Radcal® CORPORATION
426 WEST DUARTE ROAD
MONROVIA, CA 91016 - USA
TEL: 626.357.7921 FAX: 626.357.8863
EMAIL: service@radcal.com
WEB: www.radcal.com

Report No: 25704

Certificate of Calibration

Issued To: FACEPE/Helen Jamil Khoury
CNPJ: 25466.440/0001-79 /CPF:763758208-63
PRONEM-APQ-1343-3.09/10
Rua Benfica, 150-Madalena-Recife-PE
CEP 50720.001

Equipment Description	Model	S/N	Asset No.
Dynalyzer IIIA	M-96311A	74-001471	N/A

Condition of Equipment As-Left:
Equipment is in tolerance
Remarks:
When received, the equipment was found to be in good condition and for the tests contained in this report, performed in accordance with the manufacturer's specifications with the exceptions listed below:
1. None.

The equipment identified above has been calibrated and tested using standard Radcal calibration and acceptance procedures in accordance with Radcal Quality Manual PP1007, 25704.xls and technical requirements contained in the customer's order. These procedures are designed to ensure that the tested equipment meets or exceeds the stated specifications and the requirements of ANSI/NCLS Z540-1-1994.

All measurements performed during the testing employ equipment traceable to NIST or another recognized National Laboratory). All calibration results included with this certificate
were recorded at the time of measurement and shall not imply anything about the instrument's future stability. This must be determined from previous historical data.

Calibration Date: 18 May 2015
Date of Report 21 May 2015
Interval, as defined by customer: 12 months after date of calibration
Calibration Due: 18 May 2016

Calibration Tech: _____
D. Acuna

By: _____
Authorized Reviewers
P. Sunde/E. Macintosh

This report relates only to the items calibrated and shall not be reproduced except in full, without the written approval of Radcal Corporation.

Radcal® CORPORATION
426 WEST DUARTE ROAD
MONROVIA, CA 91016 - USA
TEL: 626.357.7921 FAX: 626.357.8863
EMAIL: service@radcal.com
WEB: www.radcal.com

Report No: 25704

Certificate of Calibration

Measurement Test Conditions

KV calibration is performed using a calibrated 100 kV power supply and a precision DC volt meter. High voltage is applied to the anode/cathode transformer connections and the 'A' and 'C' BNC outputs are measured. Uncertainty in the applied kV is 0.14% at the 95% confidence level. kV frequency calibration is performed using a frequency generator driving 10 Hz to 10 kHz sinusoidal signal into a power amplifier producing a 600 VAC signal which is applied to the anode/cathode receptacles. The measurement is performed by recording the input/output AC voltage ratio at set frequencies. The uncertainty in the kV frequency response measurement is 1% at the 95% confidence level. Anode current calibration is performed by connecting a calibrated precision current source the the Anode (+ to transformer, - to tube) divider and a precision DC volt meter measures the output at the 'mA' BNC. The uncertainty in the applied mA measurement is 1% at the 95% confidence level. Filament current calibration applies a 10 Amp AC current to the cathode receptacles via a 0.1 Ohm precision shunt. The uncertainty in the filament current measurement is 1% at the 95% confidence level. The description and traceability of all standards and equipment used in this calibration are found in Appendix A of this report.

Limitations of Use:

See Manufacturer's specifications

Uncertainty:

The lowest Test Uncertainty Ratio (TUR) for the calibration of this equipment is: 5.9

Measurement Results

Conditions of Measurement

Temperature: 24 °C
Humidity: 32%
Note: Corrections for environmental conditions are not required for this equipment.

High Voltage Cable Test

Cables Received: n/a
Cable Length: ft. **Cable Condition:** N/A

Hi Pot Test **(withstand 80 kV for 5 min. Fail >20 mA or breakdown)**

Cable	Pass/Fail	Fail Reason
N/A		
N/A		

Continuity Test: **(mV Voltage Drop max , Fail > 100 mV / ft at 12 Amps)**

	Small		Large		Common		Shell	Pass/Fail
Cable	mV drop	Pass/Fail	mV drop	Pass/Fail	mV drop	Pass/Fail	mV drop	< 700 mV
N/A								
N/A								

This report relates only to the items calibrated and shall not be reproduced except in full, without the written approval of Radcal Corporation.

Radcal® CORPORATION
426 WEST DUARTE ROAD
MONROVIA, CA 91016 - USA
TEL: 626.357.7921 FAX: 626.357.8863
EMAIL: service@radcal.com
WEB: www.radcal.com

Report No: 25704

Certificate of Calibration

High Voltage Cable Tests cont'd

Leakage Test: (160 V, 12 A, 1 min. Fail >100 mV)

Cable	Small	Large	Common
N/A			
N/A			

Dynalyzer Tank Tests

Internal Tank Pressure

	Final psig	Pass/Fail Final > 20
Tank pressure	30.00	Pass

mA Calibration

Description	Displayed Value	Error %	Criteria	Pass/Fail
Fluoro Noise(mV)	0.00	N/A	<=2 mA	Pass
Fluoro 10 mA	10.02	0.2%	<=2%	Pass
Fluoro 20 mA	20.09	0.4%	<=2%	Pass
Rad Noise (mV)	0.00	N/A	<=2 mA	Pass
Rad 50 mA	50.13	0.3%	<=2%	Pass
Rad 100 mA	100.42	0.4%	<=2%	Pass
Rad 250 mA	249.94	0.0%	<=2%	Pass

Filament Calibration

Filament	Expected Value	Measured Value	Error %	Criteria	Pass/Fail
Filament Zero	0.0 mV	0.0 mV	N/A	N/A	N/A
2.4 Amp Filament:	2.59	2.59	0.0%	<=1%	Pass

kV Calibration

Anode

	Dynalyzer output				
Set kV	Measured kV	Error kV	Error %	Correction Factor	Pass/Fail 0.99-1.01
10	9.98	-0.02	-0.2%	1.002	Pass
20	19.98	-0.02	-0.1%	1.001	Pass
30	29.98	-0.02	-0.1%	1.001	Pass
40	40.00	0.00	0.0%	1.000	Pass
45	44.99	-0.01	0.0%	1.000	Pass
50	49.98	-0.02	0.0%	1.000	Pass
60	59.98	-0.02	0.0%	1.000	Pass
70	69.98	-0.02	0.0%	1.000	Pass
75	74.95	-0.05	-0.1%	1.001	Pass

This report relates only to the items calibrated and shall not be reproduced except in full, without the written approval of Radcal Corporation.

Radcal® CORPORATION
426 WEST DUARTE ROAD
MONROVIA, CA 91016 - USA
TEL: 626.357.7921 FAX: 626.357.8863
EMAIL: service@radcal.com
WEB: www.radcal.com

Report No: 25704

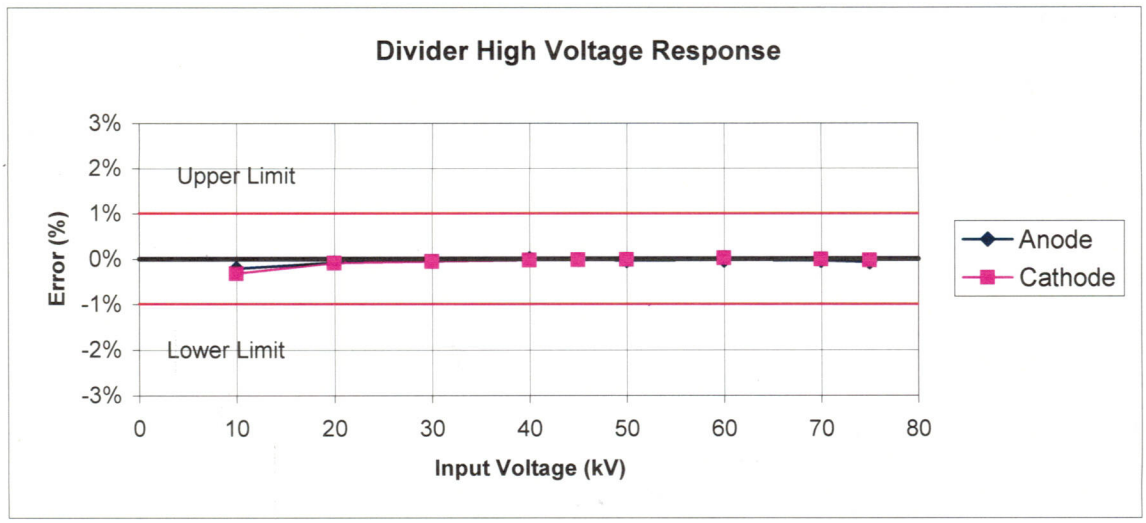
Certificate of Calibration

Dynalyzer Tank Tests cont'd.

kV Calibration cont'd.

Cathode

	Dynalyzer output				
Set kV	Measured kV	Error kV	Error %	Correction Factor	Pass/Fail 0.99-1.01
-10	-9.97	0.03	-0.3%	1.003	Pass
-20	-19.98	0.02	-0.1%	1.001	Pass
-30	-29.98	0.02	-0.1%	1.001	Pass
-40	-39.99	0.01	0.0%	1.000	Pass
-45	-44.99	0.01	0.0%	1.000	Pass
-50	-49.99	0.01	0.0%	1.000	Pass
-60	-60.01	-0.01	0.0%	1.000	Pass
-70	-69.99	0.01	0.0%	1.000	Pass
-75	-74.98	0.02	0.0%	1.000	Pass



This report relates only to the items calibrated and shall not be reproduced except in full, without the written approval of Radcal Corporation.

Radcal® CORPORATION
426 WEST DUARTE ROAD
MONROVIA, CA 91016 - USA
TEL: 626.357.7921 FAX: 626.357.8863
EMAIL: service@radcal.com
WEB: www.radcal.com

Report No: 25704

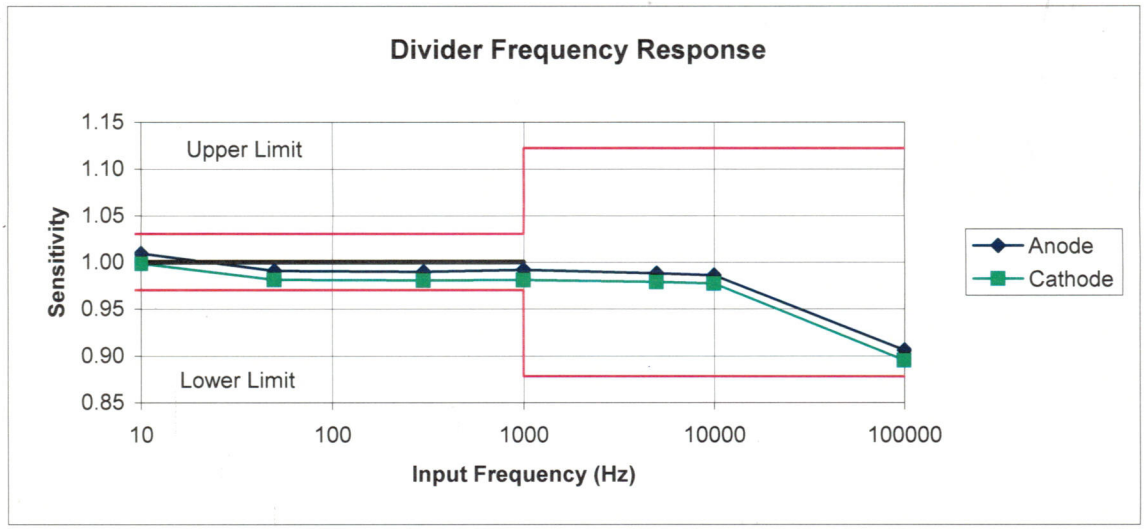
Certificate of Calibration

Dynalyzer Tank Tests cont'd.

Divider Frequecy Response

Frequency	Anode		PassFail	Cathode		PassFail
Hz	Sensitivity	Error %	±3%*	Sensitivity	Error %	±3%*
DC Offset	-0.001	N/A	N/A	0.000	N/A	N/A
DC/10	1.009	0.9%	Pass	0.998	-0.2%	Pass
50/10	0.990	-1.0%	Pass	0.981	-1.9%	Pass
300/10	0.989	-1.1%	Pass	0.980	-2.0%	Pass
1k/10	0.991	-0.9%	Pass	0.981	-1.9%	Pass
5k/10	0.988	-1.2%	Pass	0.979	-2.1%	Pass
10k/10	0.986	-1.4%	Pass	0.977	-2.3%	Pass
100k/10	0.906	-9.4%	Pass	0.895	-10.5%	Pass

* ±12.2% 1kHz to 10kHz



Divider X-ray Generator Pulse Functional Test (not calibration)

Generator Set: 70 kVp & 100 ms nominal

	X-ray Current 40 mA			X-ray Current 150 mA			X-ray Current 300 mA		
Output	Reading	Limits	Pass/Fail	Reading	Limits	Pass/Fail	Reading	Limits	Pass/Fail
A + C (kV	70.5	70.28±5%	Pass	70.35	70.18±5%	Pass	70.28	70.06±5%	Pass
Anode mA (mA)	39.36	37.53±5%	Pass	150.8	150.4±5%	Pass	292.3	294.2±5%	Pass
Duration (ms)	103.6	102.3±5%	Pass	99.17	97.75±5%	Pass	101.9	100.5±5%	Pass
Filament (A)	1.378	1.445±5%	Pass	1.55	1.629±5%	Pass	1.653	1.739±5%	Pass

This report relates only to the items calibrated and shall not be reproduced except in full, without the written approval of Radcal Corporation.

Radcal® CORPORATION
426 WEST DUARTE ROAD
MONROVIA, CA 91016 - USA
TEL: 626.357.7921 FAX: 626.357.8863
EMAIL: service@radcal.com
WEB: www.radcal.com

Report No: 25704

Certificate of Calibration

APPENDIX -A-

Equipment Used

Inv. #	Description	Model	S/N	Cal Due [1]
R546	DMM	DM5010	B021830	31-Jan-2016
R483	Dyn Test Rack and Data	n/a	n/a	30-Sep-2015
R281	DMM	DM5010	B021236	29-Feb-2016
R292	System DCPS	6634A	3004A-02195	30-Nov-2015
R293	Program. PS	PS5010	B010111	30-Sep-2015
R688	Programmable 20MHz Function Gener	FG 5010	B053204	30-Apr-2016
R306	HV DC SUPPLY	RHR 120W	C007271B	30-Sep-2015
R307	HV DC SUPPLY	RHR 120W	C007271A	30-Sep-2015
R449	Multimeter	34401A	US36109199	31-Oct-2015
R686	Shunt, 5 milliohms, 10A	0.5 04	R686	30-Apr-2016

Note [1]: Radcal policy (PI1034) provides up to 30 days post cal due date for standards recalibraton

Inv. #	Traceability Number(s)
R546	29628
R483	483-093014
R281	020515-02
R292	612501-7
R293	293-092914
R688	32493
R306	306-092914
R307	307-092914
R449	27715

This report relates only to the items calibrated and shall not be reproduced except in full, without the written approval of Radcal Corporation.