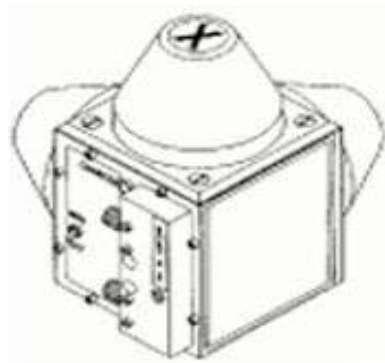
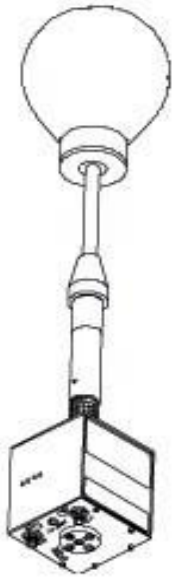




Probe Calibration Services

Innovative
Quality
Service & Solutions



Effective January 1, 2007
SUPERCEDES ALL PREVIOUS PRICE LISTS

Liberty Labs, Inc.
1346 Yellowwood Road, POB 230
Kimballton, Iowa 51543
Phone: (712) 773-2199
Fax: (712) 773-2299

www.liberty-labs.com

Prices and specifications subject to change without notice



Certificate Number 2123.01

Notes for Probe Calibrations

Liberty Labs, Inc. offers complete calibration services for a variety of RF Isotropic probes such as the Amplifier Research FP1000/2000/4000 series, IFI Narda Probes, EMCO 7120 series and probes from Holaday Industries. Our laboratory is equipped with four fully functional probe stations. Calibrations for probes are available from 10 kHz to 40 GHz.

Liberty Labs, Inc. offers a choice of four calibration services for Isotropic probes. See each package for specific details. A calibration request form, and a list of sample data formats is included.

The Request form is **Mandatory** and **MUST** accompany all probe calibration requests.

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DEVIATION FROM IEEE 1309 (Frequencies below 1 GHz) TECHNICAL JUSTIFICATION AND REASONING

Liberty Labs calibrates Isotropic (ISO) Field Probes using the IEEE 1309 standard. This standard lists a variety of devices that are capable of producing an Electric Field such as the GTEM, TEM Cell, Discrete Antennas, and Open Ended Waveguides.

ISO Probes which require Frequency Response and Channel Match calibrations below 1 GHz will contain a note indicating a deviation from the IEEE 1309 standard in that a tri-plate line is used, instead of the GTEM and/or TEM.

As the variety of probes calibrated here at Liberty Labs became more diverse in size a need to find an alternate method for transference became necessary to facilitate turn-a round time. Although not listed in the ISO 1309 standard, but known throughout the industry, the tri-plate quickly became an option to explore for this measurement method. Our comparative study focused on the equipment called for in the standard and the tri-plate. The study produced information which drove our decision to deviate from the standard. As mentioned earlier the initial reason to use the tri-plate was to accommodate a wide range of probe sizes, but following the study it was apparent that increased field stability and accuracy would also be realized as a benefit.

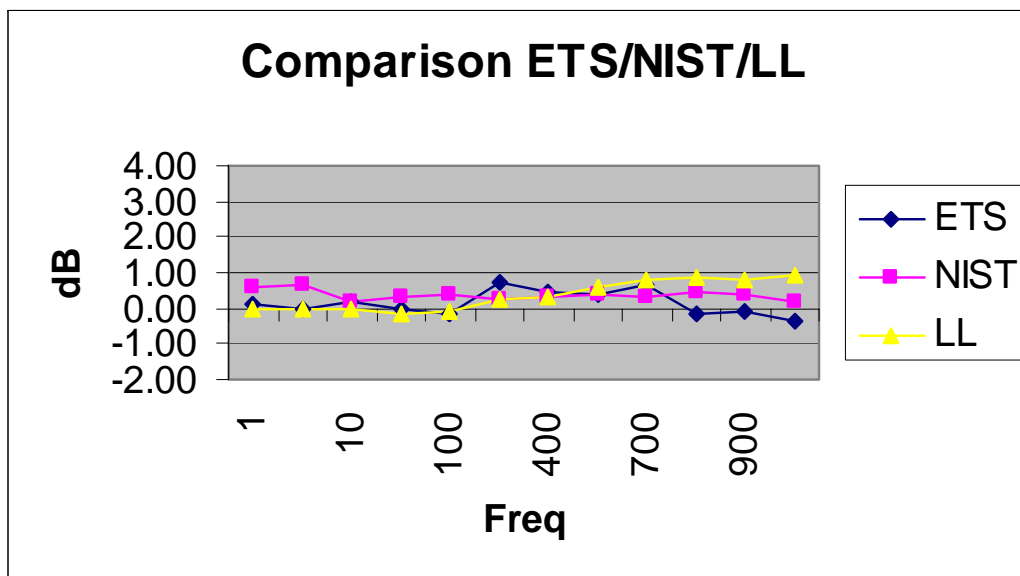
Therefore, the methodology outlined in the IEEE 1309 is still adhered to, with the exception of the use of a tri-plate line. The transfer standard characterized by NIST is still utilized to measure the generated field, and the probe under test is substituted and placed in the same position the transfer standard was in. This measurement process and calibration system was evaluated and accepted by A2LA (during assessment).

Please refer to the data below which correlates the transfer standard in the cells listed in the standard.

Liberty Labs is currently a member of the IEEE 1309 committee and we have requested that Tri-Plates and Strip-lines be added to the standard. Unfortunately, if you are familiar with the process involved in making changes to a standard, it may take up to 5 years to accomplish.

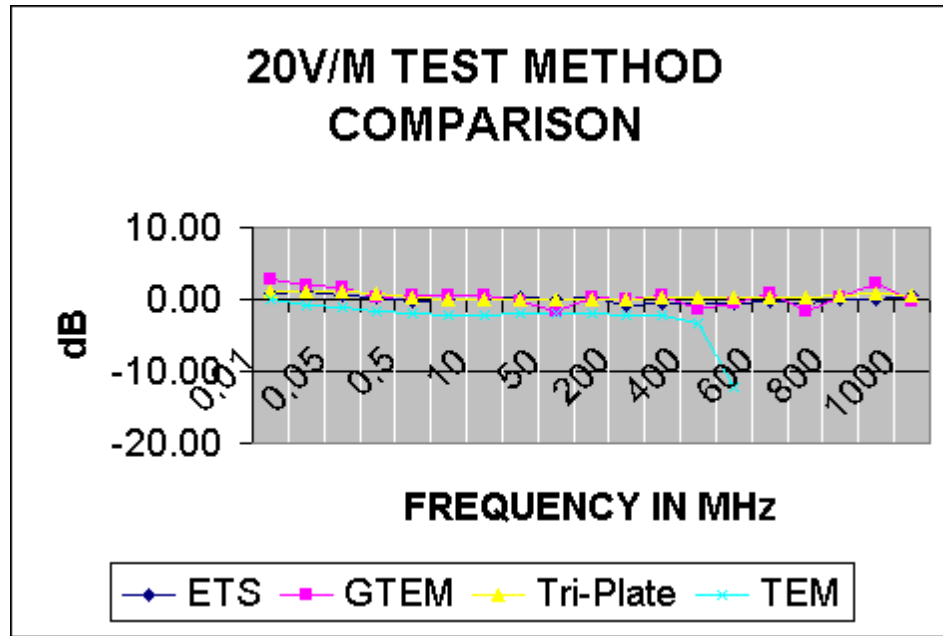
Comparing ETS, NIST and LIB LAB

Freq	Comparing ETS, NIST and LIB LAB						TEM/WG	TEM/WG	Calc	SUB	10022	10021	mult	dB
	ETS	NIST	GTEM	ETS	NIST	GTEM	ETS in dB	NIST in dB	Tri-plate	GTEM dB	Subs TRIPlate			
1	14.85	14.04	14.8	1.01	1.07	1.01	0.09	0.57	0.00	0.12	15	15	1	0
5		13.86	15.1		1.08	0.99		0.69	0.00	-0.06	15.1	15.1	1	0
10	14.7	14.7	14.9	1.02	1.02	1.01	0.18	0.18	0.00	0.06	15.1	15.1	1	0
50	15	14.5	12.2	1.00	1.03	1.23	0.00	0.29	-0.17	1.79	15	15.3	0.98	0.17
100	15.3	14.4	14.9	0.98	1.04	1.01	-0.17	0.35	-0.06	0.06	15.1	15.2	0.99	0.06
150	13.8	14.6	17.5	1.09	1.03	0.86	0.72	0.23	0.23	-1.34	15.1	14.7	1.03	0.23
400	14.2	14.5	12.8	1.06	1.03	1.17	0.48	0.29	0.29	1.38	15.1	14.6	1.03	0.29
600	14.4	14.4	17.9	1.04	1.04	0.84	0.35	0.35	0.59	-1.54	15.2	14.2	1.07	0.59
700	13.9	14.5	11.9	1.08	1.03	1.26	0.66	0.29	0.79	2.01	15	13.7	1.09	0.79
800	15.3	14.2	16.5	0.98	1.06	0.91	-0.17	0.48	0.86	-0.83	14.9	13.5	1.10	0.86
900	15.1	14.4	21.5	0.99	1.04	0.70	-0.06	0.35	0.79	-3.13	15	13.7	1.09	0.79
1000	15.7	14.7	18.2	0.96	1.02	0.82	-0.40	0.18	0.90	-1.68	15.2	13.7	1.11	0.90

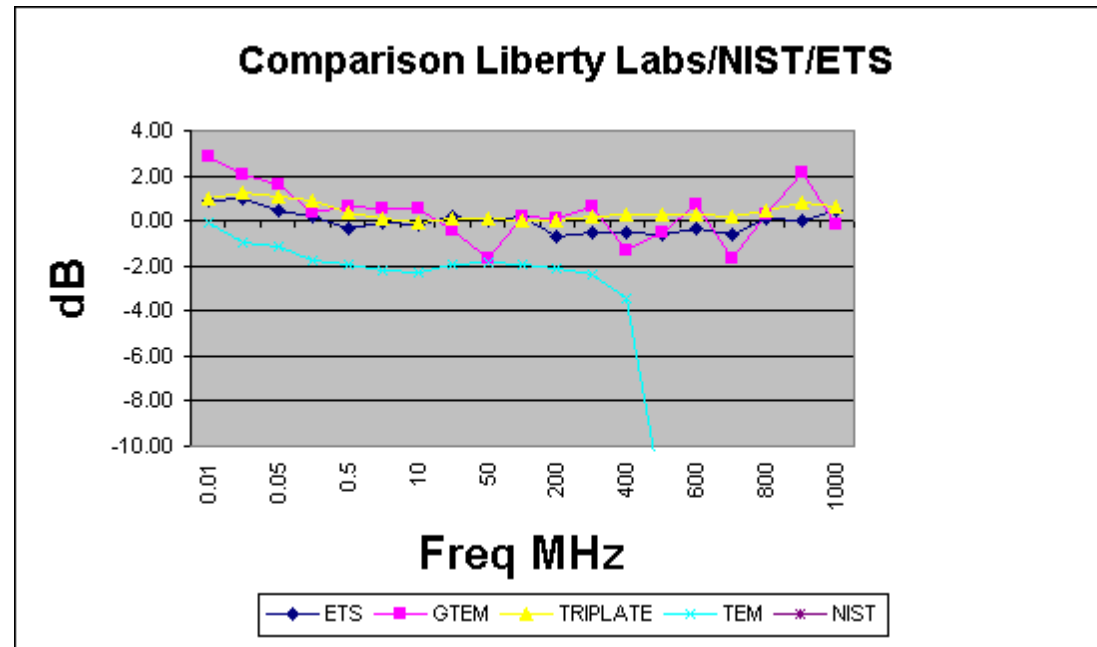


20V/m

Freq	ETS	GTEM	Tri Plate	TEM
0.01	1.11	1.39	1.13	0.99
0.03	1.12	1.26	1.15	0.57
0.05	1.05	1.20	1.13	0.87
0.1	0.97	1.04	1.11	0.82
0.5	0.96	1.07	1.04	0.80
1	0.99	1.06	1.01	0.78
10	0.98	1.06	0.99	0.77
20	1.02	0.96	1.01	0.80
50	1.00	0.82	1.01	0.81
100	1.02	1.02	1.01	0.80
200	0.92	1.01	1.01	0.78
300	0.95	1.08	1.02	0.76
400	0.94	0.86	1.03	0.68
500	0.93	0.94	1.03	0.24
600	0.96	1.09	1.03	
700	0.93	0.83	1.02	
800	1.01	1.03	1.06	
900	1.01	1.29	1.09	
1000	1.05	0.98	1.07	



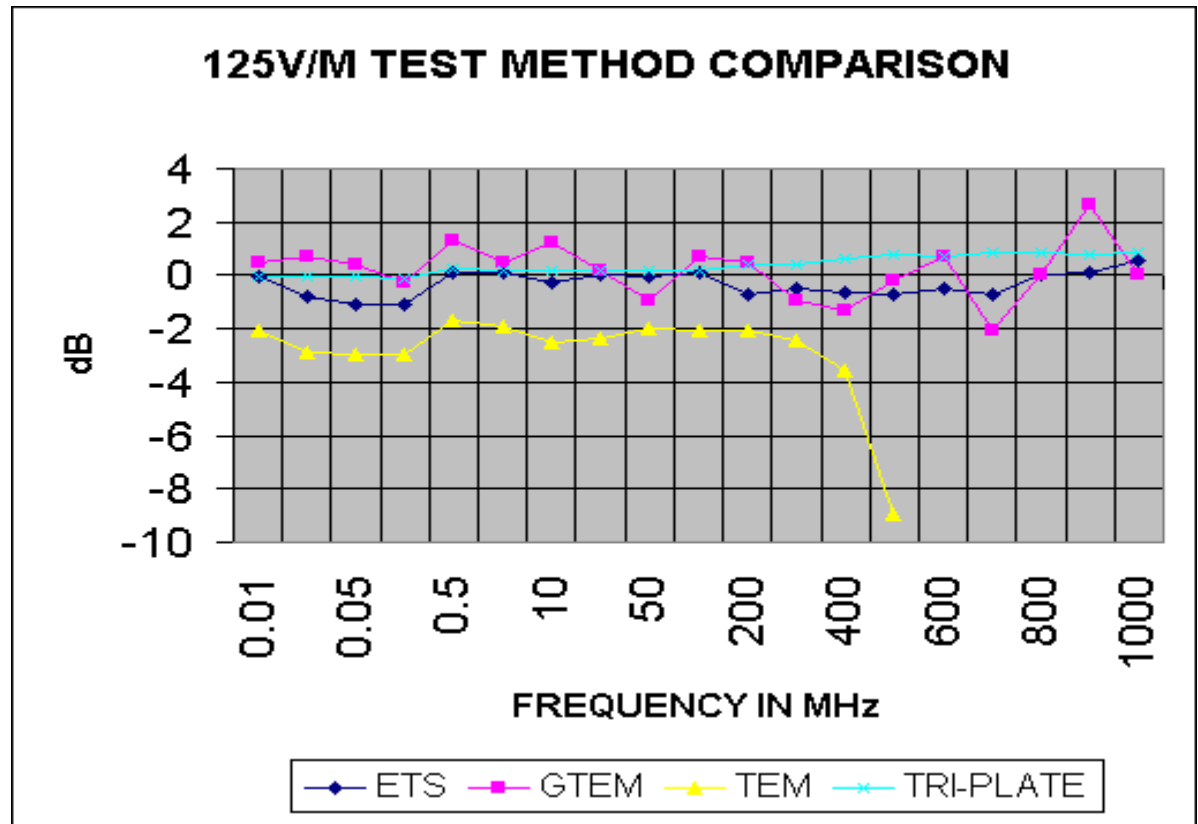
0.01	0.94	2.85	1.02	-0.10
0.03	0.99	2.04	1.22	-0.95
0.05	0.46	1.57	1.07	-1.16
0.1	0.23	0.35	0.88	-1.77
0.5	-0.32	0.60	0.32	-1.93
1	-0.11	0.54	0.10	-2.21
10	-0.13	0.54	-0.09	-2.30
20	0.15	-0.39	0.06	-1.95
50	0.02	-1.67	0.06	-1.81
100	0.21	0.19	0.04	-1.97
200	-0.73	0.10	0.04	-2.14
300	-0.49	0.65	0.18	-2.34
400	-0.50	-1.31	0.24	-3.40
500	-0.59	-0.54	0.25	-12.34
600	-0.33	0.75	0.24	
700	-0.61	-1.67	0.16	
800	0.13	0.25	0.48	
900	0.05	2.18	0.77	



1000 0.42 -0.18 0.61

125 V/M

Freq	ETS	GTEM	TEM	TRIPLATE		
0.01	-0.05	0.48	-2.09	-0.01	ETS 3 Sigma	0.464971
0.03	-0.79	0.71	-2.9	-0.08		
0.05	-1.07	0.43	-2.98	-0.06	GTEM 3 Sigma	1.046974
0.1	-1.12	-0.27	-2.97	-0.15		
0.5	0.07	1.3	-1.66	0.22	TEM 3 sigma	1.811861
1	0.12	0.48	-1.91	0.19		
10	-0.24	1.2	-2.55	0.17	TriPlate 3 sigma	0.352396
20	0.04	0.17	-2.34	0.17		
50	-0.07	-0.97	-1.99	0.17		
100	0.12	0.71	-2.05	0.15		
200	-0.75	0.48	-2.1	0.41		
300	-0.47	-0.93	-2.42	0.41		
400	-0.62	-1.29	-3.53	0.65		
500	-0.69	-0.17	-8.92	0.75		
600	-0.48	0.68		0.71		
700	-0.71	-2.09		0.88		
800	0.04	0.04		0.83		
900	0.1	2.64		0.8		
1000	0.54	0.01		0.83		



Package A

Standard Calibration Service

* Standard Discounts Apply

** Typical Frequencies and or V/m may vary by product type and probe capabilities

Frequency Response:

Using Standard Frequencies at mid-level Field Strength of each range of probe. For example, for the FP2000 this is done at 5V/m, 15V/m, 50 V/m and 150 V/m. Limitations for Fields above 1 GHz apply. Please check with Liberty for highest field levels that can be provided.

Low Frequency Probes (Typical):

10kHz, 30kHz, 50kHz, 100kHz, 500kHz, 1MHz, 5 MHz, 10 MHz, 50 MHz, 100 MHz, 200 MHz, 300 MHz, 400 MHz, 500 MHz, 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1000 MHz.

High Frequency Probes 1-18 GHz (Typical):

1 GHz, 1.2 GHz, 2.45 GHz, 3.80 GHz, 8 GHz, 12 GHz, 18 GHz

1 GHz, 1.5 GHz, 2 GHz, 2.5 GHz, 3 GHz, 3.5 GHz, 4 GHz, 4.5 GHz, 5 GHz

High Frequency Probes 1-40 GHz (Typical):

1 GHz, 1.2 GHz, 2.45 GHz, 3.80 GHz, 8 GHz, 12 GHz, 18 GHz, 26 GHz, 33 GHz, 40 GHz

Package B

Premium Calibration Service

* Standard Discounts Apply

Frequency Response and Customer Choice of: Channel Match **OR Iso Response.**

** Typical Frequencies and or V/m may vary by product type and probe capabilities

Frequency Response:

Using Standard Frequencies at mid-level Field Strength of each range of probe. For example, for the FP2000 this is done at 5V/m, 15V/m, 50 V/m and 150 V/m. Limitations for Fields above 1 GHz apply. Please check with Liberty for highest field levels that can be provided.

Low Frequency Probes (Typical):

10kHz, 30kHz, 50kHz, 100kHz, 500kHz, 1MHz, 5 MHz, 10 MHz, 50 MHz, 100 MHz, 200 MHz, 300 MHz, 400 MHz, 500 MHz, 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1000 MHz.

High Frequency Probes 1-18 GHz (Typical):

80 MHz, 100 MHz, 300 MHz, 1 GHz, 1.2 GHz, 2.45 GHz, 3.80 GHz, 8 GHz, 12 GHz, 18 GHz

High Frequency Probes 1-40 GHz (Typical):

80 MHz, 100 MHz, 300 MHz, 1 GHz, 1.2 GHz, 2.45 GHz, 3.80 GHz, 8 GHz, 12 GHz, 18 GHz, 26 GHz, 33 GHz, 40 GHz

Choose ONE of the following Tests:

Channel Match:

Typically this is done at 90V/m at 10kHz, 30 kHz, 1.5 MHz, 3 MHz, 30 MHz, 150 MHz, 500 MHz, 700 MHz, and 1 GHz.

OR

Isotropic Response:

This is done at 400 MHz at 20 V/m. (Note: only available for 3 axis probes that are clearly marked for their axis).

Package C

Gold Calibration Service

*Standard Discounts Apply

Frequency Response\Channel Match\and Iso Response.

** Typical Frequencies and or V/m may vary by product type and probe capabilities

Frequency Response:

Using Standard Frequencies at mid-level Field Strength of each range of probe. For example, for the FP2000 this is done at 5V/m, 15V/m, 50 V/m and 150 V/m. Limitations for Fields above 1 GHz apply. Please check with Liberty for highest field levels that can be provided.

Low Frequency Probes (Typical):

10kHz, 30kHz, 50kHz, 100kHz, 500kHz, 1MHz, 5 MHz, 10 MHz, 50 MHz, 100 MHz, 200 MHz, 300 MHz, 400 MHz, 500 MHz, 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1000 MHz.

High Frequency Probes 1-18 GHz (Typical):

80 MHz, 100 MHz, 300 MHz, 1 GHz, 1.2 GHz, 2.45 GHz, 3.80 GHz, 8 GHz, 12 GHz, 18 GHz

High Frequency Probes 1-40 GHz (Typical):

80 MHz, 100 MHz, 300 MHz, 1 GHz, 1.2 GHz, 2.45 GHz, 3.80 GHz, 8 GHz, 12 GHz, 18 GHz, 26 GHz, 33 GHz, 40 GHz

Both Channel Match and Isotropic Response is included

Channel Match:

Typically this is done at 90V/m at 10kHz, 30 kHz, 1.5 MHz, 3 MHz, 30 MHz, 150 MHz, 500 MHz, 700 MHz, and 1 GHz.

AND

Isotropic Response:

This is done at 400 MHz at 20 V/m. (Note: only available for 3 axis probes that are clearly marked for their axis).

Package D Custom Calibration Service

*****No Discounts Apply**

This package covers special calibration requests outside of our Standard, Premium and Gold Service packages. This service must be pre-approved by Liberty Labs, Inc. before unit is shipped for Calibration.

This includes, but is not limited following:

Frequency Response at other Frequencies and/or field strengths other than standard Frequencies **Price: Call for Quote**

Channel Match\Linearity at 6 Frequencies at 10 V/m, 30 V/m and 100 V/m. **Price: Call for Quote**
If other than default listed here, please list here:

Isotropic Response at Customer Specified Frequency and or V/m **Price: Call for Quote**
(Note: only available for 3 axis probes that are clearly marked for their axis). If other frequencies required for Isotropic Response, please list here.

Individual Axis Frequency Response **Price: Call for Quote**

Customer Specified Test **Price: Call for Quote**

Linearity Check **Price: Call for Quote**

Standard Sample Data Formats:

Frequency Response

Date of Calibration = January XX, 20XX

Date Printed: Tuesday, January XX, 20XX 1:54 PM

Customer Name: Customer B

Probe Manufacturer: Amplifier Research

Probe Model: FP2000

Probe Serial No.: XXXXXX

Temperature (Deg C): 21

Humidity (%): 16

Notes: For detailed information on this calibration, please refer to the calibration certificate

CAL CERT #: 2008XXXXXX

Correction Factors for Probe are shown in Numerical Multiplier and dB

Freq (MHz)	Rng 1 Mult	Rng 1 dB	Rng 2 Mult	Rng 2 dB	Rng 3 Mult	Rng 3 dB	Rng 4 Mult	Rng 4 dB
0.01	0.89	-1.06	0.89	-1.06	0.93	-0.65	0.98	-0.14
0.03	0.89	-0.97	0.89	-1.01	0.93	-0.60	1.01	0.09
0.05	0.89	-0.97	0.89	-1.01	0.93	-0.64	1.00	0.02
0.10	0.90	-0.88	0.89	-0.99	0.93	-0.62	0.99	-0.08
0.50	0.89	-1.04	0.89	-0.97	0.93	-0.62	0.95	-0.41
1.00	0.89	-1.05	0.89	-0.98	0.93	-0.67	0.94	-0.53
5.00	0.87	-1.17	0.89	-1.04	0.92	-0.70	0.96	-0.33
10.00	0.89	-1.04	0.89	-1.04	0.92	-0.70	0.98	-0.20
50.00	0.89	-0.98	0.90	-0.96	0.94	-0.58	0.98	-0.15
100.00	0.89	-1.06	0.90	-0.95	0.94	-0.58	0.99	-0.05
200.00	0.87	-1.26	0.90	-0.94	0.93	-0.62	0.95	-0.45
300.00	0.87	-1.22	0.90	-0.92	0.93	-0.62	0.97	-0.29
400.00	0.90	-0.95	0.93	-0.63	1.04	0.34	1.05	0.45
500.00	0.85	-1.38	0.87	-1.23	0.89	-0.97	0.91	-0.86
600.00	0.78	-2.16	0.78	-2.11	0.82	-1.69	0.83	-1.63
700.00	0.93	-0.64	0.96	-0.40	0.99	-0.08	1.00	-0.01
800.00	0.98	-0.18	1.05	0.40	1.08	0.71	1.09	0.75
900.00	0.98	-0.14	1.04	0.34	1.10	0.86	1.13	1.07
1000.00	0.82	-1.73	0.83	-1.60	0.88	-1.11	0.92	-0.74

Channel Match

Date of Calibration: XX-Month-Year
Date Printed: Tuesday, December X, 20XX
Customer Name: XXXX Corporation
Probe Manufacturer: Amplifier Research
Probe Model: FP2000
Probe Serial No.: XXXXXX
Temperature (Deg C): 23
Humidity (%): 28
Notes:
CAL CERT #: 2008XXXXXX

Channel Match Data

Frequency in MHz	Applied Field V/m	Range V/m	Indicated Field			Max Deviation dB	Channel Match %
			X	Y	Z		
0.01	90.20	100	94.60	93.20	92.60	-0.41	97.89
0.03	90.20	100	97.00	95.60	94.40	-0.63	97.32
1.5	89.80	100	93.60	93.80	90.60	-0.38	96.59
3	90.20	100	94.40	95.00	91.40	-0.45	96.21
30	90.40	100	94.60	94.60	90.40	-0.39	95.56
150	89.80	100	94.80	96.00	91.80	-0.58	95.63
1000	29.40	30	34.00	30.00	31.00	-1.31	96.15

Iso Response

Date of Calibration: XX-Month-Year
Date Printed: Tuesday, December XX, 20XX
Customer Name: XXXX Corporation
Probe Manufacturer: Amplifier Research
Probe Model: FP2000
Probe Serial No.: XXXXX
Temperature (Deg C): 23
Humidity (%): 28
Notes:
CAL CERT #: 2008XXXXXX

Isotropic Response at 400MHz at 20V/m

Degree	Response	Degree	Response
0	0.00	185	0.46
5	-0.04	190	0.49
10	-0.07	195	0.50
70	0.33	255	0.14
75	0.36	260	0.11
80	0.39	265	0.11
85	0.39	270	0.11
90	0.39	275	0.13
95	0.38	280	0.13
100	0.36	285	0.16
105	0.34	290	0.19
110	0.30	295	0.23
115	0.28	300	0.25
120	0.25	305	0.28
125	0.23	310	0.28
130	0.22	315	0.30
135	0.21	320	0.30
140	0.21	325	0.27
145	0.22	330	0.25
150	0.23	335	0.21
155	0.26	340	0.17
160	0.29	345	0.13
165	0.33	350	0.08
170	0.35	355	0.03
175	0.40	360	-0.01
180	0.43		

Maximum Deviation = 0.39

Linearity Check

Date of Calibration: XX-Month-Year
Date Printed: Tuesday, December XX, 20XX
Customer Name: XXXX Corporation
Probe Manufacturer: Amplifier Research
Probe Model: FP2000
Probe Serial No.: XXXXX
Temperature (Deg C): 23
Humidity (%): 28
Notes:
CAL CERT #: 2008XXXXXX

Linearity

Frequency	Applied Field	Range	Indicated Field	Max Deviation
in MHz	V/m	V/m	V/m	dB
0.03	9.24	10	9.50	-0.24
0.03	28.30	30	30.20	-0.56
0.03	89.40	100	86.60	0.28
0.03	179.05	300	176.00	0.15
3	9.26	10	9.50	-0.22
3	28.04	30	29.50	-0.44
3	91.59	100	94.80	-0.30
3	156.73	300	164.00	-0.39

Probe Calibration Request Form

Customer Name			Contact
Address 1		City	State
Address 2		Telephone Number	Fax Number
Manufacturer:		Serial Number:	
Model Number:		Asset Number:	
Special Data Formatting (Additional fee \$25 per document) List Below <input type="checkbox"/> Yes <input type="checkbox"/> No		Previous Year's Cal Data to Be Included with Calibration Package (Additional \$ 10 Fee) <input type="checkbox"/> Yes <input type="checkbox"/> No	
TXT files are Standard (Doc. Or XLS are Special)		List Year's to be included:	
Charger Included:	Monitor Included: (call to see if monitor should be included)	Other Accessories:	

Check the Appropriate box for calibration

<input type="checkbox"/> Package A: Standard Frequency Points & Ranges One Position	<input type="checkbox"/> Package C: Standard Frequency Points & Ranges One Position, Iso Response & Ch.Match/Linearity
<input type="checkbox"/> Package B: Standard Frequency Points & Ranges One Position, Choose either Iso Resp or Ch.Match/Linearity Check Item: <input type="checkbox"/> Iso Response <input type="checkbox"/> Ch.Match/Linearity	<input type="checkbox"/> Package D: Custom Frequency Points, Ranges, Multiple Positions, etc. (Must have Prior Approval)

PLEASE CIRCLE POSITION UNIT IS TO BE CALIBRATED IN

Each Position Chosen Counts as One Calibration

Top View except for those drawings marked Side.

X-Up Z towards Source RF Source	Z-Up X towards Source RF Source	Z-Up Y towards Source RF Source	X-Up Y towards Source RF Source
Y-Up Z towards Source RF Source	Y-Up X towards Source RF Source	Z-Up X-Y towards Source RF Source	Y-Up X-Z towards Source RF Source
X-Up Y-Z towards Source RF Source	Mid-Point towards Source (Critical Angle) RF Source	Horizontal parallel to Source RF Source	Horizontal towards Source RF Source
Vertical Side View RF Source Optics Towards Source	Vertical Side View RF Source Optics Away from Source	Critical Angle Towards Source Side View	Other Sketch Position

Liberty Labs, Inc. Phone: 712-773-2199 Fax: 712-773-2299
 For additional information: Please call Michael Howard or Dave Grabill

Field Probe Position Issues

Due to the issues about the position of the probe when calibrated and/or used, Liberty Labs, Inc. has started including an Alignment/Mounting Position document with each calibration certificate for the fieldprobe.

The certificate issued will state that the correction factors given are valid only for the position indicated.

We are contacting our customers & getting the probe position they use in order to give the most applicable correction factors. The information we need before performing the calibration is how the probe is positioned in reference to the source. (See Request Form)

We have performed a probe position study and will be doing more soon. Our study has shown that the position of the probe does make a difference & that the probe may not necessarily be isotropic at all frequencies. Our study also indicated that the manufacturer's specifications may not always be true at all frequencies. The testing we perform on the probe gives you a characterization of the probe. We do not do any adjustments to the probes. The In/Out of tolerance indication on the certificate is based on the alignment/mounting position of the probe and not on the manufacturer's specifications.

Competitive Comparison

	<u>Liberty Labs, Inc.</u>	<u>Major Competitor</u>
# of Freq. Points	24	9
# of Field Strengths	4	1
Iso Response	Yes	No
Linearity	Yes- Mult. Pts &Field Strengths	Yes-/Single Field Strength
Turn Around Time	< 10 Working Days	Up to a Month



Liberty Labs, Inc. PRICE POLICY

PRICING POLICY

All prices are in US dollars, FOB, Kimballton, Iowa, USA. Payments for equipment and services received from companies located outside the United States (including Canada and Mexico) are due in US funds drawn upon a US bank. Freight, insurance, duties, and handling fees are additional.

Terms - Net 30 days.

Liberty Labs, Inc.
1346 Yellowwood Road, POB 230
Kimballton, Iowa 51543
Phone: (712) 773-2199
Fax: (712) 773-2299

www.liberty-labs.com

Prices and specifications subject to change without notice

