TTI-P-G 158

Appendix for the Report

Dosimetric Assessment of the Siemens C65 (FCC ID: PWX-C65) According to the FCC Requirements

Calibration Data

May 13, 2004

IMST GmbH
Carl-Friedrich-Gauß-Str. 2
D-47475 Kamp-Lintfort

Customer
Siemens Information & Communication Mobile LLC
16745 West Bernado Drive, Suite 400
San Diego-CA 92127

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

Client **IMST**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1669
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	March 18, 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	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS, No. 251-0340)	Apr-04
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-03)	In house check: Oct 05

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

Date issued: March 19, 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:1669

Manufactured:	February 8, 2002
Last calibrated:	March 21, 2003
Recalibrated:	March 18, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1669

Sensitivity in Free Space

NormX	1.83 $\mu V/(V/m)^2$
NormY	1.93 $\mu V/(V/m)^2$
NormZ	1.81 $\mu V/(V/m)^2$

Diode Compression[A]

DCP X	96	mV
DCP Y	96	mV
DCP Z	96	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Plese see Page 7.

Boundary Effect

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

Sensor Cener to Phantom Surface Distance		3.7 mm	4.7 mm
SAR_{be} [%]	Without Correction Algorithm	9.7	5.2
SAR_{be} [%]	With Correction Algorithm	0.1	0.3

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

Sensor to Surface Distance		3.7 mm	4.7 mm
SAR_{be} [%]	Without Correction Algorithm	14.1	9.8
SAR_{be} [%]	With Correction Algorithm	0.2	0.2

Sensor Offset

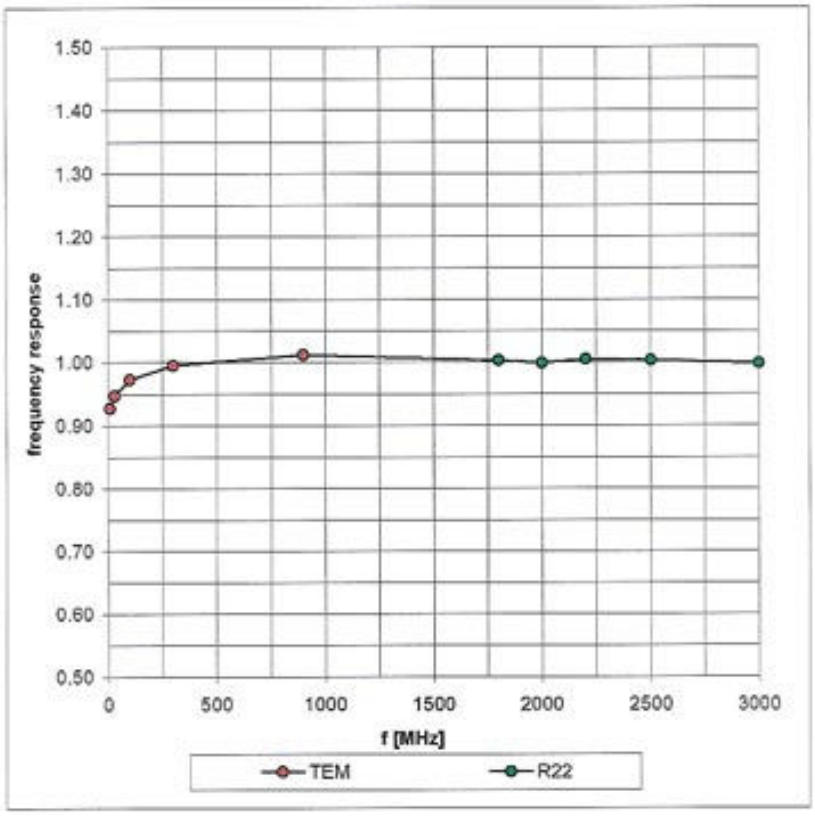
Probe Tip to Sensor Center	2.7 mm
Optical Surface Detection	in tolerance

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%.

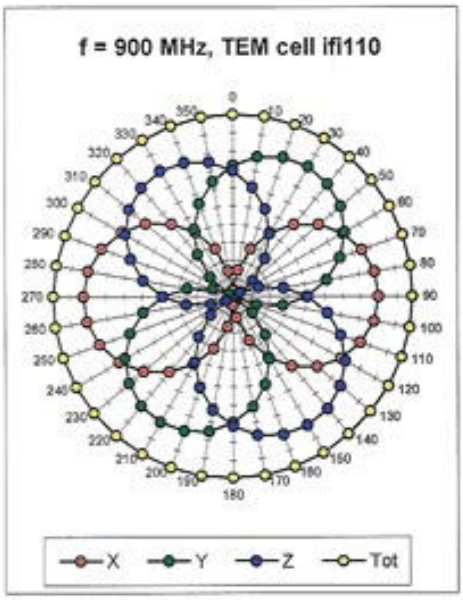
[A] numerical linearization parameter: uncertainty not required

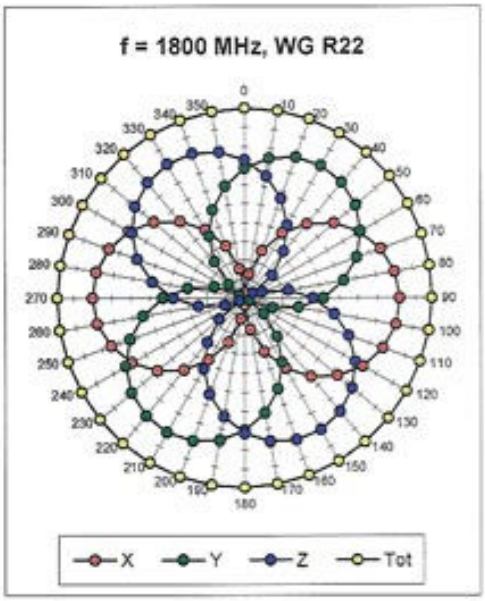
Frequency Response of E-Field

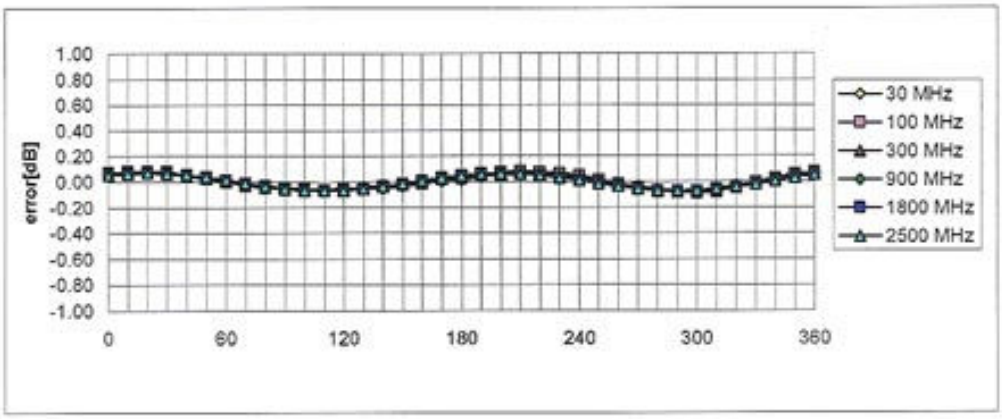
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (ϕ) , θ = 0°



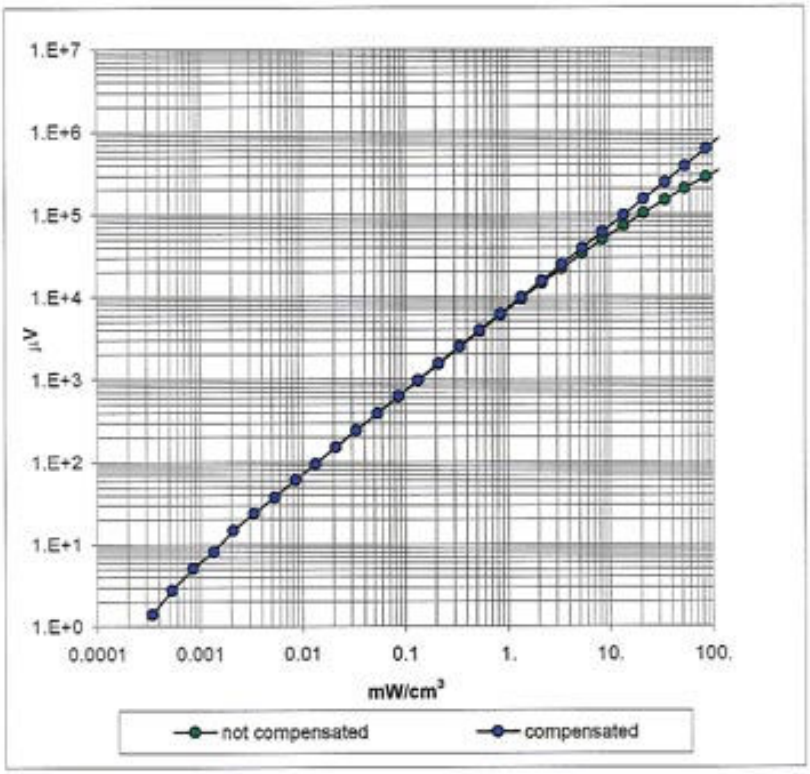


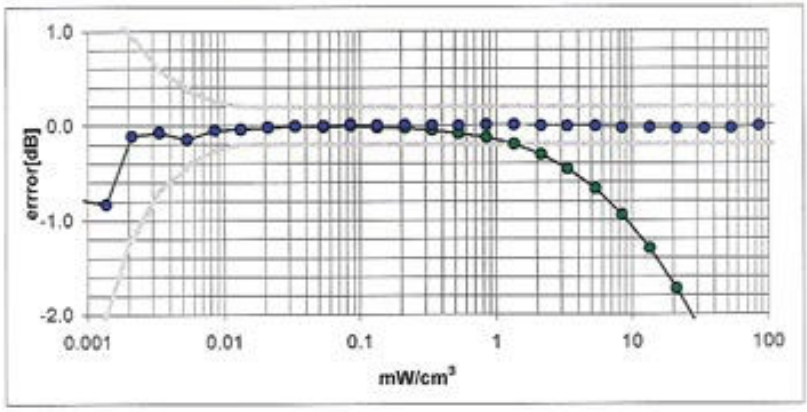


Axial Isotropy Error < ± 0.2 dB

Dynamic Range f(SAR_{head})

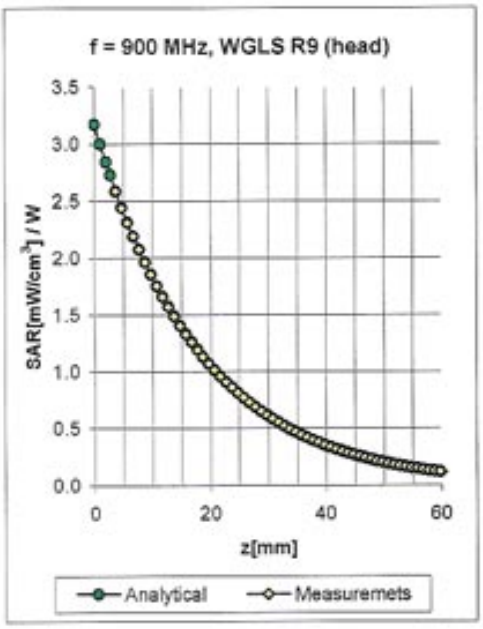
(Waveguide R22)

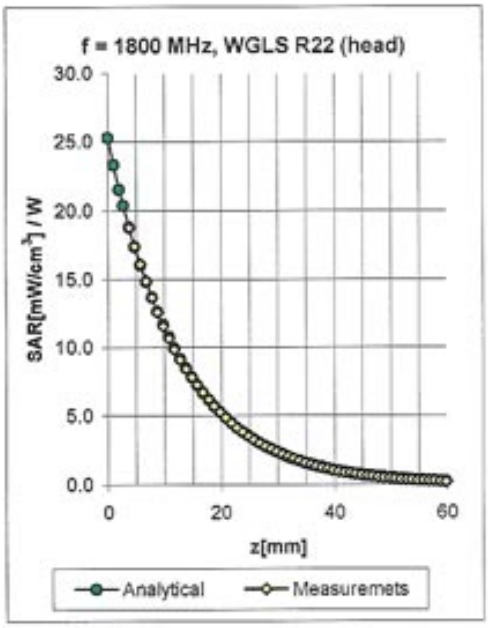




Probe Linearity < ± 0.2 dB

Conversion Factor Assessment



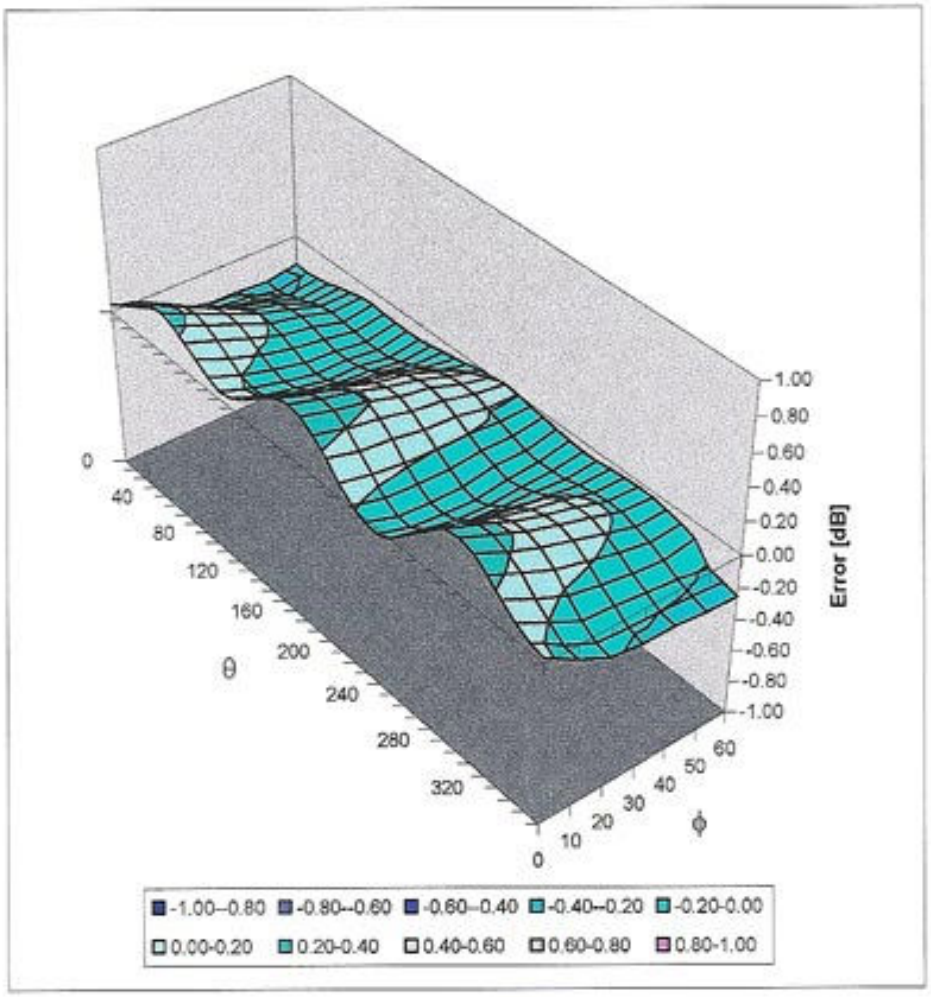


f [MHz]	Validity [MHz][§]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	785-885	Head	41.5 ± 5%	0.90 ± 5%	0.54	2.00	6.67 ± 9.7% (k=2)
900	850-950	Head	41.5 ± 5%	0.97 ± 5%	0.61	1.91	6.47 ± 9.7% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.48	2.73	5.38 ± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.51	2.81	5.19 ± 9.7% (k=2)
1950	1900-2000	Head	40.0 ± 5%	1.40 ± 5%	0.53	2.73	4.88 ± 9.7% (k=2)
835	785-885	Body	55.2 ± 5%	0.97 ± 5%	0.41	2.51	6.32 ± 9.7% (k=2)
900	850-950	Body	55.0 ± 5%	1.05 ± 5%	0.48	2.23	6.13 ± 9.7% (k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.56	2.85	4.66 ± 9.7% (k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.61	2.80	4.54 ± 9.7% (k=2)
1950	1900-2000	Body	53.3 ± 5%	1.52 ± 5%	0.67	2.46	4.35 ± 9.7% (k=2)

[§] 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.

Deviation from Isotropy in HSL

Error (θ,ϕ), f = 900 MHz



Spherical Isotropy Error < ± 0.4 dB

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Client IMST

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1579
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	May 15, 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 (Calibrated by, Certificate No.)	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	Sep-03
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Network Analyzer HP 8753E	US38432426	3-May-00 (Agilent, No. 8702K064602)	In house check: May 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01 (ELCAL, No.2360)	Sep-03

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

Date issued: May 15, 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

s p e a g

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info@speag.com, http://www.speag.com

Probe ET3DV6

SN:1579

Manufactured:	May 7, 2001
Last calibration:	August 27, 2002
Recalibrated:	May 15, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1579

Sensitivity in Free Space

Diode Compression

NormX	1.65 $\mu V/(V/m)^2$	DCP X	94	mV
NormY	1.59 $\mu V/(V/m)^2$	DCP Y	94	mV
NormZ	1.58 $\mu V/(V/m)^2$	DCP Z	94	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	6.7 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.7 ± 9.5% (k=2)	Alpha	0.34
ConvF Z	6.7 ± 9.5% (k=2)	Depth	2.58

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	5.3 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	5.3 ± 9.5% (k=2)	Alpha	0.45
ConvF Z	5.3 ± 9.5% (k=2)	Depth	2.77

Boundary Effect

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

Probe Tip to Boundary		1 mm	2 mm
SAR_{be} [%]	Without Correction Algorithm	9.2	5.3
SAR_{be} [%]	With Correction Algorithm	0.3	0.5

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

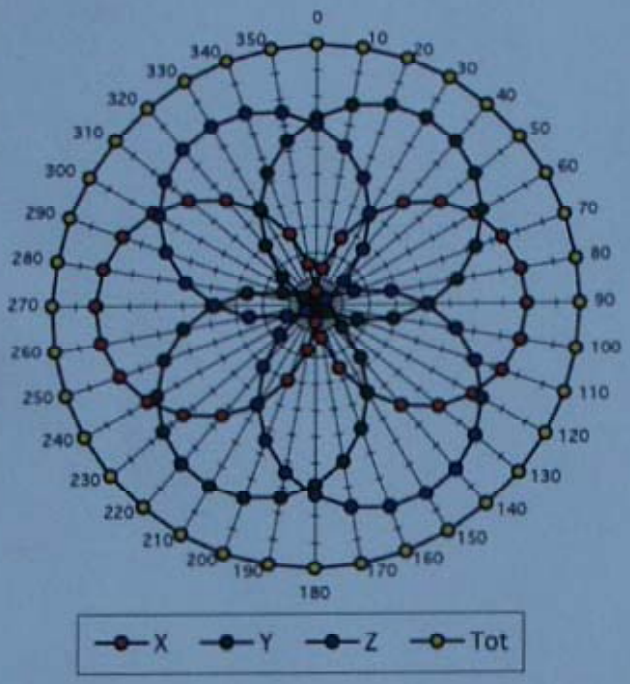
Probe Tip to Boundary		1 mm	2 mm
SAR_{be} [%]	Without Correction Algorithm	13.2	9.3
SAR_{be} [%]	With Correction Algorithm	0.2	0.2

Sensor Offset

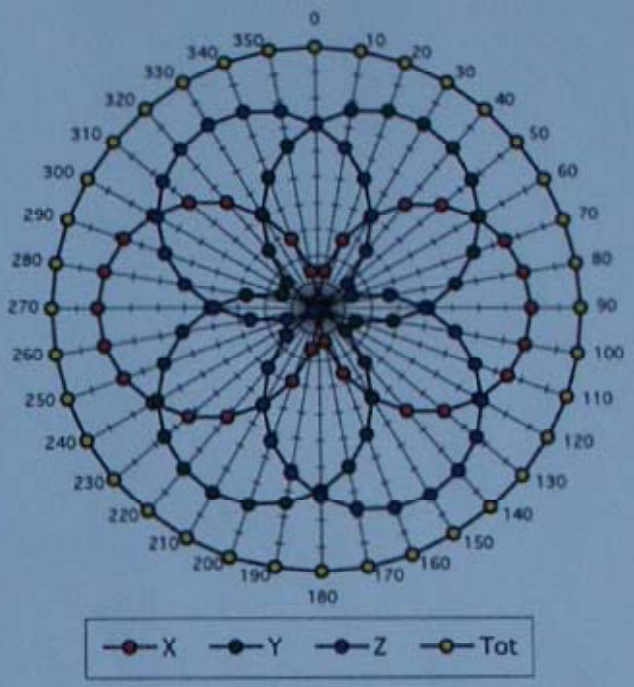
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.1 ± 0.2	mm

Receiving Pattern (ϕ), θ = 0°

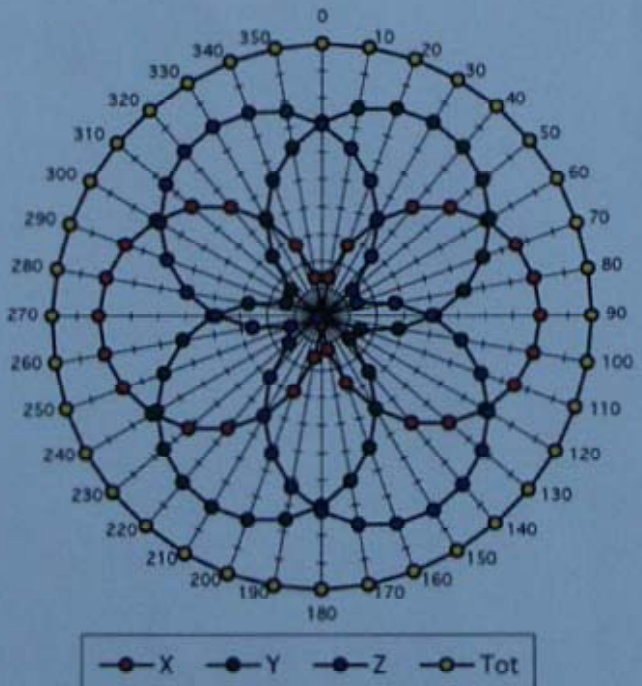
f = 30 MHz, TEM cell ifi110



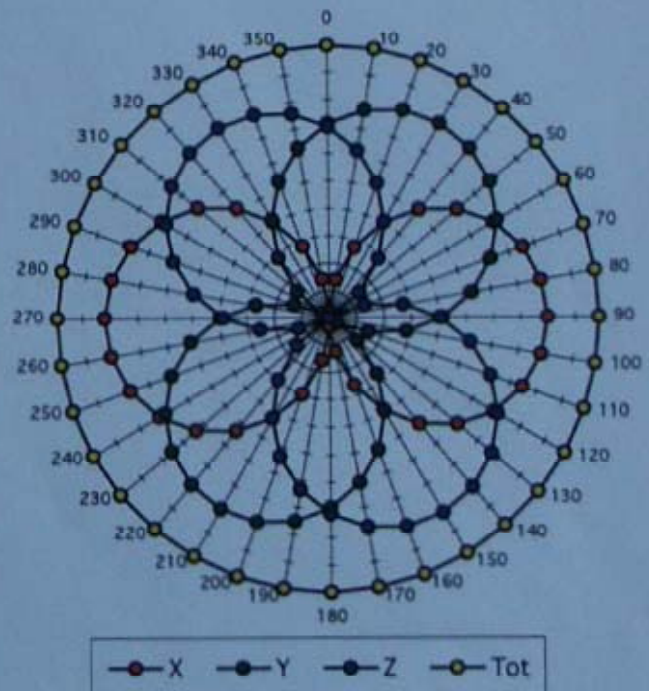
f = 100 MHz, TEM cell ifi110

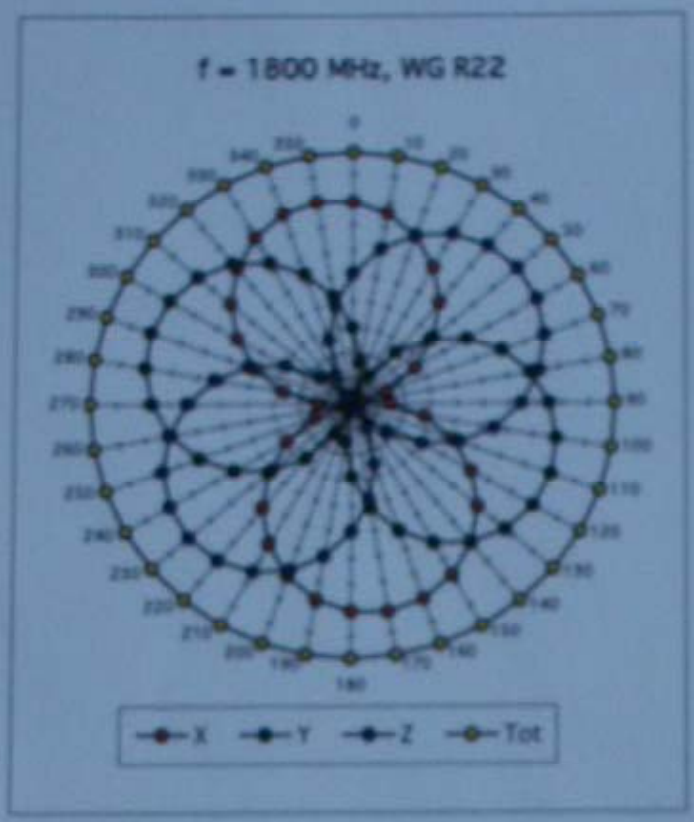


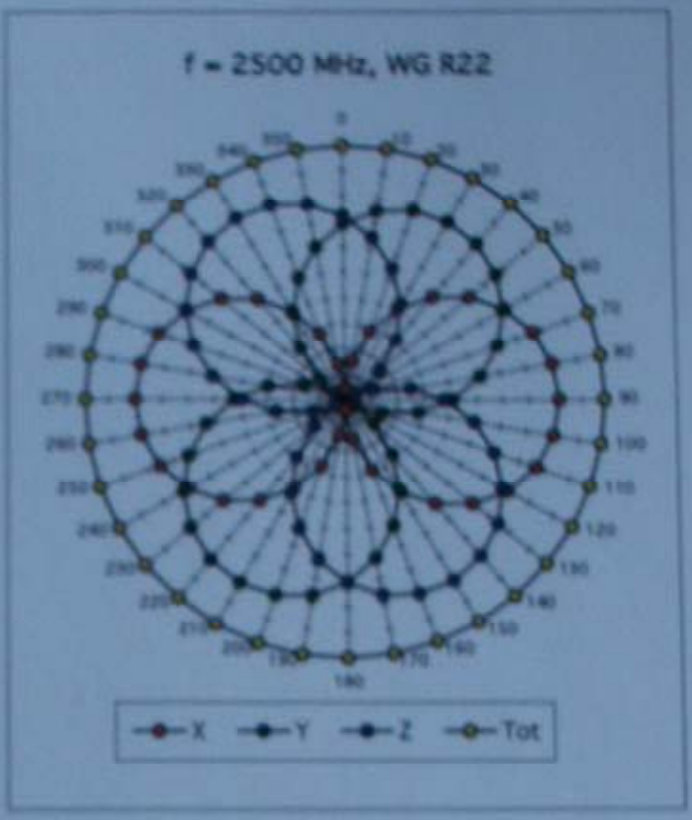
f = 300 MHz, TEM cell ifi110



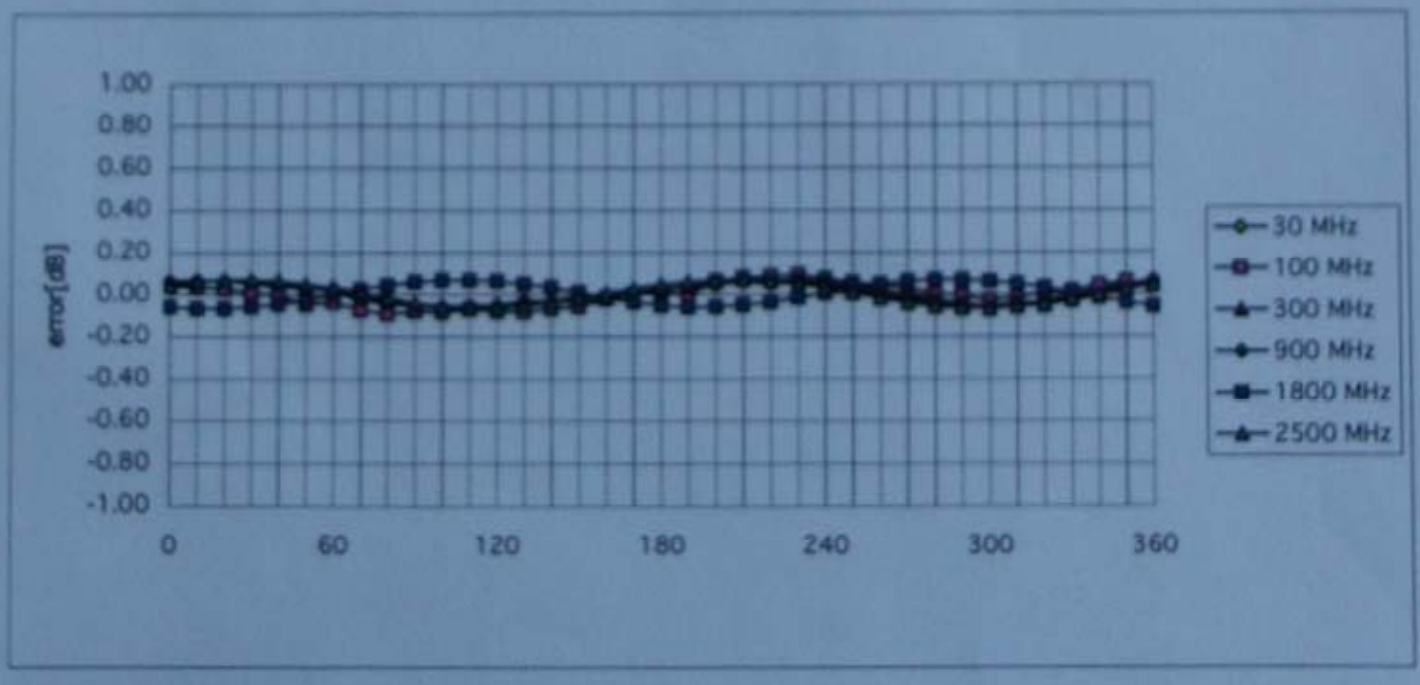
f = 900 MHz, TEM cell ifi110





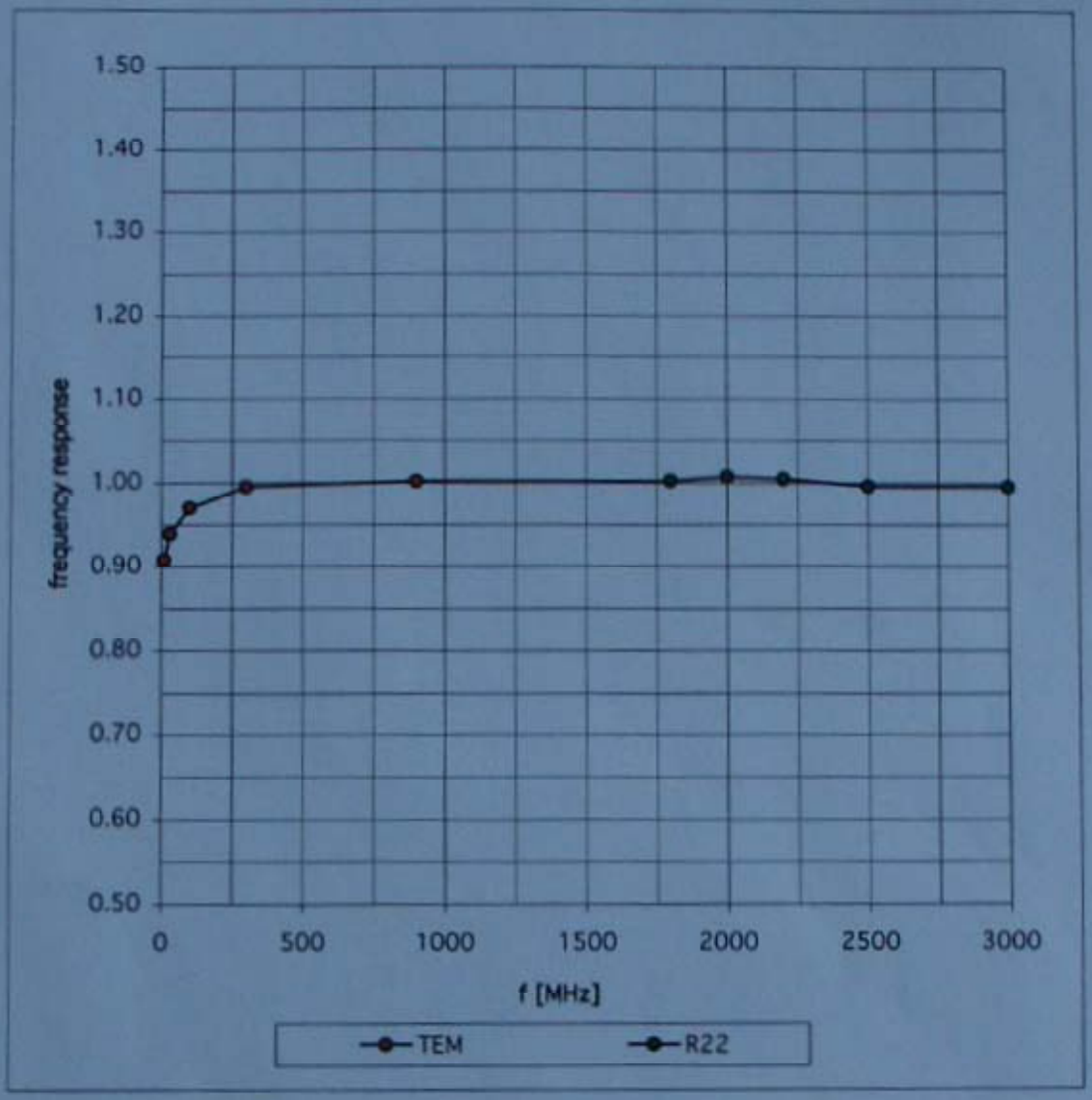


Isotropy Error (ϕ), θ = 0°



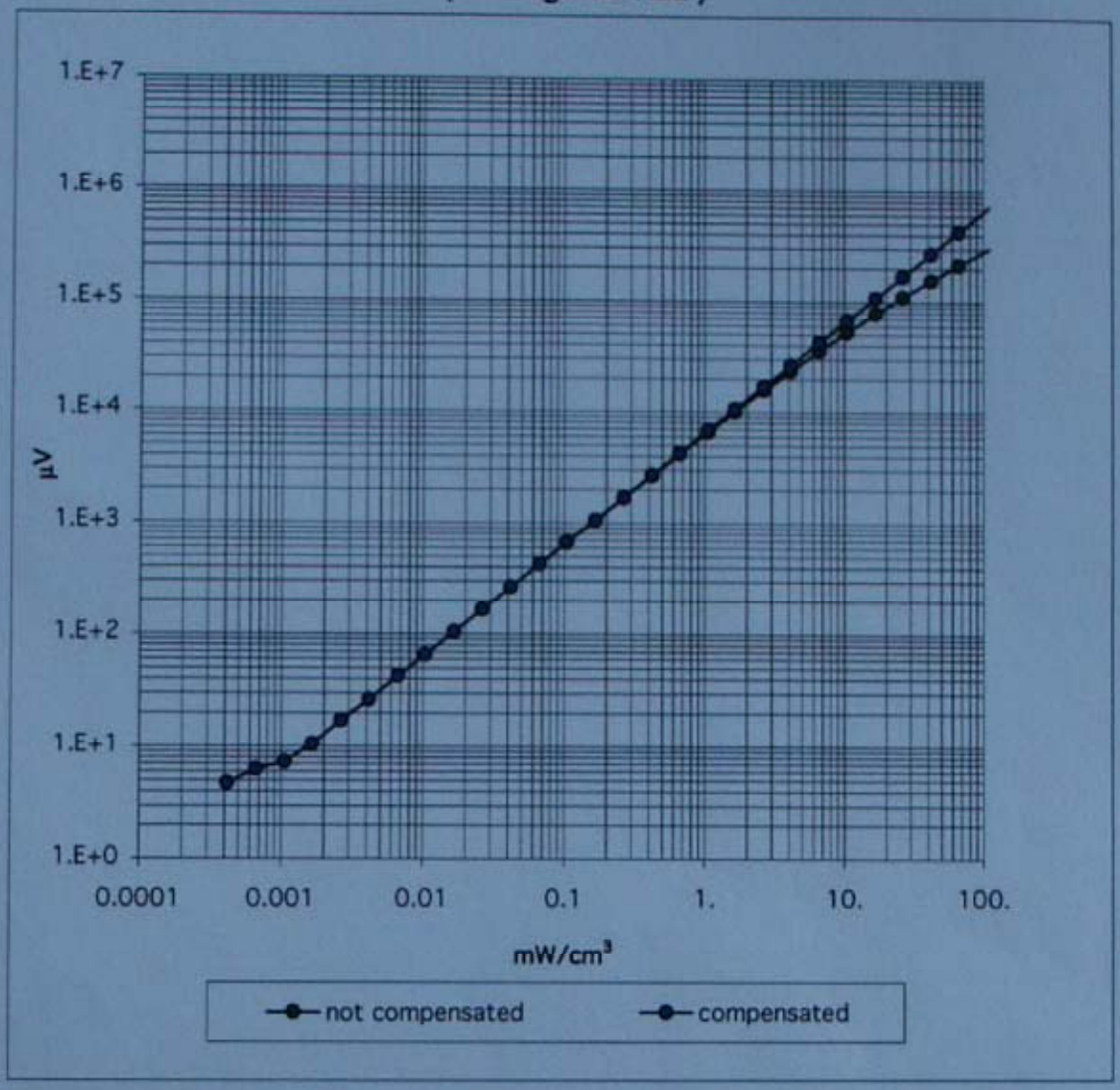
Frequency Response of E-Field

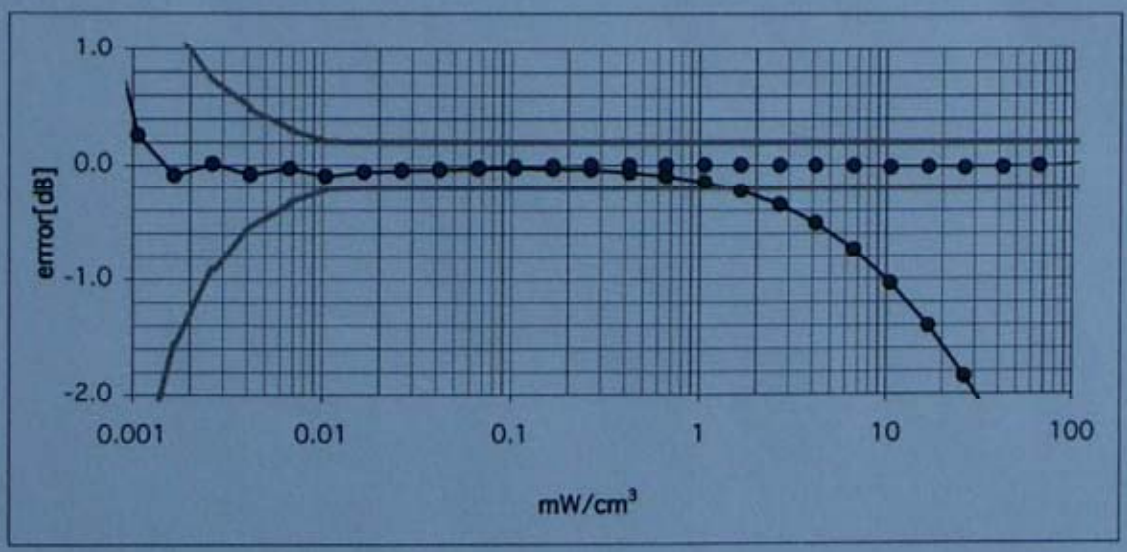
(TEM-Cell:ifi110, Waveguide R22)



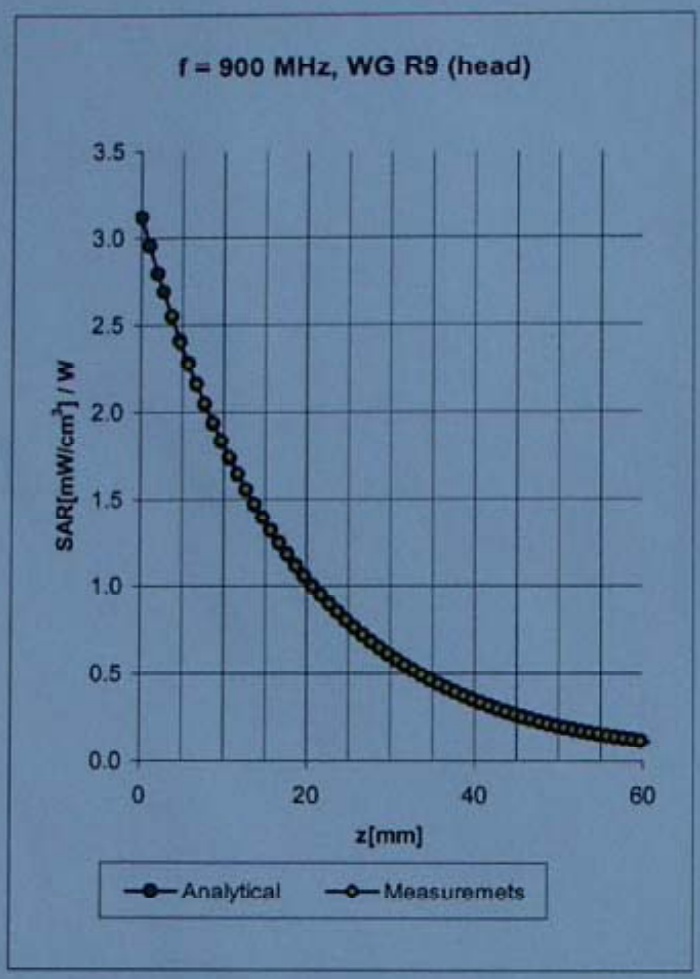
Dynamic Range f(SAR_{brain})

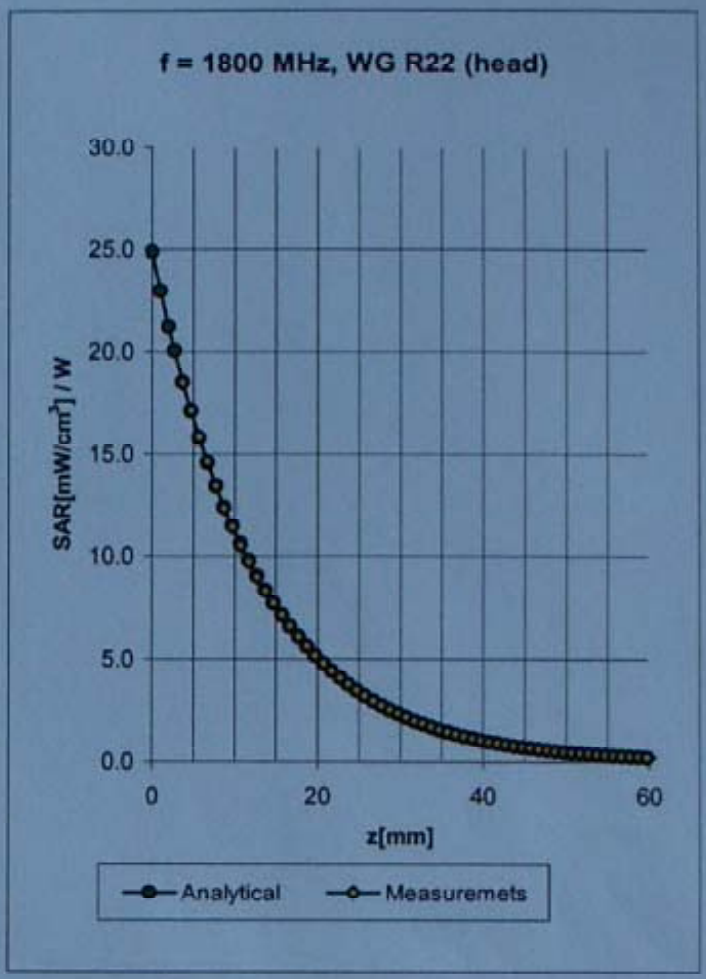
(Waveguide R22)





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

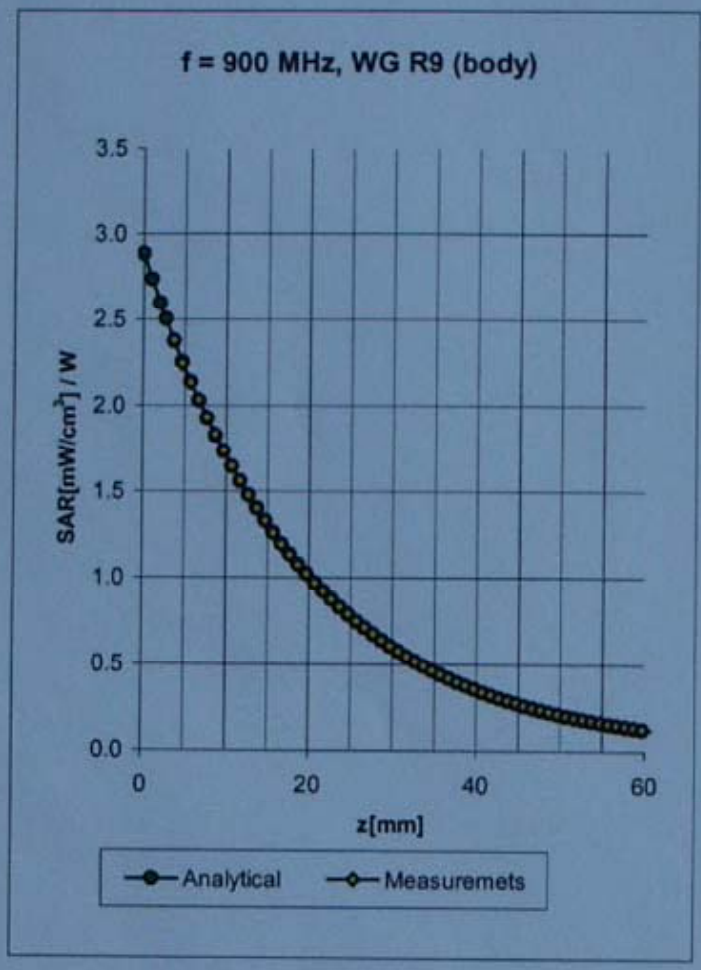
ConvF X	6.7 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.7 ± 9.5% (k=2)	Alpha	**0.34**
ConvF Z	6.7 ± 9.5% (k=2)	Depth	**2.58**

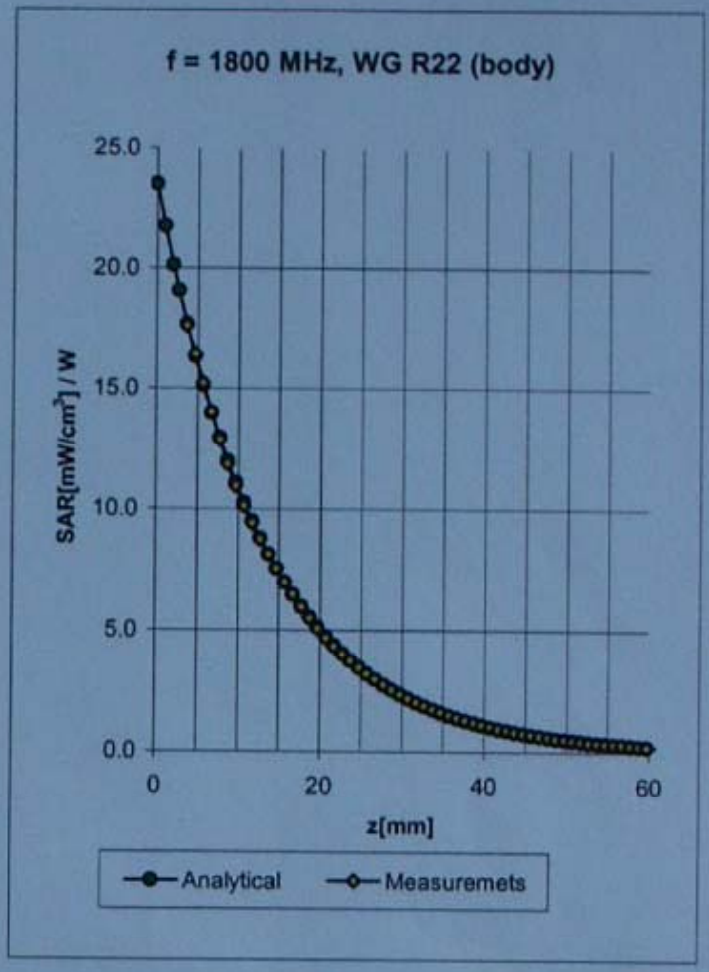
Head 1800 MHz ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

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

ConvF X	5.3 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	5.3 ± 9.5% (k=2)	Alpha	**0.45**
ConvF Z	5.3 ± 9.5% (k=2)	Depth	**2.77**

Conversion Factor Assessment





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

Valid for f=800-1000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

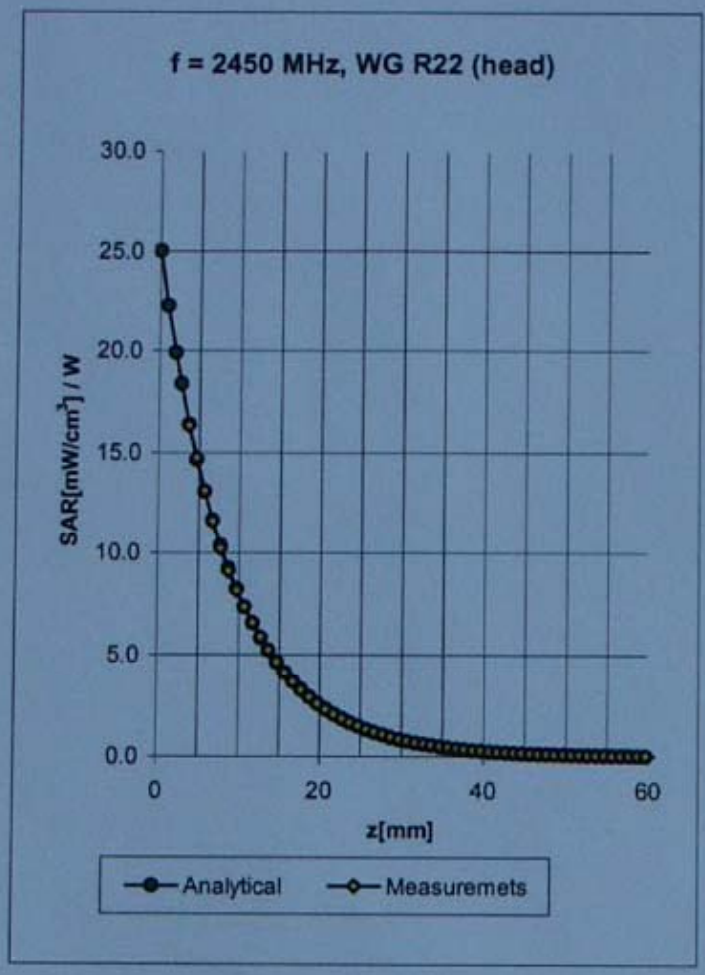
ConvF X	6.5 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.5 ± 9.5% (k=2)	Alpha	0.37
ConvF Z	6.5 ± 9.5% (k=2)	Depth	2.52

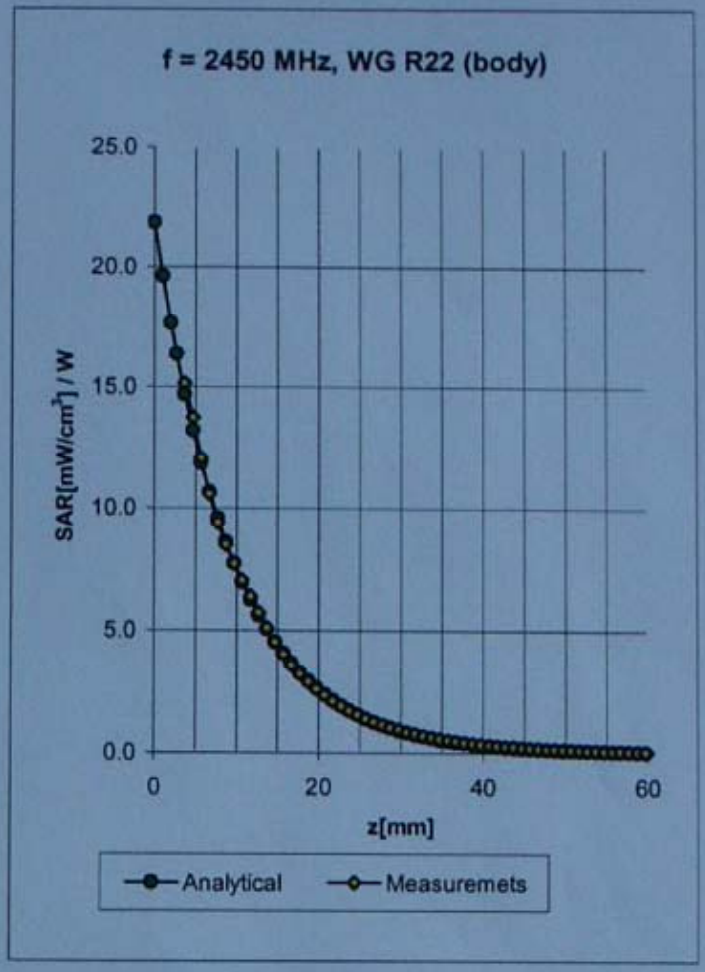
Body 1800 MHz ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

Valid for f=1710-1910 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.8 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	4.8 ± 9.5% (k=2)	Alpha	0.53
ConvF Z	4.8 ± 9.5% (k=2)	Depth	2.66

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	**0.93**
ConvF Z	4.8 ± 8.9% (k=2)	Depth	**1.95**

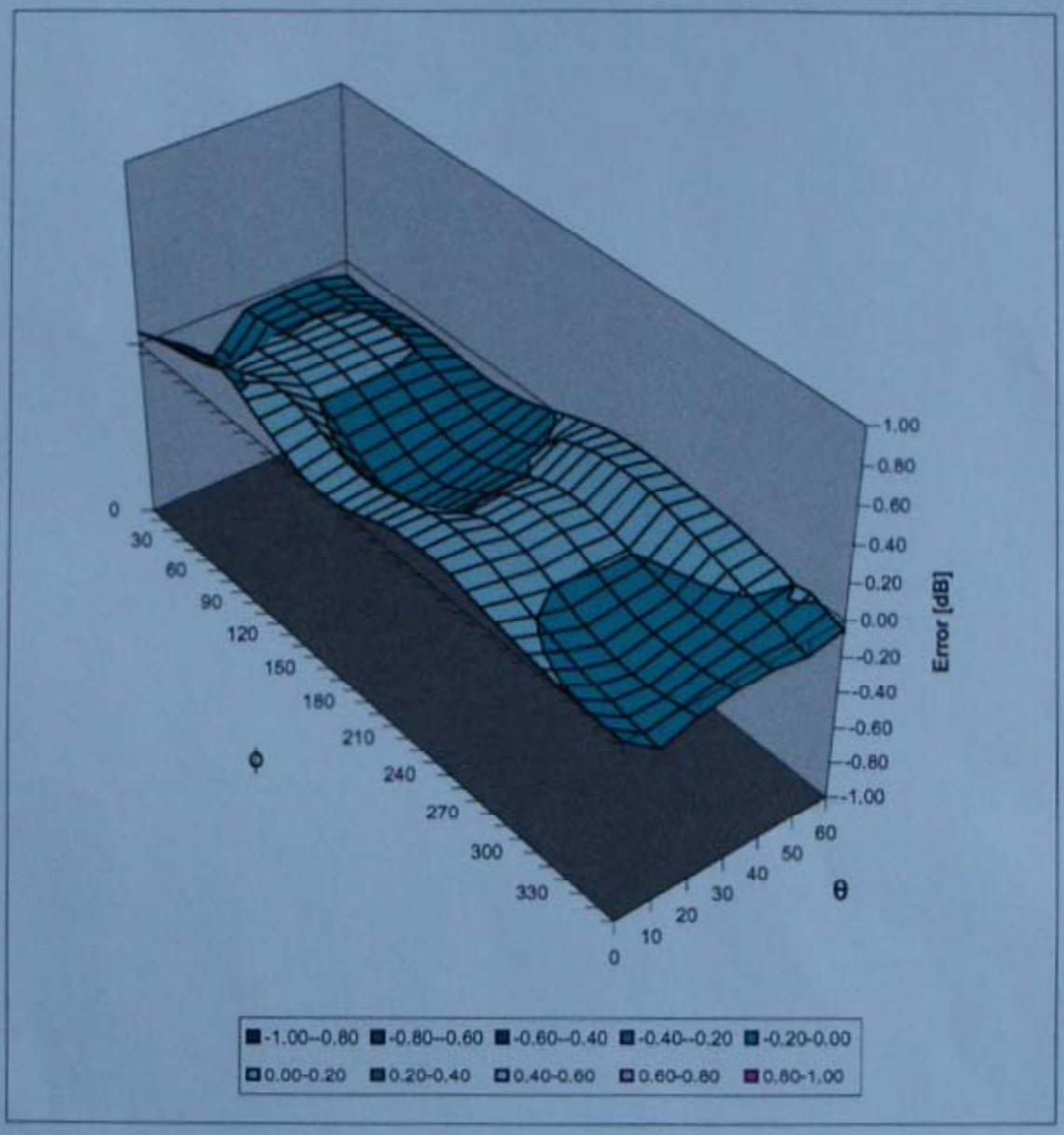
Body	2450	MHz	ε_r = 52.7 ± 5%	σ = 1.95 ± 5% mho/m

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	**1.35**
ConvF Z	4.4 ± 8.9% (k=2)	Depth	**1.50**

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

1900 MHz System Validation Dipole

Type:	**D1900V2**
Serial Number:	**535**
Place of Calibration:	**Zurich**
Date of Calibration:	**November 14, 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:	D. Vellen
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: D1900V2

Serial: 535

Manufactured: March 22, 2001
Calibrated: November 14, 2002

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating glycol solution of the following electrical parameters at 1900 MHz:

Relative Dielectricity	**39.8**	± 5%
Conductivity	**1.45 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.2 at 1900 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 10mm 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:	**40.8 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**20.7 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:	**1.2184 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 1900 MHz:	Re{Z} = **50.9 Ω**
	Im {Z} = **3.6 Ω**
Return Loss at 1900 MHz	**-28.6 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with body simulating glycol solution of the following electrical parameters at 1900 MHz:

Relative Dielectricity	**52.2**	± 5%
Conductivity	**1.57 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 4.9 at 1900 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 10mm 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.

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 cm^3 (1 g) of tissue:	**41.2 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**21.0 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 1900 MHz:	Re{Z} = **46.5 Ω**
	Im {Z} = **3.4 Ω**
Return Loss at 1900 MHz	**-26.0 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.

Small end caps have been added to the dipole arms in order to improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

9. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 11/14/02 17:19:55

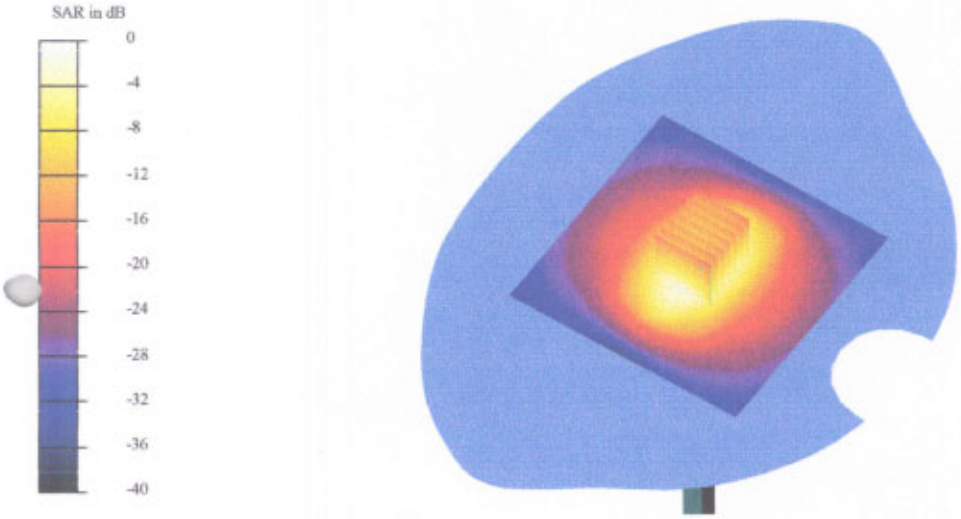
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN535caps_SN1507_HSL1900_141102.da4

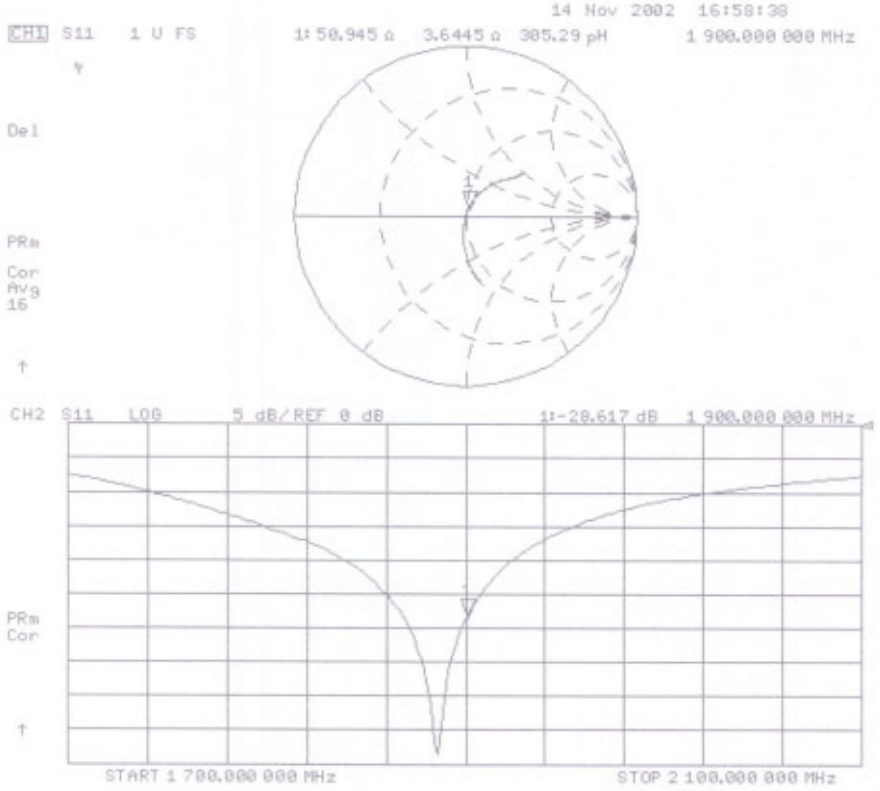
DUT: Dipole 1900 MHz Type & Serial Number: D1900V2 - SN535
Program: Dipole Calibration; Pin = 250 mW; d = 10 mm

Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL 1900 MHz (σ = 1.45 mho/m, ε = 39.75, ρ = 1000 kg/m3)
Phantom section: FlatSection

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(5.2, 5.2, 5.2); 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 35

Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm
Reference Value = 94 V/m
Peak SAR = 18.5 mW/g
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.18 mW/g
Power Drift = -0.01 dB




14 Nov 2002 16:58:38
CH1 S11 1 U FS
1: 50.945 Ω 3.6445 Ω 385.29 pH
1 900.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF 0 dB
1: -28.617 dB 1 900.000 000 MHz
PRm
Cor
START 1 700.000 000 MHz
STOP 2 100.000 000 MHz

Date/Time: 11/14/02 18:52:22

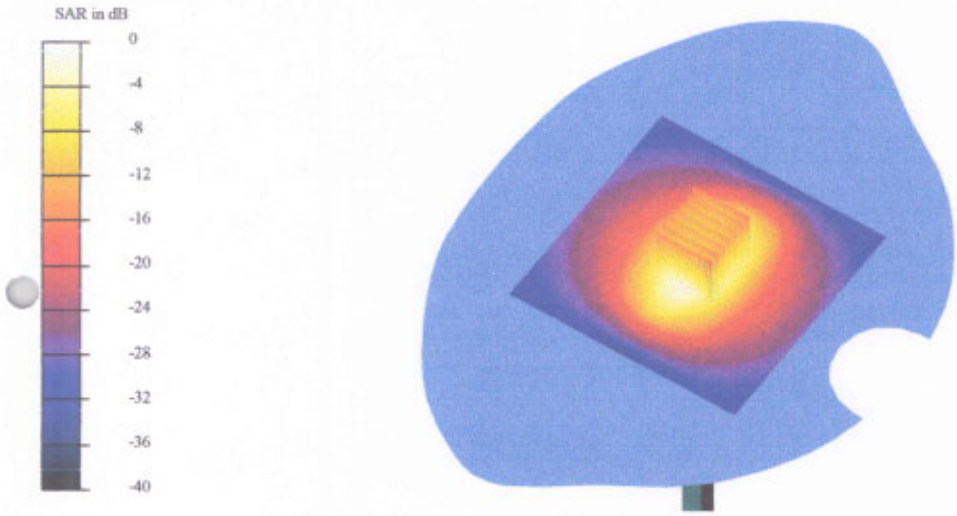
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN535_SN1507_M1900_141102.da4

DUT: Dipole 1900 MHz Type & Serial Number: D1900V2 - SN535
Program: Dipole Calibration; Pin = 250 mW; d = 10 mm

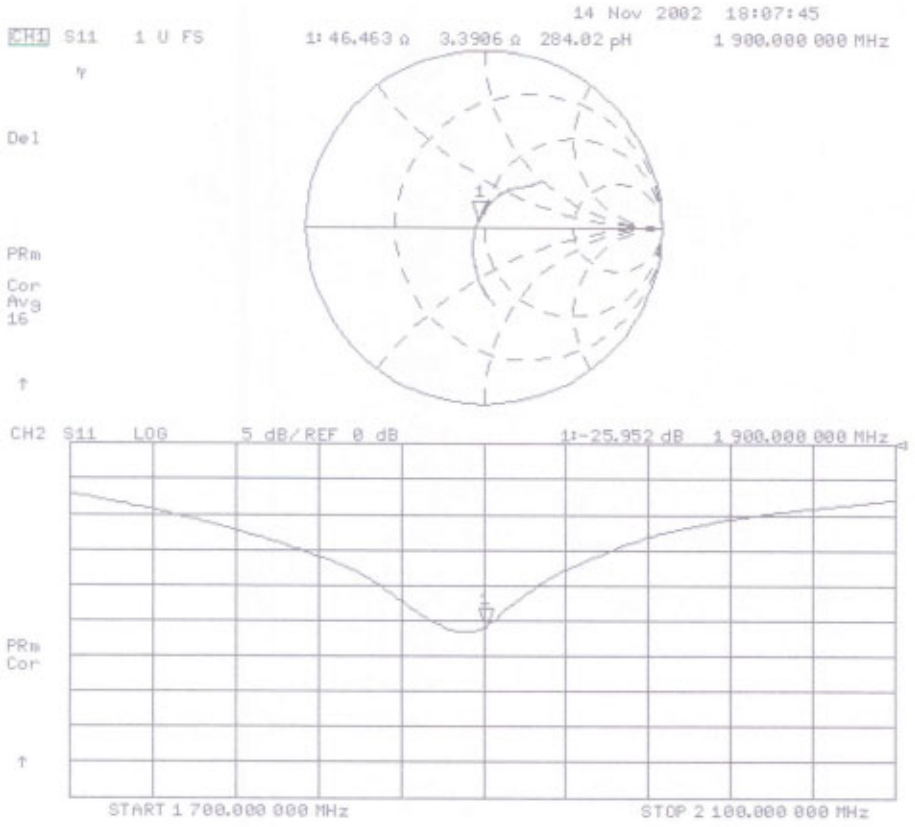
Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: Muscle 1900 MHz (σ = 1.57 mho/m, ε = 52.15, ρ = 1000 kg/m3)
Phantom section: FlatSection

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(4.9, 4.9, 4.9); 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 35

Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm
Reference Value = 90.7 V/m
Peak SAR = 18.8 mW/g
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.26 mW/g
Power Drift = -0.03 dB



Muscle


14 Nov 2002 18:07:45
CH1 S11 1 U FS
1: 46.463 Ω 3.3906 Ω 284.02 pH
1 900.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF 0 dB
1: -25.952 dB 1 900.000 000 MHz
PRm
Cor
START 1 700.000 000 MHz
STOP 2 100.000 000 MHz