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HEWLETT PACKARD

OPERATING AND SERVICE MANUAL

MODEL 3048A

OPTION K21

AM DETECTOR FILTER

How To Use This Manual

This Manual should be used in conjunction with the 3048A Operating Manual, HP Part Number 03048-90001 (printed March 1988), and the 3048A Reference Manual, HP Part Number 03048-90002 (printed June 1988).

Applicable Serial Numbers

This Manual Modification Insert applies to instruments with serial number prefixes greater that or equal to 2820A.

Updates to this Manual Insert

Periodically, changes are made to this Manual Insert to correct errors in the original printing and to include Option improvements. Corrections are indicated by a mark at the right-hand edge of the modified test. The mark used is keyed to the date the corrections are added (found on this cover page below the issue date).

Manual Modification Inset
HP Part Number 03048-92035

Issued November 1988
Updated June 1989 *

SECTION I. GENERAL INFORMATION

1-1. INTRODUCTION

This manual contains information required to install, operate, and service the Hewlett-Packard Model 3048A Option K21 AM Detector Filter, an optional accessory for the HP 3048A Phase Noise Measurement System.

The AM Detector Filter Operating and Service Manual has five sections. The subjects addressed are:

SECTION I.....GENERAL INFORMATION
SECTION II.....OPERATION
SECTION III.....PERFORMANCE TESTS
SECTION IV.....REPLACEABLE PARTS
SECTION V.....SERVICE

1-2. SPECIFICATIONS

Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument may be tested.

Table 1-1. Specifications

Characteristics	Performance Limits	Conditions
MAXIMUM INPUT DC	+/-5 V	
FLATNESS	+/-0.5 dB	1 Hz to 40 MHz

1-3. DESCRIPTION

The HP Model 3048A Option K21 AM Detector Filter is an accessory to the HP 3048A Phase Noise Measurement System. It contains a DC return for an AM detector, such as the HP 33330C/D, and a DC blocking capacitor.

The insertion loss of the AM Detector Filter is *typically less than 1.5 dB. The switch on the front* cover can be set for either positive or negative AM detector polarity.

1-4. INITIAL INSPECTION

Inspect the shipping container. If the container and/or packing material is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. If there is mechanical damage or if the instrument does not pass the performance tests, notify the nearest Hewlett-Packard office. Keep the damaged shipping materials (if any) for inspection by the carrier and a Hewlett-Packard representative.

1-5. ACCESSORIES

The accessories supplied with the HP 3048A Opt. K21 are listed below:

IMPEDANCE MATCHING NETWORK.....03048-62013	*
CALIBRATION LOAD.....03048-62014	*
CALIBRATION CABLES (2).....03048-62017	*
ADAPTOR SMA(F) TO SMC(F) (3).....1250-1694	*
ADAPTOR SMA(M) TO SMC(F) (1).....1250-1697	

SECTION II. OPERATION

2-1. APPLICATIONS

An AM noise measurement can be made with a HP 3048A as described in 'AM Noise Using an HP 33330C' on page 3-111 of the HP 3048A Phase Noise Measurement System Operating Manual. The HP 3048A Opt. K21 AM Detector Filter is substituted for the filter network described in Table 3-22, and shown schematically in Figure 3-31.

2-2. CONNECTIONS

To setup the equipment for an AM Noise Measurement with the HP 3048A and AM Detector Filter, refer to Figure 2-1. The best results will be obtained when semi-rigid coaxial cables are used to connect the components used in the measurement and should be used whenever possible.

Ground loops can be a problem in this type of measurement. To minimize ground loops, a DC Block is inserted between the RF source under test and the AM detector. The recommended DC Block is the Narda 562 (Type-N connectors, 10 MHz to 12.4 GHz) or the Narda 4563 (SMA connectors, 500 MHz to 18 GHz). DC Blocks may also be referred to as Audio Interface Suppressors or Noise Suppressors. A ground loop can be suspected if the 60 Hz spurs have an amplitude greater than -80 dBc.

Connect the AM detector directly to the input connector of the HP 3048A Opt. K21 AM Detector Filter. The output of the AM Detector Filter should be connected directly to the HP 11848A Phase Noise Interface front-panel 'NOISE INPUT' connector. However, if a DC Block is inserted between the RF source under test and the AM detector, it is not necessary to connect the output of the AM Detector Filter to the 'NOISE INPUT' of the HP 11848A. A short semi-rigid cable will be sufficient to make this connection if a DC Block is used. To connect the AM Detector Filter directly to the 'NOISE INPUT', connect a N(m) to SMA(m) adaptor (HP part number 1250-1994, one is supplied with the HP 3048A as part of the Noise Floor Fixture, HP part number 03048-61032) to the HP 11848A 'NOISE INPUT'. Then connect a SMA(m) to SMA(f) right angle adaptor (HP part number 1250-1249) to the N(m) to SMA(m) adaptor and the HP 3048A Opt. K21 AM Detector Filter output.

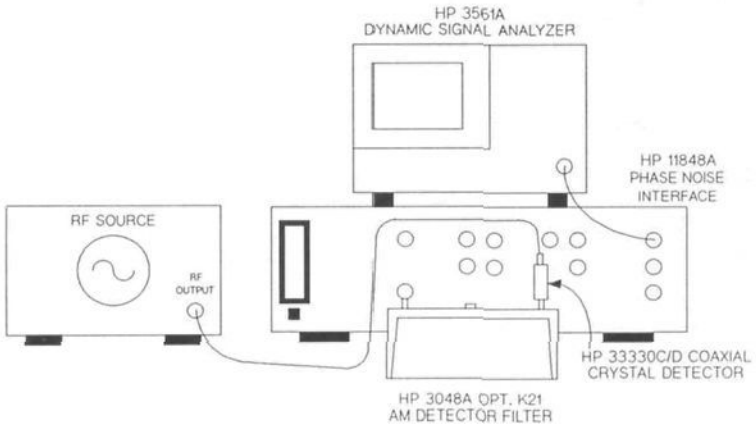

FIGURE 2-1. SETUP FOR AM NOISE MEASUREMENT WITH HP 3048A

SECTION III. PERFORMANCE TESTS

3-1. INTRODUCTION

The procedures in this section test the instrument's electrical performance using the specifications of Table 1-1 as performance standards. All tests are performed without accessing the interior of the instrument.

NOTE

For greatest accuracy, allow the test equipment to warm up at least one-half hour.

3-2. PERFORMANCE TEST RESULTS

Results of the performance tests may be tabulated in the Test Results Tables at the end of each procedure. The Test Results Tables list all of the tests specifications and acceptable limits. The results recorded at incoming inspection, can be used for comparison in periodic maintenance, troubleshooting, and after repairs.

3-3. CALIBRATION CYCLE

This instrument requires periodic verification of performance. Depending on the use and environmental conditions, the instrument should be checked using the following performance test at least once every year.

3-4. SPECIAL EQUIPMENT

A Calibration Load and Impedance Matching Network are required to run these Performance Tests. One of each is supplied with the HP 3048A Opt. K21 AM Detector Filter. Service information on these devices and an easy method to build replacements if the originals are lost or damaged are given starting on page 16 of this manual.

3-5. PERFORMANCE TESTING

No abbreviation of the performance testing is recommended.

PERFORMANCE TEST 1

100 KHZ TO 40 MHZ FLATNESS TEST

DESCRIPTION

This test measures the flatness of the HP 3048A Opt. K21 AM Detector Filter from 100 kHz to 40 MHz with a HP 3585A/B. A reference is taken with the HP 3585A/B tracking generator connected by a short cable to the impedance matching network and calibration load. The calibration load output is connected to the 50 ohm input of the HP 3585A/B with a short cable. Once the reference trace is measured and stored in the HP 3585A/B memory, the reference load is replaced with the device under test (DUT). The results are then measured and recorded in Table 3-1.

EQUIPMENT

SPECTRUM ANALYZER.....HP 3585A/B
IMPEDANCE MATCHING NETWORK.....03048-62013
CALIBRATION LOAD.....03048-62014
CALIBRATION CABLES (2).....03048-62017

PROCEDURE

1. Connect the equipment up as shown in Figure 3-1.

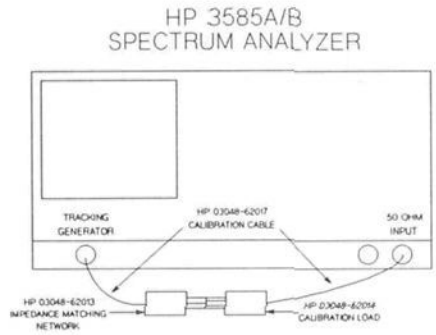

FIGURE 3-1. SETUP FOR REFERENCE MEASUREMENT WITH HP 3585A/B

2. Press the green [INSTR PRESET] key on the HP 3585A/B.

3. Setup the HP 3585A/B as follows:

   START FREQ.....100 kHz
   STOP FREQ.....40 MHz
   dB/DIV.....1 dB
   REFERENCE LEVEL.....-30 dBm
   AUTO RANGE.....OFF

4. The trace should be in the upper half of the HP 3585A/B display. If the trace looks good, press the [STORE A -> B] key on the HP 3585A/B.

5. Press the [A-B] key on the HP 3585A/B to activate the trace.

6. Turn off the B trace by pressing the [VIEW B] key on the HP 3585A/B. There should only be one trace on the HP 3585A/B CRT and it should be a straight line in the middle of the screen.

7. Replace the Calibration Load with the Opt. K21 AM Detector Filter as shown in Figure 3-2.

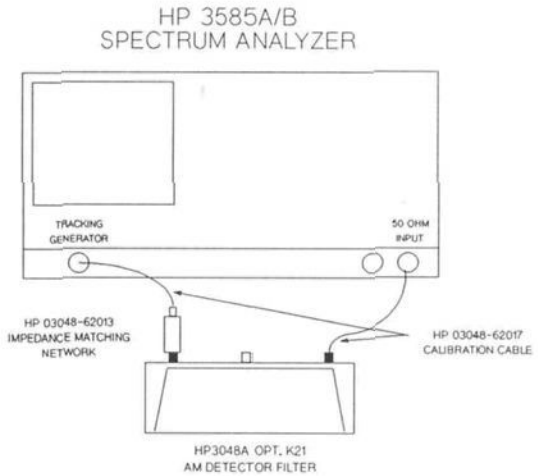

FIGURE 3-2. SETUP FOR FLATNESS TEST WITH HP 3585A/B.

8. Set the 'DETECTOR POLARITY' switch on the HP 3048A Opt. K21 AM Detector Filter to the 'POS' position.

9. Use the rotory knob on the HP 3585A/B to position the cursor within 700 Hz of the frequencies listed in Table 3-1. Record the cursor level under the 'POS DETECTOR POLARITY' in Table 3-1.

10. Set the 'DETECTOR POLARITY' switch to the 'NEG' position and repeat Step 9. Record the results under 'NEG DETECTOR POLARITY' in Table 3-1.

TABLE 3-1. FLATNESS TEST RESULTS FROM 100 kHz TO 40 MHz

FREQ (MHz)	MEASURED RESULTS					
	POS DETECTOR POLARITY			NEG DETECTOR POLARITY		
	LEVEL (dB)	LOWER LIMIT (dB)	UPPER LIMIT (dB)	LEVEL (dB)	LOWER LIMIT (dB)	UPPER LIMIT (dB)
.1	_____	-0.5	0.5	_____	-0.5	0.5
4.0	_____	-0.5	0.5	_____	-0.5	0.5
8.0	_____	-0.5	0.5	_____	-0.5	0.5
12.0	_____	-0.5	0.5	_____	-0.5	0.5
16.0	_____	-0.5	0.5	_____	-0.5	0.5
20.0	_____	-0.5	0.5	_____	-0.5	0.5
24.0	_____	-0.5	0.5	_____	-0.5	0.5
28.0	_____	-0.5	0.5	_____	-0.5	0.5
32.0	_____	-0.5	0.5	_____	-0.5	0.5
36.0	_____	-0.5	0.5	_____	-0.5	0.5
40.0	_____	-0.5	0.5	_____	-0.5	0.5

PERFORMANCE TEST 2

.1 HZ TO 10 HZ FLATNESS TEST

DESCRIPTION

This test measures the flatness of the HP 3048A Opt. K21 from .1 Hz to 10 Hz with a HP 3561A. A reference is taken with the HP 3561A Noise Source (rear panel) connected with a BNC cable to the impedance matching network and calibration load. The calibration load output is connected to the HP 3561A input through a 50 ohm feed-thru with a short cable. After the reference trace is measured and stored in the HP 3561A's memory, the reference load is replaced with the device under test (DUT). The results are measured and recorded in Table 3-2.

EQUIPMENT

SPECTRUM ANALYZER	HP 3561A
IMPEDANCE MATCHING NETWORK	03048-62013
CALIBRATION LOAD	03048-62014
CALIBRATION CABLE (2)	03048-62017
50 OHM FEEDTHRU	HP 10100C *
BNC CABLE	8120-1840
BNC ADAPTOR	1250-0080

PROCEDURE

1. Connect the equipment as shown in Figure 3-3.

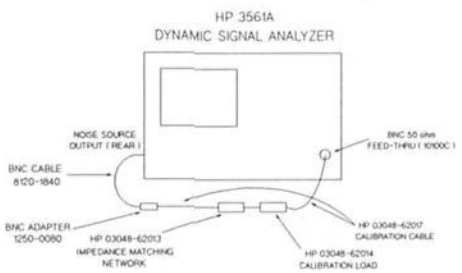

FIGURE 3-3. SETUP FOR REFERENCE MEASUREMENT WITH HP 3561A

2. Press the green [PRESET] key on the HP 3561A.

3. *Setup the HP 3561A as follows:*

FORMAT	SINGLE
FREQ	START 0 Hz
	10 Hz SPAN
	FREQ AXIS to log
WINDOW	UNIFORM
SOURCE	PERIODIC NOISE
	0 dB ATTN
RANGE	AUTO RNG off
	perform SINGLE AUTO RNG
INPUT	RMS
	4 AVGS
START	start a measurement
	sweep

4. Wait for the HP 3561A to complete the sweep of 4 averages and then continue the setup of the HP 3561A as follows:

VERT SCALE	SINGLE AUTO SCL
STORE/RECALL	STORE IN M1
DEFINE TRACE	MATH FCN SELECT
	MAG / M1
VERT SCALE	perform SINGLE AUTO SCL
	2 dBV FULL SCALE

5. The trace should be a straight line in the center of the HP 3561A display.

6. Replace the Calibration Load with the AM Detector Filter as shown in Figure 3-4 and set the 'DETECTOR POLARITY' switch to the 'POS' position.

7. Press the [START] key on the HP 3561A and wait for the HP 3561A to complete the measurement.

8. Position the HP 3561A marker to each of the frequencies listed in Table 3-2 by pressing [MKR], (DEFINE MKR POS), frequency to be measured (in hertz), and (Hz) on the HP 3561A. Record the marker level for each frequency under 'POS DETECTOR POLARITY' in Table 3-2.

9. Set the 'DETECTOR POLARITY' switch to the 'NEG' position. Repeat Steps 7 and 8. Record the results under 'NEG DETECTOR POLARITY' in Table 3-2.

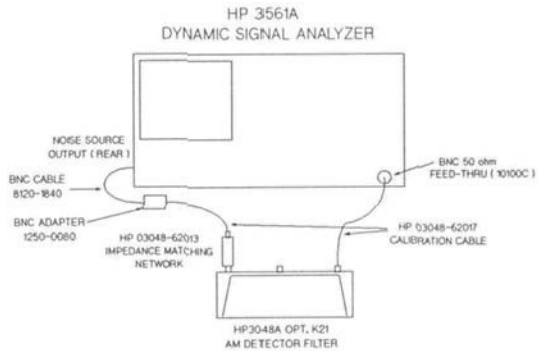

FIGURE 3-4. SETUP FOR FLATNESS TEST WITH HP 3561A

TABLE 3-2. FLATNESS TEST RESULTS FROM .1 Hz TO 10 Hz

FREQ (MHz)	MEASURED RESULTS					
	POS DETECTOR POLARITY			NEG DETECTOR POLARITY		
	LEVEL (dB)	LOWER LIMIT (dB)	UPPER LIMIT (dB)	LEVEL (dB)	LOWER LIMIT (dB)	UPPER LIMIT (dB)
0.1	_____	-5.0	-2.0	_____	-5.0	-2.0
1.0	_____	-0.5	0.5	_____	-0.5	0.5
5.0	_____	-0.5	0.5	_____	-0.5	0.5
10.0	_____	-0.5	0.5	_____	-0.5	0.5

PERFORMANCE TEST 3

DC LEAKAGE TEST

DESCRIPTION

This test measures the leakage current of the capacitors in the AM Detector Filter. A 5V supply is applied to the input. The output is connected through a 50 ohm feed-thru to the input of a voltmeter. The leakage current is measured by measuring the voltage dropped across the 50 ohm feed-thru.

EQUIPMENT

VOLTMETER.....HP 3478A
POWER SUPPLY.....HP 6205B
50 OHM FEED-THRU.....HP 10100C *

PROCEDURE

1. Connect the equipment up as shown in Figure 3-5.

2. Set the 'DETECTOR POLARITY' switch to the 'POS' position.

3. Turn on the power supply and set it for +5 Volts.

4. Wait for 2 minutes and then read the voltmeter. Record the voltmeter reading below:

   Voltmeter reading _____ spec: < 3.5 mV

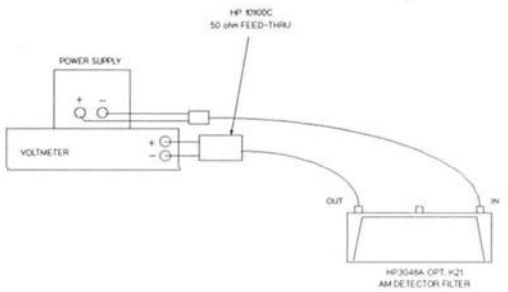

FIGURE 3-5.

SECTION IV. REPLACEABLE PARTS

Table 4-1 lists the replaceable parts. It is organized with the electrical components first, in alphabetical order by reference designator, followed by mechanical parts. The following information is given for each part:

a. the reference designator;
b. the HP Part Number;
c. the total quantity (Qty) used in the instrument;
d. the part number check digit (CD); and
e. the description of the parts.

TABLE 4-1. REPLACEABLE PARTS

REFER. DESIG.	HP PART NUMBER	QTY	C D	DESCRIPTION
A1	03048-62101	1	3	AM DETECTOR FILTER ASSEMBLY
A1C1	0160-4380	1	0	CAPACITOR-FXD 1PF ±.25PF 200V CER
A1C2	0160-3873	1	3	CAPACITOR-FXD 4.7PF ±.5F 200V CER
A1C3	0160-5469	1	9	CAPACITOR-FXD 1UF ±10% 50VDC MET-POLYE
A1C4	0180-2144	13	4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C5	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C6	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C7	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C8	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C9	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C10	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C11	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C12	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C13	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C14	*0180-2144*		*4*	*CAPACITOR-FXD 200UF +75-10% 25VDC AL*
A1C15	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1C16	0180-2144		4	CAPACITOR-FXD 200UF +75-10% 25VDC AL
A1CR1	1901-0880	2	5	DIODE-GEN PRP 125MA DO-35
A1CR2	1901-0880		5	DIODE-GEN PRP 125MA DO-35
A1CR3	1901-0731	1	5	DIODE-PWR RECT 400V 1A
A1J1	1250-2091	2	5	CONNECTOR-RF SMA FEM PC 50-OHM

TABLE 4-1. REPLACEABLE PARTS (cont'd)

REFER. DESIG.	HP PART NUMBER	QTY	C D	DESCRIPTION
A1J2	1250-2091		5	CONNECTOR-RF SMA FEM PC 50-OHM
A1J3	1251-1998	12	3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J4	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J5	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J6	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J7	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J8	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J9	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J10	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J11	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J12	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J13	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ
A1J14	1251-1998		3	CONNECTOR-SGL CONT SKT .025-IN-BDC-SZ
A1L1	9100-2249	1	6	INDUCTOR RF-CH-MLD 150NH ±10%
A1MP1	5041-0201	1	6	PUSHBUTTON 1/4 CHINA WHITE
A1R1	0757-0346	6	2	RESISTOR 10 1% .125W TF TC=0±100
A1R2	0757-0416	1	7	RESISTOR 511 1% .125W TF TC=0±100
A1R3	0698-7260	1	2	RESISTOR 10K 1% .05W TF TC=0±100
A1R4	0757-0346		2	RESISTOR 10 1% .125W TF TC=0±100
A1R5	0757-0346		2	RESISTOR 10 1% .125W TF TC=0±100
A1R6	0757-0346		2	RESISTOR 10 1% .125W TF TC=0±100
A1R7	0757-0346		2	RESISTOR 10 1% .125W TF TC=0±100
A1R8	0757-0346		2	RESISTOR 10 1% .125W TF TC=0±100
A1S1	3101-2252	1	3	SWITCH-PB DPDT ALTNG 4A 250 VAC
MP1	08640-20230	1	6	FILTER OR AMPLIFIER HOUSING
MP2	2200-0139	6	6	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI
MP3	2200-0139		6	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI
MP4	2200-0139		6	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI
MP5	2200-0139		6	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI
MP6	2200-0139		6	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI
MP7	2200-0139		6	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI
MP8	6960-0016	4	0	PLUG-HOLE TR-HD FOR .125-D-HOLE NYL
MP9	6960-0016		0	PLUG-HOLE TR-HD FOR .125-D-HOLE NYL

TABLE 4-1. REPLACEABLE PARTS (cont'd)

REFER. DESIG.	HP PART NUMBER	QTY	C D	DESCRIPTION
MP10	6960-0016		0	PLUG-HOLE TR-HD FOR .125-D-HOLE NYL
MP11	6960-0016		0	PLUG-HOLE TR-HD FOR .125-D-HOLE NYL
MP12	03048-02011	1	8	AM DETECTOR FILTER HOUSING COVER
MP13	08665-21006	2	7	SPACER
MP14	08665-21006		7	SPACER
MP15	1250-0569	2	8	NUT-RF CONN, 1/4-36 THD, 5/16-IN
MP16	1250-0569		8	NUT-RF CONN, 1/4-36 THD, 5/16-IN
MP17	1250-2280	2	4	WASHER-RF CONN
MP18	1250-2280		4	WASHER-RF CONN

SECTION V. SERVICE

5-1. INTRODUCTION

This section contains information for troubleshooting and repairing the AM Detector Filter. Also included in this section are schematics and parts lists for the Impedance Matching Network and Calibration Load required to run the Performance Tests.

5-2. IMPEDANCE MATCHING NETWORK

The Impedance Matching Network requires no periodic maintenance. If servicing is required, refer to the schematic diagram in Figure 5-1 on page 18 of this manual.

5-3. CALIBRATION LOAD

The Calibration Load requires no periodic maintenance. If servicing is required, refer to the schematic diagram in Figure 5-3 on page 19 of this manual.

5-4. REPLACEMENTS

Replacements for the Impedance Matching Network and Calibration Load can be built with the following procedure:

1. *The parts required to build these devices are* listed on pages 18 and 19.

2. Solder two SMC right angle pc board connectors (1250-0836) together as shown in Figures 5-2 and 5-4.

3. Cut the inside ground posts from the connectors.

4. Solder the resistors to the center and ground posts.

5. A resistor lead or buss wire must be connected between the two center posts and soldered as shown in Figure 5-4.

5-5. FUSES

To protect the AM Detector Filter from a large dc voltage at the input, A1R1 acts as a fuse. If A1R1 is damaged, A1R4 through A1R8 are spare and can be used to replace A1R1. A1R1 and A1R4 through A1R8 are inserted into sockets for easy removal and replacement.

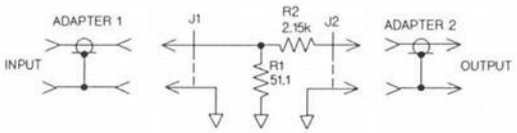

FIGURE 5-1. IMPEDANCE MATCHING NETWORK SCHEMATIC

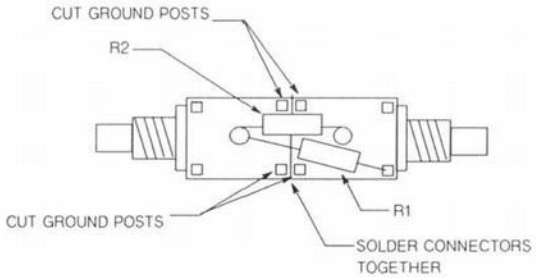

FIGURE 5-2. REPLACEMENT IMPEDANCE MATCHING NETWORK

TABLE 5-1. REPLACEMENT IMPEDANCE MATCHING NETWORK PARTS LIST

REFER. DESIG.	HP PART NUMBER	QTY	C D	DESCRIPTION
R1	0698-7205	1	0	RESISTOR 51.1 1% .05W TF TC=0±100
R2	0698-7244	1	7	RESISTOR 2.15K 1% .05W TF TC=0±100
	1250-0836	2	2	CONNECTOR-RF SMC M PC 50-OHM
	1250-0836	2	2	CONNECTOR-RF SMC M PC 50-OHM
	1250-1694	1	2	ADAPTER-COAX STR F-SMA F-SMC
	1250-1697	1	5	ADAPTER-COAX STR M-SMA F-SMC

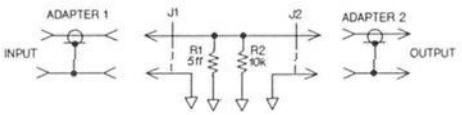

FIGURE 5-3. CALIBRATION LOAD SCHEMATIC

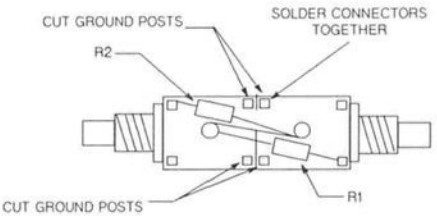

FIGURE 5-4. REPLACEMENT CALIBRATION LOAD

TABLE 5-2. REPLACEMENT CALIBRATION LOAD PARTS

REFER. DESIG.	HP PART NUMBER	QTY	C D	DESCRIPTION
R1	0698-7229	1	8	RESISTOR 511 1% .05W TF TC=0±100
R2	0698-7260	1	7	RESISTOR 10K 1% .05W TF TC=0±100
	1250-0836	2	2	CONNECTOR-RF SMC M PC 50-OHM
	1250-0836		2	CONNECTOR-RF SMC M PC 50-OHM
	1250-1694	2	2	ADAPTER-COAX STR F-SMA F-SMC
	1250-1694		2	ADAPTER-COAX STR F-SMA F-SMC

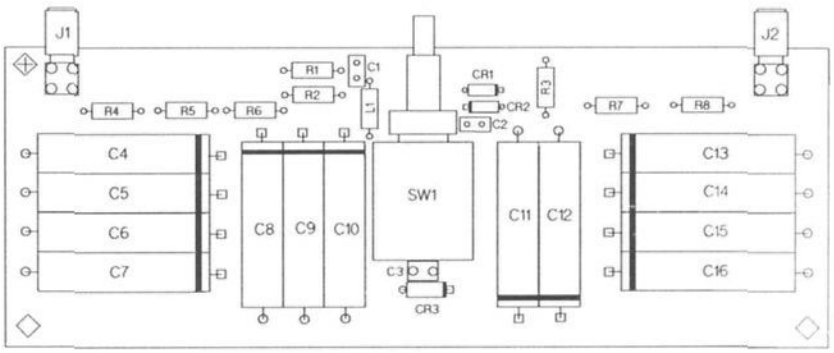

FIGURE 5-5. A1 COMPONENT LOCATOR