

EX3DV4– SN:3842

June 6, 2013

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3842

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	10.34	10.34	10.34	0.09	1.00	± 13.4 %
835	55.2	0.98	9.09	9.09	9.09	0.42	0.84	± 12.0 %
900	55.0	1.05	9.16	9.16	9.16	0.47	0.79	± 12.0 %
1810	53.3	1.52	7.78	7.78	7.78	0.50	0.81	± 12.0 %
1900	53.3	1.52	7.43	7.43	7.43	0.29	1.07	± 12.0 %
2450	52.7	1.95	6.93	6.93	6.93	0.80	0.59	± 12.0 %

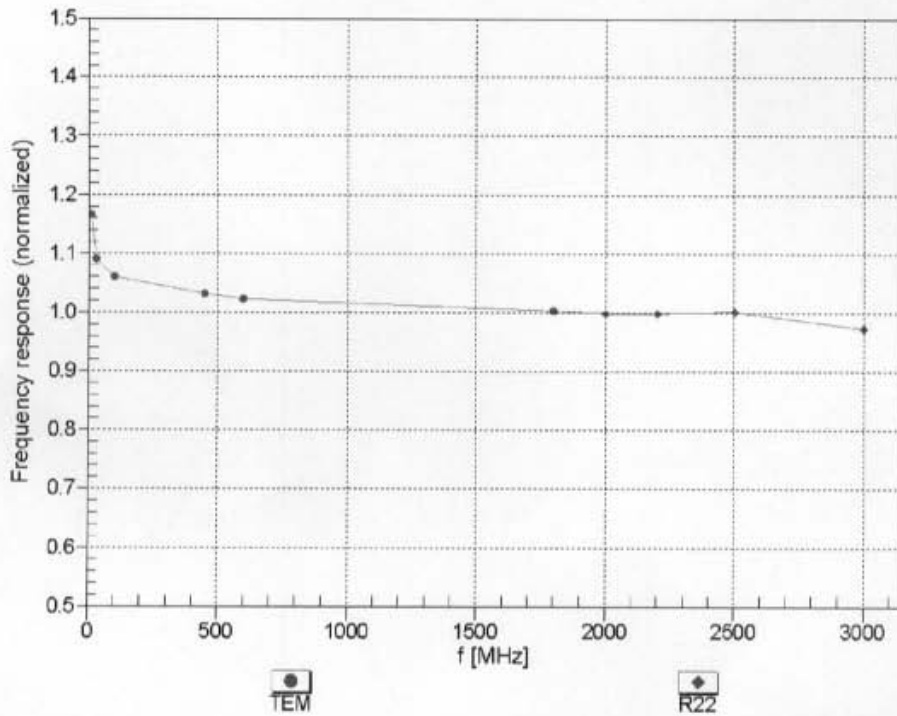
^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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



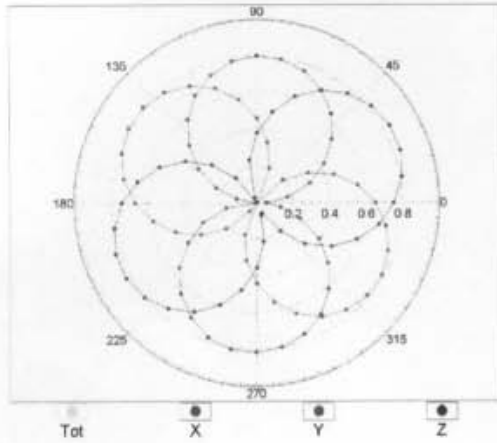
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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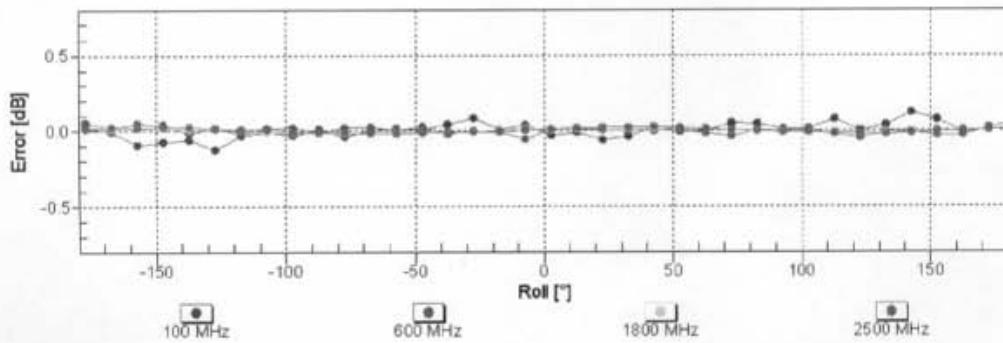
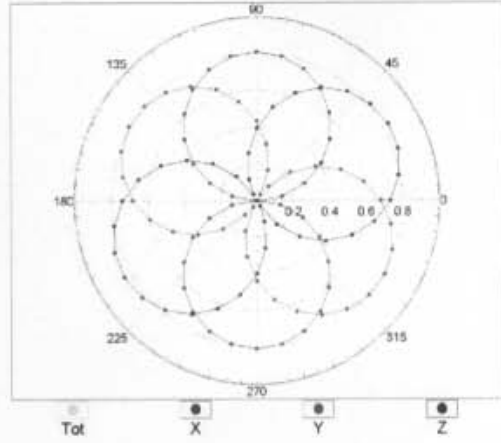
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Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM



f=1800 MHz,R22

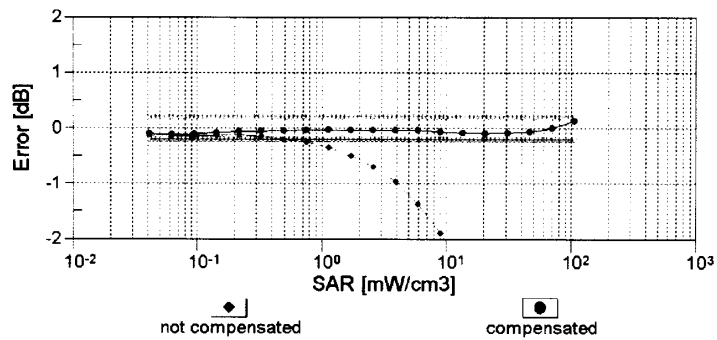
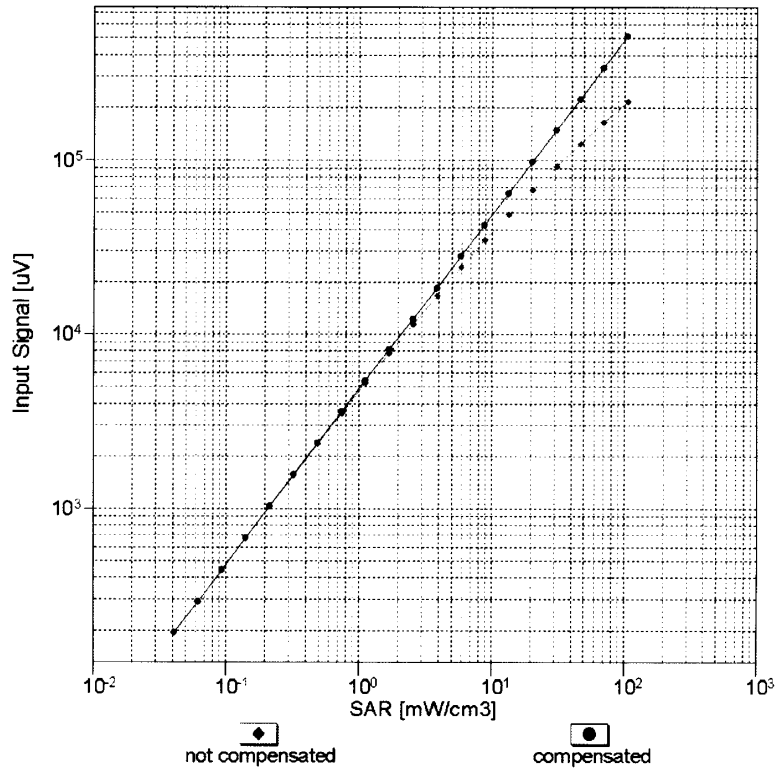


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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Dynamic Range $f(SAR_{head})$ (TEM cell, $f = 900$ MHz)

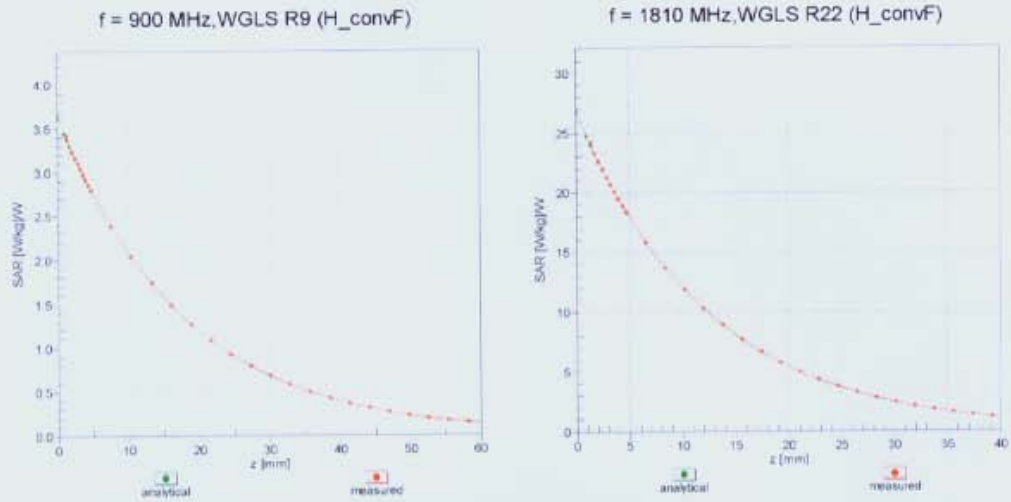


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

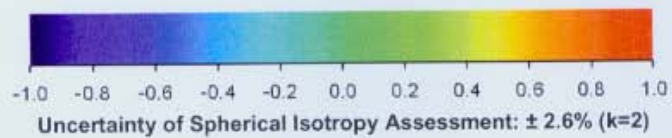
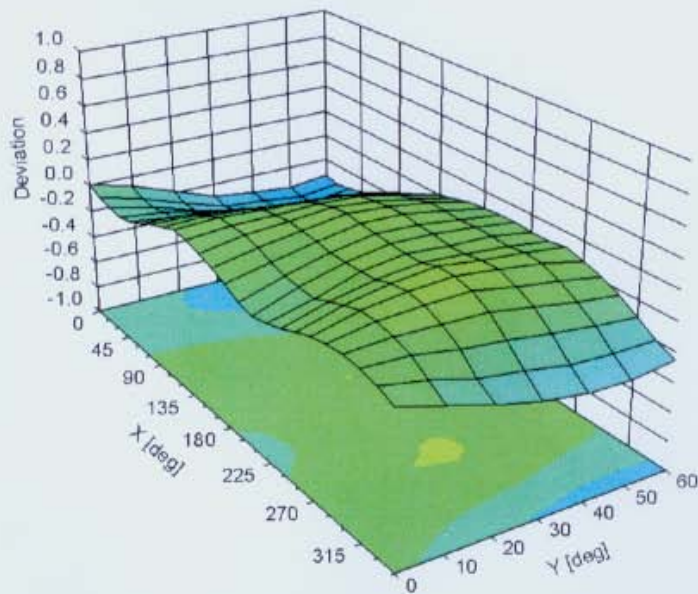
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Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, θ), f = 900 MHz



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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3842**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	-117.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

6.2. D2450V2 Dipole Calibration Certificate



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Client **CIQ SZ (Auden)**

Certificate No: **J13-2-3053**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 884**

Calibration Procedure(s) **TMC-OS-E-02-194**
Calibration procedure for dipole validation kits

Calibration date: **December 11, 2013**

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)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	11-Sep-13 (TMC, No.JZ13-443)	Sep-14
Power sensor NRV-Z5	100595	11-Sep-13 (TMC, No. JZ13-443)	Sep -14
Reference Probe ES3DV3	SN 3149	5- Sep-13 (SPEAG, No.ES3-3149_Sep13)	Sep-14
DAE4	SN 777	22-Feb-13 (SPEAG, DAE4-777_Feb13)	Feb -14
Signal Generator E4438C	MY49070393	13-Nov-13 (TMC, No.JZ13-394)	Nov-14
Network Analyzer E8362B	MY43021135	19-Oct-13 (TMC, No.JZ13-278)	Oct-14

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

Issued: December 17, 2013

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



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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.



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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.8.7.1137
Extrapolation	Advanced Extrapolation	
Phantom	Twin Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.0 \pm 6 %	1.82 mho/m \pm 6 %
Head TSL temperature change during test	<0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	51.7 mW / g \pm 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.05 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.1 mW / g \pm 20.4 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	52.8 \pm 6 %	1.94 mho/m \pm 6 %
Body TSL temperature change during test	<0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.8 mW / g \pm 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.98 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.0 mW / g \pm 20.4 % (k=2)



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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	46.8Ω+ 3.76jΩ
Return Loss	- 25.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	55.2Ω+ 2.38jΩ
Return Loss	- 25.4dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

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DASY5 Validation Report for Head TSL

Date: 12.10.2013

Test Laboratory: TMC, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 884

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.817$ mho/m; $\epsilon_r = 38.96$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3149; ConvF(4.48,4.48,4.48); Calibrated: 2013/9/5
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 22/2/2013
- Phantom: SAM 1593; Type: QD000P40CC;
- DASY52 52.8.7(1137); SEMCAD X Version 14.6.10 (7164)

Dipole Calibration for Head Tissue/Pin=250mW, d=10mm/Zoom Scan

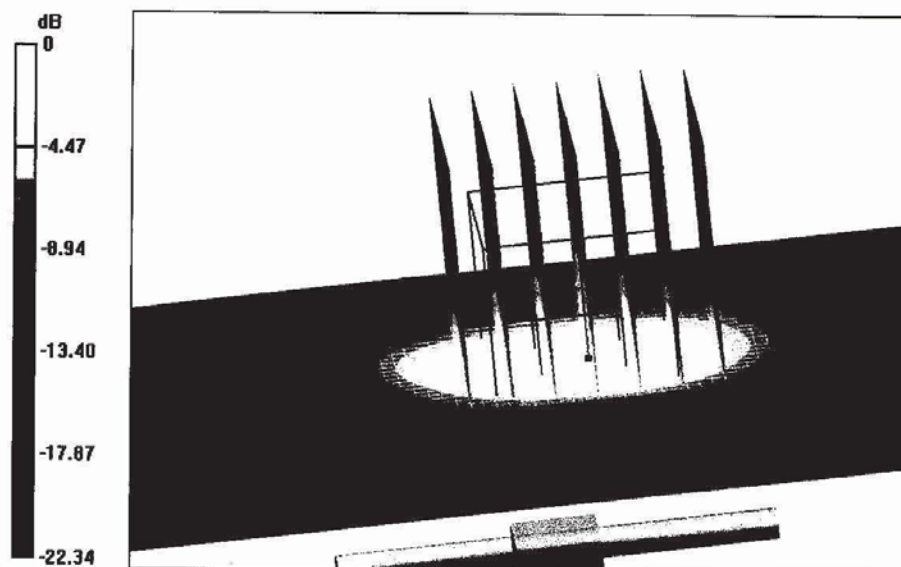
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 86.529 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 27.0 W/kg

SAR(1 g) = 13 W/kg; SAR(10 g) = 6.05 W/kg

Maximum value of SAR (measured) = 16.2 W/kg



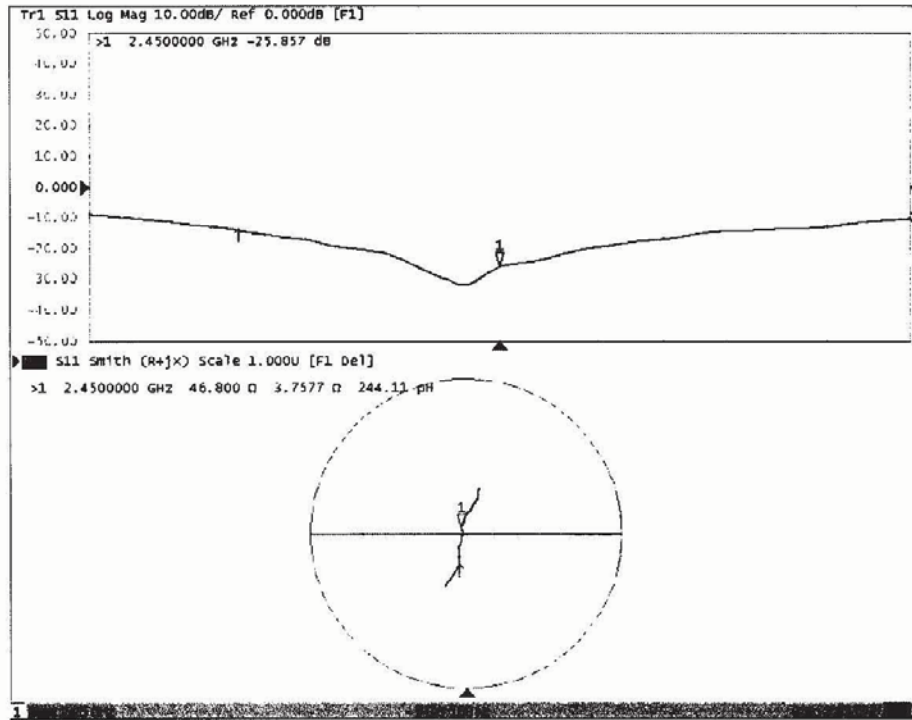
0 dB = 16.2 W/kg = 12.10 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 12.11.2013

Test Laboratory: TMC, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 884

Communication System: CW; Frequency: 2450 MHz;

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.939$ mho/m; $\epsilon_r = 52.97$; $\rho = 1000$ kg/m³

Phantom section: Flat Phantom

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DVS - SN3149; ConvF(4.21,4.21,4.21) ; Calibrated: 2013/9/5
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 22/2/2013
- Phantom: SAM1186; Type: QD000P40CC;
- DASY52 52.8.7(1137); SEMCAD X Version 14.6.10 (7164)

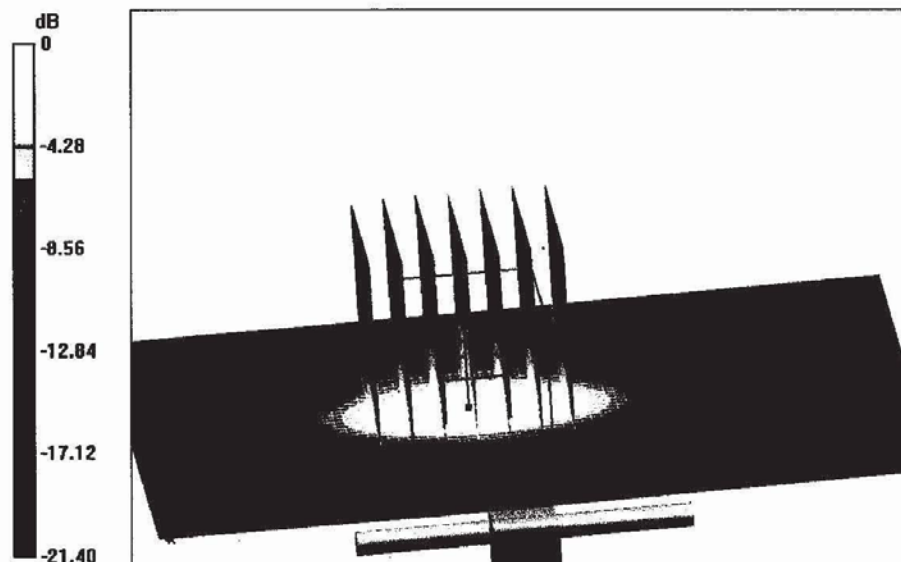
Dipole Calibration for Body Tissue/Pin=250mW, d=10mm/Zoom Scan**(7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 84.687 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 27.1 W/kg

SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.98 W/kg

Maximum value of SAR (measured) = 16.0 W/kg



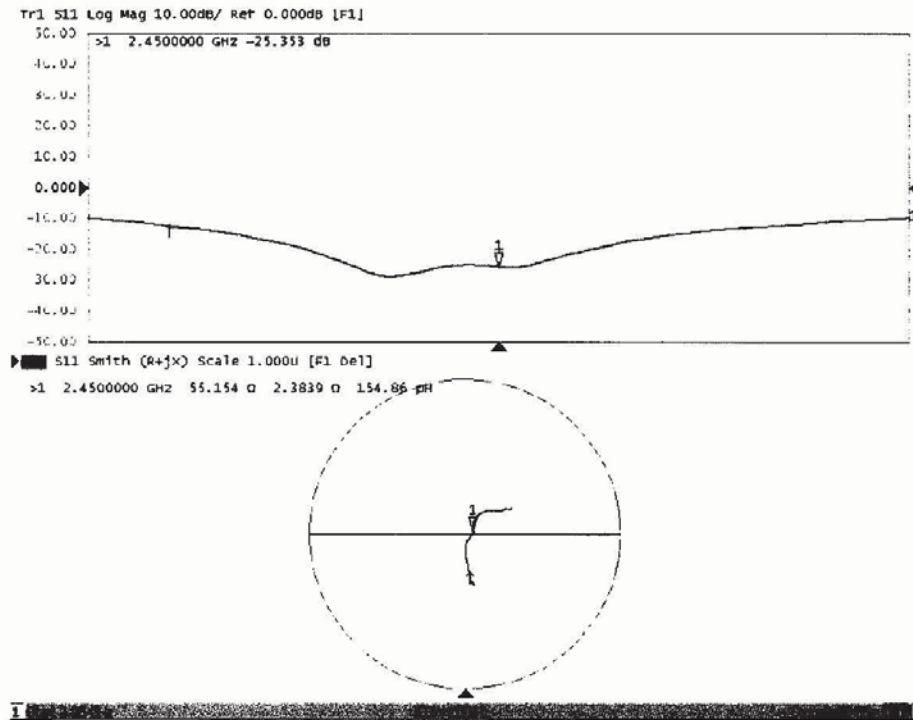
0 dB = 16.0 W/kg = 12.04 dBW/kg



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Impedance Measurement Plot for Body TSL



6.3. DAE4 Calibration Certificate



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Client : **CIQ SZ (Auden)**

Certificate No: **J13-2-3048**

CALIBRATION CERTIFICATE			
Object	DAE4 - SN: 1315		
Calibration Procedure(s)	TMC-OS-E-01-198 Calibration Procedure for the Data Acquisition Electronics (DAEx)		
Calibration date:	November 25, 2013		
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p>			
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Documenting Process Calibrator 753	1971018	01-July-13 (TMC, No:JW13-049)	July-14
Calibrated by:	Name Yu zongying	Function SAR Test Engineer	Signature
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	
			Issued: November 25, 2013
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Glossary:

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.



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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.915 \pm 0.15% (k=2)	405.171 \pm 0.15% (k=2)	404.667 \pm 0.15% (k=2)
Low Range	3.98903 \pm 0.7% (k=2)	3.94180 \pm 0.7% (k=2)	3.93862 \pm 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	162.5° \pm 1°
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7. Test Setup Photos



Photograph of the depth in the Body Phantom (2450MHz)



0mm Body-worn Front Side Setup Photo



0mm Body-worn Rear Side Setup Photo



0mm Body-worn Left Side Setup Photo



0mm Body-worn Right Side Setup Photo



0mm Body-worn Top Side Setup Photo



0mm Body-worn Bottom Side Setup Photo

8. External Photos of the EUT

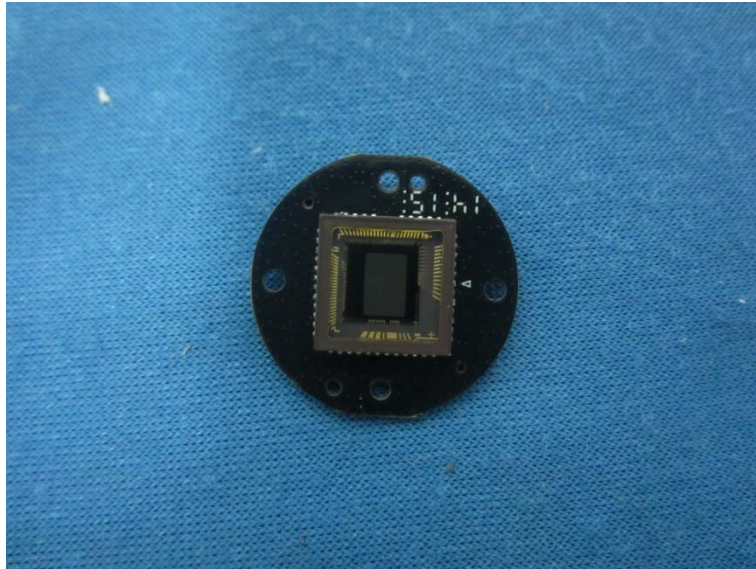
External Photos





Internal Photos





.....End of Report.....