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ilac-MRA

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

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConF	sensitivity in TSL / NORMx,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:

a) 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

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization $\vartheta = 0$ (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below ConF).

- *NORM(f)x,y,z* = NORMx,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 *ConF*.

- *DCPx,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.

- *ConF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 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 NORMx,y,z * ConF whereby the uncertainty corresponds to that given for *ConF*. A frequency dependent *ConF* 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:1787

Manufactured:	May 28, 2003
Last calibrated:	May 31, 2006
Recalibrated:	August 28, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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DASY - Parameters of Probe: ET3DV6 SN:1787

Sensitivity in Free Space[A]   Diode Compression[B]

NormX	$1.63 \pm 10.1\%$	$\mu V/(V/m)^2$	DCP X	92 mV
NormY	$1.66 \pm 10.1\%$	$\mu V/(V/m)^2$	DCP Y	96 mV
NormZ	$2.08 \pm 10.1\%$	$\mu V/(V/m)^2$	DCP Z	91 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		4.7	2.0
SAR_{be} [%]	With Correction Algorithm		0.1	0.0

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		11.8	7.0
SAR_{be} [%]	With Correction Algorithm		0.2	0.4

Sensor Offset

Probe Tip to Sensor Center   **2.7** mm

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%.
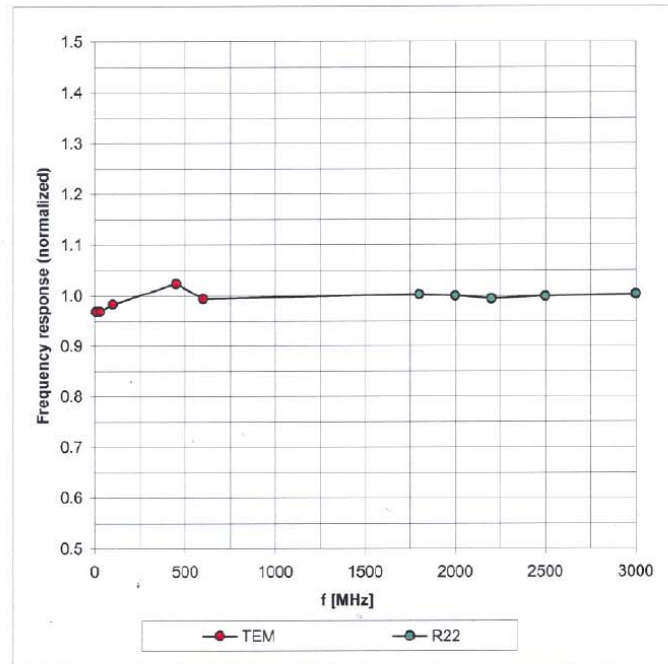

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

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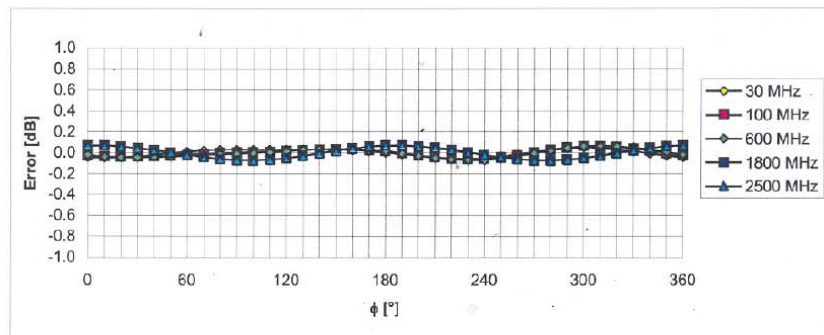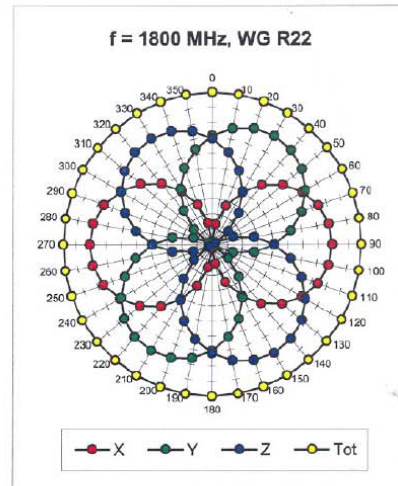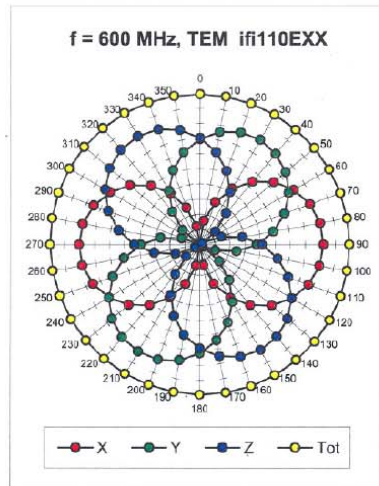
(TEM-Cell:ifi110 EXX, Waveguide: R22)

Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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Receiving Pattern (φ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX

f = 1800 MHz, WG R22

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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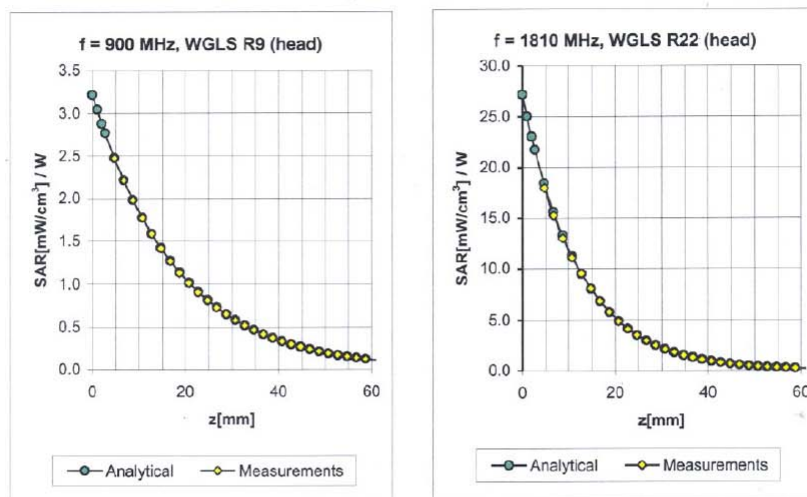ET3DV6 SN:1787   August 28, 2007

Dynamic Range f(SAR$_{head}$)
(Waveguide R22, f = 1800 MHz)
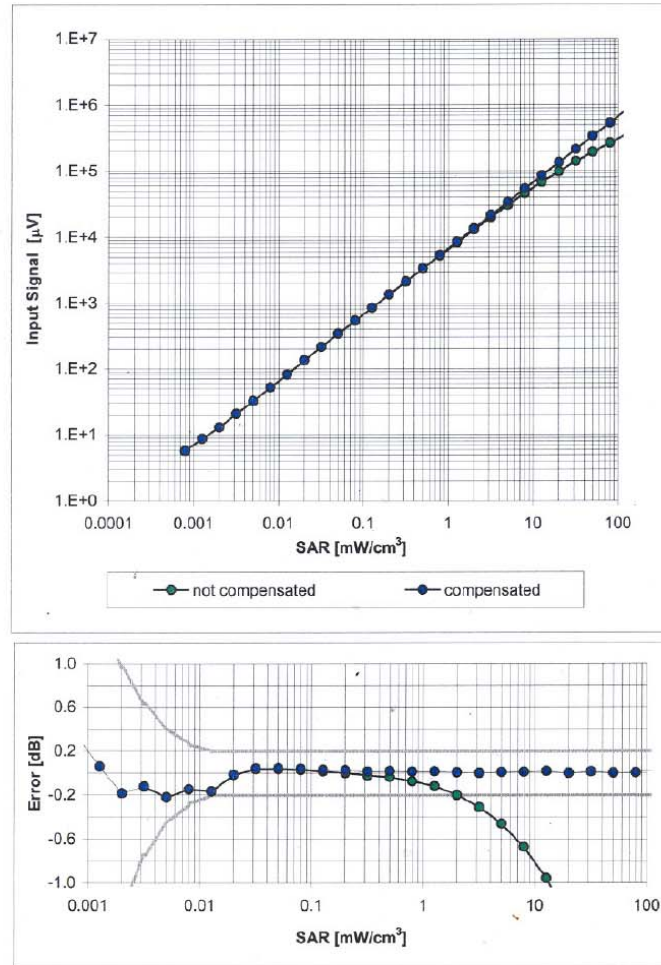
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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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%	0.32	2.42	6.58	± 11.0% (κ=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.50	2.61	5.16	± 11.0% (κ=2)
2000	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.55	2.45	4.80	± 11.0% (κ=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.67	1.81	4.50	± 11.8% (κ=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.36	2.52	6.10	± 11.0% (κ=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.61	2.56	4.68	± 11.0% (κ=2)
2000	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.60	2.40	4.30	± 11.0% (κ=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.65	2.15	4.02	± 11.8% (κ=2)

c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
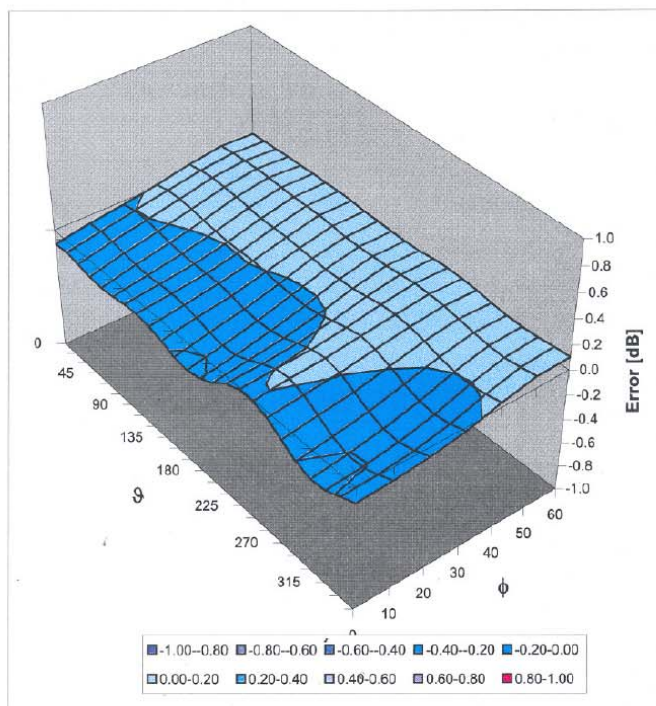
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Deviation from Isotropy in HSL
Error (φ, ϑ), f = 900 MHz

■-1.00--0.80	■-0.80--0.60	■-0.60--0.40	■-0.40--0.20	■-0.20-0.00
□0.00-0.20	■0.20-0.40	■0.40-0.60	■0.60-0.80	■0.80-1.00

Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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