Submit 3 Dipole Calibration Report

CALIBRATION CERTIFICATE

上海市计量测试技术研究院
华东国家计量测试中心

校 准 证 书

委 托 者 Customer	程智科技股份（昆山）有限公司 Compliance Certification Services Inc.
委托者地址 Address of customer	江苏省昆山市（留学创业园）伟业路 10 号 No. 10, Wei-Ye Rd., Innovation park, Eco & Tec, Development Zone, Kun Shan City, Jiang Su, P. R. O. C.
器具名称 Name of instrument	偶极子天线 DIPOLE ANTENNA
制 造 厂 Manufacturer	ANTENNESSA 公司 /
型号/规格 Model/Specification	DIPOLE 900MHz
器具编号 No. of instrument	SN 48/05 DIPD33
器具准确度 Instrument accuracy	/

证书批准人 Approved by

核 验 员 Checked by 刘麟

校 准 员 Calibrated by 高晨

(机构校准专用章)

校准日期 Date for calibrated 2008 年 Year 12 月 Month 10 日 Day

投诉电话：021-50798262 Tel. for complaint

地址：上海市张衡路 1500 号（总部） Address No.1500 Zhangheng Road, Shanghai(headquarters) 电话：021-38839800 Tel. 传真：021-50798390 Fax. 邮编：201203 Post Code

上海市宜山路 716 号（分部） No. 716 Yishan Road, Shanghai(branch) 电话：021-64701390 Tel. 传真：021-64701810 Fax. 邮编：200233 Post Code

国家法定计量检定机构计量授权证书号（中心/院）：（国）法计（2002）01039 号/（2002）01019 号
The number of the Certificate of Metrological Authorization to The Legal Metrological Verification Institution is No.（2002）01039 / No.（2002）01019

中国合格评定国家认可委员会实验室认可证书号：No. CNAS L0134
The number of the certificate accredited by CNAS is No.L0134

本次校准所依据的技术规范（代号、名称）：
Reference documents for the calibration (code 、name)

JCJ/J101002.1/0-2007 SAR偶极子天线校准规范

IEEE Std 1528-2003 "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head form Wireless Communications Devices: Measure Techniques"

IEC 62209-1: 2005 Procedure to measure the Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz Part 1: hand-held mobile wireless communication devices

本次校准所使用的主要计量标准器具：
Main measurement standards used in this calibration

名称/型号 Name/Model	编号 Number	证书编号/有效期限 Certificate No./Due date	测量范围/准确度 Measuring range/accuracy
VECTOR NETWORK ANALYZER ZVB 8	容-027-27	2008F31-10-001907 2009.06.26	300 kHz~8 GHz，Frequency resolution：100 μHz，Measurement time：< 8 ms，Measurement bandwidths：1 Hz~500 kHz

以上计量标准器具的量值溯源至国家基准。
Quantity values of above measurement standards used in this calibration are traced to those of the national primary standards in the P.R. China.

校准地点及环境条件：
Location and environmental condition for the calibration

地点：Location 宜山路 716 号 (No. 716 Yishan Road)

温度：Ambient temperature 23 ℃；湿度：Relative humidity 49 %RH；其它：Others /

本次校准结果的扩展不确定度：
Expanded uncertainty

+3dB 至-15dB：U =0.8 dB（k=2）
-15dB至-25dB：U =1.2 dB（k=2）
-25dB至-35dB：U =3.1 dB（k=2）

校准结果/说明：
Results of calibration and additional explanation

Pass

The requirements of the calibration criterion: return Loss must be less than -20dB

本证书提供的结果仅对本次被校的器具有效。
The data are valid only for the instrument(s).

校准结果/说明（续页）：
Results of calibration and additional explanation（continued page）

1. Calibration procedure:

Return Loss is measured with the dipole 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. During calibration, the flat phantom is filled with the liquid whose parameters are calibrated relative to different frequency.

2. Calibration Conditions:

A. The spacer from Dipole center to TSL

Distance Dipole Center - TSL	Frequency
15mm±0.2mm with spacer	900MHz

B. Head TSL parameters

The following parameters and calculation were applied.
Head TSL temperature change is well controlled to be within 22±0.2°C during test.

Frequency	Nominal Head TSL Parameters (Permittivity/ Conductivity)	Measurement Head TSL parameters (Permittivity/ Conductivity)
900 MHz	41.50/0.97	41.71/1.00

C. Body TSL parameters

The following parameters and calculation were applied.
Body TSL temperature change is well controlled to be within 22±0.2°C during test.

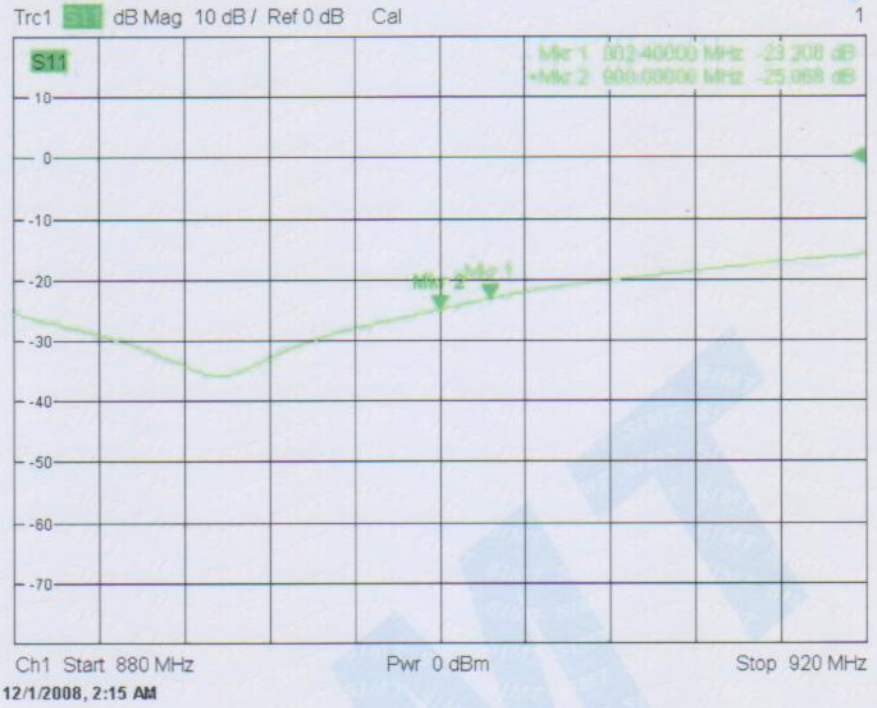
Frequency	Nominal Body TSL Parameters (Permittivity/ Conductivity)	Measurement Body TSL parameters (Permittivity/ Conductivity)
900 MHz	55.00/1.05	54.62/1.04

3. Measurement Results

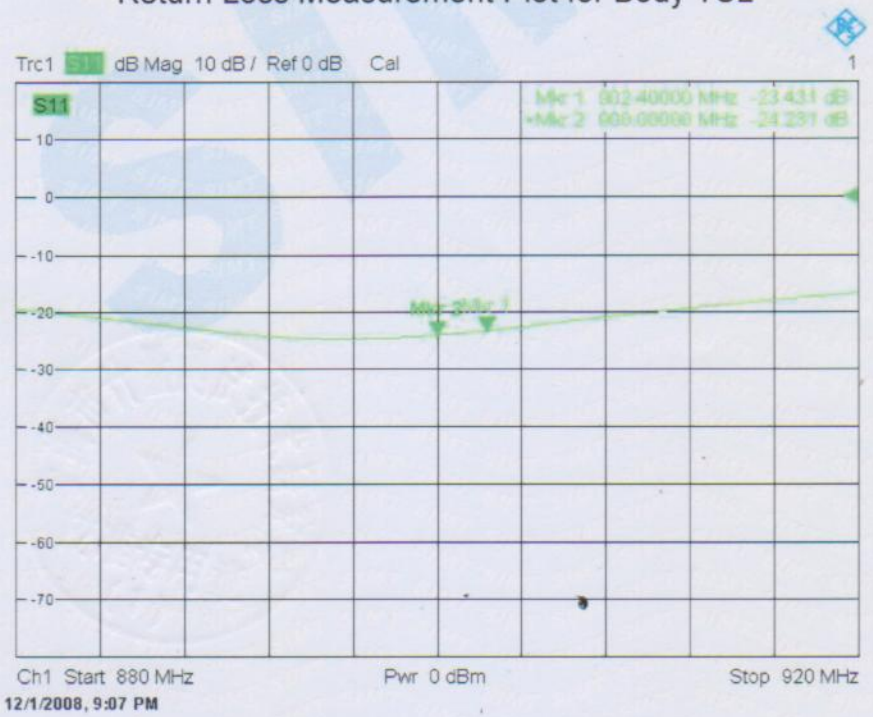
Frequency	Return Loss with Head TSL	Return Loss with Body TSL
900 MHz	-25.06 dB	-24.23 dB

校准结果/说明（续页）：
Results of calibration and additional explanation（continued page）

Return Loss Measurement Plot for head TSL



Return Loss Measurement Plot for Body TSL



Remark: Attachment 1:SAR validation & Test equipment

End

Attachment 1: SAR validation & Test equipment

Validation	Condition	SAR Value (W/kg)	
		1g	10g
SAR measured with Head TSL	1W (input power)	11.11	7.27
SAR measured with Body TSL	1W (input power)	10.98	7.29

名称/型号 Name/Model	编号 Number	证书编号/有效期限 Certificate No./Due date	测量范围/准确度 Measuring range/accuracy
6 axis Robot KR3	容-027-01	/	6 axes, Repeatability： ± 0.05 mm, Nominal payload： 3 kg
Vector Network Analyzer ZVB 8	容-027-27	2008F31-10-001907 2009.06.26	300 kHz to 8 GHz，Frequency resolution：100 μHz，Measurement time：< 8 ms，Measurement bandwidths：1 Hz to 500 kHz
Signal Generator SMT 06	容-027-15	2008F33-10-001469 2009.06.26	5 kHz - 6 GHz,Resolution:0.1Hz,-144 to + 13 dBm,Max.RF power:1W,Max.DC voltage:0V / Level > -127 dBm:f<1.5 GHz:< 1dB; F>1.5 GHz:< 1.5dB; f> 3GHz:< 2dB
Power Meter NRVD	容-027-16	2008F31-10-001906 2009.06.24	100 kHz to 6 GHz,10nW to 500mW
Millivoltmeter 2000	容-027-26	2008F11-10-001004 2009.06.19	Measurement range:100.0000mV~ 1000.000V Sensibility: 0.1μ V~1mV.
Power Amplifier BLMA 0820-6	容-027-18	2008F33-10-001467 2009.06.26	0.8 - 2 GHz; Output:6W; Gain:min 37.8 / typ 40,± 2 dB; Harmonics:2nd:20dBc, 3rd:20dBc; Line power:125 W.
Isotropic E-Field Probe E-FIELD PROBE	容-027-54	2008J10-10-801001 2008.12.25	Dipole resistance (in the connector plane)：1M . to 2M Axial isotropy in human-equivalent liquids：<0.25dBHemispherical Isotropy in humanequivalent liquids<0.5dB,Linearity<0.5dB,Lower SAR detection threshold: 0.0015 Watts/kg
SAM Phantom	容-027-22	/	/

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器具名称 Name of instrument	偶极子天线 DIPOLE ANTENNA
制 造 厂 Manufacturer	ANTENNESSA 公司 /
型号/规格 Model/Specification	DIPOLE 1800MHz
器具编号 No. of instrument	SN 48/05 DIPF34
器具准确度 Instrument accuracy	/

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温度：Ambient temperature 23 ℃；湿度：Relative humidity 49 %RH；其它：Others /

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1. Calibration procedure:

Return Loss is measured with the dipole 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. During calibration, the flat phantom is filled with the liquid whose parameters are calibrated relative to different frequency.

2. Calibration Conditions:

A. The spacer from Dipole center to TSL

Distance Dipole Center - TSL	Frequency
10mm±0.2mm with spacer	1800MHz

B. Head TSL parameters

The following parameters and calculation were applied.
Head TSL temperature change is well controlled to be within 22±0.2°C during test.

Frequency	Nominal Head TSL Parameters (Permittivity/ Conductivity)	Measurement Head TSL parameters (Permittivity/ Conductivity)
1800 MHz	40.00/1.40	39.40/1.37

C. Body TSL parameters

The following parameters and calculation were applied.
Body TSL temperature change is well controlled to be within 22±0.2°C during test.

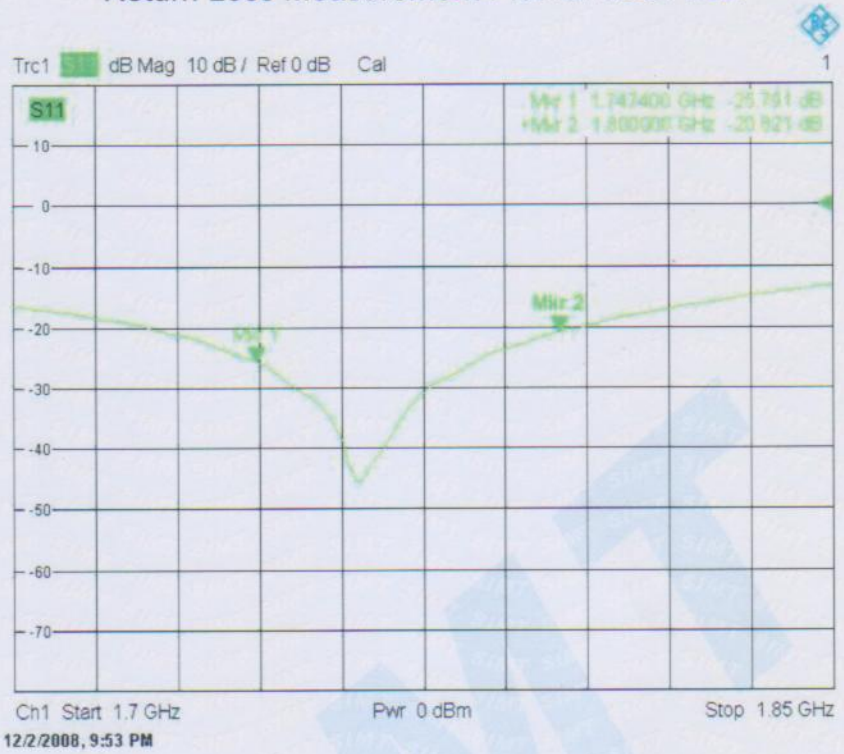
Frequency	Nominal Body TSL Parameters (Permittivity/ Conductivity)	Measurement Body TSL parameters (Permittivity/ Conductivity)
1800 MHz	53.30/1.52	51.86/1.52

3. Measurement Results

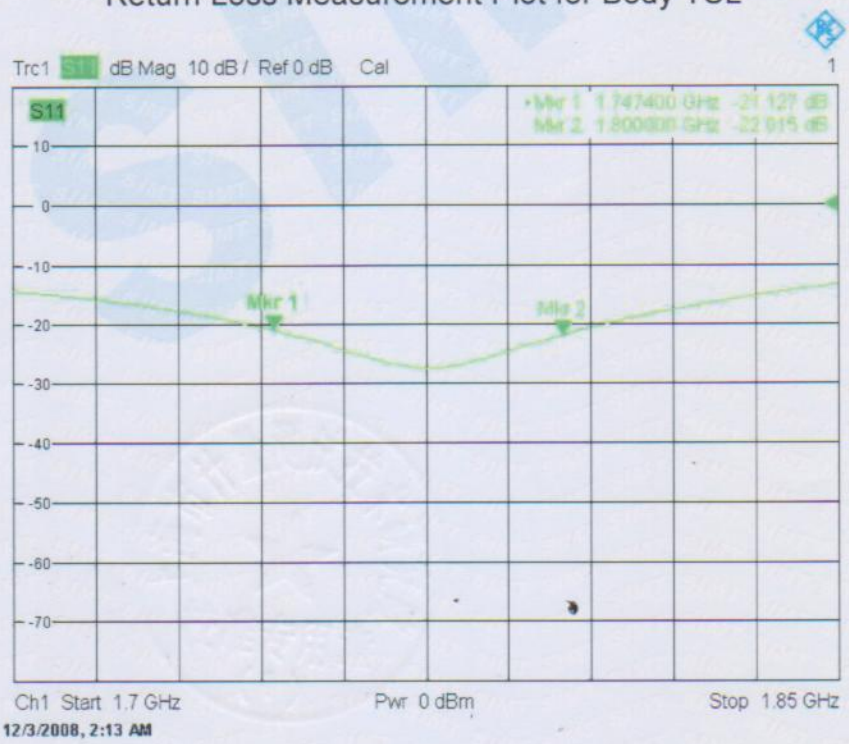
Frequency	Return Loss with Head TSL	Return Loss with Body TSL
1800 MHz	-20.82 dB	-22.01 dB

校准结果/说明（续页）：
Results of calibration and additional explanation（continued page）

Return Loss Measurement Plot for head TSL



Return Loss Measurement Plot for Body TSL



Remark: Attachment 1:SAR validation & Test equipment

End

Attachment 1: SAR validation & Test equipment

Validation	Condition	SAR Value (W/kg)	
		1g	10g
SAR measured with Head TSL	1W (input power)	38.49	20.39
SAR measured with Body TSL	1W (input power)	37.78	20.06

名称/型号 Name/Model	编号 Number	证书编号/有效期限 Certificate No./Due date	测量范围/准确度 Measuring range/accuracy
6 axis Robot KR3	容-027-01	/	6 axes, Repeatability： ± 0.05 mm, Nominal payload： 3 kg
Vector Network Analyzer ZVB 8	容-027-27	2008F31-10-001907 2009.06.26	300 kHz to 8 GHz，Frequency resolution：100 μHz，Measurement time：< 8 ms，Measurement bandwidths：1 Hz to 500 kHz
Signal Generator SMT 06	容-027-15	2008F33-10-001469 2009.06.26	5 kHz - 6 GHz,Resolution:0.1Hz,-144 to + 13 dBm,Max.RF power:1W,Max.DC voltage:0V / Level > -127 dBm:f<1.5 GHz:< 1dB; F>1.5 GHz:< 1.5dB; f> 3GHz:< 2dB
Power Meter NRVD	容-027-16	2008F31-10-001906 2009.06.24	100 kHz to 6 GHz,10nW to 500mW
Millivoltmeter 2000	容-027-26	2008F11-10-001004 2009.06.19	Measurement range:100.0000mV~1000.000V Sensibility: 0.1μV~1mV.
Power Amplifier BLMA 0820-6	容-027-18	2008F33-10-001467 2009.06.26	0.8 - 2 GHz; Output:6W; Gain:min 37.8 / typ 40,± 2 dB; Harmonics:2nd:20dBc, 3rd:20dBc; Line power:125 W.
Isotropic E-Field Probe E-FIELD PROBE	容-027-54	2008J10-10-801001 2008.12.25	Dipole resistance (in the connector plane)：1M . to 2M Axial isotropy in human-equivalent liquids：<0.25dBHemispherical Isotropy in humanequivalent liquids<0.5dB,Linearity<0.5dB,Lower SAR detection threshold: 0.0015 Watts/kg
SAM Phantom	容-027-22	/	/

Submit 4 E-field Calibration Report

COMOSAR E-FIELD PROBE CALIBRATION REPORT

Prepared By: BUTET Romain, SATIMO

Project Description: COMOSAR E-FIELD PROBE

Prepared For (End User): CCS

COMOSAR SEPT ISOTROPIC E-FIELD PROBE CALIBRATION REPORT

DATE: 6/8/2009

OFFER REFERENCE: PF.127.1.09.SATB.A

OBJECT: COMOSAR SEPT ISOTROPIC E-FIELD PROBE

MANUFACTURER: SATIMO

SERIAL NUMBER: SN 11/09 EP100

CUSTOMER: CCS

CONTRACT: B01351

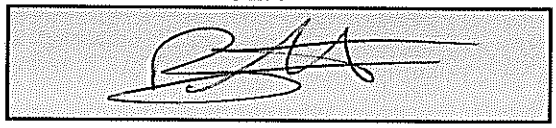
DATE OF CALIBRATION: 16/04/2009

WARRANTY:

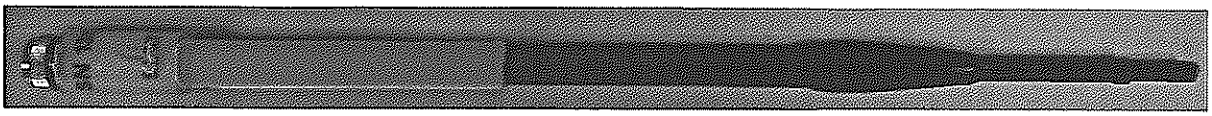
Date

11/05/2009

SAR TEAM MANAGER



PRODUCT DESCRIPTION



Frequency Range	100 MHz - 30 GHz
Probe length	330 mm
Length of one dipole	4.5 mm
Maximum external diameter	8 mm
Probe extremity diameter	6.5 mm
Distance between dipoles/probe extremity	< 2.7 mm
Resistance of the three dipole (at the connector)	Dipole 1: R1=2.5307 MΩ Dipole 2: R2=2.6353 MΩ Dipole 3: R3=2.5471 MΩ
Connector (HIROSE series SR30)	6 wire male (Hirose SR30series)

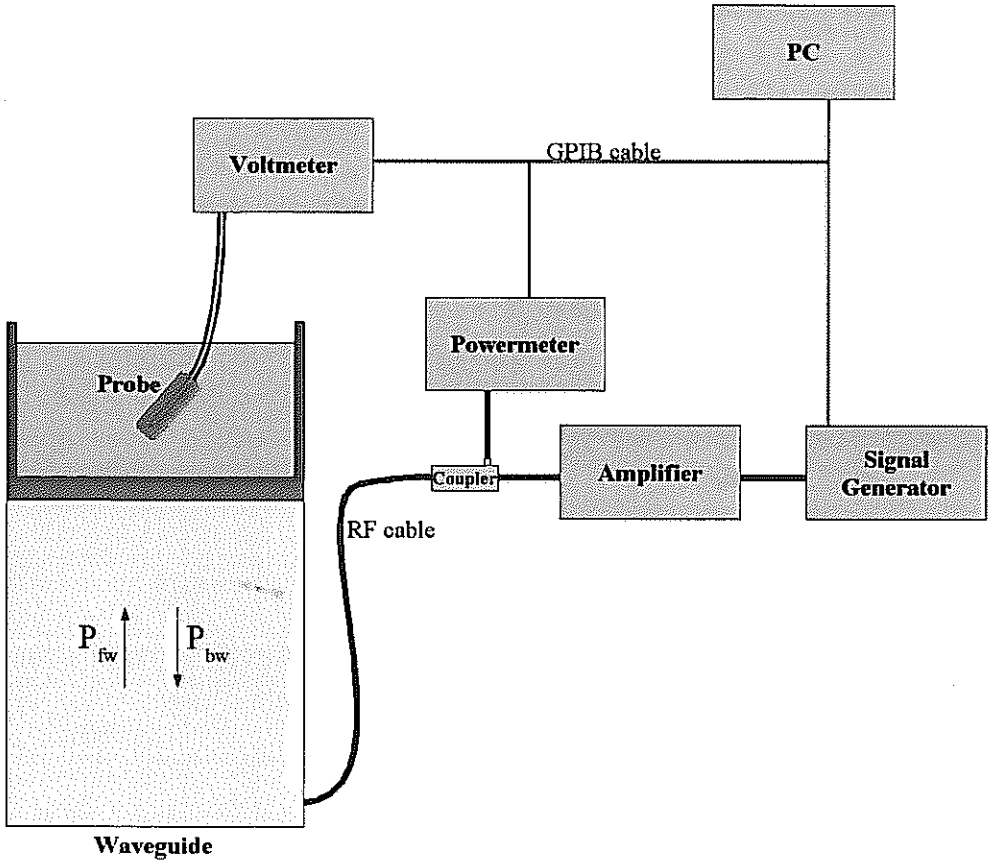
The probe could be checked by measuring the resistance of the three dipoles.

CALIBRATION TEST EQUIPMENT

TYPE	IDENTIFICATION	DATE OF CALIBRATION
Calibration bench	CALISAR CALIBRATION SYSTEM V2.0	
Multimeter	Keithley (2000, SN: 1000572)	Date of calibration: 01-07-2008

MEASUREMENT PROCEDURE

Probe calibration is realized, in compliance with CENELEC EN 50361 and IEEE 1528 std, with CALISAR, SATIMO proprietary calibration system. The calibration is performed with the EN 50361 annexe technique using reference guide at the five frequencies.



$$SAR = \frac{4\,(P_{fw} - P_{bw})}{ab\delta} \cos^2\left(\pi \frac{y}{a}\right) e^{-(2z/\delta)}$$

Where :

P_{fw}	= Forward Power
P_{bw}	= Backward Power
a and b	= Waveguide dimensions
d	= Skin depth

Keithley configuration:

Rate = Medium; Filter =ON; RDGS=10; FILTER TYPE =MOVING AVERAGE; RANGE AUTO

After each calibration, a SAR measurement is performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

PROBE UNCERTAINTIES

Calibration report of dosimetric SATIMO probe

Uncertainty on calibration system

ERROR SOURCES	Uncertainty value (%)	Probability Distribution	Divisor	ci	Standard Uncertainty (%)
Incident or forward power	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Reflected power	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Liquid conductivity	5,00%	Rectangular	$\sqrt{3}$	1	2,887%
Liquid permittivity	4,00%	Rectangular	$\sqrt{3}$	1	2,309%
Field homogeneity	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Field probe positioning	5,00%	Rectangular	$\sqrt{3}$	1	2,887%
Field probe linearity	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Combined standard uncertainty					4,761%
Expanded uncertainty (confidence interval of 95%)					9,331%

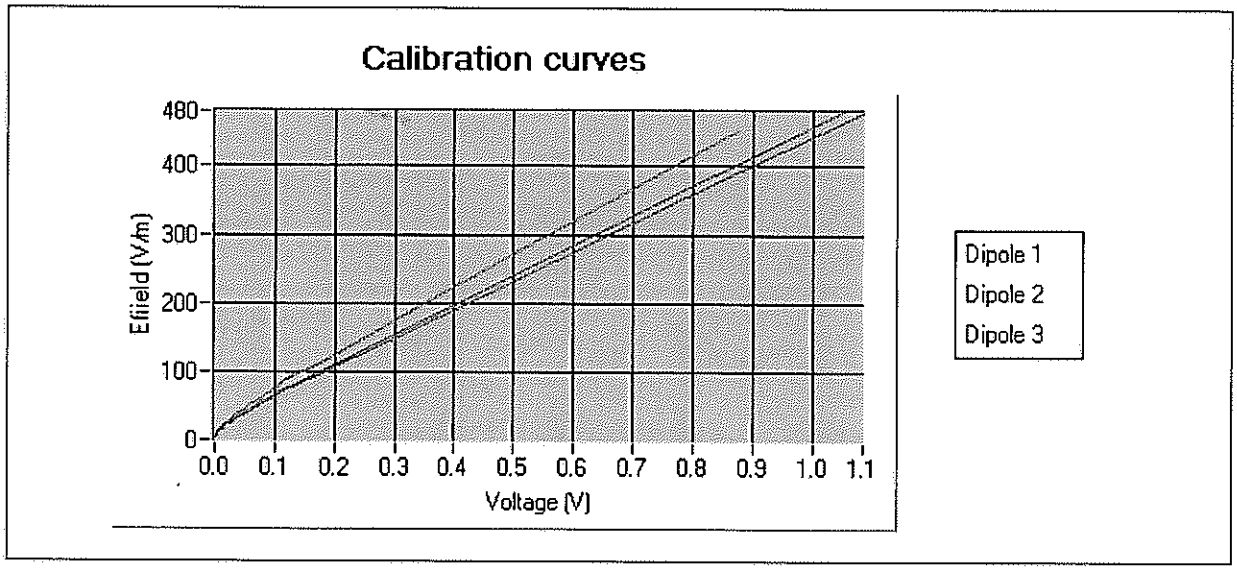
1. Calibration at 835.00 MHz

A. Calibration parameters.

Label	850
Epsilon	41.82
Sigma	0.89 S/m
Temperature	21°C
Cable loss	0.11 dB
Coupler loss	20.50 dB
Waveguide S11	-11.20 dB
Low limit detection	0.824 V/m (0.604 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:

$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



The following tables represent the calibration curves linearization by curve segment in CW signal.

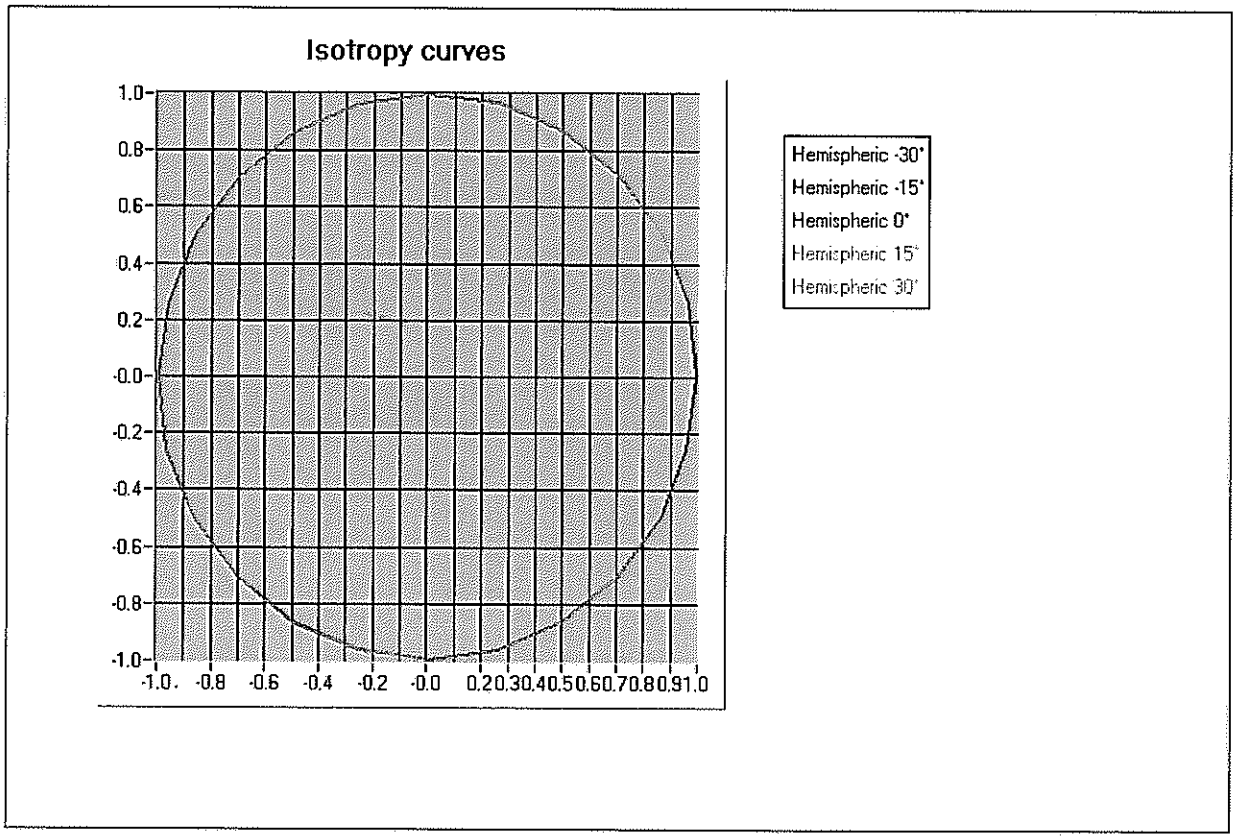
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	41.82	0.89	20.63	20.50	28.35
Body	55.09	0.94	20.01	19.89	27.76

B. Isotropy.

- Axial isotropy: 0.029 dB
- Hemispherical isotropy: 0.030 dB



C. Linearity.

- Linearity: 0.04 dB

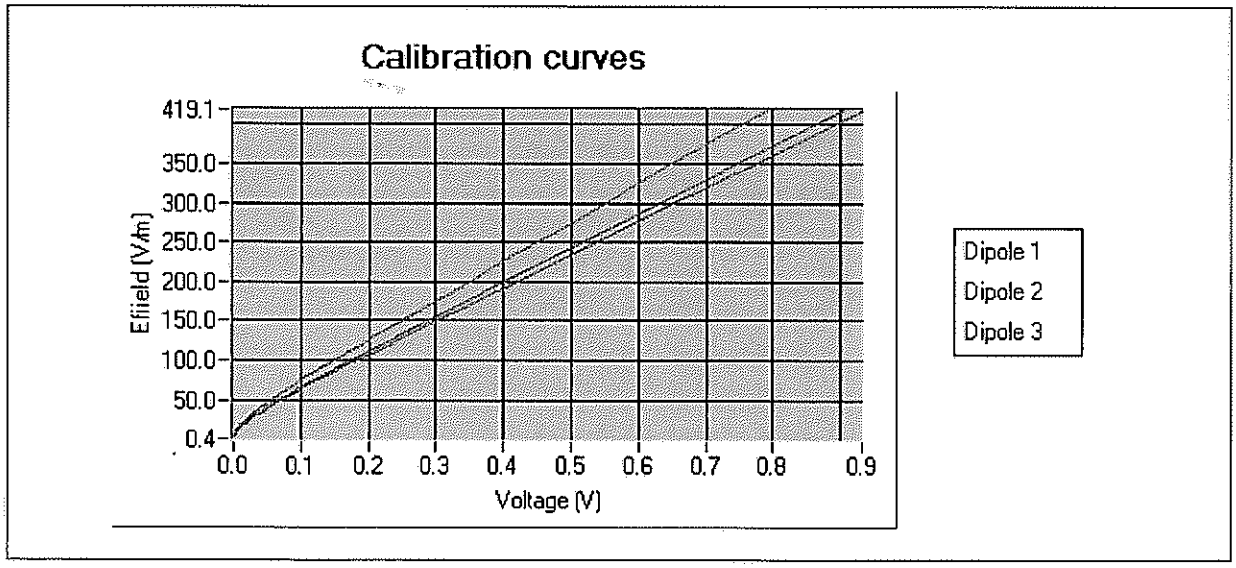
2. Calibration at 897.00 MHz

A. Calibration parameters.

Label	900
Epsilon	41.24
Sigma	0.94 S/m
Temperature	21°C
Cable loss	0.10 dB
Coupler loss	20.27 dB
Waveguide S11	-16.70 dB
Low limit detection	0.795 V/m (0.59 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:

$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



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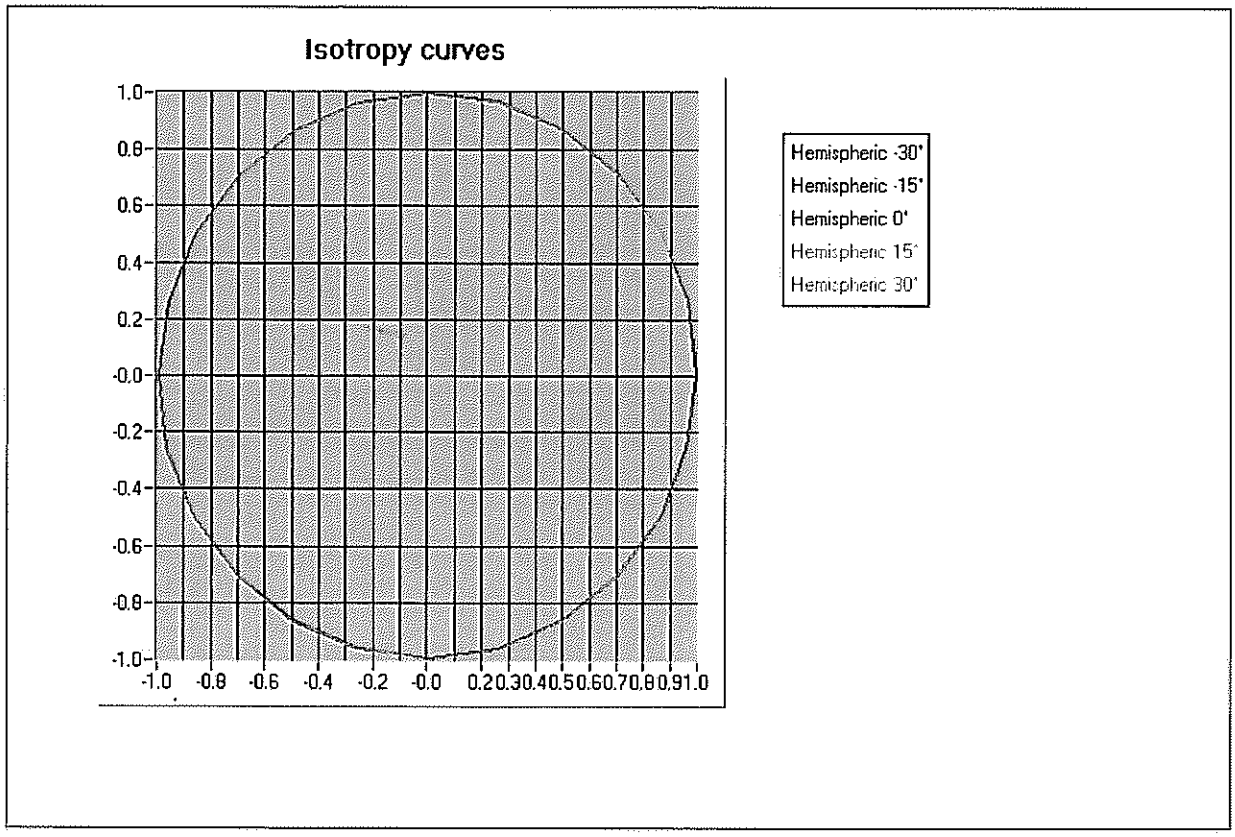
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	41.24	0.94	22.07	22.01	30.17
Body	55.99	1.02	21.56	21.33	29.11

B. Isotropy.

- Axial isotropy: 0.029 dB
- Hemispherical isotropy: 0.030 dB



C. Linearity.

- Linearity: 0.04 dB

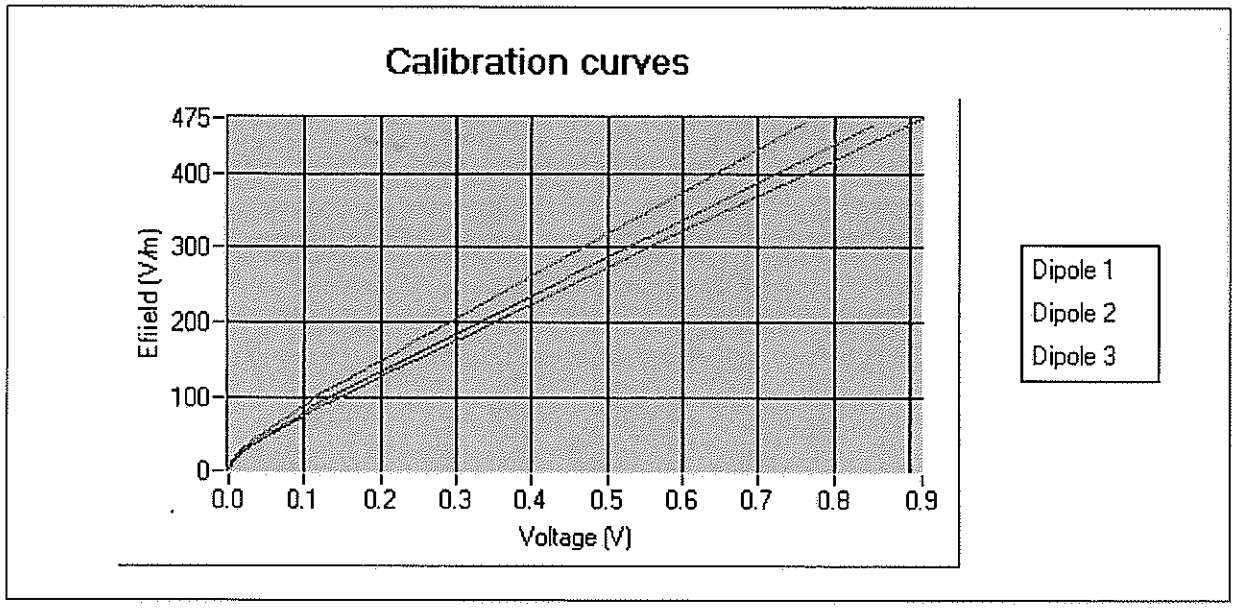
3. Calibration at 1747.00 MHz

A. Calibration parameters.

Label	1800
Epsilon	38.57
Sigma	1.34 S/m
Temperature	21°C
Cable loss	0.18 dB
Coupler loss	20.20 dB
Waveguide S11	-13.15 dB
Low limit detection	0.832 V/m (0.93 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:

$$E = \sqrt{E_1^{\,2} + E_2^{\,2} + E_3^{\,2}}$$



The following tables represent the calibration curves linearization by curve segment in CW signal.

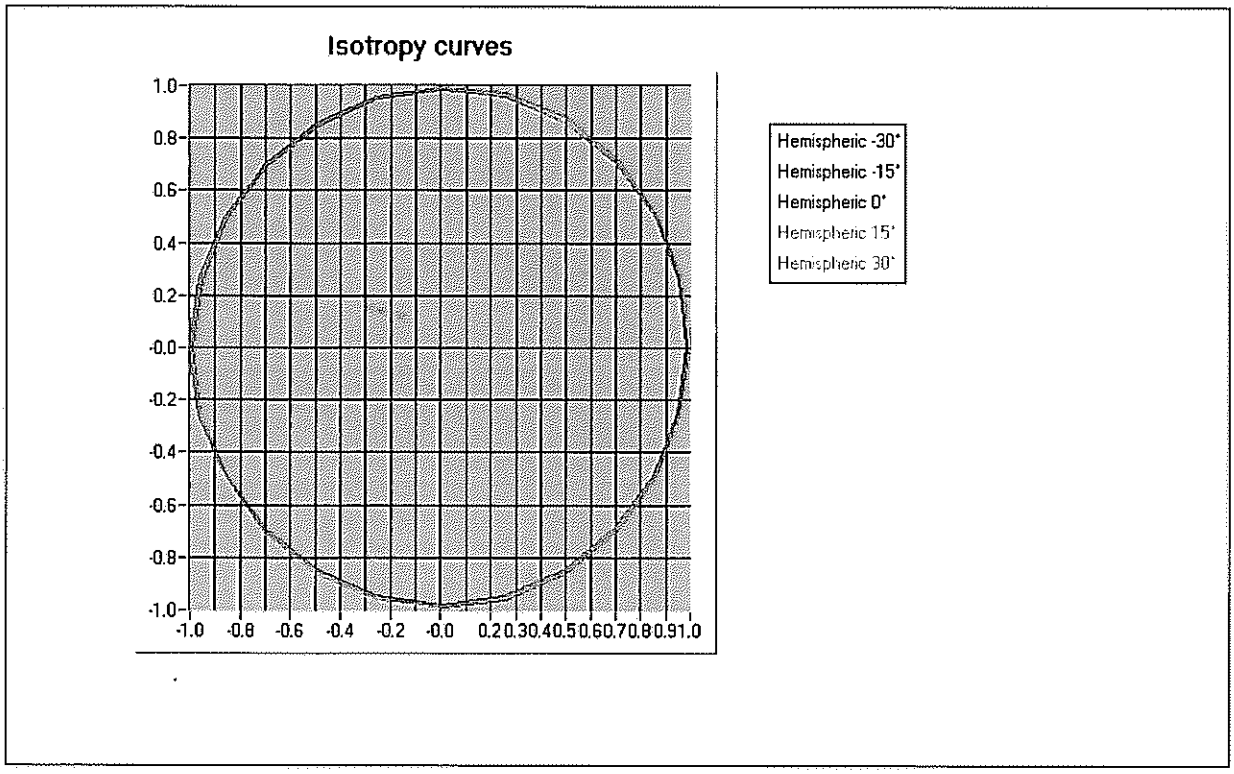
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	38.57	1.34	37.12	38.57	50.40
Body	51.99	1.49	36.65	37.99	49.65

B. Isotropy.

- Axial isotropy: 0.050 dB
- Hemispherical isotropy: 0.076 dB



C. Linearity.

- Linearity: 0.03 dB

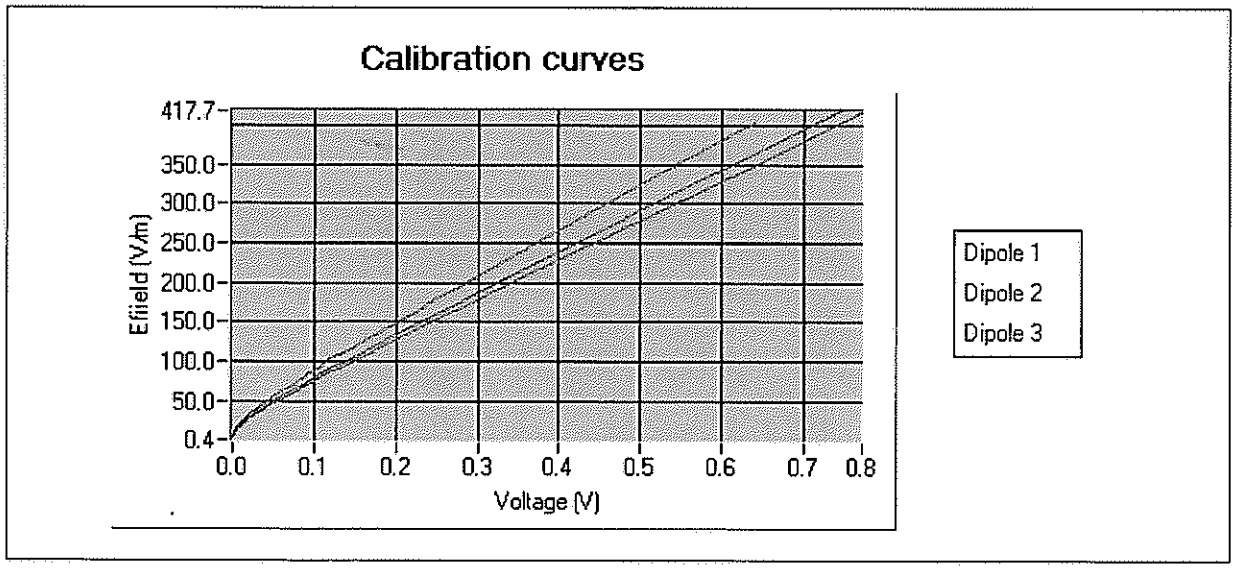
4. Calibration at 1880.00 MHz

A. Calibration parameters.

Label	1900
Epsilon	38.34
Sigma	1.45 S/m
Temperature	21°C
Cable loss	0.18 dB
Coupler loss	21.15 dB
Waveguide S11	-26.90 dB
Low limit detection	0.796 V/m (0.92 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:

$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



The following tables represent the calibration curves linearization by curve segment in CW signal.

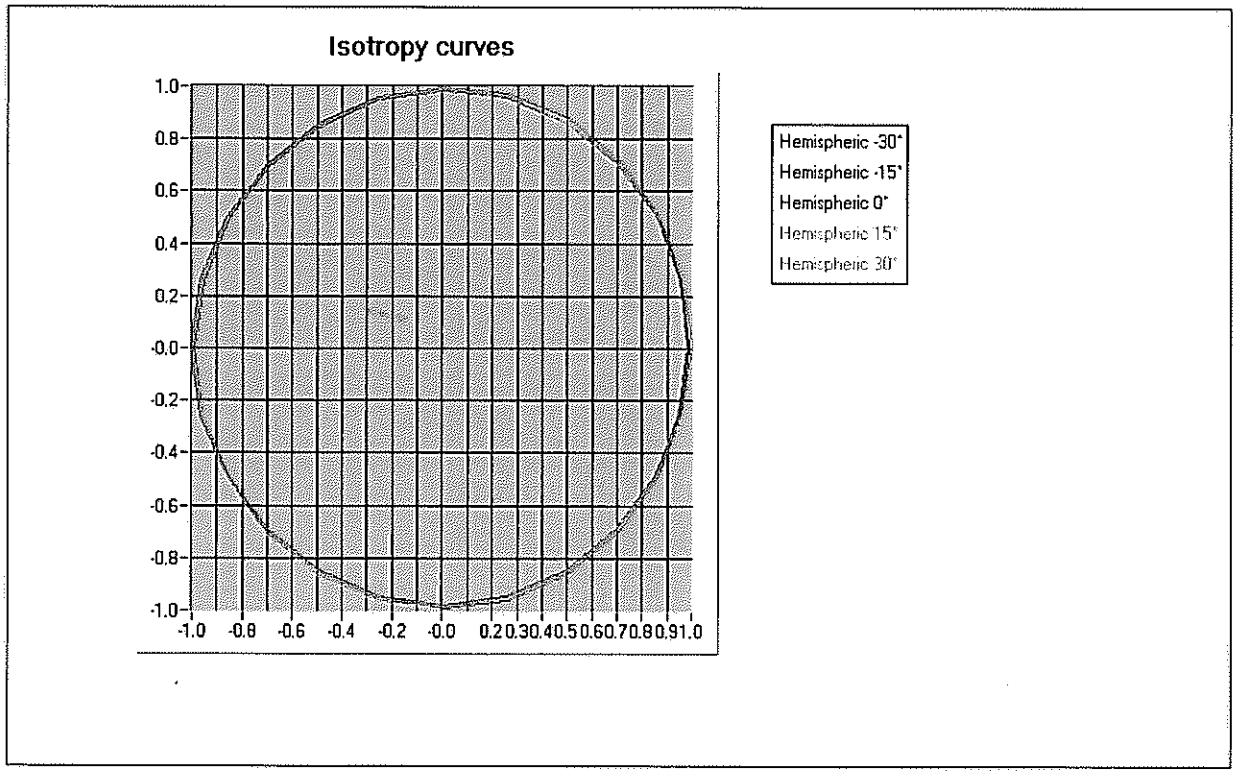
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	38.34	1.45	41.07	42.36	55.46
Body	52.13	1.50	40.41	41.11	54.77

B. Isotropy.

- Axial isotropy: 0.050 dB
- Hemispherical isotropy: 0.076 dB



C. Linearity.

- Linearity: 0.03 dB

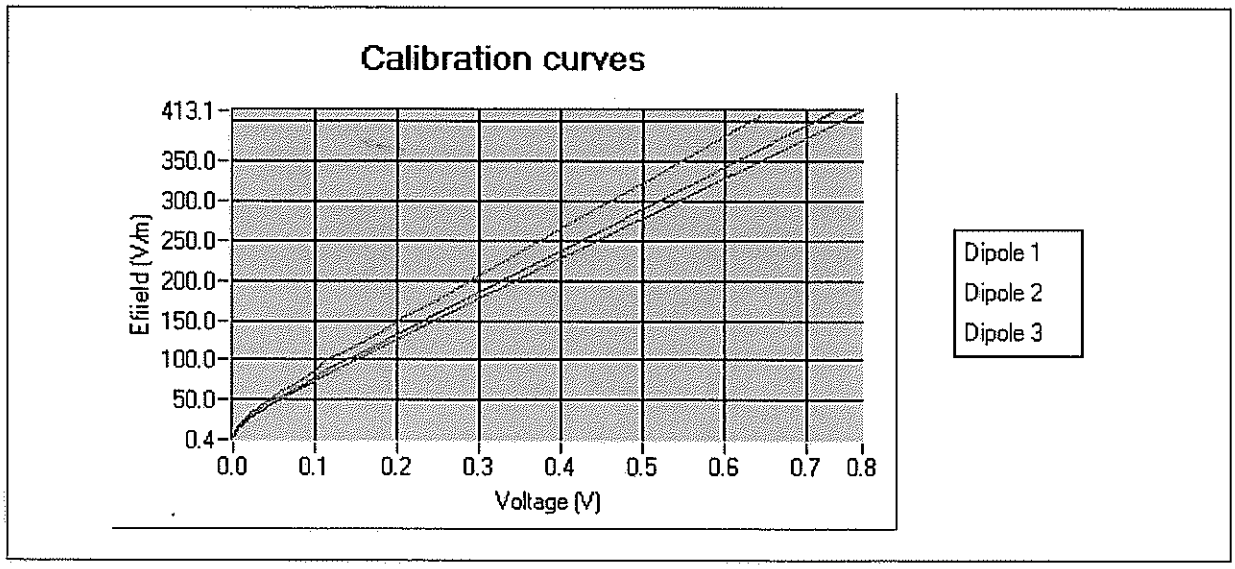
5. Calibration at 1950.00 MHz

A. Calibration parameters.

Label	2000
Epsilon	38.19
Sigma	1.47 S/m
Temperature	21°C
Cable loss	0.19 dB
Coupler loss	20.10 dB
Waveguide S11	-30.10 dB
Low limit detection	0.787 V/m (0.94 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:

$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



The following tables represent the calibration curves linearization by curve segment in CW signal.

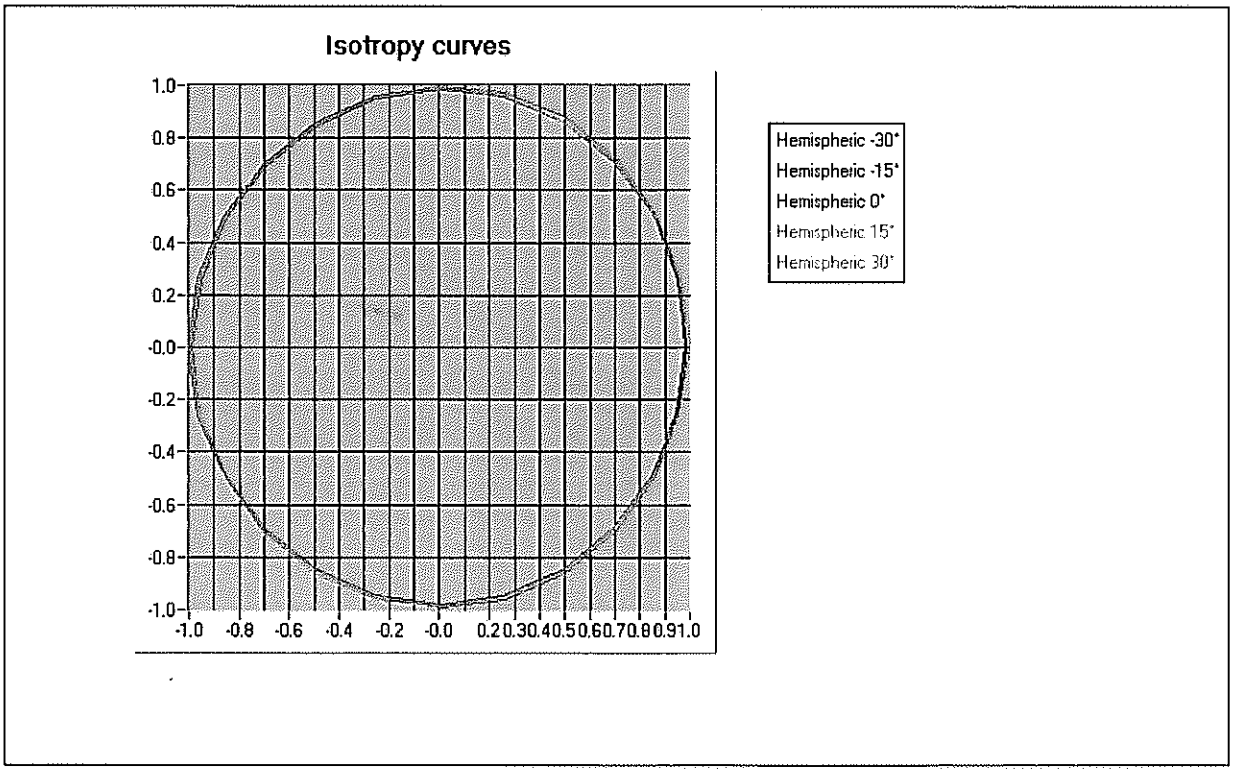
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	38.19	1.46	41.92	43.16	56.44
Body	54.05	1.52	41.01	42.41	55.66

B. Isotropy.

- Axial isotropy: 0.050 dB
- Hemispherical isotropy: 0.076 dB



C. Linearity.

- Linearity: 0.03 dB

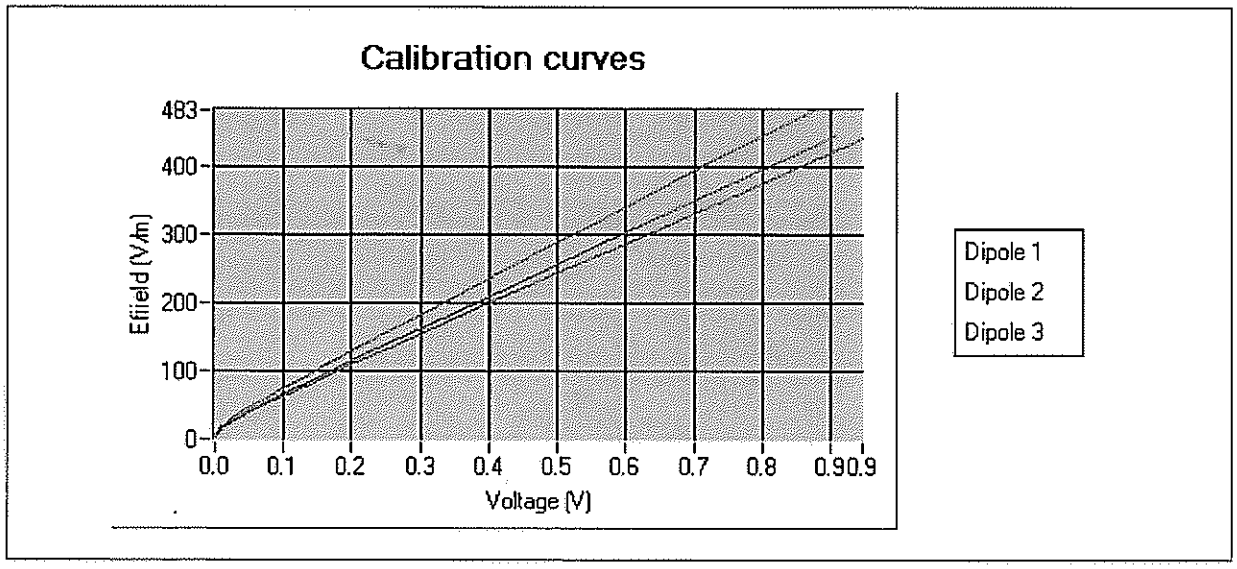
6. Calibration at 2450.00 MHz

A. Calibration parameters.

Label	2450
Epsilon	37.44
Sigma	1.75 S/m
Temperature	21°C
Cable loss	0.20 dB
Coupler loss	21.50 dB
Waveguide S11	-13.65 dB
Low limit detection	0.793 V/m (1.09 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:

$$E = \sqrt{E_1^{\,2} + E_2^{\,2} + E_3^{\,2}}$$



The following tables represent the calibration curves linearization by curve segment in CW signal.

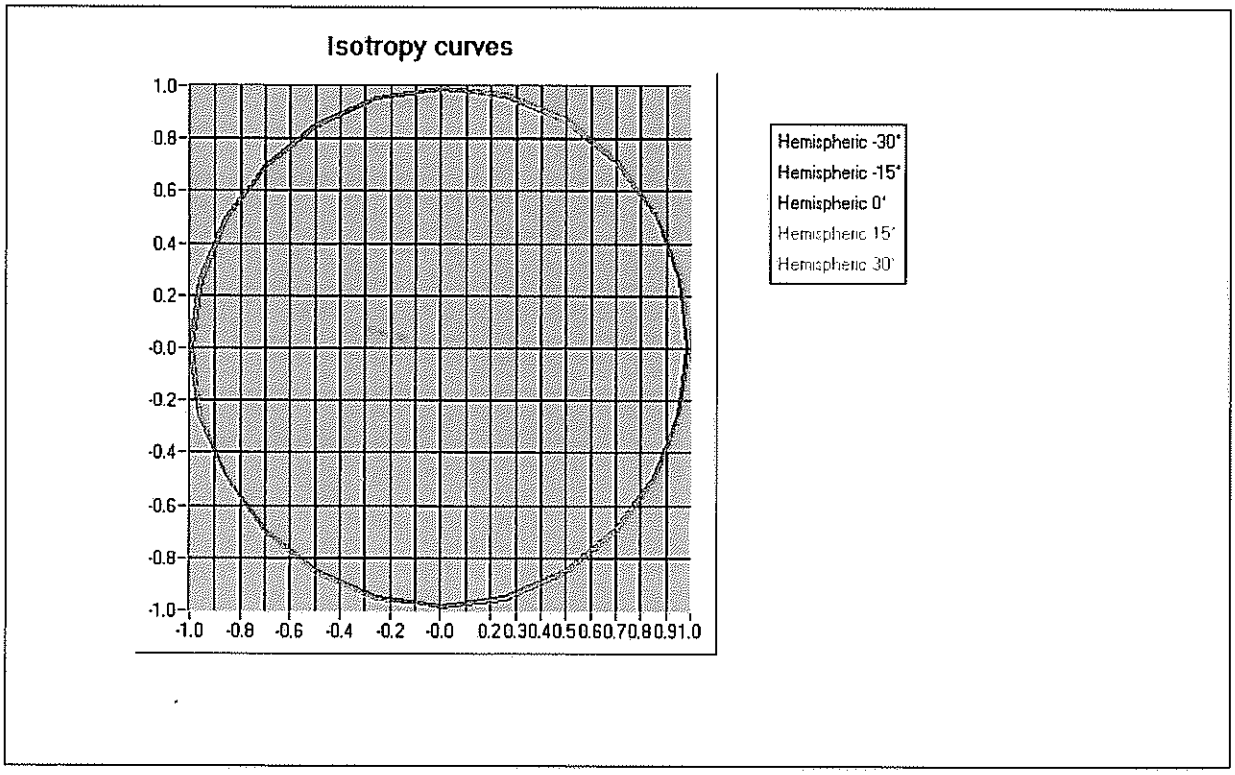
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	37.44	1.75	51.19	53.87	70.49
Body	53.70	1.96	50.36	52.99	69.77

B. Isotropy.

- Axial isotropy: 0.050 dB
- Hemispherical isotropy: 0.076 dB



C. Linearity.

- Linearity: 0.03 dB