AMC 18/
File

ELECTRICAL TESTS

1.0 ELECTRICAL TESTS

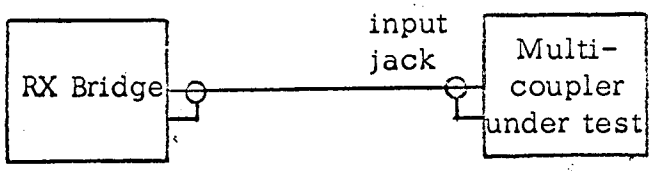
Note: During the tests described in this section all unused RF connectors shall be terminated with 50 ohm and all connector shells shall be grounded by strapping their ground terminals to chassis.

1.1 Input Impedance - ref. para. C-4d(1)

1.1.1 Test Equipment

No. Used	Description	Model
1	RX Bridge 50 ohm Coax Terminators	Boonton 250A or equivalent

1.1.2 Test Set-up Block Diagram



Note: Make leads between RX Bridge and Multicoupler as short as possible. Terminate all outputs with 50 ohms.

1.1.3 PROCEDURE:

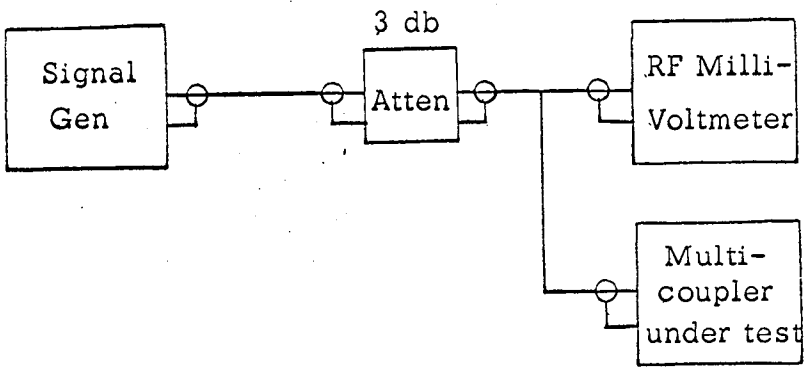
Measure the input impedance of the multicoupler using the Boonton 250A RX Bridge connected as shown in para. 1.1.2. Take measurements at 2,4,8,16, and 30 MHz. Enter the readings in the table below.

Freq (MHz)	R (Ω)	C (pf)
2	51	-
4	52	-55.4
8	51.5	+27
16	-	-1.9
30	47	-19.5

1.1.4 Test Equipment

No. Used	Description	Model (or equivalent)
1	Signal Generator	HP-606A
1	1 db Step Attenuator	HP-355C
1	RF Millivoltmeter	Boonton 91C

1.1.5 Test Set-Up Block Diagram



Note: Make leads from Attenuator to Multicoupler and RF Millivoltmeter probe as short as possible.

1.1.6 PROCEDURE:

1.1.6.1 Set Signal Generator to 2MHz and with the Multicoupler disconnected set the Generator level so that the RF Millivoltmeter reads 2 millivolts.

1.1.6.2 Reconnect the Multicoupler and read the voltage level indicated on the millivoltmeter. Enter this reading in the table below.

1.1.6.3 Repeat paragraphs 1.1.6.1 and 1.1.6.2 with generator level set so that the RF Millivoltmeter reads 20 mv, 200 mv, and 2.0 volts (para.1.1.6.1)

Open Circuit Generator Level

Freq (MHz)	2 mv	20 mv	200 mv	2.0 volts
2	107	1.09	1.09	1.0
4	96	1.09	1.09	1.0
8	108	1.09	1.09	1.09
16	100	1.09	99	.98
30	100	1.09	99	.98

1.1.6.4 Repeat paragraphs 1.1.6.1 through 1.1.6.3 at 4,8,16, and 30 MHZ.

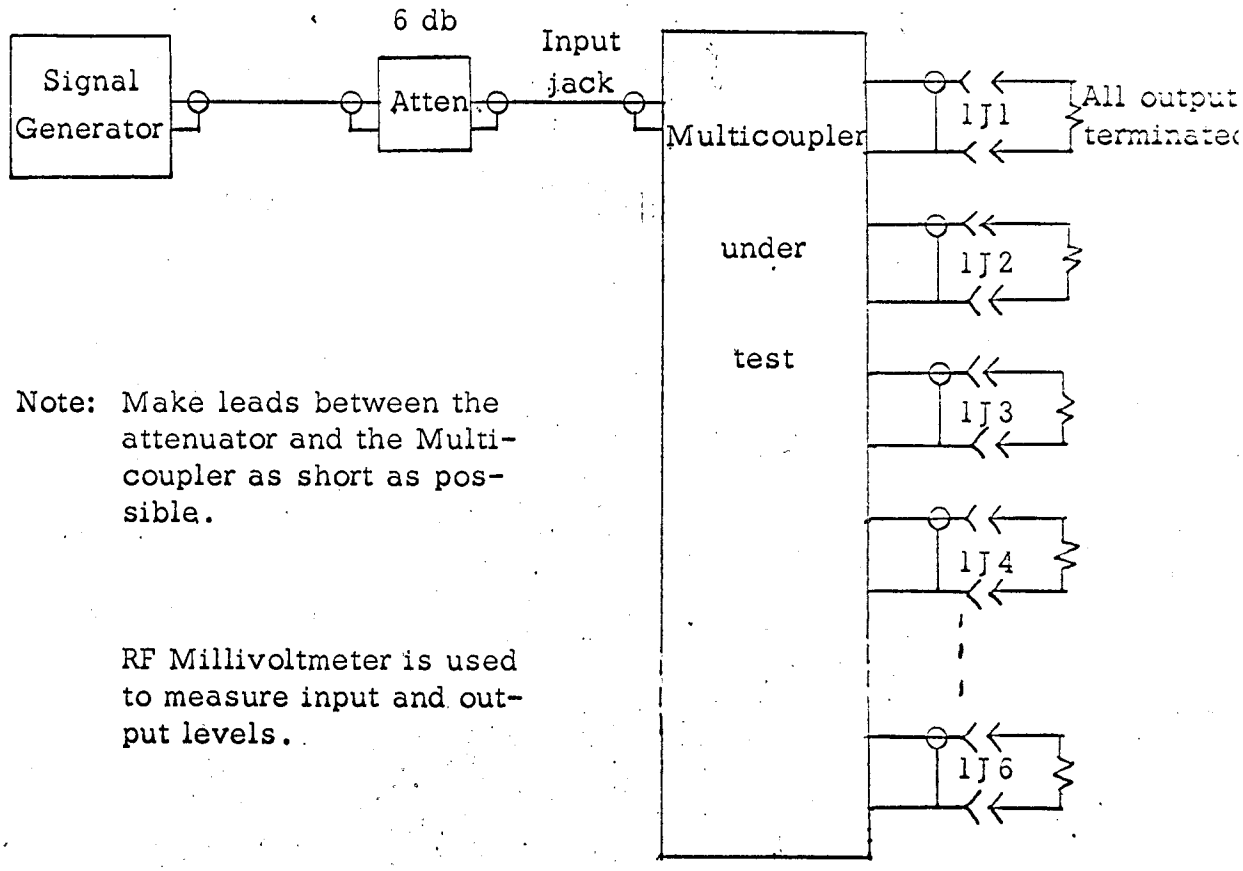
1.1.6.5 If no significant change occurs in the significant figures of the measurements, the input impedance is independent of level.

1.2 Gain ref. para C4-b, C-4d(1)(a), C-4d(2), C-4e, C-4h(1), C-4h(2)

1.2.1 Test Equipment

No. Used	Description	Model
1	Signal Generator	HP-606A or equivalent
1	Oscilloscope	Tektronix 541A or equivalent
1	1 db step Attenuator	HP-355C or equivalent
1	RF Millivoltmeter	Boonton 91C or equivalent
7	50 ohm Coax Terminator	
1	20 ohm Coax Terminator	
1	125 ohm Coax Terminator	
1	51 ohm 1/2 watt composition Resistor	

1.2.2 Test Set-Up Block Diagram



Note: Make leads between the attenuator and the Multicoupler as short as possible.

RF Millivoltmeter is used to measure input and output levels.

1.2.3 PROCEDURE:

1.2.3.1 Connect the test equipment as shown in paragraph 1.2.2 with all outputs terminated in 50 ohms.

1.2.3.2 Set the generator to 2 MHz and using the RF millivoltmeter set the level into the multicoupler at 100 millivolts.

1.2.3.3 Using the RF millivoltmeter measure the output level at each output jack and enter these readings in the table at the end of this section.

1.2.3.4 Repeat paragraph 1.2.3.3 with the output being measured terminated into 20 ohms.

1.2.3.5 Repeat paragraph 1.2.3.3 with the output being measured terminated into 125 ohms.

1.2.3.6 Repeat paragraphs 1.2.3.1 through 1.2.3.5 with the input to the Multicoupler shunted with a 50 ohm coax terminator. (25 ohm source impedance).

1.2.3.7 Repeat paragraphs 1.2.3.1 through 1.2.3.5 with the 51 ohm composition resistor in series with the input to the Multicoupler. (100 ohm source impedance).

Note: Be sure that input level is measured directly at the input terminals AFTER the 51 ohm resistor.

1.2.3.8 Repeat paragraph 1.2.3.1 and 1.2.3.2 .

1.2.3.9 With the Oscilloscope connected to one of the outputs increase the generator level until the output of the Multicoupler just limits.

1.2.3.10 Using the RF millivoltmeter, measure the input level to the Multicoupler and enter this measurement in the table at the end of this section.

1.2.3.11 Repeat paragraphs 1.2.3.1 through 1.2.3.11 at 4,8,16, and 30 MHz.

Paragraph 1.2.3.3

Freq(MHz)	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6
2	130	130	131	130	127	
4	133	133	134	134		
8	132	132	133	133	130	
16						
30	172	111	170	160	162	171

Paragraph 1.2.3.4

Freq(MHz)	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6
2	77	78	77.5	77.5	76	80
4	79.5	80	81	80	79	82.5
8	78	78	79	79	77	81
16	82	82	82	81	81	84
30	94	94	93	88	90	93

Paragraph 1.2.3.5

Freq(MHz)	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6
2	187	187	188	188	186	195
4	192	191	193	194	190	200
8	190	190	191	191	189	199
16	210	210	210	208	205	218
30	263	261	258	247	247	267

Paragraph 1.2.3.6 (50 ohm Terminations)

Freq(MHz)	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6
2	130	130	131	130	129	135
4	133	132	137	135	132	140
8	131	131	132	132	130	137
16	141	142	142	142	140	147
30	176	174	170	169	165	174

20 ohm Terminations

Freq(MHz)	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6
2	76	77	76	78	74	80
4	79	80	80	80	78	82
8	79	79	79	78	77	81
16	82	82	82	81	80	84
30	94	94	92	89	90	93

125 ohm Terminations

Freq(MHz)	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6
2	187	187	187	189	185	195
4	191	191	192	192	189	199
8	190	190	191	191	189	199
16	210	210	210	208	206	218
30	268	262	260	248	250	260

Paragraph 1.2.3.7

50 ohm Terminations

Freq(MHz)	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6
2	130	130	131	130	130	135
4	132	133	135	134	132	139
8	131	131	132	132	130	136
16	141	140	141	140	139	146
30	172	170	169	160	161	170

20 ohm Terminations

Freq(MHz)	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6
2	76	77	78	77	76	80
4	79	80	81	80	78	82
8	78	78	79	78	77	81
16	82	82	83	82	81	84
30	94	94	93	88	90	93

125 ohm Terminations

Freq(MHz)	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6
2	187	186	189	188	184	191
4	191	190	192	193	190	200
8	190	190	190	191	188	198
16	209	209	209	208	204	216
30	262	260	258	247	247	259

Paragraph 1.2.3.11

Freq (MHz)	Input Level at Limiting Point
2	2.8
4	2.8
8	2.8
16	2.7
30	1.7

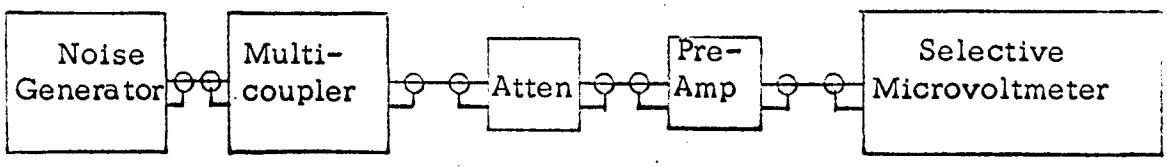
1.3 Noise Figure

Ref paragraphs C-4f and C-4k of SC-A-46801-B

1.3.1. Equipment

No. Used	Description	Model	Tolerance
1	Noise Generator (Noise Diode 5722)	TMCR	or equivalent
1	1 db step Attenuator	HP-355C	or equivalent
1	Broadband Preamp.	TMCR PA-001	or equivalent
5	50 Coax Terminator		
1	Selective Microvoltmeter	Rohde & Schwarz 10KHz to MHz Type USVH	or equivalent

1.3.2. BLOCK DIAGRAM



1.3.3 PROCEDURE

1.3.3.1 Connect test equipment as shown in paragraph 1.3.2.

Note: 1. All leads must be as short as possible

2. Any one of the six Multicoupler outputs may be used.

1.3.3.2 Turn the Multicoupler on, the Noise Generator off, and the Attenuator to 0 db.

1.3.3.3 Tune the selective microvoltmeter to 2.0 MHz.

1.3.3.4 Note and record the "average" reading of the meter in the table at the end of this section.

1.3.3.5 Switch the attenuator to the 3 db position.

1.3.3.6 Turn on the noise generator and adjust the noise output until the indication on the meter is the same as in paragraph 1.3.3.4.

1.3.3.7 Note and record the current indicated on the noise generator meter in the table at the end of this section.

1.3.3.8 Repeat paragraphs 1.3.3.1 through 1.3.3.7 at 4, 8, 16, and 30 MHz.

1.3.3.9 The Multicoupler Noise Factor (NFm) and in turn the "Spot" Noise Figure (Fm) can be determined from the following equations:

a. NFm = 1000 I (where I = is the noise diode current obtained in 1.3.3.7)

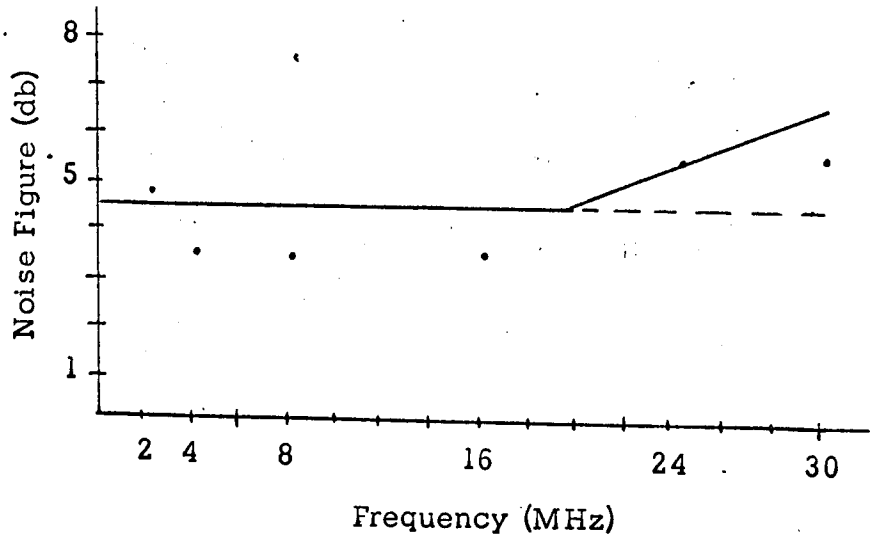
b. $Fm = 10 \log_{10} NFm$

c. Enter the calculated Spot Noise Figure in the table at the end of this section.

1.3.3.10 The average Multicoupler Noise Figure (F) is then found in a manner indicated in the example below (Plot on data sheet at the end of this section).

For example consider

f(MHz)	Fm
2	4.9 db
4	3.6 db
8	3.5 db
16	3.6 db
24	5.6 db
30	5.7 db



Straight lines are drawn which will in any case include sufficient area to cover all points.

Then the average Noise Figure represented by the straight lines is calculated

$$\text{Area} = (4.5)\,(30-2) + 1/2 \quad [2.1 \times (30-20)]$$

$$= 126 + 10.5 = 136.5$$

$$\text{Favg} = \frac{\text{Area}}{30-2} = \frac{136.5}{28} = \underline{4.87\ \text{db}}$$

1.3.3.11 The noise figure for two Multicouplers in cascade may be determined by repeating the steps above or may be calculated from

$$NF_c = NF_1 + \frac{NF_2 - 1}{G_1}$$

where NF_c = Noise Figure of cascaded Multicouplers

NF_1 = Noise Figure of 1st Multicoupler

NF_2 = Noise Figure of 2nd Multicoupler

G_1 = Power gain of 1st Multicoupler

Enter value in space provided on data sheet.

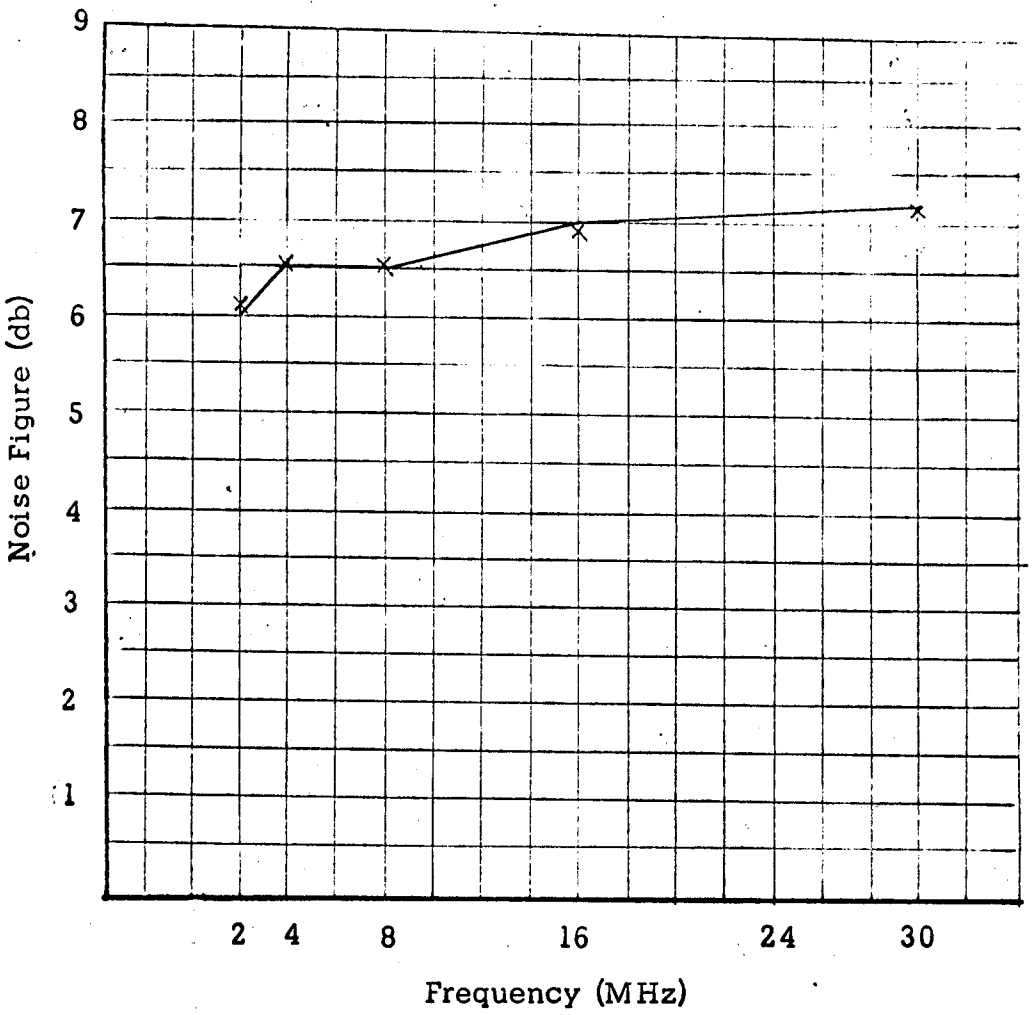
	Para 1.3.3.4	Para. 1.3.3.7
Freq. (MHz)	Ref. Reading	Noise Generator Current (System 1 ma)
2	5.1	4.1
4	4.7	4.5
8	3.8	4.5
16	3.1	4.9
30	3.7	5.2

Paragraph 1.3.3.9 channel 3

Freg (MHz)	Noise Figure (db)
2	6.13
4	6.53
8	6.53
16	6.90
30	7.16

- USE SPACE BELOW FOR CALCULATIONS -

PARAGRAPH 1.3.3.10



Average Multicoupler Noise Figure = 6.85

--Use Space Below for Calculations --

$$\frac{(6)(28)+(.5)(.5)(2)+(.5)(26)+(.5)(.5)(8)+(.5)(14)+(.5)(.2)(14)}{28} =$$

$$\frac{168+.5+13+2+7+1.4}{28} = 6.85$$

168.0
.5
13.0
2.0
7.0
1.4
191.9

PARAGRAPH 1.3.3.11

Noise Figure for Two Multicouplers in Cascade = _____

-- Use Space Below for Calculations --

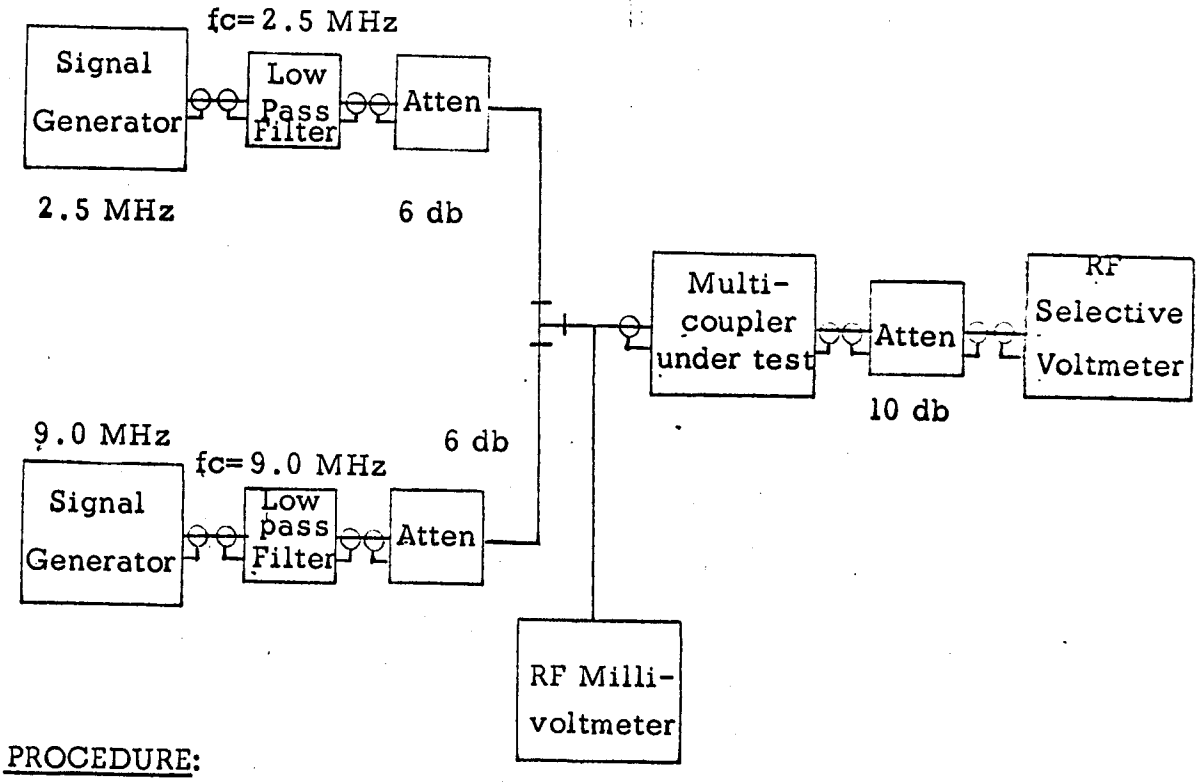
1.4 INTERMODULATION

Ref paragraph C-4g of SC-A-46801-B

1.4.1 EQUIPMENT

No. Used	Description	Model	Tolerance
2	Signal Generator	HP 606 A	or equivalent
1	Low Pass Filter with fc of 2.5 MHz	-	-
1	Low Pass Filter with fc of 9.0 MHz	-	-
2	1 db step attenuators	HP-355 C	or equivalent
1	10 db step attenuator	HP-355 D	or equivalent
1	RF Millivoltmeter	Boonton 91 C	"
1	RF Selective Voltmeter	Rhode & Schworz	"

1.4.2 BLOCK DIAGRAM



1.4.3 PROCEDURE:

1.4.3.1 Connect test equipment as shown in 1.4.2. Adjust the signal generator driving the 2.5 MHz low pass filter to 2.5 MHz . Adjust the other signal generator to 9.0 MHz.

1.4.3.2 Switch the 2.5 MHz signal generator output level to less than -60 dbv and adjust the 9.0 MHz signal generator output to 0.5 VRMS as indicated by the RF Millivoltmeter.

1.4.3.3 Switch the 9.0 MHz signal generator output level to less than 60 dbv and adjust the 2.5 MHz signal level to 0.5 VRMS as indicated by the RF Millivoltmeter.

1.4.3.4 Switch the 9.0 MHz signal generator level back to the position which produced the 9.5 VRMS signal. The total input as indicated by the RF millivoltmeter will be approximately 1 VRMS.

1.4.3.5 Adjust the RF Selective Voltmeter to measure the 9.0 MHz signal level at the Multicoupler output. Note and record this level on the data sheet. (Reference Level).

1.4.3.6 Tune the RF Selective Voltmeter to the frequencies indicated on the data sheet. Measure and record the output levels.

1.4.3.7 Remove the 2.5 MHz low pass filter and the 10 db step attenuator from the test setup and place the 2.5 MHz low pass filter in the position from which the 10 db step attenuator was removed. Connect the 2.5 MHz signal generator directly to the 1 db step attenuator, bypassing the original location of the 2.5 MHz low pass filter.

1.4.3.8 Repeat paragraph 1.4.3.3 except set the 2.5 MHz level to 1.0 vrms.

1.4.3.9 Using the switch attenuator on the 2.5 MHz signal generator decrease the level 120 db.

1.4.3.10 Tune the RF selective voltmeter to the 2.5 MHz signal.

1.4.3.11 Increase the 9 MHz signal generator output until the level indicated by the RF selective voltmeter drops 3 db. Enter the level required on the data sheet.

PARAGRAPH 1.4.3.5

Reference Level (f_1) +0.5 db

PARAGRAPH 1.4.3.6

Freq (MHz)	Product	Channel 1 Level (db)
2.5	f_2	-.25
4.0	f_1-2f_2	-63
5.0	$2f_2$	<-70
6.5	$f_1 - f_2$	<-70
11.5	$f_1 + f_2$	-64
14.0	$f_1 + 2f_2$	-63
15.5	$2f_1 - f_2$	-61.5
18.0	$2f_1$	-61
20.5	$2f_1 + f_2$	-62

Note: The 2.5 MHz signal level should be approximately equal to the 9.0 MHz signal level. The other signal levels should be at least 60 db down from either the 9.0 or 2.5 MHz signal level.

PARAGRAPH 1.4.3.11

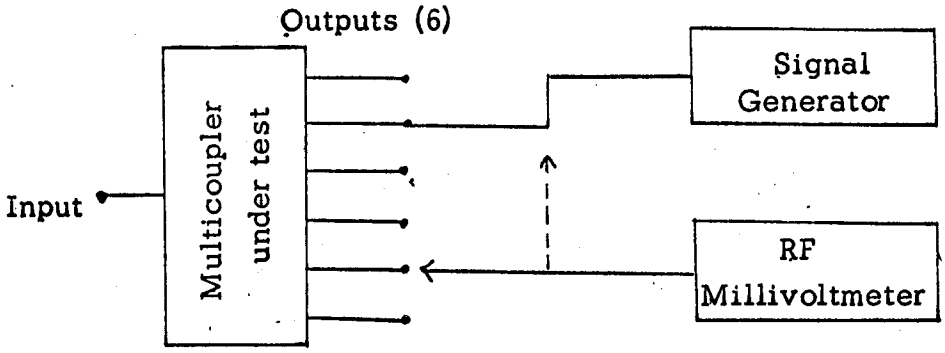
Level required to desensitize unit 3 db = >3v rms

1.5 ISOLATION OF OUTPUTS Ref C4h

1.5.1 TEST EQUIPMENT

No. Used	Description	Model
1	Signal Generator	HP 606A or equivalent
1	RF Millivoltmeter	Boonton 91C or "
6	50 ohm Coax Terminators	- -

1.5.2 BLOCK DIAGRAM



1.5.3 PROCEDURE:

1.5.3.1 Connect all ground terminals together and to chassis with heavy buss wire.

Connect the signal generator to any one of the output jacks. Terminate the input and all other outputs with 50 ohms.

1.5.3.2 Adjust the signal generator to 2 MHz and using the RF Millivoltmeter, set the generator output level to 1.0 volts.

1.5.3.3 Connect the RF millivoltmeter to each of the other five outputs. (Keeping outputs terminated into 50 ohms) and measure the relative level in db. Enter the values in the Table.

1.5.3.4 Repeat paragraphs 1.5.3.2 through 1.5.3.3 as desired with the signal generator connected to any one of the other output jacks.

1.5.3.5 Repeat paragraphs 1.5.3.2 through 1.5.3.4 at 4,8,16, and 30 MHz.

Paragraph 1.5.3.3

Freq(MHz)	Channel 2 Level (db)	Channel 3 Level (db)	Channel 4 Level (db)	Channel 5 Level (db)	Channel 6 Level (db)
2	54	53.5	53.5	53.5	53
4	53	53	53	53.5	53.5
8	50	51	51	51	51
16	44	46	46.5	46.5	46
30	40.5	42	42.5	42.5	42

Paragraph 1.5.3.4

Freq(MHz)	Channel 1 Level (db)	Channel 2 Level (db)	Channel 3 Level (db)	Channel 5 Level (db)	Channel 6 Level (db)
2	55.5	56	56	56	55.5
4	55	55	54.5	54.5	54
8	52	52	51.5	51.5	52
16	47	46.5	46	46	46.5
30	45	45	45	45	45

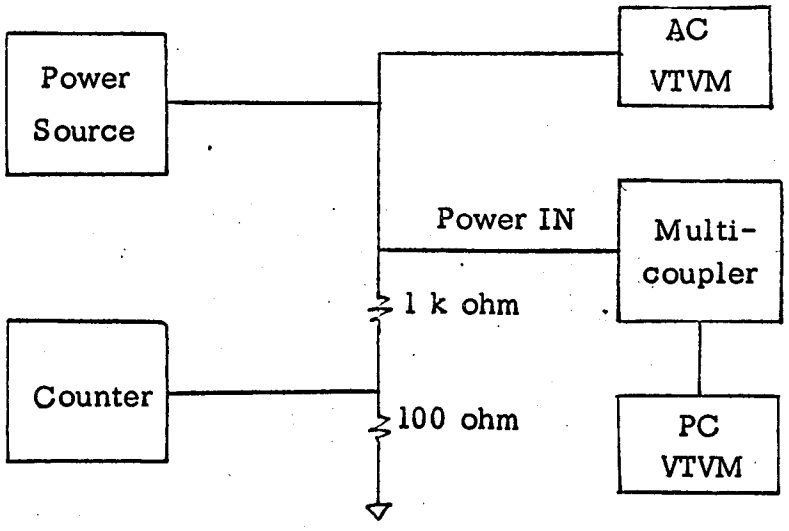
1.6 AC SUPPLY REQUIREMENTS

Ref Paragraph C-4a, C-4o

1.6.1 EQUIPMENT

No. Used	Description	Model
1	115 V variable frequency power source	Heath Kit Model AA-81 Power amplifier or equiv.
1	60 Hz variable voltage power source	Hp 200 CD Wide Range Oscillator or equiv.
1	Frequency Counter	HP 5233L or equivalent
1	AC Voltmeter	HP 410 C or equivalent
1	DC Voltmeter	HP 410 C or equivalent
1	1 K ohm Resistor	
1	100 ohm Resistor	

1.6.2 BLOCK DIAGRAM



1.6.3 PROCEDURE:

1.6.3.1 With the Variable Voltage source supplying power to the Multicoupler, adjust the supply voltage to 104 VAC as indicated by the AC Voltmeter.

1.6.3.2 With the DC Voltmeter, measure the output voltage of the Multicoupler power supply. Enter the results on the data sheet.

1.6.3.3 Repeat paragraph 1.6.3.1 and 1.6.3.2 at 115 volts and 126 volts.

1.6.3.4 With the variable frequency power source supplying power to the Multicoupler, adjust the supply frequency to 47 Hz as indicated by the counter.

1.6.3.5 With the DC Voltmeter, measure the output voltage of the Multicoupler power supply. Enter the results on the data sheet.

1.6.3.6 Repeat para. 1.6.3.4 and 1.6.3.5 at 60 and 63 Hz.

AC Input(Volts)	DC Output(Volts)	AC Input (Hz)	DC Output(Volts)
104	24.3	47	24.3
115	24.3	60	24.3
126	24.3	63	24.3

Note: DC output voltage should be approximately the same for all measurements and if so, the rest of the electrical tests should not be affected by the variations of supply voltage and frequency.

2.0 ENVIRONMENTAL TESTS

2.1 ELEVATION TESTS

Elevation Tests shall be made as specified in Paragraph D-10a of SC-A-46801-B.

2.2 TEMPERATURE TESTS

The equipment shall be subjected to the temperature cycle shown on MIL-STD-169 as required by Paragraph D-10b of SC-A-46801-B with the following modification:

2.2.1 Step 2A shall be limited to 4 hours per Paragraph C-8b(2) .

2.2.2 Steps 3,5,7, and 9 are to be eliminated per Note 3 of MIL-STD-169.

2.2.3. Step 4 is to be run at a temperature of 122° F ± 3° F (50°c) for a duration of no more than 4 hours per Paragraph C-8b (1) of SC-A-46801-B.

2.2.4 Electrical Tests are to be performed during steps 4,8, and 10.

2.3 MOISTURE RESISTANT TESTS

Moisture Resistant Tests shall be made as specified in Paragraph D-10c of SC-A-46801-B.