

ANNEX E PROBE CALIBRATION CERTIFICATE

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



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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Telecommunication Metrology Center of MIIT**

Certificate No: **ES3DV3-3151_Apr11**

CALIBRATION CERTIFICATE			
Object	ES3DV3-SN: 3151		
Calibration procedure(s)	QA CAL-01.v6 Calibration procedure for dosimetric E-field probes		
Calibration date:	April 27, 2011		
Condition of the calibrated item	In Tolerance		
<p>This calibration certify 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 at an environment temperature (22±3)^oC and humidity<70%</p>			
Calibration Equipment used (M&TE critical for calibration)			
Primary Standards	ID#	Cal Data (Calibrated by, Certification NO.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-May-10 (METAS, NO. 251-00388)	May-11
Power sensor E4412A	MY41495277	5-May-10 (METAS, NO. 251-00388)	May-11
Reference 3 dB Attenuator	SN:S5054 (3c)	10-Aug-10 (METAS, NO. 251-00403)	Aug-11
Reference 20 dB Attenuator	SN:S5086 (20b)	3-May-10 (METAS, NO. 251-00389)	May-11
Reference 30 dB Attenuator	SN:S5129 (30b)	10-Aug-10 (METAS, NO. 251-00404)	Aug-11
DAE4	SN:617	10-Jun-10 (SPEAG, NO.DAE4-907_Jun10)	Jun-11
Reference Probe ES3DV2	SN: 3013	11-Jan-11 (SPEAG, NO. ES3-3013_Jan11)	Jan-12
Secondary Standards	ID#	Check Data (in house)	Scheduled Calibration
RF generator HP8648C	US3642U01700	4-Aug-99(SPEAG, in house check Oct-10)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01(SPEAG, in house check Nov-10)	In house check: Nov-11
Calibrated by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	
Approved by:	Name	Function	Signature
	Niels Kuster	Quality Manager	
Issued: April 27, 2011			
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:

- 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:

- 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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April 27, 2011

Probe ES3DV3

SN: 3151

Manufactured: June 12, 2007

Calibrated: April 27, 2011

Calibrated for DASY4 System

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DASY – Parameters of Probe: ES3DV3 SN:3151

Sensitivity in Free Space^A

Diode Compression^B

NormX	1.18±10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	93mV
NormY	1.25±10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	96mV
NormZ	1.21±10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	94mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)
Please see Page 8

Boundary Effect

TSL 900MHz Typical SAR gradient: 5% per mm

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SARbe[%]	Without Correction Algorithm	10.7	6.5
SARbe[%]	With Correction Algorithm	1.0	0.5

TSL 1810MHz Typical SAR gradient: 10% per mm

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SARbe[%]	Without Correction Algorithm	10.1	5.4
SARbe[%]	With Correction Algorithm	0.7	0.6

Sensor Offset

Probe Tip to Sensor Center 2.0 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%.

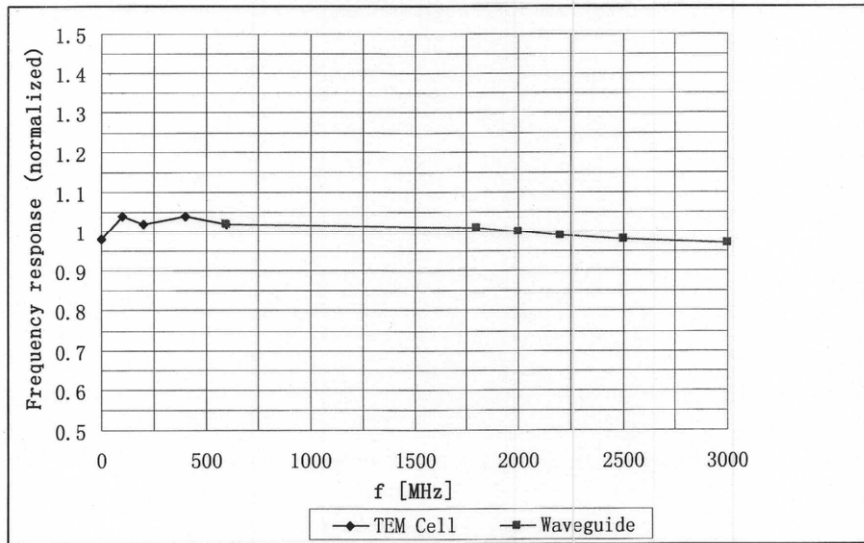
^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Page 8).

^B Numerical linearization parameter: uncertainty not required.

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Frequency Response of E-Field

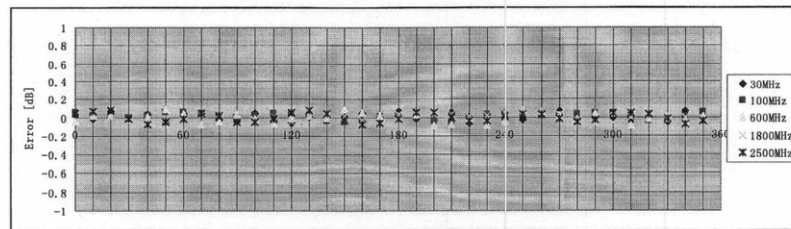
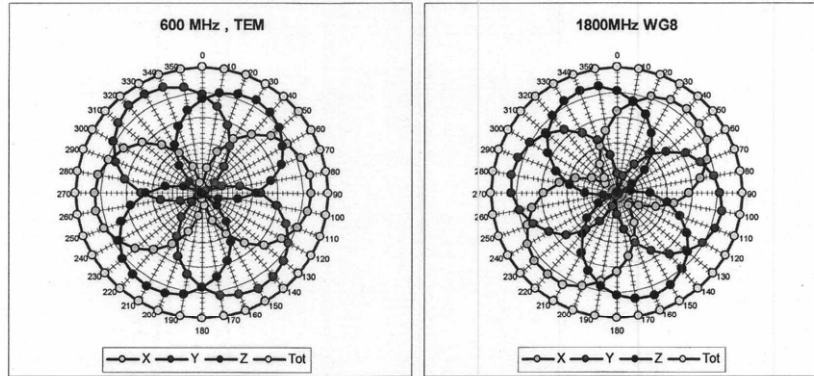


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

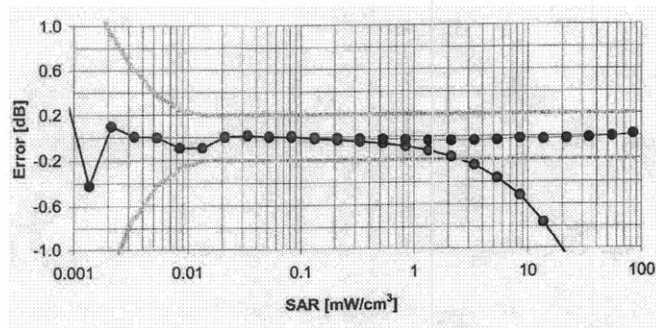
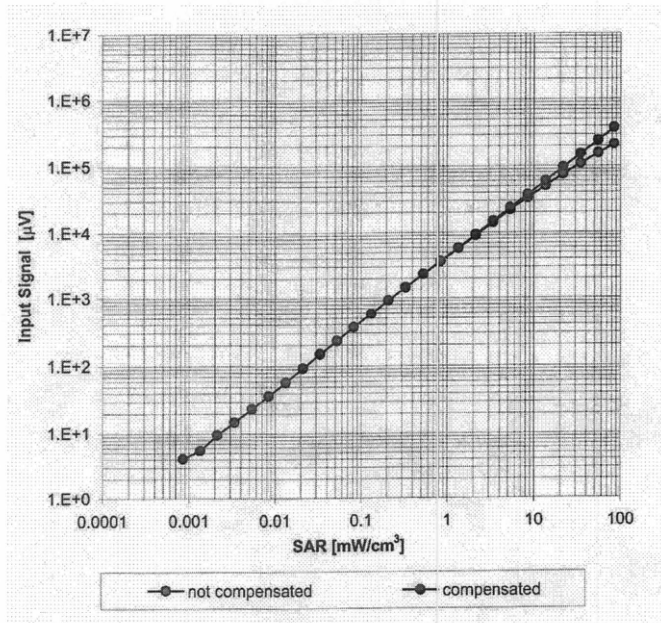


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide: WG8, $f = 1800 \text{ MHz}$)

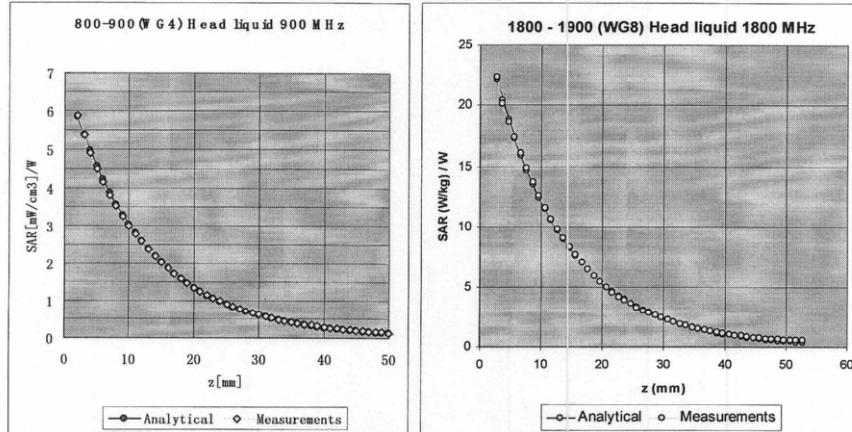


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

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Conversion Factor Assessment



f[MHz]	Validity[MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
450	±50 / ±100	Head	43.5±5%	0.87±5%	0.82	1.44	7.42	±13.3% (k=2)
900	±50 / ±100	Head	41.5±5%	0.97±5%	0.80	1.29	6.23	±11.0% (k=2)
1810	±50 / ±100	Head	40.0±5%	1.40±5%	0.61	1.57	5.08	±11.0% (k=2)
1900	±50 / ±100	Head	40.0±5%	1.40±5%	0.63	1.44	4.98	±11.0% (k=2)
2100	±50 / ±100	Head	39.8±5%	1.49±5%	0.66	1.34	4.58	±11.0% (k=2)
900	±50 / ±100	Body	55.0±5%	1.05±5%	0.99	1.06	6.02	±11.0% (k=2)
1810	±50 / ±100	Body	53.3±5%	1.52±5%	0.75	1.34	4.87	±11.0% (k=2)
1900	±50 / ±100	Body	53.3±5%	1.52±5%	0.62	1.47	4.73	±11.0% (k=2)
2100	±50 / ±100	Body	53.5±5%	1.57±5%	0.68	1.34	4.35	±11.0% (k=2)
2450	±50 / ±100	Body	52.7±5%	1.95±5%	0.60	1.40	3.72	±11.0% (k=2)

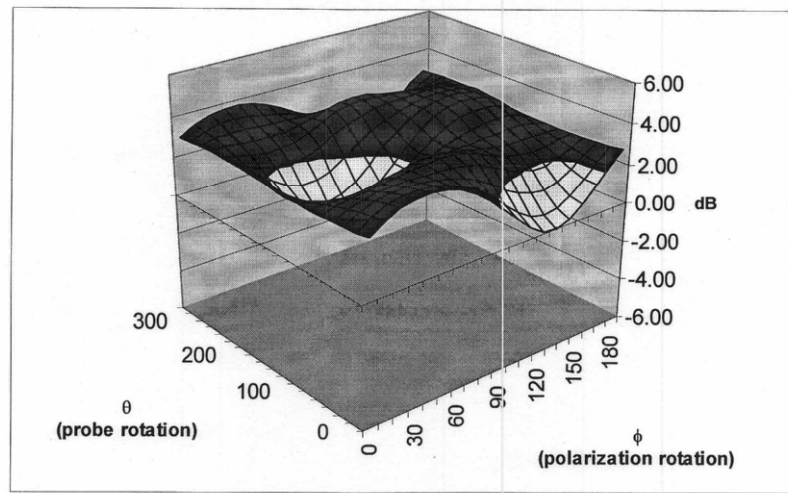
^c The validity of ±100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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Deviation from Isotropy

Error (ϕ, θ), $f = 900$ MHz



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