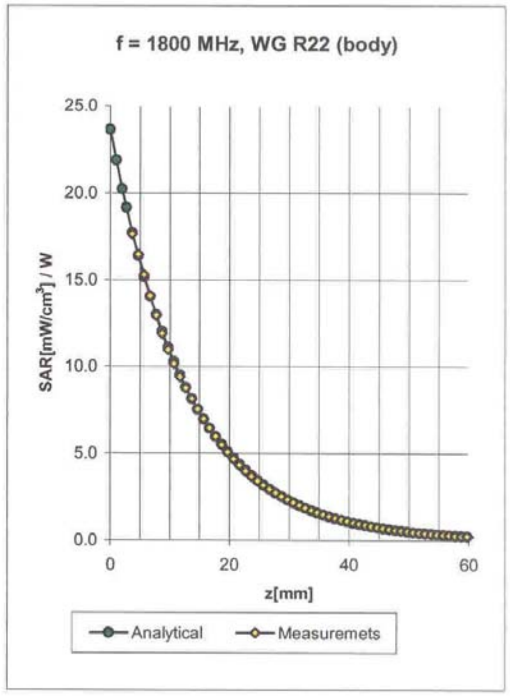
Head	1800 MHz	ε_r = 40.0 ± 5%	σ = 1.40 ± 5% mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.2 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	5.2 ± 9.5% (k=2)	Alpha	0.49
ConvF Z	5.2 ± 9.5% (k=2)	Depth	2.55

Conversion Factor Assessment





Body 900 MHz ε_r = 55.0 ± 5% σ = 1.05 ± 5% mho/m

Valid for f=855-945 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

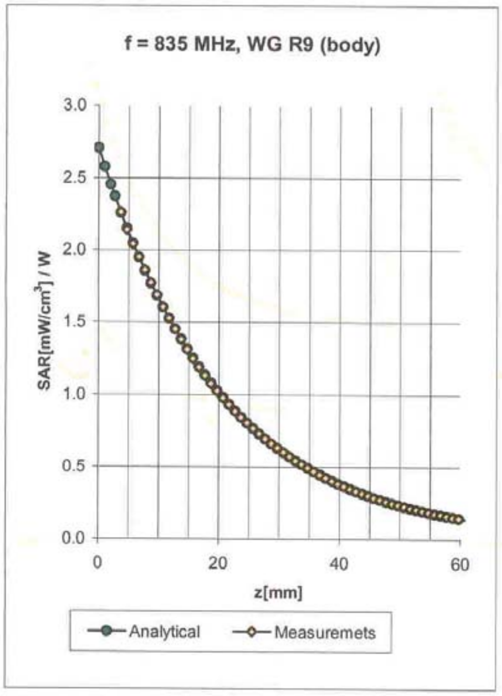
ConvF X	6.3	± 8.9% (k=2)	Boundary effect:	
ConvF Y	6.3	± 8.9% (k=2)	Alpha	0.43
ConvF Z	6.3	± 8.9% (k=2)	Depth	2.32

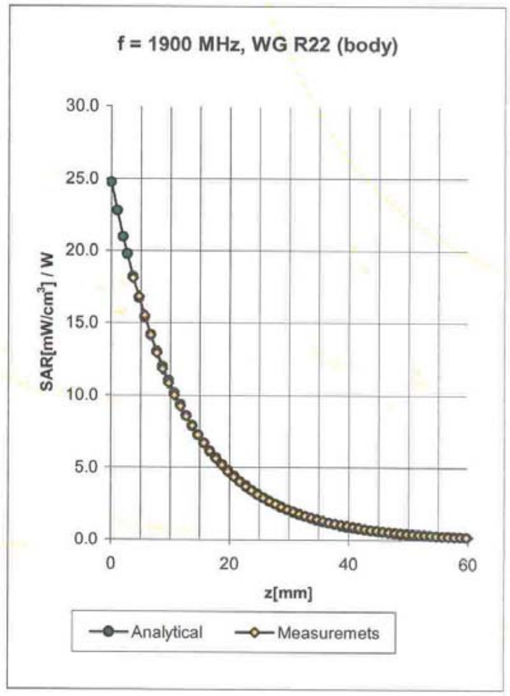
Body 1800 MHz ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

Valid for f=1710-1890 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.9	± 8.9% (k=2)	Boundary effect:	
ConvF Y	4.9	± 8.9% (k=2)	Alpha	0.55
ConvF Z	4.9	± 8.9% (k=2)	Depth	2.70

Conversion Factor Assessment





Body 835 MHz ε_r = 55.2 ± 5% σ = 0.97 ± 5% mho/m

Valid for f=793-877 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

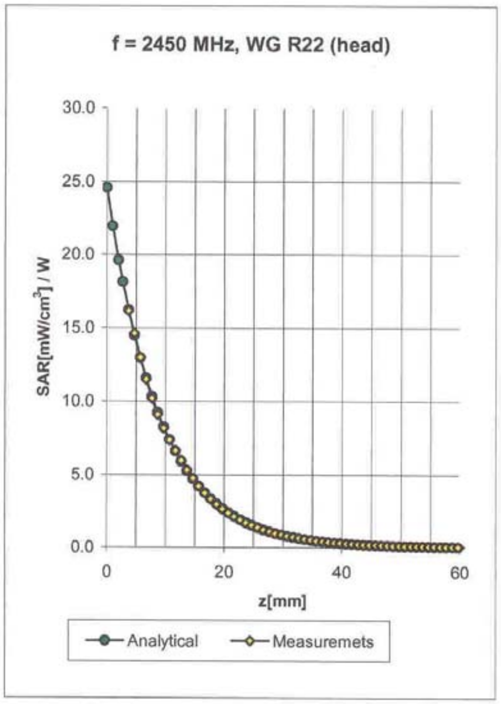
ConvF X	6.3	± 8.9% (k=2)	Boundary effect:	
ConvF Y	6.3	± 8.9% (k=2)	Alpha	0.45
ConvF Z	6.3	± 8.9% (k=2)	Depth	2.17

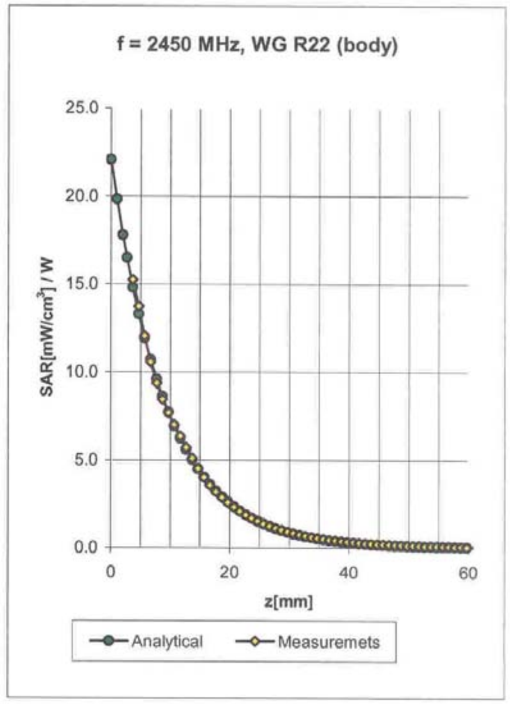
Body 1900 MHz ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

Valid for f=1805-1995 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.7	± 8.9% (k=2)	Boundary effect:	
ConvF Y	4.7	± 8.9% (k=2)	Alpha	0.61
ConvF Z	4.7	± 8.9% (k=2)	Depth	2.46

Conversion Factor Assessment





Head	2450	MHz	ε_r = 39.2 ± 5%	σ = 1.80 ± 5% mho/m

Valid for f=2400-2500 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

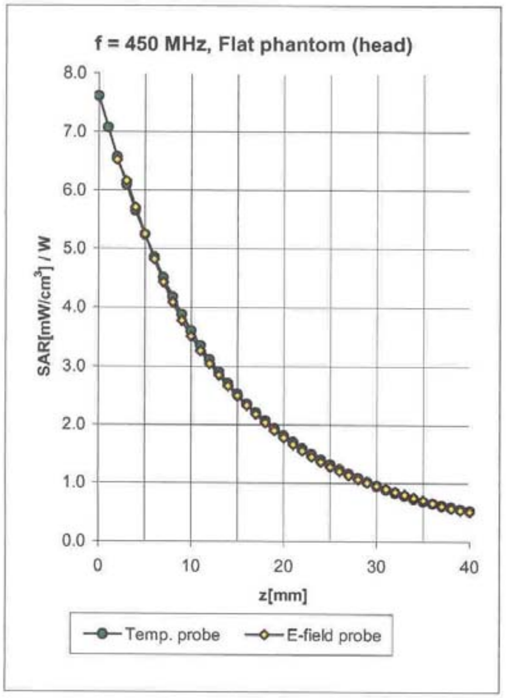
ConvF X	4.8	± 8.9% (k=2)	Boundary effect:	
ConvF Y	4.8	± 8.9% (k=2)	Alpha	1.01
ConvF Z	4.8	± 8.9% (k=2)	Depth	1.83

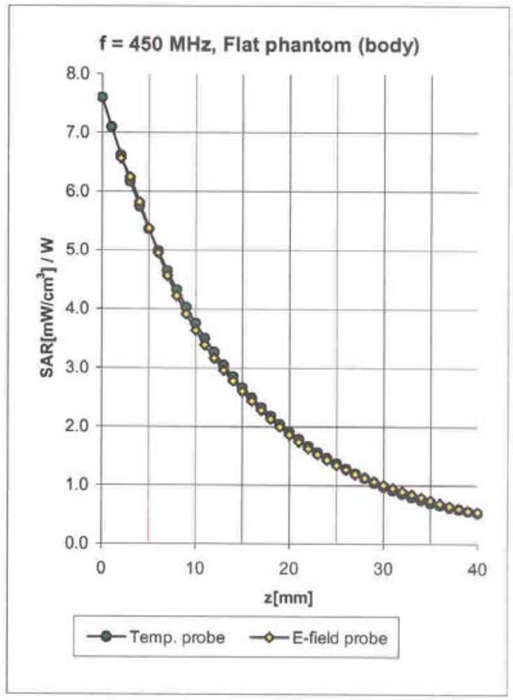
Body	2450	MHz	ε_r = 52.7 ± 5%	σ = 1.95 ± 5% mho/m

Valid for f=2400-2500 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.4	± 8.9% (k=2)	Boundary effect:	
ConvF Y	4.4	± 8.9% (k=2)	Alpha	1.05
ConvF Z	4.4	± 8.9% (k=2)	Depth	1.66

Conversion Factor Assessment





Head	450	MHz	ε_r = 43.5 ± 5%	σ = 0.87 ± 5% mho/m

Valid for f=400-500 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	7.0	± 15.5% (k=2)	Boundary effect:	
ConvF Y	7.0	± 15.5% (k=2)	Alpha	**0.40**
ConvF Z	7.0	± 15.5% (k=2)	Depth	**2.22**

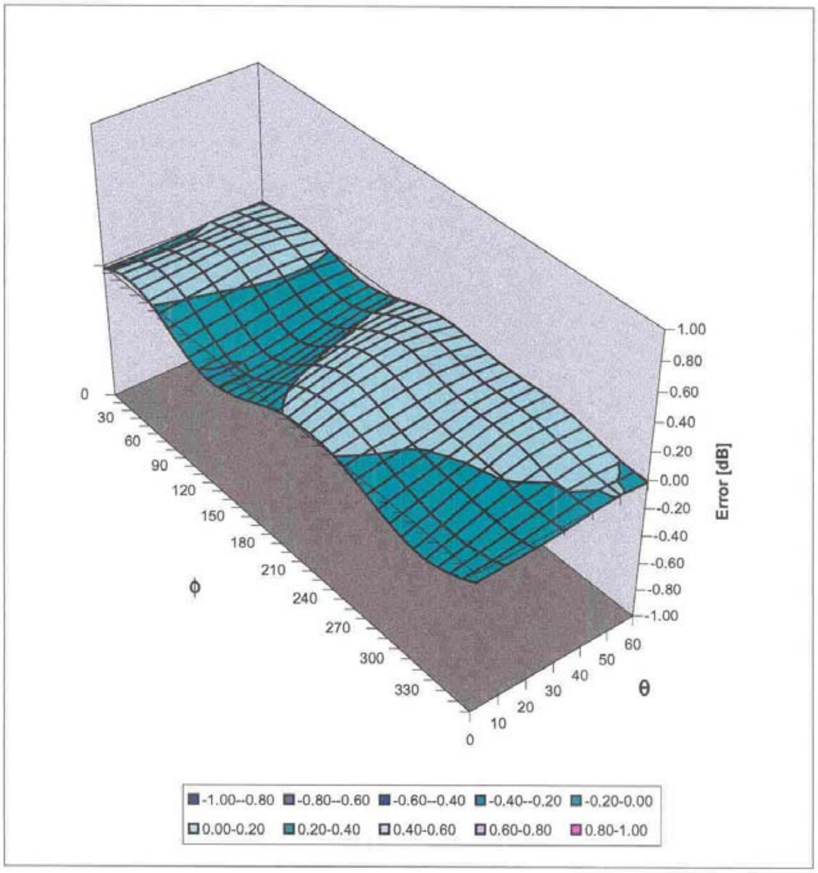
Body	450	MHz	ε_r = 56.7 ± 5%	σ = 0.94 ± 5% mho/m

Valid for f=400-500 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	6.5	± 15.5% (k=2)	Boundary effect:	
ConvF Y	6.5	± 15.5% (k=2)	Alpha	**0.43**
ConvF Z	6.5	± 15.5% (k=2)	Depth	**2.36**

Deviation from Isotropy in HSL

Error (θ,φ), f = 900 MHz



APPENDIX A – PHANTOM CERTIFICATE

Schmid & Partner
Engineering AG

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

Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 BA
Series No	TP-1002 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-series, First article

Standards

[1] CENELEC EN 50361
[2] IEEE P1528-200x draft 6.5
[3] IEC PT 62209 draft 0.9
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 18.11.2001

Signature / Stamp

APPENDIX B – 900 MHZ DIPOLE CALIBRATION CERTIFICATE

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:	**013**
Place of Calibration:	**Zurich**
Date of Calibration:	**December 19, 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:	

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: 013

Manufactured: July 1997
Calibrated: December 19, 2002

1. Measurement Conditions

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

Relative Dielectricity	**42.4**	± 5%
Conductivity	**0.97 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.5 at 900 MHz) was used for the measurements.

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

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 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:	**6.72 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:	**1.418 ns**	(one direction)
Transmission factor:	**0.994**	(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} = **50.3 Ω**
	Im {Z} = **0.7 Ω**
Return Loss at 900 MHz	**-41.9 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.

Date/Time: 12/19/02 11:57:16

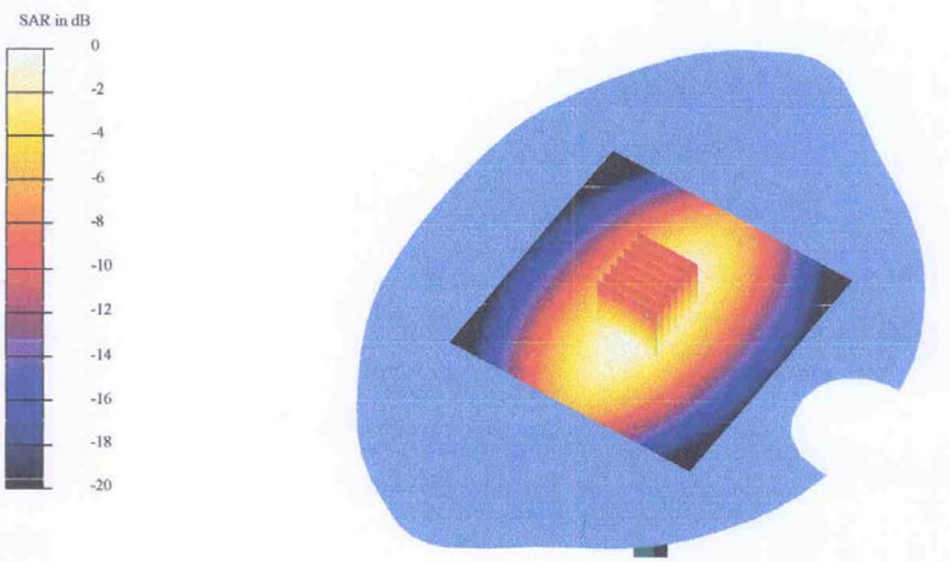
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN013_SN1507_HSL900_191202.da4

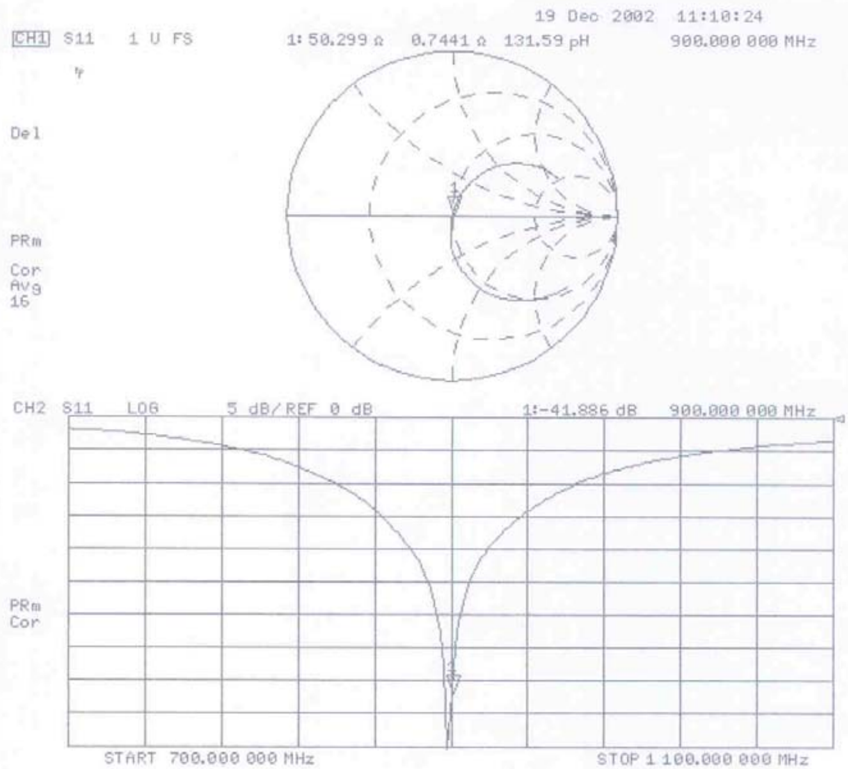
DUT: Dipole 900 MHz Type & Serial Number: D900V2 - SN013
Program: Dipole Calibration; Pin = 250 mW; d = 15 mm

Communication System: CW-900; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL 900 MHz (σ = 0.97 mho/m, ε = 42.44, ρ = 1000 kg/m3)
Phantom section: FlatSection

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(6.5, 6.5, 6.5); Calibrated: 1/24/2002
- *Sensor-Surface: 4mm (Mechanical Surface Detection)*
- Electronics: DAE3 - SN410; Calibrated: 7/18/2002
- 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 = 56.5 V/m
Peak SAR = 4.03 mW/g
SAR(1 g) = 2.66 mW/g; *SAR(10 g)* = 1.68 mW/g
Power Drift = -0.003 dB




19 Dec 2002 11:10:24
CH1 S11 1 U FS
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900.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/REF 0 dB
1:-41.886 dB 900.000 000 MHz
PRm
Cor
START 700.000 000 MHz
STOP 1 100.000 000 MHz