Certificate of Calibration

INSTRUMENT MODEL:	RS-711
MANUFACTURER:	Radian Research, Inc.
SERIAL NUMBER:	703225
CUSTOMER NAME:	RADIAN RESEARCH, INC.
P.O. NUMBER:	
CE NUMBER:	none
RMA NUMBER:	RO12345
CALIBRATION DATE:	22-Jun-11
CALIBRATION DUE DATE:	21-Jun-12
ERROR SPECIFICATION:	+/-0.005% +/- traceability using fundamental waveforms
ACCURACY CONFIDENCE LEVE	99%

ISO 9001Certified

Radian Research's As-Found Test Results showed this Instrument to be:

[ ] New [X] In Tolerance [ ] Out of Tolerance [ ] Inoperative [ ] Limited Calibration

For Out of Tolerance conditions, As-Found Data Reports are furnished.

Radian Research recommends a 12 month Calibration interval for RS-711 modules.

This certifies the above listed instrument was calibrated in compliance with ISO 9001:2000 and ANSI/NCSL Z540-1 using applicable Radian Research procedures. Radian Research certifies this instrument meets or exceeds all published specifications. For reference to watt-hours the RS-711 was calibrated to a bank of custom RD-22-RTS Dytronic Primary Transfer Standards that are traceable to the National Institute of Standards and Technology, or by accuracies derived from accepted values of natural physical constants, or by accuracies derived from accepted ratio type calibration techniques. Calibration is then confirmed across all ranges with RD-22-RTS DytronicTransfer Standards. A complete calibration report is provided that illustrates the various test results.

For reference to volts the RS-711 was calibrated by a bank of custom RD-22-RTS Dytronic Primary Transfer Standards that is traceable to the National Institute of Standards and Technology.

For reference to frequency, Radian Research uses a Hewlett Packard 100 MHz Universal Counter calibrated using the Arbiter Systems Model 1083B listed below. No measurements or adjustments were made referencing frequency for this calibration because there are no time references located within the RS-711 Syntron Signal Source. The frequency reference for the RS-703A system is located within the RS-740 Data Collection Module and our records indicate that it was last tested by Radian Research at time of original shipment. This frequency is a High Stability Quartz Crystal with an output frequency of 2.097120 MHz for 60Hz systems and 2.097000 MHz for 50Hz systems. Therefore, this calibration is predicted on the RS-740's frequency reference being within +/-0.0003%. All other measurement functions are mathematical calculations derived from known variables.

Applicable Traceability & Report Numbers for Primary References used by Radian Research's Metrology Laboratory:

Watt-hour, VA-hour, VAR-hour, Q-hour, Amp-hour
Volt-hour, Volt-Squared hour, AC Volt

Radian Dytronic Primary Transfer Standards Consisting of (3) RD-22-RTS
Serial Numbers: 200717, 200718, 200719
NIST Test Report Number: 697/280054-10; Calibration Due Date 6-Jan-2012.

Time Base (Frequency)

Arbiter Systems Model 1083B Satellite-Controlled Frequency Standard s/n B1057. GPS controlled system with an uncertainty of 0.000002ppm. No calibration required.

DC Volts

Fluke Model 732B DC Volt Standard s/n 7703004 with an uncertainty of ± .1ppm.
Fluke Certificate Number 9D5460; Calibration Due Date: 14-July-2012.

Resistance

Guildline Standard Resistor Model 9330/10K s/n 62623, 62624. Guildline Test Certificate Numbers C13274 and C13275;with an Expanded Uncertainty of ±.39ppm. Calibration Due Date:25-May-2012.

Other

Radian Dytronic Transfer Standards Consisting of (3) RD-22-RTS
Serial Numbers: 201973, 201974, 202101. Calibration Due Date 9-September-2011
Hewlett Packard 8 Digit Multi-Meter Model 3458A s/n 2823A02816. Agilent Technologies
Test Certificate Number 53298: Calibration Due Date 1-Mar-2012.

Metrology Laboratory Technician Signature

Calibration Report

RS-711 Syntron Signal Source

Function..... Watt-hour 60 Hz

Date..... 22-Jun-11

Serial Number..... 703225

The following data was collected by a bank of three RD-22-RTS Dytronic Transfer Standards. The RS-711 was first calibrated to the RD-22-RTS Dytronic Primay Transfer Standards. The RD-22-RTS Dytronic Primary Transfer Standards were certified in Vhr mode by the National Institute of Standards and Technology (NIST) to an uncertainty of ±0.0005%. The RD-22-RTS Dytronic Primary Transfer Standards were certified in Watthour mode by the National Insititute of Standards and Technology (NIST) to an uncertainty of ±0.0006% @ unity Power Factor and ±0.0012% @ lagging Power Factor. Calibration temperature is 23 degrees Centigrade. The test time is 15 seconds and the stabilization time between points is 5 seconds. For lagging power factors the current lags the voltage. All results are listed in Parts Per Million (PPM).

Voltage & Phase Angle

AMPS	120 UNITY	120 60' LAG	240 UNITY	240 60' LAG	480 UNITY	480 60' LAG	600 UNITY	600 60' LAG
0.20	16.97	11.05	20.10	09.15	13.96	02.10	14.85	05.87
0.25	22.18	15.74	21.61	13.30	17.44	05.46	20.72	10.86
0.30	19.27	13.18	19.97	11.05	14.25	02.68	18.26	07.97
0.50	19.68	13.36	20.60	11.42	14.88	03.31	18.36	08.67
1.00	01.08	00.39	02.03	-01.37	-03.51	-09.53	-00.09	-04.11
2.00	03.67	00.51	04.90	-01.22	-00.62	-09.41	02.82	-03.85
2.50	06.56	02.35	07.56	00.75	02.20	-07.30	05.92	-01.56
3.00	06.65	06.22	07.53	04.28	02.28	-03.59	03.40	00.26
4.00	01.71	02.48	02.72	00.78	-02.56	-07.39	00.67	-01.94
5.00	00.07	-00.22	00.96	-01.99	-04.29	-10.16	-00.72	-04.27
7.00	03.42	03.55	04.58	01.92	-00.70	-06.32	02.08	-01.51
10.00	07.58	05.40	08.70	03.78	03.70	-04.56	06.76	01.26
15.00	12.01	10.28	13.25	08.91	07.75	00.80	10.88	05.81
20.00	06.18	04.45	07.44	02.92	02.10	-05.23	05.54	00.54
25.00	07.60	07.06	08.93	05.99	03.40	-02.29	04.27	01.64
30.00	07.50	08.02	08.86	07.10	03.30	-01.39	06.28	03.80
35.00	03.09	03.31	04.62	02.44	-00.91	-06.09	02.45	-00.10
40.00	-00.26	-00.94	01.34	-01.51	-04.12	-09.88	-00.60	-04.08
45.00	01.86	00.76	03.66	00.10	-01.98	-08.20	-00.69	-03.66
50.00	04.39	04.54	06.22	03.89	00.77	-04.61	01.71	-00.65
55.00	03.87	04.89	05.57	04.58	00.12	-03.81	02.76	00.71
60.00	02.03	03.06	04.03	02.61	-01.56	-05.65	01.47	-00.55
65.00	01.15	01.36	02.82	00.92	-02.61	-07.71	00.57	-02.10
AVE	**6.88**	**5.26**	**8.17**	**3.91**	**2.75**	**-4.29**	**5.55**	**0.83**
MAX	22.18	15.74	21.61	13.30	17.44	05.46	20.72	10.86
MIN	-00.26	-00.94	00.96	-01.99	-04.29	-10.16	-00.72	-04.27

All data in Parts per Million

OVERALL

	UNITY	60' LAG
AVERAGE	05.84	01.43
MAXIMUM	22.18	15.74
MINIMUM	-04.29	-10.16

All data in Parts per Million

Example

(7.1ppm=0.00071% error)