ANNEX D: Probe Calibration Certificate

CNAS 检测 CNAS L0442

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Client TA

Certificate No: ET3-1737_Nov09

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN: 1737
Calibration Procedure(s)	TMC-XZ-01-028 Calibration procedure for dosimetric E-field probes
Calibration date:	November 20, 2009
Condition of the calibrated item	In Tolerance

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±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	SN.	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	101253	18-Jun-09 (TMC, No.JZ09-248)	Jun-10
Power sensor NRV-Z5	100333	18-Jun-09 (TMC, No. JZ08-248)	Jun-10
Reference Probe EX3DV4	SN 3631	13-Dec-08(TMC, No.EX3-3631_Dec08)	Dec-09
DAE4	SN 777	09-Jul-09(TMC, No.DAE4-777_Jul09)	Jul-10
RF generator E4438C	MY45092879	17-Jun-09(TMC, No.JZ09-302)	Jun-10
Network Analyzer 8753E	US38433212	02-Aug-09(TMC, No.JZ09-056)	Aug-10

	Name	Function	Signature
Calibrated by:	Lin Hao	SAR Test Engineer	林浩
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: November 20, 2009

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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., θ =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 300MHz to 3GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization θ =0 (f≤900MHz in TEM-cell; f>1800MHz: 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 ConvF).
- 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 ConvF.
- 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.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha,depth) of which typical uncertainty valued 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* 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±50MHz to±100MHz.
- 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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DASY – Parameters of Probe: ET3DV6 SN:1737

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

NormX	1.42 ± 10.1%	μ V/(V/m)^2	DCP X	93mV
NormY	1.68 ± 10.1%	μ V/(V/m)^2	DCP Y	94mV
NormZ	1.63 ± 10.1%	μ V/(V/m)^2	DCP Z	85mV

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		3.7 mm	4.7 mm
SAR_{be}[%]	Without Correction Algorithm	10.7	6.9
SAR_{be}[%]	With Correction Algorithm	0.3	0.4

TSL 1750MHz Typical SAR gradient: 10% per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR_{be}[%]	Without Correction Algorithm	12.5	8.4
SAR_{be}[%]	With Correction Algorithm	0.8	0.5

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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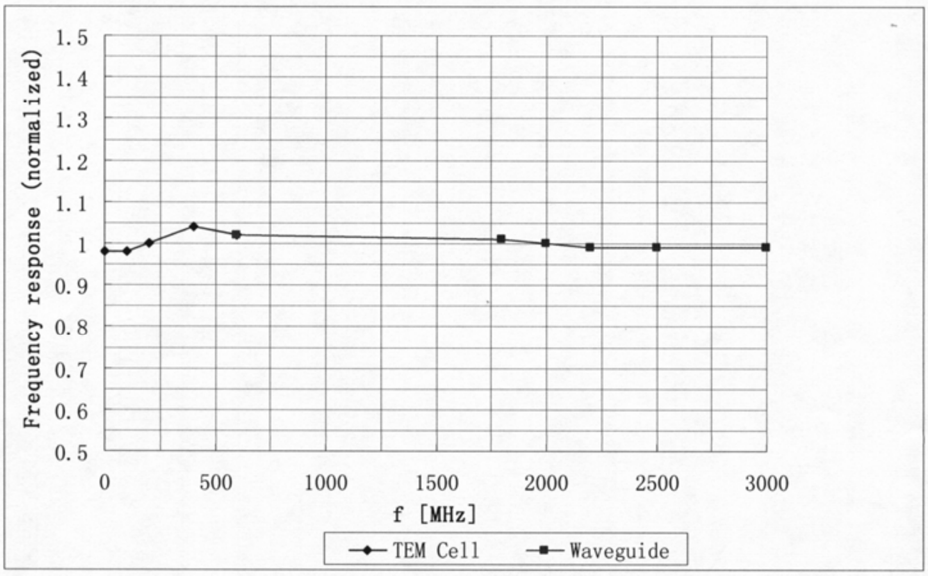
Frequency Response of E-Field



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

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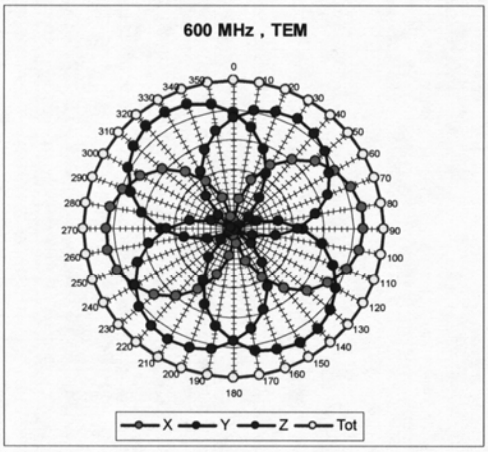
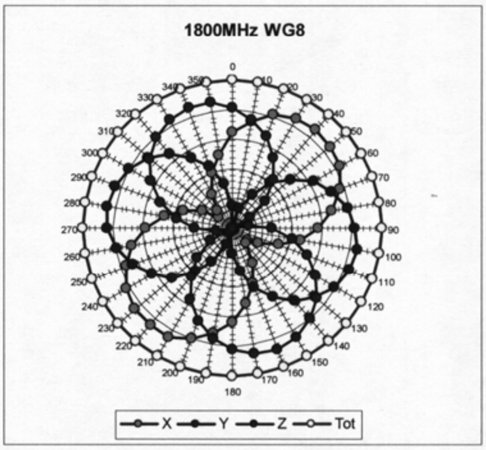
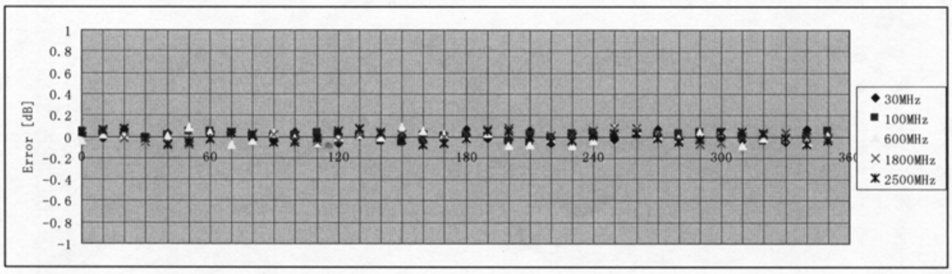
Receiving Pattern (Φ), θ =0°







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

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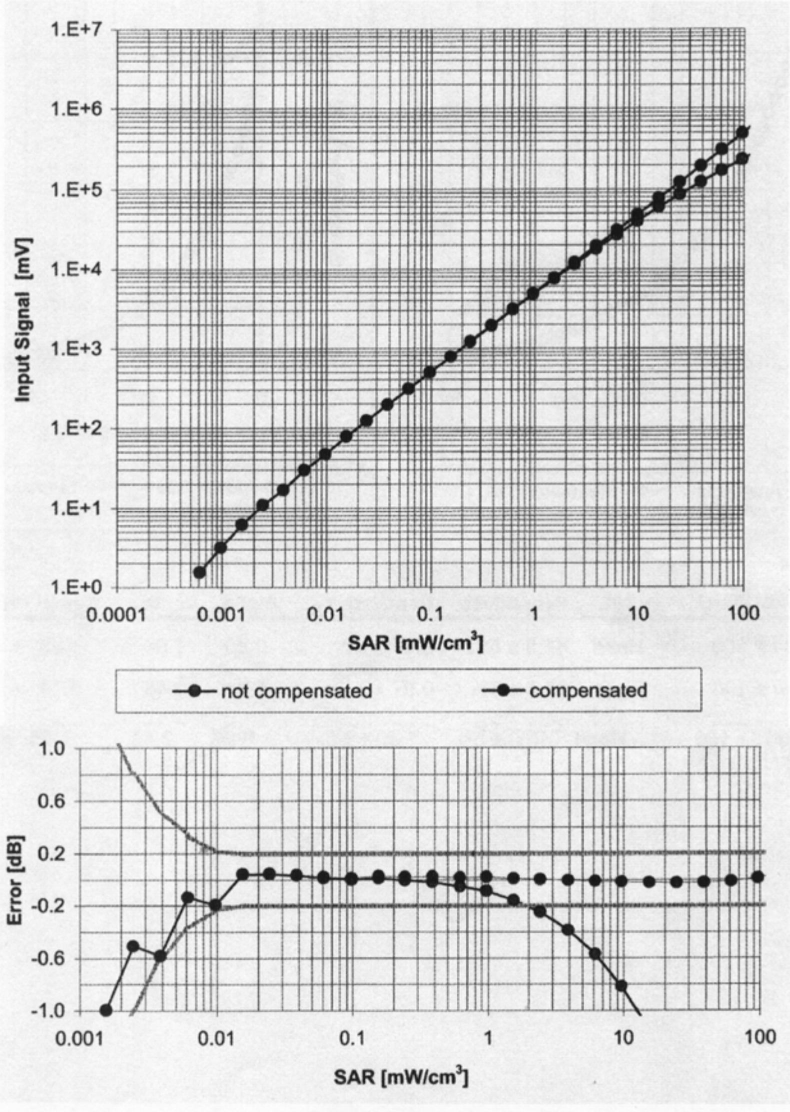
Dynamic Range f(SAR_{head})

(Waveguide: WG8, f = 1800 MHz)



Uncertainty of Linearity Assessment: ±0.6% (k=2)

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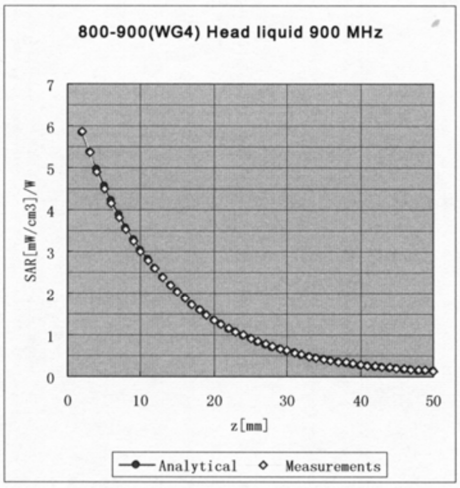
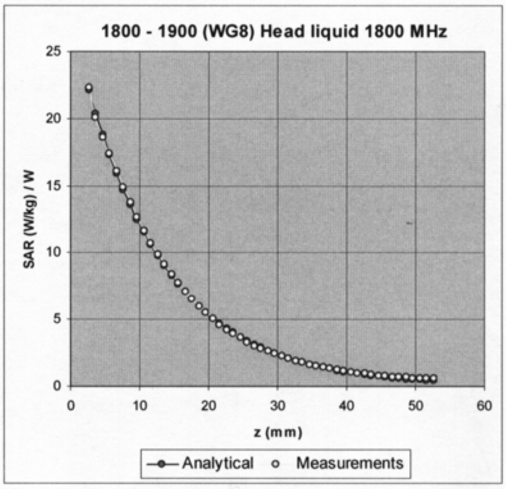
Conversion Factor Assessment





f[MHz]	Validity[MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
450	±50 / ±100	Head	43.5±5%	0.87±5%	0.36	1.84	7.20	±13.3% (k=2)
835	±50 / ±100	Head	41.5±5%	0.90±5%	0.25	3.53	6.33	±11.0% (k=2)
900	±50 / ±100	Head	41.5±5%	0.97±5%	0.27	3.53	6.14	±11.0% (k=2)
1750	±50 / ±100	Head	40.0±5%	1.37±5%	0.56	2.77	5.35	±11.0% (k=2)
1950	±50 / ±100	Head	40.0±5%	1.40±5%	0.57	2.72	4.89	±11.0% (k=2)
2450	±50 / ±100	Head	39.2±5%	1.80±5%	0.51	1.60	4.39	±11.0% (k=2)
450	±50 / ±100	Body	56.7±5%	0.94±5%	0.27	1.80	7.52	±13.3% (k=2)
835	±50 / ±100	Body	55.2±5%	0.97±5%	0.36	2.75	6.14	±11.0% (k=2)
900	±50 / ±100	Body	55.0±5%	1.05±5%	0.43	2.51	5.98	±11.0% (k=2)
1750	±50 / ±100	Body	53.4±5%	1.49±5%	0.99	1.74	4.84	±11.0% (k=2)
1950	±50 / ±100	Body	53.3±5%	1.52±5%	0.99	1.50	4.60	±11.0% (k=2)
2450	±50 / ±100	Body	52.7±5%	1.95±5%	0.98	1.42	3.91	±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.