

ANNEX E PROBE CALIBRATION CERTIFICATE

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



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

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The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates
Client TMC China

Accreditation No.: **SCS 108**

Certificate No.: ET3DV6-1736_Dec06

CALIBRATION CERTIFICATE

Object	ET3DV6-SN: 1736
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	December 1, 2006
Condition of the calibrated item	In Tolerance

This calibration certify documents the traceability to national standards, which realize the physical units of measurements(SI).
All calibrations have been conducted at an environment temperature (22±3)^oC and humidity<70%

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Data (Calibrated by, Certification NO.)	Scheduled Calibration
Power meter E4419B	GB341293874	22-May-06 (METAS, NO. 251-00466)	May-07
Power sensor E4412A	MY41495277	22-May-06 (METAS, NO. 251-00466)	May-07
Power sensor E4412A	MY41498087	22-May-06 (METAS, NO. 251-00466)	May-07
Reference 20 dB Attenuator	SN:S5086 (20b)	22-May-06 (METAS, NO. 251-00467)	May-07
Reference Probe ES3DV2	SN:S5086 (20b)	22-May-06 (METAS, NO. 251-00467)	May-07
DAE4	SN:3013	13-Jan-06 (SPEAG, NO. ES3-3013_Jan06)	Jan-07
Reference Probe ES3DV2	SN: 907	11-Jun-06 (SPEAG, NO.DAE4-907_Jun06)	Jun-07
Secondary Standards	ID#	Check Data (in house)	Scheduled Calibration
RF generator HP8648C	US3642U01700	4-Dec-05(SPEAG, in house check Dec-03)	In house check: Dec-09
Network Analyzer HP 8753E	US37390585	10-Nov-05(SPEAG, NO. DAE4-901_Nov-04)	In house check: Nov-09

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

Issued: December 1, 2006

This calibration certificate shall not be reported except in full without written approval of the laboratory.

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- GENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}:** Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}:** DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters:** Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy):** in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset:** The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

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Probe ET3DV6

SN: 1736

Manufactured:	September 27, 2002
Last calibrated:	November 25, 2005
Recalibrated:	December 1, 2006

Calibrated for DASY System

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DASY - Parameters of Probe: ET3DV6 SN:1736

Sensitivity in Free Space^A

Diode Compression^B

NormX	1.97 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	93 mV
NormY	1.75 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	93 mV
NormZ	1.97 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	93 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL 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	5.0
SAR _{be} [%]	With Correction Algorithm	0.1	0.3

TSL 1810 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	13.2	8.8
SAR _{be} [%]	With Correction Algorithm	0.6	0.1

Sensor Offset

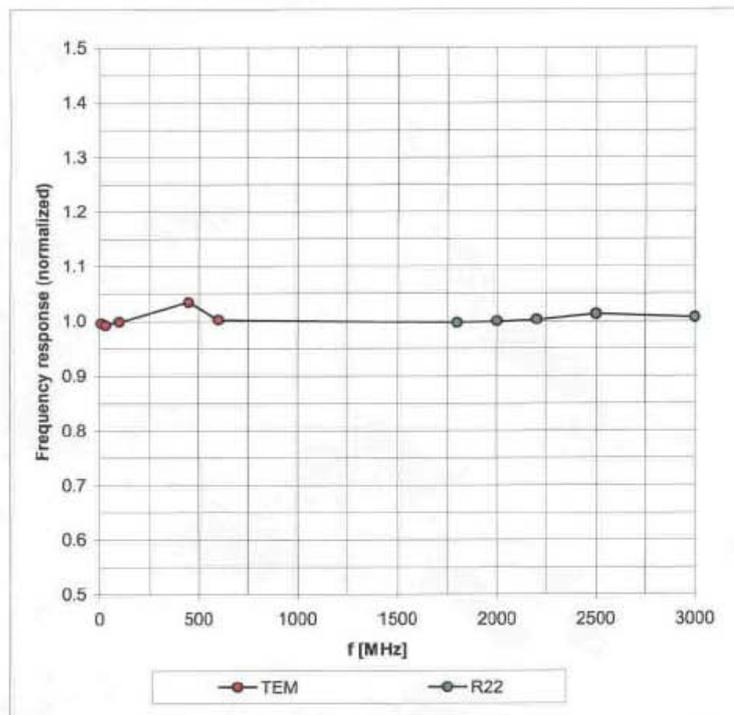
Probe Tip to Sensor Center 2.7 mm

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Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)

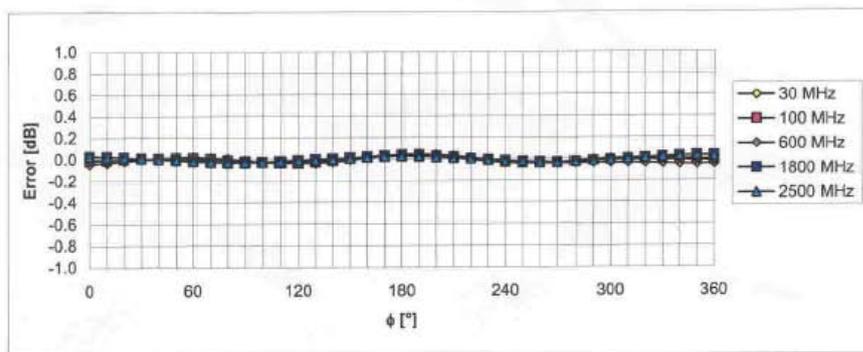
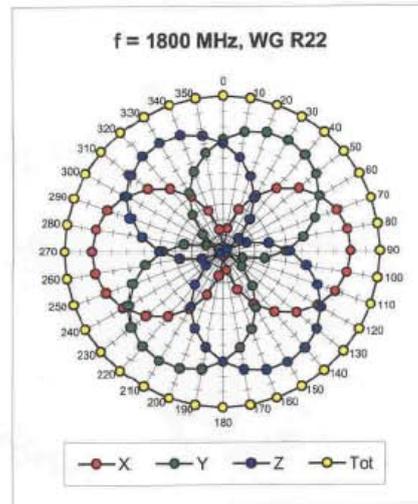
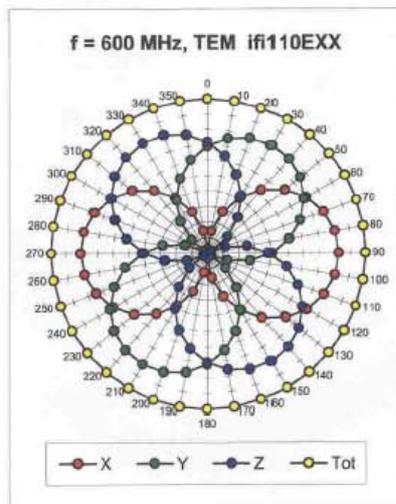


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

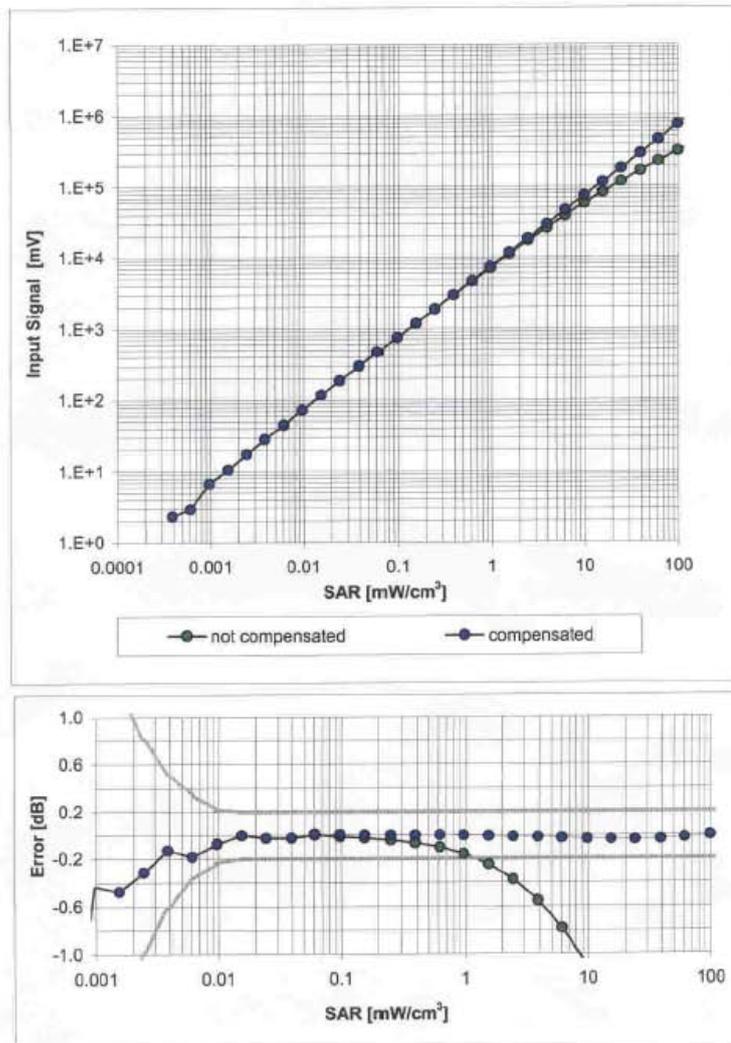


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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Dynamic Range $f(SAR_{head})$ (Waveguide R22, $f = 1800$ MHz)

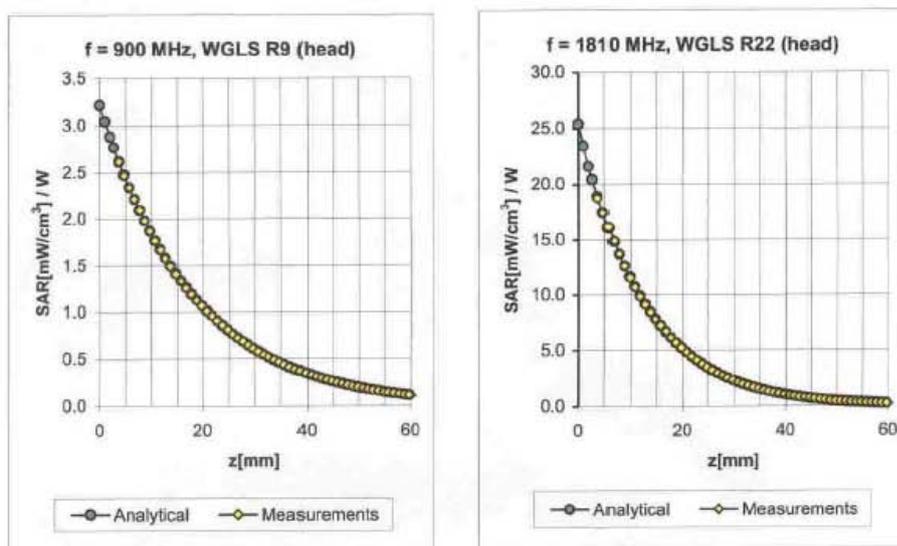


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

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Conversion Factor Assessment



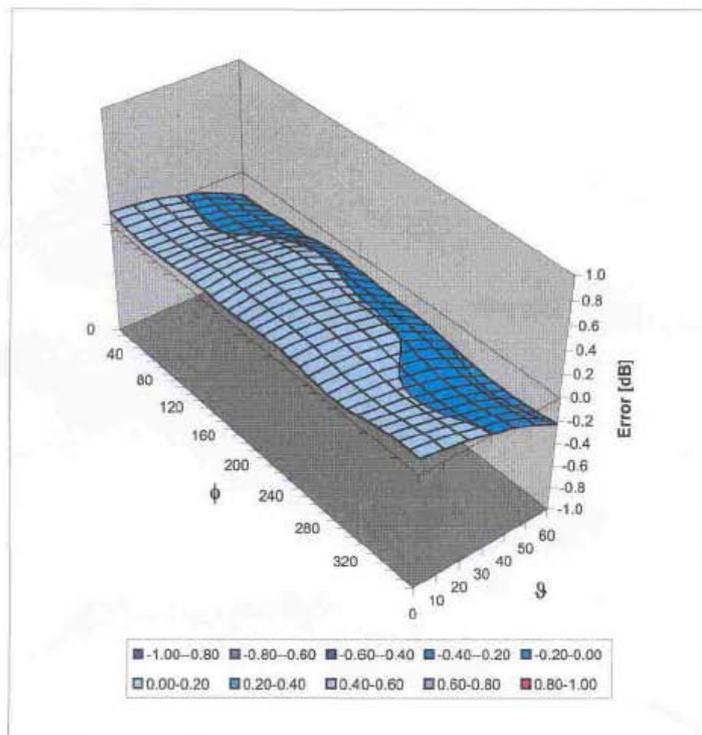
f [MHz]	Validity [MHz] ^C	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.56	1.85	6.51 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.57	2.47	5.40 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.62	2.29	4.67 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.12	1.61	7.74 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.47	2.15	6.45 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.53	2.78	4.88 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.65	2.11	4.35 ± 11.8% (k=2)

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Deviation from Isotropy in HSL

Error (ϕ , θ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)

ANNEX F DIPOLE CALIBRATION CERTIFICATE

Y357

受控文件
受控文件

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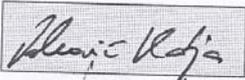
Calibration Certificate

835 MHz System Validation Dipole

Type:	D835V2
Serial Number:	443
Place of Calibration:	Zurich
Date of Calibration:	September 3, 2005
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**

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DASY

Dipole Validation Kit

Type: D835V2

Serial: 443

Manufactured: July 26, 2001
Calibrated: September 3, 2005

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with head simulating solution of the following electrical parameters at 835 MHz:

Relative Dielectricity	41.0	$\pm 5\%$
Conductivity	0.89 mho/m	$\pm 5\%$

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.27 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 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 $\pm 3\%$. 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:	10.6 mW/g
averaged over 10 cm ³ (10 g) of tissue:	6.80 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:	1.403 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 835 MHz:	$\text{Re}\{Z\} = \mathbf{50.5 \Omega}$
	$\text{Im}\{Z\} = \mathbf{-5.3 \Omega}$
Return Loss at 835 MHz	-25.6 dB

4. Handling

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.

Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

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

Validation Dipole D835V2 SN:443, d = 15 mm

Frequency: 835 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(6.27,6.27,6.27) at 900 MHz; IEEE1528 835 MHz; $\sigma = 0.89$ mho/m $\epsilon_r = 41.0$ $\rho = 1.00$ g/cm³
Cubes (2): Peak: 4.23 mW/g ± 0.05 dB, SAR (1g): 2.65 mW/g ± 0.04 dB, SAR (10g): 1.70 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 11.9 (10.5, 13.8) [mm]
Powerdrift: -0.02 dB

