Technical

Final Report
F-B2303-9

Report

RF EVALUATION OF THE SINGLE BRIDGEWIRE APOLLO STANDARD INITIATOR

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by

Paul F. Mohrbach
Raymond R. Raksnis

August, 1967

Prepared for

NASA Spacecraft Center
Houston, Texas

Contract No. NAS9-3787 Task 9.



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Final Report F-B2303-9
"RF Evaluation of the Single Bridgewire Apollo Standard Initiator"
Paul F. Mohrbach, and Raymond R. Raksnis
The Franklin Institute Research Laboratories
August 1967
for NASA Spacecraft Center

J. R. Feldmeier
Director of Laboratories

ABSTRACT

One Hundred and eighty-five (185) Single Bridgewire Apollo Standard Initiators (SBASI) were subjected to RF energy in the frequency interval of 10 to 9000 MHz (CW and Pulsed) in both the pin-to-pin and pins-to-case modes. The data show that at 9000 MHz, with pulsed power, about 100 milliwatts could fire 50% of the EEDs in either mode. Compared to the 4 pin ASI model (SOI-266-6) which was tested during May of 1965 (FIRL Report F-B2303-1) the single bridge EED is more sensitive at 9000 MHz, pulsed, by a factor of approximately 2.5 to 1. The SOI-266-6 is most sensitive in the bridgewire-to-bridgewire mode but initiations occur by a high voltage "arc" through the explosive charge in all three modes (i.e. pins-to-case, bridge-to-bridge or thru a bridge).

No significant effect on such parameters as insulation resistance and pins-to-case capacitance was detected after exposure to RF, if the SBASI was a non-fire. However, 15 of 88 fired devices showed very low final pins-to-case insulation resistance.

ACKNOWLEDGEMENTS

This report was prepared by the Applied Physics Laboratory, E. E. Hannum, Manager. Major contributors other than the authors were A. W. Cipkins and K. S. Fertner, Technical Associates. Inquiries pertaining to this contract should be directed to the sponsoring agency or to Mr. E. E. Hannum, Manager, Applied Physics Laboratory, The Franklin Institute Research Laboratories.

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1. INTRODUCTION

The purpose of Task 9 is to determine the RF susceptibility of the SBASI (Single Bridgewire Apollo Standard Initiator) in the frequency range of 10 to 9000 MHz both with CW and pulsed power.

Originally, we were scheduled to test 200 new units. We received 189 on the first shipment and preliminary dc tests showed that 15 of these were rejected mainly because of low pins-to-case resistance at 500 Vdc. A follow-up shipment of 13 were received of which 2 were rejected, so the total of qualified units upon which this report is based is 185. The 17 rejected units were mailed to NASA, Houston on 7/17/1967. The remaining 185 units were randomed sampled and grouped as follows:

Group	No.	To Be Used for
A	50	Pin-to-Pin Probing
B	50	Pins-to-Case Probing
C	43	Bruceton Pin-to-Pin Mode
D	42	Bruceton Pins-to-Case Mode

The results of tests with this EED are to be compared with previous results of a four pin ASI (SOI-266-6) which was tested by us in May of 1965 and reported in F-B2303-1 (Contract No. NAS9-3787 Tasks 1 and 2).

2. PARAMETER MEASUREMENTS ON THE SBASI BEFORE AND AFTER RF EXPOSURE

Several tests were conducted before and after exposure to RF. These were: visual inspection, bridgewire resistance, 500 Vdc insulation resistance from pins-to-case, and pins-to-case capacitance. All 202 units received the "before" RF exposure tests, but only those qualified EEDs that were exposed to RF (185) received the "after" RF exposure tests. The following sections describe these tests in detail, and Appendix B contains the test results.

2.1 VISUAL INSPECTION

The main NASA part number for the SBASI is SEB26100001 followed by a 3 digit number and a three lettered lot number designation and a 3 digit serial number. As the units were removed from their cartons the lot number and serial number were recorded. Later an FIRL number was assigned to the 185 qualified units as they were random sampled. Visual inspection with all EEDs checked "OK" but it was noticed that the Bendix connector of the EEDs were crimped at various places, we assume, to control their deployment. Since these would not fit directly on a female Bendix connector, we had to remove all keys except the master on our firing mount.

2.2 BRIDGEWIRE RESISTANCE

The pin-to-pin resistance of all EEDs (202) were measured with a Keithley Model 502 millimeter. All bridgewires were initially found intact and ranged between 0.85 to 1.16 ohms. Resistance measurements of non-fires after RF exposure showed that a few were about 50% higher, the rest were essentially the same as before. Of 88 fired items 15 bridgewires remained the same as the control values; the rest were open.

2.3 INSULATION RESISTANCE

An insulation resistance test is made by applying 500 Vdc (low current) between the shorted input pins and case of the device, holding the voltage for 60 seconds.

A General Radio Model 1862-B Megohmmeter was used. The highest finite division on this instrument is 2 x 10^6 megohms. If the reading was higher than this it was noted as "infinity". It was during these initial insulation tests on the 202 units that the 17 rejects were found. As shown in Appendix B, most of these were short circuited indicating some type of undesirable conducting path from pins-to-case. The qualifying units ranged initially from 70K to infinite. After RF exposure, readings on the non-fires showed some slight changes, but not considered significant. Of 88 fired items, 15 were essentially short circuited in the pins-to-case mode. This could be a source of battery drain if power supplies are left connected after the EED serves its intended function.

2.4 PINS-TO-CASE CAPACITANCE

The capacitance from shorted input pins to the case of the SBASI was initially measured on all 202 units using a Tektronix Model 130 LC meter. This instrument measures the capacitance at 150 KHz. Initial values ranged between 4.2 and 10.6 picafarads. Final values on non-fires and fired units showed some that increased and others that decreased in capacitance with a larger number remaining essentially the same. A change in capacitance could occur from a change in the dielectric medium (explosive) caused by heat. The changes do not appear to be significant.

3. RF TESTS

In all our RF tests, an initial system calibration is conducted with the EED terminating a given firing system in the appropriate mode. This is necessary in order to correct for transmission line losses between generator and load, so that the EED is evaluated on the basis of real power arriving at the input pins or base of the test item. Different hardware is employed at different frequencies, but the method is essentially the same for each system. Briefly a test proceeds as follows:

(1) Calibrate at low powers with load and generator "matched" to transmission line. Calculate a system efficiency factor.

(2) Conduct test at desired power to EED by employing efficiency factor determined in (1).

(3) Record power to EED and functioning time. Functioning time is the time interval between "start" of firing pulse, and detection of current output as the EED fires.

RF tests on group A and B devices were conducted in accordance with Exhibit A, Statement of work, Task order 9 (reproduced as Appendix A) at the requested frequencies. The tests with groups A and B devices were 10 item probing tests with the stipulation that the initial power level be 0.1 watt. All power levels were held for a five minute time period . If no fires occurred with 2 items at 0.1 watt the power was increased on the next two in an effort to obtain some fires and non-fires from which an approximate 50% level could be determined. The results of these tests are shown in Table 3-1 for pin-to-pin tests, and Table 3-2 for pins-to-case tests.

With both modes, it was found that an RF signal at 9000 MHz, pulsed, (1.5 microsecond pulse width and 1000 repetition rate) would fire the EEDs with the lowest average power. This was the most sensitivity frequency observed with the 4 pin ASI, but the SBAS1 appears more sen-

sitive by a factor of about 2.5 to 1. The group C and D units were then expended in two Bruceton, one in each mode. The results of all Bruceton tests with both the SBASI and the SOI-266-6 are shown on Table 3-3.

After the above required tests were conducted, a few salvaged units were tested in the pins-to-case mode at 1.5 MHz with CW power (RF-1749). If an EED is voltage sensitive, initiation will occur at low frequency in this mode. A study of the data, however, shows that the EED was not fired with powers and voltage as high as 5 watts and 800 RF volts*, but the load impedance changed (decreased). This was not permanent but returned to its initial high resistance after voltage was removed, and no change was noted when a final 500 Vdc insulation measurement was conducted. With the 4 Pin ASI, a Bruceton in the bridgewire-to-bridgewire mode showed that about 1.0 watt could fire the EEd at 1.5 MHz.

* This is an RMS voltage measured across a 50 ohm coaxial line about 10 cm from load with an HP 411A voltmeter. Since the wavelength at this frequency is quite large (200 meters) the measured voltages are close to the actual voltages across the EED.

TABLE 3-1

Results of Pin-to-Pin Probing Tests (Group A Units)

Test No.	Freq. (MHz)	Power Mode	Power To EED (Watts)	No. of Non-Fires	No. of Fires
-1736	10	CW	0.10	2	0
			3.0	1	0
			4.0	1	0
			4.5	1	1
			5.0	1	1
			6.0	0	1
			7.0	0	1
				Mean about 4.5-5.0 Watts	
-1737	243	CW	0.10	2	0
			5.0	1	0
			8.0	3	0
			9.0	0	1
			10.0	1	1
			15.0	0	1
				Mean about 9-10 watts	
-1738	950	CW	0.10	2	0
			3.0	1	0
			5.0	1	0
			6.0	2	1
			7.0	0	1
			8.0	0	1
			10.0	0	1
				Mean about 6-7 watts	
-1739	2700	Pulsed	0.10	3	0
			0.20	2	1
			0.30	0	2
			0.50	0	1
				Mean about 0.2-0.3 watts	
-1740*	9000	Pulsed	0.10	4	0
			.125	0	2
			.150	0	3
			.20	0	1
			.30	0	1
				Mean about .12 watts	

* Judged most sensitive in Pin-to-Pin

TABLE 3-2

Results of Pins-to-Case Probing Tests (Group B Units)

Test No.	Freq. (MHz)	Power Mode	Power To EED (Watts)	No. of Non-Fires	No. of Fires
-1741	10.0	CW	0.10	2	0
			.50	1	0
			.75	3	0
			1.0	0	2
			2.0	0	1
			4.0	0	1
				Mean about .75-1.0 watts	
-1742	243	CW	0.10	2	0
			0.50	1	1
			0.75	0	2
			1.0	0	1
			1.5	0	1
			2.0	0	1
				Mean about .50 watts	
-1743	950	CW	0.10	2	0
			2.0	3	0
			2.25	1	2
			2.50	0	1
			5.0	0	1
				Mean about 2.0-2.25 watts	
-1744	2700	Pulsed	0.10	2	0
			.125	0	1
			.20	2	2
			.25	2	0
			.30	0	1
				Mean about .20 watts	
-1745*	9000	Pulsed	.080	3	0
			.085	2	1
			.090	0	2
			0.10	0	2
				Mean about .085-.090 watts	
-1749	1.5	CW	.75	1	0
			1.0	1	0
			3.8	1	0
			5.0	1	0

*Judged most sensitive in Pins-to-Case Mode

TABLE 3-3

Results of Bruceton Tests

Test NO.	Freq	Mode	(2 Pin & 4 Pin ASI) STD DEV	No. Fired	No. Non Fired	Firing Prob. (Milli-Watts) 0.1*	50	99.9*	Functioning Times (Sec) Low	Avg.	High
1746	9000 Pulsed	Pin-to-Pin	.094	21	21	35.3	107.4	3267	.07	65.8	266
1747	9000 Pulsed	Pins-to-Case	.160	21	21	11.0	86.9	686.4	871	96.8	281
1136**	9000 Pulsed	Pin-to-Pin	.113	21	19	92.1	3710	1495.	244	35.7	107
1148**	9000 Pulsed	Bridge wire-to-Bridge wire	.085	21	19	89.1	2413	6533	.26	71.5	279
1149**	10CW	Pins-to-Case	.107	22	19	2999	10946	39958	.10	97.4	298

*With 95% confidence

**Data previously taken on the 4 Pin ASI (SOI-266-6)

4. INPUT IMPEDANCE

During the past several years, we have included in our evaluation studies the stipulation that all incoming hardware (EEDs) be measured to determine their input impedance at select points covering the frequency interval of 1-1300 MHz. All possible terminating modes (pin-to-pin, pins-to-case, and bridgewire-to-bridgewire) are included, and the data is referenced as close to the base of the EED as possible.*

In all cases, our measuring equipment yields impedance values expressed as a series equivalent, $R \pm jX$, at the reference section. The following equipment is used in the indicated frequency ranges:

Pin-to-Pin	Frequency Range (MHz)	Pins-to-Case or Bridgewire-to-Bridgewire
General Radio Model 916A Bridge	1-10	General Radio Twin T Bridge
General Radio Model 1607A Immittance Bridge	100-1300	Same as Pin-to-Pin

To help in analyzing the data, we plot the R and X terms on a 50Ω Smith Chart**. Although the chart is usually employed to show the impedance transformations along a uniform loss less transmission line at one fixed frequency, we consider the EED as terminating a fixed piece of transmission line and look at the input impedance of this line as the frequency

*Since we employ 50 ohm transmission lines of standard size, it it impossible to terminate an EED to this line and still maintain uniform cross section up to the base of the EED. Some small transitional section will exist, which serves to connect the pins and case of the EED to the line. Since this region is unpredictable, we have chosen our line reference at the point of divergence from a 50Ω section. At low frequencies, the effect of doing this does not significantly alter the measured impedance value. However, at high frequencies an "impedance shift" is included in the measurements which could be significant.

**For a complete description of this chart consult: *Transmission Line Calculator*, by P. H. Smith, Electronics, Jan. 1944.

is varied. The impedance data also gives a measure of the reflection coefficient (magnitude and phase angle) of the load as the frequency is varied.

Our experience with these measurements has led to the following general statements:

A. With Respect to Pin-to-Pin

1. If the magnitude of the reflection coefficient (rho) remains *constant or nearly so with only a phase angle variation with frequency*, the EED's sensitivity to CW power will be constant in this frequency interval. This statement assumes that the RF power will simply heat the bridgewire, and no skin effect or loss by radiation will occur. These later statements seem to be true for normal bridgewire elements up to about 1000 MHz. In analyzing the data, a slight shift in the phase angle could be caused by a change in zero reference, but does not alter the character of the measurements as long as rho is constant.

2. If the "impedance profile" indicates an "inward spiral" (rho decreasing), it is likely that additional losses (other than the bridgewire) are present which will *decrease the sensitivity of the item*. The rate of "inward spiral" will reflect how much the sensitivity is decreasing with frequency. Normally the variation of rho in the frequency interval of 1 to 1300 MHz is so small that for all practical purposes the sensitivity of the EED is constant. This conjecture has been shown to be quite true on the basis of test results of many hot bridgewire devices in this frequency interval.

B. With Respect to Pins-to-Case

1. Usually the reflection coefficient of pins-to-case data is very close to 1.0 at the low frequencies, and decreases very slightly up to 1300 MHz. With respect to firing sensitivity, we have found that if the EED is voltage sensitive, it will fire with the *least power*, at low frequency (1.5 MHz). This usually corresponds to the point of *minimum conductance** (G) as determined from direct measurement.

*The absolute minimum G occurs at 0 frequency (dc); here, G is equal to the reciprocal of the insulation resistance.

The input impedance in the frequency range of 1 to 1300 MHz was determined for the SBASI in both modes. Measurements were also made on the 4 pin ASI (SOI-266-6) for comparison. The data are presented on Tables 4-1 thru 4-3, and plotted on Figures 4-1 to 4-3.

5. SUMMARY AND CONCLUSIONS

RF testing of the SBASI has indicated that it is vulnerable to pulsed power if the high voltages can cause an "arc" to occur through the explosive mix from pins-to-case. Test data placed the 50% fire level at about 100 milliwatts (66.7 watts peak) in either mode at a frequency of 9000 MHz pulsed. Compared to the 4 pin ASI (SOI-266-6) this is more sensitive by a factor of 2.5 to 1. Firings with pulsed power are not, on the average, instantaneous but take about 1 minute. At low frequencies, in the pins-to-case mode, voltages approaching 800 RMS volts cause a breakdown without initiation. This breakdown causes a considerable decrease in pins-to-case impedance but is not permanent and after removal of power, the pins-to-case impedance returns to initial values.

No apparent sensitivity to CW power exists in either mode in the frequency range examined.

Input impedance of the SBASI is typical of 1 amp 1 watt EEDS and is comparable to the 4 pin version previously tested, except that in the pins-to-case mode, the SBASI remains slightly lower in reflection coefficient throughout the entire frequency range. This would tend to suggest that for a fixed RF power, a lower voltage would appear across the SBASI than the SOI-266-6. Considering pin-to-pin there is slight evidence to indicate that the 4 pin ASI affords more protection than the SBASI to high CW frequencies. Both should have similar low frequency sensitivities.

TABLE 4-1

Pin-to-Pin Input Impedance
(Avg. of 3 Readings)

Frequency (MHz)	SBASI (R±jx)	ρ_{50}	SOI-266-6 R±jx	ρ_{50}
1.			1.25 + j0	.951
1.5	1.1 + j0	.957	----------	
3	1.12 + j.67	.956	1.14 + j.33	.955
10	1.14 + j1.35	.955	1.3 + j.65	.949
100	1.97 + j15.3	.930	1.8 + j.70	.932
250	3.4 + j40.	.920	2.65 + j17.0	.909
500	13 + j77.	.859	8.03 + j46.0	.841
900	34 - j83	.716	280 + j68.0	.712
1300	9.4 + j12	.699	6.9 - j298	.992

$$\rho_{50} = + \left[\frac{(R-50)^2 + x^2}{(R+50)^2 + x^2}\right]^{\frac{1}{2}}$$

TABLE 4-2

Pins-to-Case Input Impedance
(Avg. of 3 Readings)

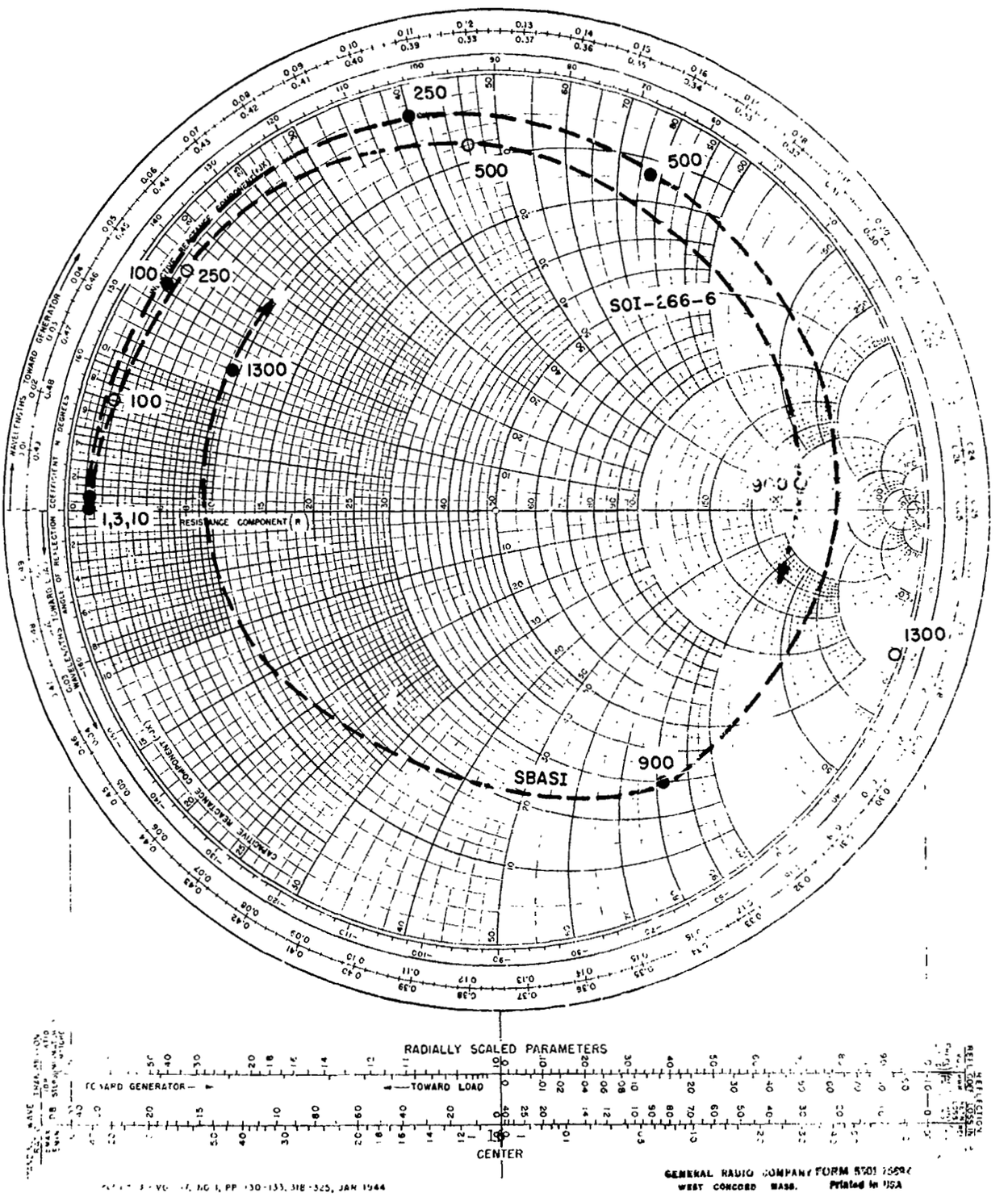
Frequency (MHz)	SBASI		SOI-266-6	
	R±jx	ρ_{50}	R±jx	ρ_{50}
1.	----------	----	228 - j10,225	.999
1.5	727 - j11,100	.999	-------	-----
3	357 - j5.30	.999	31.3 - j3120	.999
10	160 - j1760	.995	13.2 - j1009.	.998
100	16. - j112	.900	4.2 - j134.	.980
250	7.25 - j69.	.905	1.53 - j50.	.970
500	3.17 - j21.5	.898	.75 - j20.	.974
900	2.82 + j17.3	.904	.73 + j2.5	.971
1300	9.0 + j75.2	.896	3.25 + j34.	.915

TABLE 4-3
Bridgewire-to-Bridgewire Input Impedance
(Avg. of 3 Readings)

Frequency (MHz)	SOI-266-6	
	R±jx	ρ_{50}
1	303 - j12,940	.999
3	19.4 - j4190	.999
10	6.4 - j1344	.999
100	7.75 - j197	.981
250	2.15 - j73.5	.973
500	.82 - j29.	.976
900	4.55 + j12.5	.842
1300	4.7 + j516	.998

TITLE *FIG. 4-1 INPUT IMPEDANCE, SBASI AND SOI-266-6 (Pin-to-Pin Mode)* DATE

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE



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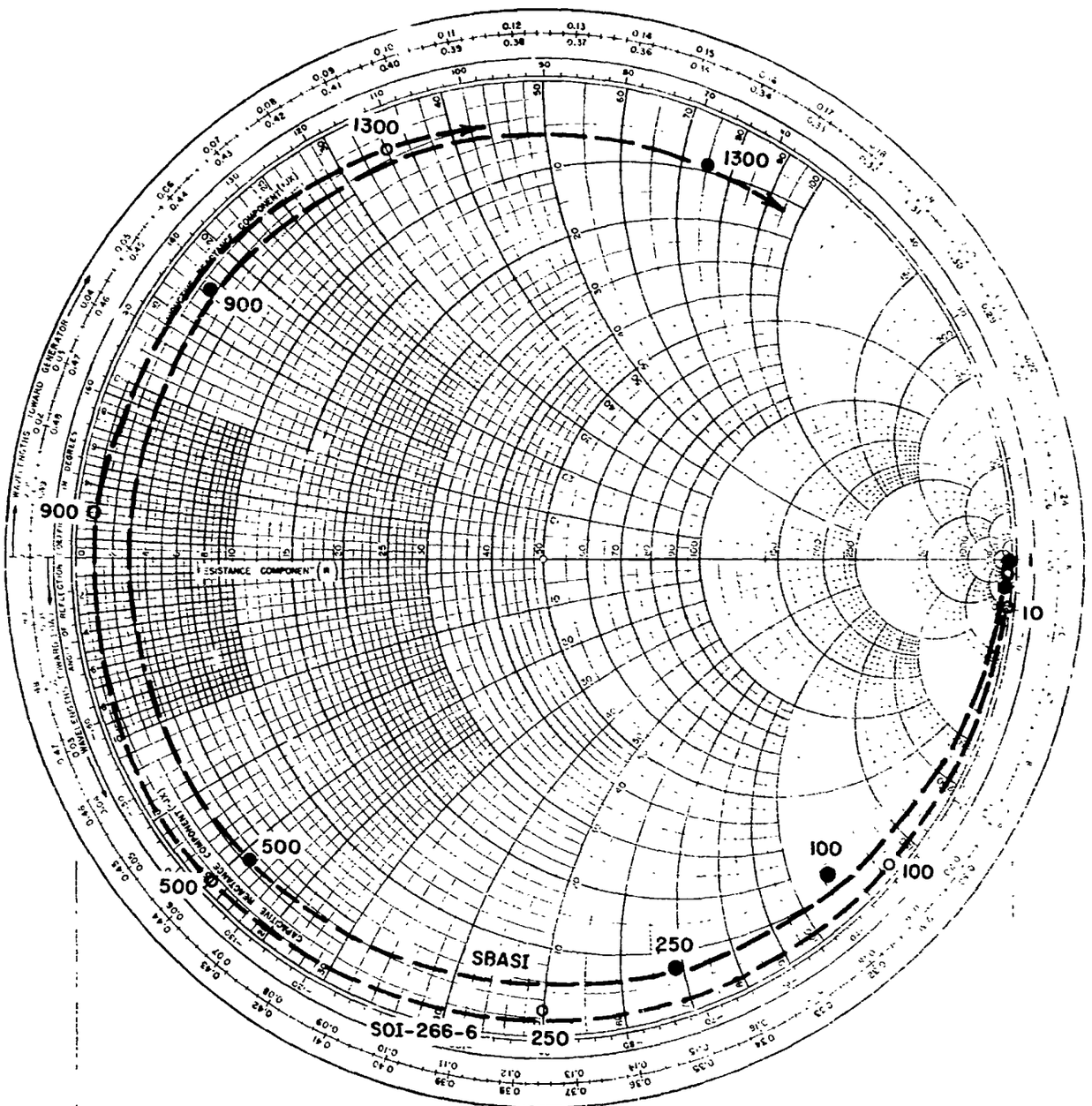
TITLE *FIG. 4-2 INPUT IMPEDANCE SBASI AND SOI-266-6 (Pins-to-Case Mode)* DATE

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

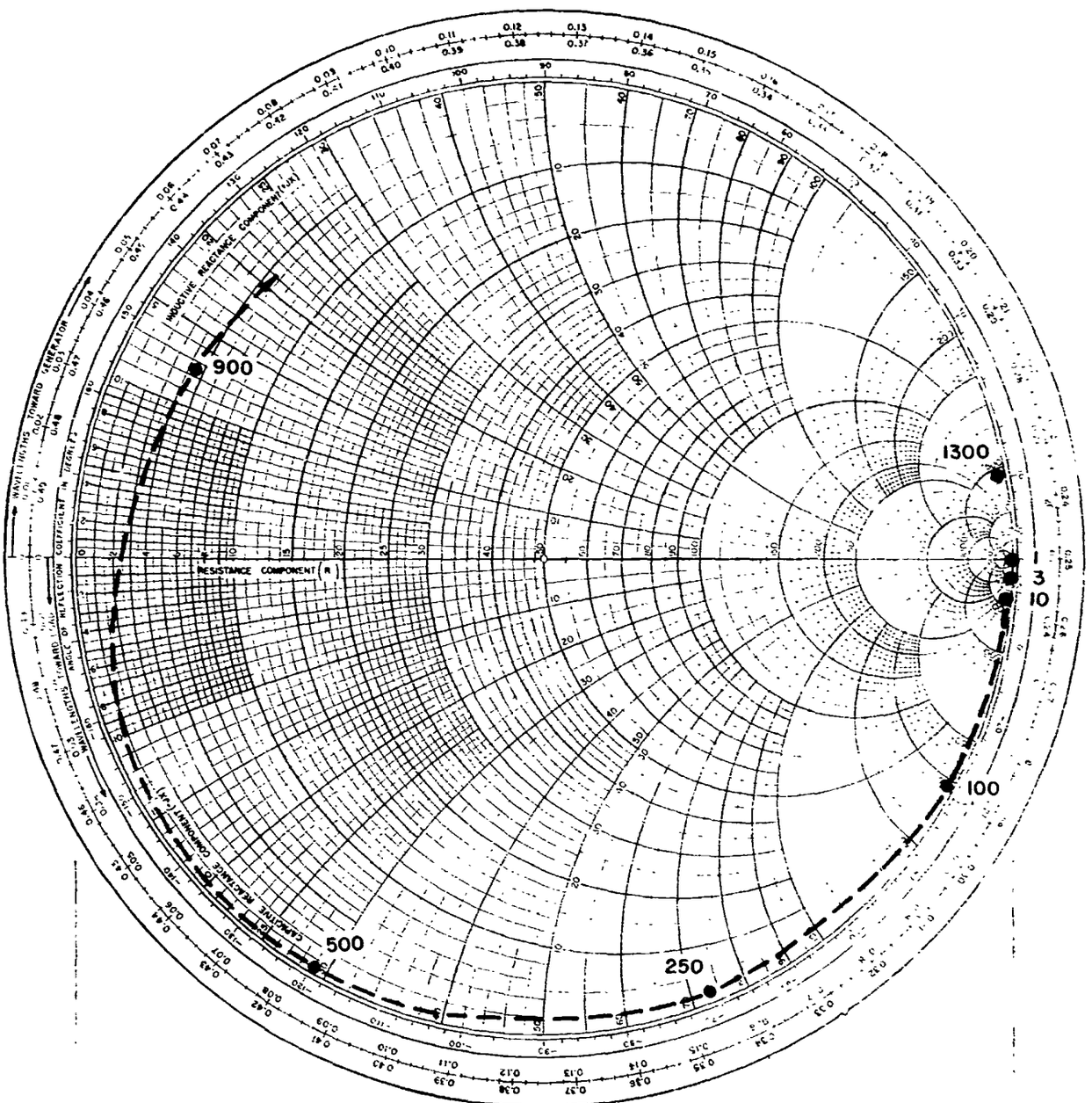


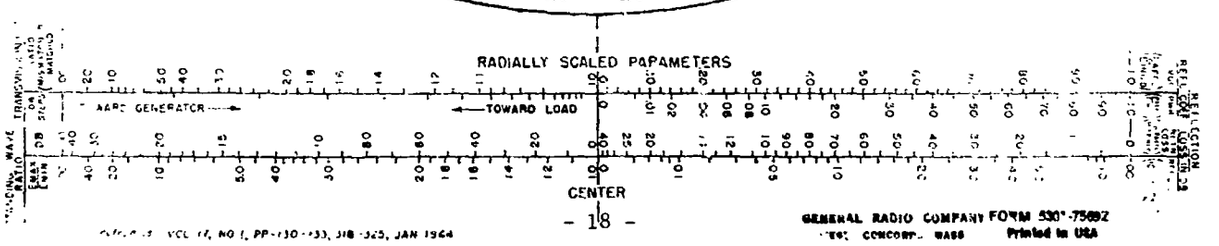
VOL 17, NO 1, PP 130 133, 318 325, JAN 1944
GENERAL RADIO COMPANY FORM 9303 /5692
WEST CONCORD MASS. Printed in USA

TITLE *FIG. 4-3 INPUT IMPEDANCE SOI-266-6*
(Bridgewire-to-Bridgewire Mode)

DATE

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE





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APPENDIX A

STATEMENT OF WORK

Exhibit "A"

STATEMENT OF WORK

Task Order No. 9 - Contract NAS 9-3787

SCOPE

The purpose of this task is to evaluate the performance characteristics of the Single Bridgewire Apollo Standard Initiator (SBASI) after exposure to a number of frequencies at fixed levels of radio-frequency (rf) energy. Information concerning its susceptibility to direct current is presently available; however, no tests have been performed to determine the rf susceptibility of the Single Bridge ASI.

Since only 200 units are available for these tests, the program will be limited to one which will probe for possible trouble areas rather than yield detailed quantitative data in a limited area.

GENERAL REQUIREMENTS

Visual inspection and checkout measurements such as electrical bridgewire resistance, insulation resistance, etc., will be taken and recorded on each unit prior to any actual tests to be conducted and, when appropriate, after each phase of rf testing. The actual rf tests will be conducted in three phases. The first will consits of probing test in the pin-to-pin mode on 50 of the units. All parameters concerning the functional characteristics of each unit will be monitored and recorded as well as functional and operational data, when required.

The second phase will be a repeat of the tests conducted on the first group using another group of 50 units in the pins-to-case mode.

Two groups of 50 each will be utilized in the third phase which will consist of Bruceton analyses based on results of Phases I and II.

DETAILED REQUIREMENTS

The suggested procedure which is to be followed is outlined below:

a. Randomly separate the units into four groups of 50 each. These groups will be identified as test groups "A" through "D".

b. Information concerning inspection and electrical measurements of each group will be recorded on data sheets similar to the one attached. Data to be recorded will include, but not necessarily be limited to, the data requested on the sample sheet provided. The following tests will be conducted on each unit prior to any rf testing, and when appropriate upon the completion of each test.

(1) Visual Inspection - Each initiator shall be visually inspected for burrs, bent pins, foreign matter or any apparent defect. Any abnormalities, whether considered to be a defect or not, shall be recorded.

(2) Bridgewire Resistance - The resistance of the bridgewire circuit (AB) shall be measured and recorded using either an Alinco Circuit tester or a cubic digital ohmmeter (the cubic digital ohmmeter is preferred, if available).

(3) Insulation Resistance - Using a megohmeter, the resistance between the shorted intitiator pins and the body of the inititator shall be measured for each initiator by applying 500 VDC for 60 $\pm$ 5 seconds.

(4) Pins to Case Capacitance - The capacitance between both pins shorted together and the case shall be measured and recorded.

c. After the tests described in paragraph (b) have been completed on all units and the data recorded, a probing type rf test shall be conducted on group "A". For this group, rf energy shall be applied through the bridgewire (pin-to-pin mode) for a maximum of five minutes. Specifically, the tests shall be conducted under the following conditions:

Approximate Frequency (MC)	Pulse Condition	No. of Items
10	cw	Two each at the
243	cw	five different
1000	cw	power levels,
3000	Pulsed	beginning at .1 watt
9000	Pulsed	(total of 10 units Per frequency)

The data from this test, along with any other pertinent firing data, such as functioning time and firing pulse duration and current applied shall be systematically recorded. Based on the information collected, a curve will be plotted from the most susceptible frequency and power level in the pin-to-pin firing mode will be obtained.

d. The tests outlined in paragraph (c) will be repeated for group "B" in the pins-to-case mode.

e. A Bruceton analysis will be conducted in the pin-to-pin firing mode on test group "C." This will be based on the "most susceptible" frequency obtained from the data plotted on test group "A".

f. A Bruceton analysis will be conducted on group "D" in the pins-to-case mode using the "most susceptible" frequency data obtained from test group "B".

g. Post-firing examination and measurements identical to those outlined in paragraph (b), 1 through 6, will be outlined in the preceding paragaphs. The information will be recorded on a data sheet similar to the sample data sheet attached.

h. The units will be retained at the Franklin Institute until advised by NASA as to their disposition.

i. A detailed test report which documents the results of all tests, including equipment and procedures used, any other pertinent data including recommendations, and conclusions will be written upon the completion of the programs.

APPENDIX B

PRE-FIRING TEST DATA SHEETS

PRE-FIRING DATA SHEET

TEST GROUP: A (50)

DATE: _____

FIL #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION MEG RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
1	45 MAA	OK	OK	1.1	1.1			∞	∞			5.7	8.5					
2	147 MAJ	OK	OK	.85	1.7			∞	∞			8.5	7.5					
3	381 MAG	OK	OK	.98	1.17			∞	∞			9.2	5.5					
4	269 VAA	OK	OK	1.07	1.1			.11	10M			7.7	9.2					
5	298 MAL	OK	XX	1.02	∞			∞	S.C.			6.5	6.0					
6	306 VAC	OK	XX	1.0	∞			∞	5M			6.2	6.0					
7	250 VAC	OK	XX	1.05	1.25			5M	30M			6.1	6.0					
8	171 MAA	OK	OK	1.0	1.55			∞	5M			6.0	6.0					
9	145 NAC	OK	OK	1.01	1.0			∞	2M			9.1	9.8					
10	226 VAC	OK	OK	1.06	1.05			2M	10M			5.6	5.2					

PRE-FIRING DATA SHEET

TEST GROUP: A

DATE: _____

FIL #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)		REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
11	269 VAC	OK	OK	1.02	1.0			∞	∞			8.7	9.2			
12	150 MAE	OK	OK	1.04	1.04			20M	20M			8.6	8.1			
13	149 MAD	OK	OK	1.11				1M	20M			7.65				
14	535 MAJ	OK	OK	.91	.92			∞	∞			7.5	10.5			
15	384 MAR	OK	XX	.98	1.15			600	2M			9.3	4.5			
16	187 VAC	OK	OK	1.05	1.05			∞	∞			8.3	9.8			
17	278 VAC	OK	OK	1.05	1.05			∞	∞			7.5	10.0			
18	271 MAK	OK	XX	.95	∞			∞	100M			7.1	5.0			
19	50 MAA	OK	XX	1.06	∞			∞	S.C.			7.8	4.5			
20	153 VAC	OK	XX	1.02	1.0			∞	2M			7.8	7.3			

PRE-FIRING DATA SHEET

TEST GROUP: A

DATE: _____

Fil #	INITIATOR SERIAL No.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS)		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	A-B BEFORE	A-B AFTER	C-D BEFORE	C-D AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
21	289 VAC	OK	OK	1.07	1.1			∞	∞			8.3	5.8			
22	268 VAA	OK	XX	1.07	∞			∞	50M			7.5	4.5			
23	54 MAA	OK	XX	1.05	∞			∞	40M			6.9	5.0			
24	281 VAC	OK	OK	1.03	1.07			∞	20M			8.6	6.7			
25	155 VAC	OK	OK	1.0	1.0			∞	∞			8.4	9.7			
26	215 VAC	OK	XX	1.0	∞			∞	20M			.1	8.0			
27	327 VAC	OK	XX	1.06	1.15			∞	50M			7.4	4.5			
28	241 VAC	OK	XX	1.07	∞			∞	S.C.			5.9	5.0			
29	346 MAE	OK	OK	1.08	1.18			∞	20M			8.1	8.0			
30	303 VAA	OK	XX	1.0	∞			2.5M	100M			8.2	5.5			

PRE-FIRING DATA SHEET

TEST GROUP: A

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
31	239 MAP	OK	XX	1.08	∞			20M	50M			8.8	4.0					
32	275 VAA	OK	XX	1.05	∞			∞	30M			8.0	5.0					
33	175 VAC	OK	OK	1.02	1.03			∞	2M			9.5	10.5					
34	211 VAC	OK	OK	1.08	1.1			∞	∞			8.6	7.0					
35	262 VAC	OK	OK	1.0	1.0			∞	∞			8.7	9.2					
36	283 VAC	OK	OK	1.0	1.0			∞	∞			7.2	10.0					
37	367 MAC	OK	XX	1.13	∞			∞	40M			8.5	5.0					
38	11 MAR	OK	XX	1.02	∞			∞	30M			7.8	5.0					
39	25 MAA	OK	OK	1.03	1.03			∞	∞			5.6	7.8					
40	213 MAB	OK	OK	1.04	1.04			70K	.2M			8.5	8.8					

PRE-FIRING DATA SHEET

TEST GROUP: A

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS)		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	A-B BEFORE	A-B AFTER	C-D BEFORE	C-D AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
41	217 VAC	OK	OK	1.04	1.05			∞	∞			7.5	7.4			
42	248 VAB	OK	XX	1.0	1.20			∞	3M			8.8	4.5			
43	307 VAC	OK	XX	1.04	∞			∞	20M			7.3	6.0			
44	297 VAA	OK	XX	1.05	∞			∞	S.C			4.8	8.0			
45	145 MAD	OK	XX	1.05	1.10			∞	50M			9.0	4.0			
46	87 MAN	OK	OK	1.0	1.06			∞	∞			7.8	6.3			
47	354 MAK	OK	XX	.93	∞			∞	1M			8.0	5.0			
48	300 MAG	OK	XX	1.05	∞			2M	3M			9.7	4.0			
49	379 MAG	OK	OK	1.1	1.06			1M	1M			10.5	10.0			
50	56 MAA	OK	XX	1.05	∞			∞	30M			7.3	4.5			

PRE-FIRING DATA SHEET

TEST GROUP: B (50)

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS)		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPAC. TANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	A-B BEFORE	A-B AFTER	C-D BEFORE	C-D AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
51	149 VAC	O.	XX	1.04	∞			∞	50M			6.3	9.5			
52	216 VAC	OK	XX	1.01	1.05			∞	20M			8.6	5.0			
53	201 VAC	OK	XX	1.05	∞			∞	S.C.			8.4	8.5			
54	511 MAJ	OK	XX	1.08	∞			∞	4M			6.5	5.5			
55																
56	160 VAC	OK	OK	1.06	1.06			20M	20M			9.1	9.6			
57	121 MAA	OK	OK	1.07	1.1			∞	∞			8.0	8.0			
58	177 VAC	OK	XX	1.01	∞			∞	2M			9.4	5.5			
59	154 VAC	OK	OK	1.07	1			∞	∞			7.3	10.0			
60	172 VAC	OK	OK	1.05	1.05			∞	10			9.4	8.0			

PRE-FIRING DATA SHEET

TEST GROUP: B

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
61	390 MAB	OK	OK	1.1	1.14			∞	∞			9.0	9.3					
62	253 VAC	OK	XX	1.05	∞			.5M	.5M			8.0	6.5					
63	162 VAC	OK	XX	1.03	∞			∞	S.C.			7.2	4.5					
64	256 MAG	OK	OK	1.1	1.1			∞	∞			10.5	11.0					
65	275 VAC	OK	OK	1.05	1.05			∞	∞			9.3	8.5					
66	70 MAK	OK	XX	.91	00			25M	5M			7.5	6.0					
67	208 VAC	OK	XX	1.06	00			∞	S.C.			8.0	6.0					
68	193 MAN	OK	OK	.95	.95			∞	∞			9.0	9.8					
69	288 VAC	OK	OK	1.07	1.05			1M	∞			8.3	10.0					
70	303 VAC	OK	XX	1.05	00			∞	20M			9.1	5.5					

PRE-FIRING DATA SHEET

TEST GROUP: B

DATE: _____

F11 #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		INSULATION RESISTANCE (OHMS) C-D		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
71	149 MAF	OK	XX	1.1	1.35			2M	20M			6.8	4.0			
72	39 MAE	OK	OK	1.07	1.07			∞	20M			6.3	5.5			
73	390 MAG	OK	XX	1.04	1.15			∞	200M			8.3	4.5			
74	324 VAC	OK	XX	1.05	∞			∞	20M			8.8	6.0			
75	274 VAA	OK	OK	1.01	1.0			∞	∞			7.5	7.8			
76	235 VAC	OK	XX		∞			∞	S.C.			6.5	6.0			
77	298 VAC	OK	OK	1.04	1.05			20M	20M			9.0	10.5			
78	305 VAA	OK	XX	1.14	∞			.3M	10M			8.8	6.0			
79	228 VAC	OK	XX	1.05	∞			.5M	50M			6.6	4.5			
80	166 VAC	OK	OK	1.04	1.05			∞	∞			6.8	9.2			

PRE-FIRING DATA SHEET

TEST GROUP: B

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B				INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (MMF)		PINS TO CASE CAPACITANCE (MMF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
81	175 MAF	OK	OK	1.02	1.04			∞	∞			9.0	10.0					
82	246 VAC	OK	OK	1.09	1.07			∞	∞			8.6	7.2					
83	310 VAC	OK	OK	1.05	1.05			∞	∞			7.3	6.5					
84	374 MAF	OK	OK	1.13	1.15			∞	∞			8.7	9.5					
85	298 VAA	OK	XX	1.09	1.25			∞	10M			8.0	7.0					
86	277 VAA	OK	XX	.98	∞			∞	1M			7.1	9.5					
87	286 VAA	OK	OK	1.04	1.05			.15M	60K			6.3	6.0					
88	314 VAC	OK	OK	1.01	1.0			∞	∞			7.3	9.0					
89	148 VAC	OK	XX	1.13	∞			∞	S.C.			8.2	5.0					
90	76 MAA	OK	XX	1.1	∞			∞	20M			7.5	6.0					

PRE-FIRING DATA SHEET

TEST GROUP: B

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFOR	FTER			BEFORE	AFTER	BEFORE	AFTER	
91	296 VAC	OK	OK	1.06	1.0			2M	∞					8.6	7.5			
92	199 VAC	OK	OK	1.025	1.04			∞	∞					8.5	10.5			
93	369 MAL	OK	OK	1.12	1.25			∞	∞					7.0	8.0			
94	168 VAC	OK	OK	1.0	1.01			∞	∞					8.4	9.5			
95	263 VAC	OK	OK	1.02	1.0			∞	∞					7.1	9.3			
96	174 VAC	OK	XX	1.0	∞			∞	S.C.					7.8	5.0			
97	159 VAC	OK	OK	1.03	1.0			.7M	∞					8.4	8.7			
98	467 MAK	OK	XX	1.02	∞			∞	10M					5.9	6.0			
99	244 VAC	OK	XX	1.07	∞			∞	200M					8.8	8.0			
100	221 VAC	OK	OK	1.05	1.05			∞	∞					7.8	9.2			

PRE-FIRING DATA SHEET

TEST GROUP: C (43)

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
101	180 VAC	OK	XX	1.02	∞			20M	1M			8.3	6.0					
102	190 VAC	OK	OK	1.03	1.03			∞	∞			7.5	10.0					
103																		
104	280 VAC	OK	OK	1.04	1.05			∞	∞			8.7	6.4					
105	196 VAC	OK	OK	1.05	1.05			1M	∞			8.7	7.3					
106	156 MAJ	OK	XX	1.03	00			∞	2M			5.7	5.0					
107	272 MAJ	OK	OK	.92	.92			20M	∞			8.5	8.5					
108	323 MAF	OK	OK	1.08	1.04			∞	∞			7.5	6.5					
109	182 VAC	OK	OK	1.01				∞	∞			8.7						
110	175 MAN	OK	OK	1.07	1.0			20M	∞			8.7	10.0					

PRE-FIRING DATA SHEET

TEST GROUP: C

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		INSULATION RESISTANCE (OHMS) C-D		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
111	276 VAA	OK	XX	1.05	1.05			∞	20M			8.3	10.			
112	52 MAA	OK	XX	1.1	∞			∞	5M			6.7	6.0			
113	231 VAC	OK	XX	1.1	∞			∞	5M			7.3	12.			
114	273 VAA	OK	XX	1.01	∞			20M	20M			7.7	14.			
115	287 VAC	OK	XX	1.04	∞			∞	200M			8.0	4.5			
116	293 VAA	OK	XX	1.07	1.10			1M	S.C.			7.7	9.0			
117	133 VAC	OK	XX	1.05	∞			∞	20M			8.6	8.5			
118	247 MAG	OK	XX	1.05	∞			∞	50M			8.25	8.0			
119	238 VAC	OK	XX	1.08	∞			∞	S.C.			8.7	5.5			
120	444 MAN	OK	OK	1.04	1.05			∞	10M			9.5	10.5			

PRE-FIRING DATA SHEET

TEST GROUP: C

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μ μF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
121	170 VAC	OK	OK	1.02	1.03			∞	∞			8.4	8.0					
122	301 VAC	OK	OK	1.04	1.06			∞	5M			8.1	9.5					
123	29 MAK	OK	XX	1.03	∞			∞	S.C.			6.5	9.0					
124	309 VAC	OK	OK	1.03	1.03			∞	∞			8.2	6.1					
125	328 VAC	OK	OK	1.04	1.04			∞	∞			9.0	7.8					
126	218 VAB	OK	XX	.99	∞			∞	1M			9.0	5.0					
127	157 VAC	OK	XX	1.0	∞			∞	5M			9.2	5.5					
128	254 VAC	OK	XX	1.05	1.3			∞	20M			8.0	5.0					
129	71 MAF	OK	OK	1.05	1.06			∞	∞			4.2	6.5					
130	237 VAC	OK	OK	1.05	1.05			.5M	∞			6.8	9.5					

PRE-FIRING DATA SHEET

TEST GROUP: C

DATE: _____

Fil #	INITIATOR SERIAL No.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS)				INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
				A-B		C-D												
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
131	222 MAF	OK	XX	1.1	∞			∞	3M			9.4	5.5					
132	No Tag	OK	OK	1.07	1.07			∞	∞			6.1	6.0					
133	212 MAK	OK	XX	1.05	∞			20M	5M			8.5	7.0					
134	214 VAC	OK	XX	1.07	∞			20M	50M			9.2	6.5					
135	42 MAA	OK	XX	1.07	∞			∞	S.C.			7.8	6.5					
136	94 VAC	OK	OK	1.05	1.06			∞	∞			6.0	6.5					
137	345 MAC	OK	OK	1.05	1.06			∞	∞			7.4	11.0					
138	380 MAN	OK	OK	1.06	1.06			∞	∞			8.7	8.0					
139	302 VAA	OK	XX	1.02	∞			.4M	5M			9.4	7.0					
140	195 VAC	OK	OK	1.0	1.05			∞	∞			6.2	11.0					

PRE-FIRING DATA SHEET

TEST GROUP: C

DATE: _____

Fil #	INITIATOR SERIAL No.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS)		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (MMF)		PINS TO CASE CAPACITANCE (MMF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	A-B BEFORE	A-B AFTER	C-D BEFORE	C-D AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
141	259 VAC	OK	OK	1.02	1.04			20M	∞			9.2	7.2			
142	212 VAC	OK	XX	1.09	∞			∞	S.C.			8.7	6.0			
143	406 MAN	OK	OK	1.05	1.05			∞	2M			9.1	7.7			

PRE-FIRING DATA SHEET

TEST GROUP D (42)

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
144	236 VAC	OK	OK	1.07	1.14			20M	20M			8.5	8.3					
145	321 VAC	OK	OK	1.0	1.0			.4M	.4M			7.5	5.2					
146	No Tag	OK	OK	1.06	1.06			∞	∞			8.2	10.0					
147	167 VAC	OK	OK	1.04	1.05			20M	20M			8.5	6.5					
148	202 VAC	OK	XX	1.0	1.05			∞	10M			8.1	10.					
149	285 VAC	OK	XX	1.05	∞			∞	7M			6.2	11.					
150	324 MAF	OK	XX	1.01	1.10			∞	50M			10.6	11.					
151	298 MAG	OK	OK	0.92	1.07			∞	∞			9.0	9.5					
152	151 VAC	OK	XX	1.05	∞			∞	1M			9.1	14.					
153	261 VAC	OK	XX	1.03	∞			∞	5M			9.0	12.					

PRE-FIRING DATA SHEET

TEST GROUP: D

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS)		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	A-B BEFORE	A-B AFTER	C-D BEFORE	C-D AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
154	37 MAK	OK	XX	1.04	∞			∞	5M			7.1	12			
155	249 VAC	OK	OK	1.05	1.07			∞	∞			7.5	6.8			
156	[illegible]	OK	XX	1.0	∞			20M	S.C.			8.8	5.0			
157	[illegible]	OK	XX	1.06	∞			20M	5M			7.5	4.5			
158	271 VAA	OK	XX	1.04	∞			.5M	1M			8.0	6.0			
159	146 VAC	OK	OK	1.05	1.1			∞	∞			9.3	7.0			
160	318 MAM	OK	XX	.98	∞			∞	5M			7.8	8.0			
161	256 VAC	OK	XX	1.1	∞			20M	50M			8.2	11			
162	165 VAC	OK	OK	1.04	1.05			.5M	∞			8.2	6.0			
163	242 VAC	OK	XX	1.0	1.05			∞	100M			8.8	10			

PRE-FIRING DATA SHEET

TEST GROUP: D

DATE: _____

F11 #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B				INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
164	137 VAC	OK	OK	1.1	1.04			∞	∞			8.2	9.1					
165	234 VAC	OK	XX	1.06	∞			∞	5M			8.25	11					
166	185 VAC	OK	XX	1.0	1.06			.15M	2M			8.5	9					
167	291 VAA	OK	OK	1.0	1.0			∞	∞			7.6	9.0					
168	140 VAC	OK	XX	1.06	∞			∞	5M			7.0	13.					
169	220 VAC	OK	OK	1.1	1.2			∞	∞			6.5	5.4					
170	383 MAG	OK	OK	1.14	1.1			∞	∞			6.4	8.0					
171	150 MAF	OK	XX	1.1	∞			∞	20M			8.5	4.0					
172																		
173	147 VAC	OK	OK	1.1	1.1			∞	∞			7.0	8.7					

PRE-FIRING DATA SHEET

TEST GROUP: D

DATE: _____

Fli #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)				REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
174	189 VAB	OK	XX	1.06	∞			20M	30M			8.1	9.0					
175	156 VAC	OK	OK	1.05	1.05			∞	∞			7.2	9.6					
176	184 VAC	OK	OK	.99	.98			∞	∞			8.8	8.0					
177	194 VAB	OK	XX	1.04	∞			1M	5M			7.9	12.0					
178	316 VAC	OK	OK	1.04	1.05			∞	∞			7.3	8.5					
179	135 MAL	OK	XX	1.03	∞			∞	3M			5.7	6.5					
180	178 VAC	OK	OK	1.01	1.0			∞	∞			8.4	10.0					
181	295 VAC	OK	OK	1.04	1.04			∞	∞			8.8	8.1					
182	320 VAC	OK	OK	1.03	1.04			∞	∞			7.8	6.7					
183	209 MAK	OK	OK	1.16	1.15			∞	∞			8.0	10.5					

PRE-FIRING DATA SHEET

TEST GROUP: D

DATE: _____

Fil #	INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)		REMARKS
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
184	191 VAB	OK	OK	1.0	1.0			∞	∞			8.0	6.5			
185																
186	225 VAC	OK	XX	1.04	∞			∞	2M			8.5	9.5			

PRE-FIRING DATA SHEET

TEST GROUP: (17) REJECTS

DATE: _____

INITIATOR SERIAL No.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		INSULATION RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (MMF)		PINS TO CASE CAPACITANCE (MMF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)			
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	REMARKS	
233 VAC	OK		1.15				Int. Short				6.6					
139 VAC	OK		1.07				Short				9.3					
186 VAC	OK		1.05				Int. Short				9.0					
181 VAC	OK		1.0				Short				8.9					
311 VAC	OK		1.04				Short				9.2					
141 VAC	OK		1.01				Erratic				9.1					
198 VAC	OK		1.0				Shorted				9.5					
267 VAC	OK		1.03				Shorted				9.2					
179 VAC	OK		1.0				Short				9.2					
161 VAC	OK		1.0				Short				9.5					

PRE-FIRING DATA SHEET

TEST GROUP: REJECTS

DATE: _____

INITIATOR SERIAL NO.	VISUAL INSPECTION		BRIDGEWIRE RESISTANCE (OHMS) A-B		BRIDGEWIRE RESISTANCE (OHMS) C-D		IN-[illegible] RESISTANCE (OHMS)		INNER BRIDGE CAPACITANCE (μμF)		PINS TO CASE CAPACITANCE (μμF)		BRIDGE TO BRIDGE RESISTANCE (OHMS)		REMARKS
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	
279 VAC	OK		1.03				short				9.2				
442 MAG	OK		1.1				Erratic				7.5				
223 MAF	OK		1.1				Erratic				9.5				
318 VAC	OK		1.0				2				9.2				
354 MAL	OK		1.03				1.7				8.7				
69 MAD	OK		1.01				2K				8.8				
286 MAB	OK		1.05				2K				8.7				

APPENDIX C

Computer Printouts of Bruceton Results

* * * B R U C E T O N A N A L Y S I S * * *

DATA,RF=1746,P-P MODE,9000P,1.5MS,1000PPS,SBASI,5MIN,B2303-09,7/13/67

	L E V E L S										LEVEL NO.	STIMULUS (WATTS)	I	I*I	NO	NX	V A L I D I T Y T E S
	1	2	3	4	5	6	7	8	9	10							
1			X														
2		X									1	0.8230E-01	0	0	3	0	EQUALITY OF
3	O																
4		O									2	0.9234E-01	1	1	5	3	OCCURRENCE -OK
5			O														
6				O							3	0.1036E 00	2	4	6	5	
7					X												
8				O							4	0.1163E 00	3	9	7	6	NO. OF RUNS= 23
9					X												
10				X							5	0.1304E 00	4	16	0	7	
11			O														
12				O							6	0.0000E 00	5	25	0	0	LENGTH OF
13					X												
14				O							7	0.0000E 00	6	36	0	0	RUNS= 4
15					X												
16				O							8	0.0000E 00	7	49	0	0	
17					X												
18				X							9	0.0000E 00	8	64	0	0	
19			X														
20		O									10	0.0000E 00	9	81	0	0	
21			O														
22				X											NO=21	NX=21	
23				O													
24				X							LOG OF FIRST LEVEL=-1.08460 D= 0.050						
25			X														
26		O									AO= 38			AX= 59			
27			X														
28		O									BO= 92			BX= 189			
29			O														
30				O							MO= 1.10658			MX= 1.10658			
31					X												
32				X							MEANO=-0.96912			MEANX=-0.96912			
33			X														
34		X									SIGMO= 0.09425			SIGMX= 0.09425		SIGMA= 0.09425	
35	O																
36		X									S= 1.88506			G= 0.978		G*G= 0.956236	
37	O																
38		O									H= 1.708			H*H= 2.917846			
39			O														
40				O							CONFIDENCE INTERVAL= 0.19200						
41					X												
42				X							LOG OF 99.9%(95%CONF)=-0.48588					99.9%(95%CONF)= 0.3267E 00	=
											LOG OF MEAN(50%)LEVEL=-0.96912					MEAN(50%)= 0.1074E 00	=
											LOG OF 0.1%(95%CONF) =-1.45237					0.1%(95%CONF)= 0.3529E-01	=

RF - 1746 Pin-to-Pin Bruceton at 9000 MHz Pulsed

No.	Ser. No.	Lot	Functioning Times (Sec)
1	222	MAF	19.68
2	133	UAC	129.48
3	309	UAC	----
4	195	UAC	----
5	259	UAC	----
6	380	MAN	----
7	157	UAC	72.37
8	328	UAC	----
9	212	UAC	0.44
10	302	UAA	107.00
11	094	UAC	----
12	170	UAC	----
13	293	UAA	0.11
14	406	MAN	----
15	212	MAK	4.74
16	345	MAG	----
17	254	UAC	228.99
18	029	UAC	49.73
19	247	UAB	0.75
20	301	MAJ	----
21	190	VAC	----
22	218	MAJ	266.38 (High)
23	272	MAN	----
24	214	UAC	22.52
25	156	MAJ	47.76
26	175	MAN	----
27	052	MAA	0.07 (Low)
28	182	UAC	----
29	237	UAC	----
30	011	MAF	----
31	238	UAC	26.69
32	276	UAA	38.58
33	231	UAC	116.13
34	273	UAA	104.31
35	280	UAC	----
36	042	MAA	1.90
37	323	MAF	----
38	196	UAC	----
39	444	MAN	----
40	No Tag	---	----
41	180	UAC	55.45
42	287	UAC	89.36
			AVG 65.83 Seconds

* * * B R U C E T O N A N A L Y S I S * * *

DATA,RF-1747,P-C MODE,9000P,1.5MS,1000PPS,SBASI,5MIN,82303-09,7/14/67

```
     L E V E L S          LEVEL  STIMULUS                                  V A L I D I T Y  T E S
     1 2 3 4 5 6 7 8 9 10  NO.   (WATTS)     I    I*I     NO      NX
 1   O
 2     X                    1   0.6450E-01   0     0       5       0        EQUALITY OF
 3   O
 4     O                    2   0.7237E-01   1     1       1       5        OCCURRENCE -OK
 5       O
 6         O                3   0.8120E-01   2     4       5       1
 7           O
 8             X            4   0.9111E-01   3     9       7       5        NO. OF RUNS- 30
 9           O
10             X            5   0.1022E 00   4    16       3       7
11           O
12             X            6   0.1147E 00   5    25       0       3        LENGTH OF
13           X
14         X                7   0.0000E 00   6    36       0       0                RUNS-  5
15       O
16         X                8   0.0000E 00   7    49       0       0
17       O
18         O                9   0.0000E 00   8    64       0       0
19           X
20         O               10   0.0000E 00   9    81       0       0
21           X
22         O                                          NO=21  NX=21
23           X
24         O                LOG OF FIRST LEVEL=-1.19044  D= 0.050
25           X
26         X                AO=   44            AX=   65
27       O
28         O                BO=  132            BX=  241
29           X
30         O                MO= 1.89569         MX= 1.89569
31           X
32         X                MEANO=-1.06068  MEANX=-1.06068
33       O
34         X                SIGMO= 0.15975  SIGMX= 0.15975  SIGMA= 0.15975
35       X
36     X                    S= 3.19500          G= 0.945     G*G=  0.893261
37   O
38     X                    H= 2.133          H*H=  4.549684
39   O
40     X                    CONFIDENCE   INTERVAL= 0.40365
41   O
42     X                    LOG OF 99.9%(95%CONF)=-0.16341   99.9%(95%CONF)= 0.6864E 00
                            LOG OF MEAN(50%)LEVEL=-1.06068        MEAN(50%)= 0.8696E-01
                            LOG OF 0.1%(95%CONF) =-1.95795    0.1%(95%CONF)= 0.1102E-01
```

RF - 1747 Pins-to-Case Bruceton at 9000 MHz Pulsed

No.	Ser. No.	Lot	Functioning Times (Sec.)	
1	320	UAC	----	
2	225	UAC	8.71	(Low)
3	156	UAC	----	
4	191	UAB	----	
5	249	UAC	----	
6	209	MAK	----	
7	178	UAC	----	
8	150	MAF	30.59	
9	316	UAC	----	
10	189	UAB	40.46	
11	184	UAC	----	
12	194	UAB	274.14	
13	173	MAB	24.30	
14	271	UAA	235.23	
15	146	UAC	----	
16	044	MAA	95.11	
17	167	MAG	----	
18	383	UAC	----	
19	234	UAC	----	
20	295	MAM	----	
21	318	UAC	45.19	
22	137	UAC	----	
23	185	UAC	21.62	
24	147	MAL	----	
25	135	MAK	29.30	
26	037	MAG	280.92	(High)
27	298	UAC	----	
28	165	UAC	----	
29	140	UAC	72.12	
30	220	UAC	----	
31	202	MAF	55.00	
32	324	UAA	250.41	
33	291	UAC	----	
34	242	UAC	54.28	
35	151	UAC	115.41	
36	261	UAC	48.51	
37	236	UAC	----	
38	285	UAC	90.75	
39	321	UAC	----	
40	256	UAC	16.70	
41	Lost Tag	---	----	
42	Lost Tag	---	147.48	
			AVG 96.80 Sec.	